Model-based scenarios of Mediterranean droughts

1 M. Weiss

Center for Environmental Systems Research, University of Kassel, Germany
(weiss@usf.uni-kassel.de)

Large areas of Europe have been affected by droughts over the past 50 years. Water shortages and poor harvests during the droughts of the early 1990s exposed an acute vulnerability of the Mediterranean region to climatic extremes. According to the National Drought Mitigation Center a drought period in Spain lasting from 1990 to 1995 caused an estimated damage of several billion Euro. Italy recorded losses of up to several billion dollars during a drought period between 1988 and 1990. Various studies conclude that drought events have deteriorated in most European regions during the last decades in frequency, duration, or intensity.

Droughts, in general, are characterised by a decrease in water availability in a particular period over a particular area. They result from a combination of meteorological, physical and human factors. A drought is usually caused by a deficiency in precipitation, which can be aggravated by a combination of factors such as temperature, evapotranspiration, but also existing storage and water demand. Therefore, different droughts can be distinguished: meteorological, hydrological, agricultural and socio-economic droughts.

This study will examine whether the upward trend of droughts as described above is likely to continue in the future. It will investigate the impacts of global change (climate and socio-economic changes) on future low flow and hydrological drought frequencies on a river basin scale. The analysis is based on the integrated global water model WaterGAP. WaterGAP, developed at the Center for Environmental Systems Research at the University of Kassel, computes current and future water availability and water use. It consists of a global hydrology model to simulate the continental water cycle and a global water use model to simulate the anthropogenic impacts on the water cycle. The hydrological model calculates daily water balances on a 0.5˚ x 0.5˚ (geographical latitude and longitude) grid cell basis.

The impact of climate change on droughts is analysed using two different global emission scenarios from IPCC (2001), A2 and B2. These emission scenarios are based on two scenarios of the future development of society. Scenario A2 assumes a strong economic growth, while B2 emphasises the protection of the environment. Both scenarios represent a world in which the differences between developed and developing

countries remain strong, and globalisation is restricted.

To complete the evaluation, the human impact on water resources will be investigated. This is done by means of water use scenarios, which are also based on the IPCC scenarios A2 and B2. As a result, both the change in magnitude of droughts and the change in frequency of 100-year droughts throughout the Mediterranean, for the time slices 2020s and 2070s (compared to the climate normal 1961-1990), is presented. The influence of emission scenarios and applied climate models is discussed.