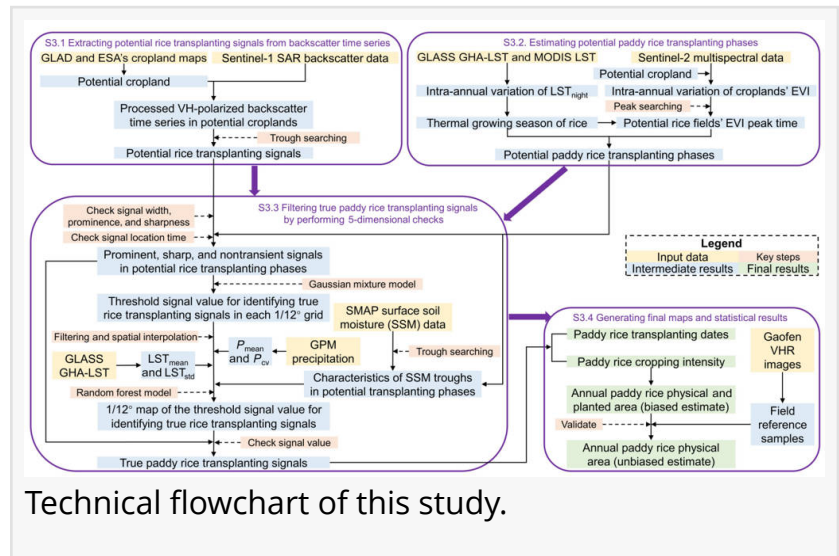


Mapping Paddy Rice Cropping Intensity and Planting Dates in Monsoon Asia at 20 m Resolution (2018–2021) using Satellites

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/EINPresswire.com/ -- Accurate information on where, when, and how often rice is planted is vital for food security, irrigation planning, and [climate](#)-impact assessment. A new multi-source satellite mapping approach has produced 20-m-resolution paddy rice cropping intensity and planting-date maps across Monsoon Asia from 2018 to 2021. By combining radar, optical, thermal, and soil-moisture observations, the study improves the detection of rice transplanting signals across complex monsoon farming systems.



Technical flowchart of this study.

Rice is a staple crop across Monsoon Asia (MA), a region that accounts for most global rice production and consumption. Yet monitoring rice fields remains difficult because many farms are small, planting calendars vary across regions, and frequent cloud cover limits the reliability of optical satellite images. Synthetic-aperture radar (SAR) can observe through clouds, but low radar backscatter may also be caused by temporary flooding, snow or ice processes, low vegetation cover, soil-moisture variation, or residual noise. Agricultural statistics can also be uncertain because of mixed cropping, crop rotation, and incomplete reporting. Due to these challenges, in-depth research is needed to develop more accurate, scalable, and high-resolution rice monitoring methods.

A research team led by the Jockey Club STEM Lab of Quantitative Remote Sensing, Department of Geography, The University of Hong Kong, reported a new satellite-based method for mapping paddy rice cropping intensity and planting dates across Monsoon Asia. The study was published (DOI: [10.34133/remotesensing.1045](https://doi.org/10.34133/remotesensing.1045)) on April 14, 2026, in Journal of Remote Sensing. The work addresses a key challenge in agricultural remote sensing: producing consistent, high-resolution rice maps over a vast monsoon region where clouds, fragmented smallholder fields, and diverse cropping systems often reduce the transferability of existing methods.

The study introduced a more generalized algorithm for identifying rice transplanting signals using Sentinel-1 C-band SAR backscatter time series. Potential croplands were first delineated based on existing cropland maps. Sentinel-1 VH-polarized backscatter data were then processed at 20 m resolution, from which candidate transplanting signals were extracted as radar backscatter troughs. To reduce false detections, the algorithm evaluates each candidate signal across five key dimensions, including timing, backscatter value, trough width, prominence, and sharpness, by integrating Sentinel-2 enhanced vegetation index (EVI) time series, land surface temperature (LST), and SMAP soil moisture (SSM) products. Annual cropping intensity was subsequently determined by the number of validated transplanting signals per year, while planting dates were derived from the timing of these confirmed signals.

The resulting paddy rice distribution map achieved high accuracy in validation. Against 2,305 self-collected reference samples and 1,484 public samples, the map reached an accuracy of approximately 82% to 84%, outperforming most existing regional products. The rice planting-date estimates also showed strong agreement with the statistics-based RiceAtlas dataset, with an R^2 of 0.92 and a root mean squared error (RMSE) of 28 days. The maps captured major spatial differences in single-, double-, and triple-rice systems and revealed that, from 2018 to 2021, single-rice areas generally declined while double- and triple-rice areas increased in Monsoon Asia. This pattern suggests a rise in average paddy rice cropping intensity in several major rice-producing countries.

“By integrating radar signals with optical, thermal, and soil-moisture information, this approach provides a clearer view of when and how often rice is planted across Monsoon Asia,” said the research team in a suggested statement for author approval. “These maps can support food-production assessment, irrigation planning, methane-emission analysis, and climate-adaptation strategies.”

Because the proposed method relies mainly on satellite observations rather than dense field surveys or uncertain agricultural statistics, it may be especially useful in regions where ground data are limited. Future work could extend the approach to longer time periods, improve detection in rainfed or highly fragmented paddy fields, and integrate the maps with crop-yield models, water-management systems, and agricultural early-warning platforms.

References

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Lucy Wang
BioDesign Research
[email us here](#)

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