Examining the Calibration Performance of Communication, Ocean and Meteorological Satellite (COMS) Visible Channel Using Cloud Targets

1Seung-Hee Ham (hamsoong@gmail.com), 2BJ. Sohn (sohn@smu.ac.kr), 3Minjin Choi (minjin@smu.ac.kr), and 4Young-Chan Noh (noyc012@snu.ac.kr)
1NASA Langley Center, Virginia, USA, 2Seoul National University, South Korea

Solar-channel calibration of Korean geostationary satellite, Communication, Ocean and Meteorological Satellite (COMS), is assessed from three vicarious methods using cloud targets. Firstly, a ray-matching technique is used for collocated targets having the same solar and viewing geometries, while Moderate Resolution Imaging Spectroradiometer (MODIS) 0.6-μm channel serves as a reference. Secondly, collocated MODIS cloud products are used as inputs to a radiative transfer model (RTM) to produce COMS visible channel reflectances for moderately thick cloud targets. Lastly, deep convective cloud (DCC) targets are chosen based on COMS (RTM) to produce COMS visible channel reflectances for moderately thick cloud targets. All three methods suggest a similar degree of biases around 9–10% in COMS visible reflectances.

Method 1: Ray-matching Method
- Threshold conditions of coincident & collocated pixels between reference sensor and COMS
  - MODIS 0.6-μm channel as a reference
  - 0.5° grid format
  - Viewing azimuth angle (VZA) ≤ 5°
  - Viewing zenith angle (VZA) ≤ 15°
  - Time ≤ 5 min
- Spectral relations between two channels
  - Radiative simulation is performed to obtain relation between two channels, under various conditions of solar and viewing geometries and cloud properties.

Method 2: Cloud simulation using MODIS cloud products
- Threshold conditions of cloud targets
  - 0.5° grid format, ATIME ≤ 5 min
  - Overcast grid over ocean
  - Cloud top optical thickness (COT) ≤ 99
  - Cloud top temperature (CTT) ≤ 227 K or CTT ≥ 273 K
- RTM inputs
  - Ocean BRDF, Tropical profiles, and MODIS cloud properties such as COT, cloud top pressure, and effective size.

Lognormal-independent column approximation (LN-ICA) (Oreopoulos and Davis, 1998) is applied to resolve subgrid variation of COT. This method finds the closest LN function to the actual distribution of COT, and then integration is performed to get grid-averaged reflectance (Ham and Sohn, 2010).

Method 3: DCC simulation method
- Threshold conditions of DCC targets
  - TB11 < 190 K, TB11: brightness temperature at 11-μm channel
  - STD(TB11) ≤ 1 K, STD(TB11): standard deviation (STD) of TB11 over surrounding 10 km x 10 km area
  - STD(R0.6) ≤ 0.03, STD(R0.6) and E(R0.6): STD and mean of visible reflectance (R0.6) over surrounding 10 km x 10 km area

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Summary
- Ray-matching method and two cloud modeling methods are developed and applied to COMS visible channel.
- In the results from three methods, it is shown that reference values of COMS reflectances are always higher than COMS Level 1B reflectances, suggesting low biases (9~10%) of COMS Level 1B visible reflectances.