Climate4you update November 2010

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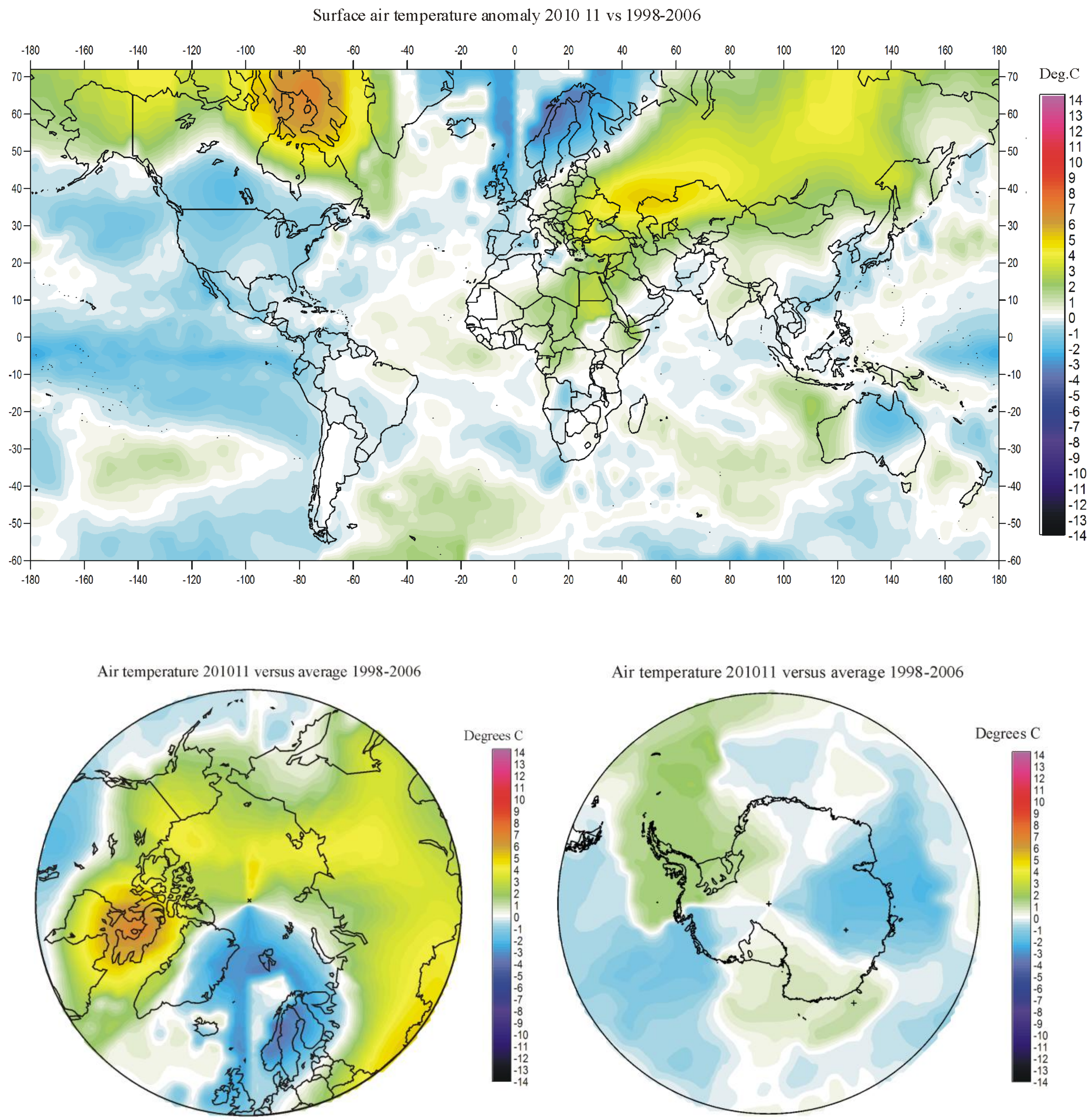
November 2010 global surface air temperature overview



November 2010 surface air temperature compared to the average 1998-2006. Green.yellow-red colours indicate areas with higher temperature than the 1998-2006 average, while blue colours indicate lower than average temperatures. Data source: [Goddard Institute for Space Studies](http://www.giss.nasa.gov/) (GISS)

Comments to the November 2010 global surface air temperature overview

General: This newsletter contains graphs showing a selection of key meteorological variables for November 2010. All temperatures are given in degrees Celsius.

In the above maps showing the geographical pattern of surface air temperatures, the period 1998-2006 is used as reference period. The reason for comparing with this recent period instead of the official WMO 'normal' period 1961-1990, is that the latter period is affected by the relatively cold period 1945-1980. Almost any comparison with such a low average value will therefore appear as high or warm, and it will be difficult to decide if modern surface air temperatures are increasing or decreasing. Comparing with a more recent period overcomes this problem. In addition to this consideration, the recent temperature development suggests that the time window 1998-2006 may roughly represent a global temperature peak. If so, negative temperature anomalies will gradually become more and more widespread as time goes on. However, if positive anomalies instead gradually become more widespread, this reference period only represented a temperature plateau.

In the other diagrams in this newsletter the thin line represents the monthly global average value, and the thick line indicate a simple running average, in most cases a 37-month average, almost corresponding to three years.

The year 1979 has been chosen as starting point in several of the diagrams, as this roughly corresponds to both the beginning of satellite observations and the onset of the late 20th century warming period.

Global surface air temperatures November 2010 in the Northern Hemisphere was characterised by regional variability. Most of Russia, Siberia, Alaska and NE Canada experienced above average 1998-2006 temperatures, while most of the Pacific, Mexico, USA, southern Canada, the North Atlantic and NW Europe had below average temperatures.

When considering the uppermost map on page 1 please remember the area limitations of the Mercator map projection used. Even though the Polar Regions have been removed in this map, problems relating to visual comparison of areas still remain. As one example, the 'hotspot' over Foxe Basin and Baffin Island in Canada in has a surface area of about the same size as Mexico further to the south.

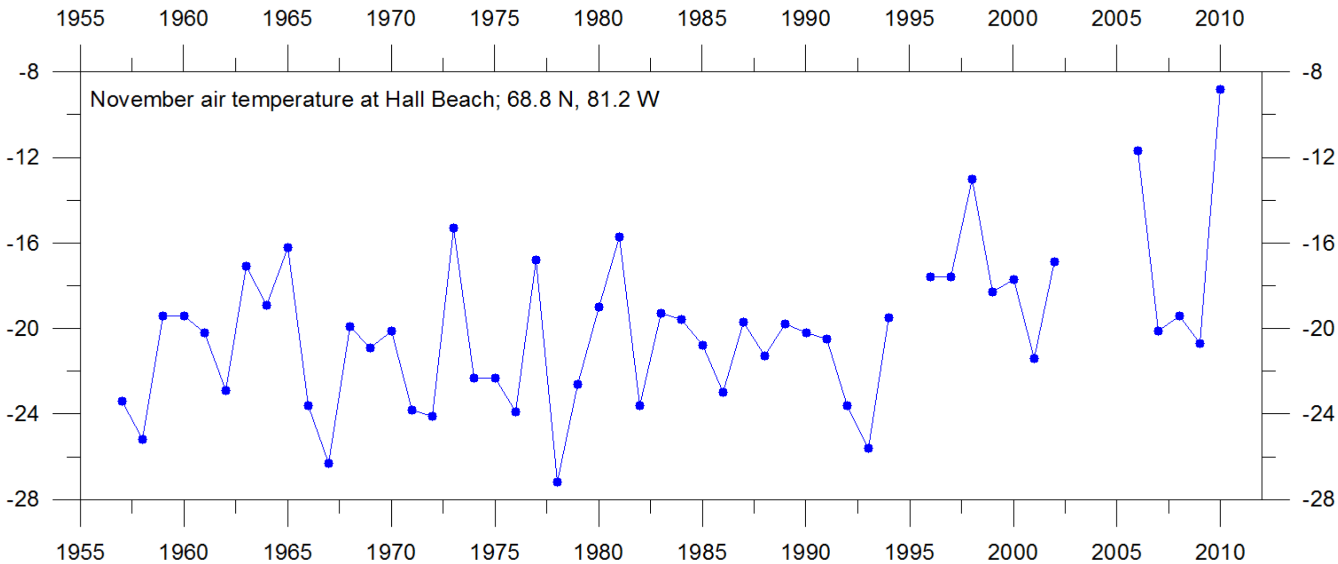
The Southern Hemisphere in general was relatively cold or close to average conditions. Especially parts of Australia experienced below average temperature. There were no major warm areas in the Southern Hemisphere.

Near Equator conditions were influenced by the new La Nina situation (see also page 8). Relatively low temperatures therefore characterised most of the Equatorial regions in the Pacific Ocean. The Equatorial Atlantic was close to average conditions, as was the Indian Ocean.

The Arctic was mainly characterized by above average temperatures, with the exception of the Greenland-European sector, which experienced below average temperatures. The temperature pattern is, however, based on a relatively small number of stations, and extrapolations are made over large distances. The 'hotspot' near Baffin Island in Arctic Canada was apparently mainly caused by data obtained at Hall Beach, situated at the coast of eastern Melville Peninsula. The two nearest stations within the region with a meteorological record including 2010 are Clyde and Coral Harbour, about 500 km east and southwest of Hall Beach, respectively. Se temperature diagram and additional information on Hall Beach on page 3.

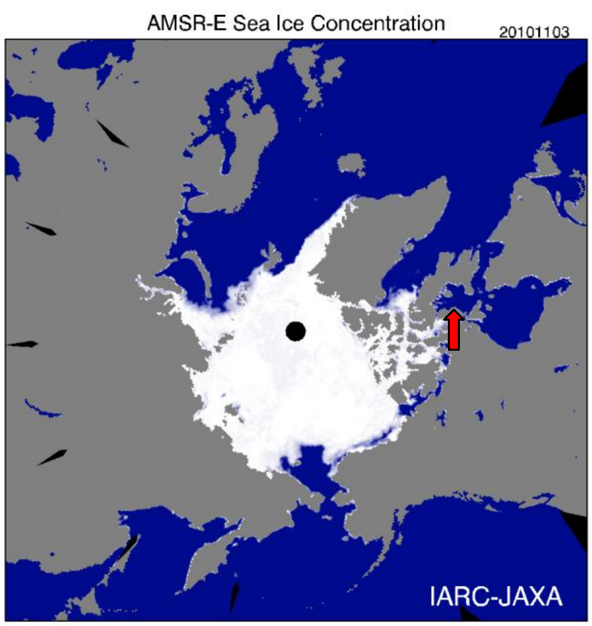
In the Antarctic relatively cold conditions characterized most of the continent, with the exception of the Peninsula, which was relatively warm.

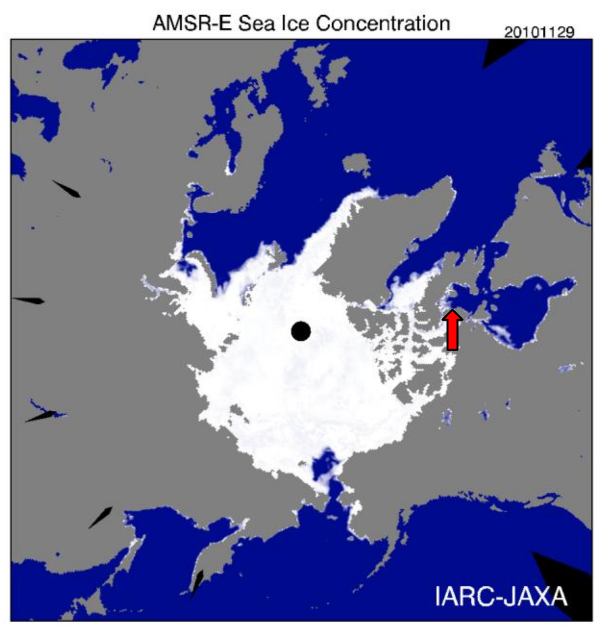
All diagrams shown in this newsletter are available for download on www.climate4you.com



November air temperature (deg.C) at Hall Beach, NW Foxe Basin, Canada, since 1957. The Hall Beach temperature record begins in 1957, and has several missing November values since 1995, which causes difficulties when calculating the average November 1998-2006 temperature from the GISS database.

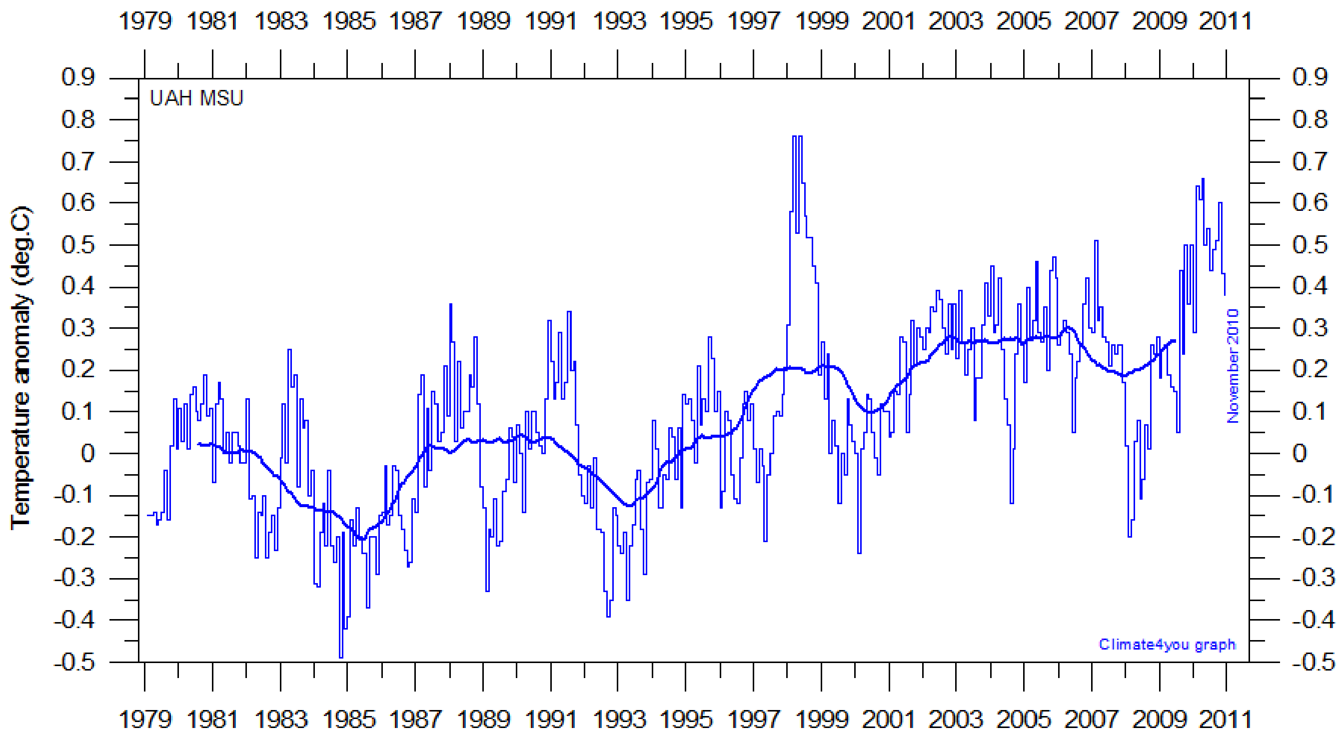
The settlement Hall Beach and its airport are located at the coast of eastern Melville Peninsula. Presumably air temperature conditions therefore are influenced by sea ice conditions on the nearby Foxe Basin. In November 2010 Foxe Basin remained ice free until late in the month (see below).



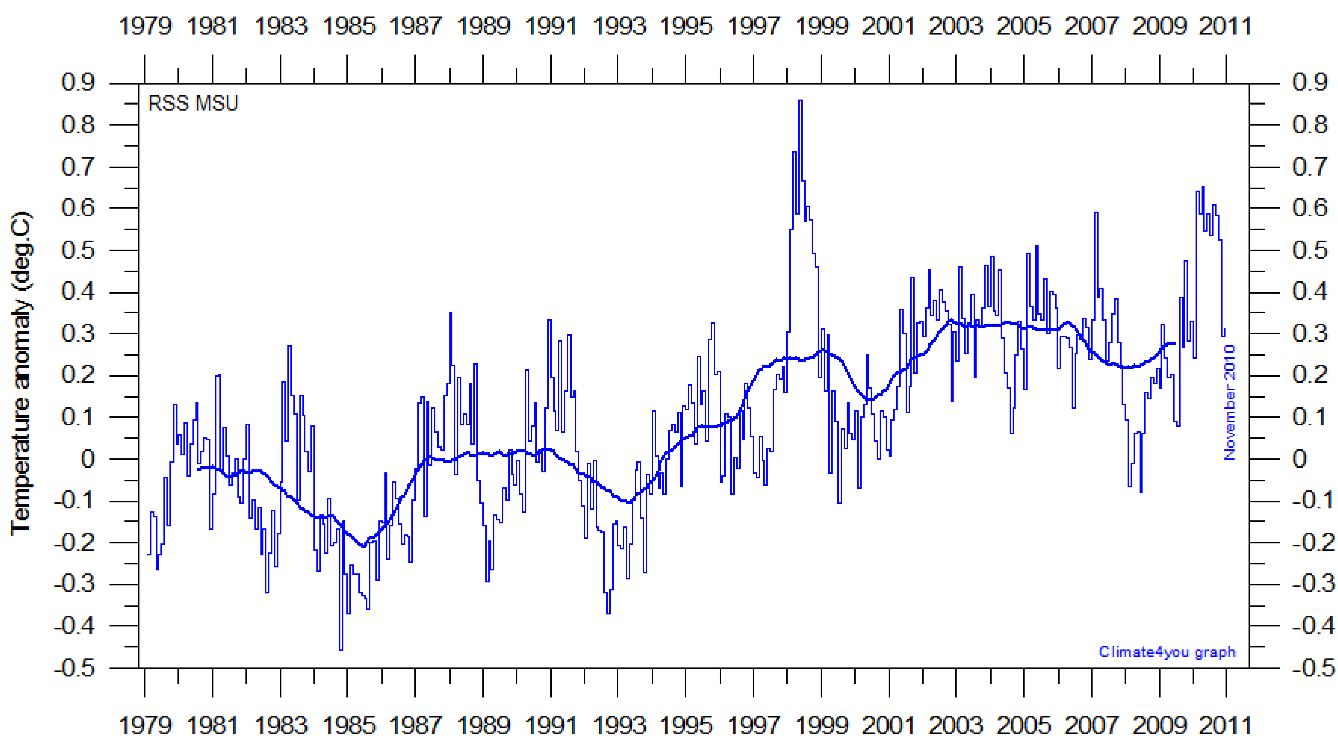


Diagrams showing Arctic sea ice extent and concentration 3 (left) and 29 (right) November 2010, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA). The red arrow shows the approximate position of Hall Beach.

[Lower troposphere temperature from satellites, updated to November 2010]

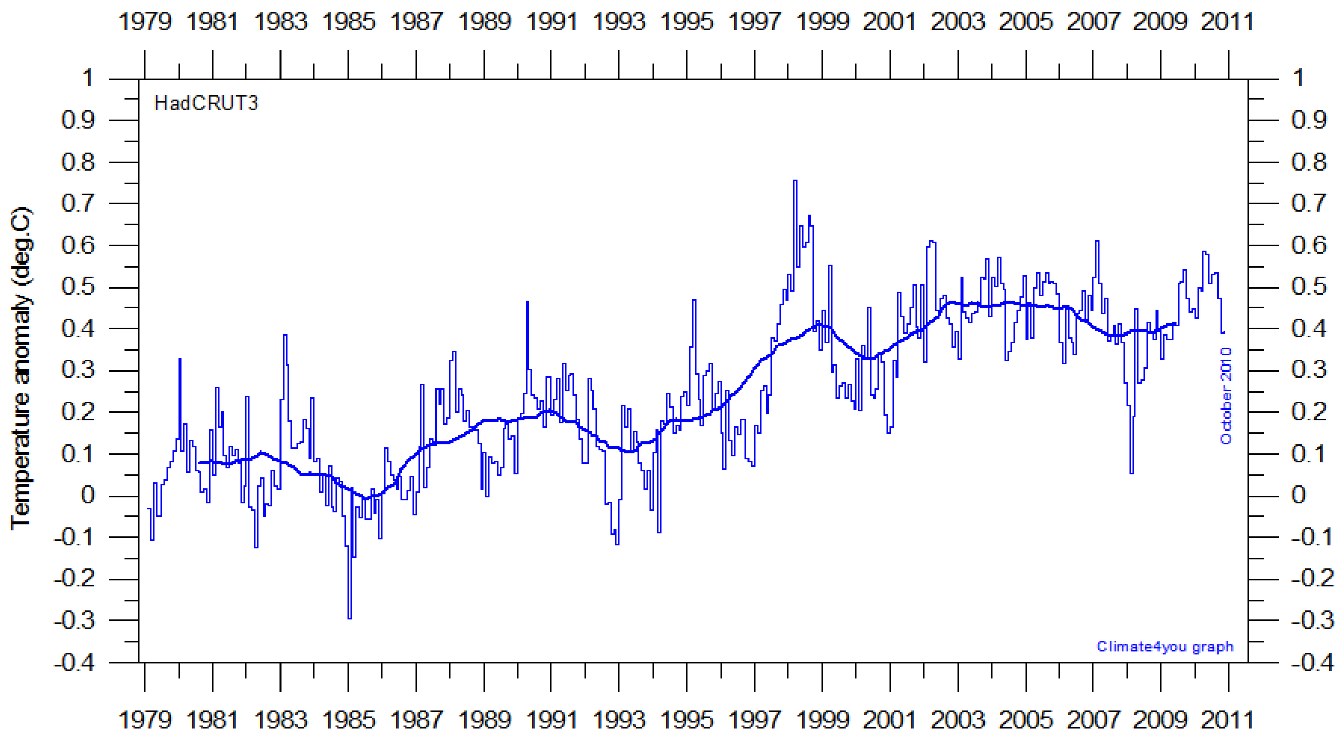


Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama] at Huntsville, USA. The thick line is the simple running 37 month average.

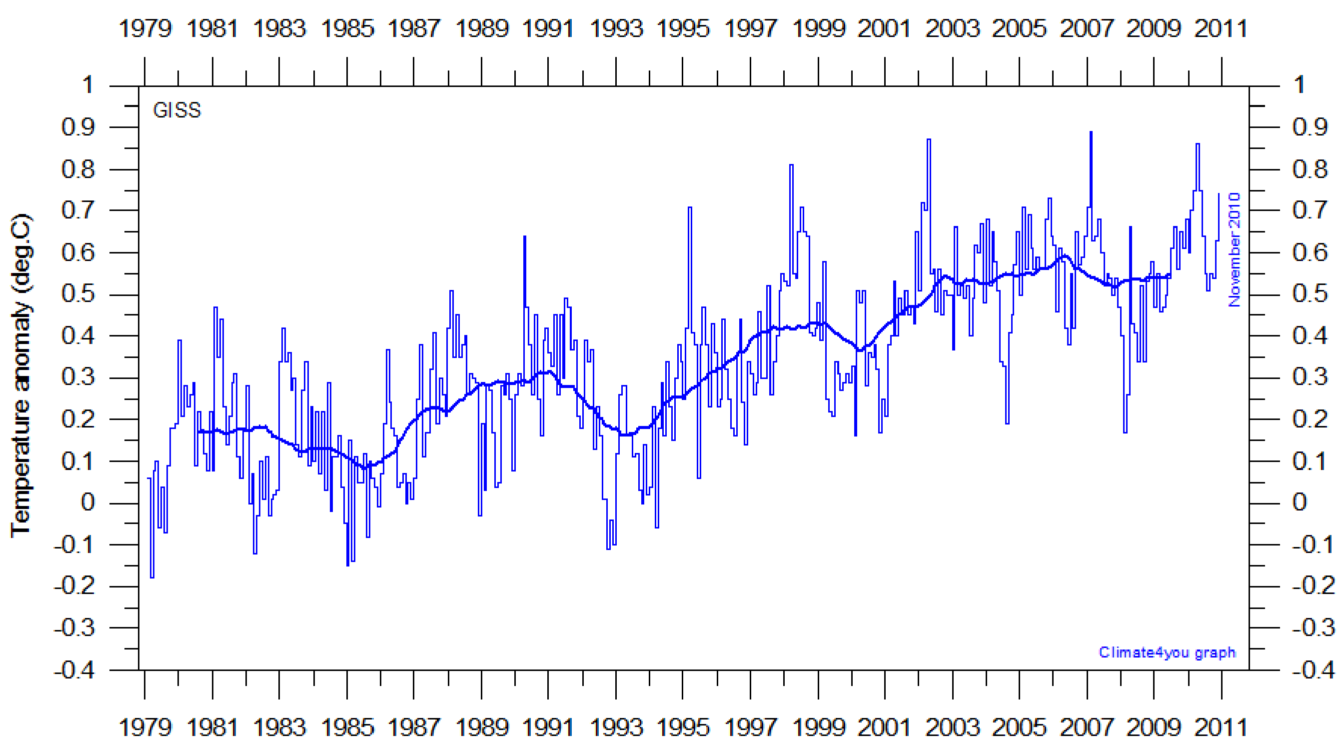


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems] (RSS), USA. The thick line is the simple running 37 month average.

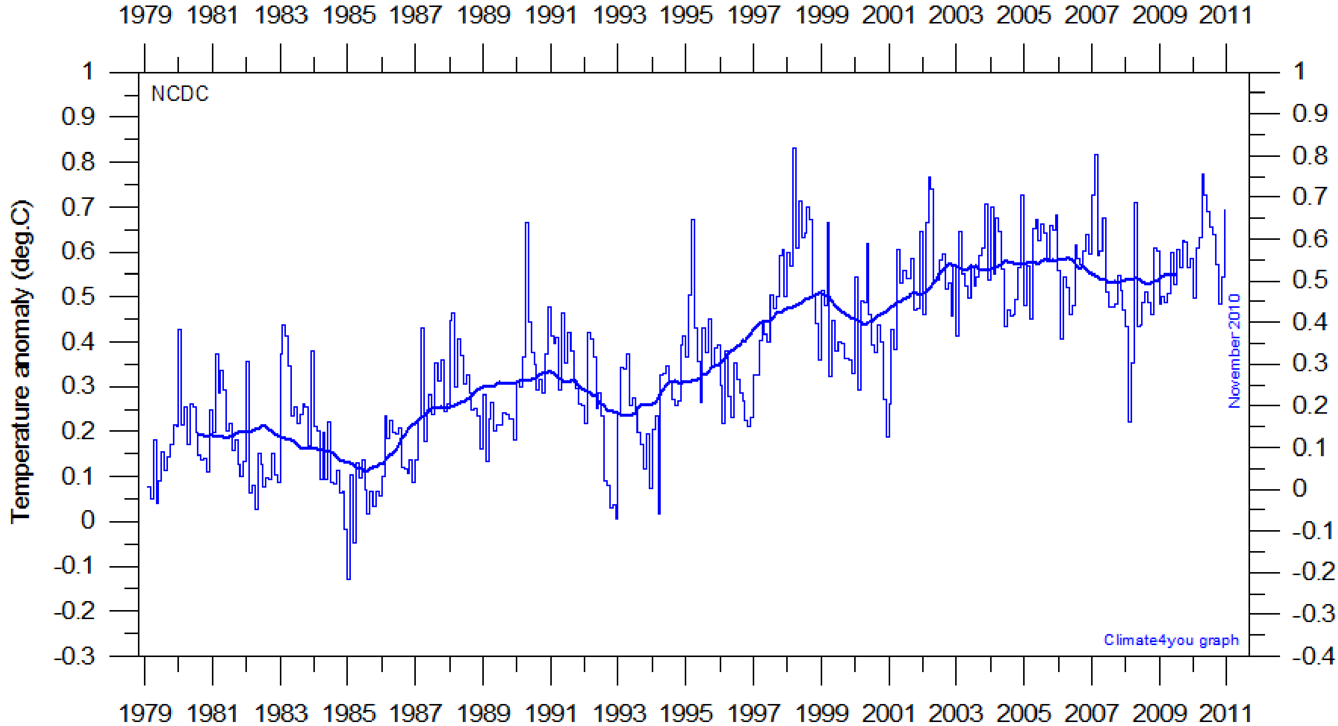
Global surface air temperature, updated to November 2010



Global monthly average surface air temperature (thin line) since 1979 according to according to the Hadley Centre for Climate Prediction and Research and the University of East Anglia's Climatic Research Unit (CRU), UK. The thick line is the simple running 37 month average. Please note that this record has not been updated beyond October 2010.

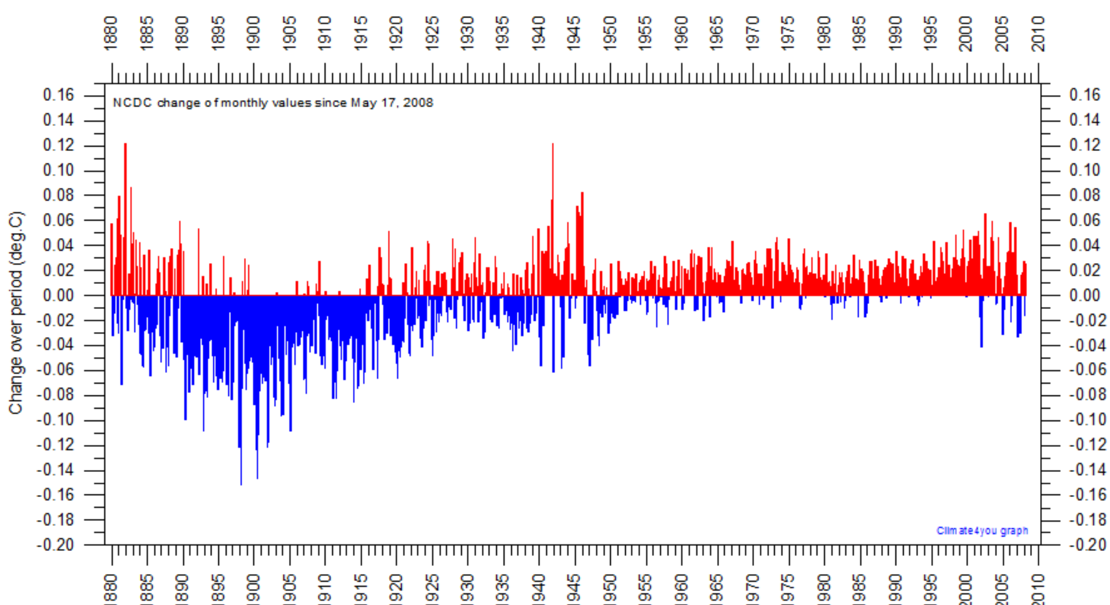


Global monthly average surface air temperature (thin line) since 1979 according to according to the Goddard Institute for Space Studies (GISS), at Columbia University, New York City, USA. The thick line is the simple running 37 month average.

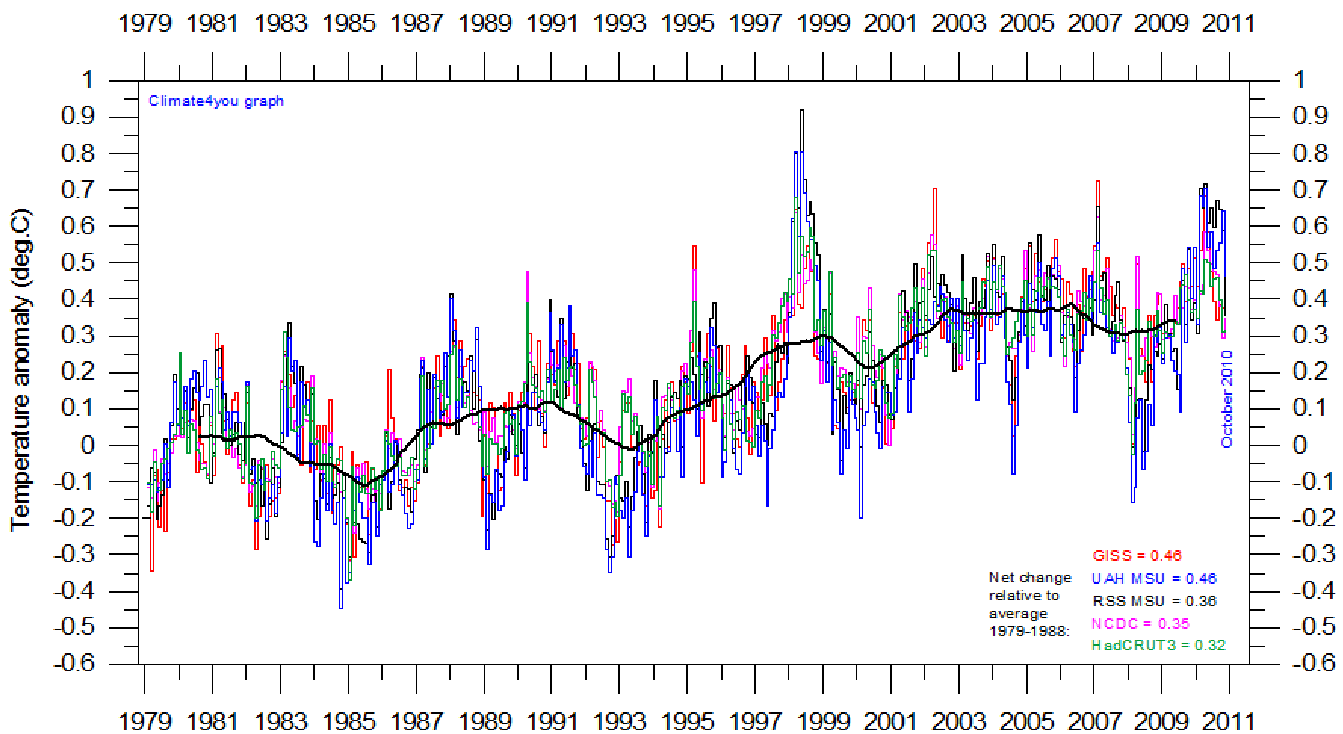


Global monthly average surface air temperature since 1979 according to according to the National Climatic Data Center (NCDC), USA. The thick line is the simple running 37 month average.

Some readers have noted that the above temperature estimates display changes when one compare with previous issues of this newsletter, not only for the most recent months, but actually for all months back to the beginning of the record. As an example, the net change of the NCDC record since 17 May 2008 is shown below. By this administrative effort the apparent global temperature increase since 1900 has been enhanced about 0.1°C, or about 14% of the total increase recorded since 1900 by NCDC. The interested reader may find more on this lack of temporal stability on www.climate4you (go to: Global Temperature and then Temporal Stability).



All in one, updated to October 2010

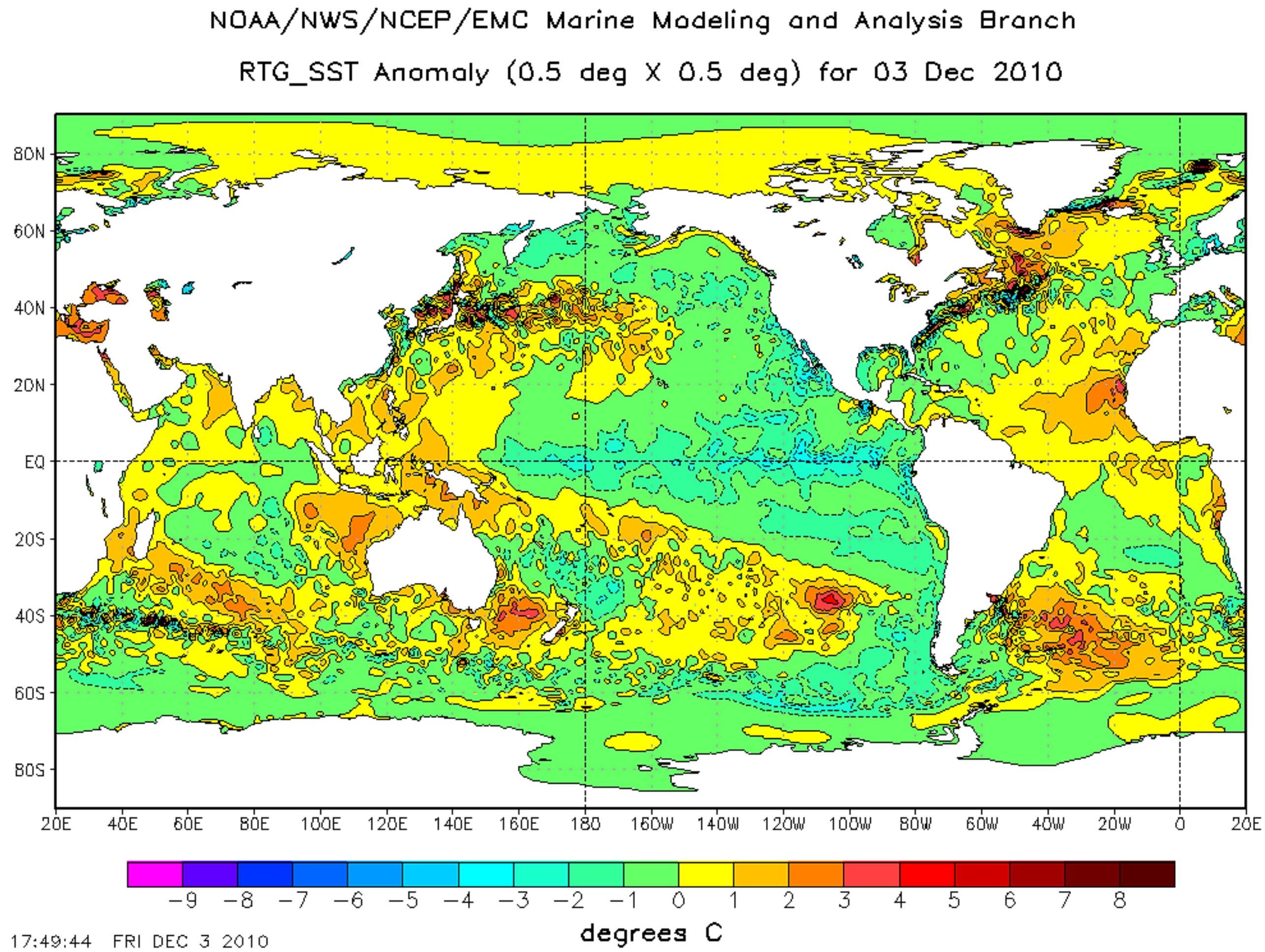


Superimposed plot of all five global monthly temperature estimates shown above. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of their initial 120 months (10 years) from January 1979 to December 1988. The heavy black line represents the simple running 37 month (c. 3 year) mean of the average of all five temperature records. The numbers shown in the lower right corner represent the temperature anomaly relative to the above average. Last month shown: October 2010.

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 is problematical. However, as both types of estimate often are discussed together, the above diagram may nevertheless be of 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 short term scale there may be considerable differences.

All five global temperature estimates presently show stagnation, at least since 2002. There has been no increase in global air temperature since 1998, which was affected by the oceanographic El Niño event. This 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 5-10 years. Only time will show which of these possibilities is correct.

Global sea surface temperature, updated to November 2010

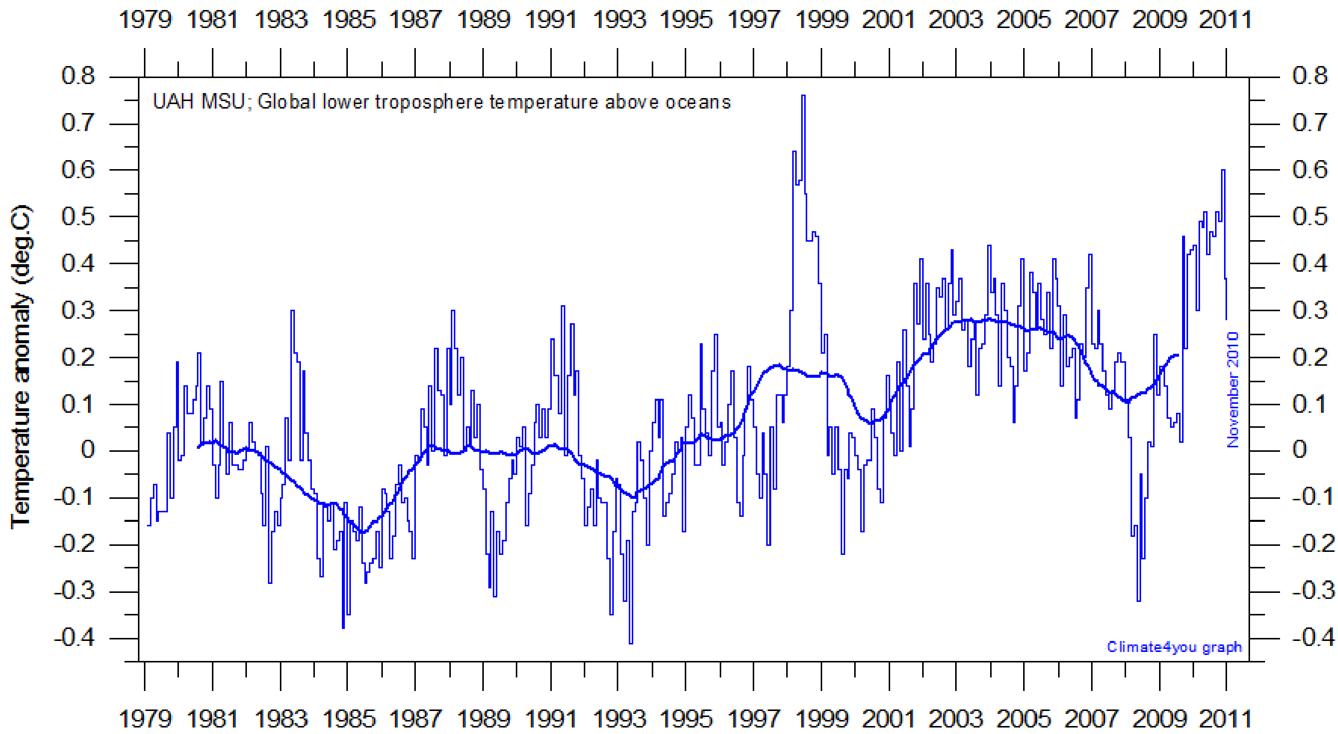


Sea surface temperature anomaly at 3 December 2010. Map source: National Centers for Environmental Prediction (NOAA).

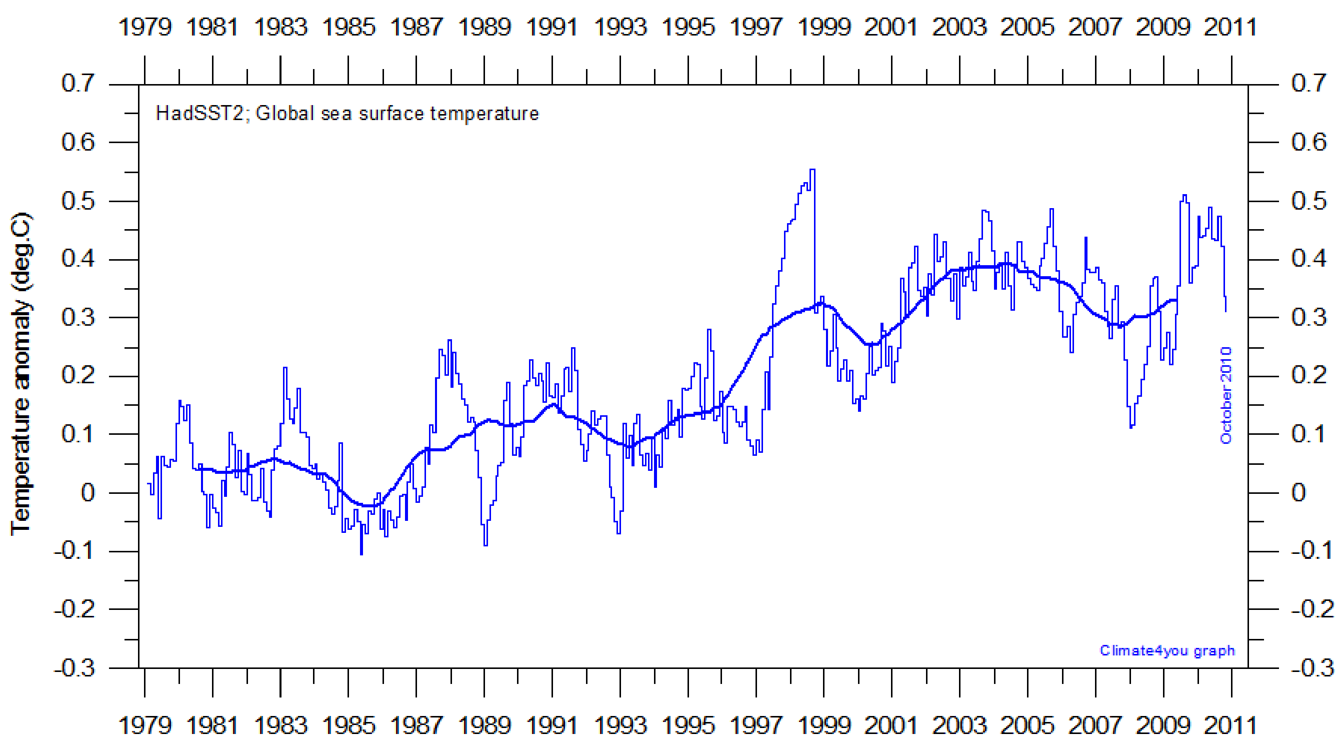
The relative cold water now spreading west along the Equator in the Pacific Ocean represents the early part of a La Niña situation and affects the temperature of the atmosphere above. Because of the large surface areas involved (near Equator) this natural cyclic development is beginning to affect the global atmospheric temperature towards lower temperatures. Perhaps this development might be even more pronounced during the coming months, affecting also land areas.

However, the significance of any such global cooling should not be over interpreted. Whenever Earth experiences cold La Niña or warm El Niño episodes major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in estimates of the global air temperature. This does not, however, reflect similar changes in the total heat content of the atmosphere-ocean system. In fact, net changes may be small, as it mainly reflects a redistribution of energy. What matters is the overall development when seen over some years.

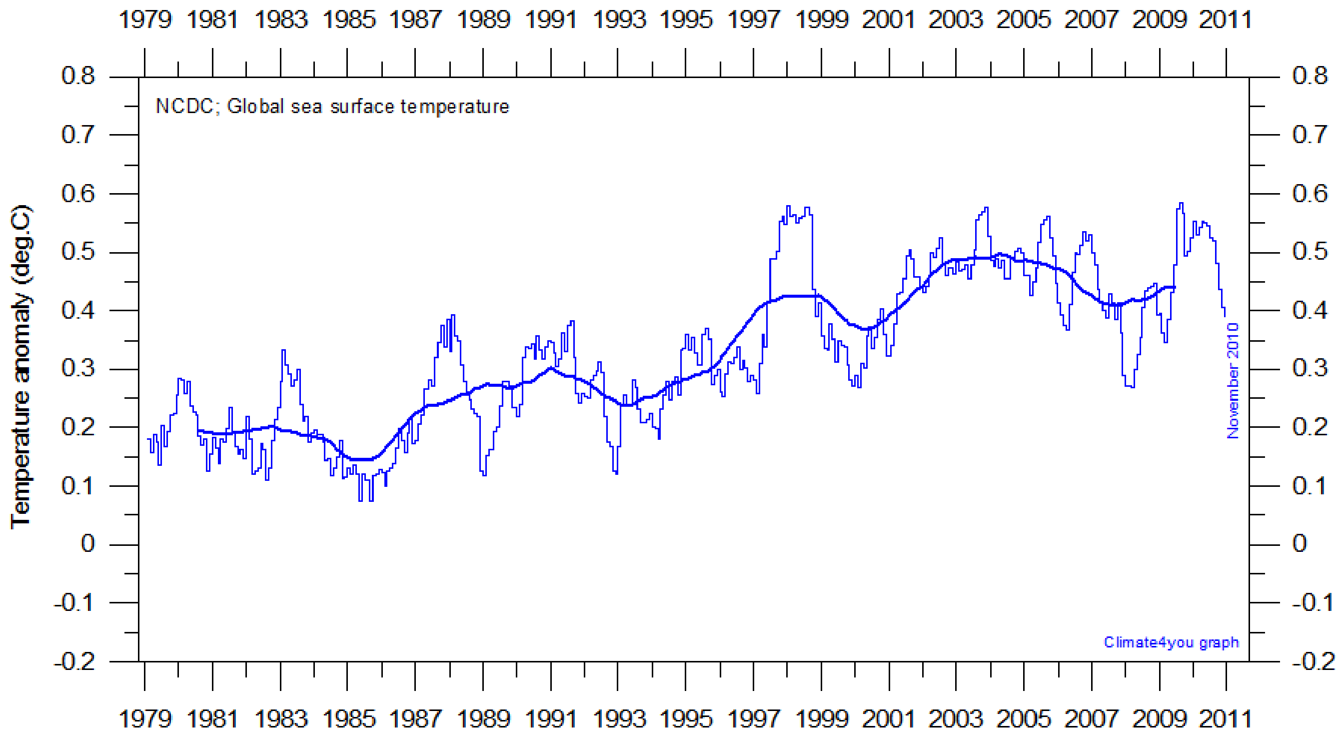
On this background it has been disappointing lately to witness several announcements in news media describing the first part of the year 2010 as being extraordinary warm, without at the same time mentioning the warm El Niño situation. Of cause global air temperatures then was affected upwards by these important oceanographic developments, without this corresponding to a similar change of the global heat content.



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

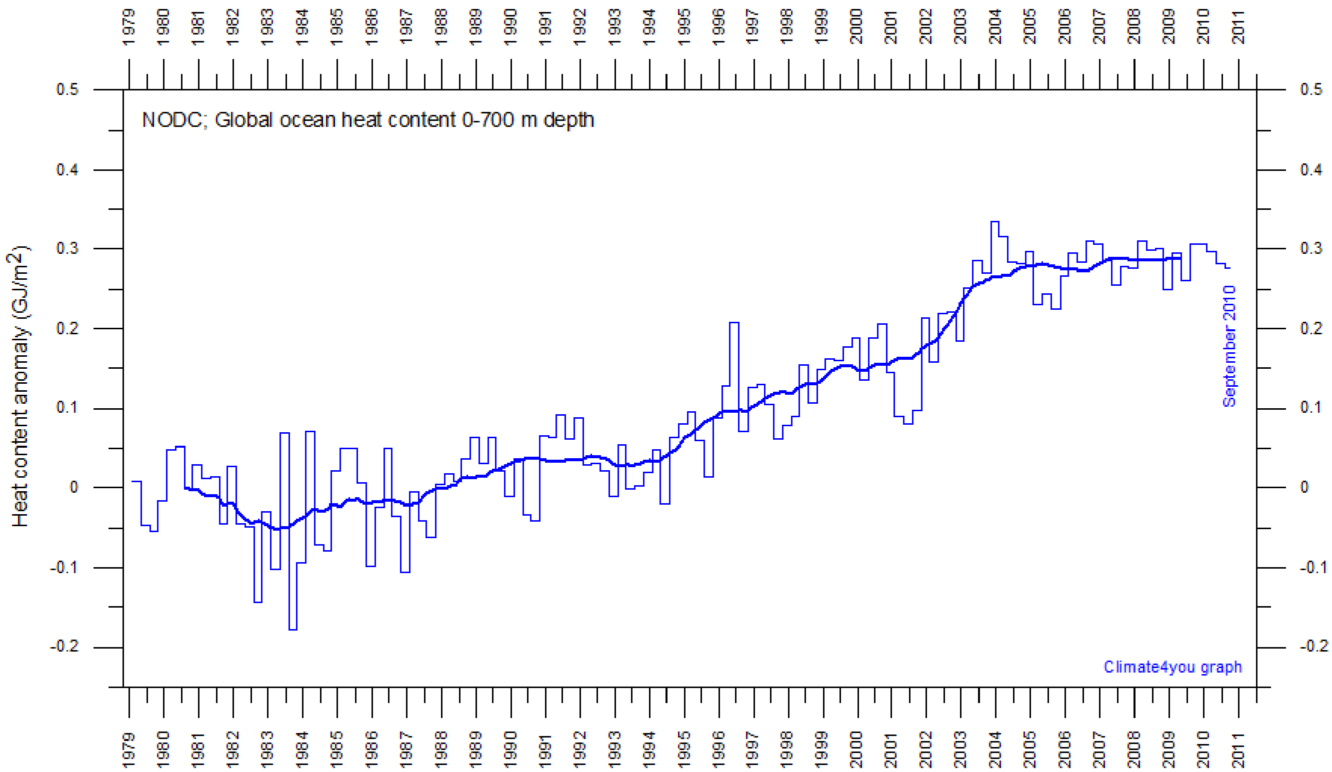


Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37 month average.

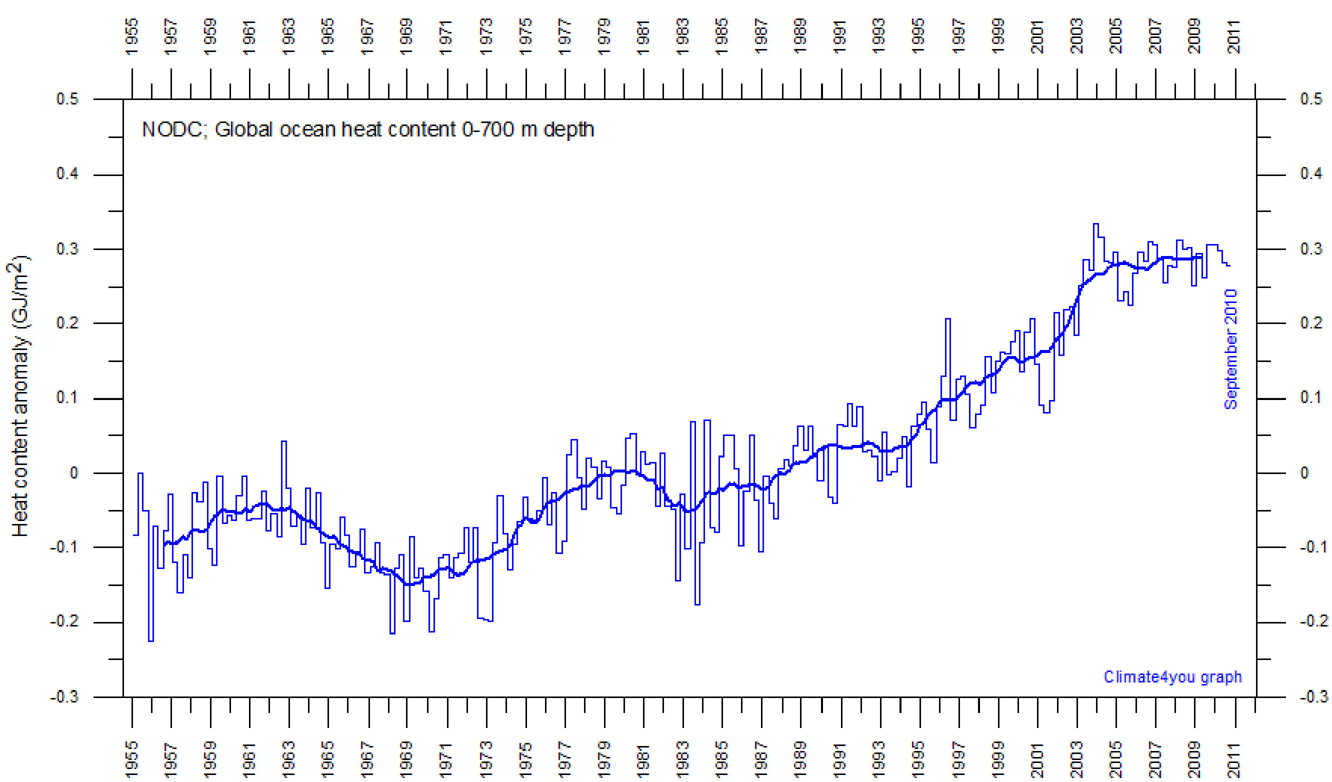


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to September 2010

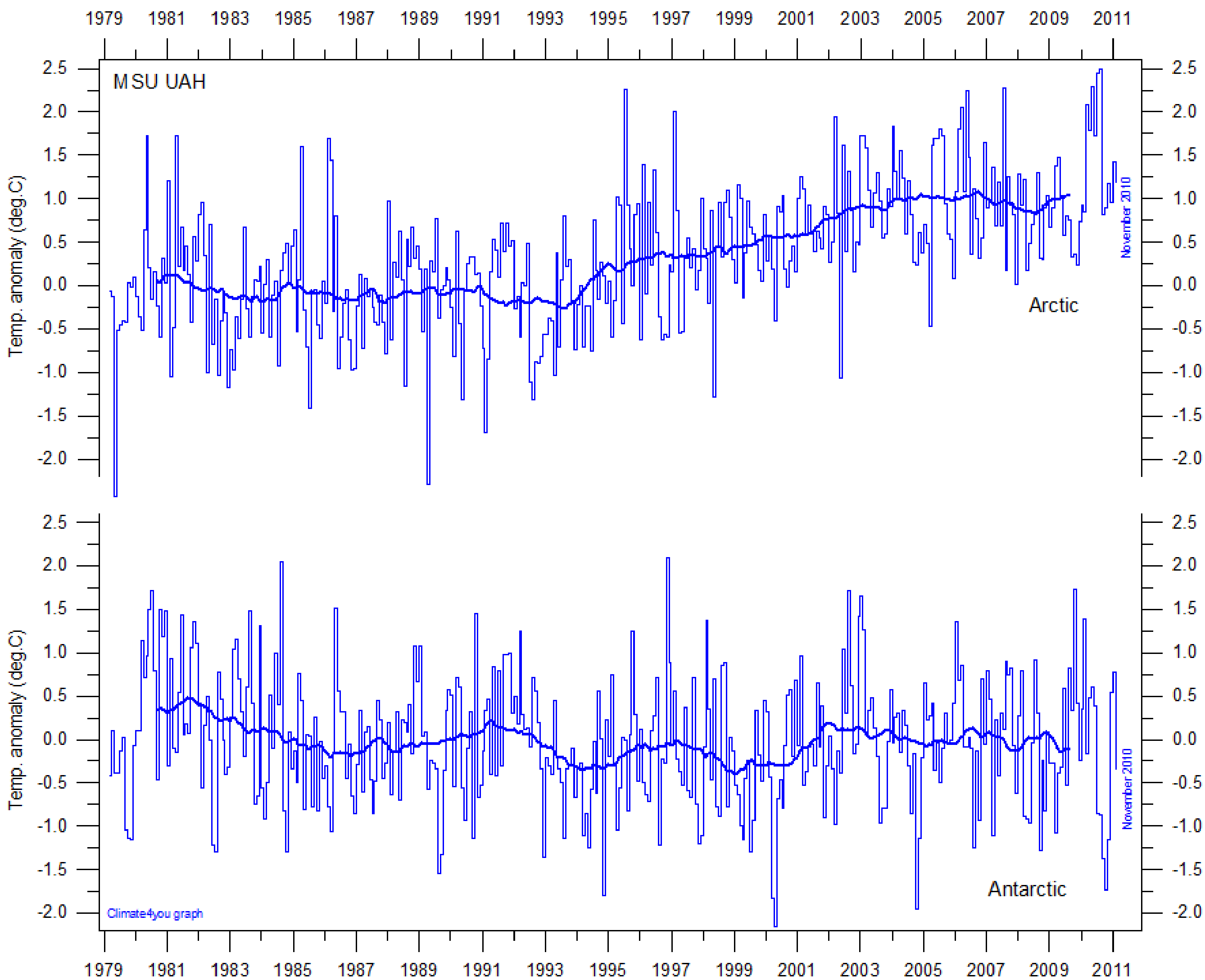


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



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

Arctic and Antarctic lower troposphere temperature, updated to November 2010



Global monthly average lower troposphere temperature since 1979 for the North Pole and South Pole regions, based on satellite observations ([University of Alabama]() at Huntsville, USA). The thick line is the simple running 37 month average, nearly corresponding to a running 3 yr average.

[Arctic and Antarctic surface air temperature, updated to October 2010]

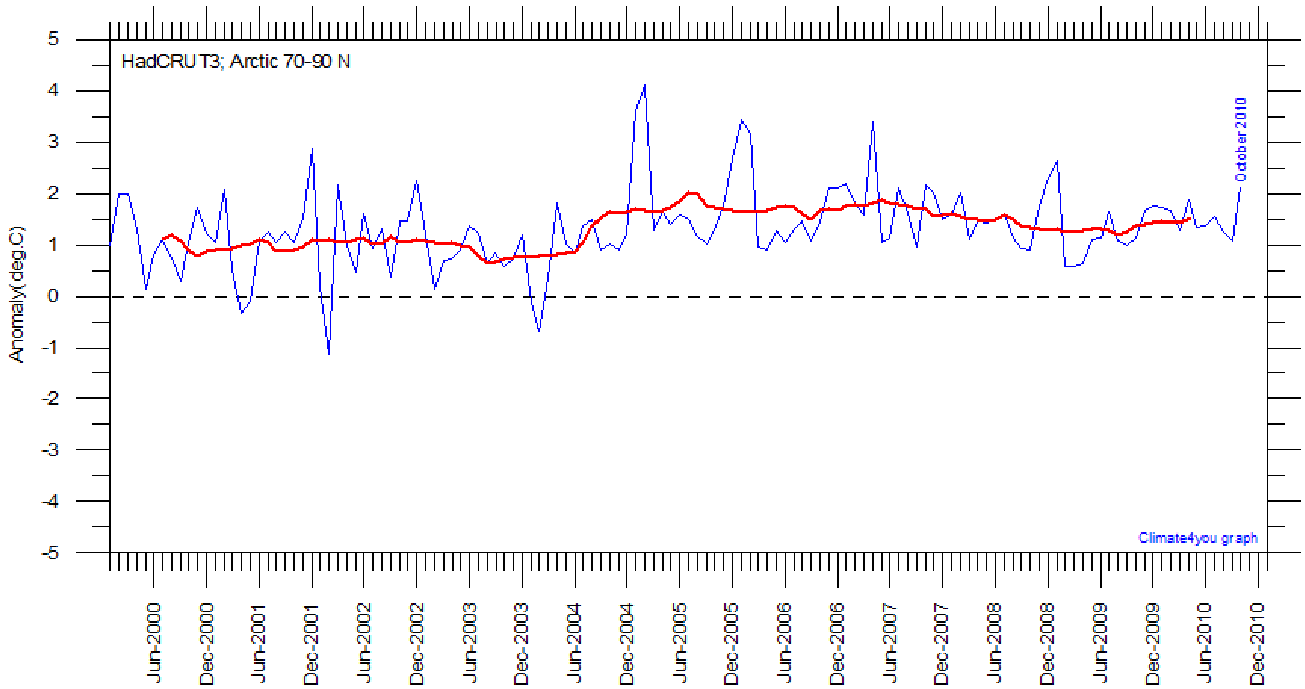


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

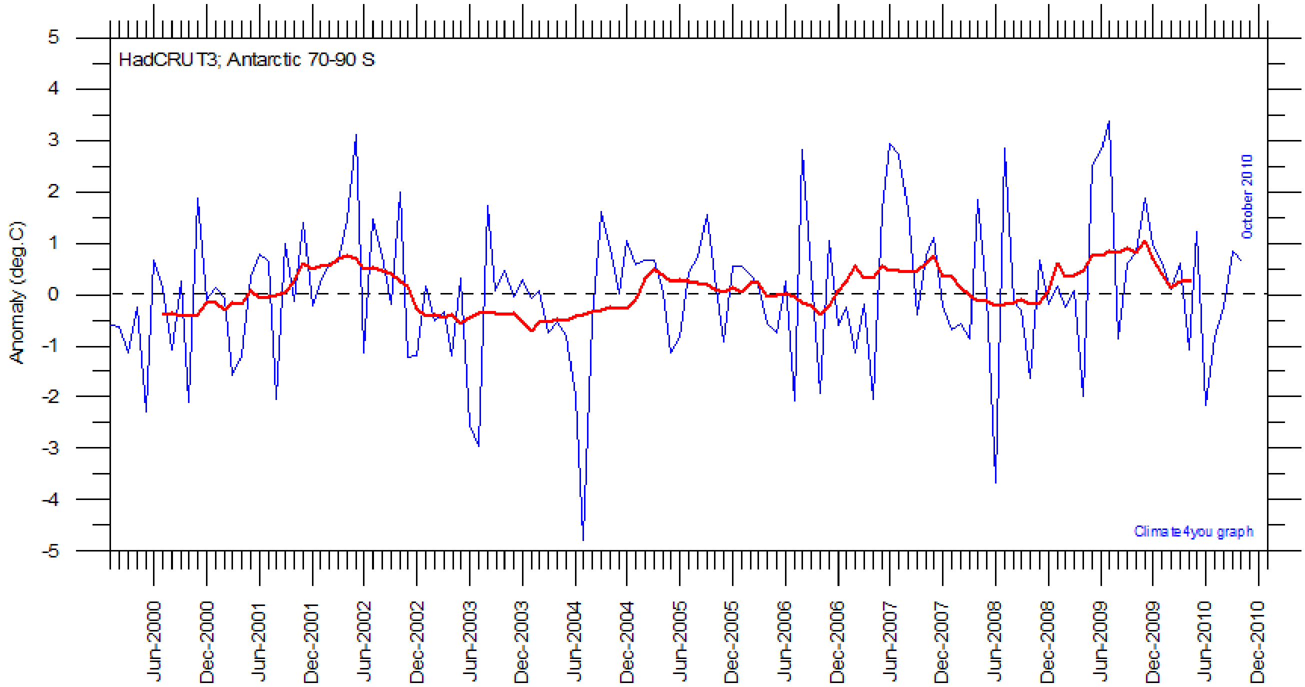


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

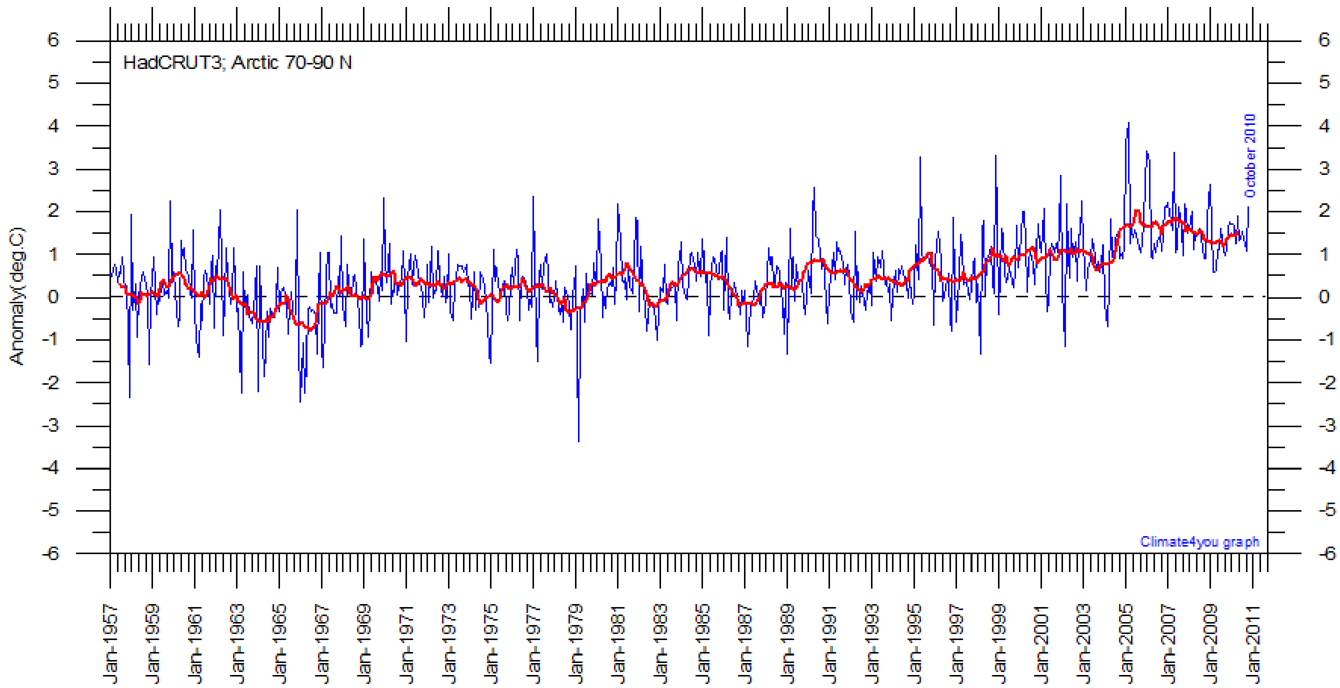


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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

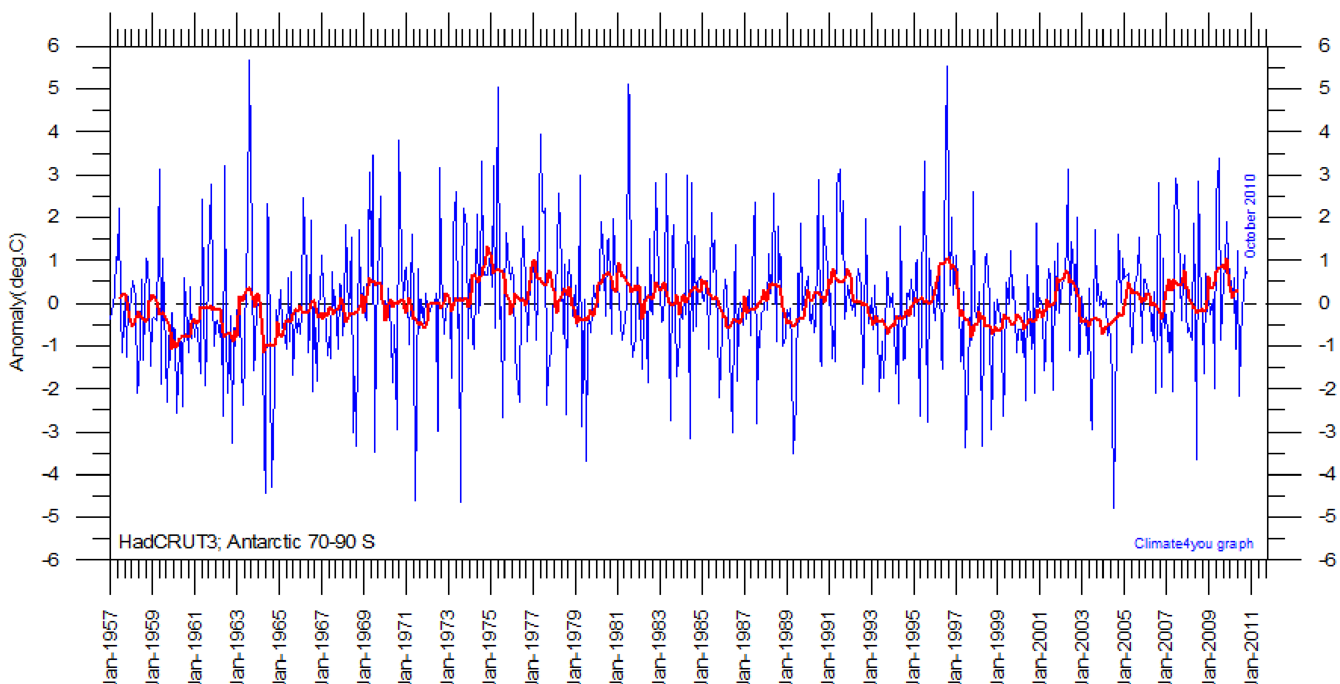


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

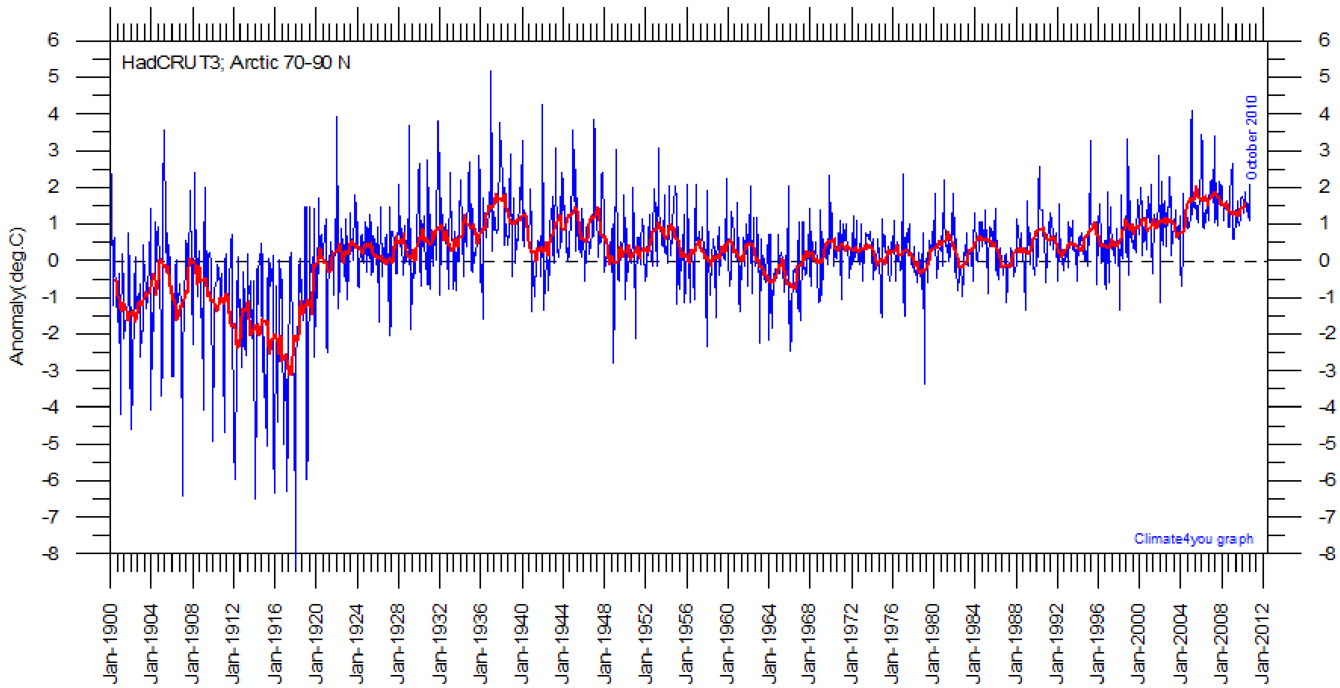


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly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

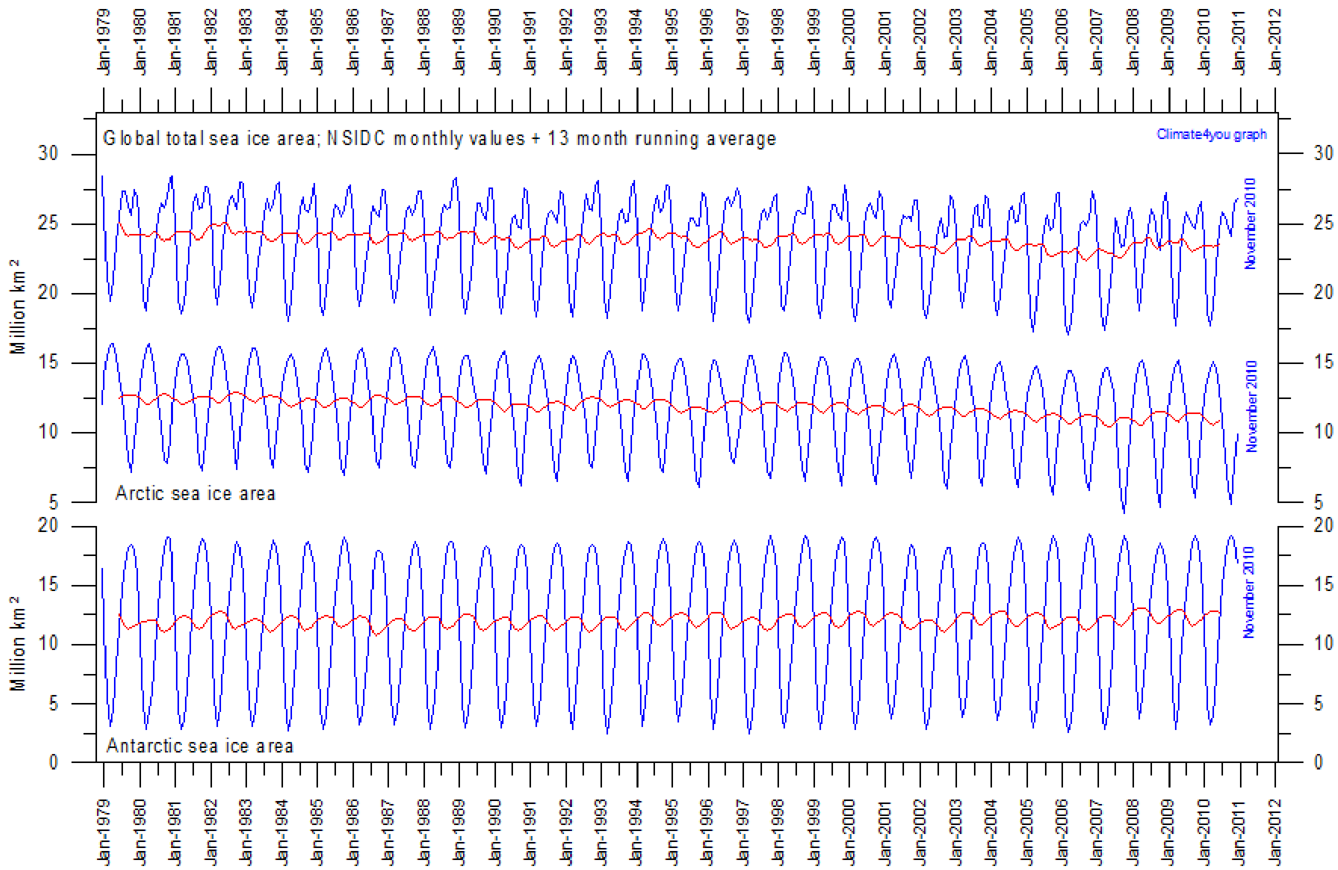
In general, the Arctic temperature record appears to be less variable than the contemporary Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

As data coverage is sparse in the Polar Regions, the procedure of Gillet et al. 2008 has been followed, giving equal weight to data in each 5°x5° grid cell when calculating means, with no weighting by the areas of the grid dells.

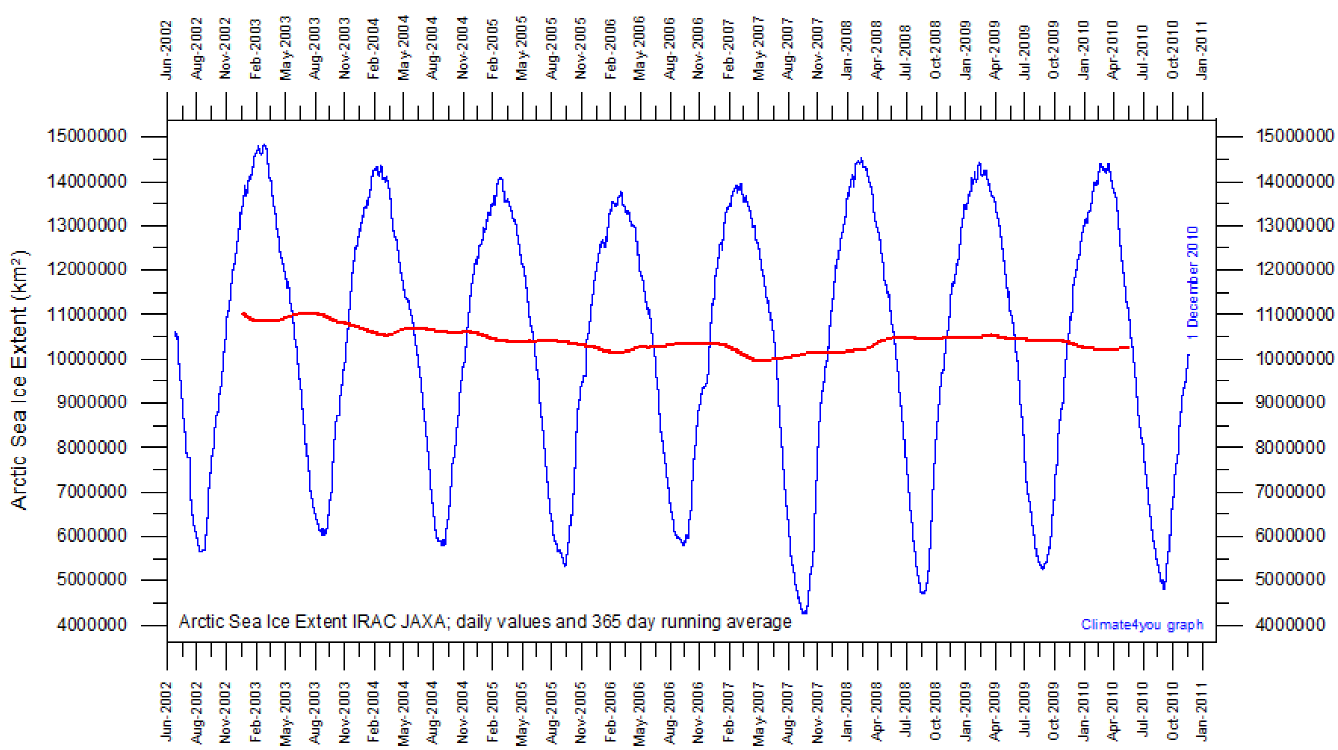
Literature:

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

Arctic and Antarctic sea ice, updated to November 2010

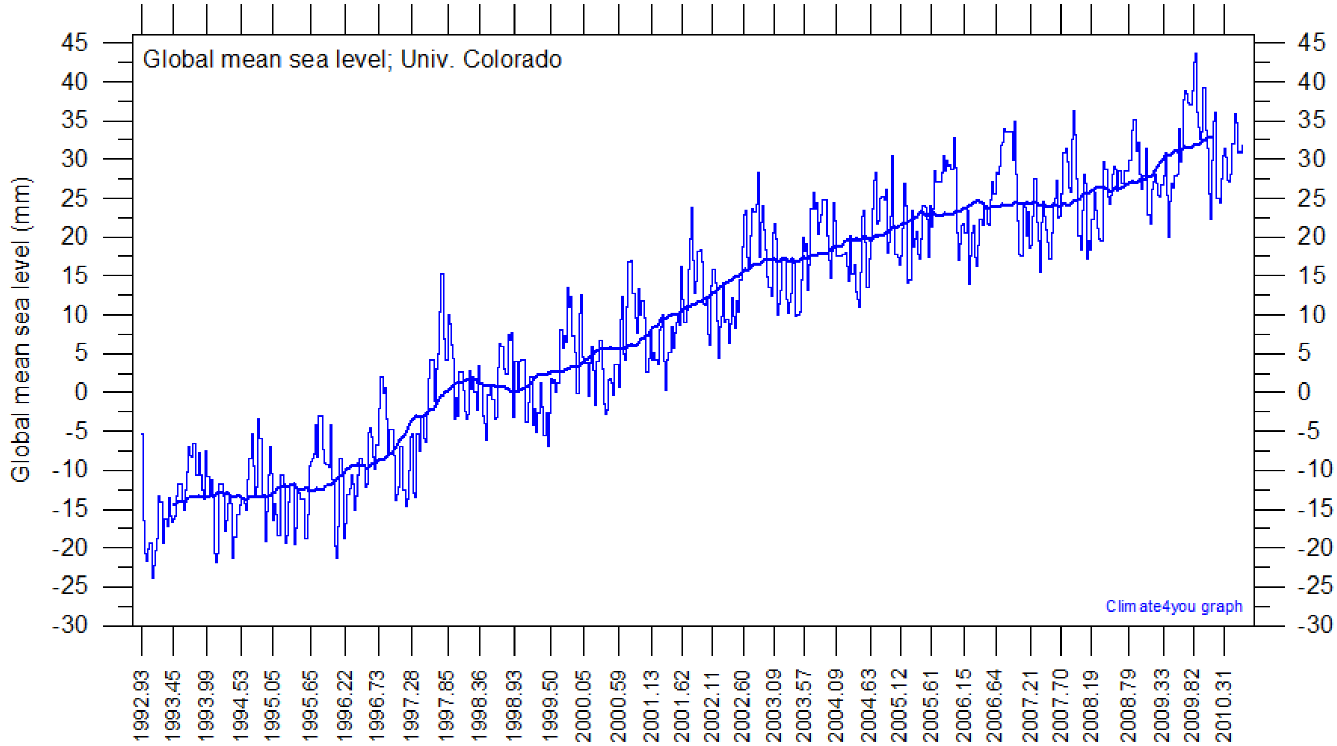


Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center](#) (NSIDC).

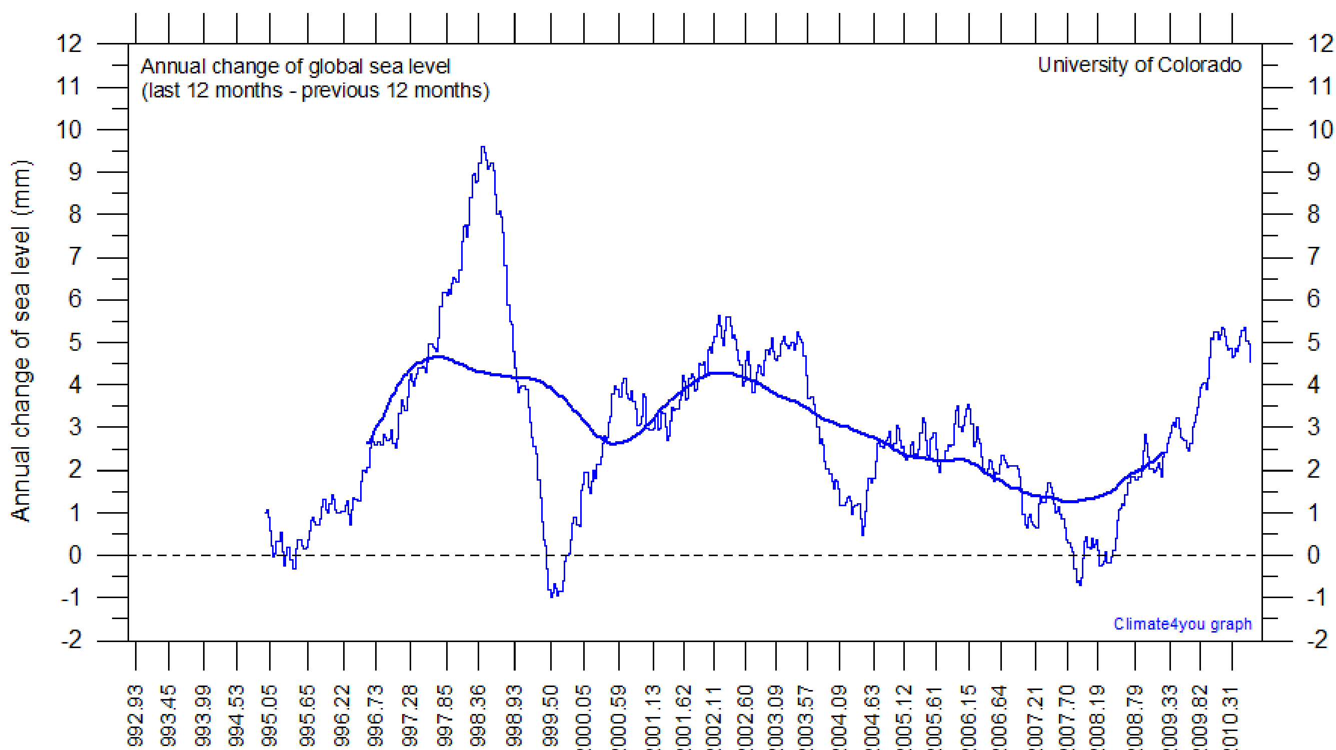


Graph showing daily Arctic sea ice extent since June 2002, to 01/12 2010, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).

Global sea level, updated to September 2010

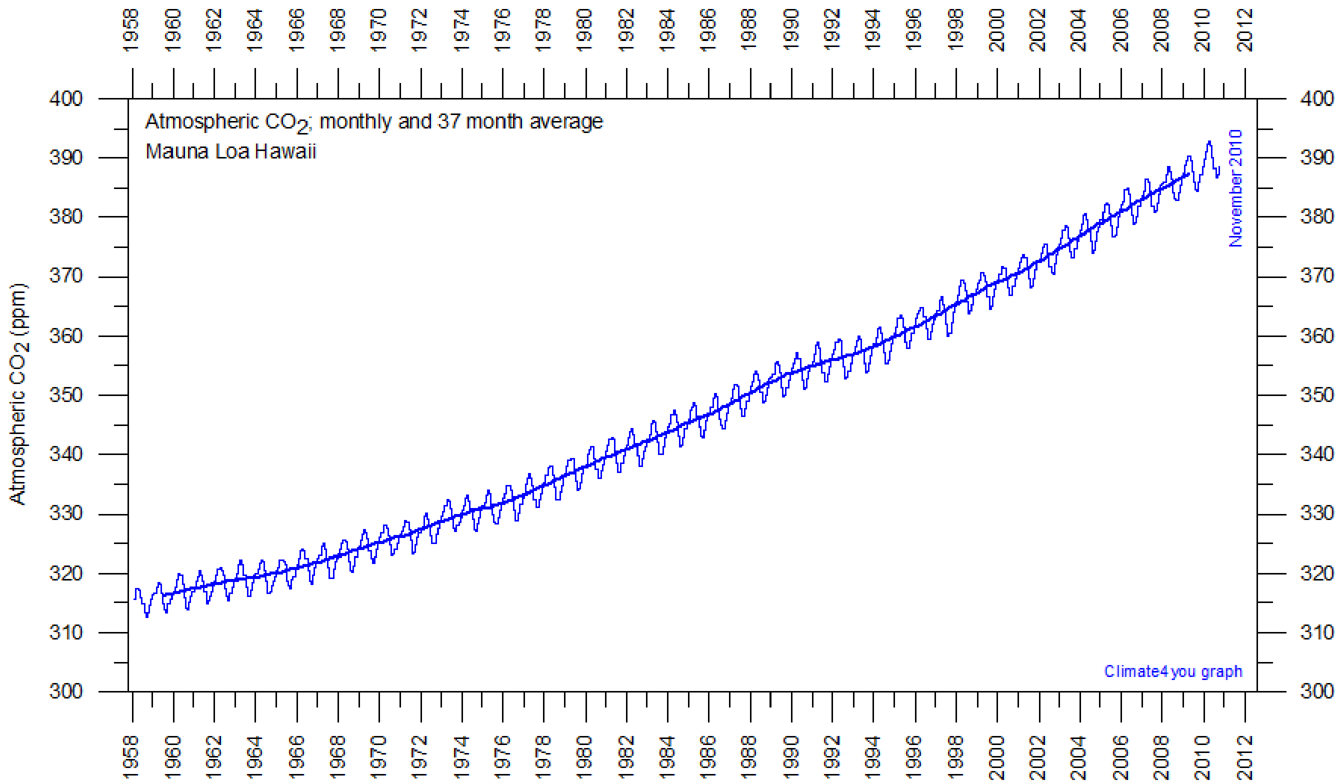


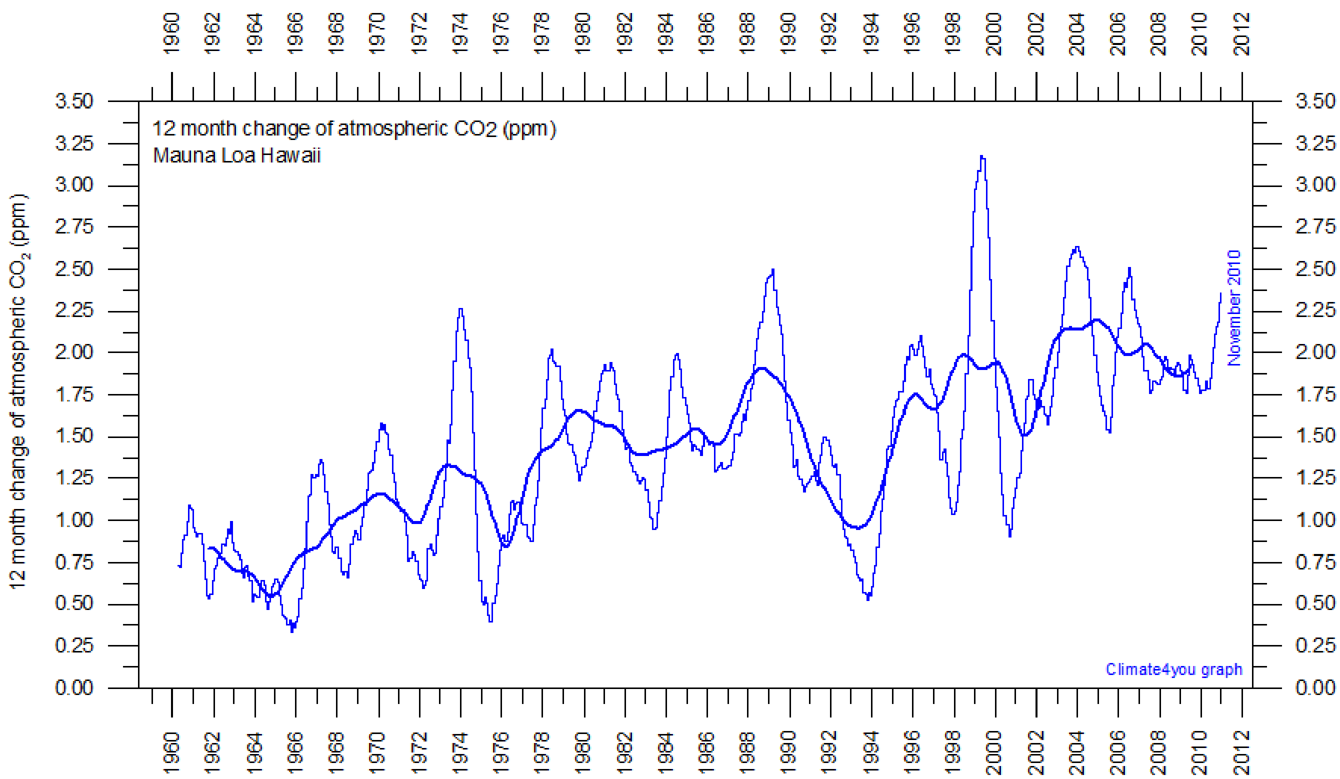
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



Annual change of global 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 3 yr average.

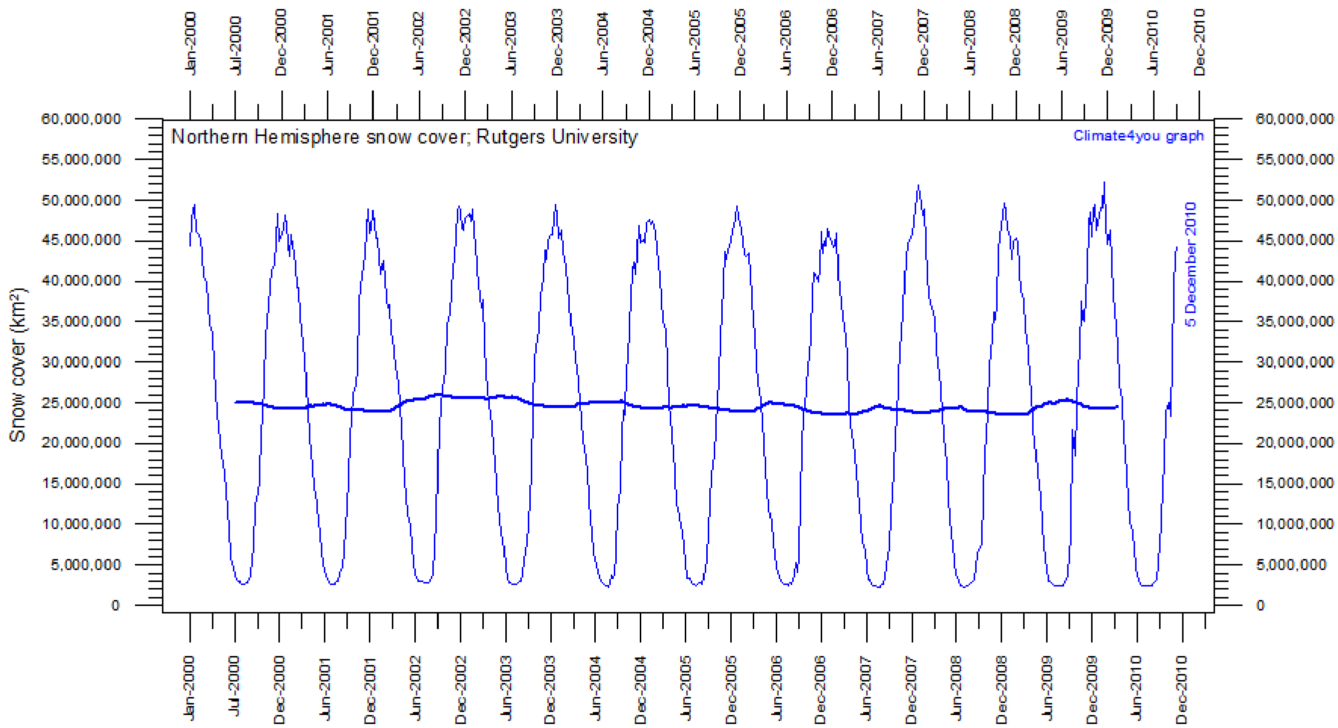
Atmospheric CO_2, updated to November 2010



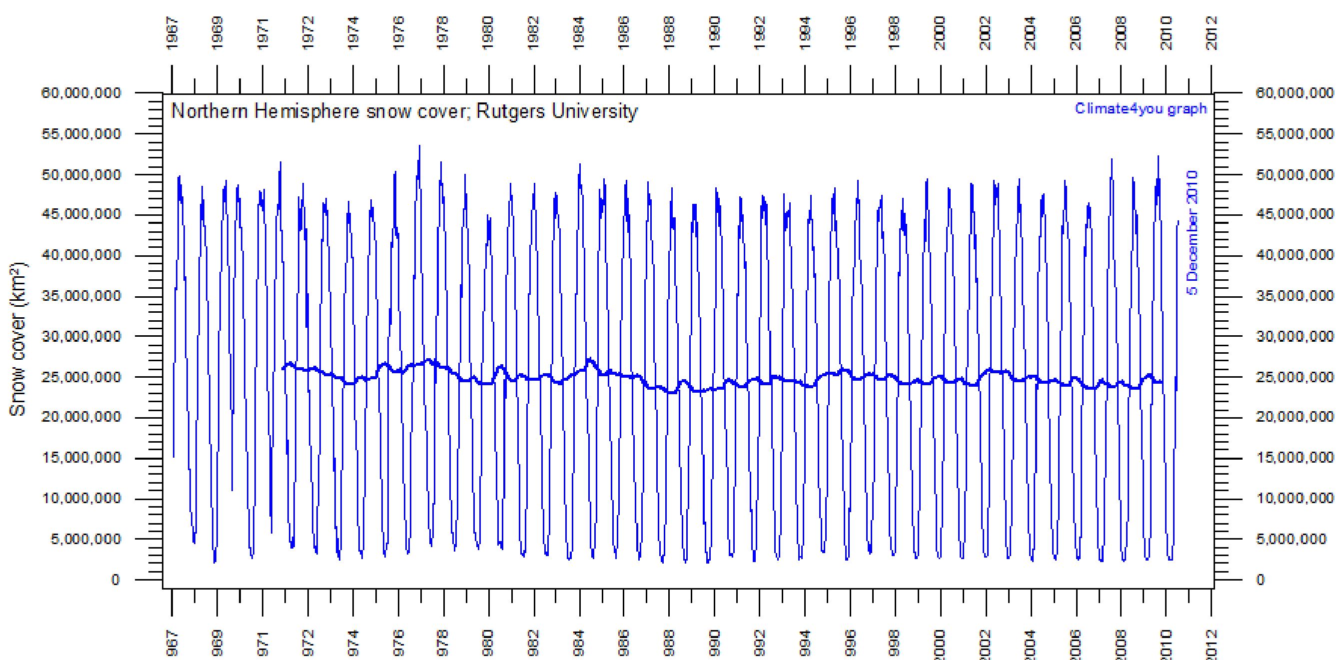


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the Mauna Loa Observatory, Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Northern Hemisphere weekly snow cover, updated to early December 2010

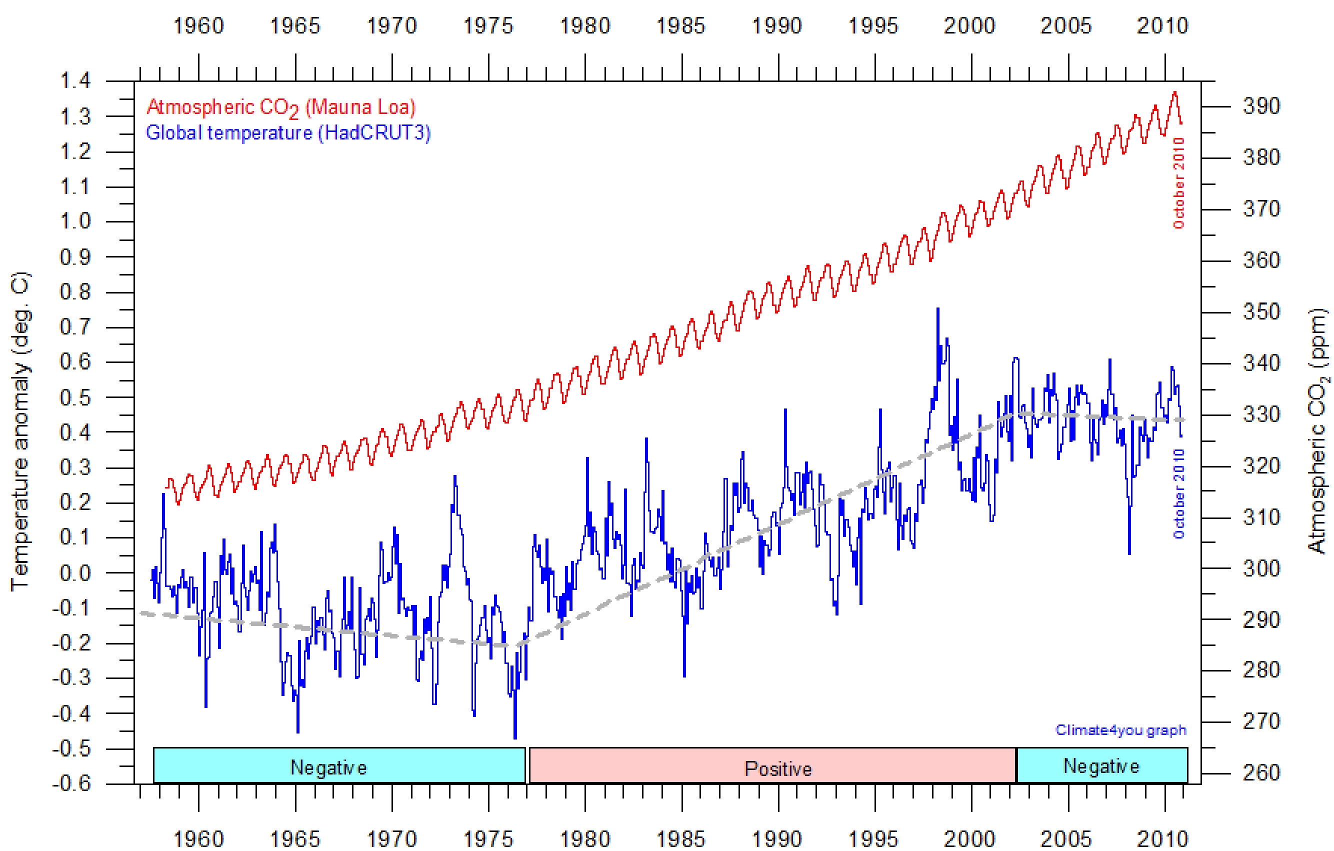


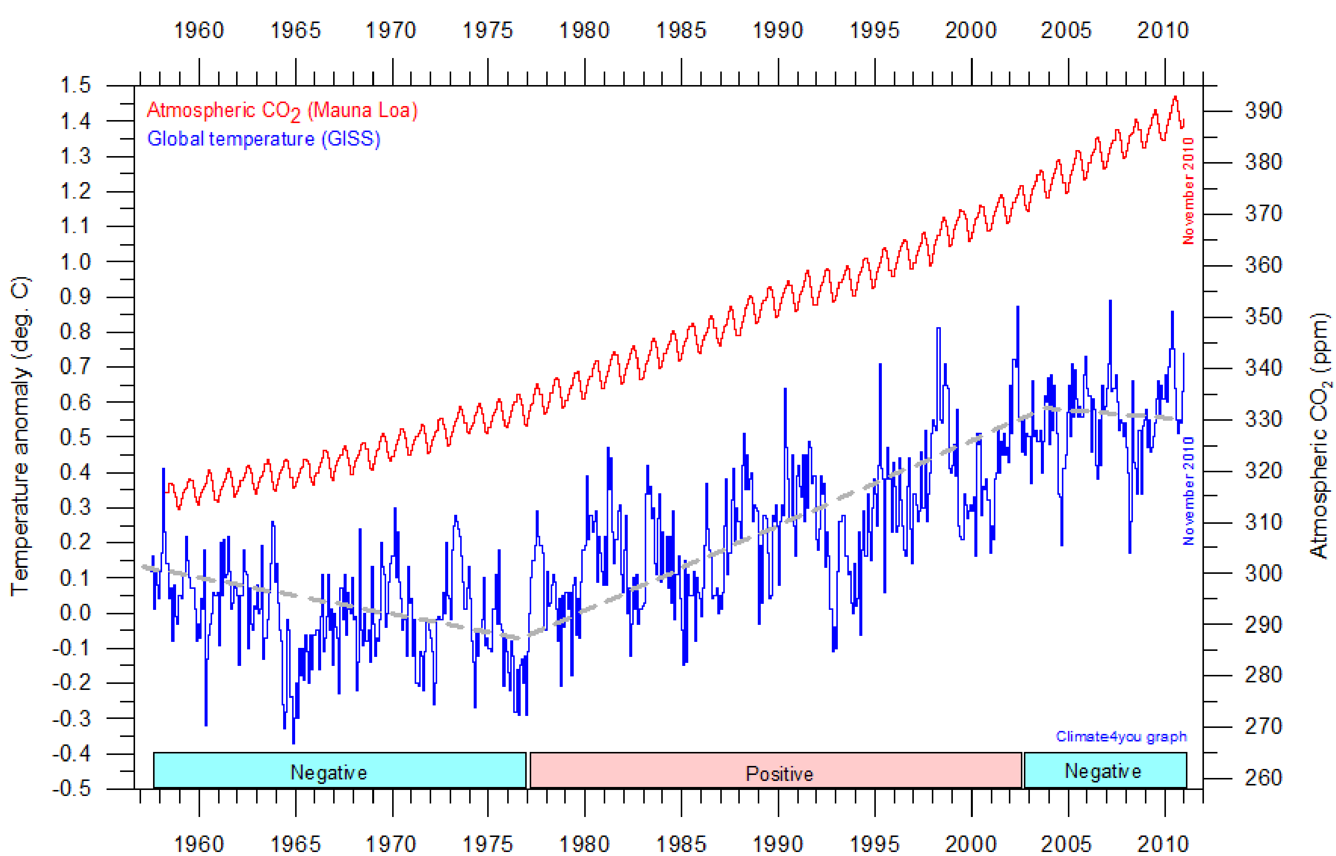
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year).

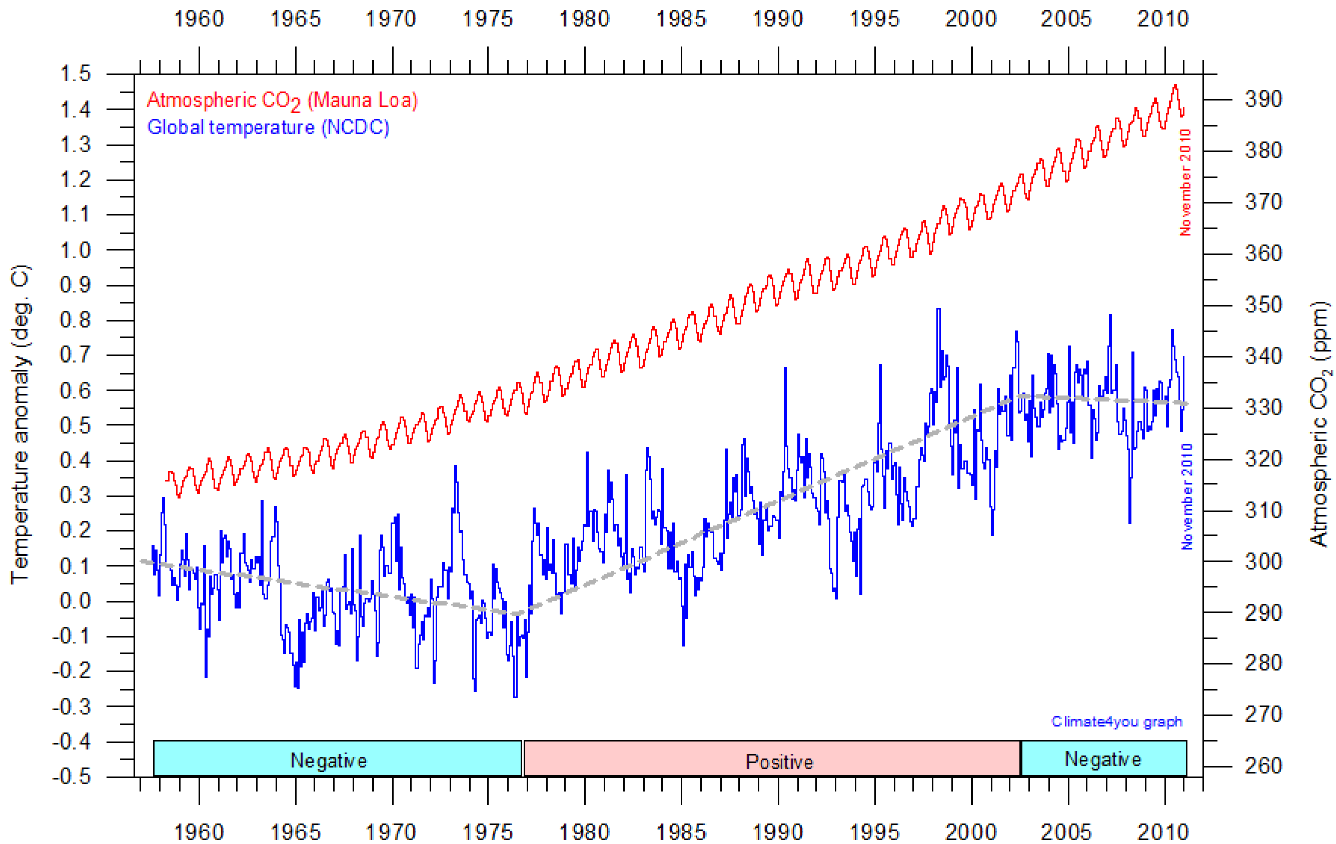


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of some data irregularities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

Global surface air temperature and atmospheric CO_2, updated to November 2010







Diagrams showing HadCRUT3, GISS, and NCDC monthly global surface air temperature estimates (blue) and the monthly atmospheric CO_2 content (red) according to the [Mauna Loa Observatory](), Hawaii. The Mauna Loa data series begins in March 1958, and 1958 has therefore been chosen as starting year for the diagrams. Reconstructions of past atmospheric CO_2 concentrations (before 1958) are not incorporated in this diagram, as such past CO_2 values are derived by other means (ice cores, stomata, or older measurements using different methodology, and therefore are not directly comparable with modern atmospheric measurements. The dotted grey line indicates the approximate linear temperature trend, and the boxes in the lower part of the diagram indicate the relation between atmospheric CO_2 and global surface air temperature, negative or positive. Please note that the HadCRUT3 record has not been updated beyond October 2010

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

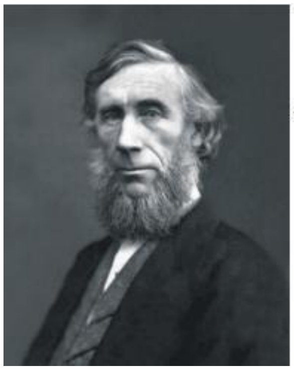
It is of cause equally inappropriate to present new meteorological record values, whether daily, monthly or annual, as support for the hypothesis ascribing high importance of atmospheric CO_2 for global temperatures. Any such short-period meteorological record value may well be the result of other phenomena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

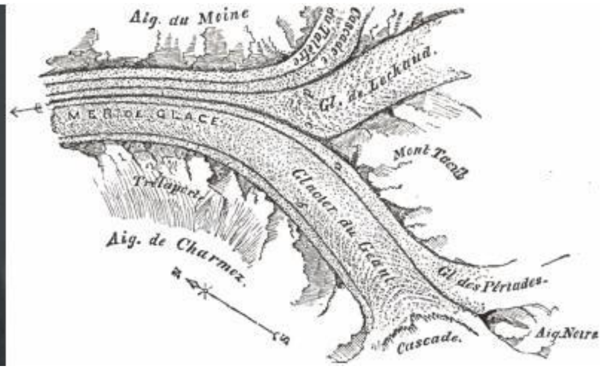
What exactly defines the critical length of a relevant time period to consider for evaluating the alleged high importance of CO_2 remains elusive, and is still a topic for debate. The critical period length must, however, be inversely proportional to the importance of CO_2 on the global temperature, including feedback effects, such as assumed by most climate models. So if the effect of CO_2 is strong, the length of the critical period is short.

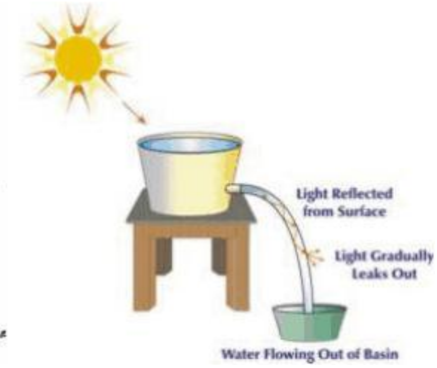
After about 10 years of global temperature increase following global cooling 1940-1978, IPCC was established in 1988. Presumably, several scientists interested in climate then felt intuitively that their empirical and theoretical understanding of climate dynamics was sufficient to conclude about the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

[Climate and history; one example among many]

1859: John Tyndall conducts experiments on the radiative properties of various gasses







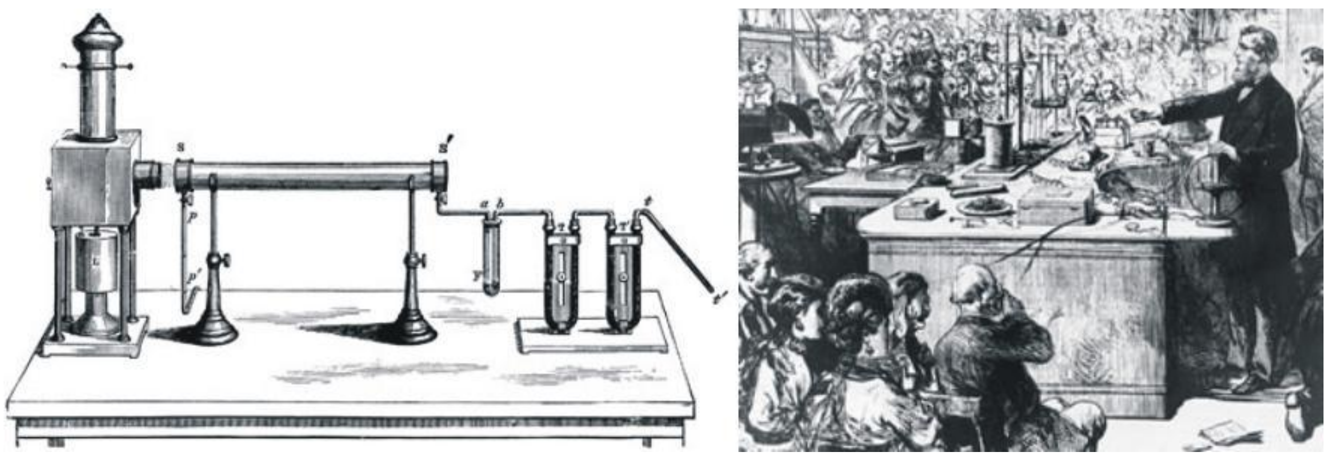
John Tyndall (left). John Tyndall's map of the French glacier Mer de Glace, where he in 1857 conducted glaciological investigations (centre). Experimental setup for one of John Tyndall's experiments (right), by which he, using a jet of water that flowed from one container to another and a beam of light, demonstrated that light used internal reflection to follow a specific path. As water poured out through the spout of the first container, Tyndall directed a beam of sunlight at the path of the water. The light, as seen by the audience in the lecture theatre, followed a zigzag path inside the curved path of the water. This simple experiment actually marked the first research into the guided transmission of light.

John Tyndall (1820-1893) was born in Leighlin Bridge, County Carlow, Ireland, the son of a part-time shoemaker and constable (Fleming 1998). At the age of eighteen, he joined the Irish Ordnance Survey as a draftsman and surveyor. During the period of railroad mania in UK, he worked 1844-1845 as a surveyor and engineer in Lancashire and Yorkshire.

In 1847, John Tyndall took a job teaching mathematics and drafting at Queenswood College in Hampshire, until he went on to study at the University of Marburg in Germany, where he completed a doctoral dissertation in mathematics. In 1852, Tyndall was elected a fellow of the Royal Academy, and one year later, with the support of Michael Faraday, he became a professor of natural philosophy at the Royal Institution of Great Britain. Here he focussed his research on the magnetic properties of crystals, the physics of ice, the transmission of heat through organic structures, and the radiative properties of gasses (Fleming 1998).

Starting in 1854, John Tyndall turned his attention to problems of geology and glaciers. This is not entirely surprising, as this was the time where the glacial hypothesis was getting its first foothold in mainstream scientific thinking, following the observations by Jean Agassiz in Scotland in 1840. He also developed an interest in meteorology, which at that time was beginning to receive widespread scientific interest as well, fuelled by the events during the Crimean War in 1854. Both of these interests presumably were also nourished by his keen interest in scientific mountaineering expeditions (Fleming 1998). He pioneered several solo attempts in the Alps, and climbed Mont Blanc (4807 m asl.) several times and was the first to climb the Weisshorn (4505 m asl.) in Switzerland.

In 1859, Tyndall begin a notable series of experiments on the radiative properties of various gasses. Inspired by his observations during mountaineering in the Alps, he established that the absorption of thermal radiation by water vapour and CO_2 was of importance in explaining meteorological phenomena such as night time cooling, the formation of dew and frost, and possibly also changes of climates in the distant past (Fleming 1998). Tyndall's interest for past climate changes was clearly motivated by the contemporary debate of Agassiz's glacial hypothesis, outlining the reality of recurrent huge natural climate variations, from time to time leading to major glaciations in Europe and North America.



Experimental setup for one of John Tyndall's experiments, by which he investigated the infrared absorptive powers of different gases (left). John Tyndall lecturing at the Royal Society (right).

On May 26, 1859, John Tyndall announced some of his early results to the Royal Society, and two weeks later, he demonstrated his experiments to a distinguished audience at the Royal Institution. Tyndall's most striking discoveries were the significant differences in the abilities of different gasses to absorb and transmit radiant heat (Fleming 1998). During his different experiments, he measured the infrared absorptive powers of different gases, such as, nitrogen, oxygen, water vapour, carbon dioxide, ozone, and hydrocarbons. Based on this, he concluded that water vapour is the strongest absorber of radiant heat in the atmosphere and is the principal gas controlling the surface air temperature. Compared to this, absorption by the other gases was found to be negligible. From these and other results, Tyndall pointed out that the role of water vapour *"must form one of the chief foundation-stones of the science of meteorology." "It is perfectly certain that more than ten percent of terrestrial radiation from the soil of England is stopped within ten feet of the surface of the soil." "Remove for a single summer-night the aqueous vapour from the air which overspreads this country, and you would assuredly destroy every plant capable of being destroyed by a freezing temperature"* (Fleming 1998).

According to Tyndall, water vapour *"acts more energetically upon the terrestrial rays than upon the solar rays; hence, its tendency is to preserve to the earth a portion of heat which would otherwise be radiated into space."* There could be no doubt about the *"extraordinary opacity of this substance to the rays of obscure heat,"* particularly to the rays emitted by the Earth after it has been warmed by the Sun (Fleming 1998). Thus, Tyndall was the first to prove by experiments, what previously had been widely surmised by other scientists, that the Earth's atmosphere has a Greenhouse Effect. Tyndall in his publications usually referred to radiant heat as *"obscure radiation", "dark waves"* or *"ultra-red undulations"*, as the word *"infrared"* did not come into use until the 1880s.

John Tyndall attempted to link his laboratory results to meteorological experiments in the free air. For that reason he did some of his experiments on the roof of the Royal Institution in London. He quickly became worried about the disturbing influences of the city on his experiments, and was lead to consider London as a *"heat island"* and *"a vast focus of artificial heat"*.

References:

Fleming, J.R. 1998. *Historical Perspectives on Climate Change*. Oxford University Press, 194 pp.

All the above diagrams with supplementary information, including links to data sources, are available on www.climate4you.com

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