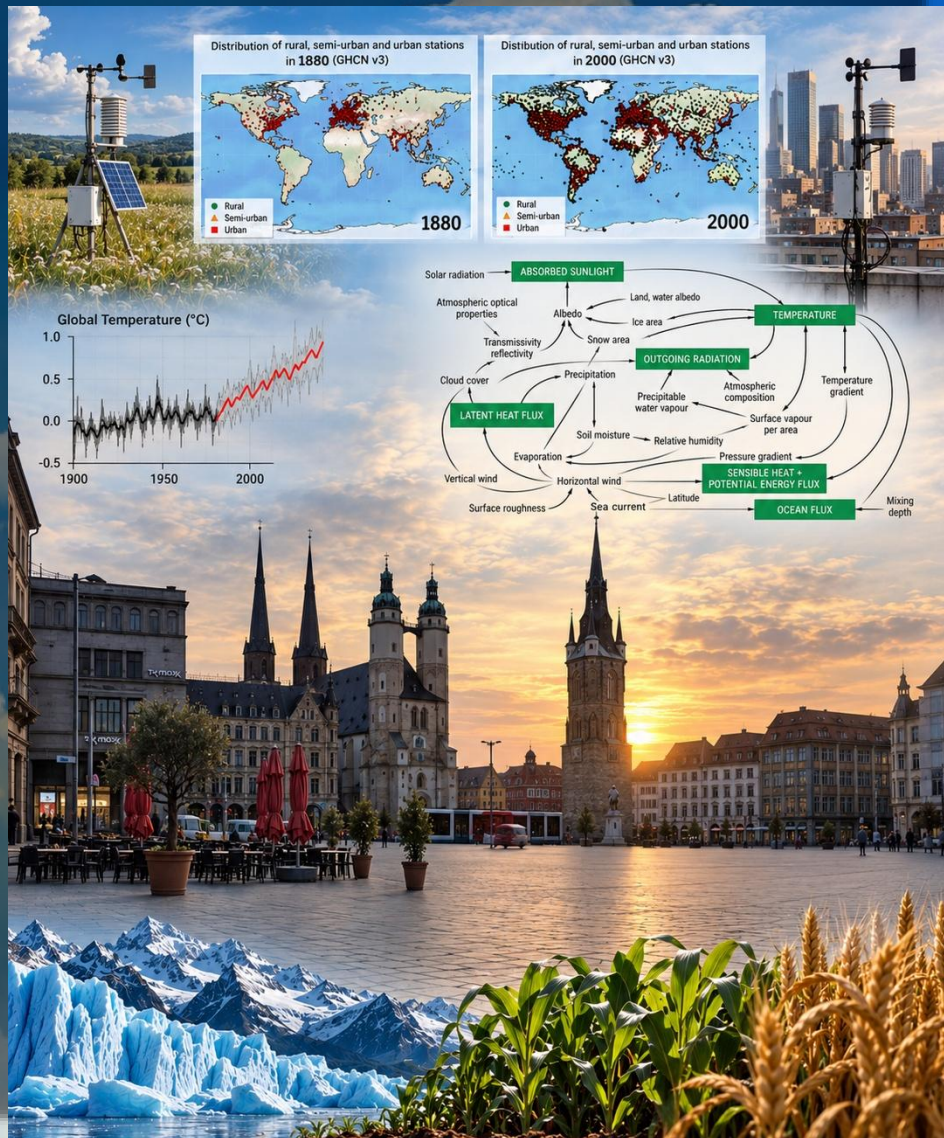


SCIENCE OF CLIMATE CHANGE

Volume 6.3
2026

<https://scienceofclimatechange.org>



Published by: SCC Publishing (Org. no. 935 567 653)

ISSN 2703-9072

Science of Climate Change (SCC)

AN OPEN ACCESS JOURNAL

Advancing scientific understanding of the Earth's climate system and its governing processes through rigorous research and open scientific dialogue.



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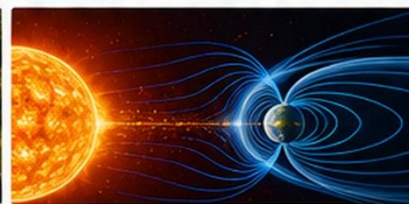
ABOUT SCC

Science of Climate Change (SCC) is an independent, peer-reviewed, open-access scholarly journal dedicated to advancing scientific understanding of the Earth's climate system and its governing processes.

Established in 2021, SCC has developed into an international publication published by the SCC Publishing Association since 2025.

SCC provides a platform for original research articles, review papers, methodological studies, data analyses, and scholarly discussion addressing climate variability and change across spatial and temporal scales.

The journal promotes open scientific discourse by welcoming a diversity of scientifically reasoned perspectives and by encouraging critical examination of current assumptions and explanations.



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Publisher

SCC Publishing Association



Address

Michelets vei 8 B
1366 Lysaker, Norway



ISSN

2703-9072



Established

2021

**Science of Climate Change
Volume 6.3**

September 2026

**Proceedings of the
17th International EIKE Climate and Energy Conference
IKEK-17**

**Halle Messe, Halle (Saale),
Germany**

ISSN 2703 9072

SCC Publishing, Michelets vei 8B, 1366 Lysaker, Norway

<https://doi.org/10.53234/scc202608/02>

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Preface

This is a special issue of *Science of Climate Change*, which contains summaries from the 17th International EIKE Climate and Energy Conference, IKEK-17, which took place in Halle, Germany, June 26 - 27, 2026.

Science of Climate Change is an independent, peer-reviewed and fully open-access scholarly journal devoted to advancing scientific understanding of the Earth's climate system and its governing processes. It welcomes original research articles, review papers, methodological studies, data analyses, essays, commentaries and scholarly discussion covering climate variability and change across different spatial and temporal scales. Its scope extends across atmospheric sciences, meteorology, hydrology and water resources, land-atmosphere interactions, oceanic and cryospheric processes, paleoclimate, remote sensing, climate-data analysis, Earth-system modelling, and solar and astronomical influences on climate.

The first EIKE conference took place in Berlin in 2007, and since then there have been 16 big and many other smaller meetings.

The Conference was arranged by EIKE, Europäisches Institut für Klima und Energie, together with The Heartland Institute (USA) and CFACT, Committee for a Constructive Tomorrow (USA).

There were 164 participants, and the list of 20 speakers was impressing, starring famous international top scientists such as Nobel Laureate John F. Clauser, Willie Soon, Jonathan Cohler (also a world class musician) Henrik Svensmark, William Happer, Nicola Scafetta, Ronan Connolly and David Legates. And, Michael Limburg, talking this year about how water vapor controls the climate, also spoke during the very first EIKE conferences!

Our journal *Science of Climate Change* was very well represented on the conference, with both the new Editor-in-Chief Prof. Nikolaos Malamos and a board member of the SCC Publishing Association and one of the former Chief Editors, Prof. Jan-Erik Solheim. Our representatives met with and had talks with many of the speakers and conference participants.

In this volume, you will find the Conference Program, the Table of Contents for this volume, an editorial as well as summaries from nearly all of the speakers.

The cooperation between EIKE and the SCC Publishing Association provides a valuable opportunity for exchanging scientific ideas, sharing research findings and perspectives, and fostering open and constructive dialogue on climate science.

September 2026

Nikolaos Malamos
Chief Editor

Stein Storlie Bergsmark
Co-Editor

Welcome to Halle and The 17th International EIKE Climate and Energy Conference



EIKE (European Institute for Climate and Energy) is an association comprising a growing number of natural scientists, scholars from the humanities and economics, engineers, publicists, and politicians who regard the claim of "man-made climate change" as scientifically unfounded, and therefore a hoax perpetrated on the public. Consequently, EIKE rejects any form of "climate policy" as a pretext for imposing controls on the economy and the public, and for burdening the population with levies.

As part of its mission, EIKE provides a platform for members and partners to discuss and publish scientific findings. EIKE produces expert reports—both on its own initiative and on behalf of others—and organizes symposia and conferences. Furthermore, EIKE contributes to public education and awareness and supports the establishment of political initiatives by providing scientific expertise. EIKE members have declared that they conduct their work for the association solely in the interest of an independent, neutral pursuit of the truth. Any form of influence—for instance, from business organizations or relevant lobby groups—is strictly excluded. The Institute's current president is the publisher Dr. Holger Thuß from Jena.

The 17th International Eike Climate and Energy Conference was arranged in Halle (Saale) on 26-27 June, 2026. Halle is the second largest city of the German state of Saxony-Anhalt with around 226 000 inhabitants. Halle is one of the main economic and educational centers of Central Germany. The Martin Luther University of Halle-Wittenberg, with campuses in Halle and Wittenberg, is Saxony-Anhalt's largest university and one of Germany's oldest. The university hospital of Halle (Universitätsklinikum Halle) is the largest hospital in the state. The German National Academy of Sciences (Leopoldina) has its seat in Halle.

Halle has a pretty broad industrial base, especially in the chemical industry, biotechnology/life sciences, mechanical and plant engineering, the food industry, logistics, and energy technology. The area around Halle is also part of the larger industrial region of Central Germany, along with Leipzig and the chemical industry belt around Leuna and Bitterfeld-Wolfen.

Halle is a major research city, with especially strong fields in life sciences, biomedicine, chemistry, materials technology, plant research, and social and cultural studies. The city's university and several institutes in the Max Planck, Fraunhofer, and Leibniz networks work closely with industry and hospitals.

Halle (Saale) is considered one of the oldest cities in Germany and Saxony Anhalt. It has a rich history and many historical sites to discover. Culture and music have always been an important part of the city's pulse. The great master Georg Friedrich Händel was born here in 1685. During his younger years he practiced on the harpsichord, and learnt violin and organ, and according to Burney his special affection was for the hautbois (oboe).

Statues, fountains and half-timbered houses line the streets, side by side with stone houses built in recent years. Popular attractions are

Marketplace and "the five towers" – the city's most famous public square, with Marktkirche, Roter Turm, and the Händel monument. This is the natural place to start a city walk. Georg Friedrich Händel Monument Roter Turm.

Händel-Haus – the birthplace of composer Georg Friedrich Händel. The museum tells about his life, music, and baroque instruments.

Franckesche Stiftungen – a very special Baroque complex from the late 1600s, originally built as a school and social institution. Here you'll find historic school buildings, art and curiosities collections, and a famous Baroque library hall. The complex is considered one of Halle's greatest cultural highlights.

Kunstmuseum Moritzburg – an art museum housed in a late medieval castle. The collection includes, among other things, medieval art, expressionism, and Bauhaus. Art Museum Moritzburg Halle (Saale).

Burg Giebichenstein – a castle with over a thousand years of history, high above the Saale River. Here you get a nice view over the river landscape, and the area is connected to Halle's.



Most of the speakers at the conference gathered up by the podium.



**Europäisches Institut
für Klima und Energie**
www.eike-klima-energie.eu



17. International EIKE Climate and Energy Conference, IKEK-17

June 26-27, 2026

Halle Messe, Halle (Saale), Germany

Address: Messestr. 10, 06116 Halle (Saale), Germany

Friday, June 26

From 9.00 am Registrations

- 9.30 am **Opening and Welcome**
Dr. Holger Thuss (Germany)
[President, Europäisches Institut für Klima und Energie \(EIKE\)](#)
- 9.45 am **The Great Reject: Triumphant Trump Dismantles The Climate Agenda With Nary A Pushback**
Marc Morano (USA)
[Executive Editor of ClimateDepot.org, CFACT](#)
- 10.30 am - 10.45 am **Coffee Break**
- 10.45 am **Europe's Energy Supply Under Pressure: The 2027 Methane Regulation Is a Politically Created Crisis Factor**
Anja Arndt, MEP (Germany)
[Member of the Committee on the Environment, Climate and Food Safety, European Parliament](#)
- 11.15 am **Data Adjustment or Historical Revisionism?
The Hidden Costs of Temperature Homogenization**
Dr. Ronan Connolly (Ireland)
[CERES Science, Ireland](#)
- 12.00 pm - 1.30 pm **Lunch Break**
- 1.30 pm **Climate Change Through The Lens Of Ancient Cultures**
Dr. Dominique Görlitz (Germany)
[Biologist, Vegetation Geographer, Non-Fiction Author, Filmmaker](#)
[Association for Experimental Archaeology \(ABORA Project\)](#)
- 2.15 pm **Reviewing the Evidence for Human-Caused Global Warming and Its Allegedly Catastrophic Consequences**
Theo Wolters (The Netherlands)
[Engineer, Entrepreneur, Researcher specializing in Climate Policy and Climate Impacts](#)
- 3.00 pm **The Limits of Climate Science: Solar Variability, Natural Cycles and Model Uncertainties**
Prof. Dr. Nicola Scafetta (Italy)
[Università di Napoli Federico II, Dipartimento di Scienze della Terra](#)
- 3.45 pm - 4.00 pm **Coffee Break**
- 4.00 pm **Returning To Nuclear Energy Instead of Expanding Wind Power!**
Dr. Paul Schmidt, Member of the German Bundestag (Germany)
[Former Operations Physicist at Philippsburg Nuclear Power Plant; Member of the Committee on Environment, Climate Protection, Nature Conservation and Nuclear Safety, German Bundestag](#)
- 4.45 pm **Radioactive Radiation – Curse or Blessing?**
Dr. Lutz Niemann (Germany)
[Physicist and Former Radiation Protection Officer](#)
- 5.30 pm **Water Vapor Determines Climate and Weather: Acquittal for CO₂**
Dipl.-Ing. Michael Limburg (Germany)
[Vice President, Europäisches Institut für Klima und Energie \(EIKE\)](#)
- 6.15 pm **From 10.000 Years to 4: One Equation Falsifies the Entire IPCC CO₂ Narrative**
Jonathan Cohler (USA) via ZOOM
[Physicist and Climate Analyst](#)
- 7.00 pm **Dinner**

Saturday, June 27

- 9.00 am **From Demon To Dinner: The Scientific Rehabilitation of CO₂ and Fossil Fuels**
Dr. Willie Soon (USA)
[Astrophysicist, Harvard-Smithsonian Center for Astrophysics](#)
- 9.45 am **Acidification of Water by CO₂?**
Prof. Dr. William Happer (USA)
[Physicist, Princeton University](#)
- 10.30 am **The Net Zero Agenda Is Creating Skyrocketing Electricity Prices**
James Taylor (USA)
[President, The Heartland Institute](#)
- 11.00 am **Science vs. Pseudoscience – Why There Is No Climate Crisis**
Dr. John Clauser (USA)
[Physicist, University of California, Berkeley, Nobel Prize Laureate in Physics 2022](#)
- 12.00 pm **Cosmic Rays and Clouds: The Latest Research Findings. What Do They Mean for Us?**
Prof. Dr. Henrik Svensmark (Denmark)
[Centre for Sun-Climate Research, Danish National Space Centre, Technical University Copenhagen](#)
- 12.45 pm – 2.15 pm **Lunch Break**
- 2.15 pm **45 Years of Climate Research in The Sahara: From Niche Topic to Political Flashpoint**
Dr. Stefan Kröpelin (Germany)
[Paleoclimatologist, Africa Research Unit, Prehistoric and Early History Institute, University of Cologne](#)
- 3.15 pm **How The Green Sahara Explains Atlantis (And Many Other Things)**
Jack Kelley (USA)
[Author and Producer of the Award-Winning Documentary „The Atlantis Puzzle“ \(2024\)](#)
- 4.00 pm – 4.30 pm **Coffee Break**
- 4.30 pm **Why The Climate Realist Movement Is On The Advance In The United States**
Craig Rucker (USA)
[President, Committee For A Constructive Tomorrow \(CFACT\)](#)
- 5.15 pm **Issues Associated With The Measurement Of Air Temperature And Precipitation For Climate Change Assessment**
Prof. em. Dr. David Legates (USA)
[University of Delaware, Former State Climatologist of Delaware](#)
- 6.00 pm **Climate Change and Food Security: Why The World Will Not Run Out Of Food**
Karl Iver Dahl-Madsen (Denmark)
[Chemical Engineer, Author and Environmental Strategist](#)
- 6.45 pm **Closing Remarks**
Dr. Holger Thuss (Germany)
[President, Europäisches Institut für Klima und Energie \(EIKE\)](#)
- 7.00 pm **Reception And End Of Conference**

Editorial

The present Volume 6.3 covers presentations during the 17th International Climate and Energy Conference (IKEK) organized by the European Institute for Climate and Energy (EIKE) and its partners, CFACT and the Heartland Institute. The conference took place on June 26 and 27, 2026, at the Halle Messe GmbH convention center in Halle (Saale).

It contains summaries from most of the speakers, and a closing remark from Dr. Holger J. Thuss.

Researchers who downplay human causes of climate change and the significance of CO₂ are often cancelled and labeled as deniers engaging in pseudoscience. But at IKEK-17, there were many scientists who proved this wrong. Many of them have brilliant academic careers. However, many of the speakers may not be well known to the conference audience and by the numerous readers of the printed version of these proceedings, so we present most of the speakers and their summaries.

The summaries vary greatly between one and 20 pages, the shorter ones because the authors were busily preparing their next speech or their next scientific paper.

During the opening, Dr. Holger Thuss wished all the 164 participants very welcome to the conference before handing over the stage to Dr. Horst-Joachim Lüdecke, with the talk titled “Wind Energy means going back to Middle Ages”.

Prof. Dr. Horst-Joachim Lüdecke is a physicist specializing in fluid mechanics and a retired professor of physics, computer science, and operations research at the University of Applied Sciences of Saarland (HTW). He is co-author of the technical standard work "Flow Calculation for Pipe Systems." Even before his retirement, he began focusing on climate research and energy policy. He became known to a wider public as the author of the popular science books "CO₂ and Climate Protection: Facts, Errors, Politics (ClimateGate)" and "Energy and Climate: Opportunities, Risks, Myths." Lüdecke publishes climate research papers in scientific journals (such as *Climate of the Past* from the European Geophysical Union, *Polar Research* from the Alfred Wegener Institute, *International Journal of Modern Physics*, *Journal of Atmospheric and Solar-Terrestrial Physics*, among others), writes for the media, and gives lectures. He is the spokesperson for the European Institute for Climate and Energy. In his speech he asks if going back in the Middle Ages’ is too polemical. After all, there was no electricity in the Middle Ages, whereas wind turbines are built using the most modern technologies.

Marc Morano serves as executive editor and chief correspondent for CFACT’s award-winning ClimateDepot.com, a news and information service he founded in 2009, perhaps the most effective source of climate communication on Earth! That’s the conclusion [published in a “peer-reviewed” scientific journal](#) on August 13, 2019, so we suppose it must be true. Morano’s presentation outlined a historic shift in global climate policy and public perception, detailing the rapid deflation of the "Great Reset" and net-zero agendas as of 2026. It argues that the climate movement has hit its lowest point of influence in fifty years due to three primary drivers: the collapse of institutional appeal to authority following COVID-19 overreach, an administrative paradigm shift under the second Trump administration that directly challenges UN climate frameworks, and the pragmatic energy demands of the artificial intelligence boom. By examining mainstream corporate media reports, institutional pullbacks from ESG metrics, and structural failures at the UN COP30 summit, Morano’s summary demonstrates how the climate narrative was decisively inverted from climate emergency framing to a focus on energy security and economic affordability.

Anja Arndt is a member of the European Parliament for AfD, (Alternative for Germany) and the Europe of Sovereign Nations (ESN) Group, Brussels/ Strasbourg. Her summary gives a

presentation on the implications of the EU Methane Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector from the political perspective of the author as an AfD Member of the European Parliament and representative of the Europe of Sovereign Nations (ESN) Group. The central thesis of the presentation is that the import requirements, which come into force from 2027, will become a politically induced crisis factor for the European energy supply. The paper criticises the imposition of monitoring, reporting and audit obligations for methane emissions – equivalent to those in the EU – on global supply chains for natural gas, crude oil and coal within a short implementation period. However, Ms Arndt never mentioned the real effect of increasing methane in the atmosphere, which is so small it hardly matters, so the methane regulation is a total waste. Will Happer has given an overview of the methane “problem”. It may take about 270 years for the concentration to double, and this will only increase the forcing by $0,8 \text{ W/m}^2$, a tiny fraction of the total midlatitude forcing of 140 W/m^2 .

Dr. Ronan Connolly is an independent scientist, environmentalist and writer based in Dublin, Ireland. I have been actively researching climate change since 2009. In 2018, he joined CERES. The Center for Environmental Research and Earth Sciences (CERES) is a multi-disciplinary and independent research group. The aims of CERES are to address important issues in the fields of environmental and earth sciences. The group strives to foster original and timely scientific understanding, in addition to re-examining old analyses with fresh insights. In his summary, he discusses the many problems related to temperature homogenization.

Dominique Görlitz is a German vegetation geographer, non-fiction author, filmmaker, and speaker. He became mainly known as the 'Stone Age sailor' through his reed boat expeditions ABORA across the Mediterranean and North Atlantic, supporting the idea of prehistoric seafaring and intercultural interactions between distant advanced civilizations in early times. His expeditions were inspired by previous trans-oceanic expeditions by the Norwegian explorer Thor Heyerdahl. Main aim of the Abora expeditions was to prove that a keel-less reed boat could be steered crosswise and against prevailing winds, using sideboards (leeboards) in lieu of a fixed keel. The name of the vessels was derived from the Canarian deity Abora. His talk about climate change and maritime mobility discusses how climatic and geomorphological changes can accelerate mobility, resource crises and the reorganization of settlement areas. The presentation ‘Archaeology and Climate’ therefore combines the Holocene flooding of the Persian Gulf, the emergence of the Naqada culture in Egypt and maritime contacts as far as the Atlantic into a large-scale working hypothesis. The present contribution examines which parts of this hypothesis are already empirically connectable.

Theodorus Wolters is a critical climate sceptic voice and a TU Delft alumnus, writing on climate matters on his own personal blog. He gave the audience a fact-checking of the current state of climate science through a critical analysis of several alleged lines of proof for the Catastrophic Anthropogenic Global Warming. Correlation alone does not constitute scientific proof in the absence of established causation; there is therefore no requirement to disprove any correlation. The water cycle of evaporation, convection, condensation, cloud formation and precipitation is poorly represented in climate models. Radiation physics is unambiguous: a doubling of CO_2 by itself produces approximately $1 \text{ }^\circ\text{C}$ of global warming. The climate system, however, contains strong feedbacks, both positive and negative. Determining the net warming that would result from a doubling of CO_2 once all feedbacks are included would require a far better understanding of the climate system than we currently possess.

Prof. Nicola Scafetta has visited the Eike conferences several times. This year, he presented his book, “The Frontier of Climate Science: Solar Variability, Natural Cycles and Model Uncertainty” The book reviews the main current open issues in climate science: the questionable near-total attribution of post-1850 warming to anthropogenic causes alone, the use of unrealistic emission scenarios (SSPs), the wide uncertainty range in equilibrium climate sensitivity, the gap between satellite and surface temperature records, the failure of models to reproduce past warm periods (the Holocene Thermal Maximum, the Roman Warm Period, the Medieval Warm Period), and the potentially underestimated role of solar variability mediated by cosmic rays and cloud cover. Building on these observations, empirical modelling is proposed based on astronomically-derived cycles - linked to the gravitational interactions among the Sun, the Moon, and the major planets - and that reproduces the observed global temperature record with greater fidelity. This yields a substantially lower estimate of climate sensitivity to a doubling of CO₂ (1-1.5 °C) than that used in CMIP models.



Dr. Paul Schmidt studied physics at the Technical University of Darmstadt, including two semesters at Syracuse University (SU), Syracuse, NY, USA, where he received a rowing scholarship. During his studies, he worked as a radiation worker in the laboratory. In 1988, he received his Bachelor-of-Science and in 1991 his MSc degree in Physics, both at Syracuse University. His first professional station was the former Karlsruhe Nuclear Research Center (now Forschungszentrum Karlsruhe), and he is a former operational physicist at a German nuclear power plant. Schmidt is a Member of the German Parliament, and spokesperson for the AfD parliamentary working group on nuclear power (AG Kernkraft). Schmidt is also a member of the Bundestag committee on the Environment, Climate Protection, Nature Conservation and Nuclear Safety. In his talk *Resumption of Nuclear instead of even more Wind Power*, he shows that Germany has expanded wind and solar electricity production capacity far beyond need, but its availableness remains as low as 25 % for wind and 13 % for solar power. Installed weather-dependent electricity production capacity already exceeds 200 GW, while peak demand has declined to 80 to 85 GW, while former German nuclear power plant managers and the Radiant Energy Group judge that about 12 GW of existing nuclear power plants could return to the grid in three to six years for some €18 billion. Resumption of nuclear power is therefore the shorter route to lower system costs, fewer imports and lower emissions than even more mandated wind-power expansion.

Dr. Lutz Niemann, AKA Atomsau, called so by his friends (we could also call him a nuclear radiation fetishist), is a physicist with a PhD in open radioactive substances, having worked for MPI fuer Metallkunde in Stuttgart. The main topic was ‘radiation damage’ in reactor metals. Later, he worked with Siemens in Munich, with electrical contacts. After retirement, he has engaged in societies working with nuclear energy, as far as there still is some interest in Germany for future use of nuclear energy. In his speech, he discussed the question: Radioactive Radiation – Curse or blessing. Carbon dioxide is a climate killer, it is claimed everywhere, so people believe it. Every little bit is supposed to be avoided. But carbon dioxide is a nutrient for plants, and a little extra plant fertilizer is good for their growth and thus good for food production. Therefore, avoiding CO₂ is NOT good. Similarly, with radiation and radioactivity, every small amount must be avoided in nuclear technology according to the law, which rests on the so called Linear-No-Threshold Model. This regulation creates the impression of a danger from radiation, with the following consequences: Firstly, Germany is moving away from its safe power supply, and secondly, radiation in low doses and low dose rates is good for living things. These benefits are a

blessing, but people are denied them due to incorrect legislation. The goal of his speech was to present scientific evidence for the second point.

Master in electrical engineering Michael Limburg is Vice President of EIKE. He is a specialist in measurement (metrology), control theory and electrical engineering. He is one of those who states that the climate change is not entirely anthropogenic and that natural variations play a big part. He is member of the political party AfD, (Alternative for Germany), and a major contribution to the party's climate policies. In his talk, he says that everyone knows by now, "climate protection" is on everyone's lips. But "climate protection" is also the mother of all problems, presented very well in his speech. And this includes the so-called energy transition. Nevertheless, all European governments, the EU, almost all parties, and almost all the media tell us: We should, no, we must, avoid CO₂ in order to protect the climate. Whatever it costs. That's what it's all about! And that's why I'm going to give you arguments in the following that massively question this common belief.

In recent years, Jonathan Cohler has emerged as a leading voice challenging the mainstream narrative on anthropogenic global warming. In 2025, he co-authored a widely viewed paper that reached over 2 million viewers on X, amplified by a feature on Dr. Robert Malone's Substack. Published in *Science of Climate Change* and co-authored with climatologist David Legates and astrophysicist Willie Soon, the paper concludes that natural climate drivers overwhelmingly dominate observed variability and that the CO₂-warming hypothesis lacks robust empirical support. Beyond his scientific work, Cohler is an internationally acclaimed classical clarinet soloist and conductor, whom *Fanfare Magazine* hailed as "the preeminent, most-recorded clarinet soloist of our time." He has released numerous critically praised recordings on Ongaku Records. In his speech, Cohler has put forward a controversial and uncompromising challenge to one of the central assumptions of modern climate science and policy. He argues that the rise in atmospheric carbon dioxide over the past few decades is not due to human emissions, but is the result of natural processes. His conclusion is clear. The rise in atmospheric CO₂ is primarily due to natural processes, while the contribution from the burning of fossil fuels is negligible.

Dr. Willie Soon is an astrophysicist and geoscientist renowned for his research on solar influences on Earth's climate, orbital dynamics, volcanism, and tectonics over more than 35 years. He challenges mainstream climate models that undervalue solar effects on clouds, oceans, and winds, and has become a prominent advocate for climate realism despite facing criticism. From 1991 to 2022 he worked at the Harvard-Smithsonian Center for Astrophysics; in 2018 he founded the Center for Environmental Research and Earth Sciences (CERES). He holds degrees from the University of Southern California, has received multiple scientific awards, and has authored or co-authored over 130 refereed papers, books, and chapters. Distinguished scientists including Freeman Dyson and Kary Mullis have publicly praised his integrity and contributions. Soon opened by challenging the legal classification of CO₂ in the United States. Following the 2007 *Massachusetts v. EPA* Supreme Court ruling, he noted, carbon dioxide is officially considered an air pollutant under US law. Quoting the dissenting Justice Antonin Scalia, Soon argued that such an interpretation stretches the meaning of "pollutant" to the point of absurdity. CO₂, he stressed, is indispensable to plant growth, and humans themselves constantly exhale it, so CO₂ is not a satanic gas, nor a demon. It is simply dinner for plants.



Co-Founder and Chair of the CO₂ Coalition, Dr. William Happer, Professor Emeritus in the Department of Physics at Princeton University, is a specialist in modern optics, optical and radiofrequency spectroscopy of atoms and molecules, radiation propagation in the atmosphere, and spin-polarized atoms and nuclei. He has published over 200 scientific papers and over the last few years he has published papers for both scientists and the interested reader on important current topics such as Radiative Transfer for Five Greenhouse gases, Infrared Forcing by Greenhouse Gases, Radiation transport in Clouds, Methane and Climate, Impact of Charging Greenhouse Gas Concentrations on Ontario's Climate, most of

them together with his former student, Prof. Wilhelm A. van Wijngaarden. His talk at the conference covered Acidification of water by CO₂, also based on work together with van Wijngaarden, but also with Peter Ridd, the coral reef specialist and M. Cornell, a chemist from Texas. Happer's speech gives a quantitative discussion of why increasing concentrations of atmospheric CO₂ will not cause harmful acidification of natural waters on Earth, and will likely benefit aquatic organisms. The reason is that alkalinity and dissolved CO₂ give high buffering capacity to most natural waters and minimize the change of pH from external influences.

The conference had the honour of presenting as a speaker Nobel laureate in physics 2022 John F. Clauser, who was awarded the prize "for experiments with entangled photons, establishing the violation of Bell's inequality and pioneering quantum information science". The title of Clauser's landmark 1972 co-authored paper with Stuart J. Freedman is "Experimental Test of Local Hidden-Variable Theories," published in *Physical Review Letters*. At that time, Dr. Clauser was only 29 years old, and he had to wait no less than 50 years before being honored with the prize. Clauser is a theoretic and experimental physicist who has worked in physics all his life. He has recently developed a theory which shows that clouds are overwhelmingly more important than is atmospheric CO₂ buildup in determining the Earth's power balance and climate stability. Indeed, cloud-cover fraction variation dominantly determines the Earth's power balance and climate stability. As a world class experimentalist, he knows better than most how to process measurement data and the related uncertainties. In his speech he provides no less than a quantitative audit which exposes fraudulent pseudoscience and fudging of the IPCC's Earth's Energy Imbalance -EEI. He shows that a positive EEI has not been proven, and consequently, there is no proven climate crisis. In these proceedings, we present an extract from his upcoming paper, which doesn't do that paper full justice. However, the full paper will be published in our journal *Science of Climate Change*, so visit the journal's website during the following weeks.

The internationally recognized climate- and space scientist Henrik Svensmark was fired this summer from his position at Denmark's Technical University. This attracted attention, but was not unexpected, because his research challenges the political consensus where all and every form of climate change is attributed to man. The summary of his speech discusses how cosmic rays may influence Earth's clouds, climate, and biosphere. Cosmic-ray ionisation promotes the formation and growth of aerosols into cloud condensation nuclei, potentially increasing cloud reflectivity and altering Earth's energy balance. Evidence for this mechanism comes from laboratory experiments, atmospheric observations, and modelling. The paper discusses correlations between cosmic-ray variability and climate change across timescales from days to millions of years, along with proposed links between supernova activity, temperature, oxygen production, and *Science of Climate Change*

<https://scienceofclimatechange.org>

biodiversity. To clarify the relative climatic effects of cosmic rays and greenhouse gases and improve estimates of climate sensitivity to carbon dioxide, Svensmark's plan is to incorporate this mechanism into global climate models.

Jack Kelley of Santa Fe in New Mexico is not a climate scientist, a paleoclimatologist or a geophysicist. He is a filmmaker and writer who, in 2019, was handed a book in a hotel lobby on Santorini and spent the following six years following where it led, producing a documentary film and a subsequent book, both titled *The Atlantis Puzzle*. The purpose of this contribution is not to defend a theory of Atlantis but to describe what an outsider's investigation of one ancient text revealed about the deep-time behavior of the Earth's climate, and about the confidence with which each generation of experts has interpreted it. The argument proceeds in three parts: a translation problem that relocated a myth by several thousand kilometres; the paleoclimate of North Africa at the opening of the Holocene and the orbital mechanics that produce it repeatedly; and what the historical record actually shows about the consequences of climate change for human societies

In 1985, the *Committee For A Constructive Tomorrow (CFACT)* was founded to promote a much-needed, positive alternative voice on issues of environment and development. Its co-founders, David Rothbard and Craig Rucker, strongly believed the power of the market combined with the applications of safe technologies could offer humanity practical solutions to many of the world's most pressing concerns. Rucker has been part of the American climate-realist movement from the start, and the country was doing well on the issue, so that would explain how we got here. None of this was an accident. We are outgunned by a margin that would make most people quit. The other side has the money, the media, the universities, the United Nations, and Hollywood. We built real influence anyway, over four decades and on purpose. Here is how we did it. We treat personnel as policy, we assemble the right people into a working network rather than a mailing list, and we borrow hard tactics from two very different books, Sun Tzu's *The Art of War* and Saul Alinsky's *Rules for Radicals*. I offer it to my European colleagues in the hope that some of it travels. So, Rucker tells us how they built America's climate-realist movement.

Prof. em. David Legates discussed issues associated with the measurement of precipitation for climate change assessment, which depend upon observations that are accurate, representative, and consistent through time. Precipitation presents particular difficulties because it is highly variable both spatially and temporally and because observational networks are unevenly distributed across the globe. Moreover, station locations, environments, instrumentation, and observing practices change through time, potentially introducing artificial discontinuities into climate records. Precipitation gauges themselves are subject to substantial measurement biases. Wind-induced undercatch is particularly important because airflow around a gauge can deflect precipitation away from its orifice, with especially large losses during snowfall. Changes in instrumentation can also produce apparent climatic trends. For example, the transition of portions of the U.S. observing network to the Automated Surface Observing System (ASOS) during the early 1990s introduced gauges with different siting and catch characteristics. Precipitation trends—particularly small trends over large spatial scales—must be interpreted in the context of measurement uncertainty, network evolution, land-use change, and observational inhomogeneity. Robust climate-change assessment requires distinguishing genuine climatic signals from artifacts introduced by the observing system itself.

Karl-Iver Dahl-Madsen is the very active leader of the Danish climate realist society Klimarealisme.dk. The society has a very good blog, with top articles of current interest almost every day of the year. Dahl-Madsen, who also has his own very good climate and energy blog, discussed global food production, which has risen strongly throughout the period of modern warming. No negative climate signal is visible in the aggregate trends for cereal, meat or aquatic-food output. The summary argues that climate and weather effects on global food production - positive as well as negative - are marginal compared with population and income growth, technology, trade, *Science of Climate Change*

<https://scienceofclimatechange.org>

institutions and farmers' adaptation. Claims that anthropogenic warming has already materially reduced global production are counterfactual estimates: they compare observed output with modelled output in an unobservable world without warming. The empirical record instead shows record production, rising yields and slight contraction of total agricultural land since 2001. Hunger persists mainly where poverty, conflict, inflation and weak governance restrict access to food. The practical conclusion is clear: affordable energy and fertilizer, open trade, innovation and good governance are the foundations of food security. Unless governments create artificial scarcity through destructive policies, the world can supply the quantity and quality of food people demand with a steadily declining environmental footprint.

Together, the contributions in this issue examine climate variability and climate-system processes across a wide range of temporal and spatial scales, from laboratory experiments and satellite-era observations to glacial cycles and geological time. They also illustrate the importance of transparent data analysis, the explicit examination of assumptions and uncertainties, and the continued testing of competing explanations. We hope that these contributions will encourage further critical, evidence-based discussion of climate science and its broader scientific, economic and societal implications. We wish our readers an engaging and thought-provoking reading.

Oslo, September, 2026

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Wind Energy means going back to the Middle Ages

Horst-Joachim Lüdecke

Abstract

Is 'going back in the Middle Ages' too polemical? After all, there was no electricity in the Middle Ages, whereas wind turbines are built using the most modern technologies.

However, the natural rule of human technical progress is to always increase the available power and energy density. This historical progression began with draft animals in agriculture, moved on to medieval windmills and water wheels, advanced with the steam engine and combustion engines, and culminated in modern coal and nuclear power plants.

Keywords: Greenhouse effect; radiative forcing.

Submitted 2026-08-11, Accepted 2026-08-15. <https://doi.org/10.53234/scc202608/10>

1. Introduction

Never before in human history has a society shifted on a large scale to a method like wind turbines, which uses methods of much lower power than the technologies that are already established. The first person to identify a key shortcoming of wind turbines was the famous German writer and illustrator Wilhelm Busch. In a humorous poem, he described the problem faced by a miller using his windmill: *'Either there's a lot of grain and no wind, or there's a lot of wind but no grain.'*

*„Aus der Mühle schaut der Müller, der so
gerne mahlen will. Stiller wird der Wind und
stiller, und die Mühle steht still.
So geht's immer, wie ich finde, rief der
Müller voller Zorn. Hat man Korn, so fehlt's
am Winde, hat man Wind, so fehlt das
Korn“*



Figure 1: A poem of Wilhelm Busch: *Either there's a lot of grain and no wind, or there's a lot of wind but no grain.*

2. Opposing views on wind turbines

Despite the obvious lack of a climate emergency, the German government and the media are nevertheless promoting wind turbines. This has confused the German people who want to protect German landscapes, birds and bats, resulting in four opposing views on wind turbines emerging in yes or no:

1. 'Wind turbines yes, but not in my backyard!' This is like the prayer to Saint Florian: 'Please exempt my home; inflame only other houses'.
2. 'Yes, but not in forests' – these people are conservationists.

3. 'Yes, because wind turbines make decarbonization possible, and without decarbonization we will perish from global warming.' These people are misinformed, though, because the IPCC has already removed catastrophic climate scenarios, such as RCP8.5. There is no climate emergency!
4. 'No, because wind turbines destroy nature and are inappropriate technical nonsense.' These people are realists.

According to checkable calculations by Professor André Thess of the University of Stuttgart, decarbonization by 2045 with wind turbines as the central pillar will cost German taxpayers ten to the power of thirteen Euros that is, ten trillion Euros. The current Secretary of State for the Economy in the German government, Katherina Reiche, explained in an interview with the Frankfurter Allgemeine Zeitung that the German energy transition with wind turbines and photovoltaics costs yearly 36 billion Euros.

Is there any benefit to spending so much money? Germany is responsible for tiny about 1.5 % of global CO₂ emissions. Any reduction of this small amount has no impact on the climate, but huge detrimental impacts on the German industry. On the other hand, China, India, the United States, and other countries accounting for 85 % of the world's population are not making serious efforts to protect the climate or implement a German energy transition.

3.The fundamental wind turbine deficits

Providing energy for an industrialized country requires realizing the three points of the energy triangle, as are 'supply', 'affordability', and 'environmental safety'. Wind turbines do not comply with any of these criteria. They have three fundamental physical deficits, without any remedy.

1. The power density of wind turbines as the produced power divided by land area is too small. As a consequence, they need too much land area and construction material to produce relatively small amounts of electrical power. In simple words, their small power density is the reason for their gigantic size, waste of construction material and weight.
2. The produced power of wind turbines depends on the weather. No wind, no electricity supply from wind.
3. Modern, huge wind turbines deform landscapes and their propellers are killing large numbers of birds, bats and insects.

Onshore wind turbines in Germany provide only a power density of about 3.6 watts per one square meter of land area. This value is based on measured data provided by the German Fraunhofer Institute and the environmental agency of the German government.

In contrast to this, big coal-fired power plants provide about seven thousand watts by one square meter land area, nuclear power stations have even more.

A modern wind turbine, as the German Enercon E-126, weights three thousand metric tons. Additionally, the foundation of ferroconcrete is of similar weight, bringing the total to seven thousand metric tons. The power rating of the E-126 for maximum wind velocity of about fifty kilometers per hour is 7.6 Megawatt. Its real power, as the yearly German average onshore, is only 1.5 Megawatt. This power corresponds to ten automotive engines, each of 150 kilowatts, but weights of 1.5 tonnes instead of seven thousand tonnes.

Obviously, 7.6 megawatts for an engine with seven thousand tonnes total weight is already tiny, but there is a second mystery. Where do 6.1 Megawatts disappear, as the difference of 7.6 and 1.5 Megawatt? The reason is the physical law for every fluid-flow engine, stating that its power is proportional to the cube of the fluid velocity, here of the wind. If the maximum wind velocity is halved, the electricity yield is not 50 %, but only 12.5 %, if the velocity is quartered, the yield is 1.6 %, as practically nothing.



Figure 2: A big coal power station, shown by a blue circle, is equivalent to 2.000 wind turbines

All this is well known, but what does the German government? Because free areas with strong wind have become scarce, wind turbines are now promoted in regions with weak wind, as in forests. This stupid energy-politics combines the highest damage of the nature with the lowest electricity yields from wind.

A look at the world and also at Germany shows that, actually, the world's total energy demand comes to 85 % from coal, oil and gas. Worldwide, only 1 % comes from wind, and another 1% from photo-voltaics. This is confirmed by the International Energy Agency (IEA). However, Germany's energy transition has increased this figure slightly, with 4.5 % of the country's total energy usage now coming from wind. Instead of this 4,5 %, the German media always cite 30 %. The trick is to refer only to electricity, which, worldwide as in Germany, accounts for just 15 % of total energy. The German media stubbornly never cite 4.5 %. As the desired result, nearly everybody in Germany believes that 30 % of the total energy of Germany comes from wind.

What is the reality? When there is little wind in Germany, old coal and gas power stations have to produce the missing electricity. As Katerina Reiche mentioned in her interview, this costs taxpayers a fortune every year. Even worse is having too much wind energy. Germany already has too many wind turbines, and for technical reasons they cannot simply be switched off. An excessive supply of wind electricity causes its price to fall below zero on the stock exchange. In the past, wind energy producers were compensated from the German budget in such cases. However, this policy is now coming to an end due to a lack of funding. Consequently, a multi-billion-euro international offshore wind project has failed. The days of easy profits for German wind energy companies are over.

4. Conclusion

The German energy transition, with its wind turbines, is the main reason for the current decline of the German industry. Wind- and photovoltaic electricity are too expensive and harmful to the environment. Using medieval windmills alongside photovoltaics to deliver all of Germany's electricity, and later even all of its total energy, is megalomaniacal. The historical law of constantly increasing available power and energy density is being violated, and this is having severe consequences.

Funding

No funding received.

Co-Editor: Stein Storlie Bergsmark

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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 5-8

The Great Reject: How the Trump Administration and Global Pushback Dismantled the Green Agenda

A Post-COVID Assessment of Climate Skepticism and Energy Realism

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Abstract

This paper outlines a historic shift in global climate policy and public perception, detailing the rapid deflation of the "Great Reset" and net-zero agendas as of 2026. It argues that the climate movement has hit its lowest point of influence in fifty years due to three primary drivers: the collapse of institutional appeal to authority following COVID-19 overreach, an administrative paradigm shift under the second Trump administration that directly challenges UN climate frameworks, and the pragmatic energy demands of the artificial intelligence boom.

By examining mainstream corporate media reports, institutional pullbacks from ESG metrics, and structural failures at the UN COP30 summit, this summary demonstrates how the climate narrative was decisively inverted from climate emergency framing to a focus on energy security and economic affordability.

Keywords: Greenhouse effect; radiative forcing; climate skepticism; net-zero; energy security; ESG breakdown.

Submitted 2026-08-11, Accepted 2026-08-15. <https://doi.org/10.53234/scc202608/09>

1. Introduction

For several decades, global governance institutions, led by the World Economic Forum (WEF) and the United Nations, successfully maintained a dominant narrative regarding an impending climate emergency. This ideological framework peaked with proposals for "The Great Reset" and strict net-zero timelines designed to restrict traditional energy, agricultural practices, and consumer freedoms.

However, as of 2026, the structural power of the climate movement has experienced an unprecedented deflation, entering what can be described as "The Great Reject". This summary synthesizes the primary arguments, administrative actions, and cultural shifts that have effectively dismantled the global climate agenda with minimal institutional pushback.

2. Theoretical Background: The Institutional Collapse of Authority

The primary catalyst for the widespread resurgence of climate skepticism was the unintended socio-political blowback from the COVID-19 pandemic lockdowns.

2.1 The Destruction of Expert Consensus

Prior to 2020, public climate policy heavily relied on an "appeal to authority," utilizing top-down

institutional mandates and assertions of scientific consensus to marginalize dissenting viewpoints. This dynamic collapsed due to the overreach of public health officials during the pandemic. High-profile figures, typified by Dr. Anthony Fauci's assertion of "I am the science," inadvertently incentivized massive public skepticism toward official narratives.

This institutional distrust rapidly translated from public health to climate science. Media gate-keeping and aggressive online censorship created an environment where independent researchers, popular media figures (e.g., Joe Rogan), and former climate activists actively re-examined established narratives, expanding the reach of climate skepticism to mainstream audiences.

2.2 The Real-World Energy Bottleneck of Artificial Intelligence

Simultaneously, the global push for a rapid transition away from hydrocarbons faced an insurmountable physical bottleneck: the tech-sector boom in artificial intelligence (AI). High-profile corporate leaders and institutions, including BlackRock's Larry Fink, were forced to publicly acknowledge that the massive, continuous power demands of AI data centers cannot be sustained by intermittent renewable sources such as solar and wind.

This realization triggered a quiet but profound capital flight among prominent billionaires and tech companies toward dispatchable power sources, specifically nuclear energy and traditional hydrocarbons, rendering the rigid tenets of the Green New Deal untenable.

3. Administrative Dismantling of the Climate Apparatus

Unlike preceding conservative administrations that adopted a conciliatory approach toward international climate science, the administrative strategy executed in 2025–2026 actively rejected the foundational premises of the global apparatus.

3.1 International Treaty Withdrawals

The defining structural action of this period occurred following public appeals at the UN COP30 summit in Belém, Brazil, resulting in the United States officially initiating a full withdrawal from the foundational 1992 UN Rio Earth Summit Treaty. While exiting secondary compacts like the Paris Agreement can be easily reversed by executive order, withdrawing from the legally binding 1992 framework alters international law.

Legal analysts note that re-entry would require a future administration to renegotiate a new treaty and secure a two-thirds ratification vote in the U.S. Senate, effectively cutting off the primary legal avenue for global climate compliance.

3.2 Domestic Policy and Bureaucratic Reform

Domestically, the administration targeted the core bureaucratic mechanism of climate regulation: the EPA's 2009 Endangerment Finding, which classified carbon dioxide as a pollutant under the Clean Air Act. By repealing and structurally undermining the legal basis of this finding, the administration successfully curtailed the power of unelected federal regulators to enforce carbon caps without explicit congressional authorization.

Parallel institutional shifts occurred across federal agencies:

- **Department of Defense:** Dismantled its widespread net-zero initiatives and diversity offices, refocusing entirely on raw military readiness.
- **NASA:** Reassigned its climate science divisions to secondary positions, restoring its organizational focus entirely to physical space exploration.
- **U.S. Congress:** Defunded more than 60 international sustainable development bodies,

including the UN Green Climate Fund, the UN Population Fund, and the Intergovernmental Panel on Climate Change (IPCC).

4. Supporting Evidence: Corporate and Financial Realities

The collapse of the climate movement is heavily documented not by skeptical blogs, but by the defensive reporting of mainstream corporate media outlets.

4.1 Financial Industry Retraction

Six years after Wall Street institutions pledged tens of trillions of dollars to enforce Environmental, Social, and Governance (ESG) criteria and net-zero banking alliances, those efforts have largely collapsed. Driven by aggressive legal challenges from a coalition of state Republican Attorneys General and a lack of viable economic returns, major financial institutions—including JPMorgan Chase—withdrew from international climate banking alliances. Major corporations quietly abandoned their public 1.5 °C warming targets as the systemic liabilities of green mandates became clear.

4.2 Failure of State Mandates and Technical Realities

Despite multi-trillion-dollar global investments over the last two decades, hydrocarbons continue to account for over 80 % of primary global energy consumption, a reality explicitly detailed by mainstream financial press outlets like Reuters.

Simultaneously, consumer demand for electric vehicles (EVs) sharply declined, leaving heavy federal and state EV mandates functionally unviable. This economic reality caused a noticeable shift among regional political figures, such as New York Governor Kathy Hochul, who deprioritized strict climate metrics to safeguard basic electrical grid security and energy affordability.

4.3 The Institutional Satire of COP30

The underlying contradictions of the climate apparatus were put on full display during the United Nations COP30 summit in Belém, Brazil. Hosted in an underdeveloped region where roughly 80 % of local residents lacked basic plumbing infrastructure, the summit was marked by severe logistical and systemic failures. Activists and UN delegates publicly demanded the installation of heavy air conditioning inside the massive temporary venue complexes while simultaneously advocating for the restriction of air conditioning use globally.

Furthermore, international press outlets like the BBC confirmed that the Brazilian environmental ministry authorized the clear-cutting of tens of thousands of acres of pristine Amazon rainforest to construct a highway exclusively designed to transport international delegates to the summit. Combined with the immediate breakdown of the venue's sanitation systems and the rapid depletion of meat products in the event's food courts, the summit served to demonstrate the persistent hypocrisy of the international green leadership.

5. Conclusions

As documented by international polling data, public concern regarding climate change has dropped to its lowest recorded levels since the late 1980s. By refusing to accept the core premises of institutional consensus and directly confronting the narrative with aggressive deregulatory action, the current political paradigm has successfully decoupled energy security from climate ideology.

While the multi-billion-dollar academic, corporate, and political structures supporting the climate movement will inevitably seek to regroup—potentially through the integration of climate narratives into public health frameworks—the current era represents a definitive structural defeat for the net-zero agenda. Decades of unfulfilled climate model tipping points, paired with the

immutable economic necessity of affordable domestic energy production, have delivered a decisive, structural blow to the global climate movement.

Funding: This summary received no institutional or corporate grant funding.

Acknowledgments: Acknowledgments are given to the research teams at CFACT and the Heartland Institute for compiling the corporate media documentation and policy timelines cited throughout this talk.

Co-Editor: Stein Storlie Bergsmark

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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 9-15

Proceedings of the 17th EIKE Climate and Energy Conference IKEK-17

Europe's Energy Supply under Pressure: The EU Methane Regulation 2027 as a politically induced Crisis Factor

*Summary of the presentation at the 17th International EIKE Climate and Energy Conference
(IKEK-17), Halle (Saale), Germany, 26 June 2026*

Anja Arndt

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Abstract

This paper summarises a presentation on the implications of the EU Methane Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector from the political perspective of the author as an AfD Member of the European Parliament and representative of the Europe of Sovereign Nations (ESN) Group. The central thesis of the presentation is that the import requirements, which come into force from 2027, will become a politically induced crisis factor for the European energy supply. The paper criticizes the imposition of monitoring, reporting and audit obligations for methane emissions – equivalent to those in the EU – on global supply chains for natural gas, crude oil and coal within a short implementation period. The focus is on the four main implementation phases of the regulation and a scenario analysis by Wood Mackenzie commissioned by IOGP Europe and Concawe. In its default scenario, around 43 per cent of EU natural gas imports and 87 per cent of EU crude oil imports in 2027 – based on the reference year 2024 – could fail to meet the requirements, leading to significant restrictions on LNG supplies and on the availability of crude oil for European refineries. From the perspective of the AfD and ESN, this climate policy measure is an irresponsible piece of legislation because its objectives are questionable and the technical feasibility, security of supply and economic competitiveness are not guaranteed. The burden on citizens is severe. The potential consequences of reduced or more expensive energy imports range from higher heating and fuel costs, through additional industrial production costs, to risks relating to inflation, business location and employment. The conclusion put forward in this presentation is that the Methane Regulation must be repealed immediately.

Keywords: EU Methane Regulation; Regulation (EU) 2024/1787; methane emissions; security of energy supply; LNG; crude oil; economy; consumers; AfD; ESN.

Submitted: 2026-09-08, accepted 2026-09-08. <https://doi.org/10.53234/scc202608/19>

1. Starting point of the presentation: climate policy, science and security of supply

This article is based on my presentation on 26 June 2026 at the 17th International EIKE Climate and Energy Conference in Halle (Saale). I spoke there as an AfD Member of the European Parliament and as a representative of the Europe of Sovereign Nations (ESN) Group. The starting point was the position that the European Union's climate policy regulations will have no measurable effect on global temperatures and that the causes of climate fluctuations must not be reduced solely to carbon dioxide and methane emissions. Scientific rigour, technical feasibility, economic consequences and the security of energy supply are not sufficiently taken into account in the Methane Regulation. From the perspective of the AfD and the ESN, this is particularly crucial when it comes to interventions in energy policy, because policy failures do not remain abstract but directly affect businesses, jobs and private households.

The Methane Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector came into force on 4 August 2024 and comprises 85 recitals, 38 articles, six chapters and nine annexes. In my presentation, I focused in particular on the climate policy rationale behind the Regulation. Recital 4 refers to estimates by UNEP and CCAC, according to which a 45 per cent reduction in global methane emissions by 2030 could prevent global warming from rising by approximately 0.3 °C by 2045. My central question was whether far-reaching European

interventions can be derived from such a global modelling assumption without giving at least equal consideration to security of supply, costs and technical feasibility. The AfD and ESN perspective presented in the lecture is thus explicitly a critique of current EU climate policy.

2. Scope of the Methane Regulation and the decisive tightening of import controls in 2027

The Methane Regulation does not apply solely to individual natural gas fields. It covers all suppliers worldwide that export natural gas, crude oil and coal to the EU. All methane emissions across the entire value chains of natural gas, crude oil and coal must be measured, reported and independently verified. For natural gas, this applies during extraction, at wells, during processing and compression, during transport, storage and at LNG facilities; for crude oil, it also applies during extraction, processing, transport and storage; for coal, the requirements even extend to measurement and reduction obligations at active as well as some closed or abandoned mines. This creates a far-reaching system of measurement, monitoring, reporting, auditing, leak detection and repair, which results in significant additional costs. For operators, this requires measuring equipment, documented procedures, reliable data and the presence of independent auditors.

In my view, what is particularly controversial from a political perspective is that the EU is effectively extending these requirements to third countries via its imports. The first reporting obligations for importers have been in force since 5 May 2025. From 1 January 2027, for new or renewed contracts, they must demonstrate and report that crude oil, natural gas and coal are subject, at producer level, to monitoring, reporting and verification measures equivalent to EU requirements. By August 2027, the Commission is to establish the method for calculating methane intensity; corresponding reports are to follow from August 2028, and from August 2030, specified maximum limits for methane intensity are to apply to new or renewed contracts. The presentation assessed this phased approach as an attempt to increasingly tie access to the European energy market to a compliance system defined by the EU. From the ESN's perspective, this is both a matter of security of supply and of political overreach into third countries. Importers who breach these rules face fines of up to 20 per cent of their annual turnover.

Table 1. The four main implementation stages outlined in the presentation: entry into force; initial reporting and information obligations; MRV equivalence for imports from 2027; and reporting and methane intensity limits from 2028/2030. Source: Presentation by the author based on Regulation (EU) 2024/1787

Stage	Date	
1. Entry into force	04.08.2024	The EU Methane Regulation applies directly in all Member States.
2. First key obligations	05.05.2025	Operators must, among other things, establish leak detection and repair programmes; importers must report information for the first time.
3. Import tightening / Equivalence	01.01.2027	Importers must demonstrate for new or renewed contracts that oil, gas and coal from third countries are subject to equivalent measurement, reporting and verification obligations.
4. Methane intensity	05.08.2027 05.08.2028 05.08.2030	By 05.08.2027 , the Commission shall establish the calculation methodology. From 05.08.2028 , methane intensity must be reported. From 05.08.2030 , new or renewed contracts must remain below the specified maximum values.

3. The key market risk highlighted in the presentation: 43 per cent of gas and 87 per cent of crude oil do not meet these standards

The empirical focus of my presentation was a scenario analysis published in March 2026 by Wood

Mackenzie on behalf of IOGP Europe and Concawe. It examines how the Methane Regulation could affect the access of energy imports to the EU market. In the so-called ‘default scenario’, which assumes a comparatively strict implementation, around 43 per cent of the EU’s natural gas imports and 87 per cent of its crude oil imports in 2027 – based on the reference year 2024 – might fail to meet the requirements. I deliberately highlighted these figures in the presentation because they illustrate the scale of the political risk. They should be understood as scenario results rather than certain predictions; nevertheless, they demonstrate the potential consequences should global supply chains fail to become verifiable within the timeframe set by the EU.

A key finding discussed in the presentation: In Wood Mackenzie’s default scenario, around 43 per cent of EU natural gas imports and 87 per cent of EU crude oil imports for the reference year 2024 could fail to meet the requirements of the EU Methane Regulation by 2027.

This is particularly evident in the LNG market. The reference case presented in the presentation shows that, without the Methane Regulation, LNG imports would continue to develop in a comparatively stable manner. In the scenario with the EU Methane Regulation, however, there would be a sharp slump from 2027 onwards, with far-reaching and risky consequences for the EU as a whole; a recovery is not seen as possible until around 2030 and would require, amongst other things, a significantly higher supply from the US as well as a more flexible European approach to the verification requirements. From the perspective of the AfD and ESN, the consequences are irresponsible. They could cause considerable damage to the economy across the entire EU. Furthermore, the Methane Regulation will lead to a further increase in the EU’s energy dependence on individual states, particularly the US. In my presentation, I therefore expressly warned against replacing the existing energy dependence on Russia with a new dependence on the US.

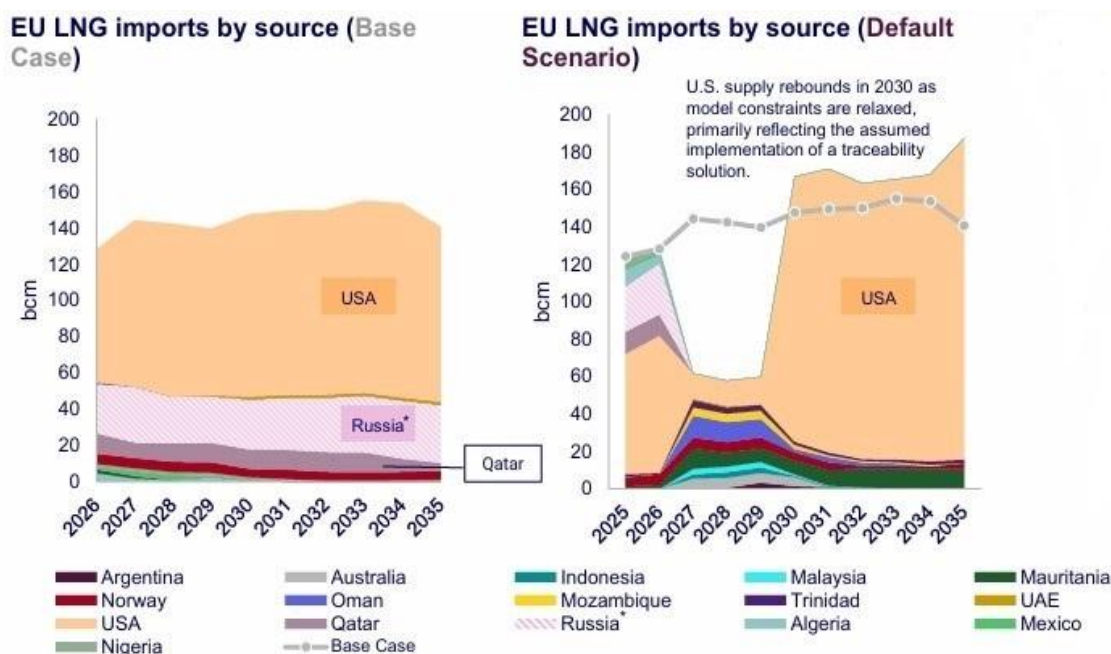


Figure 2. LNG import scenarios presented in the talk: reference case without the regulation (A) and scenario with the EU Methane Regulation (B). Source: Wood Mackenzie (2026), *EU Methane Emissions Regulation – Analysis of Market Impacts*, commissioned by Concawe and IOGP Europe, fig. 13/p.21.

4. Crude oil, refineries and industrial value creation

The presentation highlighted the potential crude oil problem as an even more serious concern. European refineries require a continuous supply of sufficient quantities of suitable crude oil grades. In the event of a shortage of compliant supplies, the Methane Regulation could therefore have an immediate impact on refinery utilization rates and the availability of fuels and

petrochemical feedstocks. According to the Wood Mackenzie analysis, in the default scenario, the globally available volume of regulation-compliant crude oil will be insufficient over several years to maintain normal operations at European refineries; the analysis models a significant decline in capacity utilization for the period 2027 to 2030. The presentation treated these findings as a warning sign that this methane regulation interferes with a core area of European energy and industrial security.

The political criticism from the AfD and ESN centers on the fact that this regulation will have serious consequences. The US and Qatar have already announced that they do not intend to comply with these conditions, which entail considerable costs. The business sector and the public bear the implementation risk and the serious consequences.

Figure 25: Impact of MER on global crude availability for EU refiners

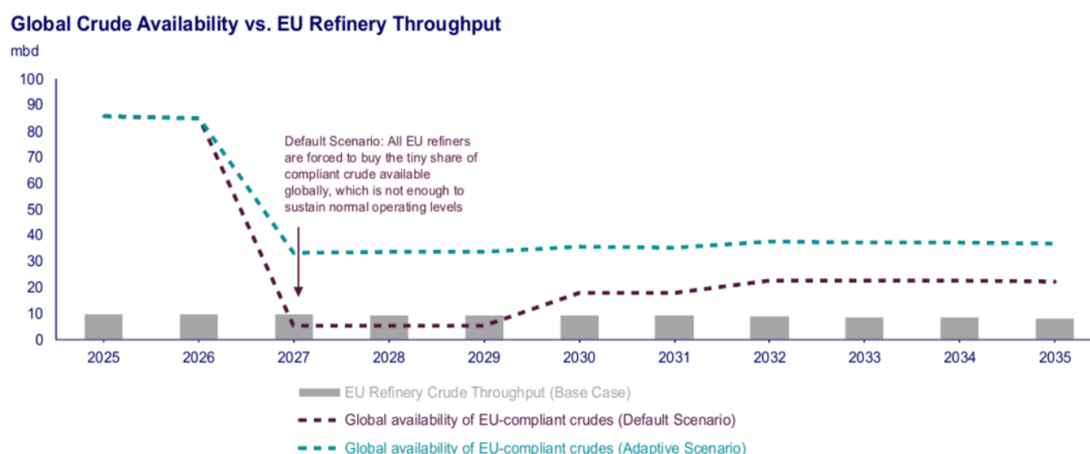


Figure 3. Modelled global crude oil availability compared with refinery utilization in the EU under the default and adaptive scenarios. Source: Wood Mackenzie (2026), *EU Methane Emissions Regulation – Analysis of Market Impacts*, commissioned by Concawe and IOGP Europe, fig.29/p.53.

5. Impact on the economy and citizens

In my presentation, I made a point of not limiting the discussion of the consequences to energy companies alone. Natural gas and crude oil are essential for heating, transport and industrial production. If the supply of imported energy tightens due to verification issues, or if procurement, verification and contract drafting become more expensive, these costs will be passed on through the supply chains. Households face additional risks of higher heating and fuel costs; for businesses, energy, transport and production costs will rise. In energy-intensive sectors, this can influence investment, production and location decisions. Higher production costs may also be reflected in consumer prices and thus in general inflation.

These causal links do not constitute a claim that every single price increase will inevitably occur. Rather, they describe the economic transmission mechanism against which I warned in my presentation: a politically induced restriction or increase in the cost of energy supply affects not only importers, but ultimately also businesses, employees and consumers. From the perspective of the AfD and ESN, therefore, any climate regulation – even if we reject it outright – must at the very least be accompanied by a robust assessment of its cost and supply implications. Questionable climate policy objectives certainly do not justify measures whose potential side effects jeopardise prosperity, industrial competitiveness or the affordability of energy, and lead to an energy crisis.

6. Political assessment from the perspective of the AfD and ESN

The fundamental criticism raised in the presentation is directed against the EU's diktat requiring global suppliers to measure, report and independently verify methane emissions, and to comply with prescribed maximum limits from 2030 onwards. It is directed against the political construct of imposing EU-equivalent standards on global supply chains, thereby effectively forcing producers in third countries to choose between adopting the European system or losing access to the EU market. In the presentation, I referred to resistance from producer countries, particularly the USA. With this regulation, the EU is creating a politically induced crisis factor. The war in Iran and the blockade of the Strait of Hormuz in 2026 will affect 4 per cent of the EU's natural gas imports and 5 per cent of its crude oil imports. Even these relatively small volumes, in relative terms, have led to major problems and significant price rises for fuel, electricity and heating. If 43 per cent of natural gas imports and 87 per cent of crude oil imports are incompatible with the requirements of the Methane Regulation and are therefore at risk, the consequences will be catastrophic. The EU is destabilising its own trade relations and cutting itself off from energy imports, creating additional conflicts, bottlenecks and dependencies. This is a self-destructive act.

In the European Parliament, together with the ESN Group, I have twice attempted to initiate a debate on the impending consequences of the Methane Regulation. Both initiatives have so far been rejected. In my view, the regulation highlights a structural problem in European climate policy: the political majority considers a supposed, scientifically unproven impact on the climate to be more desirable than the economic stability and prosperity of its own population. In this case, it is estimated that reducing methane emissions will lead to a reduction in global temperature of 0.3 °C by 2045 (!), but only if global methane emissions are reduced 'by 45 per cent by 2030, based on available targeted measures and additional measures in line with the United Nations Sustainable Development Goals', as stated in Recital 4 of the Methane Regulation. To jeopardise the future of the entire European Union for the sake of such vague, unscientific and irrational targets is incomprehensible and suggests that this Regulation and the entire European Green Deal are irrational and harmful. **The AfD and ESN therefore call for the regulation to be repealed immediately.**

7. Note for publication: Scenarios, legal clarifications and the Commission's response following the presentation

To ensure a scientifically and journalistically sound presentation, it should be noted that the Wood Mackenzie figures used in the presentation are scenario-based results. As these are scenario-based results, they are subject to uncertainty. It is precisely this uncertainty that underpins a key point of the political criticism put forward in the presentation: such a central area of energy supply should not be subject to a tight regulatory timetable on the basis of consequences that remain unclear.

Furthermore, for the purposes of publication, a legal clarification is required in relation to the oral presentation: the Regulation provides for fines for legal entities of up to 20 per cent of the annual turnover of the preceding financial year, not 20 per cent of the annual profit. The penalties are therefore even more severe.

From 1 January 2027, EU importers must demonstrate, in the case of new supply contracts or those renewed since 4 August 2024, that the imported natural gas, crude oil or coal is subject, at producer level, to monitoring, reporting and verification requirements regarding methane emissions that are equivalent to the EU's requirements. Although the Regulation does not provide for an automatic customs import ban in the event of non-compliance, it does oblige Member States to enforce the requirements through remedial measures, periodic penalty payments and fines. Non-compliant supplies may therefore become significantly more difficult for EU importers to handle in practice, or may no longer be economically viable, and will consequently be discontinued.

These corrections and clarifications do not alter the political assessment of the presentation;

however, they sharpen the legal description of the risk.

Following the conference, the European Commission responded with recommendations on model clauses for import contracts and on the suspension of sanctions. Even before the decisive tightening of import controls came into force, the European Commission itself responded to the risks to security of supply. In Recommendation (EU) 2026/1835 of 20 July 2026, it recommended that Member States, as a matter of principle, should not apply certain sanctions against importers for breaches of the obligations due between 2027 and 2029. The Commission explicitly cites the threat of energy supply bottlenecks, high prices for consumers and businesses, and the risk that importers would otherwise fail to conclude or renew supply contracts as the reasons for this. However, the substantive obligations under the Methane Regulation remain in force.

In 2026, the Commission itself acknowledges precisely the risk to which I referred in my speech – that the Methane Regulation poses an acute threat to supply contracts, security of supply and energy prices.

From the perspective of the AfD and ESN, it is crucial to note that these proposals to suspend sanctions do not resolve the underlying problem: the legal obligations remain in force, and importers must adapt supply chains, data, audits and contracts to a system. Supply contracts, security of supply and energy prices will continue to be jeopardised by these regulations even without sanctions, the suspension of which is limited to three years.

8. Conclusion

In my presentation, the EU Methane Regulation was discussed as an example of how a climate policy regulation, through technical measurement and reporting obligations, can become a risk factor for energy and economic policy. From the perspective of the AfD and ESN, the core problem lies in the combination of far-reaching requirements and Europe's dependence on global import chains. The potential consequences affect not only gas and oil importers, but also refineries, industrial companies, workers and private households. The more the available supply shrinks or becomes more expensive, the greater the risks to energy prices, competitiveness, inflation and prosperity.

My political conclusion therefore remains closer to the demand set out in the presentation: the Methane Regulation must be repealed because it jeopardises energy security and gives rise to economic costs on an unacceptable scale, whilst its effects on the climate and human well-being remain unproven. If a workable and internationally viable implementation cannot be guaranteed without significant supply and cost risks, and if the regulation's objectives and effects are doubtful, the AfD and ESN believe that repealing the regulation is the only logical option. Climate policy must not lead to Europe jeopardising its energy supply through its own regulations and passing on the resulting costs to the economy and citizens.

Funding and Disclosure

No funding was received for this paper. The author is a Member of the European Parliament for the AfD and a member of the Europe of Sovereign Nations (ESN) Group. This paper is a conference summary and reflects the political and analytical position put forward by the author in her presentation. Political assessments are identified as such; scenario results are kept separate from legal facts and subsequent interpretations. This article does not represent an institutional position of the European Parliament.

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Norway

ISSN: 2703-9072

Correspondence:

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Vol. 6.3 (2026)

pp. 16-39

Adjusting the Data or Rewriting History?

The Hidden Costs of Temperature Homogenization

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Abstract

Annual “hottest-year-on-record” headlines rely on global temperature-anomaly indices built from weather-station data that are incomplete, geographically biased and contaminated by non-climatic artefacts (urbanization, poor siting, instrument changes). Automated homogenization algorithms, especially NOAA’s Pairwise Homogenization Algorithm, are widely believed to overcome these challenges. However, in practice they often rewrite station records on a daily (or monthly) basis. Adjustments applied to the same record often change from one day to the next and rarely match documented station events. Meanwhile, current statistical homogenization techniques blend urban warming into rural series. The resulting homogenized network therefore converges on a more urbanized average rather than removing bias. In contrast, it is shown that a rural-only Northern Hemisphere reconstruction that avoids automated homogenization shows 38 % less warming than standard estimates and also implies a more cyclical alternation of warming and cooling periods since the late-19th century – a period that coincidentally marked the end of the Little Ice Age.

Keywords: Global warming; non-climatic biases; temperature homogenization.

Submitted 2026-09-17, Accepted 2026-09-17. <https://doi.org/10.53234/scc202608/20>

1. Introduction

Almost every year, the public is told that the year just ended was globally “the hottest on record” (Stevens, 1996; McCarthy, 1998; Bhattacharya, 2006; UN News, 2025) – sometimes even the “hottest in 100,000 years” (Associated Press, 2016; Hess, 2024). The dramatic nature of such headlines coupled with the fact that it seems to be continually recycled can lead to opposing reactions depending on the reader: for some, cynicism (“how many times has this boy cried wolf?”); for others, despair (“how many times must we hear this before something is done about it?”). However, in this article¹, we will investigate how this “global temperature record” is constructed and discover that all of these headlines were based on flawed datasets that were never fit for purpose – due to a combination of what are called “non-climatic biases” in the individual temperature records and the failure of the various “homogenization algorithms” that have been implemented in a foolhardy attempt to correct for these biases. Along the way, we will discover that these homogenization algorithms effectively “rewrite history” on a monthly or even daily basis by continually altering the temperature records of each station according to the latest iteration of various computer algorithms. We will conclude by comparing the standard “global temperature records” to the much less dramatic or concerning temperature changes observed when you try to reduce these non-climatic biases *without* relying on automated statistical homogenization

¹ This article is adapted from a presentation given by the author at EIKE’s 17th International Climate and Energy Conference (IKEK-17), Halle (an der Saale), Germany, 26-27 June 2026. At the time of writing., this presentation can be viewed on Youtube at either the CERES-Science channel at <https://youtu.be/9mdFR04FfJM?si=oMIR1PYWTEnVEXjx> or the EIKE channel at <https://youtu.be/vH91b5toNLo?si=87gq8bjVonWd1a59>.

computer algorithms.

2. The limitations of the “global temperature data”

2.1 Is there such a thing as a “global temperature”?

Beforehand, however, we should first address a surprisingly basic question that is usually overlooked in most discussions on this topic – does the Earth even have a “global temperature”? Nearly 20 years ago, Essex et al. pointed out in their article, “Does a global temperature exist?” (Essex, McKittrick and Andresen, 2007) and in a pop science book (Essex and McKittrick, 2007) that the Earth doesn’t actually have a “global temperature”. We all know this intuitively, it is warmer: in the summer than the winter; in the Sahara Desert than the Arctic tundra; at sea level versus at the top of the mountain; in the Earth’s magma versus in the stratosphere. However, Essex et al. demonstrate on physical, mathematical and observational ground that “there is no physically meaningful global temperature for the Earth” (Essex, McKittrick and Andresen, 2007). Recently, another speaker at this conference, Jonathan Cohler, has extended the arguments of Essex et al. to conclude that even the concept of a global mean surface temperature (GMST) anomaly index is “physically meaningless” and a “meaningless statistical artifact” (Cohler, 2025).

While I agree with Cohler that Essex et al.’s observations on the concept of a “global temperature” for the Earth are valid and important, I think there is still potential scientific value in the concept of a GMST anomaly index – provided it is correctly recognized that it is not a “global temperature” *per se*. Indeed, Essex et al. emphasized that “an index need not be a physical variable explicitly” and that it can potentially be scientifically useful if “the statistic usefully encapsulates a possibly large set of data into one dimension for a specific purpose” (Essex, McKittrick and Andresen, 2007). However, they also caution that, “Proposing a statistic to be an index can be risky. What is regarded as ‘useful’ may prove to be quite imprecise and subjective”.

When my late father (Dr. Michael Connolly, 1949-2025²) and I published our first analysis on the “global temperature” datasets through a series of working papers that we shared for public open peer review on our Open Peer Review Journal³ website (Connolly and Connolly, 2014c, 2014d, 2014e, 2014b, 2014a), we explicitly grappled with the issues raised by Essex et al. in the Supporting Information for (Connolly and Connolly, 2014e)⁴. We concluded that if temperature changes are experienced simultaneously across multiple parts of the world, then averaging together the temperature *changes* (as opposed to the temperatures themselves) into a regionally-averaged (and potentially, globally-averaged) index can potentially be a scientifically useful way to collectively analyse these changes.

This is typically done by converting each temperature record into an “anomaly” record of changes relative to the average temperature for that station. For instance, in Figure 1, we can see that the annual temperature changes experienced over the period 1960-2014 across the island of Ireland were remarkably similar – even though the temperatures themselves increased from the south of the island to the north, and each location experienced slight differences (Soon, Connolly and Connolly, 2015, 2024).

² <https://www.ceres-science.com/post/dr-michael-connolly-1949-2025>

³ <https://opri.net/>

⁴ See the file called “statistics_for_gridded_analysis.pdf” in the Supporting Information files at <https://doi.org/10.6084/m9.figshare.1004125>.

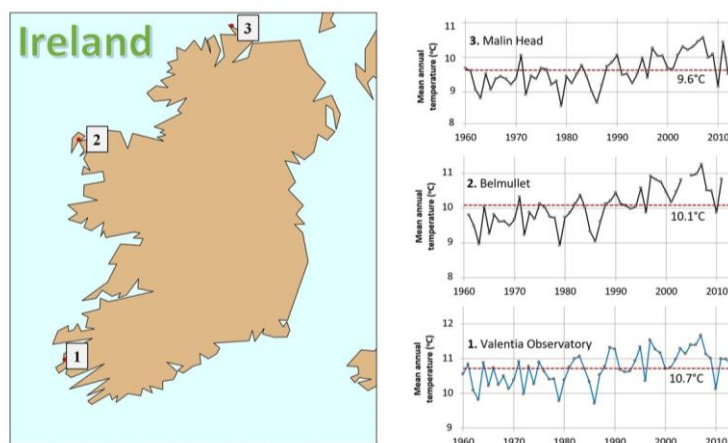


Figure 1: Comparison of the annual average temperature records for three different weather stations on the island of Ireland over a common period of reference (1960-2014). Adapted from Soon *et al.* (2015). See also Soon *et al.* (2024).

Of course, having a lot of coherence between the temperature changes across a relatively small country is quite intuitive. However, this does not necessarily mean that the correlations hold on the other side of the world. Indeed, several studies have attempted to quantify the distances over which temperature changes are correlated, e.g., (Jones, Osborn and Briffa, 1997; Christiansen and Ljungqvist, 2017). It is found that the correlations between temperature records fall off with distance, but that stations even 1000s of kilometres apart often have meaningful correlations – especially over longer time scales – decadal changes are better correlated than annual changes which are better correlated than daily changes (Jones, Osborn and Briffa, 1997). Meanwhile, it has been observed that some temperature changes seem to affect multiple regions across the world simultaneously, e.g., cooling following major volcanic events or warming during El Niño events (Chylek *et al.*, 2020).

Hence, if we remember that a globally-averaged index of local temperature anomaly records is not “a global temperature record”, it could still be useful for investigating whether similar local temperature changes might be occurring simultaneously across large regions of the planet.

As we will discuss, this optimistic desire needs to be tempered by the lack of good geographical coverage for much of the globe before the mid-20th century and the problem that most long temperature records are plagued by various non-climatic biases. In my experience, most people using “global temperature” data either have never considered these problems, or they mistakenly assume that the groups in charge of these datasets have adequately resolved the problems. Hence, establishing accurately how globally-averaged temperature anomalies have changed over the last century or longer is a much more challenging problem than most assume.

Moreover, identifying that there have been globally-averaged temperature anomaly changes over a given period, does not in itself prove the cause. Current global climate models calculate that human-caused greenhouse gas emissions should have been causing unprecedented “anthropogenic global warming” and so this seems to have led to the presumption that any long-term “global warming” trend that is identified must be human-caused. However, it is important to remember that the model-based “attribution” studies that claim to have proven this, e.g., (Gillett *et al.*, 2021), have substantially underestimated potential natural drivers of long-term climate change and overlooked the possibility of non-climatic biases in the data, see e.g., (Soon, Connolly and Connolly, 2015, 2024; Connolly *et al.*, 2021, 2023; Soon *et al.*, 2023). Indeed, temperature proxies suggest that the 19th century marked the end of a relatively cold period across much of the globe that is known as the “Little Ice Age” (Soon and Baliunas, 2003; Soon, Baliunas and Legates, 2003; Soon *et al.*, 2003; Connolly and Connolly, 2014a; Christiansen and Ljungqvist, 2017). This suggests that if there has been a long-term “global warming” since then, at least some of this could represent a “recovery from the Little Ice Age” (Akasofu, 2010).

2.2 The monthly average temperature is not the average monthly temperature

Some of the earliest weather station records were actually recorded indoors, e.g., Hohenpeißenberg (Winkler, 2009), although typically in uninsulated rooms. However, especially since the late-19th century, outdoor measurements rapidly became the standard. In order to protect the thermometers from the elements, they are normally housed in a Stevenson screen⁵ or a similar louvered shelter that blocks direct radiation and precipitation while allowing ventilation.

The classic thermometer system is actually a pair of thermometers: a maximum–minimum thermometer system (MMTS). The maximum thermometer has a marker that is pushed upwards whenever a new high is reached and the minimum thermometer has a marker pushed downwards by new lows. This means that if an observer takes the readings every day and then resets the markers for the next day, he/she can know the two temperature extremes that had been reached in the preceding 24 hours.

By convention, the arithmetic mean of this daily maximum and minimum is treated as the “daily mean” even though it is clearly not the average temperature of the day – rather, it is just the average of the two extremes of the previous 24 hours. This can also lead to a subtle “time of observation bias” because if the observation time occurs near the time of day/night when temperature extremes tend to occur, the extreme for the previous 24 hours might get doubled up for the next 24 hours (Karl *et al.*, 1986; Connolly and Connolly, 2014e). Furthermore, if the observation time is later changed to a different time, this could introduce a non-climatic bias in the record (Karl *et al.*, 1986; Connolly and Connolly, 2014e).

Nonetheless, the fact that some average of the temperature variability of the preceding 24 hours period could be recorded with one daily observation was revolutionary before the invention of modern automated electronic thermometer systems. Hence, most “daily average temperature” records are of this form. In the schematic in Figure 2, we illustrate how these daily “averages” are typically then averaged into monthly averages and then afterwards the monthly temperature records are often converted into “temperature anomalies” relative to a 30-year reference period at that station.

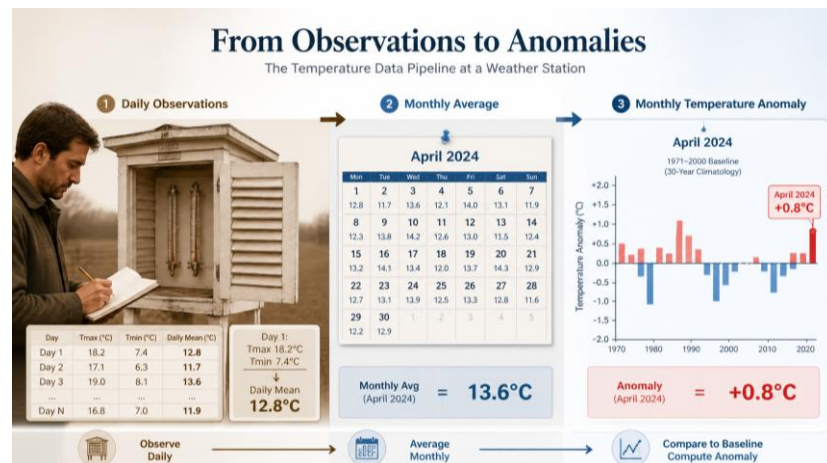


Figure 2: Schematic infographic illustrating how daily minimum and maximum temperature readings are converted into a monthly temperature anomaly series for a given weather station. This infographic was generated through iterative prompting of various AI LLMs.

These individual anomaly records then need to be averaged further to give us regional or even “global” averages. Several averaging techniques have been used, e.g., statistical kriging (Rohde and Hausfather, 2020), but one of the simpler approaches is the gridded average approach (Jones *et al.*, 1986; Jones, Wigley and Wright, 1986): The globe is divided up into grid boxes. Then for a given month, all of the available stations in a given grid box are averaged to yield a “gridded average”. These grid averages are then typically area-weighted and averaged further to produce

⁵ Invented in 1864 by Thomas Stevenson, the father of the well-known author, Robert Louis Stevenson.

regional, hemispheric or global indices.

Some readers might be wondering what should you do scientifically with the grid boxes without data? This is unclear, although in the Supporting Information for (Connolly and Connolly, 2014e), we considered several different approaches. However, a more challenging problem arises when stations are only available in many grids for some parts of the record.

2.3 Geographical biases over time

One of the main monthly temperature datasets used for calculating global land temperature anomalies is NOAA's Global Historical Climatology Network (GHCN) (Lawrimore *et al.*, 2011; Menne *et al.*, 2018). When we first began our research on this topic, Version 3 of this dataset was available and this was an improved and updated version of the previous versions (Vose *et al.*, 1992; Peterson and Vose, 1997). Usefully, this dataset provided two different urbanization metrics (associated population and night-lights) for each station (Peterson *et al.*, 1999). Although each urbanization metric was quite crude and approximate, we realized that by combining these metrics we could distinguish between the most rural stations (rural by both metrics) and the most urban stations (urban by both metrics) and all other stations ("semi-urban").

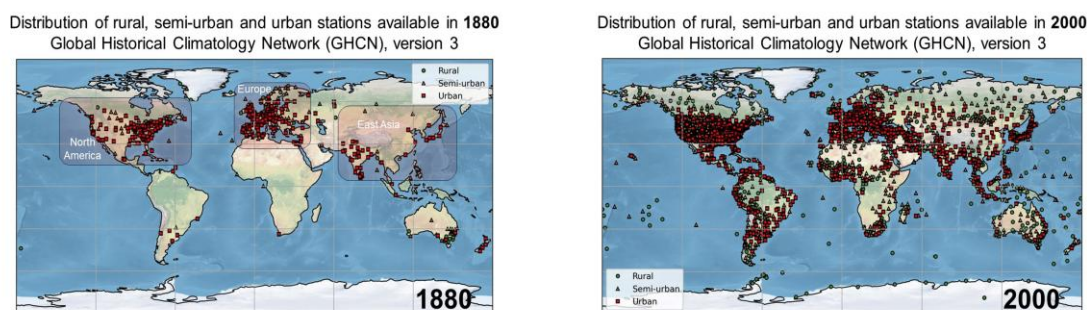


Figure 3: Maps showing the stations available in version 3 of the GHCN dataset in 1880 (left) compared to 2000 (right). Degree of "current" urbanization (at the time of Peterson *et al.* 1999) is indicated using the legend. See text for details.

From Figure 3, we can already see several problems for any groups attempting to calculate "global temperature changes" since 1880 (or earlier), i.e., the groups whose "global temperature record" were used to justify the headlines we discussed in the introduction:

- While there is reasonable geographical coverage for analysing the modern era, e.g., 2000 AD, there was almost no coverage in the southern hemisphere for the earlier years, e.g., 1880 AD.
- The northern hemisphere coverage in the earlier years was mostly confined to Europe and North America – with some East Asian coverage.
- The vast majority of the stations from either hemisphere with data in 1880 are now urbanized. As we will discuss later, urban stations tend to be warmer than the surrounding countryside due to the "urban heat island" (UHI) effect (Oke, 1973; Mills, 2008; Connolly and Connolly, 2014c; Stewart, 2019). Hence, as these key temperature stations with long records have become urbanized over the years since 1880, we would expect their temperature records to have experienced a long-term localized warming due to the growing urban heat island that is not representative of the climate outside the urban areas, i.e., an "urbanization bias" (Ren *et al.*, 2008; Connolly and Connolly, 2014c; Soon, Connolly and Connolly, 2015; Connolly *et al.*, 2021; Scafetta, 2021; Zhang *et al.*, 2021).
- While there are more rural stations available for the modern era, e.g., 2000, most of the modern stations are also urbanized to some extent.

Version 3 comprised 7200 stations, 1200 of which were part of a high-density, relatively rural, dataset specifically for the contiguous United States (i.e., the states excluding Alaska and Hawaii) known as the United States Historical Climatology Network, USHCN (Menne, Williams

and Vose, 2009; Katata, Connolly and O'Neill, 2023). However, as we saw from Figure 3, the data coverage was much less impressive in 1880. Indeed, most of the station records only began after 1950. A surprising legacy of the dataset compilation is that the sources for many of the stations (especially the rural stations) were only compiled up to 1990. This meant that there was a marked drop-off in station data before about 1950 and after 1990 (Soon, Connolly and Connolly, 2015; Soon *et al.*, 2018; Katata, Connolly and O'Neill, 2023).

When NOAA switched to Version 4 in 2018, these drop-off problems were partially reduced, but only partially. They built the dataset up independently from the previous versions – even though many of the sources used for compiling Versions 1- 3 were re-used. This means that Version 4 is not backwards compatible with the earlier versions, e.g., a completely different station ID system is now used. Unfortunately, NOAA have so far neglected to estimate the degree of urbanization of the stations in the new dataset. So, the type of analysis in Figure 3 in terms of urban subsets is not as straightforward for Version 4.

Nonetheless, analysing the spatial coverage including all stations regardless of urbanization remains straightforward. From Figure 4 we can see that while the total number of stations has nominally increased dramatically from 7,200 to ~20,000, most of the extra stations are from the contiguous United States – a region that had already been relatively well covered in Version 3. The data for the earlier years remains mostly confined to Europe, North America, and some of East Asia, and the southern hemisphere only represents a small minority of the stations for the entire record.

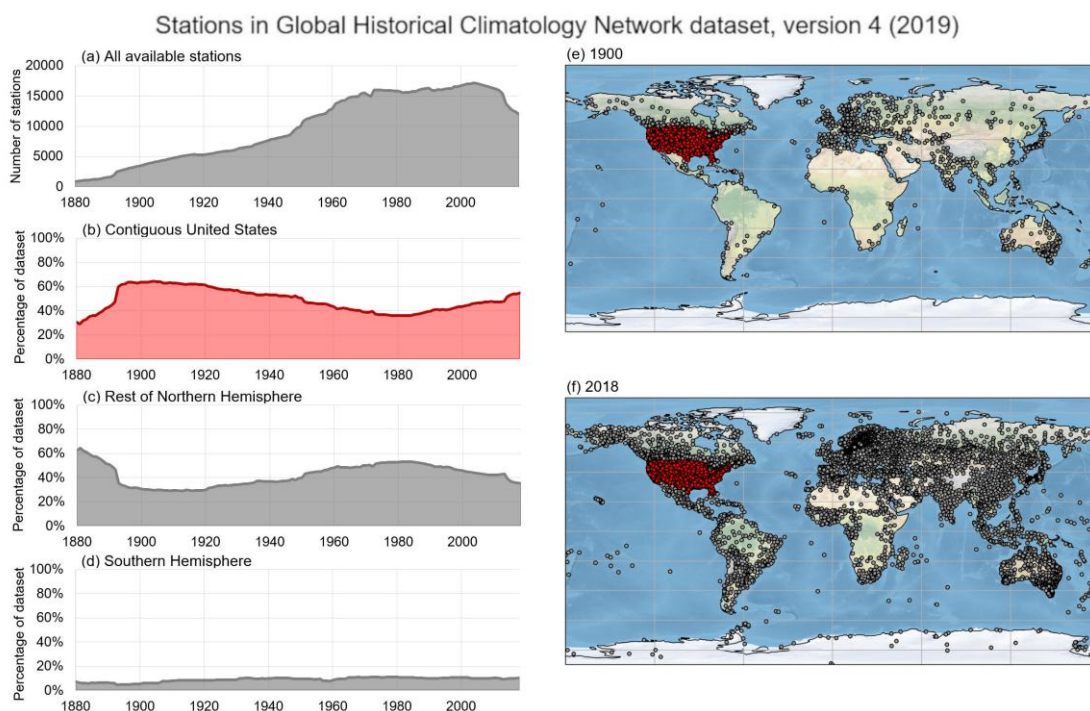


Figure 4: The stations available in version 4 of the GHCN dataset. (a) number available for each year since 1880; (b)-(d) percentage of the dataset in (b) Contiguous U.S.; (c) the rest of the northern hemisphere; (d) the southern hemisphere; maps of stations with data available for (e) 1900 or (f) 2018). Contiguous U.S. stations are shown in red.

While the infamous “1990 drop-off” associated with previous versions has been partially alleviated and is no longer obvious from the station counts in Figure 4(a), a close inspection of the available data reveals that for many regions, this has been achieved by introducing new short station records for the post-1990 period after the longer records have dropped out – see e.g., (Soon *et al.*, 2018; Katata, Connolly and O'Neill, 2023). In some cases, if the old and new station records are suitable, it might be plausible to combine them into composite records, e.g., see (Christy,

2026) – indeed, this was done for many stations in the original USHCN dataset (Karl, Diaz and Kukla, 1988). However, this should be done with caution and awareness that it could introduce additional non-climatic biases.

So, when we see a “global temperature record” covering the period 1880 to present, 1850 to present or even longer, we need to recognize that most of the stations used for calculating the post-1950s part of the record were not available for the bulk of “the record” – just the most recent decades. We have also touched on another challenge – non-climatic biases in each of the individual temperature records.

2.4 Non-climatic biases and the bias in the biases that are considered biases

Figure 5 is a schematic infographic that provides an overview of the problem of non-climatic biases. The bottom panel shows a hypothetical temperature record that experienced multiple non-climatic events over the course of the record that altered the temperatures afterwards. For simplicity, this hypothetical record only experienced one bias at a time. However, it shows how a temperature record can be altered by many factors that have nothing to do with the regional climate: station relocation, change of instrument type or screen, change in observation time, growth of trees or buildings around the site, and urbanization of the surrounding landscape.

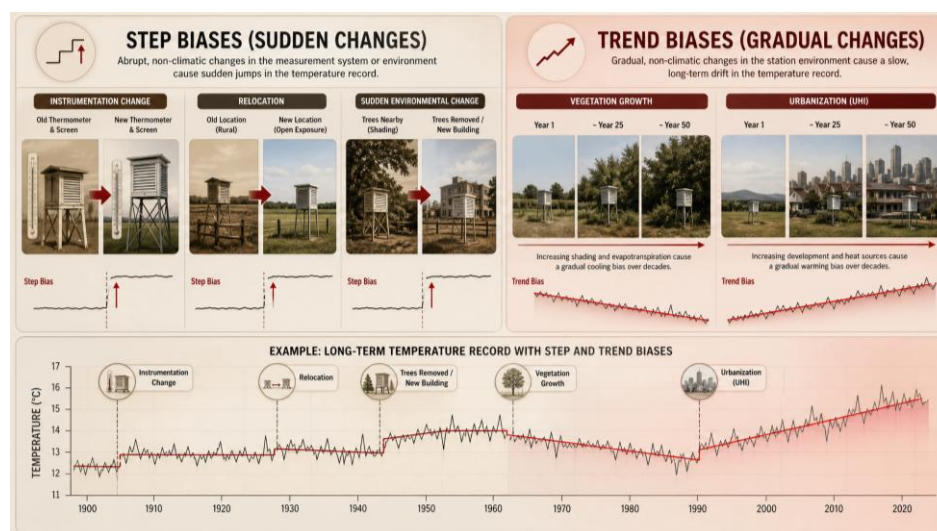


Figure 5: Schematic infographic for a hypothetical weather station record illustrating how various non-climatic factors can introduce non-climatic biases into a temperature record. This infographic was generated through iterative prompting of various AI LLMs.

In theory, these non-climatic biases could lead to either warming or cooling – or even a mixture of warming or cooling. However, anecdotally, something I have personally noticed from carefully reading the literature on non-climatic biases is that whenever the non-climatic biases lead to a long-term cooling trend, e.g., time of observation biases in the U.S. (Vose *et al.*, 2003) or both signs, e.g., some changes in thermometer systems (Quayle *et al.*, 1991; Hubbard and Lin, 2006), the groups compiling global temperature records seem to insist that these particular non-climatic biases need to be corrected for, i.e., adding extra warming to the data (Balling and Idso, 2002; Vose *et al.*, 2003; Böhm *et al.*, 2010). Yet, whenever the non-climatic biases lead to a long-term warming trend, there is considerable effort made to suggest that these non-climatic biases are trivial and/or not especially concerning (Jones *et al.*, 1990; Li *et al.*, 2004; Parker, 2006; Menne, Williams Jr. and Palecki, 2010). That is, there seems to me to be a bias in the types of biases that are considered to be biases.

With that in mind, let us briefly discuss two of these non-climatic biases that seem to have been unfairly dismissed due to them being of the wrong sign, i.e., introducing long-term warming biases.

2.4.1 Urban warming bias

We mentioned earlier that urban areas tend to be warmer than the surrounding countryside (the urban heat island). This was already noted for London, England as early as the early-19th century (Mills, 2008). Therefore, as a station's surroundings urbanize, there is a serious risk that its record will experience a gradual, but long-term warming trend due to the growth of that UHI.

This urban warming is a real climatic change, and human-caused. Since the majority of the world's population live in urban areas, it is also a form of climate change that is experienced by many of us. Indeed, I have noticed that urban dwellers tend to be more concerned about unusual climate change than rural dwellers. But, urban warming is a localized climate change, and is not due to greenhouse gas emissions. So, if you are using urbanized stations to calculate global temperature trends, or even regional temperature trends, then this UHI growth can introduce "urbanization bias", i.e., a long-term warming that is not representative of the climatic changes that occur outside of the urban areas.

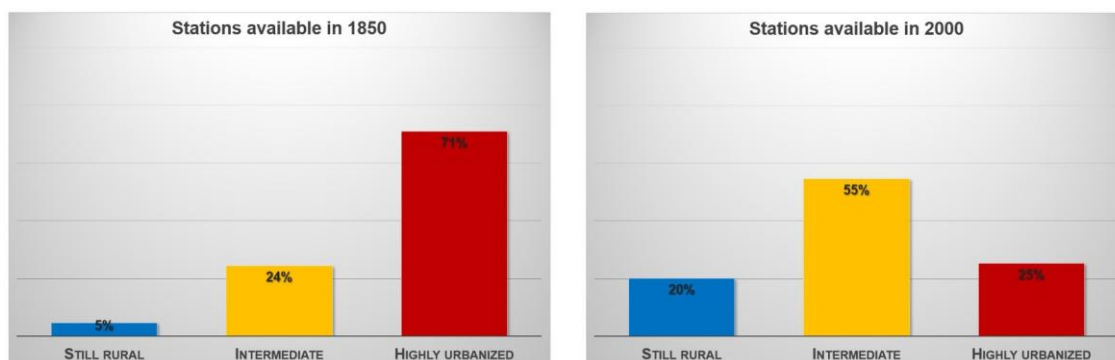


Figure 6: Breakdown of the stations in Version 3 of the Global Historical Climatology Network dataset with data available for 1850 (left) compared to 2000 (right), according to their current degree of urbanization.

We saw from Figure 3 that most of the stations with data available for the earlier parts of the record are urbanized. We can see this more starkly in Figure 6. Only 5 % of the stations in GHCN version 3 with data in 1850 are still rural, while 71 % of the stations with data in 1850 are now highly urbanized. Counterintuitively, this breakdown shows that while the rates of urbanization have accelerated in recent decades, because there has also been a considerable increase in the available rural stations, it is in many ways the earliest parts of the record that are most affected by urbanization biases (Connolly *et al.*, 2021; Soon *et al.*, 2023). This is because when looking at the temperature trends since 2000, only 25 % of the stations are highly urbanized and 20 % of the stations are still rural. But, if you are looking at the temperature trends since 1850, 71 % of the stations available to you are now highly urbanized and only 5 % are still rural.

Despite this there have been multiple papers published over the years insisting that urbanization bias is a small or negligible problem, e.g., (Jones *et al.*, 1990; Li *et al.*, 2004; Parker, 2006; Wickham *et al.*, 2013). In particular, the UN's Intergovernmental Panel on Climate Change (IPCC) reports have repeatedly asserted since their 4th Assessment Report (IPCC, 2007) to their most recent 6th Assessment Report (IPCC, 2021) that the magnitude of urbanization bias is less than 10% of the reported global temperature trends – with the implication that this is not a major concern.

However, in one of our first working papers, we investigated each of these studies in turn and found fundamental flaws in each case that either negated their conclusion or showed their conclusion to be unjustified by their analysis (Connolly and Connolly, 2014c). In another working paper, we demonstrated that urbanization bias was a significant problem for the U.S. at least – where there was enough data for a rigorous analysis (Connolly and Connolly, 2014e). In later peer-reviewed papers, we confirmed these preliminary findings for the U.S. also apply more generally across the northern hemisphere and shown that urbanization bias is greater than the IPCC's

“<10 %” optimistic estimate (Soon, Connolly and Connolly, 2015; Soon *et al.*, 2018, 2023; Connolly *et al.*, 2021; Katata, Connolly and O’Neill, 2023). Other groups have also independently shown that urbanization bias is more substantial than the IPCC maintains, e.g., (Scafetta, 2021; Zhang *et al.*, 2021; Spencer, Christy and Braswell, 2025).

One blind spot seems to be that most of the “homogenization” algorithms used by the various groups in an attempt to correct for non-climatic biases only focus on “step change biases” and ignore “trend change biases”, e.g., (Easterling and Peterson, 1995; Menne and Williams, 2009). As we saw from Figure 5, urbanization biases are generally of the latter type.

Hence, it turns out that NASA GISS is the only major group that has attempted an explicit urbanization adjustment, using night-lights or population to classify stations and then forcing urban trends to match nearby rural trends (Hansen *et al.*, 2001, 2010). Yet, their GISTEMP global temperature record looks remarkably similar to the global temperature records of the other groups that do not include any explicit correction for urbanization bias. This appears to have convinced the other groups that correcting for urbanization bias is not especially important. However, when we downloaded and analysed all of NASA GISS’s urbanization adjustments for another of our early working papers, we discovered that their algorithm was completely flawed and was apparently never stress-tested (Connolly and Connolly, 2014d).

We found that the great majority of the station adjustments involved “urban cooling” adjustments; that the net effect on the global series was unrealistically small (especially after 1990, when urbanization should have increased), and that highly urbanized stations were left essentially unadjusted in recent decades. Another feature that might surprise many readers is that because their algorithm was designed to adjust the earlier “less urbanized” part of the records to match the most recent parts of the records, every month their algorithm applies a fresh set of adjustments to the ~50 % of their stations they identify as “rural” (Connolly and Connolly, 2014d). Hence, each month, they effectively “rewrite” the temperature history of about half of their records.

2.4.2 Siting biases – a different warming bias from urbanization bias

Urban heat islands can increase the temperatures of large regions – covering many square kilometers depending on the size of the urban areas. Some researchers have mistakenly assumed that if a station is located within an urban park, for instance, that this would remove the problem (Peterson, 2003). However, even if an urban park is relatively cool compared to the non-green areas (“the urban park cooling effect”), it can still be warmer than outside of the urban area (Gaffin *et al.*, 2008). Indeed, (Stewart and Oke, 2012) have cautioned that many “rural/urban” comparative studies are really urban parks vs. urban non-green areas.

We should avoid conflating the large-scale urban heat island effects with local climate differences associated with the station’s microclimate, i.e., the local environment within 30-100 metres of the station. However, it turns out that non-climatic biases can also arise from changes in the microclimate. From 2007 - 2011, the “Surfacestations” project, a voluntary “crowd-sourced” survey of the microclimate of most of the stations in the U.S. Historical Climatology Network revealed that a large majority of these stations fail standard siting requirements. Poorly sited stations included those located in parking lots, near air-conditioning exhausts, surrounded by asphalt, or even on top of roofs. When the temperature trends of the worst-sited stations were compared to the best-sited stations, it became apparent that poor siting typically leads to warming biases relative to good siting (Fall *et al.*, 2011; Connolly and Connolly, 2014b).

A high profile study by the NOAA group in charge of the USHCN conceded this, but argued that after NOAA had applied their automated statistical Pairwise Homogenization Algorithm (PHA) to the data, there was very little difference between the badly-sited and well-sited stations (Menne, Williams Jr. and Palecki, 2010). They argued that this meant their homogenization algorithm was automatically able to correct for these non-climatic biases. A study involving several of the organizers of the survey conceded that the homogenized trends were similar for all stations, but argued that even after homogenization there were non-climatic biases in the differences between the maximum and minimum temperatures – suggesting that the homogenization algorithm was

not entirely removing the biases (Fall *et al.*, 2011).

In another of our working papers, we independently evaluated the results from this Surfacestations project (Connolly and Connolly, 2014b). The key results are reproduced here in Figure 7. We confirmed that the warming trend associated with each subset of the stations generally increased the worse the siting quality (top panel). Although correcting for time-of-observation biases seemed to add some long-term warming, it also seemed to make the siting biases more pronounced (middle panel). However, while we nominally confirmed (Menne, Williams Jr. and Pal-ecki, 2010)’s finding that the trends were similar among all subsets after homogenization, we showed that this arose by adding extra warming to the well-sited stations and slightly removing warming from the worst-sited stations until all stations had similar trends to the most common subset, i.e., the poor quality stations that made up 64 % of the network (bottom panel).

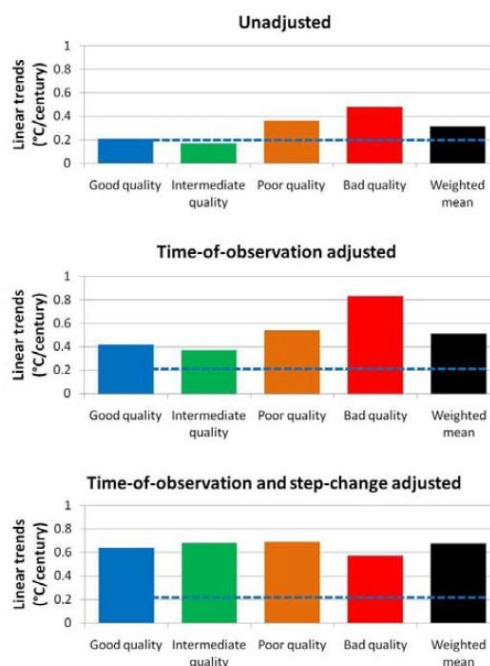


Figure 7: Comparison of the 1895-2011 linear temperature trends of each of the subsets of USHCN stations sorted by the Surfacestations team according to their siting quality. Top panel shows the trends for the raw unadjusted data; middle panel is after applying time-of-observation bias adjustments; bottom panel has also had NOAA’s PHA adjustments applied. Adapted from Connolly & Connolly (2014b).

That is, we showed that NOAA’s homogenization adjustments were effectively spreading the siting biases between all stations until they all showed similar trends to the poor-quality stations.

While our analysis was strictly confined to the USHCN dataset since those were the stations that had been surveyed, preliminary surveys of other stations around the world at the time were suggesting that poor siting was a worldwide problem (Connolly and Connolly, 2014b). But, let us now consider in more detail these homogenization adjustments.

3. The current “solution”: Automated statistical homogenization

The principle behind temperature homogenization is the recognition that multi-decade long temperature records are likely to contain multiple non-climatic biases, e.g., some of those described in Figure 5. From a philosophical perspective, some scientists might argue that it is better to analyse these records as they were – despite the biases – since those were the measurements that were actually recorded, e.g., (Courtillot *et al.*, 2008). Indeed, if the biases are equally likely to be of either sign and occur at relatively random intervals for each station, then one might argue that

“the random component of such errors tends to average out in large area averages and in calculations of temperature change over long periods” (Hansen *et al.*, 1999).

Other scientists (including myself) would argue that if the observers noted that they had made a systematic change to how they were measuring temperature after a specific date and that this altered all subsequent temperature readings, then carefully applying a suitable correction to the station’s temperature record can be scientifically justifiable and improve the reliability of your subsequent analysis.

For example, for (Soon, Connolly and Connolly, 2015), when analysing the station record for Valentia Observatory, Ireland - a significant record in that it is one of the longest and most complete stations (1869-present) that still remains relatively rural – we visited the station and consulted the station observers who provided us with “station history metadata” that documented known changes in how the temperatures were recorded over the preceding 145 years. For the two most recent events (a station move in 2001 followed by a change in 2012 to an automated electronic thermometer system), the observers also kindly provided us with 2 years of parallel measurements taken before and after the change. This allowed us to calculate that the 2001 station move led to a slight cooling bias, but that the 2012 instrument change gave almost identical readings (Soon, Connolly and Connolly, 2015).

I would also argue that if we know that some non-climatic biases are systematically of one sign and/or are not randomly distributed, that we should take this into account in our analysis. For instance, we discussed above how most of the longest station records available are now highly urbanized and therefore possibly contaminated by a long-term urban warming bias (Soon, Connolly and Connolly, 2015; Connolly *et al.*, 2021; Soon *et al.*, 2023). Similarly, the Surfacestations project revealed that the majority of stations (in the USHCN at least) are affected by siting biases due to poor siting (Fall *et al.*, 2011; Connolly and Connolly, 2014b).

Yet, what should we do when we suspect that there are non-climatic biases in a station’s temperature record but we do not have much or any relevant station history metadata? Or what do we do when we have station history metadata documenting a significant non-climatic change but we do not have any parallel measurements to quantify what bias, if any, this introduced?

The solution that most of the groups involved in compiling regional or global temperature series have converged on is to use statistical homogenization algorithms to statistically identify non-climatic jumps (“breakpoints”) in each station record and to apply corrections to the records to remove these jumps (Easterling and Peterson, 1995; Reeves *et al.*, 2007; Menne and Williams, 2009; Skrynyk *et al.*, 2019; Domonkos, 2021). I should note that researchers homogenizing regional temperature datasets will often combine their analysis explicitly with station history metadata, e.g., (Skrynyk *et al.*, 2019), but most of the groups generating global temperature records rarely even consider the use of station history metadata (Jones, Wigley and Wright, 1986; Hansen *et al.*, 2010; Menne *et al.*, 2018; Rohde and Hausfather, 2020; Osborn *et al.*, 2021).

3.1 What is temperature homogenization?

The infographic in Figure 8 describes the general outline of a typical temperature homogenization algorithm, e.g., NOAA’s Pairwise Homogenization Algorithm (PHA) that is currently used to homogenize the GHCN dataset. The exact algorithm varies between different groups, e.g., (Easterling and Peterson, 1995; Reeves *et al.*, 2007; Menne and Williams, 2009; Skrynyk *et al.*, 2019; Domonkos, 2021). However, the basic principle is usually something similar to the following:

- The monthly temperature record of each station is analysed by comparison with the temperature records of neighbouring stations. In NOAA’s original homogenization algorithm for the GHCN dataset, this was done by constructing a composite reference series that was the average of five neighbours (Easterling and Peterson, 1995). The current method compares each station iteratively to up to 100 neighbours, one pair at a time (Menne and Williams, 2009).
- A temperature difference series is created between the target station’s record and its

reference record.

- A statistical test for any abrupt jumps in the difference series is applied and any jumps that pass the test are considered as potential “breakpoints”, i.e., non-climatic biases.
- If a breakpoint is identified as (a) being statistically significant and (b) associated with the target series as opposed to the reference series, then it is assumed to be a non-climatic bias. The sign and magnitude of this bias is determined by comparing the values before and after the breakpoint.
- If station history metadata are used, then either (a) only breakpoints that coincide with a documented event are adjusted, or (b) breakpoints that are associated with a documented event are given a lower threshold to be considered as requiring adjustment. Note that most of the global temperature groups rarely, if ever, use station history metadata.

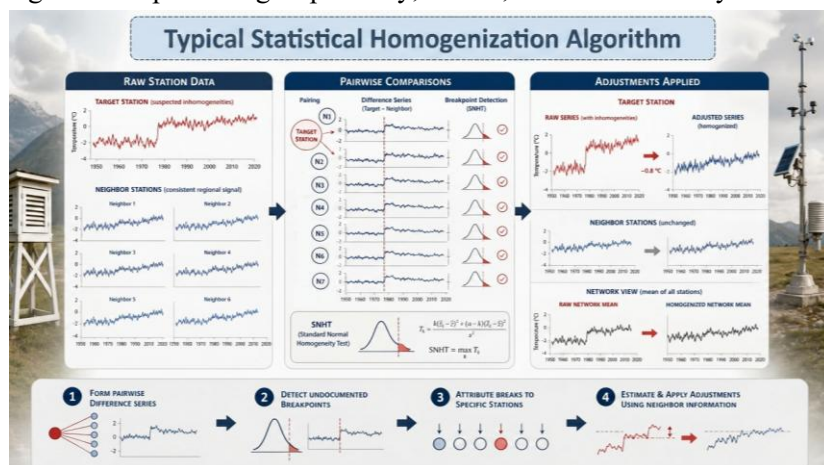


Figure 8: Schematic infographic illustrating the basis and workflow for a typical automated statistical temperature homogenization algorithm. This infographic was generated through iterative prompting of various AI LLMs.

In principle, the adjustments could be applied to either (a) bring the most recent temperatures into line with the temperatures at the start of the record, or (b) bring the earliest temperatures into line with the temperatures at the end of the record. The former approach means that all new monthly temperature values will need to be adjusted, while the oldest measurements will remain constant. However, the latter approach means that every time there is a new data point added to the record, the entire record might have to be recalculated so that the earliest data points match the latest. Since these temperature records are typically then converted into temperature anomaly records, the choice is often somewhat arbitrary. But, philosophically, the latter approach effectively means that the earlier parts of the homogenized temperature record are continually being rewritten whenever new breakpoints arise.

One thing that has been repeatedly confirmed is that after such a temperature homogenization algorithm is applied to a temperature dataset, the temperature records all converge to having similar trends to their neighbours (Menne, Williams Jr. and Palecki, 2010; Fall *et al.*, 2011; Hausfather *et al.*, 2013; Connolly and Connolly, 2014e; Katata, Connolly and O’Neill, 2023). In other words, the temperature records become much more “homogeneous” after homogenization. However, does that mean that the homogenization adjustments have correctly identified and removed the non-climatic biases from the data? Or are the homogenization adjustments merely making the station records more homogeneous with respect to each other?

Until recently, most of the attempts to address this have focused on assessing how well the algorithms perform when applied to synthetic temperature records that have had artificial biases added to them. These are often referred to as “benchmarking” experiments (Venema *et al.*, 2012; Williams, Menne and Thorne, 2012). These experiments are typically carried out as collaborations where one researcher will synthesise a dataset of multiple physically plausible temperature records and then artificially introduce breakpoints into a large number of the records. The homogenization team will be simply handed the dataset and asked to use their algorithm to identify and

correct any non-climatic biases. The other researcher then compares the proposed homogenization adjustments to their secret list of actual breakpoints. He/she then calculates how many true positives (correctly removing a bias), false positives (incorrectly applying an adjustment when none was needed), and false negatives (failing to identify a bias). Such synthetic experiments have shown that NOAA's PHA, and various other homogenization algorithms, are able to successfully homogenize these synthetic records with high true positives and low false positives and negatives, e.g., (Venema *et al.*, 2012; Williams, Menne and Thorne, 2012).

This seems to have convinced many in the homogenization community that the algorithms are doing a good job and improving the accuracy of the temperature records (Reeves *et al.*, 2007; Venema *et al.*, 2012; Menne *et al.*, 2018; Lund *et al.*, 2023). However, how do these algorithms fare when applied to real temperature records?

3.2 Does it work on real temperature data?

NOAA re-run their PHA on their GHCN datasets roughly once per day. They overwrite the older version with the new one. In 2015, we noticed when we compared the homogenized data that we had downloaded on different days, that the homogenization adjustments that NOAA applies to each station often changed radically (Soon, Connolly and Connolly, 2015). We also noticed that the homogenization adjustments NOAA was applying to the Valentia Observatory record we had specifically analysed had no match to the station history metadata we had been provided (Soon, Connolly and Connolly, 2015).

Afterwards we discovered that a colleague, Peter O'Neill, had independently noticed the inconsistency in NOAA's homogenization adjustments and had begun archiving the GHCN datasets from 2011 – initially intermittently, but eventually on a daily basis. We also noticed that, in recent years, there has been considerable effort placed into digitizing station history metadata for many stations, e.g., (Przybylak, 2010; Brázdil *et al.*, 2012; Wypych, Ustrnul and Schmatz, 2018; Skrynyk *et al.*, 2019; Chimani *et al.*, 2020).

In (O'Neill *et al.*, 2022), we decided to combine these two efforts to carry out a more practical assessment of NOAA's PHA adjustments. We collaborated with some of the groups compiling station history metadata in Europe and also identified any other published station history metadata we could find in the literature or public archives. In total, we found station history metadata for more than 800 European stations. We then analysed O'Neill's archive to identify all the different breakpoints NOAA had applied to these stations over the ~3,600 different GHCN datasets he had downloaded.

The key results are summarized in Figure 9:

- Only about 17 % of the adjustments to a given station were applied consistently.
- Only about 19 % of the breakpoints coincided with a documented station event.

We would not have been surprised if the algorithm was identifying some undocumented events, but it was surprising that only a small minority of the adjustments coincided with documented events. However, an especially concerning aspect of their adjustments was that the adjustments applied to a given station often changed wildly from one day to the next. This means that, for example, a researcher who downloaded the dataset on Tuesday might have a completely different temperature record for a station than their colleague who had downloaded the dataset on the previous Friday.

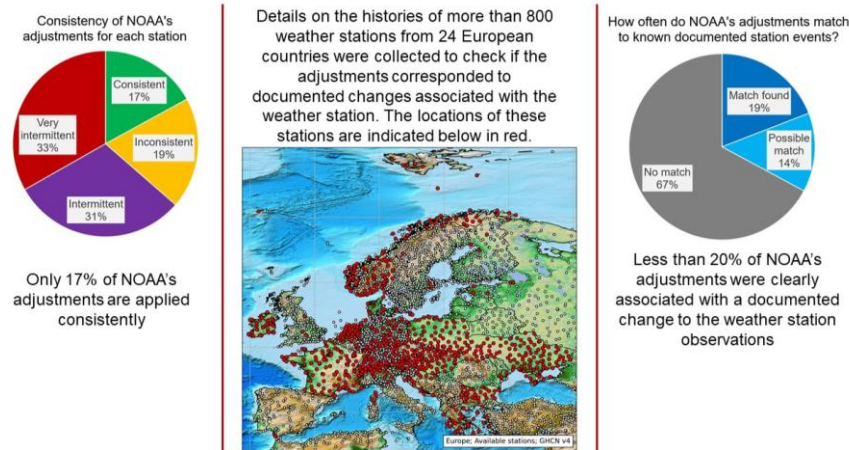


Figure 9: Summary of the key findings of our analysis in O'Neill *et al.* (2022). The left panel indicates how consistently a given set of homogenization adjustments were applied to each station. The middle panel shows the location of the stations used for our analysis. The right panel indicates how often a homogenization adjustment coincided with a documented station event ("Match found") or occurred within 1-3 years of a documented event ("Possible match").

The findings of (O'Neill *et al.*, 2022) revealed that NOAA's PHA adjustments rarely coincide with documented station history events and are remarkably inconsistent – despite the algorithm performing very well in the synthetic benchmarking experiments (Venema *et al.*, 2012; Williams, Menne and Thorne, 2012). This is important since NOAA's PHA-adjusted version of the GHCN dataset is the main dataset used for NOAA, NASA and JMA's global temperature series and a secondary dataset for CMA and CRU's equivalents. However, in a separate study, we demonstrate that there is a more systemic statistical flaw that is common to all of the current temperature homogenization algorithms, i.e., "urban blending".

3.3 The urban blending problem

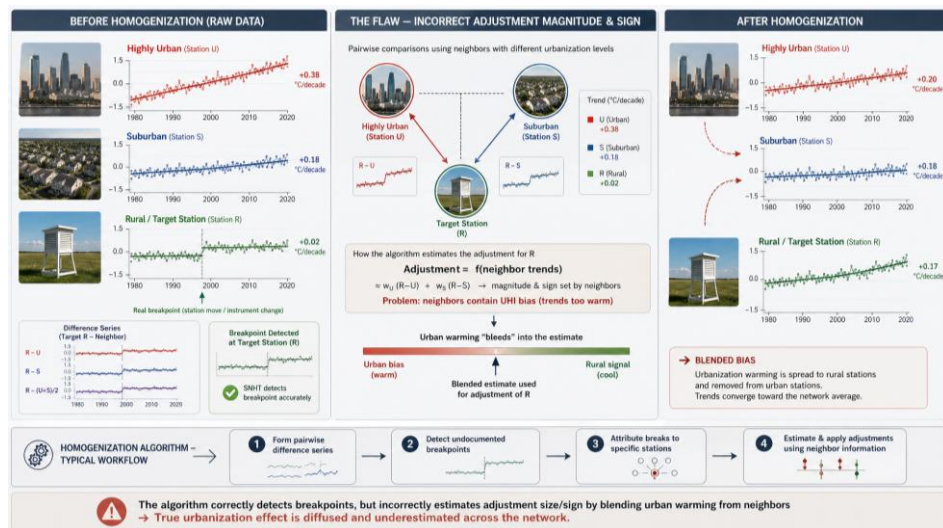


Figure 10: Schematic infographic illustrating how current temperature homogenization algorithms lead to urban blending as currently implemented. This infographic was generated through iterative prompting of various AI LLMs.

In (Katata, Connolly and O'Neill, 2023), we showed that all of the current temperature homogenization algorithms are prone to a statistical problem that we call "urban blending". The schematic in Figure 10 summarises the essential problem:

- When a breakpoint is identified in a station, the adjustments applied to "correct" for the

apparent non-climatic bias are calculated by comparing the difference series before and after the breakpoint.

- However, if the neighbours used for calculating the difference series are more urbanized than the target station, the calculated adjustments may incorporate any urbanization bias experienced by that neighbour over the comparison period.
- This means that during homogenization, rural stations will tend to have urban warming added to their records to better match the trends of its more urbanized neighbours.
- The opposite process also occurs for the most urbanized stations, i.e., if an urban station experienced more urban warming around the time of a breakpoint than its neighbours, the homogenization adjustment will have additional cooling added.
- The net result is that homogenization will tend to spread urban warming biases among all stations until all stations in a region have about the same degree of urban warming to the average of the neighbours in that region.
- This process can potentially occur every time a breakpoint is identified in the target station and it is independent of whether the breakpoint is a genuine non-climatic bias or not. So, the more breakpoints are identified in a dataset, the more widespread this urban blending.

As well as demonstrating the theoretical reason for this phenomenon, (Katata, Connolly and O'Neill, 2023) specifically evaluated the extent of this effect for two different countries: Japan and United States, and confirmed that it is real and substantial in both cases. This explains why so many studies had incorrectly concluded that homogenization was removing urbanization bias, e.g., (Li *et al.*, 2004; Menne and Williams, 2009). After homogenization, rural and urban stations all show similar trends, but not because the urbanization biases had been removed. Rather, the homogenization process leads to urban blending.

We noted that a similar process could also potentially apply to other non-climatic biases that are common to multiple neighbours, such as siting biases. This therefore explains how the siting biases also get blended between stations after homogenization (Menne, Williams Jr. and Palecki, 2010; Fall *et al.*, 2011; Connolly and Connolly, 2014b).

We suggested two potential ways that current homogenization algorithms could be adapted to reduce the urban blending problem:

1. Stations could be homogenized only using neighbours that have a similar degree of urbanization, i.e., using rural neighbours to homogenize rural stations and urban neighbours to homogenize urban stations.
2. Not calculating the homogenization adjustments from the difference series, but assuming that any temperature jump in the target station's record after the breakpoint was a non-climatic bias.

In principle, all stations could potentially be used for identifying the breakpoints. The key issue is whether to use them for also calculating the sign and magnitude of the bias.

The first method has the disadvantage that if there are a lot of additional non-climatic biases in the dataset, e.g., siting biases, they might potentially be blended during homogenization. However, the second method risks conflating any genuine temperature jumps that might have coincidentally occurred during the breakpoint as "non-climatic".

4. Bypassing the above problems: our rural Northern Hemisphere temperature reconstruction

Alternatively, another approach might be to not rely on these automated statistical homogenization algorithms. This was a path we had also worked on for more than six years (Soon, Connolly and Connolly, 2015; Connolly, Connolly and Soon, 2017; Soon *et al.*, 2018, 2019; Connolly *et al.*, 2021) yielding results that led to insightful collaborations with dozens of researchers (Connolly *et al.*, 2023; Soon *et al.*, 2023).

4.1 Using GHCN version 3 to reconstruct rural temperatures from 1850-2018

Rather than rely on automated homogenization we identified the longest, most rural stations in GHCN version 3, applied only well-documented, metadata-supported corrections, and constructed a Northern Hemisphere rural-only land series (Connolly et al., 2021; Soon et al., 2023).

In Figure 11, we first compare the conventional “all-stations” (urban-plus-rural, homogenized) series we get without taking these extra steps to the equivalent time series for the other main groups. Our series (solid black) agrees with all of the other estimates. This suggests that any other differences between our methodology and those of the other groups are relatively trivial (Connolly et al., 2021).

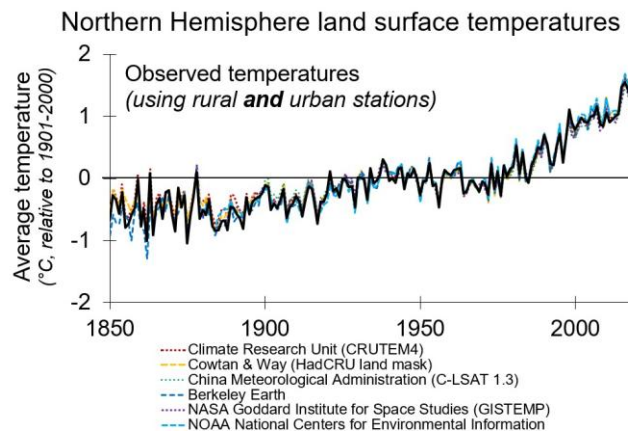


Figure 11: Comparison of the Northern Hemisphere land surface temperature series our methodology produces if we include the homogenized versions of all stations (urban and rural) – black solid line – to the equivalent series by other groups. Adapted from Soon et al. (2023). See Connolly et al. (2021) for details on each temperature series.

Yet, we can see from Figure 12 overleaf that our rural-only approach (bottom panel) leads to noticeably different results from the standard approach of using automated homogenization and all stations regardless of urbanization. For instance, the long-term (1850–2018) linear trend is approximately $0.55\text{ }^{\circ}\text{C century}^{-1}$, compared with $0.89\text{ }^{\circ}\text{C century}^{-1}$ for the standard all-station homogenized series. This implies urbanization bias and/or homogenization artefacts contributed up to 38 % of the apparent warming in the standard version. Meanwhile, the rural series suggests an almost cyclical variation in temperatures over the course of the record – warming from the late-19th century until the 1940s; cooling until the 1970s; warming since the 1980s.

4.2 How does our reconstruction compare to other temperature reconstructions?

In Figure 13 overleaf, we compare our rural-only series to various other independent estimates of Northern Hemisphere temperature changes since 1850 (and a few other climate change indicators). Surprisingly, while each estimate is constructed from very different data sources, they each imply qualitatively similar trends to the rural-only record (with the exception of worldwide precipitation which does not show much trend if any), i.e., they all are consistent with a general warming from the end of the 19th century to the 1940s, followed by a general cooling until the 1970s, followed by a general warming to present.

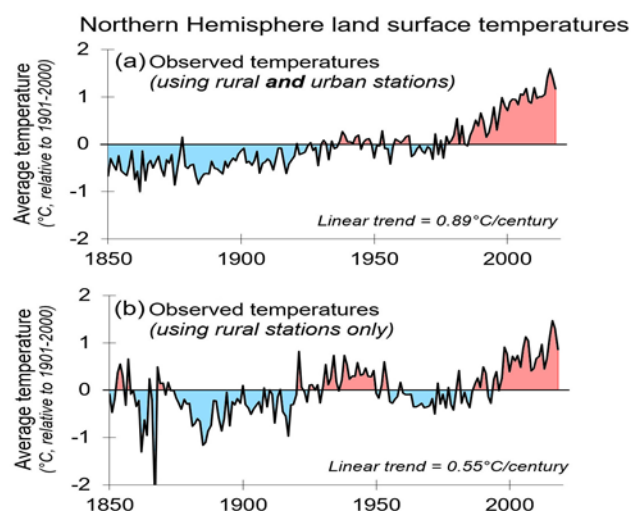


Figure 12: Comparison of the Northern Hemisphere land surface temperature series our methodology produces if we include (a) the homogenized versions of all stations (urban and rural) vs. (b) our rural-only series. Adapted from Soon et al. (2023). See Connolly et al. (2021) for de-tails on how each temperature series was constructed.

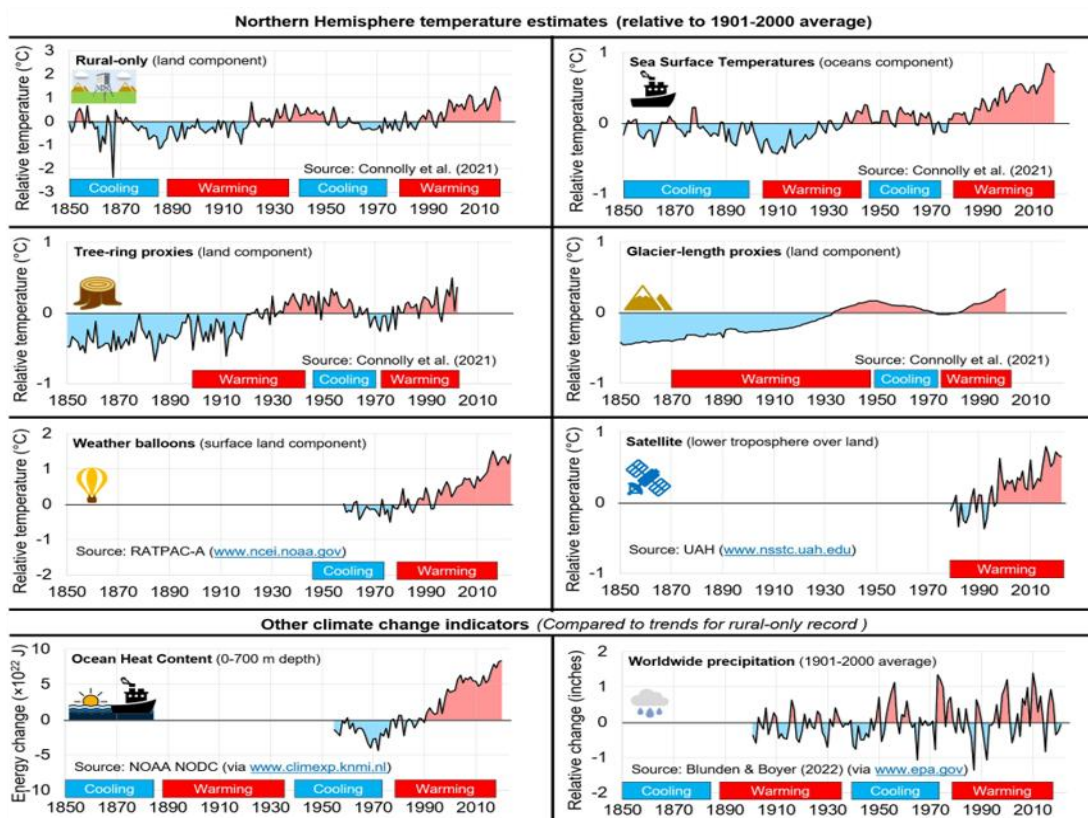


Figure 13: Comparison of our rural-only series to various other independent estimates of Northern Hemisphere temperature changes since 1850. See the sources indicated in each panel for details on how each temperature series or other climate change indicator was constructed.

4.3 Ongoing efforts to update and improve our analysis using GHCN version 4

Version 3 of the GHCN was discontinued in 2019. And Version 4 is not backwards compatible with version 3 and does not provide any urbanization metrics. Therefore, to update our rural-only record and improve on it, considerable ongoing work is necessary. We have already carried out

some work on developing new (improved) urbanization metrics for the Version 4 stations (Soon *et al.*, 2018; Katata, Connolly and O'Neill, 2023). However, we would also like to expand on the compilation of station history metadata that was begun in (O'Neill *et al.*, 2022). We also are considering availing of Peter O'Neill's archive of daily PHA runs to identify potential undocumented but persistent breakpoints. Finally, we think that the two statistical approaches to minimising urban blending we outlined in Katata *et al.* (2023) should be considered if statistical homogenization is to be continued.

5. Conclusions

There is no “global temperature” for the Earth, but averaging together temperature anomaly records from across the globe can potentially provide an index for describing widescale multi-decadal climatic changes. Unfortunately, until the mid-20th century, most of the weather station data available is heavily biased towards North America and Europe with some East Asian coverage. Most of these earlier stations were in areas that are now highly urbanized – and therefore potentially contaminated by urban warming. Nonetheless, this limited data suggests that the 20th century was warmer than the late-19th century. However, temperature proxies from across the globe suggest that on average the late-19th century coincided with the end of the Little Ice Age, i.e., a relatively cold period globally.

When we exclude stations that are potentially contaminated by urban warming, the data is too limited for the southern hemisphere to consider a global analysis. However, the rural data suggest that the northern hemisphere underwent a widespread cooling from the 1940s to the 1970s. The rural data confirm a general warming since then. Although this description of multidecadal temperature changes disagrees with the common narrative of a continuous “global warming” since the mid-19th century, it is surprisingly consistent with the trends implied by multiple independent estimates of northern hemisphere changes since the 1850s, i.e., sea surface temperatures, temperature proxies, weather balloons, satellites, ocean heat content measurements, etc.

The statistical homogenization techniques that current groups are relying on to remove any non-climatic biases from the temperature data might perform well on synthetic data, but they perform poorly on the real, incomplete, urban-contaminated datasets that are available. In particular, the adjustments from NOAA's widely used Pairwise Homogenization Algorithm change from day to day, rarely match the written station history, and systematically blend urban warming into rural records.

Claims that each new year is “the hottest on record” or “the hottest in 100 000 years” therefore rest on a short, geographically biased, heavily adjusted instrumental series whose adjustments change from day to day and only rarely match documented station events.

Funding

No funding specified.

Acknowledgements

Much of the material covered in this proceedings article reviews a collection of collaborative papers that I have co-authored over the last 12 years: (Connolly and Connolly, 2014b, 2014c, 2014d, 2014e, 2014a; Soon, Connolly and Connolly, 2015; Connolly, Connolly and Soon, 2017; Soon *et al.*, 2018, 2023; Connolly *et al.*, 2021, 2023; O'Neill *et al.*, 2022; Katata, Connolly and O'Neill, 2023). I would like to thank all my co-authors on these papers, while noting that the views expressed specifically in this article are my own and not necessarily theirs. I would especially like to thank my late father, Dr. Michael Connolly, who worked with me on this research since we first began pulling the thread of the temperature homogenization and non-climatic biases problems in 2010 until his untimely death on 25th August 2025. He is sorely missed. Dr. Willie Soon has also been an integral part of this research project since we first began collaborating in late-2014, and his unwavering passion for genuine scientific inquiry has been instrumental in keeping this project,

and our other scientific collaborations (see www.ceres-science.com for more), going. Several of the figures in this paper were generated through the iterative prompting of various AI Large Language Models (LLMs). These are indicated in the relevant captions. Finally, I would like to thank the organizers of EIKE's 17th International Climate and Energy Conference (IKEK-17), Halle (an der Saale), Germany, 26-27 June 2026, for inviting me to present this work at their conference.

Co-Editor: Stein Storlie Bergsmark

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Climate Change, Maritime Mobility and Cultural Contacts in the 4th and 3rd Millennia BC

Naqada Culture and Preliminary OSL Findings of a Step Pyramid on Tenerife

*Dominique Görlitz**ABORA Project, Germany*

Abstract

Climatic and geomorphological changes can accelerate mobility, resource crises and the reorganization of settlement areas. The presentation ‘Archaeology and Climate’ therefore combines the Holocene flooding of the Persian Gulf, the emergence of the Naqada culture in Egypt and maritime contacts as far as the Atlantic into a large-scale working hypothesis. The present contribution examines which parts of this hypothesis are already empirically connectable. Palaeogeographic reconstructions demonstrate a multiphase transgression in the Persian Gulf; archaeological finds also show highly developed seafaring in the Gulf already in the 6th and 5th millennia BC.

For a direct migration from the Gulf to Upper Egypt and onward to the Canary Islands, a continuous chain of finds had until now been lacking. This gap in the finds is increasingly being closed by the research work of the archaeologist Dr. Peter Tomkins on Crete, Sardinia and in southern Spain. At the same time, the diffusion theory receives a new chronological and cultural-historical context through the redating of the rock image of Laja Alta near Gibraltar (Morgado-Rodríguez et al. 2025; Tomkins P., report passim). As a new test case, preliminary surface-luminescence data from a step pyramid in the San Marcos complex on Tenerife are discussed. The OSL measurement gives a value of 4360 ± 330 BP. This first finding cannot yet be read as a construction age or as a cultural attribution. However, the OSL investigation opens a testable research question and provides further trans-disciplinary evidence for the spread of a Naqada migration via intermediate stations to Tenerife.

Keywords: Naqada culture; Palaeoclimate; Persian Gulf; maritime mobility; Optical Stimulated Luminescence (OSL); Tenerife; prehistoric navigation

Submitted 2026-08-27, Accepted 2026-08-31. <https://doi.org/10.53234/scc202608/13>

1. Research Question and Terms

The emergence of complex societies can be reduced neither to climate alone nor to a single migration movement. Environmental changes instead create spaces of pressure and possibility in which political organization, exchange, technical innovation and mobility interact. This non-deterministic reading forms the starting point of the presentation. Its guiding idea is that the flooding of earlier settlement areas on the Persian Gulf could have triggered population movements that had effects via Mesopotamia and the Levant as far as Egypt and the Mediterranean region.

The project title ‘Followers of Horus’ or Shemsu Hor is used here exclusively as a heuristic designation. It is not an archaeologically secured self-designation of the Naqada population and must not be equated with it. Likewise, ‘Pyramid of Santi’ in the following designates the local project name; neither function nor authorship is derived from the stepped form. This restraint transfers the diffusion idea into a testable hypothesis (Stevenson 2016).

2. Environmental Change and Maritime Reach

2.1 *The Holocene Flooding of the Persian Gulf*

Sea-level reconstructions show that the Gulf region, which was largely dry during the Last Glacial Maximum, was gradually flooded in the early and middle Holocene. According to Lambeck (1996), near-coastal areas were repeatedly displaced; the present coastal level was approximately reached around 6000 BP, followed by regionally differing high stands. Such processes could alter freshwater, hunting and grazing areas as well as settlement axes. They therefore provide a plausible context for resettlements, but prove neither a single ‘Great Flood’ nor the destination, identity or extent of migrating groups.

The model of a ‘Gulf Oasis’ discussed by Rose (2010) makes the area that is flooded today visible as a prehistoric living and refuge area. In parallel, boat remains, bitumen and maritime exchange relations in the 6th and 5th millennia BC demonstrate early nautical competence in the Gulf (Carter 2006). Seafaring is thus given as a historical mechanism. The specific conclusion that bearers of these traditions founded the Naqada culture and later migrated onward as far as the Atlantic, however, requires additional, location- and time-specific evidence.

2.2 *Naqada: Chronology, Expansion and Contacts*

Radiocarbon data and Bayesian models place Naqada I approximately in 3800/3750–3450 BC, Naqada II in 3450–3325 BC and Naqada III in 3325–3085 BC; the transition to the 1st Dynasty follows in the early 3rd millennium BC (Dee et al. 2013; Stevenson 2016). Archaeologically tangible are the spread of Old Sumerian achievements in the Nile Valley as well as contacts with the southern Levant and indirect relations with Western Asia. These contact zones make mobility probable, and for the first time form a possible migration trail from the Persian Gulf via Crete, the large Mediterranean islands as far as the Canary Islands.

In the presentation, ziggurat, mastaba and step pyramid, certain vessel motifs as well as stepped buildings are assembled as comparative forms. In addition, initial research on the astronomical alignment of the stepped structures shows further indications of a cultural transmission of specific intangible cultural elements from the eastern Mediterranean region. Such similarities are valuable for hypothesis generation. As evidence of diffusion, however, jointly occurring, sufficiently specific characteristics in securely dated find contexts would be required: production methods and clay recipes of ceramics, raw-material provenances, technological operational chains, rock-art analyses, inscriptions or biological mobility markers. The present article therefore undertakes for the first time the attempt, starting from functional convergences in architecture and their linkage with further trans-disciplinarily obtained findings, to develop a coherent model of a possible spread of the Naqada culture beyond its hitherto established geographical distribution area.

3. Santi Investigation Site and Sample Context

The structure documented in the slide set is located near San Marcos on Tenerife and consists of stepped dry-stone walls. Two positions are particularly highlighted: SPN3SL on a northern wall surface and SPR1SL in the area of a northern ramp that was placed in front of the older north wall. The graphic (Fig. 1) marking is helpful for spatial orientation; for an archaeometric evaluation, stone position, orientation, sampling depth, shading, weathering, possible relocation and assignment to construction or repair phases were additionally recorded.

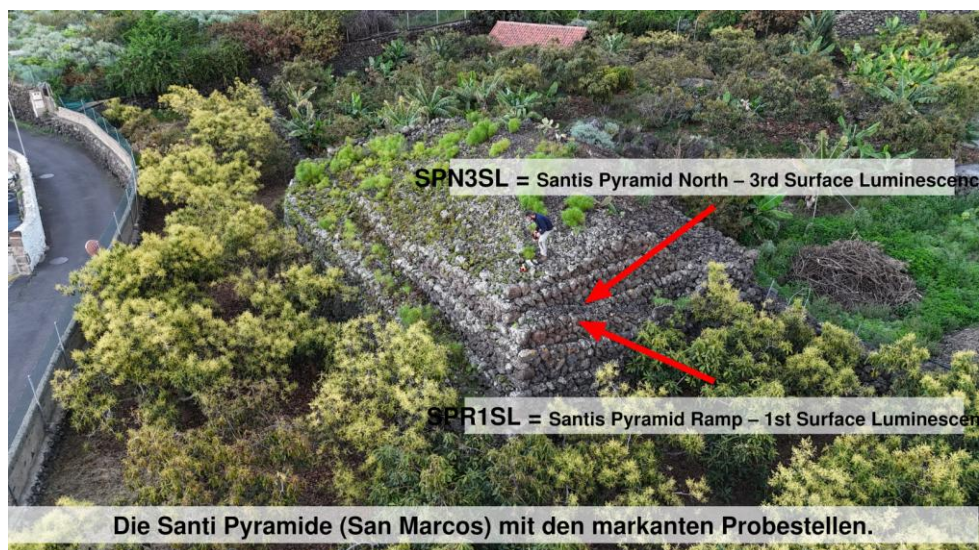


Fig. 1. Stepped dry-stone structure of Santi near San Marcos with the positions SPN3SL and SPR1SL marked in the slide set. A scale construction survey and a stratigraphic profile were not available. Source: Görlitz (2026), slide 54.

4. Preliminary OSL Findings and Dating Comparison

4.1 What OSL Dates

Surface luminescence makes use of the fact that daylight resets the luminescence signal in the outer regions of a rock. After subsequent shielding, the signal can build up again under natural radiation. Depending on sample geometry, depth profiles therefore allow statements about exposure or shielding events. Light permeability, mineralogy, dose rate, incomplete bleaching and model selection considerably influence the result (Liritzis 2011; Freiesleben et al. 2023). A surface age is therefore not automatically the construction date of an entire wall; it can also record stone working, relocation, repair or later covering.

4.2 The Transmitted Result

The presented project graphic groups several measurement series under the abbreviations SPE1SL, SPN2SL, SPN3SL, SPN4SL, SPN5SL, SPR1SL, SPT1SL and SPW1SL. Within a grey-shaded area, ‘4360 ± 330 BP’ is given. Alongside this, both very young signals and clearly older individual values occur. These “outliers” are explained by the two nuclear physicists Polymeris & Sánchez through sampling at the outer areas of the north wall and northern ramp. I.e. all samples that were recovered from the deep inner area of both dry-stone walls show considerably older individual ages, which were summarized in the medians.

The exact analysis of the individual measurements yields values from 2,200 to 5,100 BP for the two samples SPN3SL and SPR1SL. The listing of the individual values per wall structure is, however, not the target orientation in this article. Here it is about the possible influence of climate change, diffusion factors and trans-Mediterranean migrations at the end of the Neolithic.

4.3 Three Currently Non-Congruent Time Indications

For further publication, a formal data comparison is mandatory. First, the raw graphic gives 4360 ± 330 BP. If BP is referred purely arithmetically and conventionally to 1950, this would correspond to a central value around 2410 BC and a range of approximately 2740–2080 BC; this is not a technical recalculation of the OSL result. Second, the slide translates the range 3500–4700 BP as 2300–2700 BC.

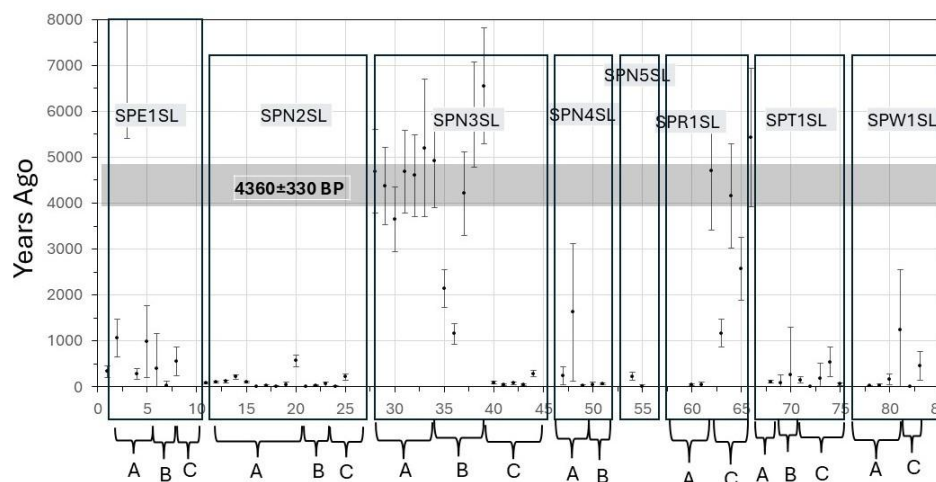


Fig. 2. Preliminary project graphic of the surface-luminescence measurements: 4360 ± 330 BP; y-axis 'Years Ago'. Reference year, raw data, dose rates and model parameters are not documented. Source: Görlitz (2026), slide 55.

5. Archaeological Significance

5.1 Conflict with the Established Canary Islands Chronology

The currently most robust chronological synthesis places the permanent indigenous settlement of the Canary Islands in the first centuries AD; for Tenerife, the Bayesian model gives approximately 155–385 AD (Santana et al. 2024). Genome-wide data at the same time trace the indigenous population predominantly to North African origin and record individuals from the 3rd century AD onward (Serrano et al. 2023). A robust construction event in the 3rd millennium BC would therefore lie more than two millennia before the currently accepted settlement phase. This does not make the finding logically impossible, but considerably increases the requirements for context, reproducibility and independent confirmation.



Fig. 3. The Canary Islands are home to large complexes with step pyramids. Our measurements demonstrate an alignment with stars, the Milky Way and landscape profiles. Using "Stellarium" we were able to calculate an age of 3000-2700 BC. Source: Görlitz & Rappenglück (2026), slide 48.

The separation of three statements is decisive: A stone surface can be old; the structure can have been built or rebuilt at a certain point in time; and its builders can have belonged to a certain cultural tradition. Each stage requires its own evidence. The current dataset touches the first statement, can address the second for the first time through the construction context (step pyramid as astro-alignment), but cannot yet answer the third without diagnostic material.

From this follow three levels of testing: The surface age requires a laboratory report and replication; the construction time additionally requires stratigraphy and independent datings; a Naqada connection finally requires diagnostic finds, provenance or biological mobility data.

5.2 A Testable Research Program

For a robust publication, the laboratory report should contain raw data, sample orientation and depth, mineral fraction, measurement protocols, doses, dose rates, depth profiles, model selection, reference year, uncertainties as well as exclusion rules. An independent replication on sealed contact surfaces is in progress. Sediment OSL, C₁₄ data from primary construction horizons and micromorphology can separate surface age and construction. The team is working on it.

In addition, the ABORA team already dated three further stepped structures in the north, south and east of Tenerife by means of OSL in July 2026. The preparation of the samples as well as the readout of the light traces will take place in the next 8-9 months. Should these samples show a similarly high age, they would further support the working hypothesis. In addition, the OSL team, in cooperation with the Canarian archaeologist Prof. Carmen del Arco, plans the redating of petroglyphs that show ship images very similar to those of the Naqada culture. The corresponding methodology using the novel Surface-Exposure dating – an improved methodology of OSL in daylight – is already under testing. Two known rock-art stations as well as a Curt-Ruts station have already been physically sampled. The results will likewise be available in 8-9 months.

A successful validation of the Surface-Exposure method could subsequently be carried out on corresponding ship depictions, which could form a maritime and seafaring-historical bridge to the redated rock images of Laja Alta as well as to further presumed ship depictions of the Naqada culture.

Accompanying the project, the Naqada hypothesis requires a defined feature matrix: rare technical characteristics, ceramics in secured context with determinable origin, raw-material and isotope signatures as well as, where applicable, ancient DNA. Image motifs or rock signs should be blind-coded and tested against regional controls. The team will provide this in the coming months in cooperation with two British archaeologists. The indicated connection to Mesoamerica is an independent, farther-reaching hypothesis and does not belong in the evidentiary argument of this contribution.

6. Conclusion

The presentation connects three factually justified fields of research: Holocene environmental changes, early maritime mobility and the archaeometric dating of stone structures that are difficult to classify. The flooding of the Persian Gulf could shift settlement areas; early seafaring is archaeologically documented; the Naqada culture emerged in an era of intense regional networking. From this there does not yet follow a demonstrated migration of a ‘Followers of Horus’ as far as Tenerife. It does, however, provide further evidence for the Chalcolithic spread of this population group from Mesopotamia via the Nile Valley as far as the Levant and beyond, which has been undervalued for decades.

The scientifically strongest point of departure of the project is therefore not the immediate confirmation of a maximal route, but the transparent publication of the Santi dataset. If the surface age is confirmed by complete documentation, construction context and independent measurements, a chronological finding that must be taken seriously emerges. Only subsequently is it to be examined whether culturally diagnostic traces bear a connection to Naqada or other Mediterranean traditions. In this graduated form, the hypothesis is clear, risky in the good scientific sense and falsifiable.



Fig. 4. Is it really so difficult to imagine that the highly developed reed sailing vessels of the Naqada culture were capable of navigating via several intermediate stations as far as the Atlantic? The author's ABORA expeditions have documented that keelless reed sailing vessels can even tack slightly against the wind through the use of leeboards. Source: Görlitz (ABORA IV, 2019), slide 58.

Funding

No information about funding

Acknowledgements

The slide set acknowledges Jorge Sanjurjo Sánchez (Universidade da Coruña) and Georgios S. P. Polymeris (NCSR Demokritos) as participating luminescence researchers. Dr. Michael Rappenglück (archaeoastronomer) is working on the archaeoastronomical alignments of these cult structures on Tenerife. Thanks, are also due to the Association for Experimental Archaeology and Research Chemnitz e.V., which supports this project with donations: www.abora.eu.

Data Availability and Conflicts of Interest

The basis is the slide set 'Archaeology and Climate', the trailer and the preliminary OSL graphic; the laboratory report and raw data were not available. Conflicts of interest and funding are to be added.

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Norway

ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 47-52

Fact checking Climate Science

Four Alleged Lines of Proof for CAGW: A Critical Analysis

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Abstract

The presentation analyses the four existing lines of proof for the CAGW hypothesis and concludes that all four fail:

The first line of proof is the “proof by contradiction”: the observed temperature change can only be explained by the known climate forcings if CO₂ is responsible for all the warming.

However, the ensemble of forcings used contains only two natural forcings — a marginal influence from the sun and intermittent cooling from volcanic eruptions. This would require either that temperatures before 1850 were essentially “flatlining”, or that the ensemble is incomplete. Since temperatures before 1850 were highly dynamic, it follows that the ensemble underlying this proof lacks an unknown but significant forcing that could readily account for most of the warming observed since 1850.

Correlation alone does not constitute scientific proof in the absence of established causation; there is therefore no requirement to disprove any correlation. Nevertheless, no timescale exhibits a convincing and consistent correlation between CO₂ and temperature — neither over 120 years, 11.000 years, 400.000 years, 600 million years, nor 4.5 billion years.

The water cycle of evaporation, convection, condensation, cloud formation and precipitation is poorly represented in climate models. As a result, almost all models predict more warming than has been observed.

Radiation physics is unambiguous: a doubling of CO₂ by itself produces approximately 1 °C of global warming. The climate system, however, contains strong feedbacks, both positive and negative. Determining the net warming that would result from a doubling of CO₂ once all feedbacks are included would require a far better understanding of the climate system than we currently possess.

The presentation concludes with a perspective on the nature of climate change. It is suggested that a warming climate essentially consists of climate zones shifting poleward away from the equator and expanding in extent — thereby providing more habitat for all species and enabling greater food production for humankind.

Keywords: Proof of CAGW; greenhouse effect; climate models; climate change.

Submitted 2026-08-03, **Accepted** 2026-08-15. <https://doi.org/10.53234/scc202426/08>

1. Introduction

In Western Europe, most politicians and almost all mainstream media have accepted the claim that “the science is settled”, meaning that the Catastrophic Anthropogenic Global Warming (CAGW) hypothesis, promoted by most climate scientists, can no longer be disputed.

The core of this hypothesis is the central claim of the IPCC’s Sixth Assessment Report: that all warming over the past century has been caused by human forcings, primarily greenhouse gas

emissions. Yet the foundation of good science is that every claim advanced by scientists can and should be open to challenge. Science is, by its very nature, never settled.

One would therefore expect that when scientists (for non-scientific reasons such as ethics) nevertheless demand immunity from debate and criticism, their evidence must be exceptionally strong and their conclusions clear and robust. To determine whether this is indeed the case, this presentation analyses the four lines of evidence advanced in support of the anthropogenic global warming hypothesis.

After examining whether humans are responsible for all recent warming (AGW), it remains necessary to assess whether the projected warming would in fact be catastrophic (CAGW). Accordingly, the nature of climate change and its effects on nature and humanity are also examined from the perspective of recent history.

2. Four lines of proof for the CAGW hypothesis

The presentation analyses the four lines of proof commonly advanced for the CAGW hypothesis:

1. Proof by contradiction
2. Correlation between CO₂ concentration and temperature
3. Climate models
4. (Radiation) physics

It is noteworthy that the first of these — proof by contradiction — is accepted as rigorous proof only in mathematics. Nevertheless, it constitutes the principal argument for anthropogenic warming presented by the IPCC in its Sixth Assessment Report. The second and third lines of proof are also frequently invoked. Yet correlation without demonstrated causation, and models without experimental verification, cannot be regarded as scientific proof either. The only potentially rigorous scientific proof would be the fourth: physics. However, because the other three are so widely used and appear to persuade many people, all four are examined in this presentation.

2.1 Proof by contradiction

In the case of CO₂ being assumed as the cause of all warming over the past century, “proof by contradiction” means the following: “The observed temperature change can only be explained by the known climate forcings if CO₂ is responsible for almost all of the warming.” This constitutes the principal line of proof presented by the IPCC in its Sixth Assessment Report (AR6, 2021), specifically in FAQ 3.1, and is accompanied by the Figure 1 overleaf.

However, the ensemble of forcings employed contains only two natural components: a marginal influence from the sun and intermittent cooling spikes from volcanic eruptions. All other forcings are anthropogenic and were absent before 1850. This implies that either the black temperature line in the above figure must have been essentially flat before 1750, or the ensemble is incomplete.

Since temperatures before 1850 were in fact highly dynamic — exhibiting, for example, a roughly thousand-year cycle with 1.5–3 °C of warming in the Northern Hemisphere and approximately 0.5 °C globally — it follows that the ensemble of forcings used in the proof omits an unknown but significant forcing. Given that this is a thousand-year cycle and that the previous warming peak occurred about 1.000 years ago, the cycle may well have been responsible for most of the warming observed since 1750. We do not yet know the nature of this forcing, but we know that it exists.

This illustrates why proof by contradiction can be valid only in domains where every variable is precisely known, such as mathematics. In climate science we do not know what we do not know, and major forcings have evidently been overlooked.

It is therefore clear that the proof by contradiction fails.

FAQ 3.1: How do we know humans are causing climate change?

Observed warming (1850-2019) is only reproduced in simulations including human influence.

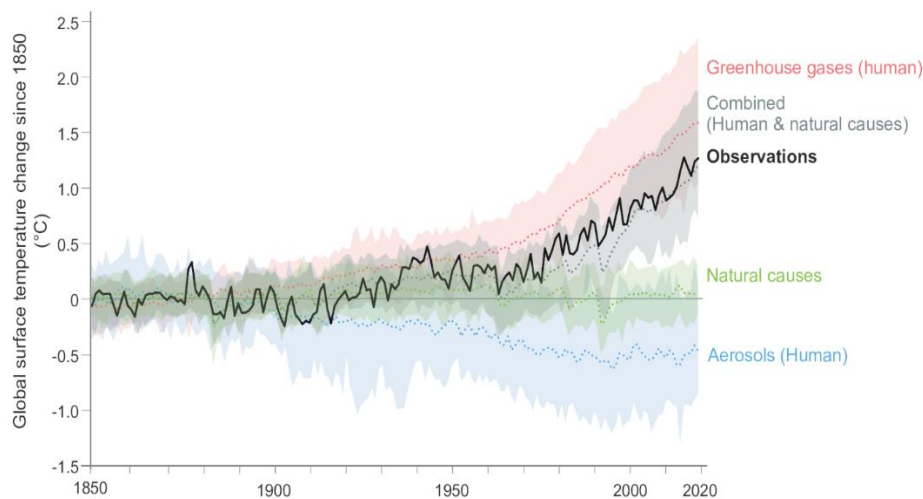


Figure 1: FAQ 3.1: proof by contradiction from AR6 - IPCC

2.2 Proof by correlation

Correlation is not regarded as scientific proof in the absence of demonstrated causation. In climate science, however, this principle is inverted: the alleged correlation is itself taken as proof of causation.

This alone is sufficient to dismiss the correlation argument. Nevertheless, because the idea appears intuitively persuasive to many people, the claimed correlation is examined here in any case.

The apparent correlation between CO₂ and temperature over the past 120 years strikes many as highly convincing. In reality, the only correlation is that both quantities have risen. The temperature record displays a distinctive “Z” shape: a similar warming trend in the first 40 years and in the last 50 years, interrupted by a cooling period between 1940 and 1970 — a pattern entirely absent in the CO₂ concentration record. Actually, when atmospheric CO₂ began its steep post-Second World War rise, global temperatures had just entered a 30-year cooling phase.

By way of illustration, the correlation between CO₂ and, for example, the number of global birthdays is far stronger — yet this does not prove that CO₂ causes birthdays worldwide, see Figure 2 overleaf.

There is no timescale on which a convincing and consistent correlation between CO₂ and temperature can be found — neither over 120 years, 11 000 years, 600 million years, nor 4.5 billion years.

The only strong correlation appears on the 400 000-year timescale of the ice-age cycles. In that case, however, the temperature change precedes the change in CO₂ concentration, so the direction of causation runs from temperature to CO₂.

It can therefore be concluded that the proof by correlation also fails.

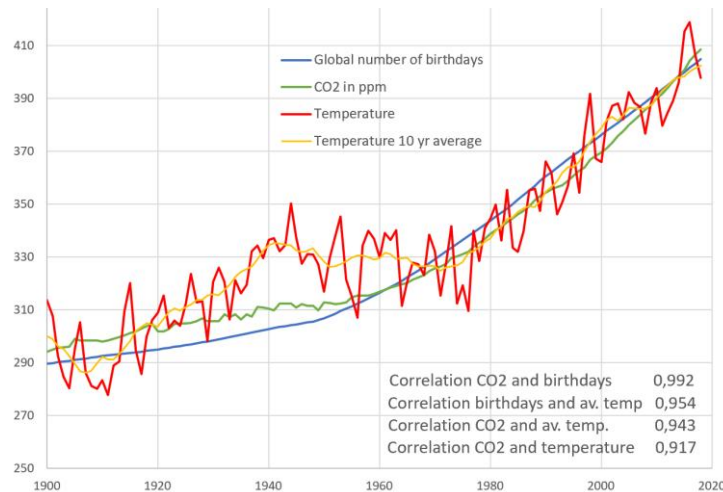


Figure 2: Correlation of birthdays, CO2 concentration, temperature and 10 yr av. temperature

2.3 Proof by climate models

The principal factor controlling atmospheric energy flow is the water cycle — evaporation, convection, condensation, cloud formation and precipitation. All five components of this cycle are poorly represented in climate models. This is demonstrated by every comparison between observations and model output, most notably by the so-called “missing tropical hot spot”, see Figure 3.

The tropical hot spot is a model-predicted amplification of the surface warming that roughly doubles the temperature increase at approximately 12 km altitude across the entire tropical region. Such a feature would constitute a major warming event over half the Earth’s surface. Yet none of the numerous radiosonde observations conducted over recent decades has ever detected this predicted but elusive hot spot.

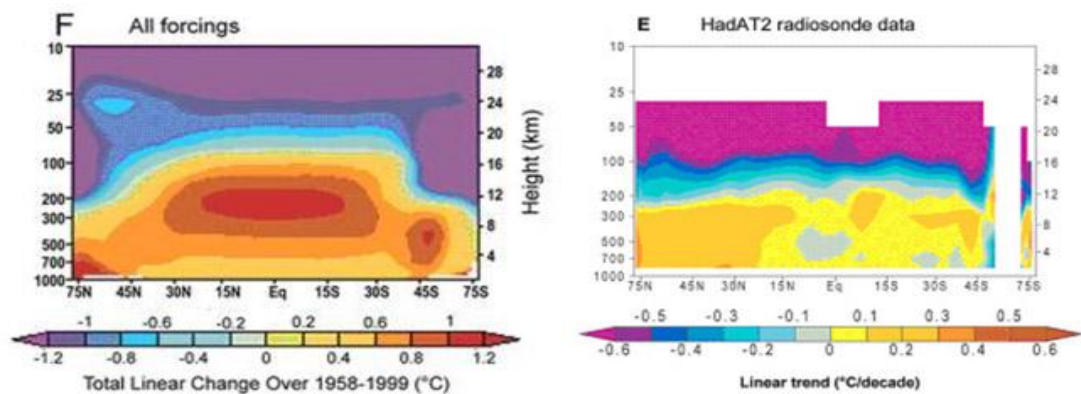


Figure 3: Hotspot predicted by the models (left) versus radiosonde observations (right)

This is one of many demonstrations that climate models are far from capable of describing atmospheric temperature and energy flows with any reliability.

The proof based on climate models therefore fails as well.

2.4 Proof by (radiation) physics

Radiation physics is unambiguous: a doubling of CO₂ by itself produces approximately 1 °C of global warming. There is no scientific debate on this point, although the IPCC revised the value from 0.9 °C in AR4 (2007) to 1.2 °C in AR6 (2021).

The climate system, however, contains numerous positive and negative feedbacks — and possibly

even a thermostat — that may strongly modify this 1 °C effect. The IPCC AR6 claims that the 1 °C warming per CO₂ doubling is amplified by the combined positive and negative feedbacks (primarily the increase in water vapour) to approximately 3 °C. This would require a feedback factor of 0.675, which lies very close to the runaway threshold: any modest change in the water-cycle feedbacks could trigger a thermal runaway. Given that no thermal runaway has occurred for millions of years, such a high feedback factor is extremely implausible.

In particular, because so many aspects of the water cycle remain poorly understood, science cannot credibly claim this critical feedback factor with any accuracy. Doing so would require a far better understanding of the climate system than we currently possess.

The only firm conclusion that physics can offer is that a doubling of CO₂ in isolation would produce roughly 1 °C of warming — a change that would raise little concern. At the present rate of CO₂ increase (approximately 3 ppm per year), the next doubling, and the associated 1 °C warming, would not be expected until around 2168.

The combined effect of all climate feedbacks, however, could produce a completely different outcome from a CO₂ doubling. Nature is full of negative feedbacks, while positive feedbacks are rare. No one knows what the resulting temperature change would actually be.

Thus, physics cannot provide proof for the CAGW hypothesis either.

3. Conclusion

Analysis of the four lines of proof advanced for the CAGW hypothesis shows that none of them provides scientific proof for the hypothesis.

This does not mean that the hypothesis has been proven false; it simply means that no scientific proof for it has been established.

Such a finding should lead to a climate policy different from the present one, which rests on the assertion that “the science is settled” and treats CAGW as a political dogma. If CO₂ is not the (main) cause of the recent warming, the trillions of dollars spent on climate mitigation policies may be wasted, and the resulting damage to our prosperity — as well as to the economic advancement of developing nations — may prove to have been in vain.

The alternative is to do what humanity has always done: adapt to climate change. Even Nobel laureate and climate economist Professor William Nordhaus — for decades the leading authority on the economic costs of climate change and himself a proponent of the CAGW hypothesis — concluded in his Nobel Prize acceptance speech in Oslo that attempting to combat climate change through CO₂ reduction is far more costly than adapting to it.

In the absence of solid scientific proof for CAGW, the only prudent course is therefore to shift from a mitigation policy to an adaptation policy.

The warming climate is actually very comforting to humanity. However, the prevailing narrative of global warming treats the present or recent climate as ideal for every region and interprets all climatic changes as dramatic local threats to biodiversity, food production, disease patterns, hunger and human well-being.

In this presentation it is suggested that a warming climate essentially consists of climate zones shifting poleward away from the equator while expanding in area. With a 2 °C warming, Berlin would acquire roughly the present climate of Mannheim; New York that of Washington, D.C. Why would any species suffer or face extinction as a result? And is it an established fact that living conditions deteriorate as one moves southward? The millions of people who travel south precisely during the hottest part of the year would suggest otherwise.

Because warming is limited in the tropics and increases with latitude towards the Arctic, the effect of global warming is that climate zones shift northward and become larger. In essence this provides more space and more food for virtually all species, with the possible exception of those

adapted to the tundra and steppe biomes.

This pattern is illustrated by the climatic changes that the Great European Plain has undergone through successive ice-age cycles. In the present interglacial the plain is occupied mainly by temperate broadleaf and mixed forest, with boreal forest in the northern part. During glacial periods, however, almost the entire plain is transformed into tundra and steppe on permafrost, driving all present-day plants and animals back into small Mediterranean coastal and Balkan refugia.

The Holocene warming of 5–10 °C expanded their habitats more than a hundred-fold. Further warming would enlarge those habitats still more. In general, therefore, warming benefits the great majority of species, with the exception of the few that can survive only in a sub-Arctic climate, such as the reindeer. Yet even these species have survived hundreds of warm interglacials, just as the species of the temperate zones have survived hundreds of ice ages.

Nature always adapts to climate change — and so should we.

A summary of the lecture given by the author on IKEK 17, the EIKE climate conference in Halle, Germany: (www.youtube.com/watch?v=IKEKxxxxxx)

Funding

Not specified.

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Norway

ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 53-57

Presentation of the book:

“The Frontier of Climate Science: Solar Variability, Natural Cycles and Model Uncertainty”

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Abstract

This article summarizes my public presentation of the book *The Frontier of Climate Science: Solar Variability, Natural Cycles and Model Uncertainty*. The book reviews the main current open issues in climate science: the questionable near-total attribution of post-1850 warming to anthropogenic causes alone, the use of unrealistic emission scenarios (SSPs), the wide uncertainty range in equilibrium climate sensitivity, the gap between satellite and surface temperature records, the failure of models to reproduce past warm periods (the Holocene Thermal Maximum, the Roman Warm Period, the Medieval Warm Period), and the potentially underestimated role of solar variability mediated by cosmic rays and cloud cover. Building on these observations, empirical modelling is proposed based on astronomically-derived cycles - linked to the gravitational interactions among the Sun, the Moon, and the major planets - and that reproduces the observed global temperature record with greater fidelity. This yields a substantially lower estimate of climate sensitivity to a doubling of CO₂ (1-1.5 °C) than that used in CMIP models, with important implications for climate policy: moderate warming over the course of the 21st century would be manageable primarily through adaptation strategies, rather than through costly net-zero emission-reduction policies.

Keywords: Natural climate variability; climate sensitivity; astronomical cycles; solar forcing; cosmic rays; urban heat island; SSP scenarios; Paris Agreement; climate adaptation.

Submitted 2026-07-12, Accepted 2026-08-01. <https://doi.org/10.53234/scc202608/07>

1. Introduction

Public debate on climate change tends to treat the human contribution to global warming as a settled fact, while pushing discussion of the natural component of climate variability to the margins. However, the current state of climate science is much more complex and challenging.

At the 17th EIKE International Conference, I presented the scientific arguments developed in my recent book *The Frontier of Climate Science: Solar Variability, Natural Cycles and Model Uncertainty* (Scafetta, 2026), which draws on a review of roughly 650 peer-reviewed papers and includes forewords by M. Santosh, A. Prestininzi, and J. Curry. The book has also been endorsed by the International Association for Gondwana Research and by the CERI Research Centre at Sapienza University of Rome. Translations of the book in Italian, German, French and Spanish are also available.

The central thesis is that the global climate models used by the IPCC (2021) systematically underestimate natural variability - of oceanic, solar, and astronomical origin - and that this gap leads to an overestimation of the climate risk expected for the 21st century, with significant consequences for public policy.

2. The Limits of IPCC Attribution

In its Sixth Assessment Report (2021), the IPCC attributes essentially 100 % of the warming observed between 1850 -1900 and the present to anthropogenic forcings alone, chiefly rising CO₂, leaving an almost negligible role for solar, volcanic, and internal variability. This conclusion rests on a comparison between simulations run with natural forcing only - which yield an essentially flat temperature trend - and simulations that also include the anthropogenic component, the only ones able to reproduce the observed warming.

The critical issue, from the standpoint of scientific method, is that the "nature-only" scenario cannot be empirically validated: there is no parallel Earth free of human emissions against which the prediction could be checked. It is therefore a non-falsifiable counterfactual, and the near-total attribution of warming to human activity remains, in this sense, a model output rather than an experimentally established fact.

3. Emission Scenarios and the Paris Target

Alarm over future climate risk rests largely on the Shared Socioeconomic Pathway (SSP) scenarios, including SSP1 (compatible with net zero), SSP2, SSP3, and SSP5. Most of the more alarming projections in circulation are based on SSP5, now widely regarded as implausible, alongside SSP3. The most realistic scenario, consistent with the emission trajectories countries are actually following, is instead SSP2, which - according to the empirical climate change estimates presented in the book - would also keep warming at or below the 2 °C threshold set by the Paris Agreement (2016) without requiring *Net-Zero* to be reached. This point carries political weight: net-zero policies, pursued chiefly in Europe (which account for a minority share of global emissions at around 6-7 %), would have a negligible climate impact at the planetary scale, while imposing very high economic costs.

4. Climate Sensitivity and Model Uncertainty

The principal source of uncertainty in climate models remains equilibrium climate sensitivity (ECS) - the warming expected from a doubling of atmospheric CO₂. Estimates available since 1979 have not narrowed over time - if anything, the range has widened in the most recent assessments - and across the current CMIP models it spans from 1.8 to 5.6 °C, a wide spread that largely reflects uncertainty in how clouds are represented, which are likely the true "*regulator*" of the climate system.

Comparison between models and observations suggests that only low-sensitivity models are consistent with the data, while medium- and high-sensitivity models tend to overstate warming (models "*running too hot*"). If satellite records - which show less warming than surface records - are taken as reliable, the conclusion follows that practically all of the global climate models (GCMs) currently in use systematically overestimate future warming.

5. Satellite Observations and the Urban Heat Island

A further point of discussion concerns the discrepancy between satellite data (e.g., the UAH MSU record) and surface temperature data. Over the ocean the two records are broadly consistent; over land, however, the surface record shows significantly greater warming. One possible explanation is the persistence, in the land surface record, of an incompletely removed urban heat island component linked to the expansion of urbanized areas around weather stations. If correct, this would imply that the warming measured over land is partly overstated relative to the genuine climate signal.

6. Past Warm Periods Missing from the Models

An important test of model credibility is their ability to reproduce past climate variability. The models used by the IPCC reproduce neither the mid-Holocene Thermal Maximum (6,000 - 8,000 years ago), since it finds no counterpart in a corresponding CO₂ maximum (the so-called "temperature-CO₂ conundrum"), nor the Medieval Warm Period, as the IPCC itself explicitly acknowledges for periods prior to 1300. Indirect evidence - from Viking farming settlements in Greenland, to wood remains found beneath alpine glaciers, to the discovery of the Similaun Iceman in an area then free of ice - indicates that these warm periods were real and, in some regions, of an intensity comparable to or greater than today's.

The reconstruction of the last two thousand years reveals a recurring succession of warm and cold phases - the Roman Warm Period, the Dark Ages Cold Period, the Medieval Warm Period, the Little Ice Age, the Modern Warm Period - consistent with a roughly millennial cycle that repeats over earlier millennia as well, as shown by Alpine records. The fact that current models fail to reproduce this oscillation suggests the absence of a relevant physical mechanism, one plausibly also partly responsible for recent warming.

7. Solar Forcing, Cosmic Rays, and Cloud Cover

The correspondence, sustained over millennia, between proxies for solar activity (such as carbon-14) and climate records appears difficult to reconcile with the standard models' assumption that the Sun has had a negligible effect on climate since 1850. Two questions remain open: the true magnitude of total solar irradiance variations (with the ACRIM and PMOD reconstructions in disagreement), and the existence of a second solar-forcing mechanism, independent of luminosity alone, linked to the modulation of galactic cosmic-ray flux by the solar magnetic field.

The mechanism proposed - traceable to the work of H. Svensmark - holds that strong solar activity strengthens Earth's magnetic shield, reducing cosmic-ray flux, atmospheric ionization, and consequently cloud formation, with a net warming effect. Observations of Forbush events (sharp drops in cosmic-ray flux associated with solar storms) reportedly show a measurable decrease in cloud cover in the following days, offering direct empirical support for this mechanism.

8. A New Paradigm: The Astronomical Theory of Climate Cycles

Just as Milankovitch theory explains the large-scale glacial-interglacial oscillations through orbital variations induced by gravitational interaction among the planets, the sixth part of the book proposes extending the same principle to shorter time scales. The relative configurations of the giant planets (Jupiter, Saturn, Uranus, and Neptune) generate a set of frequencies - so-called orbital invariant inequalities - clustering around periodicities of roughly 45, 60, and 90 years (the Gleissberg cycles), 200 years (the de Vries/Suess cycle), 1,000 years (the Eddy cycle), and 2,318 years (the Bray-Hallstatt cycle). Each of these periodicities finds an independent counterpart in both climate records and solar activity records.

A model built on three principal harmonics — the solar dynamo cycle (about 10.87 years), modulated by the Jupiter orbital cycle and the Jupiter-Saturn tidal cycle (about 9.93 years) — reproduces, through beating, millennial and secular (100 -150 year) cycles plus a roughly 60-year multidecadal cycle consistent with the observed global temperature record, including the 1940s warming that standard models fail to explain.

9. Implications for Climate Policy

If the natural component of the warming observed over the last 175 years were equal to or greater than 50 %, as argued here - with a further roughly 20 % attributable to incompletely filtered urban heat island bias - the anthropogenic contribution would be reduced to about one-third of the total warming, corresponding to a climate sensitivity of around 1-1.5 °C per CO₂ doubling, considerably lower than the 1.5-6 °C range typical of CMIP models.

In this framework, the warming expected over the course of the 21st century would be moderate and manageable primarily through region-specific adaptation policies, rather than through net-zero mitigation policies, whose economic costs, on this analysis, would be disproportionate to the global climate benefits expected, especially if adopted unilaterally by economies that account for only a minority share of global emissions.

It should also be noted that the millennial and multidecadal cycles described here are currently in an ascending phase, but the 60-year component is expected to enter a negative phase between 2060-2070 and 2100, while the millennial component should begin a slow decline after 2060: this makes plausible a further slowdown, or a new hiatus, in global warming toward the end of the century, before the Milankovitch orbital cycles, operating on scales of thousands of years, drive the climate system back toward a new glacial phase.

10. Conclusions

The argument developed in the book does not deny climate change or the human contribution to it but rescales its expected magnitude in light of a broader natural variability of oceanic, solar, and astronomical origin, not adequately represented in the global climate models currently in use. A fuller understanding of the underlying physical mechanisms - particularly the role of clouds, and the second solar-forcing channel linked to cosmic rays - appears indispensable before numerical models can be fully trusted for climate scenario prediction and related risk assessment. In the meantime, an empirical approach based on observed cycles suggests a more modest level of 21st-century climate risk than currently assumed, and points policy priorities toward adaptation rather than net-zero mitigation.

The positions set out here belong to an ongoing scientific debate and are subject to critical discussion within the climate science community; interested readers are encouraged to consult both the book from which this article is drawn and the literature that critically engages with its conclusions.

Author Biography

Nicola Scafetta is Professor of Atmospheric Physics and Oceanography at the Department of Earth, Environmental and Resource Sciences, University of Naples Federico II. Trained as a physicist, he has conducted research in the United States, focusing in particular on solar variability, astronomical cycles, and their relationship to natural climate variability, as well as on the analysis of uncertainty in global climate models. He is the author of numerous peer-reviewed papers on climate sensitivity and empirical climate modeling and several books.

Funding: None.

Co-Editor: Stein Storlie Bergsmark

Acknowledgements: None

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- See book presentation on the following page!**

SCIENTIFIC MONOGRAPH • CLIMATE PHYSICS & ASTRONOMY

The Frontier of Climate Science

Solar Variability, Natural Cycles and Model Uncertainty

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Professor of Oceanography, Meteorology & Climatology
University of Naples Federico II

ABOUT THIS VOLUME

This work critically reviews the **scientific foundations of modern climate theory**, the evolution of IPCC assessments, and the **limits of global climate models (GCMs)** when confronted with observations. It investigates **natural variability across multiple timescales** — oceanic oscillations, solar variability, astronomical cycles — integrating satellite data, paleoclimate reconstructions, and empirical modelling.

KEY TOPICS

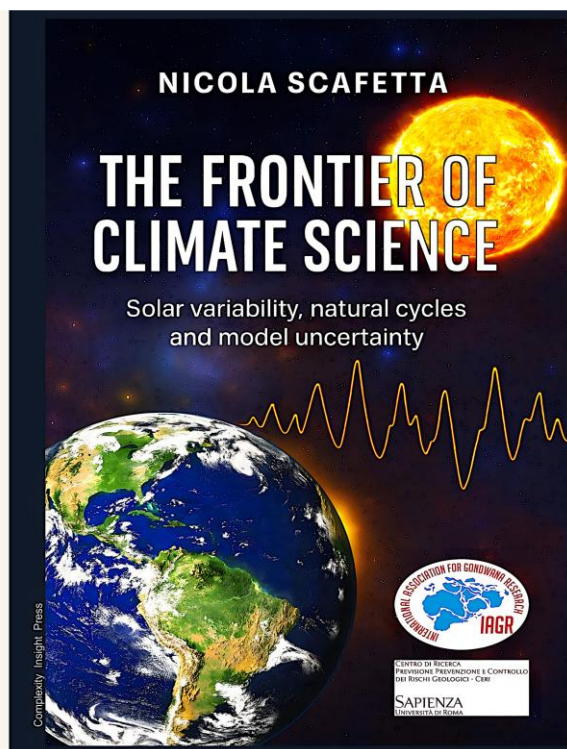
- Solar variability and its influence on the climate system
- Multidecadal and millennial natural cycles
- Structural limitations of current climate models
- Divergences between observations and simulations
- Implications for climate projections and policy

INTENDED AUDIENCE

Researchers, climatologists, atmospheric physicists, university students, policy-makers, and readers seeking a scientifically grounded understanding of climate dynamics.

AVAILABILITY

ISBN : 979-1298617605 (English, paperback, gray-scale)	• ISBN : 979-1298617612 (English, hardcopy, color)	• ISBN : 979-1298617620 (Italian, paperback, gray-scale)
ISBN : 979-1298617636 (German, paperback, gray-scale)	• ISBN : 979-1298617643 (French, paperback, gray-scale)	• ISBN : 979-1298617650 (Spanish, paperback, gray-scale)



How well do we truly understand Earth's climate? What natural forces remain beyond our grasp?

The Frontier of Climate Science explores climate dynamics through **physics, complex systems, and astronomy**, synthesising several decades of peer-reviewed research.

From this evidence emerges a **balanced view of climate risk**, favouring **pragmatic adaptation** over narrowly defined policy pathways such as Net Zero. Rich in insights and analytical approaches, the book helps readers understand climate variability, assess risks, think critically, and explore key open questions in climate science.

The volume is endorsed by the **IAGR** and by the **CERI – Sapienza University of Rome**. It includes forewords by Prof. M. Santosh, Prof. Alberto Prestinini, and Prof. Judith Curry.

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FOREWORDS & ENDORSEMENTS

- Prof. M. Santosh
- Prof. Alberto Prestinini
- Prof. Judith Curry
- International Association for Gondwana Research (IAGR)
- CERI – Sapienza Università di Roma

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SCC Publishing
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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 58-64

Resumption of Nuclear instead of even more Wind Power

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Abstract

On April 15, 2023, Germany took its last three commercial nuclear power plants off the grid. Only thirteen years before then, in 2010, 17 reactors had supplied about one third of the German electricity consumption. Since then, Germany has expanded wind and solar electricity production capacity far beyond need, but its availableness remains as low as 25 % for wind and 13 % for solar power. Installed weather-dependent electricity production capacity already exceeds 200 GW, while peak demand has declined to 80 to 85 GW. Renewable droughts during dark-winter or hot-summer periods without wind, negative prices and rising imports show that surplus capacity does not mean reliable supply. In addition, the grid-expansion and system costs dominate the bill, not the turbine prices; household electricity charges have roughly tripled since 2000 and German industrial electricity prices are now among the highest in world, more than double compared to China or the USA. Nevertheless, German power-sector CO₂ intensity remains at the ten-fold of that of France, which gets about 70 % of its electricity from its own nuclear plants. Former German nuclear power plant managers and the Radiant Energy Group judge that about 12 GW of existing nuclear power plants could return to the grid in three to six years for some €18 billion. Resumption of nuclear power is therefore the shorter route to lower system costs, fewer imports and lower emissions than even more mandated wind-power expansion.

Keywords: Nuclear energy; Germany; energy transition; wind power; photovoltaics; system costs; grid stability; reactivation

Submitted 2026-08-28, Accepted 2026-08-30. <https://doi.org/10.53234/scc202608/16>

1. Introduction

This article summarizes the presentation given on 26 June 2026 at the 17th International EIKE Climate and Energy Conference (IKEK-17) in Halle (Saale). The political basis is the AfD federal election manifesto of 2025, which states that existing nuclear power plants (NPP) should be returned to service as quickly as possible [1]. The technical basis is that electric generation must equal the load in every second, whereas weather-dependent fluctuating electricity production capacity based upon wind and sunlight has surpassed twice the maximum German demand while base-load production capacity has been taken off the grid too quickly.

In 2010, 17 reactors were still operating: six boiling-water and eleven pressurized-water units. In the North these were Brunsbüttel, Brokdorf, Krümmel, Unterweser, Grohnde and Emsland; in the South Biblis A and B, Grafenrheinfeld, Philippsburg 1 and 2, Neckarwestheim 1 and 2, Gundremmingen B and C, and Isar 1 and 2 [2]. For about three decades they supplied roughly one third of the German electricity. On April 15, 2023, Germany took its last three commercial NPPs off the grid. All German NPPs are currently being dismantled.

2. Installed capacity, utilization and land take

A comparison compiled by Hofmann-Reinecke for 2024, using data from the Federal Statistical Office and related series, shows the gap between nameplate capacity and annual output. German wind farms, with a capacity of 63.5 GW, generated 24.5 per cent of their nameplate capacity; Spanish wind farms, with a capacity of 30.8 GW, generated 22.5 per cent. German photovoltaic installations, with a capacity of 81.5 GW, generated 10.4 per cent; Spanish

photovoltaic installations, with a capacity of 33.2 GW, generated 15.3 per cent [3].

Energy-Charts, which draw on the market master data register, recorded around 80 GW of wind power (69 GW onshore, 10 GW offshore) and 120 GW of photovoltaic power at the beginning of March 2026, making a total of around 200 GW [4]. Germany's peak load stands at around 80 to 85 GW. Periods of surplus generation are therefore structural in nature.

Nevertheless, the Renewable Energy Sources Act (EEG) and the Offshore Wind Energy Act set targets for 2040 of 400 GW of photovoltaic capacity, 55 GW of offshore wind energy and 160 GW of onshore wind energy – totaling 615 GW – whilst assuming the same peak load [5, 6]. The BDEW's 'Spotlight' report from June 2026 records an installed capacity of 118 GW of photovoltaics, 10 GW of offshore wind energy and 68 GW of onshore wind energy at the end of 2025 [7].

The federal law requires the federal states to designate approximately 2 per cent of their territory for onshore wind energy. Baden-Württemberg was allocated 1.8 per cent for wind energy and 0.2 per cent for ground-mounted photovoltaic installations. Commercial and industrial areas already account for around 2.5 per cent of the state's territory. By the end of 2023, only 0.5 per cent of this area had been designated for wind energy [8].

New installations of photovoltaic systems totaled 17.6 GW in 2024 and are estimated at 17.7 GW for 2025. Plug-in balcony systems contributed 0.4 GW in 2024 and 0.5 GW in 2025. Ground-mounted systems alone accounted for 8.4 GW in 2025 [7]. Private rooftop systems remain very popular with households. The photovoltaic systems mandated in public buildings place a triple burden on the taxpayer: he has to pay at the time of purchase, during operation and upon subsequent decommissioning.

3. Investment and system costs

Gross investment in the electricity supply sector rose from 12.9 billion euros in 2016 to 21.4 billion euros in 2023 and 31.5 billion euros in 2024, with estimates of 40.8 billion euros for 2025 and forecasts of 44.8 billion euros and 46.6 billion euros for 2026 and 2027 respectively [9]. The lion's share is accounted for by transmission and distribution networks, with a smaller proportion going to power plants. Centralized power plants with a capacity of around 1.4 GW – or up to 1.6 GW in the case of an EPR reactor unit – fed into a grid that became sparser towards the periphery. Decentralized wind and solar power plants reverse this topology and require an additional collection grid, which is enormous and whose construction has merely been started.

A system cost study commissioned by EnBW (Energie Baden-Württemberg) and carried out by Aurora Energy Research estimates the cost of the energy transition up to 2045 at more than three trillion euros [10]. The study assumes a figure of 3.2 trillion euros, which, spread over 20 years, corresponds to around 160 billion euros per year. As German end-user prices are already among the highest in the world [7, 9], further investment expenditure must be covered through additional tariffs or taxation. This approach, without recurring extra-budgetary support, is not financially viable.

4. The phase-out and its operational consequences

The civilian use of nuclear energy began in the 1960s. Today, the World Nuclear Association lists a total of 36 power reactors in Germany as having been permanently decommissioned [11]. Following German reunification in 1998, the Rheinsberg and Greifswald plants in the former German Democratic Republic were decommissioned immediately. The 2001 consensus under Chancellor Schröder, SPD, set the remaining operating lifetimes of all the other German NPPs. Stade and Obrigheim were taken off the grid in 2005. In 2010, the CDU/FDP government extended the remaining operating lifetimes. Following the Fukushima accident in March 2011, caused by a

tsunami in which around 20,000 people lost their lives, the reactors commissioned before 1980, as well as Krümmel, were shut down immediately. The remaining NPPs followed in the years after. Emsland, Neckarwestheim 2 and Isar 2 were the last German NPPs to be taken off the grid on April 15, 2023 [12].

Nuclear energy – From the 2000s to today

- Nuclear phase-out at the beginning of the 2000s under the red-green Chancellor Schröder - nuclear consensus in 2001
- Obrigheim (1969, BW) and Stade (1972, NI, 672 MW) were shut down in 2005
- Extension of the operating time through the 11th amendment to the Atomic Energy Act under Chancellor Merkel in 2010 (CDU-FDP)
- The other nuclear power plants then had to be taken offline one by one.
- The last three nuclear power plants, Emsland, GKN II, and Isar 2, went out of operation on April 15, 2023 (Scholz, SPD-FDP-Greens)



Philippsburg (SWR+DWR, 1979-2019)



Figure 12: Timeline of the German nuclear phase-out.
Shown are pictures taken by the author.

The gross generation statistics show that nuclear power's share has fallen over the years from one-third to zero in Germany, as well as an over-all decline in domestic generation [9]. Nowadays, when wind and solar power generation is low, Germany relies on imports, primarily from NPPs in France and Switzerland. In 2025, the physical net import balance from France amounted to around 19.6 TWh, as shown in the conference slides. The French energy mix consists to 69 to 75 per cent of nuclear power.

In Baden-Württemberg, gross generation fell from 53,899 GWh in 2022 to 37,147 GWh in 2023 (a reduction of 31 per cent). Nuclear output in this state fell from 11,142 GWh to 1,947 GWh (–82.5 per cent) in 2023; the 2023 figure represents the operation of Neckarwestheim 2 from January to April 15 [13]. The state has since been a structural importer of about one third of its electric power.

The Iberian Peninsula blackout was cited as a warning for the system. At the critical moment, approximately 62 per cent of generation came from photovoltaic sources and 12 per cent from wind, whilst several of Spain's seven nuclear units were offline, as shown on the conference slides. Rotating masses in thermal power plants dampen frequency deviations; photovoltaic inverters did not, at that time, and thereby allowed this enormous black out to happen. Germany got lucky, as it was cushioned by the Ibraheim inertia of the intervening French nuclear fleet.

5. Prices, EEG support, periods of low wind and low sunlight and storage

Monthly bills for a three-person household rose from around €40 in 2000/01 to just under €100 before the 2022 crisis, peaked at around €135 to €140, and remain at over €115 to €120 since then [9]. In a press release from the BMU (Federal Ministry of the Environment) dated July 30, 2004, Federal Environment Minister Jürgen Trittin stated that EEG subsidies would cost the average household around one euro per month, “as much as a scoop of ice cream”, which corresponds to 480 million euros per year for 40 million households [14]. But even in that year, the federal

subsidies amounted already to more than 2000 million euros; and they continued thereafter to rise up to 29 billion euros in 2020. Following the period of high gas and electricity prices after the start of the Russian invasion into the Ukraine, they stood at 18.9 billion euros in 2024; the BDEW's forecast from June 2026 anticipates 16.3 billion euros for 2025 and 14.3 billion euros for 2026 [7]. However, the general trend in German energy policy gives cause for concern that subsidies may return to the 2020 levels soon.

Photovoltaic full-load hours plummet in January, February, November and December, when demand is at its highest [7]. SMARD records for January 26–29 2026 show low photovoltaic output and a residual share of conventional energy from lignite, hard coal and gas. From the 5th to the 8th of August 2025, solar energy dominated during the day; at night, coal and gas were needed. On the 24th and 25th of June 2026, a summer lull meant that onshore and offshore wind energy was virtually zero at night, pumped-storage reserves were depleted and imports from French and Swiss NPPs were required [15]. The day-ahead price in the DE-LU zone reached €747.10 per MWh or 74.7 cents per kWh [16].

The usable capacity of large electricity storage plants connected to the German grid (6.3 GW and 1 MWh and above) totaled 143.6 GWh at the end of 2025, of which 137.9 GWh corresponded to pumped-storage power plants with a capacity of 6.3 GW. Installed batteries contributed a maximum of 15.9 GW and 25.3 GWh; household batteries alone accounted for around 20 GWh [9]. The Federal Network Agency estimates the capacity of the 28 operational pumped-storage power plants to be at around 6.2 GW and 147 GWh [17]. Combined storage capacities of this magnitude – around 175 GWh – would cover a 40 GW shortfall for only 4.5 hours, if all storage facilities were full; however, the latter is never the case as they form the operational reserves of several separate utilities.

As a result of the addition of wind and solar power to the German grid, the number of hours with a negative day-ahead balance rose from 301 in 2023 (3.4 per cent of the year) to 457 in 2024 (5.2 per cent) and to 576 hours in 2025, which corresponds to around 6.6 per cent or an average of more than 1.5 hours per day [7, 15]. During these hours, Germany needs to pay neighboring countries huge amounts of money to take the German surplus electricity.

6. CO₂ intensity

Nevertheless, Germany remains responsible for 1.53 per cent of global CO₂ emissions, placing it tenth amongst emitters, behind China with 32.85 per cent and the United States with 13.11 per cent [18], but way ahead of France, for instance. According to Ember's annual electricity data, the CO₂ intensity of the electricity sector in Germany stood at 344 g CO₂ per kWh in 2024 and at 329.65 g in 2025. France recorded 44 g in 2024 and 41.44 g in 2025, with nuclear energy accounting for around 70 per cent of the electric energy used in France [19]. Annual increases in renewable energy of almost 18 GW in Germany led to only a tiny reduction in German CO₂ output per kWh. This demonstrates that NPPs play a key role in reducing CO₂ emissions as well as securing the energy supply of industrialized nations.

7. Reactivation, the international setting and German options

NPPs provide energy that is not dependent on weather conditions, offer inertia, can follow the load within their design limits and do not require a corresponding phased expansion of the grid.

Poland is preparing the Lubiatowo-Kopalino site for three Westinghouse AP1000 reactors. Following the European Commission's approval of the state aid in December 2025 [20], groundworks began in August 2026 and the site was handed over to Bechtel; the first concrete for the reactor is scheduled for late 2028 [21]. Italy is currently re-establishing the legal framework for nuclear power generation; the Italian Minister for the Environment is expecting initial electricity generation to occur between 2033 to 2034 [22, 23]. In Canada, Westinghouse is preparing for construction and has signed supply chain agreements such as the PROMATION memorandum

[24]. Belgium suspended decommissioning of its seven reactors in April 2026 [25]. A Radiant Energy Group study had previously judged a restart to be technically feasible [26].

For Germany, the Radiant Energy Group concludes that recommissioning remains technically and economically feasible. The top-priority NPPs for recommissioning – Brokdorf, Emsland, Grohnde, Neckarwestheim 2 and Isar 2 – generate around 7 GW of net capacity and 53.7 TWh per year. According to this analysis, together with a second priority group, around 12 GW could be brought back online in three to five and a half years at a cost of around 18 billion euros, definitely cheaper than the up to 12 GW of new gas-fired power plants planned to be built only for peak loads [27]. Suppliers such as Westinghouse offer the replacement of the key components of the German NPPs, as they have done as part of license extension campaigns in the United States [28]. The prerequisite that is still missing is an amendment to the Atomic Energy Act and a change in licensing practice.

In January 2026, Chancellor Friedrich Merz described the phase-out as a serious strategic error [29]. At Kloster Seeon in January 2026, the CSU backed a return to nuclear power using modern reactors [30]. On 25 June 2026, former German NPP site managers and nuclear engineers, including Horst Kemmeter, Thomas Franke, Sascha Bechtel and Jürgen Haag, wrote in an open letter, that a restart is technically feasible and economically viable, and that they agree with the order of magnitude of the numbers provided by Radiant Energy Group and the German nuclear suppliers' association KernD [31].

The Working Group on Nuclear Power of the AfD fraction therefore calls for the preservation of Isar 2, Neckarwestheim II and Emsland; a review of Brokdorf, Grohnde, Krümmel, Gundremmingen and Philippsburg 2; reform of legislation and licensing procedures; renewed research; the eventual construction of new plants; and the recognition that a solution for a final repository can be found within a finite timeframe.

8. Conclusions

In Germany, installed wind and solar capacity already exceeds peak demand, yet gaps still remain in winter and at night. The existing storage capacity of 175 GWh is not sufficient to bridge even one day without wind or sunshine. Negative prices and import costs reflect the same pattern of surpluses and shortfalls of wind and solar power generation. The CO₂ intensity of the electricity sector has almost remained the same, even though a lot of wind and solar power generation has recently been added to the grid. Based on these findings, a program to bring back into operation around 12 GW of nuclear power over three to five and a half years, with published costs of just under 18 billion euros, is the quickest route back to a reliable, low-carbon electricity supply. Further expansion of wind energy is more expensive and less reliable and therefore not really an alternative.

Funding

No third-party funding.

Co-Editor: Stein Storlie Bergsmark

Acknowledgements

This text summarizes the lecture given at IKEK-17 in Halle (Saale) on 26 June 2026. The data shown on the conference slides are taken from the statistical sources cited.

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Radioactive Radiation – Curse or Blessing?

On the Significance of Radiation for Health

Dr. Lutz Niemann

Abstract

Carbon dioxide is a climate killer, it is claimed everywhere, so people believe it. Every little bit is supposed to be avoided. But carbon dioxide is a nutrient for plants, and a little extra plant fertilizer is good for their growth and thus good for food production. Therefore, avoiding CO₂ is NOT good.

Similarly, with radioactive radiation every small amount must be avoided in nuclear technology according to the law. This regulation creates the impression of a danger from radiation, with the following consequences:

- 1) Germany is moving away from its safe power supply, and
- 2) Radiation in low doses and low dose rates is good for living things.

These benefits are a blessing, but people are denied them due to incorrect legislation. Here, the goal is to present scientific evidence for the second point.

Keywords: Carbon dioxide; radioactive radiation; nuclear energy; health; lethal doses

Submitted 2026-08-11, Accepted 2026-08-15. <https://doi.org/10.53234/scc202608/11>

1. What is the right benchmark for measuring curse or blessing?

For comparison, we use alcohol, the toxic substance in beer, wine, sparkling wine, spirits, or merely a flavor enhancer in a praline. Everyone knows the effect of a small dose of alcohol: it stimulates the circulation and has a positive effect. Above an individually very different threshold, problems arise; then the person becomes incapable of functioning. Fortunately, this already occurs well below the lethal dose of several bottles of spirits. For alcohol, the legislator has set a threshold between curse and blessing at 0.5 per mille alcohol in the blood.

The dose-response curve for alcohol is shown in Figure 1 below.

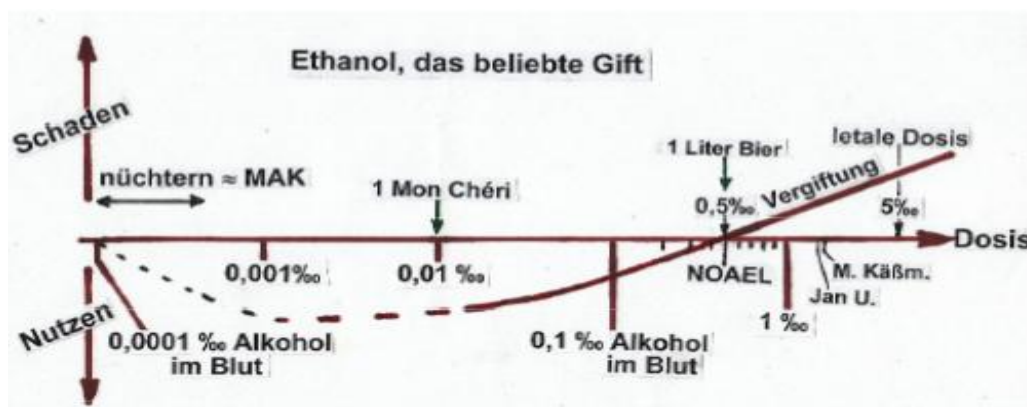


Figure 1: Dose-response curve for alcohol showing the areas of benefit and harm.

Similar dose-response curves exist for many substances, including many substances known as poisons such as Hg, Cd, lindane, etc. There is always an area of beneficial effects at low doses. The toxicologist Edward Calabrese has written extensively about this. A beneficial range of effects can also be found for radiation; here is one example each of its effects on animals and plants:

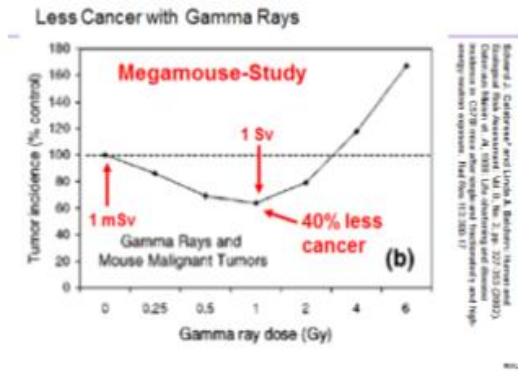
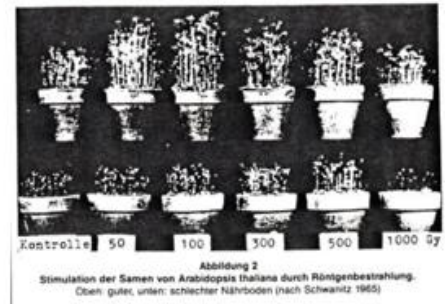


Figure 2: Less cancer with gamma rays
(Walter Ruegg)



Stimulation von Samen durch Röntgenbestrahlung ergibt bei den Pflanzen kräftigeren Wuchs

Figure 3: Better growth also for plants (F. Wachs-mann)

In the contaminated areas around Chernobyl, a small effect of improved health was observed from long-term exposure to low dose rates and low doses. Source: Prof. Jaworowski



Figure 4: Emergency workers have less cancer

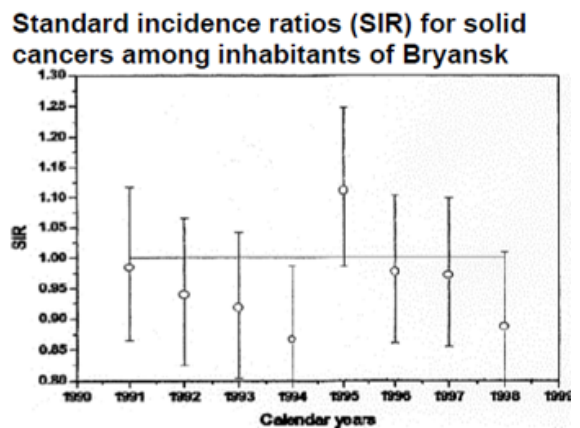


Figure 5: Less cancer in the strongly contaminated Bryansk region

It can be seen: The evacuations were carried out because the law required them. Had the evacuations not been carried out, the people would have experienced a small health benefit.

2. The Co-60 incident in Taiwan [1]

In Taiwan, structural steel was contaminated with cobalt-60, so that residents were continuously exposed to whole-body irradiation from hard gamma radiation. The elevated gamma radiation in the buildings was not discovered until 1992, after 10 years. A search was made for other contaminated buildings and more were found. Altogether, there was a cohort of 10,000 people who were exposed for 9 to 20 years to a radiation level not found either in nature or in the nuclear-technology sector.

The result: In the subgroup of 1,100 people with the highest dose, at the beginning in 1983 was **the mean annual dose 74 mSv, and the maximum was 910 mSv.**

In the entire cohort of 10,000 people, there should have been **186 cancer deaths among the adults.** According to the LNT model used in radiation protection, radiation should have caused **another 56 cancer deaths.** In fact, **only 5 cancer deaths were observed.**

Thus, the positive effect of radiation on humans has been impressively proven.

3. Creating the appearance of a radiation hazard in nuclear technology through limits

A limit is understood as the boundary between danger and harmlessness. For radiation, the limit in nuclear technology is 1 millisievert per year for the general population; this was decisive for the evacuations after the Chernobyl and Fukushima accidents.

The two radiation dose-response curves in Figures 2 and 3 clearly show that at a dose of 1 mSv/y there is no effect on living organisms.

This can also be understood by comparison with alcohol: 1 mSv per year corresponds to less than one-thousandth of the lethal dose distributed over a year. For alcohol, one-thousandth of the lethal dose is less than a sip of wine distributed over a year, so it is truly insignificant.

The 1 mSv/year limit is exceeded in other areas:

- In medicine, a CT examination involves approximately 4 mSv/15 minutes of exposure.
- Lufthansa flight crews are exposed to a maximum of 10 mSv/year.
- Patients at a radon spa “suffer” a dose of approximately 1 mSv per treatment.

These examples clearly show: the radiation dose prohibited by law in nuclear technology is insignificant; in other areas, it can clearly be a blessing.

The limits applicable in nuclear technology are misleading; they create the appearance of a danger.

4. What does 1 millisievert mean for living tissue?

Radiation causes chemical changes in body cells by displacing bonding electrons from molecules. The immune system is then required to correct the resulting errors. 1 millisievert means one hit on a cell, corresponding to around 10,000 destroyed chemical bonds. Thus, 1 millisievert per year means that, in one year, the immune system is called upon once to repair the 10,000 altered molecules. If the immune system is trained only once a year, then this is insignificant.

There are proposals in the scientific community for achieving a benefit from radiation for living tissue. The forced training of the immune system appears plausible; compare it with training in sport. Here are proposals from four authors, Table 1.

Table 1: Proposed training of the immune system

	T.D. Luckey [2]	W. Allison [3]	M. Doss [4]	C.L. Sanders [5]
Dosis im Jahr	60 mSv	600 mSv	200 mSv	150 bis 3000 mSv
Dosisleistung	7µSv/h	70µSv/h	25µSv/h	20 bis 400 µSv/h
Training	1 x / Woche	10 x / Woche	3 x / Woche	3 x / Woche bis 10 x täglich

To illustrate the relationships, Figure 6 shows a logarithmic scale of the dose rate.

It shows:

- The cancer rate measured among survivors of the atomic bombings in Japan, increased by 5 to 10%, is extrapolated over up to 9 orders of magnitude toward lower dose rates; a calculation rule is then used to calculate the hypothetical cancer risk — this risk has nothing to do with reality.

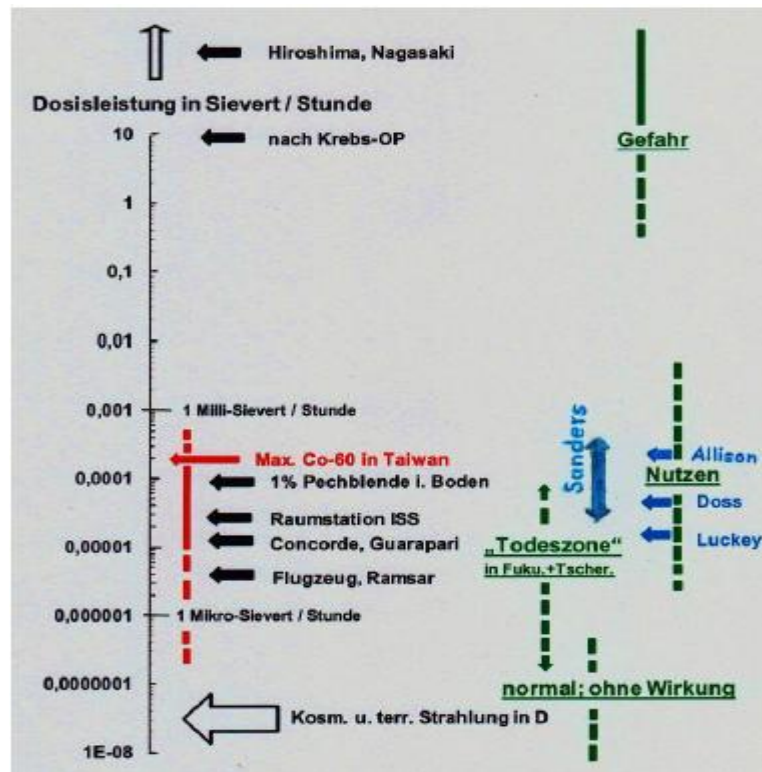


Figure 6: Radioactive doses and their effect

- The range of beneficial radiation effects is 1,000 times higher than normal environmental radiation; red (Co-60 incident in Taiwan) and blue (proposals by experts) are shown. The area around Chernobyl and Fukushima described as a “death zone” extends somewhat into this range; it was not a death zone, as Figures 4 and 5 show. The evacuations caused more than 1,000 demonstrably confirmed deaths in Japan; that was a true catastrophe.

If a radioactive release occurs in nuclear technology, then dose and dose rate show that a little additional dose can provide a small health benefit for people. The radiation-protection regulations are wrong.

5. Germany’s path into the abyss

This path began with the “energy transition” of the Schröder/Fischer government, replacing electricity from nuclear power plants at 2.4 cents/kWh with intermittent electricity from sun and wind at around 50 cents/kWh. Through the demagogic trick of concealing the truth behind the appealing term “feed-in tariff,” citizens were bribed with money. The fatal consequences:

- The replacement value of all German nuclear power plants is approximately **€250 billion**. Replacing them with solar and wind has so far consumed well **over €500 billion**.
- **€2 billion** was invested in Gorleben; now the underground cavities are being refilled, which will cost additional billions of euros.
- The legally mandated retrieval of waste from ASSE requires construction of a new retrieval shaft. By the time retrieval begins, costs of **€3 billion** will have accumulated. Calculations show that retrieval could avoid an additional dose of 20 μ Sv/year for residents after 2,500 years (!!!). As everywhere on Earth, the overburden above ASSE contains 100 times as much radioactivity as the waste deep underground. The law known as the ASSE Act concerning waste retrieval is a political pseudo-problem created to generate fear and win votes.
- Spent fuel elements are called and treated as waste in Germany, although they still contain 95 % of the energy. They should be reprocessed.
- The one-meter-thick outer walls of the interim storage facility at Gundremmingen were protected along the 100-meter-long side by a second one-meter-thick reinforced-concrete

wall, because of the “danger of terrorist attacks.” For reasons of “secrecy,” there were no media reports about this.

- Depleted uranium can still be used completely for energy generation through nuclear fission in fast reactors; this technology works in Russia without problems. Fast reactors are being developed all over the world; in Germany only sparingly.

Germany is throwing its prosperity out the window. Because of high energy prices, German companies are becoming uncompetitive, moving abroad or shutting down operations altogether. A majority of citizens have not yet noticed this. Presumably, it will take a very cold winter with power outages and cold homes before citizens wake up. Only about 28% of citizens had recognized the problem according to the latest polls, but these citizens are disparaged by successfully “throwing brown dirt” at them.

6. What does the rest of the world say?

Germany is committing economic suicide with its energy policy. Through the relocation of its industry, its foreign competitors’ benefit, so naturally they remain silent. Radiation experts abroad know what is going on; here are some statements:

- The ICRP describes the danger of any tiny dose of radiation as “speculative, unproven, undetectable, phantom” — a phantom is a ghostly image or ghost. Germany is abandoning its secure electricity supply out of fear of ghosts.
- Professor Jaworowski, the Polish “pope of radiation,” called the LNT hypothesis “criminal.”
- In 2015 there was a petition to the NRC by four professors from the USA, with excellent reasons for replacing the LNT hypothesis with legislation corresponding to hormesis. In its response, the NRC agreed with the petitioners but passed responsibility to the ICRP on the grounds that it lacked jurisdiction.
- Luckey: “500,000 cancer deaths could be avoided each year in the USA if people were allowed a dose that is good for their health.”

Opinions often arise not through thought processes but are skillfully shaped by the leading media. In Jürgen Kiefer’s 2012 textbook [6], the following is written about positive radiation effects: “Naive minds might conclude from this that radiation is beneficial to health. Some do so and call it radiation hormesis”. Among the 163 sources cited by Jürgen Kiefer, all people who contradict the LNT hypothesis and ALARA are missing, including the German professors Ludwig E. Feinendegen and Klaus Becker. Since 2024 there has finally been a good book by Walter Rüegg [7] on the supposed radiation danger.

All over the world, nuclear technology continues to develop with new ideas; only Germany continues to move back toward the “good old days.”

Another topic should be mentioned in which the whole world is allegedly being misled by skillful propaganda: it is said that methane has a “30-fold climate-damaging potential compared with CO₂.” This is wrong, because the methane molecule, like oxygen and nitrogen, has no dipole moment. It has a tetrahedral structure with C in the center and the H atoms at the four corners. In my professional career at Siemens Munich, Hofmannstrasse, I was responsible for the infrared spectrometer and was trained in it (by Perkin Elmer). I never saw methane bands, and methane was not present in my extensive IR library.

Funding

No funding specified.

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Nor-
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ISSN: 2703-9072

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Vol. 6.3 (2026)
pp. 71- 77

Water Vapor Determines Climate and Weather

Acquittal for CO₂

Michael Limburg

Vice President Eike, Germany

Abstract

As everyone knows by now, "climate protection" is on everyone's lips. But "climate protection" is also the mother of all problems. I will present that here. And this includes the so-called energy transition. Nevertheless, all European governments, the EU, almost all parties, and almost all the media tell us: We should, no, we must, avoid CO₂ in order to protect the climate. Whatever it costs. That's what it's all about! And that's why I'm going to give you arguments in the following that massively question this common belief.

Keywords: Greenhouse effect; water vapor, CO₂

Submitted 2026-08-11, Accepted 2026-08-13. <https://doi.org/10.53234/scc202608/06>

1. The blackout on January 26 in Berlin

But before that, I have to name the biggest blackout in January 2026 - nicely paraphrased by the media as a "power outage" - which has affected Germany since the end of World War II. 45,000 households in the southwest of Berlin were without electricity for 5 days, about 115,000 people had no heating – at – 15 to 20 °C at night, no light, no mobile phone, no cooking, no elevator, no traffic lights, no street lighting. Nothing, they literally had nothing. An old woman died of hypothermia. Climate terrorists from the volcano group then "took over" responsibility. They placed a short circuit on the line of the supplying power plant. And they know very precisely what the goals of their terrorism are. They want CO₂ avoidance, at any price! „End the use of fossil fuels". This is what they wrote in their letter of confession.

And that is exactly what the EU, what Germany demands of everyone. Just not quite as fast, a little slower. The EU is to be CO₂ neutral by 2050, and Germany by 2045.

2. How much CO₂ is there in the atmosphere?

To recall the magnitude of the volume of individual gases in the atmosphere, here is an overview. Let's assume that the volume of the atmosphere is as high as the Eiffel Tower in Paris. That is 324 m. Nitrogen would then have 253 m, oxygen 68 m, water vapor about 5 m, and all other gases together about 3 m. That is just under 1% by volume. And CO₂ would then have a share of 0.14 m, or 0.043 vol%. And what the IPCC attributes to humans would have another 1/4 or 0.035 m, or 0.0016 vol % or 3.5 cm.

These are the real conditions. And that's why we're looking at how CO₂ has been measured currently and in the past. The "gold standard" is now considered to be "measurements" from ice cores. In Figure 1 overleaf, the CO₂ content of the atmosphere over the period from 1750 to today was determined from two time series that were joined together.

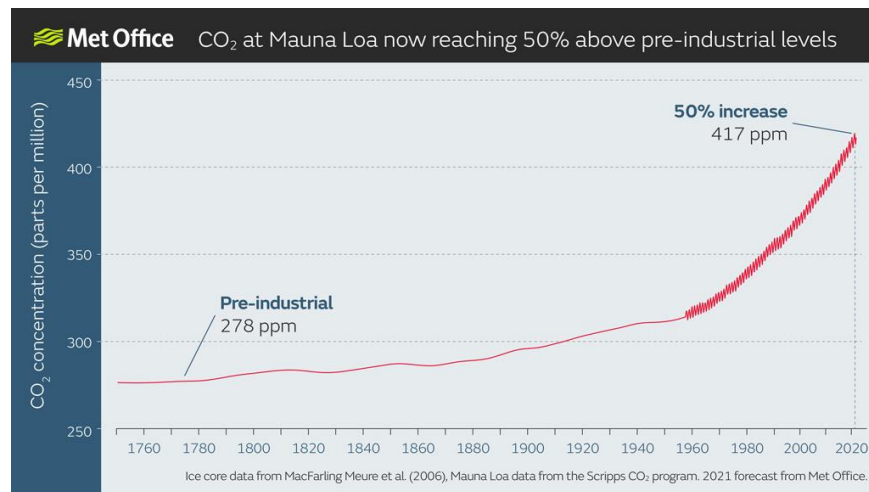


Figure 1: Representation of the British Met Office, compiled with data from ice drilling measurements (Law Dome) on the left with data from Mauna Loa, Hawaii. (right)

The time series on the left is from the Law Dome. It was calculated by 3 ice cores. The Law Dome is 1,395 m high, is located in Antarctica, i.e. in the southern hemisphere, and this measurement was spliced together with the measurement from Mauna Loa. This is an active volcano at an altitude of about 4000 m. It is located in Hawaii. And it is 10,800 km away from the Law Dome and is located in the northern hemisphere. And yet both time series meet except for ± 0.375 ppm. Now you have to know that none of these time series were measured directly. They were calculated in a very complicated way. That's why I say - as a studied measurement engineer - that there was trickery. And massively. At this distance and completely different measurement methods, this agreement is completely implausible. If you just assume that the Mauna Loa data has been sufficiently checked, then only the Law Dome data remains for the trickery. They were determined from 3 drillings of ice cores. The questions are: How does it work? How do you do that?

First of all, you have to know that Antarctica is the driest, or perhaps one of the driest deserts in the world. The low precipitation – often swirled and blown away by long-lasting snowstorms – then settles as snow on the ice below. With increasing density, due to more and more snow, many years or decades later, the snow becomes firn and much later ice. And only then does the ice enclose the air bubbles from the surrounding area. So, there is an almost indefinable period of time between the ice and the air. In any case, the existing uncertainty is great for many years or even decades. In reality, the "measurement" is much, much more complicated.

3. Gas bubbles that were not present in the ice

The problem is that the CO₂ values are reconstructed from gas bubbles that were not originally present in the ice. Rather, they only form when the ice is decompressed, i.e. it is cut and recovered. Until then, the gas molecules are only hydrated as a result of the high pressure, as clathrates. But we are not interested in that at the moment. Rather, we want to focus on previous measurements of CO₂ levels. For example, in an edition of Meyer's *Konversationslexikon* from 1892. It states that carbonic acid – as CO₂ used to be called – is present in the atmosphere at 0.04 percent. Not around 0.029 % as the ice cores show. According to Meyer's *Konversationslexikon*, it was significantly higher. And there are many more of them, even in previous editions. EIKE co-founder

Ernst Georg Beck – unfortunately already deceased – had collected and listed around 90,000 such measurements⁶. Almost all of them show a higher, sometimes significantly higher CO₂ concentration. Here is his account from 1920 onwards.

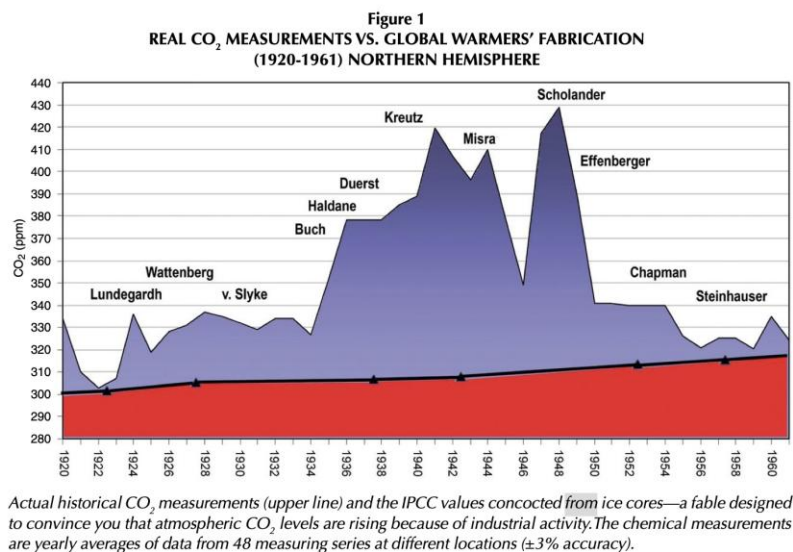


Figure 2: Presentation by E.G. Beck of CO₂ measurements from real measurements and calculated CO₂ data from ice cores. Source see footnote 6

If, on the other hand, you look at what the most important proponents of the CO₂ hypothesis, Callendar and Keeling, did with these measurements in their time, it quickly becomes clear that they had sorted out all those values that did not fit their hypothesis⁷.

This means, to put it clearly, the ice core measurements are not measurements, but calculations supported by many assumptions, which by no means show the CO₂ content of earlier times. Obviously, many of the assumptions are wrong, a circumstance that has already shown by Jaworowski and Segalstad, who wrote as early as 1992⁸:

"Numerous studies suggest that the CO₂ content in the ice can increase or decrease sharply compared to the original atmospheric value due to various chemical and physical processes. In the air pockets from pre-industrial ice, CO₂ concentrations between 135 and 500 ppmv were measured. Therefore, the results of the CO₂ determinations in the air pockets of the ice cannot be considered representative of the original atmospheric composition."

Now there was a voice from the audience that explained in great detail that the high CO₂ values of the past as mentioned above would not have been feasible – if only for theoretical reasons. On the other hand, the measurements from ice cores have been tested several times and are therefore reliable. Thus, my objections are not plausible.

⁶ From the paper: A validation check has been made for 3 historical CO₂ series. *The overall impression is one of continental European historic regional CO₂ background levels significantly higher than the commonly assumed global ice-core proxy levels. The CO₂ versus wind-speed plot seems to be a good first level validation tool for historical data. With the required caveats*

⁷ „Carbon Dioxide Variations in the Atmosphere“ Zeitschrift Tellus Volume 8, Issue 2, Seiten 176–183 (Mai 1956).

⁸ ATMOSPHERIC CO₂ AND GLOBAL WARMING: A CRITICAL REVIEW SECOND REVISED EDITION MEDDELSELSER NR. 119 SA POLARINSTITUT OSLO 1992

That may well be the case. The emphasis is on "can". But it doesn't have to be that way, because in contrast to the well-known enormous uncertainties that the ice core measurements have, and which even multiple checks cannot define away, Beck's measurements are real. They really happened. Even if you interpret it in retrospect that this or that would not have been observed. That may also be the case, but we don't know. And that's why these real CO₂ measurements are the only thing that can provide information about the CO₂ concentration in the past. And these are far away from the calculated results from ice cores.

4. What determines the weather and thus according to the WMO the climate?

Let's go back to the starting point and ask ourselves what influences the climate, in this case the weather, on this planet. It is, as all climate researchers in the world report in unison, water vapor. Together with the driver, the radiation of the sun.

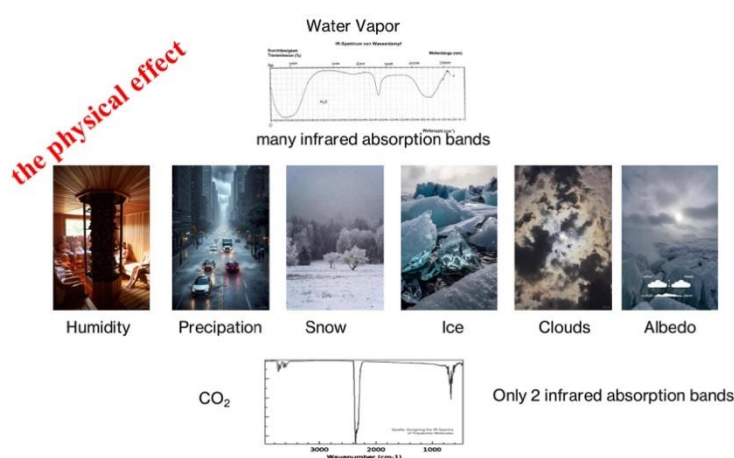


Figure 3: Representation of the physical effect of CO₂ and H₂O. It speaks for itself.

If you only look at the physical effect of CO₂ and water vapor in comparison, it becomes clear that CO₂ only has a real band in the 15 µm range that can absorb and emit infrared radiation. Water vapor, on the other hand, has many of these bands. And what is more, water vapor is responsible for moisture, rain, snow, ice, clouds and thus for albedo. And it is also present in the atmosphere with an average of 1.5 %, and in the weather-determining zones of this earth even with 4 %. And that's why it's no wonder that water vapor is responsible for the weather and thus for the climate.

Even the two well-known climate researchers Stefan Rahmstorf and Hans-Joachim Schellnhuber see it this way:

Quote⁹: "The most important greenhouse gas overall is water vapor. The only reason it does not appear in the above discussion is that humans cannot directly change their concentration." That's a strange sentence. "because humans cannot directly change their concentration". And they later define what they mean by that. Quote: **one could not influence him because of this, ...because water vapor is the consequence of CO₂ warming**

⁹ Page 44 Kindle Edition of the Book: S. Rahmstorf and H. J. Schellnhuber: *Der Klimawandel: Diagnose, Prognose, Therapie* Editor's note: **The book is currently available on Kindle only in German**

and not the cause".

This all sounds very scientific and erudite, but it is simple nonsense. It is scientifically disguised humbug. Because, as the IPCC itself stated in its 3rd report, climate is chaotic. Willie Soon has captured how chaotic it is in the following graphic¹⁰. There, driven by the sun's radiant energy of approx. 1,363 W/m², 18 processes are at work, all of which are directly or indirectly dependent on each other and are thus connected to each other. And all of them are linked to the water vapor. Only one, the "atmospheric composition", also contains CO₂. With just 0.043% by volume. And if at least 18 processes, triggered by the sun, are connected to each other and controlled indirectly or directly, then no one can say what is cause and what is effect. Climate is, precisely for these reasons, chaotic. And only in passing should it be noted that climate calculations are all non-ergodic. I.e. conversely, all model calculations that refer to probability considerations, mean value, variance or the like are not allowed here. Their results are simply garbage.

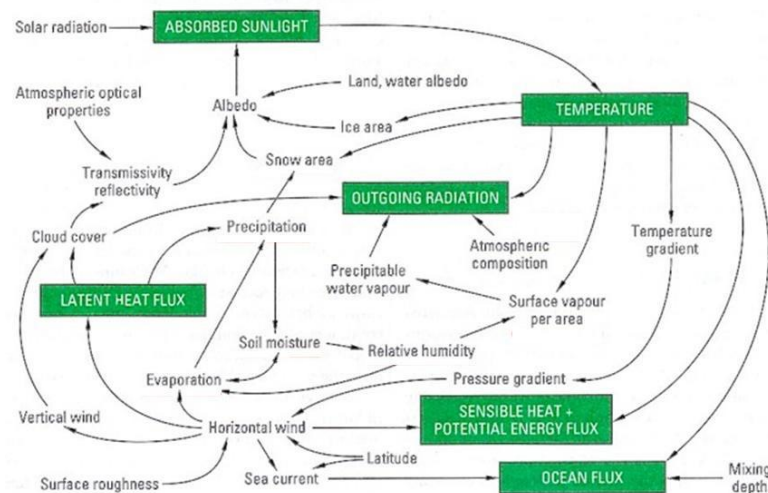


Figure 4. Representation of the energy balance of the Earth's atmosphere with its many different processes, all of which influence or are influenced by each other in a direct or indirect way. Source see footnote 10

5. The chemical effect of CO₂ in the atmosphere

The situation is different when you look at the chemical effect of CO₂. It is enormous. The following image shows the significant impact of more CO₂ on the growth of plants,

Sherwood Idso, an American physicist, photographed it in his experimental garden in 2008. The picture speaks for itself. CO₂ is plant food par excellence. And that's why you can say. Without CO₂, there would be no life on earth.

With currently only 0.043 vol %, we have just scraped past a global famine by a factor of 2. This is because plants begin to starve at 180 to 200 ppm. And everything else lives with them. If you take all this together, then the successful attempt to convince us that atmospheric CO₂ is the reason

¹⁰ Quelle: Willie Soon adapted Kellogg and Schneider (1974) paper in *Science*

for the only small measurable warming on earth is nothing more than successful brainwashing

The effect of increasing levels of atmospheric CO₂ on plant growth. The numbers are additional CO₂ above ambient, and total atmospheric CO₂, suggesting relative CO₂ starvation from right to left.



Atmospheric CO₂ is an essential plant fertilizer, delivered free daily to every plant on earth and is not a toxin. At levels below 200 ppm CO₂, plant growth virtually ceases. A 90% reduction in atmospheric CO₂ has occurred in one billion years.

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Figure 5: Sherwood Idso shows the plant growth of 4 spruce trees that grew in the same experimental garden under 4 different CO₂ concentrations.

6. Temperature is an intensive quantity that cannot be averaged

In the last century, the "measured" warming, i.e. what was called the increase in the mean temperature of the Earth's atmosphere, according to the IPCC, was just 0.9 °C. It doesn't really matter whether you write °C on it or not, because as Jonathan Cohler, among others, explained before, and as it is written in every physics textbook, temperature is **an intensive quantity that cannot be averaged**. Neither about time nor about the place, i.e. about the surface of a planet, like the Earth. Temperature is always bound to the matter at the place where it is created.

7. We Have Been Brainwashed

And that's why we have all been subjected to comprehensive, massive brainwashing – and have been for over 50 years. This brainwashing has led us to believe that atmospheric CO₂ is a bad thing. Something that must be prevented at all costs.

And that's where the circle closes. Let's remember back to the beginning, when climate terrorists left the southwest of Berlin without electricity for days. Approximately 115,000 people were affected, many of them old and/or disabled. An old woman died of hypothermia. And that is exactly the same thing that the EU intends to do with us. Only not as fast, but evenly. The Green Deal stipulates – with huge interim targets in between – that the EU must become "climate neutral" by 2050.

If we do not defend ourselves against this, it will mean our downfall. And it all started with the Club of Rome:

Quote: *In search of a common enemy against which we could unite, we **came** up with the idea that pollution, **the threat of global warming**, water shortages, famine and the like are possible. They can only be overcome through changed attitudes and behaviors. **So, the real enemy is***

humanity itself.

Alexander King (1909–2007),
Co-founder of the Club of Rome,
The First Global Revolution, 1991

Anyone who now suspects a conspiracy theory in this is just right. One that is particularly well documented. For example, in my new book, on Figure 6 below: "The Greenhouse Lie: What if the greatest political and economic upheaval of our time is based on scientific misconceptions?" There you can read a lot more about the biggest scam the world has seen so far.



Figure 6: The Author's book *Die Treibhaus Lüge* (*The Greenhouse Lie*)

Funding

No funding was provided.

Co-Editor: Stein Storlie Bergsmark

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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 78-80

From Ten Thousand Years to Four

One Equation Falsifies the Entire IPCC CO₂ Narrative

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Abstract

Physicist and AI researcher Jonathan Cohler has put forward a controversial and uncompromising challenge to one of the central assumptions of modern climate science and policy. He argues that the rise in atmospheric carbon dioxide over the past few decades is not due to human emissions, but is the result of natural processes. His conclusion is clear. The rise in atmospheric CO₂ is primarily due to natural processes, while the contribution from the burning of fossil fuels is negligible. His argument is based mainly on an analysis of the decline in atmospheric carbon-14 by nuclear weapons testing.

His presentation was not limited to CO₂. He claims to have refuted a chain of mutually reinforcing assumptions made by the Intergovernmental Panel on Climate Change (IPCC). He argued that the global mean surface temperature, climate models, the heat content of the oceans, and the Earth's alleged energy imbalance are either physically meaningless or insufficiently supported by observations. The final link in this chain, he said, is the IPCC's attribution of rising atmospheric CO₂ levels to human activities.

Keywords: Nuclear testing; carbon-14; carbon flow; carbon-13; carbon cycle models

Submitted 2026-09-3, Accepted 2026-09-03. <https://doi.org/10.53234/scc202608/18>

1. Introduction

Cohler's most important findings regarding atmospheric CO₂ stem from what he called the "bomb radiocarbon experiment." Between 1955 and 1963, atmospheric nuclear weapons tests doubled the amount of the (chemically identical) isotope carbon-14, also known as radiocarbon, in the atmosphere (in CO₂ molecules). Nearly all carbon atoms in the atmosphere are contained in CO₂ molecules.

After atmospheric nuclear testing ended, the excess radiocarbon in the atmosphere began to decline. Because the initial "pulse" was generated suddenly and its subsequent disappearance could be measured over decades, Cohler regards the radiocarbon data from the atomic bombs as an unusually clean natural experiment. "The atmosphere provided us with the answer," he said.

Cohler and his co-author Willie Soon analyzed radiocarbon measurements spanning more than five decades. They concluded that the radiocarbon excess follows a nearly perfect monoexponential decay with a characteristic timescale of about 18.4 years. He contrasts this with the significantly longer timescales used in the IPCC's carbon cycle models.

This distinction is crucial to his argument. The IPCC's carbon cycle calculations use impulse response functions with multiple exponential components and a permanent component of atmospheric CO₂. These models therefore imply that a significant portion of emissions remains in the atmosphere for centuries or even millennia.

Cohler argues that observations of radiocarbon from atomic bombs do not support the existence

¹¹ Transcript from video by Peter Baeten, Clintel

of such a long-lived atmospheric component. He also points out that the characteristic timescales and permanent fractions of the carbon cycle models published by the IPCC have changed significantly between the assessment reports. In his view, these changes demonstrate that the parameters are based more on model assumptions than on immutable properties of the carbon cycle.

The most striking comparison arose from the amount of radiocarbon that remained after 54 years. According to Cohler, the IPCC models predict that between 33 and 48 percent of a pulse would remain, whereas the observed radiocarbon signal from the atomic bomb indicates only about 4 percent.

For Cohler, this is not a matter of fine-tuning a model. It is evidence that the mathematical structure of the model is fundamentally flawed.

2. Parallel versus serial carbon flows

Cohler's criticism goes beyond the numerical parameters. He argues that the IPCC's carbon cycle models describe carbon reservoirs in the wrong physical configuration.

The IPCC's approach, he argues, essentially treats the atmosphere as a system of multiple reservoirs operating in parallel, each with its own decay time. According to Cohler, however, the physical carbon cycle is primarily serial: carbon moves from the atmosphere to the ocean surface, from there to deeper layers, and finally to the deep ocean.

This difference, he argues, leads to radically different mathematical behavior. According to his interpretation, the "long tail" in the IPCC models is therefore not a phenomenon observed in nature, but rather a product of the mathematical architecture imposed on the carbon cycle.

This is at the heart of Cohler's broader critique of the concept of cumulative carbon budgets. If an emission does not remain in the atmosphere for centuries or millennia, he argues, then the rationale for viewing today's emissions as long-term accumulation in the atmosphere changes fundamentally.

3. Carbon isotopes provide a second test

Cohler then turned to measurements of the carbon isotope carbon-13, which he presented as an independent test of radiocarbon analysis. Different sources of CO₂ exhibit different isotopic signatures. Fossil fuels are relatively low in carbon-13, while natural sources such as terrestrial respiration and oceanic outgassing exhibit different signatures. If emissions from fossil fuels were responsible for a significant portion of the net increase in atmospheric CO₂, Cohler argues, the isotopic composition of the net input would consequently have to become increasingly negative (with less carbon-13).

He cited an analysis by Demetris Koutsoyiannis that encompassed measurements from four air monitoring stations in both hemispheres over four decades (1978 to 2022). According to Cohler, the isotopic signature of the net CO₂ input remained approximately constant, with no significant trend. He argues that this is inconsistent with the notion that the burning of fossil fuels is the primary cause of the observed increase.

Cohler's third piece of evidence is a mass balance calculation. He compared the increase in atmospheric CO₂ with total natural and anthropogenic carbon fluxes. According to Cohler, during the period under study, the annual CO₂ input rose from about 179 gigatons to 241 gigatons. The anthropogenic contribution increased from about 2.5 to 4.7 percent of the total flux, while the natural input rose by more than 30 percent. Of particular importance to Cohler was that the natural flux tracked the atmospheric CO₂ mass remarkably closely during the study period.

He argues that these three independent approaches—the decay of radiocarbon produced by atomic bombs, the carbon-13 signature of the net input, and the mass balance—all lead to the same conclusion: "The rise in atmospheric CO₂ levels over 62 years is of natural origin," he explained to the audience. "The human contribution to this increase is negligible."

4. An attack on the foundations of climate attribution

Cohler nevertheless framed the CO₂ debate within a broader critique of the IPCC. His presentation was structured around five “key points” that, in his view, form a circular chain. First, he cited the global mean surface temperature, which, according to Cohler, is not a physically meaningful quantity, since temperature is an intensive quantity and the Earth’s atmosphere, oceans, and land form a heterogeneous, non-equilibrium system. Building on this premise, he criticized the calibration process of climate models, arguing that they are calibrated to reproduce a quantity for which there is no unambiguous physical definition.

He then questioned the IPCC’s estimates of ocean heat content, particularly those derived from the Argo observation system, and argued that the Earth’s alleged energy imbalance is indistinguishable from zero once measurement and sampling uncertainties are properly accounted for.

These claims are relevant to his CO₂ argument, as Cohler views the entire climate attribution model as circular. Models are calibrated using calculated global temperature data. They are then used to estimate radiative forcing and the energy balance. These quantities are then used to attribute warming to greenhouse gases.

Carbon cycle models are the final link in the chain. If they inaccurately describe the atmospheric persistence of CO₂, Cohler argues, then the resulting calculations of greenhouse potential, carbon budgets, and net-zero pathways lose their physical basis.

5. Conclusion

The presentation therefore went far beyond the debate over the exact extent of human influence on atmospheric CO₂. Cohler put forward a much more fundamental thesis: The prevailing causal narrative underlying current climate policy is based on mathematical assumptions that contradict direct observations. Whether this interpretation will stand up to critical scrutiny by the broader scientific community is another question. This is a challenge with far-reaching consequences.

Funding

No funding specified

Co-Editor: Stein Storlie Bergsmark

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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 81-83

From Demon To Dinner

The Scientific Rehabilitation of CO₂ and Fossil Fuels

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Soon opened by challenging the legal classification of CO₂ in the United States. Following the 2007 *Massachusetts v. EPA* Supreme Court ruling, he noted, carbon dioxide is officially considered an air pollutant under US law. Quoting the dissenting Justice Antonin Scalia, Soon argued that such an interpretation stretches the meaning of “pollutant” to the point of absurdity. CO₂, he stressed, is indispensable to plant growth, and humans themselves constantly exhale it, so CO₂ is not a satanic gas, nor a demon. It is simply dinner for plants. And fossil fuels should be understood not as an environmental curse, but as a major driver of human prosperity.

Keywords: Carbon dioxide; plant food; biosphere; benefits of CO₂

Submitted 2026-09-3, Accepted 2026-09-03. <https://doi.org/10.53234/scc202608/17>

1. Introduction

Our plants provided the central theme of his presentation: “Plants do not call it a pollutant. They call it dinner.” Soon argued that atmospheric CO₂ concentrations are essential for the functioning of the biosphere. Below roughly 150 parts per million photosynthesis would fail for most plants. At around 425 ppm today, humanity has moved away from a CO₂-starvation regime.

Soon then connected CO₂ with the history of fossil-fuel use and rising living standards. Over the past two centuries, he argued, more than a billion people have escaped extreme poverty, largely because of access to cheap, dense and reliable energy from coal, oil and natural gas. Wealthier societies tend to have cleaner air and water, greater forest cover and better public-health outcomes. Economic development, therefore, should be regarded as part of the solution to environmental problems rather than as their cause.

The same logic applies to energy policy. Every major successful energy transition in history has moved toward greater energy density—from wood to coal, oil, natural gas and nuclear power. A transition toward intermittent, weather-dependent energy sources such as wind and solar therefore represents a reversal rather than technological progress. Citing Professor Colin McInnes, Soon described an energy transition toward more expensive and less efficient energy as “a regression.”

Germany’s nuclear phase-out was presented as a particularly stark example. Soon contrasted Germany with Switzerland, arguing that Switzerland’s continued reliance on nuclear power has provided cheaper and more reliable electricity, while Germany has combined the closure of nuclear plants with massive investment in wind and solar and continued reliance on lignite. He characterized the destruction of functioning nuclear infrastructure as “energy vandalism.”

2. The rise of atmospheric CO₂

Soon’s most substantial scientific argument concerned the source of the continuing rise in atmospheric CO₂. He challenged the conventional interpretation that the increase is primarily a consequence of

¹² Transcript from video by Peter Baeten, Clintel

human emissions. According to Soon, global fossil-fuel emissions have been broadly flat for more than a decade, while atmospheric CO₂ has continued to rise smoothly. He cited declining or flattening emissions in the United States, Germany and China as evidence that the relationship is not as straightforward as commonly presented.

The key to understanding atmospheric CO₂, Soon argued, lies in the enormous natural exchanges between the atmosphere, oceans and biosphere. More than 200 gigatons of carbon move annually between the atmosphere and natural reservoirs, while the atmosphere contains only around 750–900 gigatons. This means that a substantial fraction of atmospheric carbon is exchanged every year. In Soon's interpretation, relatively small changes in the balance of these enormous natural fluxes could therefore have a major influence on atmospheric CO₂.

He pointed to the seasonal CO₂ cycle as another indication of the dominance of natural processes. Atmospheric CO₂ falls during the Northern Hemisphere growing season and rises again during autumn and winter as vegetation dies back and decomposes. Soon emphasized that the magnitude of this seasonal variation is far greater than the seasonal variation in human fossil-fuel emissions. He cited earlier research concluding that fossil-fuel use cannot account for the annual cycle of atmospheric CO₂.

3. The Biosphere

Soon also challenged the use of carbon isotopes as a decisive “fingerprint” of fossil-fuel emissions. “You cannot tell the difference between CO₂ emission from coal, gasoline, natural gas, and a hamburger using the Delta 13C isotope alone,” he said.

A further element of Soon's argument was his estimate that the terrestrial biosphere has accumulated approximately 55.3 gigatons of carbon between 1961 and 2023. He interpreted this as evidence of a growing and increasingly active biosphere responding positively to rising CO₂ concentrations. Rather than being a passive victim of atmospheric change, vegetation, he argued, is itself a major component of the carbon cycle.

Soon extended the argument into paleoclimate research, questioning the assumption that pre-industrial atmospheric CO₂ remained essentially fixed at 280 ppm throughout the Holocene. He pointed to evidence from plant stomata and other records suggesting considerably larger natural variations in CO₂ before industrial fossil-fuel use. Such evidence, he argued, raises questions about the extent to which recent atmospheric changes can automatically be attributed to human emissions.

He then turned to temperature sensitivity. Using Germany's seasonal cycle as what he described as a natural experiment, Soon compared the approximately 26°C difference between winter and summer temperatures with the corresponding change in solar radiation. Applying the radiative forcing convention commonly used by the IPCC, he calculated a climate sensitivity to doubled CO₂ of roughly 0.5 °C, or less than 1°C under a more conservative calculation. This, he argued, is substantially below the IPCC's central estimate of around 3 °C.

4. The positive consequences of CO₂

The second half of the presentation emphasized what Soon regards as the positive consequences of higher atmospheric CO₂. Satellite observations show that the Earth has become substantially greener, with particularly pronounced greening in China and India. Higher CO₂ increases photosynthetic productivity and allows plants to partially close their stomata while continuing to absorb carbon, thereby reducing water loss and improving drought tolerance.

Soon cited research suggesting that rising CO₂ has contributed significantly to increased crop yields and that forests have also benefited. He pointed to experiments in which elevated CO₂ increased plant productivity and wood production, as well as research indicating increasing tree growth in the Amazon.

The oceans, he added, are showing signs of increased biological productivity in some regions, while the Arctic is also experiencing greater vegetation and biological activity.

Finally, Soon discussed medical applications of CO₂, citing research into transcutaneous CO₂ therapy for wound healing and experimental work involving tumours. These examples, he argued, further illustrate how strange it is to characterize the molecule itself as a toxic pollutant.

Soon concluded by returning to his central metaphor. CO₂, he argued, is not a poison threatening the biosphere but a molecule on which the biosphere depends. The world, in his view, is not facing an “emission emergency”; instead, natural carbon fluxes remain enormous, the biosphere is expanding, and the planet is becoming greener.

His closing message was therefore as much political as scientific: energy and climate policies should be based on measurement, physics and an honest assessment of uncertainty rather than on what he sees as the politicization of CO₂. “CO₂ is not a satanic gas, nor a demon. It is simply dinner,” Soon concluded.

Funding

No funding specified

Co-Editor: Stein Storlie Bergsmark

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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 84-87

Acidification of Water by CO₂

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Abstract

In the 17th EIKE Conference (IKEK-17) Will Happer summarised a recently published paper *Acidification of Water by CO₂*, [1] by the four authors, which gives a quantitative discussion of why increasing concentrations of atmospheric CO₂ will not cause harmful acidification of natural waters on Earth and will likely benefit aquatic organisms. The reason is that alkalinity and dissolved CO₂ give high buffering capacity to most natural waters and minimize the change of pH from external influences.

Keywords: Ocean acidification; pH; alkalinity; buffering; carbonate chemistry.

Submitted 2026-08-27, Accepted 2026-08-30. <https://doi.org/10.53234/scc202608/15>

1. Introduction

Natural surface waters and rainwater contain dissolved CO₂, in equilibrium with atmospheric CO₂. As atmospheric CO₂ concentrations increase, the increase of the dissolved weak acid, CO₂, will lower the pH of the waters. Fig. 1, taken from reference [1], shows how the pH values of freshwater and seawater depend on the atmospheric partial pressure P of CO₂. The decrease of the pH of seawater from doubling the CO₂ partial pressure P at a temperature of $T = 25$ C would reduce the pH by $\Delta\text{pH} = -0.25$. The doubling would take more than a century at the current rates of CO₂ increase.

2. Sea Surface pH

Fig. 2, taken from the work of Hofmann *et al.* [2], shows the pH from doubling atmospheric CO₂ concentrations is comparable to, or smaller, than typical day-night fluctuations of pH in biologically active parts of the ocean, like coral reefs. Photosynthesis converts dissolved inorganic CO₂ into organic carbon in the tissues of living organisms. During the day, photosynthesis removes CO₂ faster than it can be replaced by eddy diffusion from the atmosphere above or from deeper water below. With less of the dissolved weak acid CO₂, less of the natural alkalinity of the seawater is cancelled and the pH can increase by several fractions of a pH unit, or more. During the night, aerobic respiration by living organisms converts organic compounds back to dissolved inorganic CO₂, and this approximately cancels the daytime pH increase.

Fig. 3, taken from work by Byrne *et al.* [3], shows the pH of the North Pacific Ocean, measured in the year 2006 along the longitude 152 ° W between Hawaii and Alaska.

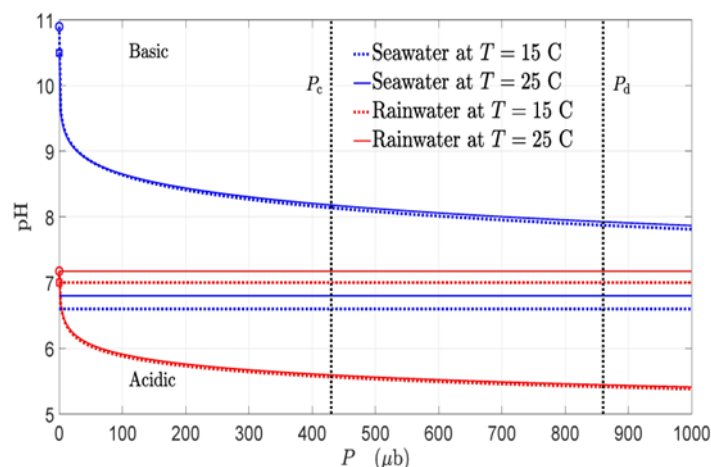


Figure 1: The curved lines are pH values of seawater (blue) and rainwater (red) in equilibrium with atmospheric partial pressure P of CO_2 . In 2025, the pressure was $P_c = 430 \mu\text{b}$. The doubled value is $P_d = 860 \mu\text{b}$. Representative seawater has a salinity $S = 35 \text{‰}$, an alkalinity $[A] = 2.4 \text{ mM}$ and a boron molality $[B] = 0.43 \text{ mM}$. Rainwater contains only dissolved CO_2 . The horizontal lines are neutral pH values, pH_n , when $[H^+] = [\text{OH}^-]$, for the four combinations of salinity and temperature. Only for freshwater at temperature $T = 25$ is neutral $\text{pH}_n = 7$.

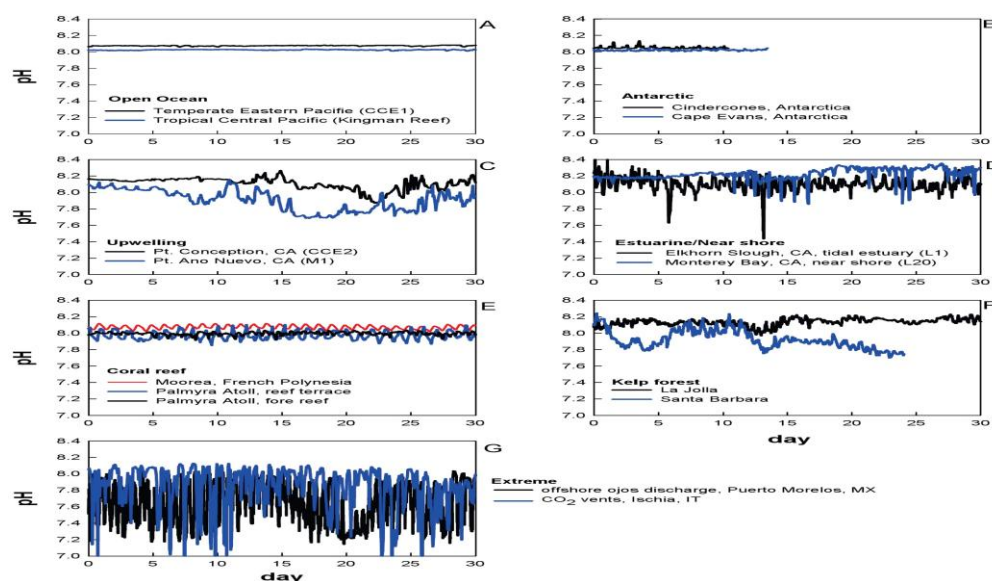


Figure 2: Time dependence of the pH of ocean surface waters from [2]. The very small pH decrease, 0.25 units from doubling atmospheric concentrations of CO_2 , shown in Fig. 1, is smaller than the day-to-night fluctuations of pH in biologically active parts of the ocean.

The decrease of the pH with moderate depths below the surface is mostly due to the increase of dissolved inorganic carbon (DIC) as a result of the biological pump, the aerobic decomposition of sinking organic debris created by photosynthesis at the surface, and the dissolution of biomineralized parts at depths below the lysocline. The decrease of surface pH with increasingly northerly latitudes is due to the decrease in alkalinity, $[A]$, which is correlated with the decrease

in surface salinity. Much of the very deep water of the North Pacific comes from cold, salty water that was formed off of Antarctica and other parts of the globe.

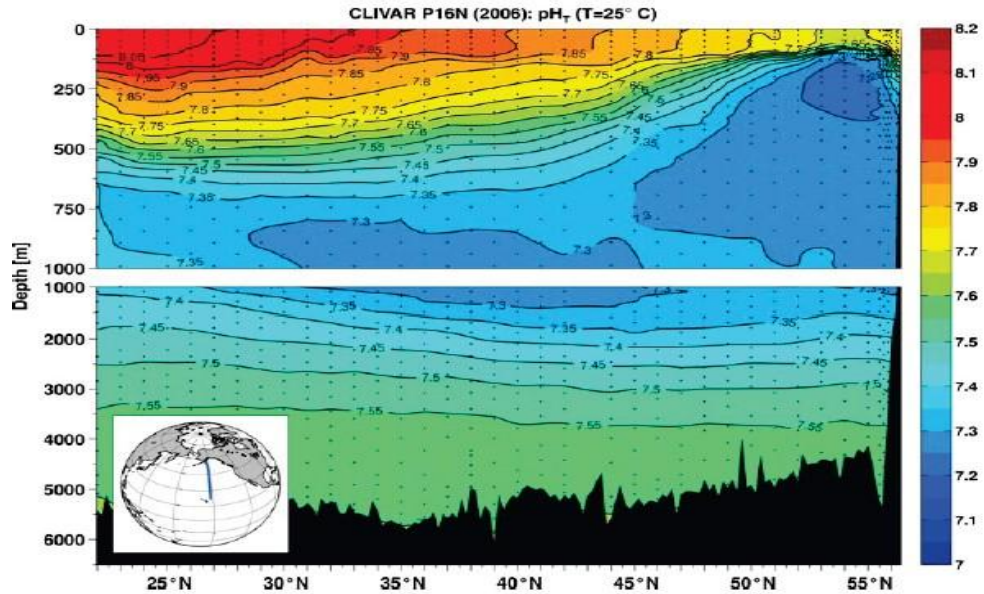


Figure 3: The pH of the North Pacific Ocean [3] along the longitude 152° W in 2006. The pH changes with latitude and depth are much larger than the pH change $\Delta\text{pH} = -0.25$ shown in Fig. 1 for doubling the atmospheric concentration of CO_2 .

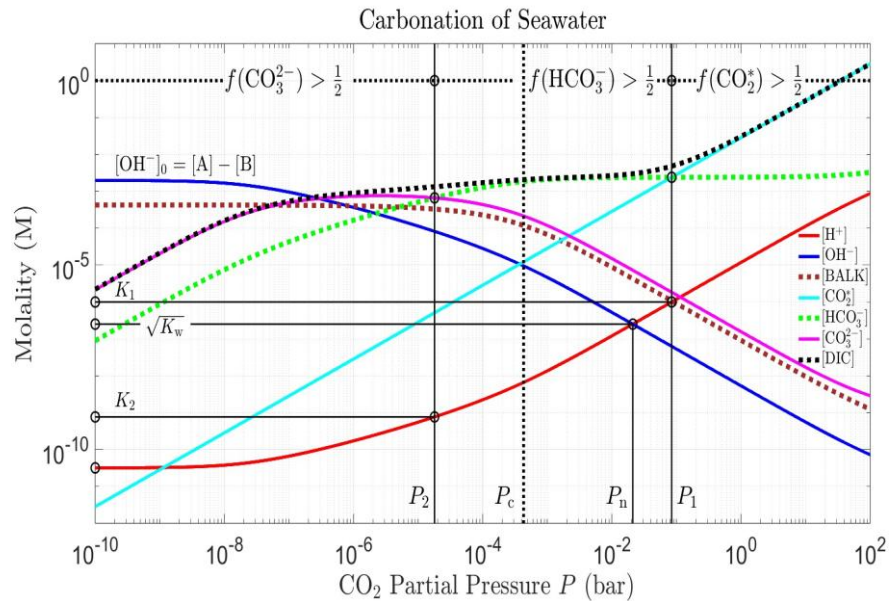


Figure 4: The molalities $[\text{CO}_2^*]$, $[\text{HCO}_3^-]$ and $[\text{CO}_3^{2-}]$ of dissolved CO_2 , and their sum $[\text{DIC}]$ are plotted versus the partial pressure P of atmospheric CO_2 which is in equilibrium with seawater at a temperature $T = 25^\circ\text{C}$. The contemporary partial pressure of CO_2 is $P_c = 430 \mu\text{b}$.

Typical quantitative results of reference [1] are shown in Fig. 4. Shown, as a function of sea-level atmospheric partial pressure P of CO_2 , are the molalities (moles per kilogram, M) of DIC, including uncharged dissolved CO_2 molecules and sea-level undissociated carbonic acid H_2CO_3 , denoted collectively as CO_2^* , singly charged bicarbonate ions HCO_3^- and doubly charged carbonate

ions CO_3^{2-} . Also shown are the hydrogen-ion and hydroxyl-ion molalities, $[\text{H}^+]$ and $[\text{OH}^-]$, and the boron alkalinity $[\text{BALK}] = [\text{B}(\text{OH})_4^-]$ from boric acid, the second most abundant weak acid in seawater, after CO_2 . At the contemporary partial pressure P_c of CO_2 , large increases in P causes relatively small increases of $[\text{DIC}]$.

3. Conclusion

We have in the referenced paper [1] reviewed the inorganic carbonate chemistry of natural waters, seawater, groundwater and rainwater, in equilibrium with the partial pressures P of CO_2 in the atmosphere. We have shown that even very large changes of P , like doubling from $P_c = 430 \mu\text{b}$ to $P_d = 860 \mu\text{b}$, change the pH of natural waters less than the day-to-night changes due photosynthesis of aquatic organisms, or due to local variations of seawater alkalinity. The pH changes are so small that any credible future increases of atmospheric CO_2 will cause no harm to aquatic life.

Funding

No information about funding

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Norway

ISSN: 2703-9072

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com

Vol. 6.3 (2026)

pp. 88-95

Extract from:

Global Warming, Climate Change, and Scientific Consensus have not been proven. There is no proven Climate Crisis!

A Quantitative Audit exposes Fraudulent Pseudoscience and Fudging of the IPCC's Earth's Energy Imbalance

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Abstract

The United Nations Intergovernmental Panel on Climate Change (IPCC), along with its various collaborators and contributors (IPCC *et al.*), forecast an impending climate crisis with catastrophic consequences for the Earth's population. They predict an alarming increase in the frequency of dangerous extreme weather events and other bad natural phenomena. This work provides a quantitative scientific review of their efforts. It is a whistle-blower report that exposes serious scientific misconduct. It provides a quantitative audit of the bad arithmetic and flawed scientific methodology behind their claims regarding the Earth's Energy Imbalance (EEI), global warming, climate change, and an impending "climate change crisis". It shows exactly where their claims amount to quantitatively fraudulent bad science. This work exposes a subtle but critical design flaw of the CERES Terra and Aqua workhorse satellites. The flaw's existence was admittedly known by IPCC *et al.* scientists, and the herein exposed data fudges were used to cover up the flaw. Seriously flawed and fudged pseudoscience was then employed in a massive futile attempt to bolster the original global warming crisis prediction using fudged ocean-temperature-anomaly data. This work also shows that Al Gore's alarmist claim of a "scientific consensus" alleging a proven impending climate change crisis is a total fantasy. Independent climate scientists at 20 different laboratories worldwide used the CMIP5 computer code to perform climate simulations using 43 different climate simulation models. There is vast quantitative disagreement among their variously assumed climate simulation parameters, their calculated predictions and observations. There are also errors clearly evident in the code's assumed physics. This paper's demonstrated conclusion is that contrary to claims by the IPCC *et al.* a positive energy imbalance, global warming and climate change have not been proven! There is no proven climate crisis! The world is correspondingly wasting trillions of dollars by attempting to limit the use of fossil fuels. *If it ain't been proved broke, don't fix it!*

Keywords: Greenhouse effect; radiative forcing;

Submitted 2026-08-10, Accepted 2026-08-11. <https://doi.org/10.53234/scc202608/14>

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1. Introduction

The United Nations Intergovernmental Panel on Climate Change (IPCC), along with its various collaborators and contributors (IPCC *et al.*), forecast an impending climate crisis with catastrophic consequences for the Earth’s population. They predict an alarming increase in the frequency of dangerous extreme weather events and other bad natural phenomena. This work provides a quantitative scientific review of their efforts. *It is a whistle-blower report that exposes serious scientific misconduct.* It provides a quantitative audit of the IPCC *et al.*’s bad arithmetic and scientific methodology regarding their claims of the Earth’s Energy Imbalance (EEI), global warming, climate change, and an impending “climate-change crisis”. It shows that their claims amount to quantitatively fraudulent bad science.

Importantly, it exposes a subtle but critical flaw in the design of the workhorse CERES Terra and Aqua satellites. The satellites were effectively totally blind to specular reflection of sunlight from the ocean surface – sun glare! After a decade of observation, the satellites yielded a ridiculous result that was obviously flawed. “Aw [expletive] What do we do now?” The flaw was in the choice of using a MODIS line-scan camera rather than using a panoramically-viewing pyranometer to measure the Earth’s outgoing-radiation power flux. The scan-line is not parallel to the sun-glare’s directional reflection-stripe. To cover up the flaw, the satellite data were literally overwritten with data from a seriously flawed study of ocean-temperature-anomaly rate-of-increase measurements, that, in turn, was badly and fatally skewed by time-varying Southern-Ocean-fraction composition and by erroneous fabricated anomaly-offset corrections. Many data fudges were needed for the satellite-flaw’s cover up. The data fudges and incriminating evidence are all published and hiding in plain sight. The fraudulent assertions are fully documented herein by simply identifying and displaying the flawed published arithmetic and methodology. This paper shows exactly where to find the fudges for fact checking.

Conclusion: Global warming and climate change have not been proven. There is no proven crisis. The world is wasting trillions of dollars by attempting to limit the extraction and use of fossil fuels.

1.1 The IPCC *et al.*’s plausible causal chain

The IPCC *et al.* start by assuming a highly plausible climate-change model that consists of a causal linked chain. 1. Extraction and consumption of fossil fuels is assumed to cause increasing atmospheric CO₂. Increasing CO₂ is actually observed via the Keeling curve from Mauna Loa. 2. Increasing CO₂ is assumed to cause a *positive* Earth’s Energy Imbalance (EEI). Said positive energy imbalance is claimed to be observed via satellite and rising ocean heat-content “anomaly” observations. 3. A positive Earth’s Energy Imbalance, if present, is expected to cause global warming. Global warming is claimed to be observed, based on observations of a rising global average “temperature anomaly”, almost all of which is irregularly and sparsely recorded almost exclusively in urban land areas. 4. Global warming is assumed to cause climate change. Said change is claimed to be observed as an increasing frequency of extreme weather events. An

increasing frequency of extreme weather events is claimed to be well documented by NOAA's historical weather data. 5. The claimed-observed increasing frequency of extreme weather events then forebodes a predicted climate crisis and other bad stuff.

Break any one link of this chain, however, and the whole chain collapses.

Increasing atmospheric CO₂, is clearly observed via the Keeling curve. That observation is probably the only good science in the whole chain. Extraction and use of fossil fuels are claimed by the IPCC *et al.* to cause the observed increase of the atmospheric greenhouse gas, CO₂. While the associated linked observation may indeed be valid, it doesn't really matter, because the chain thereafter is herein proven to be false. The IPCC *et al.* assume all links to be true but never actually prove them to be true with observational data. This work breaks the remaining links, by requiring observational proof of the claimed links, and by demonstrating that computer modelling, by itself, provides insufficient proof.

The IPCC and its contributors were tasked with determining the Earth's climactic parameters and ascertaining the magnitude of the threat that its predicted warming has to society. To accomplish these tasks, they use computer modelling and observational data from satellites, ocean bathymetry, and a global network of surface radiation and temperature measurements to determine important parameters for the Earth's climate. From these calculations and measurements, they have attempted to determine the so-called Earth's Energy Imbalance (EEI), along with other climatic parameters, including the Earth's associated global average surface-temperature history, and the Earth's natural power-balance feedback-stability strength.

1.2 Purpose

It is the purpose of this paper to show that, contrary to claims by the IPCC *et al.*, global warming and climate change have not been proven, and that there is no proven climate crisis. Importantly, this work exposes a subtle but critical design flaw of the CERES Terra and Aqua workhorse satellites. The satellites were effectively blind to specular reflection – sun glare – reflected from the ocean surface. The flaw's existence was admittedly known by IPCC *et al.* scientists. Herein *exposed data fudges were then used to cover up the flaw, once it was recognized. Seriously flawed pseudoscience and fudged data are then employed in a massive attempt to bolster the original global-warming crisis prediction using fudged ocean-temperature-anomaly data.*

Unfortunately, with missing crucial satellite data, the IPCC *et al.*'s remaining assembled data, as referenced in the IPCC's Sixth Assessment Report (2021), are woefully insufficient to prove the existence of global warming. Neither do remaining data clearly prove a positive Earth's Energy Imbalance (EEI), nor do they prove climate change. Available data do not prove an impending "climate change crisis". Importantly, the tabulated audited EEI data, shown in Section 9.1 of this work, are shown to be mostly fudged. Moreover, Section 9.2 shows that when these fudged data are restored to their original un-fudged values, there is no evident proven energy imbalance, no proven global warming, and hence no proven climate change. *To the contrary, all available observational data are fully consistent with no energy imbalance and no global warming.*

Additionally, this work also shows that Al Gore's alarmist claim of a "scientific consensus" alleging a proven impending climate-change crisis is a total fantasy. Independent climate scientists at 20 different laboratories worldwide used the CMIP5 computer code to perform climate simulations using 43 different climate simulation models. There is vast *quantitative* disagreement among their variously assumed climate simulation parameters and their calculated predictions. Huge disagreement is both with each other and with observational data. Worse yet, the CMIP5 code, itself, is shown in Sections 8.2 – 8.6 to exhibit bad physics. It is totally incapable of simulating, even closely, the observed Earth's temperature anomaly history, let alone its observed annually oscillating albedo history. Despite these huge discrepancies, the various simulation results all suspiciously concur on an extremely precise value for their "best-guess" EEI value.

The paper's demonstrated overall conclusion is that contrary to claims by the IPCC *et al.*, global warming and climate change have not been proven, and there is no proven climate crisis! Indeed, the half-century-long IPCC program has shown itself to be dishonest and incapable of

demonstrating any such proof. The world is correspondingly wasting trillions of dollars by attempting to limit the extraction and use of fossil fuels. *If it ain't been proved broke, don't fix it!*

1.3 Foreword

In what follows, Section 2 first dispatches NOAA's claims that there is an observed increasing frequency of extreme weather events. Those claims are demonstrated to be false.

Section 3 provides some needed important preliminary comments along with a more detailed introduction to the IPCC program. First, it asks and answers the basic question - What is needed scientifically to define global annual average temperature and global warming? It shows that measurements of global temperature for use as a global warming metric are impossible, let alone totally impractical. It also gives a highly critical discussion of the IPCC *et al.*'s repeated use of and reliance upon so-called "anomaly measurements", particularly the various measurements of temperature anomalies, and especially of ocean temperature anomalies. Fortunately, given that a better global warming metric is clearly needed for scientific purposes, one was actually adopted by the IPCC *et al.* That metric is the Earth's Energy Imbalance, or EEI. Unfortunately, it is not always used by much of the work done by the IPCC *et al.* Section 3 ends with a clarification of some standard scientific terminology and conventions. It also translates some IPCC *et al.* jargon that is frequently confusing, misleading, vague, and/or pedantic.

Section 4 provides detailed definitions of "net global power/energy imbalance" or Earth's Energy Imbalance (EEI). It shows how the use of assumed conservation of energy, the continuity equation, and energy flow through a Gaussian surface is applied to measurements of the Earth's energy flow at the Top-of-Atmosphere to and from outer space. It shows how EEI is calculated and conventionally reported (and frequently misreported) using power-flow diagrams. Unfortunately, the same arguments do not work for power-flows measured at the Bottom-of- Atmosphere that use only Gaussian-surface segments.

Section 5 describes the satellite-data collection program. The original program to measure EEI was to use satellite observation of energy flow at the so-called Top-of-Atmosphere. Initial data from the ERBE satellite gave promising results for that pursuit. Unfortunately, after many years of observation using the Terra and Aqua satellites, their data are found to be insufficiently accurate to determine EEI so as to prove or disprove the global-warming hypothesis. Actually, they measured a hugely positive value for EEI, which is obviously very wrong! While the random errors were small enough, the problem was traced to a systematic flaw in the design of Terra and Aqua. The satellites were effectively blind to specular reflection of sunlight from the ocean surface – sun glare – that is radiated back out into space!

The program's dark side began when the TOA satellite data were finally recognized to be incapable of proving the existence (or non-existence) of global warming. Hansen *et al.* (2011) and Loeb *et al.* (2009) proposed the use of ocean-temperature-anomaly data as a weak substitute for the missing satellite data. To cover up the flaw, the satellite data were literally overwritten with data from a seriously flawed study of ocean temperature anomaly rate-of-increase measurements, that, in turn, was badly fatally skewed by time-varying Southern-Ocean-fraction composition, and by erroneous fabricated anomaly-offset corrections. A time-derivative of the results was fatally flawed because of this added extraneous time dependence.

Working definitions of the words fudge, "*constraint*", and scientific misconduct, are given in Section 6. Section 7 then describes the fudging of ocean temperature anomaly data via its presentation as fudged ocean-heat-content anomaly data, all taken at the Bottom-of-Atmosphere with a highly questionable linkage to the Earth's Top-of-Atmosphere Energy Imbalance. The fudged results then form the basis for the IPCC's Fifth Assessment Report, AR5 (2013). Section 8 details the progressively massive data fudging used in the progression from AR5 (2013) to the IPCC's Sixth Assessment Report, AR6 (2021).

Reporting data that is measured at Bottom-of-Atmosphere and claiming without proof that it is the same as Top-of-Atmosphere data, as is done by Loeb *et al.* (2012) (see Sect. 7.4), and then overwriting the Top-of-Atmosphere data in the EBAF satellite public database with different data

values chosen to match data that is measured at Bottom-of-Atmosphere, as is done by Loeb *et al.* (2018) (see Sect. 8.9), clearly qualifies as a “*bait and switch*” hoax!

Section 9 summarizes just how badly the IPCC *et al.*’s books have been cooked. It first tabulates the results of this work’s audit of published EEI values. It goes on to show how the resulting conclusions regarding global warming are actually reversed when corrected values are used instead. It proceeds to list details of the various dishonest fudging methods that were employed. Finally, it provides a summary of six cases of scientific misconduct that are exposed by this work. The paper’s conclusions are given in Section 10.

A second forthcoming paper addresses the net result of these data fudges. It shows that because of these fudges the IPCC *et al.* have clearly misidentified the dominant process that controls the Earth’s climate. They have ignored the big numbers of the problem and focused on the small numbers that are associated with rising atmospheric CO₂ concentration. That paper shows that the actual dominant process is the cloud-variation-thermostatic feedback mechanism. The process provides a highly stable atmosphere and temperature, and it fully cancels the negligible destabilizing effects of CO₂. It also shows confirmatory experimental evidence for this process and shows that it is fully consistent with existing observational data.

10. Conclusions

There is no positive Earth’s Energy Imbalance (EEI) that has been observably proven. There is no proven global warming. There is no proven long-term climate change. There is no observed increased frequency of extreme weather events. There is no climate-change crisis!

There is clearly no quantitative consensus regarding the Earth’s climactic parameters among climate scientists in at least 20 different laboratories worldwide. Instead, there is huge disagreement among them. A (more than) factor-of-2 disagreement among the various EEI estimates based on different investigators OHCA data analyses is also a clear repudiation of Al Gore’s misplaced claims of “*consensus*”.

The world is wasting trillions of dollars with its vain attempts to limit production and use of fossil fuels. *If it ain’t been proved broke, don’t fix it!*

The IPCC and its contributors have fraudulently fudged observational data and have committed *fraudulent scientific misconduct* on multiple occasions in order to claim falsely and dishonestly that there is a positive Earth’s Energy Imbalance and an associated impending climate crisis.

There is a design flaw in the CERES Terra and Aqua satellites that prevents them from measuring the Earth’s Energy Imbalance with an accuracy sufficient to assert the existence of global warming. The satellites are nearly totally blind to strong sun glare from the ocean surface at shallow angles of sunlight incidence. They correspondingly very-significantly underestimate the Earth’s reflected sunlight intensity. The presence of this flaw has been knowingly covered up by IPCC *et al.* climate scientists by their use of fudged ocean-heat-content-anomaly data.

Experimental measurements of the Earth’s Energy Imbalance (EEI), made by the IPCC and its contributors using satellite radiometry and ocean-heat-content anomalies, are all fully consistent with zero energy imbalance and with zero global warming.

The analysis by Lyman *et al.* (2010) of ocean-heat-content anomaly (OHCA) data is seriously flawed. It claims the widely quoted value, $EEI = 0.64 \pm 0.11 \text{ W/m}^2$, subsequently revised to $EEI = 0.6 \pm 0.4 \text{ W/m}^2$. However, a corrected analysis using only homogeneous OHCA datasets is consistent with the result $EEI = 0$. It is also consistent with their reported heat-content variation being solely due to the temporal fractional change in ocean sampling that, in turn, is due solely to a significant extension of the ocean-temperature anomaly sampling activity into more Southern-Ocean areas.

The 45-year history of OHCA data presented by Levitus *et al.* (2000) clearly reveals strong temperature oscillations that are presumably due to ENSO (El Niño) current variations, but no obvious long-term increasing global-warming trend. That is, the OHCA data presented by Levitus *et al.* (2000) are fully consistent with $EEI = 0$. Their results are in sharp contrast to the results by

Lyman *et al.* (2010) using a shorter 16-year history of highly flawed ocean-heat-content-anomaly (OHCA) data.

Archived satellite based EEI measurements by Loeb *et al.* (2018) have been fudged to match the ocean heat-content anomaly based fudged EEI measurements so that their noted agreement cannot be used as validation of either one, as has been done by the recent review by the National Academies.

Climate modelling predictions by GISS computer simulations are demonstrably unreliable. The IPCC now agrees and further admits that the RCP 8.5 scenario “*is unrealistic and should be scrapped.*”

There are serious admitted flaws in the theoretical basis behind the CMIP5 computer atmospheric simulation codes and serious structural flaws in their included physics. There is virtually no reliable agreement between CMIP5 simulation and observation. It should be noted further that so-called attribution studies that rely on these computer predictions are also totally unreliable.

Greenhouse gases, including CO₂ have negligible observed influence on the Earth’s Energy Imbalance. (See Appendix B.)

The best measured EEI values are undoubtedly those offered by Stephens and l’ Ecuyer (2015), equal for both measurement sets, at $EEI = 0 \pm 5.6 \text{ W/m}^2$, and from l’ Ecuyer *et al.* (2015), $EEI = 0 \pm 5.0 \text{ W/m}^2$ for both satellite and OHCA data sets combined. Also, the National Academies of Sciences, Engineering, and Medicine recent 2025 report misquote l’ Ecuyer *et al.* (2015). They incorrectly cite them as confirming positive EEI and global warming. (See Appendix F.)

Funding

No funding specified

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 96-104

Cosmic Rays, Clouds, and Climate

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Abstract

This paper discusses how cosmic rays may influence Earth's clouds, climate, and biosphere. Cosmic-ray ionisation promotes the formation and growth of aerosols into cloud condensation nuclei, potentially increasing cloud reflectivity and altering Earth's energy balance. Evidence for this mechanism comes from laboratory experiments, atmospheric observations, and modelling. The paper discusses correlations between cosmic-ray variability and climate change across timescales from days to millions of years, along with proposed links between supernova activity, temperature, oxygen production, and biodiversity. To clarify the relative climatic effects of cosmic rays and greenhouse gases and improve estimates of climate sensitivity to carbon dioxide, the plan is to incorporate this mechanism into global climate models.

Keywords: Cosmic rays; clouds; climate; climate change; biosphere; Milky way;
Submitted 2026-08-19, Accepted 2026-08-20. <https://doi.org/10.53234/scc202608/12>

1. Introduction

The idea that energetic particles born in the aftermath of exploding stars can affect Earth thousands of light-years away may be difficult to comprehend. However, this conclusion is emerging after almost three decades of research. Not only is the climate responding, but life itself also appears to be influenced by changes in the flux of energetic particles, called cosmic rays. We are now at a pivotal point where research can provide consistency between theory, observations and experiments. In particular, we can now test the theory in a global circulation model that includes both greenhouse gases and cosmic rays, which may shed light on the climate's sensitivity to CO₂. This note provides a concise explanation of the mechanism linking cosmic rays to cloud formation, and presents examples of this relationship across time scales from days to millions of years.

2. The Mechanism

Cosmic rays are atomic nuclei accelerated to high energies in the aftermath of explosions of large stars, called supernovae. These energetic, charged particles travel through interstellar space, and some enter our solar system, where the solar wind's magnetic field modulates them before they reach Earth's atmosphere. Once in the atmosphere, cosmic rays create a shower of secondary particles that ionise the air.

Ionisation by cosmic rays plays a key role in cloud formation. The ions help gas molecules stick together to form tiny clusters, about 1-2 nanometers in diameter. These clusters, known as aerosols, can grow by absorbing gases or by colliding with other aerosols. Once they reach about 50 nanometers, they help clouds form by providing a surface for water vapour to condense on. This process usually happens when air rises and cools, leading to cloud droplets. Figure 1 overleaf illustrates the process from gas molecules to clouds.

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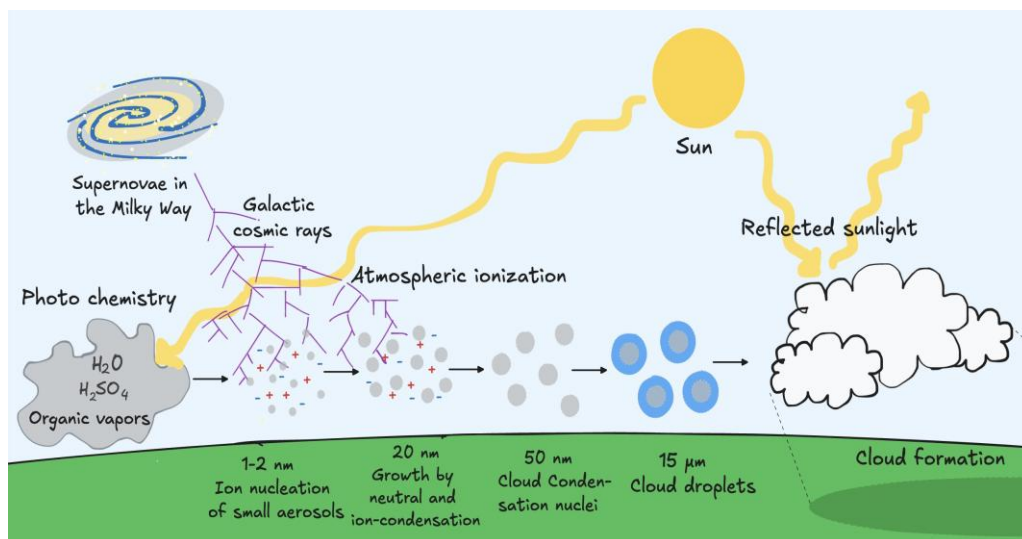


Figure 1: Illustration of cosmic ray cloud mechanism. Secondary cosmic ray particles ionise Earth's atmosphere. Ions help stabilise small molecular clusters of 1-2 nanometers and assist their growth into cloud condensation nuclei of ~50 nanometers. At this size, they can be activated as cloud droplets. The number of cloud condensation nuclei determines the radiative properties of clouds and ultimately influences the global climate.

The main idea is that as cosmic-ray ionisation increases, more cloud condensation nuclei form. For clouds, this means more cloud droplets, with smaller droplets, which makes clouds whiter and longer lasting. As a result, clouds alter the amount of energy Earth receives from the Sun. A systematic shift in cloud cover will change the climate.

3. Evidence for the cosmic ray cloud link

Experiments have confirmed that ions promote the formation of small aerosols (1-2 nanometers in diameter) from naturally occurring gases in the atmosphere [Svensmark *et al.*, 2007; Kirkby *et al.*, 2011]. In addition, ions accelerate their growth [Svensmark *et al.*, 2013; Svensmark *et al.*, 2017], making it more likely that these aerosol particles will become cloud condensation nuclei and influence cloud formation.

Observations have verified that the process shown in Fig. 1 occurs in Earth's atmosphere. For example, when the Sun ejects a charged plasma cloud that temporarily screens out cosmic rays for a week, we observe changes in aerosols, cloud properties, and Earth's energy balance [Svensmark *et al.*, 2009; Svensmark *et al.*, 2016, 2021]. Figure 2 overleaf shows an example of a clear response in aerosols and in low liquid clouds.

Both observational data and theoretical analyses indicate that the mechanism operates most efficiently in clean marine air, where aerosol concentrations are relatively low. In contrast, over land, where aerosol abundance is higher, the effect is small.

Recently, we added the ion mechanism to a global chemistry model that includes aerosols. We then looked at changes in cloud condensation nuclei between solar maximum and solar minimum. For the first time, our calculations matched the observed changes (in review). Earlier attempts did not achieve this because they overlooked the important effect of ions on accelerating aerosol growth [Kazil *et al.*, 2006; Pierce and Adams, 2009; Snow-Kropla *et al.*, 2011; Yu and Luo, 2014; Dunne *et al.*, 2016; Gordon *et al.*, 2017; Pierce, 2017].

The next step in this project is to add the ion mechanism to a Global Circulation Model. This will allow a study of how both changes in cosmic rays and anthropogenic greenhouse gas levels affect the climate system in the 20th and 21st centuries. In particular, it will provide an estimate of the

climate sensitivity to CO₂.

The following presents examples of the many apparent implications of the cosmic-ray-cloud link.

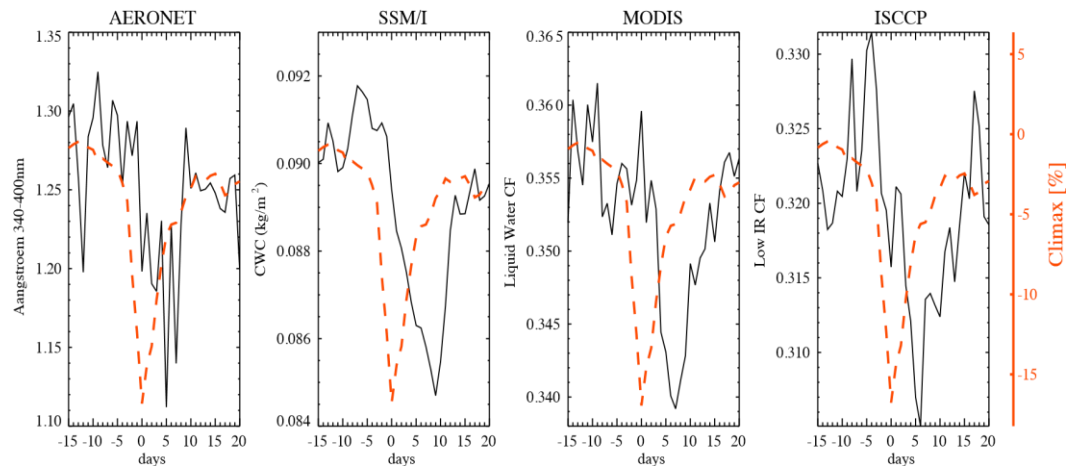


Figure 2: The daily averages of various aerosol and cloud parameters preceding and during Forbush decreases in the cosmic ray flux, averaged over the 5 strongest events between 1990 and 2005. The orange dashed line is the change in cosmic rays, and the black curves are (a) AERONET data indicating the density of aerosols in the atmosphere, (b) cloud water content (SSM/I dataset), (c) liquid water cloud fraction (MODIS dataset), and (d) low clouds (ISCCP dataset). The delay between the minimum and black curves reflects the time it takes for aerosols to grow to cloud-condensation-nucleus size. From [Svensmark et al., 2009].

4. Millennial climate change

An indication of the importance of the above mechanism is the strong correlation between climate and cosmic-ray changes over the last 10,000 years. It seems that each time cosmic rays change, climate changes in response.

Figure 3 overleaf presents temperatures and cosmic ray fluxes during the last thousand years. The top and bottom panels show a clear association between temperature variations (blue curve, top panel) and changes in cosmic ray flux (orange and green curves, bottom panel), both influenced by solar activity. Solar activity minima are evident in the blue temperature curve. The cosmic ray axis is inverted: higher cosmic ray flux corresponds to colder temperatures, while lower flux corresponds to warmer temperatures. To demonstrate the global nature of the solar-climate relationship, temperature reconstructions from worldwide borehole data are included (top panel, grey curves). As heat diffuses slowly into the ground, temperature profiles at various borehole depths provide insights into historical surface temperatures [Huang et al., 2008]. These data indicate that the peak of the Medieval Warm Period was approximately as warm as, or slightly cooler than, the 1960-1990 reference level, while the coldest phase of the Little Ice Age was about 2 °C below present temperatures.

Another beautiful example is that of a multi-millennial correlation between the temperature of the Indian Ocean as mirrored in the ratio between different oxygen isotopes in stalagmites in a cave in Oman, and solar activity, as reflected in the cosmogenic carbon-14 isotope produced by cosmic rays [Neff et al., 2001, see Figure 4 overleaf]. Another impressive result over the same timescale is that of Bond et al. [2001], which compares solar activity with the Northern Atlantic climate, as recorded on the ocean floor via ice-rafted debris. Many other correlations exist at other locations worldwide.

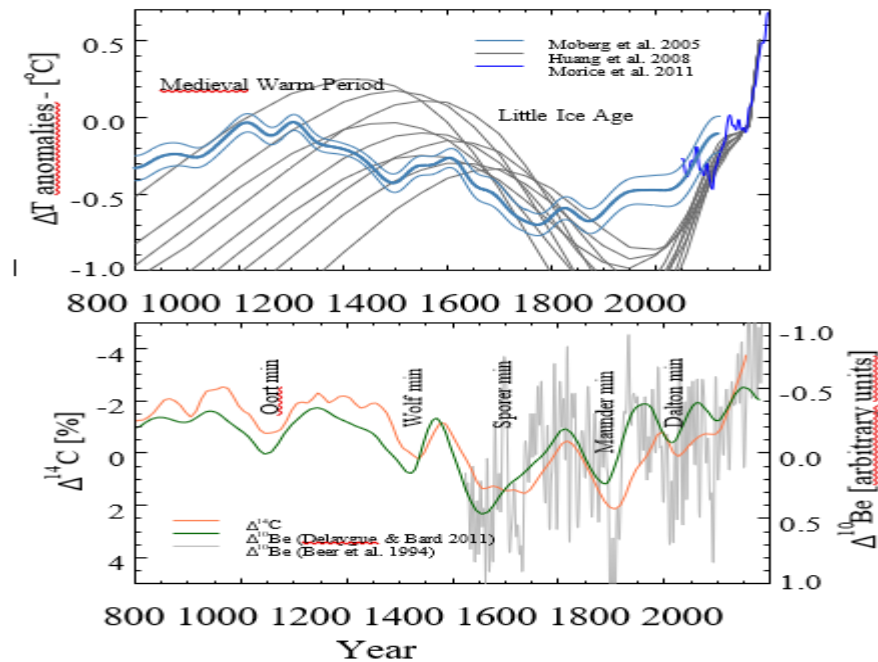


Figure 3: Comparison of variations during the last millennium of (a) temperature (with respect to the 1960 - 1990 average), (b) galactic cosmic rays (note the inverted scale; high cosmic ray fluxes are associated with cold temperatures).

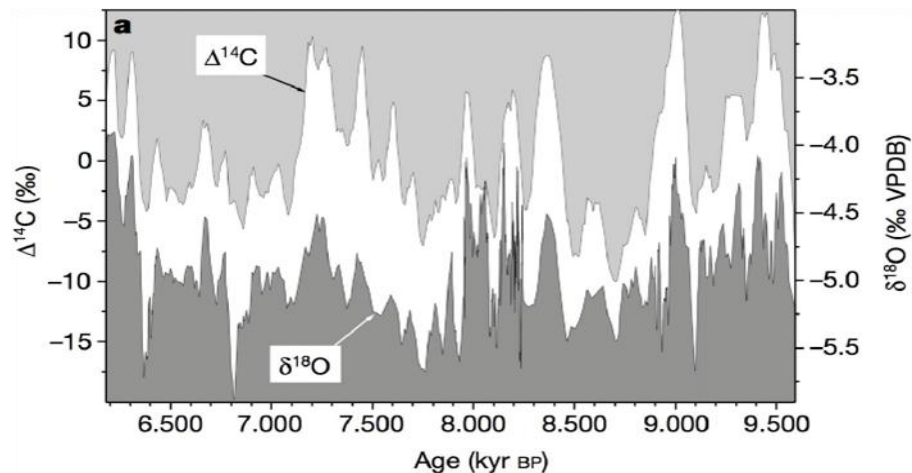


Figure 4: Climate change from a cave in Oman over a period of about 3000 years. The dark grey curve is a proxy for climate change, based on Indian Ocean surface temperature (as inferred from $\delta^{18}\text{O}$ in stalagmites). The light grey curve is the change in cosmic rays caused by solar activity (^{14}C is formed by nuclear interaction between cosmic rays and the atmosphere). From [Neff et al., 2001].

5. Climate over millions of years

The solar system orbits the centre of the Milky Way with an approximate period of 230 million years. On that journey, the solar system enters and exits regions of increased star formation that mainly occur in the Milky Way's spiral arms. Since star formation in the spiral arms also produces massive stars that explode as supernovae after relatively short lifetimes, the spiral arms are regions of elevated cosmic ray flux. The changes in cosmic rays over millions of years provide a test of the cosmic-ray climate link independent of solar activity, and even here, remarkable agreement is observed [Shaviv, 2002; Svensmark, 2012].

Approximately 150 million years ago, the solar system was located in the Scutum-Crux spiral arm and experienced elevated cosmic ray flux (see Fig. 5). Then, 70 million years ago, the solar system was positioned between the Scutum-Crux and Sagittarius-Carina spiral arms, during which cosmic ray flux was low, and Earth's temperature was about 10 °C higher than present, resulting in an ice-free planet without polar ice caps. As the solar system approached the Sagittarius-Carina spiral arm, cosmic-ray intensity increased, leading to a cooler climate. About 34 million years ago, an ice cap formed in Antarctica. Figure 6 overleaf illustrates a remarkable correlation between changes in supernova frequency (red curve) and reconstructed temperatures (grey and cyan circles) over the past 200 million years, with temperature increasing from top to bottom on the y-axis. The supernova frequency is derived from star formation rates in open stellar clusters (red curve) [Svensmark, 2012]. The supernova rate and temperature show notable agreement, particularly regarding the onset of Antarctic glaciation, the partial thawing of the ice sheet, and subsequent re-glaciation.

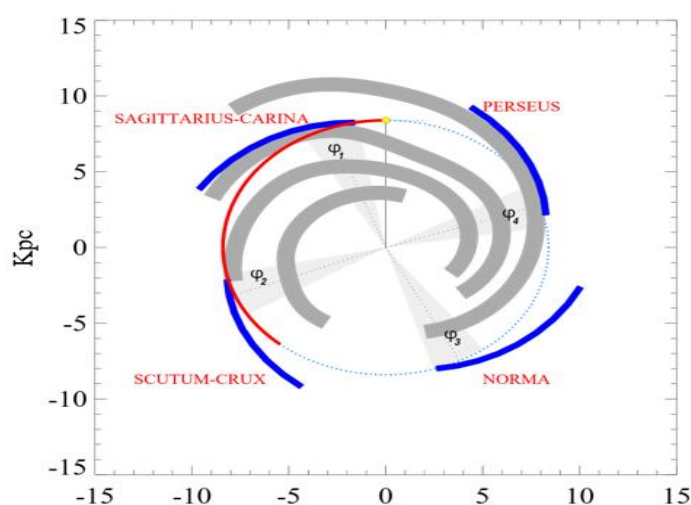


Figure 5: Illustration of the spiral structure of the Milky Way. The observed spiral arms are shown as thick grey bands and are where star formation mainly occurs. The blue arms represent the slight delay before massive stars explode as supernovae and are regions of elevated cosmic-ray flux. The yellow dot is the current position of the solar system, and the thin red line is its trajectory over the past approximately 200 million years, during which it has passed through two spiral arms. This journey in and out of spiral arms is recorded in Earth's climate as can be seen in Fig. 6 (Figure adapted from Svensmark [2012]).

As is well known from geological studies, and as exemplified in Fig. 6 overleaf, Earth's climate has changed substantially, from periods much warmer than now to severe glacial periods with huge ice sheets, and in concert with cosmic ray changes. Such large climate variations are expected to impact the conditions for life. In fact, changes in supernova rates played a role in shaping life on Earth. It can be shown that the fraction of organic material buried in sediments mirrors variations in supernova rates; see Fig. 7, two pages down. The proposed explanation is that a high supernova rate results in thicker cooling cloud cover and thus a colder Earth. A colder Earth has a larger temperature difference between the equator and the poles and stronger winds. Stronger winds increase ocean circulation, thereby increasing the flux of dissolved nutrients to living organisms. An elevated nutrient supply raises biomass, and, finally, a larger fraction of dead organic material is sedimented on the seabed. A fundamental consequence of burying organic material in sediments is that it is a source of oxygen. As is well known, photosynthesis produces oxygen by combining water, CO₂, and sunlight to form glucose and oxygen; however, for the reaction not to reverse and turn O₂ back into CO₂, it is necessary to move organic material into sediments. Therefore, the supernova rate in the Milky Way has indirectly controlled oxygen production throughout Earth's history, and oxygen underpins complex life [Svensmark, 2022].

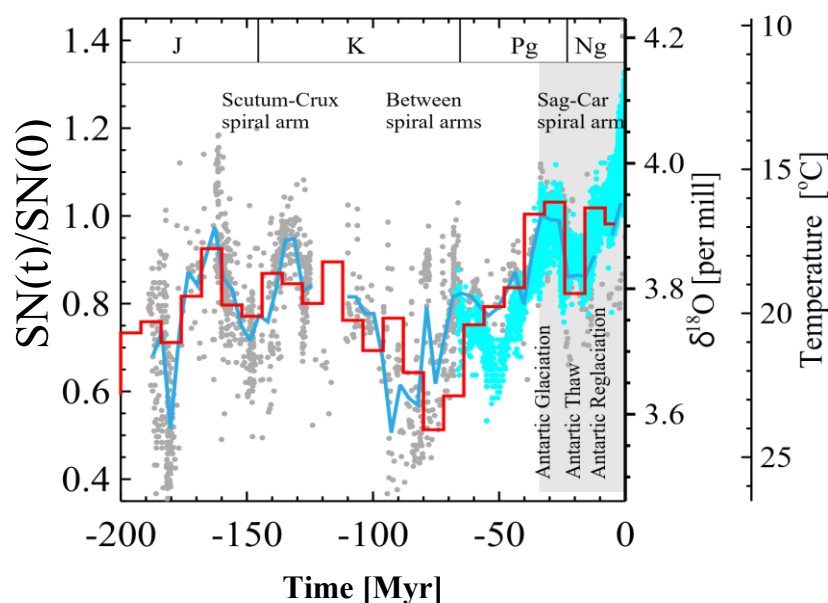


Figure 6: The evolution of Earth's temperature in the last 200 million years is inferred from measurements of $\delta^{18}\text{O}$ in fossils (planktonic foraminifera (cyan circles) and brachiopods (grey circles)). The red curve is the change in the supernova rate based on open star clusters [Svensmark, 2012]. Sag-Car is the Sagittarius-Carina spiral arm. Note that temperature increases downwards.

Supernova rates affect not only bio-productivity; they also seem to affect the diversity or richness of life. The best evidence of life's diversity comes from millions of fossils in geological sediments and is recorded in large databases. Two main influences have dominated ocean diversity over the last 500 million years: changes in supernova frequency and changes in the area of shallow marine margins (depth < 200 m) [Svensmark, 2023]. A larger area typically gives rise to greater diversity, and this has long been recognised in biology. Shallow marine margins are relevant because almost all marine life resides here. The surprise is that the supernova frequency also had a decisive effect on diversity. Figure 8 overleaf illustrates the influence of supernovae on ocean biodiversity since the Cambrian period 541 million years ago (Richness of life normalised with changes in the shallow-water area). The black curve shows supernova frequency, and the coloured curves show different extractions of genera from paleo databases, normalised to two different reconstructions of shallow-water areas along the continents. This result sheds new light on an otherwise unanswered question in evolutionary theory: why the diversity of life has varied over time.

If these results are generally accepted, they will fundamentally shift thinking from seeing the solar system as primarily isolated to understanding how processes in and around the Milky Way have helped shape life on Earth.

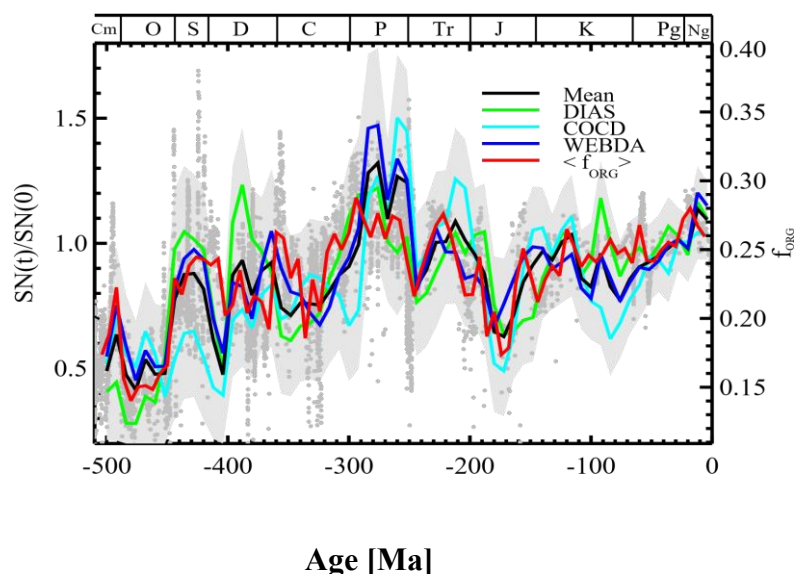


Figure 7: Illustration of the correlation between supernova frequency (green, cyan, and blue curves are based on three astrophysical datasets, and the black curve is the mean of the three datasets) and the fraction of organic material (red curve) buried in sediments over the last 500 million years (for details, see [Svensmark, 2022]).

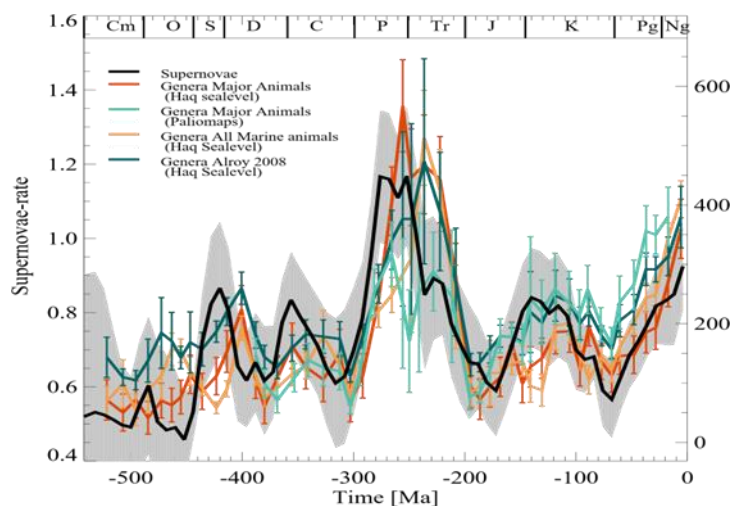


Figure 8: The change in supernova frequency (black curve) over 500 million years compared to changes in diversity (richness of life) (dark brown, light brown, dark green and light green curves). Diversity is normalised by the area of shallow-marine margins. For details, see [Svensmark, 2023]

Funding

No funding specified.

Co-Editor: Stein Storlie Bergsmark

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Vol. 6.3 (2026)

pp. 105-110

How Plato's Atlantis and the Green Sahara explain Each Other

Deep-Time Climate Change, Human Civilisation, and the Limits of Confident Interpretation

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Abstract

Plato's account of Atlantis in the *Timaeus* and *Critias* has been read for a century and a half as describing an island in the Atlantic Ocean. That reading rests on rendering the Greek *Atlantikon pelagos* as "Atlantic Ocean." Plato distinguishes *pelagos*, a partly land-enclosed sea, from *okeanos*, the encircling world-ocean he uses elsewhere, and he describes the entrance to this *pelagos* as navigable in the distant past but silted in his own era - a description that cannot apply to the Strait of Gibraltar. G. Sarantitis has argued that the passage instead points to North Africa. This paper summarises the presentation given at IKEK-17, which examined that argument against the palaeoclimatic record of the African Humid Period. During the last Green Sahara, monsoon and Mediterranean rainfall belts converged over a now-hyperarid region, supporting lakes, rivers, grasslands and large-bodied fauna across an area the size of the United States. Marine and continental records indicate that such episodes are not anomalies: over 230 Green Sahara Periods have been identified within the last eight million years, paced by orbital forcing. The presentation drew two conclusions. First, the geography implied by the myth corresponds to a landscape that demonstrably existed, which reframes the question from whether the account was invented to how much of it may preserve memory. Second, and more consequentially for climate discourse, the historical record shows no consistent mapping between the direction of climate change and human outcomes: the drying of the Eastern Sahara dispersed populations and also concentrated them along the Nile, where Pharaonic Egypt arose. Both the Victorian mistranslation and the century-long delay in interpreting Saharan rock art illustrate a recurring failure - assuming that present conditions are the baseline against which the past must be read.

Keywords: Atlantis; African Humid Period; Green Sahara; Milankovitch cycles; palaeoclimate; Chotts Megalake; climate and civilisation; scientific humility

Submitted 2026-08-11, Accepted 2026-08-11. <https://doi.org/10.53234/scc202608/05>

1. Introduction

I am not a climate scientist, a palaeoclimatologist or a geophysicist. I am a filmmaker and writer who, in 2019, was handed a book in a hotel lobby on Santorini and spent the following six years following where it led, producing a documentary film and a subsequent book, both titled *The Atlantis Puzzle*. The purpose of this contribution is not to defend a theory of Atlantis but to describe what an outsider's investigation of one ancient text revealed about the deep-time behaviour of the Earth's climate, and about the confidence with which each generation of experts has interpreted it. The argument proceeds in three parts: a translation problem that relocated a myth by

several thousand kilometres; the palaeoclimate of North Africa at the opening of the Holocene and the orbital mechanics that produce it repeatedly; and what the historical record actually shows about the consequences of climate change for human societies.

2. A Mistranslation and a Vanished Sea

The Atlantis narrative appears in two late Platonic dialogues, the *Timaeus* and the *Critias*, composed around 360 BCE. Critias relates a tradition he attributes to Solon, who is said to have received it from priests at Sais in Egypt: nine thousand years before Solon's visit - approximately 9600 BCE - a power called Atlantis made war on the Mediterranean world, and its capital was destroyed in a single day and night.

Since Donnelly's influential *Atlantis: The Antediluvian World* (1882), the setting has been fixed in the popular and scholarly imagination as an island in the mid-Atlantic. Sarantitis (2010) has argued that this placement rests on the treatment of a single term.

2.1 The Greek vocabulary for bodies of water

Greek maritime vocabulary was differentiated in a way modern translations tend to flatten. *Pontos* is used of the Black Sea (*euxeinos pontos*); *thalassa* of the Mediterranean; *pelagos* of a smaller sea substantially enclosed by land - a sense preserved in modern Greek usage for the Aegean and Ionian. The encircling world-ocean is *okeanos*, and Plato uses precisely that word for it in the *Phaedo* (112e).

In the Atlantis passages, however, Plato does not use *okeanos*. The relevant phrase in *Timaeus* 24e is *ek tou Atlantikou pelagous* - from the Atlantic *pelagos*. On the plain sense of Plato's own usage, the voyage described is not across an ocean but across a sea bordered by land and connected to the Mediterranean.

A second textual detail reinforces the difficulty. Plato states that the entrance to this body of water had silted up and become impassable by his own era, though it had been navigable at the time of the events described. Neither clause fits the Strait of Gibraltar, which was navigable throughout antiquity and has not been closed since the Zanclean flood some 5.3 million years ago. The nineteenth-century translators, working without a concept of large-scale Holocene landscape change, resolved an unfamiliar term by assuming that Plato's geography must have been their own.

2.2 The Chotts basin as a candidate

A chain of depressions runs from the Gulf of Gabes westward through southern Tunisia into Algeria, occupied today by the salt flats known as *chotts*. This basin is recognised in the palaeolimnological literature as the Chotts Megalake, one of several Saharan megalake systems alongside Megalake Chad, Megalake Fezzan and Megalake Timbuktu (Drake et al., 2022). Its outlet toward the Mediterranean lies at the Gulf of Gabes. A basin of this configuration - an inland sea connected to the Mediterranean through a narrow neck that is now dry land - answers the description in the text more directly than the Atlantic does.

It should be stated plainly that the chronology of the Saharan megalakes is contested. Drake et al. (2022) conclude that most documented highstands, including those of the Chotts basin, date to Marine Isotope Stage 5 or earlier, and that only Megalake Chad and Megalake Timbuktu - both fed from beyond the desert margin - preserve clear African Humid Period shorelines. Establishing the extent of standing water in the Chotts basin at 9600 BCE therefore remains an open problem rather than a settled result, and the present argument should be read accordingly.

What the correspondence does establish is narrower but not trivial. Plato describes a power situated beyond a partly enclosed sea, in a country of rivers, lakes and fertile plains. No such landscape existed in North Africa in his own era, and no Greek of the fourth century BCE had access to it by observation - but it had existed several millennia earlier. The setting is therefore recoverable rather than invented, which shifts the question to how much of the narrative may derive from

transmitted memory, irrespective of whether the timing provided in the Atlantis myth (circa 9600 BCE) in fact matches more or less precisely the high point of the maximal extent of the Chotts mega lake. What was observable to the Greeks or Carthaginians of the era was the remnant of an ancient hydrological process that they had no way of precisely dating. This implies that the date provided by Plato may have been intended as symbolic rather than precise.

3. The African Humid Period

3.1 *The evidence in the rocks*

Between 1850 and 1855 the German explorer Heinrich Barth crossed the Sahara by caravan from Tripoli to Timbuktu and became one of the first Europeans to record prehistoric paintings and engravings of giraffes, elephants, cattle and hunters in terrain where none of those animals could survive. In 1933 the expedition led by Laszlo Almasy found, in the Gilf Kebir of southwestern Egypt, a shelter whose walls depict human figures swimming - in a region that is now among the driest on Earth.

The implication was resisted for decades. Sediment coring, pollen analysis and radiometric dating had to be developed before the African Humid Period was established as a physical reality rather than an interpretive curiosity (Claussen et al., 2017).

3.2 *Mechanism and recurrence*

From roughly 13,000 BCE the African monsoon belt migrated northward while Mediterranean winter rainfall extended southward; the convergence of the two systems watered the desert (Cheddadi et al., 2021). By approximately 9600 BCE widespread greening was established across North Africa. Lakes, rivers and grassland supported hippopotamus, crocodile, elephant and giraffe far outside their historical ranges, and human populations followed. The humid phase persisted, with regional variation, until roughly 3500 BCE.

The mechanism is orbital: eccentricity, obliquity and precession jointly modulate Northern Hemisphere summer insolation, and when they align favourably the monsoon belts strengthen and shift latitude. The African Humid Period is therefore not an anomaly but the most recent instance of a recurring state. Skonieczny et al. (2019) resolve a dominant cycle of approximately 20,000 years in 240,000 years of West African dust deposition, and Larrasoana et al. (2013) identify more than 230 Green Sahara Periods within the last eight million years, proposing that this rhythm has shaped hominin evolution.

This bears directly on how a climatic baseline is defined. A region that has alternated between savannah and hyperarid desert more than two hundred times, under the control of solar-system geometry, does not obviously possess a normal state against which departures can be measured.

3.3 *Populations of the last Green Sahara*

If the setting was real, a further question follows: were there people in it whose experience could have entered oral tradition? Linguistic and archaeological reconstruction indicates two populations expanding across North Africa during the humid phase and meeting as a consequence of the climatic shift. Speakers of Nilo-Saharan, associated with an aquatic economy of barbed bone harpoons, fishhooks and nets, expanded northwest along the new waterways from an origin near the Sudanese Nile (Yellen, 1998). Speakers of Niger-Congo, savannah hunters using bows with Ounan-type points, appear to have originated in present-day Mauritania and Western Sahara and moved south and east in pursuit of newly available game.

The archaeological signatures of both - harpoons and fishhooks in what is now open desert, Ounan points across the northern Sahara - are recovered from the intervening terrain. The proposed north-western homeland of the second group corresponds to the region Sarantitis identifies with the Atlantean capital, in the vicinity of the Richat Structure in Mauritania, whose concentric form reveals strong comparison with Plato's description of the city's layout.

This does not demonstrate that the Atlantis narrative is historical, and several of its elements are demonstrably not. It raises a different possibility: that a large human expansion driven by natural climate change at the opening of the Holocene left a residue in the oldest strata of cultural memory, which had the potential to be drawn upon in later mythological tales that could have potentially reached the 1st millennium BCE.

4. The Double-Edged Sword

The second question is what the historical record shows about the consequences of climate change for human societies. In each well-documented episode surveyed, the outcome resists classification as benefit or harm.

The Late Bronze Age collapse, around 1200 BCE, coincided with a rapid climate change event in which polar airflow reduced eastern Mediterranean surface temperatures by as much as three degrees Celsius, producing drought, migration and warfare from central Europe to the Levant. Palaces burned and kingdoms ended - and the same disruption accompanied the decentralisation of economies and an advance in metallurgy that fed into the Iron Age and, in time, Archaic and Classical Greece. Earlier, the first fortified settlements, Jericho among them, emerged near the onset of the Holocene, bringing permanent shelter, storable surplus and larger populations - together with the first stratification of economic class, a measurable decline in stature and health relative to preceding foragers, and concentrations of resource that had to be defended at scale.

The clearest case is the drying of the Eastern Sahara between roughly 4000 and 3000 BCE. Lakes contracted, grassland reverted to sand, and pastoral populations lost their grazing; read as a contemporary event it would be reported as a catastrophe. Those populations converged on the one reliable water source remaining to them, the Nile, and the commingling of cultures and techniques along that corridor issued in Pharaonic Egypt - whose Great Pyramid, completed around 2600 BCE, remained the tallest structure built by human beings for nearly four thousand years.

The pattern recurs at smaller scale. Harvest failure during the cooling of roughly 400-800 CE contributed to the migrations that coincided with Alaric's entry into Rome in 410. The Little Ice Age brought failed harvests across the Northern Hemisphere, reduced average European stature by more than two centimetres, contributed to the fall of the Ming, and - by way of the winter of 1788-89 - to the conditions that precipitated the French Revolution. Each was ruinous for some populations and generative for others. Further back, the major transitions in hominin evolution occur across a long cooling trend punctuated by rapid warming and cooling alike. The evidence does not support a stable mapping from the direction of temperature change to human benefit or harm; every transition examined produced losers, beneficiaries, and something subsequently regarded as constitutive of civilisation.

5. An Open Question: Solar Influence Beyond Climate

A third line of inquiry is offered here as a question rather than a claim. In the early twentieth century the Russian scientist Alexander Chizhevsky proposed that geomagnetic disturbance driven by solar activity affected not only technical systems and epidemiology but human collective behaviour. Comparing sunspot records with episodes of unrest across 72 countries from 500 BCE to 1922 CE, he reported clustering of mass-movement events near maxima of the approximately eleven-year cycle. In 1942 he was ordered to retract the work by Stalin's government, as it conflicted with the official account of the 1917 revolution; he refused, and spent eight years in labor camps and a further eight in what was termed rehabilitation. He did not return to the subject.

Elements of the question have been revisited with modern methods. Ertel (1996) subjected Chizhevsky's claim to statistical scrutiny; Hrushesky et al. (2011) report periodicities in human physiology phase-locked to solar magnetic activity; Telksniene et al. (2017) and Alabdulgader et al. (2018) examine correspondence between geomagnetic variation and cardiac and neural rhythms; and Yeung (2006) notes the coincidence of the 1918, 1957 and 1968 influenza

pandemics with cycle maxima and of the 2020 pandemic with the deep minimum of cycle 24. No mechanism is established, the datasets are heterogeneous, the correlational designs are vulnerable to the usual objections, and several of these results remain contested. They are cited here not as findings but as an illustration of a category: questions foreclosed for reasons unrelated to evidence. Chizhevsky's work was suppressed because it was politically inconvenient, not because it had been refuted, and was not allowed to evolve.

6. Conclusions

Plato understood in 360 BCE that the geography of the world had changed over long intervals, and he used that understanding deliberately and symbolically, setting his account in a distant pre-history whose landscape was not his own. The nineteenth-century translators did not share the assumption about the variability of ancient climate; they read Plato's geography as a version of theirs, and the setting of the narrative was misplaced for a century and a half, spawning misguided attempts to locate a "real" Atlantis. The same pattern appears in the reception of Saharan rock art: Barth's engravings of elephants and giraffes in waterless terrain were plainly legible, and were seemingly not initially accepted at face value because the environment they described could not be reconciled with the environment then presumed normal.

Three conclusions follow. First, the geography implied by Plato's account corresponds to a landscape that demonstrably existed in North Africa in the early Holocene, which makes the question of transmitted memory legitimate even though it does not settle it. Second, Green Sahara Periods are a recurrent, orbitally paced feature of the Earth system, and the notion of a baseline climatic state for that region is correspondingly difficult to define. Third, the historical record does not show that warming or cooling reliably produces benefit or harm for human societies; the drying that emptied the Eastern Sahara also produced Pharaonic Egypt.

Confidence in the prevailing model of the world has repeatedly proved poorly matched to the evidence of deep time and continued scientific discovery. The appropriate mentality in facing unresolved questions is the one Socrates described in distinguishing himself from an acknowledged expert of his own day: whatever he did not know, he did not suppose that he knew it.

Funding

This work received no external funding.

Acknowledgements

The author thanks George Sarantitis for many hours of discussion of the Platonic texts, and the organisers of IKEK-17 for the invitation to present this material in Halle (Saale).

Co-Editor: Stein Storlie Bergsmark.

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SCC Publishing
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1366 Lysaker Norway

ISSN: 2703-9072

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Vol. 6.3 (2026)
pp. 111-116

As American as Apple Pie: How We Built America's Climate-Realist Movement

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Abstract

When EIKE invited me to speak at IKEK-17, the request was simple. I had been part of the American climate-realist movement from the start, and the country was doing well on the issue, so would I explain how we got here. None of this was an accident. We are outgunned by a margin that would make most people quit. The other side has the money, the media, the universities, the United Nations, and Hollywood. We built real influence anyway, over four decades and on purpose. Here is how we did it. We treat personnel as policy, we assemble the right people into a working network rather than a mailing list, and we borrow hard tactics from two very different books, Sun Tzu's *The Art of War* and Saul Alinsky's *Rules for Radicals*. I offer it to my European colleagues in the hope that some of it travels.

Keywords: Climate realism; climate policy; grassroots activism; energy policy; strategic communication

Submitted 2026-09-04, Accepted 2026-09-04. <https://doi.org/10.53234/scc202608/23>

1. Who We Are

A minute of shameless self-promotion first. CFACT has been around since 1985. I co-founded it with David Rothbard, which dates me more than I would like. We work on policy in Washington, D.C. We publish reports and studies, we testify, and we keep a board of scientists and academic advisors. We run the Climate Depot news service under Marc Morano, and a Collegians program that works with young people on campuses across the country. Mostly, though, we are known for our stunts. A columnist once called us “the Greenpeace of the right,” and the name stuck. We have jumped out of airplanes at conferences and boarded Greenpeace ships to drop banners off the side. The scientists here have already given your brains a workout, so I am just going to talk.

2. As American as Apple Pie

Holger Thuss asked me to explain how America ended up at the front of this movement, so let me be blunt and a little rude for a guest in someone else's country. This is going to be an unapologetically pro-American talk. We are marking 250 years since our separation from England, so my British friends will have to forgive the red coats and the blue coats before I am done.

When Europeans tell me what they admire about America, they say McDonald's. We have better exports than that. In my country, when we want to call something truly ours, we say it is “as American as apple pie.” A pickup truck on a Saturday night with Johnny Cash on the radio qualifies. So does a Red Sox game at Fenway. Well, we have a new slice. To be a climate realist in the United States today is as American as apple pie, and I want to explain how that happened.

Not everyone likes this particular pie, and the Greens have called America the problem for decades, long before Donald Trump. I was invited to the White House when George H. W. Bush signed the first global climate convention. I never made the meeting because he canceled it once he learned we were coming to talk him out of it, and he assured us the treaty would be non-binding. That enraged the Greens, who wanted something binding. When Kyoto came in 1997,

we stayed out, and George W. Bush pulled us the rest of the way out. We skipped Copenhagen. We joined Paris and then left, one of only a handful of nations outside it, in the strange company of Iran, and we have since withdrawn from the original U.N. climate framework as well. The Greens see all of this as America snubbing the world. We see it as America standing tall.

3. The Most Skeptical Nation on Earth

This is bigger than one president. Look at the data, and America is the most skeptical country on earth, and has been for a while. The most convincing survey I have seen is a 2020 poll by Ipsos, a French firm, which I still consider trustworthy, that questioned 30,000 people worldwide and found the United States the most skeptical of all. That figure counts more than the people who call climate change nonsense. It includes those who say the warming is mostly natural and those who remain undecided, and I do not know how anyone stays undecided after this much propaganda. Together they come to nearly 54%.

Critics will tell you the hard skeptics are only about 14% of Americans. That is still twice the European share, and it undersells things, because sitting next to that 14% is a 46% that has bought what the U.N. is selling. The gap shows up where it counts. Fewer than 1% of Americans name climate as a top voting issue, against about 10% in Europe. In 2024, Gallup and Pew found that 85% of EU voters say climate affects how they vote, compared with 27% in America, and those are mostly Democrats. Policy follows the public. The EU has a binding 2050 neutrality target and a 55 % emissions cut by 2030. We have repealed our greenhouse-gas finding and have almost nothing left to regulate federally. I joked to my staff that we could all quit and go home. They did not find it as funny as I did.

4. Personnel Is Policy

We have our own Captain America. Whatever you think of Donald Trump elsewhere, on this issue he has been a rock star, and he did it twice. In 2016 he pulled us out of Paris almost at once, then out of 66 other U.N. bodies, well beyond what we expected. He halted offshore wind. He called global warming a hoax, and yes, in a room full of scientists, that phrase overreaches, because the planet has warmed. What he means is that what Gore and Greta Thunberg and the U.N. are selling is a hoax, and hearing it said that forcefully moved opinion our way.

Better than any single act is who he appointed. We have a saying in Washington: people are policy. The first term was uneven on this. The second time he brought in some rock stars. Chris Wright at the Department of Energy has run one of the greatest deregulatory efforts in history, canceling 223 solar projects, limiting electric-vehicle and battery grants, and rolling back 47 energy-efficiency rules tied to climate. He convened a working group of skeptic scientists, among them Judith Curry, Roy Spencer, and John Christy, and for the first time the views you hear in this room carried a government stamp of approval. A filing error got it withdrawn, and if we handle it correctly, that should not be permanent.

Then there is Lee Zeldin at the EPA. I introduced him at a conference two months ago, where he said something I keep repeating: those of us who spent years telling the truth on climate had wondered when our day of vindication would come, and it had arrived. He has cut EPA staffing by a quarter, ended Solar for All, killed “sue and settle,” defunded a long list of grants to green groups, and moved to strike the endangerment finding, the legal foundation of nearly all federal climate regulation. So, we are happy. I do not mean to gloat, but we are rocking right now. The lesson is that this leadership was the culmination of our work, not its beginning.

5. We Are Outgunned

Why the success? Is there something in the water that turns Americans into skeptics? No. And here is what I most want you to hear. It is not because our side is well funded. If anything, we are

the underdog by an embarrassing margin.

Line up the resources, and it is not close. The alarmists have the major scientific bodies, the enormous NGOs, government grants, wealthy donors, the big foundations, social media, the United Nations, and Hollywood. On our side stand a few modest groups such as Heartland, the CO2 Coalition, and CFACT, plus conservative media that still reaches the audiences we need, from talk radio to Fox and Newsmax. We have genuinely credible scientists, many of them here, and I like to say you do not count heads on our side; you weigh them.

Now the money, and I will admit I pulled the top figure from an AI search and checked it against other tools. The ten largest organizations pushing climate alarm come to roughly \$4.7 billion, before you count the foundations behind them, from Bezos pledging up to \$10 billion to the Rockefellers. In the other corner, the ten groups fighting back total under \$200 million. Remove one of them, Heritage, and you are under \$100 million. Narrow it to the five doing this work day to day, and you are under \$25 million. So, sit with that. On one side, \$4.7 billion. On the other, under \$25 million. It is not a fair fight, which raises the obvious question: given those odds, how do you win?

6. An Army Travels on Its Belly

Step one, you need supplies. I was in the military, and we used to say an army travels on its belly. The other side needs a fortune because a lie is expensive to spread. The truth costs less, but it is not free.

So, the Greens try to starve us. You have seen the elaborate maps, like the one Sheldon Whitehouse waved in a hearing, claiming the fossil-fuel industry bankrolls the skeptic movement. It is garbage. Did those companies fund us long ago? Yes. Between roughly 1998 and 2006, it was natural for CEI, CFACT, and others to ask those industries to defend themselves, and they gave modestly, on the public record, with no hiding it. Then, in 2006, the companies became Benedict Arnolds, the American general who turned and fought for the British. They publicly announced they were not funding any skeptic group, and named us while they did it. And it was true. They stopped. Honestly, it helped us, and we have only grown since.

Big oil is now our opponent, not our patron. The major companies have all signed up for net zero by 2050. Margaret Thatcher had the phrase: they fed the crocodile, hoping it would eat them last. They threw the skeptics overboard, sure the Greens would leave them alone. The Greens did not. Boulder, Colorado, is suing them right now over heat waves and droughts, and I will be candid: I do not have much sympathy. What is being done to them is wrong, but they rather earned it. And notice who really takes the money. The Sierra Club took \$21 million from Chesapeake Energy. Reports tie green funding to the Sea Change Foundation, which traces back to Russian and Chinese interests, and you can work out why Moscow and Beijing would want to cripple American energy. Al Gore sold his television network to Al Jazeera, owned by the Qatari petro-state, and pocketed around \$100 million, against the \$30 million ExxonMobil gave 60 groups over ten years. He made three times as much on one sale as 60 organizations did in a decade. So, my advice is plain: raise from individuals, foundations, and corporations, expect the sources to be attacked, and hold the Greens to the standard they demand of you.

7. The Right People and the Network

Supplies are not enough. Since this is our 250th anniversary, let me keep the Revolutionary War picture. To fight, you need the right people, a working network, and tactics.

We are blessed with real intellects. The late Fred Singer, and here today, Will Happer, along with Willie Soon, David Legates, Richard Lindzen, Judith Curry, and Roy Spencer. Our revolution has its Thomas Jeffersons, and I picture them in powdered wigs, because they are the minds that drive it. But thinkers alone will not win. You need foot soldiers: the people who work the media, run the accounts that carry the message, and lead the NGOs, such as James Taylor at Heartland, Greg

Wrightstone, the late Fred Smith, and Myron Ebell. Sometimes being a soldier means you end up wanted. There is a photograph of Marc Morano and James Taylor holding mock wanted posters outside the Paris meeting, and we wear that as a badge of honor.

Then you network. The Greens love to chart how we supposedly connect, and they produce baffling maps. They once mapped Heartland's work in Europe in a chart I could not make sense of. Somehow everything is connected. Our real networking is far simpler than their conspiracy walls. A group of us meets monthly at the Cooler Heads Coalition, where we do not debate whether the other side is right. We talk about specific bills, specific lawsuits, and specific resolutions, and we get down and dirty. CEI and CFACT formed it around 2000, and Myron Ebell led it for years. When Trump first took office, he picked Ebell to staff the EPA transition. Each group brings its own gift. CEI was strongest on Washington policy, the CO2 Coalition owns the science, Heartland excels in the states and abroad, and we do the grassroots and the media. Nobody does everything.

8. Our Tactical Playbook

Now the fun part. Two books shaped how we operate: Sun Tzu's *The Art of War* and Saul Alinsky's *Rules for Radicals*, which was written for the left. When David Rothbard and I started CFACT in 1985, we studied how clever the left was about tactics. Obama himself trained on Alinsky's principles at the Midwest Academy in Chicago. What the left uses to advance its cause can be turned around against it. I like tactics. In high school, I organized students to take over classrooms and free their classmates from teachers, which you could never get away with today, and I served in the actual military too. We are in a war, so we fight like it. Here are five principles the two books share, each with an example.

First, win through strategy and disruption rather than costly frontal confrontation. We had an early advantage. I was there when James Hansen told the Senate in 1988 that human activity was driving the climate. Almost no one had heard of the idea. I am from Buffalo, and until then we only talked about the coming ice age. Within four years the U.N. staged its huge 1992 summit in Rio, and only a couple of groups, mainly CEI and CFACT, wanted a dissenting voice there. A protest our size would have been the mouse that roared. So instead we sent Dixy Lee Ray, a scientist, a former governor of Washington, and the author of the best-selling *Trashing the Planet*, and we got her onto Rush Limbaugh's show. Rush loved it, and even gave her a limousine to drive around Rio on the condition that she run the air conditioning full blast with the windows down to let the CFCs out. He reached 15 to 20 million Americans a day, and they heard the unvarnished truth. I believe it helped push Bush toward a non-binding treaty, because he knew his own people opposed it. The Greens never got their binding deal, and they were furious.

Second, exploit your strength against their weakness. Their great weakness is the truth. Take green energy, sold as clean and green with no downside. It has plenty. Dead eagles are a real impact, and so are land use, higher power bills, and the possible harm to whales. Blanket 20 square miles in solar panels and tell me that is good habitat. As our own president put it, every windmill costs the country a fortune to turn; it is ugly, and it kills birds. Willie Soon gave me a slide showing what a solar field does to a bird that lands on it. The public feels this. Robert Bryce has been counting the projects halted by local opposition, and the number is past 825. We organized ranchers, farmers, and Native Americans against wind in Oklahoma and Wyoming, flew banners over Atlantic City, put up billboards, held rallies in New Jersey, and took boats onto the ocean. They are vulnerable here, and we keep hammering.

Third, attack where the enemy is unprepared and appear where you are not expected. My favorite is Al Gore. After the Nobel Prize, he flew to Indonesia to be welcomed as a hero, and we secured a permit to protest right where he would arrive. When the U.N. found out, it revoked the permit, saying we would be too disruptive. Somehow that second email never reached me. So, the cameras gathered, everyone waiting for Gore, the sort of press you could never buy, and out came Lord Monckton, Joanne Nova, and a parade of skeptics instead. The officials came charging out

looking ready to remove our heads, but the media was already interviewing us. We did the same by boarding a Greenpeace ship in Copenhagen, and again by sending students with banners to greet James Hansen at Rice University. Our Collegians like to cause trouble. People say we are leading the youth astray. They are having fun.

Fourth, and one Alinsky prized, ridicule is man's most potent weapon. There is no defense against it. We film the other side saying foolish things. In Doha, Qatar, we handed U.N. delegates an ordinary construction dust mask and told them it would capture the CO₂ they exhale, and we recorded people, including some from the IPCC, agreeing to wear it and to put it on their spouse and their dog. That was before COVID, so I suppose we gave them the idea, and I am sorry. The master of ridicule at CFACT is Marc Morano. When I hired him, I told him his job, like the Hulk in the Avengers, was to clobber, but with humor. Read climatedepot.com, where this week he is mocking claims that the World Cup is dangerous and that warming will send snakes after you.

Fifth, force the opponent into hypocrisy. This one is easy, because they hand it to you. Our film *Climate Hustle* has a whole section on it. Barbra Streisand lectures on climate, then flies her two dogs across the Atlantic on a private jet to join her at a concert. Al Gore preaches the carbon-neutral life while his house burns more electricity in a month than a typical American family uses in a year. Gore is the gift that keeps giving. We also shoot our own investigative videos, catching them dining on champagne and salmon at their exclusive summits while they tell the rest of us to sacrifice.

9. It Was No Accident

So here is my message to Europe. The skeptic movement in America is not an accident, and it is not haphazard. It is orchestrated and coordinated, built over decades of publishing, testimony, coalition work, media, and grassroots trouble. When the political weather finally changed, a prepared movement had the ideas, the people, and the muscle ready to act, and the leadership we now enjoy was the culmination of that work rather than its cause. It will not copy neatly onto your own countries, because your constitutions, parties, media, and energy realities differ from ours. The core still travels. Build the institutions before the favorable election, recruit the credible scientists and the seasoned staff, coordinate around concrete bills and lawsuits, and keep the science precise and the human costs plain. Do that, and a small movement becomes a serious one. There is a vast right-wing conspiracy on climate in America, and you are looking at one of its members. Thank you.

Funding

No external funding was received specifically for the preparation of this conference contribution.

Acknowledgements

This contribution is based on my presentation at the 17th International EIKE Climate and Energy Conference (IKEK-17).

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
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ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 117-125

Issues Associated with the Measurement of Precipitation for Climate Change Assessment

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Abstract

Long-term assessments of climate change depend upon observations that are accurate, representative, and consistent through time. Precipitation presents particular difficulties because it is highly variable both spatially and temporally and because observational networks are unevenly distributed across the globe. Stations tend to be concentrated in developed, populated, low-elevation regions, while large areas of the tropics, high latitudes, mountains, and oceans remain poorly sampled. Moreover, station locations, environments, instrumentation, and observing practices change through time, potentially introducing artificial discontinuities into climate records.

Precipitation gauges themselves are subject to substantial measurement biases. Wind-induced undercatch is particularly important because airflow around a gauge can deflect precipitation away from the gauge, evaporation, gauge height, shielding, splash, and instrument design. These biases are generally systematic rather than random and can affect hydrological and climatological analyses.

Changes in instrumentation can also produce apparent climatic trends. For example, the transition of portions of the U.S. observing network to the Automated Surface Observing System (ASOS) during the early 1990s introduced gauges with different siting and catch characteristics. An examination of a U.S. extreme-precipitation index shows relatively little trend before and after this transition but an apparent discontinuity coincident with network modernization, raising questions about how much of the long-term increase represents climatic change versus observational change.

Consequently, precipitation trends, particularly small trends over large spatial scales, must be interpreted in the context of measurement uncertainty, network evolution, land-use change, and observational inhomogeneity. Robust climate-change assessment requires distinguishing genuine climatic signals from artifacts introduced by the observing system itself.

Keywords: Precipitation measurement; climate change; observational uncertainty; precipitation trends; extreme precipitation; rain-gauge undercatch; climate data homogeneity; instrumentation change; climate trend detection.

Submitted 2026-08-09, Accepted 2026-08-13. <https://doi.org/10.53234/scc202608/03>

1. Introduction

The measurement of climate seems, at first glance, to be a relatively straightforward undertaking. Meteorologists have been measuring temperature and precipitation for well over a century, and modern climate assessments routinely use these observations to identify long-term changes in climate. Yet the apparent simplicity of these measurements conceals a much more difficult

problem. Before trends in precipitation can confidently be attributed to climate change, we must first determine whether the observations themselves are sufficiently accurate, representative, consistent, and homogeneous to reveal the climatic signal we are attempting to detect.

Precipitation presents an especially difficult challenge. It is considerably more variable in both space and time than air temperature. A person can drive through an intense thunderstorm and emerge into completely dry conditions within a short distance. Whether it ‘rained’ at a particular location on a particular day may therefore depend simply upon where the raingauge happened to be located. In mountainous terrain, where precipitation changes dramatically with elevation and exposure, the problem becomes still more difficult.

These difficulties are important because climatologists frequently combine thousands of individual observations to estimate regional, national, and even global precipitation. The resulting datasets can create an impression of precision that may greatly exceed the precision of the underlying observations.

2. The Global Precipitation Network

One of the fundamental problems is the geographic distribution of precipitation gauges. Weather stations are not distributed randomly or uniformly across Earth’s surface. Dense networks exist in countries such as Germany, while enormous regions of the planet have relatively sparse coverage. Furthermore, the number and location of stations change through time. Stations enter and leave the observational network because of economic circumstances, political changes, wars, institutional decisions, and many other factors unrelated to climate.

The distribution of observations consequently contains several systematic biases. Weather stations tend to be concentrated where developed populations live. They are more common near populated areas and coastlines than in remote interiors, more common at lower elevations than on mountain peaks, more numerous in the middle latitudes than in the tropics or polar regions, and vastly more numerous over land than over the oceans. The resulting observational network therefore has urban, economic, geographic, and elevation biases built into it.

More importantly, these biases are not necessarily constant through time. Historical events can dramatically alter a country’s observing network. Japanese stations, for example, disappeared from one historical dataset around 1945, while the collapse of the Soviet Union disrupted a large observational system that researchers had hoped would provide valuable historical precipitation data. Consequently, a global precipitation record constructed for one period may not be spatially comparable with the network available several decades later.

Even where station density is relatively high, the actual area being sampled is extraordinarily small. Germany provides an instructive example. If *Deutscher Wetterdienst* operates approximately 2,000 precipitation gages and each has an opening of about 200 square centimeters, the total area collecting precipitation across Germany is only about 40 square meters. That is roughly 40 percent of the six-yard box on a soccer field. And Germany possesses one of the world’s comparatively dense observational networks. The sampled area in countries with sparse meteorological networks is dramatically smaller.

This creates another important statistical issue. Researchers may treat thousands of observations as though they were independent measurements, allowing uncertainty to decrease rapidly as sample size increases. But neighboring gauges frequently measure the same meteorological systems and therefore are not statistically independent. The true effective sample size may be considerably smaller than the raw number of stations suggests.

3. What Does “Representative” Mean?

A second problem concerns representativeness. Meteorological stations are normally expected to occupy open locations away from buildings, trees, air-conditioning exhausts, furnaces, and other artificial influences. Such standards make sense when the objective is to obtain comparable climatological measurements.

But real landscapes frequently do not resemble ideal meteorological observing sites. Cities such as Berlin, for example, consist largely of buildings, streets, trees, vehicles, and other obstructions. If the objective is to determine how much precipitation falls in Berlin, where should the rain gauge be located? A pristine open site might satisfy climatological standards while simultaneously failing to represent the environment in which most residents actually live.

Thus, there can be a distinction between **climatological representativeness** and **hydrological representativeness**. The former seeks standardized measurements under controlled conditions; the latter may seek to understand what is actually occurring across a heterogeneous landscape.

4. The Requirement for Consistency

Long-term climate analysis requires something else: consistency. Ideally, if precisely the same meteorological conditions occurred today and a gain several decades from now, the observing system would record the same value both times. In practice, observing systems rarely remain unchanged. Stations move. Buildings are constructed. Trees grow or are removed. Airports expand. Instruments are replaced. Observational procedures change. Some changes occur suddenly, while others evolve gradually and therefore do not create an obvious discontinuity in the record.

The transformation of Washington Dulles International Airport provides an illustration (Figure 1). Photographs from the early airport era show sheep grazing around largely undeveloped land. The modern airport is surrounded by extensive pavement, roads, terminals, parking facilities, and urban development. Even if a meteorological station remains geographically close to its original position, its surrounding environment may bear little resemblance to what existed when the climate record began.



Figure 1: Washington's Dulles International Airport (USA) shortly after its construction in 1962¹⁴ and in 2011¹⁵.

For temperature, urbanization generally introduces a predictable influence toward warming. The effects on precipitation are less straightforward. Does replacing fields with pavement make measured precipitation greater, smaller, or simply more variable? How should such effects be identified and corrected? And if surrounding stations have undergone similar urbanization, comparing one station with its neighbors may not solve the problem.

5. Climate Change Versus Land-Use Change

The distinction between climate change and land-use change becomes particularly important when examining floods and droughts.

Northern Delaware provides a useful case study. The region has become much more urbanized over the past century and has experienced increased problems associated with both flooding and water shortages. It is tempting to attribute such changes immediately to climate. But dramatic changes in land use can produce similar effects without any corresponding change in precipitation.

Talleyville, Delaware, illustrates the process. In 1937, the community was surrounded largely by farmland and vegetation. Rain falling on the landscape infiltrated into the soil and moved relatively slowly toward the Brandywine River. Over the following 85 years, Talleyville became part of the suburbanized Wilmington metropolitan area.

Rain falling on the modern landscape encounters roads, parking lots, rooftops, and other impervious surfaces. Streets and storm drains efficiently transport water toward streams, increasing runoff and the potential for urban flooding. At the same time, population growth and economic development increase water consumption. More households, businesses, landscaping, and other water-intensive activities place greater demands upon available supplies during dry periods.



¹⁴ https://www.reddit.com/r/nova/comments/t2t7d9/history_sundays_dulles_airport_when_it_first/

¹⁵ https://en.wikipedia.org/wiki/Dulles_International_Airport

Figure 2: Talleyville, Delaware (USA) in 1937 (left) and 2022 (right).

Thus, human activity unquestionably can increase both flood and drought problems. But the relevant human activity may be urbanization and land-use change rather than anthropogenic climate change. The distinction matters because the appropriate policy responses are very different.

6. The Surprisingly Primitive Raingauge

Precipitation measurement appears deceptively simple. At its most basic level, a rain gauge consists of a container and a ruler. Indeed, despite sophisticated modern alternatives—including optical, acoustic, weighing, hot-plate, and electronic gauges—much of the world's precipitation network still depends upon devices that are fundamentally variations on the traditional container-and-measuring-stick design.

The problem is that countries have historically used different gauges. Designs differ in shape, construction, shielding, and particularly in the height of the gauge opening above the ground. These differences affect the amount of precipitation that actually enters the gauge.

6.1 Wind-induced Errors

The greatest source of error is **wind**. A precipitation gauge is a physical obstruction placed in moving air. Wind accelerates around and over the instrument. This produces turbulence, vertical motion, and pressure differences around the opening. Falling raindrops—and especially snowflakes—can consequently be deflected away from the gauge rather than entering it.

The result is systematic **undercatch**. For rainfall the error can be significant. For snowfall it can become enormous. Under windy conditions, a gauge may capture less than one-quarter of the snow that actually falls.

One solution is to place gauges at ground level in pits, thereby reducing their exposure to wind. Such installations can provide useful reference measurements but are inconvenient for routine observations. Another approach surrounds the gauge with a windshield designed to reduce aerodynamic distortion. Different countries have developed different shield designs, including fixed and movable slats. These improve catch efficiency but do not completely eliminate the problem.

6.2 Wetting-Loss and Evaporation Errors

Wind is not the only source of precipitation loss. Some water adheres to the inside walls of the instrument—a phenomenon known as **wetting loss**—and is therefore never measured. Water can also evaporate from a gauge before the observer records it.

Based upon the global precipitation analysis developed for my dissertation, wind produces an average global underestimate of roughly 8 percent, wetting contributes approximately another 2 percent, and evaporation about 1 percent. Together these effects imply that gauges globally may measure only about 89 percent of the precipitation that actually falls. Crucially, this error is not random. The bias is overwhelmingly toward measuring too little precipitation rather than too much.

6.3 Additional Sources of Measurement Error

Even after accounting for wind, precipitation gauges remain subject to numerous other problems. Very small rainfall events may wet the internal surfaces of the gauge without producing enough measurable water to be recorded. Evaporation losses become particularly important in hot and dry climates. Installing gauges close to the ground reduces wind effects but can introduce splash-in, as raindrops strike the surrounding surface and rebound into the gauge. Poor gauge designs can also allow splash-out.

Tipping-bucket gauges introduce another difficulty during exceptionally intense rainfall: the mechanism may not tip rapidly enough to record all the incoming water. Snow creates still more complications. Blowing and drifting snow may enter a gauge even though it is not actually falling from the atmosphere at that moment. Converting accumulated snow to its liquid-water equivalent introduces another potential source of uncertainty, and gauges can freeze or become blocked by snow, ice, debris, or birds.

These errors differ according to precipitation type, climate, gauge design, wind speed, installation height, shielding, observational procedure, and local environment. They also change through time as networks evolve.

6.4 The Impact of These Errors on Hydrological Analyses

This bias also propagates through hydrological analyses. If precipitation input into a water-balance calculation is underestimated, some other component of the hydrologic cycle must compensate. Evapotranspiration or soil-moisture estimates may therefore appear anomalously low because the original precipitation input was already biased downward.

Gauge height further complicates matters. Wind speed generally increases with height above the ground. Consequently, raising a precipitation gauge increases its exposure to wind and tends to reduce catch efficiency. Yet countries experiencing heavy snowfall often need to raise gauges so that they are not buried by accumulating snow. Different national observing practices can therefore create artificial discontinuities across political boundaries. Apparent changes in precipitation at an international border may have nothing whatsoever to do with meteorology; they may simply reflect differences in instrumentation and observing procedures.

7. When Better Instruments Create an Artificial Climate Trend

These measurement issues become particularly important when examining trends in extreme precipitation. The NOAA Climate Extremes Index shows the proportion of precipitation associated with extreme one-day events. The series appears to rise over the twentieth and early twenty-first centuries. Viewed without additional information, the graph seems to provide straightforward evidence that heavy precipitation has become more common or intense.

But the history of the observing network complicates that interpretation. Until the late twentieth century, many National Weather Service precipitation observations involved traditional gauges read manually. An observer physically measured the accumulated water, emptied the gauge, and repeated the procedure at specified intervals.

During the late 1980s and early 1990s, the National Weather Service began modernizing its network with the Automated Surface Observing System, or ASOS. Among the new technologies were automated precipitation gauges. Tipping-bucket gauges, for example, use small, calibrated buckets that tip after collecting a predetermined amount of water—usually 1mm. Each tip is electronically recorded, providing both precipitation totals and much more detailed information about rainfall timing and intensity.

Automation offered obvious operational advantages. But the transition also changed the physical characteristics of the observing system. Because human observers no longer needed convenient access to the instruments, gauges could be installed closer to the ground. Lower placement meant reduced wind speed and therefore improved catch efficiency. Shields were also installed around the gauges, further reducing wind-induced undercatch.

The result was an observational system introduced around 1990–1993 that was more efficient at catching precipitation than much of the system it replaced. That change becomes highly significant when the long-term heavy-precipitation index is divided into periods.

According to the analysis presented, the record from approximately 1910 through 1990 is essentially flat. Likewise, the record after the modernization period—from roughly 1993 onward—is also essentially flat. The apparent century-long increase emerges primarily because the later, more efficient observing system records a higher level than the earlier system.

In other words, two relatively flat periods are separated by a **jump discontinuity** occurring at approximately the same time that the precipitation observing network was modernized (Figure 3). Climate generally does not change through abrupt nationwide jumps synchronized with changes in meteorological instrumentation. Such discontinuity is therefore a warning that the observational system itself may have changed.

Regional comparisons provide further support for this interpretation in the presentation. The apparent increase is larger in the northeastern United States, where more airport stations underwent the ASOS transition, and smaller in the Southwest, where cooperative observer gauges that did not undergo the same modernization constitute a larger portion of the network.

The argument, therefore, is that at least part of what appears to be an increase in heavy precipitation may actually be a **gauge-change signal rather than a climate-change signal**. Yet the discontinuity remains embedded in the observational record and consequently can be interpreted as evidence of increasing precipitation intensity.

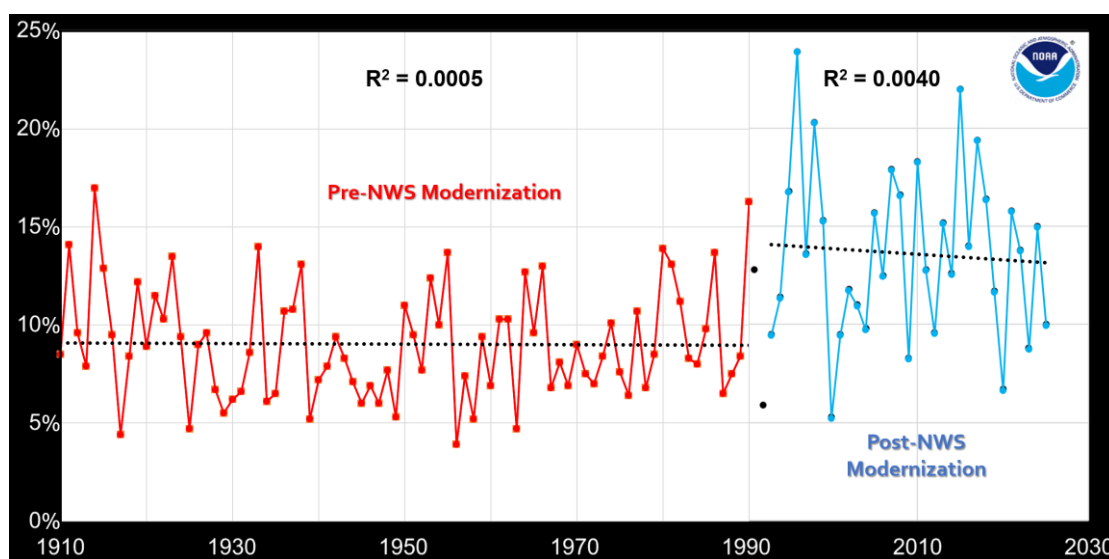


Figure 3: NOAA's Climate Extremes Index (Step 4 – Extremes in one-day precipitation)¹⁶ showing the period before the ASOS modernization (in red) and after the ASOS modernization (in blue).

8. The Larger Lesson for Climate Assessment

The central message of this presentation is not that precipitation cannot be measured, nor that precipitation patterns cannot change. Rather, it is that detecting relatively small long-term climatic trends requires a level of observational consistency that is extraordinarily difficult to achieve.

This problem becomes increasingly serious as the geographic scale of the analysis expands. Global mean surface temperature is routinely calculated, plotted, and discussed. Global mean

¹⁶ <https://www.ncei.noaa.gov/access/monitoring/cei/graph>

precipitation is much less commonly presented. There is a reason for that difference: precipitation is spatially heterogeneous, difficult to measure, poorly sampled across large portions of the planet, affected by numerous systematic gauge biases, and observed using instruments and procedures that have changed through time.

Consequently, apparently precise precipitation trends can conceal substantial uncertainty. The basic climatological question should therefore not simply be: **Does the graph show an increase or decrease?** Instead, we must first ask what produced the graph.

Were the same places sampled throughout the period? Did the number of stations change? Are the observations independent? Are they spatially representative? Did urbanization alter the surrounding landscape? Were stations relocated? Did trees grow around them or buildings appear nearby? Did national observing practices change? Were gauges raised or lowered? Were wind-shields introduced? Did the network transition from manual to automated observations? Did the new instruments catch precipitation more efficiently than the instruments they replaced?

Only after addressing these questions can researchers determine whether an apparent trend represents a genuine change in climate or a change in the observing system. This distinction becomes particularly important when changes are small. If the climatic signal is large compared with observational uncertainty, imperfect measurements may still reveal it. But when the trend being interpreted is comparable to—or smaller than—the uncertainties introduced by station distribution, instrumentation, siting, gauge undercatch, land-use change, and network modernization, strong conclusions become much more difficult to justify.

That is ultimately the reason for pessimism about precipitation trends. The problem is not merely that rain gauges are imperfect. Scientists have known for many decades that gauges suffer from wind loss, wetting loss, evaporation, siting effects, and other biases. The deeper problem is that these biases are neither spatially nor temporally constant. The observing system itself changes while researchers are attempting to measure change in the climate.

A century-long climate record is therefore not necessarily a century-long record produced by a single stable instrument under unchanging conditions. It is more often a composite assembled from stations that opened and closed, instruments that were replaced, locations that changed, cities that grew, observational procedures that evolved, and national networks that expanded, contracted, or disappeared.

The final warning is therefore one of appropriate scientific caution. Maps and graphs showing small changes in precipitation over decades can appear authoritative, particularly when they are produced by major scientific or government institutions. But the visual precision of a graph should not be confused with the precision of the underlying observations.

When precipitation trends are presented as evidence of climate change, the associated observational uncertainty must be considered alongside the trend itself. In some cases, that uncertainty may be relatively modest. In others, it may be comparable to the observed change. And in still others, particularly at very large spatial scales, the uncertainty may overwhelm the signal researchers are attempting to interpret.

The fundamental lesson is therefore straightforward: **before asking what precipitation observations tell us about climate change, we must first understand exactly what our precipitation observations can tell us.** The instrument, its surroundings, its history, its exposure to wind, its location, and changes in the observing network are not peripheral technical details. They are integral parts of the climate record itself.

This is why global precipitation trends deserve considerably more caution than they often receive. Small apparent changes can acquire considerable scientific and public significance, yet the

uncertainties behind those changes are rarely as visible as the trend lines drawn through them. In precipitation measurement especially, those uncertainties can be sufficiently large that they overwhelm the very signal we are trying to detect.

Funding

No funding was provided to produce this discussion.

Co-Editor: Stein Storlie Bergsmark

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SCC Publishing
Michelets vei 8 B
1366 Lysaker Norway

ISSN: 2703-9072

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Vol. 6.3 (2026)

pp. 126-130

Climate Change and Food Security: A Minimal-Impact Perspective

Climate and Weather are Marginal beside Technology, Trade and Adaptation

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Abstract

Global food production has risen strongly throughout the period of modern warming. No negative climate signal is visible in the aggregate trends for cereal, meat or aquatic-food output. This paper argues that climate and weather effects on global food production - positive as well as negative - are marginal compared with population and income growth, technology, trade, institutions and farmers' adaptation. Claims that anthropogenic warming has already materially reduced global production are counterfactual estimates: they compare observed output with modelled output in an unobservable world without warming. Such studies may estimate an opportunity loss, but they do not demonstrate an observed decline in food production. Many impact assessments also represent adaptation inadequately by holding crop choice, sowing dates, cultivars, irrigation, production location, trade or technological progress too rigidly. The empirical record instead shows record production, rising yields and slight contraction of total agricultural land since 2001. Hunger persists mainly where poverty, conflict, inflation and weak governance restrict access to food. The practical conclusion is clear: affordable energy and fertilizer, open trade, innovation and good governance are the foundations of food security. Unless governments create artificial scarcity through destructive policies, the world can supply the quantity and quality of food people demand with a steadily declining environmental footprint.

Keywords: food security; agricultural productivity; climate adaptation; trade; aquaculture; decoupling; energy policy

Submitted 2026-07-12. Accepted 2026-08-10. <https://doi.org/10.53234/scc202608/04>

1. Introduction

The presentation at IKEK-17 asked a deliberately simple question: how large is the impact of climate change on food security compared with the other forces shaping the food system? The answer advanced here is: marginal in relative terms, for both negative and positive effects. Weather matters greatly to an individual farmer in a particular season, but global food security is not identical to a local harvest. It is an economic and institutional outcome governed mainly by productivity, income, storage, transport, trade, processing and the ability to adapt.

The distinction between a weather effect and a food-security crisis is essential. A drought can reduce one harvest, yet a wealthy, connected society can import food, change suppliers and absorb the loss. The same shock in a poor or conflict-ridden country can become a humanitarian disaster. The decisive variables are therefore resilience, wealth, trade and governance. Climate and weather are background conditions within that system, not sufficient explanations of hunger.

2. The empirical baseline: more food from each hectare

The long-run record is one of expansion and intensification. FAO reports that global cereal production reached 3.1 billion tonnes in 2024, 27 percent above 2010, mainly because yields improved [2]. Over 2001-2023, total agricultural land contracted by about 2 percent even as cropland expanded; agricultural value produced per hectare rose by more than 60 percent [3]. This is the central decoupling result: more output does not require proportionally more land.

The same pattern is visible in animal production and in the sea. Global fisheries and aquaculture produced 195 million tonnes of aquatic animals in 2024. Aquaculture supplied 103 million tonnes, or 53 percent, and has generated nearly all growth in aquatic animal production since the late 1980s [5]. This transition from hunting wild stocks to farming aquatic animals is comparable to the much earlier transition from hunting terrestrial animals to livestock farming.

The record does not imply that food insecurity has disappeared. In 2024 an estimated 673 million people, 8.2 percent of the world population, experienced hunger [4]. However, the coexistence of record output with persistent hunger points mainly to failures of access: poverty, conflict, high food-price inflation, poor infrastructure and governance. Global scarcity is not the same thing as local deprivation.

Table 1: Selected indicators of the global food system.

Indicator	Latest level	Recent/long-run signal	Source
World population	8.2 billion (2024)	Projected peak near 10.3 billion in the mid-2080s	[1]
Cereal production	3.1 Gt (2024)	+27% since 2010, mainly yield gains	[2]
Agricultural land	4.8 billion ha (2023)	-2% since 2001; output value per ha increased >60%	[3]
People facing hunger	673 million; 8.2% (2024)	Down from 2022, but severe regional divergence	[4]
Aquatic animal production	195 Mt (2024)	Aquaculture 103 Mt and 53% of total	[5]

Note: Figures are rounded. The indicators show the scale of output, access and land-use trends; they do not by themselves identify causal effects of climate change.

3. Demand, technology and trade are the main drivers

Demand grows with population and prosperity. The United Nations estimates a world population of 8.2 billion in 2024 and projects a peak of about 10.3 billion in the mid-2080s [1]. As incomes rise, consumers demand more varied and higher-value diets, including meat, dairy, fruit and aquatic foods. This demand is not a problem to be suppressed; it is a sign that people are escaping poverty.

Supply has repeatedly responded through knowledge and capital: plant and animal breeding, mineral fertilizer, mechanization, irrigation, crop protection, refrigeration, logistics, precision agriculture and increasingly gene editing. These technologies raise output per unit of land, labour, water and feed. They also reduce vulnerability because farmers can change varieties, planting dates, inputs and production locations.

Trade is another form of adaptation. Local production shocks are inevitable, but they need not become local famine when food can move from surplus to deficit regions. FAO reports that the value of food and agricultural trade increased fivefold between 2000 and 2024 [6]. Resilient supply chains require diversified suppliers, functioning ports and storage, and predictable trade rules. Export bans and protectionism often amplify a shock that markets could otherwise distribute.

4. Climate and weather: marginal in the global record

Global food production has continued to rise during nearly 1.5 degrees C of warming. No climate penalty can be read directly from the aggregate production series. The IPCC and several statistical studies nevertheless attribute part of the difference between observed output and a modelled no-

warming counterfactual to climate change [7-9]. That is not an observed fall in food production; it is an estimated opportunity loss relative to an unknowable alternative history. The distinction matters. The measured real-world result is rapidly rising output, not climate-driven decline.

Adaptation is also commonly underrepresented. Farmers do not remain fixed while climate changes: they alter sowing dates, cultivars, crops, irrigation, inputs, production methods and sometimes location. Markets redirect trade, researchers develop new varieties, and infrastructure changes the vulnerability of the entire system. Studies that include only a narrow selection of these responses will tend to overstate damage. Even within existing models, timely adjustment of growing periods and cultivars materially improves projected yields [11], while empirical work that attempts to include producer adaptation substantially reduces estimated future calorie losses [10]. These studies still cannot capture innovations that have not yet been invented or commercialized.

The same caution applies to claimed positive climate effects. Higher atmospheric CO₂ can stimulate photosynthesis and water-use efficiency, especially in C₃ crops, while elevated temperature can help some regions and harm others. Nutrient dilution and heat stress may offset part of the benefit [10, 12]. At the scale of the global food system, however, both the positive and negative effects remain secondary to breeding, fertilizer, mechanization, crop protection, irrigation, logistics, trade and aquaculture.

5. Policy: Do not manufacture food insecurity

The most robust food-security strategy is to preserve abundance and adaptive capacity. Priorities include affordable and reliable energy, fertilizer, agricultural research, modern breeding and gene editing, irrigation and water management, precision application of inputs, improved storage, diversified trade and sustainable expansion of aquaculture. Controlled-environment agriculture and other energy-intensive systems can add further resilience where dependable low-cost electricity is available.

Environmental policy should be judged per unit of nutritious food, not by romantic labels. Organic systems yields are much lower than conventional yields, with gaps strongly dependent on crop and management [13]. A blanket conversion therefore risks increasing land demand. Likewise, food-crop biofuel mandates can divert land and grain from food markets and induce land-use change [14].

The largest avoidable threats are political: war, corruption, trade restrictions, hostility to productive technologies, and policies that make energy, fertilizer, transport, livestock or land unnecessarily expensive. A very costly green transition that weakens reliable energy systems and suppresses agricultural productivity can make society less robust to drought, conflict, crop disease and every other shock. Climate policy should therefore pass a simple test: does it strengthen or weaken the food system's capacity to adapt?

6. Conclusion

Climate and weather affect individual harvests, but their net influence on global food production is marginal compared with productivity, technology, trade and adaptation. The aggregate record contains no visible climate-driven decline: the world produces more cereal, meat and aquatic food, from less land per person, while aquaculture opens a vast additional production domain.

Hunger persists where people cannot command food, not because humanity has exhausted its biological capacity to produce it. Nothing in the production record indicates a serious risk that the world will be unable to provide all the food people can eat, in the quality they increasingly demand. The real danger is self-inflicted scarcity. Unless politicians undermine reliable energy, fertilizer, trade, technology and economic growth through foolish and excessively costly policies, global food supply will continue to expand while its footprint per unit of food declines.

Funding

No external funding was received for this work.

Acknowledgements

Based on the author's IKEK-17 presentation, Halle (Saale), 26-27 June 2026.

Co-Editor: Stein Storlie Bergsmark

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The 17th International Climate and Energy Conference

Closing Remarks

Dr. Holger Thuss

This conference report provides an overview of the presentations given during the 17th International Climate and Energy Conference (IKEK) organized by the European Institute for Climate and Energy (EIKE) and its partners, CFACT and the Heartland Institute. The conference took place on June 26 and 27, 2026, at the Halle Messe GmbH convention center in Halle (Saale).

Since the 15th EIKE Conference in neighboring Braunsbedra in 2022 could only take place under heavy police protection, amid serious threats to the participants and an attack on the conference hall, we were forced to hold the subsequent conference in 2024 in the Vienna suburb of Maria Enzersdorf, on a heavily secured site.

Apparently, in the Germany of Chancellor Merkel—the champion of the energy transition—it was no longer considered desirable to organize such conferences. Thus, the very fact that this year's conference took place in a German city is a major success for us. That said, this report also documents the deafening silence of the mainstream media: While the pre-conference events had seen plenty of hate and incitement against our speakers from the mainstream media, there was absolutely no coverage this year. However, given the immense and ever-growing popularity of the alternative media outlets in attendance and our own media platform, this hardly matters in terms of our reach. All the presentations are now available on our German and English YouTube channels, as well as on the channel of our media partner, *mitgeschnitten.tv*.

None of this detracted from the relaxed, open atmosphere that prevailed at the 17th International Climate and Energy Conference. As at our previous conferences, there were once again many stimulating conversations during the breaks and on both evenings in Halle, as the presentations had provided plenty of topics for discussion. And once again, there were many stimulating conversations during the breaks and on both evenings, as the presentations had provided plenty of food for discussion. Again, as expected, science prevailed over politics. Complex facts were discussed, unknowns were explained, and new ideas were presented, with a focus on formulas, numbers, and measurements. And in addition to familiar and new names, there was even a real Nobel laureate—John Clauser—whom attendees could meet in person.

As you will see below, this year's conference was particularly notable for the presentation of the latest research findings that have been or are being published in prestigious journals such as “Nature”, one of the world's leading scientific journals. Another new feature was a session on paleoclimatology, which also focused on empirical data. The interdisciplinary research presented here gave reason to hope for many more interesting findings, particularly regarding the question of natural climate drivers and historical climate change since the last ice age. Most speakers and participants also agreed that, thanks to the Trump administration's policies, the tide is turning globally when it comes to climate policy and the energy transition, and that this will consequently lead to significant changes in Europe as well.

However—as also became clear during the conference—these global paradigm shifts in the scientific community have so far had very little impact here in Germany or throughout the EU. The public continues to be confronted almost daily with dubious studies purporting to show that this or that climate indicator is “going haywire”—for example, that the drought has never been as extreme as it was this summer. So-called experts repeatedly claim that the so-called energy transition is the future and is being held up as a global model. Work is still underway to drive industry into the ground with unnecessary climate measures even though it has long been clear to the

attentive observer that something cannot be right about the narrative of a climate catastrophe. We see fabricated “average temperatures”—some of which even based on estimates—that are completely arbitrarily linked to averaged carbon dioxide measurement results. Based on pseudoscientific assumptions, ignorant people pass laws designed to further plunder the public and make a small group of profiteers even wealthier. Genuine potentials for more energy efficiency—such as through the expansion and reconstruction of the infrastructure—are, by contrast, simply ignored.

Since our founding almost 20 years ago, we have been able to demonstrate—at every stage of the climate and energy debate and based on scientific studies—that an immediate end to these nonsensical climate protection and energy policies is urgently needed. For nearly 20 years, we have been advocating for unbiased research aimed at developing a modern energy mix—without the environmentally destructive large-scale wind and solar projects, which could never supply the highly industrialized part of the world anyway.

In our 2022 annual report, I predicted that “climate and energy issues will continue to shape our day-to-day political life, leading even to social unrest caused by energy bills that are no longer affordable and the ultimate destruction of our country’s industrial base.” In 2026, angry protests against current climate and energy policies have become a daily occurrence and are continuing to grow. Each of us has come to realize that the social fabric has been severely damaged by climate policy and energy transition.

Incidentally, through our conference and other activities, we have also fulfilled the promise we made in our 2022 report to “continue to take a stand, using every means at our disposal. We believe we owe this to our children and grandchildren, who have a right to a life free from climate terrorism, fake science, and energy poverty.” There is nothing to add to that in 2026 either.

In closing, on behalf of our members and our board of directors, I would like to thank everyone who has helped us over the years to make our conference(s) a reality.

Dr. Holger J. Thuss, Jena, August 2026

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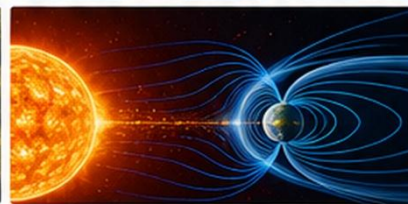
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Publisher

SCC Publishing Association



Address

Michelets vei 8 B
1366 Lysaker, Norway



ISSN

2703-9072



Established

2021