Climate4you update April 2015

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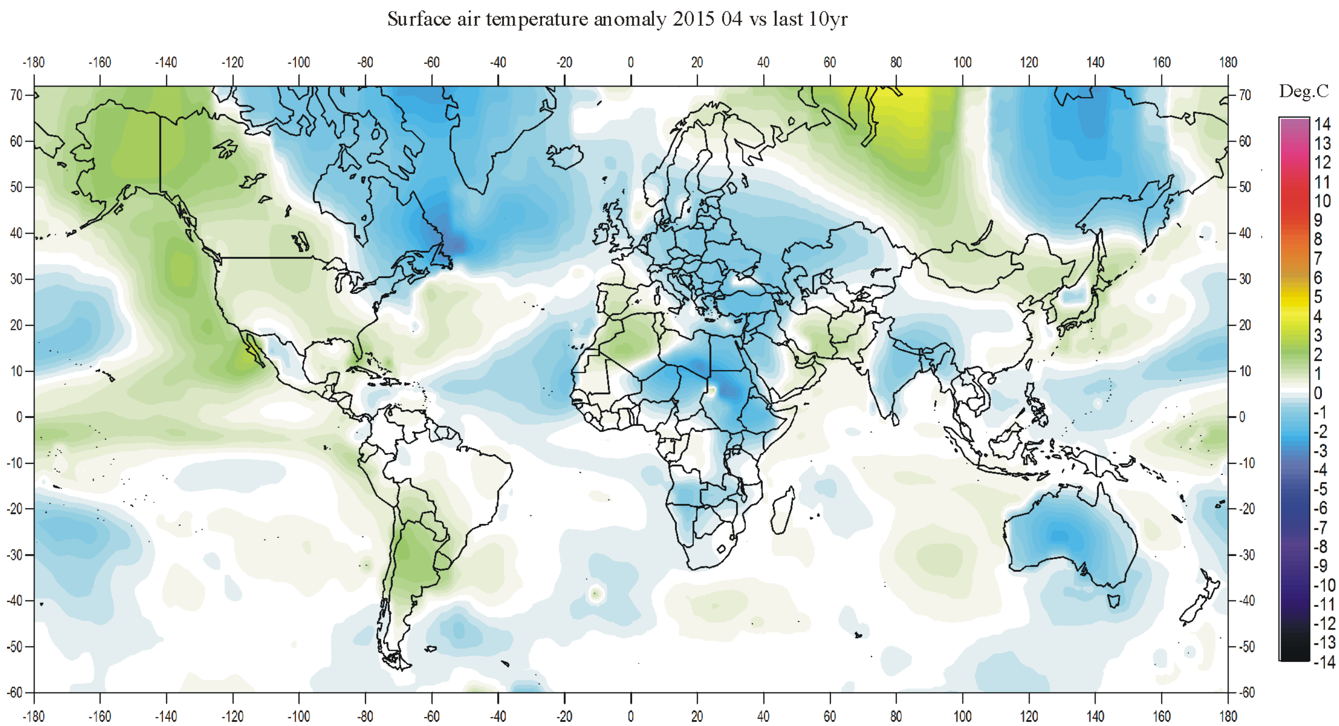
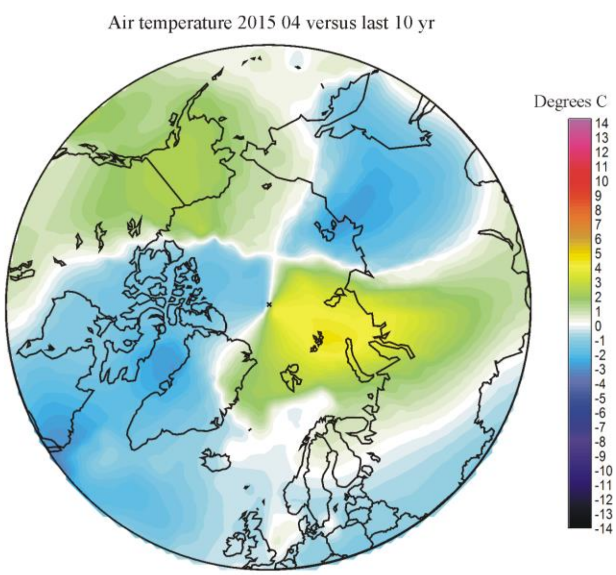
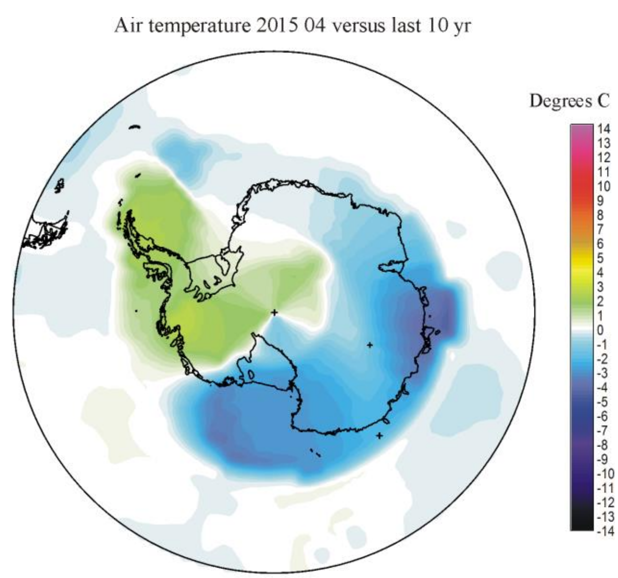
All diagrams in this newsletter as well as links to the original data are available on www.climate4you.com

April 2015 global surface air temperature overview







April 2015 surface air temperature compared to the average of the last 10 years. Green-yellow-red colours indicate areas with higher temperature than the 10 yr average, while blue colours indicate lower than average temperatures. Data source: [Goddard Institute for Space Studies](#) (GISS).

Comments to the April 2015 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 last previous 10 years (2005-2014) are 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 profoundly affected by the cold period 1945-1980. Most comparisons with this time period will obviously appear as warm, and it will be difficult to decide if modern surface air temperatures are increasing or decreasing? Comparing with a recent period overcomes this problem and displays the modern dynamics of ongoing change.

In addition, the GISS temperature data used for preparing the above diagrams display pronounced temporal instability for data before the turn of the century (see p. 7). Any comparison with the WMO 'normal' period 1961-1990 is therefore influenced by ongoing monthly changes of the so-called 'normal' period, and is not suited as reference.

In 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 data series have a much longer record length, which may be inspected in greater detail on www.Climate4you.com.

April 2015 global surface air temperatures

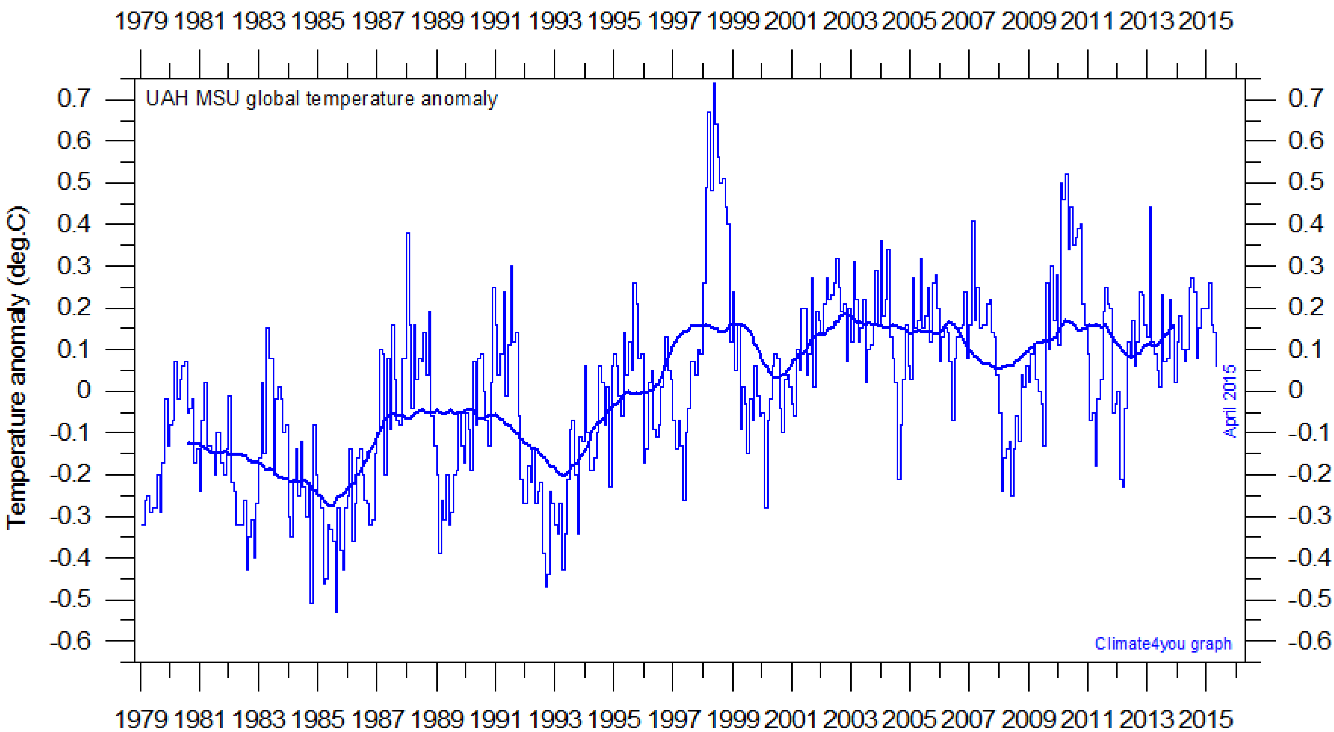
General: The average global air temperature was close to the average for the last ten years.

The Northern Hemisphere was characterised by regional air temperature contrasts, especially in the Northern Hemisphere, as usual. Western Canada, Alaska and NW Siberia had above average temperatures for the last 10 years. Eastern Canada, Greenland, Europe and most of Siberia had below average temperatures. The Arctic was apparently divided into four sectors, two warm and two cold, but presumably this reflects the GISS interpolation technique, and the pattern displayed in the Arctic temperature map on page 1 should not be over interpreted.

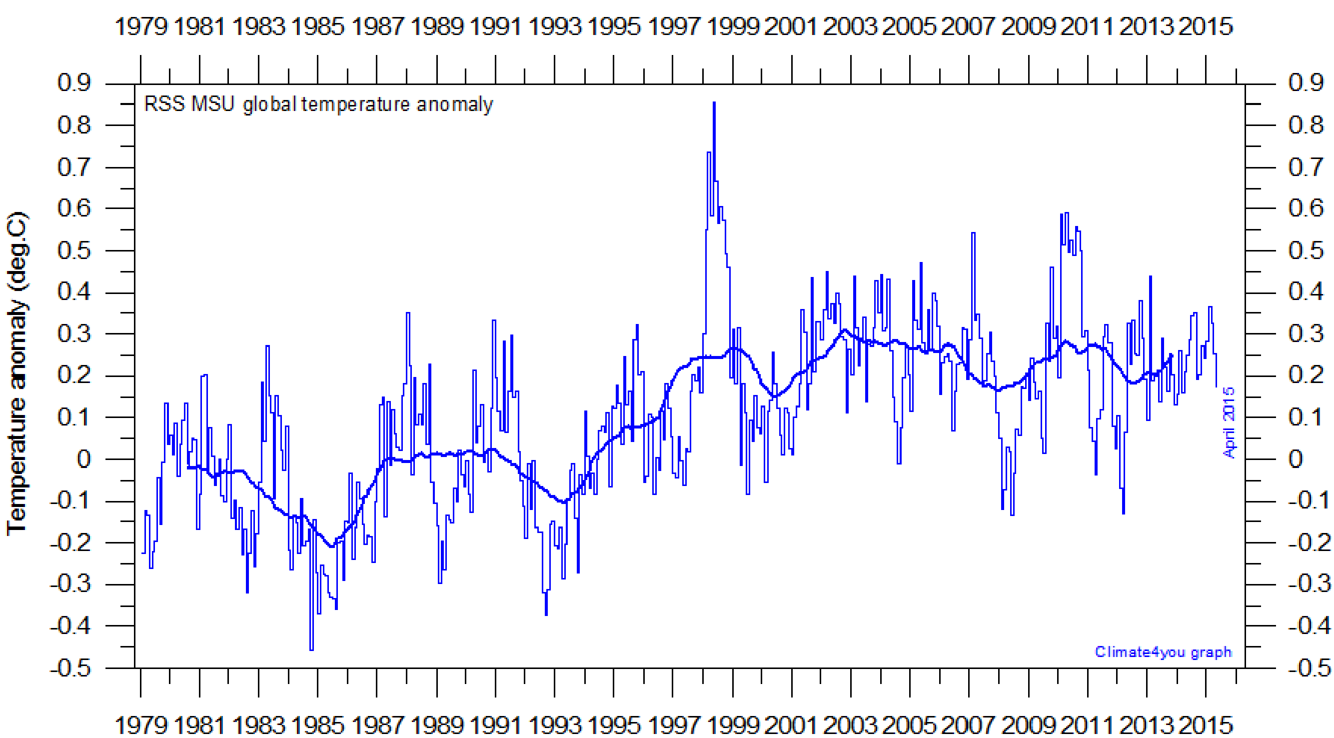
Near the Equator temperatures conditions were generally near or somewhat below the 1998-2006 average.

The Southern Hemisphere temperatures were mainly near or below average 1998-2006 conditions. The entire Australian continent had below average temperatures. The Antarctic continent had below average temperatures in most of East Antarctica, while the remaining parts had above average temperatures.

Lower troposphere temperature from satellites, updated to April 2015

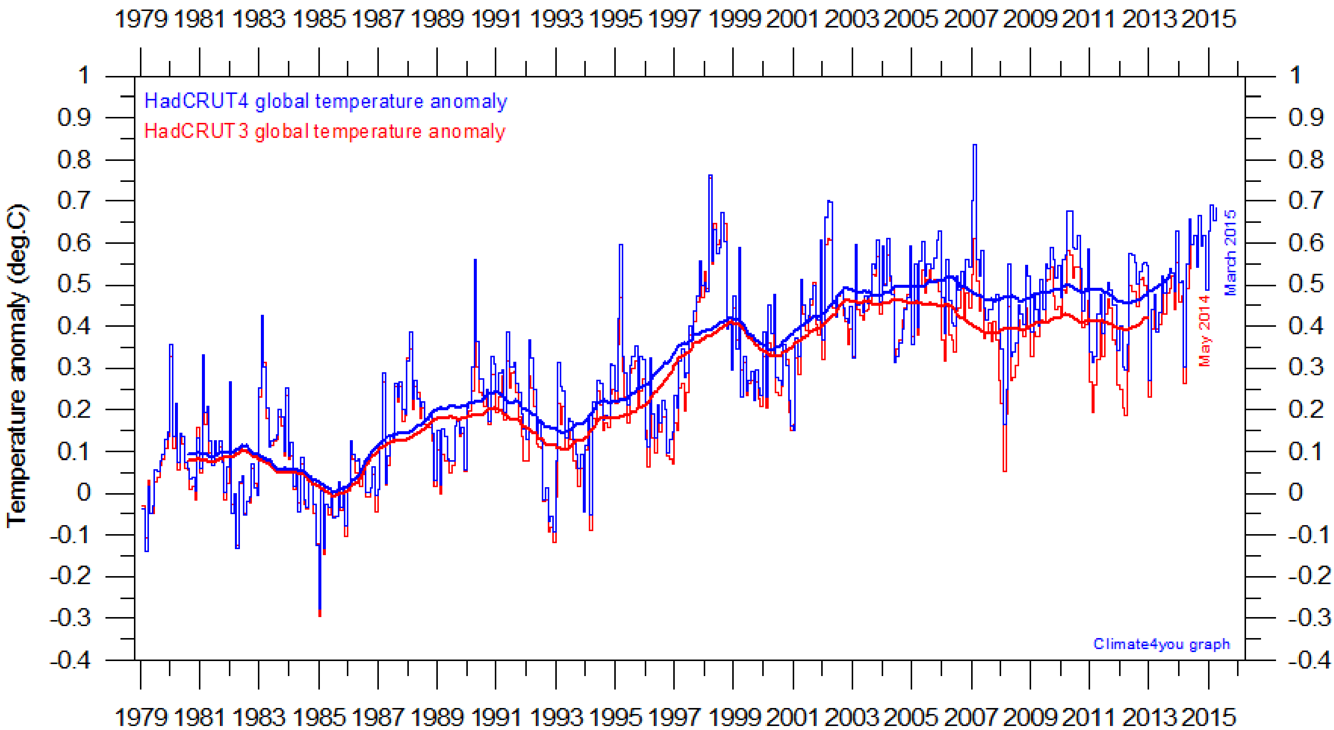


Global monthly average lower troposphere temperature (thin line) since 1979 according to University of Alabama at Huntsville, USA. The thick line is the simple running 37-month average.

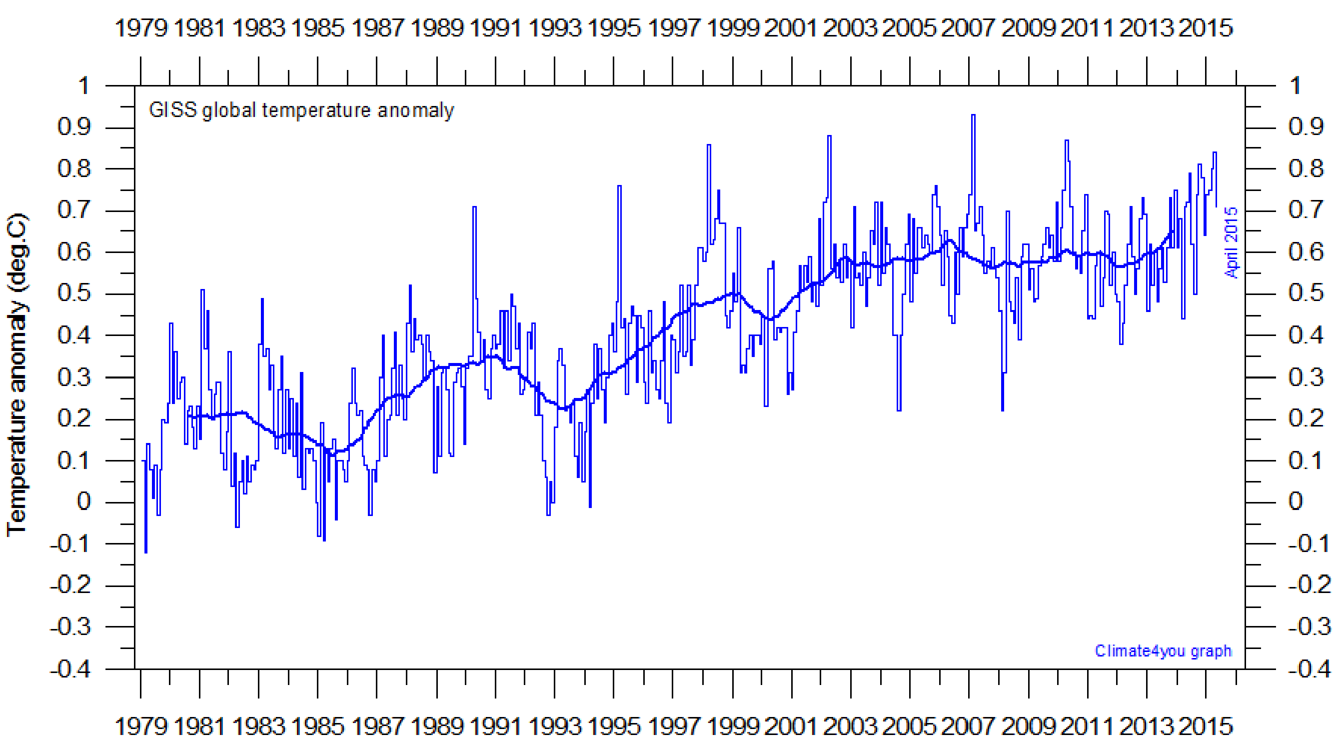


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The thick line is the simple running 37-month average.

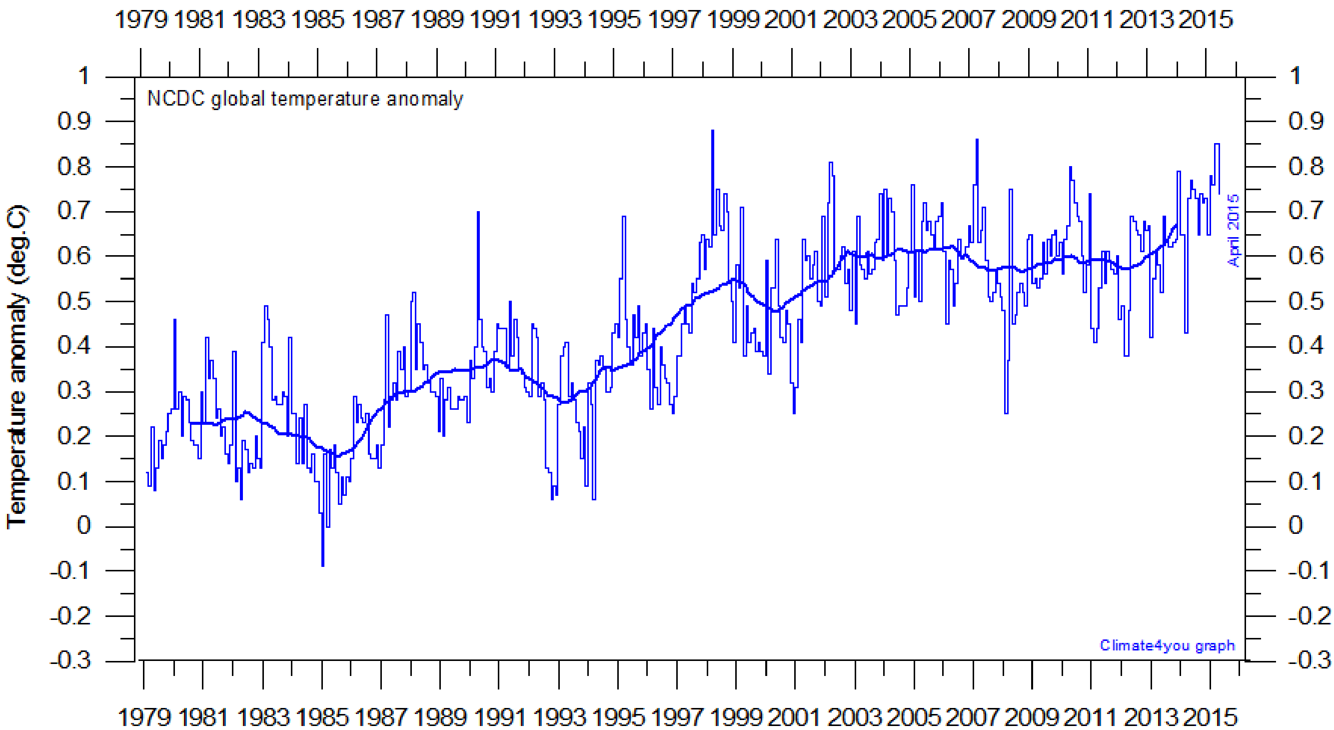
Global surface air temperature, updated to April 2015



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 March 2015.



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 such 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*).

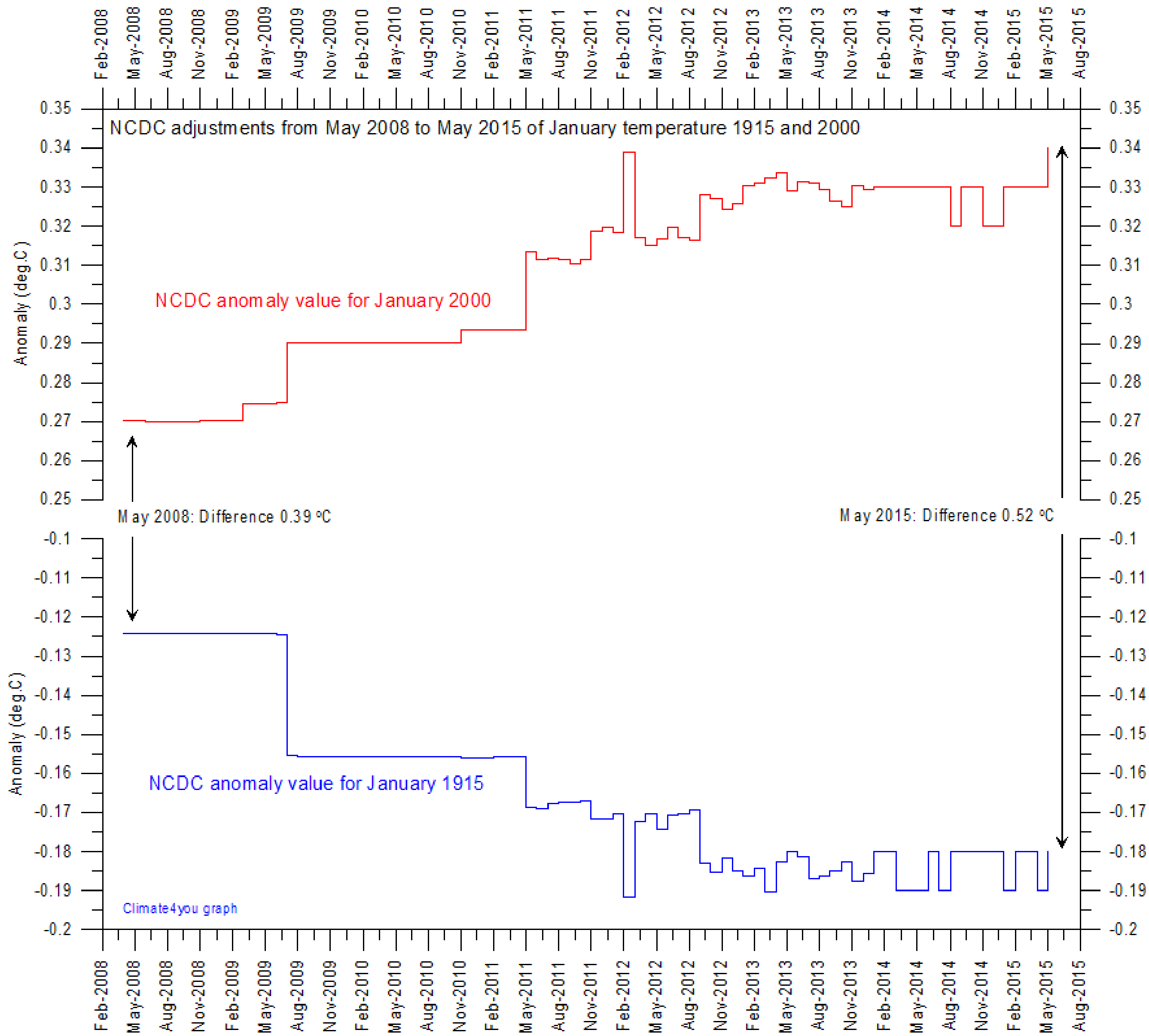


Diagram showing the adjustment made since May 2008 by the National Climatic Data Center (NCDC), USA, in anomaly values for the months January 1915 and January 2000.

Note: The administrative upsurge of the temperature increase between January 1915 and January 2000 has grown from 0.39 (May 2008) to 0.52°C (May 2015), representing an about **33%** administrative temperature increase over this period, meaning that more than half of the apparent temperature increase from January 1915 to January 2000 is due to administrative manipulations of the original data since May 2008.

Global air temperature linear trends updated to March 2015

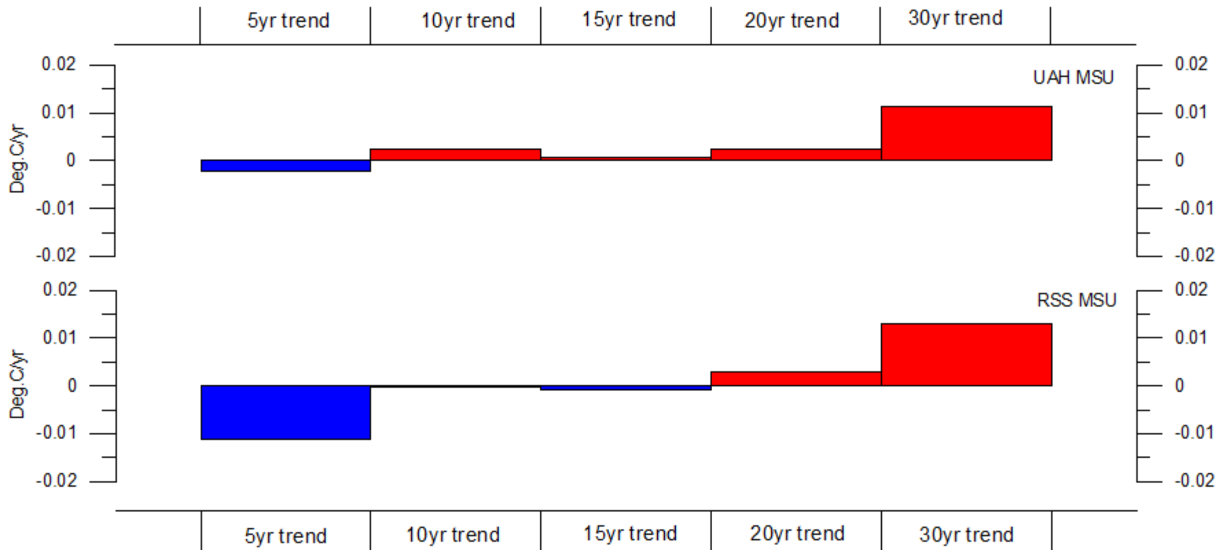


Diagram showing the latest 5, 10, 20 and 30 yr linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for two satellite-based temperature estimates (UAH MSU and RSS MSU). Last month included in analysis: March 2015.

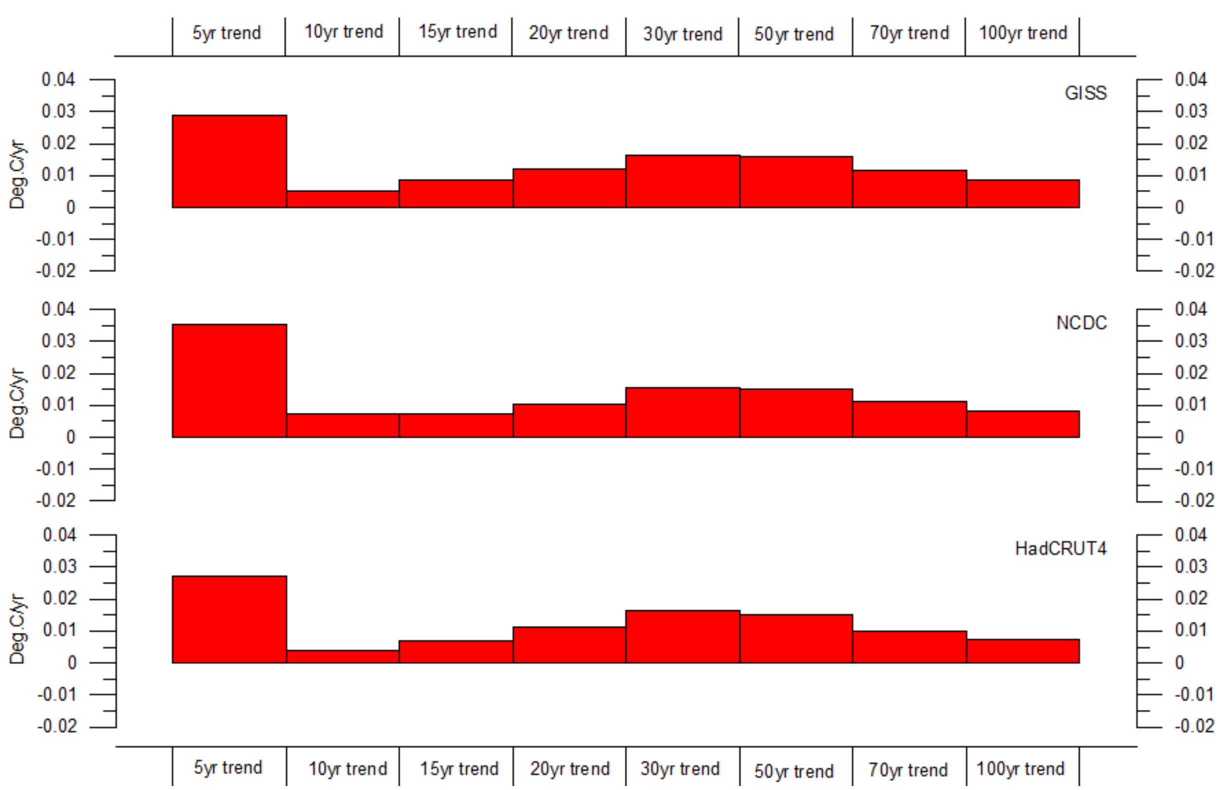
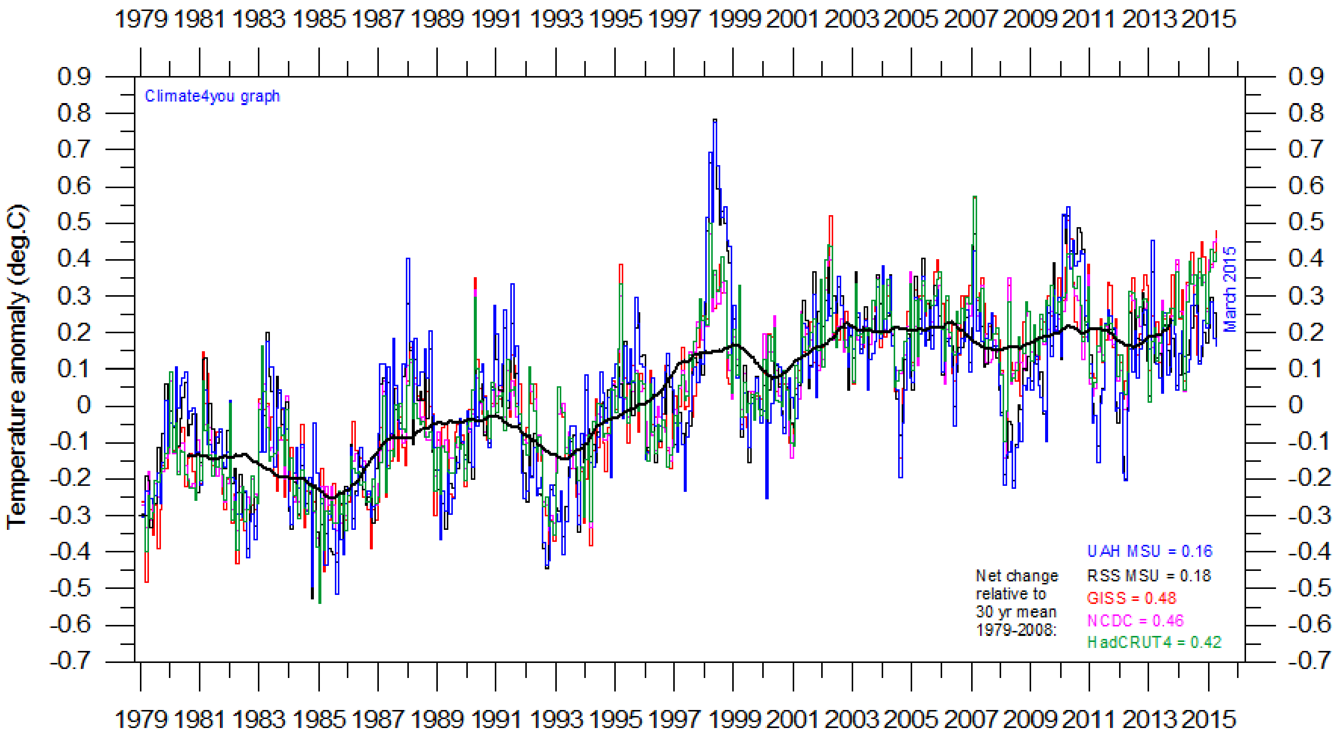


Diagram showing the latest 5, 10, 20, 30, 50, 70 and 100 year linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for three surface-based temperature estimates (GISS, NCDC and HadCRUT4). Last month included in all analyses: March 2015.

All in one, updated to March 2015

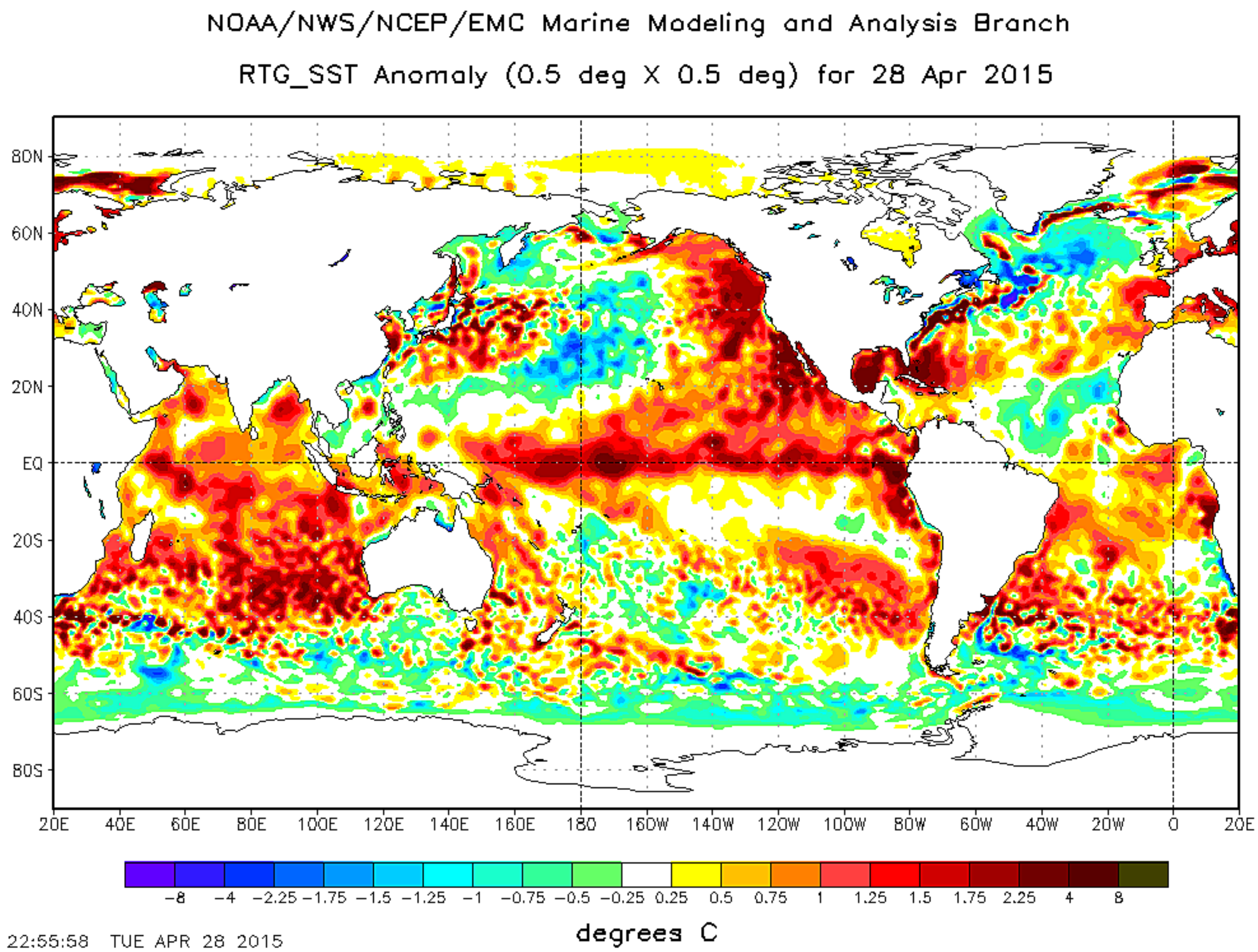


Superimposed plot of all five global monthly temperature estimates. As the base period differs for the individual temperature estimates, they have all been normalised by comparing with the average value of the initial 120 months (30 years) from January 1979 to December 2008. The heavy black line represents 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 April 2015



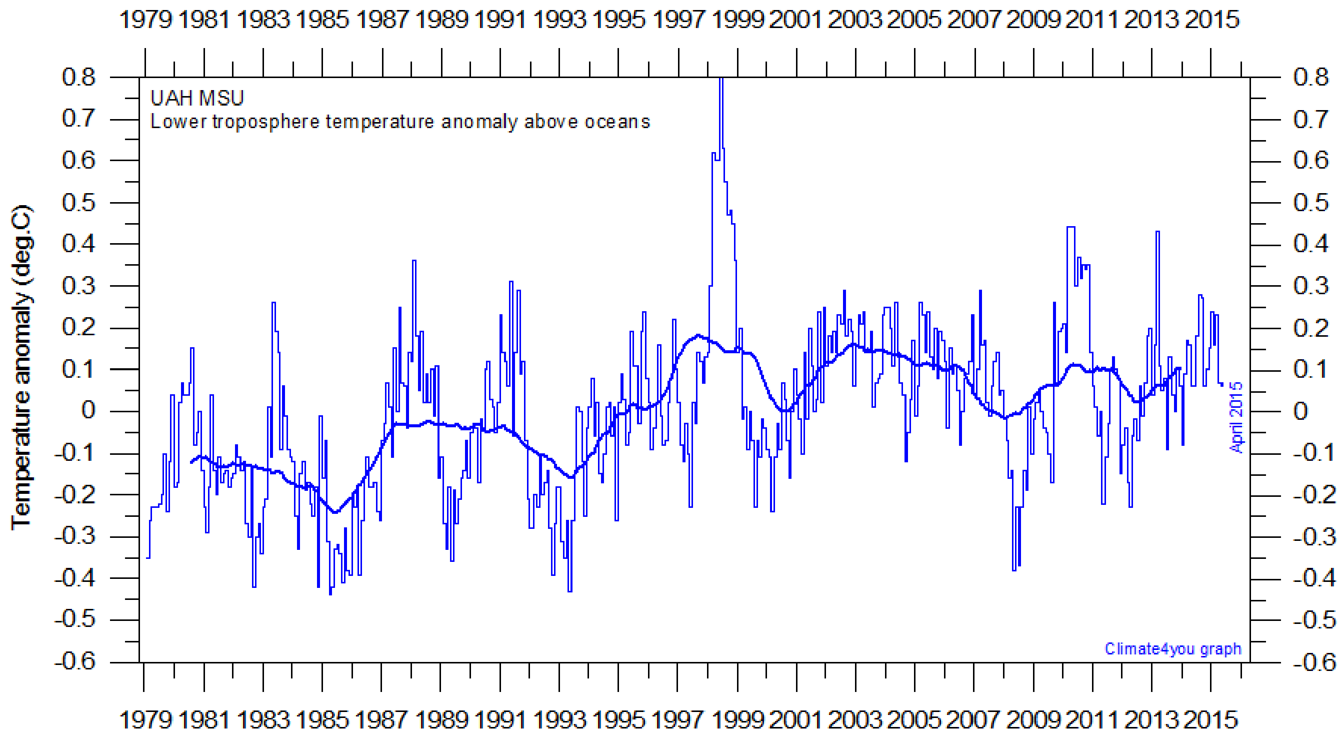
Sea surface temperature anomaly on 28 April 2015. Map source: National Centers for Environmental Prediction (NOAA).

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).

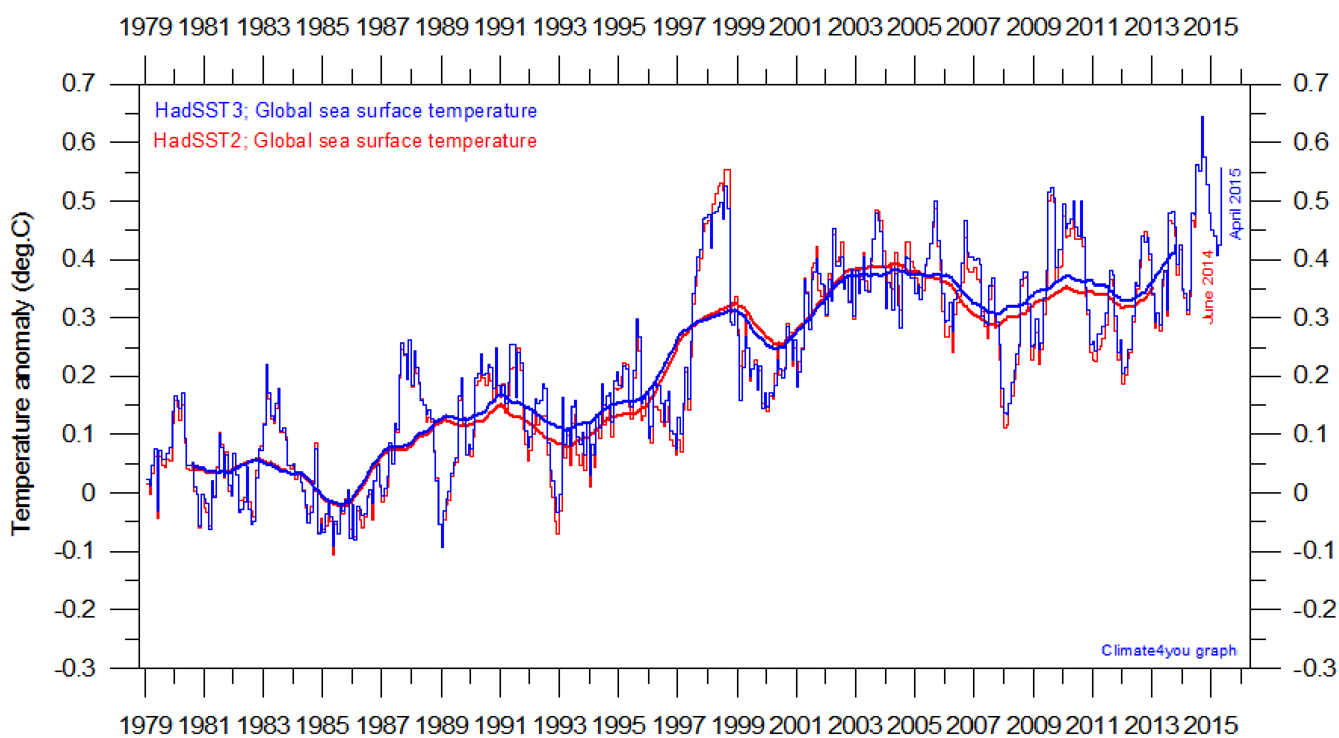
Relatively warm water is dominating the oceans near the Equator, and is influencing global air temperatures now and in the months to come.

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.

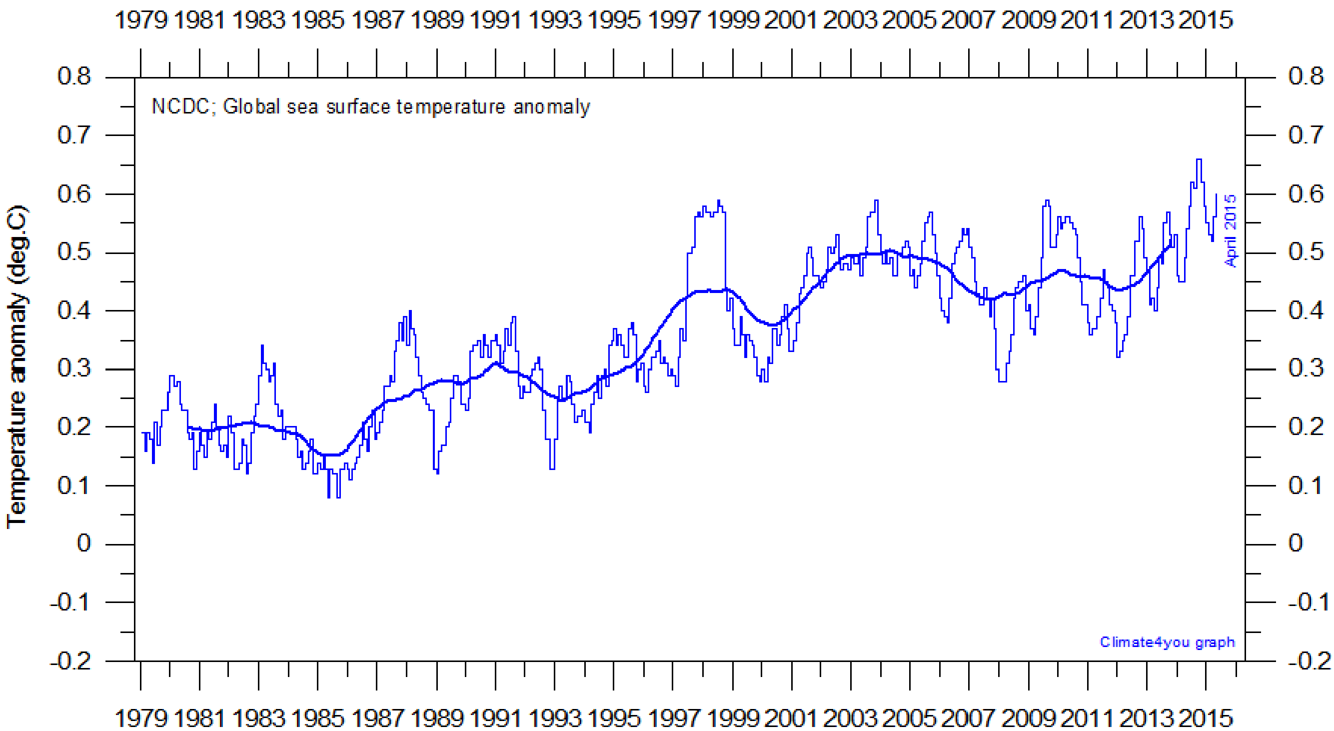
However, this does not reflect similar changes in the total heat content of the atmosphere-ocean system. In fact, global net changes can be small and such heat exchanges may mainly reflect redistribution of energy between ocean and atmosphere. What matters is the overall temperature development when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

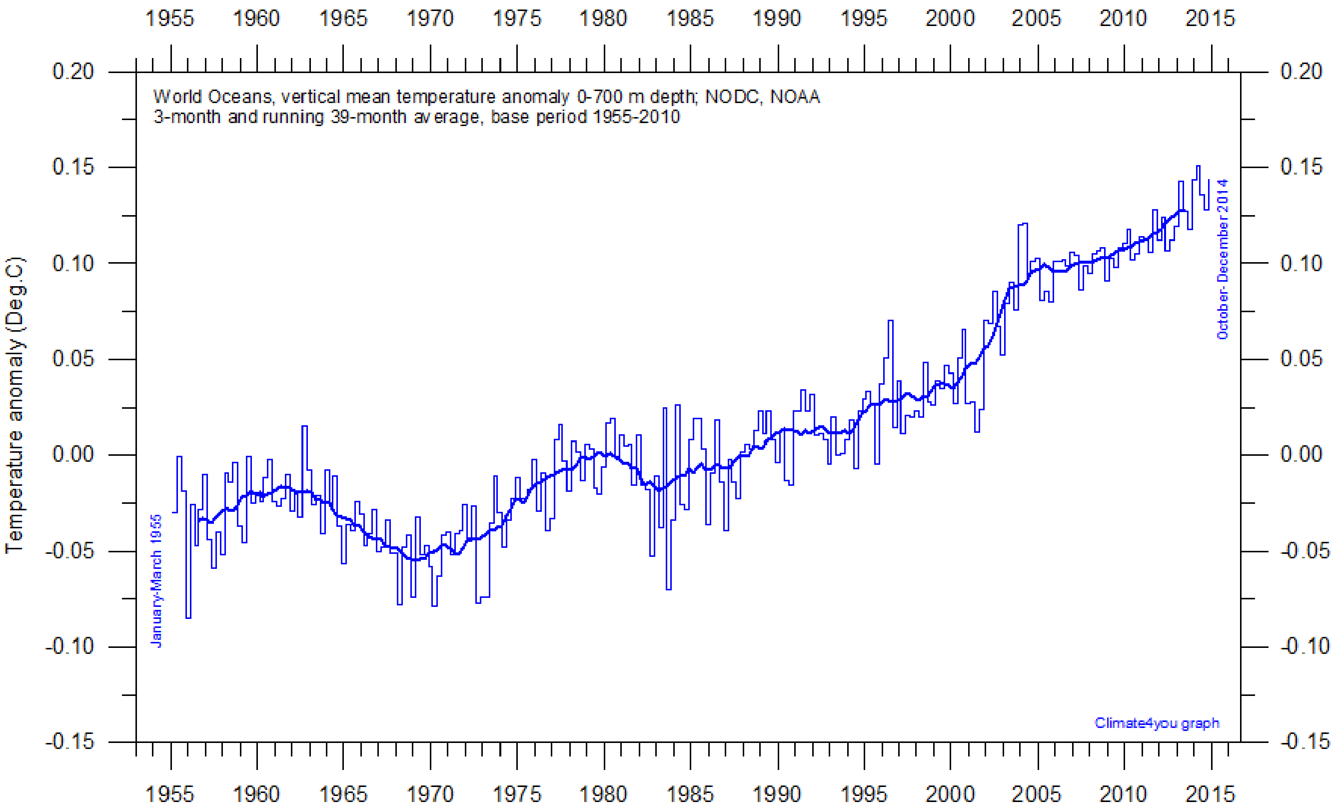


Global monthly average sea surface temperature since 1979 according to University of East Anglia's [Climatic Research Unit](#) ([CRU](#)), UK. Base period: 1961-1990. The thick line is the simple running 37-month average.

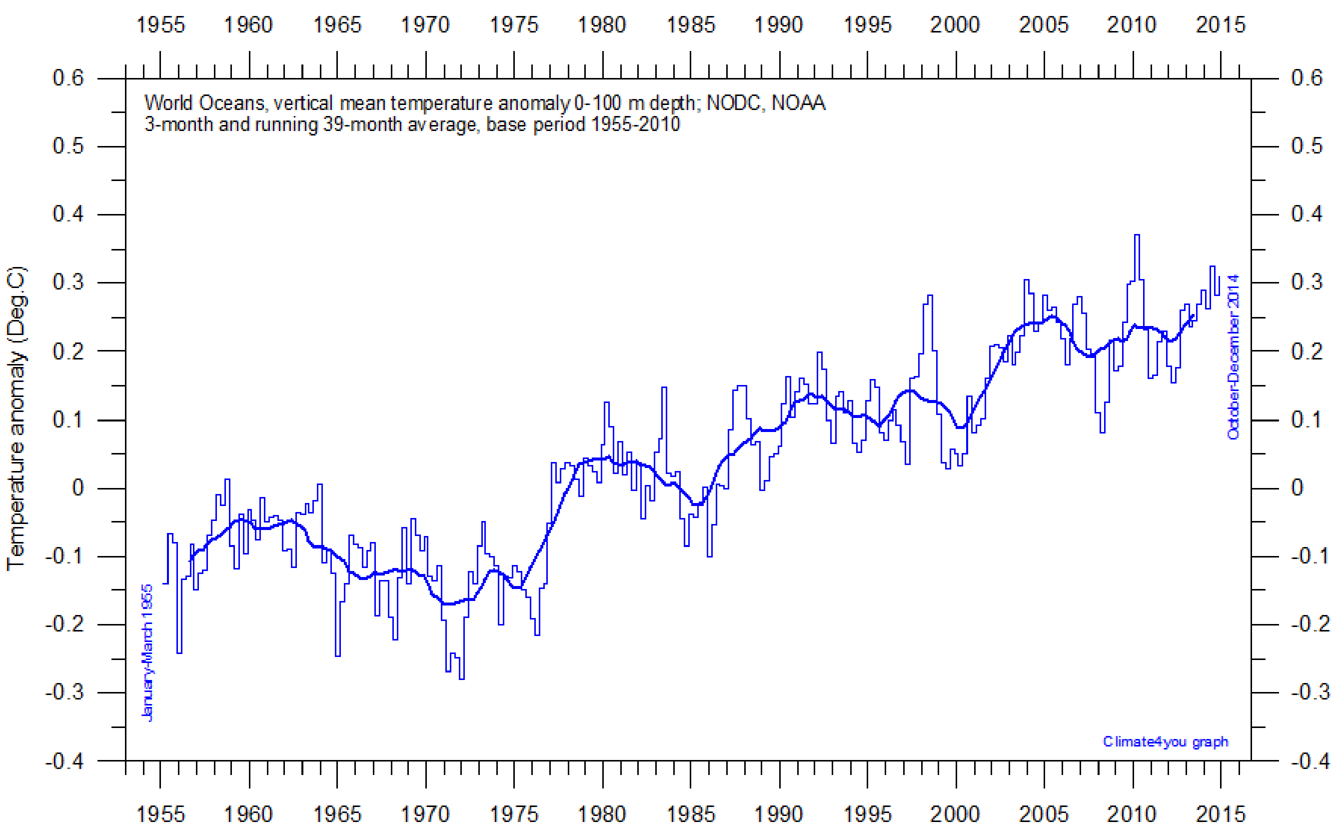


Global monthly average sea surface temperature since 1979 according to the National Climatic Data Center (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37-month average.

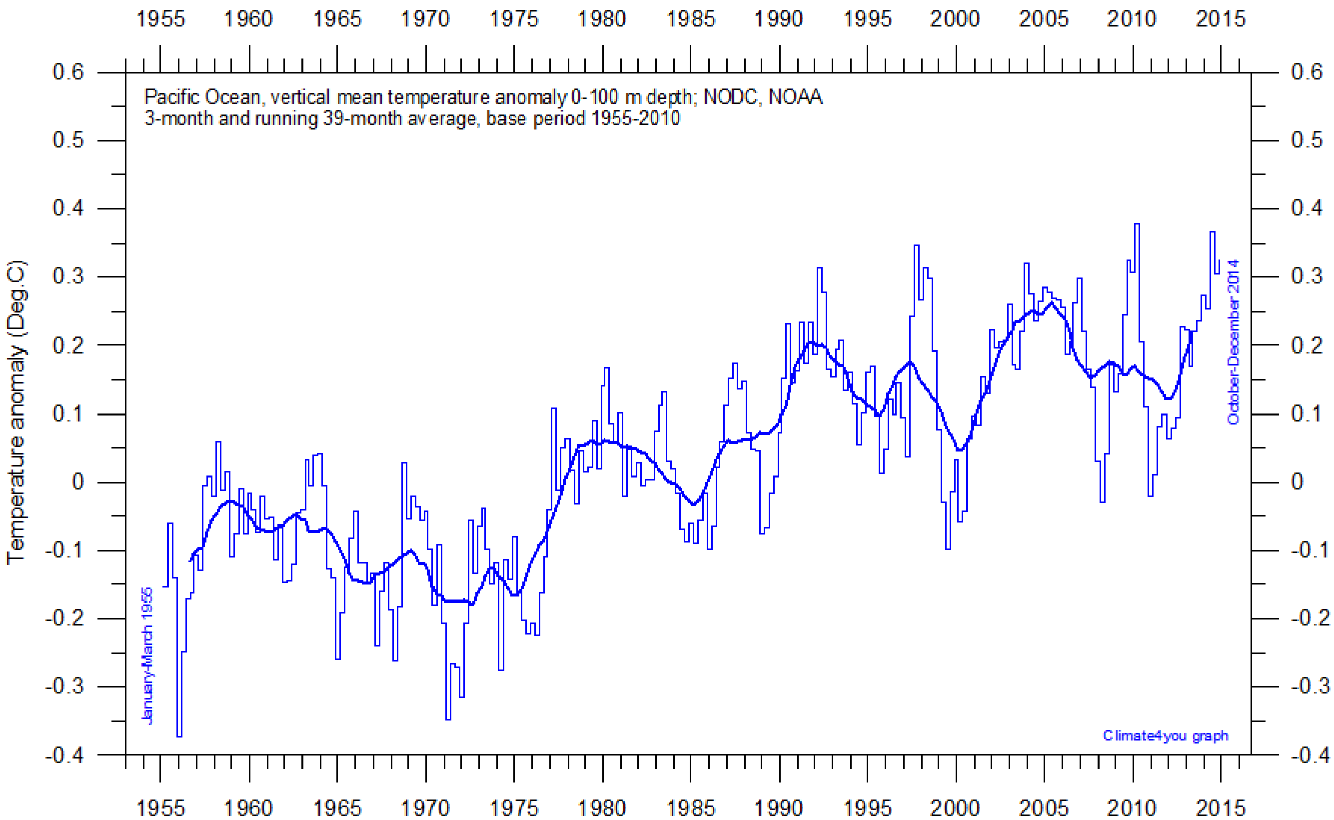
Ocean heat content uppermost 100 and 700 m, updated to December 2014



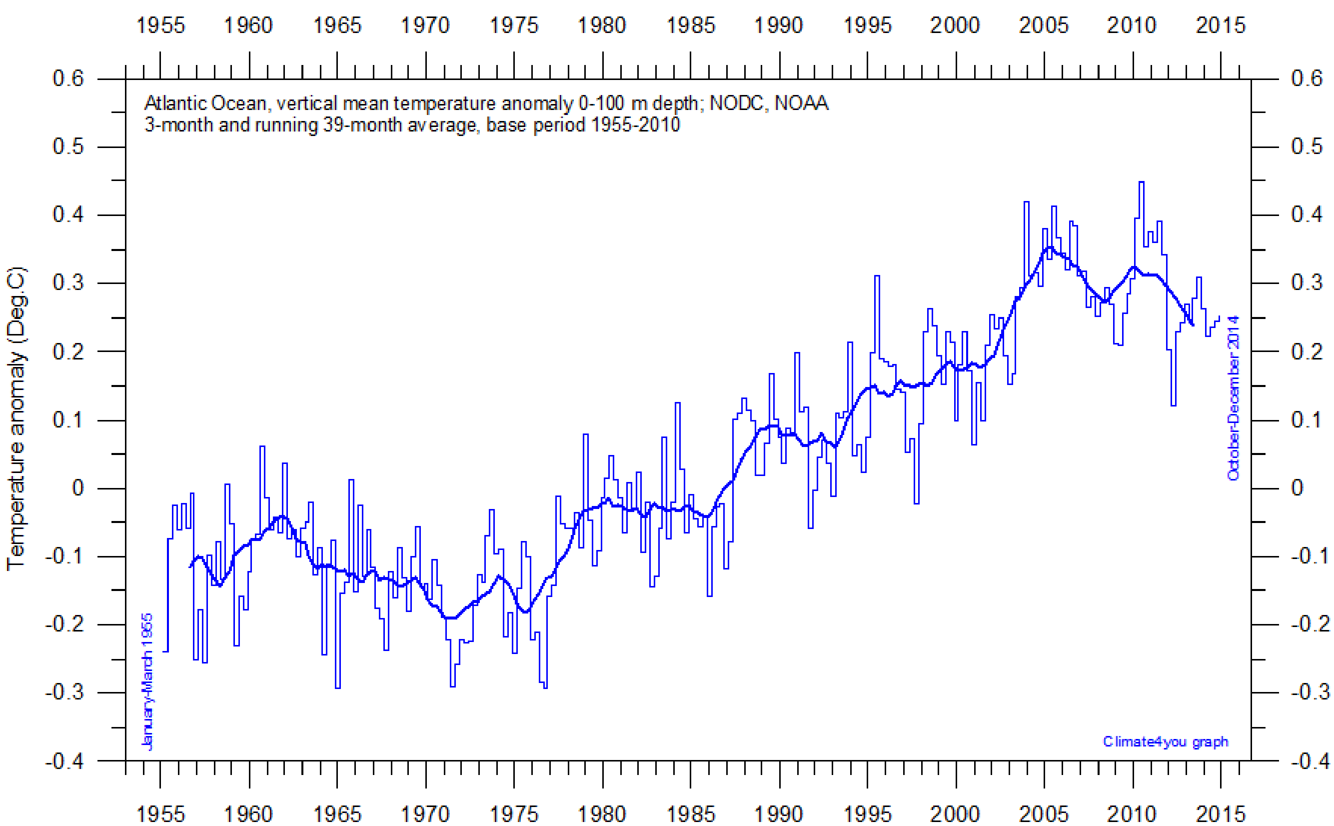
Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1955. Data source: National Oceanographic Data Center(NODC).



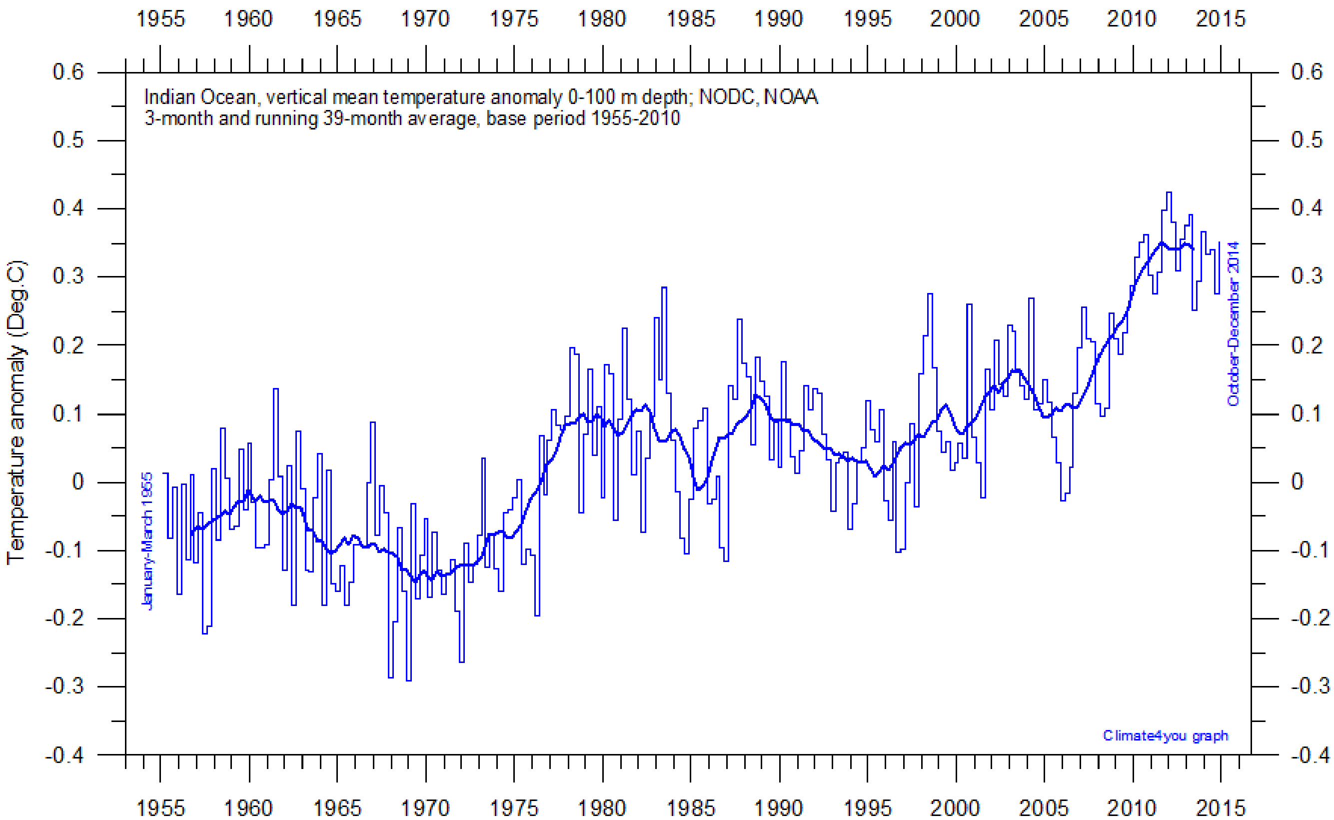
World Oceans vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center](#) (NODC). Base period 1955-2010.



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.

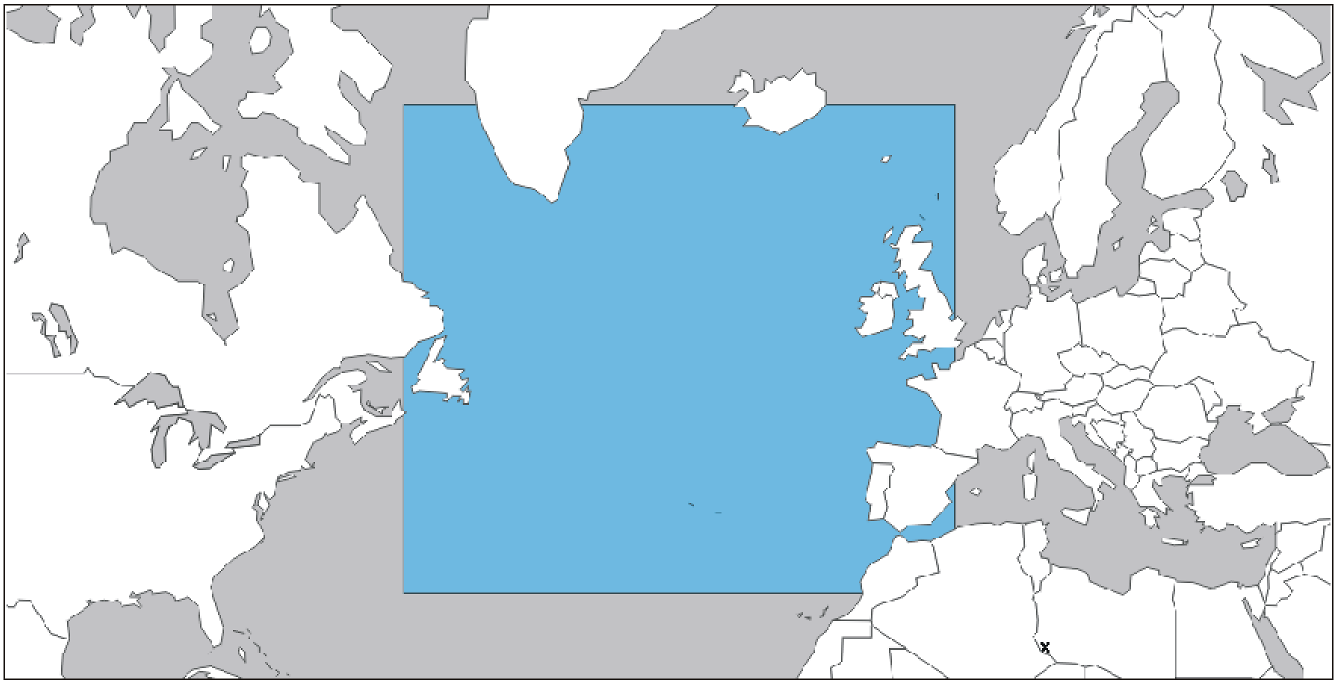


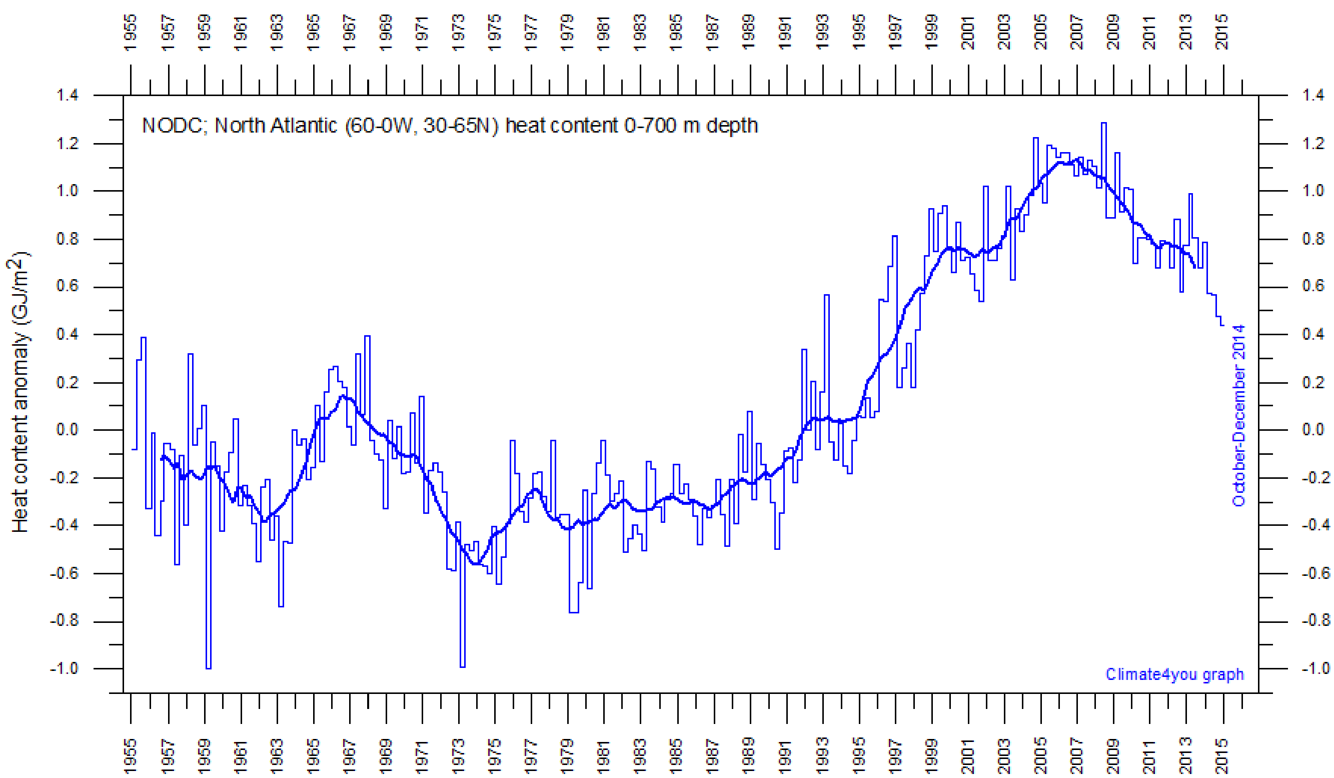
Atlantic Ocean vertical average temperature 0-100 m depth since 1955. The thin line indicate 3-month values, and the thick line represents the simple running 39-month (c. 3 year) average. Data source: [NOAA National Oceanographic Data Center](#) (NODC). Base period 1955-2010.



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.

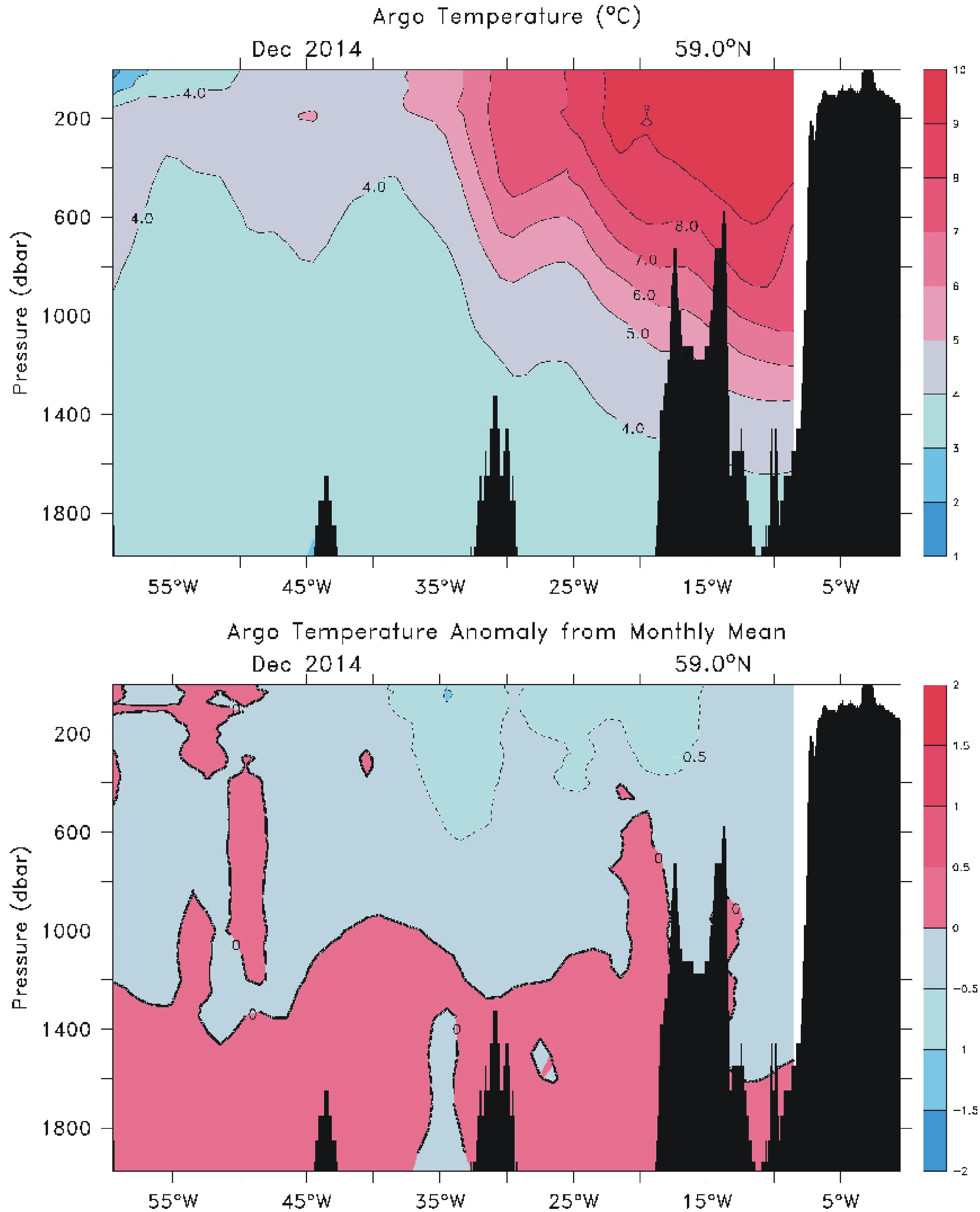
North Atlantic heat content uppermost 700 m, updated to December 2014





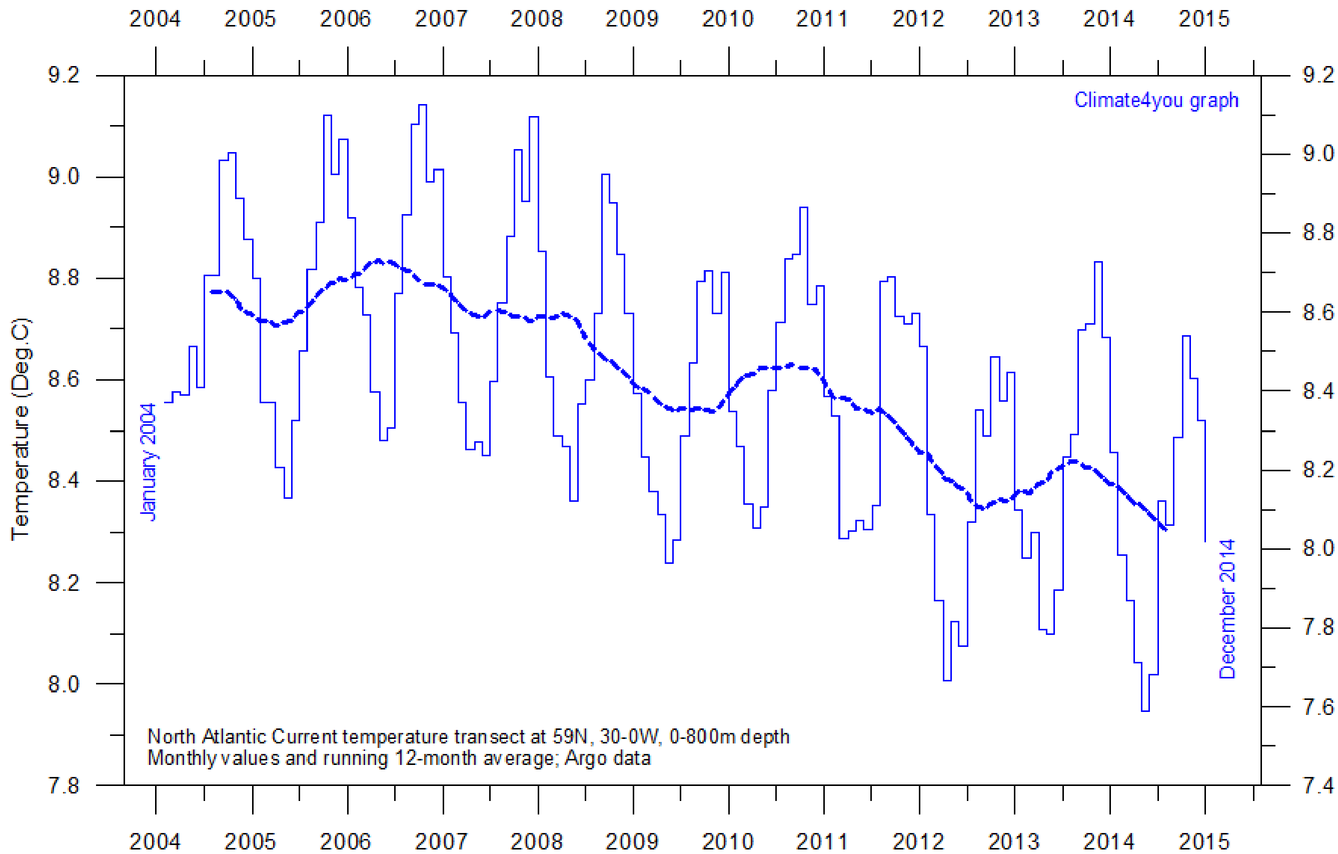
Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the North Atlantic (60-0W, 30-65N; see map above) *ocean since January 1955. The thin line indicates monthly values, and the thick line represents the simple running 37 month (c. 3 year) average. Data source: National Oceanographic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

[North Atlantic sea temperatures along 59N, updated to December 2014]



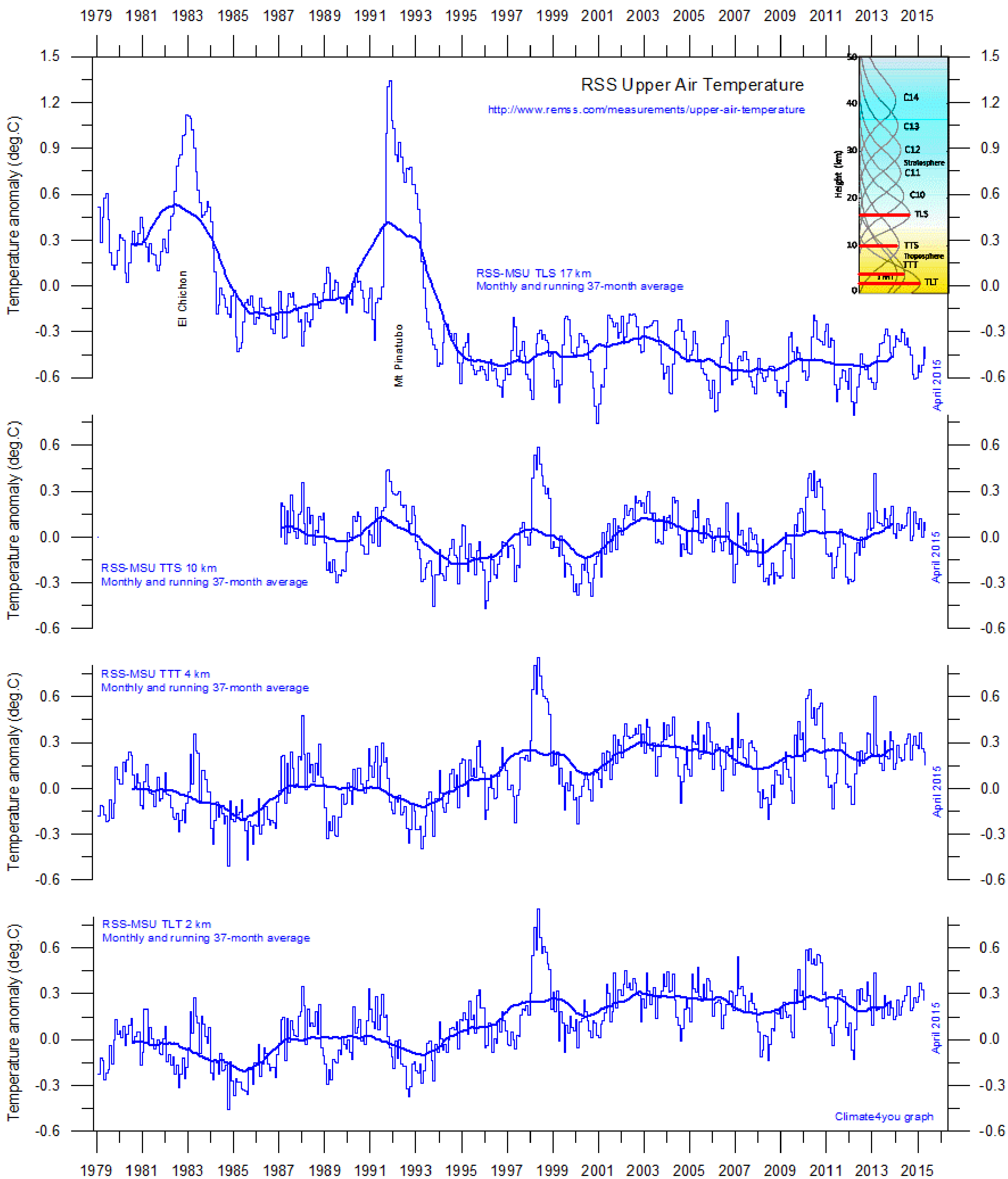
Depth-temperature diagram along 59 N across the North Atlantic, extending from northern Labrador in the west to northern Scotland in the east, using [Argo]-data. The uppermost panel shows the absolute temperature, and the lower diagram shows the temperature anomaly, using the monthly average temperature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

North Atlantic sea temperatures 30-0W at 59N, updated to December 2014



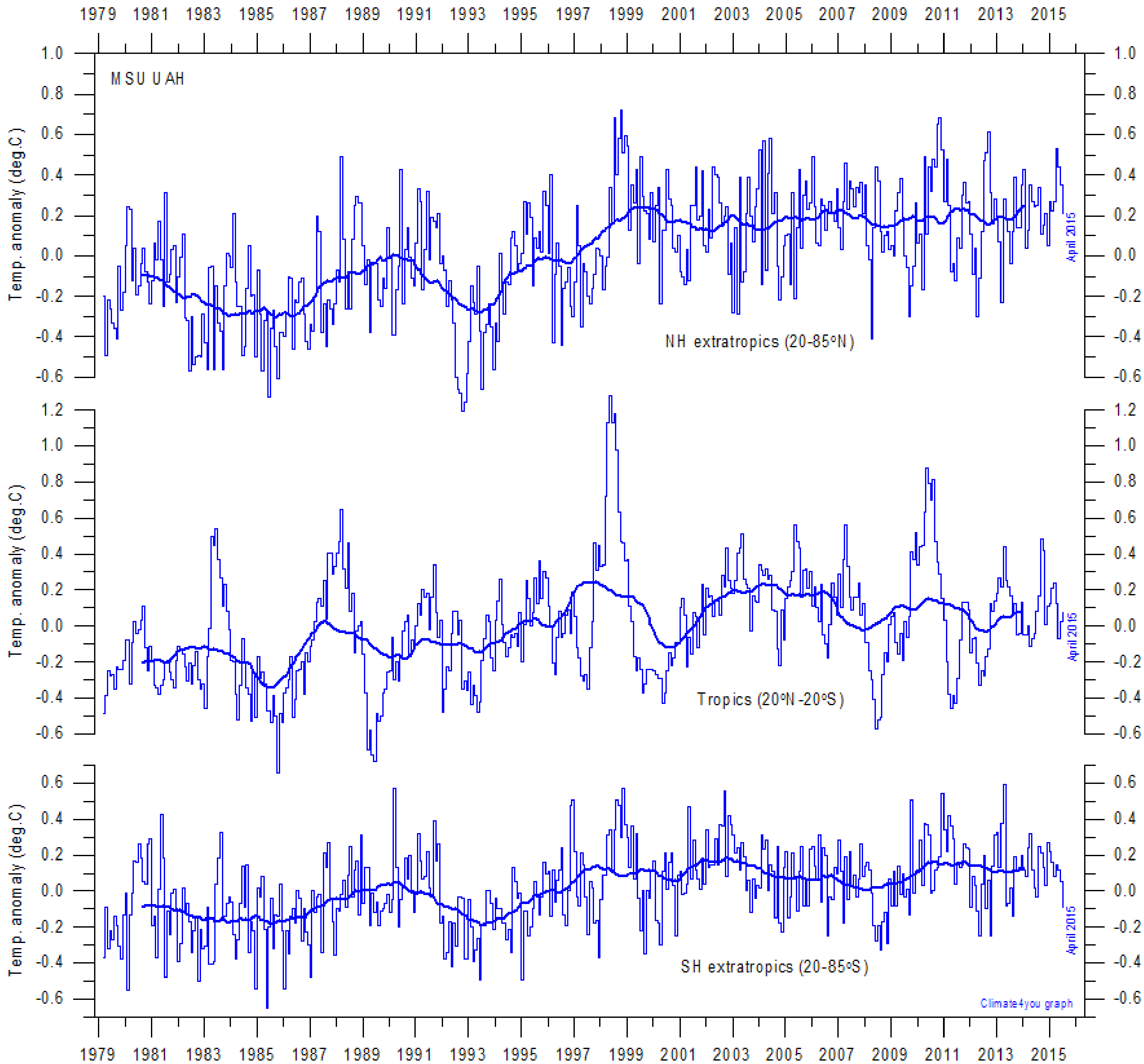
Average temperature along 59 N, 30-0W, 0-800m depth, corresponding to the main part of the North Atlantic Current, using Argo-data. Source: Global Marine Argo Atlas. Additional information can be found in: Roemmich, D. and J. Gilson, 2009. The 2004-2008 mean and annual cycle of temperature, salinity, 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 April 2015



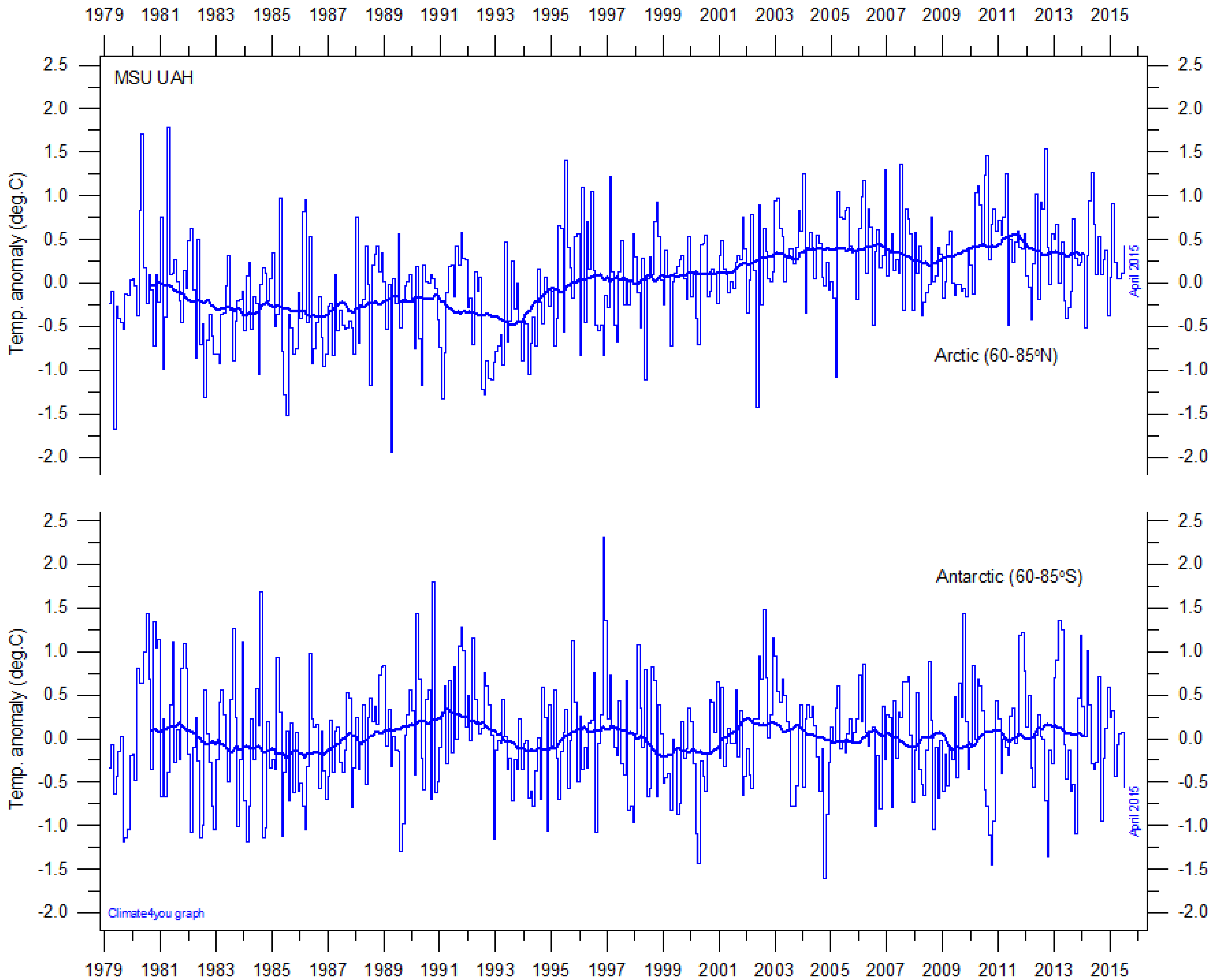
Global monthly average temperature in different altitudes according to Remote Sensing Systems (RSS). The thin lines represent the monthly average, and the thick line the simple running 37 month average, nearly corresponding to a running 3 yr average.

Zonal lower troposphere temperatures from satellites, updated to April 2015



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 April 2015



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. Reference period 1981-2010.

[Arctic and Antarctic surface air temperature, updated to March 2015]

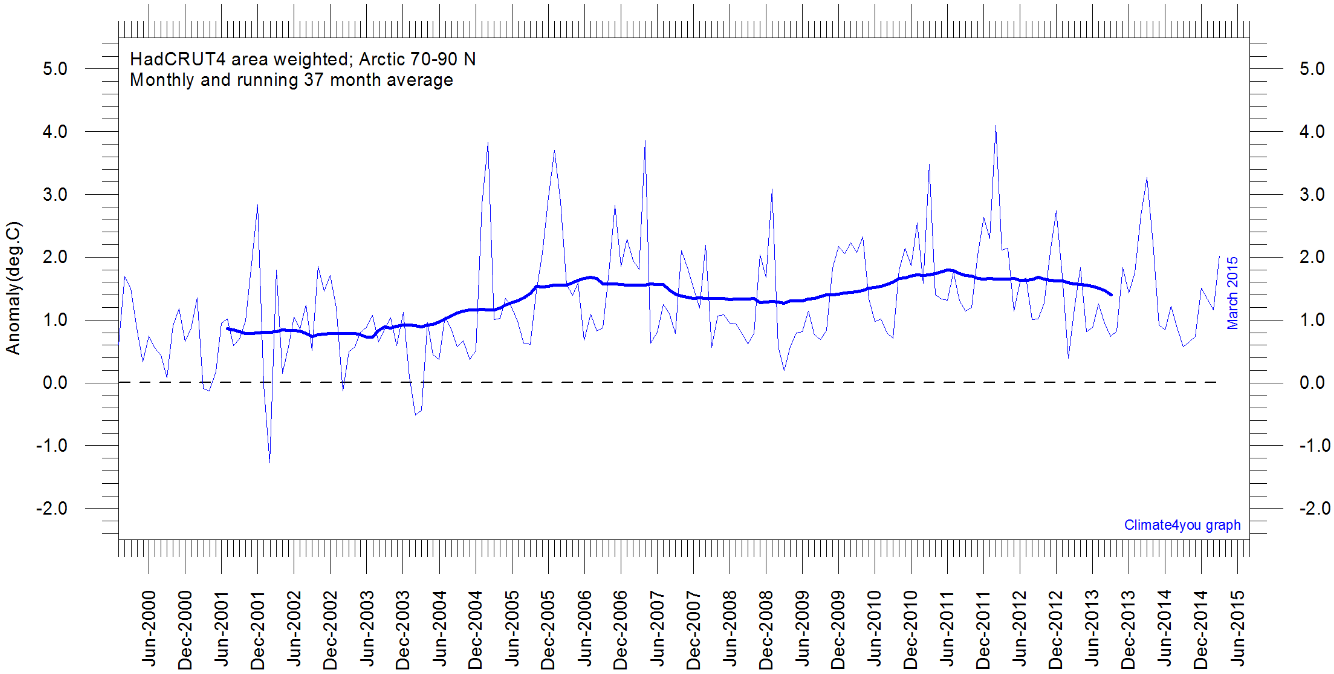


Diagram showing area weighted Arctic (70-90°N) monthly surface air temperature anomalies ([HadCRUT4]) since January 2000, in relation to the WMO [normal period] 1961-1990. The thin line shows the monthly temperature anomaly, while the thicker line shows the running 37 month (c.3 yr) average.

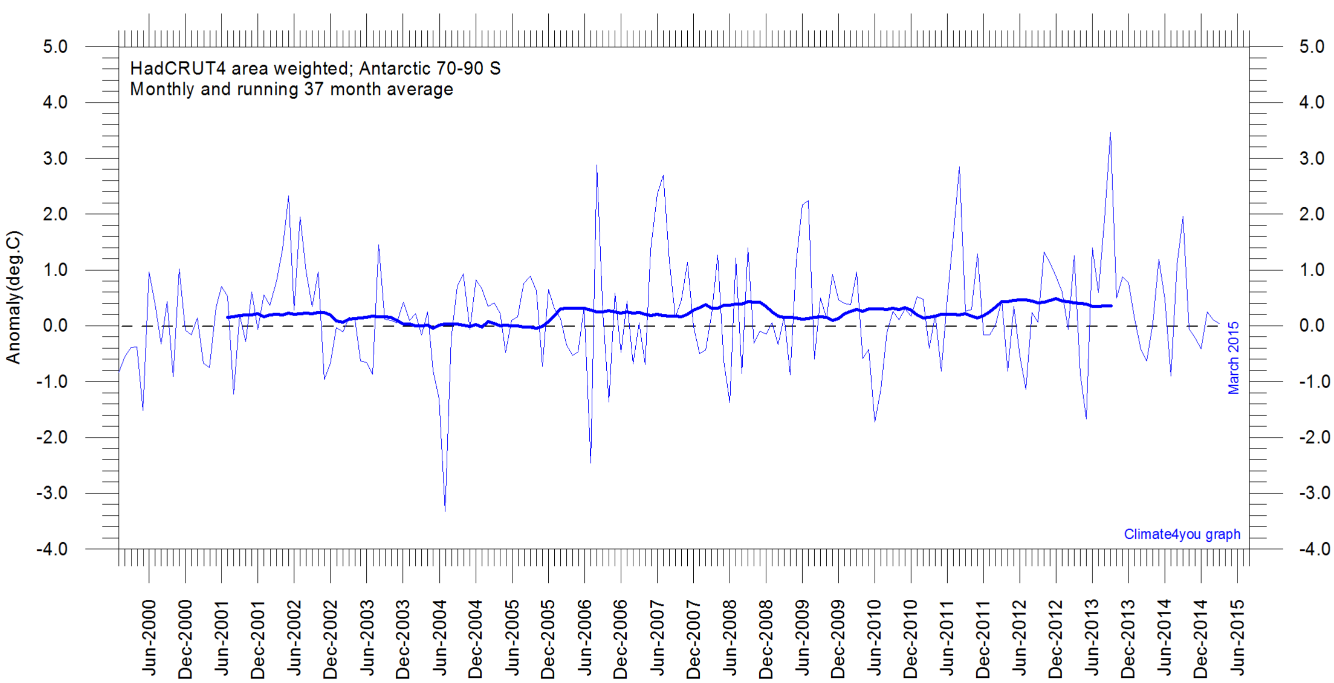


Diagram showing area weighted Antarctic (70-90°N) monthly surface air temperature anomalies ([HadCRUT4]) since January 2000, in relation to the WMO [normal period] 1961-1990. The thin line shows the monthly temperature anomaly, while the thicker line shows the running 37 month (c.3 yr) average.

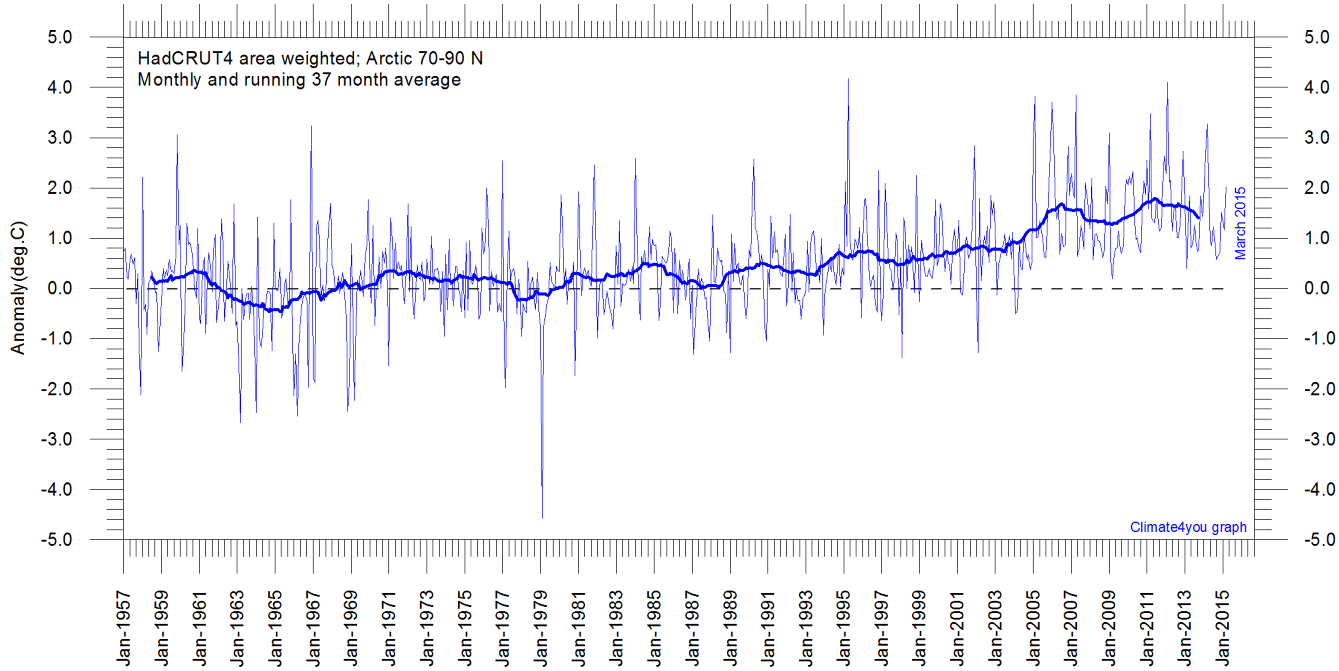


Diagram showing area weighted Arctic (70-90^{o}N) monthly surface air temperature anomalies (HadCRUT4) since January 1957, in relation to the WMO normal period 1961-1990. The thin line shows the monthly temperature anomaly, while the thicker line shows the running 37 month (c.3 yr) average.

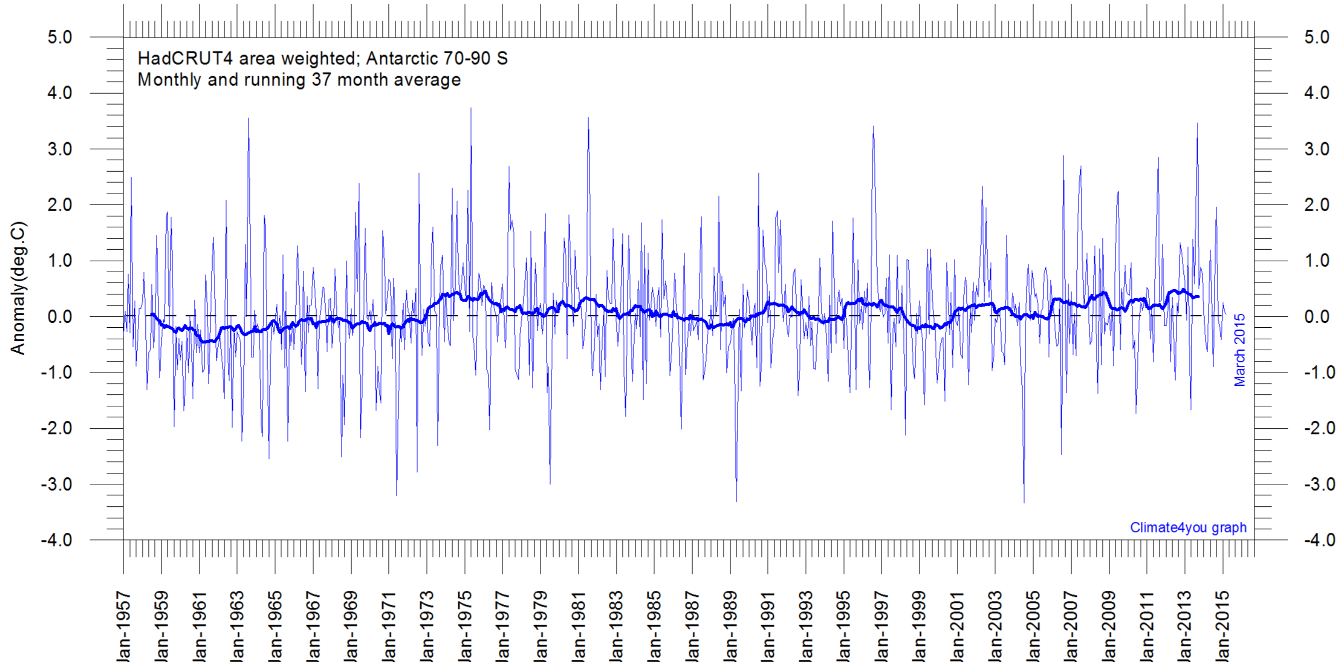


Diagram showing area weighted Antarctic (70-90^{o}N) monthly surface air temperature anomalies (HadCRUT4) since January 1957, in relation to the WMO normal period 1961-1990. The thin line shows the monthly temperature anomaly, while the thicker line shows the running 37 month (c.3 yr) average.

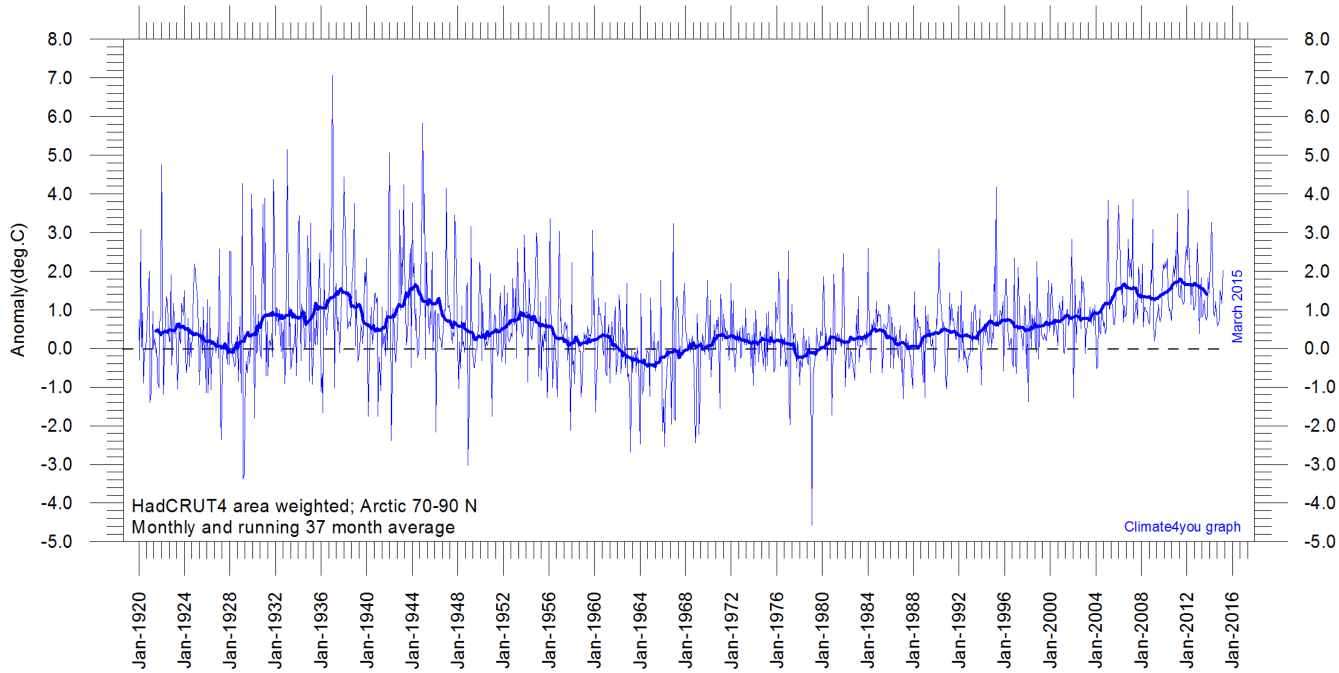


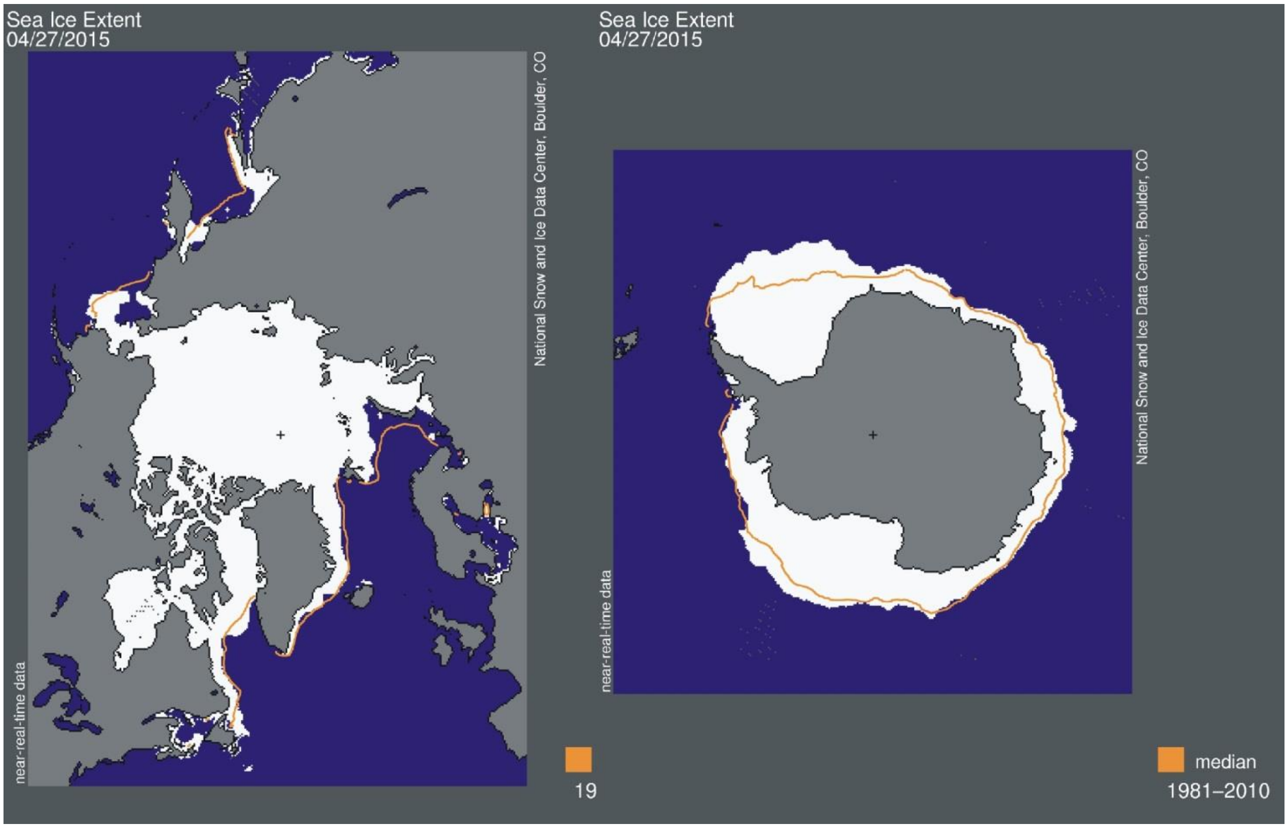
Diagram showing area-weighted Arctic (70-90°N) monthly surface air temperature anomalies ([HadCRUT4]) since January 1920, in relation to the WMO [normal period] 1961-1990. The thin line shows the monthly temperature anomaly, while the thicker line shows the running 37 month (c.3 yr) average. Because 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.

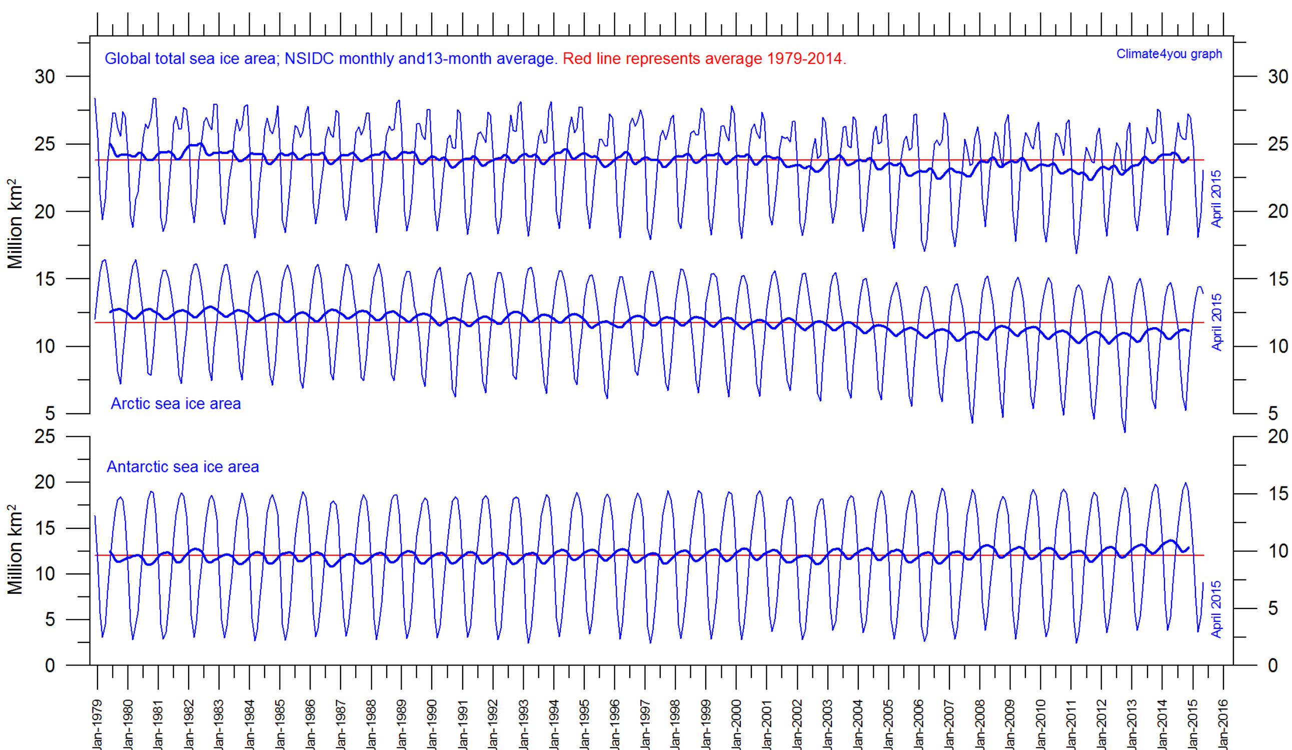
Literature:

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.

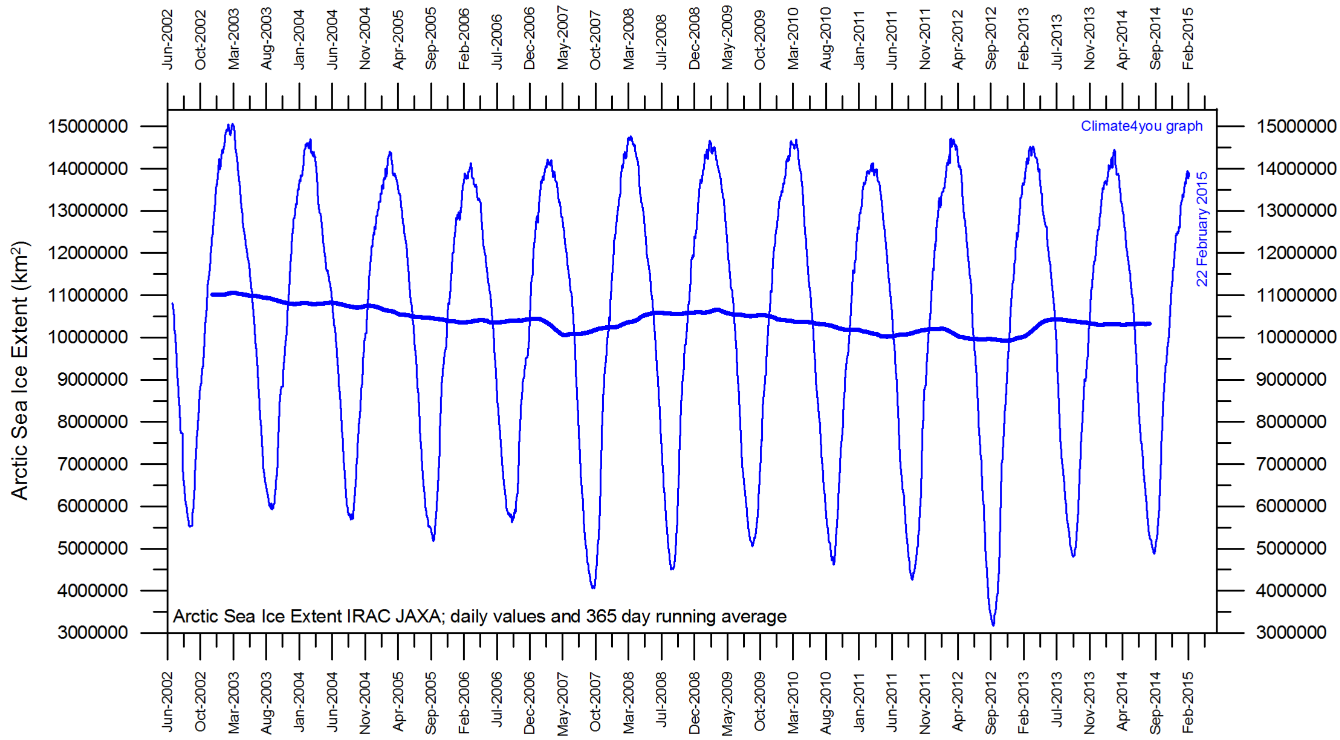
Arctic and Antarctic sea ice, updated to April 2015



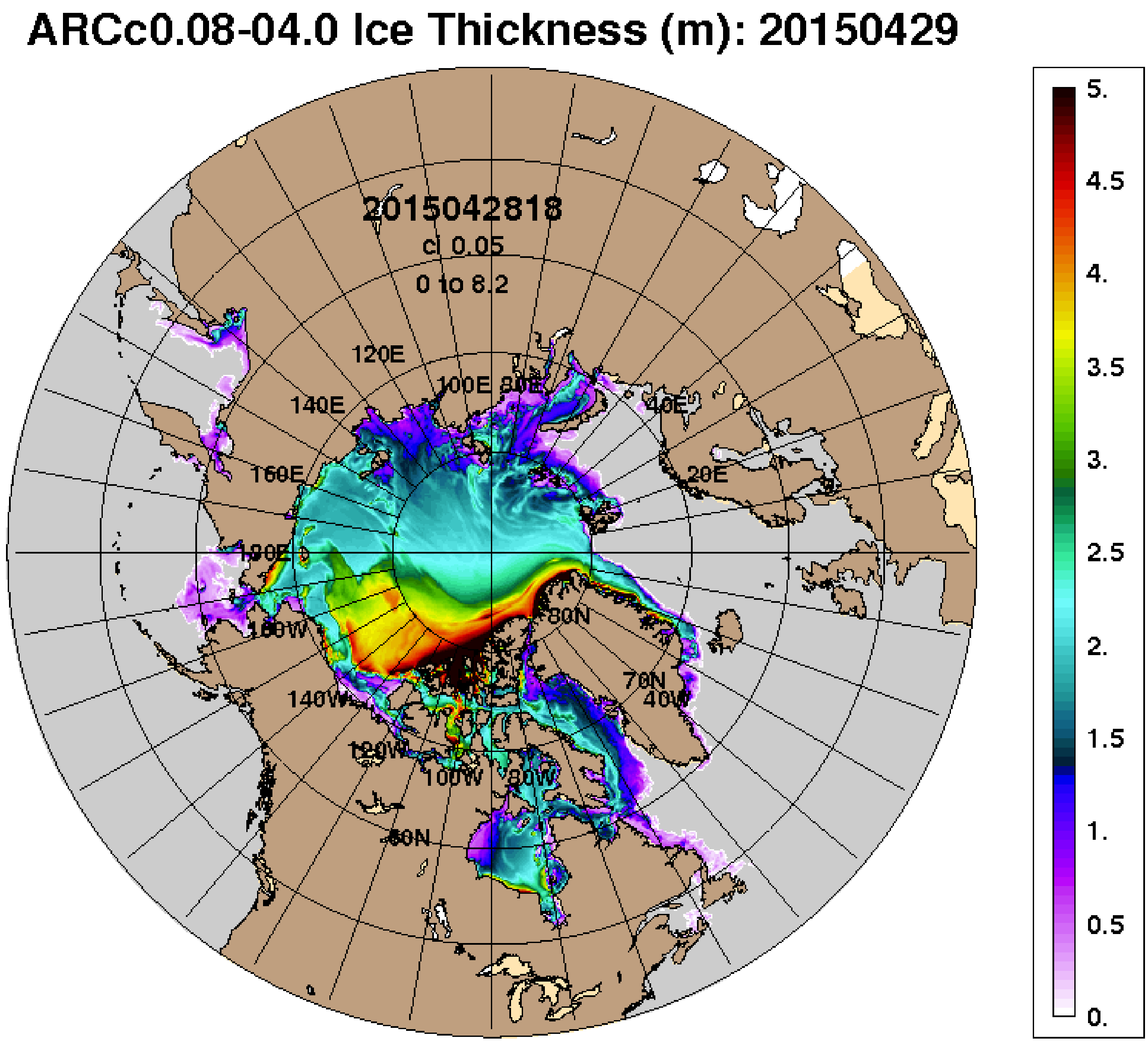
Sea ice extent 27 April 2015. The 'normal' or average limit of sea ice (orange line) is defined as 15% sea ice cover, according to the average of satellite observations 1981-2010 (both years inclusive). Sea ice may therefore well be encountered outside and open water areas inside the limit shown in the diagrams above. Map source: National Snow and Ice Data Center *(NSIDC).*



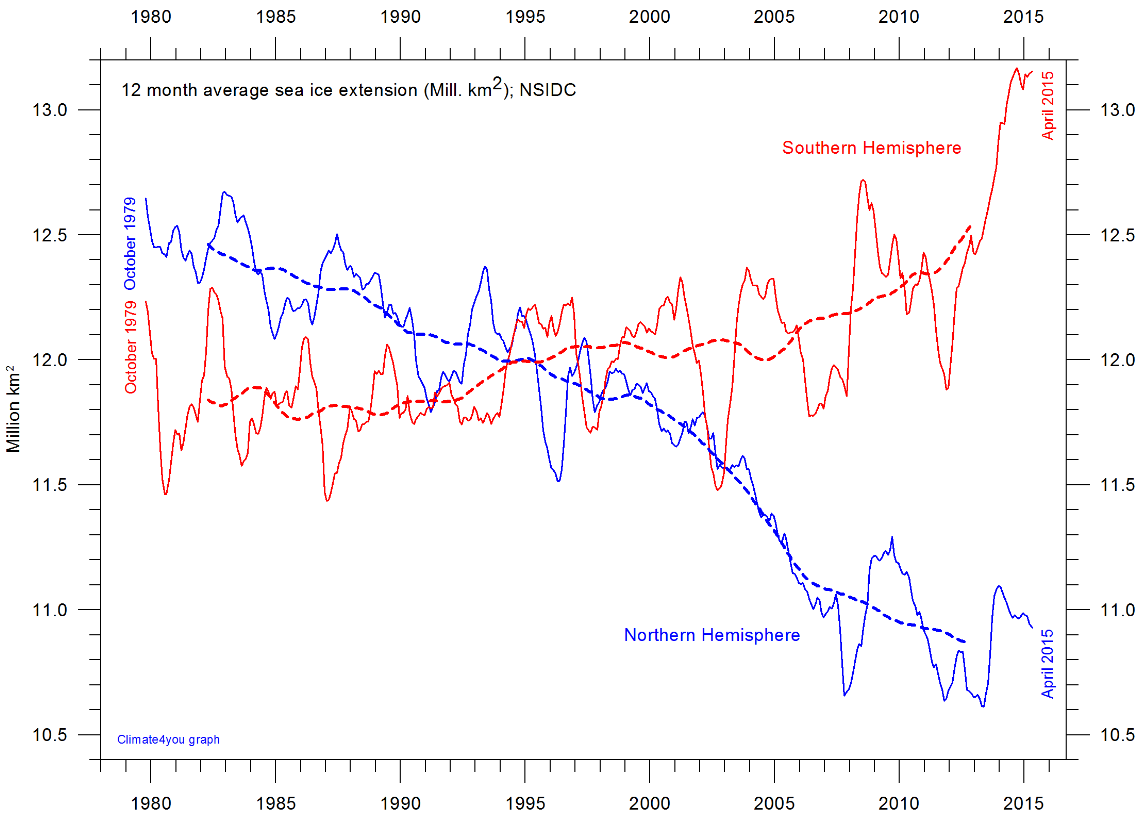
Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center](#) (NSIDC).



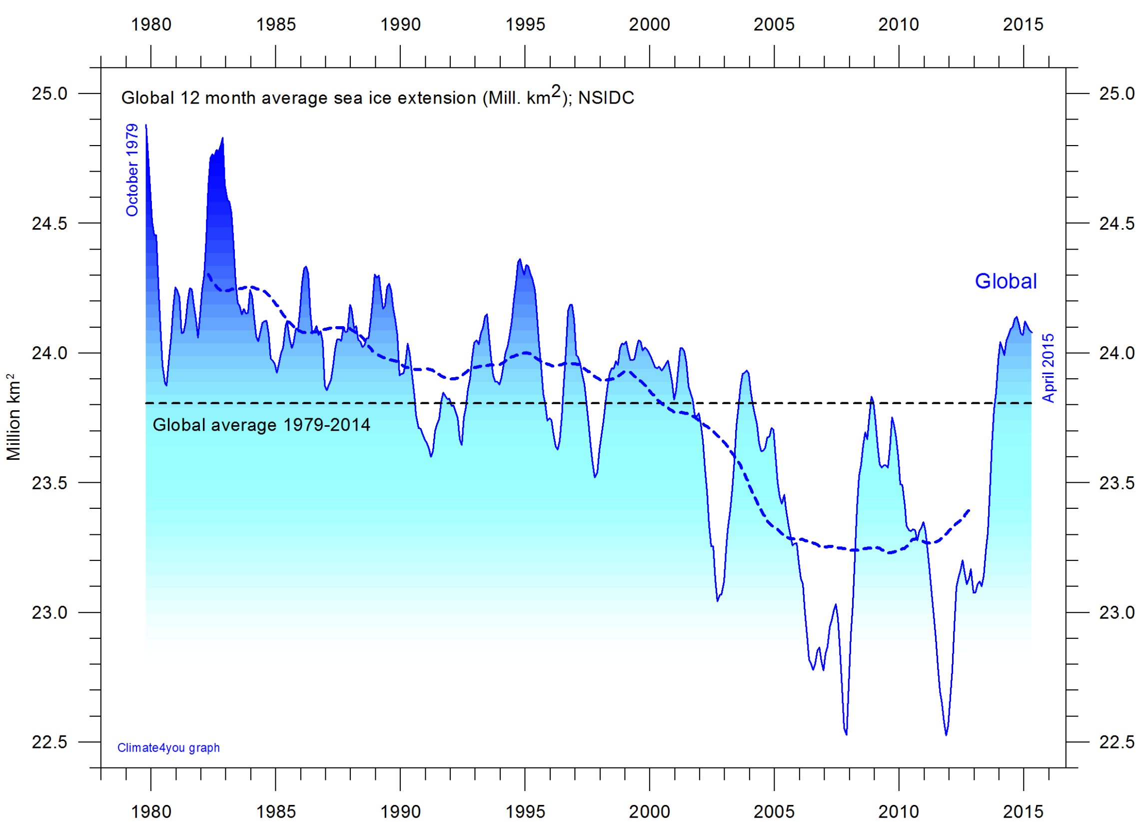
Graph showing daily Arctic sea ice extent since June 2002, to 22 February 2015, by courtesy of [Japan Aerospace Exploration Agency]() (JAXA). Please note that this diagram has not been updated beyond February 2015.



Northern hemisphere sea ice extension and thickness on 29 April 2015 according to the Arctic Cap Nowcast/Forecast System (ACNFS), US Naval Research Laboratory. Thickness scale (m) to the right.

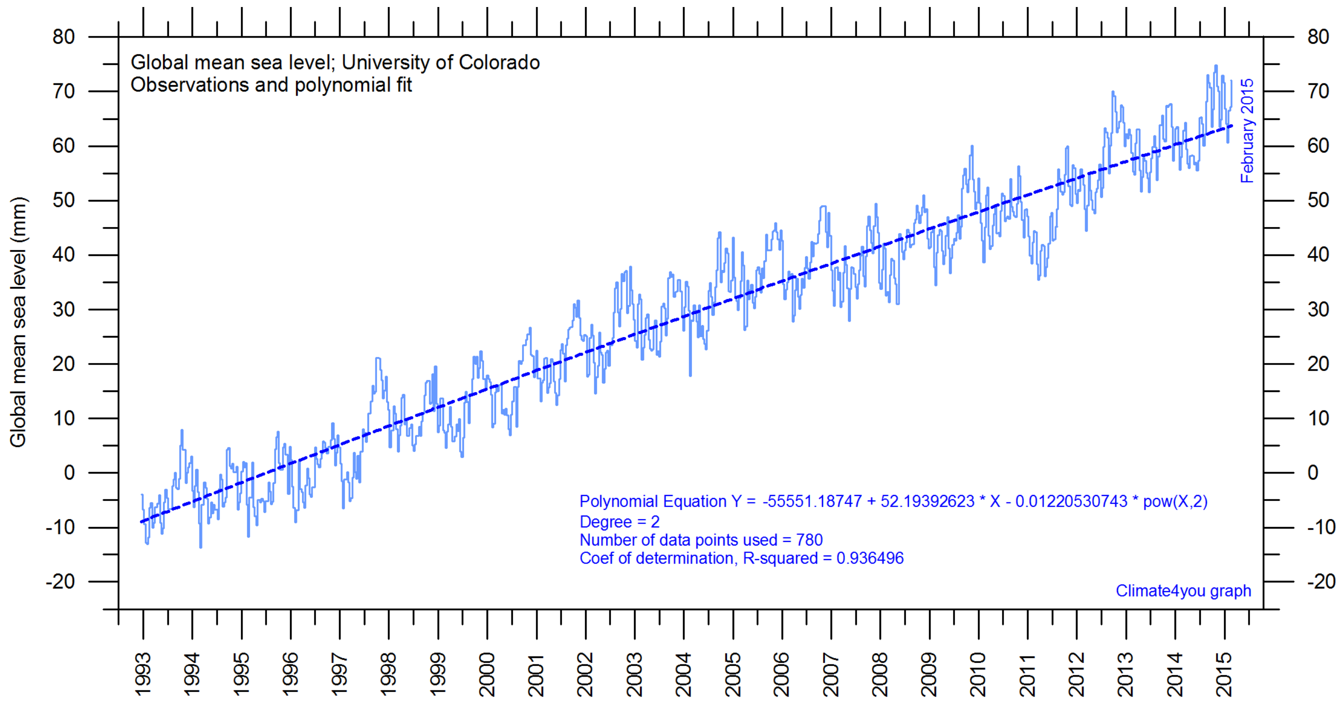


12 month running average sea ice extension in both hemispheres since 1979, the satellite-era. The October 1979 value represents the monthly average of November 1978 - October 1979, the November 1979 value represents the average of December 1978 - November 1979, etc. The stippled lines represent a 61-month (ca.5 years) average. Data source: National Snow and Ice Data Center (NSIDC).

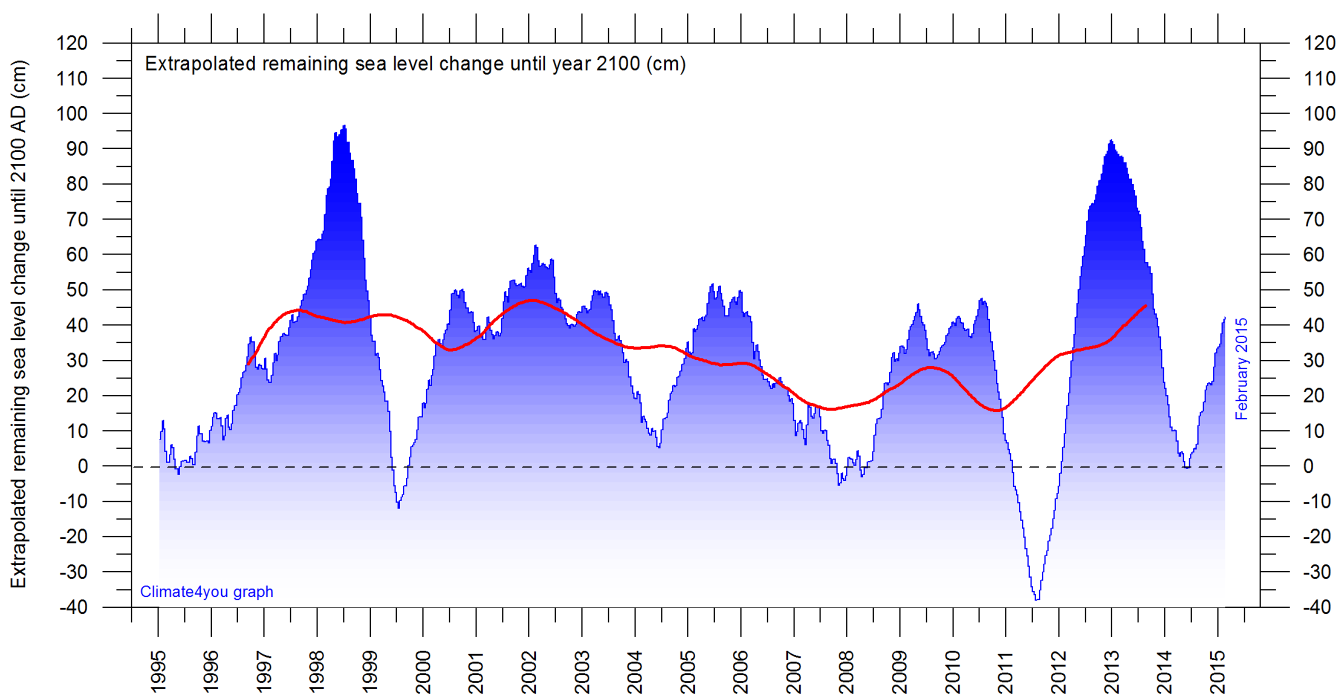


Global 12 month running average sea ice extension since 1979, the satellite-era. The October 1979 value represents the monthly average of November 1978 - October 1979, the November 1979 value represents the average of December 1978 - November 1979, etc. The stippled line represents a 61-month (ca.5 years) average. Data source: National Snow and Ice Data Center (NSIDC).

Global sea level, updated to February 2015

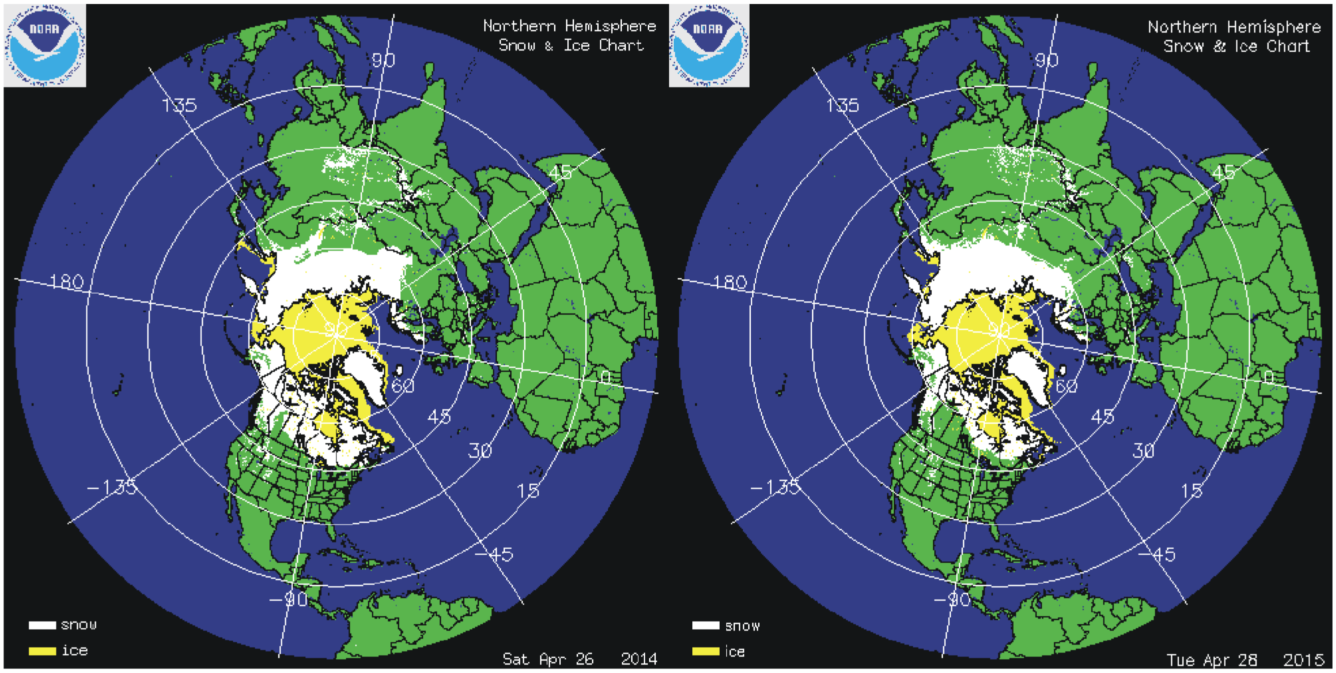


Global sea level (thin line) since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder. The thick stippled line represents a two-degree polynomium. The polynomium suggests the rate of the ongoing global sea level rise to be slowly decreasing. Time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

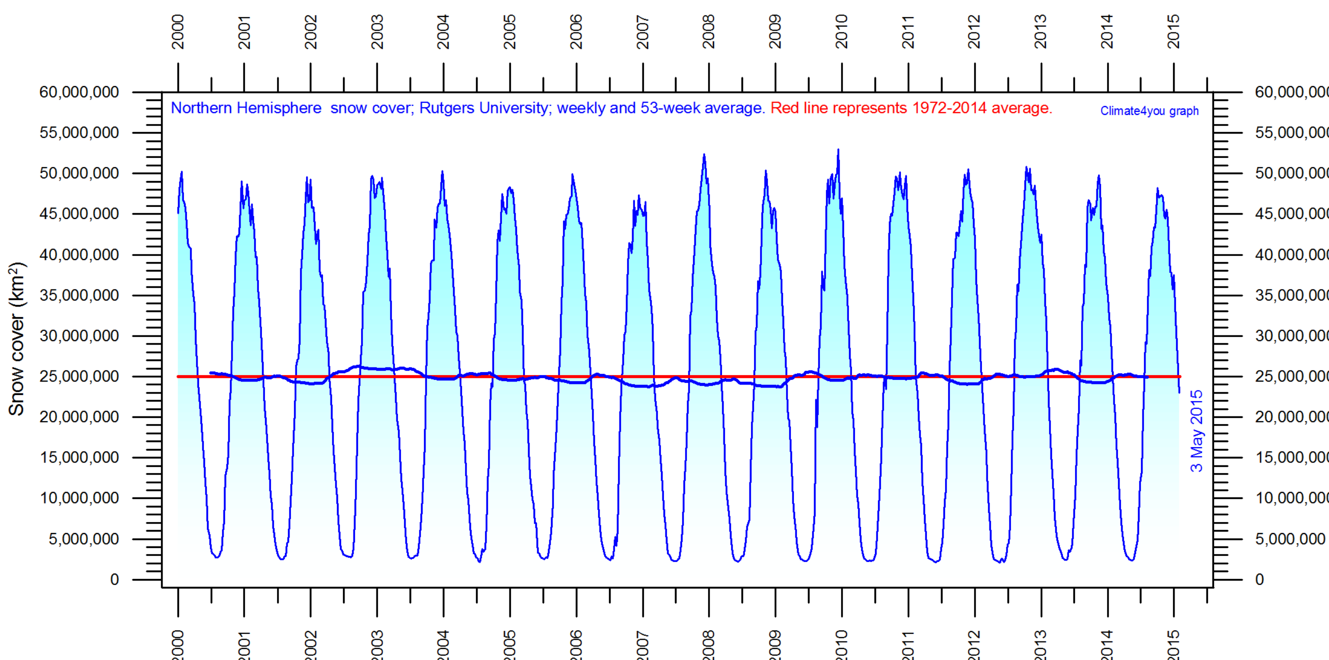


Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements done by the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 3 yr average forecast for sea level change until year 2100. Based on this (thick line), the present simple empirical forecast of sea level change until 2100 is about +45 cm.

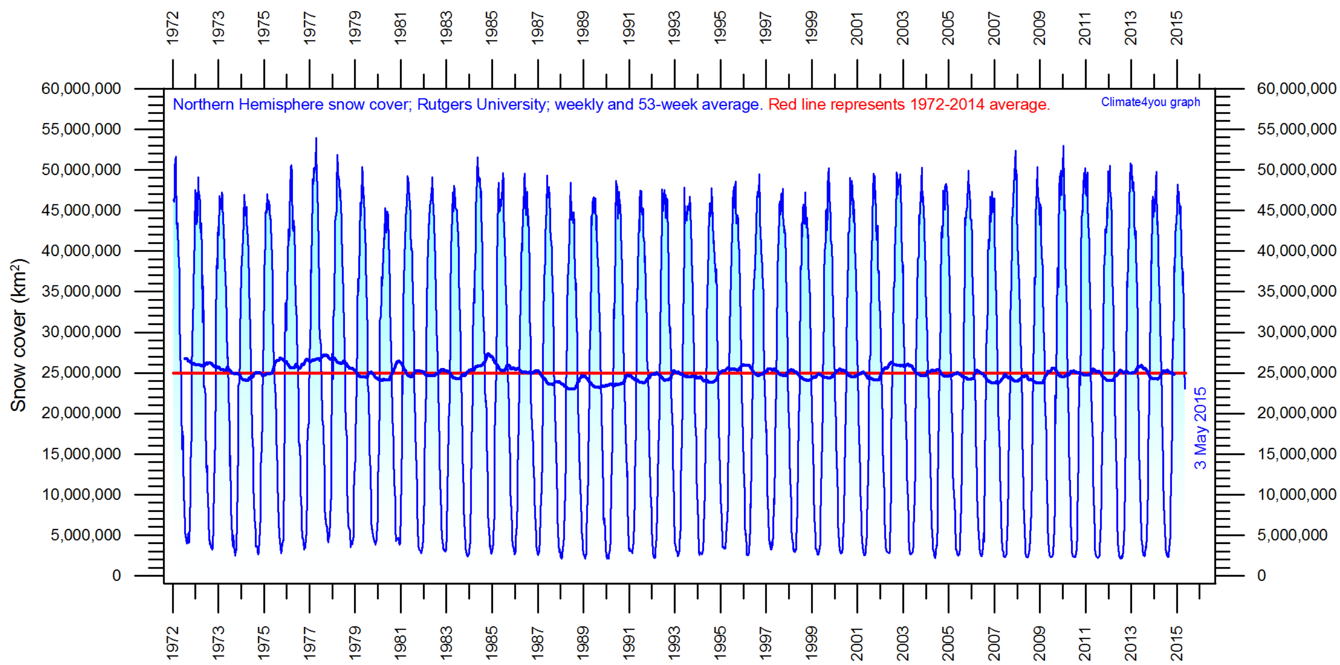
Northern Hemisphere weekly snow cover, updated to April 2015



Northern hemisphere snow cover (white) and sea ice (yellow) 26 April 2014 (left) and 2015 (right). Map source: [National Ice Center](#) (NIC).

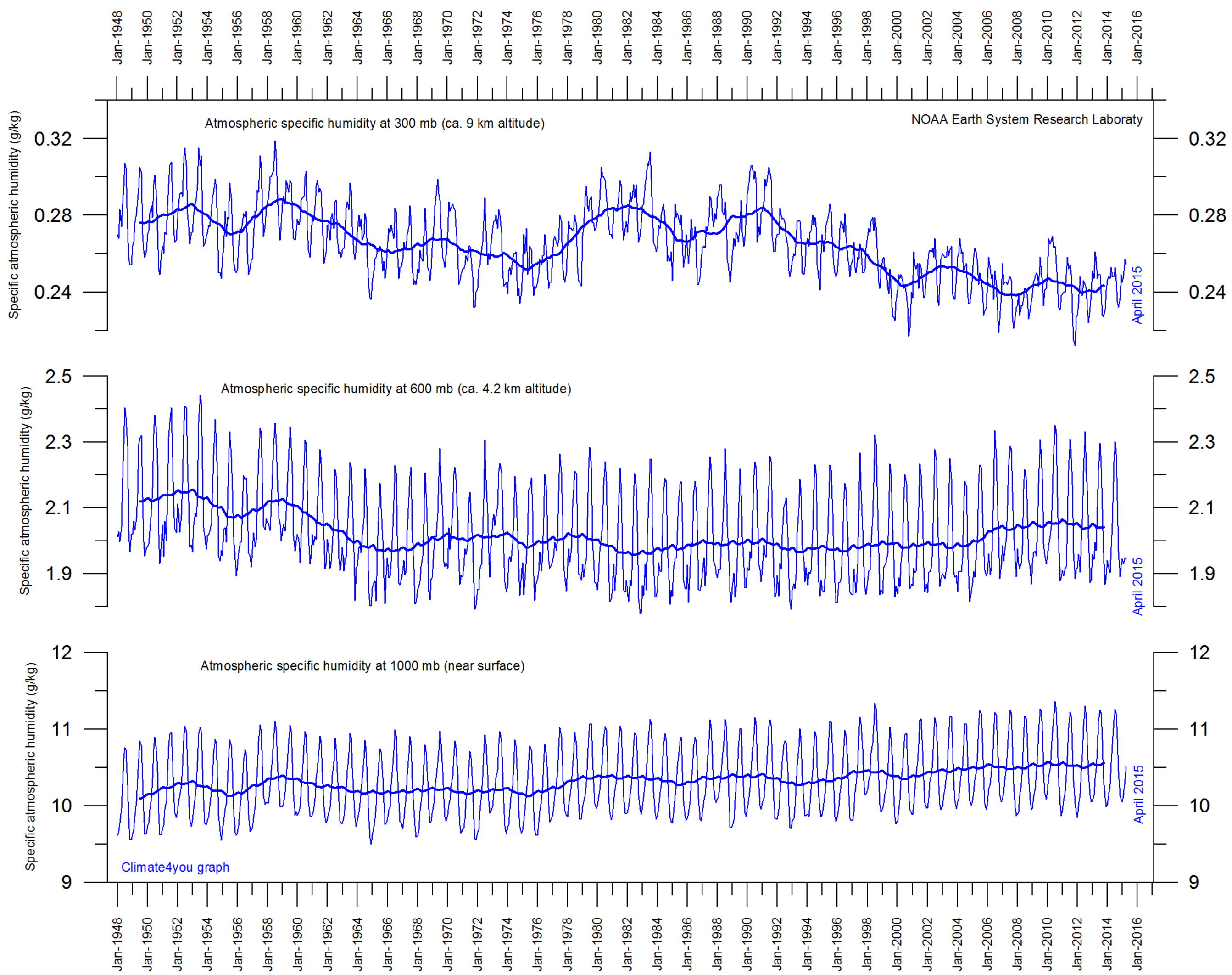


Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53-week average (approximately 1 year). The horizontal red line is the 1972-2014 average.



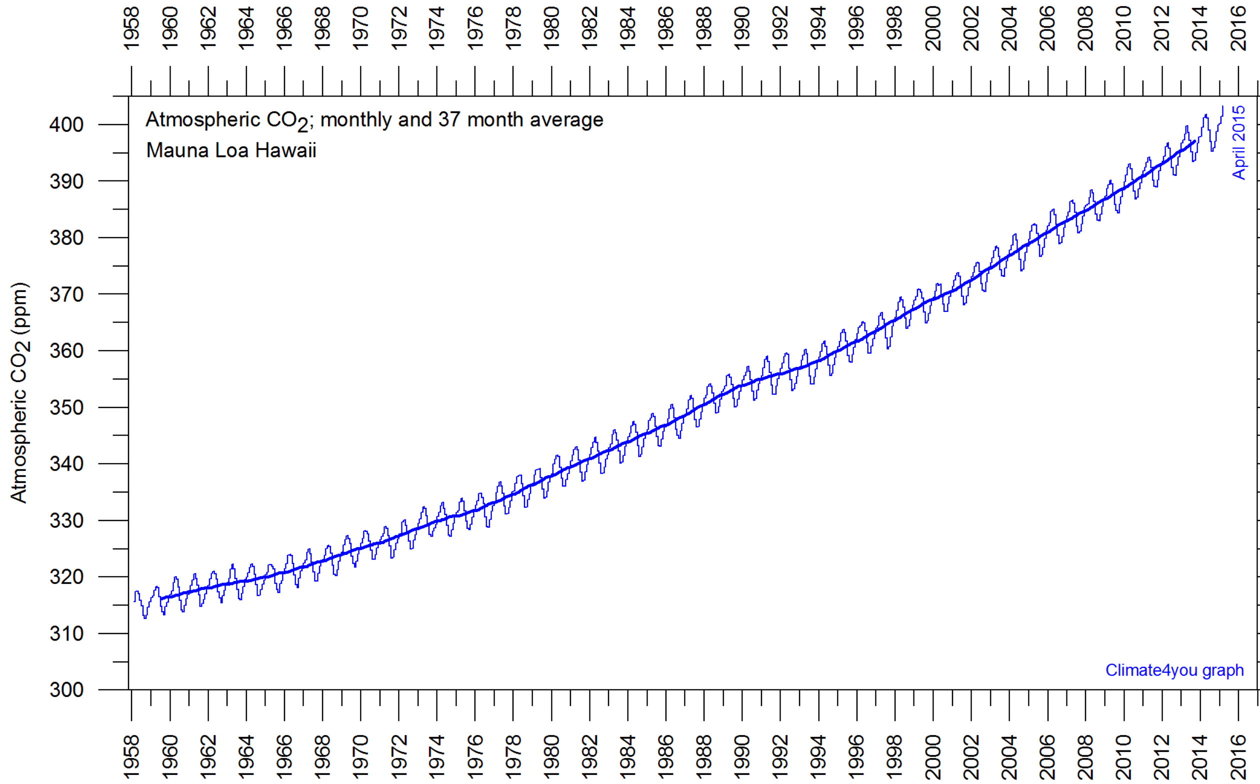
Northern hemisphere weekly snow cover since January 1972 according to Rutgers University Global Snow Laboratory. The thin blue line is the weekly data, and the thick blue line is the running 53-week average (approximately 1 year). The horizontal red line is the 1972-2014 average.

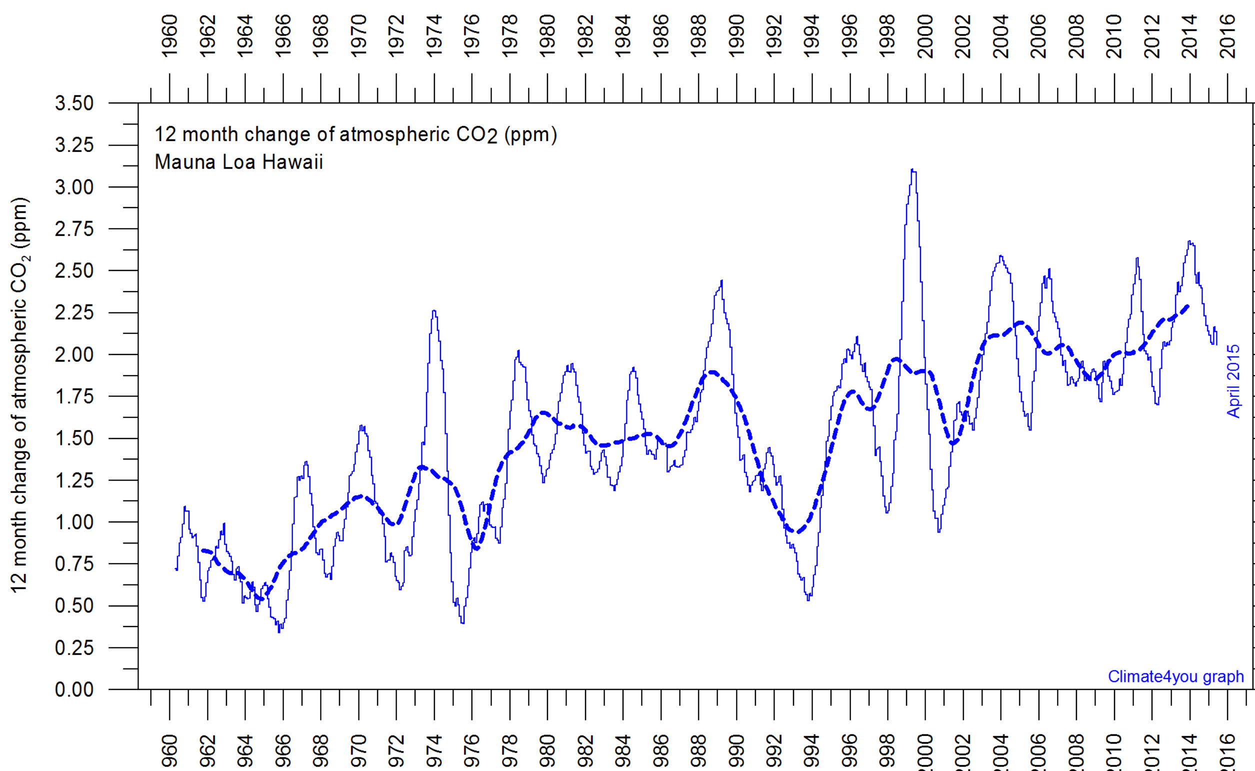
Atmospheric specific humidity, updated to April 2015



[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)](#).

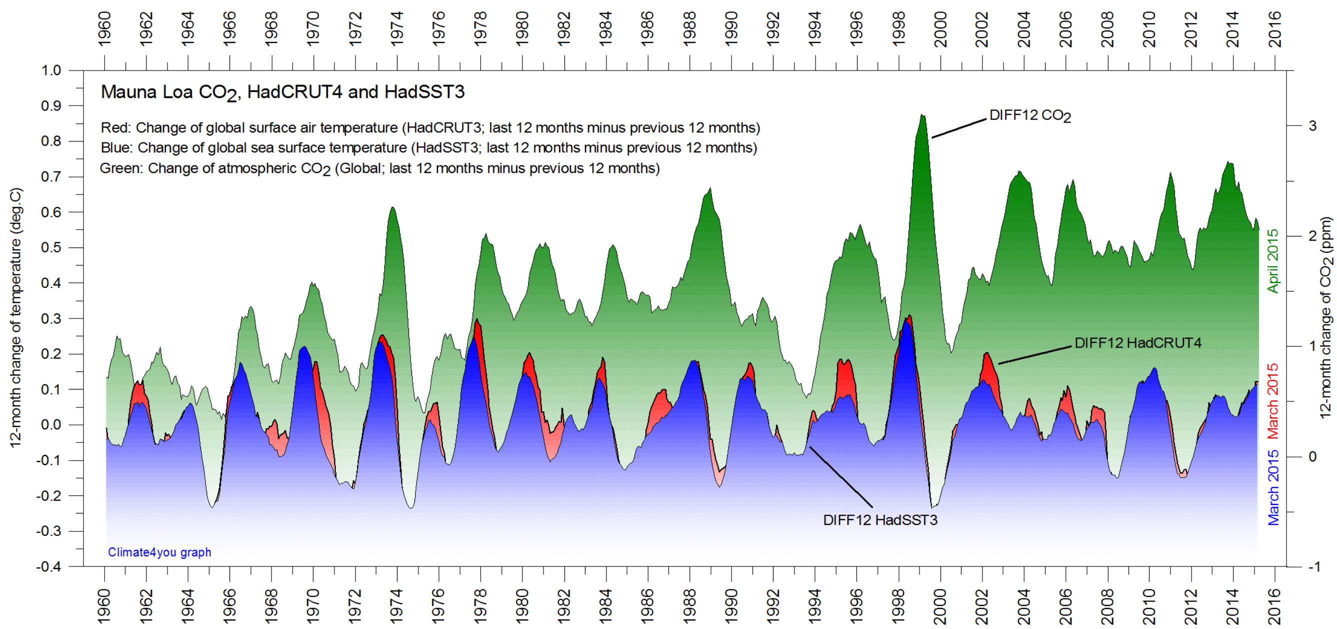
Atmospheric CO_2, updated to April 2015





Monthly amount of atmospheric CO_2 (upper diagram) and annual growth rate (lower diagram); average last 12 months minus average preceding 12 months, thin line) of atmospheric CO_2 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 CO_2 and global temperature, updated to April 2015

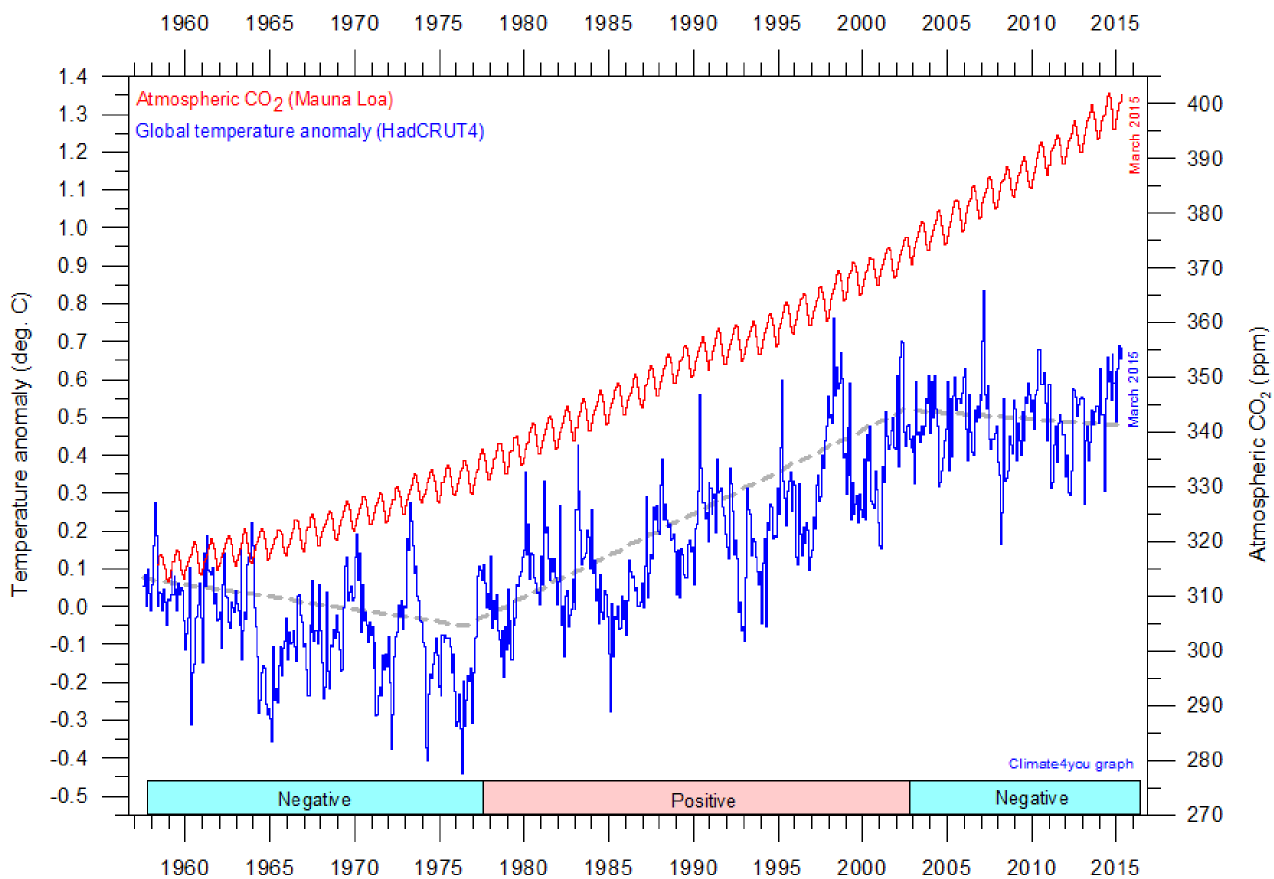


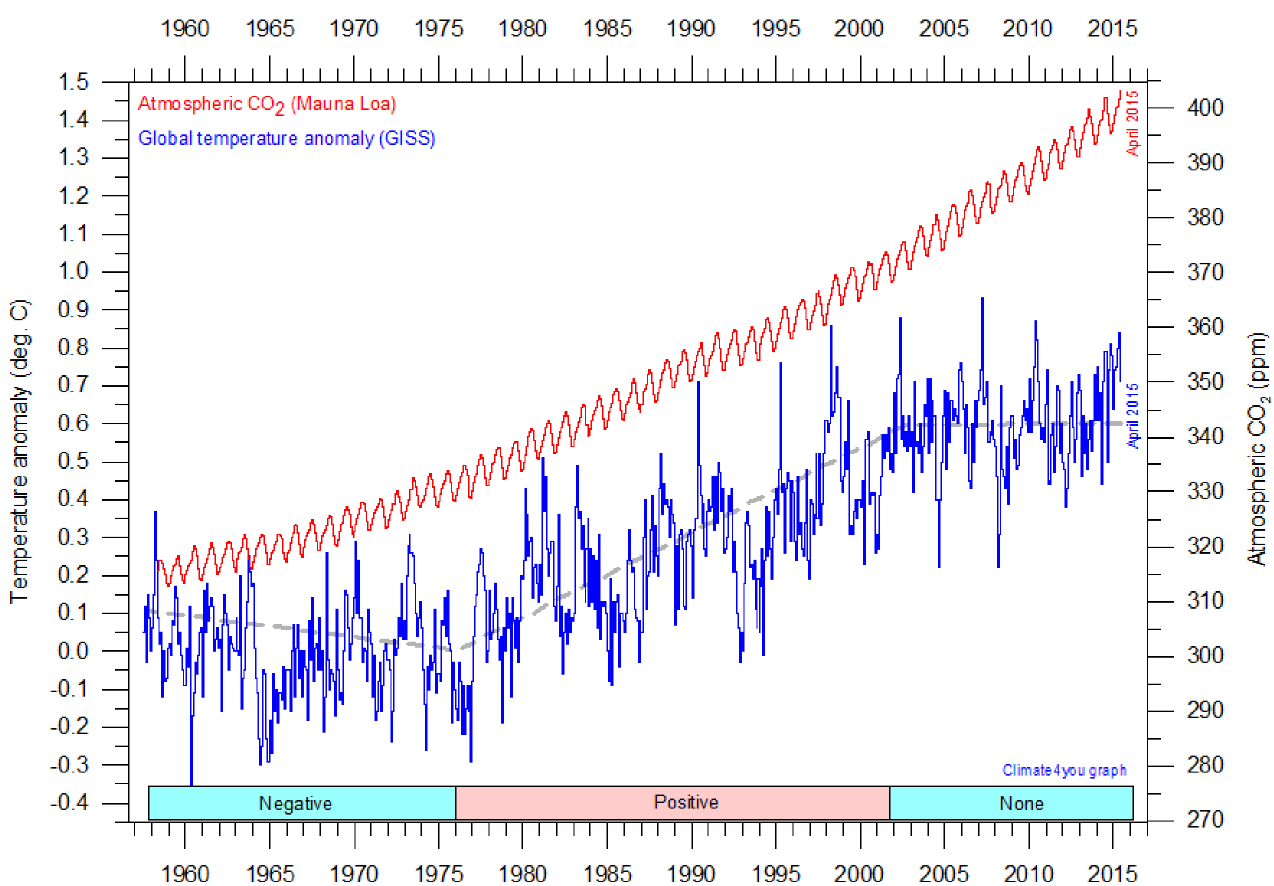
12-month change of global atmospheric CO_2 concentration ([Mauna Loa](); green), global sea surface temperature ([HadSST3](); blue) and global surface air temperature ([HadCRUT4](); red dotted). All graphs are showing monthly values of DIFF12, the difference between the average of the last 12 month and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

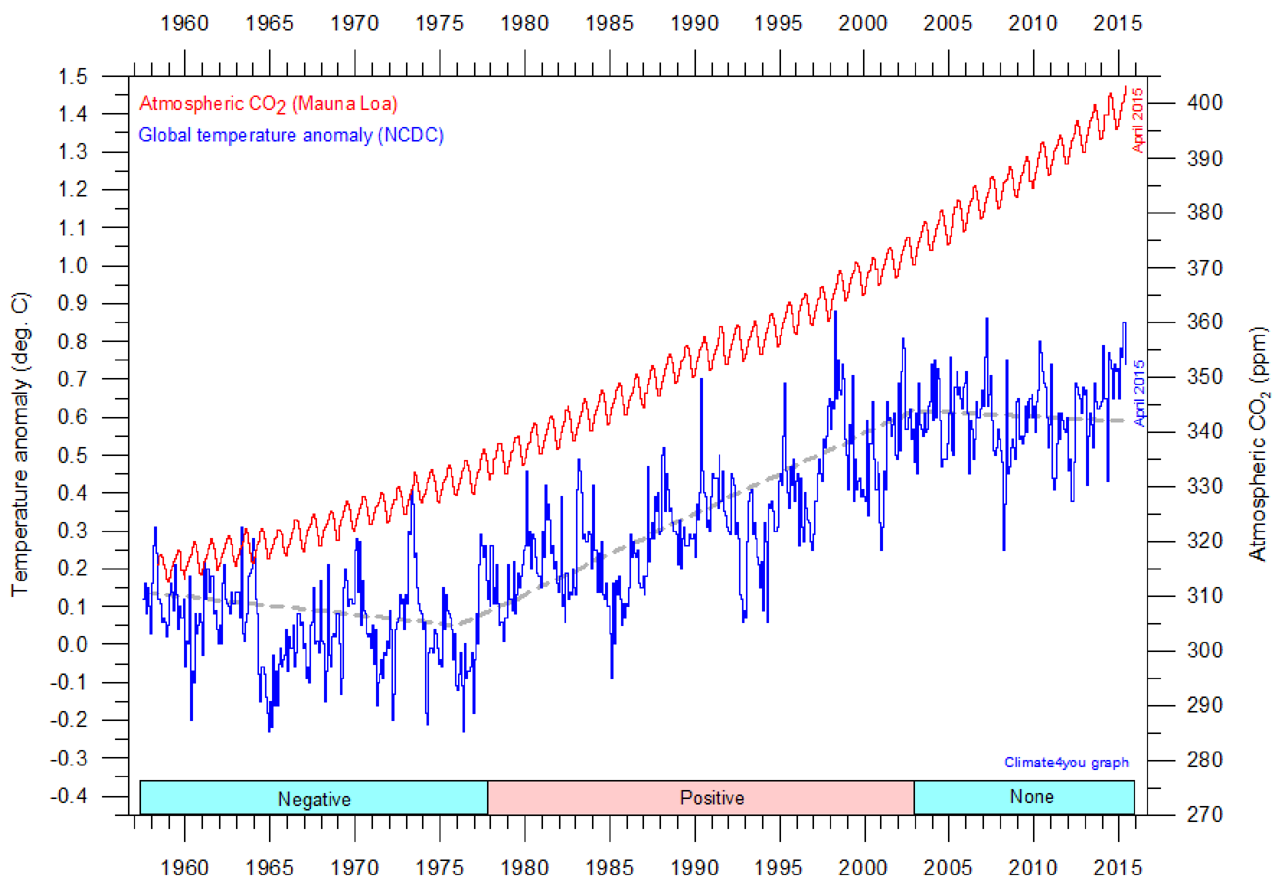
References:

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 April 2015







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 March 2015.

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.

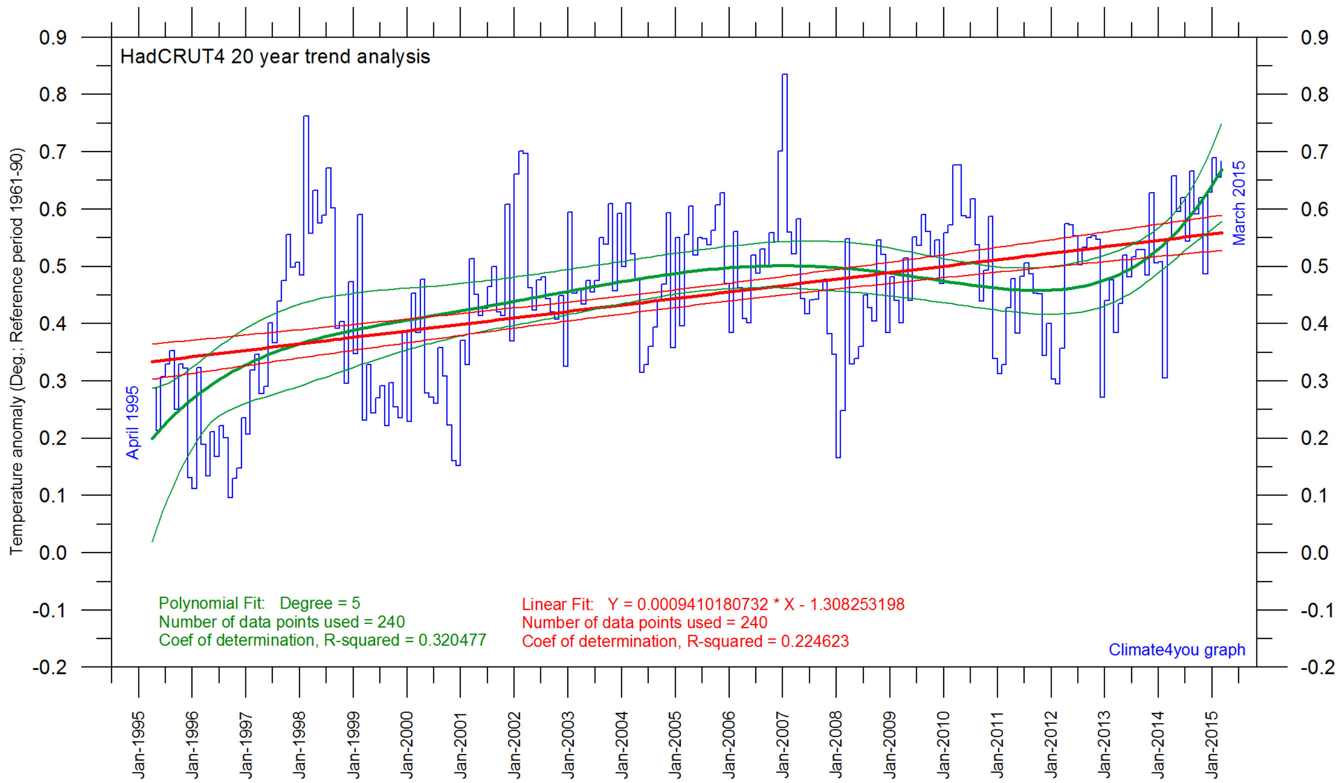
What exactly defines the critical length of a relevant time period to consider for evaluating the alleged importance of CO_2 remains elusive, and is still a topic for discussion. However, the critical period length must be inversely proportional to the temperature sensitivity of CO_2, including feedback 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 March 2015



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.

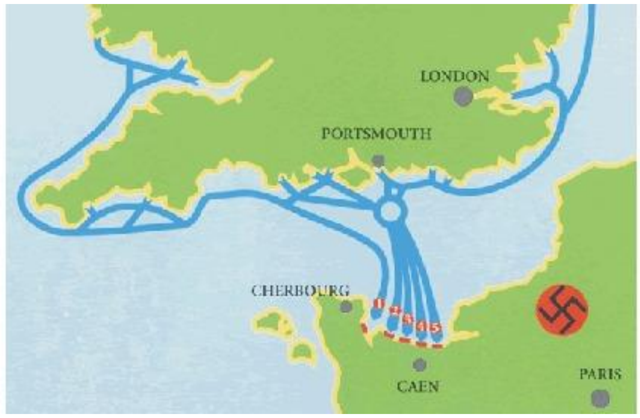
It is quite often debated if the global surface air temperature still increases, or if the temperature has levelled out during the last 15-18 years. The above diagram may be useful in this context, and demonstrates the differences between two often used statistical approaches to determine recent temperature 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.

Climate and history; one example among many

1944: D-Day in West Europe



Field Marshal Erwin J.E. Rommel (left). Sea routes active during the Allied invasion of France June 6, 1944 (centre). Five-star general Dwight D. Eisenhower (right).

In 1944, two of the greatest armoured commanders in modern history, Generaloberst Heinz Guderian and Field Marshal Erwin Rommel, disagreed on the proper way to meet the expected Allied invasion of France (Alexander 2000).

Based on his experiences in the east, Guderian recommended mobile warfare with the German panzer and panzergrenadier diversions stationed far inland in France. This would enable them to move rapidly towards the main invasion front, once it had been recognized. To Rommel the days of mobile warfare for Germany had passed because of Allied airpower, Allied mass production of tanks and armoured vehicles, and because of shortage of oil on the German side. So he wanted to place the main German units close to the coast. Bringing up operational reserves from inland would, in his opinion, not be a viable option. In the end, the decision was left to Adolf Hitler. He decided to disperse the powerful German panzer and panzergrenadier diversions all the way from northern Belgium to southern France.

From March 1944, Hitler himself actually speculated that the Allied landing might take place in Normandy, but afterward believed that such an invasion would only represent a diversion to the main assault, which was expected to take place at Pas de Calais, where the distance across the Channel is shortest. Later, also Rommel came around to the same belief, but despite frantic efforts, it was then too late to build adequate defences along the Norman Coast (Alexander 2000).

The supreme commander of the Allied invasion forces in UK, general D. Eisenhower, selected June 5, 1944, as D-Day. His decision was based on combinations of the moon, tide, and the time of sunrise. This time of year is usually characterized by pleasant weather in Northwest Europe, without strong storms. The Allies wanted to cross the Channel at night so darkness would conceal direction and strength of the attacks. In addition, they wanted the moon to make airborne drops possible. Only the period 5-7 June provided the right combination of all important factors. Any delay beyond 7 June would mean postponement for at least another two weeks. This might be critical, as the usually more unstable weather in July might then hamper sufficient supply of the allied forces, with the result that no significant breakout from the invasion area into France could be achieved before real unstable weather began in the autumn (D'Este 1994). Accordingly, the invasion was planned to take place on 5 June.

On the morning of June 4, with several divisions of the invasion force already at sea, Eisenhower and his commanders met with their meteorological committee, headed by RAF Group Captain J.M. Stagg (Alexander 2000). Unfortunately, the weather forecast was far from being good. Low clouds, high winds, and strong waves were forecasted for the planned invasion day, June 5. Eisenhower had to postpone the invasion for one day. The problem was that postponing the operation beyond June 6 or 7 would involve rescheduling the entire invasion and creating problems of enormous magnitude.

Eisenhower's decision was, however, very wise. In the early morning of June 5, a wind of almost hurricane force, along with sheets of rain, pondered the invasion coast. But at the same time, due to their network of meteorological observations from the North Atlantic region, the Allied meteorologists were able to forecast a 36 hour period of relative calm by the morning of June 6, just enough to risk launching the invasion. After that, the prospects were for more bad weather. General Eisenhower quickly decided to go ahead with the invasion on June 6. Stagg's forecast was probably one of the most important weather predictions in history.

German meteorologists were well aware of the coming bad weather. But due to their much more limited number of meteorological data from the North Atlantic region, they were not in a position to make a detailed forecast like the Allied meteorologists. Understandably, they only had a forecast of general bad weather 5-7 June, not suitable for a major seaborne invasion.

Meanwhile, in France Field Marshal Erwin Rommel was becoming more and more frustrated by his lack of direct command over the panzer divisions in the hinterland. He hoped that if, once again, he could see Hitler personally he could persuade him to lend his authority in certain directions. Making use of his good personal relations with General Schmundt, Hitler's senior Adjudant, he actually managed to secure an interview with Hitler at the Berghof in Berchtesgaden on June 8. Shortly before, on June 6, his wife Lucy, was going to celebrate her fiftieth birthday in Herrlingen in Württemberg. Having heard the German weather forecast of generally bad weather for the next few days, Rommel therefore decided to take leave to be at home in Herrlingen with his wife on her birthday (Fraser 1993). From there, there was only a short drive to Berchtesgaden.

When the Allied landing began in the morning of June 6, Rommel was therefore in Germany, and the German defence was without its commanding chief at this critical time. His absence from the field of battle presumably contributed to the slow response by the German army to the invasion, and precious hours were lost for the defence. Nevertheless, parts of the Allied invasion front - especially at Omaha beach - came in grave trouble during the initial hours of the invasion.

We will never know precisely what the outcome would have been, had Rommel been present in France on the morning of 6 June, with full command over all German forces in France. Presumably, the Allied total command of the air would have made a major German counteroffensive very difficult.

But had the Allied invasion eventually failed in June 1944, the first atomic bomb might have been dropped on Berlin, not Japan (Simmons 2008, pers. comm.). Perhaps the adverse weather conditions early June 1944 thereby saved Germany from such a cataclysmic event.

Or, alternatively, had the Allied invasion failed in June 1944, Germany may have had sufficient time to develop means of intercontinental carrying capability of a German atomic bomb. From March 1945, Germany conceivably was close to reaching such a political position (Witkowski, 2011).

References:

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D'Este, C. 1994. *Decision in Normandy*. Harper Perennial, 335 pp.

Fraser, D. 1993. *Knight's Cross. A life of Field Marshal Erwin Rommel*. Harper-Collins Publishers, London, 601 pp.

Witkowski, I. 2011. *Die Wahrheit über die Wunderwaffe. Teil 3. Geheime Waffenteknologie im Dritten Reich.* Mosquito Verlag Ltd & Co KG, Immenstadt, Germany, 321 pp. ISBN 978-3-928963-44-2.

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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)

May 20, 2015.