



## **Citizen observatory of water as a data engine supporting the people-hydrology nexus: experience of the WeSenseIt project**

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Citizen observatories (COs) present an interesting case of strong multi-facet feedback between the physical (water) system and humans. CO is a form of crowdsourcing ensuring a data flow from citizens observing environment (e.g. water level in a river) to a central data processing unit which is typically part of a more complex social arrangement (e.g. water authorities responsible for flood forecasting). The EU-funded project WeSenseIt ([www.wesenseit.eu](http://www.wesenseit.eu)) aims at developing technologies and tools supporting creation of such COs [1,2,3,4].

Citizens which form a CO play the role of “social sensors” which however are very specific. The data streams from such sensors have varying temporal and spatial coverage and information value (uncertainty). The crowdsourced data can be of course simply visualized and presented to public, but it is much more interesting to consider cases when such data are assimilated into the existing forecasting systems, e.g. flood early warning systems based on hydrological and hydraulic models. COs may also affect water management and governance [4], and in fact can be seen as data engines supporting the people-hydrology nexus.

In the framework of WeSenseIt project several approaches were developed allowing for optimal assimilation of intermittent data streams with varying spatial coverage into distributed hydrological models [1, 2]. The mentioned specific features of CO data required updates of the existing data assimilation algorithms (Ensemble Kalman Filter was used as the basic algorithm).

The developed algorithms have been implemented in the operational flood forecasting systems of the Alto Adriatico Water Authority (AAWA), Venice. In this paper we analyse various scenarios of employing citizens data (COs) for flood forecasting.

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### References

- [1] Mazzoleni, M., Alfonso, L., Chacon-Hurtado, J., Solomatine, D. (2015). Assimilating uncertain, dynamic and intermittent streamflow observations in hydrological models. *Advances in Water Res.*, 83, 323-339 (Online on September 1, 2015).
- [2] Mazzoleni M., Verlaan M., Alfonso L., Monego M., Norbiato D., Ferri M., and Solomatine D.P. (2015) Can assimilation of crowdsourced streamflow observations in hydrological modelling improve flood prediction?, *Hydrology and Earth System Sciences*, under review.
- [3] Mazzoleni M., Alfonso L. and Solomatine D.P. (2015) Effect of spatial distribution and quality of sensors on the assimilation of distributed streamflow observations in hydrological modeling, *Hydrological Sciences Journal*, under review.
- [4] Wehn, U., McCarty, S., Lanfranchi, V. and Tapsell, S. (2015) Citizen observatories as facilitators of change in water governance? Experiences from three European cases, Special Issue on ICTs and Water, *Journal of Environmental Engineering and Management*, 2073-2086.