

Preliminary SCIAMACHY Lunar observations as intercalibration source



That's no moon,
It's a calibration source

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EARTH SPACE SOLUTIONS



- SCIAMACHY
- SCIAMACHY Lunar Observations
- SCIAMACHY Degradation
- SCIAMACHY Calibration
- Future



SCIAMACHY on ENVISAT



2016-08-11 SCIAMACHY Lunar observations

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Primary purpose

The main objectives of the SCIAMACHY mission are

- to improve our knowledge of global atmospheric composition,
- its change in response to both natural and anthropogenic activity and the processes associated to it, as well as
- the related global issues of importance to the chemistry and physics of our atmosphere

Monitor the Earth atmosphere (gases, aerosols, clouds) in reflected sunlight

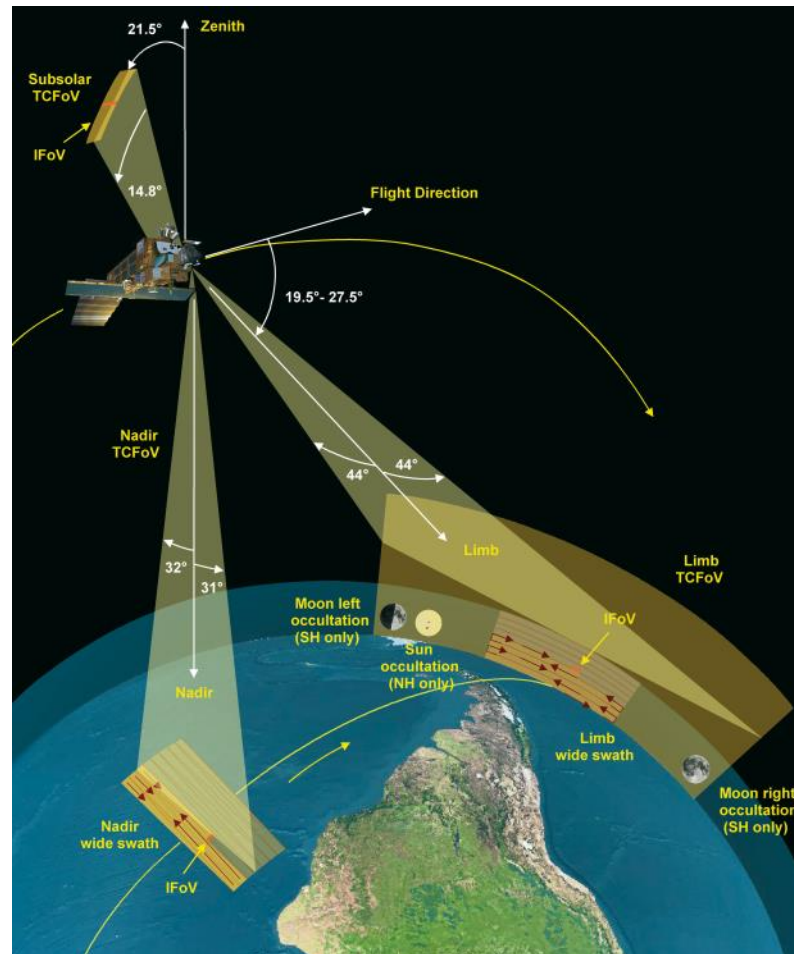


The instrument

- Imaging spectrometer
- Spatial dimensions through scan mirror(s):
 - I FoV: 0.045 degrees by 1.8 degrees
- Spectral dimension through 8-channel spectrometer, 8192 wavelengths:
 - 214 nm to 1773 nm
 - 1934 nm to 2044 nm
 - 2259 nm to 2386 nm
- Nadir, Limb, sub-solar, solar occultation and lunar occultation views
- Many in-flight calibration and monitoring modes



SCIAMACHY viewing modes



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Lunar observations

2 types of lunar observation:

- Lunar pointing using sun/moon follower (state ID 56 and 57)
- Lunar scanning, using sun/moon follower + superimposed scan of 0.66 degrees edge to edge (state ID 54)
- State IDs 56 and 57 show only a slice of the moon, not suited for this study
- State ID 54 shows the entire moon in the scans, 1-dimensional “image” in elevation direction:
 - 2 pixels high in 8192 wavelengths
 - 80 pixels high in 7 Polarisation Measurement Devices (PMDs), broadband linear polarisation, 6 wavelengths, 2 polarisation directions (90 and 45 degrees)

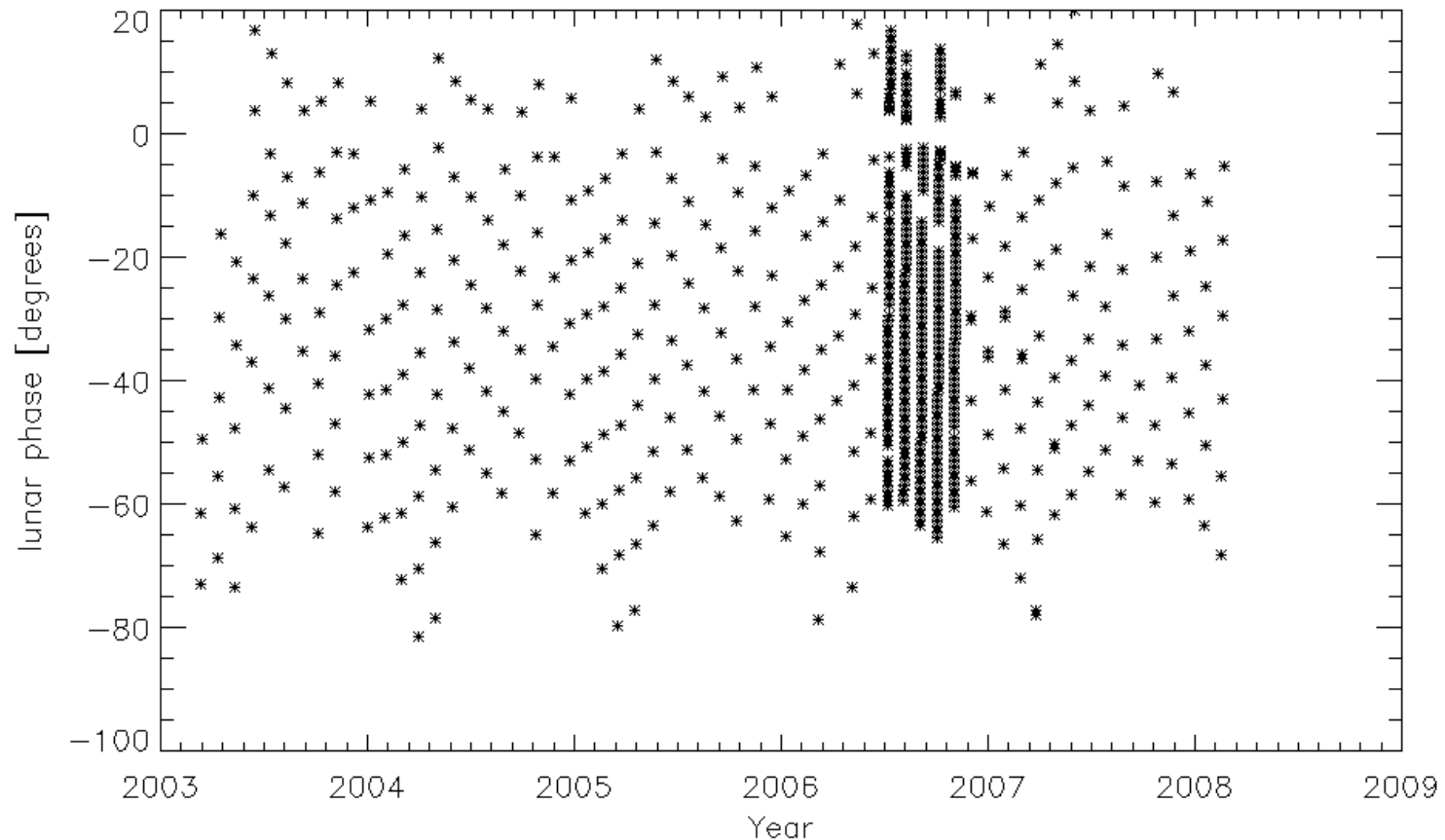


Number of lunar spectra

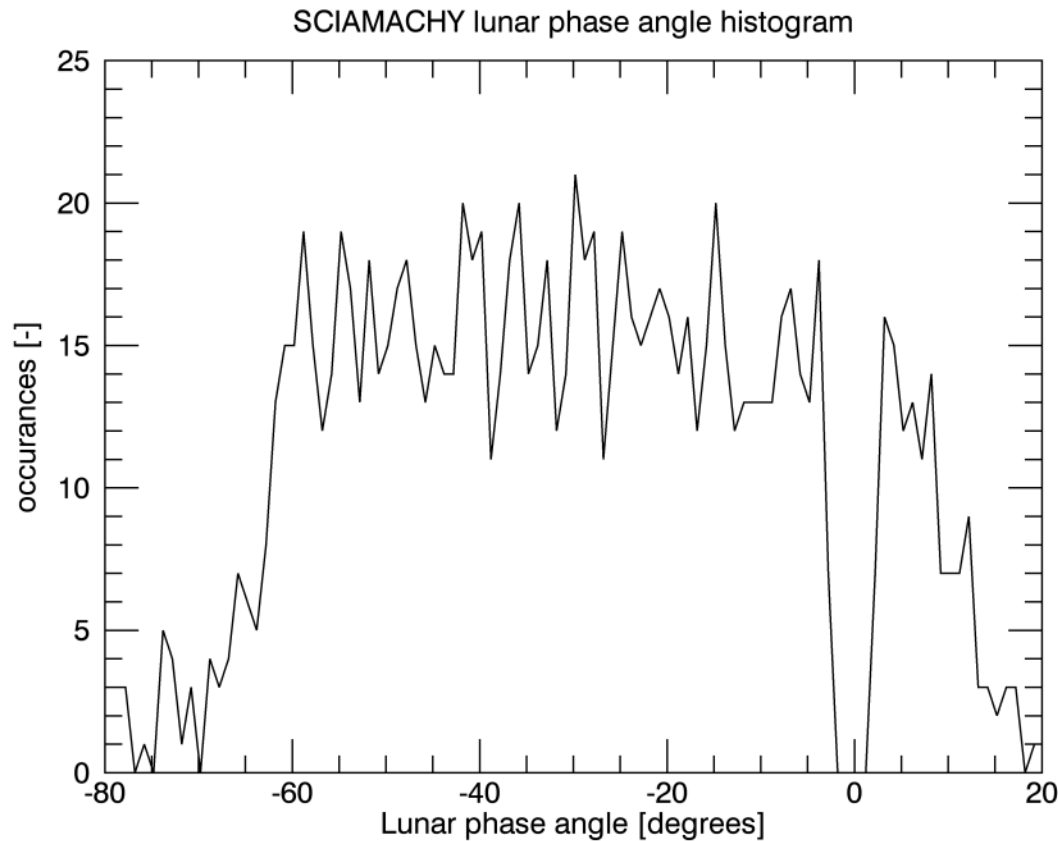
- 1112 orbits with State ID 54 (between 2002-12-16 and 2012-04-07)
- Focus here on 400 orbits between beginning 2003 and beginning 2008
- Dedicated lunar calibration campaign mid to end 2006 included
- Total number of spectra over the 400 orbits about 26000 spectra, 1 second per spectrum



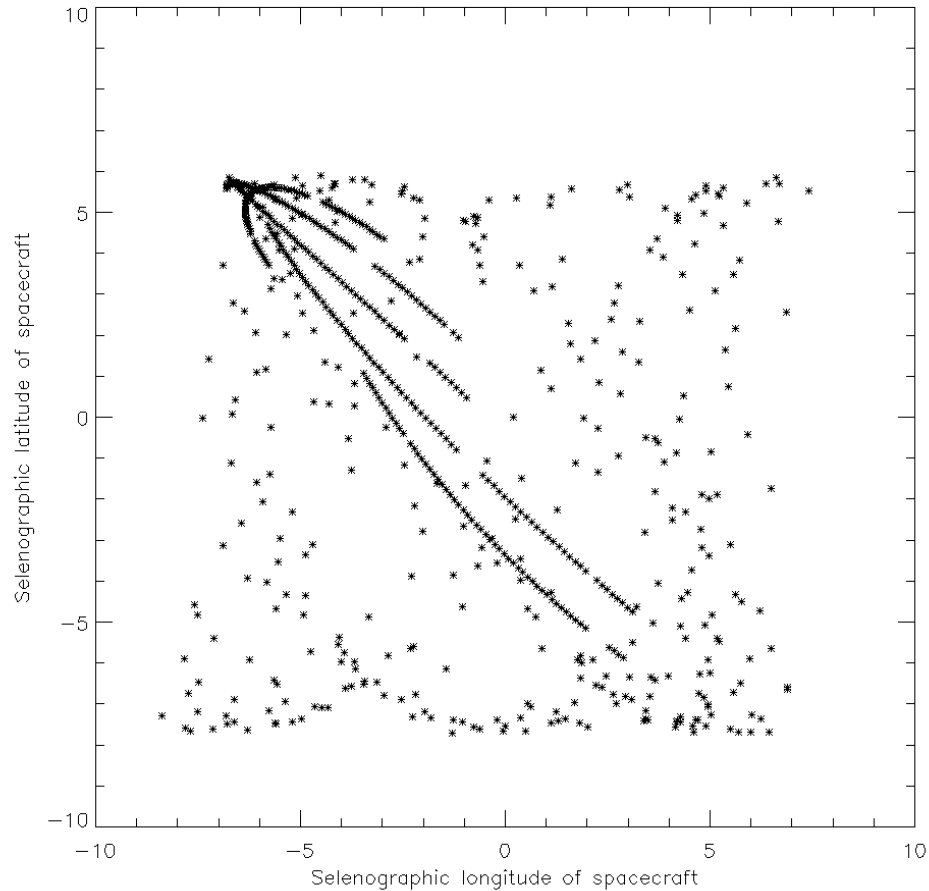
Lunar phase angle coverage (1)



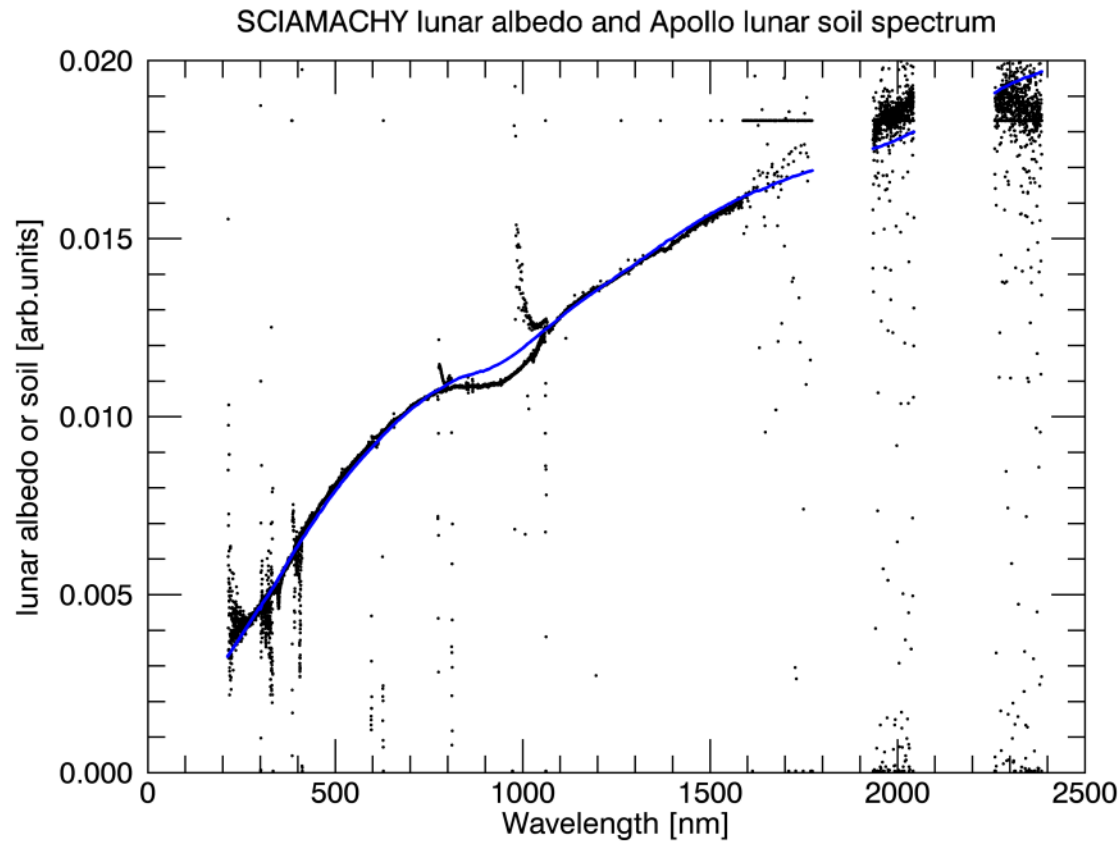
Lunar phase angle coverage (2)



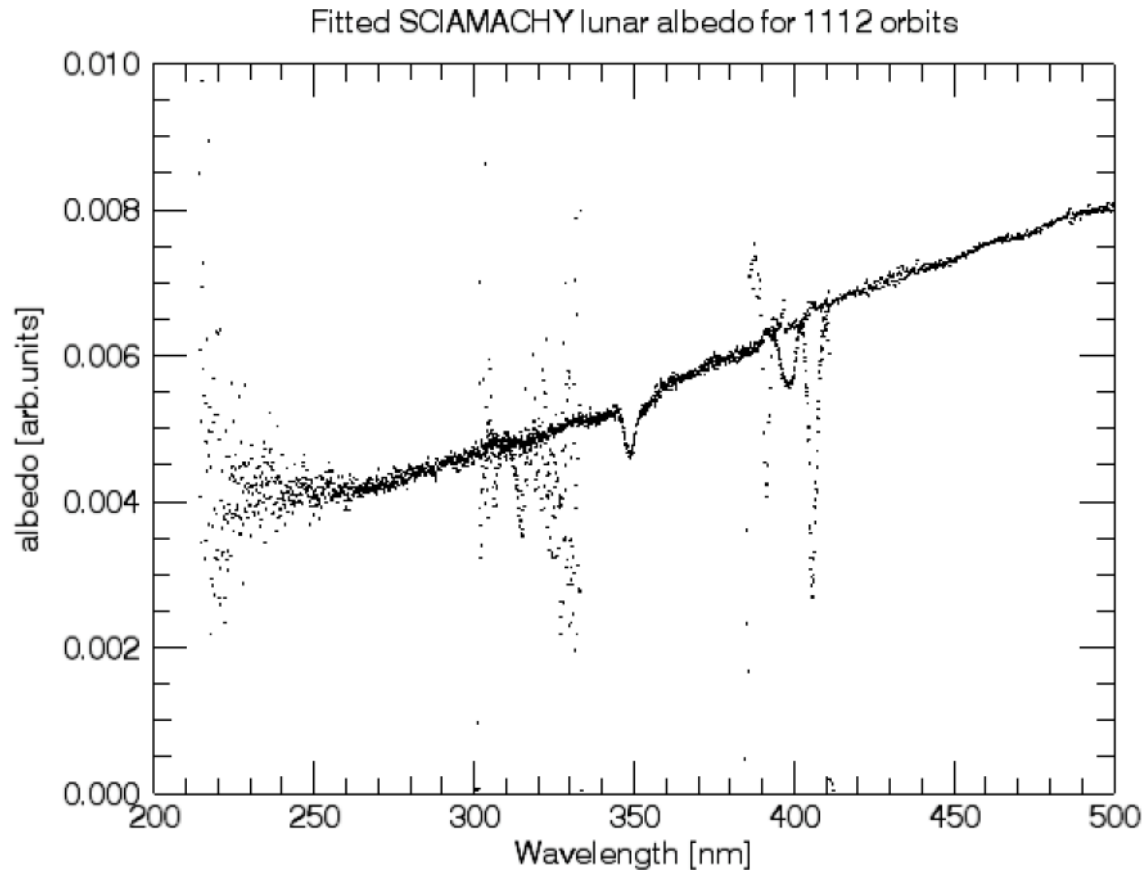
Lunar libration angle coverage



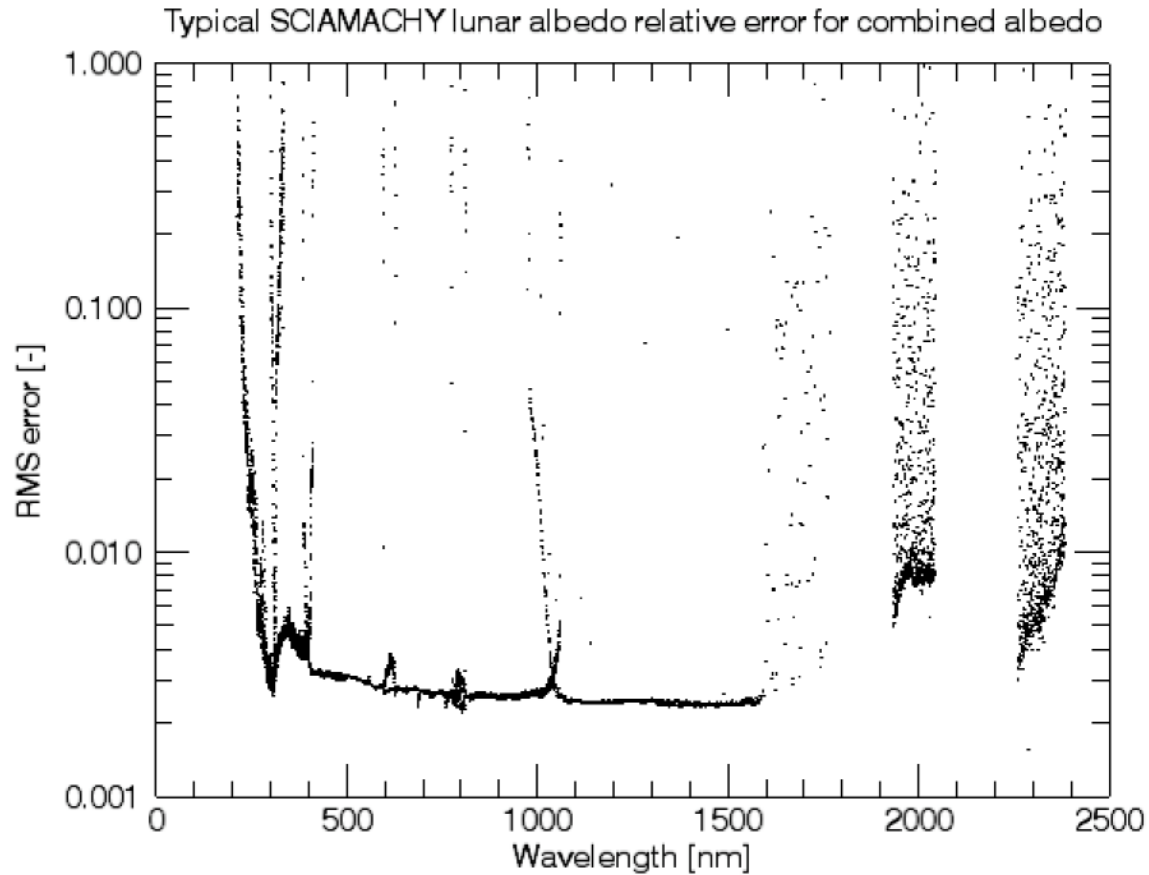
SCIAMACHY lunar albedo (1)



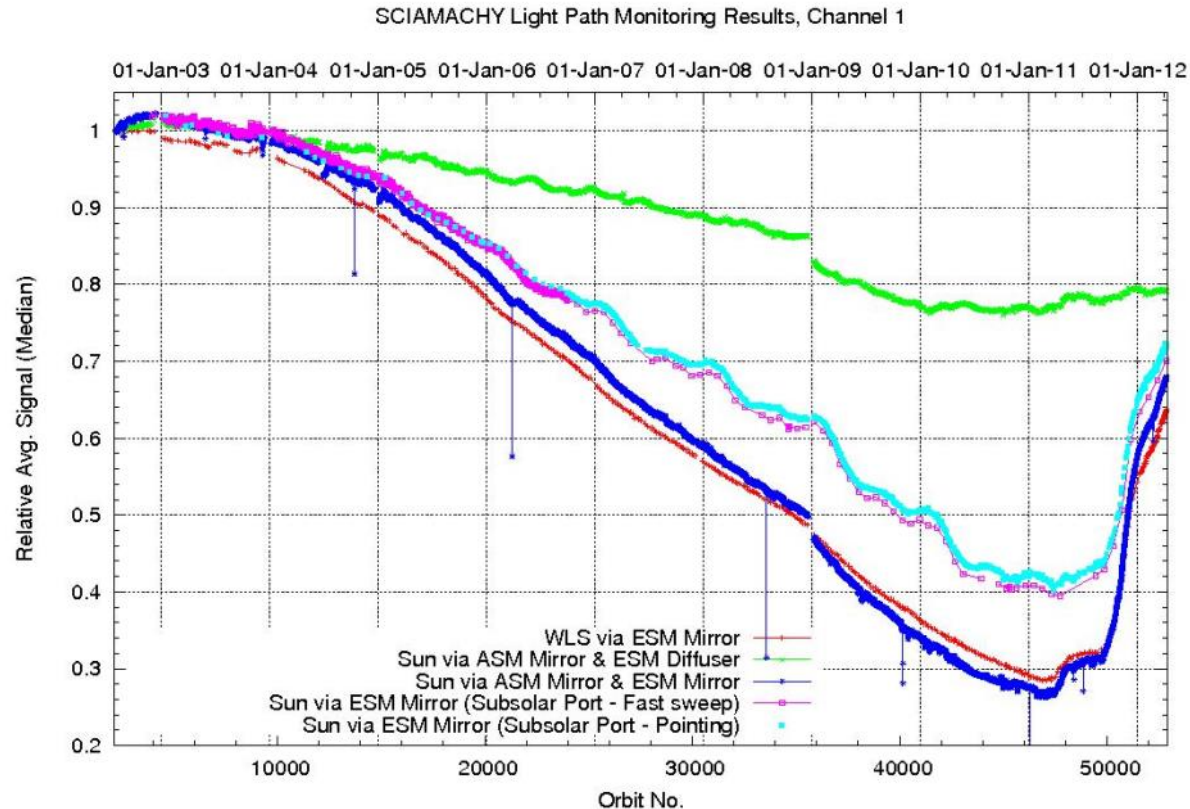
SCIAMACHY lunar albedo (2)



SCIAMACHY lunar albedo fit RMS



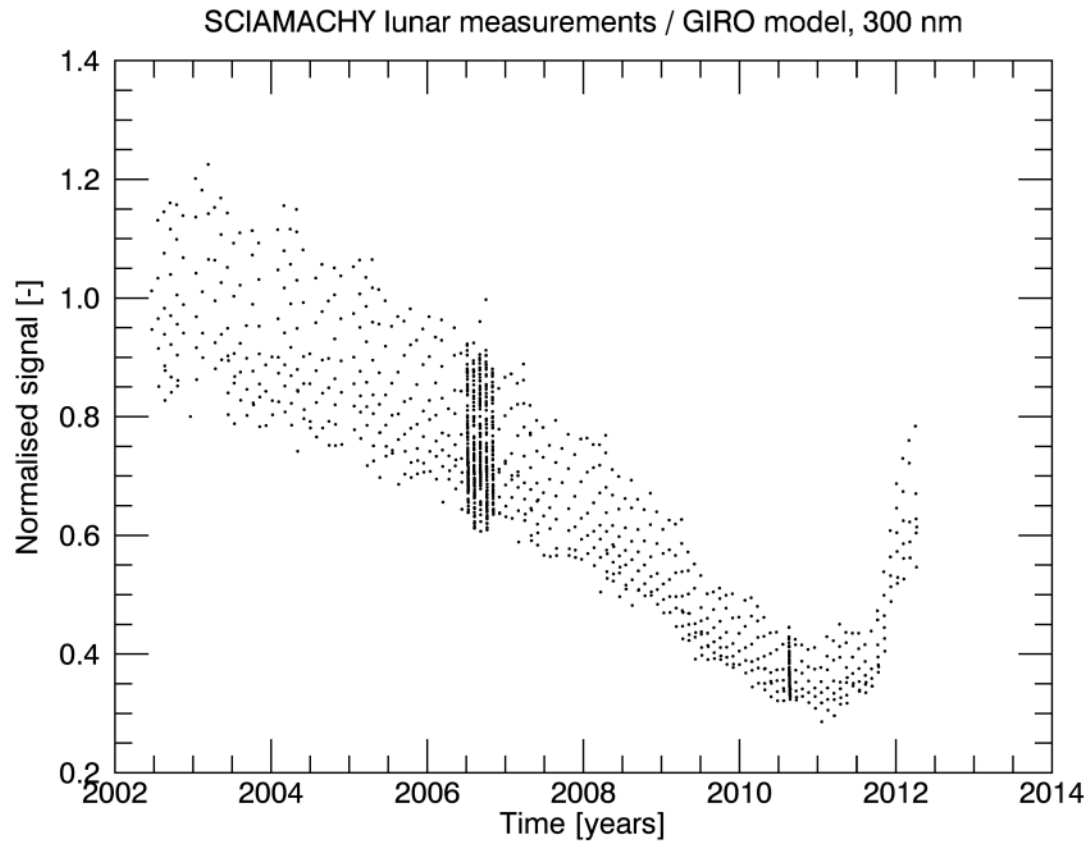
SCIAMACHY Degradation



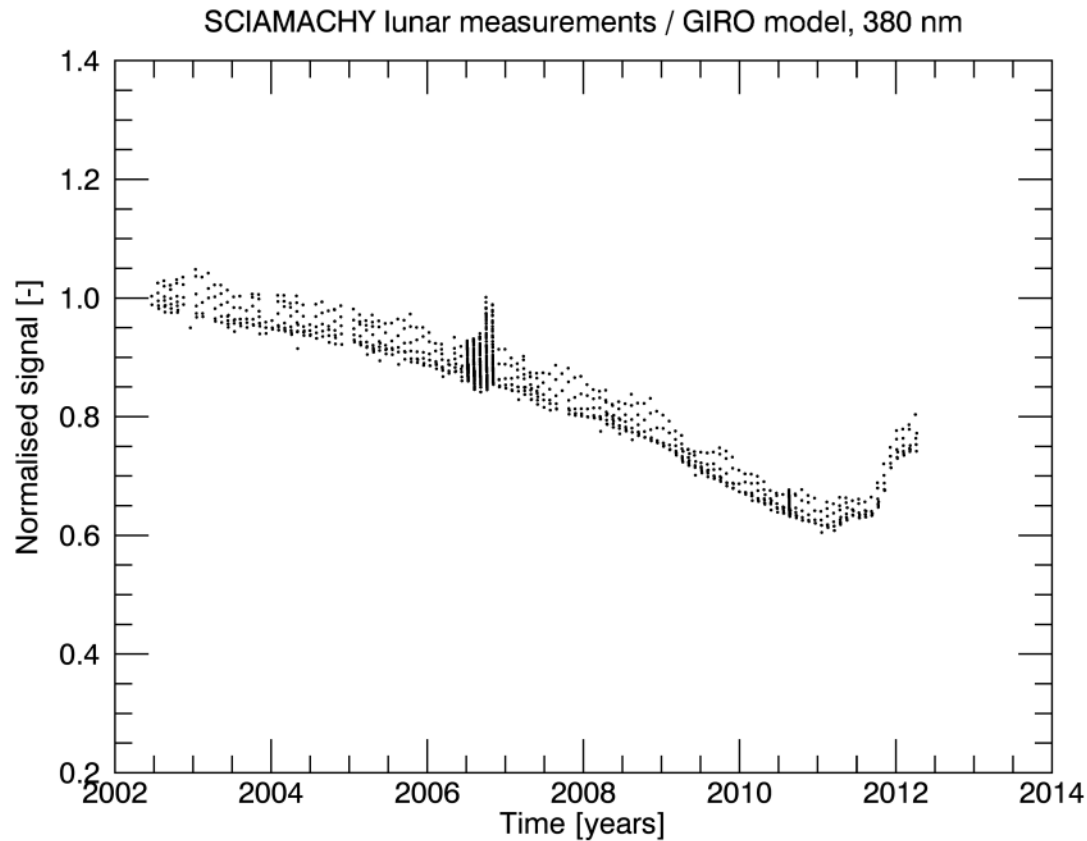
prod. 23-Apr-2012 by SOST-IFE (Stefan.Noel@iup.physik.uni-bremen.de)



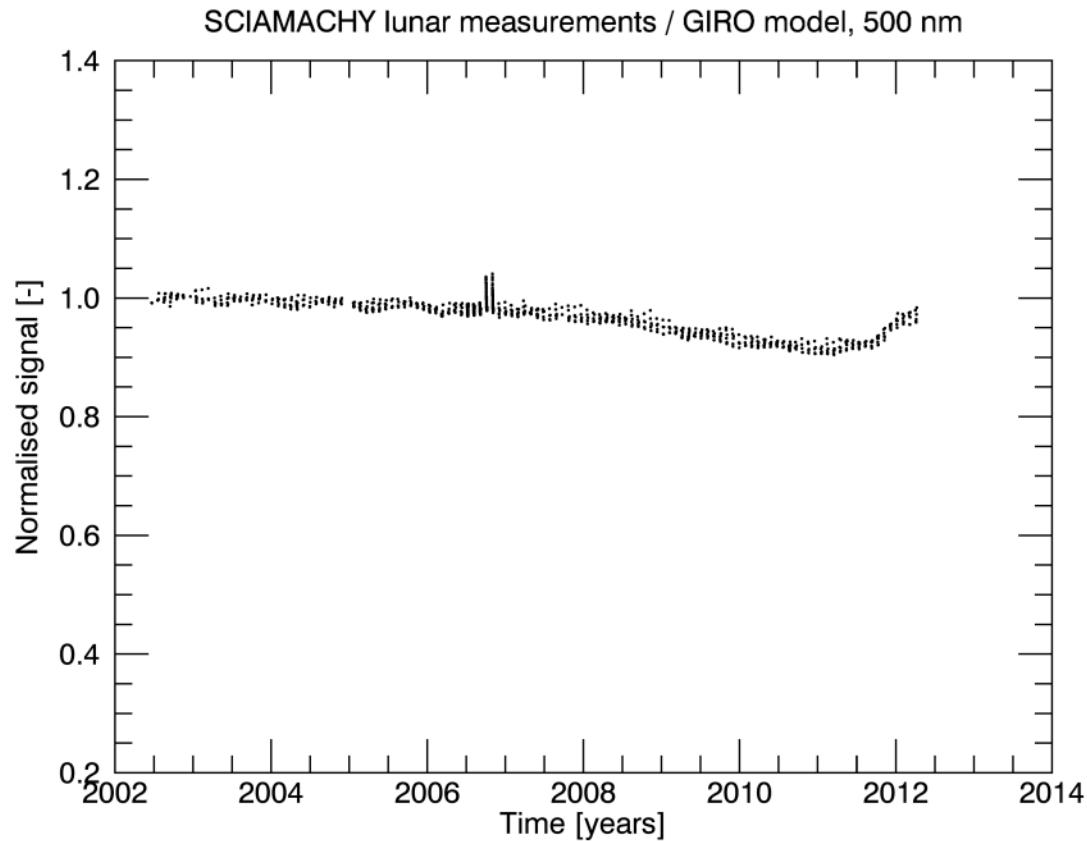
SCIAMACHY Lunar Degradation (1)



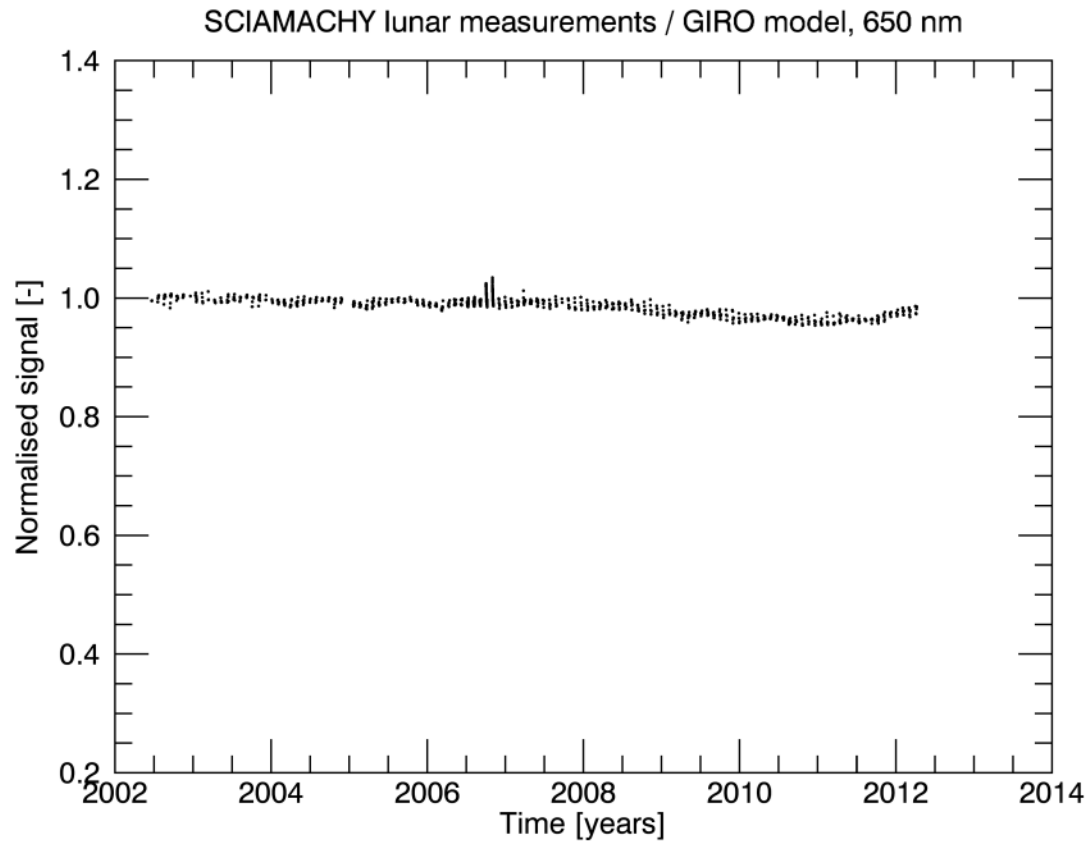
SCIAMACHY Lunar Degradation (2)



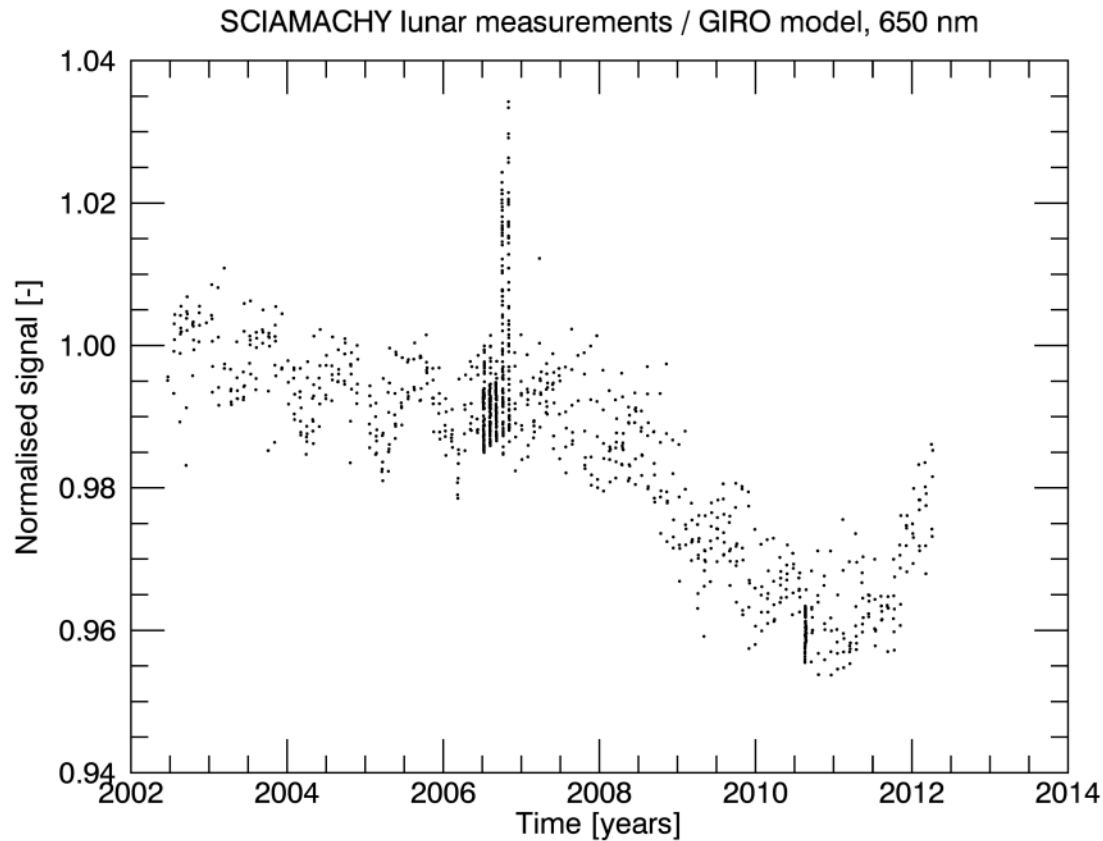
SCIAMACHY Lunar Degradation (3)



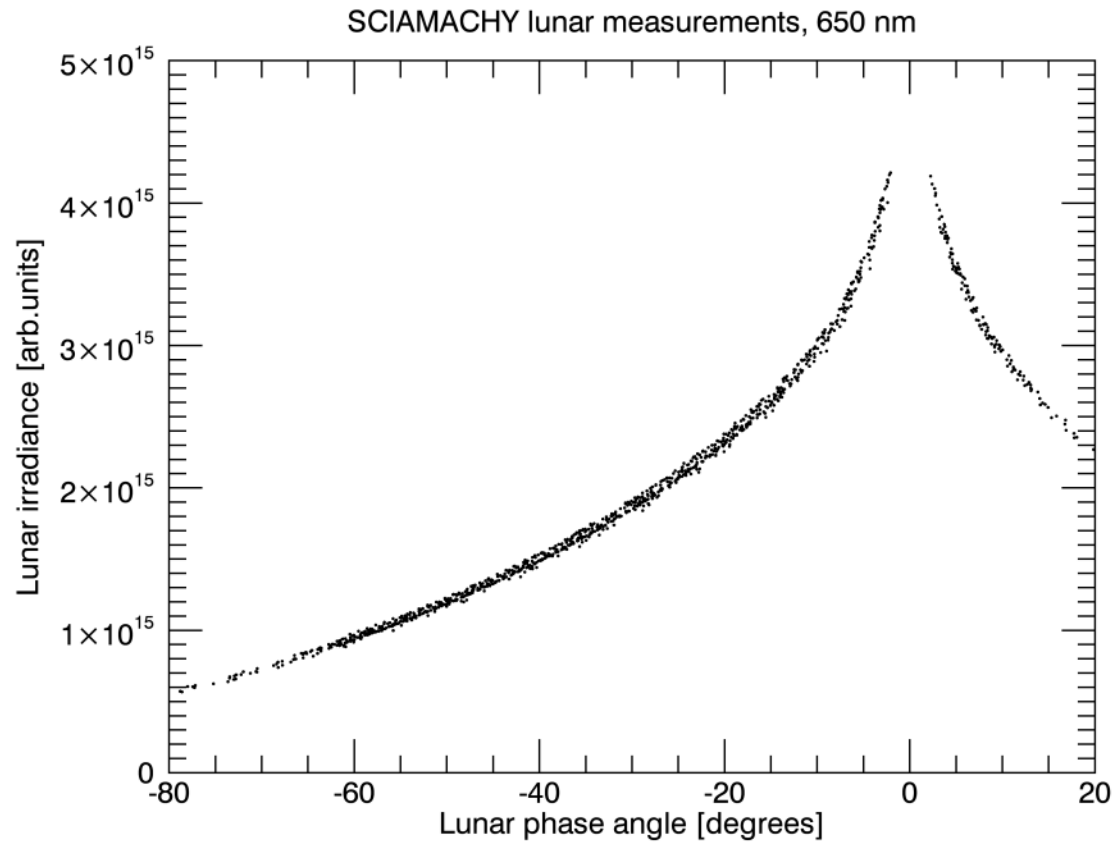
SCIAMACHY Lunar Degradation (4)



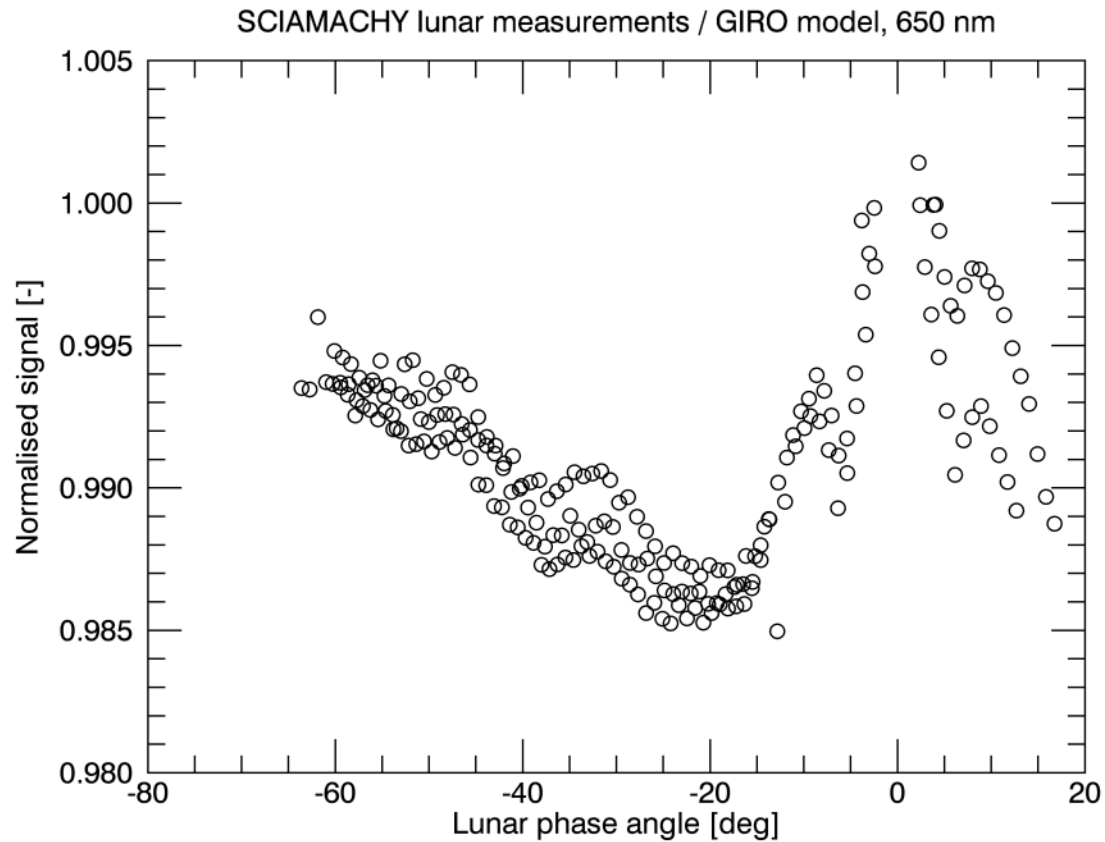
SCIAMACHY Lunar Degradation (5)



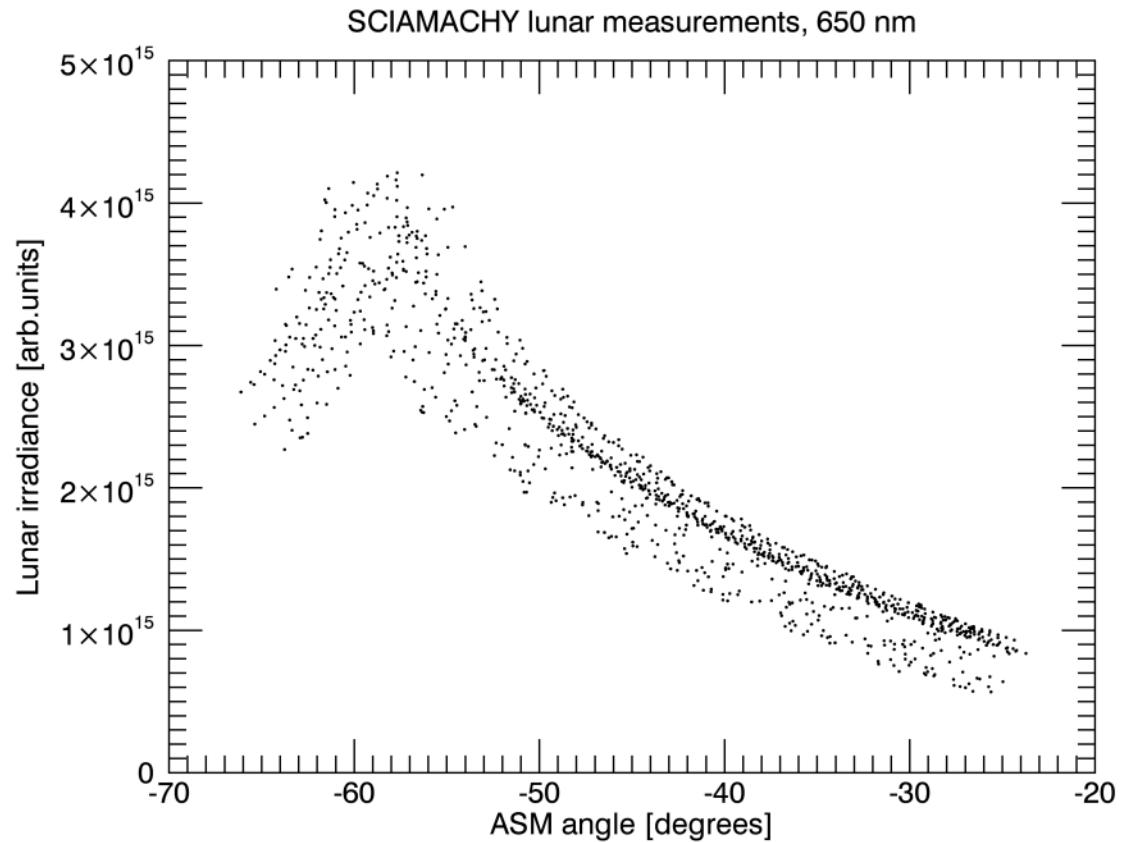
SCIAMACHY Phase Angle (1)



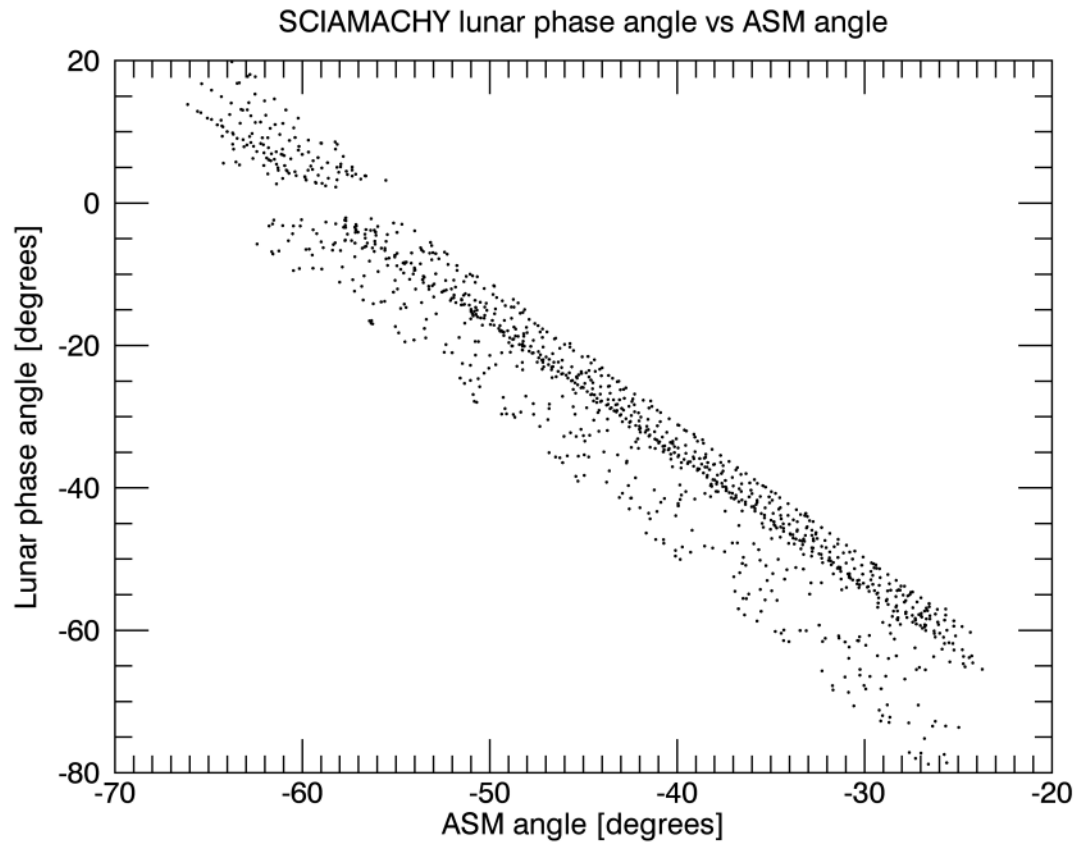
SCIAMACHY Phase Angle (2)



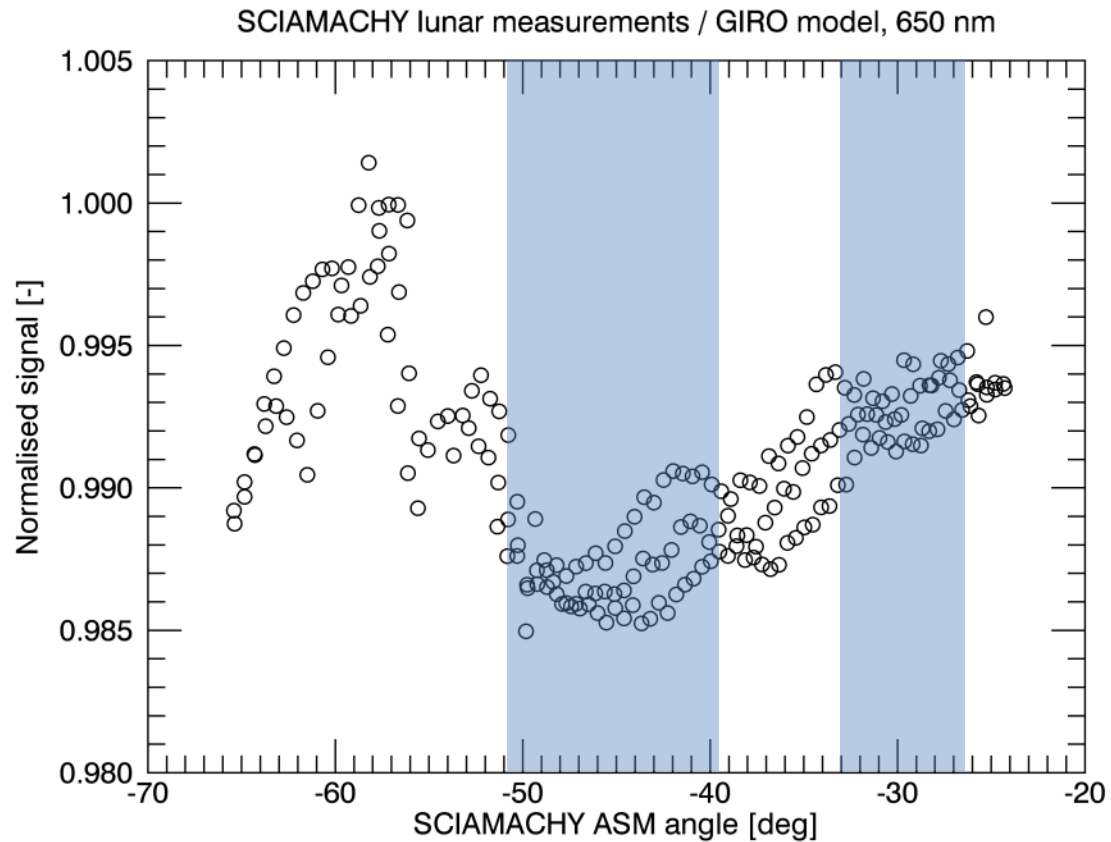
SCIAMACHY ASM Angle (1)



SCIAMACHY ASM Angle (2)



SCIAMACHY ASM angle (3)



On-ground
Calibrated



Future

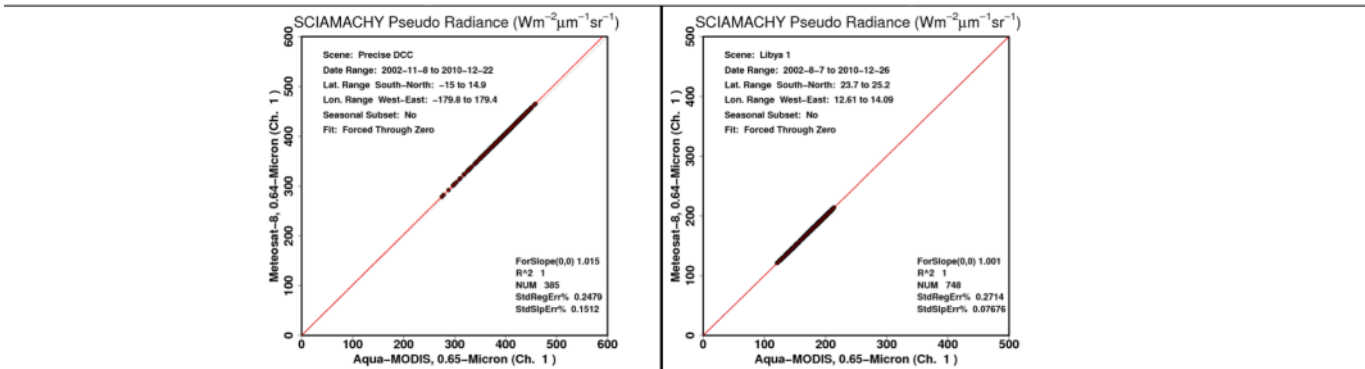
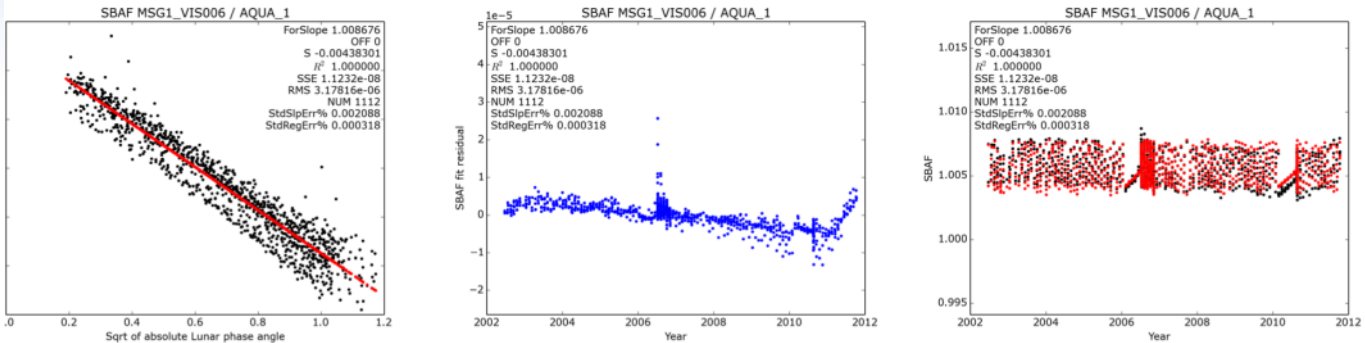
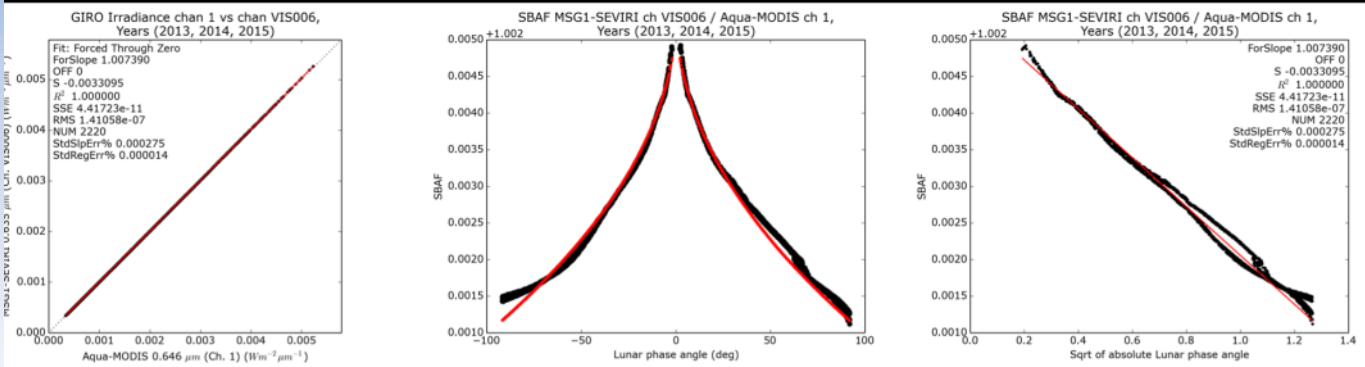
- SCIAMACHY ASM-dependence
- SCIAMACHY Polarization
- SCIAMACHY Absolute Calibration
- Put the moon to good use



Potential uses:

SBAFs:

MSG1 Vis 006 –
Aqua Ch 1



re 1. GIRO-based Lunar SBAFs (top row) and SCIAMACHY-based Lunar SBAFs (middle row) and comparison Deep veective Clouds and Libyan Desert SBDFs (bottom row) for MSG1_VIS006 / AQUA_1



Summary

- **SCIAMACHY**
 - High (0.25nm) resolution lunar spectrum
 - Precise (<0.5%) lunar spectrum
 - Many (~1100) lunar measurements
 - Different geometries
 - New improved calibration (mirror model)
- Good (relative) agreement ROLO/GIRO (<0.5%)



Thank you

