Geophysical Research Abstracts
Vol. 19, EGU2017-12406, 2017
EGU General Assembly 2017

Examining the effects of parameter regionalization schemes on parameter transferability on large basin sampling

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Assessing model complexity and performing "seamless" continental-domain model simulations (e.g., model parameters yielding good performance across entire domain) is a challenging topic in contemporary hydrology. This study presents a large-sample hydrologic modeling effort to examine the effects of parameter regionalization schemes. Two hydrological models (mHM, VIC) are set up for 500 small to medium-sized unimpaired basins over the contiguous United States for two spatial scales: lumped and 12km grid. For parameter regionalization, we use the well-established Multiscale Parameter Regionalization (MPR) technique for both models, with the specific goal of assessing the transferability of model parameters across different spatial scales (lumped basin scale to distributed), time periods (from calibration to validation period), and locations.

In terms of the scale transferability, evaluation of global model parameters at finer scale based on calibration at coarse scale improves the KGE performance (mainly due to the variance related term). Loss in model performance in temporal transferability is independent from model complexity (i.e., lumped vs. distributed). Finally, we show that although the parameter regionalization is crucial for parameter transferability to un-gauged locations, there still remains room for improvement especially for the mean and variability in streamflow. We present possible strategies to resolve this issue, including (1) assessing the importance of more detailed information on the soil data (STATSGO vs. SoilGrids), and (2) applying more advanced selection criteria for training MPR global parameters.