

Adoption and impact of remote sensing-based agrometeorological products in advisory services among farmers: a case study

P. S. Silpa^{1,*}, Sini Susan Varghese², Rahul Nigam², Gayatri Vinodh Ayyangar², Deep Chandra², V. Gopika¹, Yadav Eknathrao Kadam³, Dhani Ram Rajak², Bimal Kumar Bhattacharya² and Kailas Kamaji Dakhore³

¹Indian Space Research Organisation Headquarters, Antariksh Bhavan, Bengaluru 560 094, India

²Space Applications Centre, Indian Space Research Organisation, Ahmedabad 380 015, India

³All India Coordinated Research Project on Agrometeorology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani 431 402, India

The increasing unpredictability of daily weather patterns presents significant challenges for farming communities. Accurate and timely agro-meteorological information is essential for effective crop management, resource optimisation, and mitigation of losses caused by erratic weather conditions. The Space Applications Centre of the Indian Space Research Organisation addresses these challenges by providing satellite-derived agro-meteorological products based on remote sensing, such as surface soil moisture, potential evapotranspiration, the normalised difference vegetation index (NDVI), predicted NDVI, land surface temperature, and the surface dryness index. These products are disseminated daily to six Agro-Met Field Units across India through the Visualisation of Earth observation Data and Archival System geoportal. The present study was designed to evaluate the adoption and impact of satellite-derived agro-meteorological products augmented with weather forecasts (Agro-Met advisories) during the 2022–23 *kharif* season in Parbhani district, a predominantly rainfed region in Maharashtra, India. Additionally, a quasi-experimental research design was employed, with surveys conducted among 60 farmers using Agro-Met Advisory Services (AAS farmers) and 60 farmers not utilising these services (non-AAS farmers). The study's findings revealed that AAS farmers frequently reference soil moisture and NDVI, and they significantly influence their agricultural decision-making. A comparative analysis indicates that the agricultural input cost for AAS farmers is lower than that of non-AAS farmers by 14.8% in soybean cultivation and 27.2% in cotton cultivation, indicating an economic benefit among AAS farmers. The present study emphasises enhancing farmers' awareness of meteorological parameters through field-level training and capacity-building programs, bridging the gap between scientific knowledge and its application. The present study highlights the crucial role

of promoting the adoption of high-resolution, crop-specific, location-specific agro-meteorological products and integrating AI-driven data to address the diverse and heterogeneous agricultural systems of India.

Keywords: Agro-met advisories, decision-making, farmers, impact, ISRO, remote sensing-based agro-met products.

AGRICULTURE remains the backbone of the Indian economy, engaging approximately 45.5% of the total workforce in farming and related activities¹. However, the sector is highly vulnerable due to climatic variability and extreme weather events, such as floods, high-intensity rainfall, flash droughts, and short-duration droughts, which result in substantial economic losses to the farming community^{2,3}. These weather anomalies not only exacerbate abiotic and biotic stresses but also drive the overuse of farm inputs such as fertilisers, irrigation water, pesticides, and insecticides, leading to higher cultivation costs and environmental concerns. Timely, accurate, and location-specific weather forecasts, coupled with near-real-time crop condition assessments, are critical to supporting informed decision-making and minimising crop losses caused by weather-related uncertainties.

The advent of advanced technologies and space-based observations has significantly enhanced the accuracy and reliability of weather forecasts in India. Leading organisations, including the Indian Council of Agricultural Research (ICAR), the India Meteorological Department (IMD), State Agricultural Universities (SAUs), and Space Applications Centre (SAC), have collaborated to develop state-of-the-art Agro-Met Advisory Services (AAS) under the Gramin Krishi Mausam Sewa (GKMS) initiative⁴.

Developments in Indian AAS and role of Satellite Earth Observation (EO) products

The IMD initiated AAS in India with the dissemination of a weather bulletin for farmers in 1945 (ref. 5). Based on

*For correspondence. (e-mail: silpa@isro.gov.in)