Preface

SCATSAT-1

Ocean surface winds are an important parameter for various meteorological and oceanographic applications. These are utilized not only for the study of severe weather events like cyclones, hurricanes and typhoons, but are also important for assimilation in numerical weather forecast models to improve the forecast. The ocean surface winds also cater to the forcing of ocean wave and circulation models used for ocean state forecasts. *In situ* measurements of winds by buoys and ships are point observations and also very few in number to provide a synoptic view.

Due to this, ocean surface wind data derived from remote sensing instruments have been found extremely useful. Spaceborne microwave scatterometer is one of the major instruments which provides global ocean surface wind vector information. The scatterometer sends microwave signals to the earth's surface and measures backscattered power. Using these measurements, ocean surface winds and other parameters are derived. The scatterometers have been providing accurate and wide swath surface wind measurements for the last several years. Apart from providing ocean surface winds, the scatterometers also provide the backscatter coefficient which allows us to retrieve the soil moisture changes and helps in monitoring vegetation, sea and land ice, etc.

Being operated at microwave region, these instruments can measure winds even in the presence of clouds and thus are said to have all-weather capability. Though scatterometers have several advantages, their measurements are limited by larger footprint leading to coarser spatial resolution. Due to this, they are unable to provide ocean surface winds in the coastal regions.

India had launched its first scatterometer, i.e. OSCAT on-board Oceansat-2 in 2009. The worldwide demand of near real-time scatterometer data necessitated a quick replacement of OSCAT. Though in principle SCATSAT-1 is a replacement for OSCAT, the architecture of both instruments widely varies in terms of hardware, signal processing and data quality.

SCATSAT-1 was built and launched by the Indian Space Research Organisation (ISRO) on 26 September 2016 from Satish Dhawan Space Centre (SDSC), Sriharikota. It consists of a Ku-band (13.515 GHz) pencil-beam scatterometer similar to OSCAT. It is a dual-polarized instrument providing data at 1800 km wide outer swath at nominal resolution of 25 km with a repeat cycle of two days. Due to the importance of SCATSAT-1 data, in the absence of any other operational Ku-band scatterometers, international collaboration was a crucial component of its mission. National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA) and Royal Netherlands Meteorological Institute (KNMI) have actively collaborated with ISRO in the calibration phase of the instrument, and have contributed towards the excellent quality of wind products from the scatterometer.

This special section, consisting of nine research papers, provides an overview of the SCATSAT-1 instrument with improvements over the OSCAT hardware and payload characterization. Techniques developed for data processing radar backscatter and retrieval of wind vector have been highlighted. Stability and performance of the SCATSAT-1 data independently by international agencies through cooperation has been discussed. One article discusses post-launch calibration of the instrument by analysing backscatter data over various targets, and evaluation of the ocean surface winds using *in situ* and ancillary data. Some articles also focus on a few important applications that have positively contributed towards the society in general. They discuss the benefits to the atmospheric and oceanic sciences, such as cyclones structure, its monitoring and prediction; importance of scatterometer-derived winds in the study of ocean dynamics, and the study of polar cryosphere using enhanced-resolution SCATSAT-1 backscatter. Several novel applications such as the potential of SCATSAT-1 data for hydrological studies by developing new approaches for estimation of river water levels and detection of surface flooding, and exploitation of data for land target detection, rice crop phenology stages detection for kharif and rabi seasons, and estimation of relative soil moisture over parts of India have also been discussed.

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