Total Solar Irradiance measurements over the last 30 years and reconstruction over the last 300 years

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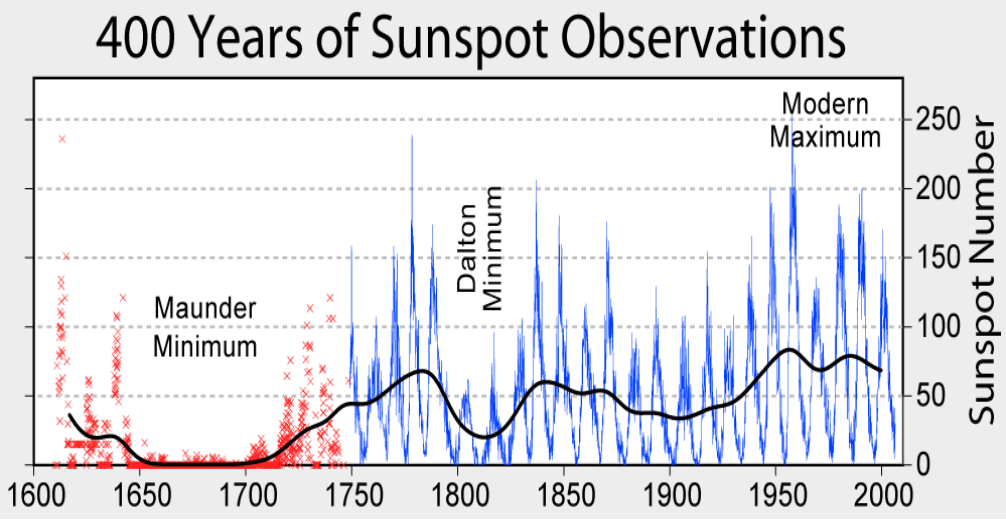
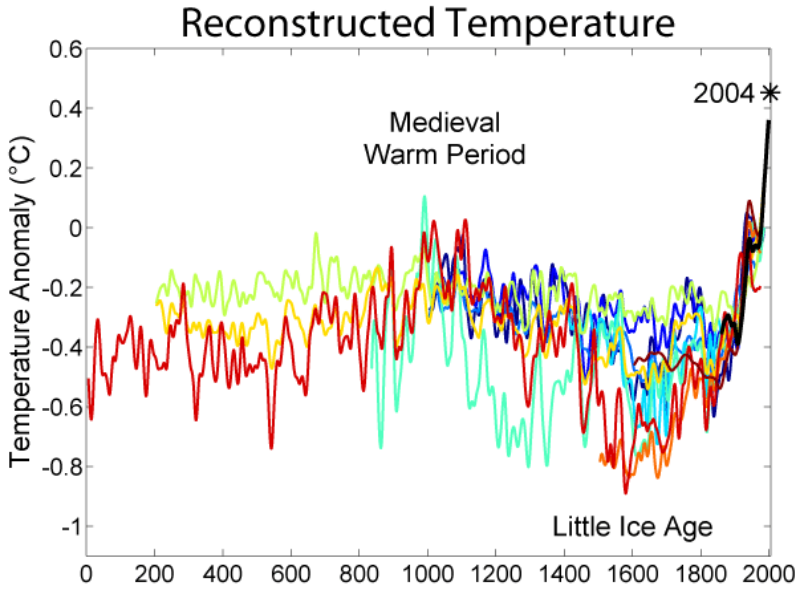
Solar Metrology Symposium, 21-23/9/2015

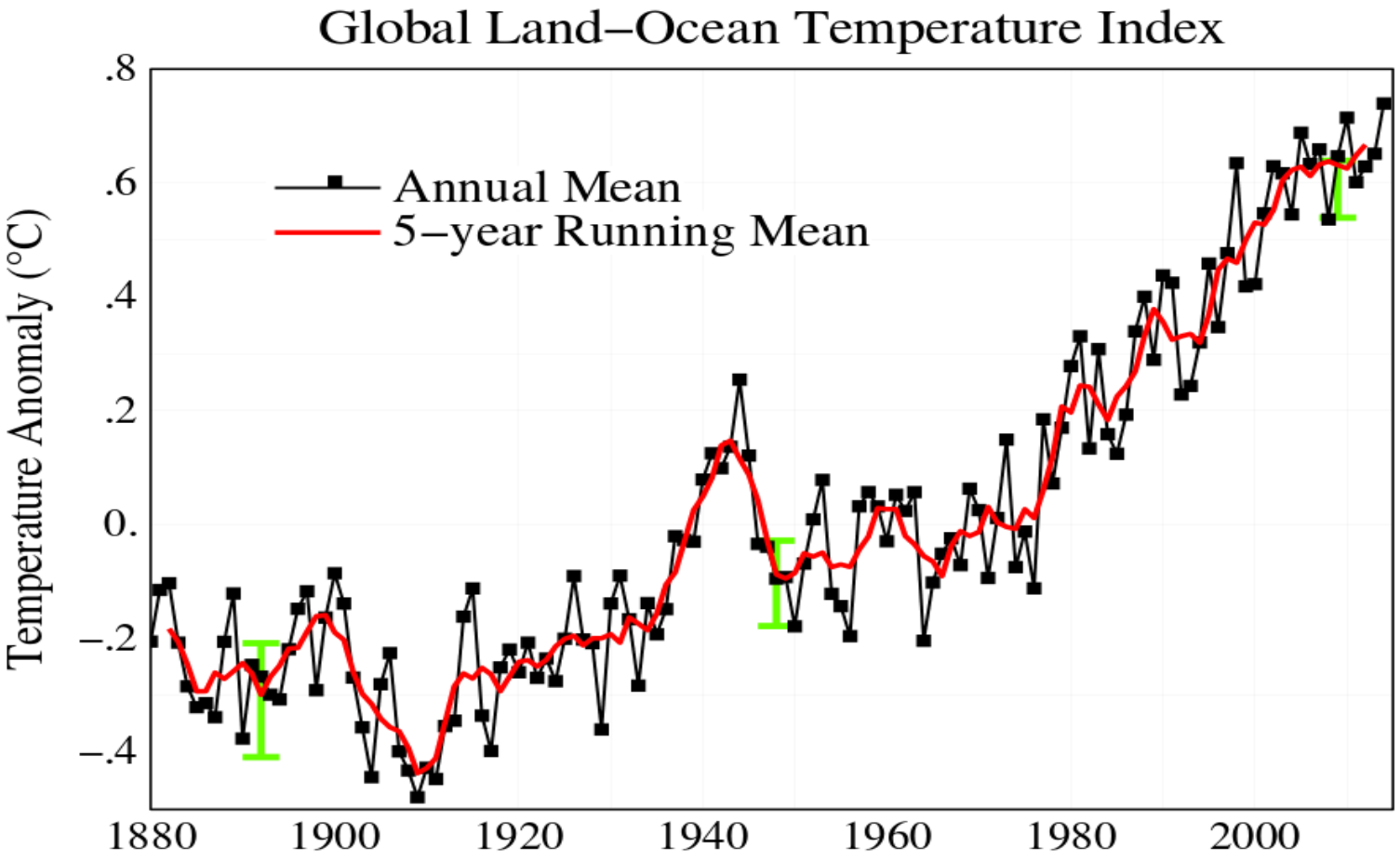
Little Ice Age caused by Maunder Minimum ?

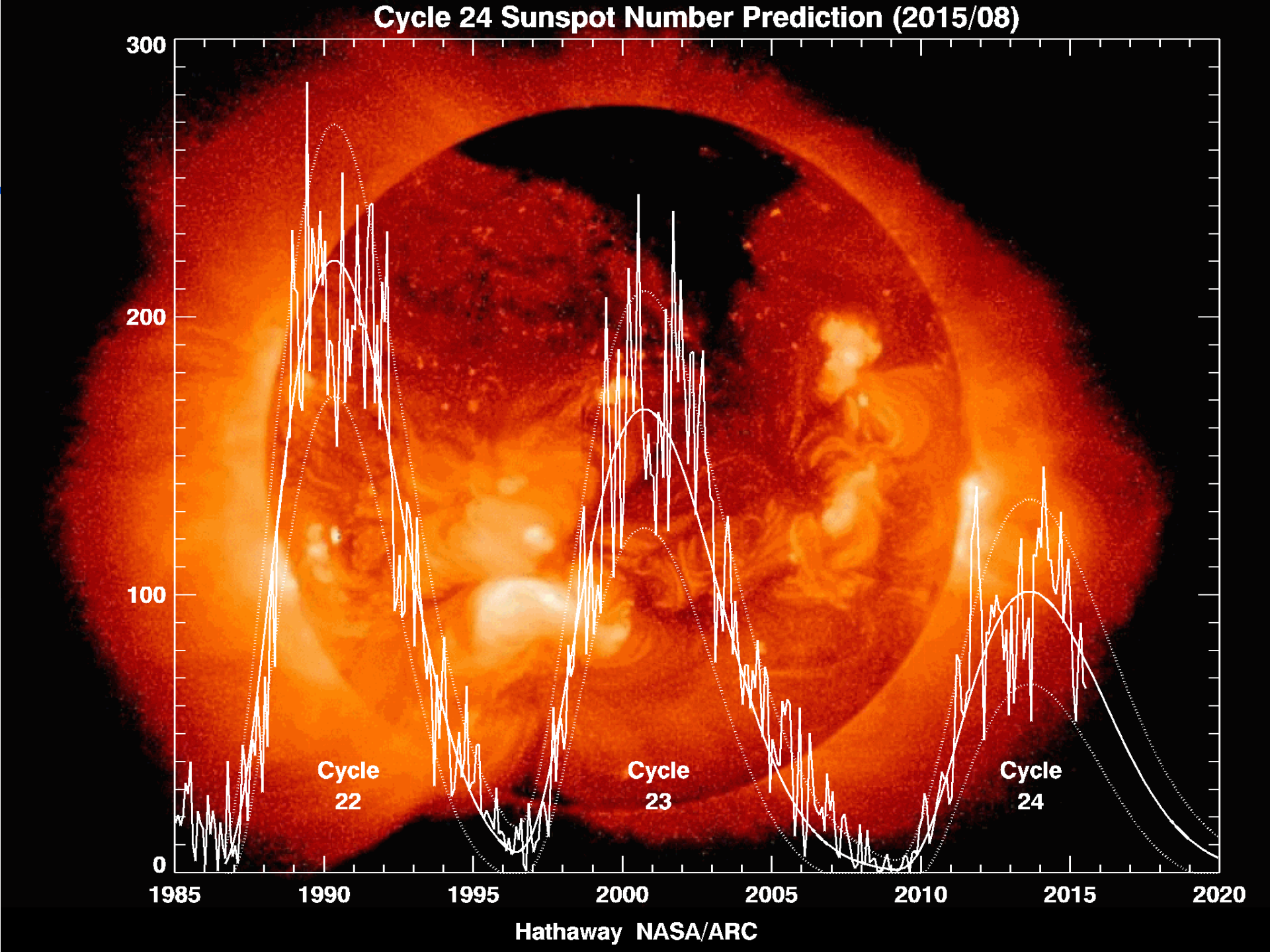
Non revised sunspot number





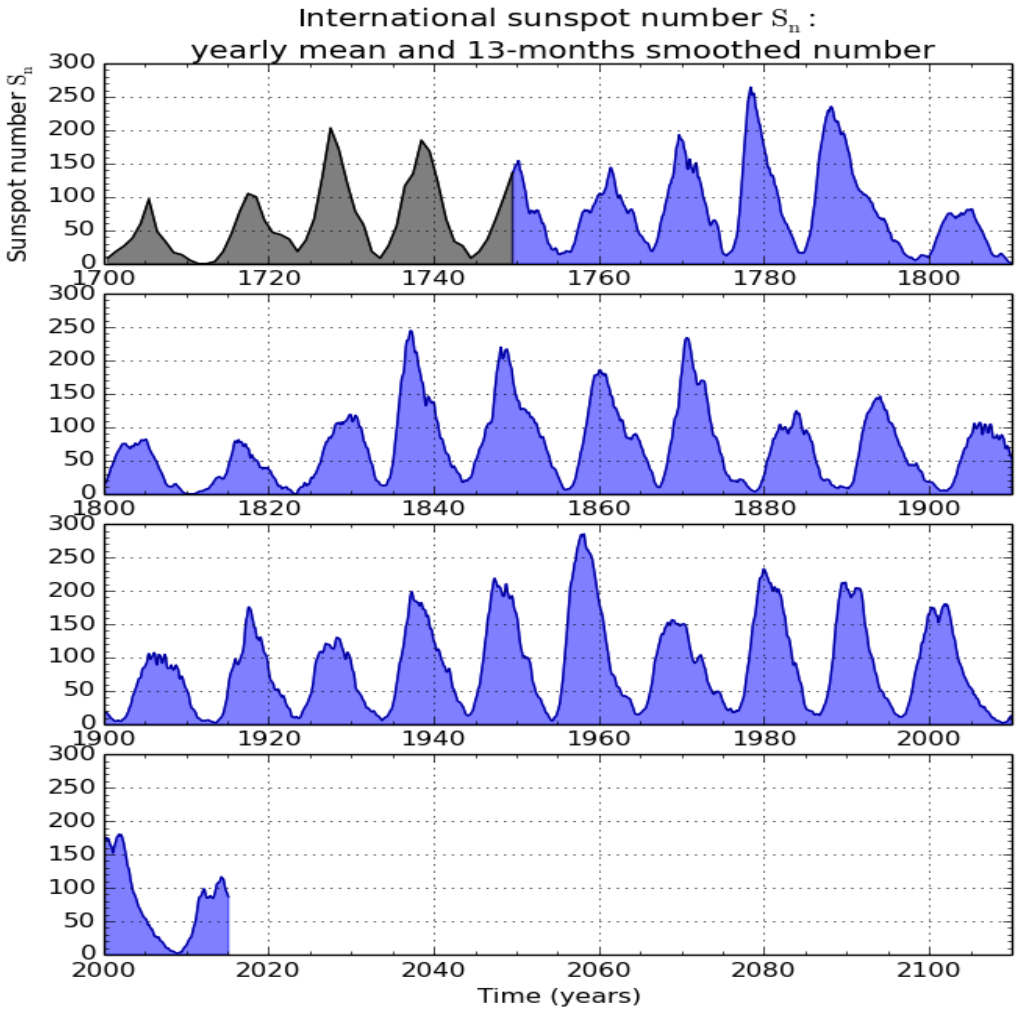
T plateau since 2000 partly caused by sun ?




Cycle 24 Sunspot Number Prediction (2015/08)
300
200
100
0
1985
1990
1995
2000
2005
2010
2015
2020
Cycle 22
Cycle 23
Cycle 24
Hathaway NASA/ARC

Revised International sunspot number

- 300+ year record
- Apparent 100 year periodicity



RMIB TSI SPACE RECORD

PAST IN SPACE:

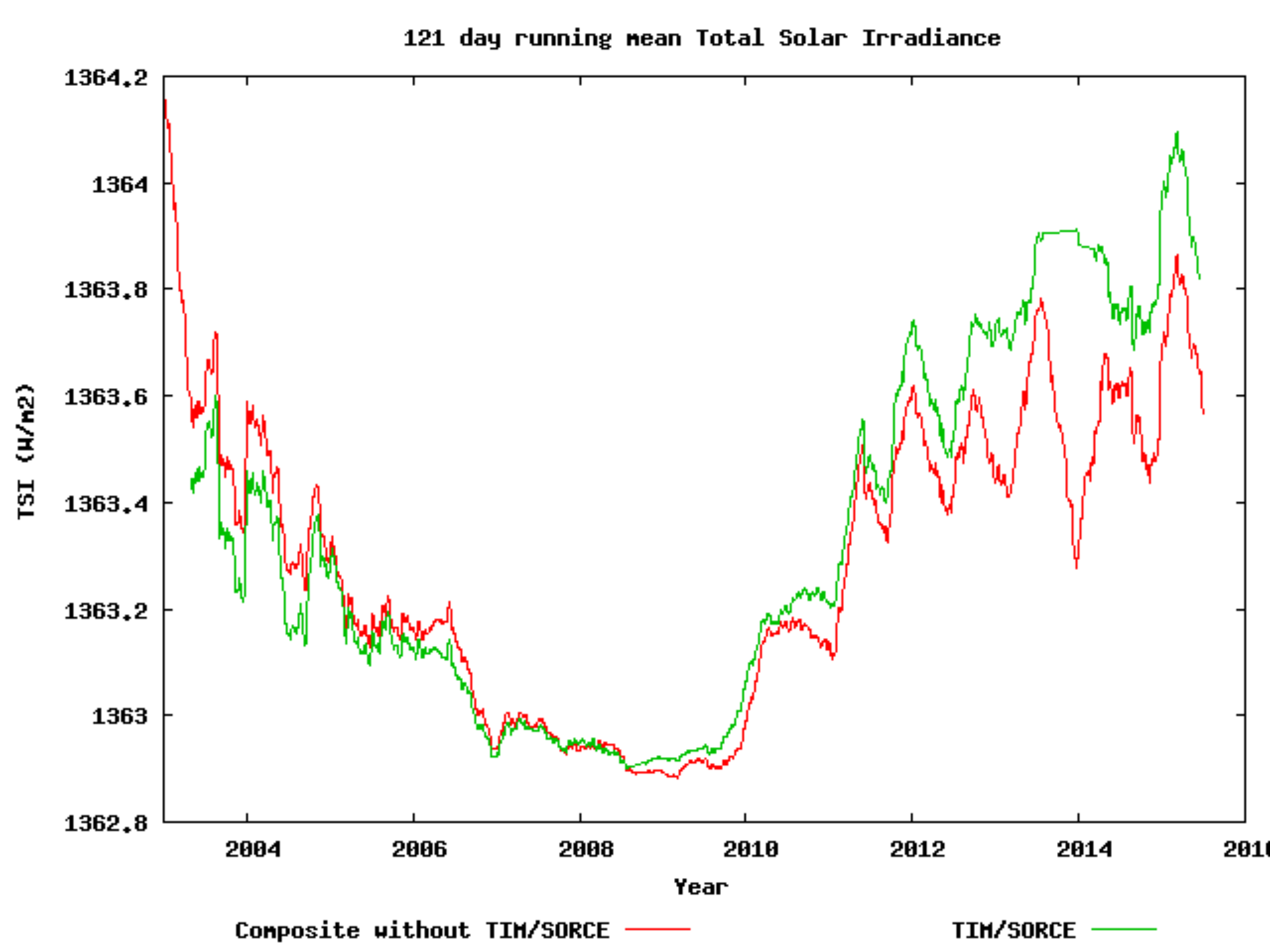
- 1983 SPACELAB 1 NASA ESA
- 1992 ATLAS-I NASA STS-45
- **1992 EURECA ESA STS-46: returned to ground**
- 1993 ATLAS-II NASA STS-56
- 1994 ATLAS-III NASA STS-66
- 1997 HITCHHIKER NASA STS-85
- 1998 HITCHHIKER NASA STS-95
- 2003 FREESTAR NASA STS-107

NOW IN SPACE:

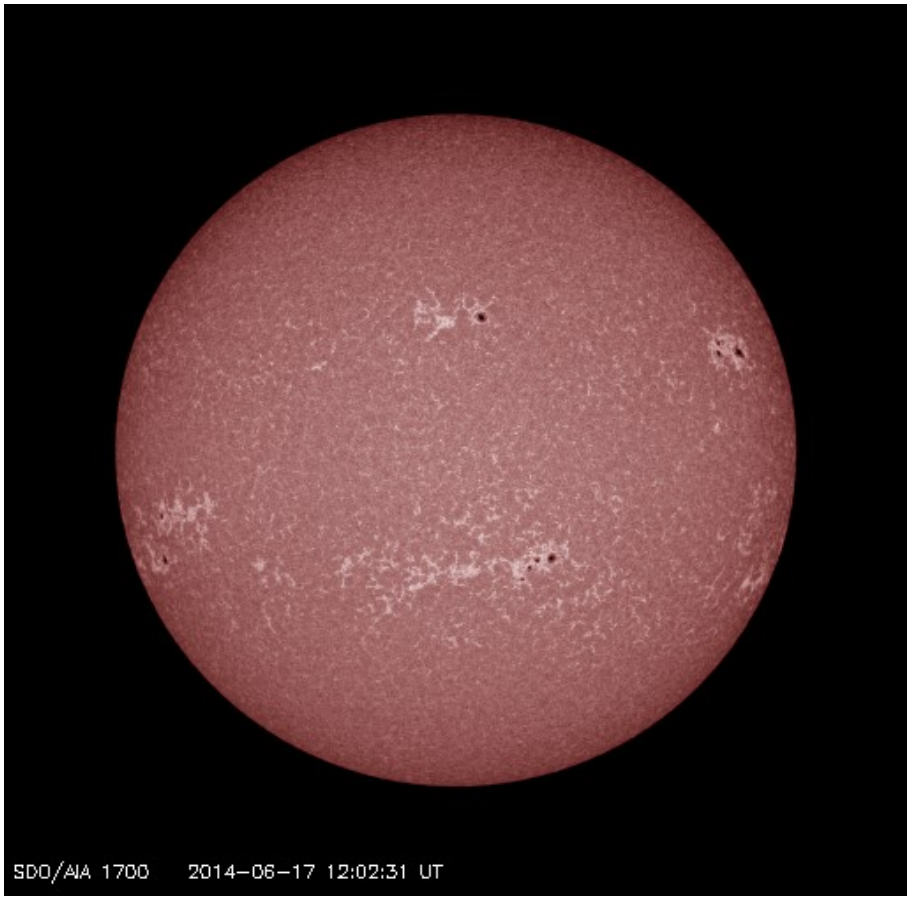
- **SOHO/VIRGO/DIARAD ESA** December 1995 > **ongoing (> 19 y)**
- **ISS/SOVIM/DIARAD ESA** February 2008 > 1 year
- PICARD/SOVAP CNES June 2010 > terminated

PLANNED:

- FY3E/JOIM/DIARAD CMA 2018

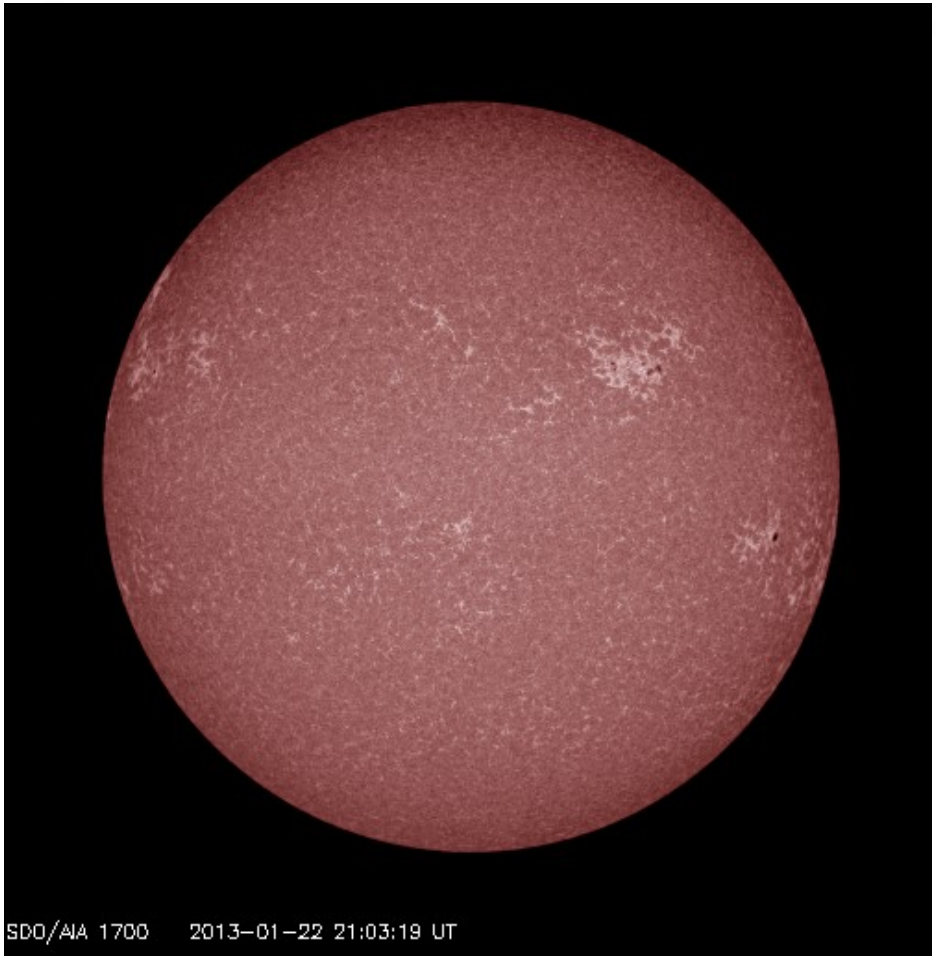

121 day running mean Total Solar Irradiance
1364.2
1364
1363.8
1363.6
1363.4
1363.2
1363
1362.8
TSI (W/m2)
2004
2006
2008
2010
2012
2014
Year
Composite without TIM/SORCE
TIM/SORCE

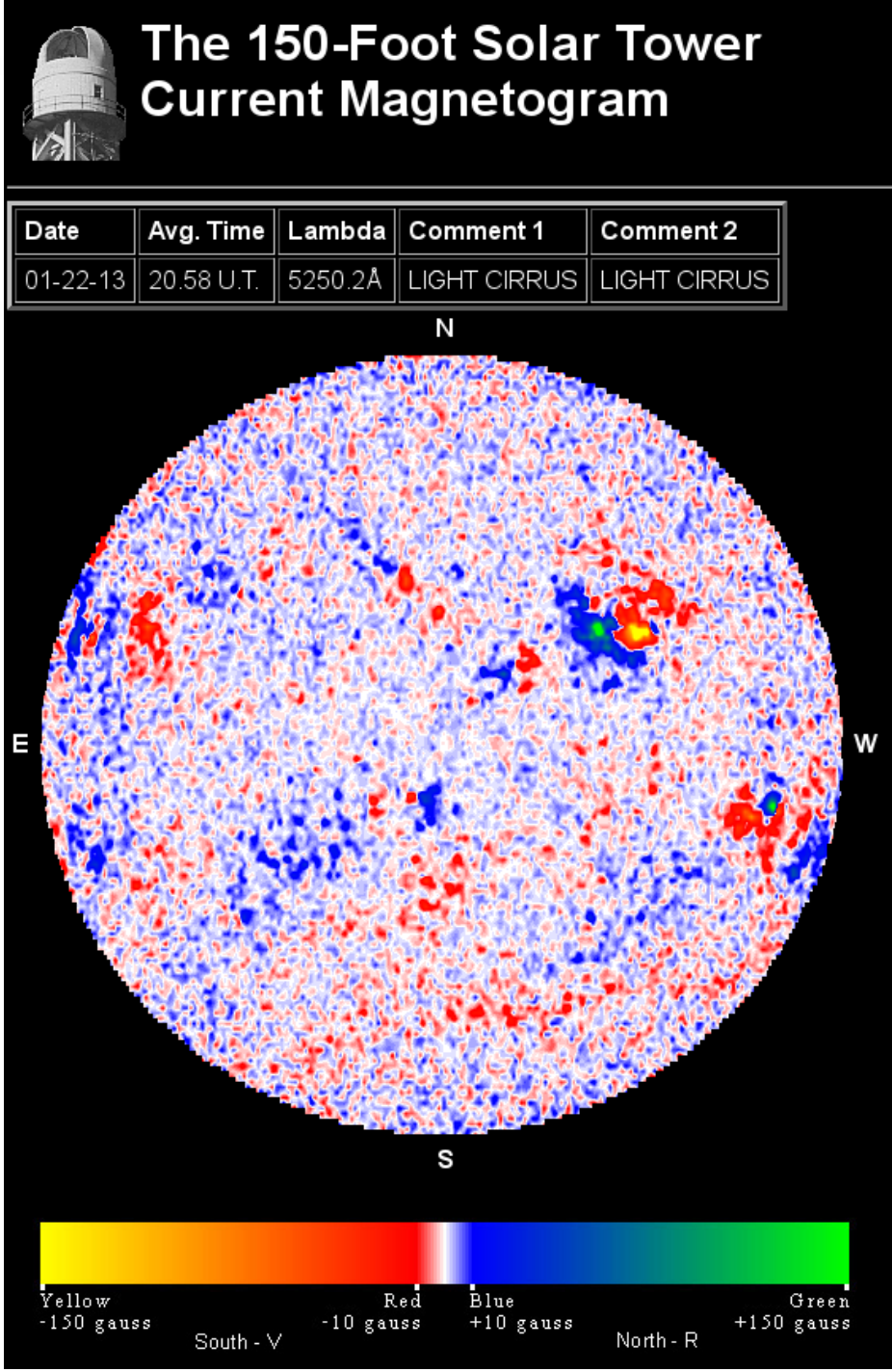
Sunspots and facula



- Sunspots: dark, strong magnetic field, relative short lifetime
- Facula: bright, intermediate magnetic field, relative long lifetime

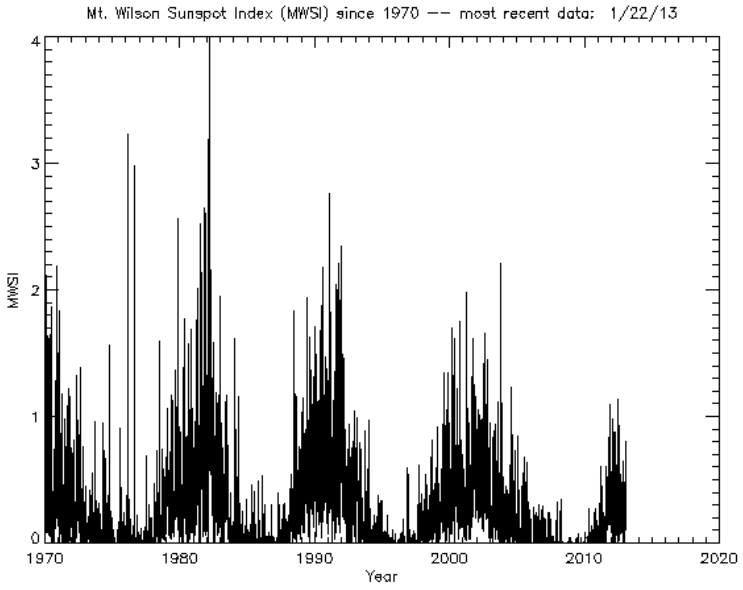
UV image


SDO/AIA 1700 2013-01-22 21:03:19 UT

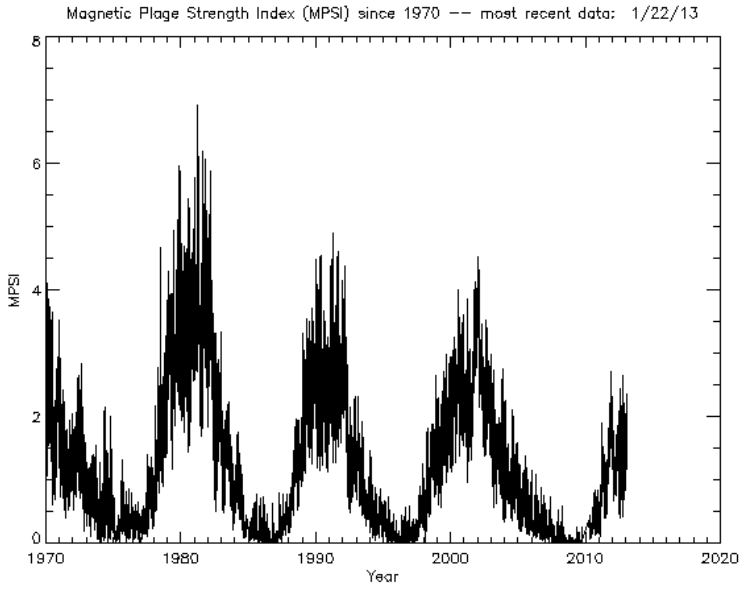

The 150-Foot Solar Tower
Current Magnetogram
Date
Avg. Time
Lambda
Comment 1
Comment 2
01-22-13
20.58 U.T.
5250.2Å
LIGHT CIRRUS
LIGHT CIRRUS
N
E
W
S
Yellow
-150 gauss
Red
-10 gauss
Blue
+10 gauss
Green
+150 gauss
South - V
North - R

Mount Willson indices

MWSI
Strong magnetic fields
Sunspots



MPSI
Intermediate magnetic fields
Facula



TSI model = A + B * MWSI + C * MPSI

Conclusions

- Within the measurement uncertainty of +/- 0.15 W/m²/dec there is no variation of the TSI quiet sun level during the last 30 years
- Over the last 300 years there is a 100 year modulation rather than a long term increase of the solar activity
- The average 11 year solar radiative forcing is of the order of 0.25 W/m² with a 100 year modulation of the order of +/- 0.125 W/m²
- So TSI variations can not explain the Little Ice Age nor the recent T plateau
- What is the cause of the 100 year modulation ?

UV image / magnetogram