Refutation of the "Greenhouse Effect" Theory on a Thermodynamic and Hydrostatic Basis

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REFUTATION OF THE "GREENHOUSE EFFECT" THEORY ON A THERMODYNAMIC AND HYDROSTATIC BASIS.

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Abstract

In an isolated global atmospheric system as that of Earth, in hydrostatic equilibrium in the cosmic vacuum, heat is transmitted only in accordance with the laws of thermodynamics, the thermal and conductive properties of different components, such as ocean waters, soils, and atmospheric gases, and the atmospheric adiabatic gradient. The same conditions apply to planets having huge atmospheric masses, such as Venus, Jupiter, and Saturn, whose surfaces and/or cores are heated only by a Kelvin-Helmholtz mechanism, gravitational compression of gases, according to their mass/density, as well as the impedance of their opaque atmospheres to solar radiation. In the case of Earth's atmosphere with relatively high rarefaction and transparency and an active water cycle, which does not exist on Venus, Saturn, or Jupiter, the main factors influencing heat transfer are irradiance related to solar cycles and the water cycle, including evaporation, rain, snow, and ice, that regulates alteration of the atmospheric gradient from dry to humid. Therefore, the so-called "greenhouse effect" and pseudo-mechanisms, such as "backradiation," have no scientific basis and are contradicted by all laws of physics and thermodynamics, including calorimetry, yields of atmospheric gases' thermodynamic cycles, entropy, heat flows to the Earth's surface, wave mechanics, and the 1st and 2nd laws of thermodynamics.

"A theory is all the more important the greater is the simplicity of its premises, as are the different types of things that relates and the more extended is the range of its applicability. Hence, the deep impression which I received from classical thermodynamics. <u>It's the only physical theory of universal content</u> which I am convinced that within the scope of its basic concepts will never be surpassed." (Albert Einstein).

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1. Introduction

The object of this study is to demonstrate the nonexistence of the so-called "greenhouse effect" (GHE) based on established physical laws of thermodynamics and material hydrostatics as well as relevant experimental data. The GHE hypothesis, widely promoted in recent years, claims that atmospheric gases, particularly carbon dioxide (CO_2) as well as methane and water vapor, are capable of "trapping" outgoing infrared radiation (IR), re-radiate IR back to the Earth's surface, and thus increase the Earth's surface temperature.

In recent years, there have been a number of reports in the scientific literature, albeit often fragmentary and published as thematic articles, that have highlighted the lack of scientific basis for various aspects of GHE "theory" and/or anthropogenic global warming (AGW) by authors such as Gehrlich & Tscheuschner,[i] Johnson & 'O Sullivan,[ii] Nahle,[iii] Siddons,[iv] Lindzen,[v] Thieme,[vi] Postma,[vii] Hertzberg,[viii] Hug,[ix] Miskolczi,[x] Svensmark,[xi] Shaviv,[xii] and Ball.[xiii]

These reports critical of GHE are in contrast to the scientific "consensus" supporting GHE and the political-ideological and media manipulation that has sought to influence public opinion during the last 25–30 years, particularly after the foundation of the Intergovernmental Panel on Climate Change (IPCC) in 1988. The veracity of the scientific "consensus" and the IPCC's credibility was publicly brought into question by the now famous "Climategate" email scandal in November 2009. The 1000 leaked emails revealed scandalous, unscientific behavior and alleged falsification of data in climate surveys and reports by a number of "climate scientists." The release of a second, larger body of 5000 emails in November 2011 confirmed and expanded the understanding of these unethical practices.

However, there has not been, thus far, an organic work based on the correct combination of thermodynamic and hydrostatic approaches required to evaluate temperature changes within a fluid in hydrostatic equilibrium and that establishes and connects the key and central concepts that disprove the GHE hypothesis. Above all, a concrete application of these concepts, illuminated with calculations of atmospheric temperature changes, has been lacking.

This presentation illustrates and explains, with accompanying calculations, that Earth's atmosphere, far from being a "greenhouse" or a "blanket" which can permanently heat the Earth's surface by about 33°C, in fact is cooling it from a maximum of ~39°C to about 12–13°C on the surface, acting as a "heat pump" (Claes Johnson)[xiv] or as a "heat sink," due to the mechanisms of expansion and adiabatic (no heat added or removed) compression of atmospheric masses, convective phenomena, such as wind and storms, the physical and chemical reactions related to the water cycle's cooling effects, via evaporation, condensation, precipitation, rain, and ice, and the albedo of clouds, which screen nearly 30% of incoming solar radiation.

Without an atmosphere, Earth would not be cold, as might be conjectured due to the cold of space, but instead would be much warmer due to solar radiative input. Its average surface temperature would be about 12–13°C above its normal 14.5–15°C and, without its albedo, the oceans, and the water cycle, could reach the temperature of the

Moon (117°C), which receives the same solar energy as Earth, but without any atmosphere. Even so, the lowest nighttime temperatures of an Earth without atmosphere would not be as low as the Moon (-203°C), as Earth's daytime is 29.5 times shorter than the Moon's and its soils would not have time to cool as much as during the Moon's nighttime.

2. Commonly accepted definition of the "greenhouse effect" (GHE)

While there are many definitions of the GHE, they are not entirely consistent in meaning. Below are only the "official" definitions, as stipulated by the IPCC.

"Short-wave solar radiation can pass through the clear atmosphere relatively unimpeded. But long-wave terrestrial radiation emitted by the warm surface of the Earth is partially absorbed and then re-emitted by a number of trace gases in the cooler atmosphere above. Since, on average, the outgoing long-wave radiation balances the incoming solar radiation, both the atmosphere and the surface will be warmer than they would be without greenhouse gases ... ".[xv]

The conceptual cornerstones of this theory, therefore, are essentially two: (i) the idea that the so-called "greenhouse gases" may “trap” outgoing IR radiation from Earth's surface and (ii) the assumption that IR radiation would be "sent back" to Earth's surface by greenhouse gases (termed "backradiation"), thereby increasing temperatures.

Both concepts are gravely mistaken and unsustainable, as they violate very basic laws of thermodynamics (LoT). (i) The 1st LoT, the principle of energy conservation, is violated because, if "backradiation" was able to increase the initial temperatures, additional energy would be created out of nothing without introducing any work from outside the system. (ii) The 2nd LoT indicates that a cooler body cannot add thermal energy to a hotter body by simple radiative "reflection." The Clausius statement of this law reads, "No process is possible whose sole result is the transfer of heat from a body of lower temperature to a body of higher temperature." An impressive number of methodologies and established physical concepts support the validity of the thermodynamic laws. They cannot be simply ignored to suit a desired result.

To avoid misunderstandings, the unproven "theory" of GHE should not be confused, as it often is, with the AGW "theory" that is effectively GHE's "daughter," making the additional assumption that human activities, through the GHE, are warming Earth's climate. As neither of these contentions has been proven scientifically, they are better described as hypotheses. In fact, the first is a physical hypothesis dealing only with the atmosphere and "heat-trapping" gases therein and, according to proponents, ignores the human element that they claim is normally heating Earth's surface. Obviously, such warming of the atmosphere must have occurred before the existence of the human species. In contrast, AGW only claims that certain gases, particularly CO_2 emitted by humans in larger quantities since the industrial revolution, would be able to increase, by "radiative forcing", and exacerbate the natural GHE.

3. The fundamental equation of calorimetry as an essential basis for calculation of atmospheric heat transfer

The fundamental equation of calorimetry is:

$$Q = m \times C_p \times \Delta T \qquad (1)$$

where Q is the heat energy (in Joules, J), C_p the specific heat of the material (solid, liquid, or gas) under consideration, (J/kg/°C), m the mass of the material (in kg), and ΔT the temperature change. Integrating and calculating the temperature for any value of T° yields:

$$Q = m \times C_p \times \int dT, \text{ or } \quad Q = m \times C_p \times (T - T°) \qquad (2)$$

This equation, despite its simplicity, is essential to any calculation of heat transfer between different substances and masses, and should always be taken into account in calculating heat transfer between materials,[xvi] as it allows calculations for non-stationary cases of variable heat transfer as a function of time.

4. Soils and oceans warm the atmosphere and not vice versa

At this point, it becomes interesting to use the basic algorithms for thermodynamic calculations in relation to the phenomenon of AGW and, more generally, to the GHE. From a thermodynamic point of view, this can be summarized as the calculation of heat transfer between the three different Earth components that are in contact with each other: the atmospheric gases and the 30% soils and 70% oceans and seas comprising the surface.

If the thermal energy of 1 cubic meter of "average" clay soil is calculated, using a C_p of 880 J/kg/°C and a mass of 2200 kg (from a density of 2200 kg/m^3), the heat capacity (*m* times C_p) of 1 m^3 of clay is produced, such that 1936 kilojoules (kJ) are required to raise the temperature of this volume of clay by 1°C. Similarly, 1 m^3 of seawater, at a C_p of 4187 J/kg/°C at normal temperature (20°C) and *m* of 1000 kg, has a heat capacity of 4187 kJ of heat energy per 1 m^3/1°C. And, moist "average" air at sea level is a very poor heat absorber, with a specific heat of 1030 J/kg/°C at 20°C and a very low density of 1.29 kg/ m^3, such that 1329 J (not kJ!) are required to heat 1 m^3 of humid air by 1°C. This is a "boundary" calculation of an alleged heating by the last (1 m^3) layer of air to the first m^3 layer of soil or water. But, of course, the same considerations apply even if you consider the "heating" of 1 dm^3 of air in contact with 1 dm^3 of underlying soil or water, or 1 cm^3 of air in contact with 1 cm^3 of soil/water. As in the model presented by GHE supporters there is no heating through solar energy, then it is the same proportionally, to take 1 m^3 or 1 cm^3, as neither volumes have thermal energy enough to heat the same volume of soil/water below. These heat capacities and related calorimetry equations can serve nicely to show that the GHE hypothesis regarding Earth's atmosphere is invalid.

Now, the air in the troposphere, the lowest layer of the atmosphere, has an average temperature of about -18°C, and, according to AGW-related science, is supposed to heat 1 m^3 of Earth's soil by 33°C to a maximum daily temperature of 14.5°C. The gases in the troposphere would thus be required to do 33°C × 1936 kJ/°C or 63,756 kJ of mechanical work. If the absurd idea that a gas at -18°C can transmit heat, by some unknown mechanism, to a warmer body is overlooked, the origin of the energy is also ignored, and the 2nd LoT ceases to exist, it might be possible to support a GHE involving such energy transfers.

However, the external energy from the Sun must also be set aside, as, according to the GHE definition, if the atmosphere always has a +33°C "gap," or a Δ33°C differential between the temperatures of the Earth's surface with no atmosphere and with an atmosphere, then it must be that the Sun does work *W* (summer energy) and *W′* (winter energy) on the gases (*G*), and *T* (summer temperatures) and *T′* (winter temperatures) will always be:

$$W/G = 33 + T \text{ and} \quad (3)$$

$$W'/G = 33 + T' \text{ so that} \quad (4)$$

$$W/G - W'/G = T - T' \text{ and therefore} \quad (5)$$

$$(W - W')/(T - T') = G \text{ (a constant) so that} \quad (6)$$

$$\Delta W/\Delta T = k \text{ and differentiating} \quad (7)$$

$$\mathrm{d}k = 0 \quad (8)$$

This means that, according to the GHE hypothesis, the Sun's work with respect to surface temperatures would not affect terrestrial atmospheric gases, because gases would maintain a stable difference of +33°C between the without-and-with-atmosphere temperatures on the surface, regardless of solar activity.

The first part of the above statement is quite correct, as atmospheric gases are rather "transparent" with respect to incoming short-wave solar radiation (not completely however, because Earth's atmosphere, although relatively thin, has an impedance factor to the propagation of electromagnetic waves; the speed of light in air is 2.75×10^8 m/s at sea level versus 3×10^8 m/s in vacuum, indicating that air does interfere with sunlight).

The second part of this statement is incorrect, however, as can be easily demonstrated. Assume, by way of contradiction, that 1 m^3 air in contact with the Earth's surface is able to provide or deliver, perhaps by conduction, energy per second equal to its heat capacity, i.e., ~1300 W/m^2. This is a remarkable, even fantastic amount of energy, being nearly equal to the Solar constant (the maximum amount of energy actually coming from the Sun to Earth), as it would be more than 5 times the heat energy emitted on average (235–240 W/m^2) from the TOA (top of atmosphere).

As the heat capacity per time (effectively power) for an average cubic meter of air is around 1.329 kJ/s, to heat the underlying soil surface 1 m^3 air would take 13.3 hours to deliver 63,756 kJ at a rate of 1.329 kJ/sec. The GHE hypothesis provides no explanation or reasonable cause for this implied effect.

But, where an attempt to support AGW-based science becomes impossible is in the warming of the ocean surface by the gases, remembering that raising one m^3 water by 33°C requires 138,171 kJ. At 1.329 kJ/sec, a heat poor m^3 of air would have to work for 28.8 hours, or 28 hours and 48 minutes! And, since the maximum limit of Earth's natural thermal cycle on Earth cannot exceed 24 hours, it can be concluded easily that tropospheric gases do not have the power or the time needed to heat the Earth's surface by as much as 33°C, as GHE requires. This is particularly a problem with regard to ocean warming, which requires enormous heat energy and unrealistic working times by the atmosphere.

The contention that atmospheric gases may continue to perform work and transmit heat to the oceans for several days, to warm them by 33°C, is also not acceptable as, with a tropospheric temperature of -18°C and +14.5°C annual temperature average at the Earth's surface, they thus include the thermal inertia or input of heat accumulated in the surface layers from previous days. However, 24 hours is really the maximum time limit for the heating cycle on Earth.

It is not surprising to note, from the thermodynamic calculation of the energy exchanged by different materials, that it takes such a long time for the atmospheric gases to heat water and soil. But, this happens because the fine air of our atmosphere is an inferior conductor of heat.

> "... Because air is a poor conductor of heat, little heat is exchanged with the surrounding air from the one that is expanding, so that we can assume this as an adiabatic expansion. Consequently, the temperature of the raising air is decreasing. On the other hand, the air coming from the upper locations of the atmosphere is undergoing adiabatic compression, and thus an increase in temperature in the lower locations ... "E. Fermi" Thermodynamics ", p. 33),[xvii] with very low heat capacity compared to solids (soil) and liquid (water), and thus dissipating heat, and not accumulating it.

Now, if, in fact, the air in contact with the soils and oceans does not have enough energy to warm them by 33°C on average, then it is clear that it is not the air that warms the soil and oceans. It is also clearly impossible for air with such a low energy content to deliver large amounts of energy to the surface by radiative means. The energy is simply not there. However, the exact opposite is true, as soils and oceans constantly transfer and emit energy, day and night, and their thermal energy heats the atmospheric gases.

The mechanism for heating of the air by the soil and ocean is clear and well-known. The Sun emits electromagnetic shortwave radiation (from 10^{-5} Å for γ-rays to 5 μm for short wave infrared (IR) rays) that resonates with and re-emits from atmospheric molecules without warming them. In contrast, this radiation excites molecules of soils (solids) and oceans (water), increasing their kinetic energy, as vibrorotational (as in water) and vibrational (electrons in soil atoms jumping to higher energy levels), producing thermal energy, or heat. The realized heat in soil and water is then emitted in the form of IR, or outgoing long-wave radiation ($3 < \lambda < 50$ μm), and also transferred by direct conduction, exciting and heating gas molecules above. This, in turn, causes the expansion and convectional rise of air to the upper troposphere, which can be described by a precise temperature and pressure gradient—from the bottom, where the pressure, temperature, and density are high, to the top, where the pressure, temperature, and density are lower, often described as more rarefied and cold.

In this light, it is quite easy to conclude that the GHE hypothesis, in which atmospheric gases can warm Earth's surface, may not have any serious foundation in real terms. Analysis of the thermal characteristics of the three main components that make up the Earth-atmosphere system reveals that soils and oceans have high heat capacities and that the atmosphere has a very low heat capacity and poor ability to dispense heat. In addition, the oceans are able to move huge masses of water via warm and cold ocean currents. Thus, the conclusion can be easily reached that the soils and oceans can warm the atmosphere and that the reverse never happens.
(See also: http://www.biocab.org/Induced_Emission.html)

5. Heat fluxes in the atmosphere and their intensity

The above conclusion is confirmed and supported by a well-known Fourier equation of heat flux or flow:

$$\Phi Q = -k \times \partial T/\partial z \tag{9}$$

where ΦQ is the heat flux through the atmosphere, k a substance's thermal conductivity constant, with a negative sign as heat flow propagates toward decreasing temperature (i.e., the rate at which heat is transmitted from hottest to coldest areas), and $\partial T/\partial z$ the space (partial) derivative of temperature on the z-axis, or the vertical temperature gradient.[xviii]

The temperature gradient in the atmosphere of humid but not saturated air, also called the adiabatic lapse rate, is approximately 6.5°C/km, while in dry air it is 9.8°C/km. This means that temperatures and pressures in the troposphere (0 to ~12 km), where all climatic phenomena occur, decrease with decreasing density and that the heat flux propagates from the ground toward space, according to the gradient direction as well as the 2nd LoT, in which heat flows naturally from warmer to colder areas.

To put some values to this concept, the thermal conductivity of still dry air is 0.026 W/m·K. The above equation shows that a thermal energy flux from terrestrial soils to the atmosphere will have an average thermal conductivity k of ~1.8 W/m·K ($1.6 < k < 2.1$). This is at least 69 times more intense than the heat flux of still dry air (1.8/0.026 = 69). Also, a heat flux from the ocean, being 0.6k, would still be 23 times more intense than the heat flow of still air (0.6/0.026 = 23). This shows mathematically that heat fluxes usually extend from the soil and water to the atmosphere and, therefore, the former are transmitting heat to the atmosphere.

Heat in the atmospheric gases, introduced by radiation and conduction, propagates through convective circulation moving generally upward, either as wind or cyclones, according to three factors: (a) vertical gradients and lateral differences in pressure, largely from warmer to colder areas; (b) friction, as dissipative contact between the air masses of Earth's atmosphere; and (c) the Coriolis force, produced by the Earth's axial rotation.

That said, it is also very interesting to examine the phenomenon of “thermal inversion" [http://en.wikipedia.org/wiki/Inversion_(meteorology)], which can occur in urban areas covered in autumn or winter with smog up to 1–2 km altitude, such that sunlight sometimes cannot penetrate to the surface for days, and in polar regions. Inversions occur in Antarctica, where due to the high albedo the air in contact with the icy surface can be many times colder than the air at low or middle altitude. Volcanic eruptions can also create inversion conditions, as they introduce heat to the upper atmosphere while, concurrently, dark cloud layers of dense silica particles prevent sunlight from penetrating to the surface for days. In these situations, where the normal temperature gradient of low altitude warm air to high altitude cold air is reversed, as the opposite of normal conditions, there is no "greenhouse effect" or warming of the surface by atmospheric gases.

In fact, considering thermal inversion from a thermodynamic point of view, if the lower troposphere (and, more generally, a fluid) is heated from above rather than from below, any type of thermal convection is blocked by the less dense, warmer overlying layer, and the gas will heat solely by conduction; with thermal inversion, heat propagates in the same direction as the gravitational force. In contrast, if a gas is heated from below, it receives kinetic energy (= ½ mv^2) as heat, which will cause gas expansion and decreased density, resulting in a buoyant force contrary to the gravitational acceleration (g = 9.8 m/s^2) and ascension of the gas, which descends after cooling at altitude, resulting in convective mixing with the lifting gases.

But, as the thermal conductivity and density of air are very low, the heat flux with thermal inversion, in which the thermal gradient is reversed, from the upper layer of overlying warm air by conduction to the soils will be extremely weak. This explains precisely why, when there is atmospheric inversion, the energy that warmer air masses at altitude transmits to the soils is always modest and does not effectively warm the ground at all, with the soils' temperature as well as the layers beneath the warm upper layers remaining cold, as the energy the warmed layers transmit decreases rapidly.

This discussion illustrates from real world observations that there is no heating of soils and oceans by atmospheric gases, and that the GHE hypothesis actually does not occur in any place or in any situation, either normally when the vertical temperature gradient is negative or when there is thermal inversion and a positive temperature gradient.

6. Why troposphere is neither a greenhouse, nor a blanket, but a refrigerator

It should be stressed that the enticing but simplistic assumption that Earth's atmosphere can be compared to a greenhouse, or a blanket, because it can retain heat in some way is totally incorrect and misleading in physical-mathematical terms. In fact, it can be easily shown that the troposphere acts in quite the opposite manner, as a refrigerator or heat pump, as has been explained by Prof. Claes Johnson.
http://climaterealists.com/index.php?id=5912

The actual thermodynamic behavior of the atmosphere is exactly the opposite to that of a greenhouse. In a small greenhouse, as in a sauna or in a car in the sun with closed windows, the temperature rises because the contents are continuously heated (heat input Q) at constant volume and pressure, as these volumes are not airtight, and most importantly, thermal convection due to changes in gas density is blocked. This response is governed by the ideal gas law, $PV = nRT$, and the trapped gases are prevented from undergoing convective cooling through contact with external air masses or adiabatic cooling.

Even more widespread—but not less erroneous!—than a "greenhouse" is the comparison of our atmosphere to a "blanket", as it is described in many articles and websites:

"To summarize: Heat from the sun warms the Earth, as heat from your body keeps you warm. The Earth loses heat to space, and your body loses heat to the environment. Greenhouse gases slow down the rate of heat-loss from the surface of the Earth, like a blanket that slows down the rate at which your body loses heat. The result is the same in both cases, the surface of the Earth, or of your body, gets warmer." http://www.skepticalscience.com/Second-law-of-thermodynamics-greenhouse-theory.htm

Unfortunately for those who still are insisting with such comparisons, our atmosphere is not surrounded by a colder environment (outer vacuum space is neither cold not hot, being almost totally devoid of matter apart from isolated molecules, and temperature is a feature of macroscopic bodies), whereas a blanket over a person is surrounded by the cooler gases of the room and keeps the body warmer by preventing or slowing convection, adding more material through which heat must be conducted, and the blanket radiates both inward and outward. Space being what it is, the atmosphere can only lose energy to space by radiative processes. Therefore, our colder atmosphere is only cooling (also through the water cycle), not heating, the Earth's warmer surface. [xix]
http://climaterealists.com/index.php?id=9153
http://www.slayingtheskydragon.com/en/blog/185-no-virginia-cooler-objects-cannot-make-warmer-objects-even-warmer-still

By contrast, in an open atmosphere, where air masses move freely, there is initially small heating of air near the ground due to gravitational compression as the above atmospheric mass exerts pressure and performs work on air layers near the ground. But at this point, heat flux from Earth's surface to the lower air also decreases its density, which then leads to convectional transport and cooling while it rises, expanding into a larger volume. The humidity, or water vapor in the air, becomes saturated as the air cools, causing condensation to form clouds and eventually precipitation, with the latent heat of condensation lost to space and cool liquid water returning to the surface.

“If air cools as it rises adiabatically and also warms as it descends, why does this happen when no apparent work is being done? This part is a deceptive concept at first and many are satisfied with equations that indicate these behaviors. But, it is quite valuable to be able to relate directly to these processes. Adiabatic cooling means that no heat is entering or leaving a gas, but the gas cools, which means that internal energy is lost. Actually, it is the buoyant force of the gas that does work against gravity as the rising molecules spread out into a larger volume. As each molecule moves, it bounces off other molecules that are moving, to some degree, away from it, such that the kinetic energy of the molecules is less after the collision than before. Thus, the gas cools as the average kinetic energy decreases.

The exact reverse occurs as air descends adiabatically back toward the surface only this time gravity is doing work on the air. The molecules are colliding with other molecules that are becoming closer and closer, thus increasing their kinetic energy and warming. Hitting a pitched baseball with a bat is exactly the same event. In a piston in which a gas is being compressed, as the piston is pushed inward by a force, the gas molecules bounce off the advancing piston face, gaining energy from their increased velocity. In our atmosphere, the extra factor in convection is that the cooling process causes water vapor to condense out as a liquid, lowering the air pressure a bit as well as decreasing the air density, effectively facilitating further rising . ." (Sabin Colton)

This is the same mechanism, although much larger and much less efficient than our artificial version, as in the thermodynamic cycle of an air conditioner, or chiller, in which the coolant is released through a one way valve/orifice on the indoor side and allowed to expand, causing evaporative as well as expansion cooling, mostly from heat absorbed as the latent heat of vaporization, as it converts from a liquid to a gas. The cold gas absorbs heat from the indoor surroundings by conduction and is moved to the exterior side where it is compressed by a compressor, producing a hot liquid due to the released heat of compression (work done by the compressor) as well as the heat of condensation. The hot liquid is then passed through a heat exchanger where it cools to the temperature of the outside and then is returned for another cycle.

On Earth, it is the Sun that provides the work (W) to the Earth-atmosphere system, sending variable inputs of heat energy (seasonal, solar cycle related, astronomical, Milankovitch[xx]), while in the case of the refrigerator or air conditioner, W is supplied by electricity driving the compressor, allowing the mechanical compression-expansion cycle.

But, it might be useful to produce a rigorous mathematical proof of this natural process, based on actual quantities involved in atmospheric heat exchange. It is possible to precisely determine the work (W) that allows the atmosphere to remove heat from the system and release it to space, based on certain considerations. As mentioned previously, when air is humid, the atmospheric gradient or lapse rate is 6.5°C/km, while the dry air lapse rate is 9.8°C/km. This means that the difference ($\Delta T/\Delta altitude$ or $\Delta T/\Delta z$) between the two gradients is ~3.3°C/km, or a negative total change in temperature of -38 – -39°C from the surface air to ~12 km in the troposphere.

What is the difference between dry and moist air?

In the words of Enrico Fermi, it is "the effect of condensation of water vapor in the air masses in expansion" ("Thermodynamics," p. 34). The internal energy contained in moist air masses is transferred as it rises to altitude, where internal energy is released as the latent heat of condensation during cloud formation due to adiabatic cooling and condensation.

Now, to calculate the maximum work that the atmosphere, or more correctly the gaseous mass it contains, can adiabatically produce, it is needed to integrate the equation:

$$\mathrm{d}W = P \times \mathrm{d}V \qquad (10)$$

to yield, for a volume of air from a height (V_a) from the ground to a height of 12 km (V_b):

$$W = \int P \times \mathrm{d}V \rightarrow P \times (V_b - V_a) \qquad (11)$$

where P is the average atmospheric pressure at 12 km altitude for moist air.

In the case of work in dry air, which is more dense than humid air, pressure will increase in proportion to the average gradient such that, to calculate the work that the atmosphere is performing in conditions of dry air, with a mean pressure $P' > P$, there is:

$$W' = \int P' \times dV \rightarrow P' \times (V_b - V_a) \qquad (12)$$

and thus $W' > W$. The above simply means that, whenever the humidity is rising, the atmosphere tends to start a natural process of rebalancing, doing work to shed the extra internal energy (at least in part) in moist air (at ~39°C) compared to dry air.

How does this process take place?

This process occurs in only one way, by precipitation as rain, snow, or hail, often accompanied by winds and storms, with attendant high electrical potential differences between the ground and clouds, caused by static negative charge transport to the surface and resulting in cloud to cloud as well as ground to cloud discharges (interestingly roughly 90% of lightning is cloud to cloud, evening out local potential differences).

During cloud formation, moisture condenses to fine particles that aggregate to form water droplets or ice crystals depending upon the ambient temperature. Eventually the particle masses are too large to remain suspended by the atmospheric updraft and precipitation occurs, resulting in the transfer of masses of cold rain or snow from high altitude to the surface. From a thermodynamic point of view, this is not a transfer of heat from a cold to a hot body, but rather a movement of a cold body (precipitation) into contact with a hot body, the surface, in effect in the opposite direction of a Carnot thermodynamic cycle, as graphically showed in a Clapeyron plot, with volume V as abscissa and pressure P as ordinate.

The atmospheric processes for converting wet air to dry and thus shedding its excess energy, compared to dry air, due to moisture accumulation requires that work be done on the system. Indeed, the atmosphere must perform work equal to the difference between W' and W (ΔW) and equal to a difference between the pressure gradients, corresponding to ~39°C maximum temperature, on a volume extending from the surface to 12 km altitude. This illustrates that the atmospheric cooling mechanism through condensation and precipitation, often followed or preceded by other dissipative heat phenomena of heat and cooling, such as wind, implements the same mechanism as the cooling phase of a refrigerator or air conditioner, which sequentially compresses hot refrigerant gas to a liquid and allows it to cool (analogous to cloud condensation). During and after cloud formation, which transfers warmed water mass from the warmer ground, internal atmospheric energy is lost to space by radiative emissions in the infrared range.

Lacking an atmosphere and thus with no water cycle, Earth's natural heat transfer and radiative mechanism would not exist. The actual mechanism allows the atmospheric system to dissipate heat energy equivalent to a temperature change of ~39°C and efficiently cool Earth's surface.

Obviously, the theoretical maximum cooling leading to a ~39°C cooling of the atmosphere is almost never completely effective because there are regions, such as tropical, equatorial, and monsoon regions, that constantly maintain a relatively high humidity in the atmosphere, even after a rain, and other regions, such as deserts, where there is almost no humidity and very little rainfall. Intermediate regions, such as temperate, subtropical, continental, and Mediterranean, show major differences in pre and post-rain humidity and thus exhibit higher levels of system cooling as they represent a more thorough depletion of water vapor content during the evaporation/convection/precipitation water cycle.

Of course, the same situation, involving cooling of the surface through the water cycle, applies to ocean waters, where different degrees of cooling are observed as a result of precipitation, due to significant differences between cold and warm seas and the humidity of the air they generate.

The energy absorbed during evaporation of water from Earth's surface, as the heat of vaporization, is not realized as warming of the air. It could be described as not sensible as temperature. However, it could be argued that, if the humidity in the atmosphere adds energy content, and then it can be removed by condensation and precipitation, in the end it is a "neutral" mechanism and, thus, it is not true that the atmosphere moves humid air and energy, with an average temperature of 12°C, away from the surface. This is not a valid argument as the system moves heat, previously delivered to the surface by solar input, to altitude where IR is more effectively lost to space due to the thinner atmosphere's lower opacity to IR.

In addition, this is not so because, if it were not for the atmosphere's clouds and precipitation, there would be much larger amounts of incoming solar radiation, as temperatures would be much higher without the shielding effect of clouds.[xxi]

Moreover, it is not true that humidity "adds" warmth to the air, as it is only adding a vapor that forms by vaporization from energy that is already present in the surface materials, after which the humid air ascends. Essentially, if water vapor added heat energy to the air, it would be creating energy from nothing, which would violate the law of conservation of energy. To the observer, humid air does feel warmer than dry air at the same temperature, as high humidity retards water evaporation from human skin, thus decreasing evaporative cooling. In all of this, the natural mechanism includes the Sun that provides the external work (W) required to heat moist soils and ocean waters, facilitating evaporation and serving as the "engine" or power source of the cycle.

Indeed, the water cycle of the atmosphere could be described as a massive heat engine. And it follows that, if the lower troposphere, where all of the atmospheric warming is claimed to be occurring, according to the GHE supporters, were to warm and increase water evaporation, this heat engine would accelerate its activity and serve as a powerful negative feedback mechanism, keeping our climate rather constant and thus only sensitive to much larger factors, such as changes in solar input, ocean currents, and astronomical variables.

7. The fundamental equation of hydrostatic distribution of atmospheric thermal energy

According to the proponents of the GHE and AGW hypotheses, Earth emits to space an average thermal IR radiation intensity of 237 W/m^2, corresponding to -18°C according to the Stefan-Boltzmann relationship, and therefore Earth's average surface temperature of 14.5–15°C is the result of the 32.5–33°C provided by the atmosphere, as "warms up" from -18ºC just like a greenhouse. This type of approach is quite rough, simplistic, and wrong, even apart from the calculation of the actual energy needed, according to the equation of calorimetry, as discussed in Section 3.

First, the basic assumption can be adopted that the atmosphere, in hydrostatic terms, is a self-gravitating system in constant hydrostatic equilibrium due to the balance of the two opposing forces of gravity and the atmospheric pressure gradient, according to the equation:

$$\mathrm{d}P/\mathrm{d}z = -\rho \times g \qquad (13)$$

where ρ is the density (mass per volume) and g the acceleration due to gravity. This equation, from a mathematical point of view, can be derived by considering the hydrostatic equilibrium function as a system of partial derivatives depending on P and ρ and considering all three spatial dimensions:

$$\partial P/\partial x = \rho \times X, \quad \partial P/\partial y = \rho \times Y, \quad \partial P/\partial z = \rho \times Z \qquad (14)$$

As, within a fluid mass in equilibrium, pressure and density does not vary along the horizontal axes (X and Y), the related partial derivatives equal zero.[xxii] But, in the remaining vertical dimension, the partial derivative is non-zero, with density and pressure varying inversely as a function of fluid height (density and pressure decrease with increasing height relative to the bottom) and, considering gravitational force as a constant connected to the measure of density, thus equation (14) can be derived.

For a precise calculation involving the valid parameters, the 1st LoT can be used:

$$\Delta U = Q - W \quad (15)$$

where U is the total internal energy of the system, Q its heat energy, and W the mechanical work the system is undergoing. Applying this relationship to Earth's atmosphere, yields:

$$U = C_{(p)}T + gh \quad (16)$$

where U is the total energy of atmospheric system in hydrostatic equilibrium and equal to the sum of the thermal energy (kinetic plus dissipative and vibrorotational), the specific heat $C_{(p)}$ multiplied by the temperature T plus the gravitational potential energy, with gravitational force g at height h of the gas. In this case, because the force of gravity has a negative sign as the system is undergoing work, the potential energy ($-g \times h$) can be equated to the mechanical work ($-W$) that the system undergoes in the 1st LoT.

Based on this equation, the atmosphere's "average" temperature change can be found for any point with the system in equilibrium; for now and for simplicity, weather phenomena and disturbances at specific locations are not considered because, with the system in overall hydrostatic and macroscopic equilibrium, any local internal, microclimatic perturbation by definition triggers a rebalancing reaction. In fact, to calculate the energy change of the system in equilibrium (here U is constant) as a function of temperature and height change, differentiation yields:

$$dU = 0 = C_{(p)}dT + g dh,$$

which becomes:

$$dT/dh = -g/C_{(p)}, \quad \text{or} \quad dT = (-g/C_{(p)})dh.$$

This is a splendid equation, describing precisely the temperatures' distribution of a gas (as the air of Earth's atmosphere) in hydrostatic equilibrium between the 2 forces of the lapse-rate (preventing the collapse of the atmosphere at the Earth's surface) and the gravity (preventing the escape of the atmosphere in the void of space).

It can be re-written as follows, in expanded shape, (here for dry air):

$(1.0 \text{ Kjoule} \times m \times 1°C) \times (T - T°) = - [G \times (m \times M/R^2)] \times (h - h°)$

Where:

1.0 Kjoule = Specific heat of dry air (it is 1.5 Kjoule for moist air)

m = Unit mass of dry air = 1 Kg

T – T° = Δ T (or dT) = Interval of temperatures

M = Mass of Earth = 5.95×10^{24} Kg.

R = Radius of Earth = 6.37×10^{6} mt.

G = Newton's gravitational constant = 6.67×10^{-11} N $(m/Kg)^{2}$

h – h° = Δ h (or dh) = Space interval (vertical) in the atmosphere

In other words, temperature variation (dT) is a function of altitude variation (dh), whose solution at any point of height ($h°$) and for any temperature ($T°$), can be found by integrating as follows:[xxiii]

$$\int dT = -g/C_{(p)} \times \int dh \quad (17)$$

and whose solution is:

$$T - T° = -g/C_{(p)} \times (h - h°) \quad (18)$$

Now, according to experimental tests, knowing that normally in variously moist air the atmospheric gradient is 6.5°C/km and that the temperature of the atmosphere at ~15 km is -18°C (corresponding to a 237 W/m^2 average terrestrial radiative emission, according to supporters of the GHE), when these values are entered into this equation, it shows:

$$T = -18 - (6.5 \times (h - 5)) \qquad (19)$$

And, if the altitude h, or sea level, is zero, this shows:

$$T = -18 + 32.5, \quad \text{or} \quad T = 14.5°\text{C} \qquad (20)$$

which is precisely the real mean global temperature at the ground.

It should be noted that the equation above is much more precise and conceptually correct, at least for the calculation of atmospheric temperature, than the well-known virial theorem:

$$-U = 2\Omega, \quad \text{or} \quad 2\Omega + U = 0 \qquad (21)$$

The virial theorem states that the total kinetic energy (2Ω) of a system of point particles is equal to the opposite of the virial, or active forces, acting on them and that the kinetic energy is half the total system energy.

What is the problem with the virial theorem here?

The virial concept links kinetic energy, as $\frac{1}{2}mv^2$, to the total energy of the system (U), but this approach has a major limitation from the thermodynamic point of view, as kinetic energy depends strictly on the speed v and, thus, only the translational energy of single particles or molecules. However, in addition to translational energy, particles also have rotational and vibrational energy as well as spin motion, according to their degrees of freedom, and they collide in a chaotic dissipative manner, as friction, vibration, rotation, or internal molecular shockwave. These considerations are not considered by virial theorem!

However, the virial equation, which is commonly used by astrophysicists to determine the limits of star masses before gravitational collapse, is also useful for disproving the validity of the GHE as well as for disproving theories in which simple percentage changes in the atmospheric gas composition of planets in hydrostatic equilibrium, including Earth, are supposed to produce temperature variations. In his classic paper of 2007 (Ref. [10]), the former NASA physicist Ferenc Miskolczi said, "Planets following the radiation scheme of Eq. (8) [the equation of hydrostatic equilibrium] can not change their surface temperatures without changing the surface pressure – total mass of the atmosphere – or the SW [Solar Work] or heat input to the system." ("Greenhouse effect in semi-transparent planetary Atmospheres," p. 8)

Returning to the hydrostatic equation (18), $T = -g/C_{(p)} \times (h - h°) + T°$,

this equation is by itself useful in negating the possibility of any "greenhouse effect" in the atmosphere. It shows that temperatures in the atmosphere, a gaseous fluid in hydrostatic equilibrium, are primarily a function of the pressure gradient, the gas heat capacity, and the gravitational force (as the pressure per unit volume over density, also under special conditions according to the ideal gas law). In contrast, the Stefan-Boltzmann (SB) equation used by supporters of the GHE is incorrectly applied. In this regard, consider the calculation often presented in which the Earth emits back to space an average of 235 W/m^2, corresponding to "black body" emission according to the SB equation:

$$j^* \, (\text{W/m}^2) = \sigma T^4 \qquad (22)$$

in which j^* is the emissive power of a black body, sigma σ the SB constant, and temperature T is to the 4th power.

The temperature corresponding to the Earth's radiative power (235 W/m²) to space is -18°C. The 33°C difference between this temperature and the +15°C average Earth temperature is claimed to represent a greenhouse effect, but the heat claimed to be retained by the atmosphere is actually, as already demonstrated by the equation of calorimetry, totally wrong.

The main concept, which astrophysicist Joseph Postma has also emphasized, is that the SB equation deals only with instantaneous radiative fluxes from a surface. Therefore, it is entirely incorrect to use the SB with an "average" flux by dividing the solar constant by a factor of 4, on the premise that a sphere has 4 times the surface area of a flat blackbody disc, producing thereby the untrue hypothesis that ¼ of the highest solar energy (1367 W/m^2) is uniformly spread over the whole Earth's surface, without any radiative change from day to night and winter to summer. As correctly pointed out by Postma: "Dividing the solar flux by a factor of 4 and then spreading it instantaneously over the entire Earth's surface as an input flux amounts to the denial of day-time and night-time, and violates the application of the Stefan Boltzmann Law which deals only with instantaneous radiative flux" ("The Model Atmospheric Greenhouse Effect," p. 10, Postma).

Moreover, another mistake in the application of the SB equation to a "radiative" atmospheric model is that the SB equation leads to an "overestimation" of the mistaken cooling (-18°C) at Earth's surface, because the SB equation mathematically links any radiative flux to the fourth power of the temperature. Therefore, with relatively low radiative flux, as in Earth's atmosphere, the resulting temperature is even cooler.

In other words, if 1367 W/m^2 is used in SB calculations, the result is $1367/\sigma = T^4$, or T = 394K = 121°C. Now, with a quarter of this, 1367/4 = 341.7, the SB equation produces $341.7/\sigma = T^4$, or T = 278.6K = 5.6°C. But, as is easily seen here, this 5.6ºC temperature is very much lower than 121°/4 = 30.25° C, at a little more than 1/5th! For another example, using the solar constant of Venus, 2614 W/m^2, the SB equation produces $2614/\sigma = T^4$, or T = 463K = 190°C. And again, 2614/4 yields 653.5 W/m^2 and the SB equation yields $653.5/\sigma = T^4$, or T = 327.6K = 54.5°C. But, if the 190ºC result is divided by 4, 190/4 = 47.5°C, the result is not too far from 54.5°C, but still cooler. This is a clear evidence of the erroneous "overestimation" of cooling whenever comparing an alleged "average" low energy flux on Earth's surface using the SB equation, with a true average 235 W/m^2 of long wave IR (LWIR) outgoing from the atmosphere to space.

To summarize this discussion, the reasons why it is totally wrong to use the SB equation to calculate the surface temperature and the alleged GHE are listed below.

a) The SB equation only deals with instantaneous radiative fluxes and, therefore, it is incorrect to work out a hypothetical (and false) "mean" flux by dividing the solar constant of 1367 W/m^2 by 4 (with the false assumption that there is no daytime and nighttime and no nighttime cooling of Earth's surfaces) and then apply the SB equation to obtain temperatures.

b) It is thus erroneous to compare a false "surface mean temperature" obtained as above, with a true average 235 W/m^2 LWIR, outgoing from the atmosphere to space.

c) The mistaken result from this approach is even greater when considering that the SB equation connects radiative fluxes to the fourth power of temperatures, rendering the cooling effect error even greater when addressing low energy fluxes of around 235–240 W/m^2 or less.

d) Hence, the famous +33°C differential, being the difference between -18°C (the alleged "average" surface temperature of Earth using the SB equation) and +15°C (the true average surface temperature) is not caused by the GHE (or "atmosphere effect") but just by an overestimation of cooling from an erroneous application of the SB equation to heat exchanges in the atmosphere.

Hence, the SB equation is completely misapplied and useless for calculating temperatures relating to heat exchanges in a complex atmosphere such as Earth's, in which heat is transmitted not only by radiation, but by conduction and convection as well.

In his 2008 article, "Proof of the Atmospheric Greenhouse Effect,"[xxiv] the author A.P. Smith spreads himself thinly in purely theoretical calculations, ultimately of little practical application, regarding the radiation effects on the temperatures of a rotating planet as opposed to a non-rotating planet or of planets with different albedo distributions, and concluded that, for a rotating and transparent planetary atmosphere such as Earth's, it would be correct to evaluate the heating effect of the atmosphere on the surface at +33°C. Unfortunately, the author lost a clear perception of the core of the problem, which is not simply the calculation of temperatures in a rotating, radiating sphere. Instead, the problem involves a model for heat transmission inside a gaseous fluid in a gravitational field and perforce in hydrostatic equilibrium between a gravitational acceleration (g) and an atmospheric gradient/lapse-rate ($-dT/dh$). As seen here, a purely "radiative" atmospheric model, as proposed by supporters of GHE, is unable to provide reliable and realistic results.

On the other hand, the thermodynamic/adiabatic equation

$$T = [-g/C_p] \times (h - h°) + T° \qquad (23)$$

can fully and effectively describe the heat distribution and temperatures inside any atmospheric field, just by considering heat capacity of the system and the gradient/lapse-rate. This equation confirms, as already discussed in Section 5, that, if Earth had no atmosphere or lacked a water cycle and was just a rotating sphere of clay and sandy soils receiving solar radiation, as is the case with Mercury or the Moon, its average temperature would be ~27°C and not the ~15°C that Earth is now. This result (27 °C = 300K) can be reached in two ways: (a) by considering the LWIR of our atmosphere (235W/m^2) as emitted just by an "average" soil (clay, sandy, and rocky) with a "mean" emissivity of 0.65 (as in the hypothesis that there are just soils and no water) and, thus, according to the SB equation: $235 = 0.65 \times \sigma \times 300^4$; and (b) by considering, more empirically, the mean temperatures of the areas of Earth having almost no water cycle, and receiving a mean solar irradiance (between the Poles and Tropics), such that 27ºC is roughly the average temperature of the Saharan desert region (mean irradiance), ranging between 30–50°C in summer and 9–15°C in winter.

But, of course, if Earth had no atmosphere, there would be no lapse-rate/gradient and Earth's soils would receive the same radiation as the Moon and would reach nearly the same temperature as the Moon (nearly 390K or 117°C) at its zenith (85° N). But, without an atmosphere and with a much faster rotation (Earth's day/night times are 29.5 times shorter than the Moon's), Earth's soils would be unable to cool in 12 hours of nighttime as much as the Moon (to 70K = -203°C) with its much longer nights.

Therefore, soils cooling without an atmosphere would depend just on their thermal diffusivity. As the thermal diffusivity of sand, which is similar to Moon regolith, and clay soils normally range between 1–1.4, the highest day temperature of ~117°C (with a 40°C day average) could be expected to drop during the night by just 11–15°C (only a 5°C average decrease), according to: (320°C the Moon's diurnal thermal range of 320ºC/29.5 terrestrial days per lunar rotation) × 1–1.4 soil thermal diffusivity). Hence, the so-called "greenhouse gases" in Earth's atmosphere and the related water cycle are cooling, not heating Earth's surface and soils.

A clear and overwhelming observational evidence of this cooling effect can be found in consideration of temperatures in humid, tropical, urban areas, such as Manila, Rio de Janeiro, or Sao Paulo, compared to temperatures in dry desert regions. In the former, it is possible to find the highest concentrations of "greenhouse gases," but the highest temperatures rarely go above 35°C, while in dry desert regions, where there is no industry, little or no population, and very modest "greenhouse gas" concentrations, the highest temperatures easily exceed 50°C. Clearly, the temperatures would also be lower toward the polar latitudes, which receive less radiation, and very cold at the two poles (even without an atmosphere). It should also not be overlooked that temperatures measured by weather stations are never measured at the ground, where they would be higher, but a height of two meters above the surface.

8. Analysis of Venus' heating denies the GHE hypothesis!

Venus has become, in the collective imagination, a symbol of the GHE, but an analysis of this planet's temperature conditions reveals some surprising results. A simple Internet search for planet Venus in the texts, articles, and websites produces a huge number of responses which link the word "runaway" with Venus and its "greenhouse effect," appearing in numerous sources with monotonous repetition. Hence, not only is Venus considered a symbol of the GHE, but it is also commonly believed that this phenomenon is so obvious as to be out of control precisely due to its magnitude. Venus is a planet quite similar to Earth in size, with 81% of its volume, and an atmosphere composed of ~96.5% CO_2. And thus, with the widespread belief in CO_2's GHE abilities, Venus = CO_2 = an impressive greenhouse effect!

However paradoxical, accurate physical and thermodynamic analysis of Venus blatantly belies the assumption that the hot temperatures (>460°C average) of Venus are due to an alleged GHE or the trapping of IR radiation by the Venusian atmosphere. Venus may paradoxically play a role in our universe as being one means of clearly showing to terrestrials that the GHE does not exist, despite the clichés and widely accepted misinformation.

First, the most striking aspect of the Venusian atmosphere to an astrophysicist is its huge mass, at well over 4.8×10^{20} kg, or 94 times larger than that of Earth, at 5.1×10^{18} kg.[xxv] Moreover, at 96.5% CO_2, the remaining gases are only "trace" gases, such as nitrogen and sulfur dioxide. And due to its smaller orbit, Venus receives about twice as much solar radiation as Earth, at 2617 vs. 1367 W/m^2, respectively. It is well-known that the surface of Venus is very similar to a furnace at high pressure, with temperatures near 460°C, an overwhelming pressure of 92 terrestrial atmospheres, and an atmospheric density of 65–67 kg/m^3. The pressure here is similar to conditions at 1 km depth in the Earth's oceans, which is capable of crushing most submarines. However, there is something even more interesting that is revealed by a thermodynamic examination of Venus.
http://nssdc.gsfc.nasa.gov/planetary/factsheet/venusfact.html

The rotational speed of Venus around its axis is minimal, such that one day and night on Venus lasts about 117 terrestrial days. Thus, a site on Venus receives no sunlight for nearly 120 days, in a very long "night" of almost 4 months. At this point, the temperatures of the hemisphere exposed to the Sun would be expected to be much higher, similar to the temperatures of Moon or Mercury, than the darkside hemisphere, where temperatures would be expected to be well below 0°C. None of this happens. Instead, the temperatures on Venus are rather uniform and the irradiated hemisphere shows the same temperature as the darkside hemisphere, around 460°C at the surface!

How is this uniform temperature on Venus possible?

Several astrophysicists have tried to explain this phenomenon, attributing it to a presumed conductive capacity of Venus's dense atmosphere and a rapid transfer of heat from one side of the planet to the other. But such rapid heat transfer is clearly impossible, considering that the ultracompressed gases up to 92 atm at the Venusian surface have a density of about 65–67 kg/m^3. Such density is remarkable for a gas but negligible compared to planetary solids, such as soil and rock, which have much greater heat conductivity, larger by a factor of tens or hundreds.

For contrast, consider Mercury, closer to the Sun than Venus, entirely devoid of atmosphere, and whose surface soils and rocks, much more conductive than any gas, remain exposed to the Sun for longer periods compared to Venus (1 Mercury day = 176 Earth days). Between the irradiated and shaded hemispheres of Mercury, there is a difference of nearly 600°C, with the irradiated hemisphere burning at 430° C and the shadowed half in the cold, down to -170°C![xxvi] Yet, Venus appears to be a hotter planet!
[http://nssdc.gsfc.nasa.gov/planetary/factsheet/mercuryfact.html]

The first piece to understanding Venus is the fact that Venusian surface winds have a very low "speed," from 0.30–1 m/s, which makes it quite impossible for "convective" heat transportation of masses of hot gas from one hemisphere to the other. In addition, the Coriolis force on Venus is necessarily weak due to the planet's slow rotation. Thus, it is absurd to accept the proposition that heat moves efficiently from one hemisphere to another simply by conduction or convection and produces uniform temperatures.

A second piece in explaining Venus involves the fact that many people forget to consider that very little of the 2,617 W/m^2 of solar radiation arriving at Venus ever reaches the planet's surface. In fact, if the solar constant of 2,617 W/m^2 is divided by the factor $\lambda = 4$, as seen above, the "average" annual radiation of Venus is 654 W/m^2; here the SB equation is not being used to find a temperature from radiative fluxes! But, of this energy, as much as 60% (nearly twice that of Earth) is reflected by the albedo of the permanent cloud deck of dense gases surrounding the planet. And, of the 262 W/m^2 of the remaining solar radiation, only a fraction reaches the Venusian surface, due to the medium's impedance, or the ability of the thick layers of hot gas to prevent the passage of solar radiation.

The impedance Z is considered by few investigators in such situations and can be calculated using the formula:

$$Z = \rho \times c \qquad (24)$$

where ρ is the medium density and c the speed of sound waves in the medium (this formula can also be used for good approximation of electromagnetic plane wave speeds) according to the formula:

$$c = \sqrt{C_t \times R \times T} \qquad (25)$$

where C_t is the heat capacity of the medium, R the gas constant, and T the temperature (K).

To calculate terrestrial air impedance,

$$c = \sqrt{1.4 \times 0.082 \times 288} = 5.74 \text{ and } \rho = 1.29$$

$$\rho \times c = 1.29 \times 5.74 = 7.41 \rightarrow \text{ impedance of the air at the Earth's surface} \qquad (26)$$

For CO_2 to the surface of Venus, however, we have:

$$c = \sqrt{1.3 \times 0.082 \times 737} = 8.86$$

$$\rho \times c = 8.86 \times 65\ (\rho) = 576 \rightarrow \text{ impedance of the gas at the surface of Venus.} \qquad (27)$$

Therefore, as the impedance of Venusian gases is 78 times higher than the one of Earth's atmosphere, using a simple proportion and a value of 1 for Earth's normalized impedance:

(average radiation entering Earth's atmosphere) / [(radiation at the surface) × 1 impedance] = (average incoming Venus radiation) / [(radiation at the surface) × (78 impedance)].

Using a geometric albedo for Earth and Venus of 36 and 67%, respectively, the planets' incoming radiation is 1367/4 – 36% = 219 W/m^2 and 2617/4 – 67% = 216 W/m^2, respectively. Then, considering a "mean" (according to the usual models) residual radiation on the Earth's surface at 168 W/m^2 and equating proportionally to the solar radiation reaching the Venusian surface:

$$219/(168 \times 1) = 216/(x \times 78)$$

where x is the unknown quantity of solar radiation at the surface of Venus. This produces $x = 2.12$ W/m^2, a very modest amount of radiation, totally unable to heat the atmosphere, and even less than that reaching the cold Uranian surface!

The results do not change much when considering the highest solar radiation entering Venus and Earth:

$$1367/168 = 2614/78x, \text{ or } x = 4.12 \text{ W/m}^2.$$

It is clear that a radiative solar flux on Venus ranging from a 2.1 W/m^2 mean up to a 4.1 W/m^2 maximum is completely incapable of heating its atmosphere anywhere close to its real temperatures!

Hans Jelbring (a Swedish astrophysicist), in his excellent work [xxvii] came to a similar conclusion: "…This provides an explanation of why Venus has an (quasi or wet) adiabatic temperature lapse rate in its troposphere. Only 2.5% of solar irradiation can reach its surface.", although no number or calculation of the final solar irradiance on the surface is shown by Jelbring.

The explanation for the high and uniform temperatures of Venus therefore lies neither in the solar irradiance nor in the alleged GHE because, obviously, it is not possible that the dark hemisphere is "trapping" IR radiation that does not reach it at all for 120 days at a time, while the irradiated hemisphere receives only 2.1–4.1 W/m^2 at the surface due to the impedance of the thick gas layer.

The workable and realistic explanation for Venus' temperature is given by the same equation for the distribution of thermal energy in the atmosphere as seen in Section 6 and is described by the fundamental parameters of heat capacity, gravitational acceleration, lapse-rate, atmospheric pressure, and density. In fact, as observed experimentally, at 50 km altitude the Venusian atmospheric temperatures are ~15°C. Thus, again the equation $T = (-g/C_t) \times (h - h°) + T°$ can be used, as in the aforementioned work by Postma, noting also that Venus has an atmospheric gradient (lapse/rate) of 9ºC/km, which is the mean between the average dry gradient of 10.4 and the "wet" of 7.7 ºC/km.[xxviii]
http://mc-computing.com/qs/Global_Warming/Venus.html

Introducing values in the above equation produces:

$$T = -9(h - 50) + 15 \qquad (29)$$

which at height (h) = 0 at the surface becomes:

$$T = 450 + 15 = 465°C \qquad (30)$$

which is precisely the average temperature observed at the Venusian surface!

The same result can also be obtained using, in a somewhat more refined manner, the ideal gas law, $PV = nRT$, with P as the pressure, V the volume, n the number of moles of particles, R the universal gas constant, and T the temperature. This is basically a rewrite, or a different form, of the hydrostatic distribution equation of heat in the atmosphere and always applicable for monoatomic or simple molecules of gases at high temperatures and undergoing no chemical reactions. And as Venus's atmosphere is almost entirely composed of CO_2, lacking chemical reactions, and possessing no water cycle as on Earth, the universal gas law for ideal gases is certainly applicable and provides accurate results.

Here on Earth, application of the ideal gas law, using 1 m^3 of air, 1.29 kg/m^3, and 1 atm of pressure and solving for the temperature, "warms up" the atmospheric temperature to 273K or 0°C. Of course, the additional 14–15°C in the Earth's average surface temperature is provided by solar heating, as Earth lacks an almost complete solar shield, as has Venus. Therefore, introducing values for Venus in the ideal gas law, $PV = nRT$:

92 atm × 1000 dm^3 = [67,000 g (/1000 dm^3)/44 g/mol (CO_2 molar mass)] × 0.082 atm·dm^3/mol·K (univ. gas constant) × T (K)

and solving for the temperature produces,

$$T = 92{,}000/124.8 = 737K = 464°C! \qquad (31)$$

All of this shows that temperatures on Venus have nothing to do with an alleged GHE or IR radiation "trapped" by gases, mostly being CO_2. In reality, the enormous gravitational pressure, gas density at the surface, and the atmospheric lapse rate, representing the distribution of thermal energy as a function of the atmospheric mass and energy flow from the surface to space, are in full agreement with the 2nd LoT.

9. Extension of the "Kelvin-Helmholtz mechanism," as heating by gravitational compression of atmospheric mass, to Venus. Hydrostatic and mathematic demonstration

The planets Jupiter and Saturn provide another example of the phenomenon of "global warming" by gravitational compression of atmospheric gases having huge gravitational mass and not as a result of solar energy heating. It is common knowledge that Jupiter is considered a "failed star" because gravitational compression of its enormous mass, as well as its 4,000,000 atmospheres of hydrogen and helium that make up its atmosphere, has produced a core of liquid helium at very high temperature (~24,000K).[xxix] On the other hand, it has been verified that Jupiter's mass would need to be at least 80 times greater to generate the pressures and temperatures sufficient to trigger the thermonuclear reaction typical of the Sun and stars. Saturn, albeit at a slightly reduced scale compared to Jupiter, offers an example of another planet which, due to its enormous mass of atmospheric gases, is able to heat the central core of the planet to temperatures above 10,000°C (estimated at ~11,700°C).

The heating mechanism of gravitational compression in gaseous planets with great atmospheric mass, such as Jupiter and Saturn, was discovered by Kelvin and Helmholtz in 19th century. However, they incorrectly extended the mechanism to the Sun and stars, not aware at that time of thermonuclear fusion from which the Sun and stars generate their energy. And also, there is no doubt that the Kelvin-Helmholtz (KH) mechanism has been proven absolutely correct for explaining the heating of opaque planets with large atmospheres that are dense and largely impenetrable to solar radiation, unlike Earth.

Hereinafter, the KH mechanism is demonstrated to be useful as a universal law for planets of such composition and mass, and it is possible to provide the mathematical and hydrostatic proof, in agreement with experimental observations. Furthermore, describing a circumstance of great importance, the KH mechanism is proven here to be also hydrostatically, mathematically, and experimentally applicable to Venus.

First, Jupiter and Saturn show a characteristic of great importance. Experimental observations have shown that the highest part of their external atmosphere is cooling, resulting in "shrinking," albeit by an infinitesimal extent, by about 2 cm per year. At the same time, the cores of both planets are heating, by an infinitesimal percentage.[xxx] This real world phenomenon confirms the theory of the KH mechanism, for which hydrostatic and mathematic proofs are simple to provide.

Starting again with the hydrostatic equation used in Section 6, $dT = (-g/C_p)) \times dh$. This equation can be differentiated for dC_p, as specific heat C_p may still vary, while the only parameter that can be neglected is the gravity acceleration g, for its $dg = 0$ by definition.
This can be seen as an iso

Thus, this can be written as the sum of partial derivatives, $-dT/dh = 1/dC_p$:

$$\partial T/\partial h + \partial T/\partial C_p + \partial C_p/\partial h + \partial C_p/\partial T + \partial h/\partial T + \partial h/\partial C_p = k \qquad (32)$$

in linear form and, recalling that by definition the equation for a fluid in hydrostatic equilibrium is a constant k, there is

$$(-T \times C_p)/H = k,$$

and the same is true if, after differentiating for dh, the "narrowing" of the height H of the atmosphere is calculated, it becomes

$$(-T' \times C_p')/H' = k$$

as a variation in the internal parameters of the fluid does not change the "k" value of balance. Thus, this becomes

$$(-T \times C_p)/H = (-T' \times C_p')/H' \ . \qquad (33)$$

And yet, if H is "narrowing" for a small dh, assuming $H > H'$ infinitesimal, and then eliminating H and H' in the equation above for simplification, this yields

$$(-T' \times C_p') < (-T \times C_p) \tag{34}$$

and this inequality will be verified only if $-T' < -T$, or if $C_p' > C_p$.

This result confirms the experimental observations, such that, for each "shrinking" or contraction of the atmosphere in a KH mechanism, there will be a new, slightly cooler temperature at the top of the atmosphere, or $-T' < -T$, or an increase in specific heat at the base, or $C_p' > C_p$, being a little further warming at the surface, due to increased gravitational compression of the gases.

To conclude now with Venus, experimental observations show that Venus is increasing, though only slightly, in brightness and energy, and thus the surface is warming, at the bottom. As already shown in Section 7, Venus gains its thermal energy almost exclusively due to gravitational compression of its gases to the surface, with the solar energy it receives being largely irrelevant due to the large impedance of the gases. Then, an increase in its energy at the surface clearly indicates that the planet is following a totally KH mechanism, maintaining its hydrostatic equilibrium and a concurrent narrowing of the atmosphere at the top from cooling, which is matched by an increase in heat capacity at the surface.

Thus, it can be concluded that experimental observations show that even Venus, as with all planets of the solar system having opaque and massive atmospheres, is following a KH mechanism of heating as a unique function of the gravitational compression of its atmospheric mass, with solar irradiance being irrelevant and unable to play any significant role.

10. The theory of GHE hypothesis violates the 1st and 2nd laws of thermodynamics

One of the most baffling and unacceptable aspects of the GHE hypothesis, one commonly taken for granted, is its overt violation of the most well established laws of thermodynamics (LoTs). In particular, the first violated law is generally referred to as the 1st LoT or the law of conservation of energy, which states that, inside a thermodynamic system, energy cannot be created from nothing (or destroyed), without work W being performed on the system by the external surroundings (or work done by the system on the surroundings). Also often violated is the 2nd LoT, which addresses the transmission of heat and the principle of entropy, stating the impossibility of the spontaneous movement of heat from a cooler body to a warmer one and the irreversibility of all natural processes, as entropy must increase in all processes.

According to supporters of the GHE, the 1st LoT does not function and atmospheric gases have the power to raise Earth's surface temperature, simply by sending some outgoing IR radiation back to the ground, often called "backradiation." A typical example is provided here [xxxi] [http://www.realclimate.org/index.php/archives/2007/04/learning-from-a-simple-model/], in which 120 of the 240 W/m^2 of outgoing IR radiation would be "backradiated" by greenhouse gases to Earth's surface, which would lead to an increase in surface thermal energy from 240 to 360 W/m^2 (240 + 120) and more—the term "amplified" is sometimes used to describe this supposed effect. Sound amplifiers amplify sound but this process requires additional energy from the power supply and not simply the echoing of sound.

This fantasy that creates energy out of nothing is a classic example of the terrible mistakes that are being spread by the media to the public without any critical verification or filtering by the media and with uncritical acceptance by the majority of the public. Even if atmospheric gases were able to backradiate as much as 50% of the radiation they receive, there is a macroscopic failure here as there is not enough energy to cause the claimed warming. In fact, it is simply not true, as heat is transmitted by the surface to the atmosphere following the temperature gradient and simply cannot move against the direction of this gradient.

In reality, IR radiation is an electromagnetic wave and, as such, its wave transmission mechanics are well described through a Poynting vector:

$$S = (E \times B)/\mu \quad (35)$$

where μ is the electromagnetic energy density and the modulus S the intensity or directional energy flux density as energy per unit area, W/m^2, and is the product of its electric field E and magnetic flux density B and whose direction is that of propagation [xxxii]

Now, even assuming that the proposed 120 W/m^2 of "backradiated" IR-waves are all able to reach Earth's surface (without undergoing, absorption interference, or diffraction along the way, typical for all types of electromagnetic), there will then be two wave flows crossing at the surface—an output of 240 W/m^2 and an input of 120 W/m^2—and to calculate the resulting heat flux, these two vectors cannot be added but must be subtracted. Thus, the balance of heat flow, according to the equation: [xxxiii]

$$\partial Q_{out}/\partial T - \partial Q_{in}/\partial T = \partial Q_{surface}/\partial T \quad (36)$$

would not be 240 + 120 = 360 W/m^2, but instead, would be 240 - 120 = 120 W/m^2, according to basic rules of vector calculus!

However odd this miscalculation is, the most absurd aspect of this serious conceptual error is that, if indeed 240 W/m^2 of outgoing energy were able to generate an additional 120 W/m^2 of "returned" energy, by simple "reflection," it would have created a perpetual motion of the 2nd kind (a perpetual motion machine based on the 2nd LoT). In fact, here, 240 W/m^2 would generate 360 W/m^2 of energy. In turn, however, the 360 W/m^2 of output would encounter greenhouse gases in the atmosphere and would in turn be 50% "backradiated," creating another 180 W/m^2 which adds to the earlier 360 W/m^2 to produce 540 W/m^2 from the initial 240 W/m^2—and with no external work!—and so on ... *ad infinitum*. Not only would the surface and atmosphere soon become searing hot, but this would have happened automatically long, long ago—it would be unavoidable, as CO2 is known to have been much higher than now on the distant past.

The best critique of the theory of "backradiation" has been that of radiochemist Alan Siddons, who proposed an example using lights and a mirror to demonstrate this "concept's" total lack of substance. [xxxiv]
http://hockeyschtick.blogspot.com/2010/06/why-conventional-greenhouse-theory.html

Here, Siddons proposes lighting a table with two equal beams of light such that the beams' brightly lit areas overlap to produce an even brighter area. Now, one of the light beams is turned off and replaced with a mirror which reflects the light reflected by the table from the first beam back to the first beam's bright area on the table. Instead of producing a bright area as in the first setup, nothing happens, and the beam's lighted area intensity remains the same as the one light alone. The trick is that the intensity of the reflected light is nowhere near as intense as the original incoming light beam and thus cannot pretend to be a second, equal light source. Also, remember that visible light and IR are both electromagnetic radiation, the former is simply in an energy range that is visible. This example demonstrates precisely why it is not possible to amplify the energy of a radiative source by simple self-reflection. With no external work on the system, additional energy cannot be realized, let alone be created from nothing!

If this misguided "science" were true, all the world's energy problems would be solved, because it would be sufficient to place a large transparent glass container filled with CO_2 over a house and thus have a new free, energy source, and plenty of it! The problem then would be how to control the overabundance of energy!

In addition to the above blatant violation of the 1st LoT, GHE theory also blatantly violates the 2nd LoT, which states that heat naturally moves from warmer to colder bodies and that all natural processes in a system move in the direction of increasing entropy.

This simply means that, in Earth's troposphere, where surface temperatures average 14.5–15°C and atmospheric gas temperatures are -18°C (= 255K), spontaneous or favorable heat exchange cannot transfer heat from the colder gas to the warmer surface. An important corollary arises from this directional limitation in heat transfer. The principle of increasing entropy, which states that randomness always must increase in a spontaneous process, describes the effect that a warmer body, with high microscopic kinetic energy or temperature, can transfer energy to a colder body, thus raising the colder body's microscopic randomness. But, if the warmer body loses randomness in the process, how is this, overall, a favorable event? It turns out that increasing the internal energy of a colder body by a change in temperature accomplishes a greater increase in entropy than an equal temperature decrease in the warmer body, thus making this a favorable process, with a net increase in entropy.

At the submicroscopic or atomic level, the inability of IR from the atmosphere to warm the surface can be described by the event of an IR ray hitting the warm surface. As the surface was the origin of the IR ray in the first place, the relevant energy levels in the surface are already full and clearly actively emitting IR. Thus, all the IR ray can do is resonate and be rejected upwards or fill an energy level just vacated by another departing IR ray—either outcome amounts to reflection—and the surface is not warmed.

Whenever two bodies in a thermodynamic system are in contact, as with Earth's surface and atmospheric gases, at different temperatures (T_s and T_g for surface and gases, respectively), any heat exchange must always occur so that the entropy change of the energy-receiving body is greater than that of the energy-donating body. Translating this into mathematical symbolism, for the definition of entropy,

$$\Delta S = \Delta Q/T, \text{ or in integral form } \Delta S = \int \mathrm{d}Q/T\,, \qquad (37)$$

with entropy S, heat Q, and temperature T, then, whenever atmospheric gases are gaining thermal energy (as seen in Section 3) from Earth's surface (soils + ocean), the heat exchange must cause an increase in the atmosphere's entropy with respect to entropy loss by the energy-transmitting Earth's surface. Thus,

$$\Delta Q/T_g > \Delta Q/T_s \qquad (38)$$

or the entropy gain of atmospheric gases must always be greater than the entropy loss of Earth's surface. But, this also necessarily means that in the inequality above, with the heat exchanged Q being equal on both sides, it shall be that

$$T_s > T_g \qquad (39)$$

or that the heat transfer will take place only if surface temperatures are greater than the atmosphere. And this is precisely what occurs experimentally. In fact, if the average surface thermal energy of 237 W/m^2 is considered corresponding to an energy movement ΔQ of 237 J/sec, for an average temperature of T_s of 14.5°C (287.6K) and an average temperature T_g at -18°C (255.1K), then there is

$$\Delta Q/T_g > \Delta Q/T_s \text{ (entropy gases > entropy surface)} \qquad (40)$$

and introducing these values, produces

$$237/255.1 > 237/287.6, \text{ which becomes } 0.92 > 0.82, \qquad (41)$$

thus confirming the experimental observation that, as the result of the 2nd LoT, the entropy change of atmospheric gases is greater than that of the Earth's surface and, therefore, it is the surface which transmits heat to the gases and not the contrary.

11. The impossible "yield" of the greenhouse gas thermodynamic cycle

Among the various absurdities that GHE hypothesis implies, there is one connected to the 2nd LoT that is flagrant and gross. It appears to have strangely escaped notice by physicists and scientists who have recklessly supported GHE and also escaped detection by GHE's many critics. It is clearly absurd to maintain that Earth's surface emits thermal energy (Q) as IR radiation to the atmosphere that is then "backradiated" at a certain percentage (say 50%) by greenhouse gases, such that the surface energy would be increased by the same percentage, thereby increasing surface temperatures. Although it superficially seems plausible, in practice, this claim would be tantamount to saying that greenhouse gases produce a thermodynamic cycle efficiency exceeding 100%, a phenomenon that obviously has never been observed in nature let alone in any man-made machine. 100% efficiency can only be attained with a cold body at a temperature of absolute zero serving as the heat sink for an engine—absolute zero is unattainable—and such conditions clearly do not occur on Earth. An efficiency greater than 100% beggars the imagination and does not even qualify as good science fiction.

The thermodynamic efficiency η of any engine thermodynamic cycle, in which an engine uses two regions at different temperatures, a heat reservoir Q_1 and a heat sink Q_2, describes the conversion of heat received from Q_1 to work by the following equation:

$$\eta = (|Q_1| - |Q_2|)/|Q_1| \qquad (42)$$

only considering the absolute values of the source temperatures because it would not be possible to have a negative yield for a cycle. This also means that the performance of any engine or thermodynamic process will always be <1 and will never reach 100%, due to the 2nd LoT.

No machine, man-made insulating material, or entity existing in nature can ever produce a thermodynamic exchange that does not dissipate at least a small portion of thermal energy as heat. A system that absorbs heat energy without yielding any to the outside, would happen if, in the expression above, the cold body Q_2 had a temperature of absolute 0K (-273.15°C). As an absolute zero temperature in nature is clearly impossible; it is unreachable, as described by Nernst in the 3rd LoT. Advanced superconducting materials, cooled to very low temperatures by helium or liquid nitrogen, still lose energy, and the most powerful and modern electrical transformers allow efficiencies or yields of around 99.85%, but never 100%.[xxxv]
http://www.enelgreenpower.com/it-IT/events_news/technologies/release.aspx?iddoc=1641626

In nature, of course, efficiencies can be high, as in the energy cycles of stars and even for K-H type planets described earlier, such that the energy dissipation at each atmospheric heating cycle is very low and the efficiency is around 99.9999%.

Now, returning to greenhouse gases and their thermodynamic efficiency, it is quite clear that, if Earth's surface emits 240 W/m^2 thermal energy in the form of IR radiation to the atmosphere (neglecting energy transfer by conduction/convection) and if gas molecules could really "send back" so much energy intensity (120 W/m^2 or 50% of output), the efficiency η of the cycle of atmospheric gases would still be only 50% because: 240 - 120/240 = 0.50. As discussed earlier, the outward and returning IR fluxes are in opposite directions and must be subtracted not added.

The absurd result propounded by the GHE hypothesis which claims that atmospheric greenhouse gases, by gaining 240 W/m^2 from the surface and backradiating 120 W/m^2 to the ground, grow the energy at the surface to 360 W/m^2 (by adding the fluxes) and increase temperatures is clearly unacceptable. This is equivalent to inventing an impossible efficiency of 150% (!), with an obviously absurd additional of the residual (120 W/m^2) energy. This basic error is so blatant that it almost does not deserve comment, as the efficiency of a thermodynamic cycle, in fact, is always to be calculated by *subtracting* the energy dissipated to the cooler body outside as $(Q_1 - Q_{2\ \mathrm{out}})/Q_1$, not by *adding* the energy lost and therefore *not* $(Q_1 + Q_{2\ \mathrm{in}})/Q_1$. In other words, here the same considerations, involving *subtraction* rather than *addition* can be applied to the electromagnetic flows in opposite directions, discussed in Section 10 above.

Advocates of GHE theory, thus also violate the most basic laws and rules for calculations in physics and thermodynamics, and they dare to call a "denier" anybody who remarks on this! Name-calling or labeling is one of the hallmarks of one who is losing an argument.

12. The erroneous theory of "backradiation" and CO_2 emissivity

As already seen in Section 2 and based on precise calculations, why it is physically impossible for atmospheric gases to possess enough energy to heat the soil and water, but instead the latter are, if anything, only able to heat the atmosphere?

There are people who claim that "backradiation" is a real and experimentally demonstrable phenomenon. They cite night measurements of the sky with pyrgeometers, which measure IR radiation, that report a "backradiation" averaged at about 300 W/m^2. It is a pity, however, that this claim has no scientific consistency and that what these pyrgeometers actually measure is everything but the IR radiation emitted by atmospheric gases at night. It is not possible for terrestrial atmospheric gases in natural conditions to "backradiate" IR radiation at the magnitude of 300–320 W/m^2, as can demonstrated by a simple calculation.

The error, here, stems from the fact that these pyrgeometers are calibrated with a "blackbody" emissivity equal to 1, which is the emissivity of bodies, such as the Sun, emitting and absorbing the entire electromagnetic spectrum. However, atmospheric gases are not "black bodies," but only gray bodies, with very low emissivity. CO_2's emissivity, for example, is only 0.002, as has been shown experimentally for many decades by many high level specialists, including Prof. Hoyt C. Hottel of MIT (for decades the world's leading authority in the field of experimental measurements of the properties of gases, flammable materials, and explosives) [xxxvi] as well as Leckner, Modest, Pitt, Sissom, and others. [xxxvii]

A gas such as CO_2, whose emissivity is only 0.002, does not heat but rather cools itself, as it absorbs and emits very little energy, only two thousandths of the radiant energy it receives. In fact, CO_2 is used industrially as a refrigerant (have you ever wondered why extinguisher cylinders contain CO_2 foam?). To be able to emit up to 324 W/m^2 of radiant energy, according to the modified Stefan-Boltzmann equation ($324 = 5.67^{-8} \times 0.002 \times T^4$), this gas would have to be at 1300K, or 1027°C! And this, please note, is imaginatively assuming a 100% CO_2 atmosphere! And, with reference to the emissivity of the air, as clearly explained also by Prof. Nasif Nahle in his recent paper: "Observations on "Backradiation" during Nightime and Daytime"[xxxviii], since "the observed (measured) total emission of air is 0.2" (Nahle), then according to the SB equation, a "backradiation" of 324 W/m^2 emitted by the air with 0.2 emissivity would require an air temperature of 411K (138°C)! Thus, it is impossible for atmospheric gases to emit at night a "backradiation" of 320 W/m^2, and there is no need to resort to pyrgeometers and imaginative diagrams as those well-known products by Kiel and Trenberth.

So, what is the 300–320 W/m^2 of IR radiation that is being measured at night?

The answer is simple. Pyrgeometers very likely measure either thermal energy from the thermocouple voltage battery unit, as has been stipulated by the IR radiation expert Mikael Chronholm, [xxxix] http://wattsupwiththat.com/2011/02/13/a-conversation-with-an-infrared-radiation-expert/ or diffuse thermal energy radiating from nearby sources, such as buildings, lighting, or automobiles. The fault lies not with the pyrgeometers, of course, but with those who wrongly apply the instruments, having little or no understanding that a gaseous atmosphere simply cannot emit so much radiant energy, particularly at night when solar input has ceased, unless it is being heated to the high temperatures discussed above.

The theory of "backradiation," in its wrongness, has led many people to imagine atmospheric gases as a sort of "plexiglass wall" which reject or reflect IR radiation from the sky to the ground like tennis balls. The real world is nothing like that. When IR radiation encounters gaseous molecules in the atmosphere, only a tiny part is absorbed by the molecules, with most radiation passing through without any problem, going unabated to space. In the case of CO_2, only 0.2–0.3% of IR radiation is absorbed, with 99.7–99.8% continuing to space.

The only difference in the current situation compared to the real atmosphere occurs when there is a high percentage of moisture in the air, which decreases the air's density as well as its thermal conductivity (k, ranging from 0.018–0.024 for moist air compared to 0.026 of dry air at ambient temperature) while the molar heat capacity (C_v) increases. [xl]
http://www.electronics-cooling.com/2003/11/the-thermal-conductivity-of-moist-air/

This means that, for heat fluxes coming from Earth's surface, heat energy (*Q*) will take a longer time in humid air to leave the atmosphere than in dry air and, therefore, heat will be "held" longer. However, this has nothing to do with the chimerical "backradiation," but only with the thermophysical and conductive properties of moist and dry air. It must be constantly repeated that the temperature of the air is a measure of the average microscopic kinetic energy of the air, or heat energy, and that IR radiation is not heat energy. IR radiation is not sensible heat energy although it is sensed as heat by an IR receiver, such as our skin. IR radiation, rather, is indicative of the temperature of the source of the IR and not the temperature where the IR is detected, which, as mentioned above, might be the problem with pyrgeometer measurements.

Gas molecules in the atmosphere in the path of heat fluxes can be compared to piers in the middle of a river, the piers representing the gases' absorption spectra, around which the water will go without problem. The piers do not block the water, but only slightly decrease its speed.

The misconception of "backradiation" derives also from a theoretical consideration, which is indeed valid but only for single molecules, taken in isolation. This is the concept that a molecule radiates as an isotropic material, a material with characteristics not depending on spatial orientation, such as fluids or noncrystalline solids as in soils, that is able to radiate in all directions, as it possesses vibrorotational as well as translational energy, and thus can radiate in the opposite direction to that of the incident or incoming radiation. Such isolation of individual molecules is not common, except in the thin, rarefied upper atmosphere. On Earth, large masses of isotropic materials are in close contact with other molecules. In reality, molecules of fluids and isotropic solids transmit their thermal energy almost exclusively in the direction of the gradient, namely of the heat flow.

“In such materials, there are two fates for electromagnetic energy (EM radiation) when encountering molecules. (1) If the radiation's energy exactly matches one of the molecule's empty electron energy levels, it is absorbed as an electron jumps to a higher energy level. The excited electron then drops almost immediately back to the ground state and the energy radiated in a random direction. It is only during the short energized instant that the energy might be distributed as heat by collisions with another molecule. (2) For EM radiation that does not match any energy level, it is transmitted through the material encountering many molecules along the way. The EM energy simply resonates, or rings the bell, of the electron clouds and is immediately radiated as EM radiation in all directions. However, in a sufficiently dense gas, such as the troposphere, there are always nearby molecules emitting EM radiation exactly 180° out of phase, such that all electromagnetic waves are cancelled by destructive interference except in the forward direction. This is how sunlight travels through the atmosphere and produces well defined shadows, and why our vision is so reliable.

However, in the very thin upper atmosphere where molecules are farther apart, the destructive interference with EM radiation emission is not total, resulting in Raleigh scattering and our blue sky (light, scattered in all directions, is pretty much totally absorbed by water vapor, except for blue). This thin air is the only place where the GHE supporters' claim, that very low concentrations of greenhouse gases reflect enormous amounts of IR radiation back to the surface, can occur. They not only are wrong regarding these gases’ ability to "backradiate," but they even neglect the required thinness of the gases, to have Raleigh scattering, and of course, that only one sixth of the energy emitted is downward and the rest horizontal or outward. Their model keeps getting thinner and weaker!

Thus a molecule of atmospheric gas, excited by an IR flux, normally will propagate very little energy, if any, in the direction opposite to the radiation flux, with almost all such energy released in the direction of the flux. "Backradiation," after all, is only a false, pseudoscientific concept, contradicted by all established laws of physics and experimental observations.” (Sabin Colton 2012)

13. CO_2 and its influence in "global warming"

The absurd demonization of CO_2, as the alleged gas most responsible for the increase in global temperatures, has been a media-cultural phenomena and pseudoscientific paradox, being completely irrational and obscurantist, for the past 30 years. Obscurantism is the practice of purposely obstructing the dissemination of the facts or full details of some matter. Thus, once again it is essential to analyze the main physical and thermodynamic data concerning CO_2 to understand all the inconsistencies and inaccuracies of this ridiculous campaign.

Far from being a pollutant or "dangerous" gas, CO_2 is essential to life on Earth planet. There have been prehistoric times during which atmospheric CO_2 concentrations were at least 20 times higher than at present. These high concentrations did not disturb or threaten the lives of plants and animals because CO_2 facilitates chlorophyll-based processes and thus oxygen production by photosynthetic organisms, and needless to say, oxygen is vitally necessary for respiration and metabolism of all plants and animals, including humans. We should not forget that plants respire at night. Furthermore, plants utilize CO_2 to form sugars, proteins, and lipids, as the basis of the food chain.

CO_2 concentration in the atmosphere today is only ~390 ppm (parts per million), i.e., 0.0390%, compared with 78% nitrogen and 21% oxygen, and it is not by chance that carbon dioxide is called "trace gas" for its very low concentration. One's first reaction to the claim that a trace gas drives the Earth's climate should be one of serious doubt. Few people realize that humans can work and live at CO_2 concentrations much higher than now, with office buildings typically operating at 5000 ppm CO_2, submarines at 8000 ppm, and rock concerts above 12,000 ppm.

GHE supporters like to claim that CO_2 has been historically low, about 260–280 ppm, until the Industrial Revolution and that only recently have human activities raised CO2 to current concentrations. It is important to note that plants cease to grow at about 200 ppm CO_2 and start to die at <190 ppm. A big concern, without entering into a discussion of the history of CO_2 concentrations, should be why CO_2 concentrations in the recent past were so dangerously close to shutting down much of Earth's photosynthetic activity. Increasing CO_2 concentrations should bring a feeling of relief!

In a cubic meter of air, weighing 1.29 kg, equivalent to 40 moles of gases, there is just 0.015 mole of CO_2, representing only 0.6 grams CO_2 per m^3 of air. Thus, CO_2 is only 1/2150th of the mass of the air. This is a very minor component in the atmosphere no matter how it is viewed.

From a chemical thermodynamics standpoint and considering the electron energy levels available for absorbing energy, CO_2 has an absorption spectrum of the IR spectrum that is only 8% of the spectrum, around 5.46 and 23.45 microns (μm). Usually, in air, only the central IR spectrum, around 15 μm, is saturated. In contrast, water has a much more broad absorption spectrum, almost triple CO_2's coverage of the IR spectrum and thus has three times the capacity to absorb IR energy. In the vast majority of such absorptions of IR radiation, the EM energy is re-emitted almost immediately, causing no change in the gas's temperature as no energy was converted to thermal energy.

Furthermore, as has been experimentally demonstrated, the emissivity (essentially the ability to convert EM energy to thermal or vice versa) of CO_2 is very low, at only 0.002, and therefore its ability to emit thermal energy, decreases with its increasing atmospheric concentration by a logarithmic function, according to Beer's Law (also called the Beer-Lambert Law). At present, Beer's Law indicates that CO_2's ability to warm the atmosphere is already over 90% spent. In addition, doubling CO_2, in essence, would mean that its effects, in terms of heating, instead of occurring in a 10 m deep space, would occur in 5 m because CO_2 tends to load near the Earth's surface as it is heavier than air.

Therefore, increasing the production of CO_2, even by man, has almost no influence on global temperature or warming. It depends, as already discussed, only on the variable inputs of solar energy and the water cycle and not on atmospheric gases. And as CO_2 produced by man is only 3% or less of that produced by the entire biosphere (plants, animals, and vegetable oceanic organisms)[xli], the "calorific value" of man's CO_2 is clearly irrelevant.

If CO_2 is only 0.039% of the total atmospheric gases and can only absorb a maximum of 8% of outgoing IR radiation, its contribution to "theoretical" global warming is only 0.00039×0.08 = 3/100,000ths of all terrestrial gases. This effect can be completely ignored in any real discussion of the energy budget. This is just a theoretical contribution, because emitted radiation is more important than absorbed radiation and, as discussed above, accounts for only 0.2%, an effect that also decreases with increasing CO_2 concentration.

And, if it is considered that human activities emit only 3% of all CO_2 emitted by the Earth's biological system, the human contribution to the theoretical "warming" would be only $0.00039 \times 0.08 \times 0.03 = 0.0001\%$, one millionth of the total! Then, for each °C of temperature increase, only 1/1,000,000th is the theoretical contribution by human CO_2 emissions. GHE supporters claim that water vapor acts as a positive feedback amplifier of the slight warming effects of CO_2 in the atmosphere, but it is absurd to believe that a tiny increase in temperature caused by a trace gas can effectively enslave another gas to augment its effect. As has been discussed earlier, water vapor, as part of the water cycle, carries energy away from the surface and thus serves as a negative feedback factor, as a warmer atmosphere would only increase evaporation and convection processes.

The above figures and the assumptions of GHE supporters deal with "static" conditions and do not take into account the fact that the atmosphere is not a closed, stationary, gaseous system. Instead, it moves constantly, such that, along with the negligible theoretical "static" contribution of CO_2 to the warming, it is extremely important to consider the dissipative thermodynamic processes within the atmosphere due to the convective motions of air masses, winds and other weather disturbances (such as cyclonic formations) and the heat removed from the atmosphere by the water cycle's evaporation, condensation, precipitation, ice, and snow and the high albedo of clouds.

Rendering the claimed threat of CO_2 "warming" of the climate even more invalid, it should be noted that, while an increase in CO_2 has an infinitesimal theoretical "heating" effect, it also has a contrary "cooling" effect, such that the contribution of CO_2 to increases in temperatures, measured at about 0.6°C over the last century, can be estimated as unconditionally negligible. Of course, when there is no solar input at night, CO_2 and water vapor can serve as active thermal to IR energy converters and aid in cooling the atmosphere itself. One need only note, on a sunny day with occasional clouds, how quickly the moving shadow of a cloud creates a local breeze. The air in shadow sheds energy so quickly as IR radiation, it creates a breeze due to the resulting air contraction and differences in local air pressures.

In the rarefied atmosphere of a planet such as Earth, solar energy produces changes in global temperatures of soils and oceans, not atmospheric gases, which are simple passive conductors with low heat capacity. And, it must not be forgotten that the main "greenhouse gas," on which man has no possible influence, is water vapor, which forms through the evaporation of the oceans, waters, and soil moisture, and is available in the atmosphere in quantities 20 times higher than CO_2 and with a calorific value three times larger than CO_2.

Hence, every effort or "battle" claiming to control the temperature and Earth's climate by reducing man-made CO_2 emissions can be considered completely useless and absurd, representing a totally wasteful use of time and resources, not even considering the enormous poverty and ecological and economic disruptions these misguided, even fraudulently derived efforts would cause.

14. Calculation of CO_2's "contribution" to global warming according to the hydrostatic equations. If the present CO_2 increased tenfold?

“Projecting the 'global warming' effects of doubling the concentration of atmospheric CO_2 is a favorite exercise of GHE supporters. The predicted warming is then assumed to be a real target to avoid. Thus, it is important to begin with consideration of the realistic possibility of human activities accomplishing such a doubling of CO_2. This question is rarely, if ever, considered by GHE proponents.

First. the solubility of CO_2 in water must be addressed regarding how this gas distributes between the air and water. CO_2 partitions at a ratio of 50 to 1 between water and air. This means that doubling CO_2 in the atmosphere does not just mean adding an amount of CO_2 equal to that in the air, but it means adding 51 times the CO_2 in the air, as 50 parts out of 51 will partition (dissolve) into the water. In the real world, CO_2's partitioning into the planet's waters may very well be much higher as organisms utilize dissolved CO_2 and the roughly pH 8 complex buffer in sea water will convert much of the carbonic acid, formed by CO_2 and water, into bicarbonate, carbonate, and even calcium carbonate in warm waters.

Taking into account the ameliorating effects of CO_2's solubility in water and the carbon fuels available for human use, release of all such carbon as CO_2 is estimated to be only capable of raising CO_2 by 20%. In light of man's small contribution, as discussed earlier, to the planet's CO_2 budget and its waters, it is unlikely that man has any measurable influence on atmospheric CO_2.” (Sabin Colton 2012) [for an in depth discussion, see Tom V. Segalstadt's paper at http://folk.uio.no/tomvs/esef/ESEFVO1.pdf]

On the other hand, it appears that the world's oceans are most likely in strong control of atmospheric CO_2. As the solubility of gases in water is subject to Henry's Law, such that its solubility in liquids is inversely related to temperature and solubility decreases as temperature increases, it is the temperature of the oceans that has the greatest ability to control atmospheric CO_2. A case in point is that, while human CO_2 emissions have been rising in an accelerating fashion in the last decade, atmospheric CO_2 has been rising in a perfectly linear fashion, apparently unaffected by human emissions.

That said, the results obtained above regarding CO_2 and its poor ability to cause warming of the climate, namely the evidence that the real "contribution" of the much-reviled man-made CO_2 to the warming of the atmosphere should be reduced to millionths of a degree, is also confirmed by analysis of the impact of CO_2 and the effects of changes in its global quantity on the temperature of the atmosphere, according to the equations of hydrostatics and thermodynamics.

As will be shown shortly, this approach also confirms conclusions reported by astrophysicists Miskolczi and Postma (see above, pag. 12), in which they state that, in order to hypothetically increase the temperature of a very large gas reservoir in hydrostatic equilibrium, as in the Earth's atmosphere, it would be required to significantly increase the reservoir's density, as is the case with the huge atmospheric masses of planets such as Venus, Jupiter, and Saturn, or by introducing new external energy inputs, as in variations of solar energy.

Thus, either solar activity increases or atmospheric density increases in order to increase climate temperatures. However, as it is impossible to increase the density of a rarefied atmosphere of a planet such as Earth, it is impossible that small percentage changes in the mass of a gas component, such as CO_2, could affect temperature more than insignificantly. In other words, alterations in atmospheric density are not an alternative explanation for climate temperature changes. This contention can be mathematically demonstrated quite clearly.

As shown above, CO_2 is only 1/2150th of the mass of Earth's atmosphere, with a mass of 0.000614 kg/m^3 out of 1.293 kg (density of air at 0°C and sea level). So, what would happen to terrestrial temperatures, if hypothetically CO_2 should become ten times the mass of the present? In this case, CO_2's mass would increase to 0.00614 kg/m^3, or 1/210 of air mass. Now, turning to hydrostatics and introducing the well-known Stevin-Pascal equation:

$$P = \rho g h \qquad (43)$$

which, for a fluid, such as air, in hydrostatic equilibrium within a container, states the direct relationship between pressure P of a fluid column at a depth h below the fluid's surface, the acceleration due to gravity g (9.8 m/s^2), and density ρ. And then, rewriting equation 43. in differential form, while also considering that the actual air density decreases with altitude ($-\rho$), produces the well-known equation for hydrostatic equilibrium, as already seen in Section 6,

$$\mathrm{d}P = -\rho g \times \mathrm{d}z \qquad (44)$$

Now, considering the Ideal Gas Law, $PV = nRT$, substitution of the volume V of a gas as simply $V = m/\rho$ (mass/density), which can be replaced in state equation above, becomes

$$Pm/\rho = nRT, \text{ yielding the density: } \rho = Pm/nRT \qquad (45)$$

which, when substituted in differential equation 44. becomes

$$\mathrm{d}P = -\,Pm/nRT \times g \times \mathrm{d}z, \text{ that is: } \mathrm{d}P/P = -mg/nRT \times \mathrm{d}z\ , \qquad (46)$$

whose solution can easily be found by integrating as follows:

$$\int \mathrm{d}P/P = -mg/nRT \times \int \mathrm{d}z \qquad (47)$$

From this, and for any values connecting each $P°$ pressure to any $z°$ height, there is the well-known barometric equation which links changes in atmospheric height to changes in pressure,

$$\ln(P/P°) = -mg/nRT(z - z°) \quad (48)$$

Hence, to calculate the P at the ground, there is

$$P/P° = e\text{^}[-mg(z - z°)/nRT] \quad (49)$$

which becomes

$$P = P° \times e\text{^}[-mg(z - z°)/nRT] \quad (50)$$

Now, as far as air is concerned, it is experimentally known that, whenever an air column 10 m high has an air pressure ($P°$) at the top equal to 1033 millibars (mb), the P at the base, at altitude 0, is 1,034.29 mb.

Returning to the hypothesis under consideration, the question asks what would happen to temperatures up to 10 m altitude if the CO2 concentration were increased tenfold. The answer needs to take into account that CO_2 is heavier than air, with a molar mass of 44 g/mol, compared to the average 28.8 g/mol of air, and tends to remain at low altitudes. If the CO_2 mass (m) at the column base would grow to 1/210 of the air mass as a result of a tenfold increase of CO_2 content (however extreme and unrealistic this might be), the air density would increase from 1293 g/m^3 (M) to 1299.1 g/m^3 (M', 1293[1 +1/210]).

In this case, according to the Stevin-Pascal equation of pressures , integrated with the Laplace equation (i.e.: $P = P° \times e\text{^}[-ah]$), and calculating an infinitesimal variation of pressure on the ground, for a unit height (dz = 1 cm) in a 1000 cm column, there is:

$$P' = P \times e\text{^}[-m'g(z - z°)/nRT] \quad (51)$$

Introducing values to this equation produces

$$P' = 1034.29 \text{ mb} \times 2.718\text{^}[(-1.2991 \times 10^{-3} \text{ g/cm}^3 \times 980 \text{ cm/s}^2 \times -1 \text{ cm})/(8.2 \times 273.\ 1\text{K})]$$

$$\rightarrow P' = 1034.29 \times 1.00056 = 1034.87 \text{ (mb)} \quad (52)$$

At this point, going to the calculus of temperature T variation throughout the 10 m column, a problem arises, as the above function, $\ln(P/P°) = - mg/nRT \times (z - z°)$, is a composite function, f($P°$)f(T), that is variable in terms of another function f(T) of temperature. As such, being composed of non-commutative functions, one cannot extrapolate back to the same value for the initial temperature (273.1K = 0°C) by extrapolating from f(P), because

$$f(T°)f(P) \neq f(P°)f(T) \quad (53)$$

Therefore, it is not possible to obtain the air temperature of 273K at the base of the column, using initial equation

$$\ln(P/P°) = -mg/nRT(z - z°) \text{ and extrapolating to: } T = -mg(z - z°)/\ln(P/P°)$$

because the value of T in the latter equation does not coincide with that in the T-initial ($T°$) function.

But, that does not mean it is not possible to calculate the magnitude of the percentage change in temperature variation as a function of the mass of the air column due to CO_2 increase. According to the above equation, with the necessary caveat that the value T, being different from that of departure, must be written differently, for example, with T_v (virtual temperature), this produces:

$$T_v = - mg(z - z°)/\ln(P/P°)R \quad (54)$$

And, to calculate the temperature change by an m equal to 0.001293 g/cm^3, considering pressure as a constant and T_v and m as independent variables, based on equation above (Note that, as there are no exact differentials tending to zero [in which case the derivative of the variable m would be 1], it is a bit improper to speak of derivatives and partial derivatives. However, the concept remains valid, even with simple substitutions of numerical values):

$$(\partial T_v/\partial m) = P\ (P, P° = \text{constants}) \text{ produces a new temperature variation } (T_v')$$

$$(\partial T_v'/\partial m') = P'\ (P, P° = \text{constant}), \text{ introducing values for normal and } 10\times CO_2 \text{ air yields:}$$

$$(\partial T_v/\partial m) \rightarrow (-0.001293 \times 980 \times -1000)/(0.012 \times 8.2) = 128{,}770$$

$$(\partial T_v'/\partial m') \rightarrow (-0.0012991 \times 980 \times -1000)/(0.012 \times 8.2) = 129{,}381 \quad (55)$$

Next, to calculate the percentage that temperature has risen with this CO_2 enrichment, it is sufficient to compare these results:

$$(\partial T_v/\partial m)/(\partial T_v'/\partial m') = 128{,}770/129{,}381 = 0.995 \text{ or } 99.5\% \quad (56)$$

That is a variation of only five 1/1000^{ths} (or 0.5%) of the initial temperatures! Thus, in the tenfold CO_2 enrichment case above, temperatures will change from 0°C (273.1K) to 1.36°C and, considering average terrestrial temperatures, will rise from 14.5°C (287.6K) to 15.9°C on average, a rather negligible increase considering the magnitude of the hypothetical CO_2 change.

It is very interesting to note that the result above, in which an imagined tenfold CO_2 increase in the atmosphere creates a 0.5% increase in average temperatures, is in full accordance with the calculus performed by Heinz Hug in 1998, in his laboratory spectroscopic measurement of IR absorption with CO_2 doubling (see above [9]). According to Hug's calculations on the slope integrals near the spectroscopic 15-µm CO_2 band with CO_2 doubling, temperatures would rise just 0.17%.

Hug's results are quite similar to the above quantitative effect on temperatures from a tenfold increase leading to a temperature increase of 1.36ºC. As a tenfold increase is effectively close to three doublings, Hug's reported "doubling" sensitivity on Earth's temperatures for CO_2 of around 0.3–0.5°C suggests that three doublings might produce a temperature rise of 0.9–1.5ºC. The most important and noteworthy conclusion in Hug's work, which the above calculations confirm, was that the alleged "radiative forcing" as reported by the IPCC should be reduced by a factor as large as 80 (!), essentially stating that the IPCC's figures were totally wrong. And, it should not be overlooked that the mathematical/physical and spectroscopic models discussed here are only examining the "warming" hypothesis of "still" or stationary atmosphere, in the absence of the convective, dissipative, as with winds, and cooling, as with the water cycle, processes that occur in a real atmosphere.

In reality, atmospheric CO_2 has been increasing for about 60 years at an average of only 1.5–2 ppm per year, amounting to a 0.0002% increased proportion in the atmosphere per annum. A very high increase in atmospheric CO_2 could only happen from a massive release from the oceans, whose CO_2 content and contributions are far greater than any other factors in Earth's global CO_2 storage and emissions. But, such a huge increase could only occur if ocean temperatures rose significantly, releasing large quantities of CO_2 into the atmosphere along with higher water evaporation.

Higher ocean temperatures would lead to a rise in cloud cover that would trigger a "feedback" cooling process, as increased cloud cover would block incoming solar radiation and increased rainfall would deliver cool water to the surface and together lead to decreased temperatures. In fact, the water cycle of evaporation, convection of warm, humid air to altitude, cooling by adiabatic expansion, condensation releasing latent heat at altitude, and the return of cool water back to the surface as rain or snow can be legitimately described as a massive heat engine. Convection and the upward transport of water vapor to altitude are generally credited with 60–63% of the energy transfer from the surface to altitude.[1] This could easily be higher, at as much as 85%, over the tropical and subtropical oceans (from 50ºN to 50ºS latitude) whose albedo is 8–13% [xlii] as incoming solar energy is absorbed into high heat capacity water, mostly below the surface, such that radiant emissions are greatly decreased. As mentioned above, increased ocean temperatures would increase evaporation and, in terms of a heat engine, more evaporation would serve to ramp up the activity of the heat engine, providing a major negative feedback effect against warming trends. This overall effect can be attributed with keeping Earth's temperatures so relatively steady over time, barring the effects of solar input changes, ocean cycles, and other external factors.

The concurrent response by the water cycle to changes in global temperatures is why it is quite "academic" to worry about the growth, although remarkable, of CO_2 in the atmosphere, as its increase is largely controlled by the oceans, and it is clearly plant food and not a pollutant. It is, of course, responsible and important to be concerned about increases in real industrial pollutant gases, such as phenols, benzenes, and sulfur compounds.

In summary, as observed by Pitt and Sissom (see: Heat Transfer, 1997), it is correct to conclude from analysis of the insignificant consequences of an atmospheric CO_2 doubling that even an "academic" hypothetical tenfold increase in CO_2 content would have no appreciable impact on Earth's temperatures.

15. The melting of Arctic ice and glaciers and atmospheric CO_2

In light of the particularly deplorable misinformation and fearmongering "catastrophic" propaganda concerning the Arctic polar ice and glaciers, it was considered worthwhile to devote a separate section to this issue. The misinformation includes the claim that the trends of changes in polar ice coverage at the North Pole in recent decades are outright "proof" of the alleged link between the growth of CO_2 and "greenhouse" gases in the atmosphere and AGW.

In this regard, it is important to immediately define some basic concepts and information. First, it is certainly true that satellite measurements of Arctic ice area, since the advent of satellite observations in 1979, have shown a marked declining trend in ice extent over the long term. However, it is often ignored that satellite observations began during the minimum of the last cold spell of our roughly 60 year climate cycle. It is thus no surprise that ice extent has tended to decline since measurements began. In the meantime, the Arctic ice extent appears to have reached a minimum in 2007 and since then has been increasing in area as well as thickness.

It should be noted that satellite measurements only report ice-covered areas and not ice thickness. Any given year, depending on the weather, floating ice can be driven by the prevailing winds into a smaller area, and reported as such, while the total ice volume might be constant or even increased. Also, in the same time frame, it is equally true that Antarctic ice has not only not experienced any "withdrawal" and has become larger, such that Earth's total polar ice has been rather constant or even slightly increasing during this period. This is an important point as GHE supporters claim that the polar regions must be the fastest warming regions during global warming.

The physical and climatic conditions of the Arctic and Antarctic are very different. The Arctic is part of the Northern hemisphere, which is notoriously a bit warmer than the Southern hemisphere, with its smaller oceanic and larger land areas, at about 15.2°C compared with 13.4°C in the Southern hemisphere, with its much larger proportion of ocean. Moreover, while ice in Antarctica resides mostly on land, except for coastal areas, Arctic ice is almost all floating in seawater. Therefore, it can definitely be established that the reason for Arctic ice melting is due to a rise of ocean temperatures in recent decades and not to an increase in atmospheric temperatures over the 20th century (the increase estimated at about 0.6°C).

"From a physical point of view, warming and ice melting by solar input is vastly over-estimated by GHE supporters, as they tend to exaggerate solar input and albedo effects. At the height of the Arctic summer, the low angle of solar input decreases the normal W/m^2 to 17% of normal. Furthermore, solar radiation must take a much longer path through the atmosphere, reducing its power also to about 17% of normal. The result is that a square meter of Arctic area only receives about 3% of what is considered normal solar input.

It is difficult to imagine this meager energy input causing much in the way of melting, particularly as the low angle also allows quite a bit of reflected light, which cannot contribute to melting. Open water also is little warmed by this small input, as any slight warming would be quickly lost or compensated for by evaporative cooling. In addition, it should be noted that this discussion is about the peak of the Arctic summer. During the rest of the year, solar input is less and for six months of that it is essentially zero. Alarmist claims that the Arctic waters could soon be tropical are wantonly unrealistic.

So, what melts the Arctic ice each summer? Warm water and warm air. Warm water can be pumped into the Arctic Basin by either weather or other natural processes, such as the North Atlantic Oscillation (NAO) which can pump large masses of warm water northward. Warm air masses can also move northward as cold air masses move south toward the equator. Although the alarmists take the presence of warm air in the Arctic as evidence of global warming, it is no surprise to others that a cold, dense air mass moving southward is replaced by a less dense warmer air mass, effectively sucked northward. It is also easy to overlook that the replacement "warm" air mass is usually still quite cold and not causing any melting; "warm" is relative to the average temperature, such that -10ºC is warm relative to -15ºC.

A case in point can be made of the 2007 "record" low Arctic ice area (remember satellite records only go back to 1979). That particular summer the NAO pumped a large warm water mass into the Arctic Basin where it efficiently melted the ice, as warm water "floats" and thus floated under the ice, facilitating melting. To make matters appear worse, the winds at the same time drove large quantities of sea ice out of the Arctic region where it melted in warmer waters—this ice melted elsewhere and was not melted by "warm" Arctic conditions. The result in 2007 was a perfect storm of melting, which provided the alarmists with data for confidently predicting the demise of future Arctic ice. In reality, since 2007 the Arctic ice extent has been increasing and the ice volume has nearly tripled, contrary to alarmist predictions." (Sabin Colton 2012)

As has been repeatedly clarified in earlier sections, it is utterly impossible for atmospheric gases to warm Earth's surface and, in particular, ocean waters. It can be concluded that there is no link between the rise in sea temperatures in the Northern hemisphere and atmospheric CO_2, as several authoritative studies have also recently confirmed.[xliii] Rather, the true cause of the melting of Arctic ice is the movement of warm water and air masses, submarine geothermal activity (some of which was reported in 2007), and slightly by changes in solar input.

This issue also offers the opportunity to clarify another important topic, glaciology science, and what it tells us regarding Earth's ice component. The ice ages are periods of 10s to 100s of millions of years, beginning 2.4 billion years ago that feature alternating glacial ice advances followed by retreats that tend to recur at intervals of about 100,000 years. Although the causal factors are not well understood, Earth appears to be in the fourth ice age, the Pliocene-Quaternary glaciation. It is the prevailing hypothesis among scholars that an interpretation of glaciology relating to the so-called "Milankovitch cycles", or variations in the Earth's axis, orbital eccentricity, and vernal point, might cause ice ages with a certain irregularity, although the frequency of the phenomenon has not been well explained. Recent research by Henrik Svensmark into the influence of the cosmic wind on upper tropospheric cloud formation suggests that the solar system's vertical oscillations above, through, and below the galactic plane may be a major factor in ice age occurrence and duration, with the cosmic wind variation dependent on the local galactic supernova occurrence. [xliv]

A very interesting phenomena that has been linked to ice ages are "pluvials," being dramatic increases, contemporary with glaciations, in rainfall by up to 10–100 times normal, particularly in tropical and subtropical latitudes. These increases in rainfall have often been connected with increased ocean temperatures, which would produce substantially increased ocean evaporation, followed by an equally abnormal growth in cloud cover and rainfall, a concurrent drastic drop in temperatures, and a massive advance of ice. This alone could be considered a demonstration of the energy transfer efficiency of the water cycle heat engine, which works most effectively in tropical and subtropical regions.

Therefore, there were and are scholars, particularly common in the 1960s and 1970s of the 20th century, before the advent of the "fashionable" catastrophism for global warming, who feared the advent of a new ice age, resulting from an increase in ocean temperatures, which could trigger increased rainfall, and possibly represent the end of the current "warm" interglacial period of nearly 12,000 years since the last glaciation.

What is definitely true is that Earth's climate always has and always will change, regardless of any anthropogenic influence with "long" warm periods with glacial retreats and disappearance of planetary ice alternating with periods of cold with ice advances. Within these cycles, there are a number of hot and cold "mini-cycles" which are shorter in duration and magnitude.

It is well-known that, in Medieval times, the climate was much warmer than the Current Warm Period and that the Vikings were colonizing Greenland while the Britons grew grapes for wine. During the Little Ice Age (LIA) from the late Middle Ages (14th century) to late 19th century, temperatures were much lower than today, even lower than the recent late 1970s low. The LIA is characterized most abundantly by descriptions of the contemporary European climate, with the Thames frozen so often in the winters of the 1600s that fairs were held on the ice; the Vikings disappeared from Greenland and Britain had to import wine, as condensed port wine, from Spain and Portugal. These events took place long before human activities produced large quantities of "greenhouse" gases.

But, the absolute certainty and definitive proof of the insignificance of "greenhouse gas" emissions by man, as an alleged major cause of global warming, is provided by a radioisotopic analysis study of peat at the base of Ruitor glacier in Val d'Aosta, one of the largest glaciers of Italy as well as Europe. Carbon-14 dating of peat found higher than 2500 m above sea level, where Ruitor's ice is withdrawing, was performed by experts of the Politecnico of Torino and it was found that, in the Neolithic period and up to 3500 years ago, the peat contained pollen of conifers and lime trees, which are mild climate plants. [xlv]
[http://crgv.fondazionemontagnasicura.org/public/allegati/54/storica_PDB_relazione.pdf]
Thus, in the time period above, where now there is a frozen lake, the climate was about 4°C warmer and amenable to human settlement. This finding is not the only discovery of this kind, as such human settlements and/or botanical finds have been discovered in other European areas, confirming that climate was much warmer in the Neolithic than today.

What is important here is that these investigations deal a serious blow to the pseudoscientific theories that insist on linking CO_2 to any growth in global temperatures. Four millennia ago, it is evident that there were only a few tens of millions of human beings in the world, compared to 7 billion today, and there was no industry. However, temperatures were about 4°C higher than the current average! (see also, for the investigations of pollen in glaciers: Ecological & Environmental Change Research Group - http://www.uib.no/rg/EECRG/opportunities/masters-studies-with-eecrg/pollen-inferred-climate-change-during-the-last-1500-years-with-focus-on-the-medieval-warm-period-and-the-little-ice-age and http://www.mendeley.com/research/late-glacial-and-holocene-vegetation-and-regional-climate-variability-evidenced-in-highresolution-pollen-records-from-lake-baikal/)

The observational and experimental data that has been discussed thus far lead to the incontrovertible conclusion that the global climate is constantly changing and that no human activity can or does have influence on it. As has been demonstrated in several discussions above, there is no real science that supports the GHE claims. Thus, it is only by ignoring or denying observational data and suspending multiple well-established scientific principles that the AGW supporters can try to claim that a trace gas has extraordinary properties in our atmosphere, effectively over-riding and canceling all other natural climate factors. In some cases, it is even suggested that CO_2 emitted by human activities is especially different from normal CO_2 and thus dangerous.

Man can affect climate, but only at the microclimate level, such as in urban areas, termed "heat islands," which are subject to the urban heat island effect. Here, the use of high heat capacity materials, such as concrete, asphalt, and steel (instead of stone and wood as in the past) in combination with the use of machines, such as cars, conditioners, and industrial devices, necessarily produces a lot of heat. Add to this the central heating of nearly all of these buildings, the paving and effective waterproofing of much of the surface, local deforestation, intensive exploitation of rivers, and deforestation inside urban areas and it is not surprising that the result is increases of 3–4°C in average temperatures. But, and a big but, this has nothing to do with the atmosphere and solar, oceanic, and astronomical cycles which are the real "drivers" and regulators of global climate changes.

Before leaving the topic of climate, it might be interesting to examine the bigger picture. When the temperatures of the various warm periods of the current interglacial, the Holocene, are examined using data unadjusted by the current data handlers, it is apparent that, from the Holocene Optimum, Minoan Warm Period (WP), Roman WP, Medieval WP, and Current WP, each successive peak temperature has been lower than the last. This suggests that the Earth is slowly sliding toward the next glaciation and renders meaningless the alarmist projections of constant warming for 100s or more years and even a permanent warm state.

16. The several mechanisms of heat transfer in Earth's atmosphere. The transport equations (Fick, Newton, and Fourier) of thermodynamics and Brownian motion. Rules and exceptions

The main purpose of this work was to employ the only appropriate science for this topic, thermodynamics, to analyze the temperatures and heat exchanges that occur between the matter of the Earth-atmosphere system, highlighting along the way the real mechanisms of heat transfer, with the goal of countering or modifying the false beliefs rooted in the minds of many individuals after decades of pseudoscientific propaganda.

The most important concept to demonstrate here was that heat movement, or heat fluxes, contrary to the misrepresentations, proceed from the soils and ocean waters and heat the atmospheric gases. And the reverse never happens, as these gases do not have sufficient energy to heat Earth's surface of soil and water, the former, gases, being cooler than the latter.

In addition, the concept of "backradiation" was addressed. This errant concept claims that a gas can transmit some IR energy, which it receives from the surface, back to the surface, thus raising its temperature. Being totally false and impossible, this concept is patently contrary to all physical and thermodynamic laws.

In reality, heat fluxes from the surface to the atmosphere strictly follow, on a global and macroscopic level, Fourier’s law of heat conduction, and thus heat flows to space according to the atmospheric gradient and the thermal conductivity *k* of the air. Fourier's law, in turn, is only the application to the thermic field of the more general transport equation,

$$\Psi x = -\delta(\partial\Psi/\partial x) \quad (57)$$

which also summarizes the equations of Fick on mass transport (Fick's Law),

$$J = -D(\partial Ø/\partial x) \quad (58)$$

and of Newton on the transport of momentum,

$$\tau(x,y) = -\mu(\partial vx/\partial y) \quad (59)$$

On the whole, the transport equations tell us that, in nature, any movement of physical quantities, such as heat, momentum, and matter in the form of molecular or atomic aggregates, always follows the rule of displacement from regions of high density to regions more rarefied or of low density. The result of this overall phenomenon is the 2^{nd} law of thermodynamics (LoT), which describes the transmission of heat from a warmer to colder body.

As it is known, the Prandtl, Nusselt, Reynolds, and Grashof numbers derived from the equations of fluid heat transport are dimensionless numbers, creating operators that correlate variables of a field, such as speed, with those of another, such as viscosity, to evaluate the state of a transport phenomenon. Thermodynamics is a statistical and macroscopic science, which does not exclude exceptions at a microscopic level. For example, if all macroscopic bodies follow the 2^{nd} LoT, it can be assumed that heat always moves from warmer to colder regions of matter. This is a universal physical law, but, on the other hand, it is also true that, at a microscopic and quantum level, exceptions can be found, as in the case of Brownian motion, [xlvi]of colloids, or smoke, in which particles do not follow the 2^{nd} LoT, behaving according to disorderly and turbulent motions and not proceeding in individual movements from hot to cold. This observation does not contradict in any way, even at a microscopic level, the universally applicable 2^{nd} LoT.

The issue here is one of turbulence[xlvii] and microscopic (molecular), or atomic and quantum level motions, of particles in the atmosphere, with respect to macroscopic variables of thermodynamics, which not infrequently give rise, even among high-level scholars, to misunderstandings that are important to clarify. There are two commonplace misconceptions, in this regard, that need to be addressed and dispelled.

The first relates to an alleged "overcoming" of thermodynamics, with regard to some of its laws at the macroscopic and statistical level, by virtue of the most recent discoveries in quantum physics and turbulent motion. In other words, some scholars maintain that, as the observation of the behavior of microscopic particles in the atmosphere and their movements follows complex rules that are yet to be fully explored, it would be incorrect to study a problem such as the GHE on a thermodynamic basis. The second misconception originates from those who respond to this objection, arguing that Brownian and turbulent motion and the observation of microscopic movements of gas particles in the atmosphere, after all, represent exceptions to the 2nd LoT only in very small percentages and, therefore, the 2nd LoT would continue to be valid at a macroscopic and statistical level.

Both statements are incorrect and rely on a mutual misunderstanding. First, with regard to the issue of turbulence, there is no problem in verifying that turbulent motion of atmospheric gas masses is the norm, not the exception and also the norm at the macroscopic, and surely beyond the microscopic, level. At a macroscopic level, it is easy to see that, on average, near-ground winds flow at speeds around 5–6 m/s in most locations. And the higher the altitude, with more rarified air at decreased pressure, the more wind speed increases, following horizontal flow paths along horizontal pressure gradients, that can be described by isobaric plots. And since, by definition, a windy flow is no longer considered laminar, or smooth, when its speed is greater than 4 m/s, it can be immediately concluded that, more or less, all gas molecules moving in the atmosphere display turbulent motion.

In fact, the well-known Reynolds number *Re* can be applied here as,

$$Re = (U \times L)/v \qquad (60)$$

where U is the typical fluid velocity (m/s), L the size (m) and v the kinematic viscosity. It is easy to see that a fluid having low viscosity and high average speed of propagation, such as blowing air, is always showing a high *Re* number, and thus the air is almost always turbulent and only rarely in laminar motion, such as in small constant breezes.

Although one might be willing to study the motion of small numbers of particles in the atmosphere and in the presence of turbulent motion, it is well-known that even the most powerful computers, using the Navier-Stokes equations, would take billions of years to derive a mathematical formulation of their motions. As has been shown in a 1997 study by Ballio on the solution of the Navier-Stokes equations for turbulent motion, [xlviii] it was prohibitive to study a turbulent flow of a liquid fluid for even short distances and even using Cray supercomputers. And, despite the greatly increased computing power in the last 14 years, it is still prohibitive to study the transport of small masses of particles in air, a far more turbulent fluid, moving in such a chaotic manner.

One might wonder if the complexities of turbulent flow in the atmosphere might not be the crux of the inabilities of the many, horribly expensive, computer global climate programs to produce useful climate models. This is ignoring, of course, that the programmers leave out dozens of important factors (The Problem(s) With Climate Models: Top 50 Major Problems Causing All The Model Prediction Failures [http://www.c3headlines.com/2009/10/the-problems-with-climate-models-top-50-major-problems-with-models-that-cause-all-the-prediction-failures.html])[xlix] which in their absence is problematic, and are also incapable of including adequate resolution or details of the Earth's surface; CO_2 is programmed as the factor that controls climate *a priori*.

Hence, despite some improvements, as provided by Kolmogorov's theory on turbulent motion,[l] and the first equations describing them, as in the theories of "fractals" by Richardson,[li] there is still no physical theory that can exhaustively describe turbulence. Possibly Heisenberg was correct when he decided that the problem of turbulence in physics was just too complex and opted to spend most of his time discovering and exploring the indetermination (uncertainty) principle.

But, there is another point to be made here. In fact, thermodynamics and hydrostatics do not care at all regarding the turbulence of particles, because it does not contradict at all, neither at the micro or macro level, their principles. In fact, it is exactly because of this insensitivity, which appears to escape some scholars, that thermodynamics deals with temperatures and the related elements—pressure, density, mass, volume, gradient, vertical heat fluxes, conductivity, and thermal diffusivity—and not to horizontal and turbulent motion of particles.

Although this has already been demonstrated mathematically, it seems useful to pursue this a bit more here, taking again equation 13. for hydrostatic equilibrium,

$$dP/dz = -\rho g$$

As shown before, this equation is derived from the system of the three Cartesian-axis *x*, *y*, and *z* equations,

$$\partial P/\partial x = \rho X,\ \partial P/\partial y = \rho Y,\ \partial P/\partial z = \rho Z$$

and hence examines changes in density, and therefore changes in pressure (*P*) and temperature, the latter which always varies depending on pressure. It can be realized that density varies only along the *z*-axis, according to a negative gradient and, thus, the partial derivatives of density according to horizontal motion in the plane, on *x* and *y*-axes, are zero. This is why it makes no sense to worry about microscopic motion, Brownian or non-Brownian, of gas particles in the atmosphere from a thermodynamic, hydrostatic, or temperature standpoint. Thermodynamics and hydrostatics only deal with what happens to particles along the *z*-axis and do not care what is taking place as horizontal motion along the *x* and *y*-axes, because horizontal motion does not change the pressure, density, or ultimately temperatures! And that is why, from a general thermodynamic standpoint, there is little or no importance in studying convective movement of warm masses along isobar trajectories or horizontal planes.

"How?" someone will object. "Heat is also transmitted by convection. If I'm sitting outside during summer, I feel heated by warm winds coming from the south, while in winter cold winds from the north are freezing the environment."

True! But, it must be emphasized that thermodynamics and hydrostatics do not consider, for the balance of system applications, the motion or transport of warm fluid masses along the horizontal axis. By definition, horizontal motion occurs at constant temperatures, along equipotential and isothermal surfaces, and thus such motion does not change the system; from a thermodynamics point of view, no work is being done relative to gravity.

What is relevant here regarding thermodynamics could be, at most, the description of a thermodynamic cycle, in which it would be necessary to calculate the total work involved in the component adiabatic compression and expansion and isothermal compression and expansion in the cycle. But, keeping in mind the problem of GHE, it only matters whether atmospheric gases alone may or may not change Earth's surface temperatures, thereby affecting the hydrostatic equilibrium of the atmosphere. It has been shown here that this cannot take place because heat proceeds almost always, except in thermal inversion situations, according to a negative gradient from the hot surface to cold gases at altitude.

Returning to Fourier's law on heat conduction (section 5, eq. [9])

$$\Phi_Q = -k \times \partial T/\partial z$$

and reviewing the discussion in Section 5, Fourier tells us something very important regarding the present discussion. It teaches us that, in any heat flux Φ_Q, the only thing that matters regarding variation in temperature is the negative temperature gradient ($-dT/dz$) and the fluid's thermal conductivity *k*.

Thus, it does not matter whether heat in the atmosphere moves by horizontal convective motions of gas masses, either slow or fast or uniform or turbulent, as well as by conduction and irradiation. Attention need only be given to the gradient and the vertical flow, according to the air's thermal conductivity. This is the reason why, not by chance, it was important to carefully address, as in Section 5, the effects of changes in the temperature gradient or lapse rate from 6.5 to 9.8ºC/km, which occurs in the transition from moist to dry air, because, along with altering the temperature gradient, humidity also alters the air's thermal conductivity, being higher when dry. In addition, it was shown earlier that the atmosphere cools, not heats because in the transition of moist to dry air, as with atmospheric perturbations, a shift of cold to hot masses is taking place, as occurs in a heat pump or in a refrigerator.

However, to deny that such movements of heat and air are commonplace or impossible, even at a microscopic level, presents a conflict between the 2nd LoT and the motion of particles. Even in the case of a refrigerator, or in rainy or snowy perturbations, one sure process is that masses of cold particles, in the coolant plumbing of a refrigerator or in clouds, move toward warmer bodies, such as the room to be cooled or the Earth's surface, to cool them, according to a reversed thermodynamic cycle. Another key point is that GHE supporters wrongly claim that cold particles can heat up a warmer body, which is simply impossible and thus cannot happen.

In conclusion, regarding the question of turbulence and particle transport in the atmosphere, it can be said that turbulence and molecular motion at the microscopic level have no relevance for atmospheric thermodynamics and hydrostatics. To use a metaphor, thermodynamics and hydrostatics are like elevator operators in department stores and people going up and down are like gas particles. It only matters to the operators what people go up and down, but they do not care what people do on each floor or horizontal plane, wandering around the departments and displays. Similarly, thermodynamics and hydrostatics only deal with what is taking place vertically in the atmosphere and not along the horizontal. Thus, there is no conflict between the thermodynamics and hydrostatics of fluids, which actually proceed hand in hand, and quantum mechanics or the fluid dynamics of turbulence.

The situation here is similar to that of the sciences that deal with different levels or areas of medicine, such that there is, for example, no contradiction between dermatology and internal medicine. The first deals with disorders of the skin, the latter to those of internal organs. Thus, the argument of proponents of GHE theory, that quantum mechanics and the fluid dynamics of turbulence somehow contradict the laws of thermodynamics and thus confirm their theory, is completely untrue.

17. Thermodynamics and its historical achievements

The GHE and AGW hypotheses, spread by the IPCC since the 1990s, have been radically challenged in recent years in the scientific world by much research and numerous studies by physicists, geophysicists, mathematicians, astrophysicists, and radiochemists. More precisely, there actually has never been any real, theoretical, or experimental demonstration of the GHE in the atmosphere, not to mention a manmade effect, per AGW, based on physical laws established over 150 years ago and in particular the LoTs.

As Postma correctly stated in "Understanding the Thermodynamic Atmosphere Effect," thermodynamics is a relatively young (from the mid-1800s) but absolutely solid branch of physics, as it was born from observations and practical demands and then was encoded and transfused into the consolidated laws of physics, for use in new (for then) mechanical inventions employing heat and steam in power, trains, and ships for the design and execution of civil construction and industrial machines. Since then, thermodynamics has always provided good proof of itself, as it has allowed tens of thousands of engineers, physicists, chemists, geologists, and industrial technicians to design and perform the construction of plants, machinery, power stations, thermal, solar, and nuclear plants, space rockets, engines of all kinds, buildings, and space clothing, and for protection from heat and cold. In these cases and many more, thermodynamics has allowed precise calculations of heat exchanges between materials, confirming every day that these equations are correct and valid.

And as an experimental science, thermodynamics in the course of more than 150 years has borrowed from as well as been expanded by findings in other sciences, such as quantum mechanics and atomic physics, such that thermodynamics in 21st century is quite different and much more robust than the "classical" form produced by Clausius, Kelvin, and Fourier so long ago, all the while keeping unchanged its basic concepts and fundamental laws. Thermodynamics and its equations, more solid and established than ever, clearly repudiate the ungrounded assumption that gases of any kind can warm the Earth's surface or, even more wrongly, that the 0.039% CO_2 content in the air can cause dramatic increases in global temperatures in the range of 5–6°C within a few decades, as is claimed by the reckless and extravagant "forecasts" by the IPCC.

While thermodynamics uses all of the most important parameters—mass, volume, temperature, amount of heat energy, radiation input, density, heat exchange, capacity, conductivity, temperature gradient, thermal diffusivity, heat flow, pressure, and emissivity—the hypotheses of GHE and AGW propounded by the IPCC are based solely on extrapolation of a single parameter, CO_2. This parameter is sometimes connected with water vapor, solar irradiance (W/m^2), and the temperature trends of only the last 150 years, an insignificant period of time in relation to Earth's geological ages. This emphasis on an arbitrarily chosen single parameter, and in particular on man-made CO_2, in the construction of relatively rough and overly simplified but very expensive computer models in the calculation of its effect (N. Scafetta) [lii], while neglecting all the basic parameters of thermodynamic exchanges, such as those relating to soils and oceans, is certain to lead to entirely wrong results and false conclusions. Unfortunately, the failure of the computer climate models to effectively model the past climate records without artificial adjustments or to usefully predict the future climate, as all predictions have failed, has produced the need for the GHE-supporting climatologists to unilaterally alter the temperature records, calling them "adjustments," and cherry-pick published data to produce the needed warming and the related effects that the IPCC needs to be able to claim.

But, of course, this simplified and biased hypothesis linking atmospheric CO_2 and global warming is gross and devoid of any scientific reliability. It is easy to find two phenomenal parameters following the same trend over a given period of time, such as the growth in life expectancy and the increased obesity in Western countries in the last 50 years, even if they have no mutual relation of cause and effect, and indeed they are sometimes mutually conflicting. It is evident that an increase in a population's obesity rate produces an increased incidence of related diseases, such as heart disease, diabetes, cancers, and joint problems, and death and, therefore, it cannot be stipulated that obesity is a factor causing increased life expectancy.

Thus, believing that 0.039% CO_2 in the atmosphere, with only a 0.002 emissivity, can effect an increase in global temperatures is something similar to believing that flies in the air can affect the motion of a space craft descending from orbit around the Earth. Any physicist or engineer having to calculate the energy required to bring a space craft from orbit to landing will consider only the basic parameters, including the rocket mass, force of gravity, centripetal and centrifugal forces, escape velocity, quantity and efficiency of fuel, engine power, angular moment, thermal resistance of materials, aerodynamics, fluid dynamics, wind speed, and friction, but certainly no one will think for even a moment to consider the impact of flies and mosquitoes in the rocket's trajectory, as insects would be considered a quantitatively irrelevant parameter.

Yet, for over 20 years, credit has been given by some to extravagant, almost fantastical "theories" from the IPCC on "climate change" (renamed from "global warming" as Earth's warming ceased in the late 1990s), attempting to make the public believe that mosquitos (CO_2) can influence space craft motion (ground temperatures). It is quite impossible to design a thermos for cold or hot beverages using the IPCC "theories," while, thanks to thermodynamics, an endless number of technologies have been devised over more than 150 years and have contributed to the progress of mankind.

18. Conclusions

One of the most amusing thoughts one can have regarding the incredible longevity in the last decades of the clumsy GHE hypothesis relates to the paradoxical and amazing contrast between its "luck" and popularity in mass media and its absolute lack of any serious or valid scientific basis. It spontaneously brings to mind the fable of the naked king, in which everyone in the court marvels over the naked king's elegant clothes because no one dares to point out the real situation. Thus, as correctly observed by the engineer Heinz Thieme ("Greenhouse Gas Hypothesis violates .... " [see ref. 6]), it is truly stunning that a "theory" with no serious scientific basis could find room in our world, albeit in a discursive way, being impossible to prove mathematically and not based on established or theoretical physical laws that can be found in any scientific texts.

Among Einstein's many documented aphorisms, there is one regarding theories of physics, the scientific method, and epistemology. Einstein rightly said, "No amount of experimentation can ever prove me right; a single experiment can prove me wrong." One could produce 99 demonstrations in favor of a scientific theory, but a solitary unfavorable result would be sufficient to refute it. This is not a new idea, as many years earlier Thomas H. Huxley stated, "Science is organized common sense where many a beautiful theory was killed by an ugly fact," and "The deepest sin of the human mind is to believe things without evidence." [liii]

Now, the most surprising aspect of the GHE hypothesis is that no real evidence can be found in its favor, but rather there are numerous of demonstrations against its validity; confirmation of GHE simply cannot be found, however much it is sought.

In this work, after the GHE hypothesis was disassembled and analyzed using multiple approaches of physics, including calorimetry, thermodynamics, hydrostatics, wave mechanics, entropy, efficiency of thermal cycles, astrophysics, fluid dynamics, and statistics, it is quite relevant to note that this hypothesis violates, sometimes in embarrassing ways, a number of laws and methods, often flagrantly. These violations include the summation of heat fluxes and opposite vectors when subtraction is required, energy being created out of nothing by self-reflection, thermodynamic cycles with impossible yields, well above 100%, decreasing entropy in irreversible phenomena, cold gases "warming" liquids having heat capacities more than 3000 times higher while not receiving any external energy, and the SB equation being wrongly calculated by ignoring the emissivity of the material being irradiated.

And, not forgetting all of the depressing and shameful "demonization" of CO_2 in these past decades, a review of botanic findings dating back to the Neolithic, 4000–6000 years ago, is enough to reveal that temperatures were higher on average than now by as much as 4°C and, where today there is the Ruitor glacier, conifers and lime trees once grew. In the end, when asking about the mysterious reasons why such a preposterous "theory" has lasted so long without a clear rejection by scientists and when trying to peer beyond the well-known political exploitation ("the worst scientific scandal of all ages," as defined by Prof. Itoh of Tokyo University[liv]), it appears that the better and more honest answer has been given by the Israeli physicist Nir Shaviv, who candidly admitted a few years ago, "If I was asked about global warming a few years ago, I would have said, 'It's for CO_2,' Why? Simply because, like everyone, I listened to what the media were saying!" This work is dedicated to those who have the intellectual honesty of Nir Shaviv and have decided to reflect on a problem using their own minds, logic, and reason, no matter what the majority of the people are saying.

Finally, one needs to ask about the political impetus or goals behind those trying to foist a patently false scientific "theory" on the public, embellishing it with apocalyptic, time-is-running-out fear-mongering, and constantly suggesting or even demanding absurd, damaging, and Draconian solutions which always hurt the people and do nothing for the planet or the climate.

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