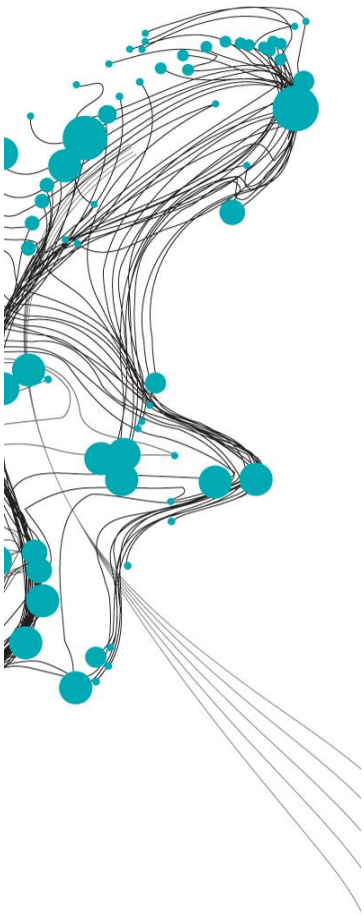
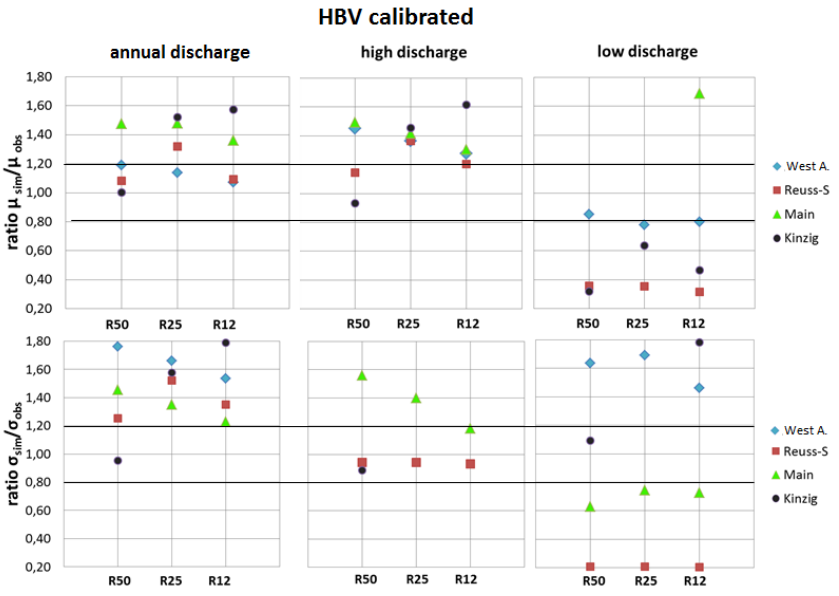
SENSITIVITY OF DISCHARGE CHARACTERISTICS TO THE SPATIAL RESOLUTION OF REGIONAL CLIMATE MODELS



Regional Climate Models (RCMs) coupled with General Circulation Models (GCMs) are among the most important tools to generate future climate projections. The output of these models, such as precipitation and temperature, is used to force hydrological models to be able to study for example the effect of climate change on discharge characteristics. The precipitation and temperature are often adjusted before forcing the hydrological model by using a bias correction. Last decades an important improvement of the RCM has been carried out, namely the RCM spatial resolution has been increased. A higher resolution improves the land surface representation and the possibility to simulate important small-scale resolution. However, there are some constraints on increasing the RCM resolution as well. First, the process is time consuming and second, the higher resolution demands significant computational resources. Therefore, it is important to study the balance between the effect of increasing the resolution on model output and the investments needed to increase the resolution. The effect of increasing the resolution on discharge characteristics has been rarely explored. This study assessed the sensitivity of discharge characteristics to RCM spatial resolution when looking at different catchment characteristics, catchment sizes and hydrological model – parameter estimation. To achieve this goal, the RCM RACMO has been selected and forced with re-analysis data instead of GCM output, four sub-catchments having different characteristics have been selected and three different calibrated versions of HBV.

In conclusion, this study shows that for larger sub-catchments an increase in RCM spatial resolution results in a small increase in total model performance. However, the small sub-catchments do not show this increase in total model performants while beforehand expected. It is important to keep in mind that this study has not applied a bias correction method. Further, the hydrological model choice and topography are not relevant for the sensitivity of discharge characteristics to the increase of RCM spatial resolution. The high discharges are having more profit of the increase in RCM spatial resolution than the annual and low discharges. Since no bias correction has been applied, the hypothesis is formulated that the bias correction and profit of increasing the RCM spatial resolution are dependent of each other. It is recommended to focus further research on the dependency of the bias correction method and increase in RCM spatial resolution.



Figuur 1: Total model performance of the annual discharge for the four selected sub-catchments West Alpine (large and mountainous), Reuss Seedorf (small and mountainous), Main (large and lowland) and Kinzig (small and lowlands). The total model performance has been calculated by the ratio of the mean and standard deviation of the observed discharge and the simulated discharge for 3 RCM spatial resolutions (R50 (lowest), R25 (middle) and R12 (highest)).

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