PICARD Workshop
April 10th, 2012

PREMOS
Instrument status and first results

G. Cessateur for the PREMOS team
PMOD/WRC, Switzerland
Radiometer 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
Degradation Issues

Head-A, continuous operation
✓ Strong degradation:
  - UV channels <1% after 461 days
  - VIS channels >50%
✓ Gap July – August 2010
  ➔ exposure related degradation?
✓ Unexpected excursion at 782nm
  +1% from D4114 to D4232?
Degradation Issues

Head-C, backup for Head-A
UV channels
210nm -7%
266nm -5%
VIS-NIR channels
535nm ≈ -1%
782nm +2%
NIR: change of the filter transmission?

First light paper in preparation

10.04.2012
Head B: Interesting first results

Degradation ~10%

No degradation (?)

10.04.2012
Comparison with SOLSTICE

- Independant correction
- Strong correlation
  13.5 and 27 days modulation
- Rotational modulation more accurate
- Solar modelling: current work (paper in preparation)
- Similar paper with PROBA2/LYRA data recently published

10.04.2012
Comparison with SOLSTICE

- Degradation correction for others UV channels in progress

- Solar modelling: current work (paper in preparation)

- Collaboration with ROB comparison of degradation model with LYRA (next summer)
Comparison with SORCE

Information about the inversion point?
Longer time series really needed!!!
Current work: comparison with SIM data
Current work: degradation correction to get a better statistics
Interesting Physics buried in PREMOS data

Solar modelling
Climate modelling
Head B and C still excellent for duty!

The only one instrument left after SORCE ends!
(2012 ? 2013 ?)

Herzberg, Visible and InfraRed ranges
Continuous measurements is a real necessity for the community!
Additional Material
Eclipses and Occultations

(a) January 15, 2010

(b) July 11, 2010
The light curves of the eclipses allow one to accurately retrieve the center-to-limb variations (CLV) of the solar brightness.

CLV

Important for modeling of the irradiance variations on the time-scale of the solar rotation

Provide a valuable information about the solar atmosphere

We employ the 1D NLTE radiative transfer COde for Solar Irradiance (see Shapiro et al. 2010, A&A 529, 67) to calculate the CLV.
Comparison of the eclipses profiles COSI/PREMOS

June 01, 2011 (Transit 2)

- Similar paper with PROBA2/LYRA data recently published (only one Herzberg channel)
- PREMOS: more information about the whole spectral range (paper in preparation)
Comparison with SIM?

SIM/SOLSPEC/SCHIMACHY data needed to compare 535 nm, 607 nm and 782 nm!
Effect of the temperature

Long term trend

Occultation season
Effect of the temperature

Daily effect

535 nm

607 nm

10.04.2012
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,...)
Plan

- TSI PMO6 absolute radiometer
- SSI filter radiometer at 6 wavelengths
- Comparison with SORCE/SOLSTICE
Calibration of TSI instrument

- TSI-PREMOS-A is calibrated (fully SI-traceable!)
- Absolute uncertainty is 280 ppm or 0.4 W/m$^2$ (k=1)
- PICARD/PREMOS measures 0.4 W/m$^2$ lower than SORCE/TIM – thus, *agrees* with TIM within the uncertainty of the absolute calibration
- PICARD/PREMOS is about 4.5 W/m$^2$ lower than SOHO/VIRGO – thus, the high value is *outside* the uncertainty limit.

13 April 2012
Comparison PREMOS to TIM

First light
July 27, 2010

PREMOS A
regular operation
started in
September 2010
Ratio PREMOS to TIM

± 100 ppm (0.1 W/m²)
Redundancy strategies

- The sensitivity of radiometers in space change with time.
- It is thought the sensitivity change is a function of exposure time, or more accurately, of a (UV-)radiation dose.
- The sensitivity changes are evaluated by comparing two radiometers which are as identical as possible:
  - one observing the Sun operationally: PREMOS A
  - the other only occasionally: PREMOS B
Ratio PREMOS A/B

bump after freezing of the satellite

bump (cause unclear)
Increase relative to TIM

- A real time: 4 days
  - slope PREMOS L1A / TIM = 95 ± 8 ppm/day
  - slope PREMOS L1A / TIM = 65 ± 10 ppm/day
- B real time: 1 year
  - 50 ppm
• The ratio of PREMOS to TIM over the first year was constant within ±100 ppm.

• Over one year PREMOS-B, corrected with the observed sensitivity change of A, drifted relative to TIM systematically by 50 ppm.

• This can be interpreted as either:
  • TIM was drifting by 50 ppm
  or
  • The sensitivity changes of the two radiometers A and B are not identical as a function of exposure time!