Hydrological regionalization based on available hydrological information for daily runoff prediction

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Regionalization provides a way of transferring hydrological information from gauged to ungauged catchments. The past few decades has seen several kinds of regionalization approaches for catchment classification and runoff predictions. The underlying assumption is that catchments having similar catchment properties are hydrological similar. This requires the appropriate selection of catchment properties, particularly the inclusion of observed hydrological information, to explain the similarity of hydrological behavior. We selected observable catchments properties and flow duration curves to reflect the hydrological behavior, and to regionalize rainfall-runoff response for runoff prediction. As a case study, we investigated 15 catchments located in the Yangtze and Yellow River under multiple hydro-climatic conditions. A clustering scheme was developed to separate the catchments into 4 homogeneous regions by employing catchment properties including hydro-climatic attributes, topographic attributes and land cover etc. We utilized daily flow duration curves as the indicator of hydrological response and interpreted hydrological similarity by root mean square errors. The combined analysis of similarity in catchment properties and hydrological response suggested that catchments in the same homogenous region were hydrological similar. These results underscored the necessity of using hydrological response indices in regional studies. A further validation was conducted by establishing a rainfall-runoff coaxial correlation diagram for each catchment. The transfer of the coaxial correlation diagram from one catchment to another within the homogenous region showed a high performance in terms of a qualified rate for runoff prediction at an hourly time scale. This finding is important given coaxial correlation diagrams are commonly used tools for runoff prediction, particularly in China. The coaxial correlation diagram can be transferred within the homogeneous region for runoff prediction in ungauged catchments at an hourly time scale.

Key words: regionalization; clustering analysis; hydrological response; coaxial correlation diagrams; runoff prediction