

Spatial coherence of flood clustering across Germany

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The repeated occurrence of exceptional floods within a few years, such as the Rhine floods in 1993 and 1995 and the Elbe and Danube floods in 2002 and 2013, suggests that floods in Central Europe are temporally organized in flood-rich and flood-poor periods. This suggestion is studied by testing the significance of temporal clustering in flood occurrence for 68 catchments and a joint period of 74 years. The catchments are distributed across Germany and cover different flood regimes. To assess the robustness of the results, different methods are used: Firstly, the index of dispersion which quantifies the degree of temporal clustering and the departure from a homogeneous Poisson process is investigated. Further, the time-varying flood occurrence rate is derived by kernel occurrence rate estimation including parametric and nonparametric significance tests. To understand whether clustering changes with flood severity and time scale, the significance is assessed for different thresholds and time scales, from the intra-annual to the decadal time scale. It is found that the large majority of catchments shows temporal clustering at the 5 % significance level for low thresholds and intra-annual to inter-annual time scales. However, the relevance of clustering decreases substantially with increasing threshold and time scale. Further, there is a strong spatial coherence of flood-rich and flood poor years across Germany. The hydro-meteorological processes driving the clustering and its spatial coherence are discussed.