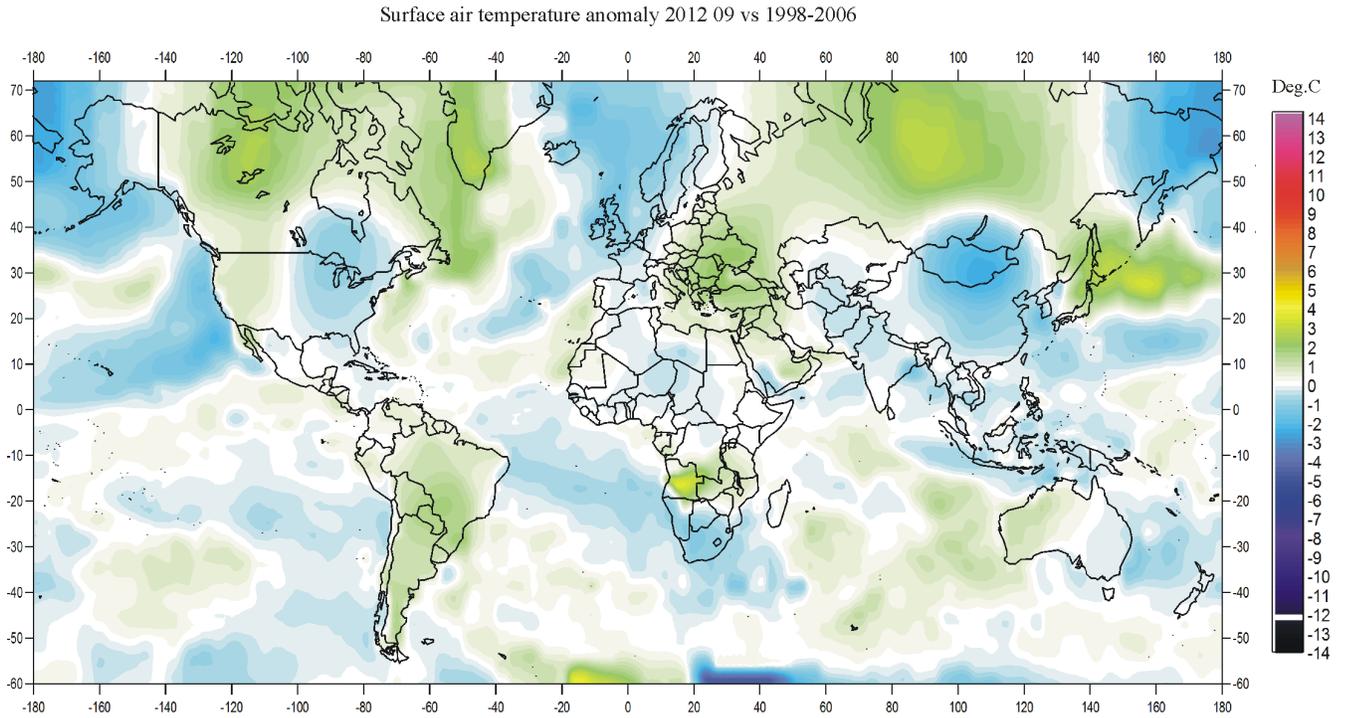


# Climate4you update September 2012

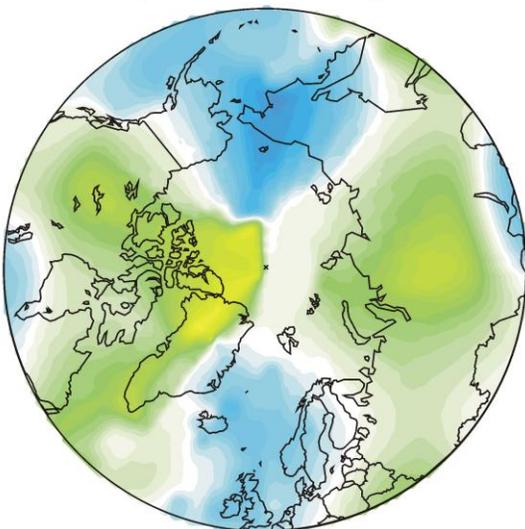
[www.climate4you.com](http://www.climate4you.com)

## September 2012 global surface air temperature overview

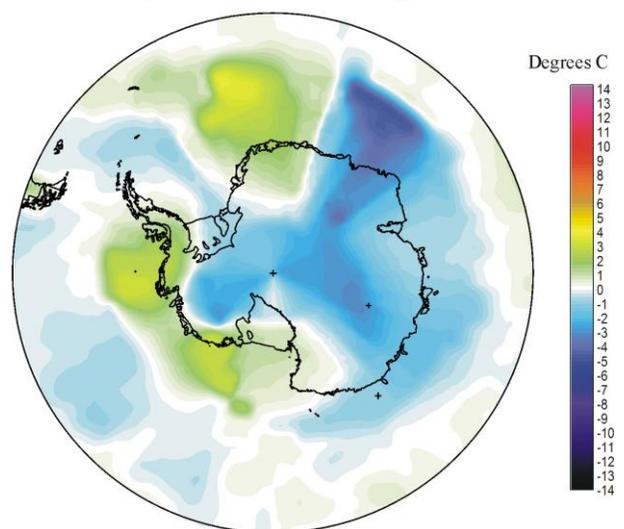


1

Air temperature 201209 versus average 1998-2006



Air temperature 201209 versus average 1998-2006



September 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](http://www.giss.nasa.gov) (GISS)

## Comments to the September 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 20<sup>th</sup> 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](http://www.Climate4you.com).

### September 2012 global surface air temperatures

General: Global air temperatures were close to average for the period 1998-2006.

The Northern Hemisphere was characterised by regional variability, as usual. Most of the North Atlantic, NW Europe, eastern Siberia, China, Alaska and eastern Canada and USA were relatively cold. Northern Canada, W Greenland, and Russia with most of Siberia were relative warm. The marked limit between warm and cold areas over the Arctic Ocean is an artefact derived from the GISS interpolation technique and should be ignored.

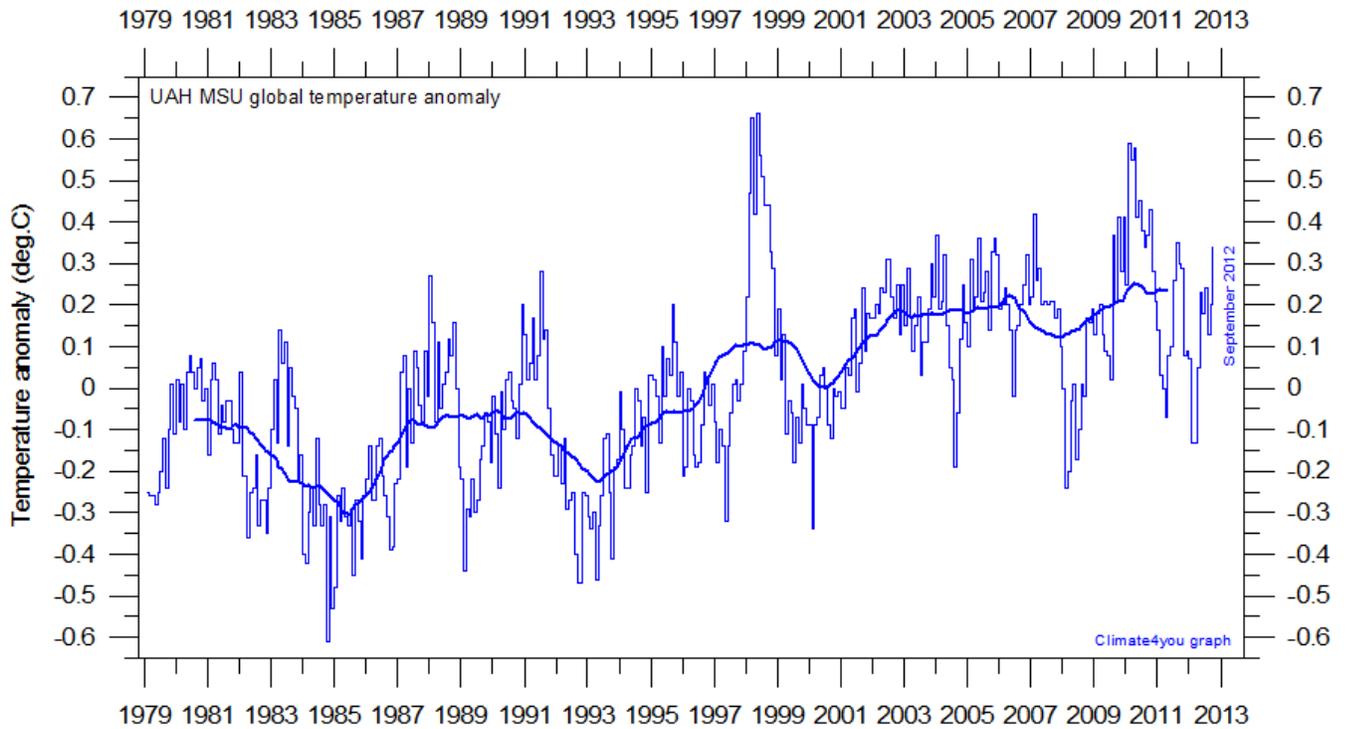
Near Equator temperatures conditions were near average, but with the region from India to Indonesia being relatively cold. Relatively cold areas also extended across much of northern Africa.

The Southern Hemisphere was at or below average 1998-2006 conditions. Only South America was in general relatively warm. South Africa was cold, and Australia was near average conditions, however, being relatively cold in the east and warm in the west. New Zealand was close to or a little below average conditions. The Antarctic continent experienced large contrasts. The southern part of the Antarctic Peninsula was warm, as were coastal areas along Amundsen Sea and coastal areas of Queen Maud Land. Most of East Antarctica experienced below average temperatures.

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

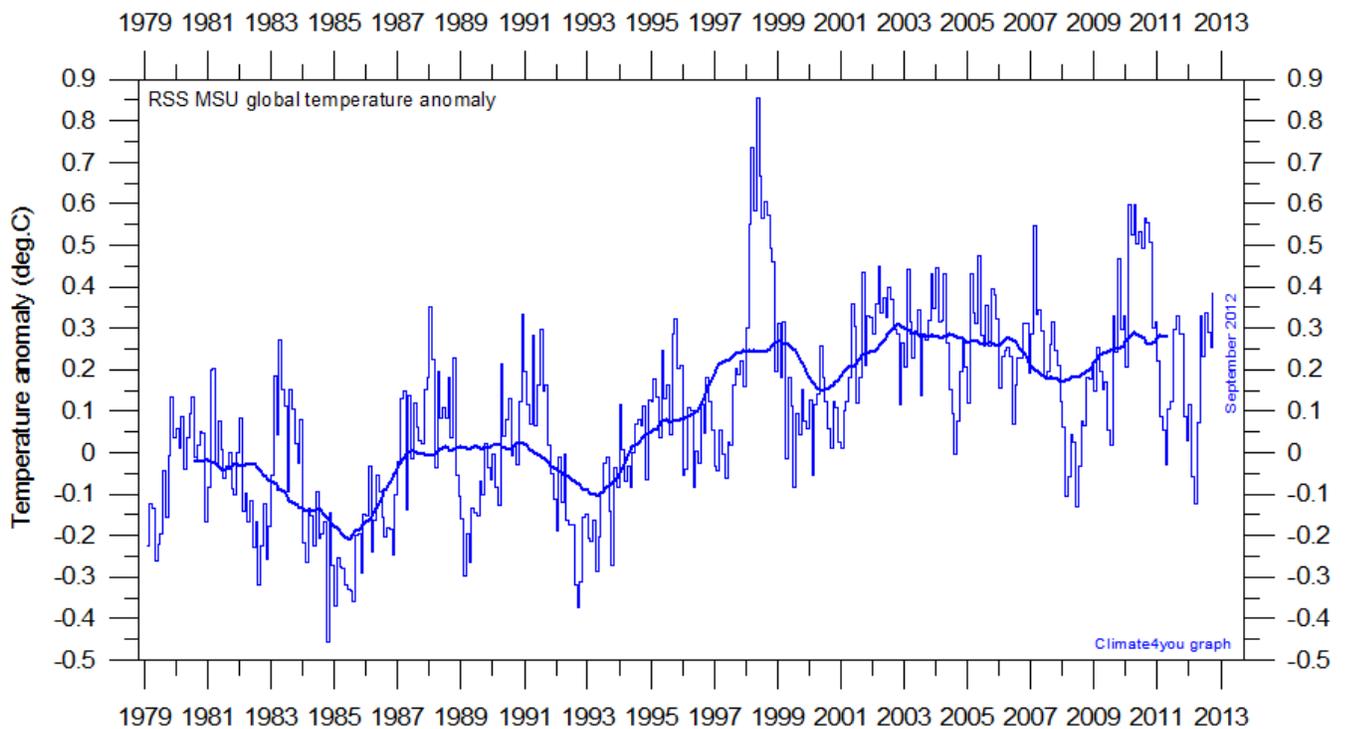
All diagrams shown in this newsletter and links to original data are available on [www.climate4you.com](http://www.climate4you.com)

## Lower troposphere temperature from satellites, updated to September 2012



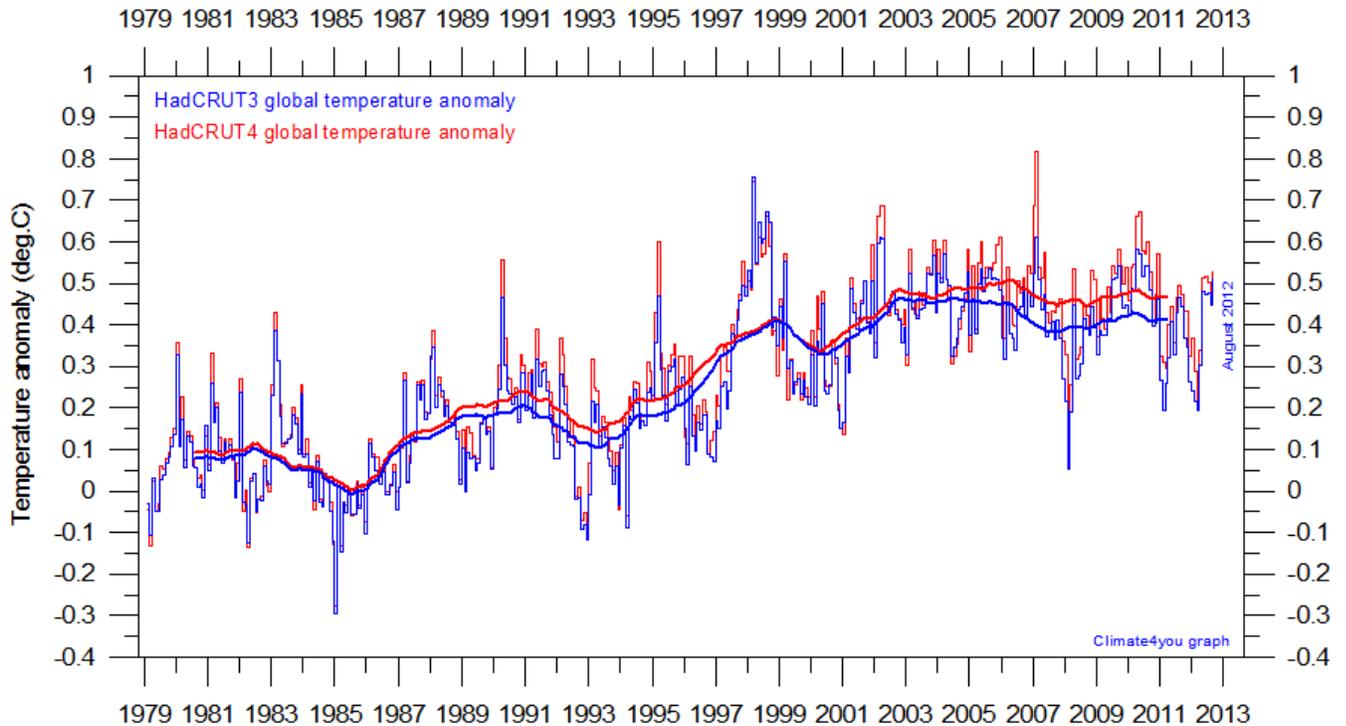
Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama](#) at Huntsville, USA. The thick line is the simple running 37 month average.

3



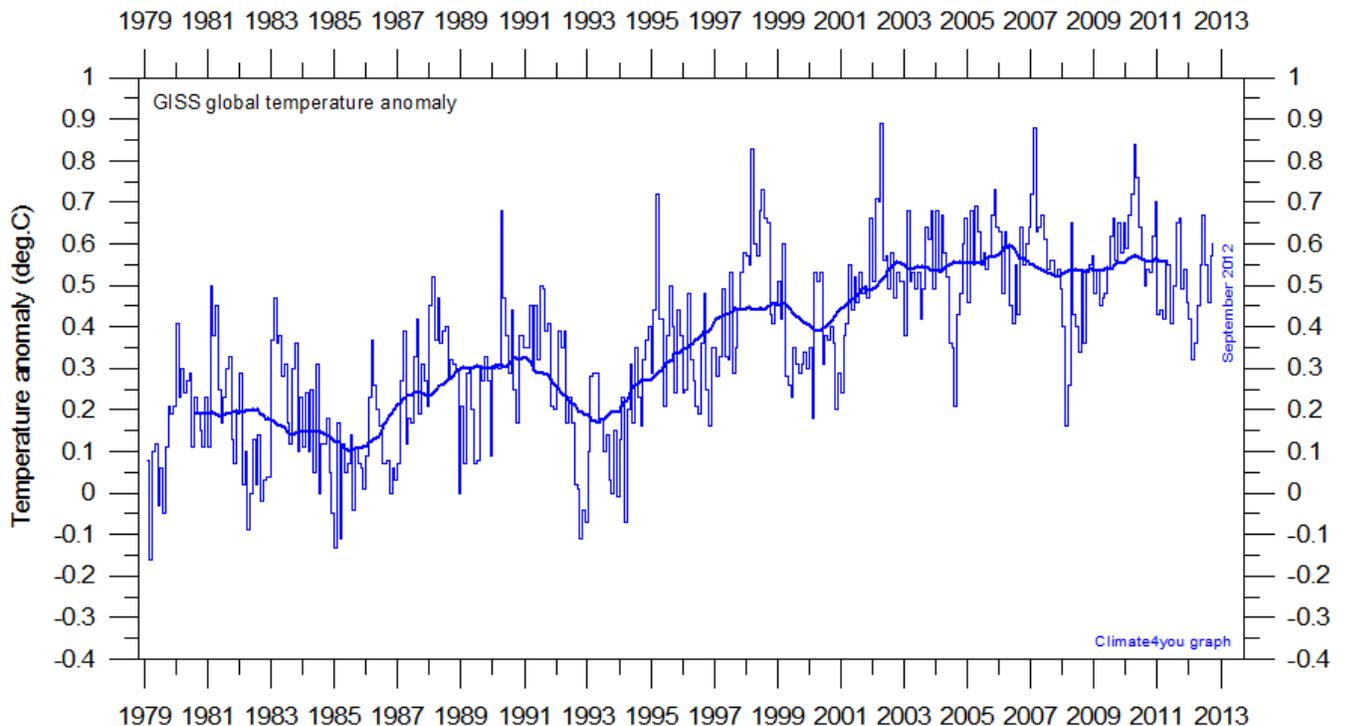
Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems](#) (RSS), USA. The thick line is the simple running 37 month average.

## Global surface air temperature, updated to September 2012

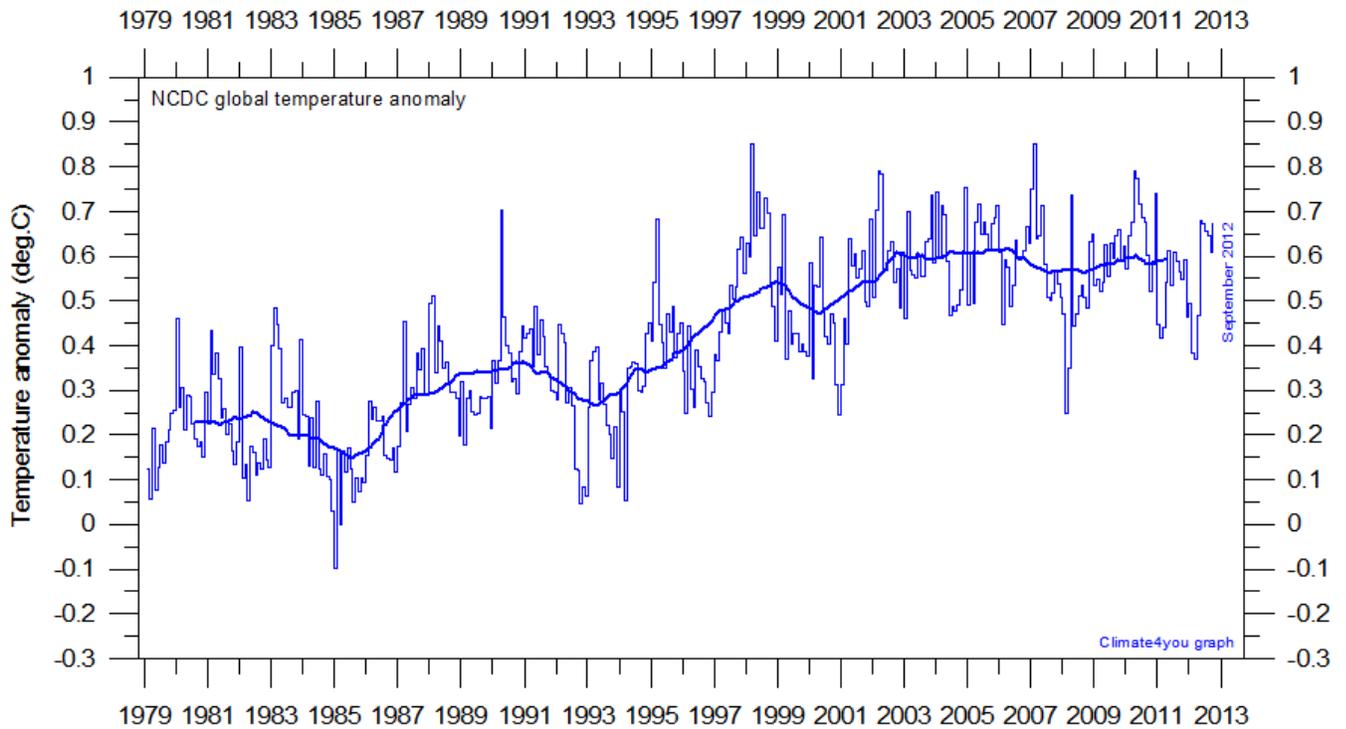


Global monthly average surface air temperature (thin line) since 1979 according to according to the Hadley Centre for Climate Prediction and Research and the University of East Anglia's [Climatic Research Unit \(CRU\)](#), UK. The thick line is the simple running 37 month average. Please note that this diagram has not been updated beyond August 2012. Version HadCRUT4 (red) is now replacing HadCRUT3 (blue).

4



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.

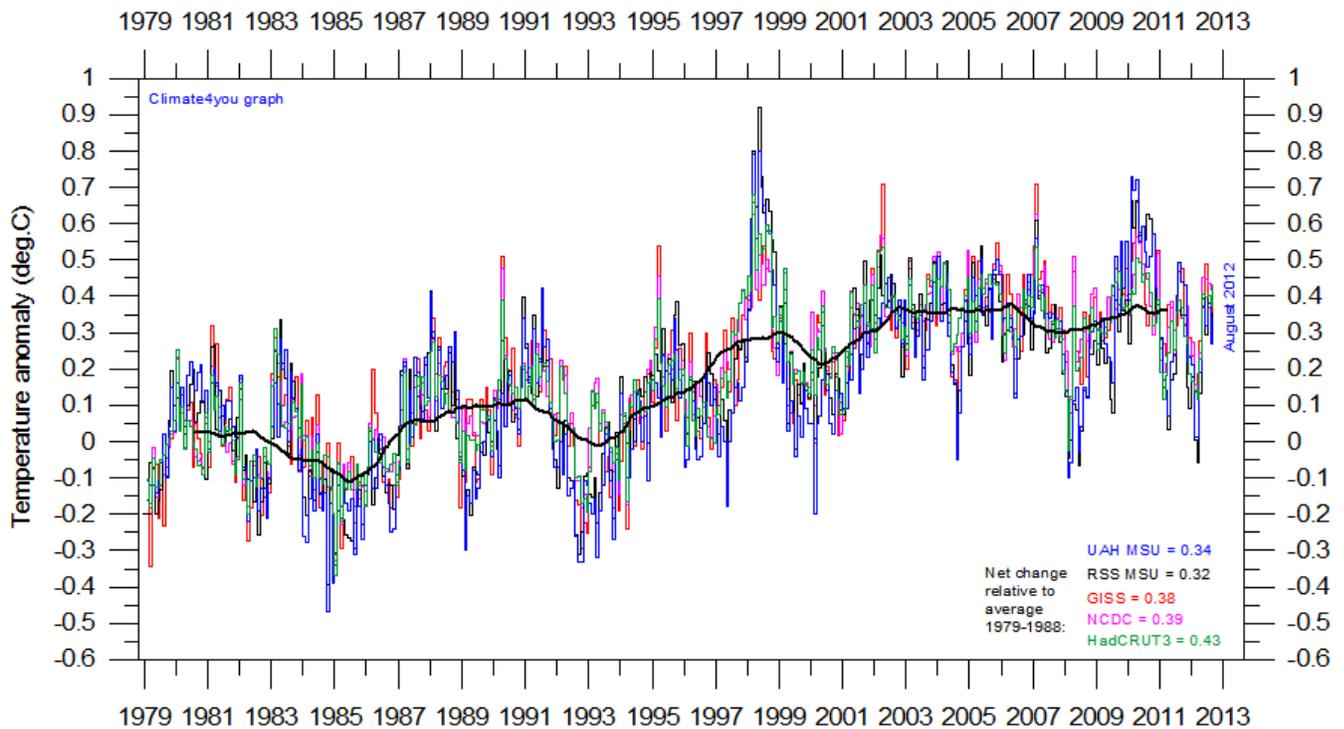
5

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. The two other surface air temperature records, NCDC and GISS, show an apparent systematic change over time, as is illustrated by the diagram on the next page.

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



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*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.*

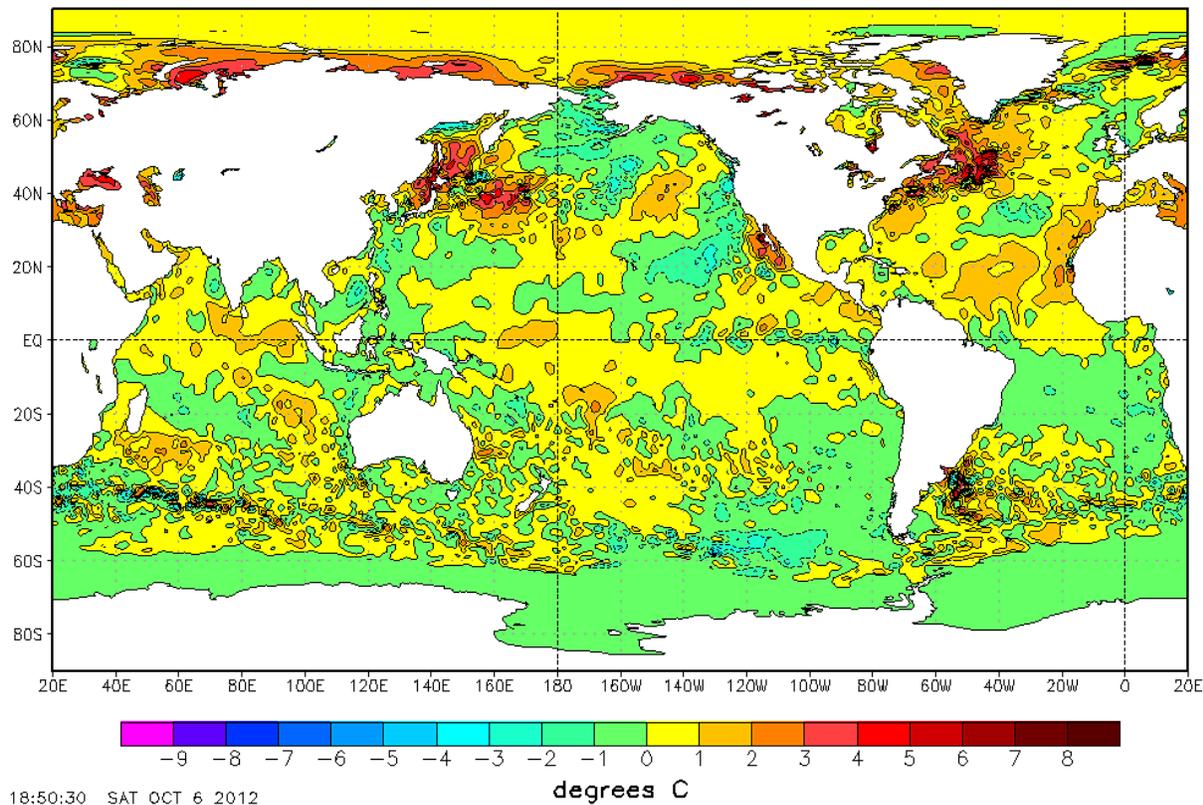
It should be kept in mind that satellite- and surface-based temperature estimates are derived from different types of measurements, and that comparing them directly as done in the diagram above therefore in principle may be problematical. However, as both types of estimate often are discussed together, 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 September 2012

NOAA/NWS/NCEP/EMC Marine Modeling and Analysis Branch

RTG\_SST Anomaly (0.5 deg X 0.5 deg) for 06 Oct 2012



7

*Sea surface temperature anomaly at 6 October 2012. Map source: National Centers for Environmental Prediction (NOAA).*

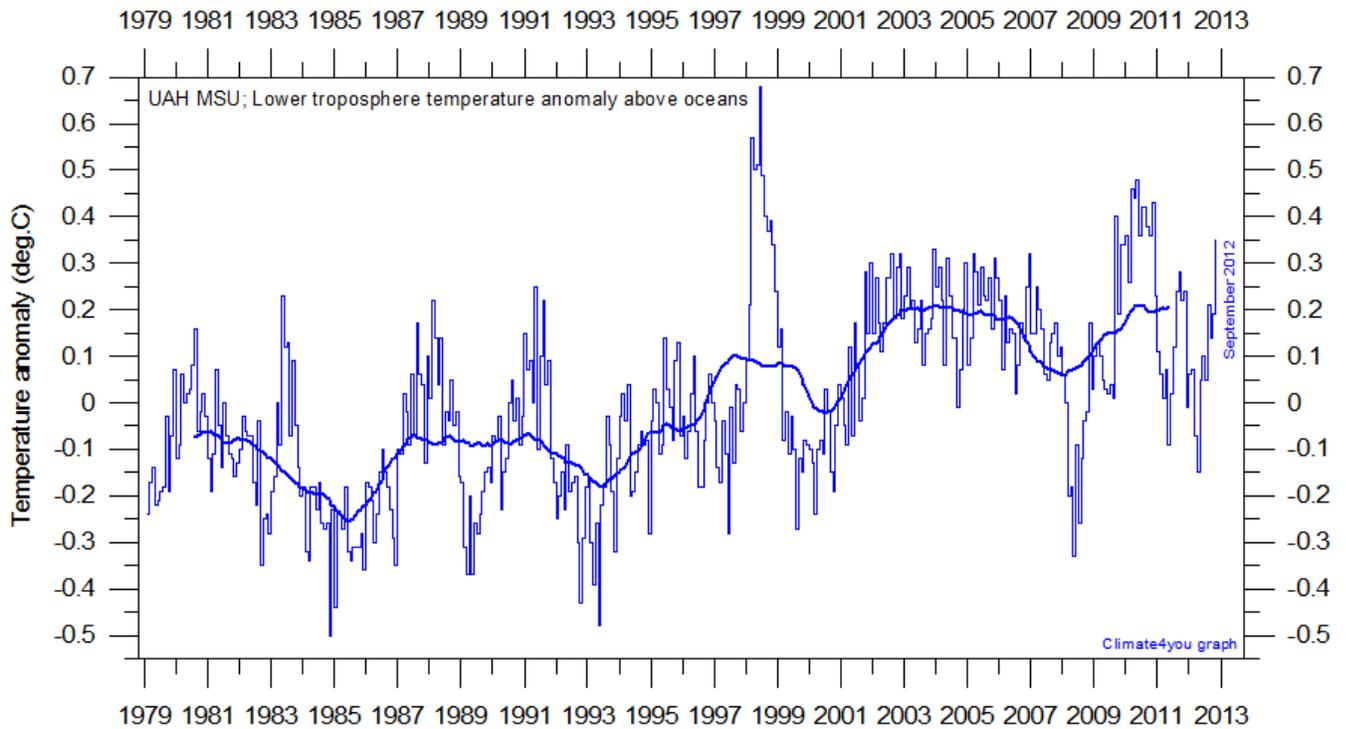
A clear ocean surface temperature asymmetry is apparent between the two hemispheres, with relatively warm conditions in the northern hemisphere, and relatively cold conditions in the southern hemisphere.

The ocean regions near the Equator are dominated by relative warm sea surface water, and the ongoing El Niño episode in the Pacific is still developing.

Because of the large surface areas involved especially near Equator, the temperature of the surface water in these regions clearly affects the global atmospheric temperature (p.3-5).

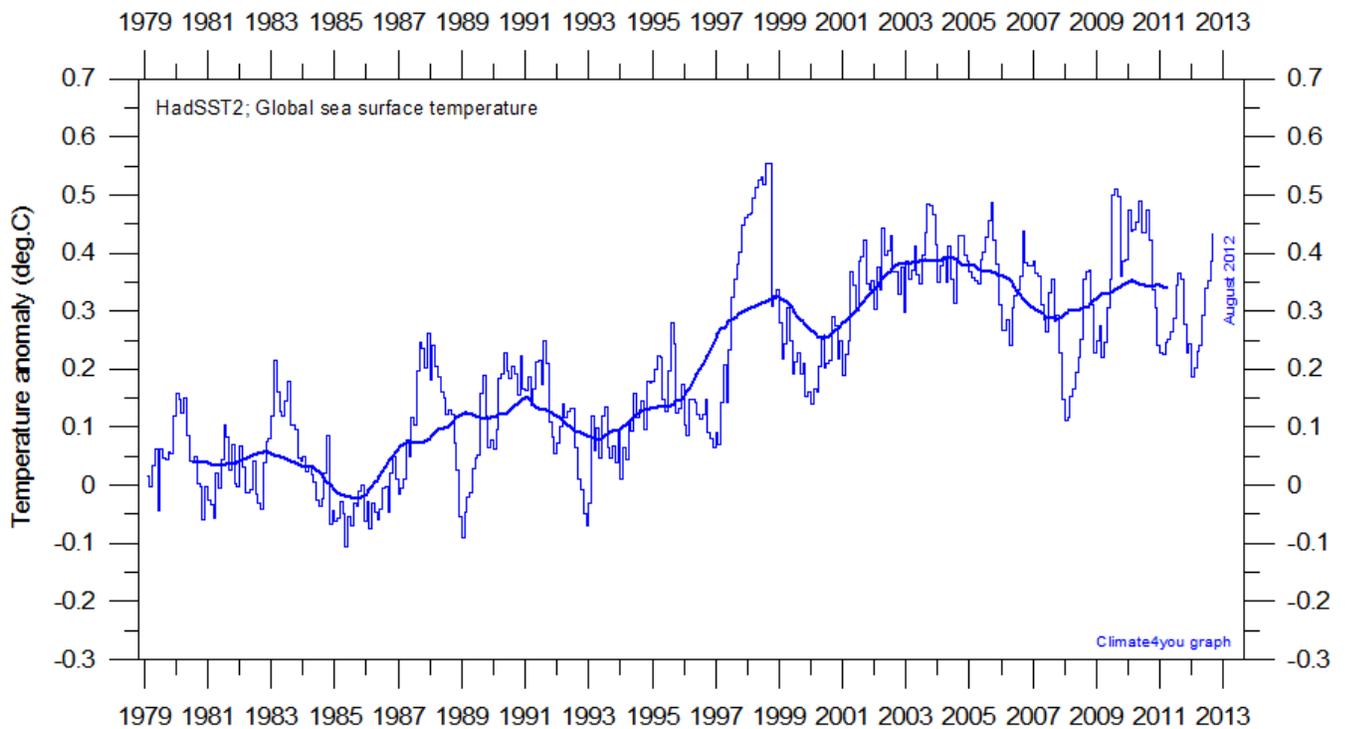
The significance of any such short-term warming or cooling seen in air temperatures should not be overstated. Whenever Earth experiences cold La Niña or warm El Niño episodes (Pacific Ocean) major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in 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.

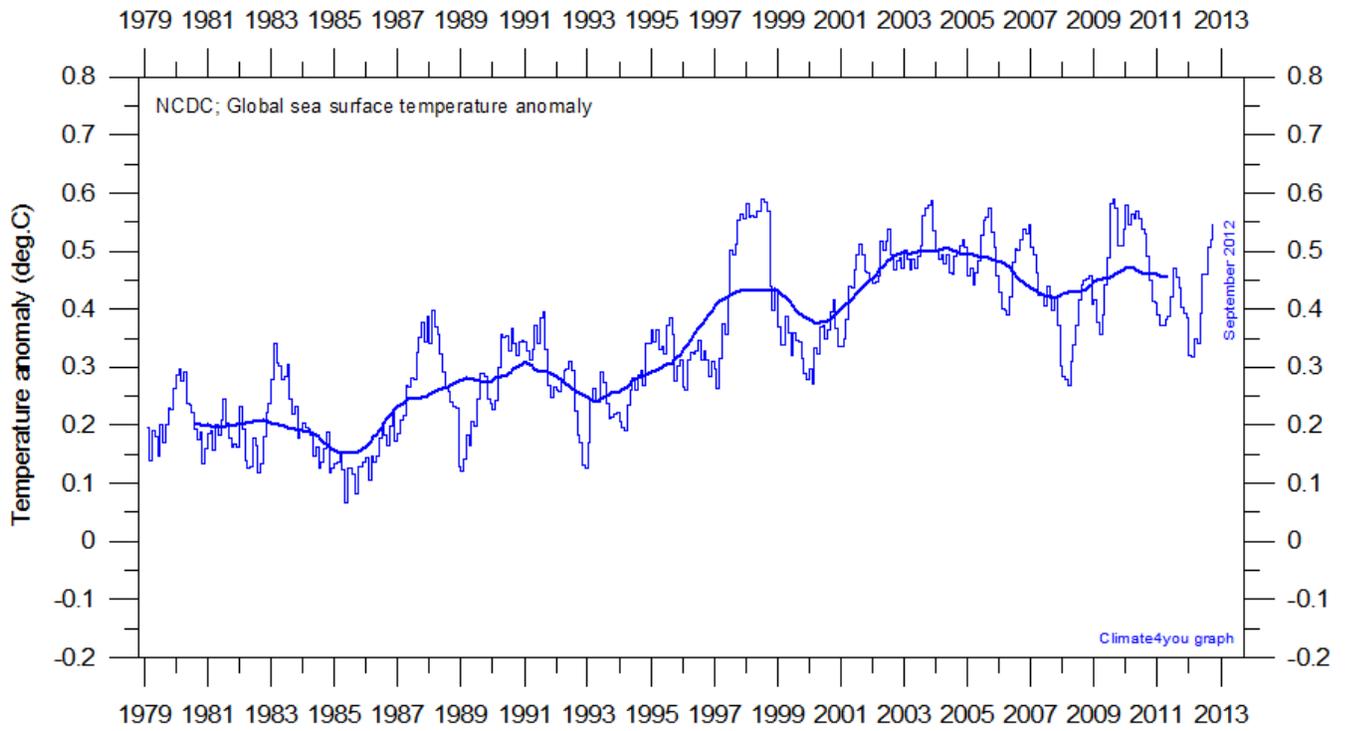


Global monthly average lower troposphere temperature over oceans (thin line) since 1979 according to [University of Alabama](#) at Huntsville, USA. The thick line is the simple running 37 month average.

8

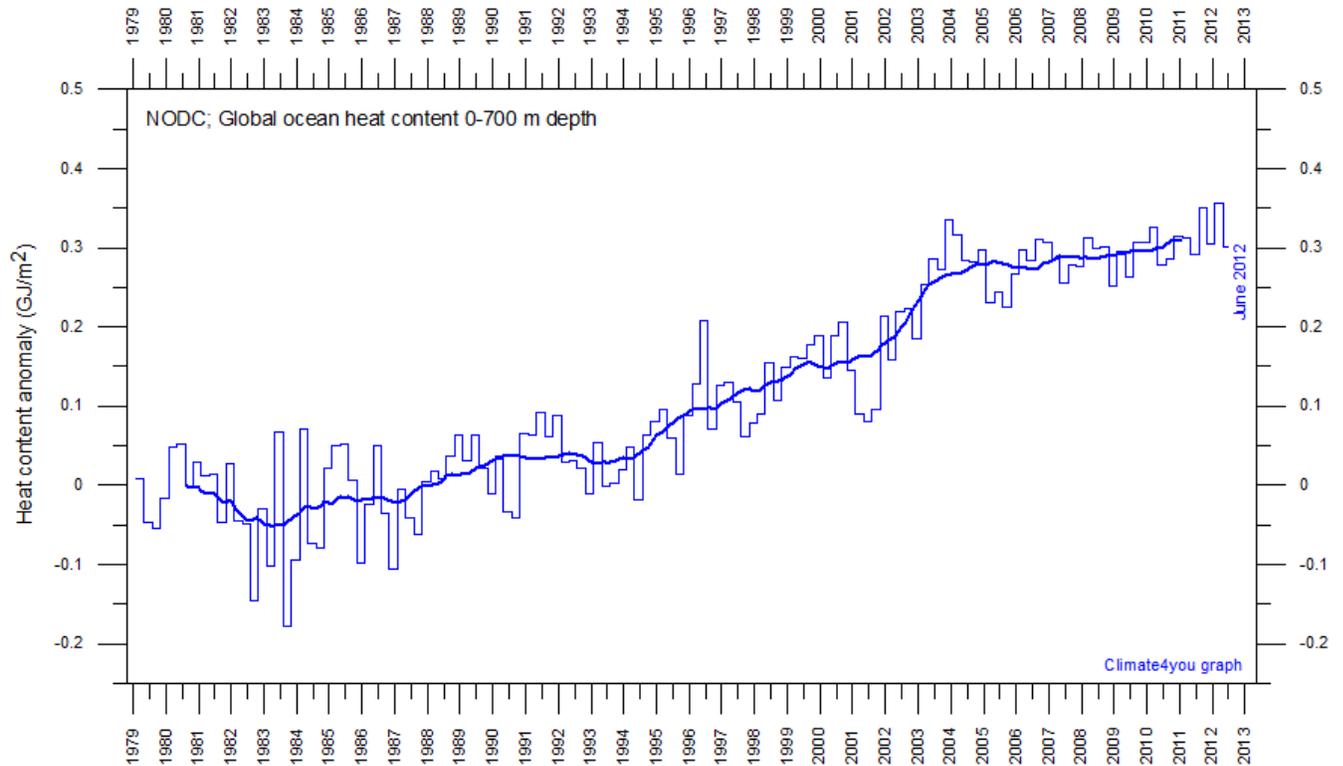


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit \(CRU\)](#), UK. Base period: 1961-1990. The thick line is the simple running 37 month average. Please note that no update beyond August 2012 is available at the moment.



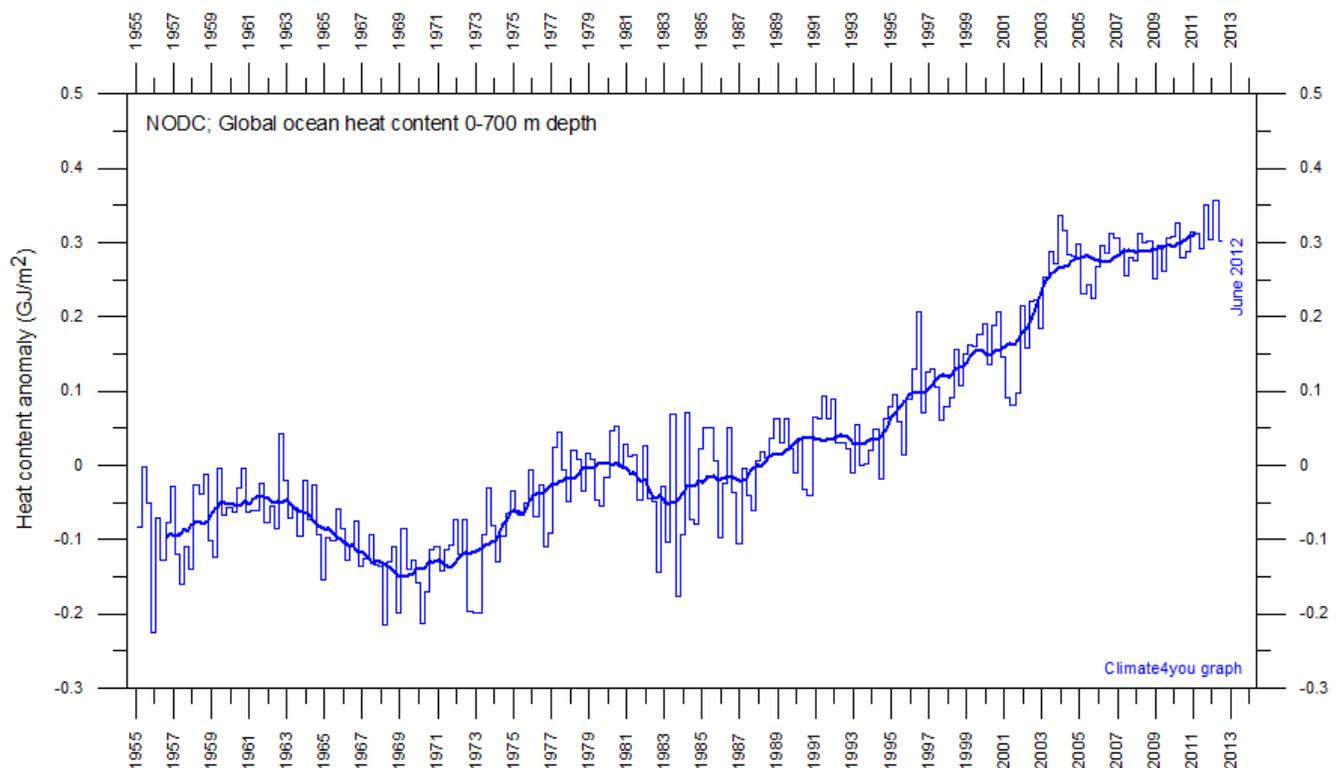
Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center \(NCDC\)](#), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

## Global ocean heat content, updated to June 2012



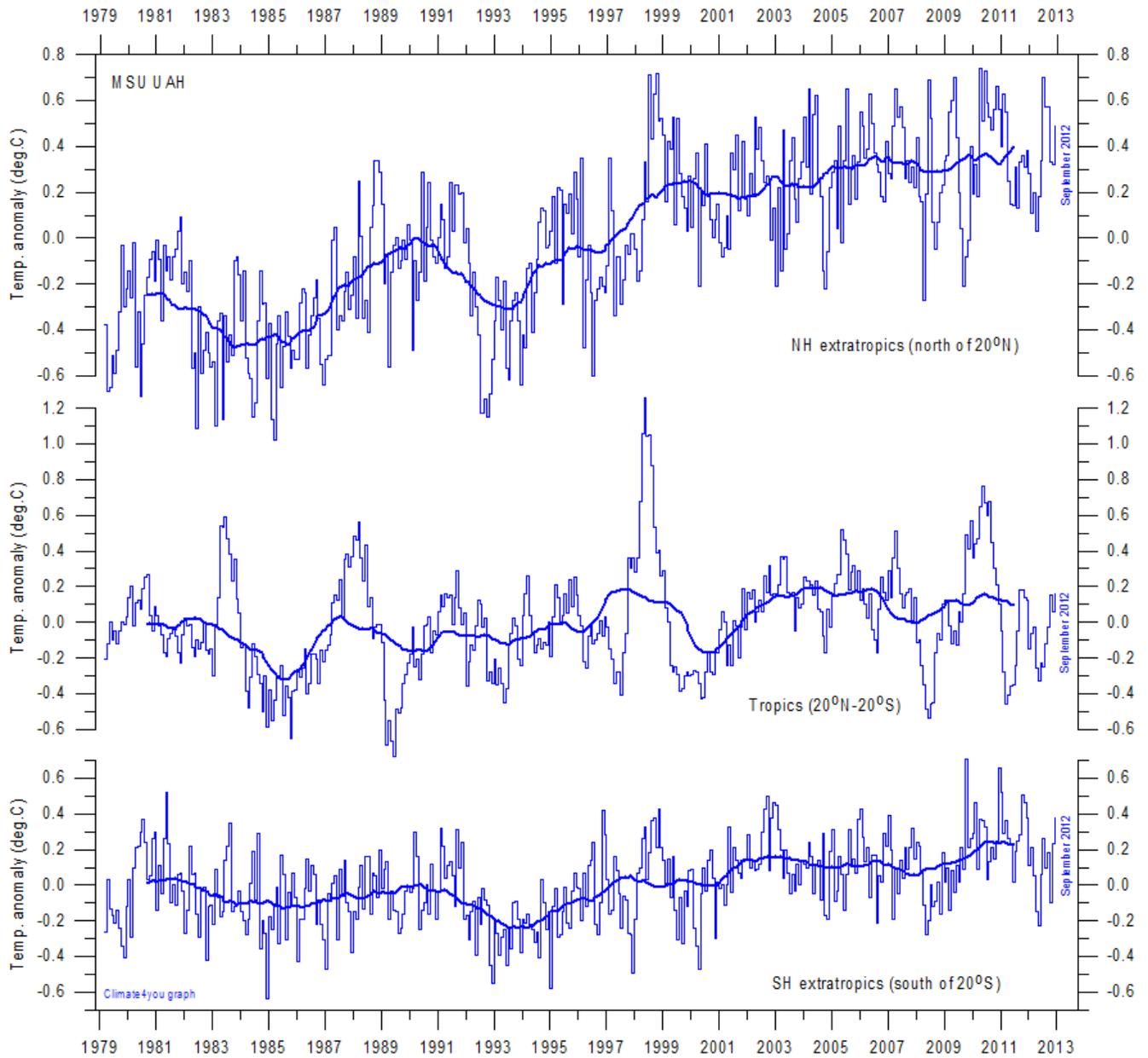
Global monthly heat content anomaly ( $GJ/m^2$ ) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).

10



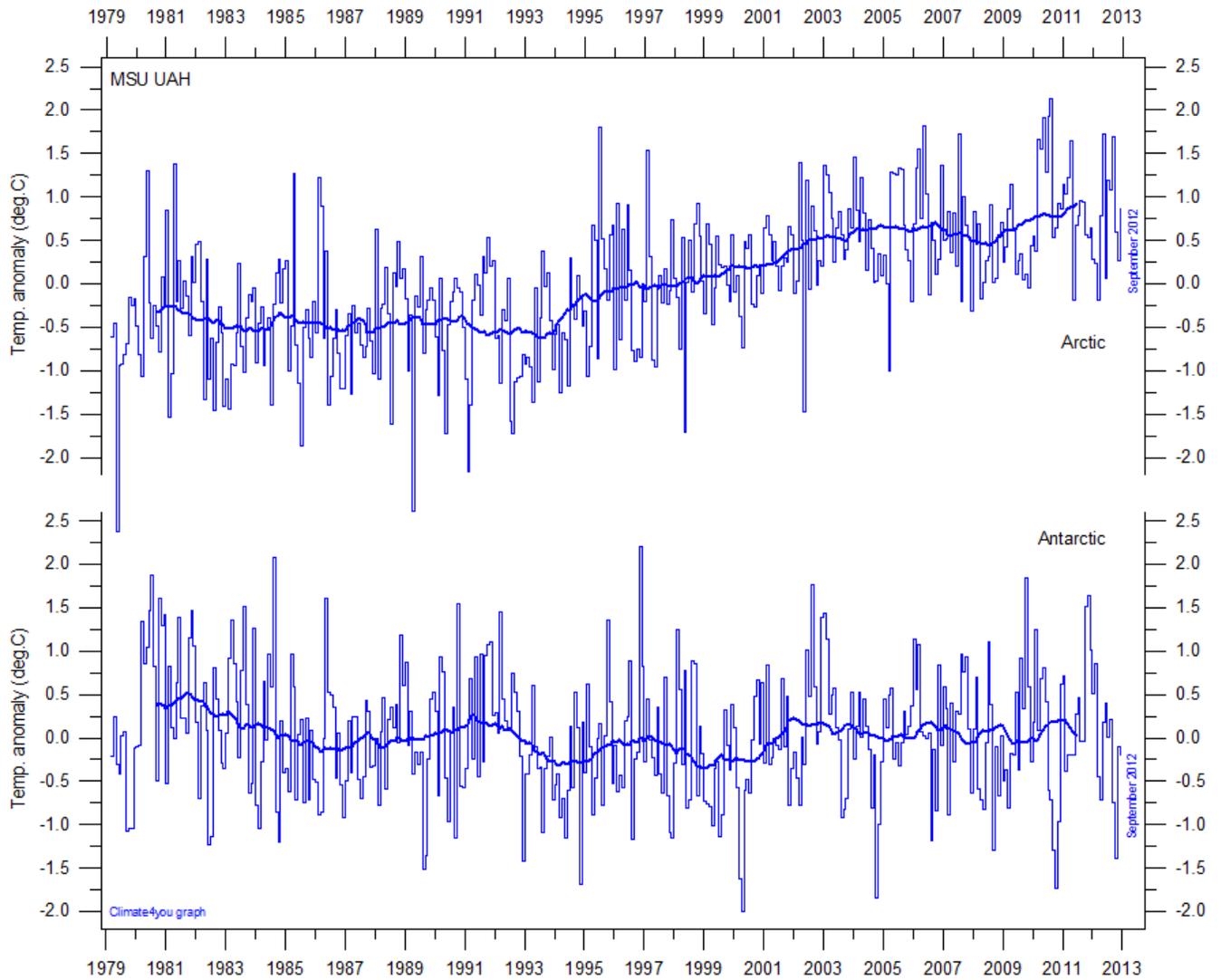
Global monthly heat content anomaly ( $GJ/m^2$ ) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).

## Zonal air temperatures, updated to September 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 September 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 August 2012

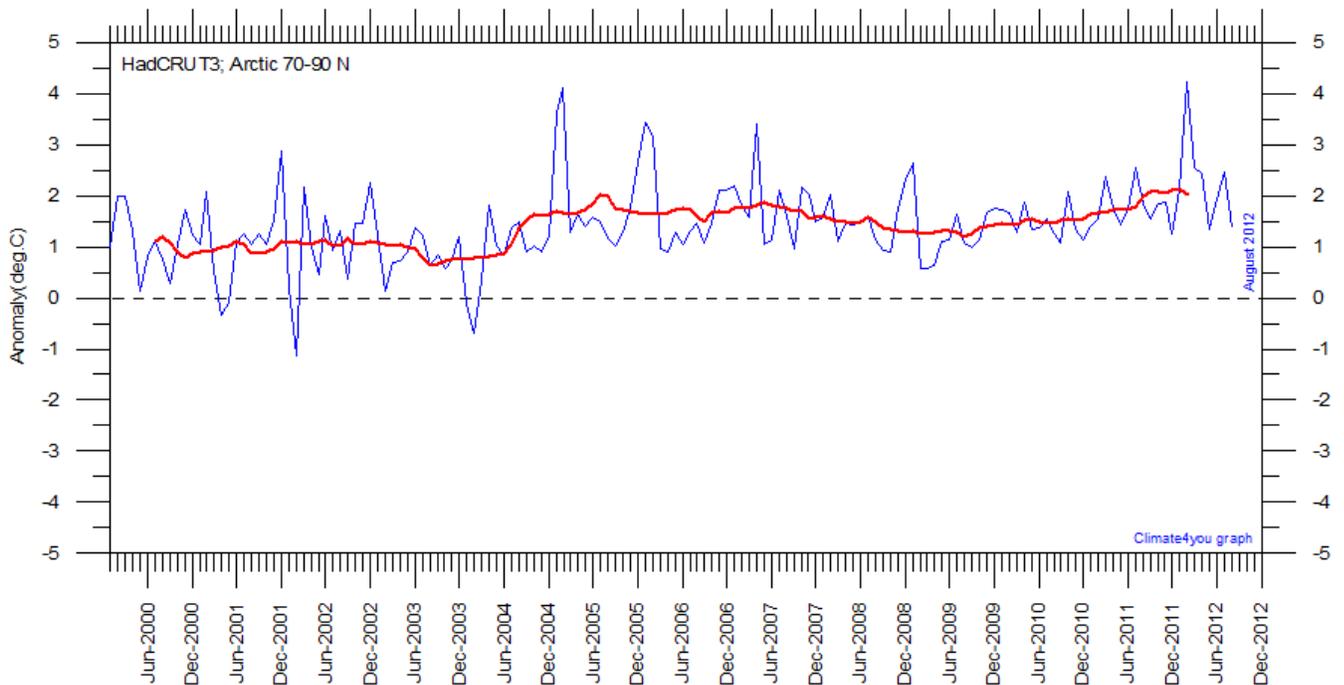


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

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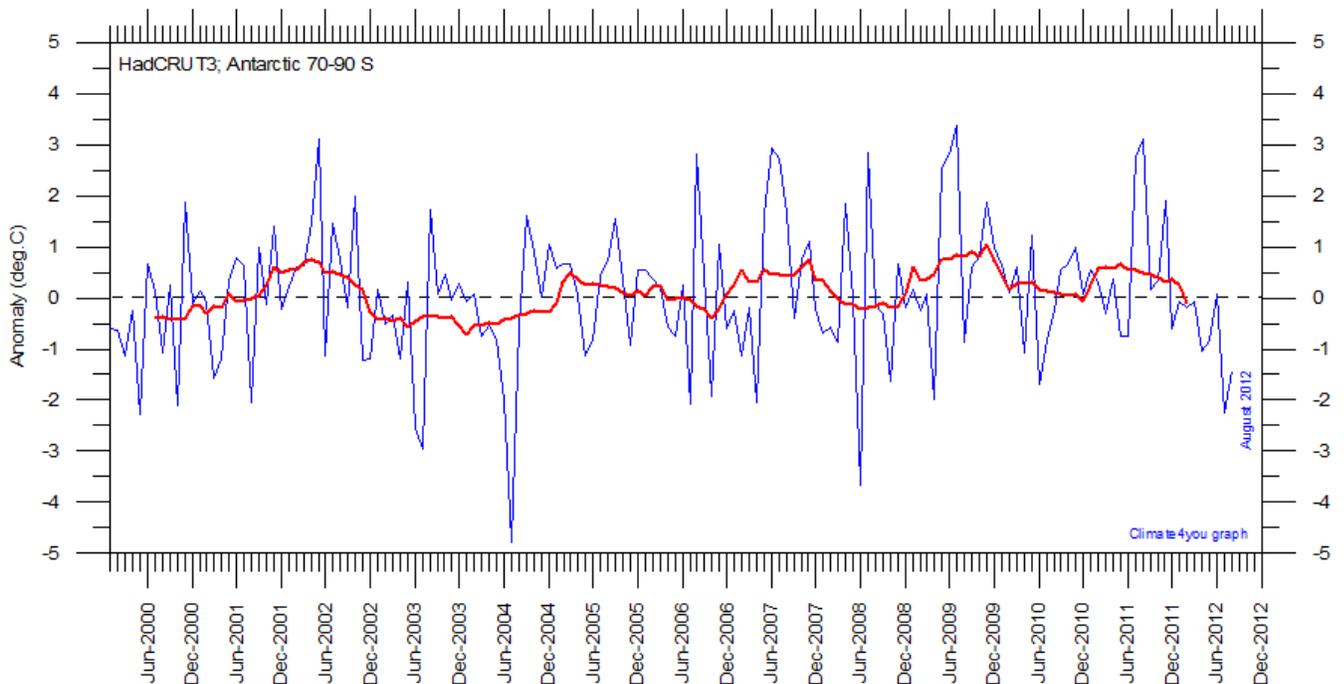


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

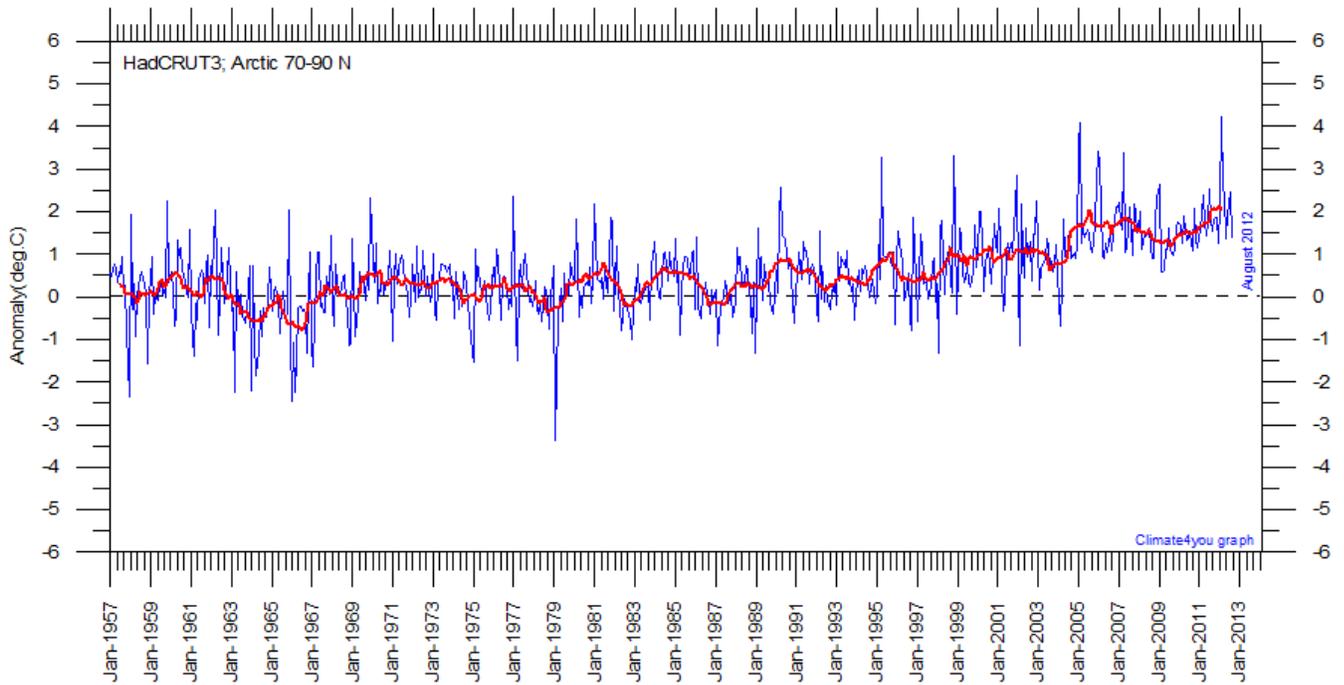


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference “normal” period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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

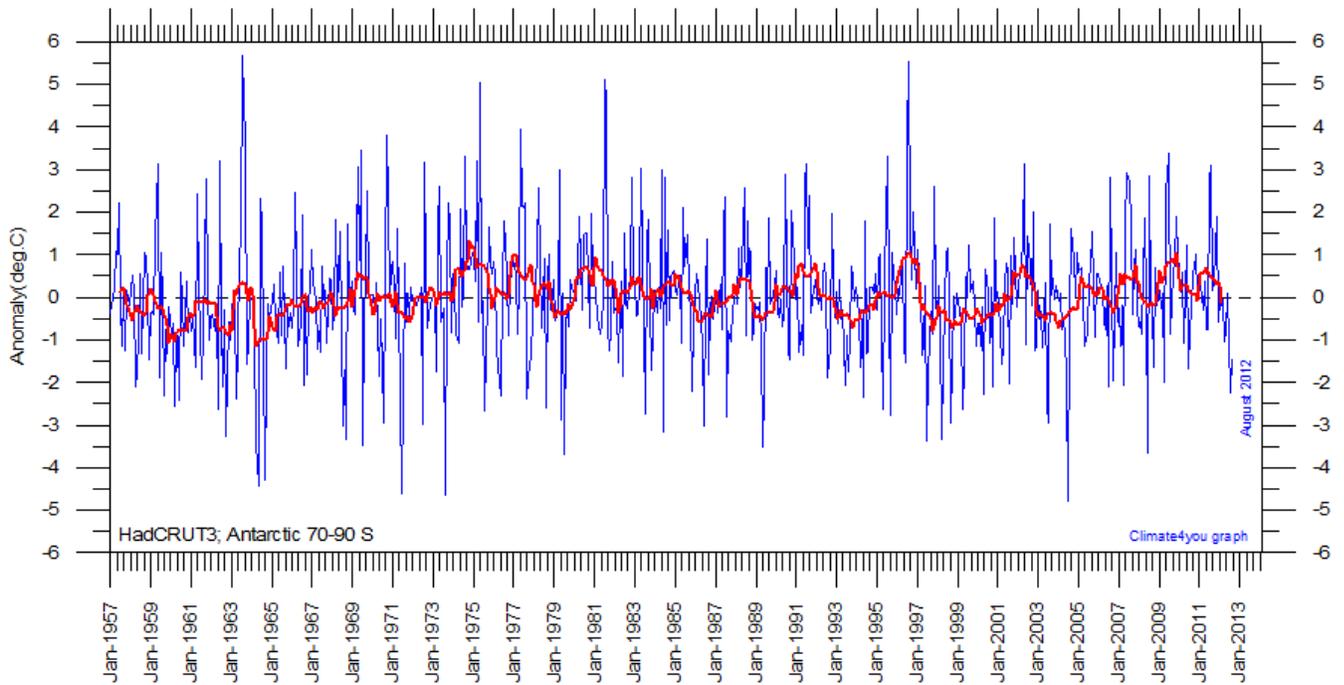


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference “normal” period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

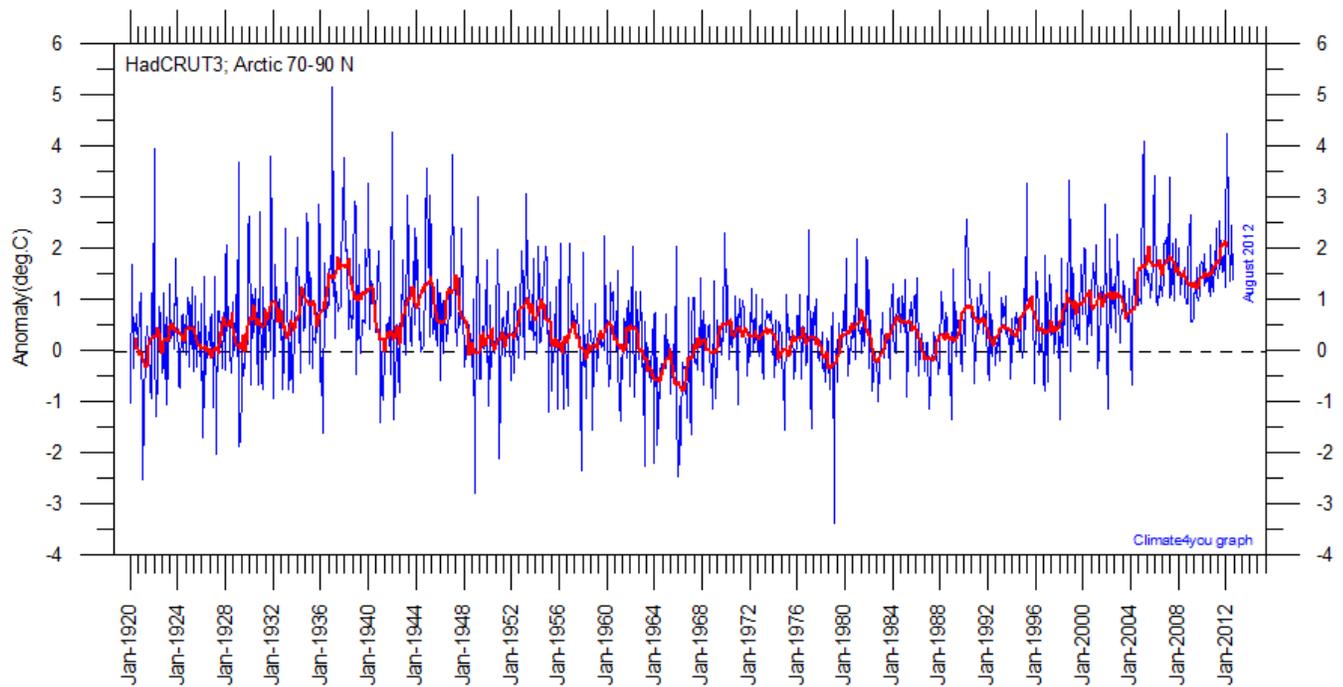


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1920, in relation to the WMO reference “normal” period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly 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, month-to-month variations in the early part of the Arctic temperature record are larger than later. 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

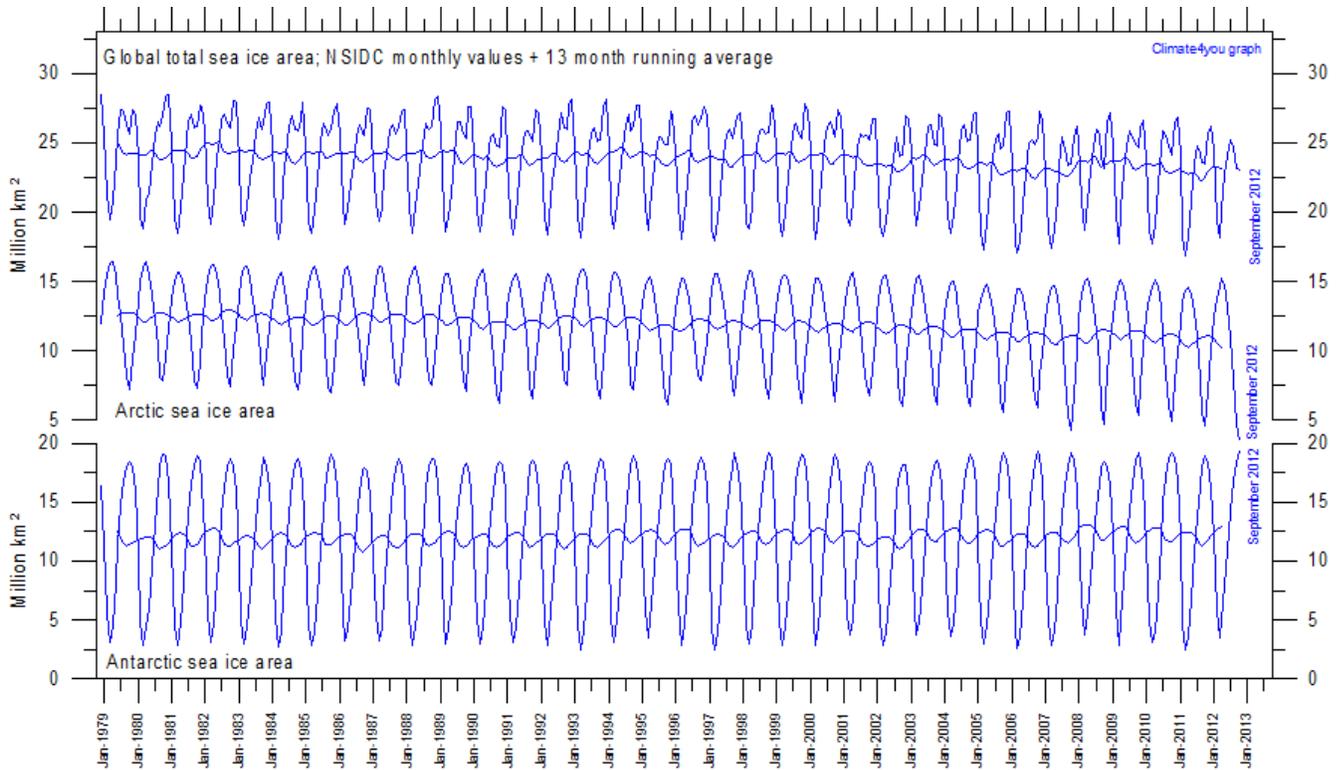
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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 cells.

Literature:

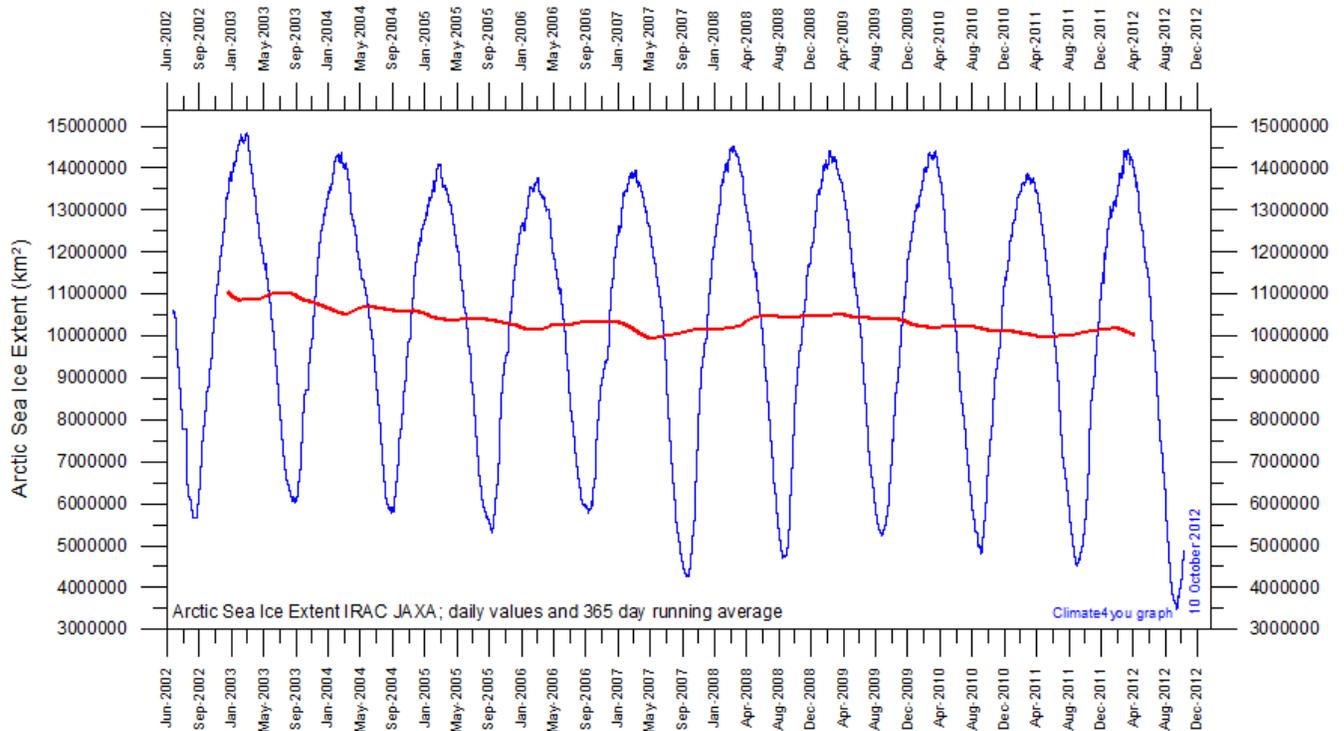
Gillett, N.P., Stone, D.A., Stott, P.A., Nozawa, T., Karpechko, A.Y.U., Hegerl, G.C., Wehner, M.F. and Jones, P.D. 2008. Attribution of polar warming to human influence. *Nature Geoscience* 1, 750-754.

## Arctic and Antarctic sea ice, updated to September 2012



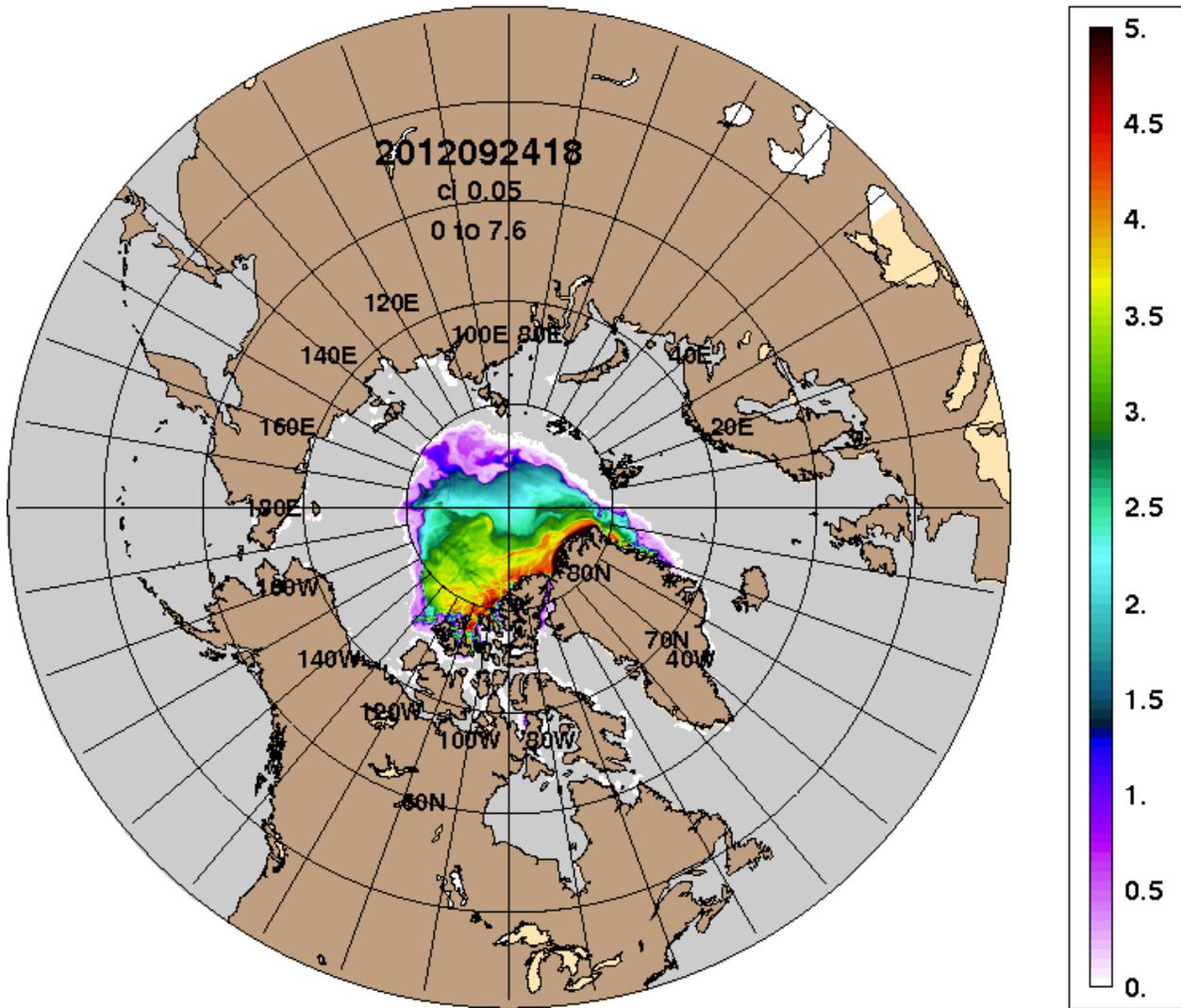
Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center \(NSIDC\)](#).

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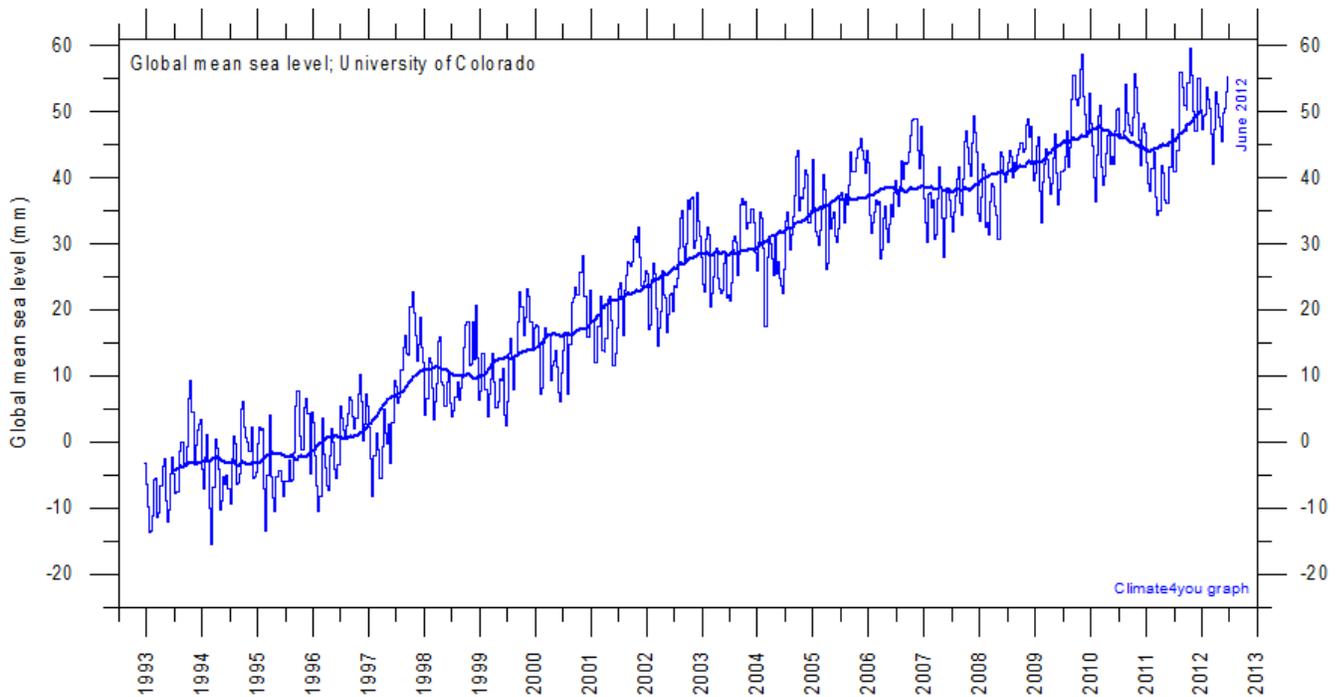
Graph showing daily Arctic sea ice extent since June 2002, to October 10, 2012, by courtesy of [Japan Aerospace Exploration Agency \(JAXA\)](#).

# ARCc0.08-03.5 Ice Thickness: 20120925



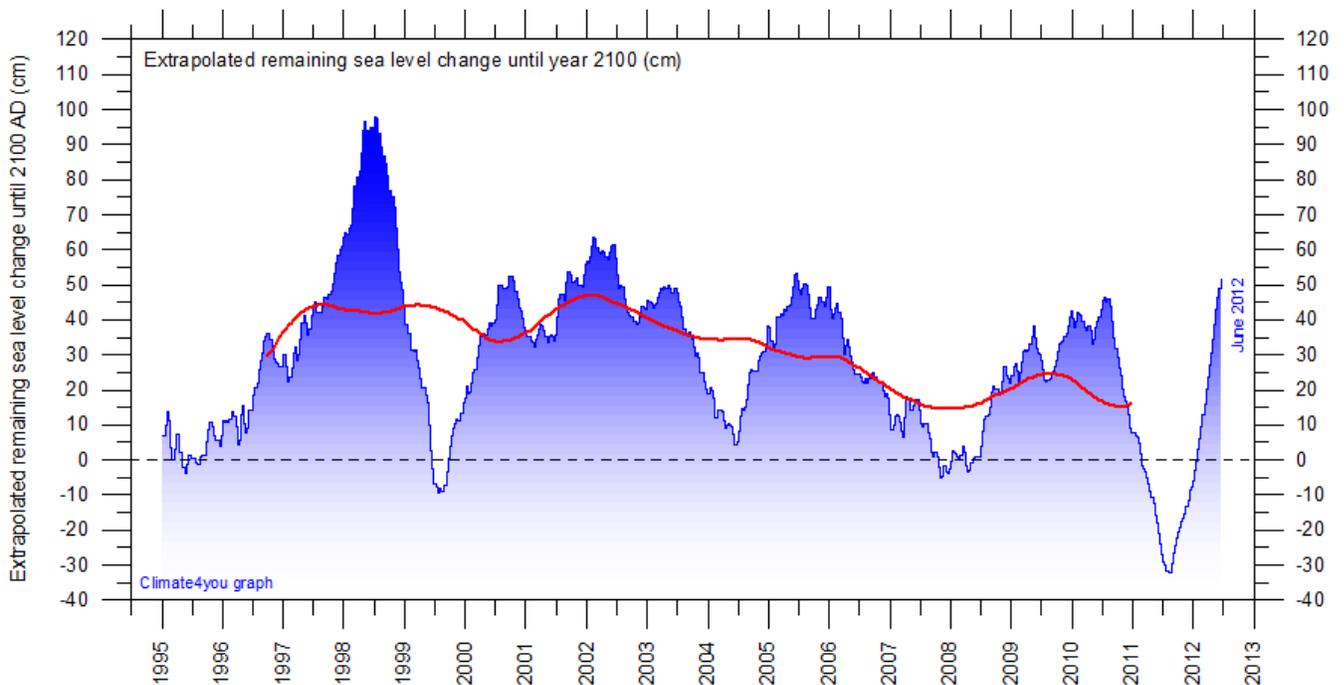
Northern hemisphere sea ice extension and thickness on 25 September 2012 according to the [Arctic Cap Nowcast/Forecast System \(ACNFS\)](#), US Naval Research Laboratory. Thickness scale (m) is shown to the right.

## Global sea level, updated to June 2012



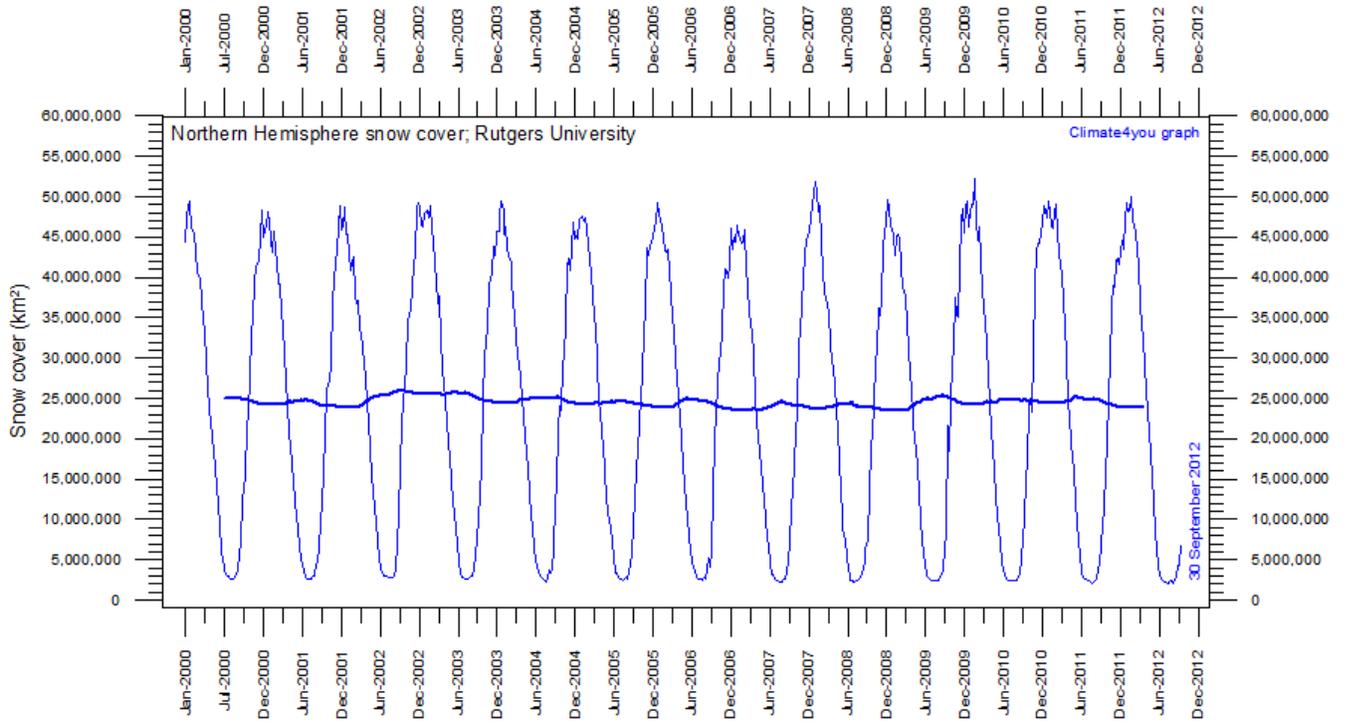
Global monthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](#), USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.

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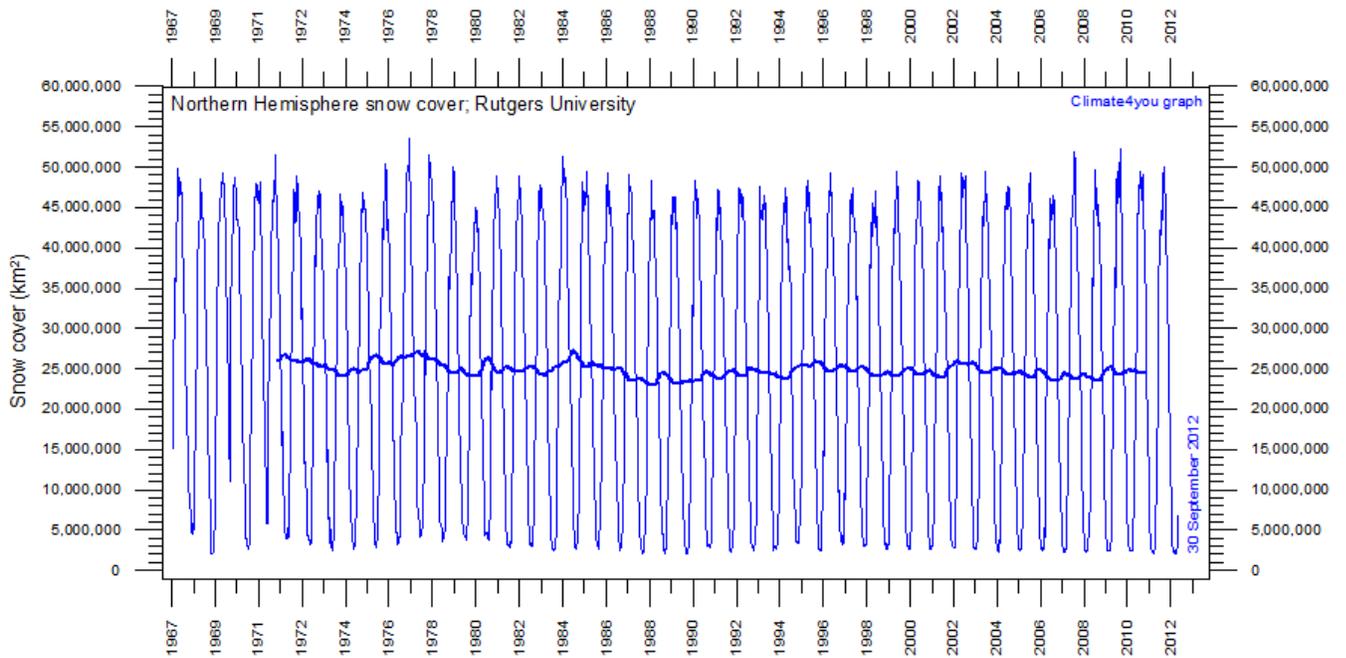
Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](#), USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based on this (thick line), the present simple empirical forecast of sea level change until 2100 is about +17 cm.

## Northern Hemisphere weekly snow cover, updated to late September 2012



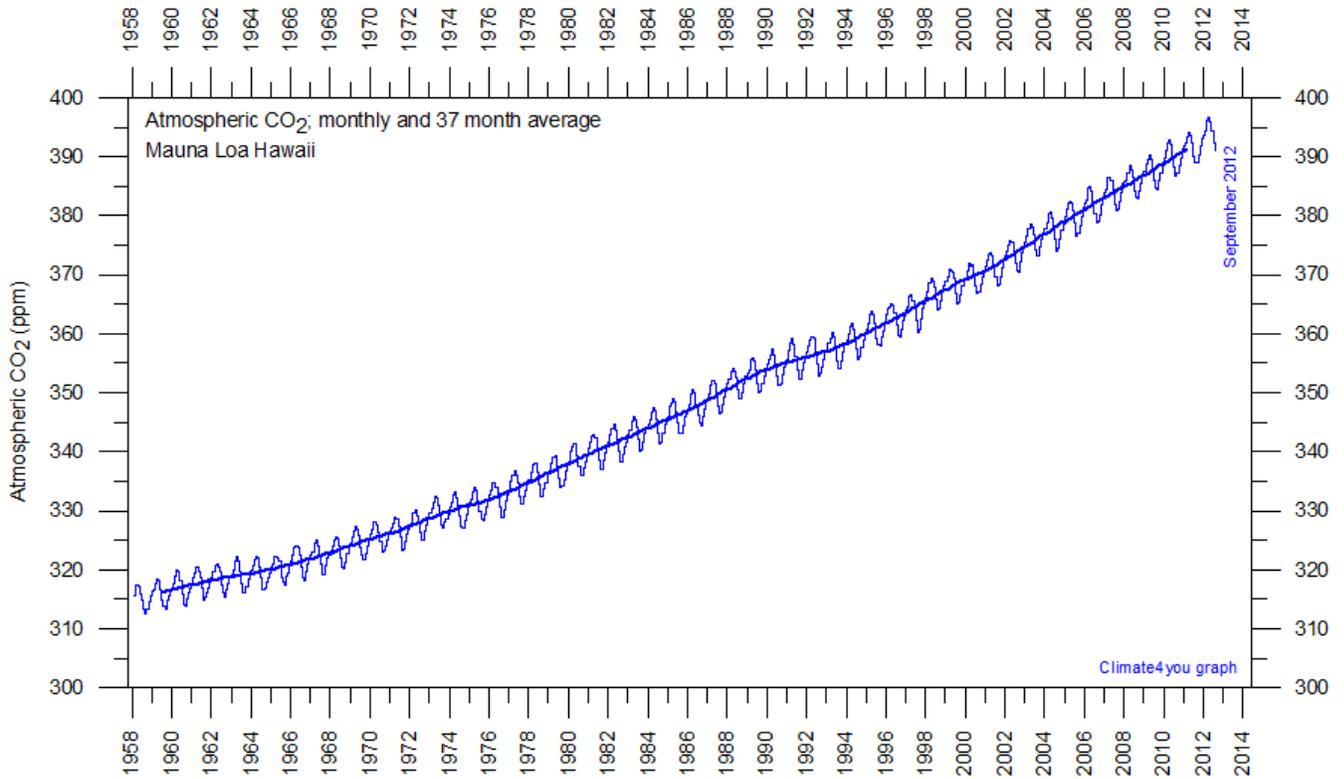
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year).

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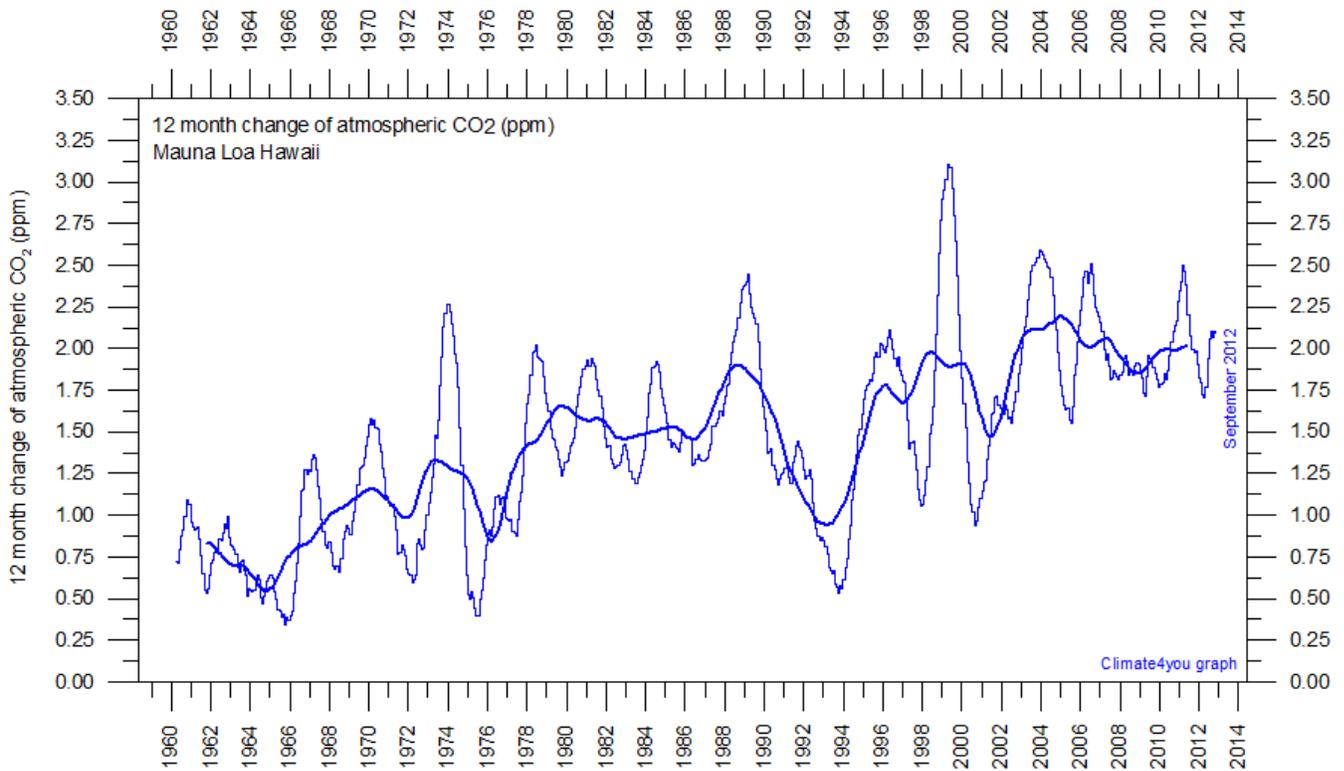


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of data gaps in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

## Atmospheric CO<sub>2</sub>, updated to September 2012

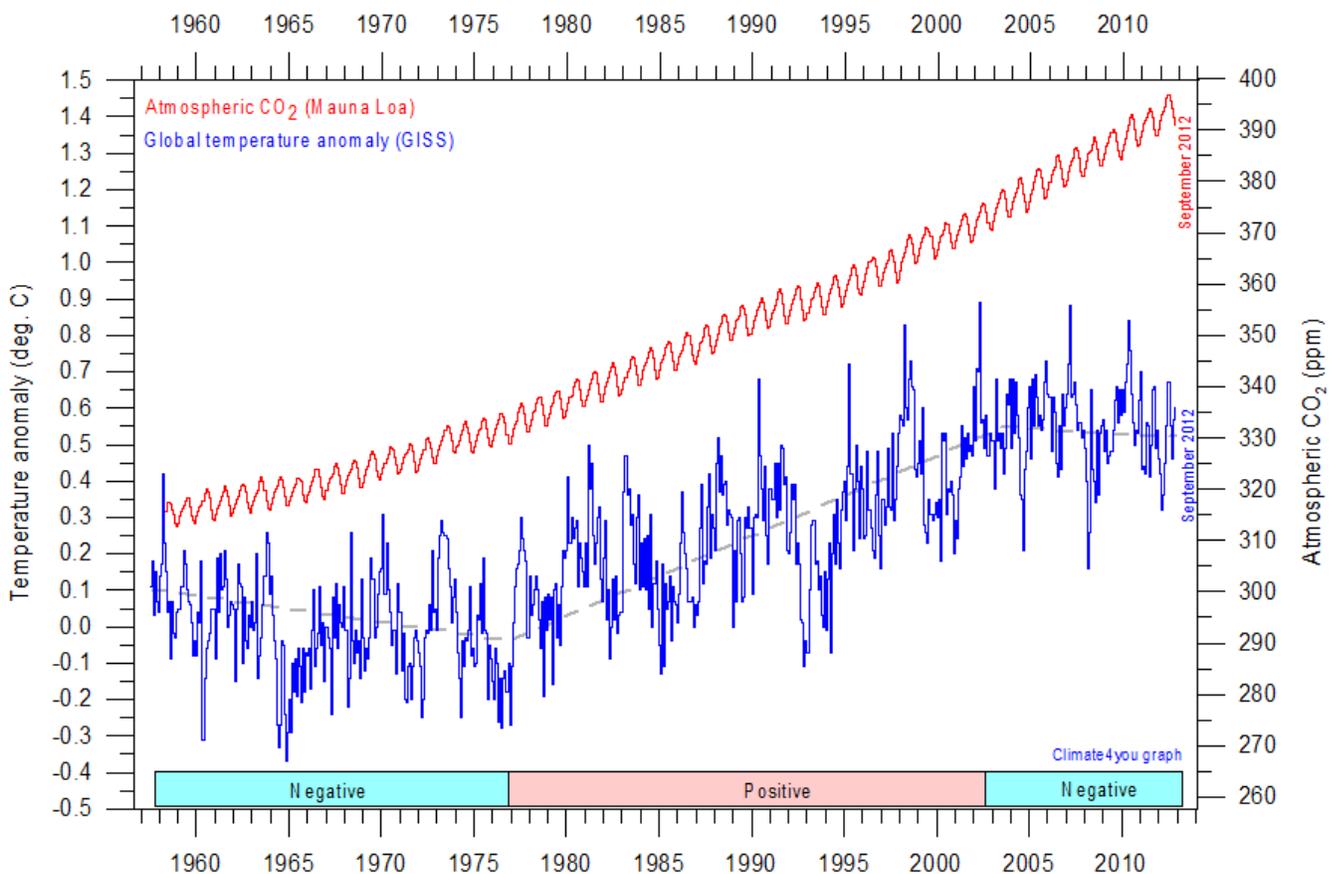
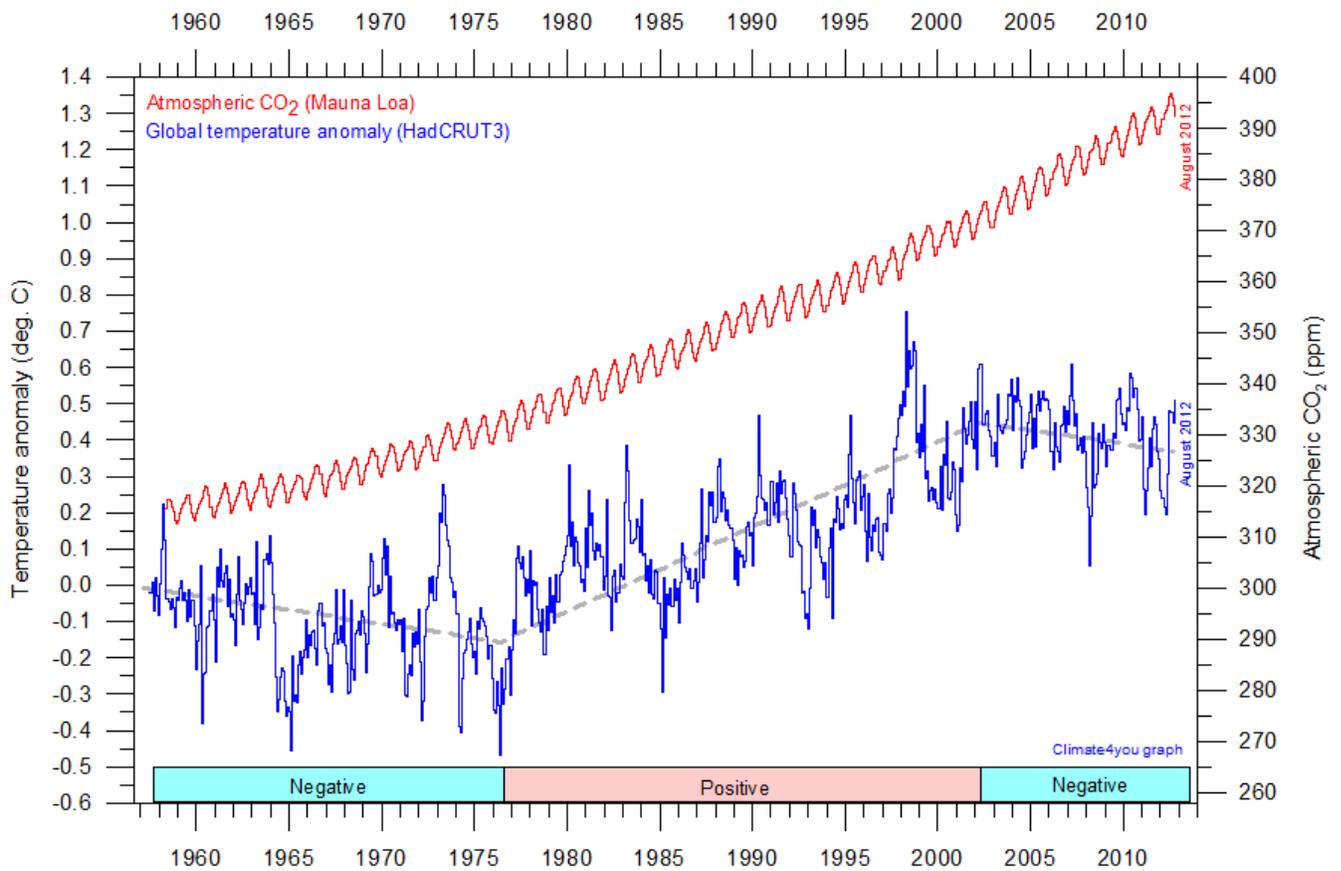


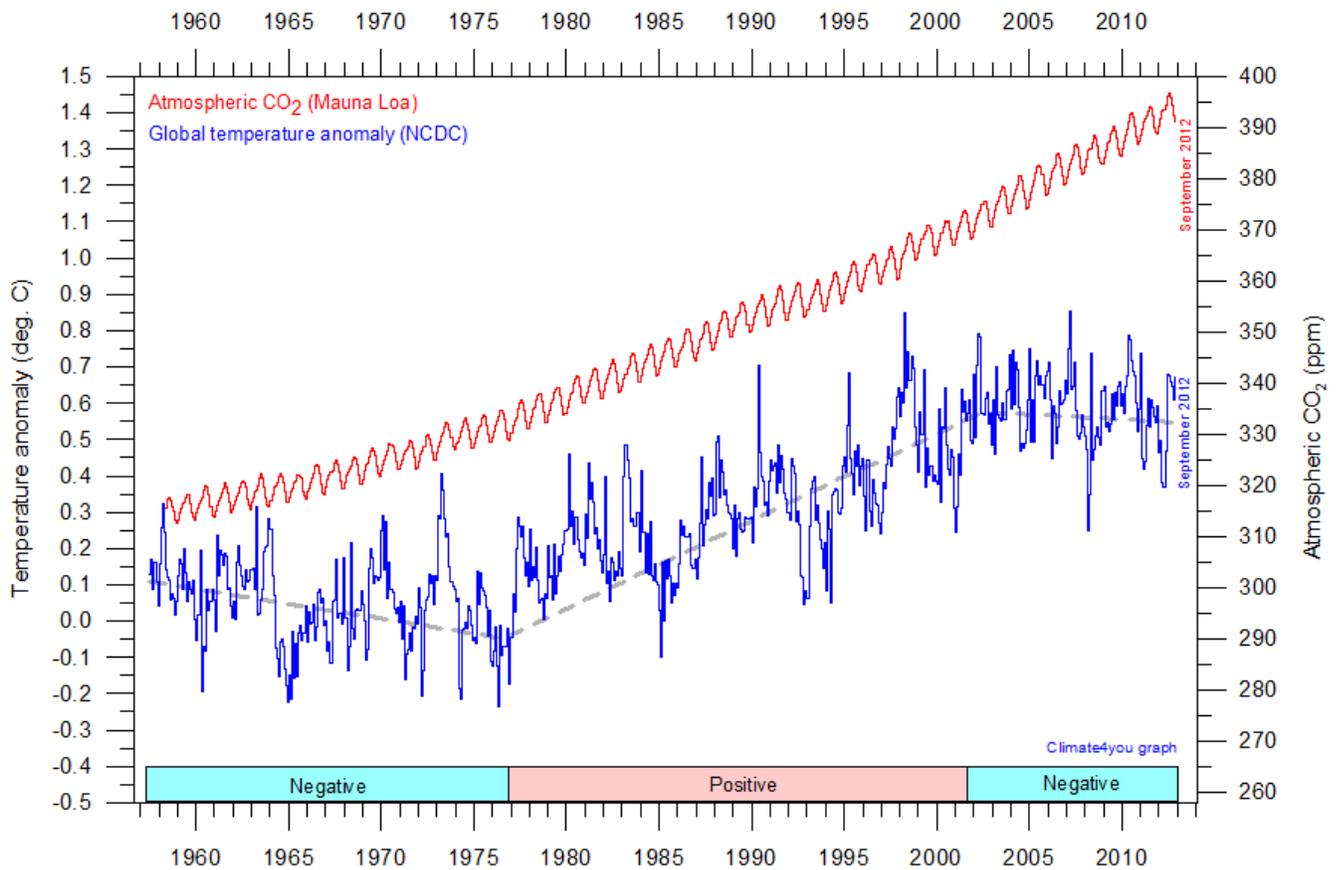
20



Monthly amount of atmospheric CO<sub>2</sub> (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO<sub>2</sub> 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<sub>2</sub>, updated to September 2012





Diagrams showing HadCRUT3, GISS, and NCDC monthly global surface air temperature estimates (blue) and the monthly atmospheric CO<sub>2</sub> 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<sub>2</sub> concentrations (before 1958) are not incorporated in this diagram, as such past CO<sub>2</sub> 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<sub>2</sub> and global surface air temperature, negative or positive. Please note that the HadCRUT3 diagram has not yet been updated beyond July 2012.

Most climate models assume the greenhouse gas carbon dioxide CO<sub>2</sub> to influence significantly upon global temperature. It is therefore relevant to compare different temperature records with measurements of atmospheric CO<sub>2</sub>, 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<sub>2</sub> on short time scales such as just a few years. It is of course equally inappropriate to present new meteorological record values, whether daily, monthly or annual, as support for the hypothesis ascribing high

importance of atmospheric CO<sub>2</sub> 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<sub>2</sub> remains elusive, and is still a topic for discussion. However, the critical period length must be inversely proportional to the temperature sensitivity of CO<sub>2</sub>, including feedback effects. If the net temperature effect of atmospheric CO<sub>2</sub> is strong, the critical time period will be short, and vice versa.

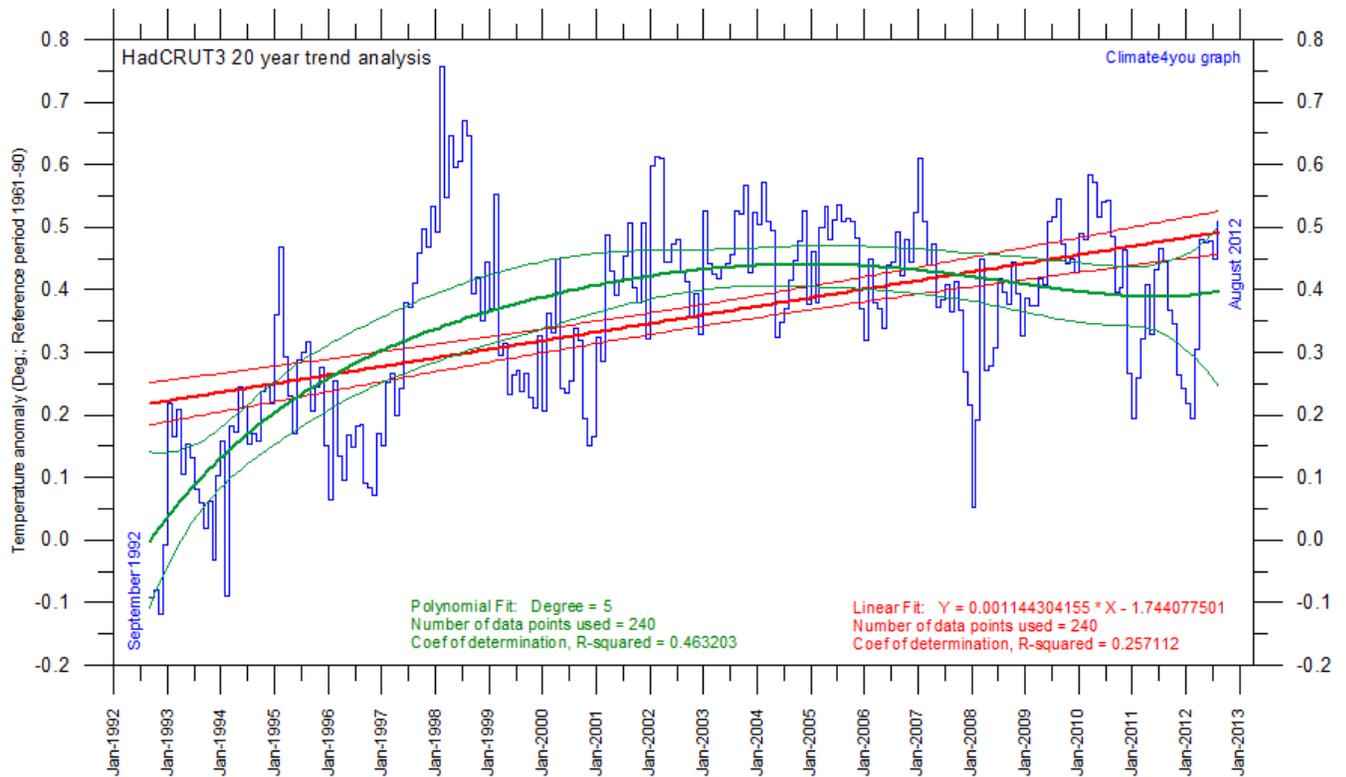
However, past climate research history provides some clues as to what has traditionally been considered the relevant length of period over which to compare temperature and atmospheric CO<sub>2</sub>. After about 10 years of concurrent global temperature- and CO<sub>2</sub>-increase, IPCC was established in 1988. For obtaining public and political support for the CO<sub>2</sub>-hypothesis the 10 year warming period leading up to 1988 in all likelihood was important. Had the global temperature instead been decreasing, political support for the hypothesis would have been difficult to obtain.

Based on the previous 10 years of concurrent temperature- and CO<sub>2</sub>-increase, many climate

scientists in 1988 presumably felt that their understanding of climate dynamics was sufficient to conclude about the importance of CO<sub>2</sub> 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<sub>2</sub> 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 CO<sub>2</sub> has been indicated in the lower panels of the diagrams above.

## Last 20 year surface temperature changes, updated to August 2012



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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.

## 1576-1578: Martin Frobisher attempts to find the Northwest Passage



*Sir Martin Frobisher painted by Cornelis Ketel in 1577 (left). World map used by Frobisher on his first voyage to the Arctic, produced 1569 by the geographer Gerardus Mercator (centre). The map indicates the existence of a broad channel between the New World (North America; lower left) and a continent with four big river systems in the centre of the Arctic Ocean. Frobisher's route from England to Baffin Island (right).*

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[Sir Martin Frobisher](#) (1535-1594) was an English seaman who became known for his three voyages to northeastern Canada to find the [Northwest Passage](#). As early as around 1560, Frobisher had decided to undertake a voyage in search of a Northwest Passage as a trade-route to India and China (Cathay).

In 1576, at last, Frobisher had gained the necessary funding for his project. He managed to convince the English merchant consortium the [Muscovy Company](#), which previously had sent out parties searching for the Northwest Passage, to license his expedition.

With the help of Micheal Lok, the Muscovy Company's director, Frobisher was able to raise enough capital for three small ships: the *Gabriel* and *Michael*, of about 20-25 tons each, and a [pinnace](#) of ten tons, with a total crew of

35. He set sail for the New World on June 7, 1576. In a storm, however, the pinnace was lost, and the *Michael* was abandoned, but on July 28, the *Gabriel* sighted the coast of Labrador. Frobisher turned north, and a few days later the mouth of [Frobisher Bay](#) (Baffin Island) was reached. Sea ice and wind made further travel north impossible, and Frobisher therefore determined to sail westward up this passage to see where it lead.

Frobisher landed on [Baffin Island](#) on the 18 August 1576, and the expedition met a group of Inuits. He agreed with one of the Inuits to guide them through the region, and sent five of his men in a ship's boat to return the person to shore. The boat's crew, however, were apparently taken captive by the Inuits, without Frobisher being able to recover them. He therefore took hostage the man who had

agreed to guide them, to see if an exchange for the captured five men could be arranged. The effort was however fruitless, and the men were never seen again. Frobisher then turned homewards, and reached London on October 9. Here he presented a piece of black stone as representing potentially valuable gold ore. Not all experts agreed entirely on this geological interpretation, but The Muscovy Company nevertheless in a skilled way used Frobishers assessment of the rock to lobby for investment for another voyage.

During the following year, 1577, a second and much bigger expedition was prepared. The English Queen now was very supportive, and sold the Royal Navy ship *Ayde* to the expedition (the Company of Cathay) and provided £1000 to cover the expenses of the expedition. The Company of Cathay was granted a charter from the crown, giving the

company the sole right of sailing in every direction but the east. Frobisher himself was appointed high admiral of all lands and waters that might be discovered by him.

With the three ships *Ayde*, *Gabriel* and *Michael* the expedition left on 25 May 1577 with 150 men, including miners, refiners, a number of gentlemen, and soldiers. Hall's Island at the mouth of Frobisher Bay was reached on 17 July. A few days later the region and the south side of the bay was solemnly taken possession of in the queen's name.

The following time was spent in collecting ore, and only little was done in the way of geographical discovery. There was parleying and some skirmishing with the Inuits, and futile attempts were made to recover the five men captured during the first expedition. A couple of Inuits were taken prisoner and brought back to England for display and study.



*Contact between Martin Frobisher's expedition and the Inuits of Baffin Island (left). Drawings of two Inuits brought back to England (centre and right).*

The return journey was begun on 23 August 1577, and the expedition arrived back in England on 23 September, with about 200 tons of alleged gold ore. Frobisher was received by

the queen, who decided to name the newly discovered territory *Meta Incognita*. On this promising background, it was resolved to send

out a third expedition, to establish a colony of 100 men.

The third expedition left Harwich on 30 June 1578, with no less than fifteen vessels. June 20 Southern Greenland was reached, and Frobisher and some of his men managed to land, but without meeting any local inhabitants. A few days later, on 2 July, the mouth of Frobisher Bay was sighted. Stormy weather and sea ice prevented the ships to proceed up the bay, and caused the loss of one ship. The remaining ships were forced to retreat into a unknown strait ([Hudson Strait](#)). After proceeding about sixty miles up this "mistaken strait," Frobisher with reluctance turned back, and the fleet at last came to anchor in Frobisher Bay.

Some attempt was made at founding a settlement, and a large quantity of ore was

shipped. A successful settlement, however, was prevented by dissension and discontent. On the last day of August, the fleet set out on its return to England, which was reached in the beginning of October. The ore was taken to a specially constructed smelting plant. Here it unfortunately turned out that the ore was not worth smelting, but instead it made good use in Elizabethan road construction. This ended Frobisher's attempts at the Northwest Passage.

Martin Frobisher still proved interested in economical aspects of life, and later as an English pirate collected riches from French ships. He was later knighted for his service in the dispersion of the [Spanish Armada](#) in 1588, under the supreme command of [Sir Francis Drake](#).

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All the above diagrams with supplementary information, including links to data sources and previous issues of this newsletter, are available on [www.climate4you.com](http://www.climate4you.com)

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

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