

The concept and the application of high-resolution satellite synthetic aperture radar (TerraSAR-X)

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This paper reports the concept and the applications of TerraSAR-X. TerraSAR-X, which is the state-of-the-art SAR satellite, is developed by German Government (DLR) and EADS Astrium and applied for both scientific and commercial applications. It uses the frequency of X-band and achieves high spatial resolution of up to 1 meter. It was successfully launched on June, 2007, and after the calibration and validation for a half of the year, the commercial service has begun since January, 2008. DLR has developed the various applications such as mapping, hazard recognitions, agriculture, environmental issues and oceanology using airborne X-band SAR data. Especially, the TerraSAR-X is expected for building global high-resolution DEM (DTED: Level 3) by single-pass interferometry with the second satellite, TanDEM-X which is scheduled to be launched on 2009.

The orbit repeat cycle of the satellite is 11 days, and equatorial crossing time is about 6:00 (Descending) and 18:00 (Ascending). It has three imaging modes: SpotLight, StripMap and ScanSAR. The highest resolution of TerraSAR-X image is achieved on the Spotlight mode image with approximately 1m of resolution. The onboard SAR system has phased-array antenna and makes it possible to acquire the image effectively by beaming with arbitrary incidence angles (e.g. 20 to 55 degree of the incidence angle in SpotLight mode). TerraSAR-X can also acquire multi-polarized images and is expected to obtain quad-polarization image data in the future as well as present dual-polarization.

The commercially distributed data are Level-1b basic product: SSC (Singlelook Slant Range Complex) described in complex number, MGD (Multilook Ground Range Detected) which is intensity data without geocoding, GEC (Geocoded Ellipsoid Corrected) which is intensity data with geocoding and EEC (Enhanced Ellipsoid Corrected) which is geocoded and orthorectified by DEM. Some other types of commercial data are also planned to be developed and released.

PASCO has an exclusive right to sell the TerraSAR-X data to the domestic customers, and conducts the business including the operation of the ground receiving station, which make it possible to downlink the data simultaneously with the acquisition for most of the areas in Japan. TerraSAR-X has 3 programming types, standard, priority, and exclusive, and the duration from the submission of the order to the delivery of the data is about 10 weekdays. The image can be acquired in a short time by setting the higher priority level in case of the disaster. The archived data will be sold as well as the acquisitions in future.

PASCO has continued to develop the value added products and the service. The production of the DEM and the development of the change detection method were carried out using airborne SAR data for supposing the actual application of TerraSAR-X data. We examine the applicability of the developed methods to the TerraSAR-X data. In addition to these services, the joint project is planned to do with both domestic and foreign research institutes and private companies.