Living Room Model

Sjaak Uitterdijk

Abstract

By presenting the relevant, in relation to the climate problem, measured variables as exponential functions, truthfully representing the real values, surprising informative mutual relations show up. One of these relations led to the successful investigation of the possibility that the global temperature raise can not be caused by indirect heating, prescribed by the Green House model, but is caused by direct heating, prescribed by the here named Living Room Model. It is of fundamental importance to realize that sun, wind and earth energy that is transformed to energy, intended to be consumed by mankind, also directly heats the atmosphere. Besides that it has been proven that the Sea is heated by the geothermal heat flux. The final outcome therefore is that aiming for reduced CO2 emissions will not result in any improvement of the climate. Only a drastically reduction of the consumed energy, of whichever kind, will help.

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Edition 1

Mankind is addicted to energy consumption

and

grows explosively

Prologue

One of the original objections to the Greenhouse Model is the conflicting observation that it happened the last 200 years four times that the global temperature dropped while the CO_2 concentration in the atmosphere kept rising.

To support this opinion more scientifically, a special mathematical operation has been applied to the very noise-like graph of the global temperature, which filters out all that noise, but preserves the essence.
The result was even a much more clear contradiction between global temperature and CO_2 concentration.

However the graph of the global temperature also shows a long-term increase, having a strong correlation with the CO_2 concentration in the atmosphere.

Eventually it has been made clearly visible that a precise sinusoidal (64-year period) change is the cause of what led originally to the conflicting observations. This yet incomprehensible periodical phenomenon has to be considered as a completely independent part of the long-term increasing global temperature.

As a result the aforementioned long-term correlation now strongly tempts the observer to consider the increasing CO_2 concentration in the atmosphere as the cause of its increasing temperature. However, a correlation does not necessarily mean a causation.

Studying the basic principle of the Greenhouse Model led to the conclusion that the alleged difference between the incoming radiation of the Sun during day-time and the outgoing radiation during night-time has been adapted to the heat power density, necessary to heat the Sea in conformity to what has been measured. What has actually been measured is an increase of the temperature, at the surface being equal to the increase in the atmosphere. This increase is diminishing with depth to zero at a few kilometres depth. The related increase of the heat energy in the Sea has now been calculated from the measured increased temperature and used as argument in favour of the Greenhouse Model. However, there is no evidence whatsoever for the alleged relation between the difference of incoming and outgoing radiation and the rise of atmosphere's temperature.

Besides this misleading presentation it can be proven that the heating of the Sea, decreasing with depth, can not be caused, as assumed in the Greenhouse Model, by a top down heating, whether directly by the mentioned radiation, or indirectly via the atmosphere. Such a result can only be achieved by a bottom up heating. The most obvious solution turns out to be the million years old natural geothermal heat flow. In a way just like the water level in the estuary of a river enhances with the tide of the sea into which it flows. And it also resembles very well the phenomenon that the further inland, the less remains in the river of that elevated level in the estuary.

Based on the physical law that prescribes that all consumed energy is fully converted into heat, the idea arose that the increase of atmosphere's temperature could, in principle, be caused by direct heating due to the consumed energy by mankind, in this book called Living Room Model.

With this model the so-called Hot Spots on Earth can perfectly explained too.

The result of the theoretical research into the Living Room Model and some additional fundamental objections against the Greenhouse Model should lead to the conclusion that the Greenhouse Model represents an untenable theory.

Contents

I Mathematical expression for the CO_2

From here on, for simplicity's sake, the variable "CO_2 concentration in the atmosphere" will be called: CO_2. The CO_2 measurements, as presented in reference [I], are called: Monthly Mean Concentrations at the Mauna Loa Observatory. For the purpose of this investigation their monthly registrations are transformed to yearly mean values. The measurements have been carried out since 1958. The units are in parts per million or ppm.

The graphics of these measurements show a very smooth tendency, hardly possessing random deviations and are therefore very suitable for applying the curve fitting $y = c + a\cdot\exp(t/b)$. See Appendix 1.2.
The outcome, based on the measurements in the years 1958, 1986 and 2014, is:

$CO_2(t) = 259.4 + 6.60\cdot10^{-13}\cdot\exp(t/61.06)$

Taking $b = 61$, $c = 259$ and $a = 6.4\cdot10^{-13}$, learns that hardly any deviation can be found in the graph in fig. I.1.

Therefore the mathematical expression for the concentration of the CO_2 is chosen as:

$$CO_2(t) = 259 + 6.4\cdot10^{-13}\cdot\exp(t/61) \quad \text{ppm} \qquad (1)$$

In this function the variable t is the actual year number, which explains the small value of the constant a.
Based on the fact that the calculated curve shows an excellent fit with the measurements, it is considered justifiable to extrapolate the values back to 1850.

1850 is the year in which the recording of the *global temperature*, to be considered hereafter, was started.

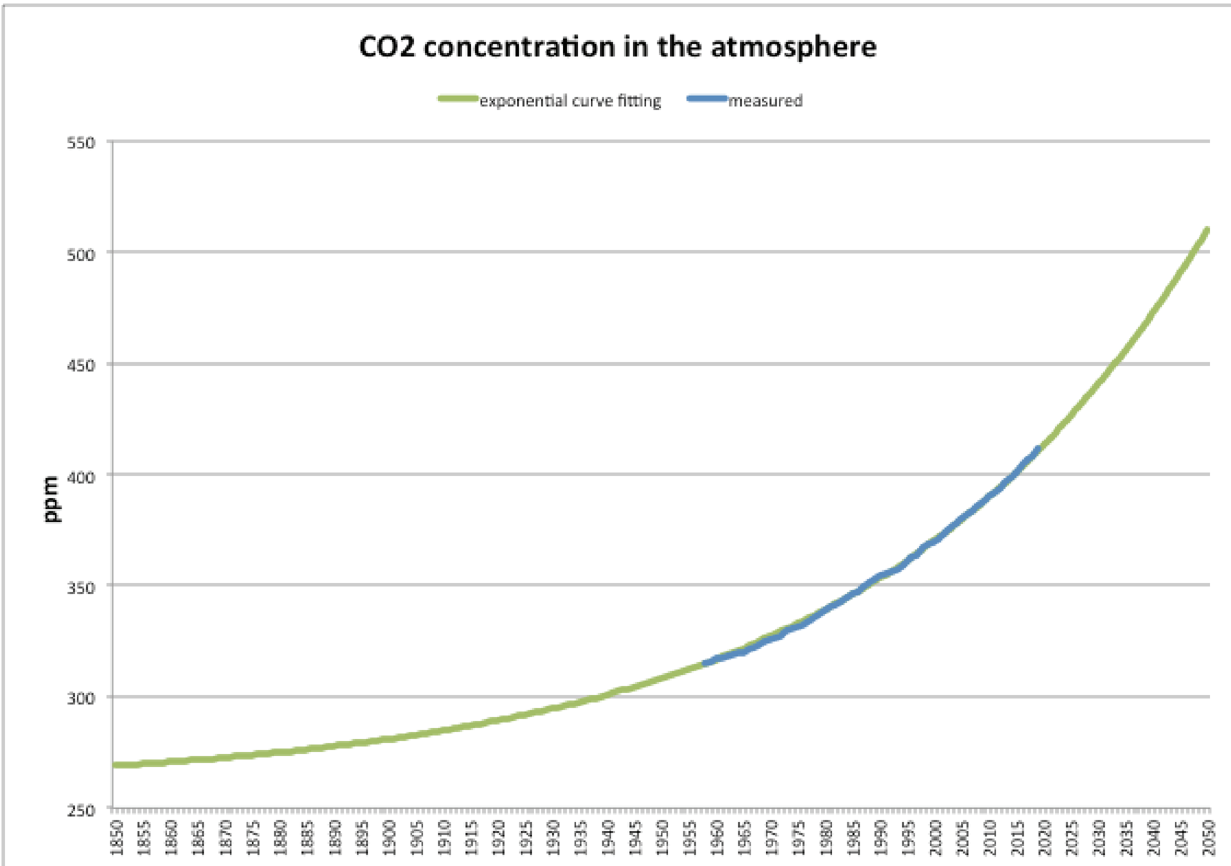

Figure I.1: Measured CO_2 since 1958 and fitted curve extrapolated back to 1850 and forward to 2050

II Mathematical expression for the global temperature

II.1 Definition of the global temperature

The global temperature is calculated as the average temperature, measured in a few thousand stations throughout the world. The measurements take place at a height of 1.5 to 2 meters above Earth's surface. The global temperature is therefore the temperature of the atmosphere at that height. For that reason, the heat capacity of the atmosphere is considered to be the most crucial parameter in the following assessments. From now on the variable 'global temperature' will be used to express the *yearly mean* value of the measurements.

II.2 Short-term-trend

The measurements of the global temperature had been downloaded around 2015 from a site called: National Aeronautics and Space Administration, Goddard Institute for Space Studies, showing measurements starting in 1850. However the link to that site has been removed. The new link (reference [II]) now shows measurements starting in 1880. The measurements since 1850 have been used for the fitting described below.
The measurements have been fitted to an 8th and 9th order polynomial, shown in figure II.1. See Appendix 1.1 for the mathematical background. Considering the mutual rather divergent behaviour, between the 8th and 9th order curves, *only during the last five years*, the mean value of these two polynomials has been calculated and applied as the final high order polynomial fitting.

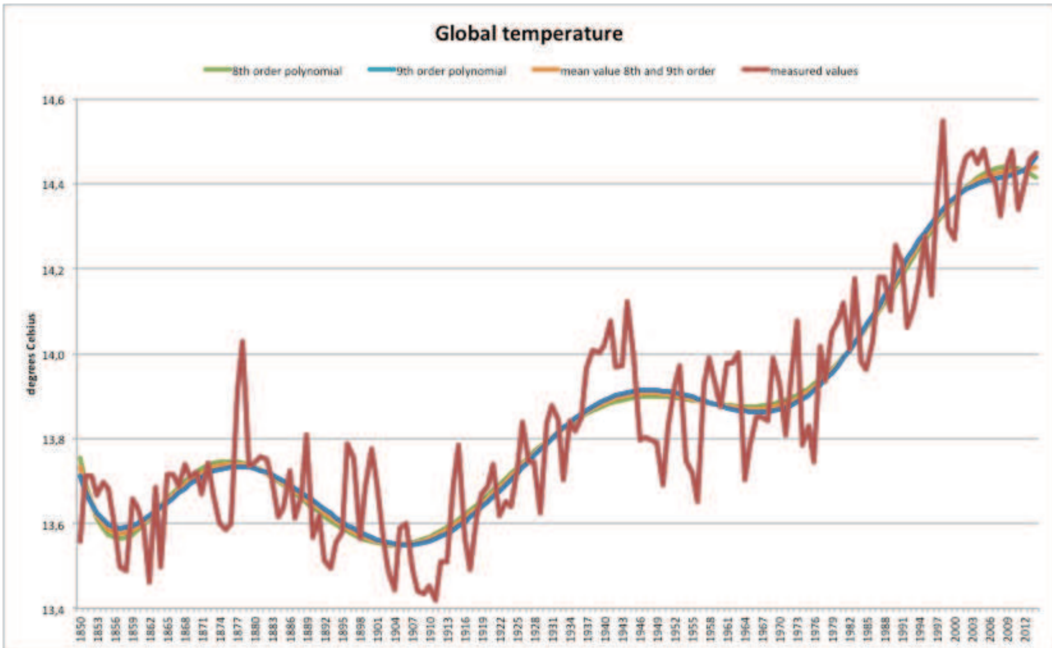

Figure II.1: Global temperature, measured and polynomial fitted

Over the past 10 years, the global temperature no longer significantly increased (0.03 °C), despite the ongoing increase of the CO_2 concentration, as presented above. This means that, assuming the Greenhouse theory is correct, seemingly other processes determine the global temperature too.
This conclusion is supported by the observation that during the periods 1945-1965, 1875-1905 and ?* - 1855 this temperature even decreased notwithstanding the always increasing CO_2 concentration.
So it might even be that the Greenhouse theory is not correct, with the consequence that the CO_2 concentration in the atmosphere is not responsible for the increase of the global temperature. To investigate this in more detail a long-term-trend of the global temperature only has to be extracted.

* The question mark concerns data that started in 1834, but this data is not found at Internet anymore since about 2017.

II.3 Long-term-trend

In order to extract a pure long-term-trend of the global temperature, in first instance a 2nd order polynomial fitting has been carried out. See figure II.2. The result shows an unrealistic trend in the first four decades. To eliminate this, the curve fitting y = c + a•exp(t/b) has been applied to 3 places where the 2nd order polynomial equals the high order polynomial. That means the years 1892, 1958 and 2012.
At the same time it is investigated whether the curvature of the CO_2, to read as the value of b, can be used.

Figure II.2 shows the graph of the function:

$$T_G(t) = 13.5 + 4.4 \cdot 10^{-15} \cdot \exp(t/61) \quad {}^0C \qquad (2)$$

No reason can be assigned to reject such a curvature, starting at 1890.

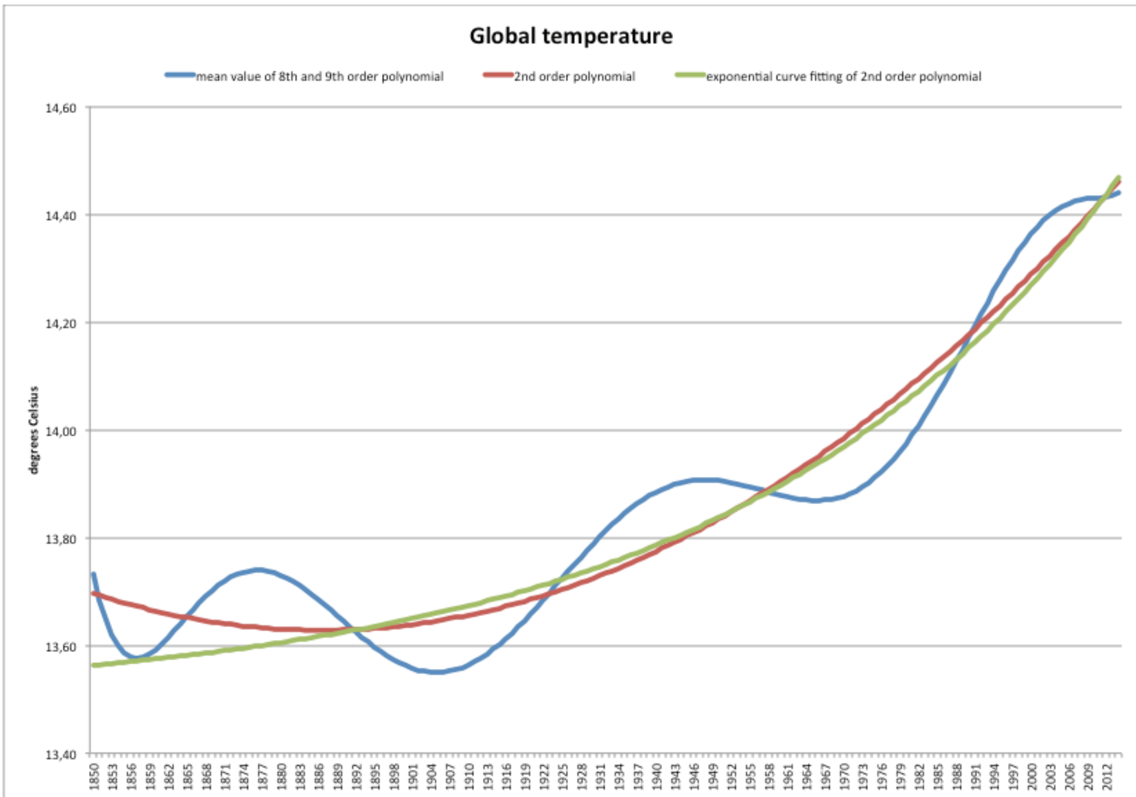

Figure II.2: Global temperature, polynomial and curve fitted, as function of time

II.3 Interesting spin-off

If the exponentially fitted long-term-trend curve is subtracted from the total curve a surprising periodical curve results! See fig II.3. The graphics shows 2.5 periods in 160 years. That is 64 years per period.
Interesting stuff for relevant specialists to figure out what might be causing this.

Remark: The red curve in figure II.3, obtained by taking the second order polynomial function as reference, shows a more perfect sinusoidal function, except the first half period. The surprising upwards trend in this period might be the reason for withdrawing the data from 1850 – 1880 from Internet.
N.B. The information shown in this chapter has been available at least until 2016.

The amplitude of this periodic phenomenon seems to decrease somewhat as a function of time, but the next decades it will expected to be 0.1 °C.

This periodic function has been continued smoothly after 2012 by applying the function: -Asin{ω(t – 2012)} with ω= 2π/64, and A = 0.1, as shown in figure II.3.

Doing so, the global temperature can be predicted precisely until 2050, as shown in figure II.4.

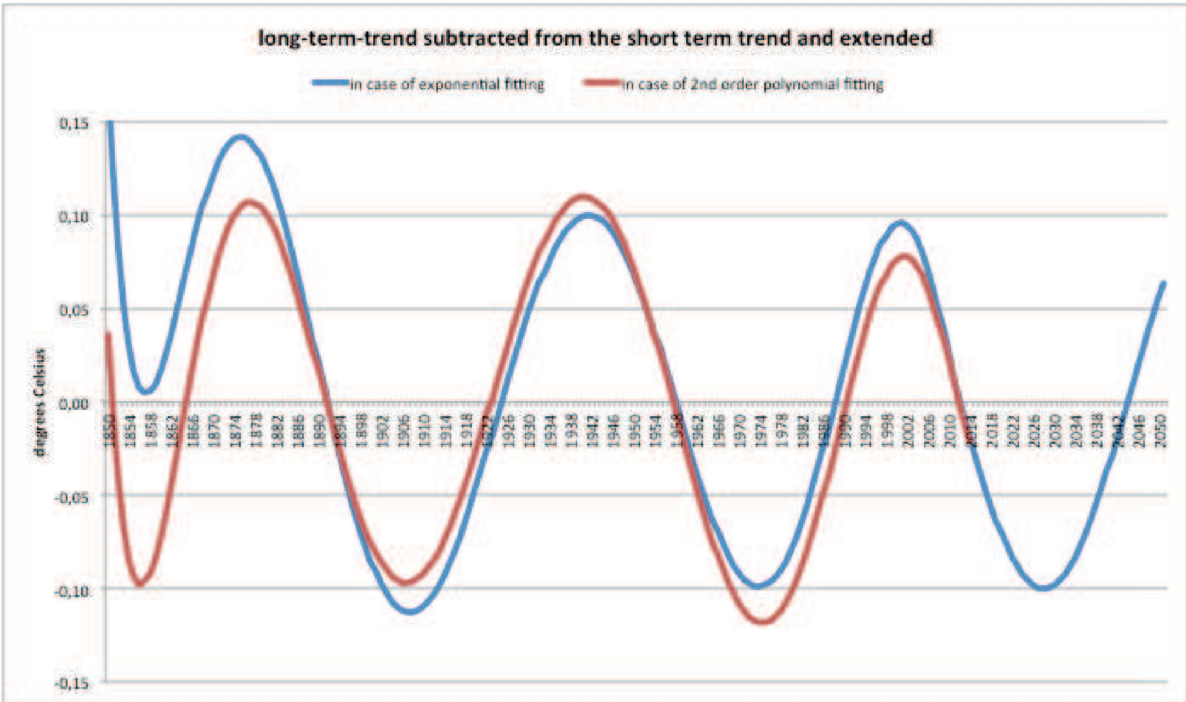

Figure II.3: Periodic function extended after 2012 with Asin{ω(t – 2012)}

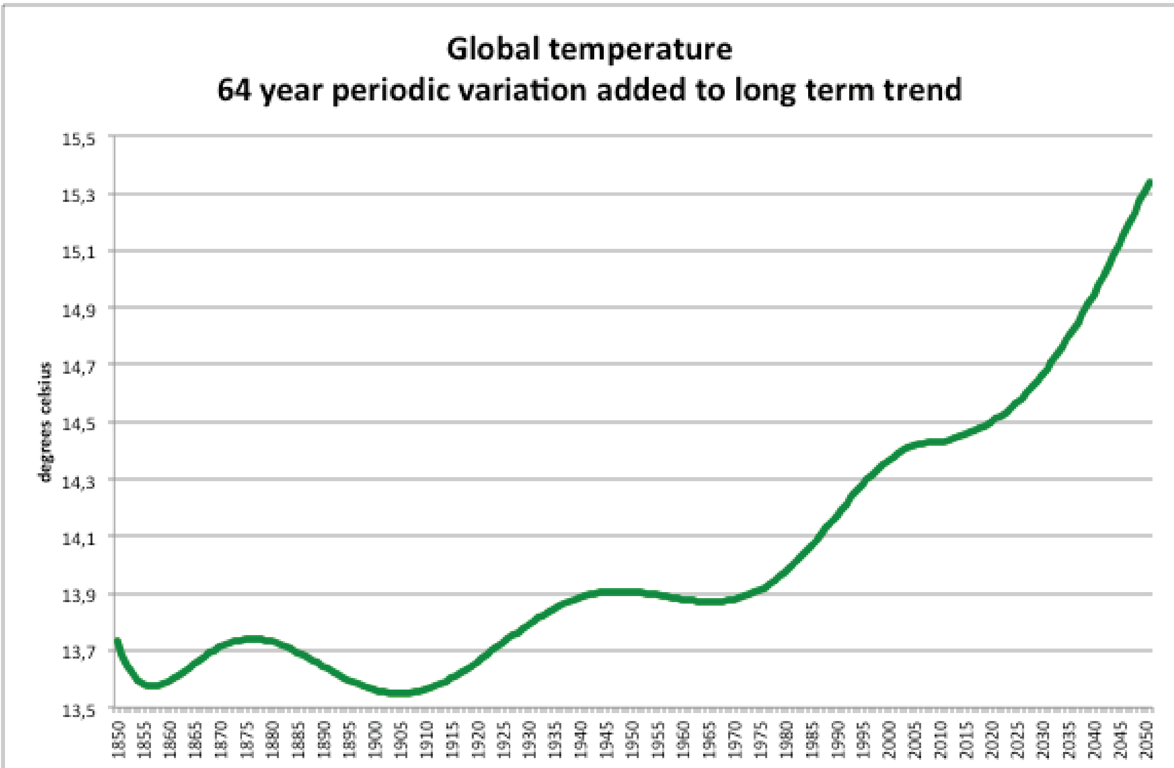

Figure II.4: Predicted global temperature (°C) until 2050, including the periodical variations

III Mathematical expression for the world population

There are several sources at the Internet informing about this subject. The world population as shown in reference [III] has been taken as the first approximation. “As the first approximation”, because the graphics show such an unnatural character that it is impossible to qualify this as correct:

- an artificial nod in 1925 as well as in 1950,
- in between the two nods and from 1800 to 1925 a straight line,

In order to obtain a more credible curve, which means: as belonging to a natural process, the exponential curve $y = c + a{\cdot}\exp(t/b)$ is chosen. The value of b is, in advance, taken 61.

The two artificial nods have been eliminated by using the inputs belonging to 2014 and 1914.
The result is:

$$W_p(t) = 0.47 + 3.2{\cdot}10^{-14}{\cdot}\exp(t/61) \qquad \text{[billion]} \tag{3}$$

Figure III.1 proves that this is an entirely acceptable representation of reality.

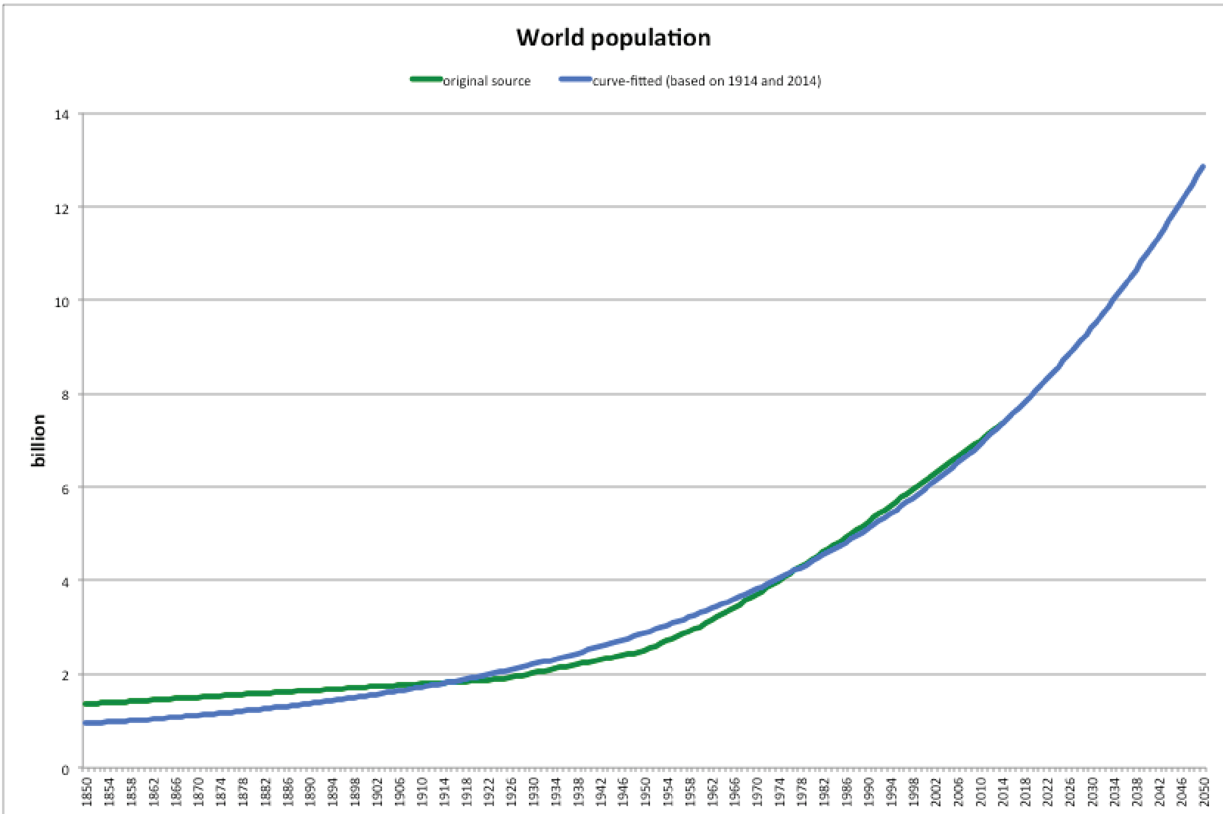

Figure III.1: The world population as function of time: the original and the most likely curve

Formula (3) expresses that such a growth will lead to a world population of 29 billion in 2100!

IV Mathematical expression for the worldwide energy consumption

Global administrations of the consumption of fossil fuels has led to the graph, as shown in figure IV.1, of the annual energy consumption in the past 200 years. The figure has been copied from reference [IV].

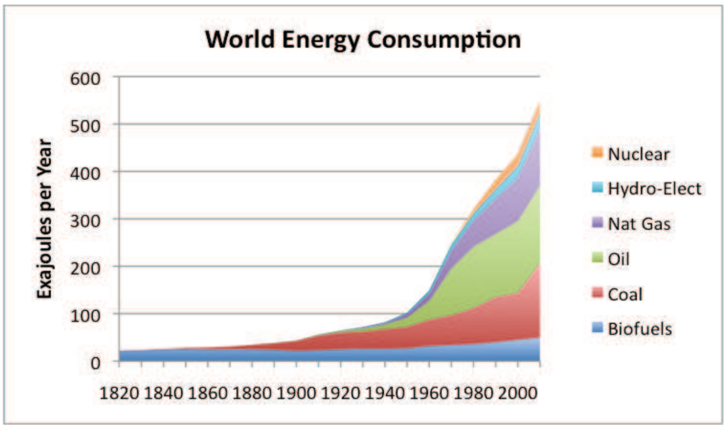

Figure IV.1 World Energy Consumption by Source, Based on Vaclav Smil estimates from Energy Transitions

Figure IV.1 shows "humps" and "dents" that conflict with the extremely streamlined graph of the measured and backwards extrapolated CO_2 concentration in the atmosphere. See chapter I. For this reason the graph of figure IV.1 has also been streamlined by means of exponential curve-fitting.

The data has first been converted to a stylized graph and at the same time to TeraWatt (TW), applying the relation: 1 Exajoule/year $=10^{18}/(3600{\cdot}24{\cdot}365)$ W = 0.0317 TW. See the blue curve in figure IV.2.

The years 2010 and 1810 have been taken as references for the curve fitting. The time constant (b) is, in advance, taken 61 year. The result is: $P_G(t) = -0.06 + 8.4{\cdot}10^{-14}{\cdot}\exp(t/61)$. The value -0.06 is not realistic, but small enough to be ignored. So the globally applied power, expressed in TW, will be written as:

$$P_G(t) = 8.4{\cdot}10^{-14}{\cdot}\exp(t/61) \text{ TW} \tag{4}$$

Figure IV.2 shows the related graphs and also that, without compromising credibility, the curvature of the applied power graph may be chosen as 61. The legitimate question namely is how reliable these registrations were until the discovery of the climate problem!

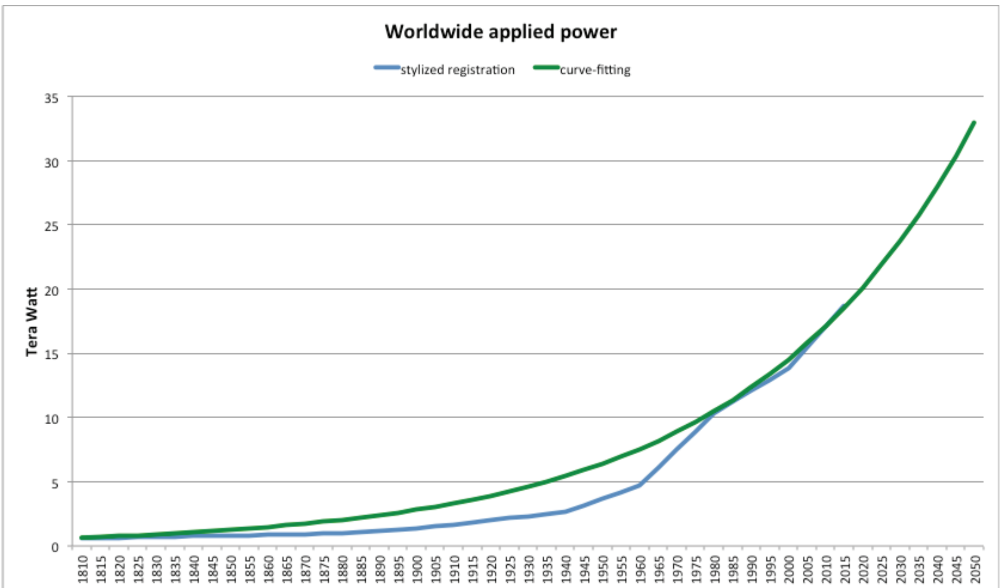

Figure IV.2. Worldwide power usage from 1810 to 2050

V Mathematical expression for the increased Sea heat energy

Figure V.1 is a copy of figure 6 from reference [V.1]. It shows the heat absorbed by the Sea (all oceans and seas together) over the past 55 years. The period 1960 to 1985 doesn't show a sufficiently reliable measured increase. For that reason, only the energy values for the period 1985 - 2015 have been considered. These can be read directly on the vertical axis. These energies are not directly measured, but calculated from actually measured temperature rises. So these temperature rises have to be calculated back from the presented energy rises, by means of the relation:

Δtemp = Δenergy / volume of the related layer / specific heat capacity of water.

The rounded specific heat capacity of water equals $4{\cdot}10^6$ J/m³/K.

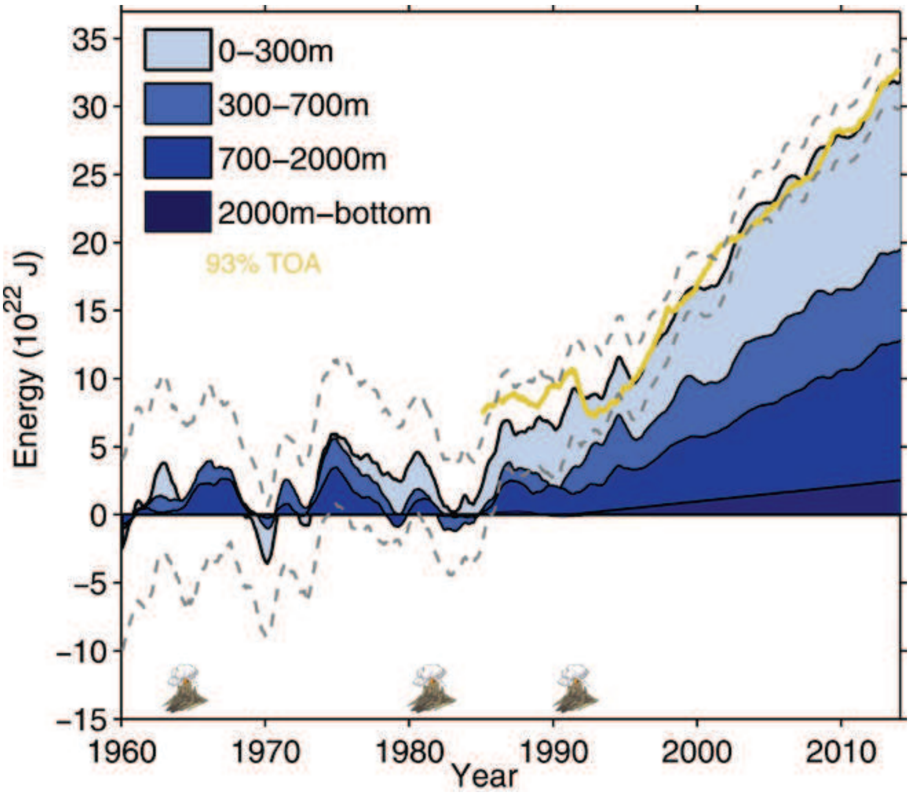

Figure V.1 Improved estimates of Sea heat content from 1960 to 2015

The fourth mentioned layer in figure V.1 has been changed into 2000m-3700m, with 3700m the rounded mean value of the depth of the Sea, presented in reference [V.2]. The same reference also shows that the total surface of the Sea is $3.6{\cdot}10^6$ m², so the volume of a layer equals its thickness times this surface.

Table V.1 shows the results for each layer. The variable ΔV is the increased volume, only as a result of the expansion of the water, so ΔV = Δtemp (K) · volume · volume expansion coefficient water (0.00021) m³. The variable Δheight is the resulting level rise, calculated as ΔV/total surface of the Sea · 100 (cm). The total of Δtemp is the temperature increase *at the surface* of the Sea.

layer (m)	thickness (m)	volume (m³)	Δenergy (J)	Δtemp. (mK)	ΔV (m³)	Δheight (cm)
0-300	300	$1.1{\cdot}10^{17}$	$1.3{\cdot}10^{23}$	303	$6.8{\cdot}10^{12}$	1,9
300-700	400	$1.4{\cdot}10^{17}$	$7.0{\cdot}10^{22}$	123	$3.7{\cdot}10^{12}$	1,0
700-2000	1300	$4.6{\cdot}10^{17}$	$1.0{\cdot}10^{23}$	54	$5.3{\cdot}10^{12}$	1,5
2000-3700	1700	$6.1{\cdot}10^{17}$	$2.0{\cdot}10^{22}$	8	$1.1{\cdot}10^{12}$	0,3
totals	**3700**	$\mathbf{1.3{\cdot}10^{18}}$	$\mathbf{3.2{\cdot}10^{23}}$	**488**	$\mathbf{1.7{\cdot}10^{13}}$	**4,7**

Table V.1 deduced from figure V.1 for the period 1985-2015

Given the variable Δenergy, valid for the period 1985-2015, the increase starting in 1870 will be determined mathematically, by assuming in first instance that it can be represented by $c + a \cdot \exp(t/61)$, with t the year and c and a yet to be determined. The increase over the period 1985 – 2015 has been measured as $3.2 \cdot 10^{23}$ J. Such an increase is mathematically presented by $a \cdot \{\exp(2015/61) - \exp(1985/61)\} = a \cdot (2.2 - 1.4) \cdot 10^{14}$. So in first instance $a = 3.7 \cdot 10^{9}$ Joule.

The next page shows, by means of equation (2), that the increase of the temperature of the atmosphere during this period has been $4.4 \cdot 10^{-15} \cdot \{\exp(2015/61) - \exp(1985/61)\} = 380$ mK. This value is considered much more reliable than the value 488 mK in Table V.1, so 'a' is adjusted by -20% to $3 \cdot 10^{9}$ Joule.
Applying this value to Δenergy during the period 1870 to 2020 results in an energy increase of $3 \cdot 10^{9} \cdot \{\exp(2020/61) - \exp(1870/61)\} = 6.6 \cdot 10^{23}$ J. Because all the calculations in Table V.1 are linear, the temperature increase at Sea surface is $6.6 \cdot 10^{23}/3.2 \cdot 10^{23} \cdot 488$ mK = 1 K. Applying equation (2) for this period, also results in a rise of 1 K.

These results are considered reliable enough to conclude that Δenergy, written as $\Delta E_S(t)$, can mathematically be presented by $\Delta E_S(t) = c + 3 \cdot 10^{9} \cdot \exp(t/61)$. Applying the border condition $\Delta E_S(1870)=0$, results in $c = -6.2 \cdot 10^{22}$ J, so for $t \geq 1870$:

$$\Delta E_S(t) = -6.2 \cdot 10^{22} + 3 \cdot 10^{9} \cdot \exp(t/61) \quad \text{J} \qquad (5)$$

Figure V.2 shows this mathematical function (green), together with the *original* values as shown in figure V.1, starting in 1985 on top of the exponential fit in that year.

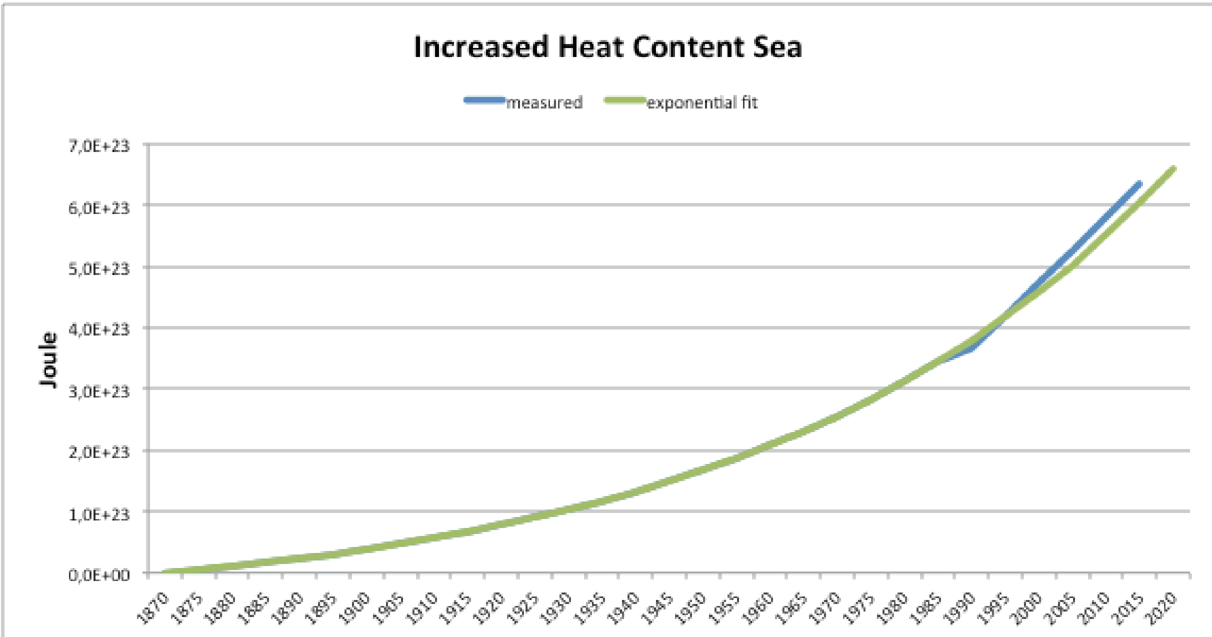

Figure V.2

The differentiation of $\Delta E_S(t)$ to time results in a mathematical expression for the related power. This variable divided by the surface of the Sea results in the power density:

$$PD_S(t) = a/61/3.6 \cdot 10^{14} \cdot \exp(t/61) \ \text{Joule/year} = 4.3 \cdot 10^{-15} \cdot \exp(t/61) \quad \text{W/m}^2 \qquad (6)$$

This variable varies from 0.1 to 1 W/m^2 in the period 1870 – 2020 and will be used later on.

VI Mutual relations between the variables

Given the fact that the time constant of 61 years can be applied successfully to all of the six variables under consideration, the following expressions have been found:

CO_2 concentration	ppm	$CO_2(t) = 259 + 6.4 \cdot 10^{-13} \cdot \exp(t/61)$	(1)
Global temperature	^0C	$T_G(t) = 13.5 + 4.4 \cdot 10^{-15} \cdot \exp(t/61)$	(2)
World population	billion	$W_p(t) = 0.5 + 3.2 \cdot 10^{-14} \cdot \exp(t/61)$	(3)
Globally applied power	TW	$P_G(t) = 8.4 \cdot 10^{-14} \cdot \exp(t/61)$	(4)
Increased energy Sea	J	$\Delta E_S(t) = -6.2 \cdot 10^{22} + 3 \cdot 10^{9} \cdot \exp(t/61)$	(5)
Power density Sea	W/m^2	$PD_S(t) = 4.3 \cdot 10^{-15} \cdot \exp(t/61)$	(6)

The mutual relations between these variables can be deduced as shown below by means of an example.

$CO_2(t) - 259 = 6.4 \cdot 10^{-13} \cdot \exp(t/61)$

$T_G(t) - 13.5 = 4.4 \cdot 10^{-15} \cdot \exp(t/61)$

so

$\{T_G(t) - 13.5\}/\{CO_2(t) - 259\} = 4.4 \cdot 10^{-15} / 6.4 \cdot 10^{-13} = 7 \cdot 10^{-3}$ resulting in:

$$\textbf{global temperature} = 13.5 + 0.007 \cdot (CO_2 - 259)$$

Inversely:

$$CO_2 = 259 + 145 \cdot (\textbf{global temperature} - 13.5)$$

Warning: the shown relations should not be interpreted as causations!

The world population (in billions) can be expressed as function of CO_2 by:

$$\textbf{population} = 0.5 + 0.05 \cdot (CO_2 - 259)$$

eliminating for example the necessity to *count* the world population!

For each 1 billion humans extra the global temperature rises 0.14 °C:

$$\textbf{global temperature} = 13.5 + 0.14 \cdot (\textbf{population} - 0.5)$$

The global temperature as function of the globally applied power in TW is:

$$\textbf{global temperature} = 13.5 + 0.05 \cdot \textbf{GAP}$$

The very fundamental deduction that can be drawn from the last shown expression is that *possibly* the CO_2 concentration doesn't play any role in the increasing global temperature.

This will be further investigated after having had a critical look at the Greenhouse model (GHM).

VII Critical look at the Greenhouse Model

VII.1 Introduction

The generally accepted reasoning in the GHM is that the atmosphere, and the oceans and seas (Sea) are heated simultaneously and from the same source, with the result that the temperature of the Sea rises to a great depth, gradually decreasing to zero. However, in this chapter it will be shown that, from a physical point of view, it is impossible to heat the Sea in such a way to great depth. At most a thin top layer would be heated, which would then serve as a kind of thermal insulation to prevent heating at greater depths. Instead, the heat in the atmosphere will, via convection respectively radiation, largely disappear into the universe. The GHM states that a net difference between the incoming and outgoing heat flux in the atmosphere of about 1 W/m^2, valid for roughly the past ten years, is heating the atmosphere and the Sea as just described. It appears that this claimed net heat flux is not based on measured incoming and outgoing fluxes. It was created solely to explain the increased thermal energy in the Sea, which in turn is derived from actually measured temperature increases in multiple layers, as shown in chapter V.

VII.2 Principle of the GHM

It is beyond dispute that half of the Earth is heated during the day and that, at the same time, the other half gives off the previously absorbed heat during the night. That release is eventually done to the universe through radiation. According to the GHM, cooling is more impeded by the atmosphere the more it contains greenhouse gases. The defence that these greenhouse gases should therefore hinder the much stronger incoming solar radiation too and thus cool the Earth is refuted by the following alleged reasoning put forward by the GHM supporters.
The incoming radiation has a shorter wavelength than the cooling one. According to the GHM, this short-wave radiation is not blocked by the greenhouse gases, while the long-wave radiation is. The spectrum of the solar radiation is maximum at a wavelength of ~ 600 nm. According to the GHM, the spectrum of the cooling radiation lies at a wavelength of ~ 20000 nm.

N.B. It is not mentioned that the cooling starts primarily with convection through the atmosphere, to eventually be completed as radiation from the exosphere.

VII.3 A closer look at spectra

Originally the idea, based on the above-described principle of the GHM, was that a thorough theoretical investigation of the spectrum of the radiation during cooling is essential. After this investigation was completed, it appeared to play no role. The result of the investigation is considered noteworthy. In brief:

The cooling hemisphere of the Earth can be regarded as a black radiator, with a temperature at the surface of 525 K (250 °C). The note on that surface is that the associated so-called exosphere is so thin that it borders on vacuum. By definition vacuum has no temperature. But only 1 molecule in any volume does! The temperature of that exosphere is very high indeed. The maximum of the spectrum of its radiation is, at a temperature of 250 °C, at a wavelength of ~ 10000 nm. So not at the 20000 nm, as alleged by the GHM. The temperature of a black radiator with the maximum at a wavelength of 20000 nm is -20 °C!

VII.4 A closer look at the heat fluxes of the GHM

“Heat flux” stands for: “heat power per surface unit” and is therefore expressed in W/m^2.

The GHM focuses on heat fluxes, mainly in the form of radiation, which are intended to indicate the heating and cooling of the Earth. All this is done by means of figure VII.1, copied from reference [VII], intended to provide insight. The yellow fluxes represent the heating and the red, upward, the cooling. The downward directed red ones, referred to as radiation from greenhouse gases, are thought to determine the heating of both the atmosphere and the Sea. The “net absorbed” flux is postulated to be 0.6 W/m^2.

However, in no way whatsoever it can be found that this alleged net absorbed flux should be 0.6 W/m². Further study of reference [VII] also offers no guidance. It is therefore unbelievable that this small difference could have been derived from the much larger fluxes, with an accuracy that also suggests to be significant smaller than 0.1 W/m².

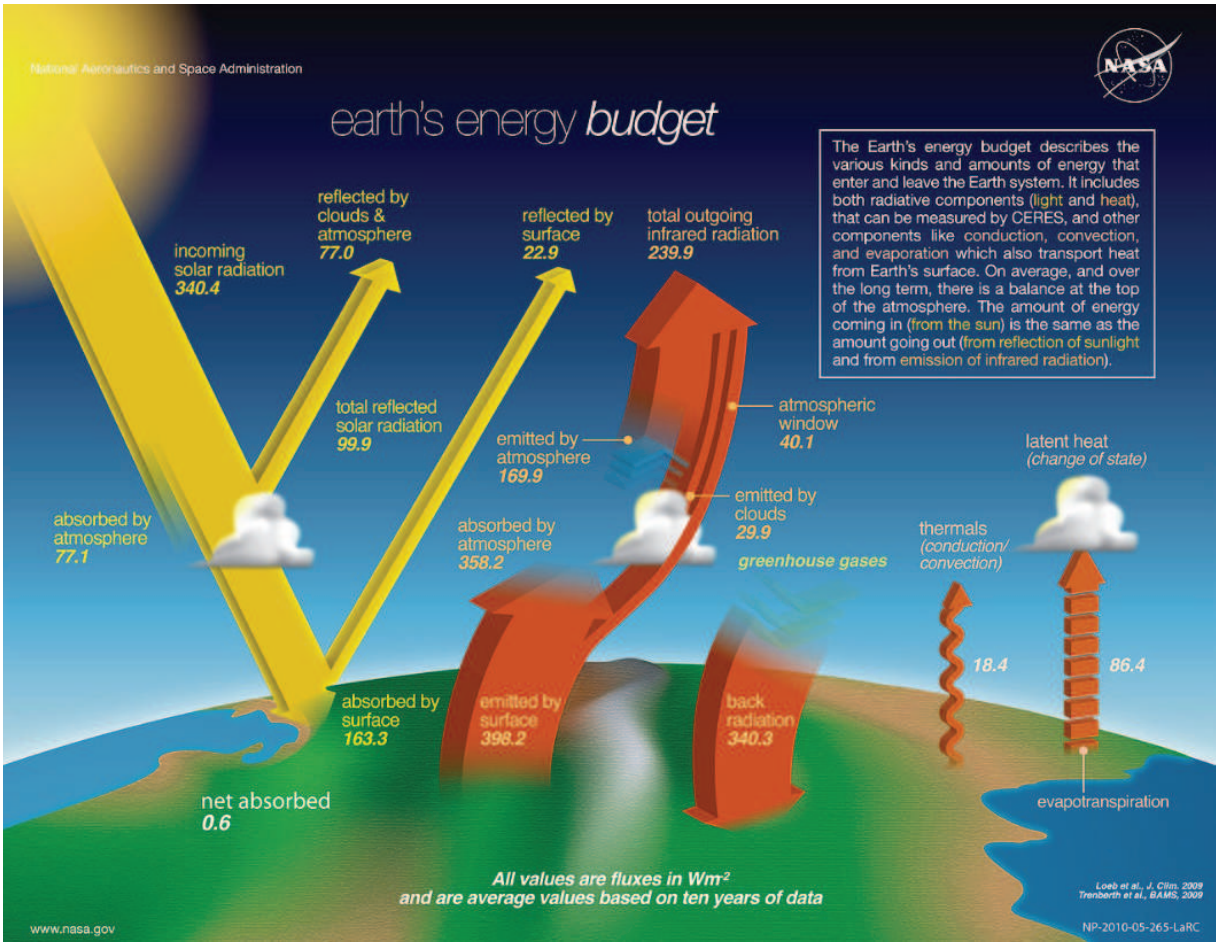

Figure VII.1

Reference [VII] reports under the chapter "Climate Forcings and Global Warming":

"The absorption of outgoing thermal infrared by carbon dioxide means that the Earth is still absorbing about 70 percent of the incoming solar energy, but an equivalent amount of heat is not emitted again. The exact amount of energy imbalance is very difficult to measure, but turns out to be slightly more than 0.8 watts per square meter. The imbalance is derived from a combination of measurements, including… .. observations of sea level rise and warming. "

In the next paragraph it is made plausible that the last sentence should almost certainly have read:

The imbalance is *only* deduced from the measured increased temperature of the Sea, transformed to warmth.

VII.5 The heating of the Sea in the GHM

According to the GHM the Sea is heated top down to great depth, gradually decreasing to zero, while simultaneously the atmosphere is heated too. The alleged related "net absorbed" power density/heat flux is 0.6 W/m^2 in the year 2010, as shown in figure VII.1. In chapter V it shown theoretically, based on measurements of the increased temperature of the Sea, that in the year 2010 a power density $PD_S(t)$ of $4.3 \cdot 10^{-15} \cdot \exp(2010/61) = 0.9\ W/m^2$ is necessary to heat the Sea as has been measured. That density is based on only the surface of the Sea. But the GHM prescribes that its "net absorbed" heat flux of 0.6 W/m^2 is related to the total Earth's surface, because it originated in the total atmosphere "on the basis of" all prevailing heat fluxes there. For that reason, the 0.6 W/m^2 in figure VII.1 is a factor 1.5 too low. However, as noted in VII.4, the correctness of this heat flux has not been proven at all on the basis of measured values. Therefore, this significantly incorrect outcome is not noticeable.

This consideration brings us to a shortcoming of the GHM with much more far-reaching consequences.

The top down heating of the Sea to a great depth should be considered impossible. Convection is out of the question because a thin layer of heated water keeps floating at the surface. And conduction is not possible as can be proven with the associated physical law $\Delta T = R \cdot \Phi$ with:

Φ	the applicable heat flux	W/m^2
R	the thermal resistance	$K/(W/m^2)$
ΔT	the temperature difference	K

The thermal resistance, to be considered, of the layer of water with thickness d is determined by $R=d/\lambda$, with λ the specific thermal conductivity of water: 0.6 $W/(m \cdot K)$. The thermal resistance R of a layer of water of 3600 m is therefore 3600/0.6 = 6000 $K/(W/m^2)$. Applying the heat flux 0.6 W/m^2 of the GHM to this, leads to a ΔT of 3600 K. This result has to be interpreted as the impossibility of allowing such a heat flux to flow through such a layer of water by means of conduction.
The counter argument put forward by Ocean Specialists is that the Sea does not stand still, meaning that it has a three dimensional circulation that takes heat from the surface into the subsurface layers, for example caused by: storms mixing the upper 100 m, large-scale winds that drive Sea currents filling Sea basins to depths greater than 1000 m, equatorial waters flowing in the direction of the poles and tidal currents.
Despite these mixing processes, figure V.1 shows a fair smooth and gradually increasing pattern of the mean temperature rise of the Sea from great depth up to the surface.

This indicates the second most fundamental reason for the untenability of the GHM.

VII.6 GHM versus the atmosphere on Mars

The Sun is by far the predominant source of the heating of the Earth during the day. This heat is completely dissipated at night, resulting in a constant and perfect temperature of the atmosphere to create the present nature. One hundred "greenhouse gas molecules" more or less in 1 million air molecules will not disturb that equilibrium significantly, given the fact that the atmosphere of Mars consists of 96% CO_2, while its temperature is -63 °C.

This shows the most fundamental reason for the untenability of the GHM.

The cause of the measured global warming, inclusive the heating of the Sea, is presented in the next chapter by the introduction of the so-called Living Room Model, at the same time as the introduction of a hitherto ignored heat source.

VIII Living Room Model

VIII.1 Introduction

Imagine a living room occupied by a lot of people being very busy with whatever. The more people and / or the more hustle and bustle, the higher the temperature in that living room rises, assuming no external influences. This situation perfectly resembles the Earth's atmosphere in which many people consume a lot of energy of any kind.
The thermodynamic law of conservation of energy forces us to conclude that all energy consumed worldwide, of whatever nature, such as solar, wind and nuclear energy, is eventually converted into heat. Also when basic energy is converted into kinetic energy, such as with propulsion. This kinetic energy is inevitably converted into heat by friction with the medium in and on which the propulsion takes place, and by the friction in the machine itself. If the propulsion also results in an increase in the potential energy of the vehicle, as in the case of an airplane, or a car driving up a mountain, this potential energy is still converted into heat as soon as the vehicle returns to its original height.
By converting solar energy into electrical energy, that part is eventually transformed into thermal energy in the atmosphere, fully equivalent to, for example, the heat generated by fossil combustion. It could be argued that if this part had not been converted into electrical energy, it would still have heated the earth and the atmosphere. But history has proven for thousands of years that solar heating did not raise the temperature of the atmosphere higher than the level it was 200 years ago. It must therefore be seriously taken into account that generating electrical energy from solar energy will not contribute to the reduction of the warming of the atmosphere.

VIII.2 Heat balance of the atmosphere

Apparently there has been a balance between absorbed and released heat by the atmosphere for many centuries, but this balance has been severely disrupted for about 200 years, as shown in figure VIII.1.
This disturbance has an increase in the global temperature with a time-dependent gradient as shown in Table VIII.1. These values can be calculated by taking the derivative to time of (2) in chapter II.

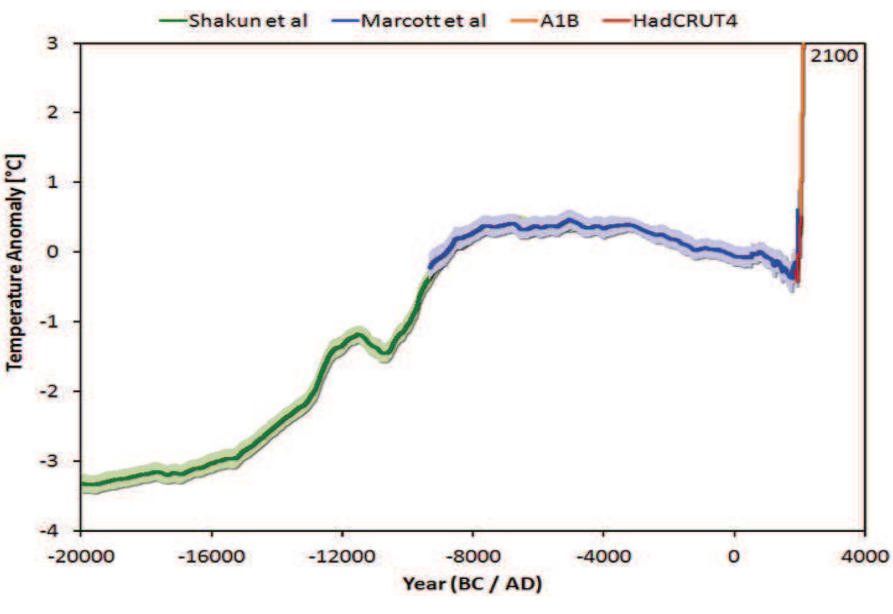

Figure VIII.1: Global temperature since the year -20000

year	mK/year
1850	1,1
1875	1,6
1900	2,4
1925	3,7
1950	5,5
1975	8,3
2000	12,5
2005	13,6
2010	14,7
2020	17,4
2100	64,5

Table VIII.1 Gradient global temperature

VIII.3 The heating of the atmosphere in the LRM

In order to calculate the temperature increase of the atmosphere by *direct* heating, it is necessary to know its heat capacity. The heat capacity of the atmosphere, expressed in J/K, determines how much the atmosphere rises in temperature, given the *net* heat supplied to it. Here "net" is defined as the difference between the supplied and released heat. In Appendix 2 it has been calculated by two methods that this heat capacity is $5 \cdot 10^{21}$ J/K.
In as well the GHM as the LRM the (alleged) supplied heat is well defined. It is not known which part of it is released, in order to calculate the net supplied heat. But the actually measured temperature rise as function of time is known and can be expressed mathematically by equation (2).
The following equation applies in both models:

"Atmospheric heat capacity [J/K]" *times* "atmospheric temperature increase during a year [K/year]" = "net heat energy absorbed by the atmosphere during that year [J/year]".

The dimension [J/year] is equivalent to the dimension [W], so the last mentioned variable in the equation above can also be presented as: "net average heat power applied during that year", expressed in W. The atmospheric heat capacity can also be written in the dimension W/(K/s). Table VIII.1 shows that the atmospheric temperature gradient in 2010 was 14.7 mK/year = $0.0147/3.1536 \cdot 10^{7} = 4.7 \cdot 10^{-10}$ K/s. So in the year 2010 a net heat power of 'Atmospheric heat capacity' times 'atmospheric temperature gradient', being: $5 \cdot 10^{21} \cdot 4.7 \cdot 10^{-10} = 2.4$ TW is sufficient to achieve that gradient in 2010.

Equation (4) shows that the globally applied power in 2010 is $8.4 \cdot 10^{-14} \cdot \exp(2010/61) = 17.2$ TW. The required net power, to heat the atmosphere as has been measured, thus is only 14% of this globally generated power. In terms of energy: the gross heat energy generated by the LRM in 2010 is significant higher than the energy needed in that year in order to increase the temperature of the atmosphere as has been measured!

The generated gross power of the LRM can be expressed in terms of (mean) global gross power density, by dividing this power by Earth's surface ($5.1 \cdot 10^{14}$ m^2), resulting in 0.034W/m^2. This value compared to the value of the GHM (0.6 W/m^2, to be corrected to 0.9 W/m^2) shows an extremely large difference of about a factor 30. The cause is that the GHM-value, in terms of radiation, is *created* in order to explain the heating of the Sea.

VIII.4 LRM heating since 1810

The derivative of the *actually measured* temperature gradient equals the derivative of equation (2), being: $7.2 \cdot 10^{-14} \cdot \exp(t/61)$ mK/year.

Taking 14% of the globally applied power, equation (4) results in: $0.14 \cdot 8.4 \cdot 10^{-14} \cdot 10^{12} \cdot \exp(t/61)$ W.

This expression, divided by the above mentioned heat capacity of the atmosphere and multiplied with the ratio "sec/year", results in $7.4 \cdot 10^{-14} \cdot \exp(t/61)$ mK/year. The small deviation from $7.2 \cdot 10^{-14} \cdot \exp(t/61)$ is eliminated when the heat capacity of the atmosphere is taken $5.1 \cdot 10^{21}$ instead of $5.0 \cdot 10^{21}$ J/K !

Qualifying this expression as the *calculated* temperature gradient, based on the worldwide consumed energy, it has been proven that the yearly increase of the global temperature during the past 200 years can perfectly be calculated from the yearly energy consumption. And thus be predicted too on this basis!

VIII.5 The heating of the Sea in the LRM

In view of the findings in section VII.5 "The heating of the Sea in the GHM", such a heating can only take place bottom up and by means of convection.

The application of a heat pump with a so-called horizontal ground exchanger (at a depth of 2 meters) teaches that a continuous heat flux of 50 W/m^2 can be generated. But then the temperature at that depth drops from +10 °C to -5 °C. At such a place heat is extracted from Earth in a forced way. Incidentally, that temperature will return to its original value within a few hours after the heat abduction has been stopped. So most likely the natural geothermal heat flux is at least an order of magnitude lower than this 50 W/m^2.

Right at the end of chapter V the variable $PD_S(t)$ has been deduced as equation (6). This power density is shown to be the source of the heating of the Sea. As mentioned already there this heat flux varies from 0.1 to 1 W/m^2 during the period 1870-2020.

Such a natural heat flux may be considered realistic, compared to the mentioned forced flux of 50 W/m^2.

In order to understand the influence of that geothermal heat flux on the temperature of the Sea, we consider a basically comparable situation: a river flowing into a sea. Mind the difference between sea and Sea! The level of that sea varies with the tide. The level of the river water in the estuary rises and falls without delay with the level of the sea. The further inland, the less remains in the river of that varying level in the estuary.

If we replace, in this reality, the height of that sea by the temperature of the atmosphere, then the temperature difference at the transition of the atmosphere and the Sea's surface is always zero, given the slow change in temperature of the atmosphere. Thus, as the long-term temperature of the atmosphere increases, the long-term temperature of the Sea at its surface increases by the same amount, through the supply of thermal energy in the form of geothermal heat flux. And for this reality also applies: the deeper into the Sea, the less remains of that increase in temperature at the surface.

The amount of heat in the Sea is $15 \cdot 10^{26}$ J, as follows from the parameters below:

specific heat capacity per m^3	$4.0 \cdot 10^6$	$J/K/m^3$
volume	$1.3 \cdot 10^{18}$	m^3
mean temperature	280	K

The increased amount of heat in the Sea over the past 150 years can be calculated by means of equation (5) and equals $66 \cdot 10^{22}$ J. In comparison to the total amount of heat in the Sea this is only about 0.4‰!

Summarized: The geothermal heat flux, that has existed for millions of years, once brought at some moment the Sea and the atmosphere to certain temperatures, equal to each other at the transition of both media. As mankind has raised the temperature of the atmosphere by 1 °C, the geothermal heat flux does adjust the temperature at the surface of the Sea to this increase, gradually decreasing to 0 at the bottom.

N.B.
Permafrost is of course in the same way affected by the geothermal heat as the Sea is heated by this phenomenon.

IX Hot Spots on Earth

Hot spots are columns in the atmosphere where the temperature is significantly higher than the mean temperature of the atmosphere. The explanation for these thermal columns cannot be given by the GHM. After all, a column of increased CO_2 concentration would be spread over the rest of the atmosphere before that gas would be able to cause an increase in temperature exactly above the considered surface. Only a *continuous* heat flow, significantly higher than the globally mean value, can maintain such a local higher temperature. The force of that flow/flux is proportional to the applied power on the related area, divided by the surface of that area. No data has been found on the Internet about the amount of energy consumed per country per year. There are data of the Gross Domestic Product (GDP), expressed in US $, per country per year. It is therefore assumed that the higher the GDP of a country, the more energy is consumed. In order to transform 'GDP' to 'Watt' the globally GDP (GWP), i.e. the sum of the GDPs of all countries, has been divided by the globally applied power, as shown by (4): $P_G(t)=8.4\cdot10^{-14}\cdot\exp(t/61)$. According to reference [IX.1], the GWP for the year 2015 is about 75000 billion ($75\cdot10^{12}$) $. In that year the applied power was 19 TW. The requested conversion factor thus is 0.25 W/$. Ref. [IX.2] and [IX.3] show, by country, their GDP in 2015, respectively their surface. The values are converted to $ resp. m^2.

The power density per country can now be calculated from: GDP($)/surface ($m^2$) $\cdot$ 0.25 W/$ in W/m^2. The results of the 10 countries with the highest resp. lowest values are shown in Table IX.1 resp. IX.2. The warming of the Netherlands is measured as twice as high as the rise of the global mean value [IX.4]. Due to the influence of the surrounding atmosphere a factor 2 higher than the global mean value in 2015: 19 TW /$5.1\cdot10^{14}$ = 0.037 W/m^2 would not be enough of course. But still the value 4.5 is surprisingly high. Multiplying the power densities with the related surfaces and adding these results shows a worldwide applied power of $18\cdot10^{12}$ W. The difference with the number $19\cdot10^{12}$ W is caused by the fact that about 20 of the 200 countries are not found in as well reference [IX.2] as in [IX.3].

Country	W/m^2
Singapore	101
Bahrain	9,9
Malta	7,6
San Marino	6,5
Luxembourg	5,5
Netherlands	4,5
Switzerland	4,0
Belgium	3,7
Qatar	3,6
Korea	3,4
Israel	3,4

Table IX.1 Highest ranked countries

Country	W/m^2
Guyana	0,0037
Namibia	0,0035
Mali	0,0026
Chad	0,0021
Mongolia	0,0019
Niger	0,0014
Mauritania	0,0012
Zimbabwe	0,0009
Kyrgyz Republic	0,0008
Suriname	0,0008
Central African Rep.	0,0006

Table IX.2 Lowest ranked countries

If only Earth's land (30% of the total surface) is chosen as the reference surface, as is effectively done in the above calculations, the related mean power density in 2015 would be 0.12 W/m^2.

The five countries: Nigeria, Estonia, Equatorial Guinea, Indonesia and Bulgaria show roughly this value. These countries are ranked around the position 70 in the list of 180.

The total power of the 17 countries below, in descending order, includes 80% of the worldwide applied power. The related mean power density is 0.2 W/m^2 and the total surface 0.4 times Earth's land surface.

These countries are: United States, China, Japan, Germany, United Kingdom, France, India, Italy, Brazil, Canada, Korea, Russia, Australia, Spain, Mexico, Indonesia, Netherlands.

X Global Mean Sea Level until 2100

X.1 Introduction

Global Mean Sea Level is a hot topic nowadays, because maybe we will eventually drown in the oceans. The most intricate models for it's increase in the future have been created and will be created, some of them leading to the most worst thinkable scenario in 2100. See for example reference [X.1].
Several organisations realize data sets for the GMSL. They have been asked all for numerical data. The only one that did react fast as well as with appropriate data was CSIRO.

X.2 Mathematical expression for CSIRO measurements

The data, presented as monthly mean values in mm, is shown in de link under reference [X.2]. These values have been transformed to yearly mean values in cm. Figure X.2 shows the measured Sea level rise, as well as the corresponding exponential function:

$$SL(t) = -26+1.7 \cdot 10^{-6} \cdot \exp(t/120) \quad (7)$$

The figure proves that this function fits the measured values perfectly.
The sea level rise mentioned in Table V.1 is actually 2 times 4.7, so about 9 cm, solely as a result of the expansion of the water during the past 150 years. The measured increase is about 25 cm. The missing 16 cm is a result of the melting of the snow on the mountains of Earth's mainland and of the snow on both poles. Not of the melting of the *ice* on and around the poles, because when ice melts, its volume decreases by 10%. On the basis of the currently measured Sea level rise, it is therefore grossly exaggerated to predict that we have to take meters of increase into account.
Figure X.2 shows that if the prevailing increasing trend of global warming is maintained over the next 100 years, the Sea level will rise only 30 cm from the current level.

There are much bigger problems that threaten nature and mankind.

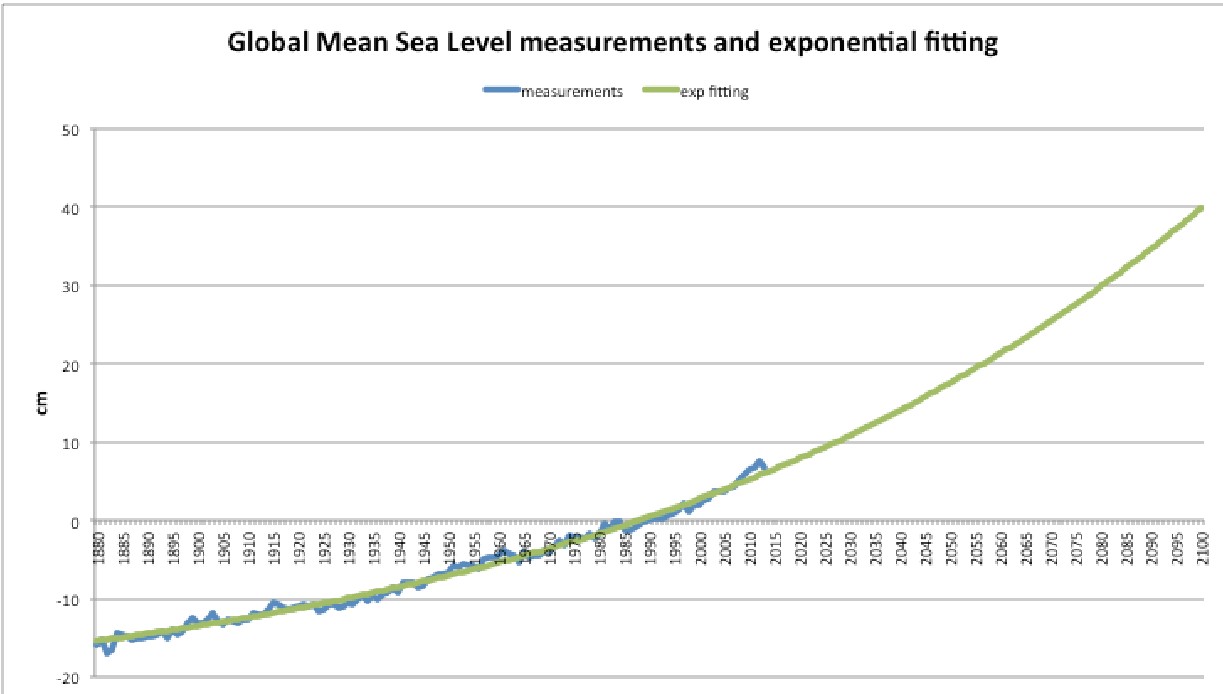

Figure X.2

XI Investigation of remarkable phenomena

The following phenomena have been investigated:

XI.1 The monthly global temperature and CO_2 anomalies
XI.2 CO_2 absorbed by atmosphere and by Earth's surface
XI.3 The Reverse Greenhouse Effect

This chapter analyses these phenomena, especially in order to investigate possible relations with the Greenhouse Model, or with the Living Room Model.

XI.1 The monthly global temperature and CO_2 anomalies

Monthly averaged records of the global temperature and of the CO_2 concentration in the atmosphere show both a surprisingly yearly periodic anomaly.

XI.1.1 Monthly temperature anomalies

Figure XI.1.1, copied from reference [XI.1], shows a graph of the monthly temperature deviations per year relative to the worldwide mean global temperature for that year since 1880. The separation of the curves has been realized by adding the related *long-term* increase of the worldwide mean global temperature during that year. As a result the curve for the year 2017 is drawn about 1 °C higher than the curve for 1880. See note* regarding the original source: reference [XI.2].

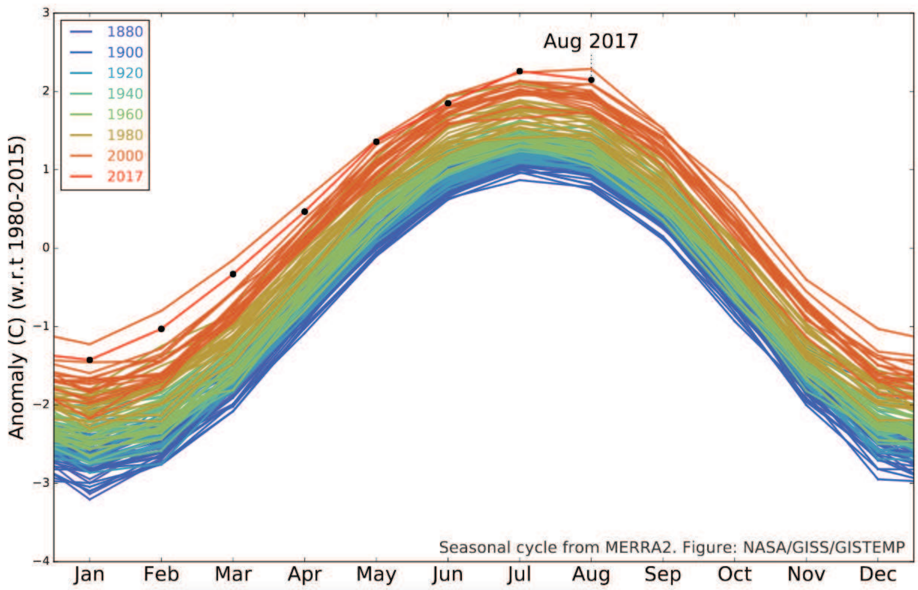

Figure XI.1.1: GISTEMP Seasonal Cycle since 1880

Possible background for the presented anomalies.

Reference [XI.3] presents that during the summer the rise in temperature around the North pole (between 60^0 and 82.5^0 latitude) is significantly higher than the fall in temperature around the South pole in the same months. A similar phenomenon occurs between 32.5^0 and 50^0 latitude. The graphs of these anomalies are shown in the figures XI.1.2 and XI.1.3. The blue line shows the mean value during the period 1980–1989 and the red line during the period 2000–2009. The curves prove that this phenomenon is perfectly consistent.

* Reference [XI.2] should have shown such anomalies, but doesn't anymore. The person who is responsible for this data has been sent an email for clarification. It has been admitted that this data has been removed, but a clarification is not given, not even after two other attempts.

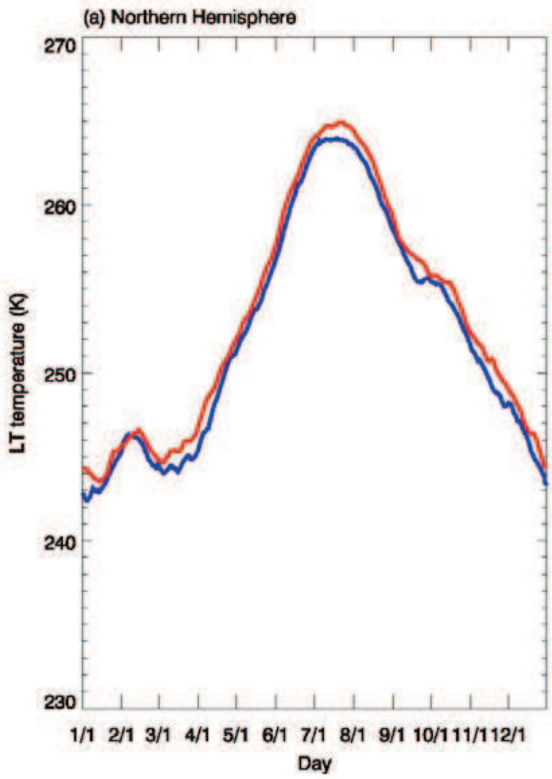

Figure XI.1.2: Temperature measurements between 60⁰ and 82.5⁰ latitude

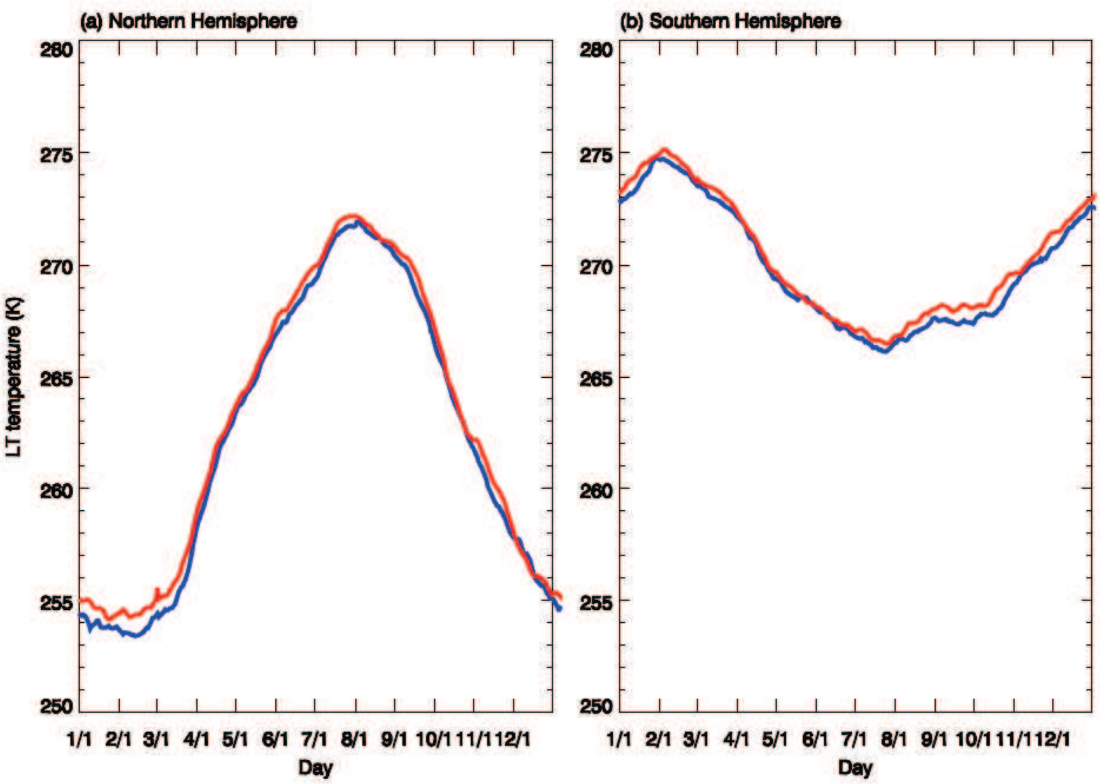

Figure XI.1.3: Temperature measurements between 32.5⁰ and 50⁰ latitude

These graphs have been converted into data shown in Table XI.1 in the columns marked with NH and SH. Although the differences between the red and blue lines are very small, the mean value is presented.

	latitudes (60° to 82.5°)		**latitudes (32,5° to 50°)**		latitudes	dev. latitudes
	NH	SH	NH	SH	mean °C	mean
month	temp	temp	temp	temp	**-15,8**	
1	243,4	249,5	255,0	273,1	-17,8	-2,0
2	245,6	249,2	254,0	274,8	-17,1	-1,3
3	244,6	245,4	255,0	273,5	-18,4	-2,6
4	246,0	241,6	258,6	272,1	-18,4	-2,6
5	251,5	242,6	263,3	269,4	-16,3	-0,5
6	257,1	243,0	267,1	268,0	-14,2	1,6
7	263,6	240,7	269,5	266,9	-12,8	3,0
8	264,0	239,1	271,9	266,7	-12,6	3,2
9	258,9	238,1	270,6	267,8	-14,2	1,6
10	255,6	240,9	266,9	269,2	-14,9	0,9
11	252,0	242,3	262,0	271,0	-16,2	-0,4
12	248,5	246,1	258,0	272,8	-16,7	-0,9

Table XI.1

The variable "Latitudes mean" shows the mean values of all the 4 temperatures on its left side in °C. The green value is the mean value of these mean values, used to calculate "dev. latitudes mean". The top-top value of this variable is 5 to 6 °C, so significantly higher than the top-top value of 4 °C in figure XI.1.1. That is logical, because the variable "Latitudes mean" is a very poor representative of the *globally mean* temperature. The last one is the mean value of thousands of stations on the global surface. But their respective maximum and minimum value are in the same months (Jul-Aug resp. Dec-Jan).
This investigation thus learns that the monthly global temperature anomalies, as shown in figure XI.1.1, are strongly related to the orientation of the Earth's rotation axis relative to the Sun. However, it doesn't explain yet in more detail what happens on Earth during summer and winter, in NH, resp. SH, that causes these mutual significant differences. More details will be presented in the next section.
The map in figure XI.1.4 shows perfectly the seasonal temperature differences between NH and SH.

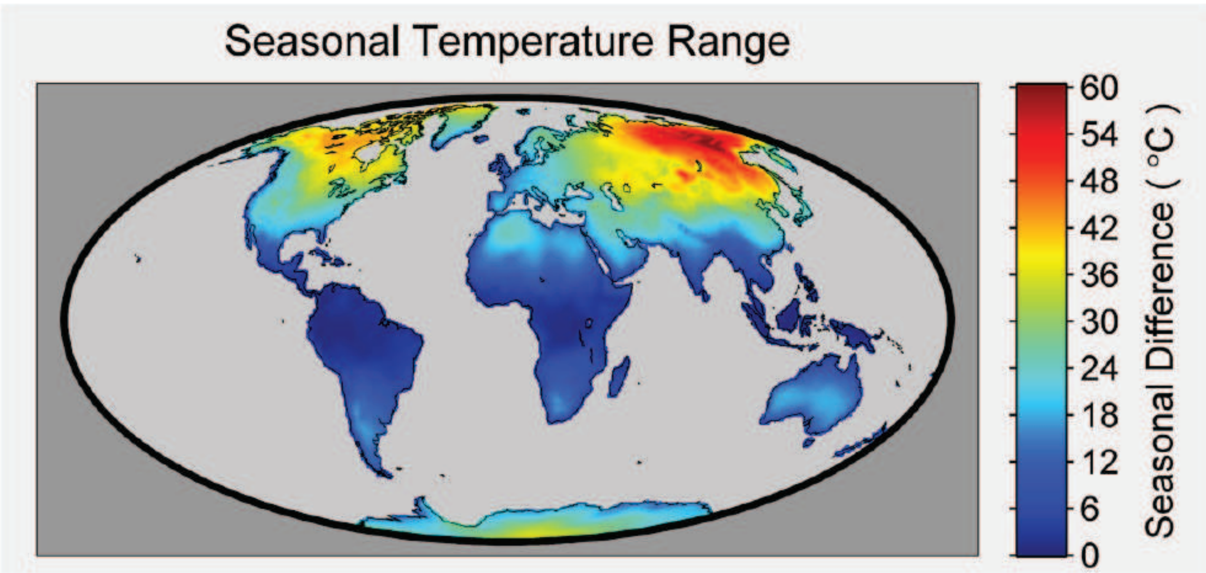

Figure XI.1.4: "Using the Berkeley Earth Surface Air Temperature (SAT) dataset the seasonal temperature range was calculated over the entire land surface of the globe. For the purposes of this map the seasonal range was defined as the difference between the warmest month and the coolest month. The difference ranges from a low of 0 degrees C in equatorial regions to a high of 60 degrees C in north eastern Russia. While not as dramatic as the ranges found in Siberia, the seasonal range in northern Canada is also large."

XI.1.2 Monthly CO_2 anomalies

Reference [I] shows the monthly records of the CO_2-concentration in the atmosphere in ppm since 1958. It has been used to make a graph of this anomaly averaged over the total period of measurements.
Figure XI.1.5 shows this graph as well as the monthly temperature anomalies, also as averaged values over the whole period of measurements*. The curves have been made symmetrical around zero by subtracting the yearly mean value over the respective periods.

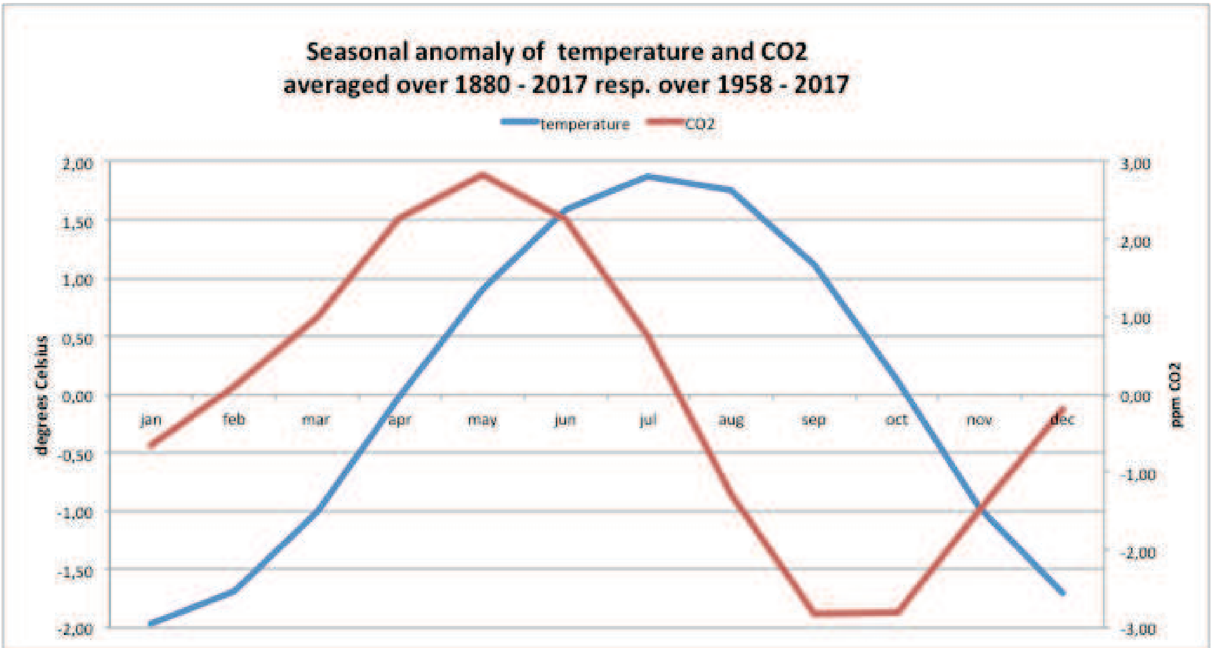

Figure XI.1.5: Mean monthly CO_2 and global temperature anomalies w.r.t. yearly mean values

Figure XI.1.5 shows that during the summer of the NH (around July) the globally averaged CO_2 concentration starts to become lower than the yearly mean value. This can possibly understood as follows. A property of plants is that they grow more during warm periods than during cold periods and that they thus absorb more CO_2 during a growing period. During the summer of the NH it is winter in the SH. However the SH has by far less area where plants grow and at all these areas it never becomes cold, because they are all located closer to the equator. So the plants at the SH will not create a significant anomaly in the absorption of CO_2 during a year. As a result the globally mean value is season dependent, without any relation with the long-term trend of this variable

The question remains what the fundamental cause of the monthly temperature anomaly might be.

The generally accepted idea is that the Sea absorbs more heat than land does. Given the fact that the SH contains by far more water than the NH, the temperature *of the atmosphere* at SH increases less during summer at SH (Oct-Feb) than this temperature does at NH during summer at NH (Apr-Aug).

Given these argumentations the conclusion must be that the seasonal anomalies don't have any relation with the long-term increase of the yearly averaged global atmospheric temperature, neither of the yearly averaged CO_2 concentration in the atmosphere.

* The curve in figure XI.1.5 is based on data that was available at the original site until the end of 2017!

XI.2 CO_2 absorbed by atmosphere and by Earth's surface

XI.2.1 CO_2 emission factor in terms of Gigaton/consumed energy

CO_2 emissions, as a result of the combustion of fossil fuels, are for example expressed in terms of the number of tons of CO_2 per released amount of energy in TeraJoule. This emission factor depends on the type of fossil fuel. Reference [XI.4] shows the following CO_2 emission factors, together with the here added transformation factor: 'Gigaton CO_2/TWyear'.

	ton CO_2/TeraJ	Gt CO_2/TWyear
gas	55	1,7
oil	74	2,3
coal	100	3,2

Table XI.2.1

The relative distribution of the consumed energy in the years 2010, 1910 and 1810 of these fuels is shown in table XI.2.2 on the left side. The emission factor of biofuel/biomass is taken the same as of coal. The contributions of Nuclear and Hydro-elect energies (both 5%) to the CO_2 emissions are left away. The column in the middle shows the related emission factor from Table XI.2.1 The right side of Table XI.2.2 shows the left side, after multiplication with the middle column.

					emission factor in Gt/TeraWatt-year		
	2010	1910	1810	X	2010	1910	1810
Gas	0,20	0	0	1,7	0,4	0,0	0,0
Oil	0,31	0	0	2,3	0,7	0,0	0,0
Coal+Biomass	0,39	1	1	3,2	1,2	3,2	3,2
				sum	**2,3**	**3,2**	**3,2**

Table XI.2.2

In the next section this 'sum', being the weighed average emission factor, will be applied in the years 1850 – 2050 in steps of 20 year. The values for the years since 1910 are found by linear interpolation between the values at 1910 and 2010. The values for 2030 and 2050 are taken the same as for 2010 is.

year	1850	1870	1890	1910	1930	1950	1970	1990	2010	2030	2050
emission factor	3,2	3,2	3,2	3,2	3,0	2,8	2,7	2,5	2,3	2,3	2,3

Table XI.2.3 Emission factor in Gt/TWyear

XI.2.2 CO_2 concentration expressed in Gigaton

The CO_2 concentration in the atmosphere is normally expressed in ppm, that is to say, the amount of CO_2 in relation to the amount of molecules in the atmosphere, both expressed in mol.

The total mass of air in the atmosphere is $5.3 \cdot 10^{18}$ kg. Given the definition of ppm, this mass has to be converted to the unit mol, defined as the mass of N_A atoms/molecules of that substance. N_A is the number/constant of Avogadro ($6 \cdot 10^{23}$ mol^{-1}). The mean molar mass of air is 29 kg/kmol, so the amount of 'mean' air molecules in the atmosphere is $5.3 \cdot 10^{18}/29 = 1.8 \cdot 10^{17}$ kmol.

The worldwide mean concentration of 400 ppm CO_2 in the atmosphere in the year 2018 thus represents $400 \cdot 10^{-6} \cdot 1.8 \cdot 10^{17} = 7.3 \cdot 10^{13}$ kmol CO_2. The molar mass of CO_2 is 44 kg/kmol, so the mass of 400 ppm CO_2 in the atmosphere is $44 \cdot 7.3 \cdot 10^{13} = 3.2 \cdot 10^{15}$ kg = 3200 Gigaton (Gt).
The conversion from ppm CO_2 to *absorbed* Gt CO_2 in the atmosphere thus is 3200/400 = 8 Gt/ppm.

This factor has been used calculating ΔCO_{2aA} from ΔCO_{2aR} in table XI.2.4

	atmospheric absorption			**emission**			**results**	
year	**CO_{2a} (ppm)**	**ΔCO_{2aR} (ppm/year)**	**ΔCO_{2aA} (Gt/year)**	**Power (TW)**	**E factor (Gt/TWyear)**	**CO_{2e} (Gt/year)**	**CO_{2s} (Gt/year)**	**$\Delta CO_{2aA}/CO_{2e}$ (%)**
1850	269	0,15	1,2	1,2	3,2	4,0	2,7	31
1870	273	0,22	1,7	1,7	3,2	5,5	3,8	31
1890	278	0,30	2,4	2,4	3,2	7,7	5,3	31
1910	285	0,4	3,3	3,3	3,2	10,6	7,3	31
1930	295	0,6	4,6	4,6	3,0	13,9	9,3	33
1950	308	0,8	6,4	6,4	2,8	18,2	12	35
1970	327	1,1	8,9	8,9	2,7	23,7	15	37
1990	353	1,5	12	12	2,5	31	18	40
2010	390	2,1	17	17	2,3	39	22	43
2030	440	3,0	24	24	2,3	55	31	43
2050	510	4,1	33	33	2,3	76	43	43

Table XI.2.4

CO_{2a}	relative CO_2 concentration in the atmosphere	[ppm]
ΔCO_{2aR}	relative increase of CO_2 in the atmosphere	[ppm/year]
ΔCO_{2aA}	absolute increase of CO_2 in the atmosphere ($=8 \cdot \Delta CO_{2aR}$)	[Gt/year]
Power	applied power by mankind **(*)**	[TW]
E factor	emission factor for CO_2, as shown in table XI.2.3	[Gt/TWyear]
CO_{2e}	emitted CO_2 per year (E factor · Power)	[Gt/year]
CO_{2s}	absorbed CO_2 by Earth's surface per year (CO_{2e} - ΔCO_{2aA})	[Gt/year]
$\Delta CO_{2aA}/CO_{2e}$	relative (to CO_{2e}) increase of CO_2 absorbed by atmosphere	[%]

(*) By applying power (in terms of TW) instead of energy (in terms of TWyear), the multiplication of this power by the emission factor, expressed in Gt/TWyear, results in the CO_{2e} in Gt/year.

Check of the column 'ΔCO_{2aA}'.
Digital integration of the column 'ΔCO_{2aA}' by taking 20 times the value of each year, up to and including the year 1990, plus 8 times the value of 2010 in order to find the result for the period 1850 - 2018, shows 953 Gigaton. This result has to be compared with the difference between the CO_2 concentration in 2018 (400 ppm) and in 1850, multiplied by 8 Gt/ppm. That outcome is 1048 Gigaton. The 10% difference is caused by the large integration step of 20 years.

Remark:
In first instance the columns 'ΔCO_{2aA}' and 'Power' show surprisingly exactly the same numbers. The background is as follows. 'ΔCO_{2aA}' is calculated as the derivative of $CO_2(t) = 259 + 6.4 \cdot 10^{-13} \cdot \exp(t/61)$, shown as equation (1) in chapter I, times 8 Gt/ppm, resulting in: $8.4 \cdot 10^{-14} \cdot \exp(t/61)$ ppm/year.
The variable 'Power' is fitted by $P_G(t) = 8.4 \cdot 10^{-14} \cdot \exp(t/61)$ TW, shown as equation (4) in chapter IV.

The importance of the variable '$\Delta CO_{2aA}/CO_{2e}$' will be considered in the next section

XI.3 The Reverse Greenhouse Effect

XI.3.1 Short term historical relations between CO_2 and global temperature

Table XI.2.4 in the previous section shows that most of the CO_2 emission is absorbed by Earth's surface. It also shows that the absorption increases with time from roughly a 30–70 to a 40–60% distribution. During that same period the temperature of the atmosphere increased 1^0C.
Given this phenomenon the following hypothesis is posited: the increase of the CO_2 concentration in the atmosphere is *only* caused by the increase of its temperature. A Reverse Greenhouse Effect.

If this hypothesis would be valid then the gradient of the growth of the CO_2 concentration in the atmosphere, as function of the atmosphere's temperature T_G, would be 145 ppm/^0C.
This number is calculated as the quotient of the derivatives of (1) and (2): $dCO_2(t)/dt$ resp. $dT_G(t)/dt$.

In chapter II it has been found that the temperature of the atmosphere changes, on top of the long-term-trend, with $-0.1 \cdot \sin\{\omega(t - 2012)\}$ (^0C), in which ω represents a period of 64 years. Chapter I shows the CO_2 measurements during the period 1958-2018. These 60 years form a just long enough period to investigate the relation between atmosphere's CO_2 concentration and temperature in more detail.

Figure XI.3.1 shows the measured CO_2 minus the exponential fitted curve + 0.5, indicated as "measured". The "+0.5" is applied in order to make the curve symmetrical around zero, just like the, to investigate, sinusoidal CO_2 curve is. This curve has been drawn with two amplitudes, indicated as "theoretical CO_2 1.5 ppm" resp. as "theoretical CO_2 1.0 ppm". Comparison with the measured curves leads to the conclusion that the hypothesis has to be rejected, because the amplitude should have been 0.1 times 145, say 15 ppm. But there is clearly an influence of atmosphere's temperature on its CO_2 concentration.

A partially Reversed Greenhouse Effect has been demonstrated, with a gradient of 10 to 15 ppm/^0C.

The word 'partially' has to be understood as: only about 10% of the total increase of the atmospheric CO_2 concentration is caused by the atmospheric temperature increase. The other 90% is caused by emission.

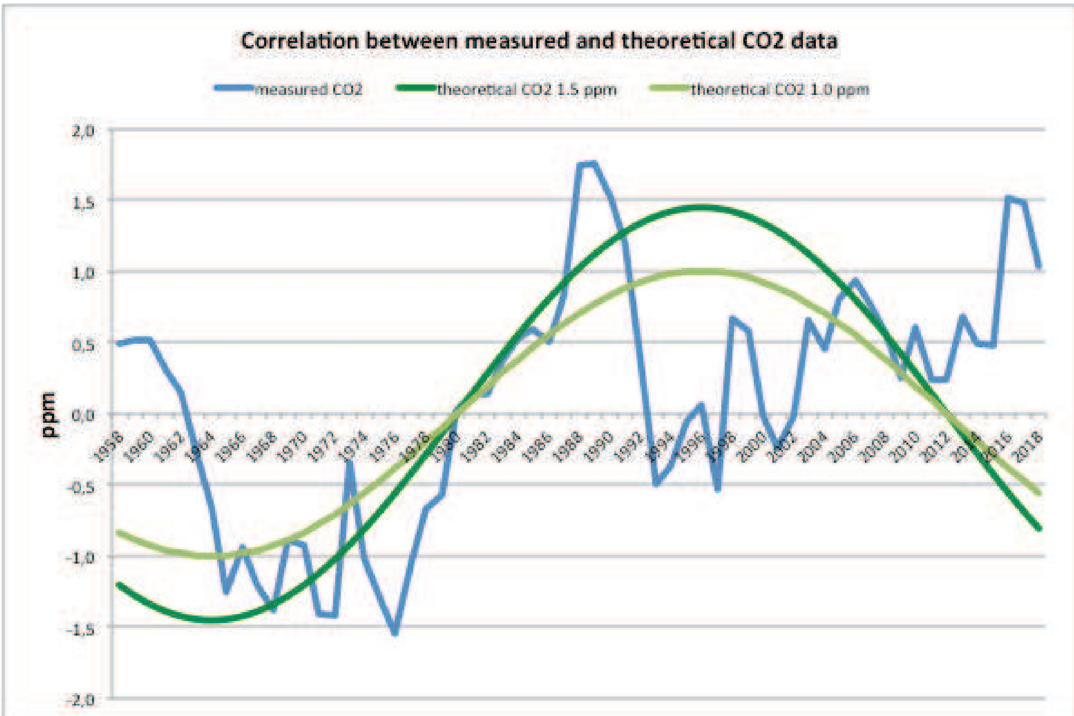

Figure XI.3.1

Another way of presenting the correlation between "measured CO_2" and " theoretical CO_2" is to fit a high order polynomial curve to the differences between the measured CO_2 data and the exponential fitting of this data, as shown in chapter I. Taking a 8th order fitting of these deviations the result is as shown in figure XI.3.2. The resemblance is fundamentally the same as shown in figure XI.3.1.

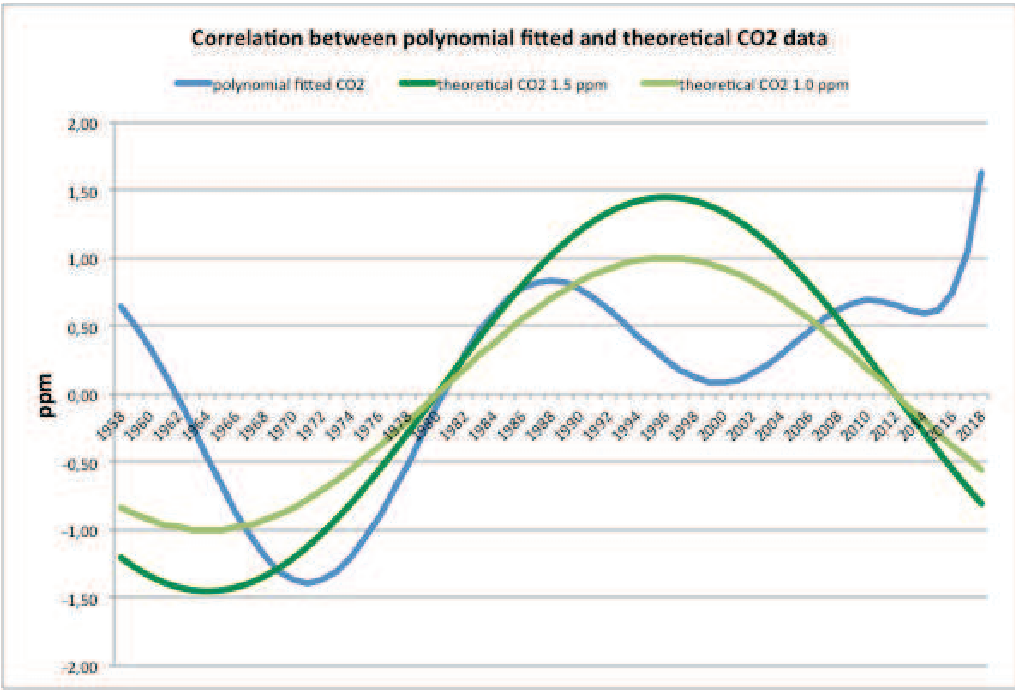

Figure XI.3.2

Figure XI.3.3 shows that there is a rather high resemblance between the patterns of the CO_2 *deviations* and of the temperature *deviations*. To investigate this, the derivative in each year has been calculated for both variables. The quotient of these derivatives has been calculated in case they are both positive and in case they are both negative. This turned out to happen in 32 of the 55 years. Such a result is from a statistical point of view not convincing. But their mean value is ~10 ppm/^{0}C, showing a remarkable good agreement with the range 10 - 15 ppm/^{0}C, found in the sinusoidal curve above.

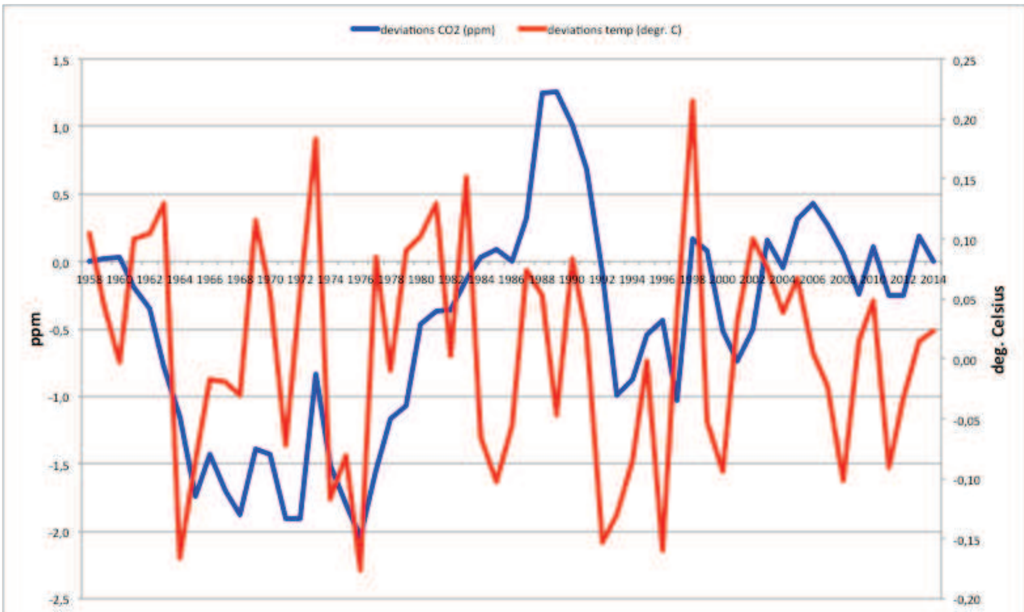

Figure XI.3.3 Yearly deviations of global temperature and atmospheric CO_2 concentration

XI.3.2 Long term historical relations between CO_2 and global temperature

Figure XI.3.4 shows very long term historical relations between CO_2 and global temperature. This figure has been deduced from the original article, ref. [XI.5]. The abstract sounds:

> *"The recent completion of drilling at Vostok station in East Antarctica has allowed the extension of the ice record of atmospheric composition and climate to the past four glacial–interglacial cycles. The succession of changes through each climate cycle and termination was similar, and atmospheric and climate properties oscillated between stable bounds. Interglacial periods differed in temporal evolution and duration. Atmospheric concentrations of carbon dioxide and methane correlate well with Antarctic air-temperature throughout the record. Present-day atmospheric burdens of these two important greenhouse gases seem to have been unprecedented during the past 420,000 years."*

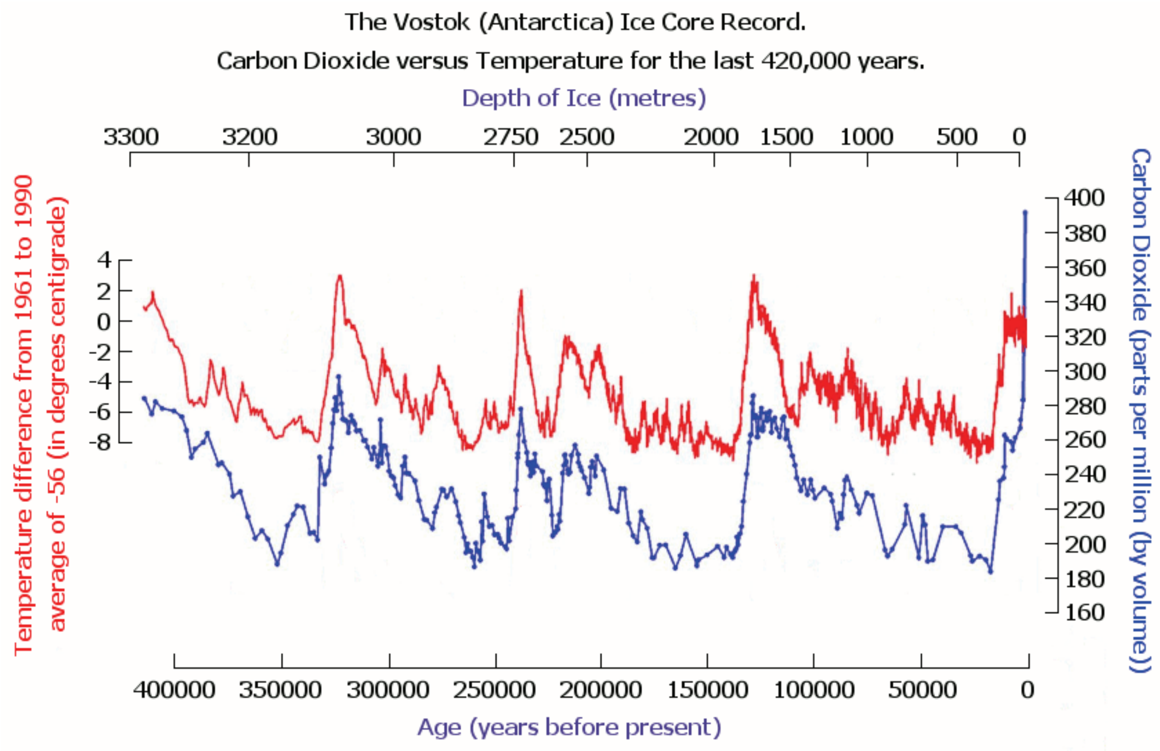

Figure XI.3.4 420000 years of global temperature and atmospheric CO_2 concentration

From the point of view of the Reverse Greenhouse Effect it is interesting to deduce, just like it is done in figure XI.3.3, the ratio: $\Delta CO_2(t)/\Delta T(t)$. Given the uniformity between the two curves in Figure XI.3.4, only one sample is already representative for the whole period. This sample is taken at the steep change in the middle of the graph, where $\Delta CO_2/\Delta T \sim 80/8 = 10$ ppm/^{0}C, also in remarkable good agreement with the range 10-15 ppm/^{0}C, found in the previous section.

From the point of view of the Greenhouse Model the gradient $\Delta T/\Delta CO_2$=0.1^{0}C/ppm is now considered. If the above shown comment: "*Present-day atmospheric burdens of these two important greenhouse gases seem to have been unprecedented during the past 420,000 years.*" would be correct, the gradient $\Delta T/\Delta CO_2$ should have been 0.007 ^{0}C/ppm, as shown in chapter VI. So the temperature variations over the past 420000 years have not been caused by CO_2 variations, but vice versa. What has been proven with the Vostok study is the validity of the Reverse Greenhouse Effect, instead of the Greenhouse Effect.

The consequence of the existence of the Reverse Greenhouse Effect is that the Greenhouse Model must be declared non-existent, because if they existed together, an increase in atmospheric temperature would cause an increase in the atmospheric CO_2 concentration, which in turn would lead to an increase in atmospheric temperature. Definitely an explosive process.

Conclusions

1. The long-term-trends of the variables: atmospheric CO_2 concentration, global temperature, world population, worldwide consumed energy, heat content of Sea and power density of the heating of the Sea can all six truthfully be represented by the function: $y_i = c_i + a_i \cdot \exp(t/b)$, with b the same for all of them and equal to 61 years.

2. Superimposed on this trend the global temperature turned out to have a perfect sinusoidal variation with a period of 64 years and an amplitude of 0.1 ^{0}C. This variation is many times used as argument against the validity of the Greenhouse Model, but it hasn't anything to do with global warming.

3. Given their same curvature, these variables can all simply be expressed as function of each other. For example: global temperature equals 13.5 ^{0}C + 0.05 (^{0}C/TW) $\cdot$ globally applied power (TW).

4. The just shown expression and the calculation of the heat capacity of the atmosphere has eventually lead to the evidence that the increase of atmosphere's temperature is caused by the worldwide consumed energy, *of whatever kind*. The here called Living Room Model.

5. The alleged power density (W/m^2) of the Greenhouse Model is about 30 times higher than the one of the Living Room Model, as a result of the assumption in the GHM that the Sea is heated by the net difference between Sun's heating radiation and Earth's cooling radiation at night time.

6. It has been shown that the heating of the Sea, as shown by measurements, cannot be caused by a heating top down, but must take place bottom up by the geothermal heat flux of Earth's core.

7. Permafrost is also affected by the geothermal heat in exactly the same way as the Sea is heated by this phenomenon.

8. A convincing argument against the Greenhouse Model is the observation of so-called Hot Spots on Earth. The only way to explain them is to apply the Living Room Model.

9. It has been proven, based on 3 different kinds of observations, that the atmosphere absorbs 10 ppm more CO_2 per °C rise of its temperature, here called the Reverse Greenhouse Effect. The existence of this phenomenon, excludes the existence of the Greenhouse Effect, because the simultaneous existence would lead to an 'explosive' increase of both variables.

10. Given these evidences the Greenhouse Model has to be rejected in favour of the Living Room Model.

11. An exponential fit has been applied to the Global Mean See Level measurements. Extrapolation to the year 2100 shows a rise of ~30 cm relative to the present year, assumed that the global warming keeps rising with the same curvature, so up to an increase of 4 ^{0}C.

Appendix 1 Mathematical background of the polynomial and exponential curve fitting

1.1 Polynomial curve fitting

Polynomial fitting means the fitting of the measured data y_n, as function of the variable x_n, to a polynomial y of order k: $y = \Sigma_0^k\, a_i\, x^i$, in such a way that the sum R(esiduals) of the quadratic deviations between the measurements y_n and y is minimal. The variable x is an arbitrary value inside as well as outside the original range of x_n, just like y is in relation to y_n.

$R = \Sigma_1^n \{y_i - y\}^2 = \Sigma_1^n \{y_i - (a_0 + a_1 x_i + \ldots\ldots + a_k x_i^k)\}^2$ N.B. The symbol Σ is exclusively assigned to i.

For minimization the following relations have to be fulfilled:

$$\partial R/\partial a_0 = -2\, \Sigma_1^n \quad \{y_i - (a_0 + a_1 x_i + \ldots\ldots + a_k x_i^k)\} = 0$$
$$\partial R/\partial a_1 = -2\, \Sigma_1^n\, x_i\, \{y_i - (a_0 + a_1 x_i + \ldots\ldots + a_k x_i^k)\} = 0$$
$$\partial R/\partial a_2 = -2\, \Sigma_1^n\, x_i^2 \{y_i - (a_0 + a_1 x_i + \ldots\ldots + a_k x_i^k)\} = 0$$
.
.
$$\partial R/\partial a_k = -2\, \Sigma_1^n\, x_i^k \{y_i - (a_0 + a_1 x_i + \ldots\ldots + a_k x_i^k)\} = 0$$

These relations can be written as:

$$\begin{array}{lcl} a_0\, \Sigma_1^n 1 + a_1\, \Sigma_1^n x_i + \ldots + a_k\, \Sigma_1^n x_i^k & = & \Sigma_1^n y_i \\ a_0\, \Sigma_1^n x_i + a_1\, \Sigma_1^n x_i^2 + \ldots + a_k\, \Sigma_1^n x_i^{k+1} & = & \Sigma_1^n x_i\, y_i \\ . & & \\ . & & \\ a_0\, \Sigma_1^n x_i^k + a_1\, \Sigma_1^n x_i^{k+1} + \ldots + a_k\, \Sigma_1^n x_i^{2k} & = & \Sigma_1^n x_i^k y_i \end{array}$$

In matrix format:

$$\begin{array}{llll} \Sigma_1^n 1 & \Sigma_1^n x_i & \ldots & \Sigma_1^n x_i^k \\ \Sigma_1^n x_i & \Sigma_1^n x_i^2 & \ldots & \Sigma_1^n x_i^{k+1} \\ . & & & \\ . & & & \\ \Sigma_1^n x_i^k & \Sigma_1^n x_i^{k+1} & \ldots & \Sigma_1^n x_i^{2k} \end{array} \quad X \quad \begin{array}{l} a_0 \\ a_1 \\ \\ \\ a_k \end{array} \quad = \quad \begin{array}{l} \Sigma_1^n y_i \\ \Sigma_1^n x_i\, y_i \\ \\ \\ \Sigma_1^n x_i^k y_i \end{array}$$

Shortly written as: $M_x \cdot \underline{a} = M_y \cdot \underline{y}$, with $\underline{a}$ and $\underline{y}$ to be read as a column vectors.

The matrix M_x can be composed by the product of the 2 matrices: $M^T \cdot M$, with M^T the transpose of M and M and M^T as shown below.

$$M\ (k \times n) \qquad \begin{array}{llll} 1 & x_1 & \ldots & x_1^k \\ 1 & x_2 & \ldots & x_2^k \\ . & & & \\ . & & & \\ 1 & x_n & \ldots & x_n^k \end{array} \qquad\qquad M^T\ (n \times k) \qquad \begin{array}{llll} 1 & 1 & \ldots & 1 \\ x_1 & x_2 & \ldots & x_n \\ . & & & \\ x_1^k & x_2^k & \ldots & x_n^k \end{array}$$

It turns out that $M^T \cdot \underline{y} = M_y \cdot \underline{y}$, as defined above, so $M_y = M^T$. As a result: $M^T \cdot M \cdot \underline{a} = M^T \cdot \underline{y}$
Both sides 'left side multiplied' by $(M^T \cdot M)^{-1}$ results in: $(M^T \cdot M)^{-1} \cdot M^T \cdot M \cdot a = (M^T \cdot M)^{-1} \cdot M^T \cdot Y$.
Given: $(M^T \cdot M)^{-1} \cdot M^T \cdot M = I$, it follows that $\underline{a} = (M^T \cdot M)^{-1} \cdot M^T \cdot \underline{y}$, showing the requested coefficients a_i.

Note:
Calculating the check $(M^T \cdot M)^{-1} \cdot M^T \cdot M = I$, the result strongly departs from that unity matrix I for orders greater than 6, due to the restricted number length of Excel. However the 8th and 9th order polynomials still seem to be calculated good enough in the current investigations, given their strong similarity.

1.2 Exponential curve fitting

Exponential curve fitting is here meant to be the use of 3 points of measurement out of a collection of measurement data (here as function of time), in which a clear tendency is visible. The 3 measurements are used for the solution of the 3 variables a, b and c in the function $y = c + a \cdot \exp(t/b)$. The variable t will represent the year under consideration. As a result the dimension of b is also "year".

Given the measuring points: (t_1, y_1), (t_2, y_2) en (t_3, y_3) the solution of the constant c is as follows:

$y_1 - c = a \cdot \exp(t_1/b)$ $y_2 - c = a \cdot \exp(t_2/b)$ $y_3 - c = a \cdot \exp(t_3/b)$

$\ln(y_1 - c) = \ln(a) + t_1/b$ $\ln(y_2 - c) = \ln(a) + t_2/b$ $\ln(y_3 - c) = \ln(a) + t_3/b$

$\ln(y_1 - c) - \ln(y_2 - c) = (t_1 - t_2)/b$ $\ln(y_1 - c) - \ln(y_3 - c) = (t_1 - t_3)/b$

$b = (t_1 - t_2)/\{\ln(y_1 - c) - \ln(y_2 - c)\}$ $b = (t_1 - t_3)/\{\ln(y_1 - c) - \ln(y_3 - c)\}$

c can only be solved numerically by means of an iteration process, applied to the function :

$$(t_1 - t_2)/\{\ln(y_1 - c) - \ln(y_2 - c)\} - (t_1 - t_3)/\{\ln(y_1 - c) - \ln(y_3 - c)\} = 0$$

$\mathbf{b} = (t_1 - t_3)/\{\ln(y_1 - \mathbf{c}) - \ln(y_3 - \mathbf{c})\}$ $\mathbf{a} = (y_2 - \mathbf{c})/\exp(t_2/\mathbf{b})$

In this report an essential approach is that several times the fitting to other measured variables is started with the same b as found for the CO_2 concentration. In such a situation the solving of a and c is as follows:

$B_i = \exp(t_i/\mathbf{b})$ $y_1 = c + a \cdot B_1$ $y_3 = c + a \cdot B_3$ $y_1 - y_3 = a \cdot (B_1 - B_3)$

$\mathbf{a} = (y_1 - y_3)/(B_1 - B_3)$ $\mathbf{c} = y_1 - \mathbf{a} \cdot B_1$

Appendix 2 Calculation of the heat capacity of the atmosphere

2.1 Temperature constant as function of height

The specific heat capacity of air at 0 ^{0}C and 1 bar is 1000 J/kg/K. The specific weight of such air (sw_0) is 1.3 kg/m^3. Multiplication of these quantities leads to its specific volumetric heat capacity as 1300 J/m^3/K.

Quote from: https://en.wikipedia.org/wiki/Atmospheric_pressure :
” Altitude variation
Pressure on Earth varies with the altitude of the surface;...............

$$p(h) \approx p_0 \, e^{-Mgh/RT}$$

with:

p_0	Sea level standard atmospheric pressure	101325	Pa
h	Altitude		m
M	Molar mass of dry air	0.029	kg/mol
g	Earth-surface gravitational acceleration	9.8	m/s^2
R	Universal gas constant	8.31	J/(mol·K)
T	Sea level standard temperature	288.15	K ”

In stead of p(h) the variable sw(h) can be chosen. Replacing the e-power function into e^{a-Ch}, with the boundary condition that $e^{a-Ch}=1$ for h=r (r the radius of the Earth), this function becomes e^{Cr-Ch}.
The total mass of air in the atmosphere can now be calculated as: $sw_0\int_r^{\infty} e^{Cr-Ch} \cdot O(h) \cdot dh$, with $O(h)=4\pi h^2$.
The function to be calculated is therefore: $4\pi \cdot sw_0 \cdot e^{Cr} \cdot \int_r^{\infty} e^{-Ch} \cdot h^2 \cdot dh$.

After applying twice partial integration to $\int_r^{\infty} e^{-Ch} \cdot h^2 \cdot dh$ the result is $-C^{-1} \cdot e^{-Ch} \cdot (h^2 + 2C^{-1}h - 2C^{-2})|_r^{\infty}$
A few calculations of $e^{-Ch} \cdot h^2$ learn that the value of de integral is zero for $h \rightarrow \infty$.
The result for the total mass of the atmosphere thus is:
$4\pi \cdot sw_0 \cdot e^{Cr} \cdot C^{-1} \cdot e^{-Cr} \cdot (r^2 + 2C^{-1}r - 2C^{-2}) = 4\pi \cdot 1.3 \cdot C^{-1} \cdot (r^2 + 2C^{-1}r - 2C^{-2})$

The constant $C^{-1} = RT/Mg$ equals: $8.31 \cdot 288/(0.029 \cdot 9.8) = 8420$ m.
Because the temperature is expressed in Kelvin, the sensitivity of that parameter is low.
The radius r of the Earth is 6371000 m. With $2C^{-1}r - 2C^{-2} << r^2$, the result of the integral is $4\pi \cdot 1.3 \cdot C^{-1} \cdot r^2$.
So the total mass of the atmosphere is $5.6 \cdot 10^{18}$ kg.

This calculation forms the essential basis for the calculation of the total heat capacity of the atmosphere. The mass calculated in this way is also a check on the method used. This check is that the total mass can easily be calculated too as follows:

> The atmospheric pressure on the Earth's surface is 101325 Pa = $1.013 \cdot 10^5$ N/m^2 or kg m^{-1} s^{-2}.
> The surface of the Earth is $5.1 \cdot 10^{14}$ m^2. The total mass of air in the atmosphere is therefore $1.013 \cdot 10^5 \cdot 5.1 \cdot 10^{14}$ /g. With g = 9.8 ms^{-2} resulting in $5.3 \cdot 10^{18}$ kg.

The atmospheric heat capacity thus is (5.3 á 5.6)$\cdot 10^{18}$ kg · 1000 J/kg/K = (5.3 á 5.6)$\cdot 10^{21}$ J/K, neglecting the influence of its temperature as function of height.

This has been checked in the next section.

2.2 Temperature height dependant

The figure below shows how T depends on the height in the atmosphere.

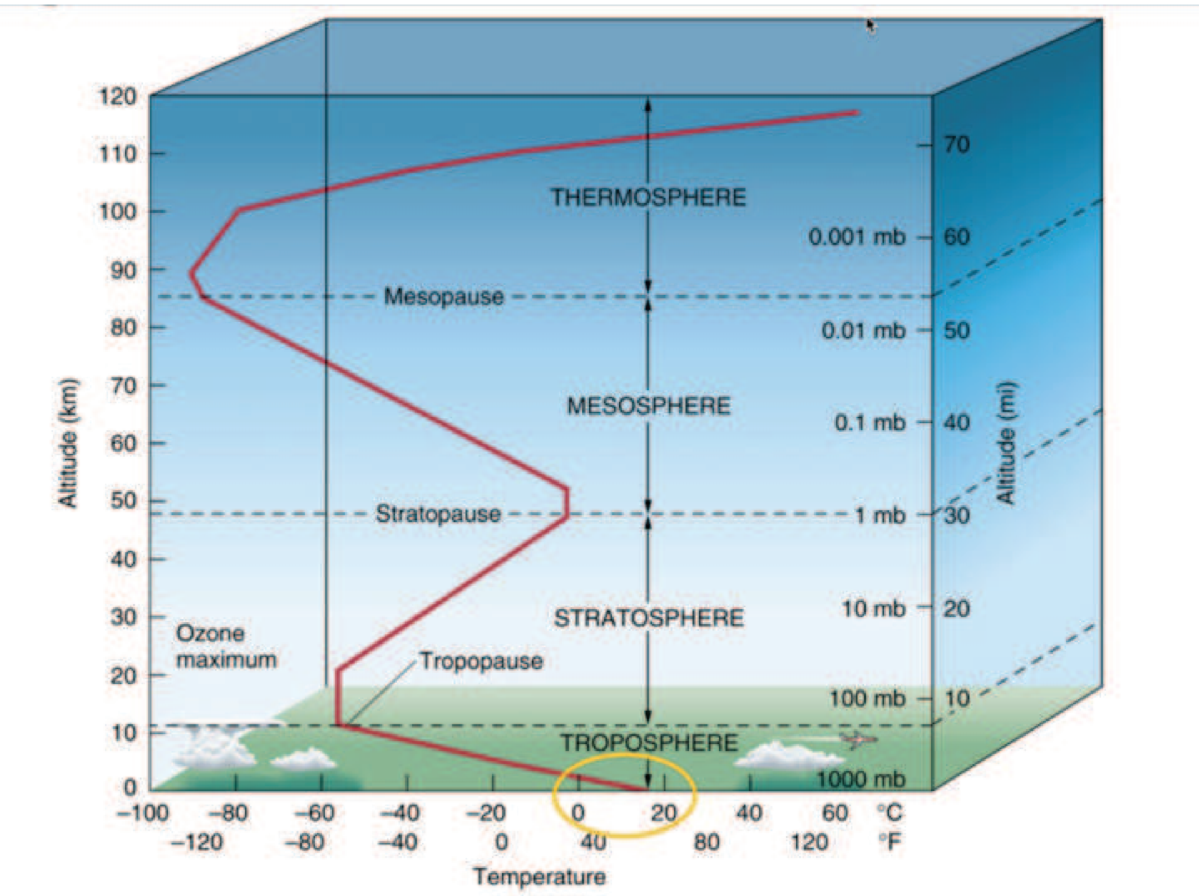

Figure Appendix 2

In order to check the influence of this variation the integral $4\pi \cdot sh_0\ e^{Cr} \int_r^\infty e^{-Ch} \cdot h^2 \cdot dh$, as used in the previous section, has now to be written as $4\pi \cdot sh_0 \cdot \int_r^\infty e^{C(h)(r-h)} \cdot h^2 \cdot dh$, with $C(h) = Mg/RT(h)$.

This integral has been calculated numerically in Excel in steps of 100 m and with $sh_0 = 1300$ J/m^3/K.

The calculation is checked by taking T height independent and 288 K and for a maximum height of 120 km, in accordance with the maximum height shown in the figure above. The outcome is $5.6 \cdot 10^{21}$ J/K, so sufficiently in agreement with the analytical outcome.

Replacing the temperature in a height dependent one in accordance with the information shown in the figure above, the result is $4.6 \cdot 10^{21}$ J/K.

This outcome, together with the two outcomes in the previous section, presents a good reason to take as a rounded value for the heat capacity of the atmosphere the value $5 \cdot 10^{21}$ J/K.

Appendix 3 Impact of sustainable energy

3.1 Sun energy

The net electrical power generated by means of sun cells is 15 W/m^2. Experience learns that a mean household of 3 persons in the prosperous part of the world can generate its own need for electrical purposes by means of 20 m^2 of sun cells. The heating of the house excluded. Including the heating would result in about 50 m^2. So heating the houses with their own sun energy is impossible.
The need for electrical energy of the meant household is, exclusive the heating, 100 W per person. The prosperous part of the world population is roughly living in the 17 countries, mentioned at the end of chapter IX, occupied by 5 billion persons. These prosperous five billion persons as a result need 0.5 TW power, exclusive the heating. Such a power is a negligible fraction of the worldwide required power of 20 TW. Nature would worldwide be destroyed, if such a power would have to be generated by sun cells.

3.2 Wind energy

The drawing in figure Appendix 3, copied from ref. [A.3], shows the power of the worldwide generated wind energy. It presents in 2014 a growth of 51 GW, so 0.05 TW/year, in terms of *capacity!*

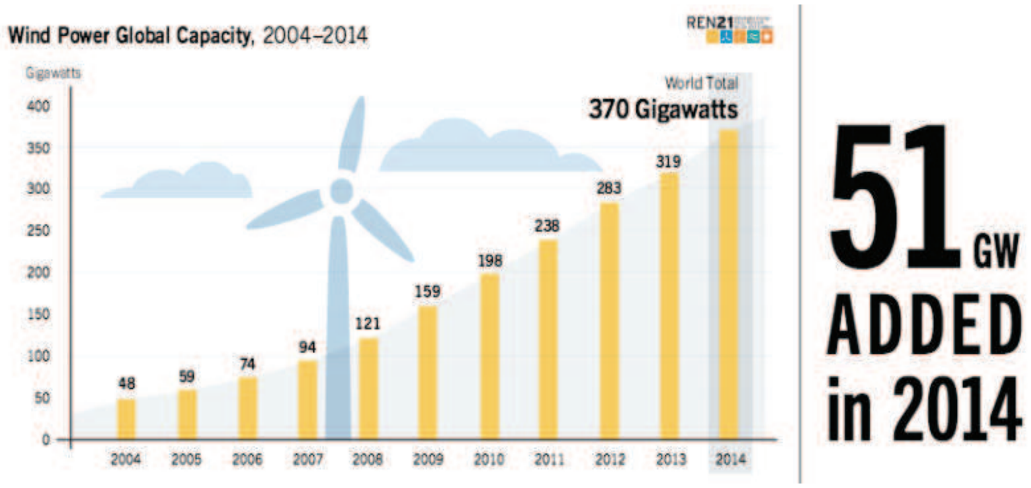

Figure Appendix 3

The expression " Wind Power Global Capacity" is misleading. It should have been presented as Globally *Installed* Wind Power. The generally accepted net power is 20% of its installed power, so the presently net wind power is < 0.1 TW. Completely negligible w.r.t the global need of about 20 TW at this moment.
The derivative of (4) in chapter VI shows a prevailing annual growth in applied power of 0.3 TW/year. The annual growth of *net* wind power is 0.01 TW/year, so also completely negligible w.r.t. the applied one.

3.3 Earth heat energy

Suppose the worldwide mean family consists of 3 persons and suppose each family needs a power of 500 W to heat its house. As soon as the world population would consists of 3 billion of such families, the required total power to heat all the houses on the world would be 1.5 TW. That is a negligible fraction of the total need at that time: 23 TW. So even in the most extreme, and at the same time most unrealistic, situation that each house on the world would be heated by means of Earth heat energy, only a negligible part of the worldwide required power would be generated by such a kind of sustainable energy.

But to top it all of. As presented in chapter VIII, whatever kind of energy is applied it is all converted into heat. So applying sustainable energy will not solve the problem of the increasing global temperature at all.

Appendix 4 The World Population in the Past and in the Future

4.1 Introduction

Given the validity of the Living Room Model, as proven in this book, it has to be concluded that the global heating problem is a symptom of a much more fundamental problem: the worldwide overpopulation.
The world population is known through censuses, but up to 1950 only by approximation. The more accurate the past is known, the better the future can be predicted therefrom. The approximations, together with the more precise-looking counts after 1950, are processed into a natural looking curve for the period 1800 up to now in chapter III. Using the mathematical expression for this curve, predictions can be calculated for the future. In addition an extremely simple model has been realized in this appendix for the growth of a population. Mutual comparison of the two curves results in interesting conclusions, of which the most important one is that the solution of the climate problem must be sought in the reduction of the world population.

4.2 Applied growth model of a population

Given the fact that a large number of statistical variables permit to work with (only) averages, the following extremely simple model of the growth of a population is established, based on the following assumptions:

1. The world population is made up of N humans.
2. There are N/2 male and N/2 female humans.
3. Each human dies at age L, where L is the average age of the N humans.
4. The age of humans is distributed evenly, so there are N/L humans by age.
5. Each couple gets at a certain age x children, of which S survive to procreate.
   The variable S thus is the net result of the birth and of the death among youth.

From this model it follows directly that if S = 2 the population is not growing nor declining.
Indeed, every year N/L humans die and every year S·(N/2)/L humans procreate.
At a constant population, these two expressions are equal.

This model is realized in an Excel program in which the increase and decrease of the population in each year is calculated from the previous year. By adding this net result of the population growth to the population in the previous the population of the present year is obtained. In symbolic form:

Year	**decrease**	**increase**	**population**
Y-1			N_{Y-1}
Y	$S\cdot (N_{Y-1}/2)/L$	N_{Y-1}/L	$N_{Y-1} + S\cdot (N_{Y-1}/2)/L - N_{Y-1}/L$ (=N_Y)

In order to verify that this model fits somewhat with actual counts/estimates (henceforth the sake of brevity from now on referred to as observations) the graph from reference [1] is taken as the reference. This graph is based on a curve fitting of the available observations. This curve fitting is based on the model $y = c + a\cdot\exp(t/b)$, with the symbol t representing the year and y the number of humans. With the aid of this expression the number of humans outside the period of observation can be calculated too for each year. The period 1800-2100 is chosen here.

The variables L and S are, by trial and error, adjusted in such a way that the populations in 2100 in both models are equal. The initial value N_{1800} of the growth model is of course selected equal to the initial value of the observations. Figure Appendix 4.1 shows this result for L = 60 and S = 3.5.

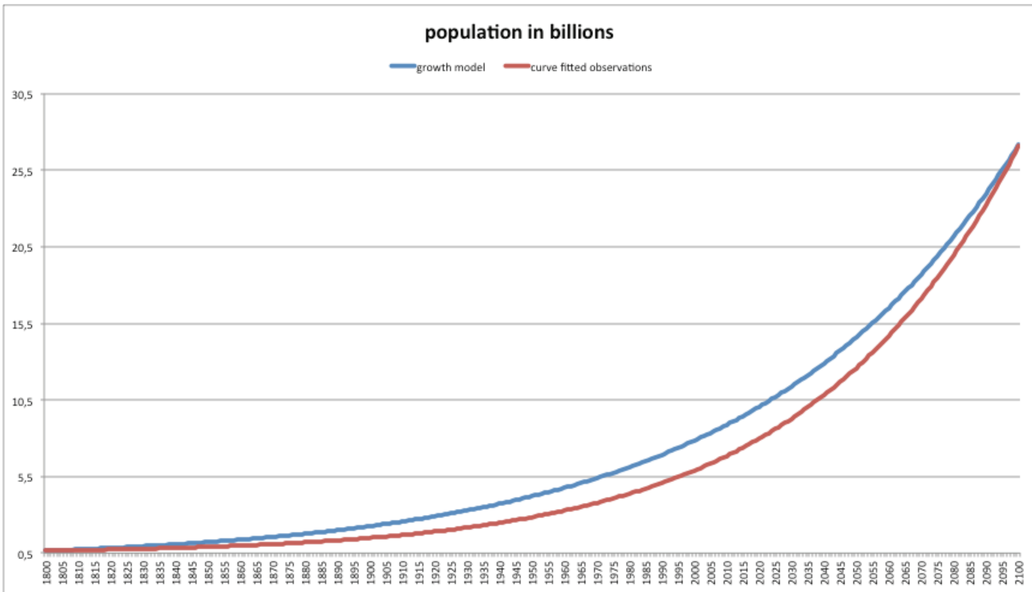

Figure Appendix 4.1 with L = 60 and S = 3.5 in the growth model

Subsequently, the growth model is adjusted by making both variables L and S as a function of time.
L in the year 1800 is, of course, chosen to be smaller than in the year 2100. In-between it increases linearly with time. For S basically the same is done.

These variables are now labelled: L_{1800} and L_{2100}, respectively S_{1800} and S_{2100}.

Figure Appendix 4.2 shows the well-fitting result for: $L_{1800} = 60$, $L_{2100} = 75$, $S_{1800} = 3$ and $S_{2100} = 4.4$
For information: the values $L_{1800} = 60$, $L_{2100} = 70$, $S_{1800} = 3$ and $S_{2100} = 4.27$ result in an equally perfect fit!

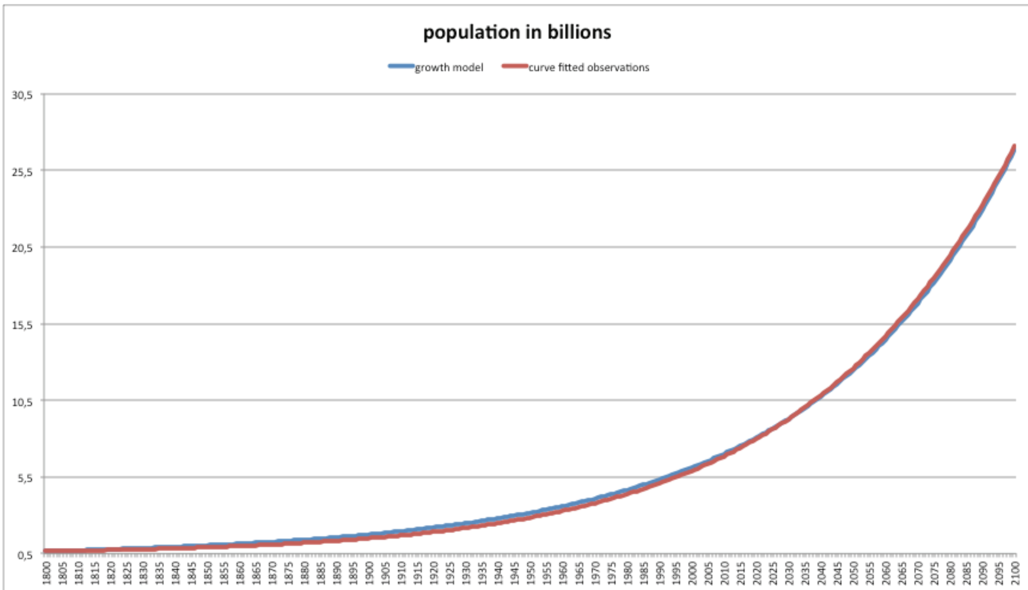

Figure Appendix 4.2 with $L_{1800} = 60$ and $L_{2100} = 75$, resp. $S_{1800} = 3$ and $S_{2100} = 4.4$ for the growth model

Based on this well-fitting growth model with the observations, this model is frozen for the period 1800-2017 in order to investigate what will be the development of the population in the future, varying only the variable S, so only S_{2100}. The reason for this is that variable L is found to be much less sensitive. It turns out that in 2017 the variable S equals 4.008. Starting from this value, S decreases linearly down to S_{2100} in the year 2100. Figure Appendix 4.3 shows the results for $S_{2100} = 2$, 1 and 0.

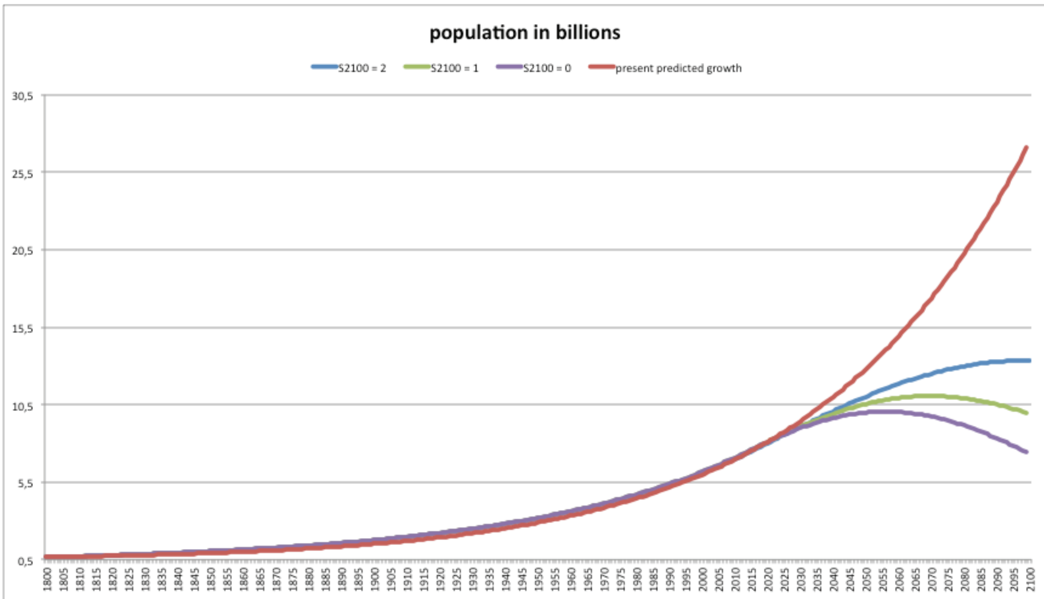

Figure Appendix 4.3, with 3 possible growth scenarios in relation to the current growth

Resume

1 With the described, extremely simple growth model, it is possible to reproduce perfectly the observed world population from the year 1800 to the present year.

2 The applied parameter values for the average age L and the average number S of people per pair that procreates again, all the way look realistic: $L_{1800} = 60$ and $L_{2017} = 71$ years, resp. $S_{1800} = 3$ and $S_{2017} = 4$. The increase of the latter parameter is representative of the global average increased human health.

3 The three possible future growth scenarios all show that the current one rises so steeply that only a drastic reduction of the variable S, translated into a drastic decrease of the global birth rate, can save nature on Earth and as a result mankind.

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Epilogue

The amount of heat in the atmosphere has been $15 \cdot 10^{23}$ J for at least thousands of years.

The increased amount of heat in the atmosphere during the past 150 years is $5 \cdot 10^{21}$ J.

In comparison to the existing heat thus an increase of only 3 pro mille.

The amount of heat in the Sea has been $15 \cdot 10^{26}$ J for at least thousands of years.

The increased amount of heat in the Sea during the past 150 years is $66 \cdot 10^{22}$ J.

In comparison to the existing heat thus an increase of only 0.4 pro mille.

The crucial question is: is such a heating of the atmosphere and the Sea really disastrous for Earth's nature and for mankind?

Should mankind in the first place not concentrate on reduction of the destruction and the pollution of nature?