Climate4you update YEAR 2015

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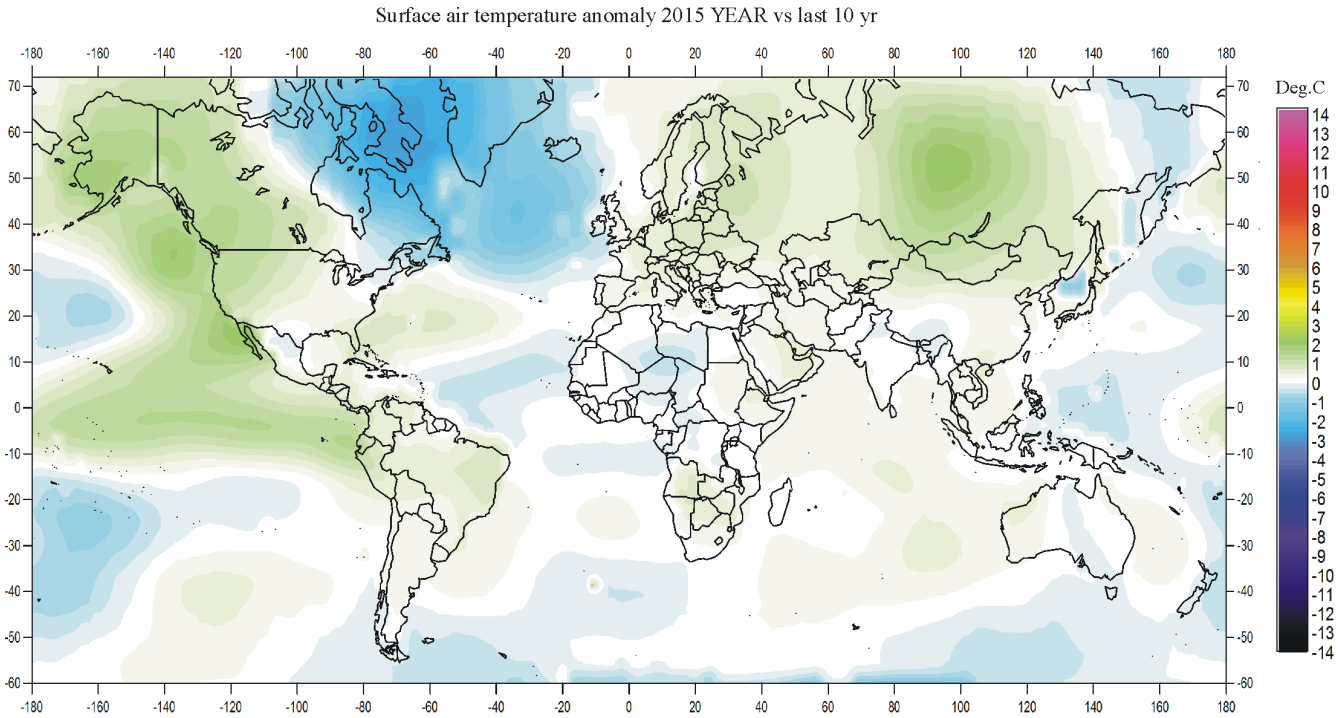
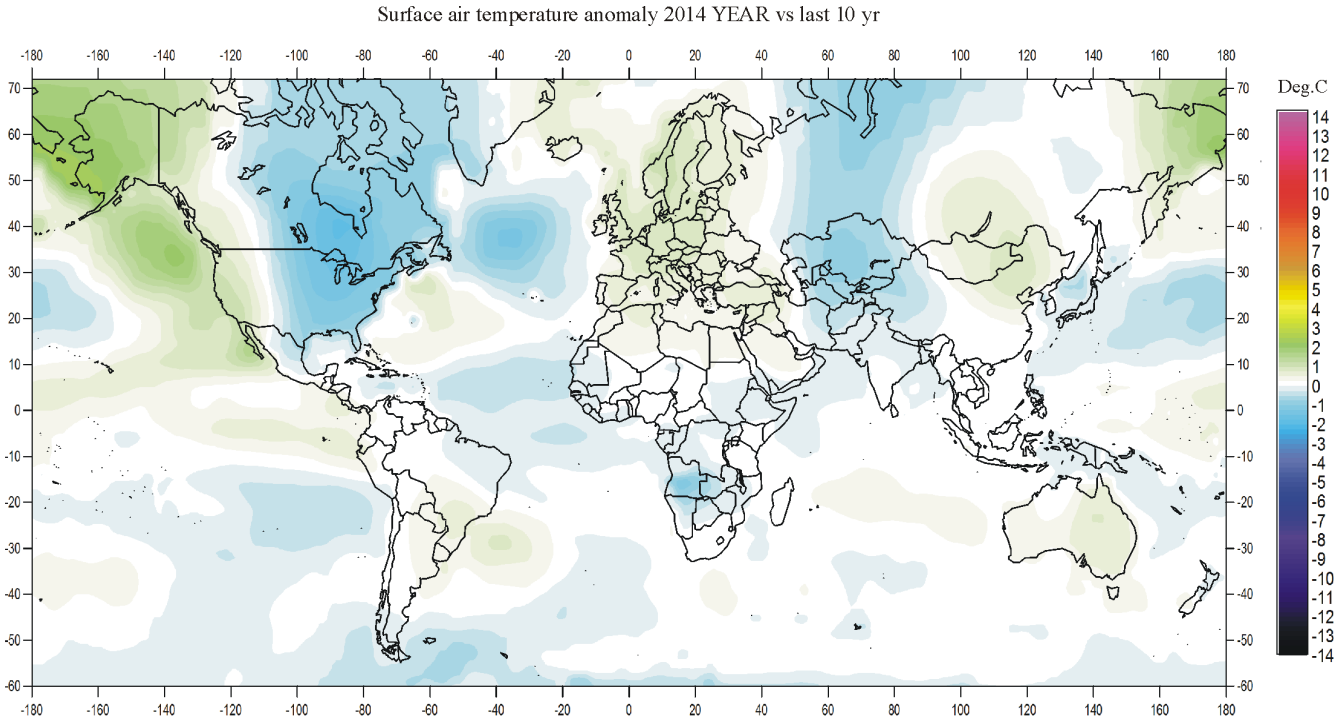
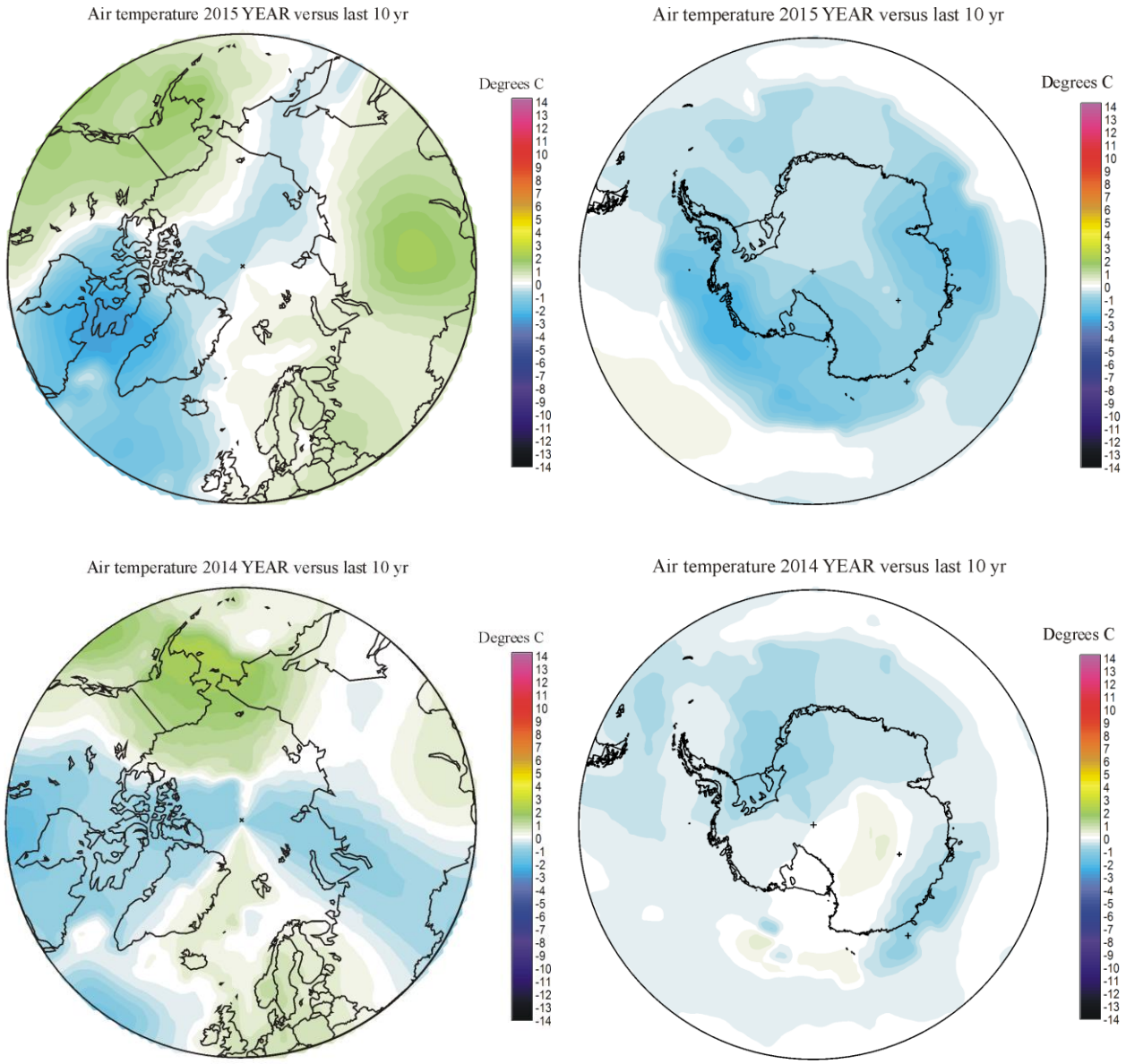
All diagrams in this newsletter as well as links to the original data are available on www.climate4you.com

Year 2015 and 2014 global surface air temperature overview





Year 2015 (upper panel) and 2014 (lower panel) surface air temperature compared to the average for the previous 10 years. Green-yellow-red colours indicate areas with higher temperature than the average, while blue colours indicate lower than average temperatures. Data source: Goddard Institute for Space Studies (GISS)



Year 2015 (upper panel) and 2014 (lower panel) Polar region surface air temperature compared to the average for the previous 10 years. Green-yellow-red colours indicate areas with higher temperature than the average, while blue colours indicate lower than average temperatures. Data source: [Goddard Institute for Space Studies](#) (GISS)

Comments to the Year 2015 global surface air temperature overview

This newsletter contains graphs showing a selection of key meteorological variables for the year 2015. 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 automatically appear as warm, and it will be difficult to decide if modern surface air temperatures are increasing or decreasing? Comparing instead with the last previous 10 years overcomes this problem and displays the dynamics of ongoing modern change.

The average global surface air temperature for 2015.

On average, the global surface air temperature for year 2015 was somewhat higher than in 2014, about 0.1°C. The corresponding sea surface temperature changes 2014-2015 is shown by the diagrams on pages 5-6.

The Northern Hemisphere was characterised by regional temperature contrasts. Greenland, eastern North America and parts of the North Atlantic had below annual average temperature conditions, while westernmost North America, Alaska and western Siberia had relatively warm conditions. Eastern Siberia has below average temperatures, and most of Europe had temperatures above average.

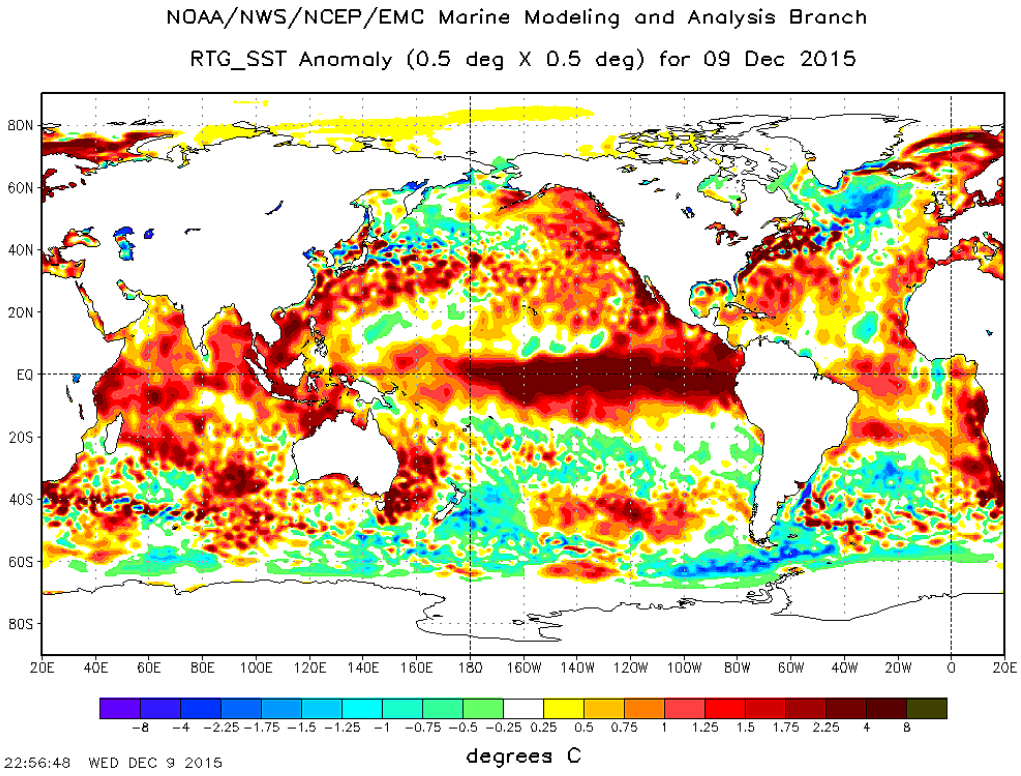
Temperature conditions near Equator were generally higher than the average for the previous 10 years, to a significant degree reflecting the full development of a strong El Niño in the Pacific Ocean during 2015. In 2014 the first indications of the present El Niño were becoming apparent (see Climate4you report for 2014).

In the Southern Hemisphere surface air temperatures were near or below the average for the previous 10 years. Eastern Australia however had an annual temperature somewhat above the average.

In the Arctic the Canada-Greenland and eastern Siberia sectors had below average temperatures, while most of the Russian and Alaska sectors had has above average temperatures.

Most of the Antarctic continent had below average temperature conditions, and more pronounced than in 2014. No regions had an annual average temperature above the average for the previous years.

Sea surface temperature anomaly at the end of the years 2015 and 2014



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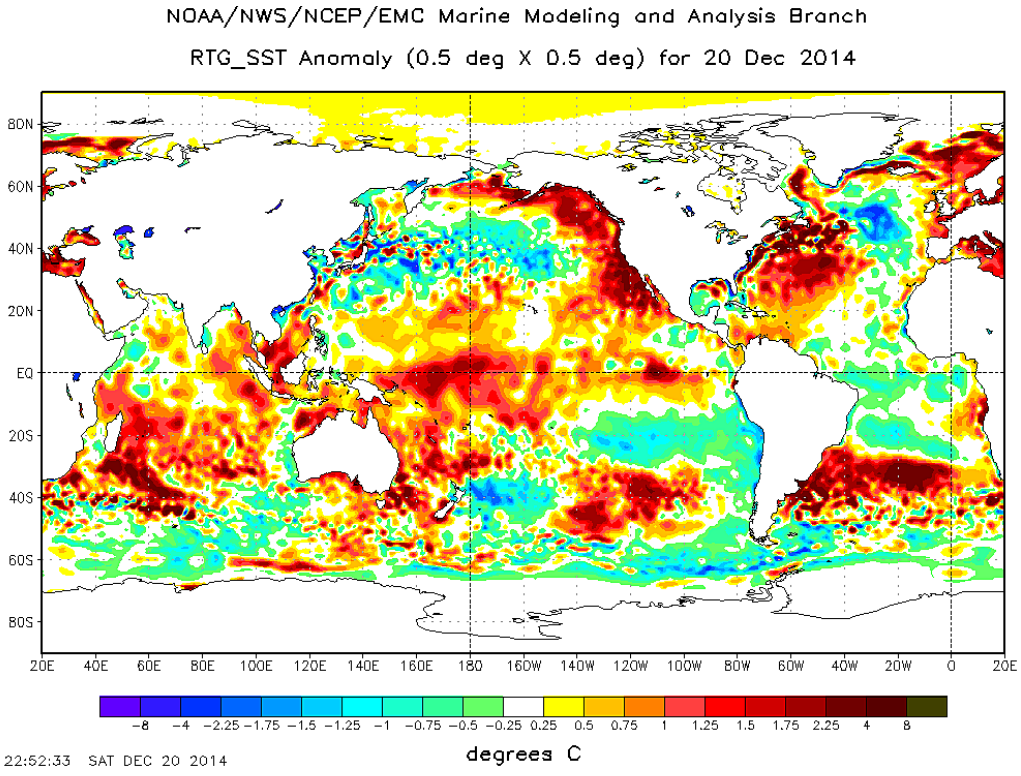
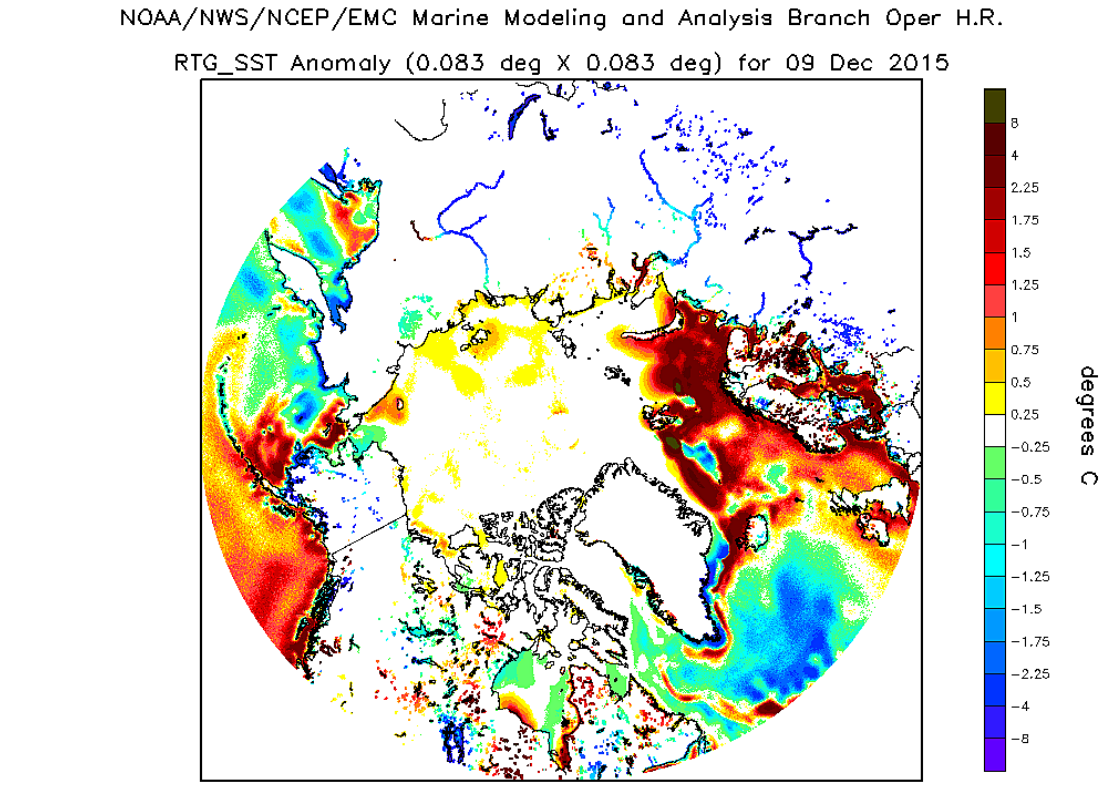
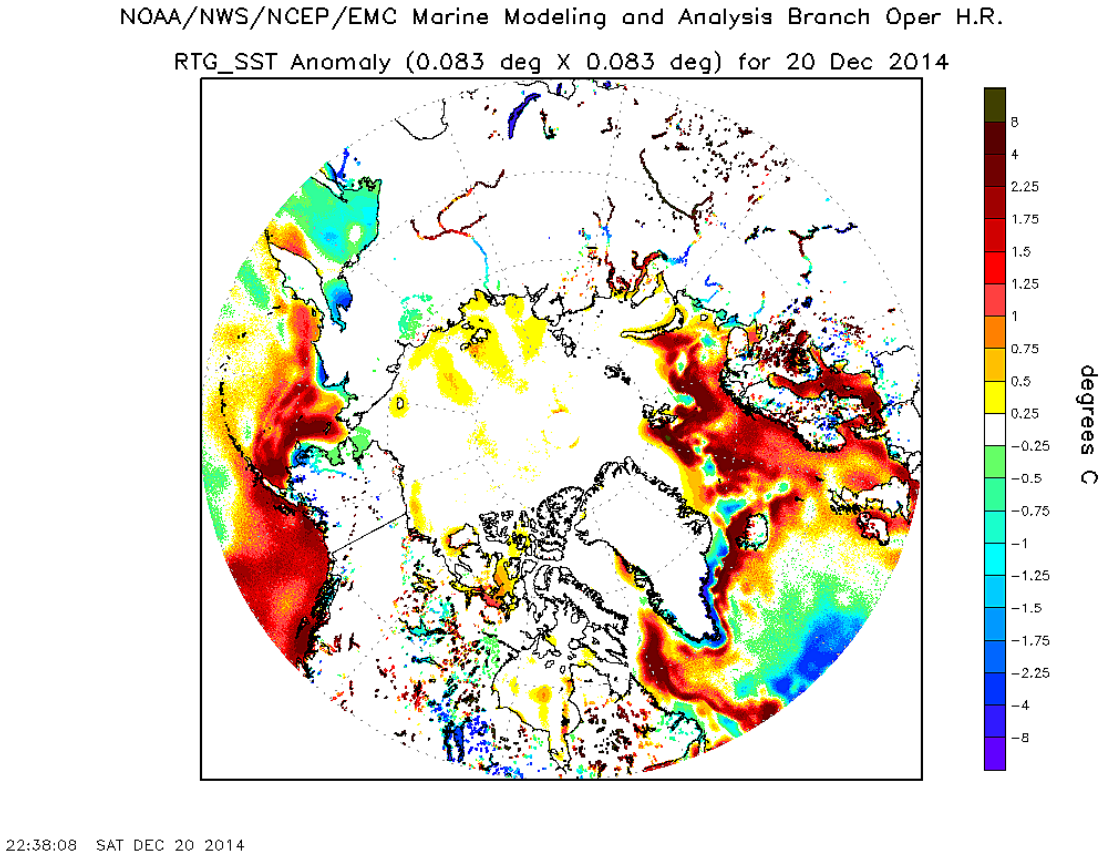


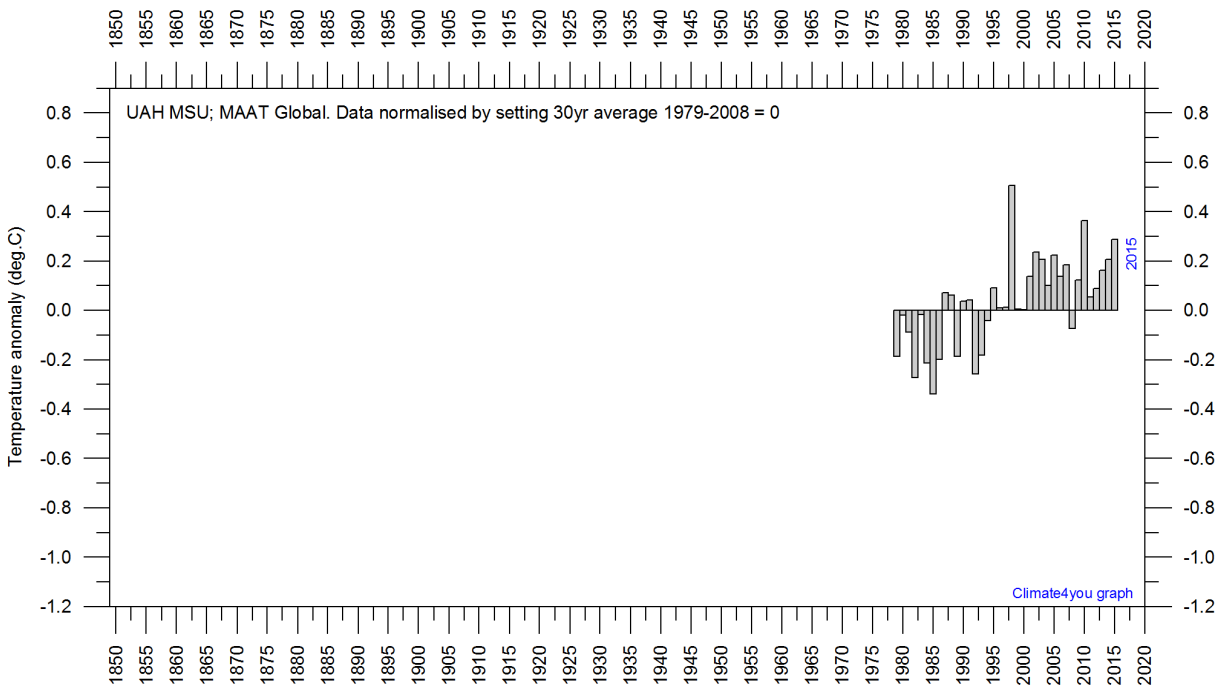
Sea surface temperature anomaly in December 2015 and 2014, upper and lower panel, respectively.



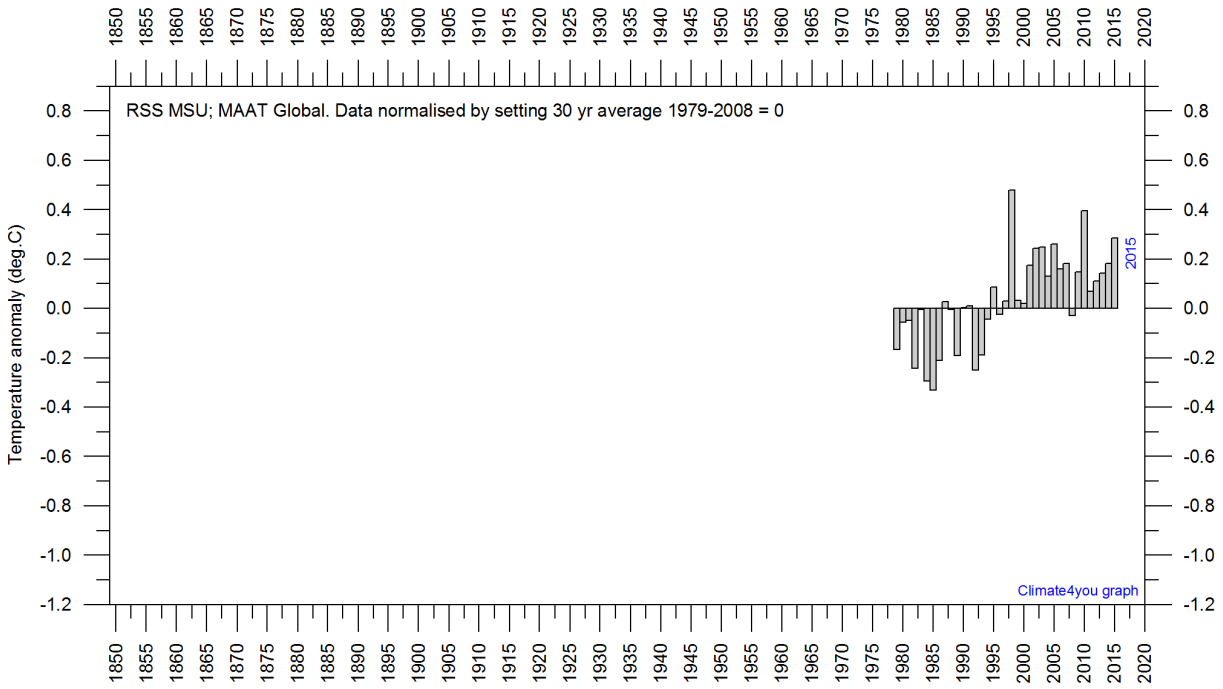


Arctic sea surface temperature anomaly in December 2015 and 2014, upper and lower panel, respectively.

Lower troposphere temperature from satellites, updated to year 2015

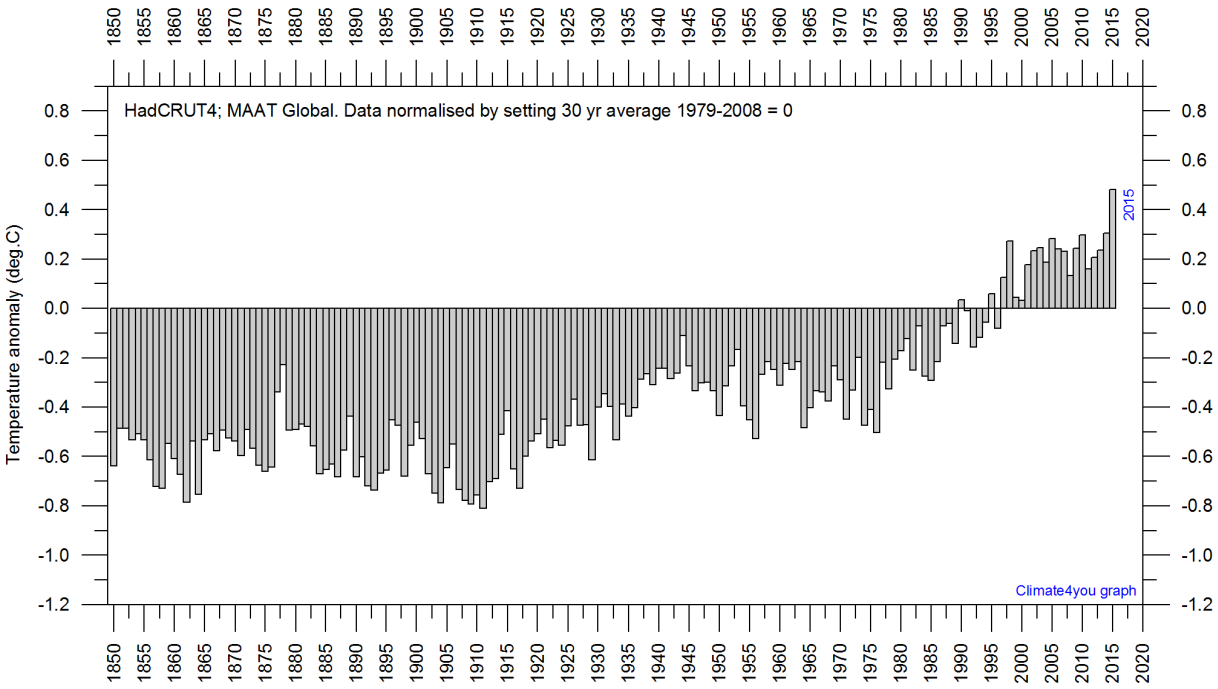


Mean annually lower troposphere temperature anomaly (thin line) since 1979 according to University of Alabama at Huntsville, USA. The average for 1979-2008 (30 yrs) has been set to zero, to make comparison with other temperature data series easy.

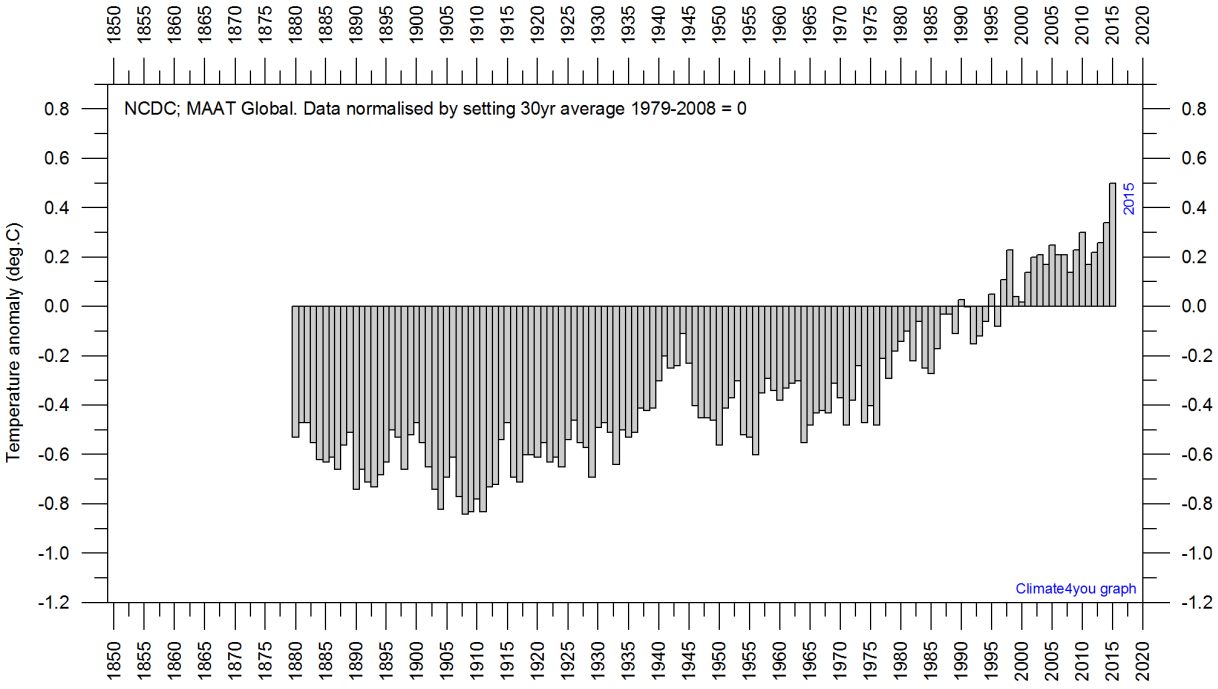


Mean annual lower troposphere temperature anomaly (thin line) since 1979 according to according to Remote Sensing Systems (RSS), USA. The average for 1979-2008 (30 yrs) has been set to zero, to make comparison with other temperature data series easy.

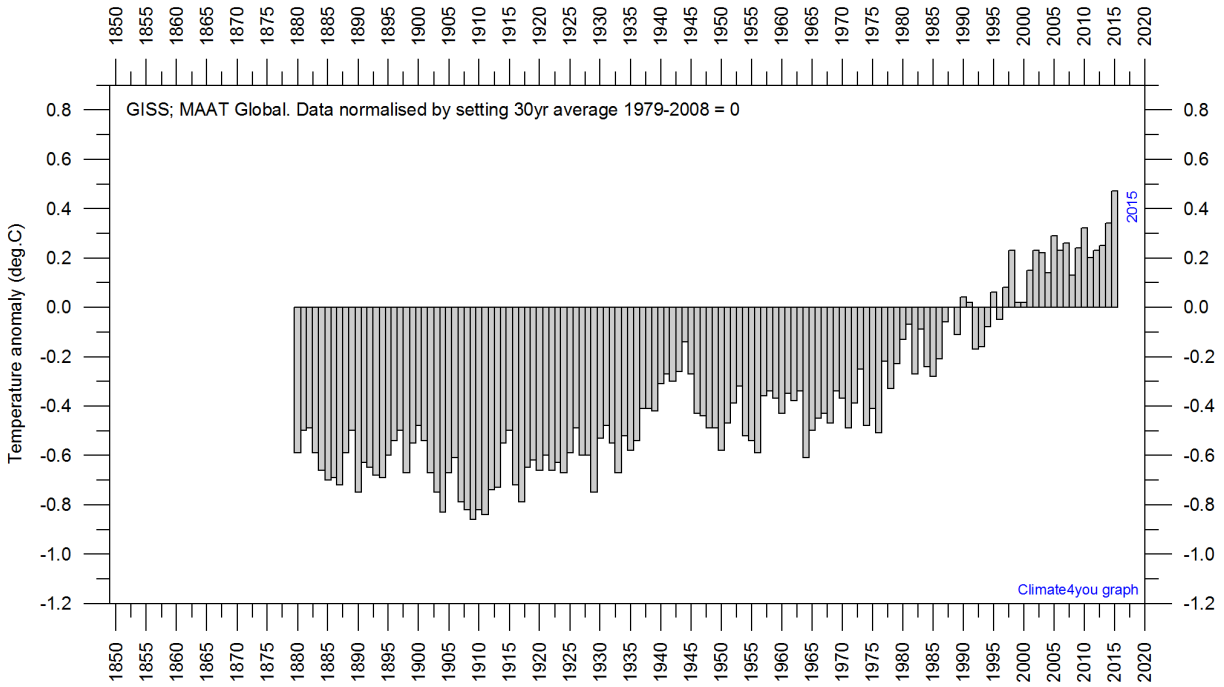
Global surface air temperature, updated to year 2015



Mean annual global surface air temperature (thin line) since 1850 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 average for 1979-2008 (30 yrs) has been set to zero.



Mean annual global surface air temperature since 1880 according to according to the National Climatic Data Center (NCDC), USA. The average for 1979-2008 (30 yrs) has been set to zero, to make comparison with other temperature data series easy.



Mean annual global surface air temperature (thin line) since 1880 according to according to the Goddard Institute for Space Studies (GISS), at Columbia University, New York City, USA. The average for 1979-2008 (30 yrs) has been set to zero, to make comparison with other temperature data series easy.

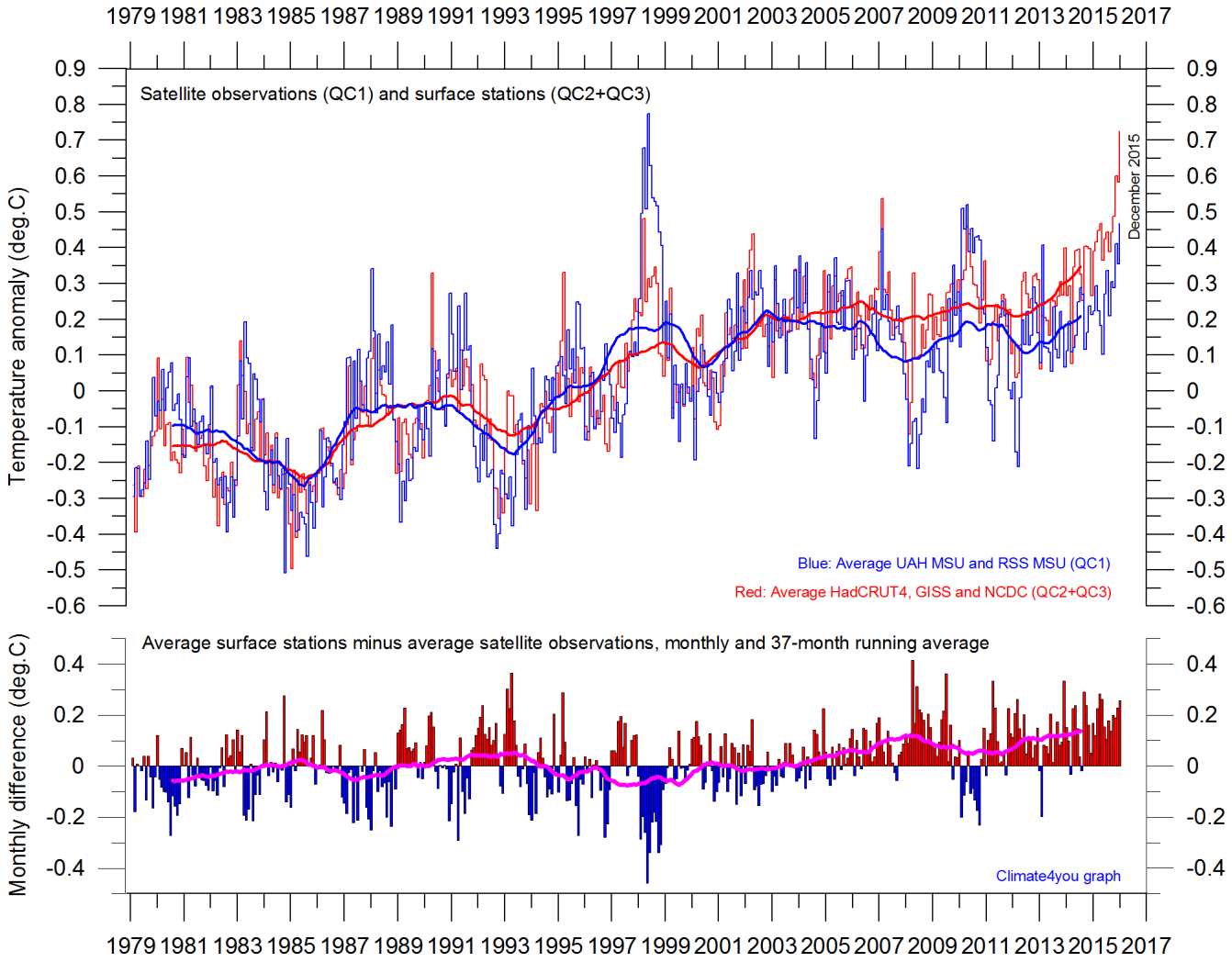
Reflections on the significance of the 2015 global annual temperature

According to the surface stations 2015 ranks as the warmest year since 1880 and 1850, depending on which data series is considered. According to the satellite records 2015 was warm, but not setting a new record.

The geographical fingerprint (p.2) of relative warm regions in 2015 demonstrate the importance of the natural oceanographic phenomena El Niño (p.5) in the Pacific Ocean for making 2015 a warm year, and affecting the calculation of especially short-period linear trends (p.11).

When the ongoing El Niño presumably fades during 2016 the effect on global temperature will be the opposite to that experienced in 2016, and may well contribute to make 2016 a somewhat cooler year than 2015. As usual, time will show. Quite often (but not always) a warm El Niño is followed by a cool oceanographic reversal, known as La Niña. Just like El Niño, also La Niña represents a natural phenomenon.

Comparing surface air temperatures with data from satellites at the end of 2015



Plot showing the average of monthly global surface air temperature estimates (HadCRUT4, GISS and NCDC) and satellite-based temperature estimates (RSS MSU and UAH MSU). The thin lines indicate the monthly value, while the thick lines represent the simple running 37 month average, nearly corresponding to a running 3 yr average. The lower panel shows the monthly difference between surface air temperature and satellite temperatures. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of 30 years from January 1979 to December 2008.

Global satellite temperature trends calculated for different periods until December 2015

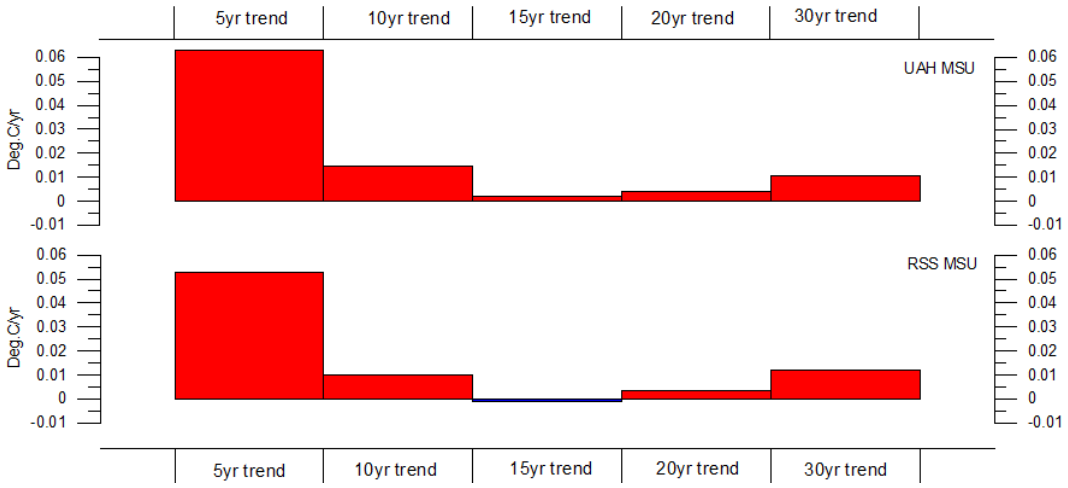
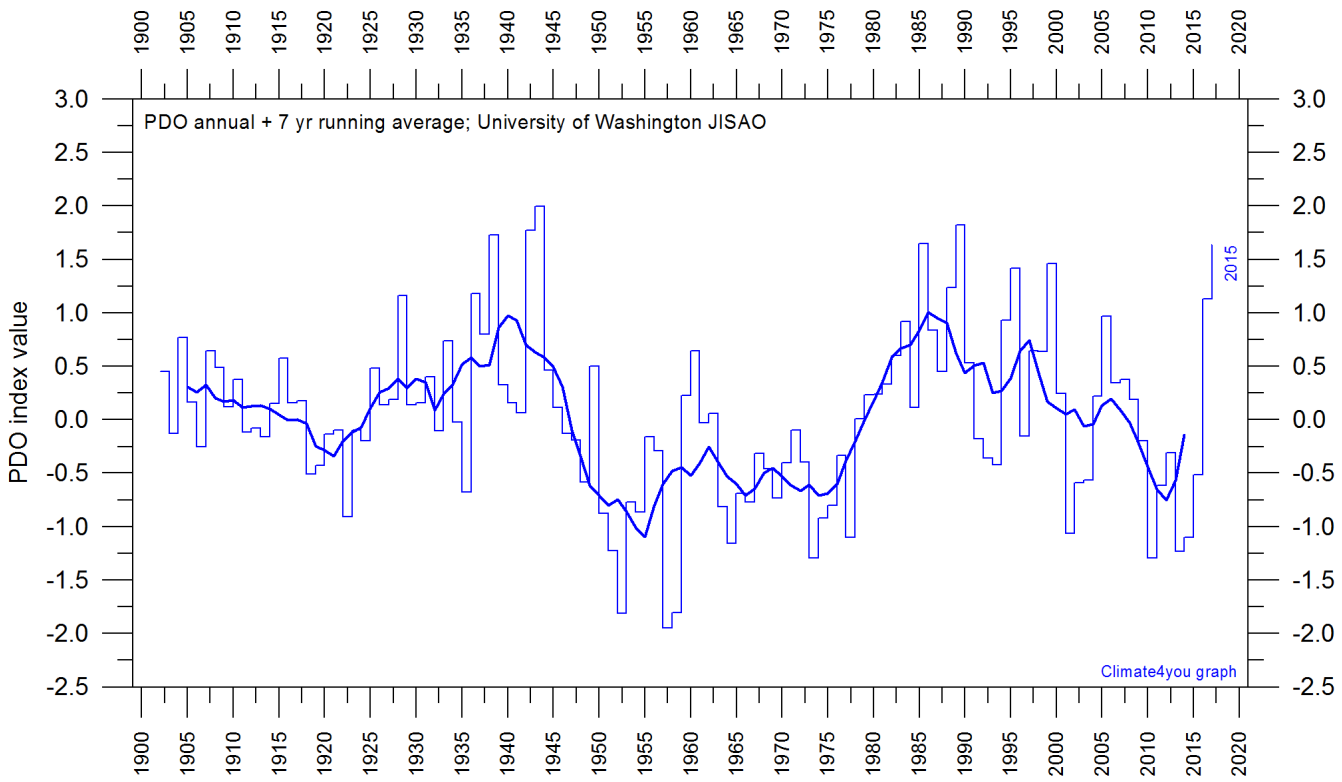


Diagram showing the latest 5, 10, 20 and 30 yr linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for two satellite-based temperature estimates (UAH MSU and RSS MSU).

Global surface air temperature trends calculated for different periods until December 2015

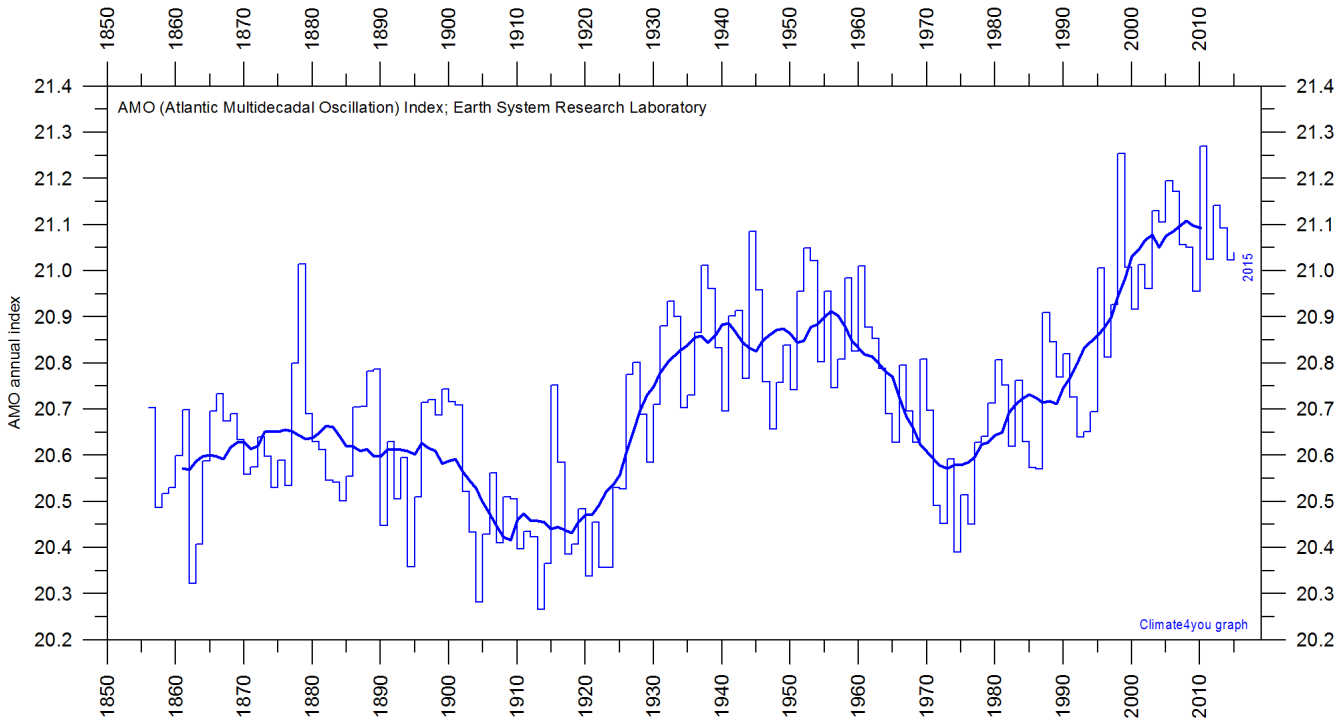
Diagram showing the latest 5, 10, 15, 20, 30, 50, 70 and 100 yr linear annual global temperature trend, calculated as the slope of the linear regression line through the data points, for three surface-based temperature estimates (GISS, NCDC and HadCRUT3).

PDO - Pacific Decadal Oscillation, updated to 2015



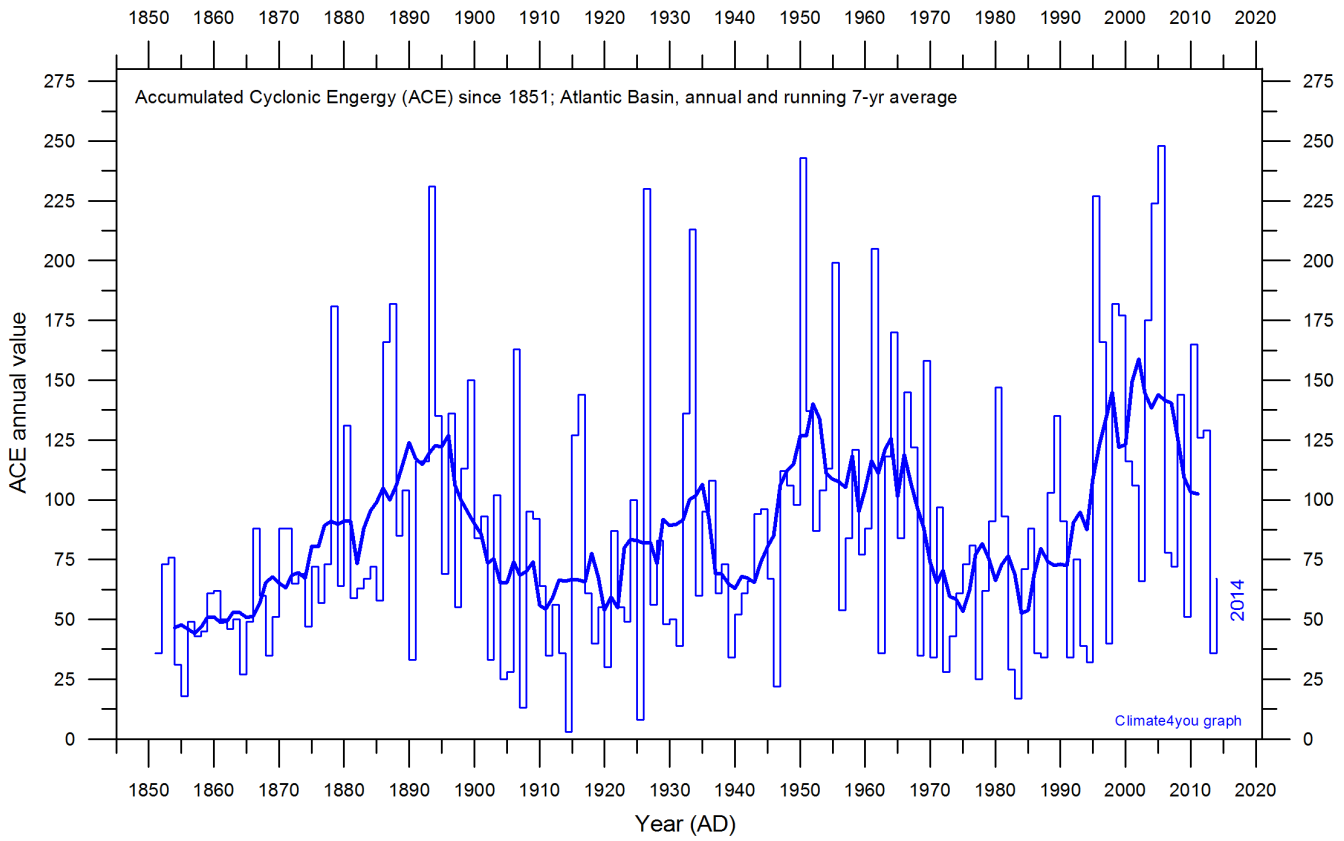
Annual values of the Pacific Decadal Oscillation (PDO) according to the Joint Institute for the Study of the Atmosphere and Ocean (JISAO), a Cooperative Institute between the National Oceanic and Atmospheric Administration and the University of Washington. The PDO is a long-lived El Niño-like pattern of Pacific climate variability, and the data series goes back to January 1900. The thin line indicates annual PDO values, and the thick line is the simple running 7 year average.

AMO (Atlantic Multidecadal Oscillation) Index, updated to 2015



Annual Atlantic Multidecadal Oscillation (AMO) index values since 1856. The thin line indicates 3 month average values, and the thick line is the simple running 11 year average. Further explanation in text above. Data source: Earth System Research Laboratory at NOAA.

Annual accumulated cyclone energy (ACE) Atlantic Basin, updated to 2014



Accumulated cyclonic engergy (ACE; Atlantic basin) per year since 1850 AD, according to data from the Atlantic Oceanographic and Meteorological Laboratory, Hurricane research Division. Thin lines show annual ACE values, and the thick line shows the running 7-yr average. Please note that this data series is not yet updated beyond 2014.

Ocean temperatures, uppermost 2000m, updated to November 2015

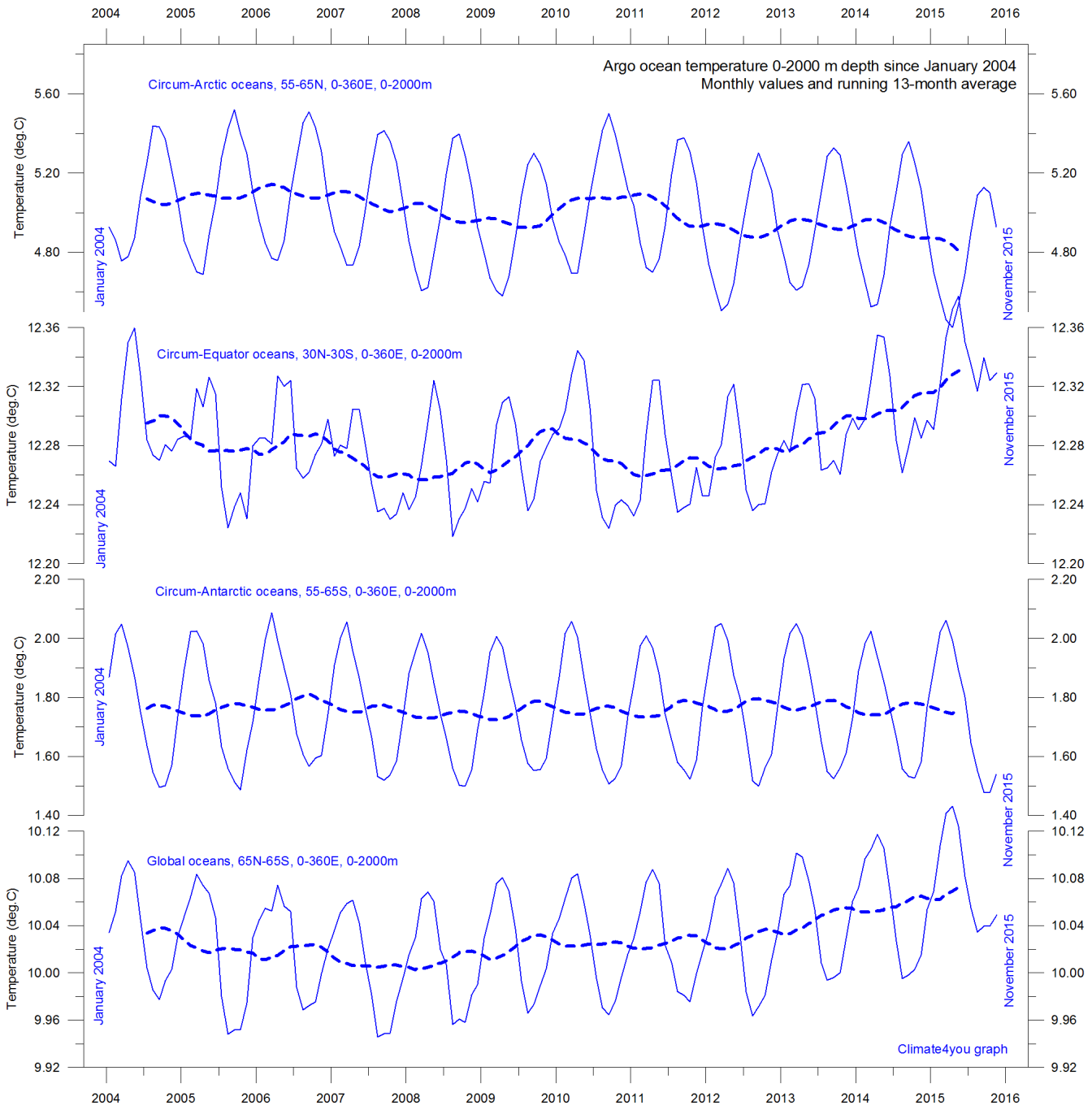
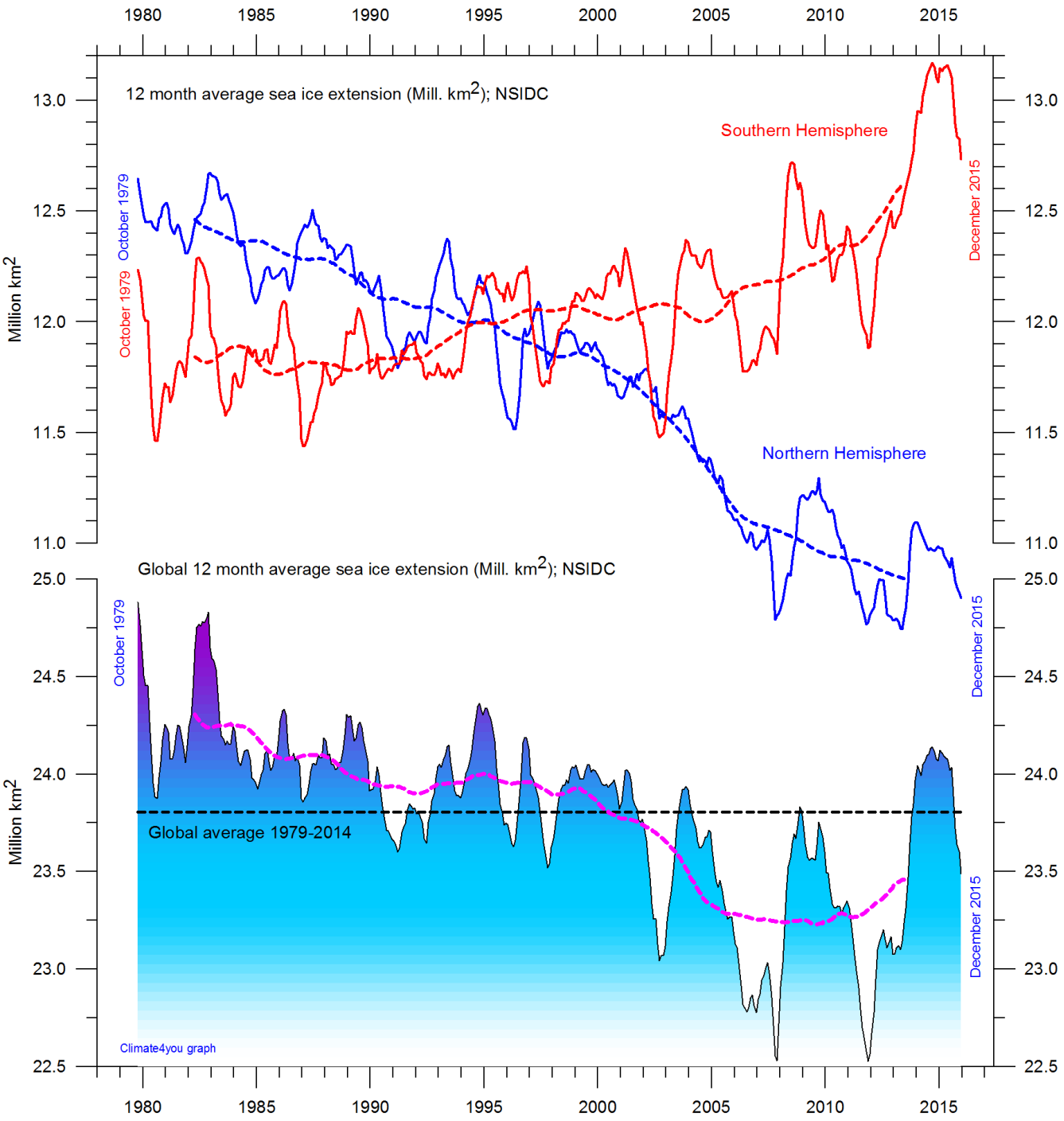


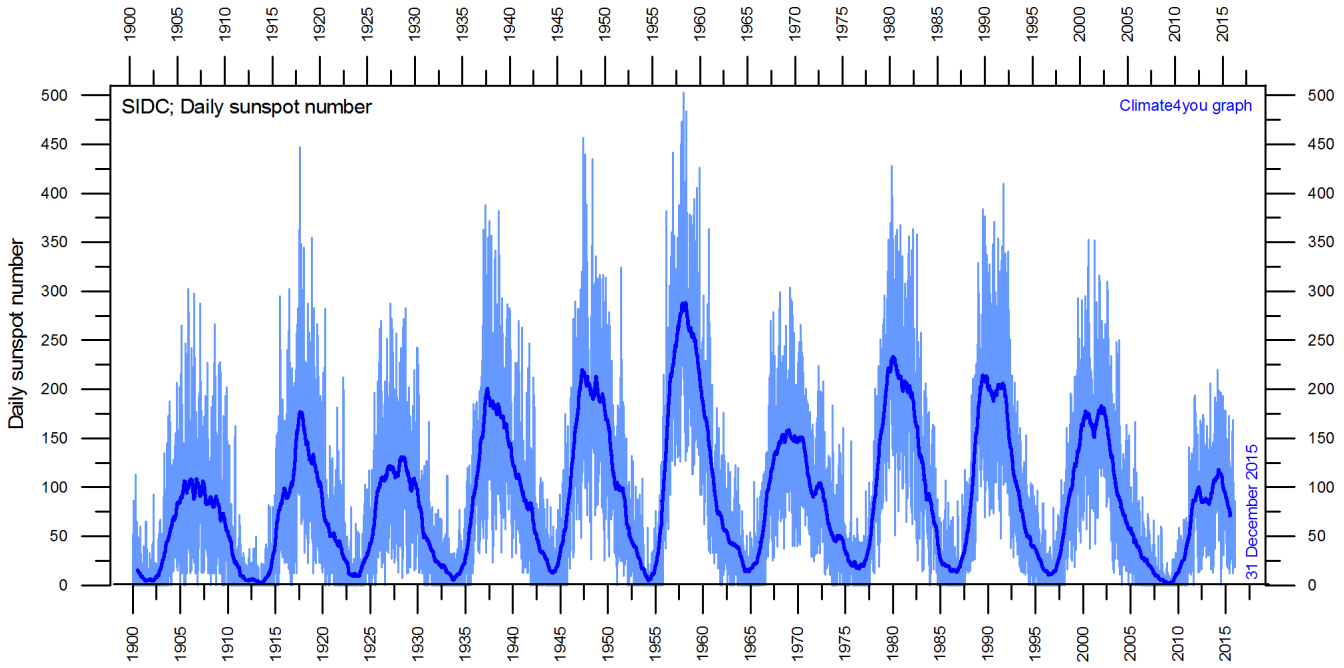
Diagram showing average 0-2000m depth ocean temperatures in selected latitudinal bands, using Argo-data. The thin line shows monthly values and the thick line shows the running 13-month average. Source: Global Marine Argo Atlas.

Arctic and Antarctic sea ice extension, updated to December 2015



Global and hemispheric 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 lines represent a 61-month (ca.5 years) average. Last month included in the 12-month calculations is shown to the right in the diagram. Data source: National Snow and Ice Data Center (NSIDC).

Number of daily sunspots since 1900, updated to December 31, 2015



Daily observations of the number of sunspots since 1 January 1900 according to Solar Influences Data Analysis Center (SIDC). The thin blue line indicates the daily sunspot number, while the dark blue line indicates the running annual average.

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All 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)

January 31, 2016.