Citizen science in hydrology: from participatory monitoring to knowledge co-generation

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Beyond the most basic measurements of manual rain and staff gauging, hydrology is not an obvious discipline for the application of citizen science. High-resolution measurements require elaborate equipment, installation, and maintenance that is typically beyond the capabilities of non-scientists. In addition, hydrological analysis has traditionally relied upon long time series of consistent accuracy and precision. Nevertheless, new opportunities for public participation in hydrological research are emerging, driven by increasingly affordable, robust, and more user-friendly technology, and ICT applications in particular.

This trend will create a large volume of new data, which ideally should be used to support better water resources management. This makes it opportune to reflect on how such data can be processed, and relevant knowledge can be extracted. In many citizen science contexts, it will be important to do so in a participatory approach, not only to acknowledge the contribution to citizens in the collection process, but also to ensure that the knowledge feeds back into local management and governance processes.

Therefore, in this paper, we reflect on the opportunities provided by citizen science to co-create actionable knowledge on the water cycle, and how this can be used to support sustainable water resources management and human development, using recent field-based experiences gained in locations as diverse as Peru, Nepal, Kyrgyzstan and Ethiopia.

We first present a simple conceptual framework on the knowledge generation process. Then, we use it to analyse empirical evidence and observations, and suggest that community-based monitoring of water resources and water-related risks can have a transformative impact on local water management by making it more inclusive, polycentric, and evidence-based. However, the results and effectiveness depend strongly on the natural and socio-economic boundary conditions and require specific conditions to be fulfilled. We conclude that a major requirement for success is the use of a highly tailored and bottom-up approach to implementing citizen science activities, which is ideally rooted in a locally based stakeholder that acts as "catalyst" between the scientific community and local realities.

We illustrate this framework with specific ICT-based tools and methods for data collection, processing and communication that were developed as part of a four-year research project (Mountain-EVO).