Climate4you update March 2012

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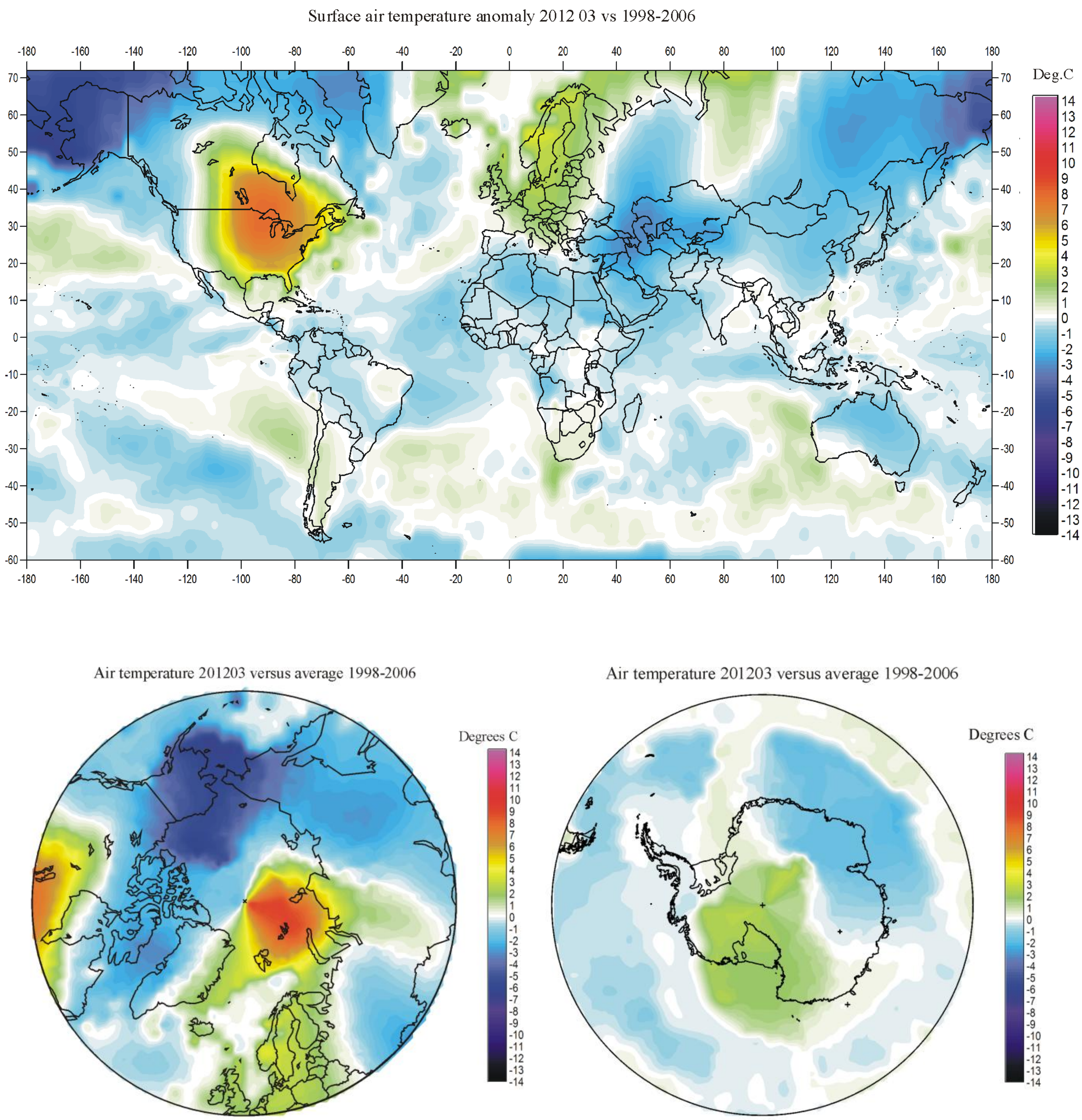
March 2012 global surface air temperature overview



March 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 March 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.

The average global surface air temperatures March 2012:

General: Global air temperatures were relatively low.

The Northern Hemisphere was characterised by high regional variability, but was generally relatively cold. Above average 1998-2006 temperatures were only experienced in a region of North America, centred on the Great Lakes, and in Europe and the European-Russian Arctic. Most of Asia and Siberia experienced below average temperatures. Also Alaska and the northern and western parts of Canada had below average temperatures. The North Atlantic was below or near average 1998-2006 conditions, except for a region extending from Scotland towards Iceland. The marked thermal contrast across the North Pole is mainly an interpolation artefact only, reflecting the sparse number of observations in this part of the Arctic, and the GISS procedure of extrapolating temperatures measured at lower latitudes.

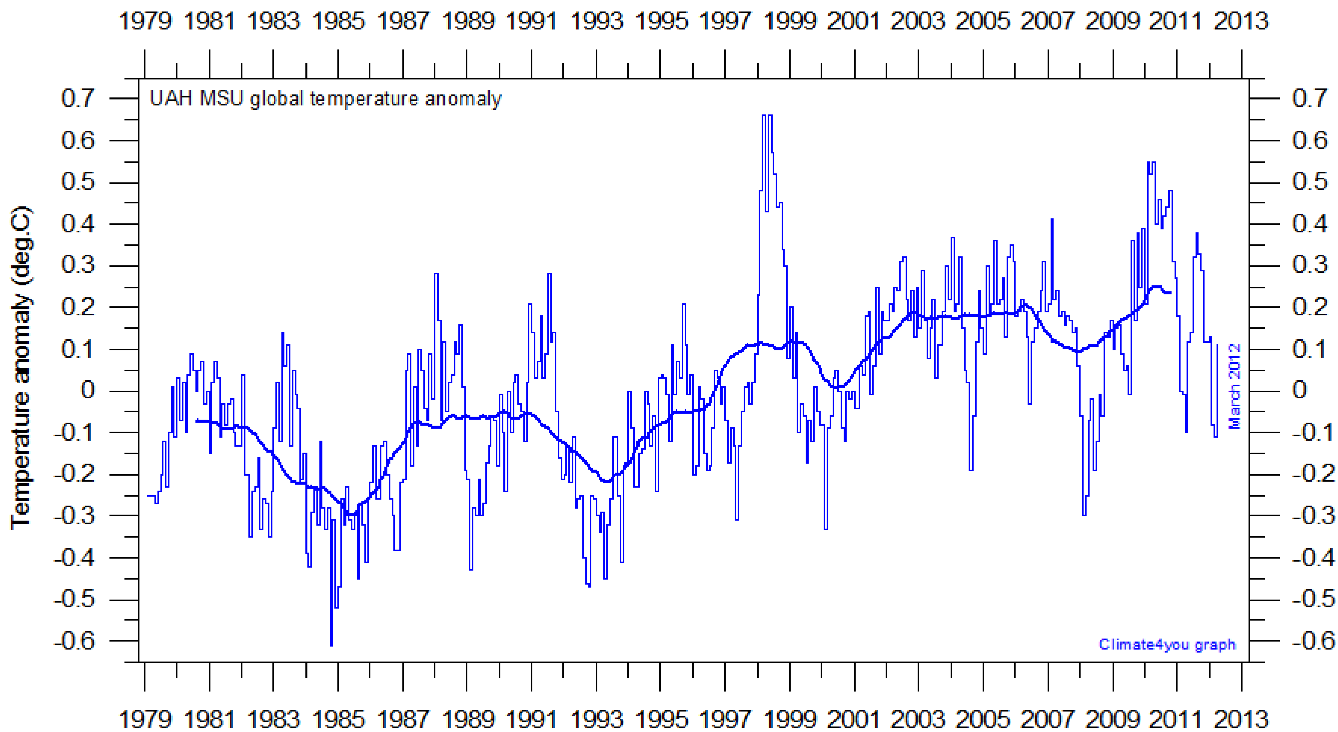
Near Equator temperatures conditions in general were below average 1998-2006 temperature conditions, both land and ocean.

The Southern Hemisphere was below or near average 1998-2006 conditions. Only central South America experienced temperatures somewhat above the 1998-2006 average. Both Africa and Australia experienced below average temperatures. Most of the oceans in the Southern Hemisphere were near or below average temperature. A new El Niño situation is developing along the west coast of South America. The Antarctic continent in general experienced at or below average 1998-2006 temperatures, although a large region centred on the Ross Sea experienced above average temperatures.

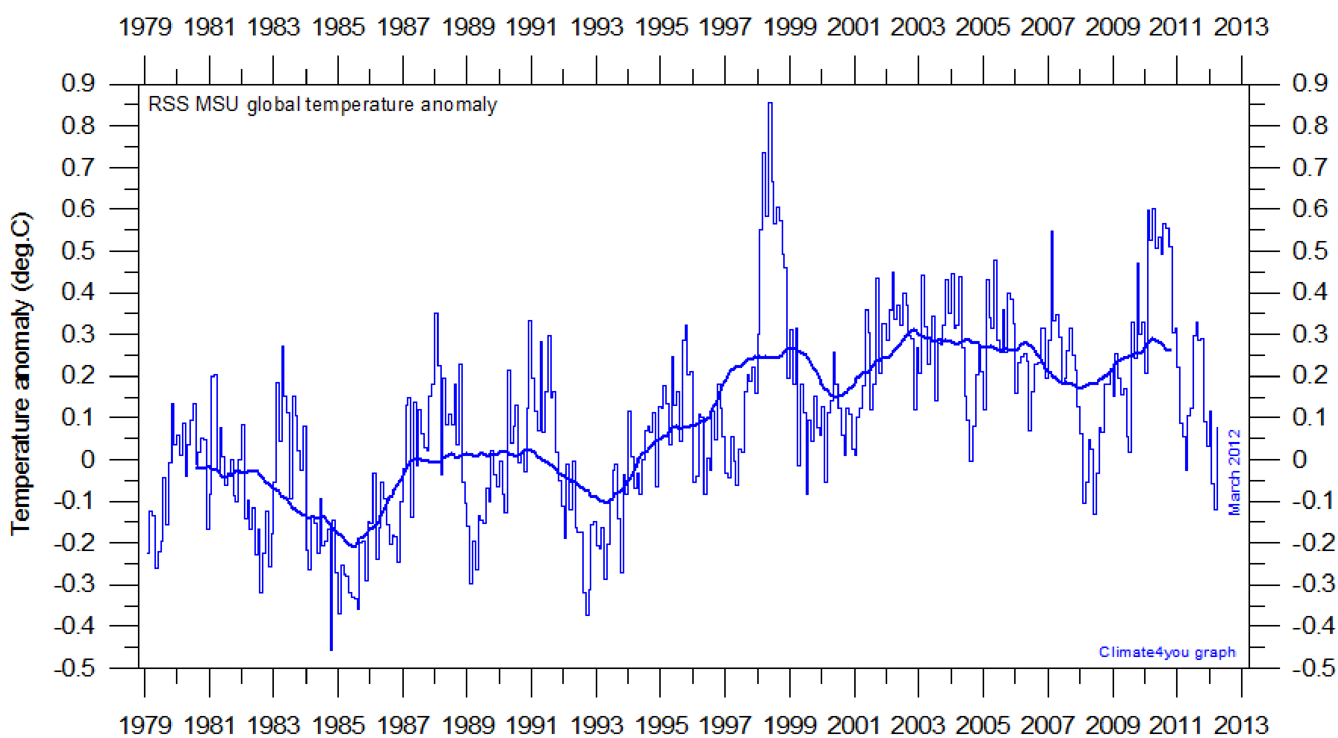
The global oceanic heat content has been almost stable since 2003/2004 (page 10).

All diagrams shown in this newsletter and links to original data are available on www.climate4you.com

Lower troposphere temperature from satellites, updated to March 2012

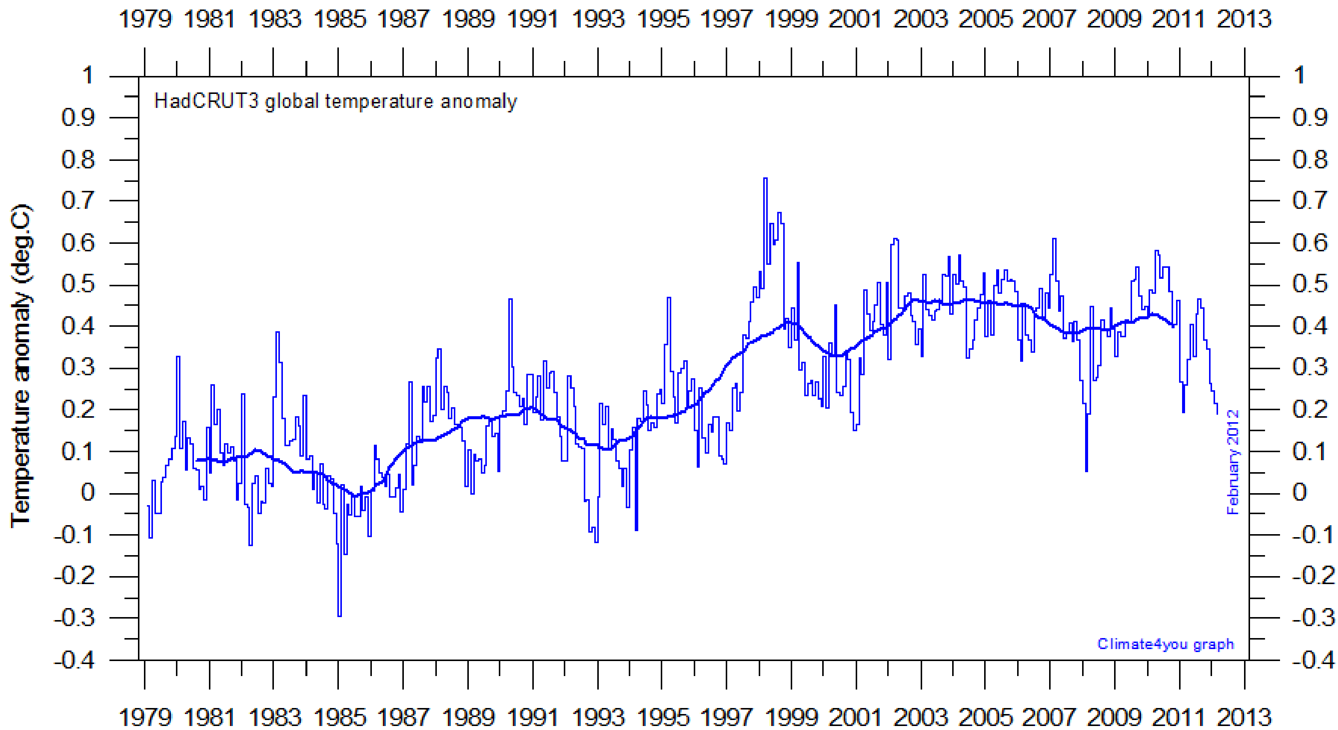


Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.

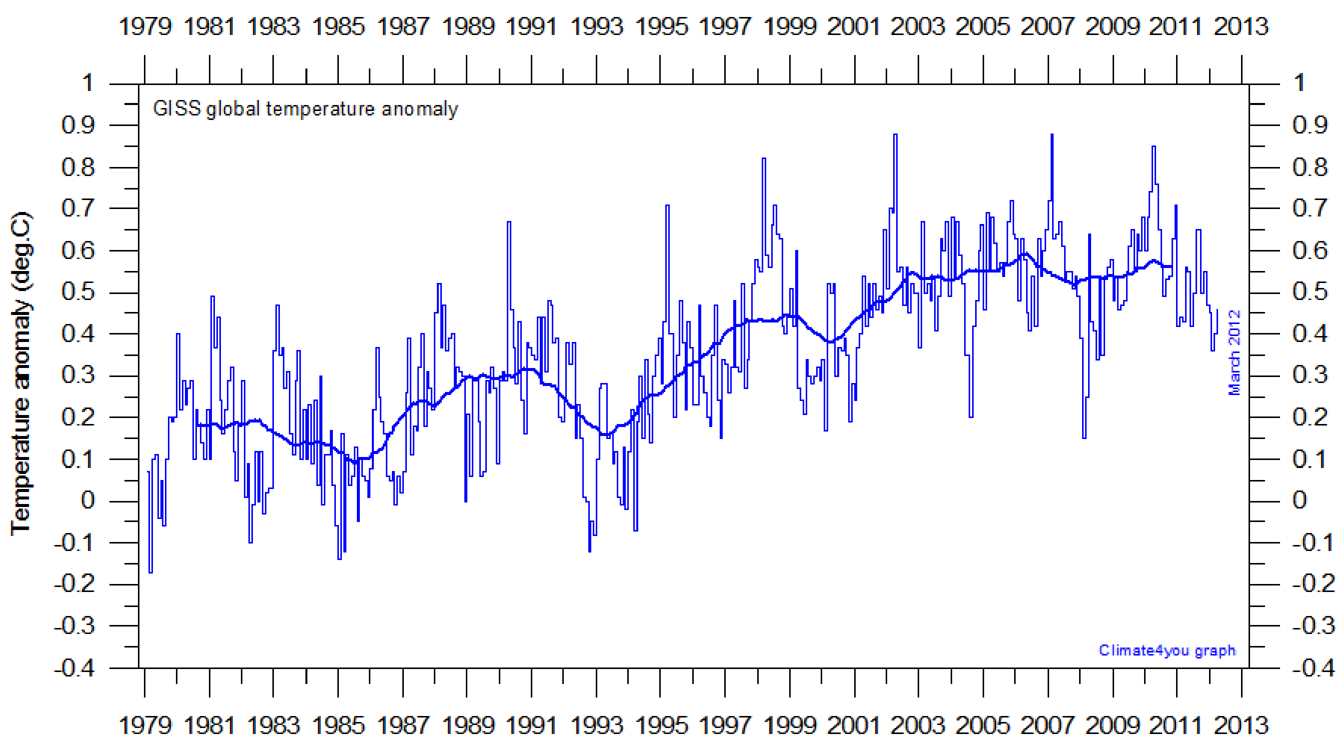


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37 month average.

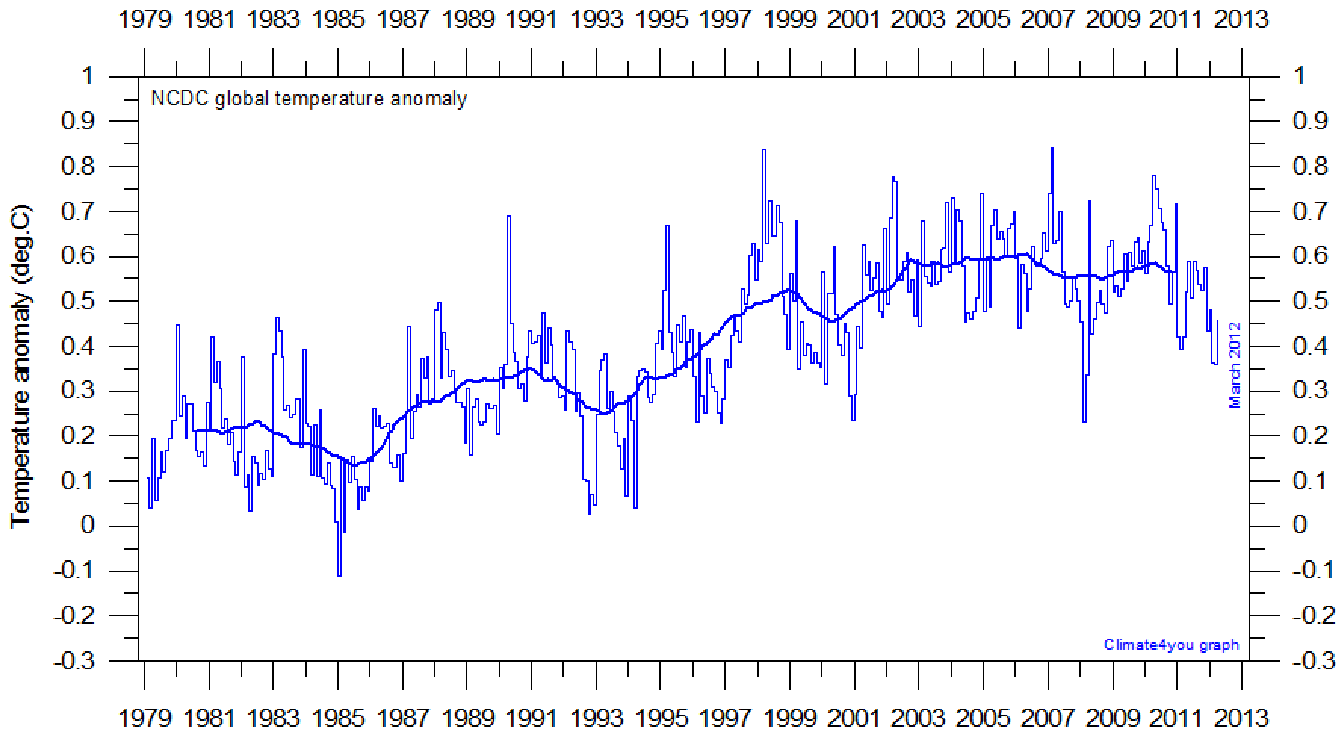
Global surface air temperature, updated to March 2012



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 February 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.

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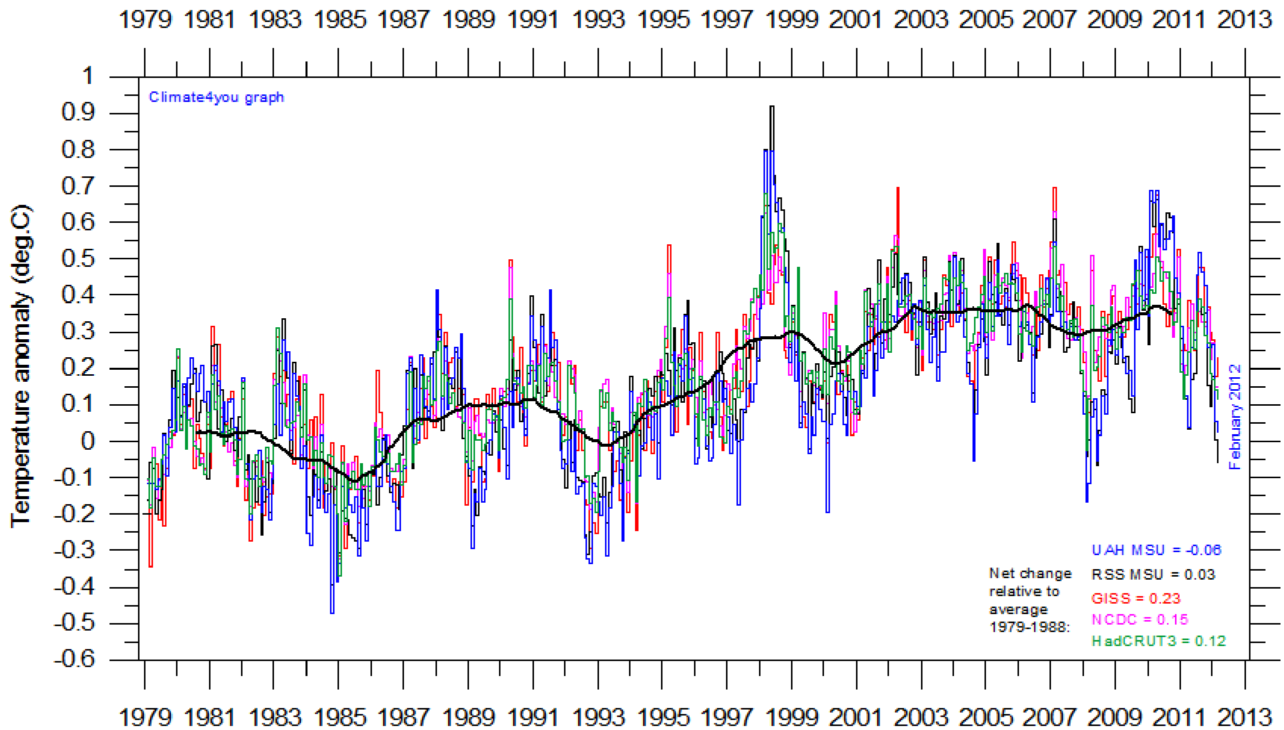
A note on data record stability:

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 additional 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 followed, and influence of other phenomena.

The most stable temperature record over time of the five global records shown above is by far the HadCRUT3 series.

You may 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 February 2012

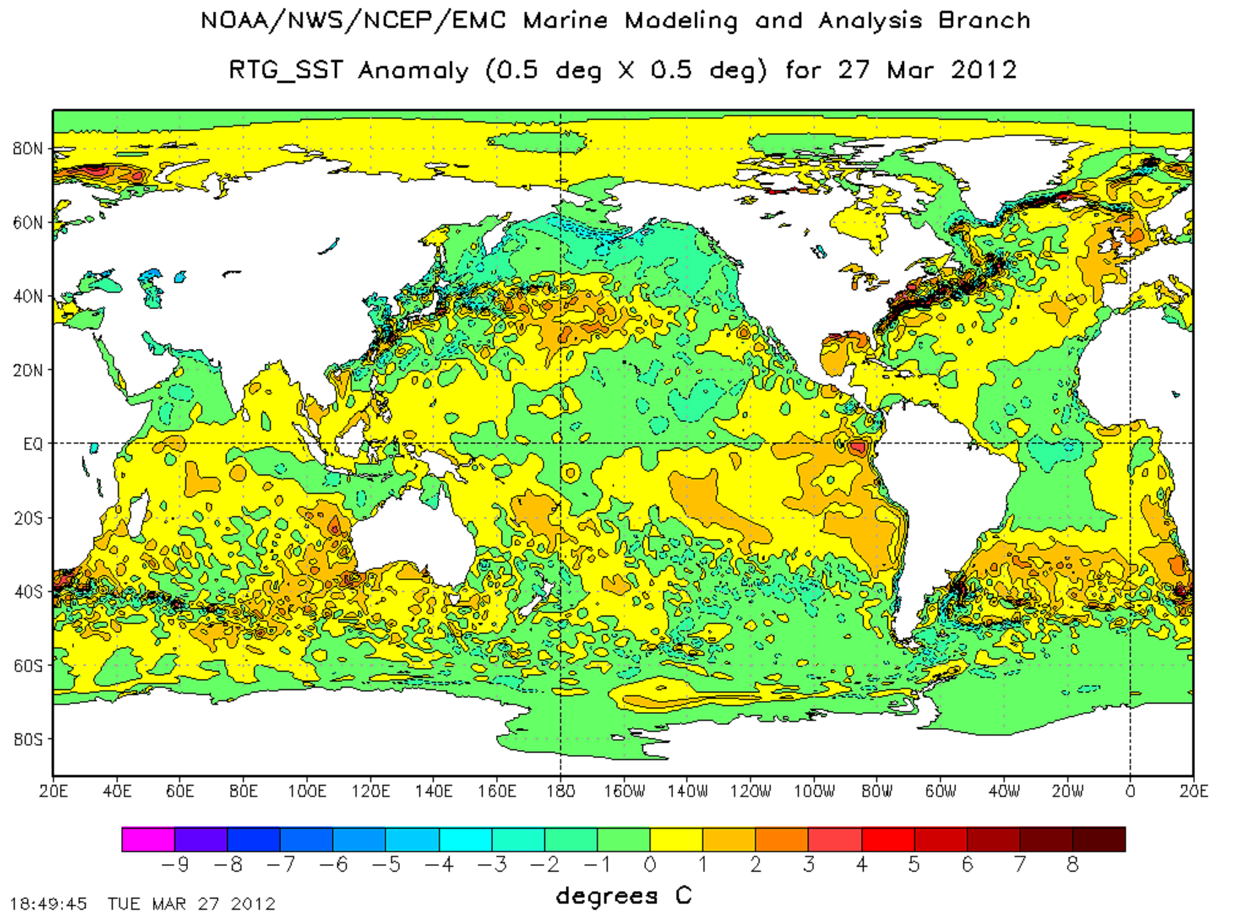


Superimposed plot of all five global monthly temperature estimates shown above. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of their initial 120 months (10 years) from January 1979 to December 1988. The heavy black 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 may be 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 March 2012

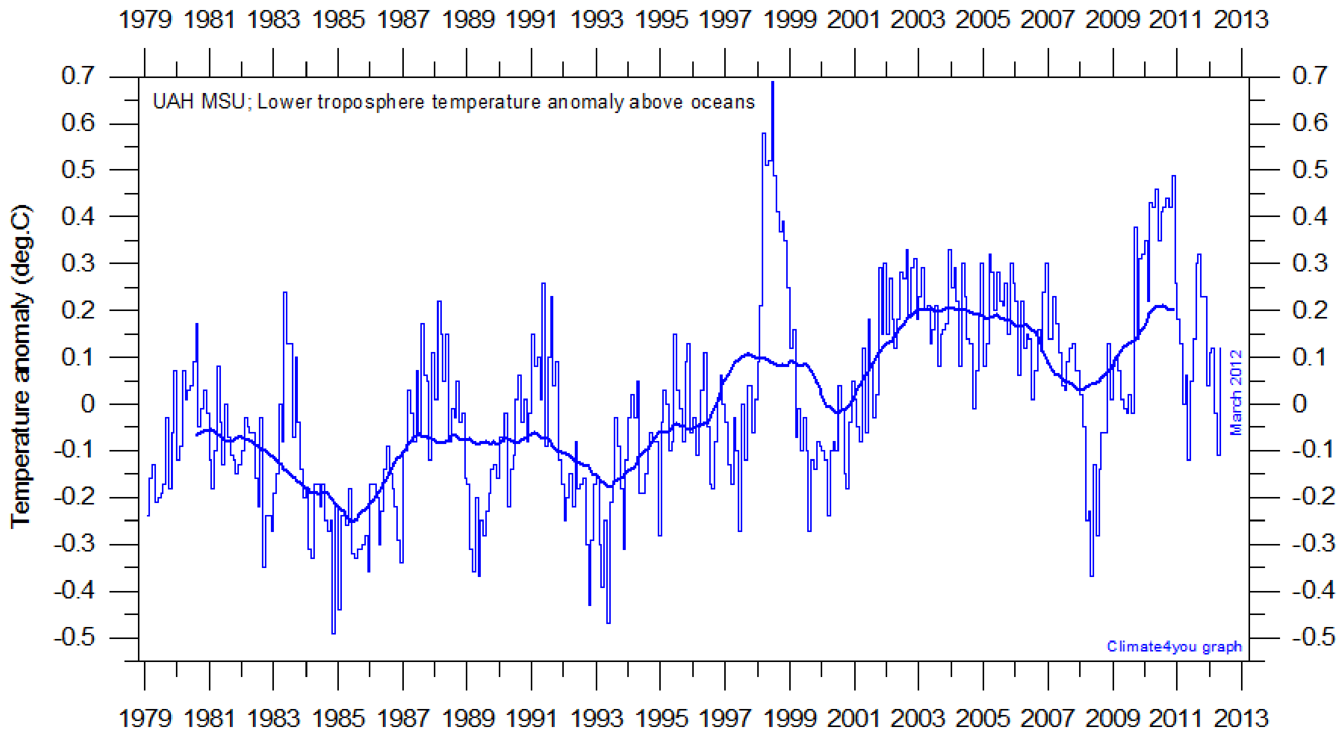


Sea surface temperature anomaly at 27 March 2012. Map source: National Centers for Environmental Prediction (NOAA).

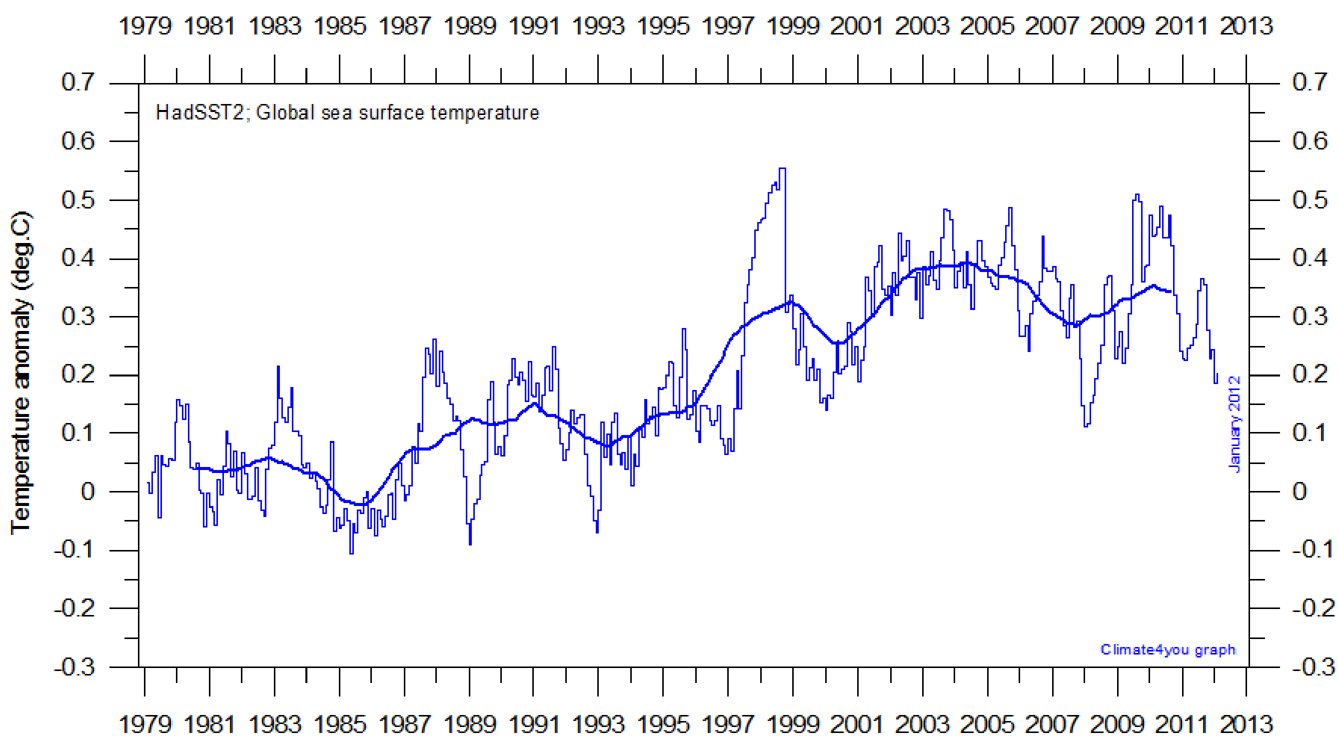
Relative cold sea surface water dominates the southern hemisphere and the regions near Equator. Because of the large surface areas involved especially near Equator, the temperature of the surface water in these regions significantly affects the global atmospheric temperature.

The next El Niño episode is now developing in earnest west of South America, and the effect of this is already seen in air temperatures (p.3-5).

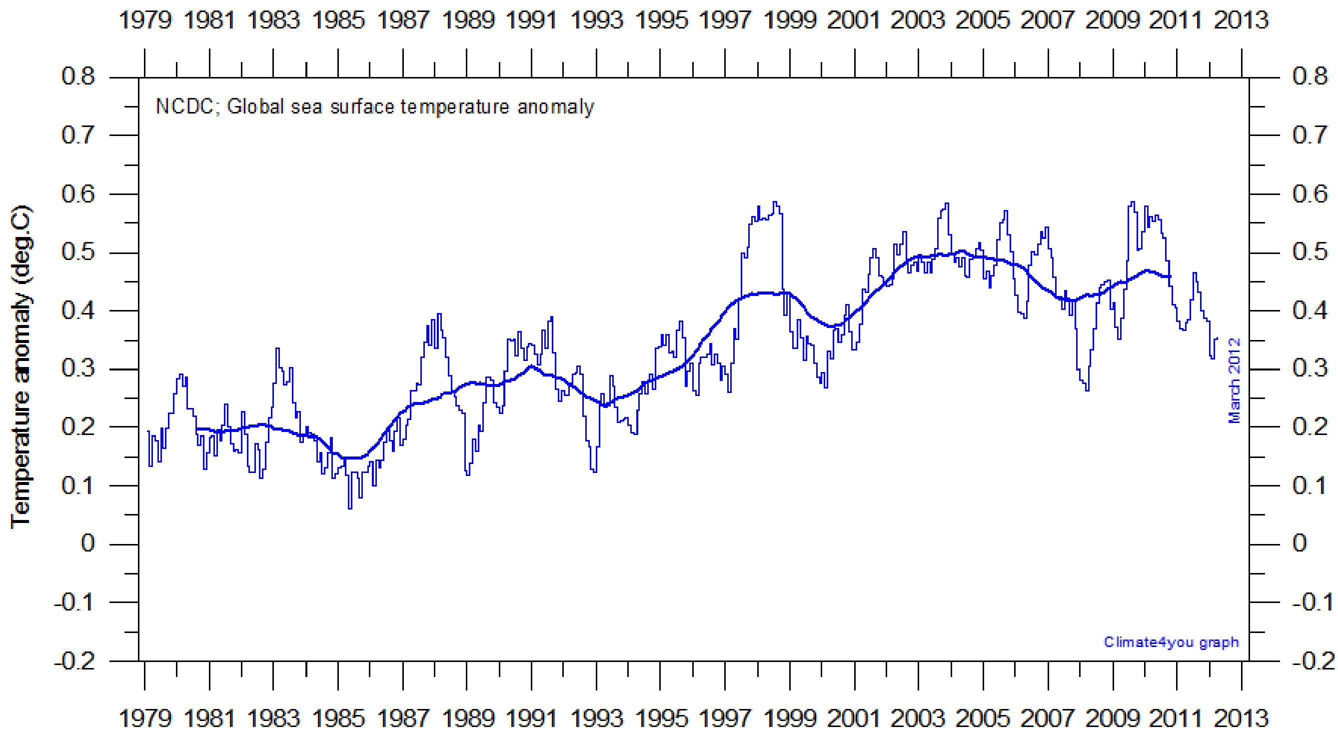
The significance of any short-term warming or cooling seen in air temperatures should not be over stated. Whenever Earth experiences cold La Niña or warm El Niño episodes (Pacific Ocean) major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in estimates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

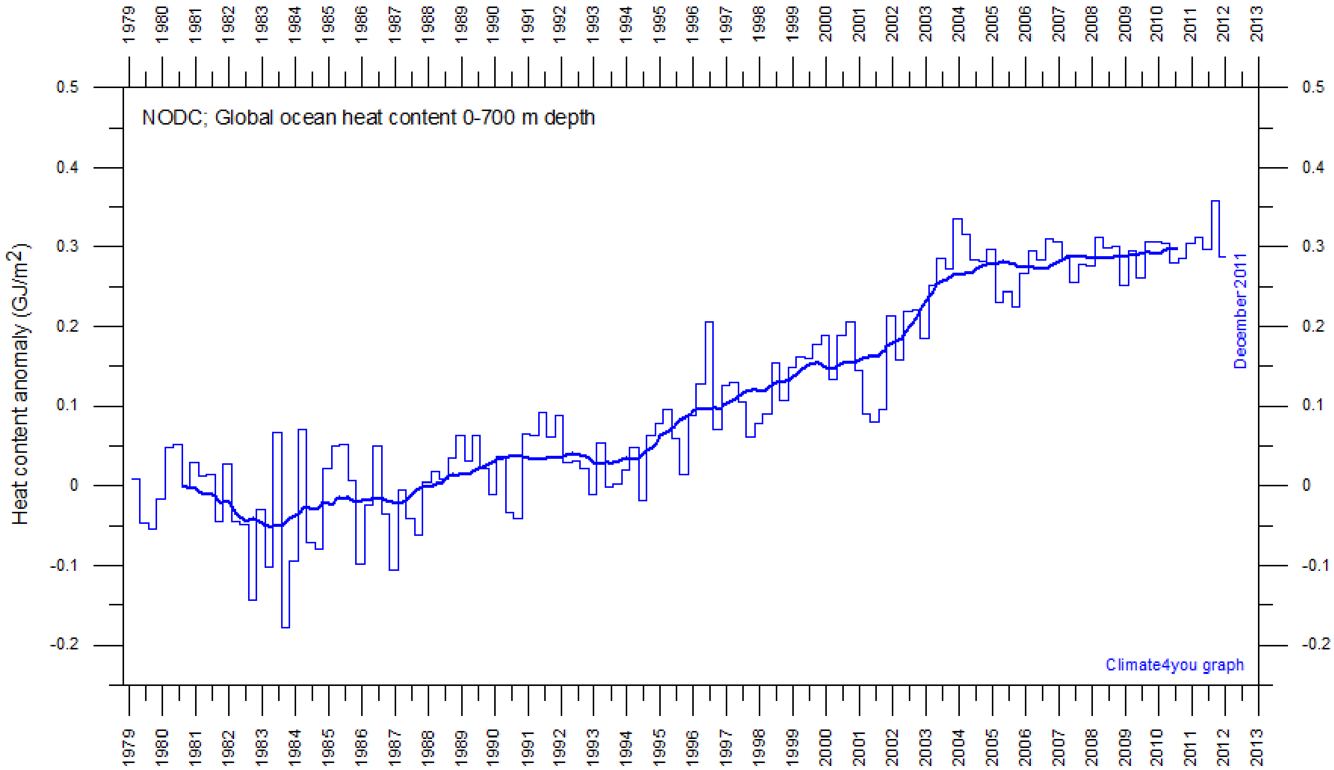


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit](#) ([CRU](#)), UK. Base period: 1961-1990. The thick line is the simple running 37 month average. Please note that no update beyond January 2012 is available at the moment.

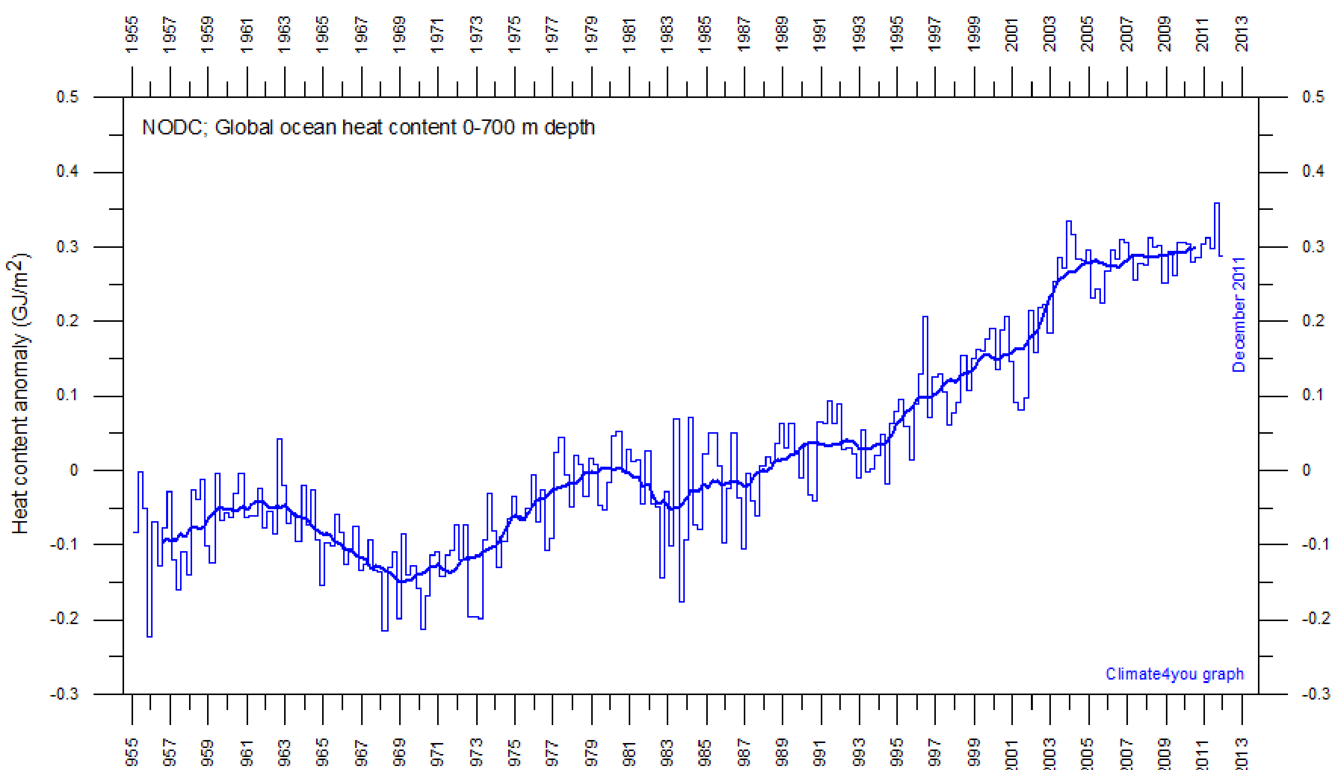


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to December 2011

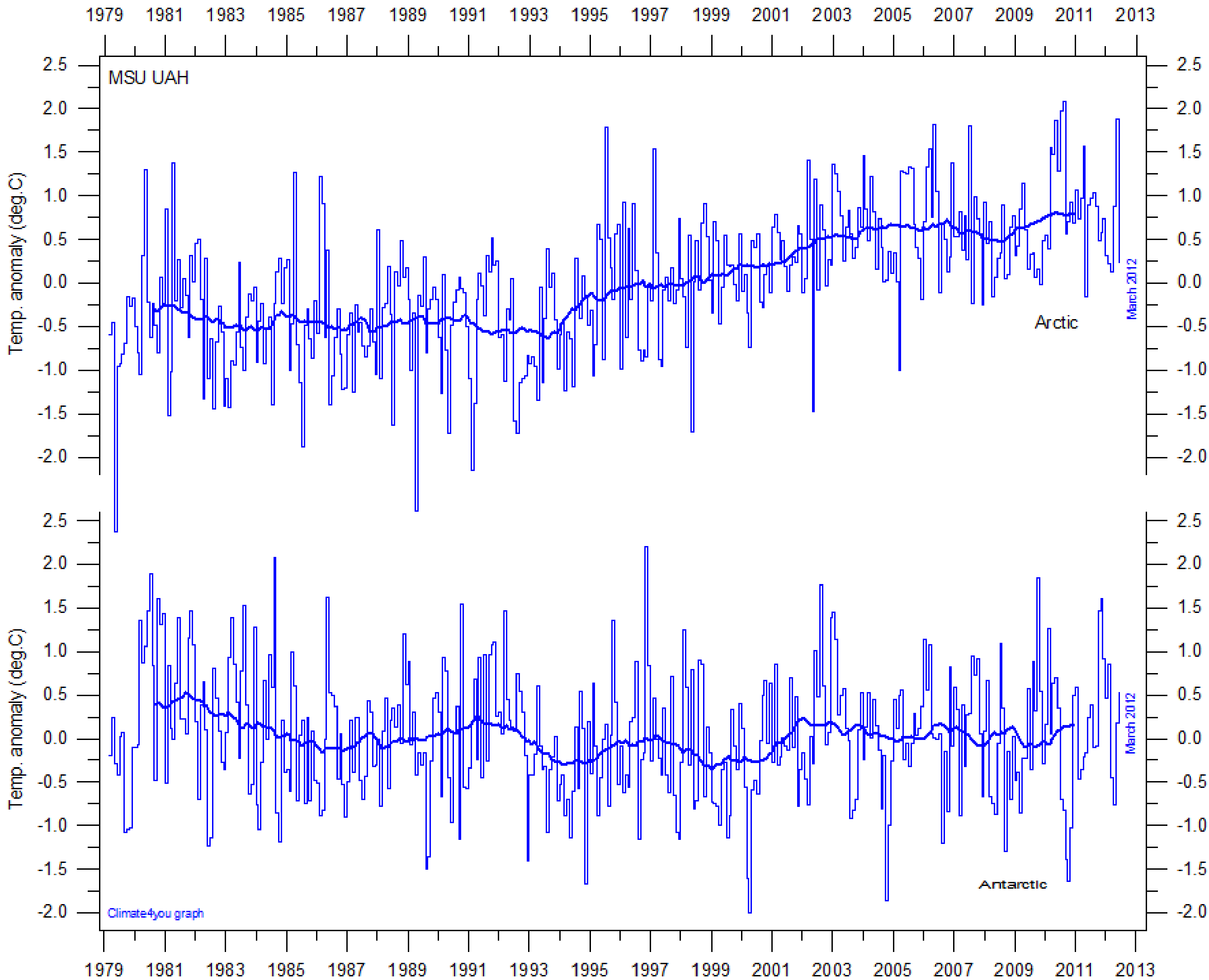


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



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

Arctic and Antarctic lower troposphere temperature, updated to March 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). 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 December 2011

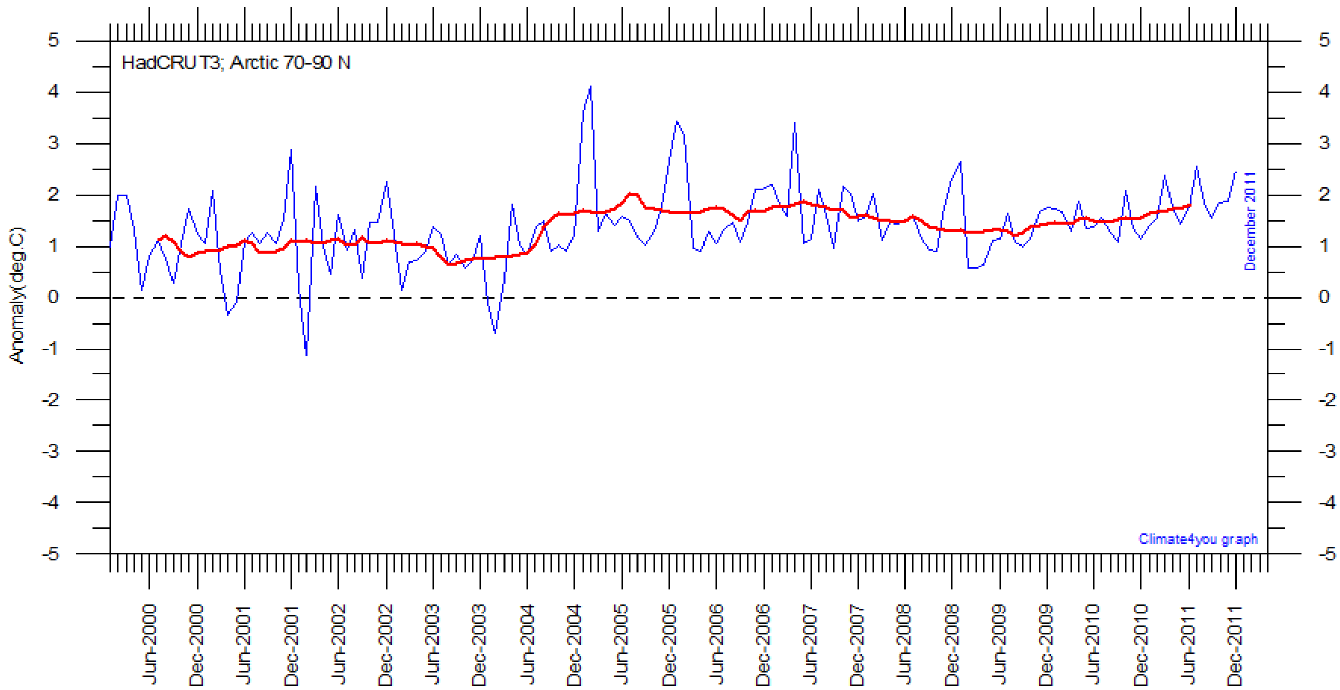


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

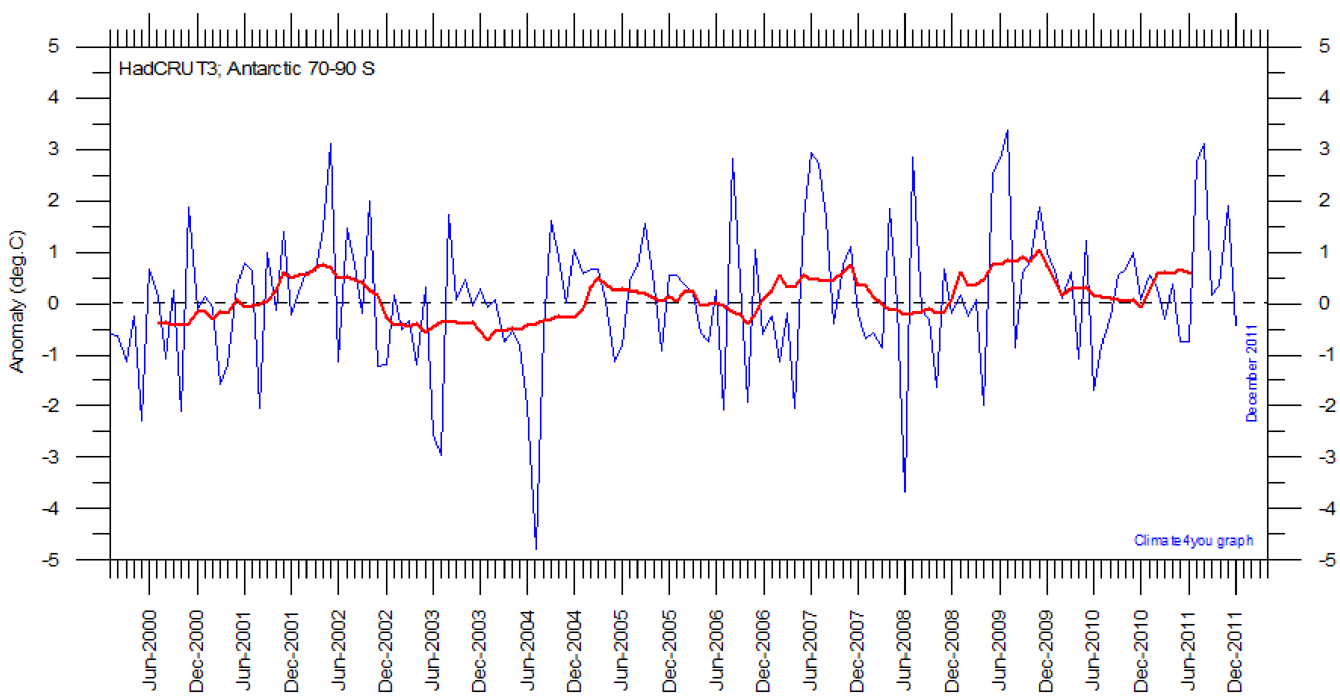


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

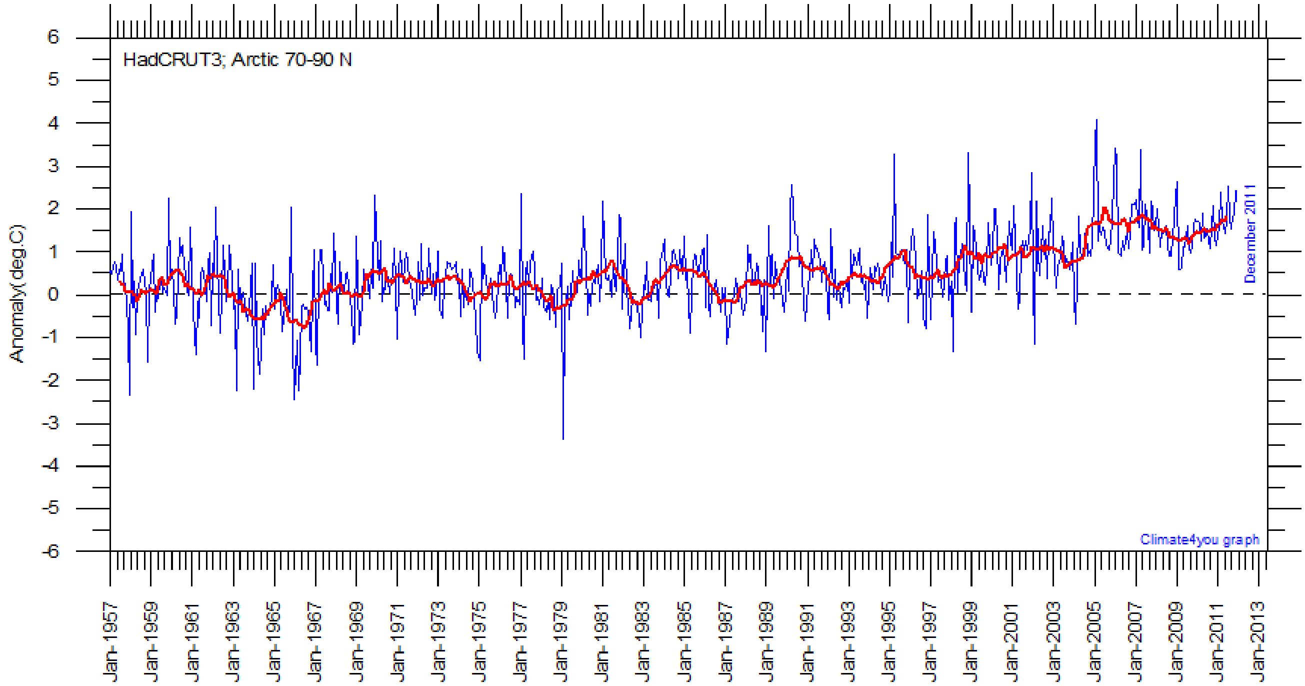


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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

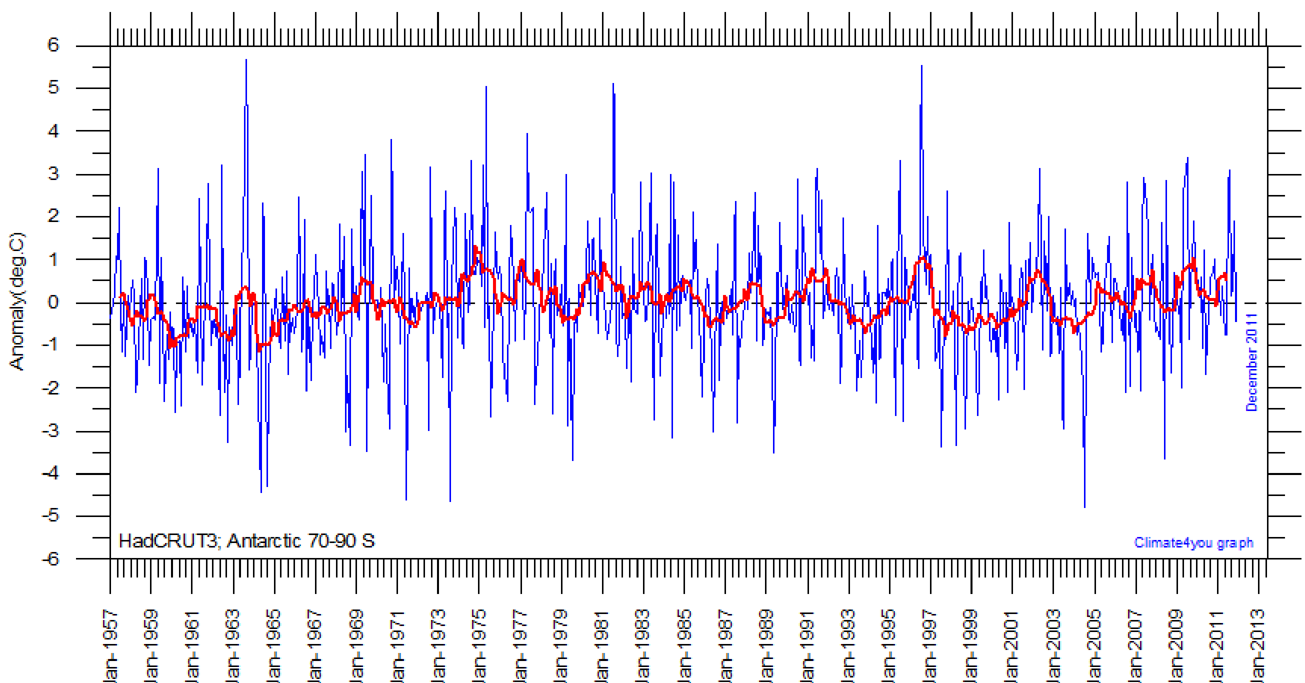


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

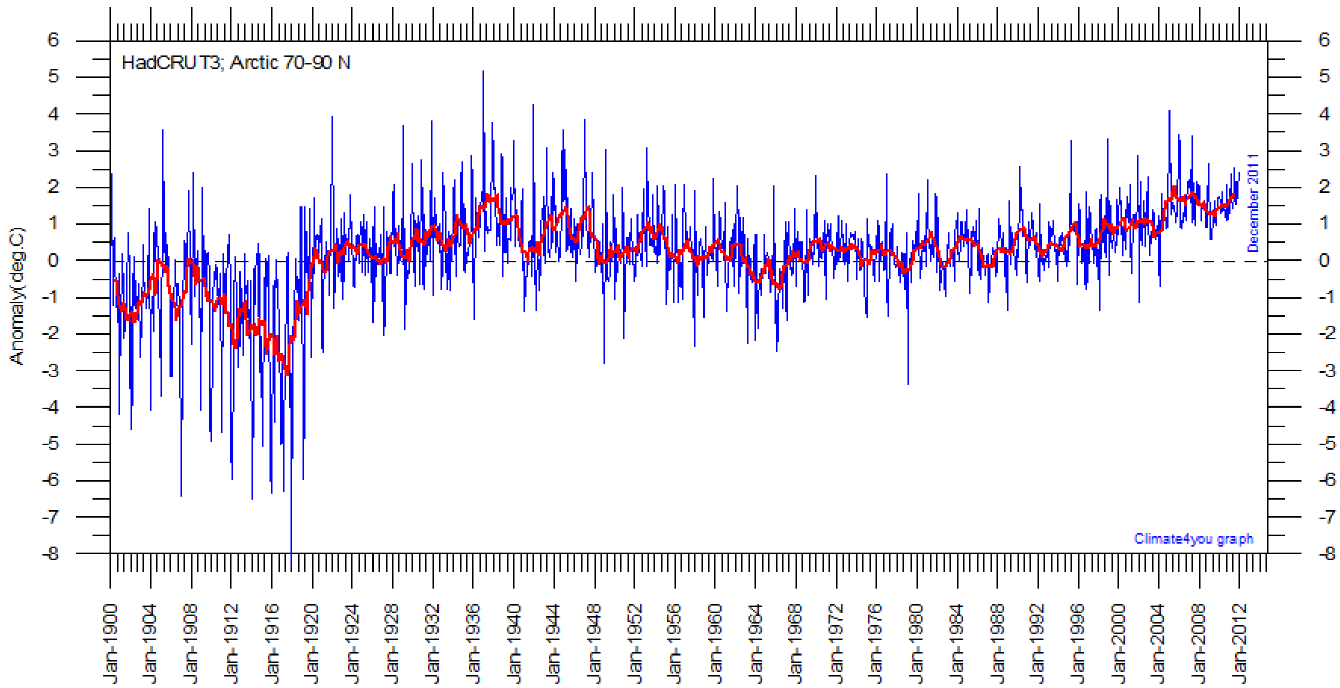


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly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

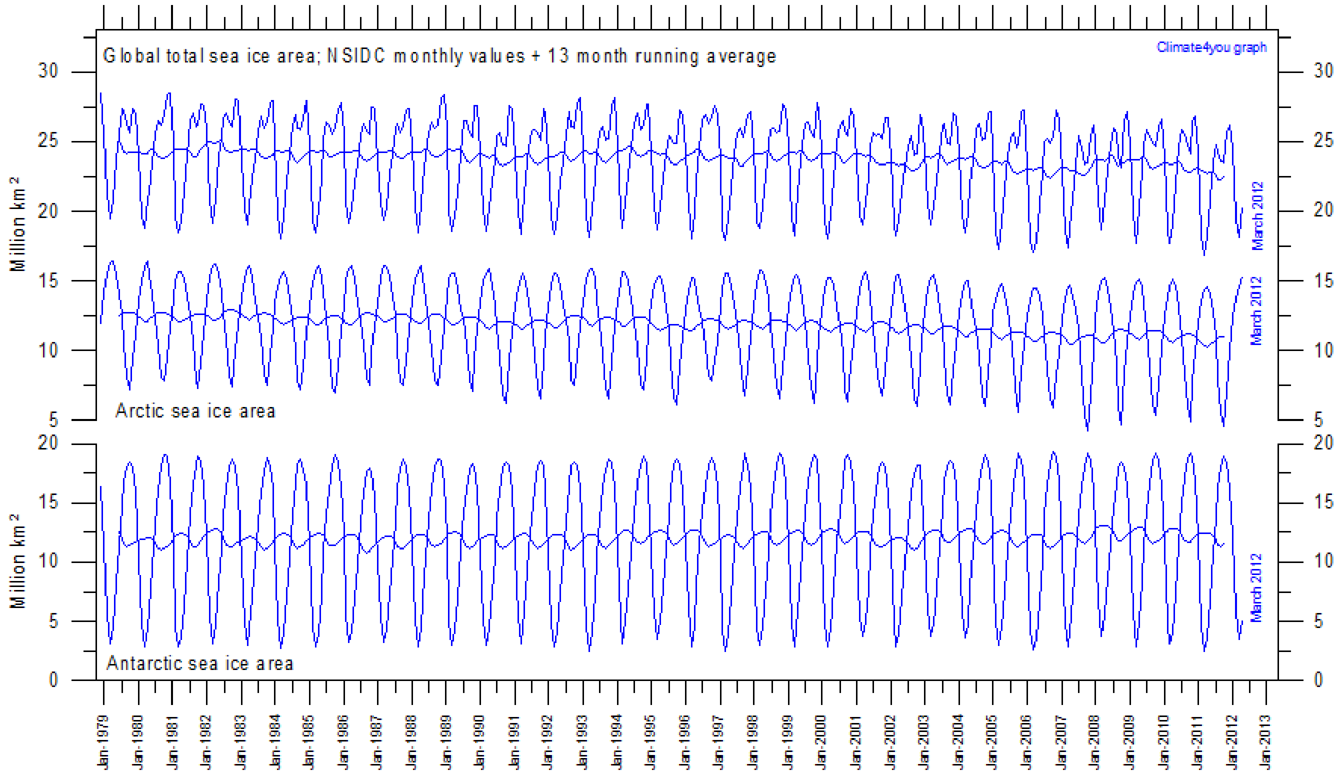
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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.

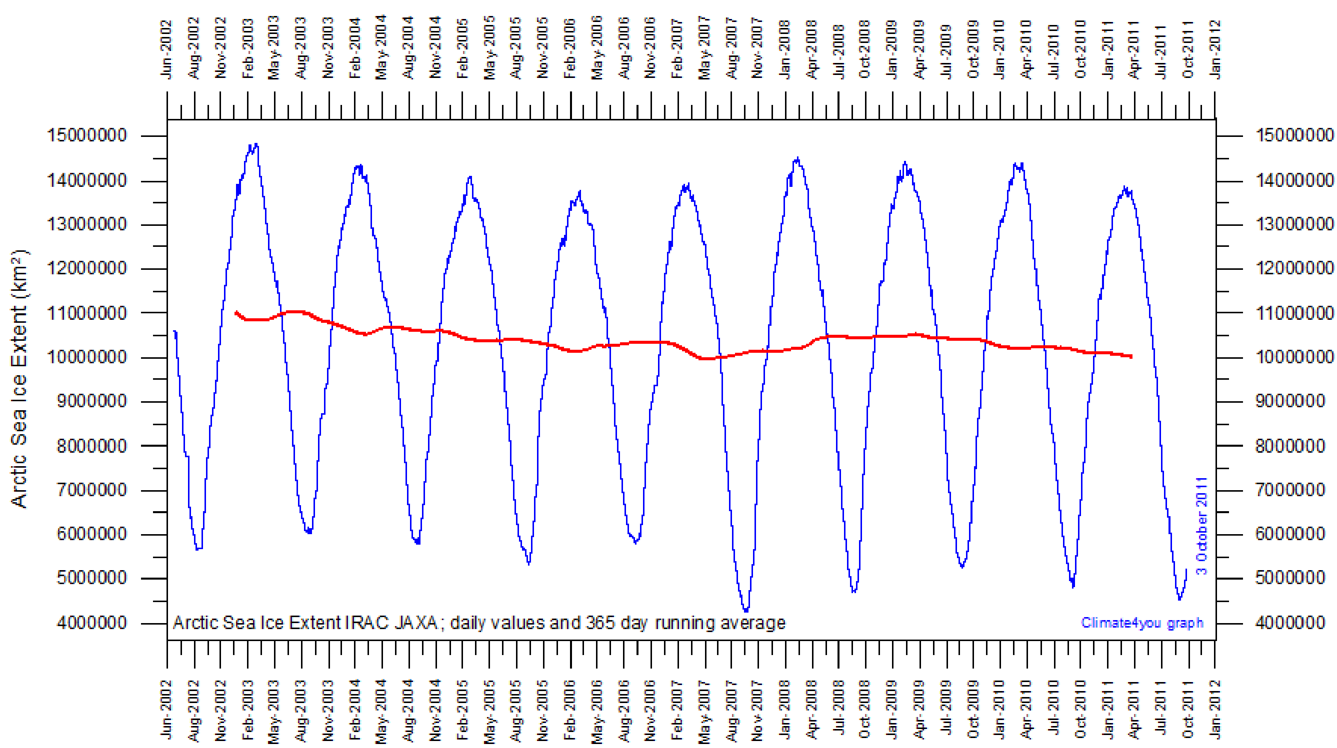
Literature:

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.

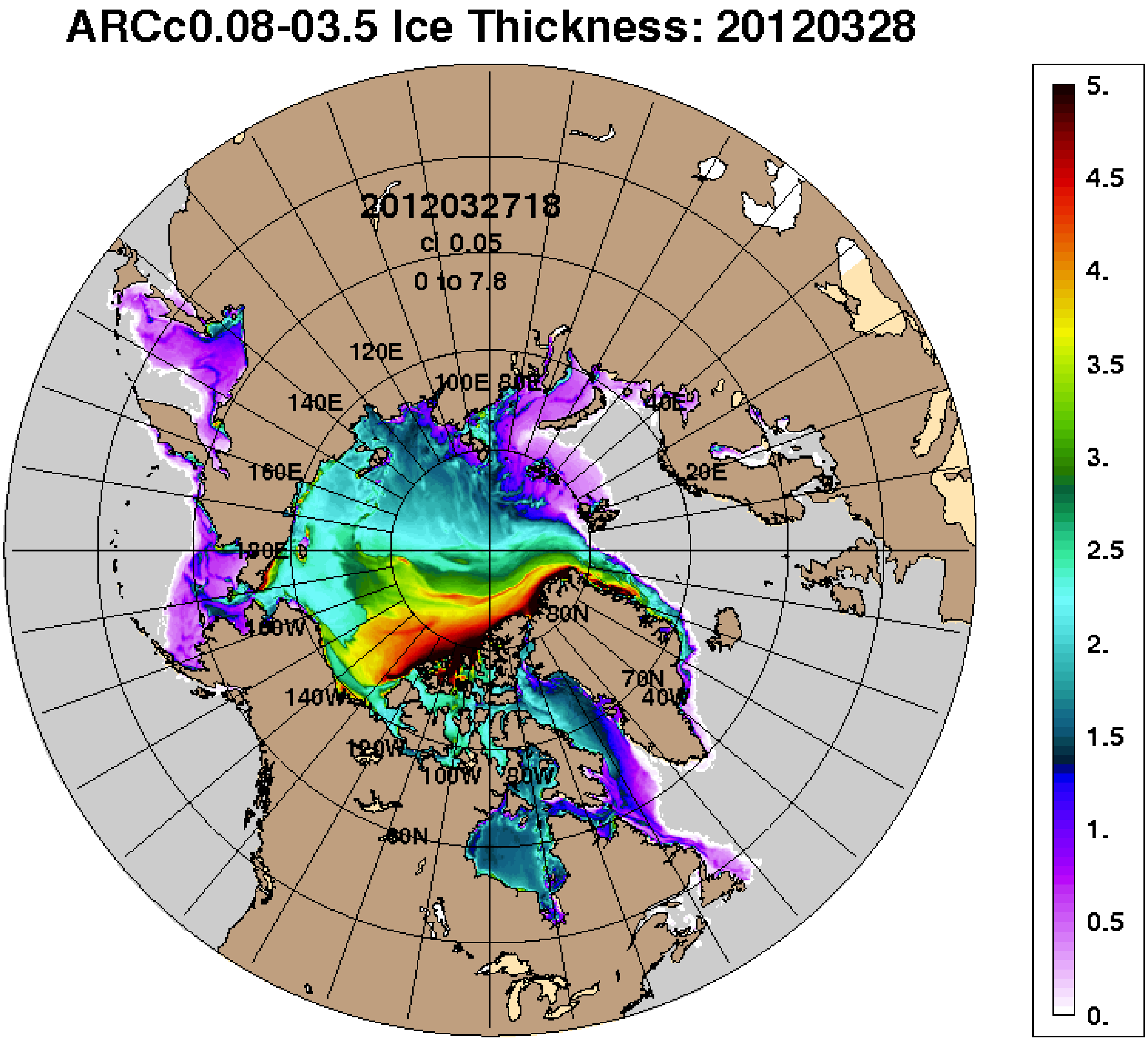
Arctic and Antarctic sea ice, updated to March 2012



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

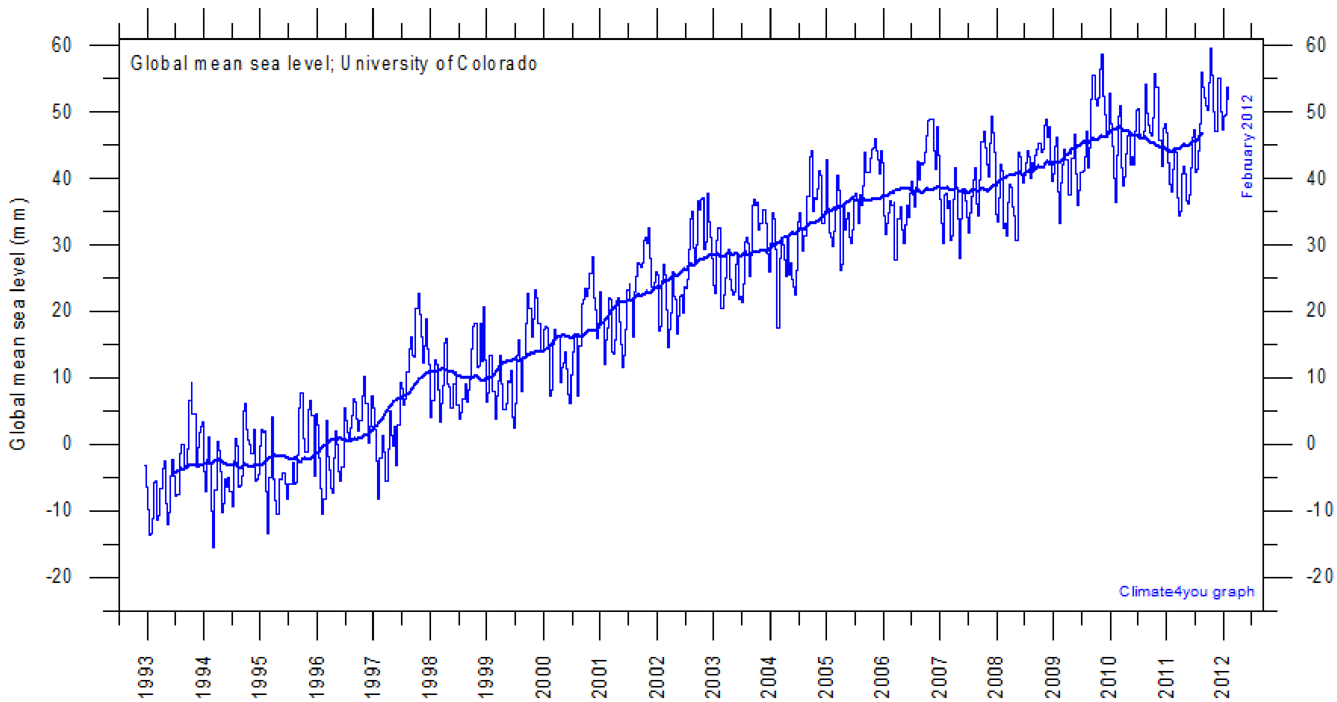


Graph showing daily Arctic sea ice extent since June 2002, to October 3, 2011, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA). Please note that this diagram is not updated beyond 3 October 2011 due to the present suspension of AMSR-E observation.

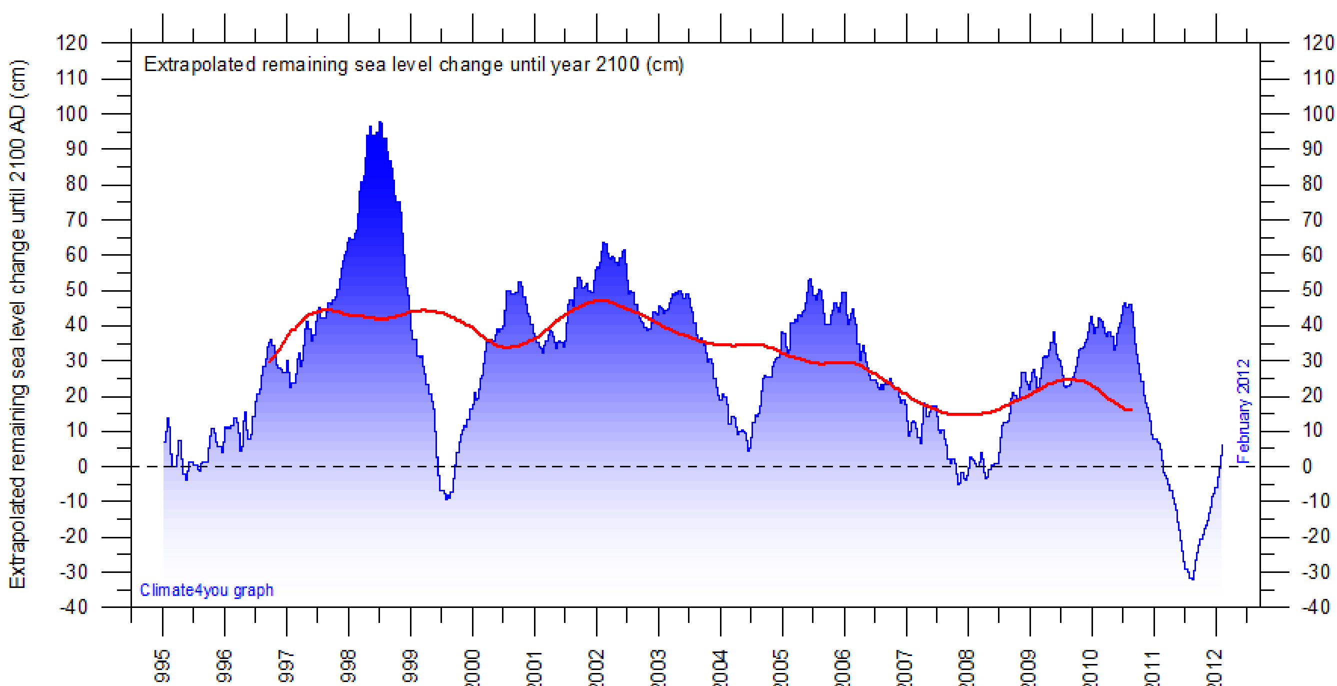


Northern hemisphere sea ice extension and thickness on 28 March 2012 according to the [Arctic Cap Nowcast/Forecast System](#) (ACNFS), US Naval Research Laboratory. Thickness scale (m) is shown to the right.

Global sea level, updated to February 2011

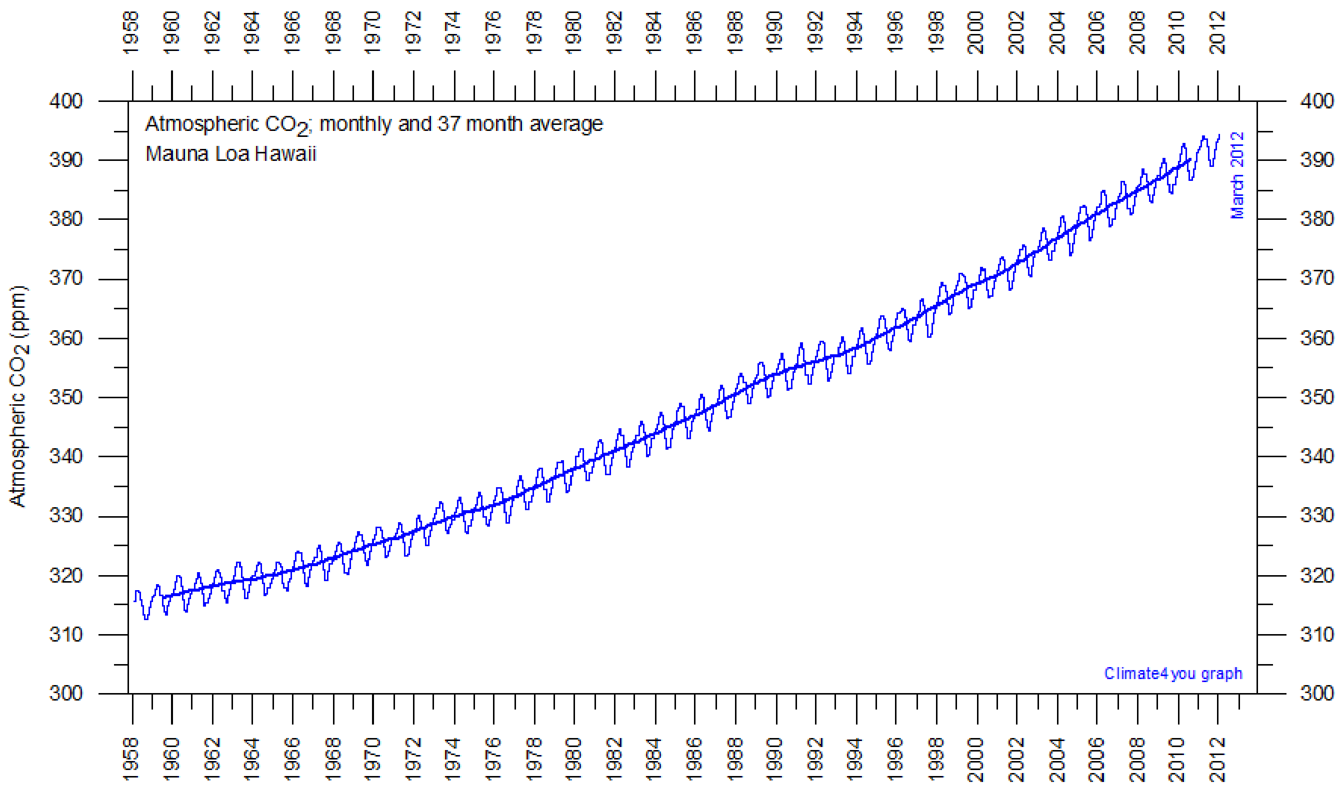


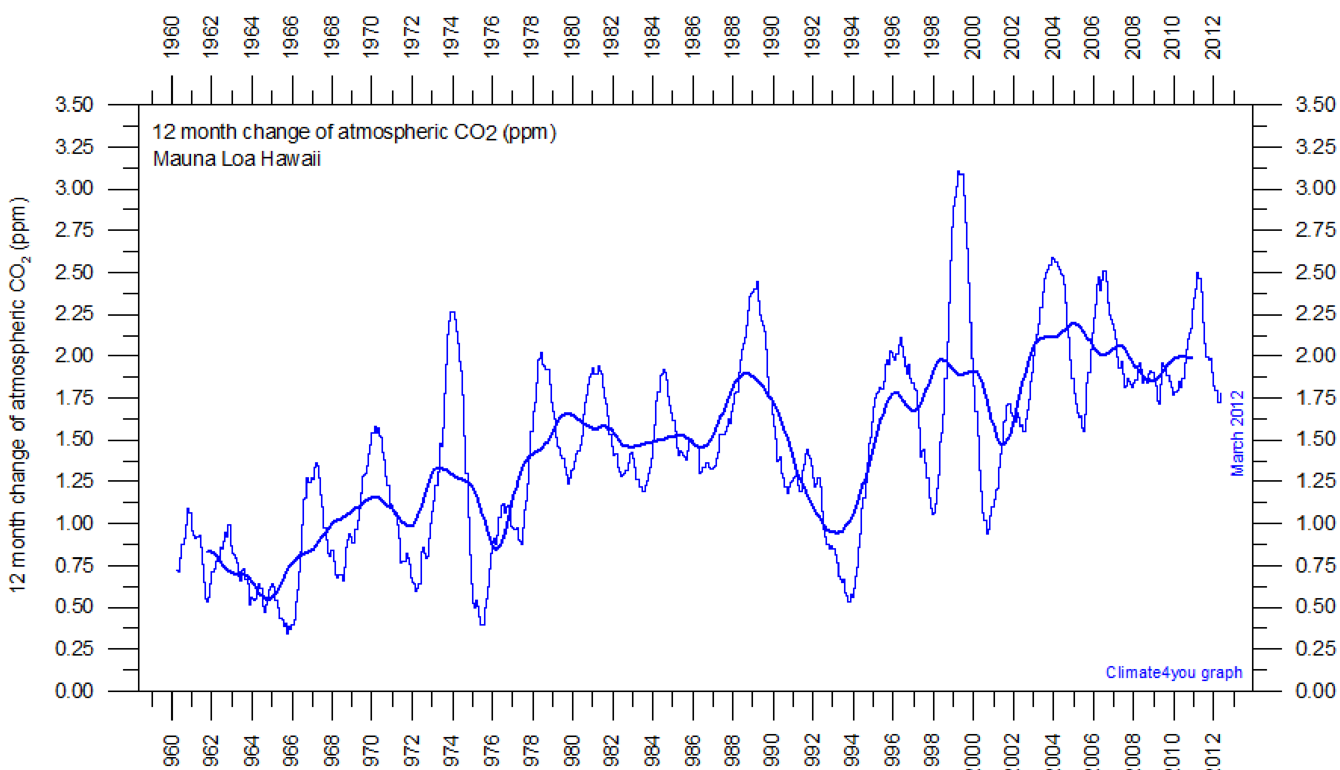
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



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.

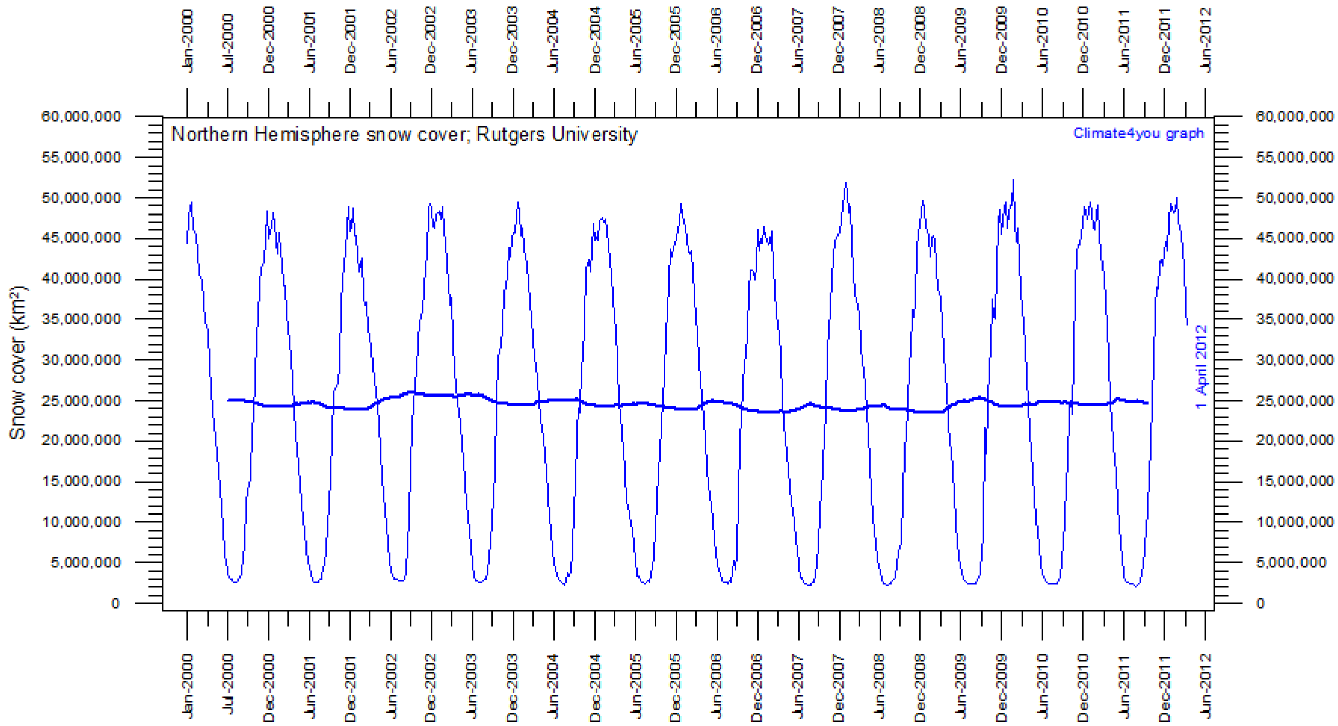
Atmospheric CO_2, updated to March 2012



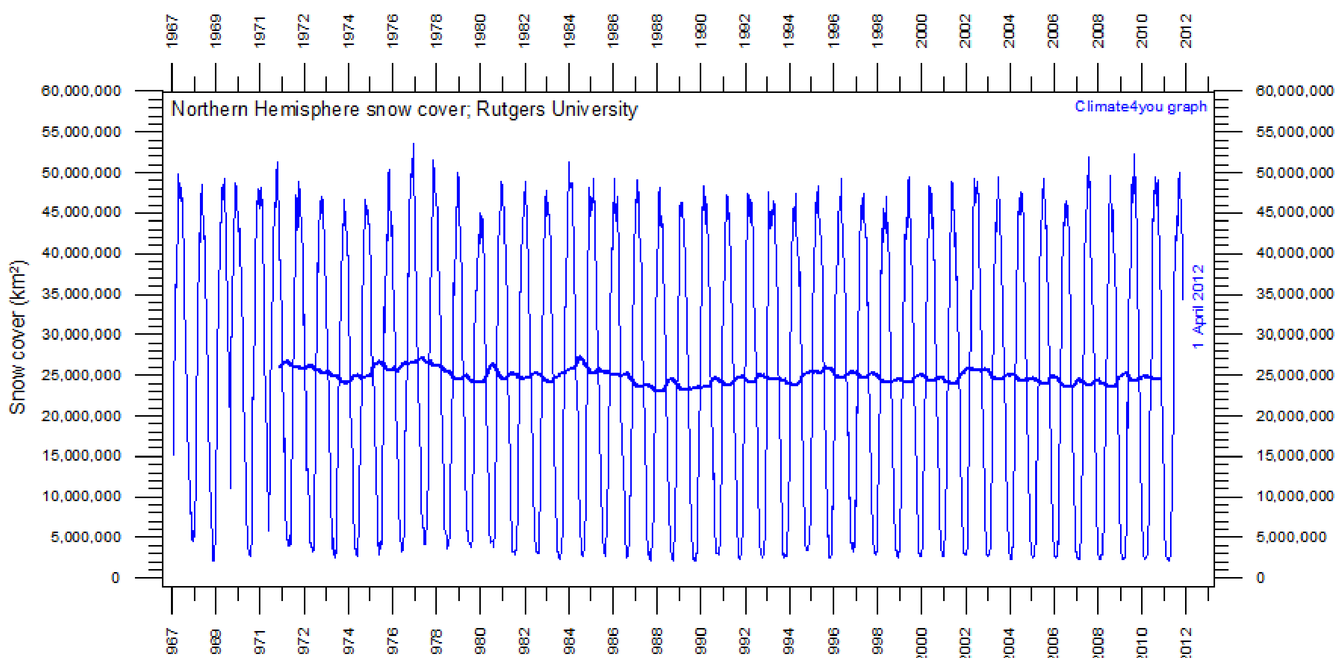


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the [Mauna Loa Observatory](), Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Northern Hemisphere weekly snow cover, updated to early April 2012

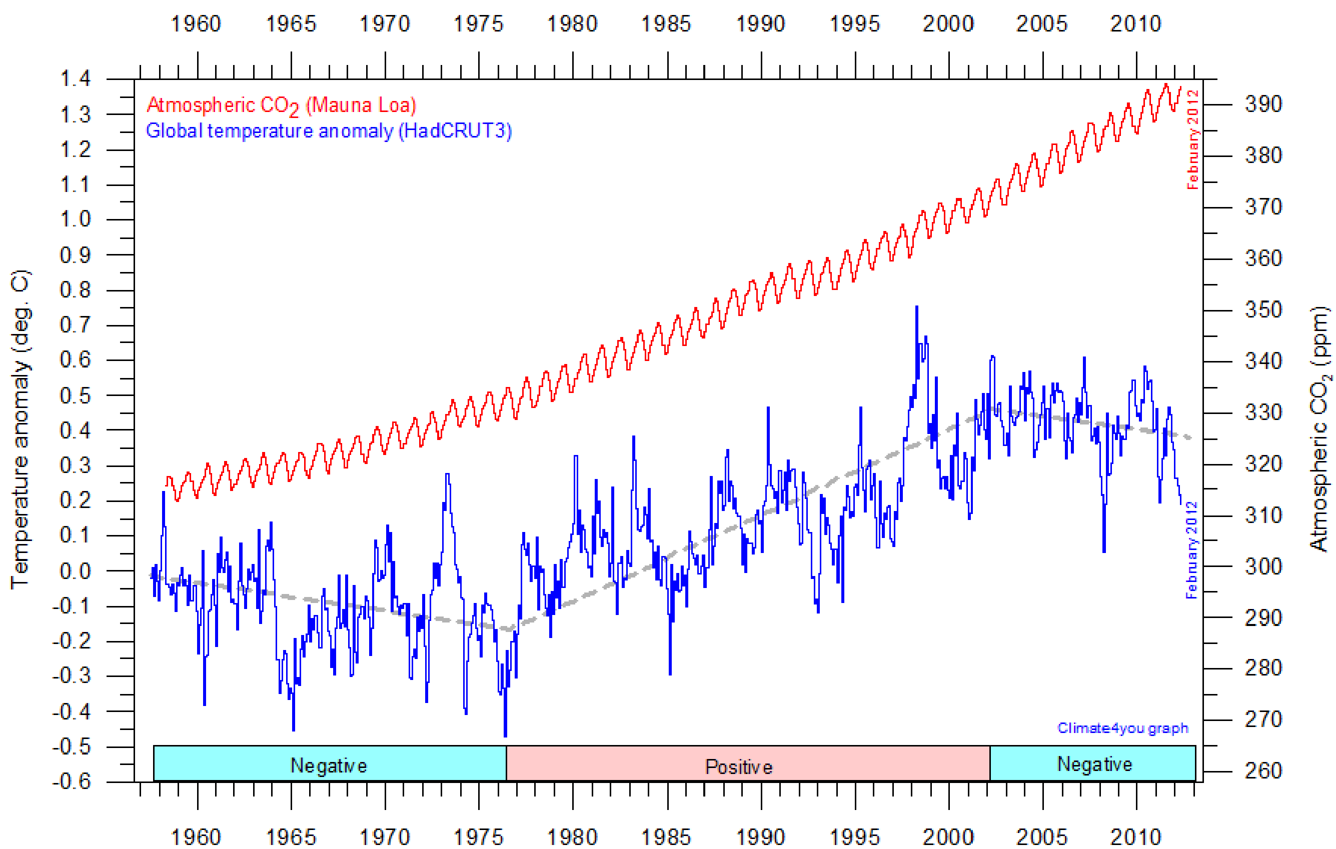


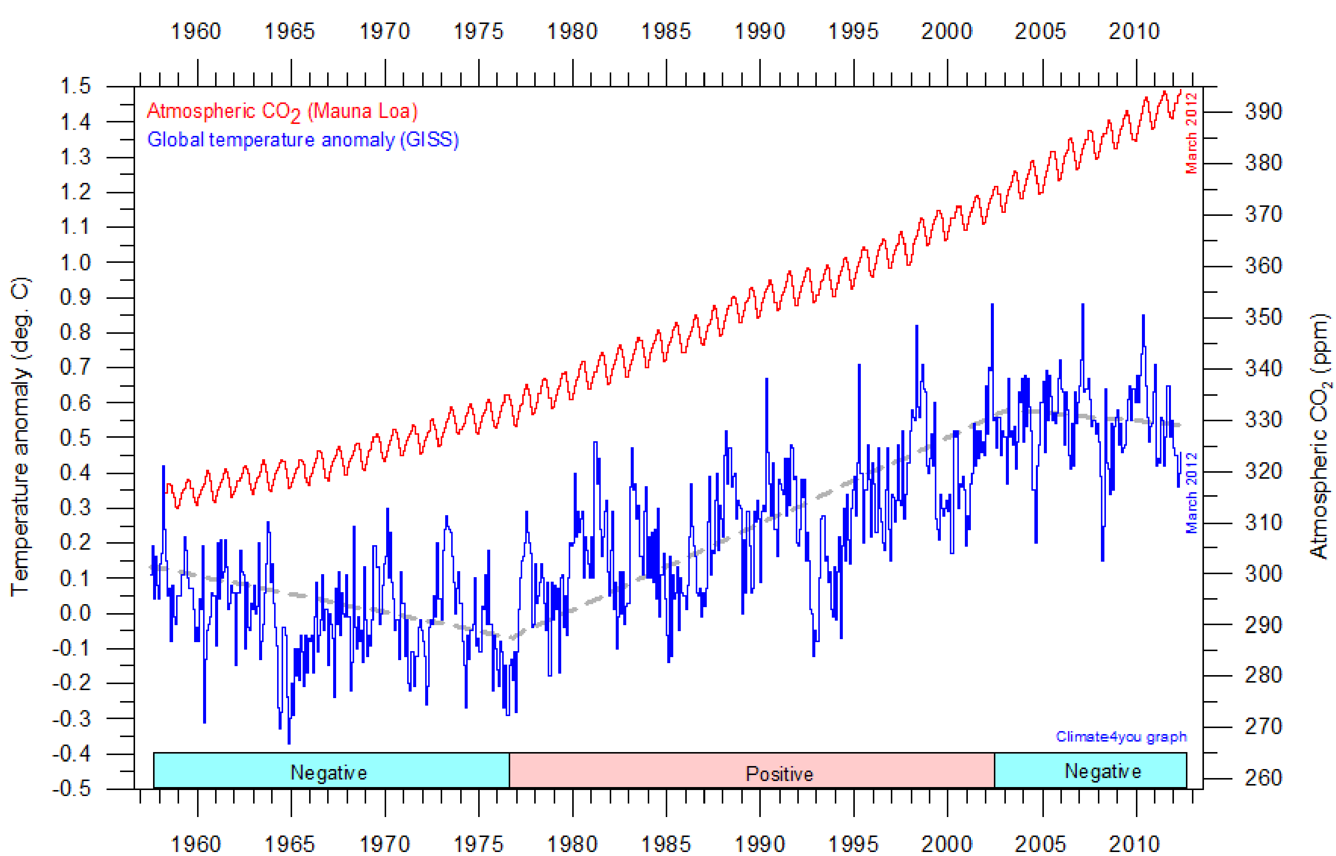
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year).

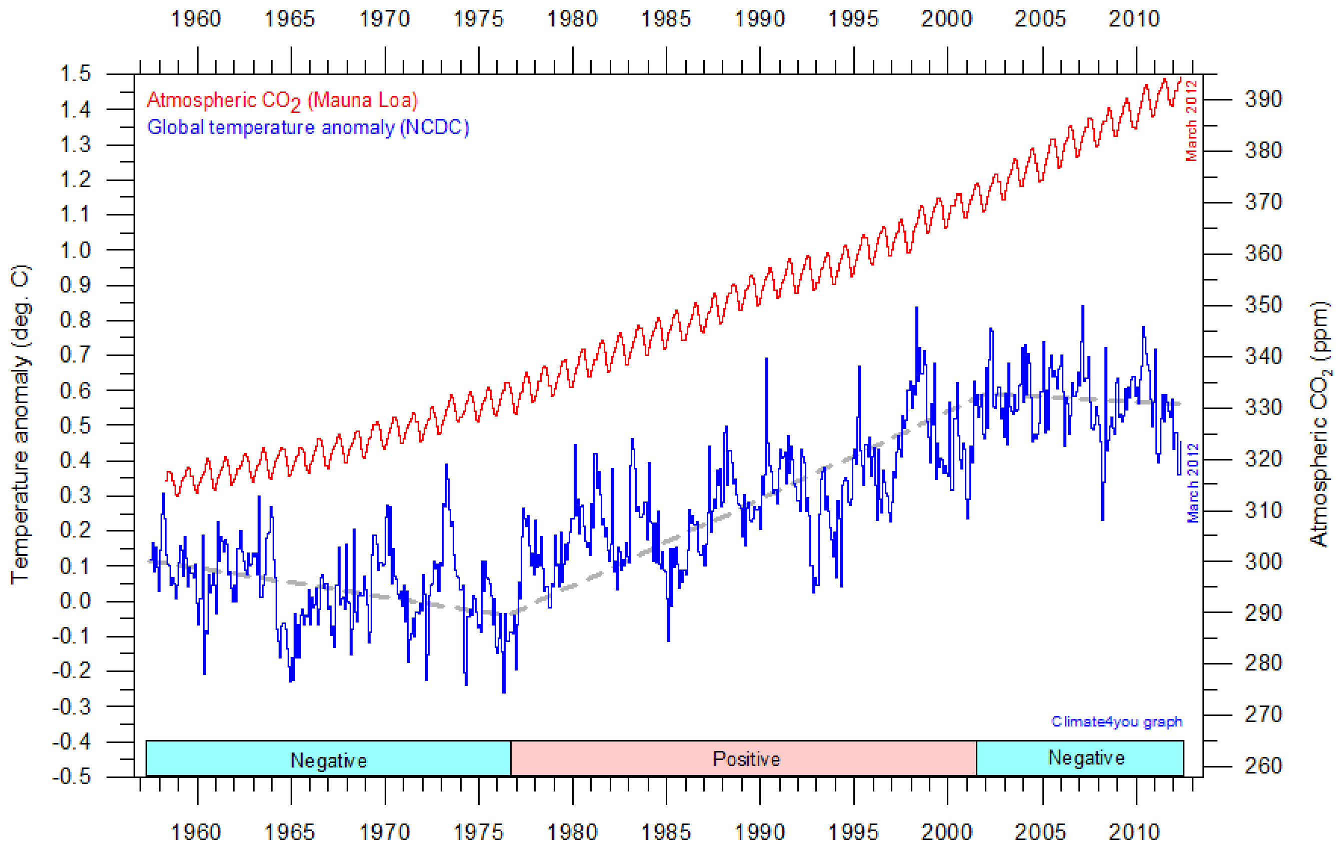


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of data gaps in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

Global surface air temperature and atmospheric CO_2, updated to March 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 modern atmospheric measurements. The dotted grey line indicates the approximate linear temperature trend, and the boxes in the lower part of the diagram indicate the relation between atmospheric CO_2 and global surface air temperature, negative or positive. Please note that the HadCRUT3 diagram has not been updated beyond January 2012.

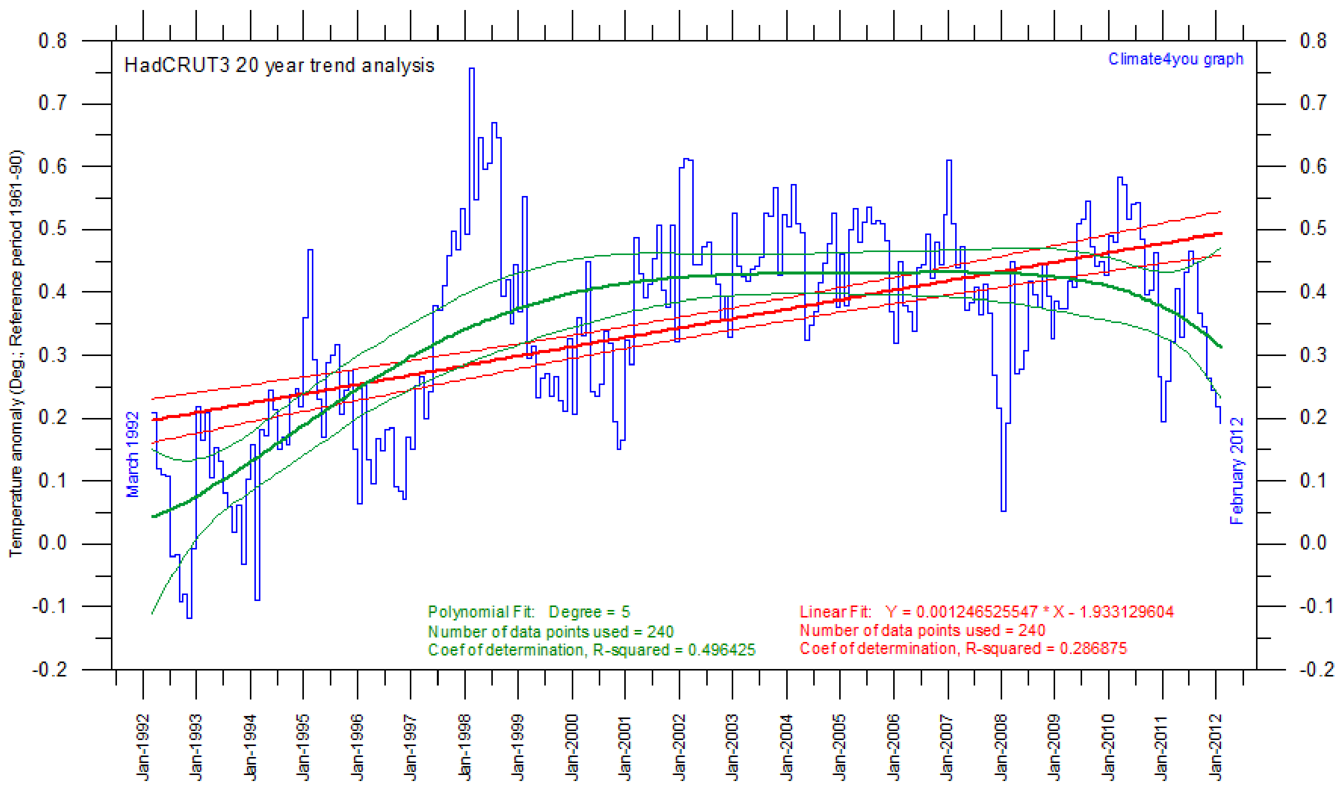
Most climate models assume the greenhouse gas carbon dioxide CO_2 to influence significantly upon global temperature. Thus, it is relevant to compare the different global temperature records with measurements of atmospheric CO_2, as shown in the diagrams above. Any comparison, however, should not be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

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

What exactly defines the critical length of a relevant time period to consider for evaluating the alleged high importance of CO_2 remains elusive. However, the length of the critical period must be inversely proportional to the importance of CO_2 on the global temperature, including possible feedback effects. So if the net effect of CO_2 is strong, the length of the critical period is short, and vice versa.

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

Last 20 year surface temperature changes, updated to February 2011



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). Last month included in analysis: February 2012.

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 have little predictive power.

Climate and history; one example among many

1634 AD: The Nordstrand flood of 1634 AD

Geography of southern Denmark and northern Germany, showing (left) the coastal outline in 1240 AD, and (right) the outline in 1651 AD, both maps compiled by Johannes Mejerus. The green area shows the modern outline of land. The red arrow shows the location of the island Nordstrand. Each map covers about 95 km from west to east. Map source: Pedersen (1977).

Nordstrand is one of the many Frisian islands extending all the way from the Netherlands to southern Denmark, with the islands north of the German Bight known as the North Frisian Islands. Until the German-Austrian-Danish war in 1864, all these islands were part of Denmark.

As can be seen from the map above, Nordstrand in the recent past was part of a much more extensive land area, extending far west into the present North Sea.

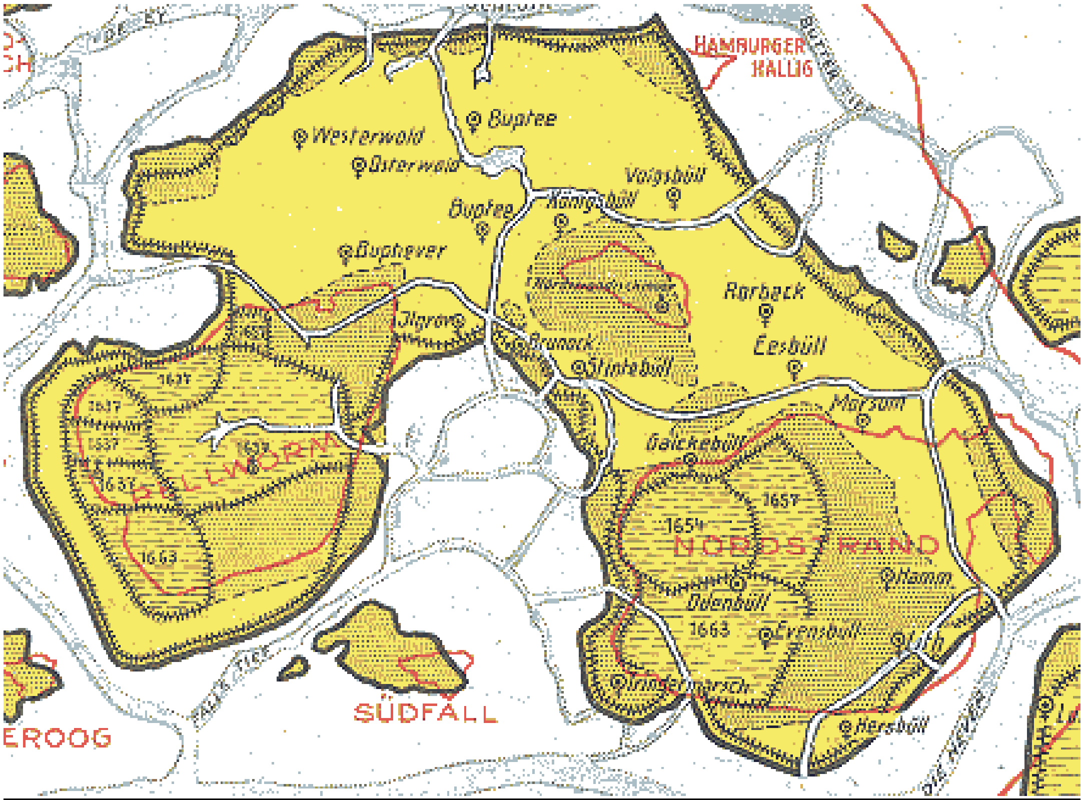
Slow regional tectonic sinking in combination with the overall Holocene global sea level rise have caused a large-scale flooding of land areas in this region of Europe over the past 9000 years. Just about 8000 years ago, most of the present North Sea was dry land, with the northern coast extending roughly from Hanstholm in NW Denmark towards Edinburgh in Scotland.

From time to time, periods with frequent strong storms have contributed to this gradual loss of land areas, as can be illustrated by outlining the main features of the large flood in the Nordstrand area in the year 1634.

The islands Pellworm (left) and Nordstrand (right) in northern Germany. The dark channels between the two land areas are large tidewater channels. Today Nordstrand is connected to the mainland, and therefore formally again a peninsula. The picture covers about 45 km from west (left) to east. See insert map showing Denmark and northern Germany for regional location. Picture source: Google earth.

The summer of 1634 is known to have been warm and dry, with excellent growing conditions on the fields of Nordstrand, which at that time was a coherent land area consisting of present Nordstrand and Pellworm, plus the now water covered areas in between (Pedersen, 1977; and map below). At that time about 8800 people were living on Nordstrand, distributed on no less than 1745 houses and farms. Nordstrand was doing quite well, and each year quantities of farm products were exported to nearby parts of Europe (Pedersen 1977).

Floods is known to have affected Nordstrand several times before 1634, among others the 'Grote Manndränke' in 1362, and also just few years before 1634 there had been a strong storm resulting in many areas in Nordstrand being flooded. For that reason the Danish government had hired the Dutch expert *Jan Adriaansz Leeghwater* to supervise a land reclamation project, including the construction of higher and stronger dikes around Nordstrand.



The geography of Nordstrand before the 1634 flood. The red lines indicate what is left today of the previous much larger Nordstrand Island: the present-day island Pellworm (W) and the small island Nordstrandischmoor (N) and Nordstrand (SE). Before the 1634 flood the island measured about 25 km from east to west. Later reclaimed areas (polders) are shown by the year of reclamation. Map source: Rabbel.nl 2012.

The first weeks of October 1634 were dominated by stable weather and easterly and southeasterly winds, but on October 11 the wind turned towards southwest, increasing in strength, and it soon began to rain. In the evening of October 11 a strong storm was blowing with rain, hail and thunder (Pedersen, 1977). Slowly the still increasing wind began turning from southwest towards northwest, which is dangerous in this part of the North Sea, as it forces water into the confined German Bight, leading to rapid increase in sea level along the adjoining coasts.

Around 22 hr in the evening the dike near Strintebøl at the head of the embayment into the southern part of the island was overrun by the rising water. This was not entirely unexpected as this was where the dikes were in a relatively bad condition, but within one hour also other and higher dikes were broken at no less than 44 different places around the coasts of the island. There were a number of inner dikes, but these were also rapidly overrun by the ocean.

Around midnight between 11 and 12 October 1634, almost the entire island was covered by several meters of sea water in rapid movement. People had to evacuate to the uppermost levels in the houses, but often the flowing water and waves eroded the houses, leading to sudden collapse and drowning of the inhabitants. Any rescue attempts from the mainland to the east were quite impossible, and most inhabitants on Nordstrand perished during this night.

Next morning the entire Nordstrand island had essentially changed into a desert of sandy sediments. Few areas escaped this flood-driven sedimentation, but they were still covered by sea water for a long time. When these areas eventually dried out, the fields were unsuitable for farming because of the high salt content (Pedersen 1977).

Later investigations found that 6035 persons of the about 8800 inhabitants had lost their lives during the flood. Of the 1754 houses and farms 1335 were totally destroyed. About 50,000 animals were lost. Before the flood there was 22 churches on the island, but due to their solid construction none of these was entirely destroyed, and many of the survivors actually made it through this night because they had taken refuge in the churches. However, only three of the 22 churches came into use after the flood. Most of the survivors left Nordstrand and moved east to the mainland, or to the Netherlands.

The northern and central parts of what used to be Nordstrand were given up, and dikes never rebuild. The western part, today called Pellworm, and the eastern part, todays Nordstrand, was slowly reclaimed from the sea by construction of new dikes. Slowly big tidewater channels developed across the former land areas in the central part of the former Nordstrand, as can be seen from the Google Earth picture above.

The Dutch dike expert *Quirinus Indervelde* was hired to lead the construction of new dikes. As reward *Indervelde* and his hundreds of Dutch dike workers were allowed to own the reclaimed land (Rabbel.nl 2012).

The reclaiming was, however, a very slow process, and it was first in 1654 that the dikes around the first polder (reclaimed land) were finished. This became the polder Alterkoog in present day Nordstrand (see map above). In 1657 and 1663, the polders Osterkoog and Trindermarschkoog were also reclaimed.

By the reclaiming process extensive parts of Nordstrand and Pellworm became owned by Deutch people, and they were allowed to practice the Roman Catholic religion, although the entire Danish kingdom mainly was Lutheran. The Catholic Church on Nordstrand was under the jurisdiction of the archbishopric of Ytrecht in the Netherlands. Even today, the archbishopric of Utricht owns about 100 acres of land on the now German island (Rabbel.nl 2012).

Sources and References:

Pedersen, K. 1977. Det tabte land I vest (Engl.: The lost land in the west). Vestkystens Forlag, Esbjerg, Denmark, 125 pp., ISBN 87-980485-1-1.

Rabbel.nl 2012. Cor Snabel's story of the Nordstrand flood of 1634. http://rabbel.nl/nordstrand.html

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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

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April 20, 2012.