THE NOAA OUTGOING LONG WAVE RADIATION DATA APPEARS TO BE INCOMPATIBLE WITH THE THEORY OF ANTHROPOGENIC GLOBAL WARMING.

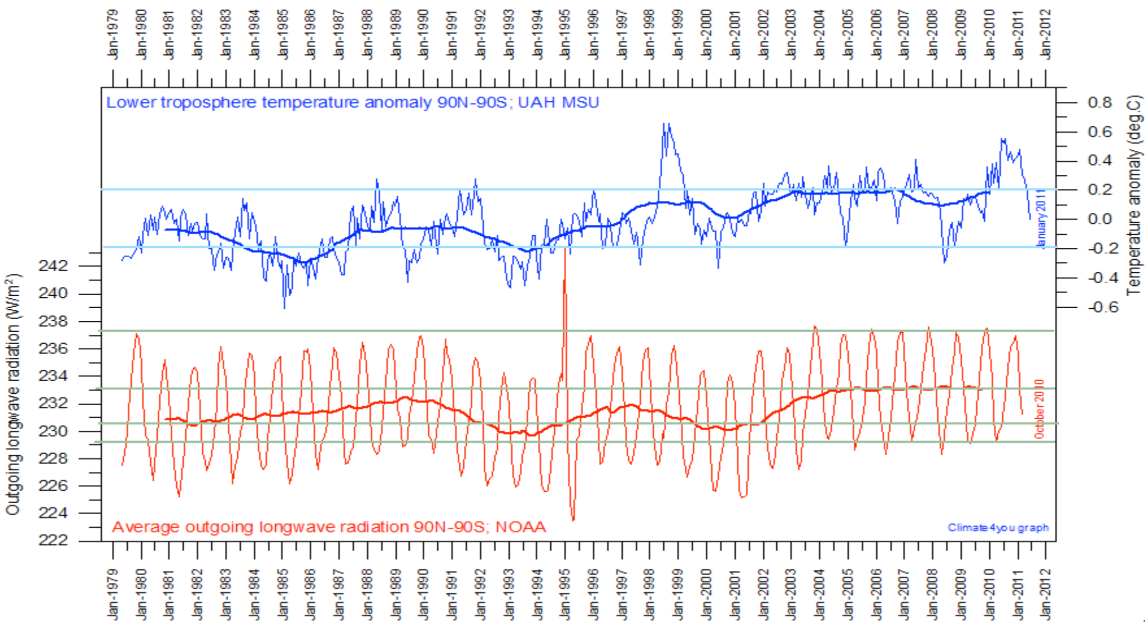
Earth absorbs energy from the sun and in turn loses an equal amount of thermal or long wave energy back out to space. This is usually termed outgoing longwave radiation or OLR for short. The emission of thermal radiation is very well understood and the emission as a function of wavelength is described by Planks law. If Planks law is integrated over all wavelengths the result is the Stefan Boltzmann (SB) law

$$\text{Emission} = \text{emissivity} * 5.67e\text{-}8 * T\text{^}4$$

This emission depends only on the temperature of the emitting surface and the emissivity, nothing else. Other factors such as green house gases, feedbacks, changes in solar input, solar magnetic fields and the like only impact the OLR by changing either the emission temperature or the emissivity.

Of course there is no single emission temperature for Earth. Green house gases for example act by reducing the emission temperature at some wavelengths (by replacing emission from the warm surface with emission from the colder top of the GHG column), and that means in theory the analysis should be based on Planks law not the SB law. However, we are most interested in the surface temperature of Earth and if we use this as the temperature in the SB equation the impact of changing GHG concentration will show up as an apparent change in emissivity which is a reasonable way to look at the situation for small incremental changes. Increasing GHG concentration reduces OLR to space – an apparent reduction in emissivity – and to restore the original OLR emission level the surface temperature of earth has to rise slightly hence global warming.

Given the above, I was very interested when I recently came across the plot of OLR versus time from climate4you reproduced below (green and blue grid lines my overlay).



This prompted me to download the original OLR data file from the NOAA website (olr.mon.mean.nc) and the seasonal temperature variations (absolute.nc) from the UEA website. (http://www.cru.uea.ac.uk/cru/data/temperature/. The tabular data in both cases is given by latitudinal bands in one case every 5 degrees and the other ever 2.5 degrees which I converted to

20 degree bands by taking the mean over each 20 degree interval, weighted by the relative area of each latitudinal band in the original data. The result is shown in the table below. The max and min values are shown red and blue respectively. The temperature is the average from 1961-1990. To approximately match this I averaged 5 years of OLR monthly data (1980-1985) avoiding the reduced stability years between 1990 and 2004 and the abnormal spike in 1995.

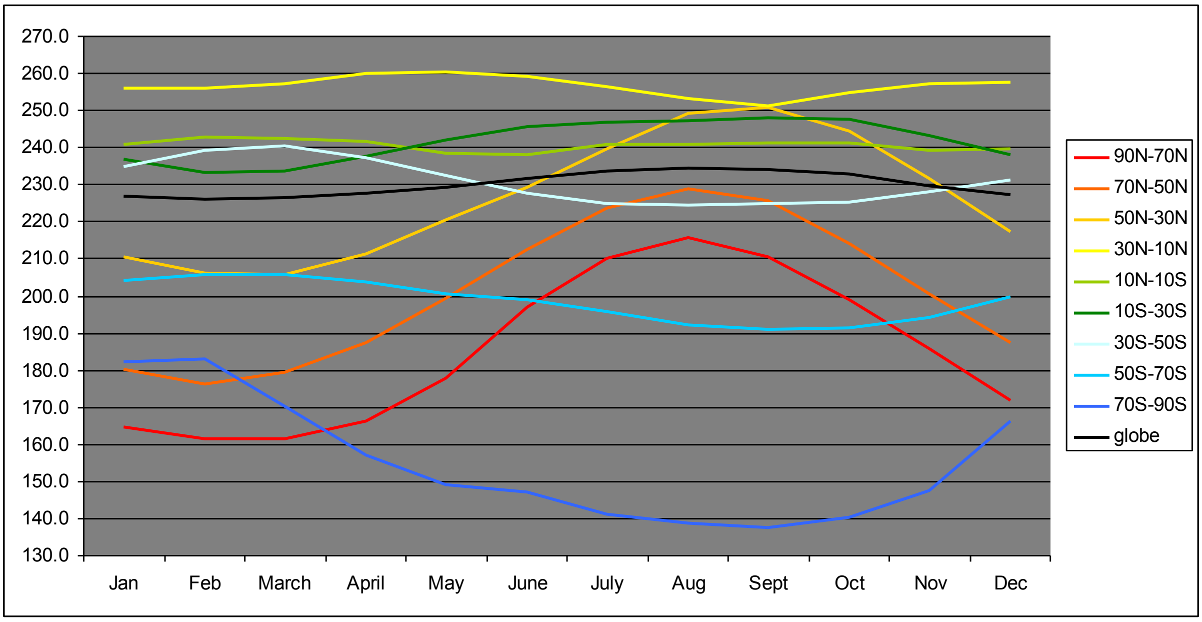
OLR in watts/sqM

latitude	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
90N-70N	164.7	161.3	161.5	166.5	177.8	196.8	210.2	215.7	210.4	199.1	185.7	171.8
70N-50N	180.2	176.2	179.3	187.6	199.3	212.6	223.8	229.0	225.6	214.1	200.6	187.4
50N-30N	210.4	206.1	205.9	211.3	220.4	229.3	239.8	249.1	250.8	244.6	231.7	217.5
30N-10N	255.9	256.0	257.3	260.0	260.5	259.2	256.6	253.4	251.3	254.7	257.2	257.7
10N-10S	240.8	243.0	242.7	241.5	238.3	238.1	240.7	240.8	241.5	241.2	239.4	239.9
10S-30S	236.8	233.3	233.7	237.8	242.0	245.8	246.8	247.1	248.0	247.7	243.2	238.3
30S-50S	235.0	239.1	240.5	237.3	232.5	227.7	224.8	224.4	224.9	225.2	228.2	231.3
50S-70S	204.2	205.9	205.7	203.8	200.7	199.0	195.7	192.4	190.9	191.6	194.2	199.6
70S-90S	182.4	183.1	170.2	157.2	149.1	147.2	141.0	138.9	137.5	140.5	147.7	166.4
globe	226.7	226.3	226.4	227.8	229.4	231.7	233.7	234.7	234.3	232.8	229.8	227.4

Temperature C

90N-70N	-27.0	-27.3	-25.7	-18.7	-7.9	-0.4	2.1	0.7	-3.9	-13.0	-21.1	-25.6
70N-50N	-15.2	-14.3	-9.7	-2.8	4.0	9.2	12.2	11.2	7.0	0.2	-7.9	-13.1
50N-30N	3.3	4.0	6.9	10.7	14.4	17.8	20.6	21.0	18.3	13.9	9.1	5.1
30N-10N	20.9	21.4	22.7	24.3	25.8	26.7	26.9	26.9	26.6	25.6	23.7	21.7
10N-10S	26.0	26.3	26.6	26.8	26.7	26.0	25.5	25.5	25.6	25.8	26.0	25.9
10S-30S	24.9	25.2	24.9	24.0	22.5	21.2	20.4	20.5	21.2	22.2	23.2	24.1
30S-50S	15.8	16.3	15.8	14.7	13.3	12.0	11.0	10.9	11.1	12.0	13.2	14.7
50S-70S	2.7	2.3	1.1	-1.0	-2.4	-3.3	-4.1	-4.9	-3.9	-2.5	-0.2	1.9
70S-90S	-15.3	-22.4	-30.8	-35.4	-37.2	-38.0	-39.6	-40.0	-38.8	-32.7	-23.2	-15.6
globe	12.3	12.5	13.1	14.1	15.0	15.6	15.8	15.7	15.1	14.2	13.2	12.5

The OLR by month for each latitude band is plotted below. For high latitudes, OLR is maximum in summer, minimum in winter following the temperature. Round the equator there is virtually no seasonal variation as might be expected but in the 10-30 latitudes the maximum OLR is in winter, opposite to the temperature variation.



This strongly suggests that OLR is modulated both by temperature and emissivity, the latter probably due to season changes in water vapour levels. At higher latitudes where absolute humidity is reasonably low, the temperature effect dominates but the 10-30 degree bands include the descending edges of the Hadley cells and here there is a very strong change in seasonal humidity, low in winter and high in summer, even though the difference in temperature is modest, thus lower emissivity in the summer relative to the winter. The differences between north hemisphere and south hemisphere are probably due to the greater land area in the north. Land heats faster than water but evaporation rates are lower hence lower humidity.

From the above data it is easy to compute the average temperature and OLR for each band of latitude, which, substituted into the Stefan Boltzmann equation gives the average emissivity of each band. Using that value, the first derivative of the SB equation gives the predicted incremental sensitivity (in watts/sqM/C) for each band at constant emissivity. Finally we can also extract the max – min difference in OLR and temperature over the year with the ratio giving the actual incremental sensitivity. The table below shows all this data (a – in the delta OLR column means the maximum was in winter not summer)

latitude	Avg temp	Avg OLR	emissivity	Sensitivity predicted	(max-min) OLR	(max-min) Temp	Sensitivity actual
90N-70N	-14.0	185.1	0.725	2.86	51.0	29.39	1.74
70N-50N	-1.6	201.3	0.654	2.97	52.8	27.46	1.92
50N-30N	12.1	226.4	0.604	3.18	44.8	17.63	2.54
30N-10N	24.4	256.7	0.578	3.45	-5.8	6.03	-0.96
10N-10S	26.1	240.7	0.531	3.22	3.5	1.31	2.64
10S-30S	22.9	241.7	0.556	3.27	-14.7	4.76	-3.09
30S-50S	13.4	230.9	0.605	3.22	16.1	5.43	2.96
50S-70S	-1.2	198.6	0.642	2.92	14.8	7.57	1.95
70S-90S	-30.8	155.1	0.794	2.56	45.6	24.68	1.85
globe	14.1	230.1	0.597	3.21	8.4	3.52	2.39

There is a smooth transition in emissivity, high at the poles where absolute water vapour is lowest and lowest at the equator. This clearly shows the green house impact of water vapour. However despite that, the predicted sensitivity in watts/sqM/C goes slightly the other way because of higher temperatures as one moves towards the equator. All this is very much in line with "orthodox climate science wisdom". Looking at the actual sensitivity (other than the 10-30 degree bands discussed earlier) the actual numbers are all lower, suggesting again that the impact of changes in water vapour levels are significant (we should however remember this is for very large temperature changes of up to 30C).

However if we look at the longer term trend shown in the very first graph at the start of this essay we find OLR has increased by 2.5 watts/sqM in the 30 years between 1980 and 2010 (30 years is the claimed interval necessary for reliable estimation of climate trends) . The global temperature rise over this time is 0.4C according to UAH (satellite) and 0.5 according to NASA GISS (land sea surface measurements). That translates to an incremental sensitivity of between 6.25 watts/sqM/C and 5 watts/sqM/C. That is significantly higher than indicated by the above data (3.21 predicted and 2.39 actual). It means that the average emissivity of earth has increased over the last 30 years which is the exact opposite of what the CAGW theory would suggest. It should also be noted that even for the 10-30 degree bands where water vapour effects dominate, the phase shift is quite small (less than 2 months). That suggests the time constant of water vapour feedback is very short, which speaks against long time constants for CAGW supposedly dominated by positive feedback from water vapour..

Remember this is based on an OLR analysis which is completely independent of any change in insolation. For example, it has been claimed by some that the recent hiatus in warming is due to increased volcanic activity because the extra dust in the atmosphere blocks more incoming sunlight, but it would also block OLR, which means it would reduce the emissivity not increase it, so it cannot explain this finding. The drop in OLR starting in 1991 to about 1997 may be due to the Mt Pinatubo eruption, although that does not explain the second drop starting in about 1999. The OLR data in isolation shows an increase in emissivity over the last 30 years despite a predicted fall due to rising CO_2 and that means, something in the atmosphere which normally partly blocks OLR has been reducing over the last 30 years and the impact of that fall significantly exceeds any impact from rising CO_2. Since the only effect of rising CO_2 (or a rising concentration of any green house gas) is to reduce the apparent emissivity of Earth for long wave radiation, and the emissivity has risen not fallen, it means that CO_2 (or indeed any increasing green house gas) cannot be primarily responsible for any global temperature rise since 1980.

Despite the increase in OLR over the last 30 years, global temperature has apparently risen. How is this possible? It must mean that incoming energy has increased even more than the increase in the OLR. But the output from the sun has not changed appreciably. That suggests the Earth is absorbing a larger fraction of the solar energy ie: Earth's albedo must have fallen. Both effects could be explained by a decrease in cloud cover. Since clouds inhibit longwave radiation to space, a reduction would increase OLR while at the same time less cloud cover would reduce Earth's albedo allowing more of the solar energy to be absorbed. Maybe there is something to Svensmark's theory after all.

There is of course an even simpler way of looking at the NOAA data. The AGW theory claims the earth is warming because rising CO2 is like a blanket, reducing Earth's energy loss to space but the NOAA data shows that at least for the last 30 years Earth's energy loss to space has been rising. The last 30 years of NOAA data is not compatible with the theory of AGW. It would appear that either 30 years of NOAA data is wrong or the theory of AGW is very severely flawed.

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