Analysis of Joe Bastardi's Comments on AGW

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August 19, 2011.

JB: The First Law of thermodynamics is often called the **Law of Conservation of Energy**. This law suggests that energy can be transferred in many forms but cannot be **created** or **destroyed**.

NSN: This assertion is correct, energy can be transferred or transformed, but it cannot be created or destroyed. The energy input is equal to the energy output.

JB: For the sake of argument, let's assume those that believe CO2 is adding energy to the system are correct. Okay, how much?

NSN: According to its concentration in the atmosphere we derive its partial pressure and the prevailing temperatures of the atmosphere, CO2 only adds 0.78 J of energy to the climatic system. Such load of energy would cause a deficit of energy in the atmosphere causing a temperature reduction of the atmosphere.

We have that the power transferred by radiation from a warm system towards a cooler system is determined by the following formula:

$$\frac{q_{1-2}}{A} = \frac{E}{\bar{F}} = \frac{\left(\sigma * (T_1^4 - T_2^4)\right)}{\left[\left(\left(\frac{1}{\epsilon_1}\right) + \left(\frac{1}{\epsilon_2}\right)\right) - 1\right]}$$

Where $\frac{q_{1-2}}{A}$ is flow of power per unit area, E is the flux of power by square meter, $\bar{F}$ is the fraction of radiation from system 1 to system 2 obtained from $\bar{F}_{1-2} = \frac{\left(\left(\frac{A_2}{A_1}\right) - (F_{1-2})^2\right)}{\left(\frac{A_2}{A_1}\right) + (1 - 2F_{1-2})}$, σ is Stefan-Boltzmann Constant, T_1^4 is the temperature of the warmer system to the fourth power, T_2^4 is the temperature of the cooler system to the fourth power, ϵ_1 is the emittance of the warmer system, and ϵ_2 is the emittance of the cooler system.

Introducing magnitudes:

$$\frac{q_{1-2}}{A} = \frac{\left[(5.6697 \times 10^{-8})\ \left(\frac{W}{m^2 K^4}\right)\ \ast\ \left((9.313 \times 10^9\ K^4)\ -(8.12\ x\ 10^9 K^4)\right)\right]}{\left[\left(\left(\frac{1}{0.7}\right)+\left(\frac{1}{0.3}\right)\right)-1\right]}$$

$$\frac{q_{1-2}}{A} = \frac{67\left(\frac{W}{m^2}\right)}{3.762} = 17.8\left(\frac{W}{m^2}\right)$$

$$q_{1-2} = 17.8\left(\frac{W}{m^2}\right) \ast (1\ m^2) = 17.8\ W$$

According to experiments conducted by H. C. Hottel[1], B. Leckner[2], M. Lapp[3], C. B. Ludwig[4], A. F. Sarofim[5] and their collaborators[4,5], and other scientists, the total absorptance potential of carbon dioxide is ~0.003; consequently, the energy absorbed by carbon dioxide is:

$$\frac{q_{1-2}}{A} = \frac{\left[(5.6697 \times 10^{-8})\ \left(\frac{W}{m^2 K^4}\right)\ \ast\ \left((9.313 \times 10^9\ K^4)\ -(8.12\ x\ 10^9 K^4)\right)\right]}{\left[\left(\left(\frac{1}{0.7}\right)+\left(\frac{1}{0.003}\right)\right)-1\right]} = 0.2\ W$$

No sane scientist on this world would argue that an increase of 0.2 W would cause a warming of the Earth. The blackbody temperature that such power would cause in the volume of carbon dioxide, if carbon dioxide were the solitary component of the Earth's atmosphere, would be 0.3 °C, which in no way would cause a change of temperature of the Earth because of its high thermal diffusivity.

Considering that carbon dioxide emits a quantum/wave at a longer wavelength and a lower frequency and, therefore, with a lower energy density, the photons emitted by a molecule of this gas cannot be absorbed by other molecules of the same species.

The energy density of the quantum/wave is lower at higher altitudes than at the surface level in the finite moment that the quantum/wave is emitted. Therefore, the photons emitted by carbon dioxide suffer a redshift that takes them into a continuous decreasing of their energy density each time they are absorbed and emitted towards systems of different species.

Additionally, carbon dioxide cannot trap heat because it takes only 5 milliseconds to dissipate its acquired energy into heat sinks; that is, into outer space.

(Please, read http://www.biocab.org/Mean_Free_Path_Length_Photons.html)

Hence, Joe Bastardi is correct on his assertion.

JB: Then there is the energy budget. The amount of heat energy in the atmosphere is dwarfed by the energy in the land and especially the oceans. Trying to measure the changes from a trace gas in the atmosphere, if it were shown to definitively play a role in change (and it never has), is a daunting task.

NSN: Actually, if the atmospheric carbon dioxide mass increases, the change of temperature caused by this gas decreases. Let us take some presupposed concentrations of carbon dioxide; for example, 390 ppmV, 780 ppmV, and 1560 ppmV:

$$\Delta T = \frac{q}{m(Cp)}$$

At 390 ppmV, the change of temperature of the mass of carbon dioxide is 0.3 °C.

At 780 ppmV, the change of temperature of the mass of carbon dioxide would be 0.2 °C.

At 1560 ppmV, the change of temperature of the mass of carbon dioxide would be 0.1 °C.

These results actually are lower because the Cp of CO_2 increases as its temperature increases; on the other hand, the density of CO_2 decreases as its thermal diffusivity increases due to increases of temperature. For example, at 220 K, the Cp of CO_2 is 783 J/ (kg * K) and its thermal diffusivity is 0.00000592 m^2/s, while the Cp of CO2 at 350 K is 900 J/ (kg*K) and its thermal diffusivity is 0.14808 m^2/s. The reason is that the density of this gas decreases with temperature while the absolute pressure (of the atmosphere) and the atmospheric proportion of CO_2 remain constant.

For emissions from the surface to increase, the input of solar power must previously increase. (Please, read http://www.biocab.org/Heat_Stored.html)

It is obvious that the multiplication of the energy argued as backradiation by the AGW proponents is a falsification of reality. As Joe Bastardi points it out, the energy cannot be created or destroyed. The energy balance consists on having an amount of incoming energy equal to the outgoing energy.

JB: NASA satellites suggest that the heat the models say is trapped, is really escaping to space, that the 'sensitivity' of the atmosphere to CO2 is low, and the model assumed positive feedbacks with water vapor and clouds are really negative. Even IPCC Lead Author Kevin Trenberth said "*Climatologists are nowhere near knowing where the energy goes or what the effect of clouds is…the fact is that we can't account for the lack of warming at the moment, and it is a travesty that we can't.*"

Here, we find that Joe Bastardi is correct again, although we could add that the "sensitivity" of the atmosphere to CO_2 is negligible, i.e. near zero. Through a controlled experiment, I demonstrated that a temperature increase from "trapped radiation" does not occur; the results of my experiment are thus consistent with NASA's findings. (Please, read details of my experiment at http://principia-scientific.org/publications/Experiment_on_Greenhouse_Effect.pdf)

The hypothesis of a greenhouse effect (GHE) created by trapped radiation is unphysical and opposed to evidence; consequently, the greenhouse effect hypothesis is falsified by experimentation and observations of nature.

JB: Ah, but here is where the 1st law comes in because the sun is an energy source, while CO2 is not. After a prolonged period of LACK OF SUNSPOT ACTIVITY, the world was quite cold around 1800. The ramping up of solar activity after 1800 to the grand maximum in the late twentieth century could be argued as the ultimate cause of any warming through the introduction of extra energy into the oceans, land and then the atmosphere.

NSN: Indeed, the Sun is a primary energy source, while carbon dioxide is not. Consequently, carbon dioxide cannot emit more energy than the energy it absorbs. Some schemes of the Earth's energy budget show the atmosphere emitting more energy than the energy of the whole system. It is opposed to scientific knowledge regarding the 1st. law of thermodynamics: The energy can be transformed, but never created or destroyed.

The following scheme is an example of this kind of flawed energy budget schemes:

http://www.cgd.ucar.edu/cas/Trenberth/trenberth.papers/BAMSmarTrenberth.pdf   [Page 4]

On the other assertion about the storage of extra energy into oceans, land and atmosphere, we cannot disagree because the oceans are the major reservoir of thermal energy of the Earth, followed by the land and the subsurface materials. Dry air is not capable of retaining thermal energy for extended periods of time, although the capability of air to retain thermal energy increases after the addition of water vapor. The following table shows the capacity that water, dry soil, and atmospheric dry air have to retain thermal energy:

Thermal Characteristics of Dry Air, Water and Dry Clay Soil

Material / Thermal Property	Dry Air	Water	Dry Clay Soil
Density (ρ)	1.2 Kg/m³	1000 Kg/m³	2000 Kg/m³
Specific Heat (Cp)	1000 J/Kg K	4190 J/Kg K	890 J/Kg K
Heat Capacity (ρC)	1200 J/m³ K	4190000 J/m³ K	1780000 J/m³ K
Thermal Conductivity (k)	0.026 W/m K	0.58 W/m s	0.25 W/m s
Thermal Diffusivity ($k*$)	0.0000215 m²/s	0.00000014 m²/s	0.00000018 m²/s
Conductive Capacity ($C*$)	6 J/m² K s$^{1/2}$	1570 J/m² K s$^{1/2}$	600 J/m² K s$^{1/2}$
Specific Volume (ρV)	0.83 m³/Kg	0.001 m³/Kg	0.0005 m³/Kg

$P = 1$ atm and $T = 293$ K

Sources:

1. Modest, Michael F. Radiative Heat Transfer-Second Edition. 2003. Elsevier Science, USA and Academic Press, UK.
2. Pitts, Donald and Sissom, Leighton. Heat Transfer. 1998. McGraw-Hill.
3. Peixoto, José P., Oort, Abraham H. 1992. Physics of Climate. Springer-Verlag New York Inc. New York.

The conductive capacity (C*), or thermal inertia (P), is the thermal response of a material to fluctuations of temperature. Dry air response to fluctuations of temperature is quite low because of its high thermal diffusivity, while water and dry clay soil thermal inertias are high in response to their lower thermal diffusivity.

For the reason described in the above paragraph, water and dry clay reach thermal equilibrium in a short time, while dry air cannot reach thermal equilibrium with the surrounding gas molecules.
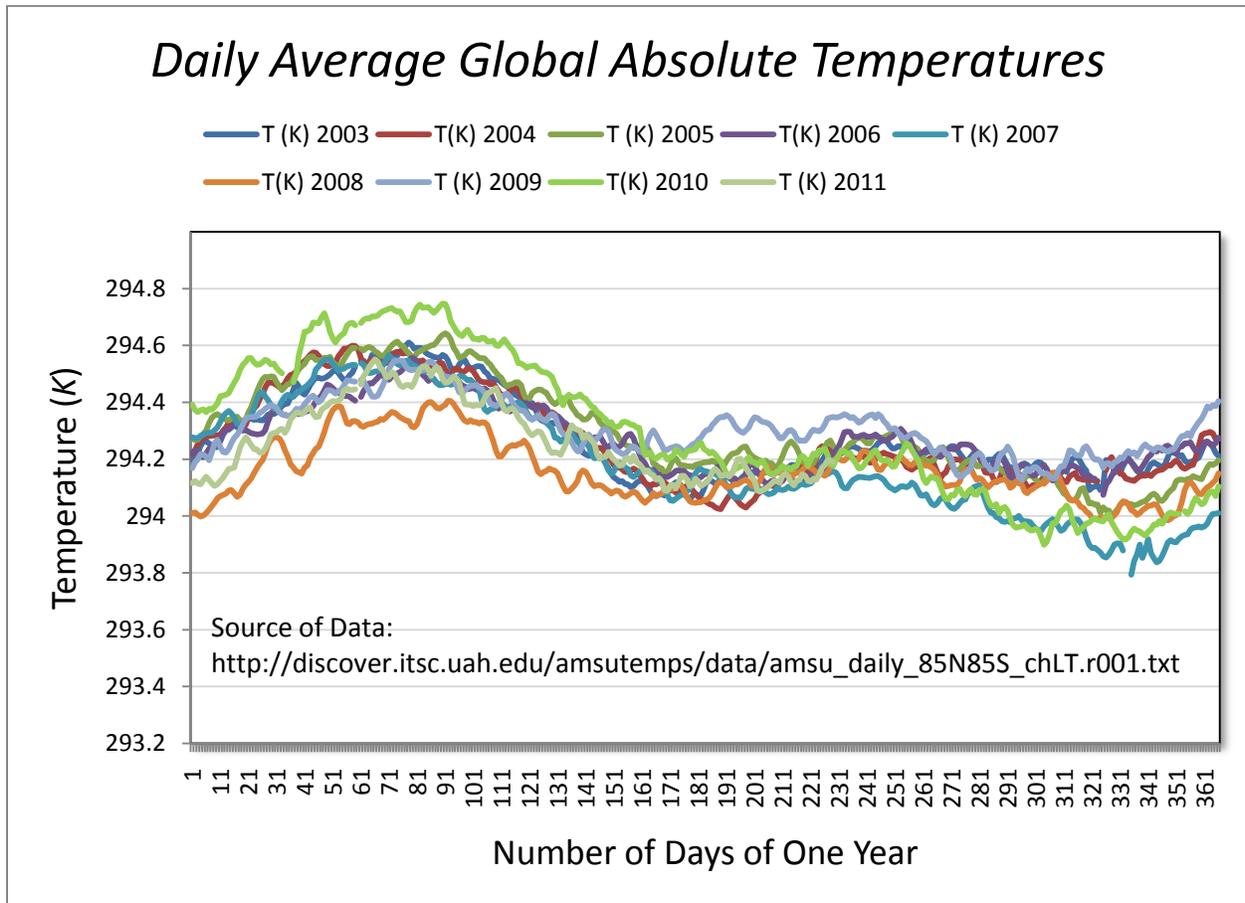
JB: It is the earth's temperature (largely the ocean) which is driving CO2 release into the atmosphere. That is what the ice cores tell us and recently that Salby showed using isotopes in an important peer review paper. These use real world observations not tinker toy models or a 186 year old theory that has never been validated.

The theory Joe Bastardi refers to is the Tyndall's hypothesis, which was followed by Arrhenius in 1906 with some inconsistent calculations. Prof. Robert Wood refuted experimentally Arrhenius hypothesis, but his experiment was conveniently hidden from public and academic scrutiny because it contradicted, with experimental evidence, the greenhouse effect hypothesis, i.e. with scientific arguments, not just calculations.

I verified systematically Prof. Wood's experiment and found it is absolutely repeatable. Prof. Wood, in 1906, and I, in 2011, demonstrated that the greenhouse effect caused by trapped radiation is unreal.

We could say the trend has smoothed, but definitely is not of a global warming. The following graph depicts the day by day average annual global temperatures through the last decade. There is not warming signal:

Daily Average Global Absolute Temperatures

Legend: T (K) 2003 · T(K) 2004 · T(K) 2005 · T(K) 2006 · T (K) 2007 · T(K) 2008 · T (K) 2009 · T(K) 2010 · T (K) 2011

Source of Data:
http://discover.itsc.uah.edu/amsutemps/data/amsu_daily_85N85S_chLT.r001.txt

Y-axis: Temperature (K), ranging 293.2 to 294.8

X-axis: Number of Days of One Year (1 to 361)

2010 had a warmer summer, but a cooler winter, so the trend of absolute temperatures is normal.

The following graph depicts the average temperatures year by year during the last ten years:

Annual Average Global Temperature Last Decade
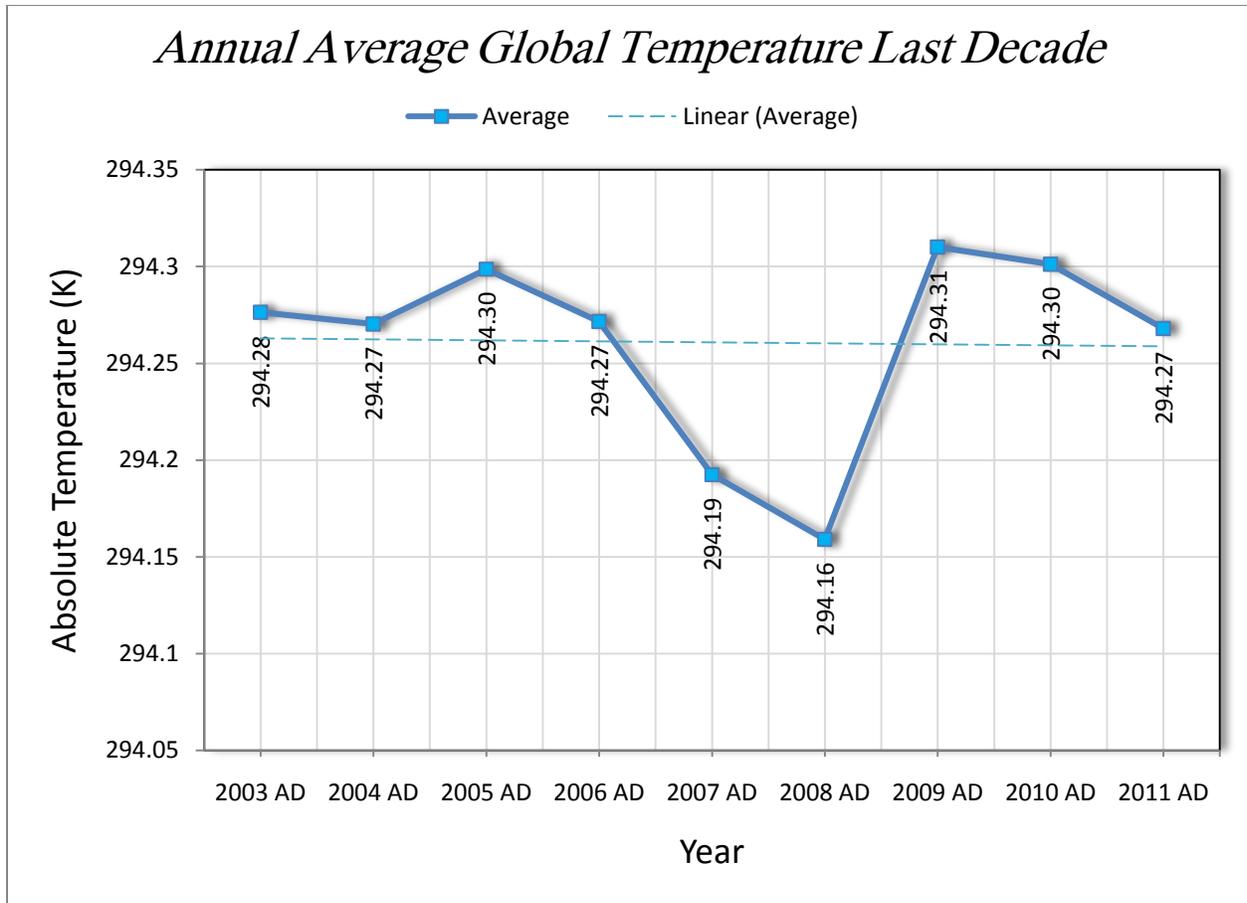
The trend is sloping down and it points out toward a cooling of the globe.

JB: Finally, as to the matter of LeChatelier's principle. The earth is always in a state of imbalance and weather is the way the imbalances are corrected in the atmosphere. Extreme weather occurs when factors that increase imbalances are occurring. The extremes represent an attempt to return to a state of equilibrium.

Although there are subsystems in the climate that are in temporary thermal equilibrium, we can say that the Earth as a whole is in thermal nonequilibrium. If the Earth were in a state of thermal equilibrium, changes of weather would not be possible.

The subsystems that are notoriously in a state of thermal nonequilibrium are the air, the oceans, the biosphere, and the clouds. The most identifiable subsystems in a state of thermal nonequilibrium are the clouds and the biosphere.

In brief, Joe Bastardi's arguments are correct and in agreement to physics and climatology.

References:

1. Hottel, H. C. *Radiant Heat Transmission-3rd Edition*. 1954. McGraw-Hill, NY.

2. Leckner, B. *The Spectral and Total Emissivity of Water Vapor and Carbon Dioxide*. Combustion and Flame. Volume 17; Issue 1; August 1971, Pages 37-44.

3. **http://thesis.library.caltech.edu/2809/1/Lapp_m_1960.pdf**

4. Ludwig, C. B., Malkmus, W., Reardon, J. E., and Thomson, J. A. L. Handbook of Infrared Radiation from Combustion Gases. Technical Report SP-3080.NASA. 1973.

5. Sarofim, A. F., Farag, I. H., Hottel, H. C. Radiative Heat Transmission from Nonluminous Gases. Computational Study of the Emissivities of Carbon Dioxide. ASME paper No. 78-HT-55.1978.