Hydrological Observatories
Featured in VZJ Special Section

Image courtesy of Jenny Parks
Understanding how water moves through the environment, from evapotranspiration from plants, to precipitation, and ground water storage is a critical part of the earth sciences. Changes in water flow associated with changes in land use and climate can have short- and long-term impacts on access to clean water for a variety of uses from drinking water to irrigation.

Across the globe, there are hydrological observatories monitoring water flow and flux, many of which either have or are building long-term data sets. *Vadose Zone Journal* recently published a special section, “Hydrological Observatories,” to highlight 23 of these observatories from around the world. The observatories included are from across four continents, covering diverse climate zones and geological conditions, and vary in the data each site collect. Hydrological observatories that have been established for many years are ideal for detecting the effects of climate change and land use change. Newly established observatories are equipped with modern technology that monitors fluxes in the atmosphere, precipitation, infiltration, and evapotranspiration. This collection of open access papers will make researchers more aware of the data that hydrological observatories collect and can provide to them.

The following excerpt from the introductory paper (https://doi.org/10.2136/vzj2018.10.0194) provides a preview of this special section.

**Overall, the new insights and novel scientific findings presented in this special section illustrate that long-term integrated hydrological monitoring is essential for expanding our understanding of hydrological processes at various temporal and spatial scales (i.e., from the field to the catchment). For instance, Zhang et al. (2017) examined about 312 small and large catchments worldwide to provide a generalized framework to evaluate hydrological responses to forest cover change and to identify the contributions of spatial scale, climate, forest type, and hydrological regime. They found a general tendency for runoff responses to be more sensitive to forest change in water-limited watersheds than in energy-limited watersheds. Clearly, such studies are only possible if data from a large number of hydrological observatories with a wide range of different environmental conditions are available.

The ongoing long-term monitoring of a large number of hydrological variables across multiple compartments in many experimental catchments around the world representing a variety of climatic and hydrological conditions will help solve important scientific questions such as:

- How will climate change affect the major hydrological fluxes (including the fluxes of solutes, gases, and sediments) in the long term?
- How will land use change influence the hydrological cycle and especially the quality of surface water and groundwater?
- How can local information (e.g., from in situ sensors) be used to predict large-scale hydrological processes?
- What will be the impact of an improved understanding of interface processes and feedback mechanisms between the different compartments of the terrestrial system (soil, plant, atmosphere, and groundwater) on long-term predictions of hydrological and atmospheric processes under changing climate conditions?
- What will be the effect of climate and human-induced changes on physical, chemical, and biological indicators used to assess the status of water bodies?

The high number of contributions to this special section demonstrates that the hydrological community is very active. However, one of the challenges in the coming years will be to better coordinate these efforts (e.g., Blöschl et al., 2017; Bogena et al., 2017). This is required not only for improving data analysis and model-driven design of catchment experiments, but also to perform hydrological forecasts at larger, perhaps global scales, to develop interdisciplinary research at all scales, and to better address the pressing societally relevant environmental problems related to the impacts of climate and land use change on the hydrologic cycle. The presented hydrological observatories and their associated databases are crucial for the advancement of integrated hydrological models that consider complex feedback mechanisms between the hydrological compartments. Thus, in our view, it is essential to increase the awareness and knowledge of these infrastructures in the international hydrological community to increase their utilization for the exploration of new hypotheses in hydrology and related disciplines.

**References**


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