Geophysical Research Abstracts
Vol. 14, EGU2012-7559, 2012
EGU General Assembly 2012
© Author(s) 2012

Bayesian inference and B-spline representation of model parameters for the global hydrological model WGHM

W. Liang (1), M. Wattenbach (2), M. Schmidt (1), A. Güntner (2), F. Seitz (3), and M. Van Oijen (4)

(1) Deutsches Geodätisches Forschungsinstitut, München, Germany (liang@dgfi.badw.de), (2) GFZ German Research Centre for Geosciences, Potsdam, Germany, (3) Institut für Astronomische und Physikalische Geodäsie (IAPG), Technische Universität München, Germany, (4) Center for Ecology and Hydrology(CEH-Edinburgh), United Kingdom

In this study we apply Bayesian Inference to improve model parameters of the WaterGAP Global Hydrology Model (WGHM) from a suite of satellite and in-situ data. The alpha-coefficient of the potential evapotranspiration module was identified by a sensitivity analysis as one of the most sensitive parameters of WGHM. According to the Priestley-Taylor equation, alpha relates the net radiation to the reference crop evaporation. In the standard approach, alpha is set to 1.26 and 1.74 in humid and arid climates, respectively. We performed a Monte Carlo simulation with Latin Hypercube sampling of alpha from a truncated normal distribution with a mean of 1.5 and a standard deviation of 0.3. We represent alpha regionally on a 0.5 degree grid as a two-dimensional series expansion in terms of tensor products of two one-dimensional endpoint-interpolating B-spline functions depending on longitude and latitude, respectively. Since the relation between the model output and alpha is non-linear, a Taylor expansion is applied. Consequently, the B-spline series coefficients are decomposed into an initial part and an unknown correction term. Whereas the initial values are derived from the simple a priori values of alpha mentioned before, the first derivatives of the model with respect to alpha within the Taylor expansion are approximated by Bayesian Inference from 2000 model runs. The corrections to the B-spline coefficients are estimated from different observation data such as GRACE total water storage variations, MODIS-based actual evapotranspiration and gauge-based river discharge.