# Advances in EOS-04 SAR data processing: polarimetry, repeat-pass interferometry and analysis-ready data products

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**EOS-04 (Earth Observation Satellite-04), launched on 14 February 2022, is a follow-on mission to Indian Space Research Organisation's first synthetic aperture radar (SAR) satellite RISAT-1. It is capable of imaging in either side of the track with incidence angle range from 12.2° to 55.1°. Onboard SAR system supports variety of resolution and swath requirements and can operate in various modes like StripMap, ScanSAR and Sliding Spotlight modes with various polarization combinations like linear, hybrid and full/quad polarimetry. EOS-04 is the first spaceborne SAR mission worldwide supporting full-polarimetry (FP) data acquisitions in ScanSAR modes. Availability of FP datasets in wide swath modes (ScanSAR modes) is a big step towards scientific analysis for various applications in a time-bound manner. For enabling interferometric processing, EOS-04 orbits are being maintained within the baseline requirements of 500 m. EOS-04 has 17 days repetivity resulting in less temporal decorrelation to use the datasets for various deformation studies. In addition to this, analysis ready data (ARD) product, normalized radar backscatter (NRB) Gamma0 product, are introduced to minimize the user efforts for any immediate analysis. In NRB Gamma0 products, terrain induced variations particularly on hill-slopes affecting the brightness of the radar return is normalized by applying radiometric terrain correction (RTC) on SAR images. This paper discusses about the data processing aspects related to calibration, polarimetry, interferometry and NRB Gamma0 product generation.**

**Keywords:** ARD, data processing, EOS-04, interferometry, polarimetry.

## Introduction

to a gamut of applications like crop acreage estimation, crop production forecasting, disaster management, cartography, coastal zone mapping, oil slick detection, bathymetry, forestry, geology, hydrology, flood mapping and monitoring, oceanography, glacier studies and urban mapping. Active phased array antenna technology allows the electronic beam steering that is used for acquiring data in ScanSAR imaging modes like medium resolution ScanSAR (MRS) and coarse resolution ScanSAR (CRS) mode[2]. In addition to the RISAT-1 heritage of acquisitions in single/dual linear[3] and Circular Transmit and Linear (H and V) Receive (CTLR), a type of circular polarimetry, it supports the full-polarimetry (FP) data acquisitions both in StripMap and ScanSAR modes. ScanSAR modes are operated in 6/8/12 beam configuration giving a swath of 115/160/223 km for single/dual/circular polarization (SP/DP/CP), and 85/115/168 km for FP acquisitions supporting the look angle ranges 11°–49° and 11°–36° respectively. Complete polar imaging is possible using special beams with look angles up to 54°.

EOS-04 capability to acquire data in FP and CP ScanSAR mode enables large opportunities to user community for carrying out several scientific applications. Absolute and relative radiometric calibration has been established within ±1 dB using data collection over calibration sites like Amazon rain forests and corner reflectors. Repeat cycle of 17 days and orbit maintenance within 500 m enables interferometric related applications. A new analysis ready data (ARD) product, normalized radar backscatter (NRB) Gamma0, is introduced where radiometric terrain correction is being applied on the SAR image using a locally illuminated area. EOS-04 state vectors and Copernicus digital elevation model (DEM) are utilized for determination of this area for carrying out SAR image terrain normalization in