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# Linking flood occurrence and weather type frequencies: projections for climate change in Austria

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One of the major concerns with climate change and its impact on the hydrological cycle is whether extreme events are likely to increase in frequency or magnitude. The aim of the presented contribution is therefore to assess changes in occurrence of flood events due to climate change in Austria. Local hydrological observations were linked with the occurrence of weather types. Changes in weather type frequencies, as projected by General Circulation Model (GCM) scenario data, were regarded as indicators of changing flood occurrences. The analysis was performed for seven climatic regions on a seasonal basis.
Runoff time series from 1971 to 2000 of 554 gauges were analysed to determine flood events with a peak over threshold approach. Thresholds were chosen to yield an average of four events per year and, to compare results for higher peaks, an average of one event per year. The day of the peak and the two days before were regarded as the critical flood generating period and were linked with the respective weather types occurring on these days. Weather types were classified automatically according to a classification scheme developed in the framework of the EU research network COST733. The geopotential height at 500 hPa and 925 hPa and the true wind at 700 hPa were used as input variables to classify 36 resulting weather types. The output of the method refers to 9 flow directions and the cyclonic and anticyclonic vorticity at lower and upper tropospheric levels. Weather types were calculated for each day from ERA40 re-analysis data using variable values at 12:00 UTC. Weather types occurring with high relative frequencies on days just preceding flood events were considered as flood generating circulation patterns and selected for the investigation of future changes in occurrence. The analysis was based on climate model data of the ECHAM5 B1 and A1B scenarios and of the HADCM3C A1B scenario and their respective control runs. Shifts due to climate change were identified by comparing mean weather type frequencies and variances of two 50-year periods, the second half of the 20th and of the 21th century.
Comparison of weather type frequencies calculated from ERA40 data and from GCM control runs showed considerable discrepancies for specific weather types, but a generally good agreement for flow directions. Differences between ERA40 and control run results, however, were found to be typically larger than shifts from GCM control runs to climate change scenarios. Also, for some weather types and seasons, changes projected by different climate models and scenarios varied significantly. Due to these large uncertainties associated with the use of GCM data, simple qualitative analyses of potential changes were performed. Consistent findings were detected for winter and spring: higher frequencies of north-western and western flows indicate more frequent flood occurrences in northern and western regions of Austria, where these circulation patterns prevalently cause flood events.