INTRODUCTION

The Medium Resolution Spectral Imager (MERSI) and Visible Infrared Radiometer (VIRR) are two major multi-spectral imaging instruments onboard the second generation solar orbiting meteorological satellite Fengyun-3 (FY-3) in China. The VIRR is inherited from Multispectral Visible Infrared Scanning Radiometer (MVISR) of the first generation solar orbiting meteorological satellite (FY-1). The Fengyun satellite historical dataset reprocessing project carried out the task of FY-1/3 VIR and MERSI reprocessing to generate the long time series data record. The on-orbit radiometric response changes of FY-1/3C VIRR, FY-3A/B/C VIRR and FY-3A/B MERSI reflective solar bands are derived using stable target tracking such as desert, ocean and cloud. The long-term radiometric quality is evaluated using multisite calibration tracking (MST), deep convective cloud (DCC) and simultaneous nadir overpass (SNO) methods. The dataset is re-calibrated mainly using the daily coefficients derived by MST. It shows that the long-term varying of sensor radiometric response is corrected and the radiometric stability is improved.

METHOD

- **Evaluation:**
  1. Comparison with radiometric references: radiometric references : PICs (desert/ocean/DCC), reference instrument(SNO).
     \[ \text{Relative error} = \frac{\text{Mea} - \text{Ref}}{\text{Ref}} \times 100\% \]
  2. Find instrumental characteristics.
  3. Correction for the response time variation: MST trending model.
  4. Correction for other potential issues: stray light, nonlinearity, temperature dependence.
  5. Correction for the radiometric bias : MODIS-FY-3-FY-1.

RESULTS

- **Sensor Normalized Response**
  Sensor response was derived using MST and DCC methods. For VIRR, it showed faster attenuation at smaller wavelength and obvious seasonal variation at 865nm. For MERSI, it showed large degradation at short wavelength and 1030nm. For both VIRR and MERSI, there was larger seasonal change for FY-3B.

- **Calibration Performance**
  The dataset is re-calibrated using the daily coefficients derived by MST. The re-calibrated TOA reflectance was evaluated using SNO and stable targets. The lifetime stability and inter-platform consistency were improved.

SUMMARY

Vicarious methods are used to evaluate the FY-1/3 VIR B & MERSI RSB data performance and correct the time variation of instrument response. The data performance could be improved after re-calibration simply using the MST trending result, while the absolute accuracy may be improved. The time factor in re-calibration model needs to be adjusted, especially for the early phase in orbit and blue bands. The seasonal features in normalized response and PDF time series reveal unresolved issues related to instrumental characteristics, such as stray light, nonlinearity, temperature dependence, etc. Result differences between MST, DCC, SNO need to be investigated to obtain consistency.

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