On the theory of the Earth's physical parameters, distributed in space and time.

by

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Abstract
Present day treatises dealing with weather and climate often use seemingly physical quantities, while they are in fact averages of such. Inserting these into formulas is physically not permitted. It leads to an assumption of the magnitude of the so-called 'greenhouse effect' several tens of K off. The often used explanation of the 'average temperature of the earth' of 288 K is physically untenable. Another widely accepted property of the greenhouse, the 'back radiation', violates elementary thermodynamics. A well-insulated, sun-heated home is a better model. It would diminish the role of atmospheric CO_2. Air in general is a fairly strong insulator and also a good heat transporter depending on mass motion and latent heat. The article presents theoretical and experimental arguments in support of these statements.

Contents

1. Introduction

The notion 'the earth's climate' is vague and non-physical. There is no measurable quantity associated with it. We can take local measurements of temperature (T), pressure (P), humidity, precipitation, incident radiation (I_{eff}), etc., but these quantities vary; not only with geographic location, but also with time, altitude, and depth. Several quantities only have a definite meaning in a well-defined volume and in a state of equilibrium, which on earth rarely prevails. One can calculate averages over locations and time periods, but such values have little overlap with the human experience on Earth. The local climates of Greenland and the Sahara are very different. Moreover, taking averages has no physical meaning.

In response to societal requests, meteorologists have developed admirable techniques, that, with certain probability in a limited time interval, will predict T, precipitation, wind force, etc. Weathermen translate those forecasts into terms such as '*fair in the morning with showers in the afternoon followed by a cool night*'. International co-operation, better measuring techniques, increasing the number of weather stations, balloons, radar, satellites, greatly improved computation facilities, and additional knowledge of the atmospheric transport processes allow for an extension in the time interval for which forecasts have some validity.

This time interval is now approximately a week. (In fact, when comparing predictions with later measurements and by utilising probability theory, the forecasts have significance over a longer range. However, to a farmer, a 55% chance of frost after 8 days and a 45% chance of a heat wave is useless).

There is a difference between our tacit implicit knowledge of the climate and the capacity of meteorology to predict the weather. Suppose that on December 22nd we wish to predict the temperature around noon on January 31st. Meteorology is unable to provide an answer. However, we all know that, in all probability, it will be colder by then, despite the sun being higher in the sky end of January. In order to get some idea about the evolvement of the physical parameters, processes other than those taking place in the atmosphere alone play a key role. Changes in solar activity, the role of the biosphere, and the oceans covering about 70% of the surface of the earth should be considered.

The retention of heat within our oceans and the Earth's solid surface is vital for the energy balance of our planet. The effects on the distribution of parameters such as P,T over location and time are major. These influences are handled as perturbations on the atmospheric circulation models in current computations. However, there is evidence that relevant relaxation times might stretch over periods of hundreds of years[2]. Major influences of this kind are unsuitable to be dealt with by perturbation theory.

The term 'the Earth's temperature' is frequently used, while the concept is an ill-defined fallacy. The temperature of the Earth's core is about 5000 K. The air temperature about 10 km above the surface is usually around 223 K. That is roughly the same as the temperatures in the polar regions at ground level. Elsewhere, temperatures may reach 323 K. In scientific papers 288 K is often mentioned as the average surface temperature. As we shall demonstrate in sections 2 and 3, this value is not explained through physics, or rather, the explanation is wrong. This value of 288 K is the starting point for hypotheses on temperature change and its causes. It is the unsolid base for public discussions and government measures, referred to as the average of station temperatures 2 m above ground. There is some fuzziness about the inclusion of polar regions, partly due to the scarcity of data available. It remains unclear how one can scientifically justify how to compare measurements at sea level with those in mountainous regions and on high-level plateaus.

2. Averaging temperatures and Stefan-Boltzmann (SB)

In a nutshell, the current assumption about the 'temperature of the Earth' is the AGW (anthropogenic global warming) hypothesis. A solid black sphere at our distance from the Sun with albedo $\alpha = 0{,}3$ and emissivity $\varepsilon = 1$ absorbs and emits equal amounts of radiation. It would have a stable temperature of 255 K, according to Stefan-Boltzmann's Law, $I_{eff} = \sigma T^4$ (the SB-constant, $\sigma = 5{,}67\ldots\ .\ 10^{-8}\ Wm^{-2}K^{-4}$).
The measured averaged temperature of the Earth (2 m) is 288 K. The difference of 33 K is bridged by the atmospheric greenhouse effect, a radiative phenomenon mainly provided by H_2O and CO_2. Adding to the latter raises the temperature. The strength of the CO_2 contribution is discussed in terms of CO_2 sensitivity and is said to be about +1 K in case of doubling of the CO_2 concentration. This temperature increase is subsequently re-enforced by more H_2O vapour into the atmosphere, referred to as a positive 'forcing' or feedback, resulting in a combined effect between +1,5 K and + 4 K. Other influences that may affect temperature are either not considered or assumed to remain constant.

However, this AGW hypothesis, rests on two assumptions: first, the solid black sphere distributes the energy received from the Sun uniformly over its surface, *i.e.* everywhere and all times the *same temperature* prevails; secondly, the sphere is opaque and may be treated as a SB-radiator, while the Earth is merely a (semi-)transparent body. This second point will be dealt with in section 3.

Assuming a completely equalised temperature over the total radiative surface of the Earth is clearly disregarding the observations. Due to a lack of data concerning the real temperature distribution, we look at the opposite extreme of a completely uniform temperature. That would be every square meter at any moment in equilibrium with the there and then incoming solar energy; or at 3 K, the temperature of the universe in dark places. Such a sphere would also maintain a constant *average* surface temperature. Properly calculated, with the same α and ε like in the case of the uniform temperature, we find an average temperature T = 145 K. Please note the difference 255 K and 145 K. This shows that a small change in temperature distribution would have a dramatic effect on the average temperature.

A picture of the radiation balance used in the AGW hypothesis is given in Figure 1. It underlines the role of greenhouse gases and shows a so-called 'back radiation' of 342 Wm^{-2}.

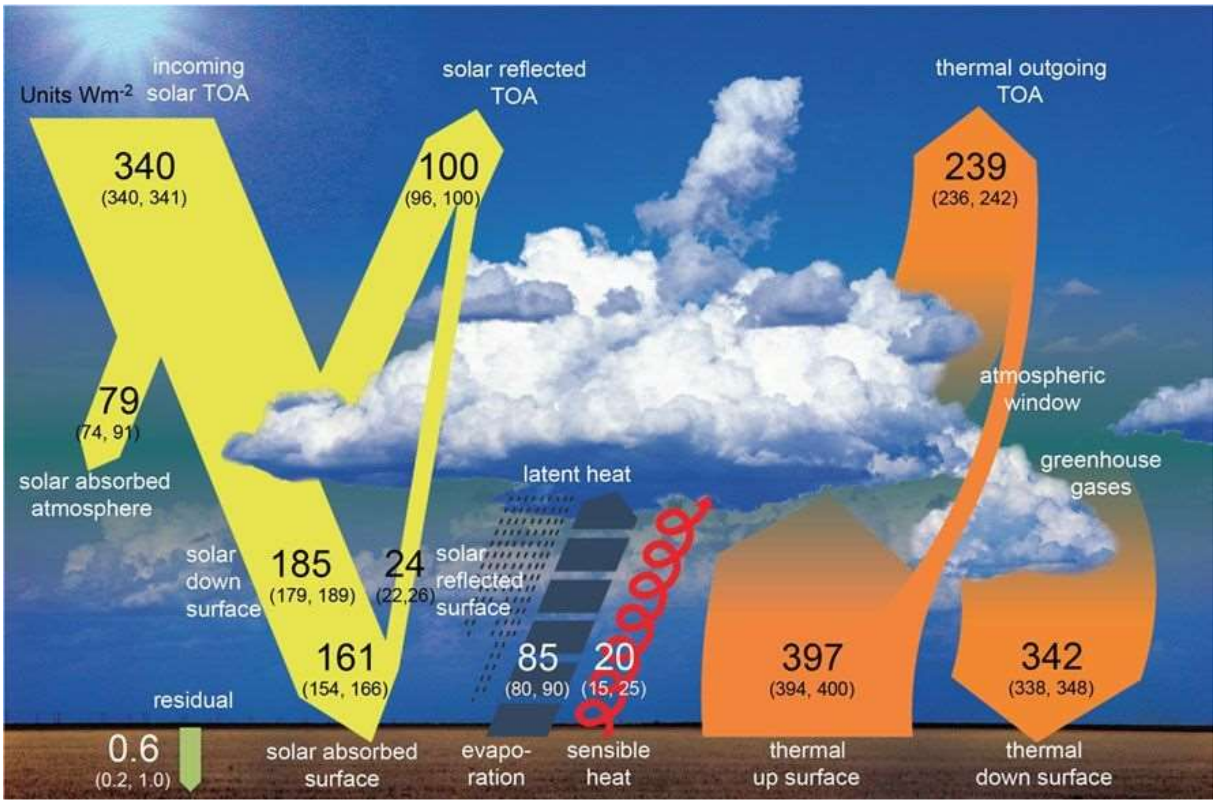

Fig.1. Radiation balance (AGW) with an appreciable role for greenhouse gases. (Wild[3] e.o. 2013).

The depicted back radiation is a physical curiosity, or oddity if you like. In the troposphere, the temperature normally decreases with altitude. According to the second law of thermodynamics, heat and thermal radiation do not flow against a temperature gradient. Mixing collective phenomena with quanta is tricky.

In conclusion, it is not correct to consider the temperature of 255 K as the base from which the greenhouse effect does its '*beneficial*' work, namely to raise the average temperature of the Earth to 288 K. The greenhouse effect should either bridge a much wider gap than 33 K, perhaps even 40-60 K wider, or other factors should be invoked to make up for the deficit. If the 400 ppM CO_2 in the atmosphere, as well as the H_2O vapour, would make up 83 K instead of 33 K, a doubling of the CO_2 concentration would have a much stronger effect than the current 1 K predicted. In the last few years we have seen a steady decline in the estimated forcing in climate literature. We therefore reject the possibility of CO_2 as the main cause for an extensive greenhouse effect.

3. Opaque and transparent media

Many papers and textbooks on the climate issue treat the Earth as a solid opaque medium, radiating according to SB. The atmosphere and the oceans, however, are partly transparent. The solar energy penetrates. It passes through them and is absorbed following a general absorption law $I_d = I_o.e^{-kd}$, in which *k* is a frequency dependent coefficient. The AGW hypothesis accounts for this effect only when dealing with the atmosphere. The greenhouse gases are supposed to block most infrared radiation, with a temperature augmentation of 33 K as a result. The oceans, however, are treated in a different way, although their heat capacity exceeds by far that of the atmosphere. In order to restore the energy balance in the oceans, the dissipated energy (at a depth of 100+ m) has to be transported back to the surface, and ultimately back to space. Since water has a high absorption coefficient for the relevant frequency range, this transport is mainly achieved by slow mass movement with help from conduction. At the surface, the options for transport are: evaporation, conduction, radiation and again mass movement[4].

These processes result in higher internal temperatures of turbid medium bodies than in solid opaque 'SB-bodies'. Since the transport processes and the interaction of different frequencies with matter are complicated, we have not been able to make verifiable estimates of the size of the effect. However, rough calculations[5] suggest that the turbidity effect is large enough to waive possible doubt on its determining influence on the temperature at all spatial locations relevant for climate on Earth.

We must therefore conclude that the AGW hypothesis and accompanying models are incomplete and undeserving of 'theory' status due to the unaccountability of the oceanic phenomenon and its smaller, solid-surface counterpart.

4. Origin of the greenhouse assumption

The greenhouse CO_2 supposition originated around 1975. The Earth had just gone through a 30 year cooling period, lasting from 1940 – 1972. Observe Figure 2; the GISS-NASA records of Arctic temperatures. After 1975 we entered a period in which atmospheric CO_2 and temperature seemed to rise at the same rate.

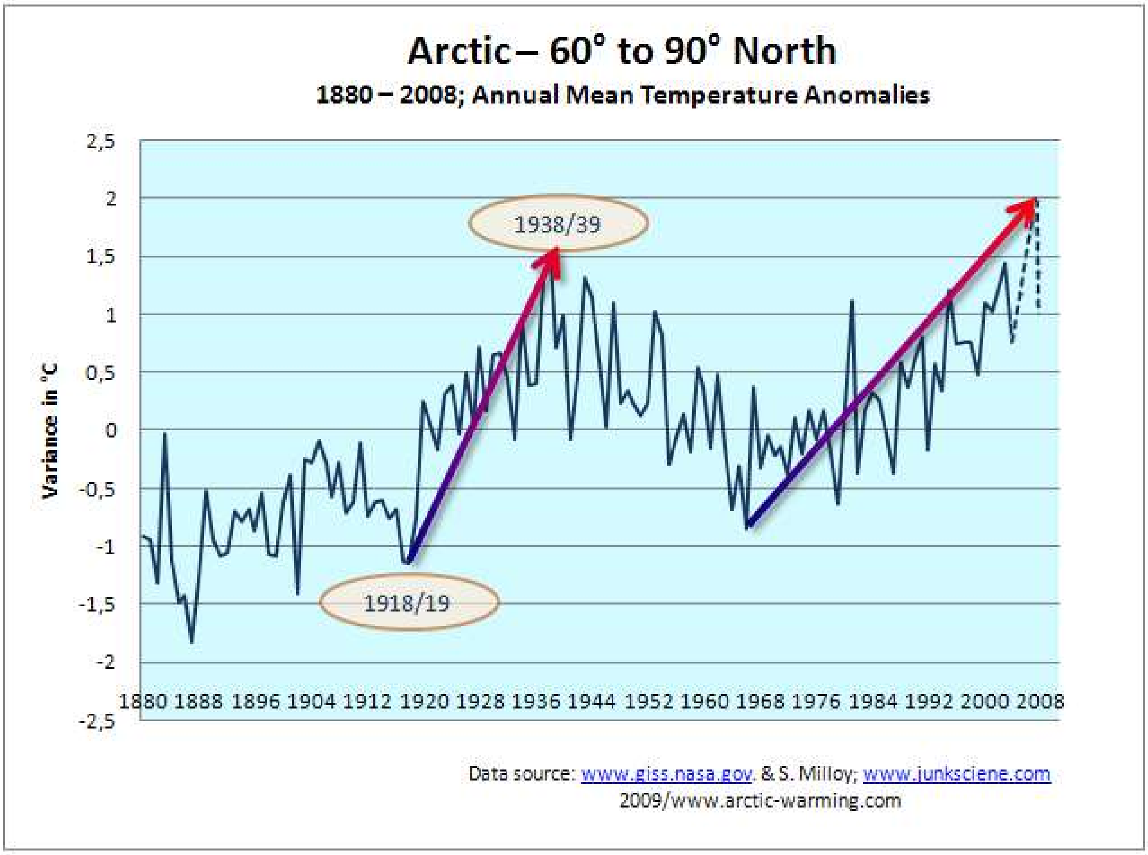

Fig.2. Arctic temperature variance relative to the year 1974, www.giss.nasa.gov.

During those 30 years, climate scientists warned about an incoming ice age. They advised to decrease fossil fuel consumption in order to avoid this fate, see Figure 3.


The Washington Post

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U.S. Scientist Sees New Ice Age Coming

The Washington Post, Times Herald (1959-1973) - Washington, D.C.

Author:	By Victor Cohn|||||Washington Post Staff Writer
Date:	Jul 9, 1971
Start Page:	A4

Fig.3. Climate warning in 1971. Less fossil fuel consumption would prevent the ice age.

Please note that the atmospheric CO_2 concentration in those days was rising as well, albeit at a slightly slower pace.

5. Ultimate test of the model

The real test for the AGW climate models is a comparison with experimental results. After all, a model may be a useful tool even if it contains mistakes. When some errors cancel each other, the instrument may still provide a useful rule of thumb. Observe the example of AGW projections of the tropical 'mid-tropospheric' temperatures as predicted by 32 model runs, used by the International Climate Panel IPCC. Figure 4 depicts these projections, alongside the satellite and balloon measurements during the period 1979 – 2018.

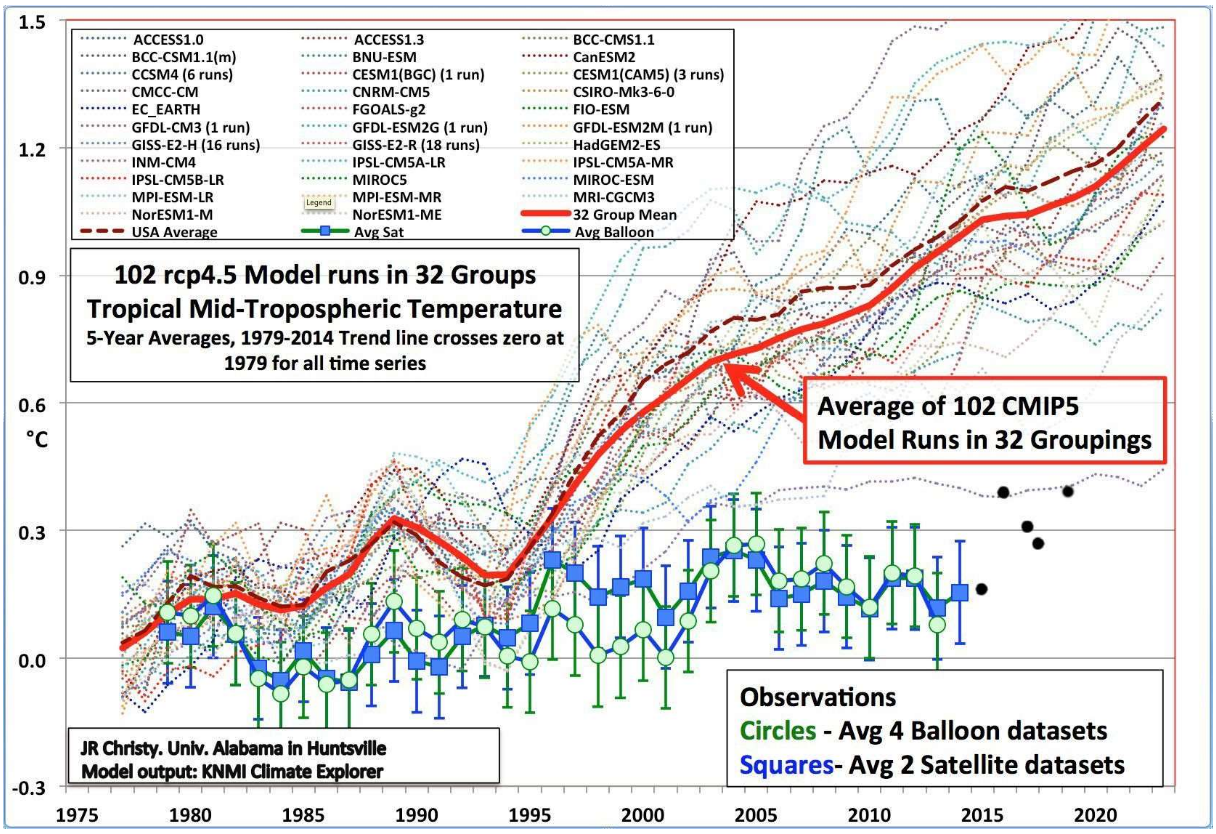

Fig.4. Comparison between AGW-model results and actual measurements. Explanations in the picture. J.R. Christy's, UAH, series ended 2014. We added later data provided by Roy Spencer of the same experiments, the black dots.

The atmospheric CO_2 content is the sole factor that determines the AGW model results. Furthermore, these models are parametrized to account for effects such as cloud formation, for which no hard physical laws exist. Even the IPCC has reservations about the long-term predictive power of complex climate models containing a multitude of non-linear coupled integro-differential equations. In any case, the predictions displayed in Figure 4 differ too much from the experimental satellite and balloon data available to be considered reliable theoretical predictions. The average model outcome shows a warming of 1,1 K during period 1979-2018. In the same period, the measurements show 0,4 K. This disparity disqualifies the predictive quality of the models. No real solid physical proof justifying the causal relationship between CO_2 and temperature exists, thus this result should come as no surprise. The only evidence presented consists of probabilistic calculations, which have been criticised by renowned statisticians due to the uncertainty of the data and shortage of time series.

Perhaps the most serious criticism of the AGW hypothesis is its assumption that no other natural phenomena cause climatological change except for atmospheric CO_2. We know from reliable proxies that European temperatures in the Medieval Warm Period were higher than at present (e.g. glaciers were smaller then). At the moment, the world is recovering from the Little Ice Age, which was not a regional, but a world-wide event. It ended around 1670, after which proxy temperatures indicated a steady rise; long before industrialisation set in and humanity began to use fossil fuel in significant quantities. Moreover, the AGW claim that the only driver of warming is atmospheric CO_2 has been falsified. M. Lockwood[6] revealed that the Sun's coronal magnetic flux increased by a *factor* of 2,3 (!) since 1901. Our prime heating source has undergone changes in some way.

The IPCC have also presented model calculations on the Arctic sea ice extent[7]. The 21 model runs show the percentage of minimum sea ice compared to the mean during the period 1980 – 2000. The runs cover *all* possibilities between 10% to 100% reduction in ~~a~~ the period 2020 – 2100(!). This does not deserve the qualification 'theory building'. It is merely a clumsy approach that declares the target to be whatever you hit afterwards. Whatever it may be, it is not physics.

Thus, by comparing AGW model results with the best measurements available in various areas, we may reject the CO_2 hypothesis without reservations. CO_2 may be influential, or it may not be. In any case, its role is overestimated.

6. **Our Sun-heated home.**

With the greenhouse hypothesis rejected, the question arises: which theory describes the observed changes in the Earth's physical observables? Changes clearly occur. The rising sea level is the phenomenon which may well be the most conclusive indicator of the Earth's rising temperature. The level increase is caused by melting land ice and by the thermal expansion of the oceans. Nothing suggests that the ocean basin is shrinking due to tectonic movement, or that other esoteric causes are to blame. 15,000 years ago, the sea level was 120 m lower than at present.
The records from Dutch coastal stations are possibly the most trustworthy records to exist. They show a steady rise of 19 cm per century[8] during a period of some 150 years. Accidentally, this concurs with NOAA's world-wide average of coastal station data[9]. Due to tectonic movements, Dutch soil is sinking at a rate of roughly 4 cm per century, while the soil is rising in Scandinavia. Big land masses and ice masses make the sea's less level than is often thought. However, there is general consensus that sea levels rise, providing significant evidence to support global warming.

It is an undeniable fact that without oceans, atmosphere, O_2, N_2, H_2O, CO_2, CH_4 and some other rare gases our planet would be much less pleasant to inhabit. They act as insulators, radiation shields, heat transporters, heat storage and more, thus globally affecting temperatures, whether averaged or not.

The surplus energy collected in oceans and the Earth's surface is transported to higher atmospheric layers and, ultimately, out to space. Due to their low density, gases are notoriously bad radiation emitters. Instead, the upper layers of the atmosphere are suitable insulators to keep us warm.

In section 3 we argued that in order to obtain temperatures significantly higher than those above a simple opaque surface irradiated by the Sun, one would not need infrared shielding as such. The effect of turbidity on the temperature distribution can be quite powerful. We visualise the Earth, our home, as a lone sphere orbiting the Sun wrapped in turbid blankets of water and air. On its path through space and time, it periodically catches different amounts of solar energy, which it accumulates, keeps, disperses, stores, re-emits and keeps as heat, bioenergy, chemical energy, and fossil energy for later use. Some processes take a second, others millions of years. It is much like keeping ourselves warm under a cosy cover in a cold night with a hot water bottle that is occasionally refilled.

How all these mechanisms really function in detail is not yet known. The processes are far too many and too complex. However, their existence is irrefutable. The future of young physicists is not without opportunity for new discoveries.

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This article appeared also on: Principia Scientific International: https://principia-scientific.org/on-the-theory-of-the-earths-physical-parameters-distributed-in-space-and-time/

Notes

1. CLINTEL affiliates (Climate Intelligence Foundation, The Netherlands; office@clintel.org). Correspondence: clepair@casema.nl & cadelange@gmail.com .
2. Ice core measurements on glacial cycles show: rise and fall of atmospheric CO_2 concentration lags about 700 years behind rise and fall of atmospheric temperature. The ocean needs time to warm up, before it releases its dissolved CO_2.
3. M. Wild, D. Folini, Chr. Schar, N. Loeb, E.G. Dutton, G. König-Langlo (2013). “The global energy balance from a surface perspective.” Climate Dynamics **40** (11-12), p.3107/34.
4. On solid ground the effect is different, but also there we have energy retainment, wich causes a radiative behaviour quite different from that of an opaque black body in which the surface temperature is determined by incoming light and immediate balancing SB-radiation.
5. https://principia-scientific.org/radiation-balance-and-transparent-media-3/ (or: http://www.clepair.net/transparant-3.html).
6. M. Lockwood, R. Stamper, M.N. Wild; Nature Vol. **399**, 3 June 1999. Pages 437/9.
7. Eisenman et al., J. Clim. 2011; part of the IPCC model forecasts.
8. Sea level data from satellites vary between 24 and 19 cm/century and between coastal stations from plus to minus. NOAA’s estimate for the sinking speed of Dutch soil is ~ 4 cm/century. https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=150-031
9. https://tidesandcurrents.noaa.gov/sltrends/sltrends_global.html