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Developments in hydrological modelling: from Darcy's work on public fountains to observations by the public

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Darcy's experiments for the public fountains in Dijon in the 1850s aimed at estimating a single parameter value, namely the saturated hydraulic conductivity (K_{sat}). Lumped hydrological models that are nowadays used to simulate streamflow at the catchment scale use at least a handful of model parameters. These parameters can not be measured in the field and are typically poorly defined. Therefore, despite all our efforts, catchment hydrological modelling still faces equifinality issues that can not be solved by the dramatically increased computational opportunities since Darcy's work. In addition to the increased computational power, data availability for hydrological modelling has dramatically improved as well. Especially in the last decade, the emergence of large-sample datasets for various regions around the globe has enable modelling studies using data from hundreds of catchments. This has helped to ensure more generally applicable findings. These new data sets also allow us to study the value of data in more detail. This is interesting, for instance, when we want to evaluate the potential value of different datasets, including those of public observations in citizen science projects, such as CrowdWater. In this lecture, I will present findings of recent modeling studies based on large samples of catchments with a focus on the value of different types of data and the question how to best simulate (almost) ungauged catchments.