Exploring the Inter-Field-of-Regard Radiance Differences of S-NPP/CRIS

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Abstract

The Cross-track Infrared Sounder (CrIS) onboard the S-NPP (NPOSS Preparatory Project) satellite has been working for almost two years. Its Sensor Data Record (SDR) product has been approved as a 'mature product', which means all significant bugs are fixed and it is time to do fine tuning. The extremely low-noise feature of this instrument makes it possible to be a baseline for climate change study and for inter-calibration with other instruments. Since each cross-track scanning contains 30 field-of-regards (FORs) and each FOR contains 9 field-of-views (FOVs), as a first step, the inter-FOV (FOV2FOV) and inter-FOR (FOR2FOR) radiance differences are evaluated in this study, using 10-month re-processed SDR dataset, together with the latest version of engineering packet (v36).

The S-NPP CrIS SDR data between Jan 1st, 2013 and Oct 31st, 2013 are re-processed with ADL8.1. To minimize the contamination from cloud, uneven surface and scan angle, only clear sky scenes of two nadir views, i.e. FOR15 and 16, over water surface between ±60 Lat. are in consideration. Selecting clear sky scenes is based on some tests adopted in MODIS cloud detection algorithms. The minimal 11-micron brightness temperature (BT) is set at 284K to remove warm water clouds. 75252 and 75907 samples are found for FOR15 and 16 respectively. Radiances are Hamming apodized before converted into BT.

For all three bands, FOV2 is the best rep of the scene. For LW, in general, the FOV2FOV difference is less than 50 mK in most absorbing channels and is less than 20mK in window channels, and corner FOVs are noisier than side FOVs. For MW, the FOV2FOV difference is less than 50mK in the low frequency end and it increases to about 100 mK in the high frequency end for all FOVs except FOV7. Such a ringing pattern indicates a phase shift and it should be further studied. For SW, the FOV2FOV difference is less than 0.2K except at around 2380 nm, where the bias can go up to 0.8K. The difference anomaly at 2380 nm is negative in FOV1/3/5 and positive in FOV3/6/7/8/9, indicating an asymmetric pattern of the scenes on the focal plane.

The FOR2FOR difference is in general, less than 20mK for all FOVs/Bands. The biggest difference is in the high frequency end of MW FOV8 where the forward scanning scene (FOR15) is 50 mK brighter than the reverse scanning scene (FOR16).

All of the BT differences discussed here are below the standard deviation.