DEIMOS-2 Post-launch Radiometric Calibration

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Abstract

On June 19 th , 2014 the DEIMOS-2 very-high-resolution Earth Observation satellite was successfully launched, and CAL/VAL activities began shortly after. Designed and developed by ELECNOR DEIMOS (Spain) in partnership with Satrec Initiative (South Korea), and operated by ELECNOR DEIMOS from its control center in Spain, DEIMOS-2 is the highest-resolution fully private satellite in Europe.

DEIMOS-2 is an agile platform, based on the SI-300 architecture which has flight heritage from Malaysia's RazakSAT and UAE's DubaiSat-1 and DubaiSat-2. Accurate and agile three-axis attitude control supports precise imaging operations. The payload, HiRAIS, is a push-broom type camera (TDI linear array) with 1 m Ground Sampling Distance (GSD) for a panchromatic band and 4 m GSD for four multi-spectral bands (NIR, red, green and blue), which produces 75-cm pan-sharpened imagery after ground processing. The 12-km swath can be increased to 24 km in the wide-area acquisition mode. A high performance solid-state recorder is installed to receive, process, store, and transmit the image data at high speed. During the transmission of the stored image data using X-band transmitter, the solid-state recorder compresses, encrypts, and encodes the data in real time. CAL/VAL activities were performed by Deimos-Imaging in cooperation with Satrec-I team. The post-launch calibration plan first addressed the task of validating the sensor's radiometric model, which was developed using pre-launch data. To do so we performed specific acquisitions to ensure that the sensor behavior was consistent with the laboratory characterization.

When the radiometric consistency was assured, we addressed the sensor absolute calibration. In our experience with DEIMOS-1 so far (since its launch in 2009) we have used data coming from confidence sources, like Landsat-7/ETM+ to cross-calibrate DEIMOS-1 and monitor sensor trending, complemented with vicarious data to validate the cross-calibration. The DEIMOS-2/HiRAIS sensor characteristics, especially its spectral response, require a new approach to the calibration procedures, since we lack of a confidence reference sensor to cross-calibrate. The methodology we use relies on pseudo-invariant calibration sites to perform the absolute calibration, being Libya-4 the main one. To do so we had to thoroughly characterize the sites beforehand, using EO-1/Hyperion hyperspectral data and other data sources, and comparing our results with similar characterizations found in the literature.

Once developed, we checked the new methodology and found good consistency using Landsat-8/OLI and DEIMOS-1/SLIM6 data, so we considered the procedure ready to be

used for the absolute calibration of the DEIMOS-2/HiRAIS. The methodology is also valid to monitor the sensor trending. Vicarious measurements are still needed to provide a strong confidence level to the absolute calibration based on PICS.

In this presentation we will show how we validated the DEIMOS-2/HiRAIS radiometric model, the method to characterize PICS with EO-1/Hyperion and other data sources, the comparison with similar characterizations found in the literature, the methodology validation using Landsat-8/OLI and DEIMOS-1/SLIM6 data, the results of the methodology applied to DEIMOS-2/HiRAIS.

Keywords - Calibration methodology and techniques