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# Global Budyko water balance assessment application as a diagnostic tool to improve seasonal forecasts

**Ehsan Modiri**[1], Luis Samaniego[1], Robert Schweppe[1], Pallav Kumar Shrestha[1], Oldrich Rakovec[1], Matthias Kelbling[1], Alberto Martínez-de La Torre[2], Edwin Sutanudjaja[3], Eleanor Blyth[2], Niko Wanders[3], and Stephan Thober[1]

[1]Helmholtz Centre for Environmental Research - UFZ, Department of computational Hydrosystems, Leipzig, Germany
[2]UK Centre for Ecology and Hydrology, Wallingford, United Kingdom
[3]Utrecht University, Department of Physical Geography, Utrecht, Netherlands

A primary objective of hydrological modelling (HM) is to monitor the water balance in catchments and provide forecasts of key variables and fluxes (i.e., soil moisture and streamflow) at the seasonal scale. Within the Copernicus Climate Change Service, a global seasonal forecasting framework using four state-of-the-art HMs (i.e., HTESSEL, Jules, mHM and PCR-GLOBWB) is developed. The system is required to provide skillful forecasts to provide an added-value to society. In this study, we evaluate the skill of streamflow forecasts using established skill metrics such as Continuous Rank Probability Score and Brier Score.

As a first step, we evaluated the performance of the reference run of the four models that is based on ERA5-Land forcing. We employed more than 3100 river flow measurements obtained from the Global Runoff Data Centre (GRDC). These data allow us to classify basins according to aridity and evaporation indices and to evaluate their performance according to geographical regions. In a Budyko analysis, all models adhere to the expected theoretical functions that respect both the conservation of energy and water. However, applying the Budyko analysis to the observational records and reanalysis data only, some basins do not adhere to the energy limit by, for example, having more actual evaporation than potential evaporation. These findings suggest that water may have been transported across basins or that groundwater wells may have been overdrafted. For the development of the global forecasting system, an evaluation of model performance at these basins should be taken with care, and hydrologic models should not be calibrated here. By comparing the regional differentiated Budyko analysis and evaluating the skill metrics of the four HMs, we aim to discriminate among structural and forcing errors. Eventually, this analysis would allow improving the skills of the global seasonal forecasts system.