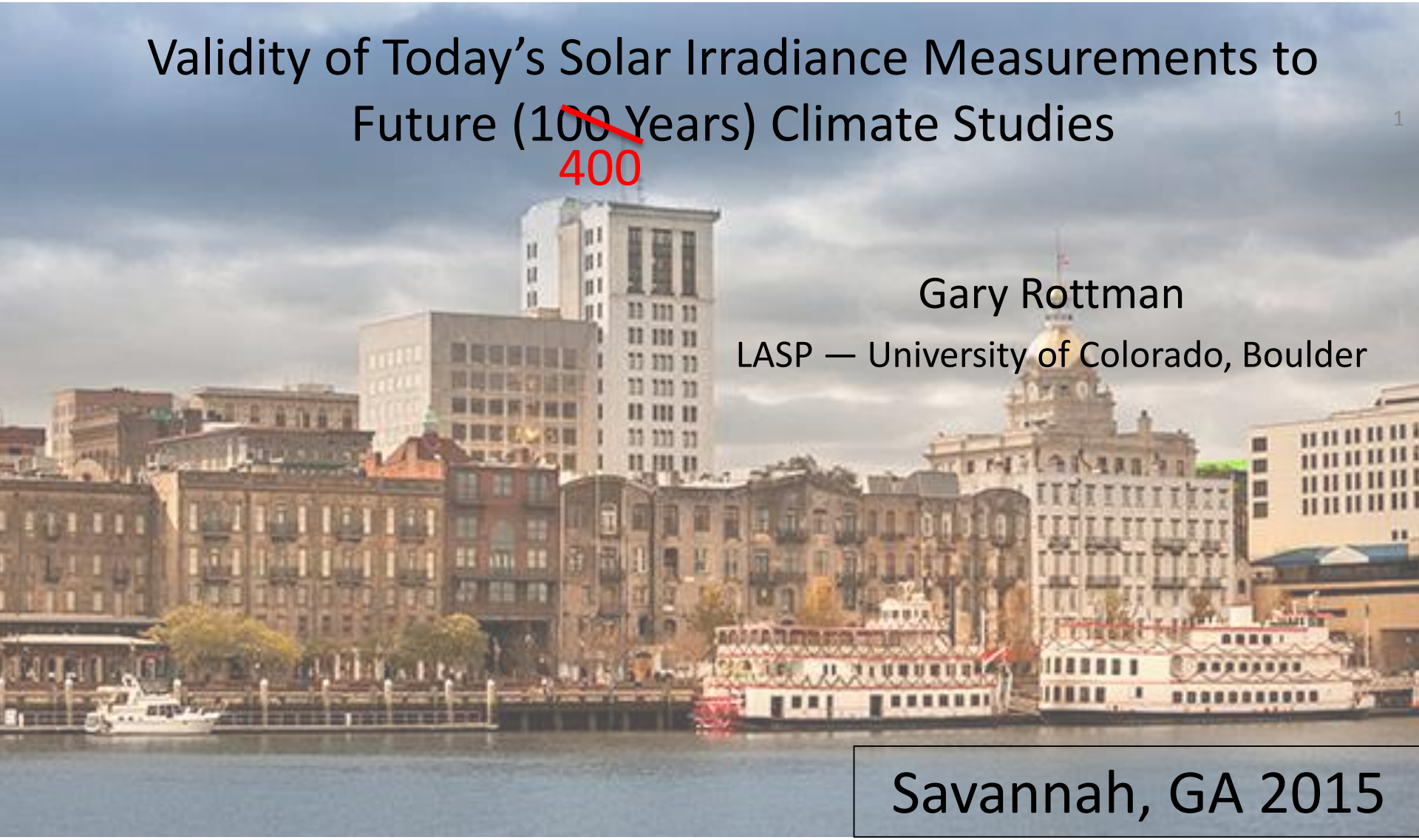
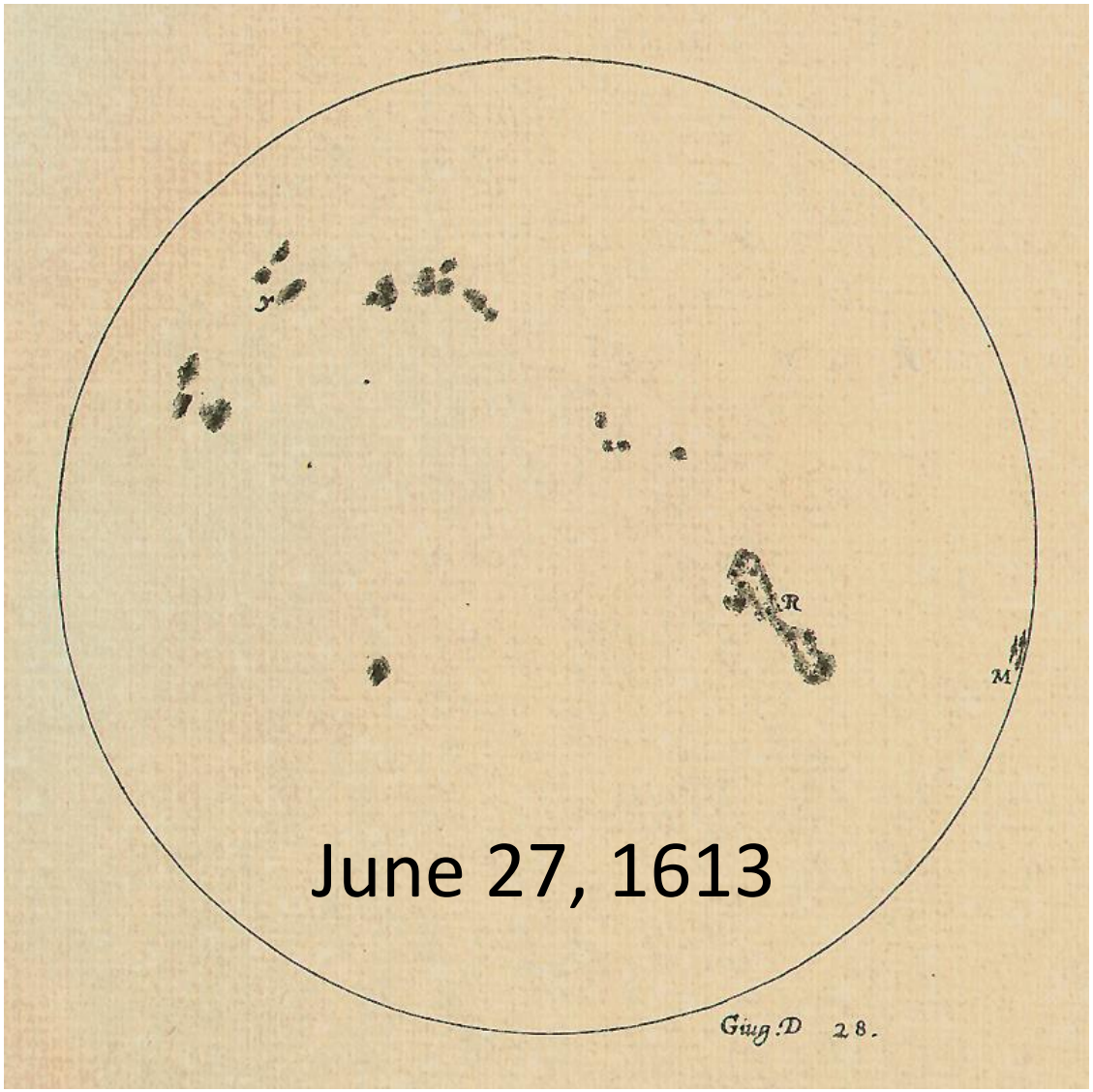
Validity of Today's Solar Irradiance Measurements to Future (~~100~~ 400 Years) Climate Studies



Gary Rottman

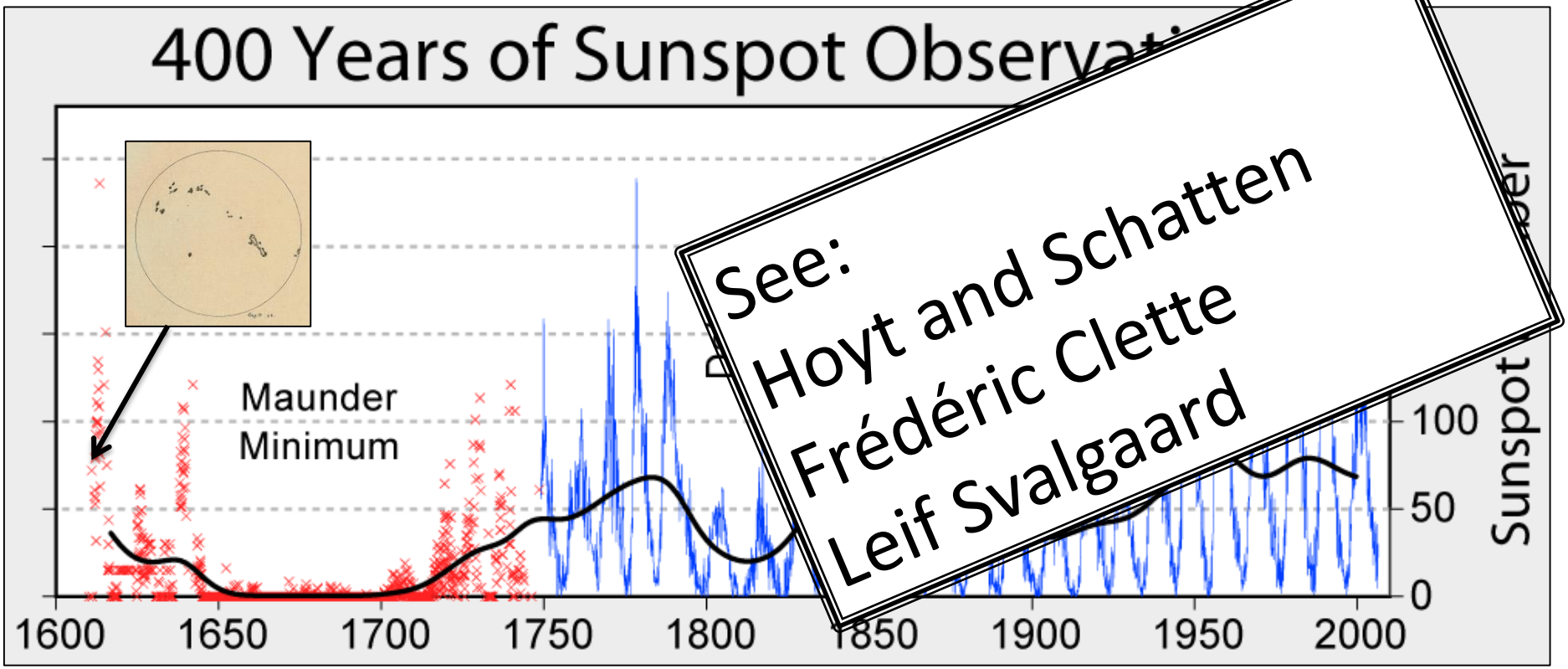
LASP — University of Colorado, Boulder

Savannah, GA 2015



June 27, 1613

Sunspot Data Record



- Longest Observational Climate Record
- Instrumental Temperature Record

Committees and Reports of the 1980's

Global Change: Impacts on Habitability

Richard Goody (Chairman), July 1982, Woods Hole (JPL, 1982)

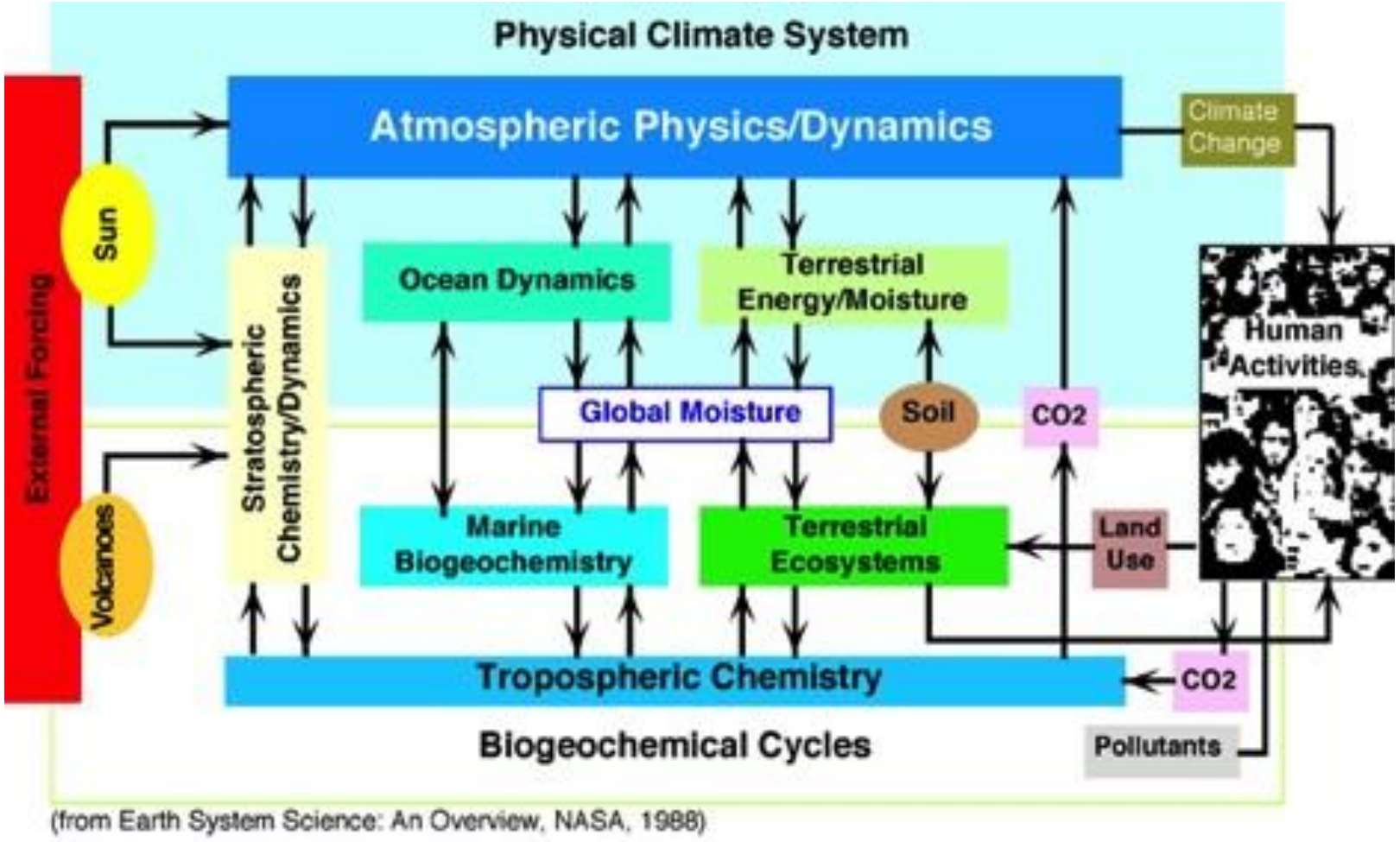
Toward an International Geosphere-Biosphere Program

Herbert Friedman, NRC 1983

Earth System Science: A Program for Global Change

Francis Bretherton, ESSC, 1986 and 1988

Earth System Science: A Program for Global Change
Bretherton + 15 Others, 1988



Environmental Data Records (EDR's)

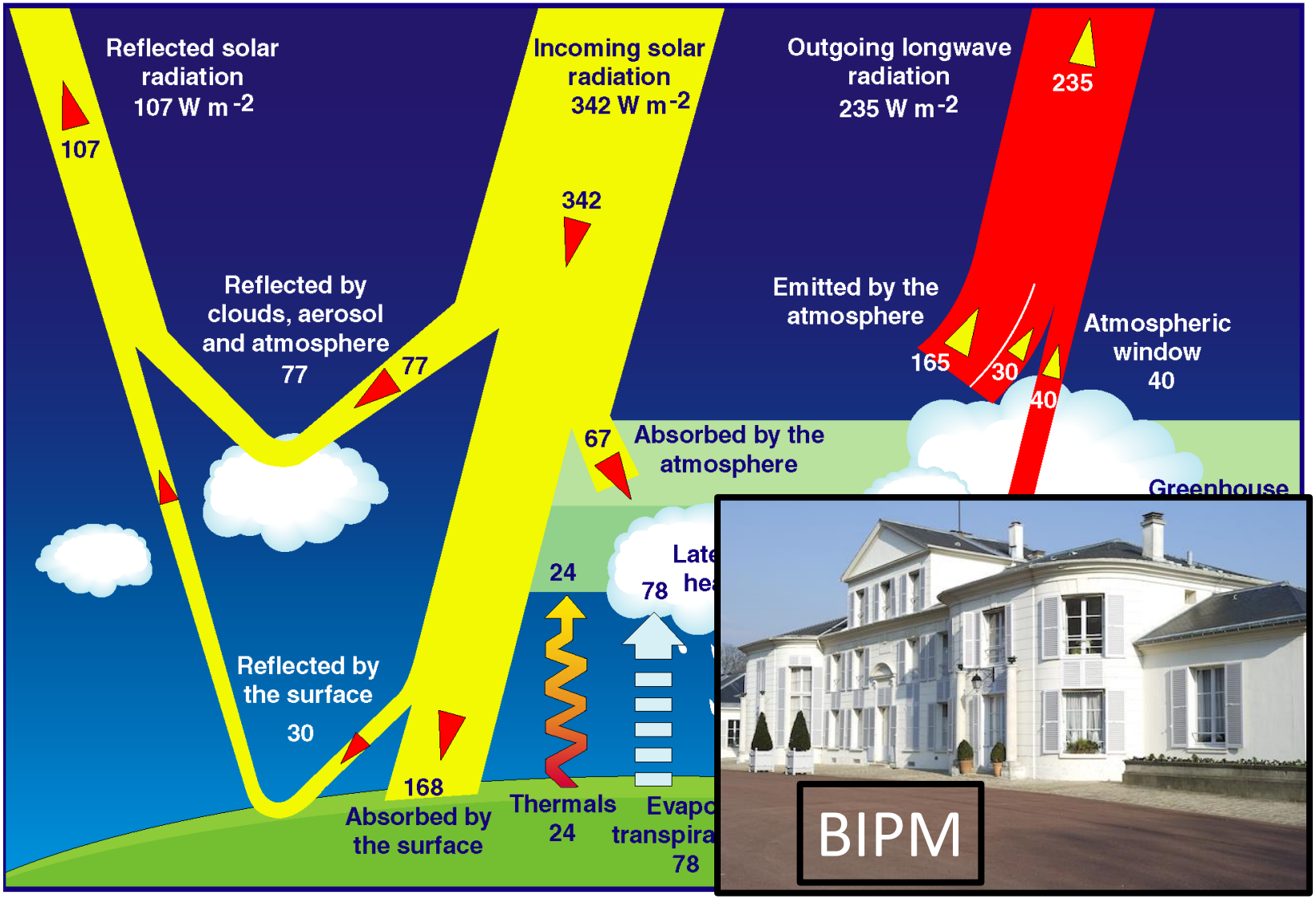
EOS Instruments were designed to measure the following environmental variables:

- Cloud Properties
- Surface Temp
- low of glaciers
  and rocks
  and dynamics of the atmosphere — winds
  and precipitation
  Changes in stress and surface elevation around geological faults
- Exchange of energy, momentum and gases between the Earth's surface and atmosphere
- Biological activity on land and in near-surface waters
- Input of solar radiation and energetic particles to the Earth

EDR — a time series of measurements of sufficient length, consistency, and continuity to determine climate variability and change. [NRC, 2004]

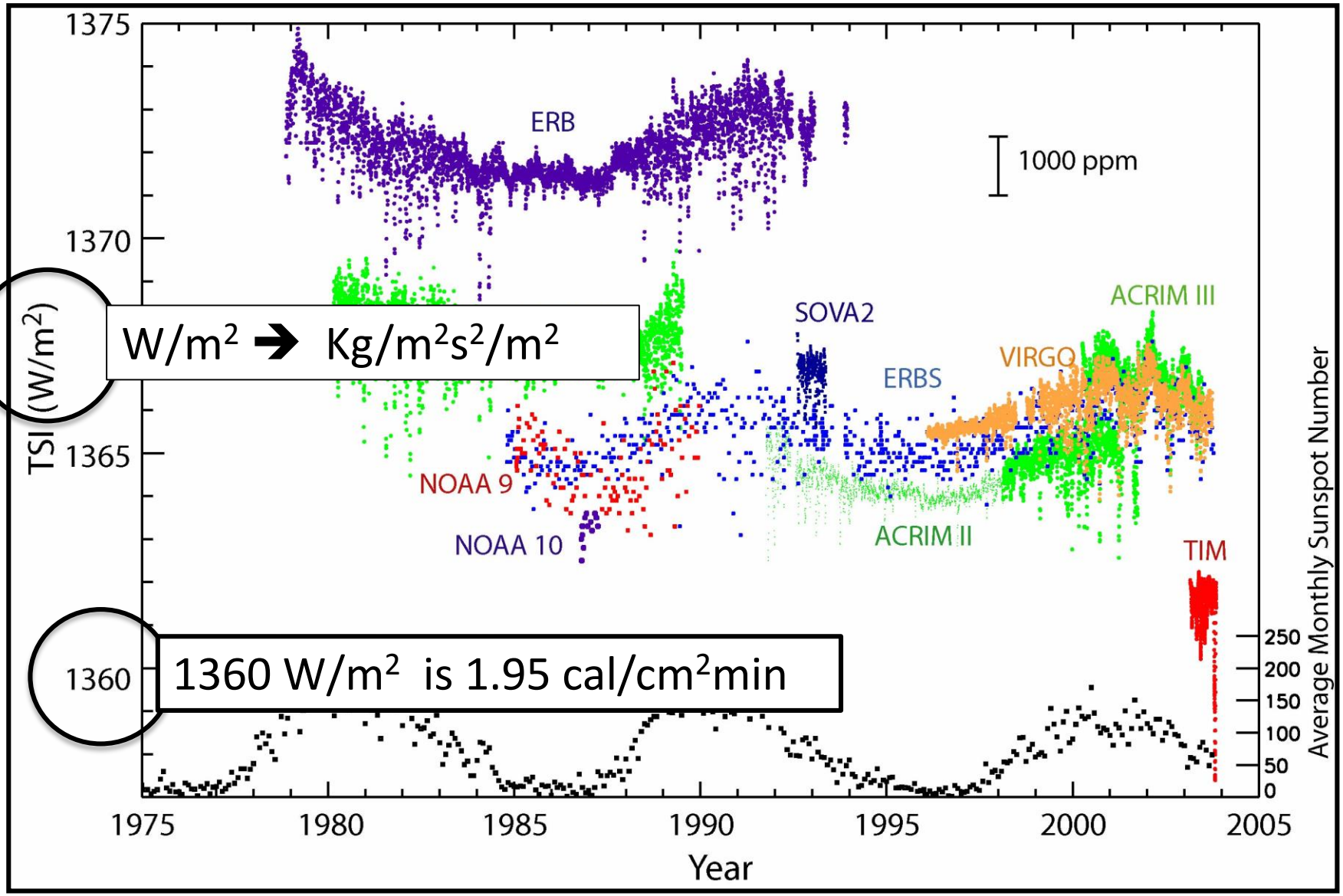
The Earth's Energy Balance

Radiation Balance of the Earth (Jeffrey T. Kiehl)

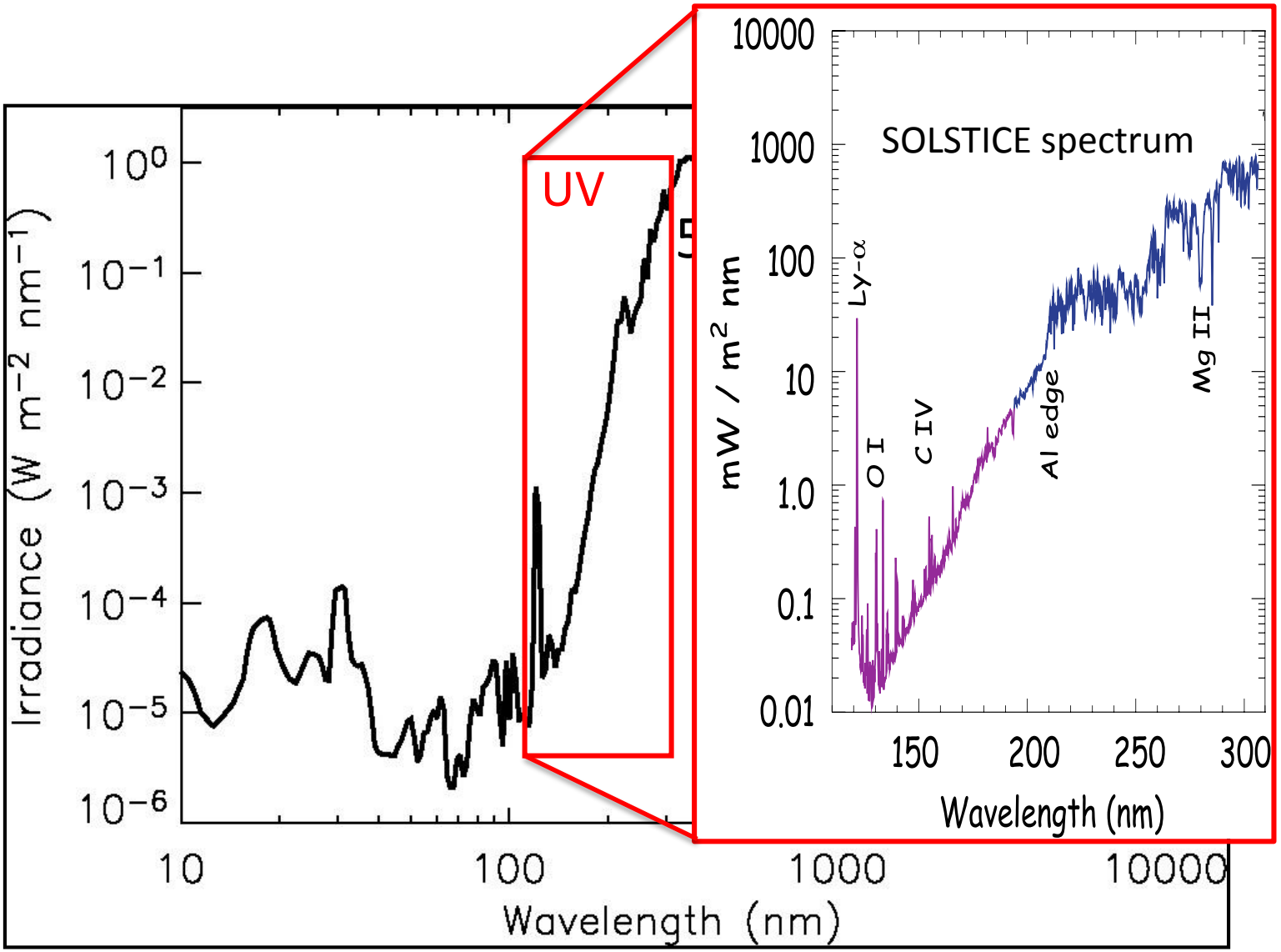


Radiation Balance of the Earth (Jeffrey T. Kiehl)

TSI Observations 1978 to 2003



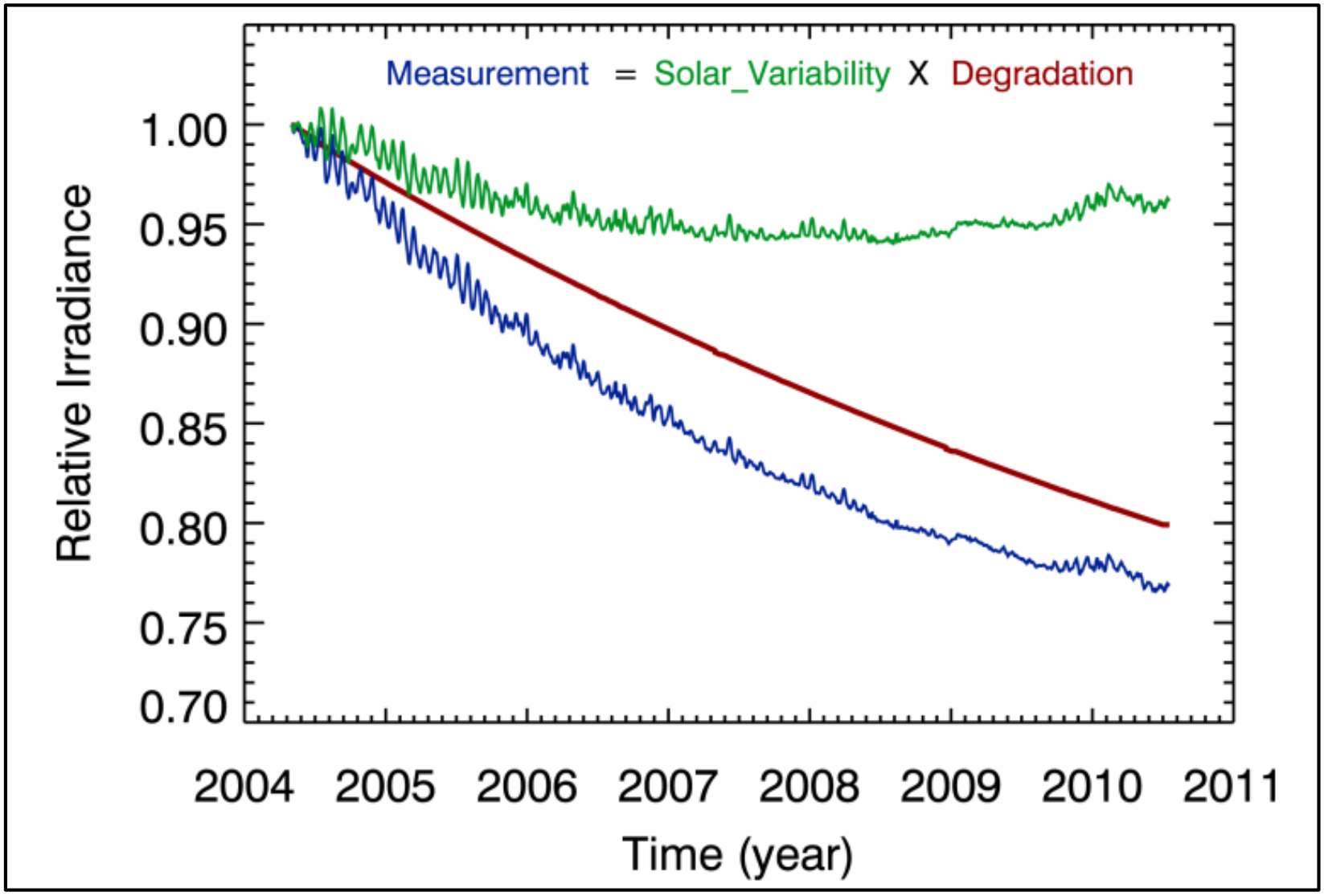
Full Solar Spectrum

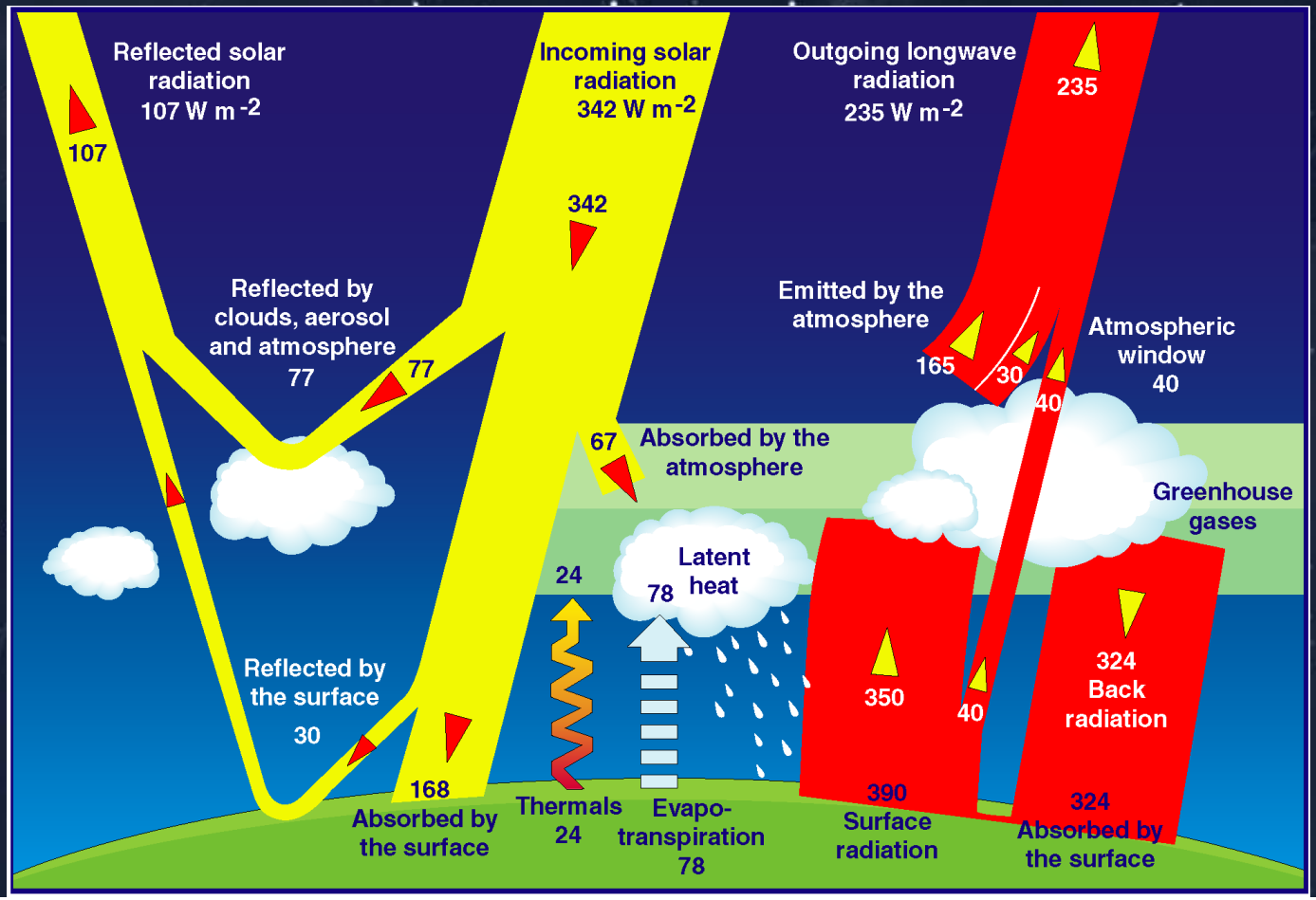


Achieving an Accurate TSI/SSI Observation

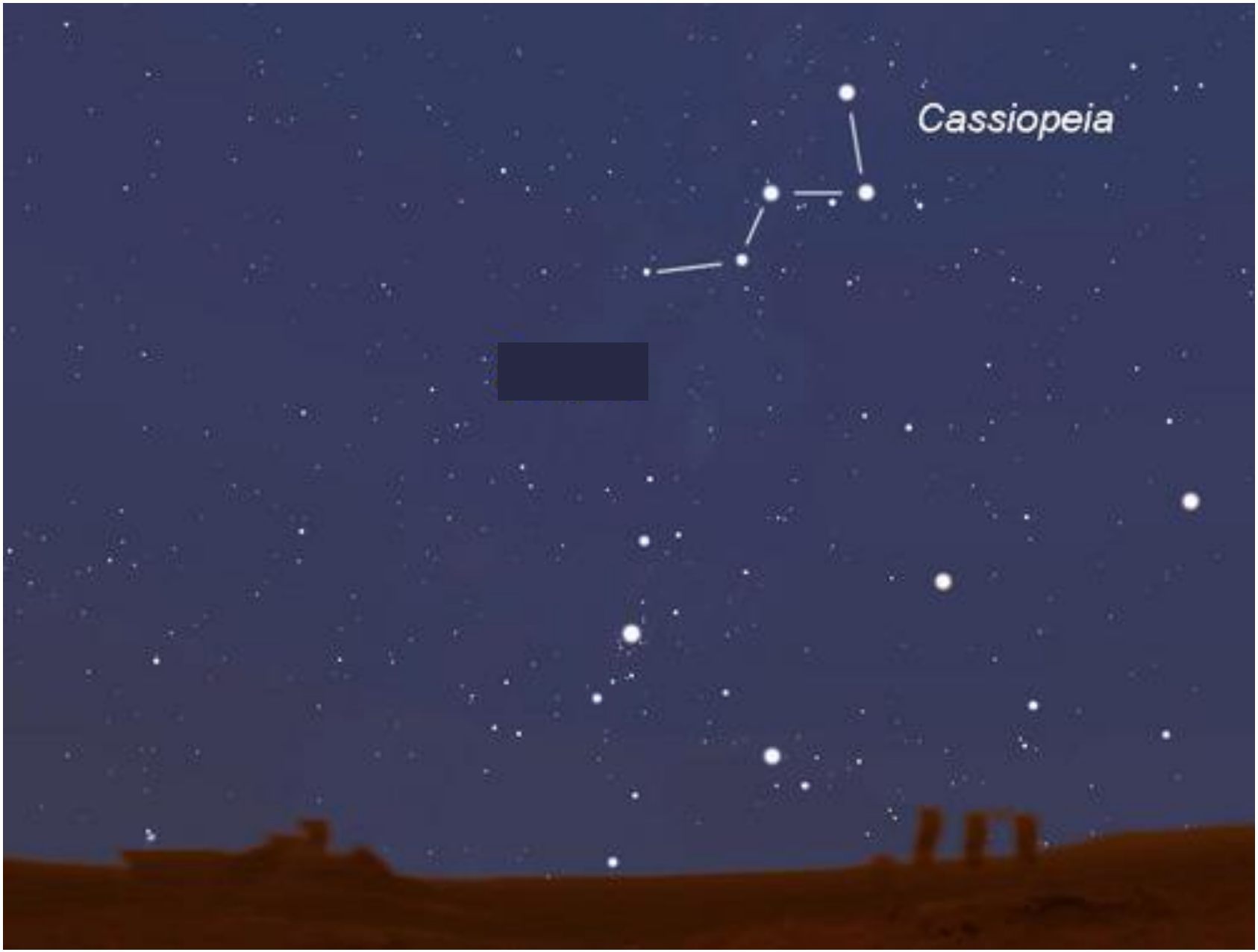
- GOAL # 1 — place the instrument on orbit with the best possible calibration (SI units) and characterization
- GOAL # 2 — Determine on-orbit changes in instrument responsivity, correct solar data
- GOAL # 3 — Establish a solar irradiance EDR that can be reliably compared to future observations

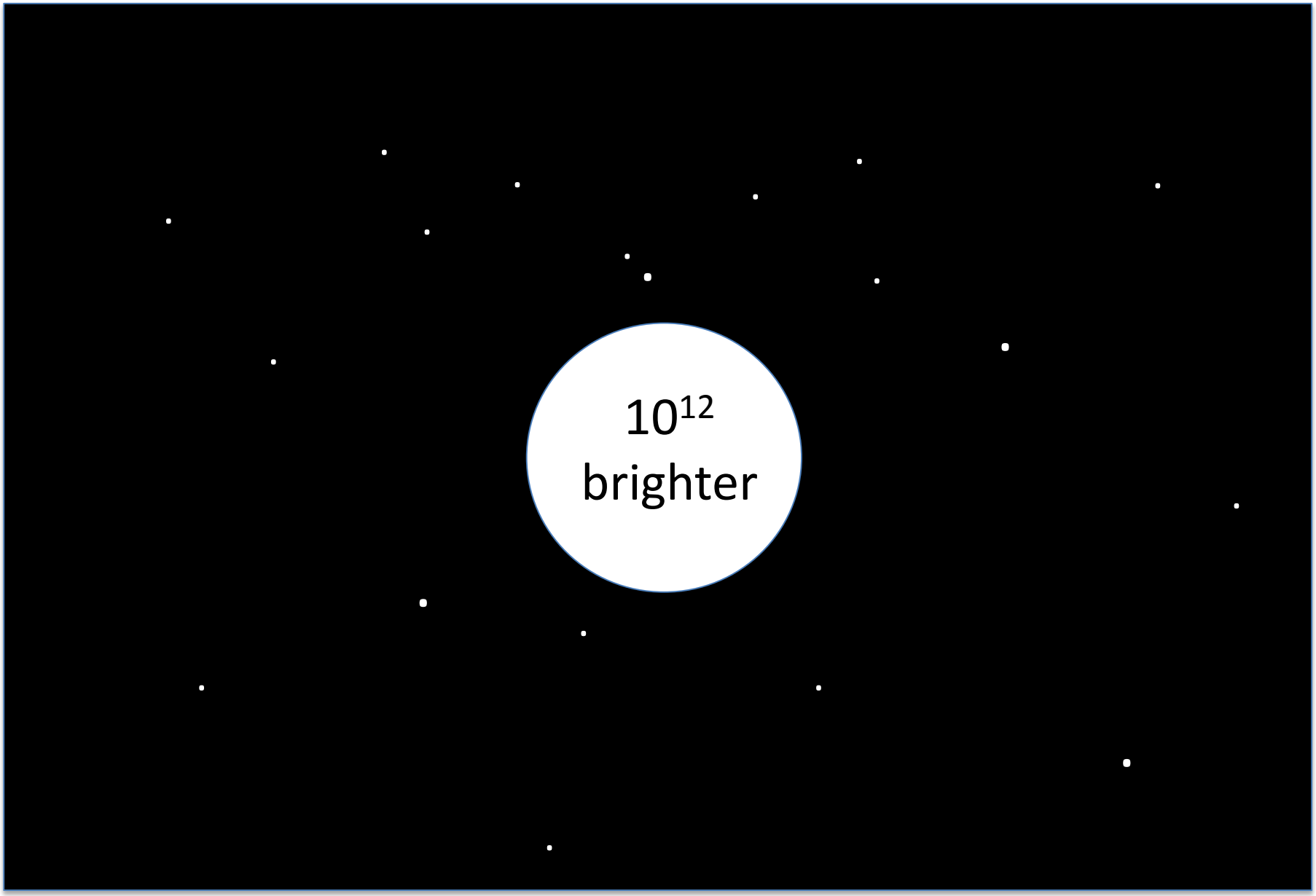
GOAL # 2 — Determine on-orbit and correct changes in instrument responsivity

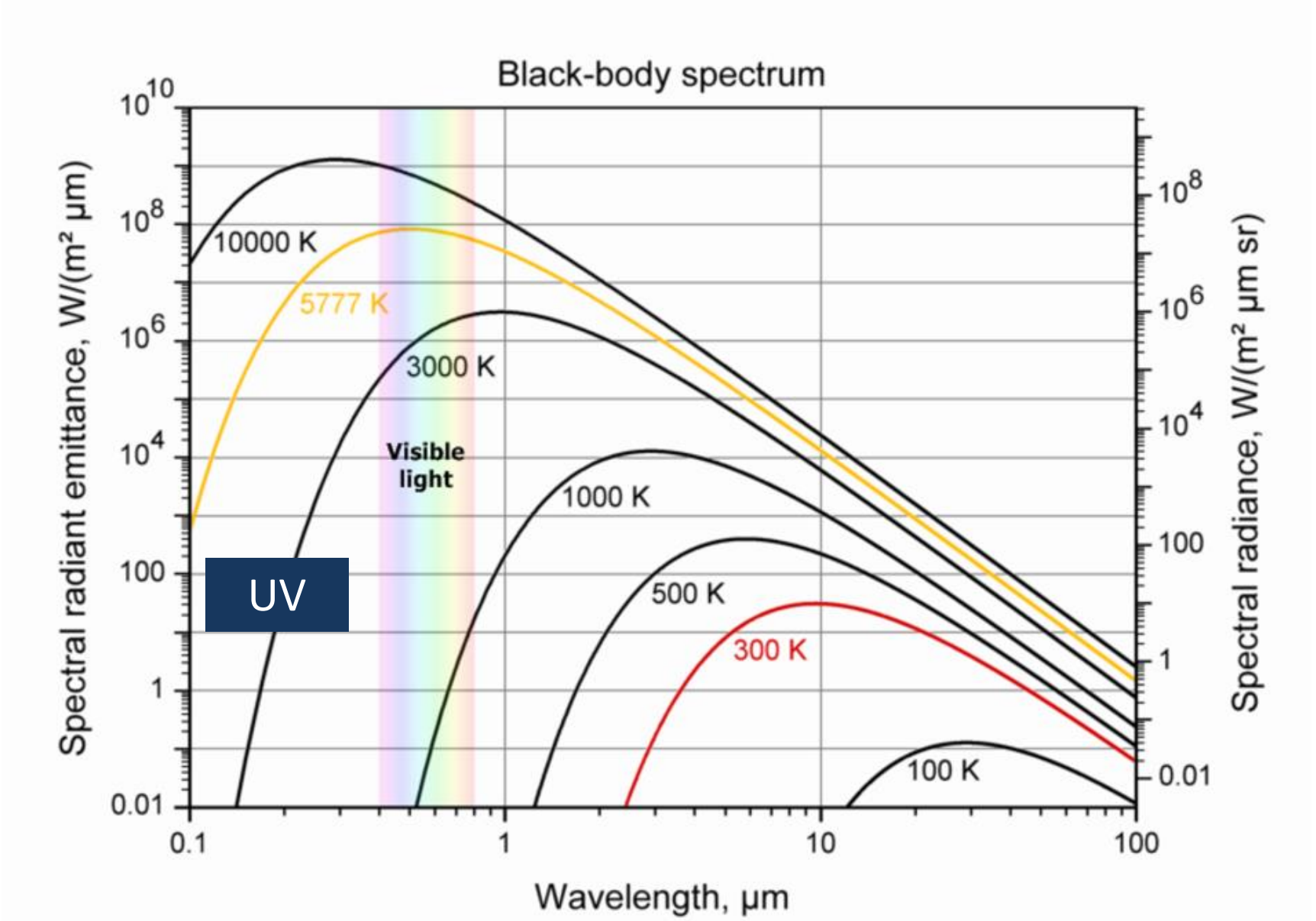




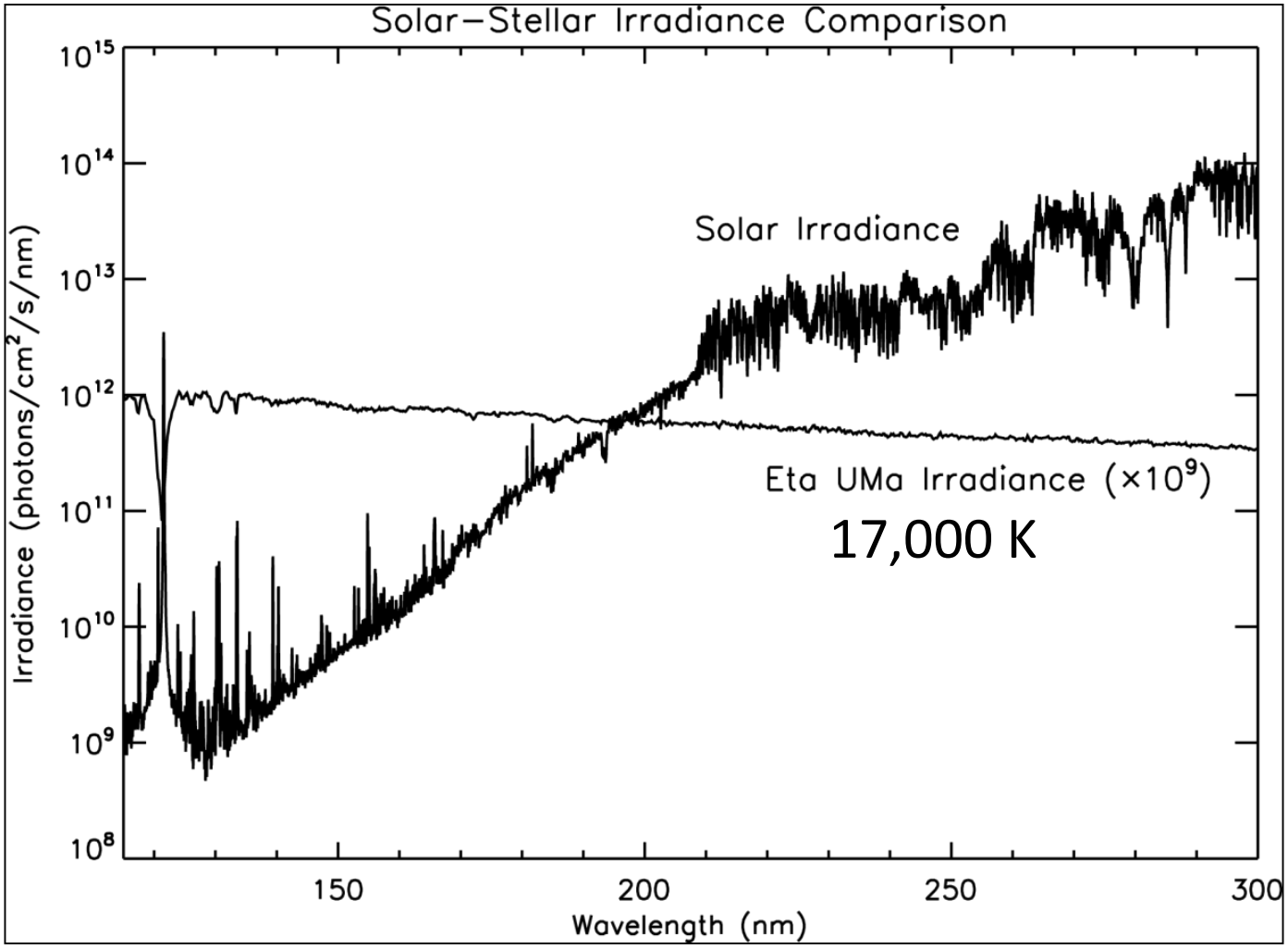
Radiation Balance of the Earth (Jeffrey T. Kiehl)


Cassiopeia

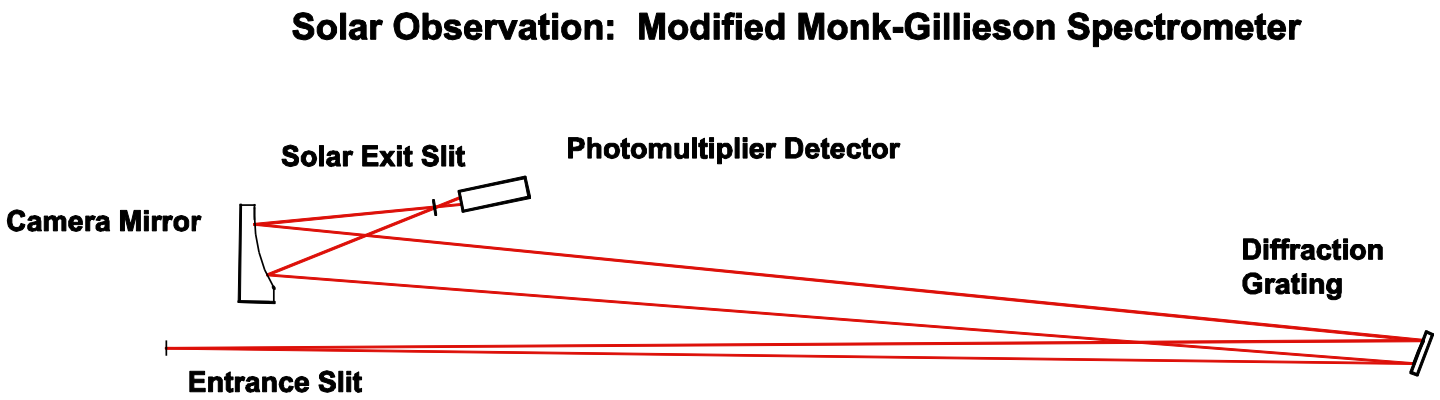

10^{12}
brighter



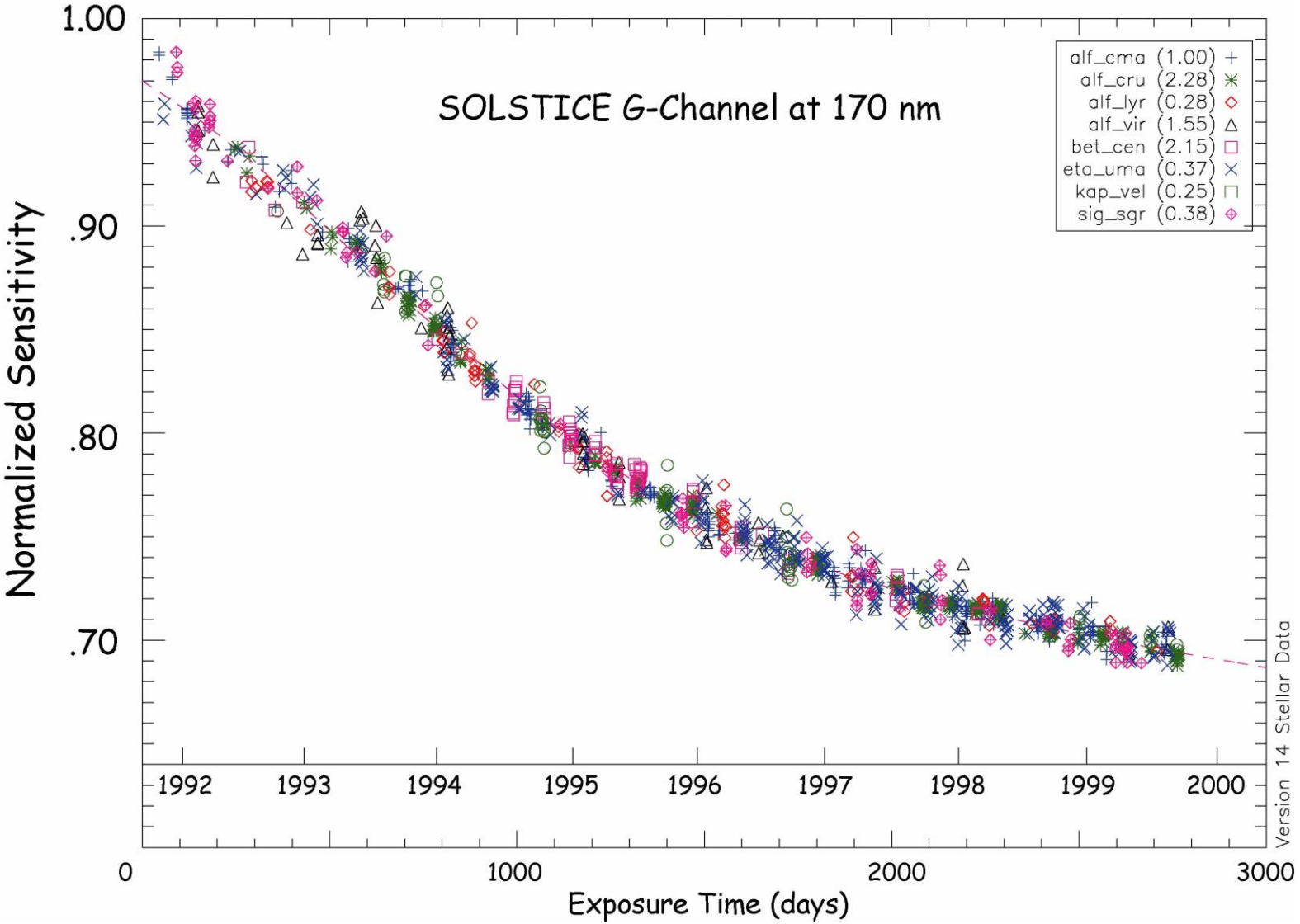
Gary Rottman
2015 Sun-Climate Symposium
November 10, 2015


Solar–Stellar Irradiance Comparison
Solar Irradiance
Eta UMa Irradiance (×10^9)
17,000 K
Irradiance (photons/cm^2/s/nm)
Wavelength (nm)
10^15
10^14
10^13
10^12
10^11
10^10
10^9
10^8
150
200
250
300

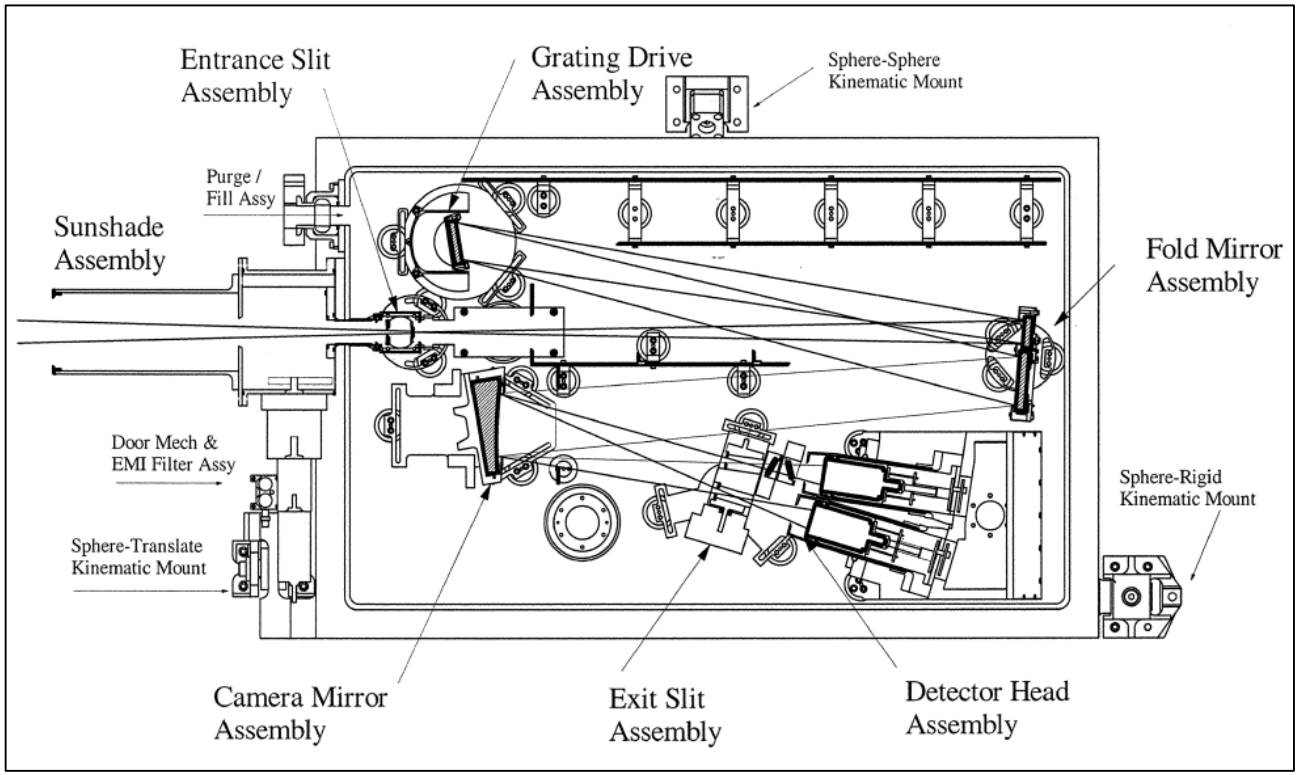
SOLSTICE Design



Stars at 170 nm



SORCE SOLSTICE Instrument



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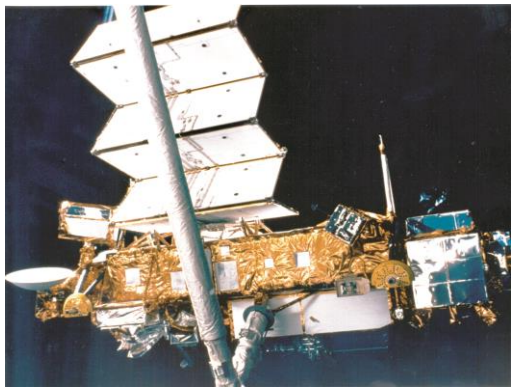
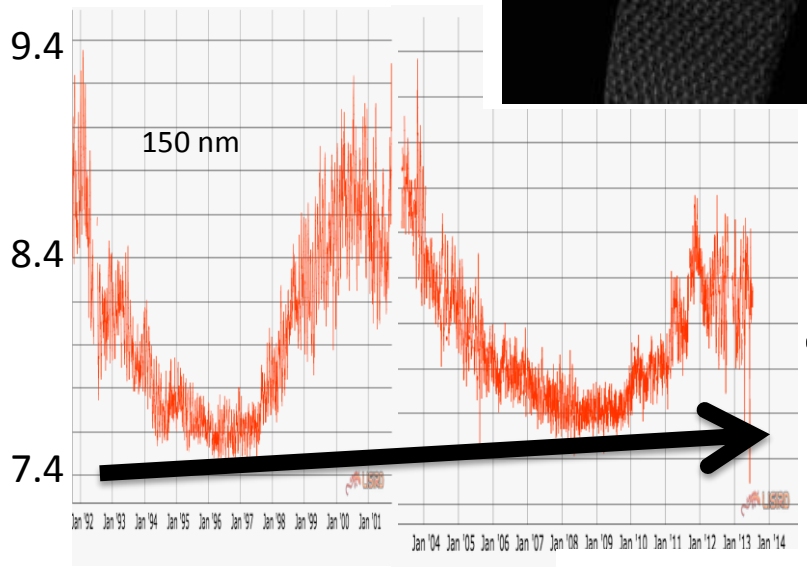
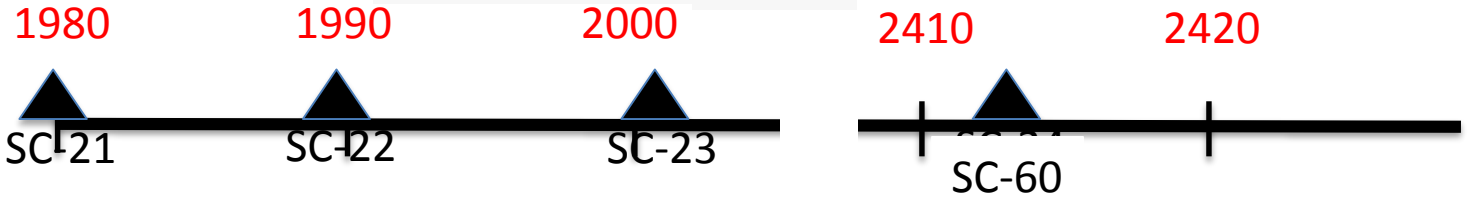
GOAL # 3 — solar irradiance EDR, is directly compared to other observations

UARS (1991-2005)

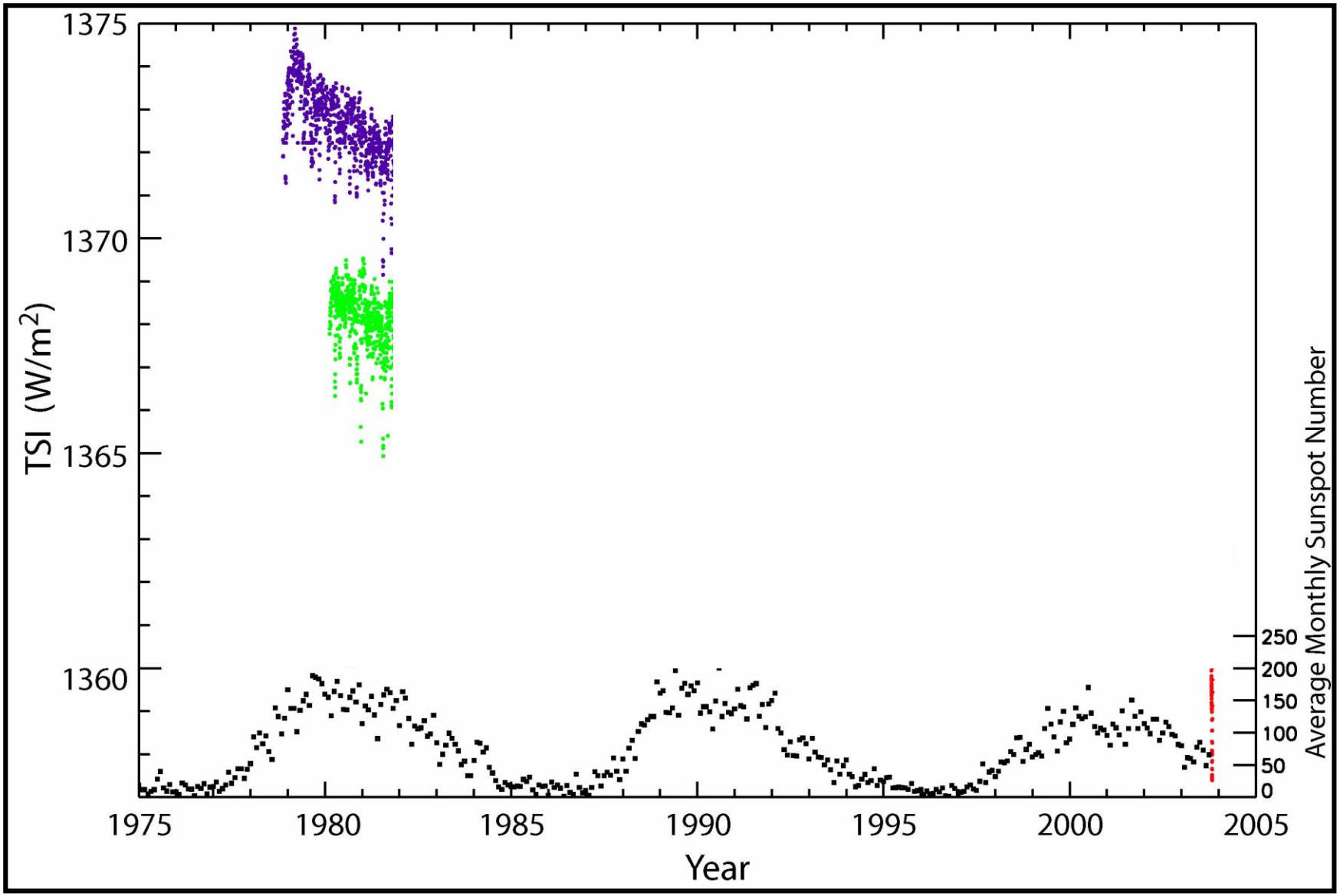




Trend?



TSI Observations 1978 to 2003



Savannah, GA — 2415