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A Citizen Observatory at schools to train a rainfall retrieval algorithm based on Earth Observation

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West Africa's economy is mainly sustained on agriculture and over 70% of crops are rain-fed. Economic growth and food security in this region is therefore highly dependent on the knowledge of rainfall patterns. According to the IPCC, the Global South will seriously suffer from climate change. As traditional rainfall patterns shift, accurate rainfall information becomes crucial for farmers to optimize food production.

The scarce rain gauge distribution and data transmission challenges make rainfall analysis difficult in these regions. Satellites could offer a solution to this problem, but present satellite products do not account for local characteristics and perform poorly in West Africa.

A rainfall retrieval algorithm, developed within the Schools and Satellites (SaS) project, could overcome the lack of ground data and good rainfall satellite products through earth observation and advanced machine learning. However, to validate such an algorithm requires a high amount of rainfall data from ground stations. Since rain gauges are scarce in West Africa, a (temporary) high density observation network is necessary to strengthen the training and validation dataset provided by TAHMO and GMet ground measurements. SaS therefore engages with schools in Northern Ghana to build a Citizen Observatory.

SaS is being funded by the European Space Agency as one of the pilot projects of CSEOL (Citizen Science and Earth Observation Lab). It is being developed in a cooperation between TU Delft, PULSAQUA, TAHMO Ghana, Smartphones4Water (S4W) and GMet. The Proof-of-Concept Algorithm will be fed with data collected in the Citizen Observatory during the rainy season of 2020.

This Citizen Observatory will be built around the already existing infrastructure of a classroom where Climate Change is amongst the topics in the Ghanaian teaching curriculum. We aim to provide a Climate Change educational module that can be used directly by the teachers. The educational module incorporates the building of their own low-cost rain gauge to be used for manual rainfall data collection. This rainfall collection method has already been highly tested by S4W in Nepal. Students will design their own research around the daily rainfall measurements, which they will submit via a web application called Open Data Kit (ODK). The data is being validated by including a picture of the rainfall measurement that is checked with the number passed on by the citizen scientist.

The Citizen Observatory will be placed under the existing TAHMO and S4W infrastructures to respectively continue the interaction with schools and to continue data collection, -validation and -visualization. If the algorithm proofs to indeed perform better than current satellite products for the pilot area in Northern Ghana, the Citizen Observatory could in the future help to validate and improve the product for the whole of West-Africa.

To enable the use of this Citizen Observatory for management of water resources and in this case more and better rainfall data, much effort is needed. We will demonstrate which measures we have taken to ensure that the Citizen Observatory performs with enough quality, and how (if done well) it has the potential to increase the impact of this study.