Geophysical Research Abstracts, Vol. 8, 08894, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08894

Modeling low-level extremes in case of climate change for an oxbow lake of the river Tisza

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Due to the expected changes of the climate system it is likely that the vulnerability of oxbow ecosystems will increase in the coming decades. Changes of water levels may result in temporary or irreversible dry-up of oxbows, which highlights the key role of this indicator in regional climate change. The main purpose of the study is to demonstrate a methodology to determine water level changes of oxbows in case of global climate change. This methodology is especially useful when very few climatological and hydrological parameters are available. In order to illustrate the potential applicability of this method, a case study is discussed for the Csatlói oxbow, located on the floodplain of river Tisza in Hungary. The hydraulic module of the applied climatological-hydraulic model system computes daily water level changes of the oxbow using generated climate parameters as boundary conditions (i.e., temperature and precipitation parameters computed by the climatological module of the system). The monthly climate anomaly generator consists of an empirical AR(1) stochastic process perturbed by SRES A1B climate change scenario using the MAGICC/SCENGEN package (Version 4.1). Morphological conditions are assumed to be constant during the simulations, as well as standard deviation, auto-correlation and inter-variable correlation of the simulated monthly mean temperature and precipitation. Fifty runs are considered in the study. The post-processing is focused on the lowest levels within a calendar month and on the extremes of the 50-member ensembles.

The simulated behaviour of the water level extremes projects an increasing vulnerability level of the oxbow ecosystems, especially for the last 30 years of the 21^{st} century. This may lead to further negative consequences on local economic conditions.