

Abstract: **In-orbit references for Global Space Based Inter-Calibration System**

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On-orbit references play a vital role in the Global Space Based Inter-calibration System (GSICS). GSICS member agencies have used IASI-A AIRS (for Infrared) and EOS MODIS (for Visible) as the on-orbit references to monitor their GEO (SEVIRI, GOES, & MTSAT) and LEO (AVHRR) instruments. The main idea is to select a reference instrument that has very stable and accurate global mean (temporal and geographical) measurements of the Top of Atmosphere radiance and inter-compare the monitored instrument to them.

While this approach is able to select a reference instrument and empirically correct mean biases in the monitored instrument. This assumption is not enough if one were to re-calibrate the monitored instrument in-order to permanently correct any biases. For a re-calibration one needs to know the cause of the biases for which it is important to select a reference instrument with minimal scan angle dependence of measurements, minimal temperature dependence bias and an extremely high stability so that its inter-comparison with monitored instrument is able to reveal these biases in the monitored instrument and give more insights into in-orbit calibration defects. Possible anomalies in the reference instrument also need to be taken into account.

The first goal of this presentation is to present a GSICS reference selection criterion (Weng 2016, Bali 2016) that uses stringent (evaluates scan angle, spectral, temperature and time dependent biases) conditions of candidate references to select reference instrument. We apply this on selection of IR and Microwave instruments and show that IASI -A, AIRS and CrIS fulfill our selection criterion. For the Microwave we show that Fundamental Advanced Microwave Sounding Unit (AMSU-A)/Microwave Sounding Unit (MSU) Fundamental Climate Data Record (FCDR, Zou 2016) meets many of the selection criteria and can act as a robust reference for monitoring the ATMS

instrument. We would also suggest a path forward to mitigate the impact of anomalies in reference instrument on inter-comparison results and suggest the use of 'reference records' (Flynn and Bali, 2016) instead of directly using L1 radiances.