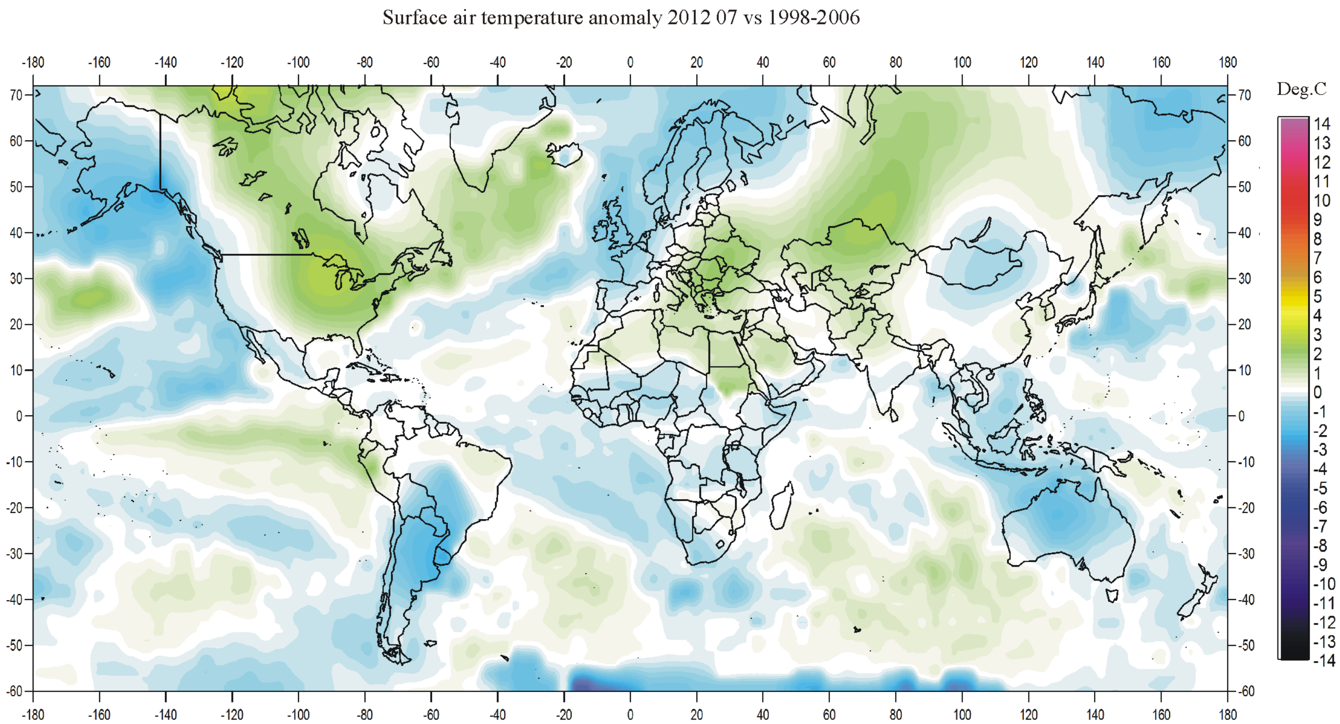
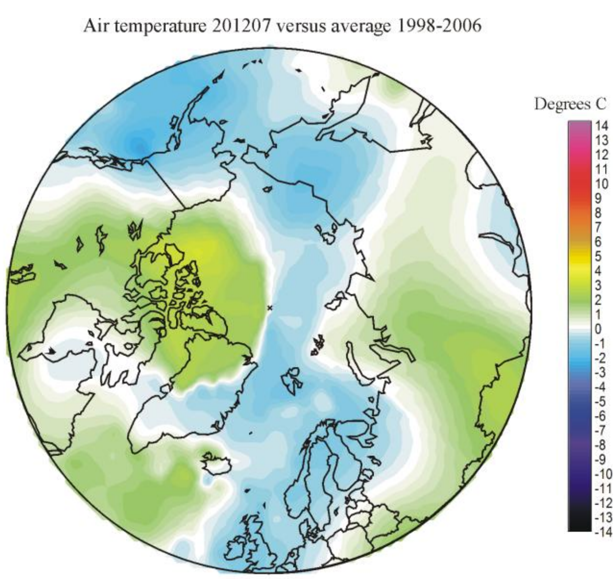
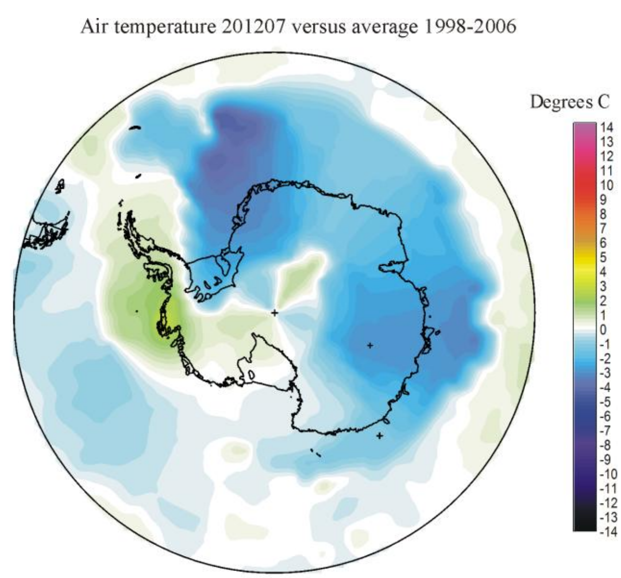
Climate4you update July 2012

www.climate4you.com

July 2012 global surface air temperature overview







July 2012 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 July 2012 global surface air temperature overview

General: This newsletter contains graphs showing a selection of key meteorological variables for the past month. *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 and where modern surface air temperatures are increasing or decreasing at the moment. 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 simple moving 37-month average, nearly corresponding to a three year average. The 37-month average is calculated from values covering a range from 18 month before to 18 months after, with equal weight for every month.

The year 1979 has been chosen as starting point in many diagrams, as this roughly corresponds to both the beginning of satellite observations and the onset of the late 20th century warming period. However, several of the records have a much longer record length, which may be inspected in grater detail on www.Climate4you.com.

July 2012 average global surface air temperatures

General: Global air temperatures were close to average for the period 1998-2006, and slightly lower than the previous month.

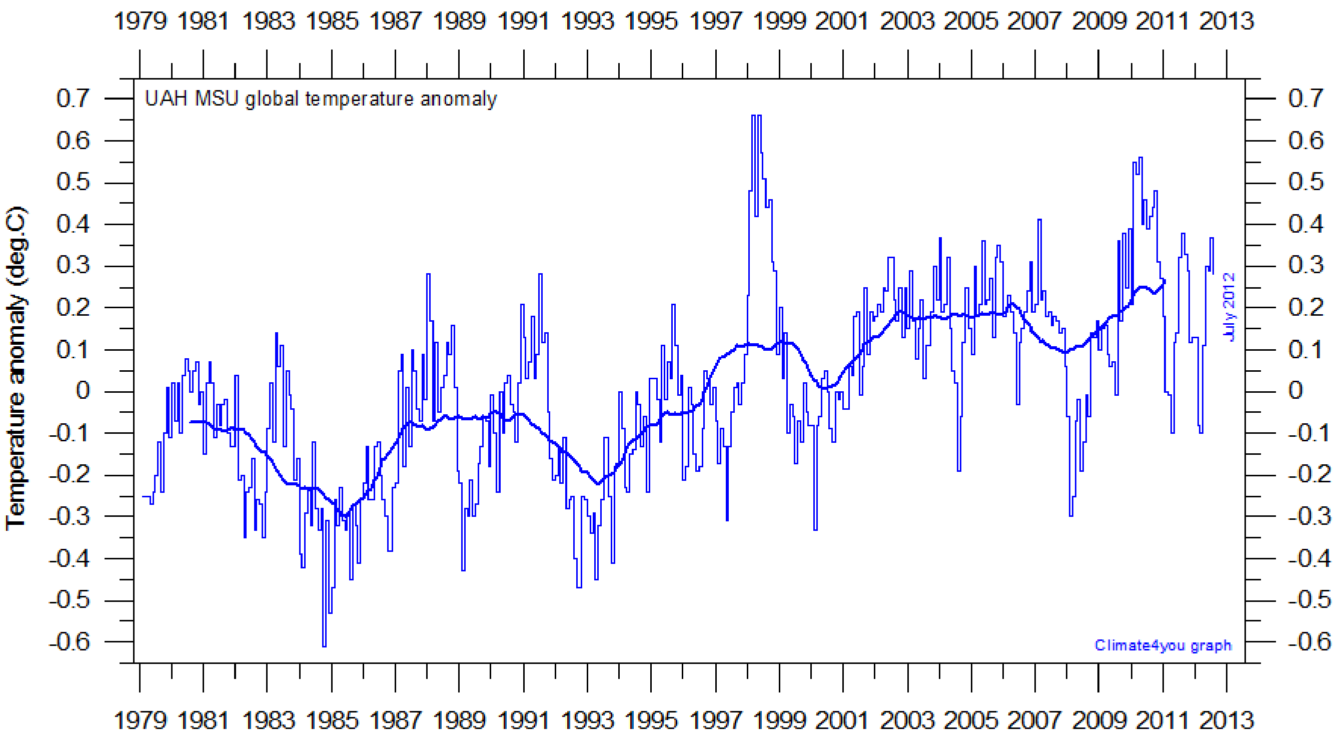
The Northern Hemisphere was characterised by relatively high regional variability, as usual. Northern and western Europe was relatively cold, as was eastern Siberia and Alaska. In contrast, western Siberia and NE North America experienced relatively warm conditions. The Arctic had a region of relatively low temperatures spanning from the European sector to Alaska and eastern Siberia, while regions in western Siberia and northern Canada experienced relatively high temperatures. NW Greenland was warm, while most of E Greenland was cold. In general, however, the distribution of temperatures in the Arctic to a high degree reflect the sparse number of observations in the central part of the Arctic, and the GISS procedure of extrapolating temperatures measured at lower latitudes to high latitudes.

Near Equator temperatures conditions in general were at or below average 1998-2006 temperature conditions, both for land and ocean. The only clear exception was represented by the region west of South America, where an El Niño situation is developing.

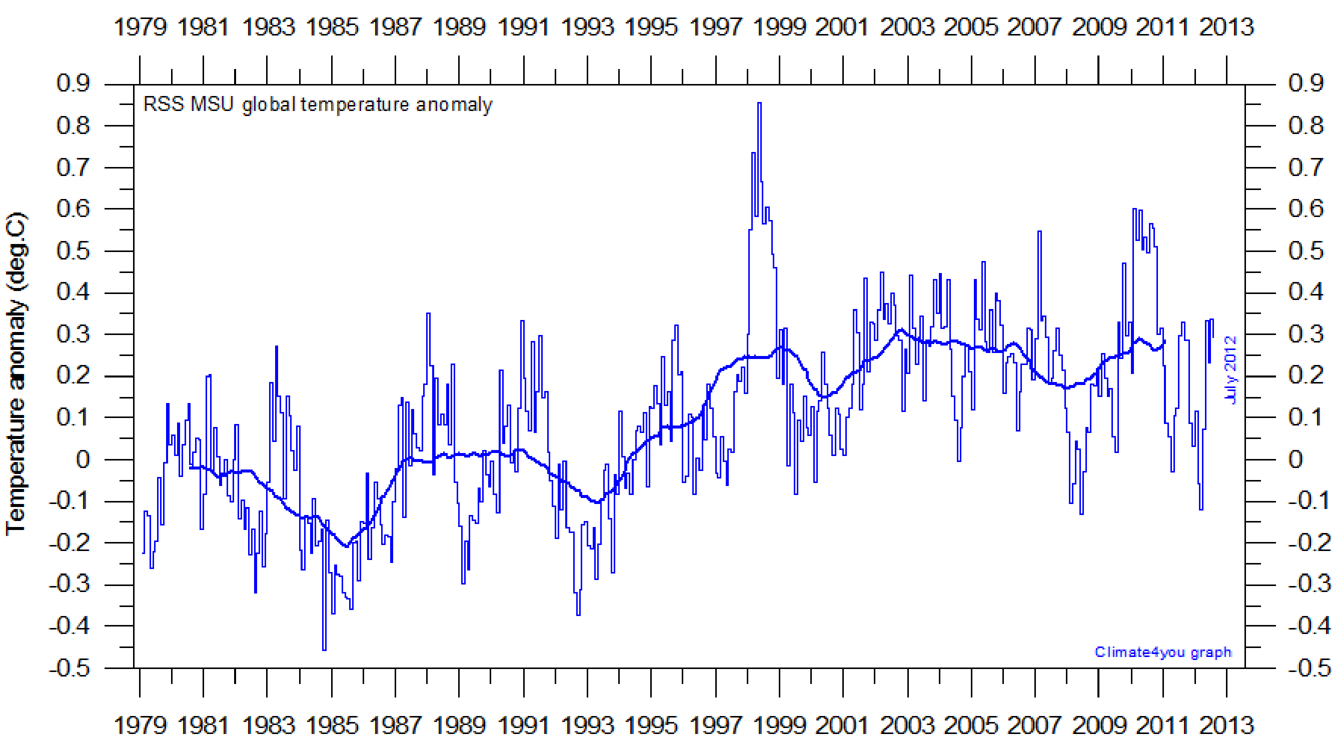
The Southern Hemisphere was at or below average 1998-2006 conditions. No extensive land areas experienced temperatures above the 1998-2006 average. Most of South America, Africa and Australia had below average temperatures. Most of the oceans in the Southern Hemisphere were near or below average temperature. The Antarctic continent generally experienced below average 1998-2006 temperatures. The only warm region was the peninsula and parts of West Antarctica. Once again, a temperature contrast is seen between the two Polar regions.

The global oceanic heat content has been more or less stable since 2003/2004 (page 10).

Lower troposphere temperature from satellites, updated to July 2012

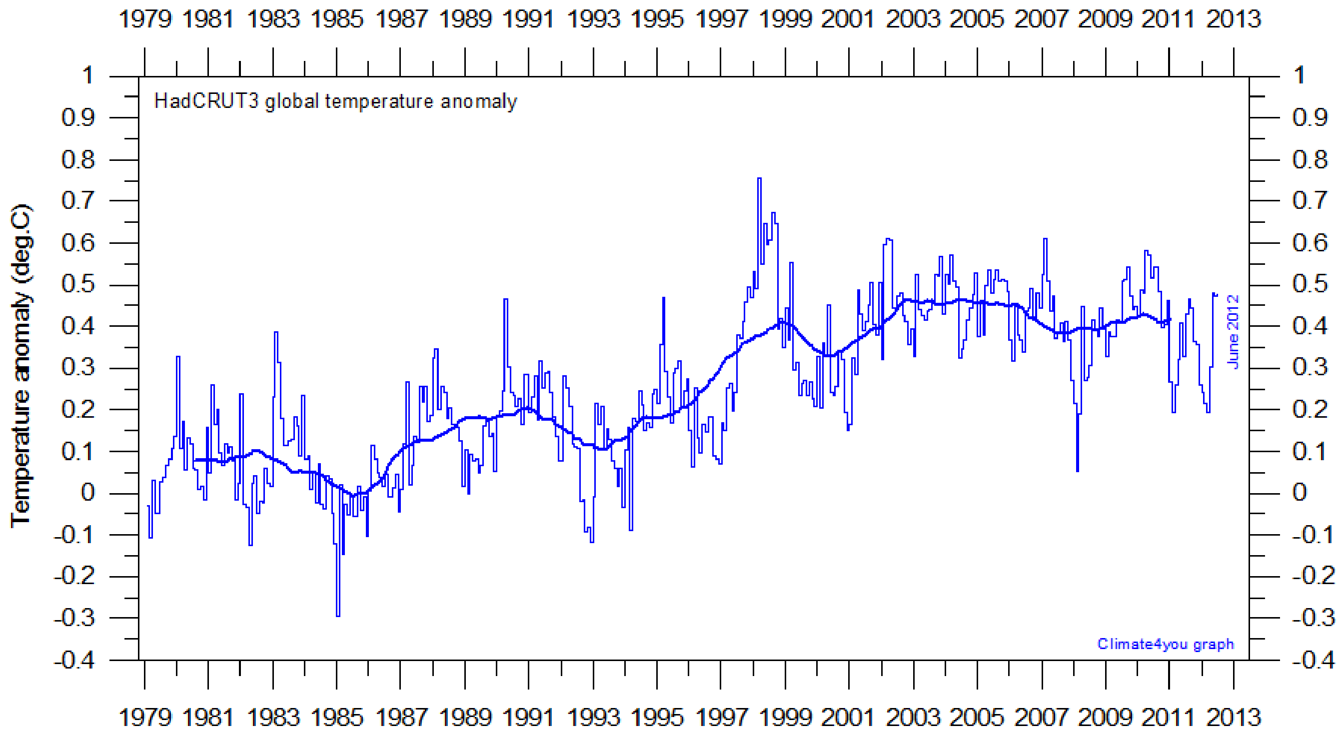


Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama] at Huntsville, USA. The thick line is the simple running 37 month average.

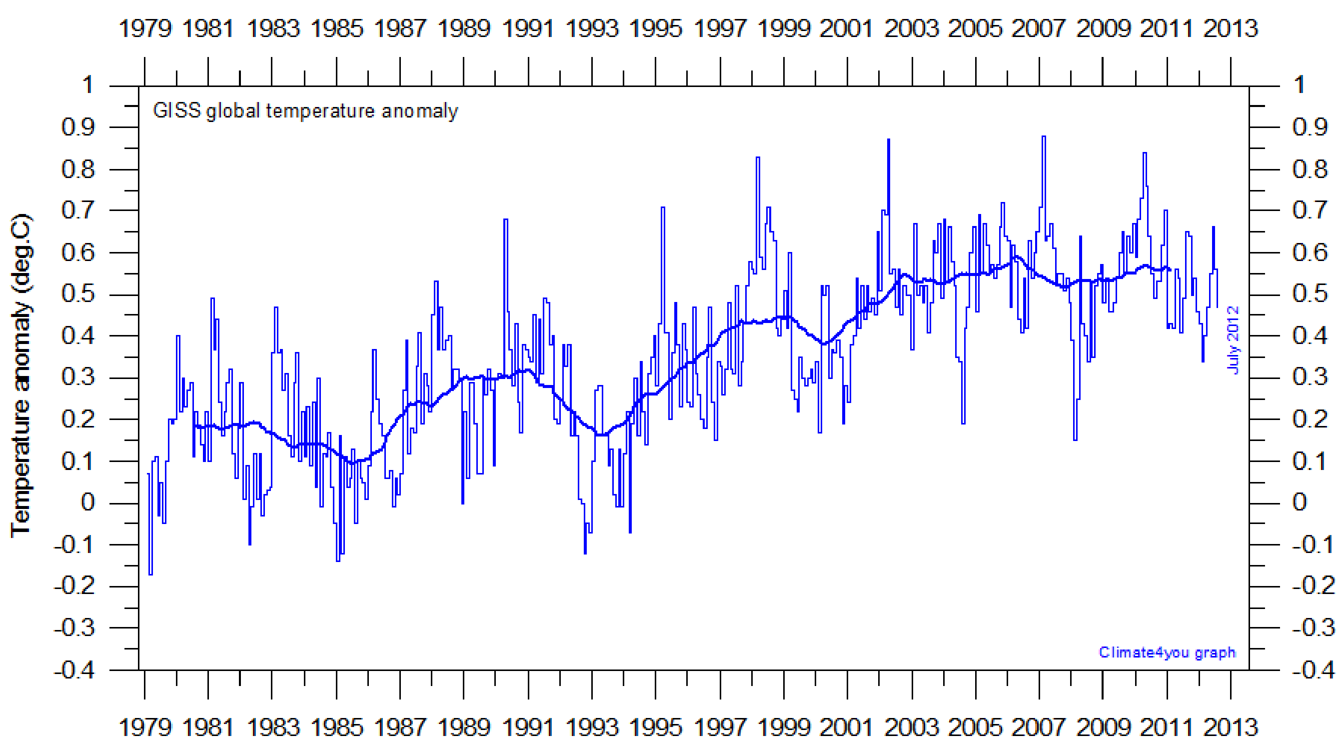


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems] (RSS), USA. The thick line is the simple running 37 month average.

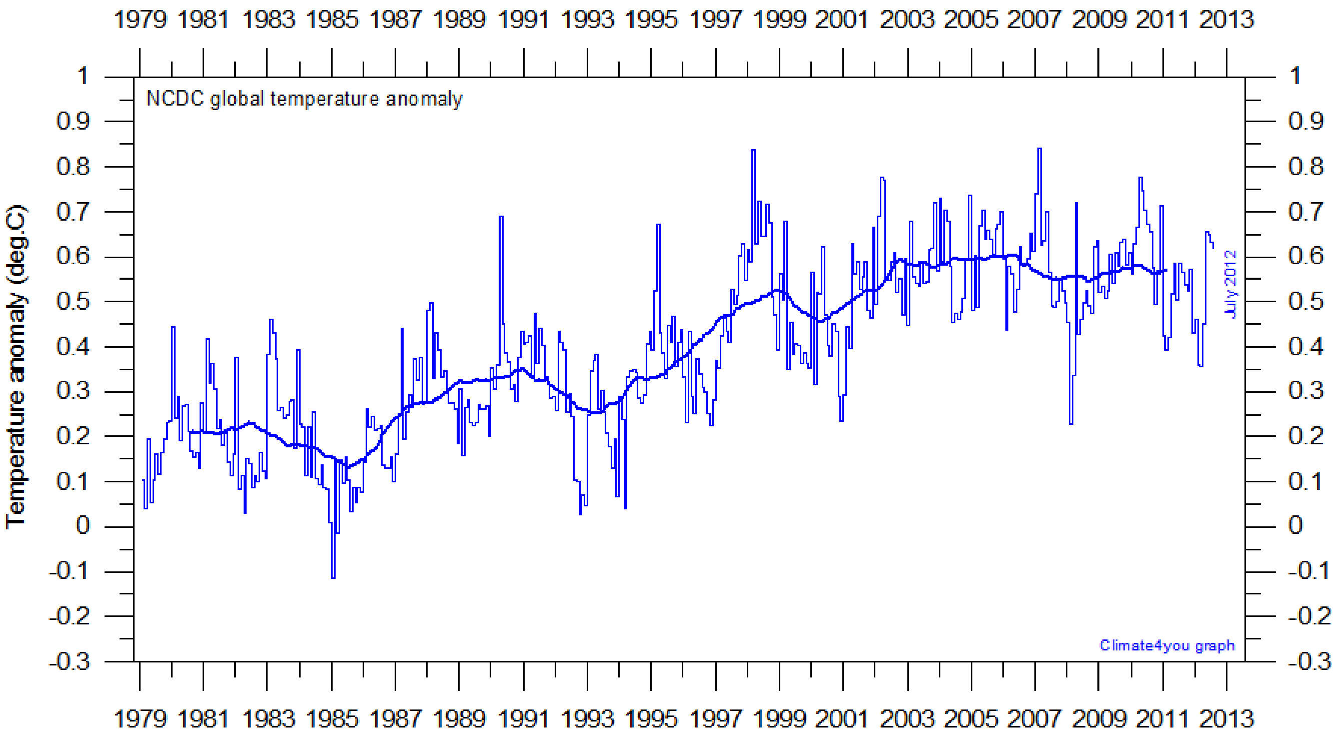
Global surface air temperature, updated to July 2012



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. Please note that this diagram has not been updated beyond June 2012.



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.

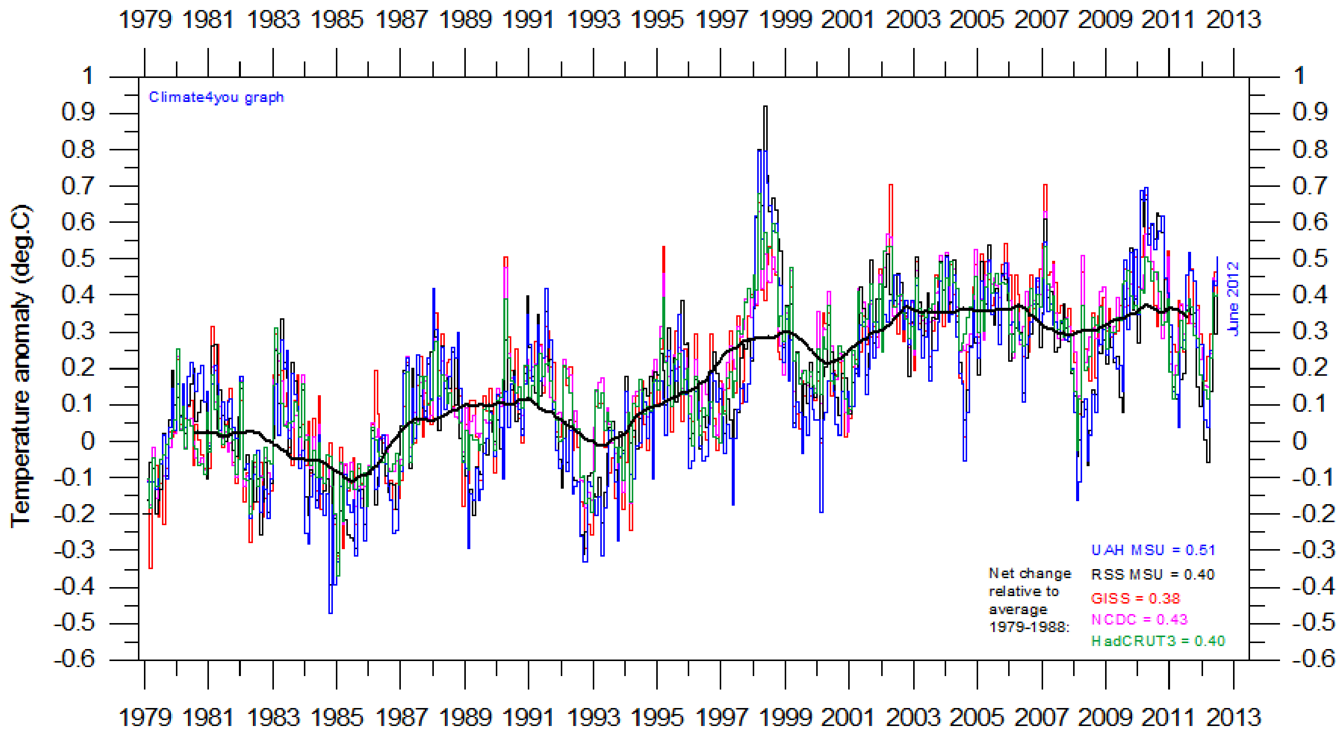
A note on data record stability:

All the above temperature estimates display changes when one compare with previous monthly data sets, not only for the most recent months as a result of supplementary data being added, but actually for all months back to the very beginning of the records. Presumably this reflects recognition of errors, changes in the averaging procedure, and the influence of other phenomena.

Of the five global records shown above the most stable temperature record seen over time (since 2008) is by far the HadCRUT3 series.

You can find more on the issue of temporal stability (or lack of this) on www.climate4you (go to: *Global Temperature*, followed by *Temporal Stability*).

All in one, updated to June 2012

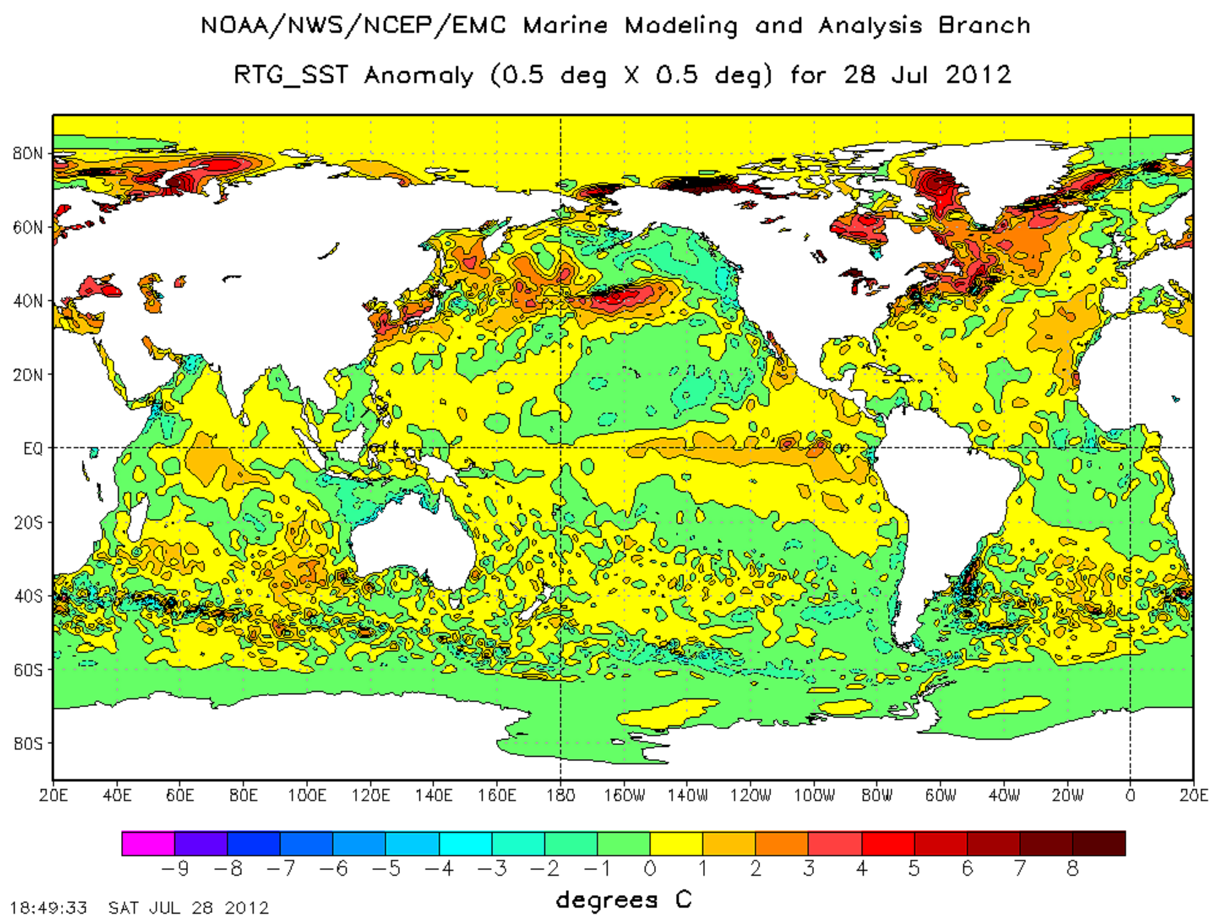


Superimposed plot of all five global monthly temperature estimates. As the base period differs for the individual temperature estimates, they have all been normalised by comparing with the average value of the initial 120 months (10 years) from January 1979 to December 1988. The heavy black line represents the simple running 37 month (c. 3 year) mean of the average of all five temperature records. The numbers shown in the lower right corner represent the temperature anomaly relative to the individual 1979-1988 averages.

It should be kept in mind that satellite- and surface-based temperature estimates are derived from different types of measurements, and that comparing them directly as done in the diagram above therefore in principle may be problematical. However, as both types of estimate often are discussed together, the above diagram may nevertheless be of some interest. In fact, the different types of temperature estimates appear to agree quite well as to the overall temperature variations on a 2-3 year scale, although on a shorter time scale there are often considerable differences between the individual records.

All five global temperature estimates presently show an overall stagnation, at least since 2002. There has been no increase in global air temperature since 1998, which however was affected by the oceanographic El Niño event. This stagnation does not exclude the possibility that global temperatures will begin to increase again later. On the other hand, it also remain a possibility that Earth just now is passing a temperature peak, and that global temperatures will begin to decrease within the coming years. Time will show which of these two possibilities is correct.

Global sea surface temperature, updated to late July 2012

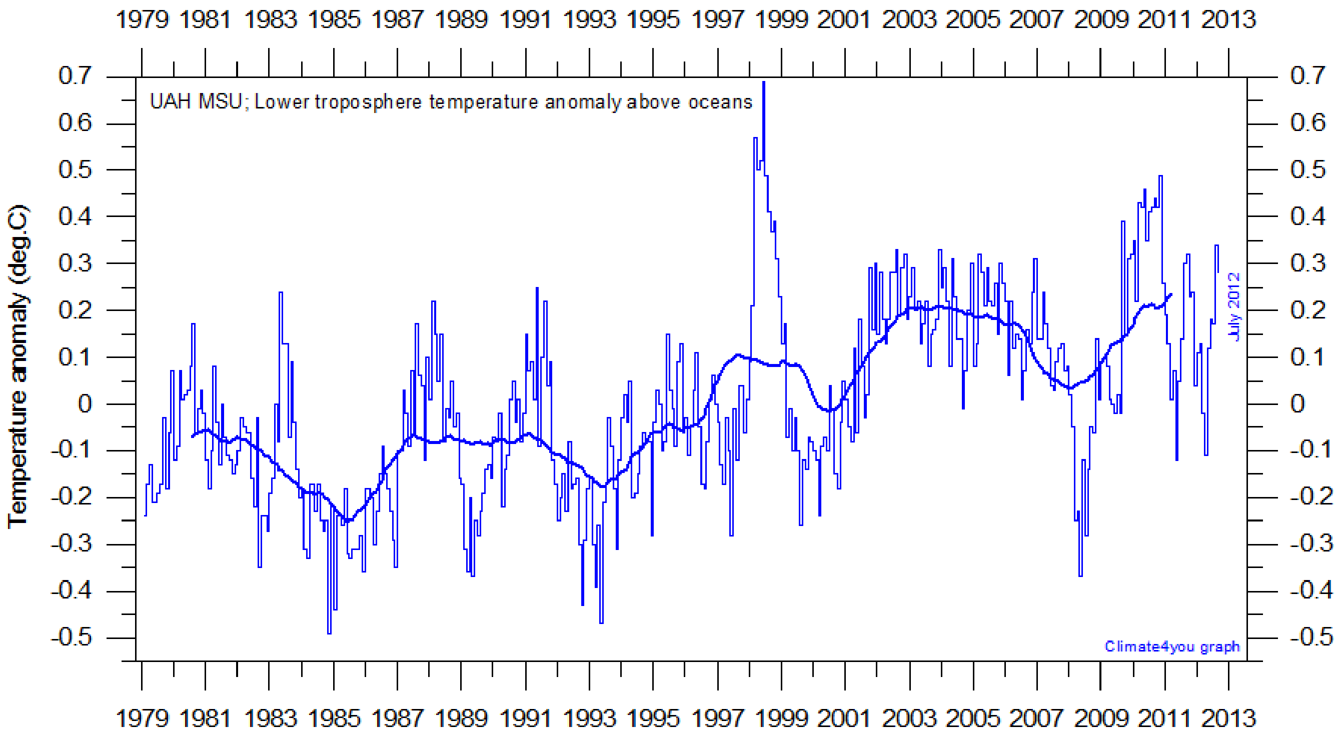


Sea surface temperature anomaly at 28 July 2012. Map source: National Centers for Environmental Prediction (NOAA).

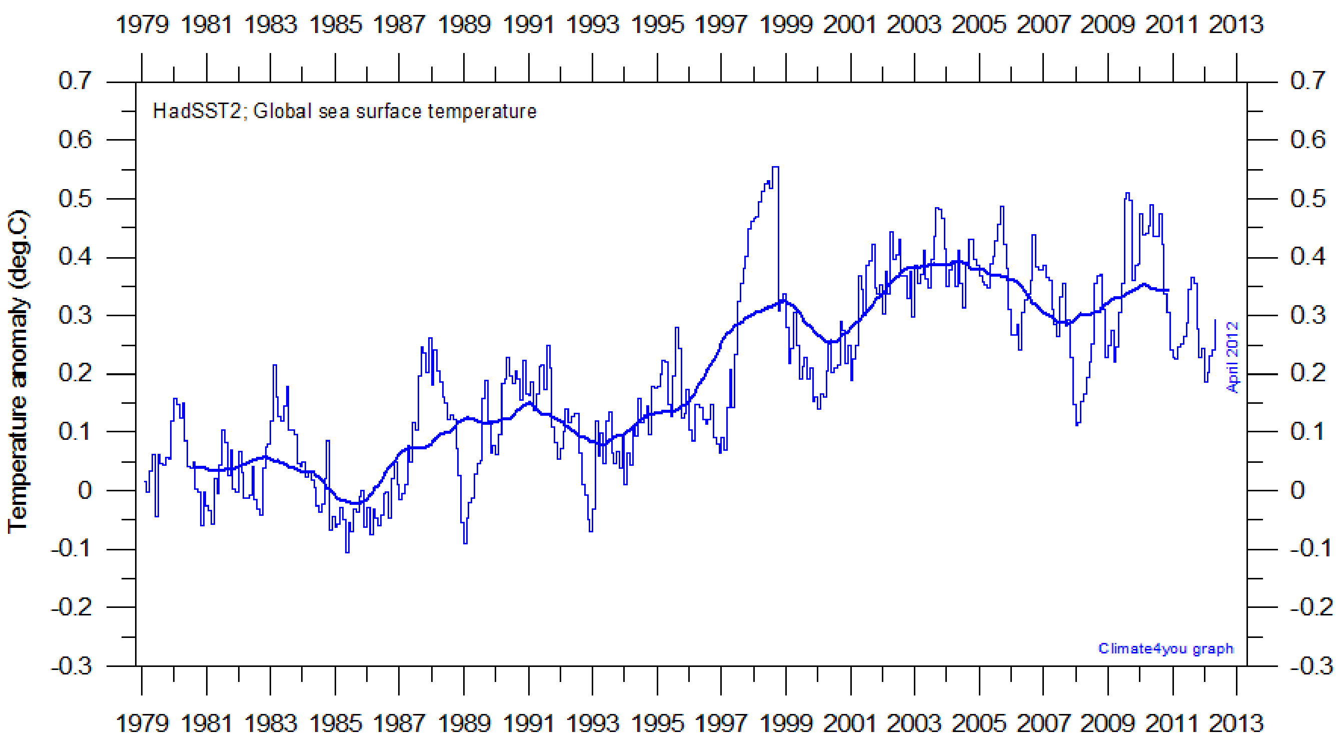
Relative warm sea surface water now dominates the ocean regions near Equator, especially in the Indian Ocean and in the Pacific. Because of the large surface areas involved especially near Equator, the temperature of the surface water in these regions significantly affects the global atmospheric temperature.

An El Niño episode is developing along the west coast of South America, and the effect of this is seen in the global air temperature estimates (p.3-5).

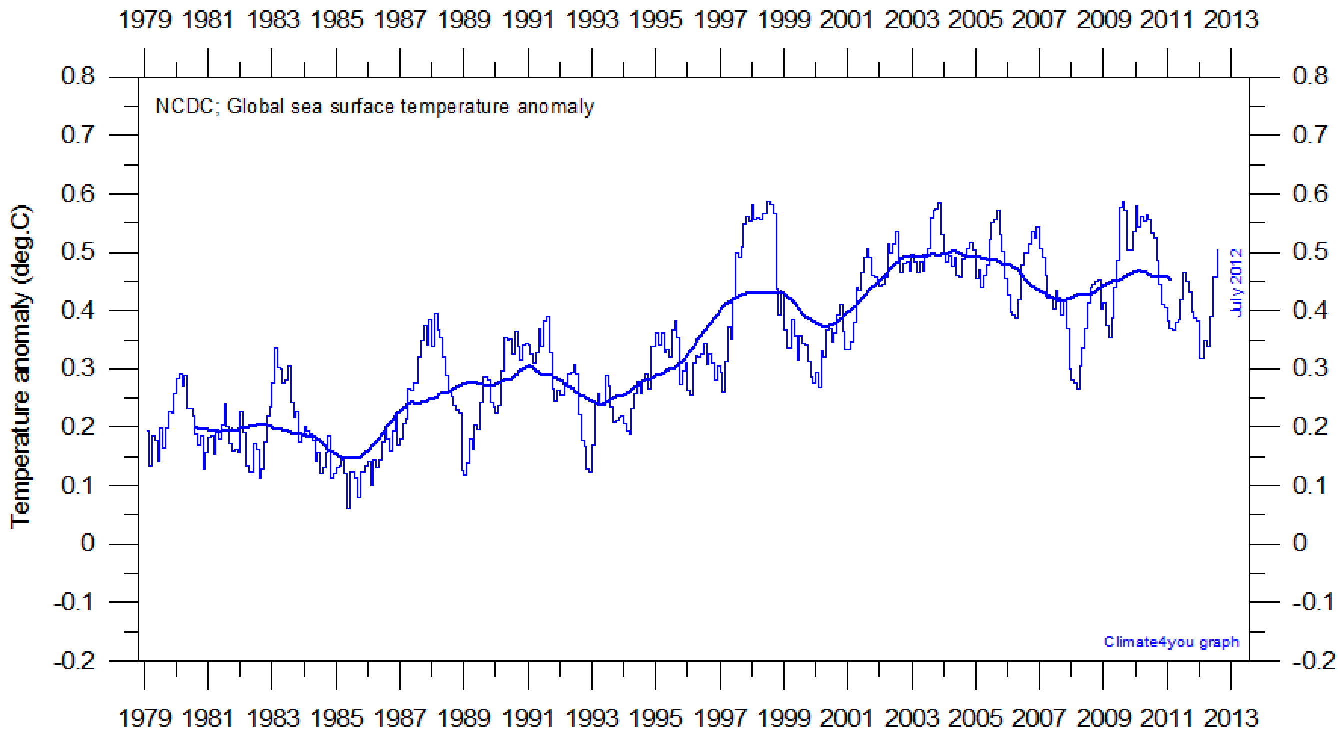
The significance of any such short-term warming or cooling seen in air temperatures should not be over stated. Whenever Earth experiences cold La Niña or warm El Niño episodes (Pacific Ocean) major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in estimates of the global air temperature. However, this does not reflect similar changes in the total heat content of the atmosphere-ocean system. In fact, net changes may be small, as heat exchanges as the above mainly reflect redistribution of energy between ocean and atmosphere. What matters is the overall temperature development when seen over a number of years.



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.

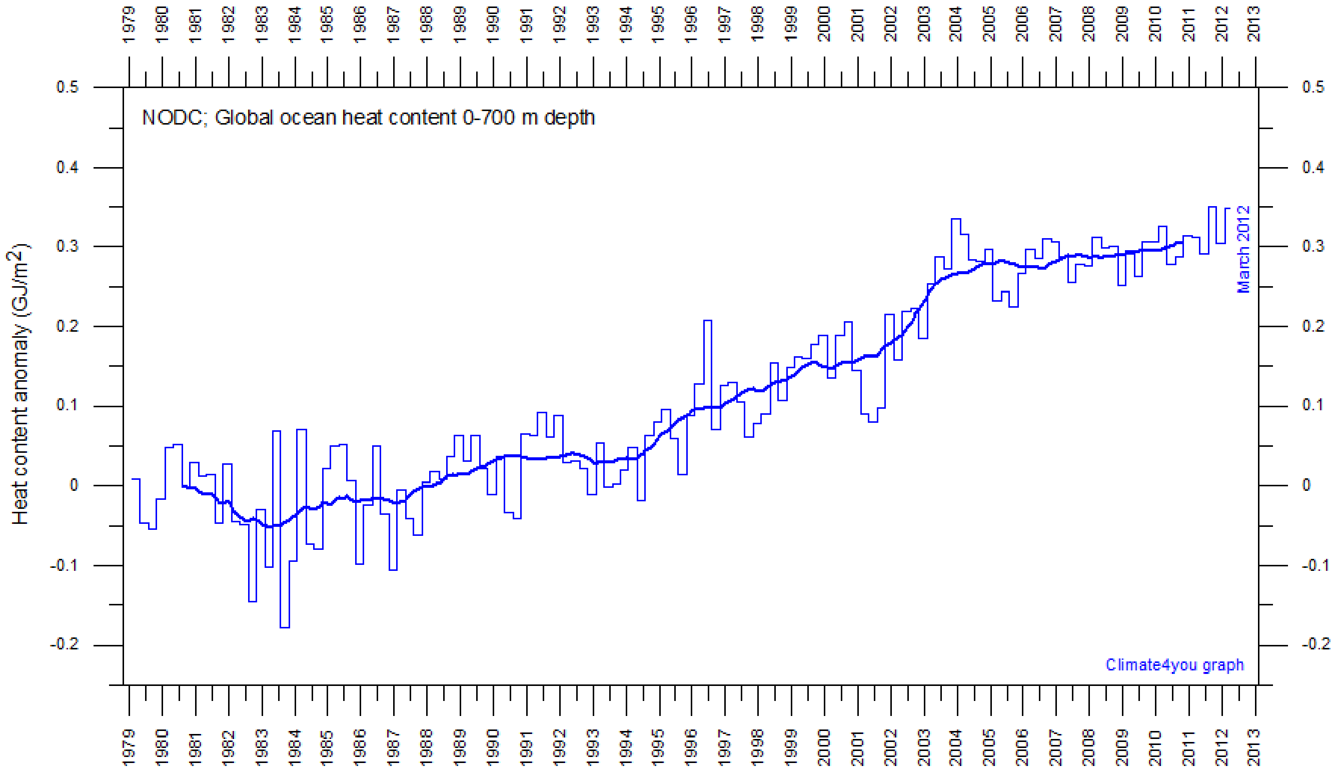


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit](#) ([CRU](#)), UK. Base period: 1961-1990. The thick line is the simple running 37 month average. Please note that no update beyond April 2012 is available at the moment.

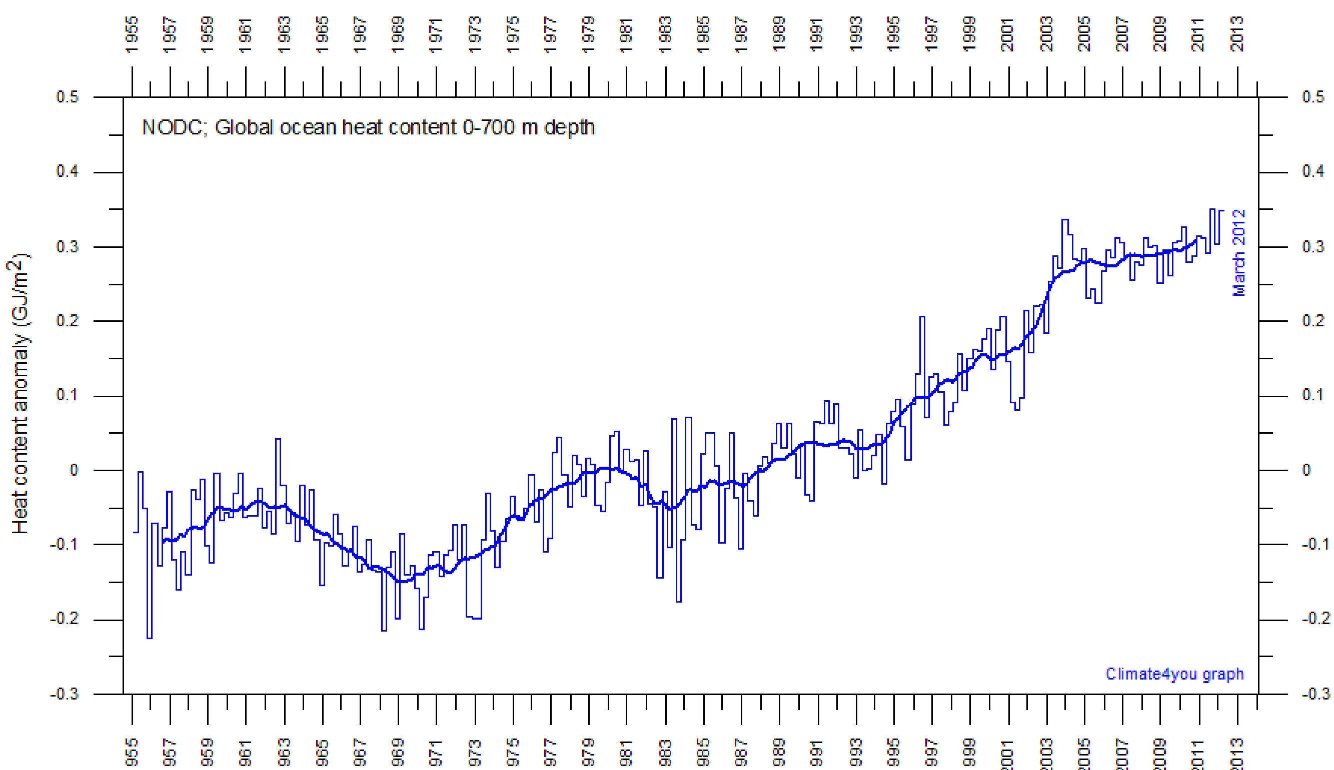


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to March 2012

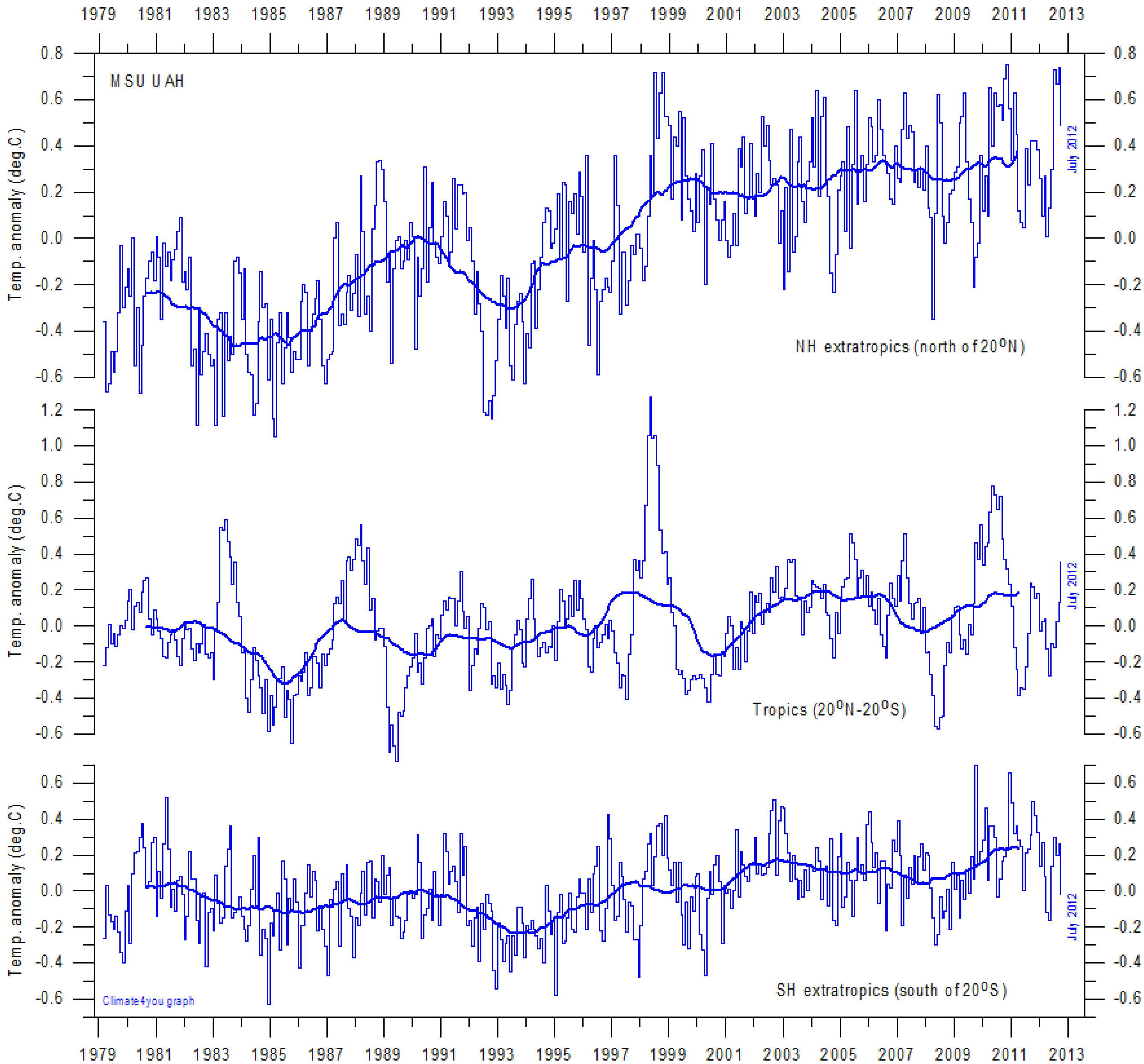


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



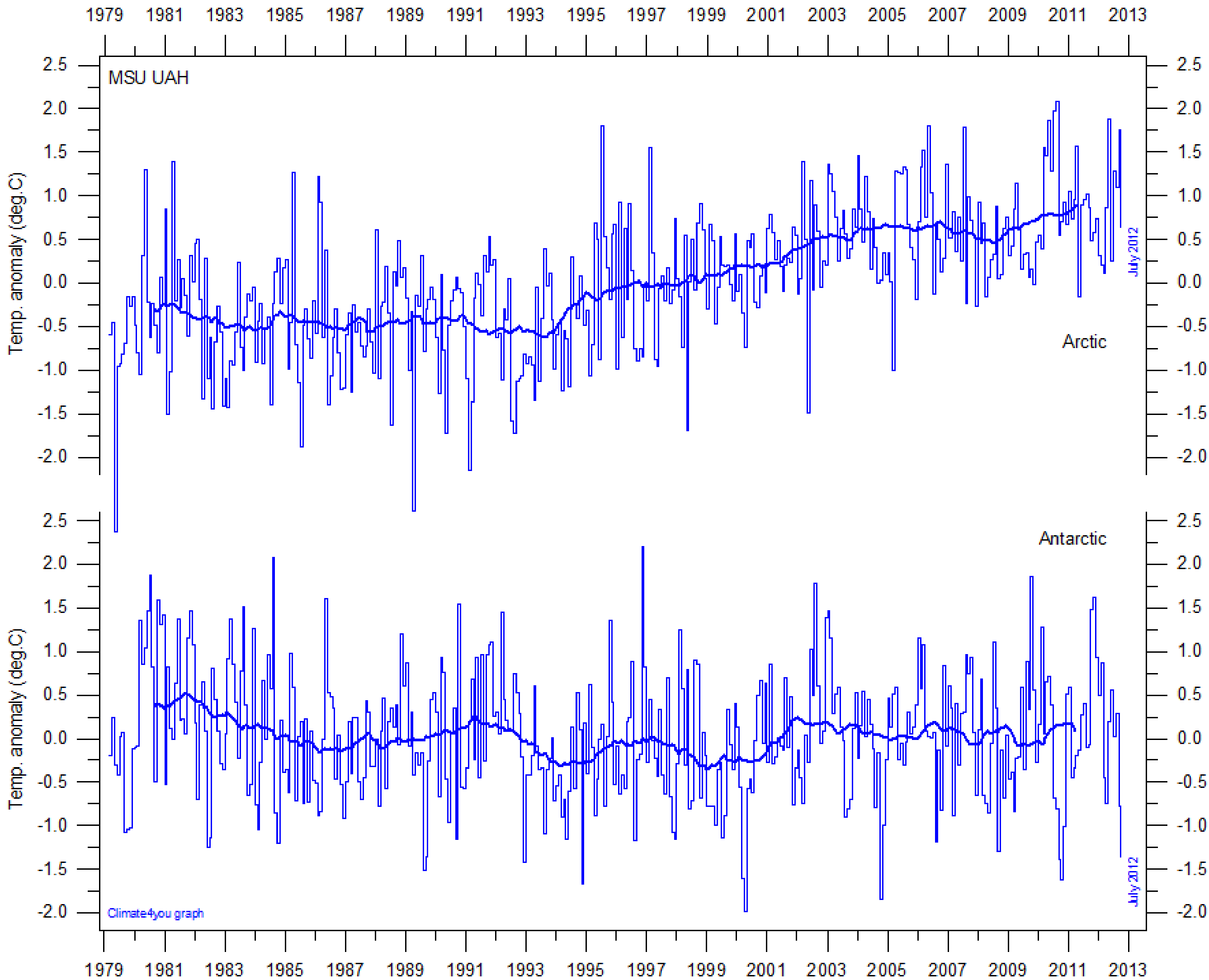
Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).

Zonal air temperatures, updated to July 2012



Global monthly average lower troposphere temperature since 1979 for the tropics and the northern and southern extratropics, according to [University of Alabama](#) at Huntsville, USA. Thin lines show the monthly temperature. Thick lines represent the simple running 37 month average, nearly corresponding to a running 3 yr average. Reference period 1981-2010.

Arctic and Antarctic lower troposphere temperature, updated to July 2012



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). Thin lines show the monthly temperature. 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 March 2012

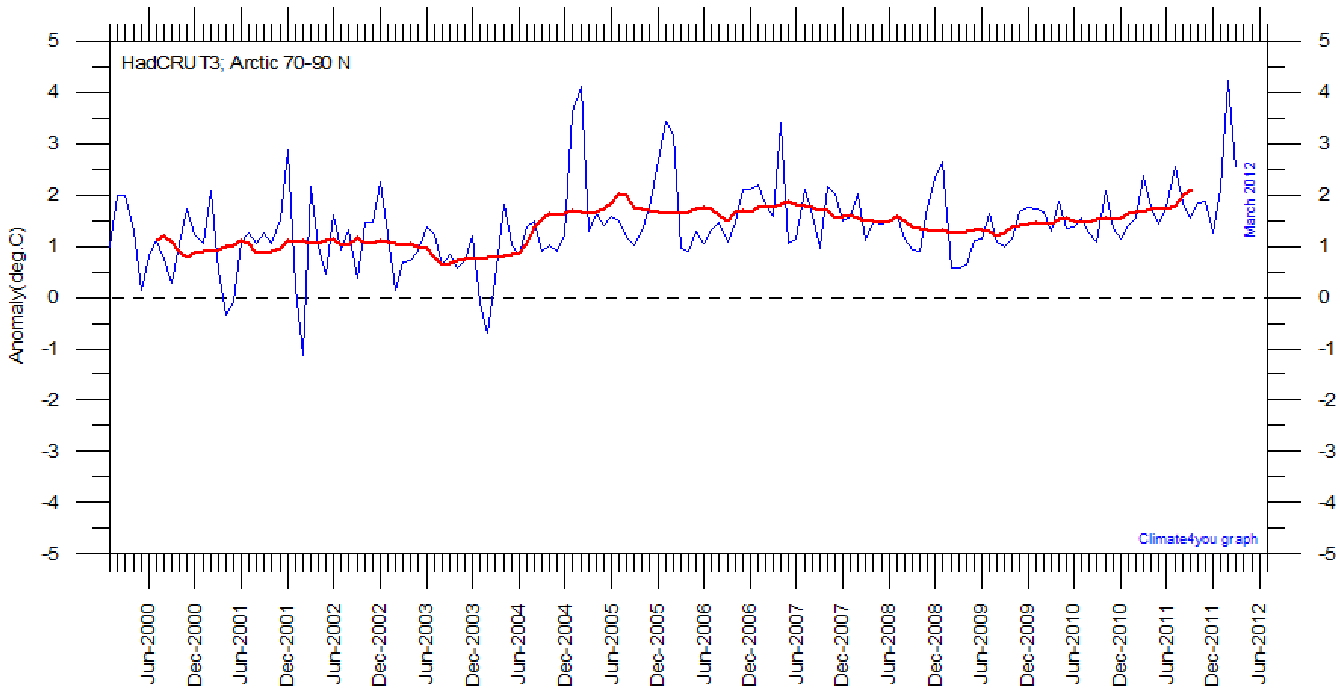


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

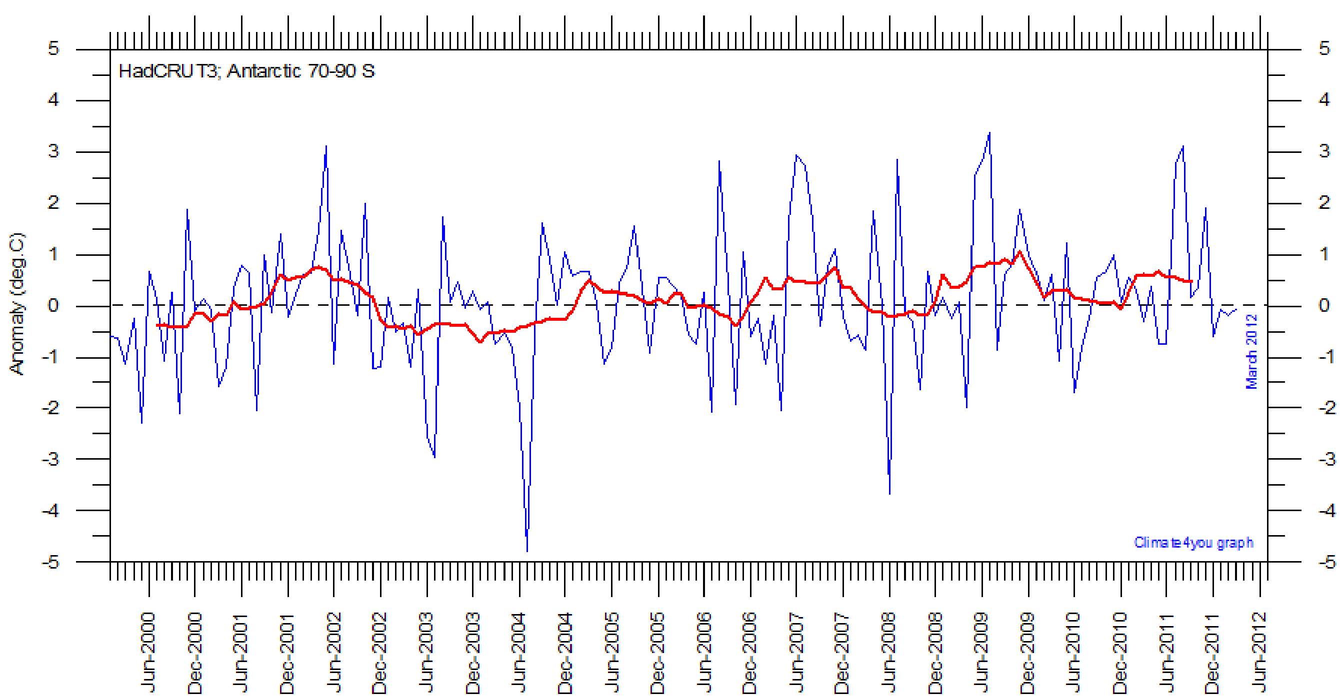


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

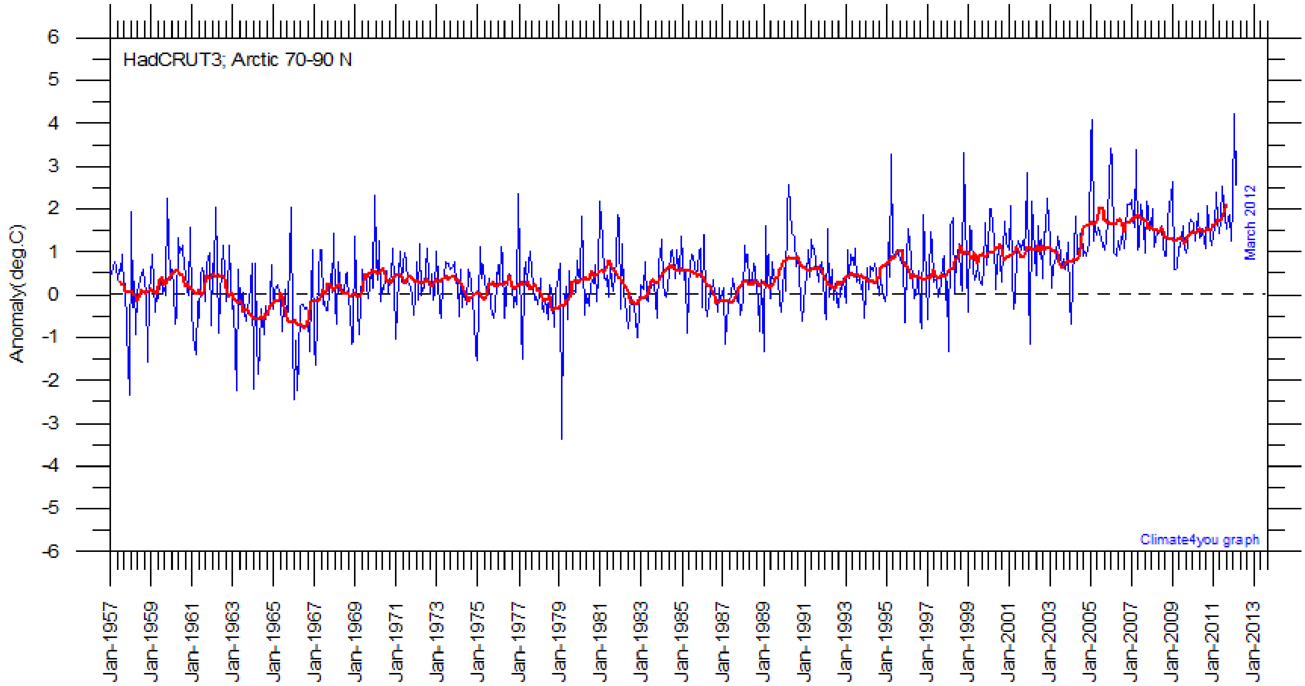


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown 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) ([CRU]), UK.

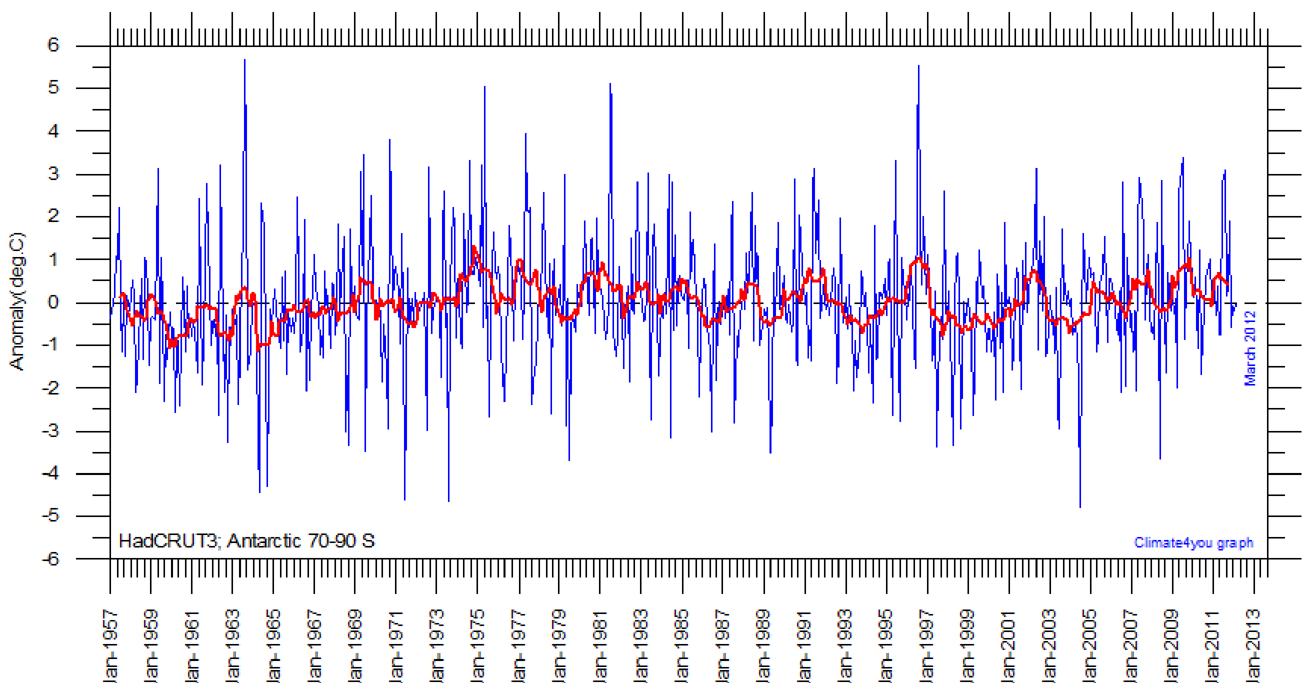


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before 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.

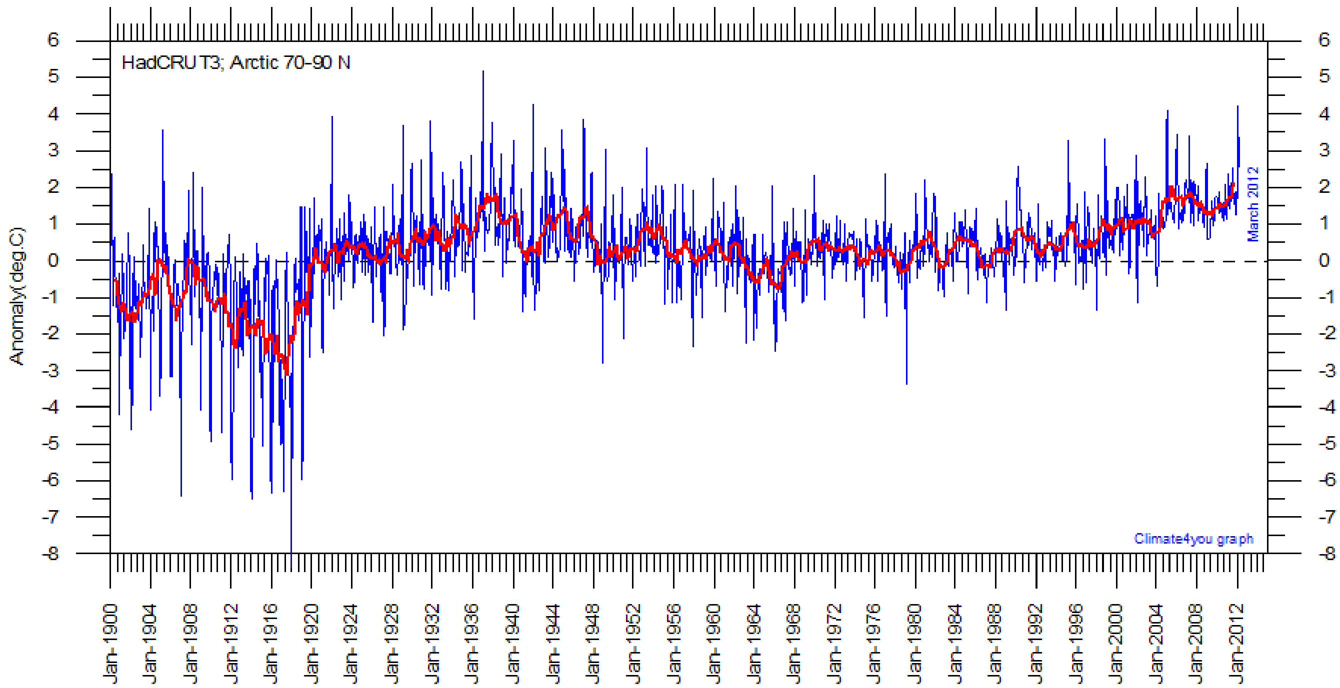


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly 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

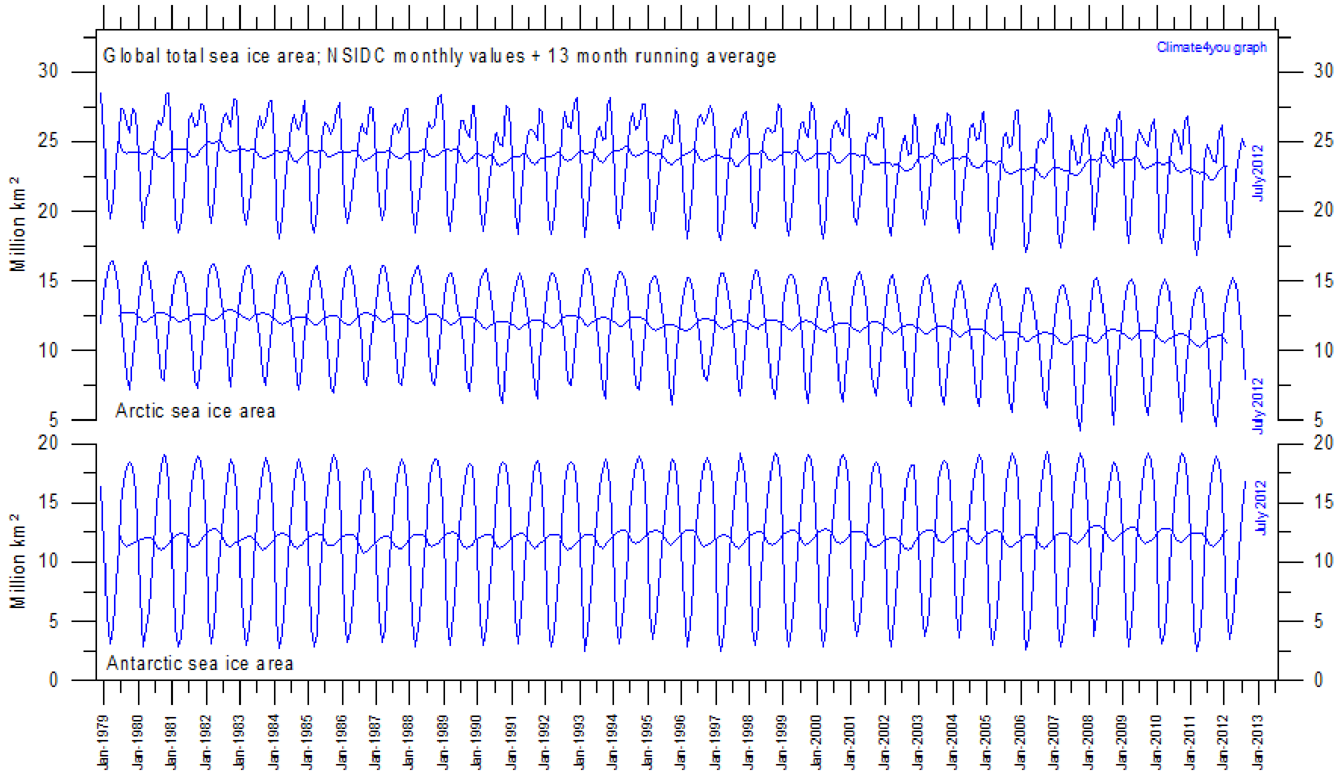
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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 surface areas of the individual grid dells.

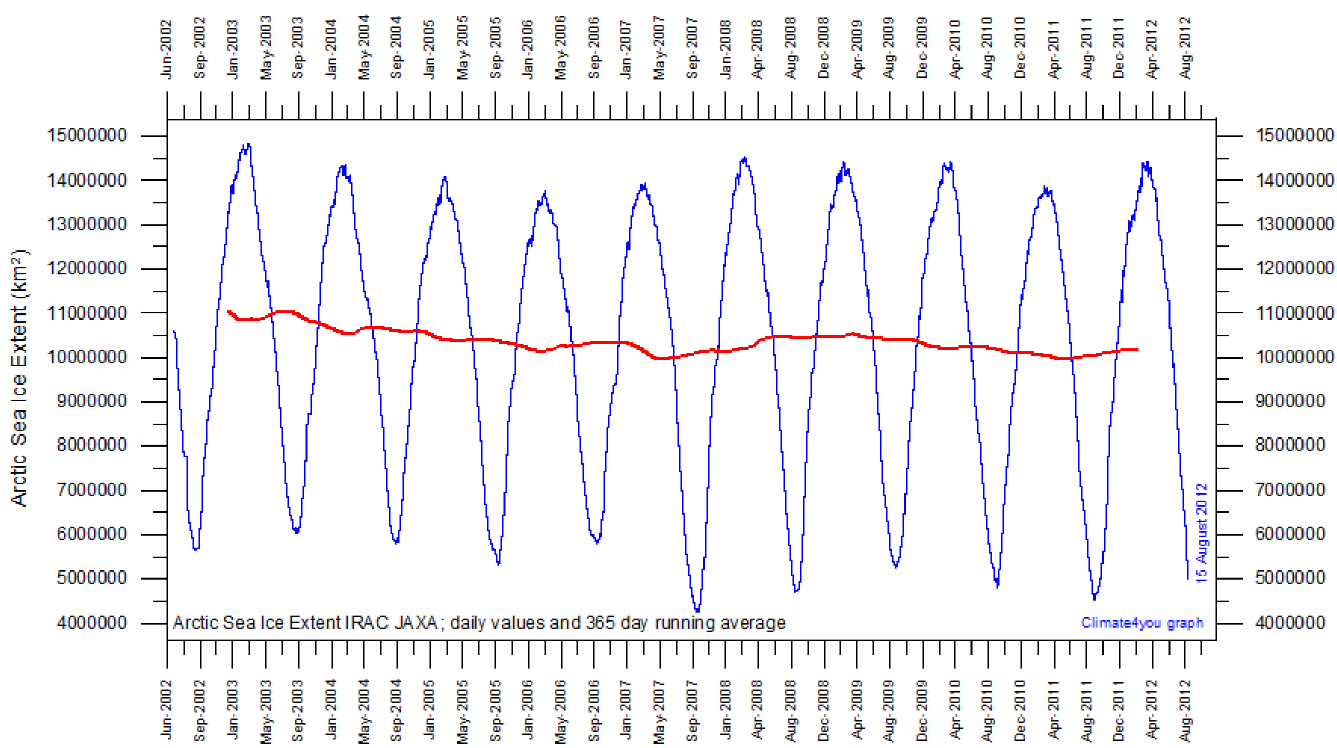
Literature:

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.

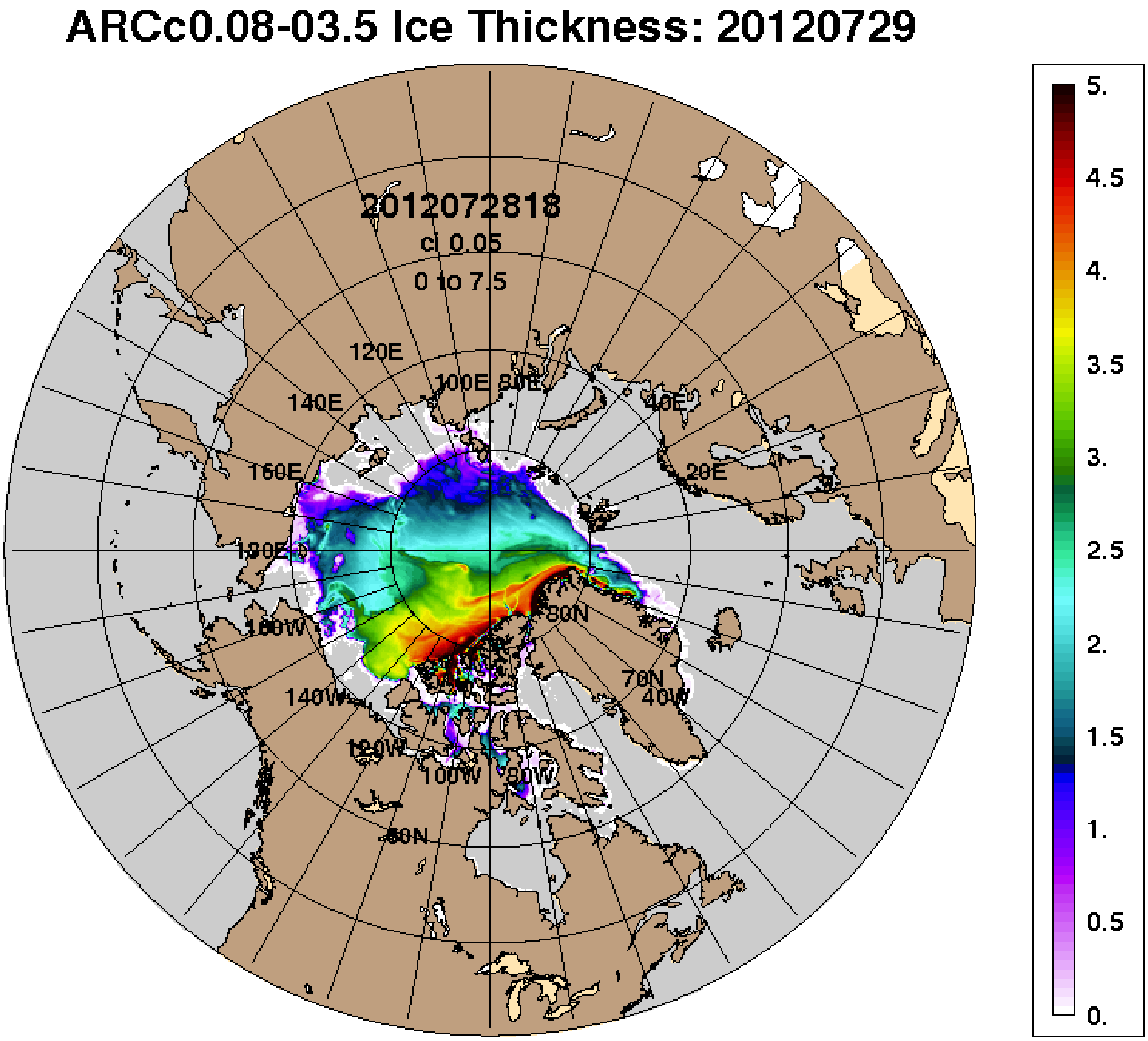
Arctic and Antarctic sea ice, updated to July 2012



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



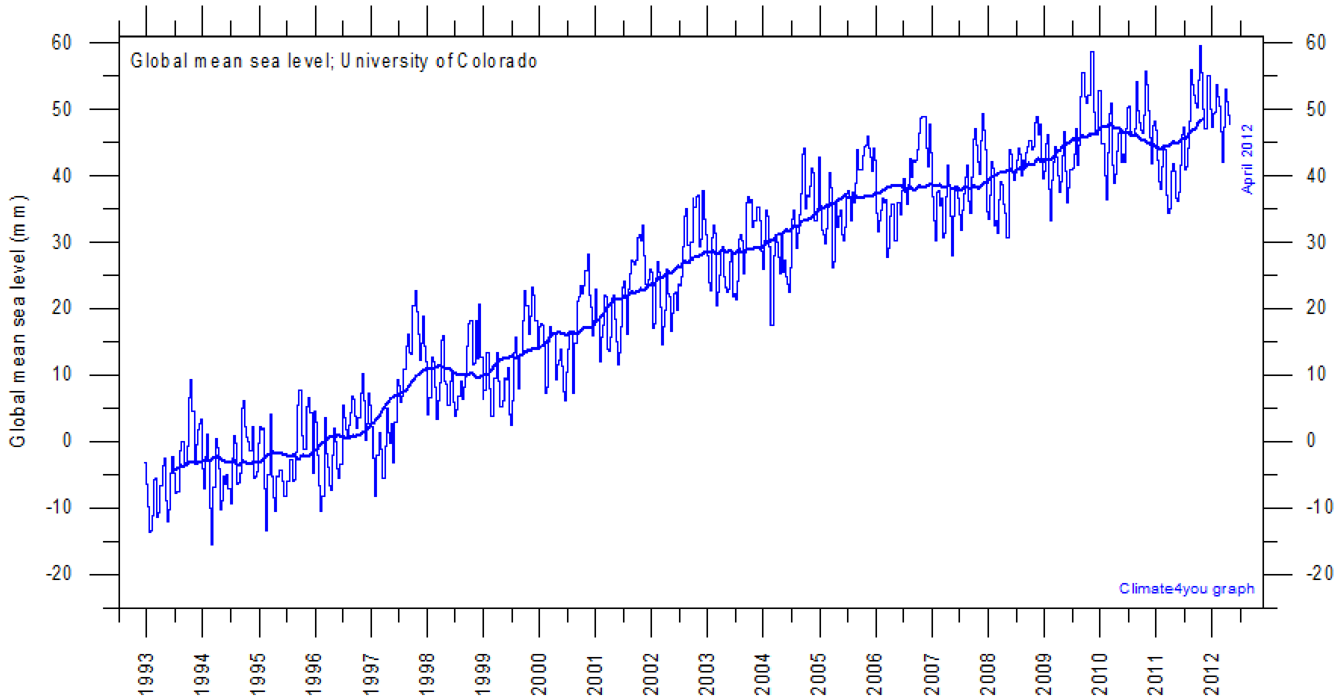
Graph showing daily Arctic sea ice extent since June 2002, to August 15, 2012, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).



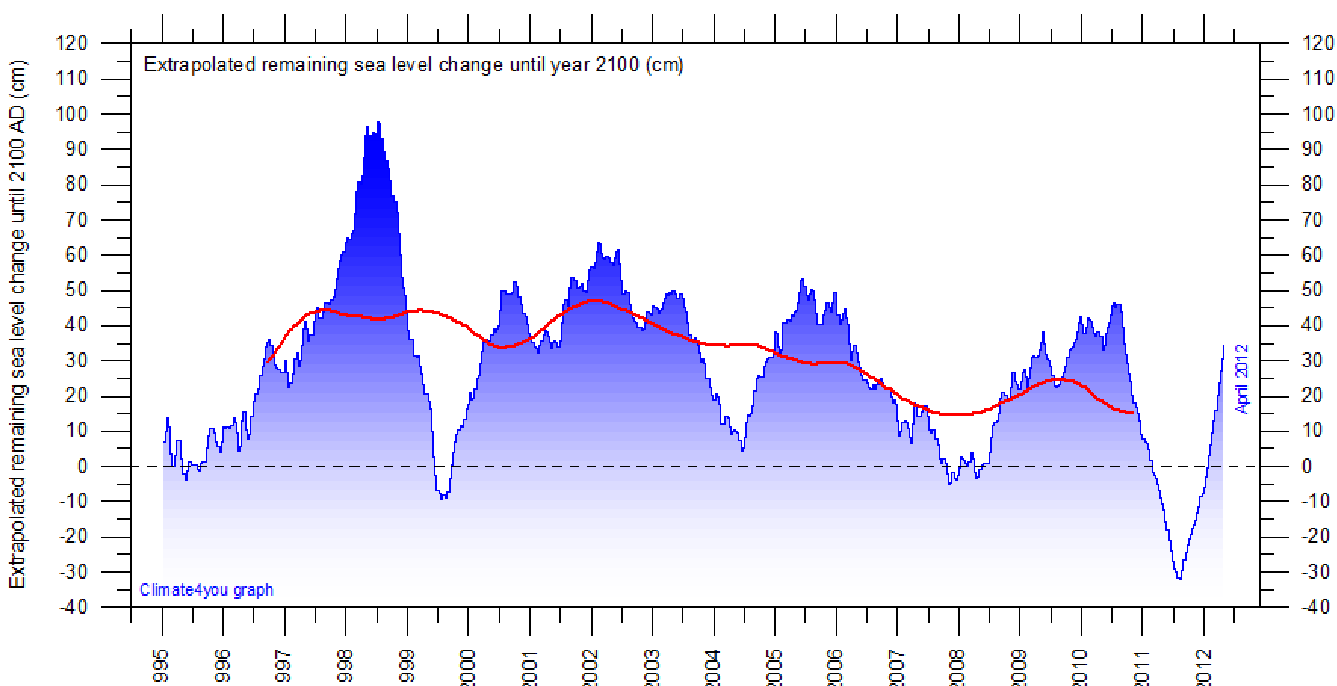
17

Northern hemisphere sea ice extension and thickness on 29 July 2012 according to the Arctic Cap Nowcast/Forecast System (ACNFS), US Naval Research Laboratory. Thickness scale (m) is shown to the right.

Global sea level, updated to April 2012

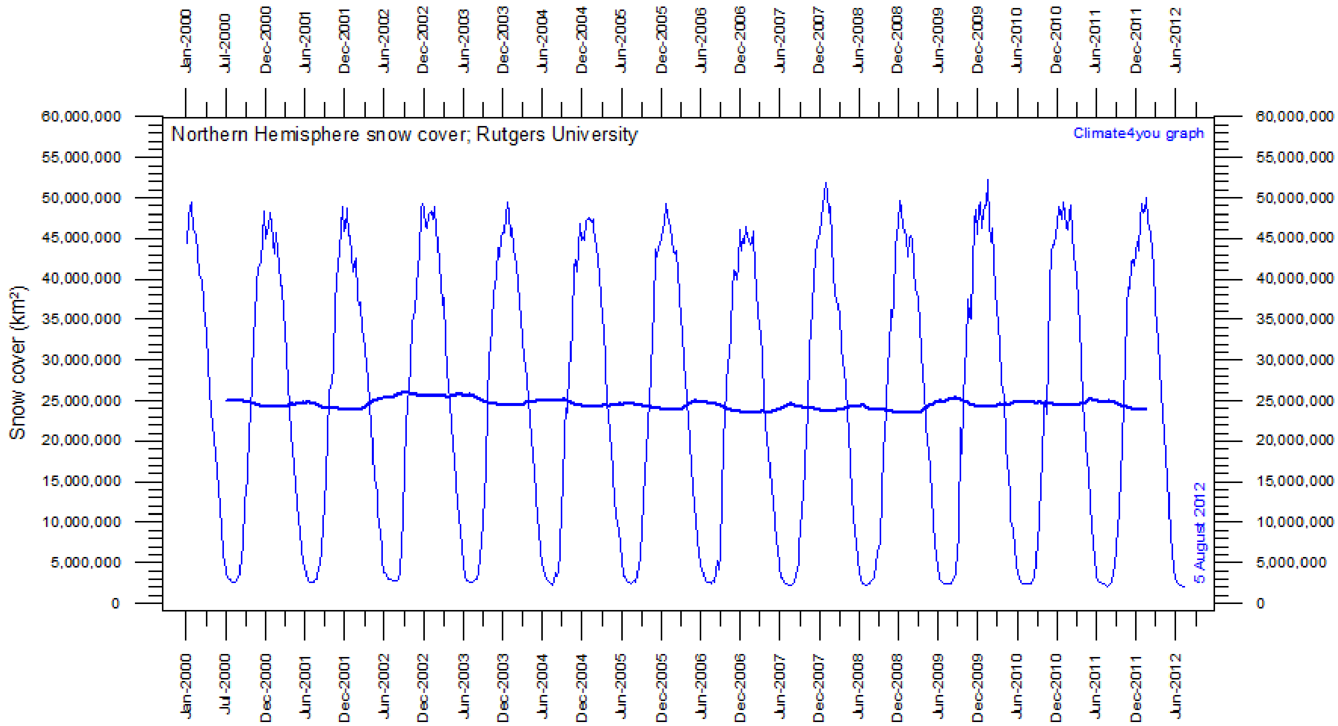


Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.

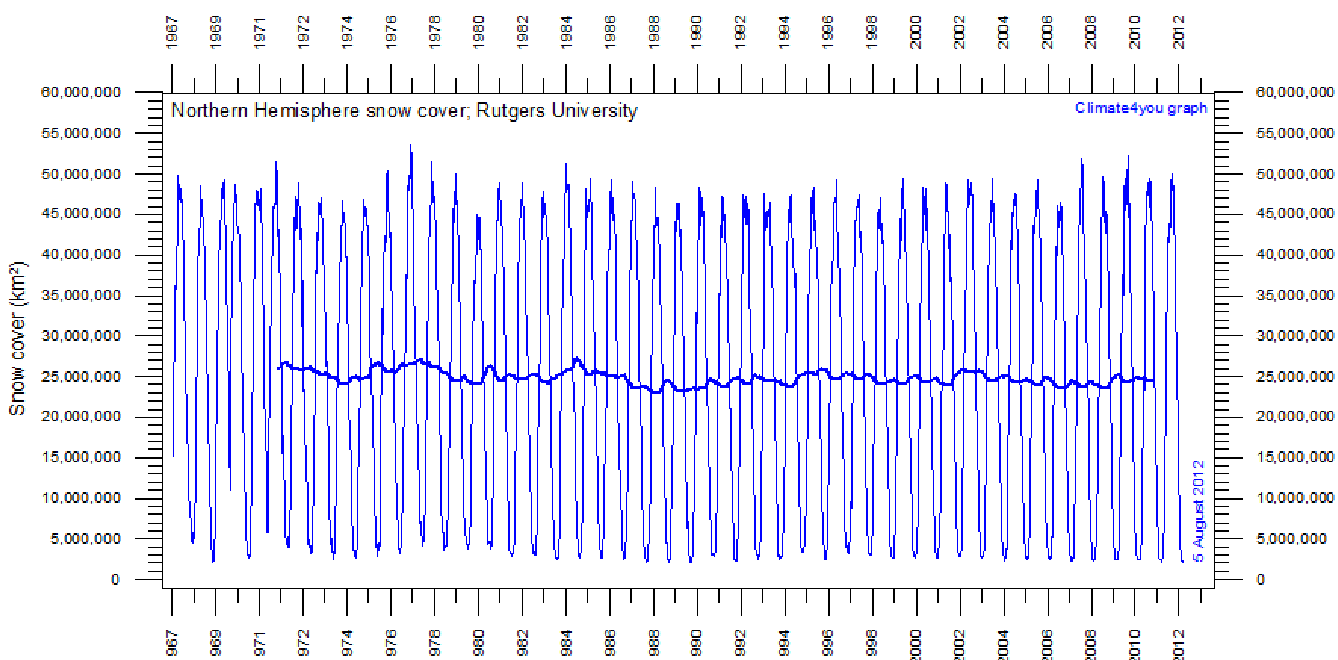


Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based on this (thick line), the present simple empirical forecast of sea level change until 2100 is about +18 cm.

Northern Hemisphere weekly snow cover, updated to early August 2012

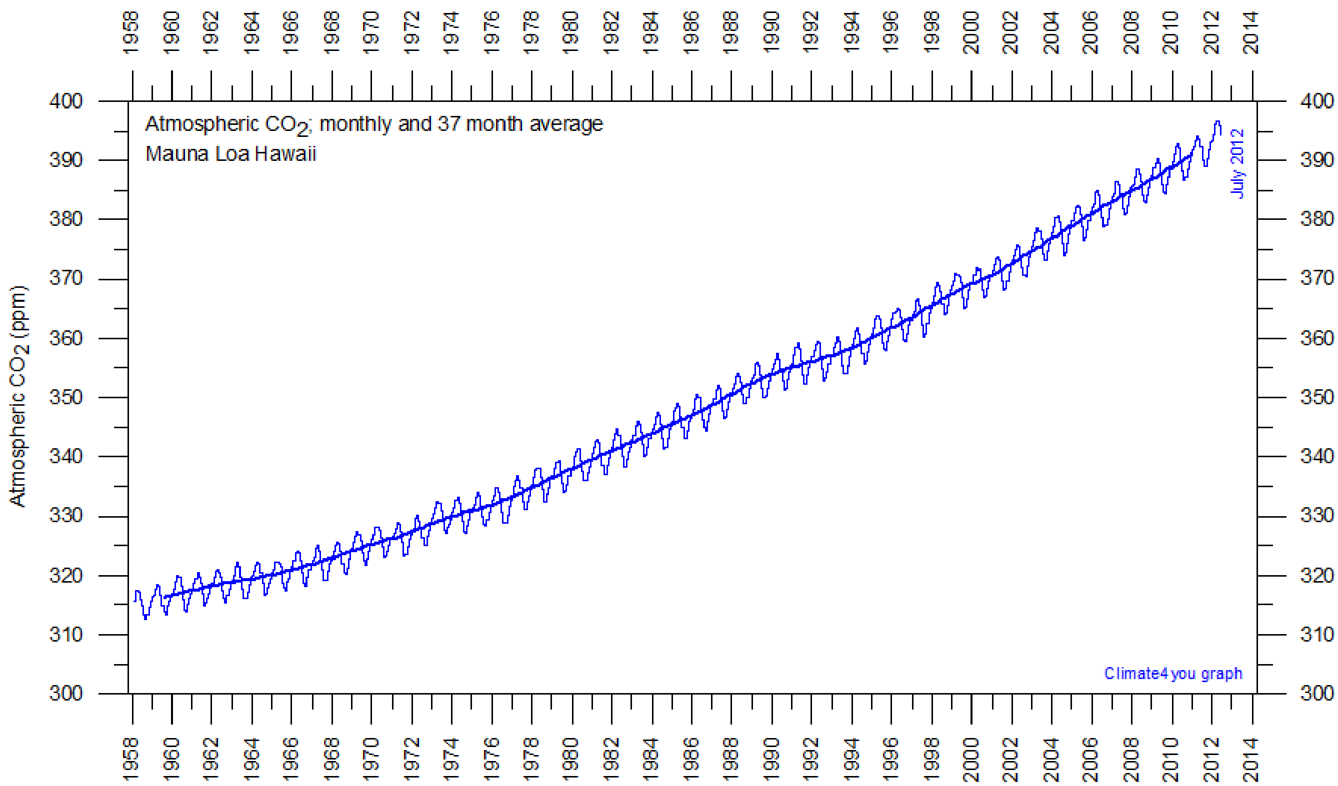


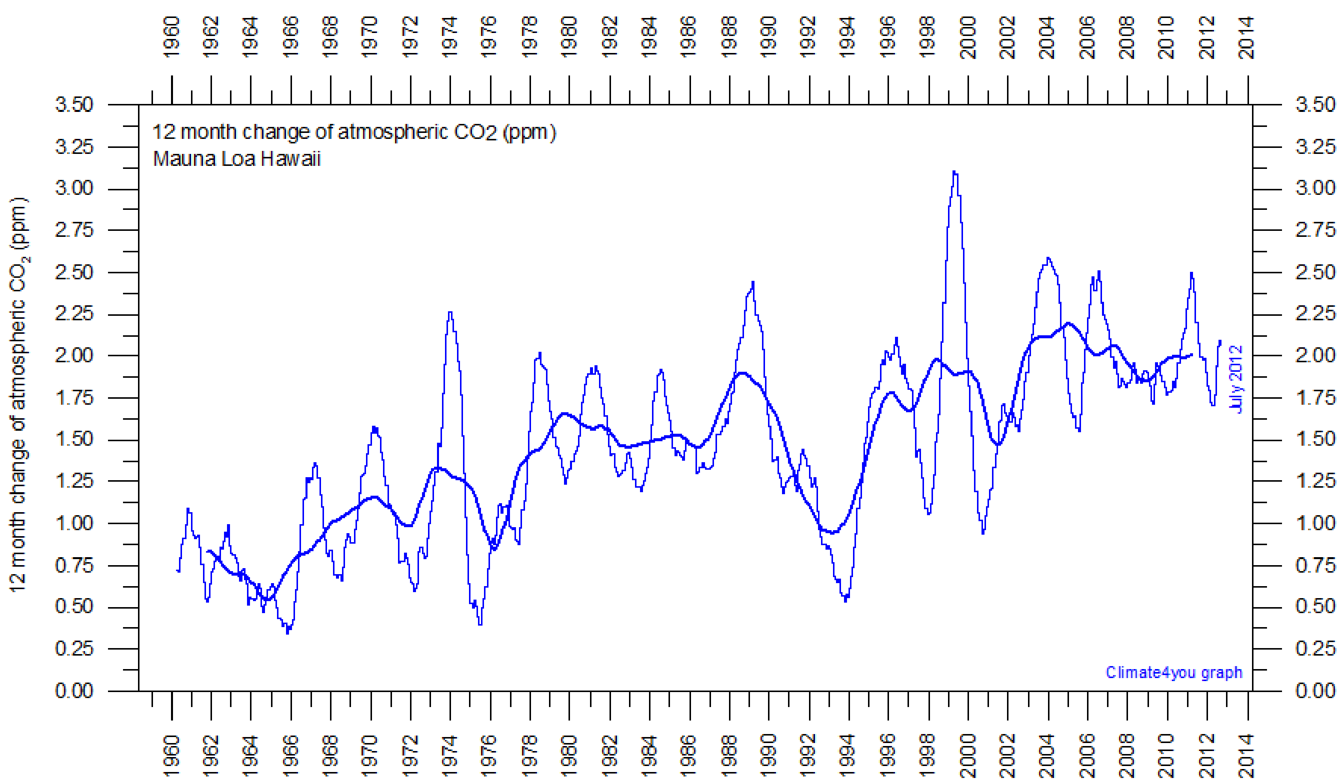
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year).



Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line represents 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 data gaps in this early period.

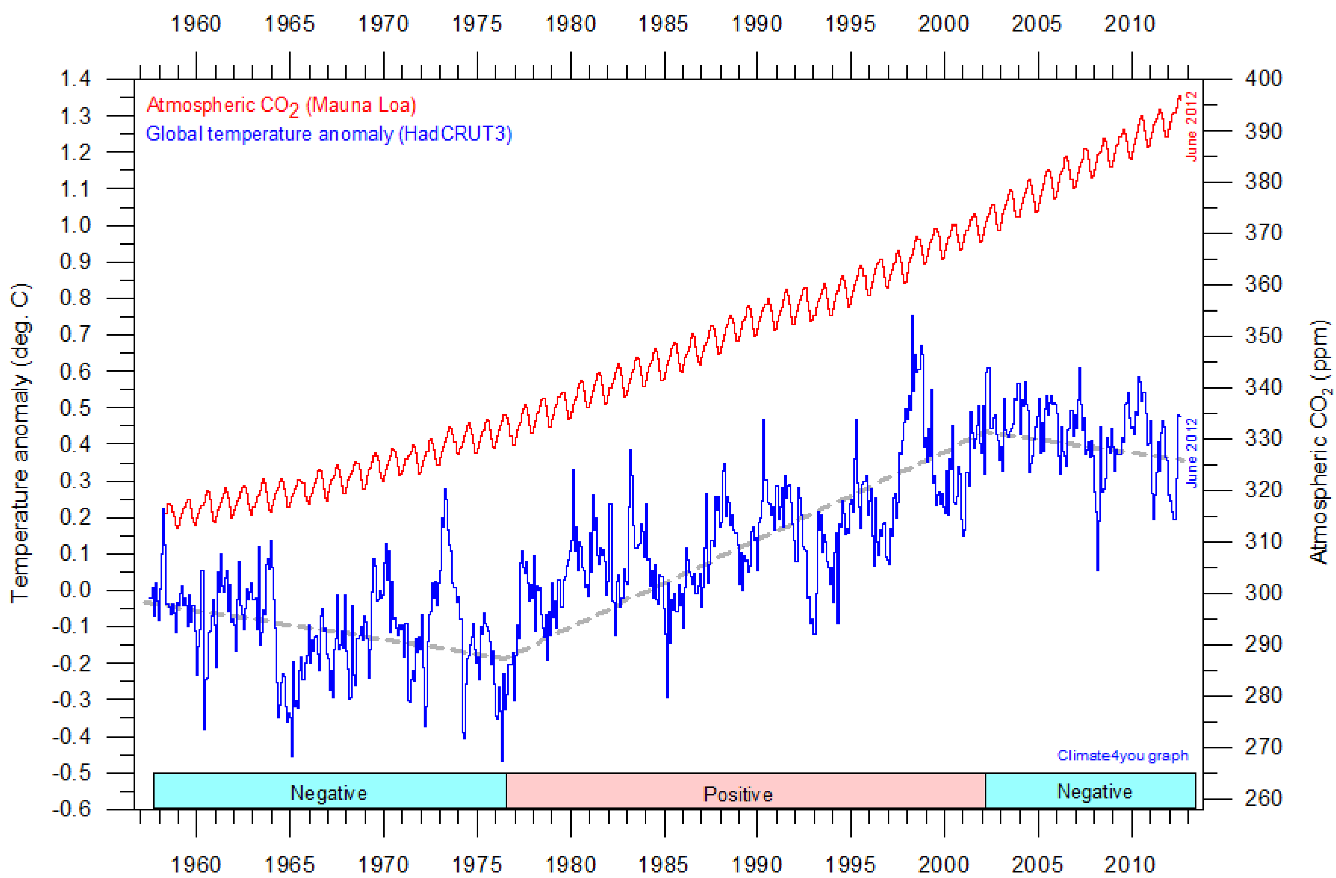
Atmospheric CO_2, updated to July 2012

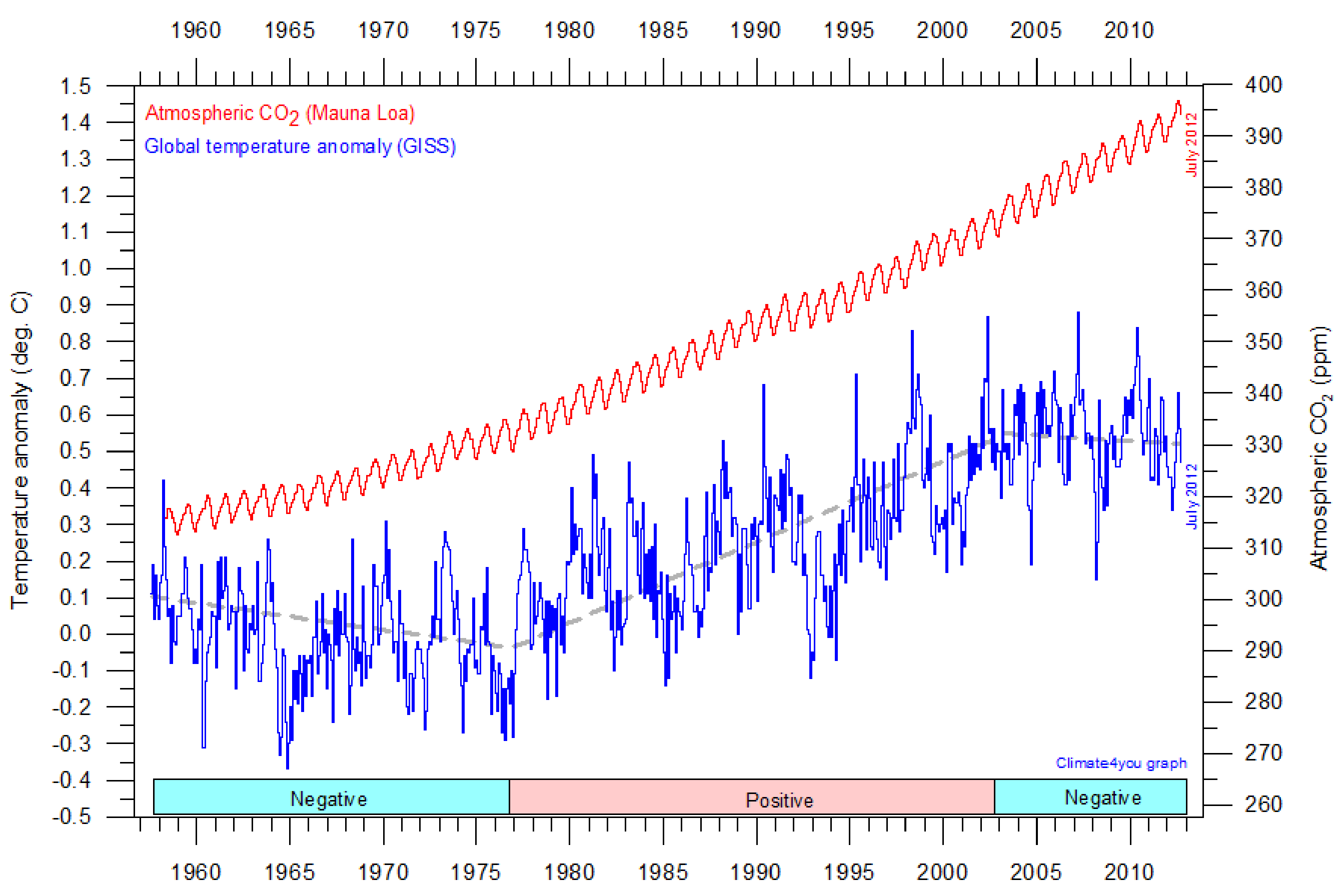


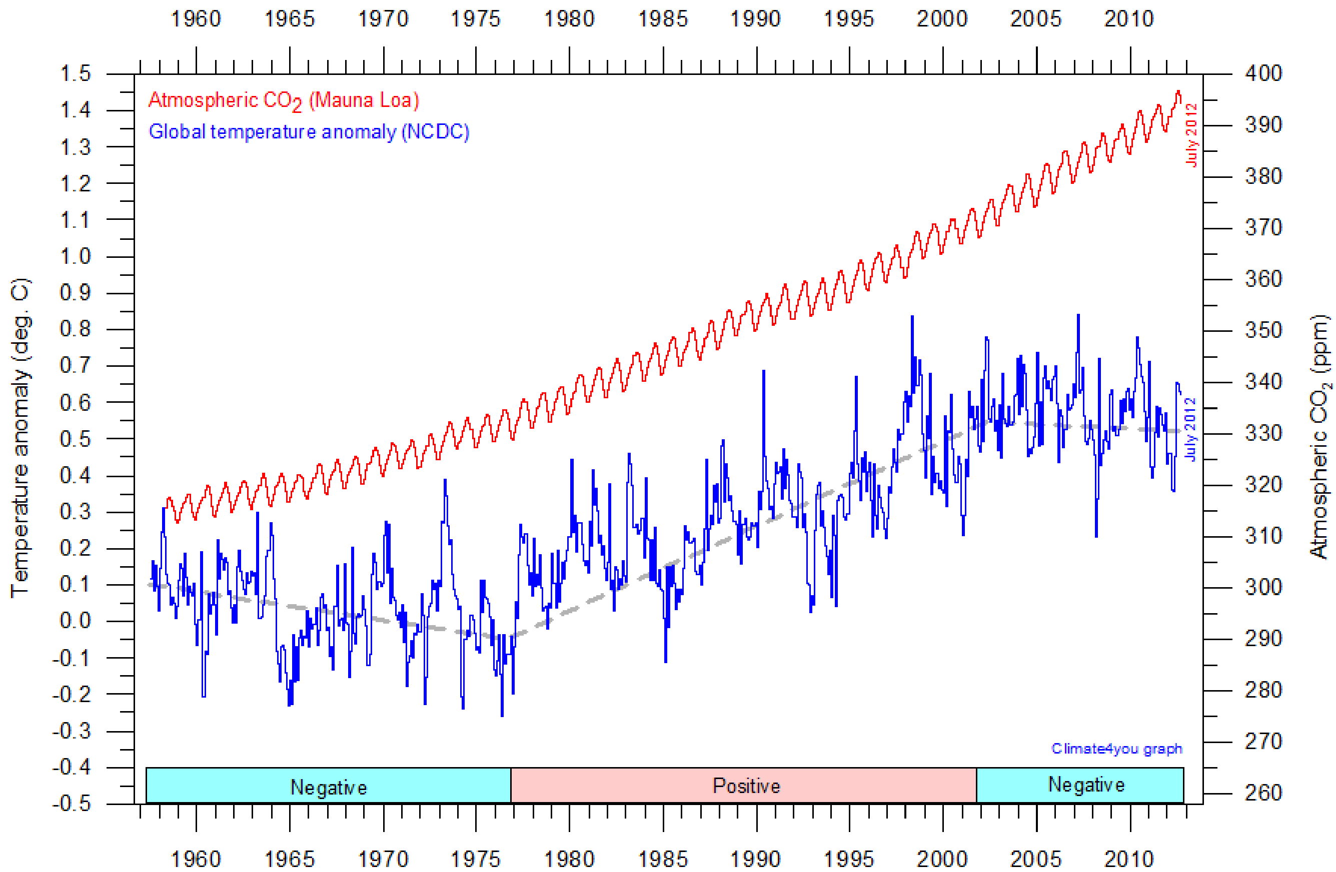


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the Mauna Loa Observatory, Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Global surface air temperature and atmospheric CO_2, updated to July 2012







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 direct 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. Please note that the HadCRUT3 diagram has not yet been updated beyond June 2012.

Most climate models assume the greenhouse gas carbon dioxide CO_2 to influence significantly upon global temperature. It is therefore relevant to compare different 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, 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.

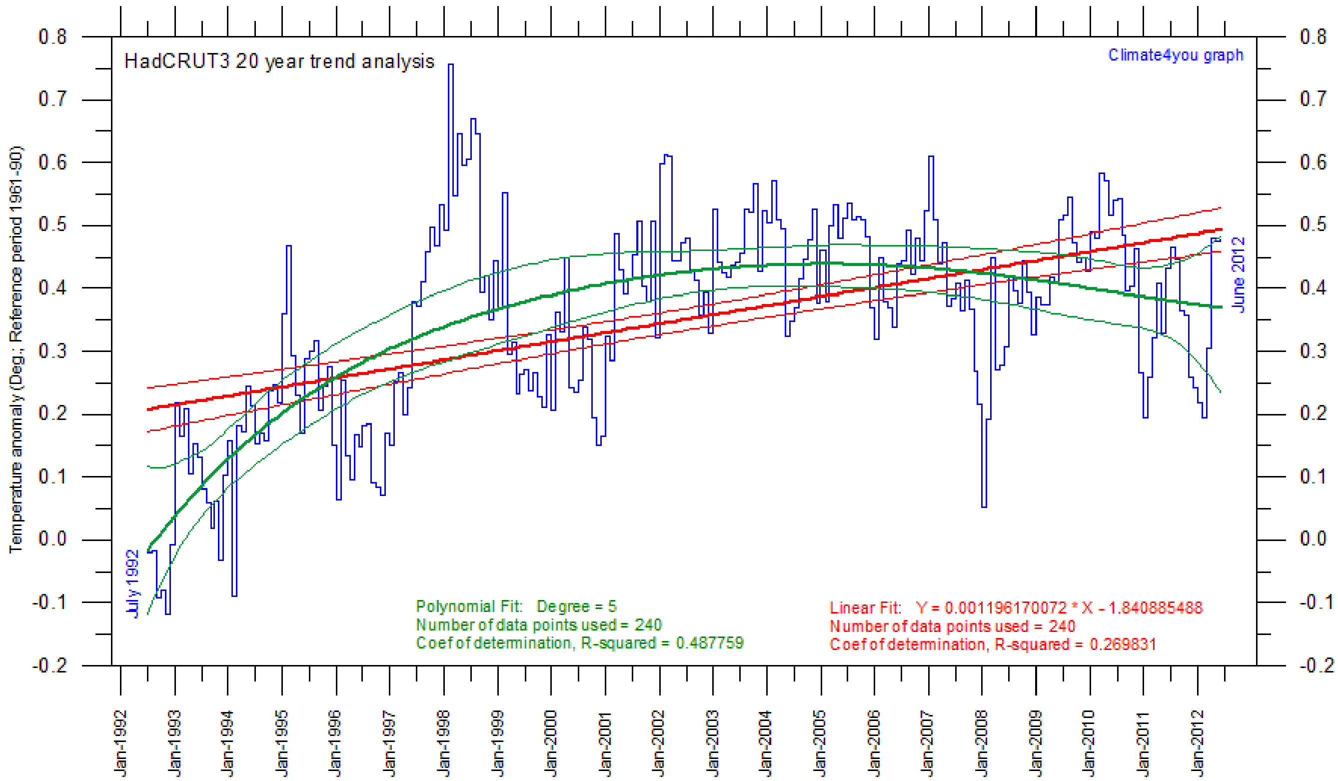
What exactly defines the critical length of a relevant time period to consider for evaluating the alleged importance of CO_2 remains elusive, and is still a topic for discussion. However, the critical period length must be inversely proportional to the temperature sensitivity of CO_2, including feedback effects. If the net temperature effect of atmospheric CO_2 is strong, the critical time period will be short, and vice versa.

However, past climate research history provides some clues as to what has traditionally been considered the relevant length of period over which to compare temperature and atmospheric CO_2. After about 10 years of concurrent global temperature- and CO_2-increase, IPCC was established in 1988. 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, politic support for the hypothesis would have been difficult to obtain.

Based on the previous 10 years of concurrent temperature- and CO_2-increase, many climate scientists in 1988 presumably felt that their understanding of climate dynamics was sufficient to conclude about the importance of CO_2 for global temperature changes. From this it may safely be concluded that 10 years was considered a period long enough to demonstrate the effect of increasing atmospheric CO_2 on global temperatures.

Adopting this approach as to critical time length (at least 10 years), the varying relation (positive or negative) between global temperature and atmospheric CO2 has been indicated in the lower panels of the diagrams above.

[Last 20 year surface temperature changes, updated to June 2012]



Last 20 years global monthly average surface air temperature according to Hadley CRUT, a cooperative effort between the [Hadley Centre for Climate Prediction and Research] and the [University of East Anglia]'s [Climatic Research Unit] ([CRU]), UK. The thin blue line represents the monthly values. The thick red line is the linear fit, with 95% confidence intervals indicated by the two thin red lines. The thick green line represents a 5-degree polynomial fit, with 95% confidence intervals indicated by the two thin green lines. A few key statistics is given in the lower part of the diagram (note that the linear trend is the monthly trend)..

From time to time it is debated if the global surface temperature is increasing, or if the temperature has levelled out during the last 10-15 years. The above diagram may be useful in this context, and it clearly demonstrates the differences between two often used statistical approaches to determine recent temperature trends. Please also note that such fits only attempt to describe the past, and usually have little predictive power.

Climate and history; one example among many

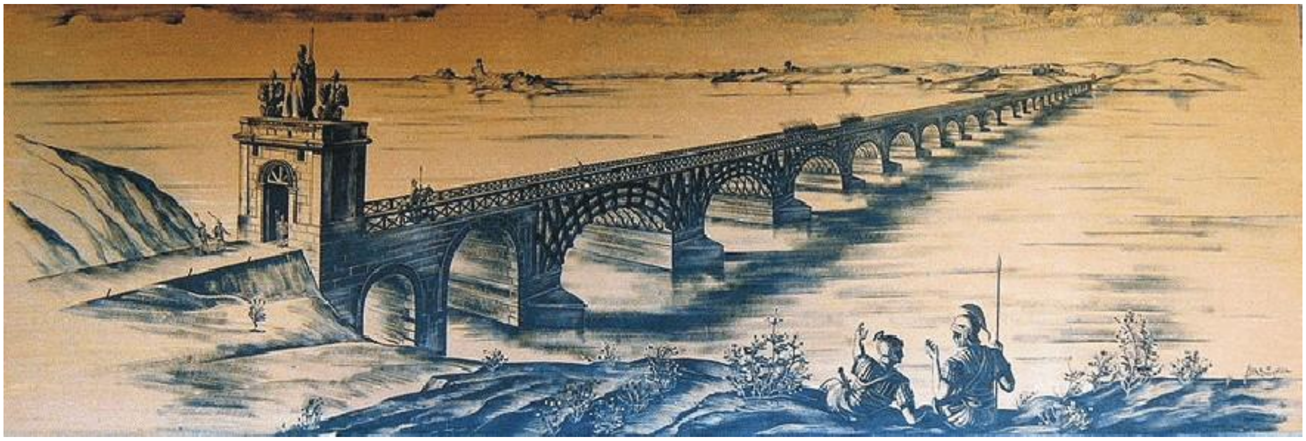
101-106 AD: Bridge constructed across the River Danube at the Iron Gate

Map showing the location of the Iron Gate (black arrow) in south-east Europe.

An indication of the benign climate of Roman times with a rather long immunity from cold winters in Europe may be seen in the building between AD 101 and 106 of a bridge with many stone piers across the River Danube at the Iron Gate in south-east Europe, between Serbia and the Transylvian highlands in Romania (cf. Lamb 1995).

The bridge was designed by Appolodorus of Damascus for the Emperor Trajan for efficient passage of the Roman armies and administration across the Danube, preceding Trajan's subsequent conquest of Dacia, a large region broadly corresponding to modern Romania and Moldova.

Trajan's bridge apparently stood for no less than about 170 years Lamb (1977, 1995). This must be considered an amazing fact, as in any recent century such a construction would rapidly have been carried away by river ice during a cold winter. In the end the bridge is said to have been destroyed by the Dacian tribes when the Romans later withdrew from this part of Europe (Lamb 1977, 1995).



Artistic reconstruction of Trajan's bridge across the river Danube (source: Wikimedia Commons).

Trajan's bridge was 1,135 m in length (the Danube is about 800 m wide at the place of crossing), 15 m in width, and 19 m in height above the average water level. At each end of the bridge was a Roman castrum, each built around an entrance to the bridge. In other words, in order to cross the bridge you had first to pass through a Roman military camp.

For the bridge's construction Appolodorus of Damascus used wooden arches set on twenty masonry pillars (made of bricks, mortar and pozzolana cement) that spanned 38 m each. The entire bridge was built quickly within two years only (between 103 and 105 AD), employing the construction of a wooden caisson for each pier. For more than 1000 years Trajan's bridge was the longest arch bridge ever constructed, in both total and span length, and it apparently survived for no less than about 170 years (Lamb 1975, 1977), before being demolished by the Dacian people. Although representing an impressive engineering feat, relative mild winters with little river ice presumably contributed to the long survival time of the bridge.

A relief on Trajan's Column shows the Roman bridge across the River Danube (see figure below). Noteworthy on this illustration are the unusually flat segmental arches on high-rising concrete piers; in the foreground of the relief Emperor Trajan sacrificing by the Danube can be seen.

The River Danube and the Kazan gorge at its narrowest point (left), and relief showing the Roman bridge across Danube on Trajan's Column in Rome (right). Source: Wikimedia Commons.

The Iron Gate gorge(s) lies between Romania in the north and Serbia in the south. At this point, the river separates the southern Carpathian Mountains from the northwestern foothills of the Balkan Mountains. The Romanian, Hungarian, Slovakian, Turkish, German and Bulgarian names literally mean "Iron Gates" and are used to name the entire range of gorges. The Romanian side of the gorge now constitutes the Iron Gates natural park, whereas the Serbian part constitutes the Đerdap national park.

The Great Kazan (kazan meaning "boiler") is the most famous and the narrowest gorge of the Iron Gate route (photo above): the river here narrows to 150 m and reaches a depth of up to 53 m (174 ft). Shortly downstream is the site where the Roman Emperor Trajan had the legendary military bridge erected between 103 and 105 AD, preceding his conquest of Dacia. On the right (Serbian) bank of the river a Roman memorial plaque (*Tabula Trajana*) commemorates Emperor Trajan's military road into Dacia. The Tabula was originally located 50 meters lower than now. The original site was flooded with the construction of a major hydroelectric dam in late 1960s and the monument was moved to a new position just above the waterline. On the opposite Romanian bank, at the Small Kazan, a statue of Trajan's Dacian opponent Decebalus was carved in rock from 1994 through 2004 (see photos below).

Rock carving showing Decebalus on the Romanian side of the Iron Gate (left), and a plate commemorating the roman Emperor Trajan on the Serbian bank (right). Source: Wikimedia Commons.

The twenty pillars carrying Trajan's bridge were still visible in 1856, when the level of the Danube hit a record low. In 1906, the International Commission of the Danube however decided to destroy two of the pillars, to ensure safe navigation on the river. In 1932, there were 16 remaining pillars underwater, but in 1982 archaeologists only manage to find 12 of these. Presumably the missing four had been swept away by river ice following the relative cold period 1960-1980 in Europe. Today, only the entrance pillars are visible on either bank of the Danube.

In 1979, Trajan's Bridge was added to the Monument of Culture of Exceptional Importance, and in 1983 it was added to the Archaeological Sites of Exceptional Importance list, and by that it is protected by Republic of Serbia.

Sources and References:

Lamb, H.H. 1977. Climate, present, past and future. Volume 2. Climatic history and the future. Methuen & Co Ltd., London, 835 pp.

Lamb, H.H. 1995. Climate, History and the Modern World. Routledge, London, 2nd edition, 433 pp.

*****

All the above diagrams with supplementary information, including links to data sources and previous issues of this newsletter, are available on www.climate4you.com

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

August 19, 2012.