Documentation of the solar activity variations and it's influence on climate

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Abstract: The four planets that influence the most the solar surface through tidal forcing seem to affect the Earth climate. A simple two cosine model with periods 251 years, of the seasonality of the Earth – Venus syzygies, and 265.4 years, of the combined syzygies of Jupiter and Mercury with Earth when Earth is in synod with Venus, fits well the Northern Hemisphere temperatures of the last 1000 years as reconstructed by Jones et al (1998). **The physical mechanism proposed is that planetary gravitational forces drive solar activity that in turn drives temperature variations in earth. The sun is in a boundary balance state at one hand collapsing due to gravity and at the other hand expanding due to fusion, and as such it should be heavily influenced by minimal external forcings such as planetary gravity. S**ound waves in the solar mass, created from the planetary movement, are responsible for the formation of solar corona and sun spots. The Earth-Venus 251 year resonance is resonant to a near surface solar layer's thermal natural frequency that "explodes" to form solar wind. The calculated solar wind properties match the observed.

Keywords: geomagnetism, solar activity, solar corona, solar wind, climate change, temperature reconstruction, climate model

Here we discuss the potential that planets that influence the solar surface through tidal forces, affect the climate of Earth. **Though such forces are relatively weak, they can become critical in the absence of stronger forces. The sun is in a boundary balance state at one hand collapsing due to gravity and at the other hand expanding due to fusion, and as such it should be heavily influenced by minimal external forcings such as planetary gravity.**

Such tidal forces can physically affect Earth either through oscillating the Solar mass, surface or Corona, and increasing Solar activity.

Since tides follow the inverse cube rule, we expect only Mercury, Venus, Earth and Jupiter, to have important effect. The rest of the planets have at least one order of magnitude less effect.

This effect should be important if there is a cyclical pattern to produce forced oscillation to solar surface. Else the response would be chaotic and damped. Since there is minimal friction these oscillations should propagate and amplify in the form of sound waves till they create such a phenomenon to diffuse the concentrated energy in an alternate to friction way.

There are two key elements in this investigation: firstly we check Northern Hemisphere temperatures as the Southern Hemisphere of Earth is mainly sea covered and secondly we focus on the seasonality of solar wind as it's effect on Geomagnetic field reverses between epochs.

The land surface should be important to electricity conduction to the atmosphere. As Earth rotates, electrons are repelled outwards for moving in geomagnetic field. They then escape to atmosphere from mountain heights to participate in cloud formation. Later in thunder storms part of the load shall return to surface.

The Earth – Venus resonance is potentially the most important parameter of the investigated subject. With a synodic period of 583 days, 22 hours, 6 minutes, 49 seconds, Venus needs 251 years to complete a cycle of the synodic longitudes. Earth comes in synod with Venus at the same five longitudes, in a repeated five synod cycle every three years. Hence the seasonality of the Earth's synods with Venus is 251 years. In Figure 1 we plot the longitude of Earth when in synod with Venus, 500 synodic periods before and after 30/3/2001. Figure produced through Alcyone Ephemeris software.

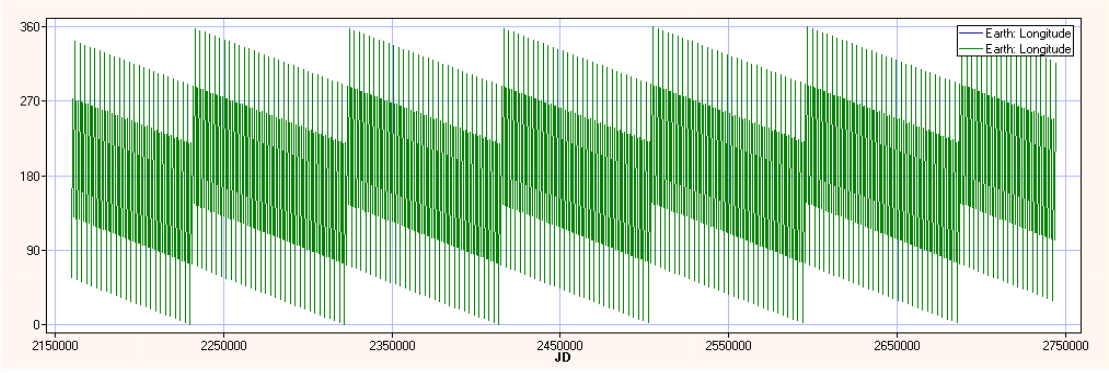

Figure 1. Longitude of Earth when in synod with Venus, 500 synodic periods before and after 30/3/2001.

The importance of the resonance is that the combined potential solar oscillation due to those two planets happens in a canonical way, cyclically at epochs, with a period of 251 years.

The investigation of the combined effect of the other two planets – Mercury and Jupiter – on this seasonality, reveals a 265.4 year cycle. In Figure 2 we plot the sum of the degrees of the Jupiter-Sun-Earth and Mercury-Sun-Earth angles, at the moments that Earth is in syzygy with Venus, for the years 1000 AD to 3000 AD.

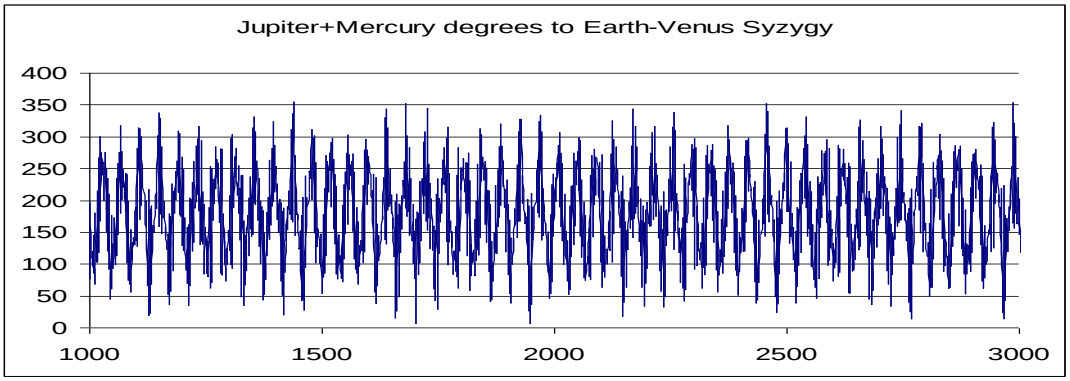

Figure 2. The sum of the degrees of the Jupiter-Sun-Earth and Mercury-Sun-Earth angles, at the moments that Earth is in syzygy with Venus, for the years 1000 AD to 3000 AD

The combined effect of the 251 and 265.4 year periods describes well the Jones et al (1998) (1) reconstruction of the last 1000 years Northern Hemisphere temperatures, and predicts that NH temperatures have reached a maximum and climate is going to change downwards in near future [Poulos (2005)] (2)

In Figure 3 we plot the simple two cosine model with periods 251 and 265.4 years we fit on the Jones et al reconstruction. We used the first 700 years to adjust the mean, amplitude and phase of the two cosines to fit the reconstructed temperatures. The model does a good prediction for the about 300 last years. The correlation of the model with the 10-year moving average of the Jones et al reconstruction data is 0.56 for both the periods 1000-1700 and 1700-1991.

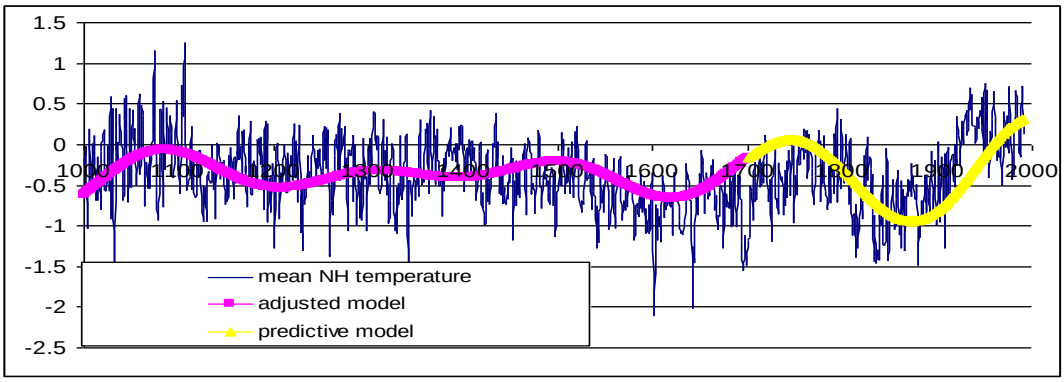

Figure 3. The simple two cosine model with periods 251 and 265.4 years and the Jones et al (1998) reconstruction

This model is a frequency beat of about 4600 years period. In Figure 4 we plot the two cosine constituents of the model. The 265.4 years constituent reaches it's maximum around 1950 AD when it was really the maximux of the syzygy cycle, saw in Figure 5. It is of interest that around 1950 AD we had a local maximum of the temperatures too.

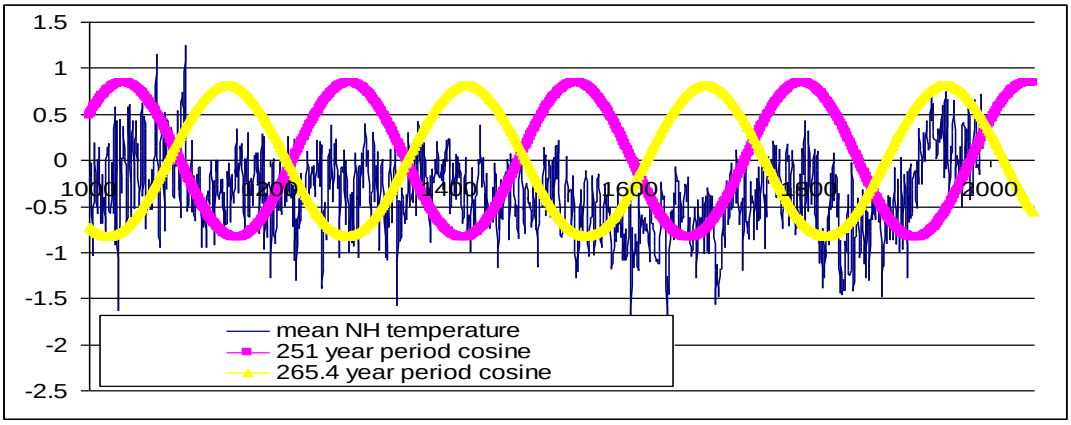

Figure 4.The two cosine constituents of the model

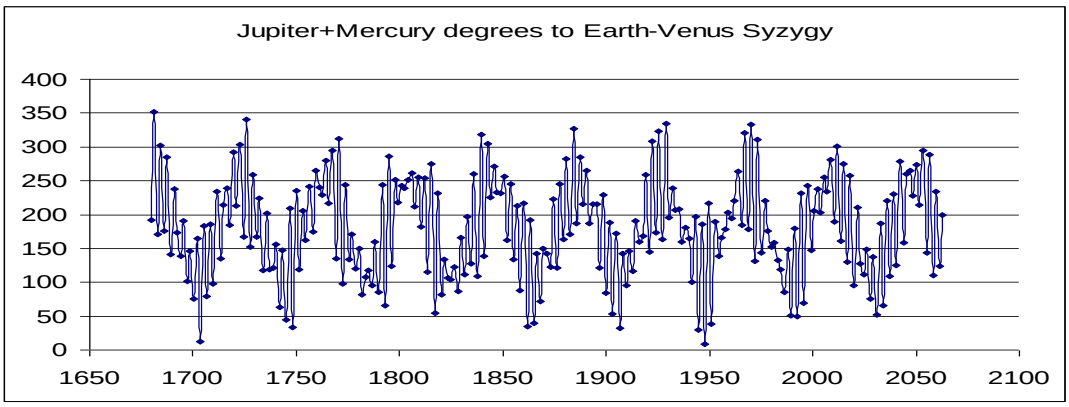

Figure 5. Jupiter + Mercury degrees to Earth – Venus syzygy 1680-2060 AD

This model as stated before is a frequency beat. In figure 6 it is superimposed on the last 10000 years of the Alley (2000) (3) temperature reconstruction of the Gisp2 from Greenland (At the end of the last "Ice Age"). The comparison arises the idea that certain long proxies tend to fit to the extrema of the temperature variation. This implies that later Northern Hemisphere reconstructions that give too much emphasis on multi-centenial or millennial variation may in fact have increased error inserted.

The frequency beat duration changes over time due to orbital eccentricity variations that change the sidereal year duration of planets. The calculated frequency beat duration, as already mentioned, is about 4600 years for our epoch, but it is expected to last fewer and fewer years as we go back in time. The expected beginning of it's formation seems to match in time (as seen in the Alley reconstruction) with the end of the last glacial age. This implies that it's formation at about 12k years ago caused the beginning of solar oscillation that most probably led to the formation of solar corona that warmed the Earth since.

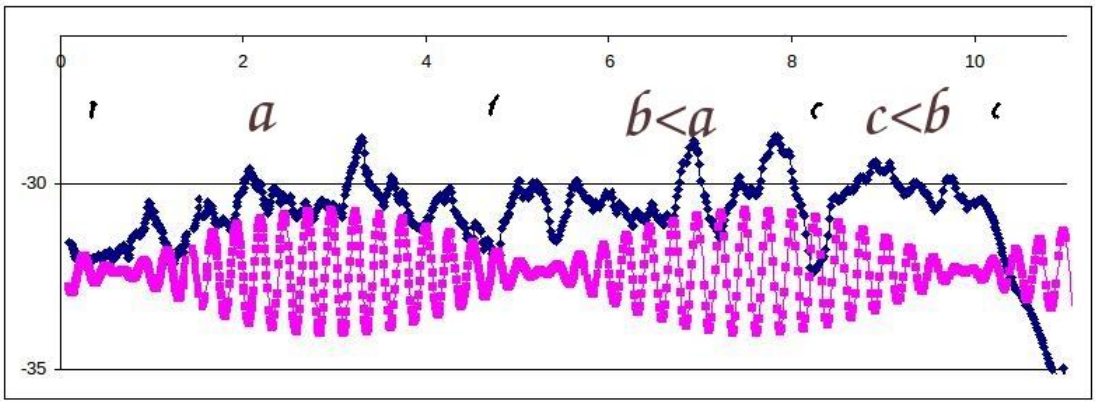

Figure 6. The NH temperature model superimposed on the last 10000 years of the Alley (2000) temperature reconstruction of the Gisp2 from Greenland. In fact the frequency beat duration changes over time due to orbital eccentricity variations that change the sidereal year duration of planets. The expected corrected duration intervals are noted with a, b, c.

To check the hypothesis that solar wind affects climate we checked Geomagnetism data from around the globe. Lerwick Northern Hemisphere Observatory (4) for example shows a constant Geomagnetism increase since the '30ies, and decrease before the 1930'ies. Indeed around 1930 the 251 years seasonal constituent of the model reaches it's minimum.

The published NGDC field models (5) of global geomagnetic intensity show the same thing too: geomagnetism decreasing till 1930 and increasing since.

A final validation for this climatic model comes from the Nile river low level record of about 800 years of data (Toussoun 1925, (6)). The record shows periodicity of about 250 years that comes in agreement in frequency and phase with the climatic model.

In the case of Jupiter orbiting the produced sound waves within the solar mass should lead to energy diffusion with 12 year periodicity leading to the formation of sunspots.

As the three inner planets to have significant tidal effect: Earth, Venus and Mercury have very sort rotating periods, the sunspot cycle is mainly manifested after Jupiter's rotation. All the four planets though participate on how strong the cycle shall finally manifest. As those planets have a mean maximum synodic period of 265 years (figure 5) the solar cycle reaches it's maximum every 265 years. The last time it became maximum was around 1950 when indeed all the four planets where in line at their maximum synodic neighboring, while the Dalton minimum of very low solar activity at 1800 AD is also present at figure 5. Inspecting figure 5 we count 2x6=12 cycles in the 265 year interval, each corresponding to the 22 years of the solar magnetic cycle. The 11=22/2 year interval correspands to the sunspot cycle as field reverses between sunspot cycles.

In the case of Earth-Venus resonance, the repeated five synod symmetry leads to the formation of stationary waves that behave as catalyst to symmetrical diffusion and the formation of solar corona.

So the 265 year cycle affects climate by the fluctuations in solar luminance derived from varied solar activity due to sun spots, while the 251 year cycle affects climate by solar wind variability.

In conclusion the Earth-Venus resonance is a regularity that leads to the formation of solar corona while the all four planets combined effect drives sunspot cycles. Solar wind oscillation produces forced oscillation to geomagnetic field. Oscillating geomagnetic field regulates electricity conduction to the atmosphere and cloud formation. Svensmark and Friis-Christensen, 1997 (7) have identified correlation between cosmic rays flux and cloud cover. Earth absorbs energy from this oscillation and heats. The presented documentation equals to a probability greater than 95%. As such this phenomenon is a combined effect of varied solar irradiance and varied solar wind affection to geomagnetic field and in turn geomagnetic field originated electricity conduction to the atmosphere.

A side effect of the Earth-Venus resonance is the interchange between Glacial Ages occurring every 100k years. As the orbital eccentricity of the planets changes, the Earth-Venus syzygy resonance is lost (because of the change of the sidereal year duration). As a result of this the Sun stops oscillating (probably the solar corona disappears) and Earth freezes.

Notes and calculations on the solar wind properties

The energy transport in the sun is very slow. It is pointed out by Stix(2003) (8) that it is of the Kelvin–Helmholtz time scale, of order 3×10^7 years. The energy transfer within the sun equals to the energy transfer of an oscillation, except that heat does not return to complete the oscillation cycle, with period twice the energy diffusion time. In the case of the whole sun the period of the oscillation should be 2×3×10^7 years. This equals to sun's thermal natural frequency. Symmetry in the Earth -Venus resonance leads to symmetric tidal sound waves and energy diffusion within the sun that lead to the formation of solar wind. For a layer's energy to take 125 years = 251/2 years to be transported to the outer of sun, it should be very near its surface. This near surface layer's thermal natural frequency is 251 years. It is stated here that the 251 year Earth-Venus resonance drives this layer to an infinite wave length oscillation and an “explosion” to produce the solar wind.

This layer should be at a radius from the solar center of GM/ (GM^2/R+125[yr]L) for L being the solar luminosity. The derived layer depth is 2800 m from the solar surface. For linear time – depth energy transfer it should roughly be at a depth from the solar surface of 125R/3*10^7=2900m. As this layer “explodes”, nuclei blast to all directions: half of them towards the inside of sun are absorbed by the sun and half towards the outside to form the solar wind. Since the layer's oscillation is of infinite length, nuclei are blast away to reach infinite distance from the sun, at escape velocity 618 km/sec. The measured solar wind velocities from various sources are of this order. This “explosion” blasts outwards, with fast moving nuclei, half the energy that otherwise would be transmitted as electromagnetic radiation. The blast outwards mass m/[time] is derived from the equation mc^2/[time]=L/2, for L the solar luminosity. For L=3.846×10^26 Watt, the solar wind is calculated to carry away 2×10^9 Kgr/sec. The measured solar wind values from various sources are very close to this.

As those nuclei escape the solar atmosphere, they are being slowed down by drag force from the outer layers of photosphere. Mass from the outer layers is accelerated and heated to produce spectacular solar flames. A rough estimation of the drag force for a single proton would be FD=ρυ^2CDA/2, for CD=0.5, υ=618×10^3 m/sec, ρ=0.1 gr/m^3 the photosphere density, A=πr^2 for r=0.85×10^(-15) m the proton's radius. The energy then for distance s of 2800 m to the surface of sun is Fds = 0.6×10^(-16) Joules. Half of this energy transforms to heat on solar wind nuclei and half to the upper layers of the solar atmosphere. The thermal energy of the solar wind gas is given under the ideal gas law 3/2NkT=0.3×10^(-16) Joules yielding to a temperature of 1.5×10^6 Kelvin. The measured solar wind temperature from various sources is very close to this.

At 1.5 solar radii, the kinetic energy of the protons has dropped for the difference in potential and thermal energy. The calculated velocity of solar wind is 420 Km/sec. The measured solar wind velocity from various sources is very close to this. This is the slow solar wind. The fast solar wind which originates from coronal holes has less drag that leads to lower temperatures than the slow wind. Particles in the fast wind are accelerated instead from magnetic currents to the observed by many sources velocities of 750 Km/sec.

Disclosure of potential conflicts of interest:

Conflict of Interest: The authors declare that they have no conflict of interest.

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