Geophysical Research Abstracts
Vol. 19, EGU2017-10100, 2017
EGU General Assembly 2017

How does the sensitivity signal change when using the rate of change of a hydrological variable instead of its magnitude?

Björn Guse (1), Matthias Pfannerstill (1), Abror Gafurov (2), Nicola Fohrer (1), and Hoshin Gupta (3)

(1) Kiel University, Institute for Natural Resource Conservation, Hydrology and Water Resources Management, Kiel, Germany (bguse@hydrology.uni-kiel.de), (2) GFZ German Research Centre for Geosciences, Section Hydrology, Potsdam, Germany, (3) Department of Hydrology and Atmospheric Sciences, University of Arizona, Tucson, AZ, USA

In a parameter sensitivity analysis, the impact of changes in the values of model parameters on a response variable, i.e. a model output, is investigated. A core point is the selection of the response variable which is in hydrology in the most cases discharge. Usually, the magnitude of the response variable is used which is reasonable for investigating the absolute values of a hydrological variable. However to capture the dynamics in hydrological behaviour, intuitively the rate of change of a hydrological variable seems to be a better response variable. In this context, the rate of change is defined as the change in a hydrological variable from day to day.
To compare the sensitivity signal using both magnitude and rate of change, we applied a temporally resolved sensitivity analysis to different hydrological variables. To obtain representative results, several hydrological variables such as water yield, different runoff components, soil water content and actual evapotranspiration are selected. Daily sensitivities of nine parameters from different model components on these hydrological variables are calculated using the temporal dynamics of parameter sensitivity (TEDPAS).
The sensitivity patterns as calculated for magnitude and rate of change are then compared for each hydrological variable. Our analysis demonstrates that the sensitivity patterns are significantly changed in certain cases between both approaches. In particular, capacity parameters such as soil water content are less sensitive using the rate of change. The sensitivities of model parameters also changed for the water yield. Whilst only four parameters are sensitive on its magnitude, two additional parameters become relevant using the rate of change.
Our study shows that model parameters which are not controlling the magnitude of a hydrological variable might be sensitive on its rate of change. Thus, we conclude that the sensitivity signal as obtained from the rate of change of a hydrological variable provides additional information of the role of a parameter in a model.