Extended reference precipitation and temperature dataset for the river Rhine

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The need of a reliable and extended dataset for the river Rhine lies in the growing necessity of evaluating the effects of climate change. For the countries directly involved, which benefit and sometimes distract from the extreme discharges of the Rhine, these kinds of datasets are of great importance. They can act as reference for the correction of errors in precipitation predictions from General Circulation Models or from simulated datasets such as the ERA-40 and ERA-interim. These errors can lead to over/underestimations of hydrological simulation and latent use of hydrological forecasts.

The purpose of this study is to present an extended reference dataset of daily values of precipitation and temperature, from 1961 until 2008, for the whole basin of the river Rhine. The proposed dataset is based on the historical data from 1961 until 1995 of the International Commission of the Hydrology of the Rhine basin (referred to as CHR). Our concern is to extend the CHR set until 2008, creating an updated reference for future studies. The Rhine basin is divided into three sub-catchments. These sub-catchments correspond to the German, French and Swiss basins of the river Rhine. For each sub-catchment, gridded datasets of daily values of precipitation and temperature are used. The datasets are obtained from REGNIE, University of Trier and MeteoSwiss-ETH, for the German, French and Swiss sub-catchment of the Rhine, respectively. Possible gaps that are found in the datasets, are filled with values from E_OBS Gridded Dataset, obtain from ECA&D. The subsets of these three sub-catchments are joined together and create a long term dataset that covers the entire Rhine basin. The extended dataset, referred to as CHR08, is rescaled to 25 km taking into account the topography of the catchment areas. In order to eliminate any artificial trend created in the CHR08 dataset, some homogeneity checks are performed, using the E_OBS dataset. Here, homogeneity tests of the variance, the mean and the maximum number of consecutive wet days are applied and presented.

The CHR08 dataset is implemented, analyzed and presented with Delft-FEWS. To determine whether the CHR08 dataset contains useful and correct information about the discharges of the Rhine, the HBV-96 hydrological model is used. The HBV-96 model produces daily discharges of the Rhine in each sub-catchment. The observed maximum annual discharges are compared with the corresponding simulated discharges at each sub-catchment. The annual extreme discharges at Lobith (German-Dutch border) and the variation of extremes discharges for the years 1961 until 2008 are also presented.