

Commentary

To “The role of greenhouse gases in radiative equilibrium–Thermodynamic evaluation” and “Zur Physikalischen Chemie des Treibhaus-Effekts” by H. Ullmann and M. Bülow (Rebuttal)

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We reject the opinion of the commented paper that the climate change does not depend mainly on antropogenic CO₂ and other trace gases.

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1. The trace gases

The main error in the commented papers ^{[1][2]} lies in the fact that differences in heat storage capacity of the various atmospheric gases are not the primary problem. The trace gases are indeed traces and they cannot store significant amounts of heat. This is correct. However, they absorb additional IR radiation at their corresponding normal mode frequencies, which would otherwise be radiated into space ^[3]. They are additional ‘filters’ for portions of the IR radiation energy. The normal modes of gaseous molecules depend on the chemical bonds and on the masses of the atoms, thus they are different for different molecules ^[4]. Consequently, different trace gases filter out different frequency lines. The main components, N₂ and O₂, do not absorb IR frequencies. The continuum of IR radiation would escape into space. The incompetent ansatz of refs. ^{[1][2]} is not improved by repetition, compare ref. ^[5] and others. The situation for IR is similar to that with visible sunlight: Some of the light is scattered in the air, which is why we see a bright sky. However, the majority of the sunlight directly comes to Earth’s surface, that is why we see a clear, defined solar disc.

Following additional IR absorption by the trace gases, the corresponding molecules usually relax their vibrational-rotational energy into impact to other gases, thereby increasing the heat of the atmosphere. A fraction of the excitation energy is re-emitted. This radiation is not mainly directed to space, however, it is directed into the atmosphere, or even back to Earth. Thus it also enforces the greenhouse effect. Emission usually takes place at higher temperatures, see for example refs.^{[6][7]}. There is no equality between absorption and emission; in the contrary case, absorption spectroscopy of gases would not be possible^[8].

Note that the corresponding incoming IR radiation from the sun is also absorbed by trace gases and partly converted into heat, not only the more important back radiated IR from the heated Earth's surface. So these trace gases act twice, what is somewhat misleading described in the refuted papers^{[1][2]}.

The relation of different climate gases is as follows: The first place has gaseous water with ~70% of the IR absorption. However, there is an equilibrium; excess water in the atmosphere immediately rains back to Earth. Important are the other gases: CO₂ makes the next large proportion, and there is no return rain to Earth. A today emitted CO₂ molecule remains in the air for about 120 years. Other dangerous trace gases are Methane CH₄, Distickstoffoxid N₂O, and fluorinated synthetic gases. Note that the absorption bands of the different molecules are different, in the most cases. Corresponding precise data can be found in the IPCC report^[9] and earlier reports which are cited by authors HU and MB, but misinterpreted by them.

2. Radiation Equilibrium

Paper^[2] discusses the energy balances of the global Earth system. It points to the small ratio of human energy production related to the energy input of the Sun. Again, while this is true, however, it is not the main problem. More precisely, it hits the main problem: climate gases emerge under the human energy production. These gases intervene into the 'natural' radiation exchange processes. They cause the amplification of the natural greenhouse effect (see above). Under the current CO₂ concentration in the atmosphere, a main band of CO₂ shows a saturation effect, which is discussed in refs.^{[1], [2]}. However, for the current and for higher concentrations, there are other bands which still absorb. It means that higher man-made CO₂ concentrations still lead to a higher warming^[10]. The fact is missing in refs.^{[1][2]}.

The Earth is an open system with a current flow equilibrium, however, the man-made climate gases disrupt it to another level. This is not understood in refs.^{[1], [2]} where the authors declare that, in contrast, a number of questions remain unresolved and are probably not accessible experimentally.

3. CO2 Capture

Paper ^[2] also examines the methods of Carbon Capture and Storage (CCS) and Carbon Capture and Utilization (CCU). It is correctly cited following ^[11] that these methods require significantly more energy than the combustion gains of fossil coal and gas, especially since CCS or CCU cause an enormous entropy increase, see ref. ^[12]. We additionally remark that the 'orchestrated lies' of politics, media, and industry regarding these methods obscure the second major problem: nature's reaction to the climate change, the extinction of many species, and the loss of biodiversity. A far more important part of the work of mankind should therefore be directed to improving renatured ecosystems and organic farming.

4. Summary

We rebut the work of Helmut Ullmann and Martin Bülow ^{[1][2]}. It contains false statements about the influence of trace gases on the anthropogenic climate change, in contrast to the known climate science ^[13] ^{[14][15]}. They do not accept the knowledge of about 200 years of climate science ^[3]. Contrary, we find in refs. ^{[1][2]} many questionable statements without citations. {acknowledgement} The Sekretar of the Natur- und Technikwissenschaftliche Klasse der Leibniz-Sozietät der Wissenschaften zu Berlin e.V., Gerhard Pfaff, inspired a climate discussion. WQ would like to thank him, K. Dethloff, R. Schimming, N. Mertzsch, and B. Wessling for discussions within the Sozietät. We thank further H.J. Schellnhuber and St. Rahmstorf for background assessment.

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Potential Competing Interests

No potential competing interests to declare.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Ethics

This article is based exclusively on published literature and theoretical analysis. It did not involve human participants, animal subjects, clinical procedures, or the collection of personal data. Therefore, ethical approval and informed consent were not required.

Use of Generative AI

The authors declare that no generative AI, large language models, or AI-assisted tools were used in the conception, writing, analysis, interpretation, or preparation of this manuscript. All arguments, evaluations, and editorial decisions were made solely by the authors, who take full responsibility for the content and integrity of the work.

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