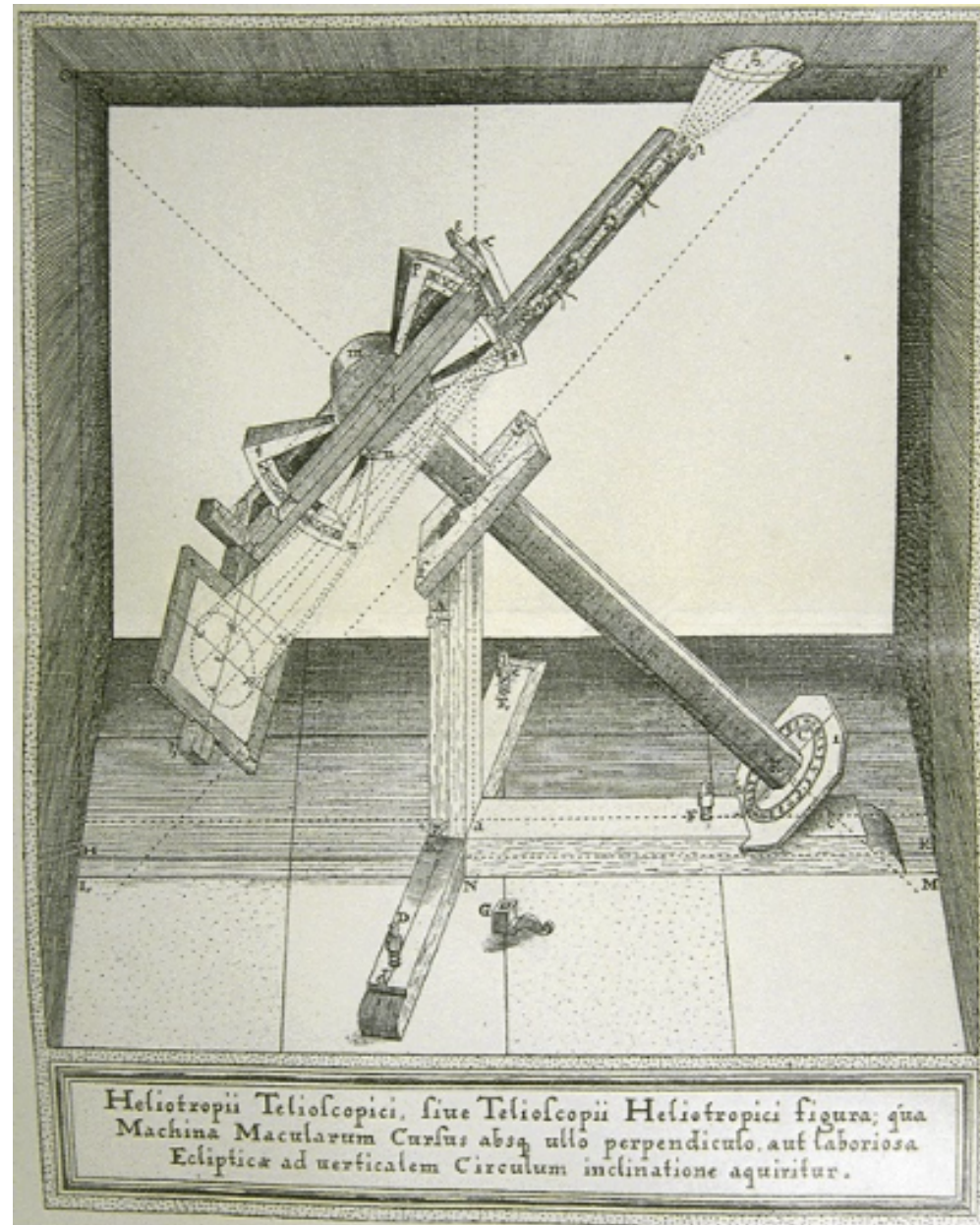


**PAST > PRESENT > FUTURE**  
**1610 > 2010 > 2050**

*Growth  
of  
Knowledge and Understanding  
of  
The Sun-Earth System*

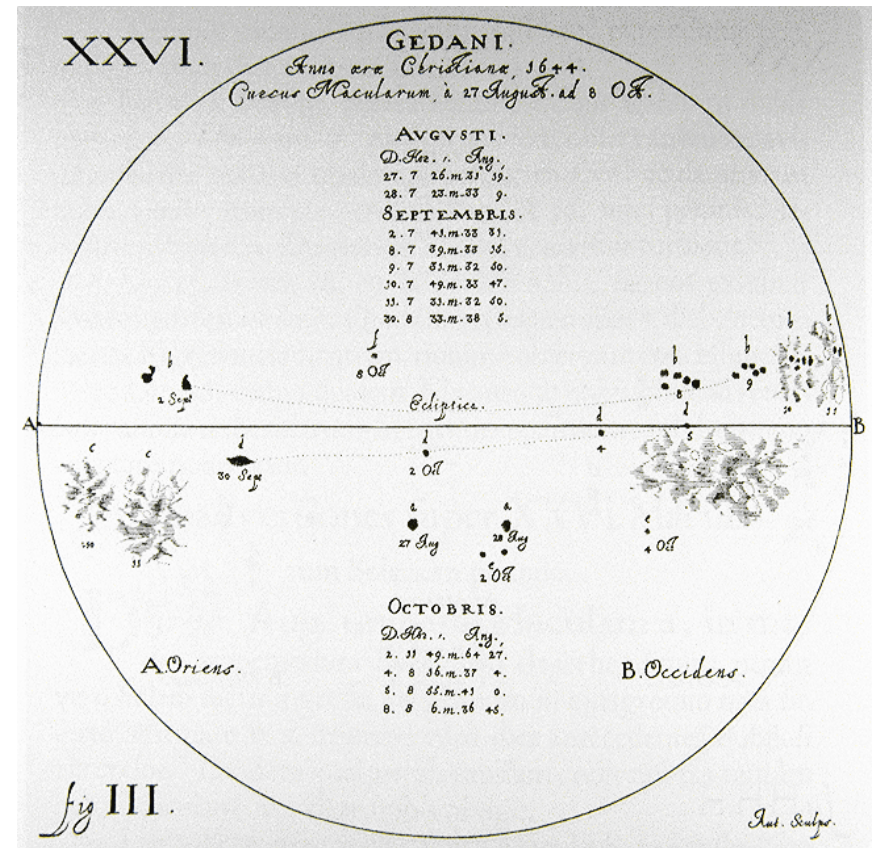
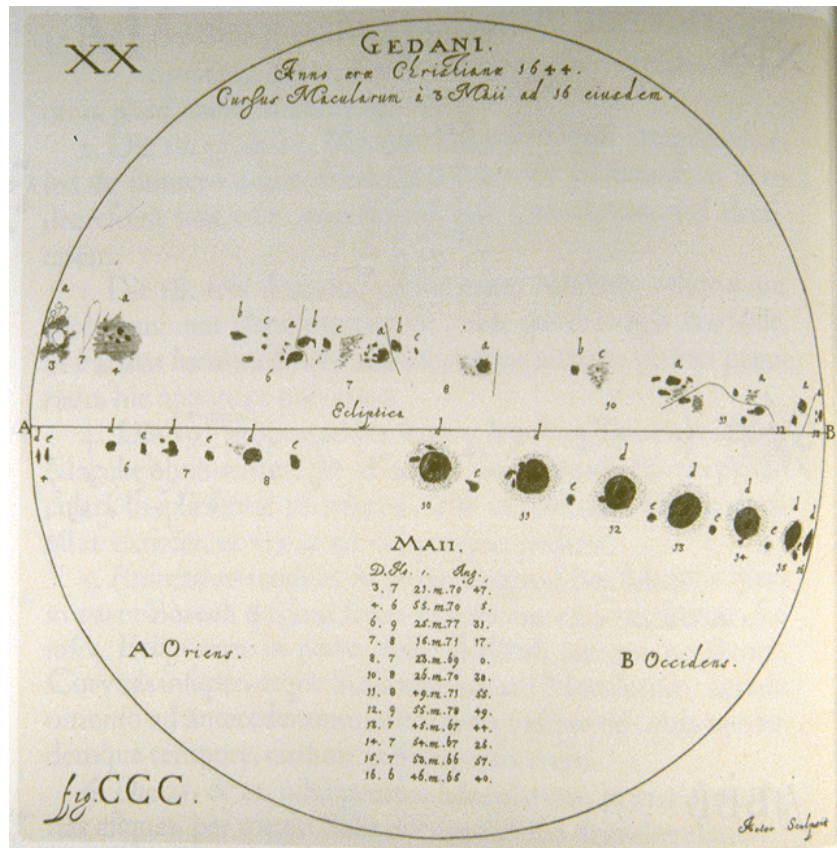
# Scheiners Helioscopium



# Helevius Observations 1644

May

August, September, October

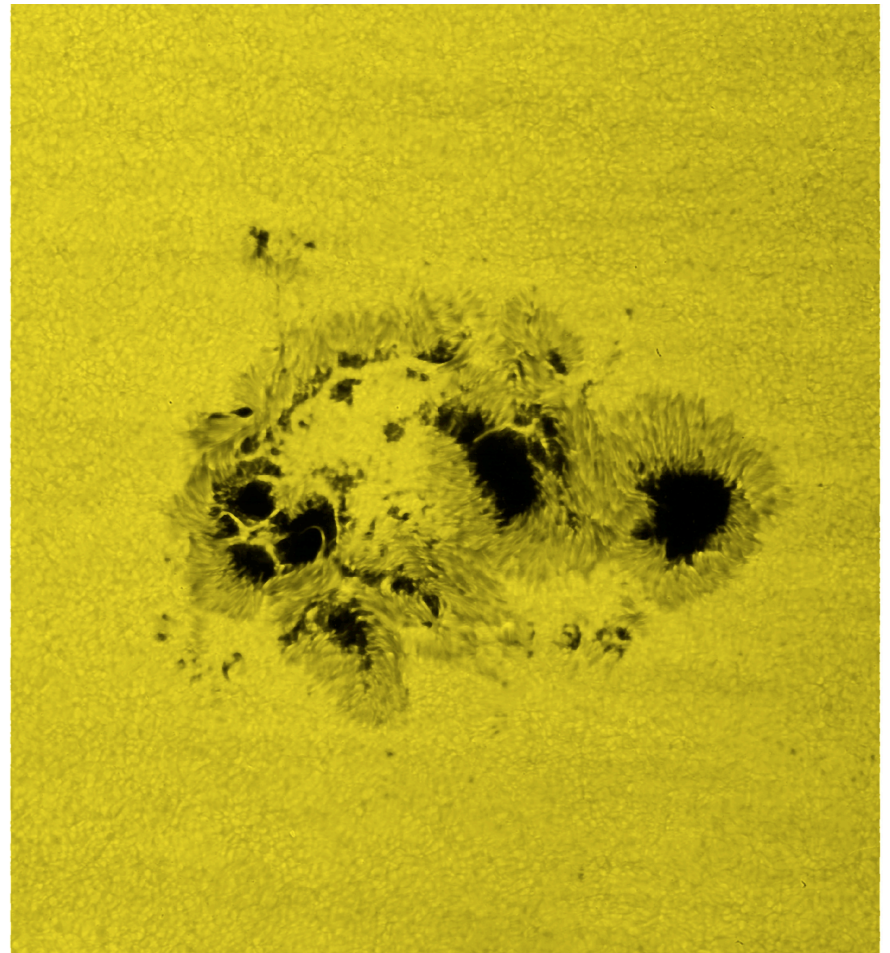
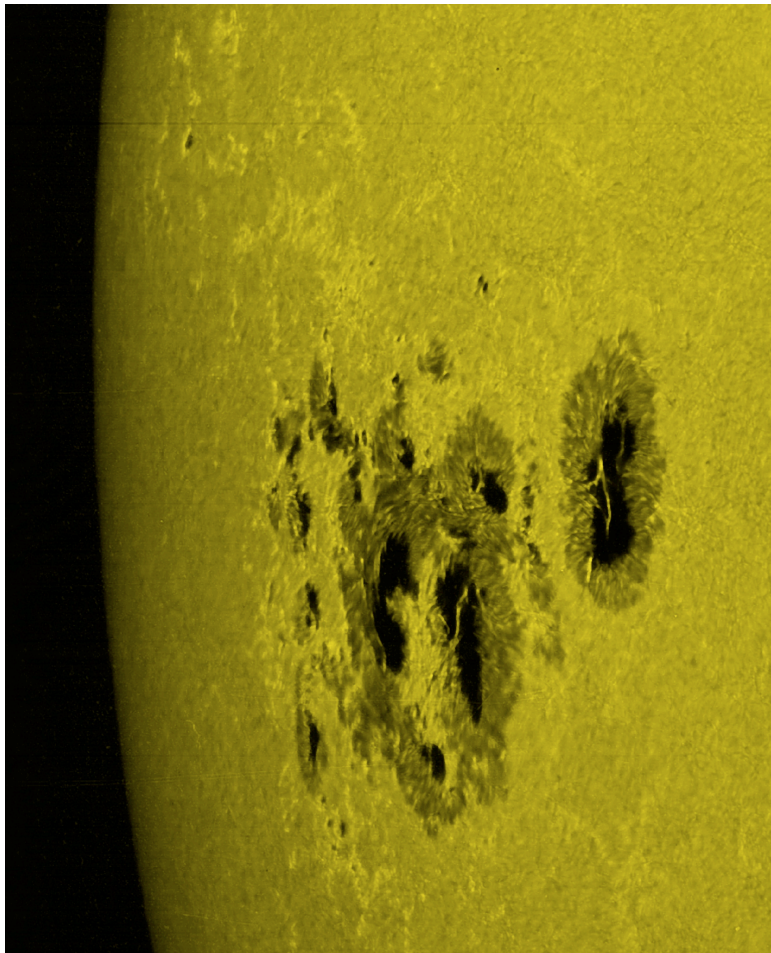


# Modern Sunspot Observations

October 24, 2003

Bill Livingston

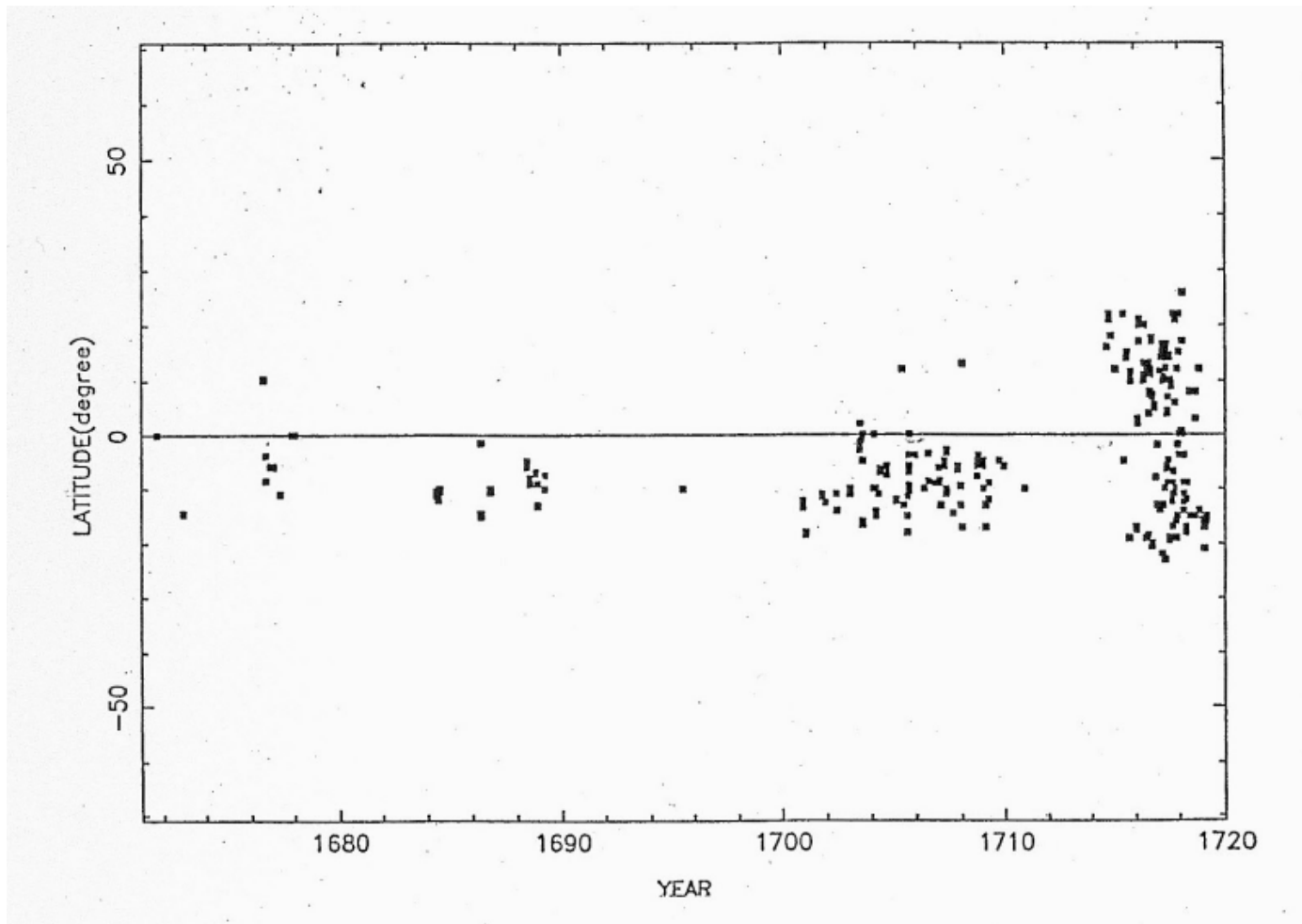
Kitt Peak NSO



# Sunspot Latitude Distribution Maunder Minimum

1660 to 1720

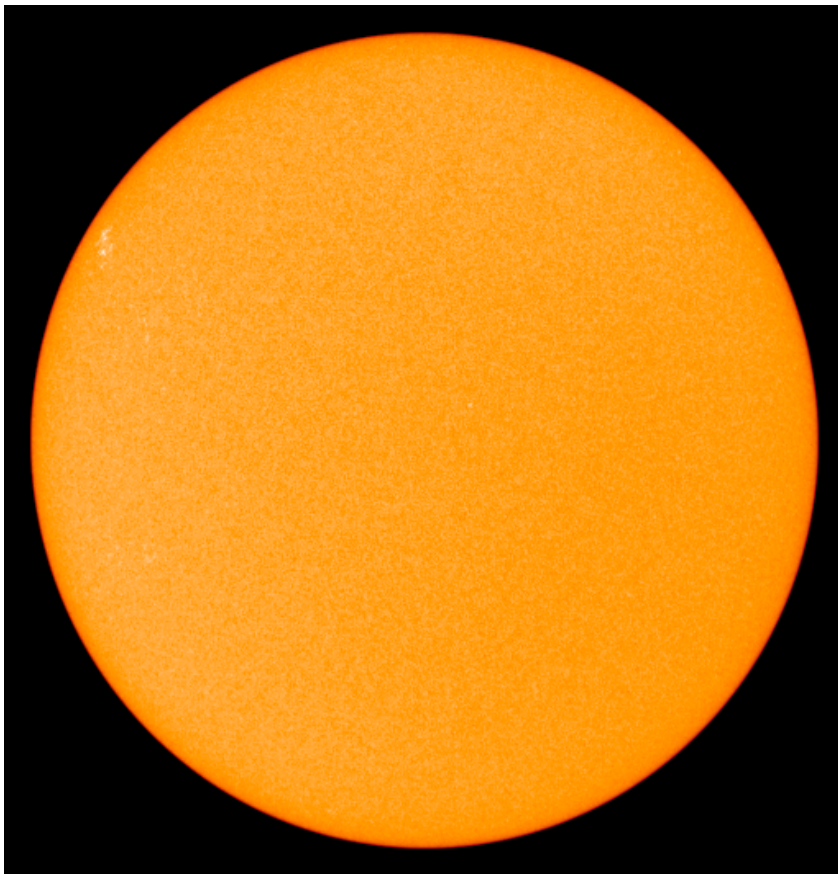
(Ribes and Ribes, 1993)



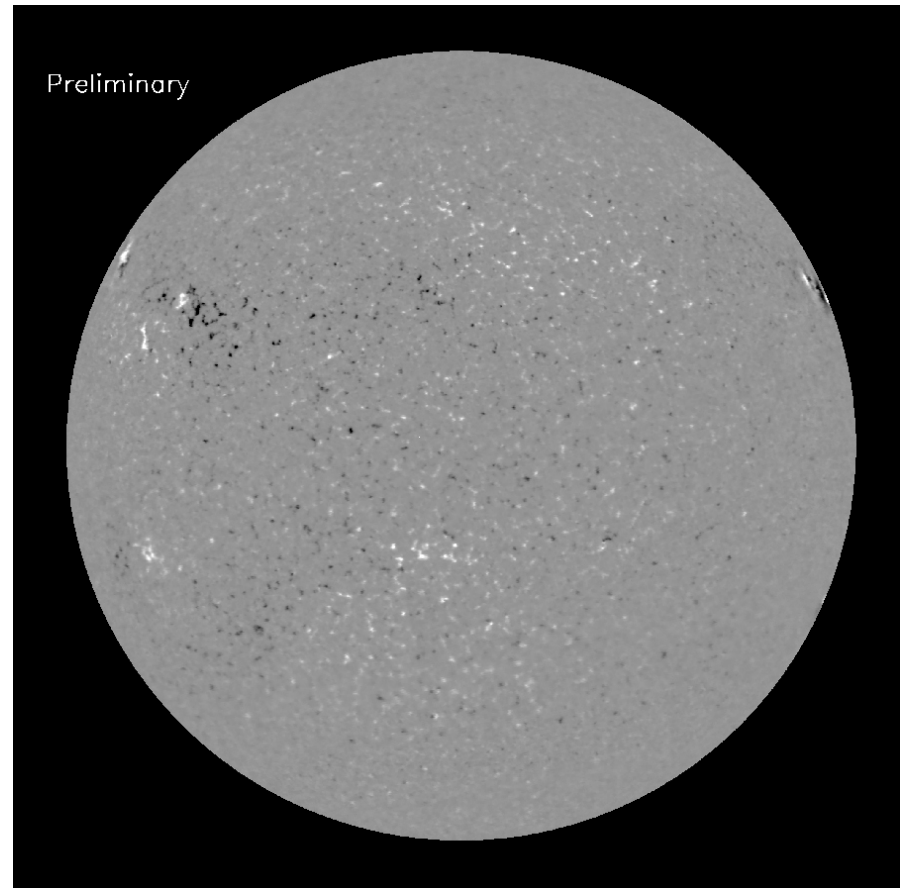
# MODERN SOLAR OBSERVATIONS

June 15, 2010

- MDI/SOHO IMAGE



NSO Magnetogram



# NEW KNOWLEDGE

1704 Newton describes solar prism spectrum

1724 Fahrenheit Hg Thermometer invented

1800 Herschel measures “heat” in solar spectrum using a prism & thermometer. He discovers *Infra-Red* solar spectrum.

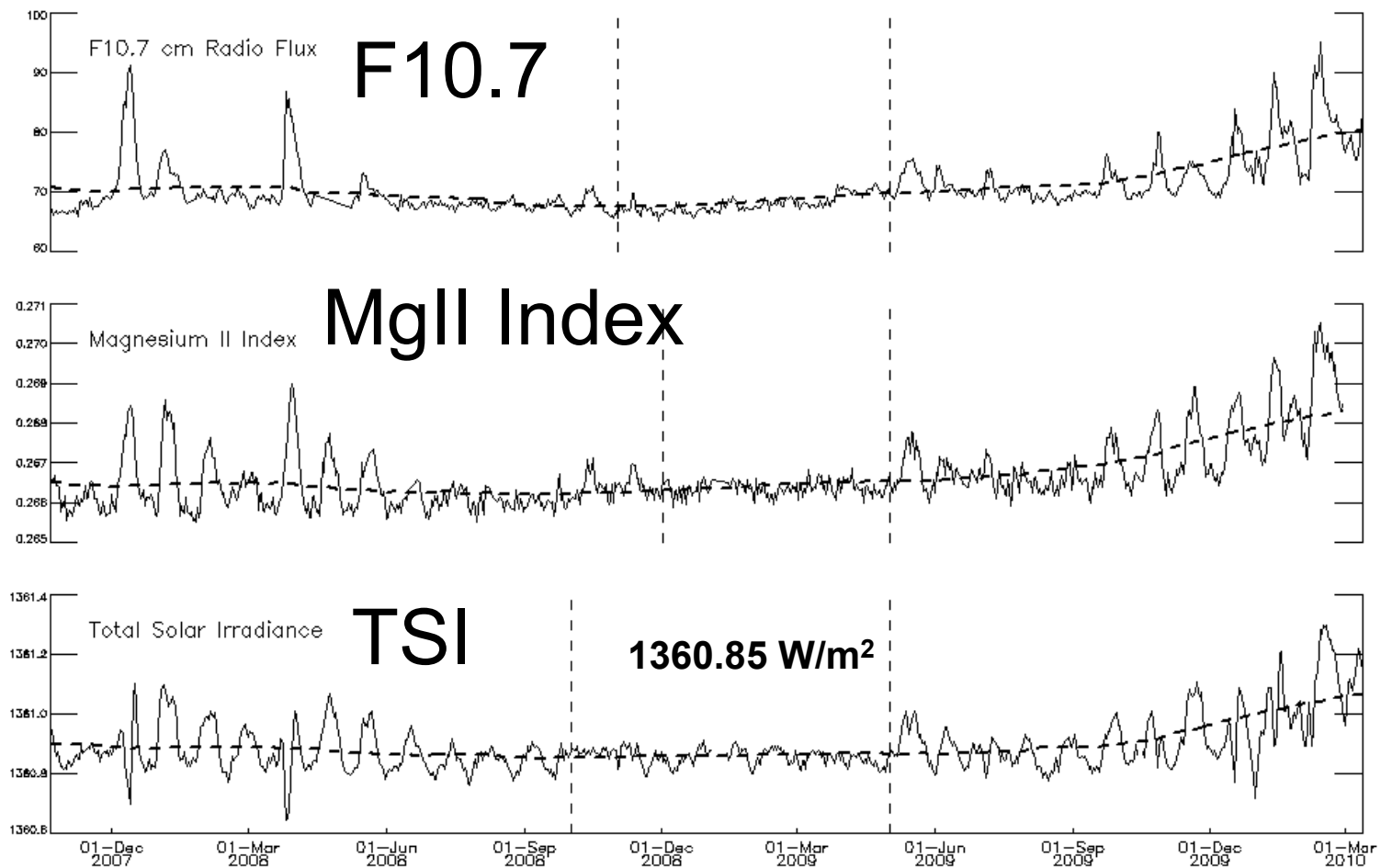
# QUEST FOR THE TOTAL SOLAR IRRADIANCE

## SORCE Total Irradiance Monitor



# Cycle 23-24 Minimum Epoch

## *“Mini Maunder Minimum”*

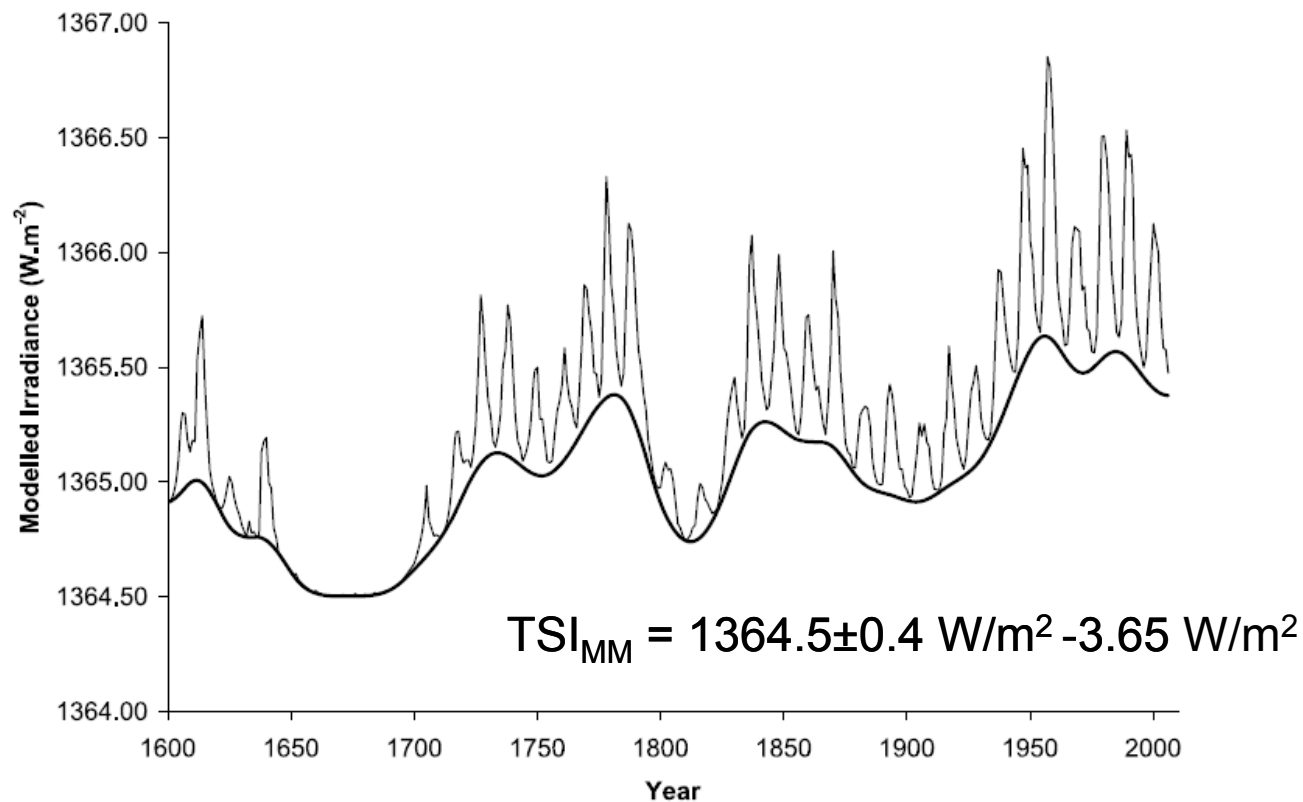


# Solar Magnetic Activity and Total Irradiance Since the Maunder Minimum

K.F. Tapping · D. Boteler · P. Charbonneau · A. Crouch ·

A. Manson · H. Paquette

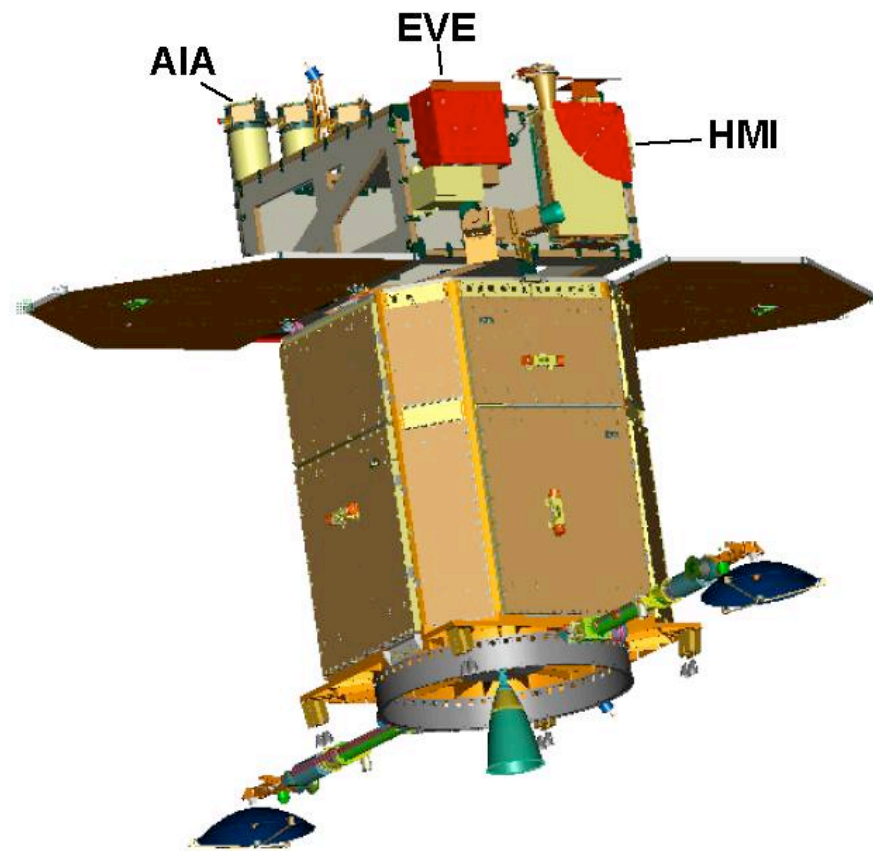
Solar Phys (2007) 246: 309–326



**Figure 9** Modelled total irradiance and disc irradiance since 1600.

# Solar Dynamics Observatory

Gives new pictures of solar atmosphere variability at beginning of Solar Cycle 24

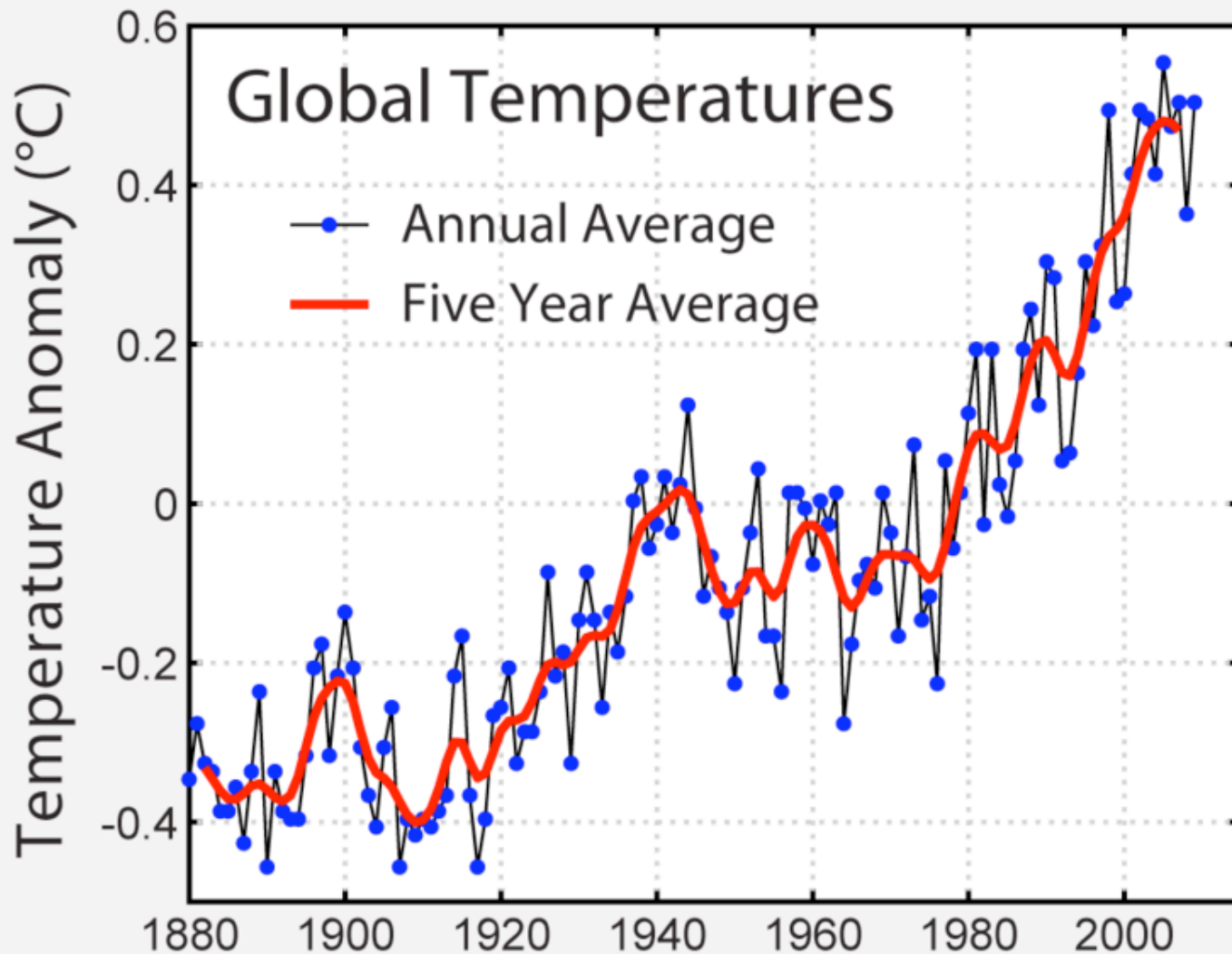


**Next 40 Years**

**2010 to 2050**

***Important?***

If trend continues to 2050,  
temperature anomaly  $\sim 1.3^{\circ}\text{C}$



# World Population Growth

