Geophysical Research Abstracts
Vol. 14, EGU2012-12205-2, 2012
EGU General Assembly 2012

Simulating river discharges on a global scale – Identifying determinants of model performance

S. Eisner, M. Flörke, and E. Kynast

Center for Environmental Systems Research, University of Kassel, Germany (eisner@usf.uni-kassel.de)

Global hydrological models and land surface models are used to understand and simulate the global terrestrial water cycle. They, in particular, are applied to assess global scale impacts of global and climate change on water resources. While in recent years the growing availability of remote sensing products, e.g. evapotranspiration and soil moisture estimates, provide valuable information to validate simulated states and fluxes, however, the validation of simulated river discharges against observed time series is still widely-used.
Thereby, most studies focus on:

1. long-term mean monthly or annual discharges,
2. discharge time series of the most downstream gauging stations of large-scale river basins (e.g. Amazon, Brahmaputra, etc.), or
3. correlation-based metrics

As global modeling approaches are constrained by simplified physical process representations and the implicit assumption that more or less the same model structure is globally valid, it is important to understand where and why these models perform good or poor in simulating 20th century river runoff and discharge fields.
We present an extensive yet deliberately kept generic evaluation of the WaterGAP (Water – Global Assessment and Prognosis) Hydrology Model to simulate 20th century discharges. The model is designed as a conceptual water balance model, in the current version, WaterGAP3, operating on 5 arc minutes global grid. River runoff generated on the individual grid cells is routed along a global drainage direction map taking into account retention in natural surface water bodies, i.e. lakes and wetlands, as well as anthropogenic impacts, i.e. flow regulation and water abstraction for agriculture, industry and domestic purposes. Simulated discharges are evaluated against 1600 observed discharge records provided by the Global Runoff Data Centre (GRDC). Globally, the selected gauging stations differ substantially concerning their corresponding catchment areas, between 3000 and 3.6 mill sqkm, as well as regarding their available time series, between 5 and > 100 yrs.
Model performance is judged by several simple metrics as Nash-Sutcliffe-Efficiency and modified forms or water balance related coefficients. Based on these metrics, we will further investigate if and how physiographic and climatic catchment characteristics impact model efficiency. Moreover we are aiming to identify the underlying determinants of spatial patterns of model performance.
Although it is generally expected that model performance improves with increasing catchment area, first results show that catchment area has no significant effect. On the other hand, we find a distinct impact of climate conditions (represented by Köppen-regions).