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The potential of crowdsourced in situ soil moisture for environmental research

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The important role of soil moisture for the hydrological cycle and the climate is already well understood and recognized. As a consequence various soil moisture products exist based on remote sensing or modelled data to enable continuous observation on a global scale. To validate these products on ground measurements are required. Due to the improving spatial resolution of satellites from tens of kilometers to tens of meters high density networks of in situ soil moisture sensors are necessary to provide an adequate source for soil moisture product validation. Conventional in situ soil moisture sensors and their maintenance are expensive and labor intensive. Thus, they are rare in number and distribution. The use of low cost soil moisture sensors with the help of citizen scientists holds the potential of establishing high density networks of unprecedented scale.
This is exactly the goal of GROW (GROW Observatory; https://growobservatory.org/), an European citizen science project, to establish a network of thousands of soil moisture sensors, consisting of high density clusters, over Europe. GROW is engaging thousands of citizens passionate about soil, environment and climate to gather information on soil moisture , soil texture and land use. While the citizens obtain data on soil texture and land use once by conducting experiments, observations and filling in forms, soil moisture is observed continuously by using low cost sensors. In order to create a valuable dataset different methodologies for data collection and measurement protocols had to be defined for the individual variables. Particular attention is given to the creation of reliable soil moisture observations. The proper choice of location, adequate installation and careful maintenance by the citizens are essential conditions for a meaningful data acquisition. In addition, the performance of the low cost sensors has to be carefully analyzed to ensure the quality of the measurements.
This presentation focuses on the different levels of quality assurance, starting with instructions for the citizen scientists, evaluating the performance of low cost sensors (e.g. by comparison with professional probes) and concluding with strategies to filter reliable sensor readings from an entire collection of crowd sourced data. We will show that citizens can create a valuable dataset suitable for scientific applications.