Observations on 'Backradiation' during Nighttime and Daytime

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By Nasif S. Nahle[1]

Do moths make a light bulb burn brighter?

—Derek Alker

Abstract

Through a series of real time measurements of thermal radiation from the atmosphere and surface materials during nighttime and daytime, I demonstrate that warming backradiation emitted from Earth's atmosphere back toward the earth's surface and the idea that a cooler system can warm a warmer system are unphysical concepts.

Introduction and Theoretical Work

Depicting the Earth's energy budget is a complicated task. Many of the thermal energy processes and phenomena of the atmosphere-surface system have not been well analyzed in climatology.

Oceans, atmospheric water vapor, surface, and subsurface materials which store thermal energy are the real drivers of the Earth's climate. Oceans are very effective integrating thermostats for the Earth's climate.

The complexity of depicting Earth's energy budget is increased by many assumptions climate modelers introduce—in contradiction to the laws of thermodynamics.

Some scientists start by averaging solar power flux through twenty-four hours (a terrestrial day) over the entire surface area of the Earth, which should not be averaged because it is already an average of satellite measurements along the trajectory of the Earth around the Sun and where night cannot exist because it is an imaginary sphere (outer sphere) whose surface area is calculated geometrically by taking into account the track of Earth's translational motion as the perimeter of an egg-shaped sphere and the distance from Earth to Sun as the maximum radius of such ellipsoidal sphere.

The incident solar power flux impinging on Earth's surface, which is $\sim 1000\ W/m^2$ (known as insolation), is already an annual average, during daylight exclusively, that should not be averaged once again [1]. The result obtained from averaging insolation twice is an unphysical average of solar power flux impinging on the outer sphere by dividing the annual average of incident solar power flux on each square meter of the outer sphere by four:

$$\frac{1360\ W/m^2}{4} = 340\ W/m^2$$

Here are the problems associated with this calculation:

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1. It averages solar thermal radiation down to 49%.

2. It multiplies this supposed coefficient of thermal radiation, 0.49, by the coefficient of mitigation of solar radiation by the atmosphere, 0.51, to obtain an unreal coefficient of 0.25.

3. It multiplies the total incident solar radiation on top of the atmosphere by the artificial coefficient, 0.25, to obtain a supposed incoming solar thermal radiation impinging on the surface:

$$\frac{1360\ W/m^2}{4} = 1360\ W/m\text{^}2\ * 0.25 = 340\ W/m^2$$

4. It multiplies the resultant incoming solar radiation by 0.48 to obtain an unreal thermal radiation absorbed by the surface:

$$340\ W/m\text{^}2\ \times 0.48 = 163\ W/m^2$$

5. It introduces a novel unreal effect of accumulation of thermal radiation by the atmosphere which is 5.7 times higher than real atmospheric thermal radiation:

$$60W/m^2\ \times 5.7 = 342\ W/m^2$$

Following this series of erroneous calculations, as the Sun is the main source of thermal radiation to Earth, the flux of solar thermal radiation on the Earth's surface would forced to be $1938\ W/m^2$, which is erroneous, and the atmosphere would be required to be 143 °C:

$$T = \frac{Q}{e \times \sigma} = \frac{342\ W\ /\ m^2}{0.201 \times 5.6697 \times 10^{-8}\ W/m^2} K = 416\ K = 143\ ℃$$

Notice the term e in the equation, which represents the total emittance of the absorbing system, the air in this case. We cannot disregard total emittance of the absorber system because we are calculating real magnitudes, not blackbody approximations.

Blackbodies do not exist in the known universe, so we must introduce total emittance of the absorber because it is a gray body, not a blackbody.

The observed (measured) total emittance of air is 0.201. Other values are incorrect, either prejudiced or estimated improperly. For example, the total absorptance of air must be altered to obtain the multiplication of energy by the atmosphere.

Following the misleading calculations of thermal radiation budget, if we observed the surface of the Earth absorbing $160\,W/m^2$, the atmosphere must have a total emittance 5.7 times greater than the total emittance of a black body. Actually, the amount of thermal radiation the atmosphere would absorb, derived from thermal radiation emitted by the Earth's surface, would be $160\ x\ 0.201\ =\ 32.16\frac{W}{m^2}$, which is completely false.

Annual average of incident power flux on the surface area of the outer sphere,$1360\ W/m^2$, divided by four gives $340\ W/m^2$. NASA-CERES scientists take this amount of solar power ($340\ W/m^2$) as incoming solar "energy", as well as "backradiation" from atmosphere [5].

We see this is not what happens in our planetary system because the Earth's surface does not receive $340\ W/m^2$ during daytime but approximately $1000\ W/m^2$. Therefore, $340\ W/m^2$ is not the solar constant and a value that never been measured by satellites on top of the atmosphere [1].

Using $340 W/m^2$, climate scientists discount the solar power reflected and absorbed by the atmosphere, and reflected by the surface; and derive an unphysical power absorbed by the surface: $163 W/m^2$.

$$340\ W\ /\ m^2\ \times 0.48 = 163\ W/m^2$$

Actual annual average of incident solar **thermal radiation** at the top of the atmosphere (TOA) is $\sim 698\ W/m^2$ ($1365\ W\ /\ m^2\ \times 0.51$), while backradiation from the atmosphere depends on the atmosphere's content of thermal energy, which always is lower than the surface's content of thermal energy.

The **remaining 49% of the solar constant**, i.e. $667\ W/m^2$, is not thermal radiation, but is comprised of other forms of radiation, like gamma rays, X-Rays, L-UV, FIR, radio, microwave, etc.[9]

Real solar thermal radiation absorbed by the surface—and the temperature derived from such amount of absorbed solar thermal radiation—are calculated from measurements as follows:

Solar thermal radiation absorbed and reflected by the atmosphere (mainly by water vapor, condensed water vapor in clouds and dust), and reflected by the surface:

$$1365\ W/m^2\ \times 0.51 = 696.15\ W/m^2$$

The factor of 0.51 represents the mitigating effect by the atmosphere on the net flux of solar radiation, not the total solar irradiance on top of the atmosphere, which is $1365\ W/m^2$ on average.

The factor 0.51 is obtained from the sum of the thermal radiation absorbed by the atmosphere before it strikes the surface (30%), the thermal radiation reflected by clouds (14%), and the thermal radiation reflected by the surface (7%)[10].

Total incident solar thermal radiation on the surface after mitigation by atmospheric water vapor, condensed water vapor in clouds, dust, and surface:

$$1365W\ /\ m^2\ - 696.15\ W/m^2\ = 668.85\ W/m^2$$

An average of incident solar thermal radiation on the surface of $668.85 W/m^2$ is absolutely consistent with measurements of thermal radiation impinging on Earth's surface (insolation), which fluctuates around the average of insolation of $1000\ W/m^2$[1].

In average, the surface of Earth, land and oceans, absorb:

$$668.85\ W\ /\ m^2\ \times 0.7 = 535.1\ Wm^2$$

0.7 is an average of total absorptance of Earth's surface. NASA- CERES scientists introduce 0.8 as total absorptance of Earth's surface[5].

From these calculations and taking into account average measurements, we find that the rate $163\ W/m^2$ for absorbed solar thermal radiation by the surface is a flawed value. The real average of solar thermal radiation absorbed by the surface during daytime is $535.1\ W/m^2$.

During daytime, from $535.1\ W/m^2$ of thermal radiation, $310\ W/m^2$ is stored by the surface as **static thermal energy** creating a global surface temperature of 24 °C. This static thermal energy is transferred by convection, conduction and radiation to the atmosphere ($62.3\ W/m^2$), by conduction and convection to subsurface materials and deep volumes of water in oceans ($246.1\ W/m^2$) and by friction dissipation in oceanic currents ($16\ W/m^2$).

As an aside, it is interesting that diagrams of Earth's energy budget ascribe to the atmosphere a net heat transfer of 14%. If we take this proportion as real, the heat transferred from surface to atmosphere would be $43.4 W/m^2$. This mistake leads to the invention of greenhouse effects to make the equations balance.

From the remaining $225.7\, W/m^2$, a portion is transferred to the atmosphere by flux of sensible heat ($13.5\, W/m^2$) and enthalpy of evaporation ($52.4\, W/m^2$); another portion is transferred directly to heat sinks, like outer space and gravity field (static energy in the amount of $158\, W/m^2$).

When we measure the surface temperature at day and night we find its average is 24 °*C*. The standard ambient temperature of Earth, scientifically correct and accepted, is 298.8 *K* (25 °*C*)[11]. To argue that the standard ambient temperature of Earth is -18 °*C* is unscientific because it does not coincide with reality and proper calculations.

The temperature of air fluctuates according to the temperature of the surface, not the opposite.

Now let us examine the issue of radiometers and infrared thermometers. What do they actually measure?

When we place a pyrometer on the ground under **direct sunlight** with its sensors facing up and measure the solar power flux during daytime, we record solar thermal radiation close to $1000\, W/m^2$, not $340\, W/m^2$.

If we place the same pyrometer on the ground, adjusted to longwave thermal radiation, **during nighttime**, the recorded power flux will be around 60 W/m^2. Nevertheless, the proponents of the greenhouse effect argue that backradiation is $340\, W/m^2$, day and night[4]] [5]. Additionally, they assert they measured backradiation and it is around 300 W/m^2.

If we measure the power flux **from the surface** to the atmosphere during nighttime, we record around 310W/m^2. This is five times higher than the power flux recorded from the atmosphere, which is around $60 W/m^2$.

As the solar power flux on the surface area of the Earth calculated by climate scientists does not coincide with reality, those scientists invented a physical process permitting them to obtain a matching amount of power absorbed by the surface, the "greenhouse effect".

The original hypothesis of the greenhouse effect, which assumed that the Earth was warmed up because of "trapped" longwave thermal energy, was debunked through experimentation and observation [2], and from measurements[3]. The assumed "greenhouse gases", with exception of water vapor, are incapable of "accumulating" longwave radiative energy as it had been assumed.

A consequence of the scientific demonstration is that the "greenhouse effect" by "trapped" longwave radiative energy is imaginary[2], proponents of the nonexistent "greenhouse effect" resort to another explanation you will not find in any serious scientific literature; they invent a process of warming a warmer surface by a cooler atmosphere through backradiation derived from thermal energy which has been impossibly accumulated by a cooler atmosphere that in the real world does not reach such average of thermal energy content.

AGW proponents and skeptics who argue about this hypothesis declare backradiation emitted from the atmosphere warms the warmer surface, as if the atmosphere was a duplicator of thermal energy. As a consequence, the second law of thermodynamics which determines the specific flow of thermal radiation from warmer to cooler is dismissed[13].

A question arises with respect to what the devices known as pyrgeometers, pyrometers, radiometers and IR thermometers actually measure. We decided to conduct a scientific experiment and use direct observations of nature to find the true science behind the phenomenon.

The above explanation is only a theoretical explanation. The following section is a brief description of terminology and symbols that I have used on this report. Soon after, I will describe the experiment that demonstrates that backradiation from a cooler atmosphere warming a warmer surface is unphysical.

Terminology and Symbols

Refer to this section for the definition of concepts and units used in this paper.

- C_p is the symbol for heat capacity at constant pressure. Heat capacity refers to the amount of thermal radiation needed to raise the temperature of a given mass of a substance in one degree Kelvin (*K*) or degree Celsius (°*C*).

- *W* (Watt) is the symbol for power. Power includes the rate at which work is performed or energy is transferred or transformed. Power can be expressed also in *J*/*s* (*Joules* per *second*); 1 *J*/*s* = 1 *W*.

- *J* (*Joule*) is a unit of energy. Energy is the capability to perform or exert work. It can be expressed also in *W**s* (*Watt* per *second*); 1 *J* = 1 *W**s*.

- *T* is symbol of temperature. Temperature is *static internal kinetic energy*. The term *static* refers to any state function, i.e. energy that is not being transferred.

- ΔT is for difference of temperature, fluctuation of temperature, or change of temperature. It can be a cause or effect of other processes in a thermodynamic system.

- *Q* or *q* is the symbol of *heat*. *Heat* is energy in transit, i.e. energy at the moment of transfer from a system at higher temperature to another system at lower temperature.

- *Thermal Energy* is the amount of energy contained in a thermodynamic system by virtue of its temperature.

  For example, the thermal energy of 10 liters of water at T_i = 17 °*C* (290.15 *K*), where temperature increases to T_f = 100 °*C* (373.15 *K*), is: 4190 *J*/*kg* °*C* * 83 °*C* * 10 *kg* = 3.48 x 10^6 *J*, or 831.2 *kcal*.

  If the same volume of water is at thermal equilibrium and its temperature does not change, but T_i remains constant at 290.15 *K*, its thermal energy will be Q = 1.5 * (1.3806503 × 10^{-23} *J*/*K* * 290.15 *K*) = 6.01 x 10^{-21} *J*, or 1.44 x 10^{-24} *kcal*.

- *Thermal Radiation* is the fraction of the electromagnetic spectrum between wavelengths 0.1 μm and 100 μm.

  Thermal Radiation includes visible spectrum, almost all of the ultraviolet spectrum (Vacuum UV, Far UV, C-UV, Middle UV, B-UV, Near UV, and A-UV. Low UV is excluded), and almost the whole infrared (IR) spectrum, except the portion of the spectrum corresponding to wavelengths of Far-IR, from 101 μm to 1000 μm.

The remaining segments of the electromagnetic spectrum do not correspond to thermal radiation and cannot be considered on calculations of thermal radiation transfer. The proportion of the spectrum concerning thermal radiation is about 51% of the whole spectrum.

Thermal radiation is dynamic energy—a process, not a state.

- *Solar Constant* is the amount of energy emitted from the Sun, at all wavelengths of the electromagnetic spectrum, impinging on the surface area of a virtual ellipsoidal sphere, known as the *outer sphere*, whose semi-major axis is twice the distance from Sun to Earth (average of 1.49597871 x 10^8 *km*, or 1 *Astronomical Unit*, i.e. 1 *AU*), and its major perimeter is traced by the orbit of the Earth moving around the Sun.

  Solar Constant to Earth system is 1365 W/m^2, which is the annual average of measurements by satellite.

- *Insolation* is the amount of solar power impinging on a given surface area of a planet. It is ~1000 W/m^2 on Earth.

  Over real situations and locations, the energy absorbed and reflected by the atmosphere, and the amount of energy reflected by the surface are discounted from the total solar irradiance impinging on top of the atmosphere. It gives a theoretical value of $668.85 W/m^2$. However, this value fluctuates due to the incident solar angle; therefore, a real measurement could be higher or lower than 668.85 *W/m*^2.

  From 668.85 *W/m*^2, only 535.1 *W/m*^2 is thermal radiation absorbed by the surface. 56% is stored by surface and subsurface materials, i.e. 309.43 W/m^2, which causes a surface temperature of 24 °*C*.

- *Backradiation* is supposed thermal radiation emitted or reflected by a thermodynamic system towards the primary source of thermal radiation.

  As a system absorbs thermal radiation, it immediately emits the absorbed radiation in all directions. If we imaginarily divide an absorber system into two identical symmetrical subsystems, the amount of radiation emitted from one subsystem will be always a fraction equal to 0.5 of total emissions.

  For example, a system emitting a total amount of 100 *J* to all directions would emit 50 *J* from the upper subsystem and 50 *J* from the lower subsystem.

  Backradiation would be thermal radiation emitted by any subsystem towards the radiating source.

- *The Greenhouse Effect is* an **imaginary** process that would be the result of backradiation absorbed by the source of primary thermal radiation, in opposition to the universal trajectory of events, i.e. against natural spontaneous progression of entropy, from low level to high level.

- *Entropy* is the trajectory that any process or event happening in the known universe follows, which is related to availability of energy microstates of thermodynamic systems.

  Entropy is considered to be irreversible, that is, that once the universe has increased its entropy, there is no way to revert such increase of entropy.

Universe's entropy can never diminish. Decreases of entropy have never been observed in the known universe. The entropy of any thermodynamic system can remain constant ($\Delta S = 0$) or increase ($\Delta S > 0$), but can never decrease.

- *Static Energy* is stationary energy contained by a system. It is not transitional energy, i.e. it is not a process, but a property of the system.

  Thermal energy is static energy, i.e. it is a property of thermodynamic systems (state function).

- *Dynamic Energy* is energy in transit from one system to another system.

  Heat, work, and heat transfer are dynamic energy; therefore, they are not properties of thermodynamic systems, but process functions.

  Heat and work cease to exist as they are taken in by thermodynamic systems and they are transformed into any form of static energy.

- *Enthalpy* is a state function and an extensive property which includes the total energy that a thermodynamic system contains, including thermal energy, potential energy, kinetic energy, electromagnetic energy, displacement energy, chemical energy, and deformation energy.

- *Deformation energy* is the energy spent on change in shape and/or dimensions of a system due to a force exerted (transfer of work) or to changes of temperature (heat transfer).

- *Chemical energy* is a form of energy related to the structural configuration of systems that can be changed to other forms of energy through chemical, biochemical, or electrochemical processes.

- The Static Energy (U) of air at 300 K is 2.141 x 10^5 J/kg.

- The Enthalpy (H) of air at 300 K is 3.002 x 10^5 J/kg.

Experiment, Problems, Underlying Principles and Results

Equipment

1 Radiometer *Kimo*, Model SAM 20. Range 1 to 1400 *W/m*^2. Spectral Response 0.1 to 1.4 μm.

2 Pyrometers-IR Thermometer *ExTech*, Model 42530-EU. Range 117 to 22950 *W/m*^2. Spectral Response 6 to 14 μm

1 Thermo-Anemometer ExTech, Model 45118.

1 Penetration Probe Hanna Instruments. Model 50-HI98503. Operative Deepness of Samples 5 *cm*.

1 Tripod.

Ray-O-Vac Head Lamp Flashlight. Model: SPHLTLED-B

Summary of the Experiment

- September 9, 2011; it is 21:00 hrs CST. I point my radiometer towards a clear sky in an angle of 90° with respect to ground surface and stand waiting thirty seconds until the instrument calculates the average of a set of records of thermal radiation received on its sensors each one second. Recorded Thermal Radiation = 61.93*W*.

- September 9, 2011; it is 21:15 hrs CST. I point my thermometer-radiometer towards the soil in an angle of 90° with respect to the plane of the ground surface area. Stand waiting for thirty seconds until the instrument gets stable and calculates the average of a series of records of thermal radiation received on its sensors each one second. Recorded Thermal Radiation from Soil = 308.2*W*.

- September 10, 2011; it is 16:00 hrs CST. I point my radiometer towards a clear sky in an angle of 90° with respect to ground surface and stand waiting during thirty seconds up to the instrument calculates the average of a set of records on thermal radiation received on to its sensors each one second. Recorded Thermal Radiation = 65.96*W*.

- September 10, 2011; it is 16:15 hrs CST. I point my radiometer towards the soil in an angle of 90° with respect to the plane of the ground surface area. Stand waiting for thirty seconds until the instrument stabilizes and records the average of a set of records of thermal radiation received on its sensors each one second. Recorded Thermal Radiation = 336*W*.

Summarized Dataset

Period of Time	Nighttime	Daytime	Diff. $ThR_{day} – ThR_{night}$
Thermal Radiation (ThR) from Soil	308.2*W*	336*W*	27.8*W*
Thermal Radiation (ThR) from Atmosphere	61.93*W*	65.96*W*	4.03*W*
$ThR_{soil} – ThR_{atm}$	246.27*W*	207.04*W*	-39.23*W*

From this data, we can answer some questions.

The problems:

Does thermal radiation emitted by a cooler atmosphere warm up a warmer surface by backradiation?

What infrared thermometers, radiometers, pyrgeometers, and pyrometers are measuring when they are pointed up towards the sky?

Underlying Principles

The power emitted by the surface during nighttime at 21:15 h CST is 308.2*W*. The equivalent absolute temperature is 296.8 *K*.

The load of heat transferred from surface to atmosphere during nighttime, at 21:15 h CST, decreases as night advances and is followed by the amount of heat transferred by the atmosphere, not the opposite.

> The power emitted by the surface before sunrise (4:00 hrs CST) is 280*W.* The equivalent absolute temperature is 290*K* (16.85 °C).

The total change of temperature (ΔT) of ground in seven hours during nighttime is -7.04*K*.

> Power emitted downwards by an inverted conical volume of atmosphere during nighttime, at 21:00 CST = 61.93*W*. Equivalence in absolute temperature: 271.51*K* (-1.64 °C).

As the night advanced, the heat transferred from the atmosphere during nighttime decreased as the thermal radiation from the surface decreased. The power emitted by an inverted conical volume of the atmosphere towards the surface before dawn (4:00 hrs CST) is 46.48 *W*, which is equivalent to an absolute temperature of 252.71 *K* (-20.44 °*C*).

The total change of temperature of the atmosphere between the first hours of night and last hours of night was -19 *K*.

The total change of temperature in the atmosphere was 12 *K* higher than the total change of temperature of the surface. This means that the atmosphere temperature decreases faster than the surface temperature.

This happens because the surface contains more thermal energy than the atmosphere and the load of heat transferred from surface to atmosphere remains constant while the lost of heat from the atmosphere towards the outer space increases in time.

Consequently, an atmosphere that increasingly cools absorbs each time a higher amount of thermal radiation from the surface, i.e. the difference between the thermal energy contained by the surface and the thermal energy contained by the atmosphere decreases.

The thermal nonequilibrium is sustained and the difference of temperature between the interacting systems decreases; however, thermal equilibrium between the interacting systems is never reached because the change of temperature of the atmosphere is always higher after each thermal interaction between soil and atmosphere due to a higher lost of thermal energy from the atmosphere. **This is the underlying principle**.

Before the nocturnal hemisphere runs out of energy, insolation starts again and the cycle restarts on this hemisphere.

The Experiment

We choose a completely clear day with Relative Humidity of 33% - 42% during the hours of observations to avoid nebular atmosphere. We performed the experiment on September 9, 2011, starting at 21:00 hrs CST and finishing at 4:15 hrs CST.

The field of view of our radiometers is an inverted three-dimensional cone-like field with a volume of 7.86 x 10^{11} m^3 with diameter on its base of 5 *km*; consequently, our radiometers are measuring the thermal energy contained by a volume of air which is 30 *km* high.

Radiometers are adjusted to record thermal radiation emitted by the target. The target during this experiment was the atmosphere.

For example, pointed in a straight perpendicular line towards the Sun in the zenith, they recorded 797.5*W*, **which was insolation at floor level**; this means the sensors have "felt" the **total solar thermal radiation received on the lowest cubic meter of air** -buoying exactly over the surface, at **1 *m* in height**, not at 30,000 *m* in height, **after being mitigated by the atmosphere**. This globule of air, which is not square, but amorphous, is what we know as **boundary layer**.

The same thing occurs during nighttime. The radiation detected by the radiometer sensors is the total thermal radiation emitted by a whole volume of atmosphere contained in the inverted cone received by the lowest cubic meter of air, not by the surface.

As we direct our radiometers towards the horizon, our radiometers detect thermal radiation of a volume of air of the lowest layer of air buoying over the surface.

The layer of atmosphere in contact with the surface, also known as boundary layer, emits more thermal radiation than upper layers because heat is being transferred from the surface to this layer of air by conduction, convection, and radiation. Above this layer heat is transferred towards even cooler layers of the atmosphere and towards the outer space.

Keeping this in mind, let us examine the results of the experiment.

We start on a nocturnal atmospheric temperature of 271.51*K*. Remember that it is **temperature, i.e. thermal energy content,** of a vertical column of atmosphere up to 30 *km* in height during nighttime.

The rate of radiative cooling of the surface is steady and our measurements show an initial power emitted by the surface of 308.2*W*. This power emitted by the surface decreased progressively by 4.03*W* each hour.

It means that after one hour, starting at 21:00 hrs CST, the power emitted by the surface was 304.17*W*, and the recorded thermal radiation of the atmosphere was 59.72*W*. The change of temperature of the atmosphere was -2.46*K*.

After two hours, the heat emitted from the surface was 300.14*W*, and the change of temperature of the atmosphere was -2.52*K*.

After three hours, the heat emitted from the surface was 296.11*W*, and the change of temperature of the atmosphere was -2.59*K*.

After four hours, the heat emitted from the surface was 292.08*W*, and the change of temperature of the atmosphere was -2.68*K*.

After five hours, the heat emitted from the surface was 288.05*W*, and the change of temperature of the atmosphere was -2.62*K*.

After six hours, the heat emitted from the surface was 284.02*W*, and the change of temperature of the atmosphere was -2.84*K*.

After seven hours, the heat emitted from the surface was 279.99*W*, and the change of temperature of the atmosphere was -2.95*K*.

The results above are shown in the following table, which includes emission of thermal radiation from soil, thermal radiation absorbed by the atmosphere, temperature caused by thermal radiation absorbed by the atmosphere and the difference between thermal radiation from soil and thermal radiation from atmosphere.

Remember that measurements of thermal radiation emitted by the atmosphere include an inverted vertical conical column 30,000 *m* in height, which is lesser than the range of measurement of our pyrometers, if and when the targeted radiating system offers a surface larger than the diameter of field of view of the device at maximum distance.

Notice on the table below these lines that the change of temperature of the atmosphere is progressive, i.e. it increases in time, while the loss of thermal radiation from the surface is steady and fixed, i.e. 4.03*W* each hour, as well as the loss of thermal radiation from the atmosphere, which is about -2.2*W* each hour.

Complete Nighttime Dataset

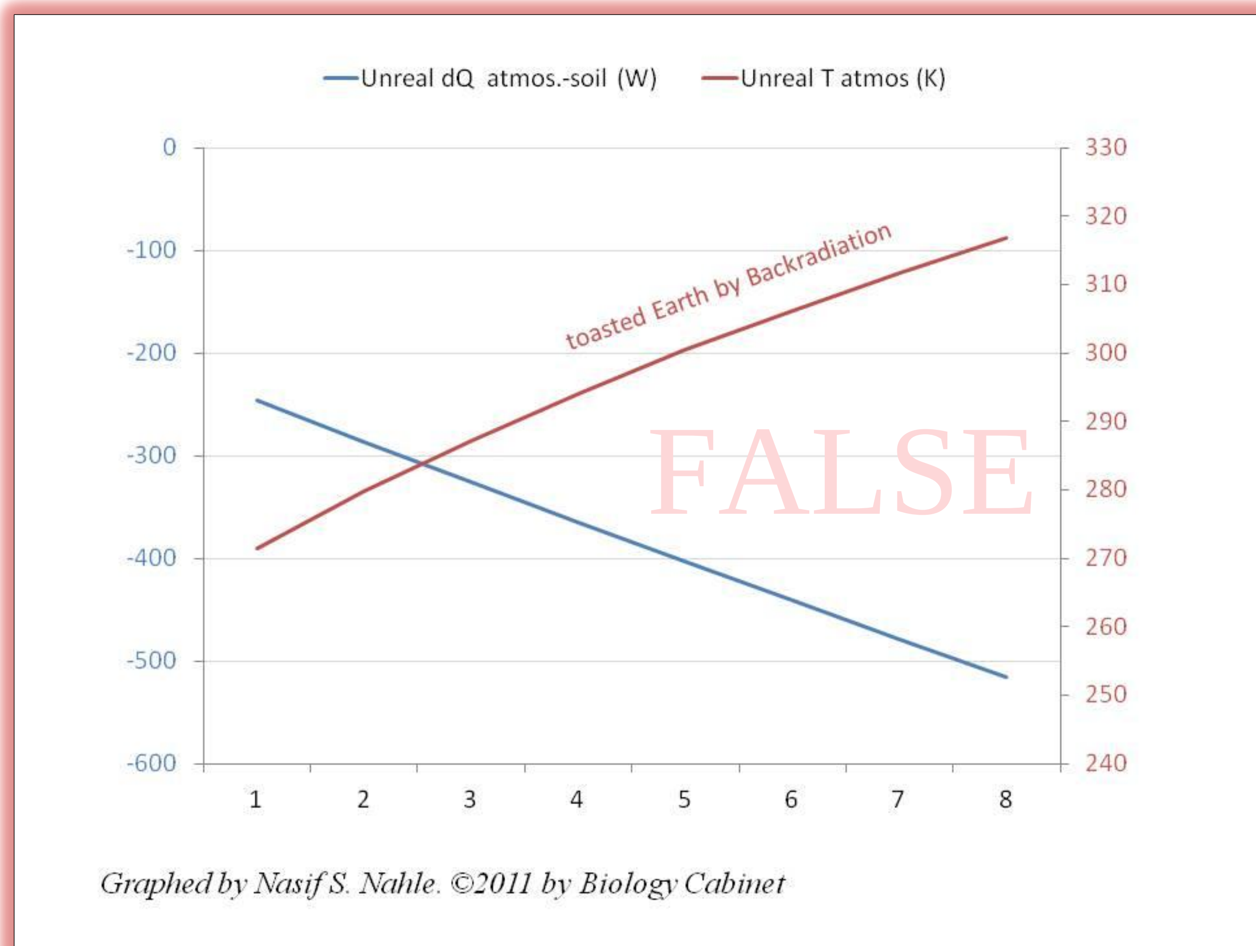
Time Interval	$Q_{rad\ \mathrm{soil}}$ (*W*)	$Q_{rad\ \mathrm{atmos}}$. (*W*)	$T_{\mathrm{atmos.}}$ (*K*)	$\Delta T_{\mathrm{atmos.}}$ (*K*)	dQ $_{\mathrm{atmos\text{-}soil}}$ (*W*)
0 h	308.20	61.93	271.51		-246.27
1 h	304.17	59.72	269.05	-2.46	-244.45
2 h	300.14	57.51	266.53	-2.52	-242.63
3 h	296.11	55.31	263.94	-2.59	-240.8
4 h	292.08	53.10	261.27	-2.68	-238.98
5 h	288.05	50.89	258.51	-2.76	-237.16
6 h	284.02	48.69	255.66	-2.84	-235.33
7 h	279.99	46.48	252.71	-2.95	-233.51

I have plotted the dataset from the above table on the following graph. The blue line is for thermal radiation from soil; the red line is the thermal radiation from the atmosphere, and the green line is the difference between the thermal radiation from the surface and the thermal radiation from the atmosphere.

The underlying Principle is clearly illustrated given that the thermal radiation from the soil decreases in time, as well as thermal radiation from the atmosphere; conversely, the change of temperature of the atmosphere increases:

Graph 1: ***The Z-Underlying Principle***; ***ΔT* steadily increases while *$Q_{rad\ soil}$* and *$Q_{rad\ atmos}$* steadily decrease.** This only means that the temperature of the atmosphere decreases faster than the temperature of the soil and the temperature of the soil does not depend on thermal radiation from the atmosphere. Notice that the thermal radiation emitted by the surface is always higher than the thermal radiation emitted by the atmosphere.

Underlying Principle would not be possible if the atmosphere radiated energy toward the Earth's surface and the surface would be absorbing it. The graph obtained from such unreal condition would be as follows. **[Do not forget that the following graph depicts an unreal situation opposed to the second law of thermodynamics]**:



*Here is the formula used to obtain the **unreal** thermal "backradiation" emitted by the atmosphere and absorbed by the soil:*

$Q'_{abs\ soil\ night} = (Q_{soil} - 4.03\ W) + (Q_{atmos} * 0.7)$

Where $Q'_{abs\ soil\ night}$ is for thermal energy absorbed by the soil during nighttime, Q_{soil} is the measured thermal radiation emitted by soil, and Q_{atmos} is the thermal radiation emitted by atmosphere. **Luckily, this situation is unreal; otherwise, life on Earth would not be possible. Imagine an Earth at 300 °C!** [3]

Under this unphysical scenario, the surface would emit thermal radiation which would be absorbed by the atmosphere, which would emit again towards the surface, which would emit more thermal radiation towards the atmosphere, which would absorb more energy and would radiate even more energy towards the surface, etcetera, etcetera, until toasting the Earth.

Have we ever recorded an atmospheric temperature of 144 °C on Earth? The assertion of an atmosphere radiating $342W/m^2$ of thermal radiation towards the surface is unreal. [3]

Answers and Conclusions

From this experiment with IR thermometers and radiometers, I found that what we are really measuring when we point these devices towards a clear sky in an angle of 90° with respect to the surface, is a limited range of thermal radiation[12] at wavelengths from 0.1 to 14 *μm* emitted by globules of air at high altitudes.

This experiment demonstrates that radiometers record thermal radiation of floating globules of rarified hot air at 6 to 30 *km* in altitude (corresponding to upper troposphere and stratosphere) that transfer thermal radiation towards cooler volumes of air.

The field of view of radiometers draws a far extreme circle that is 5 *km* in diameter. It is an inverted conical shape whose apex ends on the lenses of the devices and base ends on any region of the upper atmosphere emitting thermal energy at wavelengths detectable by these devices.

Additionally, prevalence of thin cirri, which emit longwave and shortwave thermal radiation, constitutes a partial but efficient and constant obstacle to solar thermal radiation as well as a source of thermal energy that can be detected by radiometers and IR thermometers. As soon as we focus our radiometers or IR thermometers towards the sky in an angle of 90° with respect to the surface, we measure thermal radiation from stratus clouds, cirri clouds and cirrostrati at about 6 *km* in altitude, not any backradiation from the atmosphere.

Let me be a bit more explicit. The field of view of IR thermometers, radiometers, pyrgeometers, and pyrometers goes up, up, up, until it stumbles upon a lower density region at higher temperature than the surroundings that is absorbing, scattering, reflecting [12], and emitting solar thermal radiation. Radiometers and IR thermometers make an average [12] of the globules of hot air and the thermal radiation from cirri into the whole trajectory of their fields of view.

I have found also that as we place radiometers and IR thermometers pointing sides at an angle of 0°, that is when the field of view of the radiometer is parallel to surface, we measure thermal radiation of globules of hot air which wrap the cells of the device. This is thermal radiation emitted from the boundary layer between surface and atmosphere; the hottest or warmest globules that are almost to start buoying to upper altitudes are those which are in contact (in touch) with the very hot surface.

The resulting records would depend on the altitude of those globule (e.g. a globule radiating $60W/m^2$ would be at 30 *km* in altitude; globules at surface level, which start rising and are very hot because they are in contact with the hotter surface, would emit around $92\,W/m^2$, etc.). They merely detect thermal radiation emitted by relatively-small hot globules of air rising vertically in the atmosphere.

Cirri and globules of hot air rising in the atmosphere are actually acting as vehicles to transport thermal radiation from the surface towards upper layers of the atmosphere, day and night (we have corroborated it only during nighttime).

It is very clear, from Thermodynamics, Plank's distribution of radiation[12] and Stefan-Boltzmann laws, that heat is transferred exclusively from warmer surfaces towards cooler systems, never the opposite, and this experiment demonstrates it is applicable to the climate system.

The disagreement between surface temperature caused by backradiation (which would be -91.35 °*C*) and the actual temperature of surface (23.7 °*C*), debunks the myths of a greenhouse effect by backradiation emitted by cooler greenhouse gases warming up a warmer surface.

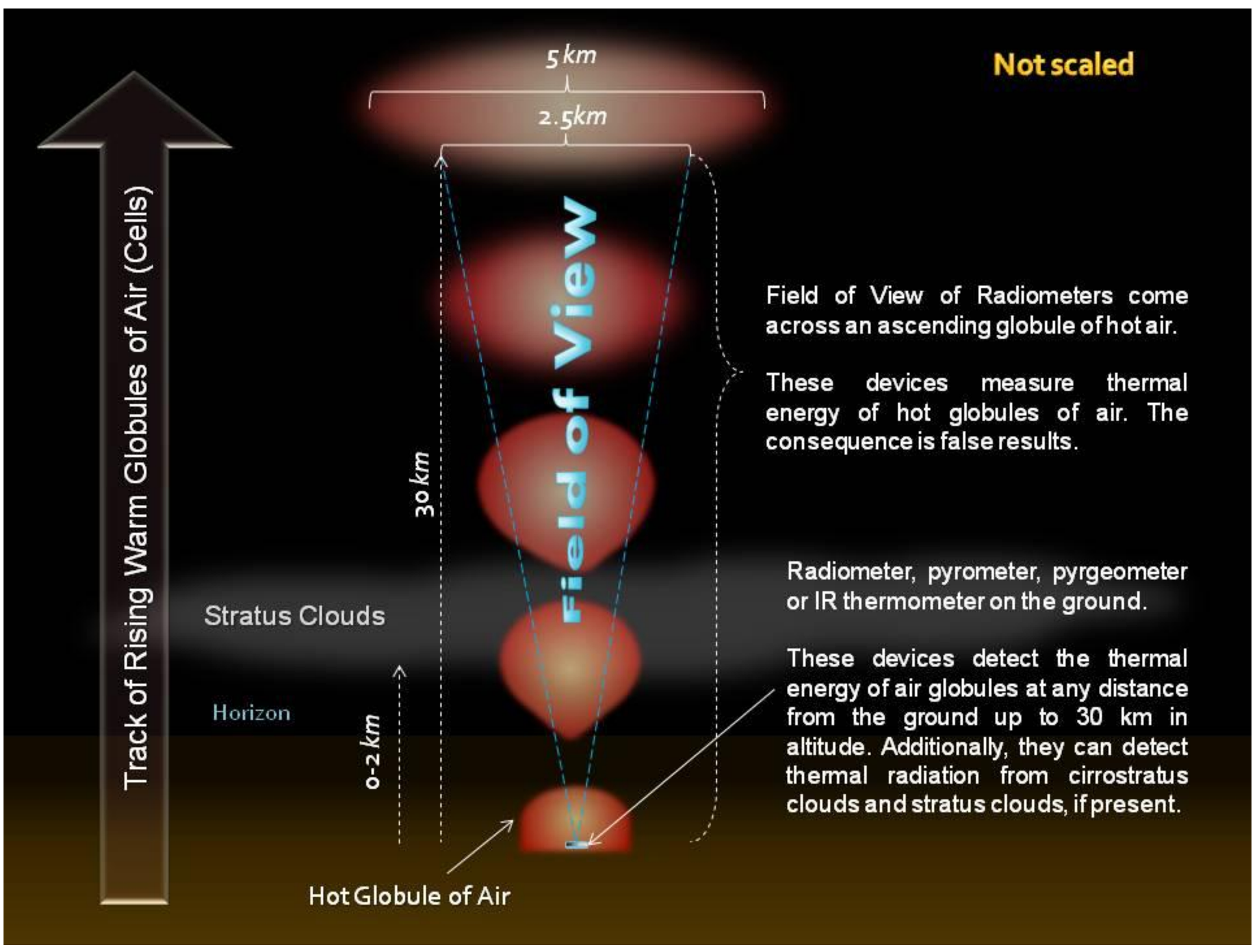
Statistical Thermodynamics easily discredits the argument of absorption of cool quantum/waves (lower frequency and longer wavelength than the absorbed quantum/waves) by warm mass particles.

We cannot take *ad arbitrium* electrons from highest energy microstates out to even higher energy microstates, from the mass particle, without breaking up the latter or without the occurrence of quantum tunneling, which has never been observed, detected, or produced in the atmosphere-surface system.

If we could produce quantum tunneling in our atmosphere, we actually could take absolute control of the planetary climate. We could warm up the poles and cool down the equator as easily as we can do it in lasers, without creating energy from nothing, but taking it from a region of the universe and placing it in another region.

If the surface were not radiating, the temperature of the atmosphere would be -72.2 °*C* (less than Mars' atmospheric temperature at 1.5 *m* above ground, which is -62 °*C* in average). If an atmosphere would not exist, the temperature of Earth on daylight side would be ~120 °C [3].

The following diagram depicts what IR thermometers, radiometers, pyrometers and pyrgeometers actually are measuring when they are placed on the ground facing up towards the sky (It was not drawn in scale):



From observations and experimentation of nature, the total absorptance potential of the whole mixture of gases in the atmosphere is 0.2, and its total emittance potential is 0.201. These potentials include water vapor total absorptance and total emittance. As total emittance of sole water vapor is 0.65, it is quite clear that other gases in the atmosphere diminish the emittance and absorptance potentials of water vapor.

Is it not clear that the temperature of the atmosphere depends mostly on the surface temperature and not the opposite? The answer to the questions on the section "*The Problem*" is as follows:

* Does thermal radiation emitted by a cooler atmosphere warm up a warmer surface by backradiation?

  No, thermal radiation emitted by the atmosphere does not warm up the warmer surface. This argument is unphysical because the thermal radiation emitted by the atmosphere is never higher than the thermal radiation emitted by the surface and it decreases in time in accordance to the thermal radiation emitted by the surface; additionally, the negative change of temperature of the atmosphere increases in time, contrary to what would happen if it were warming up the surface.

* What are infrared thermometers, radiometers, pyrgeometers, and pyrometers measuring as they are pointed up towards the sky?

  Infrared thermometers, radiometers, pyrgeometers, and pyrometers measure thermal radiation limited by the range adjusted[12] **at 0.1-14 μm emitted from cirri and globules of air at different heights, which are rising vertically through the atmosphere.**

  In other words, Infrared thermometers, radiometers, pyrgeometers, and pyrometers are measuring apparent temperature[12], i.e. content of thermal energy of an array of highly variable subsystems in the atmosphere[12], not thermal backradiation. There are not surfaces emitting radiation in the atmosphere.

  The recorded values correspond to a combination of radiation[12] which is an average made by the instruments from a series of instantaneous measurements of globules of air moving up, stratus clouds, water vapor present in the atmosphere, and dust particles.

In conclusion, **backradiation from a cooler atmosphere warming up a warmer surface is a myth that is 100% discredited by correct unbiased experimentation**.

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