The Influence of Solar System Oscillation on the Variability of the Total Solar Irradiance

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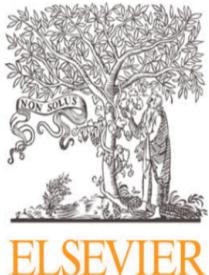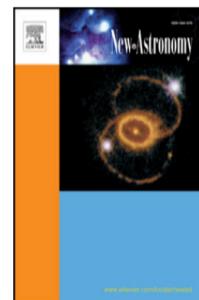
The influence of solar system oscillation on the variability of the total solar irradiance

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HIGHLIGHTS

- Deterministic TSI periods
- TSI variability control by large planets
- Next Dalton TSI minimum

Outline

Background/ Research Quest/ Importance

- B: Sun > Earth > Climate
- Q: TSI > Chaotic, or deterministic?
- I: Understand sun, predict climate

Research Approach /Methods

- A Cause of Causes?
- Data series analysis
- Reference to CoC
- Deterministic model
- Reference to known minimum
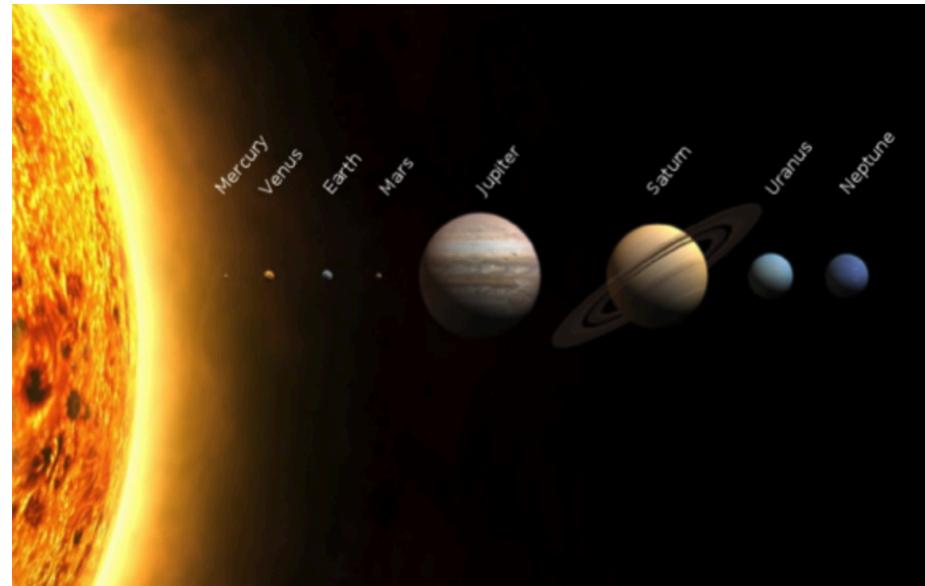
Results / Implication

- Deterministic TSI periods: Jupiter, Saturn, Uranus, Neptune
- Explain climate periods over last 1000 years
- Next Dalton TSI minimum in 2040

B: Sunspots and Sun variability

The Sunspots
- **11-year period**
- **The Sun activity**
- **A climate indicator**
- **Pure understood**

B: Sunspots and sun variability

A climate indicator

- The Maunder period
- The Dalton period
- Warm period

Question

- Sunspots -> Warm climate
- A climate turning?
- A new Maunder period?

New Question

- Sunspots =/= TSI
- Is it deteministic?
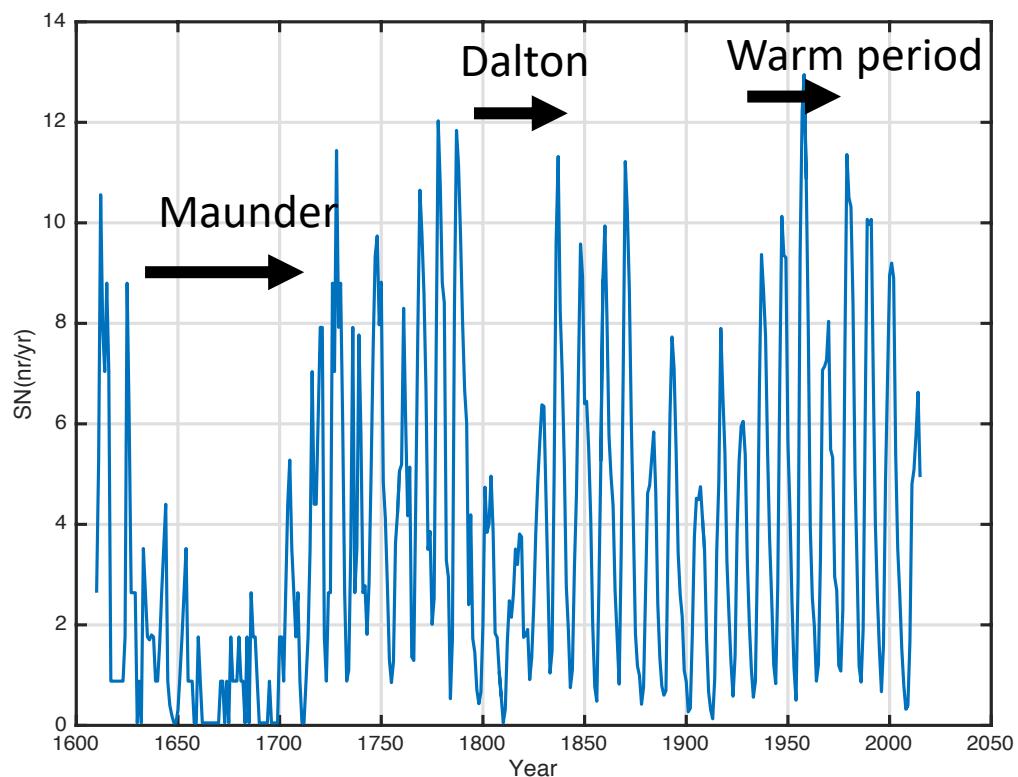
The Motive of Science

The motive of science is:
- To compute the future
- To control the future

But, is the future deterministic?
- If not,
- We can only explain the past

-- Francis Bacon (1561-1626)

The Research Questions

Is the Total Solar Irradiation (TSI) from the sun, deterministic?
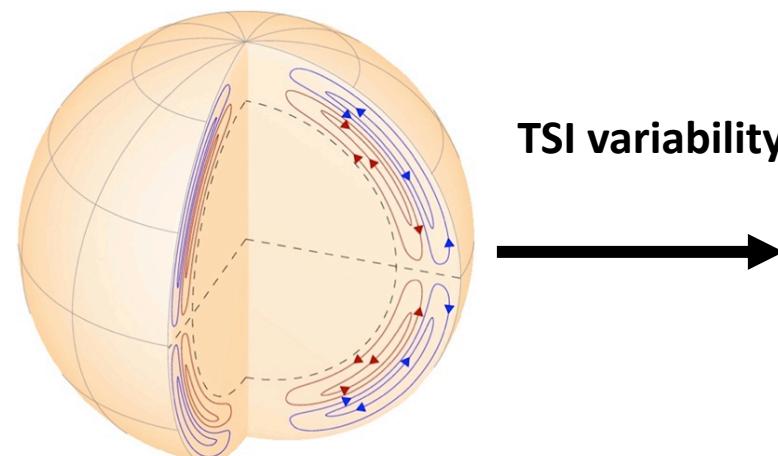
TSI variability

If deterministic TSI

Better understanding of Sun dynamo dynamics


TSI variability

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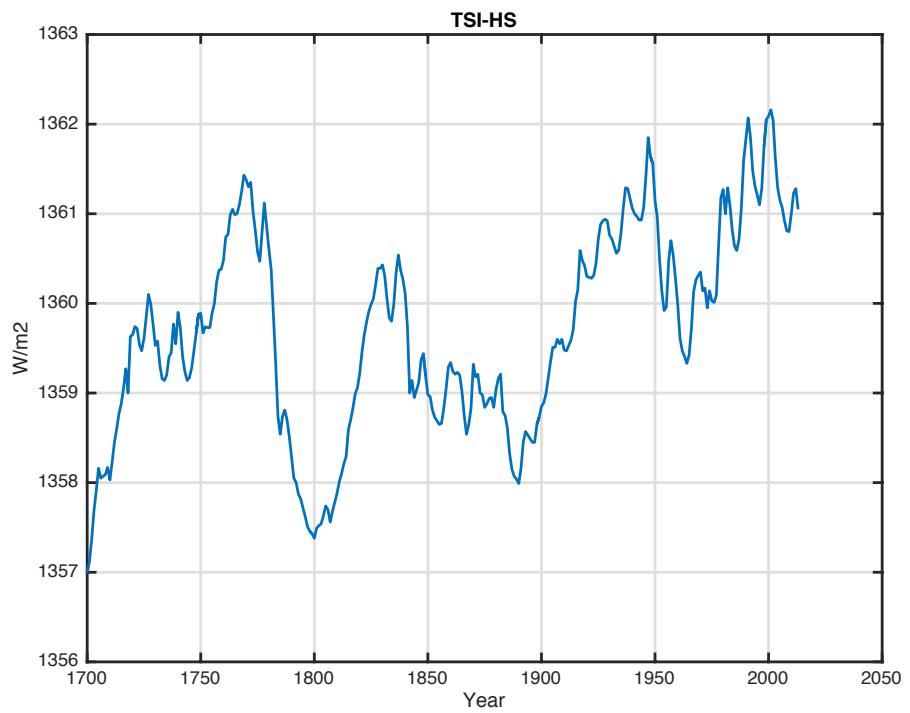
If deterministic TSI

Better understanding of Earth climate variability
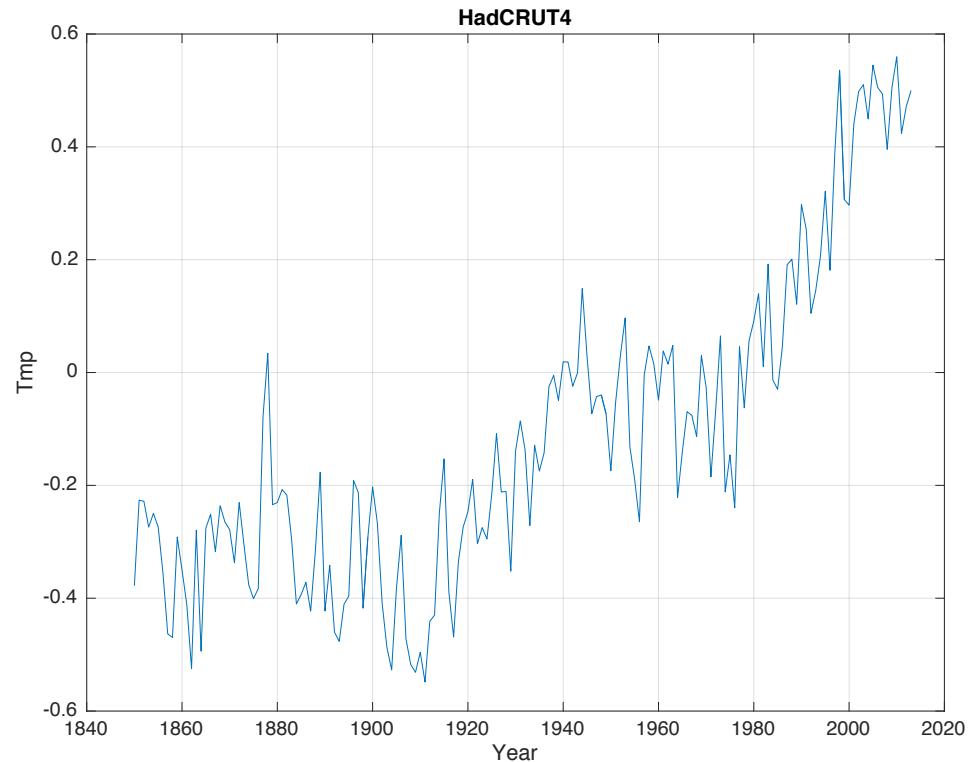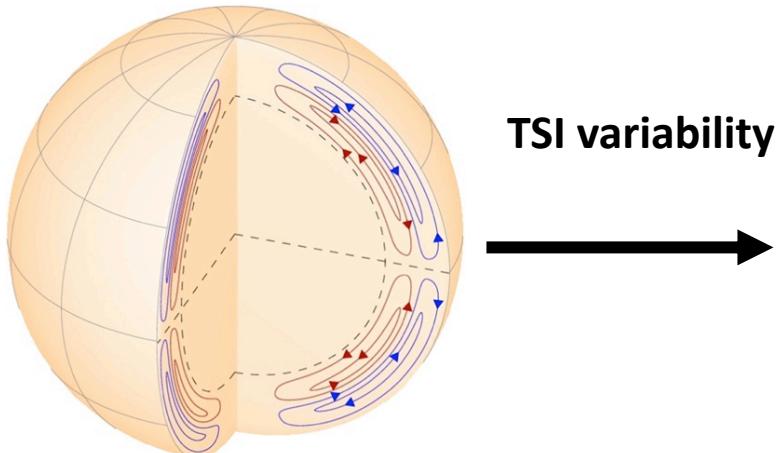

TSI variability

The Sun TSI variability

- **Is there an external deterministic force on the sun?**
- **A first Cause of causes?**
- **That has control of TSI variability?**

A force

TSI variability
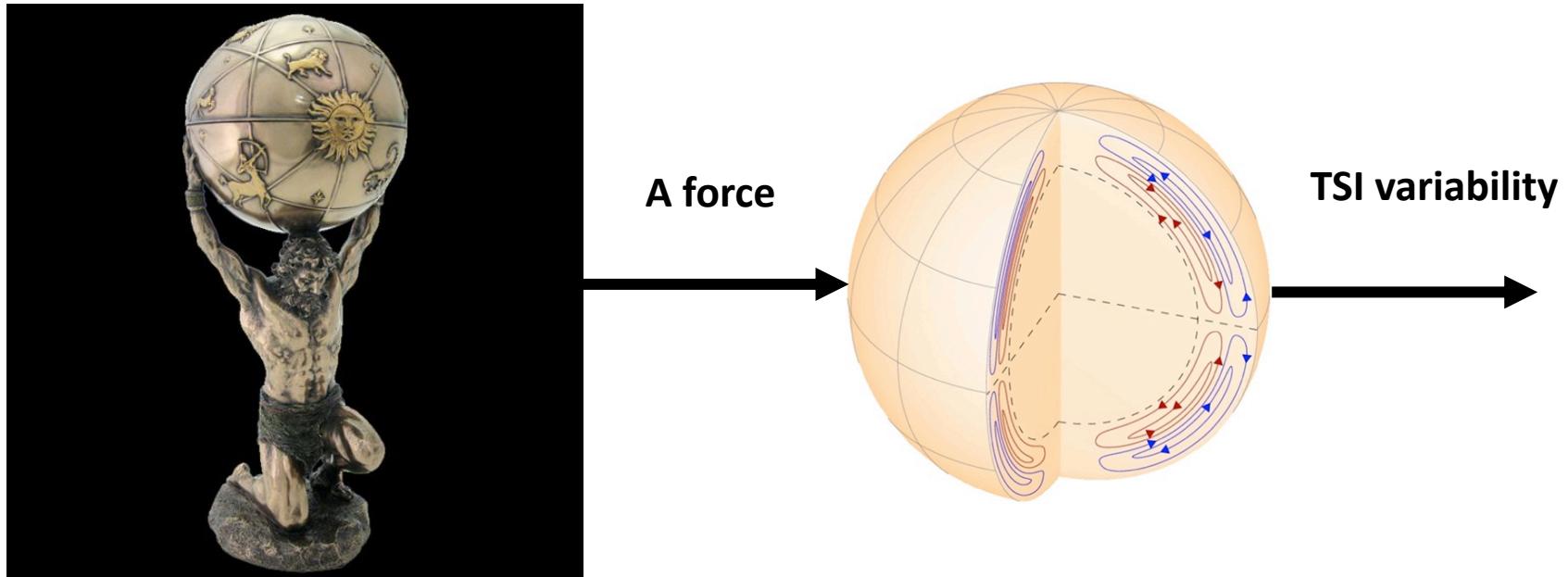
The Solar System oscillation

An Oscillating Gravity force from the 4 large planets Influences The Sun Barycenter position

Jupiter

Saturn
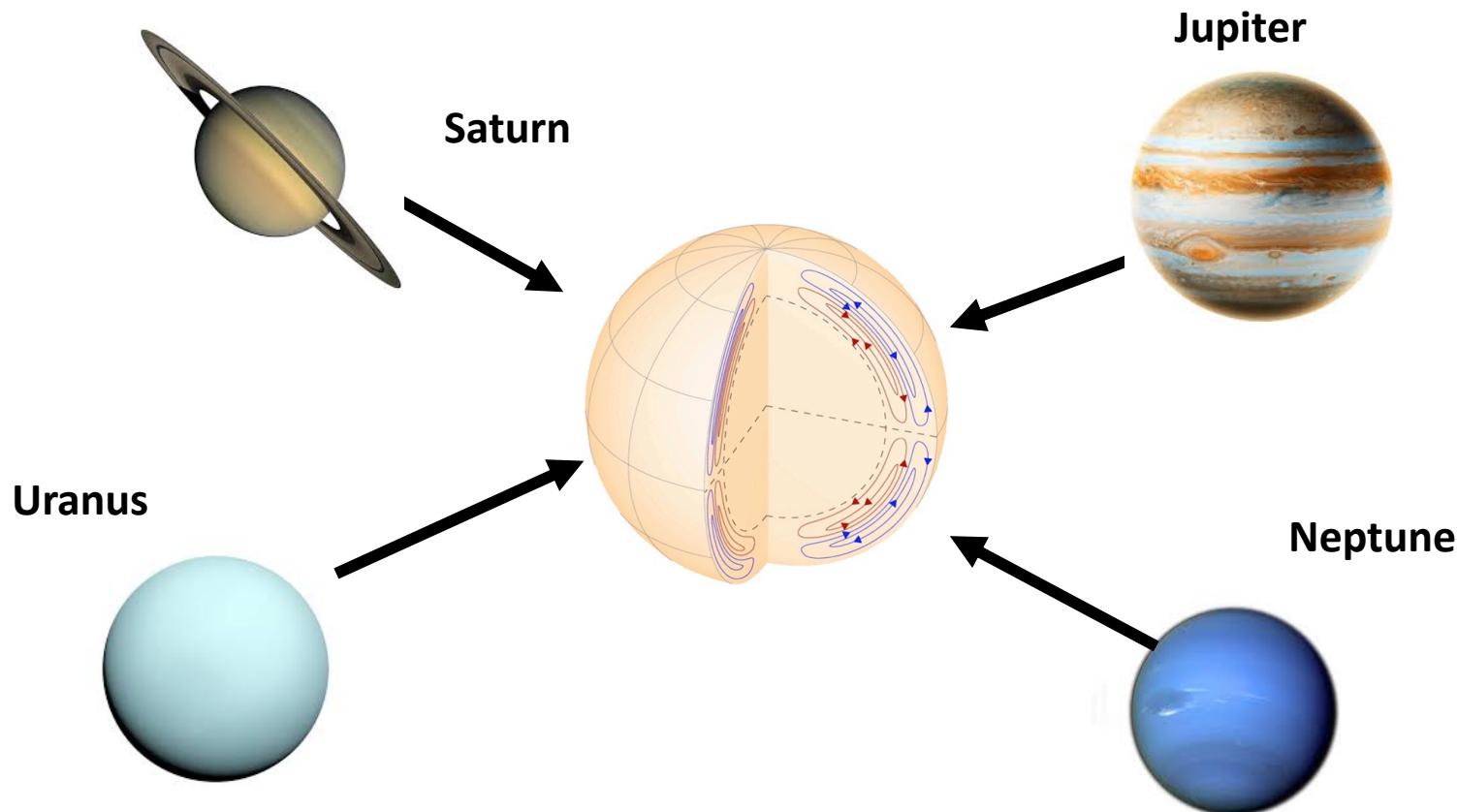
Uranus

Neptune

The Sun Barycenter oscillation

**The sun oscillation
Looks complex**

The Solar Position Oscillation
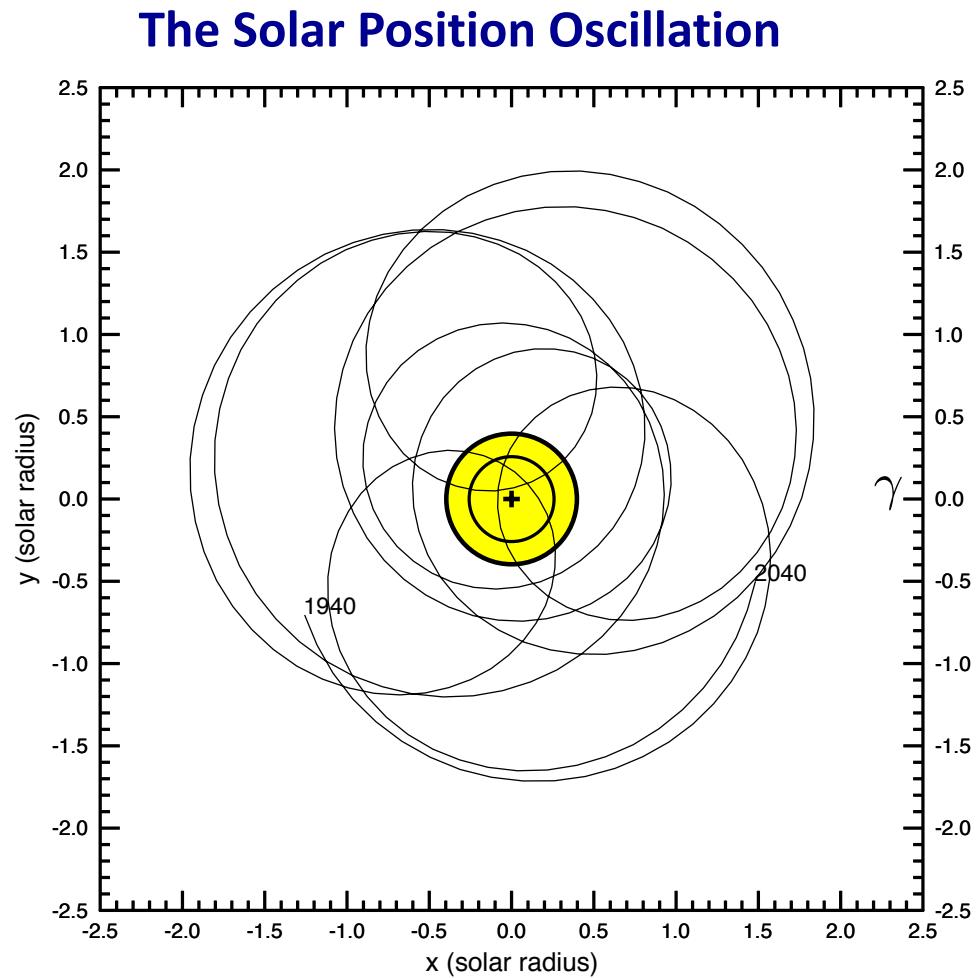
The Sun Position Oscillation

After a wavelet analysis
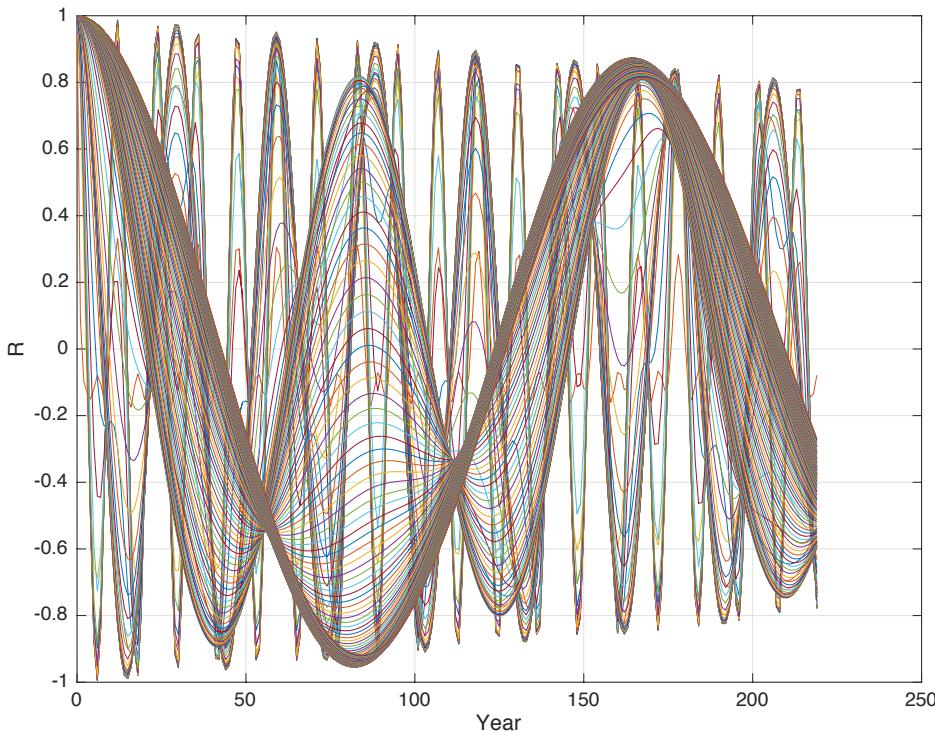
Shows:

Periods from the 4 large planets: Jupiter=11, Saturn=29, Uranus=84 , Neptune=164 years

And we have period references For TSI variability

Oscillating Sun Dynamo

Oscillating planet gravity =>
Oscillating sun dynamo

Planet
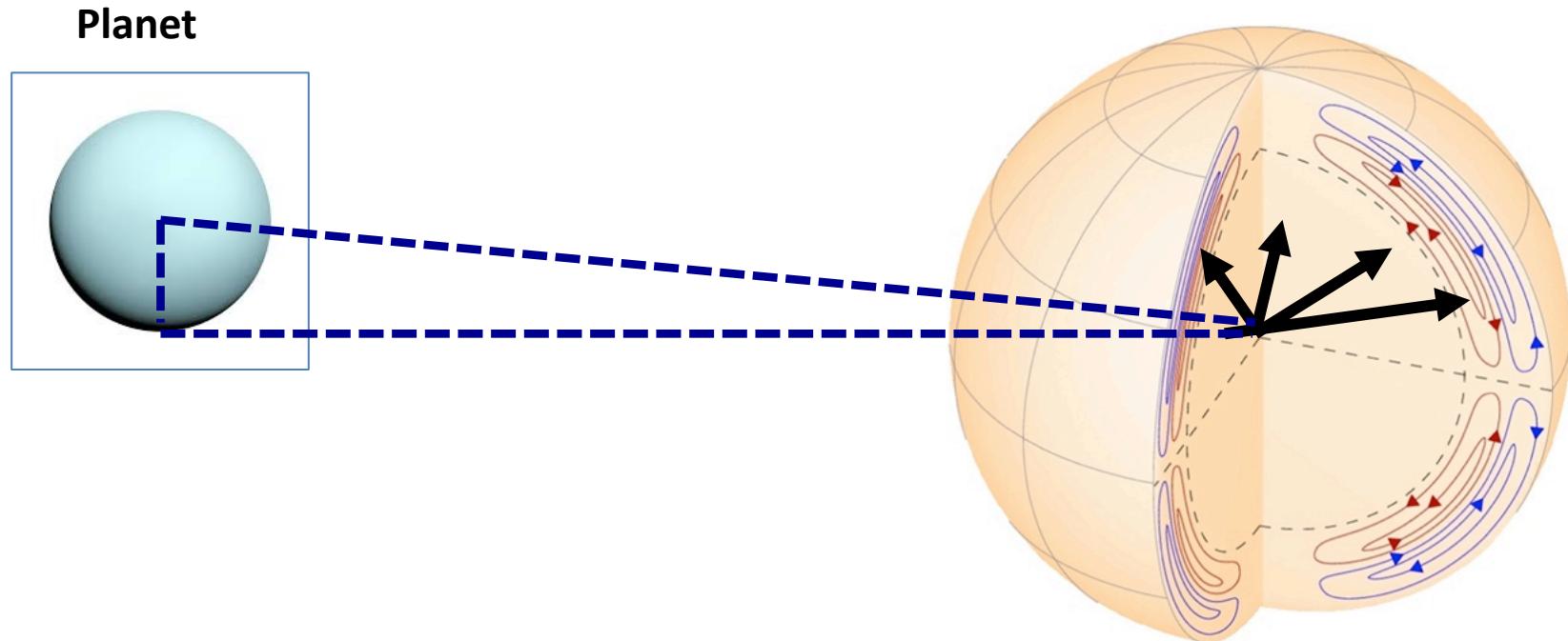
Total Solar Irradiation from 1700

The TSI-HS data series

- From 1700-2014
- Growth in 300 years
- Are fluctuation
- The next minimum

Question

- Is it deterministic?
- A next minimum?

TSI-HS
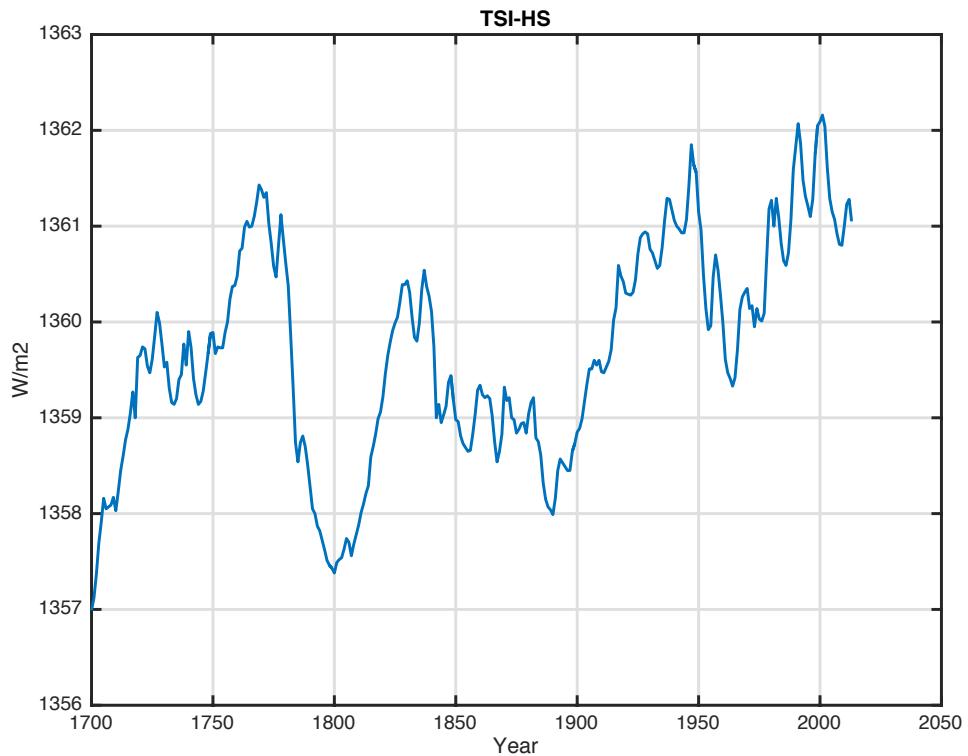
Total Solar Irradiation Periods

TSI data periods:

- 11-yr period

- 29-yr period

- 84-yr period

- 167-yr period

Periods sources:

- 11-yr => Jupiter

- 29-yr => Saturn

- 84-yr => Uranus

- 167-yr => Neptune
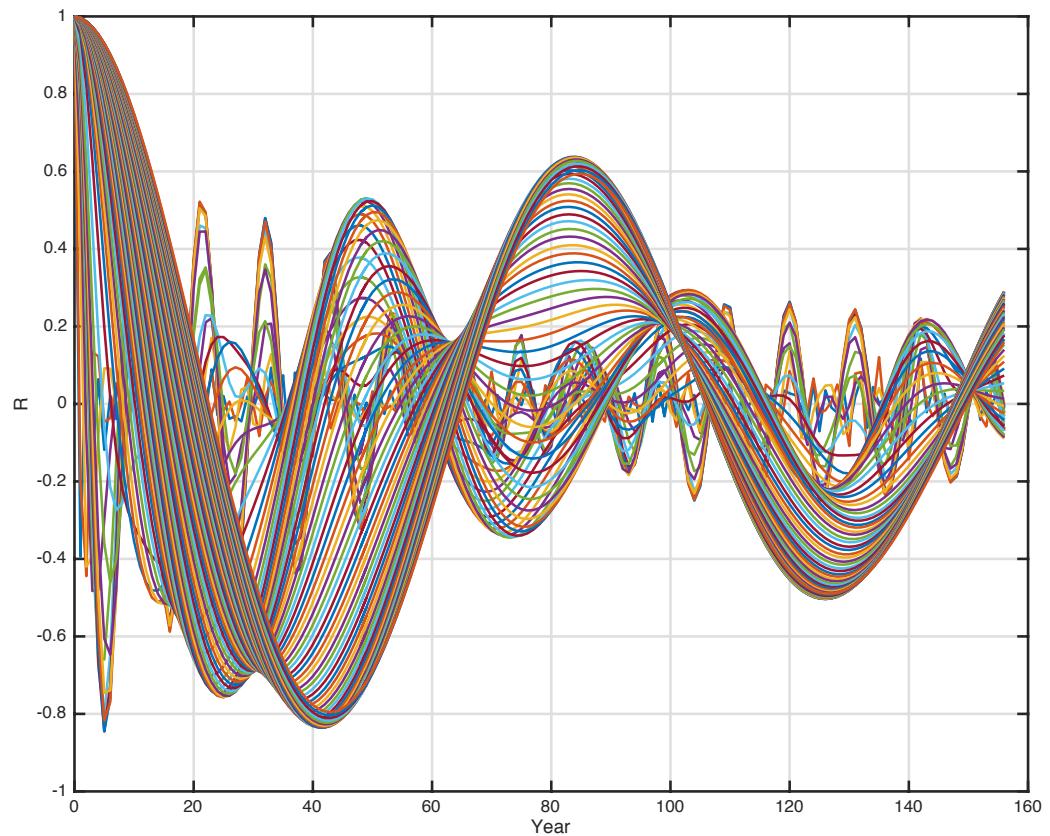
The Uranus and Neptune period

Periods sources:

- 84-yr => Uranus

- 186-yr => Neptune

Influence:

Min: 1800

Growth: 1800-2000,
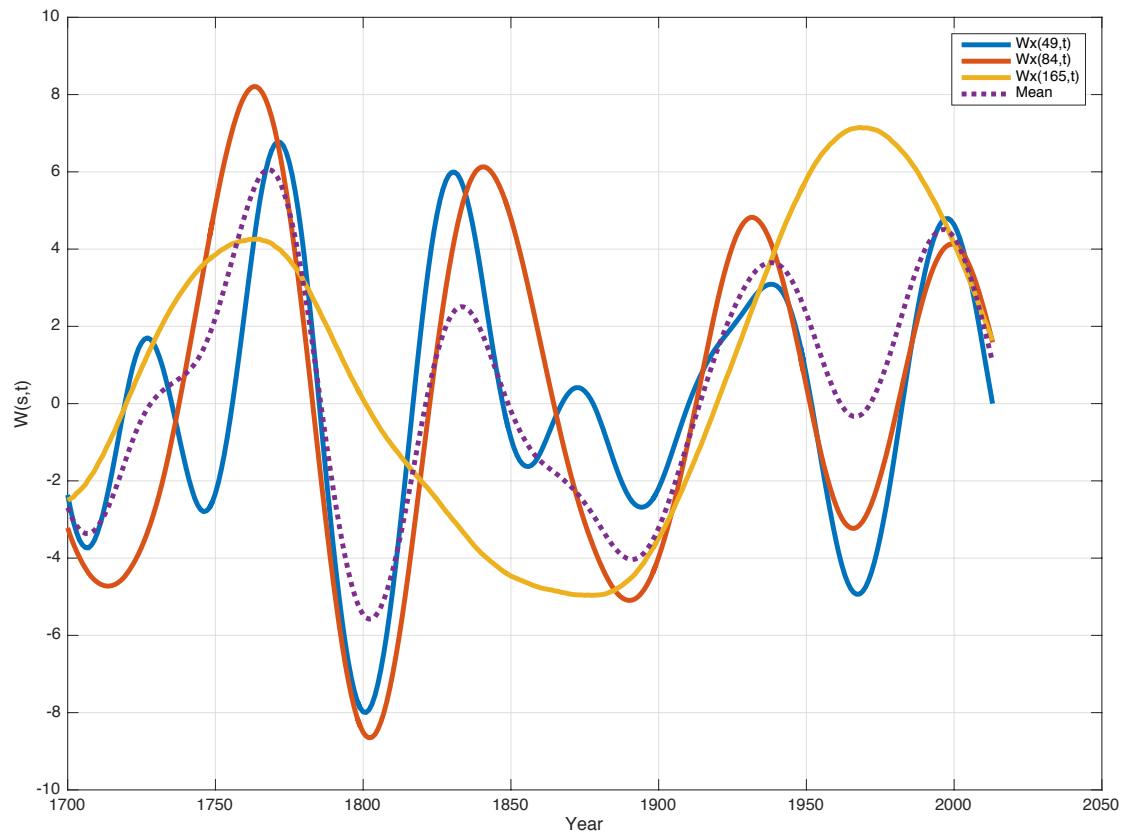
Total Solar Irradiation from 1000

The TSI-LS data series

- From 1000-2100

Question

- Is it deterministic?
- Minimum periods?
- A next minimum?
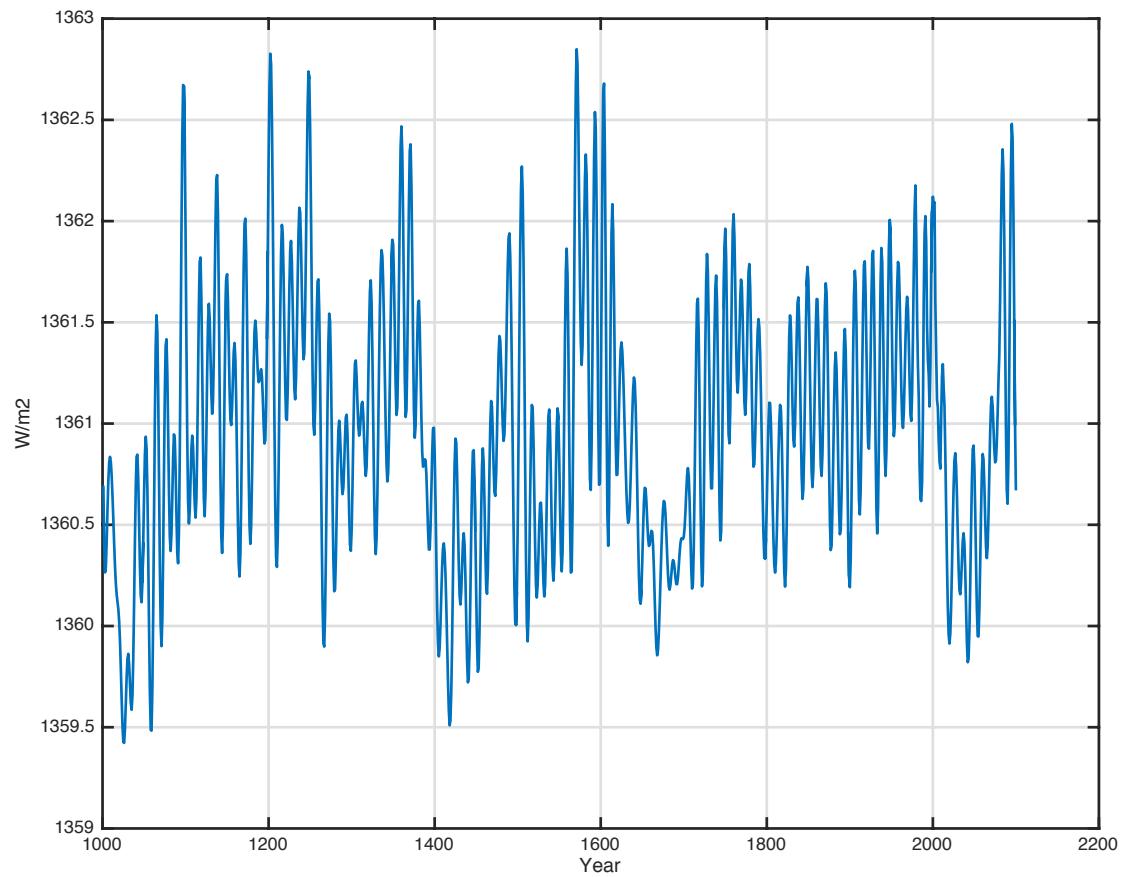
1000 yr Total Solar Irradiation Periods

1k yr TSI-LS periods
- 125 yr period
- 210 yr period
- 375 yr period

Related to
- 84-yr Uranus
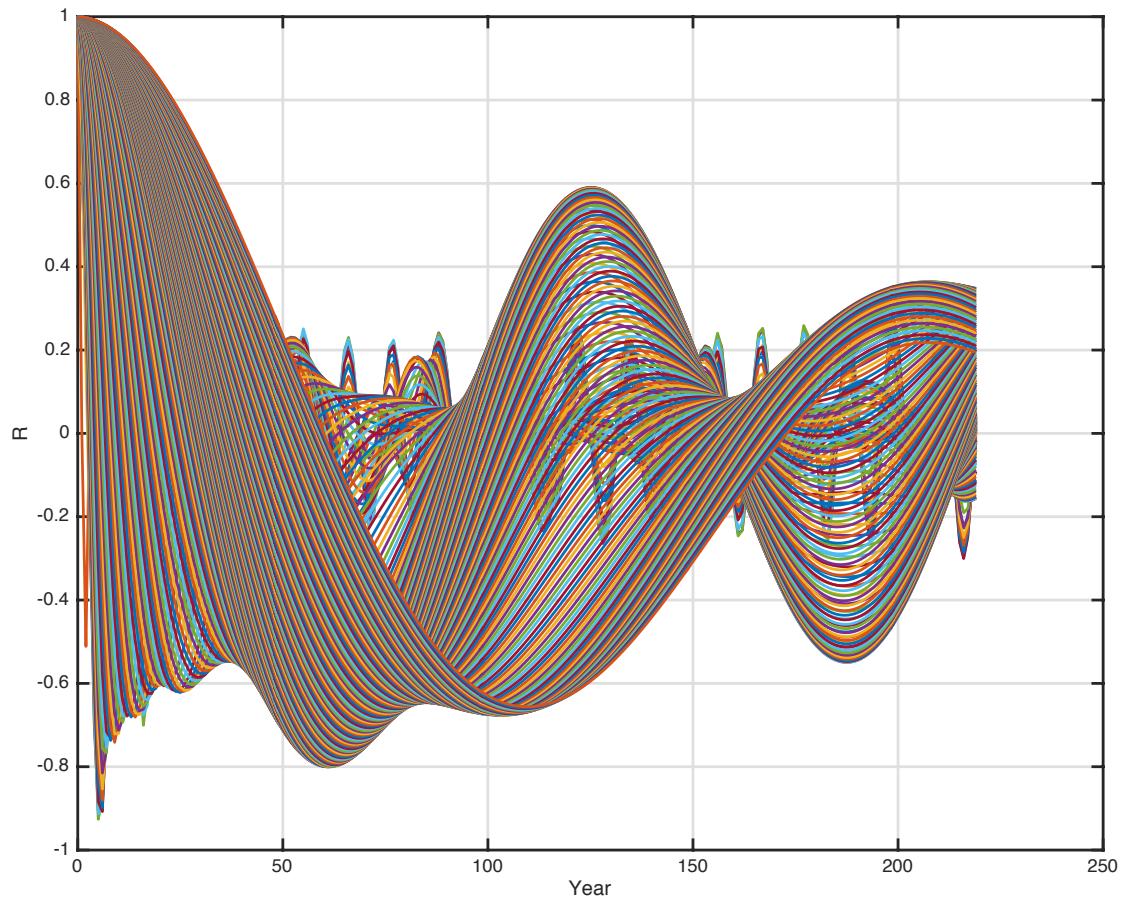
1000 yr Total Solar Irradiation Periods

Cold Climate Periods
-	Result: Periods

Next Cols Climate Periods
-	Result: Periods
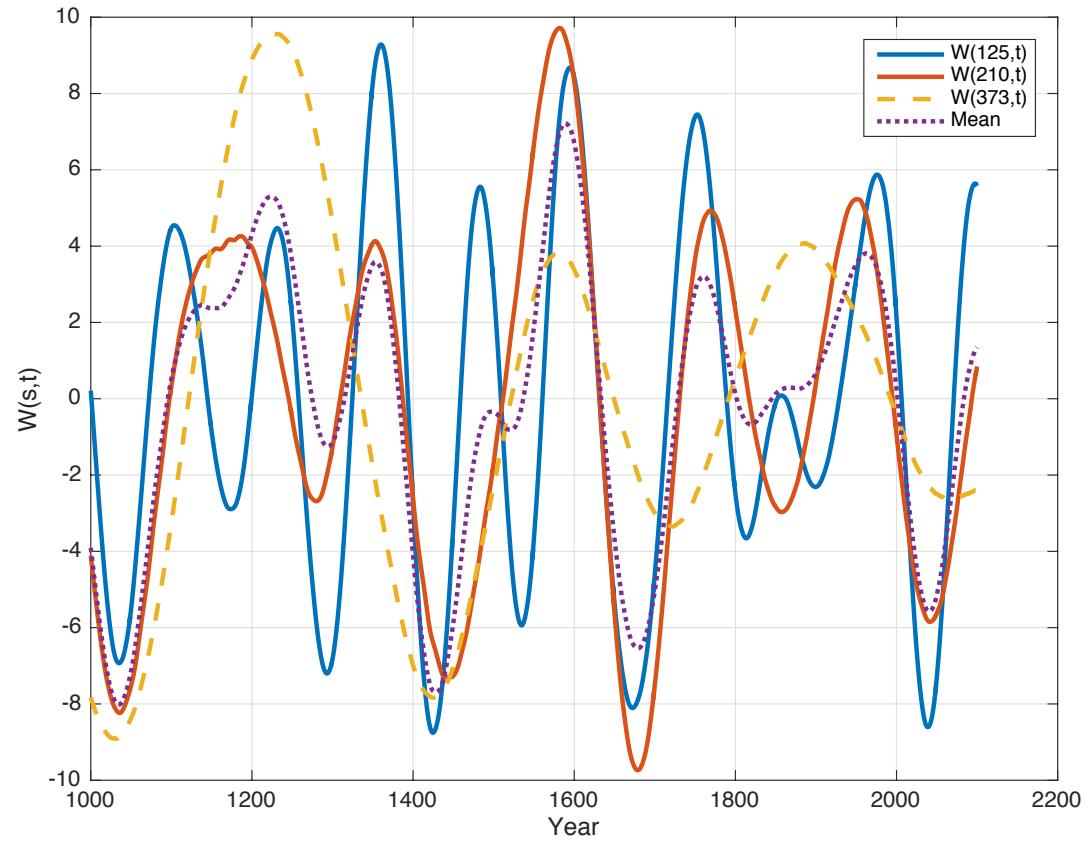
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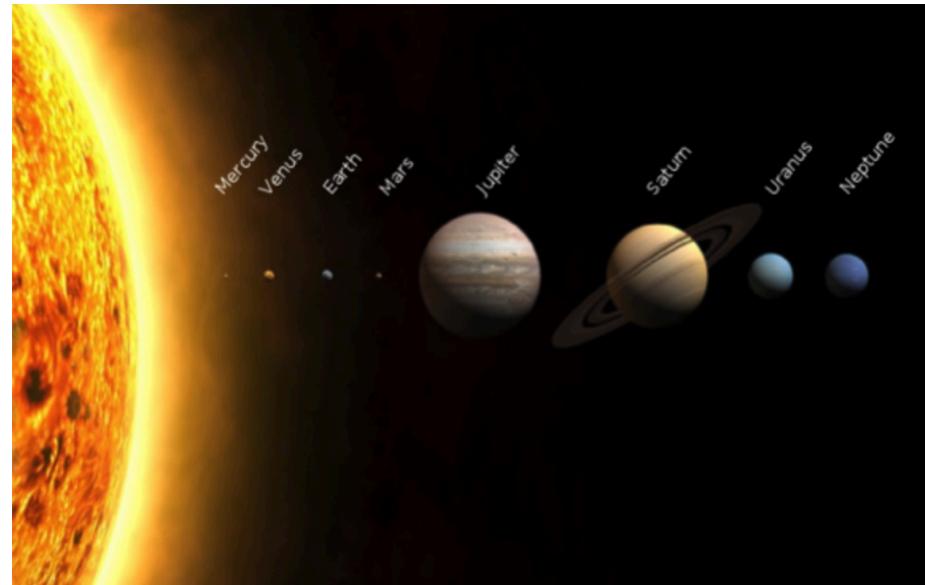
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- Explain climate periods over last 1000 years

- Next Dalton TSI minimum in 2040

Identified Stationary Periods

The stationary periods

Data	Per, R	Per, R	Per, R	Per, R	Per, R	Per, R	Per, R	Per, R
Planet period	P(Jupiter, 11.862)	P(Saturn, 29.447)	P(55= 2*84.02/3)	P(Uranus, 84.02)	P(110= 4*84.02/3)	P(Neptune, 164.79)	P(210= 3*84.02/2)	P(373= 5*84.02/2)
SPO	P(spoy,12), R=0.98	P(spoy,29), R=0.95		P(spoy,84), R=0.9		P(spoy,165), R=0.9		
TSI-HS	P(hs,11), R=0.55			P(hs,84), R=0.65		P(hs,164), R=0.7		
TSI-LS	P(ls,11), R=0.8	P(ls,29), R=0.2		P(ls,83), R=0.17	P(ls,125), R=0.6		P(ls,210), R=0.35	P(ls,373), R=0.5
SN	P(sn,11), R=0.73		P(sn,55), R=0.43	P(sn,86), R=0.35	P(sn,110), R=0.4		P(sn,210), R=0.36	

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Minimum Irradiation Periods

Relation to known periods

Data series	Oort	Wolf	Sporer	Maunder	Dalton	Next
Min per Usoskin	1010-1070	1270-1340	1390-1550	1640-1720	1790-1820	
P(spox,84 max) P(spoy,84 max) P(psox,84,164,vel) P(psoy,29,84,164)	1127 1152 1152	1296 1320 1320	1462 1487 1487 1488	1630 1654 1654	1798 1821 1821	1965,2065 1989 1989 1990
HS model period P(hsc, t)	1033-1055 <-1.0	1369-1389 <-1.00	1537-1534 <-1.0	1706-1721 <-1.0	1796-1830 <0	2035-2065 <-0.70
HS model, P(lsc, t) min	1040 -1.30	1337 -1.23	1547 -1.87	1714 -1.13	1810 -0.33	2049 -1.0
LS model period P(lsc, t)	1014-1056 <-1.0	1276-1301 <-0.5	1404-1435 <-1.0	1657-1689 <-0.70	1785-1810 <-0.70	2045-2070 <-0.70
LS-state P(lsc, t) min	1035 -1.40	1289 -0.62	1418 -1.20	1672 -0.91	1796 -0.81	2060 -0.79
SN model period P(snc, t)	1019-1032 <-1.0	1242-1256 <-1.0	1467-1478 <-1.0	1693-1699 <-1.0	1802-1820 <-0.5	2025-2050 <-0.5
SN model P(snc, t) min	1026 -1. 7	1249 -1.18	1473 -1.13	1696 -1.04	1811 -0.70	2035 -0.84

4/20/19

Thank you

My campus, et the end of the rainbow
http://www.ntnu.no/ansatte/harald.yndestad