MIDAS: a software for radiometric and polarimetric processing of EOS-04 SAR data

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Earth observation satellite-04 or EOS-04 (Radar imaging satellite-1A or RISAT-1A) provides the opportunity for characterization of surface features using C-band fully-polarimetric, hybrid-polarimetric and dual-polarimetric radar data from same platform in high to moderate resolution (2–50 m depending on mode) and varied incidence angle (12°–55°). These unique EOS-04 radar datasets can be processed using Microwave Data Analysis Software (MIDAS) tool, to derive radar polarimetric parameters. MIDAS is capable of carrying out synthetic aperture radar (SAR) data processing comprising radiometric and majority of the polarimetric processing of EOS-04 datasets. In addition, MIDAS has the functionality to orthorectify and geocode EOS-04 polarimetric products, which is missing in other softwares. Further, MIDAS contains module for bulk-processing of time-series EOS-04 products. We showcase results obtained from EOS-04 datasets and describe the scattering behaviour of various targets. Further, we also demonstrate the temporal variation in the backscatter values from different target features obtained from EOS-04 time-series stack, which has strong applicability in land use/land cover and agricultural applications. Thus, the radiometric and polarimetric products can be highly beneficial for characterization of physical properties of the scatterers based on their radar scattering behaviour and further classification of the surface features.

dataset, Microwave Data Analysis Software (MIDAS) is developed for analysis of the EOS-04 data.

MIDAS is a suite of processing tools primarily for SAR data applications. The software is indigenously developed at Space Applications Centre (SAC), ISRO with primary objective of providing processing support for SAR sensors developed at ISRO, which other softwares lack. MIDAS is capable of processing data from some of the notable ISRO sensors, such as radar imaging satellite-1 or RISAT-1 (launched in 2012), L and S-band airborne SAR, Chandrayaan-2 dual-frequency SAR (DFSAR), and the latest EOS-04 (RISAT-1A). MIDAS also provides support to important international SAR sensors as well, like, Radarsat-2 (Canadian Space Agency), ALOS-1 and 2 PALSAR (JAXA) and NASA-JPL UAVSAR. Support for future missions such as RISAT-1B and NASA-ISRO Synthetic Aperture Radar (NISAR) is also envisaged. MIDAS is designed with processing tools for radiometric and polarimetric analysis, which is elaborated in the later sections in the context of EOS-04 data processing.

EOS-04 has three different modes for data, viz. full-polarimetric (FP), hybrid-polarimetric (HP) and dual-polarimetric (DP). It also comes with two different levels: Level-1 is single look complex (SLC) data, which contains radar backscatter values in complex format. Hence, the level-1 data is essential for polarimetric analysis as it