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A Strategy for Selecting Similarity Indices across Diverse Hydrological Regimes

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Hydrologic similarity indices are usually specific to a particular environmental setting, and are not necessarily relevant in other settings. For example, a topographic similarity index may be relevant to places where topography is a major control on hydrology, e.g., storm runoff in sloping humid catchments. However, the same index might not be so relevant to boreal forests in northern Canada, or wetlands in Africa. Similarity indices are usually derived either using a geographically-limited dataset, or using an assumed set of dominant hydrological processes. This paper explores one possible strategy for selecting appropriate similarity indices to suit the environment of interest.

The approach we explore here is to use a family of similarity indices that are relevant to a variety of different environments, and a decision-tree process to infer which environments may be present in the catchment of interest, so that appropriate similarity indices are selected. We use a very simple segregation that is based on the dominant form of stored water: most of the hydrologically active storage is (i) frozen (snow and ice); (ii) in pores (soil water and groundwater); (iii) in open water (lakes, floodplains and wetlands). Within the pore-water class, we provide additional suggested discrimination regarding the relative importance of interception by plant canopies, infiltration excess runoff at the land surface, evaporation and drainage from the root zone, groundwater discharge via shallow vs deep pathways.

We evaluate some aspects of these simple quantitative methods for determining the dominant form of storage by comparing the results against numerical modelling results produced in previous studies, using time-stepping, spatially distributed models.