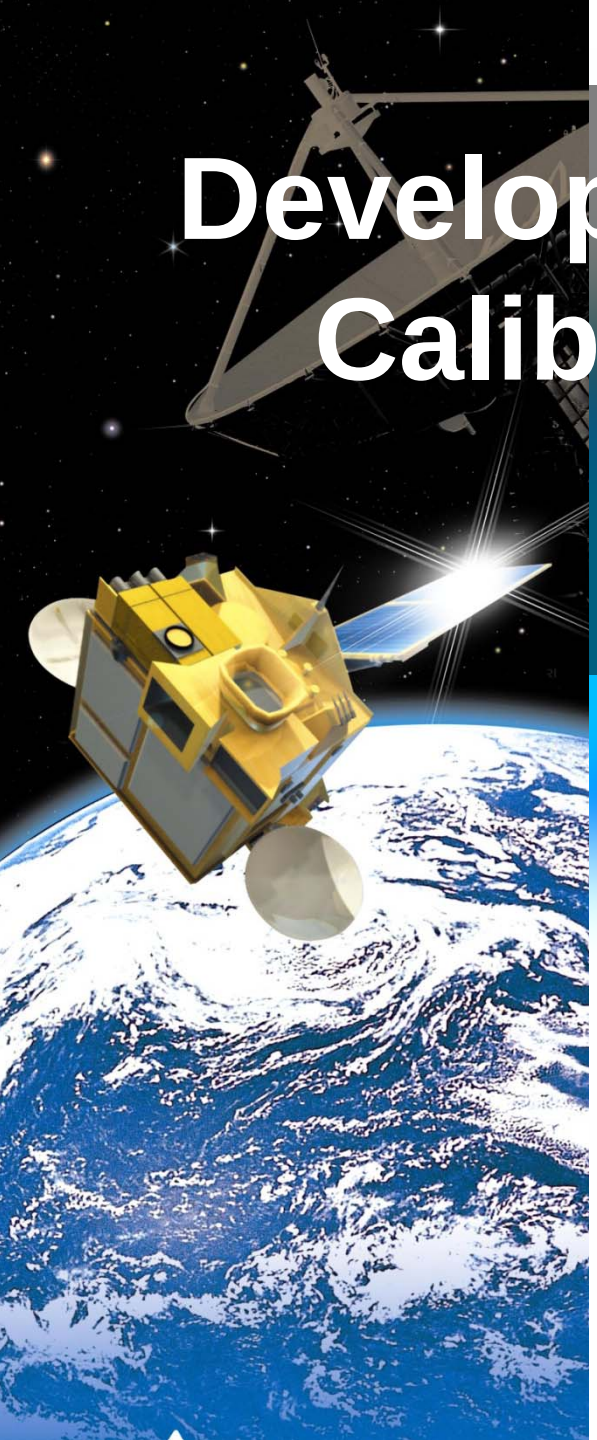
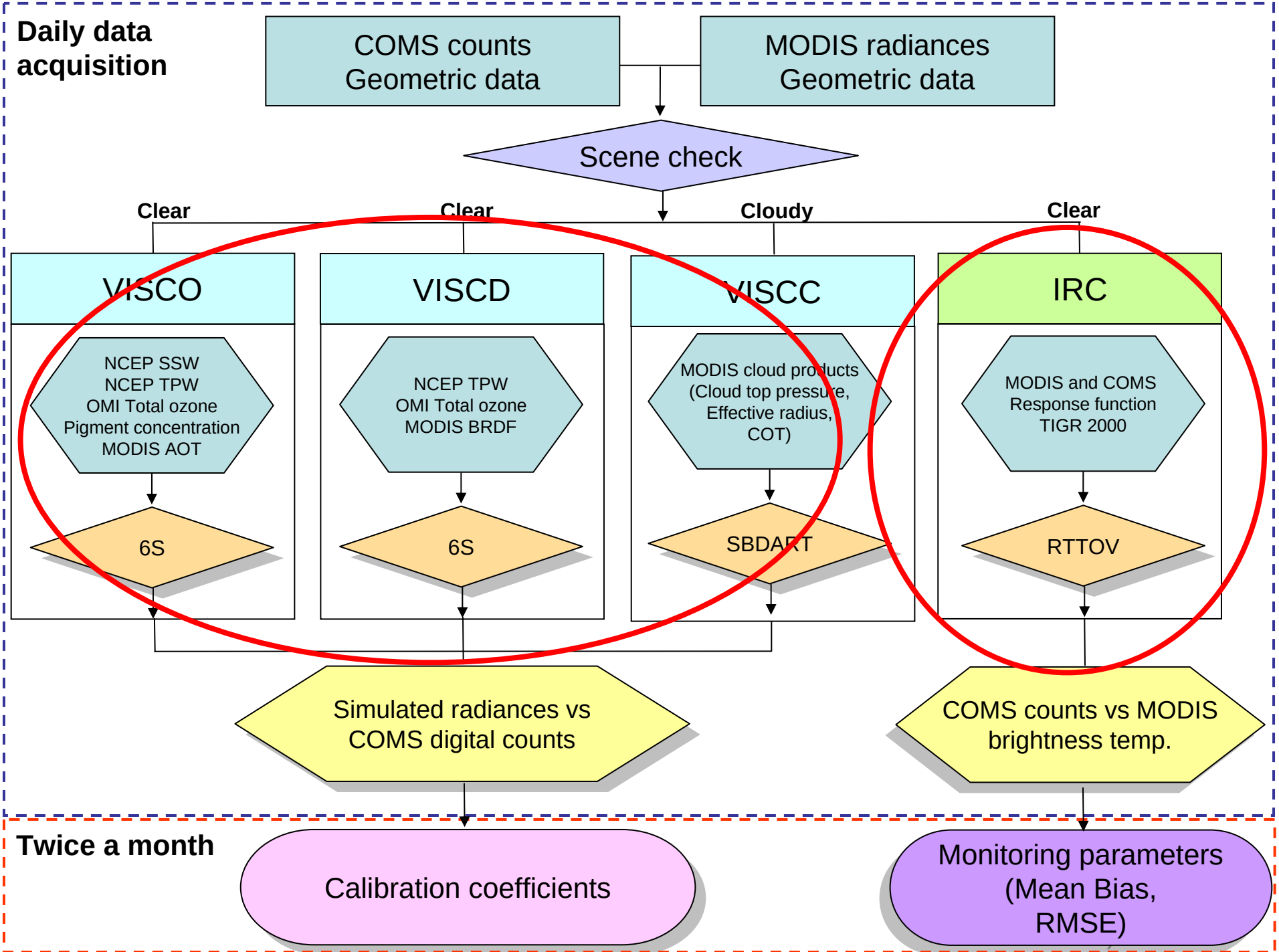


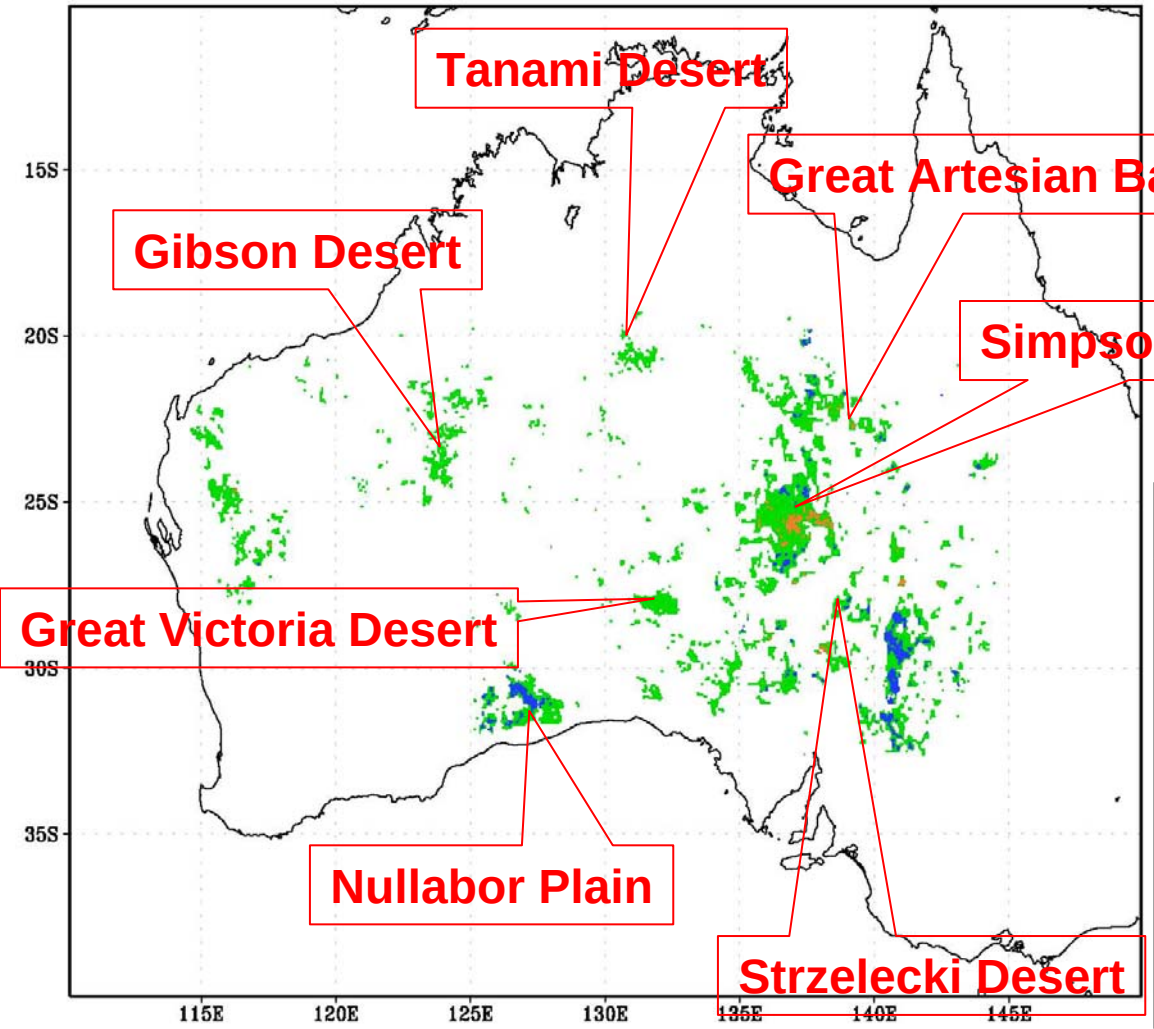
Development of Solar Channel Calibration for COMS and Application to MTSAT-1R

Byung-Ju 'B.J.' Sohn

School of Earth and Environmental Sciences
Seoul University, Korea
sohn@snu.ac.kr


Daily data acquisition
COMS counts
Geometric data
MODIS radiances
Geometric data
Scene check
Clear
Clear
Cloudy
Clear
VISCO
NCEP SSW
NCEP TPW
OMI Total ozone
Pigment concentration
MODIS AOT
6S
VISCD
NCEP TPW
OMI Total ozone
MODIS BRDF
6S
VISCC
MODIS cloud products
(Cloud top pressure,
Effective radius,
COT)
SBDART
IRC
MODIS and COMS
Response function
TIGR 2000
RTTOV
Simulated radiances vs
COMS digital counts
COMS counts vs MODIS
brightness temp.
Twice a month
Calibration coefficients
Monitoring parameters
(Mean Bias,
RMSE)

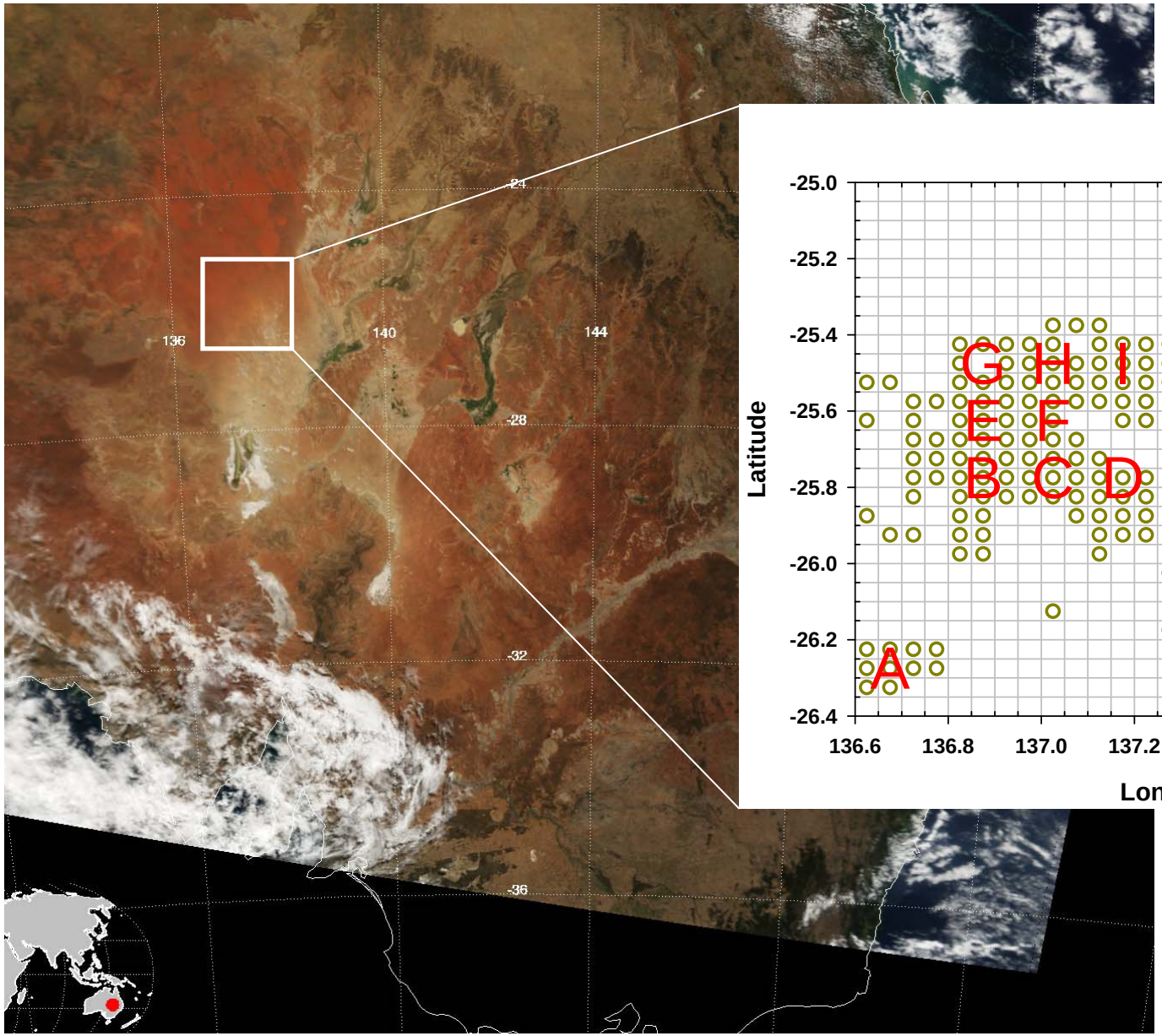
Desert targets selection



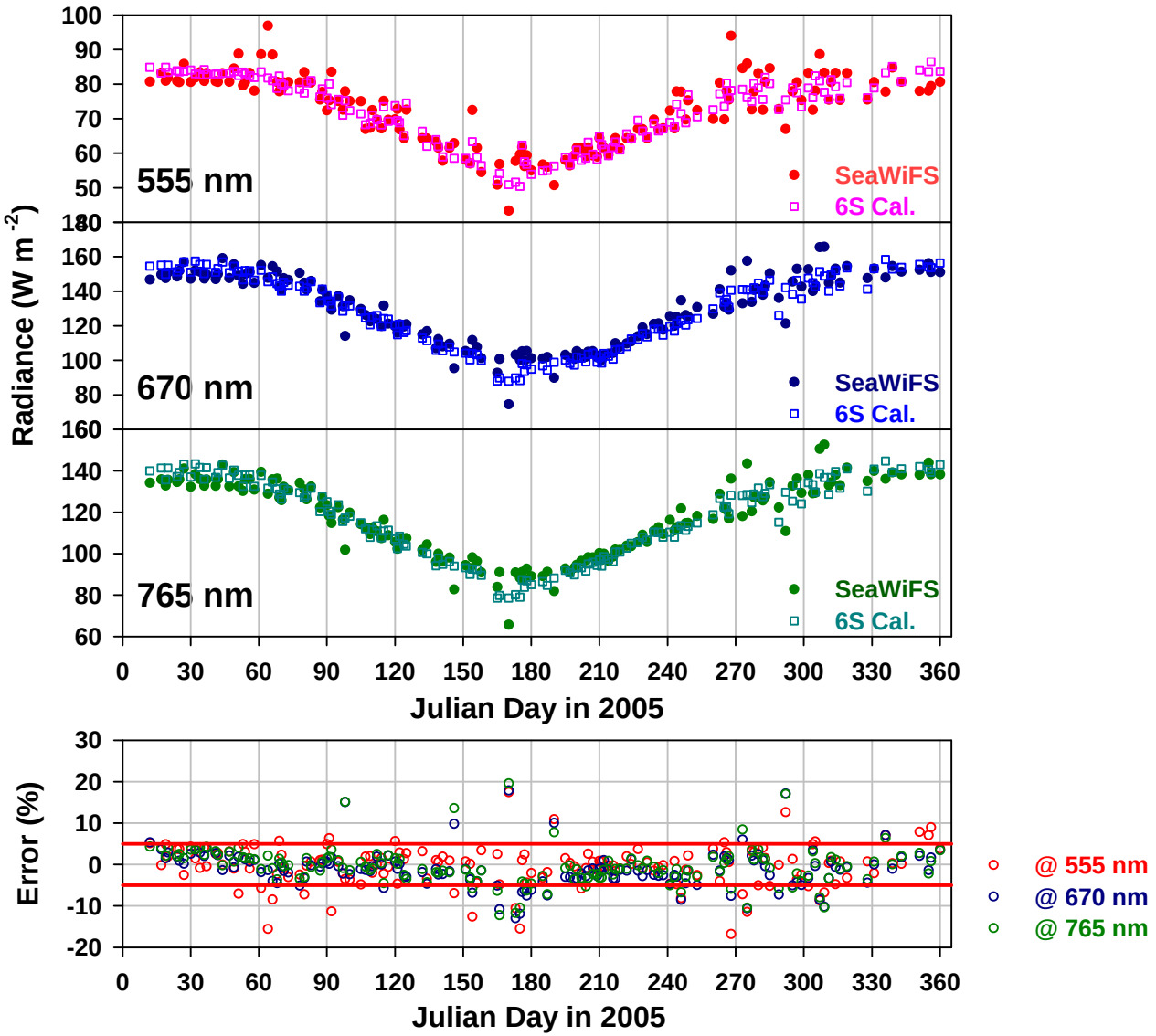
Criteria

Brightness @ band 1	20%	15%	15%
Brightness @ band 2	30%	25%	25%
Brightness @ band 4	10%	5%	5%
Annual mean σ	0.06	0.08	0.12
Spatial mean σ	0.06	0.08	0.08
NDVI	0.2	0.25	0.25

Selected targets

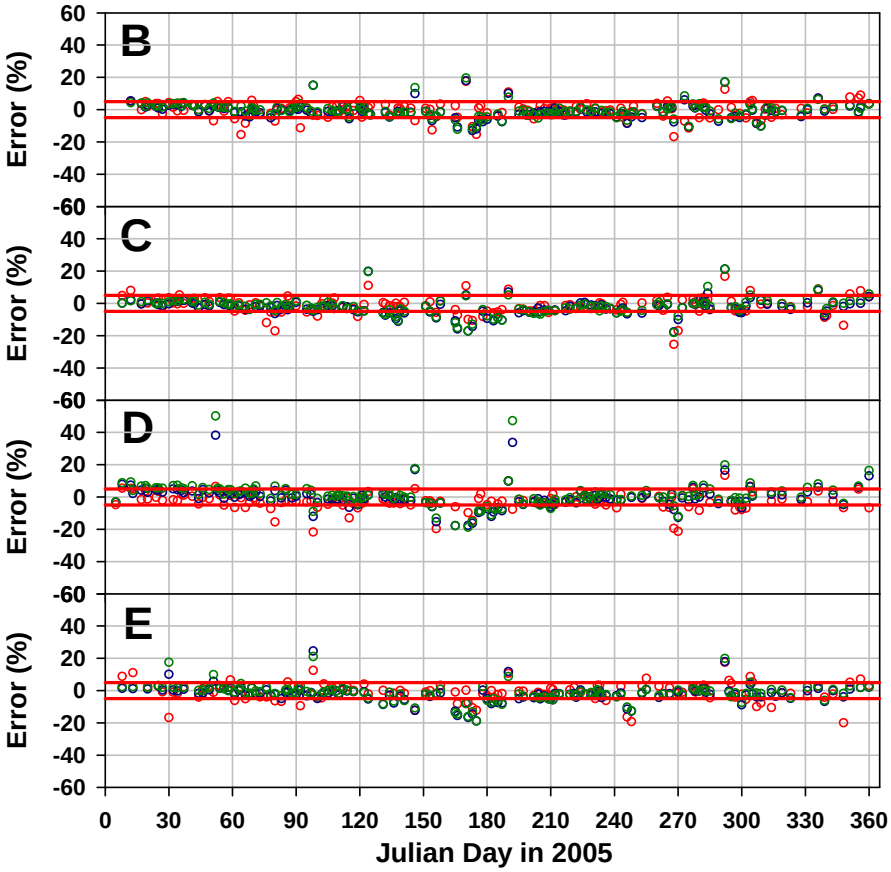


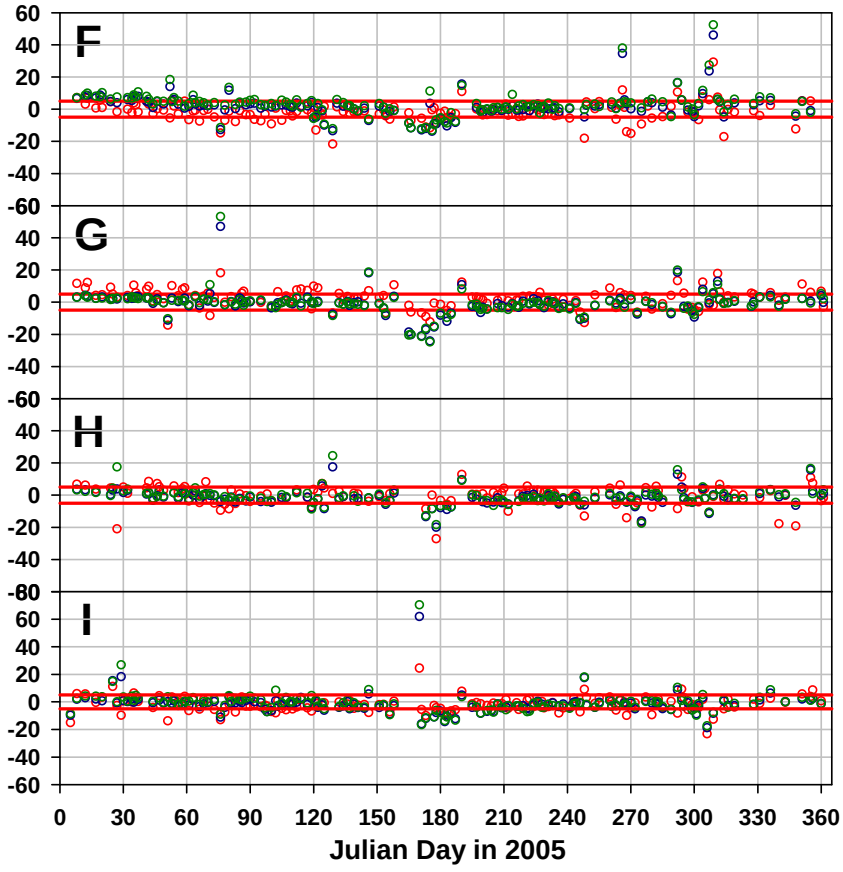
@ Target B



Error = (Cal. – Obj.) / Obj.X100

Results @ other targets



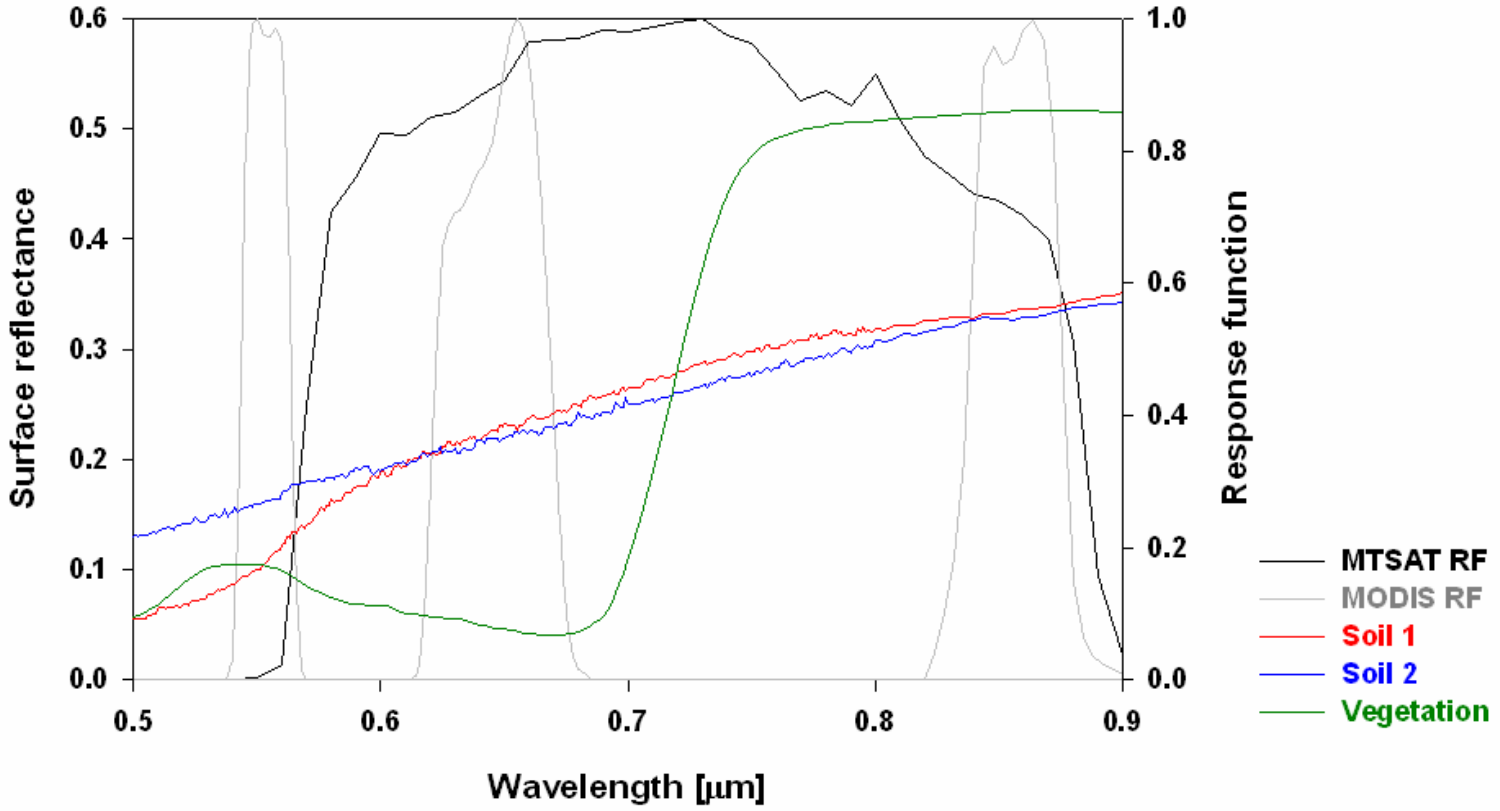


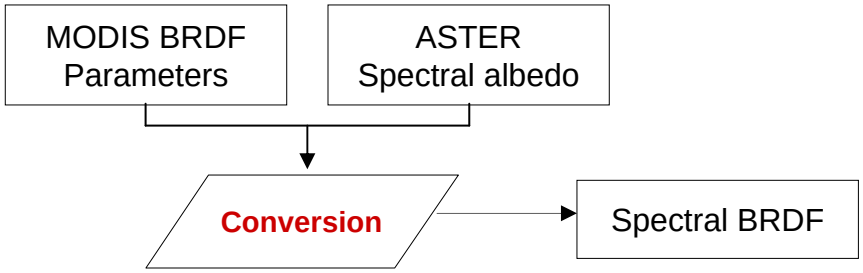
@ 555 nm

@ 670 nm

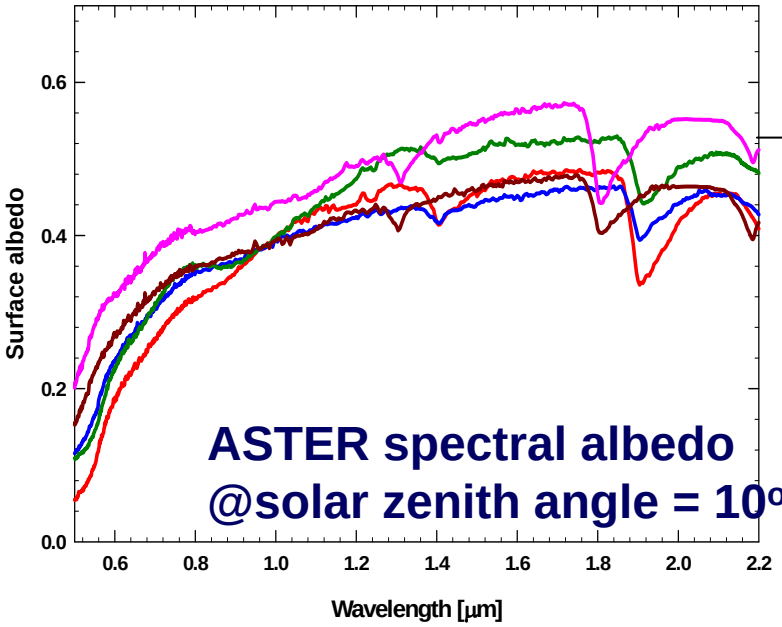
@ 765 nm

Spectral difference : MODIS vs. MTSAT 1R



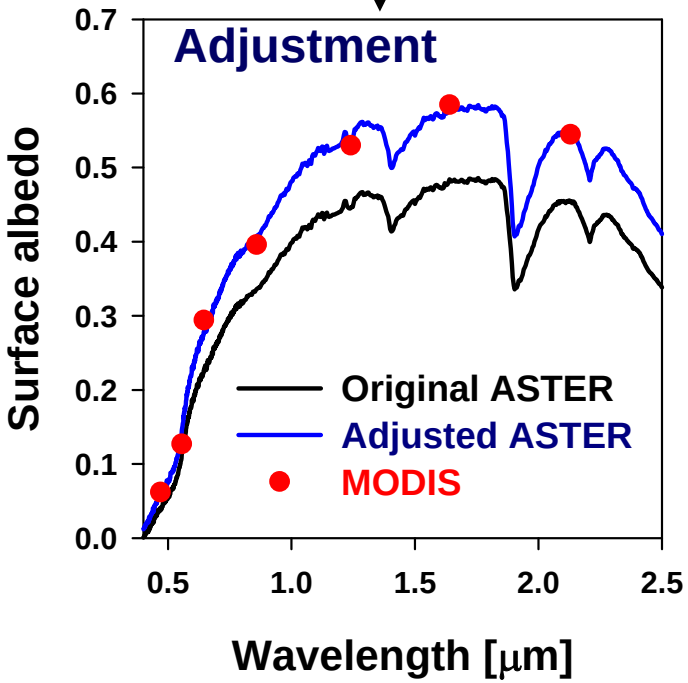


Spectral conversion



Type Selection

$$\bar{\alpha}_{MODIS} = m\bar{\alpha}_{ASTER} + b,\ R^2$$



$(\theta_s, \theta_v, \phi)$

Spectral BRDF parameter

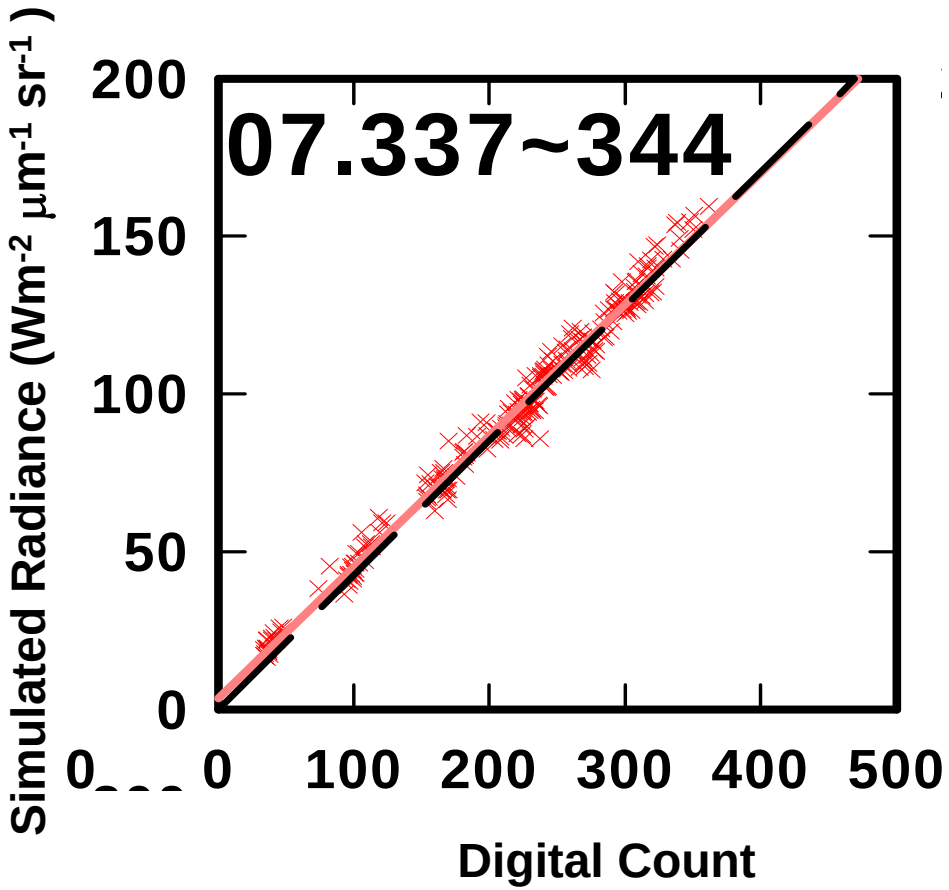
$$f_{iso,vol,geo}(\lambda, \text{target}, \text{time})$$

α_λ

Application to MTSAT 1R

MODIS BRDF Products

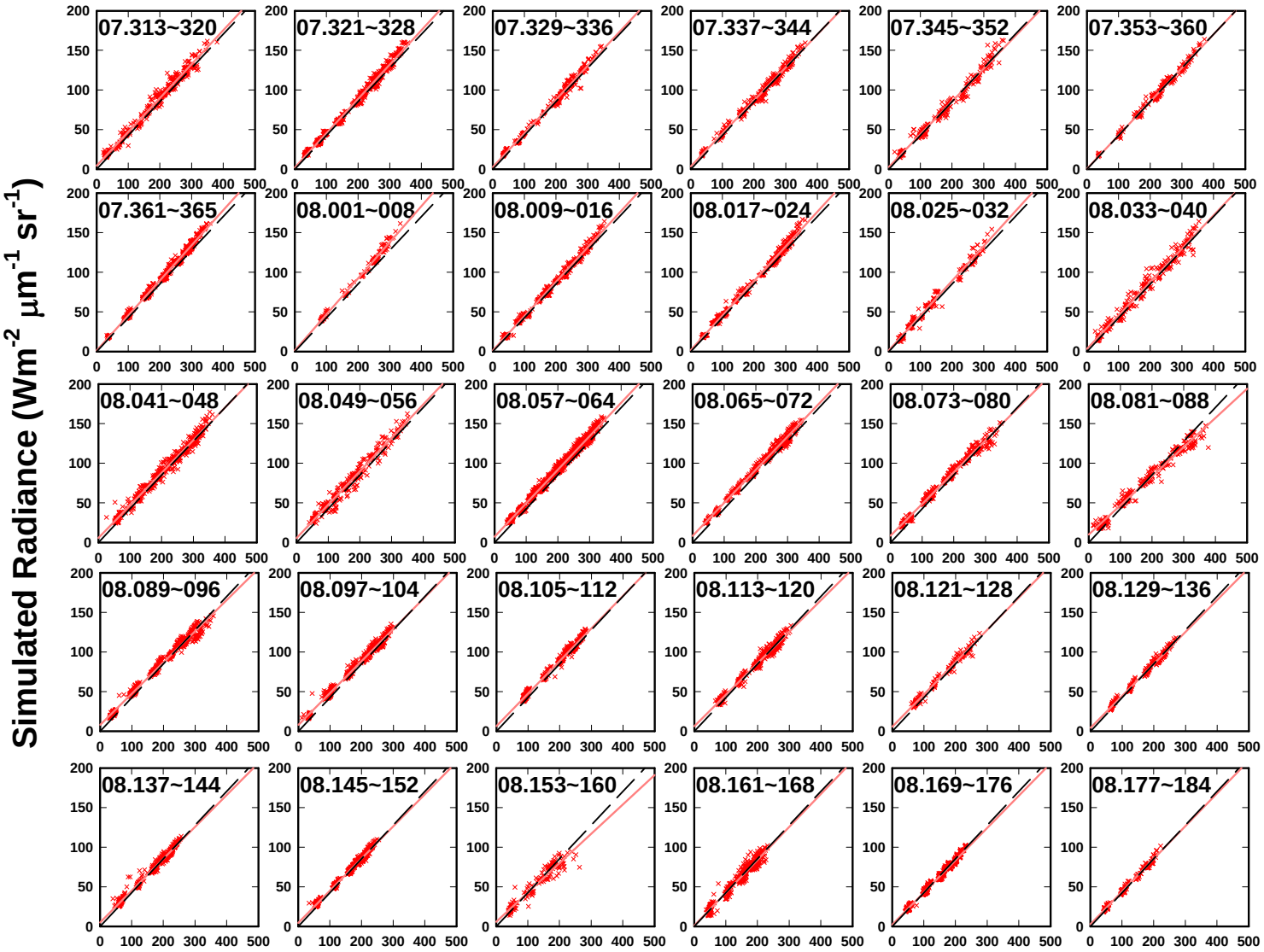
- MODIS BRDF parameters (MOD43C1) converted spectral BRDF parameters
- Temporal resolution : every 8 days
- Spatial resolution :0.05° X 0.05°



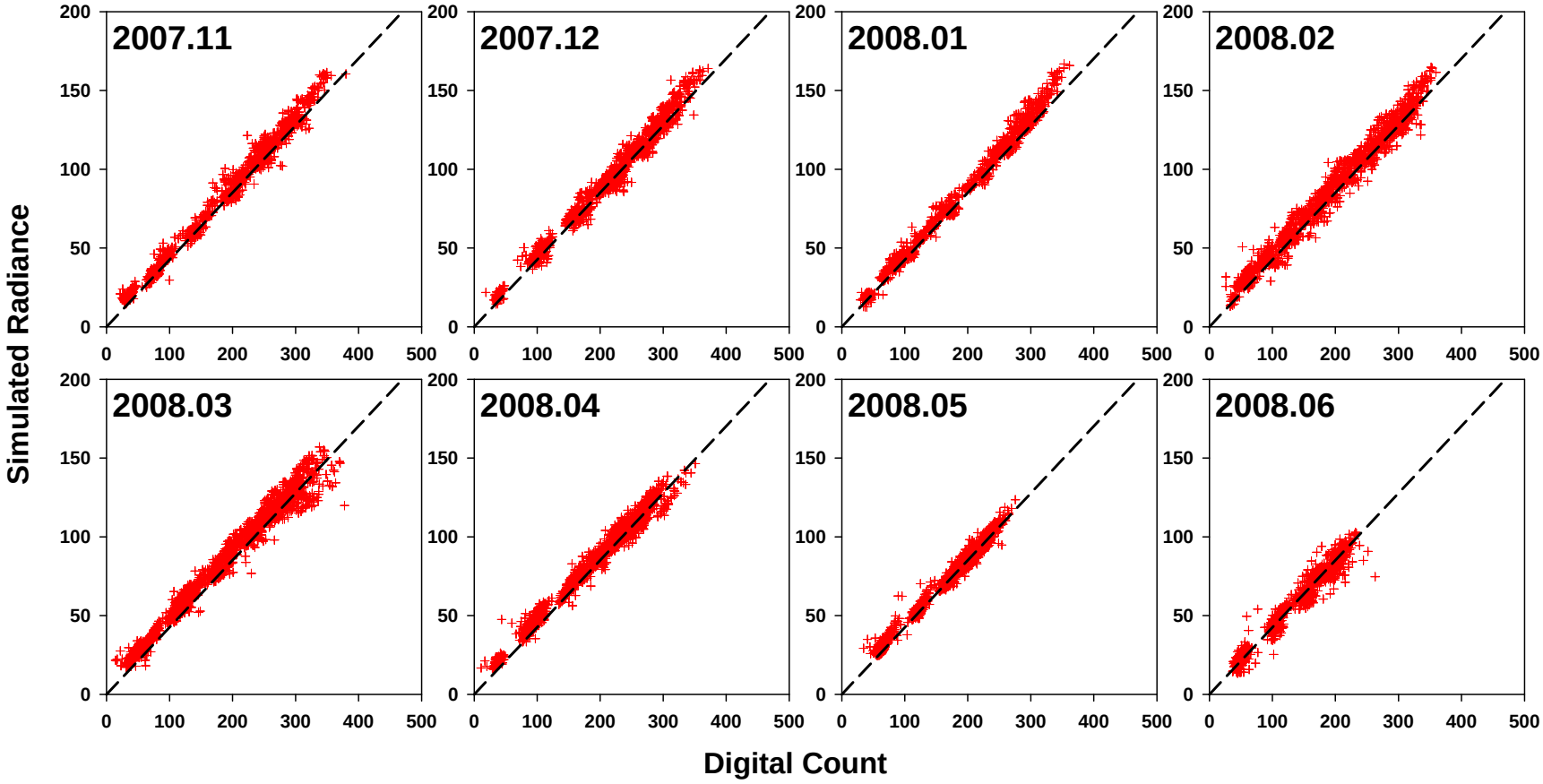
MTSAT 1R HRIT

- Full disk observation
- Geometric and radiometric calibration done
- 10 bit, (Digital count from 1 to 1024)
- Spatial resolution 1 X 1 km^2

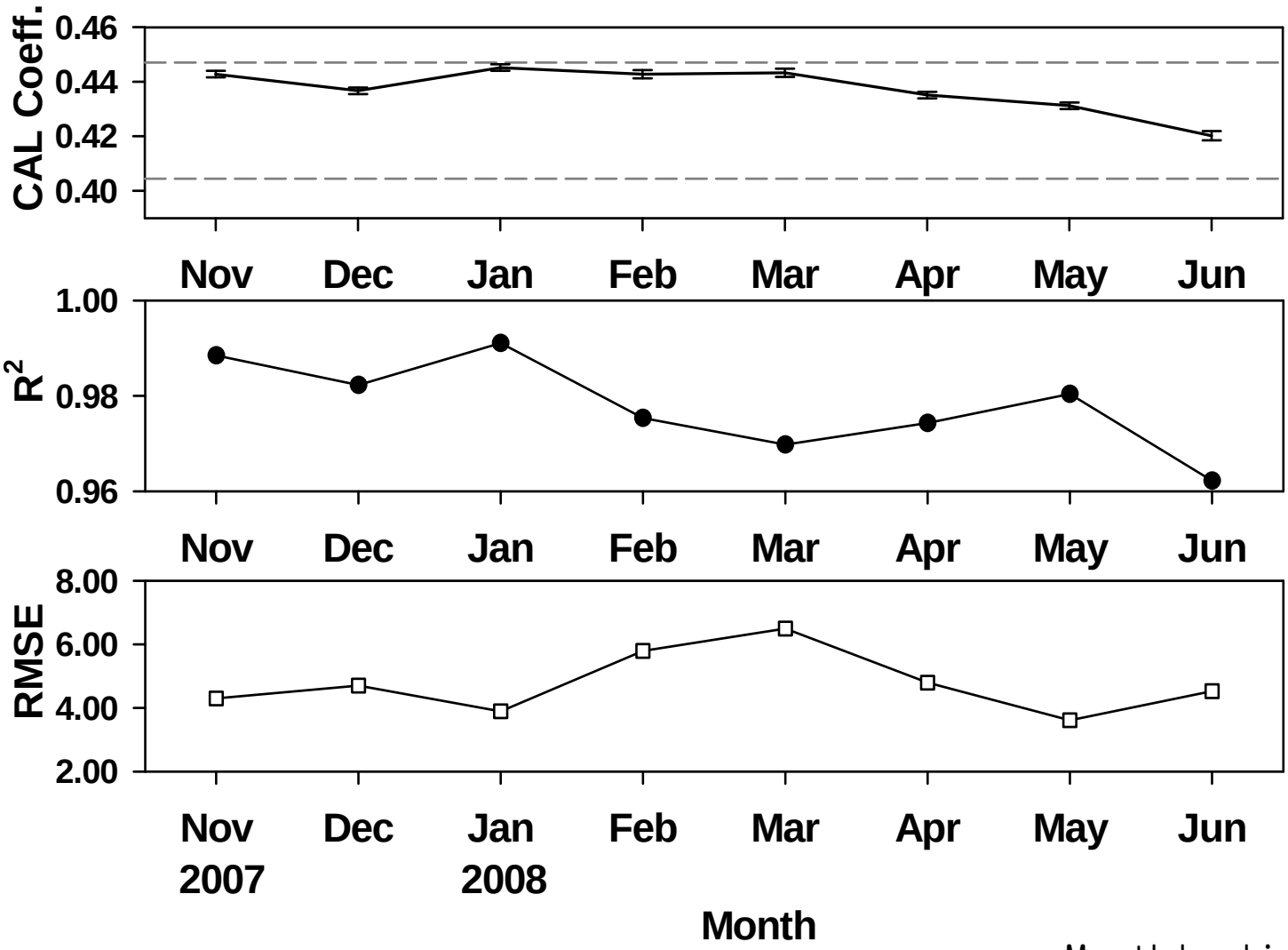
MTSAT 1R Radiance vs. Digital count



Simulate radiance vs. Digital count

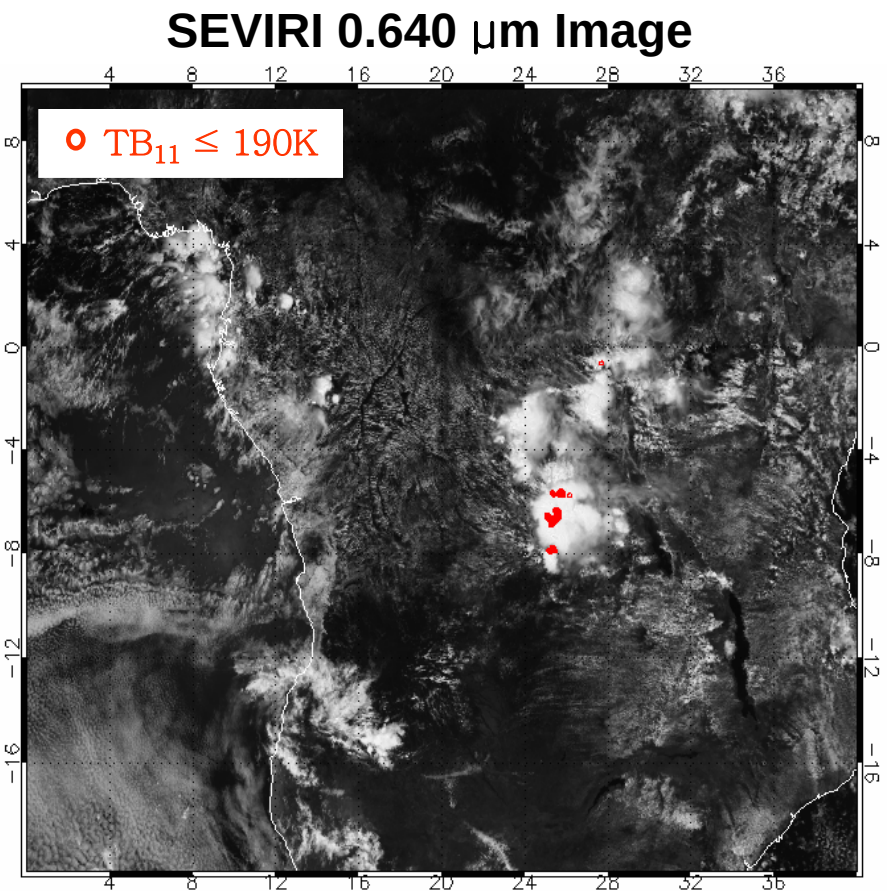


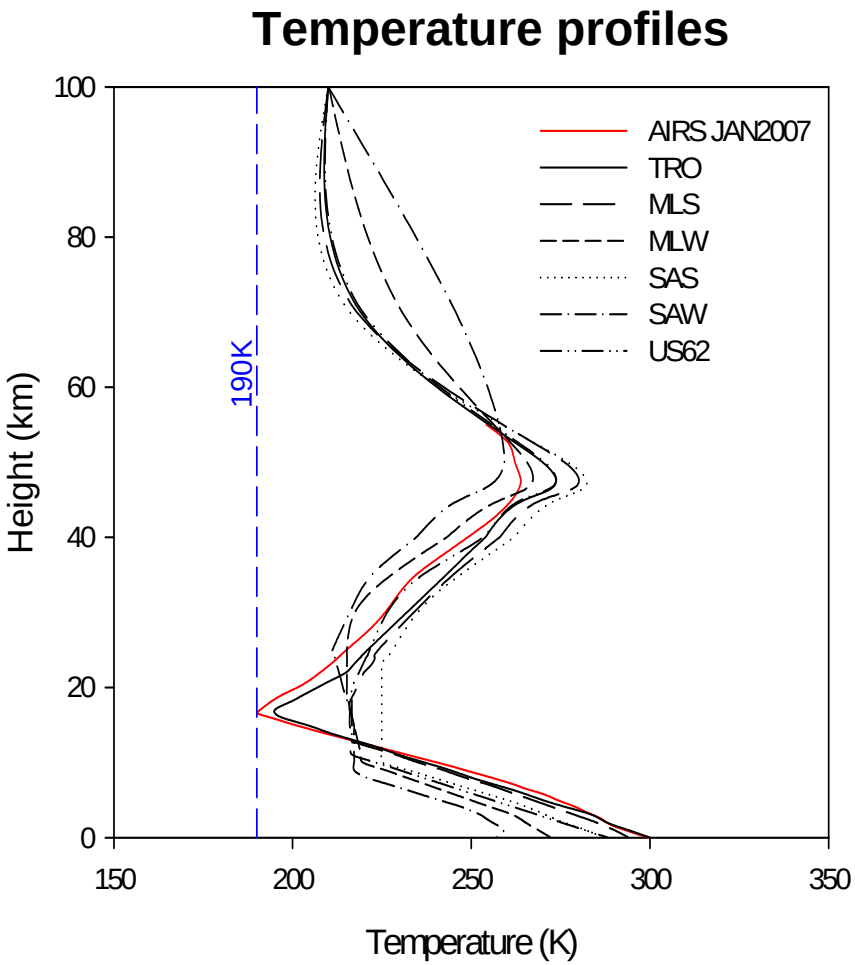
---------- **JMA provided Calibration coefficients**



Monthly linear regression
with a fixed intercept as 0

Selection of DCCs

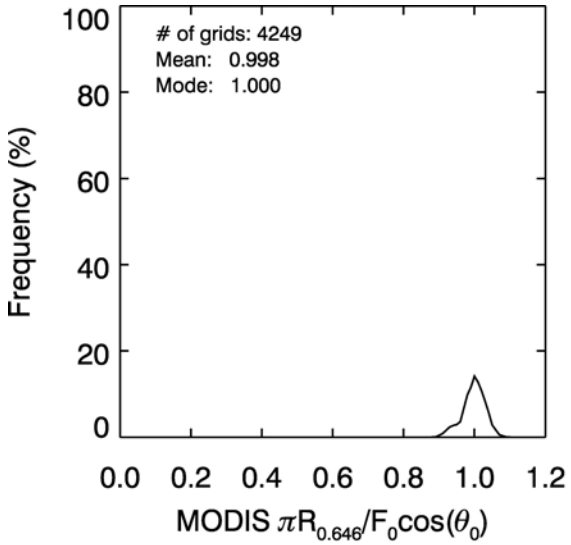


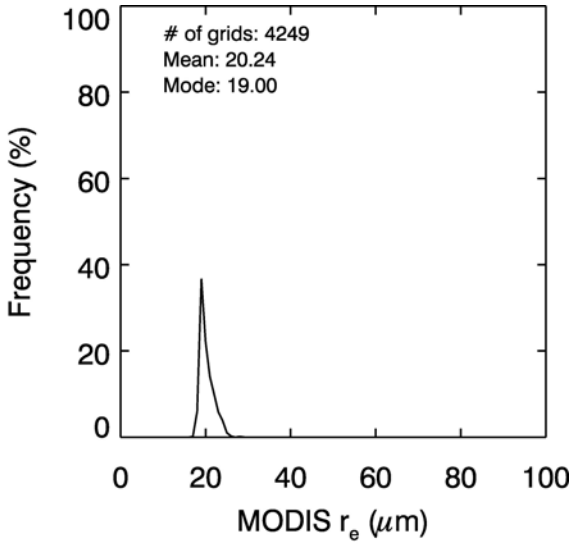


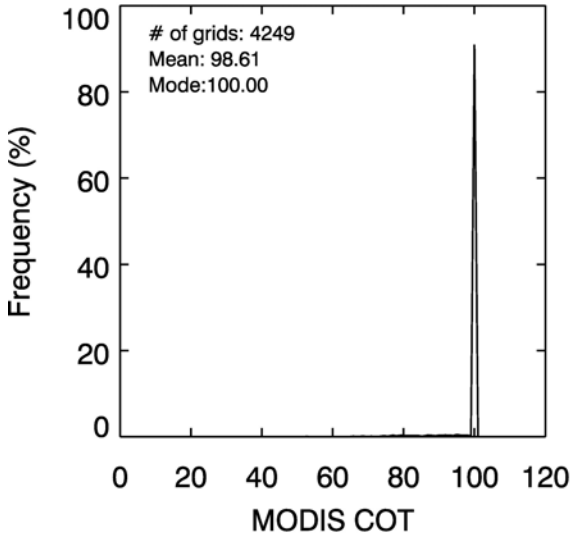
Considering seven temperature profiles, cold CTT less than 190K can be explained only by DCCs involving strong upward motion lacking of exchange with environmental air.

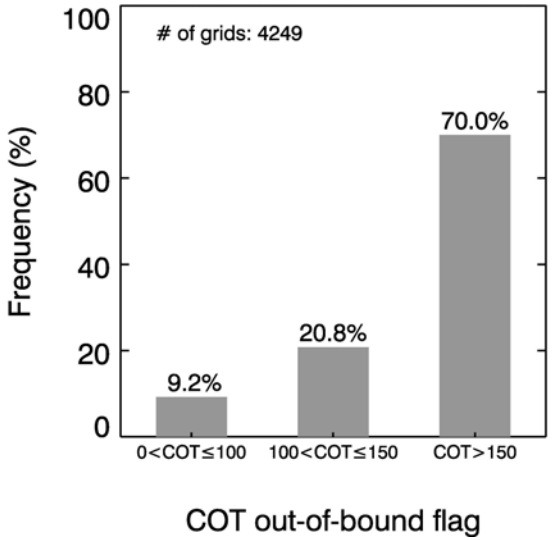
COT, Re Characteristics of DCCs (TB ≤ 190K) from MODIS

Criteria: $TB_{11} \leq 190K$, $STD_{9\times9}$ of $TB_{11} \leq 1K$





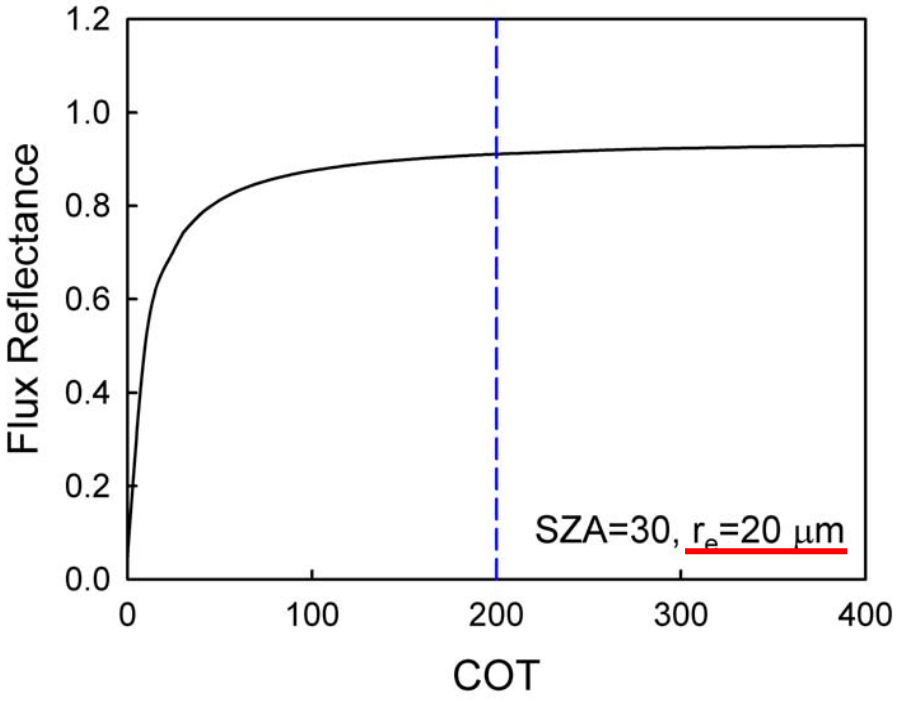


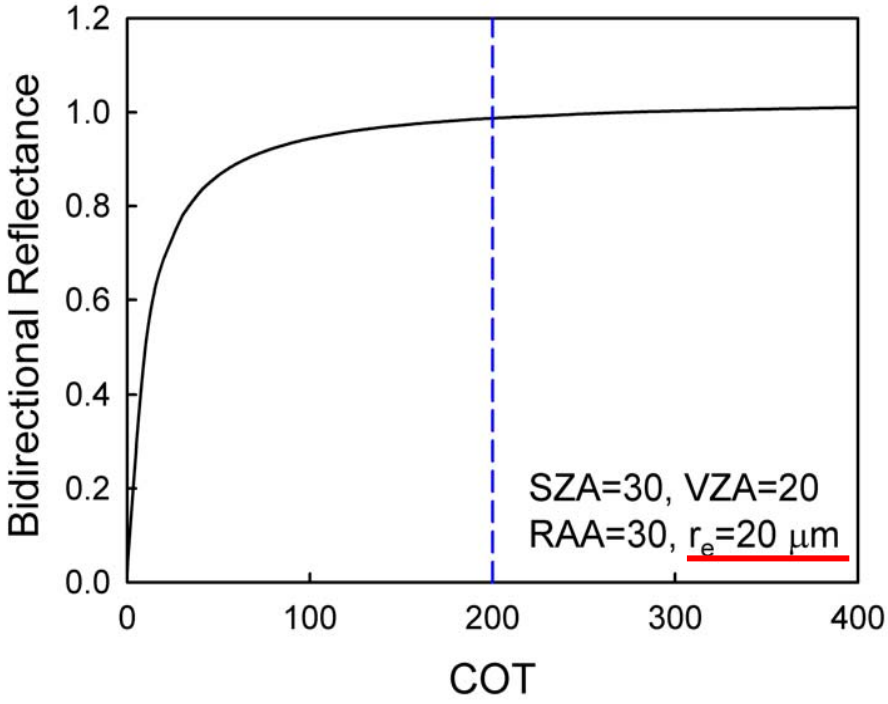


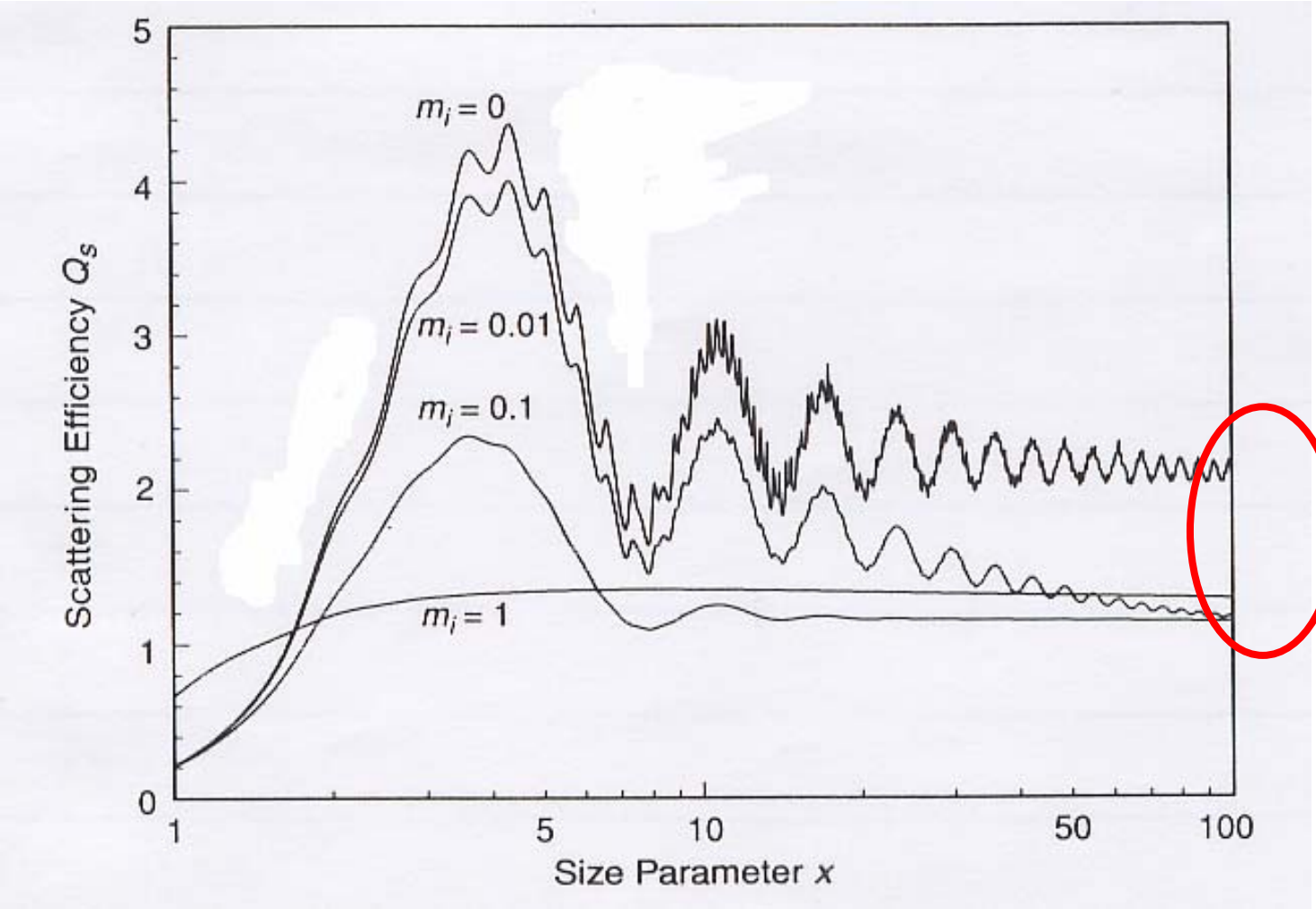
More than 90% pixels show COT=100, which means that real COT could be larger than 100.

About 70% of pixels show COT > 150.

Sensitivity of 0.646 μm reflectance to COT





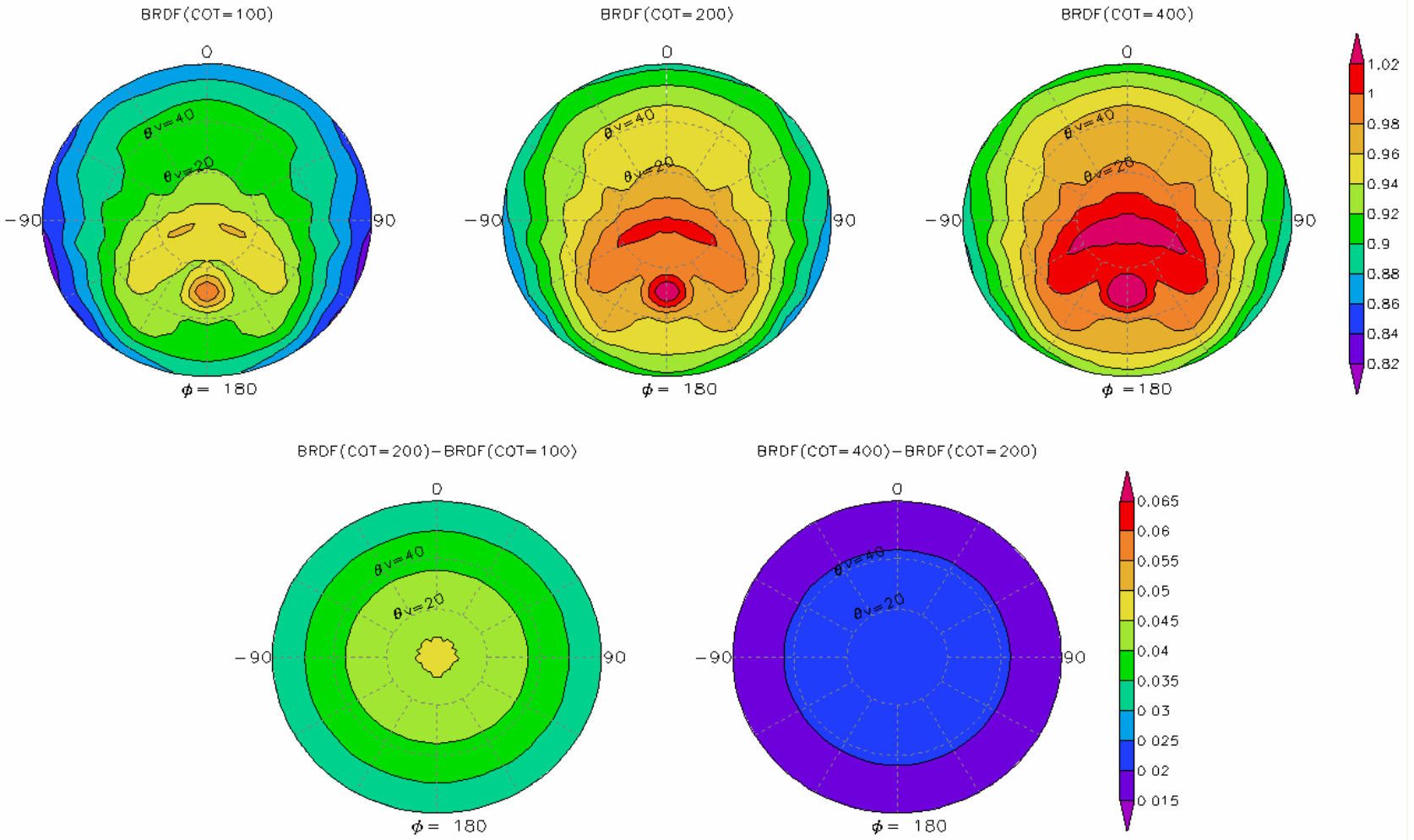


@ $\lambda = 0.64\ \mu m$ $r_e = 15\ \mu m$, → x =150

$r_e = 20\ \mu m$, → x = 200

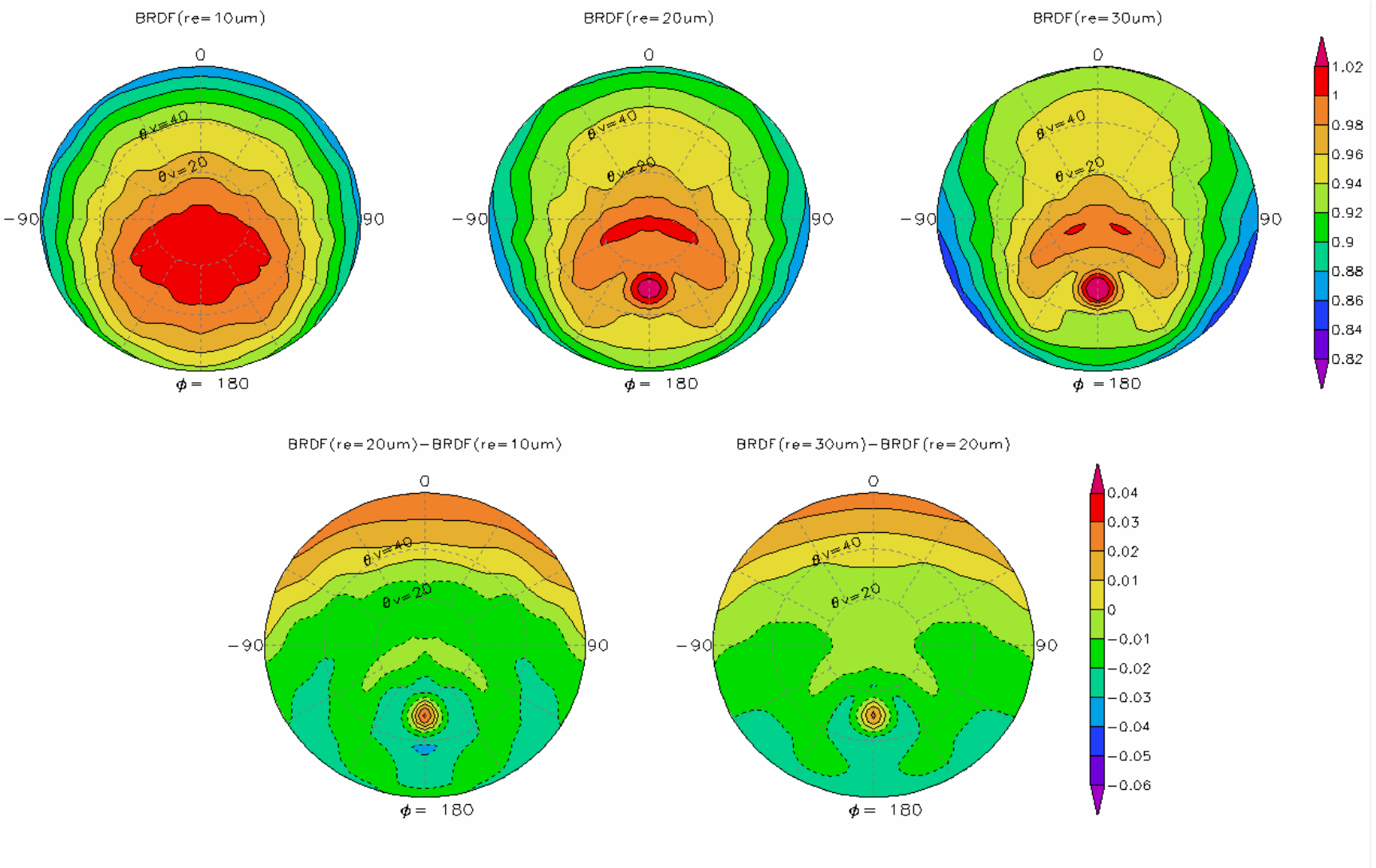
$r_e = 25\ \mu m$, → x = 250

Sensitivity of 0.646 μm reflectances to COT (SZA=30°)



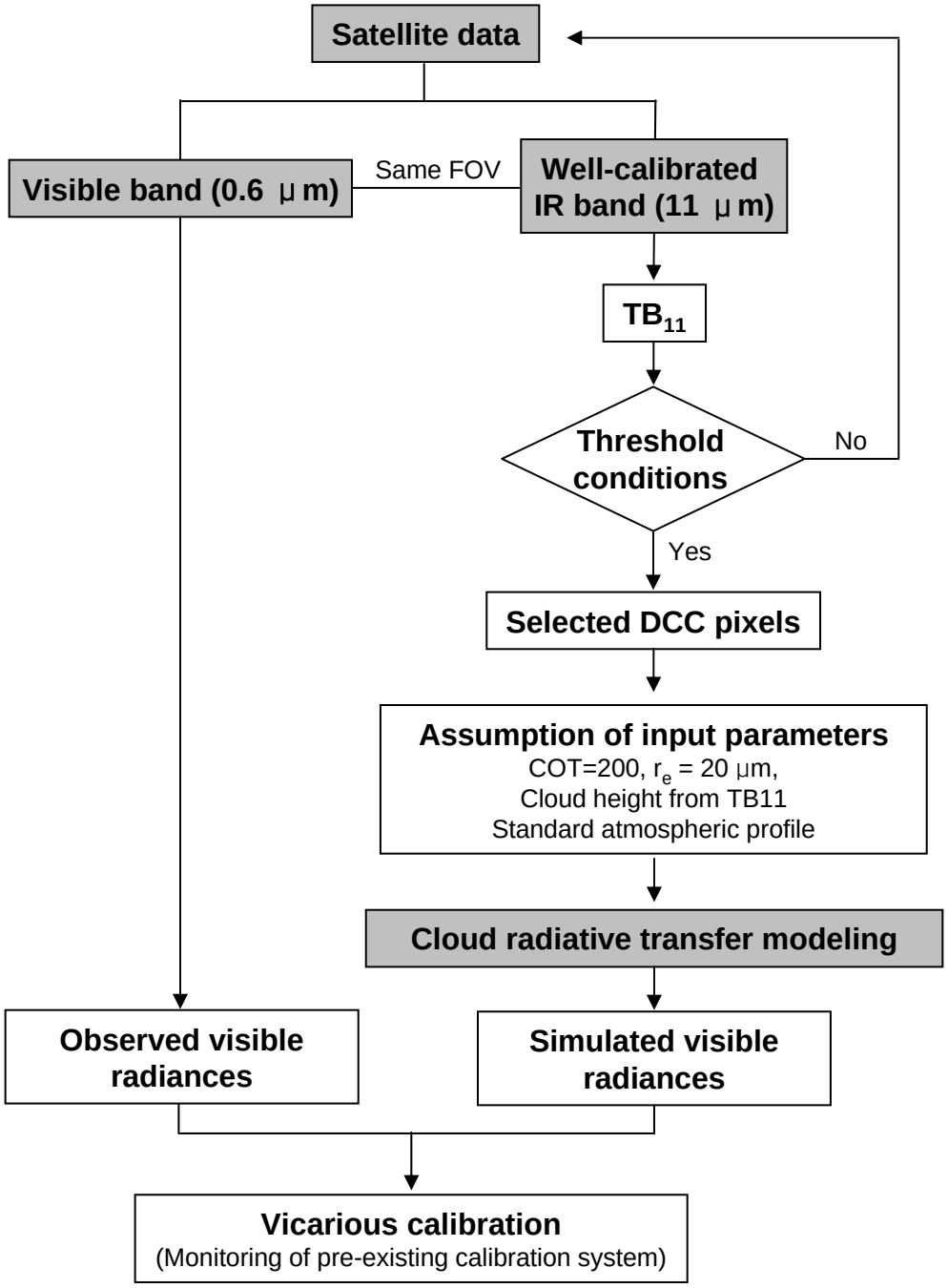
→Cloud bidirectional reflectance distribution function (BRDF) varies up to 5% when COT increases from 100 to 200 while BRDF changes up to 2.5% when COT increases from 200 to 400.
→ If we assume the COT to be 200 while real COTs range from 100 to 400, then BRDF error caused by uncertain COT values would be less than 5%.

Sensitivity of 0.646 μm reflectance to r_e (SZA=30°, COT=200)



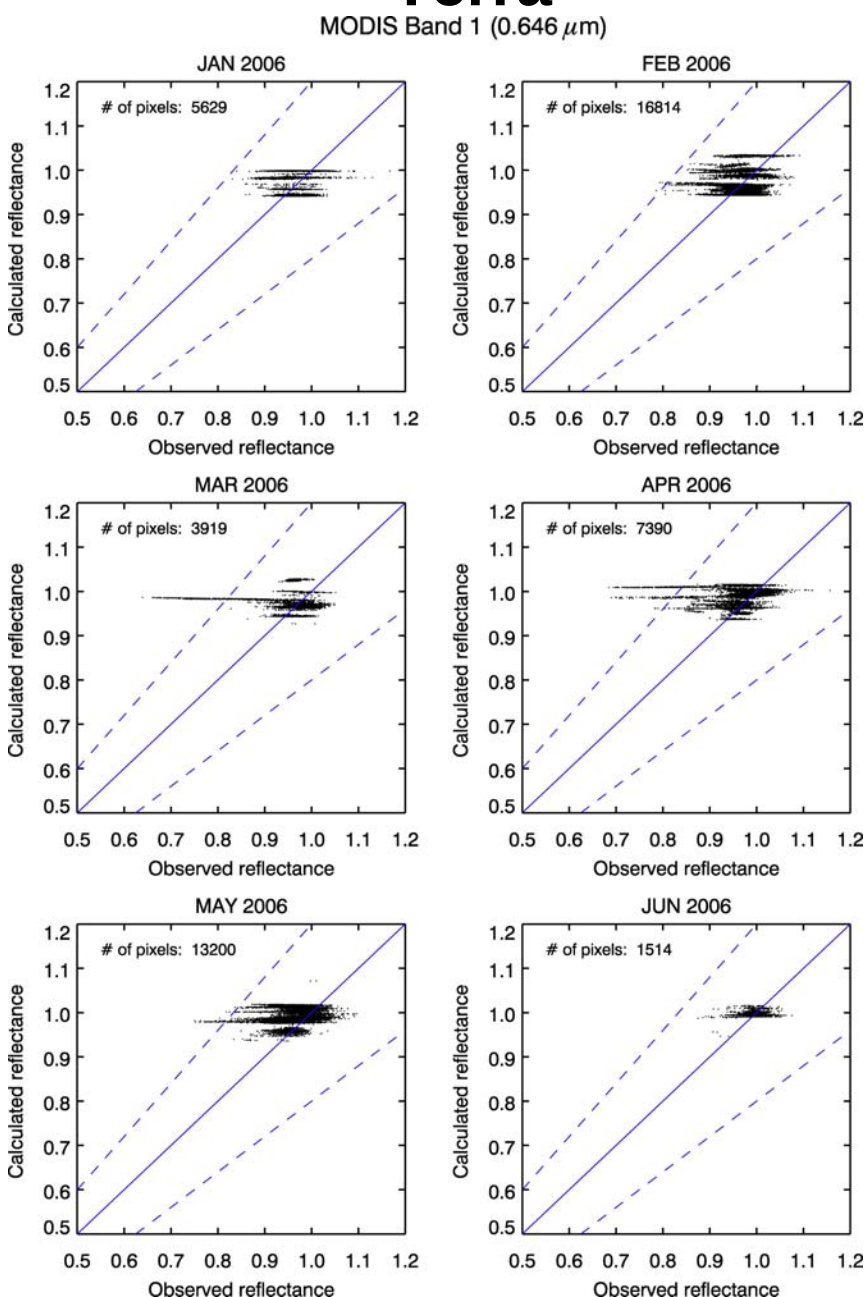
Error range < ±2%

DCC-based vicarious calibration for visible channels

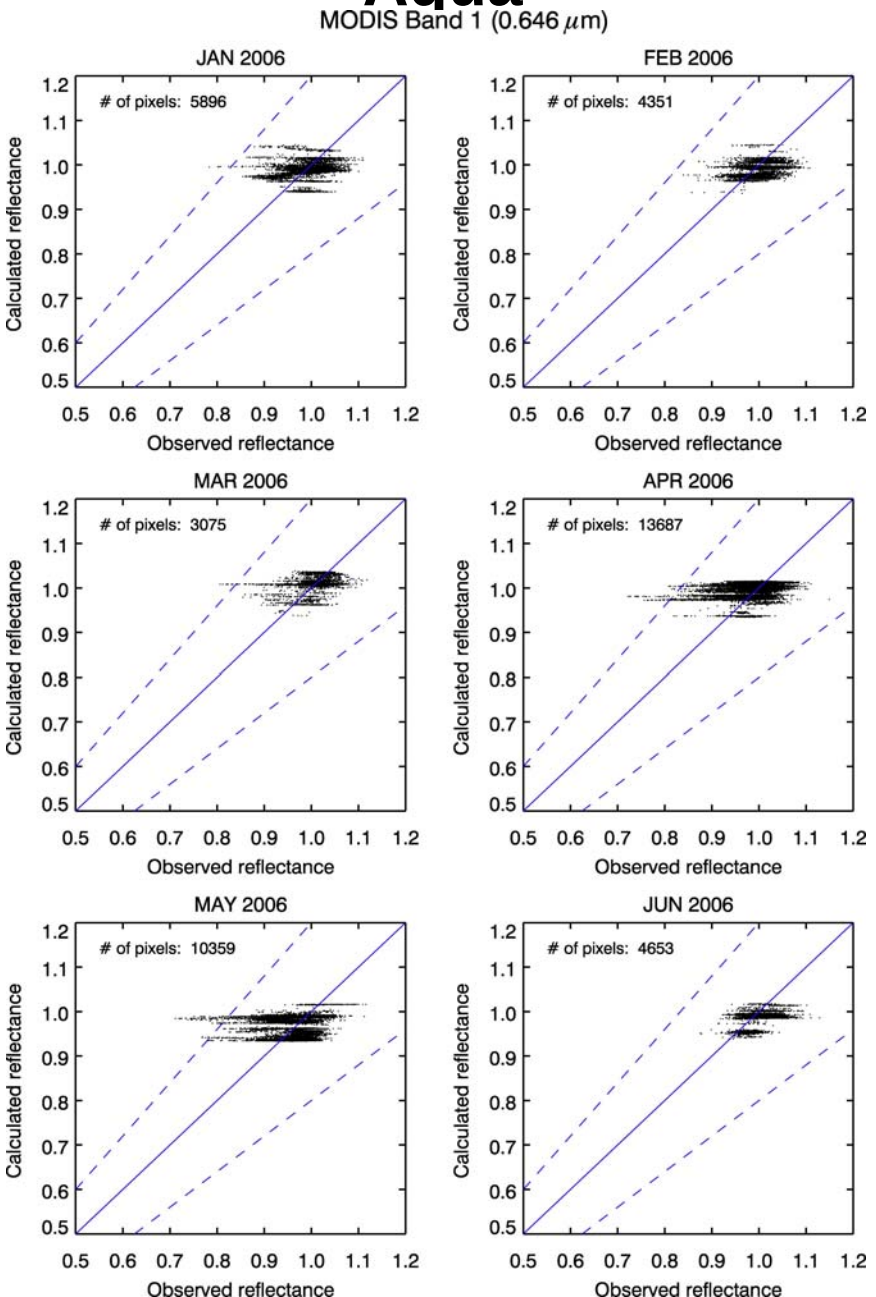


Simulated MODIS reflectances (r_e=20 μm, COT=200)

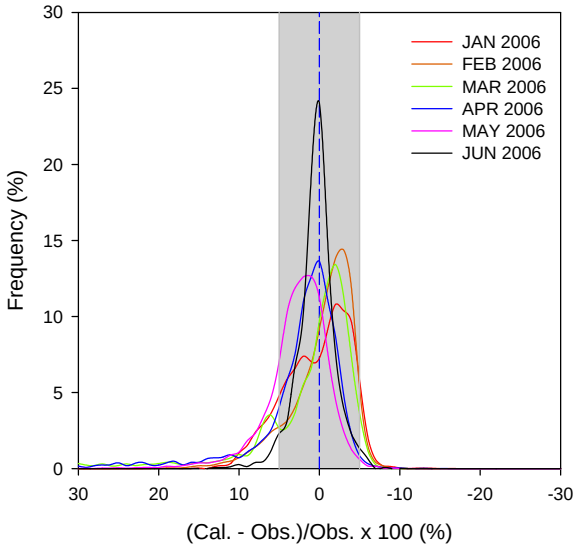
Terra



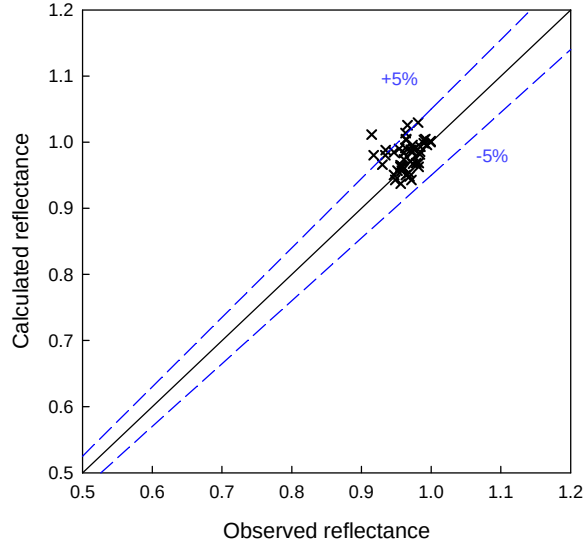
Aqua



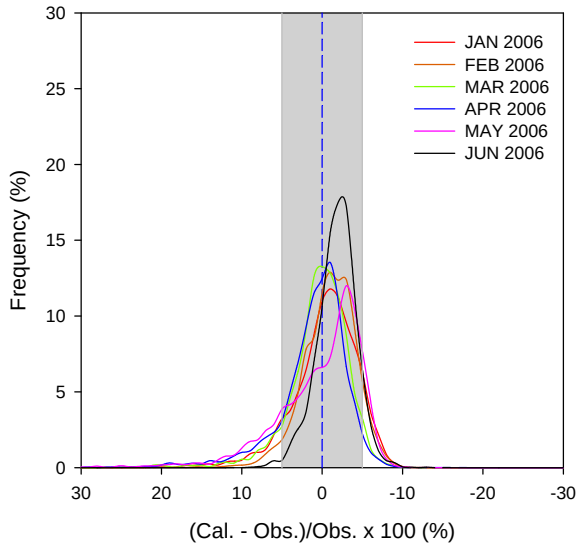
Terra



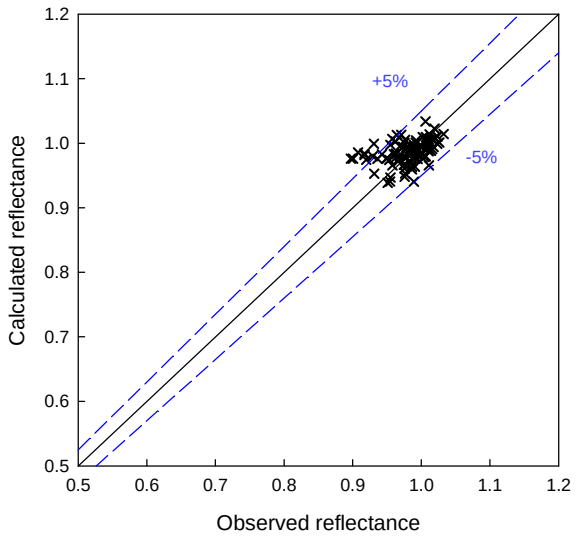
MODIS Band 1 (0.646 μm)



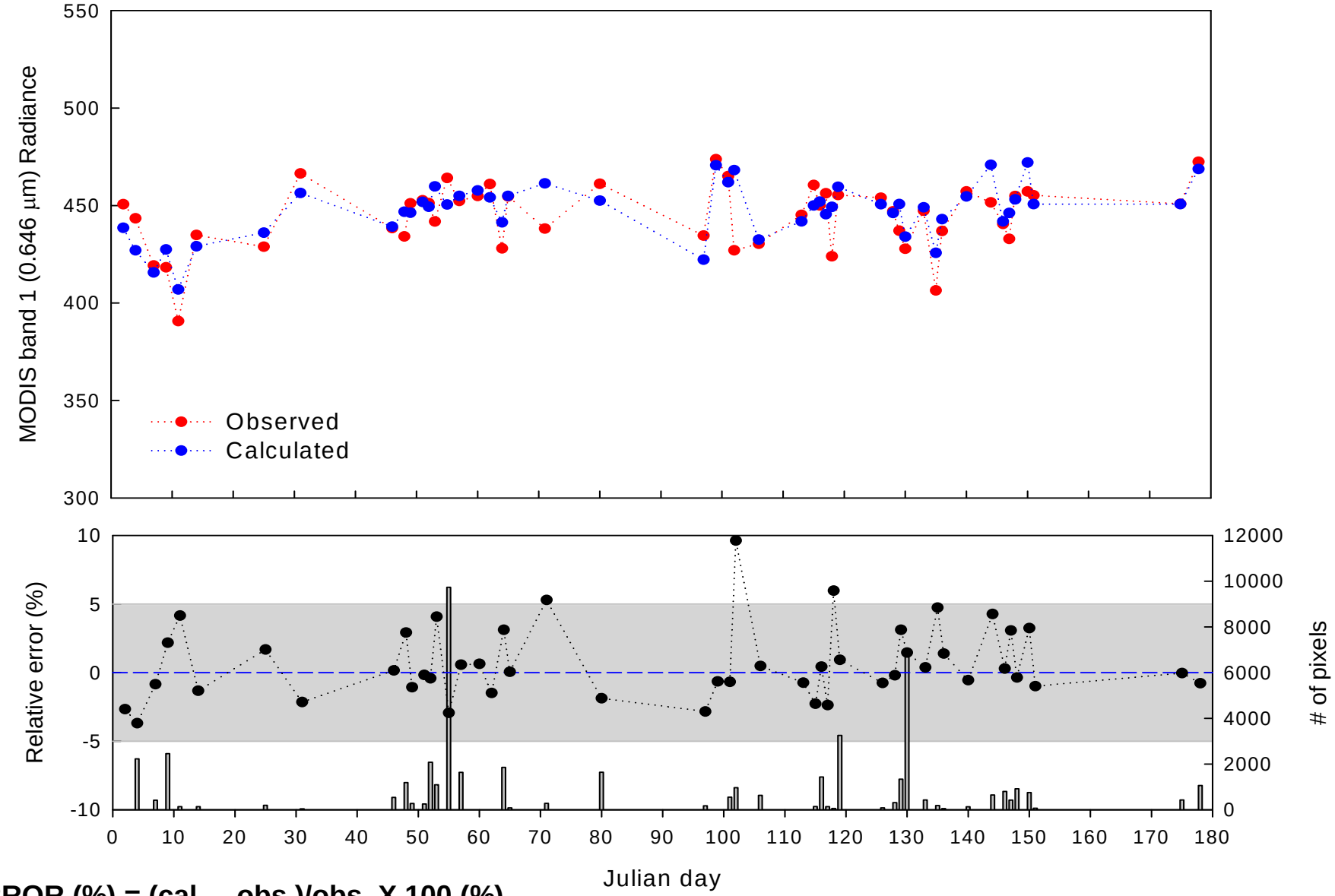
Aqua



MODIS Band 1 (0.646 μm)

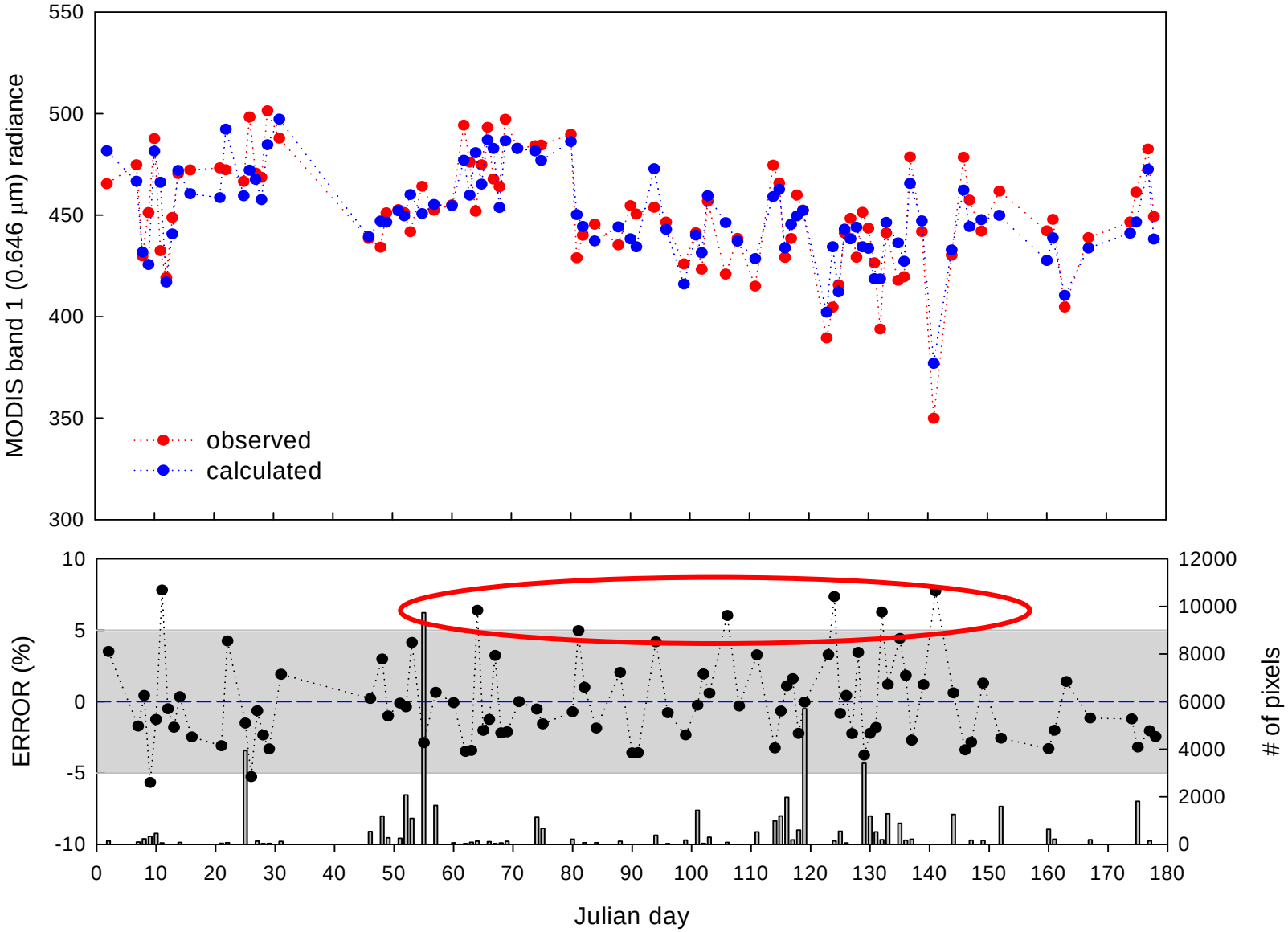


Time series of simulated vs. observed MODIS radiance (Terra)



ERROR (%) = (cal. – obs.)/obs. X 100 (%)

Time series of simulated vs. observed MODIS radiance (Aqua)



ERROR (%) = (cal. – obs.)/obs. X 100 (%)