



## **Evaluation of Multi-frequency, Multi-polarization SAR data for Crop Classification using ISRO L&S band Airborne SAR**

Tathagata Chakraborty\*<sup>(1)</sup>, Anup Das<sup>(1)</sup>, Deepak Putrevu<sup>(1)</sup>, Arundhati Misra<sup>(1)</sup>

(1) Space Applications Centre, Ahmedabad – 380015, India, e-mail: tathagata@sac.isro.gov.in; anup@sac.isro.gov.in; dputrevu@sac.isro.gov.in; arundhati@sac.isro.gov.in

Crop discrimination and accurate crop classification are vital for agricultural monitoring and timely forecasting of crop production. Synthetic Aperture Radar (SAR) due to its all-weather imaging capability has shown promising results in crop monitoring and classification with reasonably high accuracy. In India, crop monitoring is very important for agriculture management and multi-temporal and multi-polarization SAR data has shown high potential for crop monitoring especially during kharif (monsoon-post monsoon) season when the sky remains cloudy. Recently, crop classification using single-date multi-polarization SAR data has gained importance over multi-date single or dual polarization SAR data due to the ability of the former to identify and classify crops at an early stage, which helps in early forecasting of crop production. The study presents here, the crop classification results obtained from multi-frequency SAR data at various combinations of polarizations and polarimetric parameters acquired by ISRO's L&S airborne SAR over few crop areas in India. The L&S airborne SAR system has been developed by the Space Applications Centre, ISRO as a precursor to the space-borne L and S band NASA-ISRO SAR (NISAR) mission, being developed jointly by NASA and ISRO and planned for launch in early 2022. The study has identified various polarization intensity parameters and polarimetric decomposition parameters that are sensitive to crop types and applied different advanced supervised classifiers such as Support Vector Machine and polarimetric Wishart Classifier on combinations of SAR data in L&S band for crop and other associated land cover classifications. The classification accuracy for crops and other land cover features was increased as more and more input parameters were added to the classifier and saturated thereafter. In certain cases, the crop classification accuracy reduces when more number of input parameter was added to the classifier. It is therefore essential to optimize the input parameters for classification when multi-frequency and polarimetric SAR data is used for crop classification. The results showed that an overall classification accuracy of 94% (with Kappa coefficient 0.91) was achieved with 7 crops using single-date L&S band dual-frequency full-polarimetric SAR data. There is further scope for improving this accuracy by proper selection of date of acquisition of SAR data over cropped areas. Thus, the present study demonstrates the potential of multi-frequency multi-polarization SAR data for crop and land cover classification to achieve greater classification accuracy with further significance to NISAR mission.