Geophysical Research Abstracts
Vol. 16, EGU2014-15631-1, 2014
EGU General Assembly 2014

Reducing equifinality of hydrological models by integrating Functional Streamflow Disaggregation

Stefan Lüdtke (1), Heiko Apel (1), Manuela Nied (1), Peter Carl (2), and Bruno Merz (1)

(1) GFZ German Research Centre for Geosciences, Hydrology, Potsdam, Germany, (2) ASWEX - Applied Water Research, Climate Dynamics & Signal Analysis Project, Berlin, Germany

A universal problem of the calibration of hydrological models is the equifinality of different parameter sets derived from the calibration of models against total runoff values. This is an intrinsic problem stemming from the quality of the calibration data and the simplified process representation by the model. However, discharge data contains additional information which can be extracted by signal processing methods. An analysis specifically developed for the disaggregation of runoff time series into flow components is the Functional Streamflow Disaggregation (FSD; Carl & Behrendt, 2008). This method is used in the calibration of an implementation of the hydrological model SWIM in a medium sized watershed in Thailand. FSD is applied to disaggregate the discharge time series into three flow components which are interpreted as base flow, inter-flow and surface runoff. In addition to total runoff, the model is calibrated against these three components in a modified GLUE analysis, with the aim to identify structural model deficiencies, assess the internal process representation and to tackle equifinality. We developed a model dependent (MDA) approach calibrating the model runoff components against the FSD components, and a model independent (MIA) approach comparing the FSD of the model results and the FSD of calibration data. The results indicate, that the decomposition provides valuable information for the calibration. Particularly MDA highlights and discards a number of standard GLUE behavioural models underestimating the contribution of soil water to river discharge. Both, MDA and MIA yield to a reduction of the parameter ranges by a factor up to 3 in comparison to standard GLUE. Based on these results, we conclude that the developed calibration approach is able to reduce the equifinality of hydrological model parameterizations. The effect on the uncertainty of the model predictions is strongest by applying MDA and shows only minor reductions for MIA. Besides further validation of FSD, the next steps include an extension of the study to different catchments and other hydrological models with a similar structure.