Climate4you update May 2009

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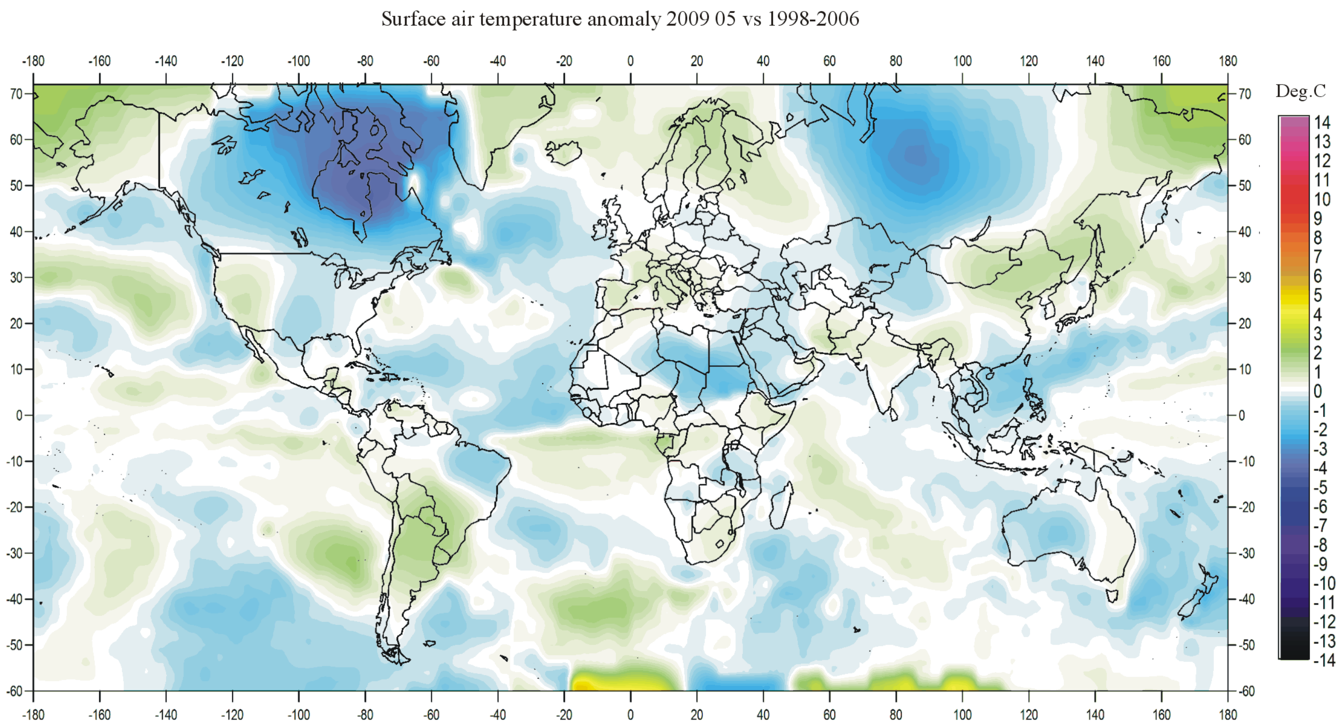
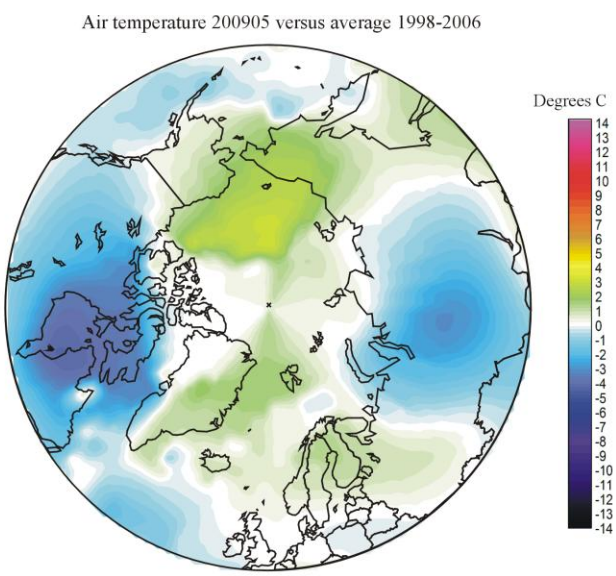
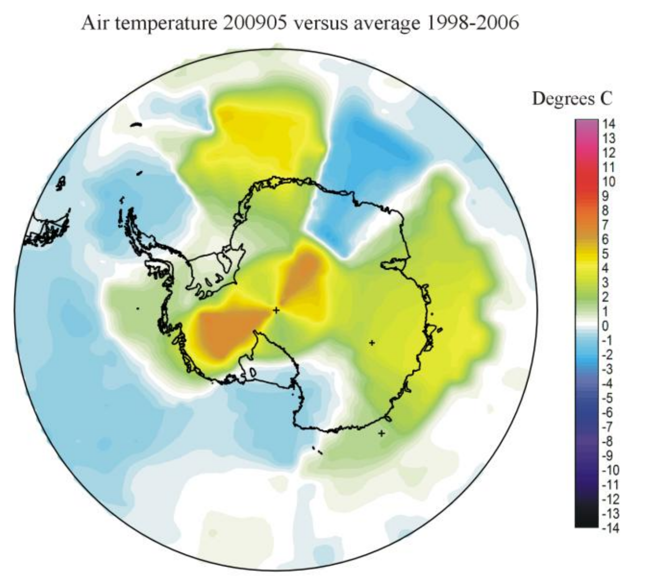
May 2009 global surface air temperature overview

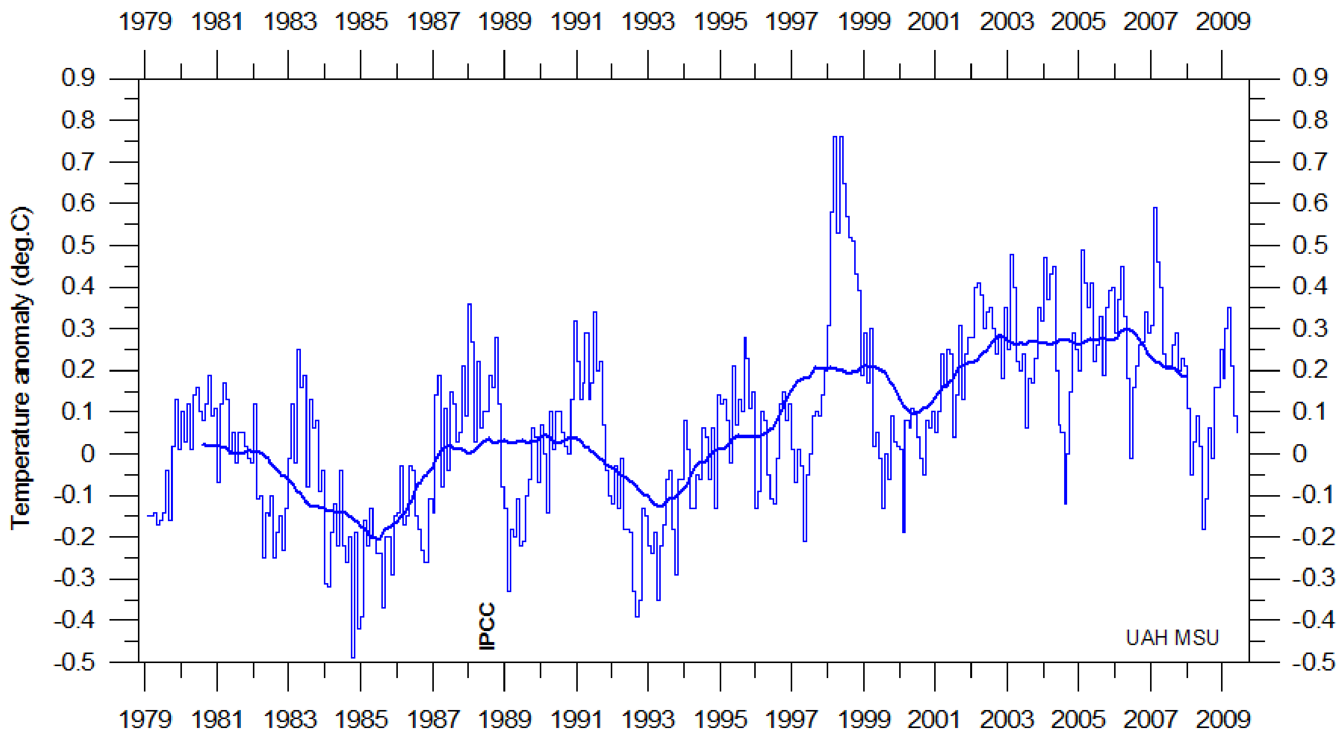




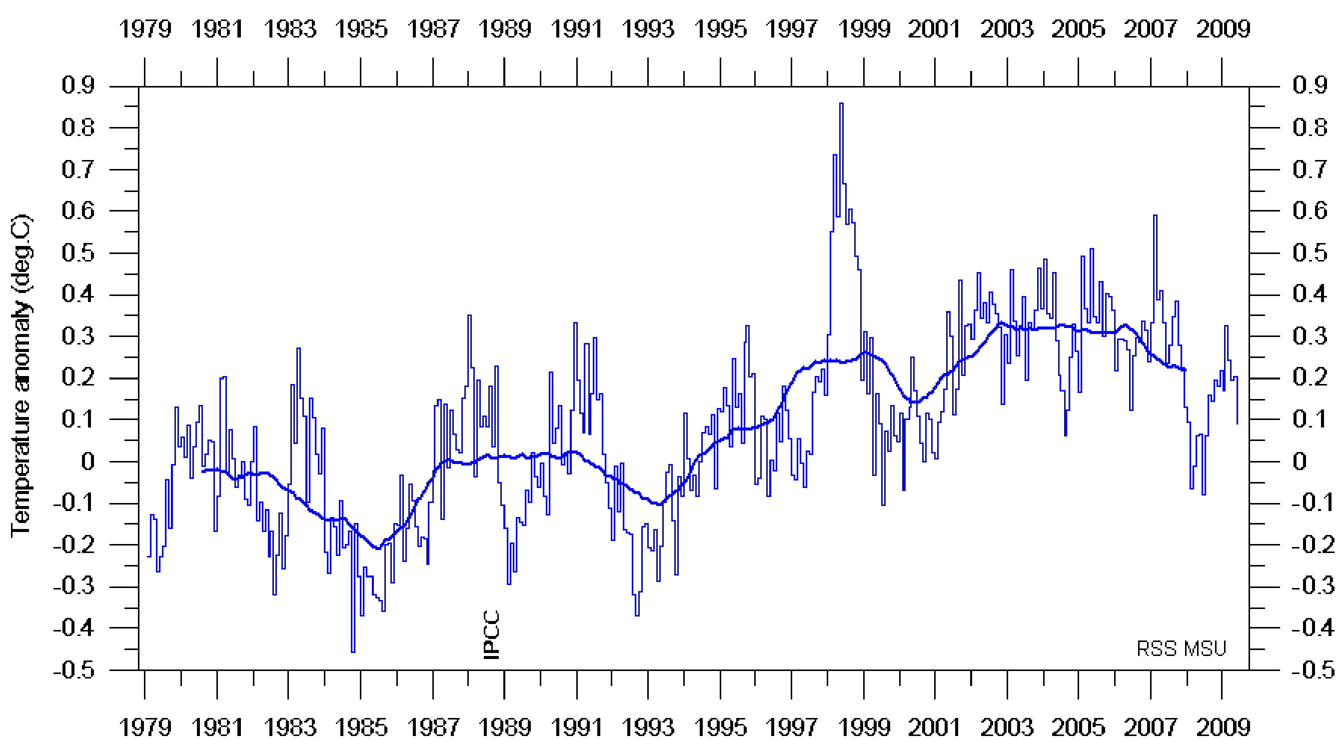


May 2009 surface air temperature compared to the average for May 1998-2006. Green.yellow-red colours indicate areas with higher temperature than the 1998-2006 average, while blue colours indicate lower than average temperatures. Data source: [Goddard Institute for Space Studies](#) (GISS)

[Lower troposphere temperature from satellites, updated to May 2009]

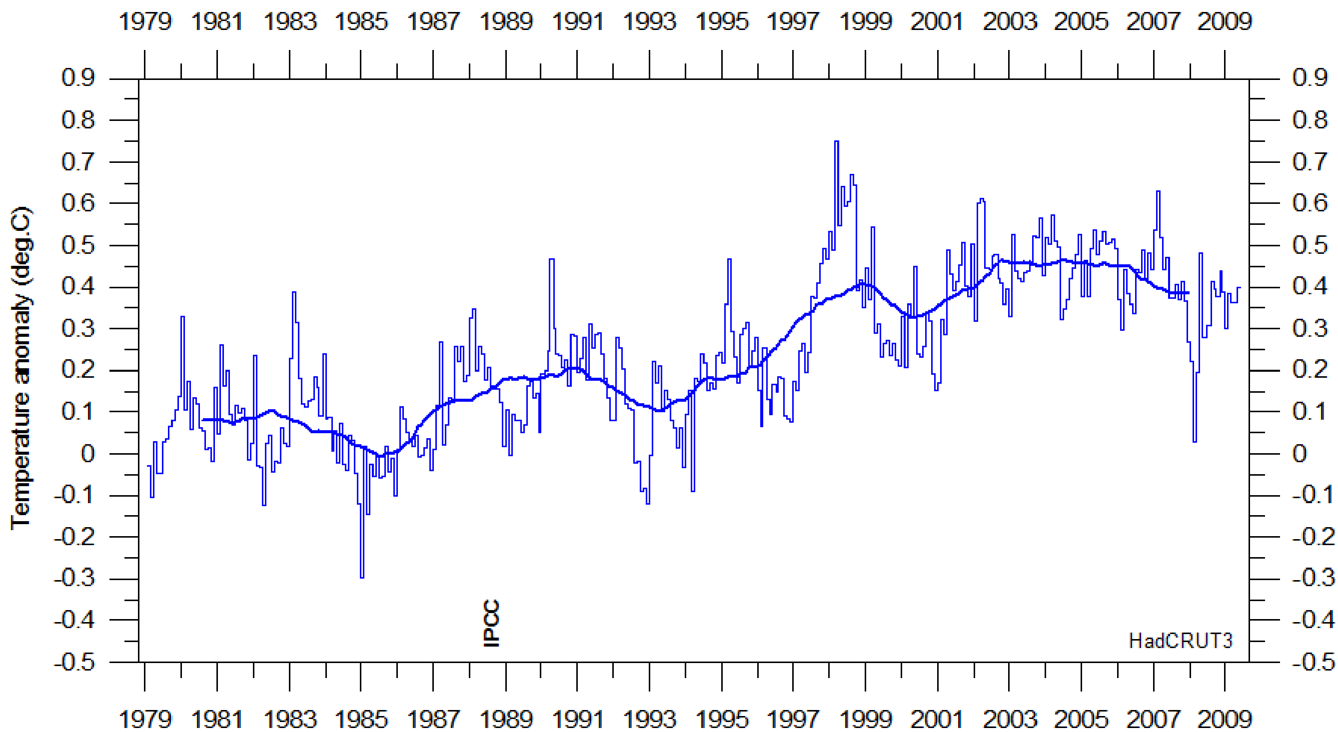


Global monthly average lower troposphere temperature (thin line) since 1979 according to [University of Alabama] at Huntsville, USA. The thick line is the simple running 37 month average.

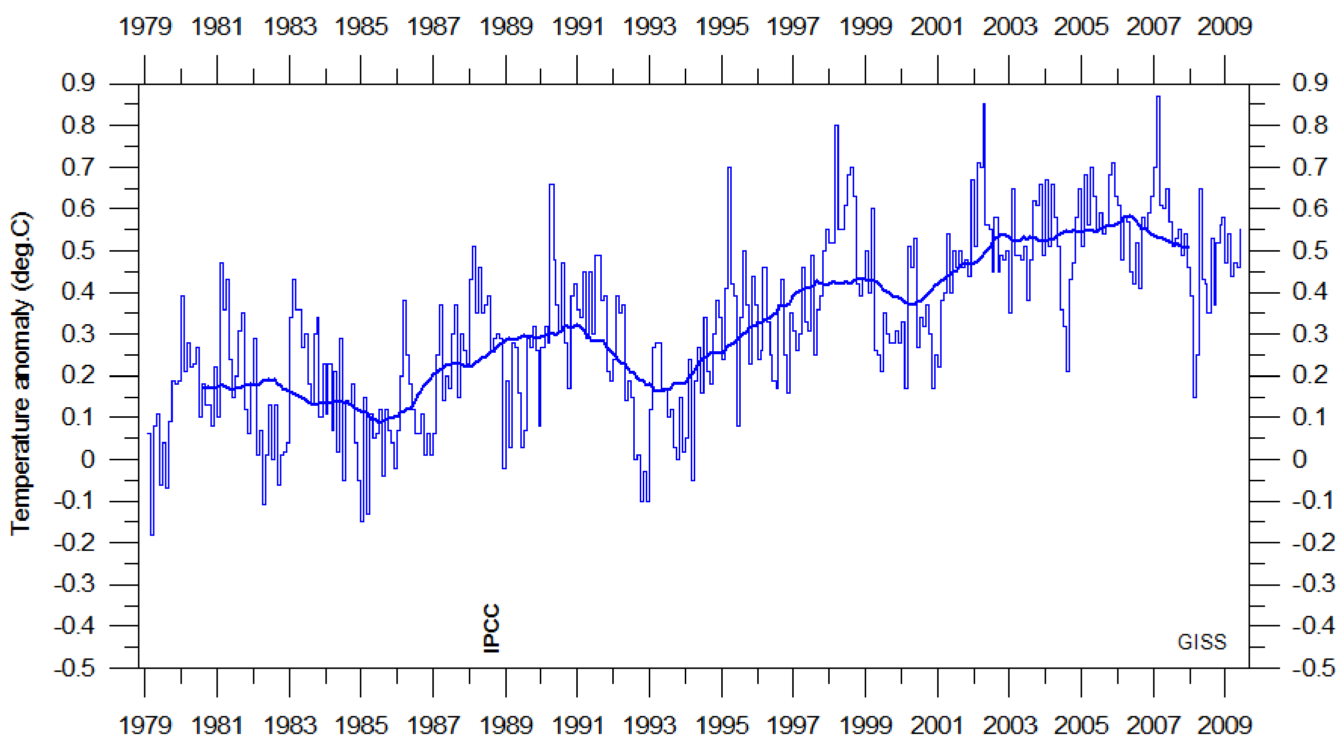


Global monthly average lower troposphere temperature (thin line) since 1979 according to according to [Remote Sensing Systems] (RSS), USA. The thick line is the simple running 37 month average.

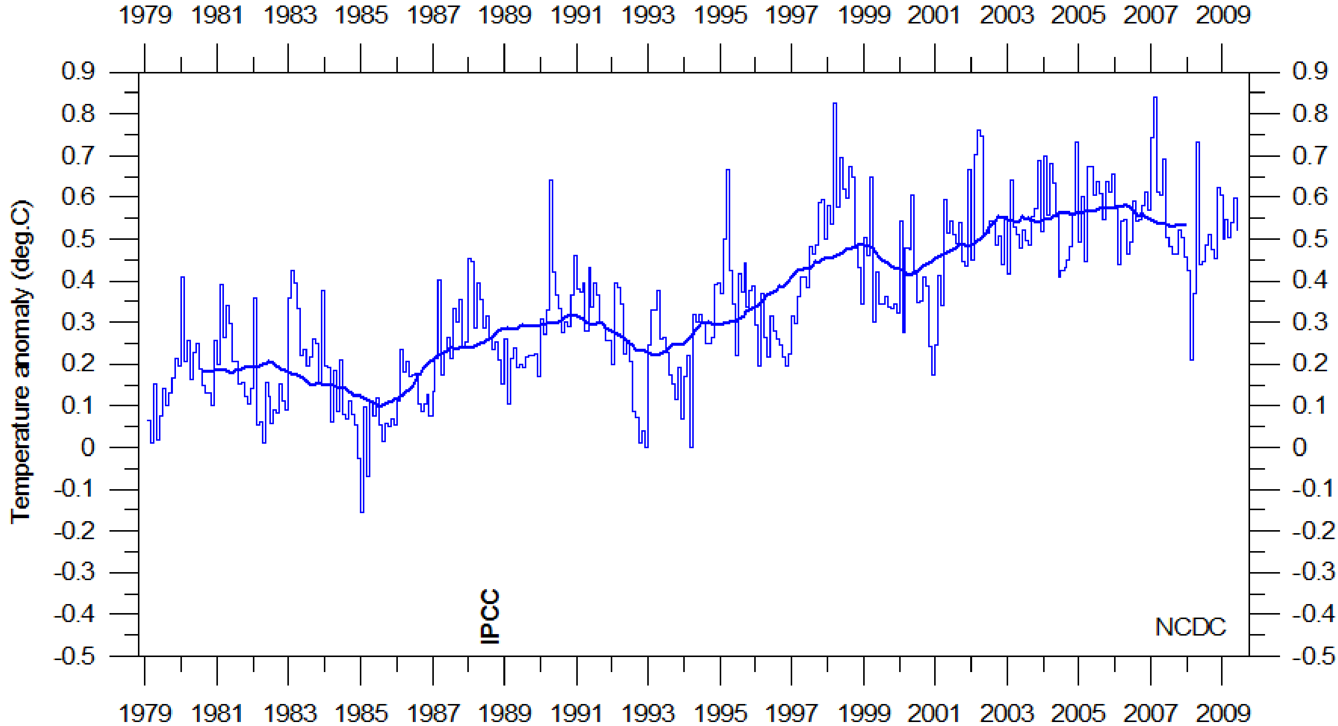
Global surface air temperature, updated to May 2009



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.

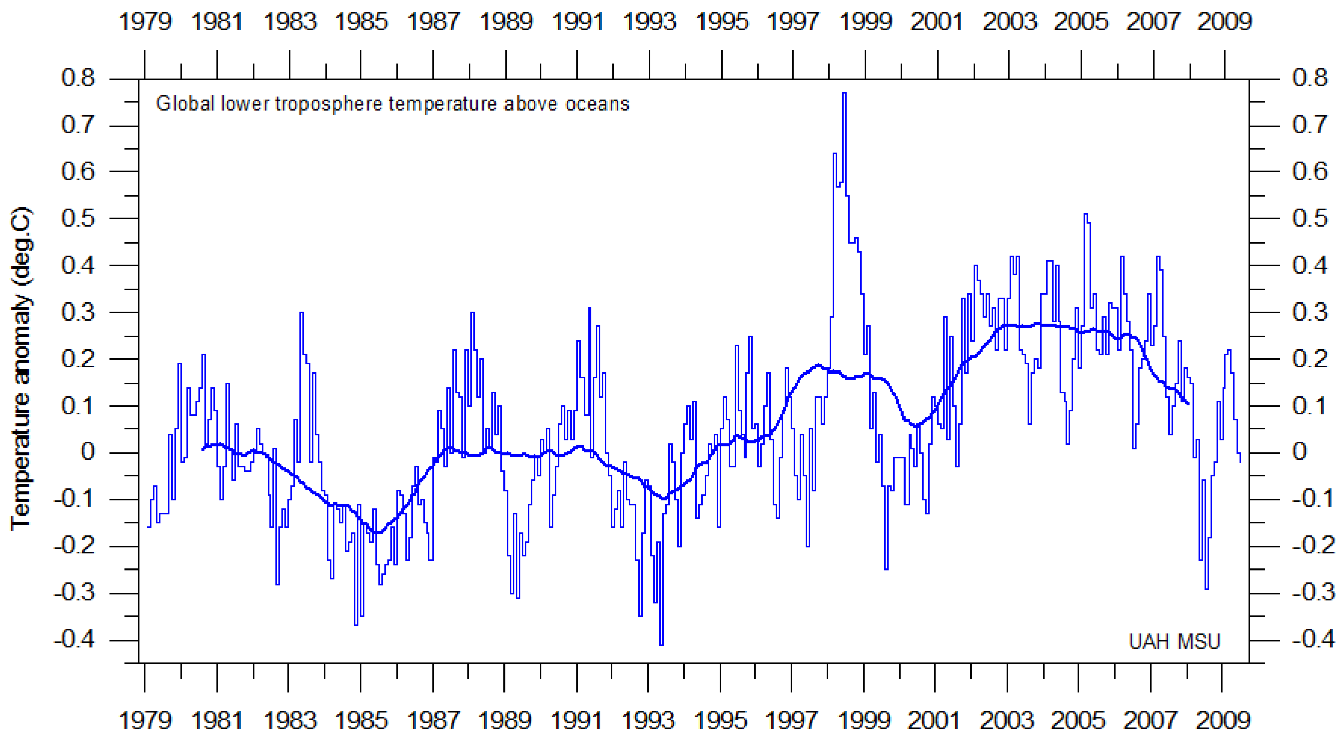


Global monthly average surface air temperature (thin line) since 1979 according to according to the [Goddard Institute for Space Studies](#) (GISS), at Columbia University, New York City, USA. The thick line is the simple running 37 month average.

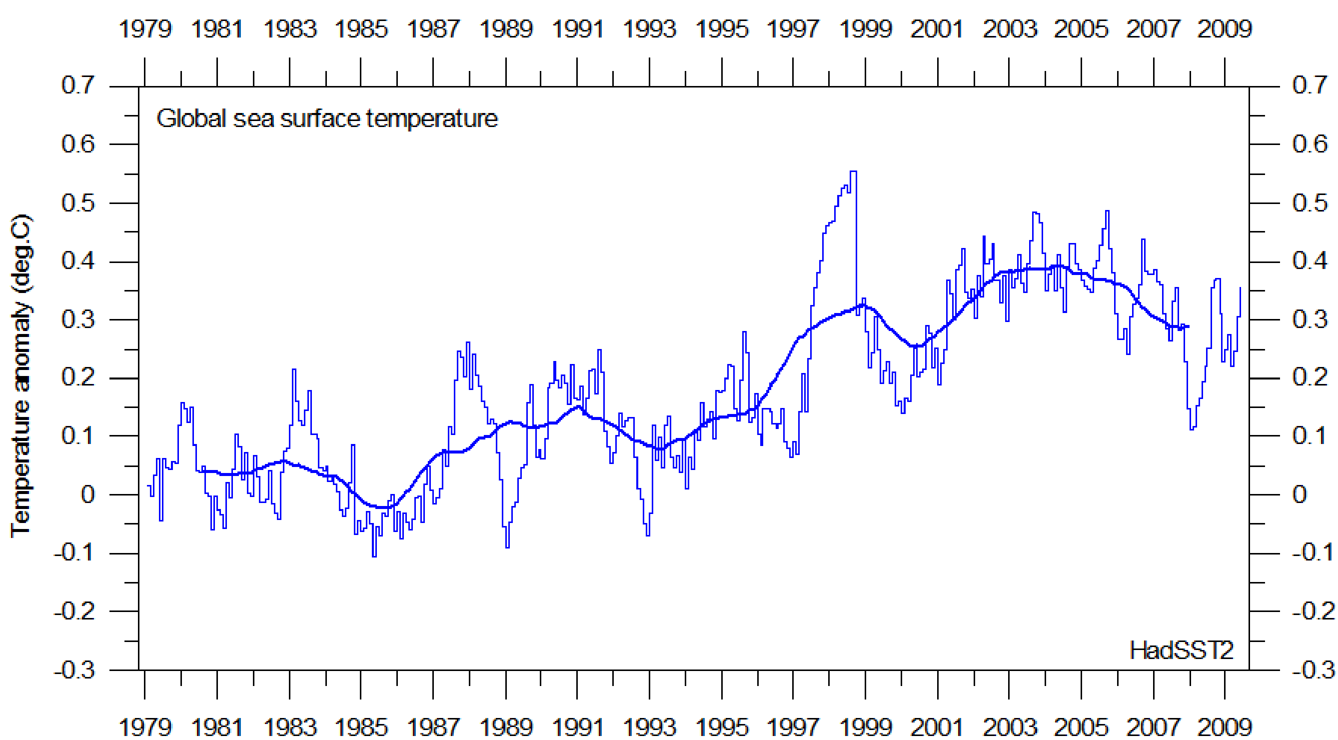


Global monthly average surface air temperature since 1979 according to according to the [*National Climatic Data Center*]() *(NCDC), USA. The thick line is the simple running 37 month average.*

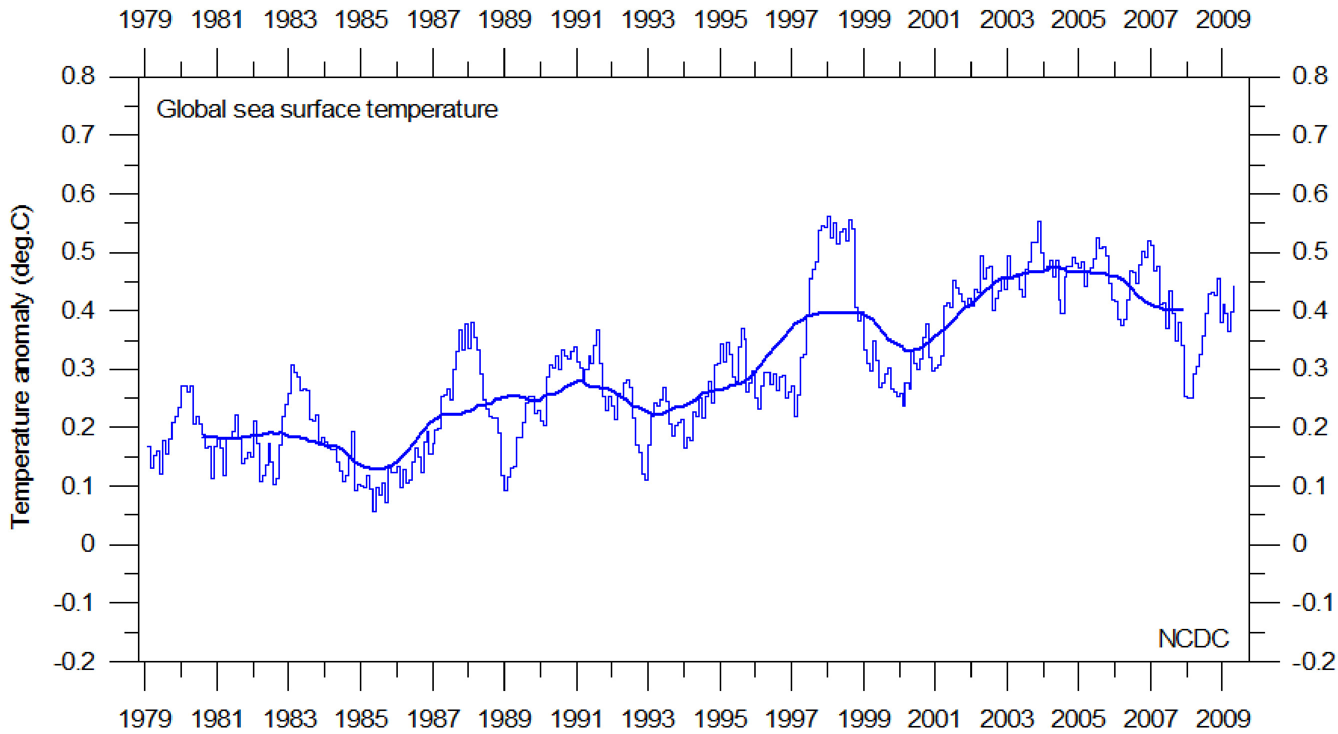
Global sea surface temperature, updated to May 2009



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.

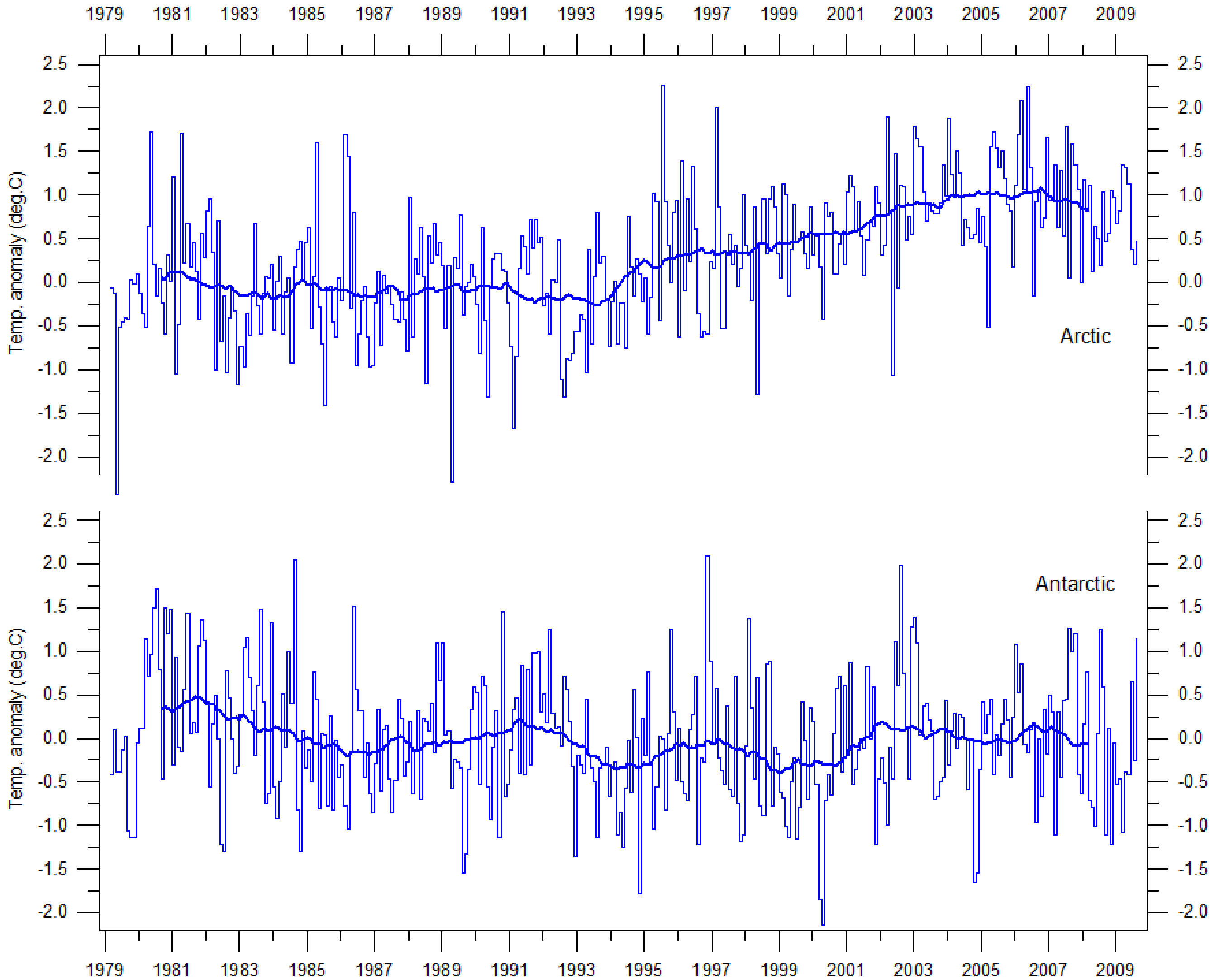


Global monthly average sea surface temperature since 1979 according to University of East Anglia's Climatic Research Unit (CRU), UK. Base period: 1961-1990. The thick line is the simple running 37 month average.



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.

Arctic and Antarctic lower troposphere temperature, updated to May 2009



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 May 2009

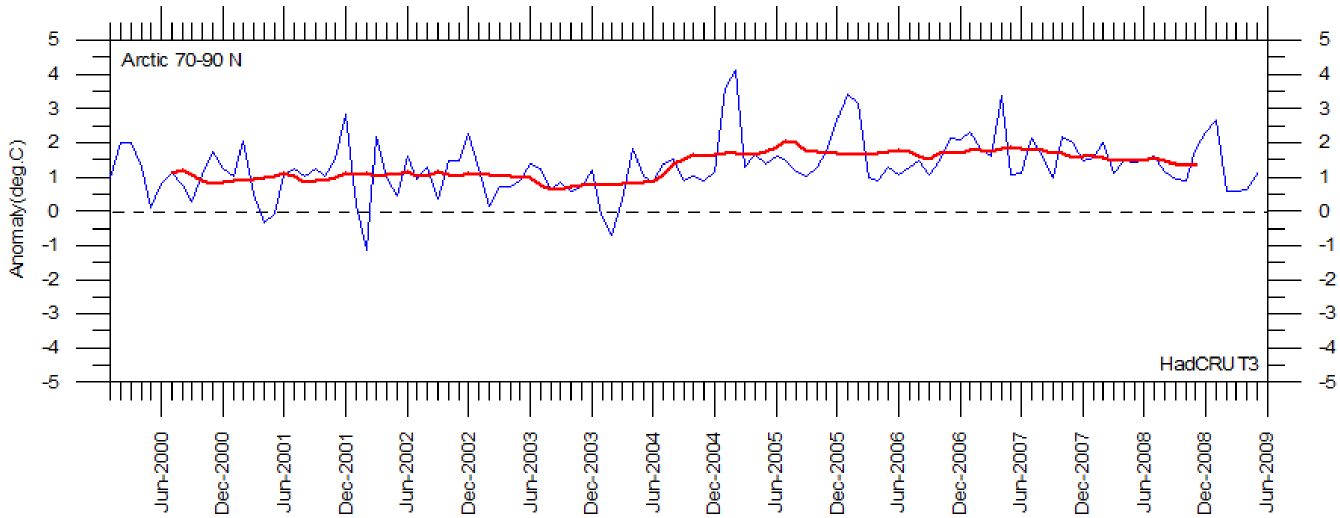


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley Centre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

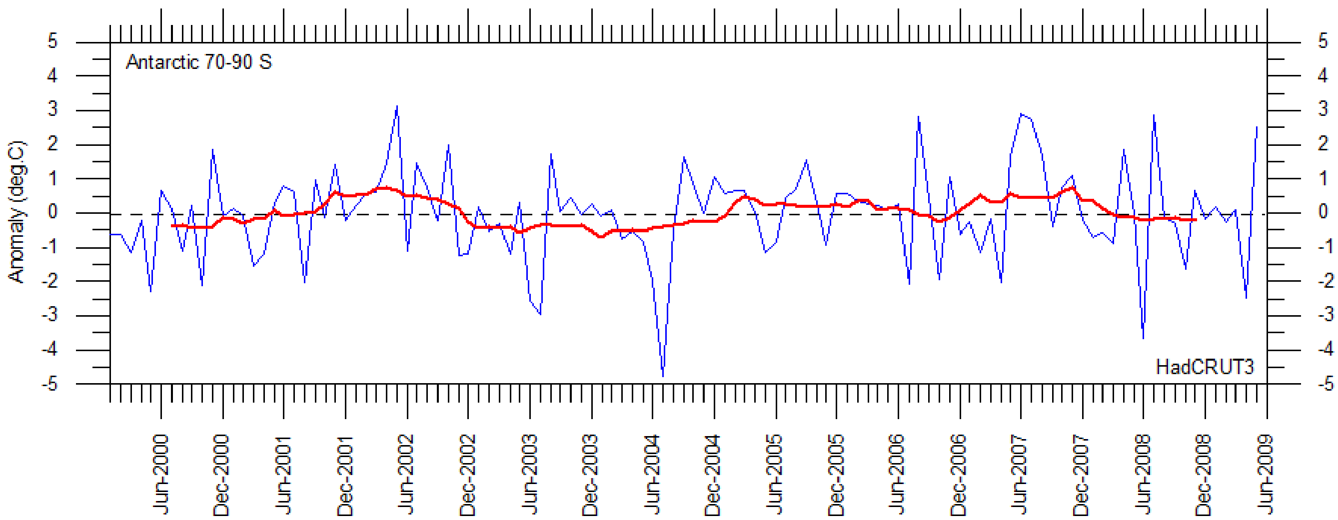


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 2000, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. Data provided by the Hadley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

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.

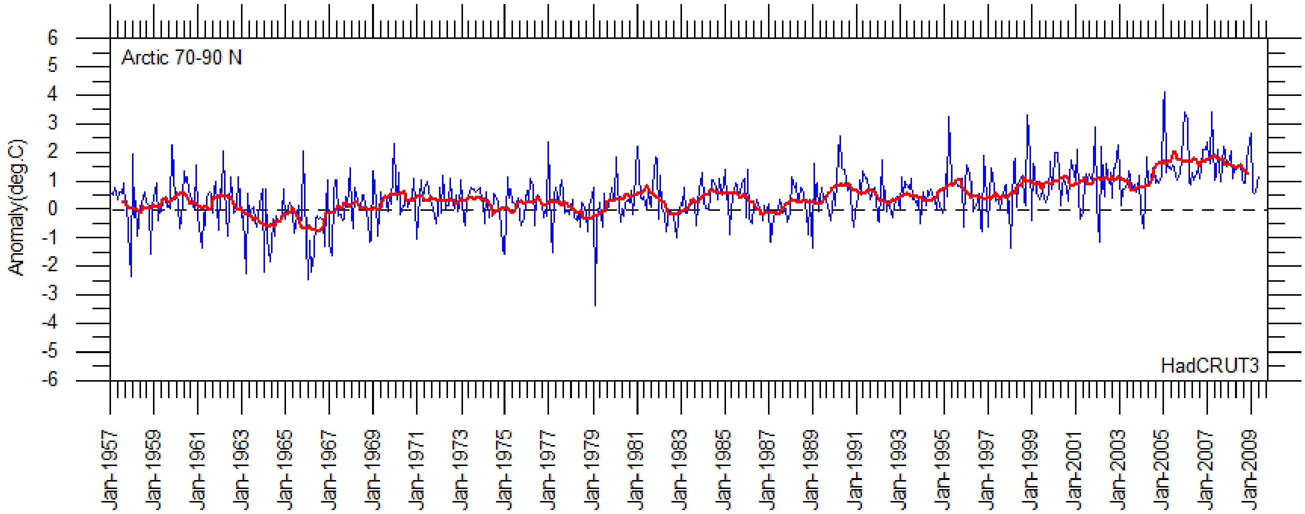


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 has been chosen as starting year, to ensure easy comparison with the maximum length of the realistic Antarctic temperature record shown 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.

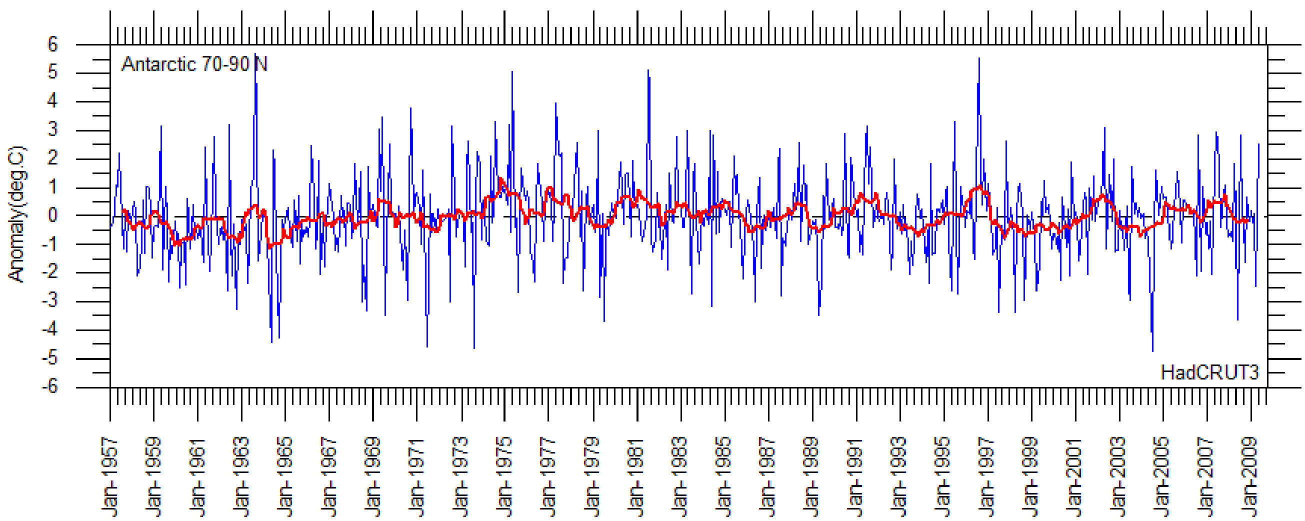


Diagram showing Antarctic monthly surface air temperature anomaly 70-90°S since January 1957, in relation to the WMO reference "normal" period 1961-1990. The year 1957 was an international geophysical year, and several meteorological stations were established in the Antarctic because of this. Before 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.

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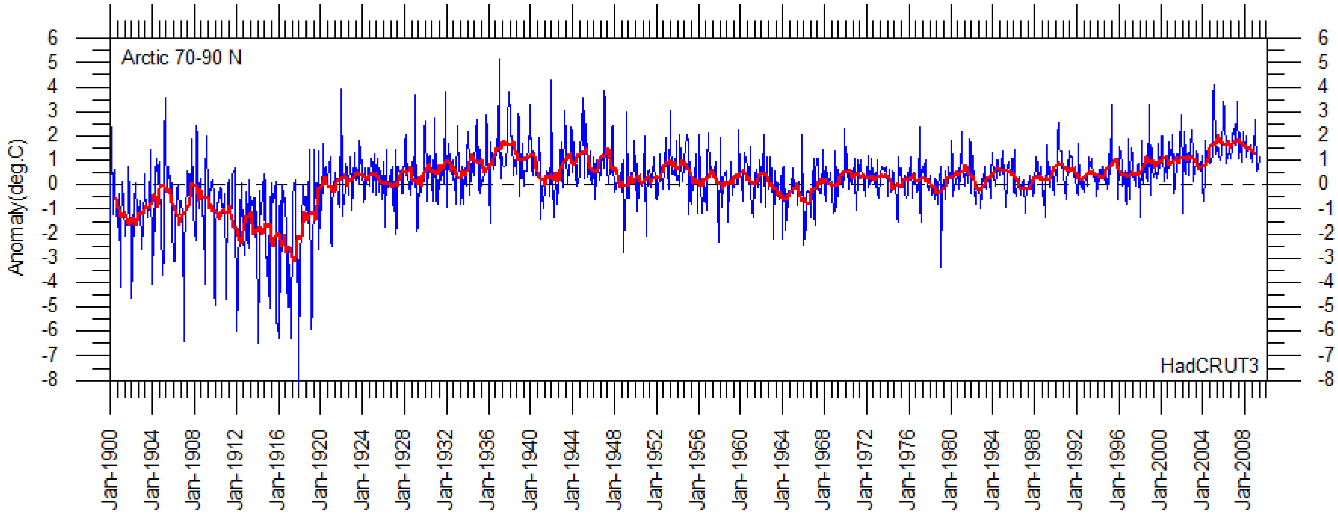
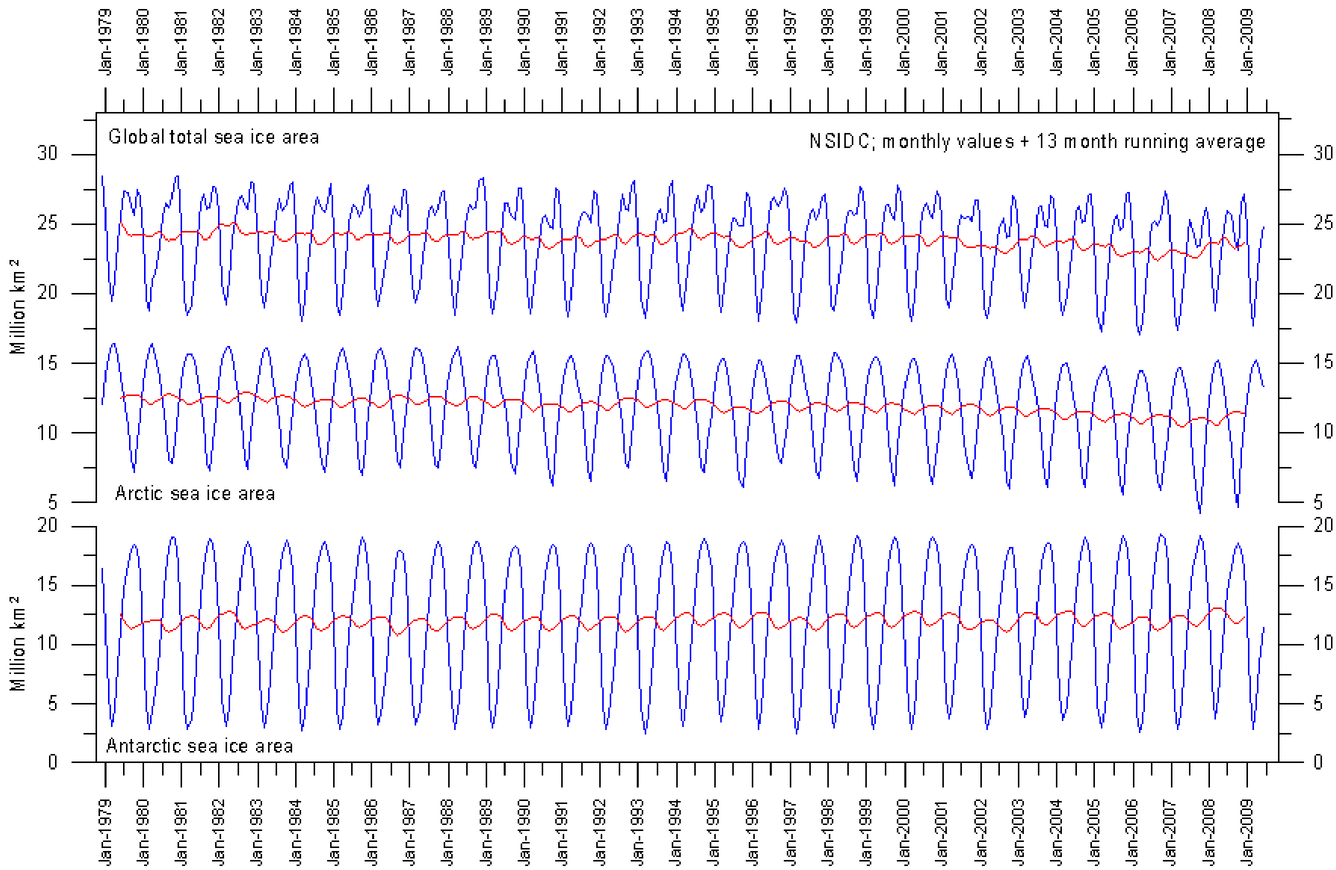
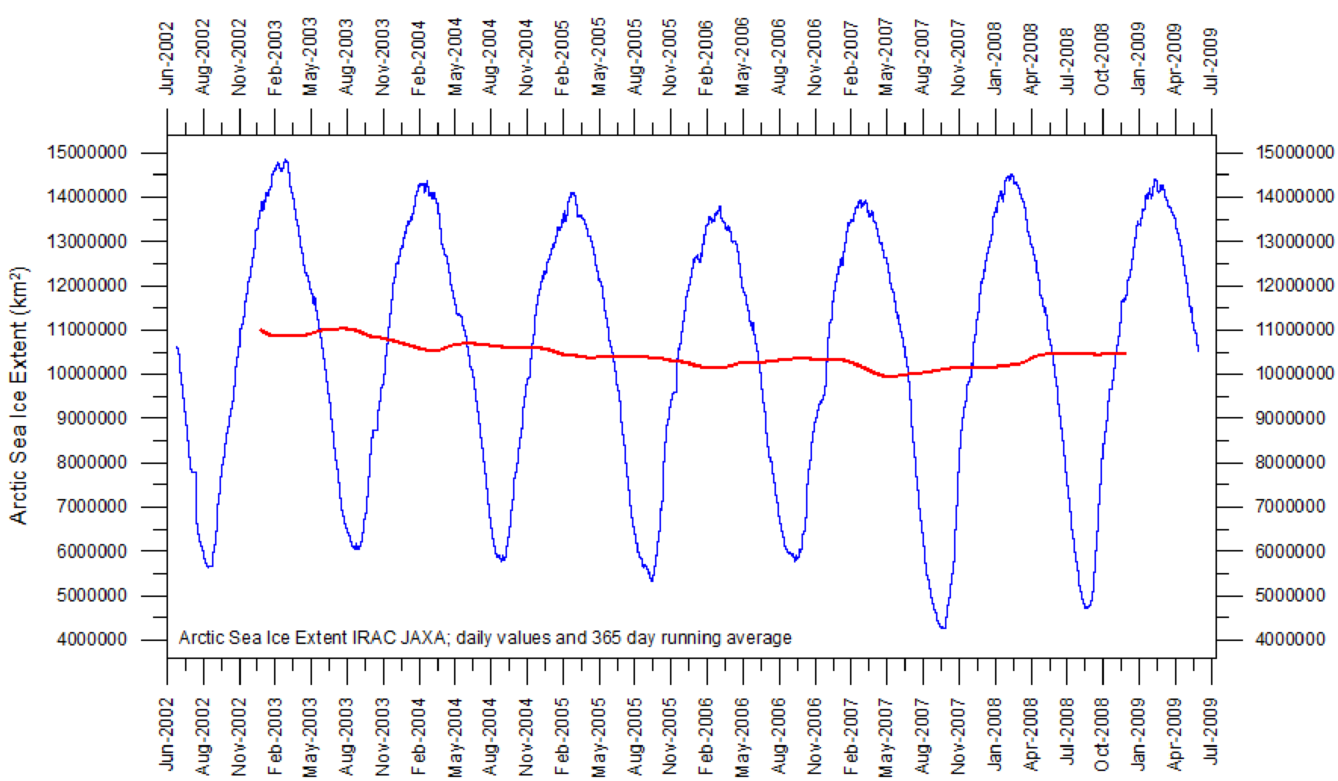


Diagram showing Arctic monthly surface air temperature anomaly 70-90°N since January 1900, in relation to the WMO reference "normal" period 1961-1990. The thin blue line shows the monthly temperature anomaly, while the thicker red line shows the running 13 month average. In general, the range of monthly 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.

[Arctic and Antarctic sea ice, updated to May 2009]

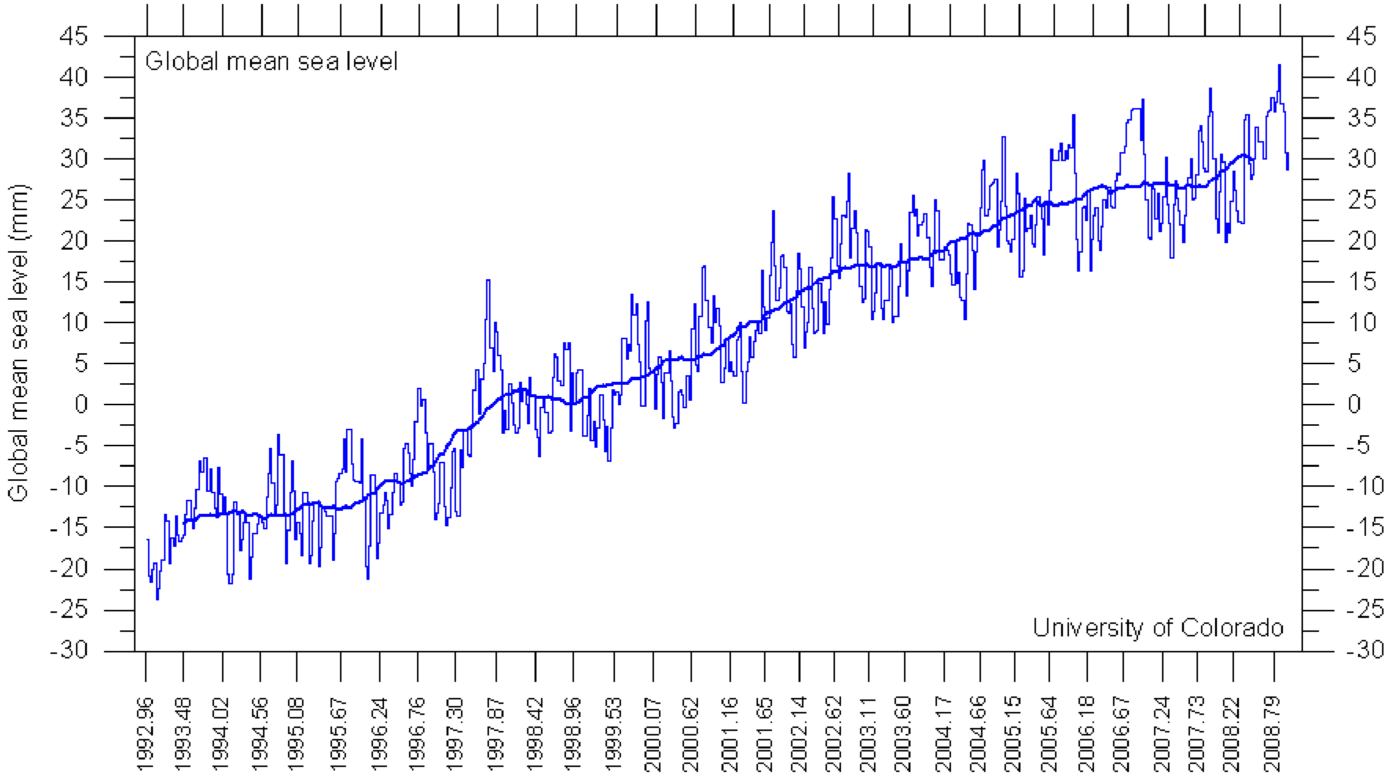


Graphs showing monthly Antarctic, Arctic and global sea ice extent since November 1978, according to the [National Snow and Ice data Center] (NSIDC).

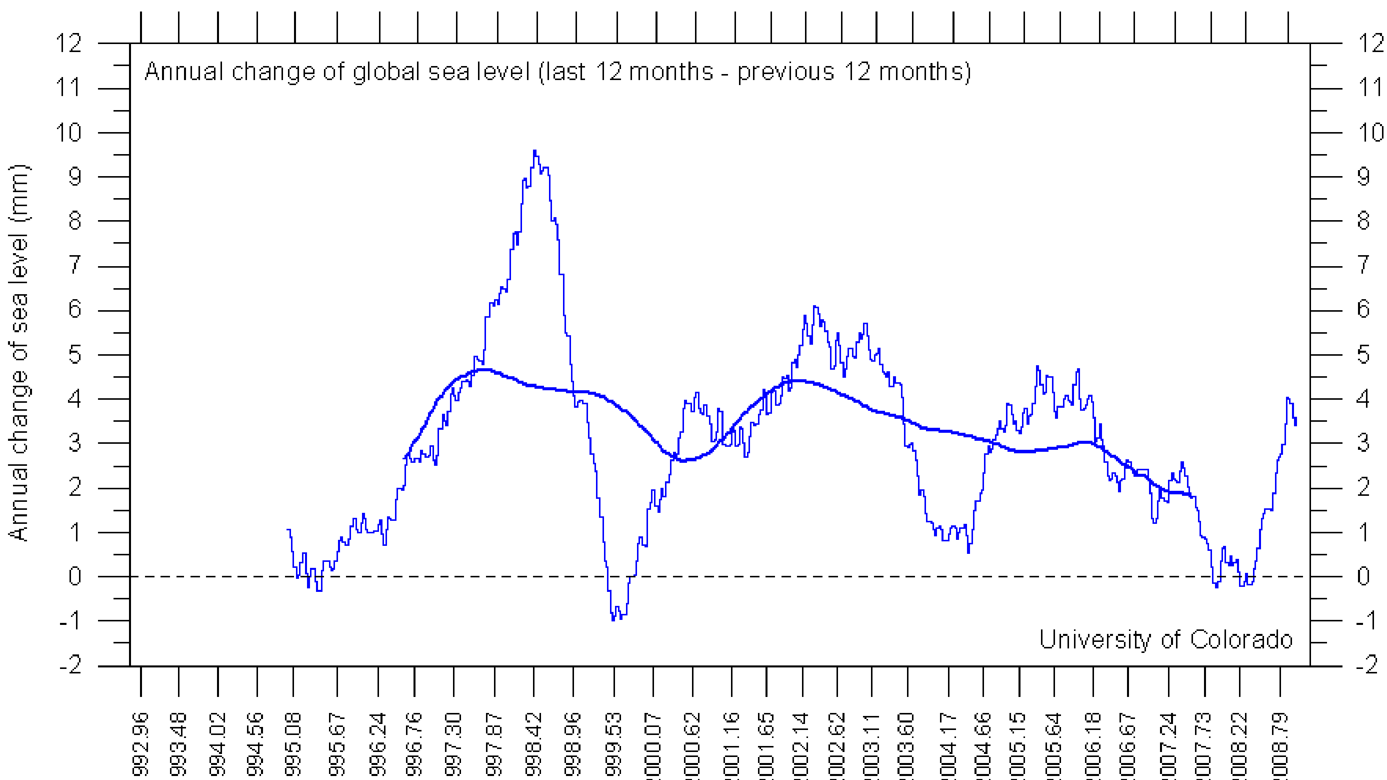


Graph showing daily Arctic sea ice extent since June 2002, by courtesy of [Japan Aerospace Exploration Agency] (JAXA).

Global sea level, updated to May 2009 (no database update since January 2009)

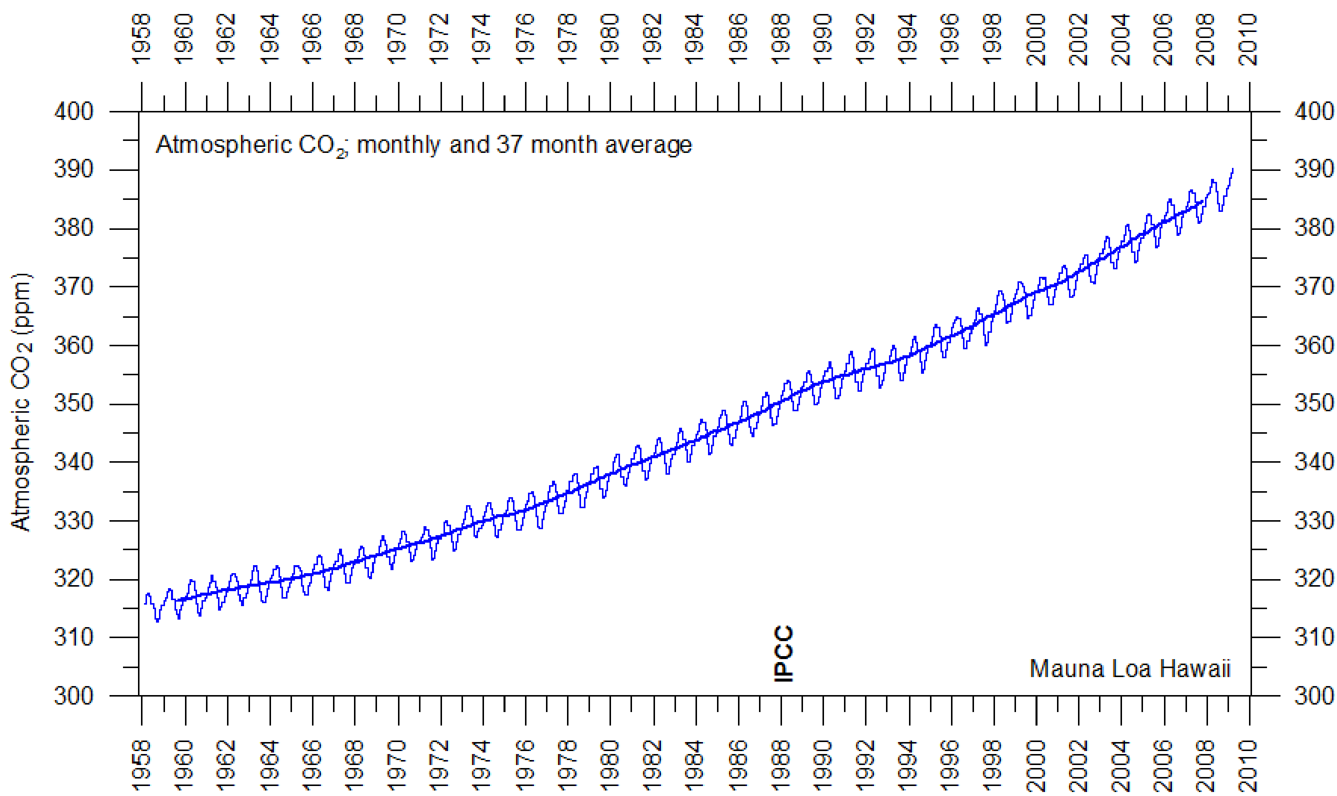


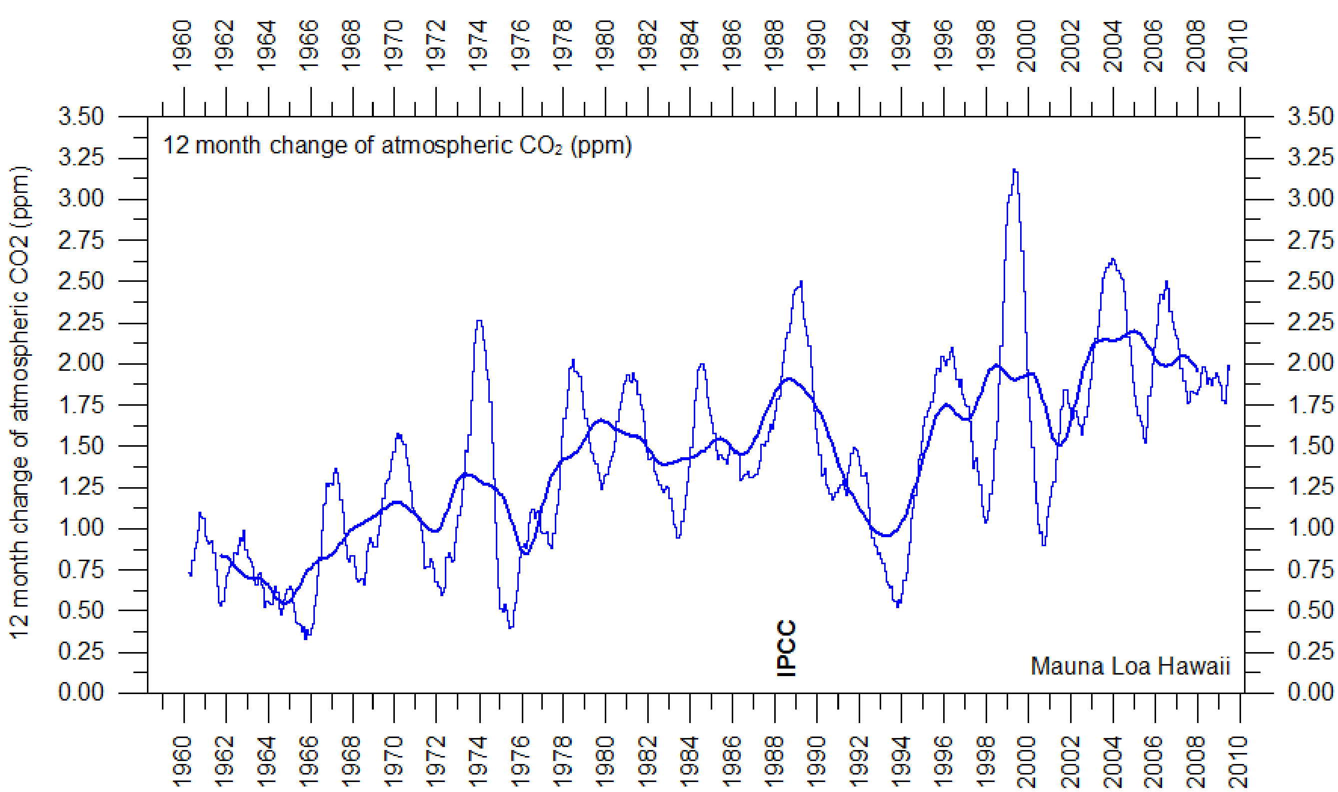
Globa lmonthly sea level since late 1992 according to the Colorado Center for Astrodynamics Research at [University of Colorado at Boulder](), USA. The thick line is the simple running 37 observation average, nearly corresponding to a running 3 yr average.



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.

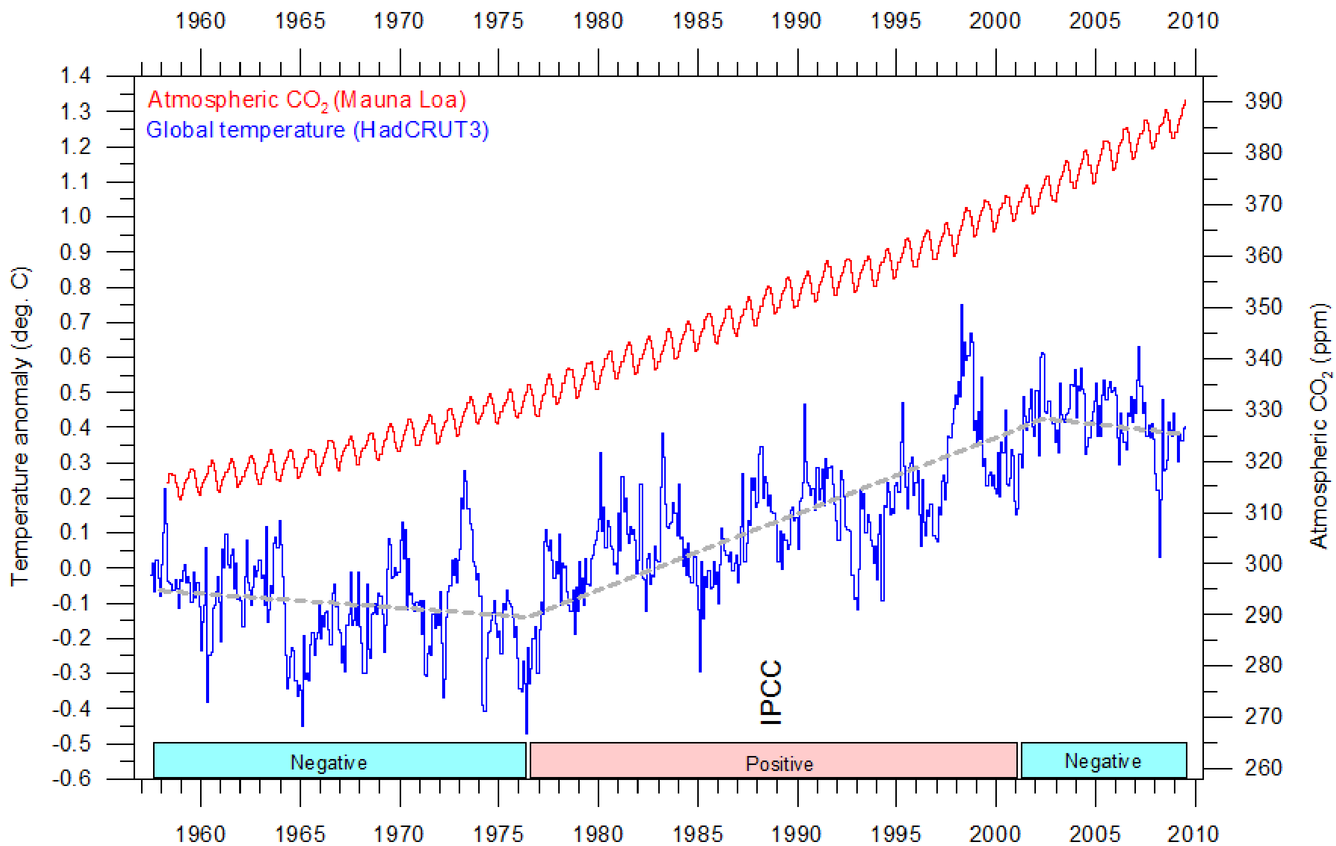
Atmospheric CO_2, updated to May 2009

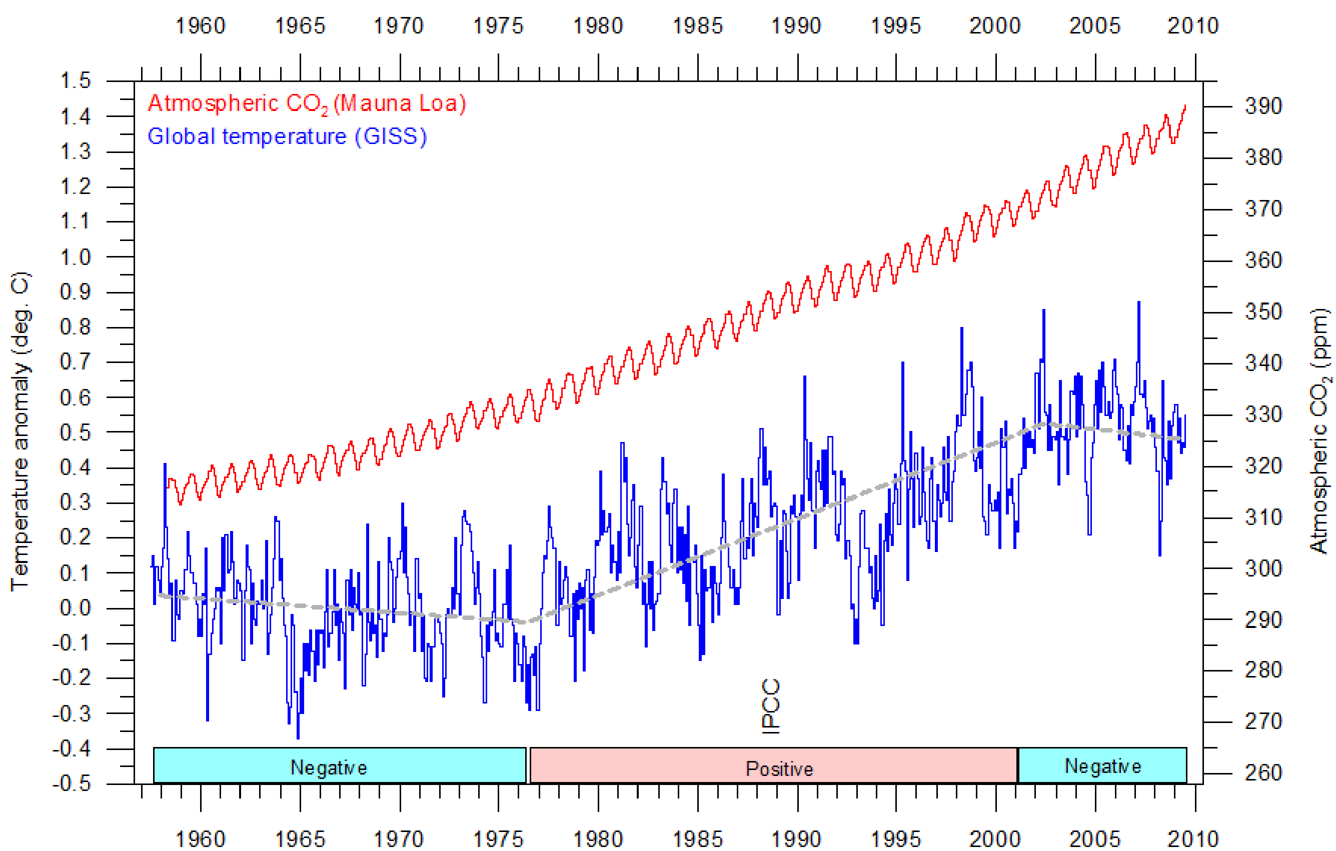


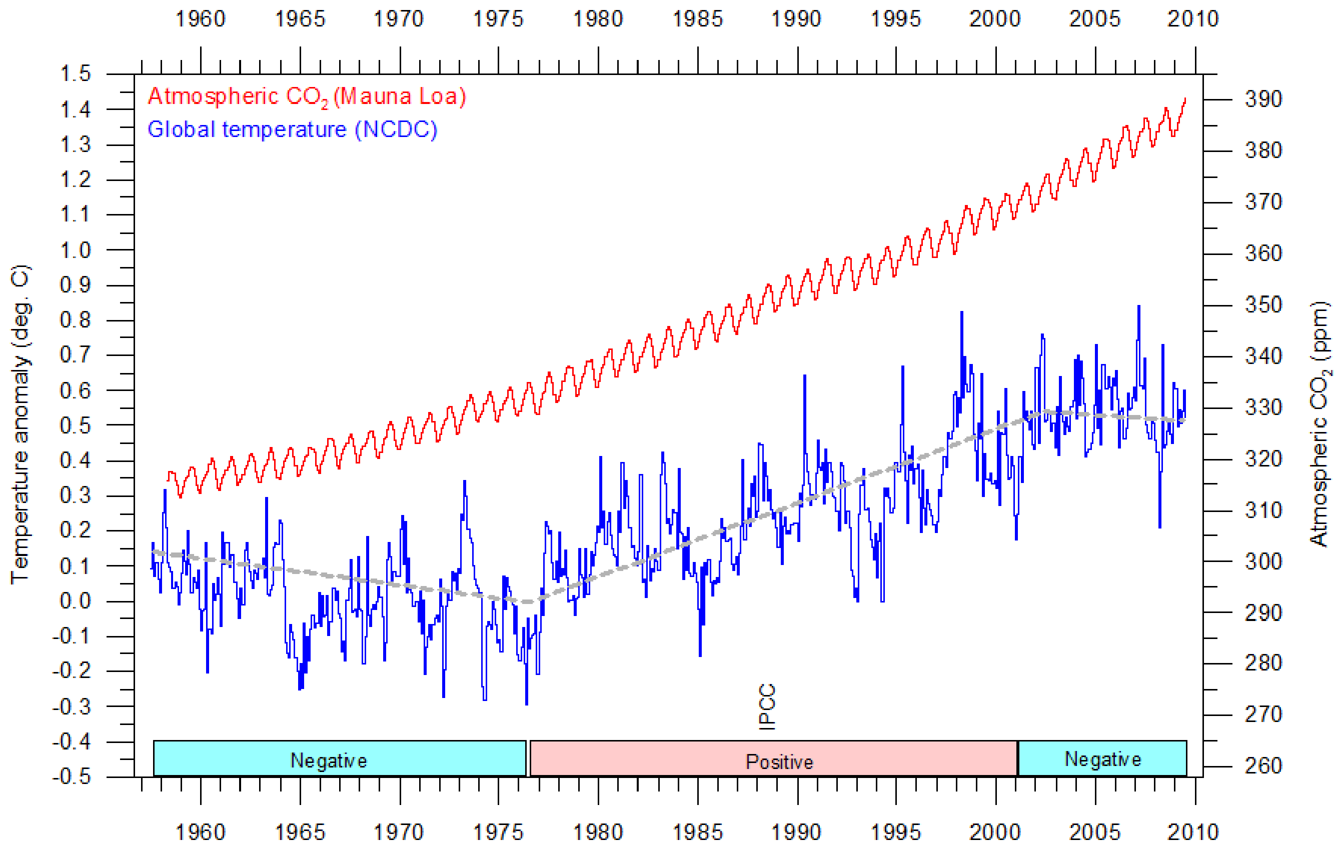


Monthly amount of atmospheric CO_2 (above) and annual growth rate (below; average last 12 months minus average preceding 12 months) of atmospheric CO_2 since 1959, according to data provided by the Mauna Loa Observatory, Hawaii, USA. The thick line is the simple running 37 observation average, nearly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

Global surface air temperature and atmospheric CO_2, updated to May 2009







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.

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.

After about 10 years of global temperature increase, 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 importance of CO2 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

1709: Swedish defeat at Poltava

In 1697 the Swedish king Karl XII (1682-1718) assumed the crown at the age of fifteen, at the death of his father. As king, he embarked on a series of battles overseas. In 1700, Denmark-Norway, Saxony, and Russia united in an alliance against Sweden, using the perceived opportunity as Sweden was ruled by the young and inexperienced King. Early that year, all three countries declared war against Sweden. King Karl had to deal with these threats one by one, which he in a very determined way set out to do.

Having first defeated Denmark-Norway in 1700, King Karl turned his attention upon the two other powerful neighbors, Poland and Russia; lead by King August II and Tsar Peter the Great, respectively. First Russia was attacked. At the Narva River the outnumbered Swedish army 20 November 1700 attacked the much larger Russian army under cover of a blizzard, divided the Russian army in two and won the battle. Next Karl next turned towards Poland and defeated King August and his allies at Kliszow in 1702. Then he turned back towards Russia, to finish Tsar Peter off for good.

In the meantime, Tsar Peter had embarked on a military reform plan to improve the quality of the Russian army. Especially the development of the artillery was emphasized. In the last days of 1707 King Karl crossed the frozen Weichsel River, and began advancing into Ukraine with his 77,400 man strong army. Already 28 January 1708 Karl together with an advanced group of 600 men crossed Njemen River and took the city Grodno. Shortly after this all hostilities were stopped, as both armies went into winter quarters.

The Russian tactical plan was to avoid a decisive battle before the Swedish army had been weakened by the progress of time. When hostilities were resumed in June 1708 the Russian army therefore slowly retreated towards Moscow, burning all villages to make the Swedish supply situation difficult. With great success this tactic would be used again 105 years later against the French invasion under Napoleon, and was in 1708 known as the Zjolkijevskij plan (Englund 1989). First Karl XII headed towards Moscow with his army, but it rapidly turned out being very difficult to supply the army in the deserted landscape. In addition, the summer 1708 was cold and wet, making life miserable for the Swedish soldiers. He therefore decided to turn south-east towards the more rich regions around the city Poltava. Before reaching Poltava the winter began, and the armies once again went into their winter quarters. The Swedish army went into winter quarters at the city Baturin, about 200 km NE of Kiev. The winter rapidly became very cold, not only in Russia, but in most of Europe, adding additional trouble to the already difficult Swedish supply situation. At the end of January 1709 the Swedish army resumed hostilities, but the winter soon made all operations virtually impossible. It became late April 1709 before Karl reached the city Poltava, 130 km SW of Kharkov.

King Karl XII of Sweden (left). Battle of Poltava (centre). King Karl at the Dnieper River during the catastrophic retreat following the battle of Poltava.

The extremely low temperatures characterizing the winter 1708-1709 had taken their toll on the Swedish soldiers. When the Swedish army finally began its siege of Poltava 1 May 1709, Karl has lost most of his army without any big battles being fought. In June Tsar Peter began concentrating an army shortly north of Poltava. Karl had to face this treat, but following the hard winter he was only able to muster about 12,000 men for the attack. The attack was launched 28 June 1709, but was affected by some tactical confusion on the Swedish side. After some initial successes, the Swedish army was defeated thoroughly by the much larger Russian army, mainly due to its numerical superiority, and partly because of the now very strong and efficient Russian artillery. A catastrophic retreat followed to the Dnieper River, where what was left of the Swedish army had to surrender.

By this, the battle at Poltava represented a climatic induced turning point for both Sweden and Russia. Sweden never regained its former military might, while Russia was beginning to emerge as a European superpower.

King Karl XII himself managed to escape with 1,200 Swedish survivors to the northerly province of the Ottoman Empire. Here he was held as a kind of prisoner until 1714, when he jumped onto a horse and escaped back to Sweden. He died 30 November 1718 during the siege of the Norwegian fortifications at Frederikssten. Some rumors claim that he was shot by a Swedish officer, but a more likely cause is that he simply did not take sufficient cover against fire from the Norwegian soldiers.

References

Englund, P. 1989. Poltava. Lindhart and Ringhof, Copenhagen, 338 pp.

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

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

22 June 2009.