Integrating active and passive microwave satellite data yields more precise global soil moisture mapping

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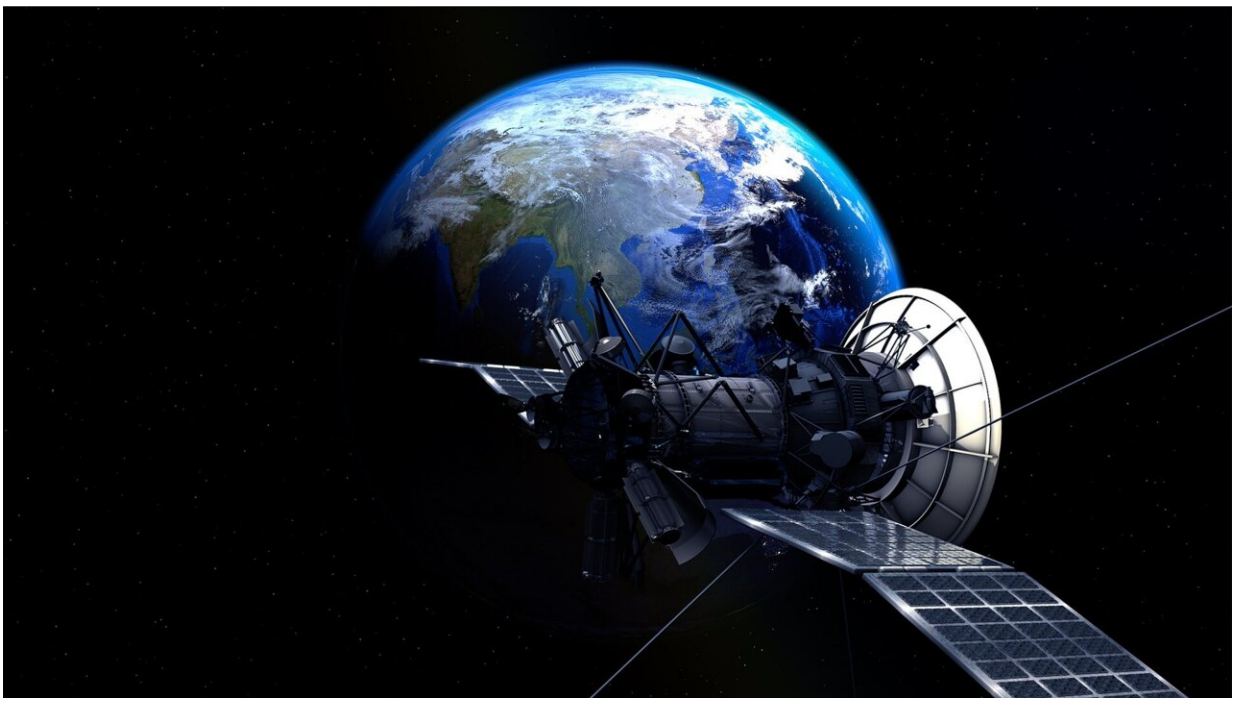

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Researchers from the Aerospace Information Research Institute of the Chinese Academy of Sciences, in partnership with international colleagues, made strides in mapping surface soil moisture across the globe. They combined data from two advanced satellite systems, the Soil

Moisture Active Passive (SMAP) and the Advanced Scatterometer (ASCAT), providing more precise and reliable soil moisture data.

The study was published in *Remote Sensing of Environment*.

Soil moisture plays a key role in many applications, including drought monitoring, flood warning, and crop yield estimation. Accurate monitoring of soil moisture is essential for understanding and managing agricultural dynamics and water resource monitoring.

Traditionally, the researchers used either passive microwave measurements, which capture the natural emissions of the Earth's surface, or active microwave measurements, which involve bouncing signals off the surface and measuring the backscattering. Each method has its advantages and disadvantages.

In this study, the researchers developed a new method to map soil moisture. They integrated passive measurements from SMAP and active measurements from ASCAT, as well as various auxiliary data that are highly related to soil moisture. Also, the researchers tested four machine learning models—Random Forest (RF), Long-Short Term Memory, Support Vector Machine, and Cascaded Neural Network—to determine the best approach. The RF model proved to be the most effective one.

The new method was tested against in situ measurements from different soil moisture networks worldwide. The results showed that the integrated data achieved an unbiased root mean squared error of 0.042 m^3/m^3 and a temporal correlation of 0.756.

This method reduced the errors and provided more reliable data compared to using SMAP or ASCAT data alone. Moreover, it greatly improved the temporal resolution of soil moisture retrievals, which is crucial for real-time monitoring and applications in hydrology and

ecology.

This study offers a promising solution for generating highly accurate soil moisture data products on a global scale, which represents a major step forward in environmental monitoring.

More information: Hongliang Ma et al, Surface soil moisture from combined active and passive microwave observations: Integrating ASCAT and SMAP observations based on machine learning approaches, *Remote Sensing of Environment* (2024). DOI: 10.1016/j.rse.2024.114197

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