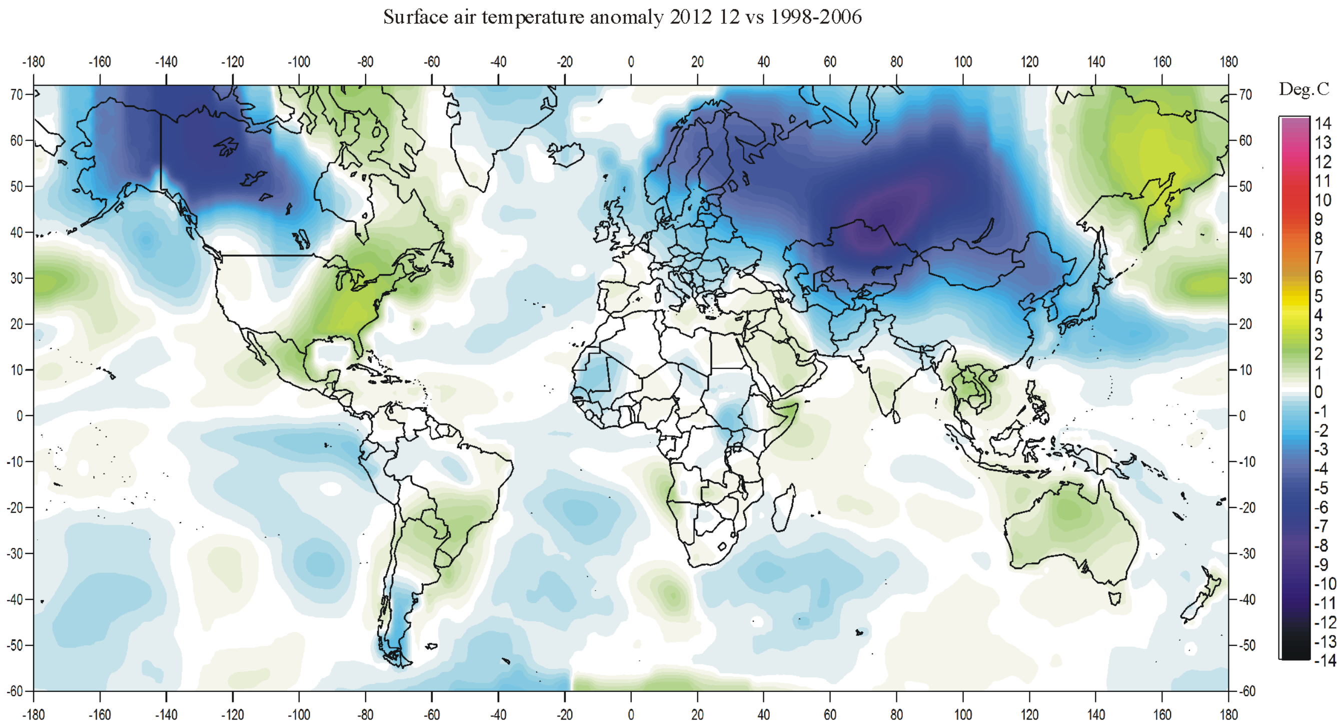
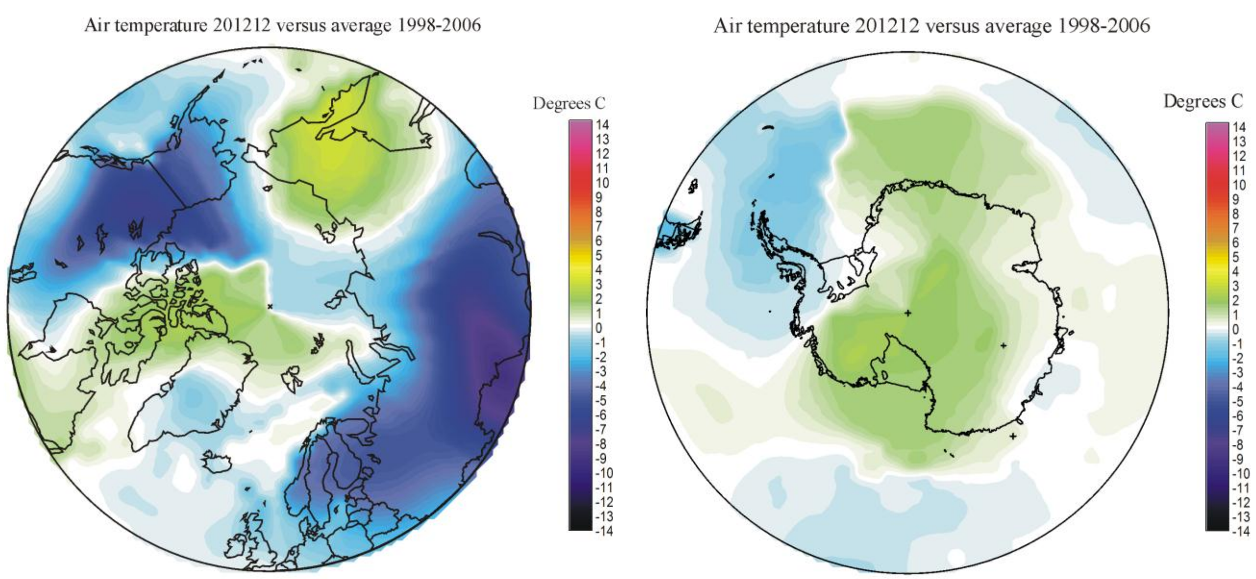
# Climate4you update December 2012

www.climate4you.com

## December 2012 global surface air temperature overview




*December 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 December 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 greater detail on www.Climate4you.com.

**December 2012 global surface air temperatures**

*General:* Global air temperatures were below average for the period 1998-2006.

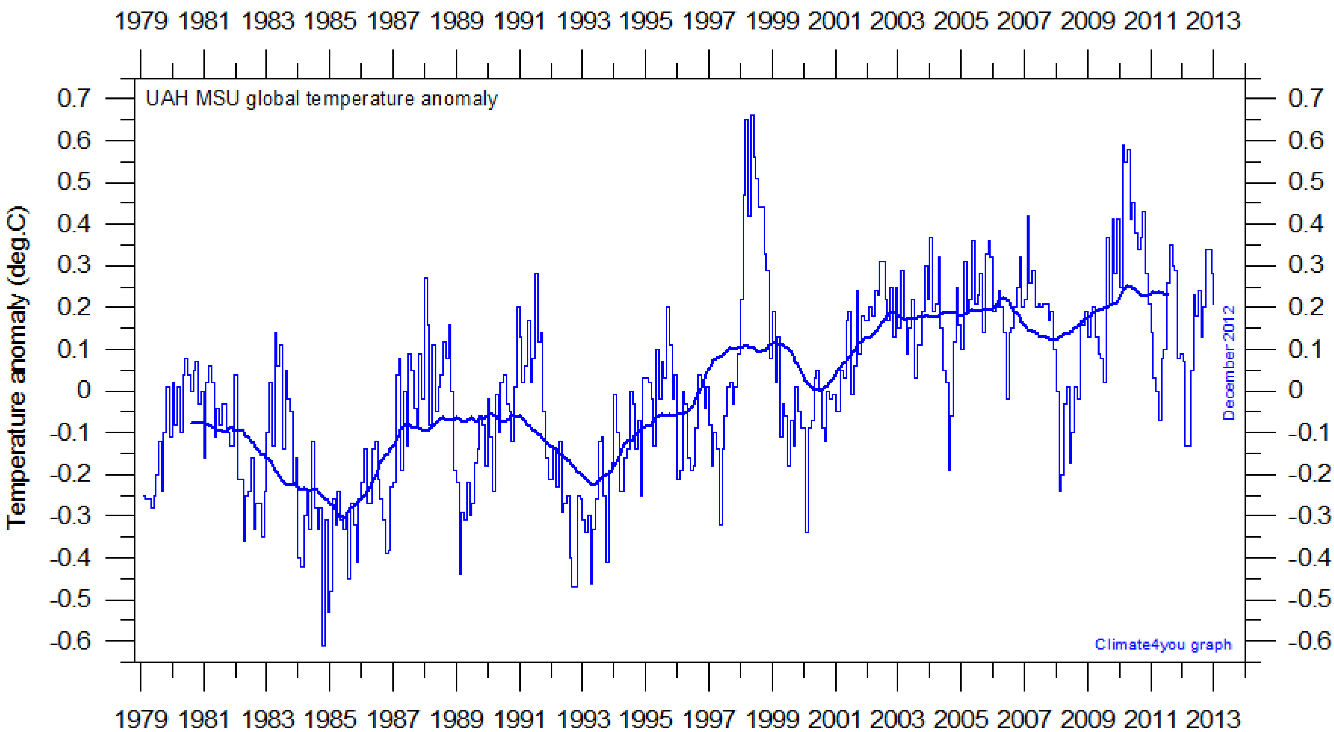
*The Northern Hemisphere* was characterised by high temperature contrast from region to region. Alaska and western Canada had temperatures considerably below the 1998-2006 average, as had Europe, Russia, and most of Asia. Eastern Siberia and eastern Canada and USA had above average temperatures. The marked limit between warm and cold areas over the Arctic Ocean represents an artefact derived from the GISS interpolation technique and should be ignored.

*Near Equator* temperatures conditions were near or below the 1998-2006 average.

*The Southern Hemisphere* was at or below average 1998-2006 conditions. Much of the South Atlantic and Africa were relatively cold. Australia, however, was relatively warm, while New Zealand was near average 1998-2006 temperature conditions. Most of South America and the southern Pacific was near or below average. The Antarctic continent was relatively warm, although the Peninsula was relatively cold.

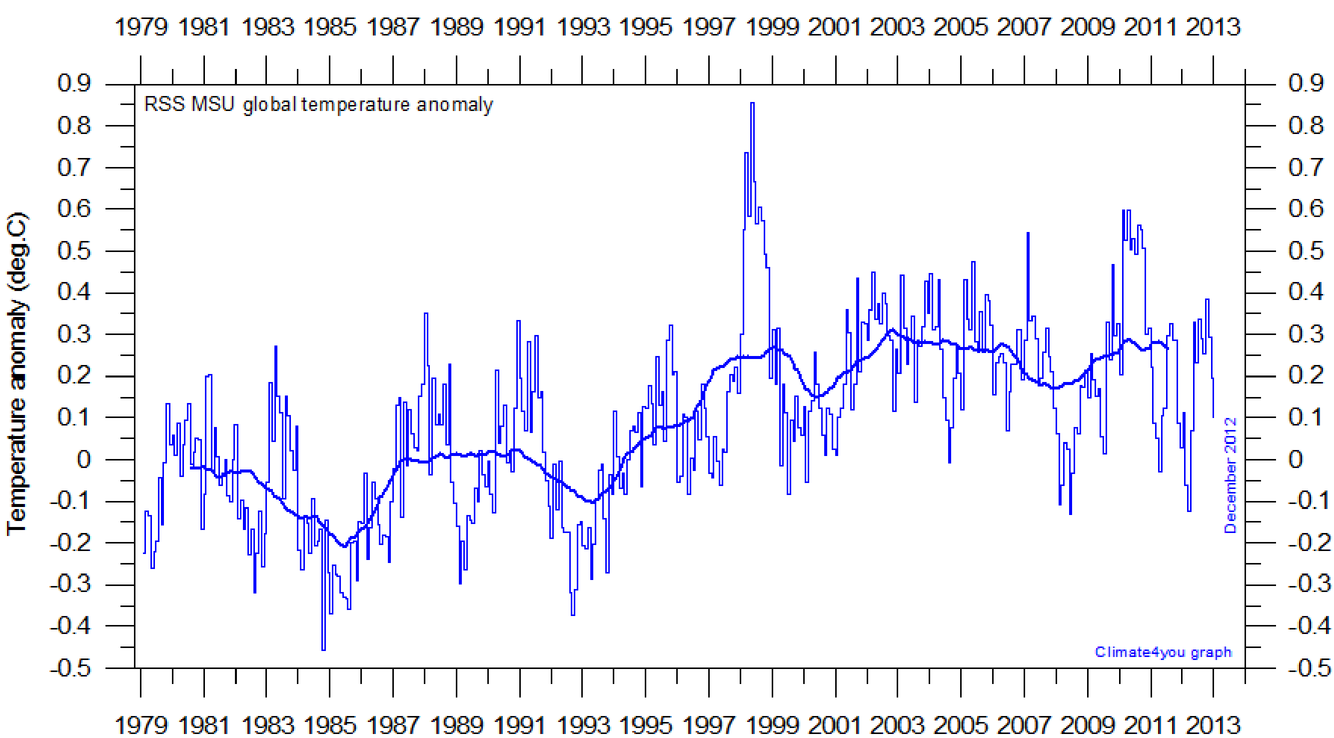
*The global oceanic heat content* has been rather stable since 2003/2004 (page 11).

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



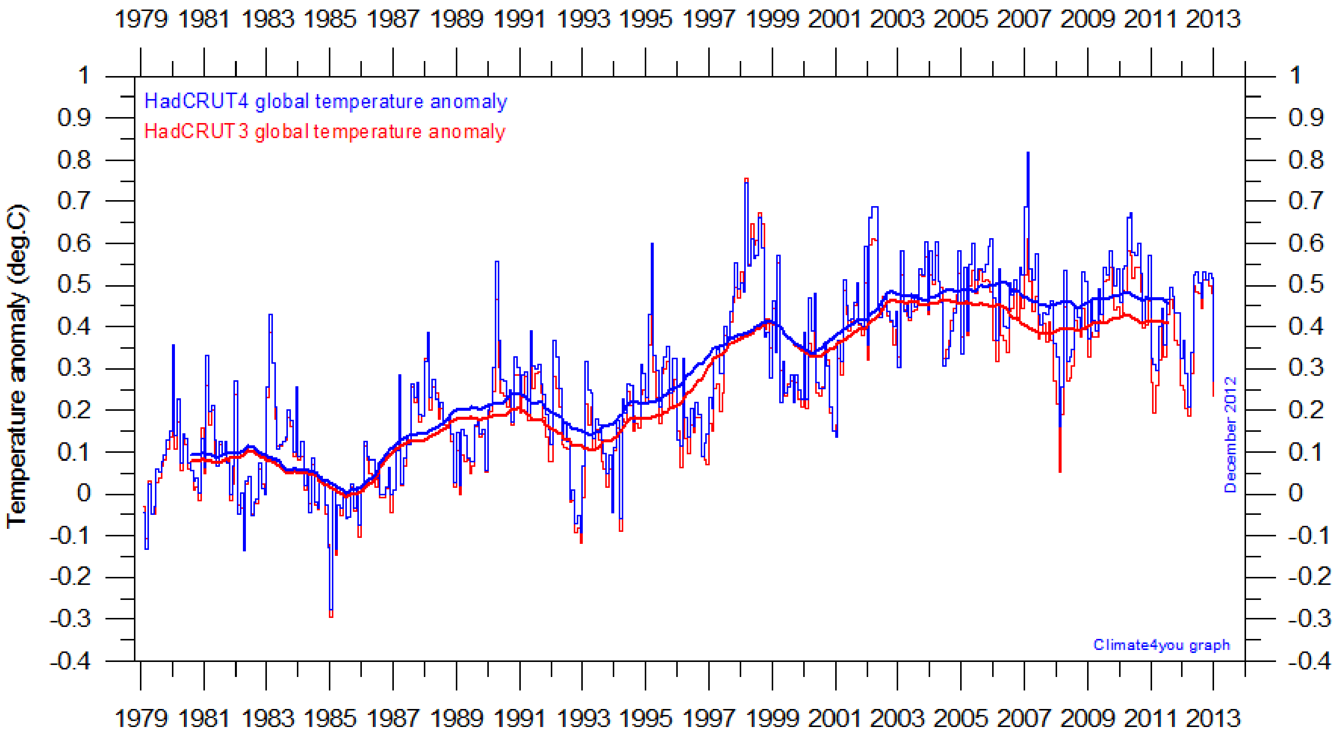

*Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.*





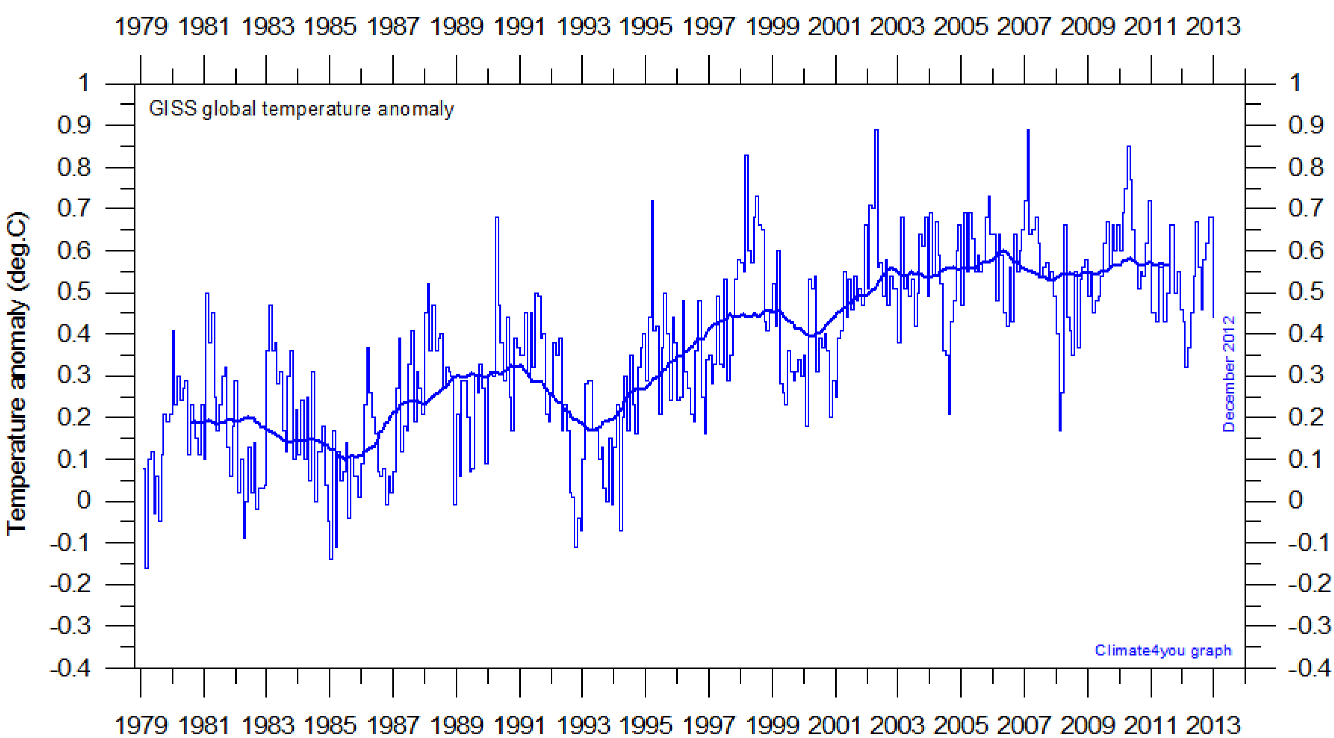

*Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37 month average.*

## Global surface air temperature, updated to December 2012

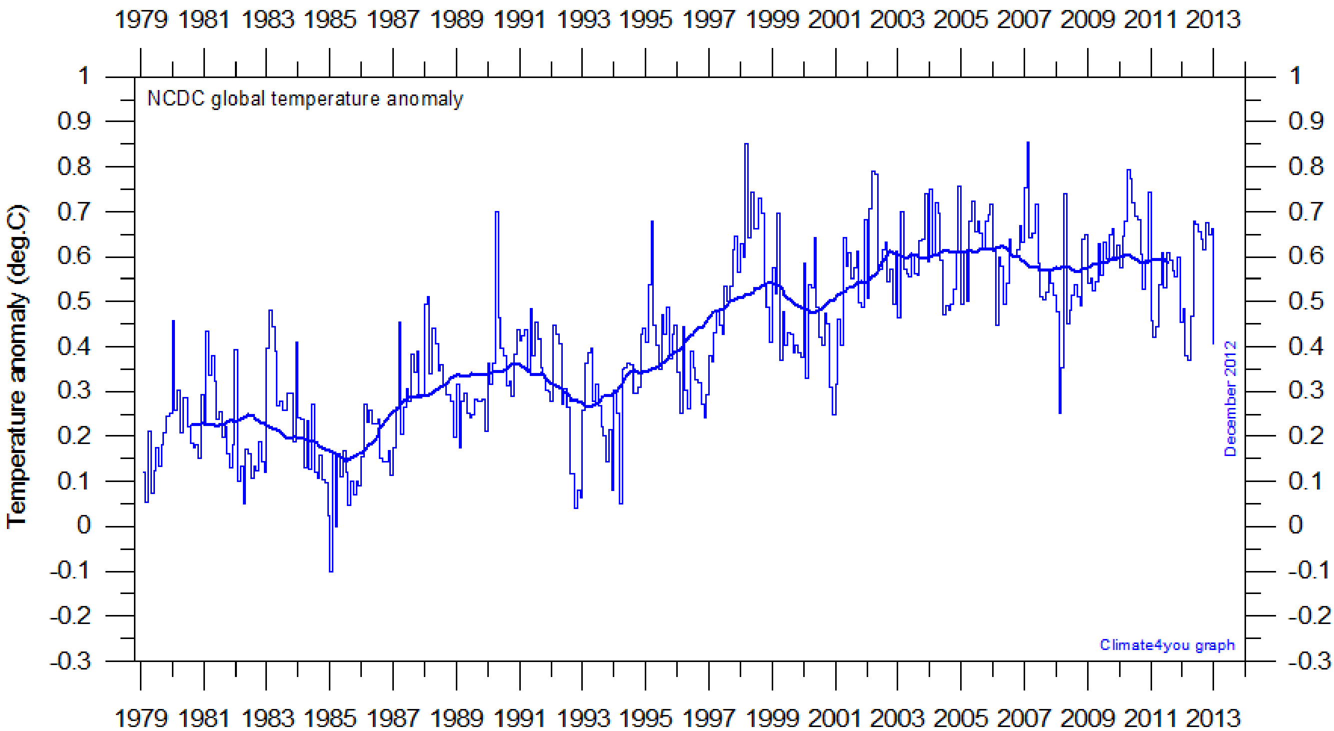



*Global monthly average surface air temperature (thin line) since 1979 according to according to the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thick line is the simple running 37 month average. Version HadCRUT4 (blue) is now replacing HadCRUT3 (red).*






*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.*



<u>A note on data record stability:</u>

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.

None of the temperature records are stable over time (since 2008). The two surface air temperature records, NCDC and GISS, show apparent systematic changes over time. This is exemplified the diagram on the following page showing the changes since May 2008 in the NCDC global surface temperature record for January 1915 and January 2000, illustrating how the difference between the early and late part of the temperature records gradually is growing by administrative means.

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*).

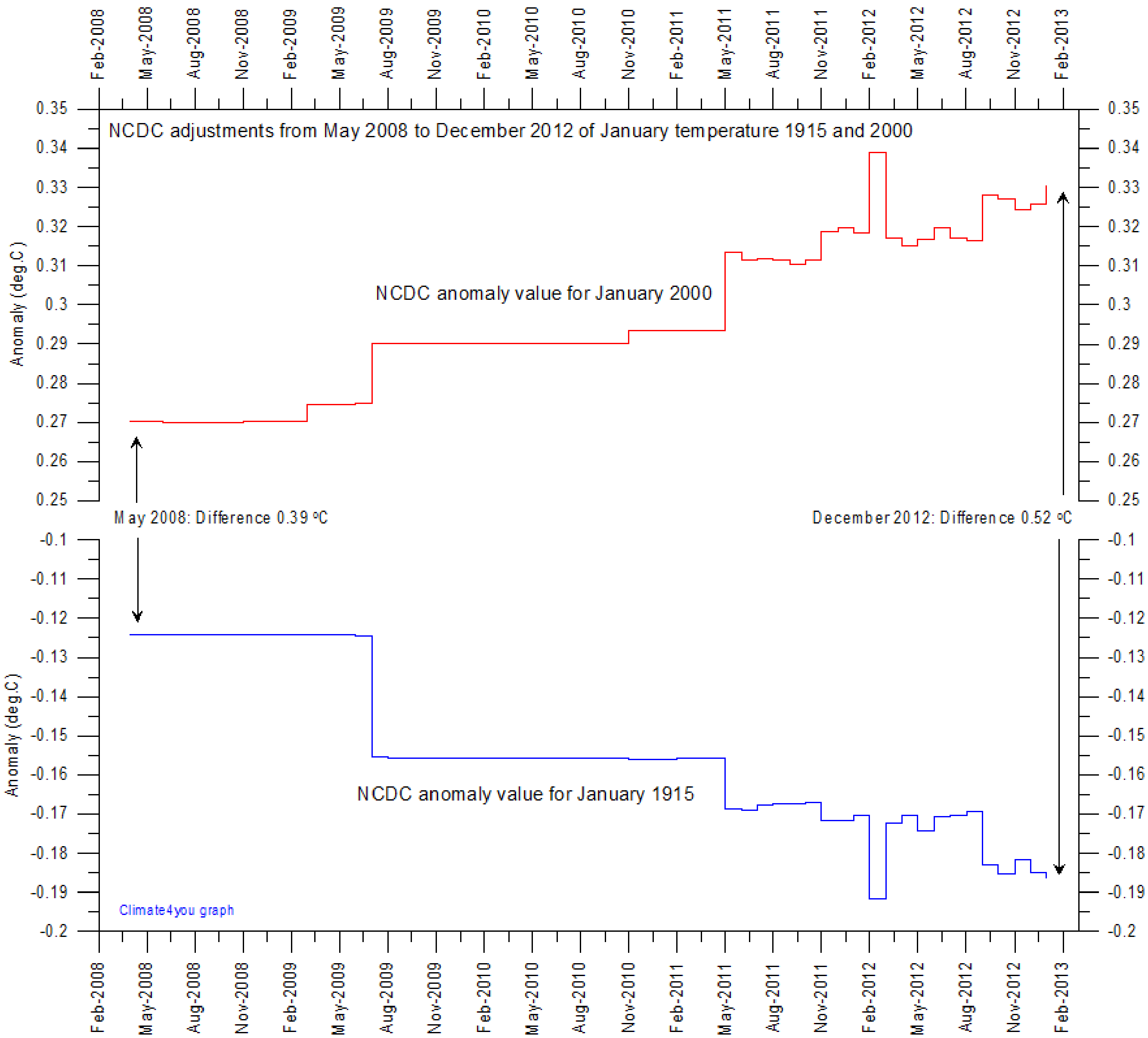
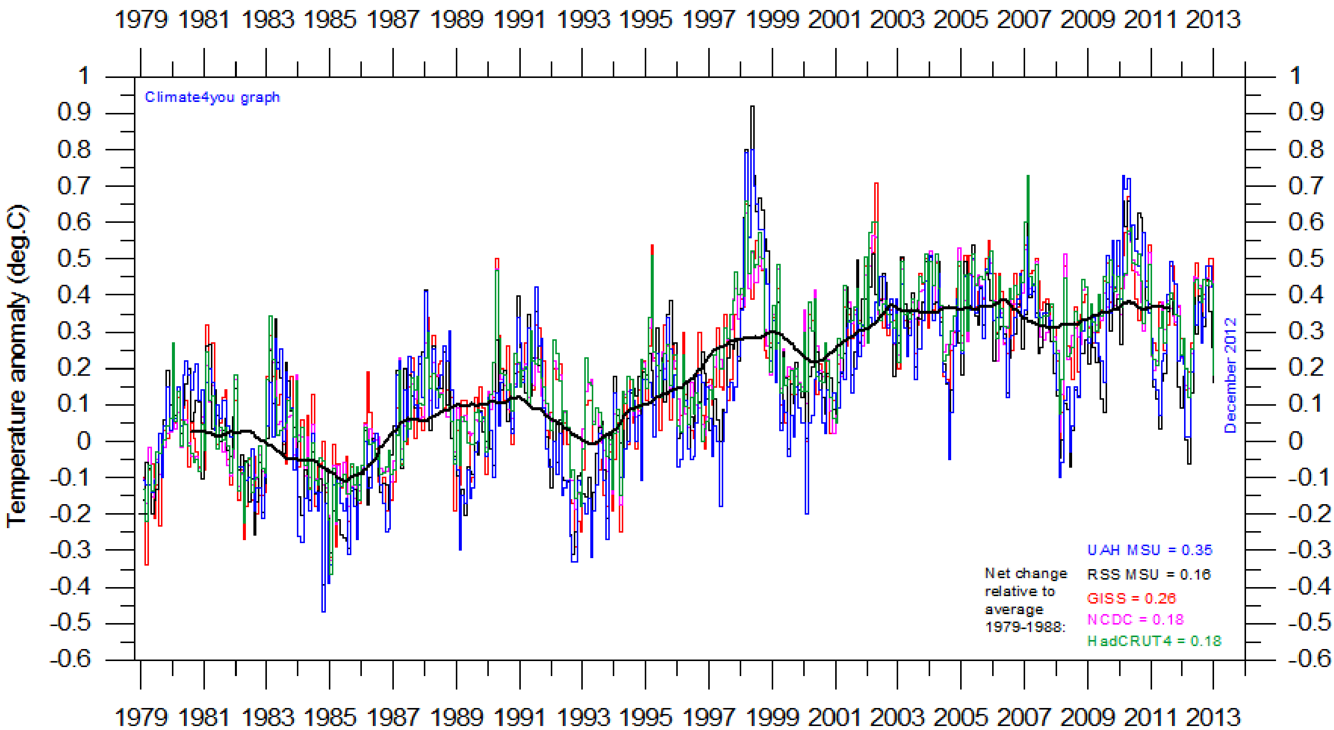





*Diagram showing the adjustment made since May 2008 by the National Climatic Data Center (NCDC) in the anomaly values for the months January 1915 and January 2000.*

## All in one, updated to December 2012

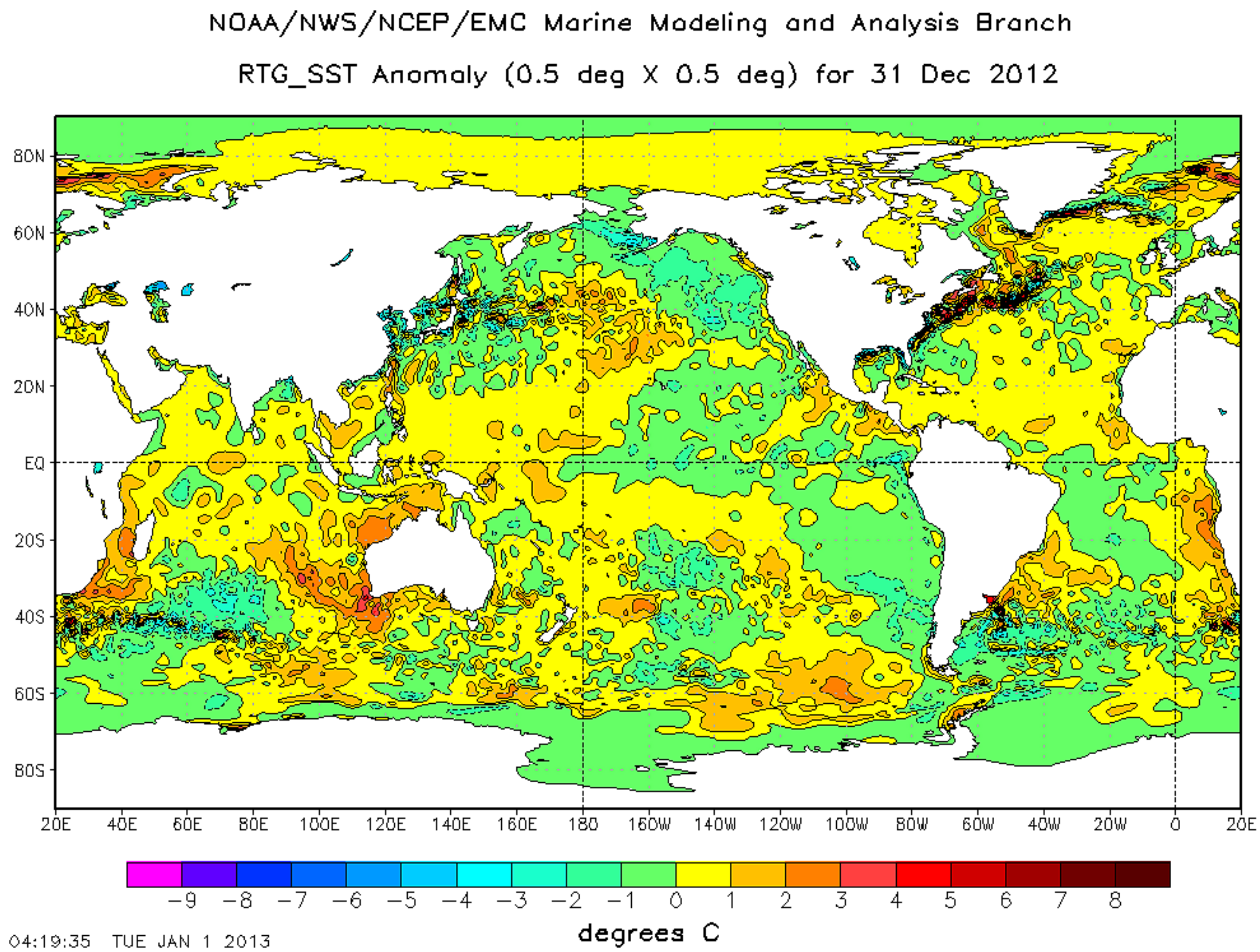



*Superimposed plot of all five global monthly temperature estimates. As the base period differs for the individual temperature estimates, they have all been normalised by comparing with the average value of the initial 120 months (10 years) from January 1979 to December 1988. The heavy black line represents 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 December 2012



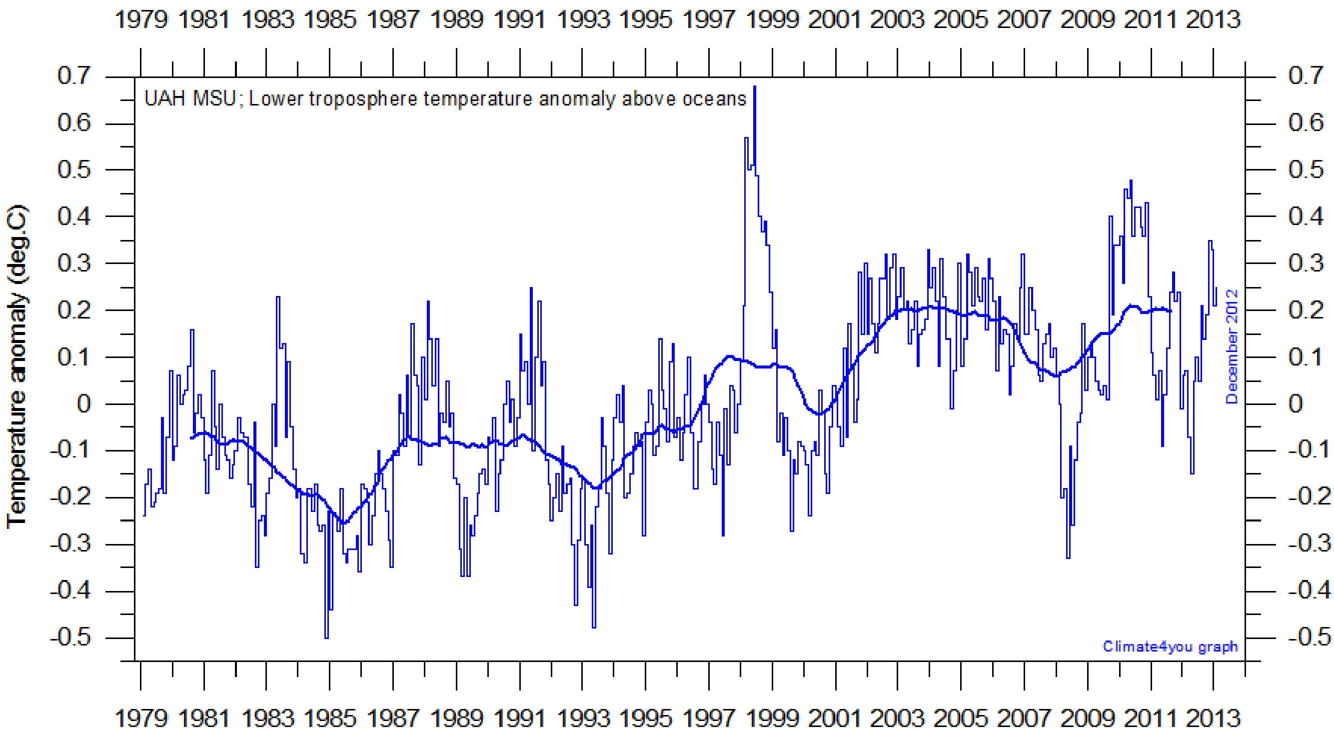

*Sea surface temperature anomaly at 31 December 2012. Map source: National Centers for Environmental Prediction (NOAA).*

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, but with large regional differences.

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).

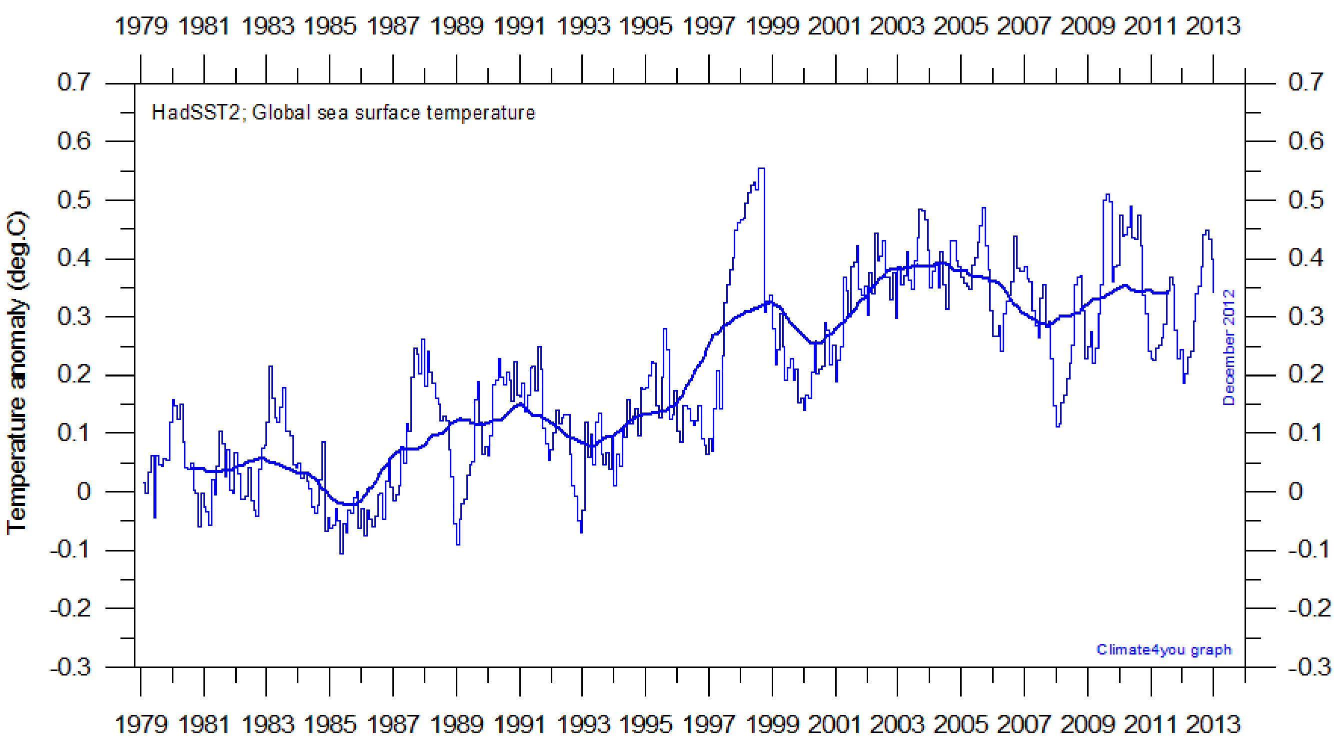
The significance of any such short-term warming or cooling seen in air temperatures should not be over stated. Whenever Earth experiences cold La Niña or warm El Niño episodes (Pacific Ocean) major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in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

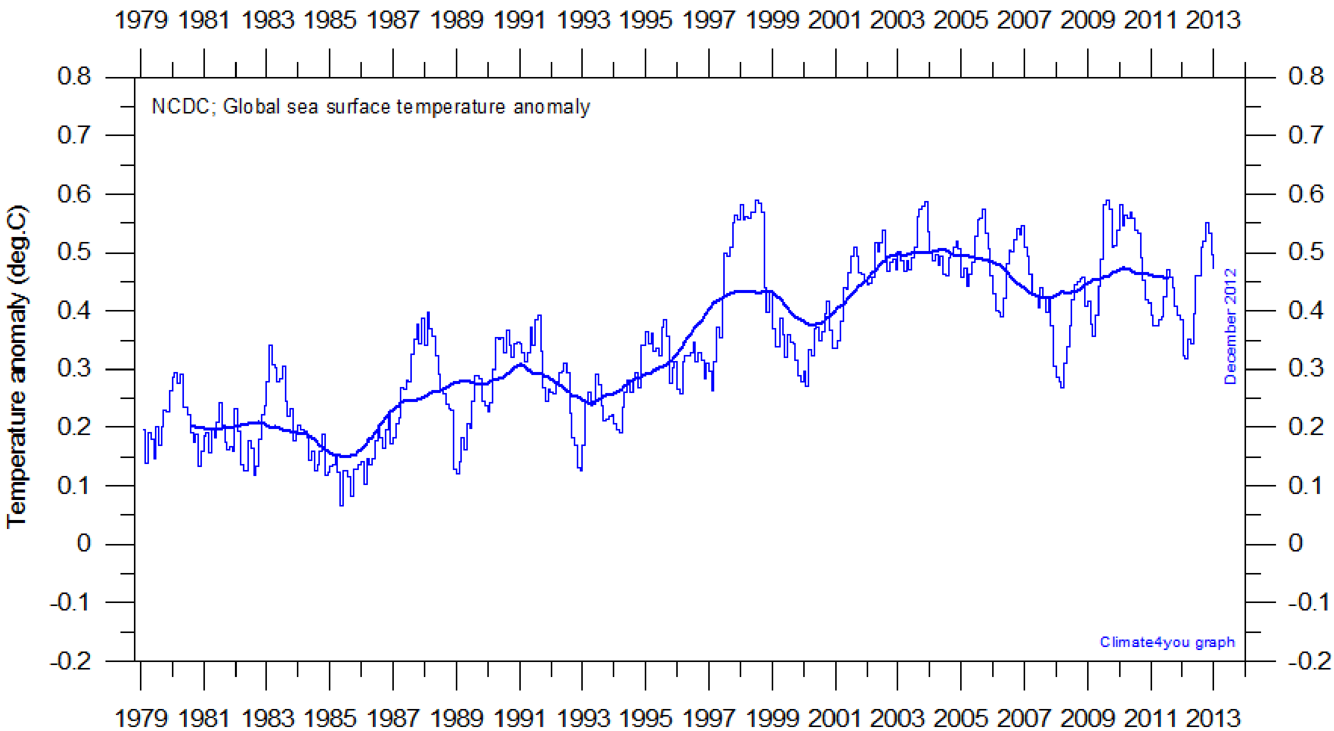



*Global monthly average lower troposphere temperature over oceans (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.*



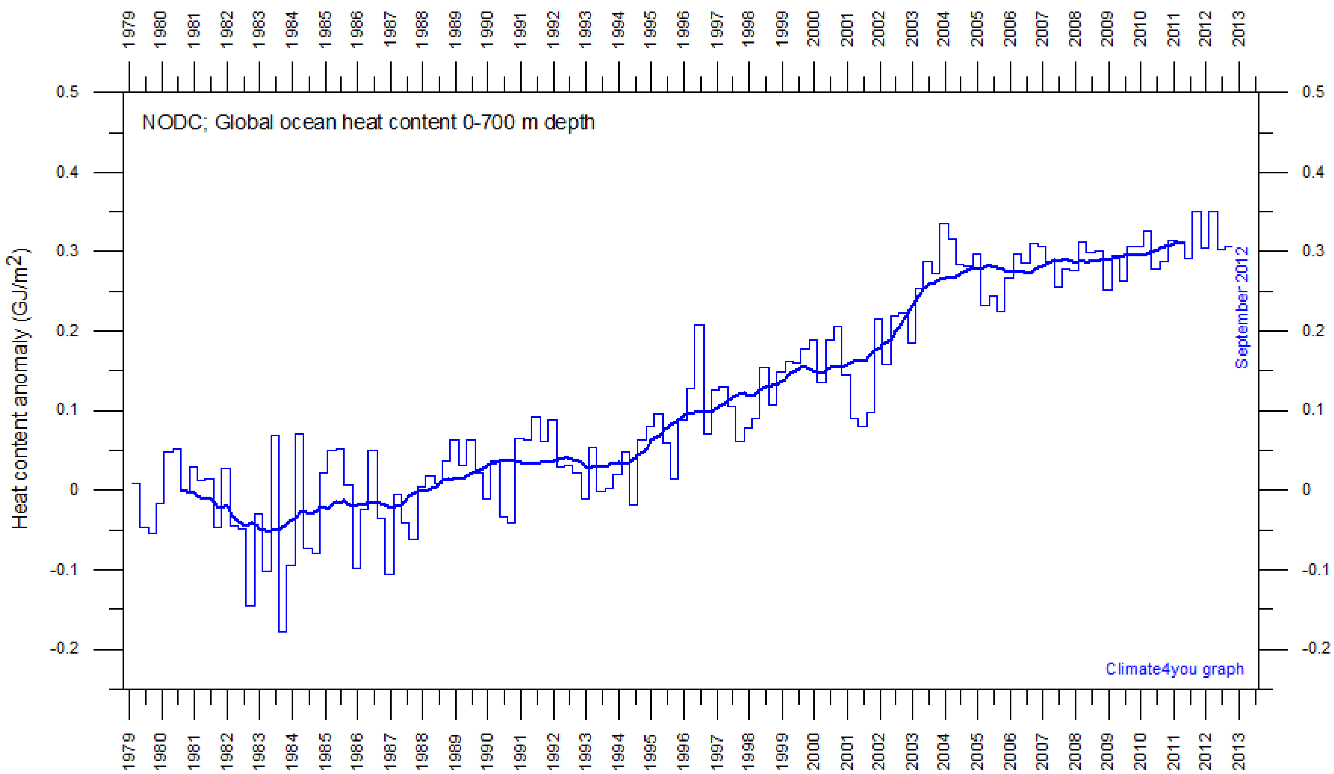



*Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37 month average.*



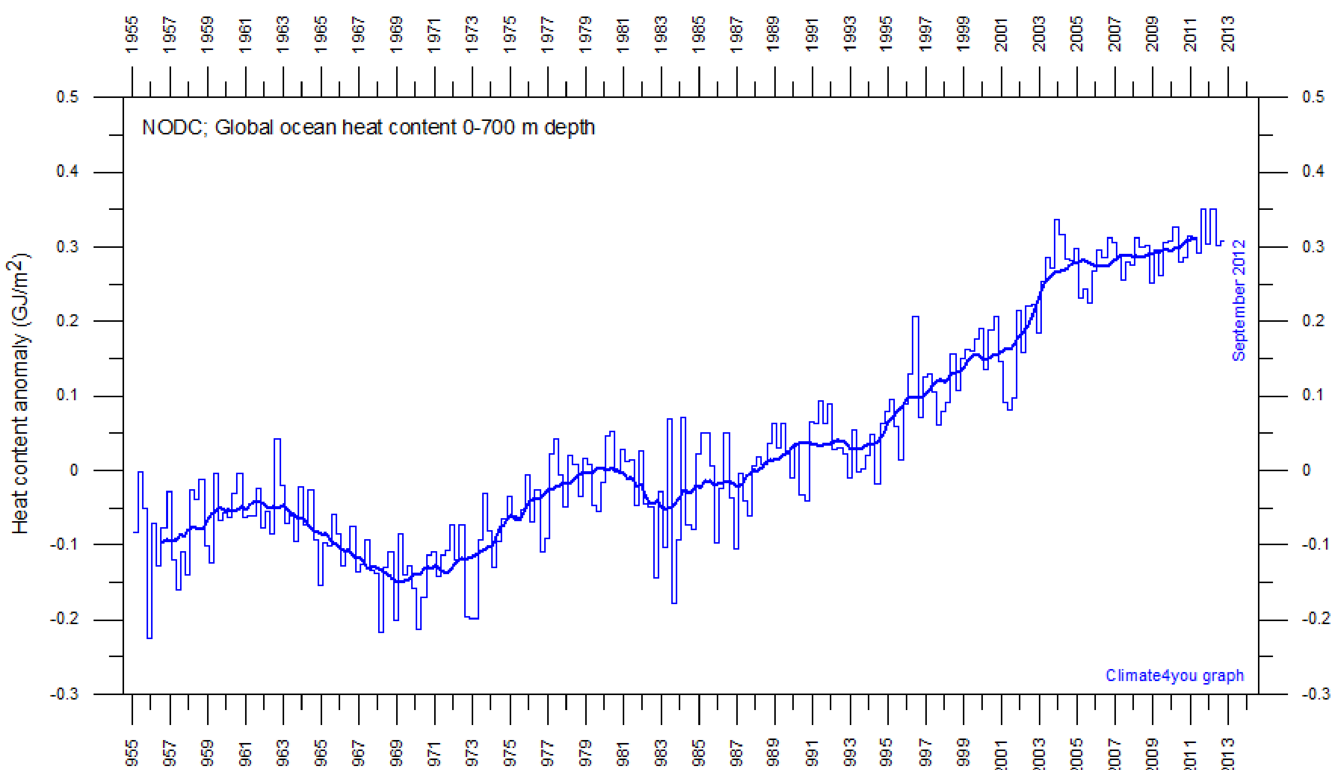

*Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.*

## Global ocean heat content uppermost 700 m, updated to September 2012



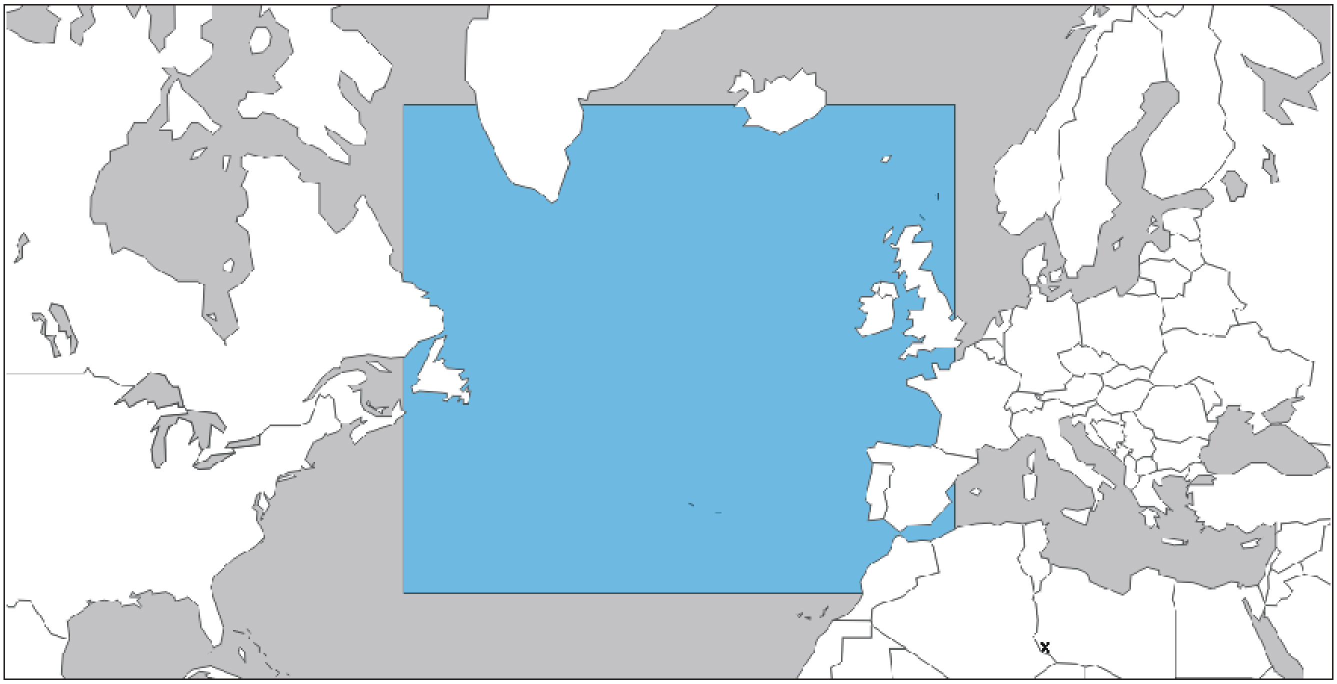

*Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).*

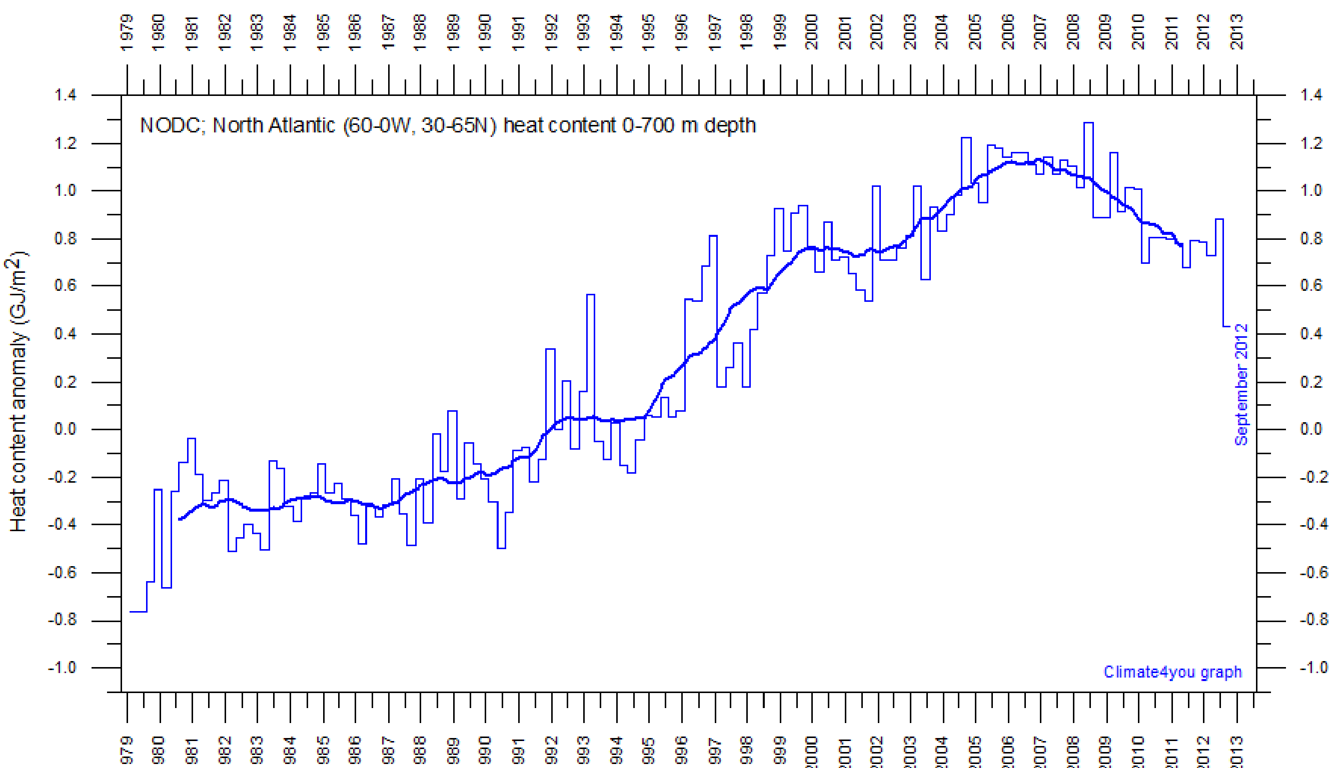





*Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).*

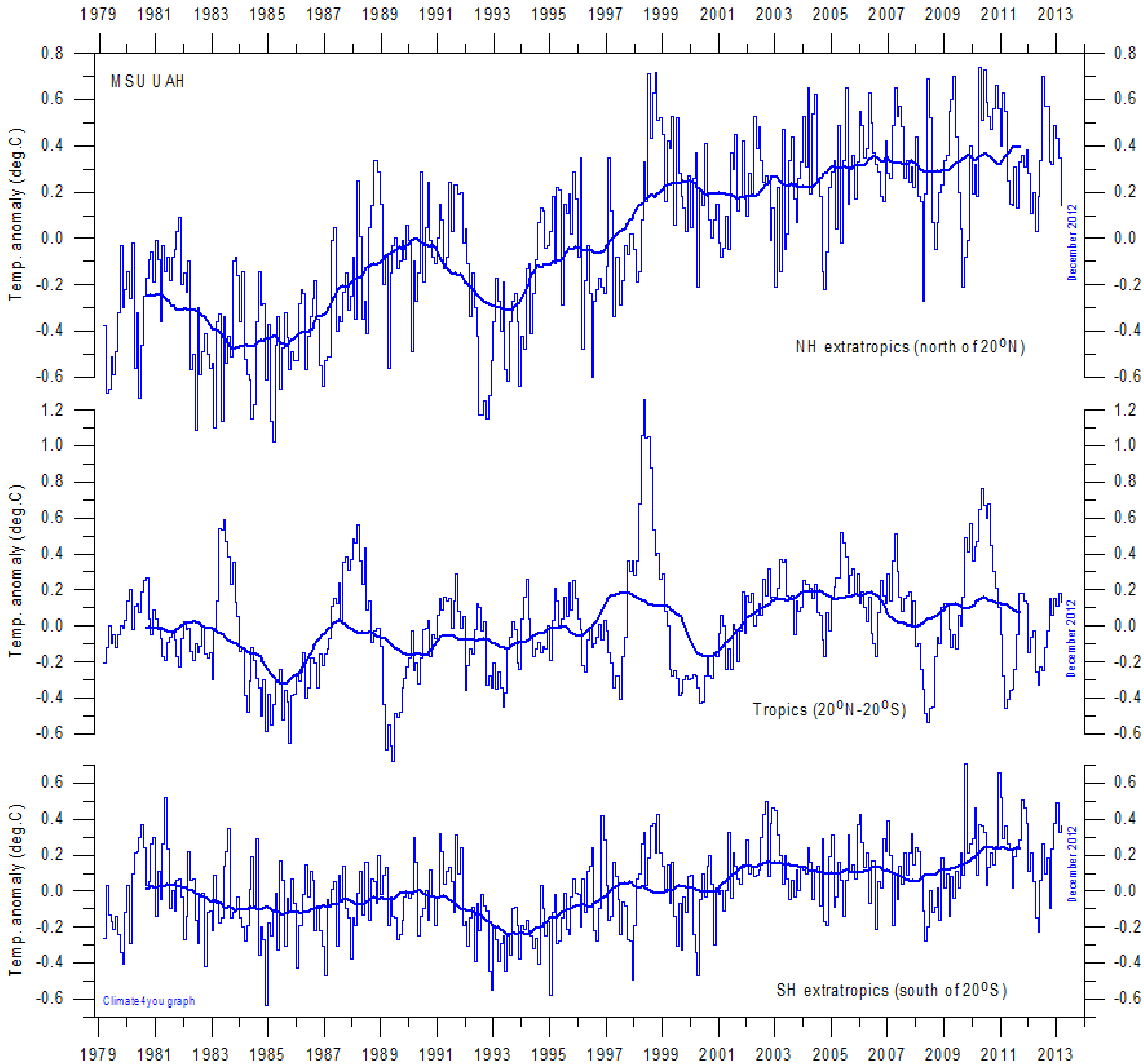
## [North Atlantic heat content uppermost 700 m, updated to September 2012]





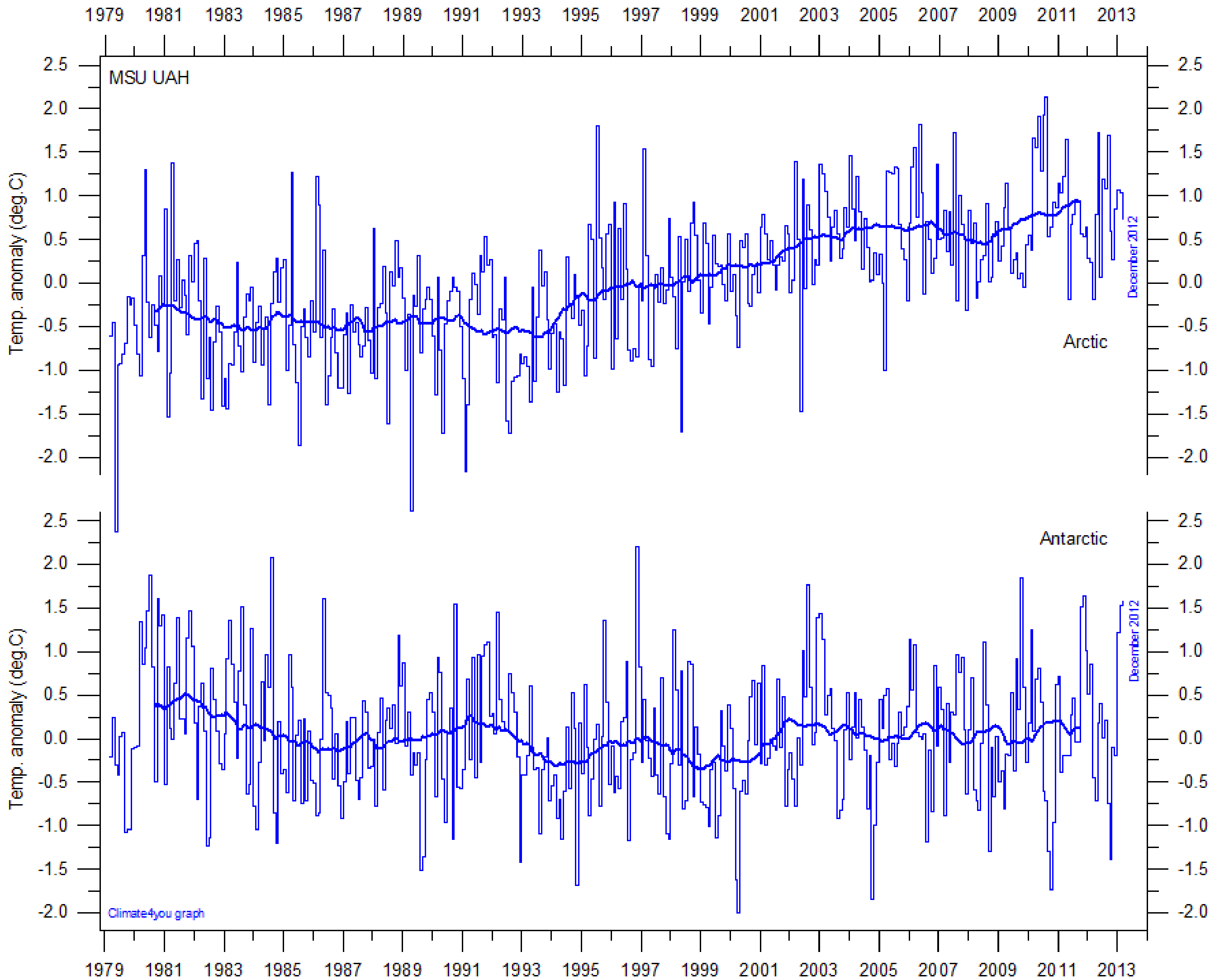

*Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the* North Atlantic (60-0W, 30-65N; see map above) *ocean since January 1979. The thin line indicate monthly values, and the thick line represents the simple running 37 month (c. 3 year) average. Data source: [National Oceanographic Data Center] (NODC). Last month shown: September 2012.*

## [Zonal air temperatures, updated to December 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 December 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 November 2012

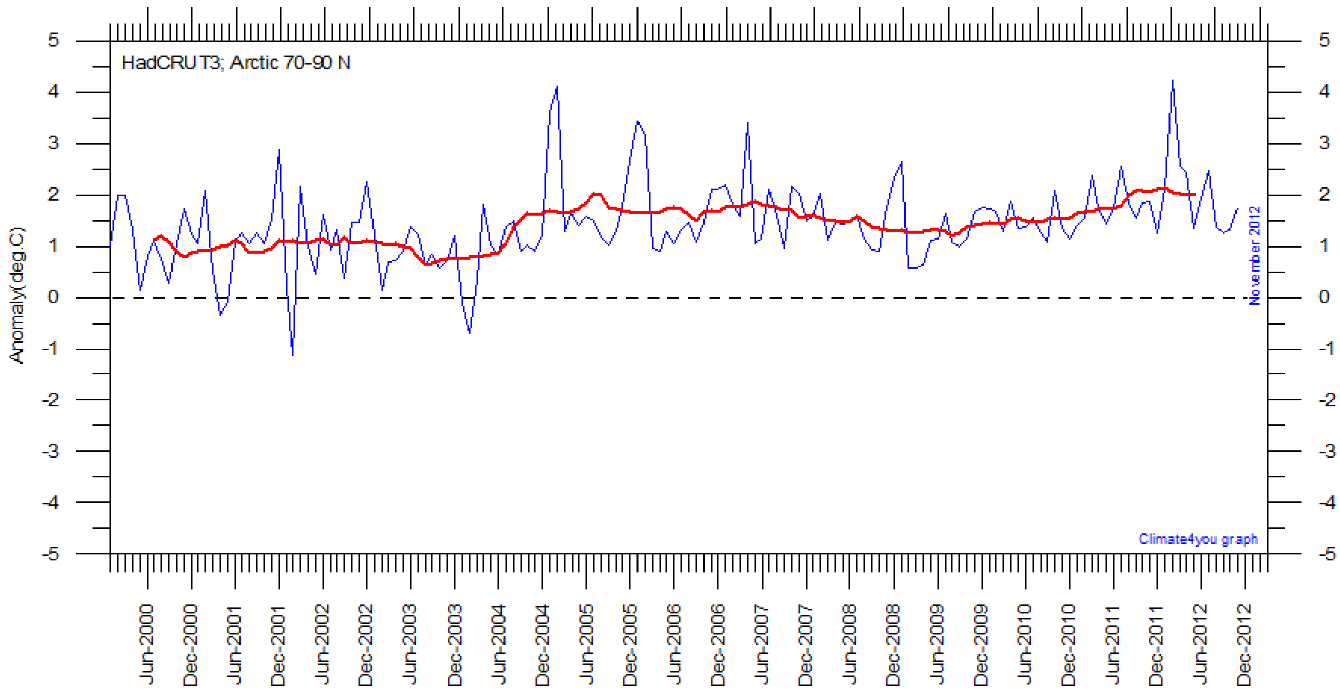



*Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

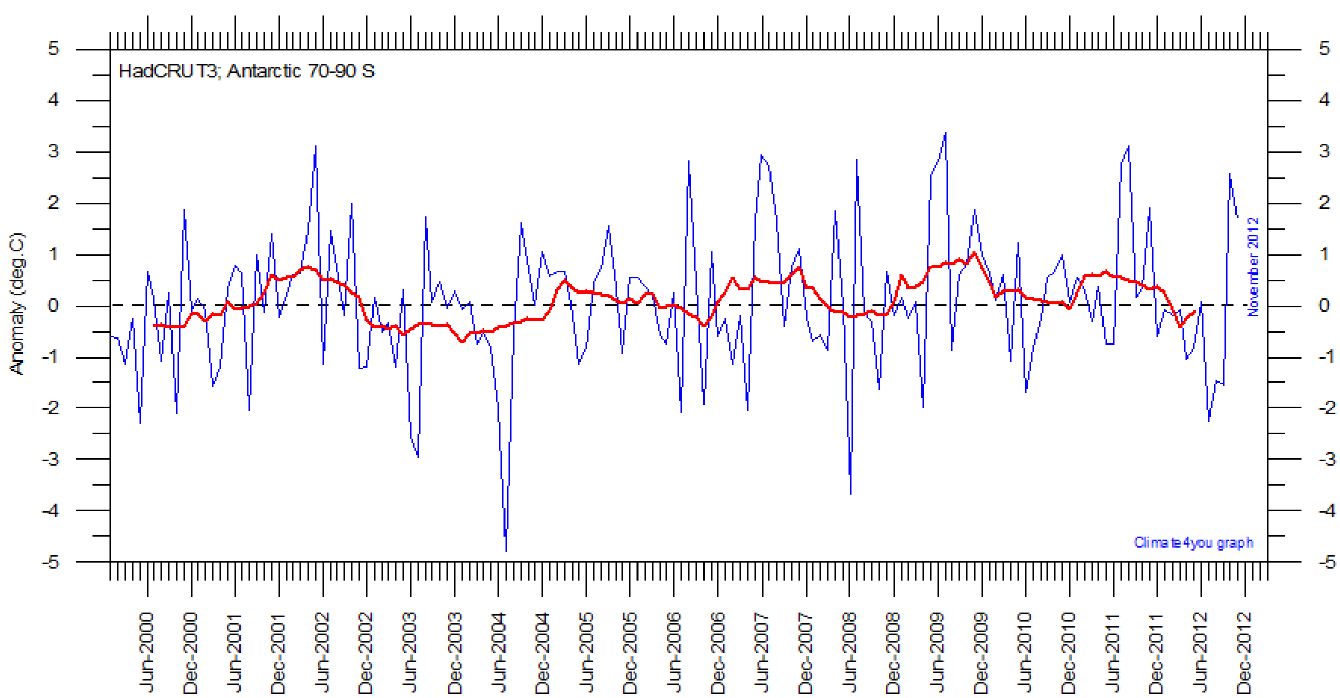



*Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

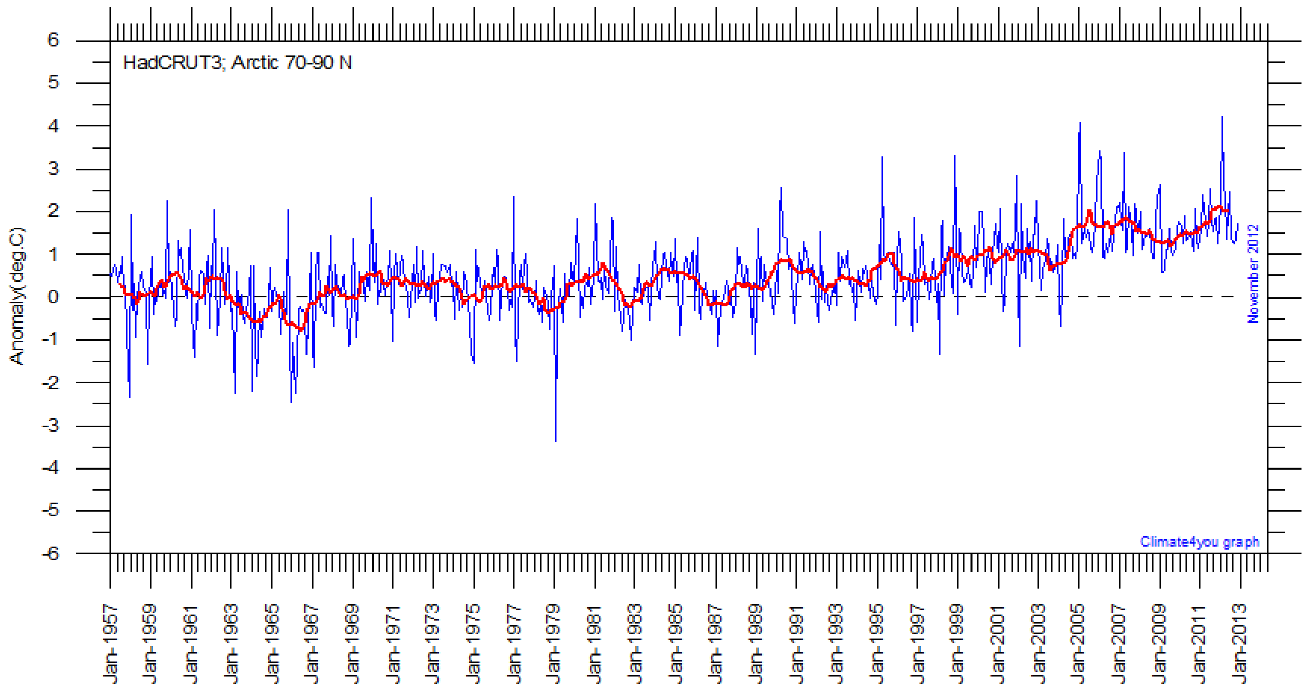



Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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



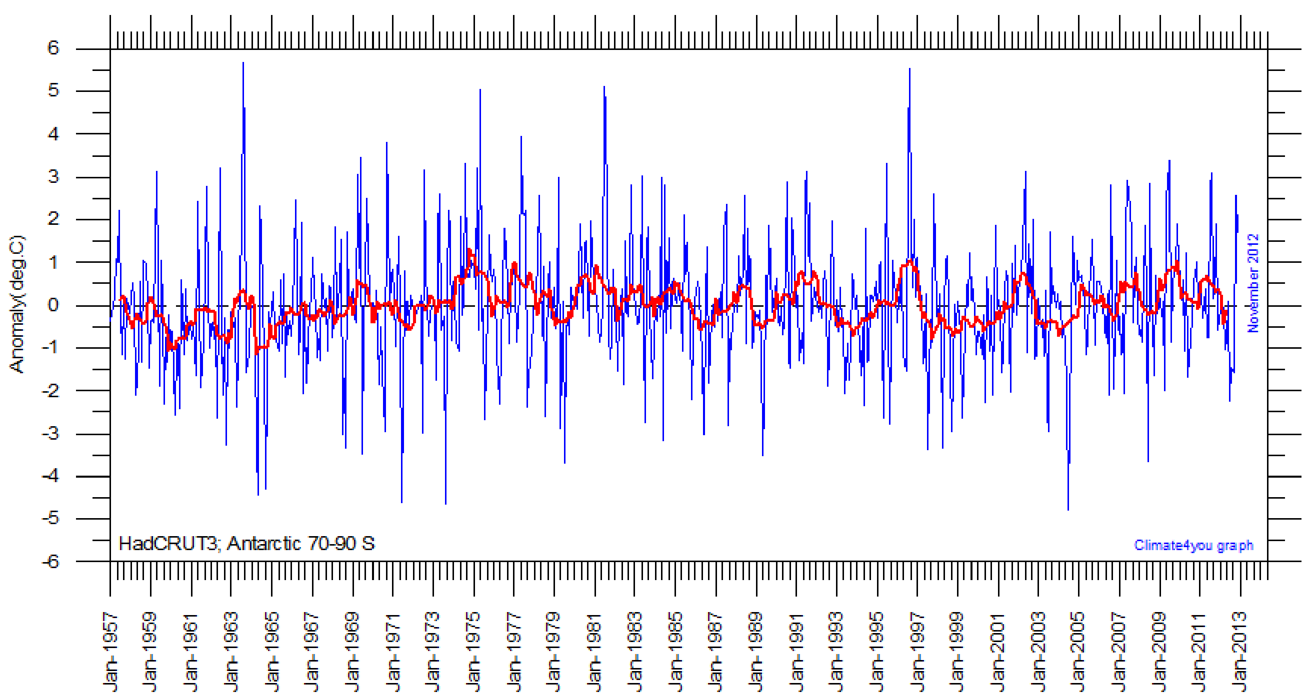



Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

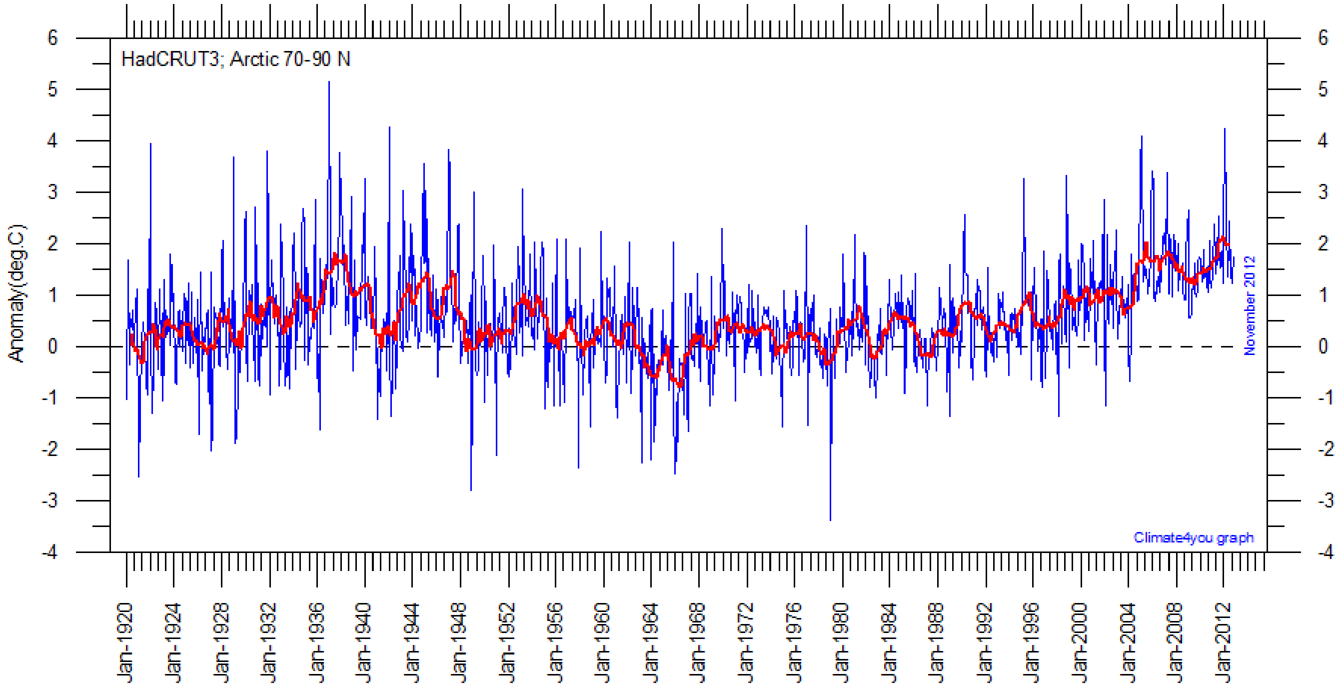



*Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1920, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly 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*



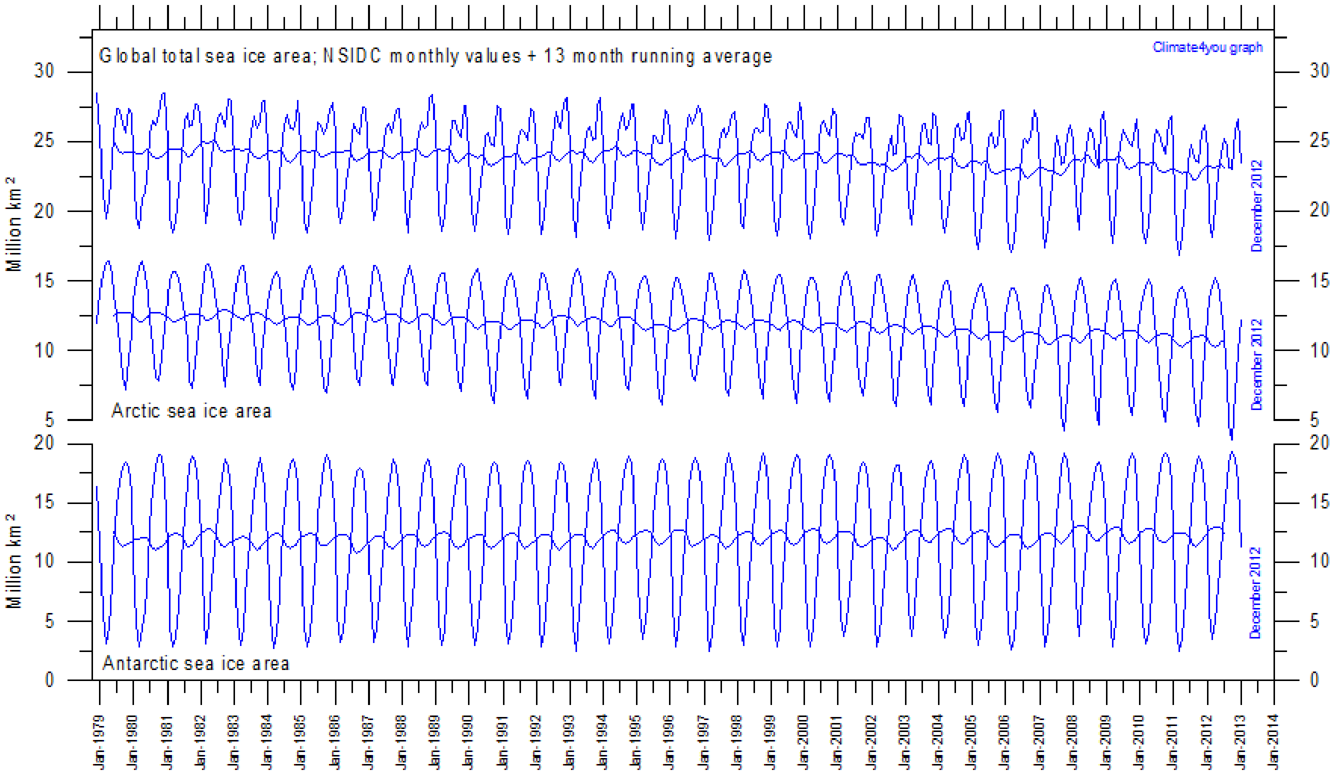
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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 dells.

Literature:

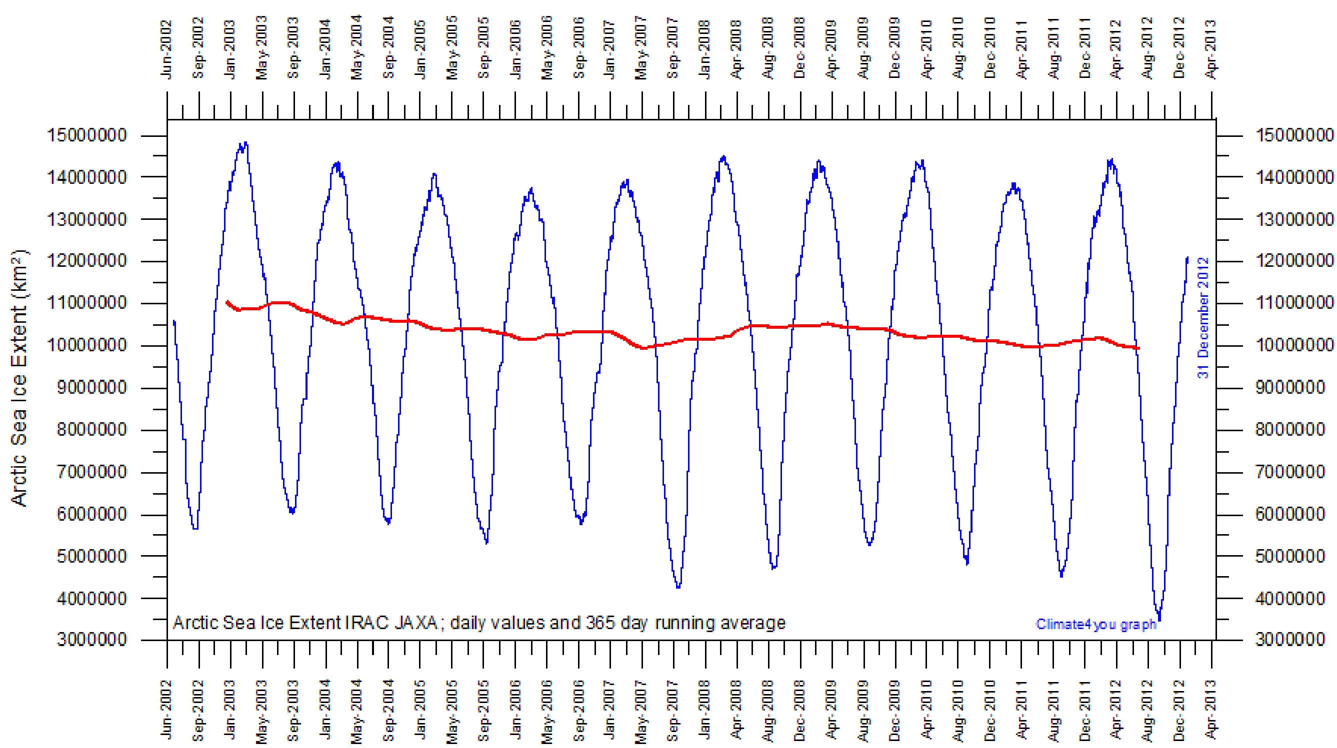
Gillett, N.P., Stone, D.A., Stott, P.A., Nozawa, T., Karpechko, A.Y.U., Hegerl, G.C., Wehner, M.F. and Jones, P.D. 2008. Attribution of polar warming to human influence. *Nature Geoscience* 1, 750-754.

# Arctic and Antarctic sea ice, updated to December 2012

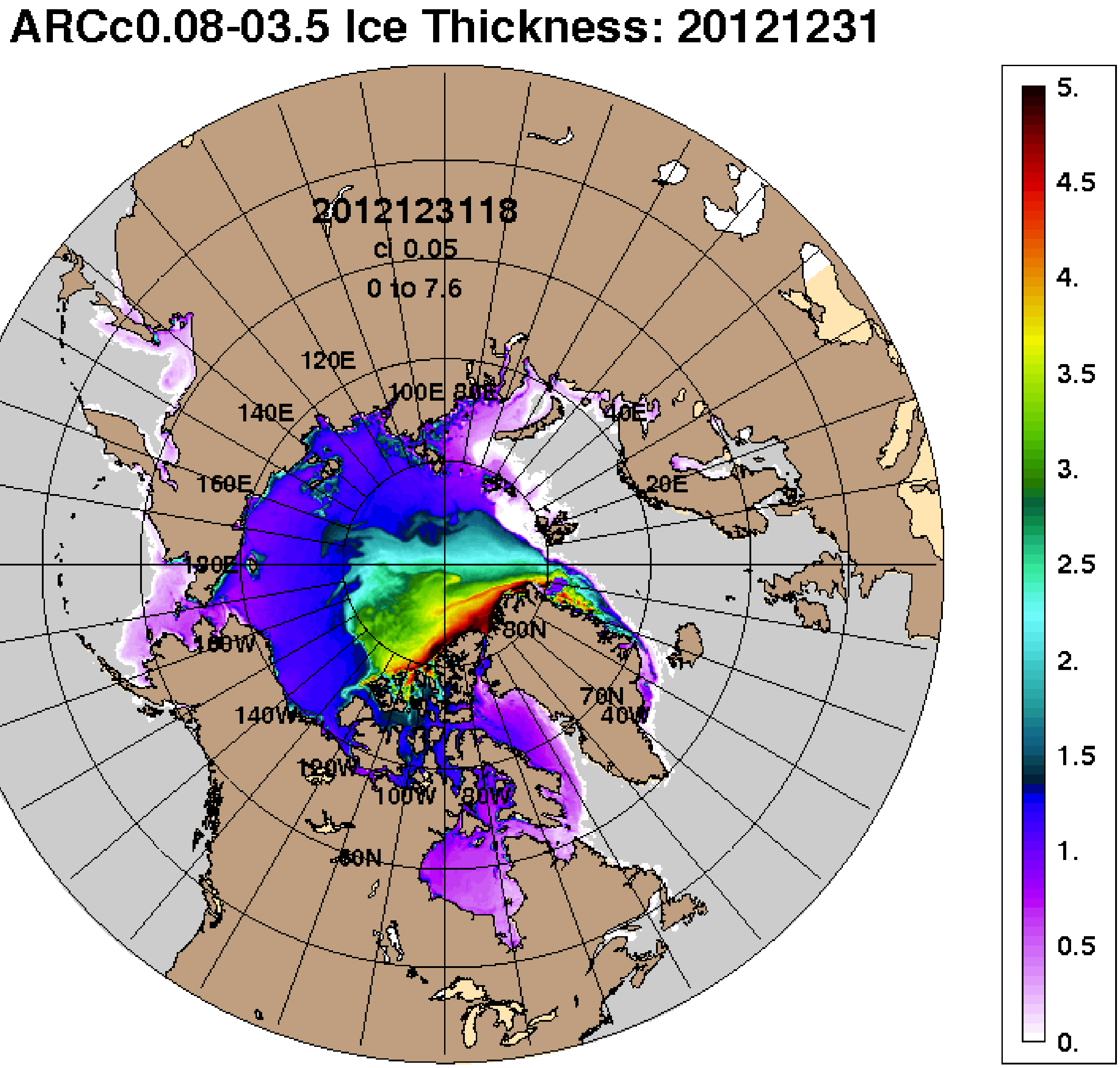



*Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center](#) (NSIDC).*





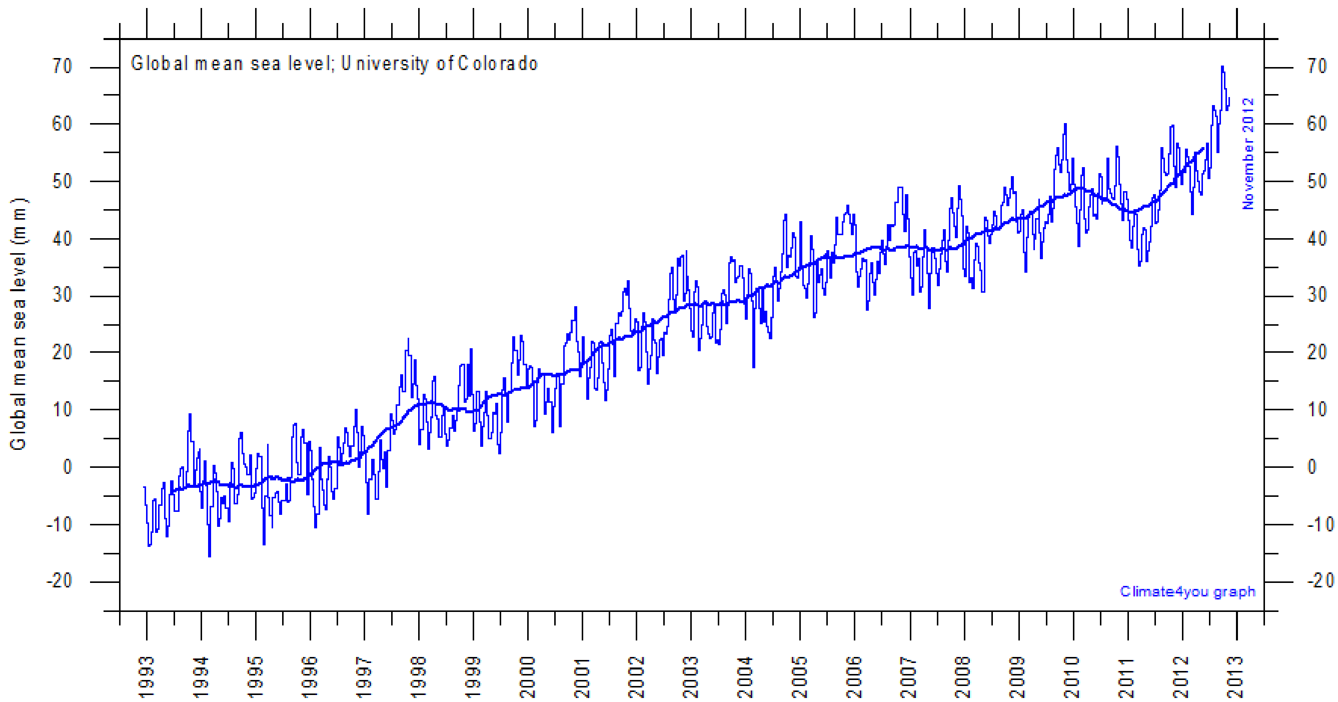

*Graph showing daily Arctic sea ice extent since June 2002, to December 31, 2012, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).*





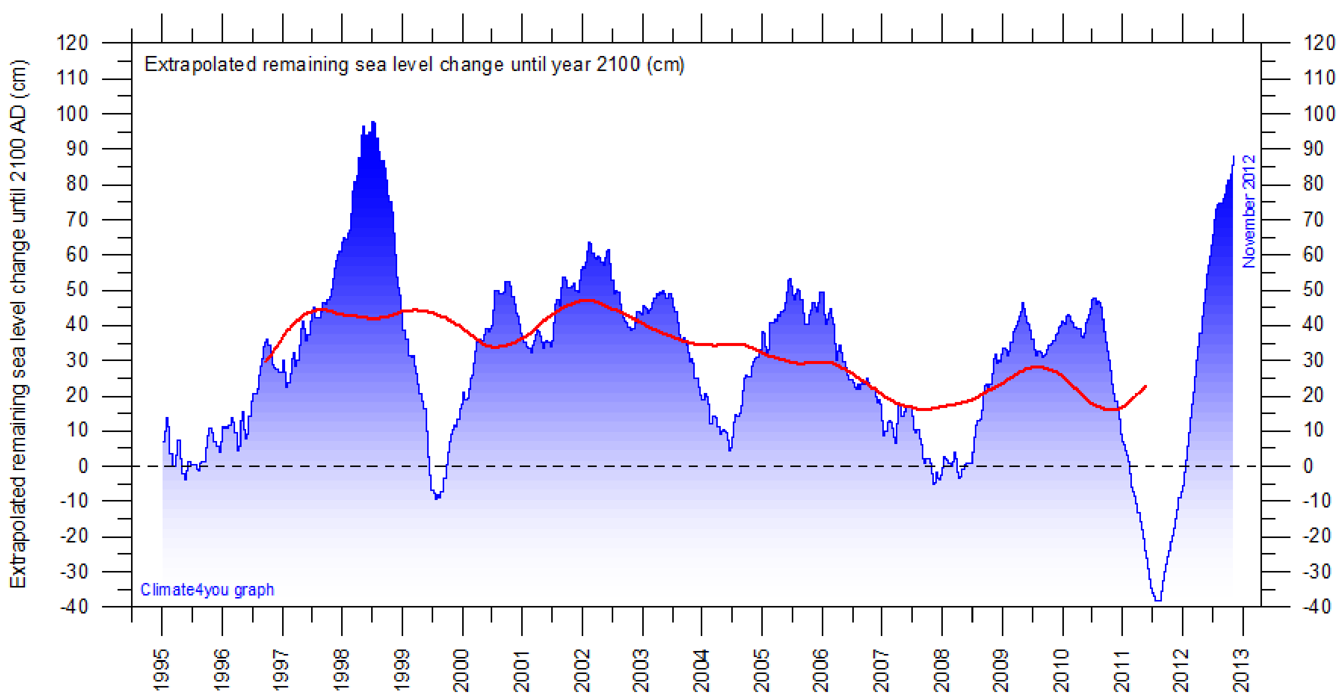

*Northern hemisphere sea ice extension and thickness on 31 December 2012 according to the [Arctic Cap Nowcast/Forecast System](#) (ACNFS), US Naval Research Laboratory. Thickness scale (m) is shown to the right.*

## Global sea level, updated to November 2012



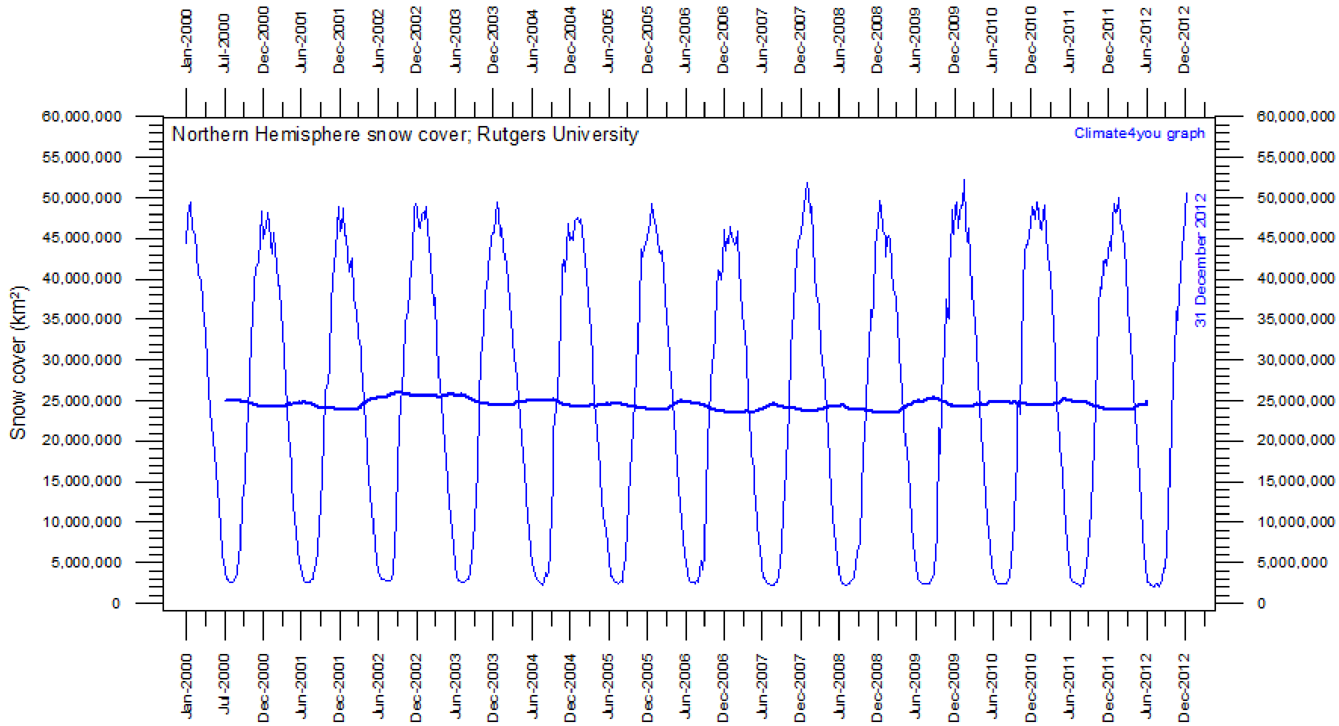

*Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.*





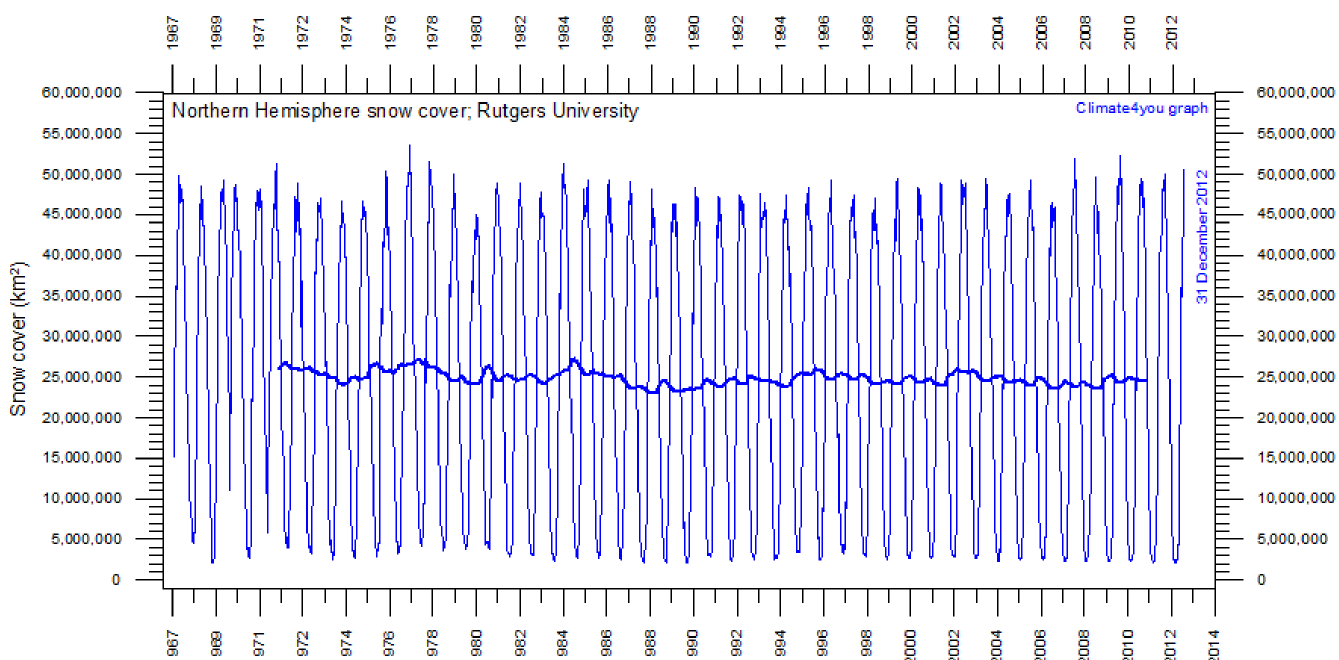

*Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based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

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



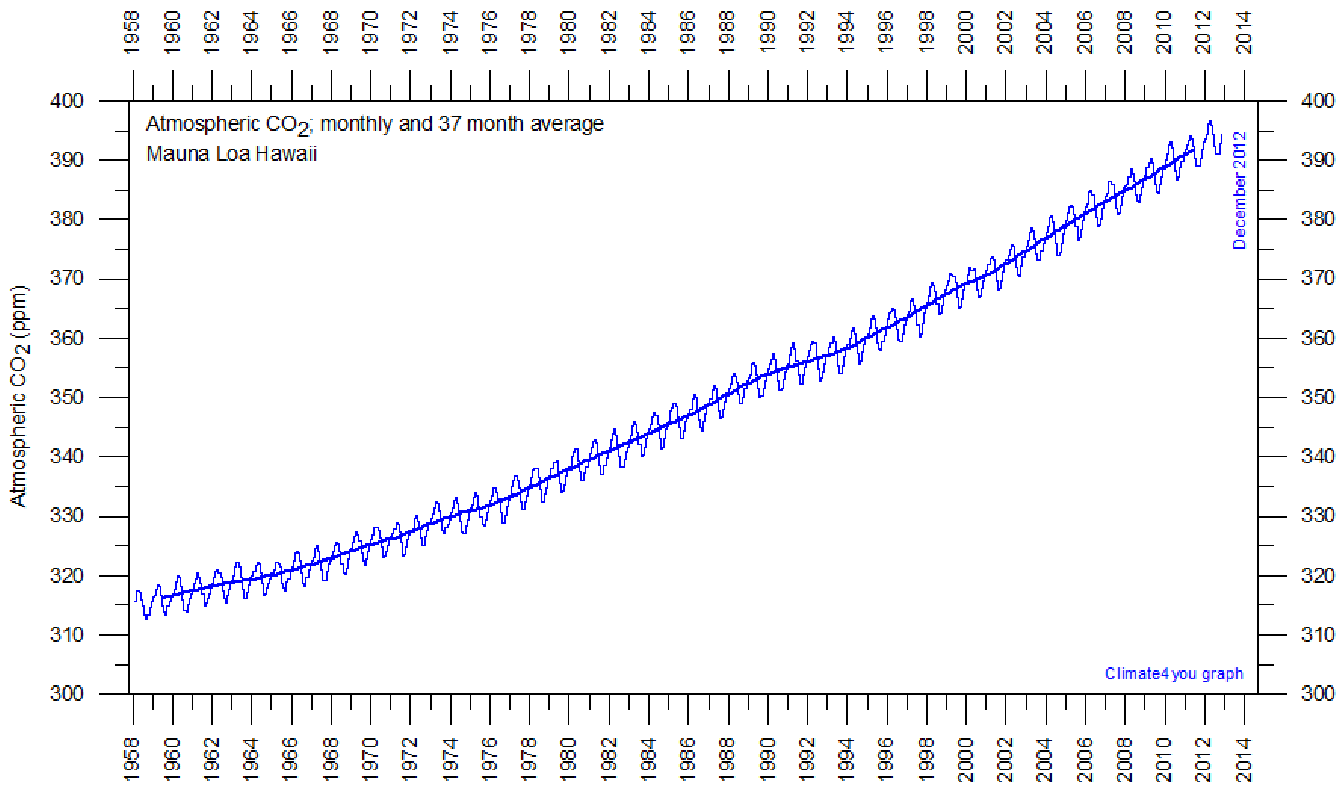

*Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year).*



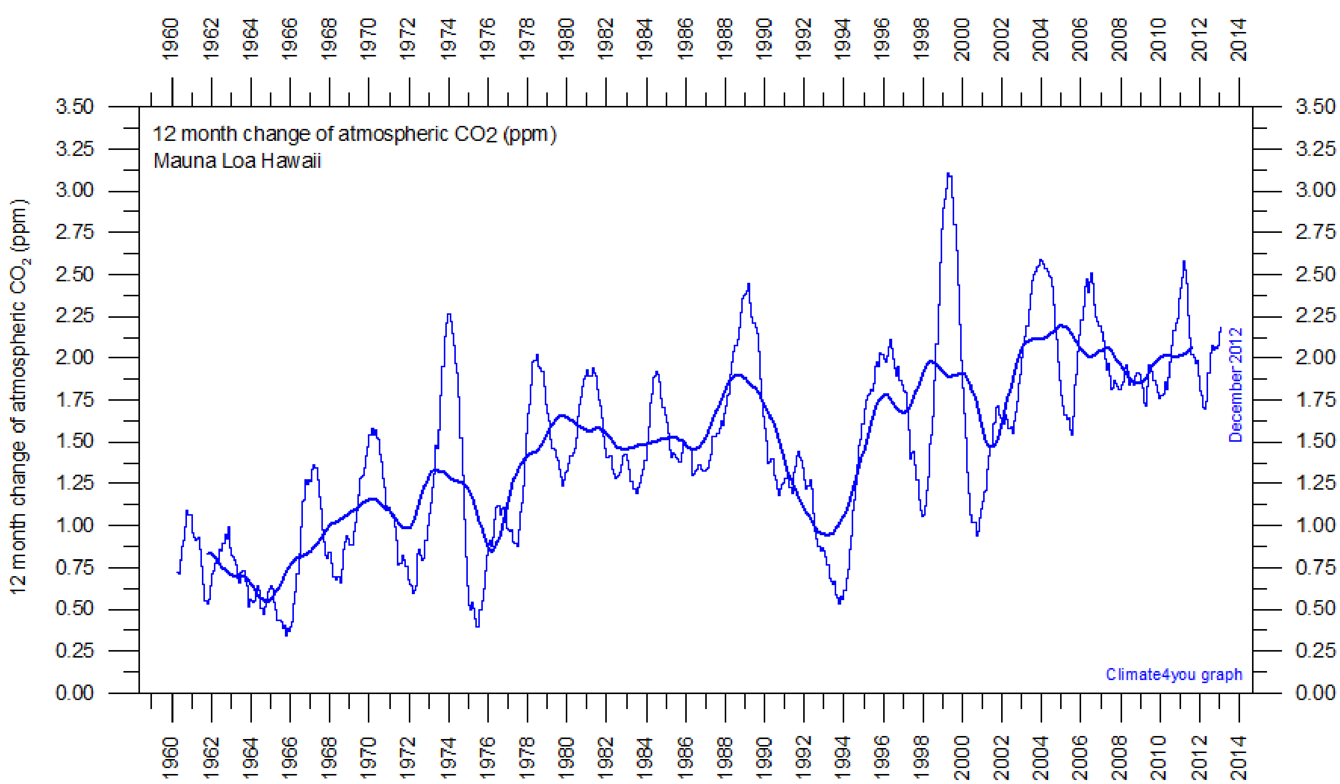



*Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of data gaps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

## Atmospheric $CO_2$, updated to December 2012

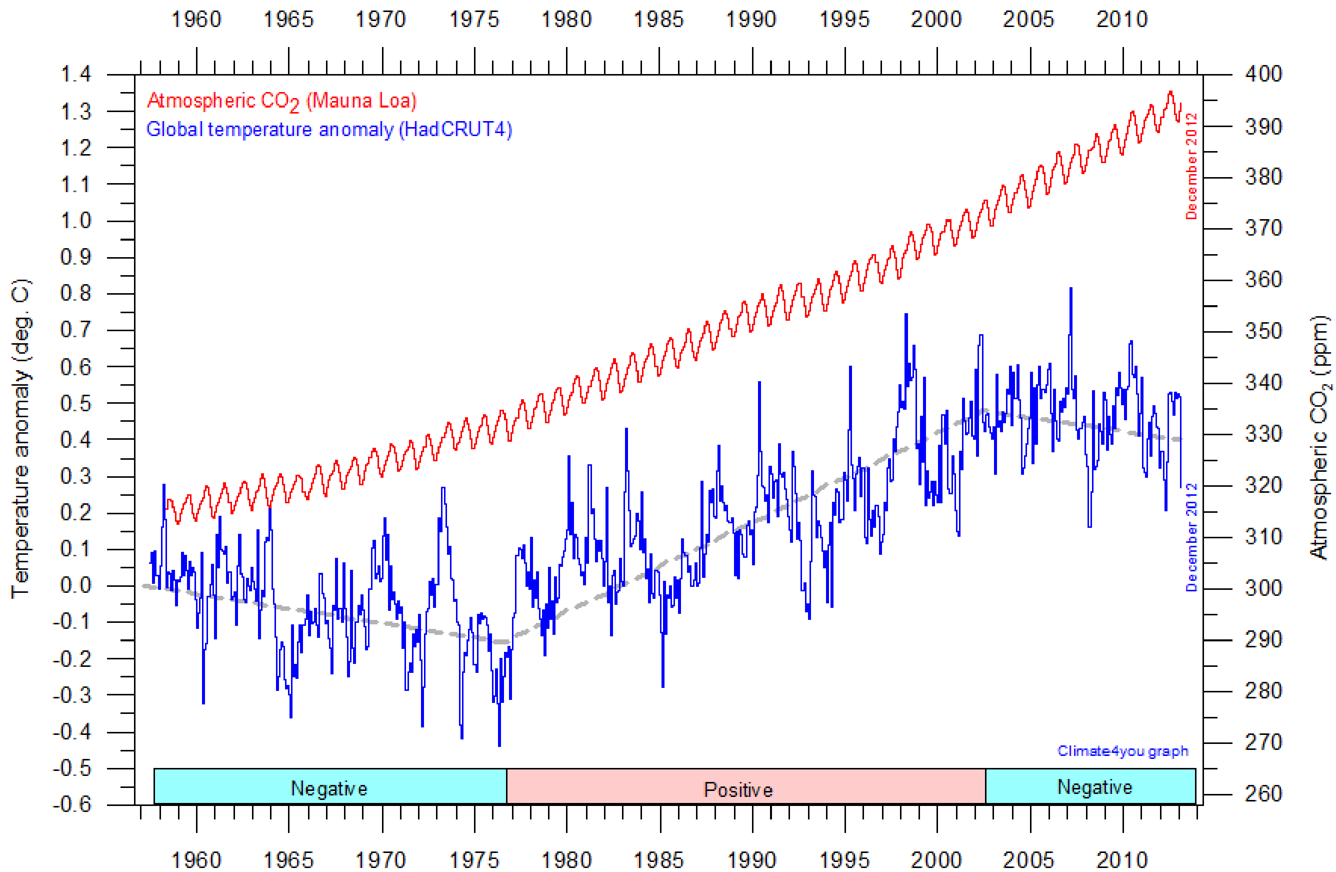




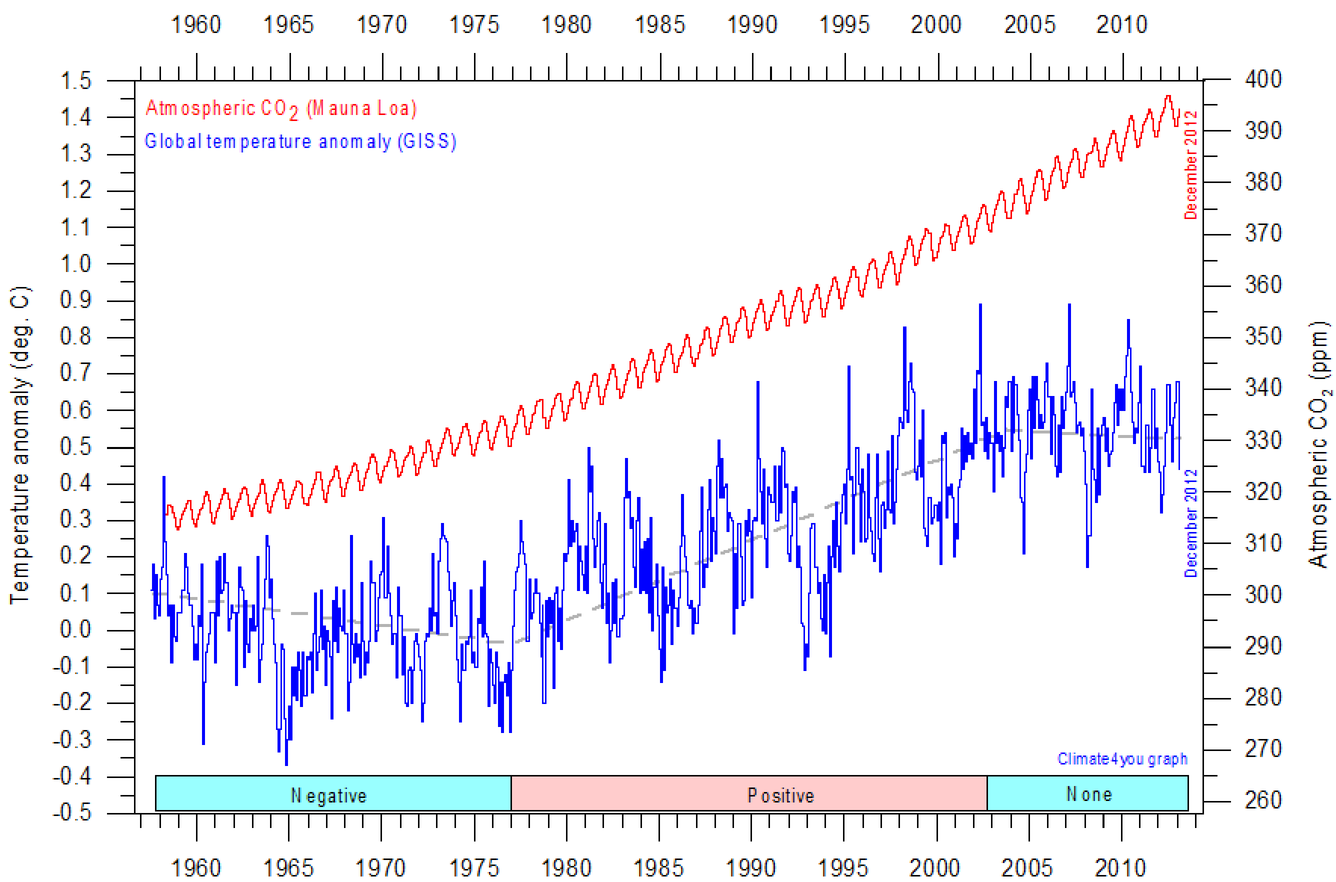



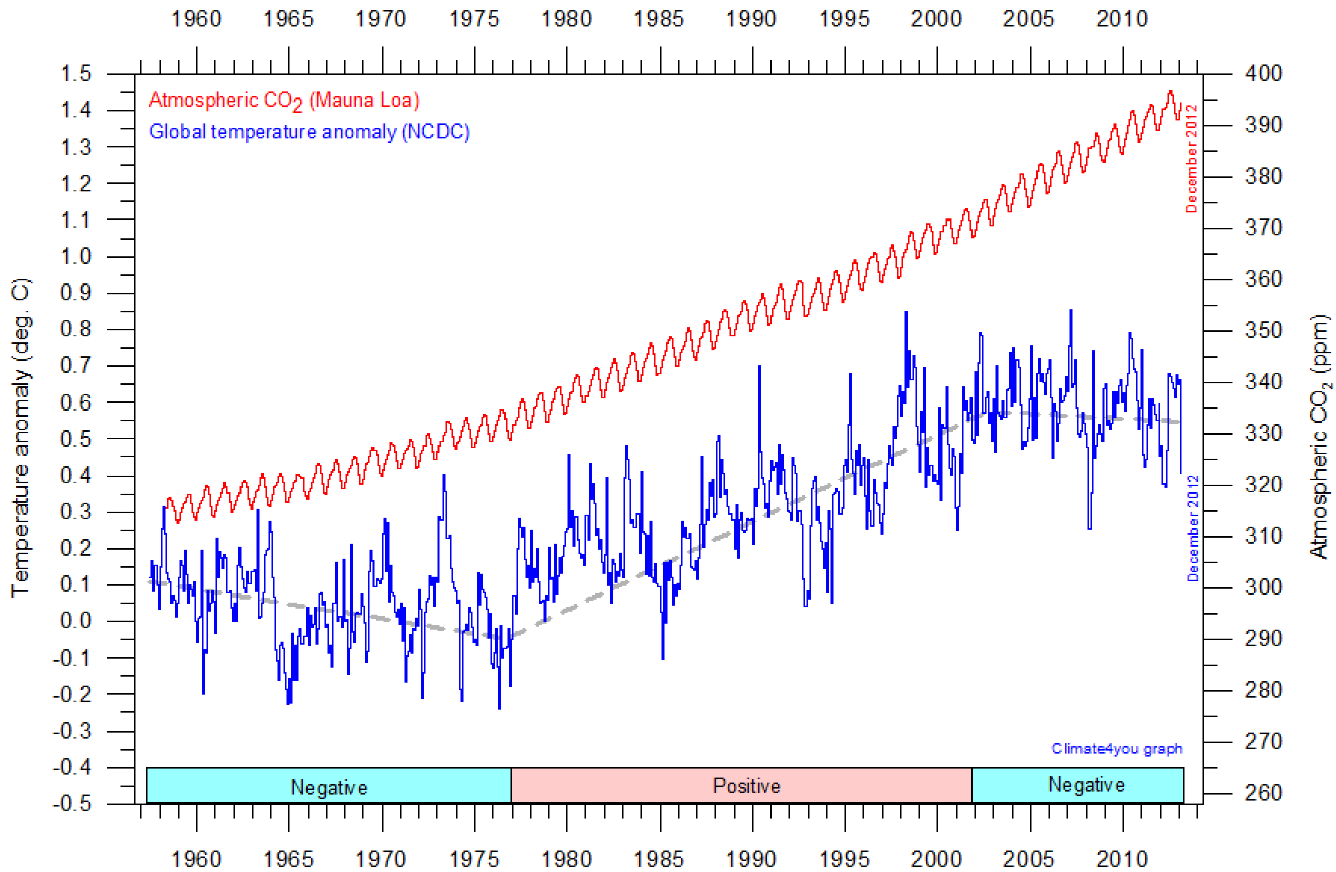

*Monthly amount of atmospheric $CO_2$ (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric $CO_2$ since 1959, according to data provided by the [Mauna Loa Observatory](), Hawaii, USA. The thick line is the simple running 37 observation average,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

## Global surface air temperature and atmospheric $CO_2$, updated to December 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.*

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.

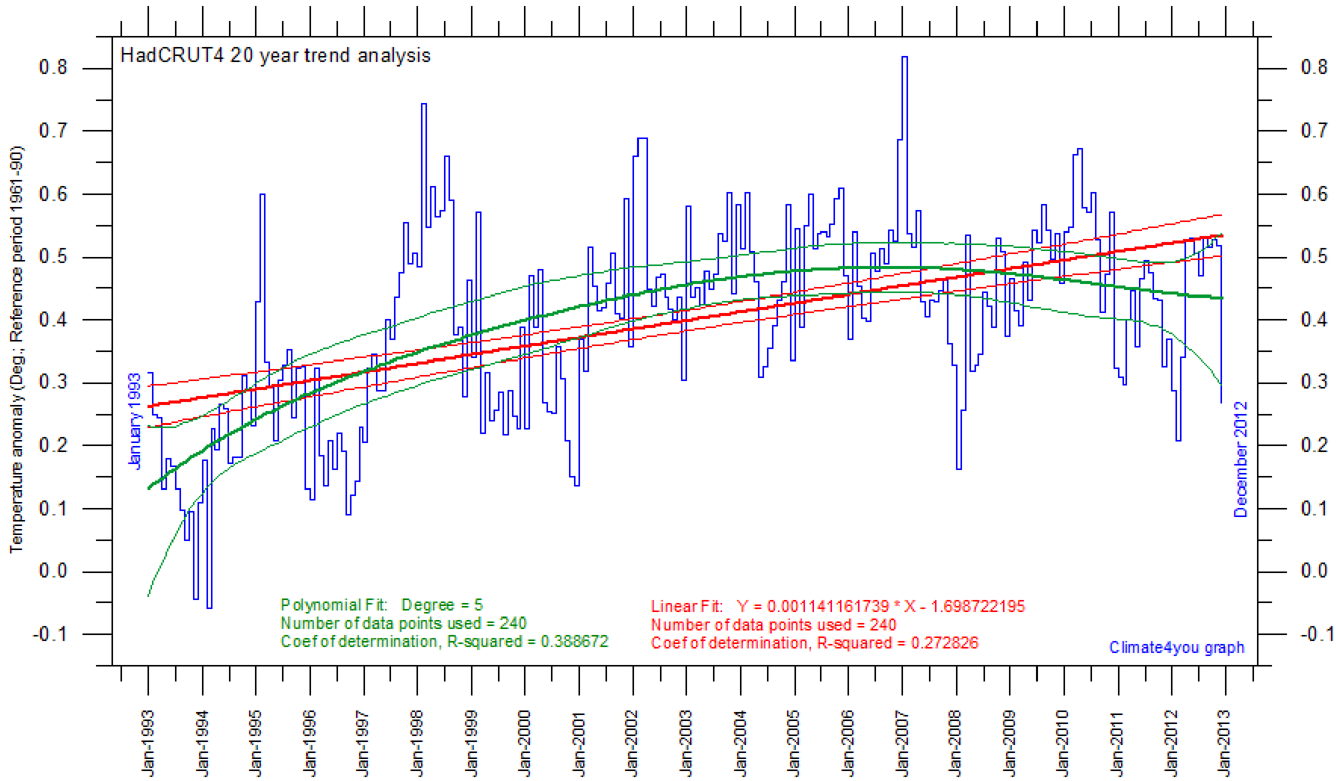
What exactly defines the critical length of a relevant time period to consider for evaluating the alleged importance of $CO_2$ remains elusive, and is still a topic for discussion. However, the critical period length must be inversely proportional to the temperature sensitivity of $CO_2$, including feedback 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 December 2012

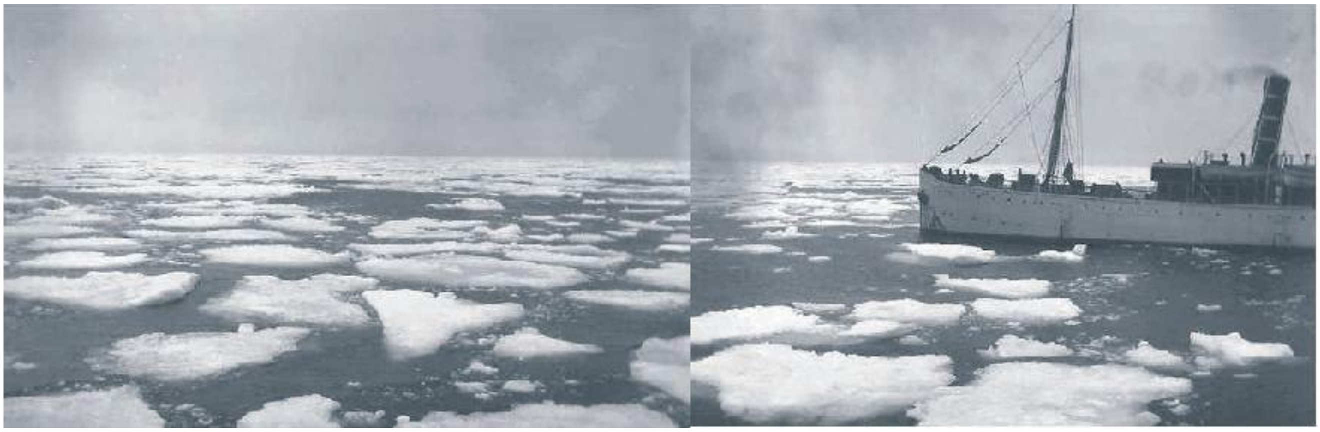



26 *Last 20 years global monthly average surface air temperature according to Hadley CRUT, a cooperative effort between the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thin blue line represents the monthly values. The thick 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 limited predictive power.

Climate and history; one example among many

## 1909-1925: Changing sea ice conditions at Svalbard



*Steamship Neptun in close sea ice at Spitsbergen, summer 1909. Picture source: Anders Beer Wilse, Norsk Folkemuseum. .*

In connection with a detailed description of the Swedish coal mining and exploration activities in Spitsbergen (main island in Svalbard ), Hoel (1966) provides information on summer sailing conditions in the main fjords and along the west coast of Spitsbergen:

July 7, 1909 : The Billefjord is blocked by ice. First ship makes it to Pyramiden in innermost Billefjord July 12.

September 1910: Geological expedition lead by Ernest Mansfield (The Northern Exploration Co., Ltd., London) find Kongsfjorden blocked by ice, and instead seeks emergency harbour in Braganzavågen, Van Milenfjorden. Here sea ice makes it impossible to leave the fjord and begin the return journey before early October.

August 11, 1912 : Braganzavågen in Van Mijenfjorden is closed by ice. Also Bellsund is blocked by ice.

The First World War (The Great War; 1914-1918) resulted in a global lack of coal for energy production, and coal prizes increased rapidly. The Swedish mining company *Aktiebolaget Spetsbergens Svenska Kolfält* was founded September 4, 1916, with the purpose of opening a coal mine at Braganzavågen, innermost Van Mijenfjorden, Spitsbergen, where promising coal seams had been found. The company rapidly decided to send an expedition with about 150 persons to Spitsbergen, to establish a coalmine at this chosen site. The planned mine was given the name *Sveagruvan*. Coal production was planned to begin during the winter 1917-1918, and a total production of about 25,000 tonnes coal was estimated for the first year of operation.

The expedition left Stockholm in Sweden early July 1917 on the steamship D/S Amsterdam, but difficult sea ice conditions in Van Mijenfjorden made it impossible to reach Braganzavågen before early August (see photo above). With little doubt the summer of 1917 must have been cold compared to early 21st century conditions, as is shown by the many floes of sea ice. Today, the last floes of the winter sea ice usually melt long before August. Also the fresh snow seen in the picture is noteworthy. Snow must have been falling at low altitudes shortly before the photo was taken. The cold character of the year 1917 is clearly shown by the official Svalbard temperature record since 1912, which shows all seasons of the year 1917 to be cold in comparison with previous and following years. The warming from 1917 to 1922 must indeed have been rapid in this part of the Arctic.

Under direction of Director Granholm the first buildings in the mining settlement *Svea* were constructed, and parts of the coming harbour for shipment of coal were established. Geological surveying was carried out in the area around the mine. About 50 persons stayed over winter along with Director Granholm, and 4,000 tonnes coal was produced, somewhat below the initial estimate of 25,000 tonnes (Hoel 1966). A layer of clay stone just above the coal layer often collapsed when the coal was removed, and it proved difficult to avoid mixing of clay stone and coal.


500 Kr.

STAM-AKTIEBREV

SVENSKA STENKOLSAKTIEBOLAGET

SPETSBERGEN

Kronor Fem Hundra Kronor

*Steamship D/S Amsterdam in Braganzavågen, innermost Van Mijenfjorden, early August 1917 (right). Photo by A. Reuterskiöld.*

July 1915: An expedition lead by Birger Johnsson finds the west coast of Spitsbergen blocked by sea ice. Westerly winds keep the ice in a state of compression. The winter sea ice in the fjords is beginning to break up, but the ice along the west coast fills the mouth of the fjords, and keeps the winter ice in place. Several vessels have to return to Tromsø in northern Norway without reaching the coast of Spitsbergen. The Birger Johnsson expedition for several weeks attempts landing on Spitsbergen, and is forced to give up on August 17.

July-August 1917: Difficult sea ice conditions in Van Milenfjorden made it impossible for the steamship D/S Amsterdam to reach Braganzavågen, innermost Van Mijenfjord, before early August (see below).

1919: The Swedish coal mine Sveagruvan in innermost Van Mijenfjorden is able to ship no less than 20,000 tonnes of coal, partly because of unusual fine sea ice conditions during the summer of 1919.

1920: The harbour at Sveagruvan is open for shipping in 98 days.

1921: The harbour at Sveagruvan is open for shipping in only 85 days because of difficult sea ice conditions.

1922: The harbour at Sveagruvan is open for shipping in 92 days. Sea ice conditions are described as 'normal'. Report on Arctic Warming in the journal *Monthly Weather Review* October 10, 1922.

1923: The harbour at Sveagruvan is open for shipping in 97 days. Sea ice conditions are described as 'normal'.

1924: The harbour at Sveagruvan is open for shipping from 9 July to 21 October (105 days). Sea ice conditions are described as 'normal'.

1925: The harbour at Sveagruvan is open for shipping from 3 July to 6 October (96 days). This year the Van Mijenfjord is still free of ice when the last ship leaves October 6.

References:

Hoel, A. 1966. *Svalbard. Svalbards historie 1596-1965*. Sverre Kildahls Boktrykkeri, Oslo, 1024 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)

February 26, 2013.