The Effect of a Doubling of the Concentration of CO_2 in the Atmosphere as Depicted by Quantum Physics

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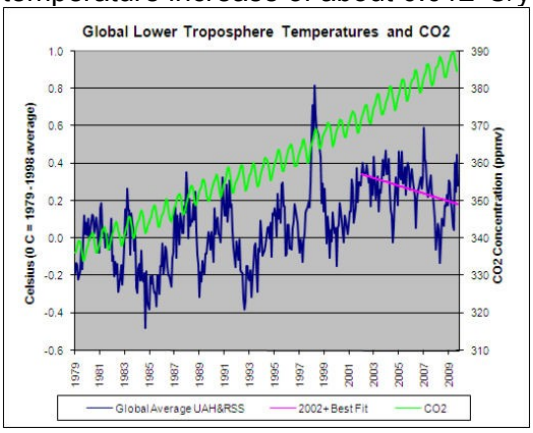
Summary

Satellites launched in late 1978, have now provided us with three decades of precise global temperature measurements that are completely free of the sampling bias and other physical problems associated with surface based data. Over these three decades the concentration of atmospheric CO_2 has increased from about 336ppmv in 1979 to 386ppmv by 2009. The CO_2 concentration is currently still increasing at a rate of 2ppmv/year. According to the forcing parameter used in the Intergovernmental Panel on Climate Change (IPCC) climate models, this increase in CO_2 should produce a global temperature increase of about 0.012°C/year.



The IPCC 'model predicted' temperature increase appears plausible on the satellite data but only up to 1999, at which point the temperature trend and the CO_2 trend began to diverge. Also, from 1979 to 1999 there were three large climatic events, the el Chicon volcanic eruption in 1983, the Mt Pinatubo volcanic eruption in 1992, and the 1998 el Niño, all of which produced such large annual global temperature variations that it was not possible to verify the validity of IPCC climate model temperature trend because the magnitude of these temperature anomalies. The past decade has been relatively free of such climatic events, and there is now a clearly defined visible cooling trend that started in 2002. Since the atmospheric CO_2 concentration has continued to increase as the globe continues to cool; there is something fundamentally wrong with the IPCC climate model projections of warming from increased atmospheric CO_2. This discrepancy led to my investigation into the physical basis for the forcing parameter of the climate models.

Introduction

The forcing parameter of the IPCC climate models appears to be based solely on the concepts developed by Svante Arrhenius in 1896, and empirically derived from the observation of a 0.6°C increase in global temperature assumed to have been caused by a 100ppmv increase in atmospheric CO_2 concentration. This was done without any verification by quantum physics theory or physical observation of the Earth's radiative spectrum. The concepts of Arrhenius predate the development of quantum physics. Quantum physics provides understanding of the physical processes involved in the

interaction between atmospheric CO_2 and the thermal energy radiated by the Earth. These physical processes demonstrate limitations in the effect of CO_2 on global temperature that have not been addressed in creating the forcing parameter of the climate models.

Theory and Method

Essentially the radiative spectrum of the Earth's only includes a single energy band centred on 14.77μ that is in resonance with the CO_2 molecule. At current concentration most of the energy in this band accessible to CO_2 has already been affected, and the energy remaining in this band is insufficient to produce the effect from a doubling of CO_2 that is predicted by the forcing parameter of the climate models.

In 1905 Einstein declared $E=mc^2$ and provided the world with a way of attributing mass to "massless packets" of energy referred to as quantum (photons). This started a new branch of physics that explained much of what could not be explained previously.

The radiative energy from the Earth is limited to a spectrum dictated by its temperature. The figure below shows the spectrum of the Earth as measured by the Nimbus 4 Satellite in 1970. This measurement was taken over Guam and should closely match the spectrum for the theoretical curve of 300k (26.85°C). The departure of the measured spectrum from the theoretical curve is primarily due to energy being blocked by water vapour, CO_2, and ozone as annotated on the graph.

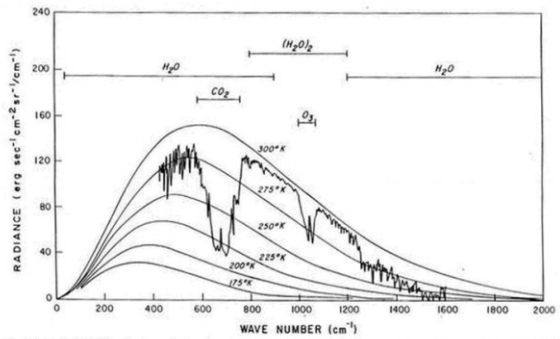


Fig. 4.1 The terrestrial infrared spectra and various absorption bands. Also shown is an actual atmospheric emission spectrum taken by the Nimbus IV IRIS instrument near Guam at 15.1 N and 215.3 W on April 27, 1970.

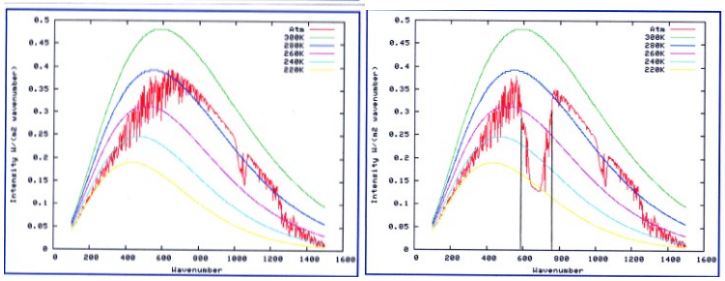
It is important to note that this spectrum was measured over an area free of clouds, because if substantial cloud cover was present well over 95% of the energy could be blocked obliterating the spectrum. This is why the effect of clouds represents over three quarters of the Earth's greenhouse effect.

Water vapour blocks more of the spectrum than CO_2, and this, combined with the effect of clouds, provides the evidence that water in the form of clouds and water vapour represent about 90% of the 34.5°C greenhouse effect. This only leaves 3.45°C of the greenhouse effect attributable to CO_2, and with such a sizeable notch already cut into the energy spectrum by CO_2 at just 325ppmv concentration as in this 1970 measurement; the question is how much more effect can be achieved if the atmospheric CO_2 concentration is doubled.

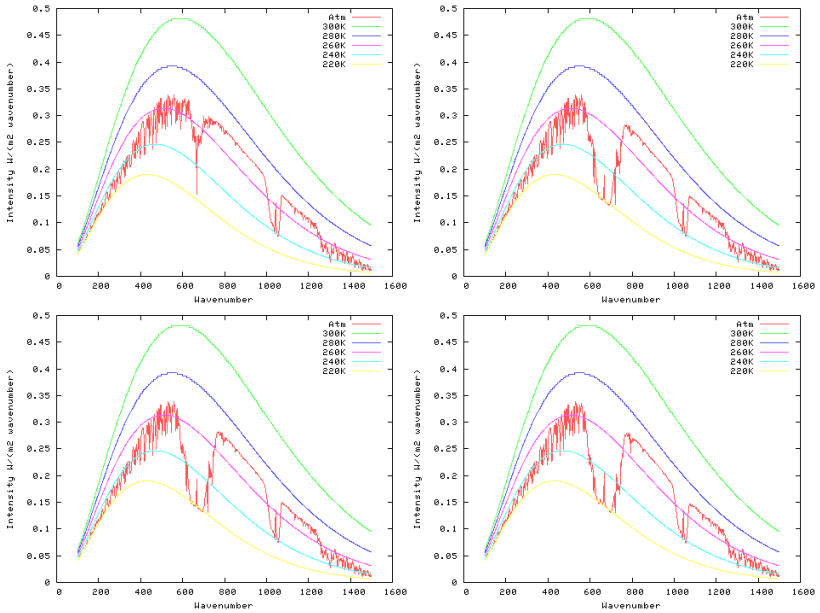
The process by which CO_2 interacts with the thermal spectrum of the Earth is key to determining this. The interaction requires a dipole moment in the molecule and the way that this is achieved in a linear symmetrical molecule such as CO_2 is through a resonant vibration from bending along its length. In the case of CO_2 this bend vibration resonates with a wavelength of 14.77μ (according to the wave theory of light) or a 14.77μ equivalent wavelength photon (according to quantum theory).

A photon radiated from the Earth at or near this wavelength will be temporarily absorbed by any CO_2 molecule that it encounters. The photon will cease to exist and its energy will

be transferred to the CO_2 molecule causing it to vibrate thereby increasing the internal energy state of the CO_2 molecule. After a short period of time the CO_2 molecule returns to its original energy state by ceasing vibration and converting this energy of vibration into a new photon which the molecule radiates in some random direction.
The new photon will encounter another CO_2 molecule and the process will be repeated. This will continue until a photon escapes into space, is returned to the surface, or travels laterally, eventually becoming insignificant relative to the incoming energy from the sun the next day. There is a narrow range of wavelengths at which this process can occur, and outside this range of wavelengths there is no effect from CO_2; regardless of the concentration. In all cases about one third of the energy in this spectral band will always escape into space which is why the spectral notch only cuts two thirds of the way into the spectrum.
These two graphs show modelled Earth radiative spectra; on the left, with zero CO_2 and on the right with a CO_2 concentration of 380ppmv. The two vertical lines represent the maximum spectral limits of the effect of CO_2 on the Earth's radiative spectrum.

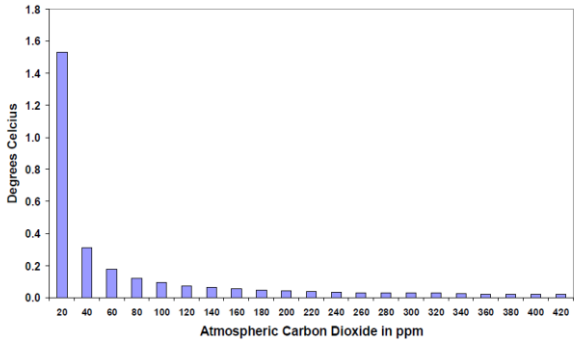


The area above the base of the notch between the two vertical lines represents all of the energy remaining that can be affected by further increases in atmospheric CO_2 concentration above the current level. The question is how much of this remaining energy will be accessed by a doubling of the concentration of atmospheric CO_2 from its current level and what effect this will have on global temperature.



The four graphs above, demonstrate the effect increasing the CO_2 concentration from 1ppmv at the top left, to 280ppmv at the top right, to 380ppmv at the bottom left and finally to a doubling of the current level to 760ppmv in the bottom right. It is obvious from

these graphs that most of the effect from CO_2 has already taken place at current levels, and even a doubling of CO_2 could not possibly have a significant further effect.
An alternate approach that comes to the same conclusion is demonstrated by the graph below. This MODTRAN study allocates global temperature increases to 20ppmv incremental increases in CO_2 concentration. The first 20ppmv has a very large effect resulting in substantially less energy for the next 20ppmv increment to affect. The next increment further reduces the remaining energy and the process is repeated resulting in the decreasing exponential curve of the graph. Once a concentration of 300ppmv is reached, the incremental 20ppmv increases have such negligible effect on temperature, that further increases, even a doubling of CO_2 concentration, will only have an insignificant effect on global temperature in the order of just a few tenths of a degree C.



Conclusions

1) Physical measurement and quantum physics theory dictate that the maximum possible increase in global temperature resulting from a doubling in atmospheric CO_2 concentration above the current level of 386ppmv is only in the order of a few tenths of a degree C, and definitely less than 0.4°C.
2) At the current rate of increase of 2ppmv/year it will take 193 years to achieve this doubling. A 0.4°C temperature increase caused by this doubling of CO_2 in 193 years is only a year to year temperature increase of just 0.002°C; i.e. 0.18°C by 2100.
3) The current IPCC predictions based on the climate models are for this doubling to take place by 2100 with a temperature increase of over 2°C from this doubling of CO_2.
4) The IPCC predicted rate of increase in atmospheric CO_2 concentration, and the IPCC climate model prediction of global warming that will result from this increase in CO_2 concentration are inconsistent with observation and are contrary to both physical data and quantum physics theory.

Acknowledgements

Special thanks to Jack Barrett and David Archibald for the graphical presentations.
Mauna Loa Observatory: ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_mm_mlo.txt
Temperature data: http://vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt

References

Jack Barrett, 2005, Greenhouse molecules, their spectra and function in the atmosphere. ENERGY & ENVIRONMENT VOLUME 16 No. 6, 1037 – 1045.