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Regional patterns of flood time scales in Austria – interplay of climatological and geological controls

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The study focuses on an analysis of the controls on flood duration based on the concept of comparative hydrology. Rather than modelling a single catchment in detail we compare small groups of pilot basins with contrasting characteristics in order to understand the controls in a holistic way. We analyse flood hydrographs of 9223 events in 396 Austrian catchments ranging from 5 to about 10 000 km^2 as a function of climatic controls such as storm type (synoptic and convective storms, rain-on-snow, snow melt), and catchment controls such as soils, soil moisture, geology and land form.

The dependence structure of two characteristics of extreme rainfall-runoff events (i.e. flood peaks and flood volumes) is examined. Unlike the common practice where the dependence between two variables is usually described by means of linear or rank correlation coefficients, here we focus on process based analysis of residual similarity of dependence between these two variables that is expressed by the flood time scale defined as the ratio of the flood volume to the flood peak.

The results indicate that, spatially, the median flood time scales range from 16 hrs in the hilly catchments where convective storms prevail to 104 hrs in the lowland catchments where substantial inundation into the floodplain occurs. The range is even larger for different flood types, from 7 hrs for flash floods in the hilly catchments to 200 hrs for snow melt floods in an Alpine area with deeply weathered rocks and deep soils. The results also indicate that catchment area is not the most important control on the flood time scales. For the range of catchments considered here, climate is very important through storm type and antecedent soil moisture, and geology is very important through soil characteristics. It is argued that the flood time scale is a rich fingerprint of the hydrological processes in a catchment because it integrates a range of climate and catchment characteristics by a time parameter.