Geophysical Research Abstracts
Vol. 13, EGU2011-6904, 2011
EGU General Assembly 2011

The assessment of the influence of different natural conditions on the particular processes of the hydrological cycle within a river basin

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Recently, water resource deficits have been a great challenge for sustainable development in many parts of the world. Integrated water resources management based on the profound understanding of the hydrological cycle may be a suitable tool for alleviating the water resource crisis. The use of distributed physically based hydrological models can be the tool for such studies of the hydrological behaviour of river basins of various natural conditions. Thus they could be used for research dealing with the topic of land-use or climate change impacts on the hydrological cycle.
The SWIM (Soil and Water Integrated Model) is physically based hydrological models that could be used for impact studies. It is a continuous-time model which works on a daily step and integrates hydrology, vegetation, erosion and nutrients (N-nitrogen and P-phosphorus) at the river basin scale. Its hydrological module is based on the water balance equation, taking into account precipitation, evapotranspiration, percolation, surface runoff and subsurface runoff for the soil column subdivided into several layers. The catchment is spatially subdivided into hydrotops (or hydrologically similar response units) by GIS.
This paper examined the suitability of the model SWIM for use in catchments of different natural conditions. Two geographically different catchments of the similar size were selected as study areas. It is the Malse River basin (432 km2) and Cidlina River basin (456 km2). The Malse River basin is located in southern Bohemia in the mountainous and forested region whereas the Cidlina River basin is located in eastern Bohemia lowlands where agriculture dominates. There are not any water dams in both basins. The first step was to evaluate the model performance. It was expected that the overall performance should be better in the case of the lowland agriculture dominated watershed of the Cidlina River as the model is based on the SCS CN method for estimating surface runoff component. Nevertheless, the model efficiency seems to be generally similar. The next step of the research was focused on runoff response to the situations caused by the similar meteorological processes in both basins. For the finer understanding of the different determining processes, the quantitative analysis of the specific components of the hydrological cycle was conducted. Further, it was shown how particular processes of the hydrological system dominated in various seasons and how they differed in selected catchments. Special attention was paid to the explanation of differences between the results obtained and to the evaluation of possible limitations to application of the SWIM model in various natural conditions.

Acknowledgement: The study was supported by the research grant GA AS CR IAA 300600901 and the Institutional Research Plan AV0Z20600510.