



Uncertainty of the hydrological response to climate change conditions; 605 basins, 3 hydrological models, 5 climate models, 5 hydrological variables

Lieke Melsen (1), Naoki Mizukami (2), Andrew Newman (2), Martyn Clark (2), and Adriaan Teuling (1)

(1) Wageningen University, Hydrology and Quantitative Water Management, Wageningen, Netherlands (lieke.melsen@wur.nl), (2) National Center for Atmospheric Research (NCAR), Boulder, CO, USA

Many studies investigated the effect of a changing climate on the hydrological response of a catchment and uncertainty of the effect coming from hydrologic modelling (e.g., forcing, hydrologic model structures, and parameters). However, most past studies used only a single or a small number of catchments. To go beyond the case-study, and to assess the uncertainty involved in modelling the hydrological impact of climate change more comprehensively, we studied 605 basins over a wide range of climate regimes throughout the contiguous USA. We used three different widely-used hydrological models (VIC, HBV, SAC), which we forced with five distinct climate model outputs. The hydrological models have been run for a base period (1986-2008) for which observations were available, and for a future period (2070-2099). Instead of calibrating each hydrological model for each basin, the model has been run with a parameter sample (varying from 1600 to 1900 samples dependent on the number of free parameters in the model). Five hydrological states and fluxes were stored; discharge, evapotranspiration, soil moisture, SWE and snow melt, and 15 different metrics and signatures have been obtained for each model run. With the results, we conduct a sensitivity analysis over the *change* in signatures from the future period compared to the base period. In this way, we can identify the parameters that are responsible for certain projected changes, and identify the processes responsible for this change. By using three different models, in which VIC is most distinctive in including explicit vegetation parameters, we can compare different process representations and the effect on the projected hydrological change.