Climate Metrics
A Reality Check
What Does the Recent Data Actually Tell Us?

• Near Surface Temperature Trends
• Lower Tropospheric Temperature Trends
• Ocean Heat Content Changes
• Arctic Sea Ice Areal Coverage
• Antarctic Sea Ice Areal Coverage
• Tropospheric Water Vapor Trends
• Regional Climate Model Downscaling Does Not Provide Added Skill In Propagating Weather Features Beyond What Is Already Present In the Parent Global Climate Model
Definition Of The Global Average Radiative Temperature

“According to the radiative-convective equilibrium concept, the equation for determining global average surface temperature of the planet is

\[ \frac{dH}{dt} = f - T' / \lambda \]  \hspace{1cm} (1)

where \( H \) is the heat content of the land-ocean-atmosphere system. Equation (1) describes the change in the heat content where \( f \) is the radiative forcing at the tropopause, \( T' \) is the change in surface temperature in response to a change in heat content, and \( \lambda \) is the climate feedback parameter [Schneider and Dickinson, 1974], also known as the climate sensitivity parameter, which denotes the rate at which the climate system returns the added forcing to space as infrared radiation or as reflected solar radiation (by changes in clouds, ice and snow, etc.)."
Issues With Near-Surface Land Temperature Measurements

- Poor Station Representativeness
- Neglect of Moisture Trends As They Affect Temperature Trends
- Bias in Nighttime Temperature Trends
- Effect of Landscape Changes
- Lack of Quantifying Uncertainties in Homogenization of Temperature Data
- Lack of Independence in Different Analyses (GISS; CRU, NCDC) in regions of sparse data
- Use of Reanalyses To Assess Representativeness of Surface Temperature Data
Several Of Our Peer Reviewed Papers on These Issues


Poor Microclimate Exposure At Many Climate Observing Sites

http://wattsupwiththat.wordpress.com/

Fort Morgan site showing images of the cardinal directions from the sensor (from Hanamean et al. 2003)
http://wattsupwiththat.wordpress.com/category/weather_stations/
As shown in *Pielke et al.* [2004], the heat content of surface air is given by

\[ H = C_p T + L q \]

where \( H \) is the heat in Joules, \( C_p \) is the heat capacity of air at constant temperature, \( T \) is the air temperature, \( L \) is the latent heat of vaporization and \( q \) is the specific humidity. This equation can be rewritten as

\[ \frac{H}{C_p} = T_E = T + \frac{L_v q}{C_p} \]
Land Use/Land Cover Change Generally Produces A Warm Bias

“Temperature trends were primarily insignificant prior to the period during which the greatest single type of LULC change occurred around Normals stations. Additionally, those trends that were significant were generally divided equally between warming and cooling trends (Table 5). However, after periods of dominant LULC change, significant trends in minimum, maximum, or mean temperature were far more common, and 90% or more of these significant trends were warming trends.”

Documentation Of A Significant Warm Bias In Long Term Trends of Minimum Temperatures


“...Therefore, the use of minimum temperatures at 1.5 or 2 m for interpreting climate system heat change is not appropriate. This means that the 1.5 to 2m observations of minimum temperatures that are used as part of the analysis to assess climate system heat changes (e.g., such as used to construct Figure SPM-3 in IPCC [2007] and in Parker [2004, 2006] study) lead to a greater long term temperature trend than would be found if higher heights within the surface boundary layer were used...."
Trend: $-0.17 \pm 0.15 ^\circ C \ (10m)^{-1} \ Dec^{-1}$

(c): TX @ Calm

Trend: $-0.46 \pm 0.29 ^\circ C \ (10m)^{-1} \ Dec^{-1}$

(e): TN @ Calm

Trend: $-0.11 \pm 0.09 ^\circ C \ (10m)^{-1} \ Dec^{-1}$

(d): TX @ Windy

(f): TN @ Windy
Climate Feedbacks Cumulatively Must Be Negative So Far

- Estimate Global Average Radiative Forcing (IPCC, 2007)
- These Two Values Provide an Estimate Of the Radiative Feedback
Figure SPM.2. Global average radiative forcing (RF) estimates and ranges in 2005 for anthropogenic carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). The net anthropogenic radiative forcing and its range are also shown. These require summing asymmetric uncertainty estimates from the component terms, and cannot be obtained by simple addition. Additional forcing factors not included here are considered to have a very low LOSU. Volcanic aerosols contribute an additional natural forcing but are not included in this figure due to their episodic nature. The range for linear contrails does not include other possible effects of aviation on cloudiness. (2.9, Figure 2.20)
Global Radiative Imbalance

Figure 1. Globally averaged annual OHCA \(10^{22} \text{ J}\) in the upper 750 m estimated using in situ data alone from 1993 through 2005 (black line) and using in situ data excluding profiling floats (gray line). Error bars (from Figure 3) reflect the standard error estimates discussed in Section 3. Linear trends are computed from a weighted least square fit [Wunsch, 1996] and reflect the OHCA estimate made using all available profile data. Errors for inset linear trend estimates are quoted at the 95% confidence interval.

2007 IPCC Total Radiative Forcing = 1.72 (0.66 to 2.7) Watts per meter squared

Best Estimate of Total Radiative Imbalance (1993-2005) = 0.33 (0.10 to 0.56) Watts per meter squared

If the IPCC Forcing is accepted as the current forcing, than the net global radiative feedbacks are negative!

• ".... a revised estimate of upper-ocean ocean heat content suggests than no significant warming or cooling has occurred in recent years, with ocean heat content increasing by only 1 (± 16) 11 × 10**21 J between 2004 and 2006."
What Do SST And Anomalies and Trends Look Like?
Annual SST and OHC(0-300m) anomalies integrated over the 60S-60N with respect to the 1961-1990 mean *2007 SST averaged by Sep 2007
What are the Tropospheric and Lower Stratospheric Temperature Trends?
http://www.remss.com/msu/msu_data_description.html
Stratospheric Temperature TLS
http://www.remss.com/msu/msu_data_description.html
Lower Tropospheric Temperature TLT 1979 to 2007
http://www.remss.com/msu/msu_data_description.html
What Are the Trends In Arctic and Antarctic Sea Ice Coverage?
Current Northern Hemisphere Sea Ice Area

recent 365 days shown

Ice Area (million square km)

Year

N.H. Sea Ice Area
Anomaly from 1979-2000 mean
Current Southern Hemisphere Sea Ice Area

recent 365 days shown

Ice Area (million square km)

Year

- N.H. Sea Ice Area
- Anomaly from 1979-2000 mean
What Is the Trend In Tropospheric Water Vapor?

“…….the Tcol from 1979 to 2006 was significant and positive; however, the PWAV and PWAT were not. This suggests that atmospheric temperature and water vapor trends do not follow the conjecture of constant relative humidity…..”
Is There Value In Dynamic Downscaling with Regional Climate Models

Is There Consensus With the 2007 IPCC Report?
ABSTRACT. An online poll of scientists' opinions shows that, while there is strong agreement on the important role of anthropogenically-caused radiative forcing of CO2 in climate change and with the largest group supporting the IPCC report, there is not a universal agreement among climate scientists about climate science as represented in the IPCC’s WG1. Claims that the human input of CO2 is not an important climate forcing, or that 'the science is more or less settled', are found to be false in our survey. The IPCC WG1 perspective is the mean response, though there are interesting differences between mean responses in the USA and in the EU. There are, also, a significant number of climate scientists who disagree with the IPCC WG1 perspective.
1. There is no warming; it is a fabrication based on inaccurate/inappropriate measurement. Human activity is not having any significant effect on Climate. The data on which such assumptions are made is so compromised as to be worthless. The physical science basis of AGW theory is founded on a false hypothesis.

2. Any recent warming is most likely natural. Human input of CO2 has very little to do with it. Solar, naturally varying water vapour and similar variables can explain most or all of the climate changes. Projections based on Global Climate Models are unreliable because these are based on too many assumptions and unreliable datasets.

3. There are changes in the atmosphere, including added CO2 from human activities, but significant climate effects are likely to be all within natural limits. The 'scares' are exaggerations with a political motive. The undue emphasis on CO2 diverts attention away from other, important research on climate variability and change.

4. There is warming and the human addition of CO2 causes some of it, but the science is too uncertain to be confident about current attributions of the precise role of CO2 with respect to other climate forcings. The IPCC WG1 overestimates the role of CO2 relative to other forcings, including a diverse variety of human climate forcings.

5. The scientific basis for human impacts on climate is well represented by the IPCC WG1 report. The lead scientists know what they are doing. We are warming the planet, with CO2 as the main culprit. At least some of the forecast consequences of this change are based on robust evidence.

6. The IPCC WG1 is compromised by political intervention; I agree with those scientists who say that the IPCC WG1 is underestimating the problem. Action to reduce human emissions of CO2 in order to mitigate against serious consequences is more urgent than the report suggests. This should be done irrespective of other climate and environmental considerations.

7. The IPCC WG1 seriously understates the human influence on climate. I agree with those scientists who say that major mitigation responses are needed immediately to prevent catastrophic warming and other impacts projected to result from human emissions of CO2. We are seriously damaging the Earth's climate, and will continue to face devastating consequences for many years.