Software Tool for Characterization of Extended Targets in SAR Data
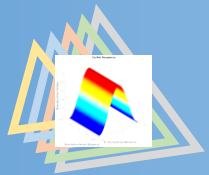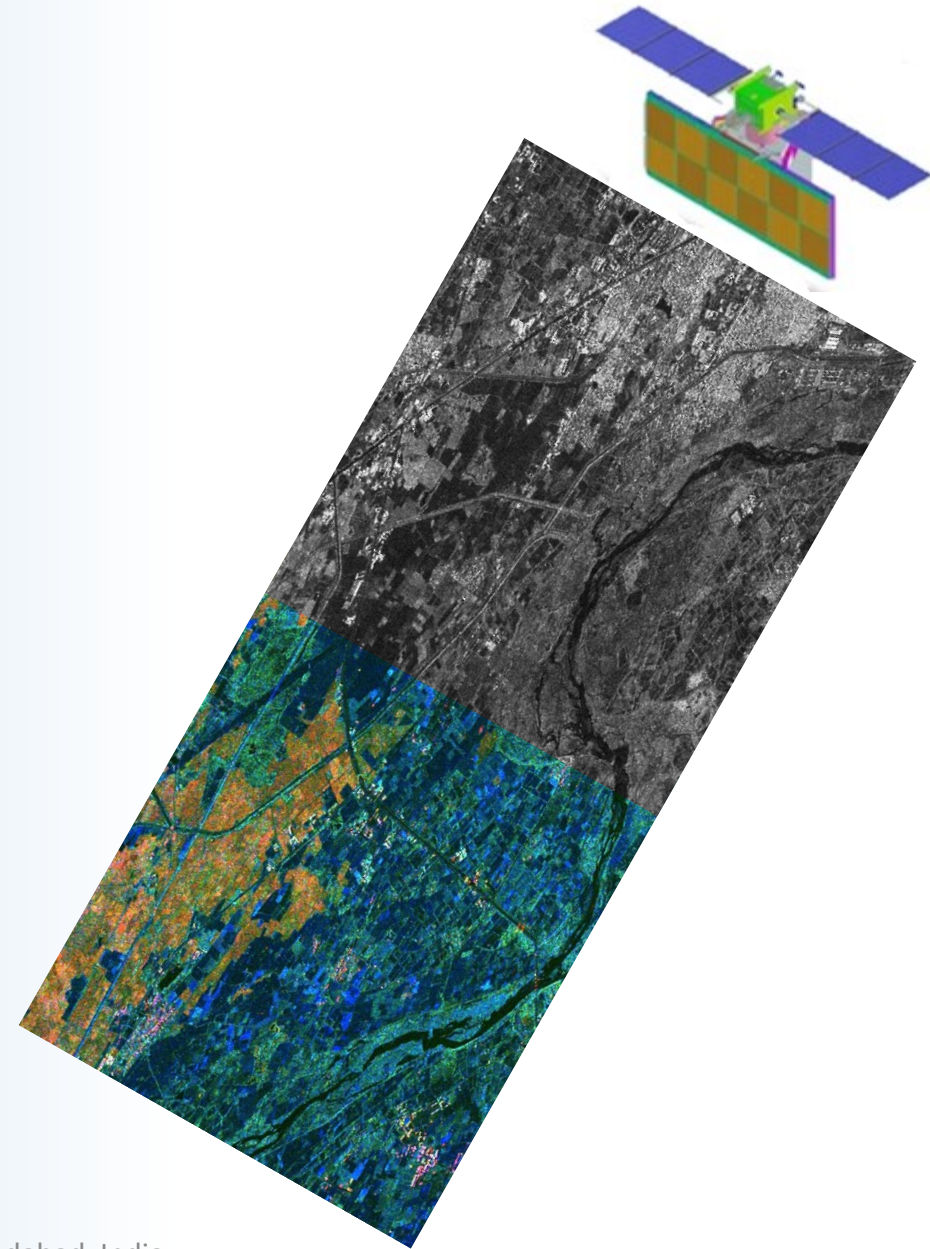
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Introduction

- **Background and Need Aspect:**

Around the world, various space agencies have launched SAR missions aimed at Earth observation in different frequencies. Each frequency band offers unique insights into Earth's surface characteristics, but to obtain reliable data, precise calibration and consistent quality control are essential.

- **Homogeneous Sites for Calibration**:

Homogeneous, isotropic sites such as the Amazon Rainforest, Sahara Desert, and Antarctica are used for radiometric calibration, antenna pattern correction, and quality monitoring.

- **Overview:**

This work introduces a software tool to characterize extended targets like the Amazon Rainforest in SAR frequencies, considering various acquisition modes and configurations.
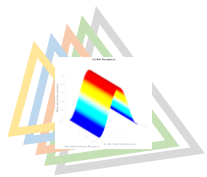
Motivation

- **Supporting Satellite Calibration**:
The tool will aid the scientific community in the initial phases of satellite launch where the data needs to be calibrated using Homogeneous extended Targets.

- **Site Characterization**:
This will enable characterizing a reference site like the Amazon Rainforest with respect to different seasons, nodes, day times, frequencies etc. and provide a consistent standard for calibration and verification.
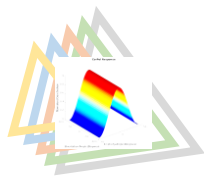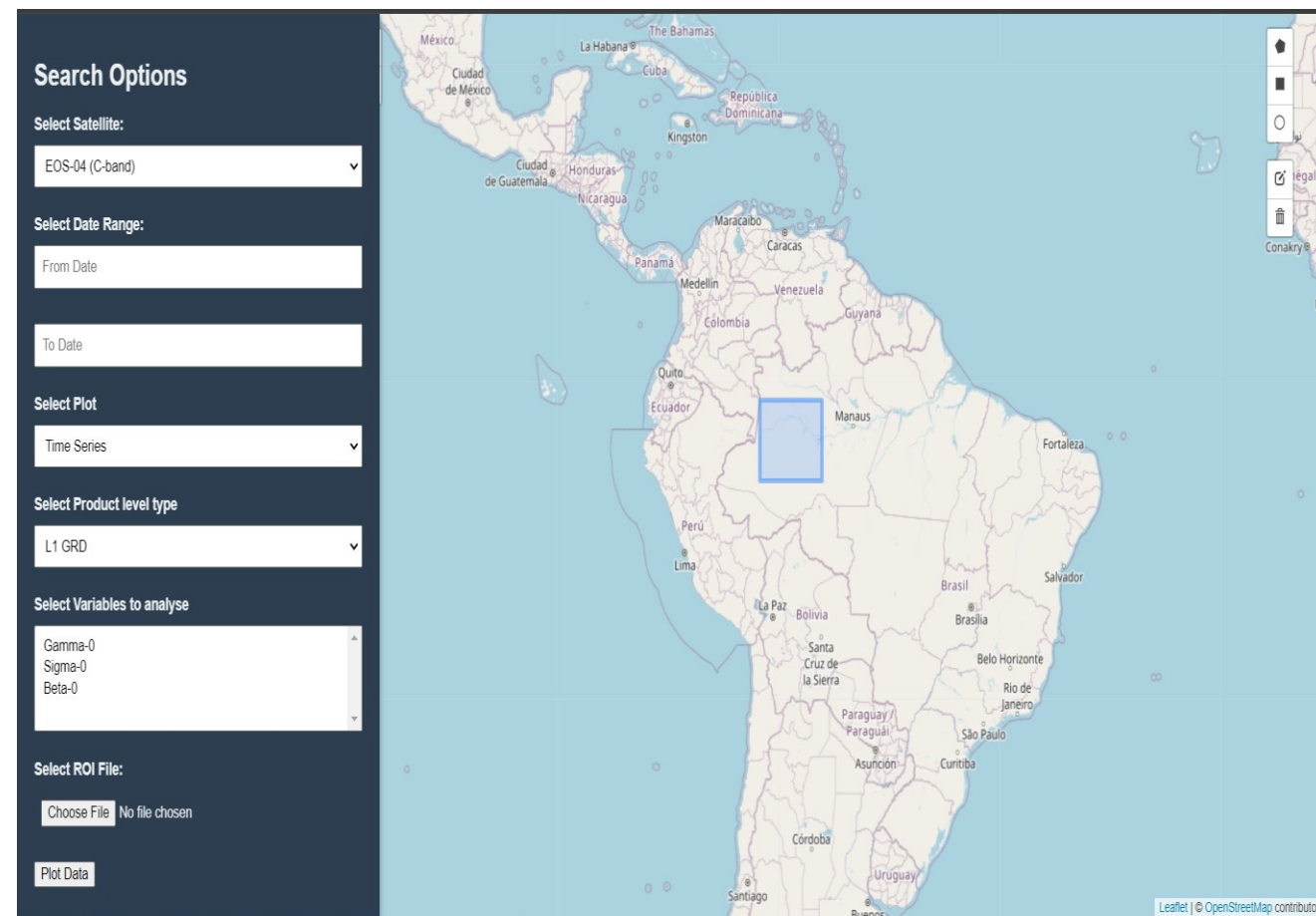
- **Scientific Importance**:
  - Help in monitoring radiometric stability, antenna patterns, and backscatter coefficients.
  - Assessing how angular variations, seasonal changes, and day-time acquisitions affect SAR data across different sites and climates.
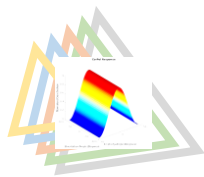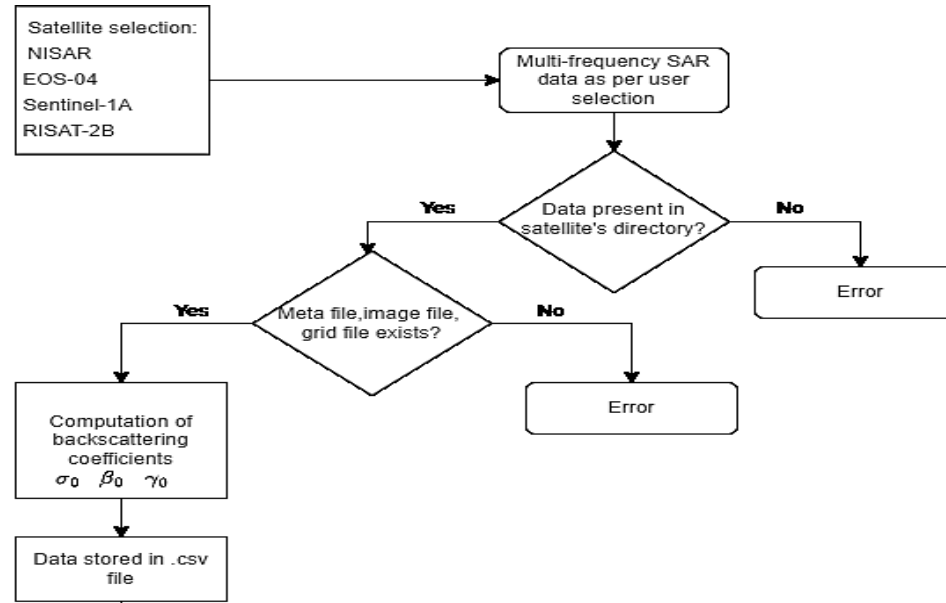
User inputs and UI

- **Study Sites**: Homogenous sites with well defined ROIs.

- **Analysis Parameters**: Examining backscattering coefficients across multiple variables—incidence angle, ascending/descending orbits, seasonal wet/dry variations.

- **Supported Satellites**: NISAR (L & S bands), EOS-04 (C-band), Sentinel-1A (C-band), and RISAT-2B (X-band) and other SAR global missions.

- **Data Products and Data Formats**: various product levels and modes for backscatter analysis. It will support Geotiff, NetCDF, HDF etc.

Design Workflow

Sample Results using EOS-04

ROI over Amazon Rain Forest as per CEOS
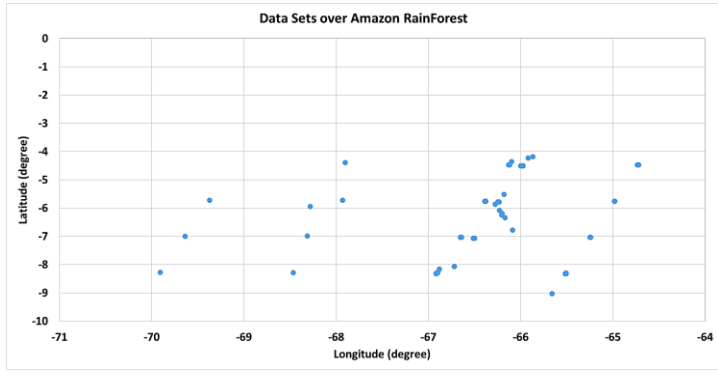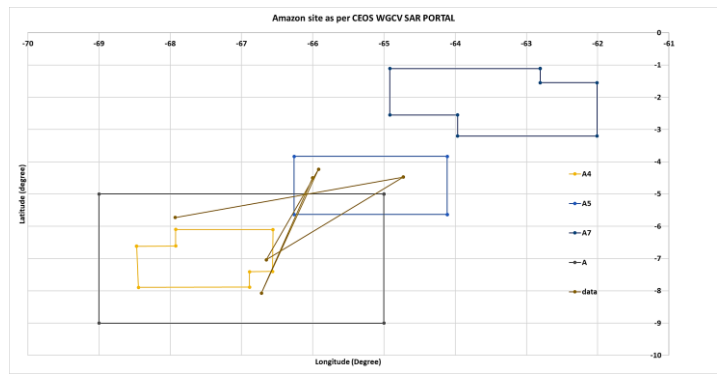
GeoTiff Datasets in Level-1 GRD
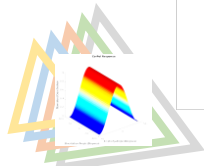
Future Scope

- **Integration with New SAR Missions**:
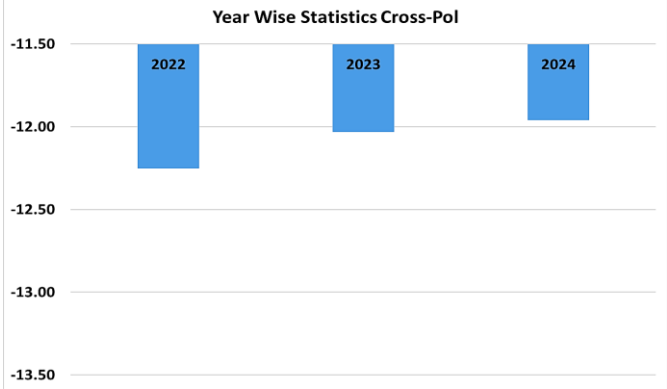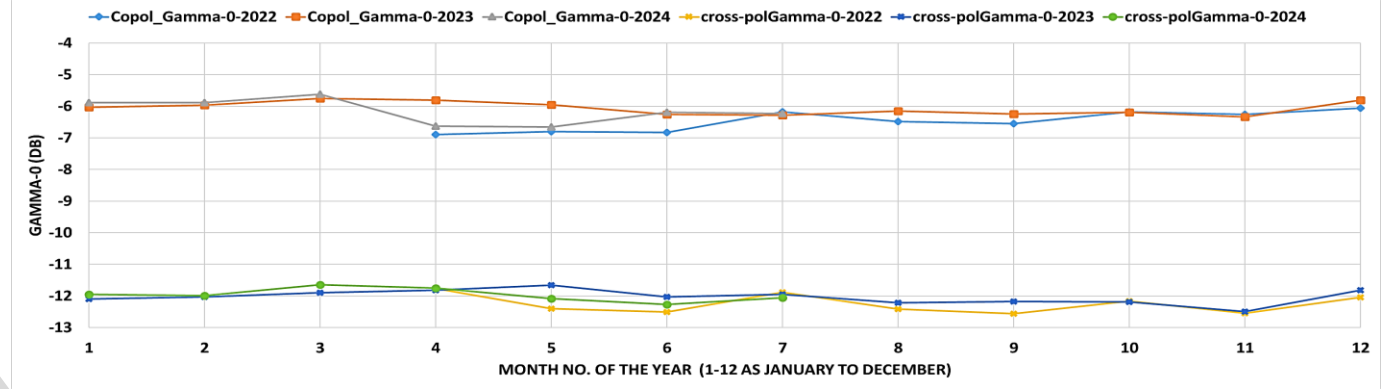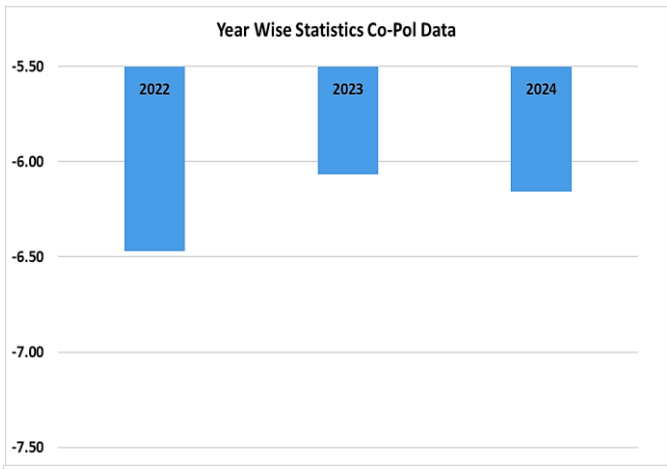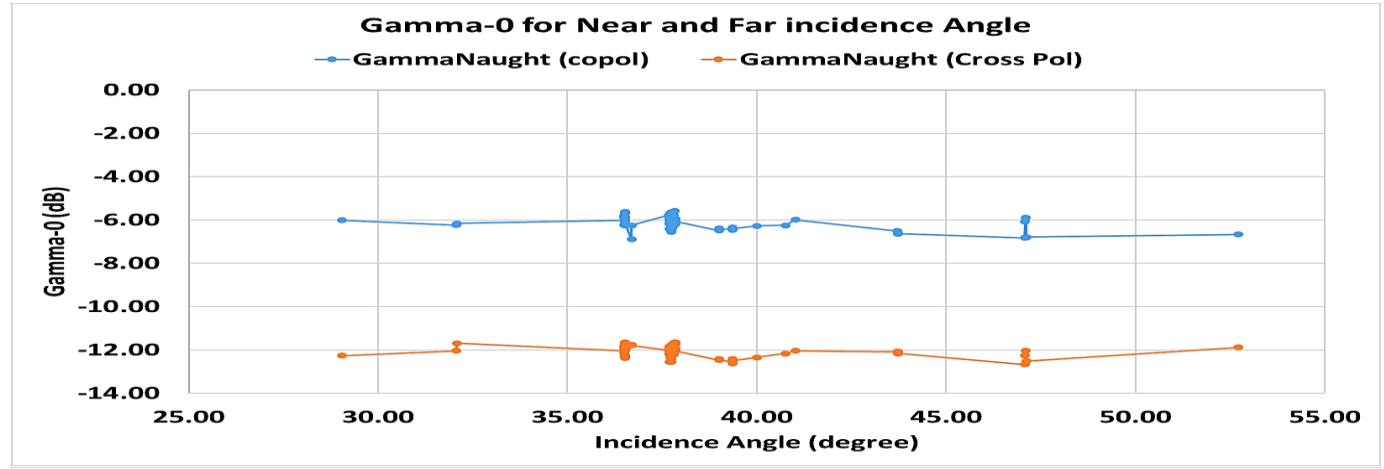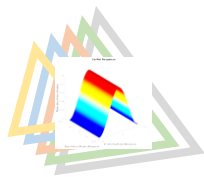As new SAR missions are launched in various frequency bands, the tool can be updated to support these datasets.

- **Expansion to AI based techniques**:
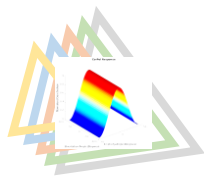Future developments might also incorporate AI-driven methods.

- **Cloud-based data accessibility**:
Implement cloud computing options to handle large datasets more efficiently.

References:

1. https://calvalportal.ceos.org/web/guest/point-distributed-targets-db
2. EOS-04 Data Products Formats (July 2023); Version1.2.4; SAC/SIPG/MDPD/EOS-04/SAR/DP/2021/TN-05/Sep, 2021
3. L. Dell'Amore, J. Bueso–Bello, P. Klenk, J. Reimann and P. Rizzoli, "Characterization of the Amazon Rainforest Backscatter at X-Band Using TanDEM-X Data," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 17.

Thank you!