Geophysical Research Abstracts
Vol. 16, EGU2014-7021, 2014
EGU General Assembly 2014

An ensemble modeling framework for understanding differences in hydrological model performance across the contiguous US

Andy Newman (1), Martyn Clark (1), Andy Wood (1), Jason Craig (1), Kevin Sampson (1), Lauren Hay (2), Andy Bock (2), Levi Brekke (3), and Jeff Arnold (4)

(1) National Center for Atmospheric Reserach, Research Applications Lab, Boulder, CO, USA, (2) United States Geological Survey, Denver, CO, USA, (3) Bureau of Reclamation, Denver, CO, USA , (4) United States Corps of Engineers, Institue for Water Resources, Alexandria, VA, USA

Given rapid increases in computing power, the field of “large sample hydrology” is becoming increasingly popular as a way to understand model shortcomings and improve model performance. This presentation summarizes (1) development of an ensemble Contiguous United States (CONUS), gridded, daily, station based historical precipitation and temperature dataset used to understand how uncertainty in precipitation and temperature affects regional variability in hydrological model performance; and (2) analysis of the performance of the Snow17-Sacramento model for 670 basins across the contiguous USA.

This work allows for characterization of model strengths and weaknesses over a large number of basins, spanning a wide range of hydro-climatic conditions. Analysis of the ensemble forcing data in an uncertainty framework provides an improved understanding of how climate station density and the hydro-climatic regime affect the relative importance of input data uncertainties and model structural weaknesses. Results show that model Nash-Sutcliffe efficiency (NSE), a popular measure of hydrologic model performance, varies regionally over the CONUS with skill in 90% of basins ranging from 0.55 to 0.94. Poor model performance is found in arid and semi-arid regions (e.g. high Plains of the U.S). Physically-based diagnostic measures show that, for example, low flow periods are generally over-predicted in rain-dominated basins and under-predicted in arid regions and basins with large seasonal snowpack. Reasons for poor NSE in arid and semi-arid basins point to uncertainties in the model forcing data and possible relationships between basin flashiness and forcing uncertainties. Future work will include a quantitative total error analysis using the Bayesian Total Error Analysis (BATEA) methodology.