Calibration and Validation Plan of the Advanced Optical Satellite (ALOS-3)

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Abstract

The “Advanced Optical Satellite” (nicknamed “ALOS-3”) is the next high-resolution optical mission as a successor of the Advanced Land Observing Satellite (ALOS) in Japan Aerospace Exploration Agency (JAXA). ALOS-3 is now in Phase D i.e. flight model development after completing the Critical Design Review (CDR) on March 2019, and will be launched in JFY 2020. The mission objectives of ALOS-3 are (1) to contribute safe and secure social including provisions for natural disasters, and (2) to create and update geospatial information. The “wide-swath and high-resolution optical imager” (OPS) is designed to be achieved these missions. In this study, the mission overview, current planned calibration and validation, and the expected product utilisations of ALOS-3 are introduced. The specifications of ALOS-3 and the onboard instrument OPS are considered to improve and enhance a fine resolution and global observation capabilities achieved by the Panchromatic Remote Sensing for Stereo Mapping (PRISM) and the Advanced Visible and Near Infrared Radiometer type-2 (AVNIR-2) onboard ALOS. For example, the ground sampling distance (GSD) is 0.8 m of OPS’s panchromatic band compared with 2.5 m of PRISM, and 3.2 m for multi-bands with 10 m of AVNIR-2, even the observation swath widths are same as them of 70 km at nadir, respectively. For multi-spectral observation, two radiometric bands are added from AVNIR-2 in coastal and red edge. The data quantization is also improved to 11 bits/pixel of OPS from 8 bits/pixel of PRISM and AVNIR-2. This improvement will contribute to obtain better image quality, however they cause a huge amount of mission data.

The satellite’s orbit is kept as the sun-synchronous and sub-recurrent with 10:30 am of local sun time, but the repeat cycle is 35 days from 46 days of ALOS’s one. This is enhanced observable frequency at middle and high latitude areas, however small pointing angle observations are necessary to cover the entire area in low latitudes. Unfortunately, along-track stereo observation by multi-sensors like PRISM had not been selected, however the satellite has the body pointing capability within 60 deg. in cone-shape from nadir that will contribute in an emergency observation if a natural disaster happens for example. In addition, ALOS-3 has a plan to acquire the stereo images using two satellite paths with three days differences.

The calibration and validation are essential to achieve the mission objectives. JAXA is now preparing the precise ground control point (GCP) network worldwide for geometric calibration as well as the definition of the radiometric calibration sites. ALOS-3 has also

capabilities of the cross-track radiometric calibration mode and the lunar calibration mode. The digital surface model (DSM), atmospheric correction and the coastal environmental monitoring validation test sites are also considered.

Keywords - Calibration of future missions