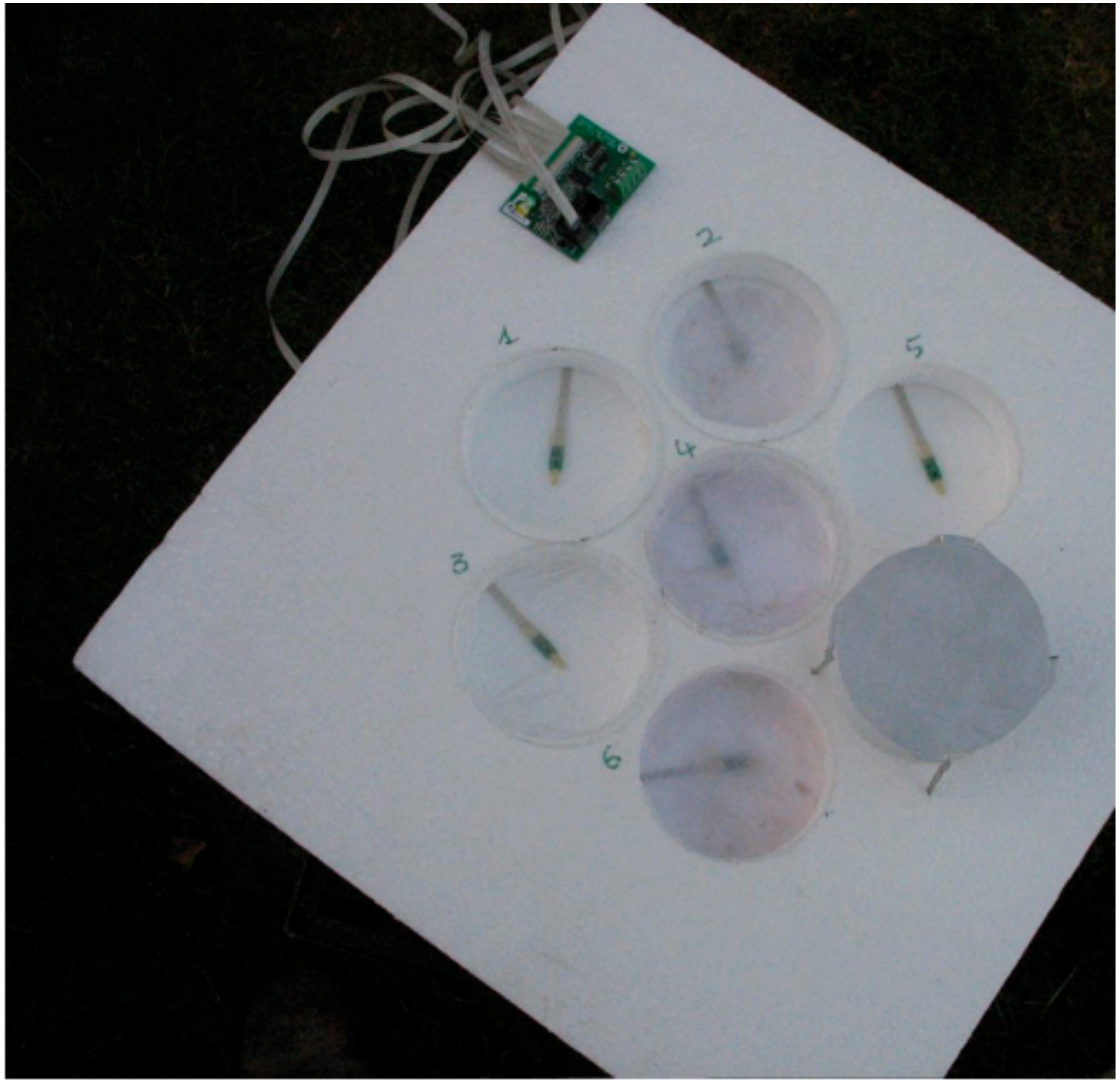
Anthropogenic global warming

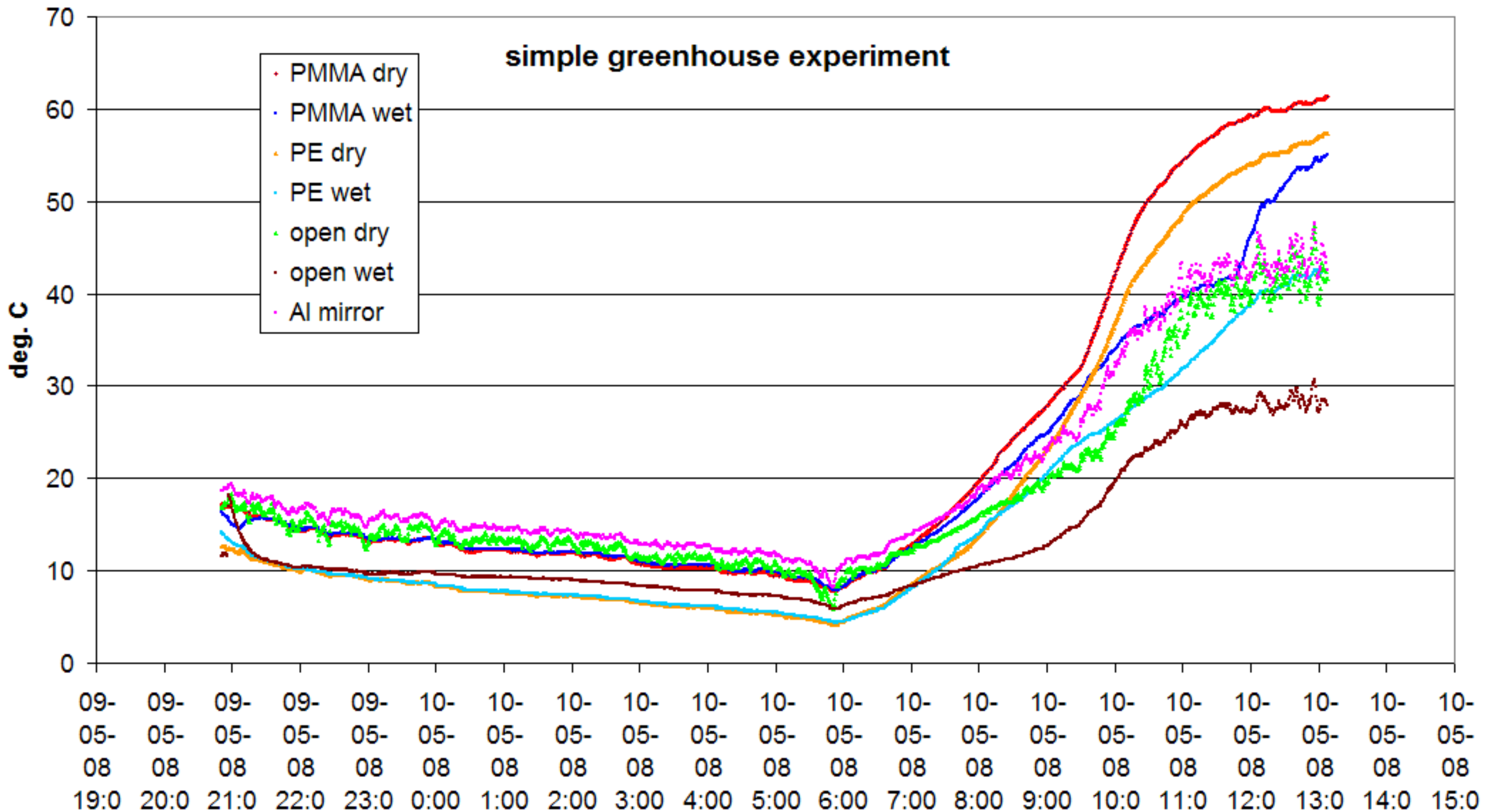
The political pressure behind sustainable energy technology development will be the victim if the IPCC looses its credibility. That must not happen. We must find the right climate physics, and the right reasons to keep going in sustainable direction. Not only in energy matters.

Please interrupt me when you think I'm wrong!

My own simple experiment
NOAA measurements
Ferenc Miskolczi's theory
The right climate & heat transfer physics IMHO

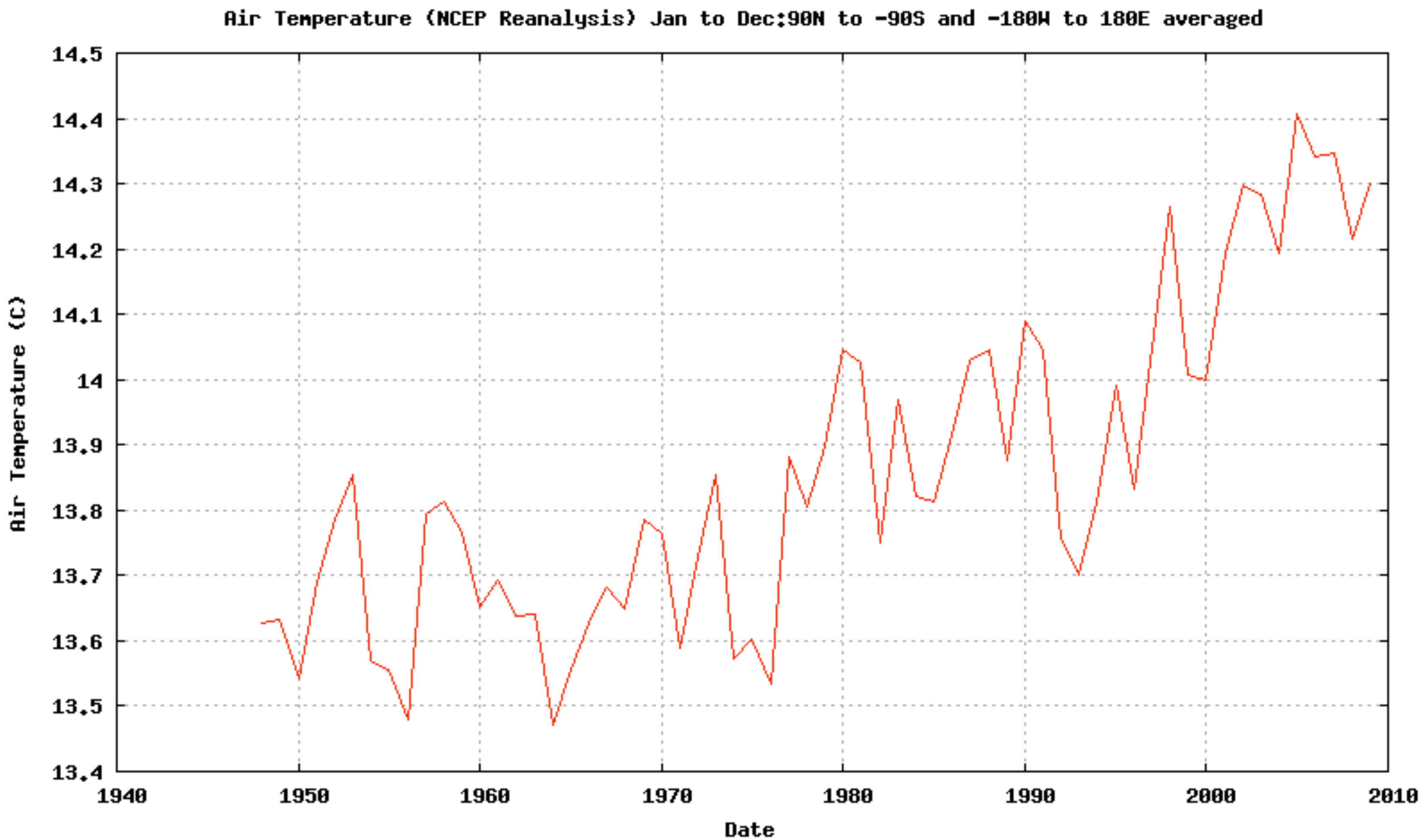


Color	**cover, mirror, wet or dry**	**# of well**
Red:	2 mm PMMA cover, dry bottom	1
Blue:	2 mm PMMA cover, wet bottom	2
Orange:	6 µ PE cover, dry bottom	3
Light blue:	6 µ PE cover, wet bottom	4
Green:	No cover, dry bottom	5
Brown:	No cover, wet bottom	6
Violet:	Aluminum mirror above well, not closed	7

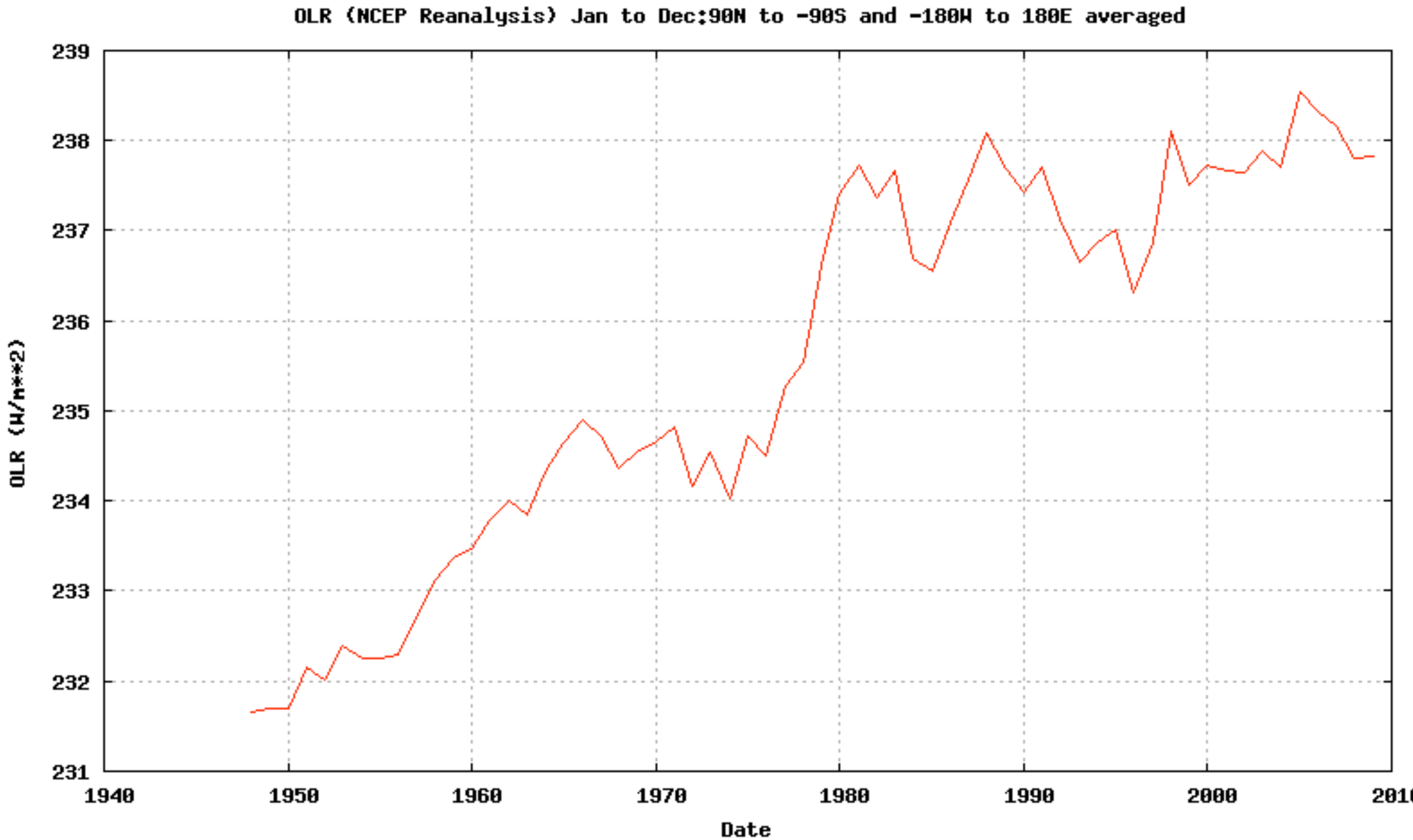


7 little greenhouses in a clear night and a clear day: 2 mm PMMA blocks all IR radiation, 0.006 mm PE stops convection but not IR radiation, and open leaves convection and IR unhindered. Wet and dry bottoms to estimate effect of latent heat flux. What do we see: At night the PE dry and wet become the coldest, because it is a clear night and the cover is IR transparent but does not let any turbulence in. The warmest at night is the one with the shining Aluminum mirror, this reflects IR but lets turbulence in. Less than 10 °C difference. During the day the PMMA dry is the warmest, the open wet bottom the coldest. Over 30 °C difference. Between PMMA and PE less than 5 °C difference. Conclusion: main heat transfer is by evaporation, only during windless nights radiation is dominant.

NOAA time series 1948-2010. Now, we all agree that it has warmed. Albeit especially at night, at cold locations and in cold seasons. That means that our climate has changed 0.7 °C for the better. Is this warming anthropogenic? Is it due to our CO2 emissions? Do we have to spend like € 1e12 to combat "AGW" to avoid disaster? Let us look at more NOAA time series.

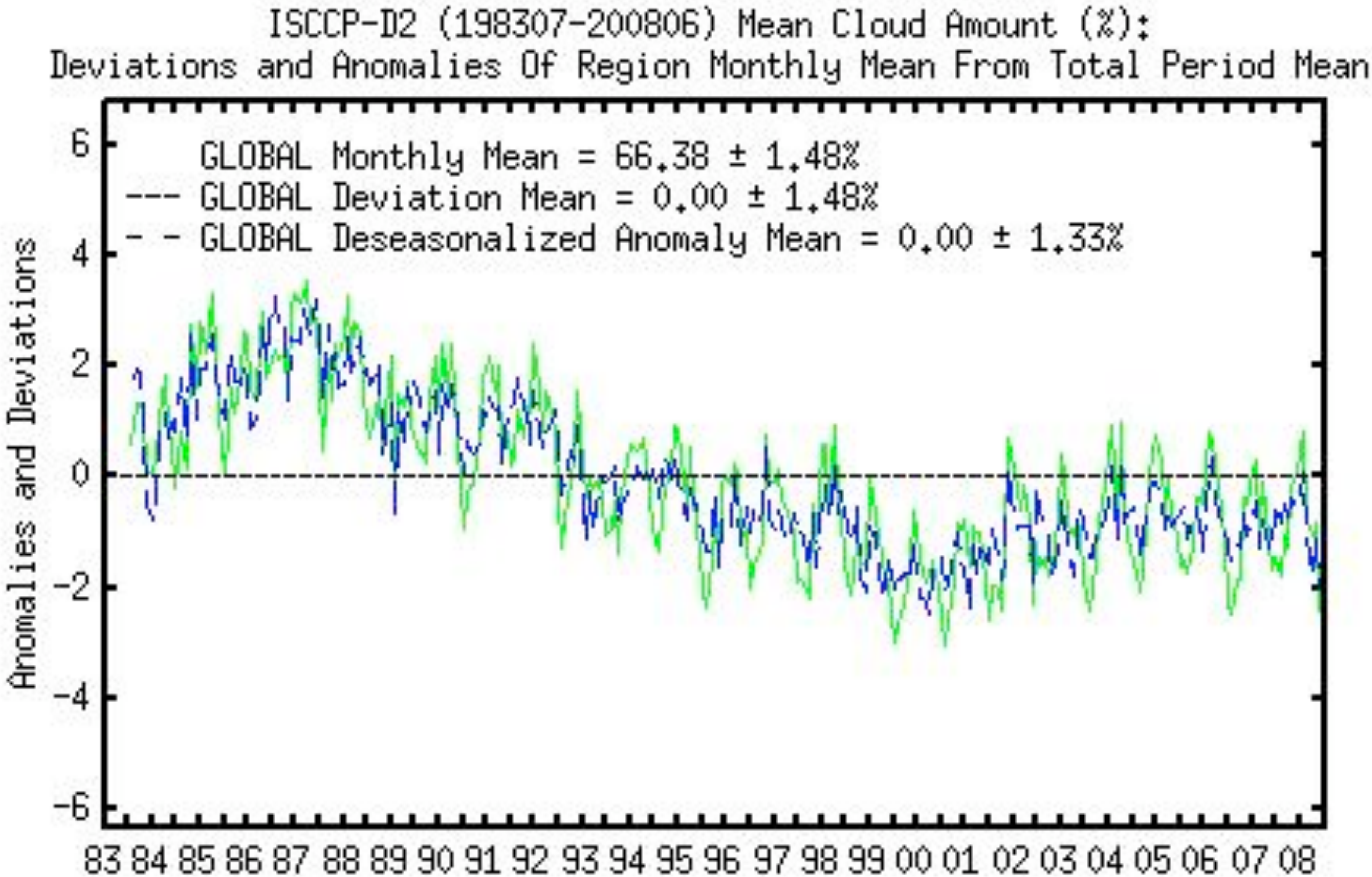


http://www.esrl.noaa.gov/psd/cgi-bin/data/timeseries/timeseries1.pl

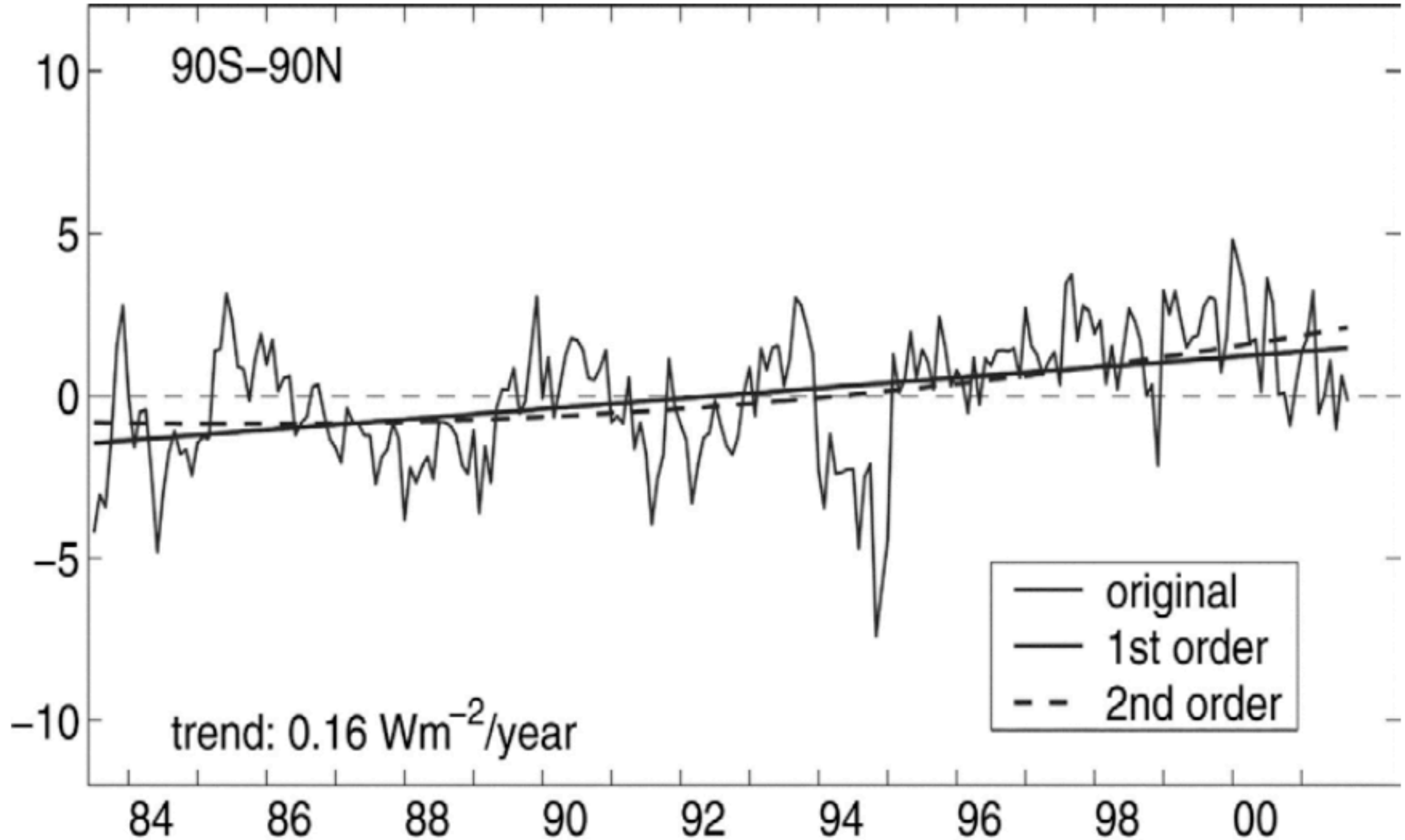


Outgoing Long-wave Radiation **rose** in 62 years 6 W/m^2, or 2.5 %, or 0.1 W/m^2 per year. This is large: it would be the effect if we reduced CO2 from 800 ppm to 280 ppm, everything else being equal.

- Rising Outgoing Longwave radiation above 3.7 W/m^2K SST cannot be the effect of rising CO2 or any other "greenhouse gas".
- OLR can only rise when more sunlight is absorbed on Earth and in the atmosphere.
- The Solar Constant is very constant indeed
- The only cause can be a lower albedo
- That can only mean less cloud cover



There is no cloud cover time series before 1984 because you need satellites. But since 1985 cloud cover has diminished by about 4%. This means that absorbed sunlight increased 2.6%, equal to the amount that we deduct from OLR increase, 2.5 %. An albedo increase of 2% between 1985 and 2004 has been measured independently by Earth-shine on the moon.

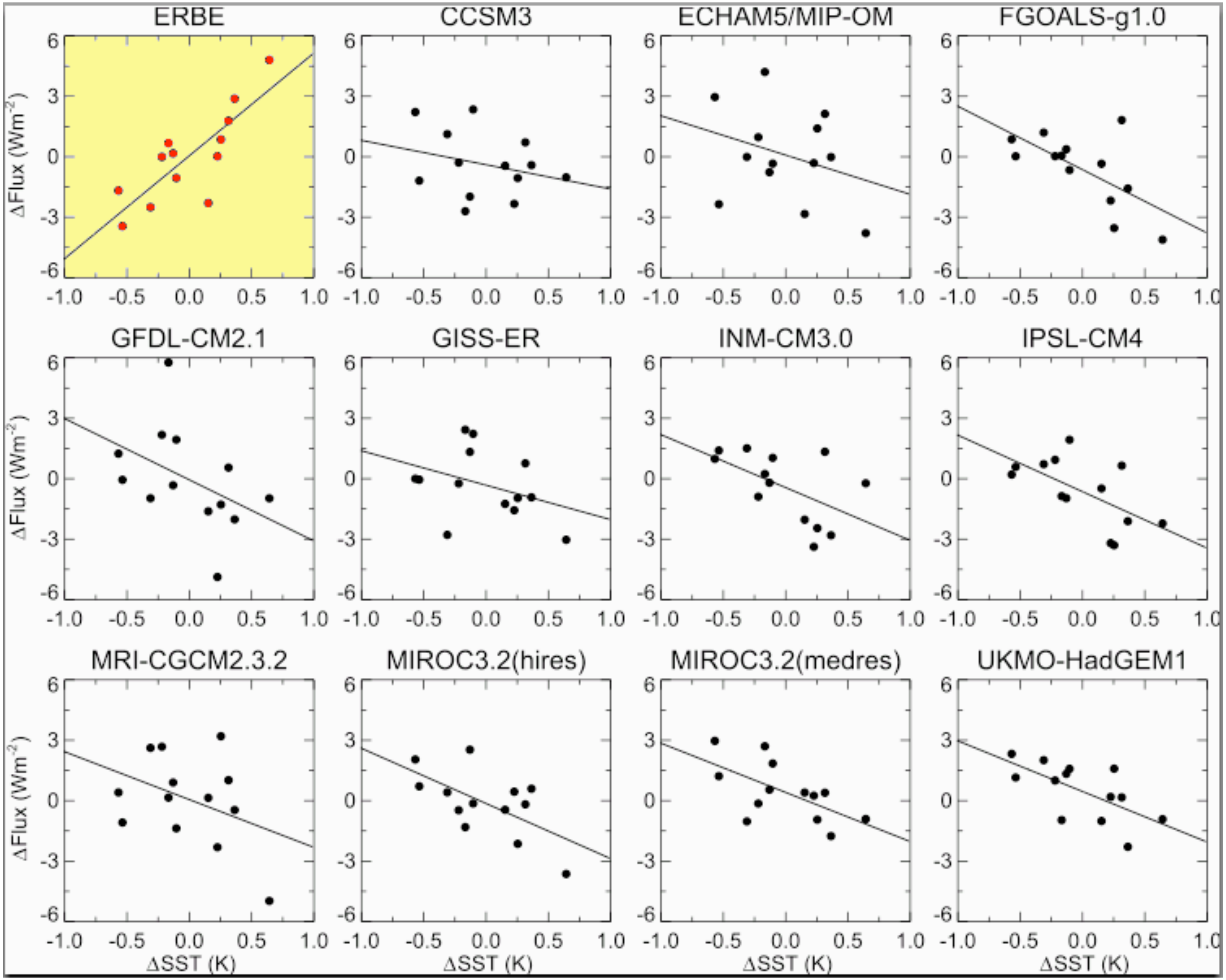


The graph from Pinker's paper shows a globally-averaged uptrend of +o.16 W m^{-2} per year in the flux of short-wave solar radiation reaching the Earth' surface over the 18 years 1983-2001.

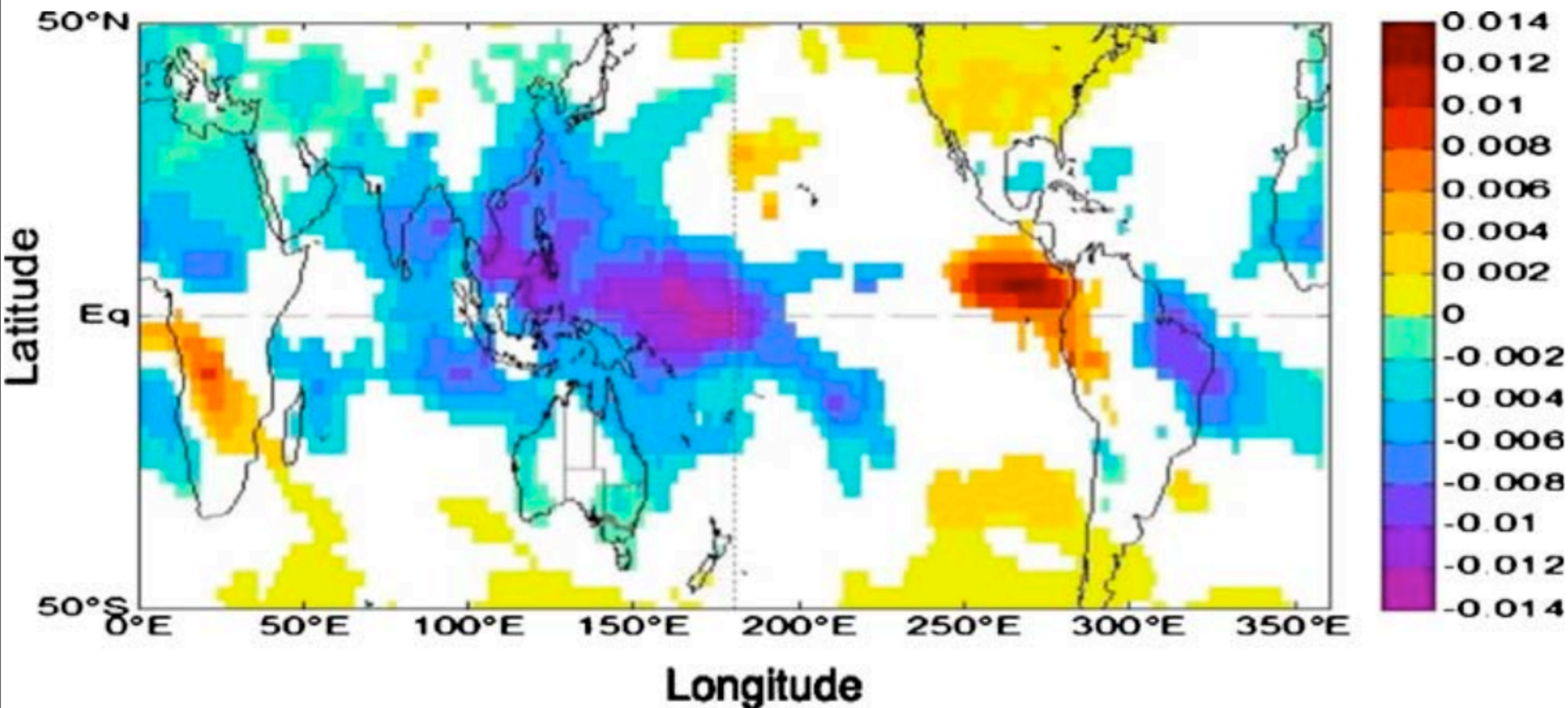
R. T. Pinker,[1] B. Zhang,[2] E. G. Dutton[3] , *Science* 6 May 2005: Vol. 308. no. 5723, pp. 850-854

Compare this with the uptrend of +0.1 W/m^2 per year in the OLR flux in 62 years 1948-2010

- We found that albedo increased 2.5%
- We found that OLR increased 2.6% or 6 W/m^2
- We found that temperature rose by 0.7 °C
- The observed total feedback is -6 / 0.7= - 8.6 W/m^2K
- The feedback in the models is positive: +2 W/m^2K
- The climate sensitivity observed is 1/[1-8.6/-3.2]=0.27 °C
- The climate sensitivity of the models 1/[1+2/-3.2]=2.7 °C

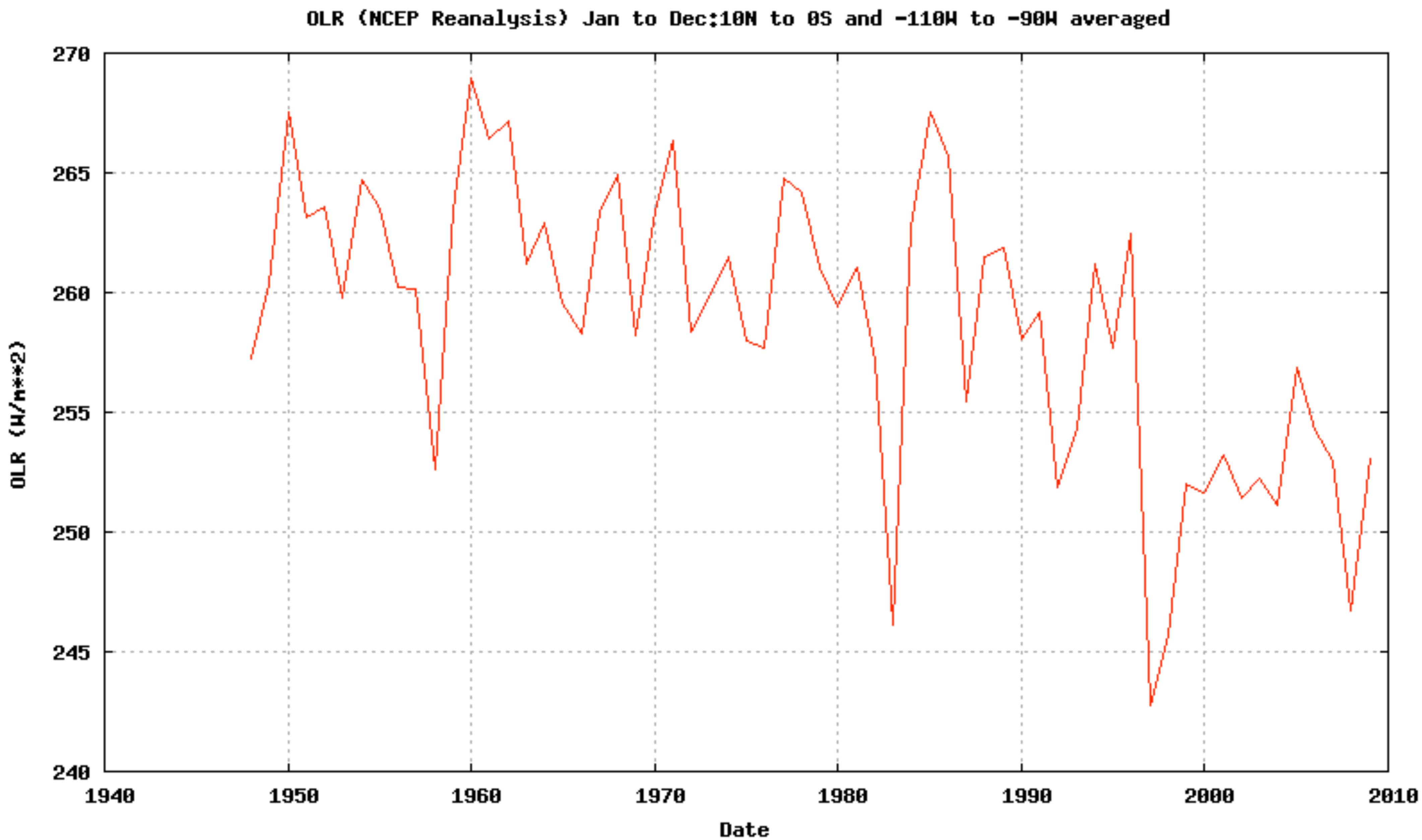


All climate models have dangerous **positive** feedbacks
Observations [ERBE] show a large and safe **negative** feedback

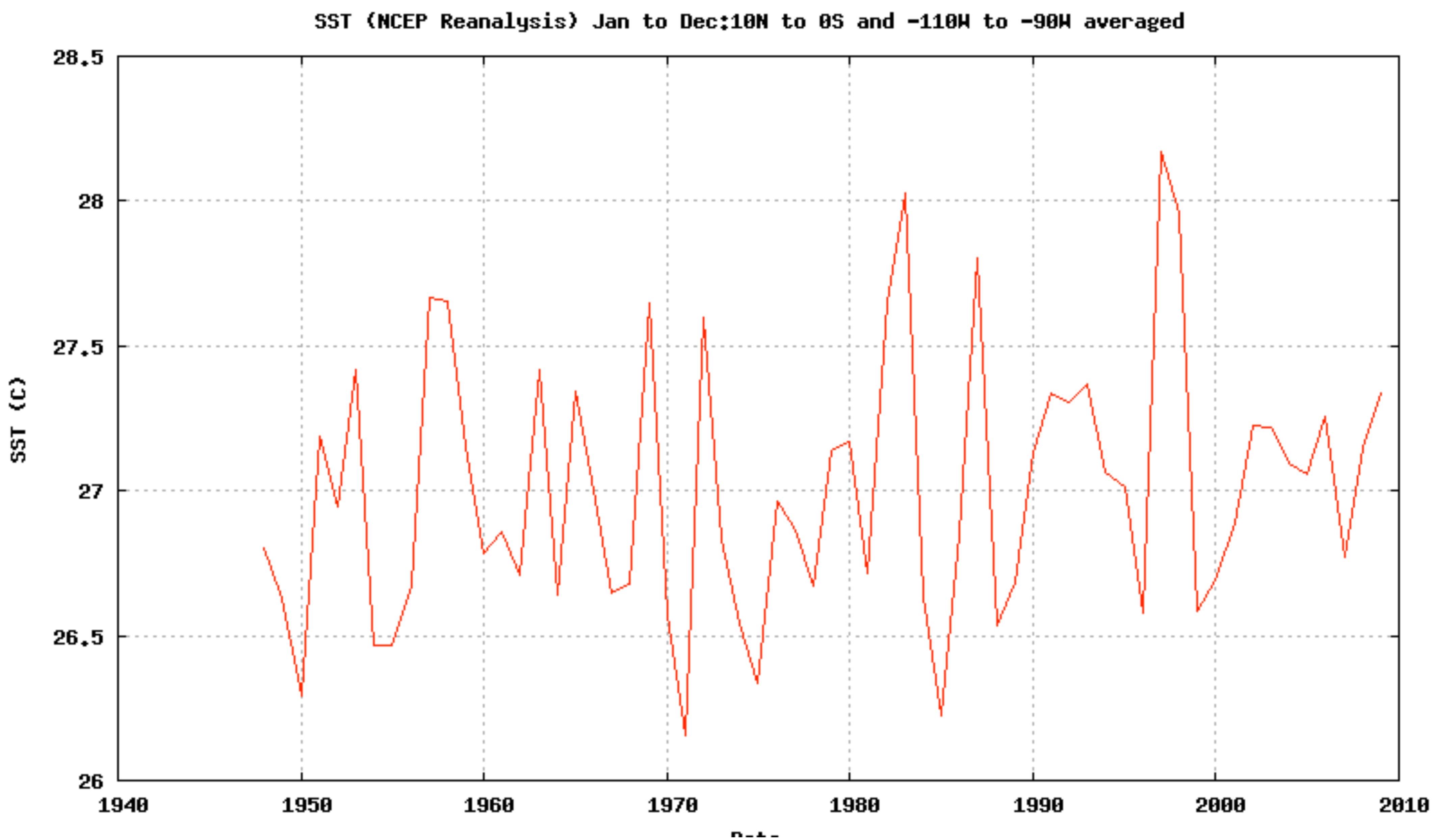


Geographic distribution of the trend in annual-average specific humidity (in g/kg per year; 0.01g/kg=1.7%) at 400 hPa over the period 1973 to 2006. White regions indicate areas where the confidence levels of the trends are less than 95%. From: Paltridge et al, Theor Appl Climatol, 2009.

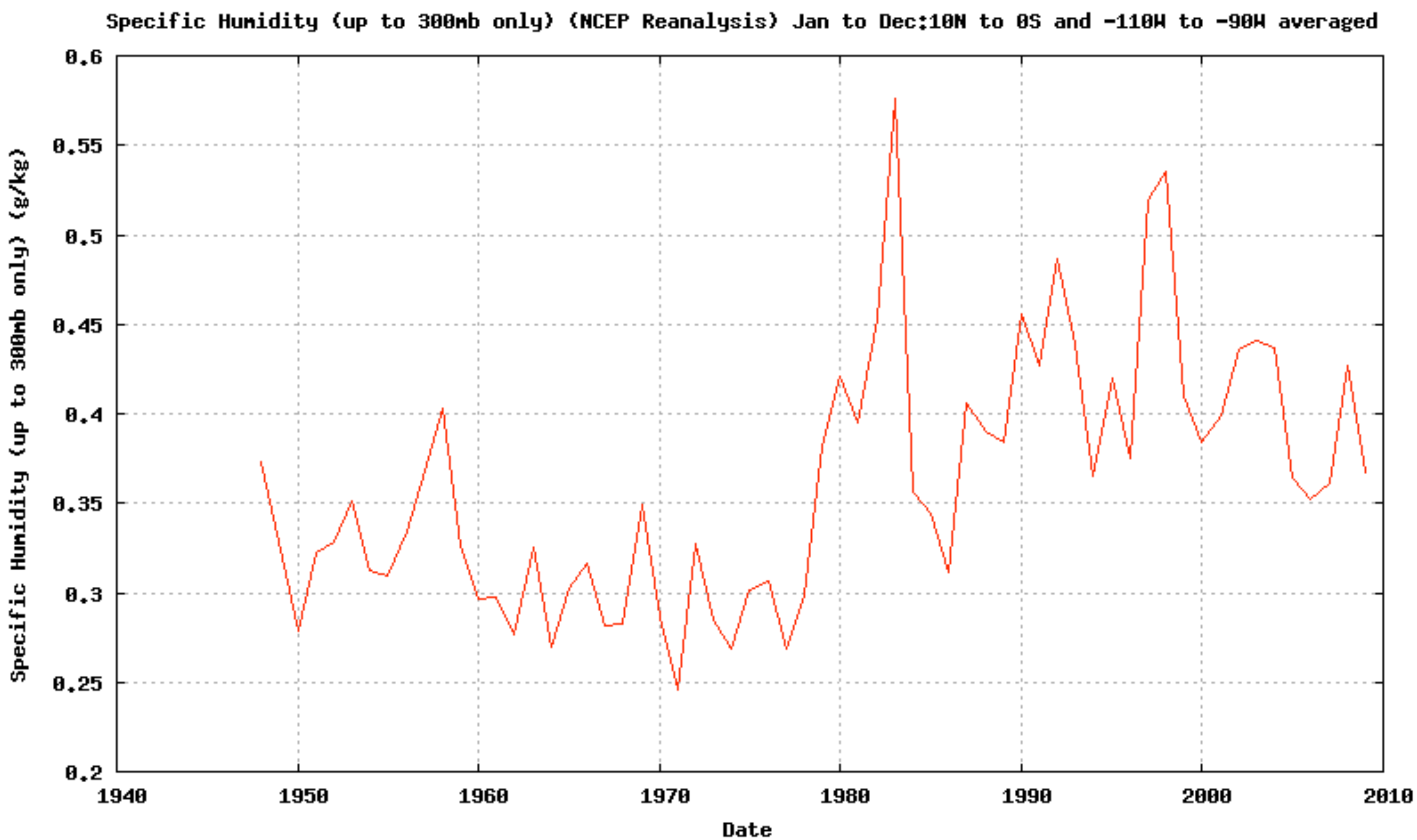
Now let us see what happens in the Eastern tropical Pacific, wetting TOA, and in the Western tropical Pacific, drying TOA. Can we correlate SST and OLR trends locally?



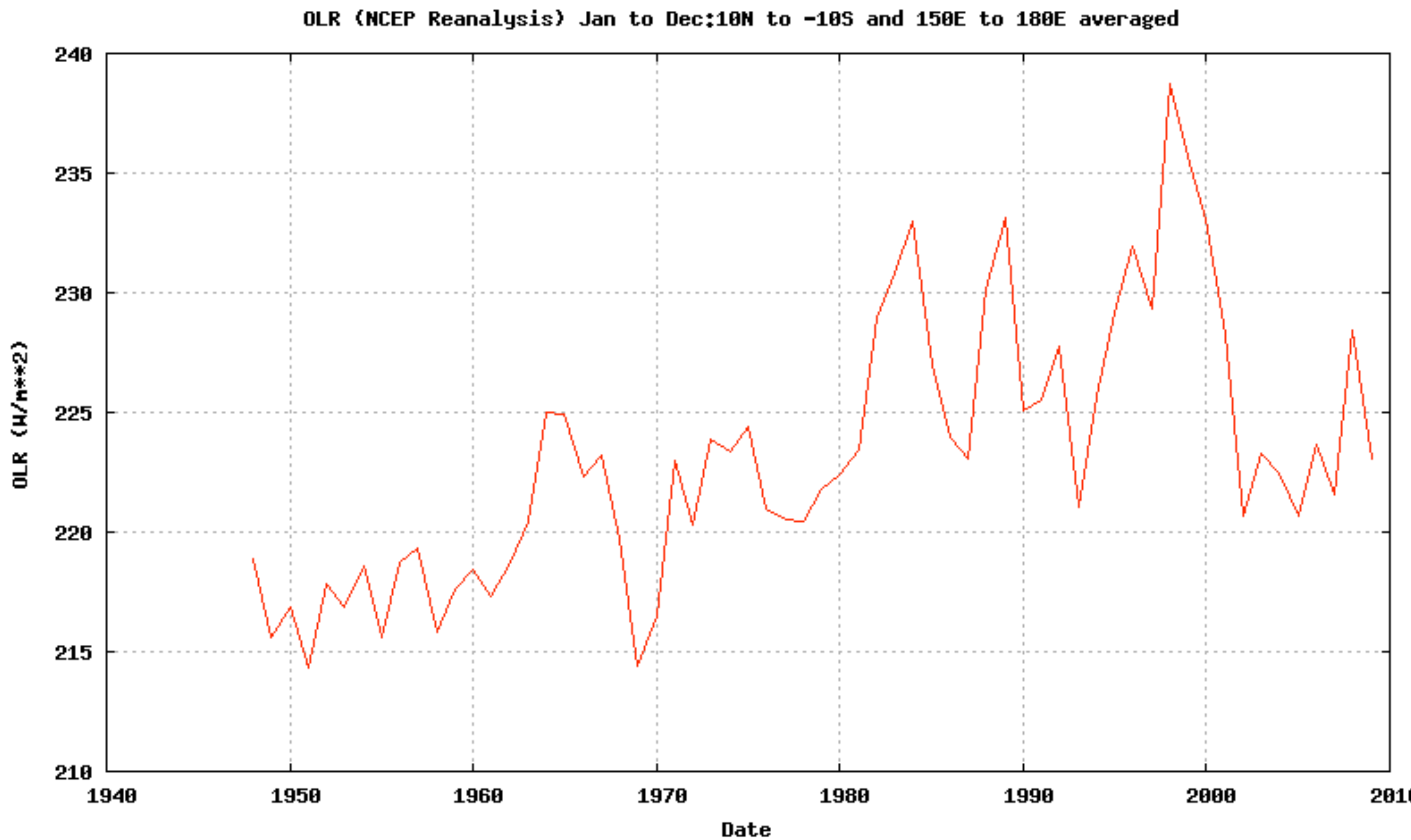
In the Eastern tropical Pacific, OLR decreased by 10 W/m^2.



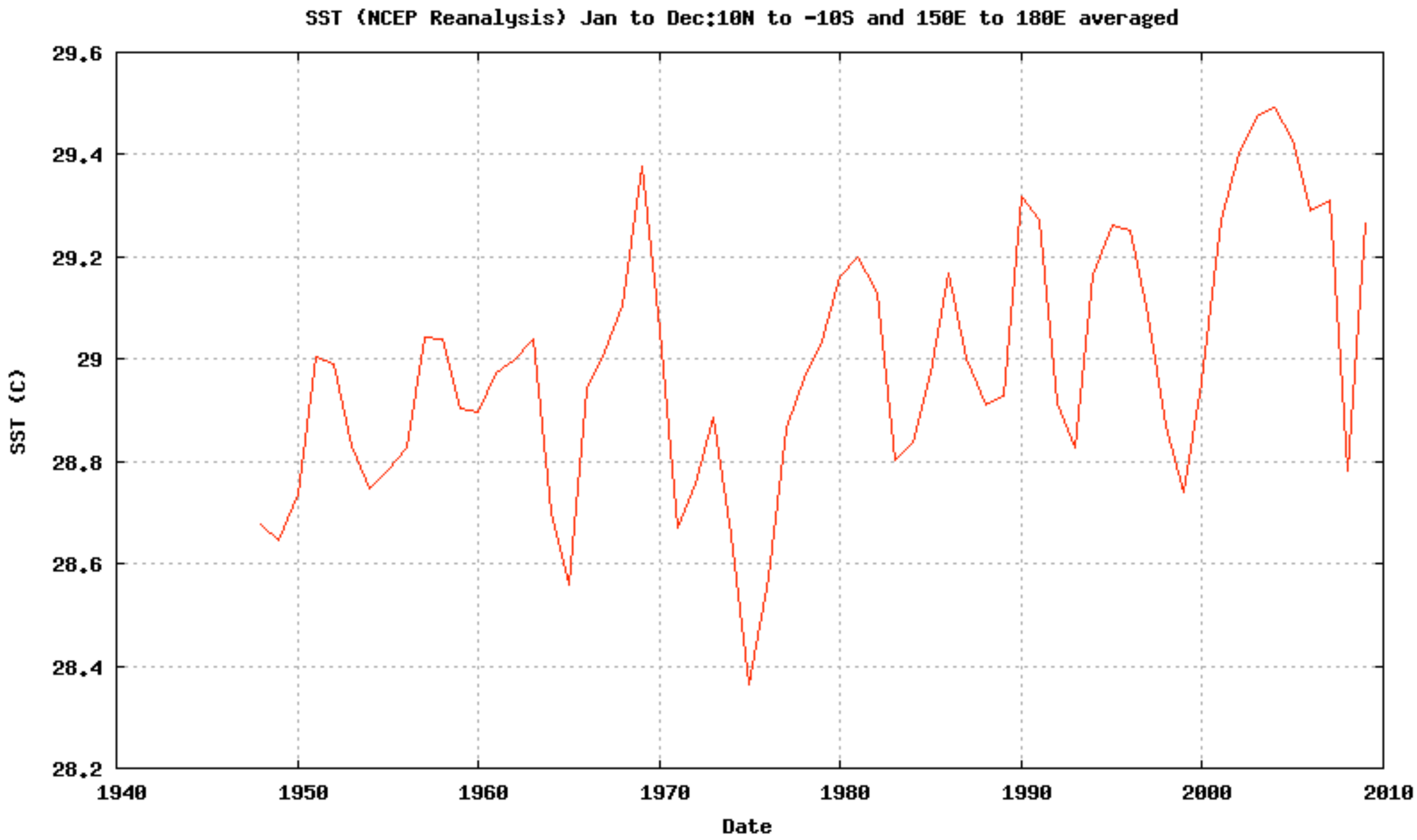
Over the Eastern Pacific the SST did not change much.
This is the pattern we expect from increased greenhouse gas.



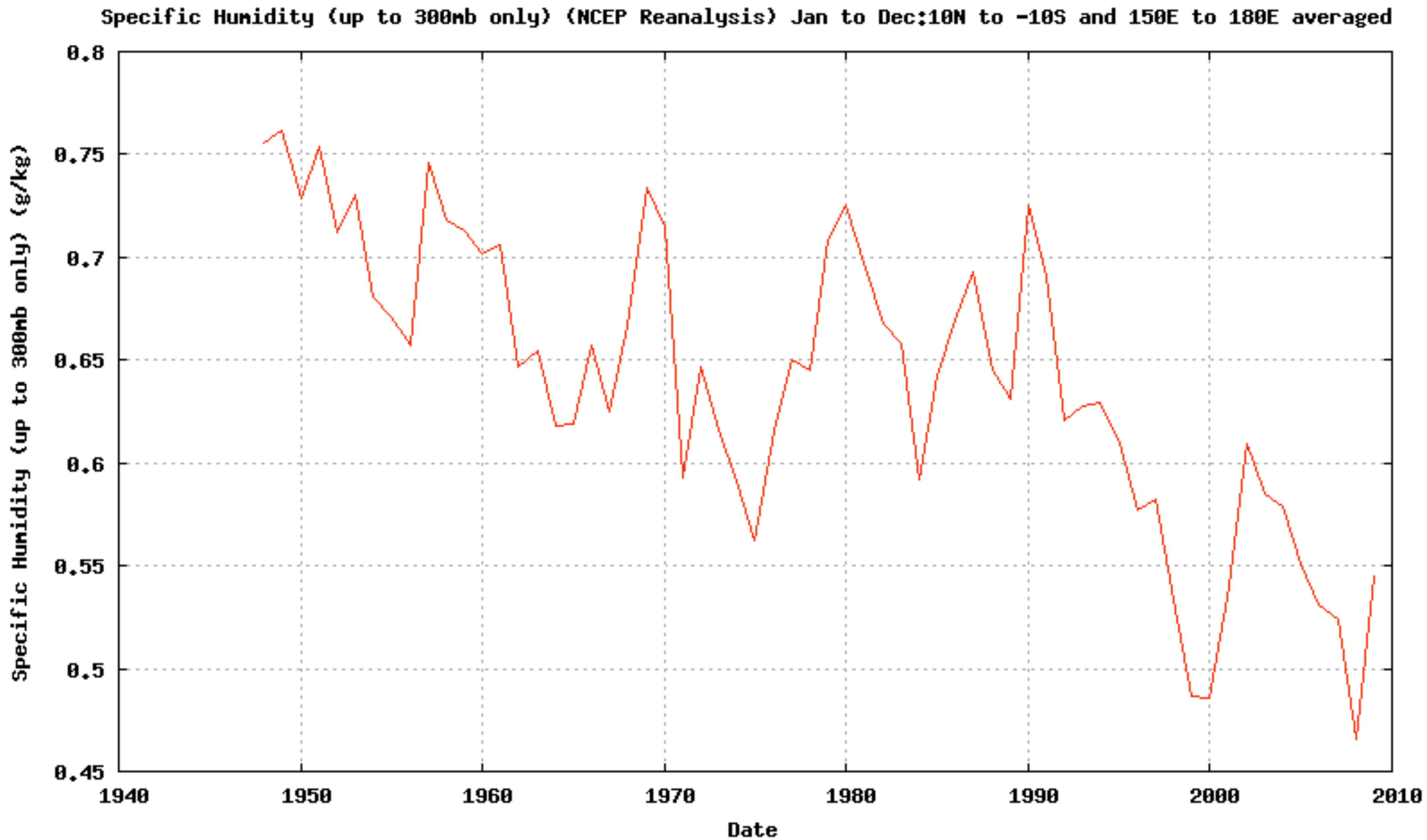
Indeed, in the Eastern tropical Pacific, humidity at 300 mB increased by 1/3!



In the West tropical Pacific, the TOGA-COARE region, the OLR increased 14 W/m^2.



And the sea surface temperature increased only 0.15 °C, so here we have a local [TOGA-COARE] heat transfer coëfficient of 14/0.15=93 W/m^2K! These enormous heat transfer coefficients regulate Earth's temperature.



The specific humidity went down by 50% over the TOGA-COARE region.
I tried to discuss this with Kevin Trenberth. He wrote back:

The NCEP reanalysis does not assimilate any water vapor data and is irrelevant, as I said before. The observations also show a marked increase in water vapor in the upper troposphere (the actual relative humidity is about the same but the temperature is rising). Please see the IPCC report chapter 3 or Soden et al 2005 Science.
Kevin Trenberth

In my view, the trend **is** relevant, firstly because non-assimilation gives a systematic error, secondly because assimilation errors are very small above 400 hPa:

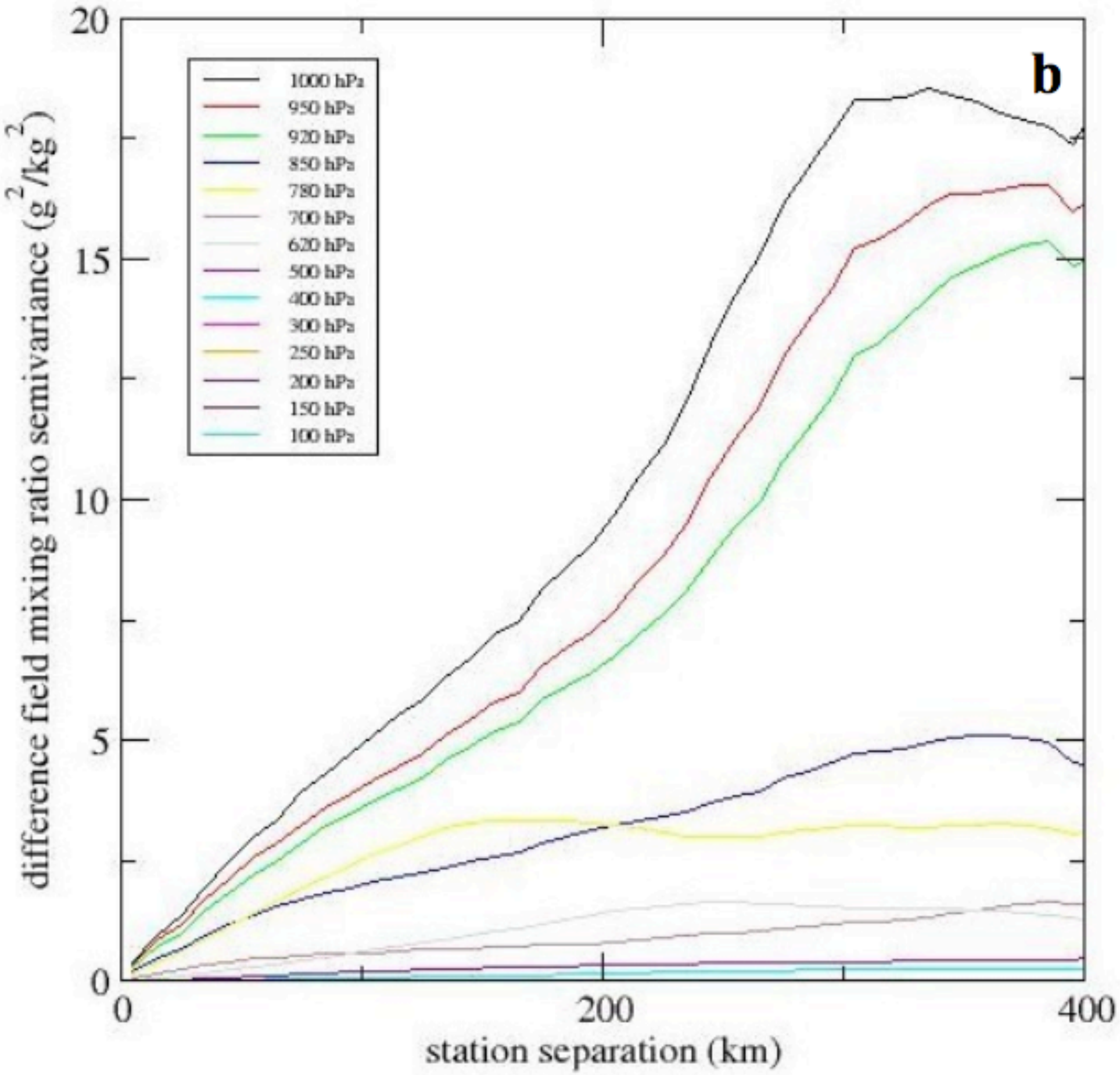
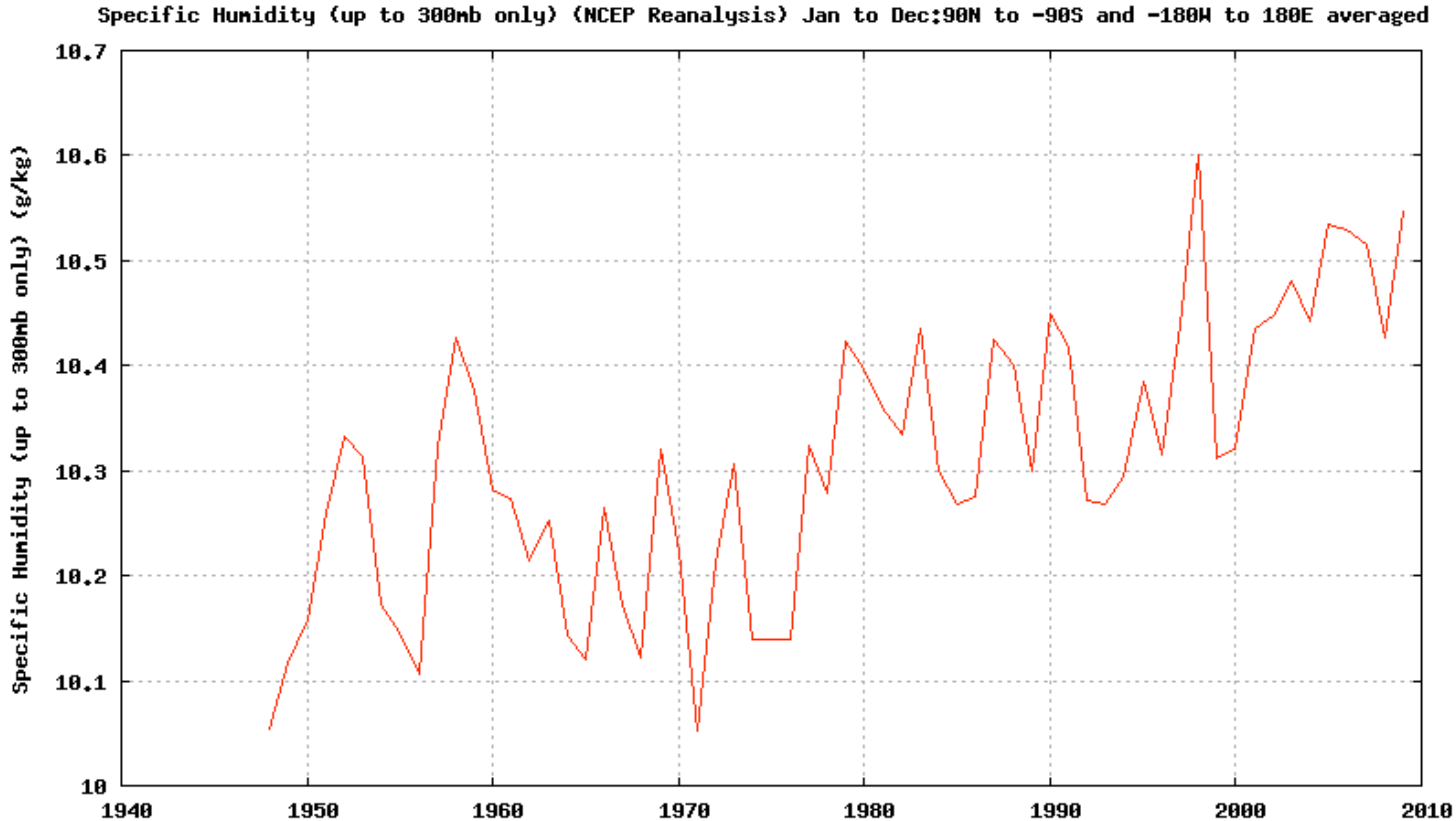


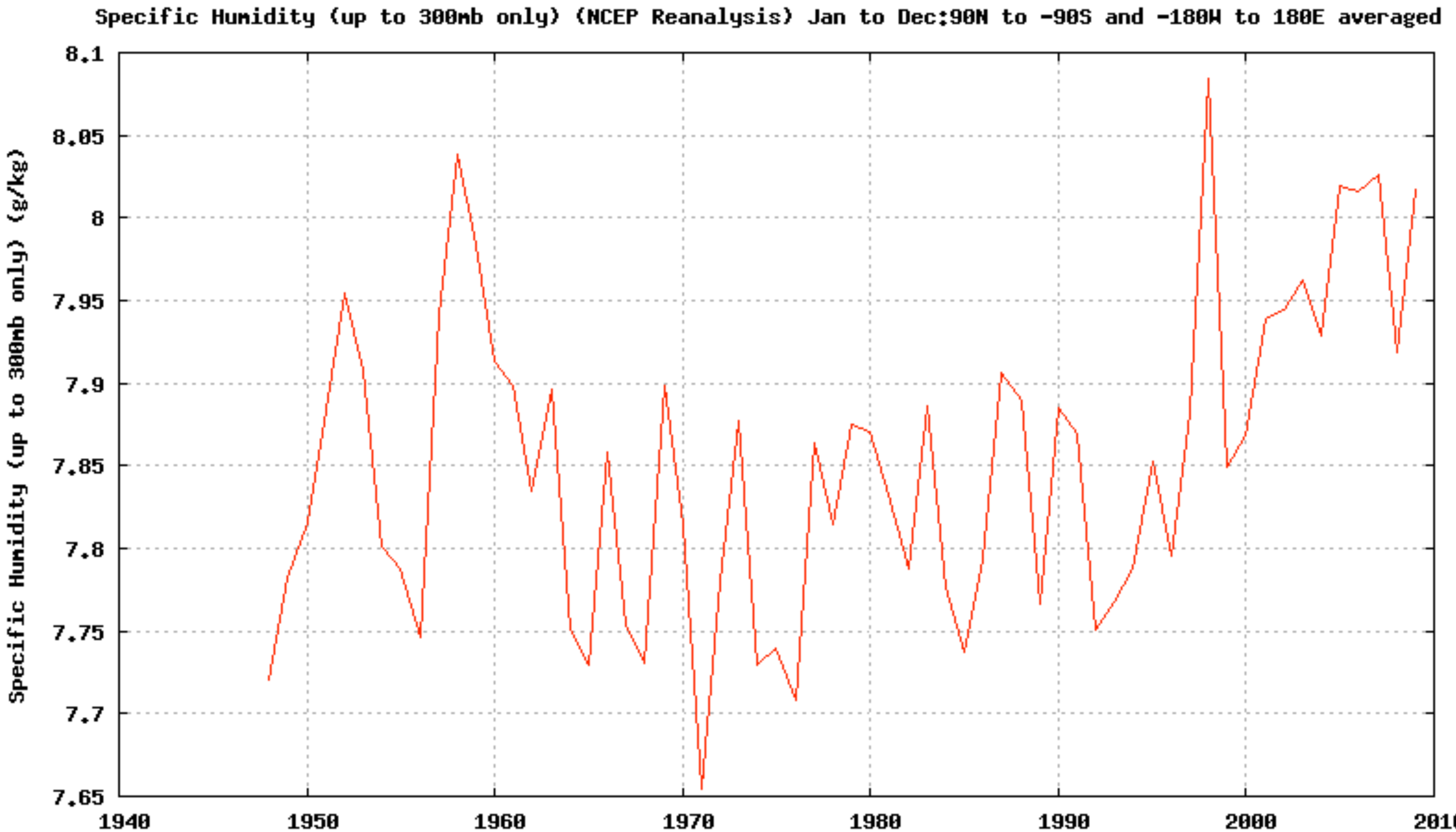
Figure 3: Averaged squared increments [i.e. observation (MODIS) minus background (20-km RUC)] for all observation pairs and pressure levels for 18 UTC Aqua overpass 3 July 2003 a) temperature, b) water vapor.

www.srh.noaa.gov/media/mlb/pdfs/ams_preprint_lazarus.pdf This gives the variance between assimilated and non-assimilated satellite specific humidity levels. We see that the higher up, or the lower the pressure, the lower the variance. For the 400 hPa level and lower, the variance is 0.1 [g/kg]^2, lower than the trend variance.

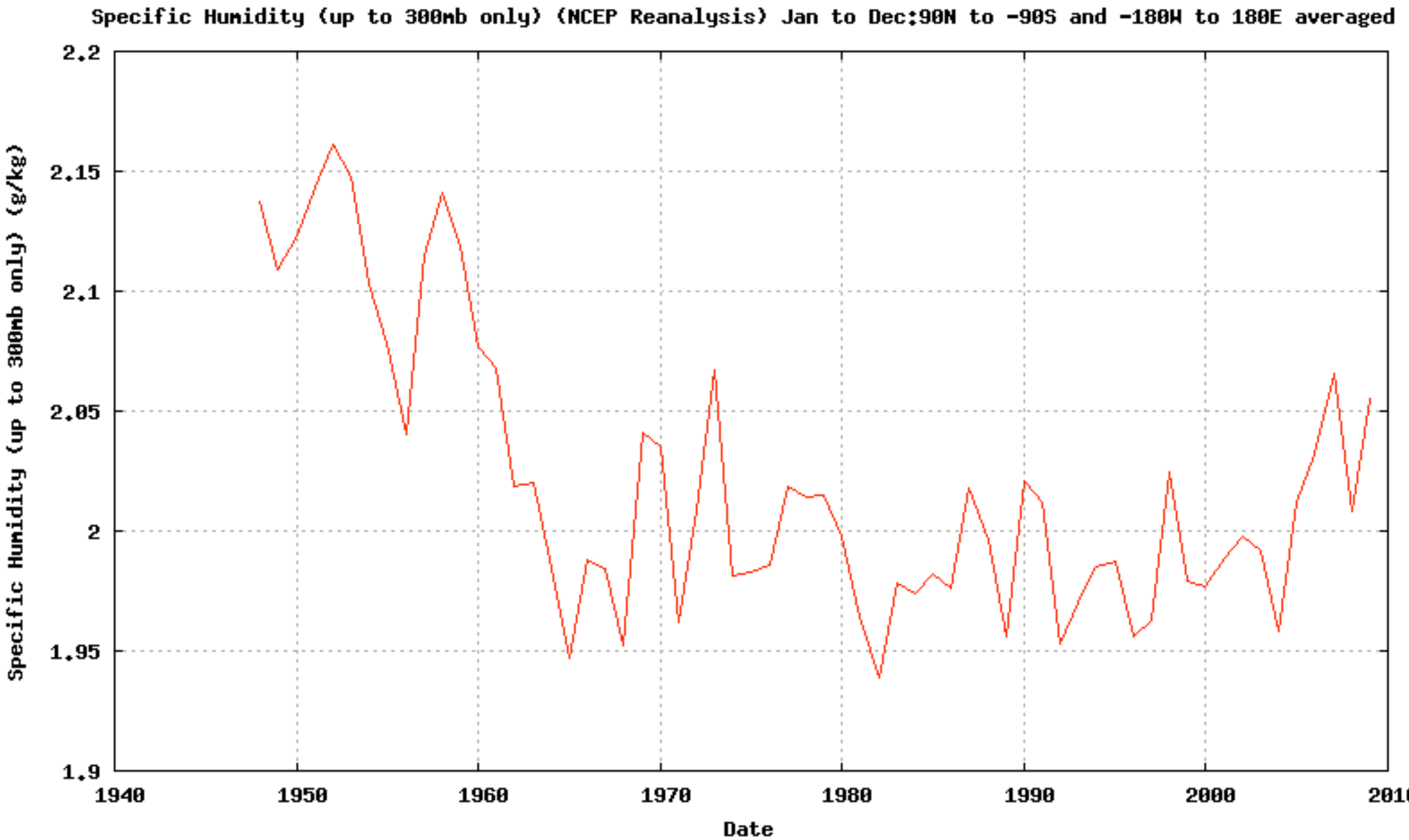


Now we go for the global weighted mean.

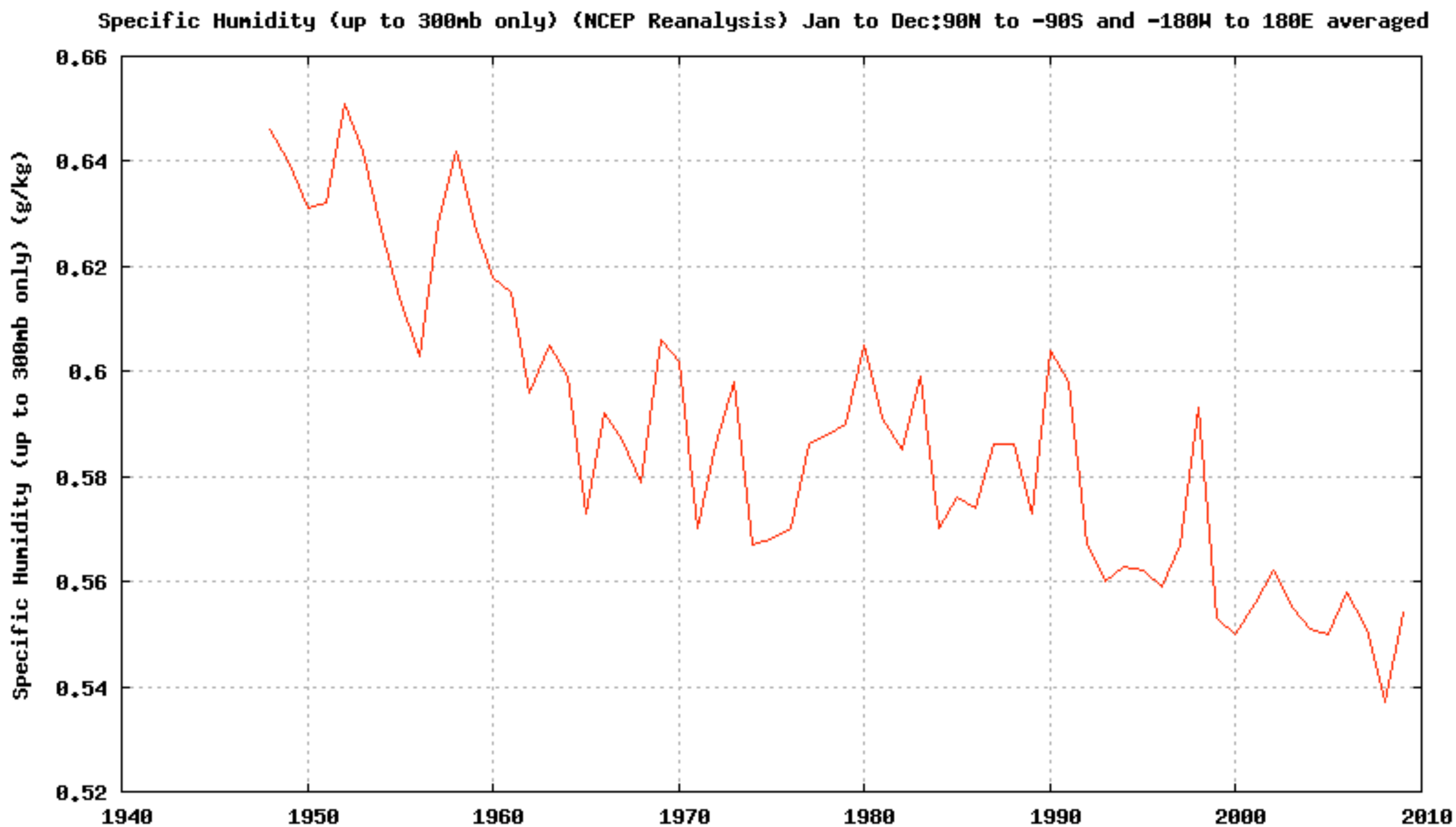
Specific humidity at 1000 mB. Current AGW theory has it that when temperature increases the *relative humidity stays constant,* and therefore the specific humidity rises on all heights, causing a positive feedback on climate sensitivity [dT/d(2logCO2)]. In the lower atmosphere, this is right. A 4.5 % increase follows the Causius-Clapeyron water vapor saturation pressure increase [6%/°C]



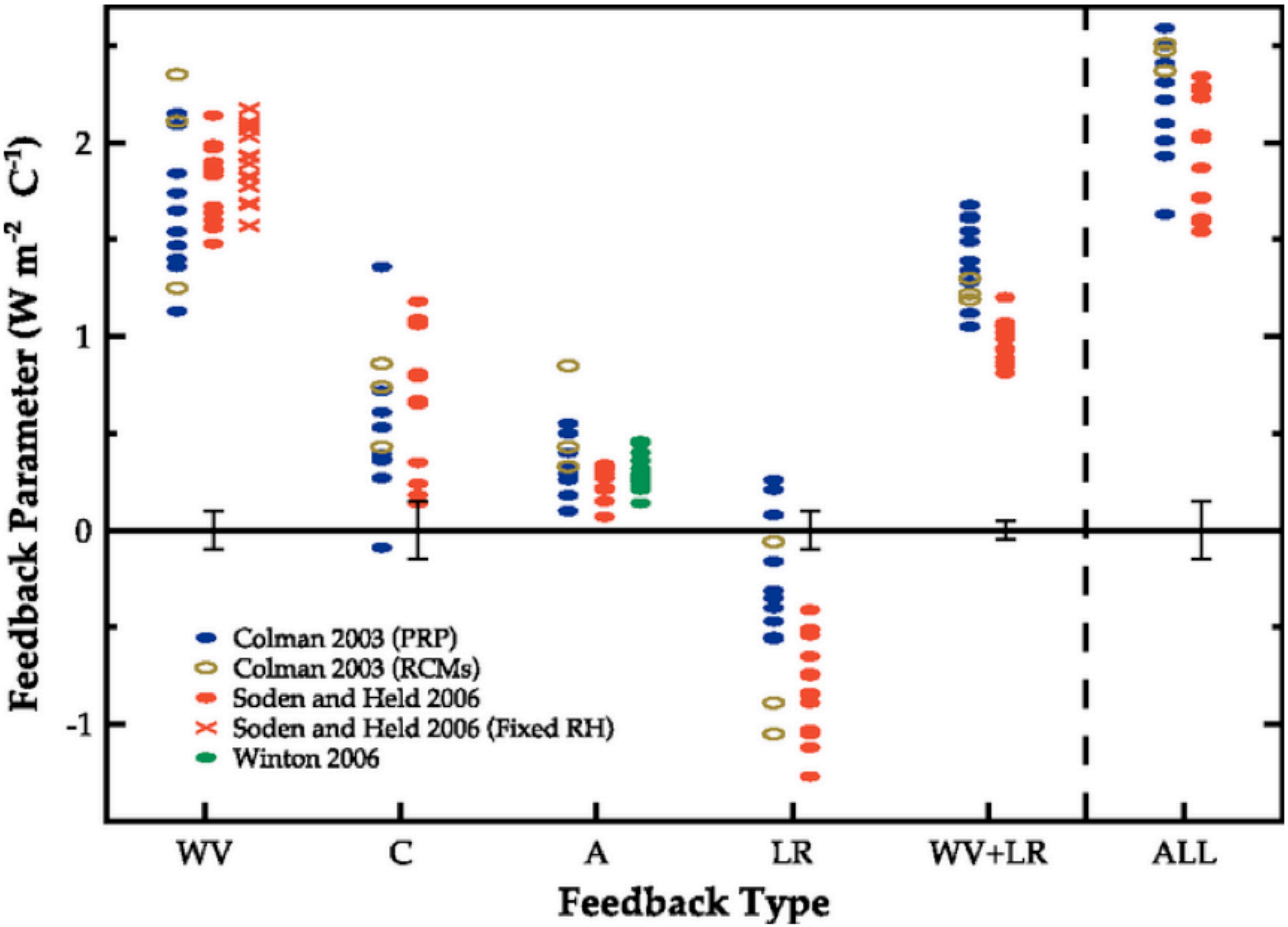
Specific humidity at 925 mB, global weighted mean. Even at the top of the turbulent mixing layer, or at cloud base, the specific humidity rises.



Specific humidity at 600 mB, global weighted mean. At 600 mB the water vapor concentration decreases. This decrease is 0.15 g/kg, or 150 ppmw or 240 ppmv, much more effective than the 50 ppmv increase of CO_2 in the same period!



Specific humidity at 400 mB, global weighted mean.
The decrease is large, 20% in these 60 years! Compare this with 15% more CO_2 in this period. At this atmospheric height, radiation is more important than convection, so this decrease is very relevant. The trend is no different before and during the satellite age, so “non-assimilation” can not have a big influence on the data. Assimilation introduces a constant bias.



Measured: -8.6W/m^2K, in the models:+2 W/m^2K.

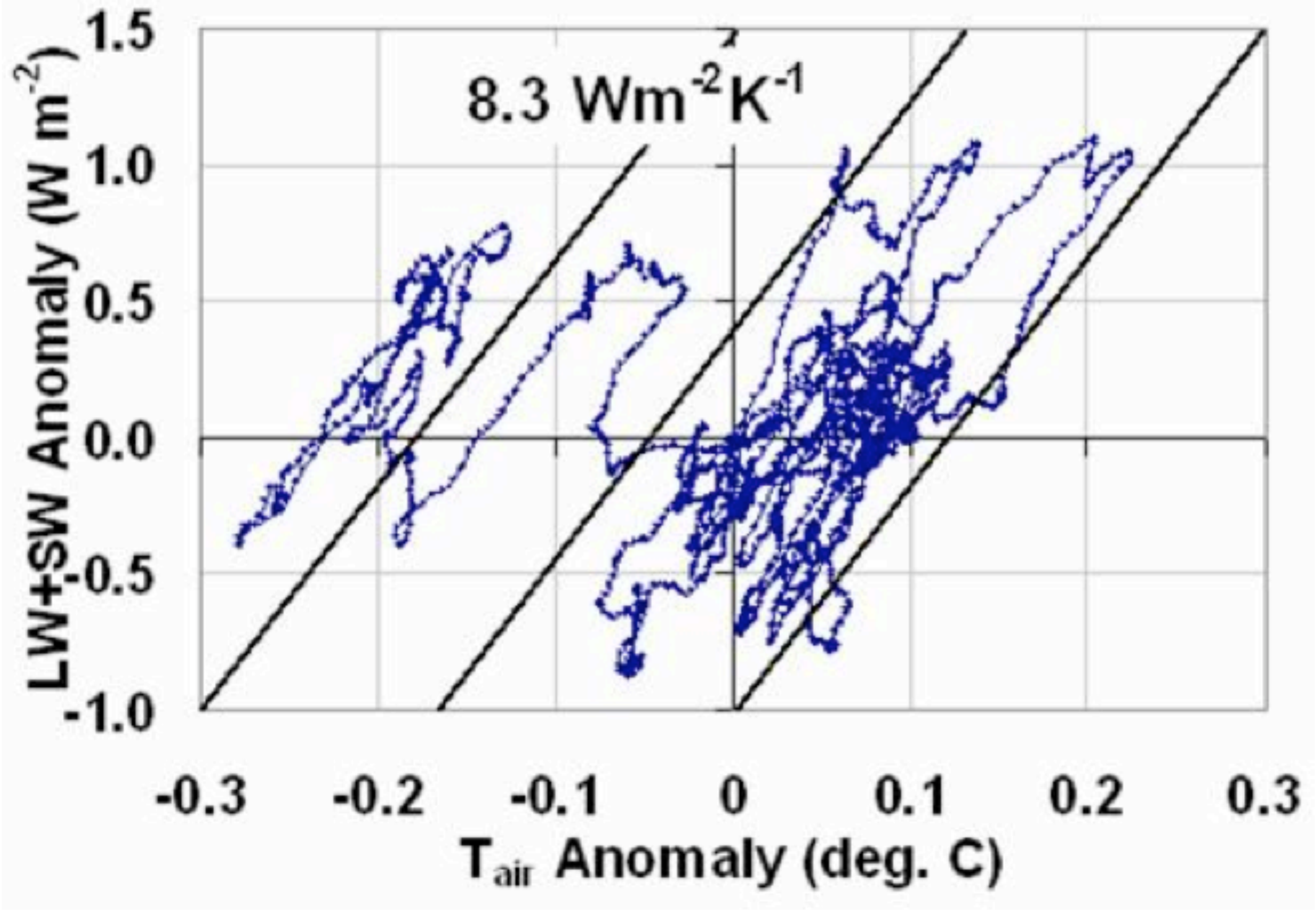
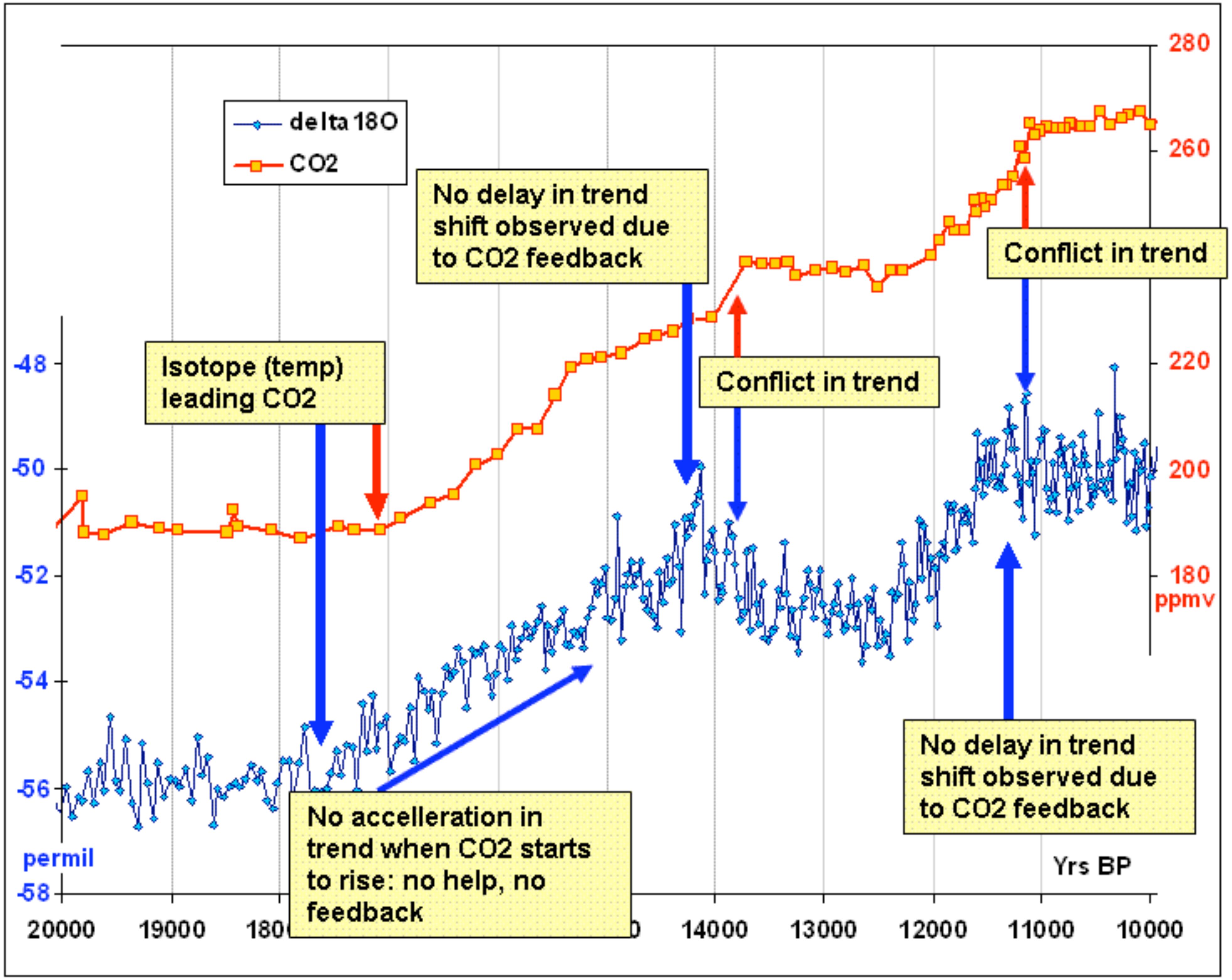


Fig. 6. Three-month running averages of global oceanic CERES radiative flux changes versus tropospheric temperature changes (from AMSU channel 5, see Christy et al., 2003) for the time period in Fig. 5. The average feedback estimate (see sloped lines) was then used together with the AMSU5 data to estimate and remove the feedback component from the CERES radiative fluxes, leaving the radiative forcing shown in Fig. 4b.

Covariance of temperature and total outgoing radiation shows clearly a large negative feedback.

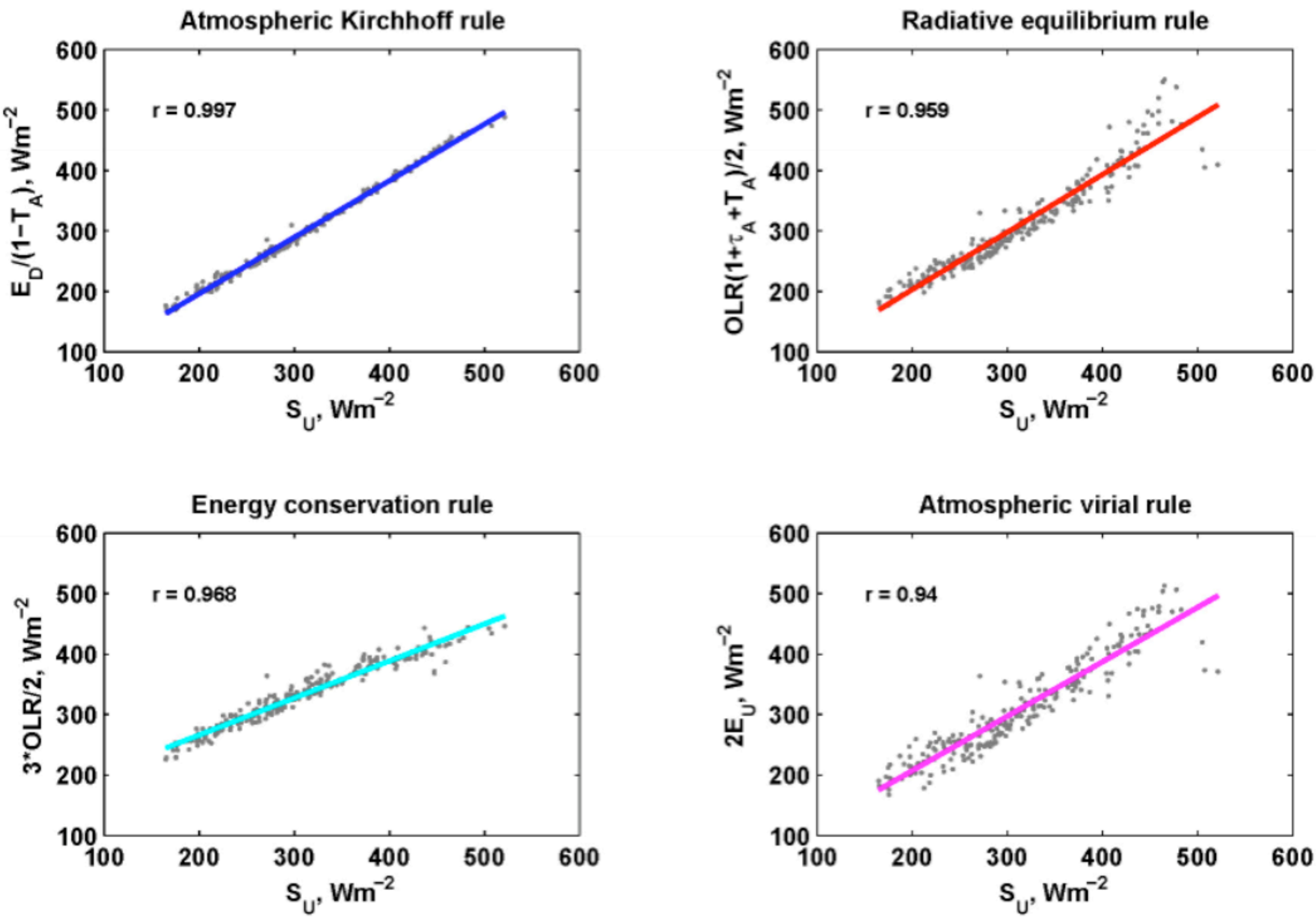


High resolution ice core analysis of the end of the last ice age: No influence from CO2 on temperature. Influence is from temperature to CO2 with 800 years delay. Ocean outgassing follows roughly CO2 solution thermodynamics. No CO2 feedback observed.

Infrared window and humidity: Miskolczi's theory

- An atmosphere without an infrared window has a much larger climate sensitivity than ours, with an infrared window
- Trenberth: Window radiation = 40 W/m^2. Satellite measurement: 66 W/m^2. Prof. Trenberth wrote us that he knows this. But he kept his 40 W/m^2 disregarding measurements.
- An atmosphere where specific humidity increases everywhere with temperature has a large climate sensitivity. It has a tipping point.
- Trenberth: Relative humidity is constant everywhere. Satellite measurement: Humidity is decreasing. Prof. Trenberth wrote me that he thinks it is increasing and advises me to read the IPCC reports.
- Miskolczi: Window radiation is exp[-1.868] or about 1/6 of surface upward IR; Clouds keep τ_{clear} at 1.868; more CO2 is compensated with less water vapor. The greenhouse effect is not a free variable. It is controlled by maximum entropy production. Surface temperature is only a function of absorbed solar radiation.
- **I challenge everybody to falsify Ferenc's hypothesis with measurements!**

The four Miskolczi rules applied to TIGR measurements



Miskolczi's terms: "Kirchhoff", "Virial Law", many climate physicists couldn't understand, and Ferenc didn't explain.

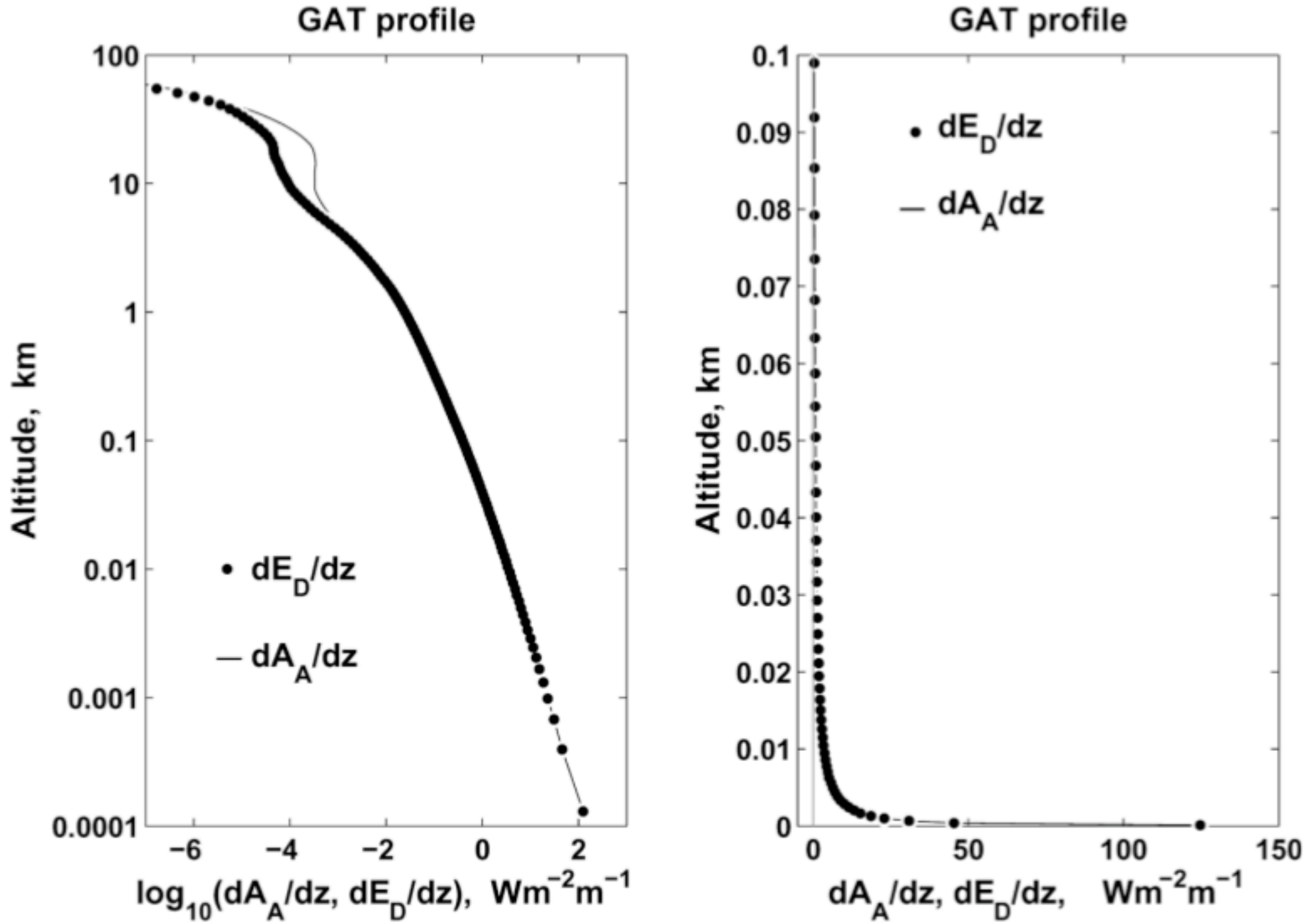
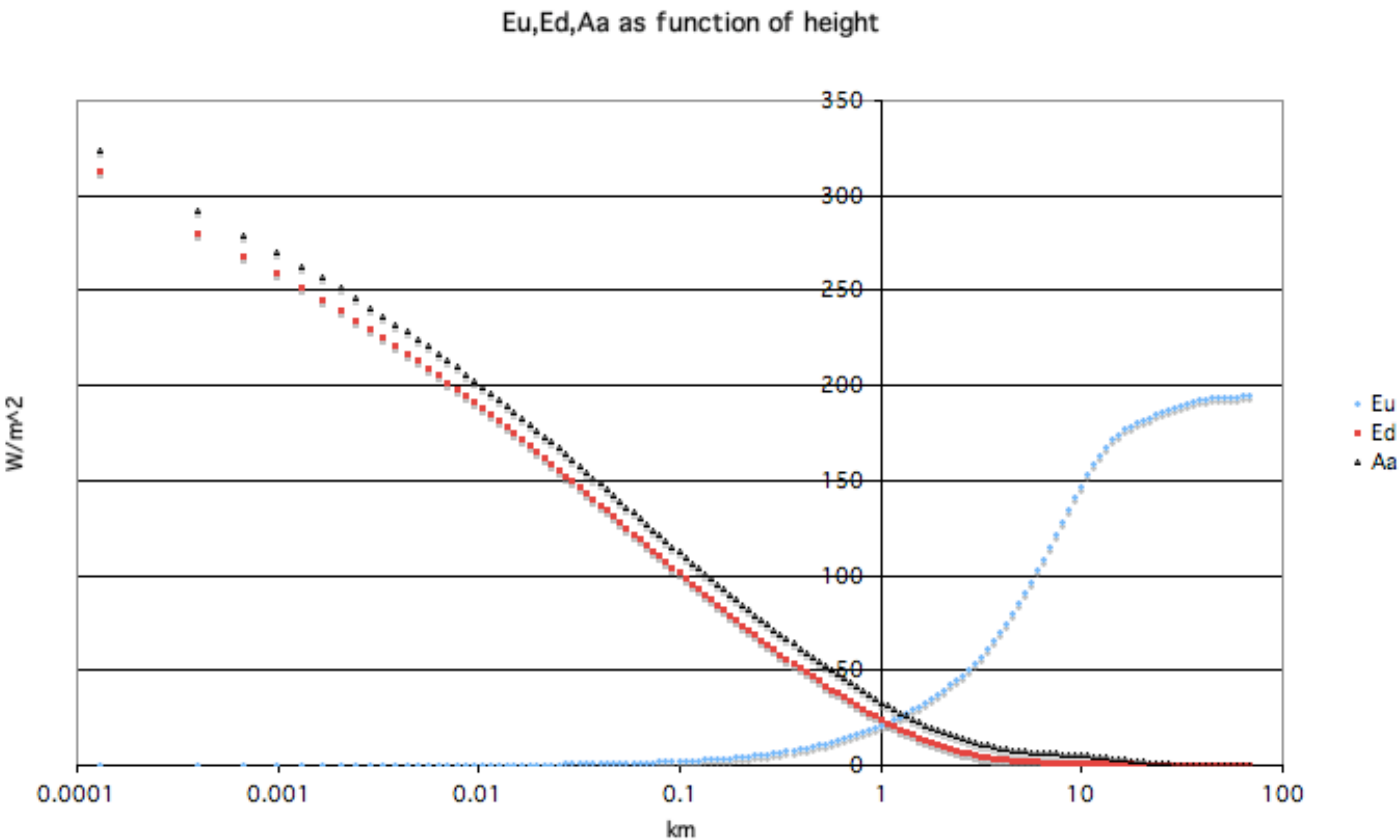


Figure 3. The law of radiative exchange equilibrium. The $E_D = S_U\, A$ relationship holds because the contribution of a layer to the downward emittance is equal to the absorbed surface upward radiation in the same layer. This law turned out to be valid for any cloud layer in the atmosphere and even holds true in the cloud free Martian atmosphere (see Fig. 4).

The heat transfer from Earth to space is by convection in series with radiation



It looks if Aa>Ed in this graph, because I did not apply the emittance/reflectance correction at the surface here. Radiation plays little role < 1km, convection plays little role > 1km.

- What is a LBL calculation? A radiosonde [weather balloon] measures only pressure, temperature and humidity. But we want to know the separate IR energy fluxes and their vertical direction. For that we have to integrate over thousands of emission & absorption lines of more than ten IR active atmospheric gases, taking account of pressure and temperature line broadening. Ferenc Miskolczi is one of the few people who wrote such a computer program. He was the first to analyze Aa, Eu and St separately this way, using hundreds of radiosonde profiles. Only OLR and Ed can be measured directly.

- What does Ferenc mean with "Kirchhoff"? The LBL calculations show that the absorbed part of the upwelling radiation is within a few percent equal to the downward radiation. Christopher Game explained to me that Ferenc's Planck/Kirchhoff emission/reflection correction at the surface / atmosphere interface is indispensable here, Su is lower than the blackbody emission and this is not compensated by Ed reflection..

- What does Ferenc mean with "Virial Law"? That Eu=Su/2 or the upwelling radiation Eu from within the atmosphere is coming from a temperature whereby the kinetic energy of the air molecule is lowered by half [Clausius,1870] of the gravitational potential energy of that molecule, as compared with a surface air molecule. The kinetic energy of air is $C_vT=5RT/2$ per mol, the potential energy is $\mu.g.h$ per mol, the atmosphere has a lapse rate of $dT=\mu g/C_p.dh=\mu g/[7R/2]dh$ and we have to correct for this. The corrected height becomes $h=1/[1+2/7]\cdot RT_s/\mu g$. The Virial law now becomes $T_e=T_s-T_s/[1+2/7]/5$ with Te the emission temperature of Eu and Ts the ground air temperature. Now Eu/Su = Te^4/Ts^4 = 0.508. From the precise value of τ=1.868 the Virial value of Eu/Su is 0.507. In fact, when we realize that there is 1% one-atomic gas in our atmosphere, the 5 becomes 4.98 and the 7 becomes 6.98, and Eu/Su becomes in deed 0.507.

- Why is the optical density τ_A of our atmosphere precisely 1.868? Because a correct solution of the radiation equations with the right constraints yields: $OLR/S_G=2/[1+ \tau_A + \exp(- \tau_A)]$ and measuring the ratios of surface flux, window flux, upward flux out of atmosphere and OLR combined with this equation all yield $\tau_A = 1.868$. Mind that τ_A is an effective global mean optical density, the IR window being partly closed by clouds and radiative heat transfer being boosted by convection in the lower atmosphere.

- What are those solution constraints? **i**] that surface temperature and air temperature at the surface are equal **ii**] that upward radiation from within the atmosphere is maximal, i.e. takes the virial value. Both constraints are in effect ensuring maximum entropy production, as we commonly observe within heat transferring dissipative structures.

- Why is the absorbed upward IR radiation almost equal to the downward radiation? Because **i**] there is Local Thermodynamic Equilibrium throughout, **ii**] the lapse rate cannot exceed the thermodynamic one and **iii**] the photon path length is so short that the atmosphere "looks like" isothermal for IR photons outside the window. At strong inversions and at night, the downward radiation will be larger; during the day, the absorbed radiation will be higher.

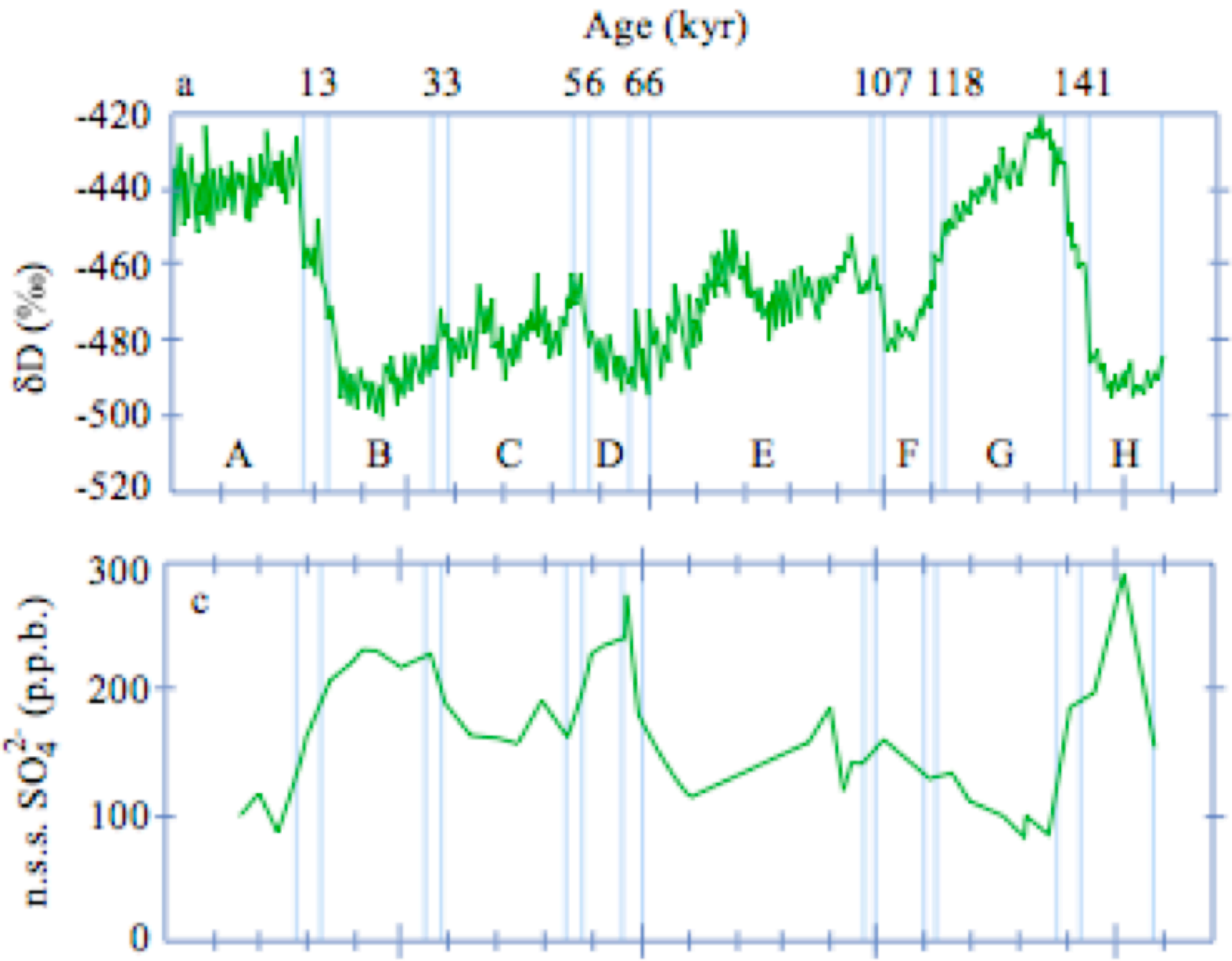
The right physics in my opinion: We have a strongly controlled climate. The solar constant and the physical properties of water keep us controlled.

- The heat transfer from surface into space uses two mechanisms in series: Convection in the lower atmosphere, IR radiation in the higher atmosphere.
- The warmer it becomes, going from pole to equator, the more important the convection part becomes. The height on which radiation flux becomes larger than convection flux, the convection top, rises.
- More convection means a higher tropopause, a lower cloud top temperature, a higher condensation efficiency, and in this way a drier upper troposphere.
- These two effects: a higher convection top and a drier upper troposphere, both increase Outgoing Longwave Radiation. This controls the temperature.

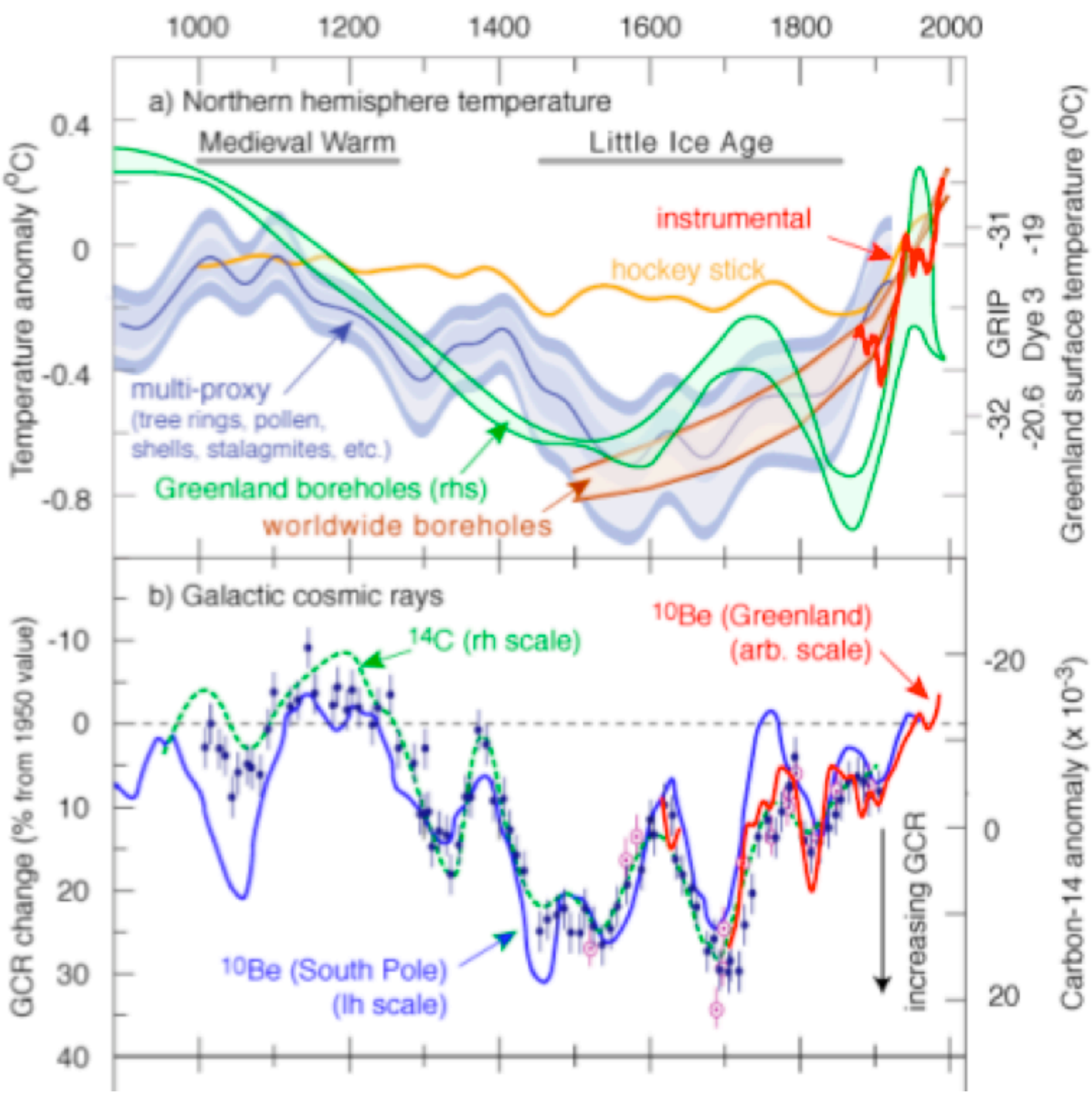
Two extreme climate episodes

- Paleocene-Eocene Thermal Maximum: 55 My ago. Tropical sea at 36 °C, poles at +20 °C. Few cloud condensation nuclei, cloud cover 45%, high condensation efficiency. Large tropical convective cooling, large convective polar heating. Very active Sun. Sulphur in pyrite reduced form.
- Deep ice age: 21 ky ago. Tropical sea at 26 °C, poles at -40, Cloud cover 70%, many cloud nuclei, finer droplets, whiter clouds. Low tropical convective cooling, low convective polar heating, high atmospheric sulphuric acid. Non-active Sun.

Sulphuric acid changes climate with 7500 °C/[gSO_4^{2-}/m^2].
Compare this with the IPCC hypothesis of 4°C/[gCO_2/m^2]



Galactic cosmic rays change climate, like sulphuric acid, by increasing CCN, whiter and more clouds, smaller droplets, decreased precipitation efficiency



concluding:

- Rising Outgoing Long-wave radiation with more than 3.7 W/m^2 per °C SST cannot be the effect of rising CO_2 or of the increase of other "greenhouse" gases. Rising OLR/SST with 8.6 W/m^2K means that the atmosphere has become more transparent to IR radiation in the past 60 years. The "greenhouse effect" has become less.
- Solar constant and the properties of water determine our climate
- Rising surface temperature is tightly controlled by increasing wet convection and concomitant upper tropospheric drying
- No observational evidence for influence of CO_2 on past or present climate
- Strong observational correlation of solar magnetic activity with climate temperatures, presumably via cloud condensation nucleation and albedo

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