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Jovian Planet Oscillations
The First Cause of Climate variability

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"EVERYTHING that is in motion must be moved by something. For if it has not the source of its motion in itself it is evident that it is moved by something other than itself, for there must be something else that moves it. Since everything that is in motion must be moved by something, let us take the case in which a thing is in locomotion and is moved by something that is itself in motion, and that again is moved by something else that is in motion, and that by something else, and so on continually: then the series cannot go on to infinity, but there must be some first movement.

–Aristotle. 350 BC. PHYSICS.

Symbols

Data series: s(t)
Frequency spectrum: S(A(), T(), F())
Amplitude vector: A() = [A1, A2,…,];
Period time vector: T() = [T1, T2,…,](yr);
Period phase vector: F() = [F1, F2,…,] (yr);
Planet period: [Tsa, Tur, Tne] (yr);
Wavelet Spectrum: W(A(), T(), F());
Wavelet Power Spectrum: WP(A(), T(), F());
Wavelet Phase Spectrum: WF(A(), T(), F());
Wavelet Autocorrelation Spectrum: WA(R(), m);
Wavelet Power Spectrum WP() = W()W();
Wavelet Autocorrelation Spectrum: WA(R(), m)=E[(W(s, t)W(s, t+m)];

Summary

This study investigates coincidence oscillations between Jovian planets Saturn, Uranus and Neptune (SUN).

1. SUN perihelion coincidences have minimum at the year 512BC, maximum at the year 1710AD in an envelope period of 4450 years.
2. The SUN perihelion envelope period has min/max coincidences in time distances of [170, 330, 500, 999, 1781, 2451, 4479] (yr).
3. SUN perihelion coincidences from 1000 AD have coincidences to Grand Solar Minima.
4. The SUN perihelion envelope from 512BC to 1710AD coincides glacials extent in Norway.
5. Europe had a Deep Freeze the year 1709. SUN periods had 4450 - year maximum perihelion coincidence in 1710 AD.
6. SUN perihelion coincidences confirm a “Little Ice Age” period from 1345 to 1833 and computes an upcoming next Grand solar minimum close to 2040 AD.

1 Introduction

1.1 Aristoteles science

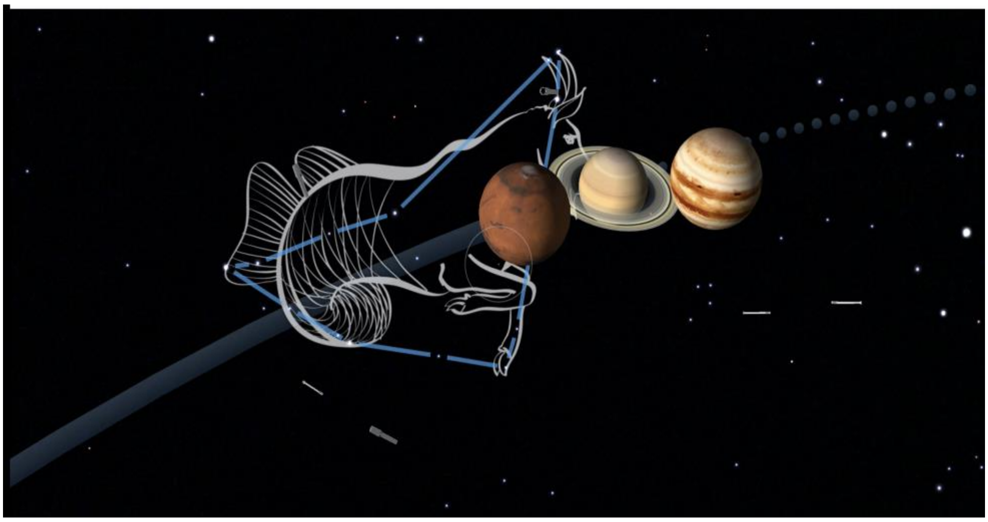

Figure 1. Movement of Mars, Saturn and Uranus in the sky.

Aristotle believed movements in nature where a chain of events from a first movable cause to a final movable cause. The first movement was the planets, which has unmovable stationary periods. In this scientific approach, planet movements represented the First Cause [1], in a chain of oscillating events, to the Final Cause, which moved nature on Earth. This scientific approach represented a holistic view of nature. Everything is connected to everything. The chain of events, from planets positions to movements in nature, represents a deterministic view of nature, controlled by the oscillating objects in the sky. Periods from the Sun, the Moon, the planets and the stars represented oscillating time-references. The oscillating time-references was used like a set of clocks, for minutes up to The Great Year, which covered a period of 26000 years. This deterministic view of nature slowed the progress of science, hundreds of years.

1.2 Newton science

The new science from Newton was based on a framework of mathematics. From mathematic it became possible to test models of nature, and slowly new science developed a new framework of understanding nature variability. This framework from Newton introduced a ballistic view nature and left the deterministic oscillating holistic approach. The motive was the same, to predict something in nature, to control something in nature. From this new science, we know more about movable bodies, period relations between the Earth, the Moon and the Sun. From period relations, we know more about about tides on Earth, ocean circulations, the Earth axis oscillation, and more. Based on this new science, we are monitoring data series in time periods from seconds to hundreds of years. At the same time, we are learning better methods to understand the nature variability. After monitoring data for decades, the data series shows fingerprints from the solar system, as an unexpected Black Swan. Fingerprints in data, that represents ideas from old science, and new science is slowly meeting ideas from old science.

1.3 The Climate Clock hypothesis

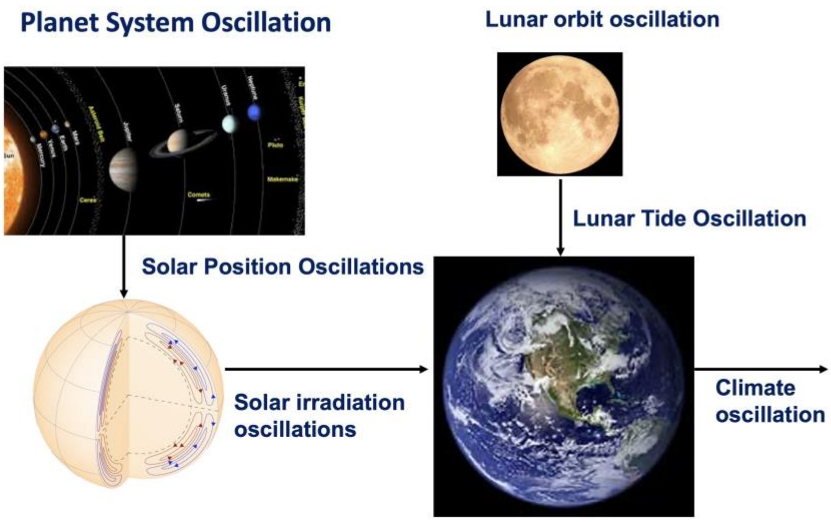

Figure 2. The Climate Clock hypothesis

The Climate Clock hypothesis is based on the simple idea:

1. The motive of science is to predict the future, to control the future.
2. To predict the future, climate variability has to be deterministic.
3. A deterministic climate must have a deterministic source.
4. A possible deterministic source is the solar system, as the First Cause.

Climate Clock hypothesis has a First Cause, controlled by the solar system, a chain of events and climate, as the Final Cause. The chain of events is simplified on Figure 2.

1. First Cause: Period phase-relations between the Jovian SUN planets.
2. Chain of events: Planets period phase-relation, Solar position oscillation, solar dynamo, solar irradiation, accumulation of heath in oceans.
3. Lunar chain of events: Earth-Moon-Sun relations, Lunar tides, vertical mixing in oceans, heath distribution in oceans.
4. Final Cause: Interference between solar forcing- and lunar forcing temperature variability in oceans.

The Climate Clock metaphor goes back to my PhD study of lunar variability influence on marine ecosystem variability. In the period 1995 to 2007 I studied the lunar-forced chain of events, from lunar nodal tides to marine ecosystem managements. In this chain of events, a lunar clock model represented a simple method to explain the phase-lag in a chain of events.

The Solar Clock model is based om studies of planet periods, barycenter oscillations, sunspot data series and Total Solar Irradiation (TSI) data series, published by Yndestad and Solheim, 2017 [2]. The study reveals that TSI variability is controlled by phase-coincidences between the Jovian planets Saturn, Uranus and Neptune. Deep TSI minimum has coincidence to the planet perihelion coincidences. The planet perihelion thus is of most importance to understand climate variability. This study investigates more closely the concept of planet perihelion coincidences, which represents the First Cause in the Climate Clock metaphor and will serve as a reference in studies of climate variability.

2 Planets Oscillations

2.1 Jovial Planets Oscillations

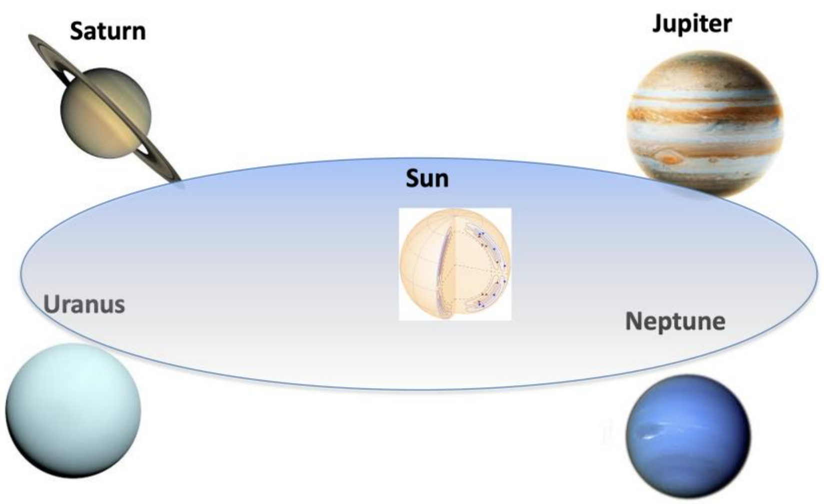

Figure 3. The Sun and the Jovial planets Jupiter, Saturn, Uranus and Neptune.

The planets have elliptic orbits around the Sun. A set of oscillating planet orbits is an oscillation planet system. The Planet System Oscillation (PSO) may be represented by the simplified model

Spso(Apso(), Tpso(), Fpso(t)) (1)

Where Apso() represents a set of planet elliptic orbits, Tpso() a set of planet periods and Fpso() the planet period phase state. The elliptic planet orbits have a time-variant amplitude Apso(). The planet Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune have the orbital periods: Tpso() = [Tme(0.3), Tve(0.6), Tea(1.0), Tma(1.9), Tju(11.862), Tsa(29.447), Tur(84.02), Tne(164.79)] (yr). The elliptic orbits of Saturn, Uranus and Neptune have a minimum distance to the Sun and a maximum orbit speed at perihelion when Fpso(per, t) = [,,Fsa(1826.78), Fur(1793.34), Fne(1876.67)](yr), respectively (Astronomical Almanac, USNO, Governmental Printing Office).

2.2 Grand Perihelion Coincidence

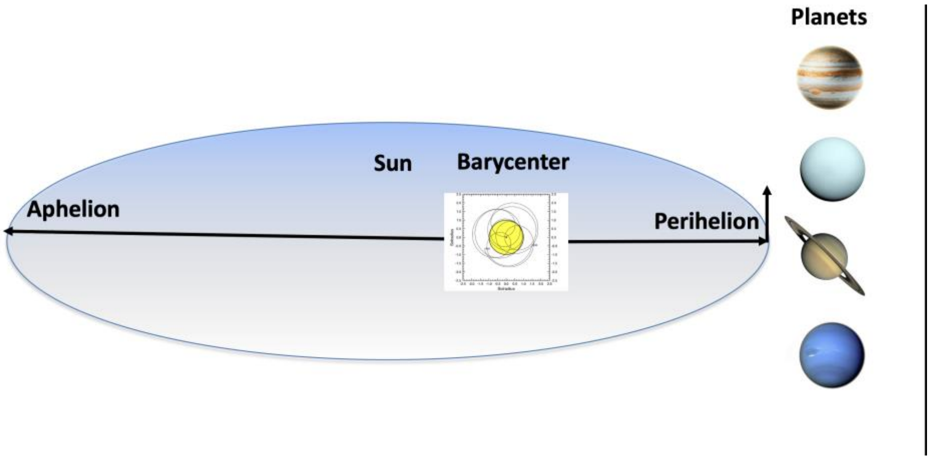

Figure 4. Planet perihelion Grand coincidence of Jupiter, Saturn, Uranus and Neptune.

The Planet System Oscillations (PSO) spectrum Spso(Apso(), Tpso(), Fpso()) have maximum speed and minimum distance from the Sun Apso(min) when the planet periods Tpso() have a perihelion coincidence Fpso(per), minimum speed and maximum distance from the Sun at the aphelion. The Barycenter represents the mass balance between the Sun and the moving planets. The planets elliptic orbits influence the mass balance between the Sun and the planets, which is compensated by a Solar Position Oscillation (SPO) close to the Barycenter. The planet system has a Grand Perihelion Coincidence (GPC) when all planets have a perihelion coincidence at the same time (Figure 4) and Grand Aphelion Coincidence (GAP) when all planets have aphelion coincidences at the same time. The GPC and GAP events influences maxima and minima in the Solar Position Oscillation, which is expected to influence maxima and minima in the sola dynamo and Total Solar Irradiation (TSI) from the surface form the Sun. GPC and GAP may then serve as a reference for solar forcing irradiation from the Sun and solar forcing climate variability on Earth.

2.3 Uranus-Neptune Perihelion Coincidences

2.3.1 The UN perihelion coincidence index

Grand Perihelion Coincidence between the Jovial planets has the longest coincidence time between the planets Uranus and Neptune. Uranus-Neptune (UN) perihelion coincidence is then expected to control the period time in UN perihelion variability. The perihelion coincidence between the planets Uranus and Neptune may be represented by the index model:

$$Aun(t) = \cos(2\pi(t-(Fun(per))/Tun) \qquad (2)$$

Where the amplitude Aun(t) = [Aur(t), Ane(t)], the period Tun() = [Tur(84.02), Tne(164.79)] (yr) and the period phase Fun(per) = [Fur(1798.34), Fne(1876.67)] (yr) represents the planets' phase vectors at perihelion. The planets have a maximum perihelion coincidence when Aun(max, t) = [Aur(t) +Ane(t)] = 2 and aphelion coincidence when Aun(min, t) = [Aur(t) +Ane(t)] = -2.

2.3.2 Uranus-Neptune coincidences envelope

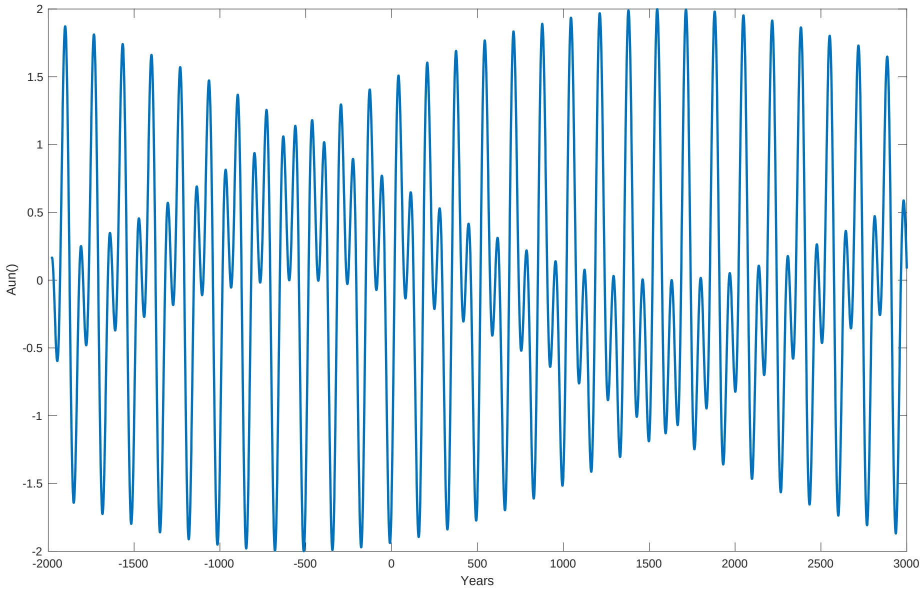

Figure 5. Uranus-Neptune perihelion coincidence sum [Aur(t)+Ane(t)] for years t = [-2000…3000].

Figure 5 shows the Uranus and Neptune (UN) perihelion coincidence index Aun(t) from 2000 B.C. to 3000 A.D. The UN coincidence index has an envelope maximum of Sun(Aur(min), Fur) = [-1.99, -512] and an envelope minimum of Sun(Aun(max), Fur) = [(1.990, 1379), (1.999, 1544), (1.996, 1714)]. The time difference [Sun(Aun(max), Fur)- Sun(Aun(mim), Fur)] = [1544+512] = 2056 years or a total envelope period of 4112 years. The total 4112-year coincidence envelope period has phase-shifts at: Sur(Aur(min/-0/max/+0)), Fur) = [(-1.99, -512), (-0, 516), (1.999, 1544), (+0, 2572)]. The number of coincidences in the total envelope period is 4112/Tne(164.79) = 25 coincidences. Uranus and Neptune have a phase coincidence of Tun(pco) = 1/(1/Tne - 1/Tur) = 171.42 years. The total envelope phase-coincidences are: 4112/Tpso(pco) = 4112/171.42 = 24 coincidences.

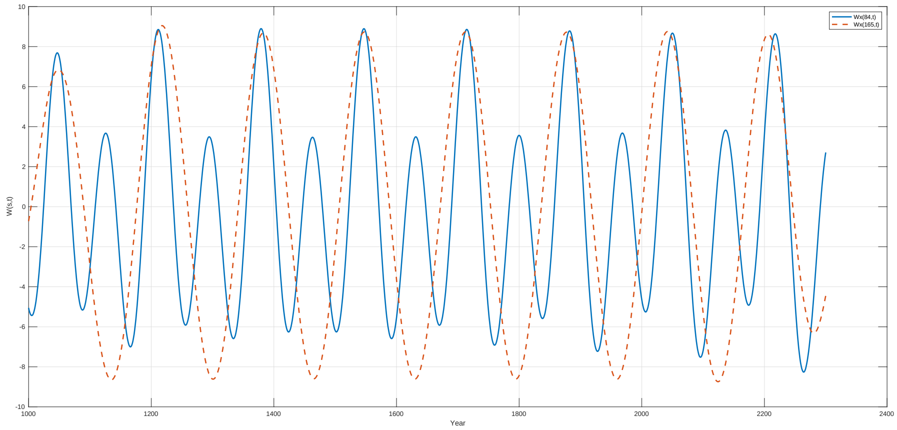

Figure 6. Uranus-Neptune periods Aur(t) and Ane(t) for the years t = [-1000...2300AD].

Figure 6 shows the perihelion coincidence periods of Uranus (Aur(t)) and Neptune (Ane(t)) from 1000 A.D. to 2300. The Figure 6 confirms a Grand Uranus-Neptune perihelion coincidence at the year 1544. The period coincidence difference between Uranus and Neptune is (2*84.03-164.79) = 3.25 years. From the Grand perihelion coincidence at the year 1544 A.D. each new UN coincidence is reduces by 3.25 years. After 25 UN coincidences, there is a total phase-difference of 25*3.25 = 81.25 years, which is close the Uranus period of 84.02 years.

2.3.3 The climate envelope period

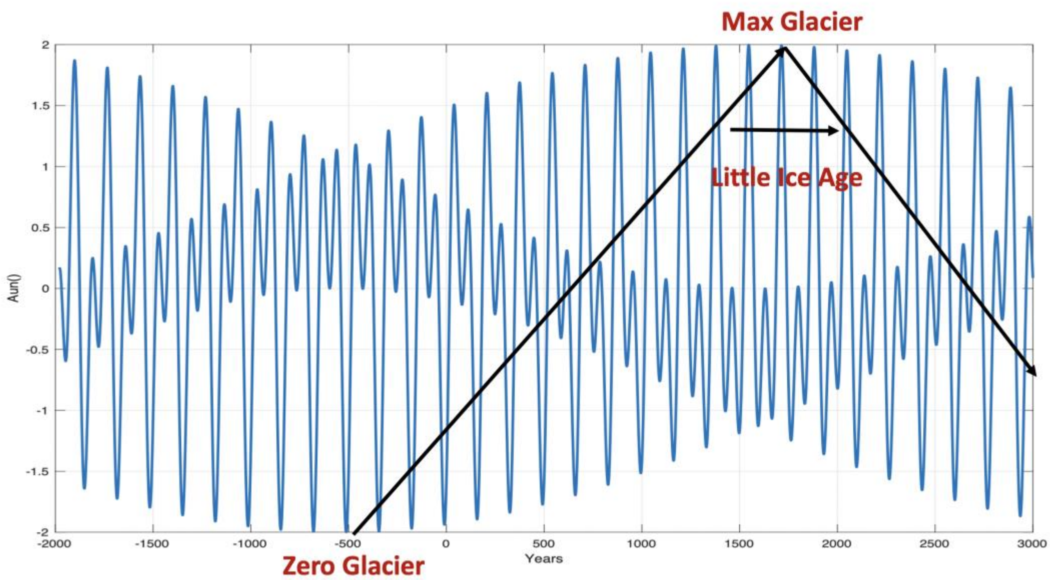

Figure 7. Uranus-Neptune perihelion coincidence sum [Aur(t)+Ane(t)] for years t = [-2000…3000], growth of glaciers (Brigsdalsbreen, Jostedalsbreen) in Norway and the Little Ice Age period.

The 4450-year climate envelope period

Norwegian glaciers (Briksdalsbreen, Jostedalsbreen) began to grow 500 B.C. and had a maximum extent in the year 1725 AD. [?] and a total envelope period of 4450 years. After its maximum spread in 1725, the glacier has begun to retreat. This growth period coincides with the Neptune-Uranus perihelion envelope period. One can then expect that the growth in the distribution of glaciers follows the envelope period. Glacier (min/max, F) = [(min, 512BC), (0, 1119), (max 1724), (0+, 2844), (min, 3962)], which indicates a warming period from 1725 to 3962 AD. (Figure 7.)

The Little Ice age

The Little Ice Age covers a time period from approximately 1300 to 1850 A.D. This time period covers the Uranus-Neptune perihelion coincidence periods [1386, 1546, 1710], where the year 1546 represents a perfect UN perihelion coincidence. The total cold period covers the years: [1386-Tne(165)/4 to 1714+3Tne(165)/4] or from 1345 to 1837AD, which cover a total period of 492 years. This time period has a coincidence maximum glacier extent as shown on Figure 7. The upcoming next UN perihelion coincidence at 2041 indicates an upcoming deep solar minimum and a new cold climate period from 2040 A.D.

2.4 Saturn-Uranus-Neptune Perihelion Coincidences

2.4.1 The SUN perihelion coincidence index

Grand Perihelion Coincidence between the Jovial planets Saturn, Uranus and Neptune (SUN) is expected to a have a shorter mutual coincidence time and more impact on the Solar Position Oscillation. The perihelion coincidence between the planets Saturn, Uranus and Neptune may be represented by the index model:

$$Asun(t) = \cos(2\pi(t-(Fsun(per))/Tsun) \qquad (3)$$

Where the amplitude Asun(t) = [Asun(t), Aur(t), Ane(t)], the periodTsun() = [Tsa(29.447), Tur(84.02), Tne(164.79)] (yr) and the period phase Fsun(per) = [Fsa(1826.76), Fur(1798.34), Fne(1876.67)] (yr) represents the planets' phase vectors at perihelion. The planets have a maximum perihelion coincidence when Asun(max, t) = [Asa(t) + Aur(t) +Ane(t)] = 3 and aphelion coincidence when Asun(min, t) = [Asa(t) + Aur(t) +Ane(t)] = -3.

2.4.2 SUN envelope coincidence

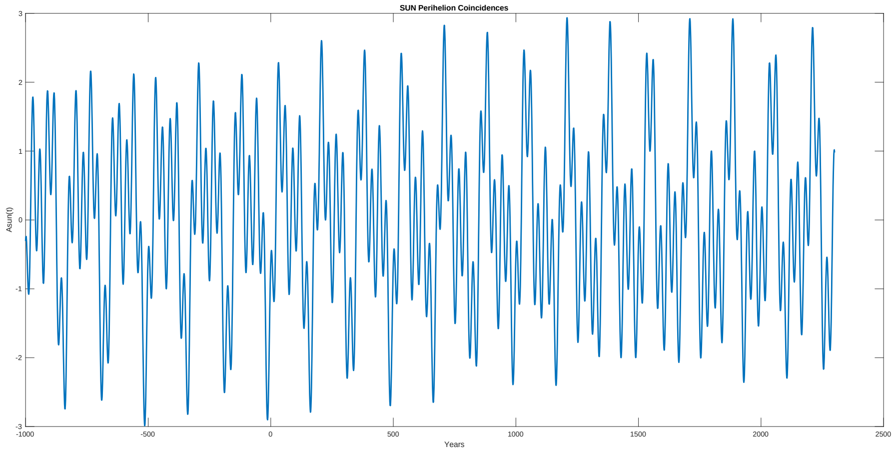

Figure 8. Computed Saturn, Uranus and Neptune perihelion coincidence index Asun(t) from 1000 B.C to 2300 A.D.

Figure 8. shows the computed [Eq. 3] Saturn-Uranus-Neptune (SUN) perihelion coincidence index Asun(t) from 1000 B.C. to 2300 A.D. The coincidence index has a global maximum and a minimum of: Ssun(Asun(max, min), Fsun) = [(2.923, 1710), (-2.989, -512)]. The perihelion coincidences cover a total envelope period of: Tsun(pco, max) = 2(1710+512) = 2*2222 = 4444 years. The envelope period has phase-shifts of: Ssun(Asun(min/max)), Fsun) = [(-2.999, -512), (-0, 599), (2.996, 1710), (+0, 2821)]. In the 4444-year envelope period there are: Tsun(pco, 4444)/Tsun(pco, 177.77) = 25 SUN perihelion phase coincidences, in a mean period of: Tsum(mco) = [154Tsa + 53Tur + 27Tne]/3 = 4479.08 years.

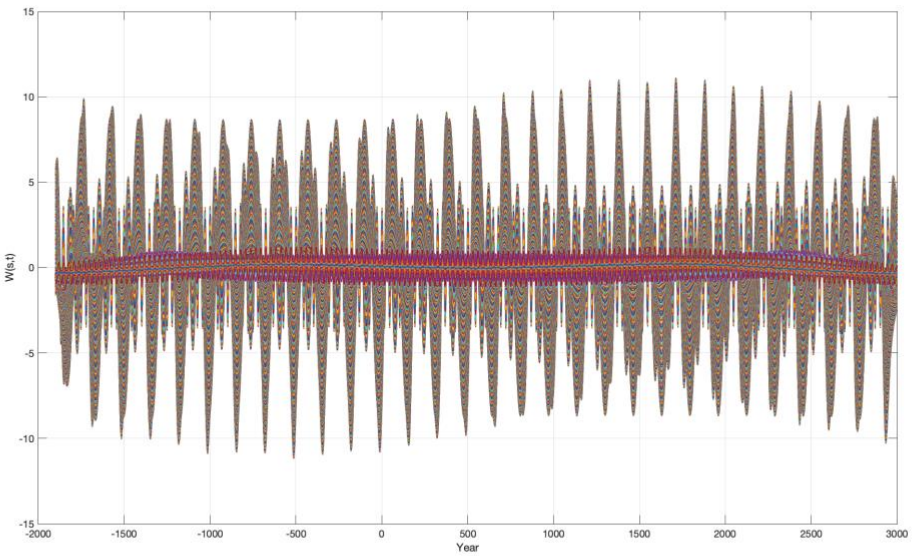

Figure 9. Wavelet spectrum Wsun(s, t) of SUN coincidences [Eq. 3] from 2000 B.C. to 3000 A.D.

Figure 9 shows the wavelet spectrum Wsun(s, t) of SUN coincidences [Eq. 3] from 2000 B.C. to 3000 A.D. The wavelet spectrum confirms the 4444-year envelope period that has a minimum close to 512 B.C. and maximum close to 1710 A.D. At the same time the wavelet spectrum reveals the maximum periods have longer negative periods.

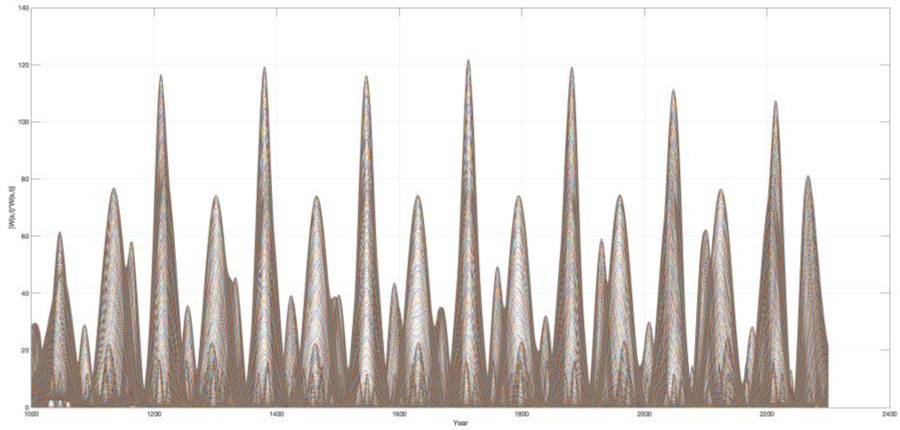

Figure 10. SUN perihelion coincidence wavelet power spectrum WPsun(s, t) for t = 1000…2300 and s = 1…500.

Figure 10 shows SUN perihelion wavelet power spectrum WPsun(s, t) = Wsun(s, t)Wsun(s, t) for t = 1000...2300. The power spectrum has maxima of: WPpso(max, Fpso) = [(60, 1046), (77, 1135), (119, 1389), (116, 1546), (121, 1713), (118, 1886), (110, 2047), (107, 2214)]. The power spectrum amplitude represents a SUN perihelion coincidence index. The power spectrum has a maximum 121 at the year 1713, which has a coincidence to the Maunder solar minimum periods. At the year 2047 the power index is reduced to 110, which indicates less perihelion coincidence between SUN periods.

SUN Mean period coincidence spectrum

The planet periods Tpso() have coincidence periods when two or more planets have a coincidence period of: [A*Tpso(1), B*Tpso(2), Tpso(3)]. The autocorrelation spectrum WA(Rsun(s), m) confirm SUN coincidence periods of: Tsun(co) = [(6Tsa, 2Tur, 1Tne), [(11Tsa, 4Tur, 2Tne), (17Tsa, 6Tur, 3Tne), (34Tsa, 12Tur, 6Tne), (27Tsa, 24Tur, 10Tnr), (83Tsa, 29Tur, 15Tne), (154Tsa, 53Tur, 27Tne)] (yr), which have mean coincidence periods of Tpso(mco) = [169.84, 329.86, 499.70, 999.39, 1780.95, 2450.84, 4289.61 4479.08] (yr).

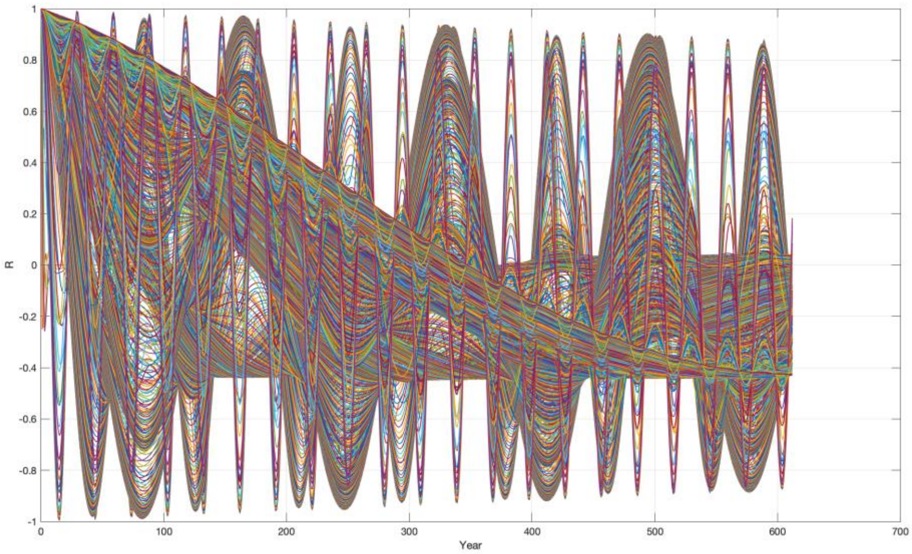

Figure 11. Wavelet spectrum autocorrelation of SUN perihelion coincidences Asun(t) [Eq. 3] 2000 B.C.

A wavelet transform of the SUN perihelion coincidences computes the correlation of all possible periods into a wavelet spectrum Wsun(s, t) (Fig 11). Figure 8 shows the computed autocorrelation spectrum WAsun(R(s), m) of all wavelets in the wavelet spectrum Wsun(s, t). The autocorrelations (Figure 9) confirm a maximum correlation R(max) to the first periods m = [29, 84, 163] and to coincidence periods close to m = [85, 170, 330, 500,,,,] (yr).

SUN Planet phase coincidence

The planet periods Tpso(1) and Tpso(2) have a Planet Phase Coincidence of: Tpso(pco) = 1/(1/Tpso(1)-1/Tpso(1)). Uranus and Neptune have a phase coincidence of Tun(pco) = 1/(1/Tne - 1/Tur) = 171.42 years. Tun(pco, 171.42) and Saturn period Tsa(29.44) have a phase coincidence of: Tsun(pco) = 177.77 years, which is close to the 179-year Jose period. The period phase coincidence Tsun(pco) and the mean period coincidences Tsun(mco) have coincidence periods of: Tsun(pmco) = Tsun(pco,177.77)[1, 2, 3, 6, 10, 24, 25] = [177.77, 355.55, 533.32, 1066.64, 1777.73, 2488.83, 4266.56, 4444.33] (yr).

2.4.3 SUN coincidence index from 1000 to 2100 A.D.

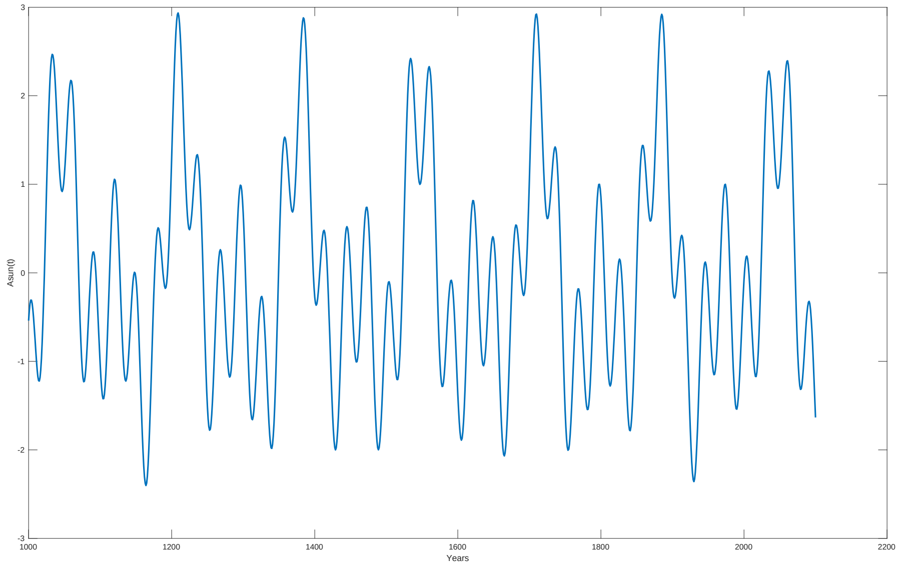

Figure 12. The Saturn, Uranus and Neptune perihelion coincidences Asun(t) (Asa(t)+Aur(t)+Ane(t)) (blue) for years t = [1000…2100].

Figure 12 shows the SUN perihelion coincidences Asun(t) = (Asa(t)+Aur(t)+Ane(t)) from 1000 A.D. to 2200 A.D. The coincidence index has a maxima coincidence of Ssun(Asun(max), Fsun) = [(2.936, 1209), (2.869, 1385), (2.923, 1710), (2.898, 1886), (2.793, 2210)] in time distances of [176, 325 ,176, 325] (yr) which is close to the coincidence periods [Tsun(pco, 177), Tsa(324), Tsun(pco, 177), Tsa(324)] (yr) or [6Tsa, 11Tsa, 6Tsa, 11Tsa] (yr), which reveals that maxima are controlled by 11Tsa(29,447) periods.

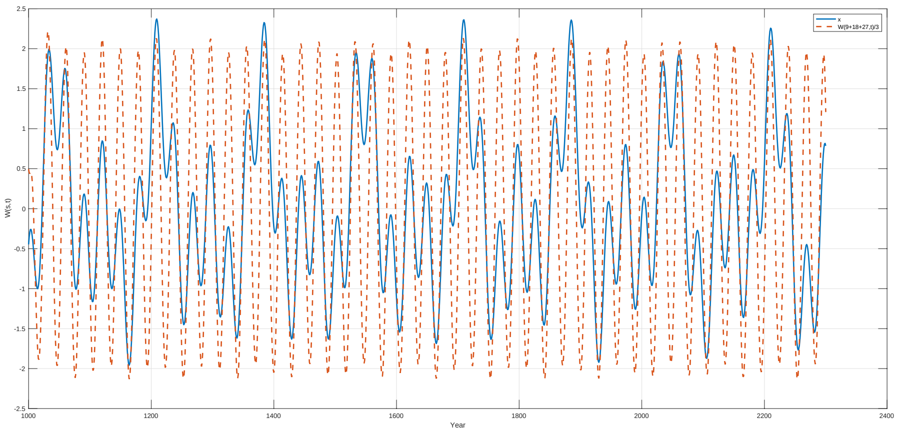

Figure 13. The Saturn, Uranus and Neptune perihelion coincidences Asun(t) (Asa(t)+Aur(t)+Ane(t)) (blue) and Asa(t) (dotted red) for years t = [1000…2100].

Figure 13 shows the SUN perihelion coincidences Asun(t) = (Asa(t)+Aur(t)+Ane(t)) and the Saturn period Tsa(t) perihelion coincidence Asa(t) from 1000 A.D. to 2200 A.D. The Figure 12 shows that the Saturn period has a perfect inverse coincidence at the year 1544 when the UN had a Grand perihelion coincidence at the year 1544. Between the UN perihelion coincidences at the year 1544 and 1710, the Saturn period Tsa(29.44) has 5.6 periods, which causes a SUN perihelion coincidence close to the year 1710. The reverse relation between UN and Saturn has inverse Grand coincidences at the years [1047, 1547, 2047], in distances of [500, 500, 500] (yr) or periods of [17Tsa, 17Tsa, 17Tsa] years.

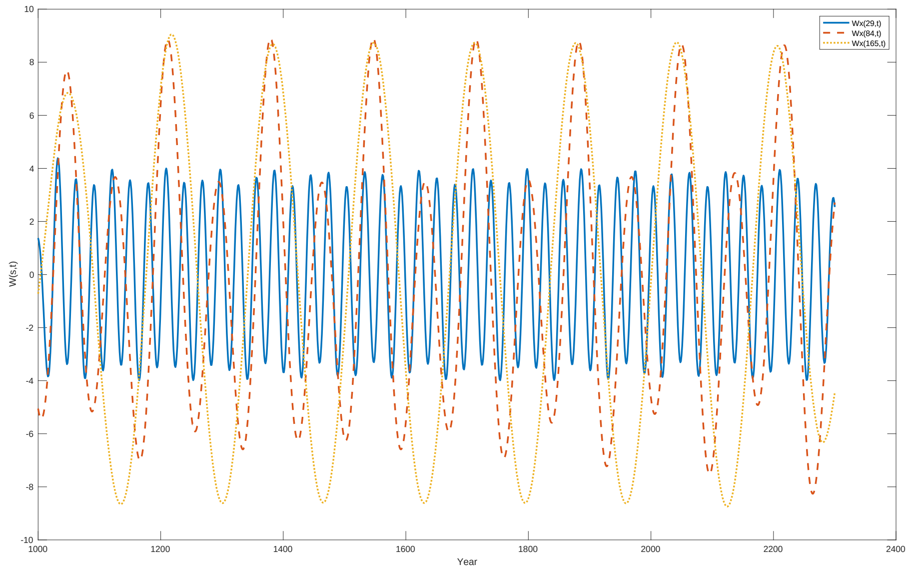

Figure 14. Wavelet periods of Saturn Asa(29, t), Uranus Aur(84, t) and Neptune Ane(164, t) period perihelion coincidence from 1000 to 2200 A.D.

Neptune and Saturn have a [17Tsa(29.44), 3Tne(164.798)] = [500.60, 494.37] (yr.) or a period relation close to 17/3= 5,67. The period relation introduces a temporary shift between SUN coincidences as shown on Figure 14. The uneven difference 0.67 introduces 2 UN coincidences and then 2 SUN coincidences.

Planet Grand perihelion positions coincidences

Neptune:	[1050, 1217, 1386, 1546, 1710, 1876, 2041, 2204]
Uranus:	[1047, 1212, 1379, 1547, 1714, 1882, 2050, 2218].
Saturn:	[1033, 1209, 1385,1565, 1710, 1886, 2062, 2210]
Max diff.	**[0017, 0008, 0007, 0019, 0004, 0010, 0017, 0012**

Solar minimum coincidence

An adjustment-free reconstruction of the solar activity over the last three millennia confirms four Grand minima since the year 1000A.D: [Oort (1010–1070), Wolf (1270–1340), Spörer (1390–1550), Maunder (1640–1720), Dalton(1790 - 1820)], (Usoskin et al., 2007). The planets Saturn, Uranus and Neptune have Grand perihelion coincidence close to the years: 1050, 1217, 1386, 1546, 1710, 1876, which reveals a coincidence difference of: [0, 53, 0, 0, 0, 56] years. Det difference indicates that [Oort, Spörer, Maunder] type solar activity is associated with SUN perihelion coincidences. [Wolf, Dalton] solar activity is associated with SU-perihelion coincidences.

2.5 The Deep Freeze in 1709

Le lagon gelé en 1709, by Gabriele Bella, part of [redacted] a lagoon which froze over in 1709, Venice, Italy.

The 4444-year Saturn-Uranus-Neptune perihelion coincidence envelope period: Ssun(Asun(min/max)), Fsun) = [(-2.999, -512), (-0, 599), (2.996, 1710), (+0, 2821)] is close to perfect perihelion coincidences at the year 1710 AD. The year 1709 is known as «The Deep Freeze». This year was the coldest winter ever recorded. The lagoon froze in Venice, Italy. In France the temperature was -20 degrees Celsius, rivers, canal network, and ports froze. Bread, meat, and even some alcoholic drinks froze solid. Only hard liquors such as vodka, whiskey, and rum remained liquid [7]. The population dropped by 600.000 from 1709 to 1710. In London, iced over the Thames River. The canals and port of Amsterdam suffered a similar fate. The Baltic Sea was solid for four whole months, and travelers were reported crossing on foot or by horse from Denmark to Sweden or Norway [7].

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