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Soil Surface Moisture retrievals from EO and cosmic ray- based approach for selected sites in the UK

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Large-scale soil moisture monitoring is a critical element of sustainable intensification of agricultural land. Remote sensing provides the way forward required for nationwide soil moisture monitoring coverage. On the other, utilising cosmic-ray neutron probes is a relatively new approach for obtaining larger area soil moisture and various relevant operational monitoring networks have been established worldwide utilising this technology to measure operationally this parameter.

This study compares retrievals of soil moisture between the COSMOS-UK cosmic-ray soil moisture observation network and the Synthetic-Aperture-Radar Soil Water Index (SCAT-SAR SWI) product across selected COSMOS-UK sites. A further objective has been to investigate the true footprint and the variations within the footprint detectable area at the COSMOS-UK sites using as a case study one such site located in Riseholme, UK. At the selected experimental site extensive fieldwork was conducted in July 2017 that allowed objectively examining the agreement between the truth data of the TDT soil moisture sensors and the COSMOS-UK product for soil moisture.

It was found that the true footprint of this COSMOS-UK station was representative for an area smaller than the general assumed footprint of 600m diameter, as generally proposed in various relevant investigations. The COSMOS network slightly overestimated soil moisture content measured by the Time Domain Transmissometry (TDT) sensor probes installed in the area. Results of our study contribute towards efforts to assess the COSMOS-UK soil moisture measurement footprint demonstrating the added value of geospatial analysis techniques for this purpose.

Results showed a strong correlation between the true data of the Time Domain Transmissometry

soil moisture sensors and the COSMOS and SCAT-SAR products for soil moisture. In addition, the true footprint of this COSMOS-UK station was discovered to be reflective of a smaller area than the usually accepted footprint of 600m diameter, as proposed in many relevant studies.

Results of our study contribute towards efforts to assess the COSMOS-UK soil moisture measurement footprint demonstrating the added value of geospatial analysis techniques for this purpose. Further scrutiny of the technique is required to establish its applicability to different areas and ecosystems. Such an investigation would require exploring the prediction accuracy of the technique for other sites would have other contributing features such as slopes, land cover differentiation and penetrating vegetation such as hedgerows which could drastically affect the footprint of the probes. All the above are topics of key importance to be taken up by future studies exploiting neutron probe data in the context of soil moisture retrievals.

Keywords: COSMOS UK; SCAT-SAR SWI; Soil Moisture Monitoring; Spatial Analysis; Remote Sensing