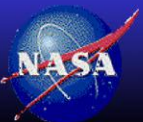


Desert based Daily Exoatmospheric Radiance Model (DERM) to calibrate collocated geostationary satellites

David Doelling, Rajendra Bhatt, Benjamin Scarino,
Arun Gopalan, Conor Haney

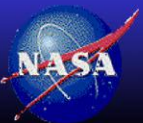
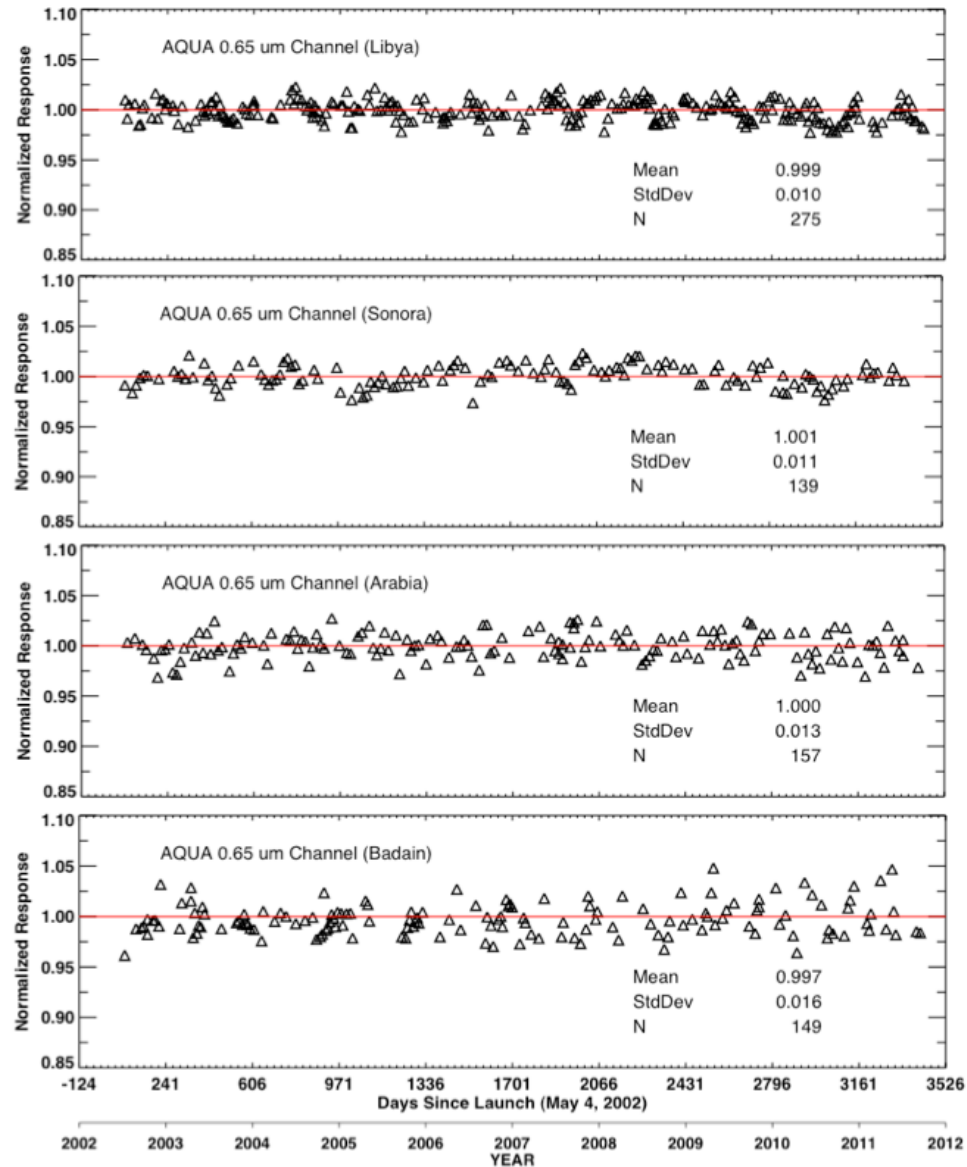
CALCON 2013 Conference, Logan, Utah, August 19-22, 2013



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Desert site stability based on Aqua-MODIS



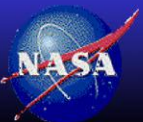
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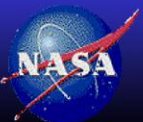
Desert PICS stability based on Aqua-MODIS

No.	PICS	Center (Lat/Lon)	ROI	Aqua-MODIS 0.65 μm		
				Mean reflectance	Homogeneity (%)	Stability (%)
1	Libya-4	28.6°/23.4°E	0.5°x0.5°	0.46	1.4	1.0
2	Sonora	32.0°/114.5°W	0.2°x0.2°	0.32	2.5	1.1
3	Arabia-2	20.1°/51.0°E	0.5°x0.5°	0.41	1.3	1.3
4	Badain	40.1°/101.8°E	0.4°x0.4°	0.22	3.2	1.6
5	Taklimakan	39.8°/80.2°E	0.4°x0.4°	0.27	6.5	3.3
6	Simpson	-24.1°/137.4E°	0.7°x0.9°	0.22	8.6	9.4

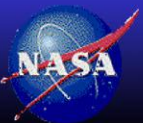
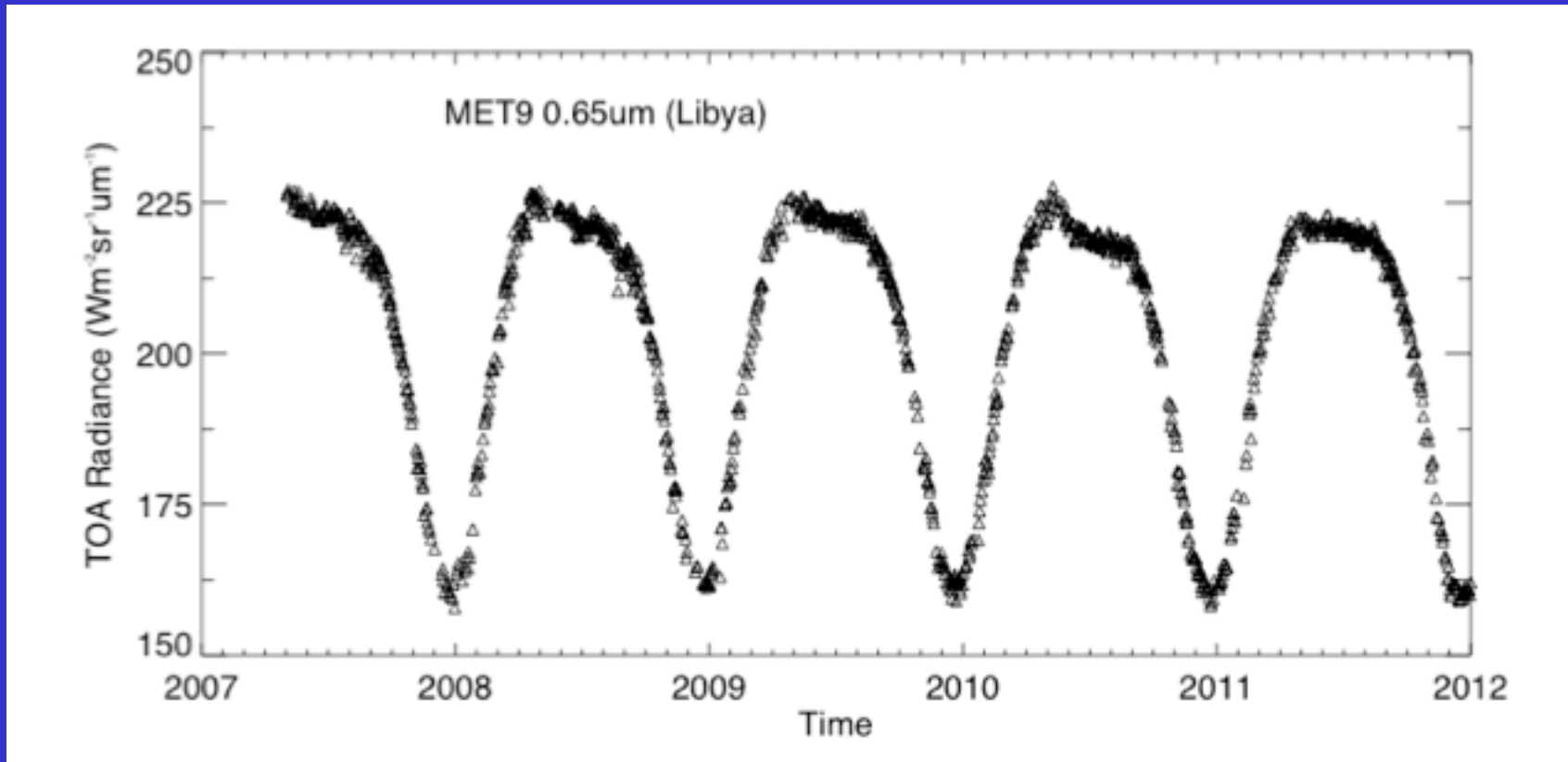


DERM procedure

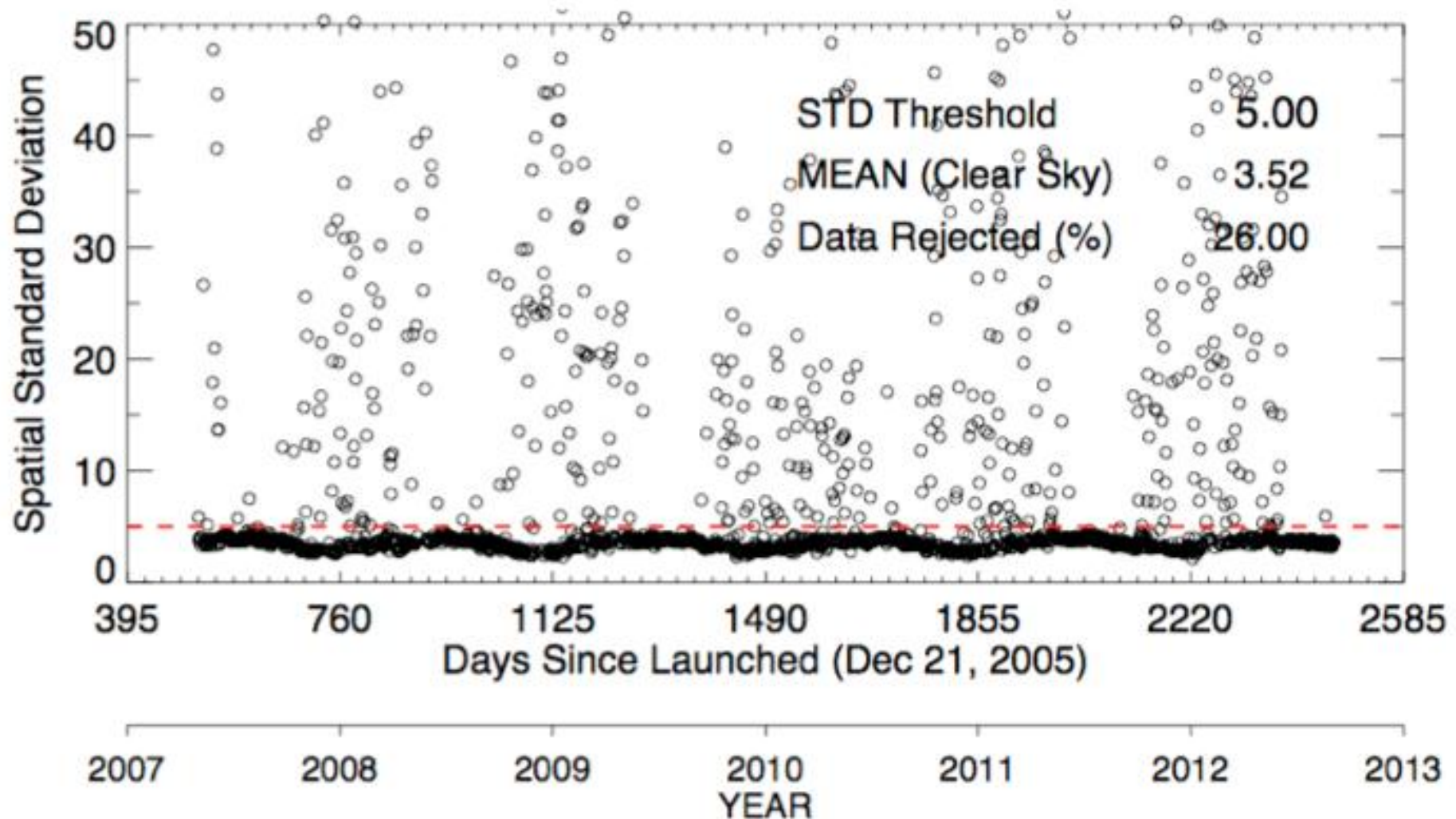
- Compute Daily TOA radiance model from reference GEO
 - Inter-calibrate GEO reference sensor with Aqua-MODIS
 - Derive daily TOA clear-sky radiances from noon image
 - Clear-sky mask is based on spatial homogeneity threshold
 - Average multiple years of TOA radiances
- Apply Daily TOA radiance model to target GEO sensor
 - Use spectral adjustment factor based on SCIAMACHY hyper-spectral radiances
 - Adjust the reference TOA radiance by the SZA difference between sensors, view and azimuthal angle should be identical



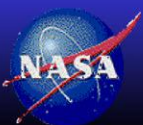
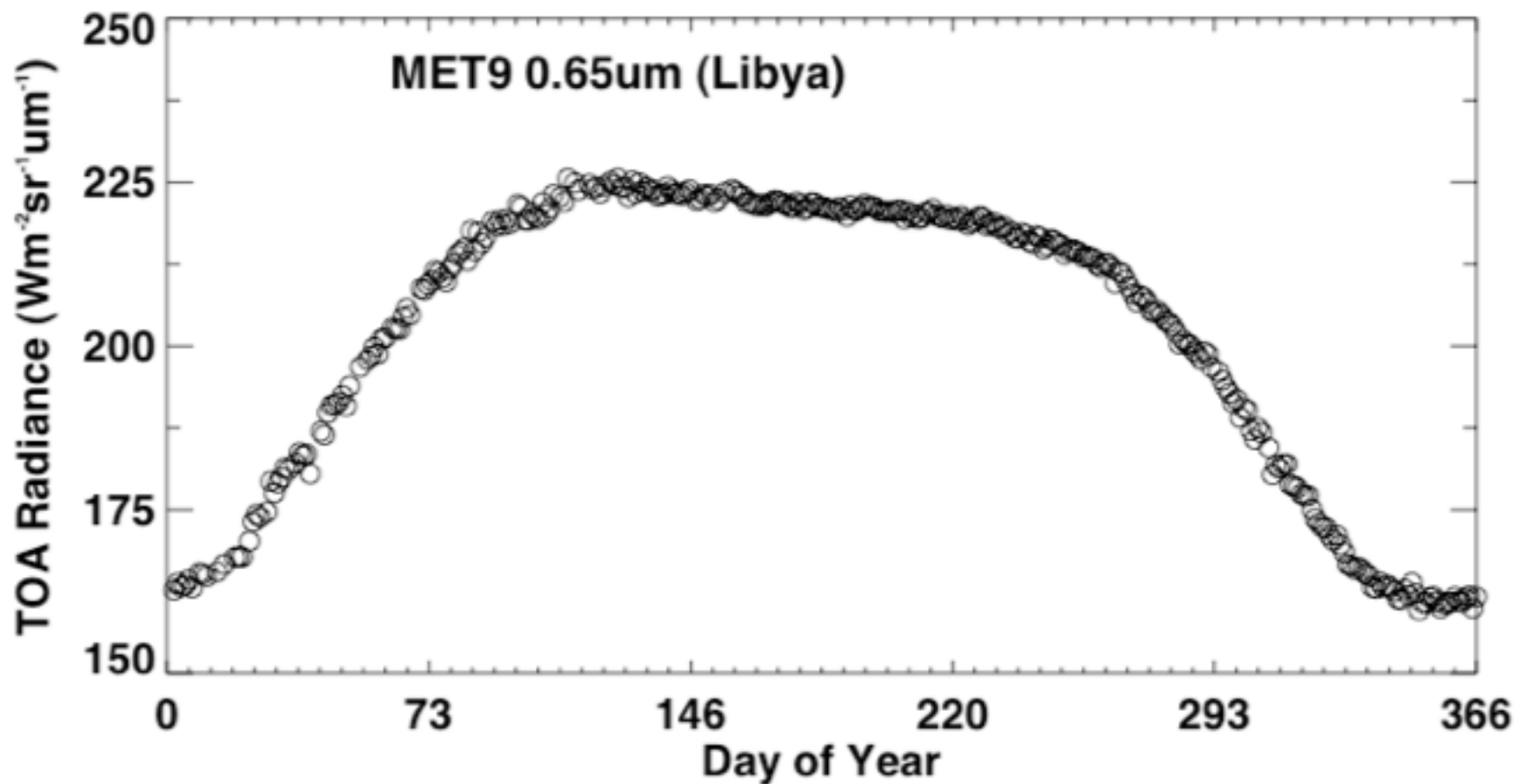
Reference Met-9 Daily TOA radiances



Met-9 clear-sky mask



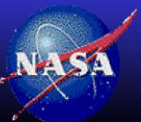
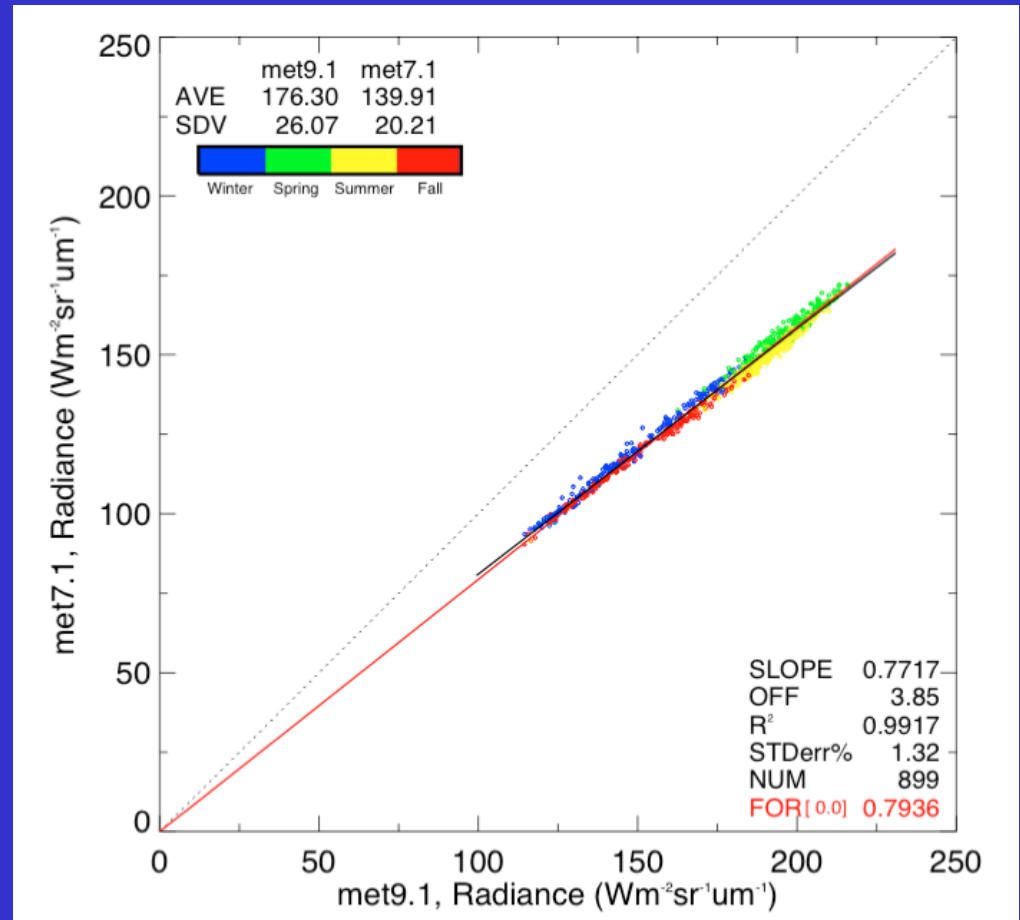
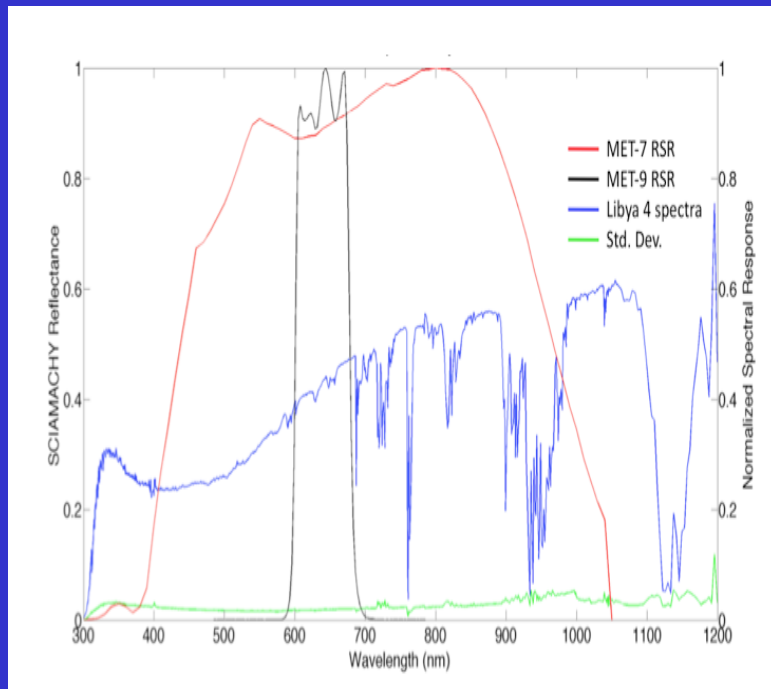
Reference MET-9 DERM radiance model



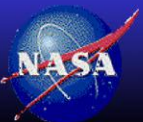
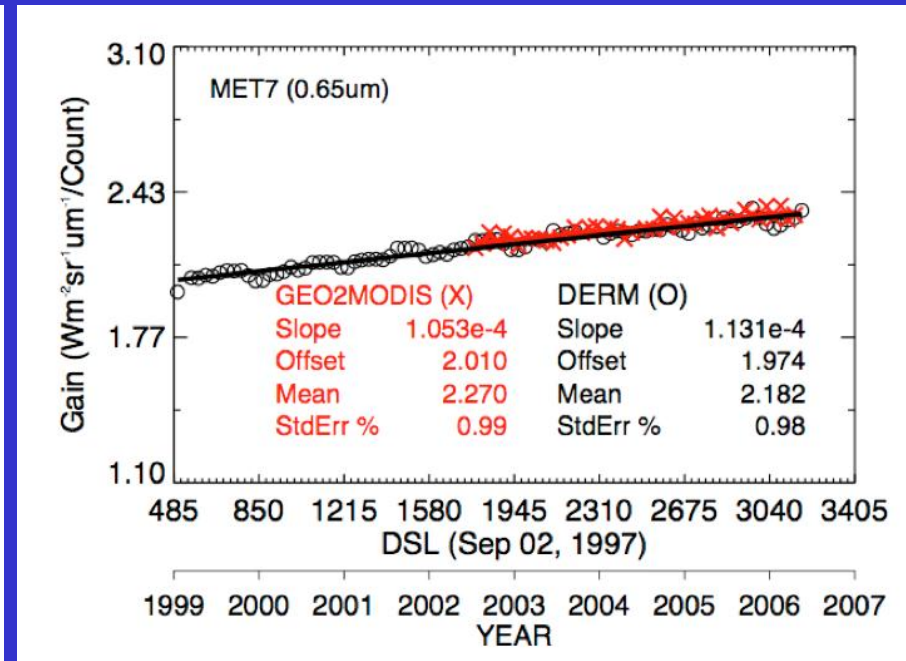
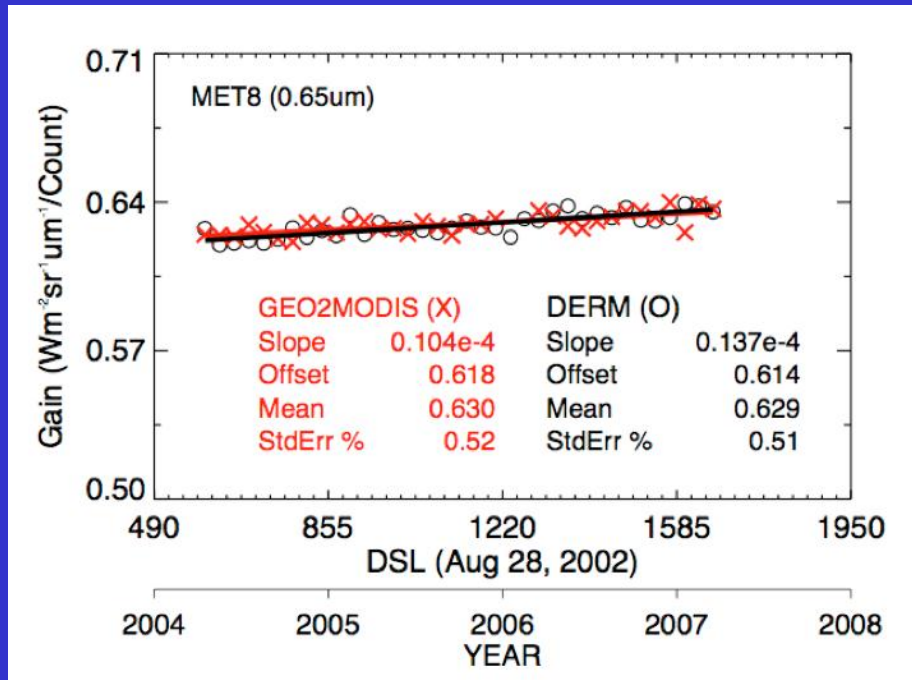
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Met-9/Met-7 spectral band adjustment factor

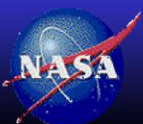


Compare DERM gain with Aqua-MODIS derived gain for Met-8 and Met-7



DERM validated with Aqua-MODIS ray-matching

GEO Satellite	DERM		Ray-Matching		Gain difference (%)
	Gain	Uncertainty (%)	Gain	Uncertainty (%)	
Meteosat-8	0.629	1.16	0.630	0.59	0.20
Meteosat-7 (2003-2007)	2.257	1.94	2.272	1.31	0.66
GOES-10 (2000-2003)	0.834	2.05	0.842	1.58	0.96



Conclusions

- DERM calibration relies on the constant geostationary imaging schedule, which allows consistent annual daily solar and viewing geometry
- The reference GEO calibration is obtained from Aqua-MODIS
- The calibration is transferred daily to the GEO target sensor.
- The DERM calibration is within 1% of the ray-matched calibration

