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Radiative versus Thermodynamic Climate Change

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Abstract

The predominant view attributes climate change to altered atmospheric radiative properties caused by greenhouse gases and aerosols. This paper proposes an additional thermodynamic framework, emphasizing the role of meridional (horizontal) energy transport between the tropics and poles. Because the greenhouse effect is strong in humid tropics and weak in dry polar regions, changes in poleward energy flux necessarily affect Earth's total energy balance. Increased transport cools the planet; reduced transport warms it. Observations of late-1990s Arctic winter warming, unaccounted for by radiative models, align with this mechanism. Paleoclimate data further show stable tropical temperatures but large polar changes, implying that global climate depends mainly on the tropical–polar temperature gradient. This model also explains the strong effects of small Milanković orbital variations, suggesting that horizontal energy redistribution, rather than radiative forcing alone, governs the planet's long-term climate dynamics.

Keywords: Greenhouse effect; radiative forcing; meridional heat transport; thermodynamic climate theory; temperature gradient.

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Beyond the Climate Consensus Conference contribution. – Budapest, December 8th, 2025

Honorable members of the Hungarian Academy of Sciences, ladies and gentlemen,

The prevailing scientific consensus on climate today holds that the fundamental cause of the climate change observed in recent decades lies in an alteration of the radiative properties of the atmosphere, driven by changes in the concentrations of greenhouse gases and aerosols. We speak, however, of a scientific consensus, but progress in science is not achieved through a democratic agreement on the most popular theory.

This consensus does rest on a reasonable theoretical foundation: the Earth's climate system, taken as a whole, is an open system that can substantially change its energy content only through radiative exchange with outer space at the top of the atmosphere. For this reason, climate models are built upon the paradigm of vertical energy transport, assuming —as a premise and without demonstration— that horizontal energy transport, known as meridional transport, does not have the capacity to significantly alter the planet's climate.

Today, I wish to defend here the hypothesis that changes in meridional energy transport not only have the capacity to alter the climates of the planet and modify the global energy content of the climate system, but that they constitute one of the principal mechanisms for doing so —and have been doing so throughout Earth's history. This thermodynamic hypothesis does not refute the principle that changes in greenhouse gas concentrations can influence the climate, but it greatly diminishes their importance.

The foundation of the thermodynamic hypothesis is based on two arguments that are not open to dispute.

The first is that the greenhouse effect is not uniform throughout the planet's atmosphere. Water vapor is responsible for about 75% of Earth's greenhouse effect, yet water vapor is not homogeneously distributed. The tropical atmosphere may contain up to 4% water vapor, whereas the polar atmosphere during winter contains essentially 0% (see Fig. 1). Therefore, the tropical atmosphere retains solar energy with great efficiency, while the polar atmosphere efficiently loses the energy it has received from lower latitudes via meridional transport.

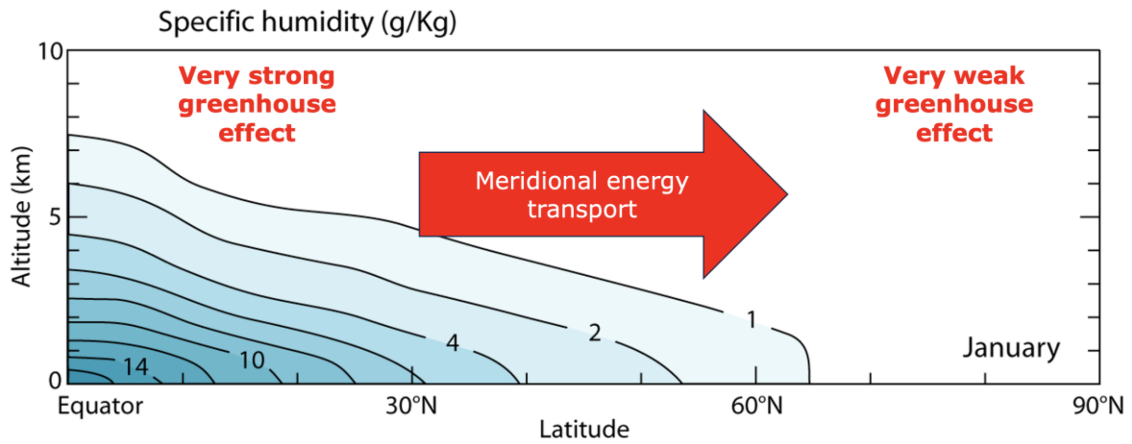

Figure 1: The greenhouse effect is very uneven on Earth due to water vapor differences.

The second argument is that, because of this heterogeneity in the greenhouse effect, any significant change in the amount of energy transported from the tropics to the poles must necessarily alter the total energy contained within the climate system. If more energy is transported poleward, the system loses energy and cools; if less energy is transported, the system gains energy and warms. The climate system comprises two well-differentiated zones: the tropics —where temperature depends essentially on the greenhouse effect— and the extratropics, where the temperature becomes increasingly dependent on meridional transport with distance from the equator.

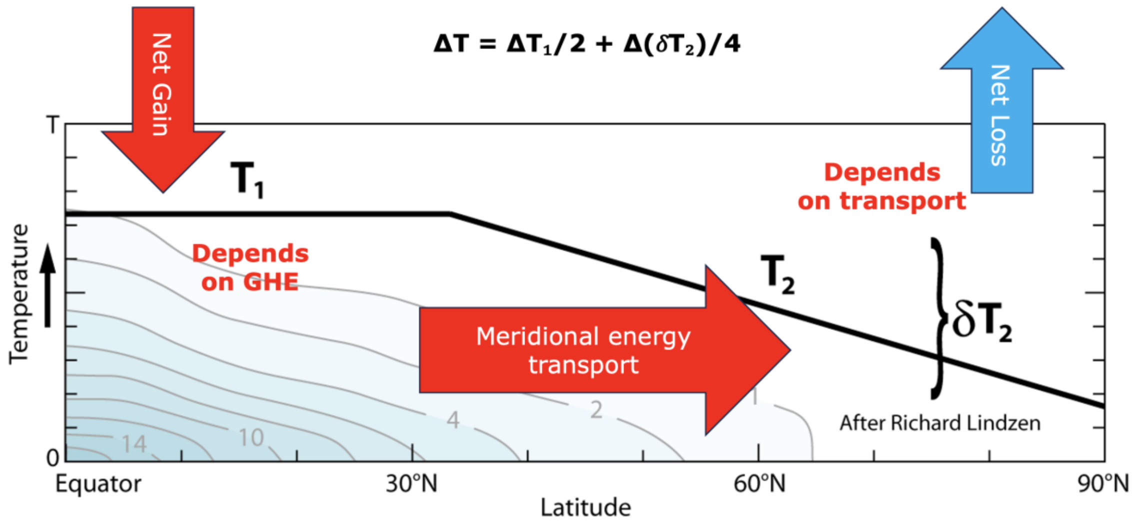

Figure 2: The gradient is key for temperature changes.

These two arguments are not debatable because they rest on basic physical principles and well-established observations. It suffices to demonstrate that there are changes in the amount of energy that meridional transport moves from the tropics to the poles, for the mechanism underlying the hypothesis to be automatically proven. And that demonstration is quite straightforward.

In winter, the Arctic receives no solar radiation. Since its atmosphere contains virtually no water vapor, it also contains virtually no clouds. Its surface is colder than the overlying air —a situation known as a thermal inversion. Under these conditions, increasing CO_2 makes the polar atmosphere more efficient at emitting radiation to space, causing it to cool. The only way the Arctic can warm in winter is by receiving additional heat from lower latitudes —that is, through an increase in meridional transport— which confirms the hypothesis. Such wintertime Arctic warming did not begin when the planet started warming in 1975, but more than twenty years later, beginning in the late 1990s. Moreover, this recent warming of about three degrees is not fundamentally different from the roughly 2.5-degree warming that occurred between 1917 and 1944. These observations cannot be explained by the consensus hypothesis or by climate models, which fail to reproduce them.

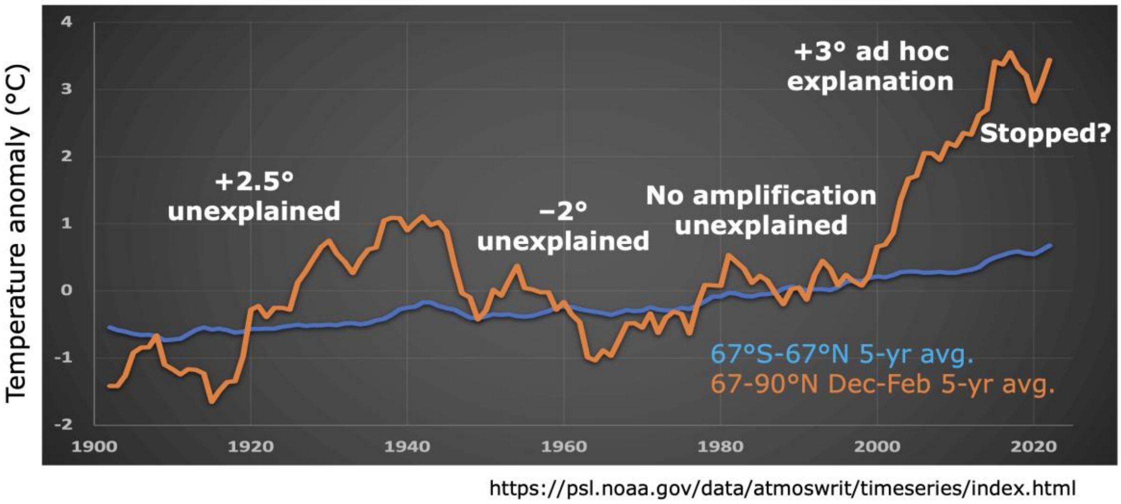

Figure 3: Consensus theory does not explain Arctic winter temperature changes, meridional transport does.

We know from proxy evidence that tropical temperatures change very little, and that it is the temperature gradient between the tropics and the poles that determines the planet's overall temperature. Since the Last Glacial Maximum, the tropics may have warmed by perhaps one degree, while the poles have warmed by roughly twenty degrees. The impact of these changes on the global mean temperature would be about half a degree due to the tropics and the greenhouse effect, and about five degrees due to the extratropics and meridional transport.

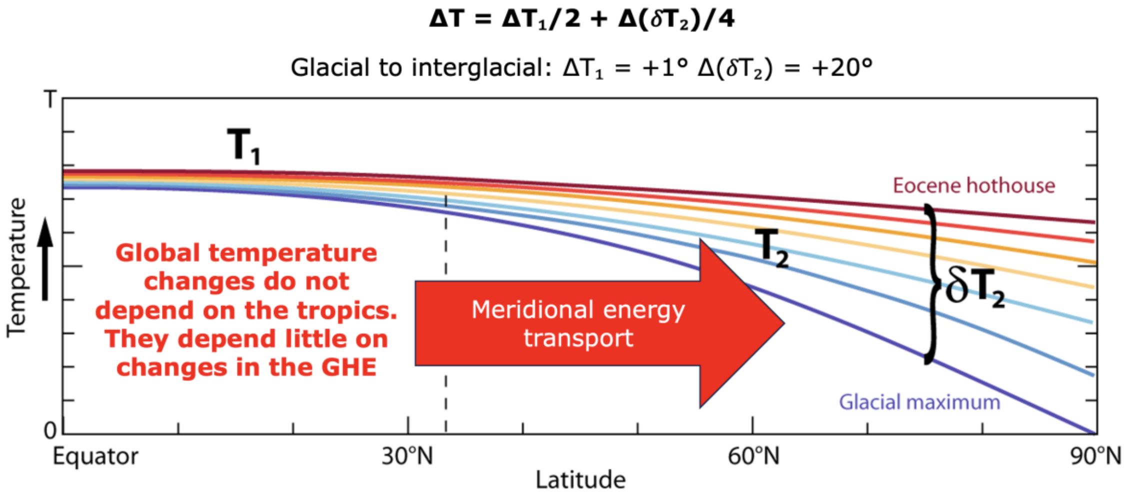

Figure 4: The gradient is key for temperature changes.

The thermodynamic hypothesis of climate change explains the paradoxical, enormous impact on climate of Milanković orbital variations, which operate through very small changes in solar insolation, occurring mainly at high latitudes and without affecting the tropics, yet they are capable of mobilizing the vast energy changes required to transport enough moisture to build the immense ice sheets that cover parts of a hemisphere within only a few thousand years. This occurs by altering the temperature gradient and therefore meridional energy transport —supporting the view that it is a much more important climate-change mechanism than the greenhouse effect.

Thank you for your attention.

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