Climate4you update October 2010

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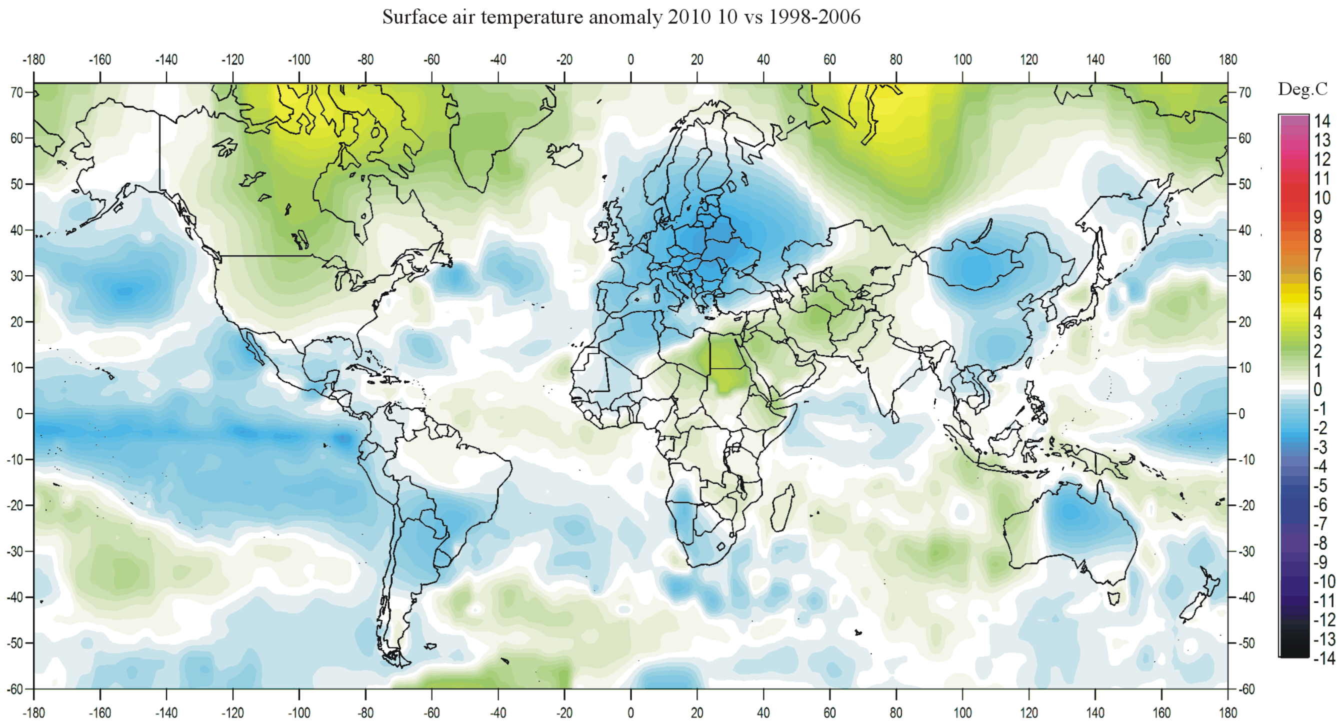
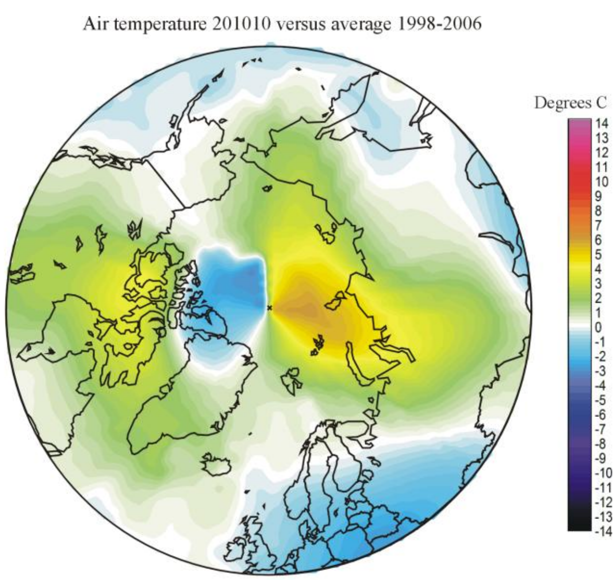
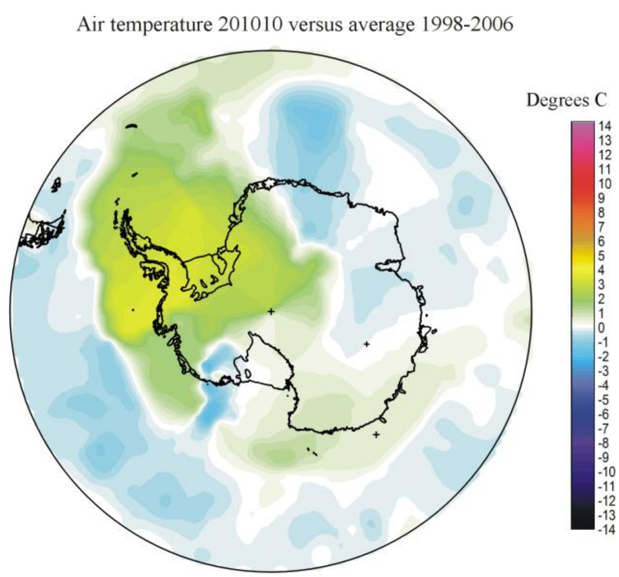
October 2010 global surface air temperature overview







October 2010 surface air temperature compared to the average 1998-2006. Green.yellow-red colours indicate areas with higher temperature than the 1998-2006 average, while blue colours indicate lower than average temperatures. Data source: Goddard Institute for Space Studies (GISS)

Comments to the October 2010 global surface air temperature overview

This newsletter contains graphs showing a selection of key meteorological variables for October 2010. All temperatures are given in degrees Celsius.

In the above maps showing the geographical pattern of surface air temperatures, the period 1998-2006 is used as reference period. The reason for comparing with this recent period instead of the official WMO 'normal' period 1961-1990, is that the latter period is affected by the relatively cold period 1945-1980. Almost any comparison with such a low average value will therefore appear as high or warm, and it will be difficult to decide if modern surface air temperatures are increasing or decreasing. Comparing with a more recent period overcomes this problem. In addition to this consideration, the recent temperature development suggests that the time window 1998-2006 may roughly represent a global temperature peak. If so, negative temperature anomalies will gradually become more and more widespread as time goes on. However, if positive anomalies instead gradually become more widespread, this reference period only represented a temperature plateau.

In the other diagrams in this newsletter the thin line represents the monthly global average value, and the thick line indicate a simple running average, in most cases a 37-month average, almost corresponding to three years.

The year 1979 has been chosen as starting point in several of the diagrams, as this roughly corresponds to both the beginning of satellite observations and the onset of the late 20th century warming period.

Global surface air temperatures October 2010 in the Northern Hemisphere was characterised by average or relatively cold conditions, except areas in NE Canada, Greenland and NW Siberia, which were warm. Otherwise, relative cold conditions prevailed, especially in Europe, China and in the northern Pacific Ocean.

The Southern Hemisphere in general was relatively cold or close to average conditions. Especially central South America, the southern part of Africa and Australia were relatively cold. There were no major warm areas.

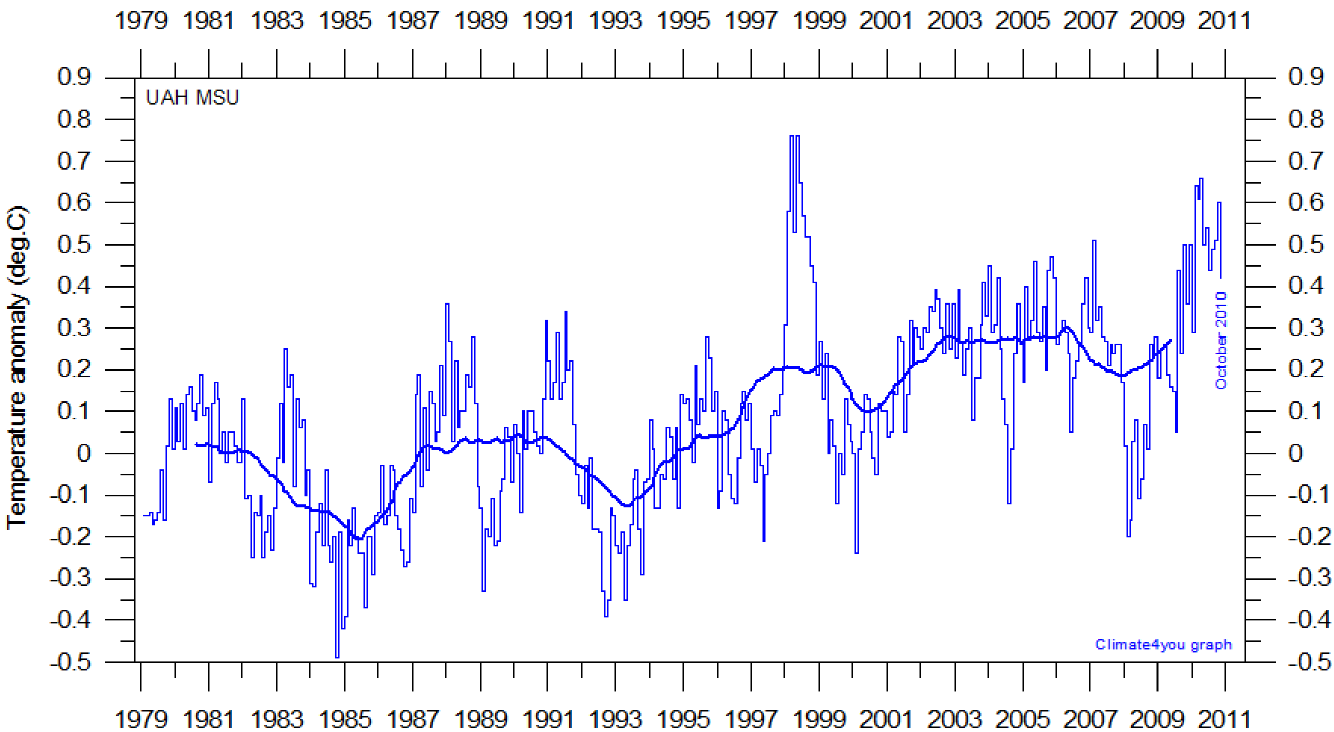
Near Equator conditions were influenced by the onset of a new La Nina situation. Relatively low temperatures therefore characterised most of the Equatorial regions in the Pacific Ocean.

In the Arctic relatively low temperatures characterised NW Greenland and the northernmost part of Canadian Arctic. Otherwise, most of the Arctic experienced above average temperatures.

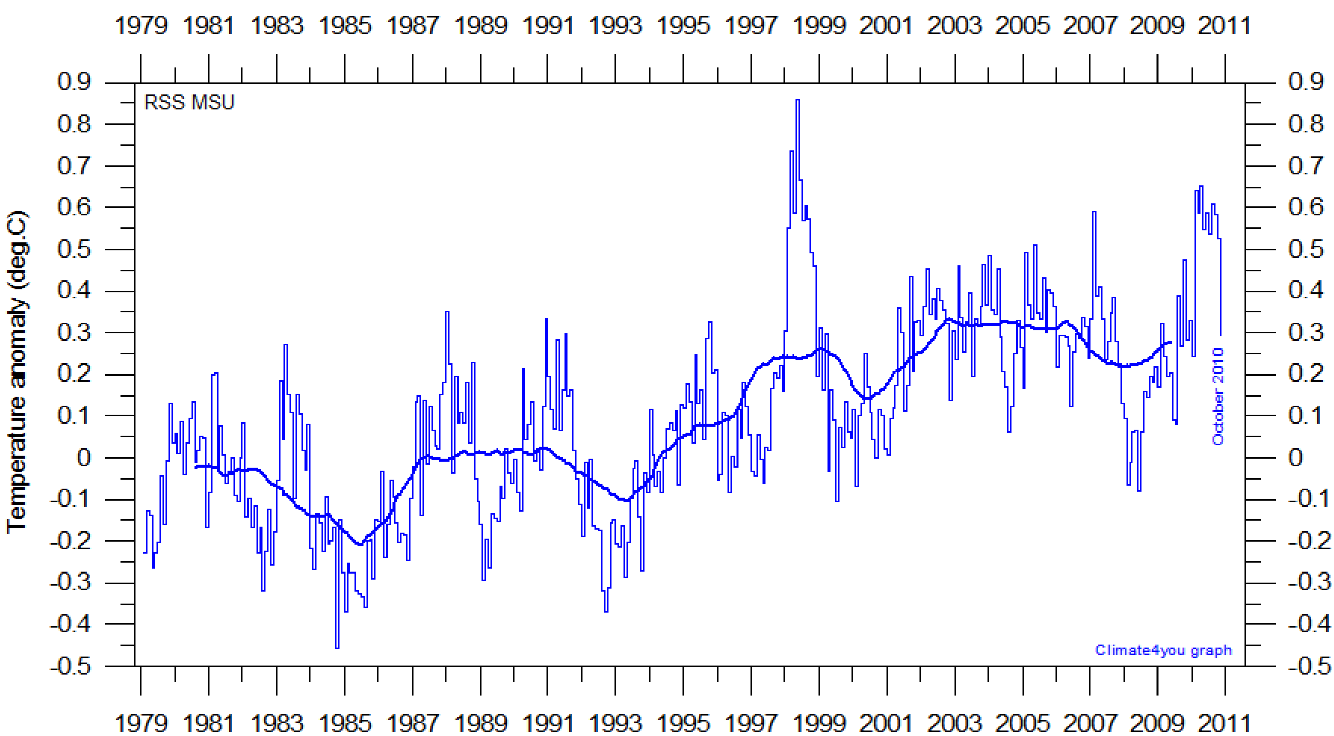
In the Antarctic relatively warm conditions characterised the Peninsula and parts of both West and East Antarctica. The major part of East Antarctic, however, was near or below average temperatures.

All diagrams shown in this newsletter are available for download on www.climate4you.com

Lower troposphere temperature from satellites, updated to October 2010

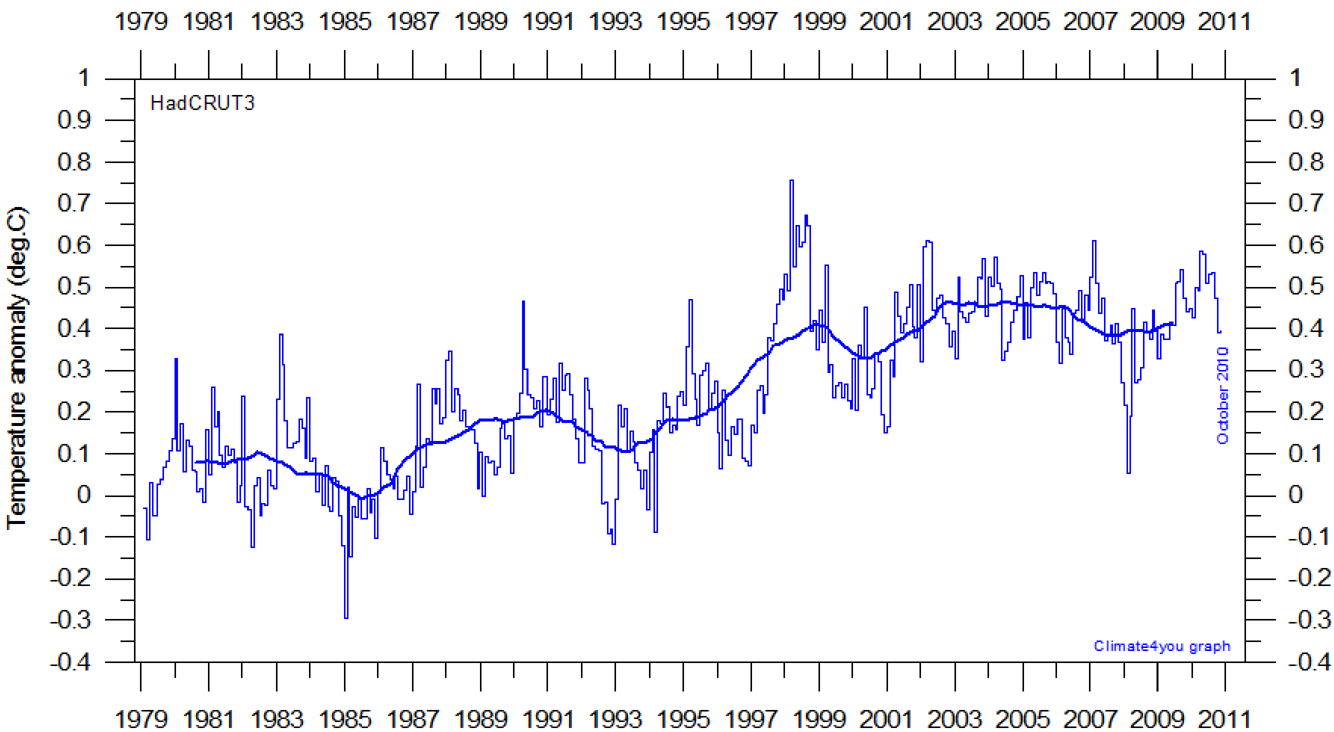


Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.

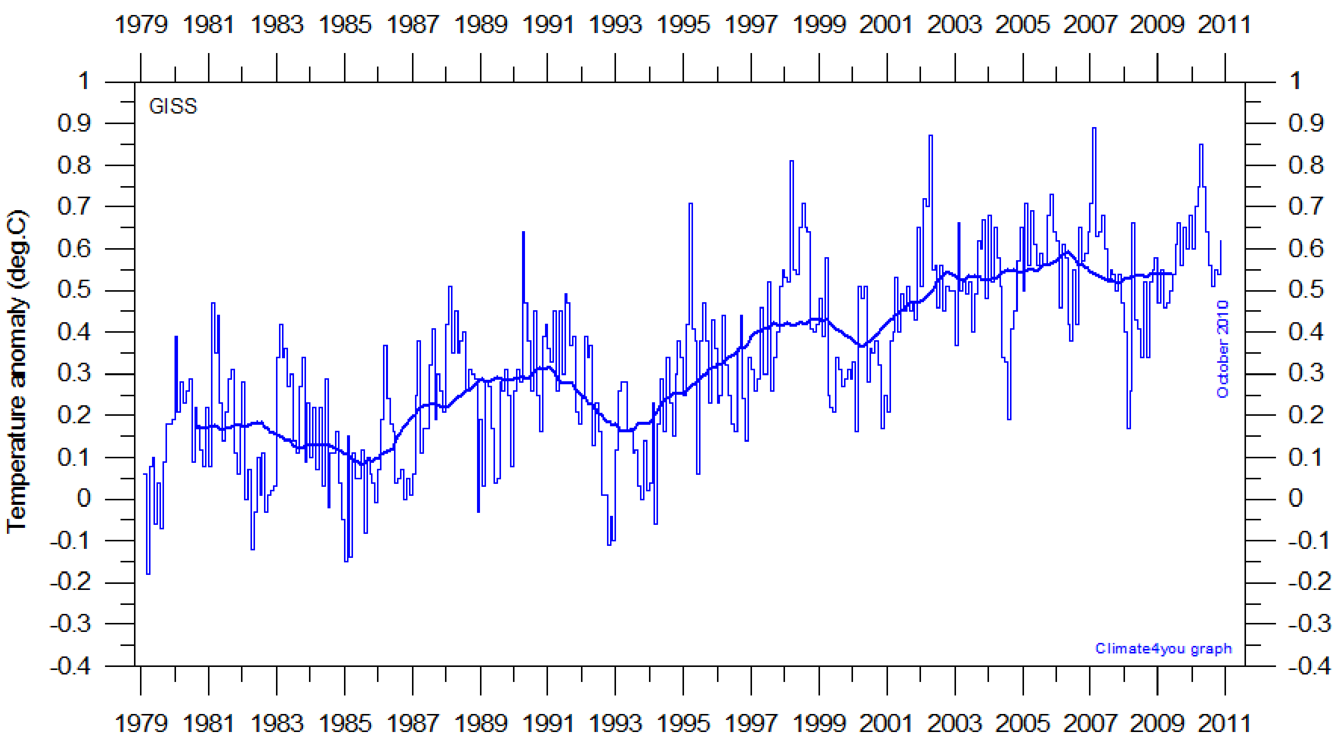


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37 month average.

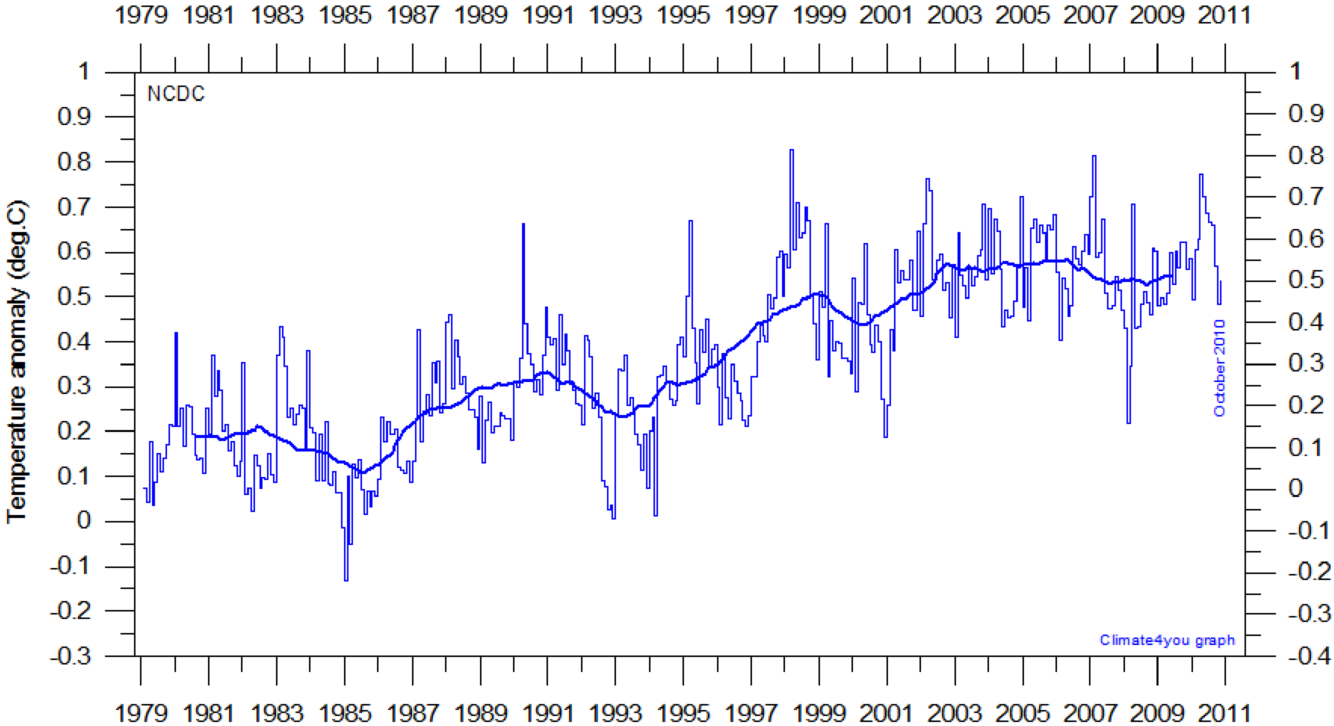
Global surface air temperature, updated to October 2010



Global monthly average surface air temperature (thin line) since 1979 according to according to the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thick line is the simple running 37 month average.



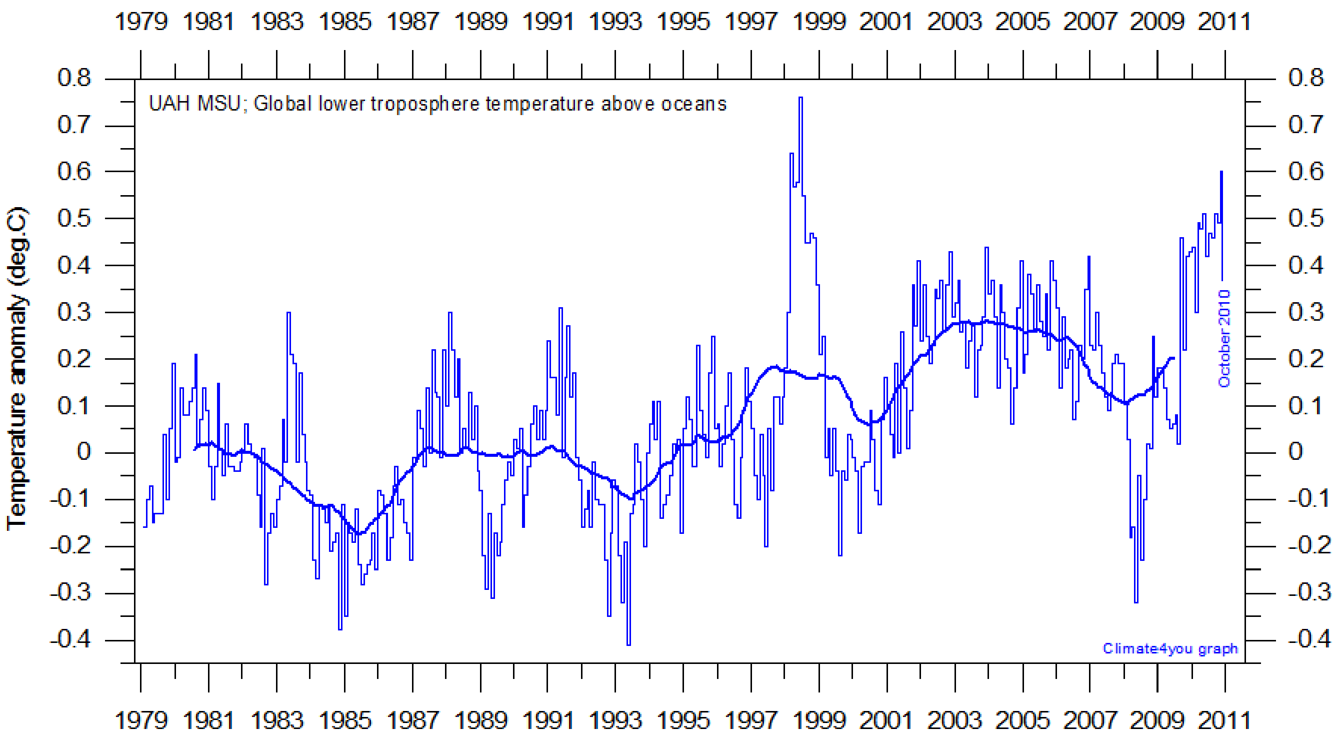
Global monthly average surface air temperature (thin line) since 1979 according to according to the Goddard Institute for Space Studies (GISS), at Columbia University, New York City, USA. The thick line is the simple running 37 month average.



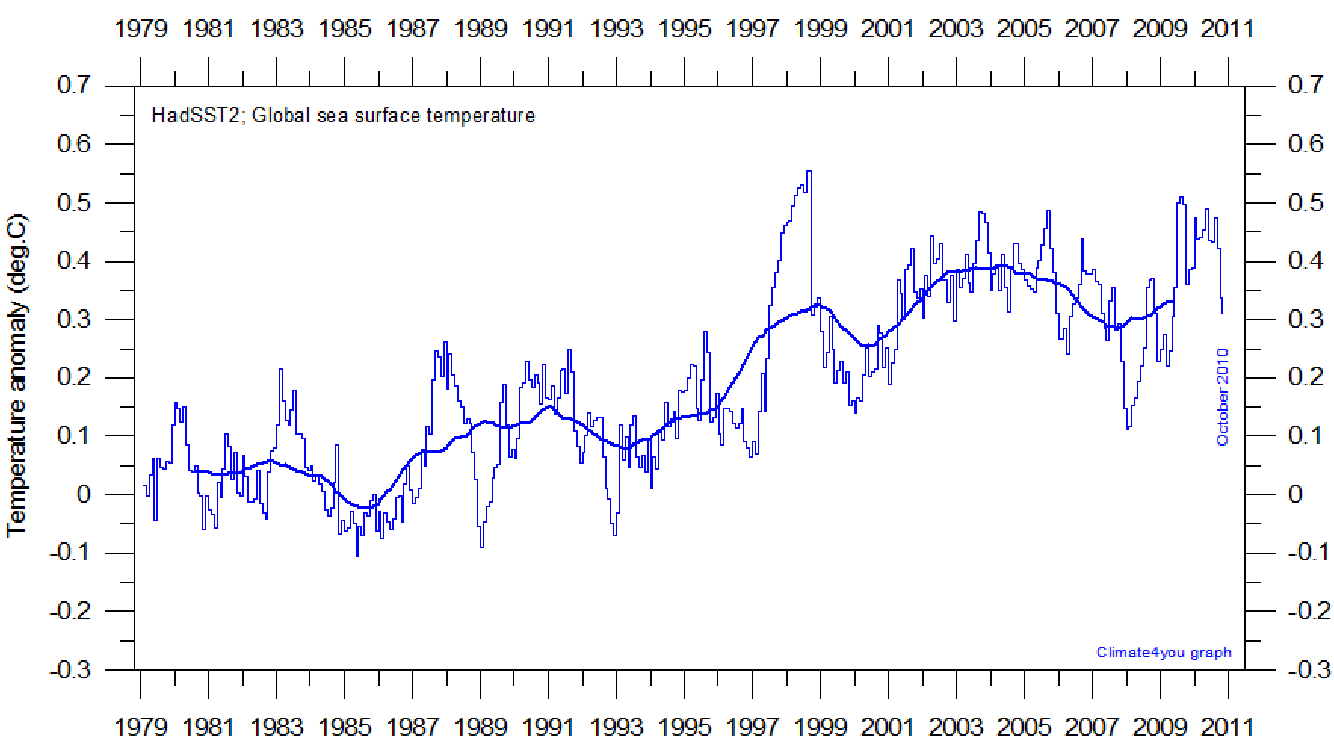
Global monthly average surface air temperature since 1979 according to according to the [National Climatic Data Center](#) (NCDC), USA. The thick line is the simple running 37 month average.

Some readers have noted that several of the above data series display changes when one compare with previous issues of this newsletter, not only for the most recent months, but actually for most of months included in the individual data series. The interested reader may find more on this lack of temporal stability on [www.climate4you](#) (go to: Global Temperature and then Temporal Stability).

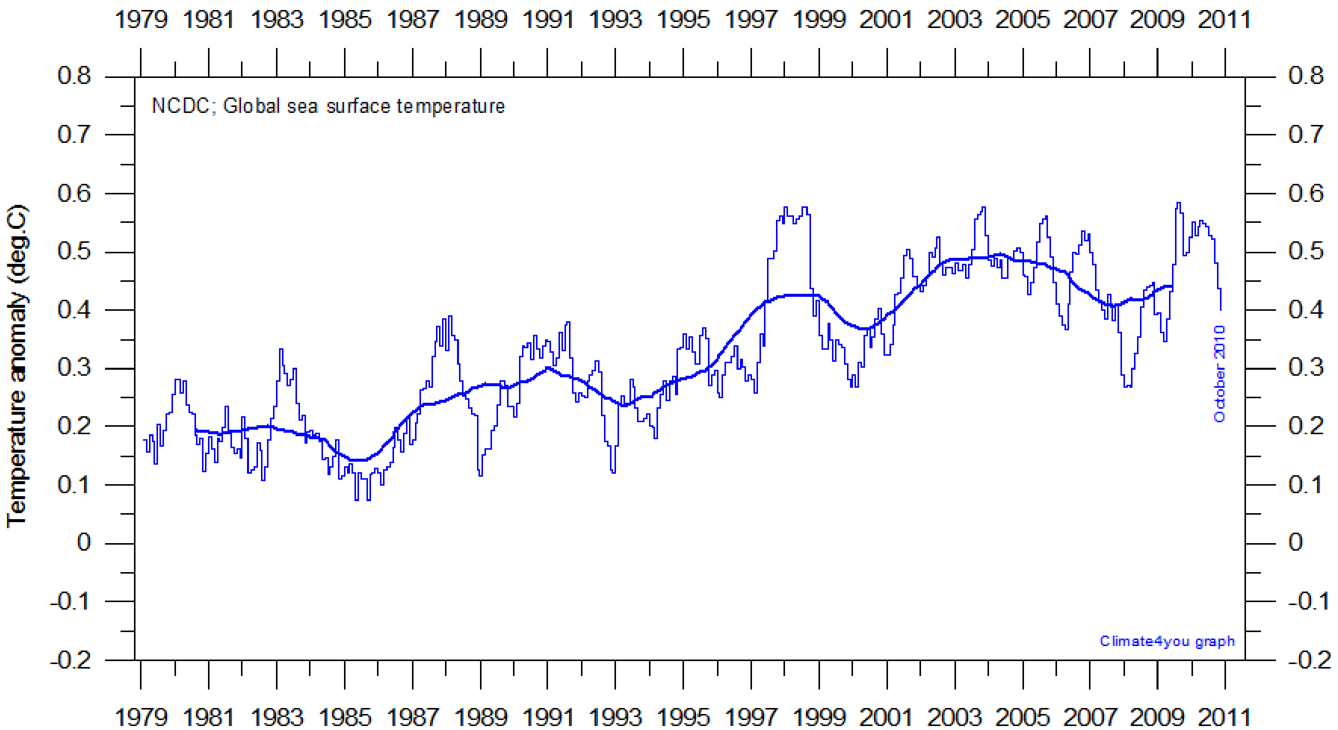
Global sea surface temperature, updated to October 2010



Global monthly average lower troposphere temperature over oceans (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.

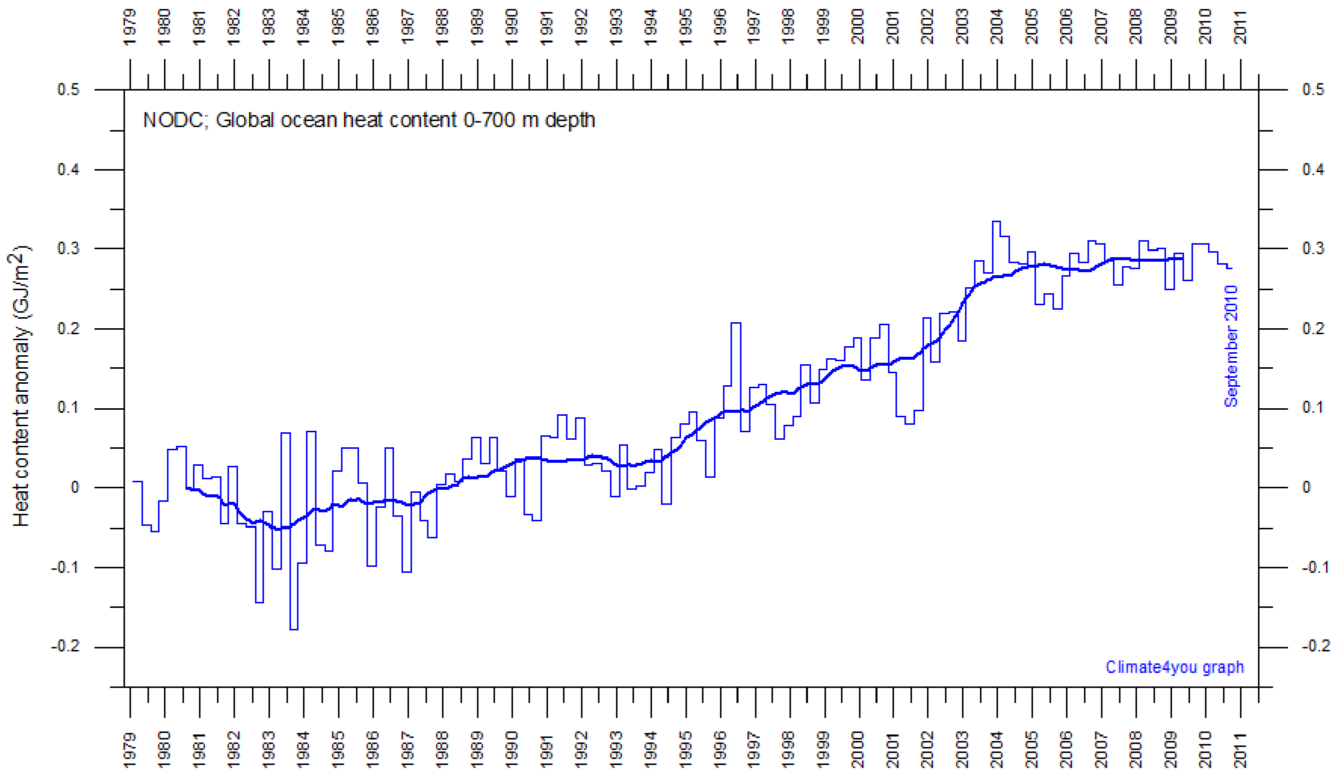


Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37 month average.

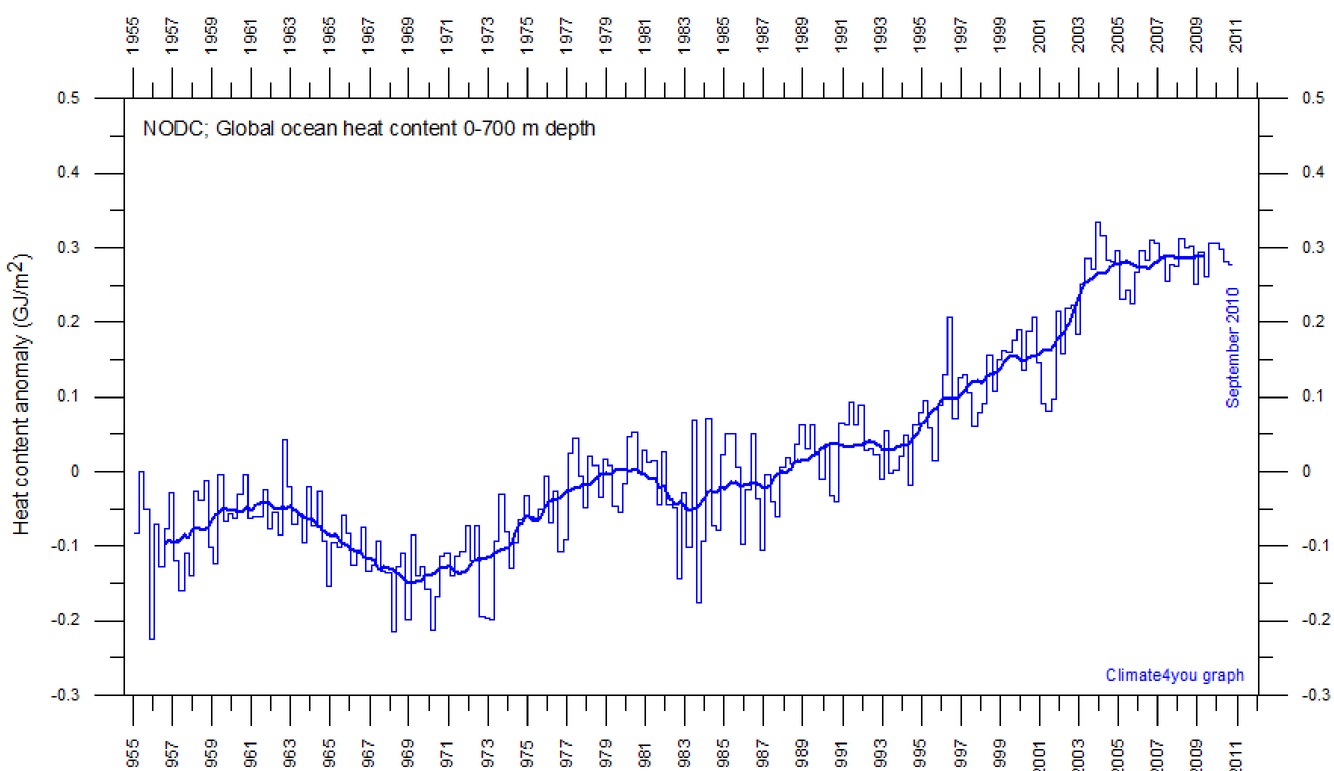


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to September 2010

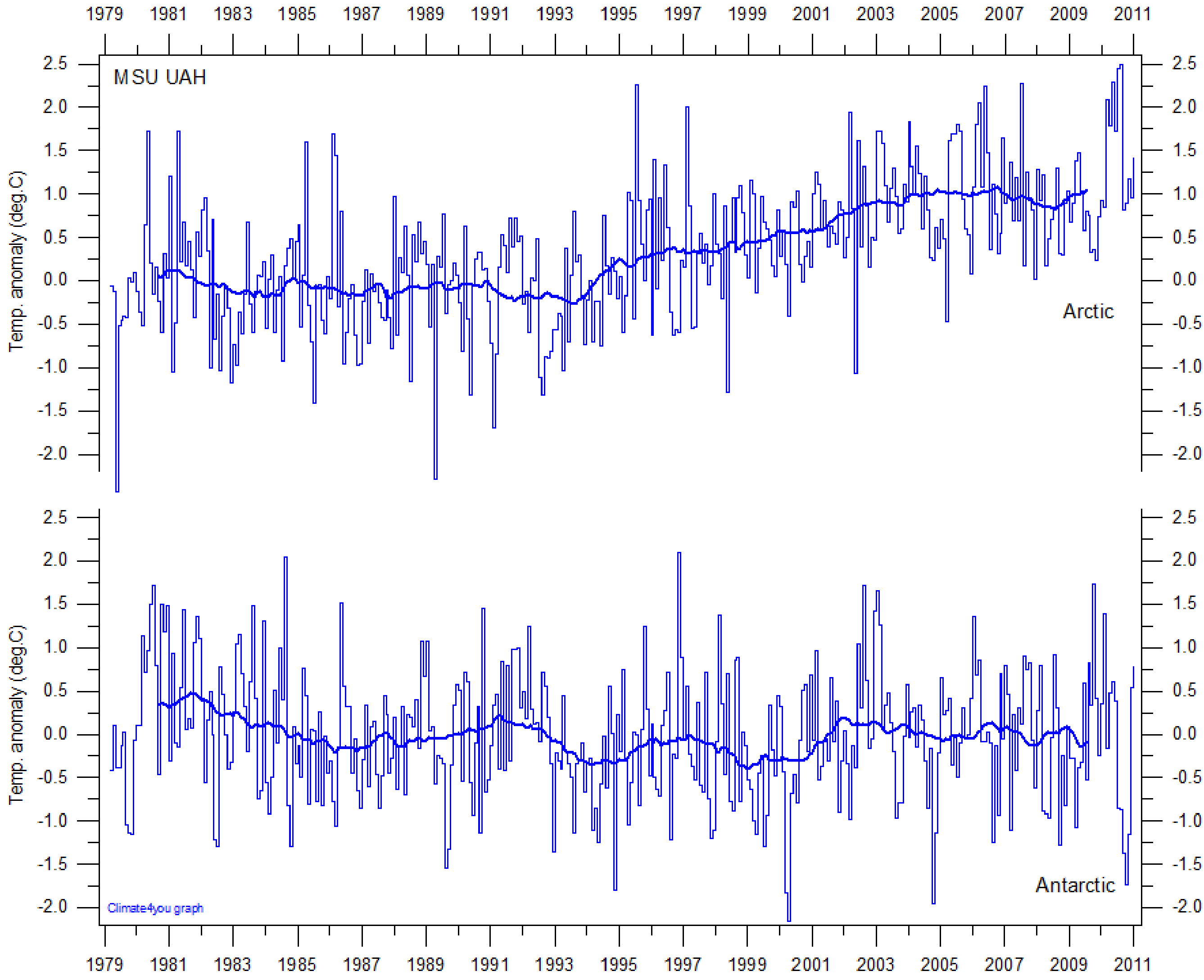


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).

[Arctic and Antarctic lower troposphere temperature, updated to October 2010](#)



Global monthly average lower troposphere temperature since 1979 for the North Pole and South Pole regions, based on satellite observations ([University of Alabama](#) at Huntsville, USA). The thick line is the simple running 37 month average, nearly corresponding to a running 3 yr average.

[Arctic and Antarctic surface air temperature, updated to September 2010]

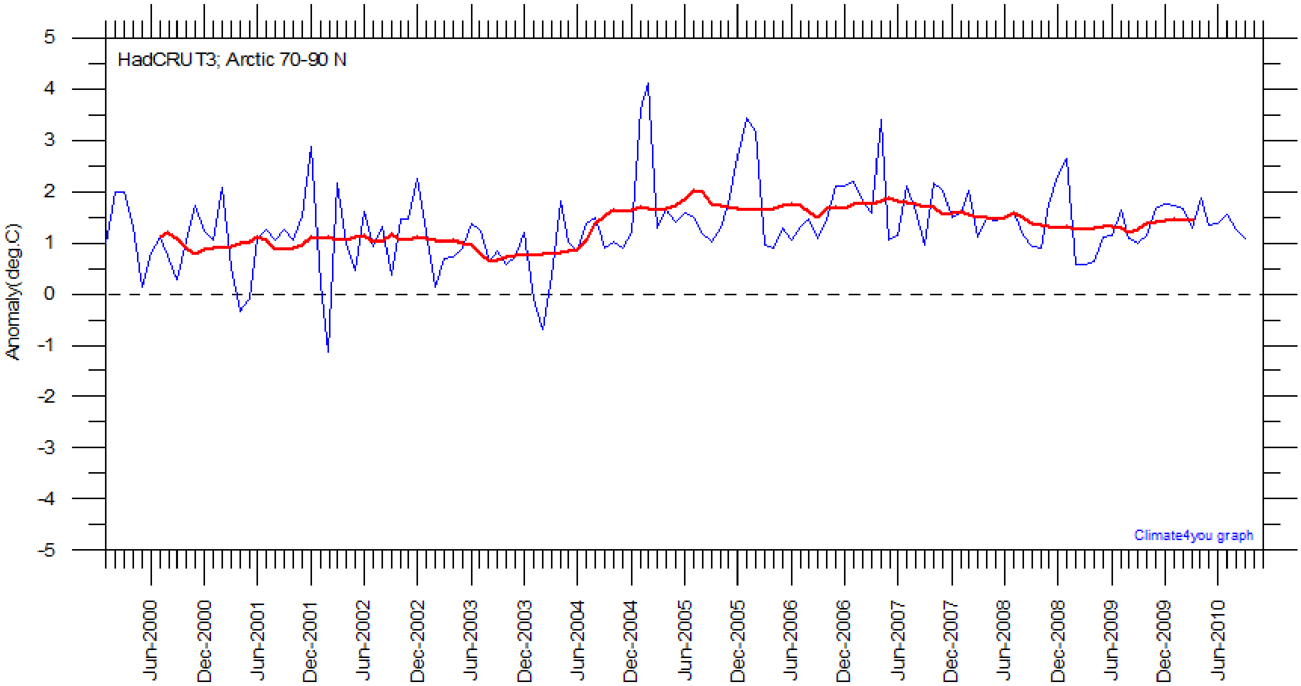


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre for Climate Prediction and Research and the University of East Anglia's [Climatic Research Unit] ([CRU]), UK.

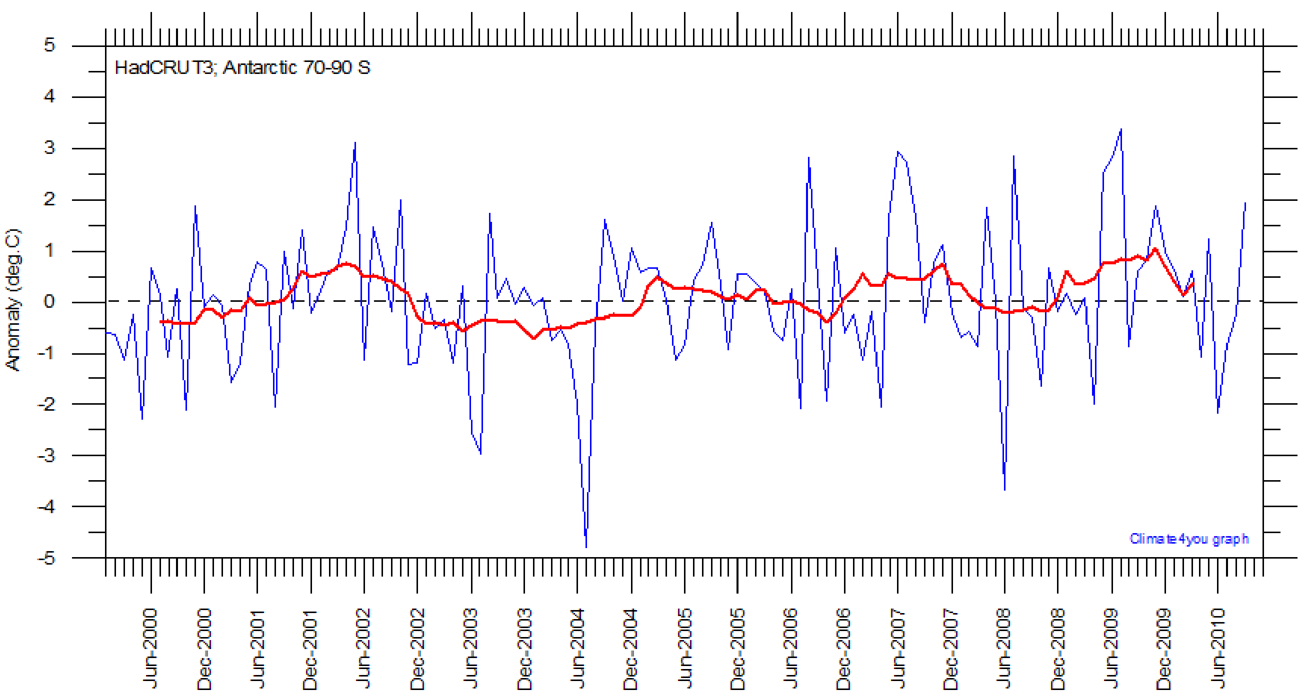


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre for Climate Prediction and Research and the University of East Anglia's [Climatic Research Unit] ([CRU]), UK.

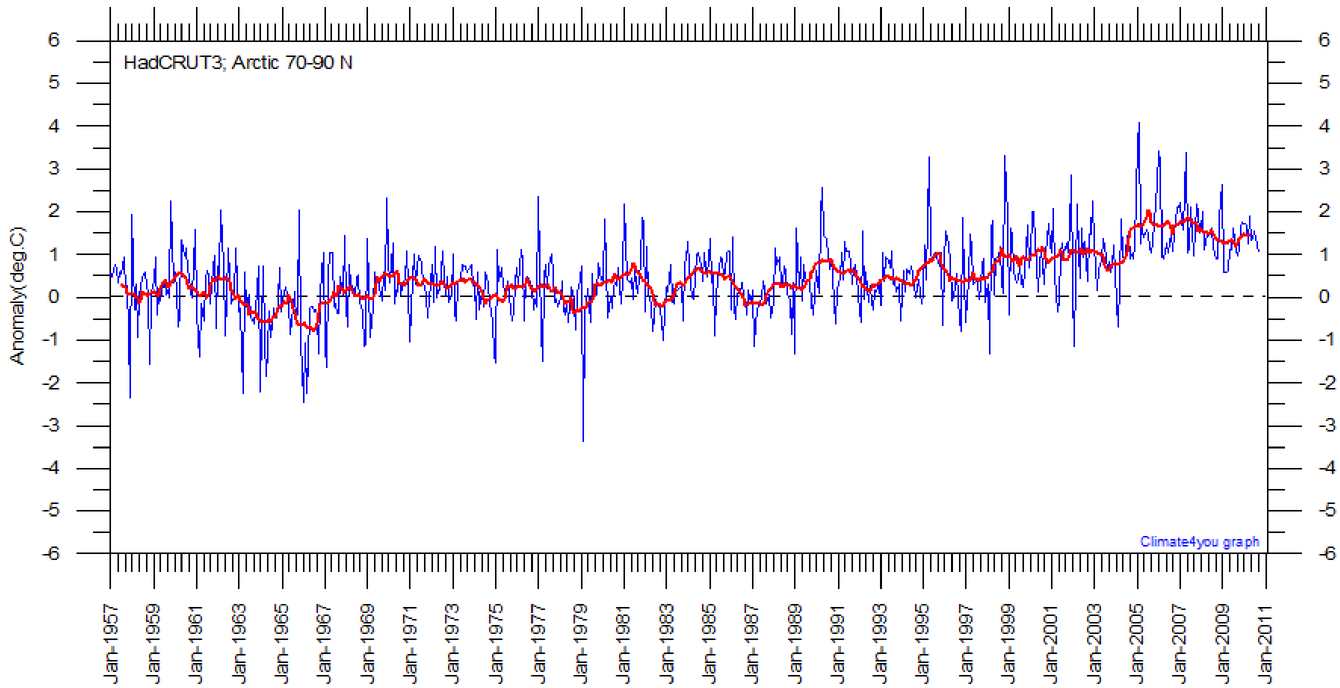


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown below. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre for Climate Prediction and Research and the University of East Anglia's [Climatic Research Unit] ([CRU]), UK.

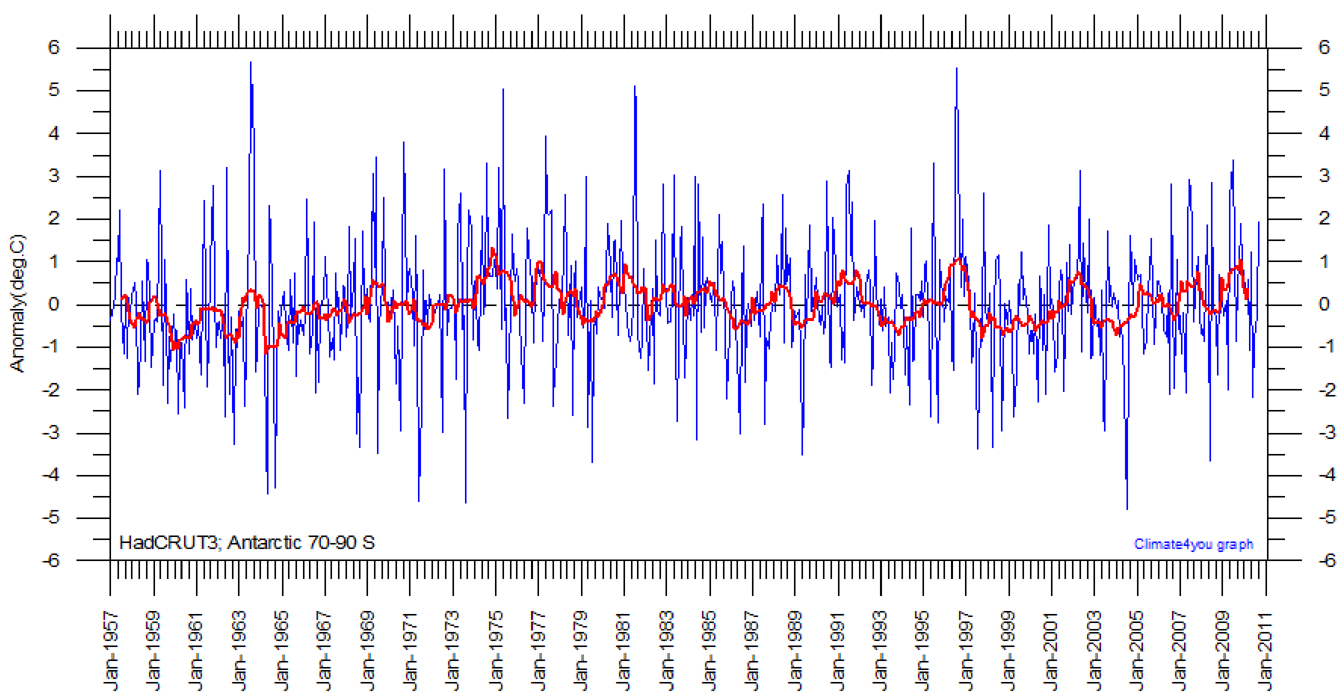


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before 1957, the meteorological coverage of the Antarctic continent is poor. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre for

Climate Prediction and Research and the University of East Anglia's [Climatic Research Unit](#) ([CRU](#)), UK.

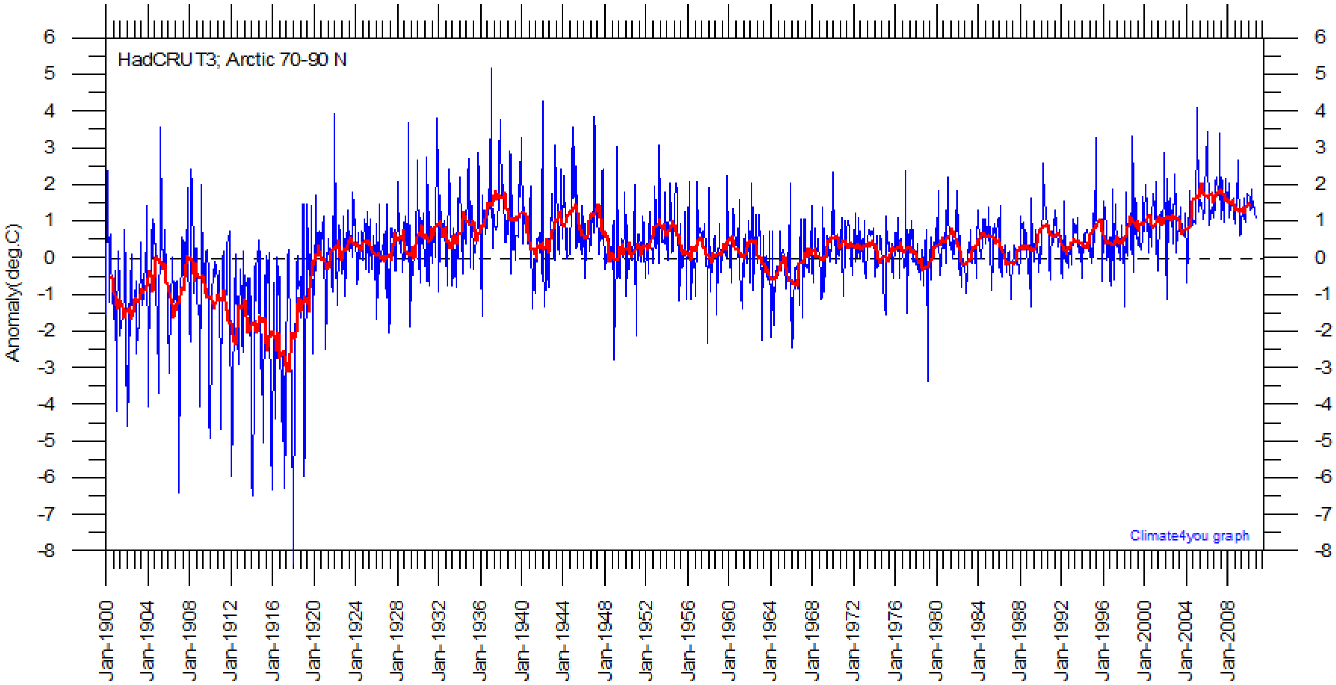


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly temperature variations decreases throughout the first 30-50 years of the record, reflecting the increasing number of meteorological stations north of 70°N over time. Especially the period from about 1930 saw the establishment of many new Arctic meteorological stations, first in Russia and Siberia, and following the 2nd World War, also in North America. Because of the relatively small number of stations before 1930, details in the early part of the Arctic temperature record should not be over interpreted. The rapid Arctic warming around 1920 is, however, clearly visible, and is also documented by other sources of information. The period since 2000 is warm, about as warm as the period 1930-1940. Data provided by the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK

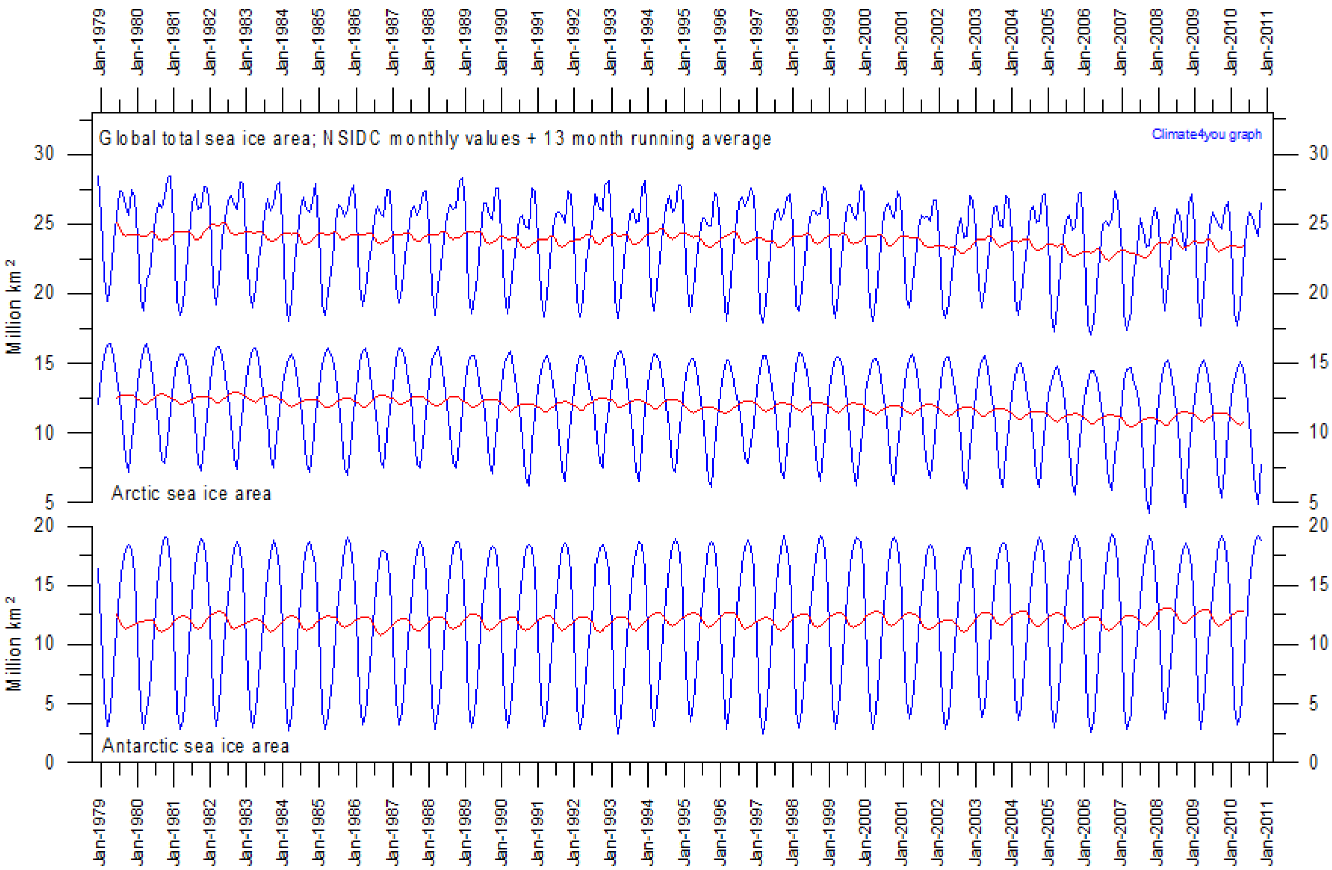
In general, the Arctic temperature record appears to be less variable than the contemporary Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

As data coverage is sparse in the Polar Regions, the procedure of Gillet et al. 2008 has been followed, giving equal weight to data in each 5°x5° grid cell when calculating means, with no weighting by the areas of the grid dells.

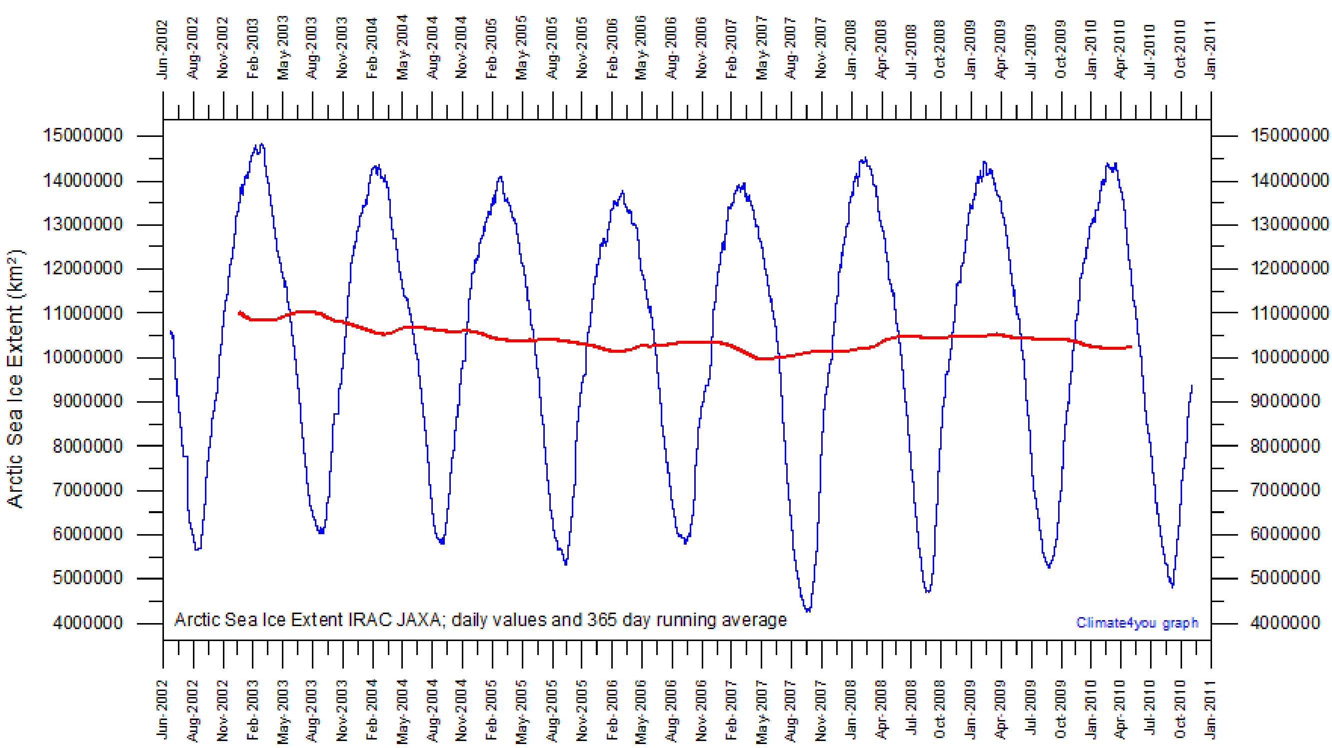
Literature:

Gillett, N.P., Stone, D.A., Stott, P.A., Nozawa, T., Karpechko, A.Y.U., Hegerl, G.C., Wehner, M.F. and Jones, P.D. 2008. Attribution of polar warming to human influence. *Nature Geoscience* 1, 750-754.

Arctic and Antarctic sea ice, updated to October 2010

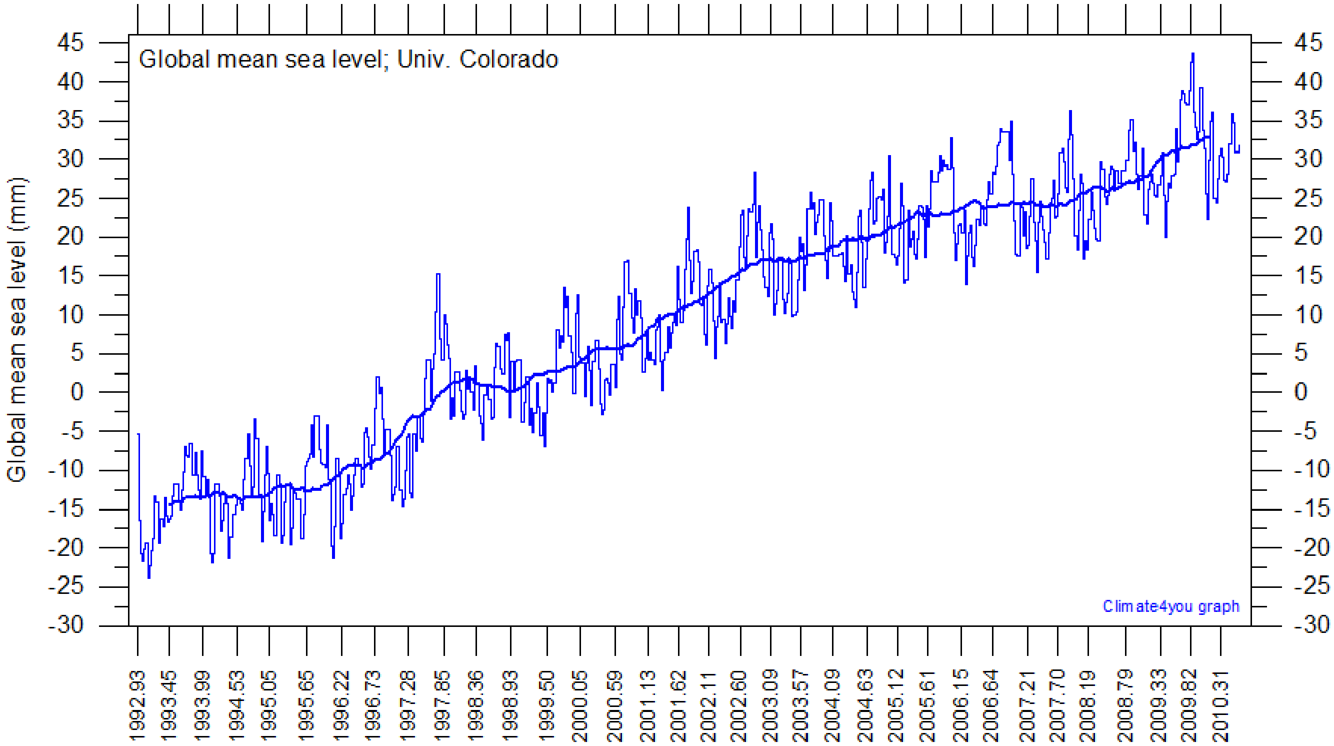


Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center](#) (NSIDC).

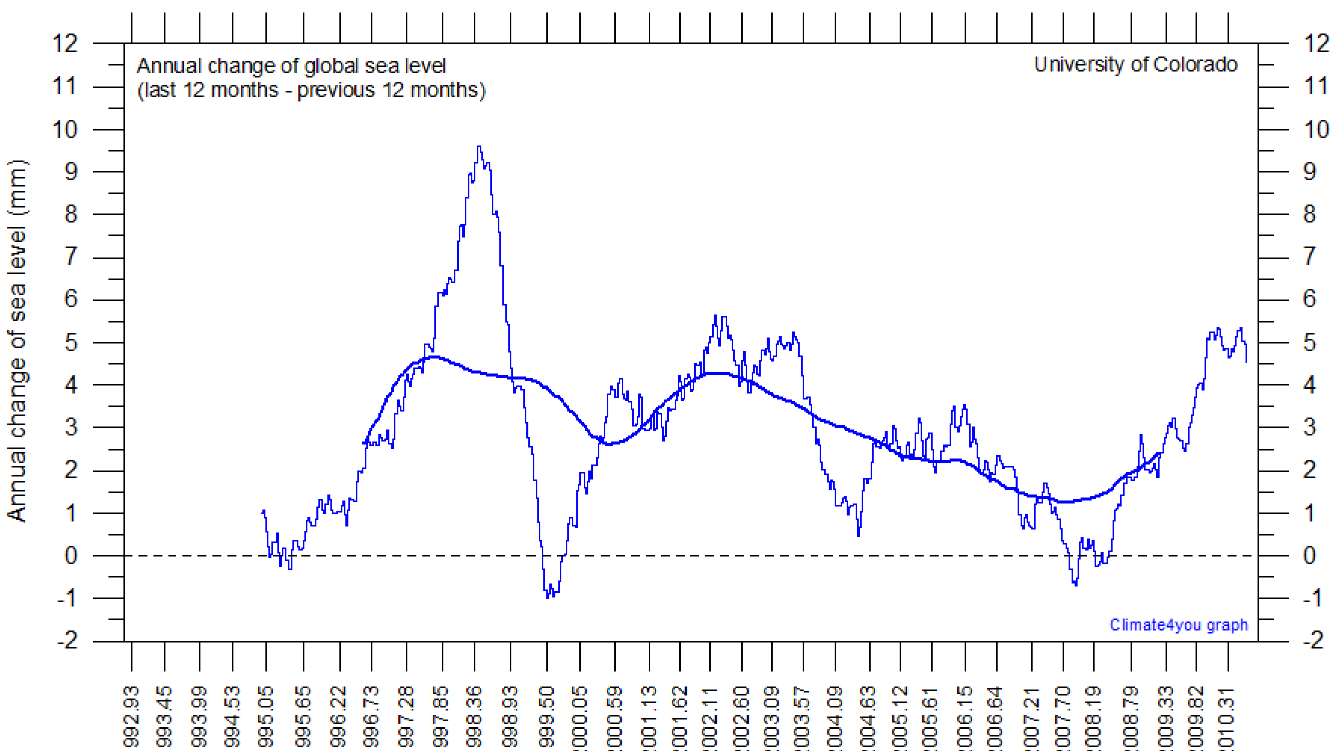


Graph showing daily Arctic sea ice extent since June 2002, to 18/11 2010, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).

Global sea level, updated to September 2010

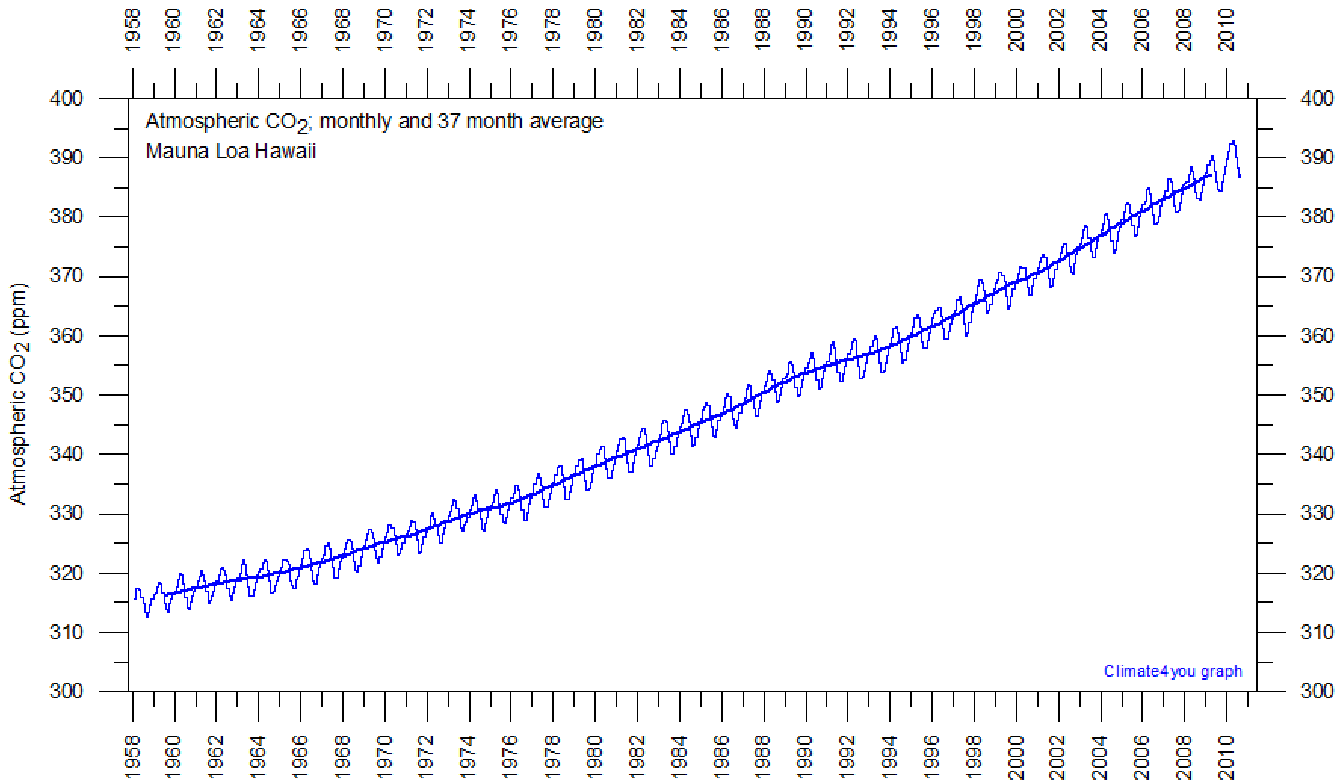


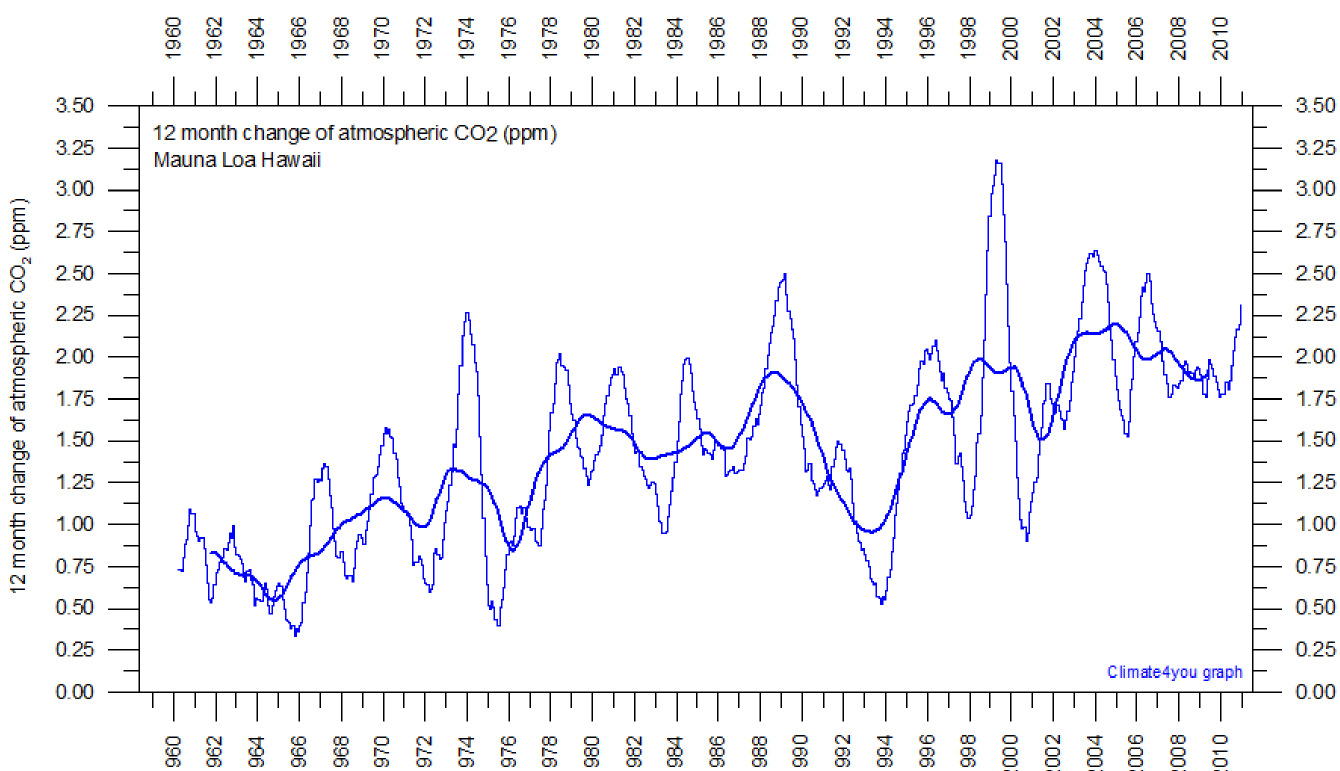
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



Annual change of global sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 3 yr average.

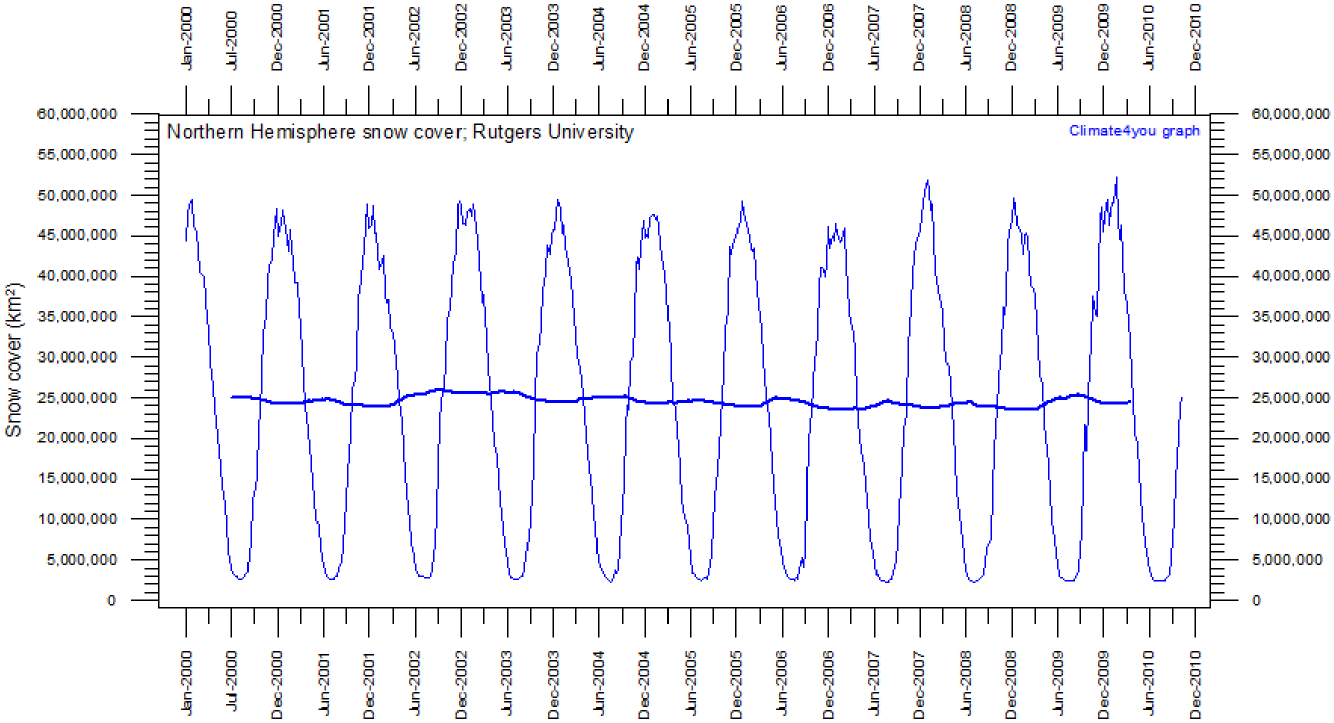
Atmospheric CO_2, updated to October 2010



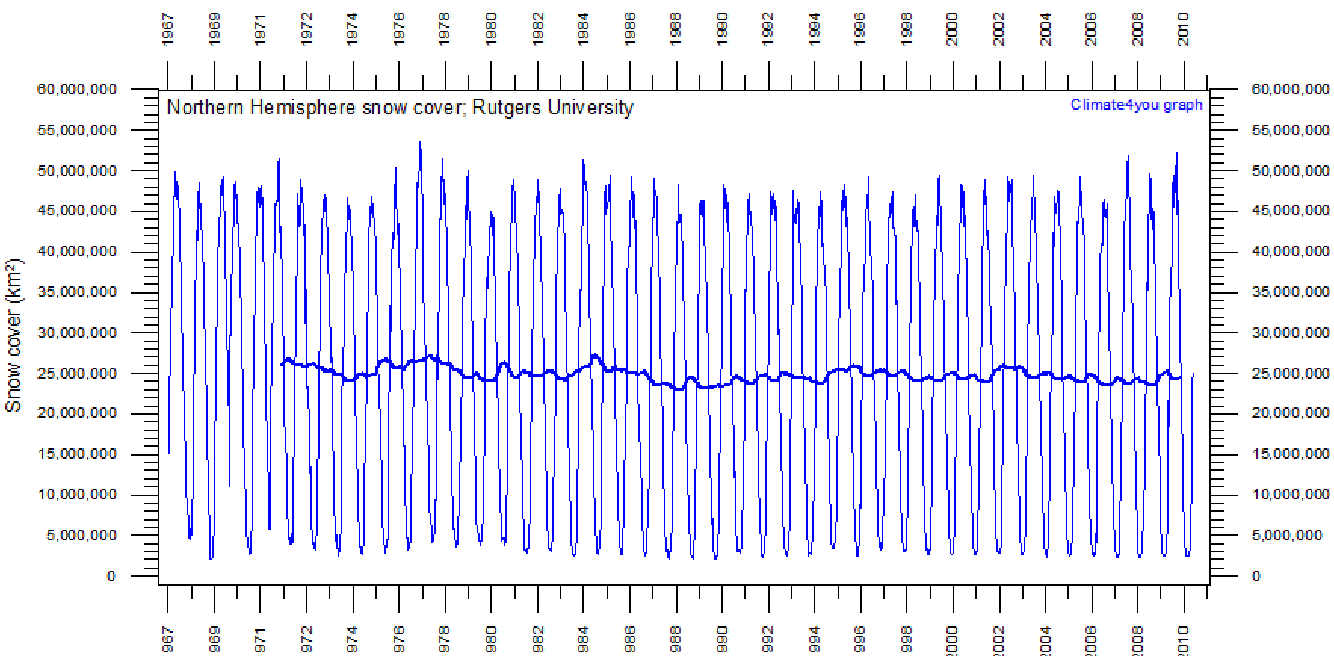


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the [Mauna Loa Observatory](), Hawaii, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.

Northern Hemisphere weekly snow cover, updated to end of October 2010

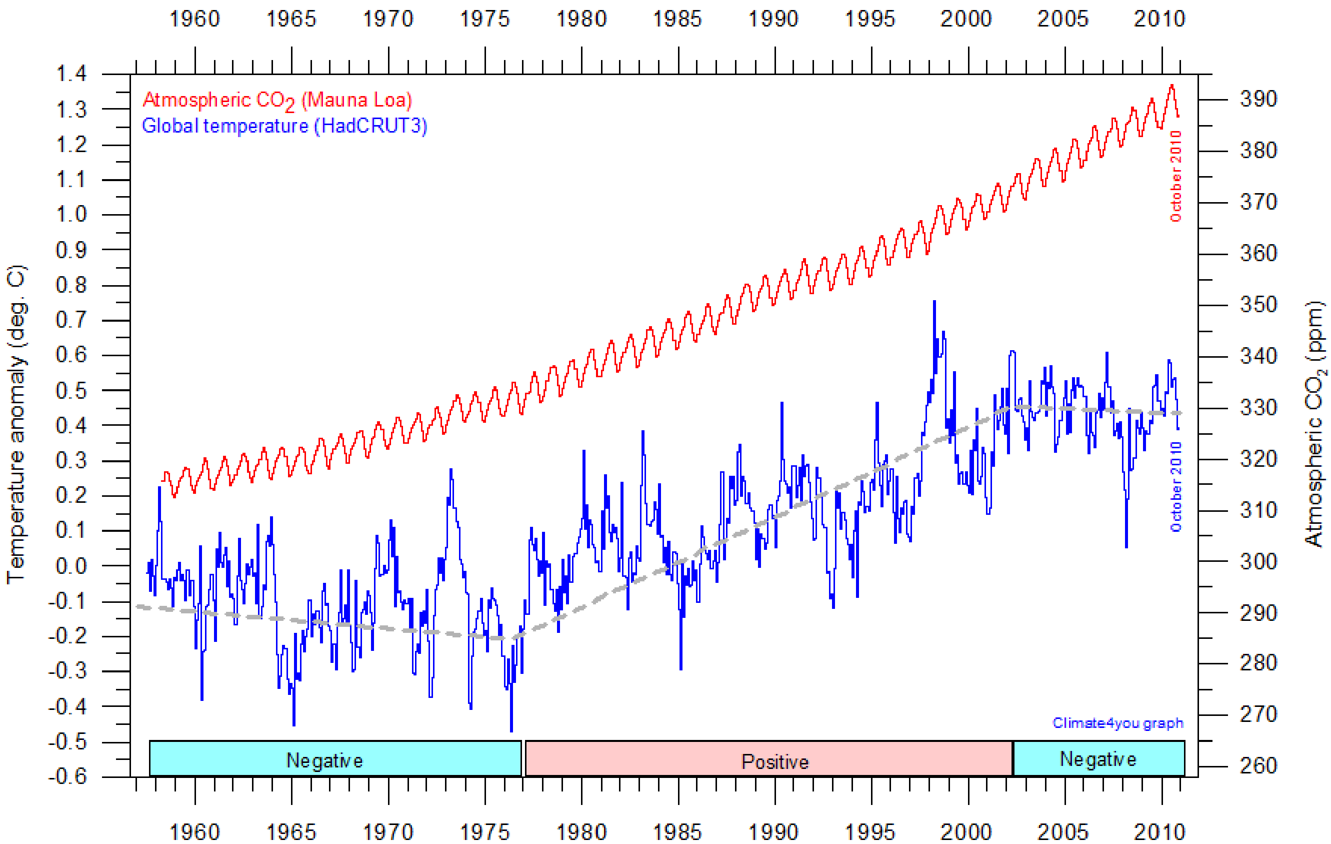


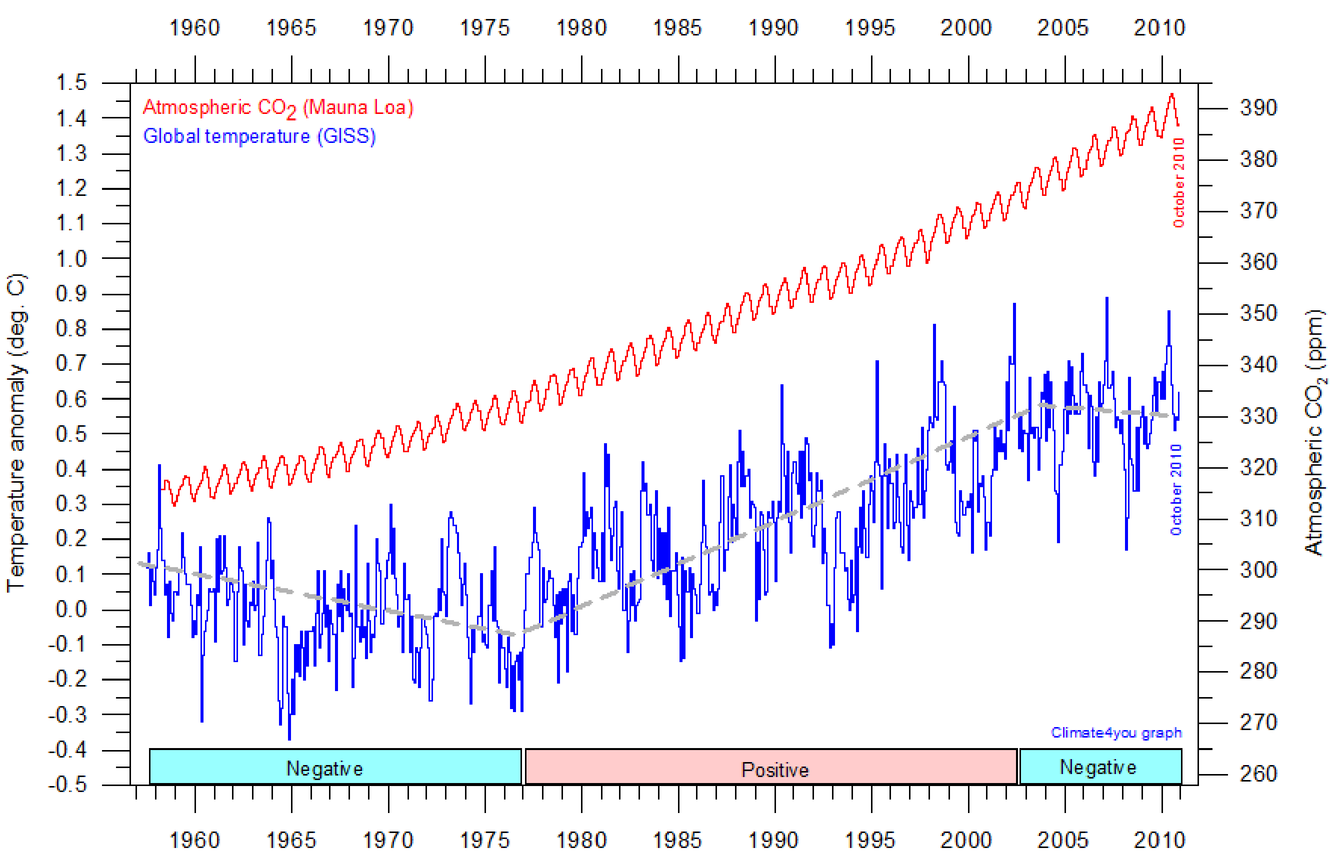
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year).

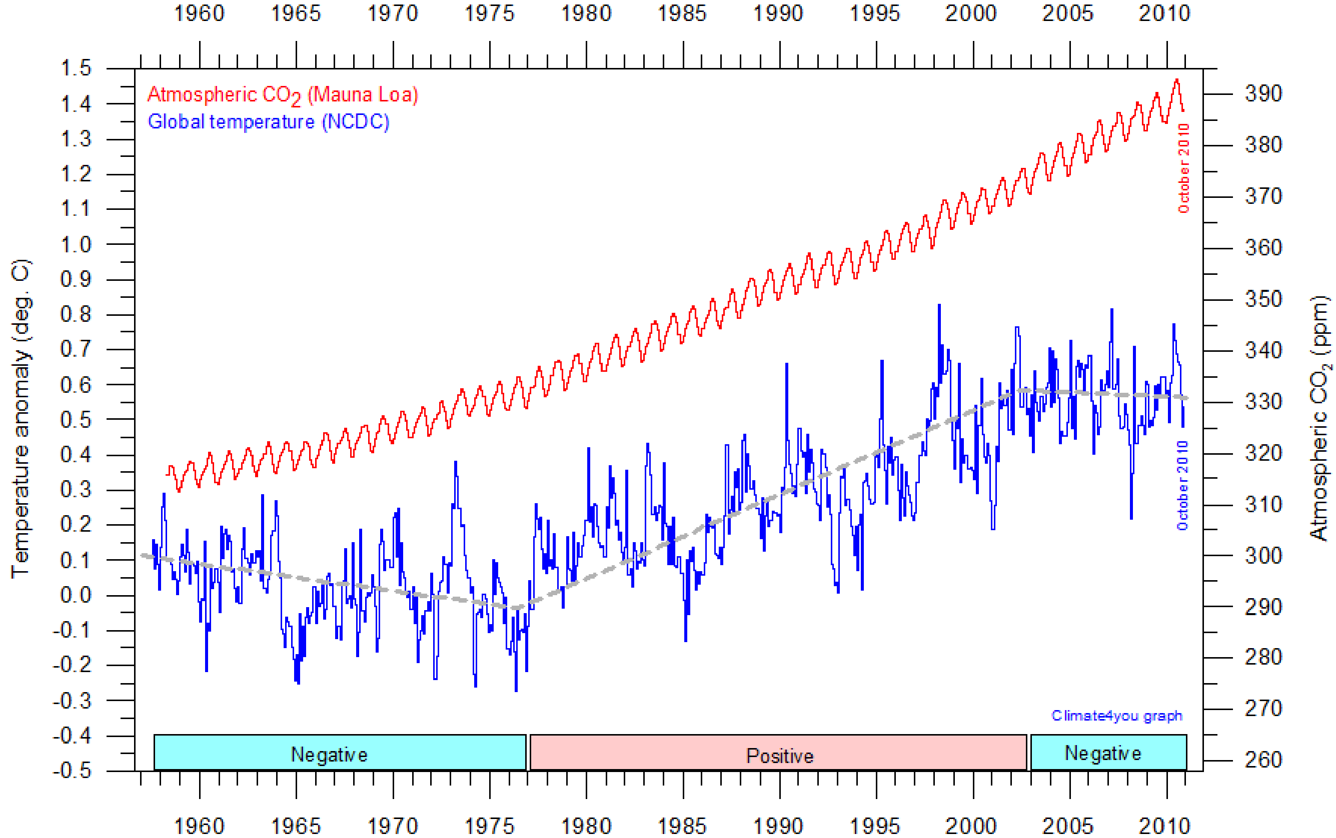


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of some data irregularities in this early period.

Global surface air temperature and atmospheric CO_2, updated to October 2010







Diagrams showing HadCRUT3, GISS, and NCDC monthly global surface air temperature estimates (blue) and the monthly atmospheric CO_2 content (red) according to the [Mauna Loa Observatory](), Hawaii. The Mauna Loa data series begins in March 1958, and 1958 has therefore been chosen as starting year for the diagrams. Reconstructions of past atmospheric CO_2 concentrations (before 1958) are not incorporated in this diagram, as such past CO_2 values are derived by other means (ice cores, stomata, or older measurements using different methodology, and therefore are not directly comparable with modern atmospheric measurements. The dotted grey line indicates the approximate linear temperature trend, and the boxes in the lower part of the diagram indicate the relation between atmospheric CO_2 and global surface air temperature, negative or positive.

Most climate models assume the greenhouse gas carbon dioxide CO_2 to influence significantly upon global temperature. Thus, it is relevant to compare the different global temperature records with measurements of atmospheric CO_2, as shown in the diagrams above. Any comparison, however, should not be made on a monthly or annual basis, but for a longer time period, as other effects (oceanographic, clouds, etc.) may well override the potential influence of CO_2 on short time scales such as just a few years.

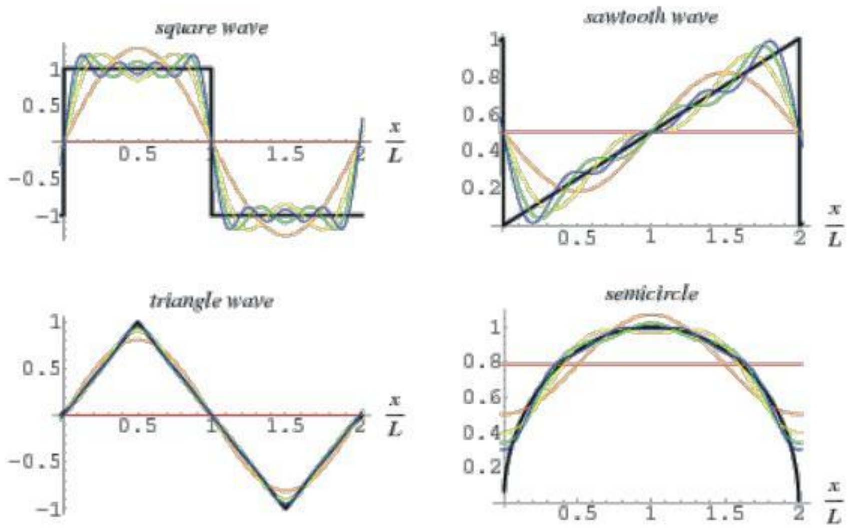
It is of cause equally inappropriate to present new meteorological record values, whether daily, monthly or annual, as support for the hypothesis ascribing high importance of atmospheric CO_2 for global temperatures. Any such short-period meteorological record value may well be the result of other phenomena than atmospheric CO_2.

What exactly defines the critical length of a relevant time period to consider for evaluating the alleged high importance of CO_2 remains elusive, and is still a topic for debate. The critical period length must, however, be inversely proportional to the importance of CO_2 on the global temperature, including feedback effects, such as assumed by most climate models. So if the effect of CO_2 is strong, the length of the critical period is short.

After about 10 years of global temperature increase following global cooling 1940-1978, IPCC was established in 1988. Presumably, several scientists interested in climate then felt intuitively that their empirical and theoretical understanding of climate dynamics was sufficient to conclude about the high importance of CO_2 for global temperature. However, for obtaining public and political support for the CO_2-hyphotesis the 10 year warming period leading up to 1988 in all likelihood was important. Had the global temperature instead been decreasing, public support for the hypothesis would have been difficult to obtain. Adopting this approach as to critical time length, the varying relation (positive or negative) between global temperature and atmospheric CO_2 has been indicated in the lower panels of the three diagrams above.

[Climate and history; one example among many]

1824: Joseph Fourier suggests an explanation of global temperature



Joseph Fourier (left), and an example of his now widely used mathematical technique in which complex functions can be represented by a series of sines and cosines (right).

Jean Baptiste Joseph Fourier (1768-1830) is best known today for his Fourier series, a widely used mathematical technique in which complex functions can be represented by a series of sines and cosines. The study of Fourier series can be considered a branch of Fourier analysis. Although being a great mathematician, most of Fourier's contemporaries knew him as an administrator, Egyptologist, and scientist. His fortunes rose and fell with the political tides. He was a mathematics teacher, friend of Napoleon, a secret policeman, governor of Egypt, prefect of Isère and Rhône, a political prisoner, baron, outcast, and perpetual member and secretary of the French Academy of Sciences (Fleming 1998).

Fourier had a keen interest in heat and heat conduction, and presumably considered himself the Newton of heat: "*The principle of heat penetrates, like gravity, all objects and all of space, and it is subject to simple and constant laws*" (Fleming 1998). The question of terrestrial temperature was on Fourier's mind as early as 1807, when he wrote on the unequal heating of the globe. He later conducted a series of experiments on daytime heating by the Sun, and on nighttime cooling.

In 1824 Joseph Fourier read a paper to the *Académie Royale des Science*, which was published the same year in the *Annales de Chimie et de Physique*. The 1924 paper relied heavily on previous publications by Fourier in 1807, 1817 and 1822. In 1837 his famous 1824 paper was translated into English and published in the *American Journal of Science* (Fleming 1998). In his discussion of the temperature of space, Fourier pointed out that the thickness of the atmosphere and the nature of the surface determine the average temperature of a planet. Fourier did not use the term "greenhouse" in his 1824 publication, but he described the temperature of the Earth as being controlled by three distinct sources: (1) solar radiation, which was considered unequally distributed over the year and which produces the diversity of climates; (2) the temperature communicated by the interplanetary space irradiated by the light from innumerable stars; and (3) heat from the interior of Earth, assumed to be remaining from its formation (Fleming 1998).

In section (2) on the temperature of space and its assumed effects on the surface temperature of Earth Fourier presented most of his comments on the heating of the atmosphere. He points out that both the thickness of the atmosphere and the nature of the planet surface controls the average surface temperature. It is here that Fourier comments on what today might be considered as an early version of the greenhouse theory by stating: "*The temperature [of the Earth] can be augmented by the interposition of the atmosphere, because heat in the state of light finds less resistance in penetrating the air, than in repassing into the air when converted into non-luminous heat*" (Fleming 1998). Fourier is here making reference to experiments done on a series of glass plates enclosing a vacuum, and glass plates separated by atmospheric air, observing that the latter experimental setup retained solar heat more efficiently, but also that all experiments were sensitive to the distances between the glass surfaces.

Fourier's experiment was related to a glass enclosure, and he was interested in the idea that such an air filled glass enclosure could trap and store 'dark light' (infrared), making it a kind of radiant battery. By this, Joseph Fourier early recognized the importance of the planetary atmosphere for the average surface air temperature, although the glass enclosure model is far from a realistic analogue for the planet's atmosphere. There also little doubt that he considered the temperature of space being more important than the atmospheric effect as a control on the average surface temperature of planet Earth.

Fleming, J.R. 1998. *Historical Perspectives on Climate Change*. Oxford University Press, 194 pp.

All the above diagrams with supplementary information, including links to data sources, are available on www.climate4you.com

Yours sincerely, Ole Humlum (Ole.Humlum@geo.uio.no)

19 November 2010.