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ISSN: 2703-9072

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Vol. 4.3(2024)

Toward a New Theoretical Paradigm of Climate Science

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Keywords: Climate science; new paradigm, atmospheric thermal effect; 21st century warming

Submitted 2024-12-05, Accepted 2024-12-05. https://doi.org/10.53234/scc202412/22

Extended Abstract

The IPCC climate models have repeatedly shown lack of skill in reproducing observed global and regional features of Earth's climate for the past 4 decades. These include inability to predict global patterns of warming since 1980. Thus, the IPCC models project higher rates of warming in the tropics than at the Poles and similar warming over the Arctic and Antarctica. However, satellite observations show the highest rate of warming in the Arctic region and almost no warming over Antarctica during the past 4 decades with the tropics only exhibiting a modest warming. The models also failed to predict the "warming pause" measured by surface and satellite monitoring systems between 1998 and 2013. Recently, Schmidt (2024) admitted that climate models could not explain the unusual global heat anomaly in 2023, which put climate science in an uncharted territory.

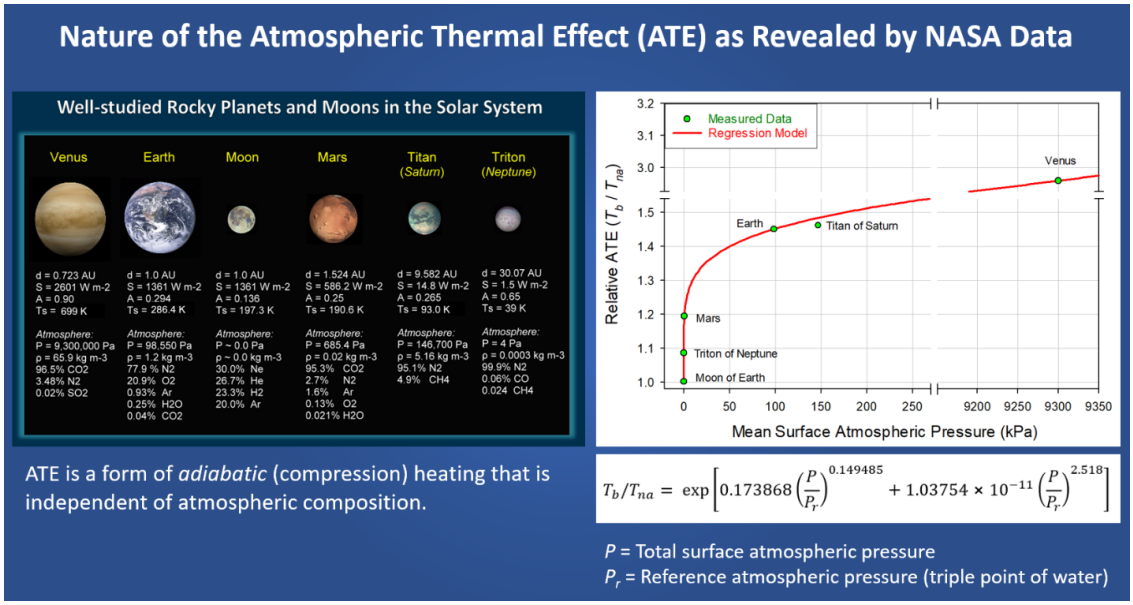
The above problems point to deficiencies in current climate models that require thorough investigation. Our research for the past 14 years focused on examining the physical foundation of the current climate theory resting on the 19th-Century "greenhouse" concept as a possible explanation for the IPCC model failure. Thus far, the results from our research have been published in 3 peer-reviewed papers (Volokin & ReLlez 2024; Nikolov & Zeller 2017; and Nikolov & Zeller 2024) and discussed at numerous science conferences around the World. Some conference presentations reported novel findings about drivers of Earth's paleo-climate that are still to be published in the scientific literature (for example, this video presentation at the 101st AMS Annual Meeting in 2021).

The outcome from our 14-year research effort is a new theoretical paradigm of climate functioning derived from vetted NASA planetary data. The fundamental premises of this new paradigm rooted in observations are numerically robust and can be summarized as follows:

1. The Atmospheric Thermal Effect/Enhancement (ATE) on Earth (currently known under the incorrect name "Greenhouse Effect") is ~90 K, not 18-33 K as oftentimes assumed (Volokin & ReLlez 2014). Previous estimates of the "greenhouse effect" were based on a mathematically incorrect application of the Stefan-Boltzmann radiation law to a sphere.

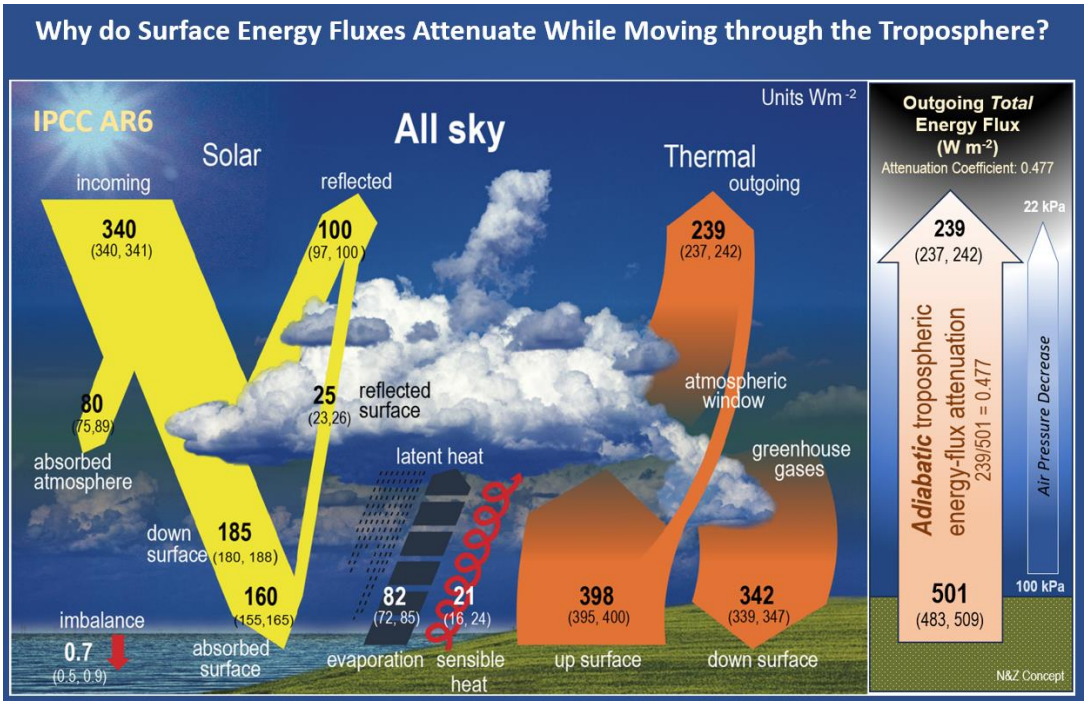
2. ATE is a form of *adiabatic heating* caused by total air pressure that is independent of atmospheric composition. Pressure enhances the energy received from the Sun through force (*PV* = Thermal Energy). NASA planetary data indicate that the radiative "greenhouse effect" does not exist in reality. That's because, across a wide range of planetary environments in the Solar System, the long-term (*baseline*) global surface temperature on rocky planets and moons is fully determined by the mean Total Solar Irradiance (i.e. distance from the Sun) and total surface atmospheric pressure (Nikolov &

Zeller 2017). Hence, ATE is a non-radiative, thermodynamic phenomenon, and changes in non-condensing trace gases cannot in principle affect climate.

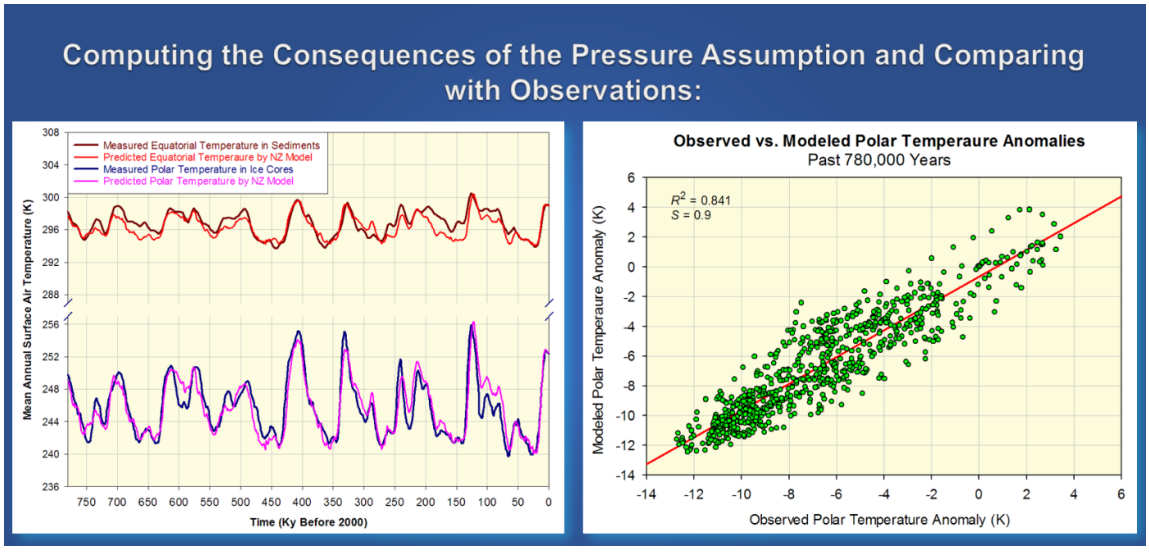


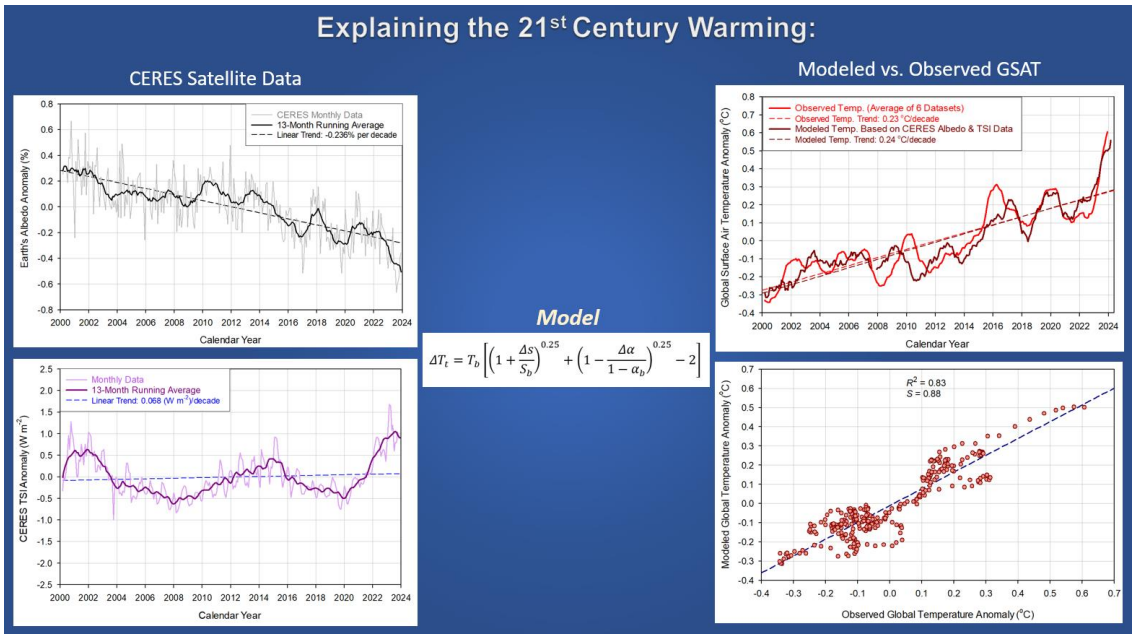
3. Atmospheric longwave radiation is a *byproduct* (*effect*) of atmospheric and surface temperatures, which are set by solar heating and pressure. As such, the atmospheric long-wave radiation does not impact/affect global surface temperature and climate, since it is simply a cooling mechanism of the atmosphere.

4. The atmospheric "greenhouse effect" has been ill-defined as a difference in the outgoing long-wave flux between Earth's surface and the top of the atmosphere (TOA) (e.g. Raval & Ramanathan 1989; Schmidt et al. 2010). The observed attenuation of surface long-wave fluxes throughout the troposphere, which is in the order of 159 W m^{-2}, has been misinterpreted as an "*absorption*" (or "*trapping*") of radiant heat by greenhouse gases such as water vapor, CO_2 and CH_4 causing the atmospheric thermal effect. Some scientists call this apparent "*absorption*" a greenhouse-gas "*radiative forcing*" (e.g. van Wijngaarden & Happer 2019, 2020, 2023). However, in reality, this flux attenuation is caused by a *quasi-adiabatic dissipation* (*loss*) of thermal energy in ascending convective currents due to a decrease of atmospheric pressure with altitude (see Section 4 in Nikolov & Zeller 2024 for details). Hence, the "greenhouse effect" and its "radiative forcing" have de-facto been defined using *nonexistent* energy. This explains, why the standard definition of the "greenhouse effect" produces nonsensical results (i.e. zero or negative values) over central Antarctica (Schmithüsen et al. 2015; Sejas et al. 2018), where the actual ATE is ~140 K and much larger than the global average ATE of ~90 K (see Nikolov & Zeller 2024 for details).

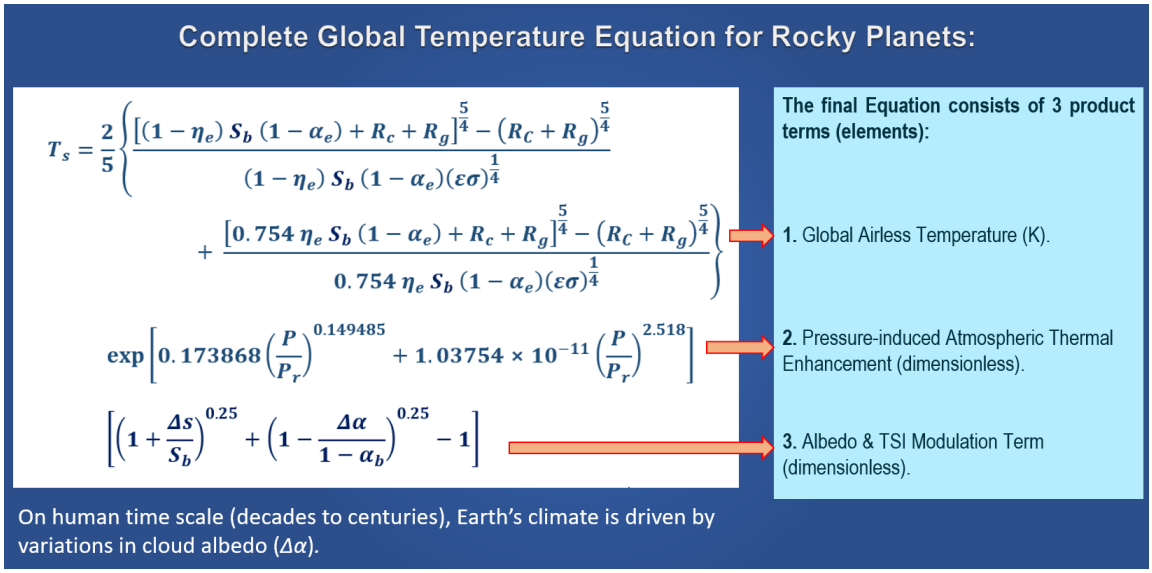


5. On time scales of thousands to millions of years, the Earth's climate is driven by changes in total atmospheric mass & surface air pressure, which control the Earth's baseline temperature. Pressure changes explain the observed polar amplification in the geological records. On time scales of decades to centuries, the climate is modulated by cosmically forced variations of cloud albedo. Albedo changes only cause limited fluctuations of the global temperature around a baseline value set by TSI and total pressure (i.e. about ±1 K) (Nikolov & Zeller 2024).





6. Our research produced a *new universal global temperature model* that accurately describes the mean average temperatures of rocky planets and moon throughout the entire Solar System as a function of TSI, total atmospheric pressure and cloud albedo fluctuations. The model is mathematically expressed by the following Equation:



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