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

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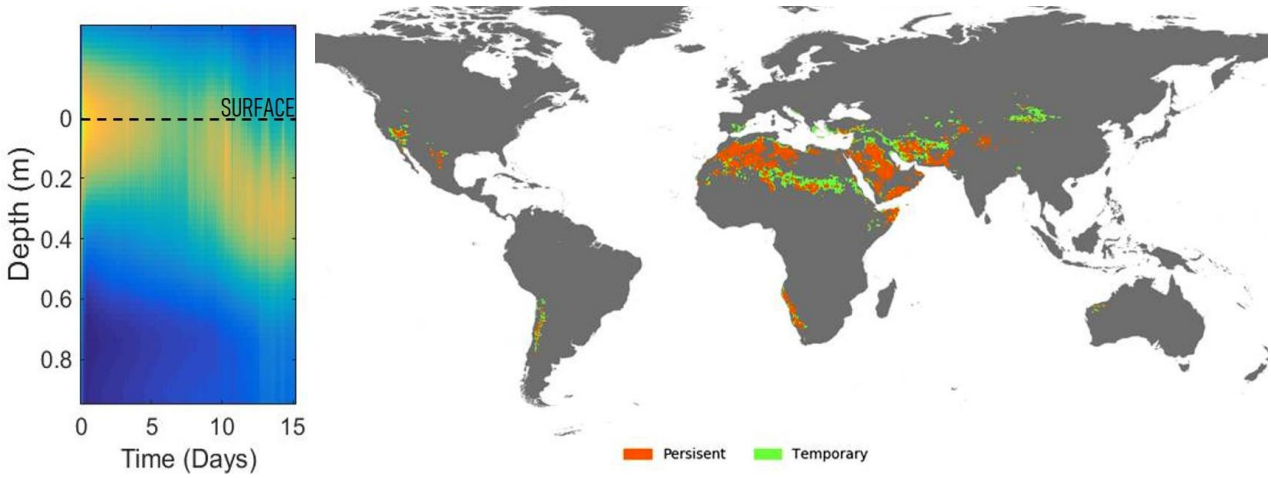
Soil moisture is a key variable in the functioning of the environment and climate system, and its regular and synoptic retrieval has entered global in-service operation utilizing radar satellites. However, persistent issues remain with those regions of the world associated with hot arid zones, and for 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.

Funding particulars:
The project is supported by NERC's Scenario Doctoral Training Partnership at the University of Reading.

References:
Examples of near-real time satellite soil moisture radar products can be found here;
https://hsaf.meteoam.it/Products/ProductsList?type=soil_moisture

More information on the doctoral training partnership:
http://www.reading.ac.uk/nercdtp