Geophysical Research Abstracts
Vol. 18, EGU2016-12665-1, 2016
EGU General Assembly 2016

Same catchment, different models, same dominant processes? – How temporal patterns of dominant parameters vary between two hydrological models

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Dominant hydrological processes change during the year. The variations in the dominance of modelled processes also lead to changes in the sensitivity of model parameters over time. An analysis of the temporal dynamics in parameter sensitivity (TEDPAS) provides daily sensitivity values for each model parameter. Thus, TEDPAS shows seasonal patterns of model parameter sensitivities and the seasonality of the corresponding processes.
Each hydrological model consists of model-specific structures and parameters. Depending on differences in the model concepts, the parameters are partly similar or can be partly difficult to compare. Thus, the application of TEDPAS to different models is expected to lead to different seasonal patterns of dominant model parameters.
However, in a world of perfect models, seasonal patterns of the corresponding dominant processes of the same catchment should be identical in different models. To investigate this, TEDPAS is applied on the hydrological models SWAT (Soil and Water Assessment Tool) and HYPE (Hydrological Predictions for the Environment) for the Treene catchment in Northern Germany.
By comparing daily sensitivities of parameters between both models, similarities and differences in the seasonal patterns of parameter dominance are detected. These results are analyzed and explained in relation to differences in the model structure of SWAT and HYPE. The comparison of SWAT and HYPE shows differences in the seasonal variations in dominant parameters and corresponding processes. Similar patterns of dominant processes in both models provide more confidence on the model structures. In contrast, differences in these patterns give insights which model components need to be reconsidered for an appropriate use in the study catchment. Based on the TEDPAS analysis it could be clearly derived which process needs to be investigated more detailed. This study contributes thus to improved hydrological consistency during model construction and a better representation of hydrological processes in models.