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Evaluation of a low-cost soil moisture sensor for citizen-driven satellite validation

Angelika Xaver (1), Luca Zappa (1), Gerhard Rab (2), Isabella Pfeil (1,2), Mariette Vreugdenhil (1,2), Drew Hemment (3), and Wouter Dorigo (1)

(1) Department of Geodesy and Geoinformation, TU Wien, Vienna, Austria (angelika.xaver@geo.tuwien.ac.at), (2) Centre of Water Resource Systems, TU Wien, Vienna, Austria, (3) Edinburgh Futures Institute and Edinburgh College of Art, University of Edinburgh, Edinburgh, United Kingdom

The involvement of non-experts in scientific work and data collection, namely citizen science, is rapidly increasing. Although the potential of citizen science activities and projects to generate huge amounts of data otherwise not feasible is widely recognized, the obtained data and observations are often treated with caution and skepticism. Their quality and reliability is not fully trusted since they are obtained by non-experts using low-cost instruments and/or simplified methods.
In this study, we evaluate the performance of the low-cost soil moisture sensor used within the European citizen science project GROW Observatory (GROW; https://growobservatory.org/). The aim of GROW is to empower hundreds of motivated citizens to monitor soil moisture and other environmental variables within nine high-density clusters around Europe covering different climate and soil conditions. The citizen's contribution is laying the foundation for scientists to validate satellite-based soil moisture products at an unprecedented high spatial resolution. Clearly, to serve as reference dataset, the quality of ground observations is crucial, especially if obtained from low-cost sensors.
To investigate the accuracy of such measurements, the low-cost sensors were installed alongside professional soil moisture probes in the Hydrological Open Air Laboratory (HOAL) in Petzenkirchen, Austria, where data has already been collected for more than a year. We assess the skill of the low cost sensors against the professional probes by the means of various methods. Apart from common statistical metrics like correlation, bias and rmsd, we investigate and compare the temporal stability as well as soil moisture memory.
We will demonstrate that low-cost sensors can be used to generate a dataset valuable for environmental monitoring and satellite validation and thus provide the basis for citizen-based soil moisture science.

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