Climate4you update November 2014

Climate4you.com
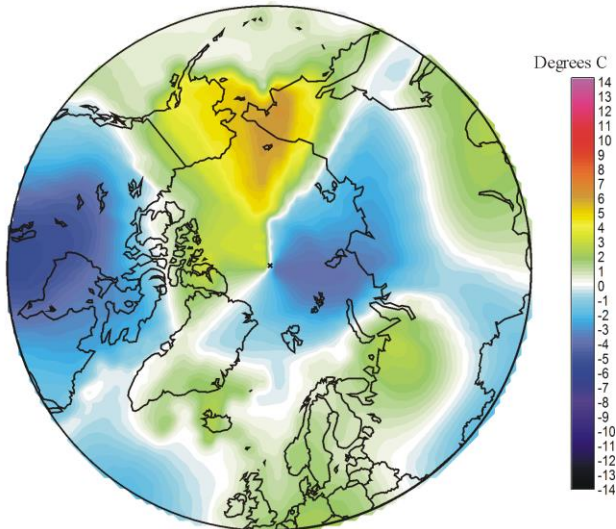
Contents:

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

November 2014 global surface air temperature overview

Surface air temperature anomaly 2014 11 vs 1998-2006
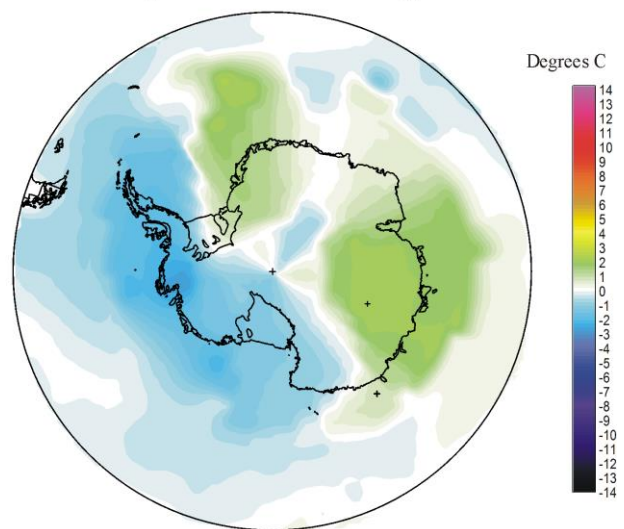
Air temperature 2014 11 versus average 1998-2006

Air temperature 2014 11 versus average 1998-2006

November 2014 surface air temperature compared to the 1998-2006 average. 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 November 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 an 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.

## November 2014 global surface air temperatures

General: In general, the global air temperature was near the 1998-2006 average, but with large regional differences, especially in the Northern Hemisphere.

The Northern Hemisphere was characterised by marked regional air temperature contrasts. Most of North America had below 1998-2006 average temperatures, with the exception of Alaska, which had above average temperature. NW-Europa and northern Russia also had above average temperatures, while a region of below-average temperatures extended from northern Siberia to the region around the Caspian Sea. Mongolia, northern China and easternmost Siberia also was warmer than the 1998-2006 average.

Near the Equator temperatures conditions were generally somewhat above or near the 1998-2006 average in the Pacific sector, but below average in the Atlantic-Africa sector.

The Southern Hemisphere temperatures were mainly near or a little below average 1998-2006 conditions. Especially NE Australia had higher than average temperatures. The Antarctic was split in two about equally large regions characterised by above and below average temperatures, in East and West Antarctic, respectively.

Lower troposphere temperature from satellites, updated to November 2014
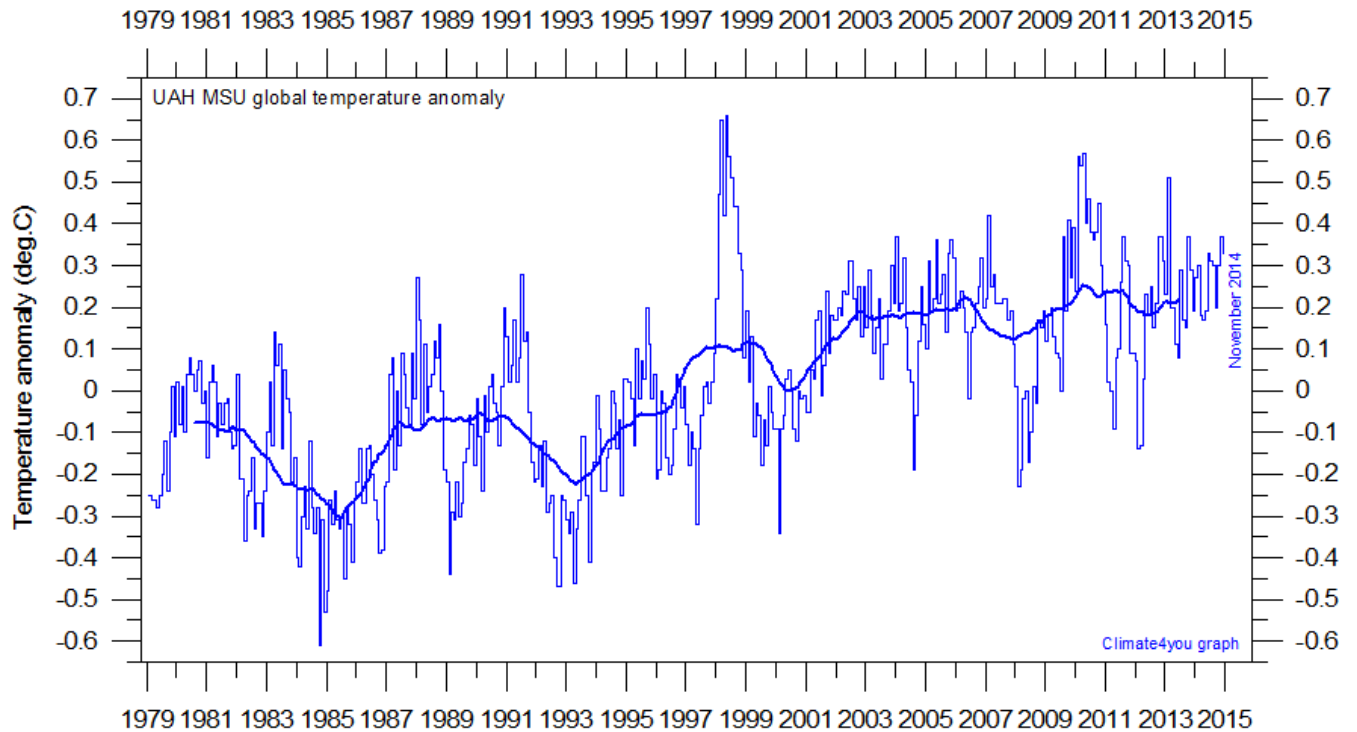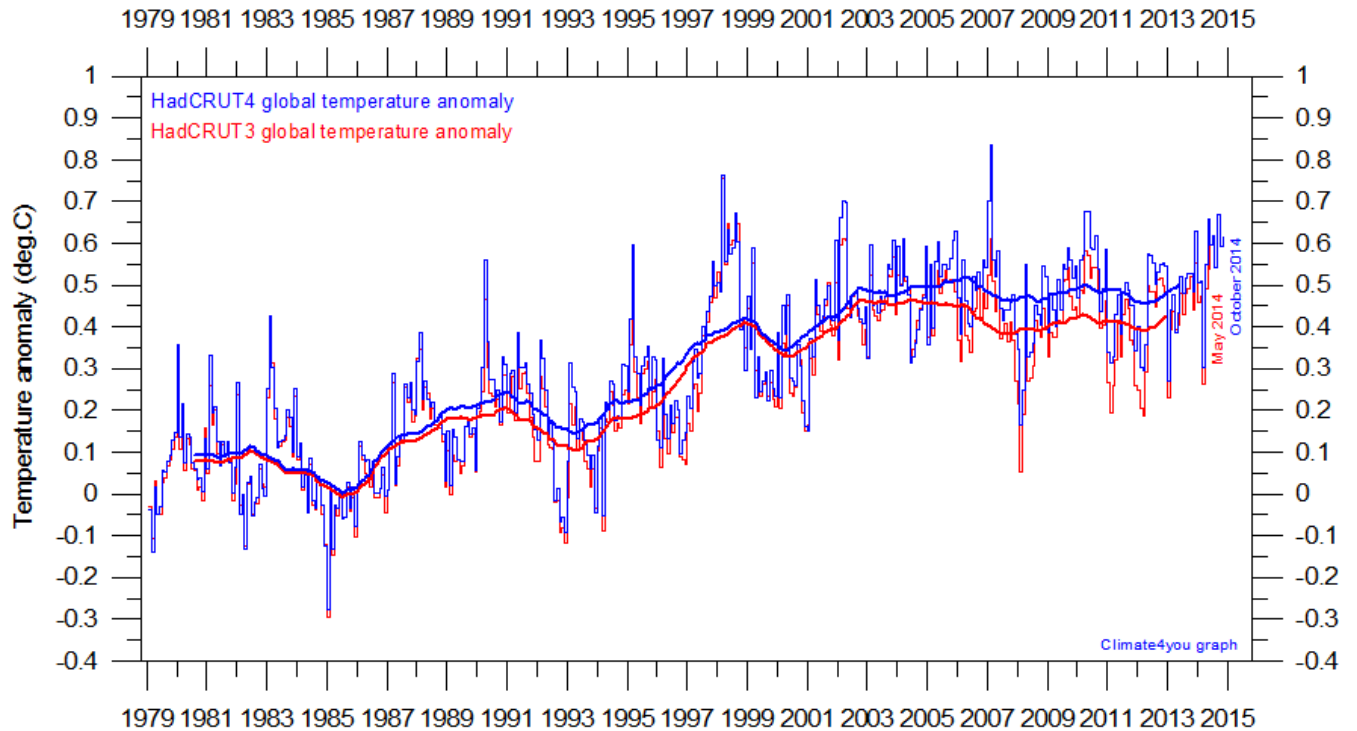

Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37-month average.

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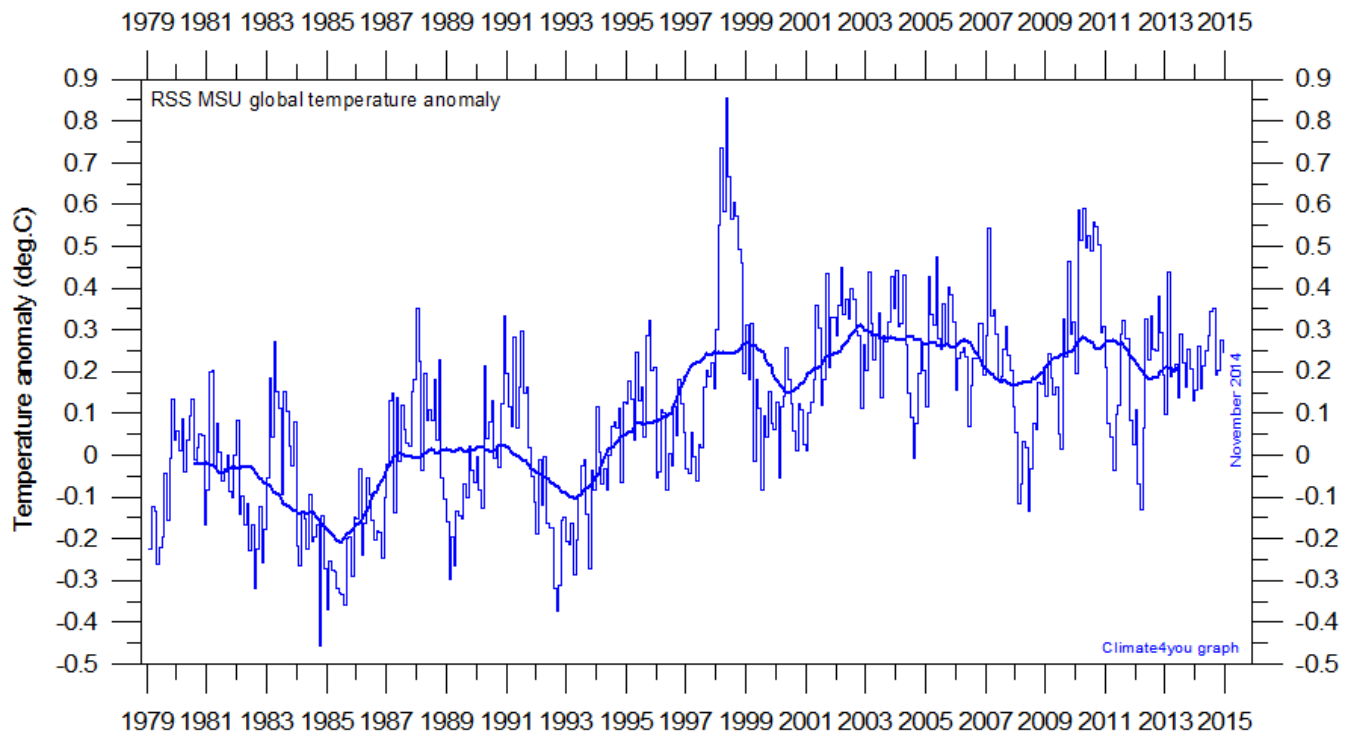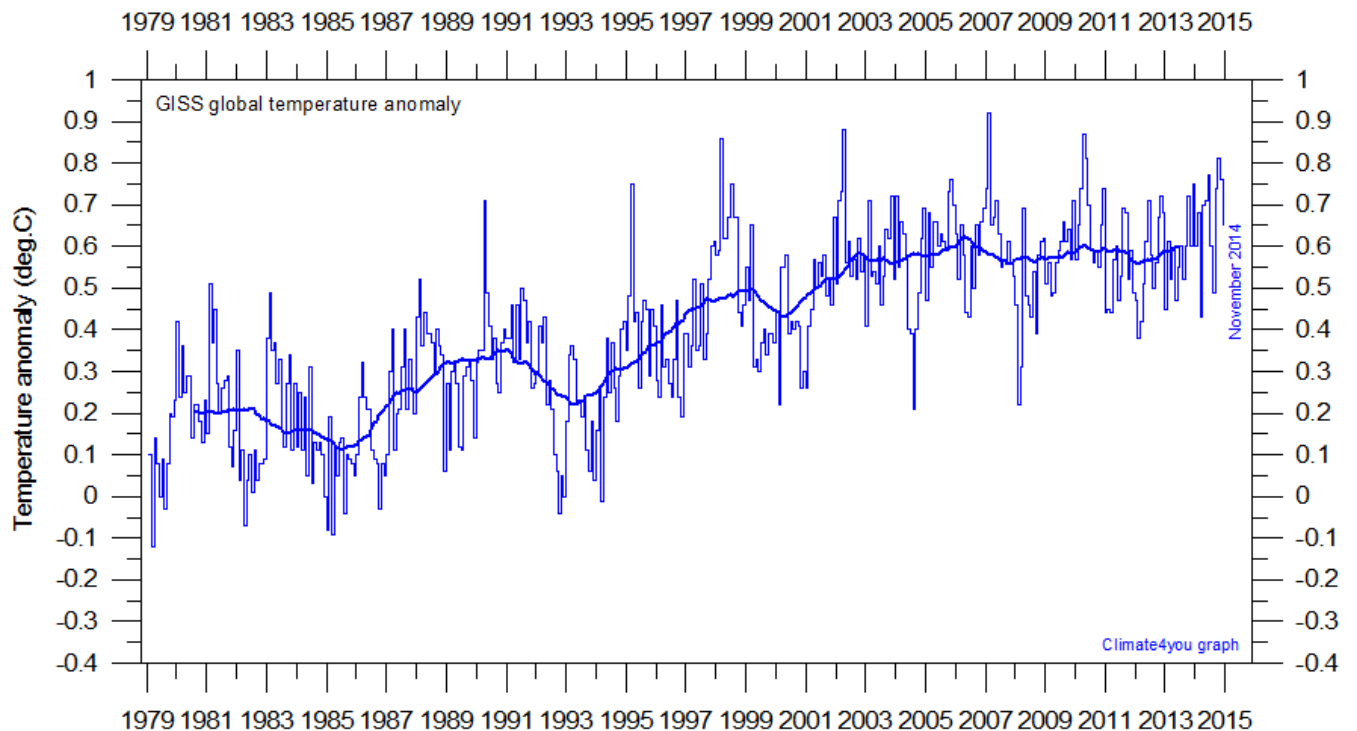

Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37-month average.

## Global surface air temperature, updated to November 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), 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 October 2014.

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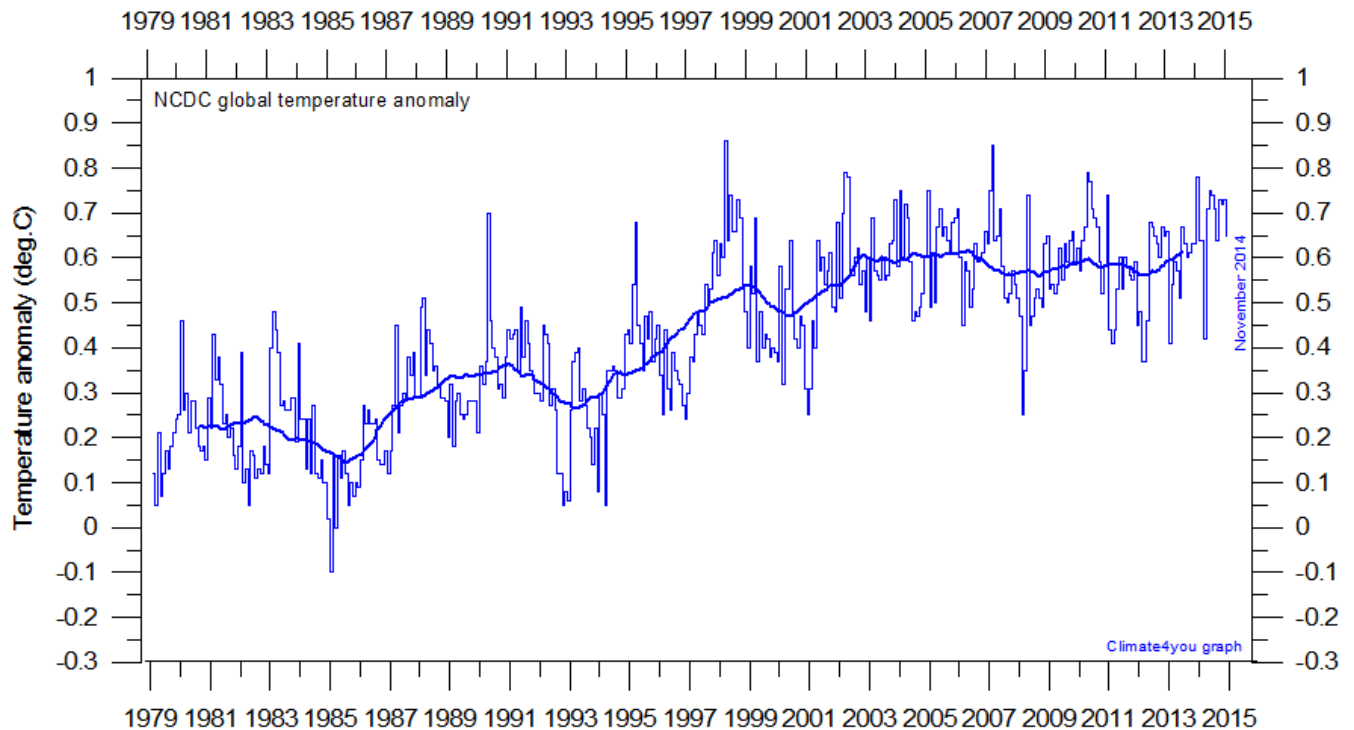
Global monthly average surface air temperature since 1979 according to according to the [National Climatic Data Center](#) (NCDC), USA. The thick line is the simple running 37-month average.

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 supplementary data being added, but actually for all months back to the very beginning of the records, more than 100 years ago. Presumably this reflects recognition of errors, changes in the averaging procedure, and the influence of other unknown phenomena.

None of the temperature records are entirely 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 adjustments.

You can find more on the issue of lack of temporal stability on [www.climate4you](#) (go to: *Global Temperature*, followed by *Temporal Stability*).
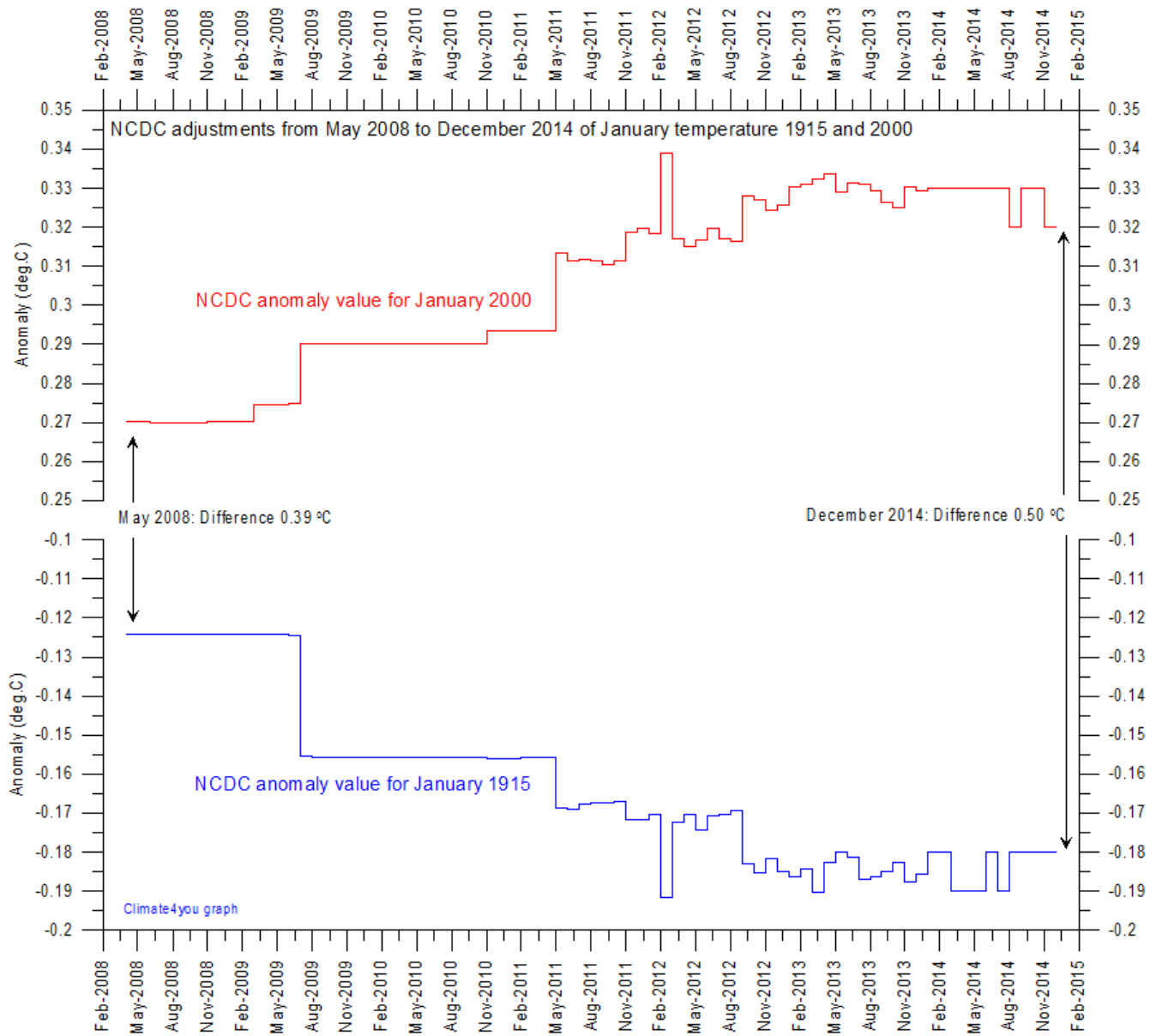
Diagram showing the adjustment made since May 2008 by the [National Climatic Data Center](#) (NCDC) in the anomaly values for the two months January 1915 and January 2000.

<u>Note:</u> The administrative upsurge of the temperature increase between January 1915 and January 2000 has grown from 0.39 (May 2008) to 0.50 °C (December 2014), representing an about 28% administrative (human) temperature increase over this period.

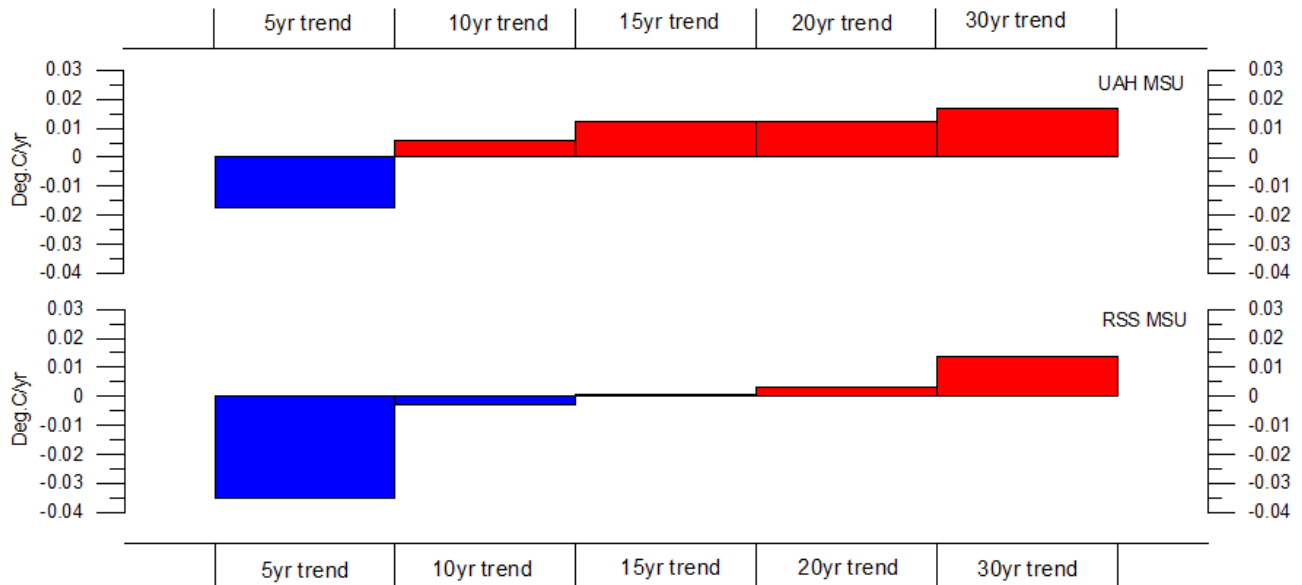## Global air temperature linear trends updated to October 2014

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: October 2014.
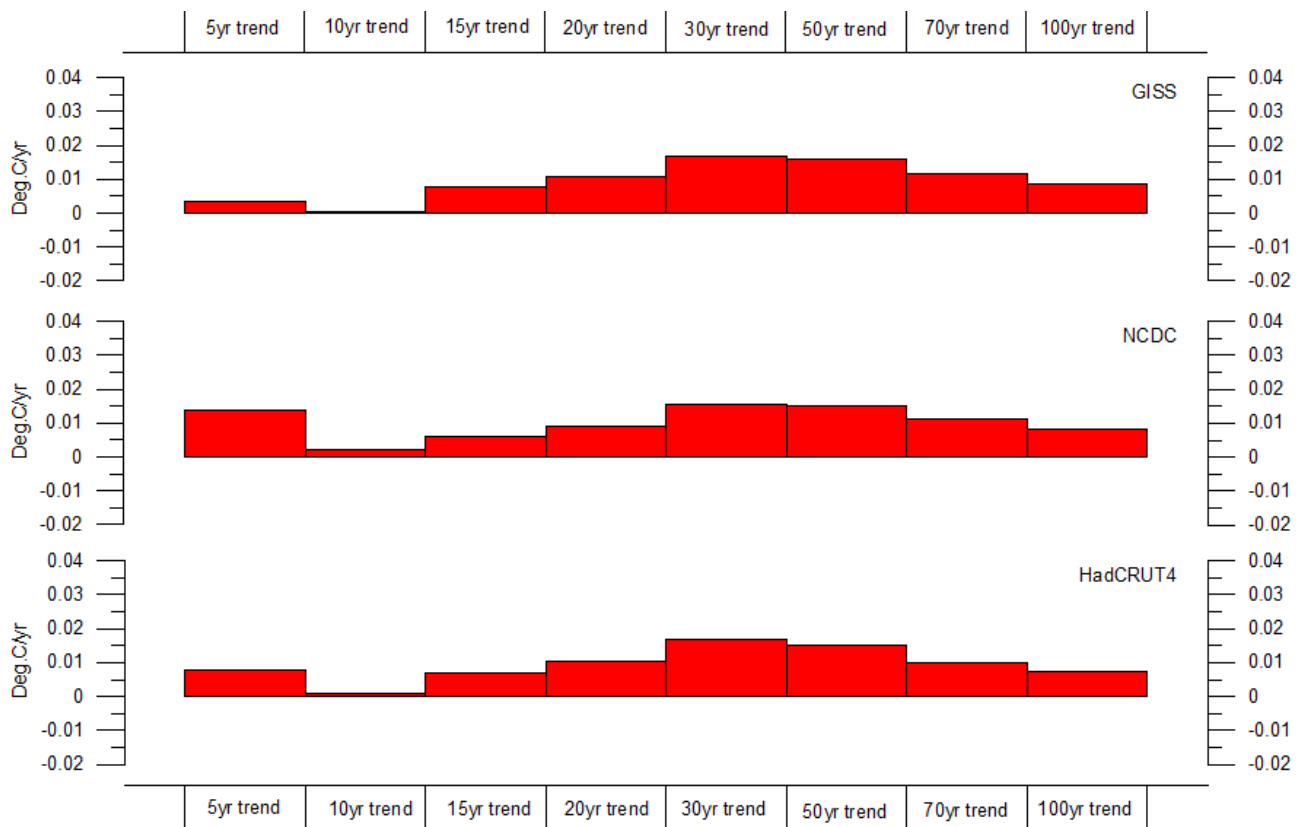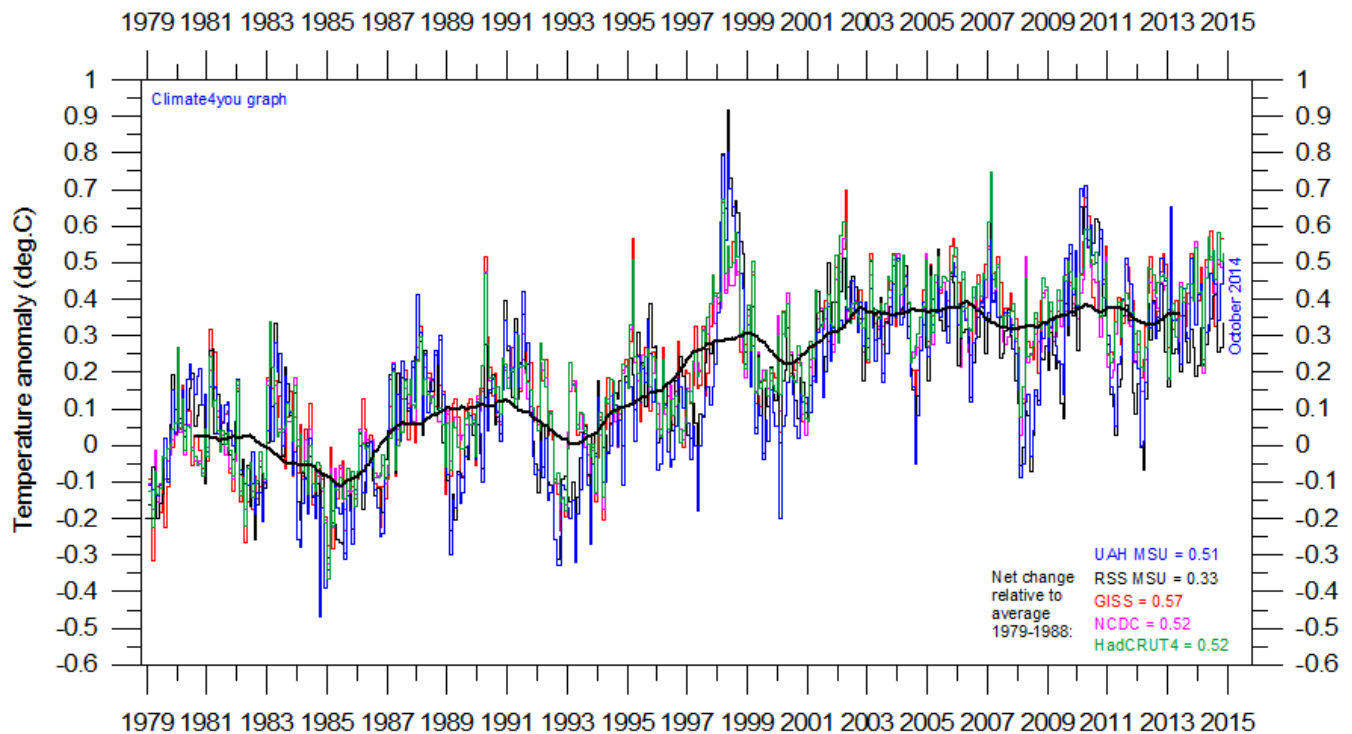
Diagram showing the latest 5, 10, 20, 30, 50, 70 and 100 year linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for three surface-based temperature estimates (GISS, NCDC and HadCRUT4). Last month included in all analyses: September 2014.

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 may be somewhat 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 during the coming years. Time will show which of these two possibilities is correct.

Global sea surface temperature, updated to November 2014

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

RTG_SST Anomaly (0.5 deg X 0.5 deg) for 30 Nov 2014

22:53:16 SUN NOV 30 2014

degrees C
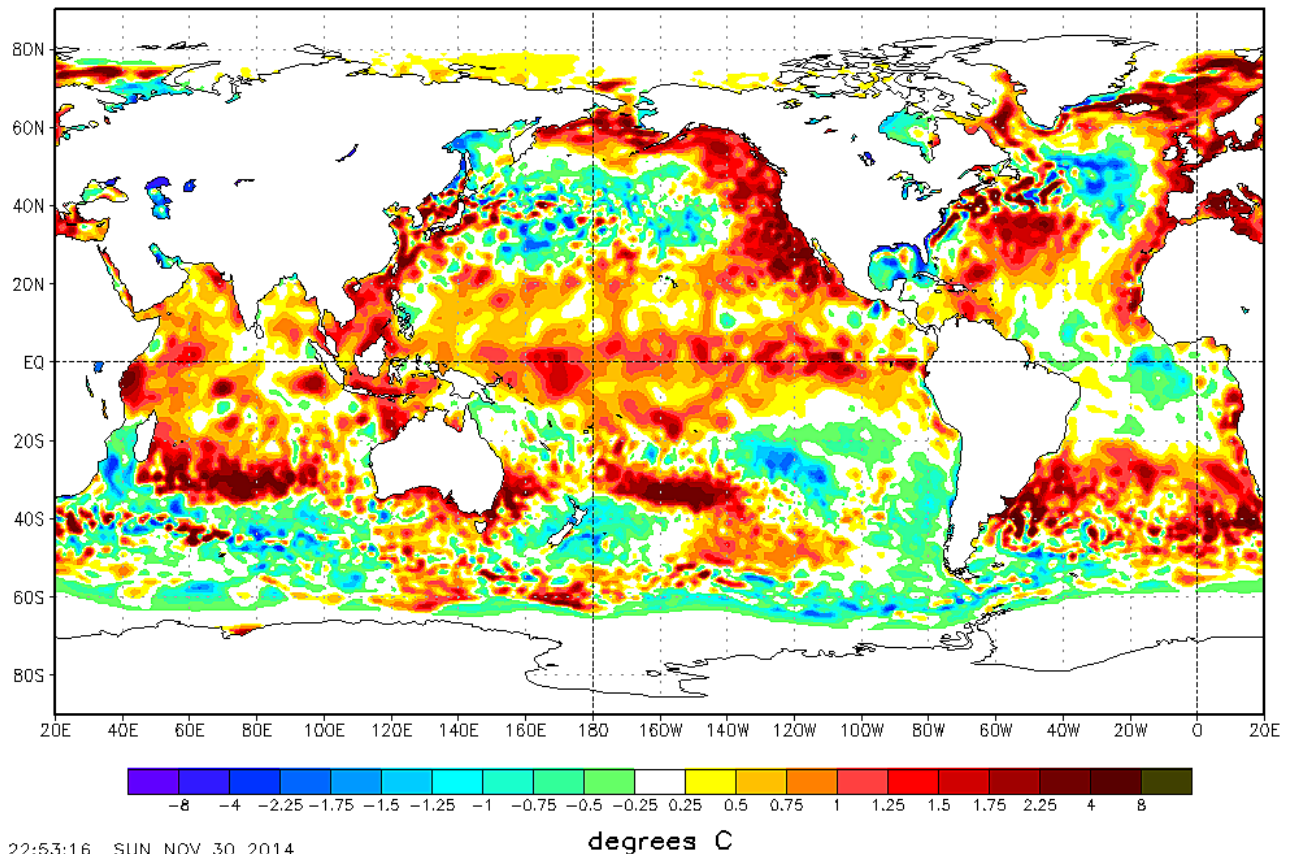
Sea surface temperature anomaly on 30 November 2014. Map source: National Centers for Environmental Prediction (NOAA).

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.4-6).

Relatively warm water is dominating the Pacific Ocean and Indian Ocean near the Equator, and is influencing global air temperatures now and 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.
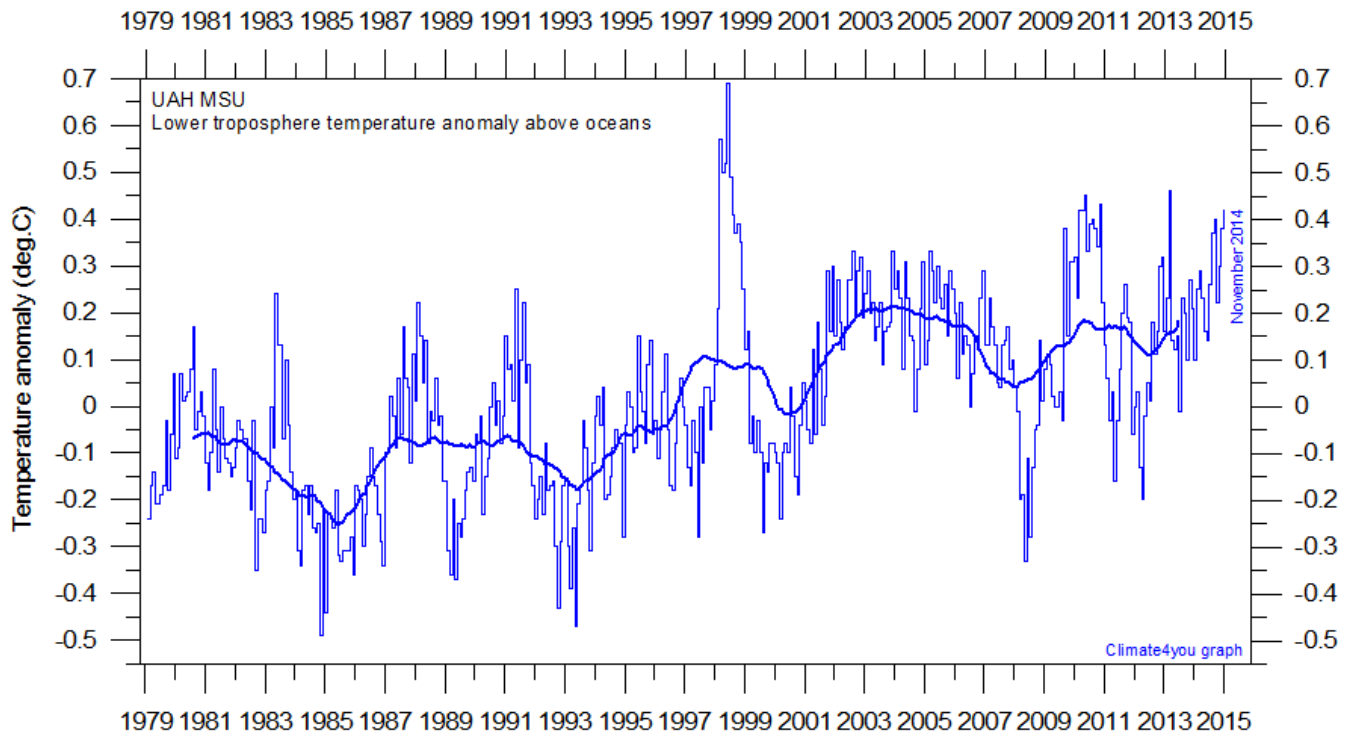
Global monthly average lower troposphere temperature over oceans (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37 month average.
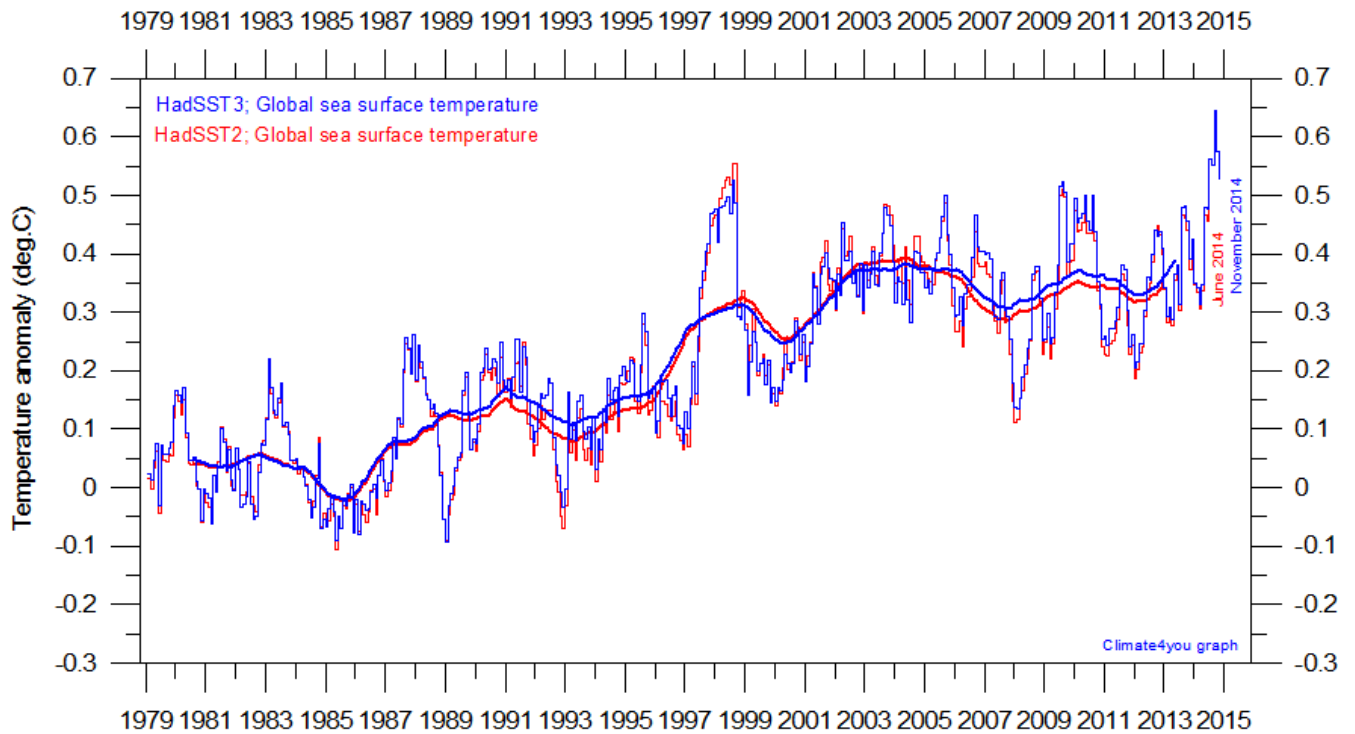
Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37-month average.
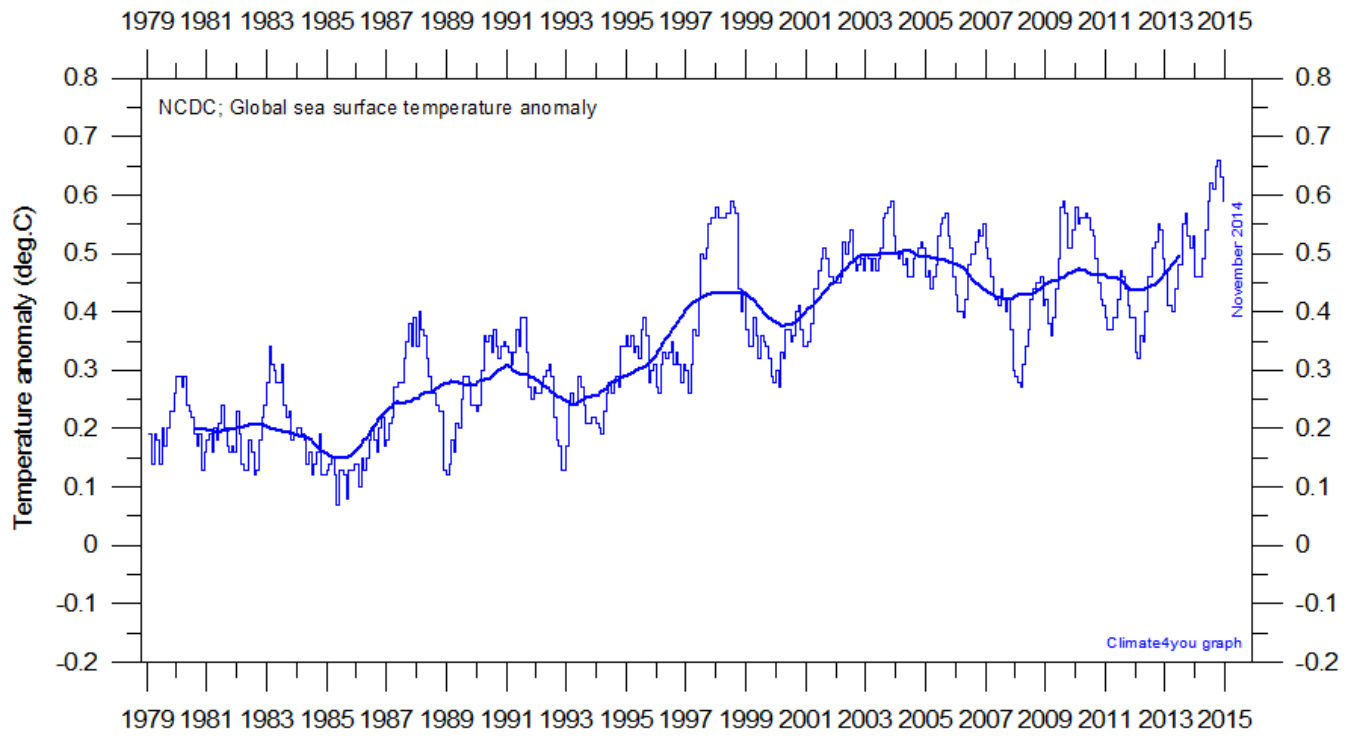
Global monthly average sea surface temperature since 1979 according to the National Climatic Data Center (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37-month average.

Ocean temperature anomaly uppermost 100 and 700 m, updated to September 2014
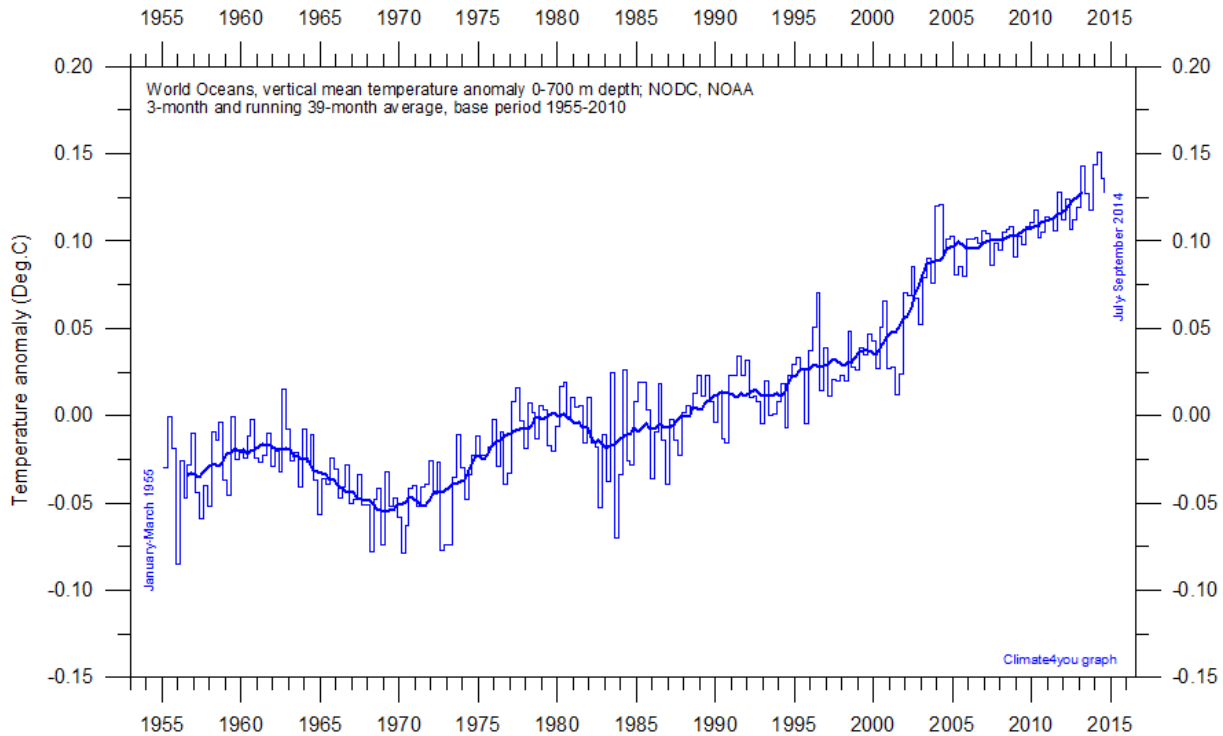
World Oceans vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: _NOAA National Oceanographic Data Center_ (NODC). Base period 1955-2010.
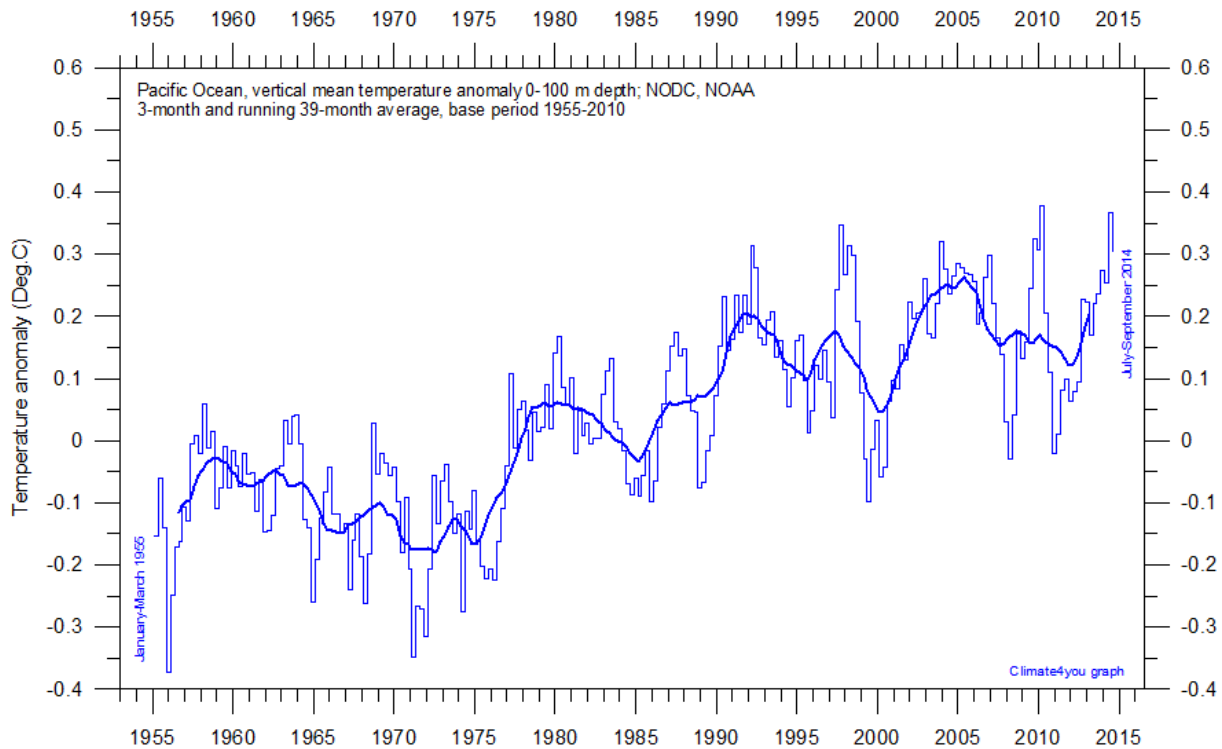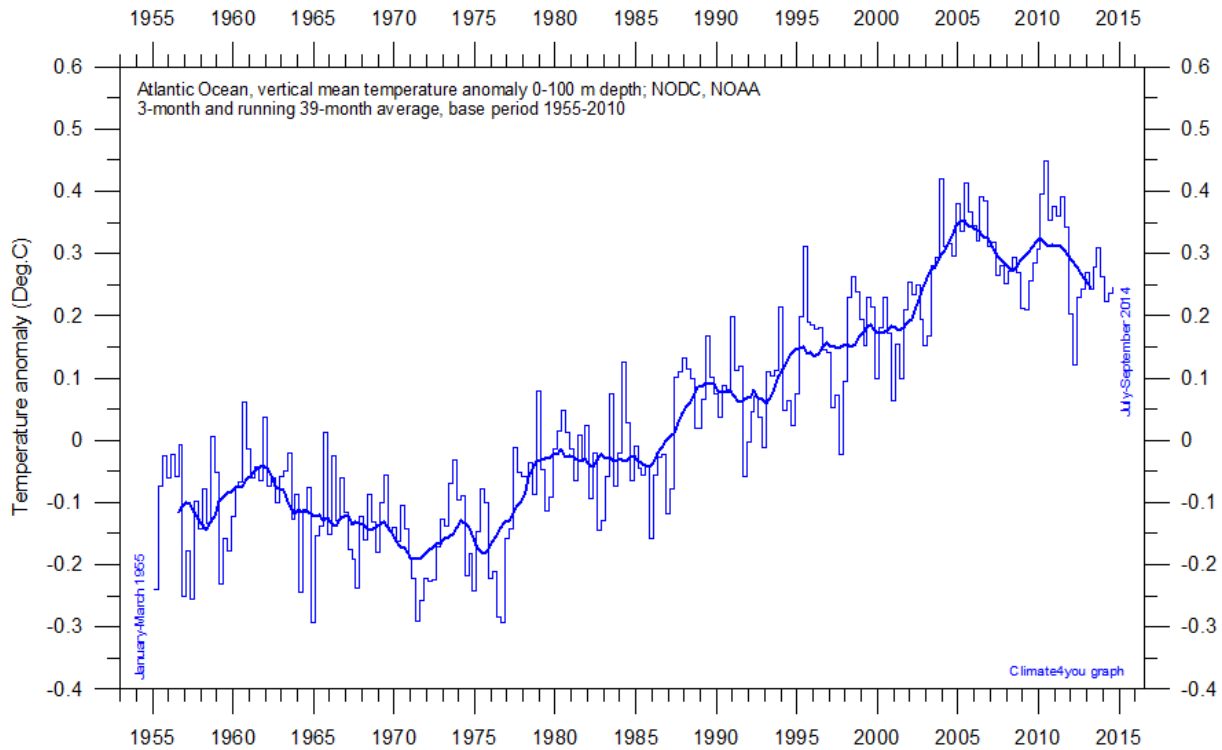
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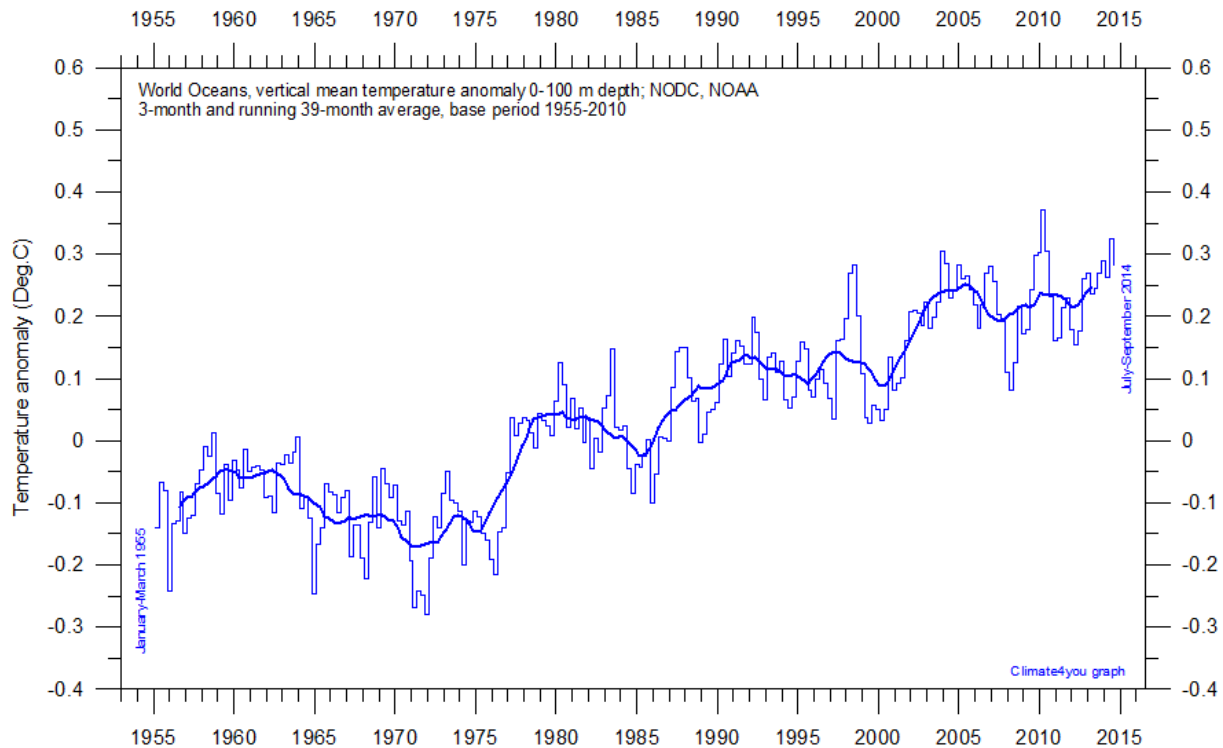
World Oceans vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: _NOAA National Oceanographic Data Center_ (NODC). Base period 1955-2010.

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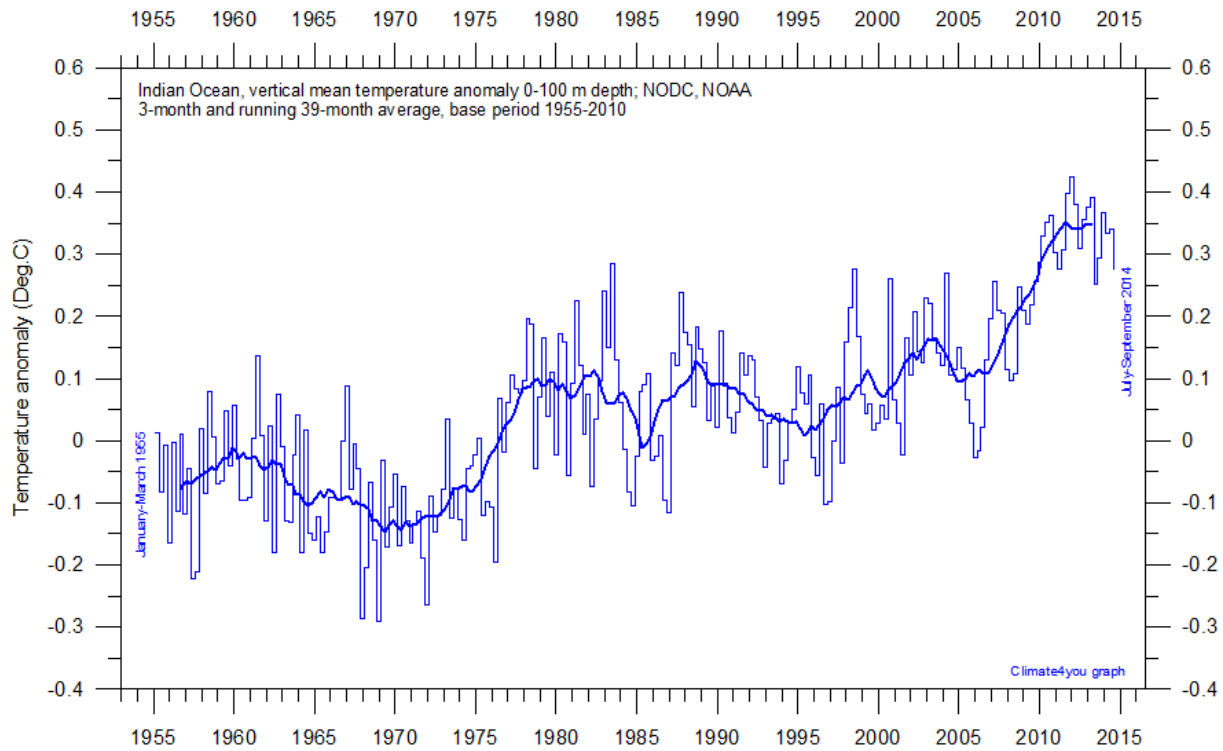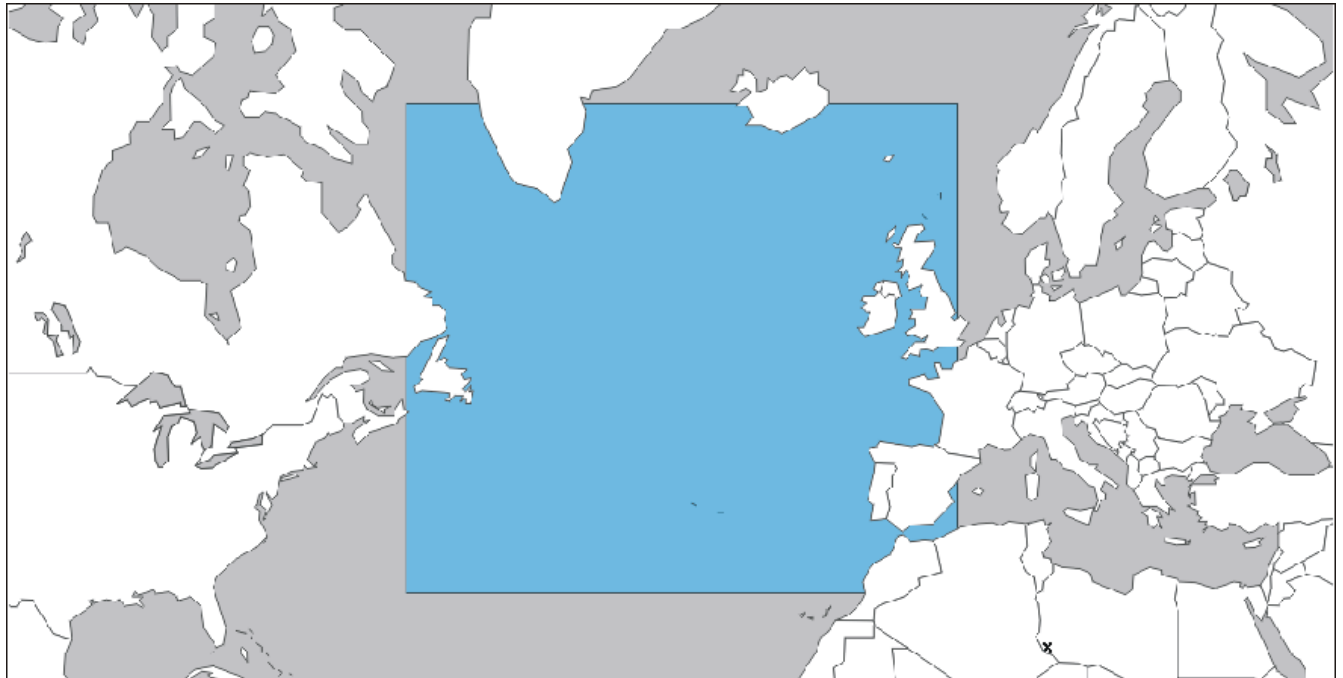
Atlantic Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: *NOAA National Oceanographic Data Center* (NODC). Base period 1955-2010.
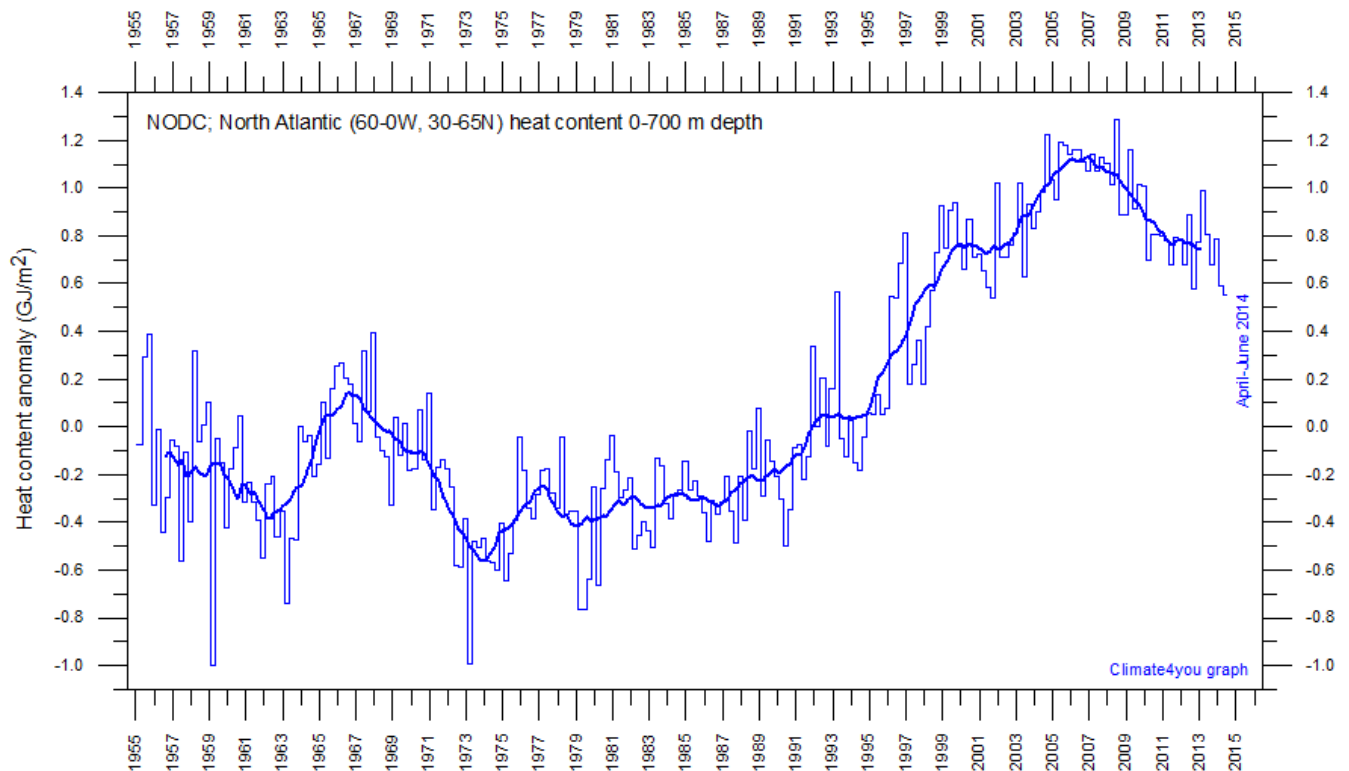
Indian Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center](#) (NODC). Base period 1955-2010.

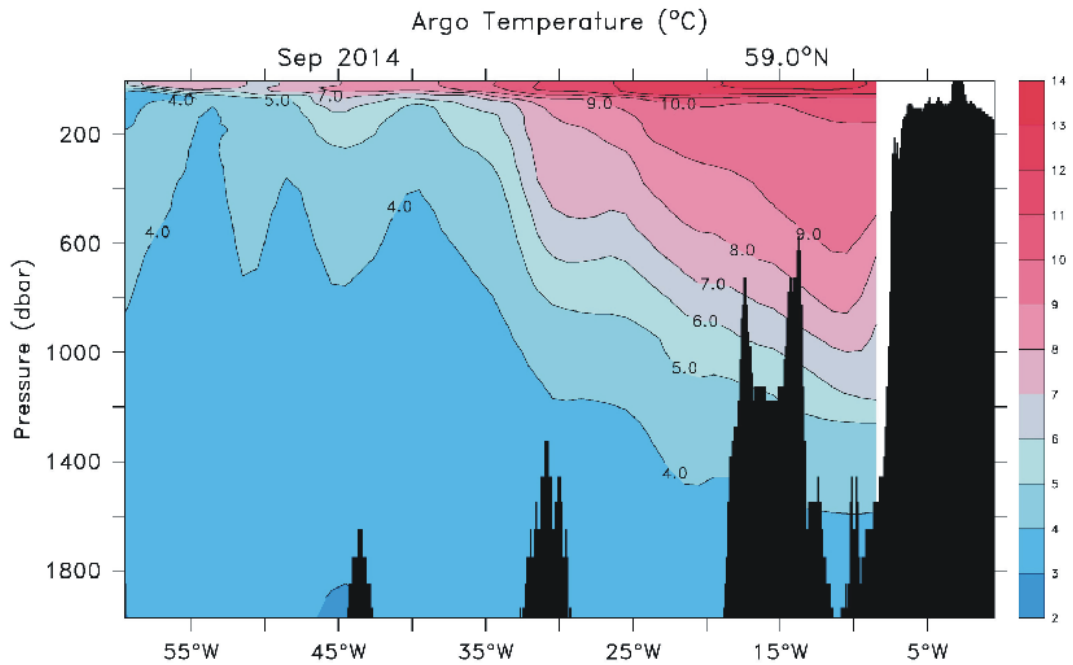**North Atlantic heat content uppermost 700 m, updated to June 2014**

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).

Depth-temperature diagram along 59 N across the North Atlantic, extending from northern Labrador in the west to northern Scotland in the east, using Argo-data. The uppermost panel shows the temperature, and the lower diagram shows the temperature anomaly, using the monthly average temperature 2004-2013 as reference. Source: Global Marine Argo Atlas.

North Atlantic sea temperatures 30-0W at 59N, updated to September 2014
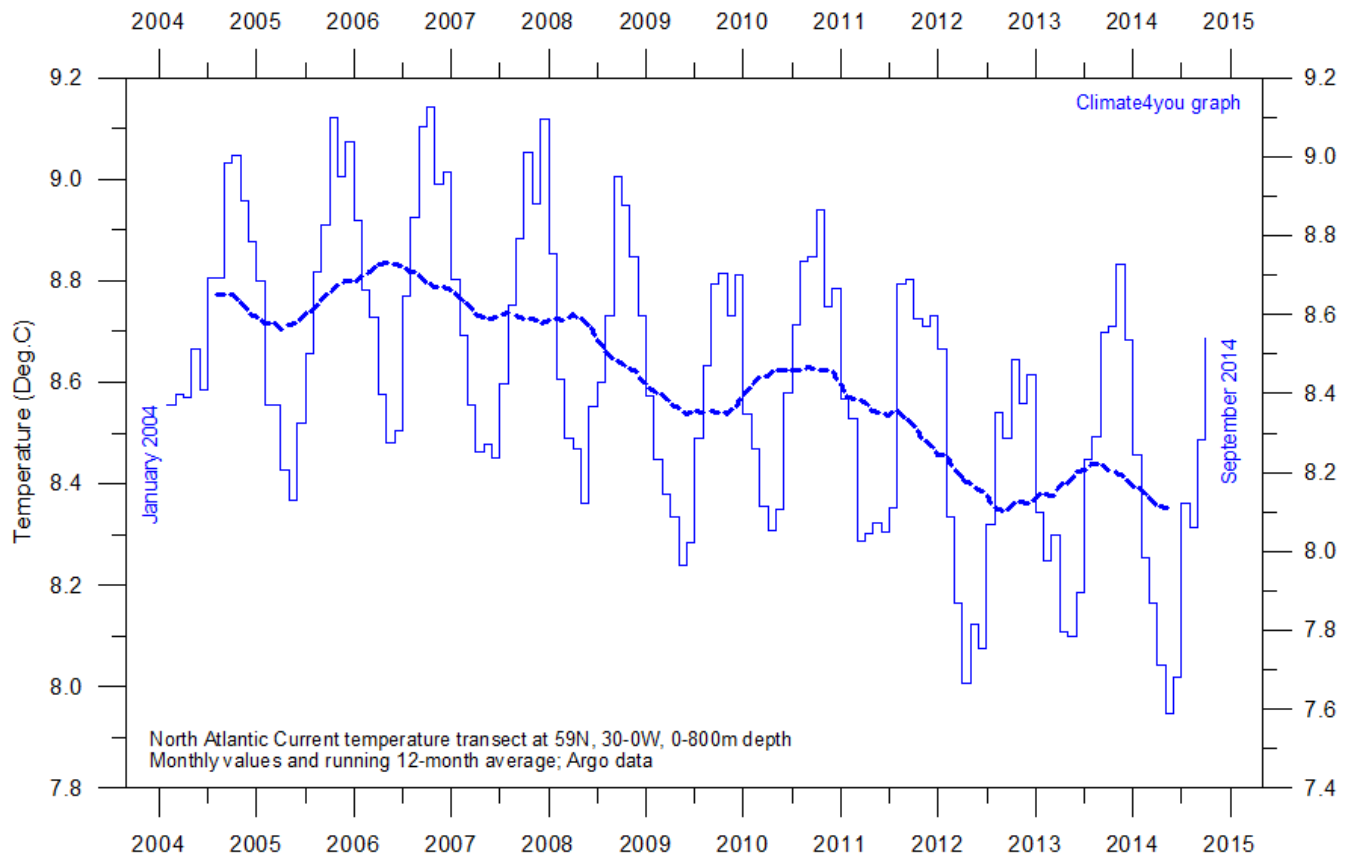
Average temperature along 59 N, 30-0W, 0-800m depth, corresponding to the main part of the North Atlantic Current, using Argo-data. Source: Global Marine Argo Atlas. Additional information can be found in: Roemmich, D. and J. Gilson, 2009. The 2004-2008 mean and annual cycle of temperature, salinity, and steric height in the global ocean from the Argo Program. Progress in Oceanography, 82, 81-100.

Troposphere and stratosphere temperatures from satellites, updated to November 2014
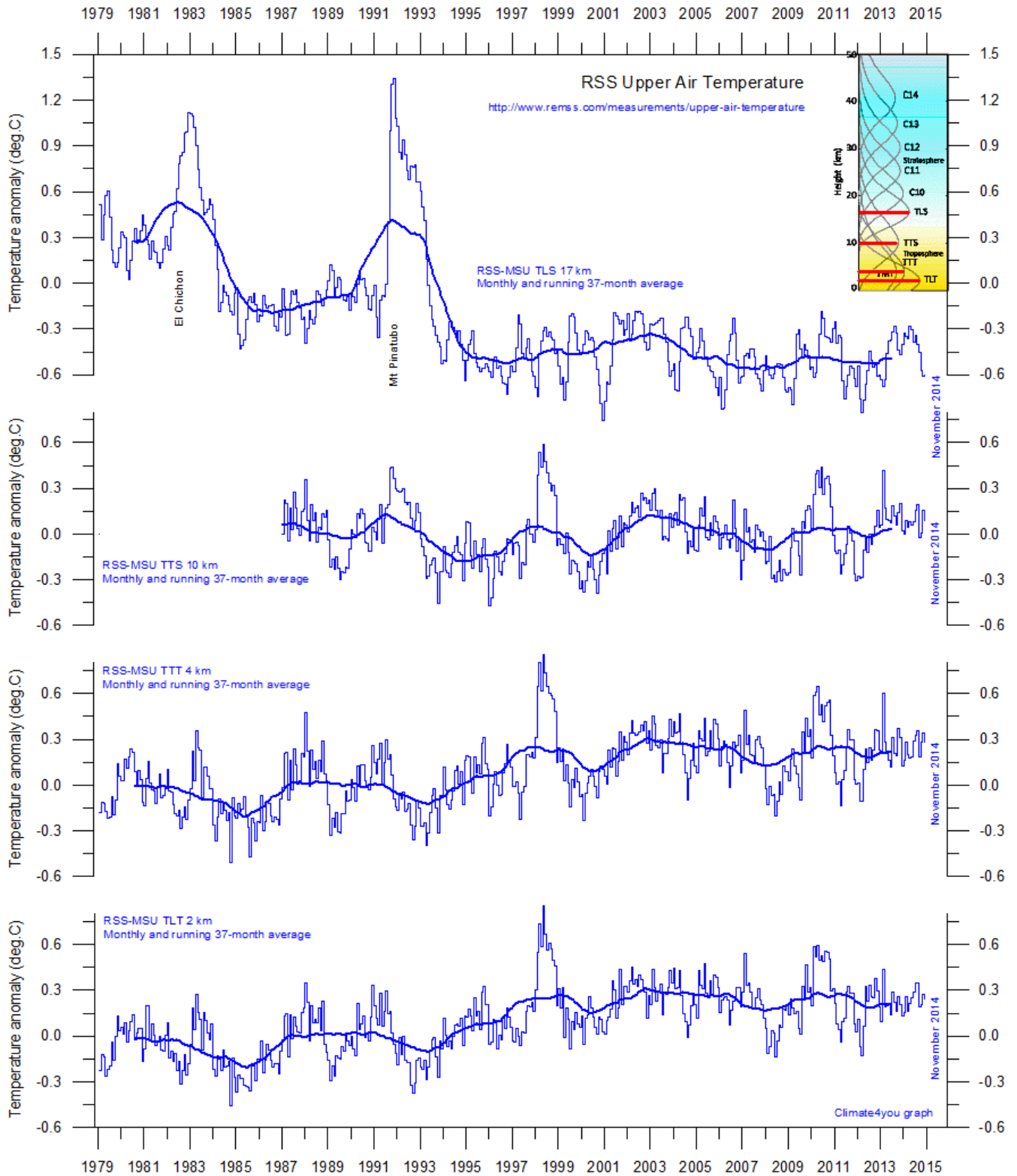
Global monthly average temperature in different altitudes according to Remote Sensing Systems (RSS). The thin lines represent the monthly average, and the thick line the simple running 37 month average, nearly corresponding to a running 3 yr average.
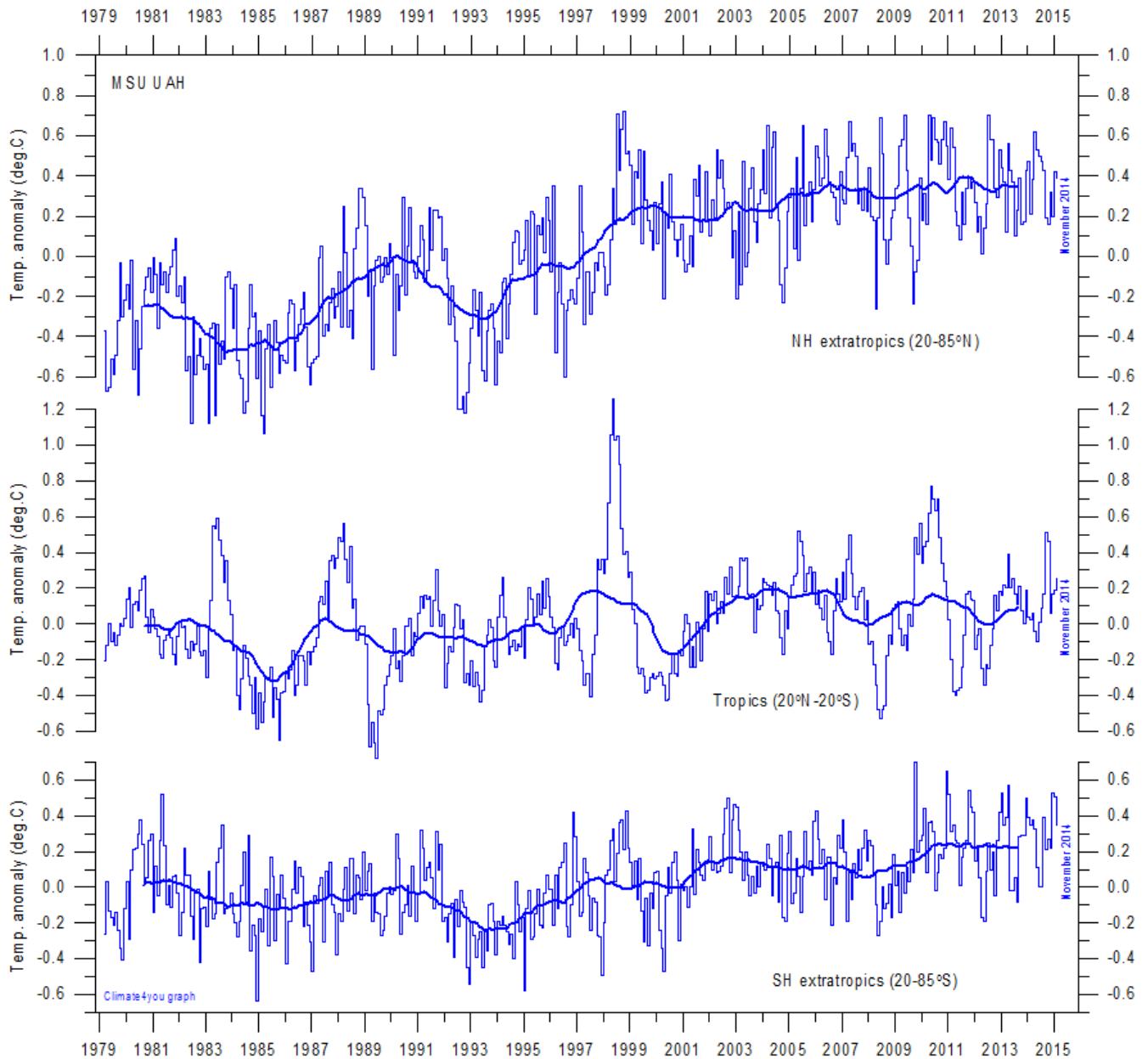
Global monthly average lower troposphere temperature since 1979 for the tropics and the northern and southern extratropics, according to University of Alabama at Huntsville, USA. Thin lines show the monthly temperature. Thick lines represent the simple running 37-month average, nearly corresponding to a running 3 yr average. Reference period 1981-2010.

Arctic and Antarctic lower troposphere temperature, updated to November 2014
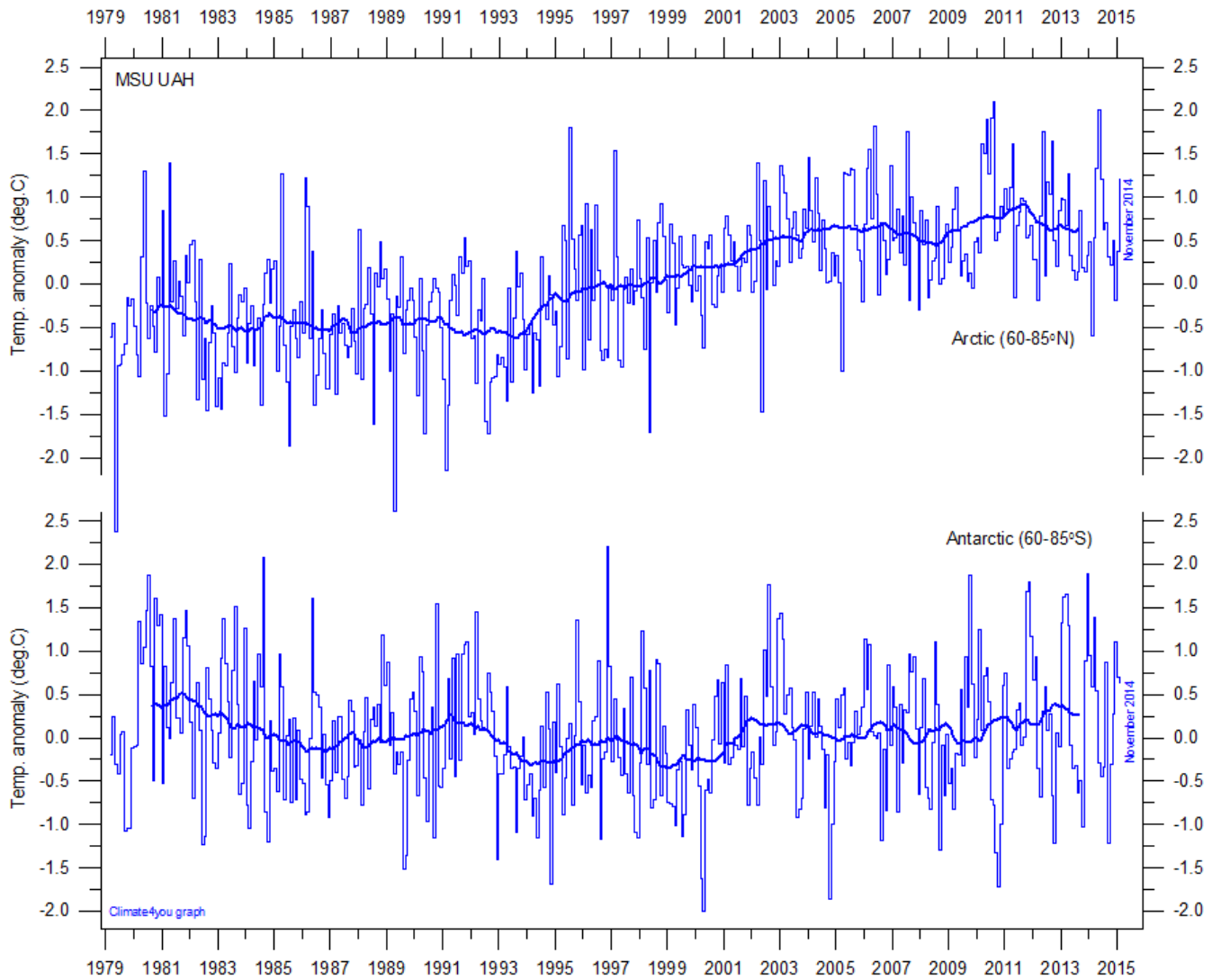
Global monthly average lower troposphere temperature since 1979 for the North Pole and South Pole regions, based on satellite observations (University of Alabama at Huntsville, USA). Thin lines show the monthly temperature. The thick line is the simple running 37-month average, nearly corresponding to a running 3 yr average.

Arctic and Antarctic surface air temperature, updated to October 2014

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 (70-90ºN) 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 (70-90ºN) 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.
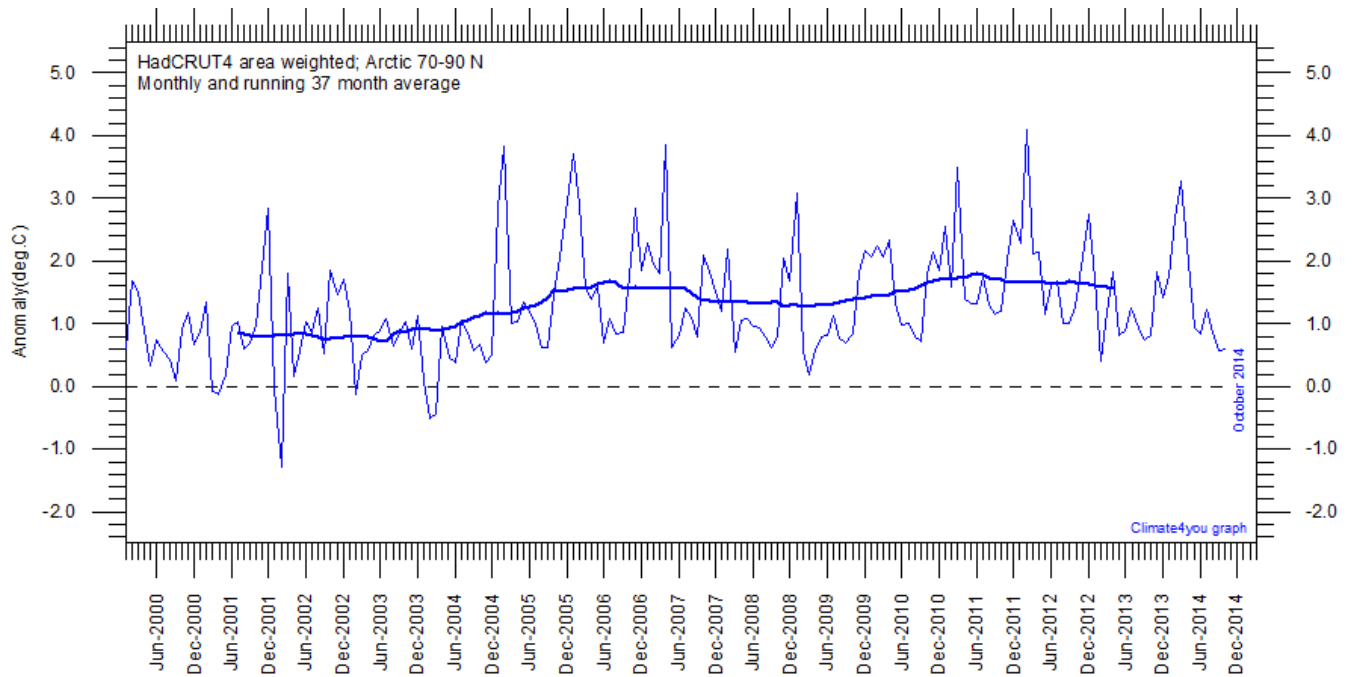
Diagram showing area-weighted Arctic (70-90ºN) monthly surface air temperature anomalies ([HadCRUT4](#)) since January 1920, in relation to the WMO [normal period](#) 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thi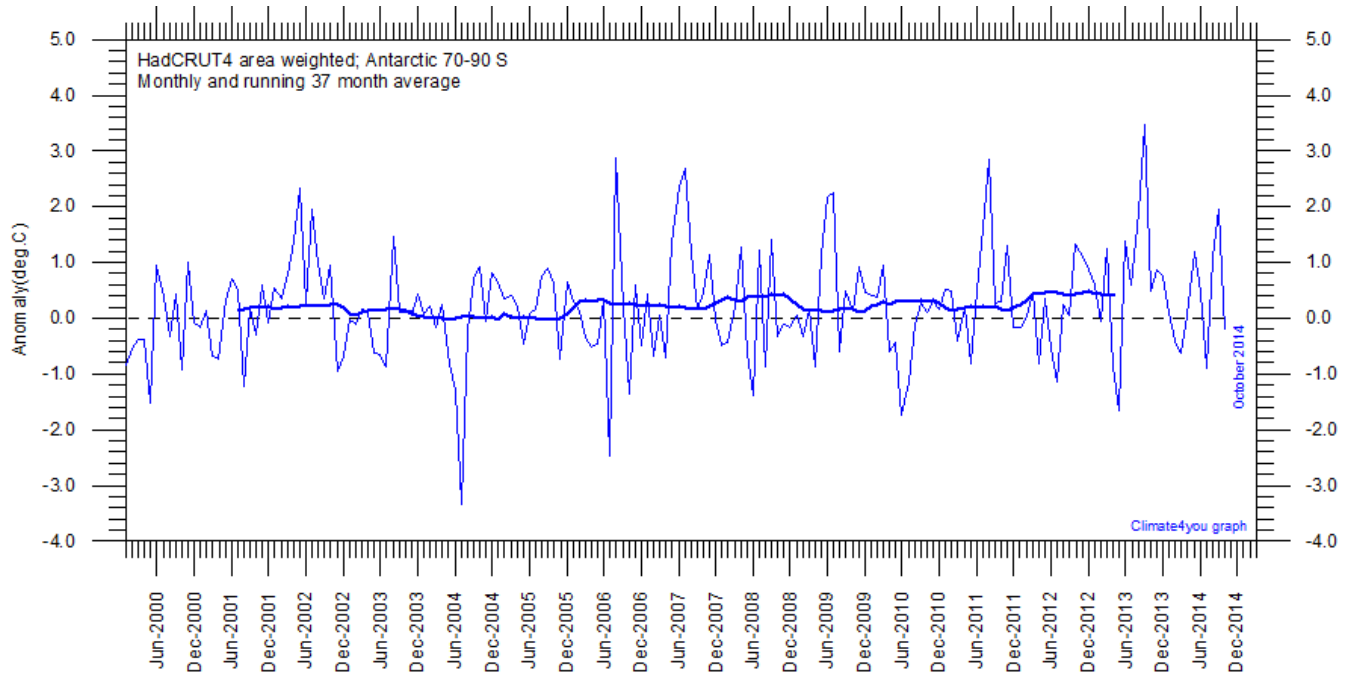cker red l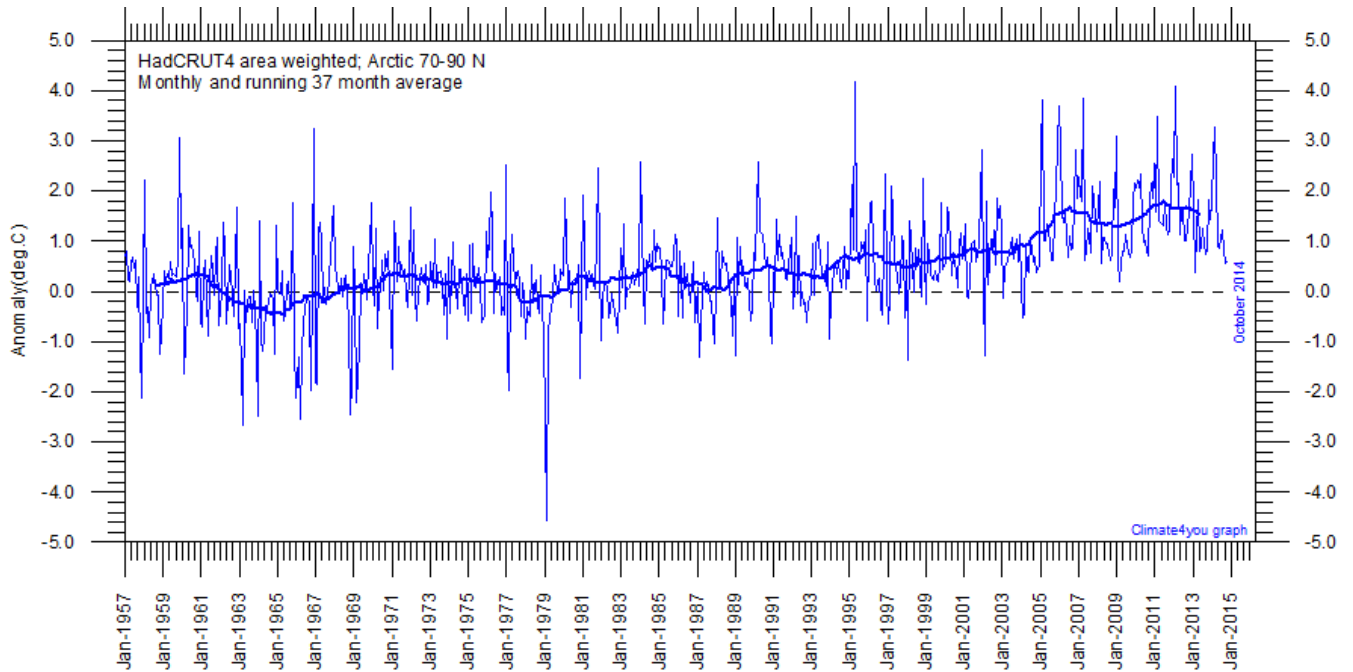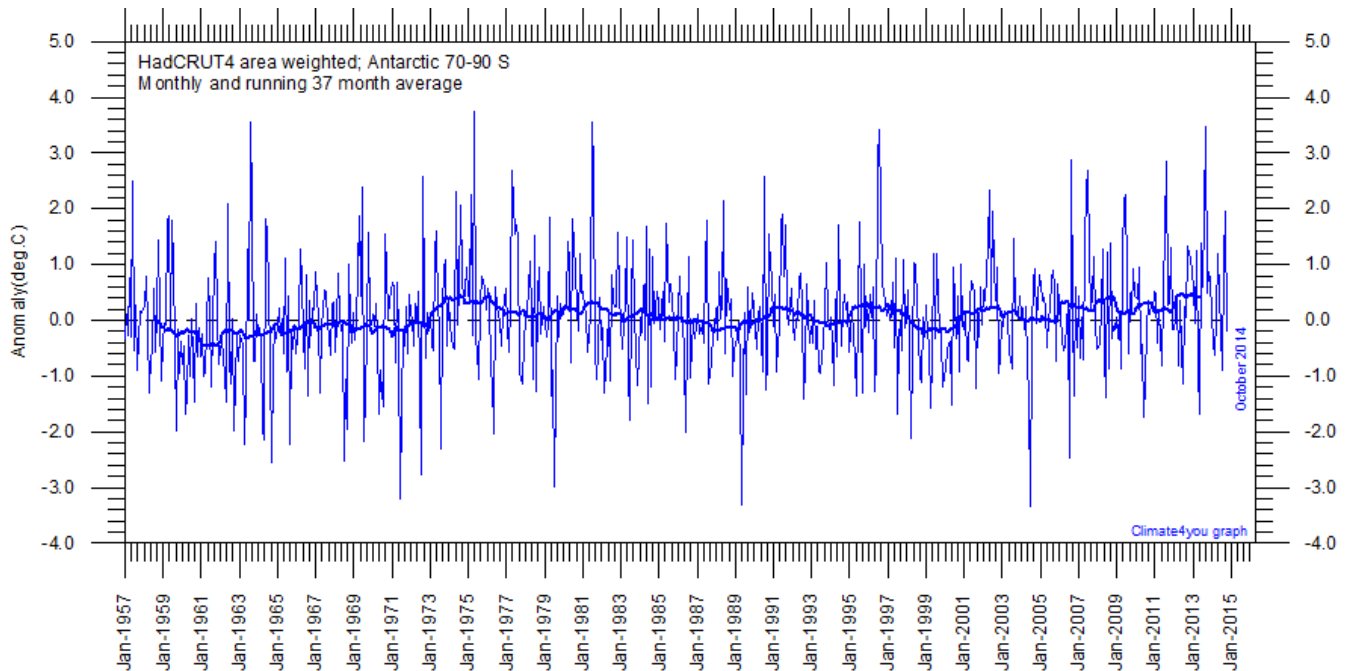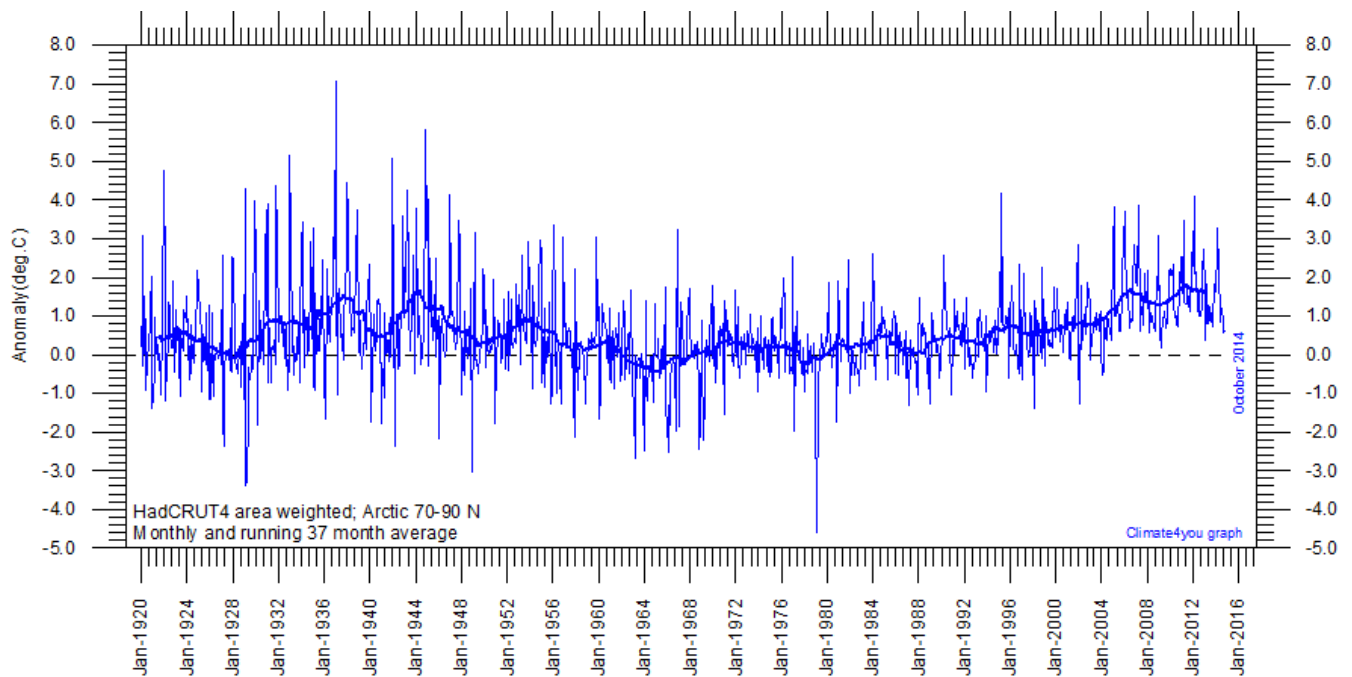ine shows the running 37 month (c.3 yr) average. Because of the relatively small number of Arctic stations before 1930, month-to-month variations in the early part of the temperature record are larger than later. The period from about 1930 saw the establishment of many new Arctic meteorological stations, 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.

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As the HadCRUT4 data series has improved high latitude coverage data coverage (compared to the HadCRUT3 series) the individual 5ºx5º 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 5ºx5º 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 November 2014
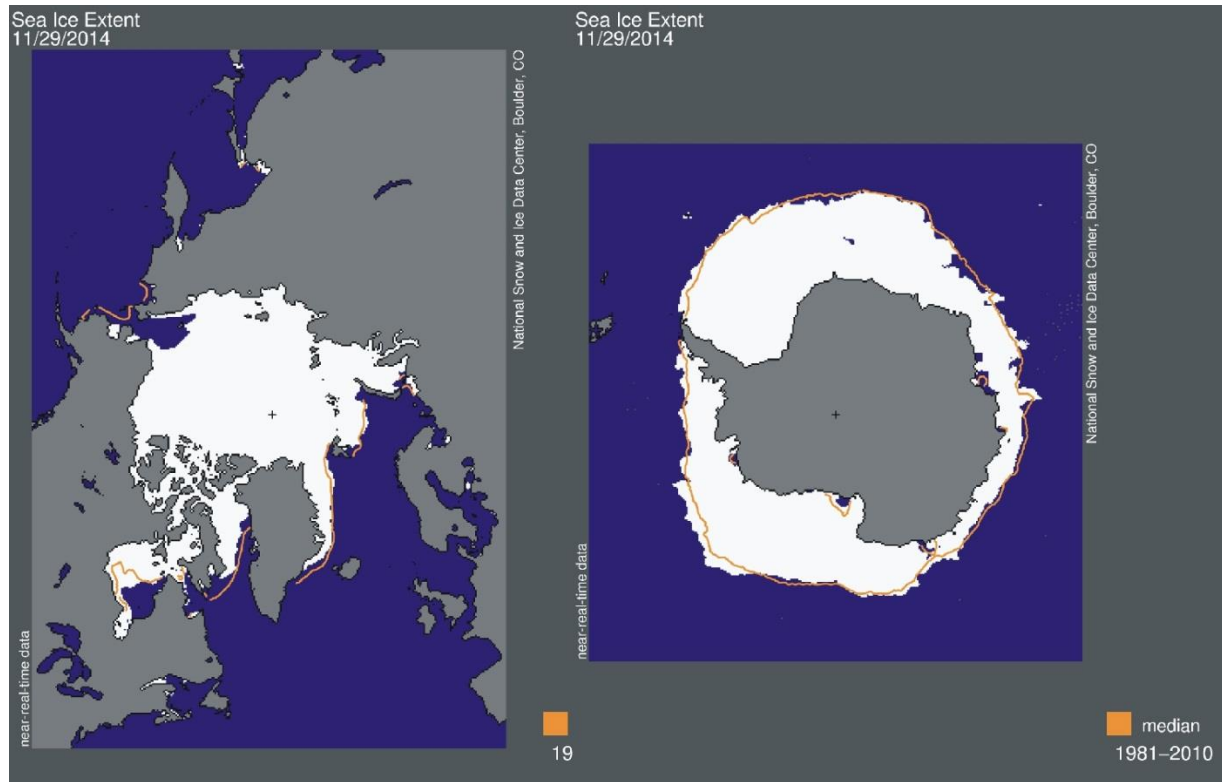
Sea ice extent 29 November 2014. The 'normal' or average limit of sea ice (orange line) is defined as 15% sea ice cover, according to the average of satellite observations 1981-2010 (both years inclusive). Sea ice may therefore well be encountered outside and open water areas inside the limit shown in the diagrams above. Map source: National Snow and Ice Data Center (NSIDC).
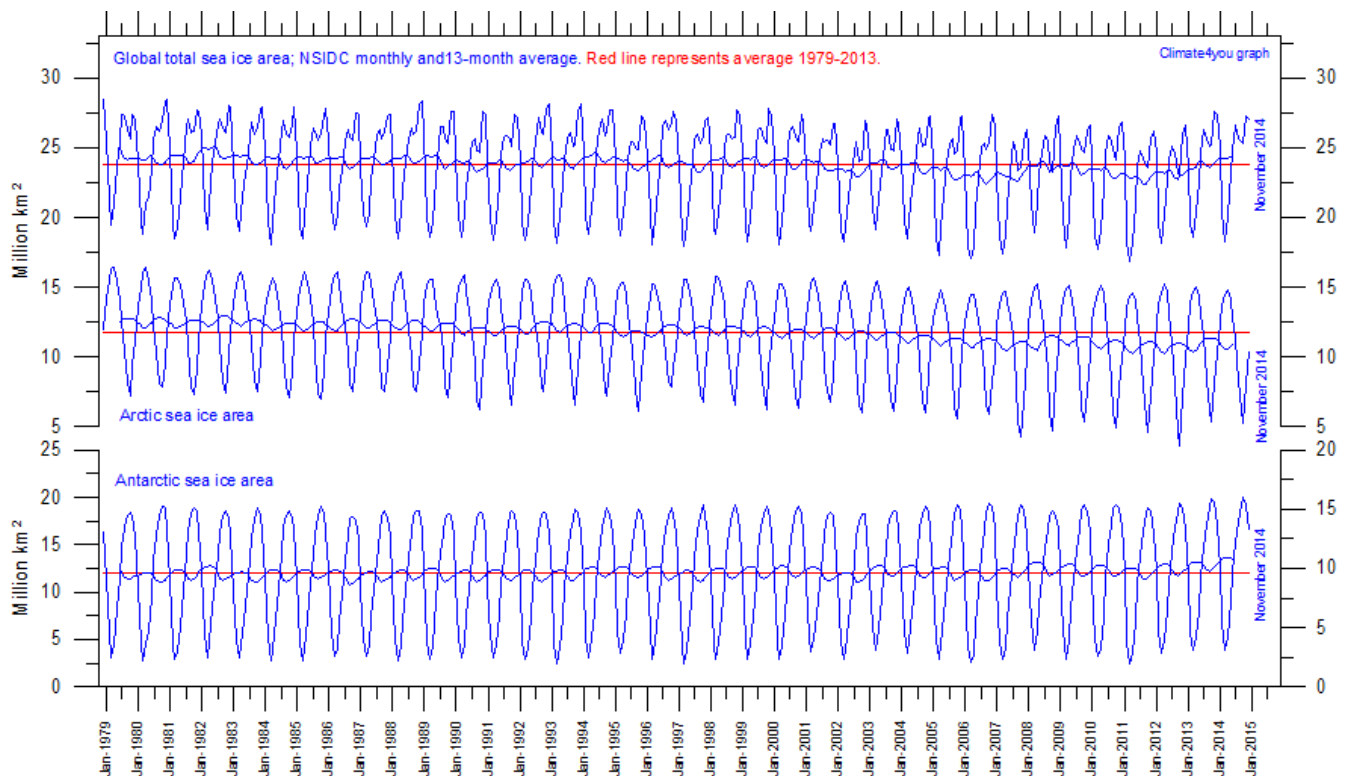
Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the National Snow and Ice data Center (NSIDC).
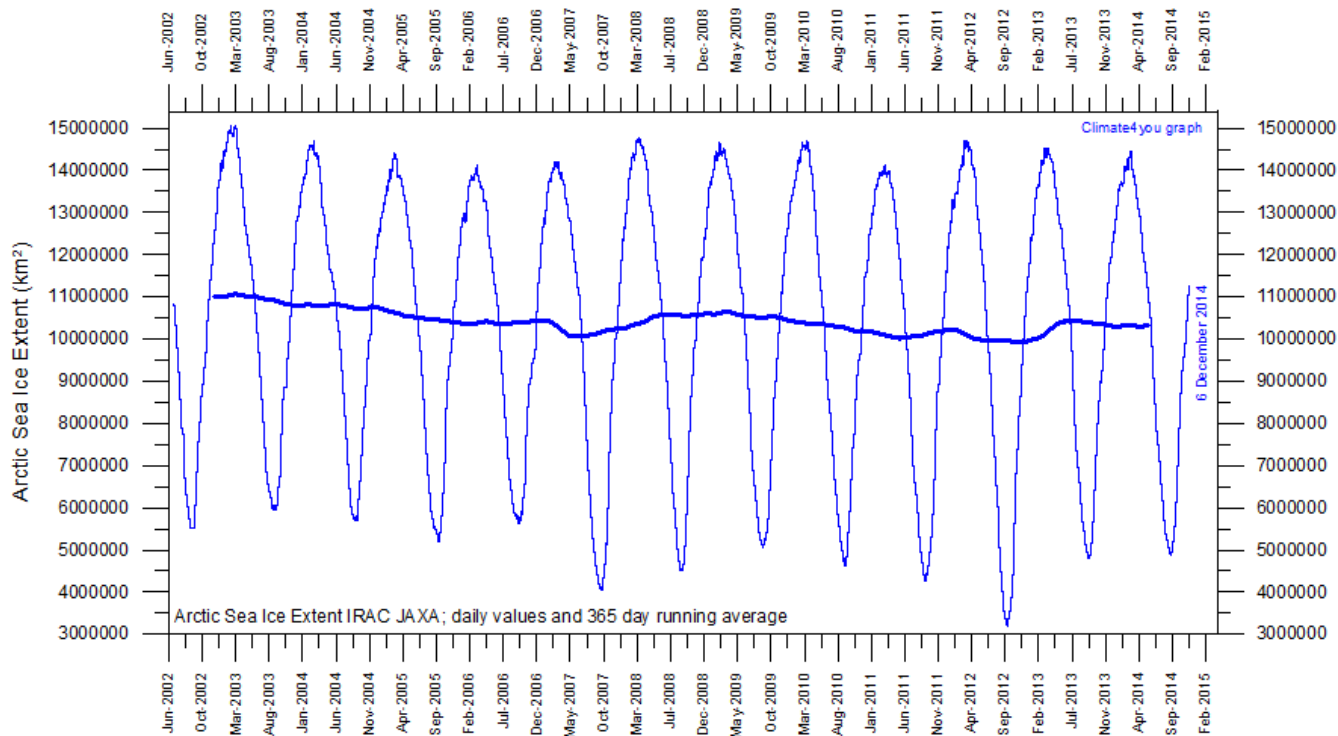
Graph showing daily Arctic sea ice extent since June 2002, to 6 December 2014, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).
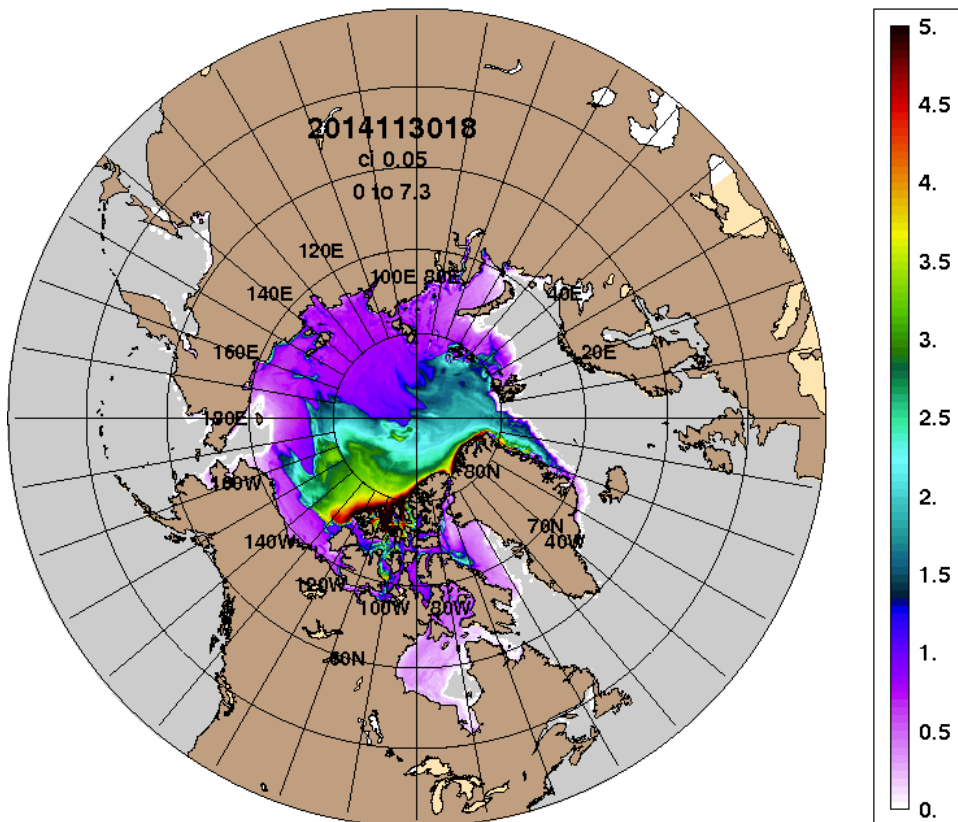
Northern hemisphere sea ice extension and thickness on 30 November 2014 according to the [Arctic Cap Nowcast/Forecast System](#) (ACNFS), US Naval Research Laboratory. Thickness scale (m) to the right.

12 month average sea ice extension (Mill. km^2); NSIDC

Southern Hemisphere

Northern Hemisphere

Million km²

October 1979

October 1979

November 2014

November 2014

Climate4you graph
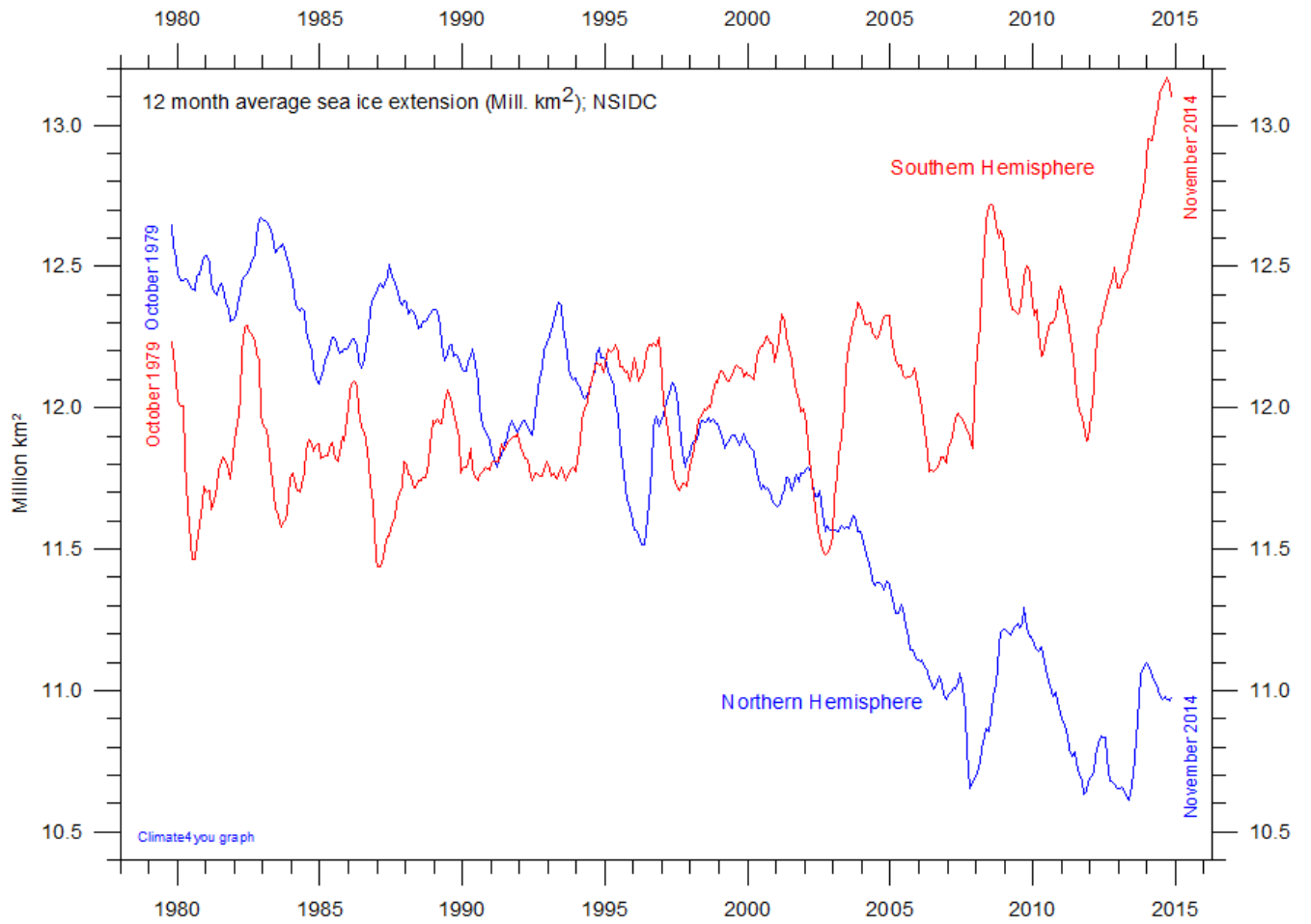
12 month running average sea ice extension in both hemispheres since 1979, the satellite-era. The October 1979 value represents the monthly average of November 1978 - October 1979, the November 1979 value represents the average of December 1978 - November 1979, etc. Last month included in the 12-month calculations: November 2014. Data source: National Snow and Ice Data Center (NSIDC).

Global sea level, updated to August 2014
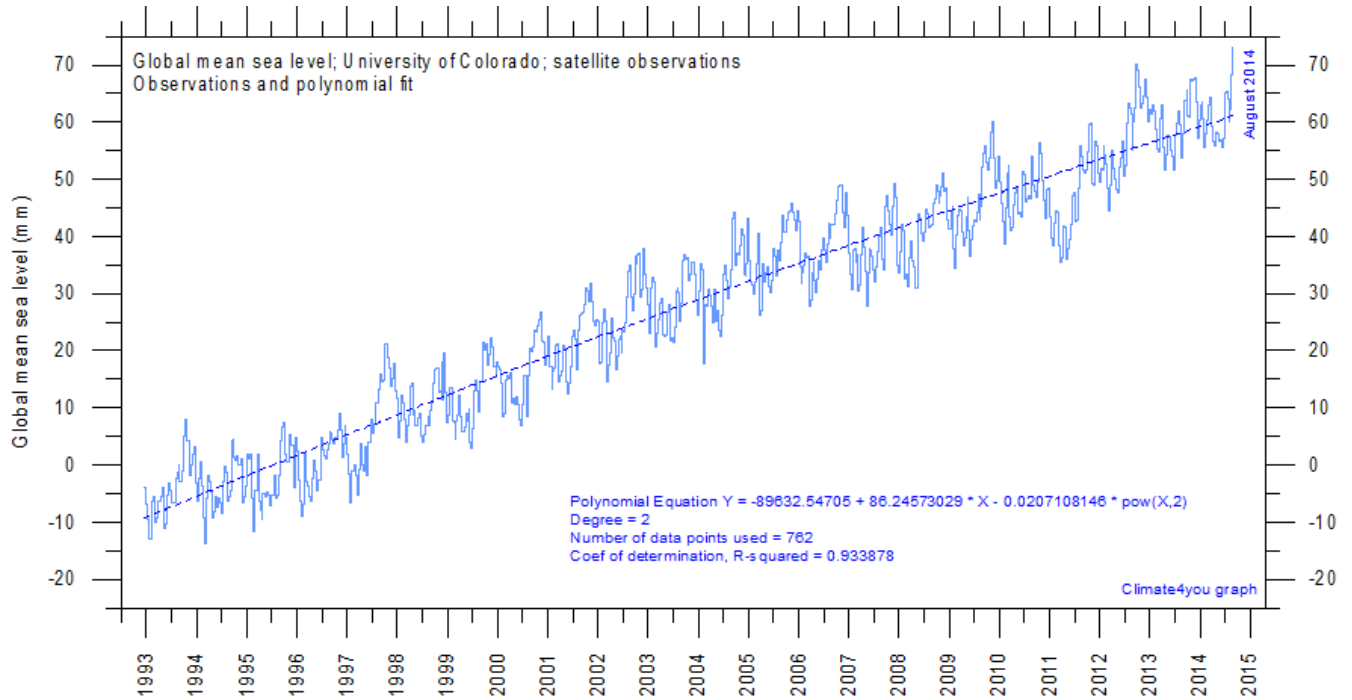
Global sea level (thin line) since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder. The thick stippled line represents a two-degree polynomium. The polynomium suggests the rate of the ongoing global sea level rise to be slowly decreasing. Time is shown along the x-axis as fractions of calendar years.

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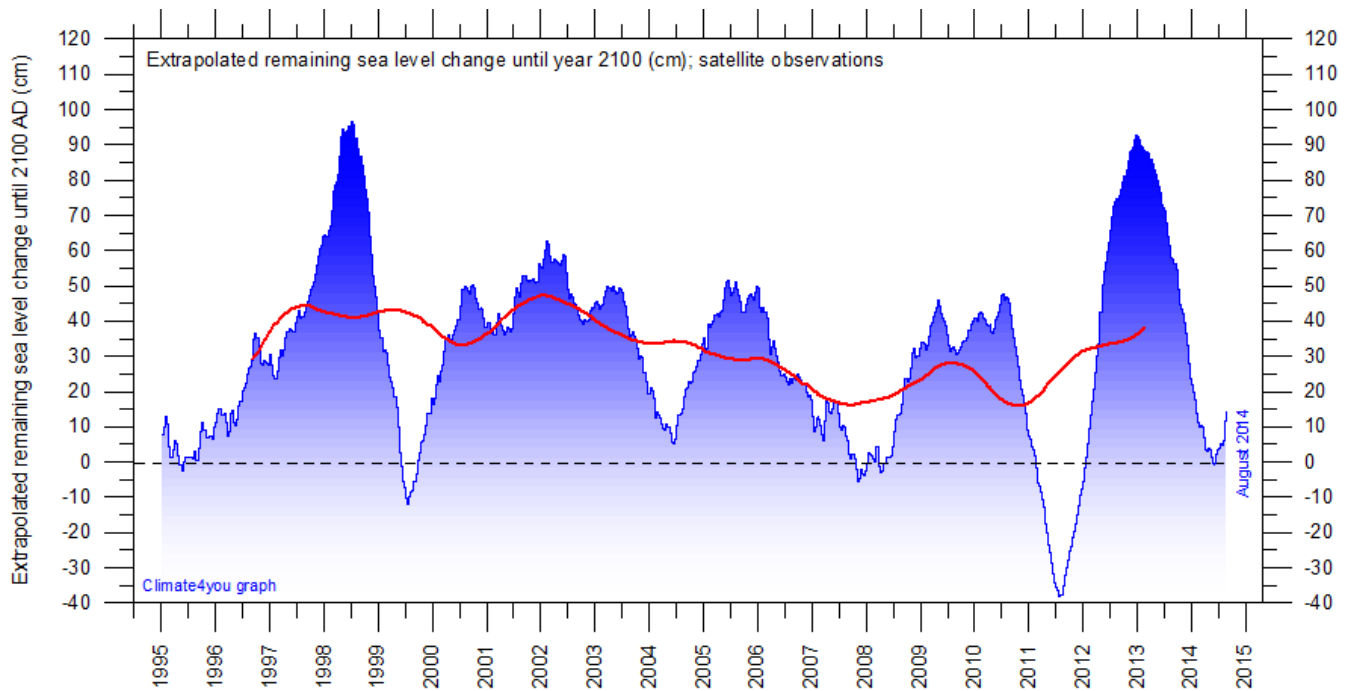
Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based on this (thick line), the present simple empirical forecast of sea level change until 2100 is about +38 cm.

Northern Hemisphere weekly snow cover, updated to early December 2014
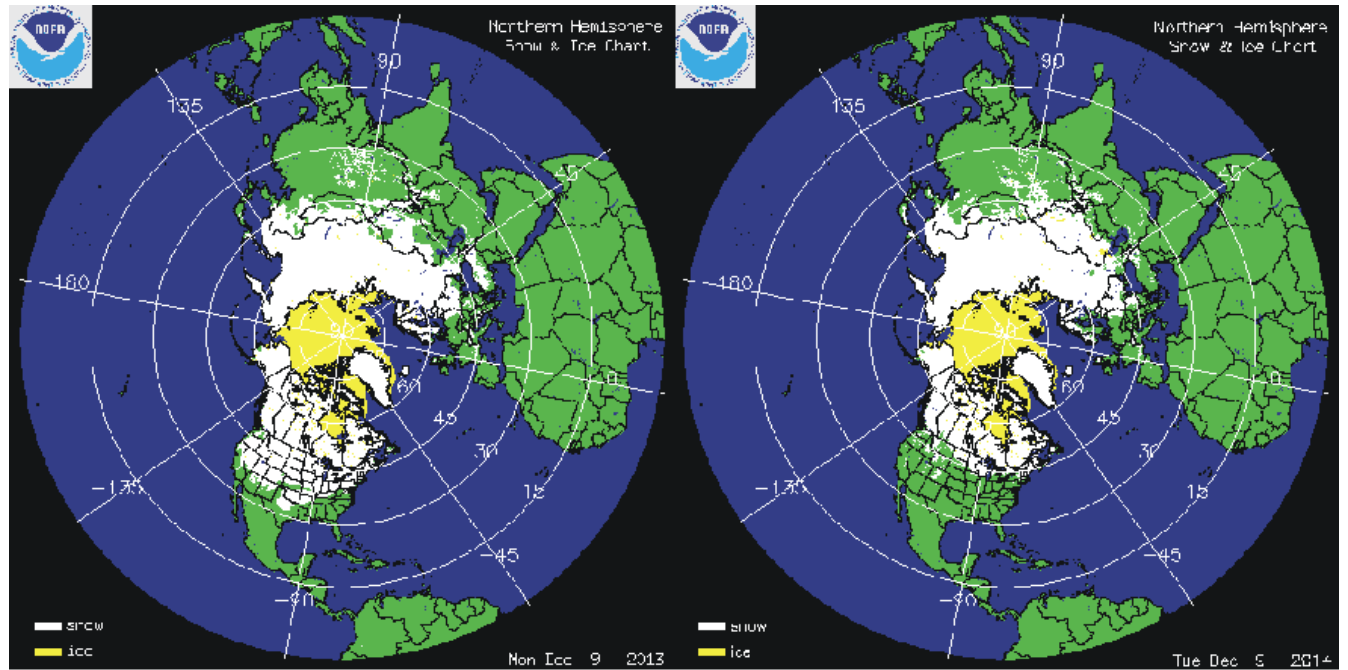
Northern hemisphere snow cover (white) and sea ice (yellow) 9 December 2013 (left) and 2014 (right). Map source: National Ice Center (NIC).
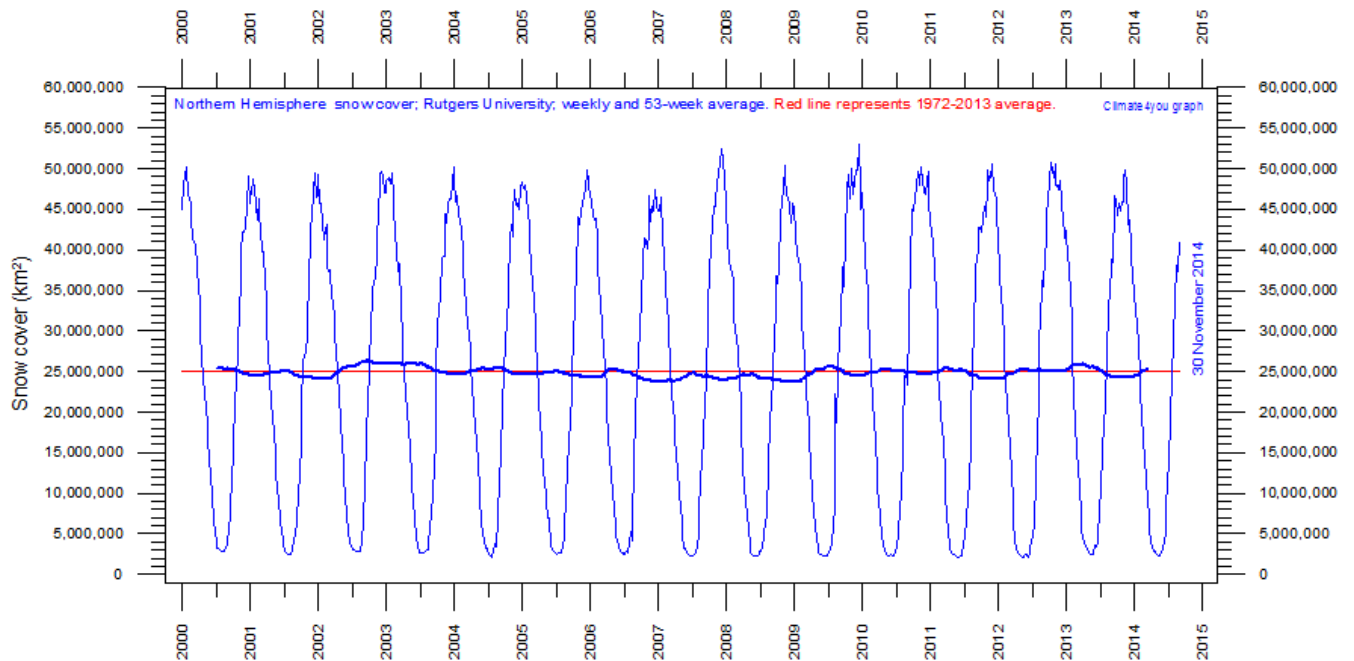
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53-week average (approximately 1 year). The horizontal red line is the 1972-2013 average.
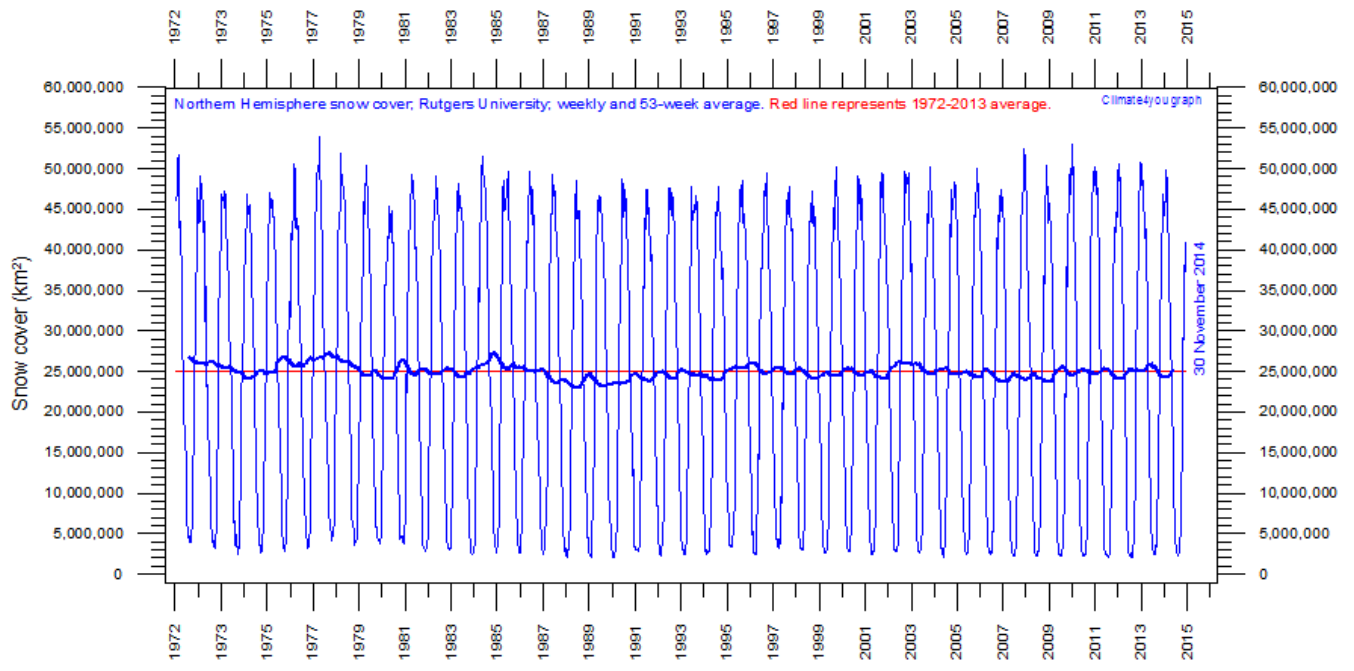
Northern hemisphere weekly snow cover since January 1972 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53-week average (approximately 1 year). The horizontal red line is the 1972-2013 average.

Atmospheric specific humidity, updated to November 2014
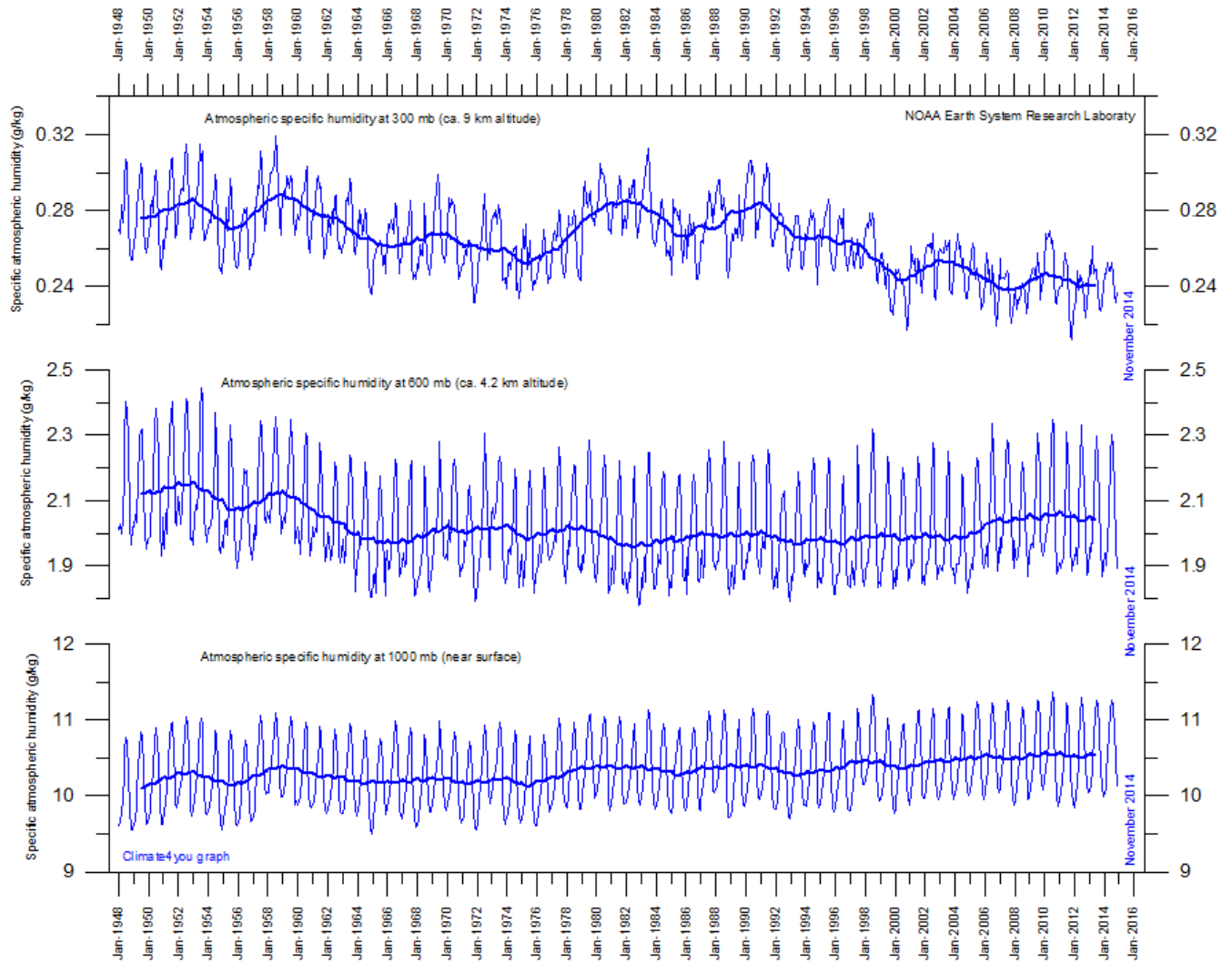
Specific atmospheric humidity (g/kg) at three different altitudes in the lower part of the atmosphere (_the Troposphere_) since January 1948 (_Kalnay et al. 1996_). The thin blue lines shows monthly values, while the thick blue lines show the running 37-month average (about 3 years). Data source: _Earth System Research Laboratory (NOAA)_.

Atmospheric CO₂, updated to November 2014

Atmospheric CO₂; monthly and 37 month average
Mauna Loa Hawaii

November 2014

Climate4you graph

12 month change of atmospheric CO2 (ppm)
Mauna Loa Hawaii

November 2014

Climate4you graph
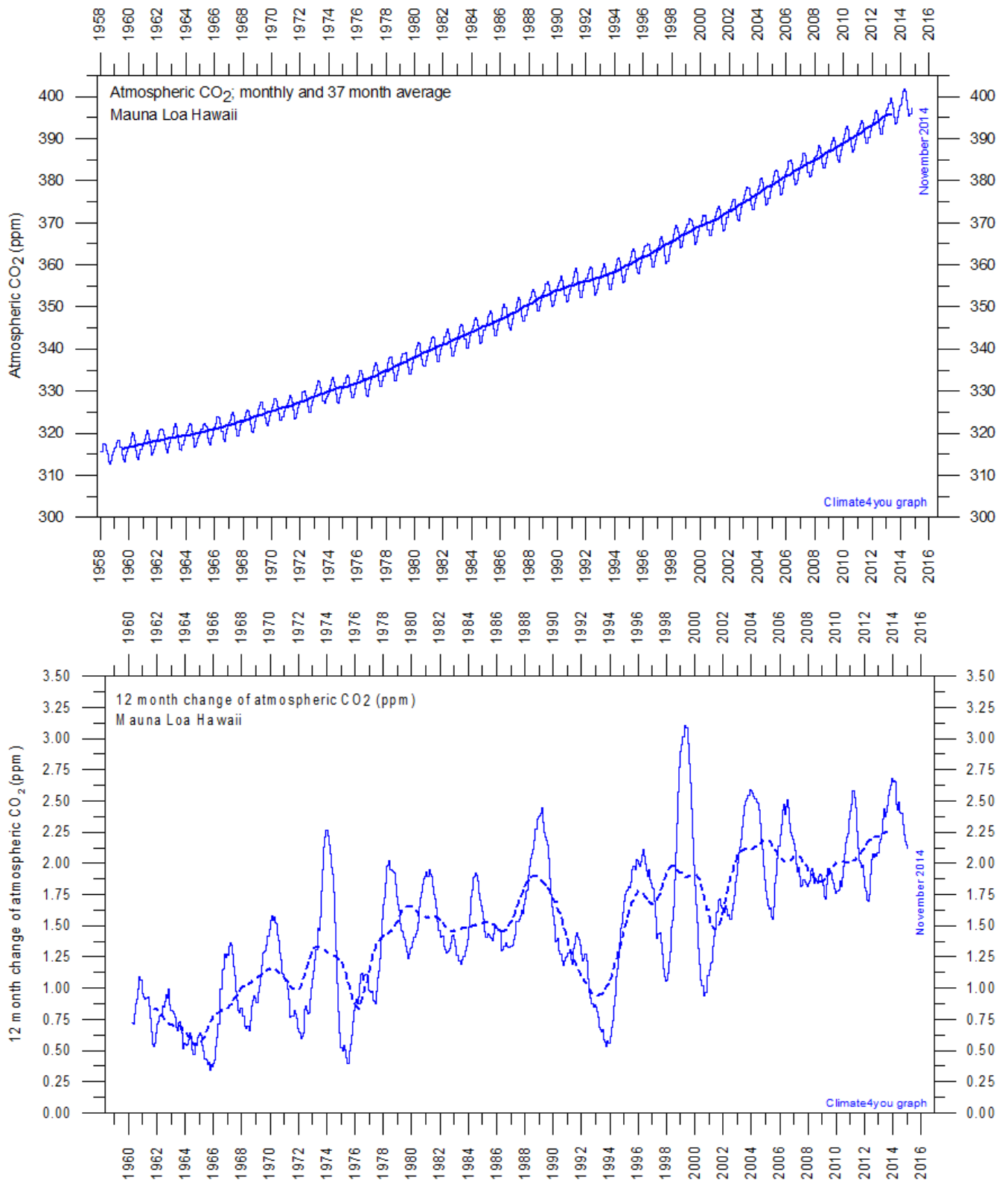
Monthly amount of atmospheric CO₂ (upper diagram) and annual growth rate (lower diagram); average last 12 months minus average preceding 12 months, thin line) of atmospheric CO₂ since 1959, according to data provided by the Mauna Loa Observatory, Hawaii, USA. The thick, stippled line is the simple running 37-observation average, nearly corresponding to a running 3 yr average.

The phase relation between atmospheric CO₂ and global temperature, updated to October 2014
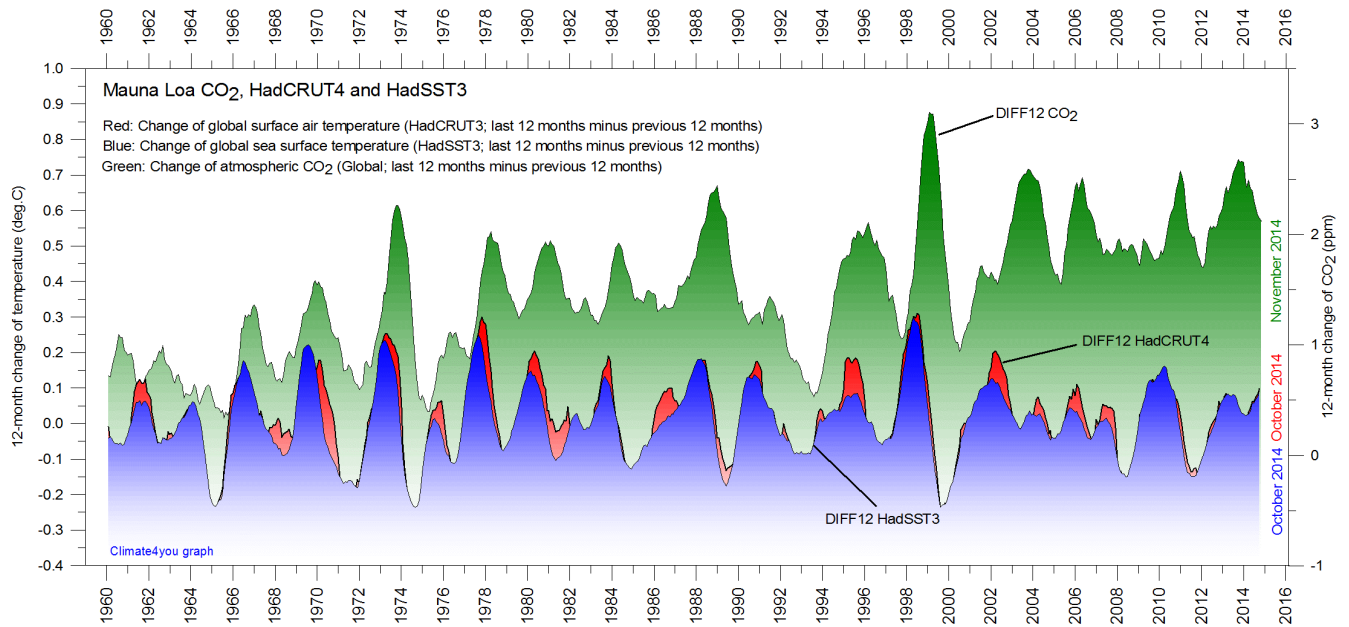
12-month change of global atmospheric CO₂ concentration (Mauna Loa; green), global sea surface temperature (HadSST3; blue) and global surface air temperature (HadCRUT4; red dotted). All graphs are showing monthly values of DIFF12, the difference between the average of the last 12 month and the average for the previous 12 months for each data series. DIFF12 values are plotted for the last month in the 2x12 months windows considered.

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
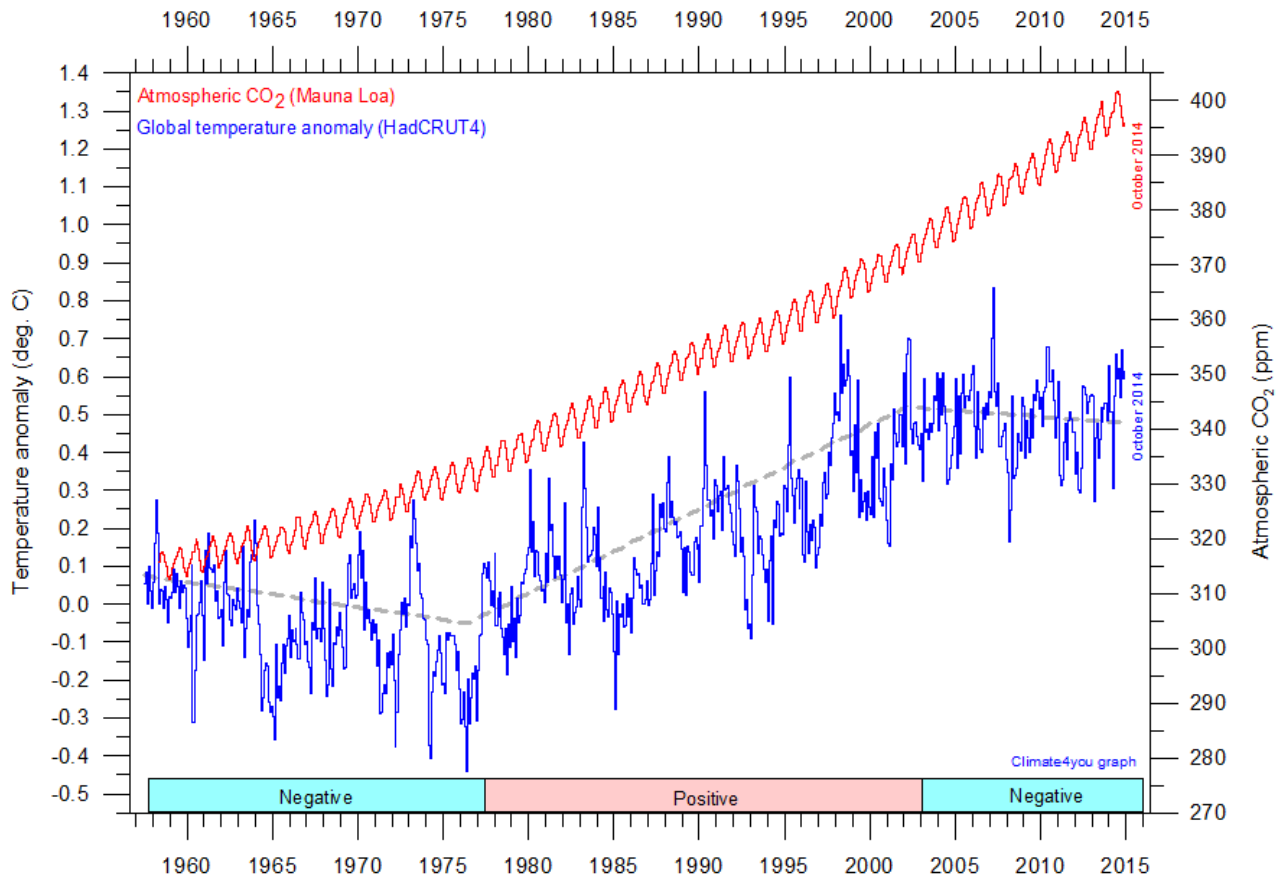
Global surface air temperature and atmospheric CO₂, updated to November 2014
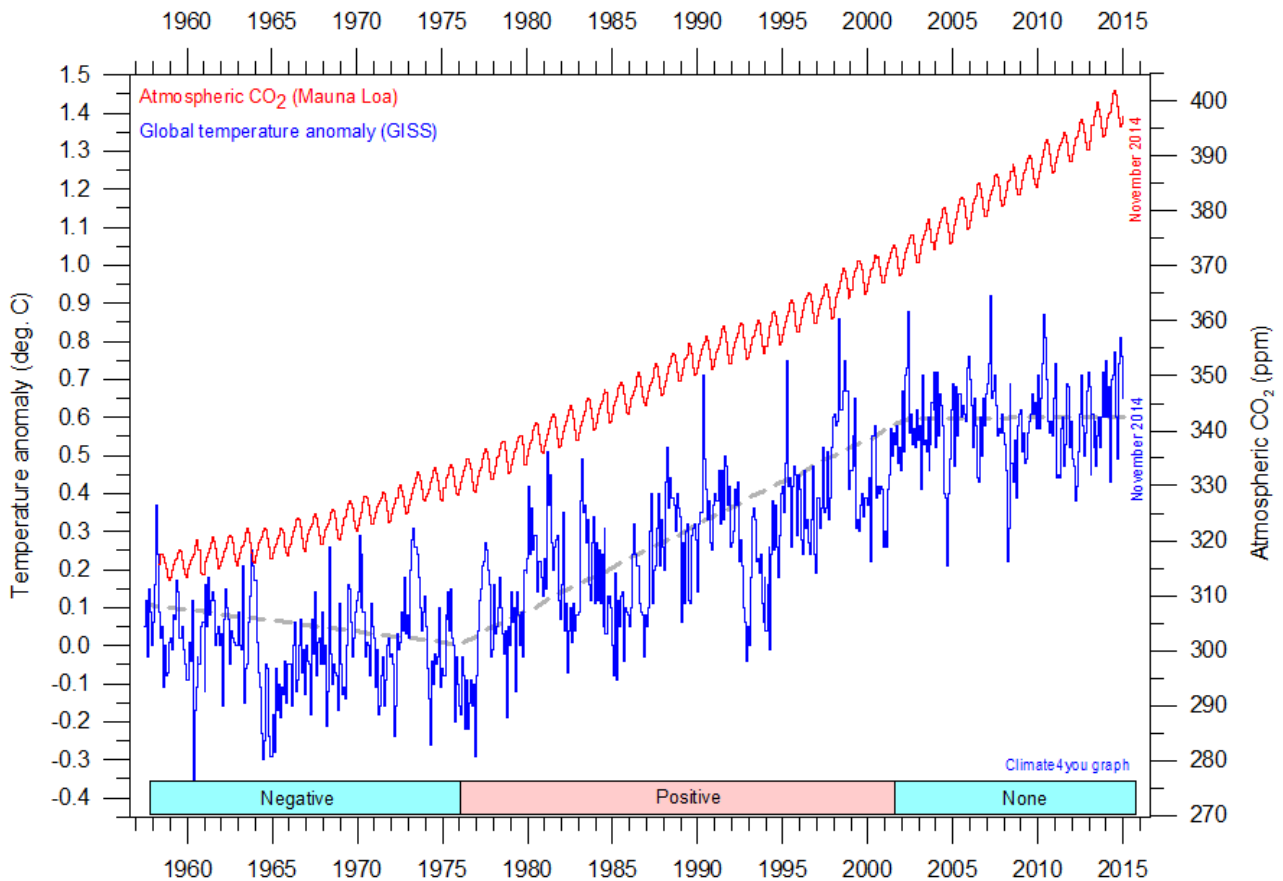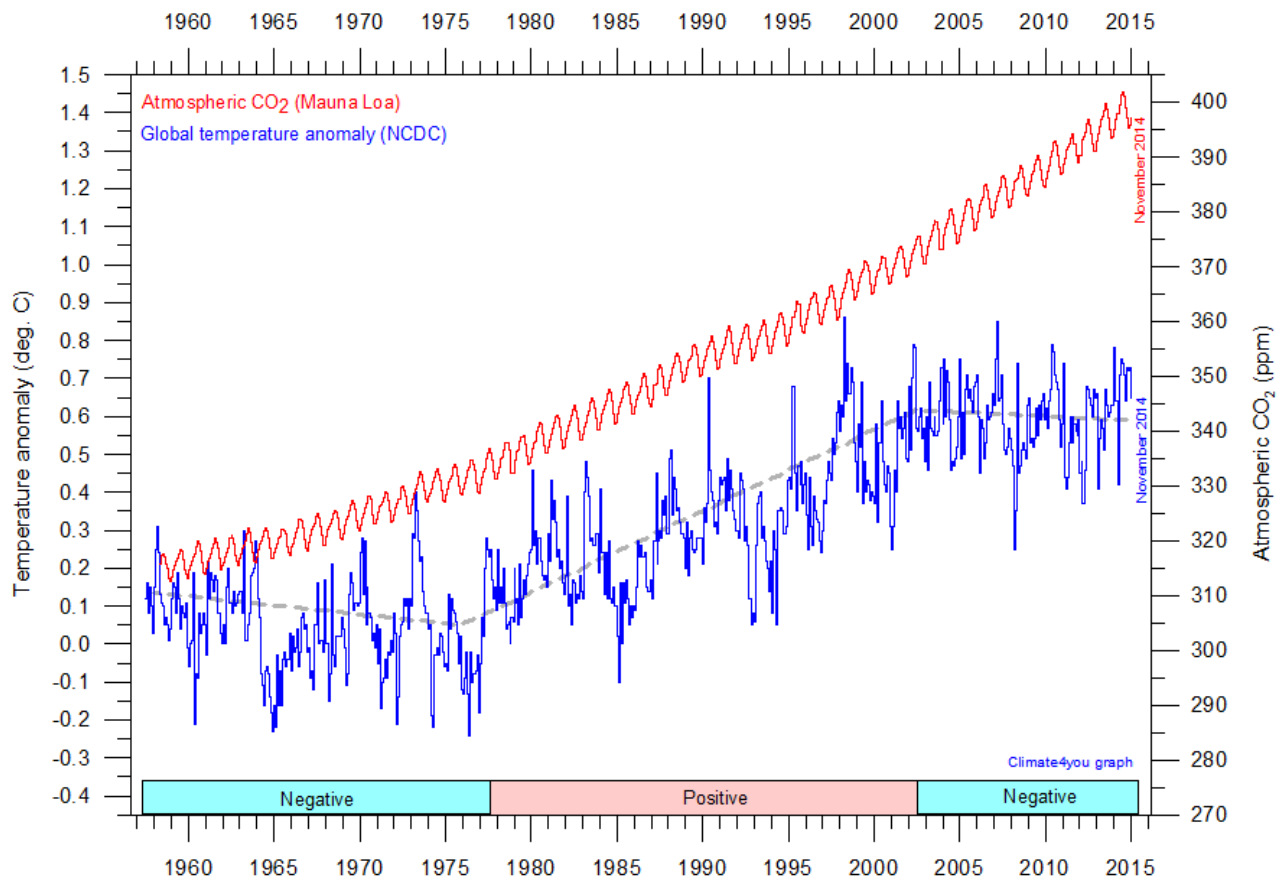
Diagrams showing HadCRUT3, GISS, and NCDC monthly global surface air temperature estimates (blue) and the monthly atmospheric CO_2 content (red) according to the [Mauna Loa Observatory](), Hawaii. The Mauna Loa data series begins in March 1958, and 1958 was therefore chosen as starting year for the diagrams. 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 October 2014.

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.

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Last 20 year monthly surface air temperature changes, updated to October 2014
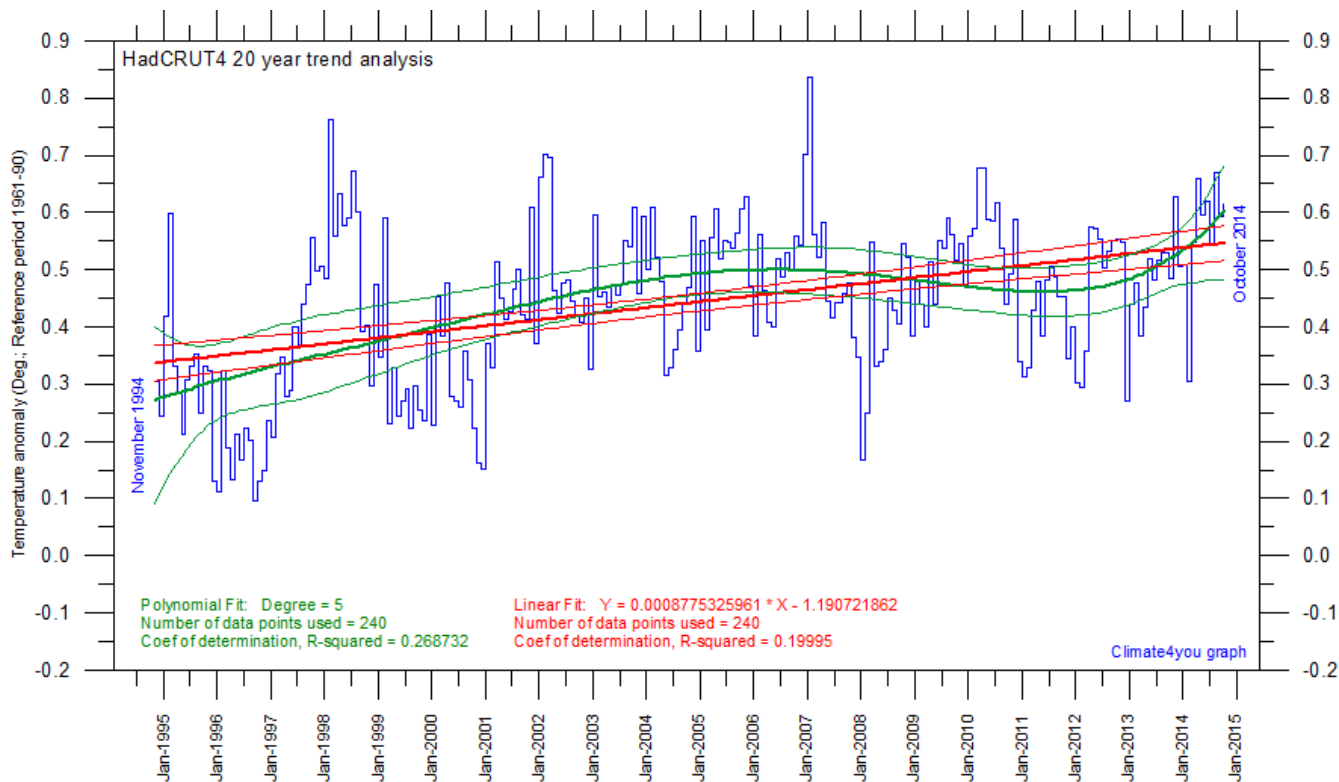
Last 20 years global monthly average surface air temperature according to Hadley CRUT, a cooperative effort between the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thin blue line represents the monthly values. The thick red 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 air temperature still increases, or if the temperature has levelled out during the last 15-18 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. In addition, before using any linear trend (or other) analysis of time series a proper statistical model should be chosen, based on statistical justification.

For temperature time series there is no *a priori* physical reason why the long-term trend should be linear in time. In fact, climatic time series often have trends for which a straight line is not a good approximation, as can clearly be seen from several of the diagrams in the present report.

For an excellent description of problems often encountered by analyses of temperature time series analyses please see Keenan, D.J. 2014: Statistical Analyses of Surface Temperatures in the IPCC Fifth Assessment Report.

1808: New diets introduced in Norway

Fig.1. Martin Richard Flor (left). Lichen Cetraria islandica (centre). Fen Polypodium vulgare (right).

The war with Britain and especially the Second Battle of Copenhagen in 1807 (Climate4you update July 2014) had serious effects for the Danish-Norwegian kingdom. Denmark lost its maritime control over the seas around Denmark, and most connections to the Norwegian part of the Danish-Norwegian kingdom were interrupted during the British blockade 1808-1811.

Climate conditions during the blockade 1808-11 were generally unfavorable for farming, with low Little Ice Age air temperatures (Fig.2). From an agricultural point of view, however, some of the main difficulties was a late spring (Fig.3) and an early autumn (Fig.5), resulting in a short growing season. The British blockade took place during the marked sunspot Dalton minimum (Fig.6), which very likely contributed to low global temperatures.

This rapidly brought Norway into a very difficult situation, as people in Norway could not any longer rely on importing farming products from Denmark. The Norwegian author Henrik Ibsen (1828-1906)

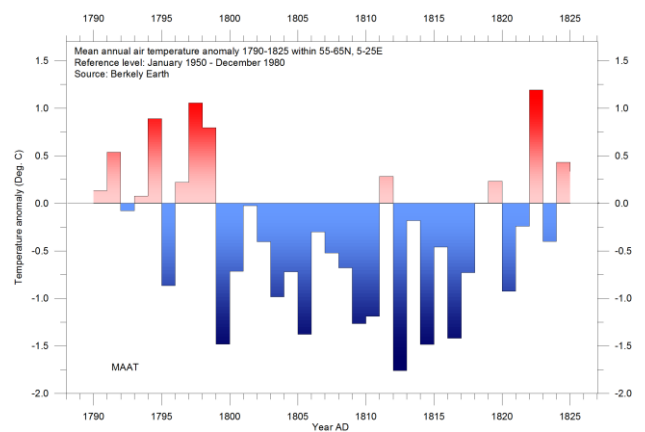described this gloomy state of affairs in his famous epic poem Terje Vigen from 1861.

Fig.2. Mean annual air temperature 1790-1825 within the southern part of the Nordic countries, compared to the average for 1950-80 (a relatively cold period). Data source: Berkeley Earth 2014.

The Danish king Frederik 6 and his government in Copenhagen therefore decided to investigate if alternative diets were available for the population in Norway. This resulted in sending the Danish

botanist [Martin Richard Flor](#) (1772-1820) to Norway. Martin Richard Flor had previously documented his interest for different plant types as alternative, potential sources for human sustenance. In spring 1808 he spent about two months travelling around in southern Norway, to investigate if useful plants were available in sufficient quantities.
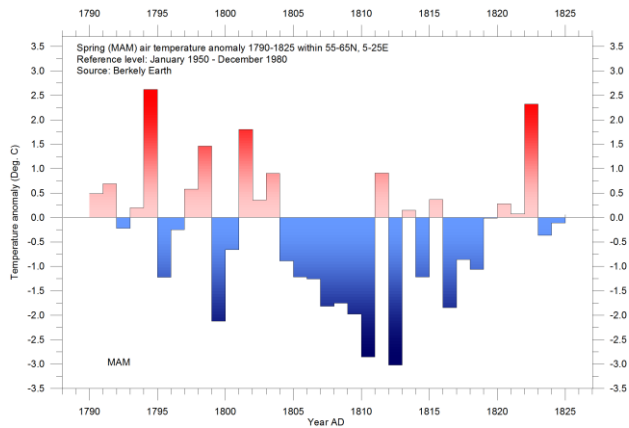

Fig.3. Mean March-May air temperature 1790-1825 within the southern part of the Nordic countries, compared to the average for 1950-80 (a relatively cold period). Data source: Berkeley Earth 2014.
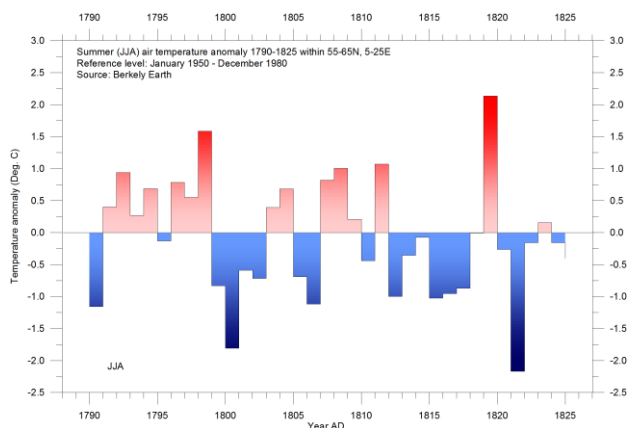
Fig.4. Mean June-August air temperature 1790-1825 within the southern part of the Nordic countries, compared to the average for 1950-80 (a relatively cold period). Data source: Berkeley Earth 2014.

Martin Richard Flor actually managed to identify a number of alternative food sources in Norway, e.g. the lichen species *Cetraria islandica* (Fig.1), and the fen type *Polypodium vulgare* (Fig.1). The Norwegian population, however, was not entirely enthusiastic about his suggestions for new diets, and the well-intentioned botanist was rapidly nicknamed the 'moss-priest'.
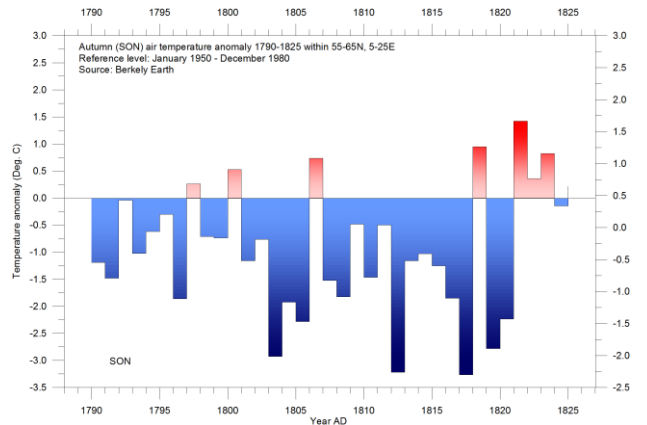

Fig.5. Mean September-November air temperature 1790-1825 within the southern part of the Nordic countries, compared to the average for 1950-80 (a relatively cold period). Data source: Berkeley Earth 2014.
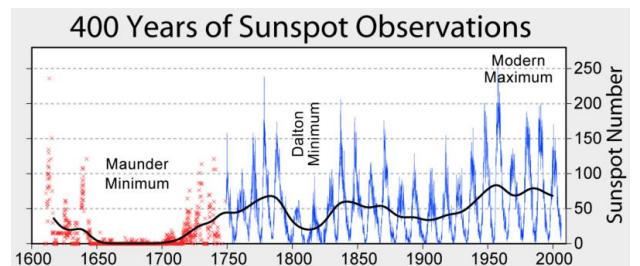

Fig.6. Sunspot number since the early 17th century. The British blockade of Denmark-Norway 1808-11 took place within the marked Dalton Minimum.

However, Martin Richard Flor was not discouraged by this, and contributed towards improving the general education of all people, both in Denmark and in Norway. Among other feats, he published the [first flora of Norwegian plants](#). He also became involved in the establishment of the society [Selskabet for Norges Vel](#) (now: [Det Kongelige Selskap for Norges Vel](#)) in 1809. This society rapidly developed into a kind of Norwegian shadow government, to ensure that Norwegian interests in matters relating to the disrupted Danish-Norwegian kingdom were taken care of.

In 1810 the society initiated the establishment of the economical foundation for the first university in Norway. King Frederik 6 was not

strongly supportive of this initiative, as he know the political potential of a university. However, he bowed to the inevitable and in 1811 formally approved of the university plans. By this, Norway's first university became a reality in Christiania (now Oslo, University of Oslo).

Martin Richard Flor was for some time considered a candidate for Professor of Botany at the new university, but was instead appointed as Senior Lecturer (*lector botanices*). As such, he was involved in the establishment of both a botanical garden and a Botanical Museum in Oslo.

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Lindeberg, L. 1974. *De så det Ske. Englandskrigene 1801-14.* Lademann Forlagsaktieselskab, Copenhagen, 244 pp.

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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

Season's Greetings, yours sincerely,

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December 20, 2014.