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Hydrograph prediction in ungauged basins – a comparative assessment of studies

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The objective of this assessment is to compare studies predicting runoff hydrographs in ungauged catchments. The aim is to learn from the similarities and differences between catchments in different places, and to interpret the differences in performance in terms of the underlying climate-landscape controls. The assessment is performed at two levels. The Level 1 assessment is a meta-analysis of 33 studies reported in the literature involving 3874 catchments. The Level 2 assessment consists of a more focused and detailed analysis of individual basins from selected studies from Level 1 in terms of how the leave-one-out cross-validation performance depends on climate and catchment characteristics as well as on the chosen regionalisation method. The results indicate that runoff hydrograph predictions in ungauged catchments tend to be more accurate in humid than in arid catchments and more accurate in large than in small catchments. The dependence of performance on elevation differs by regions and depends on how aridity varies with elevation and air temperature. The effect of parameter regionalisation method on model performance differs between studies. However, there is a tendency towards a somewhat lower performance of regressions than other methods in those studies that apply different methods in the same region. In humid catchments spatial proximity and similarity methods perform best while in arid catchments similarity and parameter regression methods perform slightly better. For studies with a large number of catchments (dense stream gauge network) there is a tendency for spatial proximity and geostatistics to perform better than regression or regionalisation based on simple averaging of model parameters from gauged catchments. There was no clear relationship between predictive performance and the number of regionalised model parameters. The implications of the findings are discussed in the context of model building.