



Guidelines for selecting hydrological signatures to measure change in space and time

Hilary McMillan (1), Ida Westerberg (2), and Flora Branger (3)

(1) San Diego State University, Department of Geography, San Diego, United States (hmcmillan@sdsu.edu), (2) IVL Swedish Environmental Research Institute, Stockholm, Sweden, (3) IRSTEA, Hydrology-Hydraulics Research Unit, Lyon, France

Hydrological signatures are index values derived from observed or modeled series of hydrological data such as rainfall, flow or soil moisture. They are designed to extract relevant information about rainfall–runoff processes, such as identifying dominant processes, and determining the strength, speed and spatiotemporal variability of the rainfall–runoff response. Hydrological signatures can be compared across catchments to understand spatial variation in runoff processes, and can be compared across time to evaluate hydrological change. Most studies use a selection of different signatures to capture different aspects of the catchment response, for example evaluating overall flow distribution as well as high and low flow extremes and flow timing. Such studies often choose their own set of signatures, or may borrow subsets of signatures used in multiple other works. There is little agreement towards a standardized set of hydrological signatures.

We discuss three aspects of signature selection. (1) Criteria for individual signatures. For example, the signatures should be identifiable in the face of data uncertainty, and they should be robust to equipment type and non-relevant factors such as catchment area. When using the signatures to make comparisons across space and time, we would wish to minimize the difference between signature values for catchments that are ‘nearby’ (in terms of hydrological behaviour), and maximize the difference between signature values for catchments that are far apart (in terms of hydrological behaviour). (2) Criteria for a set of signatures. For example, the breadth of data characteristics that a set of signatures should describe, such that the set as a whole should enable all relevant characteristics of the data series to be reproduced. The signatures in the set should be orthogonal, or independent, to minimize replication of information between signatures. (3) Guidelines for a standardized set of signatures. Discussion of the circumstances under which a standardized set of signatures might be practical or useful.

We believe that reaching a consensus on minimum criteria for hydrological signatures and a standardized set, or sets, of hydrological signatures will facilitate comparison between hydrological studies, and help hydrologists to synthesize changes in hydrological response across space and time.