Geophysical Research Abstracts
Vol. 17, EGU2015-3435, 2015
EGU General Assembly 2015

Why Bother to Calibrate? Model Consistency and the Value of Prior Information

Markus Hrachowitz (1), Ophelie Fovet (2), Laurent Ruiz (2), Tanja Euser (1), Shervan Gharari (1), Remko Nijzink (1), Hubert Savenije (1), and Chantal Gascuel-Odoux (2)

(1) Delft University of Technology, Civil Engineering and Geosciences, Water Resources Section, Delft, Netherlands (m.hrachowitz@tudelft.nl), (2) INRA, Agrocampus Ouest, UMR1069, SolAgro et hydrosysteme spatialisation, Rennes, France

Hydrological models frequently suffer from limited predictive power despite adequate calibration performances. This can indicate insufficient representations of the underlying processes. Thus ways are sought to increase model consistency while satisfying the contrasting priorities of increased model complexity and limited equifinality. In this study the value of a systematic use of hydrological signatures and expert knowledge for increasing model consistency was tested. It was found that a simple conceptual model, constrained by 4 calibration objective functions, was able to adequately reproduce the hydrograph in the calibration period. The model, however, could not reproduce 20 hydrological signatures, indicating a lack of model consistency. Subsequently, testing 11 models, model complexity was increased in a stepwise way and counter-balanced by using prior information about the system to impose "prior constraints", inferred from expert knowledge and to ensure a model which behaves well with respect to the modeller's perception of the system. We showed that, in spite of unchanged calibration performance, the most complex model set-up exhibited increased performance in the independent test period and skill to reproduce all 20 signatures, indicating a better system representation. The results suggest that a model may be inadequate despite good performance with respect to multiple calibration objectives and that increasing model complexity, if efficiently counter-balanced by available prior constraints, can increase predictive performance of a model and its skill to reproduce hydrological signatures. The results strongly illustrate the need to balance automated model calibration with a more expert-knowledge driven strategy of constraining models.