Climate4you update January 2014

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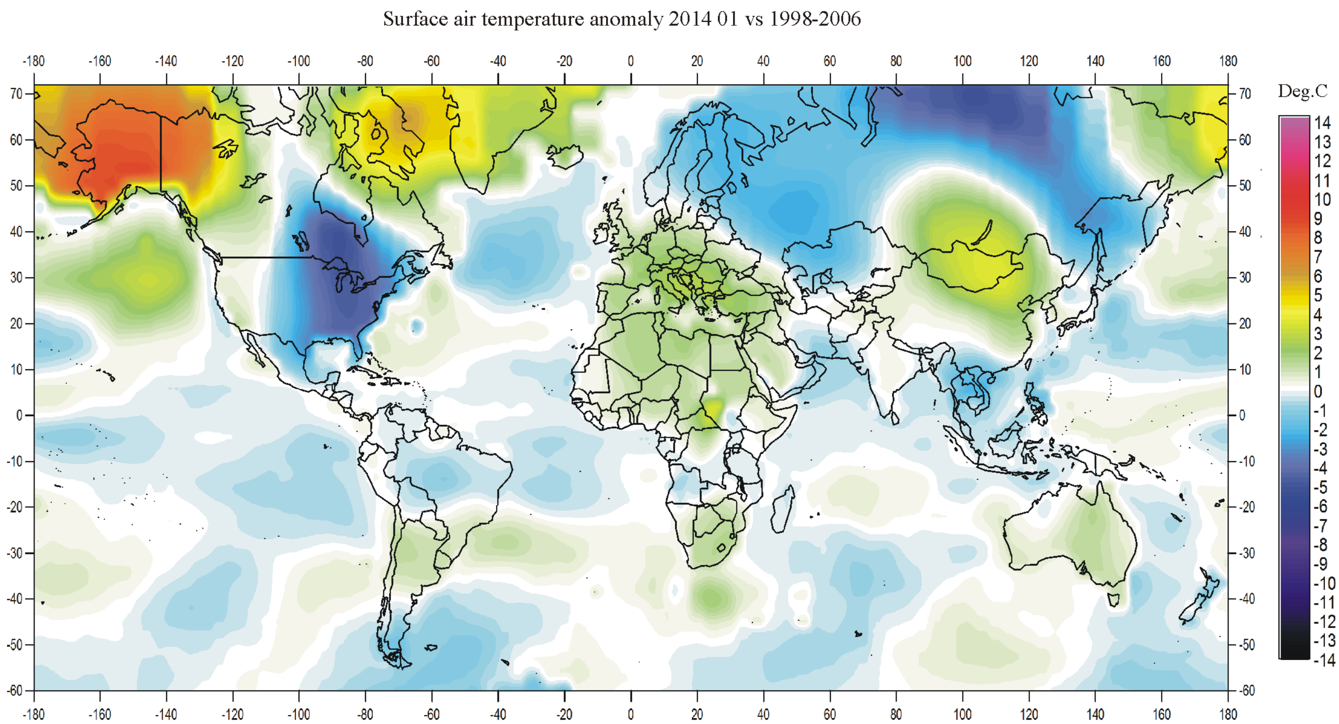
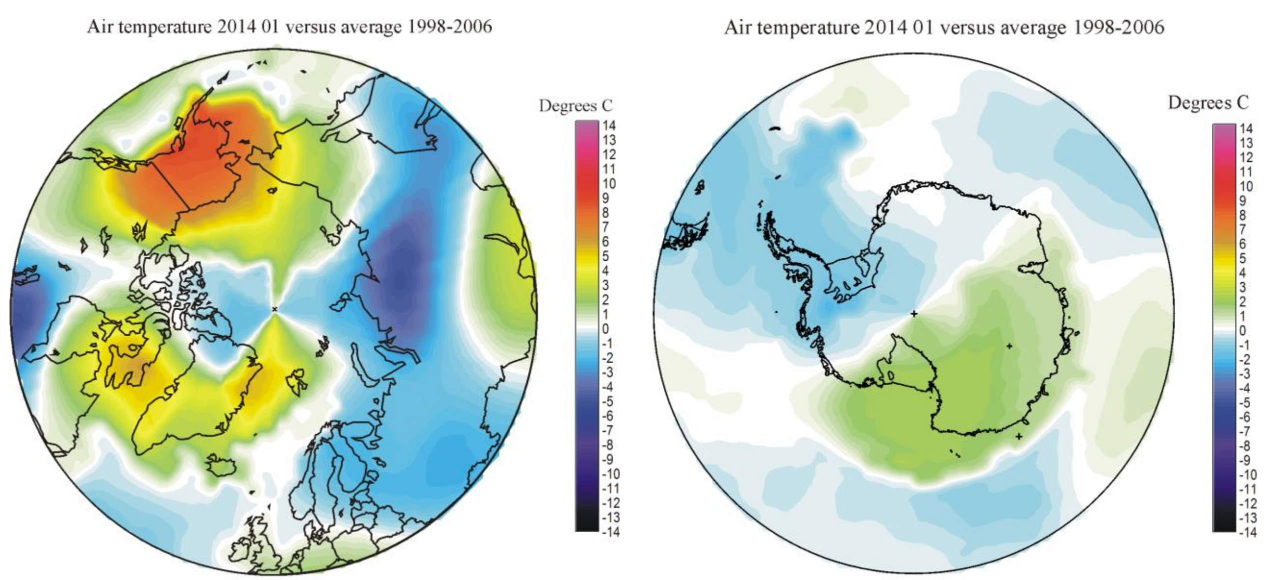
All diagrams in this newsletter as well as links to the original data are available on www.climate4you.com

January 2014 global surface air temperature overview





January 2014 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 2014 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 cold period 1945-1980. Most comparisons with such a low average value will therefore appear as warm, and it will be difficult to decide if modern surface air temperatures are increasing or decreasing. Comparing with a more recent period overcomes this problem.

In addition to the above consideration, the recent temperature development suggests that the time window 1998-2006 may roughly represent a global temperature peak (see, e.g., p. 4-6). However, it might be argued that the time interval 1999-2006 or 2000-2006 would better represent a possible temperature peak period. However, by starting in 1999 (or 2000) the cold La Niña period 1999-2000 would result in a unrealistic low reference temperature by excluding the previous warm El Niño in 1998. These two opposite phenomena must be considered together to obtain a representative reference average, and this why the year 1998 is included in the adopted reference period.

Finally, the GISS temperature data used for preparing the above diagrams show a pronounced temporal instability for data before 1998 (see p. 7). Any comparison with the WMO 'normal' period 1961-1990 is therefore influenced by monthly changing values for the so-called 'normal' period, which is therefore not suited as reference.

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.

January 2014 global surface air temperatures

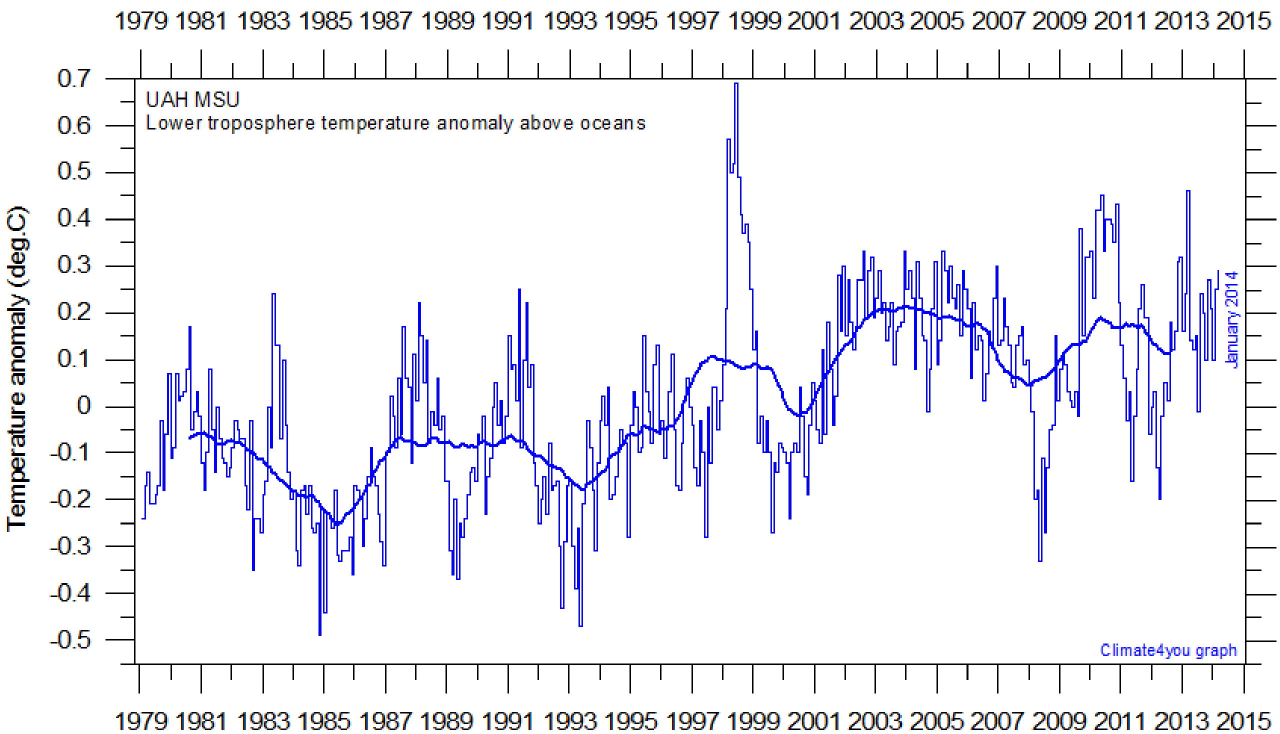
General: In general, global air temperatures were near the 1998-2006 average, but with a marked planetary North-South contrast.

The Northern Hemisphere was characterised by pronounced regional contrasts. Alaska and adjoining parts of NW Canada had strongly above average temperatures. Also NE Canada and the Greenland region had above average temperatures. In contrast, NE Europe and most of Russia and Siberia has below average temperatures. Also eastern USA and southern Canada were characterised by below average temperatures. The North Atlantic generally had temperatures near or below average. The Arctic has a mixture of below and above average temperatures. In the areas near the North Pole the temperature pattern is influenced by the interpolation procedure followed by GISS, and not too much attention should be paid to this.

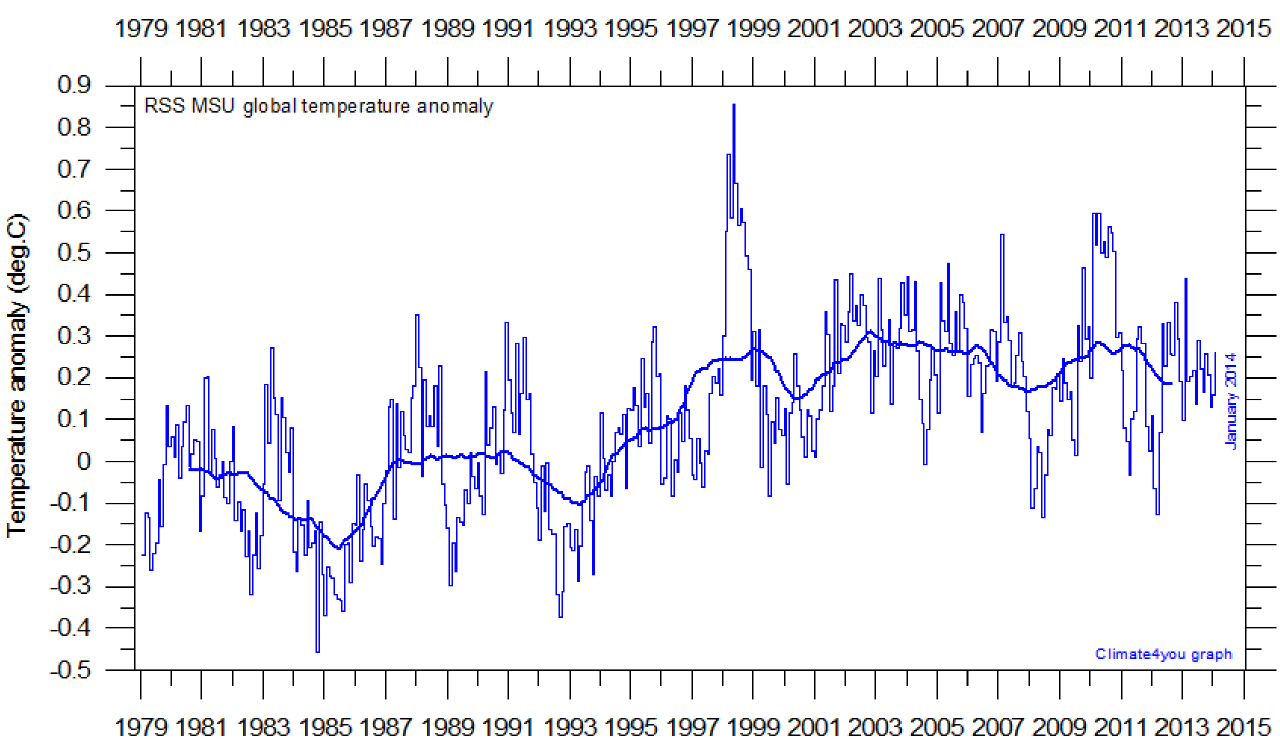
Near Equator temperatures conditions were generally near or below the 1998-2006 average.

The Southern Hemisphere temperatures was mainly below or near average 1998-2006 conditions. The only major exception from this was the northern part of Argentina, south Africa and eastern Australia, which had above average temperatures. The Antarctic continent was divided between above average temperatures in the east and below average temperatures in the west.

[Lower troposphere temperature from satellites, updated to January 2014]

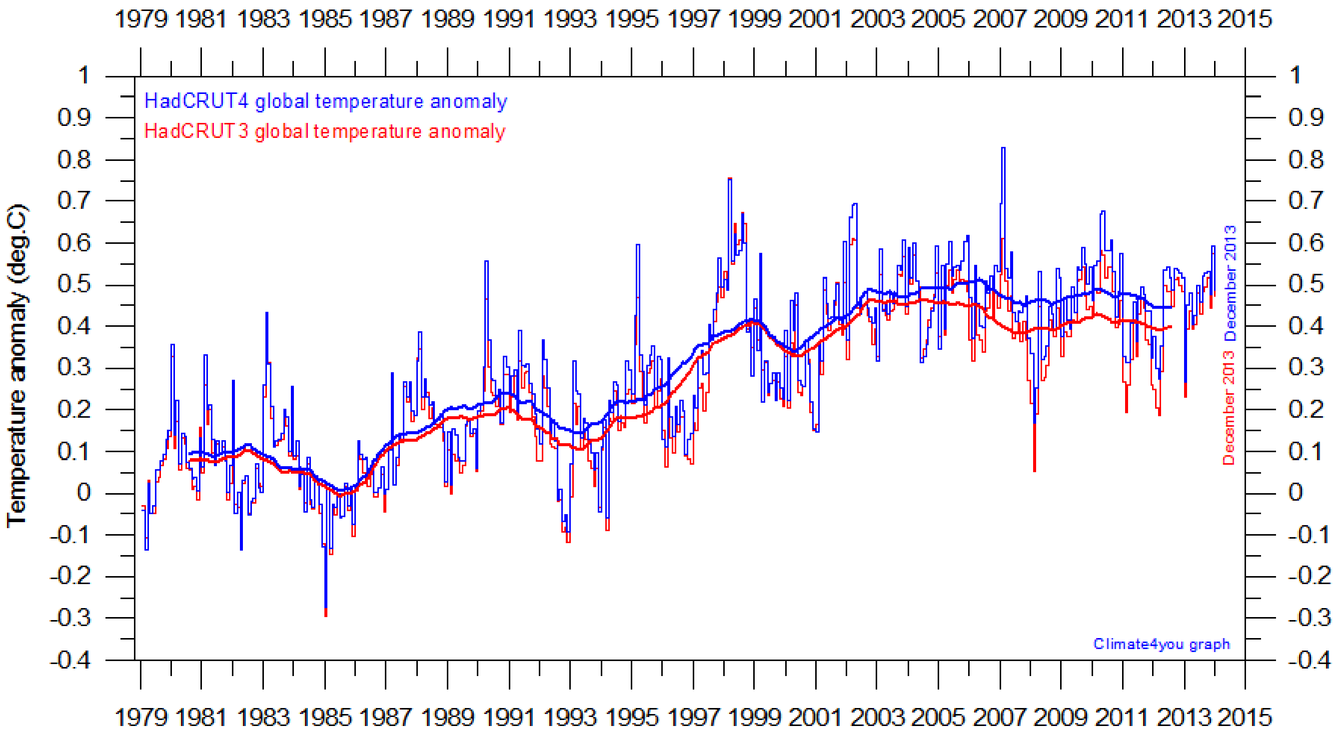


Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama] at Huntsville, USA. The thick line is the simple running 37 month average.

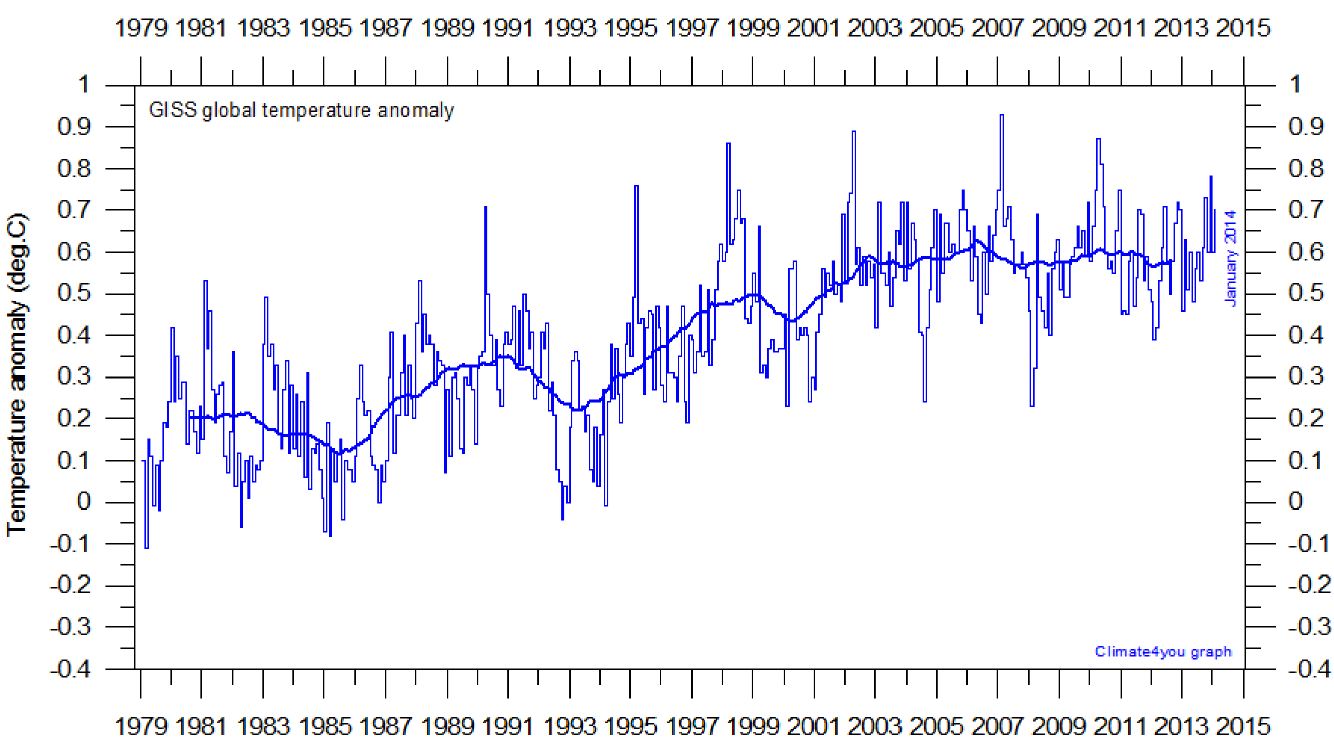


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems] (RSS), USA. The thick line is the simple running 37 month average.

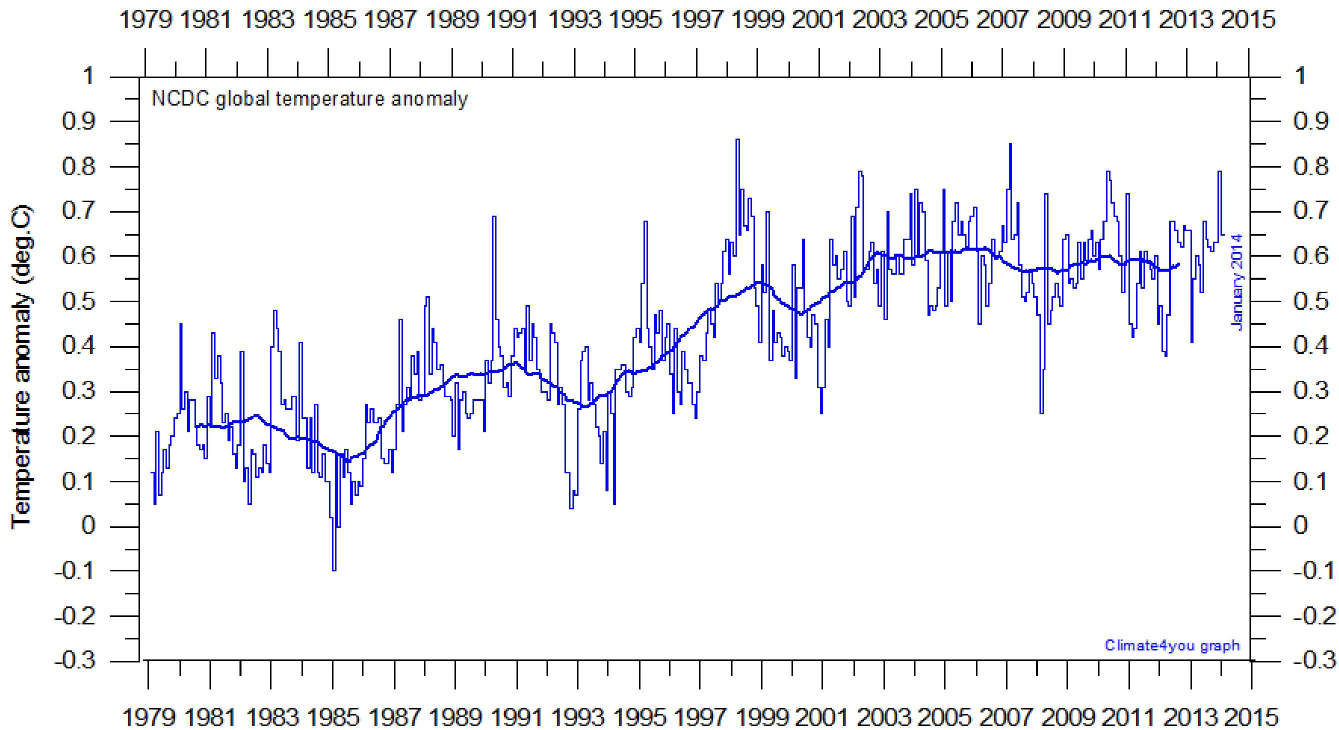
Global surface air temperature, updated to January 2014



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) ([CRU]), UK. The thick line is the simple running 37 month average. Version HadCRUT4 (blue) is now replacing HadCRUT3 (red). Please note that this diagram is not yet updated beyond December 2013.



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*).

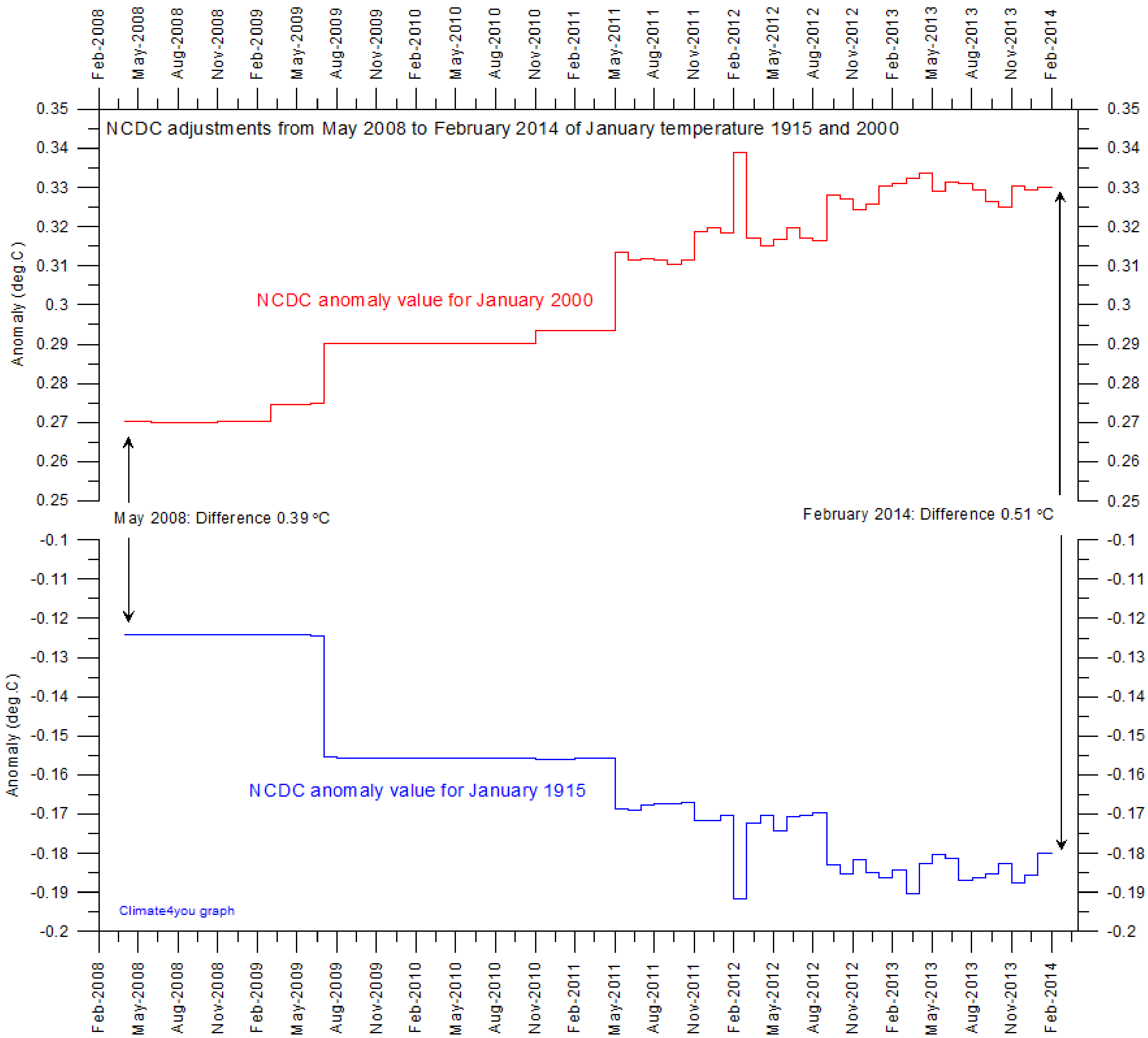


Diagram showing the adjustment made since May 2008 by the [National Climatic Data Center](#) (NCDC) in the anomaly values for the two months January 1915 and January 2000.

<u>September 2013:</u> By administrative means the July 2013 temperature increase from January 1915 to January 2000 has increased from 0.39 to 0.51 ^{o}C, representing an about 31% increase of the original temperature increase reported in May 2008.

Global air temperature linear trends

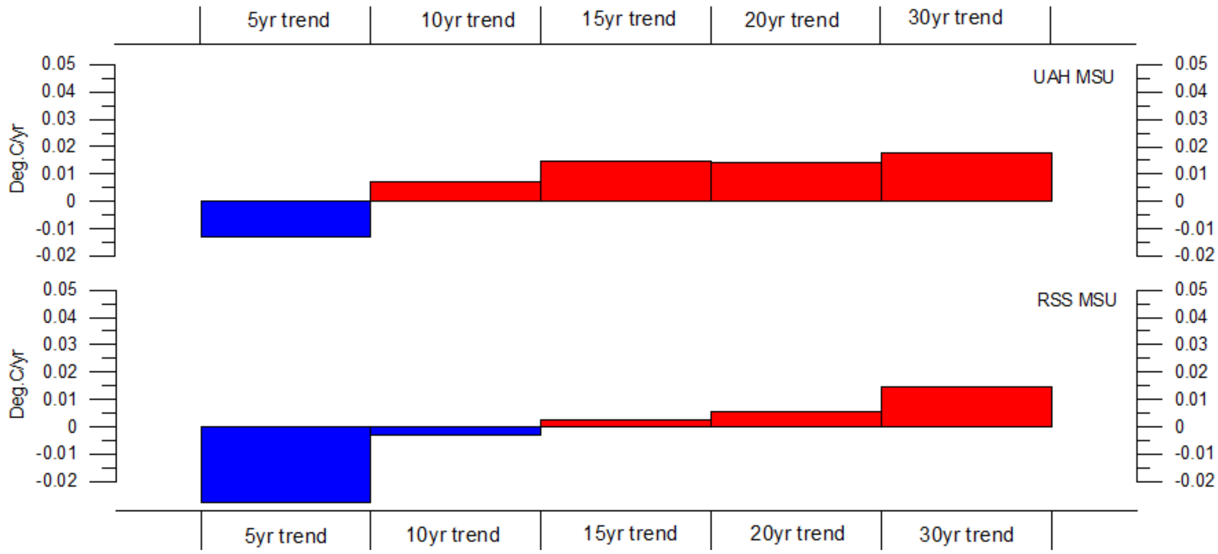


Diagram showing the latest 5, 10, 20 and 30 yr linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for two satellite-based temperature estimates (UAH MSU and RSS MSU). Last month included in analysis: December 2013.

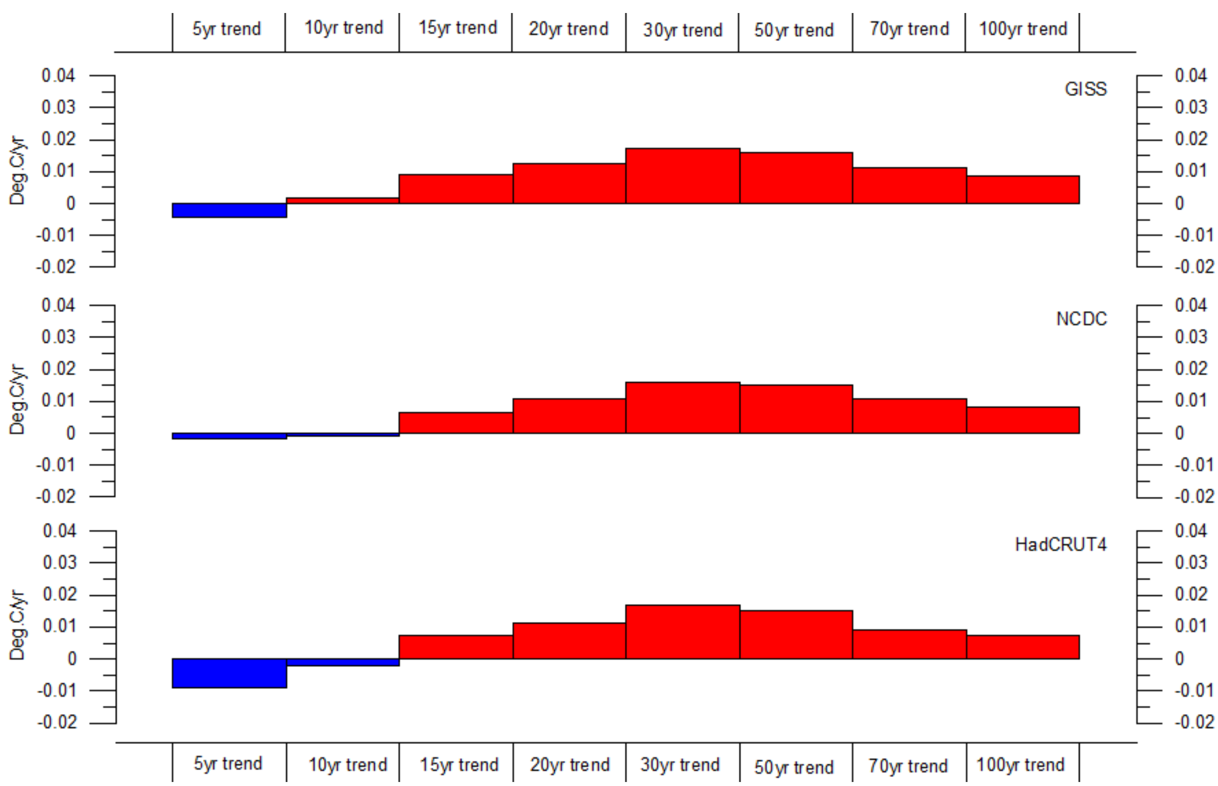
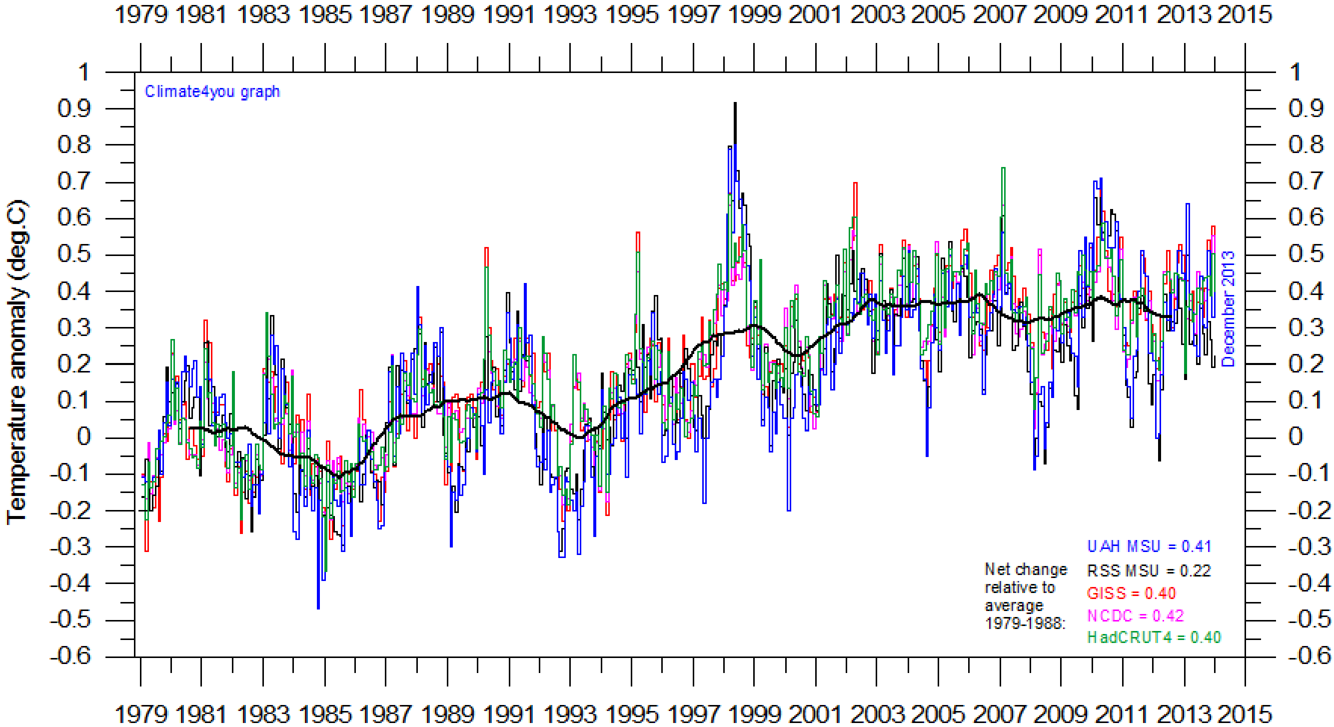


Diagram showing the latest 5, 10, 20, 30, 50, 70 and 100 year linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for three surface-based temperature estimates (GISS, NCDC and HadCRUT4). Last month included in all analyses: December 2013.

All in one, updated to December 2013

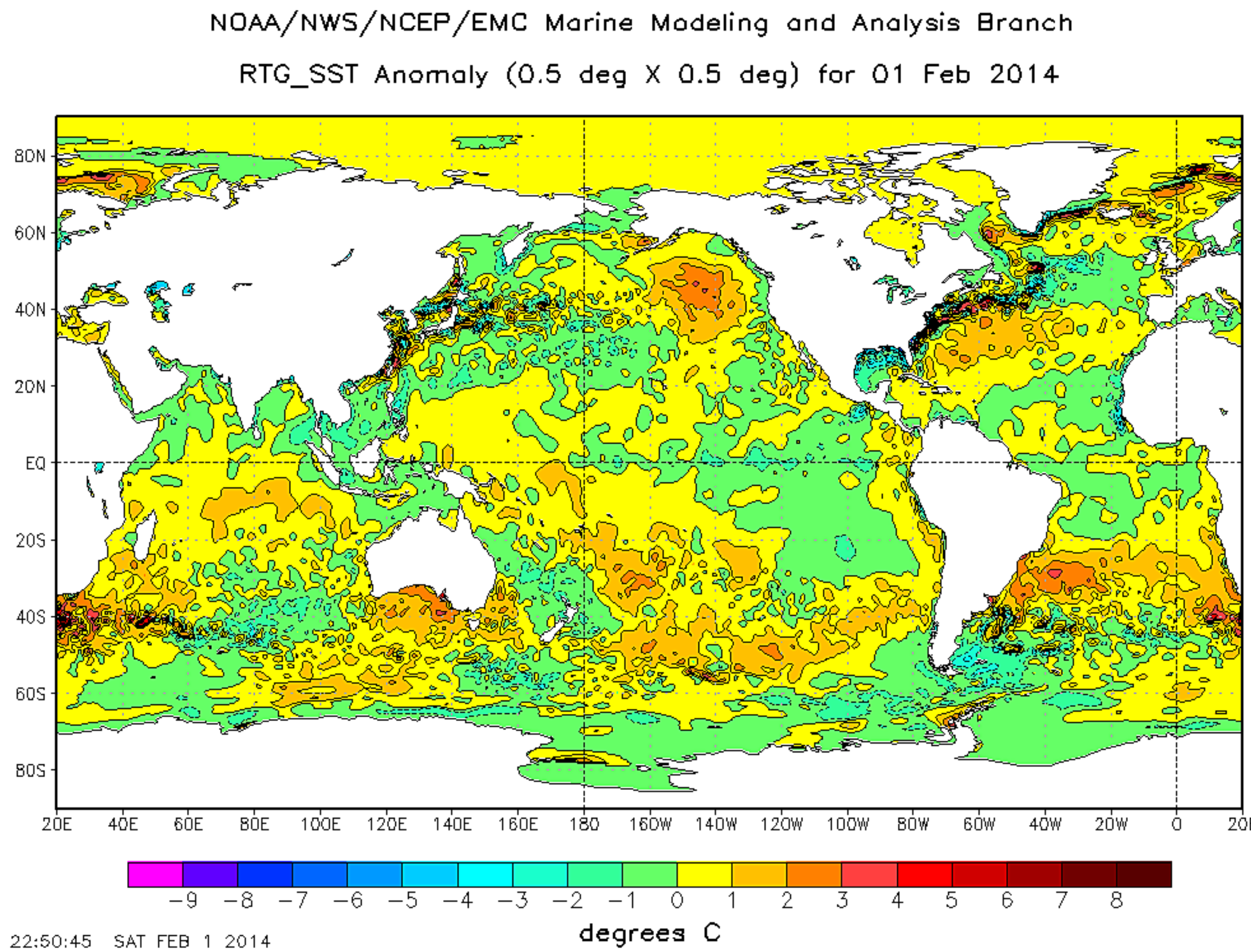


Superimposed plot of all five global monthly temperature estimates. As the base period differs for the individual temperature estimates, they have all been normalised by comparing with the average value of the initial 120 months (10 years) from January 1979 to December 1988. The heavy black line represents 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 early January 2014



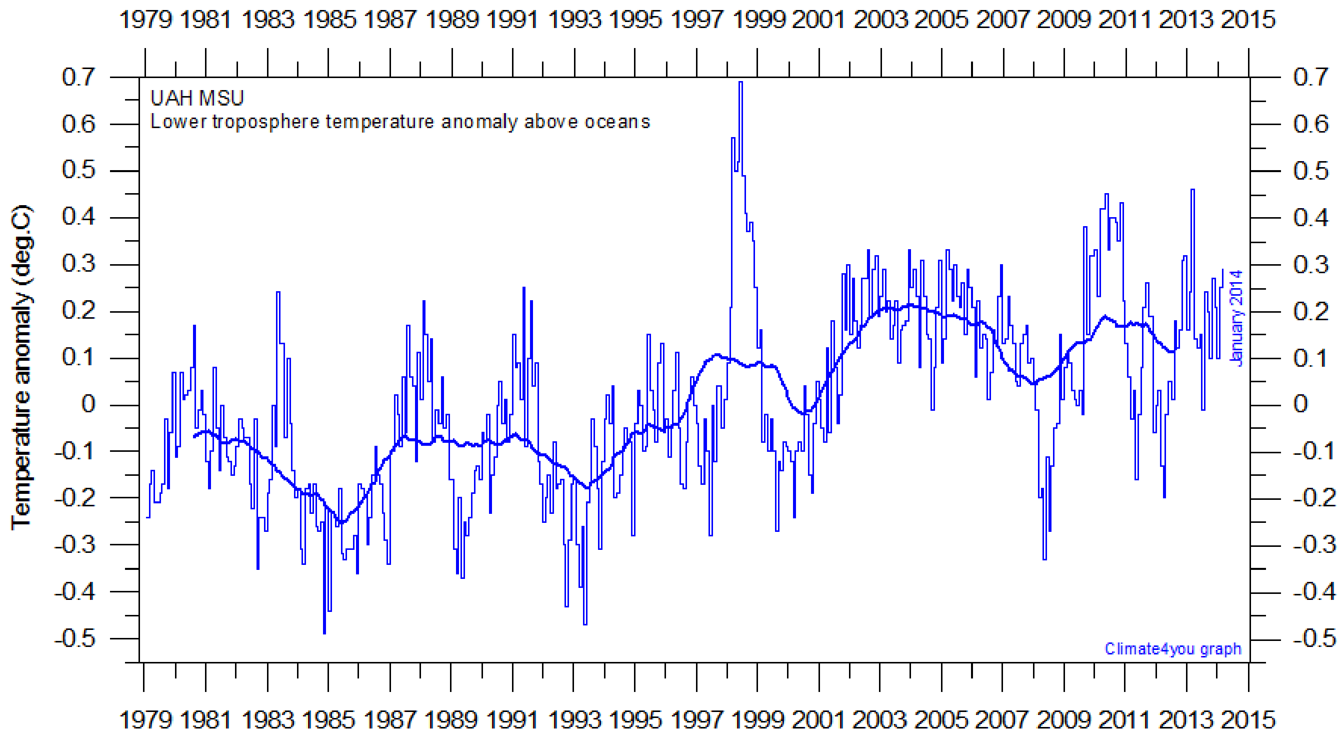
Sea surface temperature anomaly on 1 February 2014. Map source: National Centers for Environmental Prediction (NOAA).

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

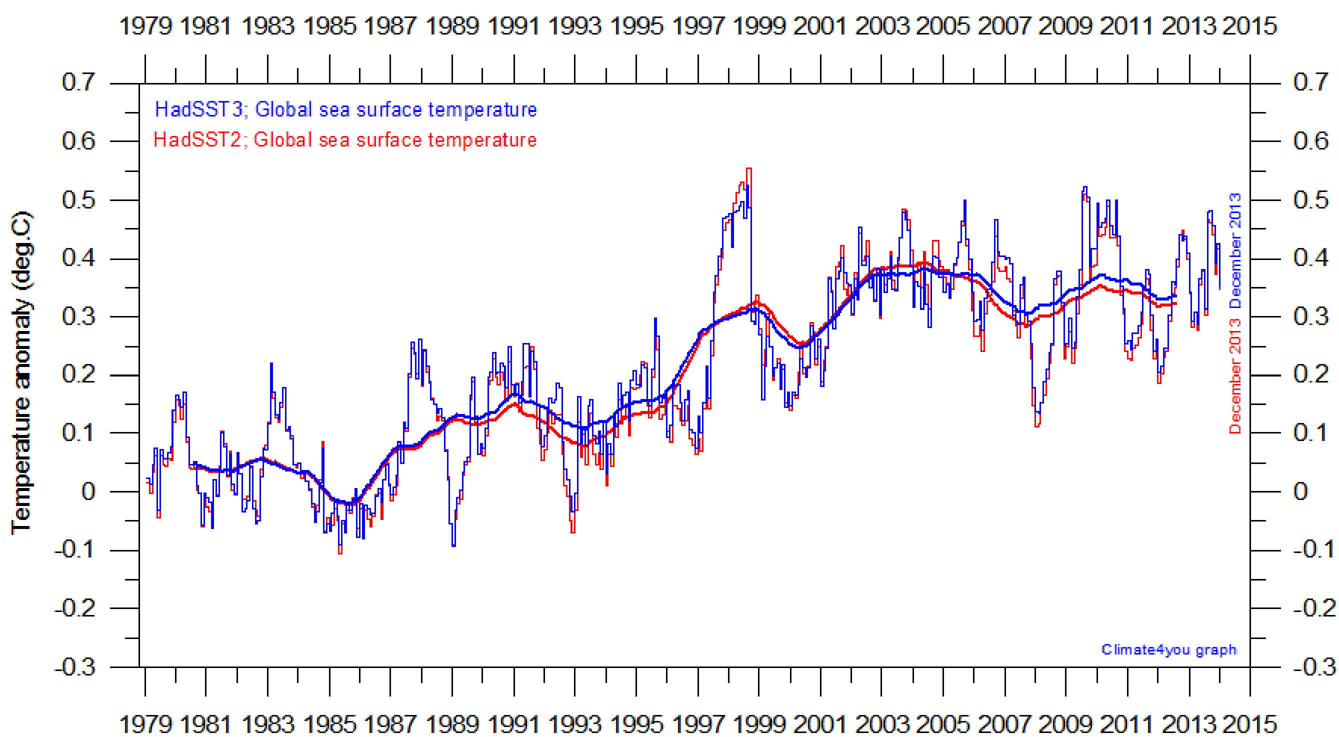
Relatively cold water is slowly spreading across the Pacific Ocean near the Equator, and may influence global air temperatures in the months to come.

The significance of any such short-term cooling or warming reflected 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.

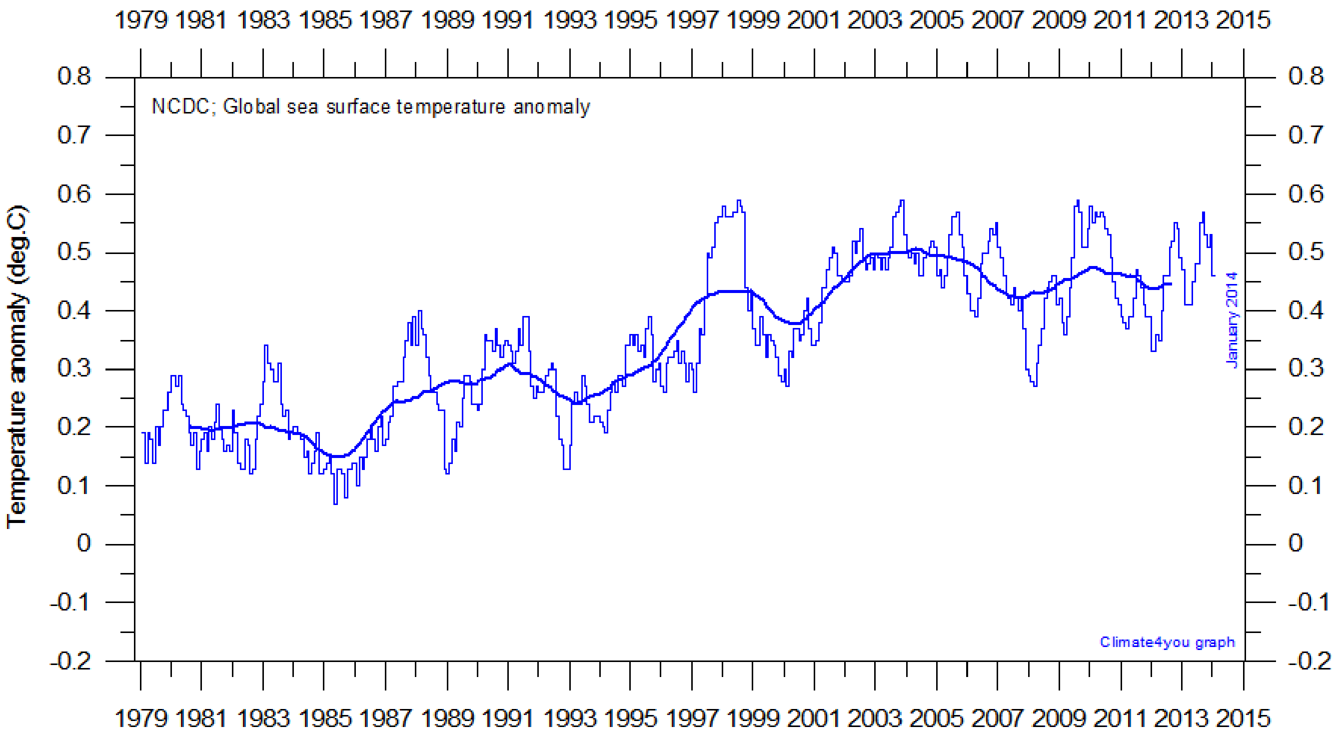
However, this does not reflect similar changes in the total heat content of the atmosphere-ocean system. In fact, global net changes can be small and such heat exchanges may mainly reflect redistribution of energy between ocean and atmosphere. What matters is the overall temperature development when 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.

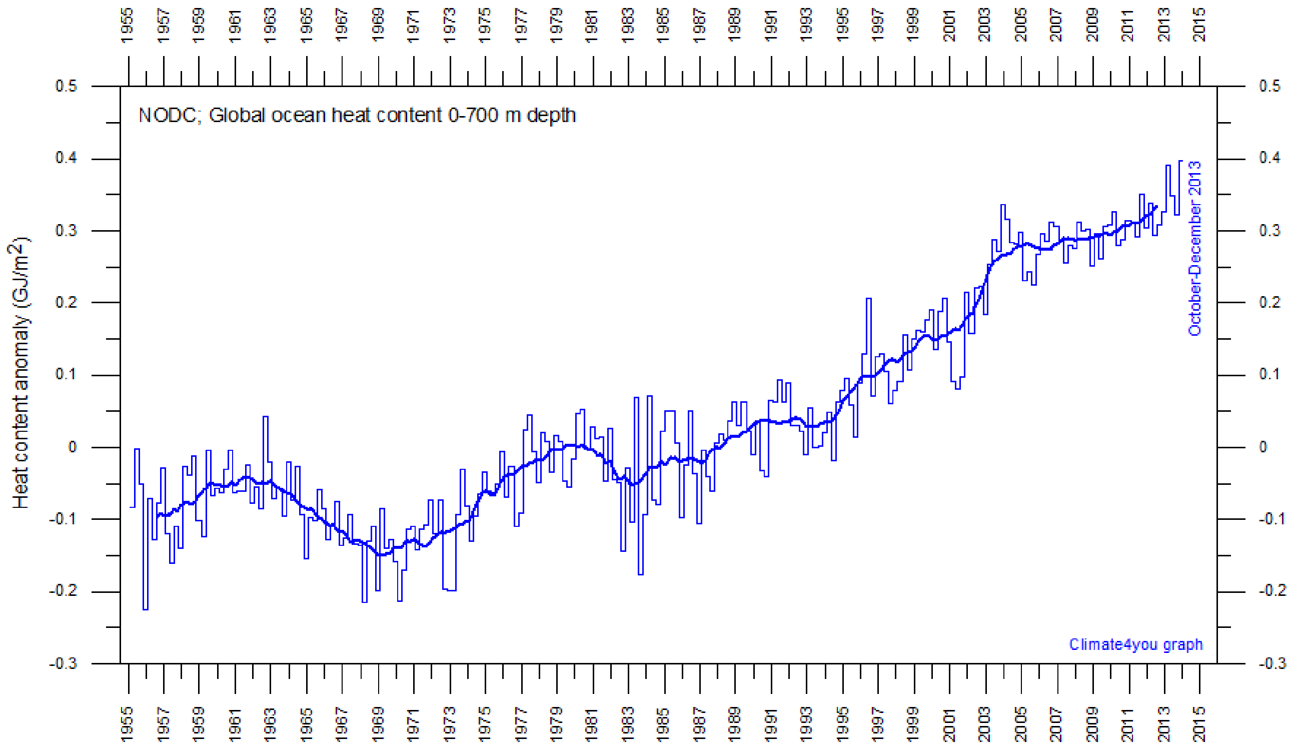


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit]() ([CRU]()), UK. Base period: 1961-1990. The thick line is the simple running 37 month average. Please note that this diagram is not yet updated beyond December 2013.

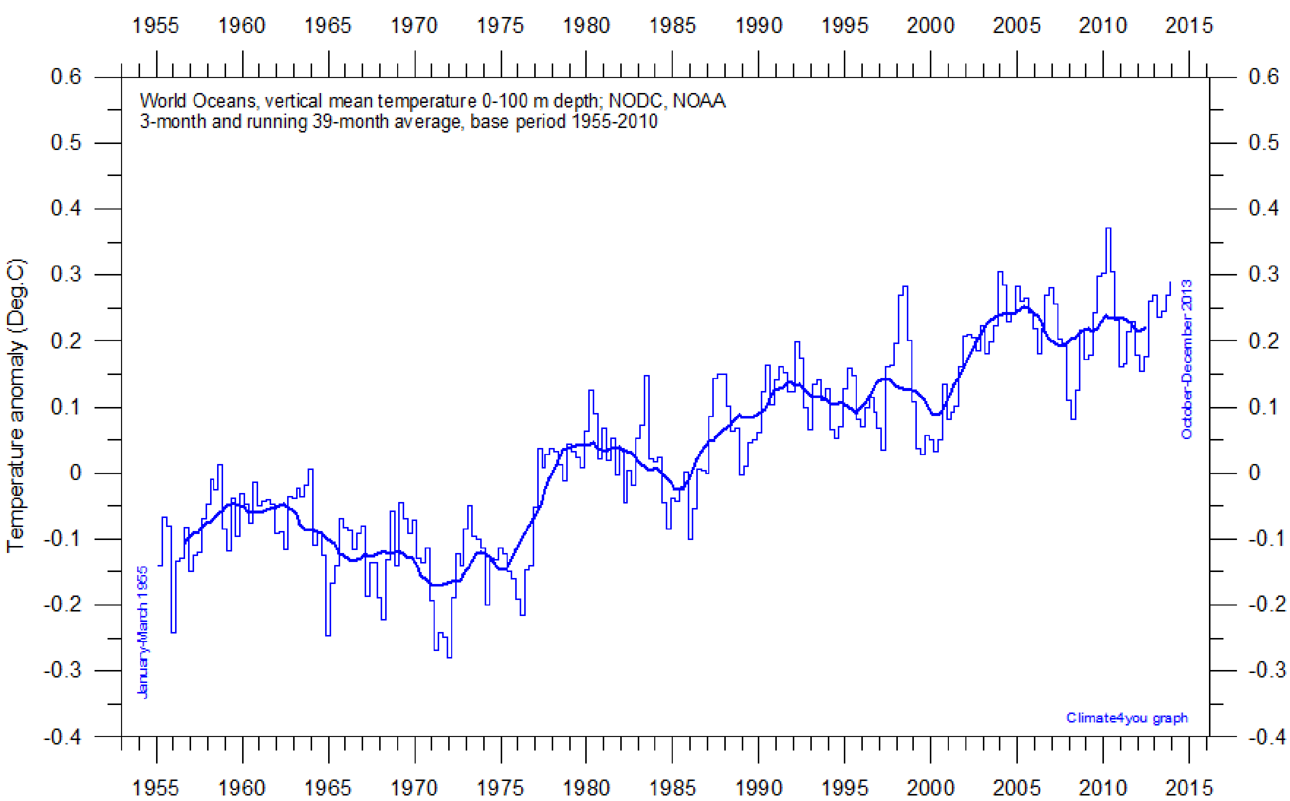


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

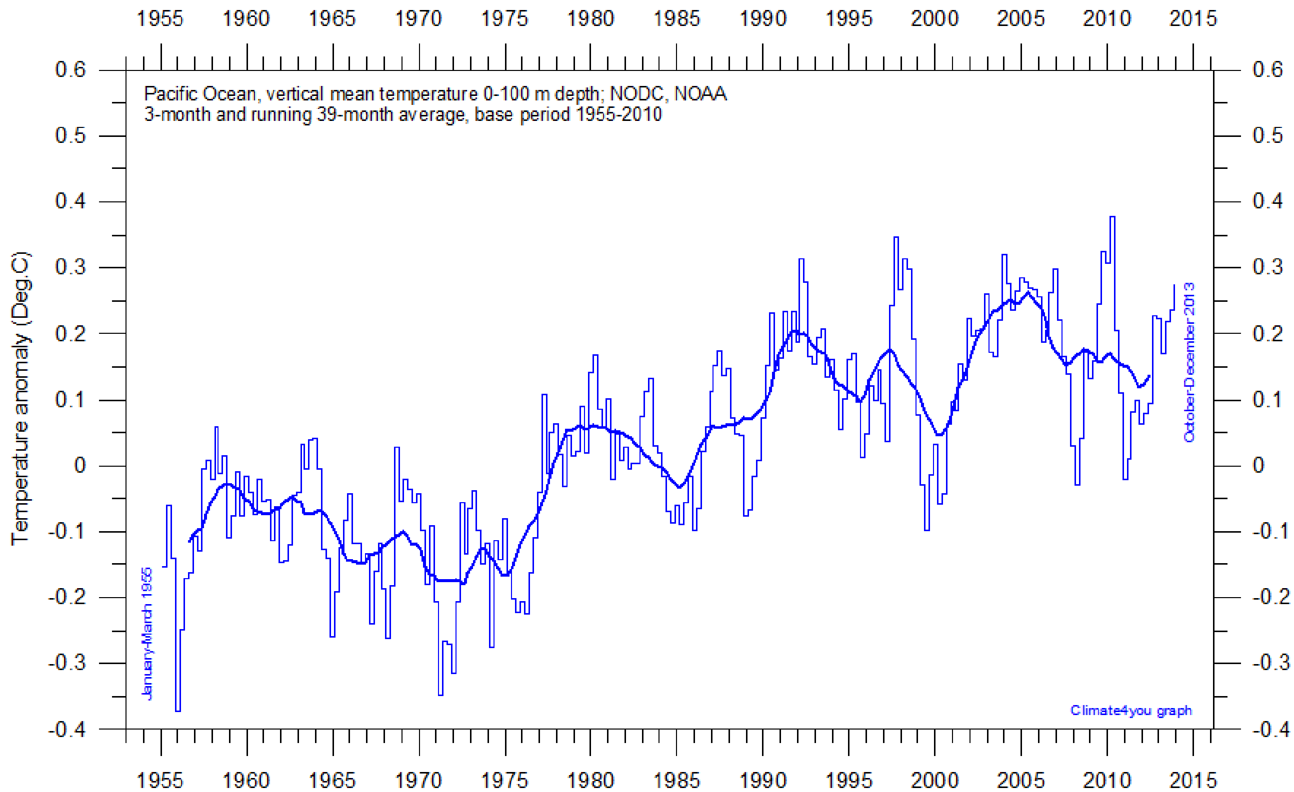
Ocean heat content uppermost 100-700 m, updated to December 2013



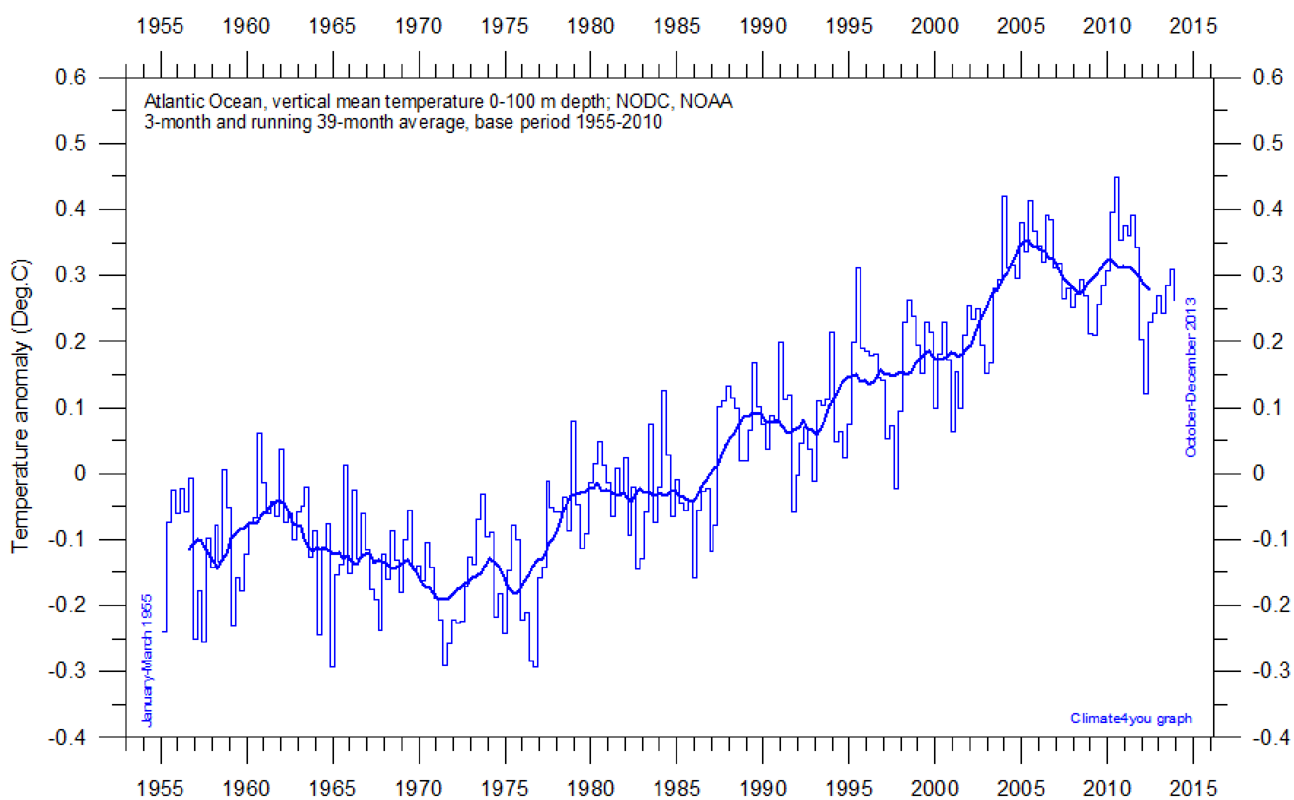
Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).



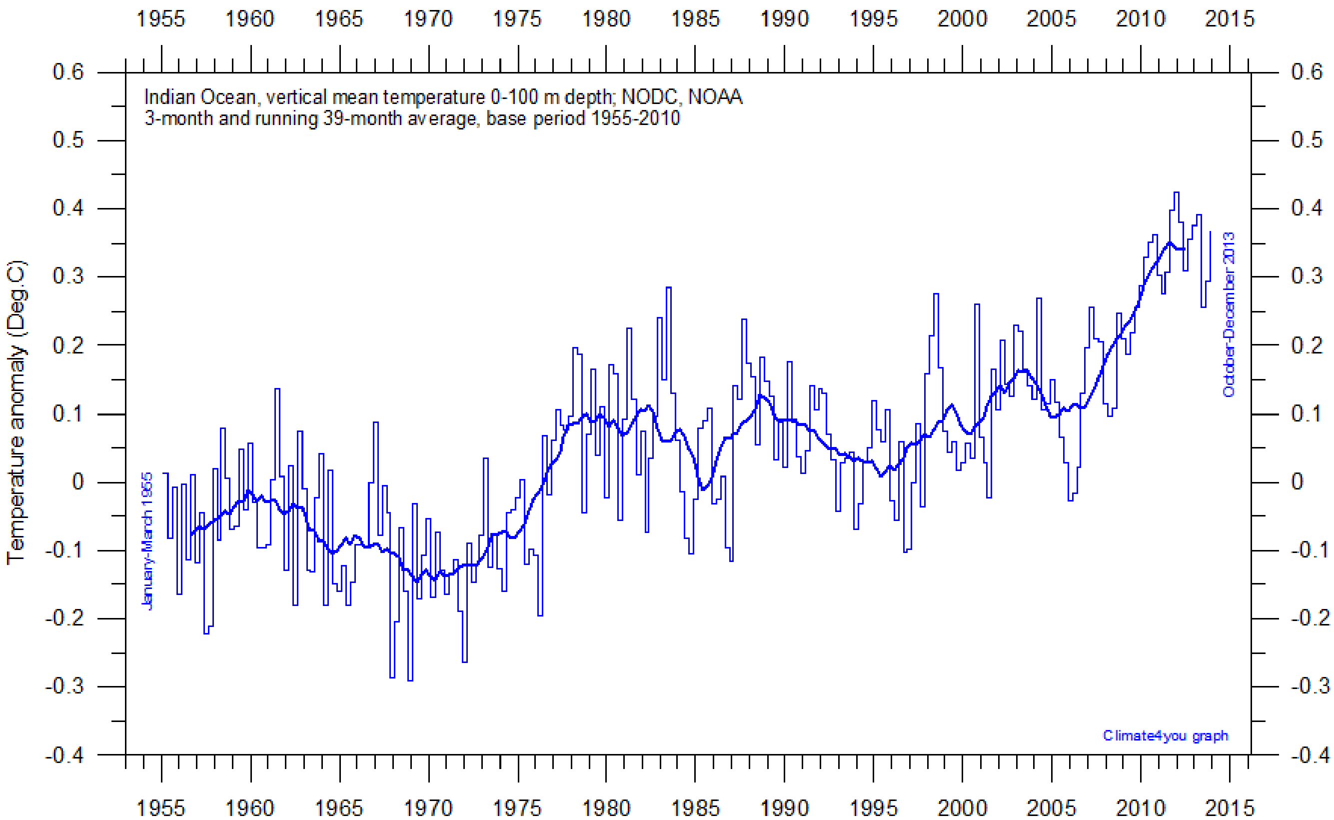
World Oceans vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center](#) (NODC). Base period 1955-2010. Last period shown: October-December 2013.



Pacific Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center]() (NODC). Base period 1955-2010. Last period shown: October-December 2013.

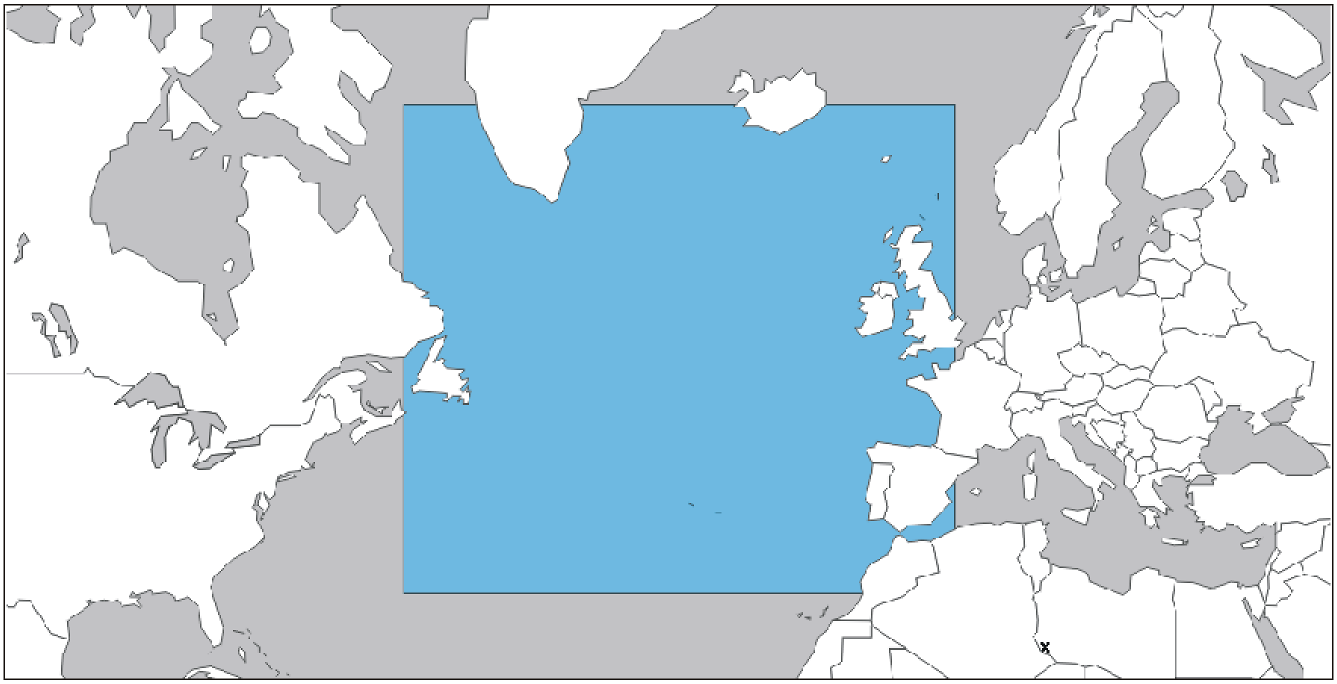


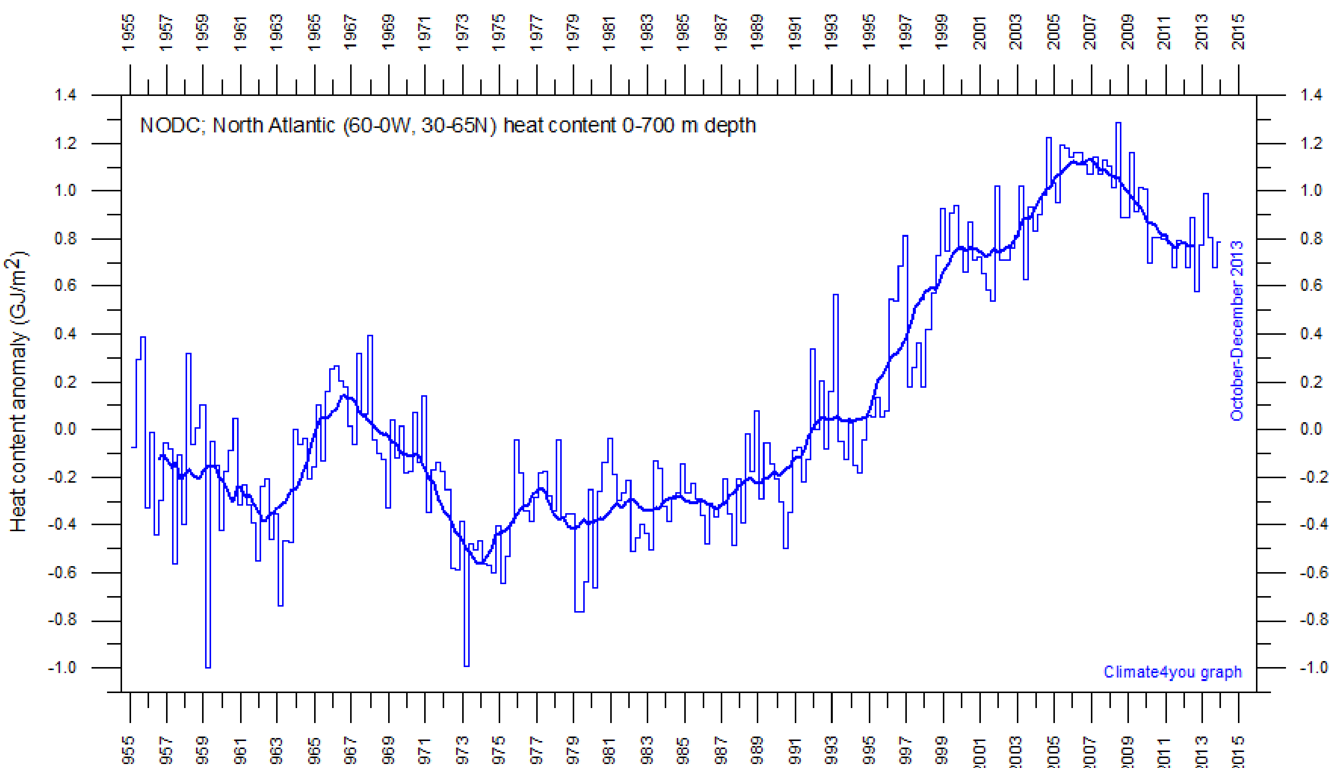
Pacific Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center]() (NODC). Base period 1955-2010. Last period shown: October-December 2013.



Indian Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: NOAA National Oceanographic Data Center (NODC). Base period 1955-2010. Last period shown: October-December 2013.

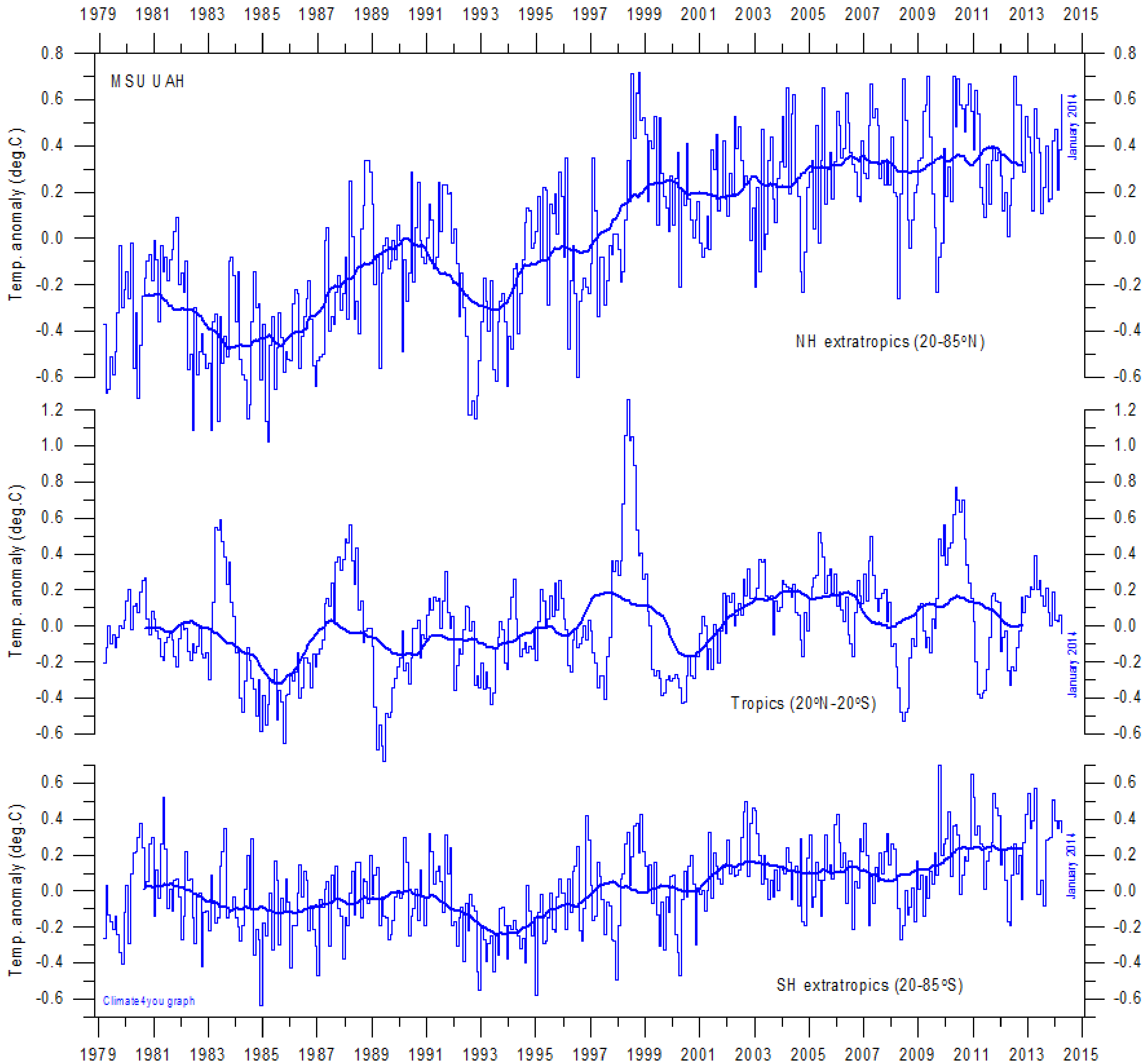
North Atlantic heat content uppermost 700 m, updated to December 2012





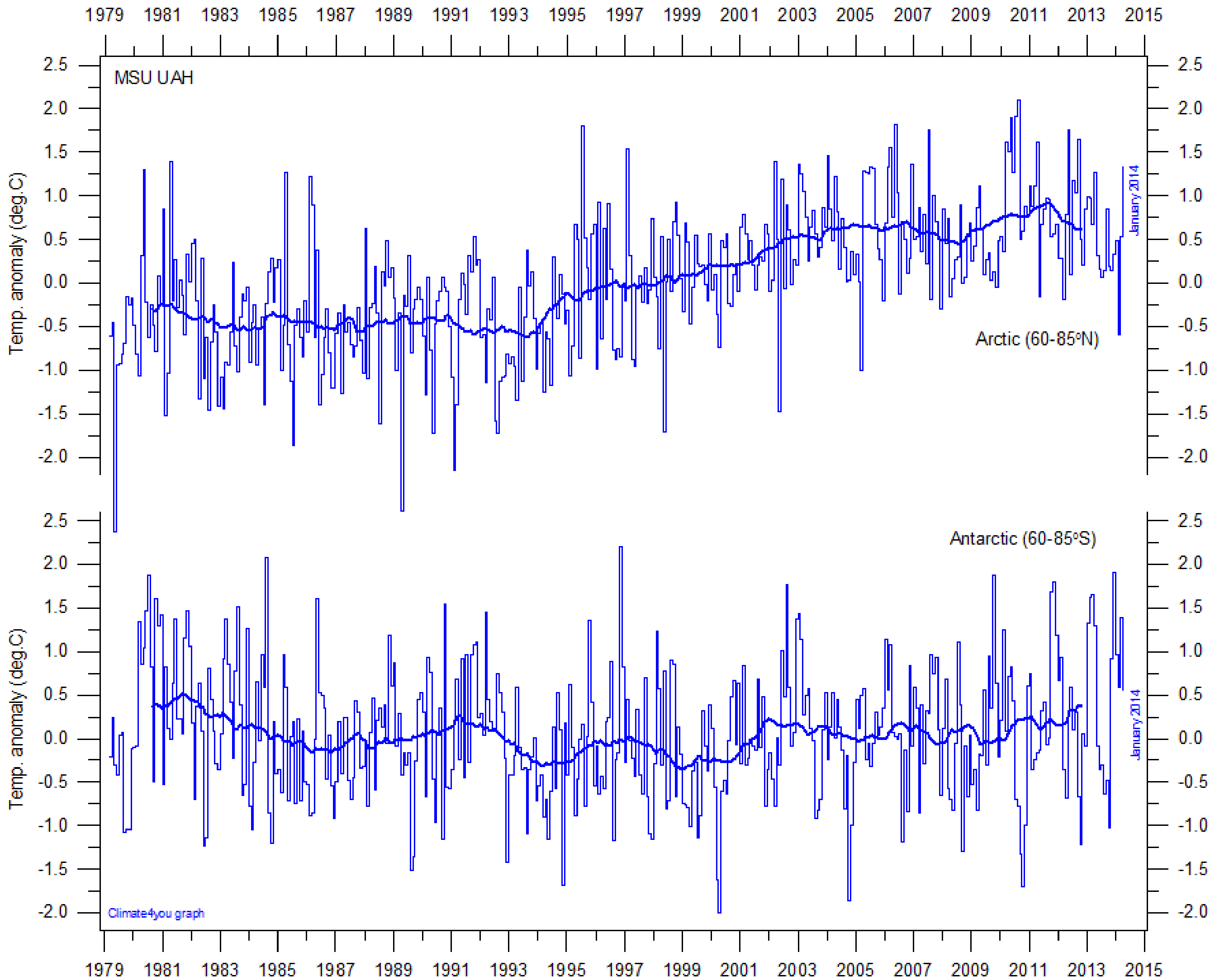
Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the North Atlantic (60-0W, 30-65N; see map above) *ocean since January 1955. The thin line indicates monthly values, and the thick line represents the simple running 37 month (c. 3 year) average. Data source: [National Oceanographic Data Center](#) (NODC).*

Zonal lower troposphere temperatures from satellites, updated to January 2014



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 January 2014



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 December 2013

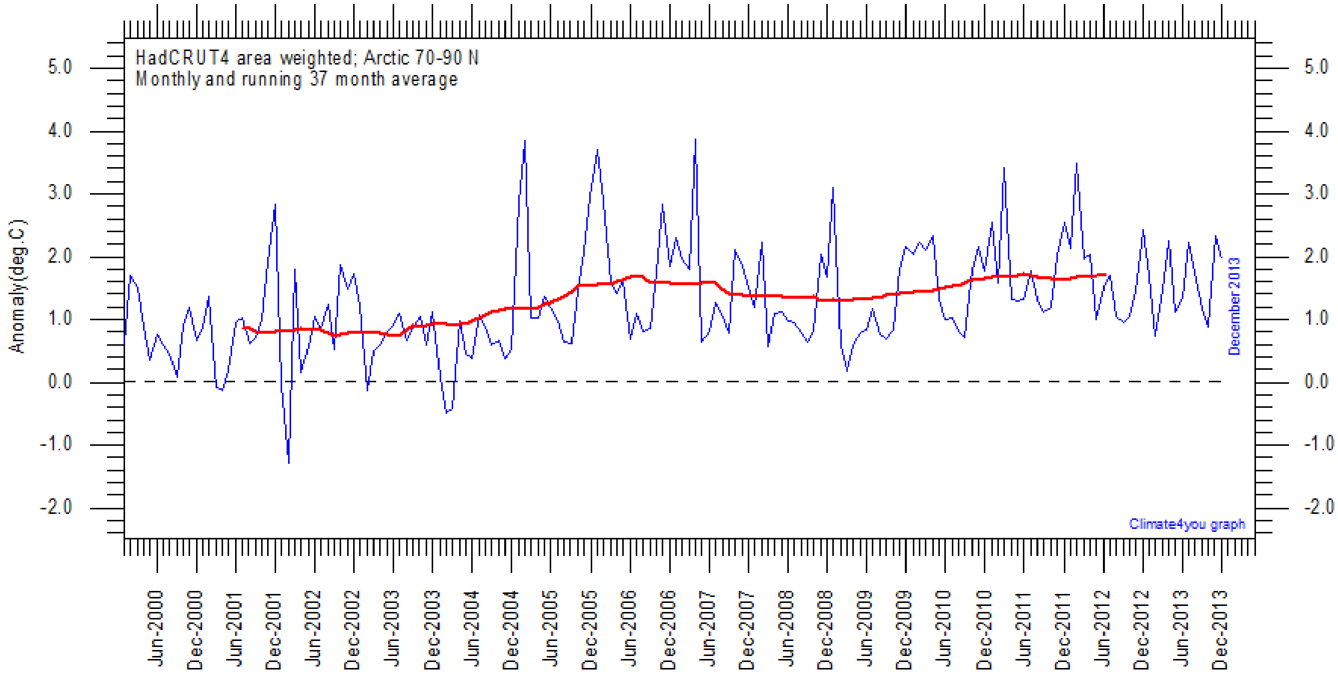


Diagram showing area weighted Arctic (70-90°N) monthly surface air temperature anomalies (HadCRUT4) since January 2000, in relation to the WMO normal period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 37 month (c.3 yr) average.

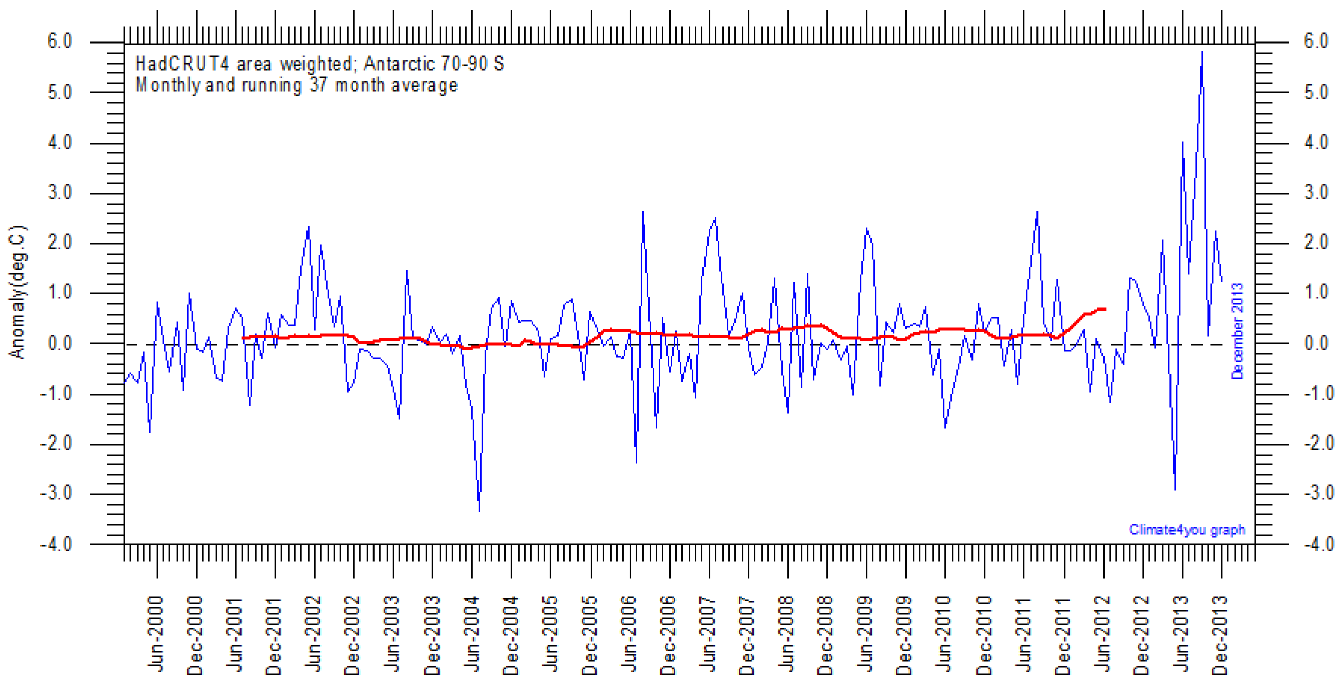


Diagram showing area weighted Antarctic (70-90°N) monthly surface air temperature anomalies (HadCRUT4) since January 2000, in relation to the WMO normal period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 37 month (c.3 yr) average.

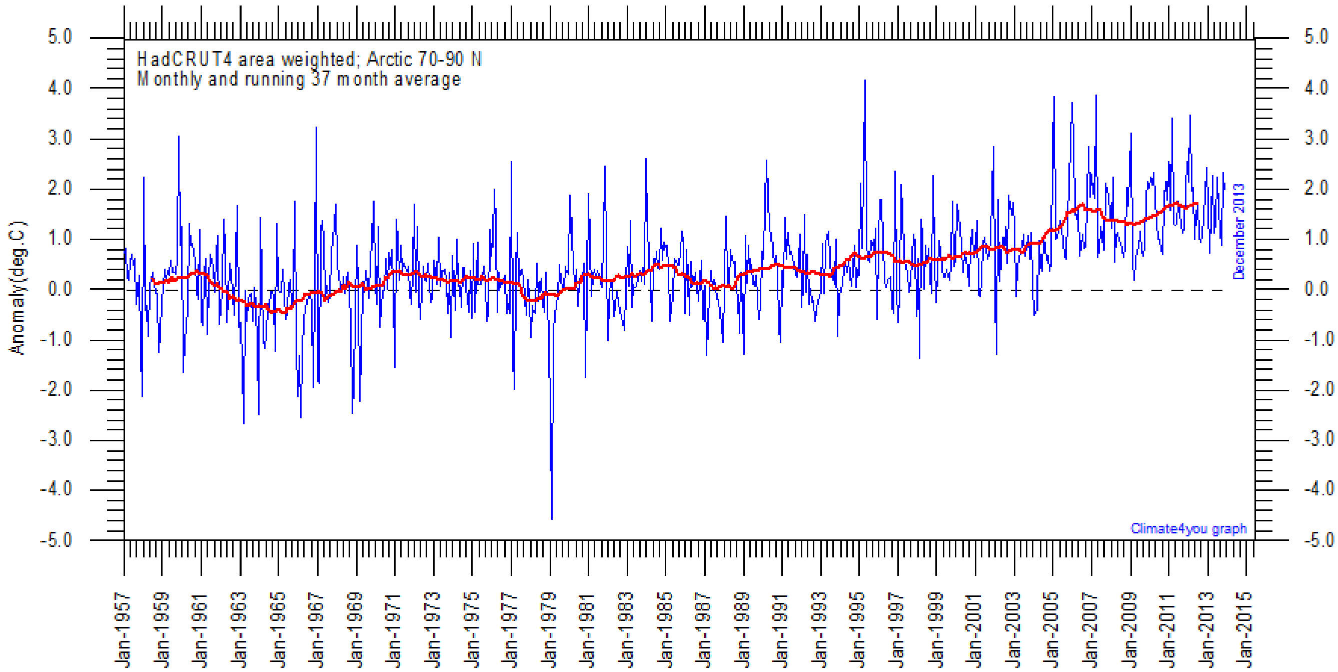


Diagram showing area weighted Arctic (70-90°N) monthly surface air temperature anomalies ([HadCRUT4]) since January 1957, in relation to the WMO [normal period] 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 37 month (c.3 yr) average.

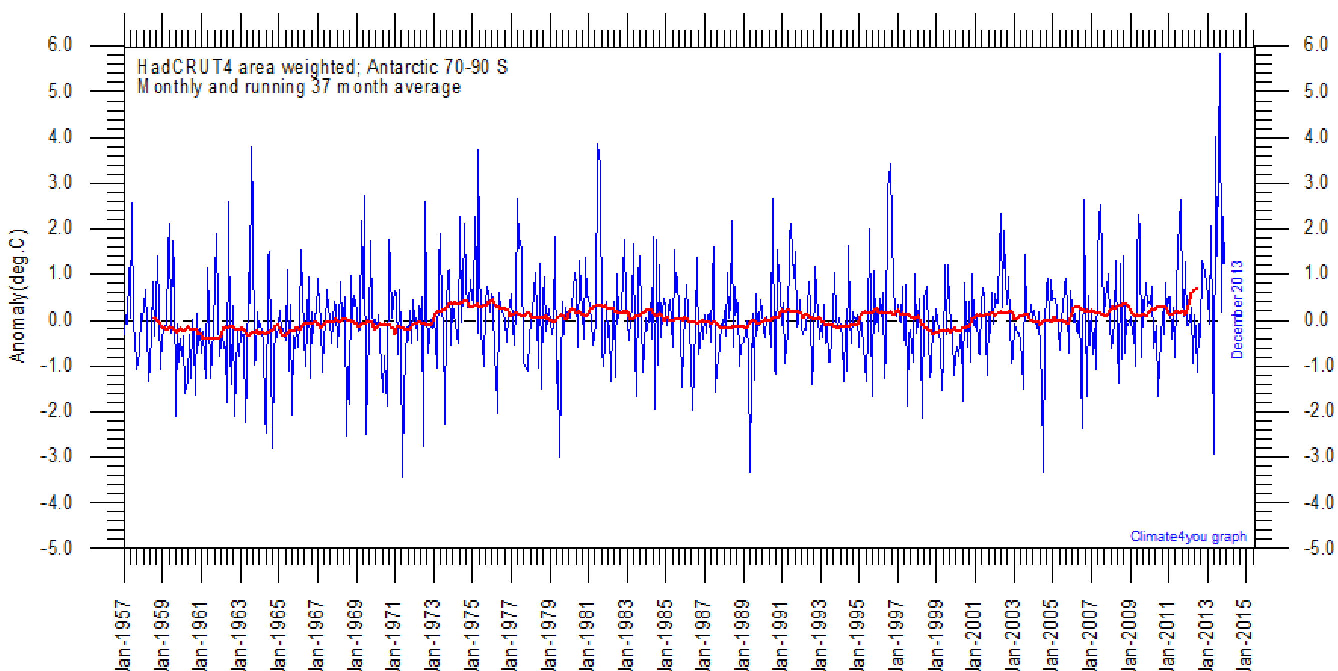


Diagram showing area weighted Antarctic (70-90°N) monthly surface air temperature anomalies ([HadCRUT4]) since January 1957, in relation to the WMO [normal period] 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 37 month (c.3 yr) average.

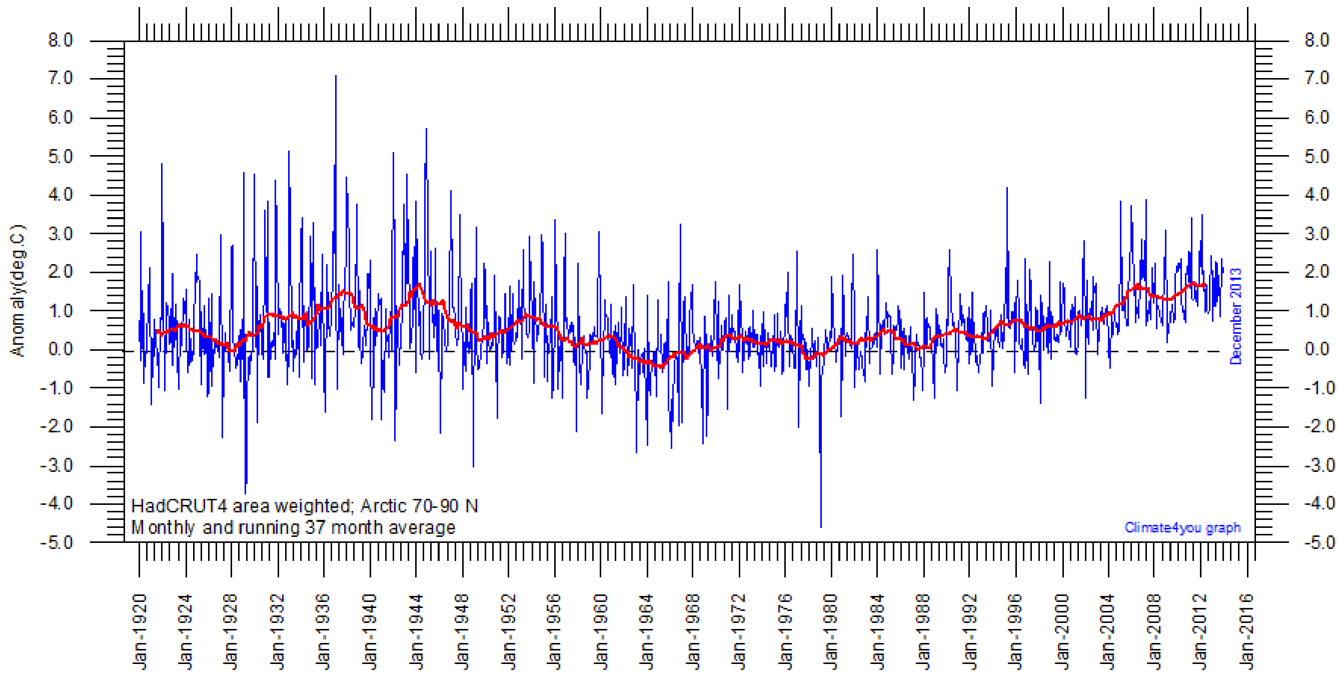


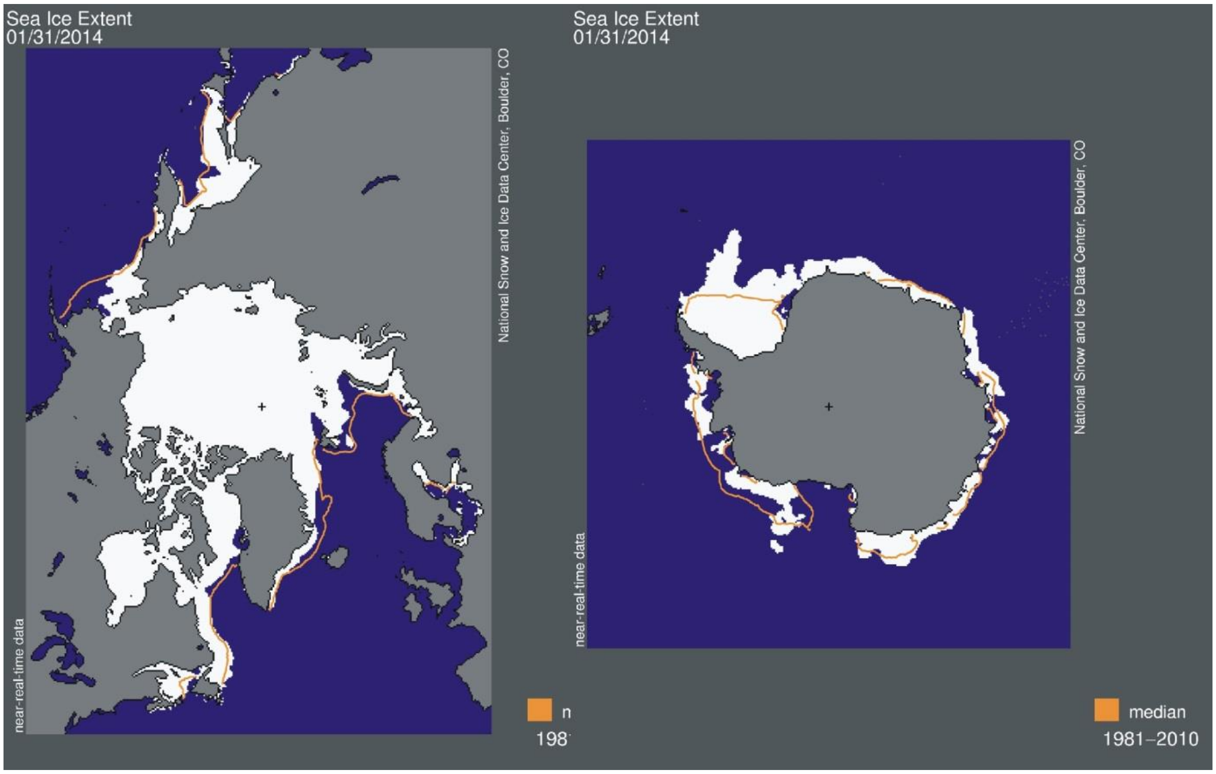
Diagram showing area weighted Arctic (70-90°N) monthly surface air temperature anomalies (HadCRUT4) since January 1920, in relation to the WMO normal period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 37 month (c.3 yr) average. Because of the relatively small number of Arctic stations before 1930, month-to-month variations in the early part of the temperature record are larger than later. 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. The period since 2000 is warm, about as warm as the period 1930-1940.

As the HadCRUT4 data series has improved high latitude coverage data coverage (compared to the HadCRUT3 series) the individual 5°x5° grid cells has been weighted according to their surface area. This is in contrast to Gillet et al. 2008 which calculated a simple average, with no consideration to the surface area represented by the individual 5°x5° grid cells.

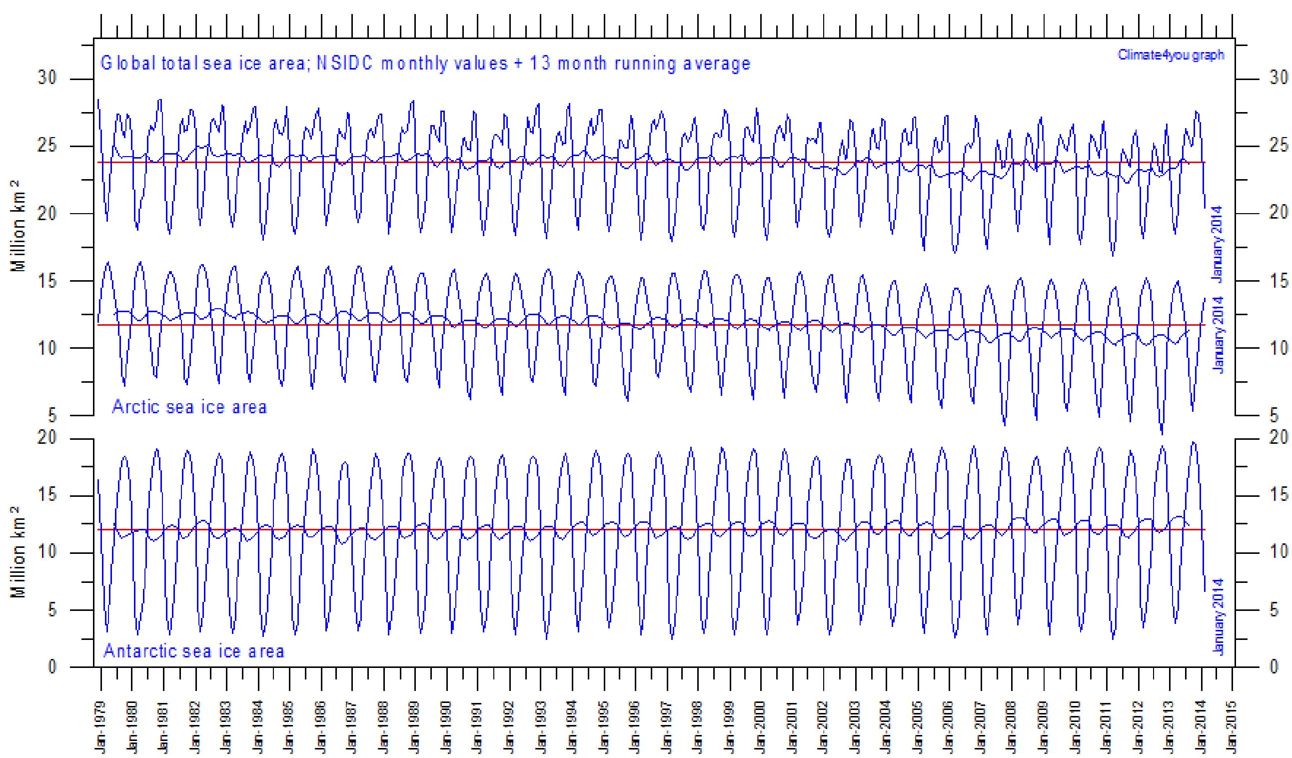
Literature:

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

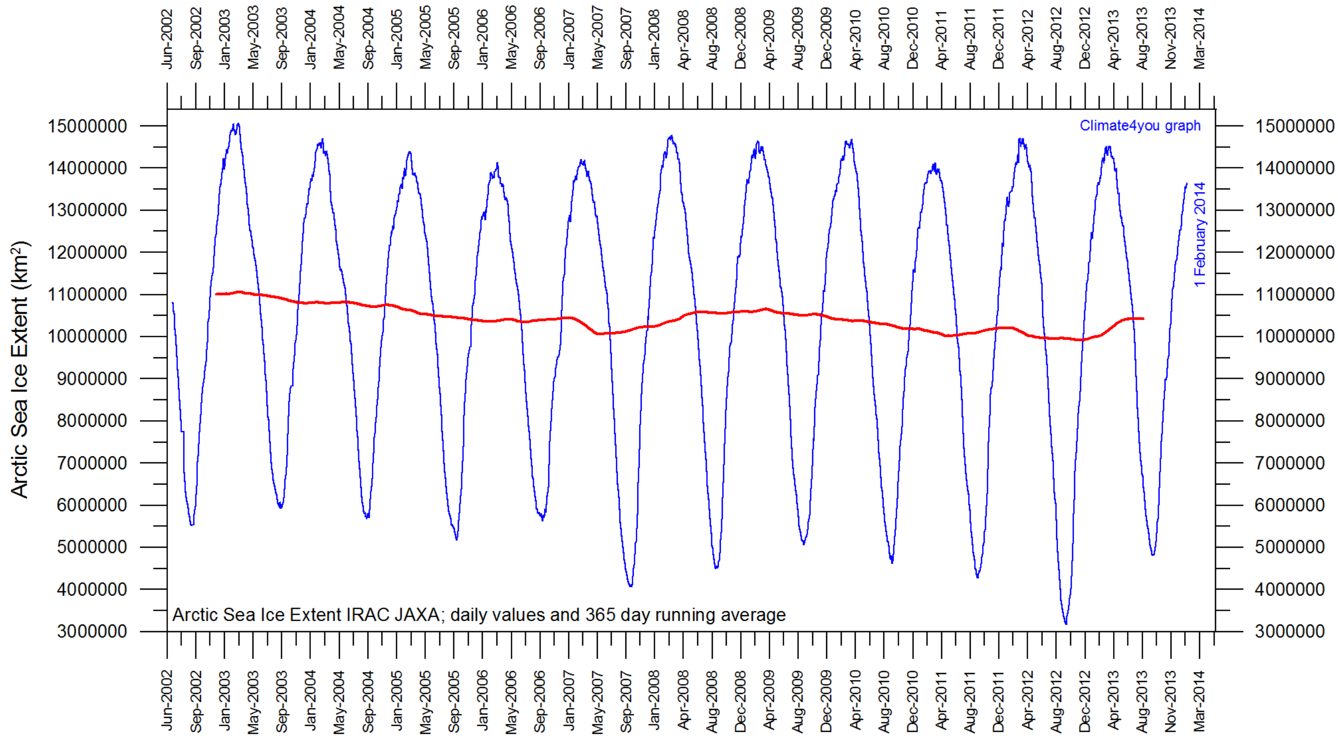
[Arctic and Antarctic sea ice, updated to January 2014]()



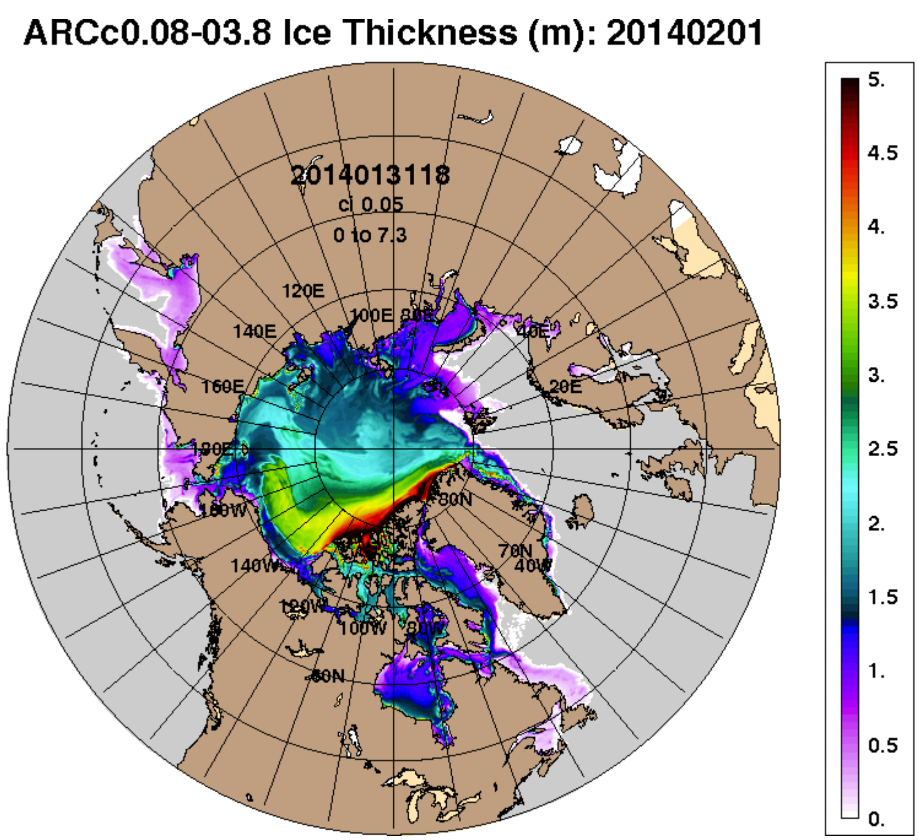
Sea ice extent 31 January 2014. The 'normal' or average limit of sea ice (orange line) is defined as 15% sea ice cover, according to the average of satellite observations 1981-2010 (both years inclusive). Sea ice may therefore well be encountered outside and open water areas inside the limit shown in the diagrams above. Map source: National Snow and Ice Data Center *(NSIDC).*



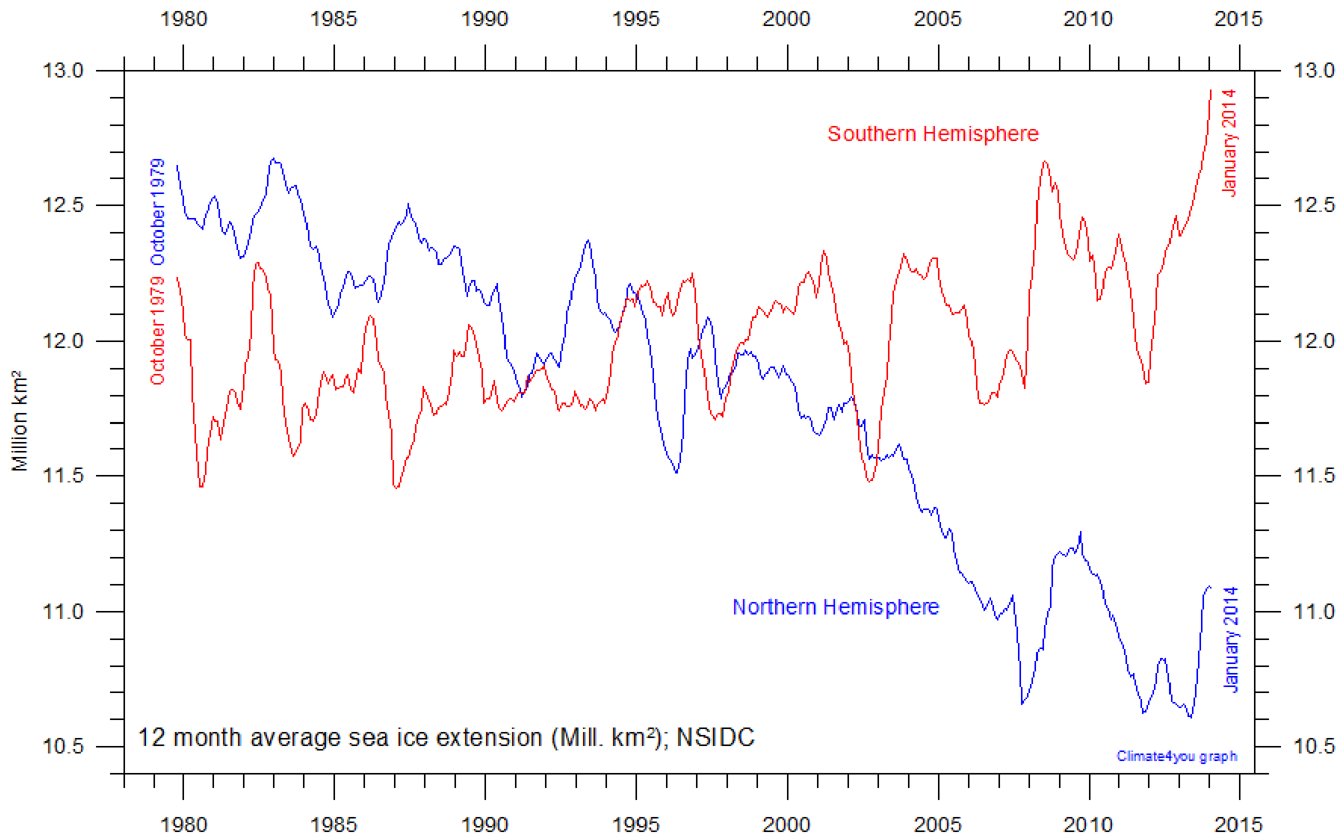
Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center]() *(NSIDC).*



Graph showing daily Arctic sea ice extent since June 2002, to 1 February 2014, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).

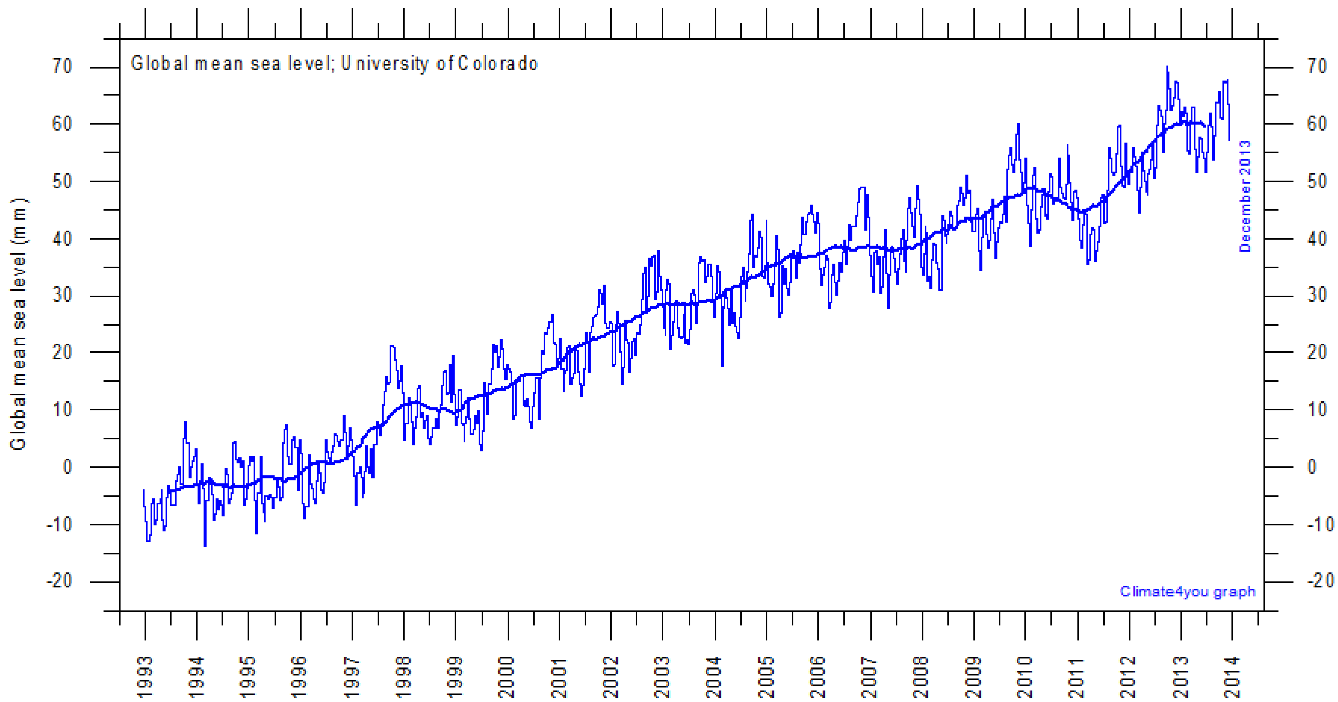


Northern hemisphere sea ice extension and thickness on 1 February 2014 according to the [Arctic Cap Nowcast/Forecast System](#) (ACNFS), US Naval Research Laboratory. Thickness scale (m) is shown to the right.

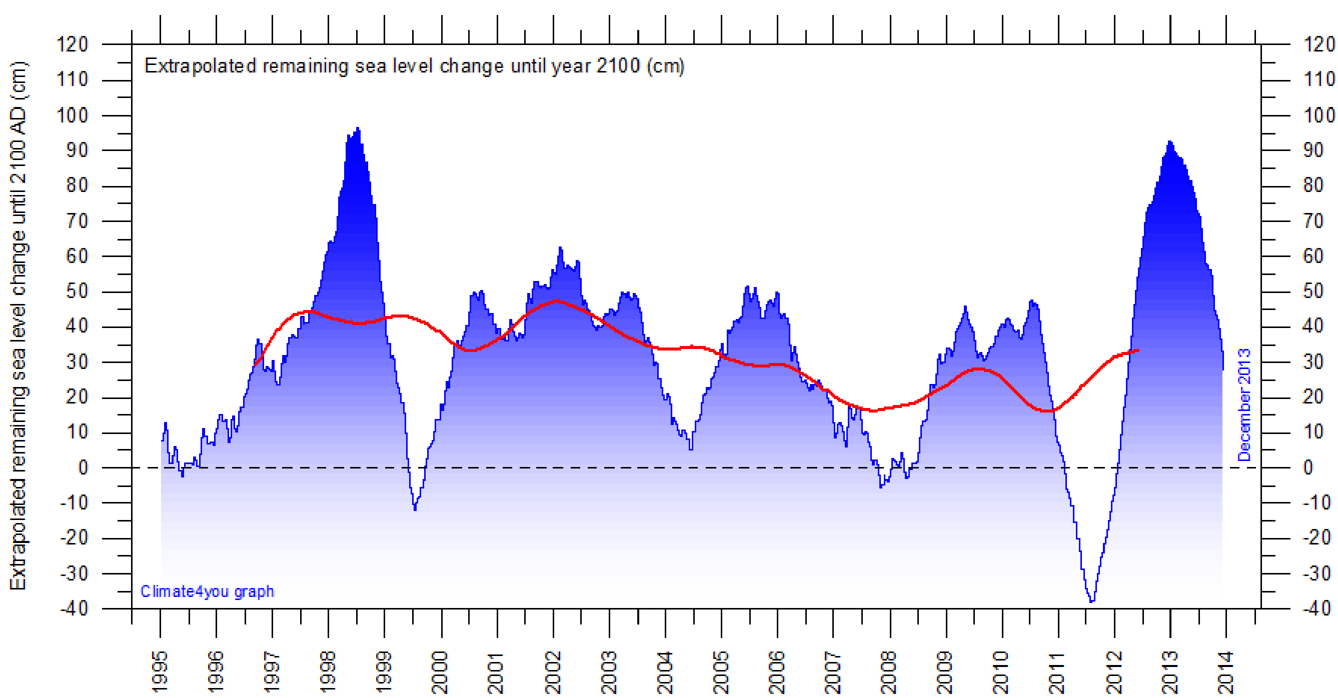


12 month running average sea ice extension in both hemispheres since 1979, the satellite-era. Data source: National Snow and Ice Data Center *(NSIDC).*

Global sea level, updated to December 2013

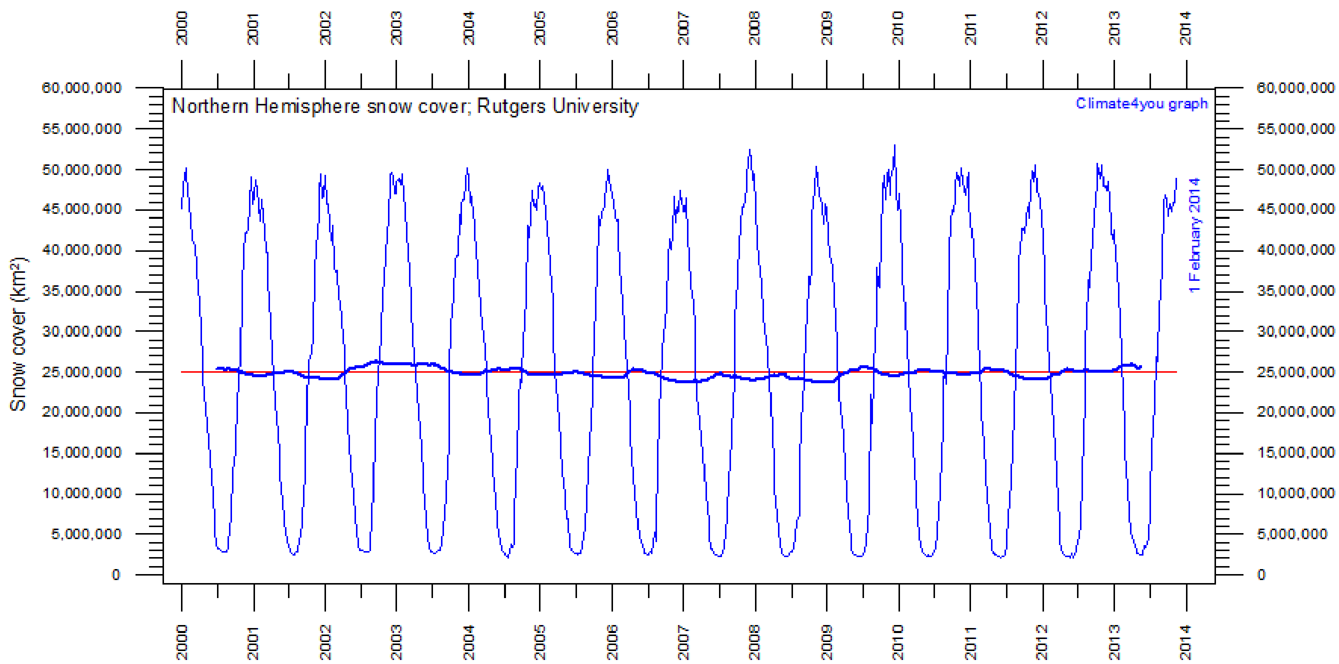


Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.

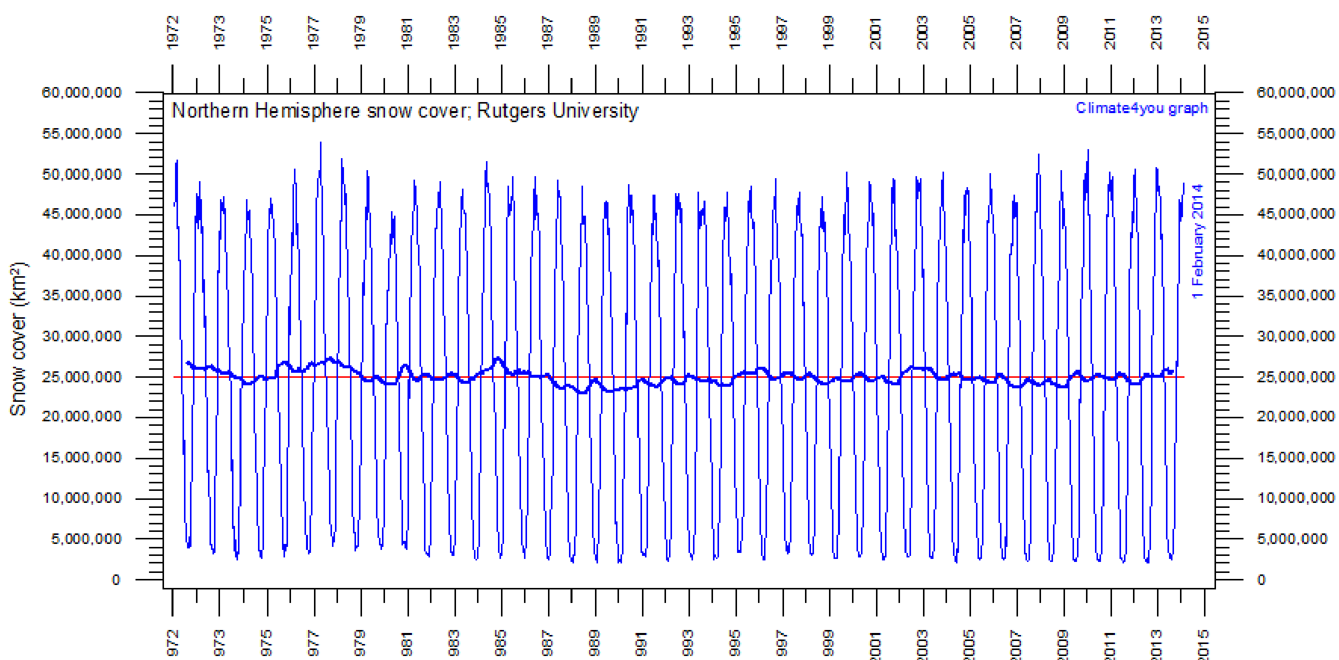


Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based on this (thick line), the present simple empirical forecast of sea level change until 2100 is about +31 cm.

Northern Hemisphere weekly snow cover, updated to early February 2014

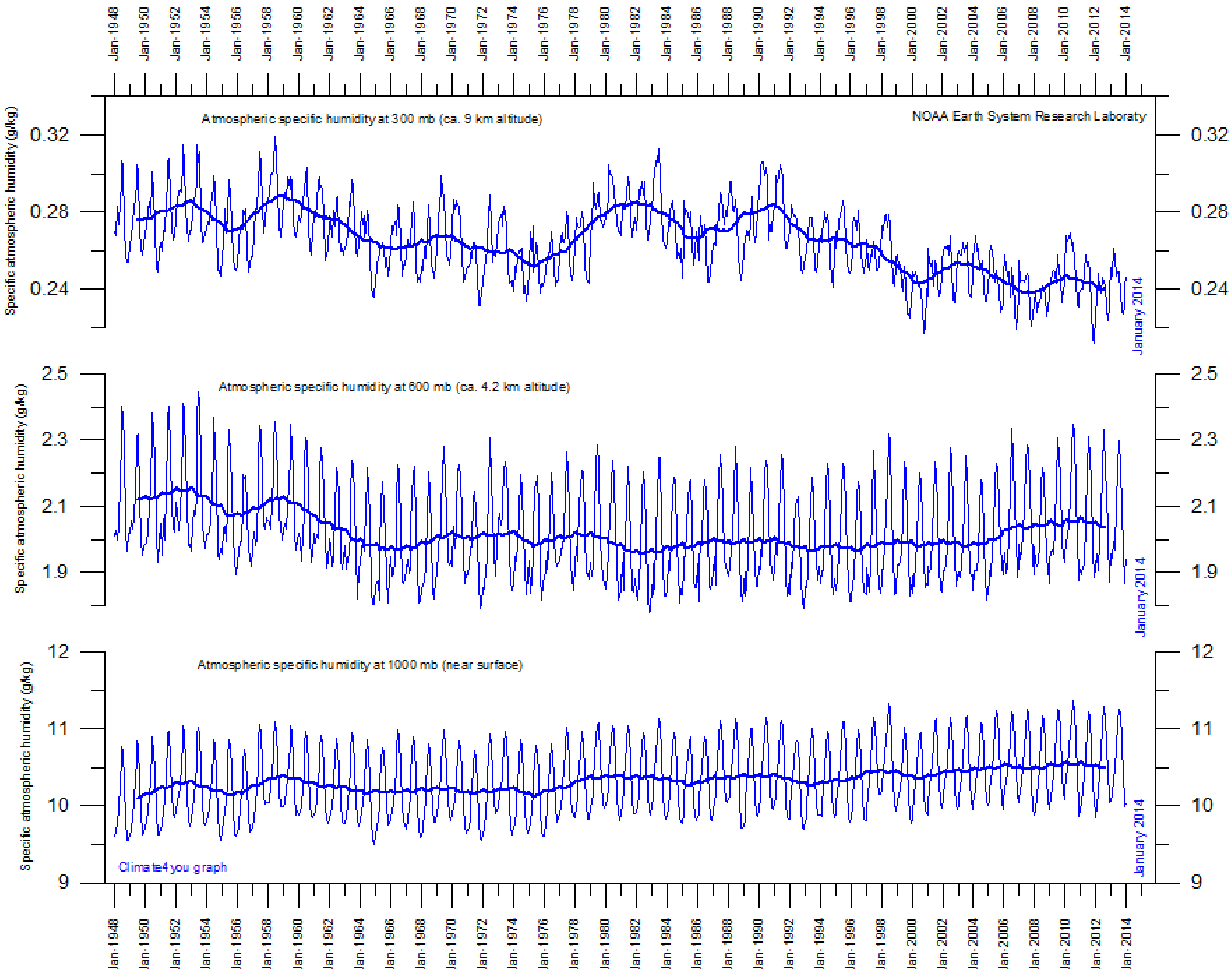


Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53 week average (approximately 1 year). The horizontal red line is the 1972-2013 average.



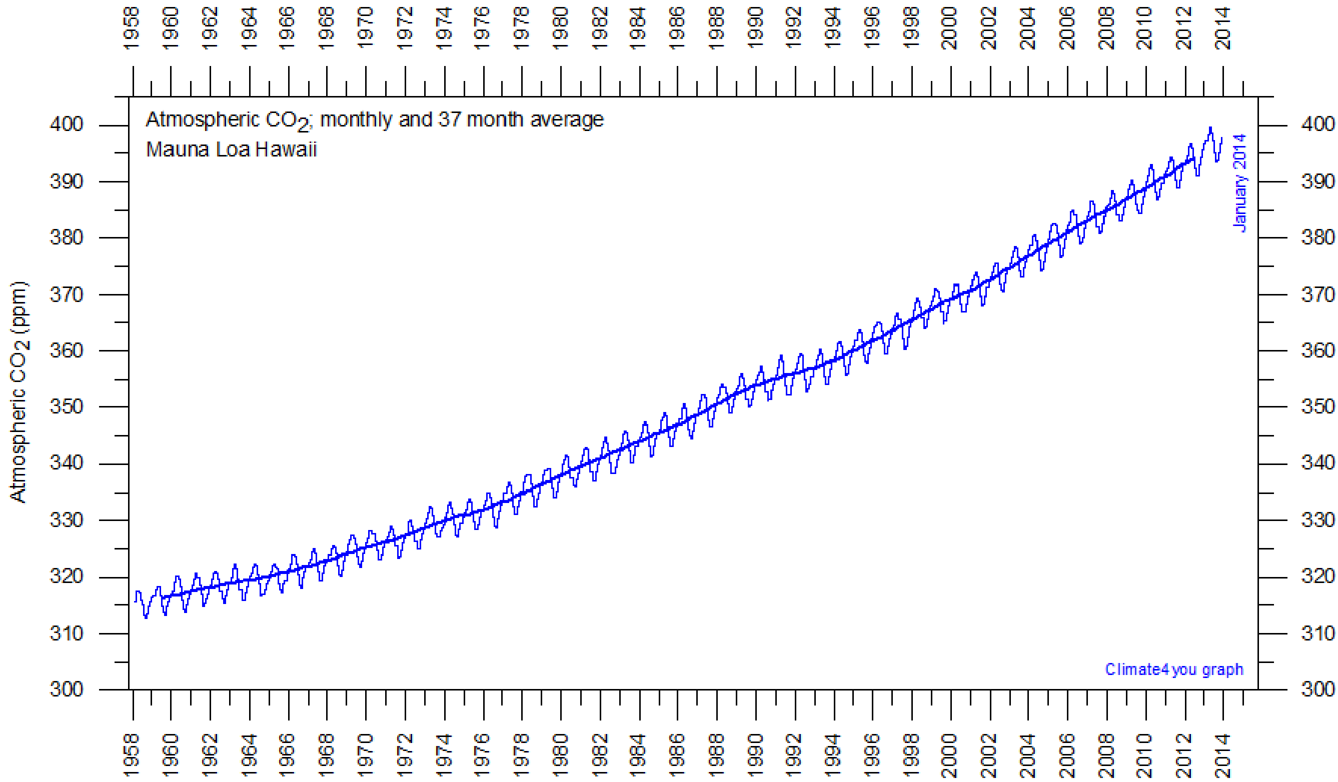
Northern hemisphere weekly snow cover since January 1972 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53 week average (approximately 1 year). The horizontal red line is the 1972-2013 average.

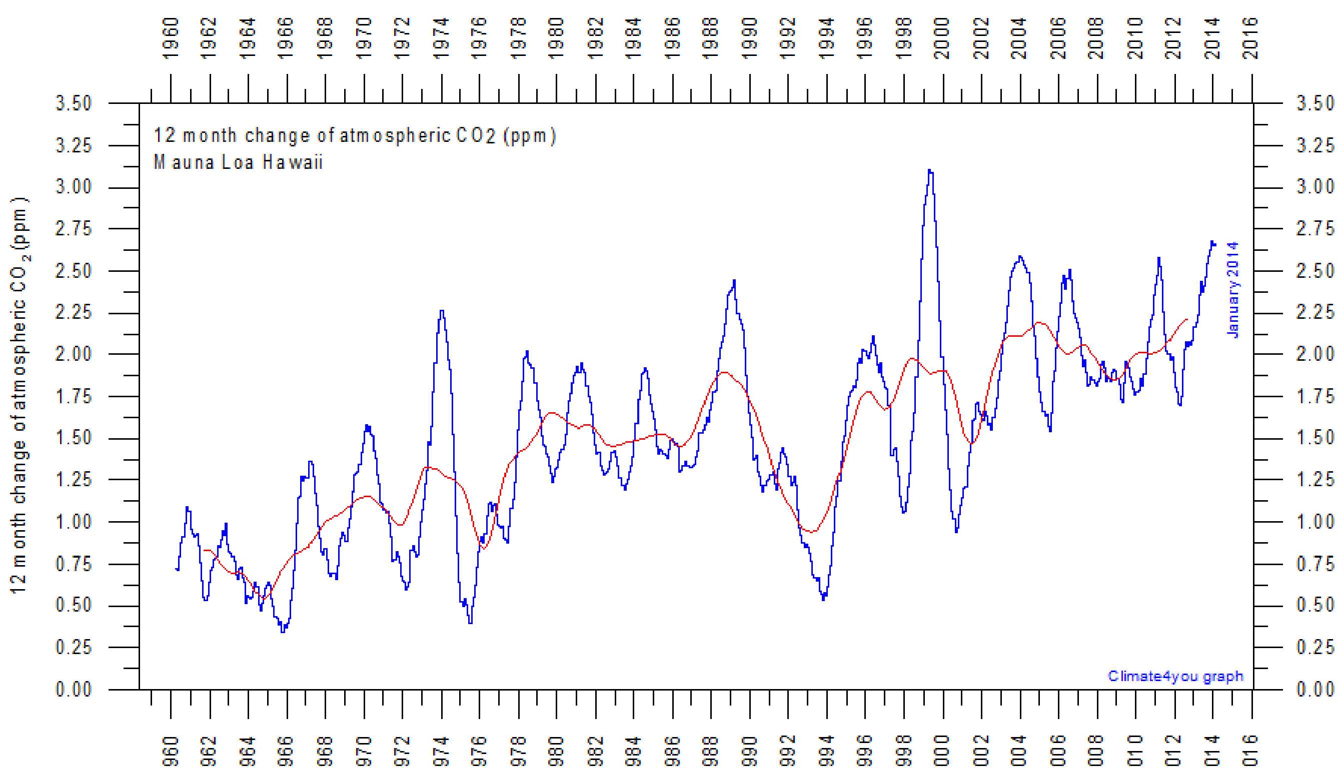
Atmospheric specific humidity, updated to January 2014



Specific atmospheric humidity (g/kg) at three different altitudes in the lower part of the atmosphere (the Troposphere) since January 1948 (Kalnay et al. 1996). The thin blue lines shows monthly values, while the thick blue lines show the running 37 month average (about 3 years). Data source: Earth System Research Laboratory (NOAA).

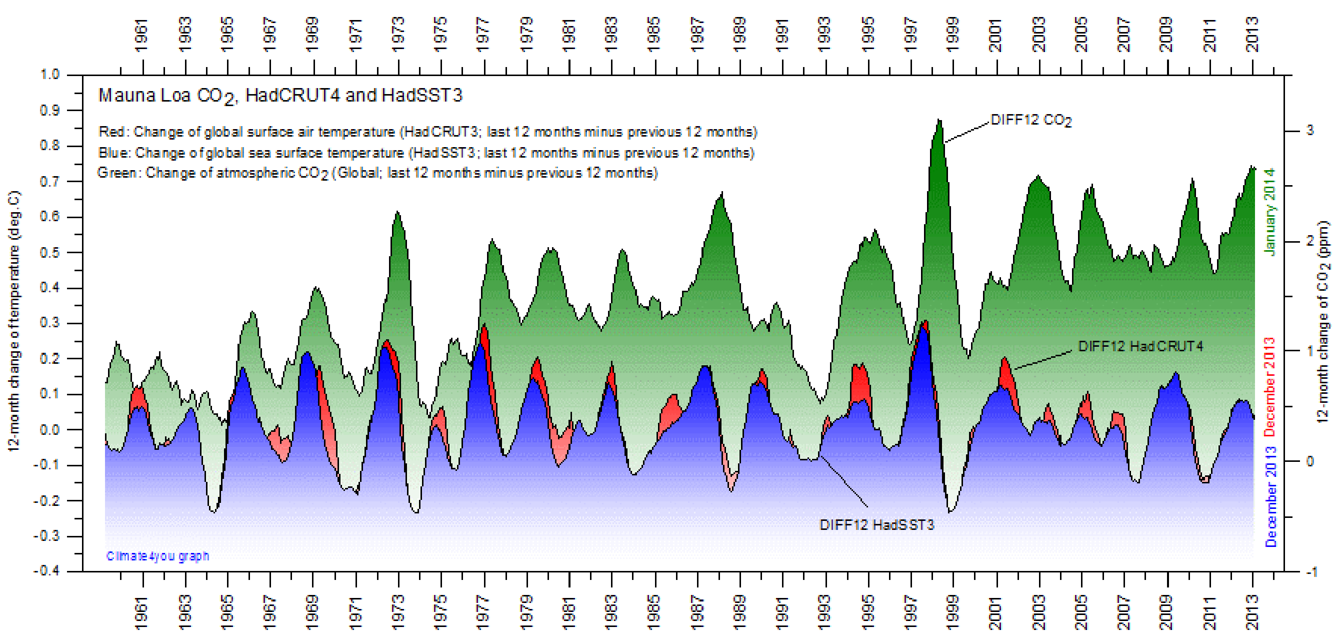
Atmospheric CO_2, updated to January 2014





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

The phase relation between atmospheric CO_2 and global temperature, updated to December 2013

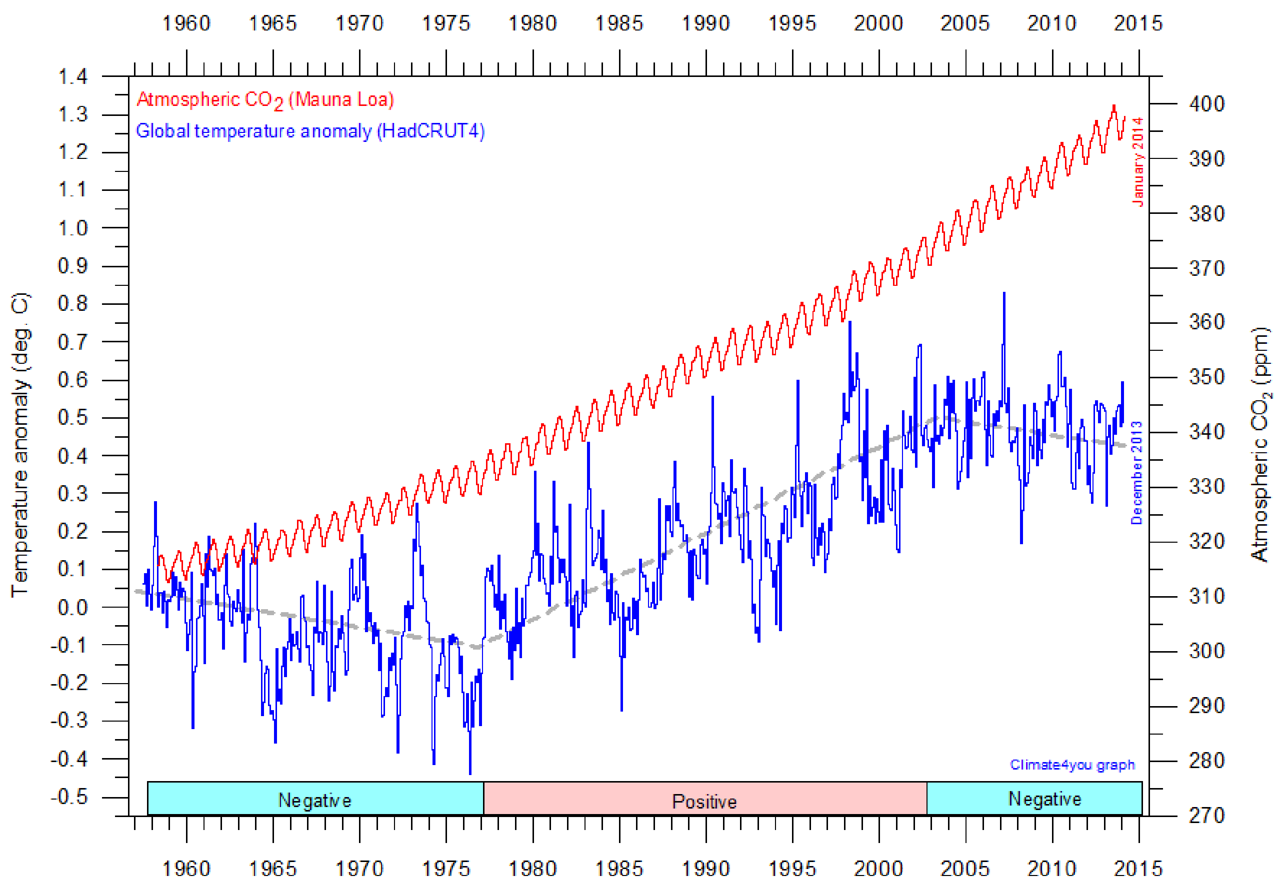


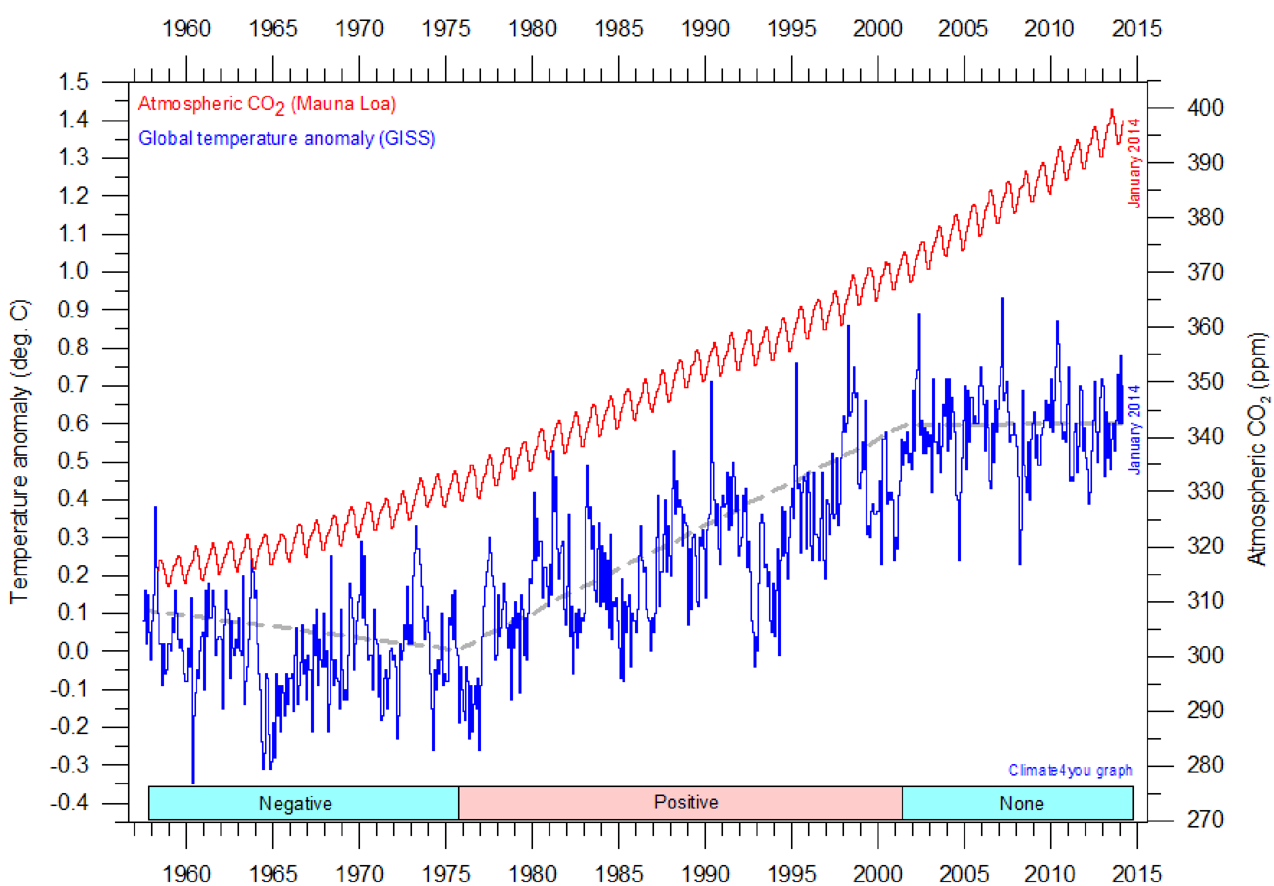
12-month change of global atmospheric CO_2 concentration (Mauna Loa; green), global sea surface temperature (HadSST3; blue) and global surface air temperature (HadCRUT4; red dotted). All graphs are showing monthly values of DIFF12, the difference between the average of the last 12 month and the average for the previous 12 months for each data series.

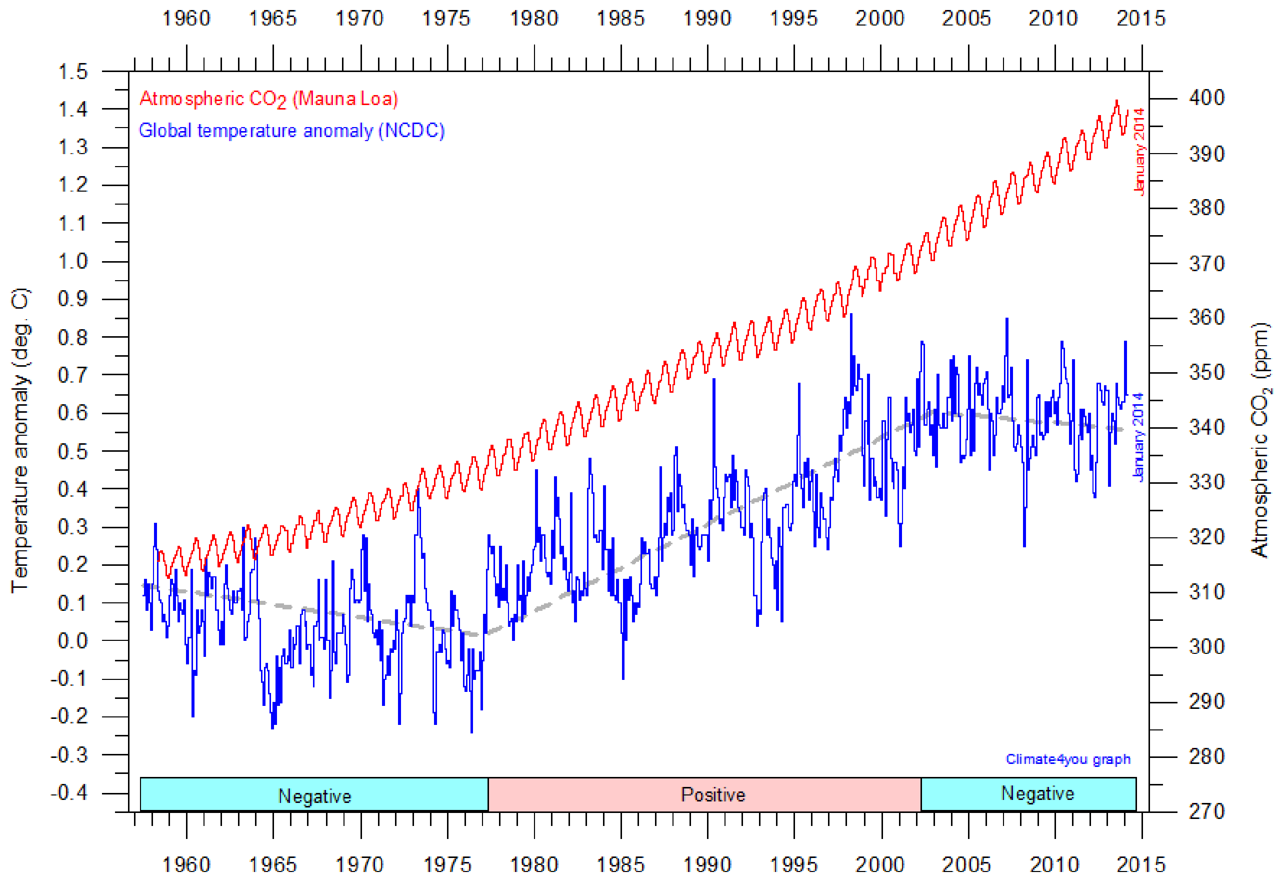
References:

Humlum, O., Stordahl, K. and Solheim, J-E. 2012. The phase relation between atmospheric carbon dioxide and global temperature. Global and Planetary Change, August 30, 2012. http://www.sciencedirect.com/science/article/pii/S0921818112001658?v=s5

Global surface air temperature and atmospheric CO_2, updated to January 2014







Diagrams showing HadCRUT3, GISS, and NCDC monthly global surface air temperature estimates (blue) and the monthly atmospheric CO_2 content (red) according to the [Mauna Loa Observatory](), Hawaii. The Mauna Loa data series begins in March 1958, and 1958 has therefore been chosen as starting year for the diagrams. Reconstructions of past atmospheric CO_2 concentrations (before 1958) are not incorporated in this diagram, as such past CO_2 values are derived by other means (ice cores, stomata, or older measurements using different methodology), and therefore are not directly comparable with direct atmospheric measurements. The dotted grey line indicates the approximate linear temperature trend, and the boxes in the lower part of the diagram indicate the relation between atmospheric CO_2 and global surface air temperature, negative or positive. Please note that the HadCRUT4 diagram is not yet updated beyond December 2013.

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 meteorological record value may well be the result of other phenomena.

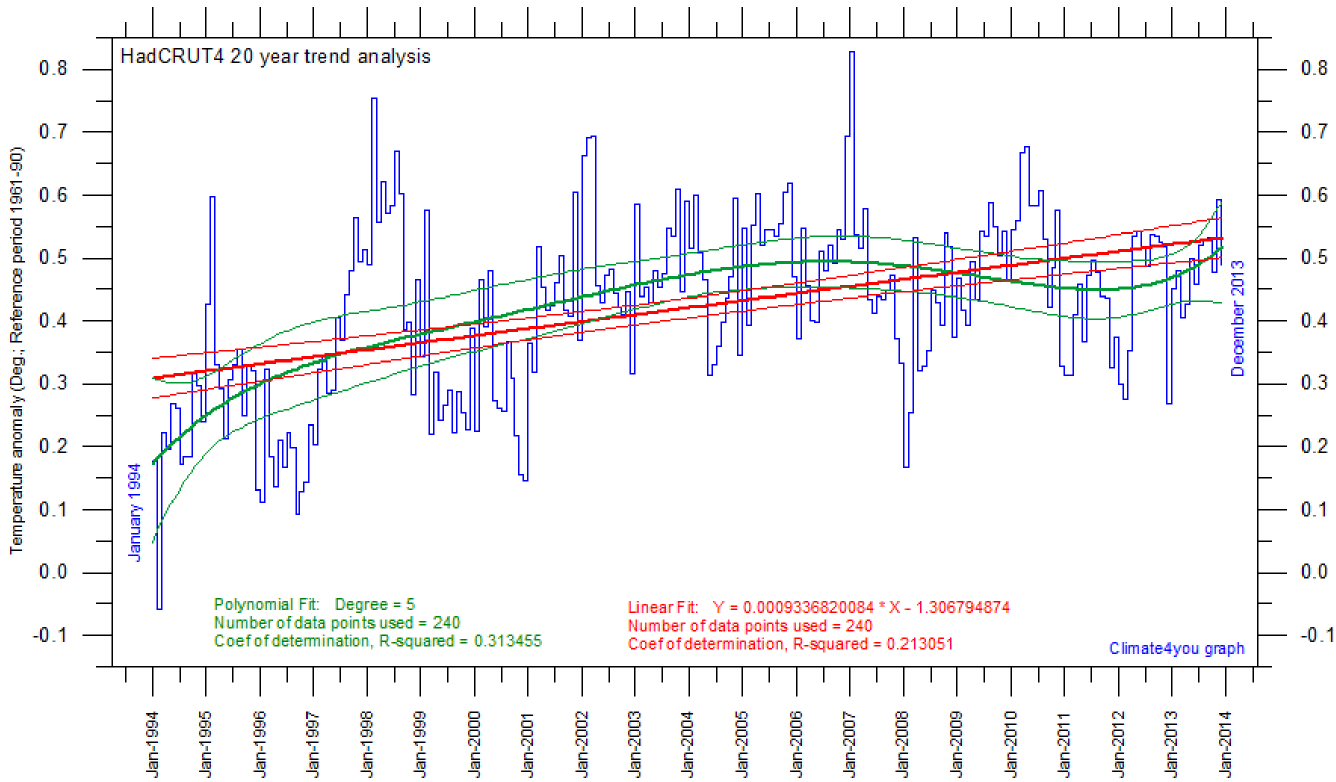
What exactly defines the critical length of a relevant time period to consider for evaluating the alleged importance of CO_2 remains elusive, and is still a topic for discussion. However, the critical period length must be inversely proportional to the temperature sensitivity of CO_2, including feedback 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 CO_2 has been indicated in the lower panels of the diagrams above.

Last 20 year monthly surface air temperature changes, updated to December 2013



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). Please note that the linear regression is done by month, not year.

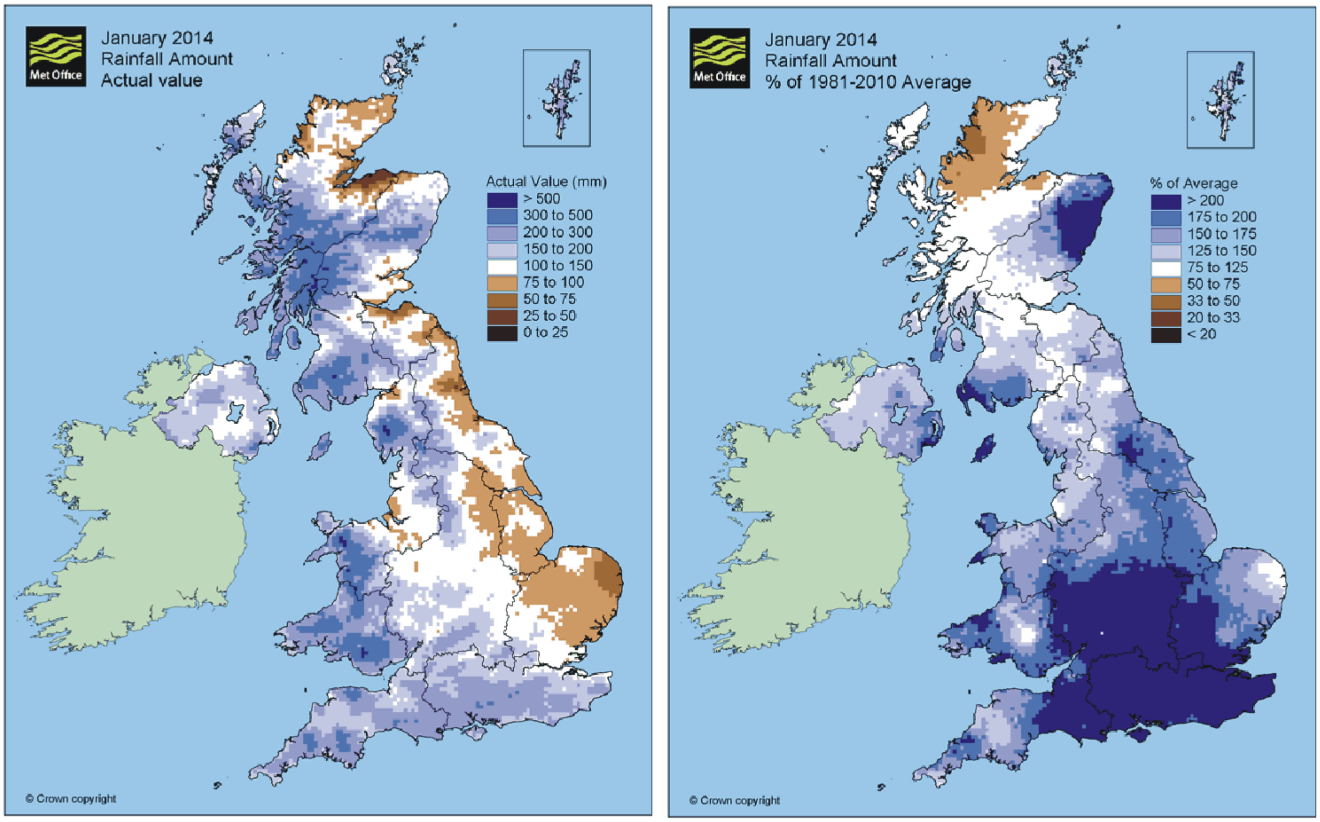
It is quite often debated if the global surface temperature still increases, or if the temperature has levelled out during the last 10-15 years. The above diagram may be useful in this context, and demonstrates the differences between two often used statistical approaches to determine recent temperature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

2014: Biblical floods in S and SE England January 2014

Birds fly past a sign surrounded by flood waters in Worcester, central England, February 13, 2014 (Reuters)

Recent floods in southwest England and elsewhere have submerged crops and destroyed cattle bedding and feed, with the consequences likely to be felt for months, or even years, in terms of lower production of both crops and meat. Britain's Environment Agency had issued 416 flood warnings and alerts, as of early Thursday, including 16 under its most serious category, indicating danger to life. Thousands of acres of farmland in Britain are under water, with some submerged for weeks, although agricultural economists say it is too early to forecast how output might be affected (London, Reuters). The British Prime Minister David Cameron has described the floods as “biblical" in extent.

The flooding was apparently made worse than necessary by unfortunate past administrative decisions. It has emerged that the UK Environment Agency rejected calls to dredge the flood-hit lower reaches of the Thames because of the presence of an endangered mollusk, making dredging of the Thames river bed ‘environmentally unacceptable’ due to the ‘high impact on aquatic species’. (Daily Mail, 13 February 2014).



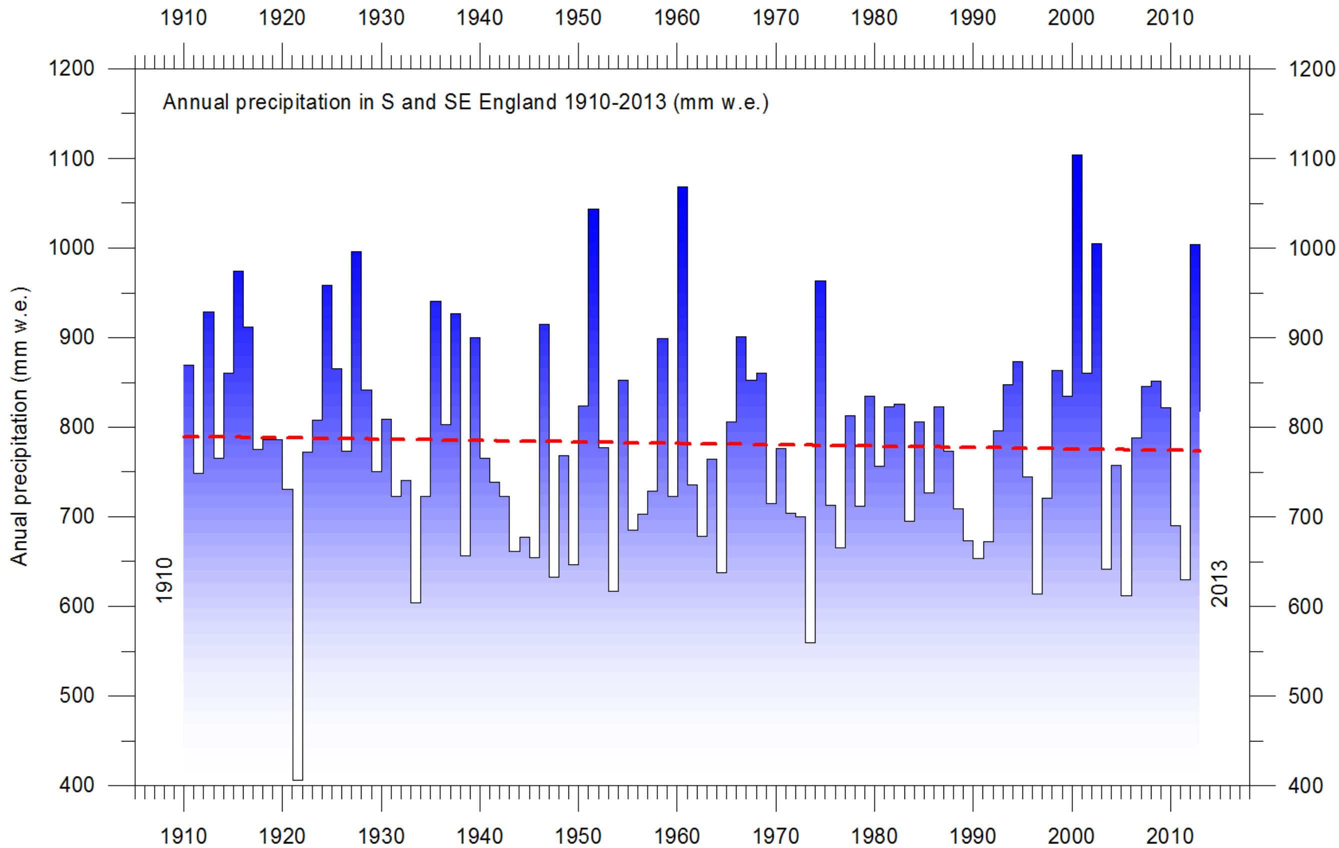
35 *January 2014 precipitation in UK, absolute values to the left, and anomaly values to the right (base period 1981-2010). Source: Met Office.*

This comes on the background that contingency planners apparently were advised by the UK Met Office to expect a dry winter 2013-14 less than four weeks before the heaviest rainfall in 250 years began. The official guidance to expect "*drier than normal*" conditions was issued in mid-November, just weeks before the onset of one of the wettest new year period on record in England.

A very high number of people in SE and S England have been affected by this sad development. It once again shows how difficult it is to make reliable meteorological forecasts beyond very short periods. Nevertheless, it is still instructive to inspect the meteorological precipitation record for SE and S central England, which are the two regions most heavily affected by the recent floods (see maps above).

However impressive and distressing the present floods may appear, the precipitation record shows that there is no long term trend towards increasing annual precipitation in S and SE England (figure on next page). If anything, there is actually a weak trend towards slightly drier conditions over the entire observational period, although not statistical significant.

At first glance, the precipitation record may look quite uncomplicated, and without much interesting information to be gained except that this part of England on average has received about 800 mm w.e. annually since 1910. As expected, there are also large variations from one year to the next, but beyond that there may be little of interest to be seen from the record.



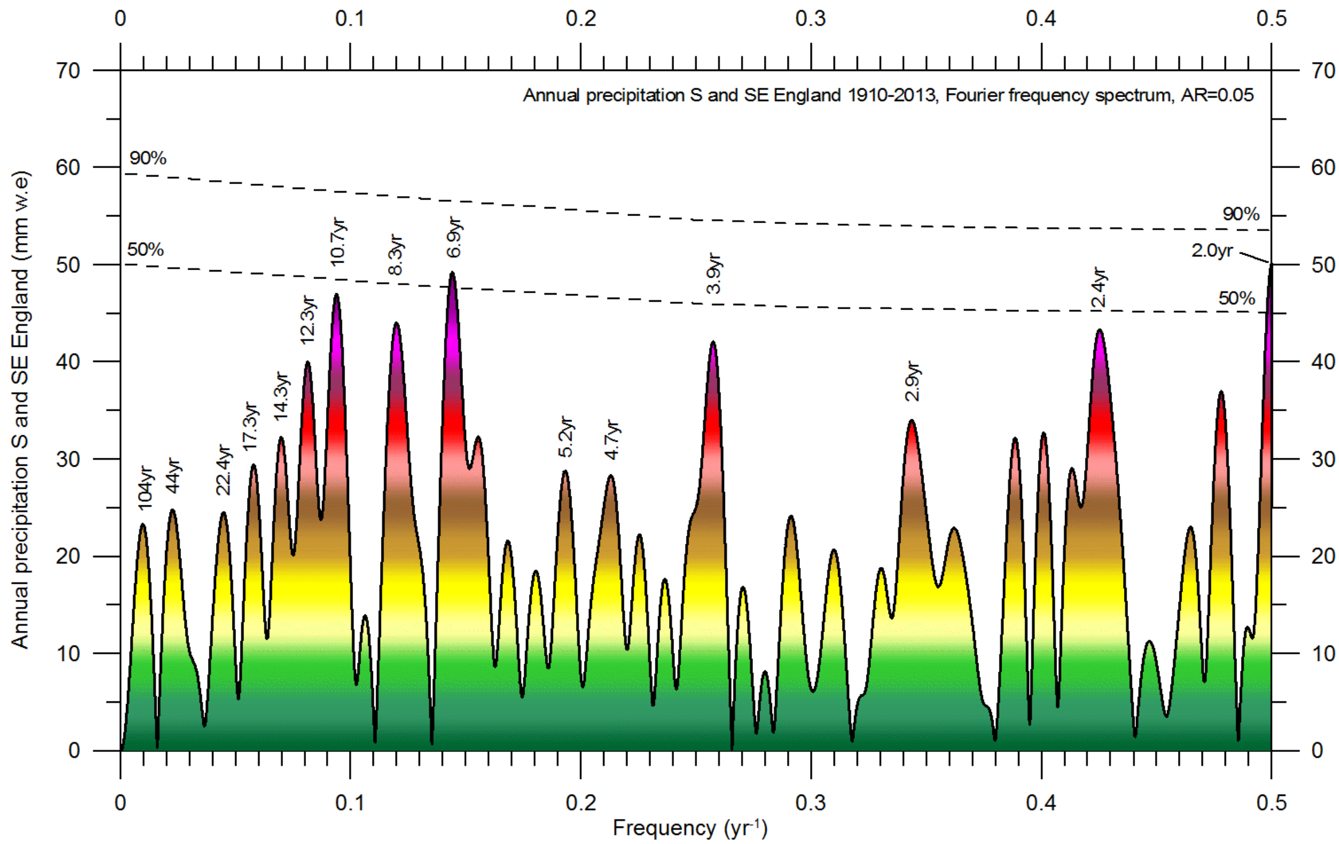
Annual precipitation in S and SE England 1910-2013. The annual values (mm w.e. = mm water equivalent) are shown by the blue columns, and the linear trend for the observation period by the red dotted line. Source: [Met Office](#).

The substantial interannual variation in precipitation is highlighted by a very small AR(1)-value for the data series, about 0.05, indicating that there is very little connection between the value recorded for one year and the next. In a a statistical sense the signal represented in the data can therefore be be considered as a purely white noise signal, with almost no red noise present.

This is in strong contrast to temperature records, where one relatively warm year for obvious reasons tend to be followed by another warm year.

This is also why the often made claim that it is highly unusual that the global temperature during the 2000-2009 decade has remained high has little scientific merit; this is simply to be expected because of high autocorrelation characterizing most natural temperature records.

However, as usual nature is trying to teach us something by way of data series, and this is also the case for the S and SE England precipitation series shown above. Consider the Fourier frequency analysis shown in the diagram below.



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Fourier analysis (using Best Exact N composite algorithm) of the detrended precipitation series from S and SE England (diagram above). The horizontal stippled lines indicate peak-based critical limit significance levels ([Humlum et al. 2011, 2012](#)), while the color scale indicates increasing amplitude. The most important periods in the record are of about 10.7, 8.3, 6.9, 3.9 and 2.4 yr length, all with amplitude greater than 40 mm w.e. However, in a statistical sense, due to the very low autocorrelation and still limited length of the precipitation record, none of the peaks can be considered significant. Only frequencies lower than 0.5 yr^{-1} (periods longer than 2 years) are shown.

The spectral analysis shows the precipitation record to be characterized by a high number of peaks, of which none from a statistical point of view can be considered significant. This does not signify, however, that they are entirely without interest, but only that none of them can be considered unique or dominant because of the still limited record length (since 1910) and the high number of peaks present in the record.

Several of the most important periods are also identified in other independent types of records, which suggests that they are not artefacts but may represent real natural phenomena, potentially worth to consider. One immediate example is the 10.7 yr period, which is close to the well-known sunspot period.

Also the temporal dynamics of the above periods is worth to consider, as is illustrated by the following diagram.

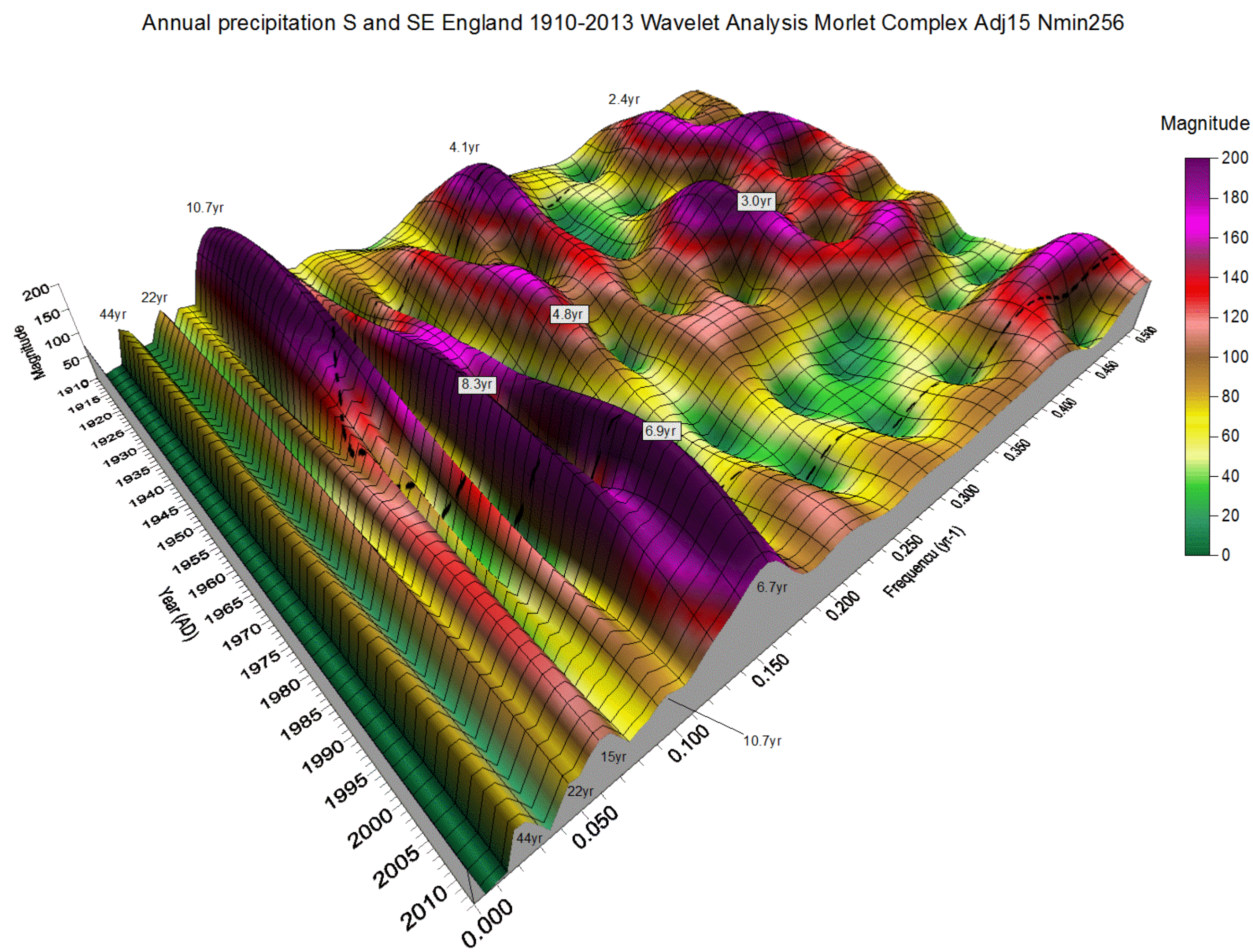

*Diagram showing the continuous wavelet time-frequency spectrum for the S and SE England precipitation record. Time (AD) and frequency (yr^{-1}) of cyclic variations embedded in the data are shown along the two horizontal axes. Frequencies higher than 0.5 yr^{-1} are not shown, corresponding to showing only periods longer than 2 yr. The vertical axis (and color scale) shows the component (magnitude) of the Continuous Wavelet Spectrum at a given time and frequency. The magnitude is calculated as sqrt(Re*Re+Im*Im), where Re is the real component of a given segment's FFT at a given frequency and Im is the imaginary component. Usually the magnitude is 3-4 times the corresponding amplitude. The dotted line indicates the extent of the cone of influence, where the magnitude of oscillations may be diminished artificially due to zero padding, especially towards the ends of the time scale.*

The wavelet-diagram above shows that the 10.7 yr period was especially important for the annual precipitation in S and SE England until about 1940, after which the relative importance slowly diminished. The 10.7 yr period is, however, still visible in the diagram also in the most recent years.

Along with the relative loss of importance for the 10.7 yr period, a period of about 8.3 yr gained importance, until also this period began to lose relative importance around 1990. Along with this development an about 6.9 yr period can be seen to gain importance, and at the same time became slightly shorter with time, now about 6.7 yr. This period has large relative influence on the annual precipitation during the most recent years, and it is unlikely that it suddenly will lose relative importance within the next few years to come. The shorter periods also visible in the two above diagrams are temporally much more unstable, and tend to appear and disappear within few years, and therefore have little prognostic value.

Summing up, during the coming years the annual precipitation in S and SE England is likely to be under relatively strong influence (but far from entirely) of the 6.9-6.7 yr periodic variation. Based on a non-linear optimization to construct a sinusoidal model approximating the original data, it appears that this important period most likely will peak around 2014. Thus, it is likely that the following years will show a general trend towards somewhat lower annual precipitation values in this part of UK. Subsequently this development probably will be followed by another increase, and so on. As usual, time will show.

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Humlum, O., Solheim, J.-E., and Stordahl, K. 2011. Identifying natural contributions to late Holocene climate change. *Global and Planetary Change* 79, 145-158.
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Humlum, O., Solheim, J-E. and Stordahl, K. 2012. Spectral analysis of the Svalbard temperature record 1912-2010. *Advances in Meteorology*. Volume 2012, Article ID 175296, 14 pages, doi:10.1155/2012/175296.

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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,

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