SIMULATED TOP-OF-ATMOSPHERE BRF OVER LIBYA-4 AS ABSOLUTE CALIBRATION REFERENCE

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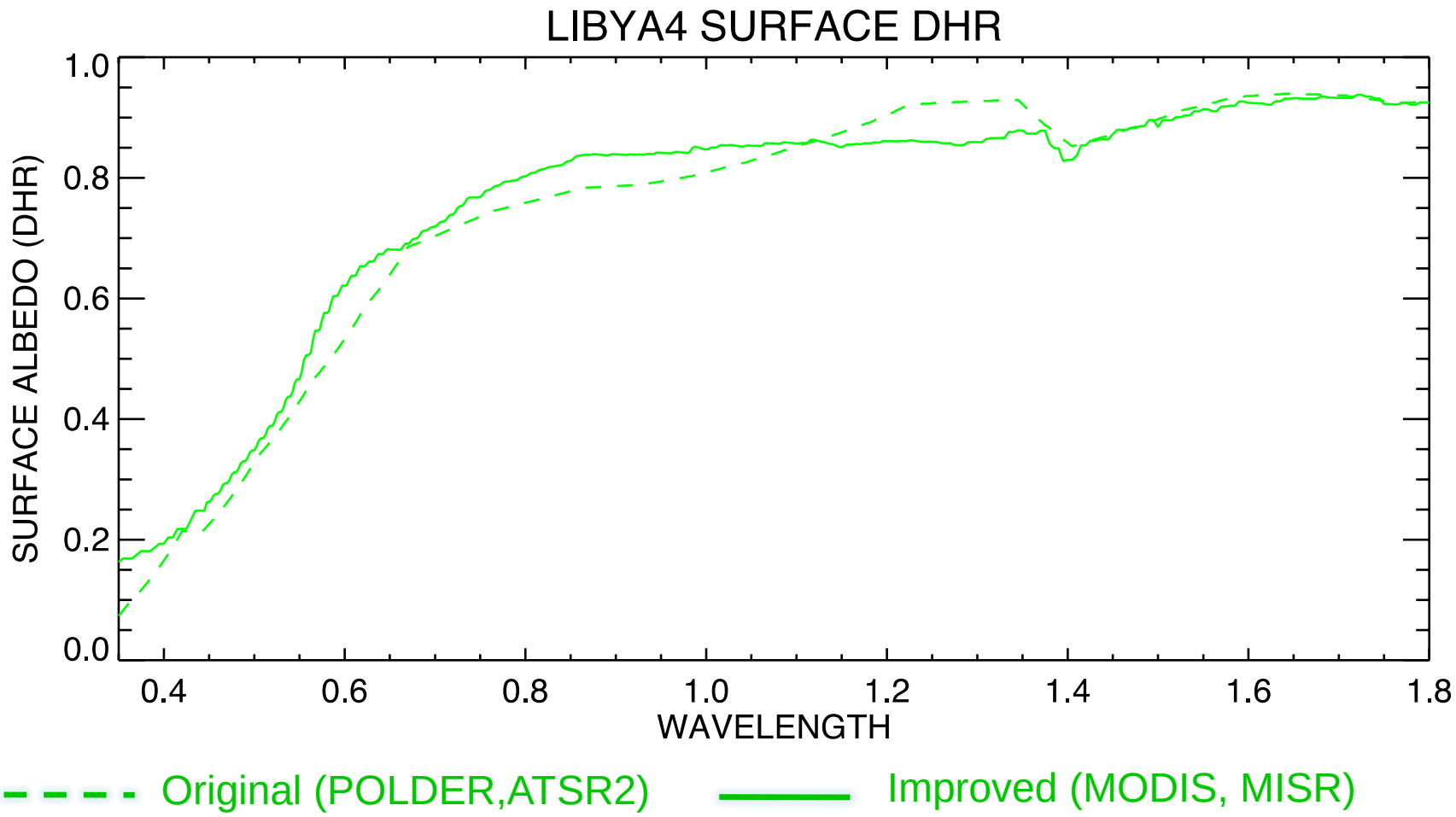
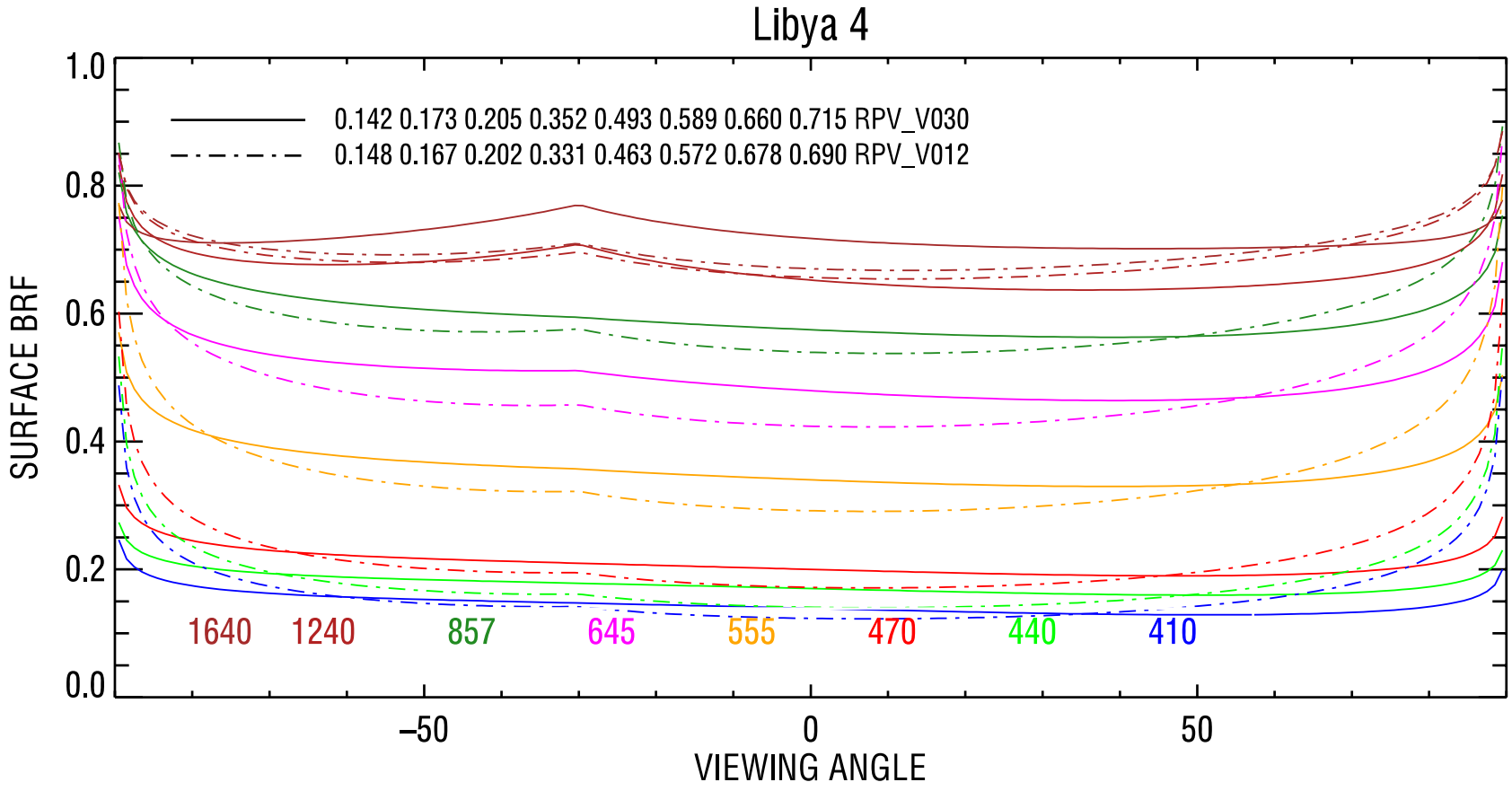
OVERVIEW

- Libya4 radiative properties (surface BRF, aerosols) originally proposed by (Govaerts and Clerici 2004).
- Several improvements are proposed with respect to this original work:
  - The radiative transfer simulations are based on the SIXSV code
  - The characterization of the surface properties of the the desert site Libya4 are now based on MODIS and MISR observations.
  - A specific aerosol model has been developed accounting for non-spherical particles and is based on AERONET observations.

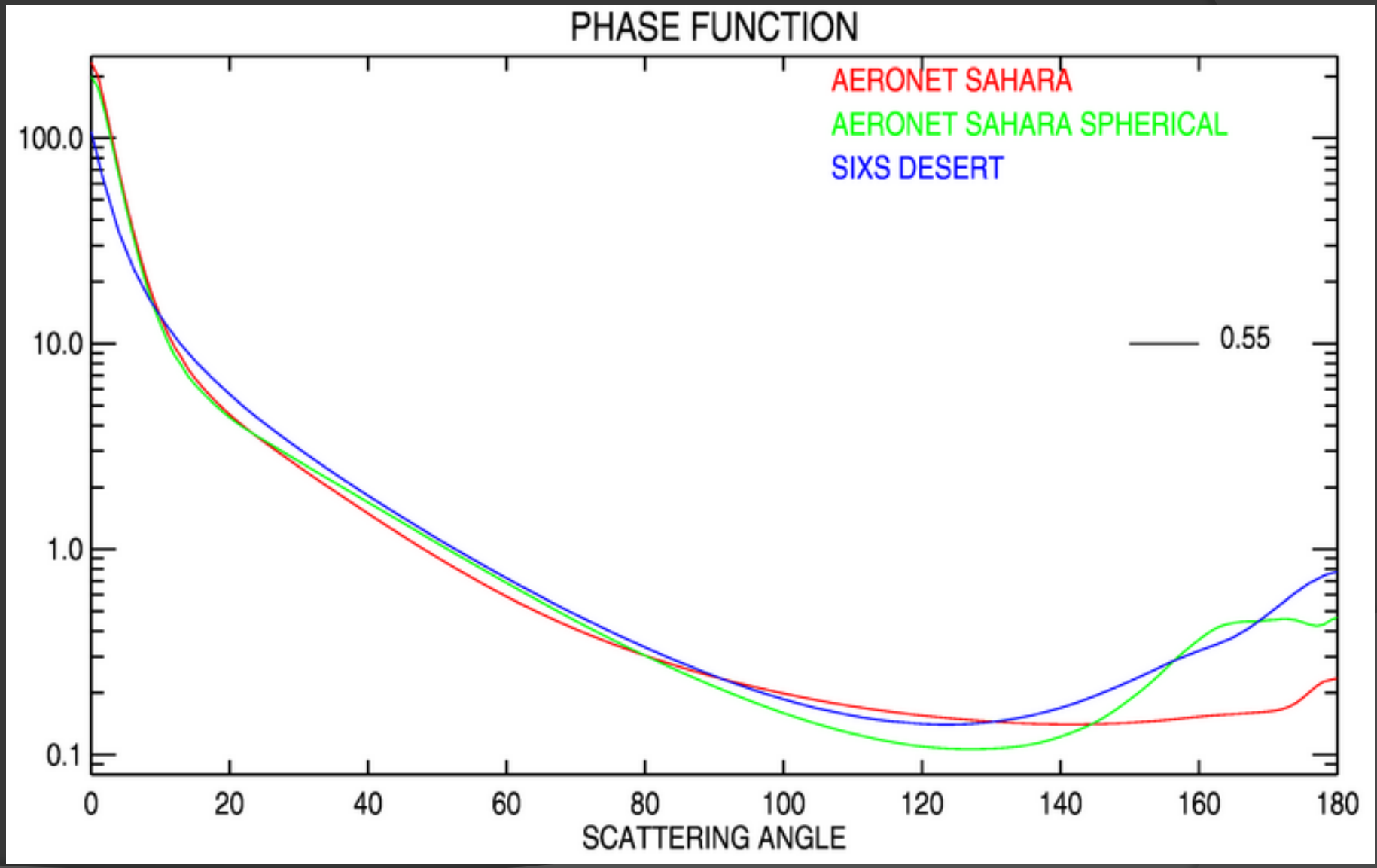
SURFACE BRF IMPROVEMENTS



SURFACE BRF IMPROVEMENTS

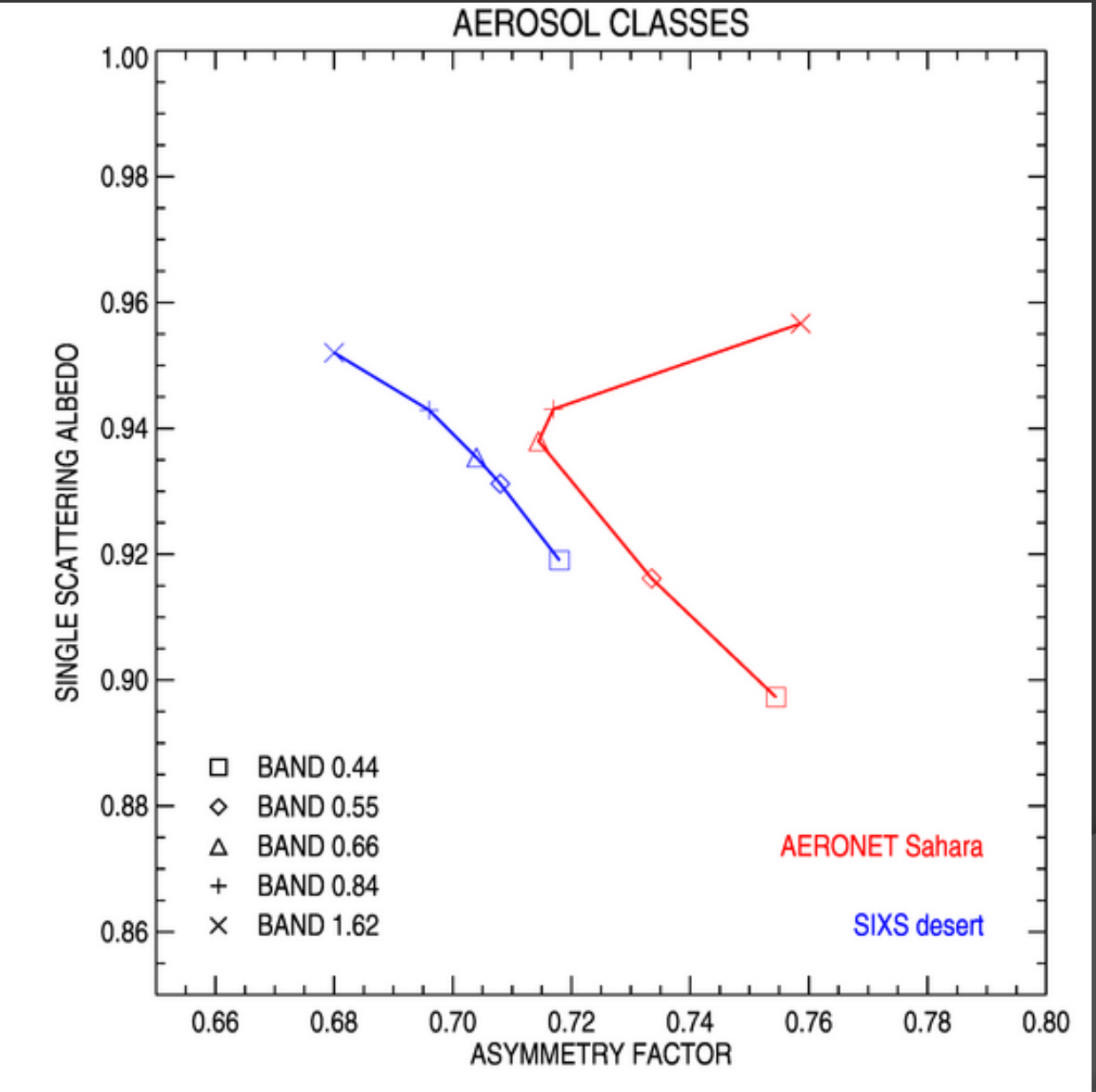


AEROSOL MODEL IMPROVEMENT

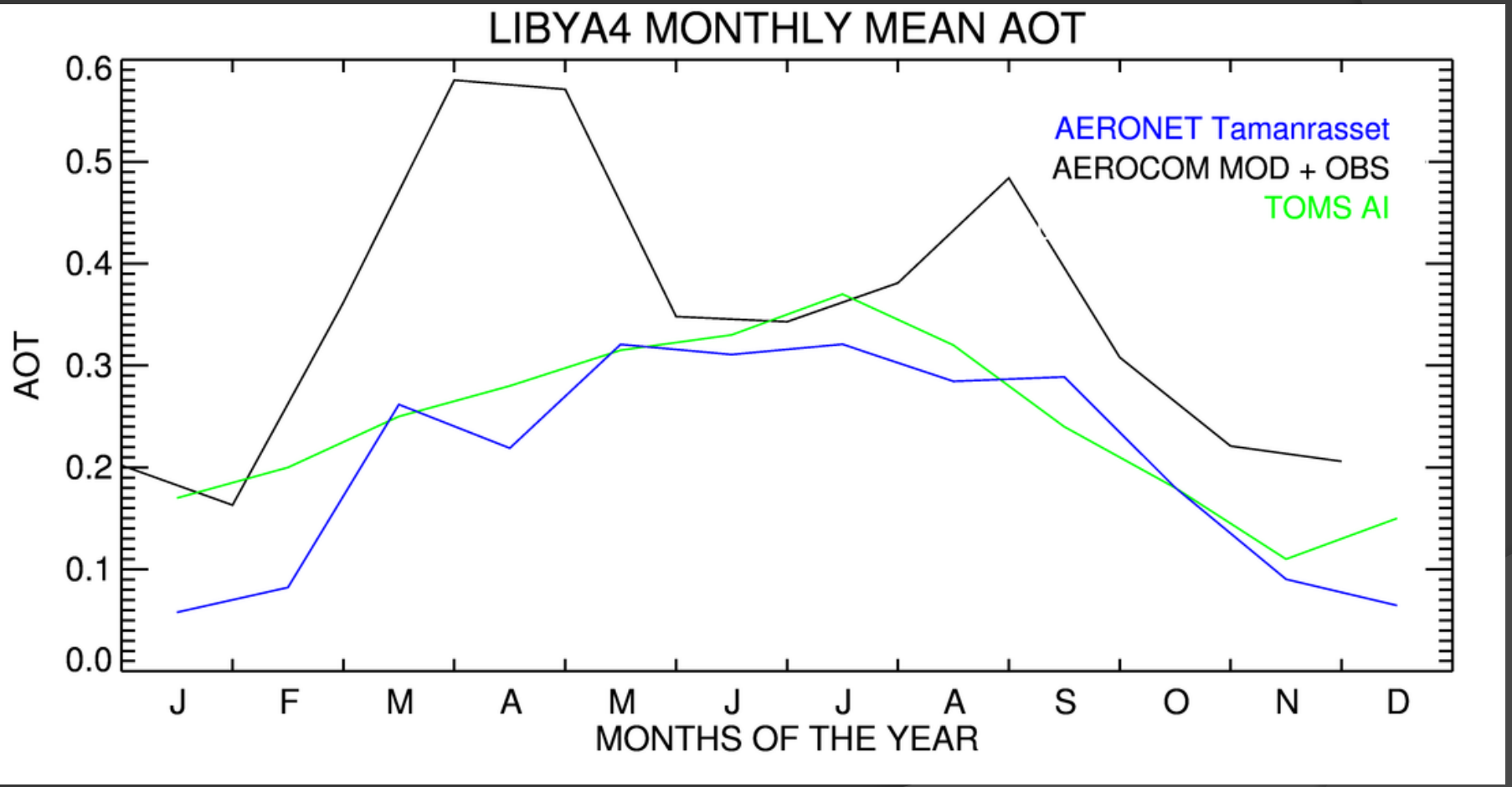


Non-spherical desert aerosol model derived from AERONET data

AEROSOL MODEL IMPROVEMENT



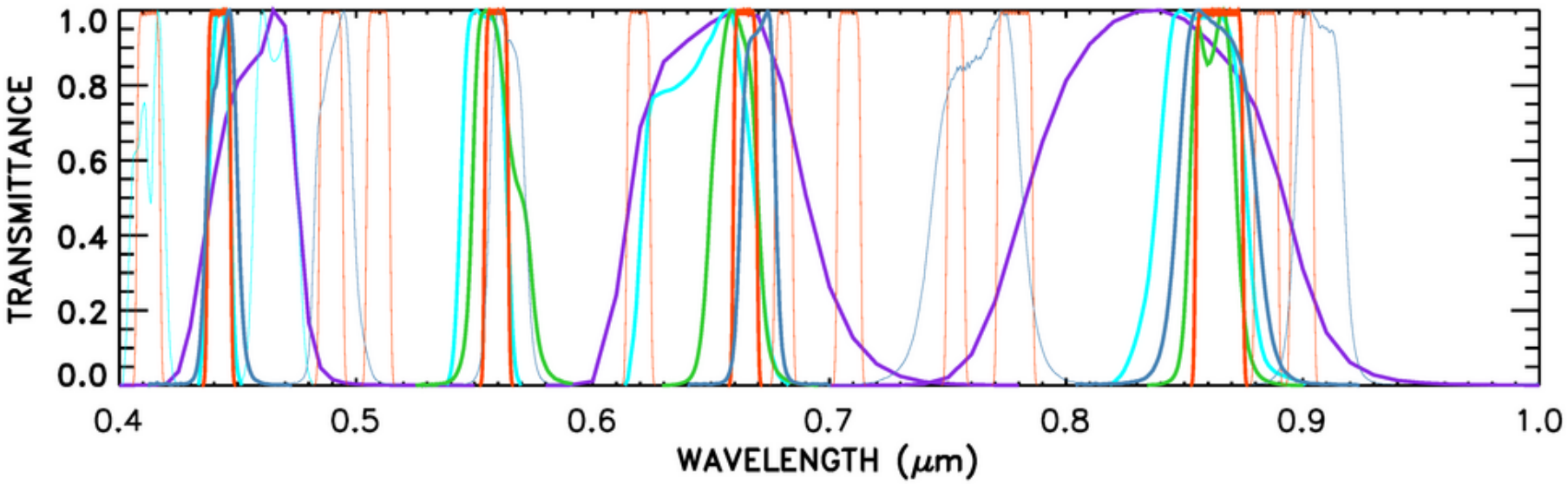
AEROSOL OPTICAL THICKNESS

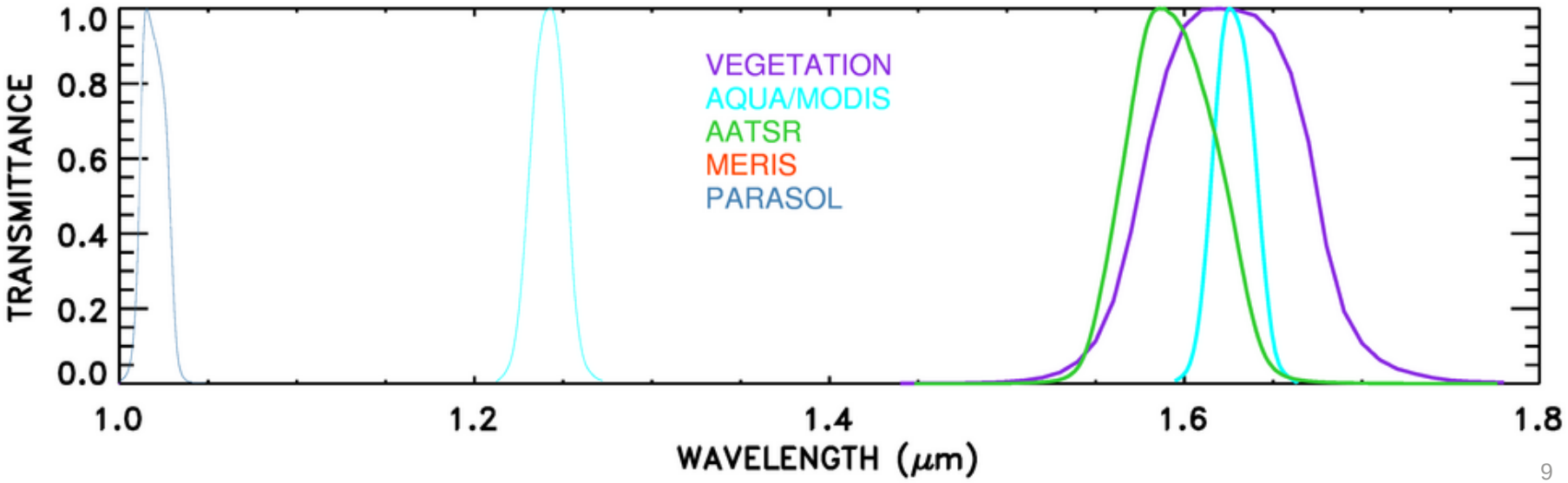


ORIGINAL VALUES (REMAIN UNCHANGED)

Evaluation of the improvements

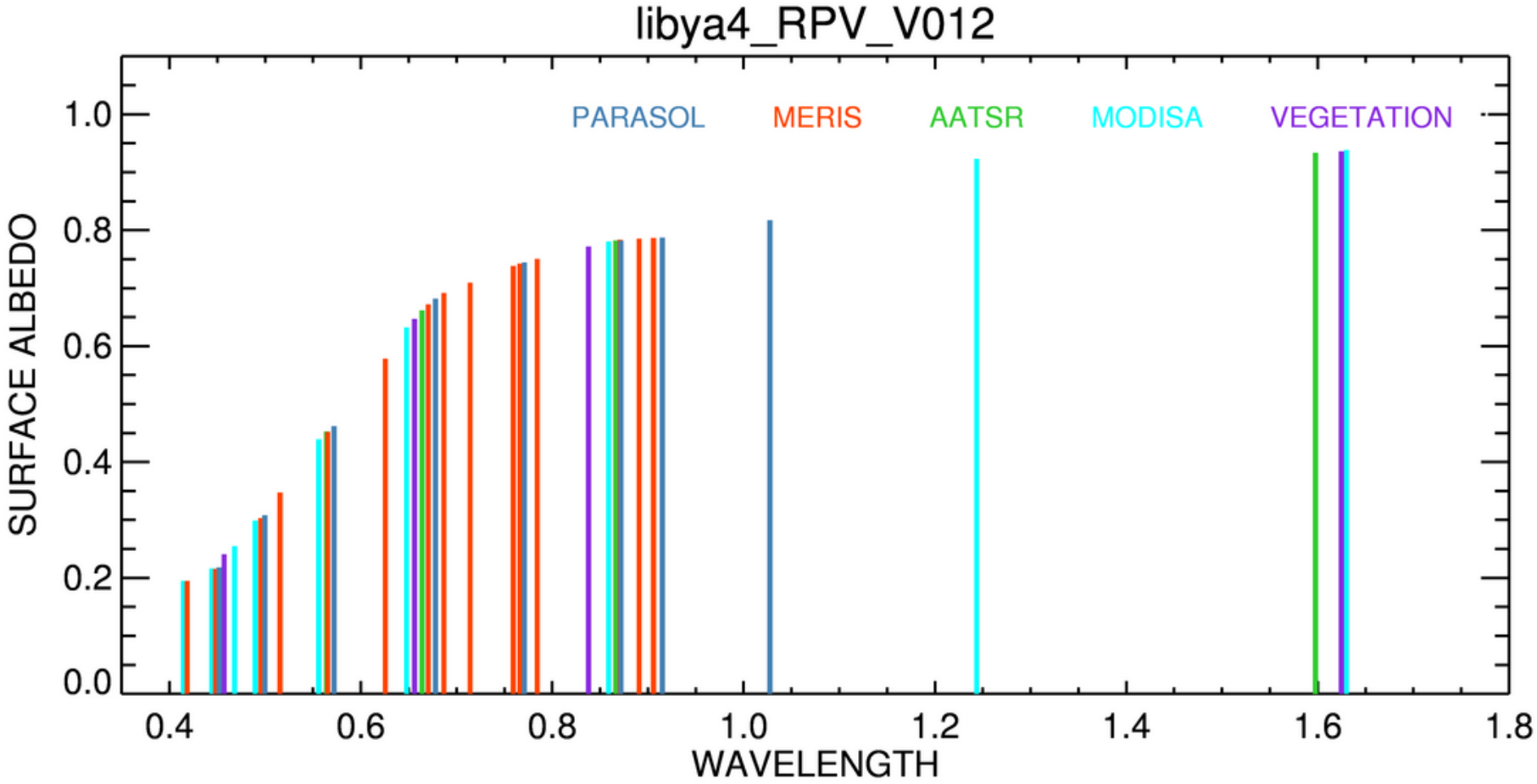
- Satellite observations acquired by VEGETATION, POLDER, AATSR, MERIS and AQUA/MODIS over target Libya4 have been used for the evaluation of the improvements.
- These data have been extracted from the ESA DIMITRI database.
- Each observation has been simulated with the 6SV model accounting for the actual observation geometries and sensor spectral response.


TRANSMITTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.4
0.5
0.6
0.7
0.8
0.9
1.0
WAVELENGTH (μm)


TRANSMITTANCE
1.0
0.8
0.6
0.4
0.2
0.0
VEGETATION
AQUA/MODIS
AATSR
MERIS
PARASOL
1.0
1.2
1.4
1.6
1.8
WAVELENGTH (μm)

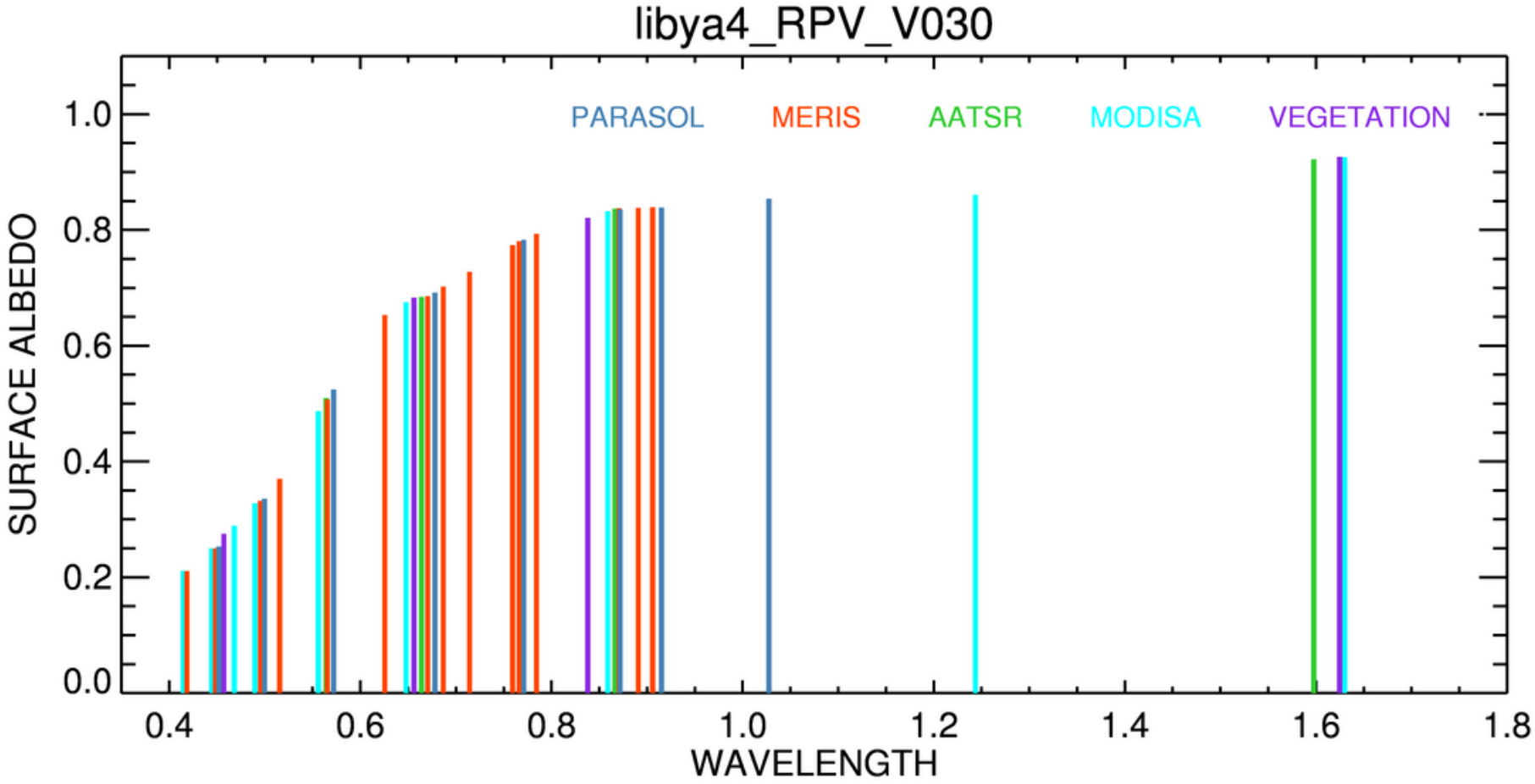
DATA SETS

MEAN SURFACE ALBEDO



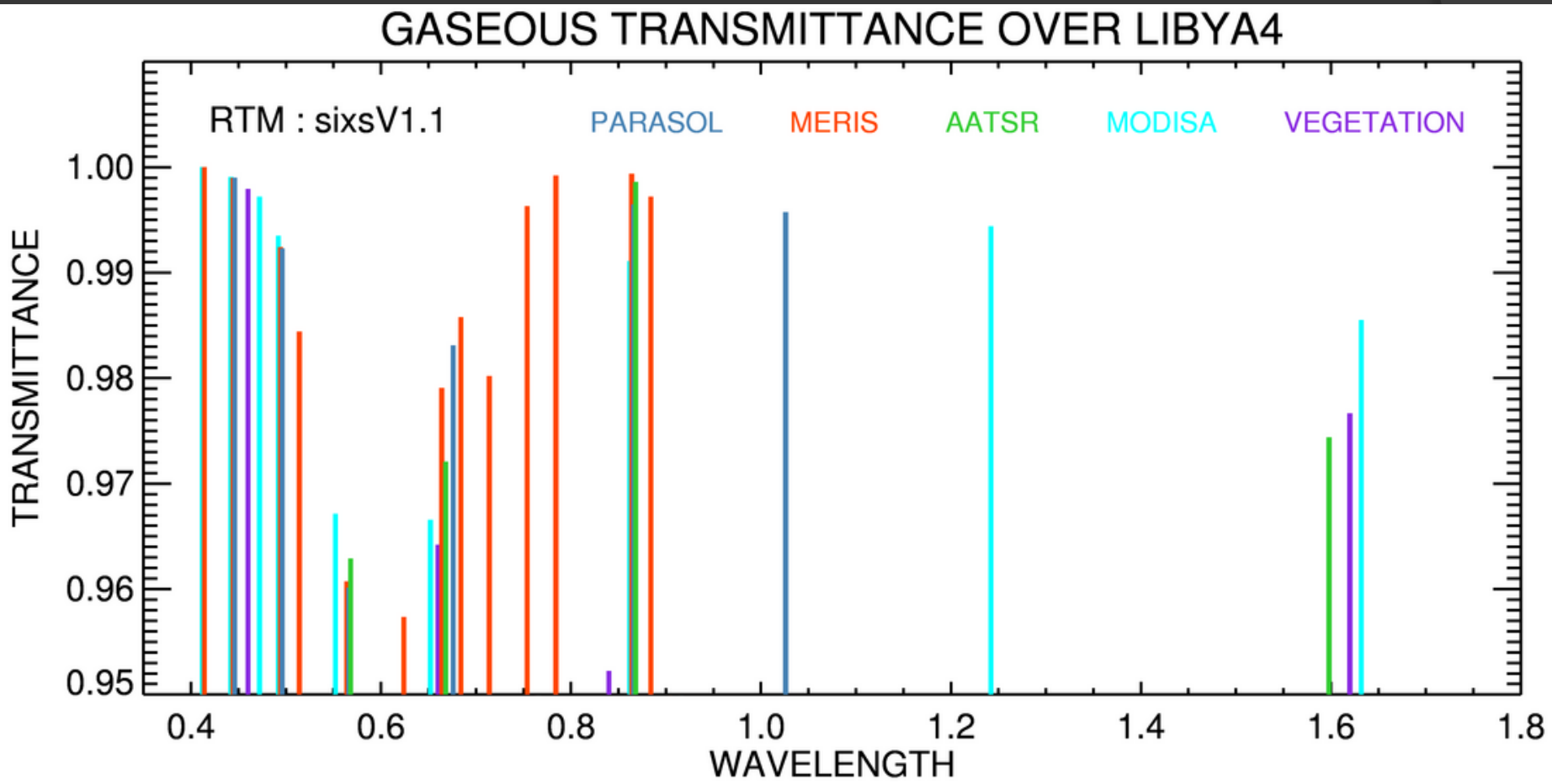
DATA SETS

MEAN SURFACE ALBEDO



DATA SETS

MEAN GASEOUS TRANSMITTANCE



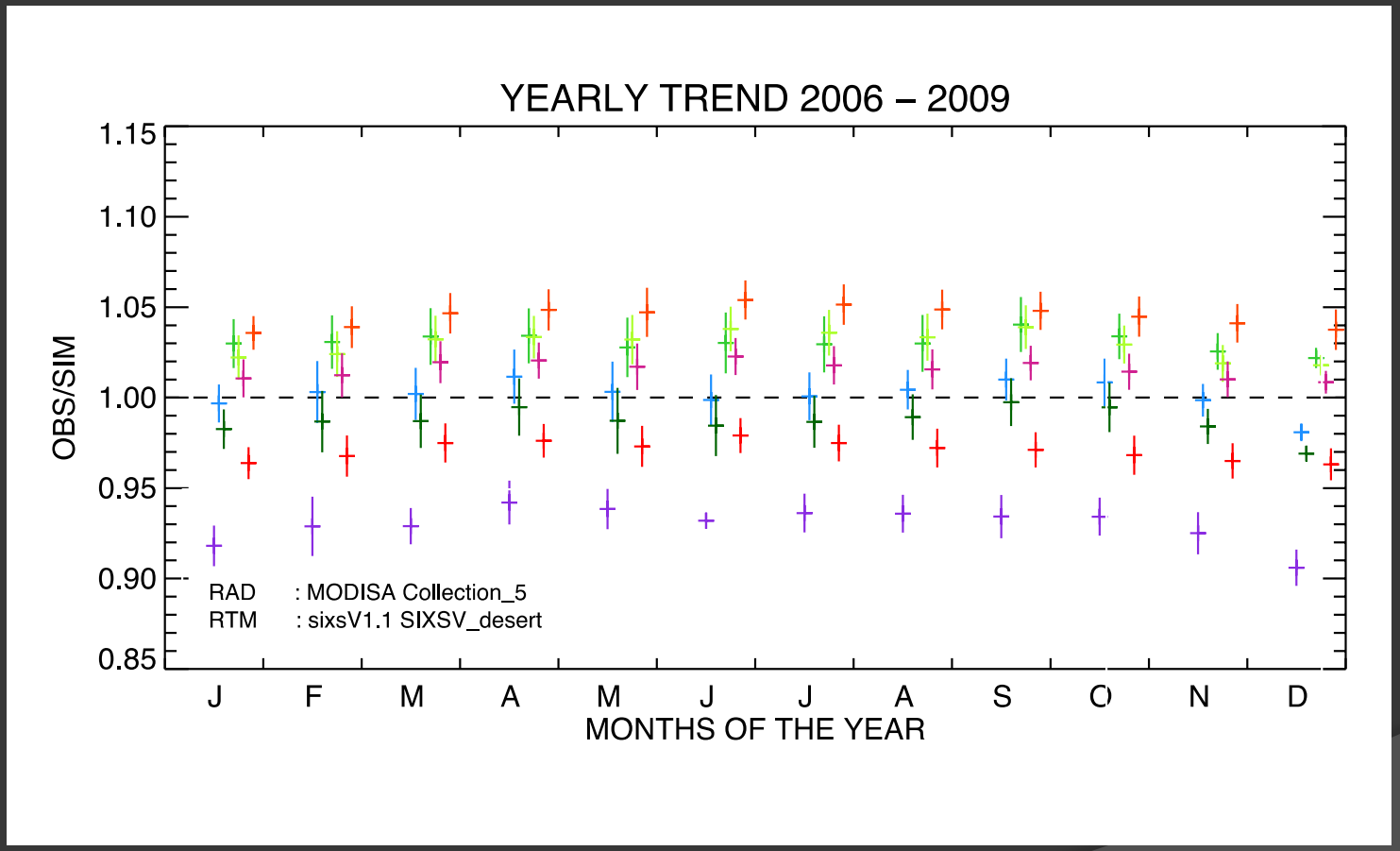
Evaluation of the improvements

BAND	0.44	0.55	0.66	0.84	1.62
VGT	723		700	709	695
AATSR		114	117	119	120
PARASOL	4078	4072	4225	4205	
MODISA	848	864	846	839	822
MERIS	371	378	372	367	

Number of selected observations in the common spectral bands during the 2006–2009 period over Libya4 after removal of the 2σ outliers. Wavelengths are expressed in μm

Evaluation of the improvements

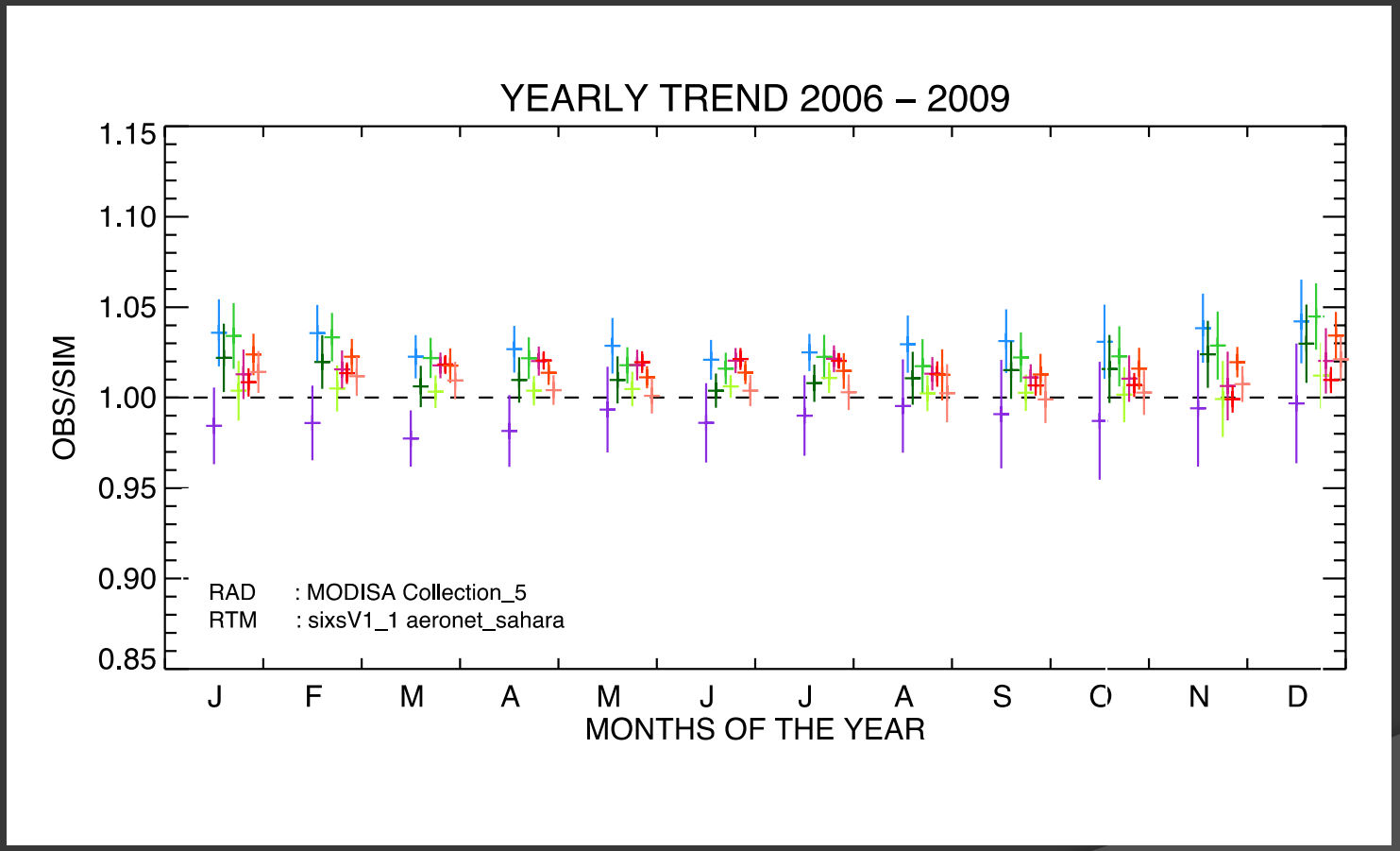
Original calibration reference (Govaerts 2004)



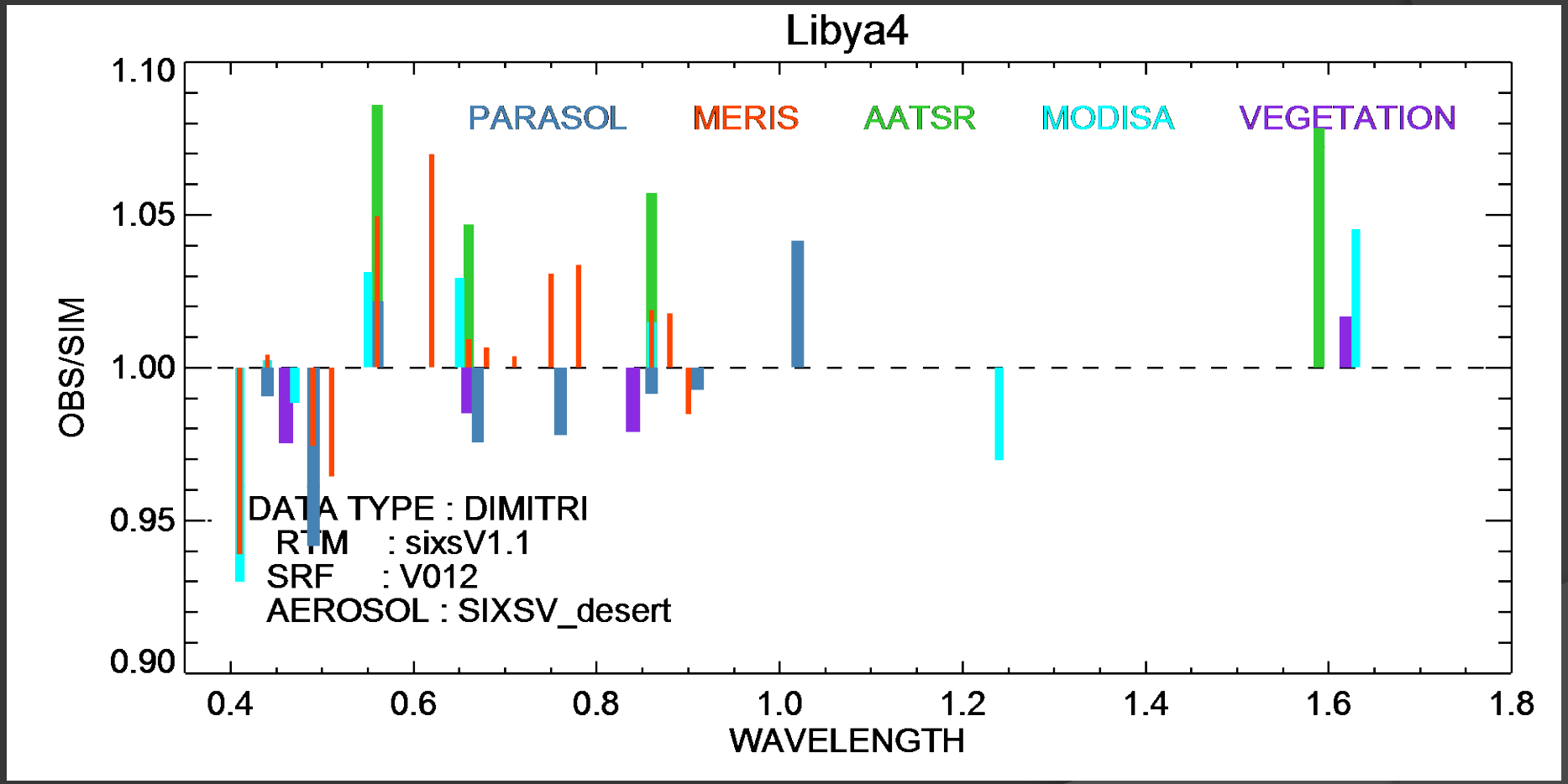
Seasonal variations of the monthly ratio (horizontal bars) between observations and simulations for the AQUA-MODIS instrument over the Libya4 site. The vertical bars show the standard deviation of the ratio obs/sim for each month

Evaluation of the improvements

Improved calibration reference

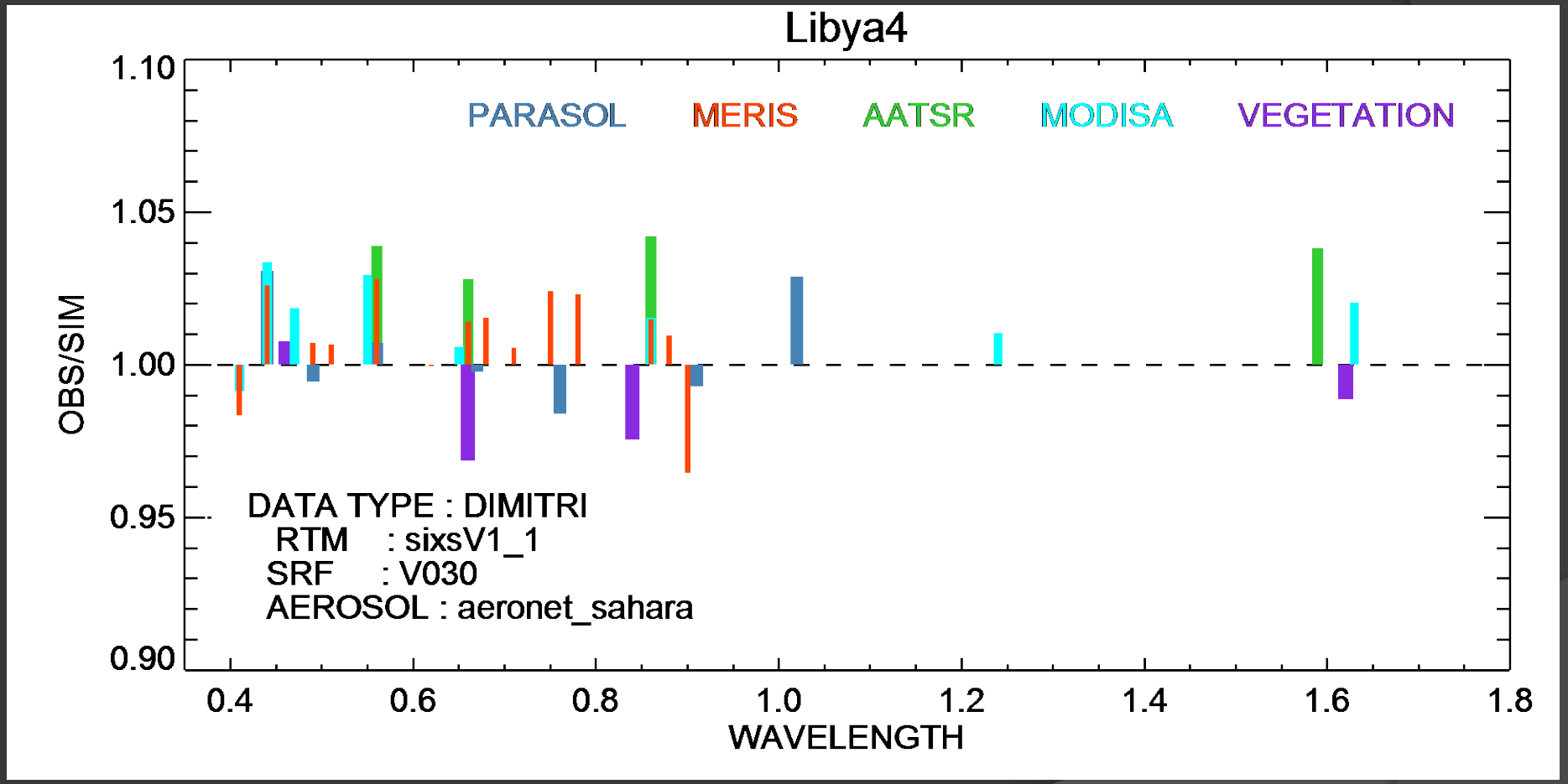


OVERALL RESULTS



Original calibration reference (Govaerts 2004)

OVERALL RESULTS



Improved calibration reference (OSCAR)

Evaluation of the improvements

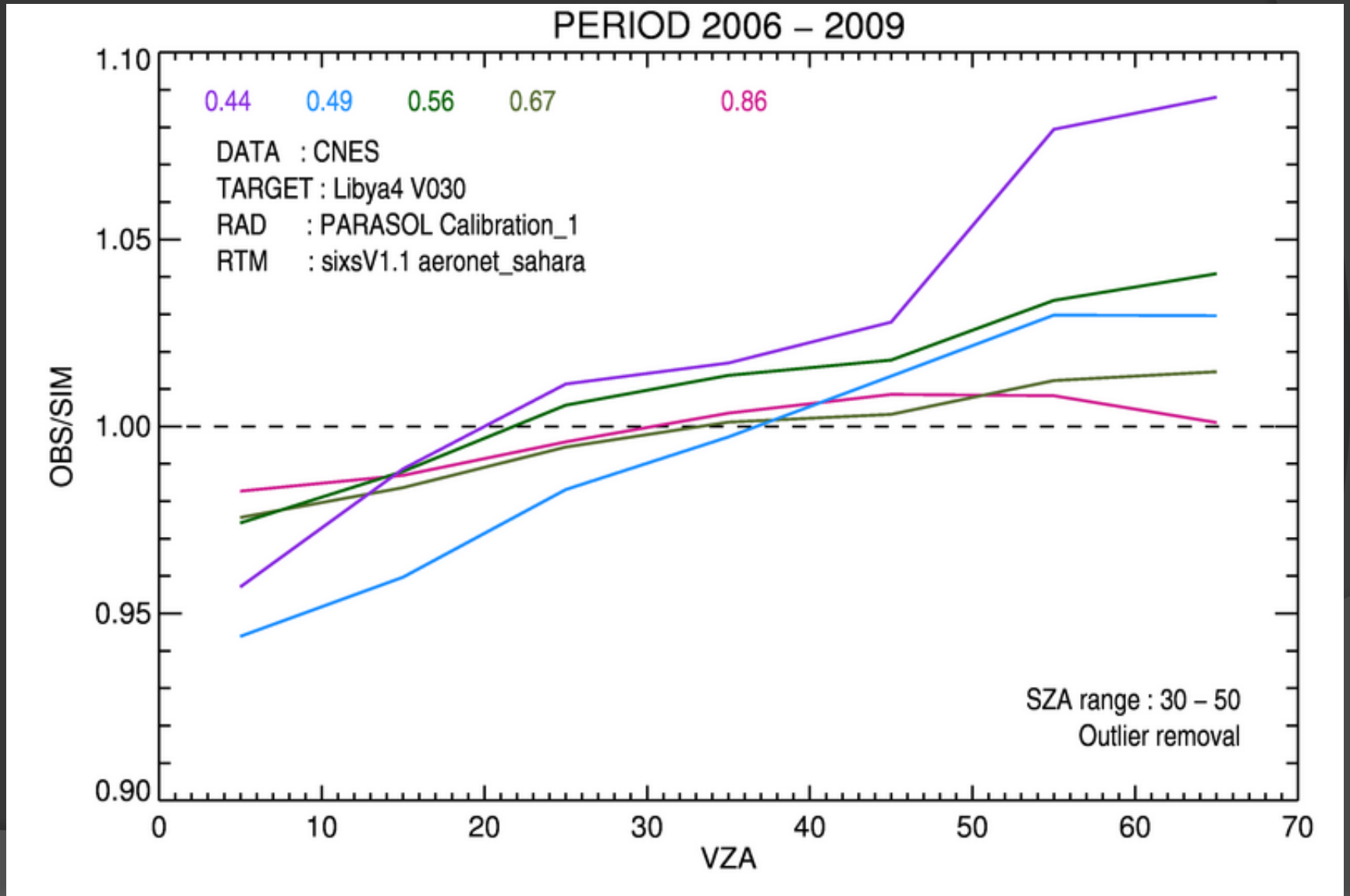
Improved calibration reference

$$B = (O - S)/S$$

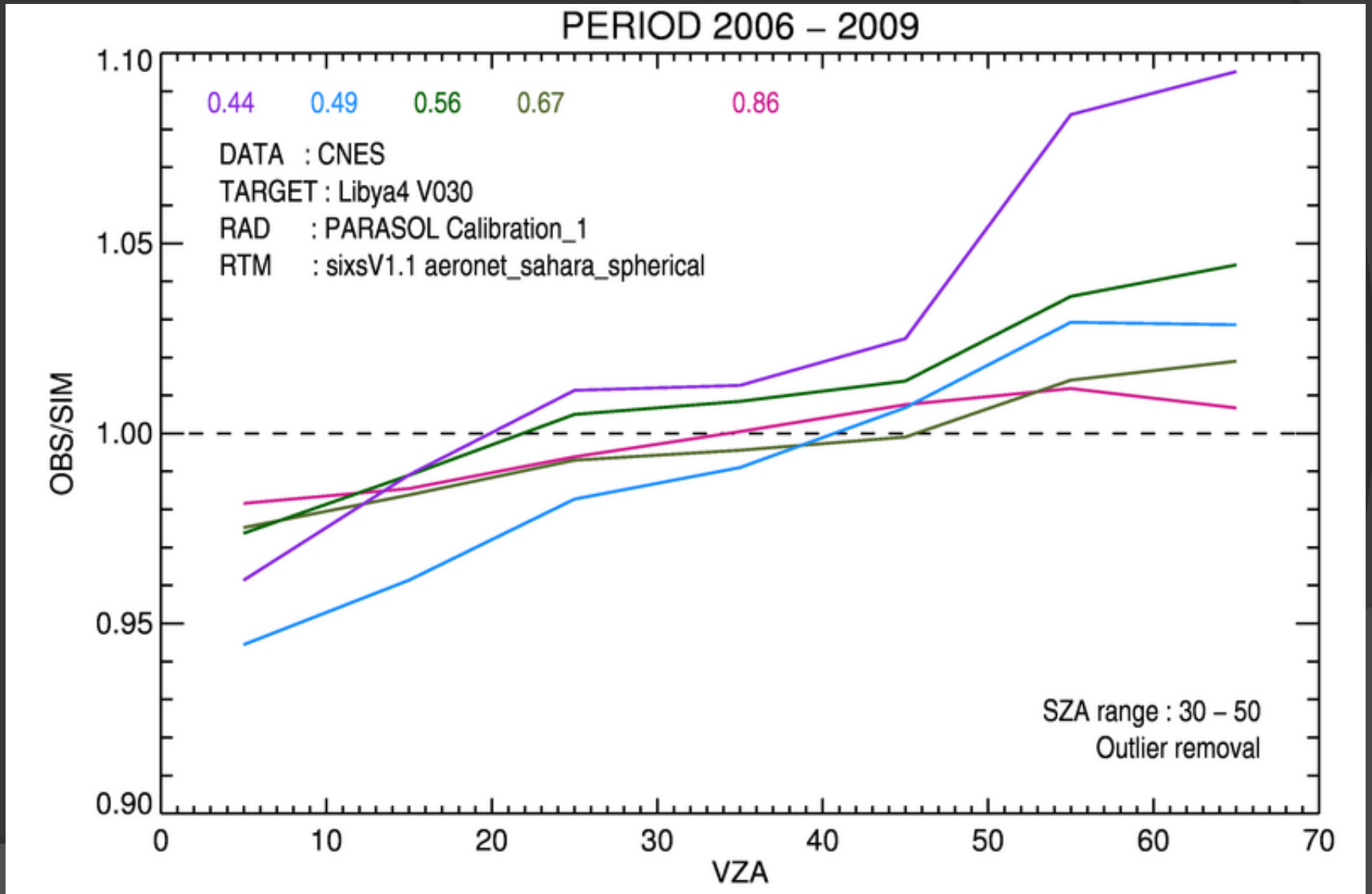
BAND	0.44	0.55	0.66	0.84	1.62
VGT	+0.79		-3.14	-2.46	-1.13
AATSR		+3.89	+2.81	+4.21	+3.82
PARASOL	+3.08	+0.71	-0.23	-0.00	
MODISA	+3.36	+2.95	+0.58	+1.55	+2.05
MERIS	+2.60	+2.80	+1.41	+1.50	
Mean	2.46	2.59	0.29	0.96	1.58
Range	2.57	3.18	5.95	6.50	4.95

Mean relative difference in per cent between satellite TOA BRFs and SIXSV simulations over Libya4 during the 2006–2009 period. Wavelengths are expressed in μm.

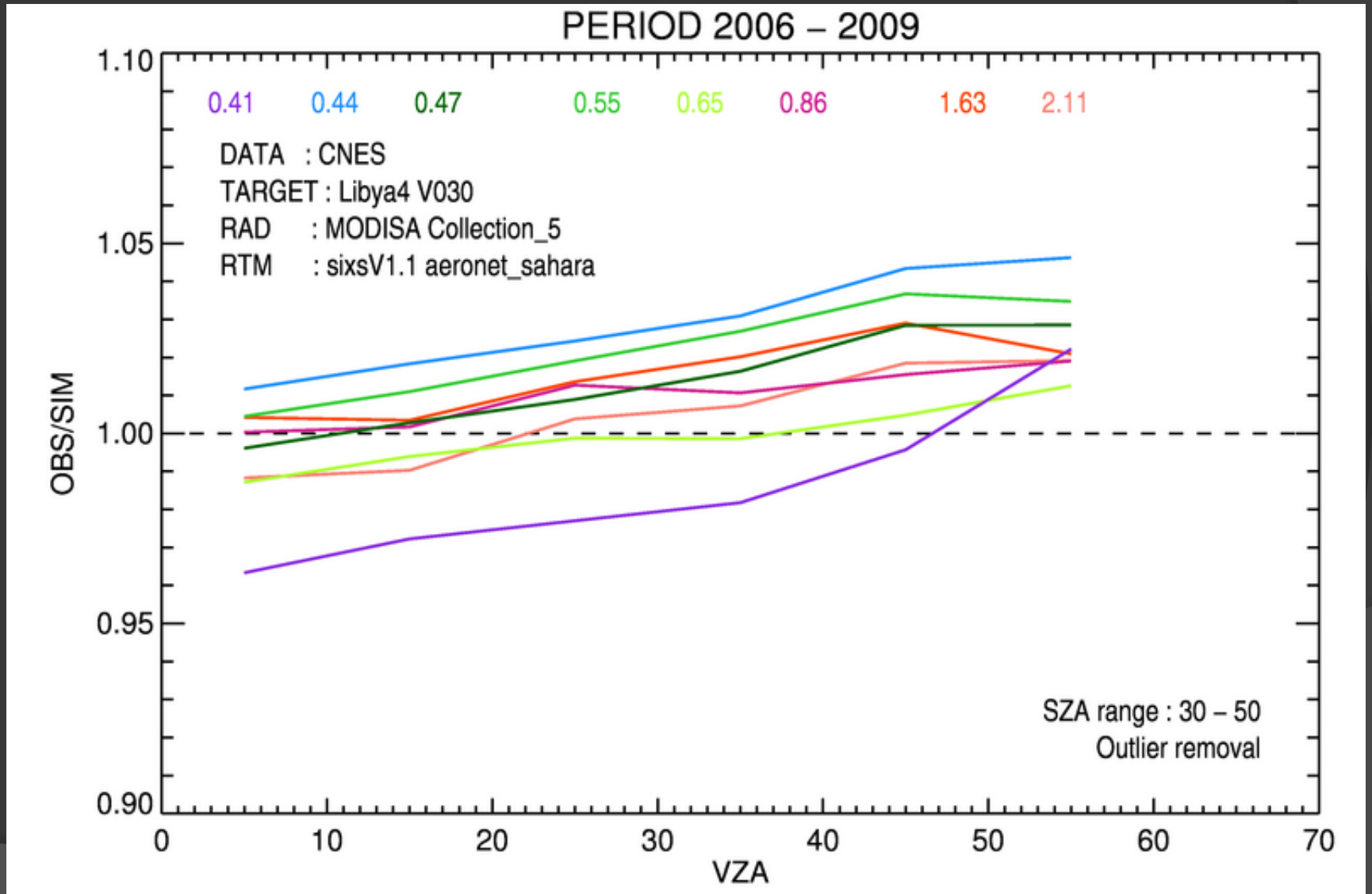
TOA BRF EFFECTS



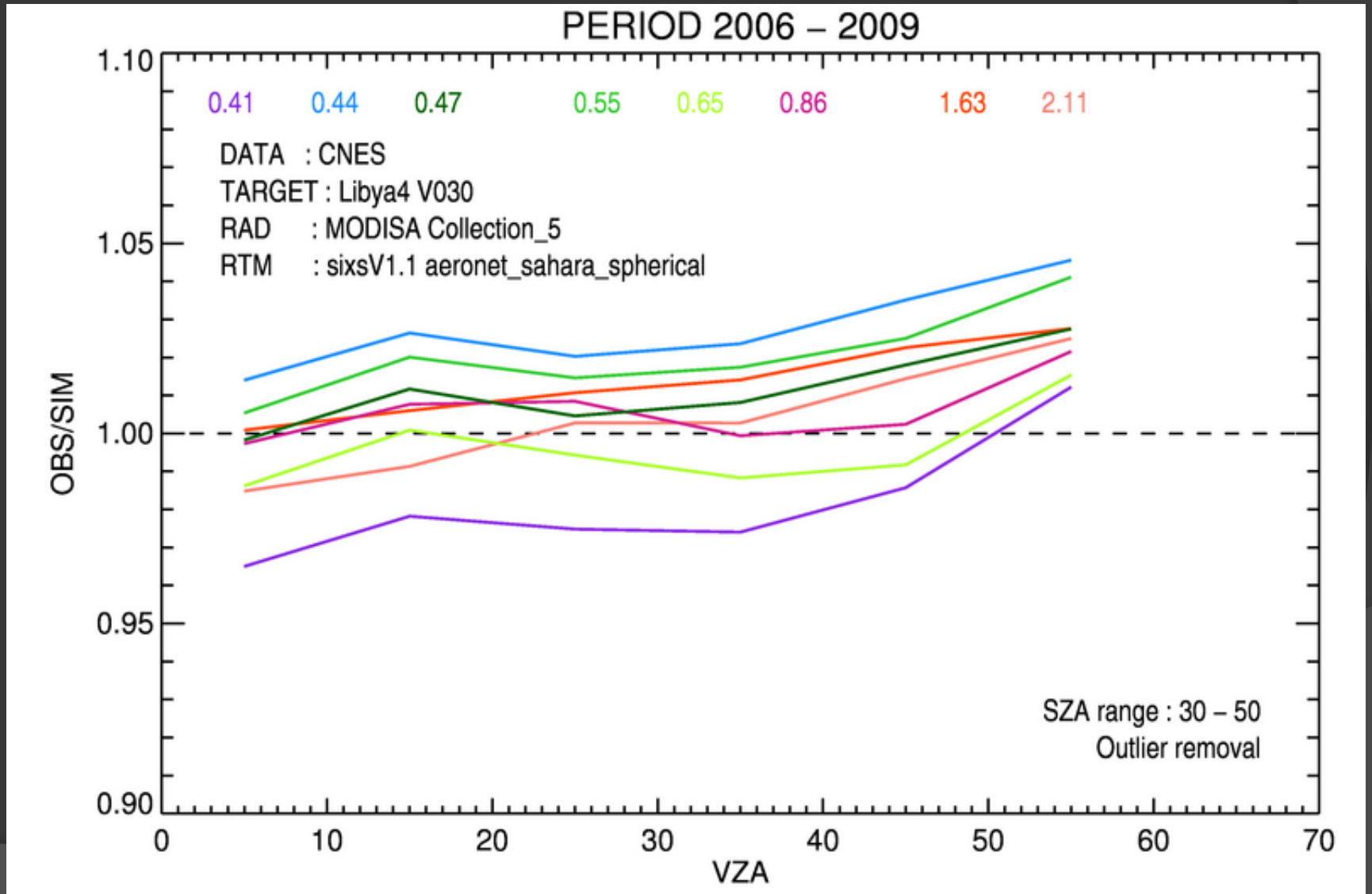
TOA BRF EFFECTS



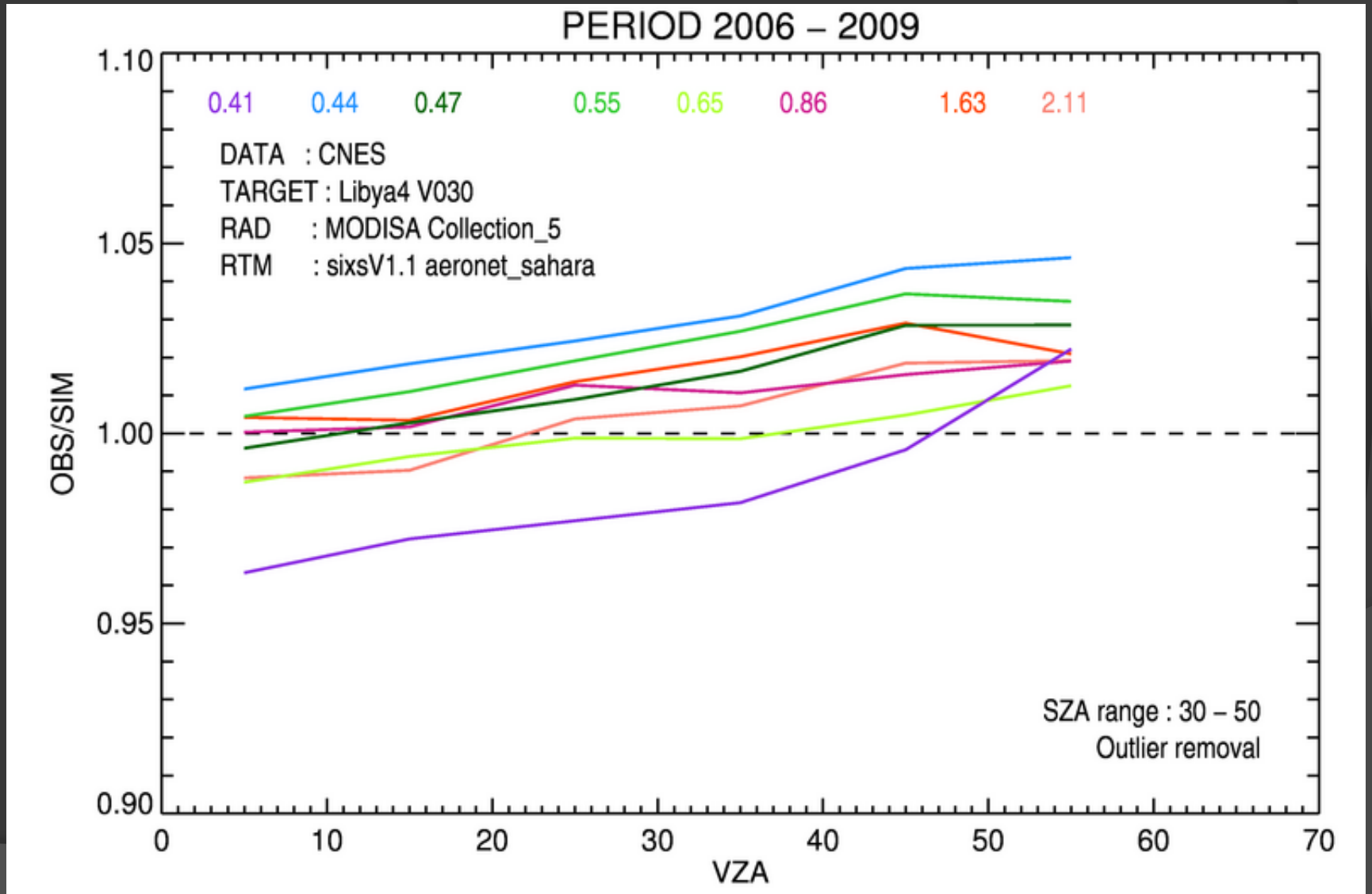
TOA BRF EFFECTS



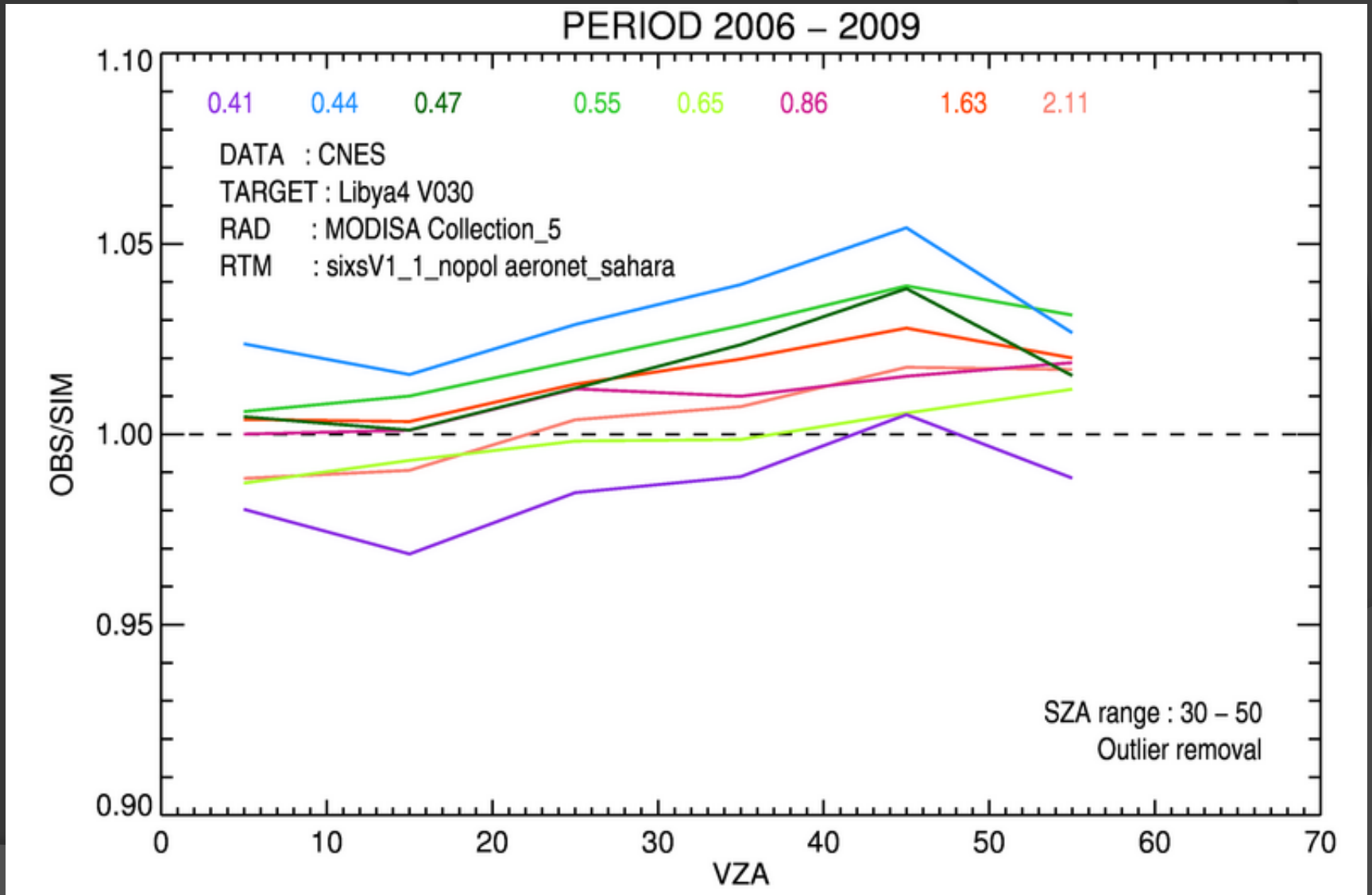
TOA BRF EFFECTS

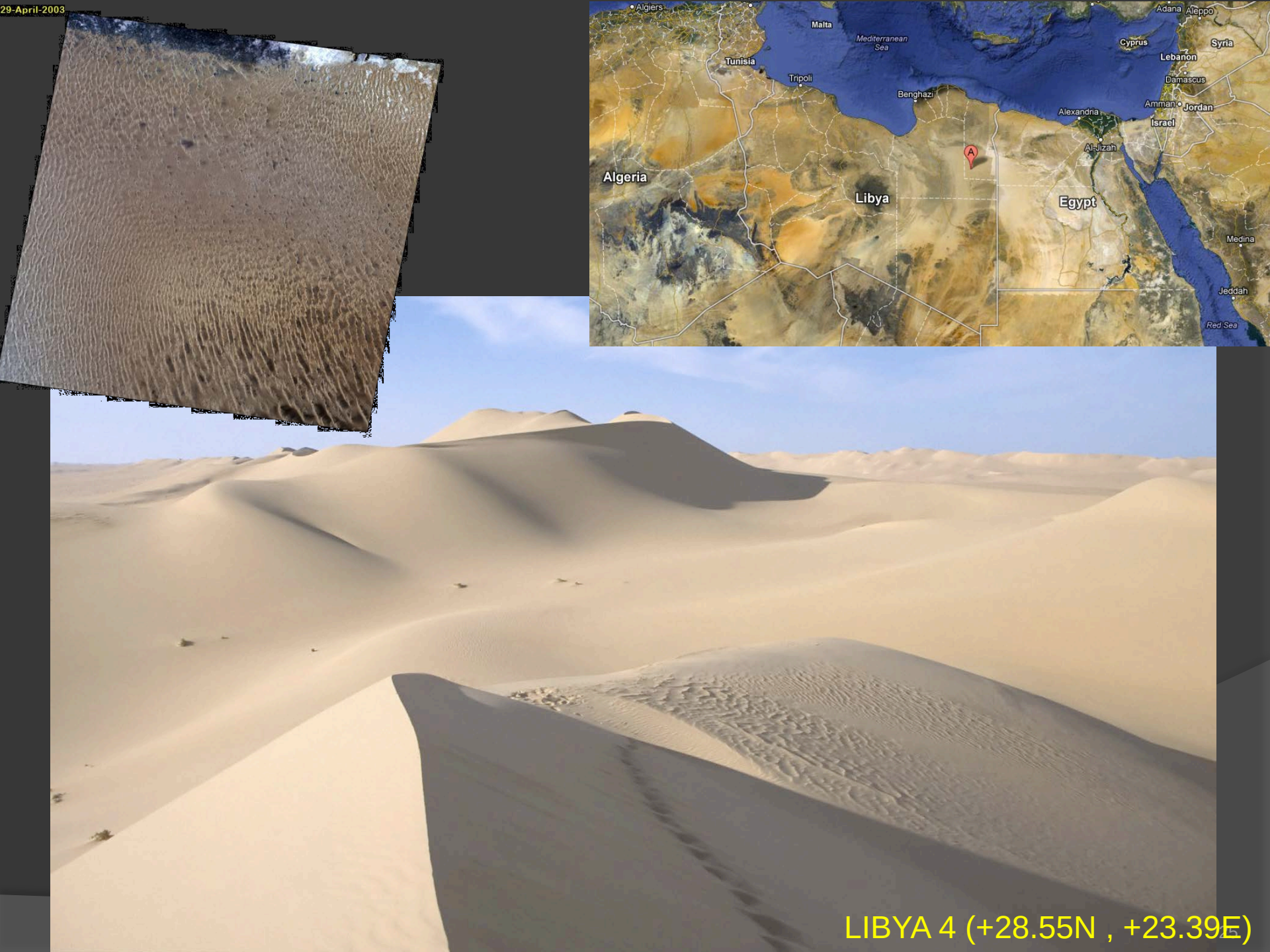


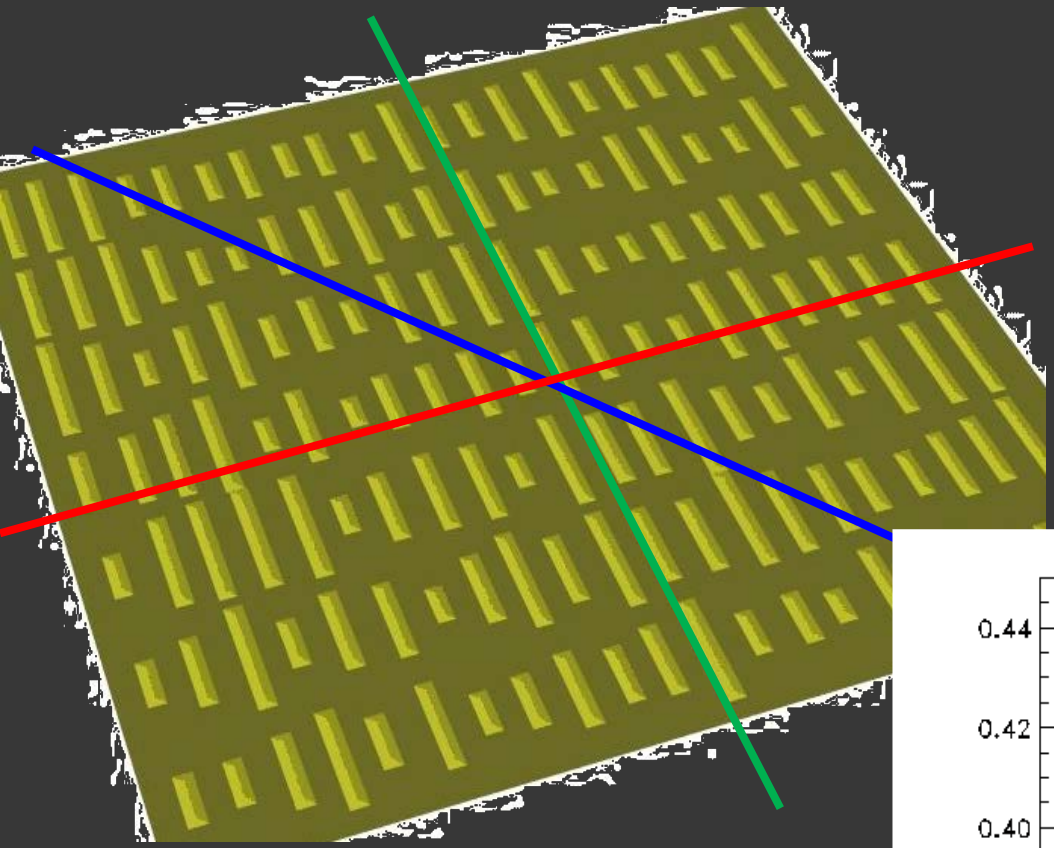
TOA BRF EFFECTS



TOA BRF EFFECTS

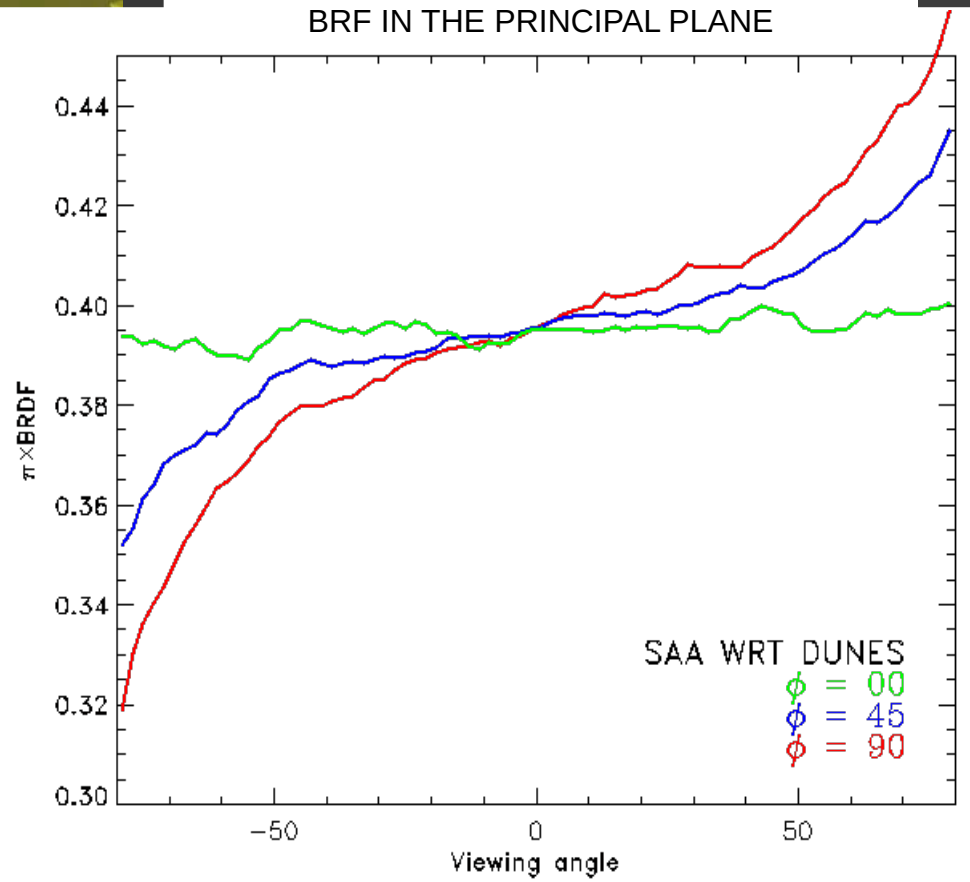



29-April-2003
Algiers
Malta
Mediterranean Sea
Tunisia
Tripoli
Benghazi
Cyprus
Adana
Aleppo
Syria
Lebanon
Damascus
Amman
Jordan
Israel
Alexandria
Al Jizah
Algeria
Libya
Egypt
Medina
Jeddah
Red Sea
LIBYA 4 (+28.55N , +23.39E)



Simulation of oriented sand dune with a 3D radiative transfer model

Effect of Sun Azimuth Angle (SAA) with respect to sand dune orientation on the BRF in the principal plane



CONCLUSIONS

- Simulated TOA radiances or BRFs over bright desert targets are used as an absolute calibration reference.
- The method accounts for the atmospheric effects , surface BRF and SSR of the simulated instruments.
- To minimize uncertainties up to 2-3%,
  - Different desert targets have to be used.
  - Further improvements of the atmospheric and surface polarization.
  - Use a different RTM that better handle gas absorption and aerosol scattering interactions
- A similar improvement can be applied to all existing bright desert targets or new ones.