PREMOS: a short story about degradation
(and modelling)

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PREMOS instrument

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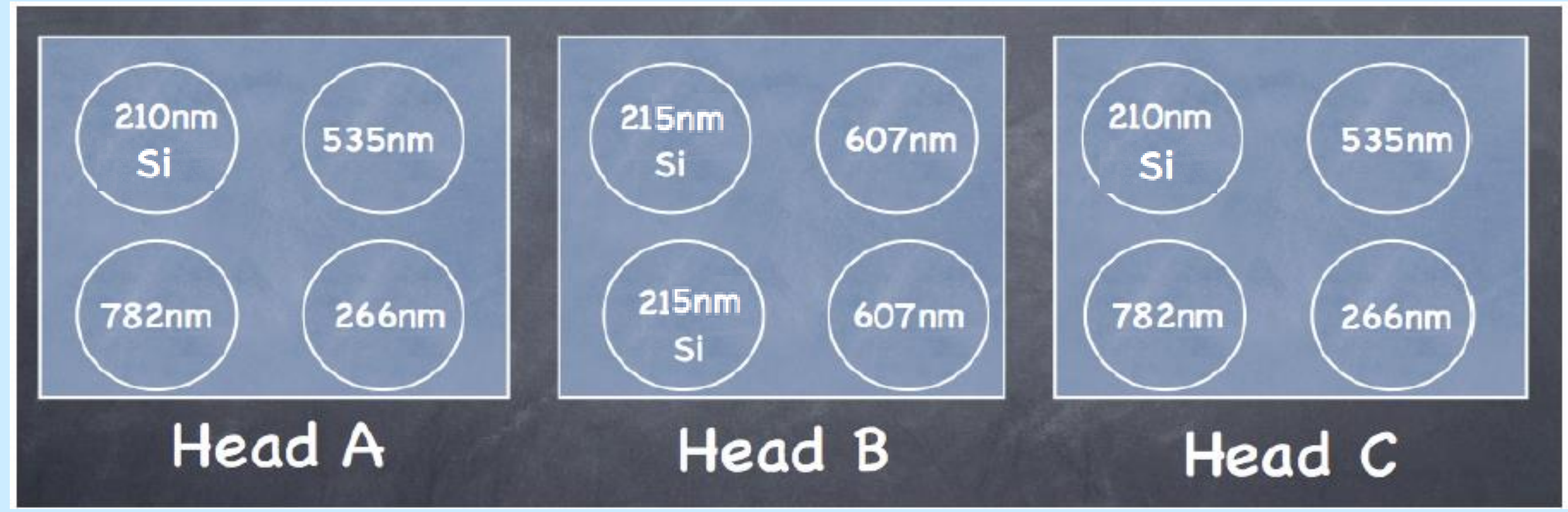
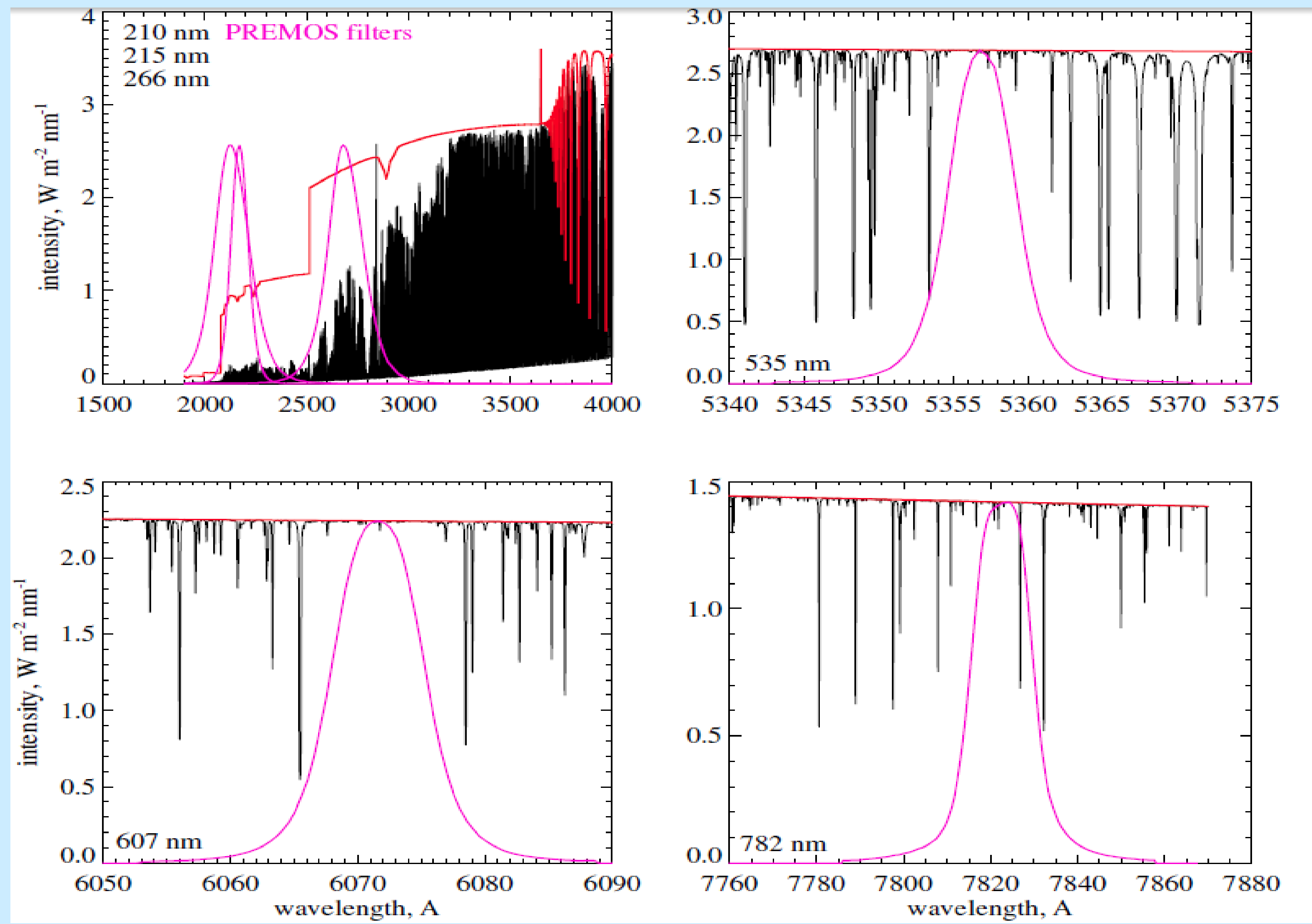
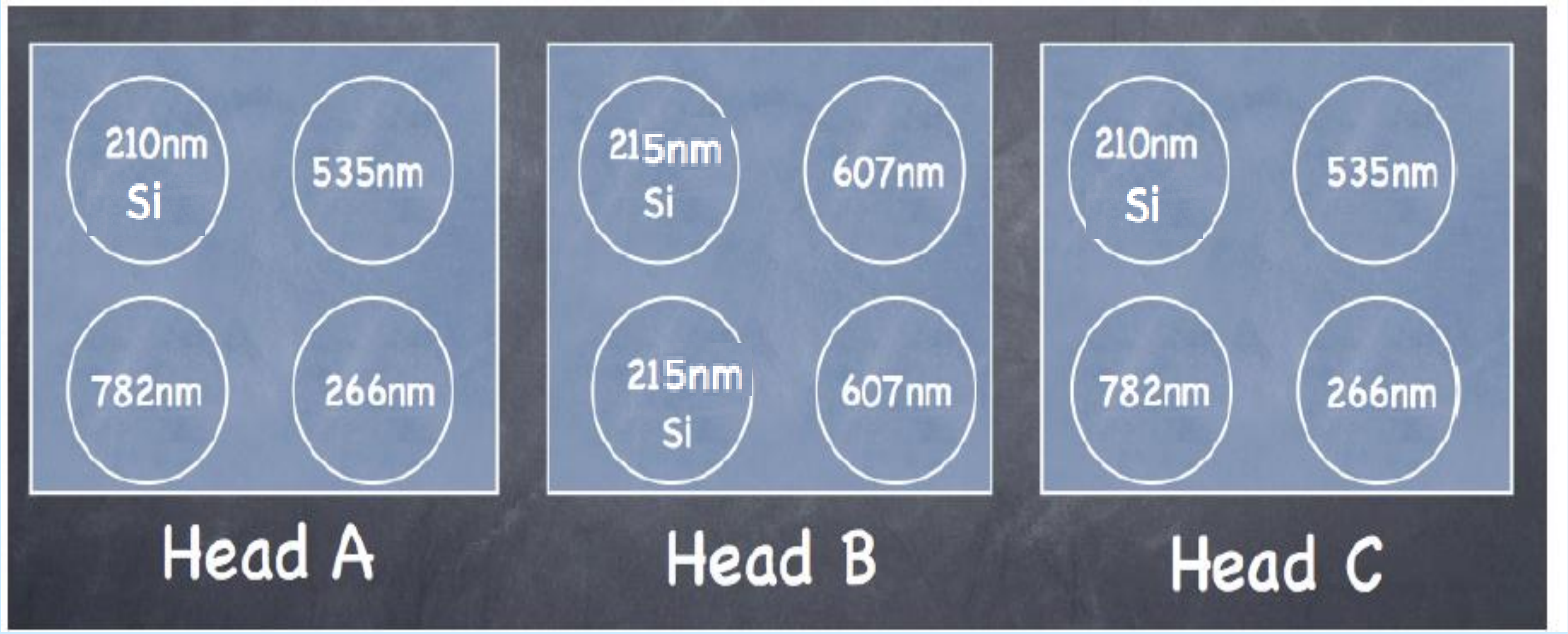
SSI irradiance at 6 wavelengths





Redundancy strategies



Head A: operational channel (1 measure every 10s)
Head C: backup channel of Head A (1 measure every day)
Head-B C1,C2 measure during 1 minute (6 samples), about every second orbit
Head-B C3,C4 measure during 2 minutes (12 samples), about once a week

PREMOS-VIS ‘First Light’

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ATLAS & SIM spectra convoluted with actual filter transmittance

PREMOS FR	535nm	607nm	782nm
First Light @1AU	1.913	1.858	1.174
@ T=20°	**1.961**	**1.858**	**1.203**
ATLAS	1.983	1.772	1.188
SORCE/SIM	1.918	1.731	1.169
	0.5%	**+6%**	**+2%**

Venus Transit as seen by PREMOS

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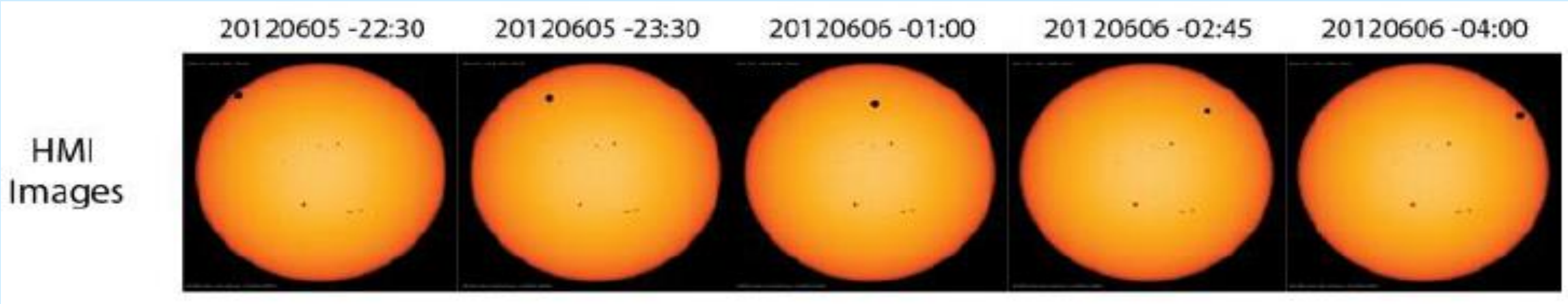
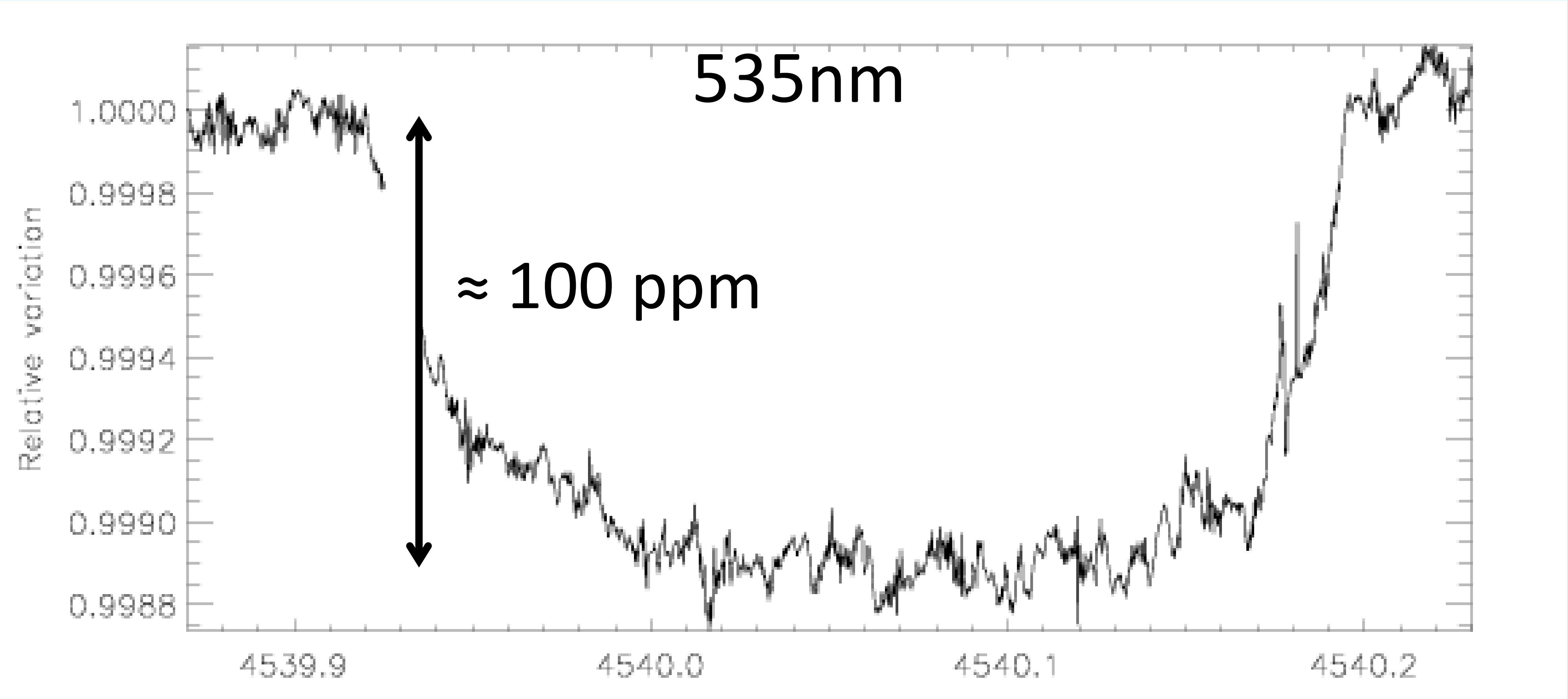
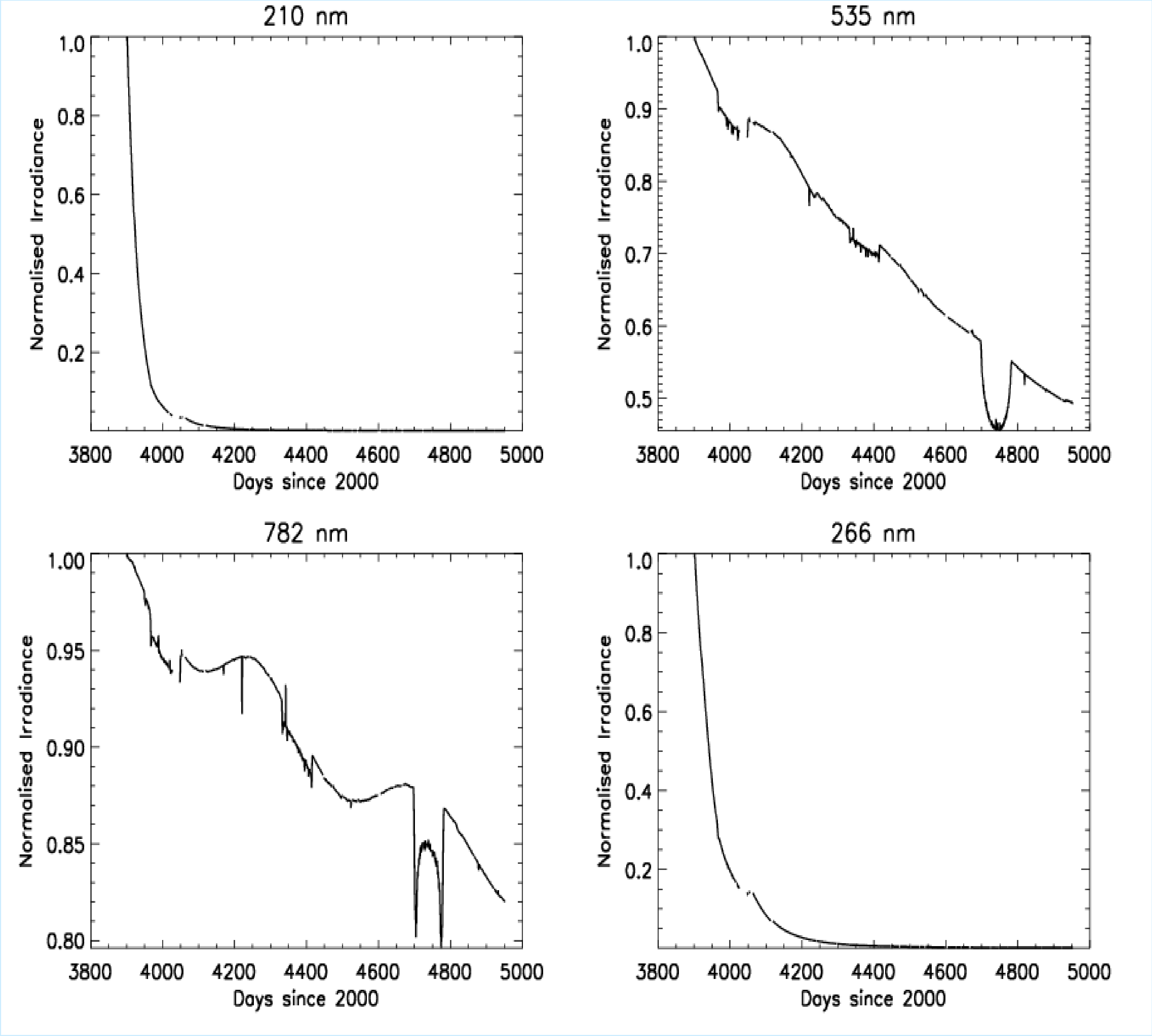




- Similar results at 782 nm (and for SIM data), no signature in the UV

Degradation Issues

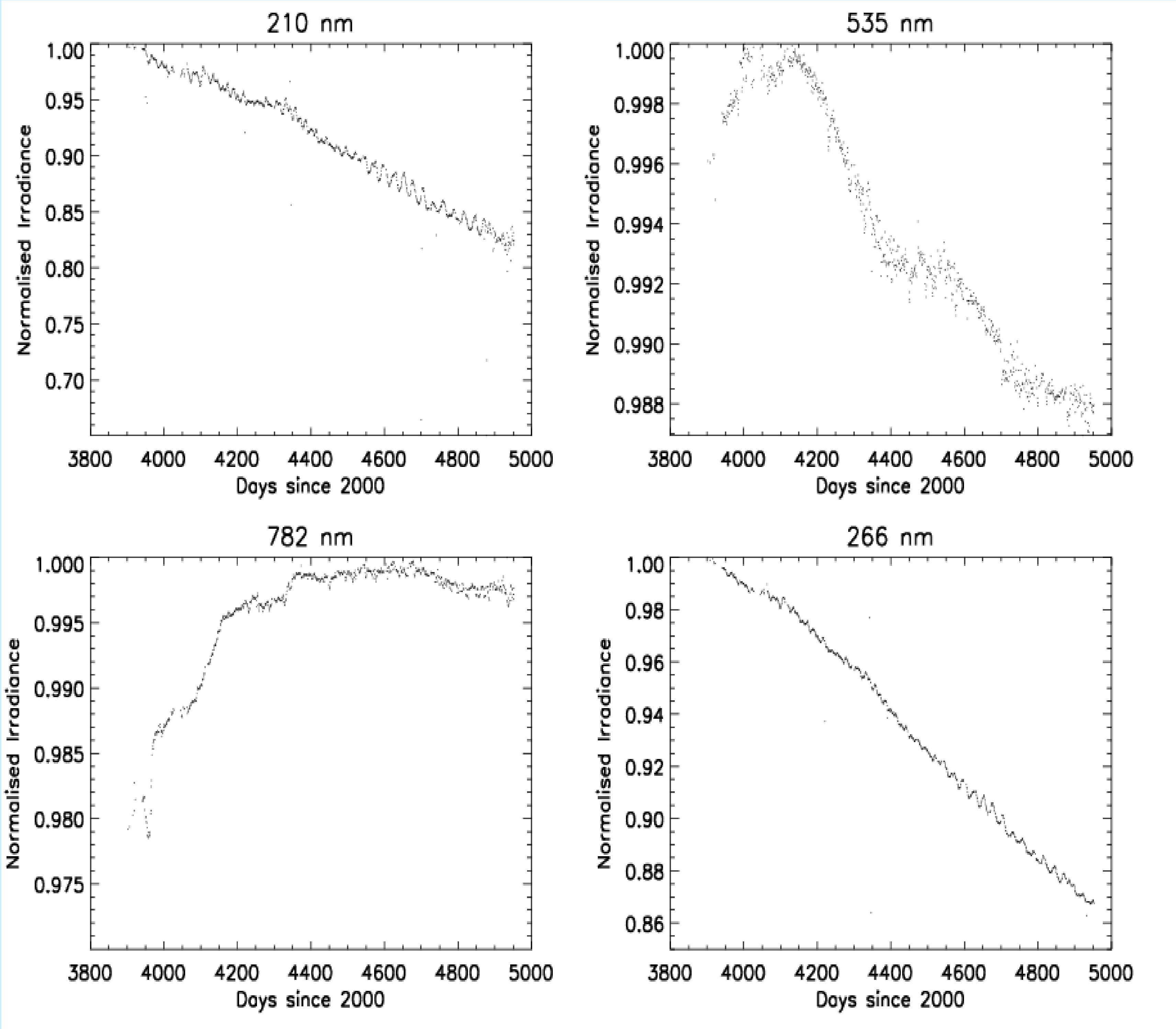


Head-A, continuous operation

- Strong degradation:
  - UV channels <1% after 300 days
  - VIS channel : 50 % left
  - IR channel > 80 %

- Contamination under solar UV exposure

Degradation Issues



Head-C, backup for Head-A

UV channels

210nm – 20%

266nm – 14 %

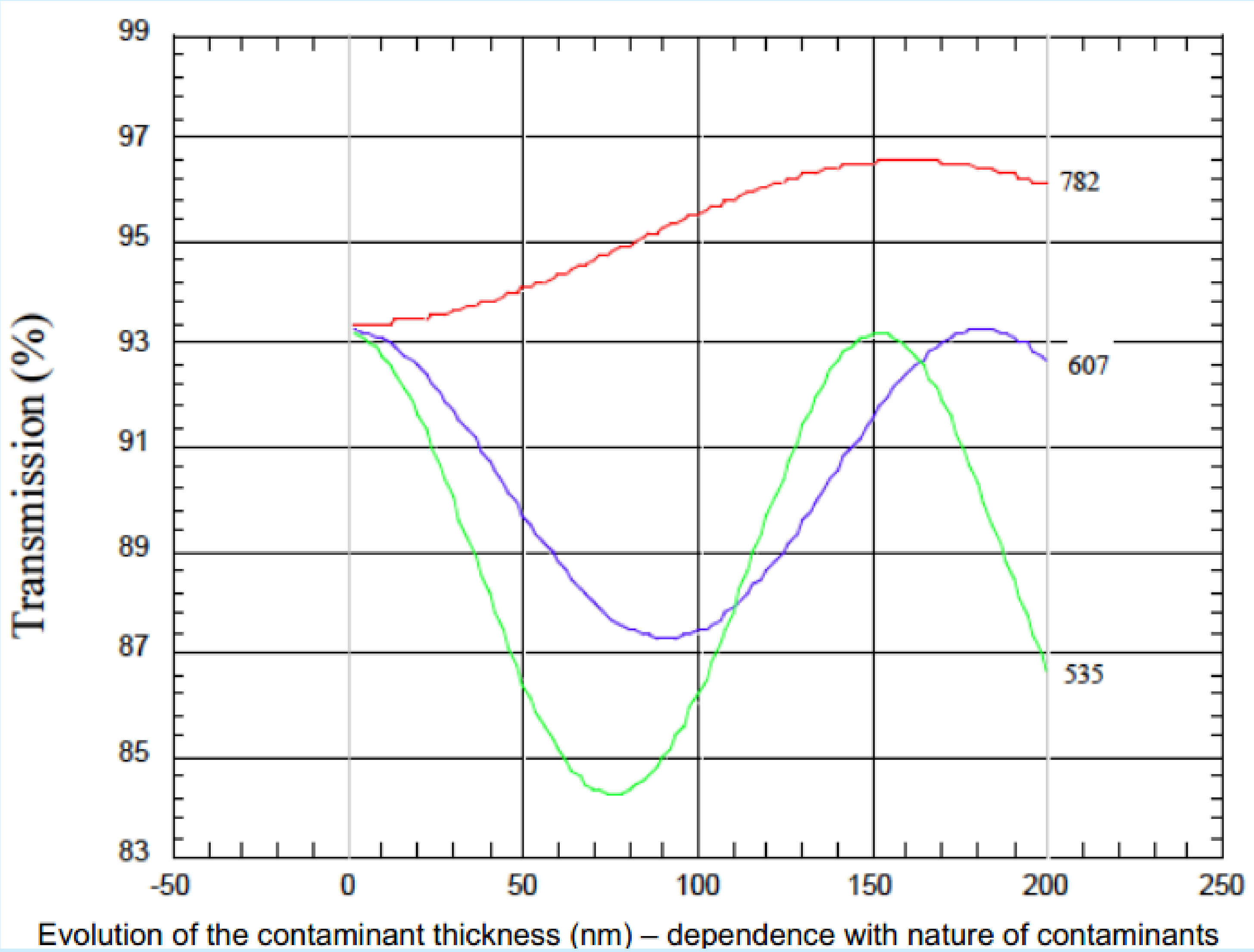
VIS-NIR channels

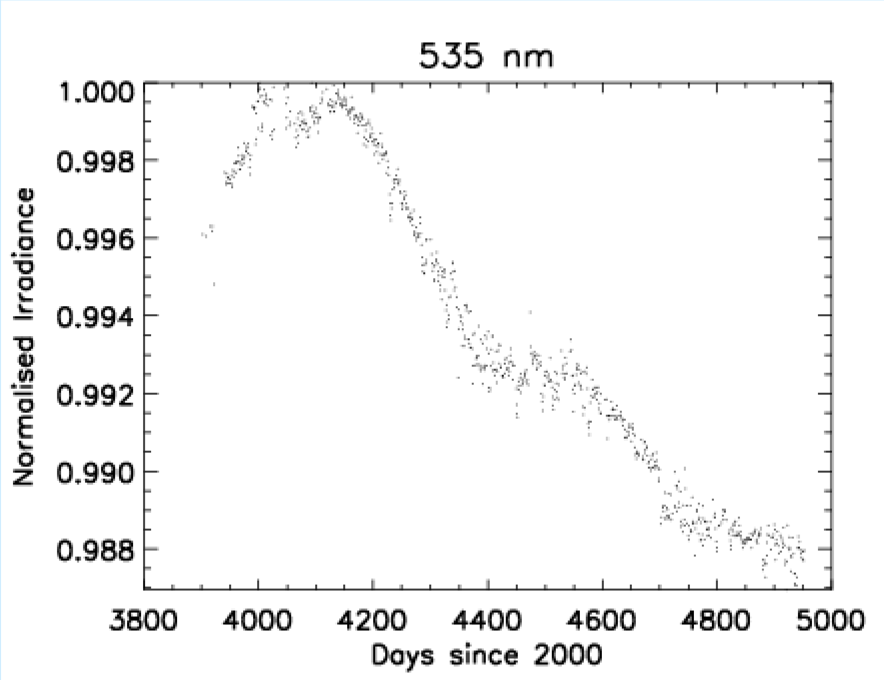
535nm ≈ -1%

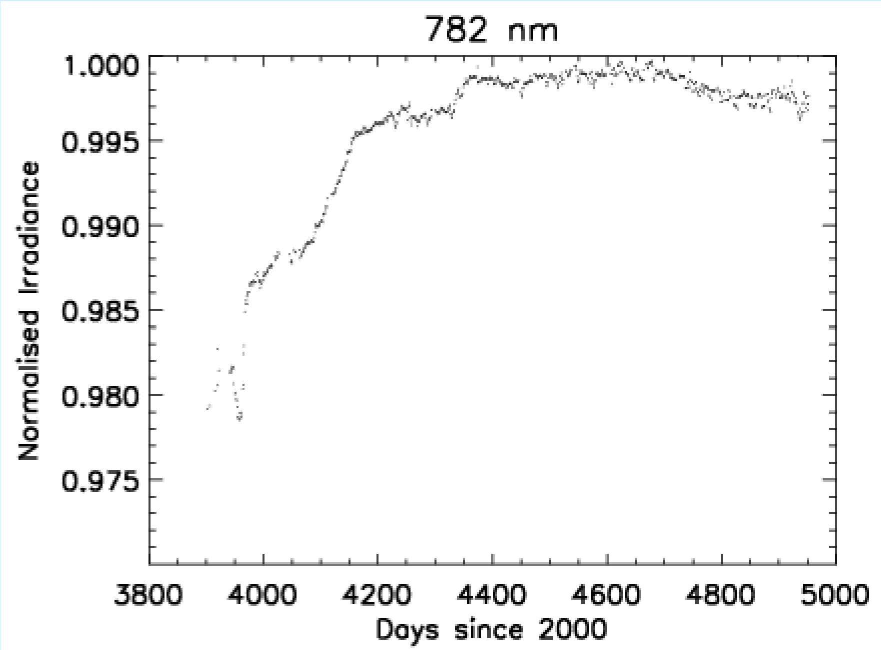
782nm +2%

Degradation issues

VIS and IR channels: contamination under solar UV exposure ?



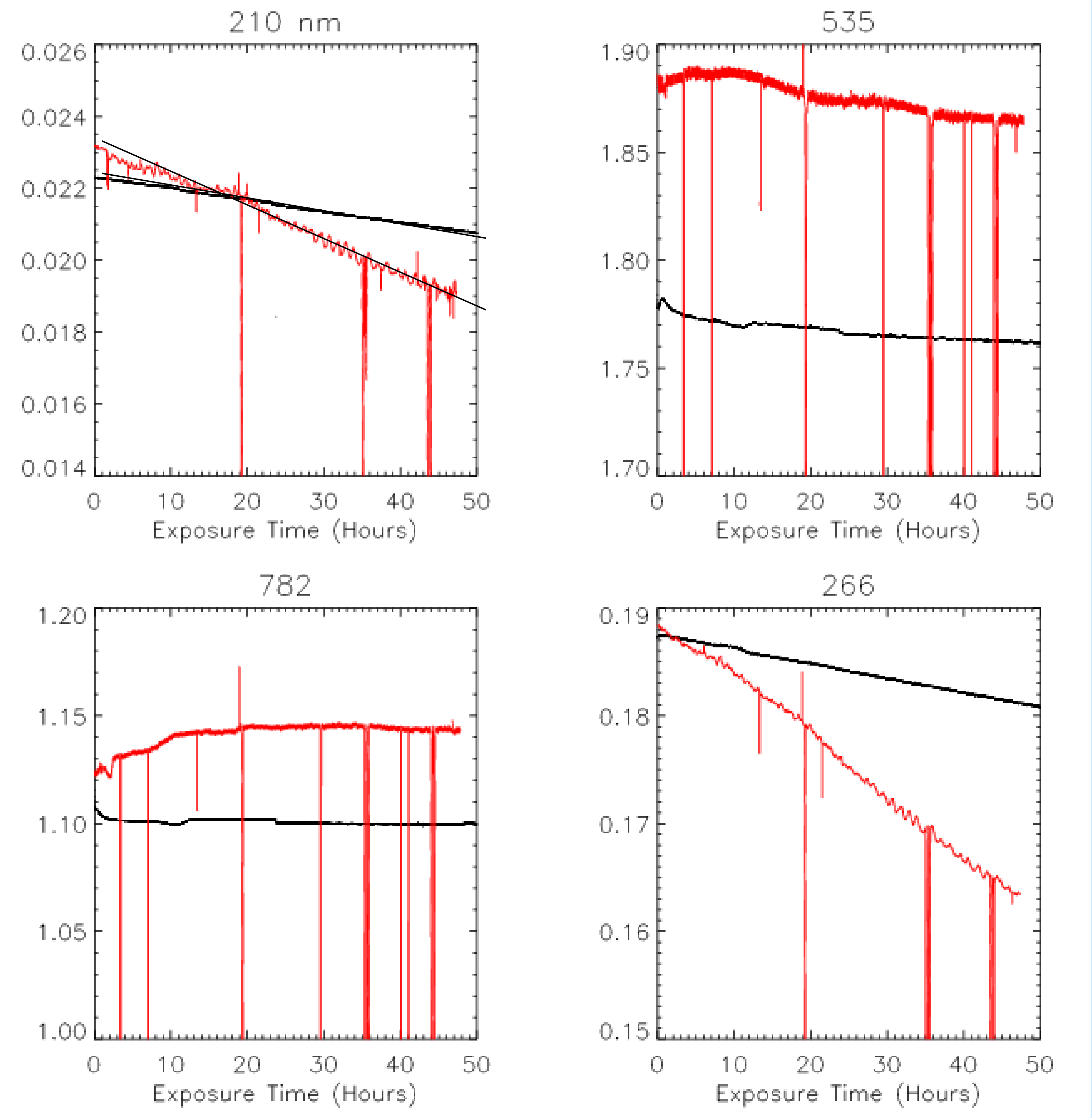




Collaboration with the LYRA team (Brussels) and the SODISM team

Degradation Issues

Exposure time: Operational vs. Backup



- Different behaviour according the time exposure
- Degradation of filters according the exposure time (contamination)
- Degradation of filters according real time
  (structural change, increasing of filters' width,...)

Degradation Issues

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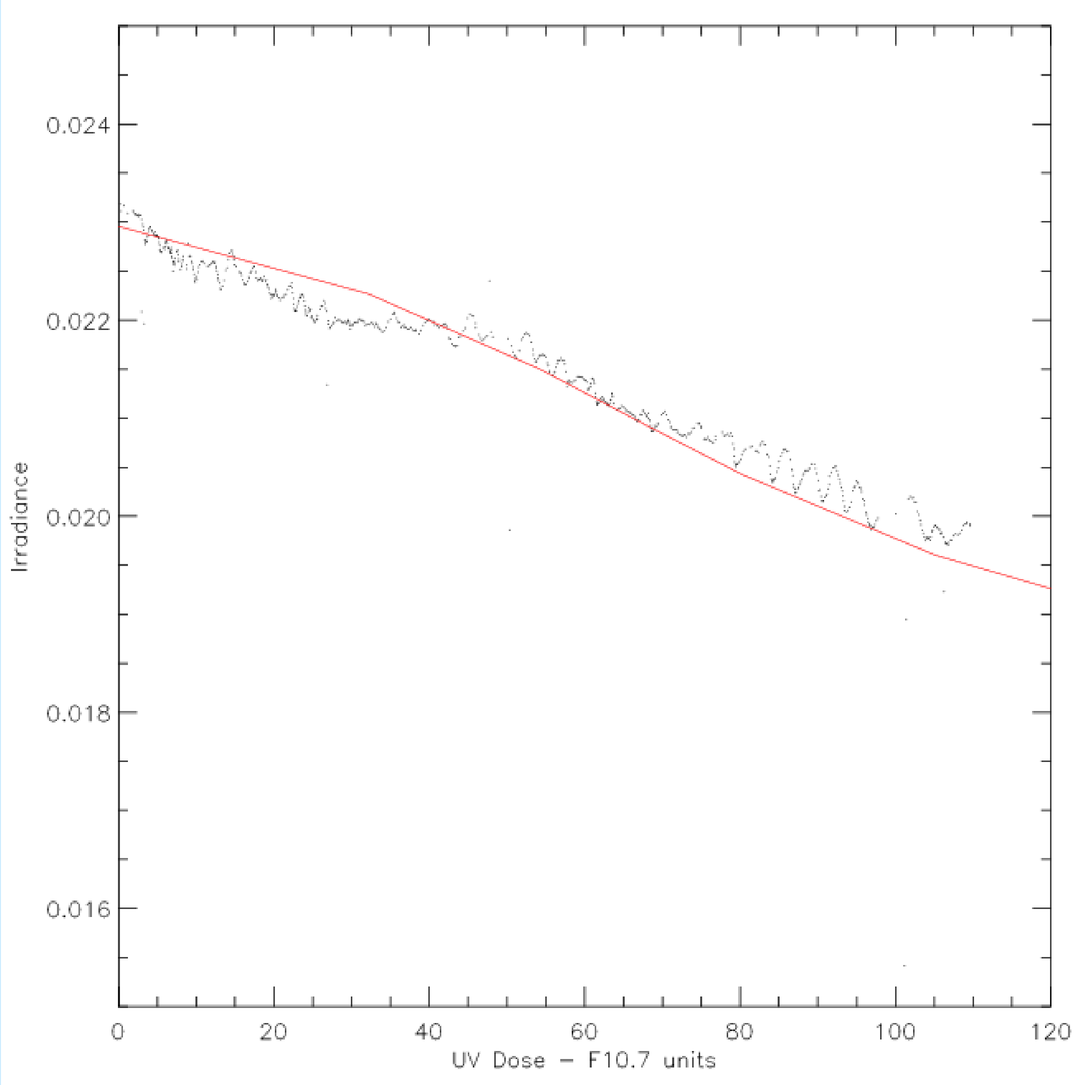
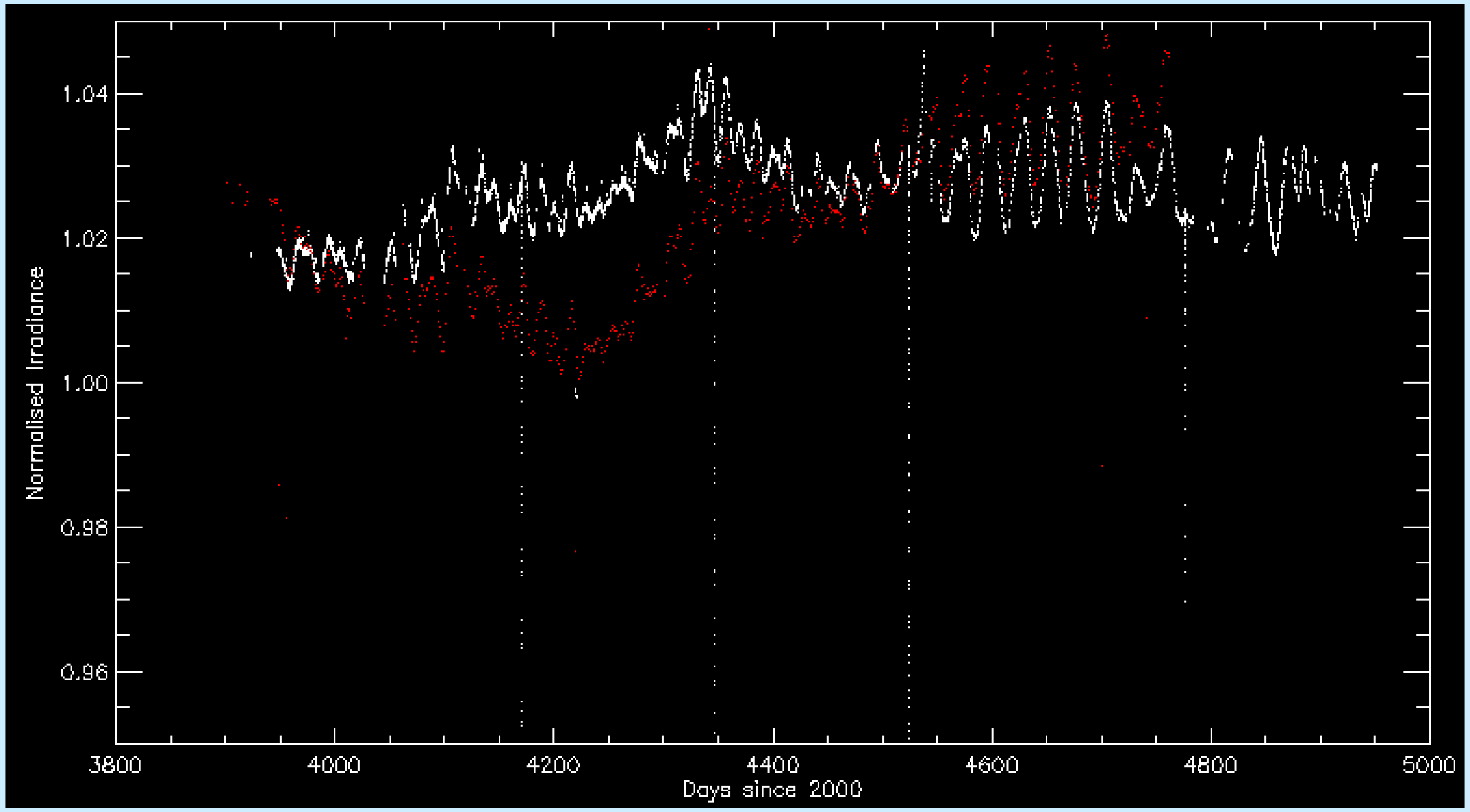
UV Dose: Operational vs. Backup

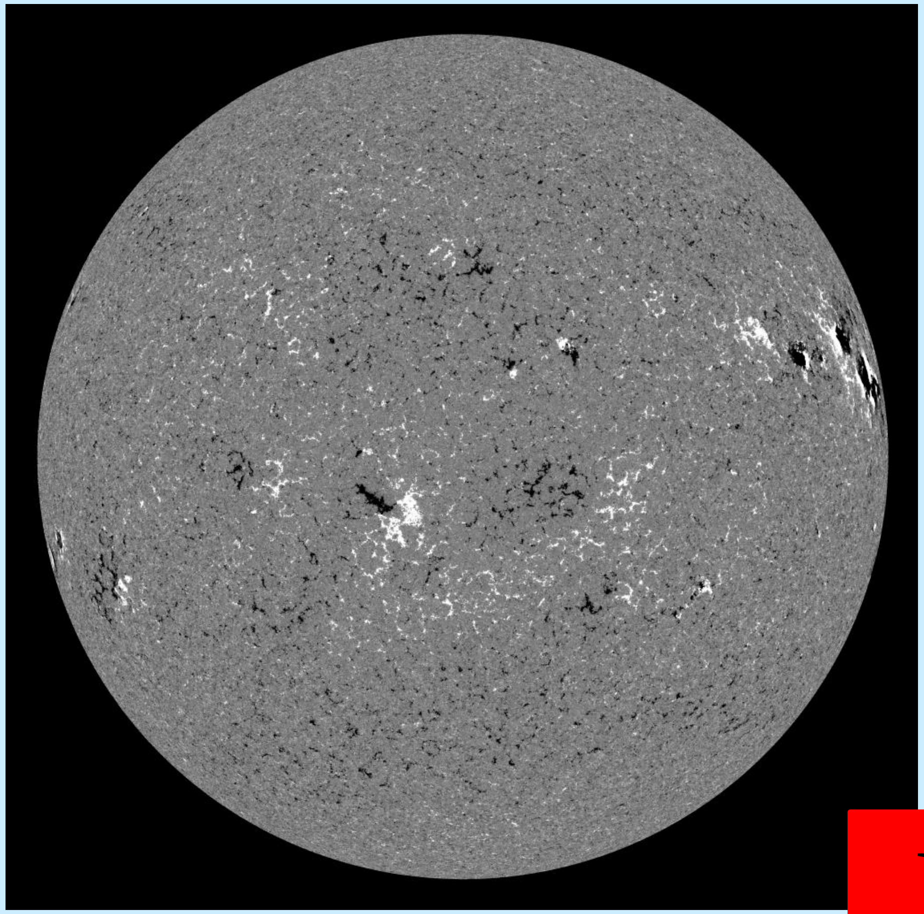


- Still an ongoing project for assessing the degradation for the UV channels (210 and 266 nm)



Solar modeling

Main assumption: Variations in the solar irradiance are directly related to the evolution of surface magnetic flux



Sunspot (umbra and penumbra) S
Faculae P
Network F
Quiet Sun C

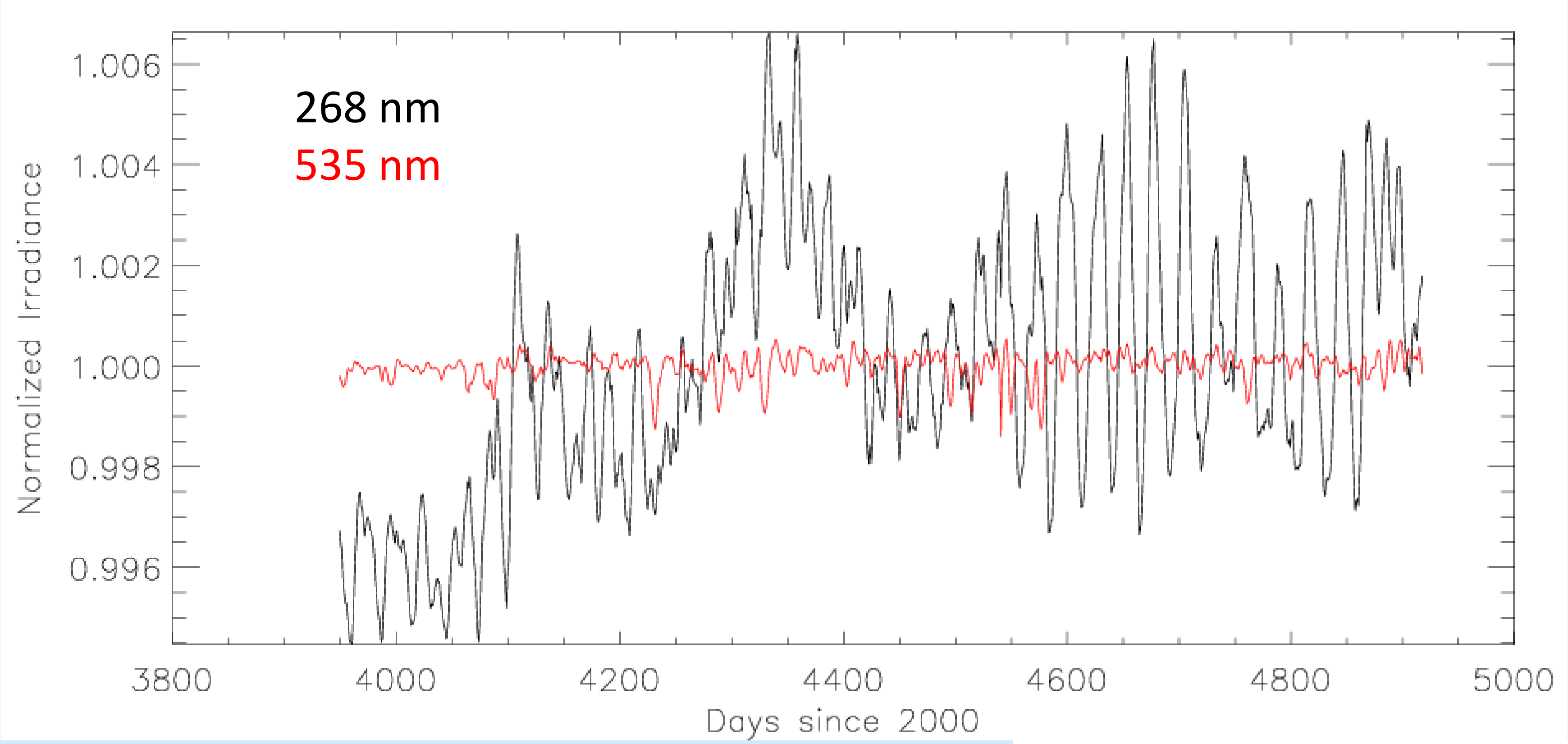
HMI data for calculating the area for each different feature

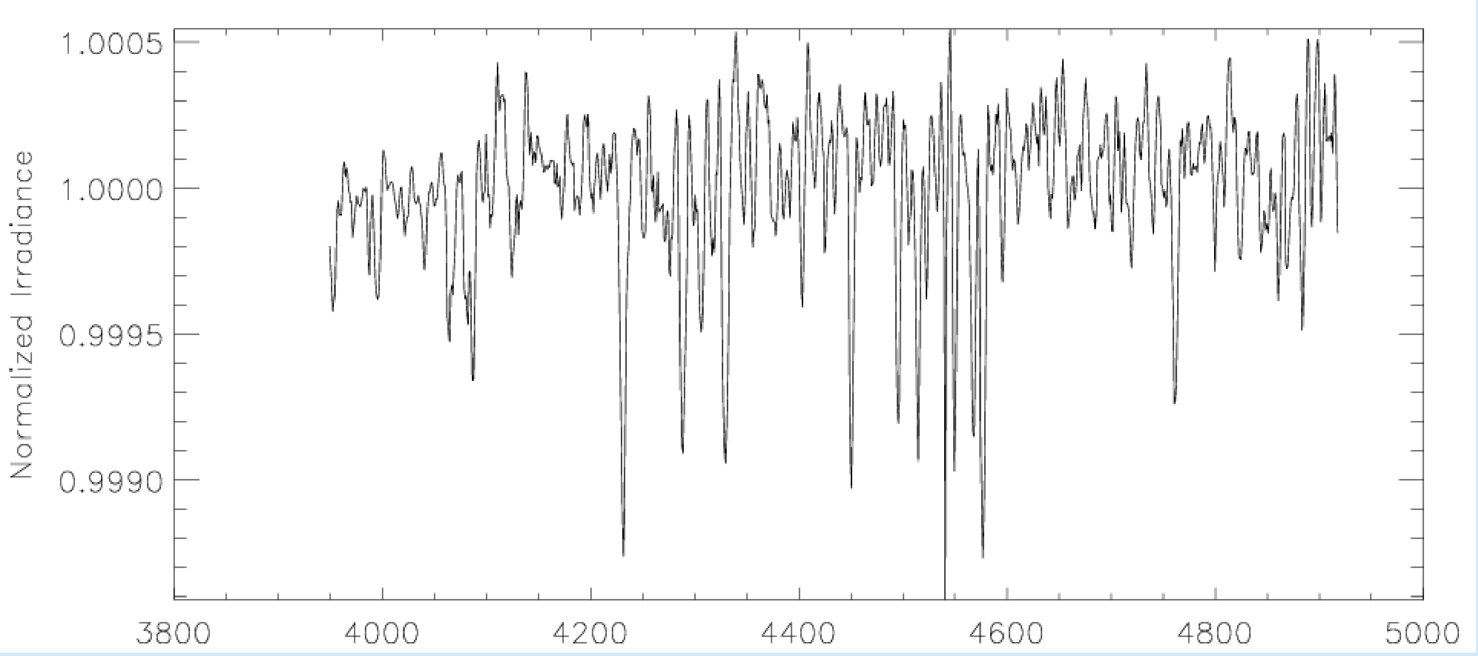
$$F(\lambda, t) = \sum_k \ldots$$
$$+ \alpha_{\mathrm{P}}(\mu_k, t) I_{\mathrm{P}}(\lambda, \mu_k) + \alpha_{\mathrm{AN}}(\mu_k, t) I_{\mathrm{AN}}(\lambda, \mu_k)$$
$$+ \alpha_{\mathrm{F}}(\mu_k, t) I_{\mathrm{F}}(\lambda, \mu_k)),$$

Solar modeling: HMI segmentation

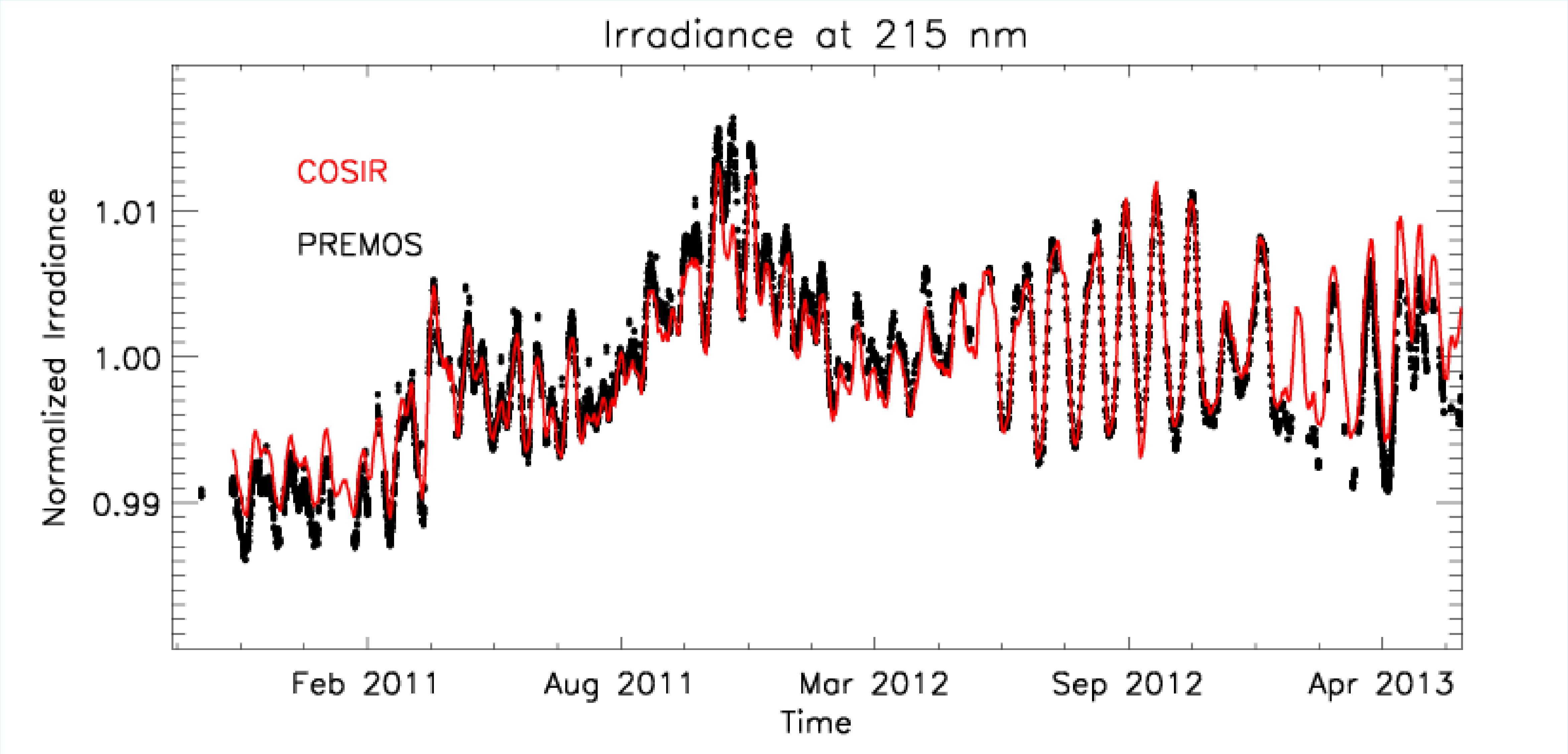
Solar modeling

COSIR: Code Of Solar Irradiance Reconstruction



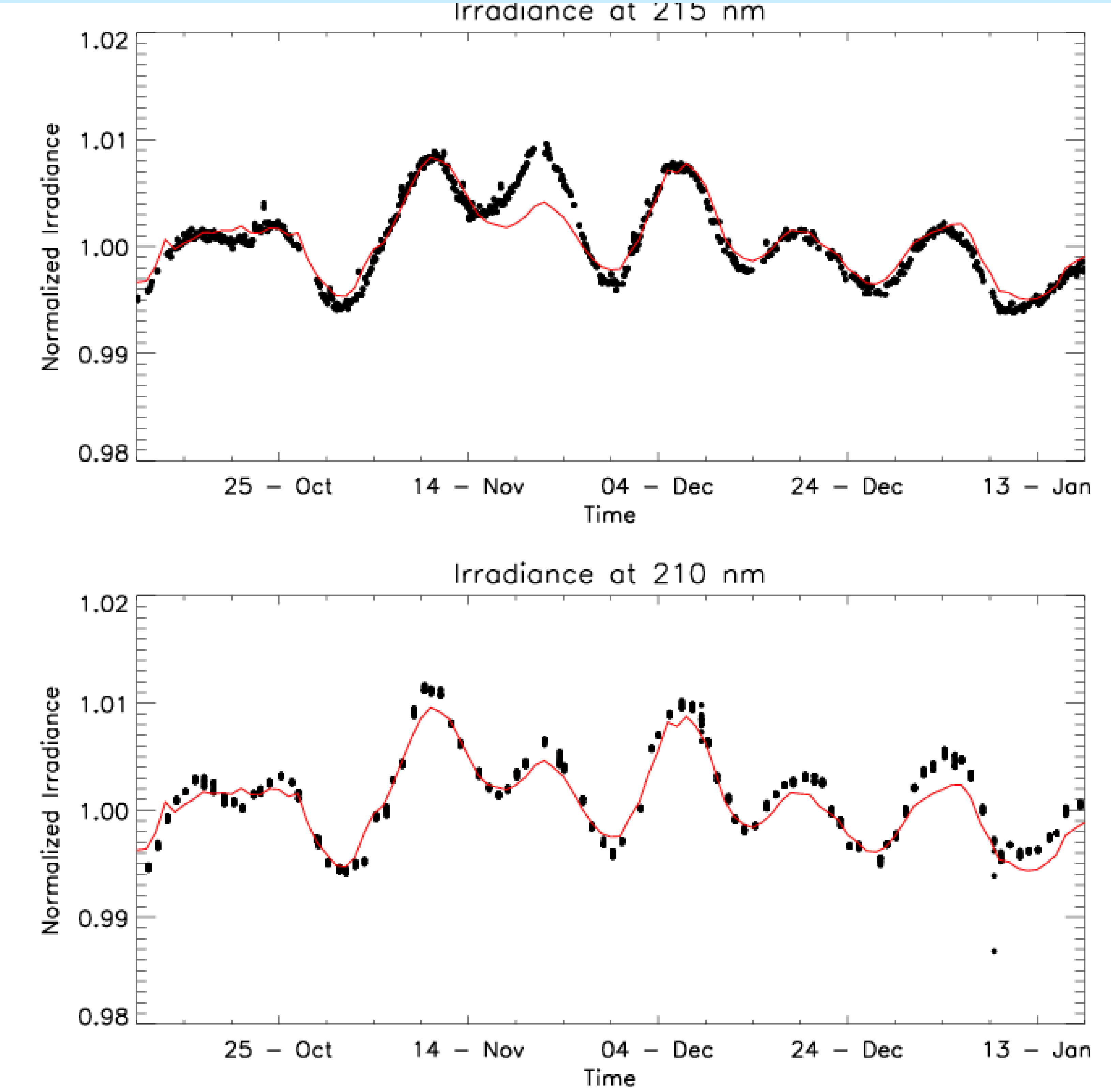


Irradiance at 215 nm



- PREMOS data could be **considered as reference** instead of SORCE data
- Calibrated data available over 3 years

PREMOS investigations



- ✓ Good agreement for 210 nm
- ✓ Same results for 266 nm
- ✓ Only one unexplained difference for 215 nm

PREMOS investigations

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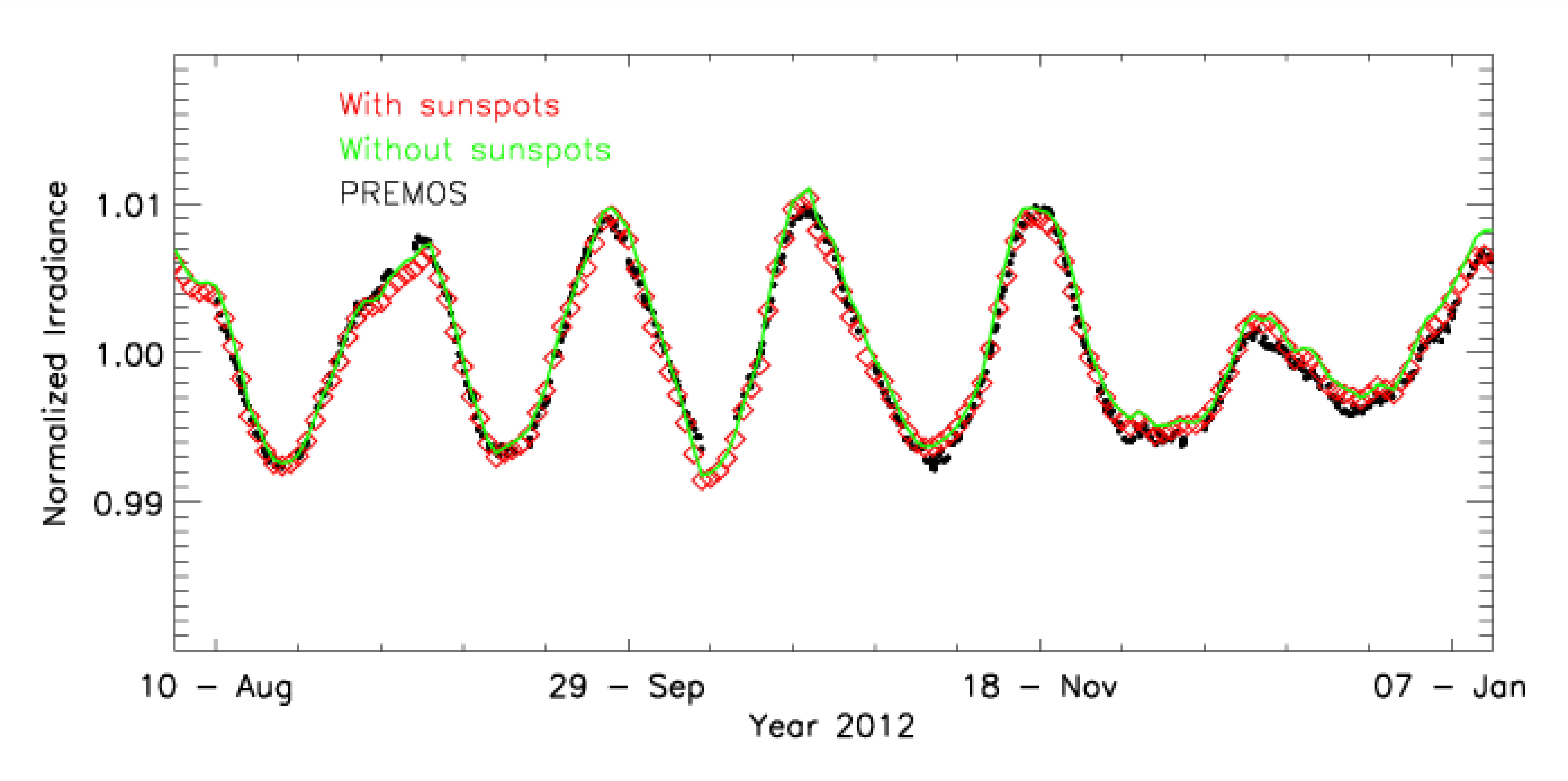
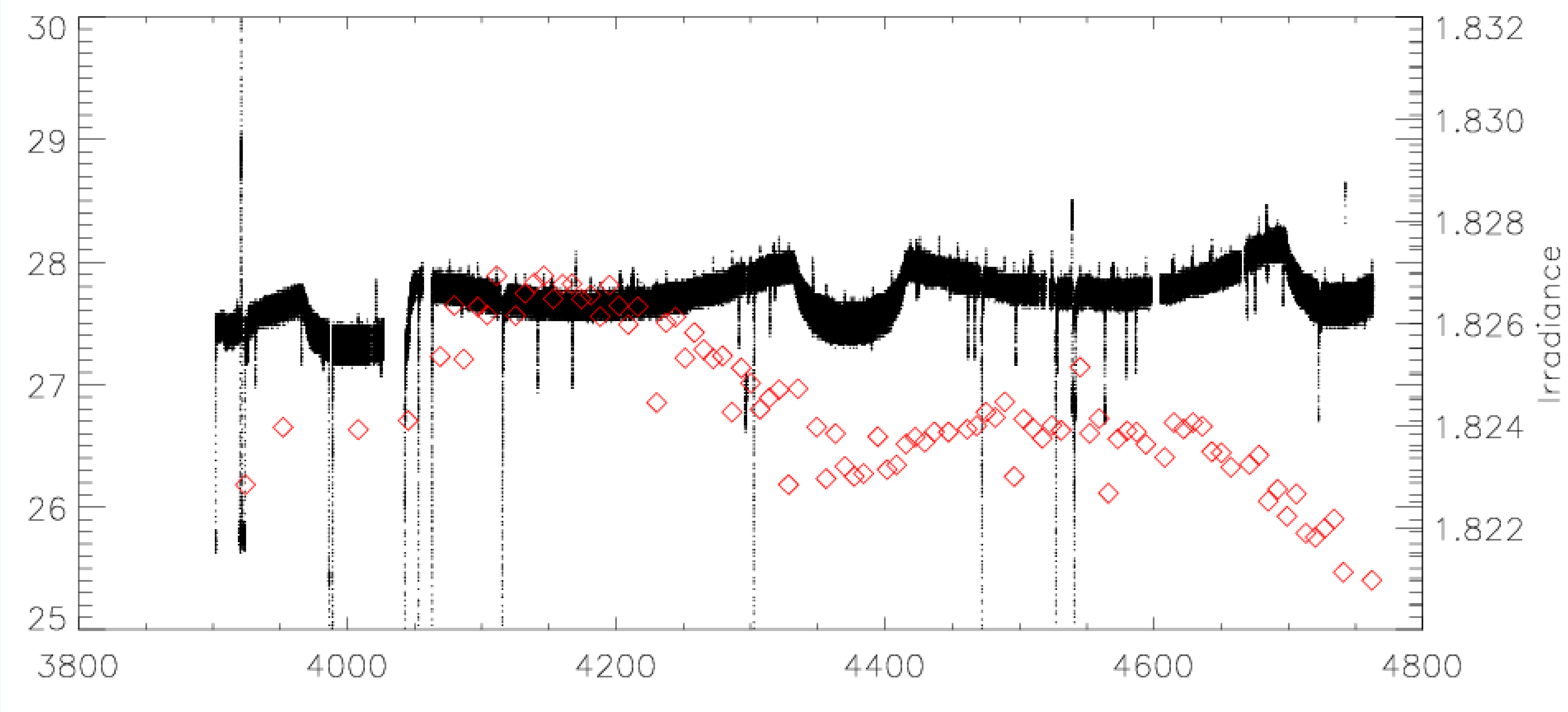


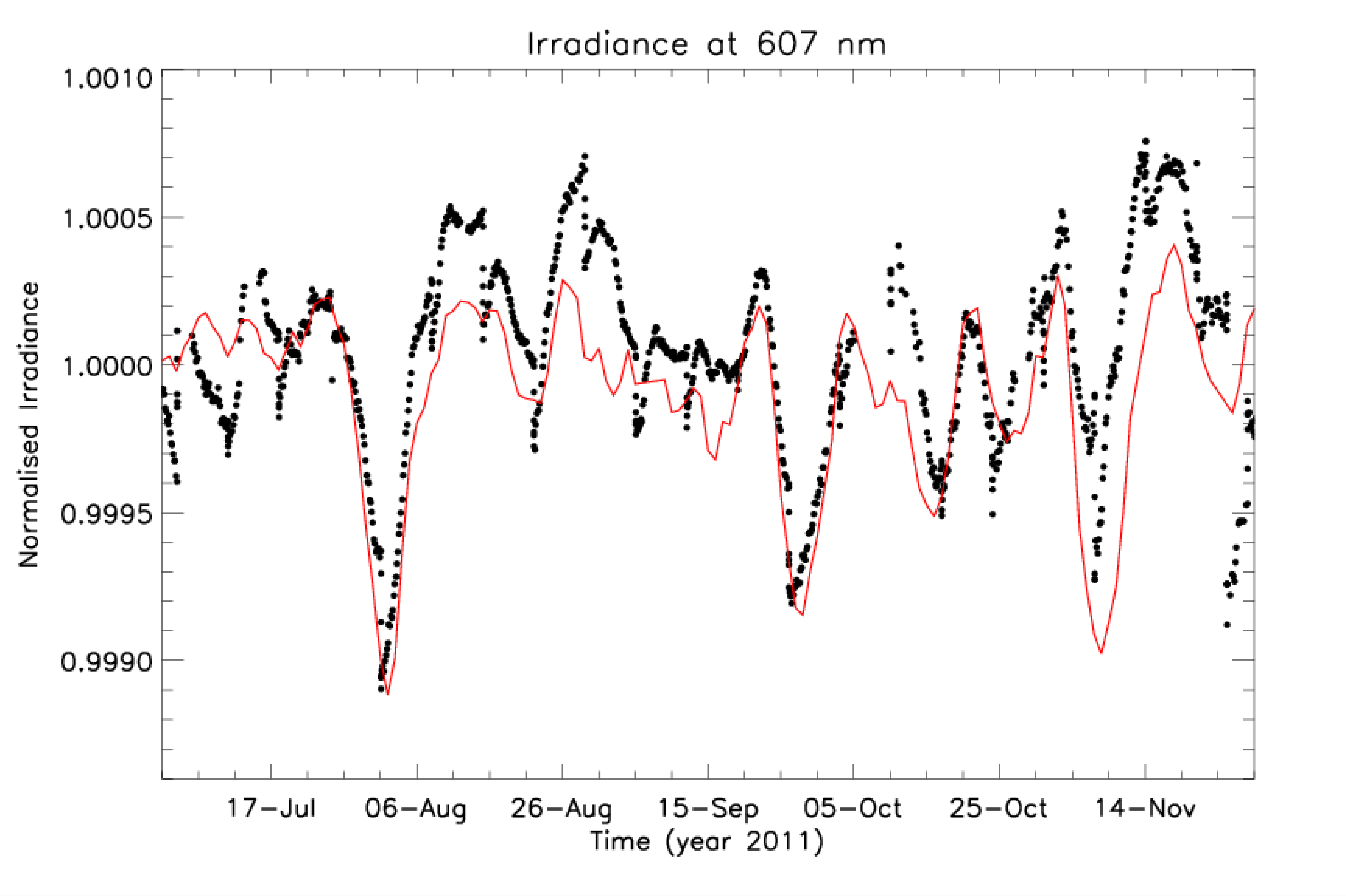
- No marked impact from the sunspots on the variability in UV
- A single model of average faculae ⟶ reproduces any facula (with any physical and geometrical properties)
- Stellar variability in the UV: only one component (Ca II K), no visible images required

Irradiance at 607 nm: influence of the temperature



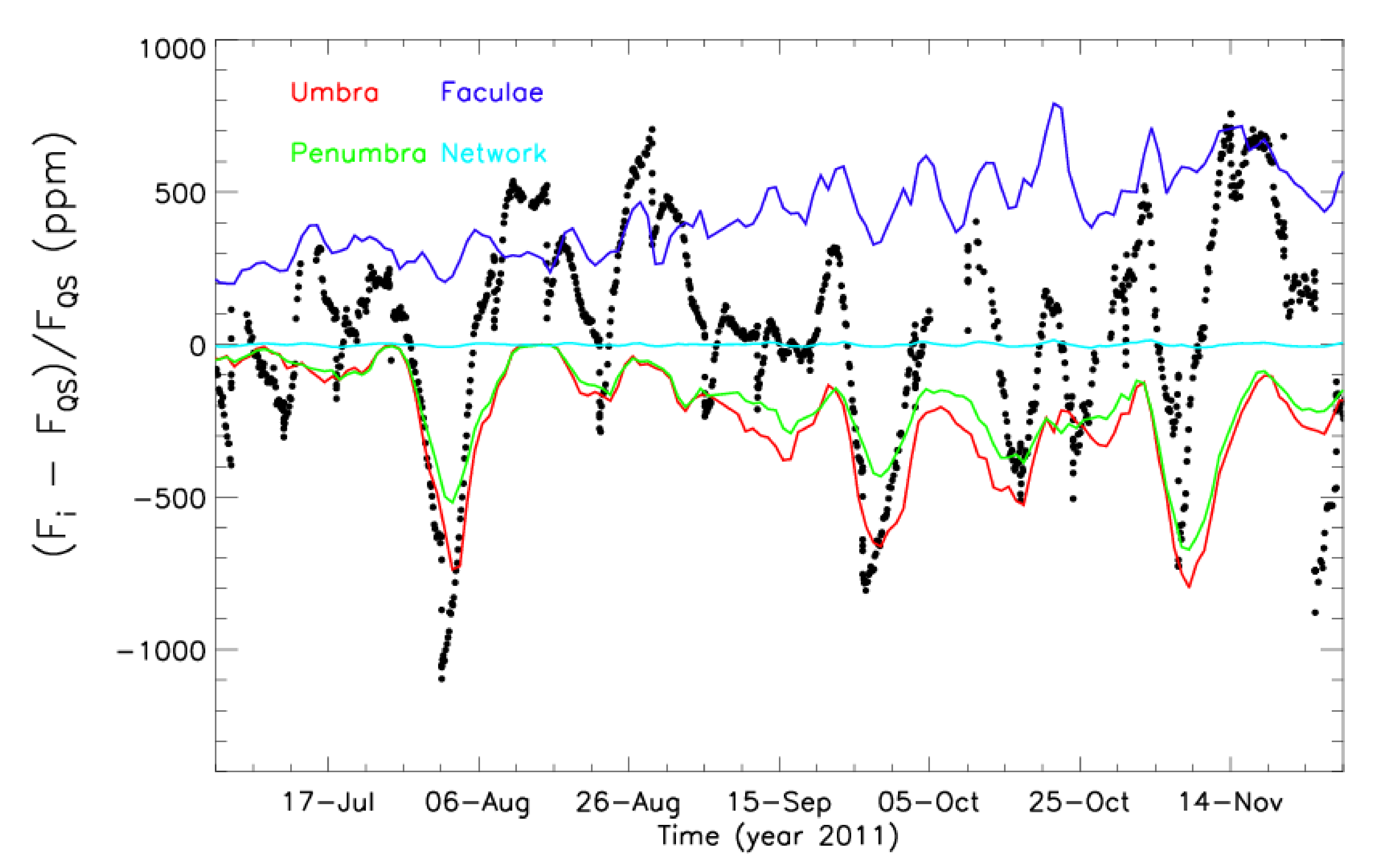
PREMOS investigations

Irradiance at 607 nm



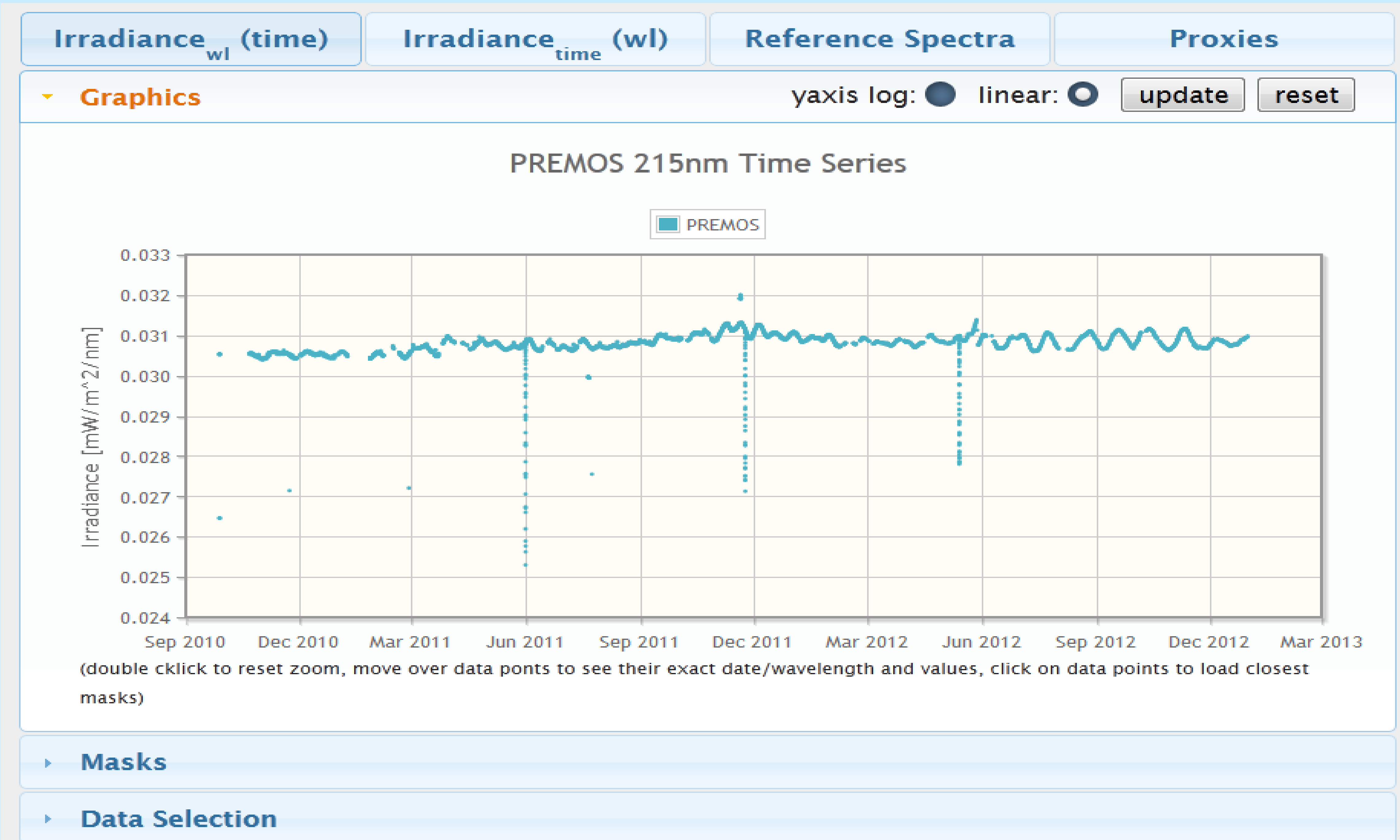
- Strong correlation for solar rotational variations !
- R= 0.55, rms = 349.10^{-6} mag / 323.10^{-6} mag

PREMOS investigations



- RMS facula= 123.10^{-6} mag ; RMS umbra = 150.10^{-6} mag ; RMS penumbra = 116.10^{-6} mag
- Facula have a marked impact on rotational variability !

Irradiance at 215nm available



http://projects.pmodwrc.ch/solid-visualization/makeover/