Global Warming - Sensibilities and Science

Richard S. Lindzen
Alfred P. Sloan Professor of Atmospheric Sciences
Massachusetts Institute of Technology

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I would like to thank the Heartland Institute for providing a forum for presenting significant opposing viewpoints to current climate hysteria. Unfortunately, the conference is premised on the assumption that there are large numbers of scientists active in climate research whose work is being suppressed. While there is a measure of truth in this assumption, it is important to realize that the alarm has the implicit or explicit support of a vast majority of the active climate research community. To a certain extent, this is indicative of the extent to which climate science has been corrupted over a period of more than twenty years. What this means is that any active scientist who disagrees with the alarm, must, in practice, deal with scientists on the other side in order to be professionally viable. There is no comparable coterie on our side.

It pays, therefore, to understand how this situation functions. I would propose that there are three primary modes.

The first might be called *triage*. The scientist at issue isolates those areas of research that are of personal importance, and, within these areas, preserves a reasonable degree of integrity. Outside this protected area, the scientist offers a measure of support to the reigning paradigm ranging from perfunctory assent to enthusiastic campaigning. Frequently, such scientists, when their protected research lends itself to alarming interpretation, allow others to cite and exaggerate such interpretations, while enjoying the rewards associated with the exaggeration, and simultaneously maintaining distance from the interpretation.

The second might be called *opportunism of the weak*. Here, scientists whose work would normally be regarded as weak and unimpressive, gain note by molding their results to the needs of the alarmists in the environmental movement. This, normally, might be of little consequence to more productive scientists. However, with the support of the environmental movement, such weak opportunists can gain unwarranted authority. The examples are well known and include the infamous 'hockey stick,' as well as the iconic statements of the IPCC.

The third consists essentially of *free riding.* Here the emphasis is on what are euphemistically called *impacts*. The specialties of the scientists involved lie well outside of climate physics, but they can find funding and recognition by attempting to relate their specialty to global warming. Their 'results' are to be found in the newspapers every day. Cockroaches and malaria spreading, sex drive of butterflies diminishing, polar bears in potential danger, etc. From the point of view of serious science, this group is mostly a nuisance, but they play a major role in the maintenance

of alarm. They also artificially swell the numbers of scientists who endorse the alarmist view.

In referring to climate alarm or hysteria, there is the important question of who is and isn't alarmed, and why. Polls generally show a surprising degree of public skepticism. Naturally, ordinary people don't want to be accused of denialism, but they rarely give the issue high priority. The situation with the so called elites is apparently different. David Brooks, the New York Times columnist, discussing Republican Party reformers, claims that "they tend to take global warming seriously, not only on its merits, but in the belief that conservatives cannot continue to insult the sensibilities of the educated classes and the entire East and West Coasts." Why global warming has appealed to this group is an interesting question. However, from eugenics to Malthusian population and resource concerns through a variety of other such movements to global warming, this group has been at the fore. The approach is generally authoritarian, with an emphasis on belief rather than understanding. There is clearly an instinct on the part of this group that is readily exploited by the environmental movement – a movement that has effectively coopted the label of scientific authority. The elite clearly fears appearing stupid by questioning authority. Moreover, accepting authority is far easier and much less risky than trying to understand the questions at issue.

The matter of what are the questions really at issue is by no means obvious. That atmospheric CO_2 levels have risen from about 280 ppmv to 380 ppmv since the industrial revolution began is generally accepted. Similarly, it appears that there has been a net increase in global mean temperature anomaly over the same period of about 0.5-0.8C. However, this increase has been irregular implying a significant contribution from natural variability. Indeed, warming, cooling, and change, in general, are natural features of the climate. The mere existence of change tells us nothing beyond this. The serious questions involve quantitative issues. Is the warming sufficiently large to exclude natural origin? Is the sensitivity of climate such that we might reasonably expect such large warming in the future as a result of human activities? Is the net impact of such warming likely to be beneficial or detrimental? Are the proposed policies of relevance to climate per se? The public discussion of the global warming (or the peculiarly relabeled climate change) issue has generally conflated the non-serious and serious issues to the detriment of significant meaning. Gore's powerpoint presentation exemplifies this intentional and misleading confusion.

Note that just as the existence of change per se is no cause for alarm or even surprise, neither is the fact that some part of such change must certainly be due to man's activities. This would hardly need mentioning but for the fact that the iconic claim of the IPCC AR4 was that most of the change of temperature over the period since 1954 was due to man. Even, if true, this statement would hardly support alarm. However, once one looks at the argument presented by the IPCC, one readily sees how embarrassing the claim really is. What was done, was to take a large number of models that could not reasonably simulate known patterns of natural behavior (such as ENSO, the Pacific Decadal Oscillation, the Atlantic Multidecadal Oscillation), claim that such models nonetheless accurately depicted natural internal climate variability, and use the fact that these models could not replicate the warming episode from the mid seventies through

the mid nineties, to argue that forcing was necessary and that the forcing must have been due to man. The argument makes arguments in support of intelligent design sound rigorous by comparison. It constitutes a rejection of scientific logic, while widely put forward as being 'demanded' by science. Equally ironic, the fact that the global mean temperature anomaly ceased increasing by the mid nineties is acknowledged by modeling groups as contradicting the main claim of the so-called attribution argument (Smith et al, 2007, Keenlyside et al, 2008). The behavior of the temperature anomalies is readily seen in the records of any of the official IPCC sources (viz figures 1 and 1a). Note that the failure of the models to predict the cessation of warming in the mid 90's (except for a bump associated with a major El Nino event in 1998), does not disprove the possibility of significant anthropogenic warming. What it does disprove is the claim that the data provides evidence that recent warming is mostly due to man. It must be emphasized that the popular projections of catastrophe hardly follow simply from warming (at any level). They all depend on many additional and unpredictable factors.

This finally brings us to the fundamental question of climate sensitivity. Here again, the IPCC relies on existing poorly performing models to argue that sensitivity to a doubling of CO_2 could be anything from 1.5 to 5C based on the claimed range of results from different models. However, in normal science one would want an independent observational test of model results. As it turns out, such a test is eminently possible.

In the usual picture of greenhouse warming due to increased CO_2, the increased greenhouse effect leads, by itself, to a relatively small warming (approximately 1C for a doubling of CO_2 which is associated with a radiative forcing or flux of about 3.7 Watts per square meter). Mathematically, we write this as

$$\Delta T_0 = G_0 \Delta Q. \qquad (1$$

G_0 is simply the climate system's temperature response to a change in forcing, Q. However, as the temperature changes, this temperature change leads, in principle, to changes in cloud cover and humidity that further impact the radiative forcing. These are known as feedbacks. If the feedbacks add to the initial flux (by either inhibiting infrared cooling or by reducing the reflection of sunlight) then we have positive feedbacks; ie, feedbacks that amplify the original warming. If the feedbacks reduce the initial flux, then we have a negative feedback. Mathematically, this is written as

$$\Delta T = G_0(\Delta Q + F\Delta T). \qquad (2$$

Note that the original Q is supplemented by the fed back flux F T. As a result, the final temperature change is given by

$$\Delta T = \frac{\Delta T_0}{1-f}, \qquad (3$$

where $f=G_0F$ is referred to as the feedback factor. In fact, feedback processes associated with water vapor and clouds operate on time scales typically less than one day. Any fluctuation in temperature will excite the feedback processes. The total radiative forcing acts to disequilibrate the climate. Equilibration involves reestablishing radiative balance by altering the temperature of the system. The time scale for equilibration ranges from about a year to decades with longer time scales being associated with higher sensitivities. In order to observe f (essentially the change in radiative flux per unit temperature change) one must look at fluctuations with time scales greater than about a day but less than the time scale for equilibration. As a practical matter, we will consider fluctuations with time scales less than a year. If, however, sensitivities prove low, such time scales will lead to an underestimate of negative feedbacks.

Data for sea surface temperature is available from the National Centers for Environmental Prediction (Kalnay et al, 1996). For the fluctuations in radiative flux, we have the 16 year record (1985-1999) of the earth radiation budget from the Earth Radiation Budget Experiment nonscanner dataset (ERBE; Barkstrom 1984). We use edition 3 of this dataset that has been corrected for altitude variations associated with satellite orbital decay (Wong et al, 2006). Further, we use 7-month moving averages of short wave fluxes to minimize temporal aliasing effects (Trenberth, 2002). Finally, we use GCM outputs from the Atmospheric Model Intercomparison Program in order to get the fluctuations in radiative fluxes produced by models used in the IPCC AR4 when forced by the observed sea surface temperatures. These time series are shown in Figure 2a for longwave (thermal) radiation and Figure 2b for shortwave (visible) radiation. We see that there are numerous fluctuations in both temperature and radiation. Looking at the temperature fluctuations, we see that the smaller fluctuations may simply be noise, and, indeed, by restricting ourselves to fluctuations larger than 0.1 or 0.2C, and looking for the associated fluctuations in radiative flux, we obtain (at least for the ERBE data) large values of R^2 (greater than 0.8) and small values for the standard error. From the above equations, we see that the feedback factor, f, is simply - $\Delta F/\Delta T$ where ΔF is the change in the total flux (infrared and visible). Thus, positive values for $\Delta F/\Delta T$ correspond to negative feedbacks and negative values of $\Delta F/\Delta T$ correspond to positive feedbacks. The results are shown in Figure 3. All GCMs show positive feedback, while ERBE unambiguously shows a strong negative feedback. This clearly illustrates the fallacy of assuming that when models agree, they are correct. Figure 4 relates climate sensitivity to feedback for both ERBE and the models. We see that for the range of sensitivities that characterize the models, the errors in the feedback factors make it impossible to narrow the range of sensitivity, thus explaining why this range has not diminished since 1979. However, for the low sensitivity obtained from the actual climate system, we see that sensitivity is narrowly constrained to about 0.5C, and strongly implies that there is little to be concerned about.

In a normal field, these results would pretty much wrap things up, but global warming/climate change has developed so much momentum that it has a life of its own – quite removed from science. One can reasonably expect that *opportunism of the weak* will lead to efforts to alter the data (though the results presented here have survived several alterations of the data already). Perhaps most important, these results will of necessity 'offend the sensibilities of the of the educated classes and the entire East and West Coasts,' and who would want to do that.

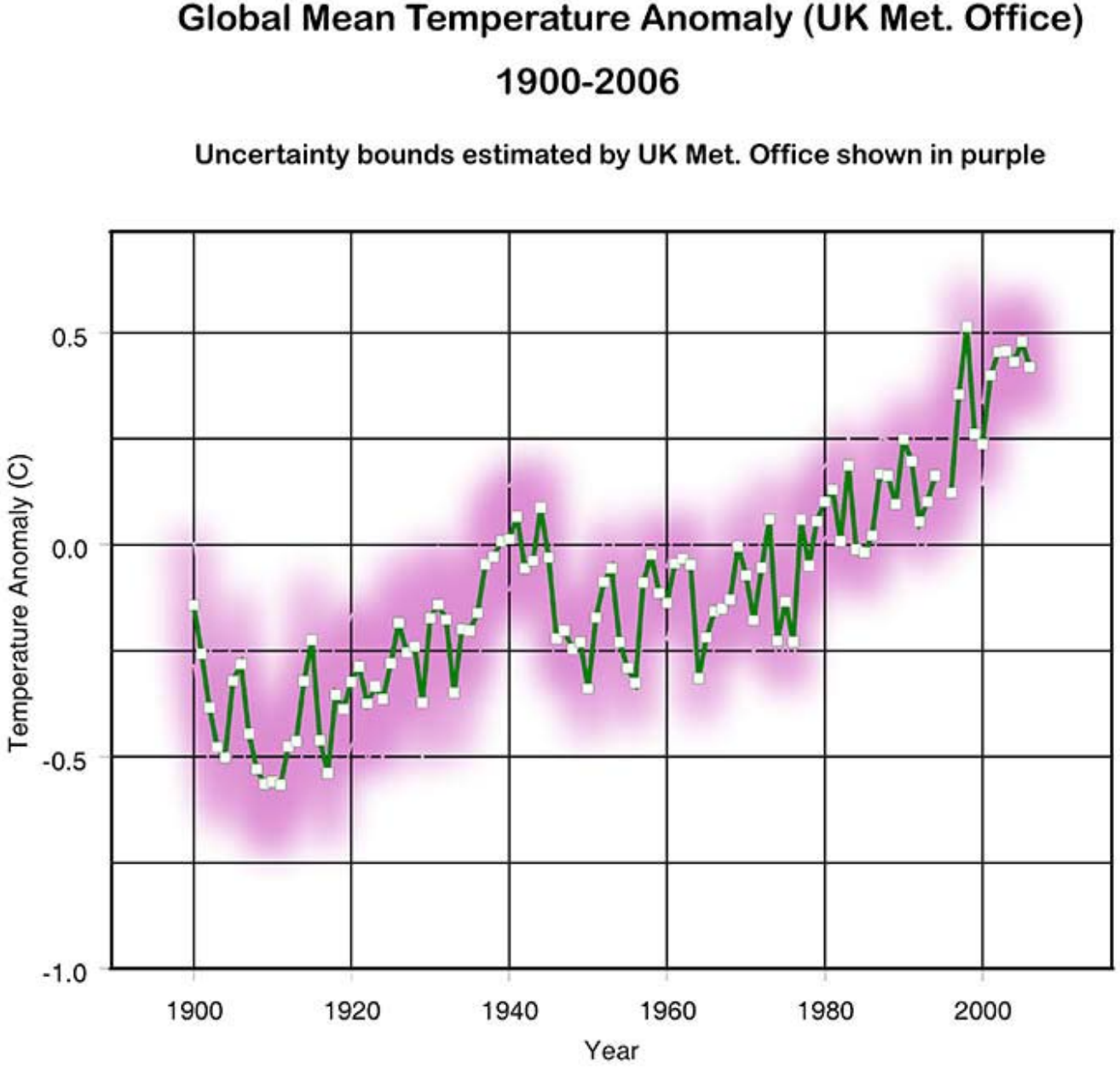
Global Mean Temperature Anomaly (UK Met. Office)
1900-2006
Uncertainty bounds estimated by UK Met. Office shown in purple
Temperature Anomaly (C)
0.5
0.0
-0.5
-1.0
1900
1920
1940
1960
1980
2000
Year

Figure 1

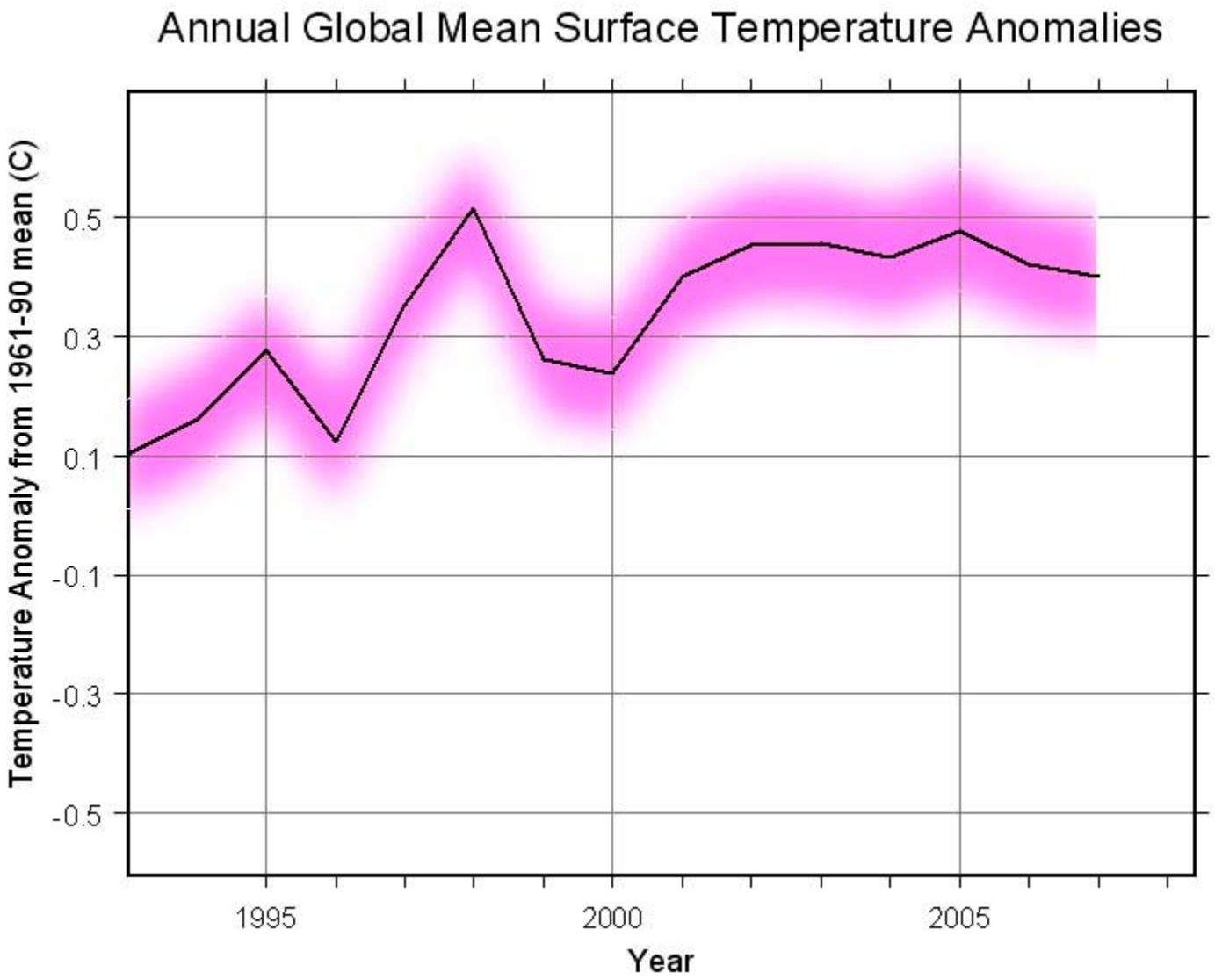
Annual Global Mean Surface Temperature Anomalies
Temperature Anomaly from 1961-90 mean (C)
0.5
0.3
0.1
-0.1
-0.3
-0.5
1995
2000
2005
Year

Figure 1a

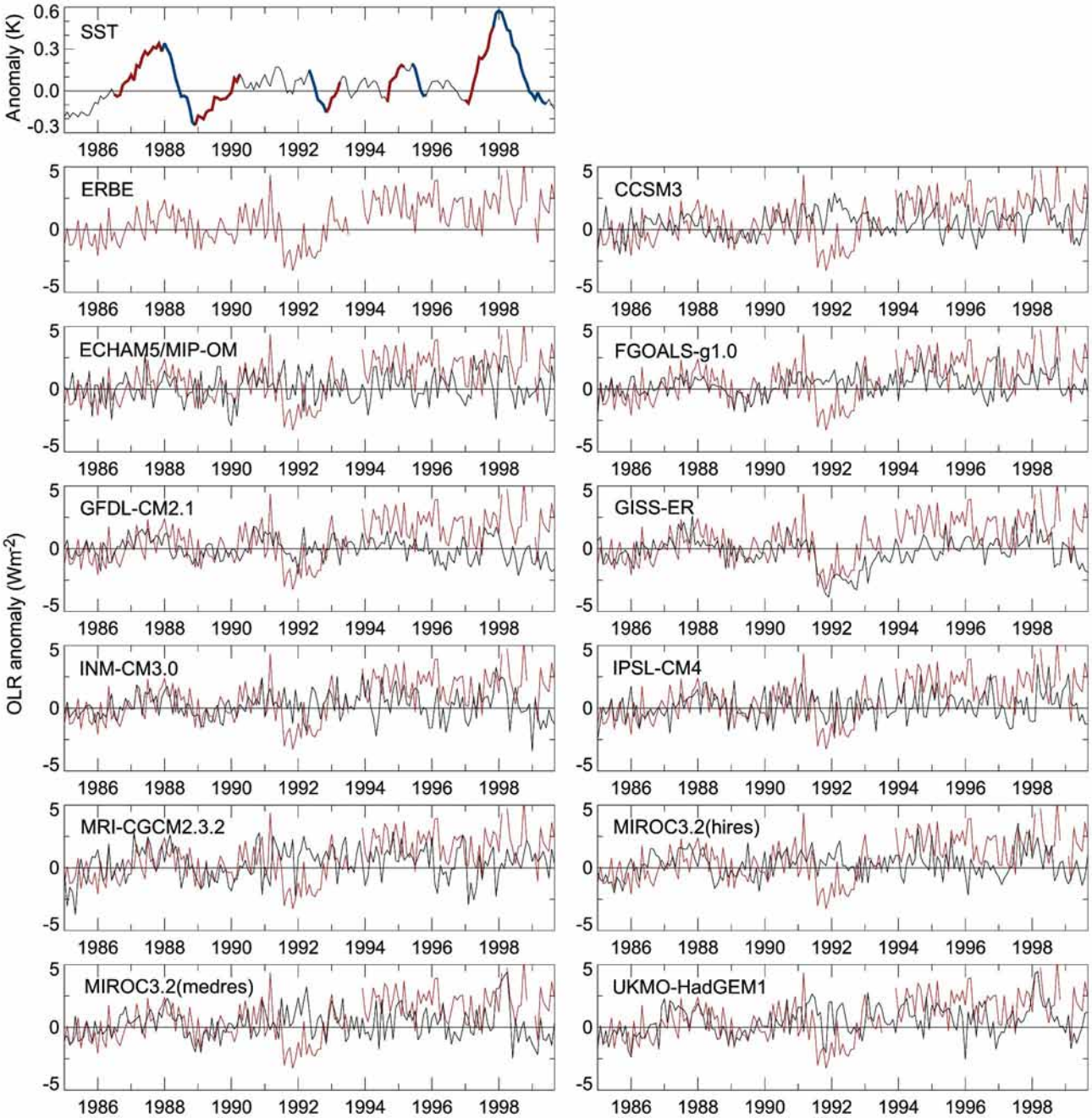
SST
Anomaly (K)
0.6
0.3
0.0
-0.3
1986 1988 1990 1992 1994 1996 1998
ERBE
CCSM3
ECHAM5/MIP-OM
FGOALS-g1.0
GFDL-CM2.1
GISS-ER
INM-CM3.0
IPSL-CM4
MRI-CGCM2.3.2
MIROC3.2(hires)
MIROC3.2(medres)
UKMO-HadGEM1
OLR anomaly (Wm-2)
5
0
-5

Figure 2a

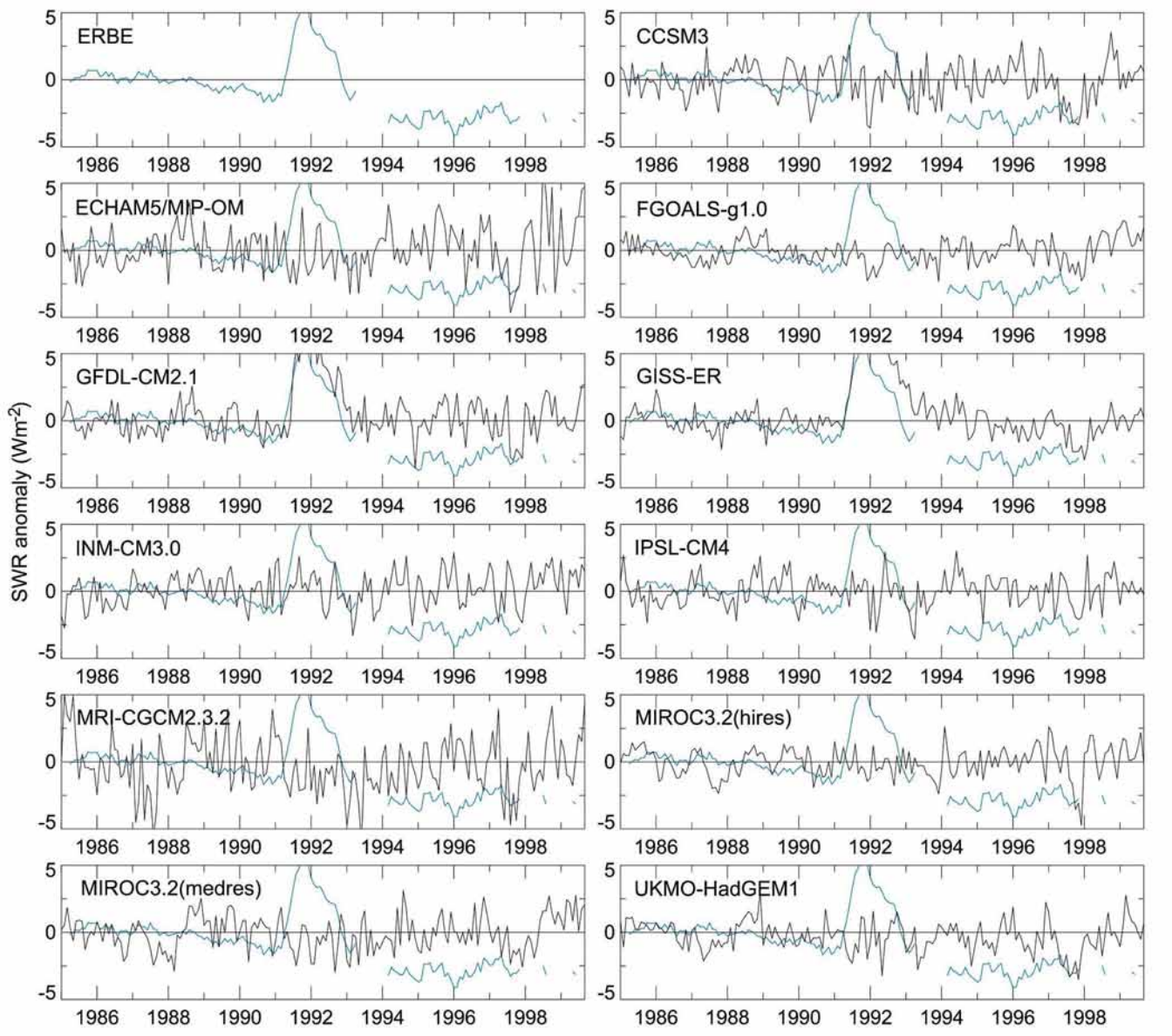
ERBE
CCSM3
ECHAM5/MIP-OM
FGOALS-g1.0
GFDL-CM2.1
GISS-ER
INM-CM3.0
IPSL-CM4
MRI-CGCM2.3.2
MIROC3.2(hires)
MIROC3.2(medres)
UKMO-HadGEM1
SWR anomaly (Wm-2)
5
0
-5
1986
1988
1990
1992
1994
1996
1998

Figure 2b

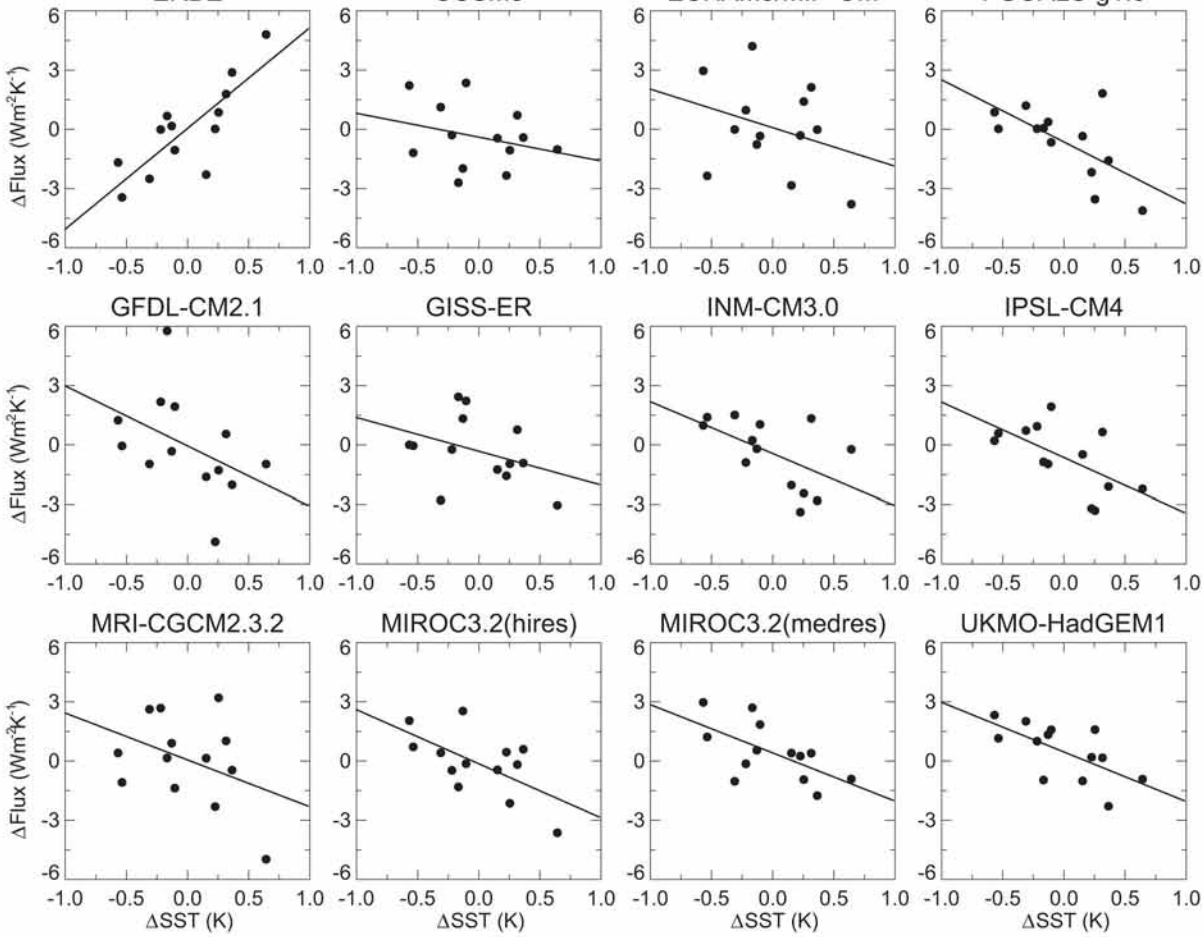
ERBE
CCSM3
ECHAM5/MIP-OM
FGOALS-g1.0
GFDL-CM2.1
GISS-ER
INM-CM3.0
IPSL-CM4
MRI-CGCM2.3.2
MIROC3.2(hires)
MIROC3.2(medres)
UKMO-HadGEM1
ΔFlux (Wm-2K-1)
ΔSST (K)
6
3
0
-3
-6
-1.0
-0.5
0.0
0.5
1.0

Figure 3

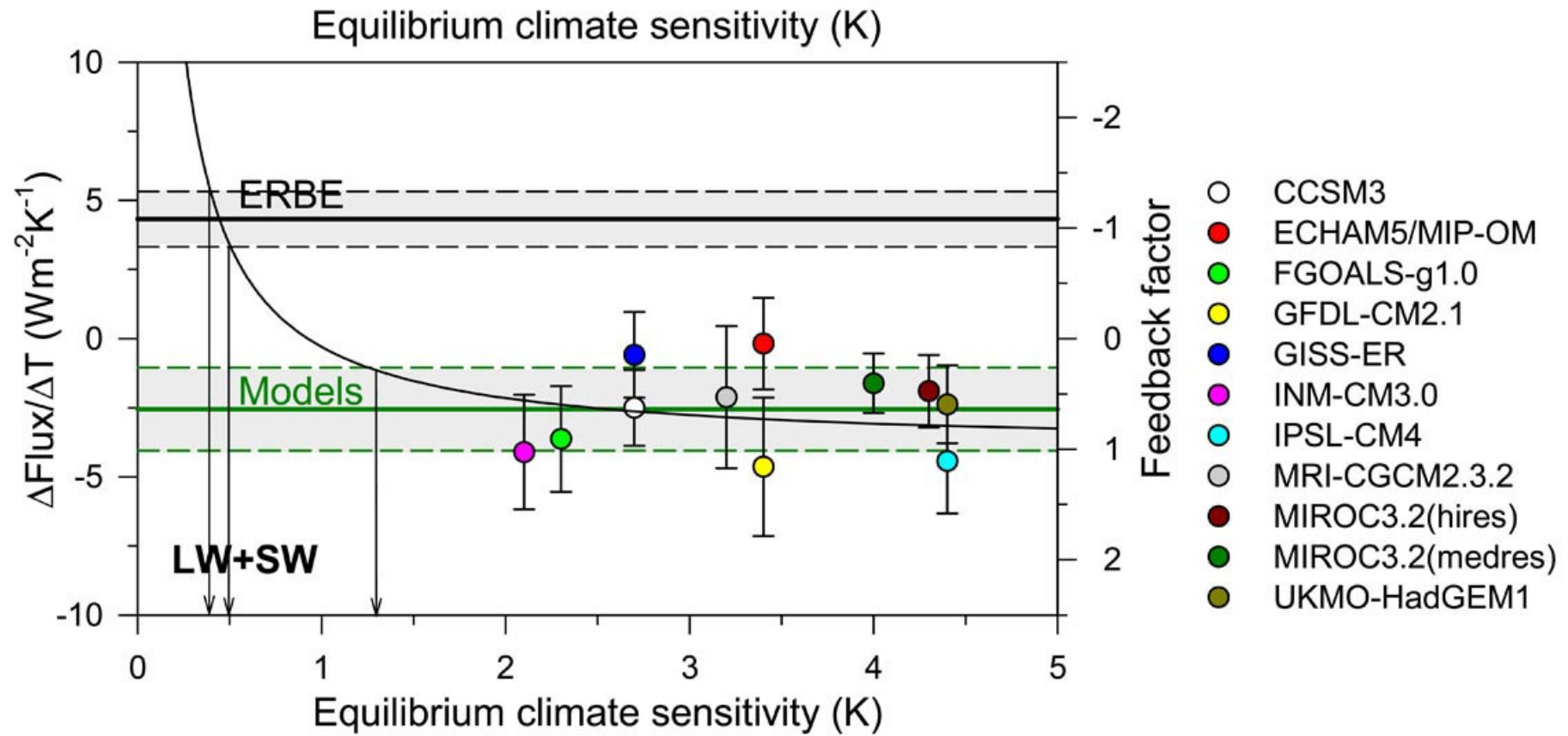
Equilibrium climate sensitivity (K)
ΔFlux/ΔT (Wm-2K-1)
Feedback factor
ERBE
Models
LW+SW
Equilibrium climate sensitivity (K)
CCSM3
ECHAM5/MIP-OM
FGOALS-g1.0
GFDL-CM2.1
GISS-ER
INM-CM3.0
IPSL-CM4
MRI-CGCM2.3.2
MIROC3.2(hires)
MIROC3.2(medres)
UKMO-HadGEM1

Figure 4