Radar Imaging Satellite (RISAT - 1)

The Radar Imaging Satellite (RISAT-1), launched by PSLV-C19 on April 26, 2012 was successfully placed in the Polar Sun-synchronous orbit of 536 km height. RISAT – 1 (Figure1) a new class of remote sensing satellite, distinct from the established IRS class, is developed by Indian Space Research Organization (ISRO) as its first satellite imaging mission using an active RADAR sensor system. RISAT - 1 carries a multimode C- band (5.35 GHz) Synthetic Aperture Radar (SAR) as the payload. The choice of C- band frequency of operation and RISAT - 1 SAR capability of imaging in HH,VV,HV,VH and circular polarizations will ensure wide applicability in the thrust areas like flood mapping, Agriculture & crop monitoring, generic Vegetation, Forestry, Soil Moisture, Geology, and Sea Ice and Coastal processes etc.

Satellite & Orbit parameters are mentioned in (Table – 1)

As it is a side looking active sensor , around 107 Km of either side of the Sub satellite Track comes under Non Imageable area for the orbit under consideration. (Figure2)

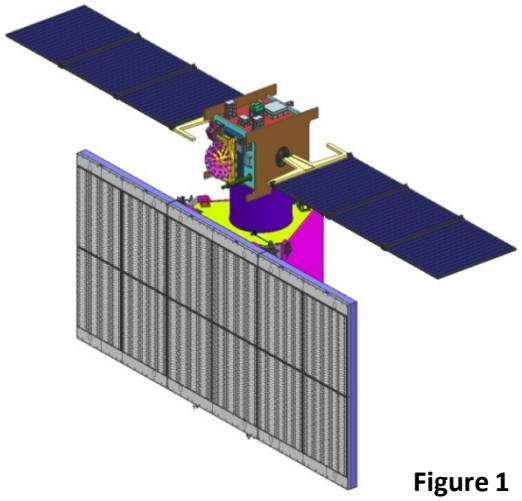


Figure 1

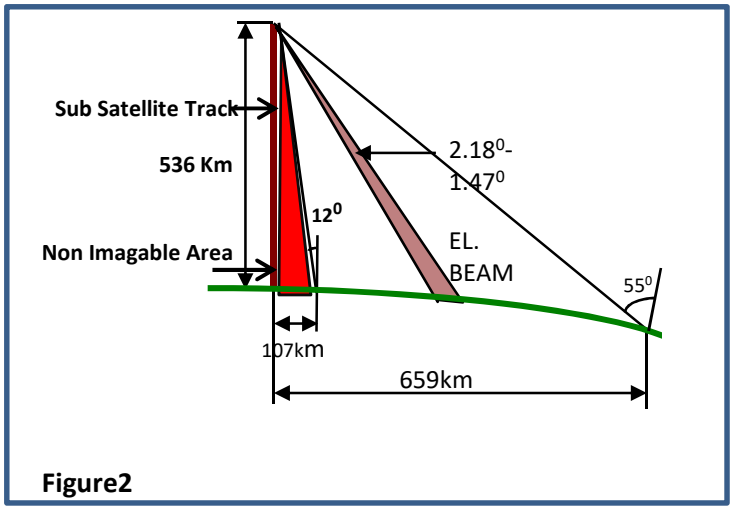


Figure2

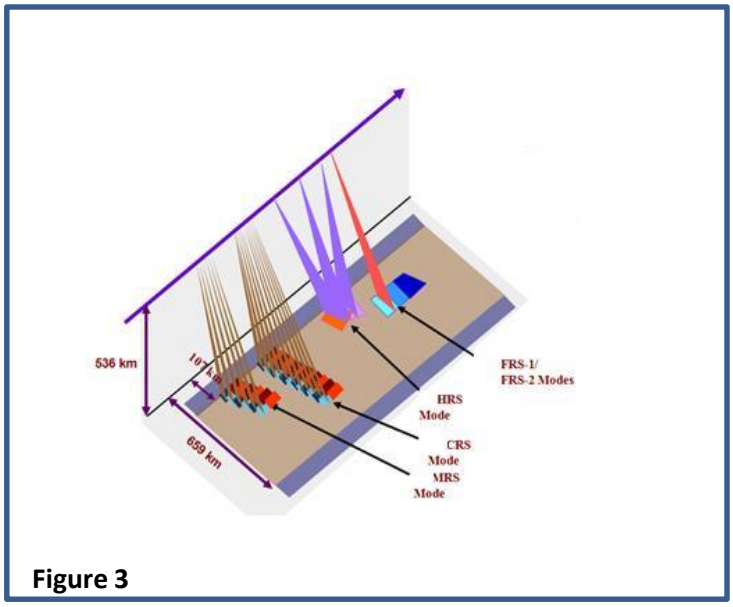


Figure 3

Table 1

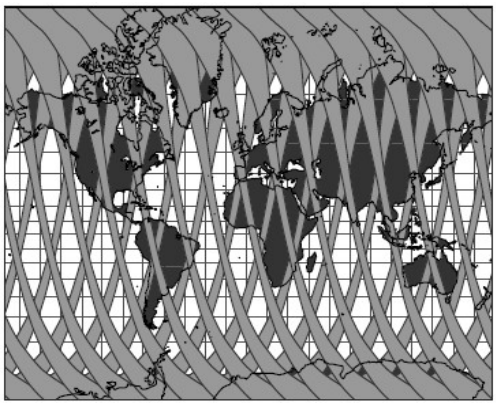
The major S/C and Orbit parameters	
Orbit	Circular Polar SunSynchronous
Altitude	536.6 Km
Inclination	97.63°
No. of Orbits per Day	14
Lift-Off Mass	1858 Kg
Antennae Type	Micro strip Active antenna
Antennae size	6m (along flight direction) 2m (across flight direction)
Local Time of pass	6 a.m. & 6 p.m
Attitude and Orbit Control	3-axis body stabilized using Reaction Wheels, Magnetic Torquers , and Hydrazine Thrusters
Power	Solar Array generating 2200 W and one 70 AH Ni-H2 battery
Nominal Mission Life	5 years
Swath Selectability	107 – 659 Km
Repitivity	25 days (MRS Mode) 13 days(CRS Mode)
Revisit Capability	3 - 4 days

IMAGING GEOMETRY AND MODES OF OPERATION:

RISAT-1 is operated in the following modes in different Polarizations. (Table-2)In the absence of the emergency/user request the default mode of collection will be MRS descending, left looking , with dual polarization with a repeat cycle of 25 days (Figure 3)

IMAGING GEOMETRY AND MODES OF OPERATION

- Acquisition in all weather conditions
- Acquisition in both ascending (Evening) and descending mode (Morning)



- Acquisition in both right look and left look

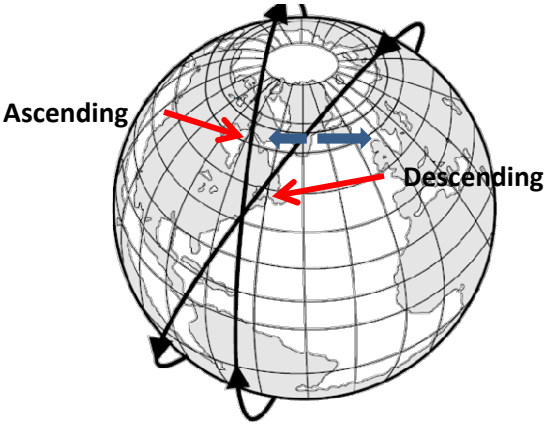


Table 2

Imaging Modes	HRS*	FRS-1	FRS-2	MRS	CRS
Swath (Km)	10*10	25	25	115	223
Polarization	Single, Dual, Circular	Single, Dual, Circular	Quad, Circular	Single, Dual, Circular	Single, Dual, Circular
Resolution (Azimuth* Slant Range) (m)	1*1	3*2	9*4 3*4	21-23*8	41-55*8

MRS - Medium Resolution ScanSAR ; FRS- Fine Resolution StripMap ;CRS –Coarse Resolution ScanSAR: HRS- High resolution SPOT Light

* Data Products under evaluation

Products &Services

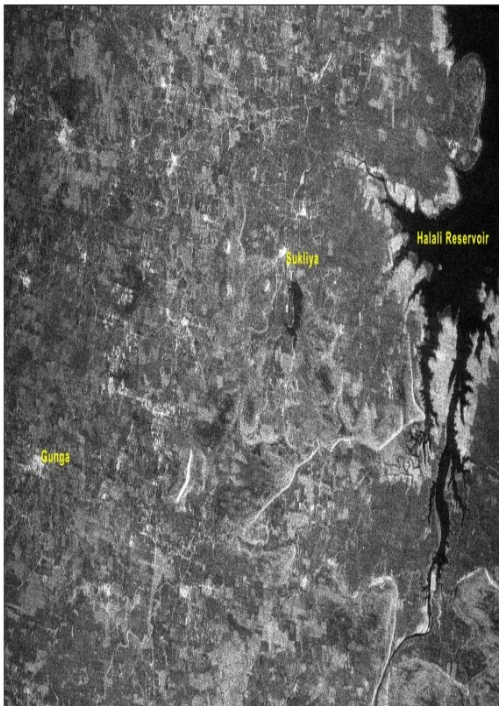
Products:

Following products are available from RISAT -1 as on 03Feb2016

- Level 0
  - Raw data for FRS-1,FRS-2,MRS & CRS
- Level 1
  - Slant range Geo-tagged products for FRS-1 & FRS2.
  - Ground range Products - FRS -1,MRS&CRS
- Level 2
  - Terrain Corrected Georeferenced Products for FRS-1,MRS&CRS
- Level 2A
  - Enhanced Terrain Corrected Georeferenced Products for FRS-1,MRS&CRS

- Projection : UTM/Polyconic (Level 2&2A)
- Datum : WGS 84 (Level 2&2A)
- Resampling : CC (Level 2&2A)
- Format : CEOS (For all)/GeoTiff (Level 2 &2A)
- Media : DVD/DISK
- Delivery : Courier/FTP

Bhopal-as viewed by RISAT-1 FRS-1 Mode



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RISAT 1 products are available with following nominal specifications:

Beam Mode	Level of Processing	Look Angle (Deg)	Nominal Scene size Azimuth* Range (Km)	Azimuth/Range No of Looks	Azimuth/Range Resolution (m) (with weighting)	Azimuth/Range Sampling (m)
FRS-1	L1SLC	11-49	25*25	1/1	3.3/2.2	2.3/1.8
	L1GR	11-24	25*25	2/1	5.8/11-5.2	4.6/4.5
		24-49	25*25	2/1	5.8/5.2-2.8	2.3/2.25
	L2/L2 A	11-24	25*25	2/1	5.8/11-5.2	4.5/4.5
		24-49	25*25	2/1	5.8/5.2-2.8	2.25/2.25
FRS-2	L1SLC	11-49	25*25	1/1	10/4.68	4.6/3.6
MRS	L1GR	11-22	115*115	1/1	24/45-22	13.8/18
		23-49	115*115	1/2	24/43-22	13.8/18
	L2/L2 A	11-22	115*115	1/1	24/45-22	18/18
		23-49	115*115	1/2	24/43-22	18/18
CRS	L1GR	11-34	223*223	1/3	48/135-46	27.6/36
		34-49	223*223	1/4	48/60-45	27.6/36
	L2/L2 A	11-34	223*223	1/3	48/135-46	36/36
		34-49	223*223	1/4	48/60-45	36/36

GR -Ground Range , SLC- Single Look Complex

Parameter	RISAT -1
Geo location accuracy (RMSE)	L2 product -300 m* (For plain areas) ~L2 A Product -200m for all terrains)
Geometric distortion	FRS1 - 100 m MRS - 150m CRS - 300m
Radiometric Resolution (SLC)	3.1 dB
PSLR	-17 dB
Relative Radiometric accuracy	1dB
Absolute Radiometric accuracy	2dB

As on 03-2-2016

FRS-1,FRS-2,MRS and CRS released for all types of terrains.

Ground Range Products(L1 Products) geo location accuracy is within specification even for Hilly terrains.

***Processed SAR Images for hilly regions are subjected to foreshortening, layover and shadow problems. Georeferenced images for hilly terrains are generated with average DEM in case of L2 products and expected geo location error is provided in meta data.**

~Enhanced Terrain corrected Georeferenced products (L2A) are generated with true height values and have significant improvement of geo location accuracy in hilly regions compared L2 products .

More information on formats, geometrical aspects of data products, utilities and sample products are available at NRSC website.

Services

Online browse facility :

Browse is available online from 01 Jul 2012 and the search is based on the meta information for the options like – Point, polygon, Shape file, Date range are available to search the metadata.

Sample Data Products for various modes are provided on NRSC web site.

Online user order processing:

Users can place order on line at their end through internet using this service, which is going to be available shortly. The order processing system handles the entire chain of selection of data to procedure of delivery.

Online payload programming facility:

Enables users to request for future collections, which will be planned after clash analysis with other requests.

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