ALOS-2 follow-on L-band SAR mission

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1. INTRODUCTION

The Advanced Land Observing Satellite 2 (ALOS-2) is a Japanese earth observation satellite launched in 2014. ALOS-2 observes the earth surface with Phased-Array type L-band Synthetic Aperture Radar 2 (PALSAR-2) that has enhanced performance compared to Japanese previous L-band SAR satellites (i.e., ALOS/PALSAR and JERS-1/SAR) in order to further fulfill social and scientific needs. ALOS-2 is currently in routine operation phase, and until now ALOS-2 has been playing important roles for a lot of applications such as quick response and unique information derived from interferometric observations with L-band SAR are especially effective for monitoring of damaged areas due to earthquakes, volcanic activities, and floods and landslides; crustal deformation mapping and forest change mapping. To keep and enhance the applications using ALOS-2 data, JAXA plans to launch a successor satellite to the ALOS-2 in JFY 2020. In the following sections, we describe the concept of the ALOS-2 follow-on mission (ALOS-4; tentative name).

2. CONCEPTS OF ALOS-2 FOLLOW-ON MISSION

The objectives of the ALOS-4 mission are; (1) sophisticated and practical implementation of land deformation and subsidence monitoring with SAR interferometry, and aiming to use data for not only a posterior damage assessment but also a prior warning assessment, (2) improvement of disaster monitoring performance: more frequent, wider coverage, and readiness for a large-scale disaster such as Nankai Trough Earthquake, (3) continuation and enhancement of the other ALOS-2 mission such as environmental monitoring, (4) new applications such as large infrastructure monitoring with time-series INSAR analysis. The above mission is considered based on the governmental policies and the review on requirements from the ALOS-2 users and lessons learned from ALOS-2 operation and applications.
To achieve the mission, the ALOS-4 satellite should observe wider swath while keeping as higher spatial resolution as that of ALOS-2. The same orbit as ALOS-2 is also required so that users can use a combination of ALOS-2 and ALOS-4 data (e.g., interferometry). The successor to PALSAR-2, namely PALSAR-3, is now designed as a active phased array antenna same as PALSAR-2 with on-board digital beam forming processor in order to improve swath width of 3 m resolution Stripmap mode to 200 km. The swath width of 200 km can cover entire earth surface in 14 days (i.e., one orbit cycle; ALOS-2 PALSAR-2 requires four cycles with 3 m resolution mode). Using the same technique, the swath width of ScanSAR mode increase to 700 km, which can cover a large-scale disaster at once. The data rate also significantly increases with increasing swath width, therefore high-capacity data recorder and high-speed data downlink antennas are prepared. The other specifications of the ALOS-2 follow-on mission are shown in Table 1.

Table 1. Characteristics of the ALOS-2 follow-on mission (ALOS-4)

1) Orbit : Same orbit as ALOS-2,
Sun-synchronous sub-recurrent orbit
Altitude 628 km
Inclination angle 97.9 degree
Local sun time 12:00 ±15 min. at descending

Revisit: 14 day
Orbit control: within ±500 m from the reference orbit
2) Lifetime : 7 years
3) Satellite Mass: Approx. 3 tons
4) Duty Ratio : maximum 50% (approx. 50 min.)
5) Data Recorder : 1 TByte
6) Downlink : Ka-band (16QAM): 3.6/1.8 Gbps
Optical link (date relay): 1.8 Gbps
7) Launch : JFY 2020, H3 launch vehicle
8) Mission Instruments : PALSAR-3 (Phased Array type L-band Synthetic Aperture Radar-3), SPAISE3 (SPace based AIS Experiment 3)

Keywords: ALOS-4, Synthetic Aperture Radar (SAR), L-band, ALOS-2, PALSAR-3