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Challenges of citizen science contributions to modelling hydrodynamics of floods

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Citizen science is an established mechanism in many fields of science, including ecology, biology and astronomy. Citizen participation ranges from collecting and interpreting data towards designing experiments with scientists and cooperating with water management authorities. In the environmental sciences, its potential has begun to be explored in the past decades and many studies on the applicability to water resources have emerged. Citizen Observatories are at the core of several EU-funded projects such as WeSenseIt, GroundTruth, GroundTruth 2.0 and SCENT (Smart Toolbox for Engaging Citizens into a People-Centric Observation Web) that already resulted in valuable contributions to the field.

Buytaert et al. (2014) has already reviewed the role of citizen science in hydrology. The work presented here aims to complement it, reporting and discussing the use of citizen science for modelling the hydrodynamics of floods in a variety of studies. Additionally, it highlights the challenges that lie ahead to utilize more fully the citizen science potential contribution. In this work, focus is given to each component of hydrodynamic models: water level, velocity, flood extent, roughness and topography. It is addressed how citizens have been contributing to each aspect, mainly considering citizens as sensors and citizens as data interpreters. We consider to which kind of model (1D or 2D) the discussed approaches contribute and what their limitations and potential uses are.

We found that although certain mechanisms are well established (e.g. the use of Volunteer Geographic Information for soft validation of land-cover and land-use maps), the applications in a modelling context are rather modest. Also, most studies involving models are limited to replacing traditional data with citizen data. We recommend that citizen science continue to be explored in modelling frameworks, in different case studies, taking advantage of the discussed mechanisms and of new sensor technologies. More than that, further work lies in evaluating its contribution for more general settings. One issue is quantifying the scalability of these mechanisms considering, for example: how many citizen observations are needed to achieve significant improvement in a hydrodynamic model? What is the necessary spatial and temporal distribution? Another issue relates to the quality of data: should citizen observatory data be treated the same way as traditional data within models? Is pre quality control enough? The mentioned Citizens Observatory projects are already tackling this problematic, showing that only by facing these challenges the real contribution of citizen science towards modelling the hydrodynamics of floods will be uncovered.

Reference:

Buytaert, W., Zulkafli, Z., Grainger, S., Acosta, L., Alemie, T. C., Bastiaensen, J., De Bièvre, B., Bhusal, J., Clark, J., Dewulf, A., Foggin, M., Hannah, D. M., Hergarten, C., Isaeva, A., Karpouzoglou, T., Pandeya, B., Paudel, D., Sharma, K., Steenhuis, T., Tilahun, S., Van Hecken, G., and Zhumanova, M.: Citizen science in hydrology and water resources: opportunities for knowledge generation, ecosystem service management, and sustainable development, Front. Earth Sci., 2, 1-4, doi: 10.3389/feart.2014.00026, 2014.