DOI: 10.2478/cdem-2025-0004 CHEM DIDACT ECOL METROL. 2025;30(1-2):15-17

Roman ZARZYCKI[1]

ANTHROPOGENIC MECHANISM OF GLOBAL TEMPERATURE CHANGE

Abstract: In the paper a new mechanism of Earth's temperature change is presented. It was named „light heat pillow". Delivery of anthropogenic heat during the night reduces the natural difference of temperature between the hydrosphere and the atmosphere, which leads to an increase of Earth's temperature. The paper is a formal continuation of work [1].

Keywords: new mechanism of heat exchange between the hydrosphere and atmosphere, increase of Earth's temperature, anthropogenic heat

Introduction

In publication [1], it was demonstrated that both past and present changes in Earth's temperature result from variations in the heat flux reaching, leaving, and being generated on Earth. These dynamic heat fluxes influence the concentrations of water vapour and greenhouse gases in the atmosphere, which in turn affect Earth's overall thermal state.

This article presents an additional mechanism - previously unreported in the scientific literature - that further explains the thermal conditions on Earth.

Formally, the paper is a continuation of work [1].

Current findings

Since Earth's formation, natural variations in its chemical composition and temperature have occurred. Superimposed on these natural processes are changes driven by human activity. For tens of millions of years, anthropogenic influences were negligible compared to natural processes - until the Industrial Revolution. The extraction and transformation of natural resources, particularly the increasing combustion of fossil fuels, have significantly altered Earth's environmental conditions, including its average temperature.

A prevailing public and scientific belief is that the increase in Earth's temperature is primarily due to CO_2 emissions from fossil fuel combustion. However, a chemical engineering-based analysis of this problem [1] has led to the following conclusions:

1. **Primary source of temperature change**: The fundamental drivers of temperature changes on Earth are variations in heat flux: incoming solar radiation, outgoing terrestrial radiation, and heat generated internally on Earth. These fluxes cause

[1] Professor emeritus, Lodz University of Technology, email: roman.zarzycki@.p.lodz.pl, ORCID: 0000-0002-5011-1724

temperature fluctuations, which in turn alter the concentrations of water vapour and greenhouse gases in the atmosphere.

2. **Dominance of water vapour**: At temperatures around 15 °C, the average atmospheric water vapour concentration exceeds 10,000 ppm, while the current CO_2 concentration is approximately 400 ppm, with other greenhouse gases present at even lower concentrations. Given the similar energetic properties of water vapour and CO_2, the concentration ratio indicates that water vapour is the dominant greenhouse gas. The combined effect of all other greenhouse gases does not exceed 5 %.
3. **Historical mechanism**: Analysis of historical climate data over the last 400,000 years shows that natural increases in solar heat flux led to warming, which in turn increased water evaporation (Clapeyron's law) and decreased gas solubility and absorption rates (Henry's Law), causing atmospheric concentrations of water vapour and greenhouse gases to rise - culminating in further temperature increase. This process reversed when solar heat flux declined. Thus, temperature increases historically preceded CO_2 increases, not the reverse.
4. **Mass and heat transfer between atmosphere and hydrosphere**: The exchange of CO_2, other greenhouse gases, and water vapour between the atmosphere and hydrosphere occurs via convection. Heat exchange occurs through radiation and convection. Convection rates differ between the gaseous and liquid phases due to varying turbulence: the atmosphere exhibits high turbulence, while the hydrosphere's turbulence is mostly confined to surface layers. This results in high heat and mass transfer rates in the gas phase, but relatively limited penetration in the liquid phase - mostly restricted to the boundary layer of the hydrosphere. Consequently, surface water temperatures increase significantly. However, due to the relatively small heat and mass exchange surface area compared to the volume of the atmosphere-hydrosphere system, this exchange is slow. As a result, much of the heat and CO_2 from fossil fuel combustion accumulates in the atmosphere.
5. **Sinusoidal character of heat and mass flow**: On Earth, heat and mass flow exhibit approximately sinusoidal behaviour. During the day, Earth absorbs solar energy; at night, it releases heat into space. Similarly, water evaporates as temperatures rise and condenses as they fall. Greenhouse gases also undergo cyclical mass transfer processes (absorption-desorption) with temperature fluctuations.
6. **Industrial impact**: Since the onset of the Industrial Revolution, the extraction and combustion of fossil fuels have continuously increased, releasing significant quantities of CO_2 and thermal energy into the atmosphere. Even today, despite fossil fuel consumption being at its historical peak, the anthropogenic heat flux remains a small fraction of the solar flux received by Earth. Therefore, the recent decades' temperature rise cannot be fully attributed to heat from fossil fuel combustion. Only the explanation is possible; there exists an as-yet unrecognised mechanism governing heat exchange between the hydrosphere and atmosphere. This new mechanism is described below.

"Light heat pillow" mechanism

Unlike the natural solar energy supply, which only occurs during daylight hours, anthropogenic energy (from fossil fuel combustion and radioactive decay) is delivered both during the day (adding to natural solar input) and at night. This continuous delivery of anthropogenic heat - especially during the night - reduces the natural temperature gradient

that drives convective heat exchange between the atmosphere and hydrosphere. As a result, this process is slowed, leading to thermal accumulation in the atmosphere and a rise in its temperature. This previously undocumented mechanism, which I have termed the **“light heat pillow”**, appears to complement and explain the observed trend of rising global temperatures.

Conclusion

This work presents a comprehensive mechanism for anthropogenic global temperature increase. The emission of large quantities of heat into the atmosphere - from fossil fuel combustion and nuclear energy - raises atmospheric temperatures. A portion of this heat is absorbed by the hydrosphere, warming it and accelerating water evaporation. This leads to increased atmospheric water vapour concentration and simultaneously slows the absorption of greenhouse gases. The combined effect enhances the greenhouse effect.

It is important to emphasise that all forms of fuel - whether fossil or nuclear - ultimately yield similar thermal impacts, as the influence of CO_2 emissions is minimal by comparison.

The primary anthropogenic warming mechanism is further intensified by the **“light heat pillow”**, which adds to this process by weakening the nighttime cooling phase of Earth’s diurnal heat cycle.

This publication addresses only the anthropogenic warming mechanisms directly tied to technical energy transformations. Beyond these thermo-convective effects, there are numerous other human-driven factors - such as lithospheric alteration, deforestation, biodiversity loss, and more - that contribute to changes in Earth’s climate.

References

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