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The Global Water Model WaterGAP 2: Hydrology Model and Water Use Model

Petra Döll, Joseph Alcamo, Thomas Henrichs, Frank Kaspar, Bernd Lehner, Thomas Rösch, Stefan Siebert, Sara Vassolo

University of Kassel, Center for Environmental Systems Research, Germany

Abstract

WaterGAP, a global model of water availability and water use, has been developed to assess the current water resources situation and to estimate the impact of global change on water resource issues, in particular on water scarcity. With a spatial resolution of 0.5°, the raster-based model is designed to simulate the characteristic macro-scale behavior of the terrestrial water cycle, including the human impact, and to take advantage of all pertinent information that is globally available. WaterGAP consists of two submodels, the Global Hydrology Model, and the Global Water Use Models. Both models are linked: consumptive water use leads to a reduction of river discharge, and the comparison of water use and water availability (as river discharge) provides an indication of water scarcity. The Global Hydrology Model computes total runoff (sum of surface runoff and groundwater recharge) and river discharge. **1)** For each cell, the daily vertical water balance (canopy, soil, open water) is calculated. **2)** The total runoff from land is partitioned into surface runoff and groundwater recharge and is then transported to the downstream cell (via lakes and wetlands). The model is calibrated against measured discharge for 50 % of the global land area its performance has been tested. The Global Water Use Model computes withdrawal and consumptive (fraction of withdrawn water that evapotranspirates) water use for irrigation, livestock, households and industry. Sectoral water use is calculated as a function of driving forces of water use (e.g. irrigated area and climate in the case of irrigation water use) and model parameters (e.g. crop coefficients). Model results of WaterGAP can be used, for example, to assess where water is available for additional irrigation or to estimate the impact of climate change or increased water use on river discharge and thus ecosystems.

Keywords: Global model, irrigation, river discharge, water resources, water use

Contact Address: Petra Döll, University of Kassel, Center for Environmental Systems Research, Kurt-Wolters-Straße 3, 34109 Kassel, Germany, e-mail: doell@usf.uni-kassel.de