Geophysical Research Abstracts
Vol. 19, EGU2017-10266, 2017
EGU General Assembly 2017

A comprehensive approach to identify dominant controls of the behavior of a land surface-hydrology model across various hydroclimatic conditions

Amin Haghnegahdar (1), Mohamed Elshamy (1), Fuad Yassin (1), Saman Razavi (1), Howard Wheater (1), and Al Pietroniro (2)

(1) University of Saskatchewan, Global Institute for Water Security, Saskatoon, Canada (amin.haghnegahdar@usask.ca), (2) Environment and Climate Change Canada, National Hydrology Research Centre, Saskatoon, Canada

Complex physically-based environmental models are being increasingly used as the primary tool for watershed planning and management due to advances in computation power and data acquisition. Model sensitivity analysis plays a crucial role in understanding the behavior of these complex models and improving their performance. Due to the non-linearity and interactions within these complex models, Global sensitivity analysis (GSA) techniques should be adopted to provide a comprehensive understanding of model behavior and identify its dominant controls. In this study we adopt a multi-basin multi-criteria GSA approach to systematically assess the behavior of the Modélisation Environmentale–Surface et Hydrologie (MESH) across various hydroclimatic conditions in Canada including areas in the Great Lakes Basin, Mackenzie River Basin, and South Saskatchewan River Basin. MESH is a semi-distributed physically-based coupled land surface-hydrology modelling system developed by Environment and Climate Change Canada (ECCC) for various water resources management purposes in Canada. We use a novel method, called Variogram Analysis of Response Surfaces (VARS), to perform sensitivity analysis. VARS is a variogram-based GSA technique that can efficiently provide a spectrum of sensitivity information across a range of scales within the parameter space. We use multiple metrics to identify dominant controls of model response (e.g. streamflow) to model parameters under various conditions such as high flows, low flows, and flow volume. We also investigate the influence of initial conditions on model behavior as part of this study. Our preliminary results suggest that this type of GSA can significantly help with estimating model parameters, decreasing calibration computational burden, and reducing prediction uncertainty.