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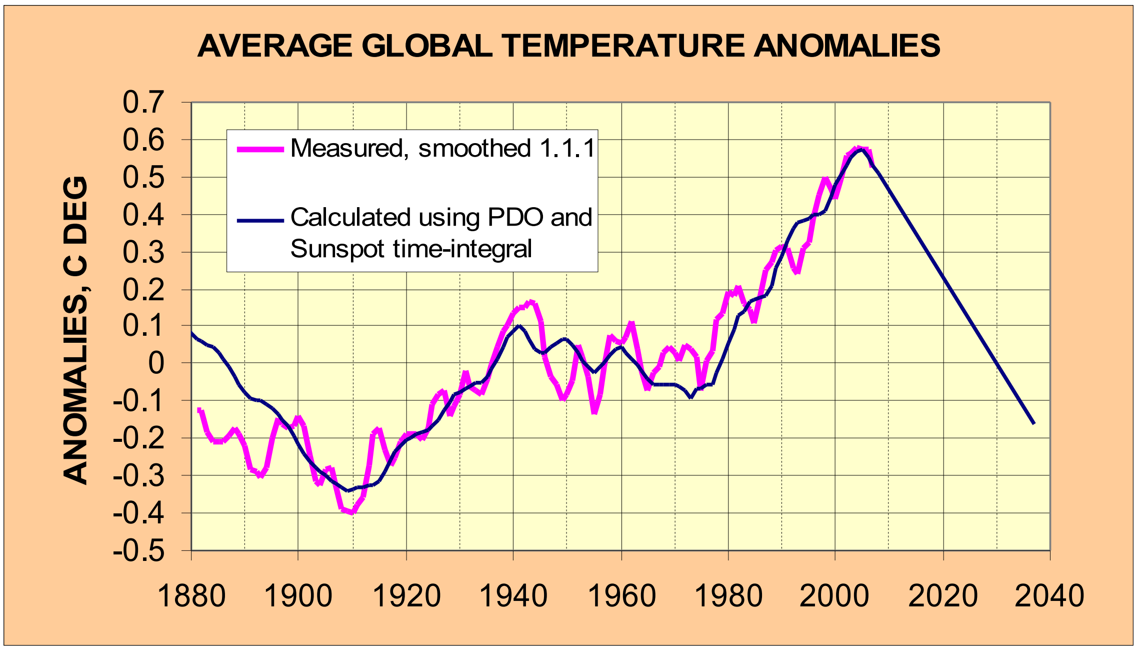
Twentieth Century Temperature Correlation with no CO2 influence (update)

The Climate Science community has made the claim that average global temperatures during the 20th century can not be calculated without incorporating the influence of carbon dioxide as a cause of warming. This appears to be invalid since the graph below was constructed assuming no influence from carbon dioxide. The calculated temperature anomalies are produced by the rather simple procedure of combining the time-integral of sunspot count with the 32-year trends of the Pacific Decadal Oscillation (PDO).



The pink line on this graph is a slightly smoothed (each year's value is averaged with values from the two adjacent years) plot of average global temperature anomalies. The global anomalies from 1880 and more recent are as reported by NOAA at ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/annual.land_ocean.90S.90N.df_1901-2000mean.dat on 14 October 2009. Earlier data which were used to determine a proportionality constant are from Vostok ice cores at http://cdiac.ornl.gov/ftp/trends/temp/vostok/vostok.1999.temp.dat

The influence of the sunspots is determined by an energy balance on the planet. The energy gained by the planet is assumed to be proportional to the time-integral of sunspot count. The energy radiated from the planet is proportional to the time-integral of the fourth power of the average global temperature. The proportionality constant, 6.36E-9, was adjusted to get a fairly constant net energy from 1700 to about 1940 as described in the pdf file titled SUNSPOTS; THE CAUSE OF THE 20TH CENTURY TEMPERATURE RUN-UP at http://climaterealists.com/index.php?tid=145&linkbox=true. The sunspot data set used here was copied from ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/SUNSPOT_NUMBERS/YEARLY.PLT . The energy difference is divided by a constant, 4000, to get a value close to the temperature anomalies and an offset, 0.4, is subtracted to move the plot to overlay the measured anomalies.

The up trend or down trend periods ascribed to the Pacific Decadal Oscillation (PDO) are taken as 32 years long for all periods. The temperature range for the PDOs alone was taken to be 0.45 K for all of the PDOs. Thus, for a PDO uptrend the value added to the above sunspot calculation is 0.45 multiplied by the fraction of the PDO time period that has taken place. For a PDO downtrend, the value added to the above sunspot calculation is 0.45 minus 0.45 multiplied by the fraction of the PDO time period that has taken place.

These calculations produce the black line on the graph. Variations in this line reflect the solar cycles which were obscured in the previous work by coarse time steps. The extension of this line beyond the present assumes that future sunspot count is zero. Future temperature anomalies depend on future sunspot counts and future PDO behavior neither of which can be confidently predicted. No attempt was made to match the local oscillations in the measured temperatures. These are likely due to an interaction of various short-cycle ocean oscillations such as el Niño with each other and with the approximately 11 year long solar cycles. Between 1900 and 2008 the standard deviation between concurrent points on the two graphs is 0.0634. The deviation prior to 1890 is probably due to PDO behavior different from that observed during the 20th century.

This work shows the influence that sunspots appear to have had on 20th century climate. The precise points to make calculations of the effective influence without bias are somewhat uncertain. I used the temperatures calculated at the end points of the PDO trends. Sunspots had little effect prior to about 1941. The temperature decline from 1941 to 1973 would have been about 57% greater if not for the high sunspot-count-time-integral during that period. The sunspot-time-integral contributed about 47% to the temperature rise from 1973 to 2005.