ASSESSING THE PERFORMANCE OF RADIOMETRIC CALIBRATION OF RISAT-1 HYBRID POLARIMETRIC DATA

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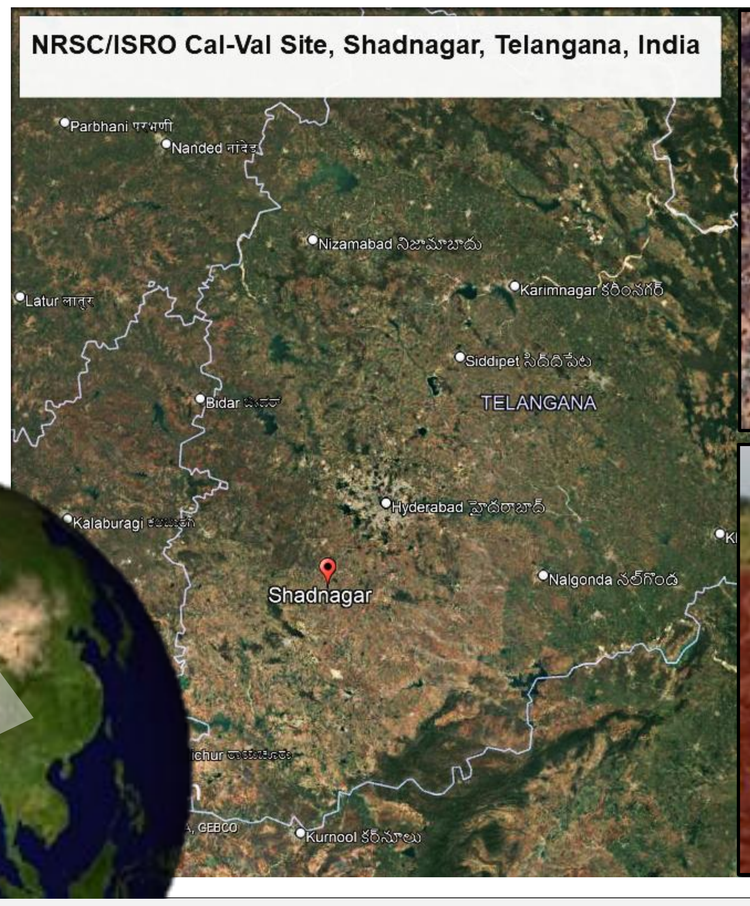
OBJECTIVE

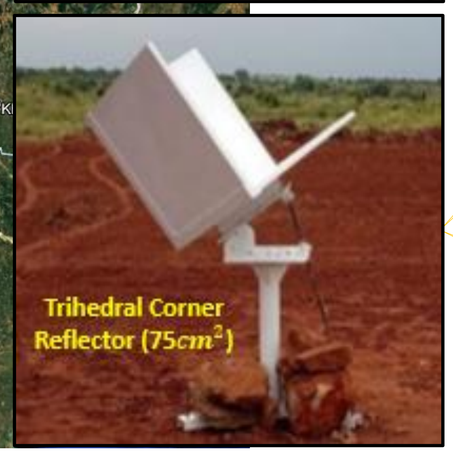
To assess the performance of radiometric calibration of the RISAT-1 Hybrid Polarimetric dataset by estimating quality parameters in a homogenous region and performing impulse response measurements using corner reflectors.

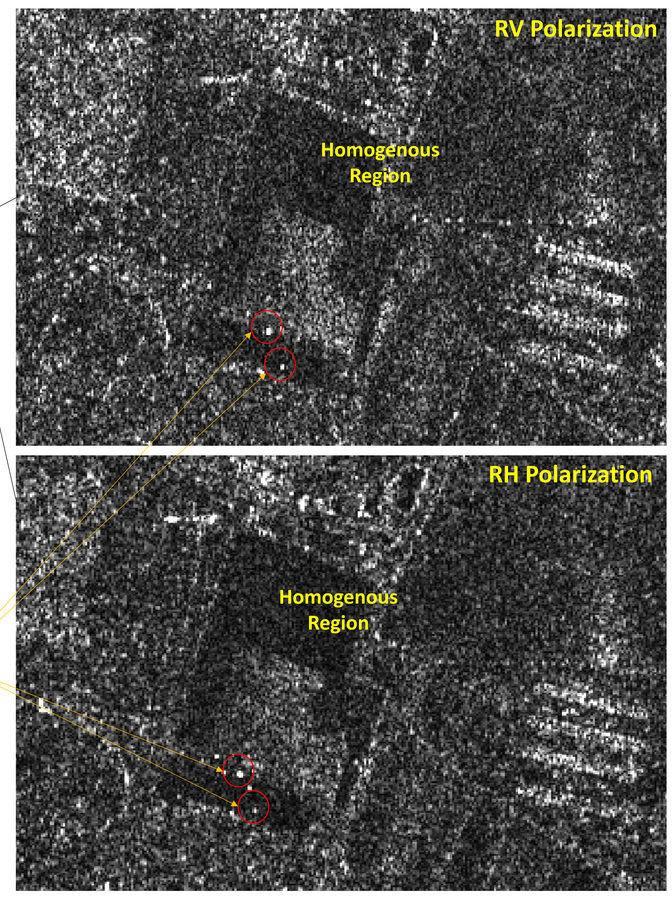
DATA USED & STUDY AREA

RISAT-1

First SAR satellite to provide data from Earth surface in compact polarimetry, launched by India on 20th April 2012







METHODOLOGY

RISAT-1 SLC data (CEOS format) → Radiometric Calibration using Calibration Constant in band metadata → Visualize ROI, Identify homogenous region and note its starting point → Estimate Quality Parameters → Impulse Response Measurement

RH Polarization
RV Polarization

$$\sigma_0 = \frac{DN^2 \sin\theta_i}{C_c}$$

where,
σ0: Backscattered Coefficient
C_C : Calibration Constant
DN: Digital Number (raw data)
sin θi : Local incidence angle

1. Select offset of lines and number of lines after offset to display for visualizing ROI
2. Select suitable window size based on the extent of homogenous region

Estimated Using Homogenous Region
1. Effective number of looks
2. Signal to Noise Ratio
3. Radiometric Resolution
4. Speckle Index

Estimated at Corner Reflector Position
1. Peak Side Lobe Ratio (PSLR)
2. Integrated Side Lobe Ratio (ISLR)

$$PSLR = \frac{First\ Side\ Lobe\ Ratio}{Main\ Lobe\ Ratio}$$

$$ISLR = \frac{Total\ Side\ Lobe\ Ratio}{Main\ Lobe\ Ratio}$$

Microwave Data Analysis Software (MIDAS)

RESULTS

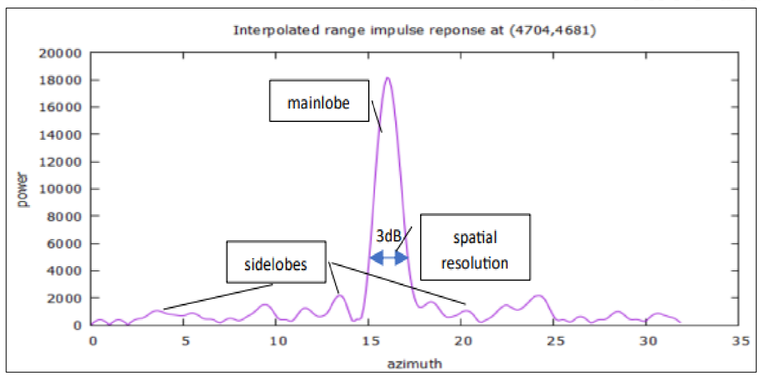
ESTIMATED QUALITY PARAMETERS

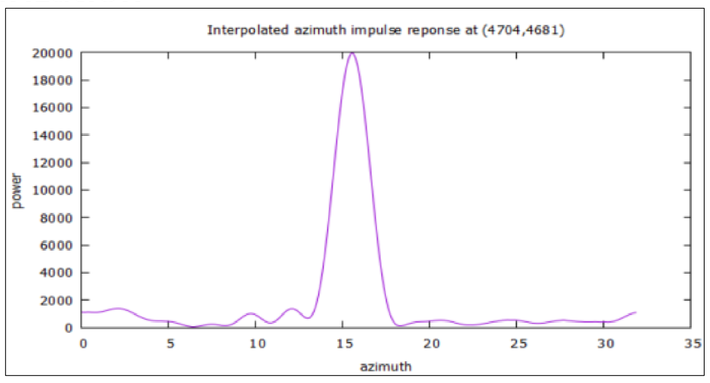
Quality Parameters	RH Polarization	RV Polarization
Effective Number of Looks	0.5912	0.6353
Signal to Noise Ratio	0.7689	0.7971
Radiometric Resolution	3.6184 dB	3.5307dB
Speckle Index	1.3006	1.2546

IMPULSE RESPONSE MEASUREMENT

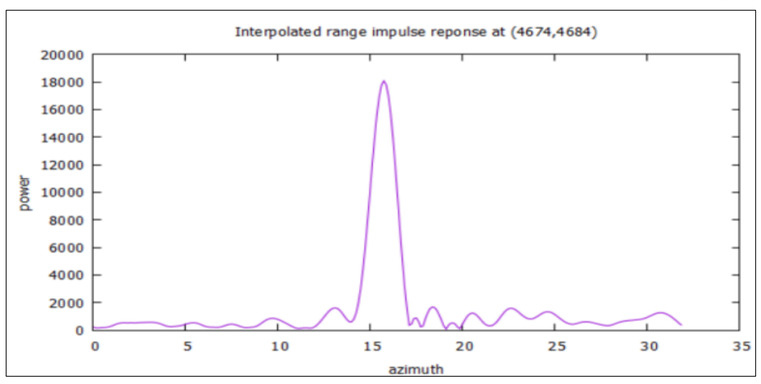
Impulse Response	Direction	RH Polarization	RV Polarization
PSLR	Range	-18.373055 dB	-20.584360 dB
	Azimuth	-23.118870 dB	-21.126133 dB
ISLR	Range	-14.066137 dB	-15.984754 dB
	Azimuth	-22.434492 dB	-20.053635 dB

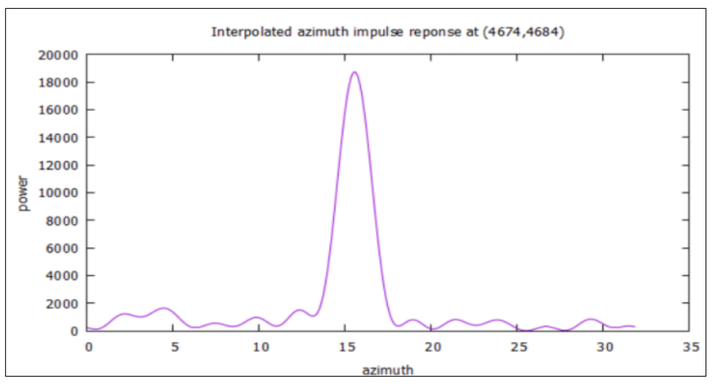
RH Polarization





RV Polarization





CONCLUSION

For SLC datasets, a radiometric resolution of around 3 dB and a high speckle index are typical. PLSR should be greater than -17 dB, and ISLR should be greater than -13 dB. All estimated quality parameters in this study meet these specifications, demonstrating higher quality and accurate radiometric calibrated hybrid-polarization SAR data.