Runoff prediction in ungauged catchments in Norway: comparing different regionalization approaches

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Prediction in Ungauged Basins (PUB) is one of the most challenging topics in current surface hydrology research. Regionalization, as one of the core objectives of PUB initiative, has been used for assessing and predicting hydrological response in ungauged regions. Regionalization methods can generally be classified as regression methods, spatial proximity methods and physical similarity methods. After more than a decade of intensive research, many methods and developments have been proposed and applied for PUB. However, there is no universal method available for regionalization that gives reliable results for different regions and models. Furthermore, only few studies have examined which methods produce the most reliable runoff predictions in ungauged basins for watersheds at high latitudes, where large regions lack hydrological observations. In this study, existing regionalisation methods have been evaluated for seasonally snow-covered mountainous catchments in Norway, which stretches from approximately 58 to 71°N and is located in Scandinavia. In this study, the monthly water balance model WAS-MOD was calibrated and regionalised using long-term data from 118 catchments. The model gives reliable results for Norway with an average value of the Nash–Sutcliffe model efficiency coefficient (NSE) equal to 0.86 for the calibratrion period and 0.83 for the validation period. Of the regionalisation methods, a combination of spatial proximity and physical similarity shows the best performance. The physical similarity method shows better results than spatial proximity, which shows higher performance than the regression method. For the mountainous regions, the spatial proximity method produces the best results. This study contributes to the theoretical understanding and development of regionalisation methods, as well as to produce spatially distributed runoff data for a high resolution water balance mapping of Norway.