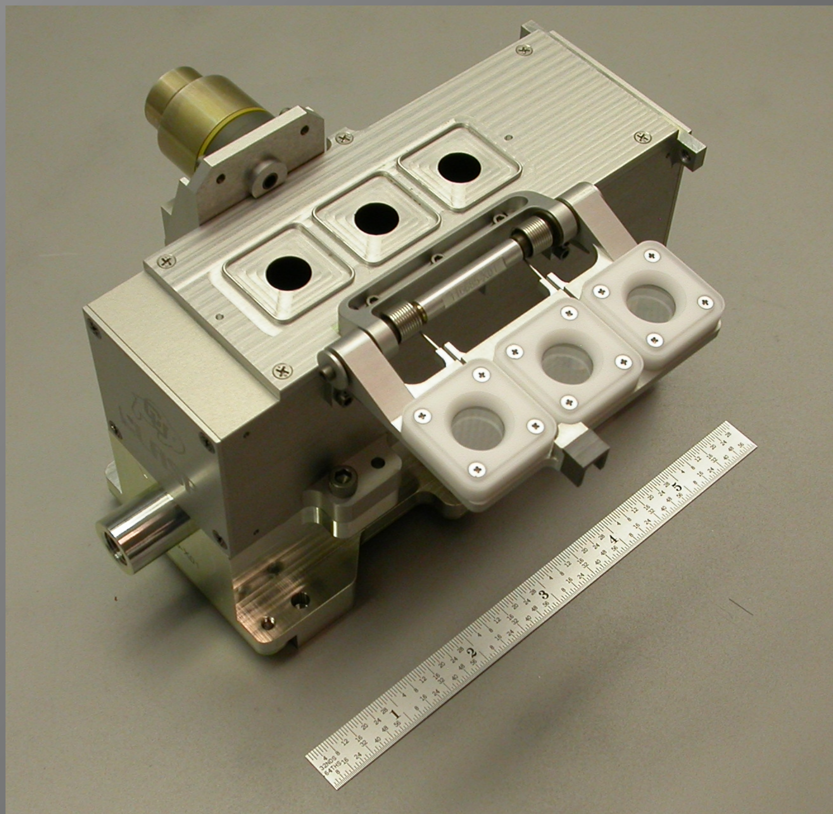

THE LPW/EUV ON MAVEN

MAVEN

CU/LASP • GSFC • UCB/SSL • LM • JPL

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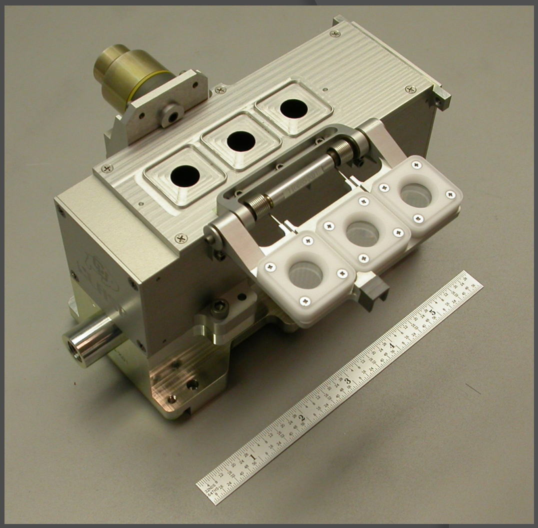
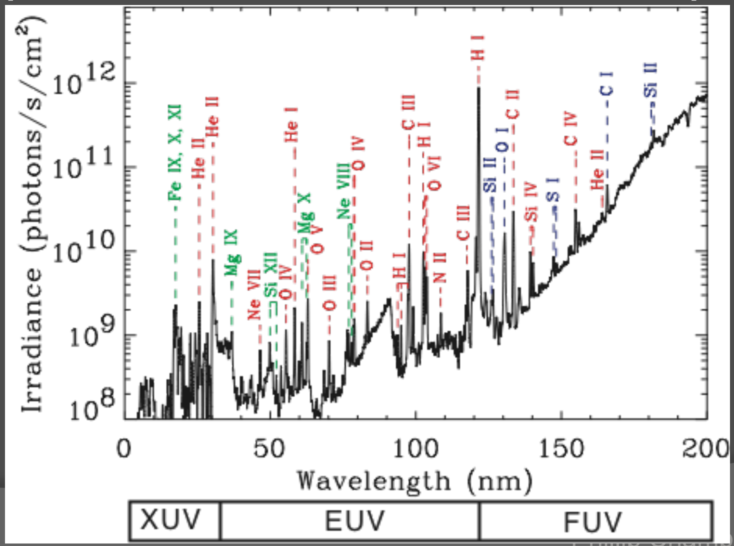
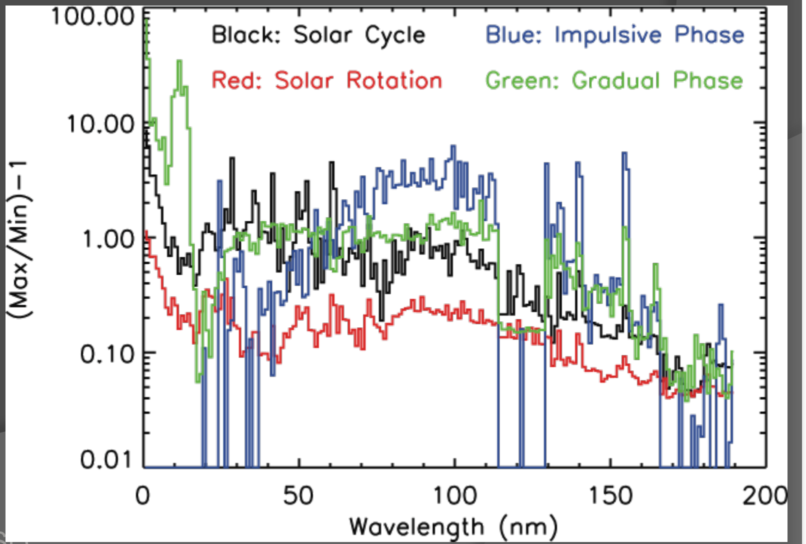
LPW/EUV channels

- Three individual science channels with a Si diode and bandpass filter
  - 0.1- 7nm
  - 17 nm
  - 121.6 nm (Lyman-Alpha)
  - Dark channel
- Door to protect from contamination pre-orbit.
  - Especially critical for the Lyman-Alpha channel
- Three channels serve as proxies as input to the FISM model to reproduce the 0.1-190 nm full spectra.

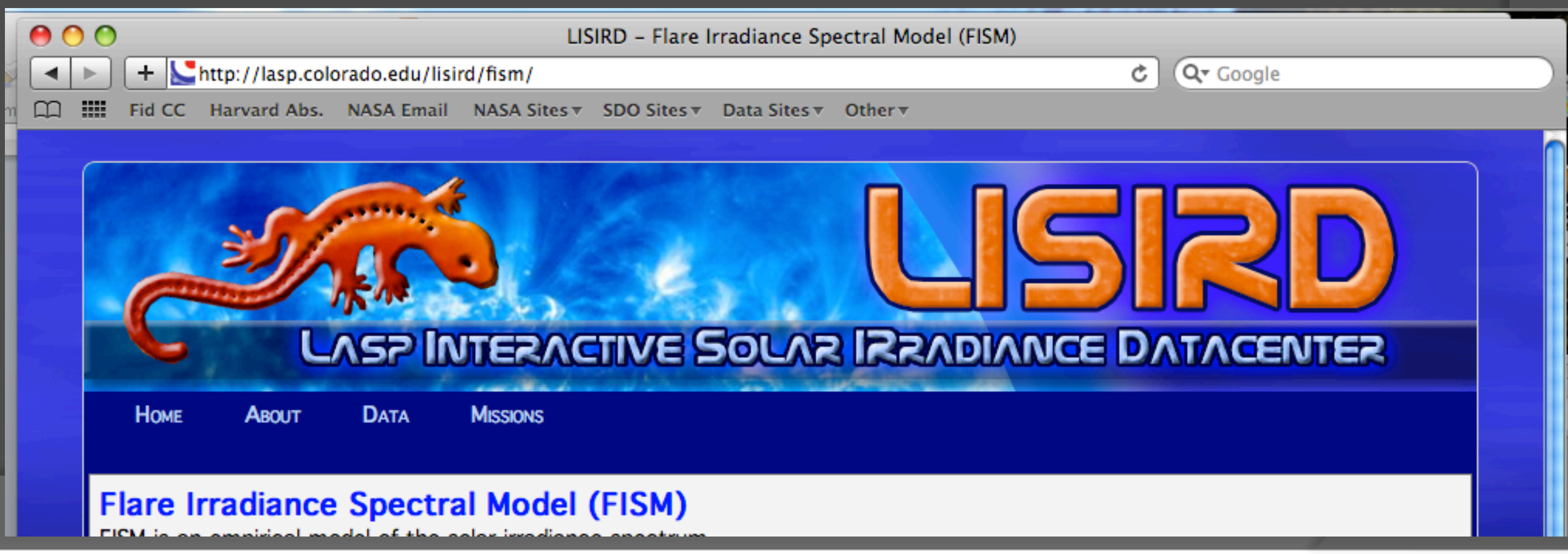






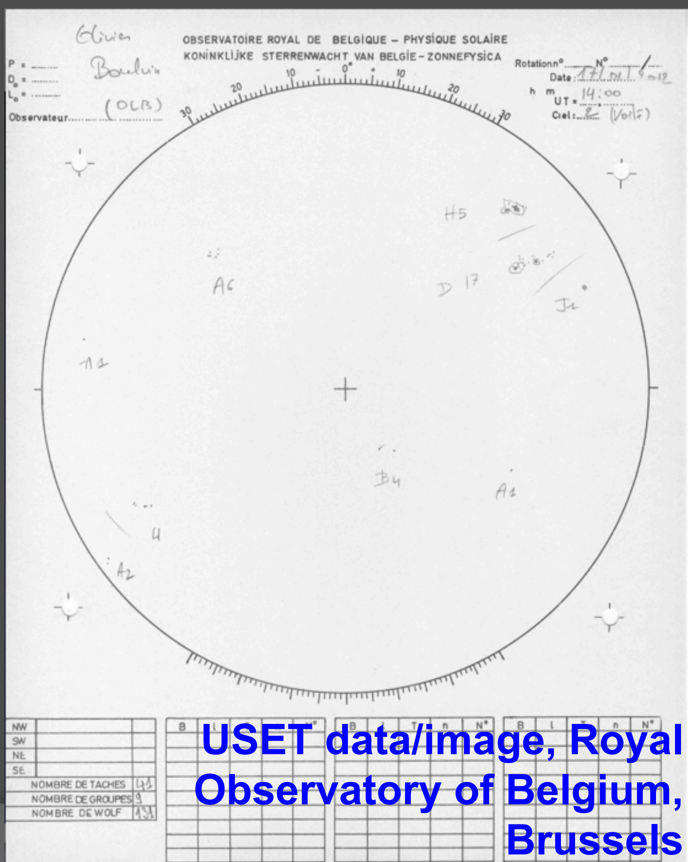
Flare Irradiance Spectral Model (FISM)

- Version 1 (based on TIMED SEE data) has been updated to be made available and run near real-time (daily) on the LASP LISIRD website.
  - http://lasp.colorado.edu/lisird/fism/
  - THANKS!!! Anne Wilson and Chris Lindholm, CU/LASP
- Implemented near real-time and continuous processing as well as results distribution.
- FISM will be updated and tested pre-launch to be based on the more accurate SDO EVE data using simulated MAVEN measurements as proxies.

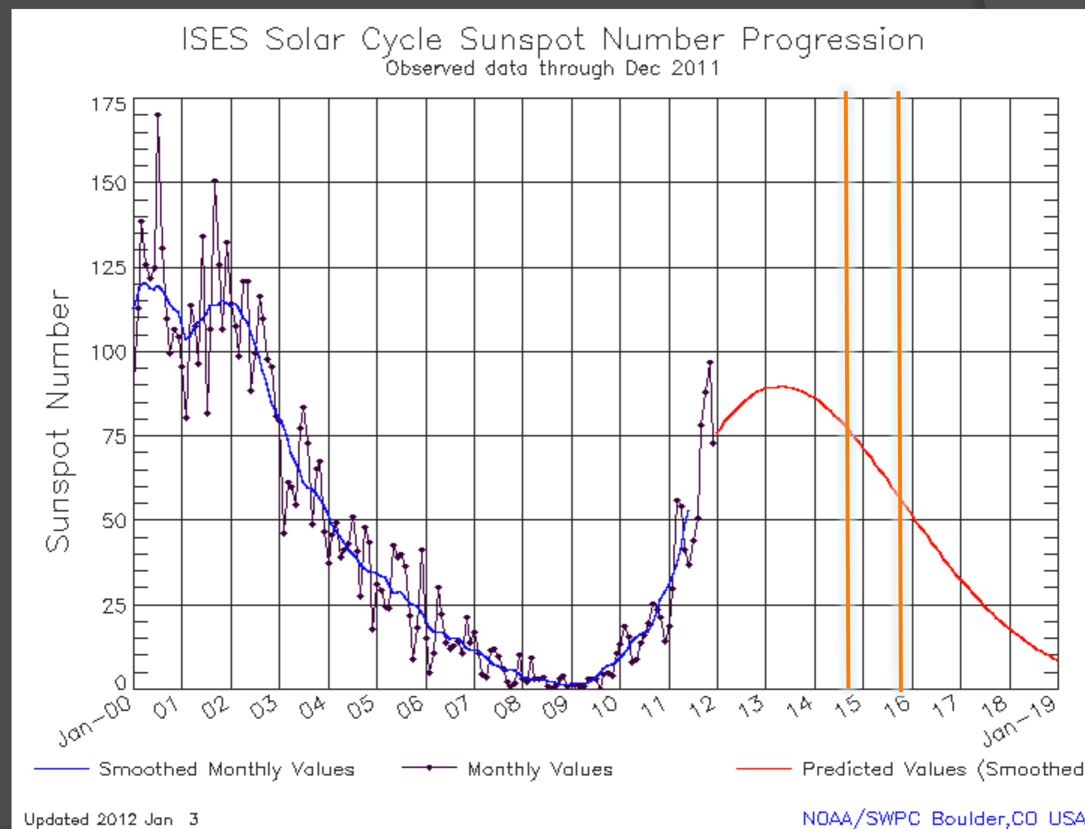


Solar Variability – Solar Cycle via SSN

- The Sun in the EUV can change significantly on the seconds, minutes, hours, days, months, years, and decades time scales.
- During the MAVEN mission, solar activity will be just after its solar cycle peak – solar max peak predicted in 2013.
- More models are now predicting Solar Cycle 24 to peak later (late 2013, early 2014)



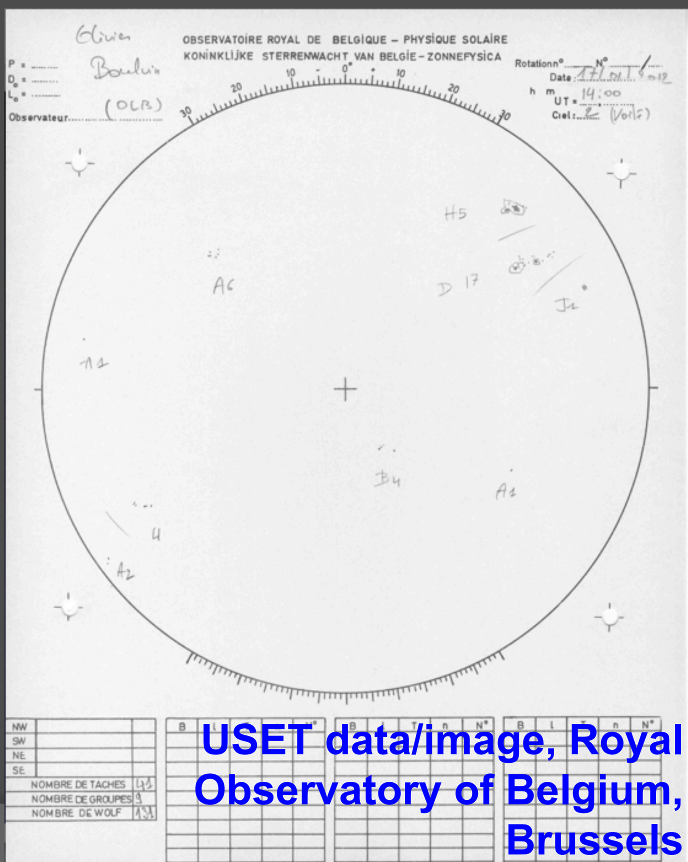
USET data/image, Royal Observatory of Belgium, Brussels



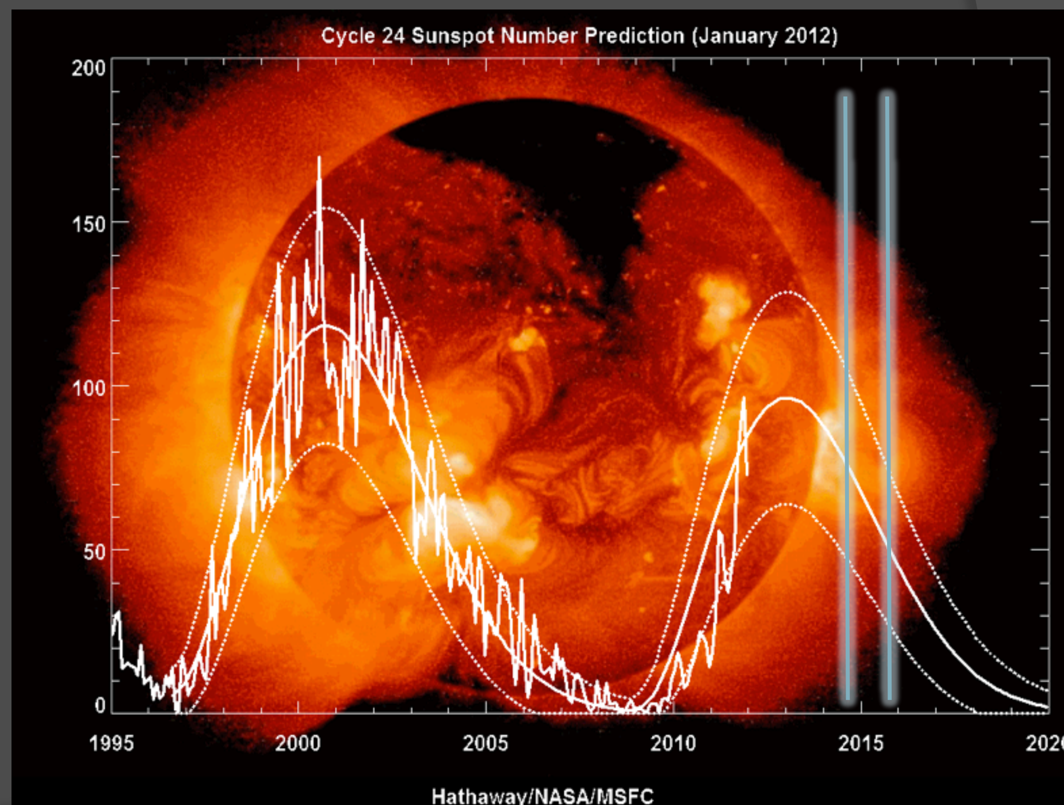
NOAA SWPC SC24 Panel

Solar Variability – Solar Cycle via SSN

- Solar cycles tend to have fast rises, then longer, more gradual falls.
- May be a ‘Double Maximum’ due to the activity dynamos in the northern and southern hemispheres being slightly out of phase.
- How well can we even predict how large the solar cycle will be and also when it will occur?



USET data/image, Royal Observatory of Belgium, Brussels

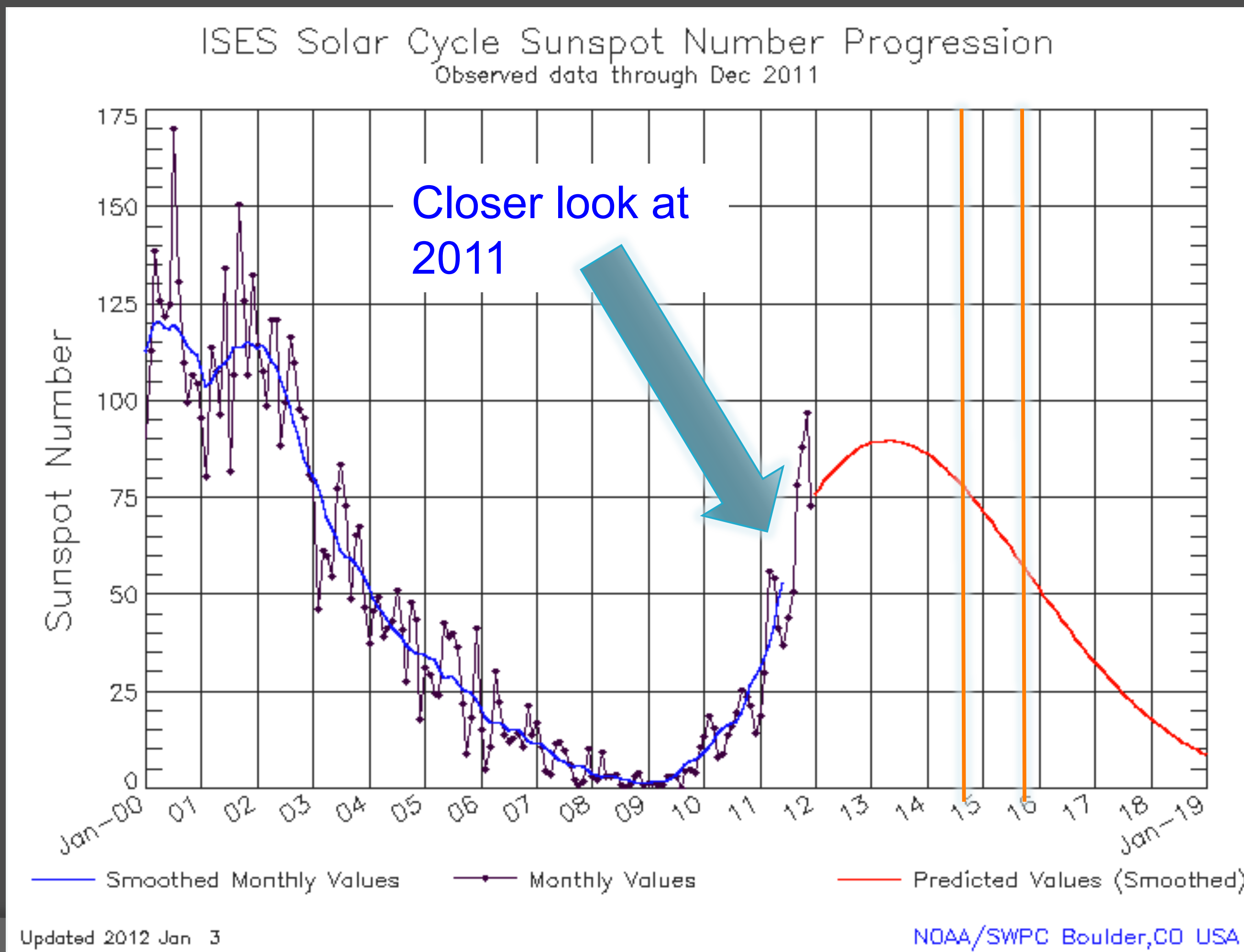


Phillip Chamberlin, NASA/GSFC

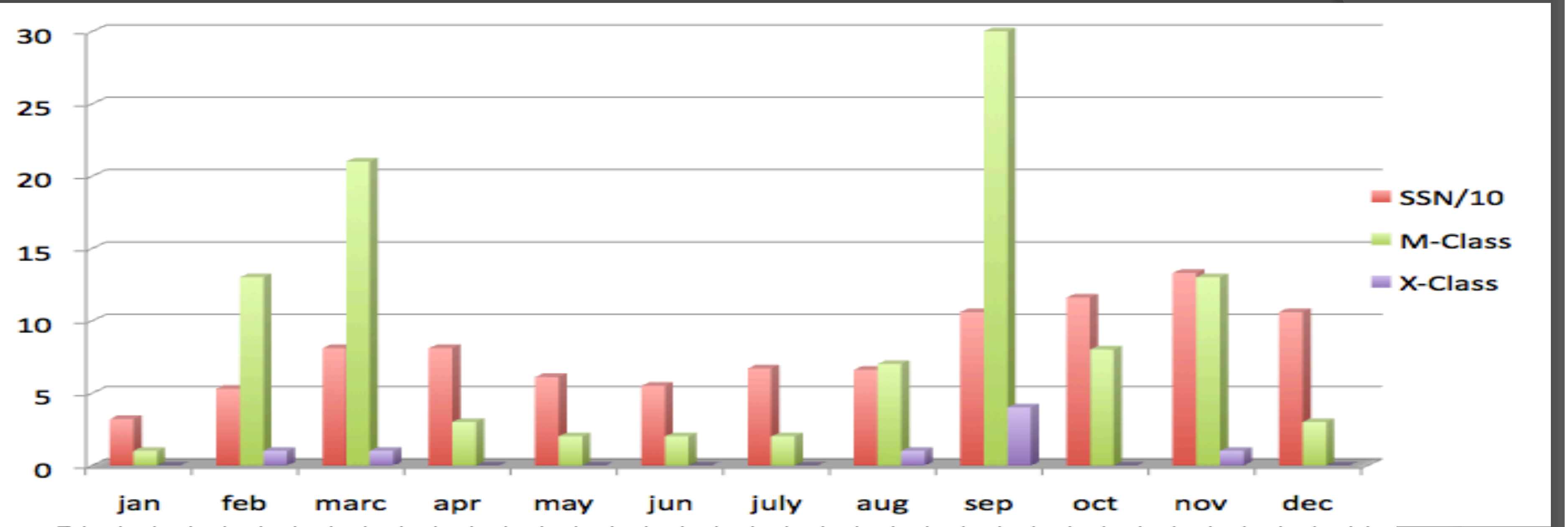
David Hathaway, NASA/MSFC

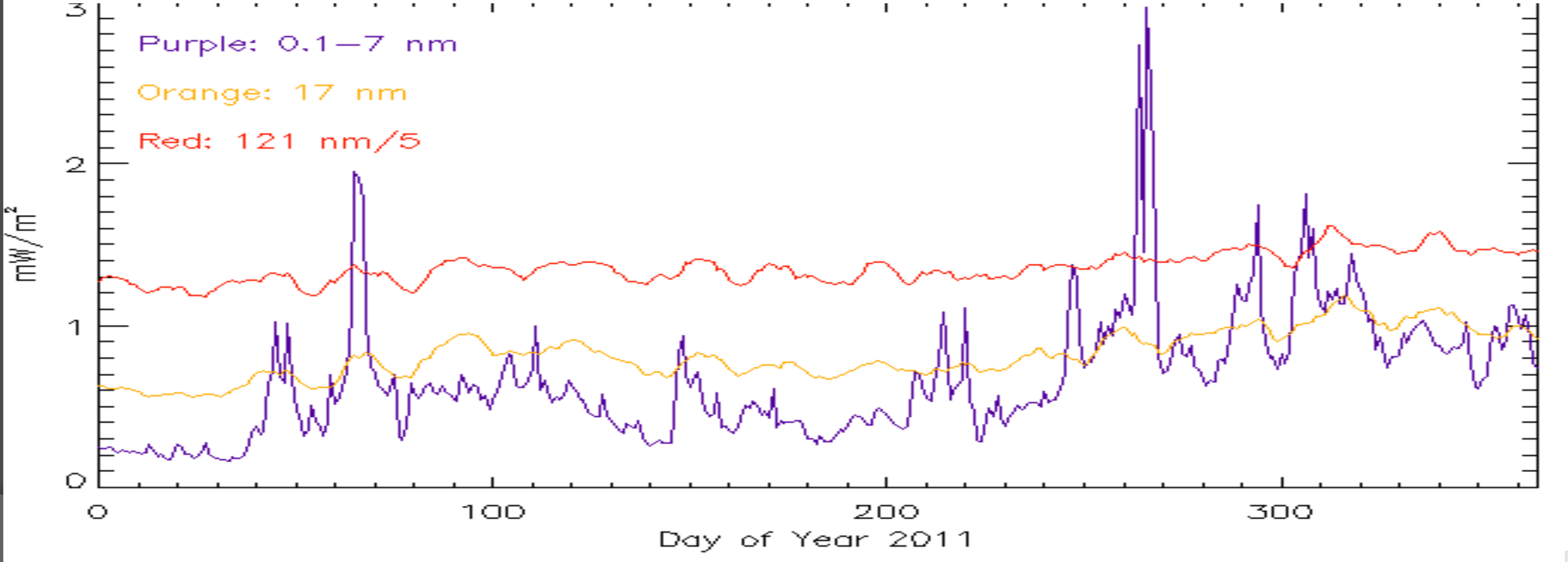
Solar Variability

- Estimate MAVEN observed activity by looking at a similar activity level in SC 24.



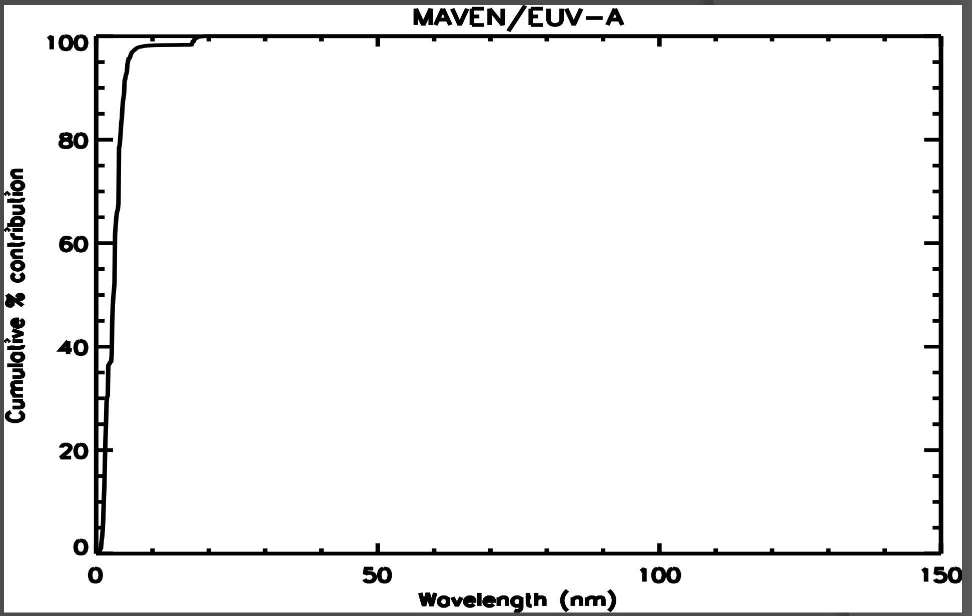
What will MAVEN LPW/EUV observe?

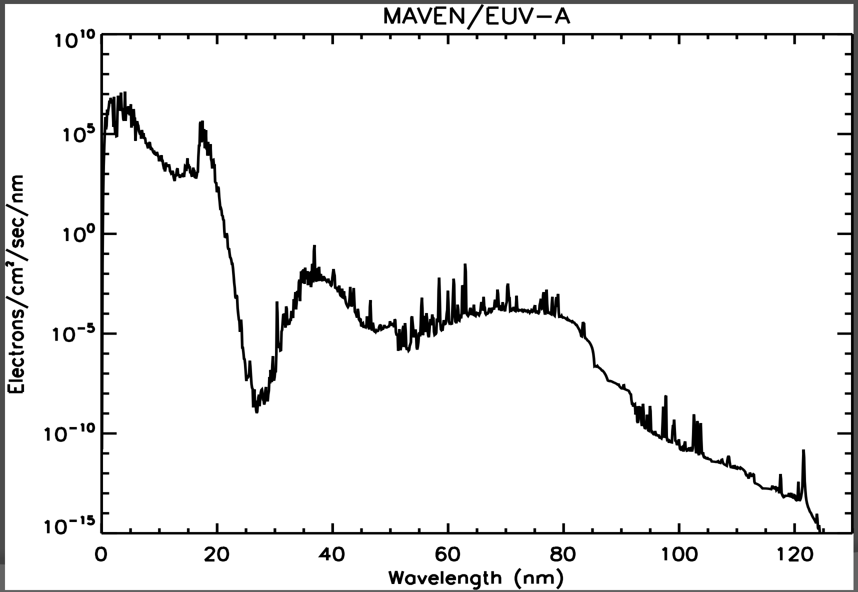


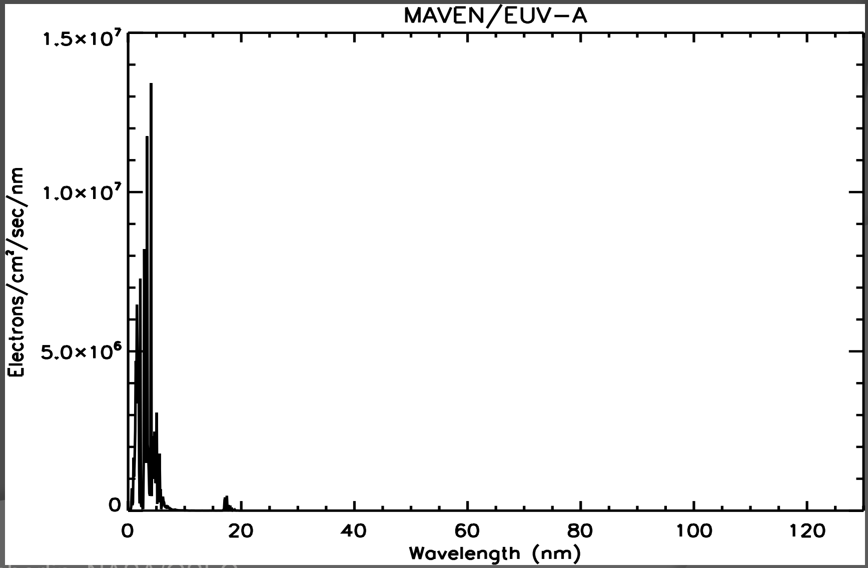


MAVEN EUV-"A" – Solar Min

- WHI Reference Spectrum with "A" channel filters and diode response.
- http://lasp.colorado.edu/lisird/whi_ref_spectra/whi_ref_spectra.html
- 97% of solar signal comes from 0.1-7nm.



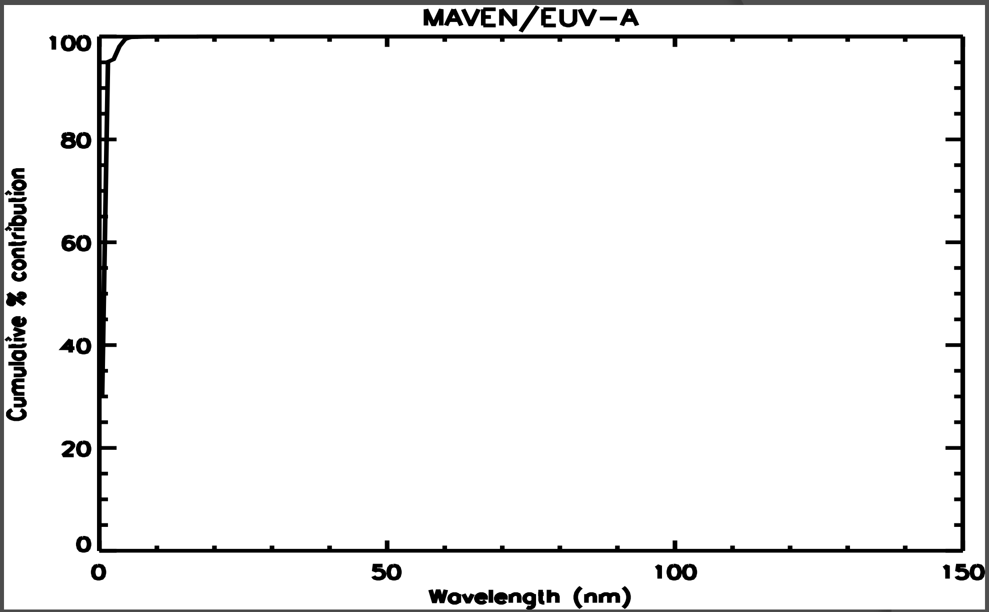


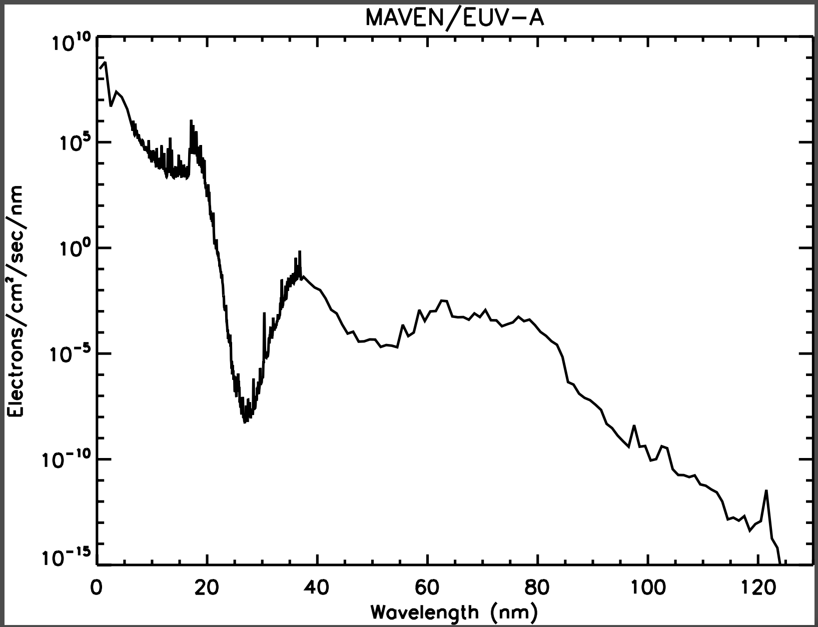


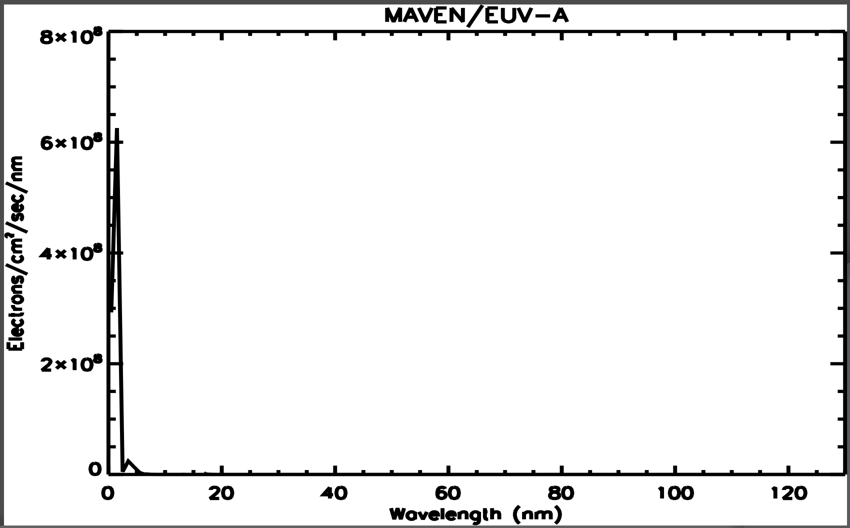
Phillip Chamberlin, NASA/GSFC

MAVEN EUV-"A" – X2.2 Flare

- SDO EVE (6.5-37 nm) and FISM (0.1-6.5 nm; 37-190nm) data using the "A" channel filters and diode response.
- 99.9% of solar signal comes from 0.1-7nm.

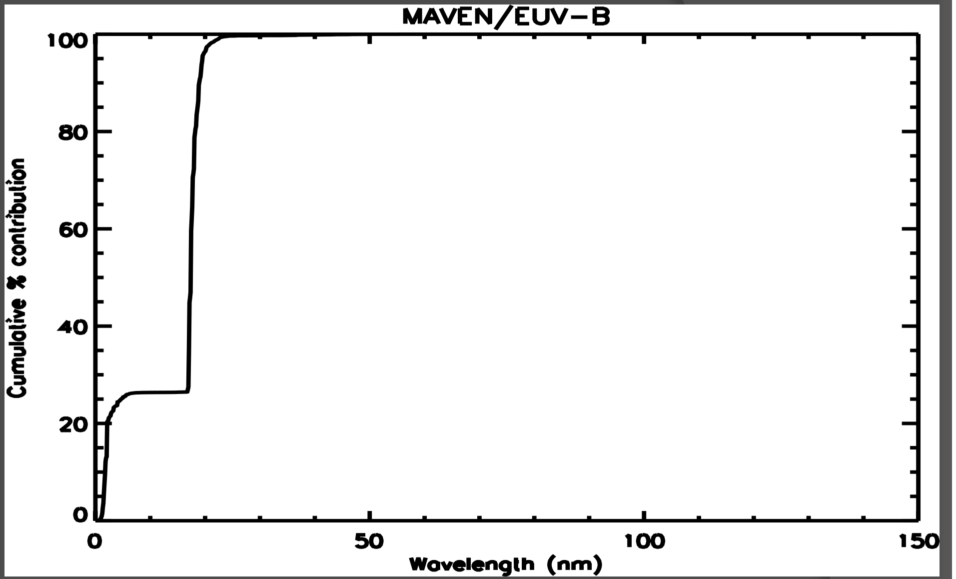


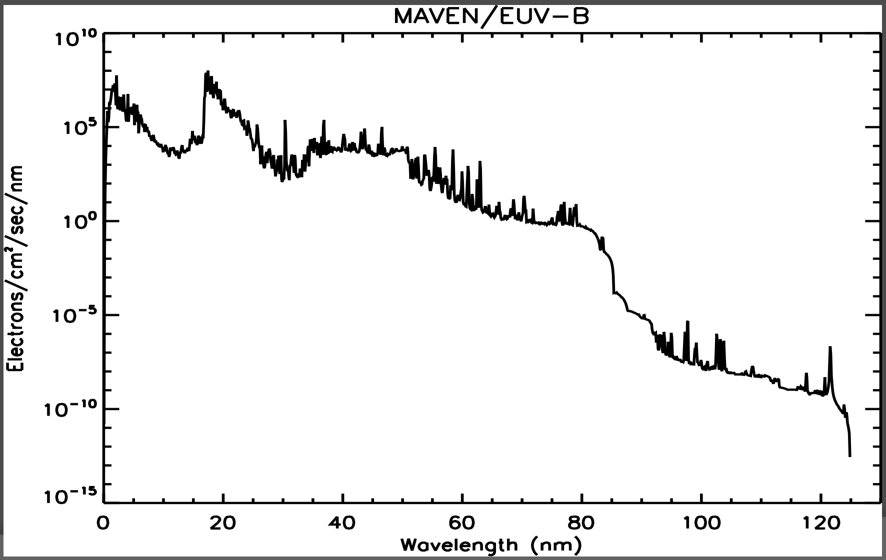


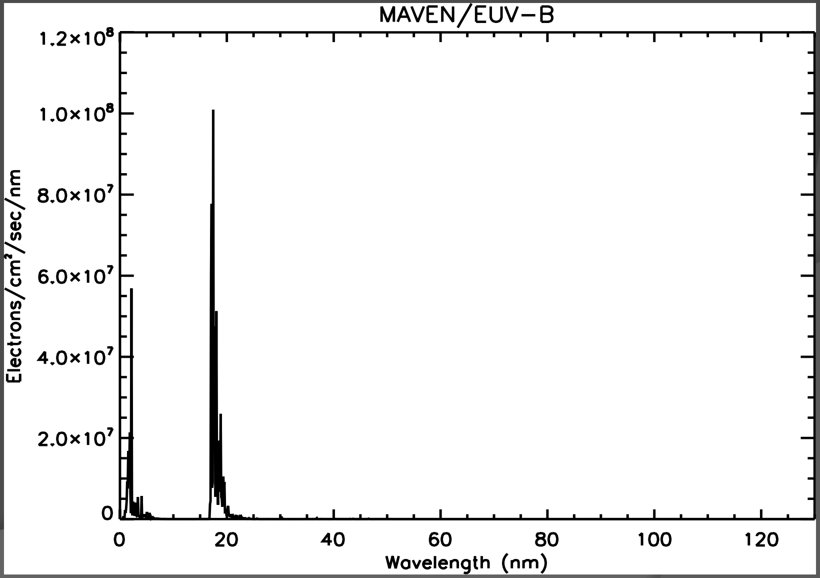


MAVEN EUV-"B" – Solar Min

- WHI Reference Spectrum with "B" filters and diode response.
- http://lasp.colorado.edu/lisird/whi_ref_spectra/whi_ref_spectra.html
- 26% of solar signal comes from 0.1-7nm.
- 74% of solar signal comes from 16-21 nm.

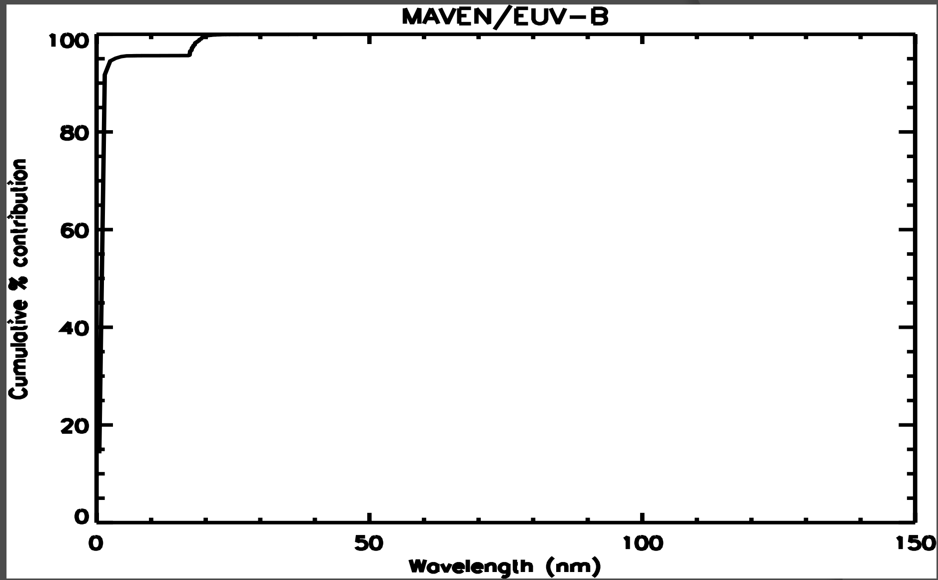


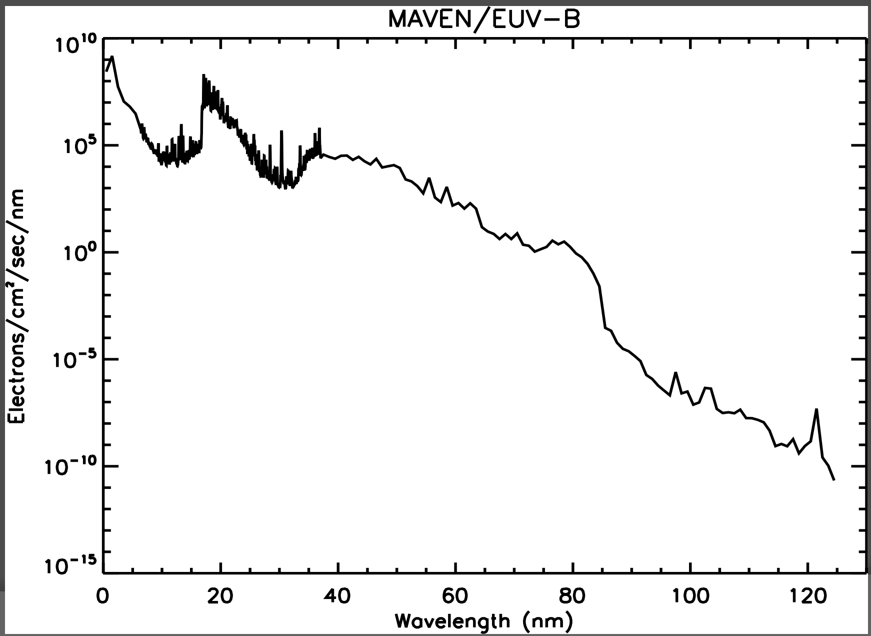


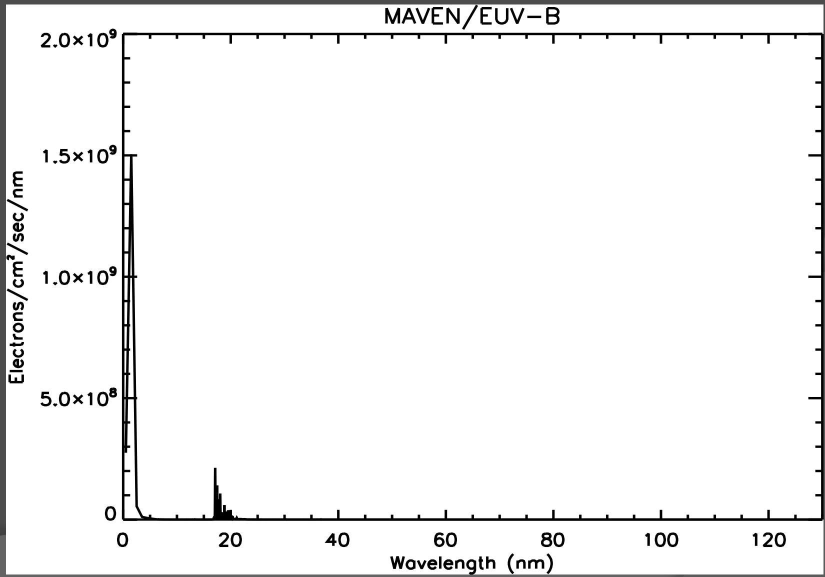


MAVEN EUV-"B" – X2.2 Flare

- SDO EVE (6.5-37 nm) and FISM (0.1-6.5 nm; 37-190nm) data using the "B" channel filters and diode response.
- 95% of solar signal comes from 0.1-7nm.
- 5% of solar signal comes from 16-21 nm.

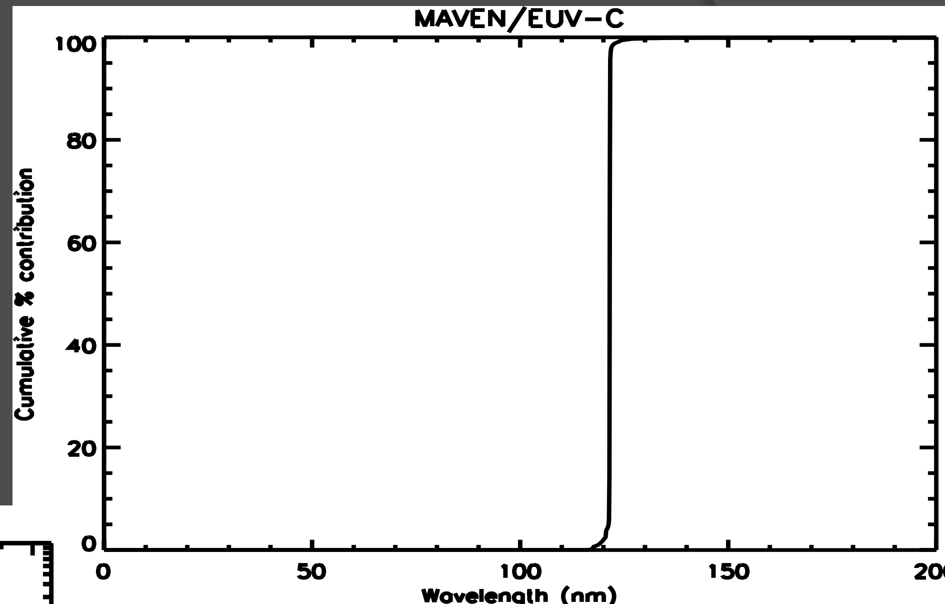


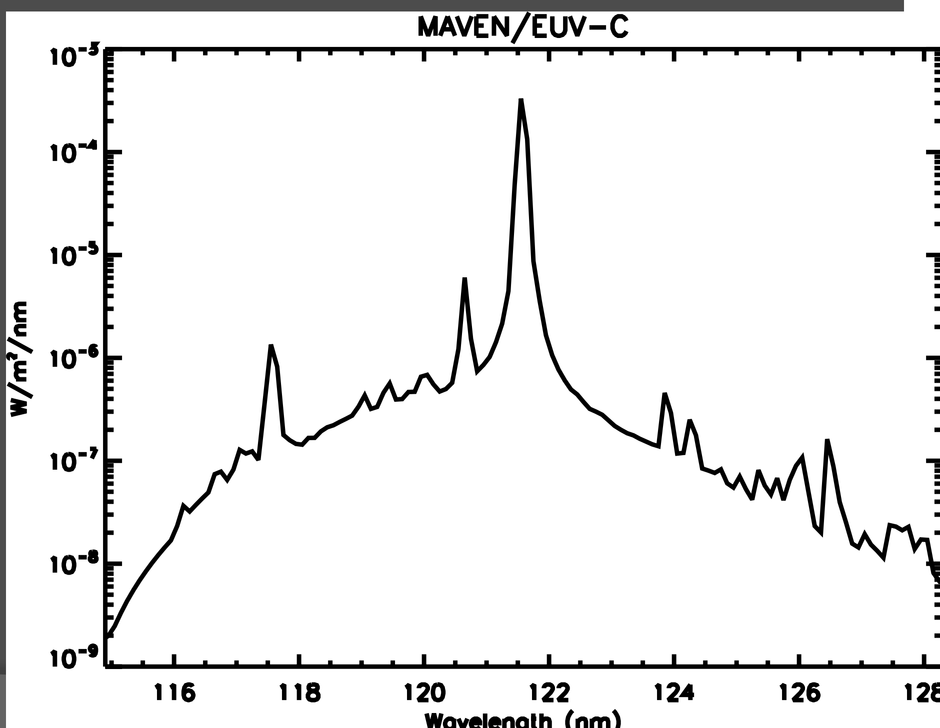


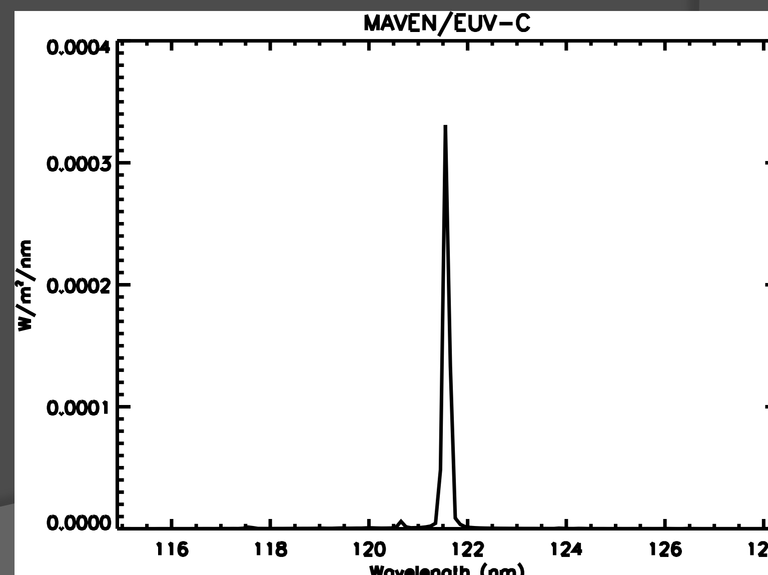


MAVEN EUV-”C” – Solar Min

- WHI Reference Spectrum with “C” filters and diode response.
- http://lasp.colorado.edu/lisird/whi_ref_spectra/whi_ref_spectra.html
- 99.9% of solar signal comes from 121-122 nm.

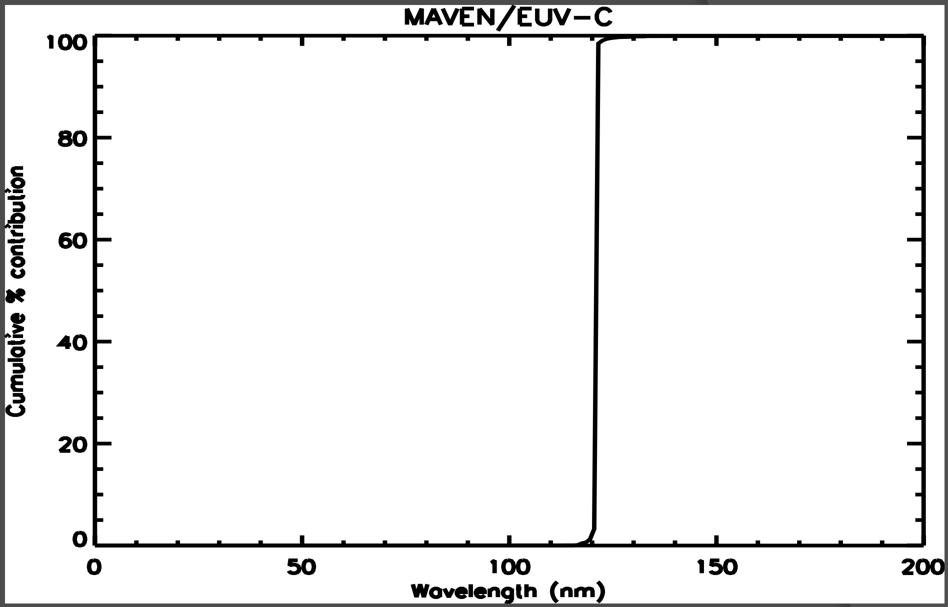


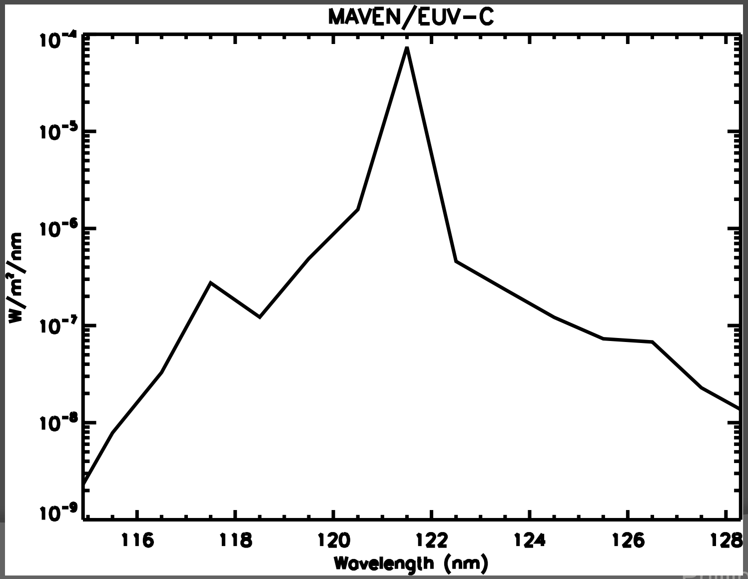


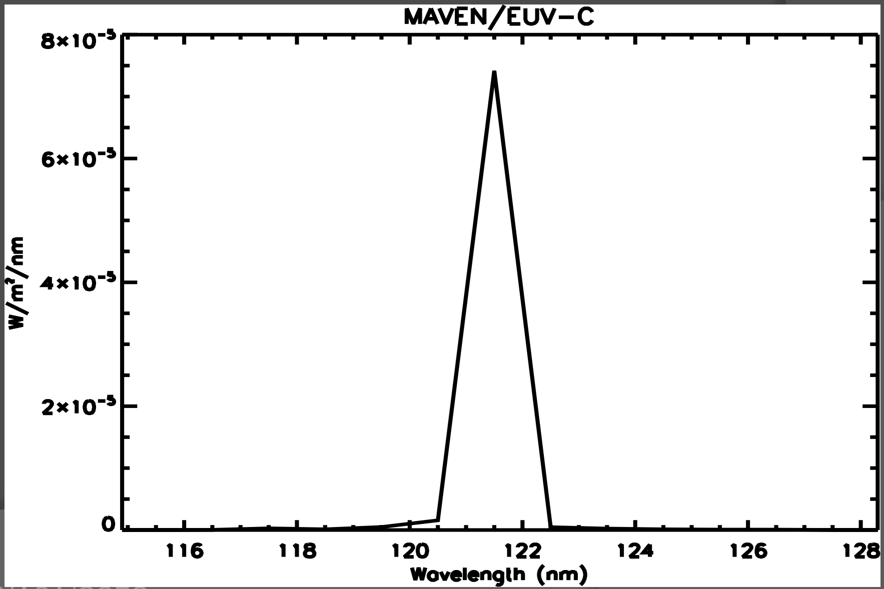


MAVEN EUV-"C" – X2.2 Flare

- SDO EVE (6.5-37 nm) and FISM (0.1-6.5 nm; 37-190nm) data using the "B" channel filters and diode response.
- 98% of solar signal comes from 121-122 nm.
- Broad 'wings' probably come from poor spectral resolution of FISM and are not real.

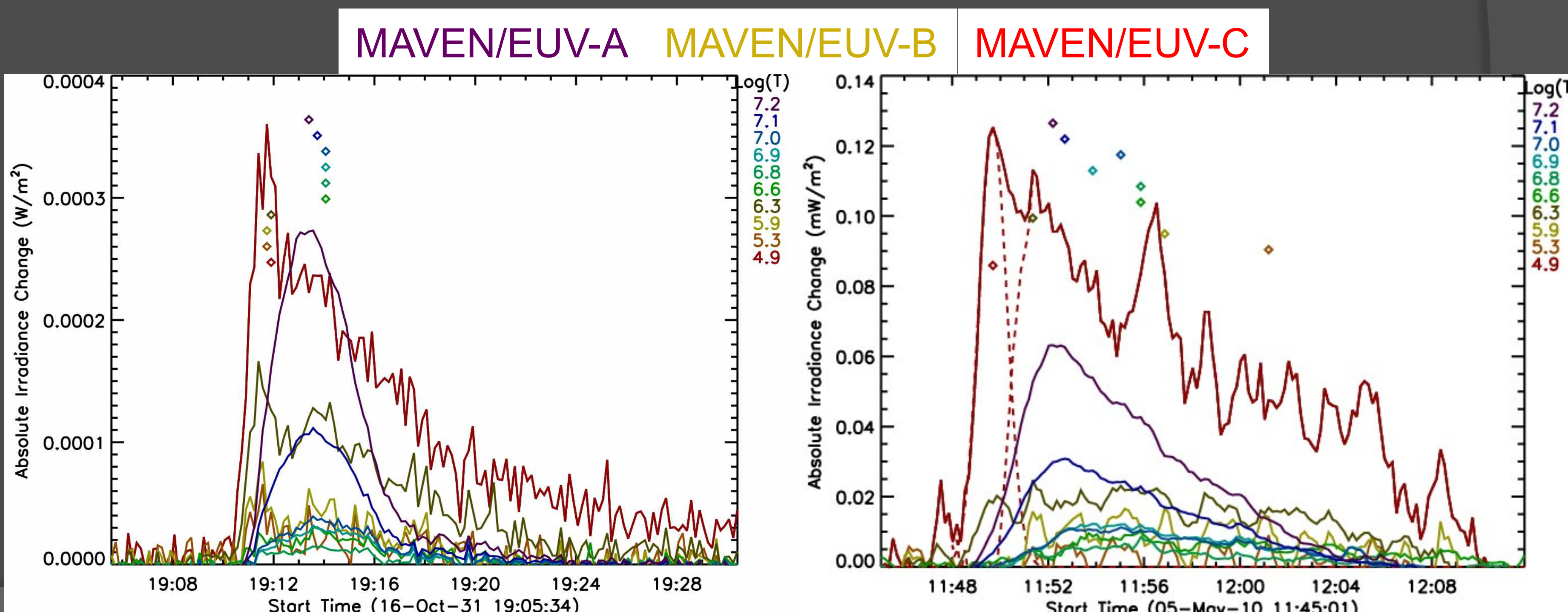






Solar Flare Thermal Evolution

- EVE is helping to determine the flare energy and particle transport through different layers of the solar atmosphere.
- EVE can now more accurately measure the energy input into the Earth's atmosphere – accuracy will lead to better models.
- There are many different types of flares – diagnostics will help better define more representative proxies that will lead to more accurate modeling of the solar flare radiative output.



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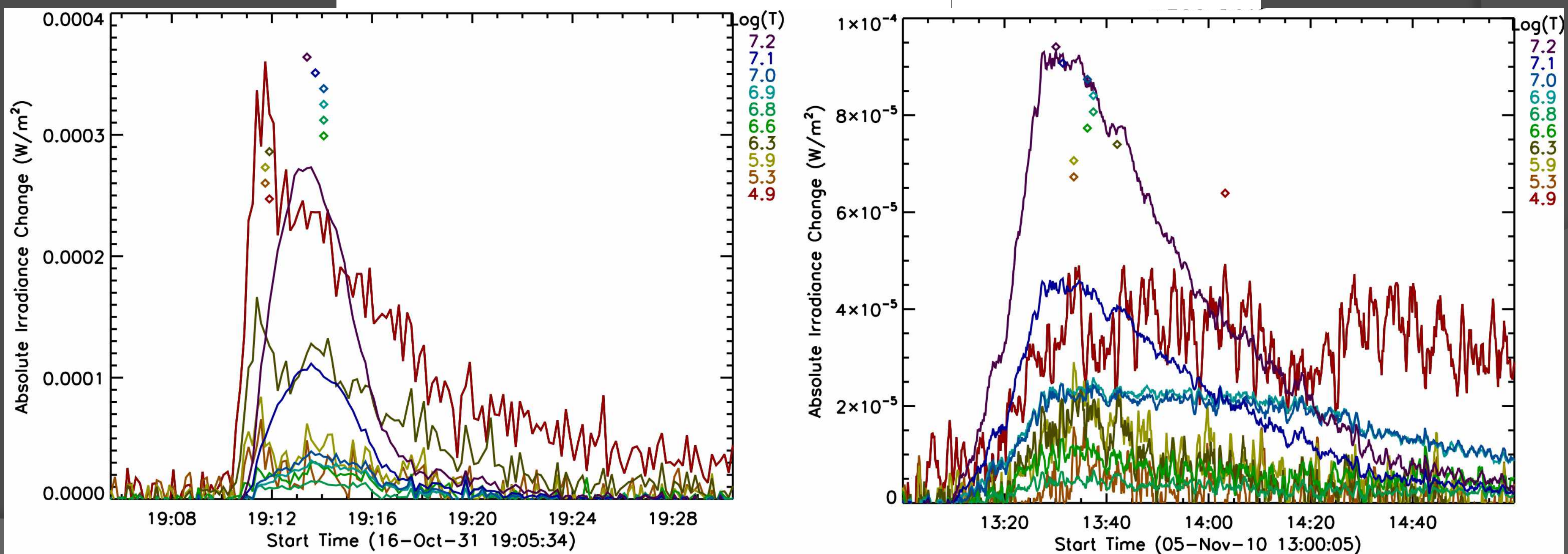
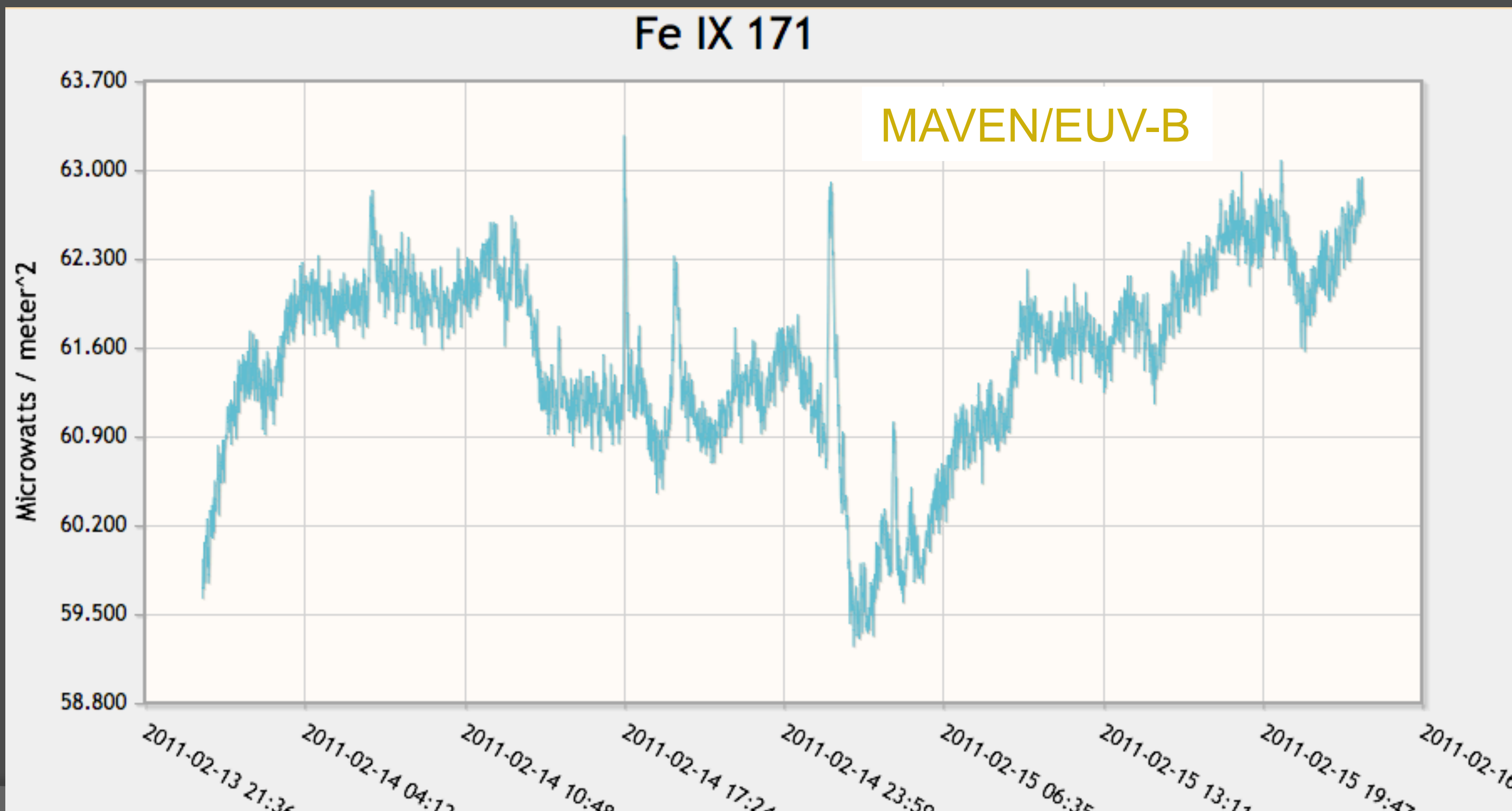
MAVEN/EUV-A MAVEN/EUV-B MAVEN/EUV-C



Phillip Chamberlin, NASA/GSFC

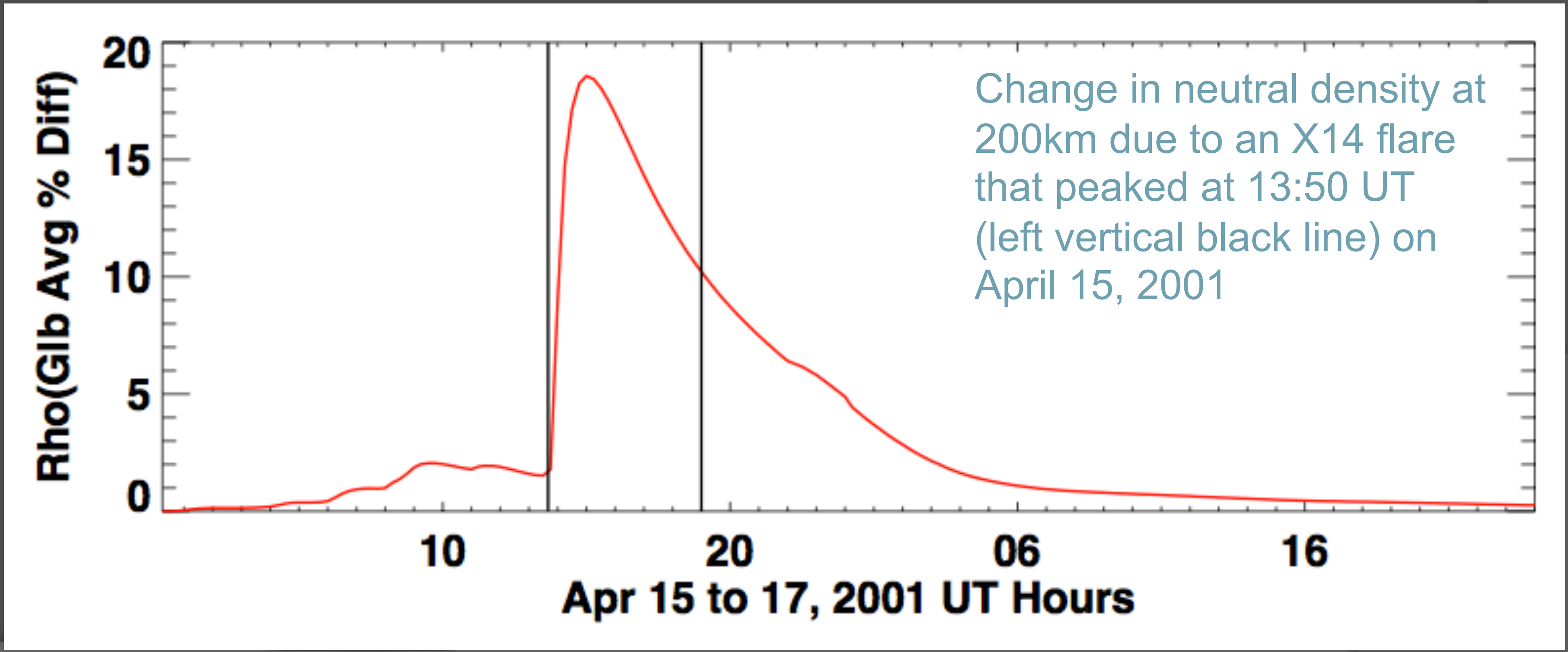
Post-flare Coronal Dimming

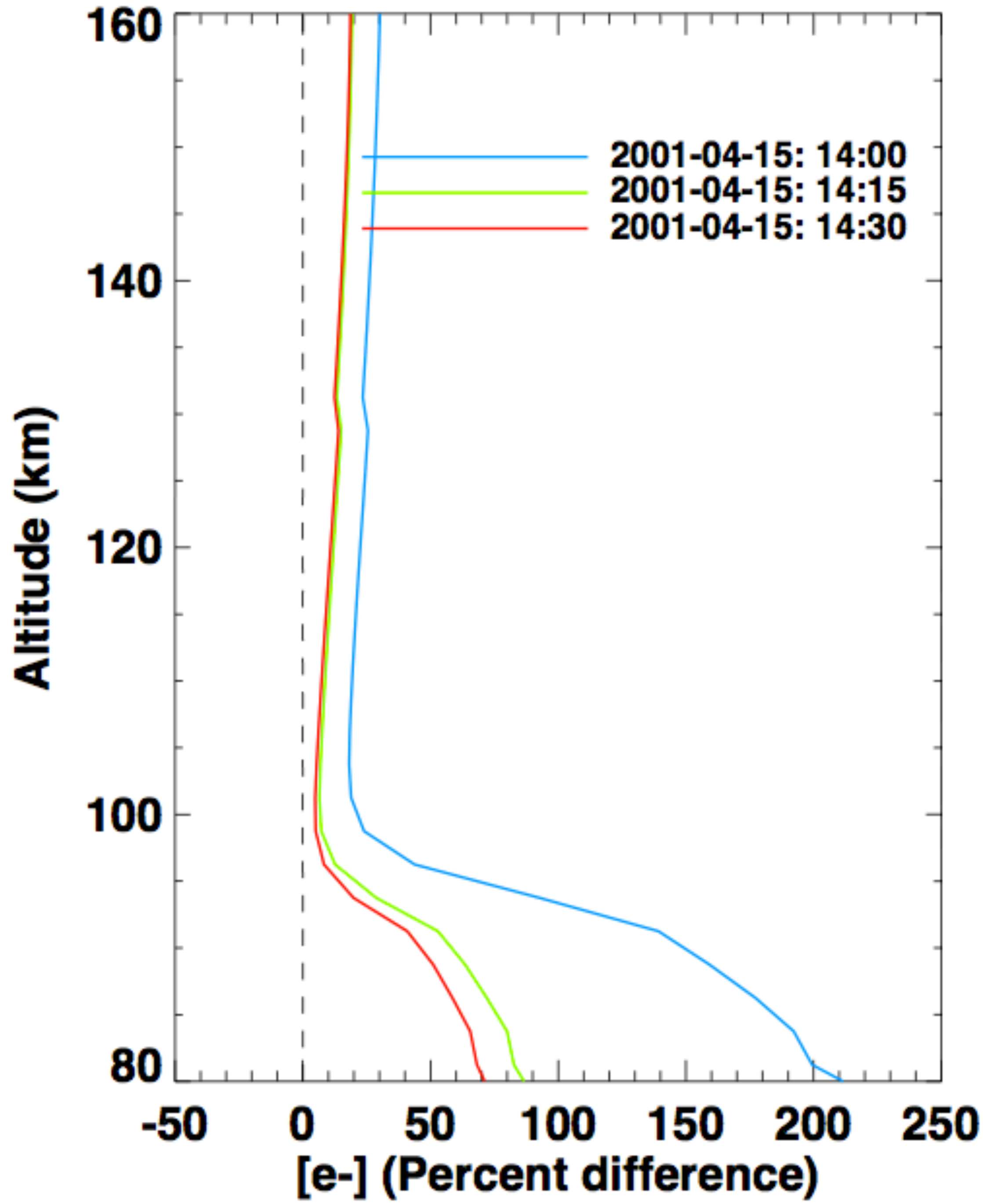
- Some emissions around 1 MK actually dim after a flare
- Believed to be due to the heating of the coronal plasma out of the emission range – 'coronal dimming'
- Temperature or species dependent?
  - Further analysis needed – but data is there w/EVE



Flare influence studies

- Dave Pawlowski – Eastern Michigan University
  - Studying the effects of flares on Martian ionosphere and thermosphere – MGITM
  - Can compare to Earth studies to help refine physics





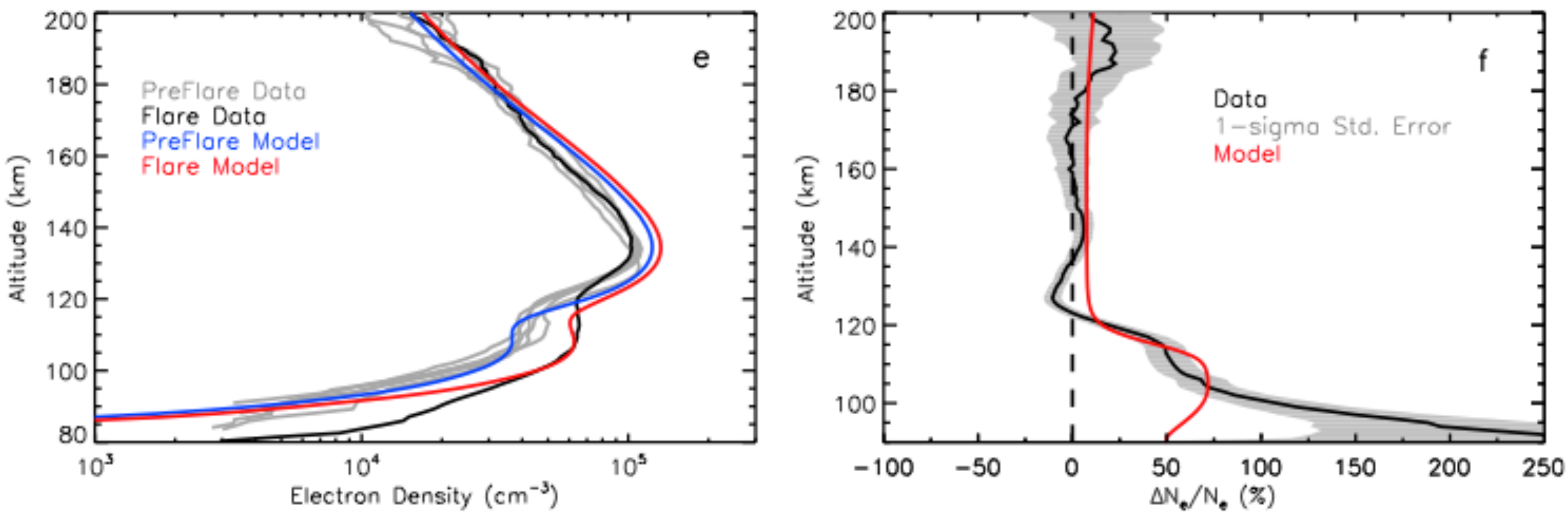
Dave Pawlowski – Eastern Michigan University

- AGU, Dec 2011

Change in the electron density profile at three times during an X14 flare that peaked at 13:50 UT on April 15, 2001

FISM Modeled Ionosphere

- Anthony Lollo et al (Boston Group)
  - Modeling the ionosphere of Mars – results published in JGR
  - Simulating responses of April 15 (X14) and April 26, 2001 (M7.8) flares
  - Compare to MGS radio occultation measurements of vertical electron density profiles.



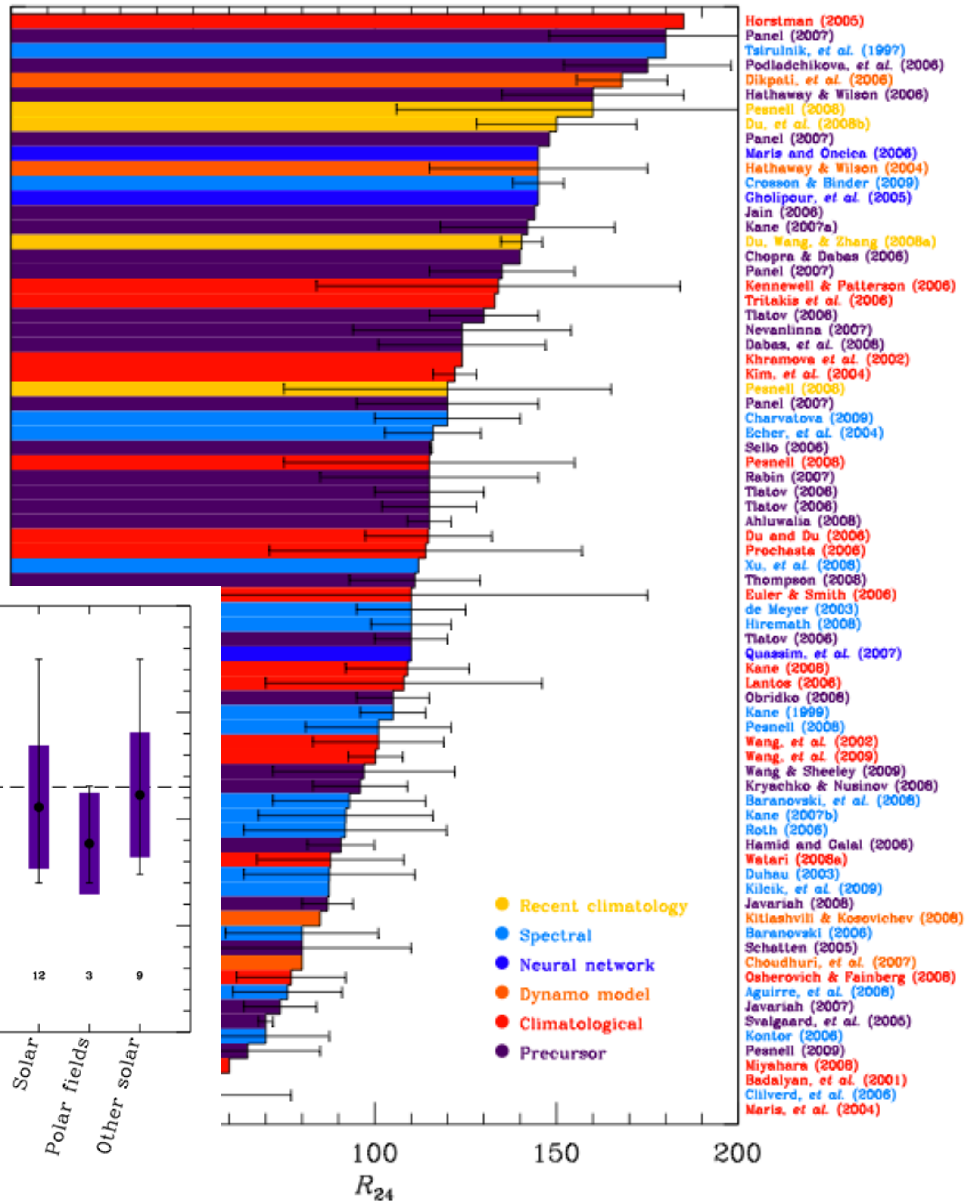
Conclusions

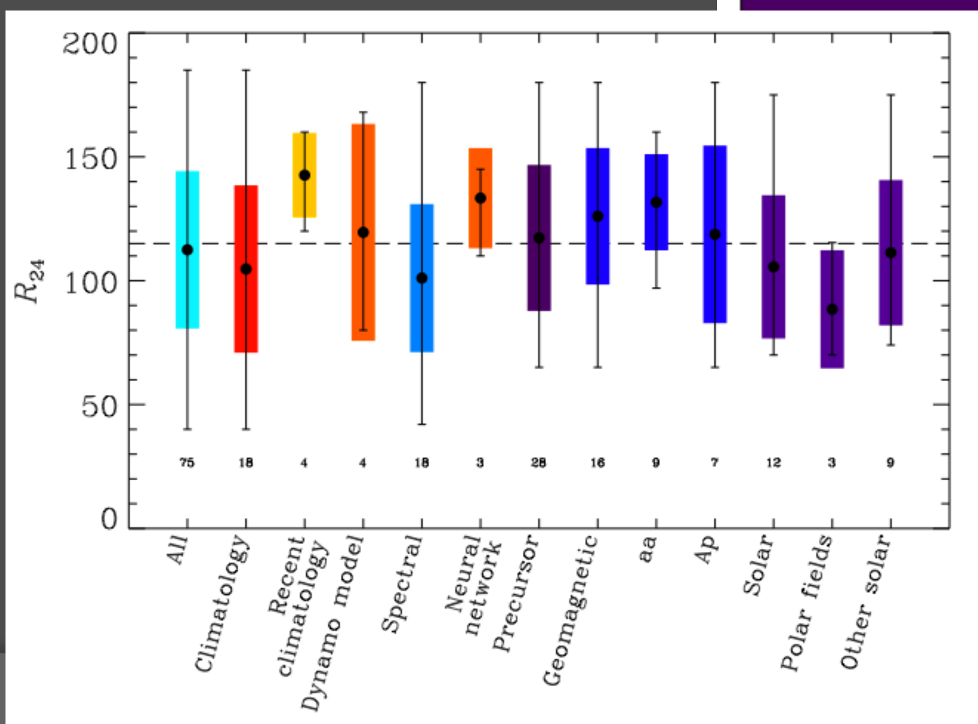
- The MAVEN LPW/EUV will be able to produce a full solar EUV spectrum with limited resources.
  - Will still be in science operations on the descending phase of solar cycle 24.
  - Will be 12 solar rotations and should be a variety of flares
- FISM empirical model is currently being updated to be based on the EVE data set
  - Being updated based on new EVE measurements and to include MAVEN EUV inputs as proxies
  - Center-to-limb correction 'reversed' to get more accurate solar input to Mars I/T studies.
- Current Mars I/T modeling is being performed and producing results. Will be ready for MAVEN for more accurate and complete studies!

Solar Variability – SC 24 Predictions

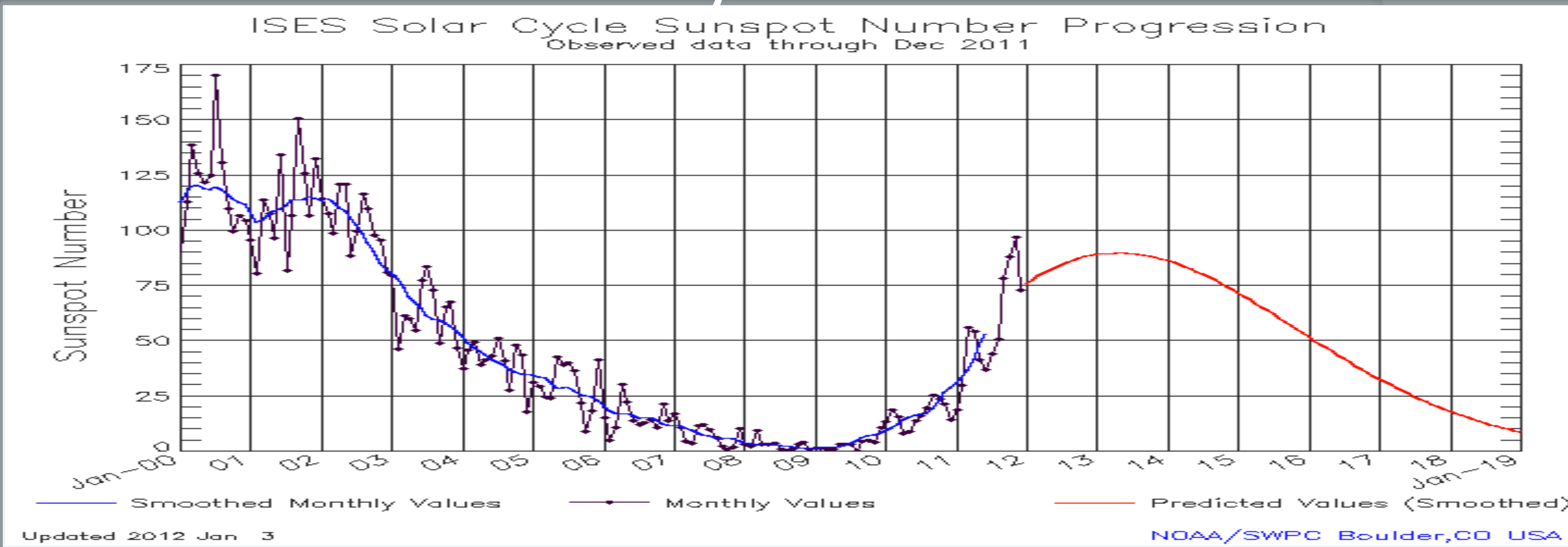
From Pesnell, Sol. Phys. 2012

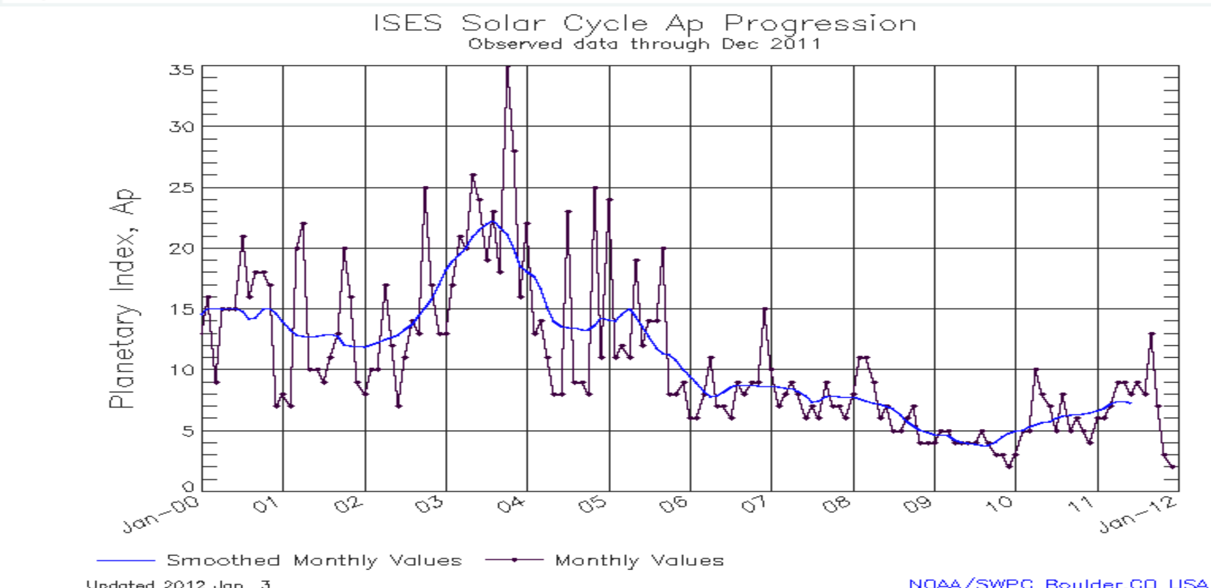
Predictions cutoff was 2009 – although some prediction were much earlier





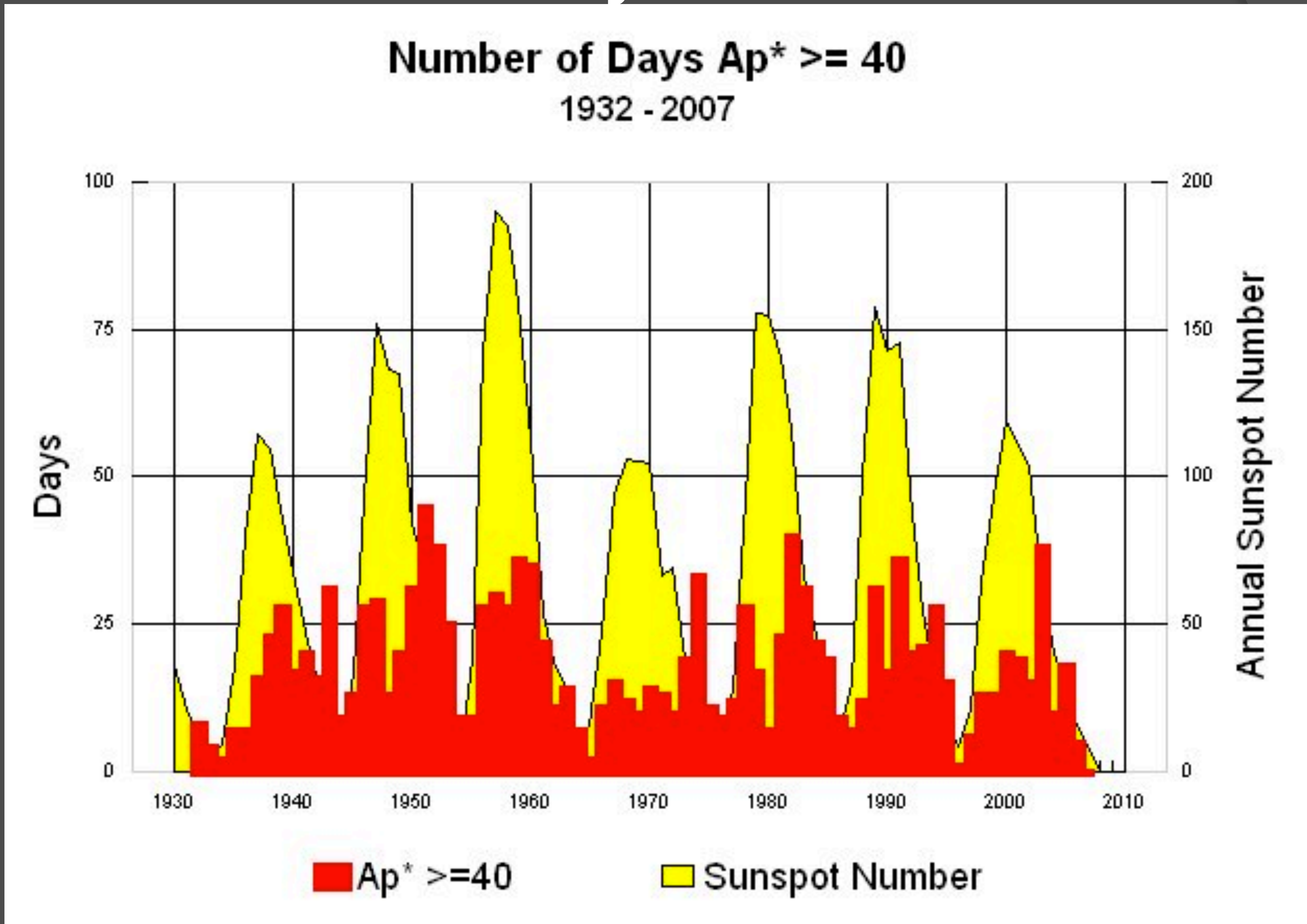
Solar Variability – Solar Storms





Large solar storms may trail the solar cycle, and may become more prevalent during the declining phase.

Solar Variability – Solar Storms



Courtesy NOAA/SWPC

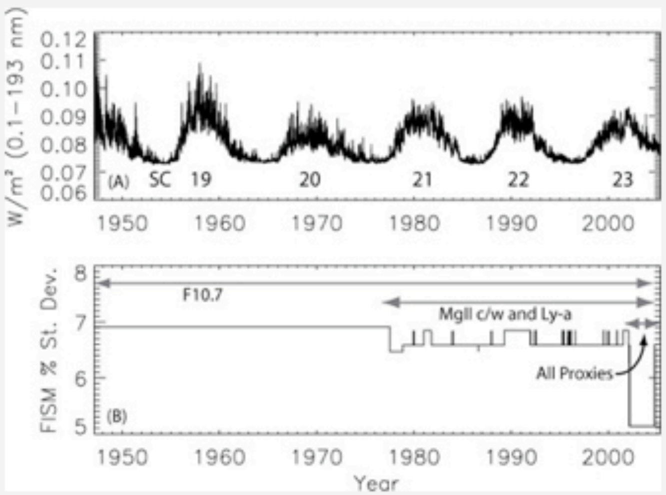
LISIRD

LASP INTERACTIVE SOLAR IRRADIANCE DATACENTER

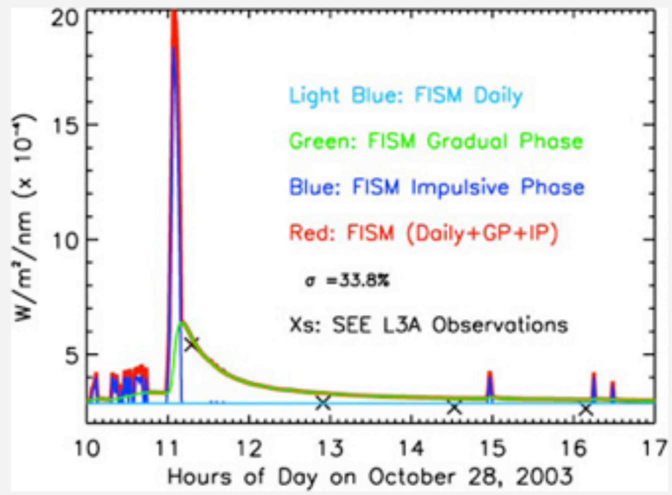
HOME ABOUT DATA MISSIONS

Flare Irradiance Spectral Model (FISM)

FISM is an empirical model of the solar irradiance spectrum.



FISM daily average data for the integrated 0.1-193 nm VUV band over 6 solar cycles from 1947-Present



FISM 1-minute resolution data for the 154.5 nm bin during the X17 flare on October 28, 2003

Download FISM Data

Dataset: Daily (1947-045 - present)

Entire dataset as IDL .sav file

Select by date: 1947-045 to 2010-344 *(YYYY-DOY)* .zip

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The Flare Irradiance Spectral Model (FISM) is an empirical model of the solar irradiance spectrum from 0.1 to 190 nm at 1 nm resolution and on