Geophysical Research Abstracts
Vol. 21, EGU2019-12264, 2019
EGU General Assembly 2019

Comparison of robustness of different hydrological models in different climatic catchments of China

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Non-stationary hydrological sequences and rainfall-runoff relationship in a changing environment have brought new challenges to the application of hydrological models. Robust hydrological models are more reliable to evaluate the impact of changing environment on water resources at the catchment scale. However, robustness differences in hydrological responses to changing environment resulting from the use of different hydrological models have received much less attention. Therefore, this study compares the robustness of six conceptual hydrological models (Xinanjiang, HBV, SIMHYD, IHACRES, GR4J and WASMOD) in different test scenarios in the Yellow River Basin and the Yangtze River Basin of China. The hierarchical scheme for systematic testing of hydrological models according to the modelling tasks proposed by Klemes (1986) and 48-year long records of daily runoff and climate are used in this study. Firstly, as the least challenging test in hierarchical scheme, the simple split-sample test is performed for testing models' ability to reproduce historical runoff under stationary conditions. Secondly, the proxy-basin test is carried out as a basic test for geographical transferability. In order to avoid the influence caused by the climate change, the single years of a basin are calibrated and the double years of other basins are validated. Thirdly, the climate comparison periods (the driest and wettest five years in a row) are selected as calibration and validation periods. The differential split-sample test and proxy-basin differential split-sample test are executed when calibration and validation occur in the same basin and in different basins respectively. By comparing the performance of different models in four tests, more stable models can be selected and used in future studies. This study can provide useful information for model selection and increase the credibility of models about the research of hydrological impacts produced by changing environment.