Geophysical Research Abstracts
Vol. 13, EGU2011-1137, 2011
EGU General Assembly 2011

Model concept for the projection of water related land-use parameters

Johanna Trümper and Jochen Schanze

TU Dresden, Faculty of Forest, Geo and Hydro Sciences, Chair of Environmental Development and Risk Management, Germany

The future water cycle with related matter fluxes analogue to climate change will be influenced by land-use change. Hence, there is an increasing need to project land-use over long-term time horizons in integrated water resources management (IWRM). Given the numerous interrelations between land use and the water cycle, projection may not be restricted to land cover only. Instead in principle all relevant parameters describing pressures, dependencies and sensitivities of land use with their specific change should be considered. This is particularly true if complex hydrological systems e.g. of river catchments are analysed with coupled models.

To deal with this challenge the model PWF-LU is being developed which aims at a projection of land-use parameters interrelated with the water cycle. Main objective of the tool is to provide consistent sets of parameter values for future scenarios of regional development. The model is based on a conceptual framework with a generic system analysis. Hereby 17 hydrological processes are identified such as evapotranspiration, discharge, or leaching which are influenced by land use. These processes are distinguished for two principal systems, one representing build-up areas, and the other one embracing areas with a predominant cover by vegetation, soil and water (open spaces).

Parameterisation of the two principal systems for a study area is carried out in various steps. First, it covers the classification of land-use types which goes beyond existing land-cover classification and reflecting features relevant for the water cycle. For instance the build-up areas are classified using urban structure types (UST) with at least two more classification level compared to CORINE. Second, for each land-use type a comprehensive set of parameters is derived from the principal system analysis. In case of the UST, these are 19 parameters (e.g. sealing or water consumption), whereof the open spaces are treated with 27 parameters (e.g. root depth or fertilization). For each land-use type specific parameter values are determined from literature reviews and field surveys. The latter encompass in-depth investigations at test sites and their statistical analysis for a transfer to all sites of the same land-use type.

Third, the PWF-LU model combines a GIS topology derived from remote-sensing data and a settlement-analyser tool with the parameter values of individual land-use types considering site-specific natural and societal conditions. It allows importing algorithms for land-cover change as well as changes of parameter values (e.g. decrease of water consumption). Consistency of these values is insured due to a particular scenario method which is being developed in parallel to the model. Model output is a comprehensive set of space and time-depended parameters. Some of these parameters are available in different units and scales to facilitate uptake by various hydrological models.

The presentation shows the concept of the model and first results from its testing in the upper part of the Western Bug River (Ukraine). The study is embedded in the international research project IWAS which is dedicated to new tools and knowledge on integrated water resources management and their proving in five model regions in the world.