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Trends in central European precipitation and temperature parameters using observations and an ensemble of climate models

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Over the past several decades there has been a marked interest in changes in hydrologically-relevant atmospheric parameters. Among them, changes in precipitation and temperature have taken a forefront because of their known large impacts on societies and economies worldwide. In central Europe, the late 20th and early 21st centuries have been wrought with some of the largest and costliest weather-related catastrophes documented. For example, the flooding of major international waterways such as the Elbe and Rhine has caused billions of Euros in property damage and inland navigation disruptions in Germany alone. On the other hand, particularly dry periods coupled with high temperatures have caused low water levels, drought, and fire – all of which place increasing stress on European economies and citizens' physical and social well-being.

In order to mitigate the climate-induced effects as successfully as possible, research initiatives such as Germany's KLIWAS programme (www.kliwas.de) have been implemented. The ultimate goals of KLIWAS are to assess the effects of climate change on river flows and waters levels of navigable inland waterways, and to provide possible future adaptation strategies that can be used by the federal government and policy makers. In order to reach these goals, a reliable, quality-controlled database of historical precipitation and temperature data was created and validated by the German Weather Service (DWD).

In this presentation, precipitation and temperature trends in central Europe are derived and analysed using two independent data bases: station observations and climate simulations. The HYRAS dataset developed by the DWD is a new, interpolated dataset composed from a high-density observation network in Germany and its neighbouring countries. The HYRAS domain has a resolution of 5 km2 and includes the river basins of the Rhine, Elbe, and upper Danube. On a per-catchment basis, precipitation and temperature trends in the HYRAS dataset were analysed from 1951-2006 for several mean and threshold/extreme parameters. In addition, trends from post-processed regional climate model output (ie downscaled with bias corrections) are presented for both past (1951-2000) and future scenarios (to 2100, based on SRES A1B emissions). The results emphasise important seasonal and spatial differences with respect to changes in temperature and precipitation amounts and frequencies. The focus on individual catchment basins is something seldom previously performed for central Europe and offers direct applications in fields such as hydrology and agriculture.

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