

# NASA-CERES GEO/MODIS Ray-matching highlights

May 12, 2022

# Ray-Matching criteria Table for A

Ray-Matching criteria	Ray-Matching threshold
Monitored sensor	GEO
Reference sensor and version	MODIS C5
Radiance or reflectance pair regression	Radiance
SBAF	SCIAMACHY 2nd order fit
Latitude Domain	$\pm 15^\circ$ latitude
Longitude Domain	$\pm 20^\circ$ longitude of sub-satellite location
Underlying surface	All-sky tropical Ocean
Spatial grid resolution	$0.5^\circ \times 0.5^\circ$ latitude by longitude
GEO/MODIS pixel resolution	1-km/1-km
GEO/MODIS pixel subsampling	subsampled to 4-km/2-km
Bin spatial homogeneity	<20% relative standard deviation
Time matching difference	<15 minutes
Solar zenith angle (SZA) difference	< $5^\circ$
View zenith angle (VZA) difference	< $10^\circ$
Relative azimuthal angle (RAA) difference	< $15^\circ$
Scattering angle difference	< $15^\circ$
Sun glint probability	<10%
Linear regression, regression through space offset	regression through space offset

please fill out a similar table

# Timeline criteria Table for B

Ray-Matching ATBD 2011 (NASA)	Ray-Matching threshold
Timeline temporal resolution	monthly
Outlier Filter	>5% of the trend
Other criteria	deseasonalization
Temporal regression	linear

please fill out a similar table

# Spatial Standard deviation threshold

- Introducing a spatial homogeneity factor of <20% reduced the radiance pair linear regression from 6.9% to 4.8%

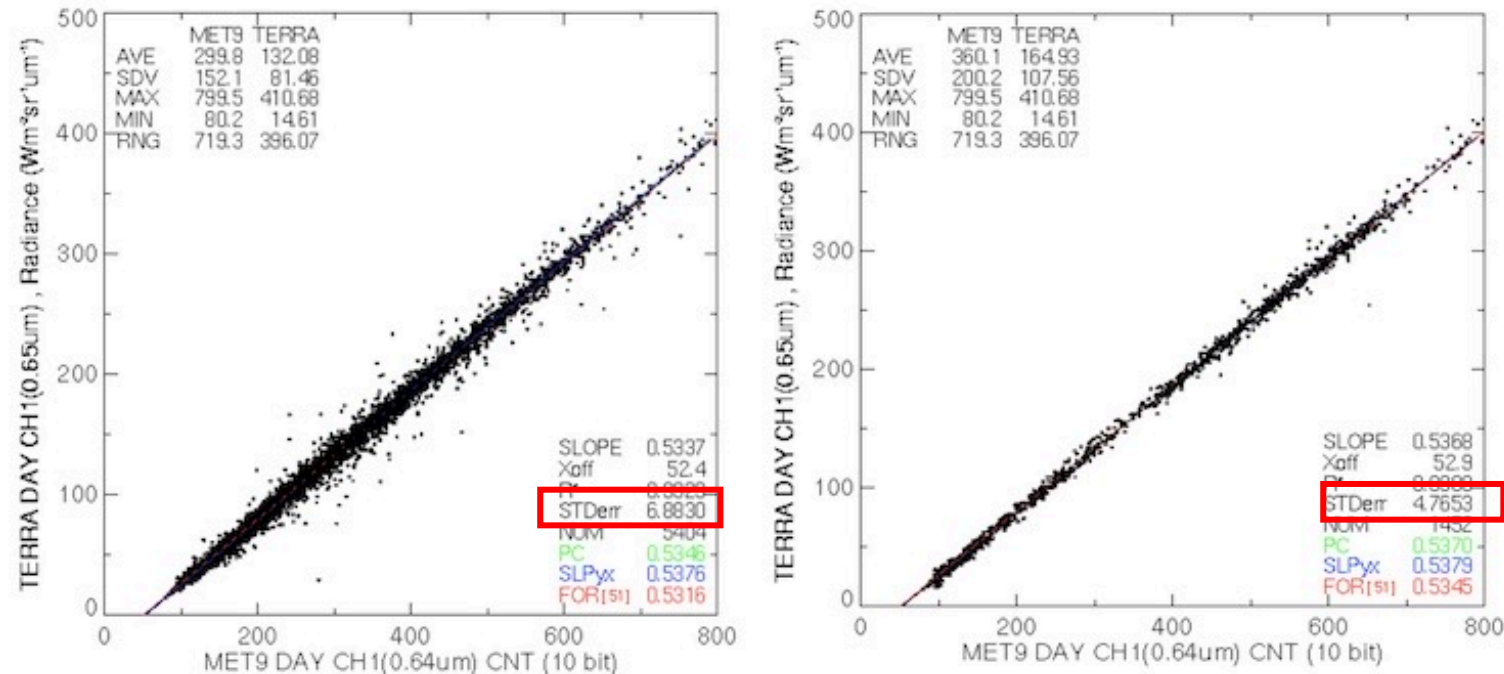
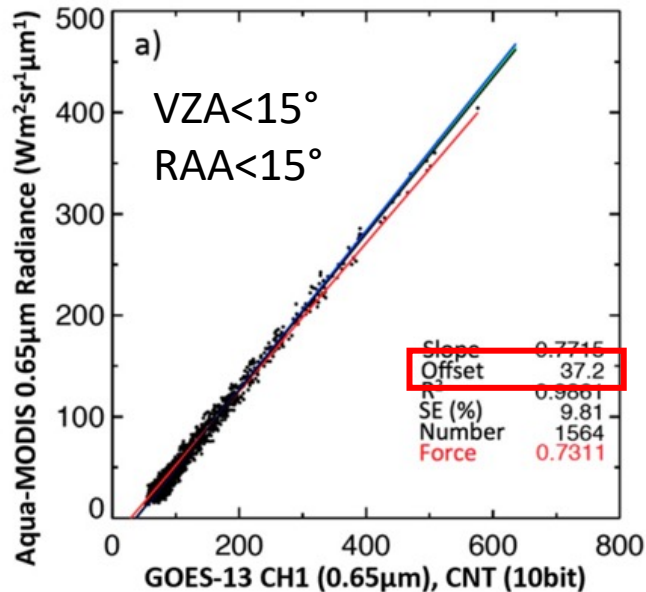


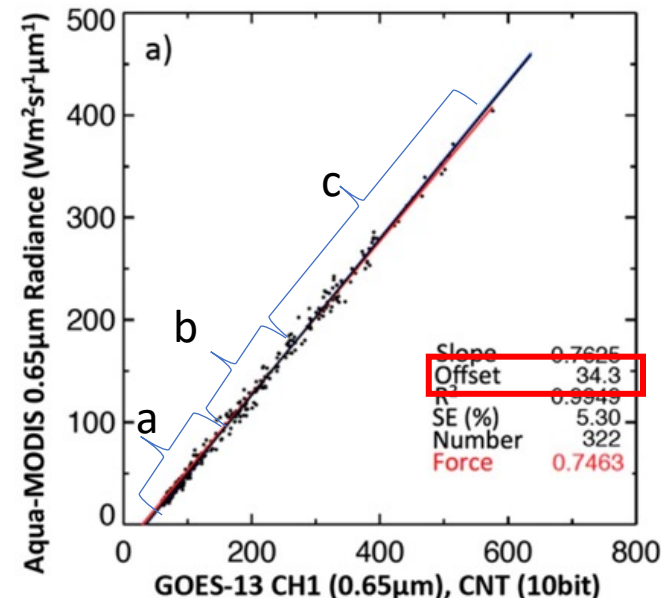
Figure 3: Monthly regression of Meteosat-9 counts and Terra-MODIS 0.5° binned radiances over the Meteosat domain. The left plot has no visible spatial standard deviation threshold applied; the right plot has a 20% threshold applied.

# Angle Matching thresholds

- The angle restrictions are a function of GEO radiance.
- Most of the matches are for clear-sky conditions and they are also the most anisotropic, whereas bright clouds are rarely sampled and they are the most Lambertian. Use tighter threshold for low reflectances to preserve the dynamic range. The linear regression is closer to the GEO space count of 29



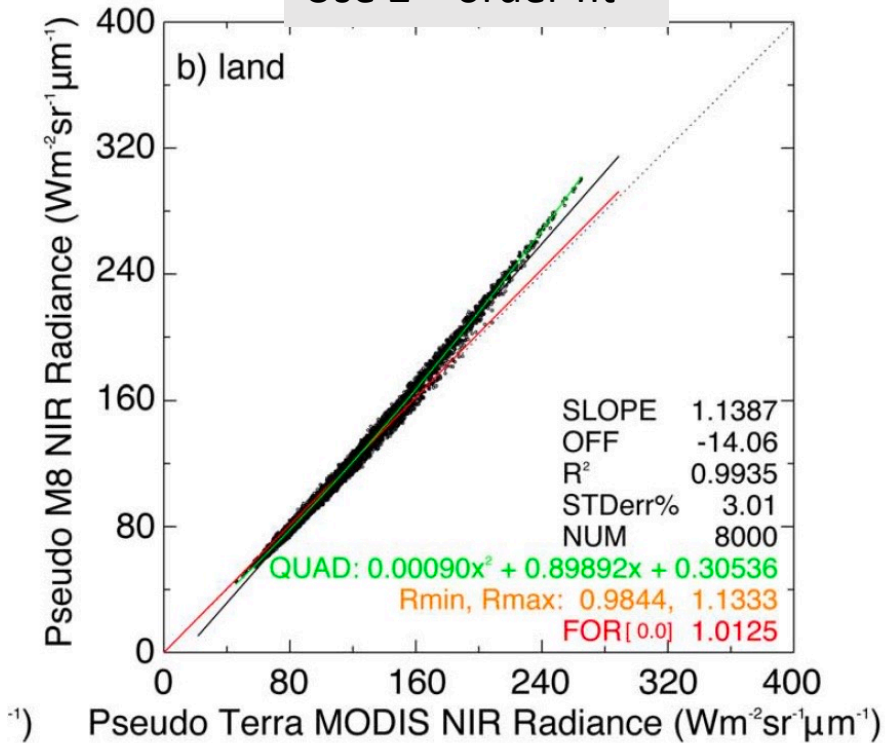
note that the force fit and the linear regression are more similar after applying graduated angle matching



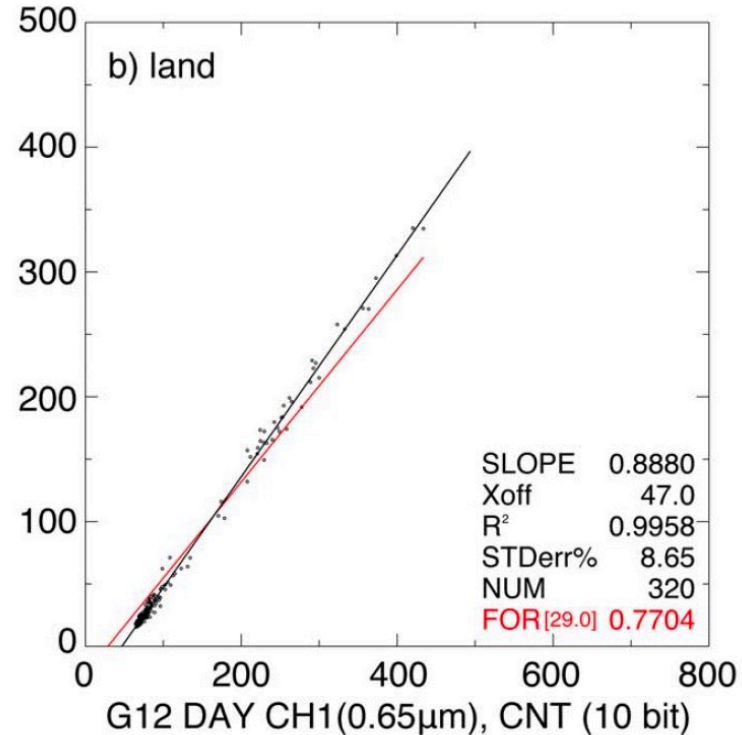
- a) VZA < 5° and RAA < 5°
- b) VZA < 10° and RAA < 10°
- c) VZA < 15° and RAA < 15°

# Spectral Band Adjustment Factor (SBAF)

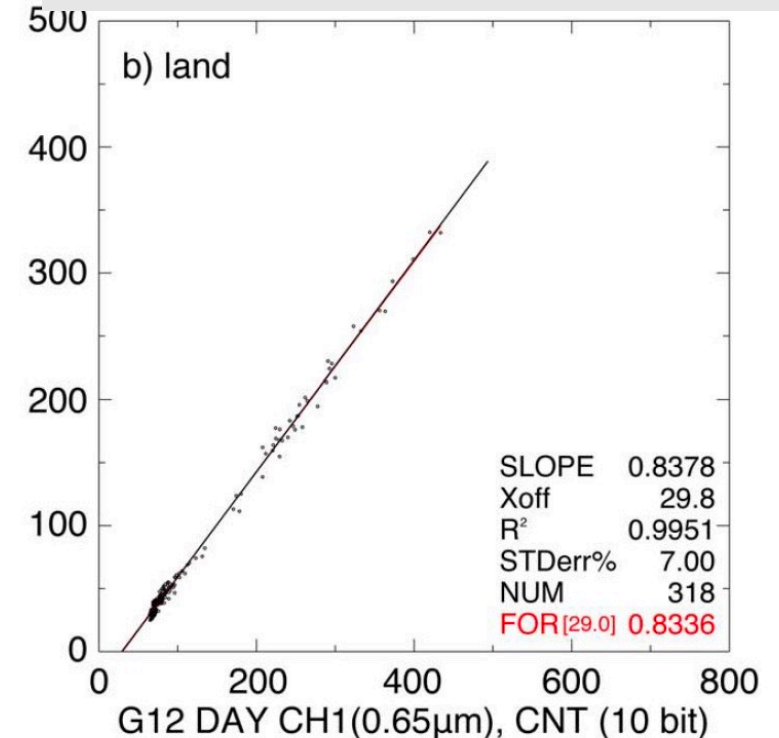
SCIAMACHY SBAF  
Use 2<sup>nd</sup> order fit



GOES-12/Terra-MODIS Ray-matching



GOES-12/Terra-MODIS Ray-matching  
with 2<sup>nd</sup> order SBAF applied



# monthly raymatching gains deseasonalization

However, if a trend is expected, a ratio-to-moving-average is used to deseasonalize data in order to leave the trend that is embedded in the time series intact. The steps are as follows:

- 1) a 12-month centered running mean is computed for each monthly value.
- 2) A relative ratio between the observed monthly value and the running mean value is determined.
- 3) An average relative ratio for each of the months is computed and is referred to as the seasonal index.
- 4) Finally, the observed monthly values are divided by their corresponding month seasonal index to compute the deseasonalized time series.

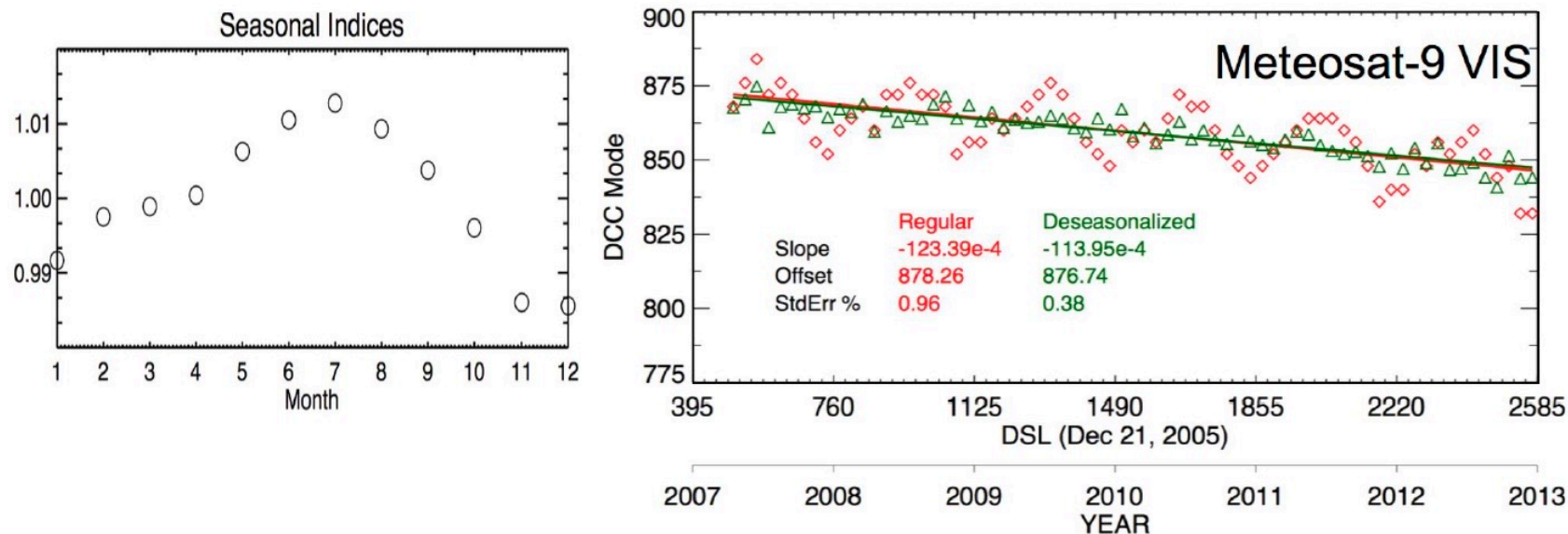


Figure 3. (left panel) Seasonal indices based on the monthly Meteosat-9 DCC-mode count response. (right panel) The monthly Meteosat-9 DCC-mode count response (red) and deseasonalized response using the seasonal indices (green).