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Effects of land use changes on ecohydrological results in a mesoscale Chinese catchment using an integrated modelling approach

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Land use and climate change affect water resources worldwide. Driven by rapid economic development and a high population pressure, land use changes occur in China particularly fast causing environmental impacts at various spatial and temporal scales.
An integrated modelling approach for depicting the effect of environmental changes on aquatic ecosystems has been developed and tested. Thereby, the catchment properties and the presence of aquatic organisms were closely linked. The Changjiang catchment in the Poyang lake area in China was selected as a test area.

Two measuring and sampling campaigns were jointly planned and carried out by hydrologists and hydrobiologists in October 2010 and February / March 2011. At 50 sampling points benthic macroinvertebrates were collected using the multi-habitat sampling method. The water and sediment balance of the entire catchment area was modelled with the ecohydrological model SWAT (Soil and Water Assessment Tool). The SWAT results as discharge and sediment time series at each of the 50 sampling points were transfered to the species distribution model BIOMOD. BIOMOD linked the occurrence of a taxon (benthic macroinvertebrates) with environmental variables at the sampling points and calculated extrapolated occurrence probabilities for the study area. The results show species distributions of benthic macroinvertebrates in dependence on various hydrological, climatic and topographic variables. Variables, which are connected to the hydrology, determine a high proportion of the modelled occurrence of the selected taxa.

This approach can also be used with changing hydrological conditions to depict the impact of environmental change on aquatic ecosystems. Various land use scenarios were developed for the Chinese study area. On the one hand, intensification of agriculture was assumed; on the other hand, an afforestation of agricultural land was calculated. The distributions of benthic macroinvertebrates resulting from the hydrological changes can also be modelled based on these scenarios.