Geophysical Research Abstracts
Vol. 20, EGU2018-2685, 2018
EGU General Assembly 2018

An operational water balance model based on maximum entropy production theory and its global verification

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This research provides a test of the maximum entropy production (MEP) theory in identifying hydrological behavior by hydrological modelling. Firstly, an operational MEP-based water balance model is developed and simplified here. By applying the model at 22 global large catchments and 346 global small catchments, we find good agreement between the observed and simulated monthly water balance components, i.e. streamflow, evapotranspiration and water storage change, during both calibration and validation periods. This results verify the applicability and robustness of the model structure and stability of the model parameters. We further provide statistical models for estimating model parameters using catchment climate, vegetation and land properties data. With predicted parameters, the model also shows good performance in comparison with global actual evapotranspiration and water storage change data from other sources. In summary, by bridging the gap between the organizing theory and observational evidence real, this research offer substantial evidence on the applicability of the MEP in hydrological system.