Climate4you update August 2011

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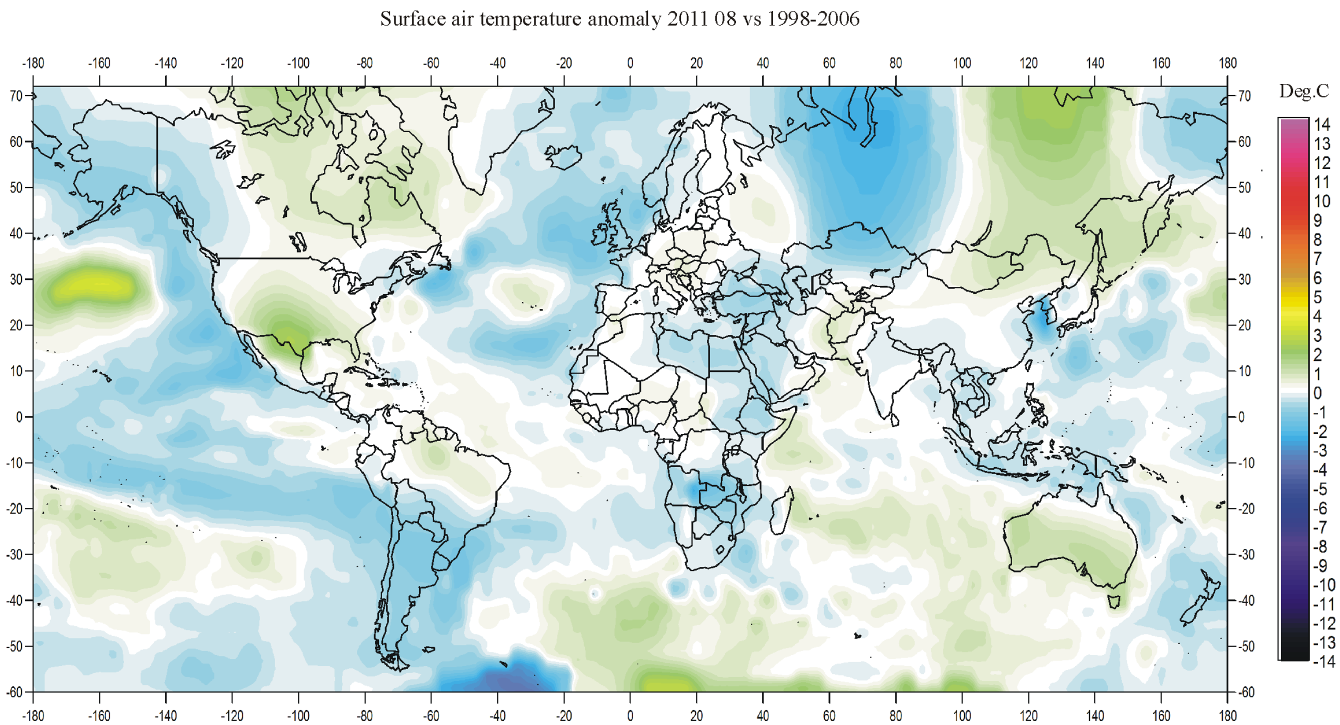
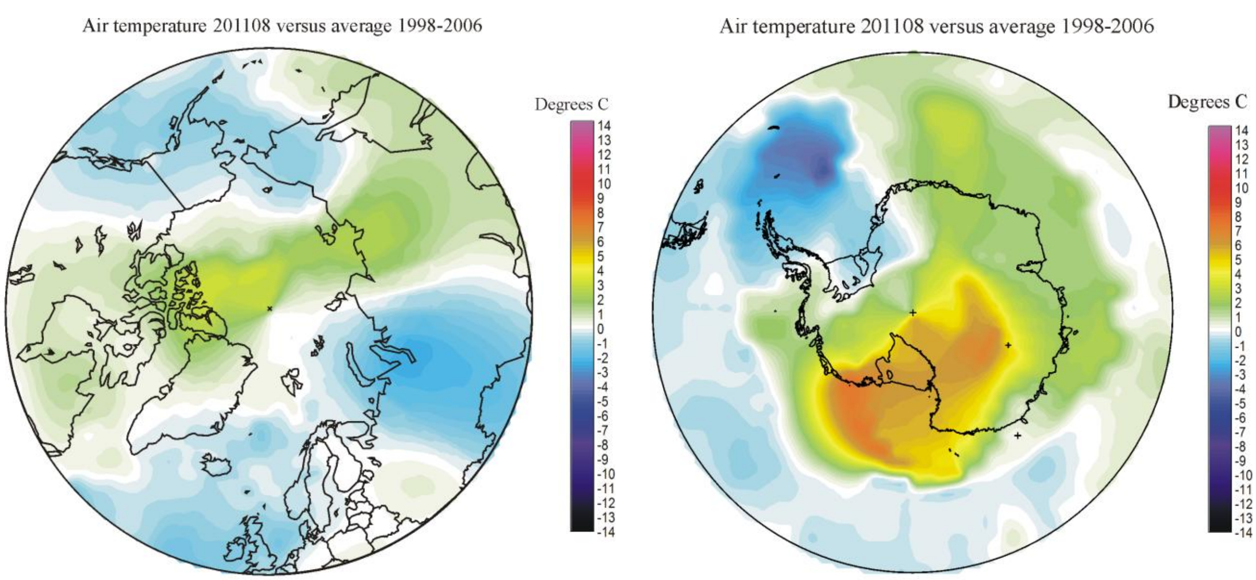
August 2011 global surface air temperature overview





August 2011 surface air temperature compared to the average 1998-2006. Green.yellow-red colours indicate areas with higher temperature than the 1998-2006 average, while blue colours indicate lower than average temperatures. Data source: Goddard Institute for Space Studies (GISS)

Comments to the August 2011 global surface air temperature overview

General: This newsletter contains graphs showing a selection of key meteorological variables for August 2011. *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 simple moving 37-month average, nearly corresponding to a three year average. The 37-month average is calculated from values covering a range from 18 month before to 18 months after, with equal weight for every month.

The year 1979 has been chosen as starting point in many diagrams, as this roughly corresponds to both the beginning of satellite observations and the onset of the late 20th century warming period. However, several of the records have a much longer record length, which may be inspected in grater detail on www.Climate4you.com.

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

The average global surface air temperatures August 2011:

The Northern Hemisphere was characterised by high regional variability. Below 1998-2006 average temperatures extended across most of Russia and Europe, the North Atlantic, westernmost Canada and Alaska. Above average temperatures characterised eastern Siberia and most of North America. A prominent August 2011 hotspot was existing in the central North Pacific.

The Southern Hemisphere in general was closer to average 1998-2006 conditions, although with Africa, South America and extensive areas of the Pacific being relatively cold. Most of Australia experienced average air temperatures somewhat above the 1998-2006 average.

Near Equator temperatures conditions were close to average 1998-2006 conditions, although with a dominance of below average temperatures especially in the Pacific.

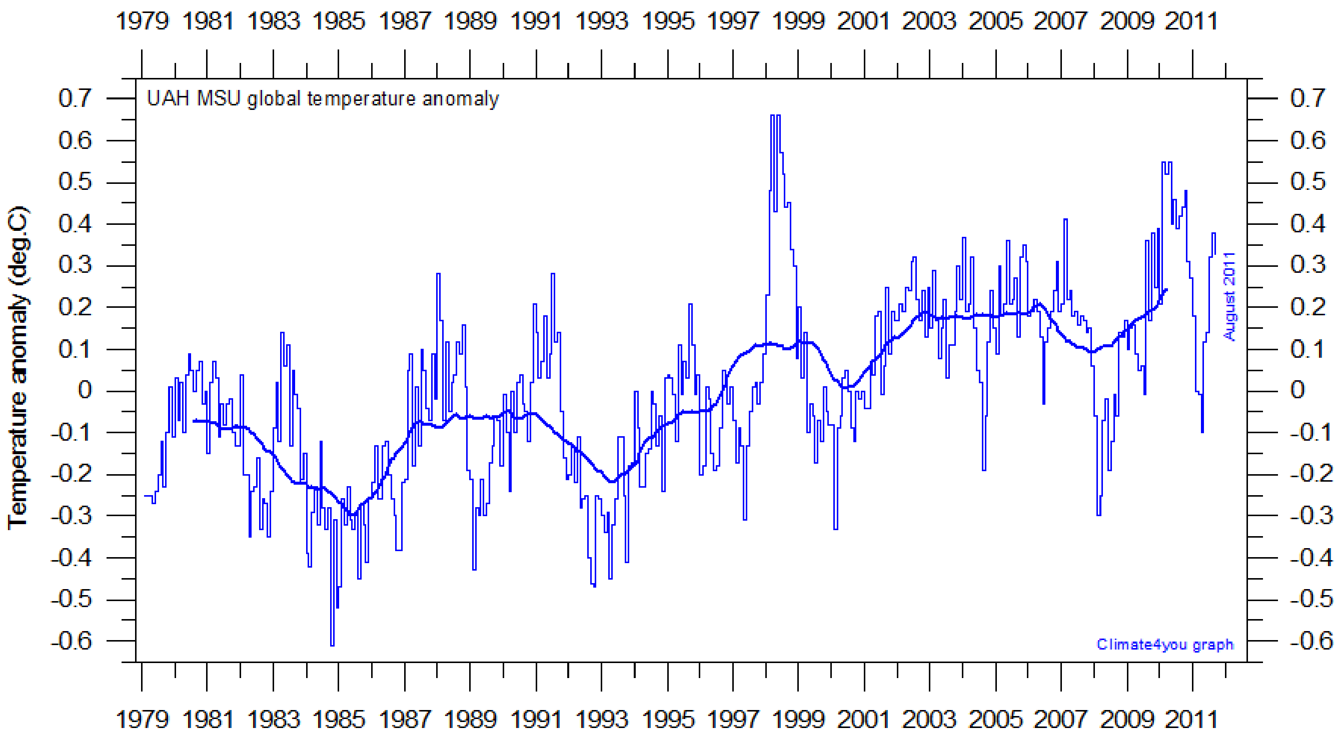
The Arctic was characterized by a high variability of average surface air temperatures. The European and Russian Arctic sectors experienced below average temperatures, as did Alaska and eastern Siberia. Most of the Canadian sector and western Siberia experienced above average temperatures.

Most of the Antarctic continent experienced above average temperatures, the only major exception being the Antarctic Peninsula and the Weddell Sea region.

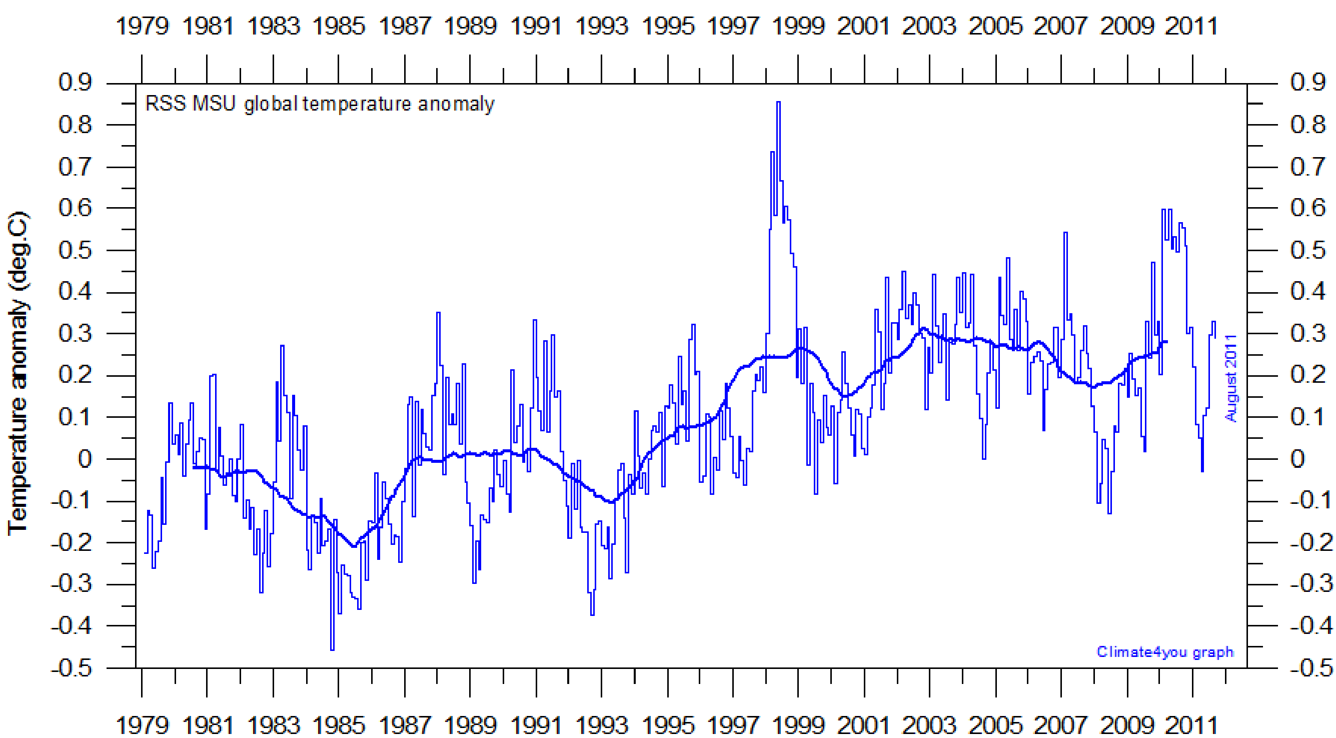
The global oceanic heat content:

The global oceanic heat content deserves a separate note this month. As the diagrams on p.10 in this newsletter show, the heat content in the uppermost 700 m of the oceans has not been increasing for several years. Instead the heat content has essentially been stable since 2003/2004 (data from the National Oceanographic Data Center).

Lower troposphere temperature from satellites, updated to August 2011

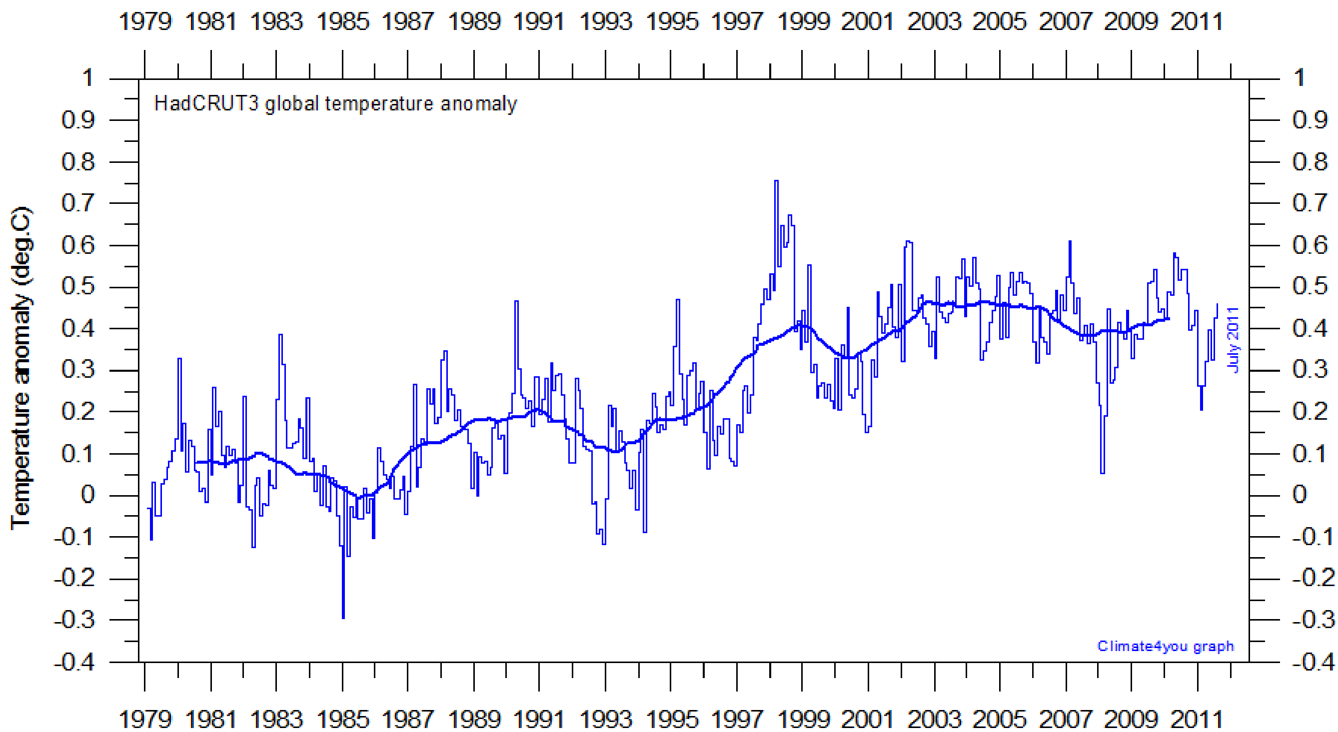


Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama] at Huntsville, USA. The thick line is the simple running 37 month average.

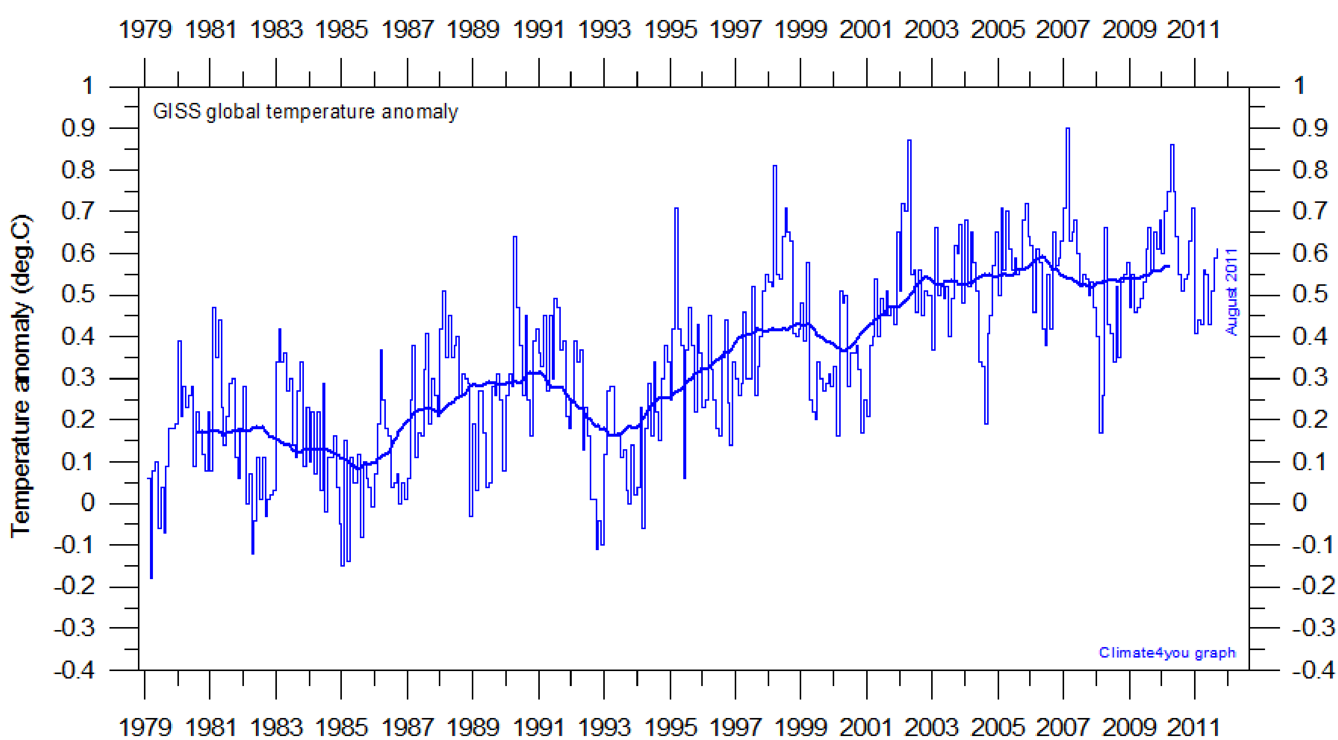


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems] (RSS), USA. The thick line is the simple running 37 month average.

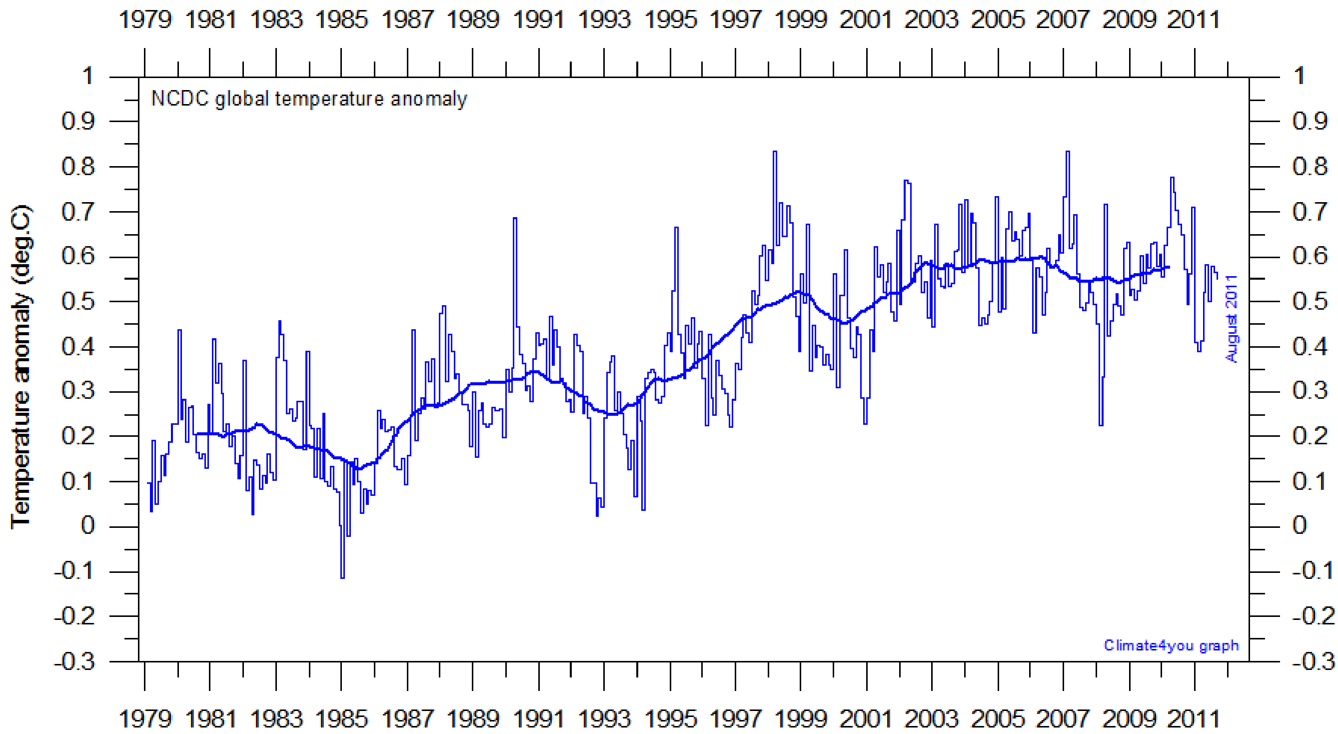
Global surface air temperature, updated to August 2011



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 the HadCRUT3 record is only updated to July 2011.



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

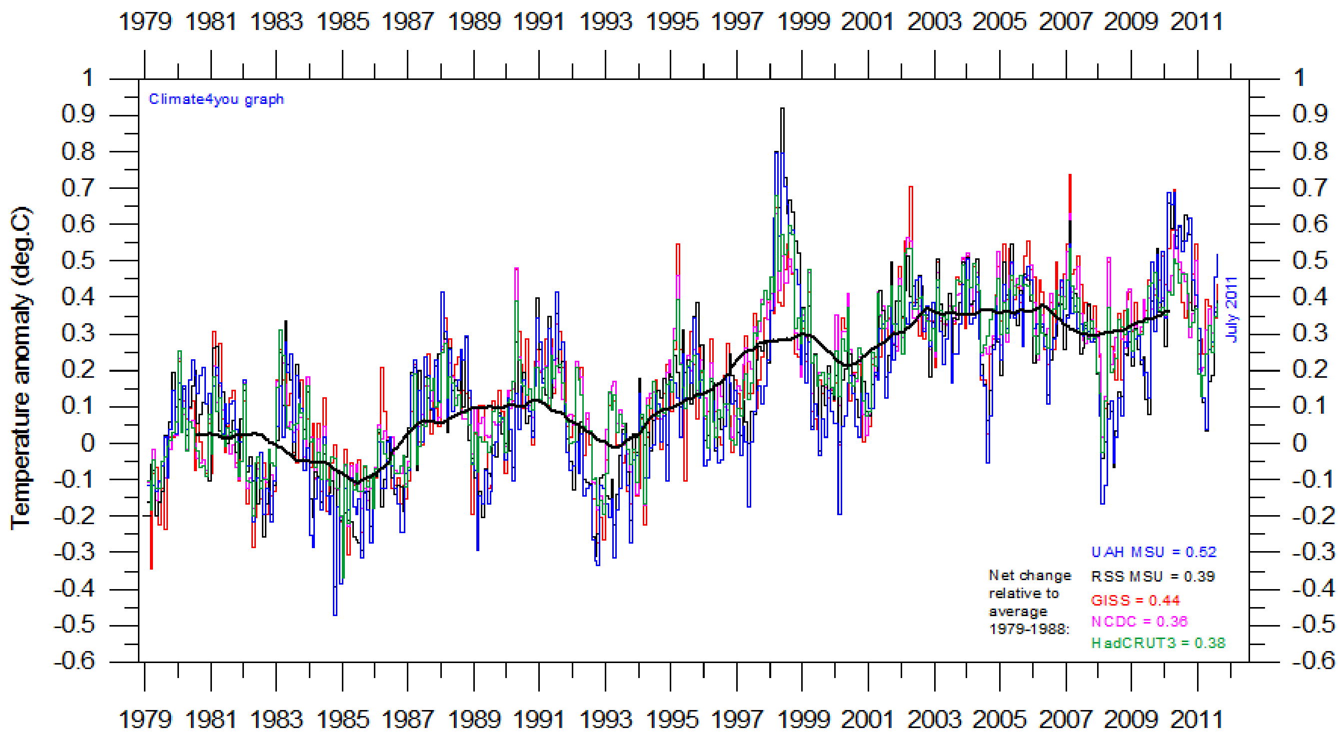


Global monthly average surface air temperature since 1979 according to according to the [National Climatic Data Center](#) (NCDC), USA. The thick line is the simple running 37 month average.

All the above temperature estimates display changes when one compare with previous monthly data sets, not only for the most recent months as a result of additional data being added, but actually for all months back to the very beginning of the records. The most stable temperature record over time of the five records shown above is the HadCRUT3 series.

The interested reader may find more on the issue of temporal stability (or lack of this) on www.climate4you (go to: *Global Temperature*, followed by *Temporal Stability*).

All in one, updated to July 2011

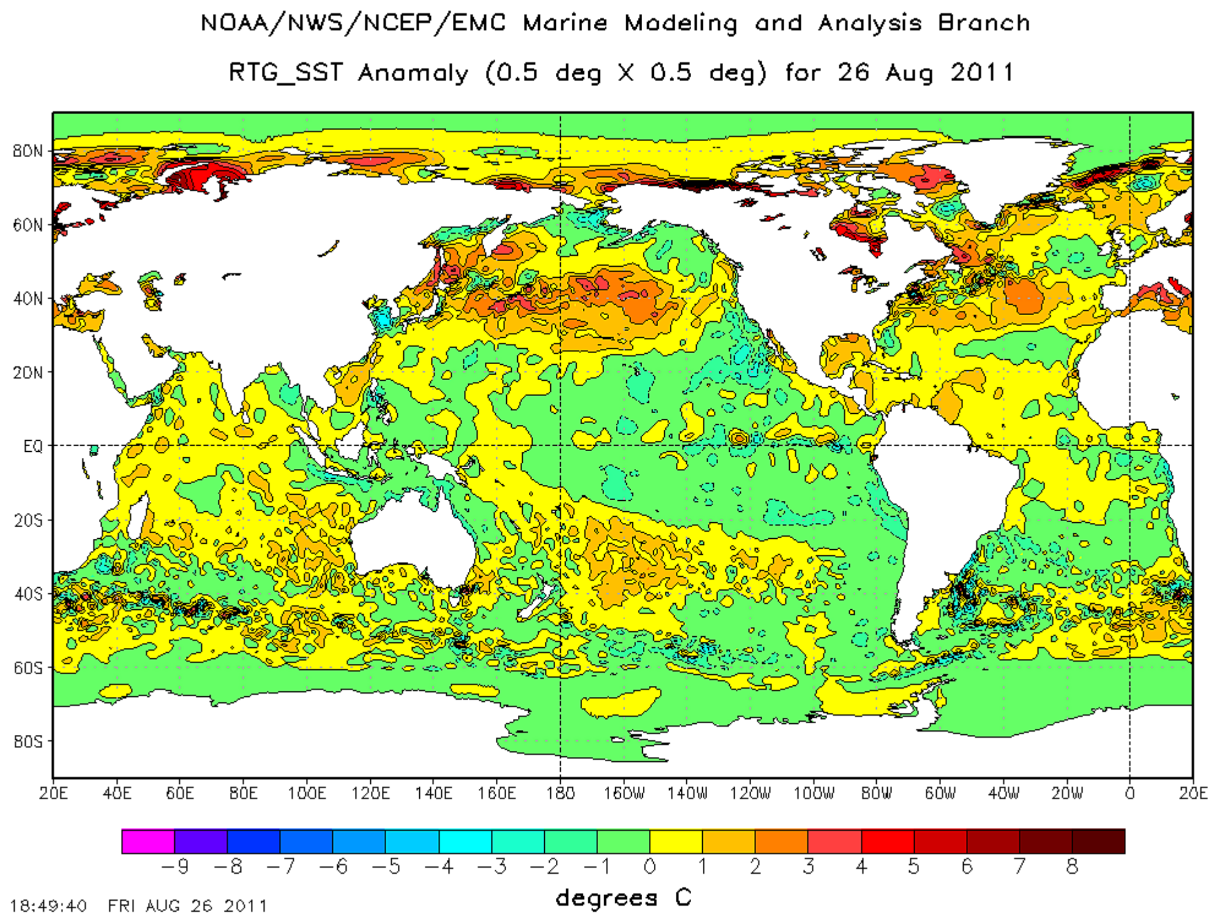


Superimposed plot of all five global monthly temperature estimates shown above. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of their initial 120 months (10 years) from January 1979 to December 1988. The heavy black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

It should be kept in mind that satellite- and surface-based temperature estimates are derived from different types of measurements, and that comparing them directly as done in the diagram above therefore in principle may be problematical. However, as both types of estimate often are discussed together, the above diagram may nevertheless be of some interest. In fact, the different types of temperature estimates appear to agree quite well as to the overall temperature variations on a 2-3 year scale, although on a shorter time scale there may be considerable differences between the individual records.

All five global temperature estimates presently show stagnation, at least since 2002. There has been no increase in global air temperature since 1998, which however was affected by the oceanographic El Niño event. This stagnation does not exclude the possibility that global temperatures will begin to increase again later. On the other hand, it also remain a possibility that Earth just now is passing a temperature peak, and that global temperatures will begin to decrease within the coming years. Time will show which of these two possibilities is correct.

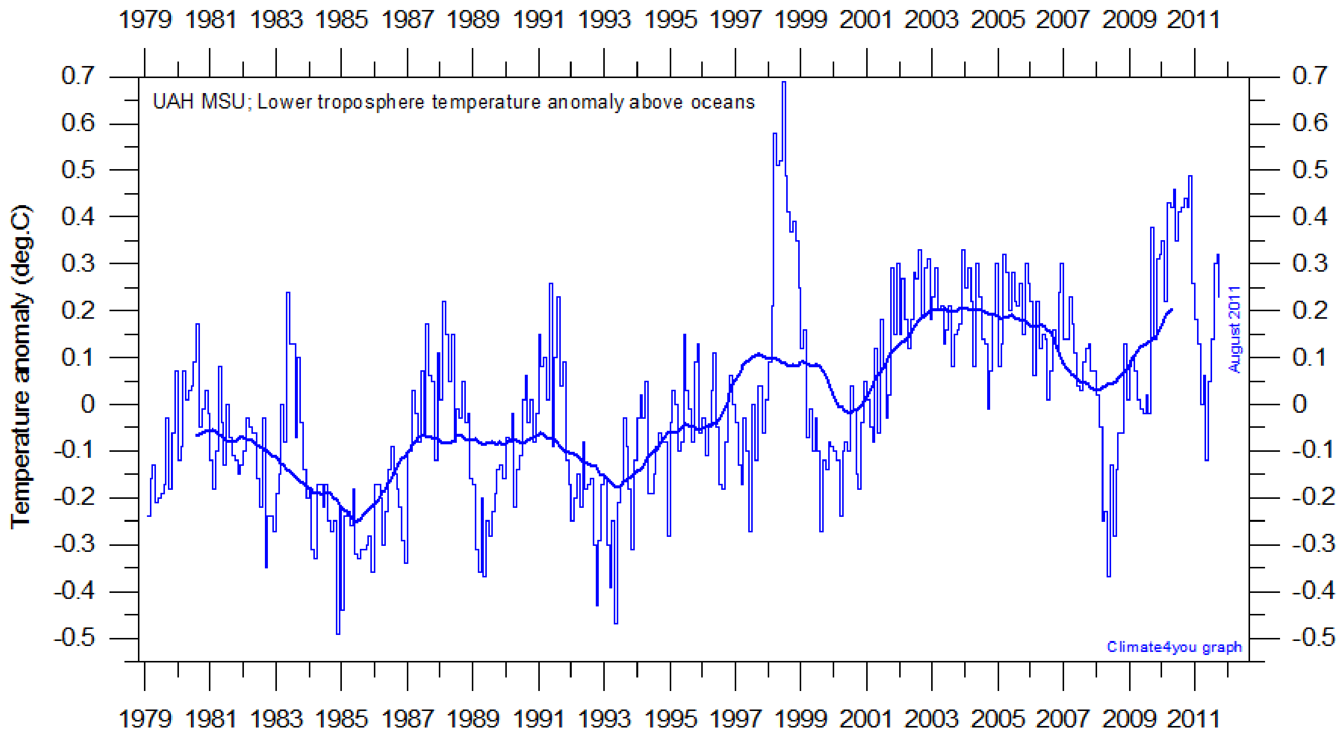
Global sea surface temperature, updated to end of August 2011



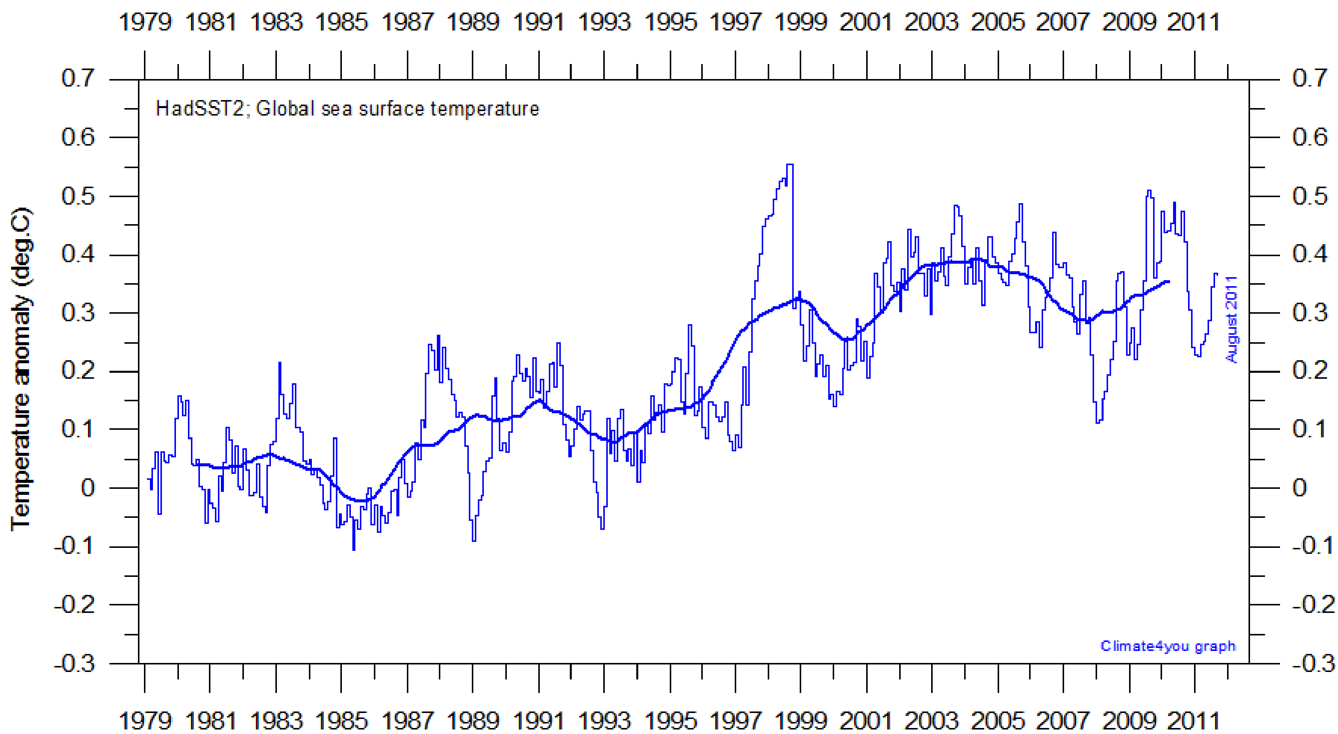
Sea surface temperature anomaly at 26 August 2011. Map source: National Centers for Environmental Prediction (NOAA).

The relative cold surface water dominating the regions near Equator in the eastern Pacific Ocean represents the remnants of the previous La Niña situation, but warmer water is only very slowly beginning to spread west from the Peruvian coast. Because of the large surface areas involved (being near Equator) this cyclic oceanographic development will affect the global atmospheric temperature in the months to come.

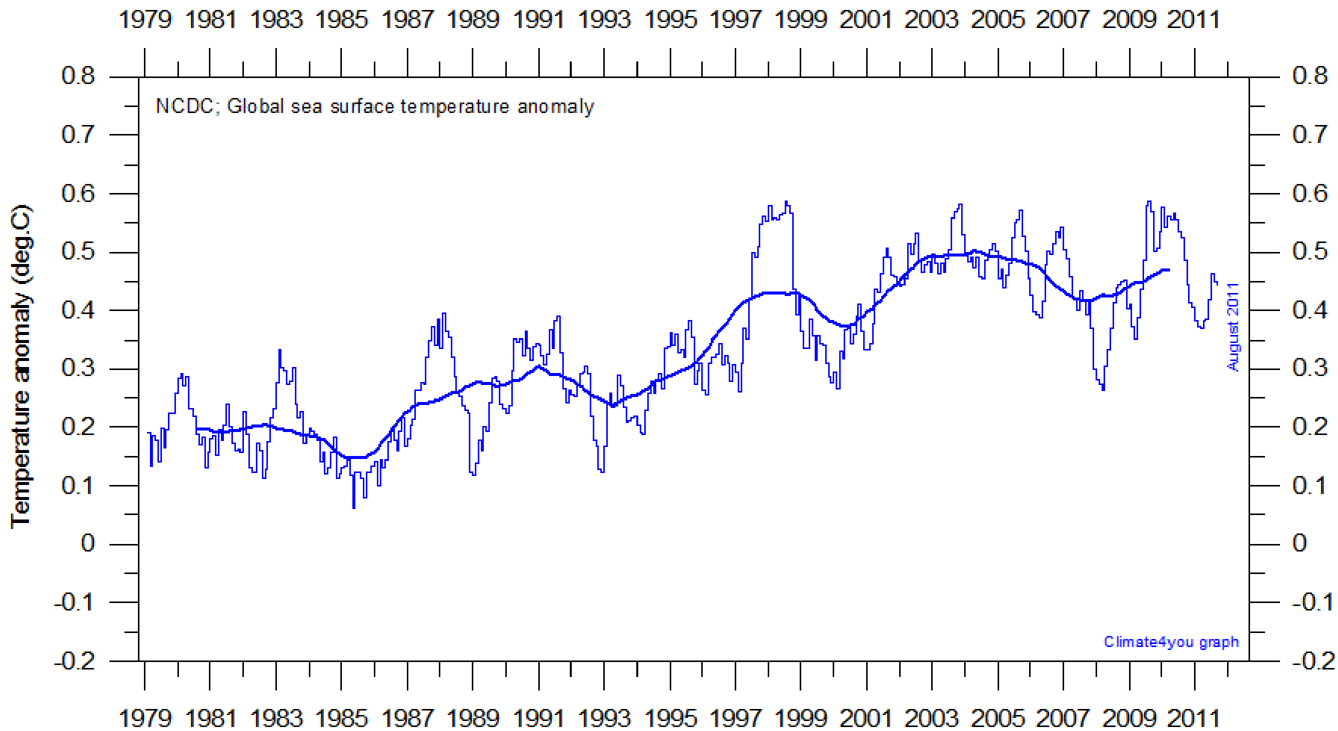
The significance of any such warming or cooling seen in surface air temperatures should not be over stated. Whenever Earth experiences cold La Niña or warm El Niño episodes major heat exchanges takes place between the Pacific Ocean and the atmosphere above, eventually showing up in estimates of the global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



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

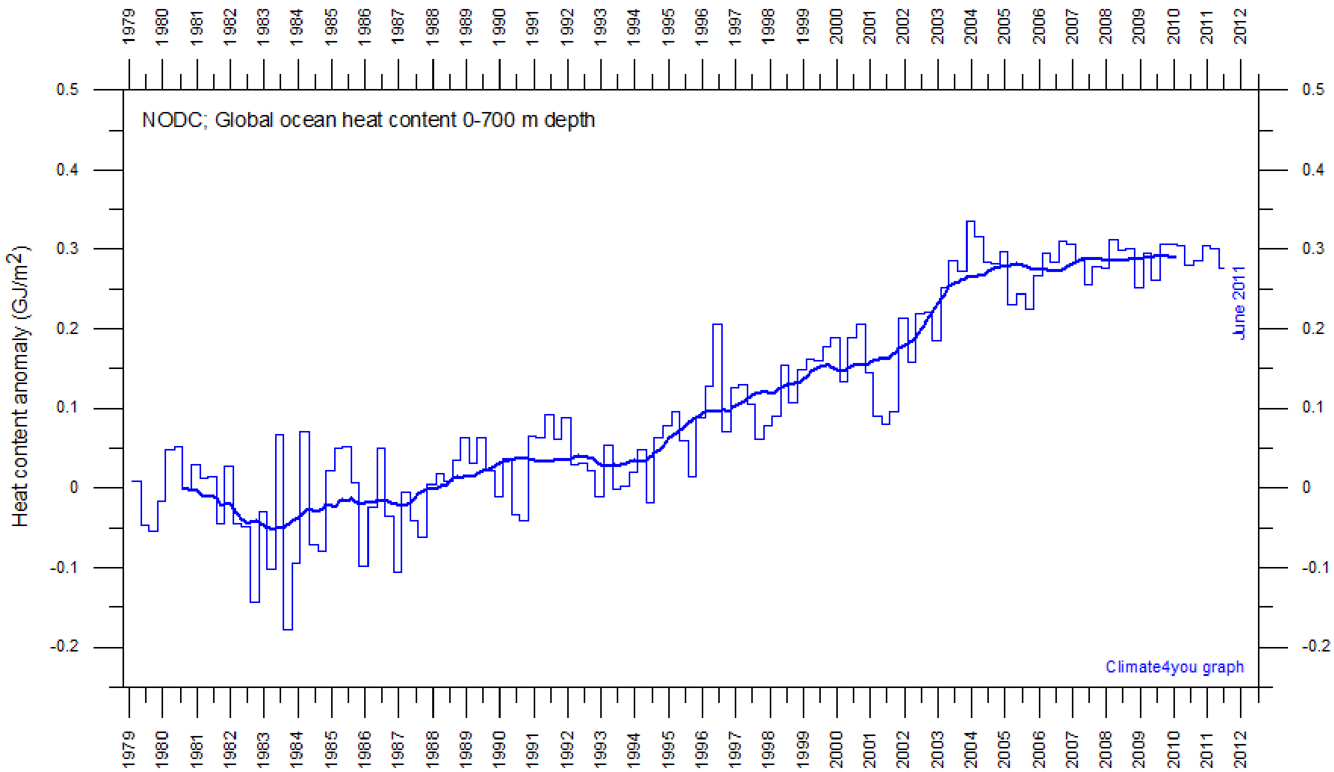


Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37 month average. Please note that this diagram is not updated beyond May 2011.

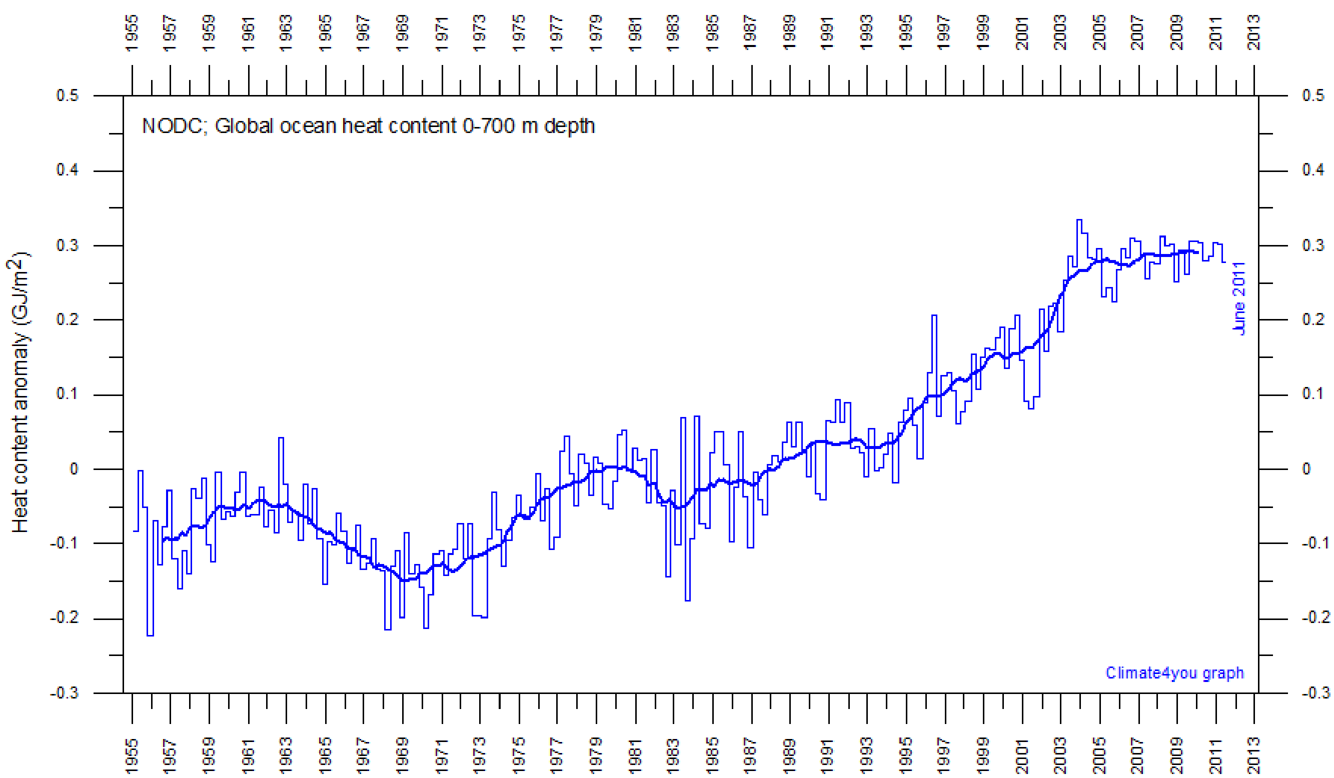


Global monthly average sea surface temperature since 1979 according to the [National Climatic Data Center](#) (NCDC), USA. Base period: 1901-2000. The thick line is the simple running 37 month average.

Global ocean heat content, updated to June 2011

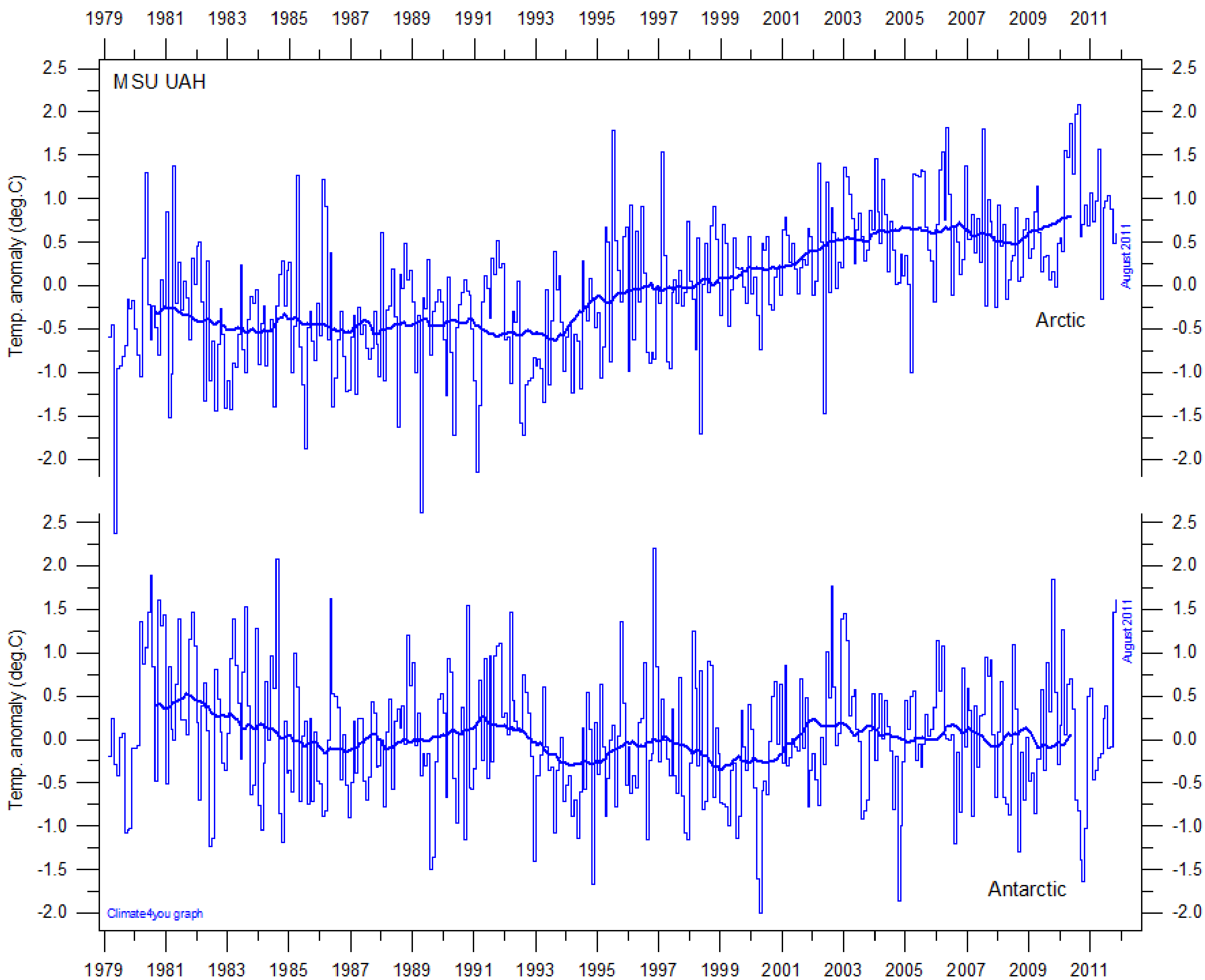


Global monthly heat content anomaly (GJ/m2) in the uppermost 700 m of the oceans since January 1979. Data source: National Oceanographic Data Center(NODC).



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

[Arctic and Antarctic lower troposphere temperature, updated to August 2011]



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 July 2011

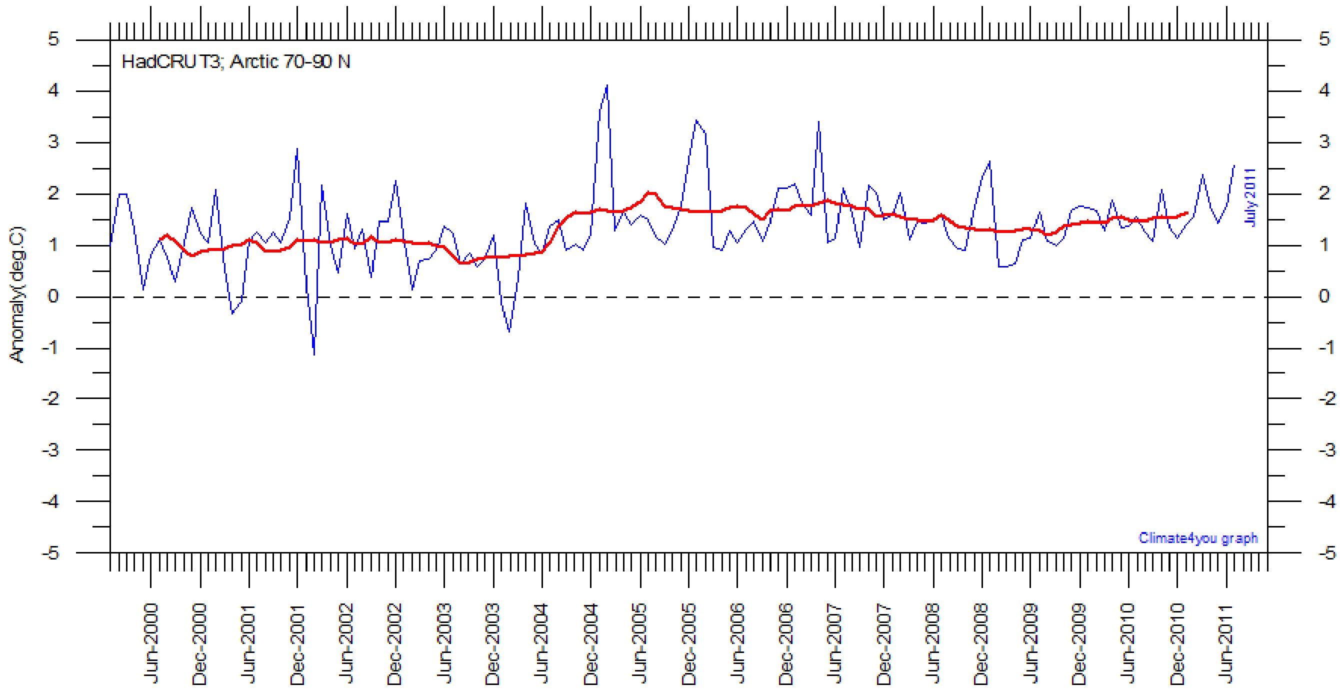


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

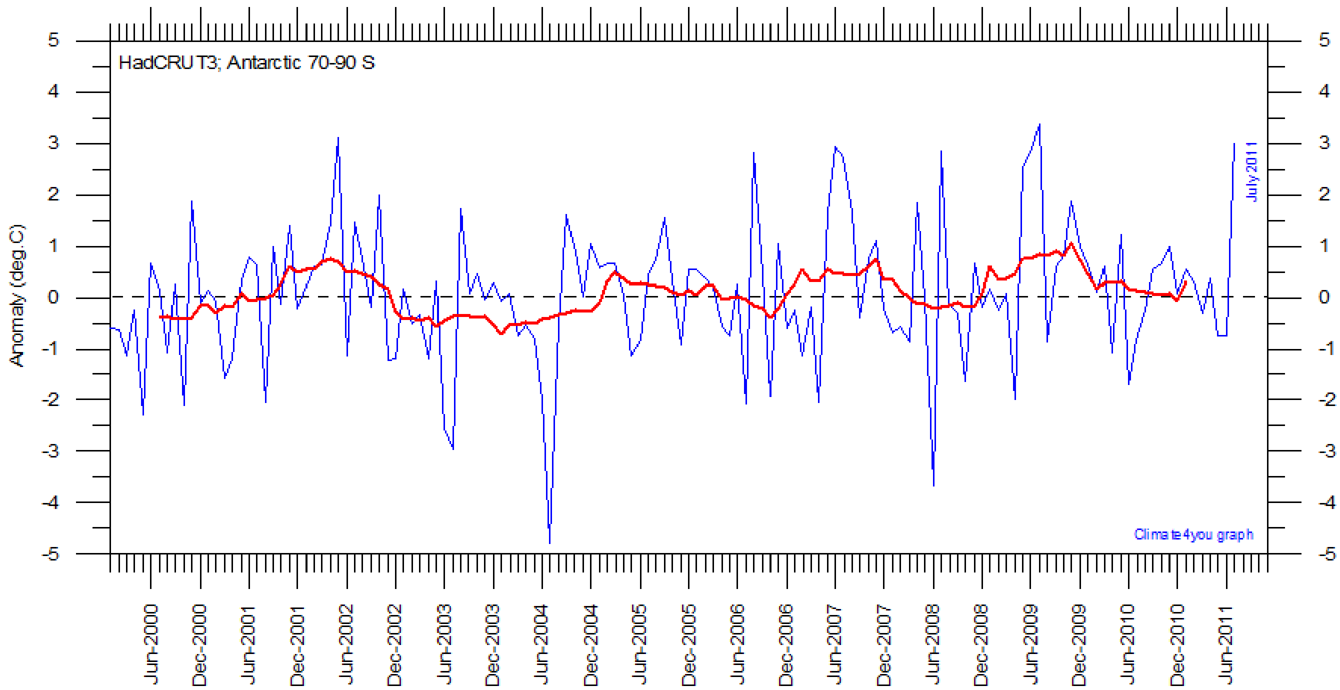


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

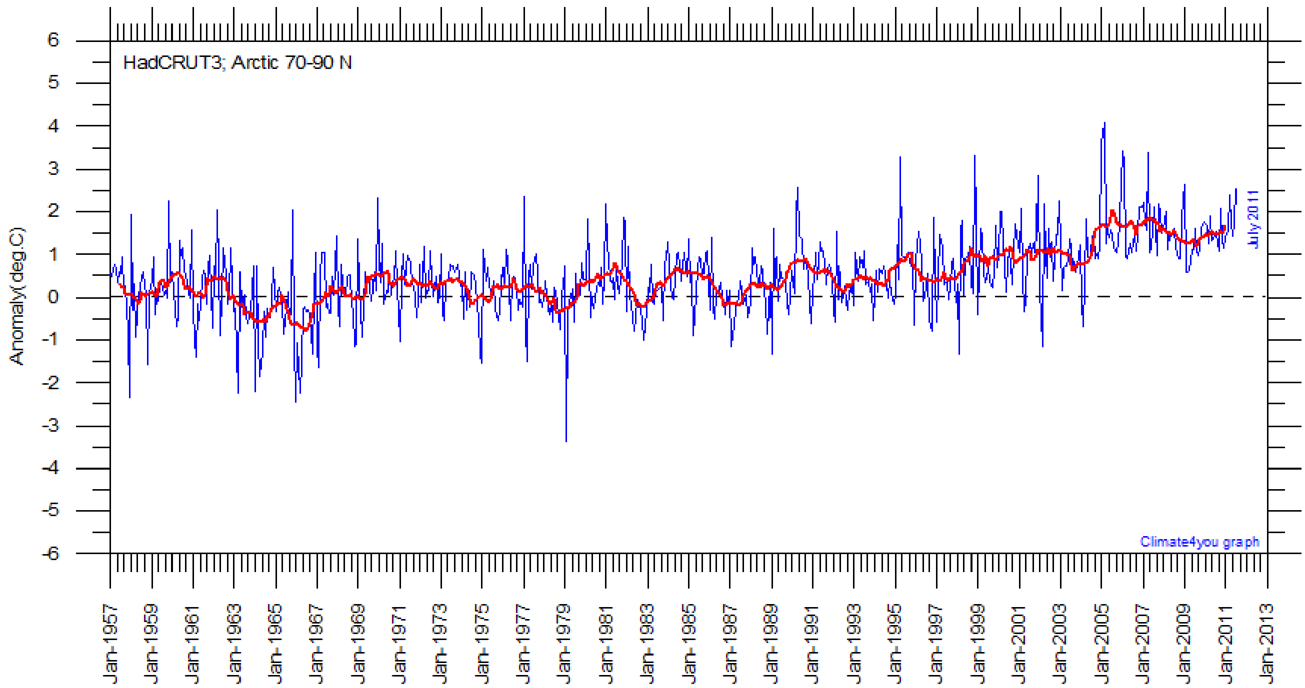


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown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

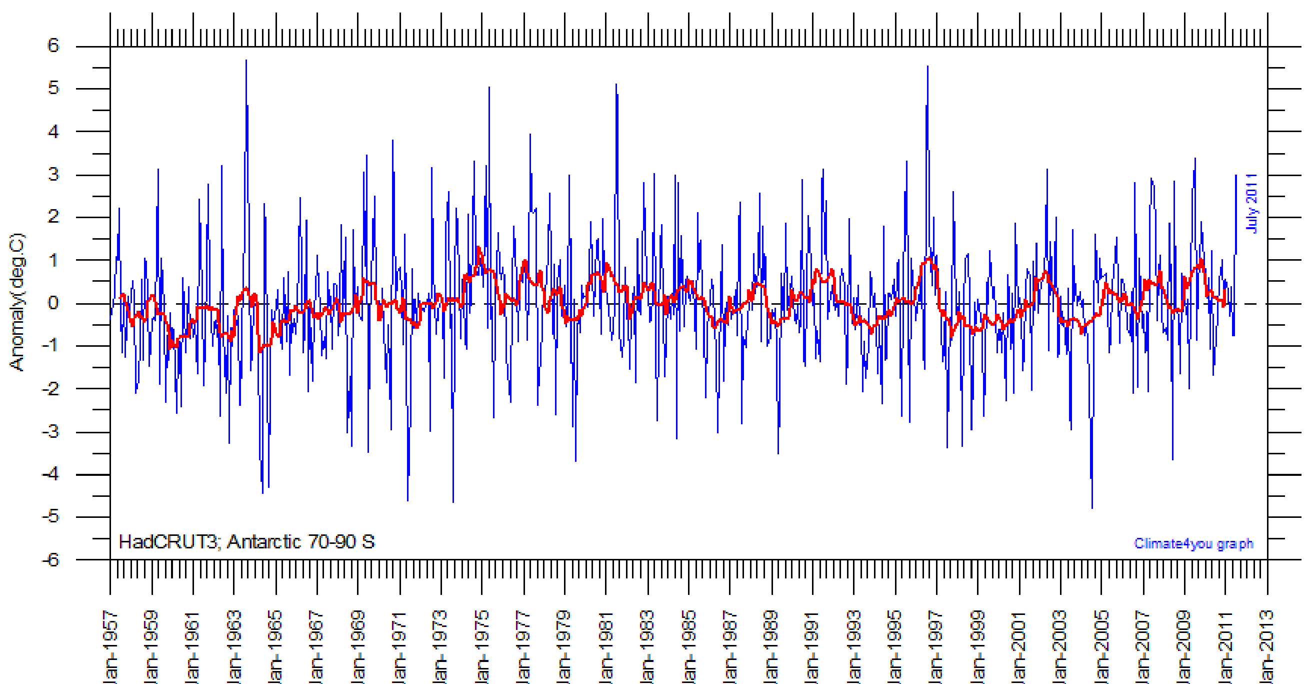


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before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

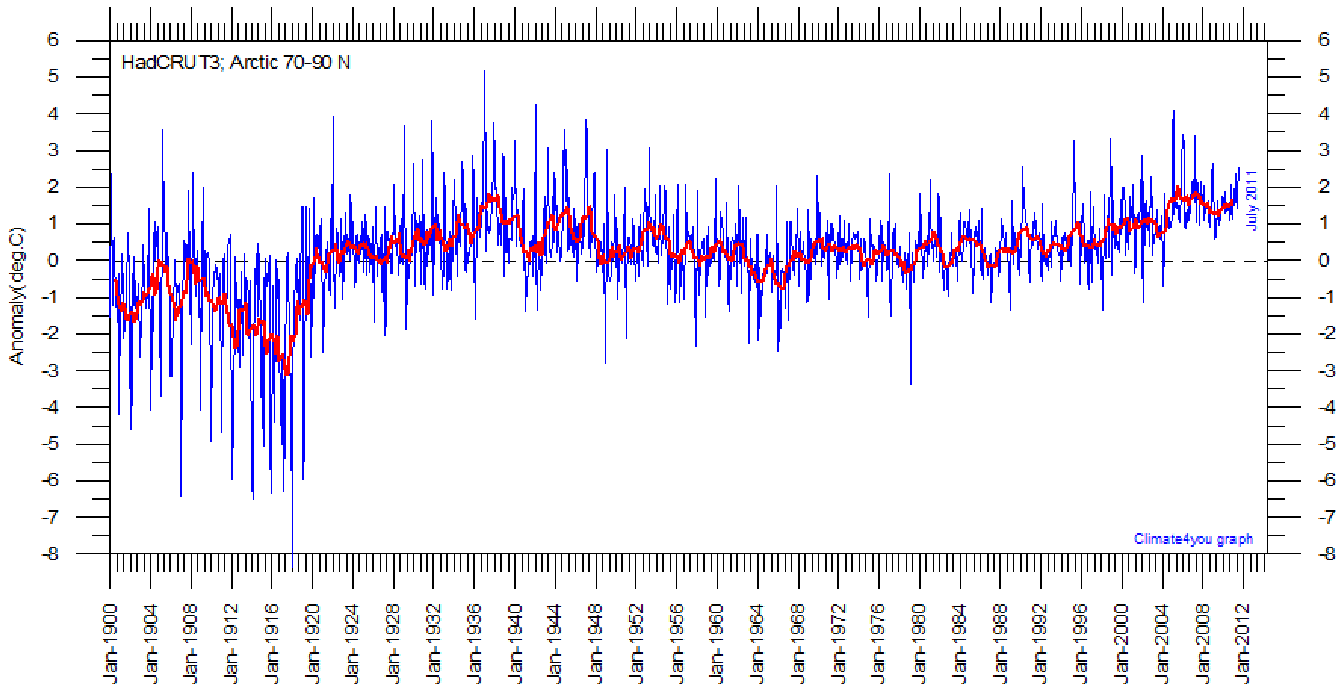


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly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

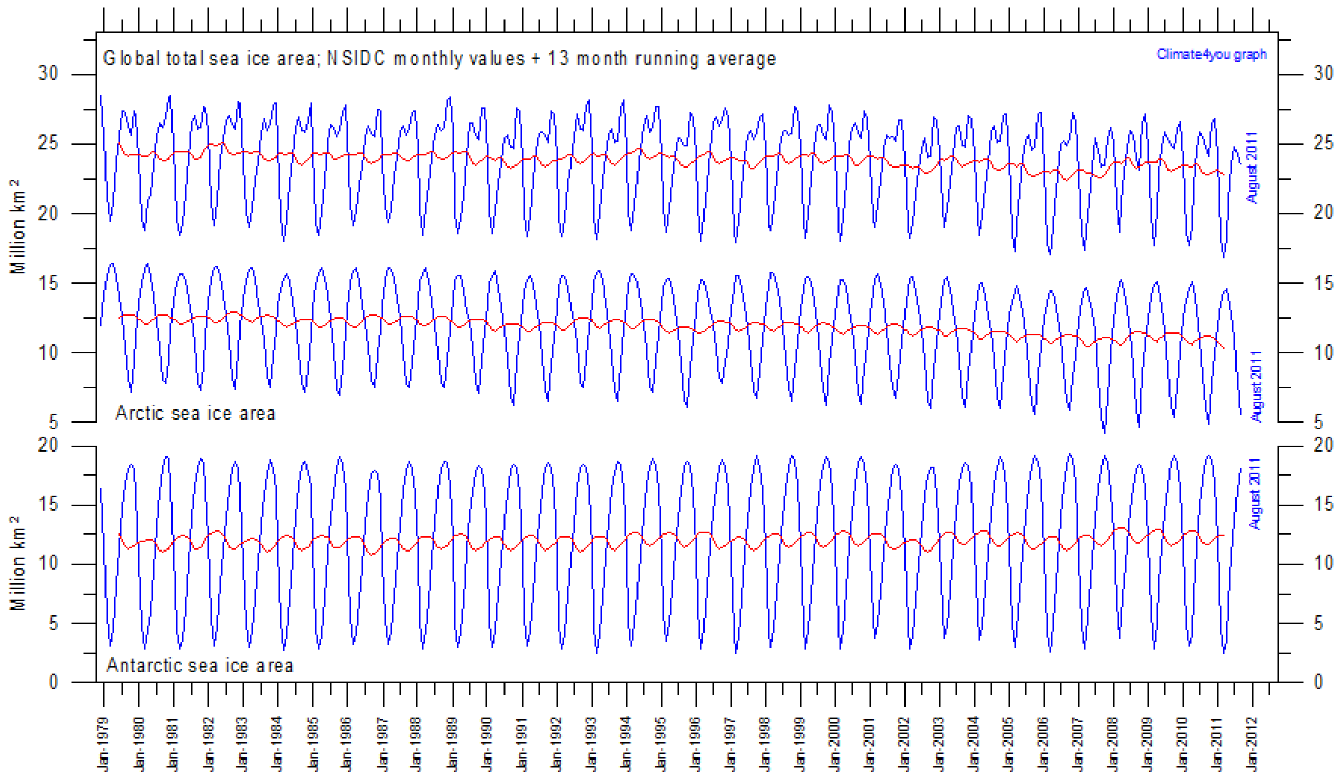
In general, the Arctic temperature record appears to be less variable than the Antarctic record, presumably at least partly due to the higher number of meteorological stations north of 70°N, compared to the number of stations south of 70°S.

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

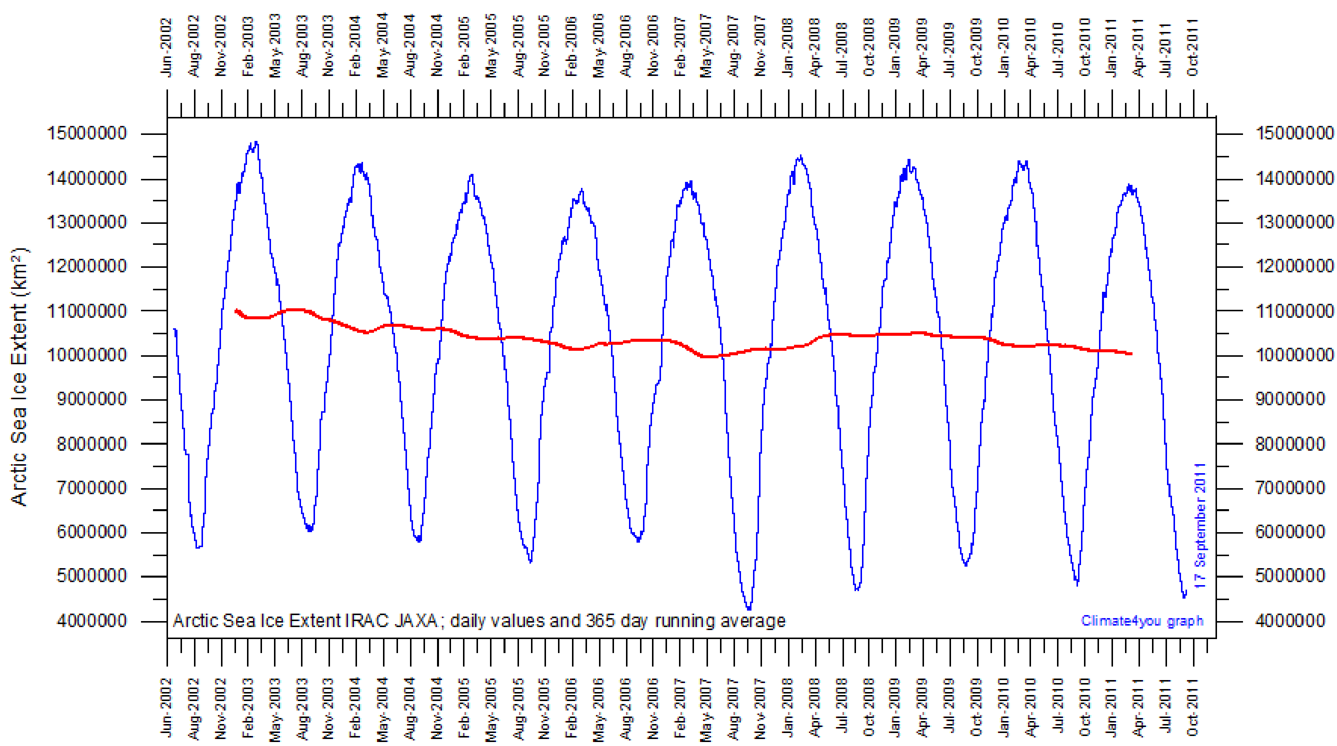
Literature:

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

[Arctic and Antarctic sea ice, updated to August 2011](#)

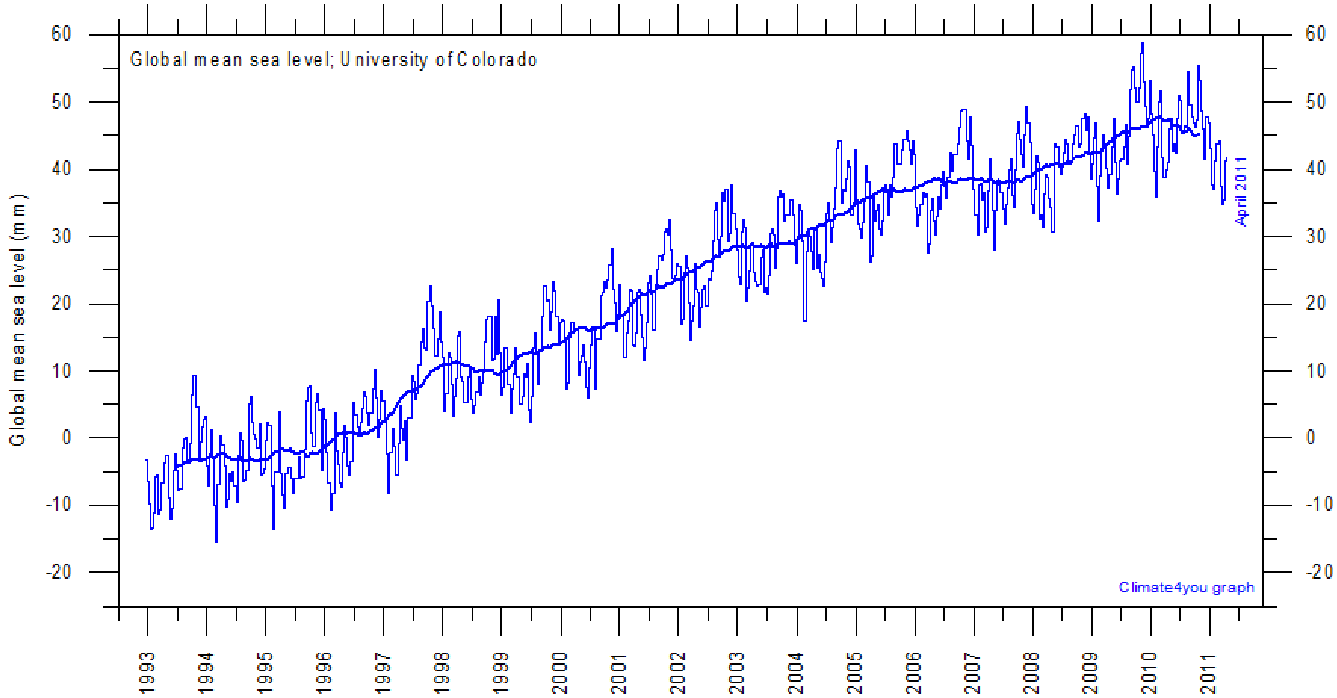


Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center](#) (NSIDC).

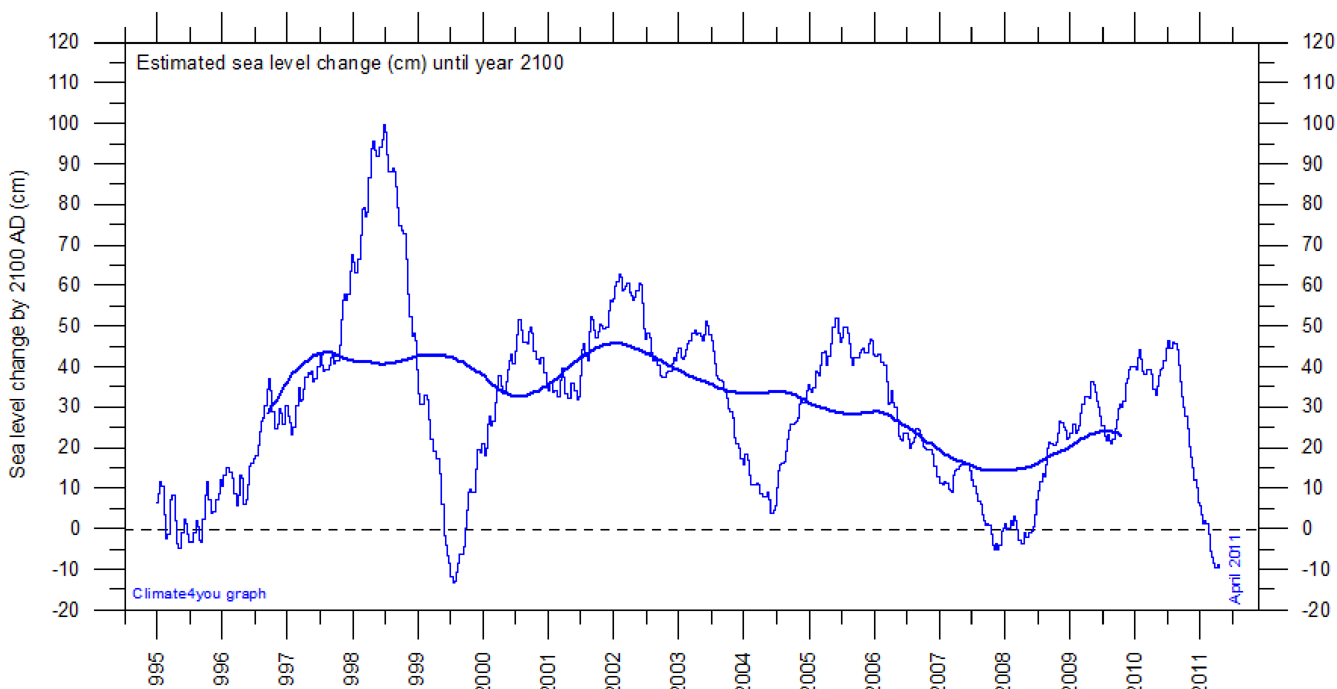


Graph showing daily Arctic sea ice extent since June 2002, to September 17,2011, by courtesy of [Japan Aerospace Exploration Agency](#) (JAXA).

Global sea level, updated to April 2011

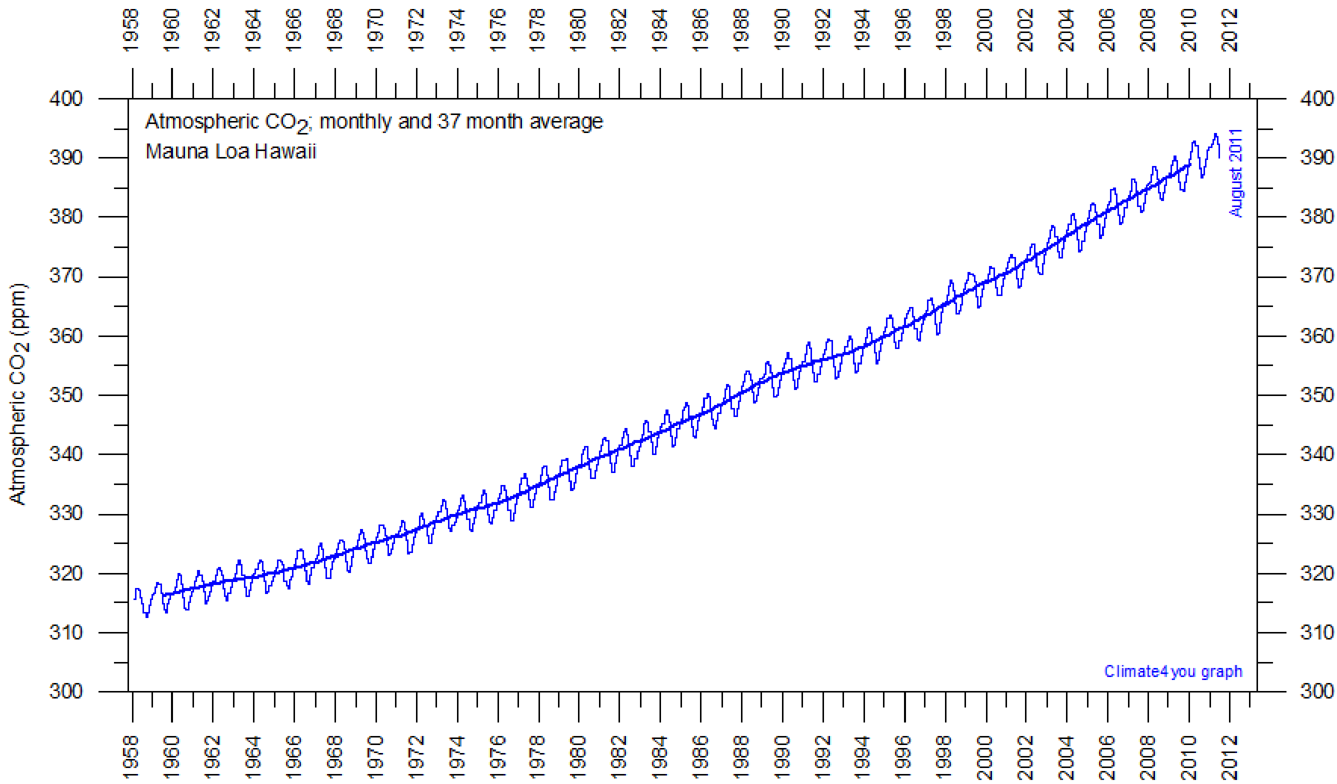


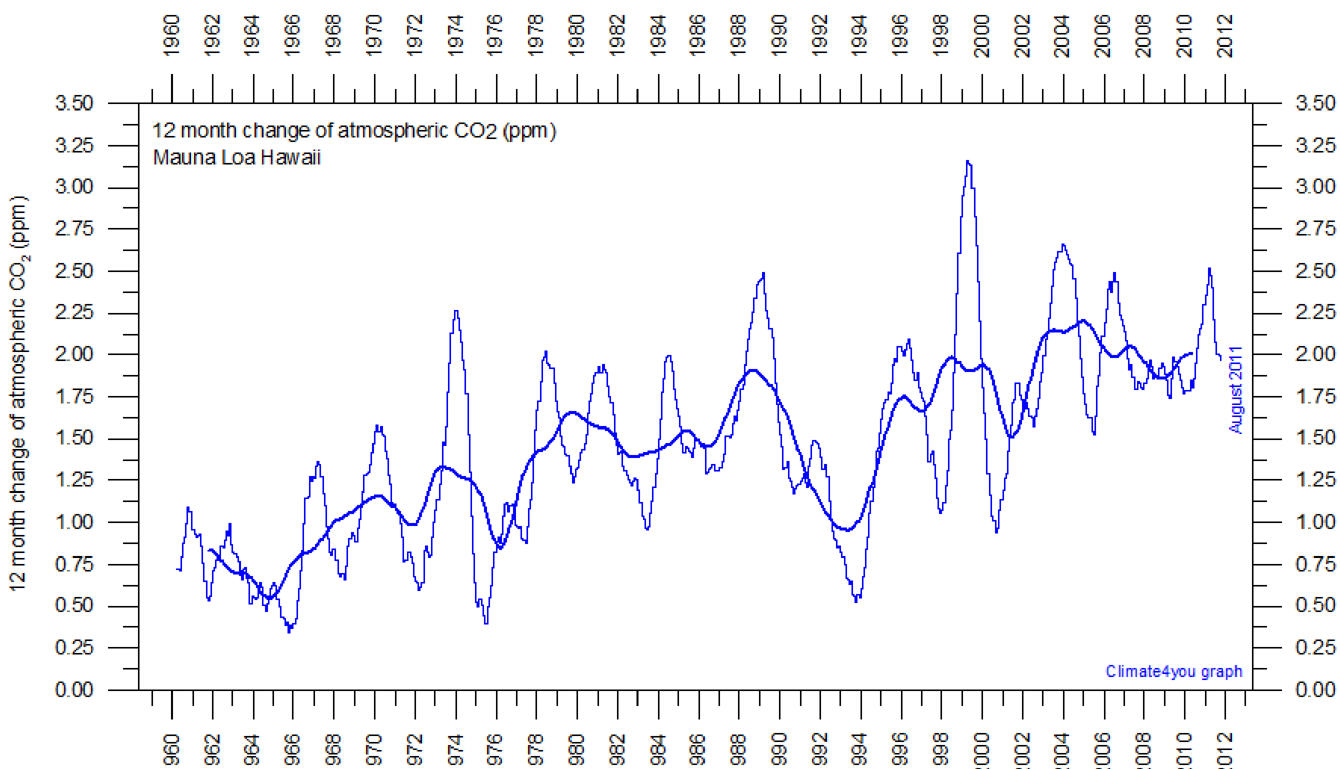
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at University of Colorado at Boulder, USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



Forecasted change of global sea level until year 2100, based on simple extrapolation of measurements dome 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. The present empirical forecast of sea level change until 2100 is 20-25 cm (end point of thick line).

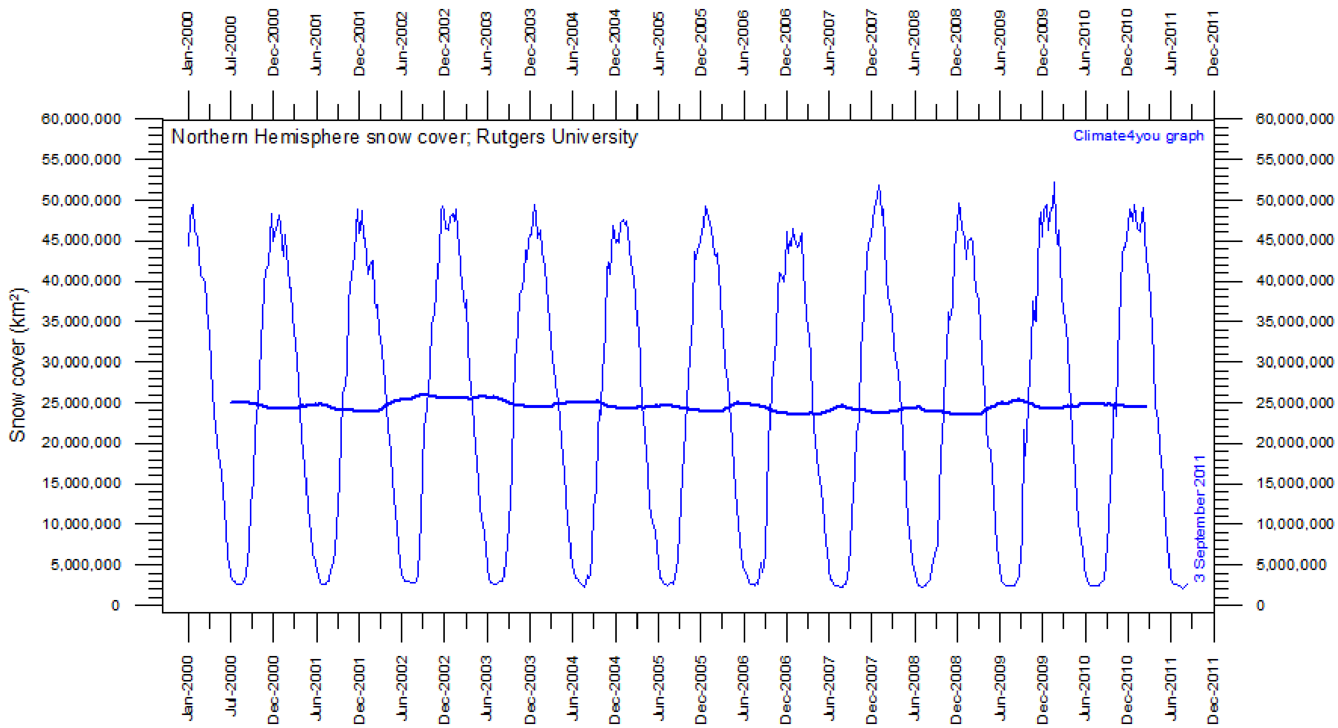
Atmospheric CO_2, updated to August 2011



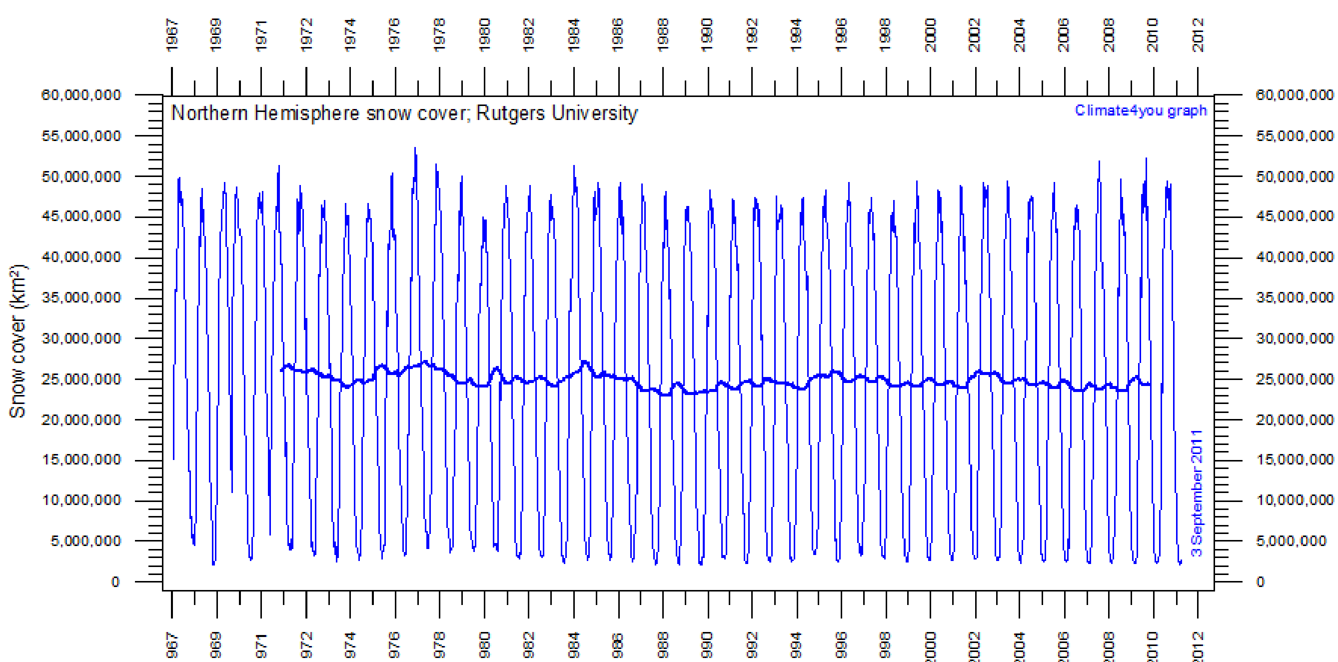


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the Mauna Loa Observatory, Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Northern Hemisphere weekly snow cover, updated to early September 2011

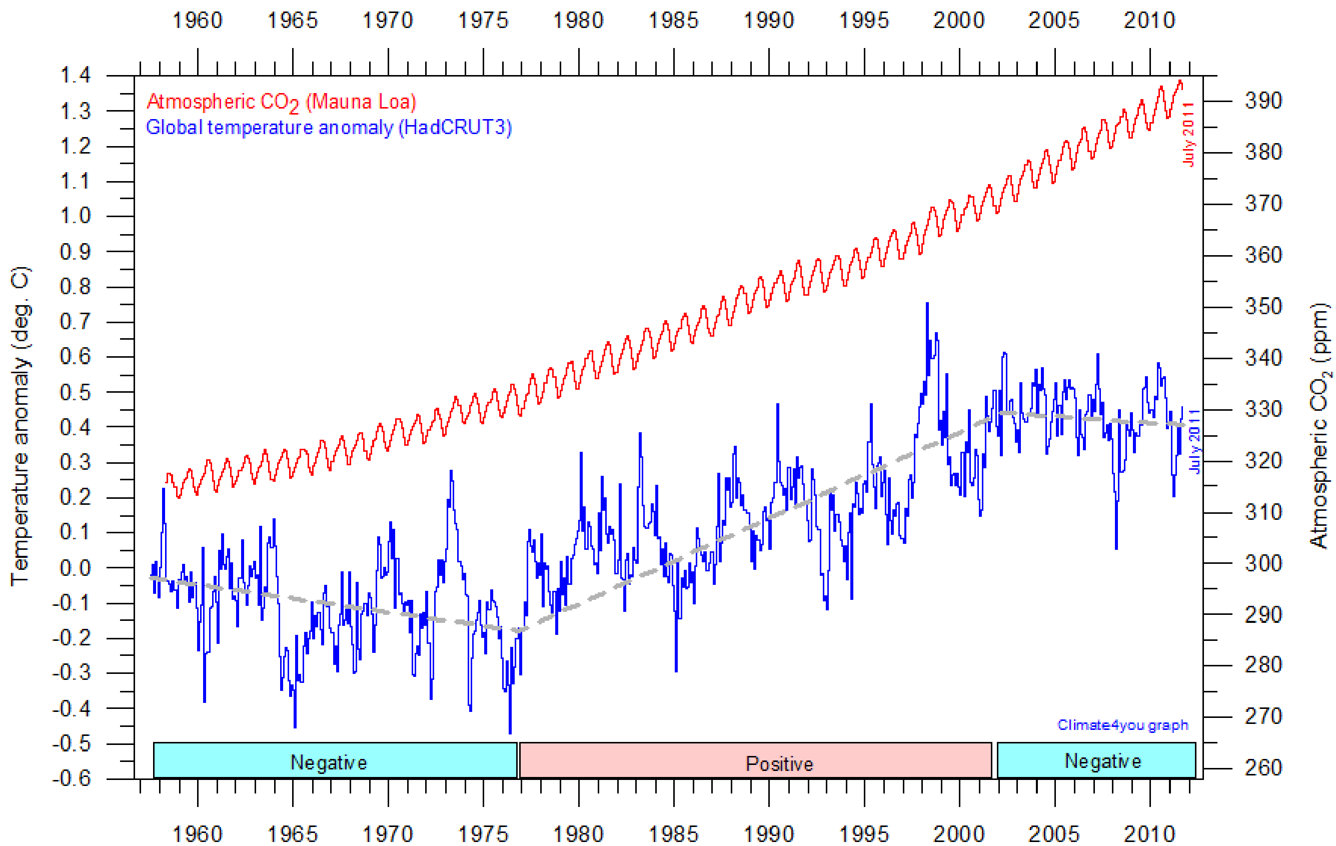


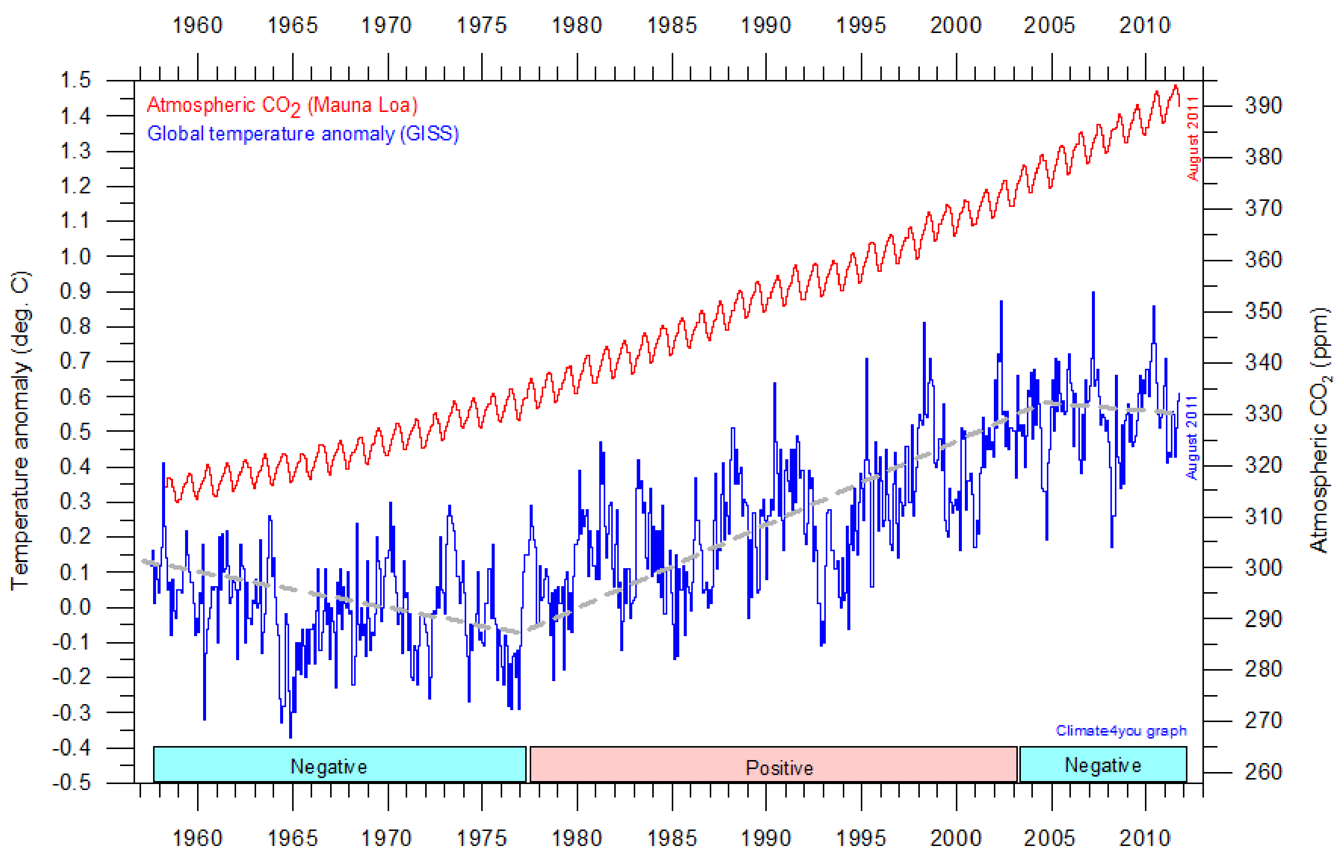
Northern hemisphere weekly snow cover since January 2000 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year).

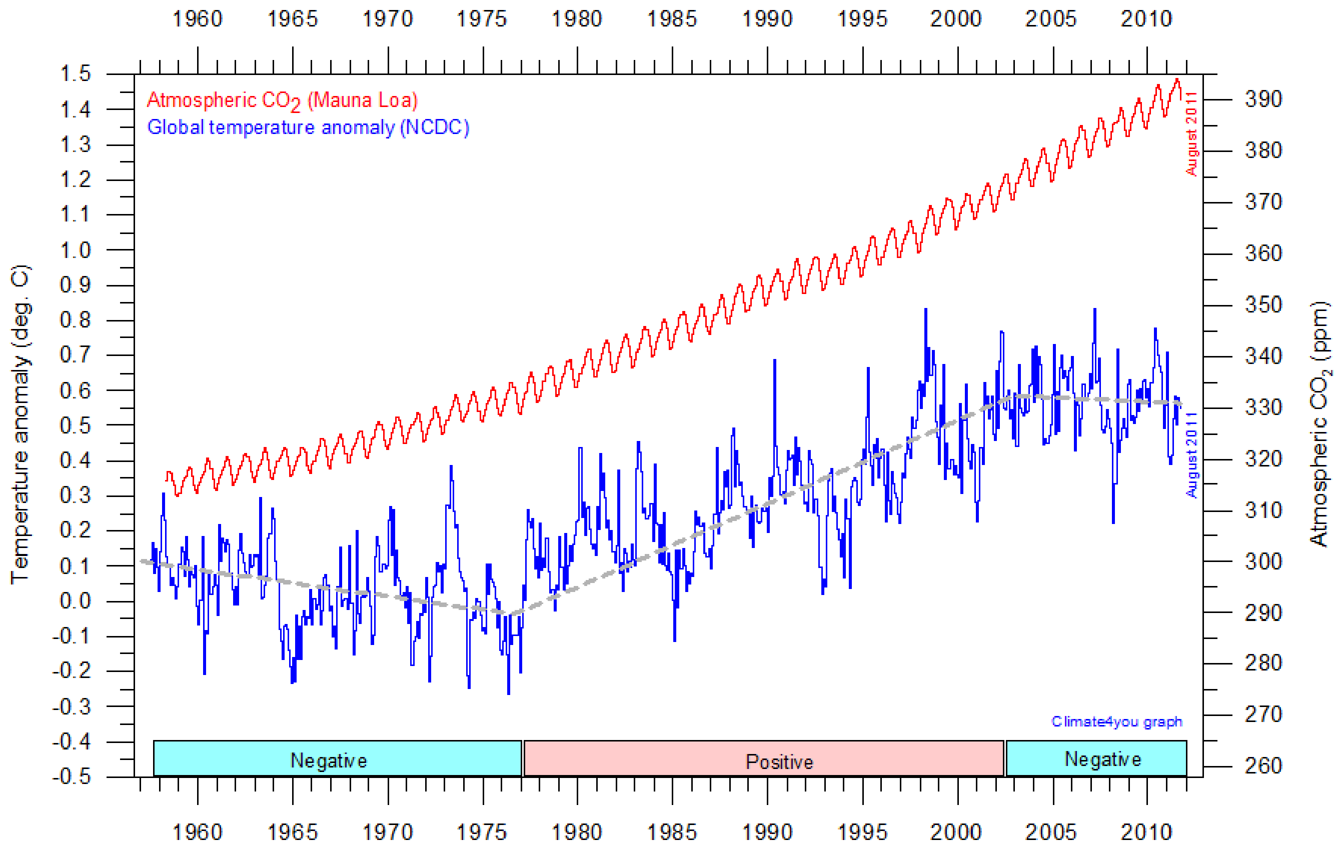


Northern hemisphere weekly snow cover since October 1966 according to Rutgers University Global Snow Laboratory. The thin line is the weekly data, and the thick line is the running 53 week average (approximately 1 year). The running average is not calculated before 1971 because of some data irregularities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

Global surface air temperature and atmospheric CO_2, updated to August 2011







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 is only updated to July 2011.

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

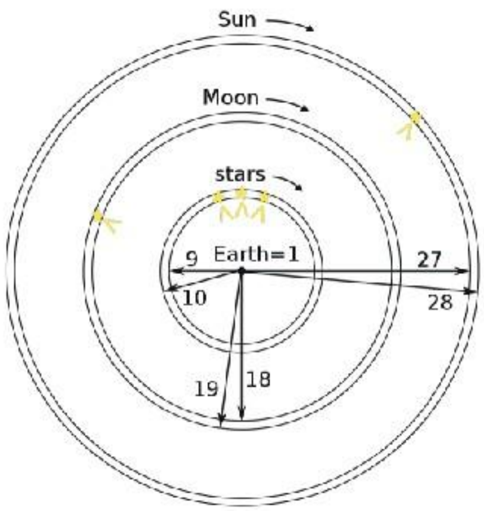
It is of cause equally inappropriate to present new meteorological record values, whether daily, monthly or annual, as support for the hypothesis ascribing high importance of atmospheric CO_2 for global temperatures. Any such short-period meteorological record value may well be the result of other phenomena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

What exactly defines the critical length of a relevant time period to consider for evaluating the alleged high importance of CO_2 remains elusive. However, the length of the critical period must be inversely proportional to the importance of CO_2 on the global temperature, including possible feedback effects. So if the net effect of CO_2 is strong, the length of the critical period is short, and vice versa.

After about 10 years of global temperature increase following global cooling 1940-1978, IPCC was established in 1988. Presumably, several scientists interested in climate in 1988 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, political and public support for the CO_2-hypothesis would have been difficult to obtain. Adopting this approach as to critical time length, the varying relation (positive or negative) between global temperature and atmospheric CO_2 has been indicated in the lower panels of the three diagrams above.

Climate and history; one example among many

620-540 BC: Ionian nature philosophers Thales and Anaximander



Thales of Miletus (left). Map of Anaximander's universe (centre). Detail of Raphael's painting The School of Athens (right). Presumably this is a representation of Anaximander leaning towards Pythagoras on his left.

Ionia is an ancient region of central coastal Anatolia in the western part of present-day Turkey. Never a unified state, it was named after the Ionian tribe who in the Archaic Period (800-480 BC) occupied mainly the shores and islands of the Aegean Sea. Ionia comprised a narrow coastal strip from near the mouth of the river Hermus in the north to the mouth of the river Meander in the south, and included the islands of Chiros and Samos. Much of the summary below is adopted from Rasmussen (2010) and Wikepedia.

Ionia was settled by the Greeks probably during the 11th century BC. Ionia was always a maritime power founded by a people who made their living by trade in peaceful times and marauding in unsettled times. The coast was rocky and the arable land limited. The coastal cities were placed in defensible positions on islands or headlands. The populations of the cities were multi-cultural and received cultural stimuli from many civilizations in the eastern Mediterranean, which resulted in a brilliant society able to make contributions of worldwide and millennial significance.

The philosopher Tales (c.620-c.540 BC) was born in the city of Miletus (Milet in modern Turkey), one of the biggest Ionian cities. Many, most notably Aristotle, regard him as the first philosopher in the Greek tradition. According to Bertrand Russell, "Western philosophy begins with Thales."

By tradition, the Greeks often invoked explanations of natural phenomena by reference to the will of gods and heroes. Thales, however, aimed to explain natural phenomena by a rational explanation that referred to natural processes themselves. For example, he attempted to explain earthquakes by hypothesizing that the Earth floats on water, and that earthquakes occur when the Earth is rocked by waves, rather than assuming that earthquakes were the result of supernatural processes.

In mathematics, Thales used geometry to solve problems such as calculating the height of pyramids and the distance of ships from the shore. He is credited with the first use of deductive reasoning applied to geometry, by deriving four corollaries to Thales' Theorem. As a result, he has been hailed as the first true mathematician and is the first known individual to whom a mathematical discovery has been attributed. Also, Thales was the first person known to have studied electricity. In addition, it appears that Thales also successfully predicted a solar eclipse.

Thales had a profound influence on other Greek thinkers and therefore on Western history. Many philosophers followed Thales' lead in searching for explanations in nature rather than in the supernatural. Eventually Thales' rejection of mythological explanations became an essential idea for the scientific revolution. He was also the first to define general principles and set forth hypotheses, and as a result he has been dubbed the "Father of Science", though it may be argued that Democritus more correctly deserve this title.

One of Thales students was Anaximander (c. 610 BC – c. 546 BC). He became famous by explaining how the four elements of ancient physics (air, earth, water and fire) are formed, and how Earth and terrestrial beings are formed through their interactions. His knowledge of geometry allowed him to introduce the gnomon (the part of a sundial that casts the shadow) in Greece. Early sources report that one of Anaximander's more famous pupils was Pythagoras. Anaximander also created a map of the world that contributed greatly to the advancement of geography.

Like many thinkers of his time, Anaximander's contributions to philosophy relate to many disciplines. In astronomy, he attempted a description of the mechanics of celestial bodies in relation to the Earth. In Anaximander's model, the Earth floats very still in the centre of the infinite, not supported by anything.

Anaximander was the first astronomer to consider the Sun as a huge mass, and consequently, to realize how far from Earth it might be. He constructed a celestial sphere and thereby was the first to present a system where the celestial bodies turned at different distances. This presumably this made him the first to realize the obliquity of the Zodiac. His knowledge and work on astronomy also suggest that he must have observed the inclination of the celestial sphere in relation to the plane of the Earth to explain the meteorological changes associated with the annual seasons.

Anaximander saw the oceans as a remnant of the mass of humidity that once surrounded Earth. A part of that mass evaporated under the sun's action, thus causing the winds and even the rotation of the celestial bodies, which he believed were attracted to places where water is more abundant. He explained rain as a product of the humidity pumped up from Earth by the sun. For him, the Earth was slowly drying up and water only remained in the deepest regions, which eventually would dry up as well.

Anaximander was the first to describe wind as the movement of air (Rasmussen 2010), a notion which later was strongly opposed by Aristotele. Anaximander attributed other meteorological phenomena, such as thunder and lightning, to the intervention of elements, rather than to divine causes. In his system, thunder results from the shock of clouds hitting each other; the loudness of the sound is proportionate with that of the shock. Thunder without lightning is the result of the wind being too weak to emit any flame, but strong enough to produce a sound. A flash of lightning without thunder is a jolt of the air that disperses and falls, allowing a less active fire to break free. Thunderbolts are the result of a thicker and more violent air flow.

References:

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

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All the above diagrams with supplementary information, including links to data sources and previous issues of this newsletter, are available on www.climate4you.com

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

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