Geophysical Research Abstracts
Vol. 13, EGU2011-11988, 2011
EGU General Assembly 2011

Parsimonious parameterization of a large-scale hydrological model: validation in worldwide large river basins

Lebing Gong (1,2), Chongyu Xu (3,4), Georgia Destouni (1,2)

(1) Department of Physical Geography and Quaternary Geology, Stockholm University. lebing@gmail.com, (2) Bert Bolin Centre for Climate Research, Stockholm University, (3) Department of Geoscience, University of Oslo, Oslo, Norway, (4) Department of Earth Sciences, Uppsala University, Uppsala, Sweden

Global hydrological models and land surface models are coupled to atmospheric models at very coarse spatial resolutions. It is usually difficult to integrate highly nonlinear hydrological processes to such large scales. In the last years, global high-quality, high-resolution topographic and hydrographic data have become available. Aggregation of high-resolution data into spatial distribution functions is one way to preserve information and the nonlinear nature of the hydrological system at lower resolution. The daily WASMOD-M global hydrological model uses a scale-independent routing algorithm, named NRF for network-response function, to aggregate the HydroSHEDS high-resolution hydrography into time-delay histograms as input for the routing model; the use of such a high resolution hydrography allows delays caused by river, lakes and dams to be represented more accurately at large scale. It also allows medium and small catchments to be visible and to contribute to model validation. Runoff generation in many of the large-scale models is based on process formulations developed at catchments scales. The division between slow runoff (baseflow) and fast runoff is primarily governed by slope and spatial distribution of effective water storage capacity, both acting at very small scales. Many hydrological models, e.g. VIC, account for the spatial storage variability in terms of statistical distributions; such models are generally proven to perform well. The statistical approaches, however, use the same runoff-generation parameters everywhere in a basin. This causes an artificial parameter-dependency in a nested basin structure. A distributed runoff-generation algorithm, named TRG for topography-derived runoff generation, was developed to represent the highly non-linear process at large scales. The algorithm, when inserted into the daily WASMOD-M global hydrological model led to the same or a slightly improved performance compared to a one-layer VIC model in the preliminary, with one parameter less to be calibrated. The TRG algorithm also offered a more realistic spatial pattern for runoff generation. This work validated the WASMOD-M model in a number of worldwide regions, including Southern China, Baltic Sea basin, Southern Africa and Central America. Combined remote sensing and reanalysis climate forcing are used to drive the model. An ensemble of GCM outputs was also compared for there skills in those regions.