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SoilMoist: A global network of soil moisture observations based on emerging low-cost technologies.

Katoria Lesaalon Lekarkar[1], Jonas Lembrechts[2], Stefaan Dondeyne[1], and Ann van Griensven[1,3]
[1]Water and Climate Group, Vrije Universiteit Brussel, Brussels, Belgium (klekarkar@gmail.com)
[2]Centre of Excellence Plants and Ecosystems, University of Antwerp, 2610 Wilrijk, Belgium (lembrechtsjonas@gmail.com)
[3]Water Science & Engineering Department, IHE Delft Institute for Water Education, 2611 AX, Delft, The Netherlands (ann.van.griensven@vub.be)

Soil moisture plays a crucial role in the earth's system cycle by connecting the water, energy, and carbon cycles. It actively influences hydrological processes and affects the occurrence of climate-related hazards, such as droughts, heatwaves, and wildfires.

This places soil moisture at the centre of agro- and biometeorological monitoring and forecasting. Despite its crucial role, the global network of soil moisture observations remains the least developed among the major land-based components of the hydrological cycle, with strong regional imbalances in coverage. Remote sensing products provide spatially and time-continuous alternatives to in-situ soil moisture data. However, these products remain coarse in spatial resolution and the lack of in-situ validation data in data-scarce regions such as Africa undermines the application of such products.

The emergence of low-cost technologies has enabled the deployment of monitoring networks that provide large spatial coverage at a fraction of the cost of traditional monitoring networks, offering unique opportunities to upscale coverage and address data scarcity. One such device is the TMS-4 logger from TOMST which has found wide application globally due to its robustness, high temporal resolution, large data storage, and long battery life, guaranteeing independent data collection over an extended period. TMS loggers also offer the advantage that a large amount of georeferenced timeseries data from these devices has already been compiled into the global SoilTemp-database (a database currently largely focused on temperature data). The available timeseries of observations from these devices already covers all the continents (including Antarctica) and comprise observations from close to **10,000** locations that are currently hosted within SoilTemp, with ongoing deployment in at least 9 African countries. Our mission is thus firstly, to consolidate this data as submitted in its raw form to the SoilTemp database, adequately calibrate it, and ultimately avail it as an open-access resource. This global coordination and standardization offer the opportunity to integrate this data into the existing global database of soil moisture monitoring (the International Soil Moisture Network). Secondly, we aim to increase global coverage of soil moisture monitoring using the low-cost TOMST TMS-4, and further facilitate its use by non-scientists in citizen science projects across the globe. The result of this initiative should be a drastic increase in the global coverage of soil moisture data, especially in data-scarce areas such as Africa,

which would provide an indispensable resource for validating satellite products, improving drought monitoring, and countless other environmental applications.