



Centennial cycles of the solar activity and Earth rotation

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OBJECTIVES

- Determination of centennial oscillations of Earth rotation, solar indices, climatic parameters and mean sea level
- Investigation of possible connection between these oscillations and centennial cycles of the solar activity

USED DATA

- UT1-TT for the period 1623-2005
- Smoothed Wolf's numbers for the period 1700-2010
- Total solar Irradiance TSI: (1610-2010); (843-1961); 9Kyr series
- Local temperature and precipitation variations: 1-2Kyr series
- Mean sea level at Stockholm for the period 1770-2001

METHODS

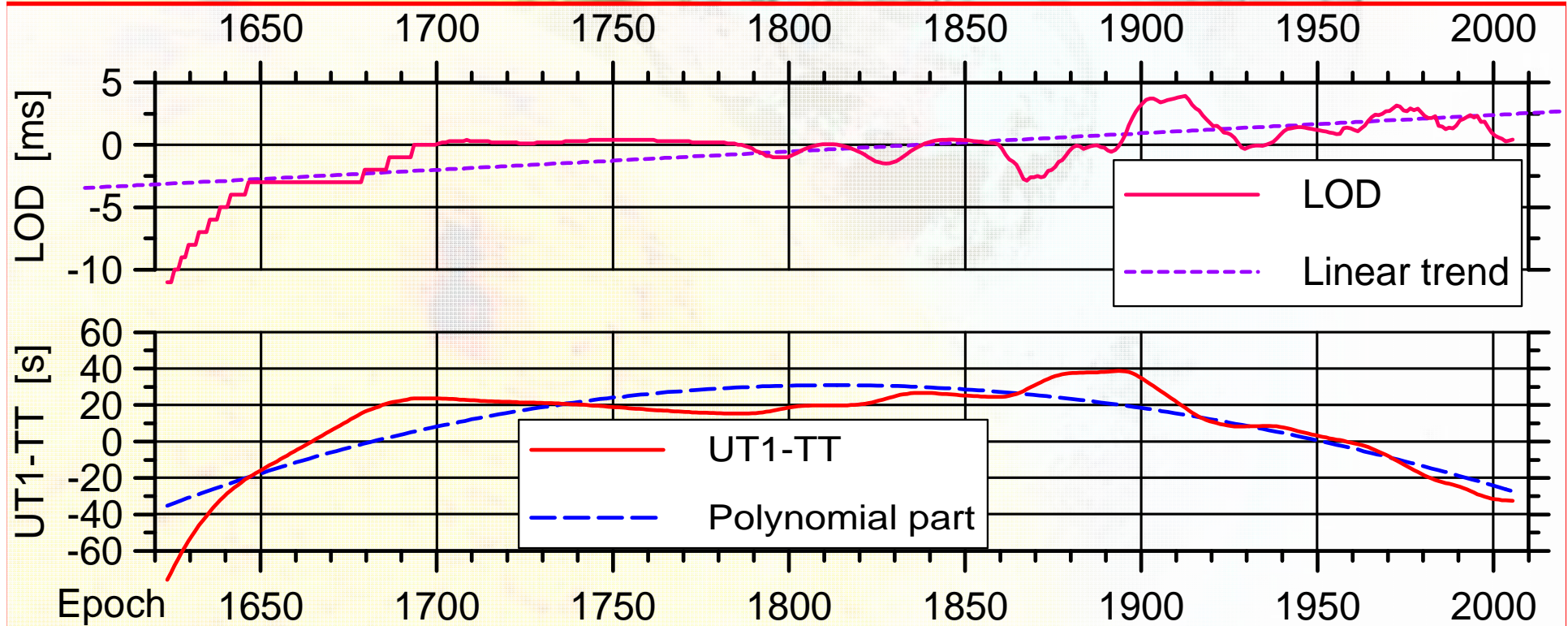
- Fourier approximation + Method of Least Squares
- Averaging and Vondrak's filtration
- Cubic spline interpolation
- FFT spectrograms

RESULTS

- The best model of centennial cycles of the solar activity and Earth rotation is based on 210a oscillations
- The appropriate model of centennial cycles should combine 180a, 210a and 230a oscillations and their harmonics

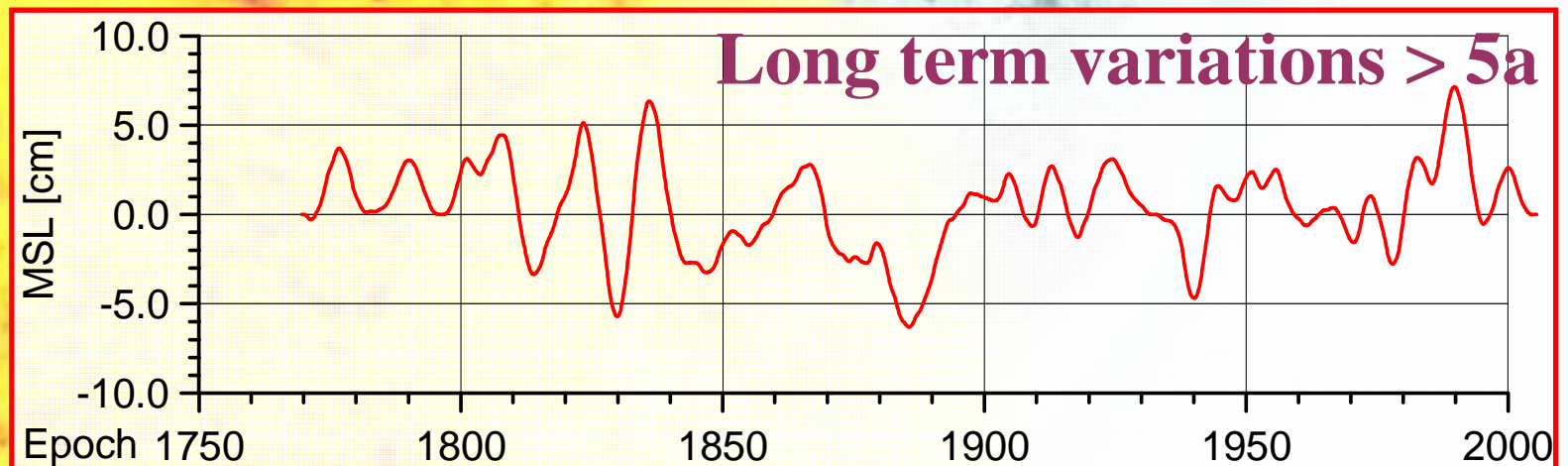
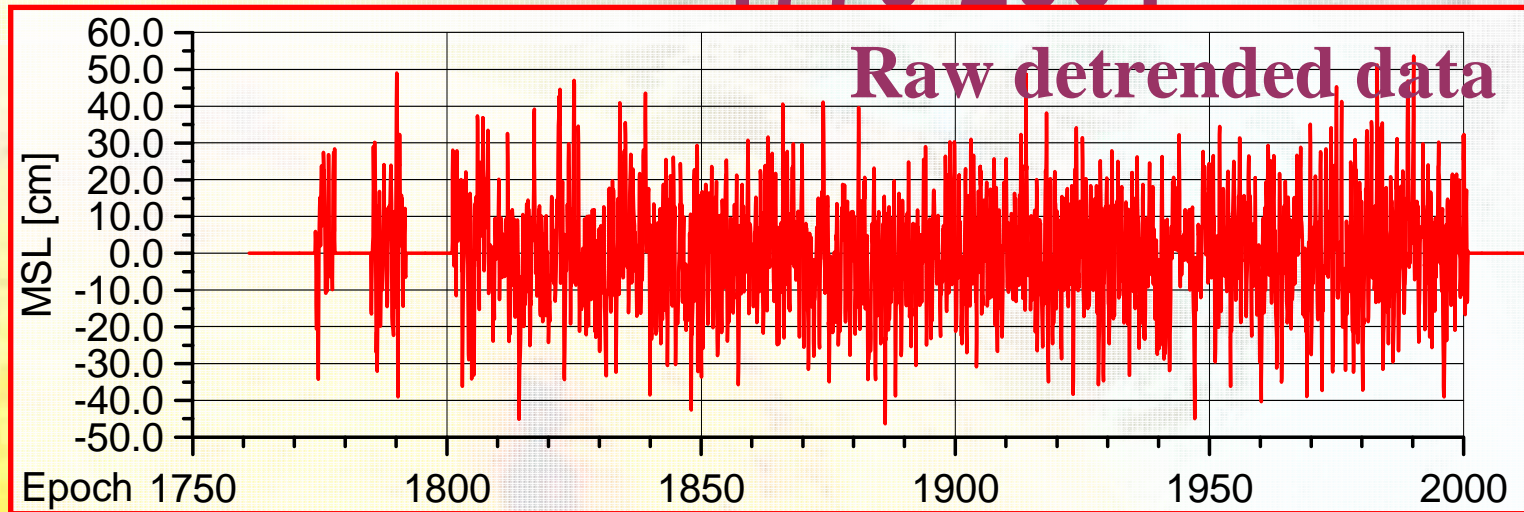
DATA

UT1 and LOD variations for 1623 - 2005



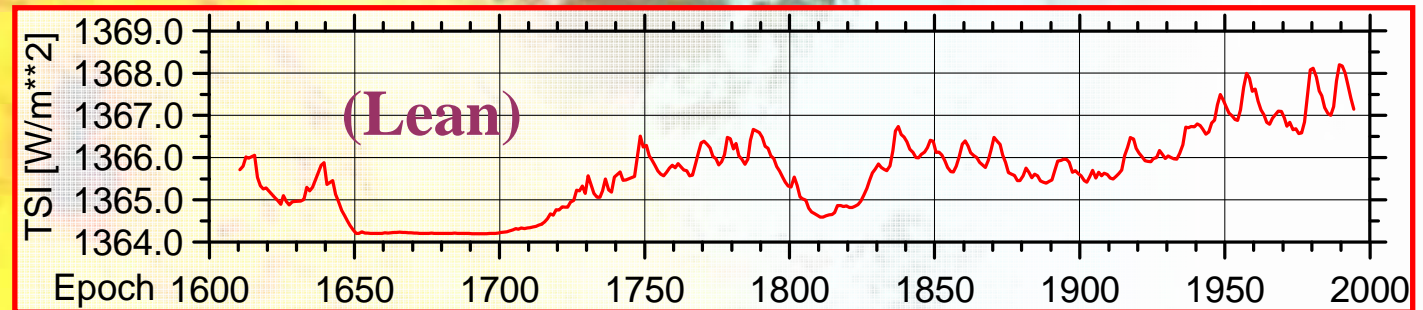
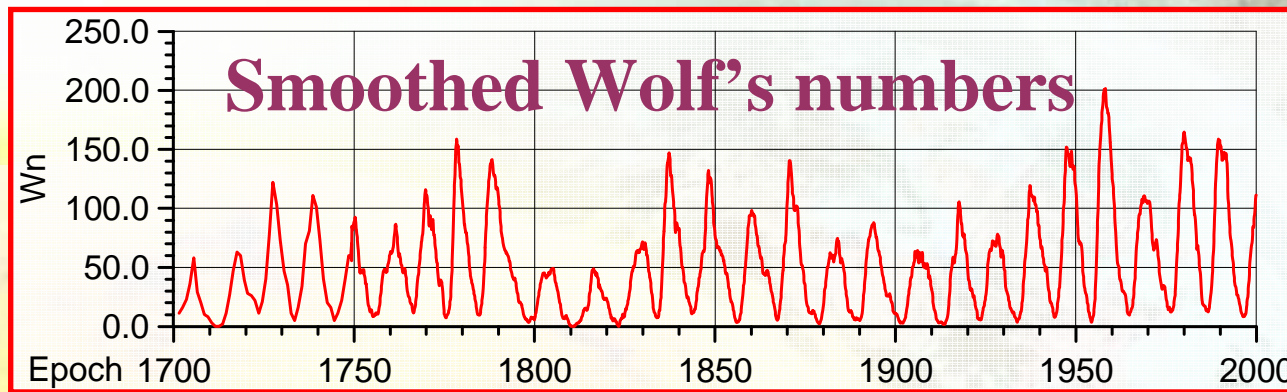
DATA

Mean Sea Level variations at Stockholm 1770-2001

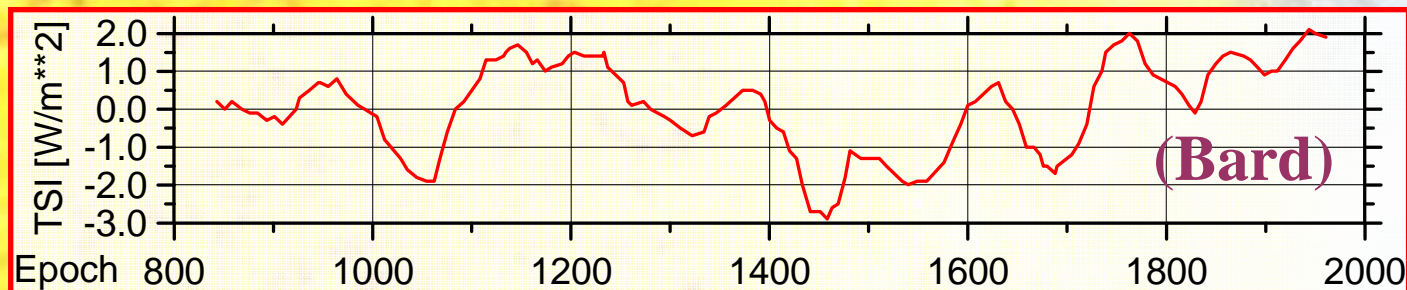


DATA

Solar Indices

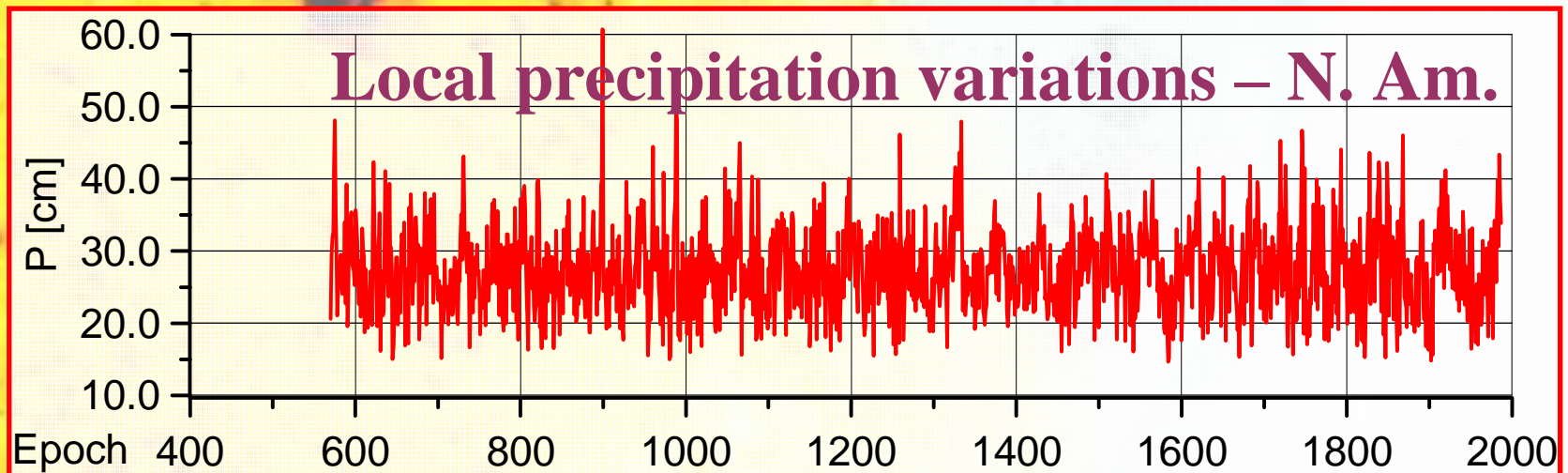
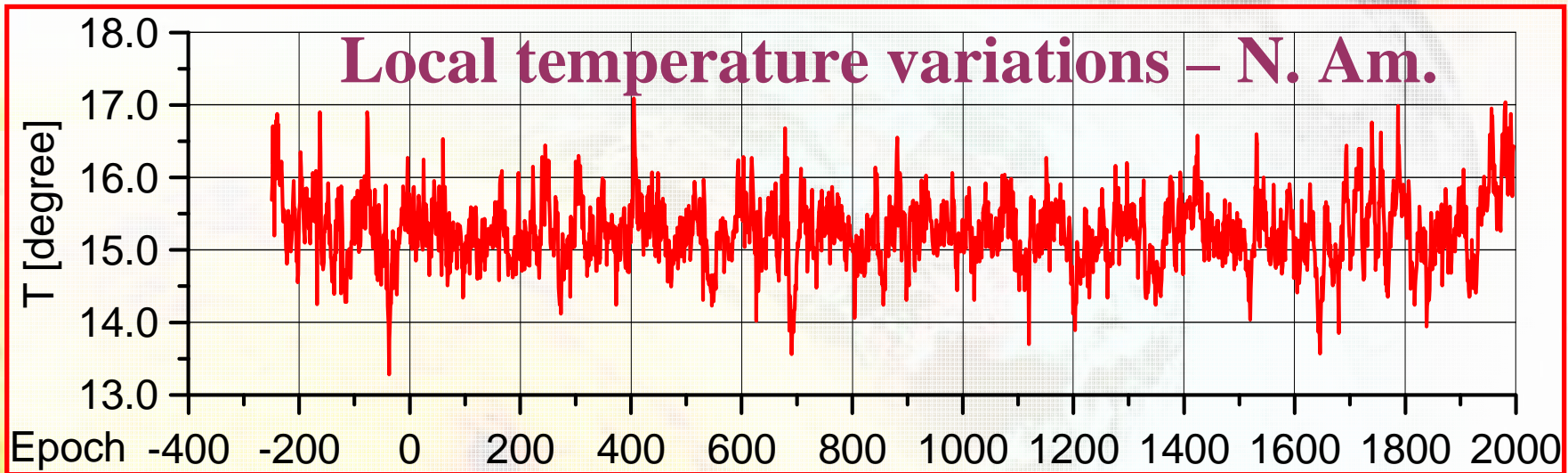


TSI variations

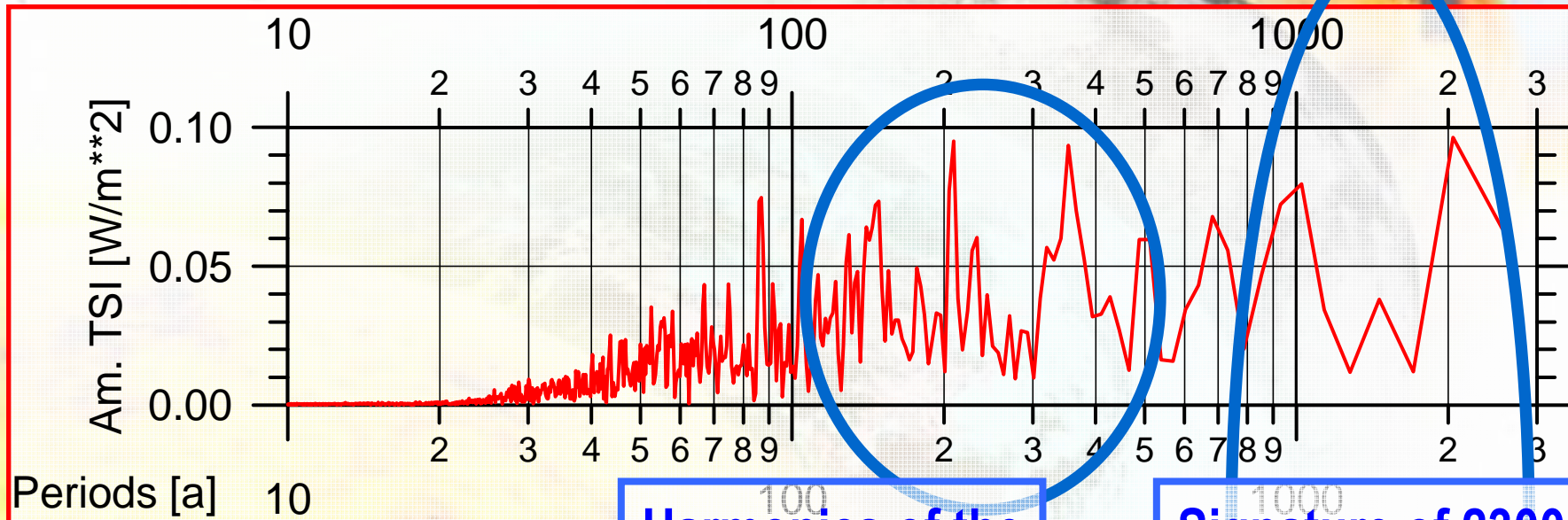


DATA

Climatic Indices

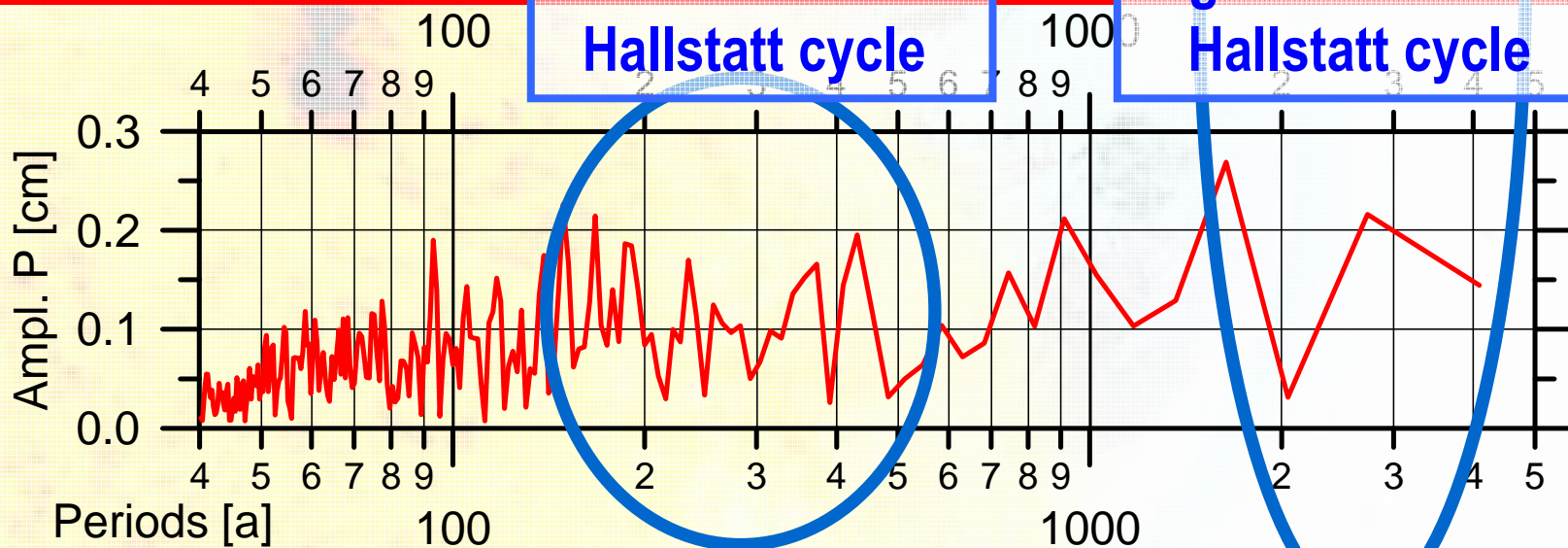


TIME SERIES SPECTRA



Harmonics of the
Hallstatt cycle

Signature of 2300a
Hallstatt cycle



TIME SERIES SPECTRA

Hallstatt cycle harmonics:

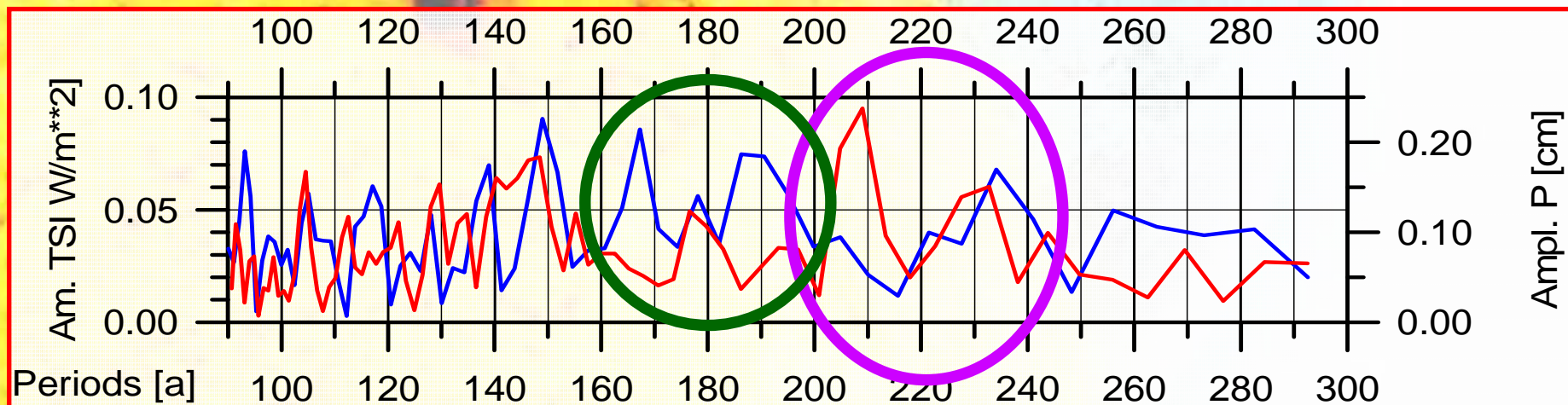
No 10 – 230a period (Suess cycle);

No 11 – 210a period (de Vries cycle);

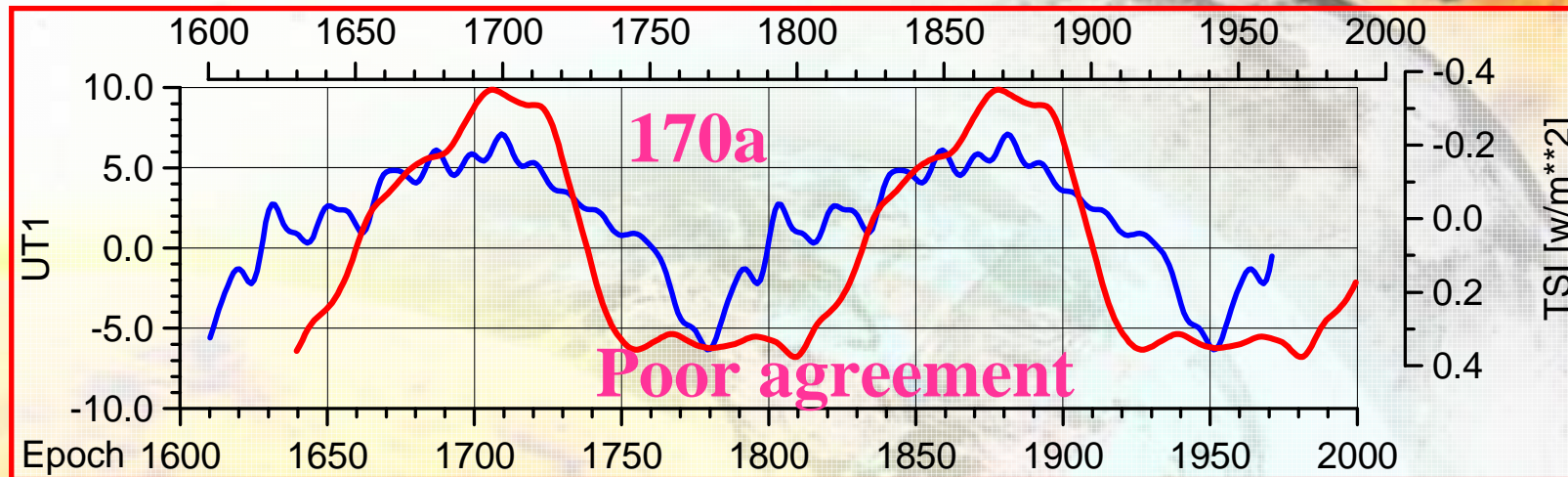
Planetary periods:

178.8a period (Jose cycle, Jupiter/Saturn syn. p.);

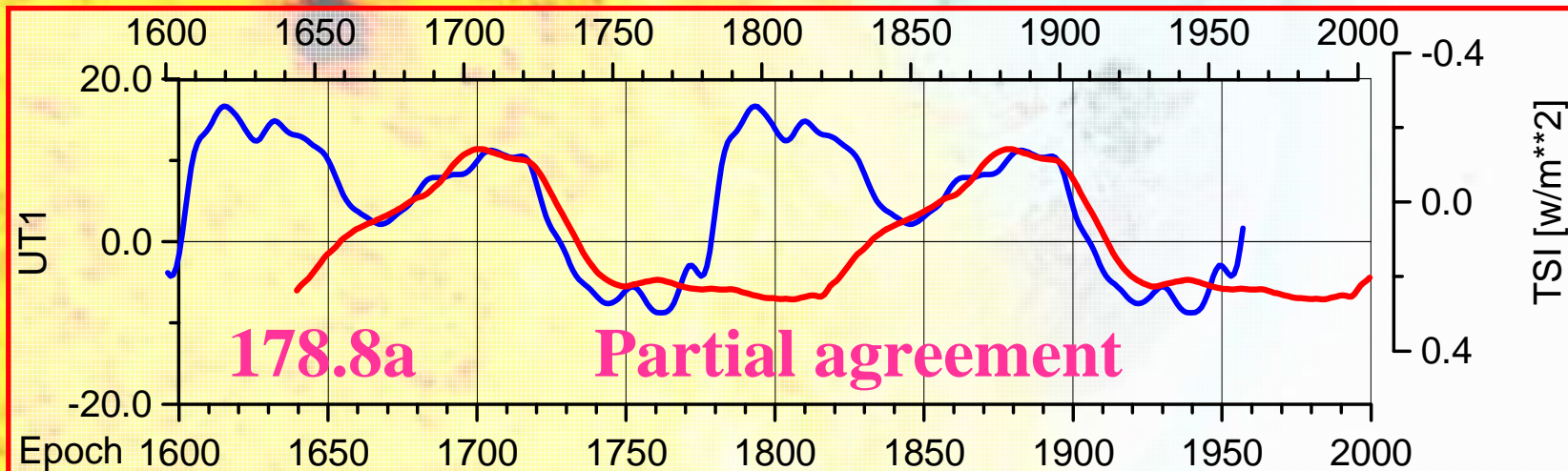
171.4a period (Uranus/Neptune synodic period).



170a-180a MODELS

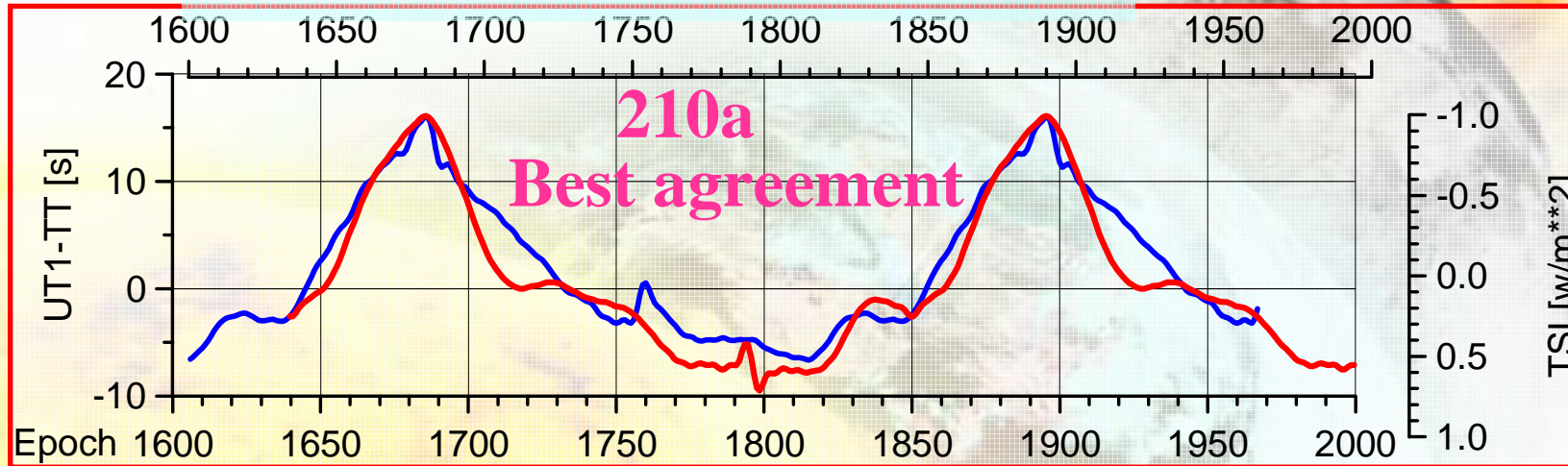


PARTIAL NEGATIVE CORRELATION

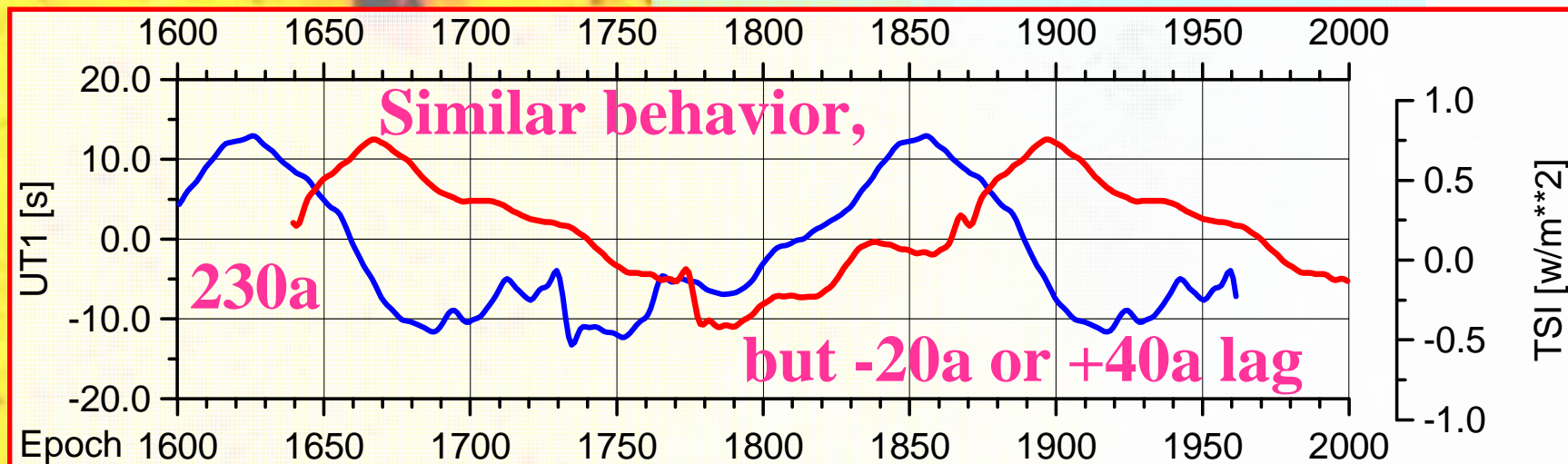


210a-230a MODELS

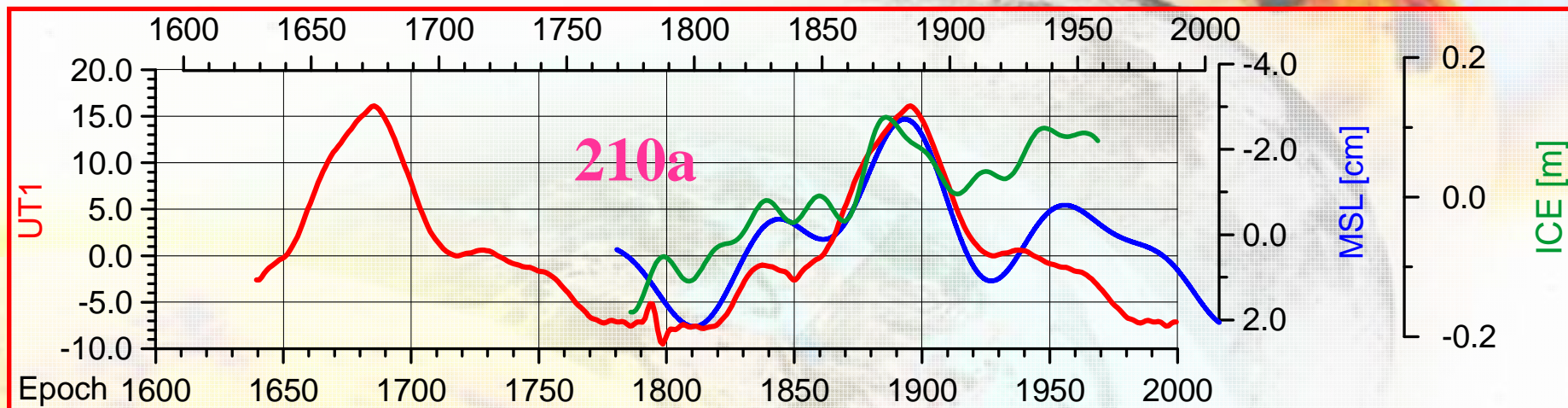
NEGATIVE CORRELATION



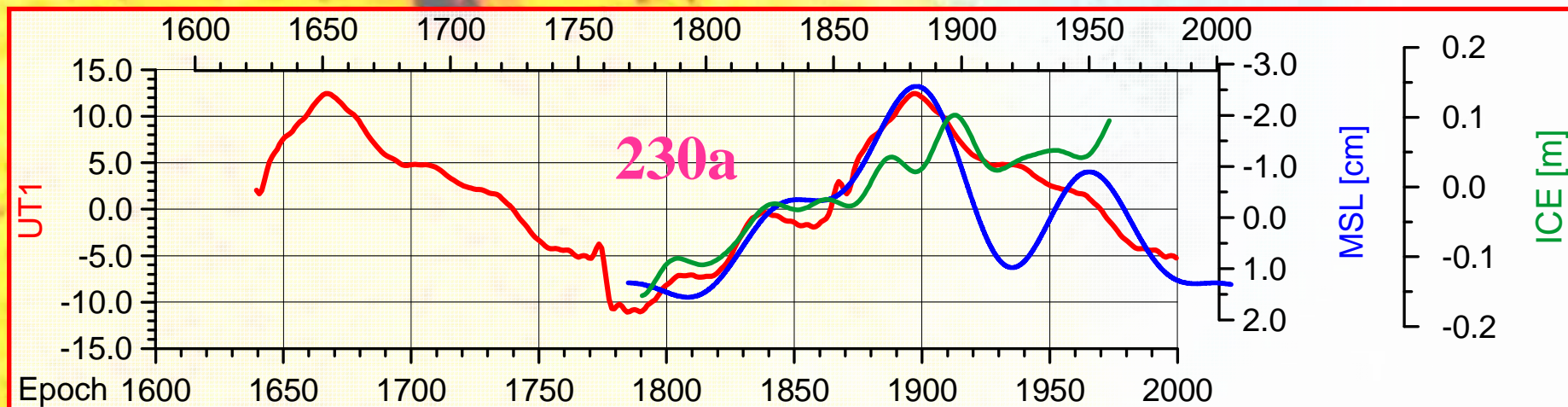
PHASE DISCREPANCY



UT1, MSL and icethickness variations



Relatively good agreement between the centennial cycles of UT1, MSL and icethickness



CONCLUSIONS



- **The best agreement between the centennial cycles of the TSI and UT1 is achieved by 210a model.**
- **Partial correlation exists between the 180- and 230-year cycles of the time series of solar and climatic indices, UT1 and LOD, so the appropriate model the centennial cycles of the Earth rotation should combine 180a, 210a, 230a oscillations and their harmonics.**
- **The dependence between the TSI and UT1 centennial variations is negative, so the Earth rotation acceleration is connected with the decrease of the MSL, due to cooling effects of solar grand minima and corresponding increasing of the polar ice thickness.**



Thank you for attention!