Falsification Of The Atmospheric CO_2 Greenhouse Effects Within The Frame Of Physics

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Full paper, 114 pages, 1.54MB at http://arxiv.org/PS_cache/arxiv/pdf/0707/0707.1161v4.pdf

This approved non-technical summary by Hans Schreuder, 24 June 2008

"The authors express their hope that in schools around the world the fundamentals of physics will be taught correctly, not by using shock-tactic 'Al Gore' movies and not misinforming physics students by confusing absorption/emission with reflection, by confusing the tropopause with the ionosphere and by confusing microwaves with shortwaves."

Abstract

The atmospheric greenhouse effect, an idea the authors trace back to the traditional works of Fourier 1824, Tyndall 1861 and Arrhenius 1896, but which is still supported in global climatology, essentially describes a fictitious mechanism by which a planetary atmosphere acts as a heat pump driven by an environment that is radiatively interacting with but radiatively equilibrated to the atmospheric system.

According to the second law of thermodynamics such a planetary machine can never exist.

Nevertheless, in almost all texts of global climatology and in widespread secondary literature it is taken for granted that such a mechanism is real and stands on a firm scientific foundation. In this paper the popular conjecture is analyzed and the underlying physical principles clarified.

By showing that

(a) there are no common physical laws between the warming phenomenon in glass houses and the fictitious atmospheric greenhouse effects,
(b) there are no calculations to determine an average surface temperature of a planet,
(c) the frequently mentioned difference of 33 °C is a meaningless number calculated wrongly,
(d) the formulas of cavity radiation are used inappropriately,
(e) the assumption of a radiative balance is unphysical,
(f) thermal conductivity and friction must not be set to zero,

the atmospheric greenhouse conjecture is falsified.

Introduction

Recently, there have been lots of discussions regarding the economic and political implications of climate variability, in particular global warming as a measurable effect of an anthropogenic, i.e. human-made, climate change. Many authors assume that carbon dioxide emissions from fossil-fuel consumption represent a serious danger to the health of our planet, since they are supposed to influence climate, in particular the average temperatures of the surface and lower atmosphere of the Earth. However, carbon dioxide is a rare trace gas, a very small part of the atmosphere found in concentrations less than 0.04 volume percent.

Among climatologists, in particular those affiliated with the Intergovernmental Panel of Climate Change (IPCC), there is a "scientific consensus" that the relevant climate mechanism is an atmospheric greenhouse effect, a mechanism heavily reliant on the presumption that radiative heat transfer dominates over other forms of heat transfer such as thermal conductivity, convection, condensation, et cetera. Supposedly to make things more precise, the IPCC introduced the notion of *radiative forcing*, tied to an assumption of *radiative equilibrium*.

However, as countless examples in history have shown, "scientific consensus" bears no resemblance whatsoever to scientific validity. "Consensus" is a political term, not a scientific one. From the viewpoint of theoretical physics, a radiative approach to the atmosphere — using physical laws such as Planck's and Stefan-Boltzmann's, which only have a limited range of validity — definitely fails to intersect with atmospheric dynamics and must be questioned deeply.

In other words, applying cavity radiation formulas to the atmosphere is sheer nonsense.

Global climatologists claim that the Earth's natural greenhouse effect keeps it 33°C warmer than it would be without trace gases in the atmosphere. 80 percent of this warming is attributed to water vapor and 20 percent to the 0.0385 volume percent of CO_2. If CO_2 exhibited such an extreme effect, however, this would show up as a thermal conductivity anomaly even in an elementary laboratory experiment. Carbon dioxide would manifest itself as a new kind of 'super-insulation,' wildly violating the conventional heat-conductivity equation.

Such anomalous heat transport properties never have been observed in CO_2, of course.

The influence of CO_2 on climate was discussed thoroughly in a number of publications that appeared between 1909 and 1980, mainly in Germany. The most influential authors were Möller, who also wrote a textbook on meteorology, and Manabe. It seems that the combined work of Möller and Manabe has had a significant influence on the formulation of modern atmospheric CO_2 greenhouse conjectures. In a very comprehensive report from the US Department of Energy (DOE), which appeared in 1985, the atmospheric greenhouse hypothesis was cast into its final form and became the cornerstone in all subsequent IPCC publications.

Of course, although the oversimplified picture drawn by IPCC climatology is physically incorrect, a thorough analysis might reveal some non-negligible influence of certain radiative effects (apart from sunlight) on the weather and hence on its local averages, the climate, which could be dubbed a CO_2 greenhouse effect. But then, even if the effect is claimed to serve only as a genuine trigger of a network of complex reactions, three key questions would remain:

1. Is there a fundamental CO_2 greenhouse effect in physics?
2. If so, what is the fundamental physical principle behind this CO_2 greenhouse effect?
3. Is it physically correct to regard radiative heat transfer as the fundamental mechanism controlling the weather, setting thermal conductivity and friction to zero?

In the language of physics *an effect* is a not-necessarily evident but reproducible *and* measurable phenomenon *together with* its theoretical explanation*. Neither* the warming mechanism in a glass house *nor* the supposed anthropogenic warming is an "effect" in this sense of the definition:

- In the first case (a glass house) one encounters a straightforward phenomenon.
- The second case (the Earth's atmosphere) one cannot measure directly, rather, one can only make heuristic calculations.

Explaining the warming mechanism in a real greenhouse is a standard problem in undergraduate courses, in which optics, nuclear physics and classical radiation theory are dealt with.

The atmospheric greenhouse mechanism is a conjecture that can be proved or disproved by concrete engineering thermodynamics. Exactly this was done many years ago by an expert in this field, namely Alfred Schack, who wrote a classical textbook on the subject. In 1972 he showed that the radiative component of heat transfer by CO_2, though relevant in combustion chamber temperatures, can be neglected at atmospheric temperatures.

CO_2's influence on the Earth's climate is definitively immeasurable.

The warming mechanism in real greenhouses

For years, the warming mechanism in real greenhouses, designated "the greenhouse effect", has been commonly misused to explain the conjectured atmospheric greenhouse effect. In school books, in popular scientific articles, and even in high-level scientific debates, it has been stated that the mechanism observed within a glass house is similar to anthropogenic global warming. Meanwhile, even mainstream climatologists admit that the warming mechanism in real glass houses must be strictly distinguished from the claimed CO_2 greenhouse effect. Nevertheless, one should look at the classical glass house problem to recapitulate some fundamental principles of thermodynamics and radiation theory. In our technical paper the relevant radiation dynamics of the atmospheric system are elaborated on and distinguished from the glass house set-up.

In section 2.1.5 many pseudo-explanations in the context of climatology are falsified by just three fundamental observations of mathematical physics.

The Sun and radiation

A *larger* portion of the incoming sunlight lies in the infrared range than in the visible range. Most papers that cover the supposed greenhouse effect completely ignore this important fact.

Especially on a hot summer's day, every car driver knows about the greenhouse effect. One does not need to be an expert in physics to explain immediately why the car gets so hot inside: The Sun has heated the car's interior. However, it is a bit harder to answer the question why it is cooler outside the car, although there the Sun shines onto the ground without obstacles. Undergraduate students with standard physical recipes at hand can easily "explain" this kind of a greenhouse effect.

On a hot summer afternoon, temperature measurements inside and outside a car were performed with a standard digital thermometer. These measurements are recommended to every climatologist who believes in the CO_2-greenhouse effect, because they show that the alleged effect *has nothing to do* with trapped thermal radiation. Neither the infrared absorption nor reflection coefficient of glass is relevant in this explanation of the real greenhouse effect, only the panes of glass hindering the movement of air.

This text is a recommended reading for all global climatologists referring to the greenhouse effect:

> *It is not the "trapped" infrared radiation which explains the warming phenomenon in a real greenhouse - it is the suppression of air cooling.*

The fictitious atmospheric greenhouse effects

Depending on the particular school and the degree of popularization, the assumption that the atmosphere is transparent to visible light but opaque to infrared radiation supposedly leads to

- a warming of the Earth's surface and/or
- a warming of the lower atmosphere and/or
- a warming of a certain layer of the atmosphere and/or
- a slow-down of the natural cooling of the Earth's surface
-

and so forth.

Sir David King, former science advisor of the British government, stated that "global warming is a greater threat to humanity than terrorism". In countless contributions to newspapers and TV shows in Germany the popular climatologist Latif continues to warn the public about the consequences of rising greenhouse gas (GHG) emissions. Yet even today it is impossible to find a book on non-equilibrium thermodynamics or radiation transfer where this presumed effect is derived from first principles.

The main objective of our paper is not to draw the line between error and fraud, only to find out whether the greenhouse effect appears or disappears within the frame of physics. Therefore, in Section 3.3 several different variations of the atmospheric greenhouse hypotheses are examined and disproved. The authors restrict themselves to statements that appeared after a publication by Lee in the well-known Journal of Applied Meteorology 1973, see Ref. [109] and references therein.

Lee's 1973 paper is a milestone. In the beginning Lee writes:

> The so-called radiation `greenhouse' effect is a misnomer. Ironically, while the concept is useful in describing what occurs in the earth's atmosphere, it is invalid for crypto-climates created when space is enclosed with glass, e.g. in greenhouses and solar energy collectors. Specifically, elevated temperatures observed under glass cannot be traced to the spectral absorptivity of glass. The misconception was demonstrated experimentally by R. W. Wood more than 60 years ago and recently in an analytical manner by Businger. Fleagle and Businger devoted a section of their text to the point, and suggested that radiation trapping by the earth's atmosphere should be called `atmosphere effect' to discourage use of the misnomer. In spite of the evidence, modern textbooks on meteorology and climatology not only repeat the misnomer, but frequently support the false notion that `heat-retaining behavior of the atmosphere is analogous to what happens in a greenhouse' (Miller, 1966). The mistake obviously is subjective, based on similarities of the atmosphere and glass, and on the `neatness' of the example in teaching. The problem can be rectified through straightforward analysis, suitable for classroom instruction.

Lee continues his analysis with a calculation based on radiative balance equations, which are physically questionable. The same holds for a comment by Berry on Lee's work. Nevertheless, Lee's paper is a milestone, marking *the day after* every serious scientist or science educator is no longer allowed to compare the greenhouse with the atmosphere, even in the classroom, which Lee explicitly refers to.

In section 3.3 of our paper, many different versions of the atmospheric greenhouse conjecture are examined and disproved. In conclusion, the authors observe the following:

- that even today the "atmospheric greenhouse effect" does not appear

    - in any fundamental work on thermodynamics
    - in any fundamental work on physical kinetics
    - in any fundamental work on radiation theory

- that the definitions given in the literature beyond straight physics are very different and, partly, contradict each other.

The conclusion of the US Department of Energy

All fictitious greenhouse effects have in common one and only one cause: A rise in the concentration of CO_2 in the atmosphere leading to higher air temperatures near the ground. Lee's 1973 result that the warming phenomenon in a glass house does not compare to the supposed atmospheric greenhouse effect was confirmed in the 1985 report of the United States Department of Energy "Projecting the climatic effects of increasing carbon dioxide".

In this comprehensive pre-IPCC publication MacCracken explicitly states that the terms "greenhouse gas" and "greenhouse effect" are misnomers.

Section 3.5 discusses the concepts of absorption, emission and reflection, recommended reading for those who wish to know the calculations behind the conclusions.

Section 3.6 the classic hypotheses of Fourier, Tyndall and Arrhenius are analysed in detail, followed by modern versions of it, and it is concluded that :

- In the 70s, computer simulations of the "global climate" predicted for a doubling of the CO_2 concentration a temperature rise of about 0.7 – 9.6 degrees Kelvin.

- Later computer simulations pointed towards a null effect.

- In the IPCC 1992 report, computer simulations of the "global climate" predicted a global temperature rise of about 0.27 - 0.82K per decade.

- In the IPCC 1995 report, computer simulations of the "global climate" predicted a global temperature rise of about 0.08 - 0.33K per decade

- In 2005, computer simulations of the "global climate" predicted for a doubling of the CO_2 concentration a global temperature rise of about 2 - 12K, whereby six so-called scenarios have been omitted that yield a global cooling.

To derive climate catastrophes from these computer games and to scare mankind to death is a crime.

Section 3.7 discusses the fallacy of radiative balance, from which the following pertinent points are taken:

- For instance, "average" temperatures are calculated for an Earth *without* an atmosphere and for an Earth *with* an atmosphere. Amusingly, there seem to exist no calculations for an Earth *without* oceans opposed to calculations for an Earth *with* oceans.

- Though there exists a huge family of generalizations, one common aspect is the assumption of a radiative balance, which plays a central role in the publications of the IPCC and, hence, in the public propaganda. In the following it is proved that this assumption is physically wrong.

- Unfortunately this [conservation laws (continuity equations, balance equations, budget equations) cannot be written down for intensities] is done in most climatologic papers, the cardinal error of global climatology, that may have been overlooked so long due to the oversimplification of the real world problem towards a quasi one-dimensional problem. Hence the popular climatologic "radiation balance" diagrams describing quasi-one-dimensional situations (cf. Figure 23) are scientific misconduct since they do not properly represent the mathematical and physical fundamentals.

The reader of this non-technical summary is urged to review all of sections 3.7 and 3.8 in their original format in order to appreciate the issues in hand and understand this further point :

> "that there is no physically meaningful global temperature for the Earth in the context of the issue of global warming. While it is always possible to construct statistics for any given set of local temperature data, an infinite range of such statistics is mathematically permissible if physical principles provide no explicit basis for choosing among them. Distinct and equally valid statistical rules can and do show opposite trends when applied to the results of computations from physical models and real data in the atmosphere. A given temperature field can be interpreted as both `warming' and `cooling' simultaneously, making the concept of warming in the context of the issue of global warming physically ill-posed."

Section 4 discusses the foundations of climate science, whilst the limits of computer models are also pointed out, with this pertinent quote by eminent theoretical physicist Freeman J Dyson:

> "The real world is muddy and messy and full of things that we do not yet understand. It is much easier for a scientist to sit in an air-conditioned building and run computer models, than to put on winter clothes and measure what is really happening outside in the swamps and the clouds. That is why the climate model experts end up believing in their own models."

"It cannot be overemphasized that even if the equations are simplified considerably, one cannot determine numerical solutions, even for small space regions and even for small time intervals. This situation will not change in the next 1000 years regardless of progress made in computer hardware. Therefore, global climatologists may continue to write updated research grant proposals demanding next-generation supercomputers *ad infinitum*. As the extremely simplified one-fluid equations are unsolvable, the many-fluid equations would be more unsolvable, the equations that include the averaged equations describing the turbulence would be yet more unsolvable, if "unsolvable" had a comparative. Regardless of the chosen level of complexity, these equations are supposed to be the backbone of climate simulations, or, in other words, the foundation of models of nature. But even this is not true: In computer simulations heat conduction and friction are completely neglected, since they are mathematically described by second order partial derivatives that cannot be represented on grids with wide meshes."

"Hence, the computer simulations of global climatology are not based on physical laws. The same holds for the speculations about the influence of carbon dioxide."

The reader is urged to review section 4.3 on "Science and Global Climate Modelling" in its entirety in order to fully appreciate the closing remarks of that section :

"Modern global climatology has confused and continues to confuse fact with fantasy by introducing the concept of a scenario replacing the concept of a model. In Ref. [29] a clear definition of what scenarios are is given: Future greenhouse gas (GHG) emissions are the product of very complex dynamics systems, determined by driving forces such as demographic development, socioeconomic development, and technological change. Their future evolution is highly uncertain. Scenarios are alternative images of how the future might unfold and are an appropriate tool with which to analyze how driving forces may influence future emission outcomes and to access the associated uncertainties. They assist in climate change analysis, including climate modeling and the assessment of impacts, adaptation and mitigation. The possibility that any single emissions path will occur as described in scenarios is highly uncertain. Evidently, this is a description of a pseudo-scientific (i.e. non-scientific) method by the experts at the IPCC. The next meta-plane beyond physics would be a questionnaire among scientists already performed by von Storch or, finally, a democratic vote about the validity of a physical law.

Exact science is going to be replaced by a sociological methodology involving a statistical field analysis and by "democratic" rules of order.

This is in harmony with the definition of science advocated by the "scientific" website RealClimate.org that has integrated inflammatory statements, personal attacks and offenses against authors as a part of their "scientific" workflow."

There are so many unsolved and unsolvable problems in non-linearity. And for climatologists to believe they've solved them with crude approximations leading to unphysical results that have to be corrected afterwards by mystical methods — flux control in the past, obscure ensemble averages over different climate institutes today, excluding incidental global cooling data by hand — merely perpetuates the greenhouse-inspired climatologic tradition of *physically meaningless* averages and *physically meaningless* statistical applications. In short, generating statements on CO_2-induced anthropogenic global warming from computer simulations lies outside of any science.

Section 5 is the final section of the paper and contains the 'Physicist's Summary', which the reader of this non-technical summary is again urged to review in its entirety. Simply quoting these few lines do an injustice to the entire paper, but set the tone for discrediting the fallacy the UN IPCC is perpetuating, aided in no small measure by many a skeptical scientist who also fails to grasp the fallacy of the so-called greenhouse effect with its double-counting of radiant energy.

"The natural greenhouse effect is a myth, not a physical reality. The CO_2-greenhouse effect, however, is a manufactured mirage.

Horrific visions of a rising sea level, melting pole caps and spreading deserts in North America and Europe are *fictitious consequences of a fictitious physical mechanism* which cannot be seen even in computer climate models.

More and more, the main tactic of CO_2-greenhouse gas defenders seems to be to hide behind a mountain of pseudo-explanations that are unrelated to an academic education or even to physics training.

The points discussed here were to answer whether the supposed atmospheric effect in question has a physical basis. It does not.

In summary, no atmospheric greenhouse effect, nor in particular a CO_2-greenhouse effect, is permissible in theoretical physics and engineering thermodynamics.

It is therefore illegitimate to use this fictitious phenomenon to extrapolate predictions as consulting solutions for economics and intergovernmental policy."
