Geophysical Research Abstracts
Vol. 20, EGU2018-7412, 2018
EGU General Assembly 2018

Using the Budyko framework for calibrating a global hydrological model in ungauged catchments of the world

Peter Burek, Peter Greve, Yusuke Satoh, and Yoshihide Wada
IIASA, Water, Laxenburg, Austria (burek@iiasa.ac.at)

In the last three decades, Global hydrological models (GHMs) have become an established tool to simulate water resources worldwide, however, most of the GHMs are uncalibrated. One of the main reasons which makes calibration necessary is large uncertainty in input data, parameters, model assumptions and grid cell heterogeneity especially at low resolution of 0.5° or even 5'. Running GHMs uncalibrated may lead to unrealistic projections of terrestrial water cycle in some regions, where input data (such as e.g., climate forcing) are not well constrained.
Calibration of hydrological models is usually performed by using and comparing to observed discharge. However, for some parts of the world it is challenging to get accurate station data and reliable time series of discharge. Also the global accessibility of these data is decreasing since the 1990s. Instead of calibrating for a few stations with existing data in Africa and Asia and trying to regionalize the results, here we attempt to use the Budyko framework for calibration with the IIASA in-house global hydrological model, the Community Water Model (CWatM). This should be seen as an intermediate approach between "traditional" calibration with discharge data and no calibration at all. This method is independent of measured discharge data and a way to achieve more realistic water projections for the future in ungauged catchments.
The hypothesis which is tested here is that "Budyko calibration" will be not as good as fitting simulated to the observed discharge, but it will be an improvement against an unfitted non-calibration run. Calibration is using an evolutionary computation framework. As objective function the modified version of the Kling-Gupta Efficiency (KGE) is taken. For calibration to observed discharge KGE is optimized directly. For "Budyko calibration" daily precipitation, potential evaporation and actual evapotranspiration are aggregated for each modeling grid cell over a time period of more than ten years. These sums enable us to compute coordinates in the "Budyko space", which are subsequently optimized towards the theoretical Budyko curve. KGE is then calculated for the optimized "Budyko calibration" and for the non-calibration simulation run.
We will show and discuss the results of the "Budyko calibration" for eight catchments of different size and in different flow and climate regimes worldwide.