

Deriving Satellite-Based Soil Moisture Products Over Arid Zones Of The World

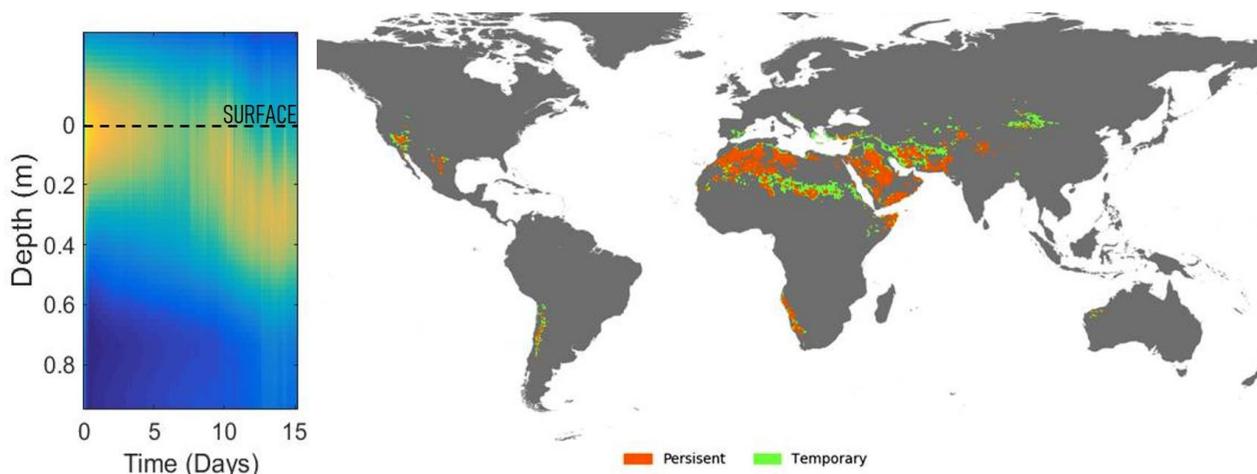
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Soil moisture is a key variable in the functioning of the environment and climate system, and its regular and synoptic retrieval has entered global in-service operation utilizing radar satellites. However, persistent issues remain with those regions of the world associated with hot arid zones, and for which no radar-derived products are currently available. The issue is particularly prevalent across large swathes of North Africa and the Near and Middle-East, as well as smaller regions in the Americas, Europe, and Australia. These regions represent some of the most fragile environments on the planet. Many are suffering climate-change related temperature increases significantly above global trends. Increasingly variable rainfall is leading to more frequent droughts, environmental degradation, and societal pressures.

The challenge here is to develop a soil moisture retrieval scheme appropriate to these arid zones, based primarily around the European Space Agency's Sentinel-1 radar satellites. This opportunity is built upon an innovative new model which describes the physics of the radar-soil interaction at low moisture conditions. The work will comprise many research strands, and three in particular; 1) laboratory radar studies to understand how real-world complexities of soil structure and moisture dynamics affect retrieval performance; 2) further developing the model advised by the experimental results; and 3) developing automated satellite image processing chains to deliver the new product.



(l) Laboratory product showing how the position of the dominant radar return shifts downwards from the surface as the soil dries. (r) Zones of the world for which it is not currently possible to derive radar-based soil moisture products, either continuously or seasonally.

Training opportunities:

The studentship provides the opportunity to be involved in an exciting, end-to-end project, working on cutting-edge applied remote sensing. Crossing disciplines, it brings together laboratory measurement, soil science, and satellite image processing. The student will get the chance to;

- acquire experimental skills in radar laboratory experimentation and measurement applied to remote sensing of the environment
- develop bespoke processing chains for radar satellite imagery
- develop an internationally-important soil moisture product for the European Union's Earth Observation Programme and EUMETSAT
- undertake an extended visit to TU Vienna to work on its in-service implementation
- an opportunity may arise to be involved in fieldwork trialling of the scheme, most likely in the deserts of southwestern USA
- work at the international level through collaborations, conference presentations, and journal publication.

Student profile:

This project would be suitable for students with a degree in physics, engineering, mathematics, or a closely related environmental or physical science degree.

References:

An example of a near-real time satellite radar product can be found here;

<http://hsaf.meteoam.it/soil-moisture.php>

<https://research.reading.ac.uk/scenario/>