We investigate whether or not the decadal and multi-decadal climate oscillations have an astronomical origin. Several global surface temperature records since 1850 and heliospheric oscillations deduced from the orbits of the planets present very similar power spectra. Eleven frequencies with period between 5 and 100 years closely correspond in the two records. Among them, large climate oscillations with peak-to-trough amplitude of about 0.1 °C and 0.2 °C, and periods of about 20 and 60 years, respectively, are synchronized to the orbital periods of Jupiter and Saturn. Schwabe and Hale solar cycles are also visible in the temperature records. A 9.1-year cycle is synchronized to the Moon's orbital cycles. A phenomenological model based on these astronomical cycles can be used to well reconstruct the temperature oscillations since 1850 and to make partial forecasts for the 21st century. It is found that at least 60% of the global warming observed since 1970 has been induced by the combined effect of the above natural climate oscillations. Additional discussions about a quasi-millennial cycle are added to the discussion. A 21st Century forecast suggests that climate may remain approximately steady until 2030-2040, and may at most warm 0.5-1.0°C by 2100 at the estimated 0.5-1.0 °C/century anthropogenic warming rate, which is at least 2-4 times smaller than the average 2.3°C/century anthropogenic warming rate projected by the IPCC up to the first decades of the 21st century. Possible physical mechanisms are qualitatively discussed with an emphasis on the phenomenon of collective synchronization of coupled oscillators.

Heliospheric oscillations and their implication for climate oscillations and climate forecast.

Nicola Scafetta
Duke University

Third Santa Fe Conference on Global and Regional Climate Change
Santa Fe, NM
Oct. 31 - Nov. 4, 2011
The IPCC's theory of Anthropogenic Global Warming

About 90% (100%) of the warming observed since 1900 (1970) is anthropic

The red simulation is obtained with GCMs forced with both anthropogenic and natural forcing.

The blue simulation is obtained with GCMs forced only with natural (solar and volcano) forcing.

Do climate models include all involved physical mechanisms?
The observed temperature is swinging with warming and cooling periods. The model GISS model E (blue) well reproduces the 1970s to 2000 observed warming. However, it fails with the observed climate variability before 1960. The model output suggests a 1880-1960 flat, linear trend (green).


~60 year oscillations in the CRU global temperature
~60 year oscillations in climate records

Twenty-year moving average of the tree-ring chronologies from Pinus Flexilis in California and Albertain: this record is used as a proxy for reconstructing the Pacific Decadal Oscillation (MacDonald and Case, 2005).

Record of G. Bulloides abundance variations (1-mm intervals) from 1650 to 1990 A.D. (black line) (Black et al., 1999); this is a proxy for the Atlantic variability since 1650.

Five-year running average of the Indian summer monsoon rainfall from 1813 to 1998 (Agnihotri and Dutta, 2003).

These three records show clear 60-year cyclical modulations that are (positively or negatively) well correlated to the 60-year cycles of the global surface temperature and the aurora records. The records are best fit with sinusoidal functions that give a statistical error about the 60-year period of 4 years.
A ~60-year cycle in Multi-millennial records

Knudsen et al., Tracking the Atlantic Multidecadal Oscillation through the last 8,000 years, Nature Communications, 2011.

GISP2 Holocene Power Spectrum (Fixed Depth Intervals)

Sea level rose by 6 cm during the 19th century and 19 cm in the 20th century.

Superimposed on the long-term acceleration are quasiperiodic fluctuations with a period of about 60 years.
Figure SPM.5. Left Panel: Global GHG emissions (in GtCO$_2$-eq) in the absence of climate policies: six illustrative SRES marker scenarios (coloured lines) and the 80th percentile range of recent scenarios published since SRES (post-SRES) (gray shaded area). Dashed lines show the full range of post-SRES scenarios. The emissions include CO$_2$, CH$_4$, N$_2$O and F-gases. Right Panel: Solid lines are multi-model global averages of surface warming for scenarios A2, A1B and B1, shown as continuations of the 20th-century simulations. These projections also take into account emissions of short-lived GHGs and aerosols. The pink line is not a scenario, but is for Atmosphere-Ocean General Circulation Model (AOGCM) simulations where atmospheric concentrations are held constant at year 2000 values. The bars at the right of the figure indicate the best estimate (solid line within each bar) and the likely range assessed for the six SRES marker scenarios at 2080-2099. All temperatures are relative to the period 1980-1999. (Figure credit: IPCC AR5 SPM)
The IPCC claims that 100% of the warming observed since 1970 has been induced by human activity.

**HOWEVER**

If the climate is characterized by a ~60-year natural cycle as large as 0.3-0.35 °C, given the fact that this cycle was in its warm phase from 1970 to 2000, then about 60-70% of the 0.5 °C warming observed since 1970 has been natural induced.

Consequently the IPCC models are severely incomplete and they have overestimate the anthropogenic effect on climate by at least a factor of times.

**RIGHT?**
Solar Cycles

After 1700 AD direct Zürich data.

Local wavelet (Morlet basis) spectrum of Wolf Numbers reconstructed by Nagovitsyn. White domains – local wavelet power <0.2; black domains – local wavelet power >1.0 (0.99 c.l.).

Fourier Spectrum Density of Wolf Numbers reconstructed by Nagovitsyn. Dotted line: 0.99 c.l. (red noise factor 0.3).
Significant cycles at 60, 85, 128, 205 yr.

Ogurtsov et al., Solar Physics, 2002
Kerr, Science 2001

$^{14}$C Reconstructed Solar activity
~1000 year oscillations

$^{18}$O Holocene Temperature reconstruction
~1000 year oscillations

$^{18}$O Holocene
Temp reconstruction

$9^\circ$C

Warm

Cold

MiW = Minoan Warm Period,
RO = Roman Optimum,
MeW = Medieval Warm Period,
MoW = Modern Warm Period.
Major cycles in the Solar system

Schwabe sunspot: 11 yr
Jupiter: 11.85 yr
Lunar Nodal Precession: 18.6 yr
Sun orbit around the Center of Mass: 19.9 yr
Hale magnetic sunspot: 22 yr
Saturn: 29.4 yr
Saturn and Jupiter (Synodic): 60 yr
Uranus: 84 yr

The 10-12, 20 and 60 cycles
Comparison between the 20 & 60 yr Jupiter/Saturn conjunction cycles and Solar Speed and the CRU global surface temperature series

Power spectra of the CRU temperatures (Global, Northern Hemisphere & Southern Hemisphere) and the Solar Speed relative to CMSS.

Global Surface Temperature (black) detrended of its quadratic fit plotted with the rescaled 60-year modulation of the Solar Speed of the CMSS.

The 20-year oscillation of the Temperature (black) plotted against the rescaled Solar Speed of the CMSS (red). No lag-time is applied.
Power spectrum comparison: HadCRUT3, GISSTEM/250, GHCN-Mv3

Data from: http://climexp.knmi.nl/selectfield_obs.cgi?someone@somewhere

9.1, 10-10.5
20-21, 60-62
year cycles
Good Evidence for Cosmic Ray and electric circuit Amplifier

1) Strong solar activity results in strong solar magnetic field.

2) The stronger the solar magnetic field, the better the earth is protected from incoming cosmic rays.

3) Cosmic Rays act as condensation nuclei for low clouds

4) Fewer condensation nuclei mean fewer cooling clouds, meaning warmer temperatures

The Earth has a Global Electric Circuit and weather that connects with space. The spacequakes and especially the fast plasma jet that causes them and the auroras is part of the Electric Universe circuit in our solar system.
A small astronomical/solar modulation of the albedo would induced a very large climate sensitivity to solar change.

By differentiating directly a corrected Stefan–Boltzmann’s black-body equation

\[ f \frac{(1-a)I}{4} = \sigma T^4, \]  

we get

\[ k_S = \frac{\Delta T}{\Delta I} = \frac{T}{4I} = 0.053 \text{ K/W m}^{-2} \]  

\[ k_S = \frac{\Delta T}{\Delta I} = \frac{4\sqrt{(1-a*0.99)(I+\Delta I)f}}{4\sigma \Delta I} - \frac{4\sqrt{(1-a)f}}{4\sigma} \approx 0.36 \text{ K/W m}^{-2}, \]
9.07-year Temperature Cycle

9-year cycle

9-year cycle
The model well agrees with secular temperature reconstruction. The model “predicts” centuries of data!

ACRIM TSI Composite may show part of a solar 60-year cycle modulation
Harmonic astronomical model based on the 9.1, 10-10.5, 20, 60 year oscillations
Reconstruction and Forecast

Global Surface Temp. (4y aver.)
fit 1850-2010: f1(t)+P1(t)
#1: validation 1850-1950; calibration 1950-2010: using f1(t)+P1(t)
#2: calibration 1850-1950; validation 1950-2010: using f2(t)+P2(t)

IPCC

3 curves!
The earthly nature could not help but respond to the dictates of heavenly harmonies. Nature is affected by an aspect just as a farmer is moved by music to dance.

Monsoon rainfall cycles as depicted in ancient Sanskrit texts

R. N. Iyengar

Year to year variation of Indian monsoon rainfall is described qualitatively in some ancient Sanskrit texts. Interestingly, these are cyclic with periods of 3, 5, 7, 18 and 60 years. Time series analysis of actual seasonal rainfall data shows that at very near the above periods the spectrum has significant peaks. The Venus visibility portent stated in the Arthaśāstra appears to be a proxy for the near three-year fluctuation cycle in the rainfall.
CONCLUSIONS

1) Current climate models are severely uncertain and poorly reconstruct the temperature.

2) Climate system appears to be characterized by large natural cycles. Some of the major cycles are about:

   9, 10-11, 20-22, 60, 800-1000 year.

3) These cycles can be easily interpreted as astronomical cycles because they are present in the orbits of the Moon, of the planets (Jupiter and Saturn) and in the solar activity.
Many Thanks for
Your kind Attention