PAZ Status After First Year of Operation

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Abstract

PAZ mission is the radar part of PNOTS (Spanish National Program for Satellite Earth Observation) composed of an X-band SAR instrument and ground segment located at INTA (National Institute for Aerospace Technology) facilities in Madrid. The satellite was launched on February 22, 2018 and took its first image on March 13. The commissioning phase started on April 3 and lasted 5 months until September 6, when the system was officially declared operational.

After one year of operation, calibration activities have been performed in three lines: system monitoring, improvement of product performances and radiometric stability characterization:

System Monitoring has two main objectives: verification of nominal performances and the stability of the instrument in order to anticipate possible degradations. To accomplish them, a dual strategy has been defined:

• To command specific acquisitions for specific analysis: as pseudo-noise (PN) data takes to monitor Transmit/Receive Modules or rainforest data takes to survey the antenna pattern. Thus, one PN data take acquisition is ingested daily in the system to check the TRM status and three acquisition per cycle (11 days) are ingested for pattern analysis, covering near, center and far incidence angles.

• To use all acquisitions to analyze general parameters, like replica or raw data statistics, allowing us maximize the available data without increasing the satellite use. During 2019, around 6000 acquisitions were analyzed, showing a system behavior with all parameters with values within the limits specified. Only a small increasing in the variation of the error in some TRMs is detected.

Improvement of product performances, focused on Geometric and Radiometric characterization:

During Commissioning Phase, Azimuth Shift characterization over INTA reflectors showed different deviations depending on the orbit direction, being corner reflectors detected after or before than expected. This problem was already stated by Balss et al. (DLR) in “Recent

Advances in Pixel Localization Accuracy" (CEOS 2011), and it was caused due to a mismatch between the reference frame used in reflectors coordinates and orbit coordinates. Updating corner reflectors coordinates to the right international reference frame, first azimuth shift measurements and pixel location accuracy have been improved.

Pixel location accuracy analysis are also being extended to detected and geocoded products. A first characterization of their location accuracy is currently been carried based on INTA corner reflectors measurements performed during Commissioning Phase.

With respect to radiometry, a correction of channel imbalance has been performed at reference subarray level for VV polarization. Preliminary verification has been carried out of a reduced group of beams, improving channel imbalance characterization down to 0.04dB in amplitude and 0.2 degrees in phase.

System radiometric stability characterization:

A radiometric calibration campaign has been carried out during three months to verify radiometric stability of the instrument. In order to maximize data, only HH polarization data takes have been used. Furthermore, results have been complemented with analysis over worldwide distributed targets acquired since beginning of the mission, obtaining a radiometric stability significantly better than requirement specified.

Keywords - Calibration methodology and techniques