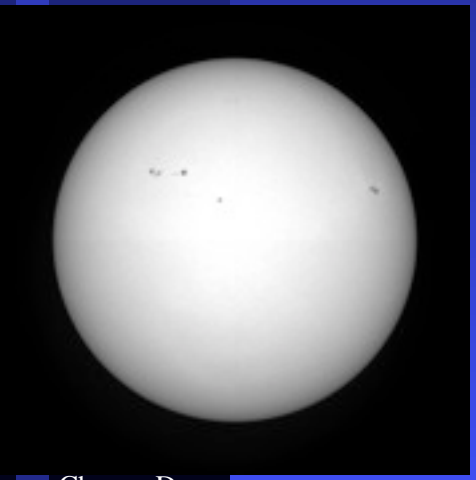
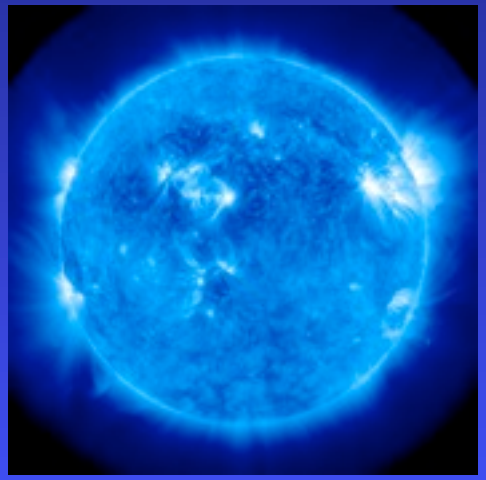
# Fading solar activity: is a new Little Ice Age under way?

Jürg Beer
beer@eawag.ch

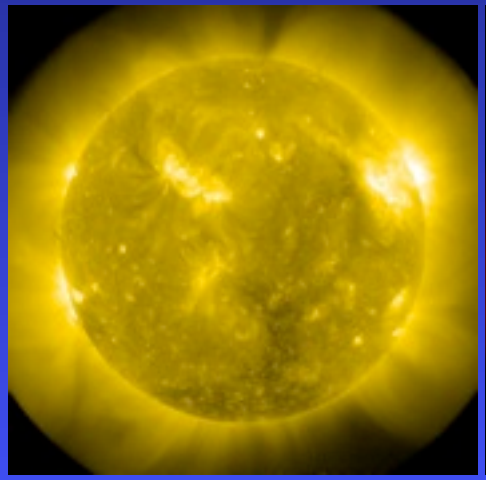
18.4.2011



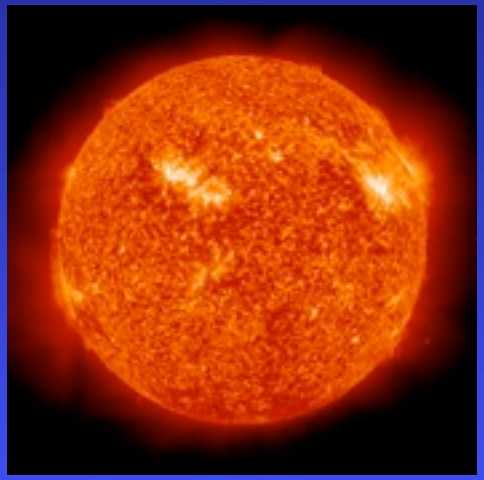
4500Å



171Å



211Å



304Å

# Thanks

- EAWAG-Group
  - F. Steinhilber
  - J. Abreu
- FUPSOL (Eawag, ETHZ, Davos, Uni Bern), NCCR
- ProClim

# Outline

- Solar Activity
- Solar Activity and Solar Forcing in the Past
- Little Ice Age
- Future Solar Forcing
- Is a new Little Ice Age under way?

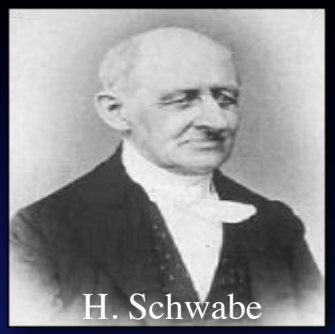
# Climate: Energy and its Distribution

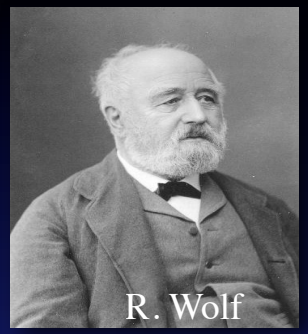
4 Mio Tons/sec
Power: $4\ 10^{26}$ W

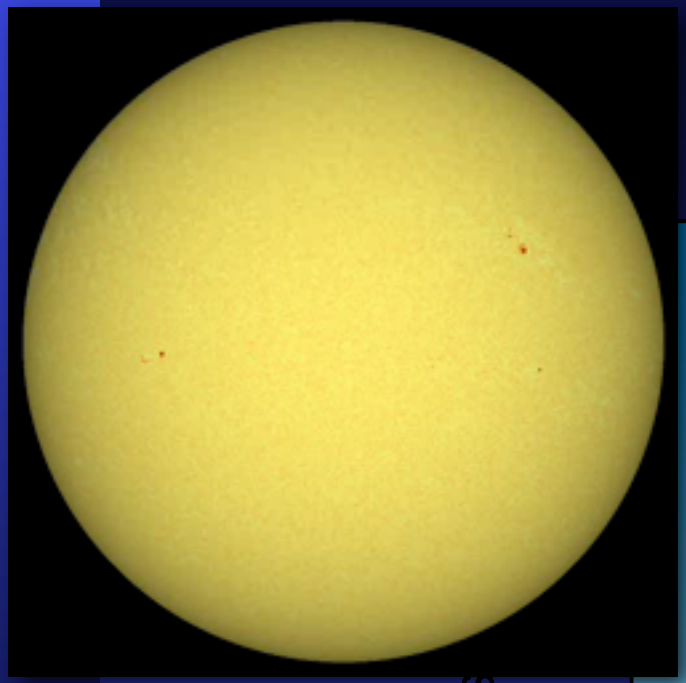
200 Mio NPP's
$2\ 10^{17}$ W

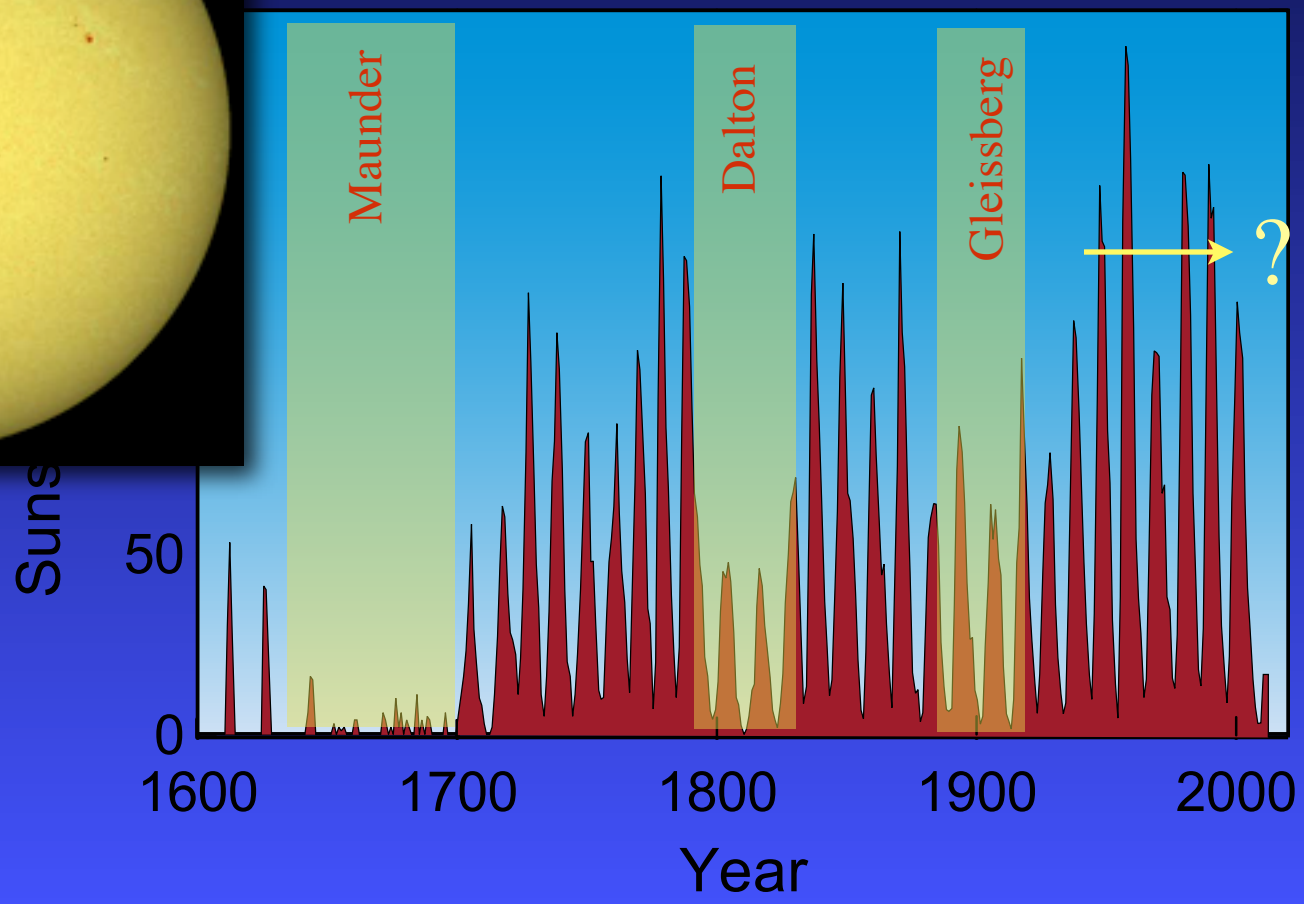
All forms of energy are ultimately nuclear, except ?

# Solar Activity



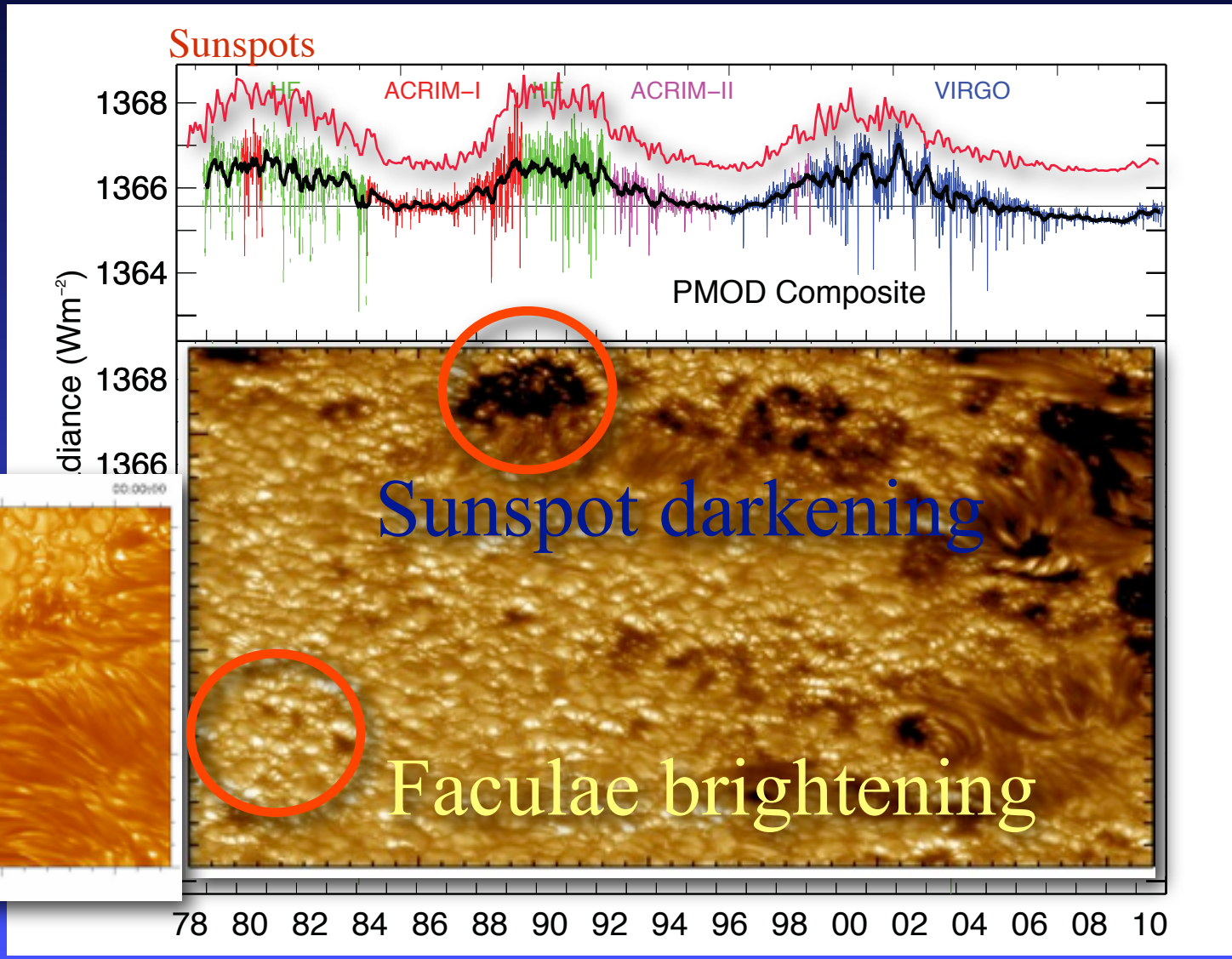



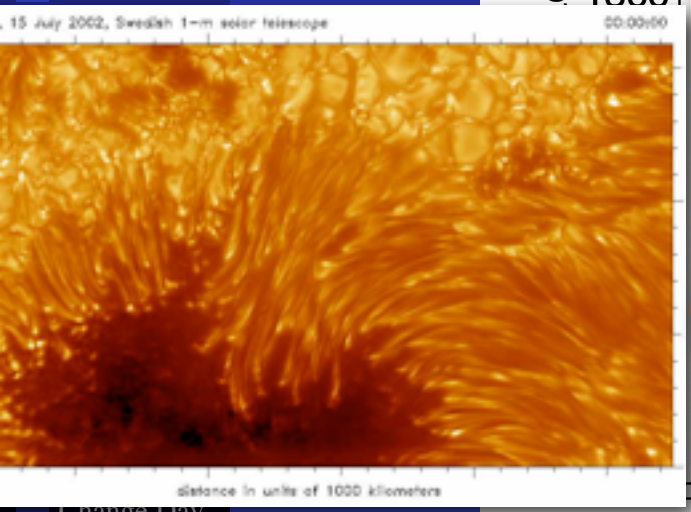





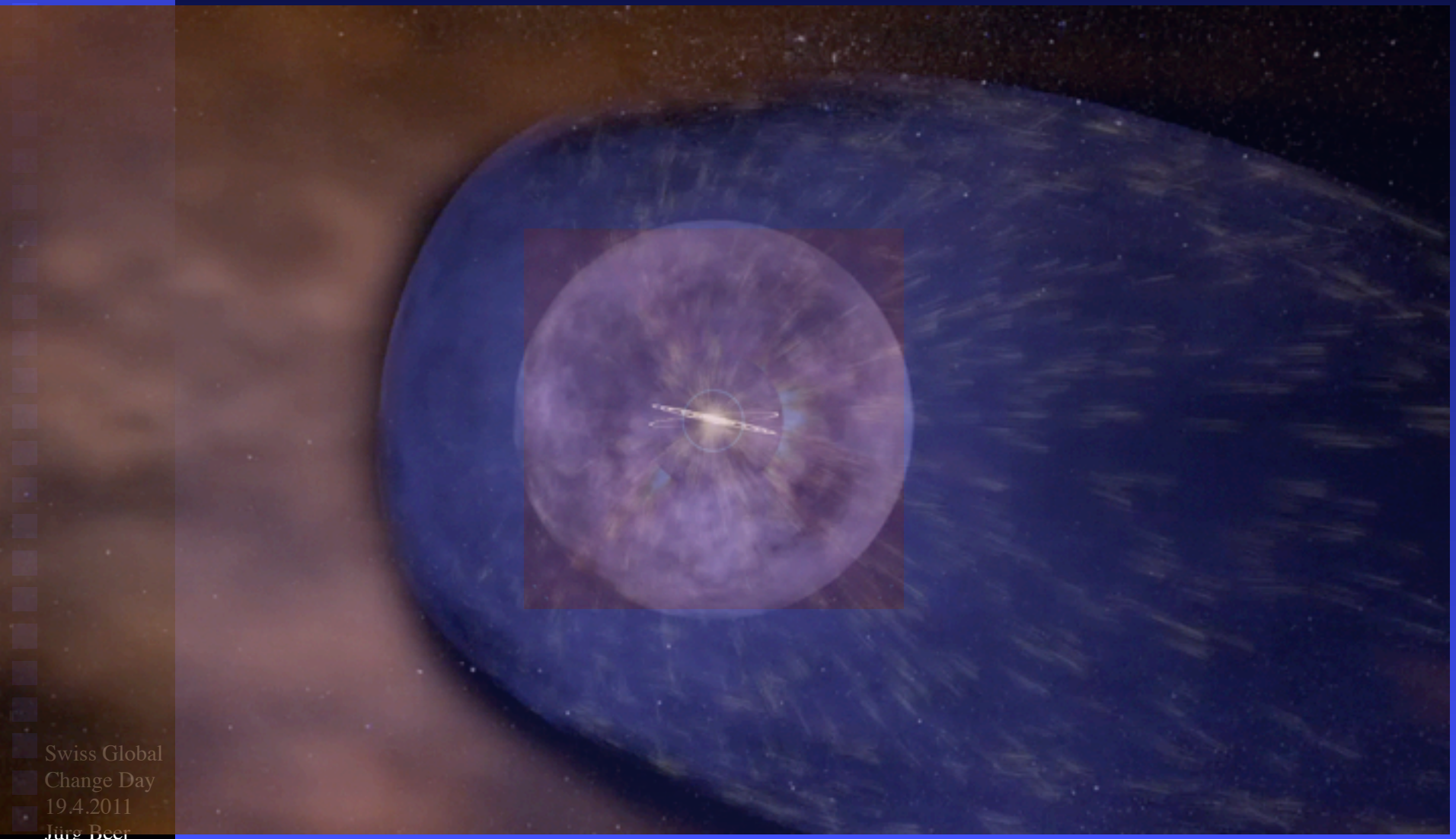
# “Solar Constant” or Total Solar Irradiance (TSI)

C. Fröhlich



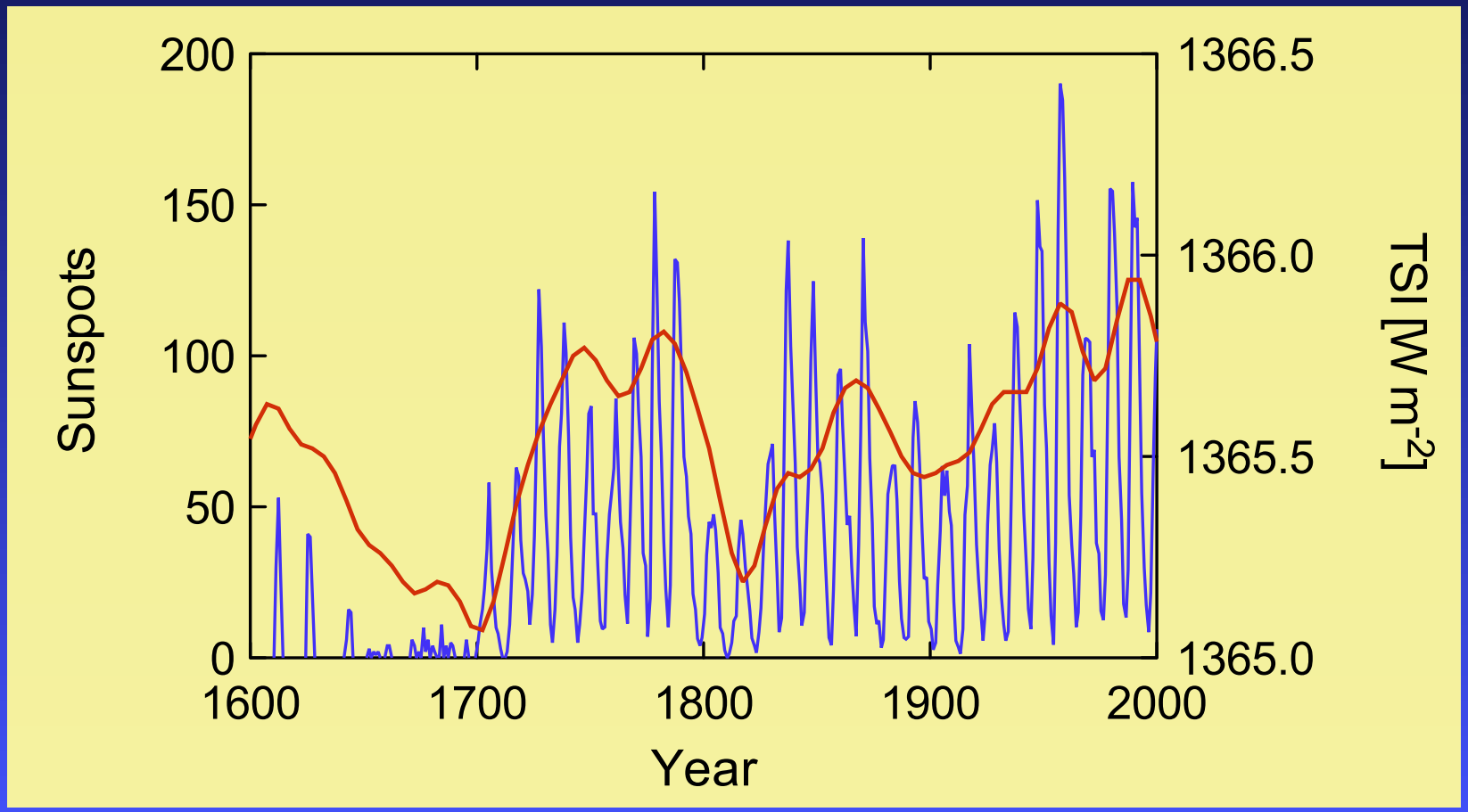
# Solar Activity and Cosmic Rays



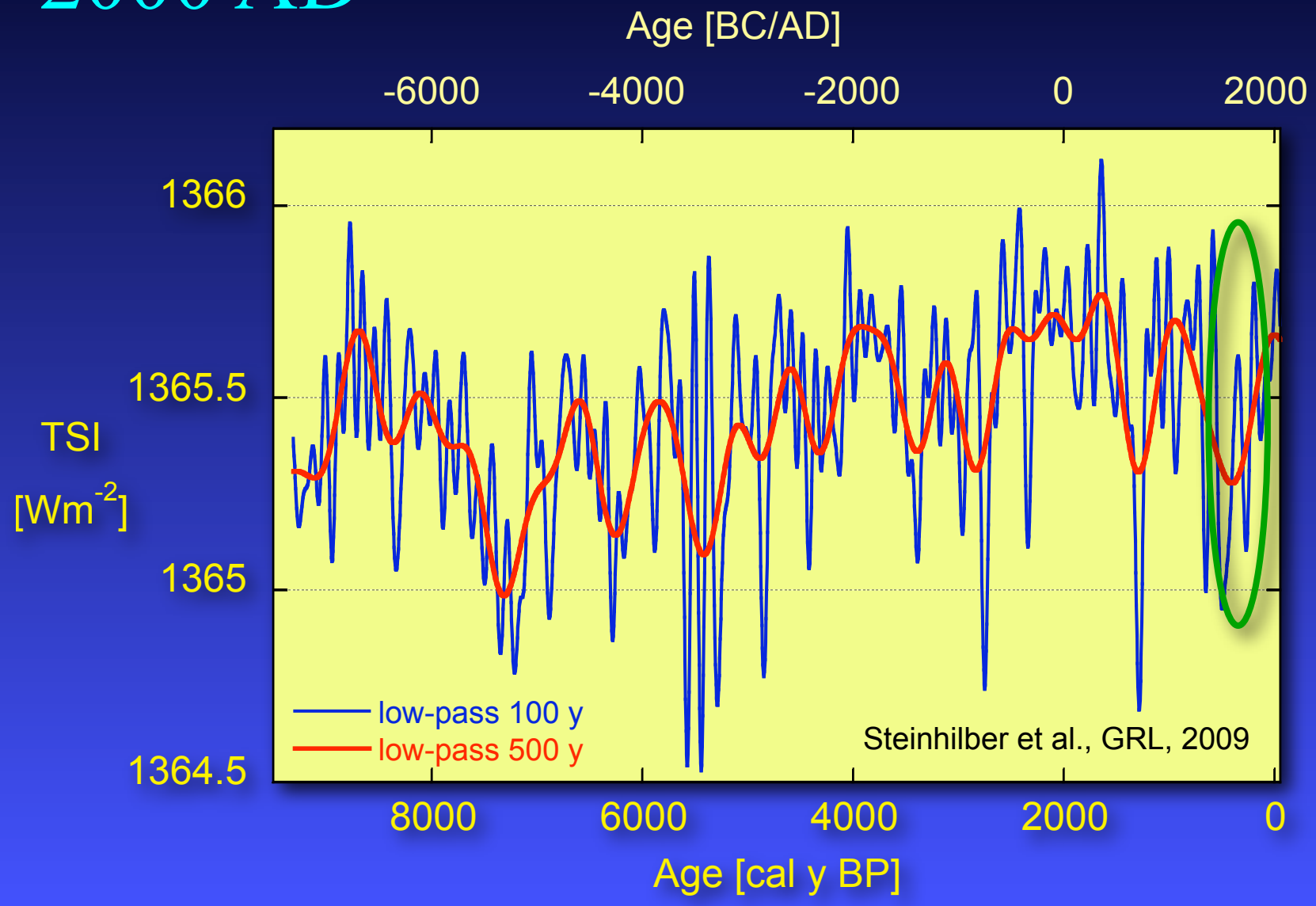
Swiss Global Change Day
19.4.2011
Jürg Beer

# Cosmic Rays: $^{10}Be$ and $^{14}C$

# Sunspots and Total Solar Irradiance (TSI) 1600 - 2000



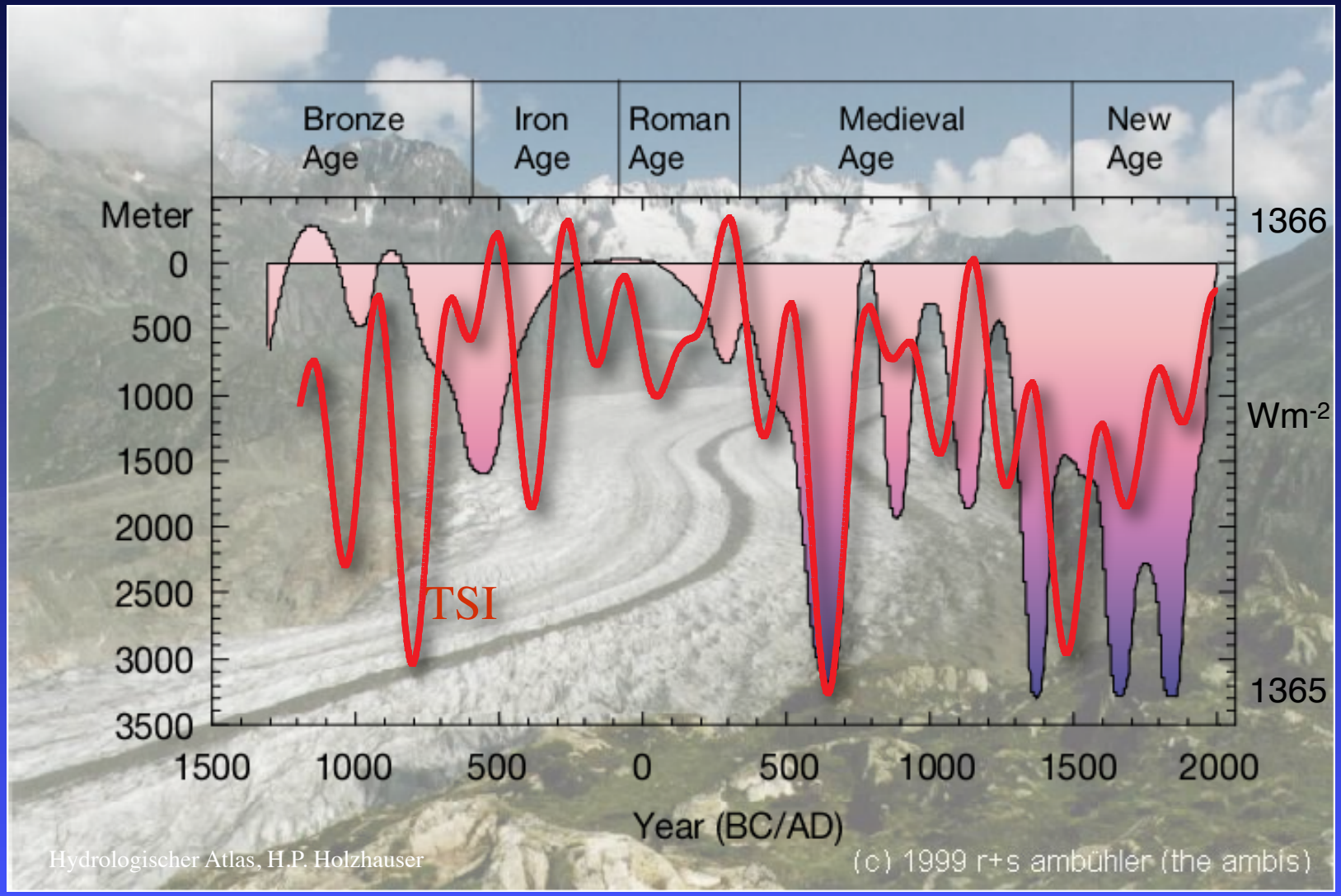
# Total Solar Irradiance 7300 BC - 2000 AD



# Evidence from glacier (Aletsch)

# Length of the Aletsch glacier

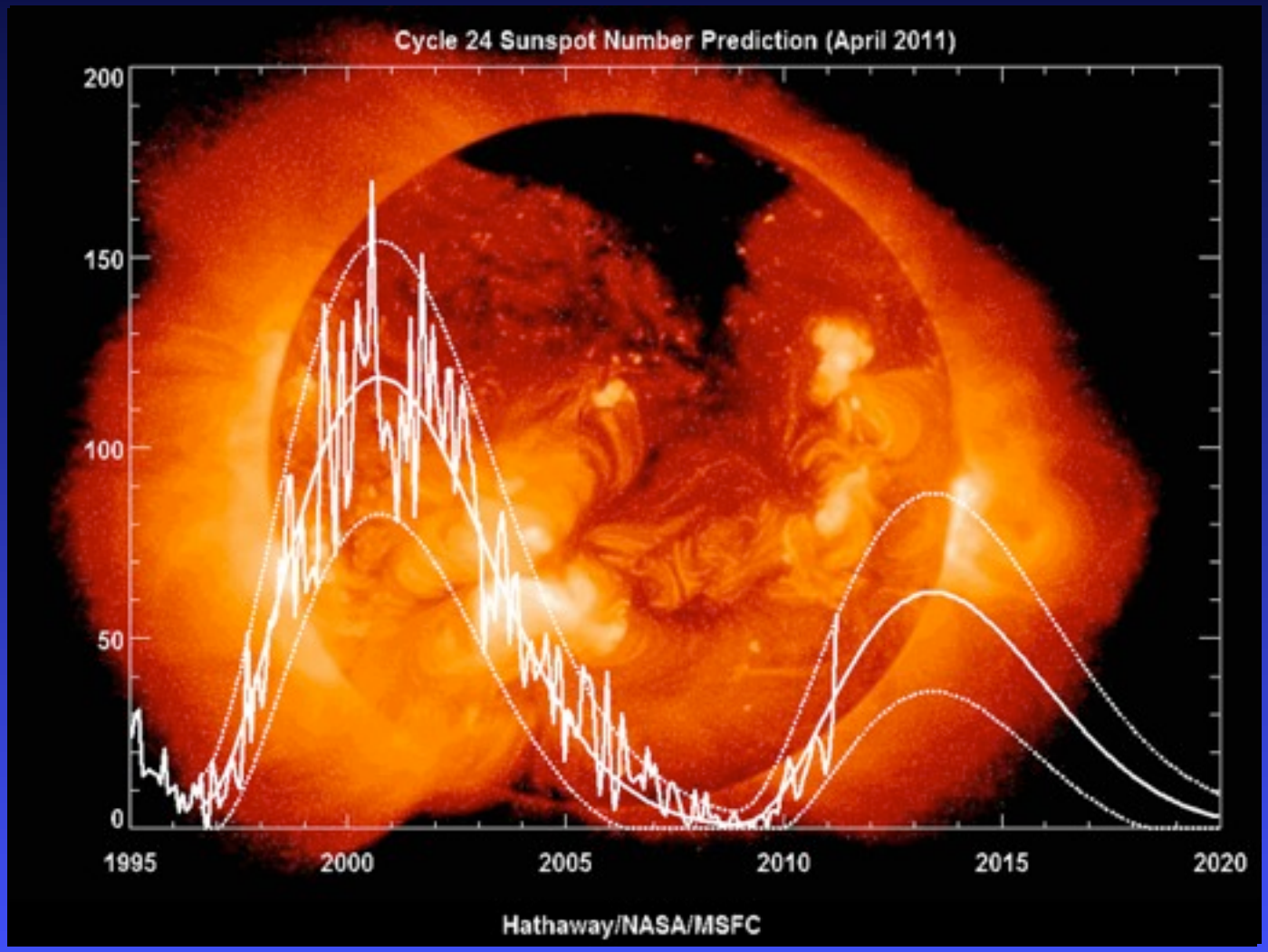
Holzhauser et al., Holocene 15(2005)789



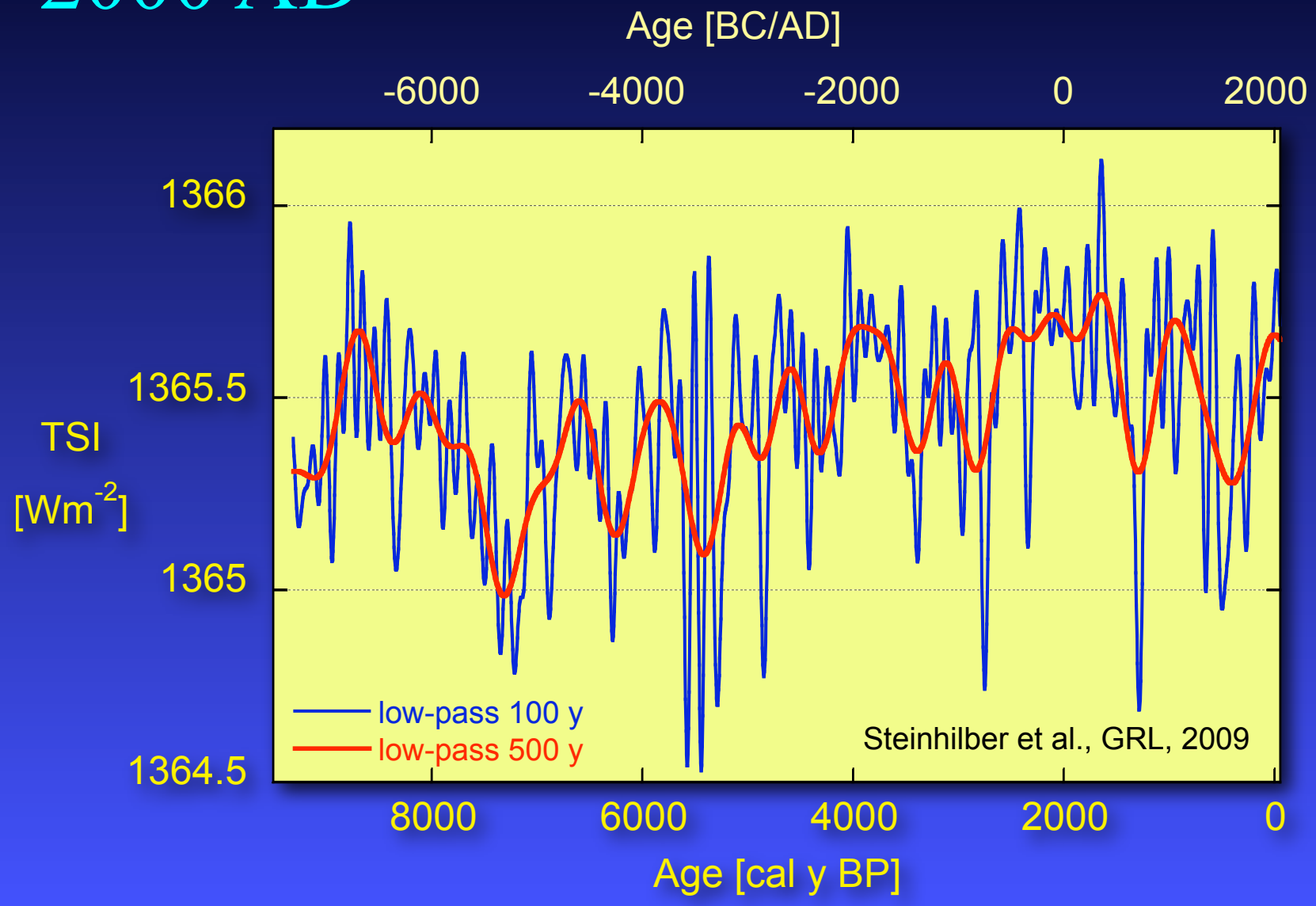
# Rise of Food Prices in Amden 1814 - 1817

| | 1814 | 1817 | Faktor |
|---|---|---|---|
| 1 Sack Korn | 13 Gulden | 106 Gulden | 8.2 |
| 1 Viertel Gerste | 2 Gulden | 14 Gulden | 7 |
| 1 Viertel Hafergrütze | 1 Gulden | 12 Gulden | 12 |
| 3 Pfund Brot | 12 Kreuzer | 54 Kreuzer | 4.5 |
| 1 Pfund Butter | 17 Kreuzer | 40 Kreuzer | 2.3 |

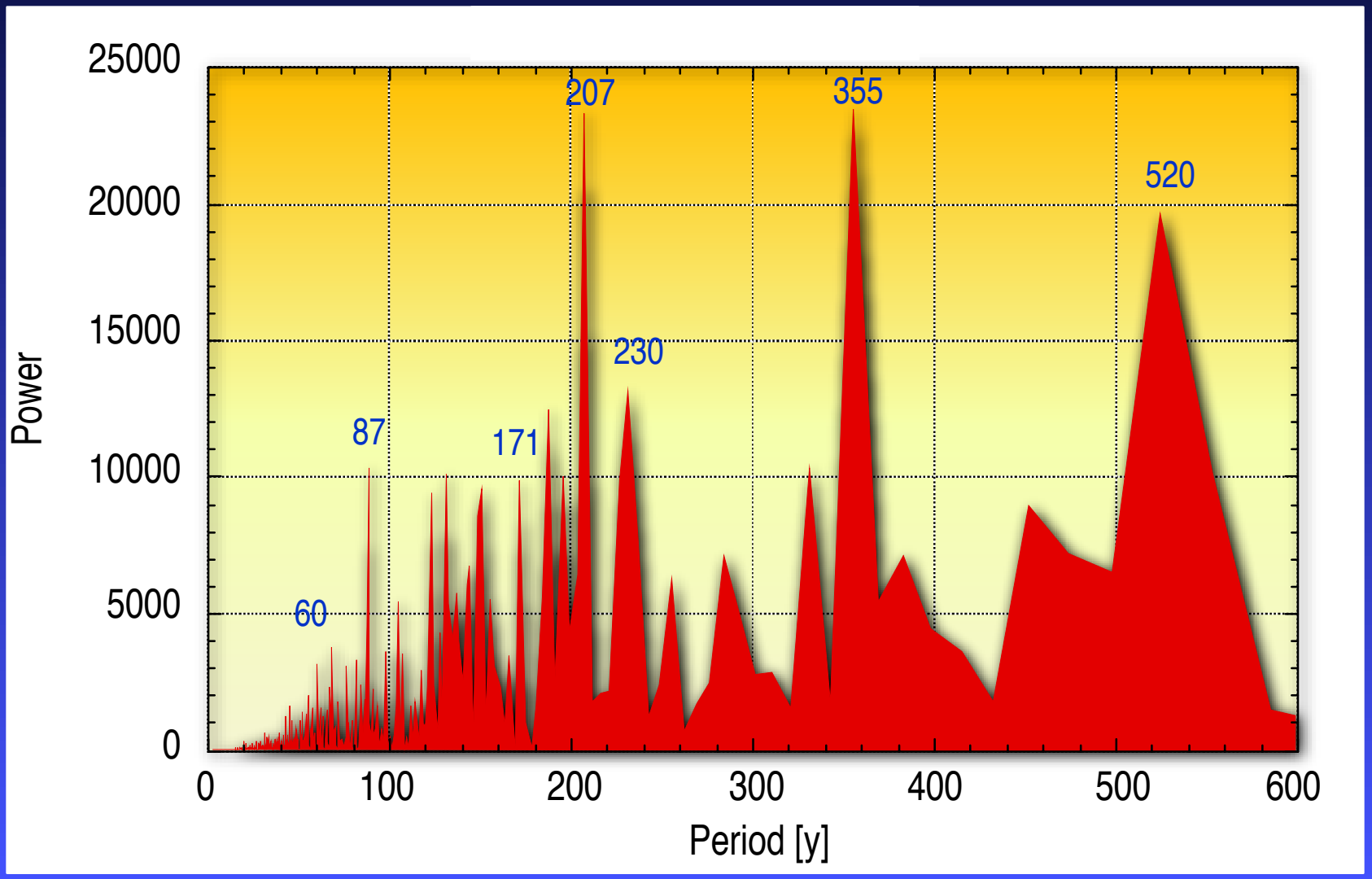
# Predictions of Sunspot Cycle 24



# Total Solar Irradiance 7300 BC - 2000 AD

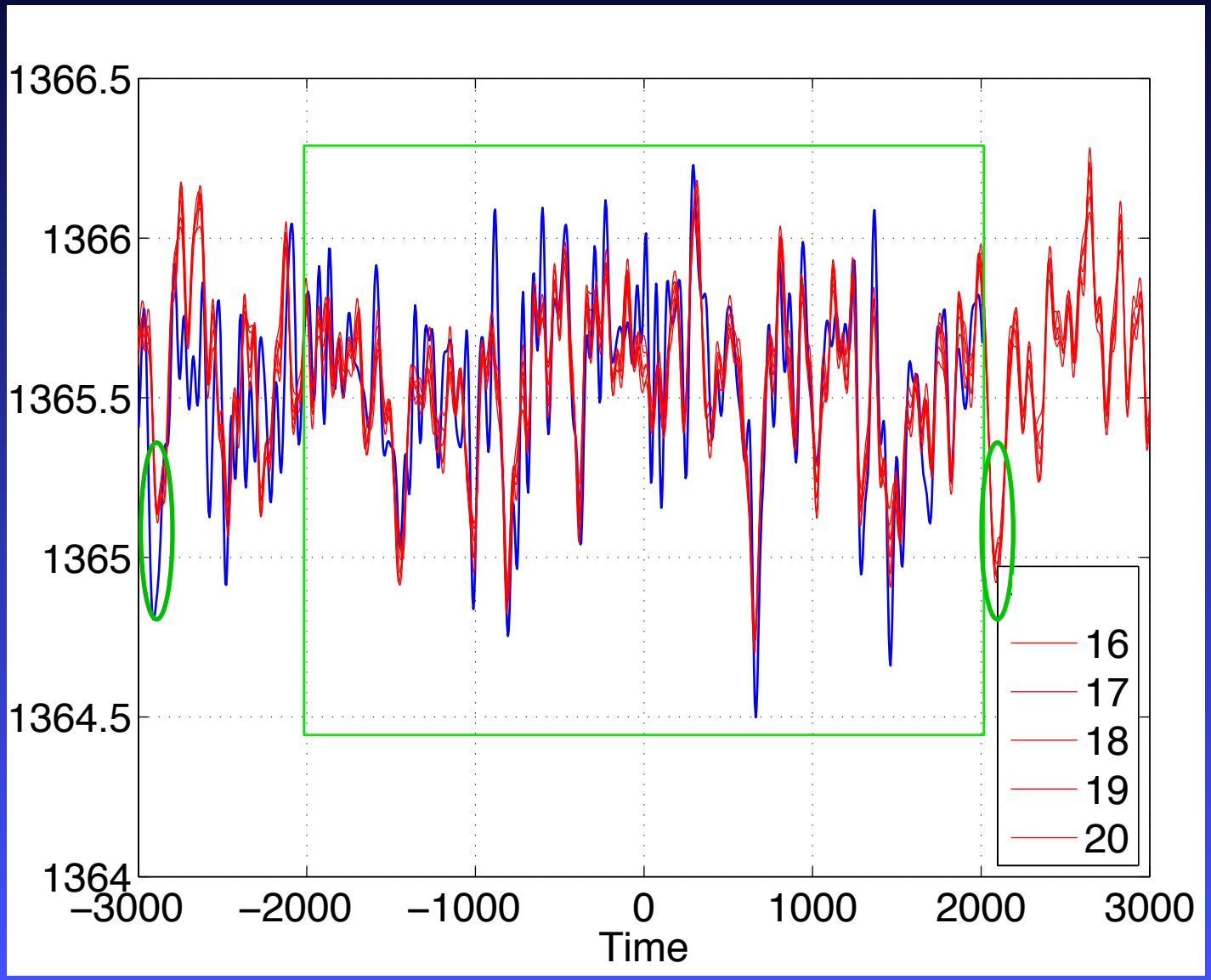


# Power Spectrum



# Spectral Extrapolation

(calibration period: -2000 - 2000)



# Conclusions

- Sun is a variable star
  - cycles
  - grand minima
- Long-term variability: deterministic component
- Period of high solar activity (~1940-2010) comes to an end
- Next grand minimum probably ~2100 AD
- Implications for global warming:
  - Temporary slow down
  - Followed by a speed up

Niels Bohr 1885-1963

Prediction is very difficult,
especially about the future