Climate4you update January 2012

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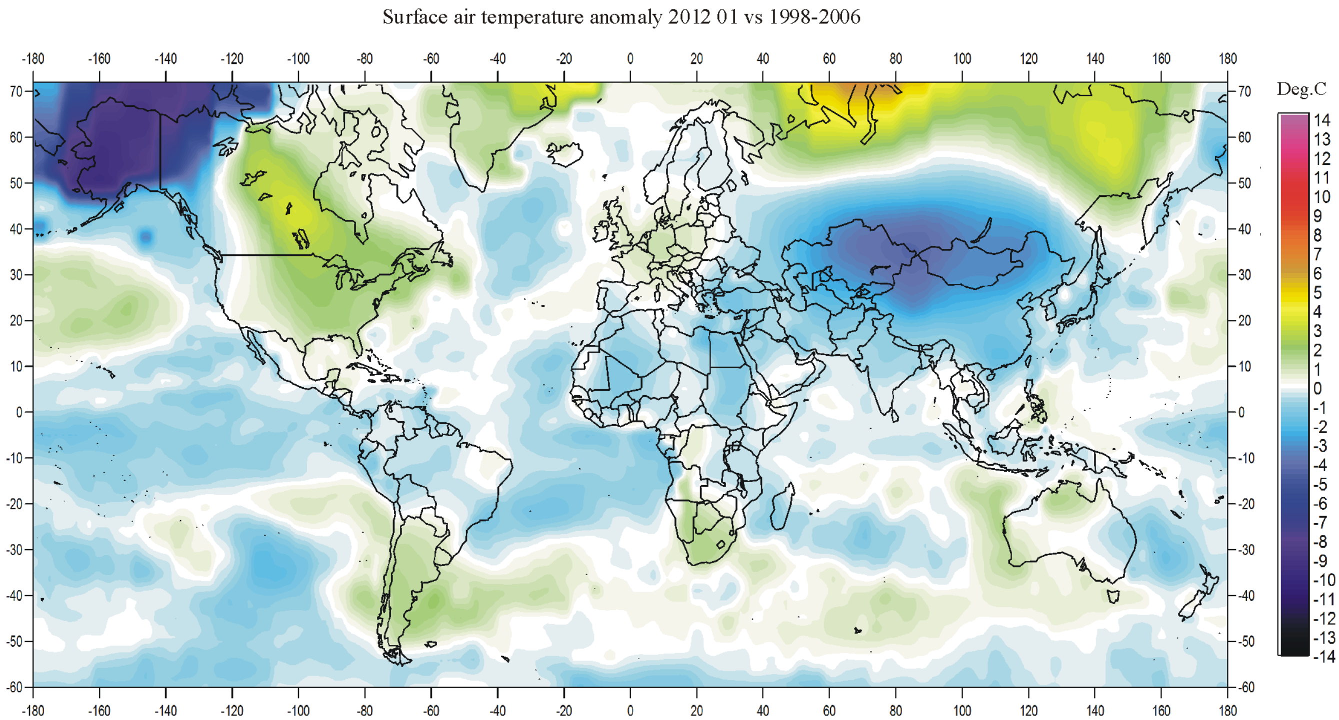
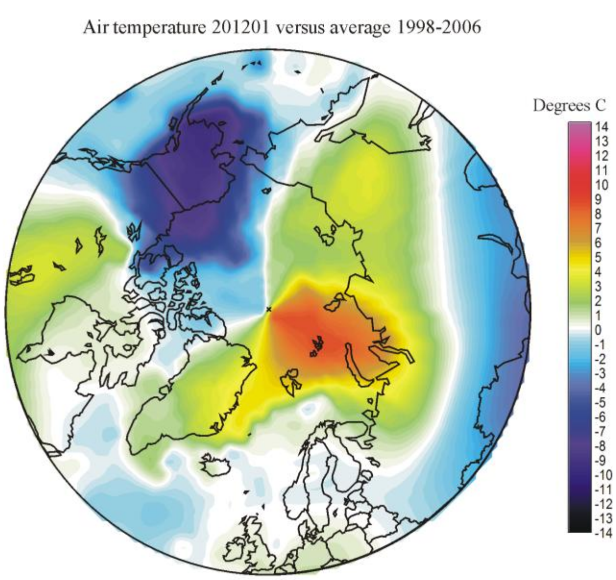
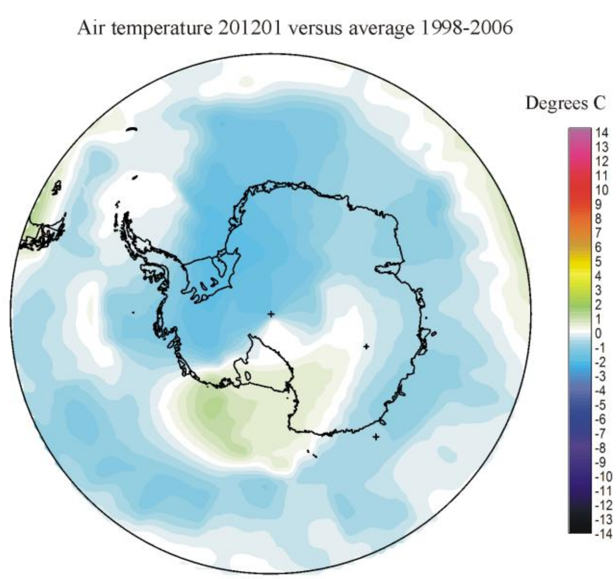
January 2012 global surface air temperature overview







January 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 January 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 January 2012:

General: Air temperatures were relatively low.

The Northern Hemisphere was characterised by high regional variability. All Asia except northern Siberia had below average temperatures, as had most of western Russia and eastern Europe. This was caused by an extensive Siberian high pressure, especially in the latter half of January. Western Canada and especially Alaska was very cold, while most of eastern Canada and USA was relatively warm. The North Atlantic was below or near average 1998-2006 conditions. In the Arctic Greenland was relatively warm, as was northern Siberia.

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 the southern part of South America and Africa experienced temperatures somewhat above the 1998-2006 average. Australia was near average conditions. Most of the oceans in the Southern Hemisphere were at or below average temperature. The Antarctic continent in general experienced below average 1998-2006 temperatures.

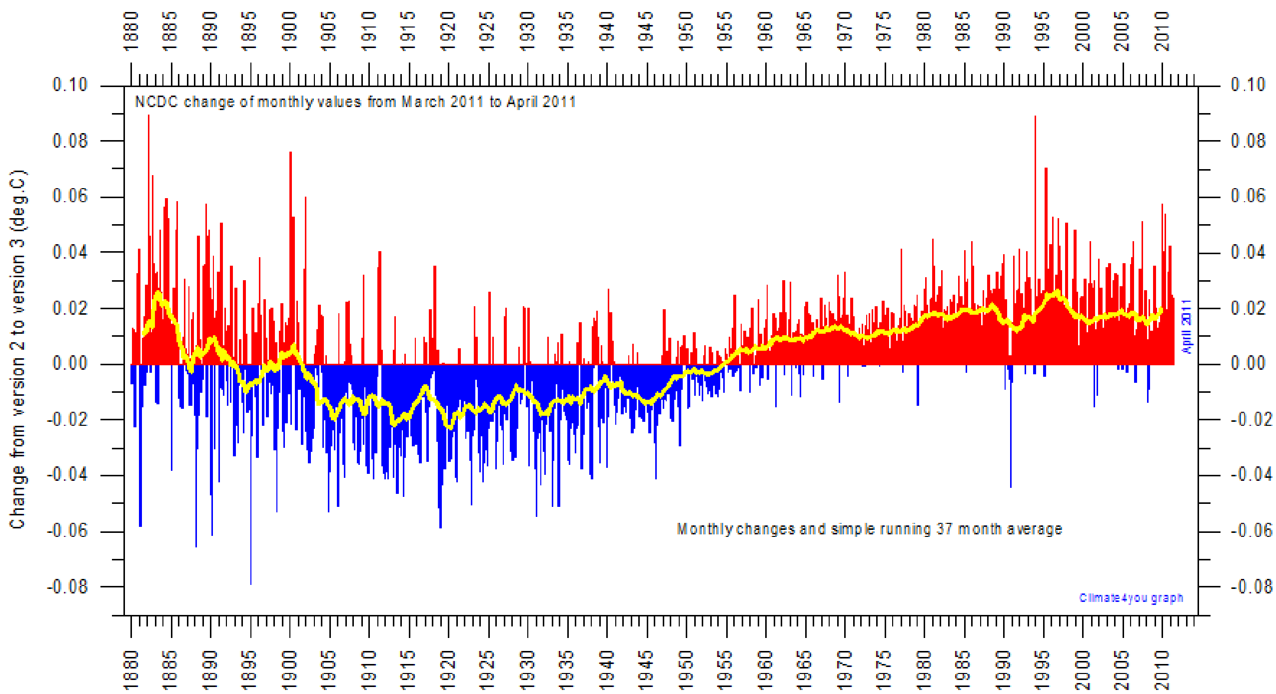
The global oceanic heat content has been almost stable since 2003/2004 (page 15).

The global sea level has not been changing very much since 2009 (page 22; updated to December 2011).

Ongoing adjustments of past temperature records are fascinating to follow, even though the scientific background for such adjustments of past temperature records often remains unclear. Examples of such temperature adjustments are shown in a special section page 3-7.

Effects of the recent NCDC and GISS transition to GHCN version 3

On May 2, 2011, NCDC transitioned to GHCN-M version 3 as the official land component of its global temperature monitoring efforts. GHCN-M version 2 mean temperature dataset will be updated through May 30, 2011, but no later support for this version of the dataset will be provided. The net effect of the change from version 2 to 3 for the NCDC global temperature estimate can be seen in the diagram below. An additional update followed November 2011.

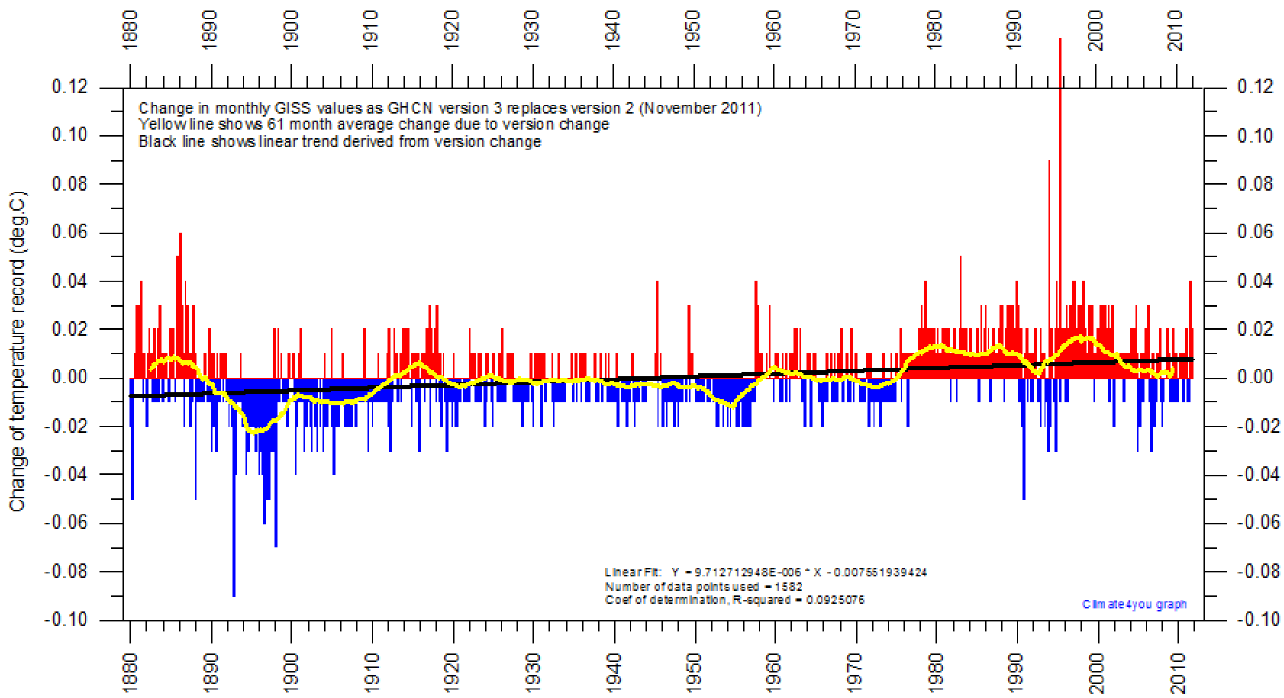


Net temperature effect on the NCDC global temperature estimate of the 2 May 2011 transition from GHCN-M version 2 to version 3 as the official land component of NCDC's global temperature monitoring efforts. The blue and red vertical lines indicate the net effect on monthly temperature values, and the yellow line shows the simple running 37 month average of the adjustments, nearly corresponding to a 3 year average.

The overall net effect of the transition from GHCN-M version 2 to version 3 is to increase global temperatures before 1900, to decrease them between 1900 and 1950, and to increase temperatures after 1950. By this the 20th century temperature rise is about 0.04 ^{o}C larger in the new version 3 compared to the previous version 2 of the NCDC record.

Beginning from late November 2011 also the GISS surface temperature estimate is based on the adjusted GHCN version 3 data. Graphs comparing results of the GISS analysis using GHCN v2 and v3 are available on the GISS homepage for inspection, and in addition to this, the diagram on page 4 displays the net effect on the GISS global temperature estimate of the recent transition.

The overall effect of the change introduced in the GISS record is towards lover temperatures in the early part of the record and higher in the latter part. The net result is therefore an enhancement of the overall global temperature rise since 1880, along with a certain flattening of the mid-20th century warm period (see also diagram on page 6.)



Net effect on the global GISS global temperature estimate of the November transition from GHCN version 2 to version 3. The vertical lines indicate the net effect on monthly temperature values, and the yellow line shows the simple running 61 month average, nearly corresponding to 5 years. The black line is the linear trend calculated for the changes introduced.

Apparently the recent version change also resulted in some quite significant changes for individual station data series available from the GISS database, which raises a number of concerns. One of the individual records which have been exposed to such unexpected adjustments is the Reykjavik (Iceland) monthly surface air data series. In the diagram below the official Reykjavik data series kindly provided by the Icelandic Met Office is shown in blue and the corresponding GISS data series in red. GISS offers three version of each station data series, of which the *after removing suspicious records* is the default choice. This is the GISS Reykjavik temperature series shown in the diagram on page 5.

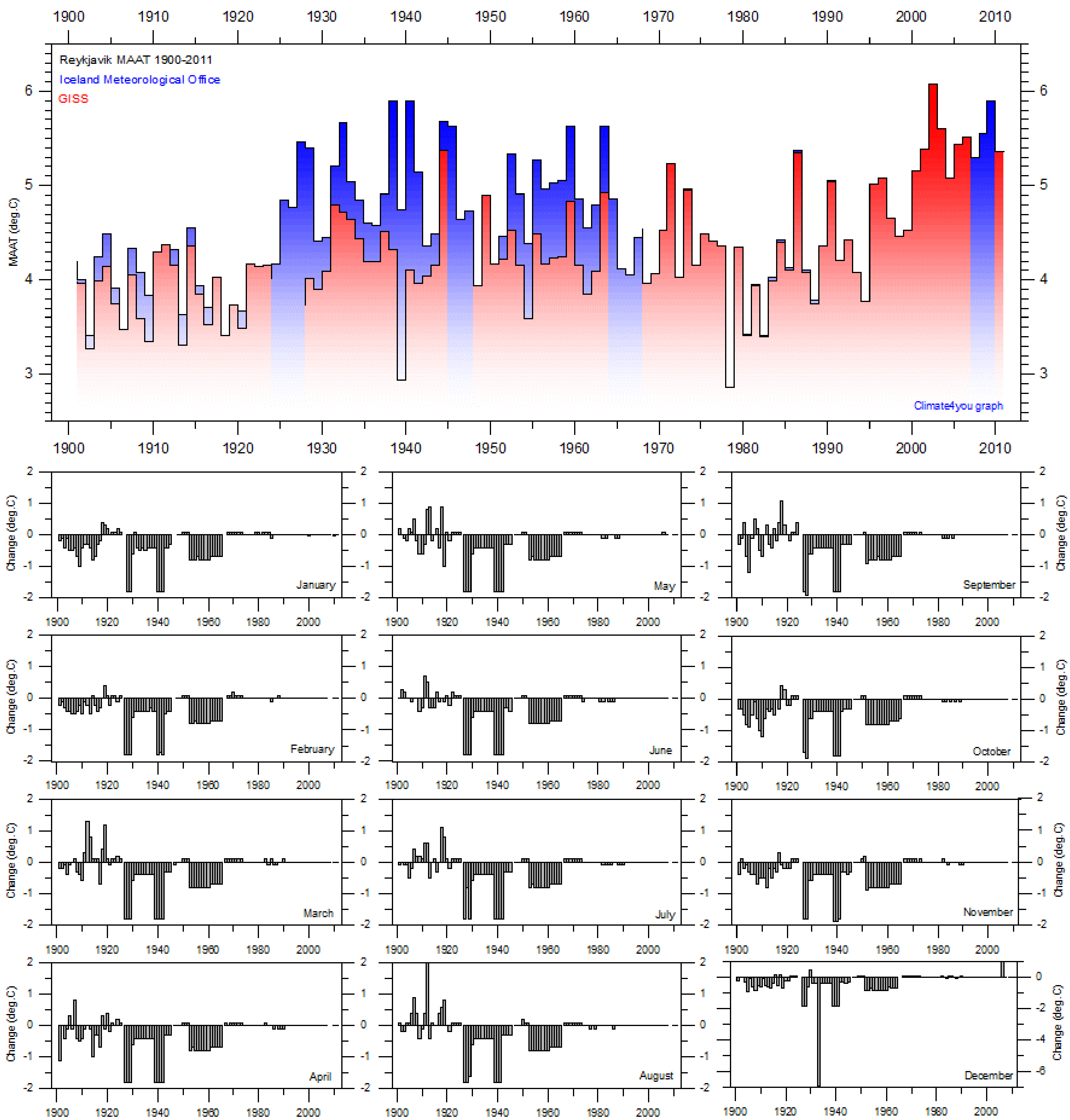
The warm period around 1940 in Reykjavik (see upper panel in diagram on page 5) has entirely disappeared due to the GISS adjustments, whereby a more uniform temperature increase throughout the 20th century is obtained, in concert with the atmospheric CO_2 increase (page 22).

It is difficult to understand the justification for the number and magnitude of adjustments introduced in the GISS record. This is not the least so because the resulting GISS data series now differs significantly from the official Icelandic data series.

Unfortunately, such large and uniform adjustments will inevitably make the GISS data series (and NCDC?) appear less reliable and useful than previously. In comparison to the GISS and NCDC surface temperature series the HadCRUT3 data series until now stands out as being much more stable over time.

At the moment it is not known how many other station records accessible from the GISS database have undergone similar adjustments as the above Reykjavik data series.

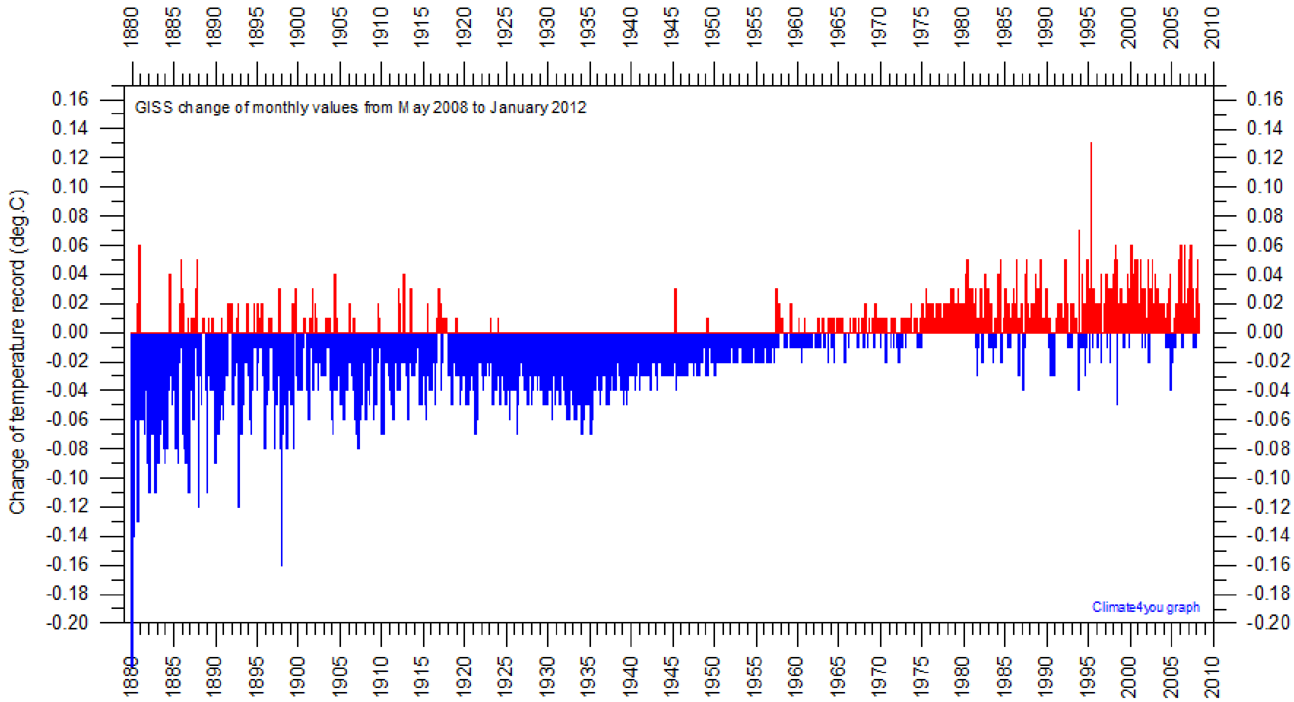
Along with the recent transition to the new GHCN version 3 the option of downloading the original, raw (unadjusted) temperature data from the GISS site has disappeared. This is most unfortunate, as the daily user of the GISS service then is cut off from inspecting the original data for individual stations. As adjustments apparently are ever increasing, access to the original data becomes very important.

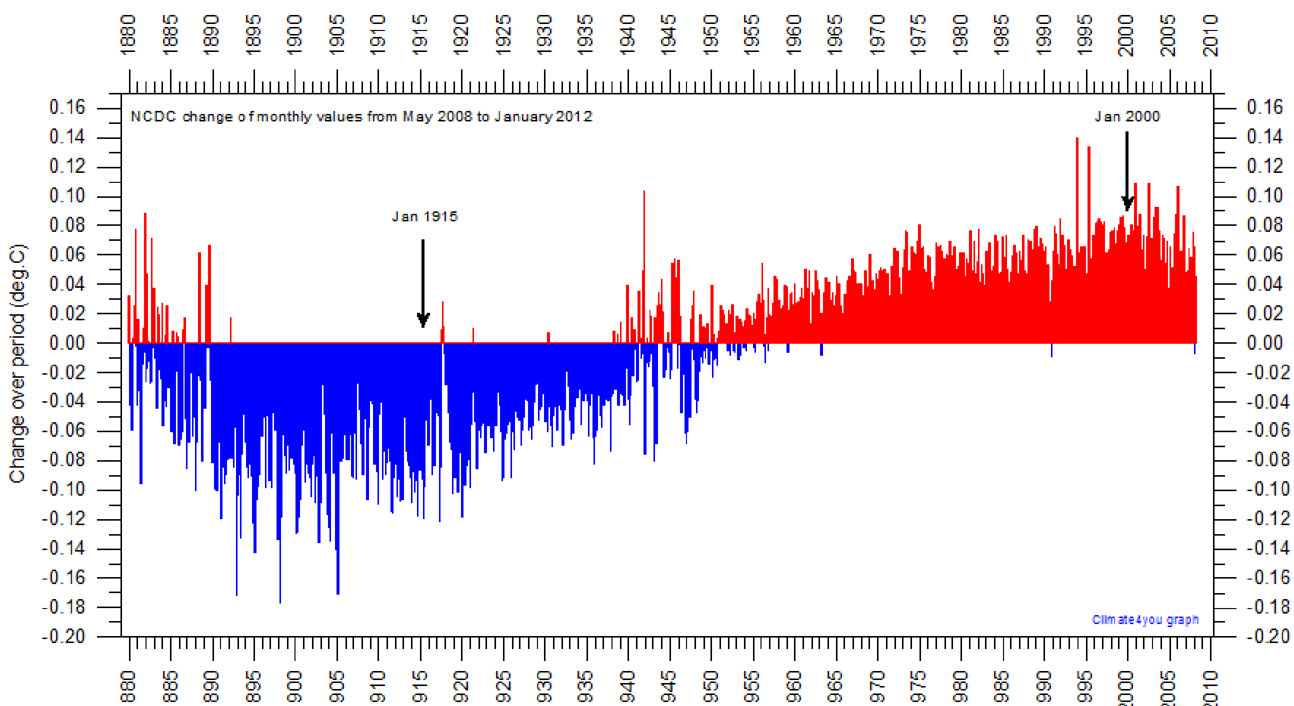


The mean annual surface air temperature 1900-2011 in Reykjavik according to the Icelandic Met Office (blue, upper panel) and the corresponding GISS data series after removing suspicious records (red, upper panel). The lower panels show the GISS adjustments introduced for the individual months. Apparently the process of removing suspicious records has resulted in a high number of monthly adjustments of exactly -0.8 and -1.8 °C, especially between 1923 and 1963. The biggest adjustment made is for December 1933, which has been adjusted with -6.9 °C. Some years are missing in the GISS data series, which is indicated by breaks in the red diagram.

The ongoing adjustments of past surface air temperatures are slowly reaching a level, where access to original, unadjusted data becomes important, to provide a reference for comparison with the adjusted data series. The new satellite temperature data have been affected by a number of understandable changes, to adjust for different technical issues. Among the longer surface air temperature databases, especially the GISS and NCDC have introduced substantial adjustments, also affecting very old records. The net adjustments made since May 2008 by GISS and NCDC are shown in the two diagrams below (p. 6).

By these efforts (GISS and NCDC) the global surface air temperature increase of about 0.75°C since the late 19th century have been enhanced by additional c. 0.1°C from May 2008 to February 2012, corresponding to about 10-15% of the original total temperature increase.





Since about 1980 the GISS adjustments are rather uniform in magnitude (diagram on page 6), which is why the GISS data still can be used to provide a realistic picture of the most recent temperature development, such as done on page 1, using the period 1998-2006 as reference period.

As an example of adjustments made, the diagram below shows the NCDC adjustments made since May 2008 through February 2012 for the months January 1915 and January 2000. The time-line position of these two months is shown by the two arrows in the diagram above (p. 6).

In conclusion one may note the somewhat surprising fact that also past temperature records apparently are able to display significant dynamics even in modern time.

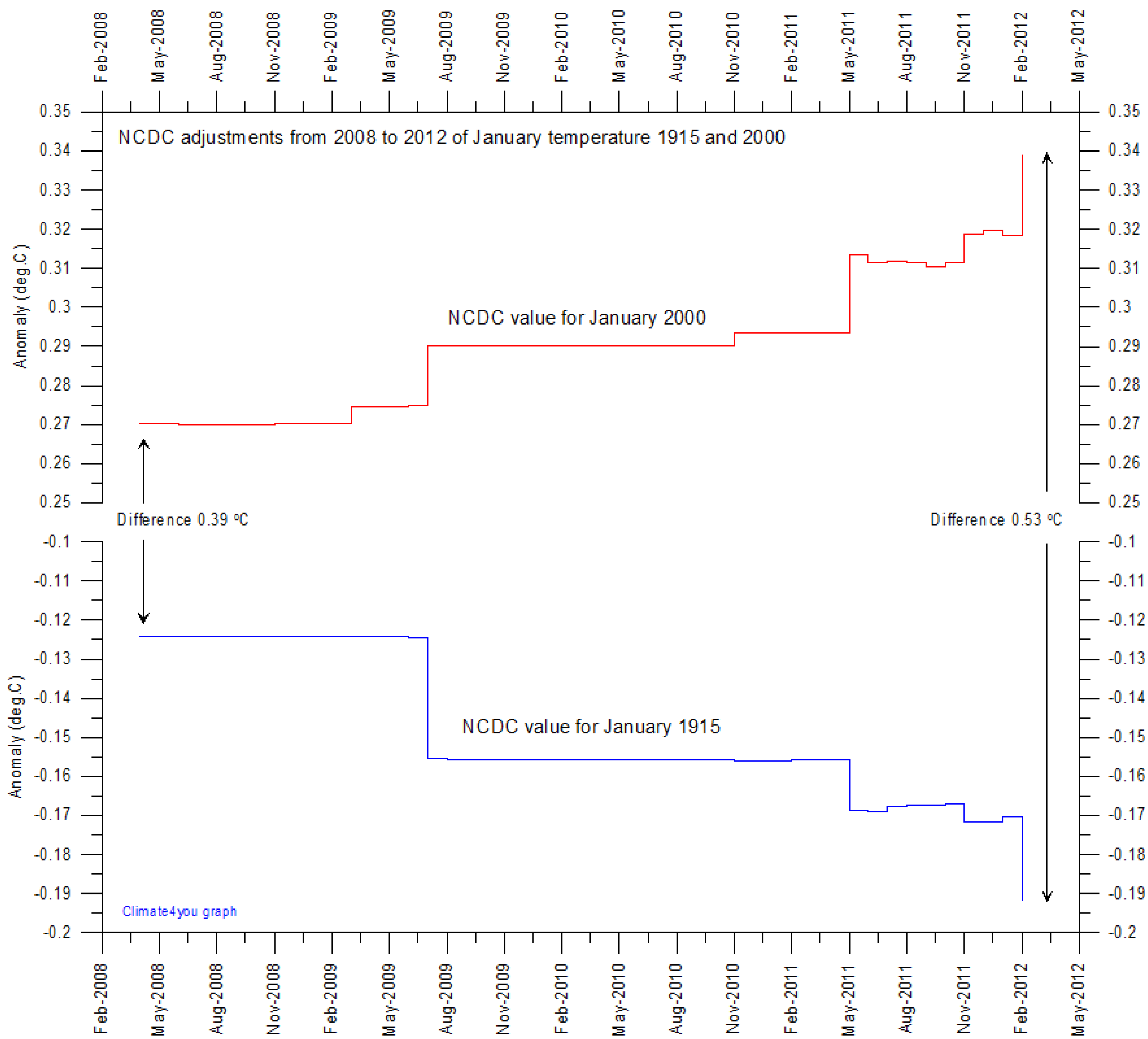
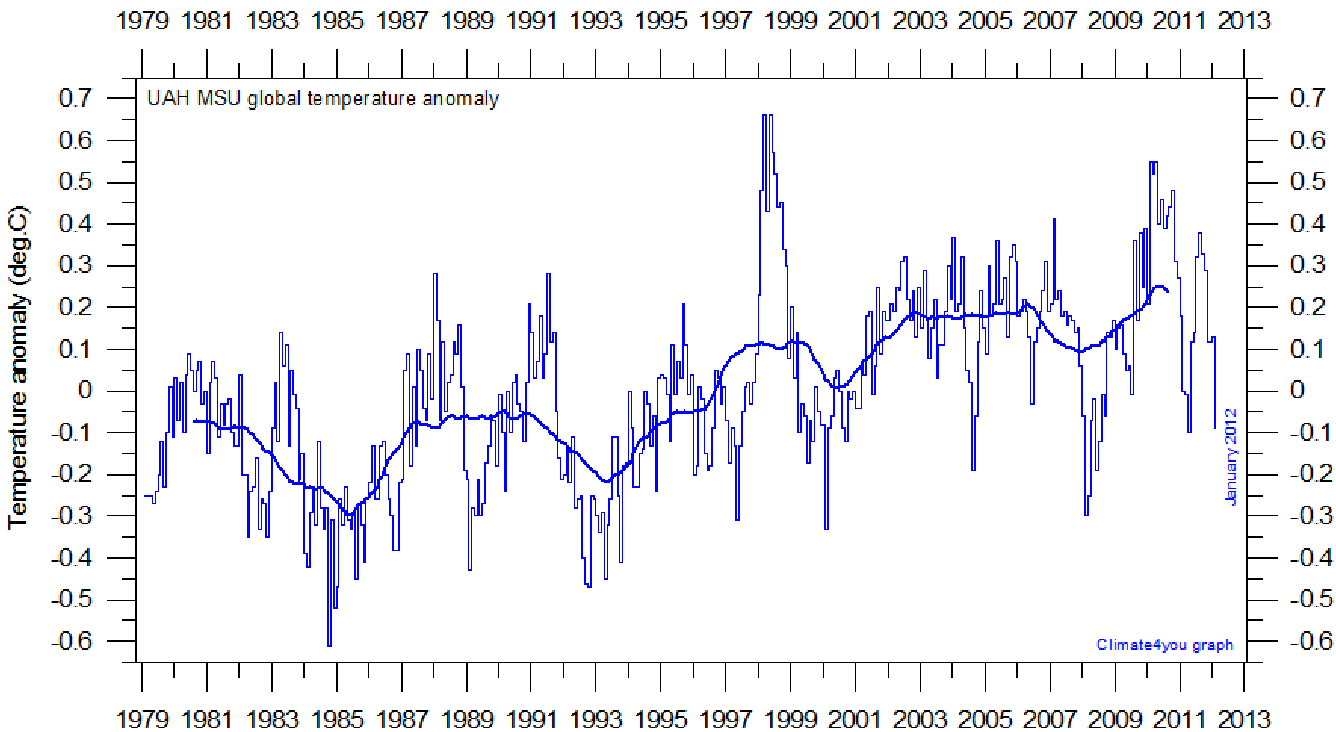
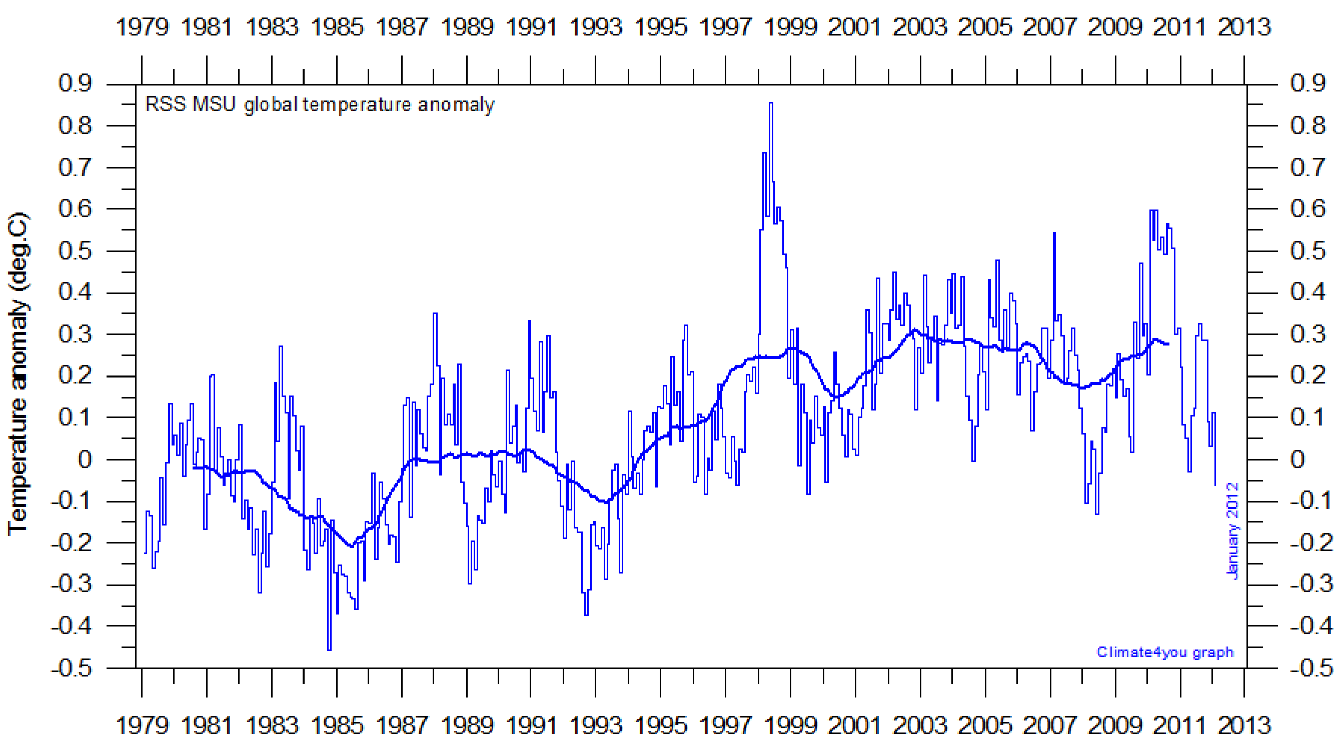


Diagram showing the adjustment made May 2008 – February 2012 by the National Climatic Data Center (NCDC) in the value for the months January 1915 and January 2000. Reference period 1901-2000.

Lower troposphere temperature from satellites, updated to January 2012

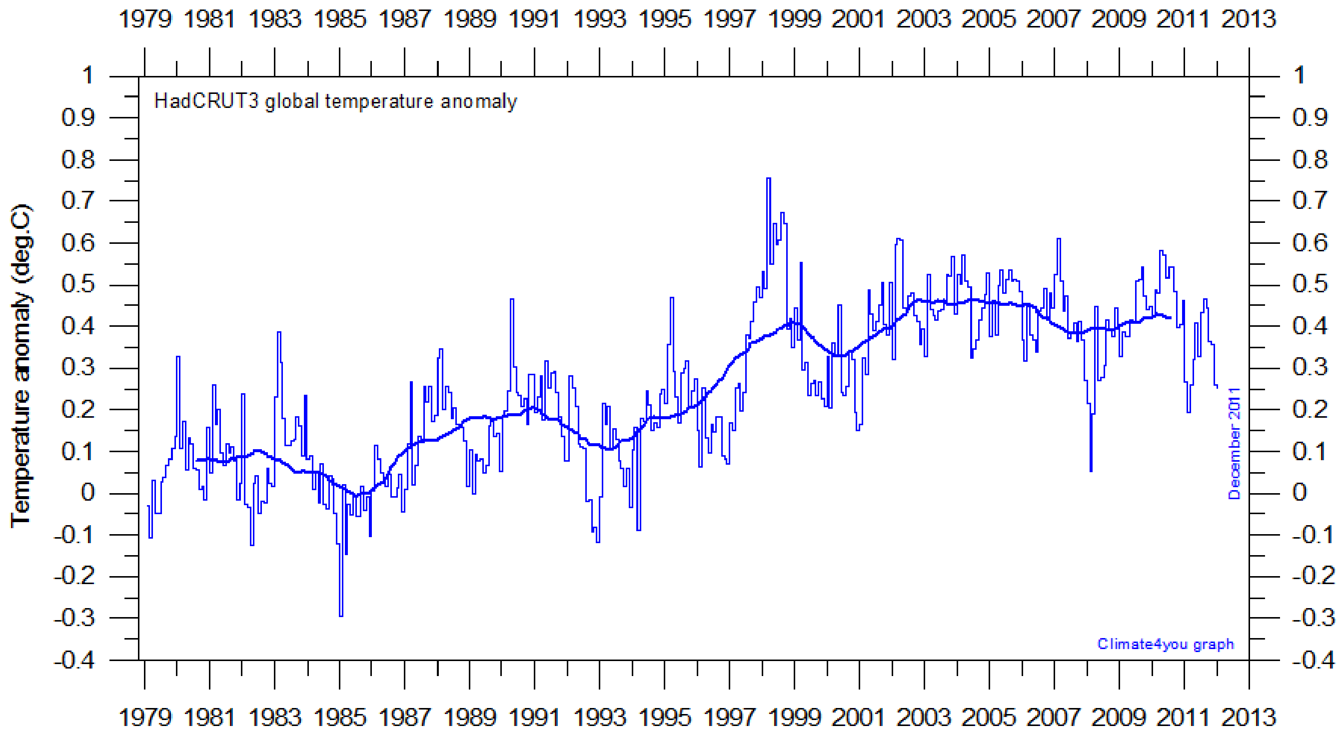


Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.

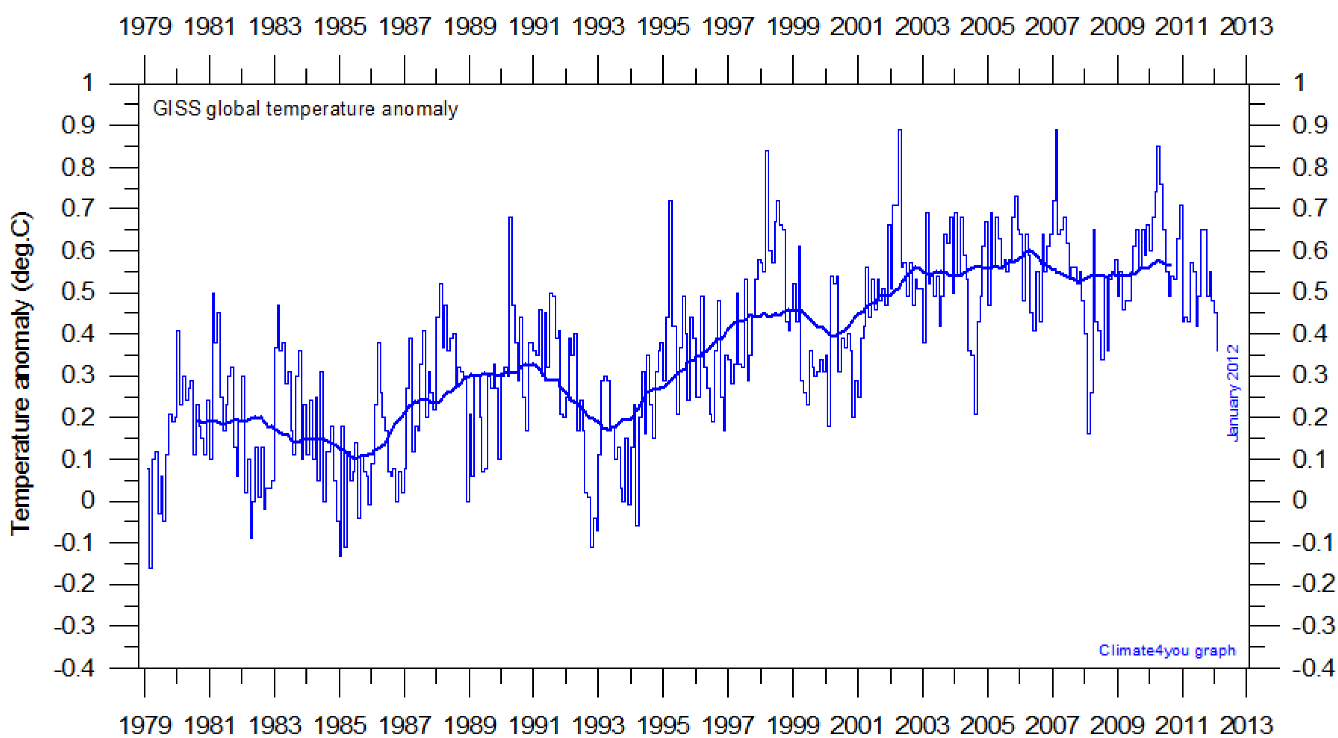


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37 month average.

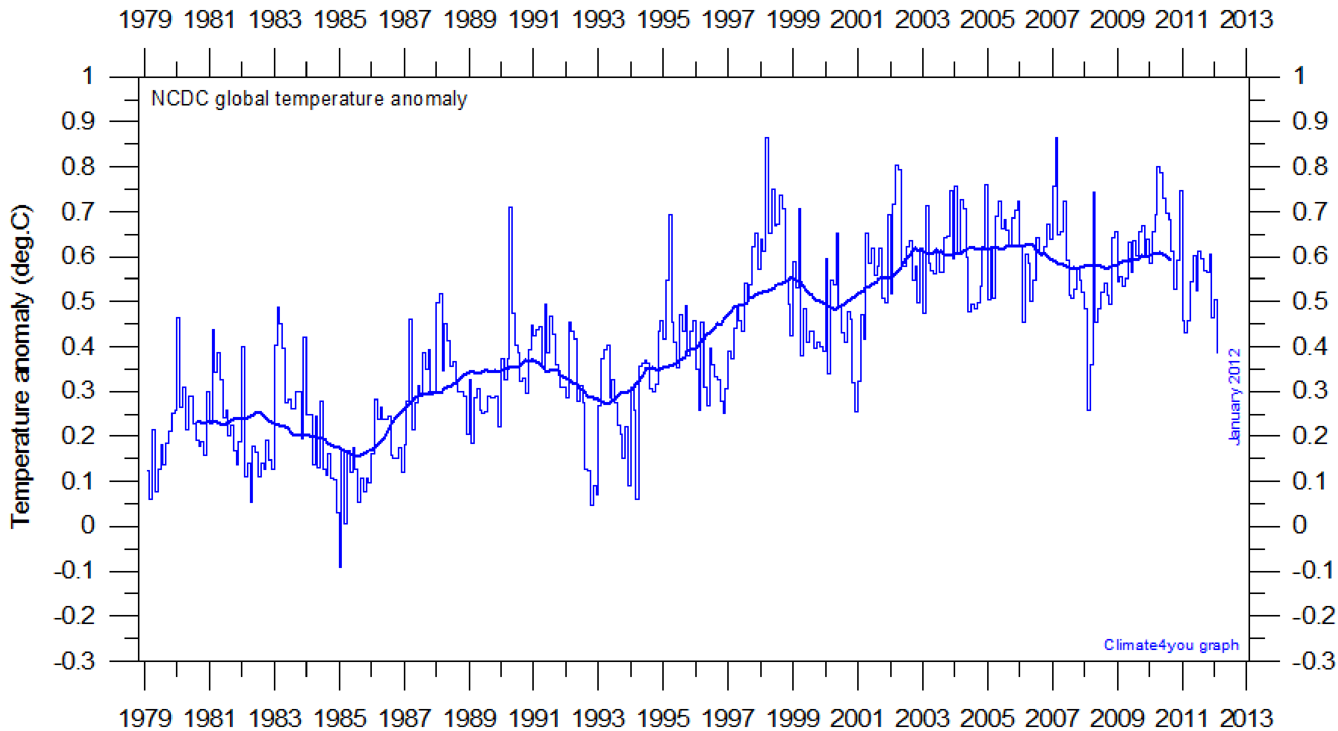
Global surface air temperature, updated to January 2012



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 December 2011.



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



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

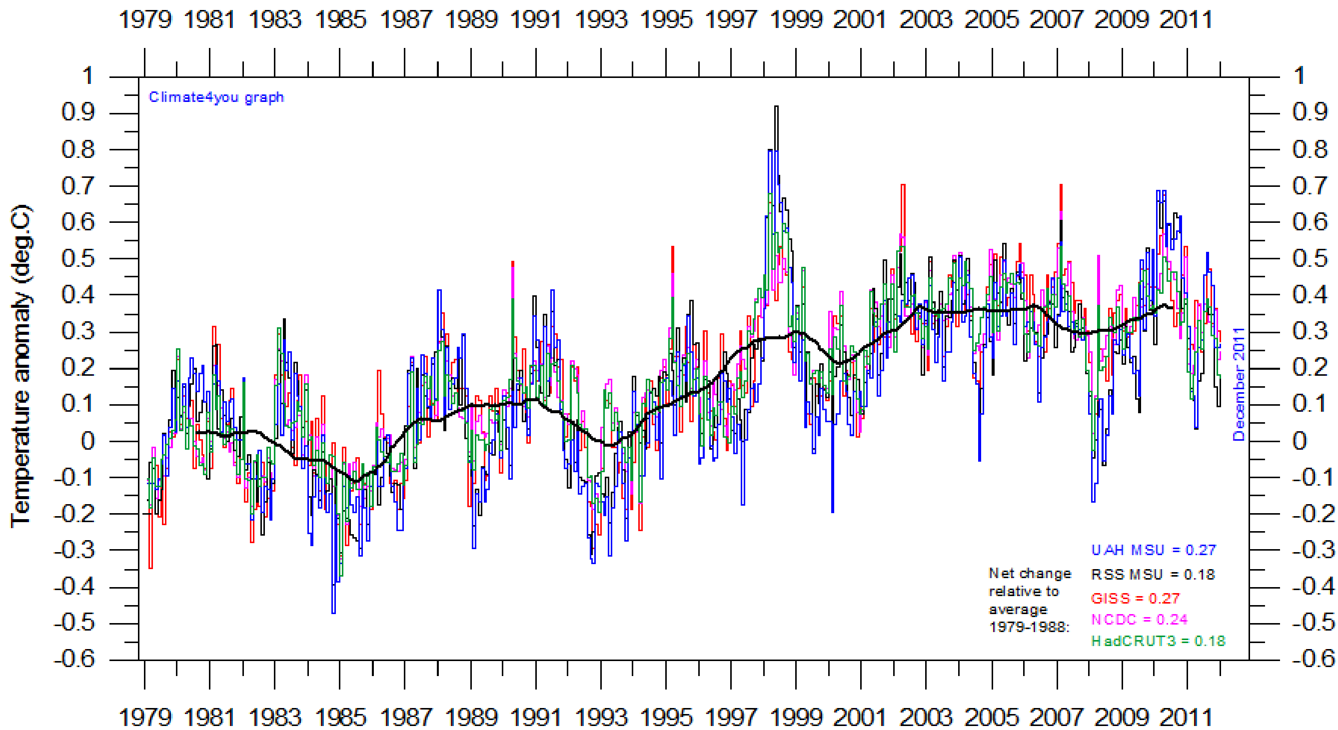
A note on data record stability:

All the above temperature estimates display changes when one compare with previous monthly data sets, not only for the most recent months as a result of 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 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*). See also page 3-7 in the present newsletter.

All in one, updated to December 2011

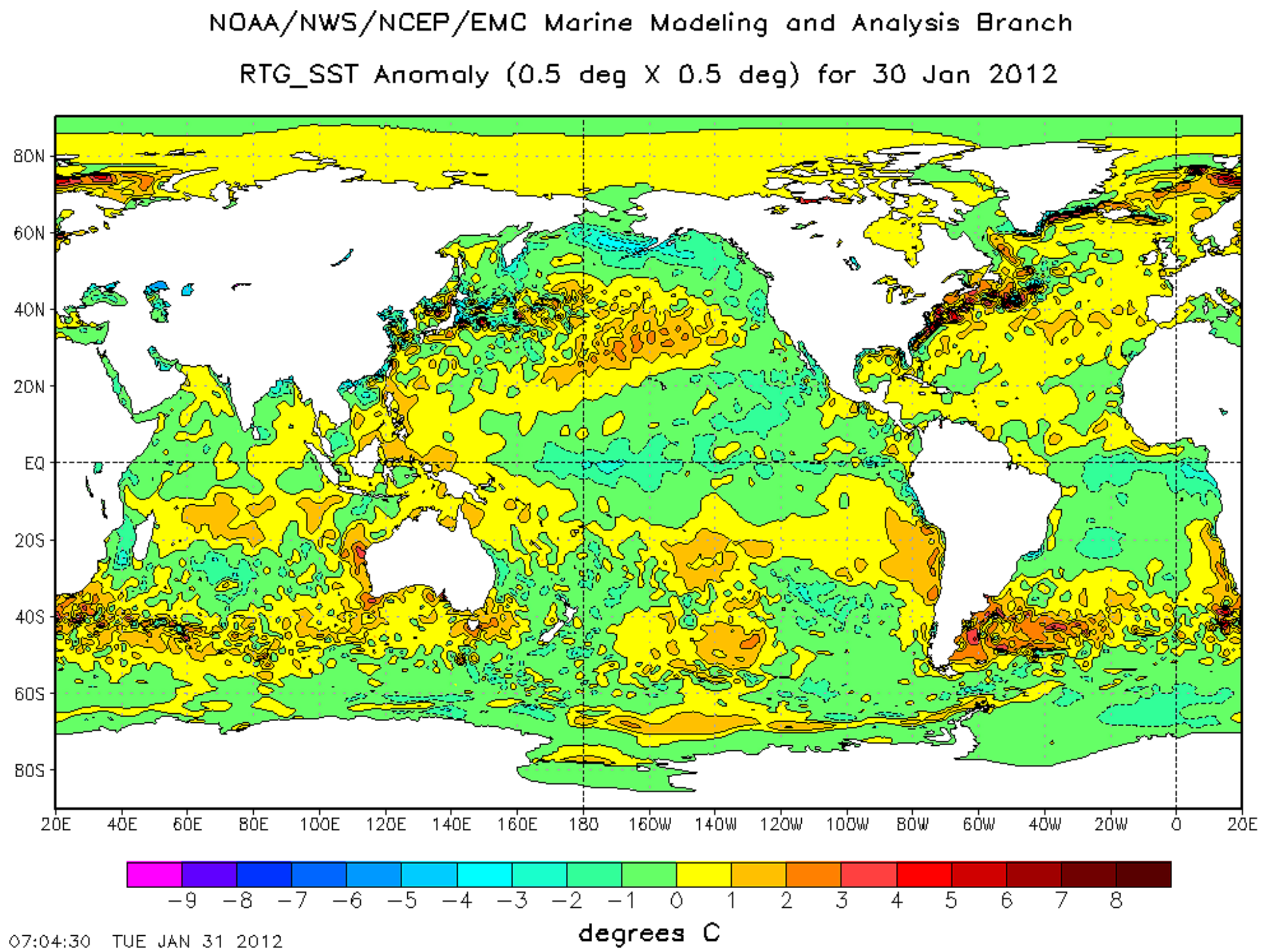


Superimposed plot of all five global monthly temperature estimates shown above. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of their initial 120 months (10 years) from January 1979 to December 1988. The heavy black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

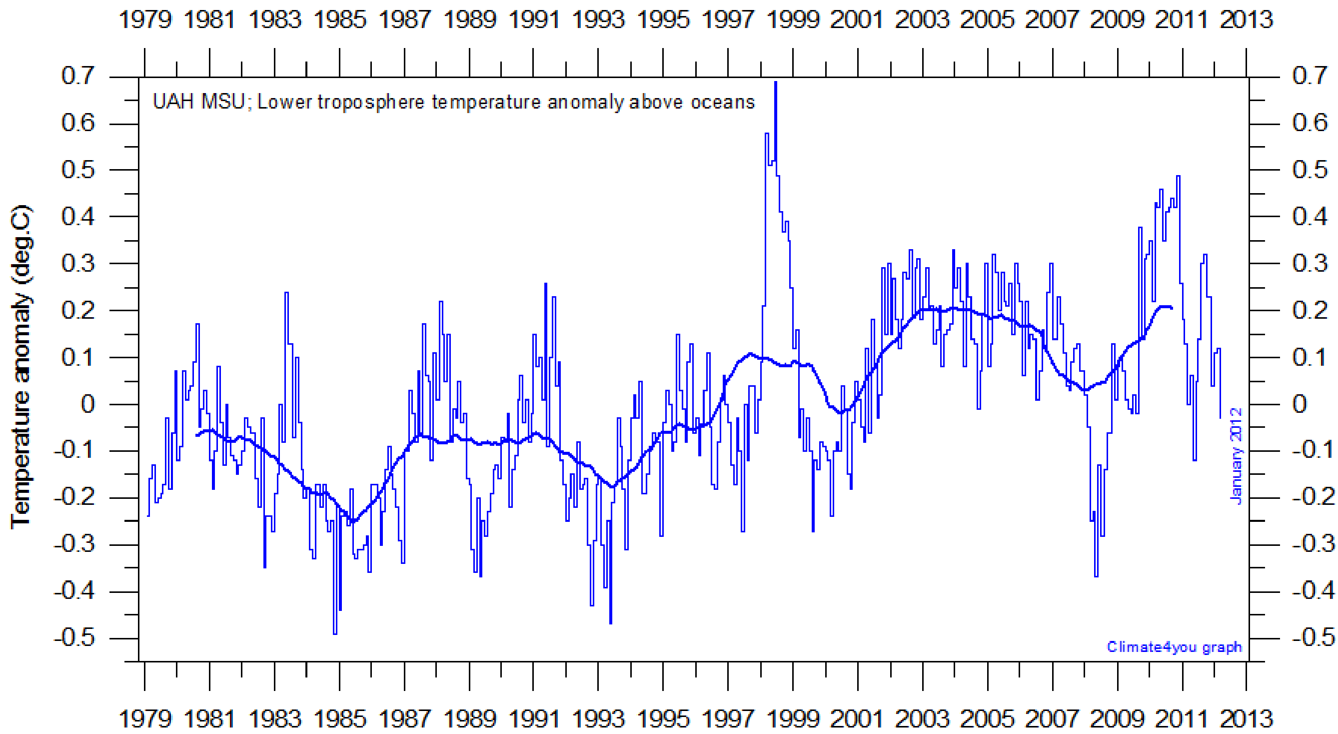
Global sea surface temperature, updated to the end of January 2012



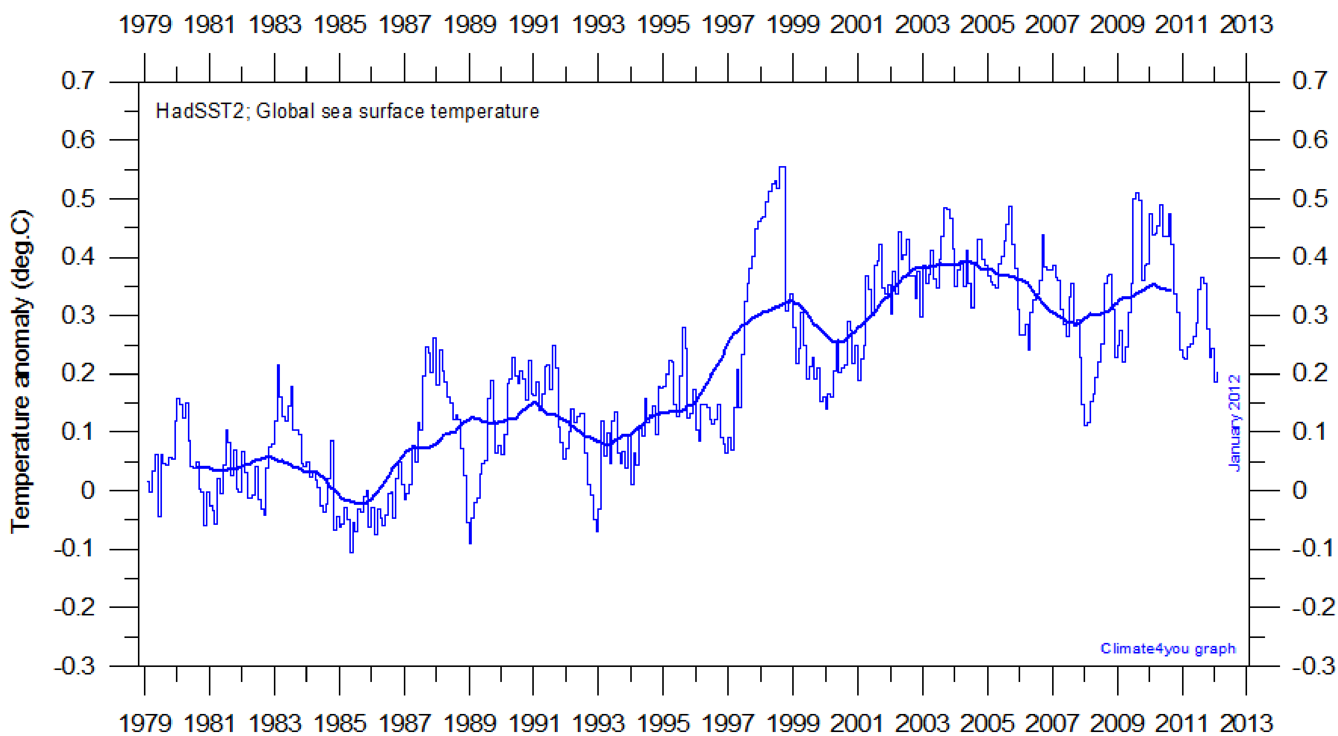
Sea surface temperature anomaly at 30 January 2012. Map source: National Centers for Environmental Prediction (NOAA).

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.

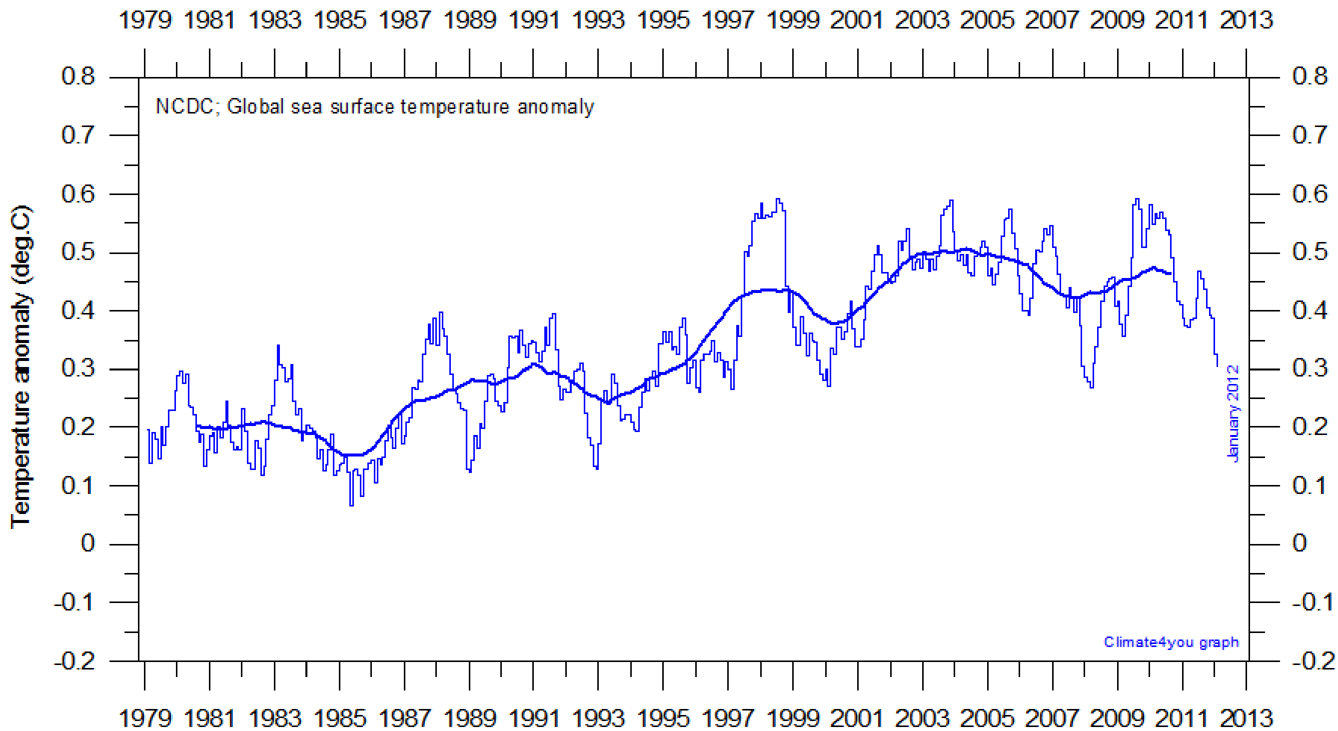
The significance of any short-term warming or cooling seen in surface air temperatures should not be over stated. Whenever Earth experiences cold La Niña or warm El Niño episodes (Pacific Ocean) major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up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

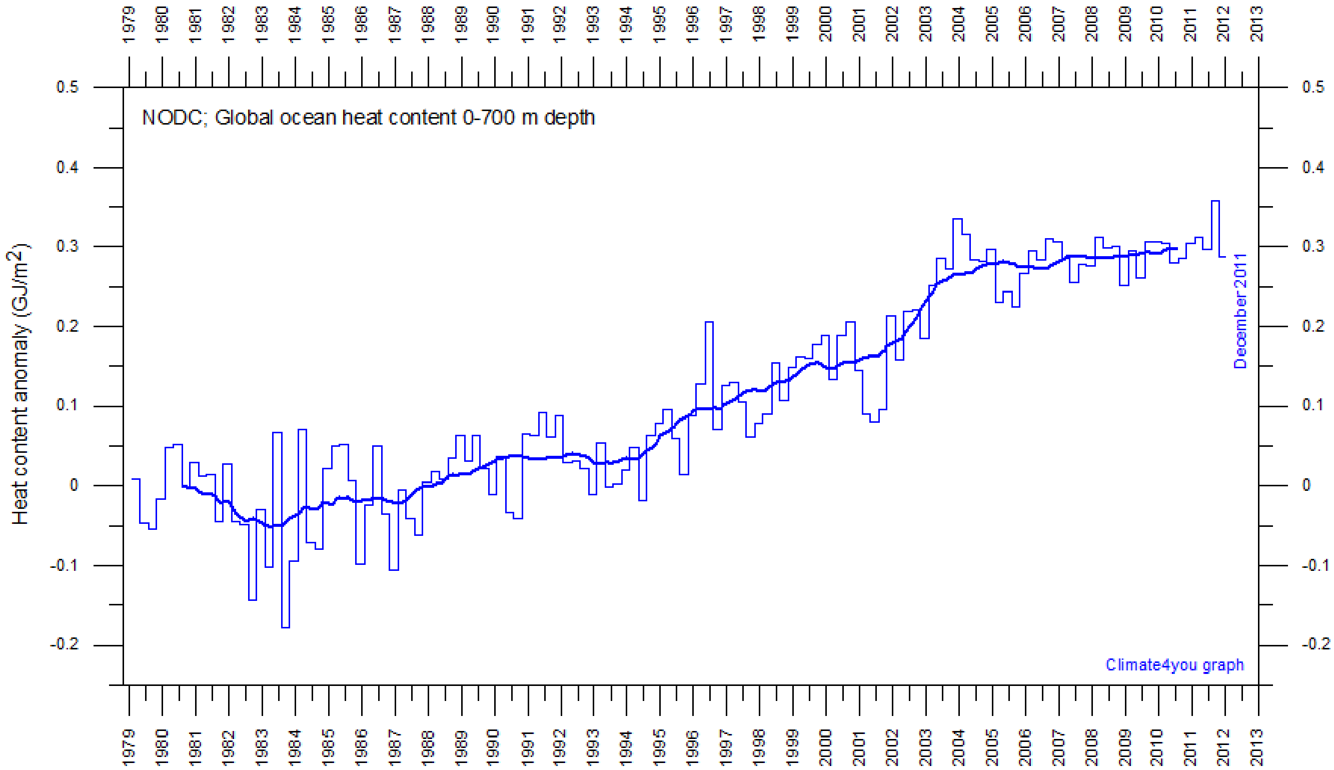


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit](#) ([CRU](#)), UK. Base period: 1961-1990. The thick line is the simple running 37 month average.

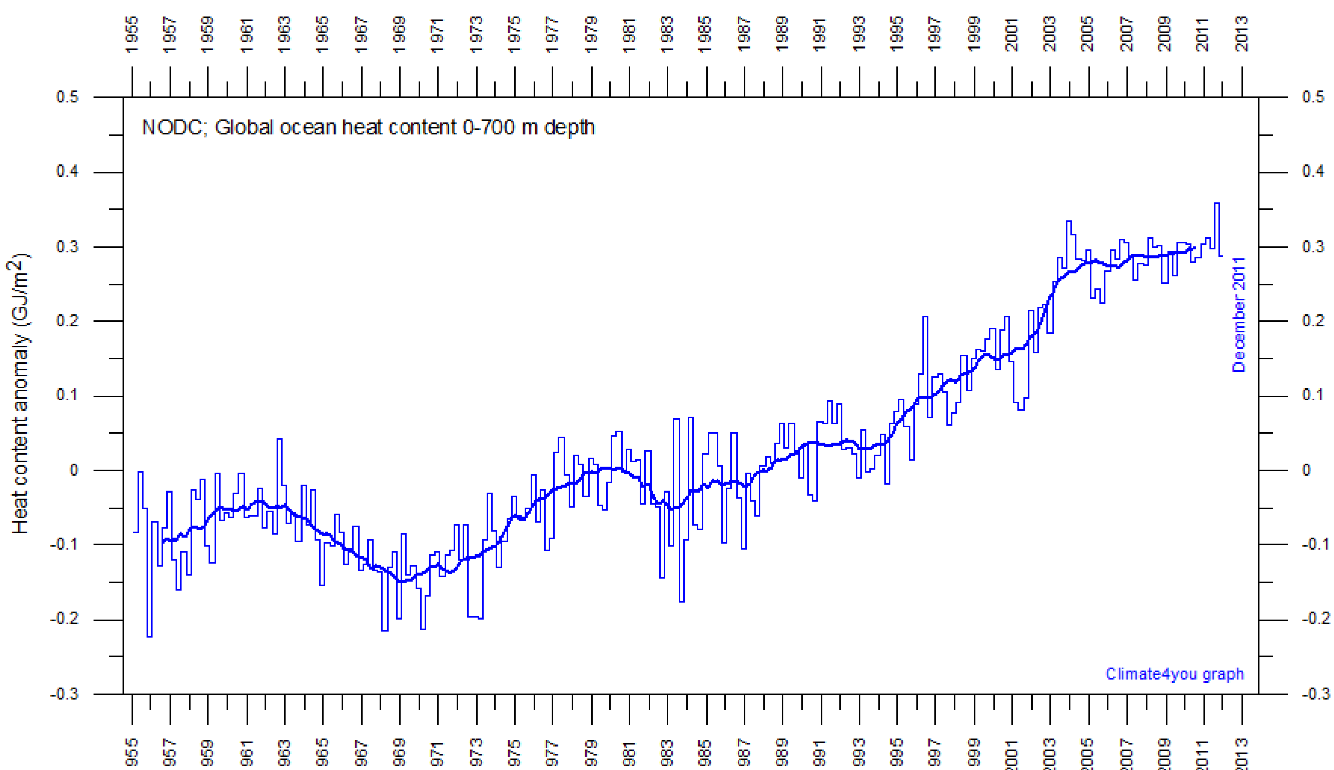


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to December 2011

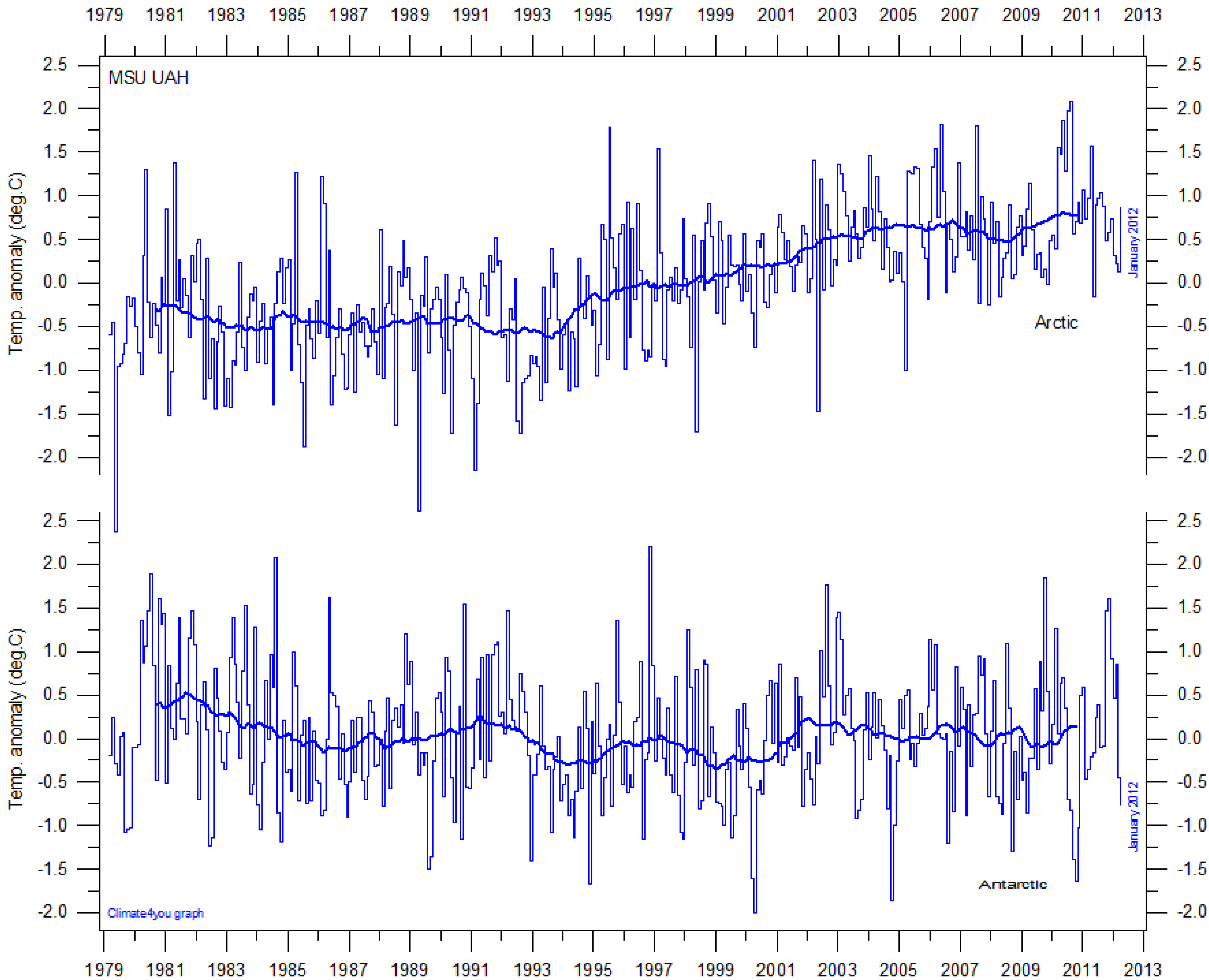


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



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 January 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

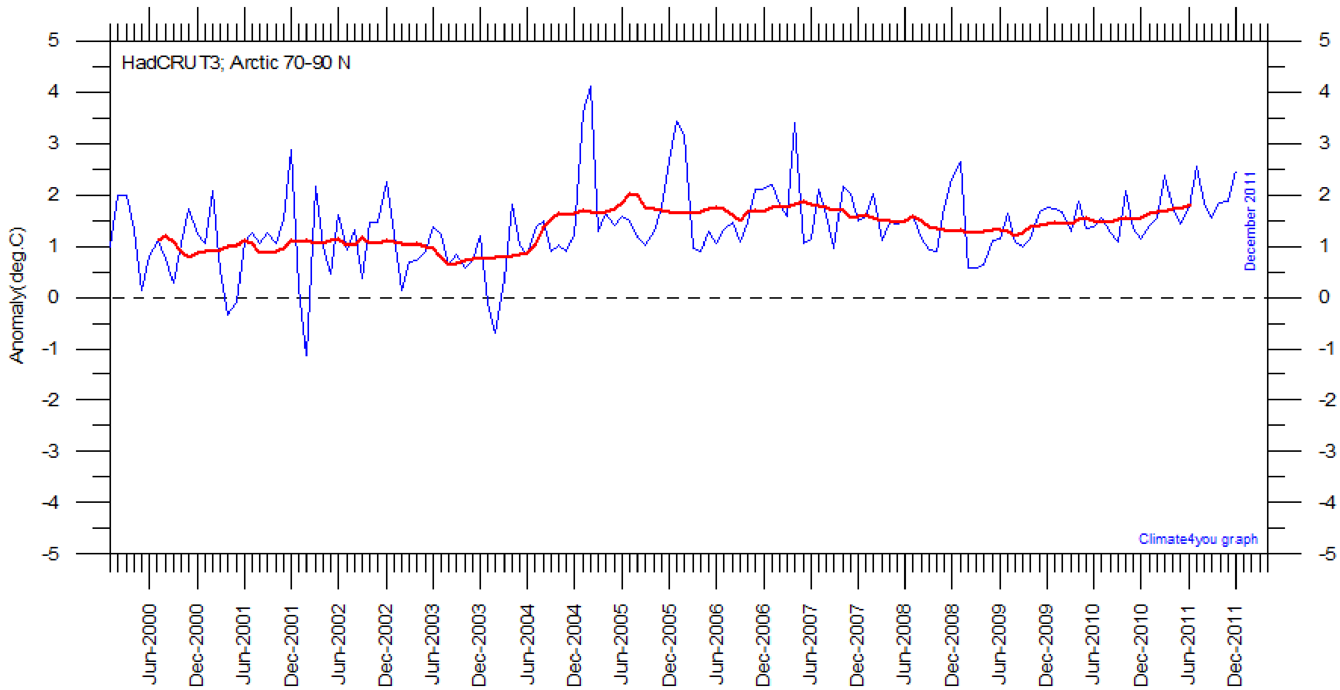


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

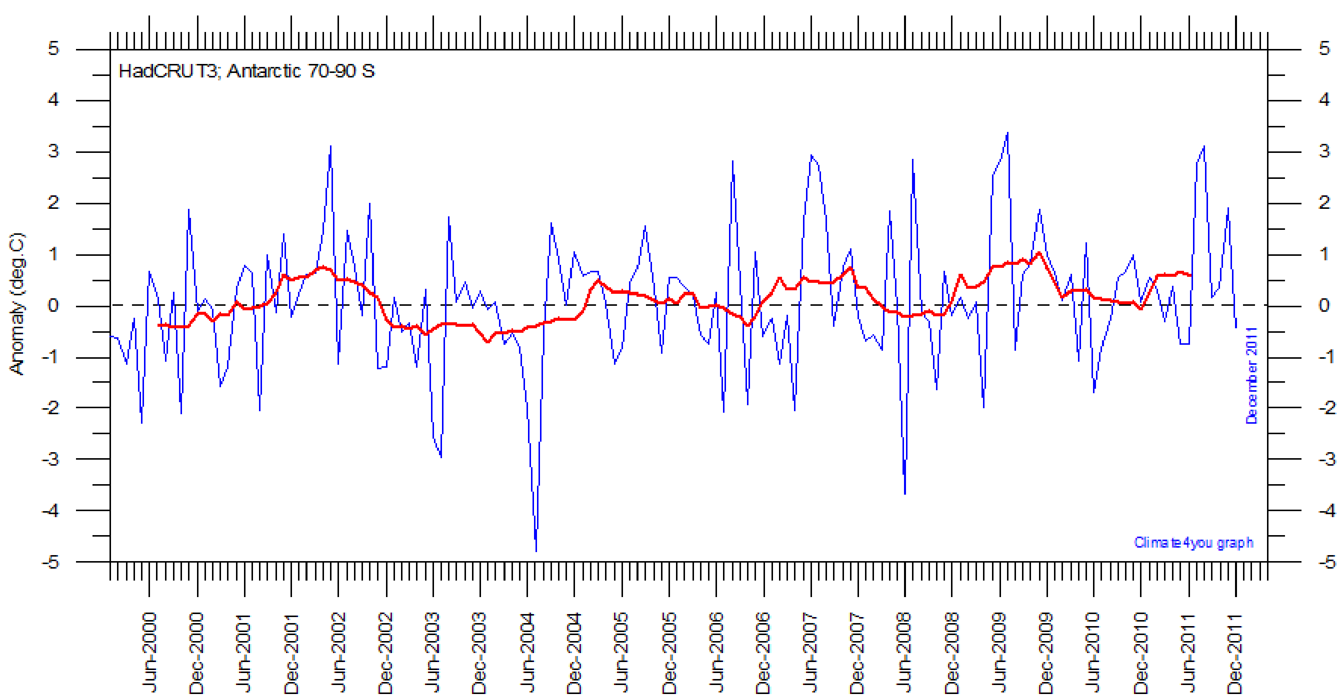


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

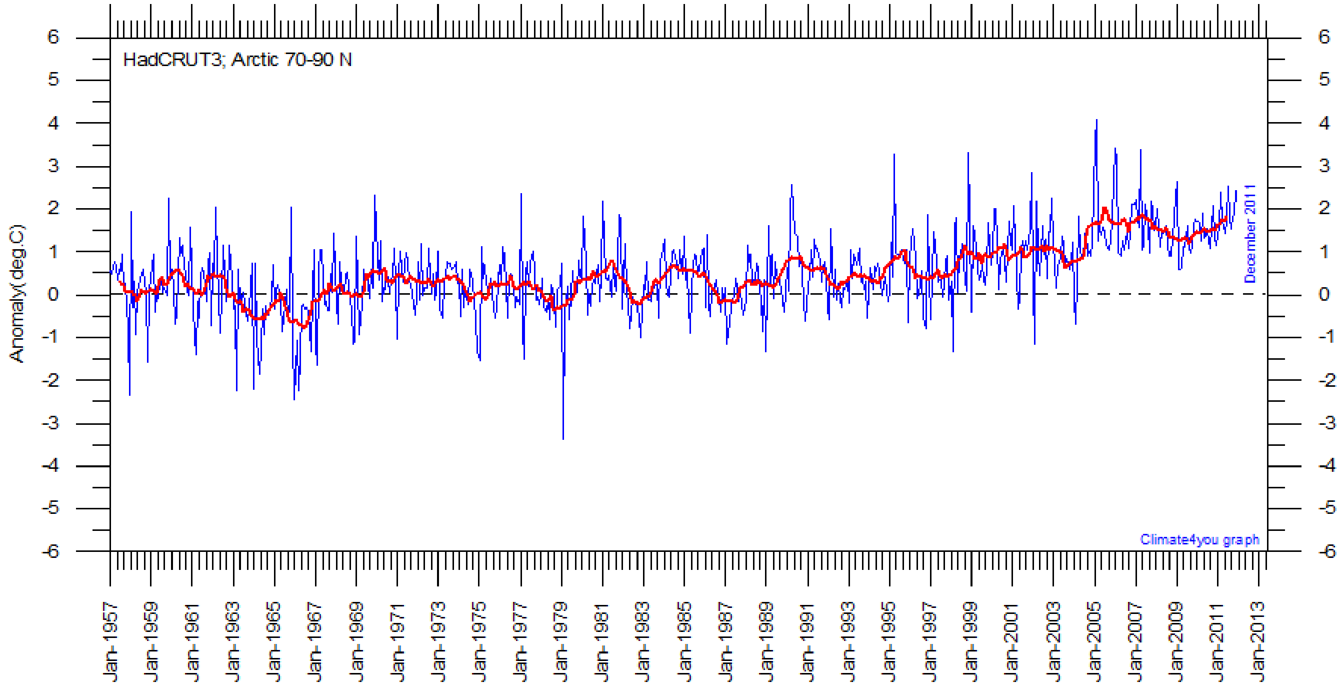


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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

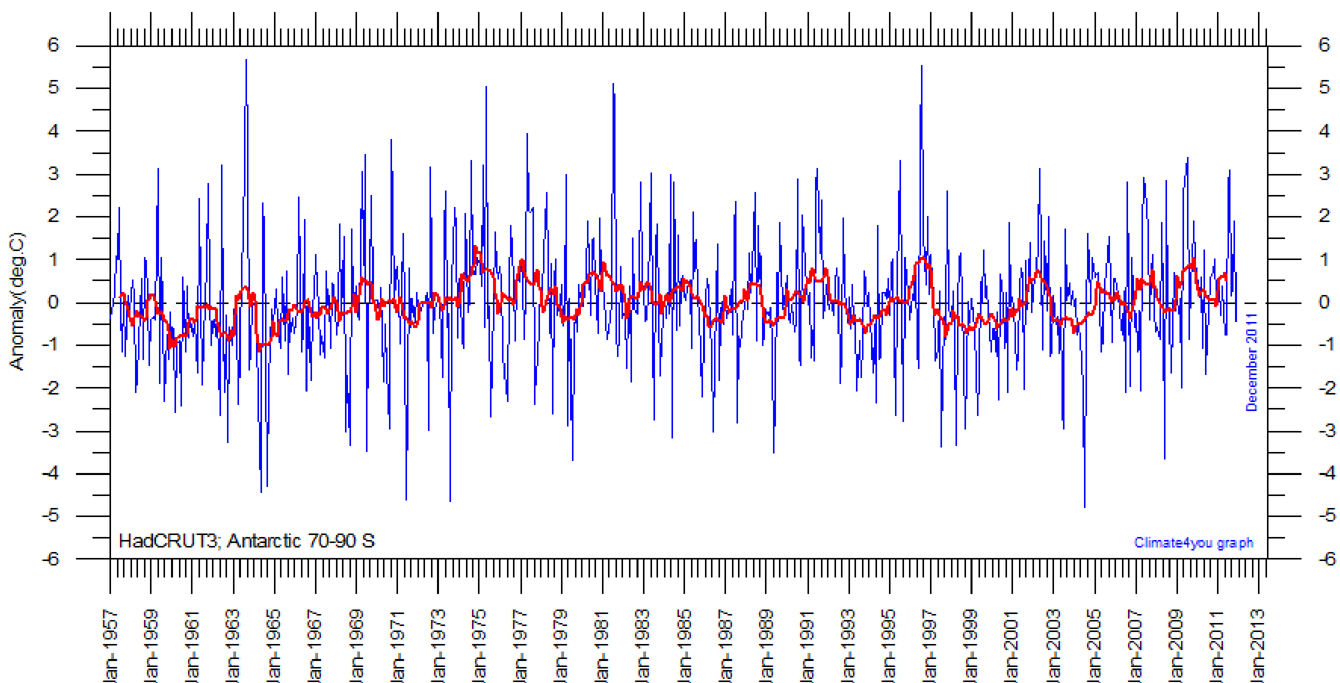


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

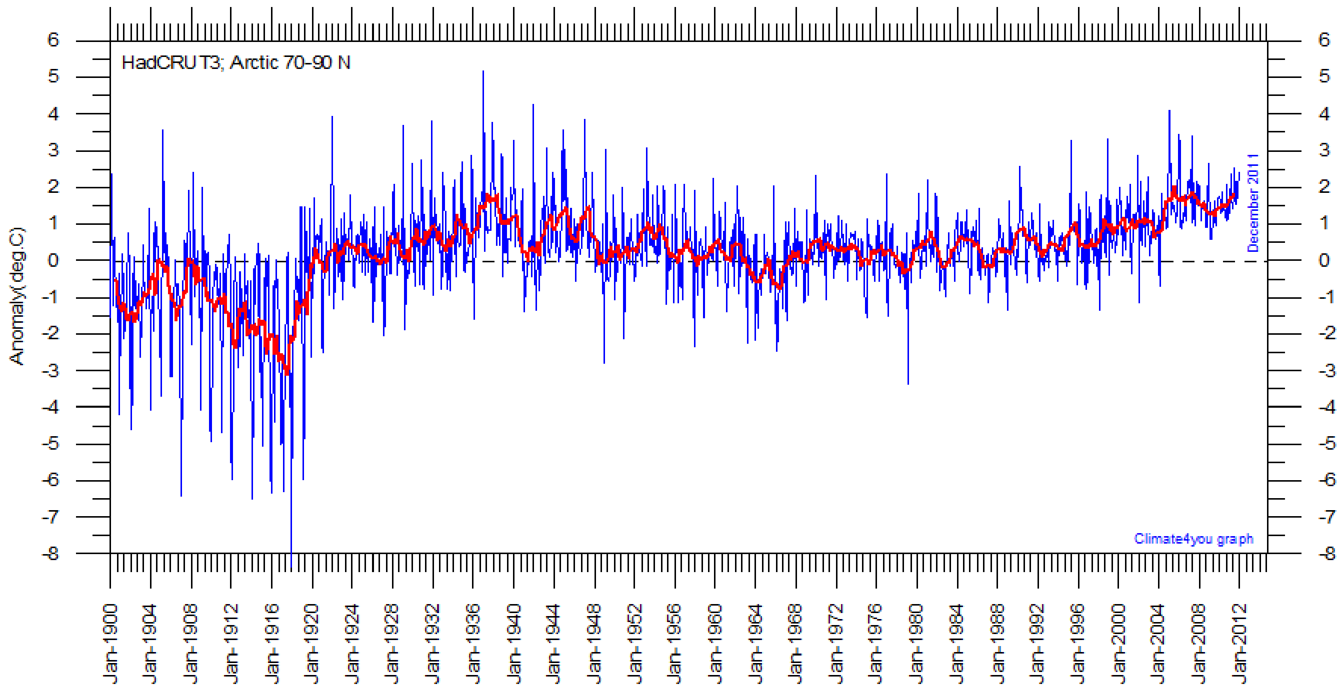


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly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

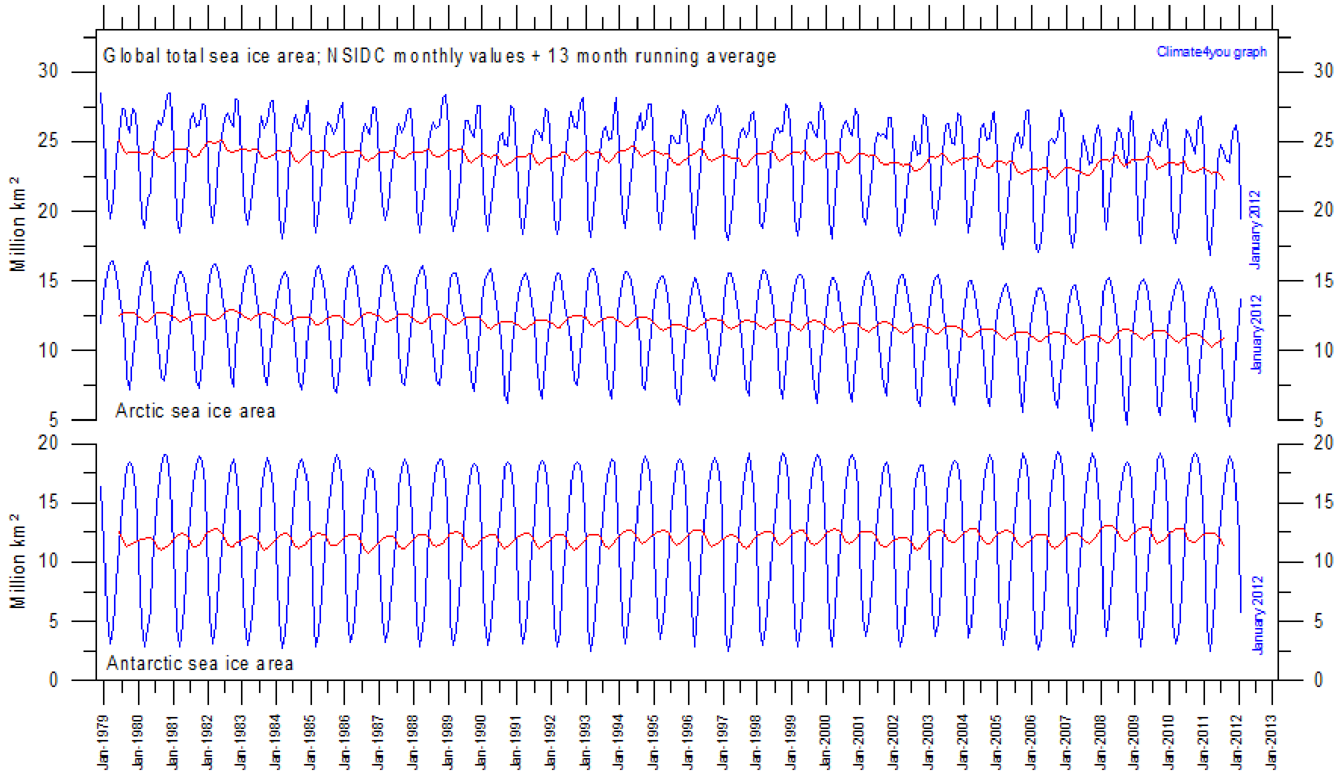
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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.

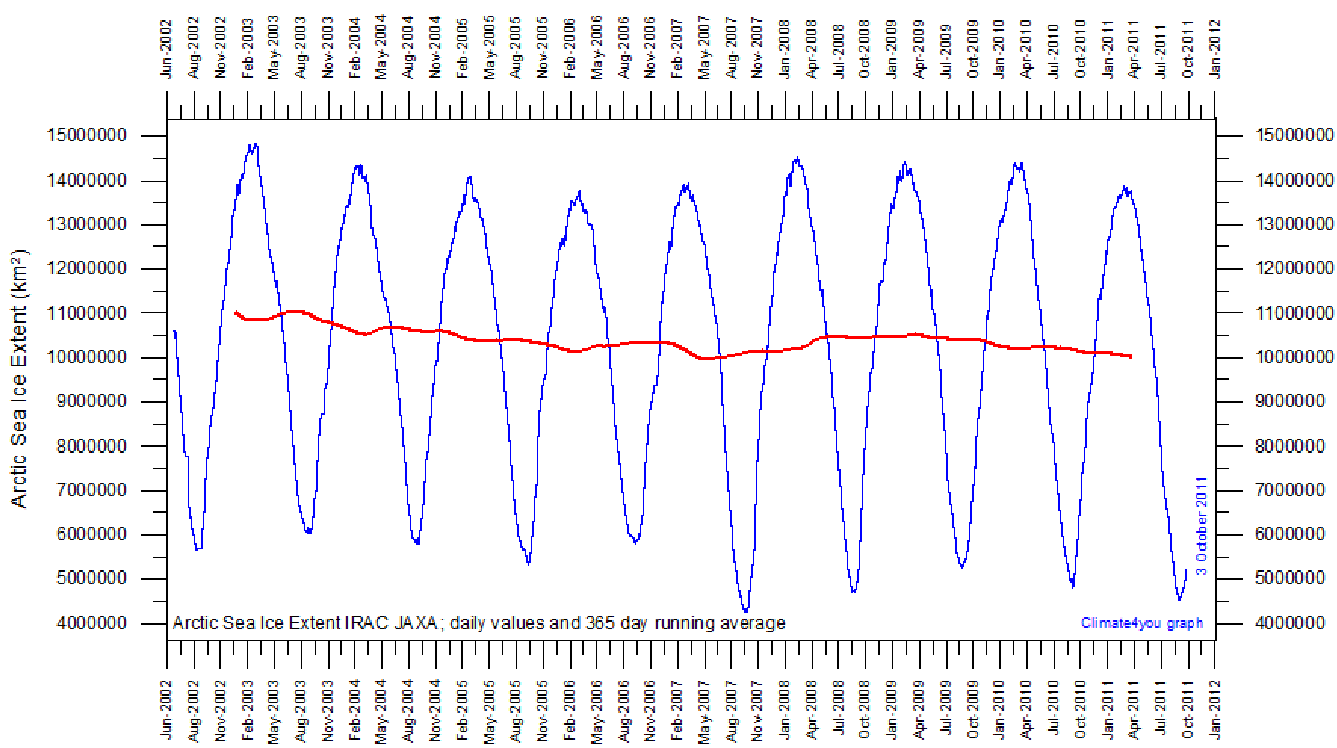
Literature:

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.

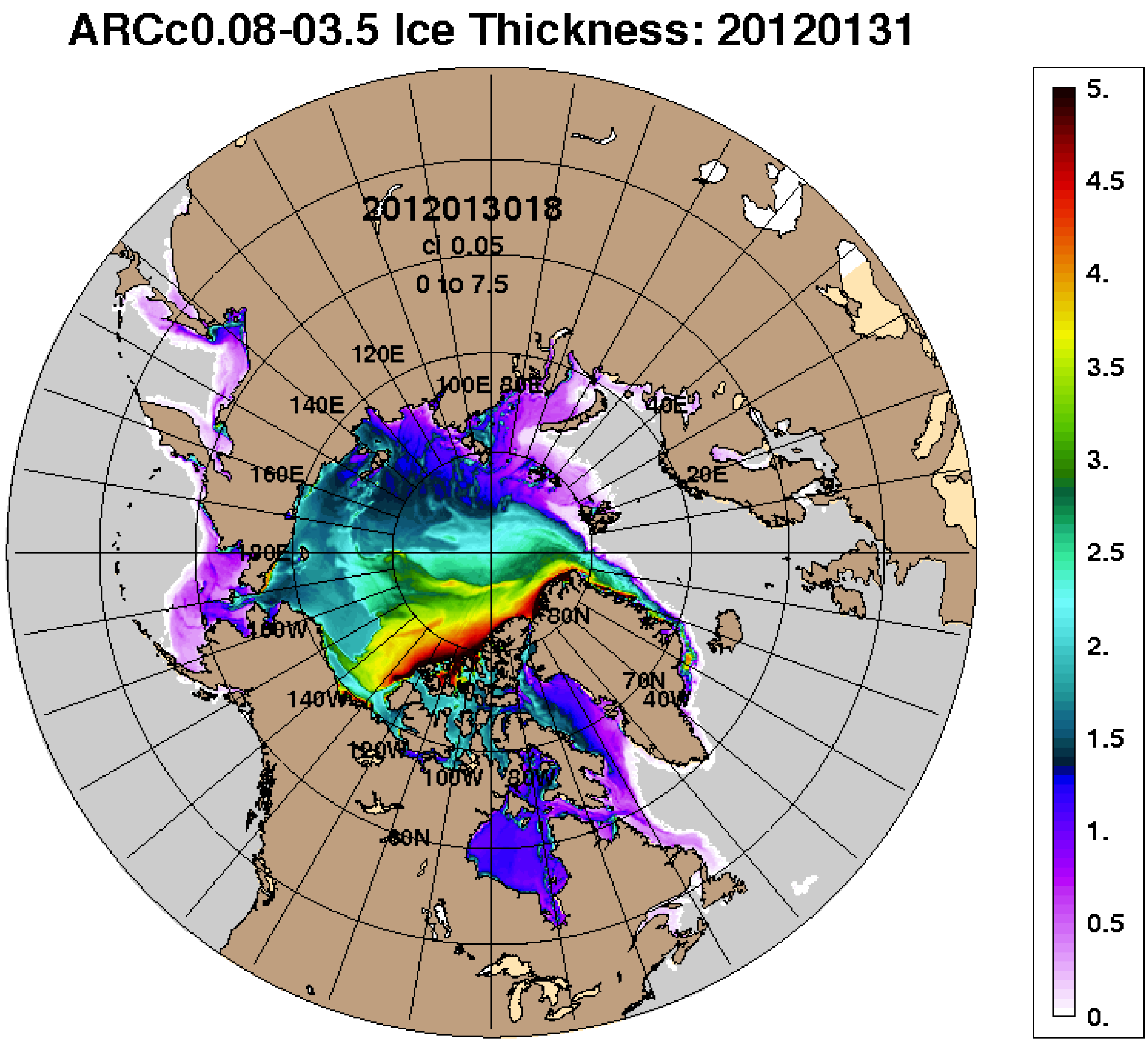
Arctic and Antarctic sea ice, updated to January 2012



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

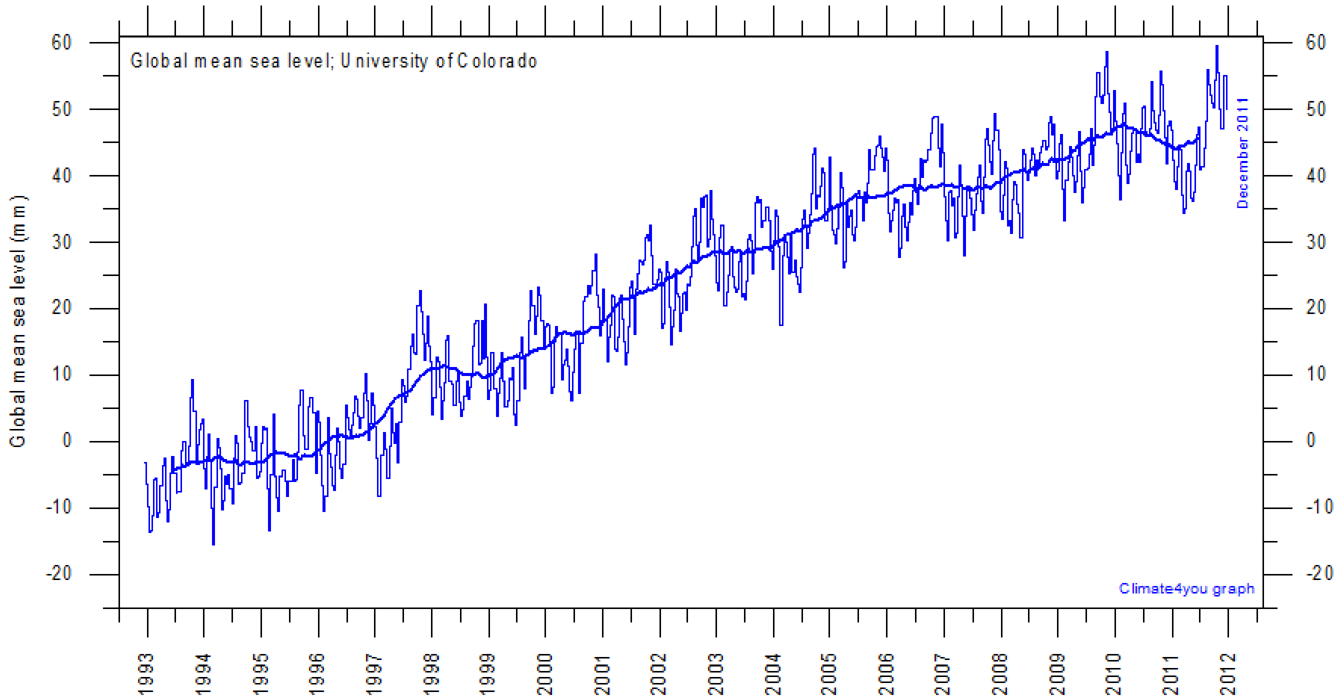


Graph showing daily Arctic sea ice extent since June 2002, to October 3, 2011, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA). Please note that this diagram is not updated beyond 3 October 2011 due to the suspension of AMSR-E observation.

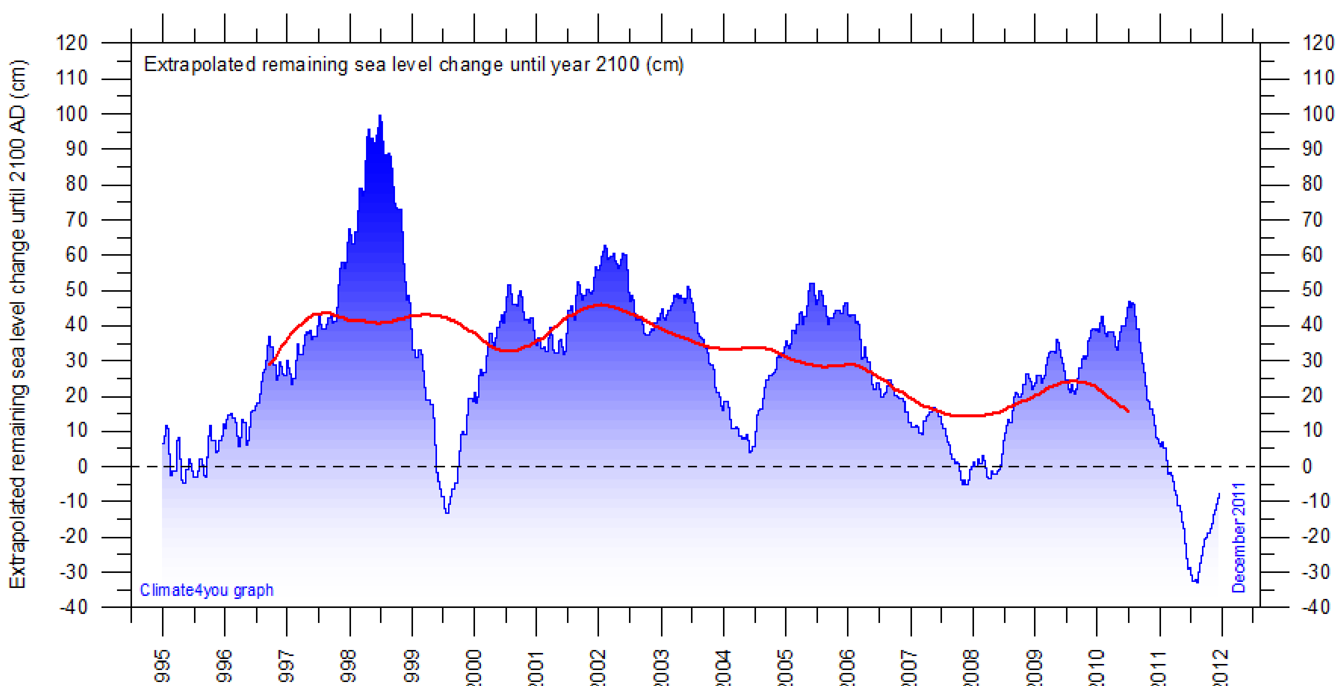


Northern hemisphere sea ice extension and thickness on 31 January 2012 according to the [*Arctic Cap Nowcast/Forecast System*]() *(ACNFS), US Naval Research Laboratory. Thickness scale (m) is shown to the right.*

[Global sea level, updated to December 2011]

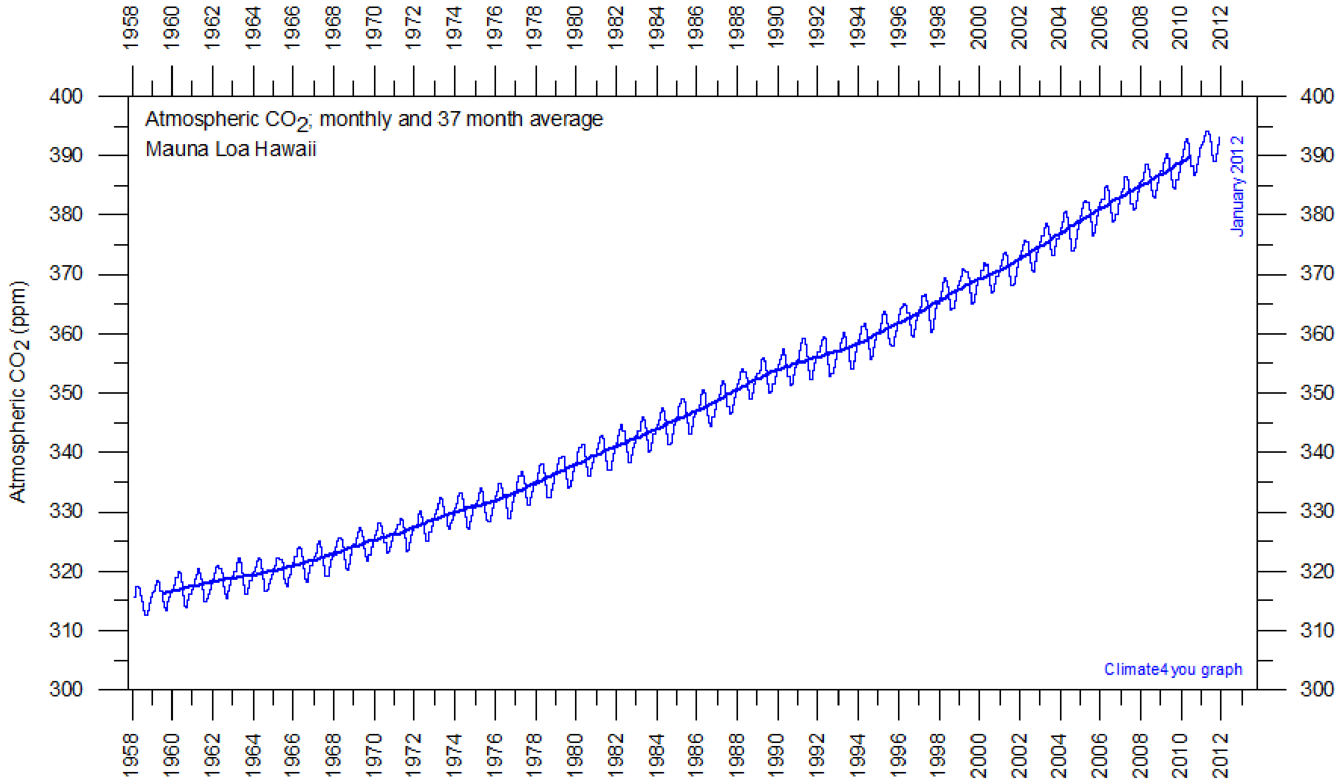


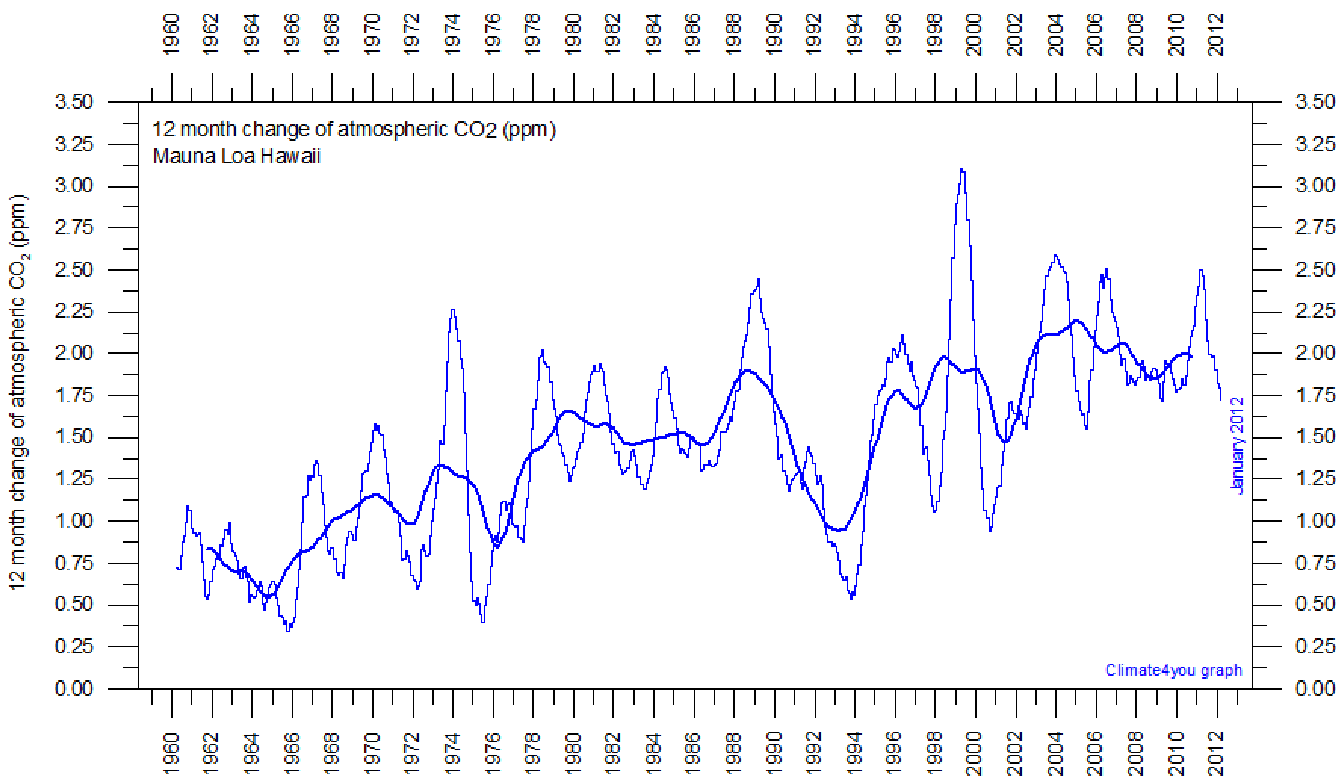
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder], USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



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.

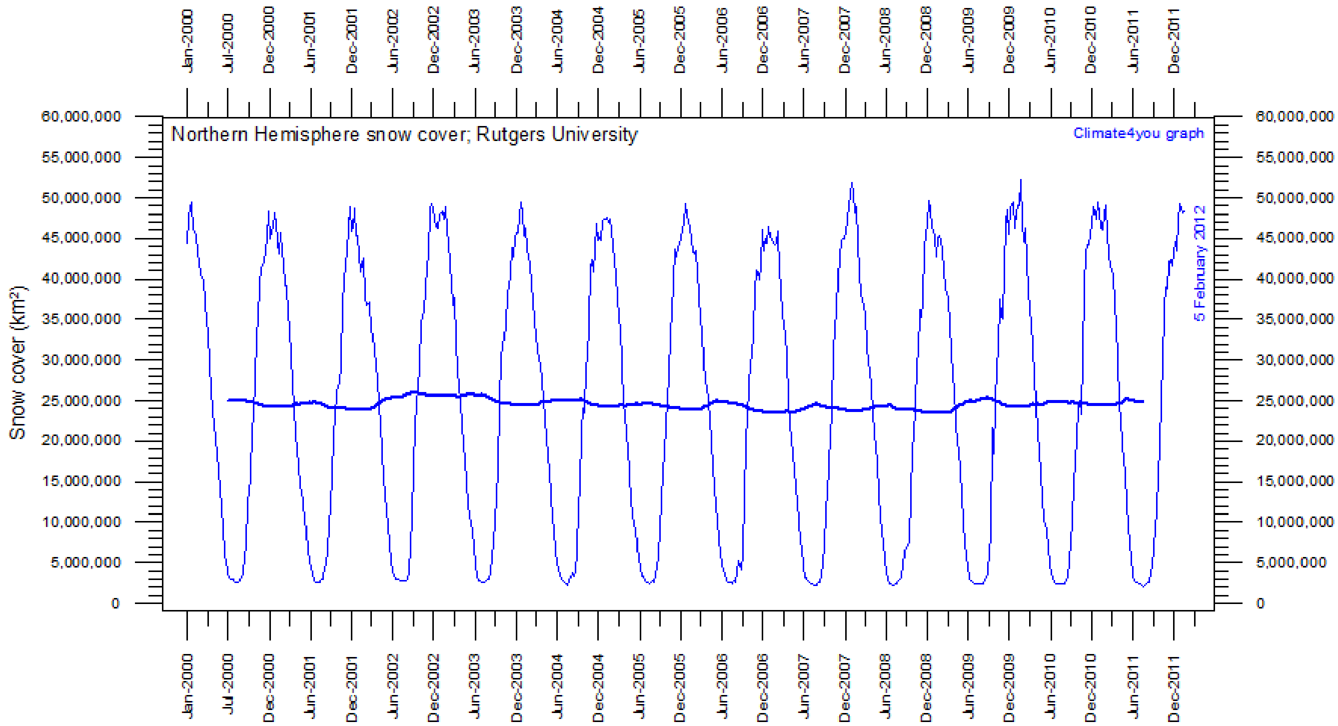
[Atmospheric CO_2, updated to January 2012]



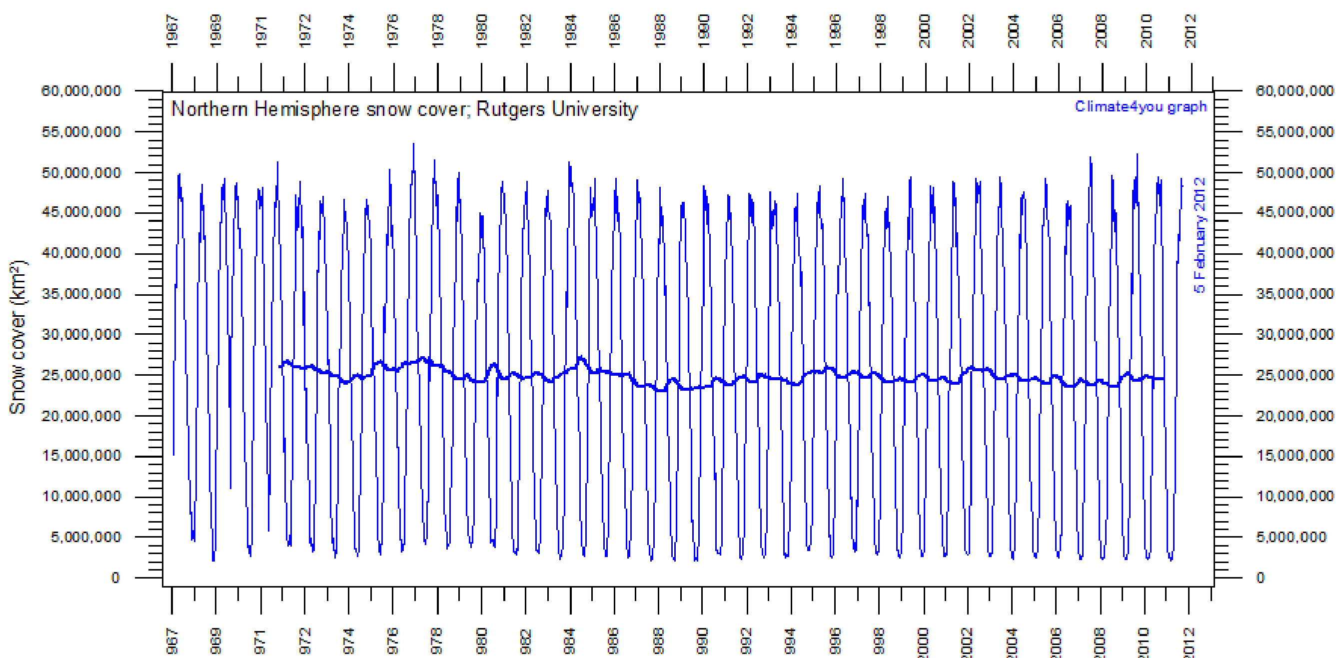


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the [Mauna Loa Observatory], Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Northern Hemisphere weekly snow cover, updated to early February 2012

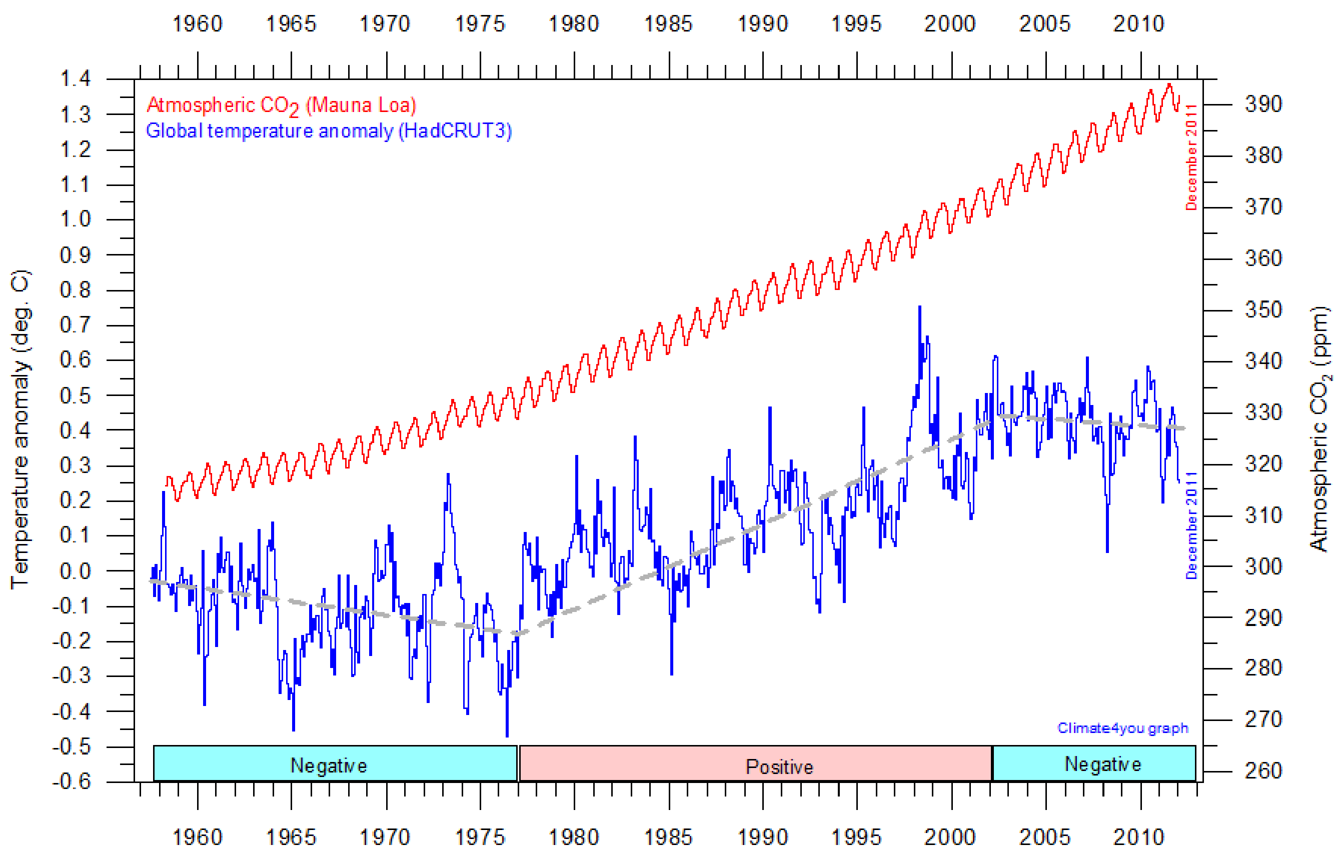


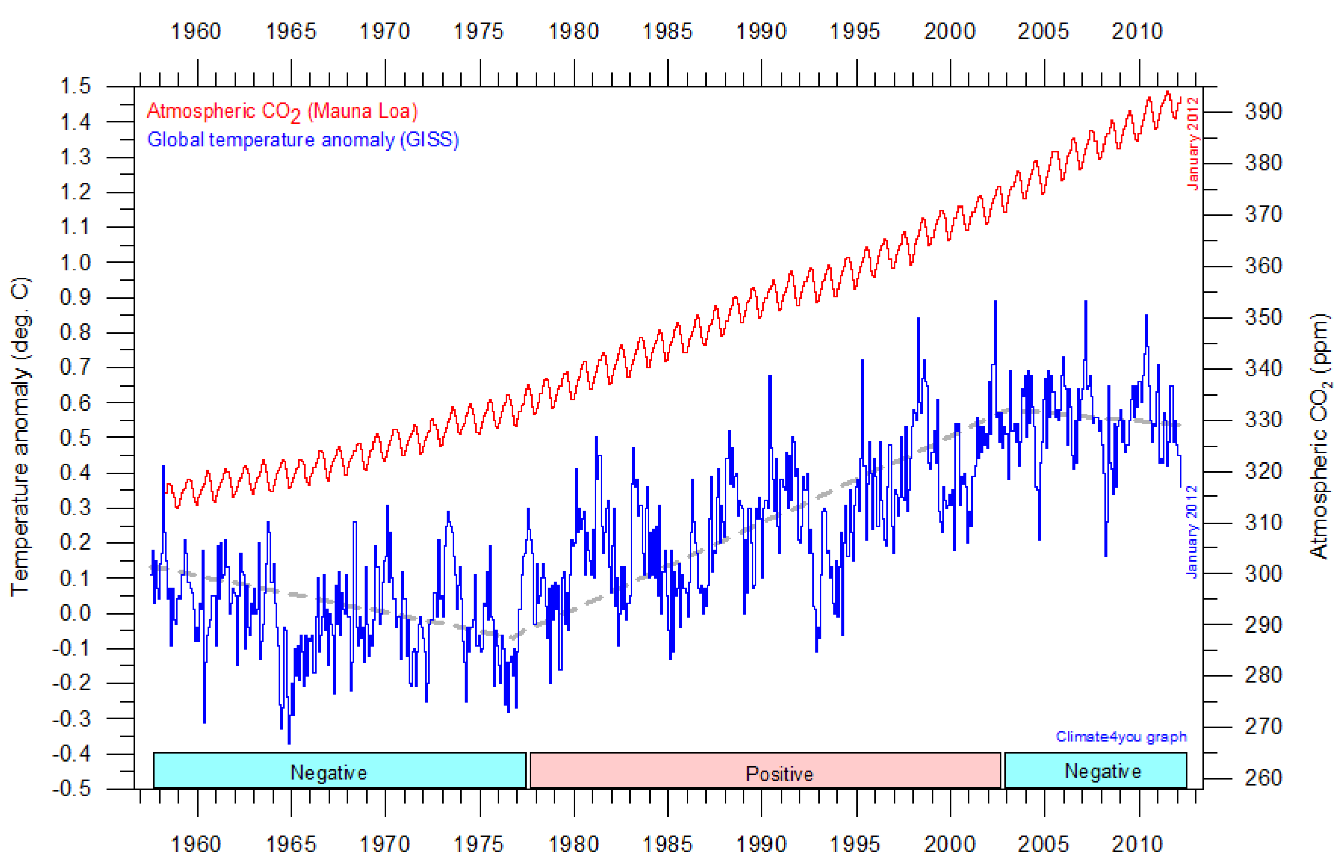
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year).

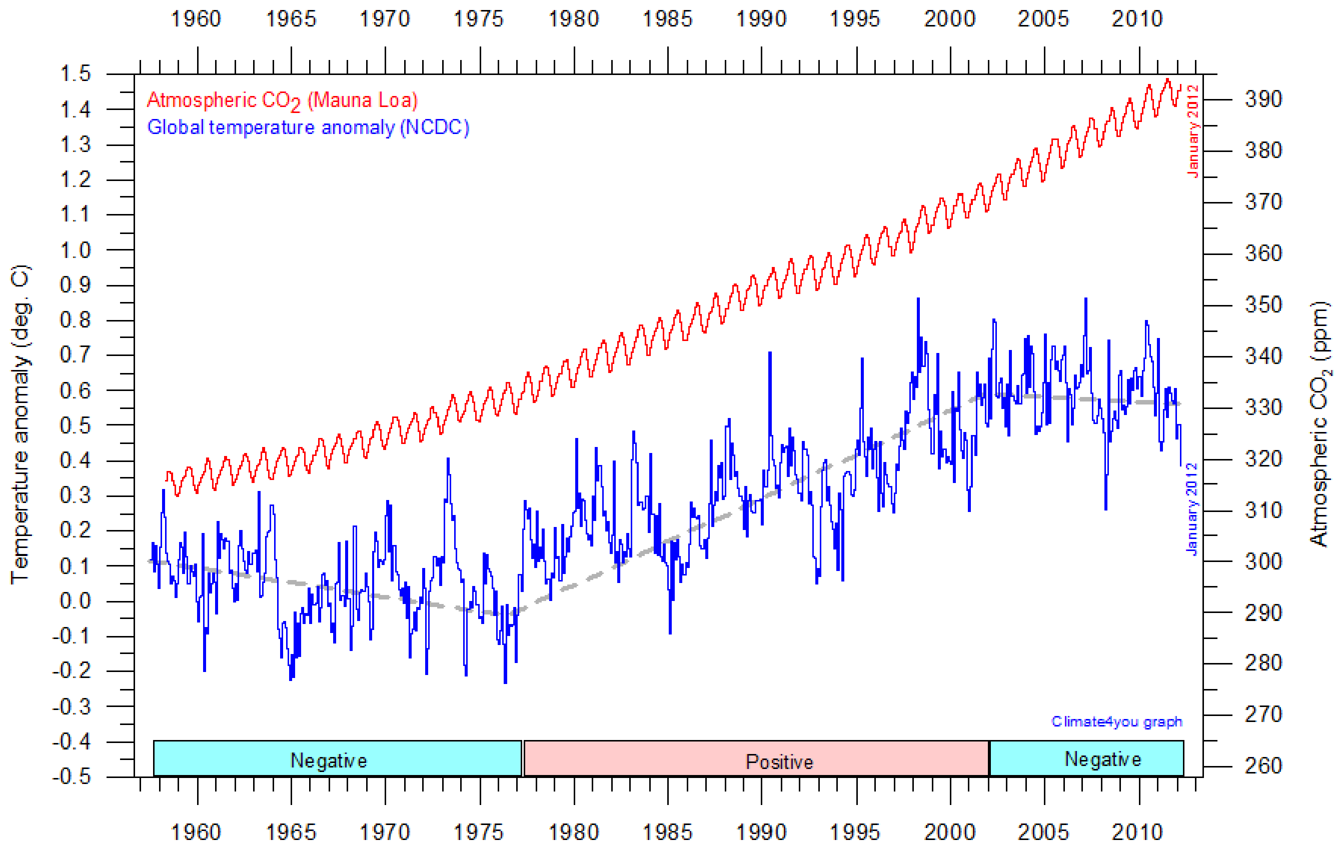


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line represents the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of data gaps in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

Global surface air temperature and atmospheric CO_2, updated to January 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 December 2011.

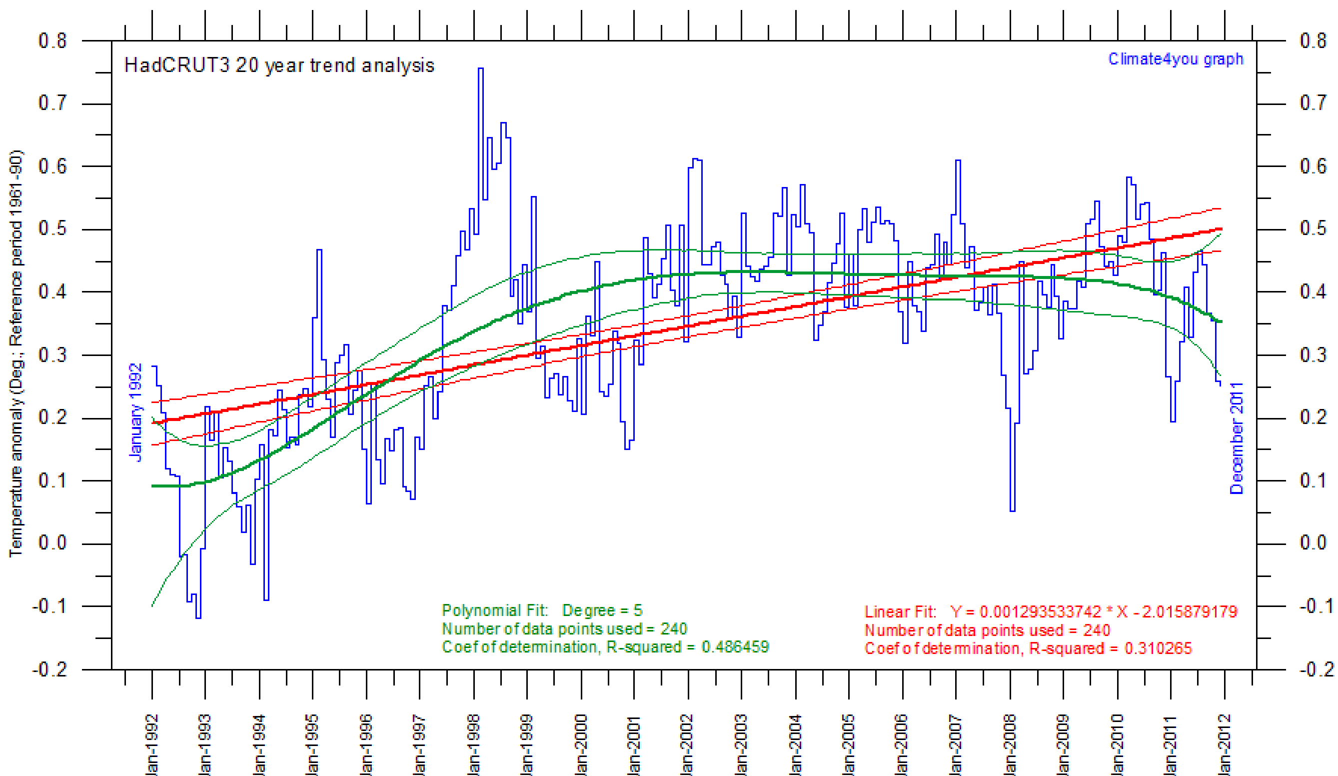
Most climate models assume the greenhouse gas carbon dioxide CO_2 to influence significantly upon global temperature. Thus, it is relevant to compare the different global temperature records with measurements of atmospheric CO_2, as shown in the diagrams above. Any comparison, however, should not be 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 December 2011

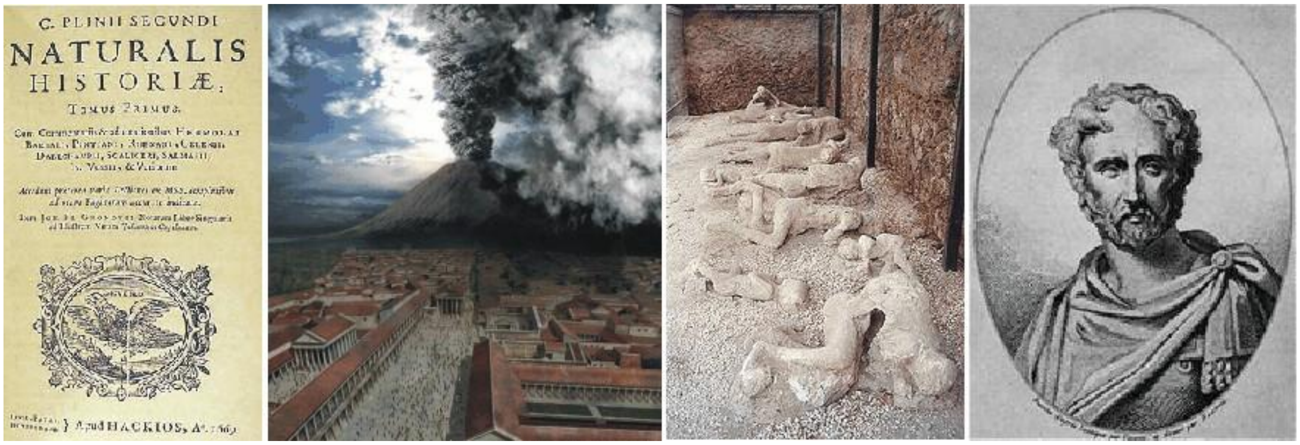


Last 20 years global monthly average surface air temperature according to Hadley CRUT, a cooperative effort between the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thin blue line represents the monthly values. The thick red 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: November 2011.

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. If nothing else, it demonstrates the differences between two different statistical approaches to determine recent temperature trends.

Climate and history; one example among many

23-79 AD: Gaius Plinius Secundus and Naturalis Historia



Naturalis Historia, 1669 edition, title page (left picture). The title at the top reads: "Volume I of the Natural History of Gaius Plinius Secundus. Computer-generated illustration of Mount Vesuvius during the 79 AD eruption (centre left). Plaster casts of the casualties of the pumice-fall, whose remains vanished leaving cavities in the pumice (centre right). Pliny the Elder (to the right): an imaginative 19th century portrait. No contemporary picture shoving Gaius Plinius Secundus has survived.

Gaius Plinius Secundus (23 AD – August 25, 79 AD) is also known as Pliny the Elder. He was a Roman author, naturalist, and natural philosopher, as well as naval and army commander of the early Roman Empire, and personal friend of the emperor Vespasian. Spending most of his spare time studying, writing or investigating natural and geographic phenomena in the field, he wrote an encyclopedic work, Naturalis Historia, which became a model for all such works written subsequently, and contributed to the survival in Europe of knowledge collected by Aristotle and his students. Some of the present summary is adopted from Rasmussen (2010) and Wikepedia.

Gaius Plinius was highly interested in agriculture, which he considered being the single most important human type of activity. Agriculture depended on correct planning of seasonal activities, and Gaius Plinius therefore collected much of what was believed to be known about weather and meteorology. Much of this knowledge on this and other natural (geological) phenomena is collected in volume two of his Naturalis Historia, which consists of no less than 37 volumes in total.

Below is reproduced (in extract) the English translation of some examples of Gaius Plinius writings on meteorological phenomena, all taken from volume two of Naturalis Historia. The Latin version of volume two can be found here.

Chap. XLII. The causes of raine, showers, winds, and clouds.

I CANNOT denie, but without these causes there arise raines and winds: for that certaine it is, how there is sent forth from the earth a mist sometimes moist, otherwhiles smokie, by reason of hote vapours and exhalations. Also, that clouds are engendred by vapours which are gone up on high, or els of the aire gathered into a waterie liquor: that they bee thicke, *grosse, and of a bodily consistence, wee guesse and collect by no doubtfull argument, considering that they overshaddow the Sunne, which otherwise may be seene through the water, as they know well, that dive to any depth whatsoever.*

Chap. XLVII. Many sorts of Winds.

MEN in old time observed foure Winds only, according to so many quarters of the world (and therefore Homer nameth no more:) a blockish reason this was, as soone after it was judged. The Age ensuing, added eight more; and they were on the other side in their conceit too subtile and concise. The Moderne sailers of late daies, found out a meane betweene both: and they put unto that short number of the first, foure winds and no more, which they tooke out of the later. Therefore every quarter of the heaven hath two winds apeece...

…The coldest winds of all other, be those which we said to blow from the North pole, and together with them their neighbour, Corus. These winds doe both allay and still all others, and also scatter and drive away clouds. Moist winds are Africus, and especially the South wind of Italie, called Auster…

…The North wind also bringeth in haile, so doth Corus. The South wind is exceeding hote and troublous withall. Vulturnus and Favonius bee warme. They also bee drier than the East: and generally all winds from the North and West, are drier than from the South and East. Of all winds the Northerne is most healthfull: the Southerne wind is noisome, and the rather when it is drie; haply, because that when it is moist, it is the colder. During the time that it bloweth, living creatures are thought to bee lesse hungrie. …

Chap. LX. Of Haile, Snow, Frost, Mist, and Dew.

HAILE is engendred of Raine congealed into an Ice: and Snow of the same humour growne togither, but not so hard. As for Frost, it is made of dewe frozen. In winter Snowes fall, and not Haile. It haileth oftner in the day time than in the night, yet haile sooner melteth by farre than snow. Mists be not seene neither in Summer, nor in the cold weather. Dewes shew not either in frost, or in hote seasons; neither when winds be up, but only after a calme and cleere night. Frostes drie up wet and moisture; for when the yce is thawed and melted, the like quantitie of water in proportion is not found.

Given the modern high interest in effects of sea level change, it is interesting to note that Gaius Plinius in volume 2 of Naturalis Historia also comments on the effects of past and contemporary sea level changes:

Chap. LXXXVIII. What Lands the Seas have broken in betweene.

EVEN within our kenning and neare to Italie, betweene the Ilands Æoliæ; in like manner neare to Creta, there was one shewed it selfe with hote fountaines out of the sea, for a mile and a halfe: and another in the third yeere of the 143 Olympias, within the Tuscane gulfe, and this burned with a violent wind. Recorded it is also, that when a great multitude of fishes floted ebbe about it, those persons died presently that fed therof. So they say, that in the Campaine gulfe, the Pithecusæ Ilands appeared. And soone after, the hill Epopos in them (at what time as sodainly there burst forth a flaming fire out of it) was laid level with the plain champion. Within the same also there was a towne swallowed up by the sea: and in one earthquake there appeared a standing poole; but in another (by the fall and tumbling downe of certaine hils) there grew the Iland Prochyta: For after this manner also Nature hath made Ilands. Thus, she disjoyned Sicilie from Italie, Cyprus from Syria, Eubœa from Bœotia, Atalante and Macris from Eubœa, Besbycus from Bithynia, Leucostia from the promontorie and cape of the Syrenes.

Chap. XC. What Lands have been turned wholly into Sea.

NATURE hath altogether taken away certaine Lands: and first and formost where as now the sea Atlanticum is, it was sometime the Continent for a mightie space of ground; if wee give credit to Plato. And soone after in our Mediteranean sea, all men may see at this day how much hath been drowned up, to wit, Acamania by the inward gulfe of Ambracia; Achaia within that of Corinth; Europe and Asia within Propontis and Pontus. Over and besides, the sea hath broken through Leucas, Antirrhium, Hellespont, and the two Bosphori.

Chap. XCII. What Citties have been drowned with the Sea.

THE sea Pontus hath overwhelmed Pyrrha and Antyssa about Mæotis, Elice, and Bura, in the gulfe of Corinth: whereof, the markes and tokens are to be seene in the deepe. Out of the Iland Cea, more than 30 miles of ground was lost sodainly at once, with many a man besides. In Sicilie also the sea came in, and had away halfe the citie Thindaris, and whatsoever Italy nourseth, even all betweene it and Sicilie. The like it did in Bœotia and Eleusina.

Pliny the Elder died on August 25, 79 AD, while attempting the rescue by ship of a friend and his family from the eruption of Mount Vesuvius that had just destroyed the cities of Pompeii and Herculaneum. The prevailing wind would not allow his ship to leave the shore below Vesuvius, and after a while Pliny is told to have collapsed. His companions attributed his collapse and death to toxic volcanic fumes, although they were themselves unaffected by these gasses.

Gaius Plinius apparently managed to publish the first ten volumes of Naturalis Historia in 77 AD and was at that time heavily engaged in revising and complementing the remaining volumes during the two last years before his death in 79 AD.

Gaius Plinius Secundus enjoyed high recognition in Europe long time after his death. As an example of this, Pliny's encyclopedic work Naturalis Historia was held in high esteem in the Middle Ages, and were to be printed in no less than 128 editions until 1669 AD.

With all due respect for Pliny the Elder, this amazing feat also to some degree indicates the lack of significant scientific progress in Europe for more than 1000 years after the death of Gaius Plinius in 79 AD.

References:

Rasmussen, E.A. 2010. *Vejret gennem 5000 år (Weather through 5000 years).* Meteorologiens historie. Aarhus Universitetsforlag, Århus, Denmark, 367 pp, ISBN 978 87 7934 300 9.

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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

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

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