



L&S Band SAR Data Processing and Products

V. Manavala Ramanujam⁽¹⁾ and Raghav Mehra⁽²⁾
 Space Applications Centre, Ahmedabad, India
 email: ⁽¹⁾ vmanavalan@sac.isro.gov.in, ⁽²⁾ raghavmehra@sac.isro.gov.in

L&S Band airborne SAR (LS-ASAR) is an airborne dual band polarimetric SAR developed by ISRO, as a precursor to NASA-ISRO Synthetic Aperture Radar (NISAR). The basic objectives of developing the L&S band airborne SAR are to study the RCS signatures of various features in L & S frequency bands at variable incidence angles, to demonstrate the utilization of multi-frequency SAR data in both independent and simultaneous operation modes for various applications and to demonstrate new hardware systems being built for NISAR. A research announcement (RA) was made to the scientists / researchers to develop algorithms for SAR data utilization corresponding to various science themes.

The LS-ASAR antenna is fixed rigidly with the aircraft. The motion of the aircraft is sensed using onboard Integrated GPS INS system (IGIS). Deviation of the actual track from a synthesized track is estimated in terms of along track and cross track displacement errors. This information is utilized by the motion compensation software to make data as if flown in a straight track in an ideal platform with constant velocity. A standard Range Doppler algorithm which takes care of squint is utilized for data processing. The processor effectively estimates motion parameters and SAR processing parameters like Doppler centroid, Doppler rate to generate co-registered polarization channel. The L and S bands are co-registered by utilizing these processing parameters and considering the wavelength difference. Radiometric and Polarimetric Calibration of LS –ASAR data was derived for hybrid and fully polarimetric imaging modes using corner reflectors and distributed targets. Flight track from IGIS, sensor geometry and Terrain Digital Elevation Model (CARTO-DEM) are utilized to generate geometrically calibrated LS-ASAR data products.

Two levels of data products are generated viz. Level-1 Single-Look Complex Geo-Tagged Products and Level-2 Geo-Coded products. The products are provided in GeoTIFF format along with extensive meta data comprising of orbit, processing, projection and calibration parameters in xml format. LS-ASAR product also comprises of Incidence angle map and a dense grid of geo-locations. Table-1 provides the specifications of LS-ASAR data products.

Table 1. LS-ASAR Data Products Specifications

S.No.	Parameter	Specification		
1	Minimum Scene Size (considering worst case squint of $\pm 15^\circ$)	5.5 km X full azimuth extent for roll bias 37 9.5 km X full azimuth extent for roll bias 51 14.5 km X full azimuth extent for roll bias 64		
2	Chirp Bandwidth	25 MHz	50MHz	75MHz
3.	SLC Resolution (m) (Azimuth X Slant Range)	2X6	2X3	2X2
4	SLC Pixel Spacing(m) (Azimuth X Slant Range)	6 X 6	3 X 3	2X2
5	L2 Pixel Spacing(m) (Azimuth X Slant Range)	6 X 6	3 X 3	2X2
6	Radiometric Resolution	~3dB-Single Look		
7	Radiometric Accuracy	2dB		
8	Geometric Accuracy (m)	<100m		
9	Polarimetry channel registration with in a band	Sub-Pixel		
10	L&S Band Registration	Sub-Pixel		

LS-ASAR was flown in two phases in 2017-18 timeframe collecting data over user sites in Gujarat and Andhra Pradesh in India. Data products were generated and distributed to relevant Principle Investigators (PIs). This SAR will provide valuable L&S Band data sets for the scientist to enable them to develop algorithms for utilizing NISAR.