



## **Temporal and spatial variability of flood quantiles in the Upper Vistula River basin, Poland**

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Temporal and spatial variability in extreme quantile anomalies of seasonal and annual maximum river flows was studied for 41 gauging stations at rivers in the Upper Vistula River basin (UVB), Poland. The Quantile Perturbation Method was used where relative differences between flood quantiles in a block and quantiles in the baseline were compared. Interdecadal oscillating components were extracted from the series of anomalies using the Hilbert-Huang transform method. Period length, part of variance of each component and part of unexplained variance were assessed. Results show an oscillating pattern in the temporal occurrence of extreme flow quantiles with clusters of high values in the 1960-70s and since the late 1990s, and of low values in the 1980s and at the beginning of the 1990s. The anomalies show a high variability on the right-bank of the UVB during the summer season with the highest values in catchments located in the western and south-western parts of the basin. Riverflow extreme quantiles were found to be associated with large-scale climatic variables from the regions of the North Atlantic Ocean, Scandinavia, Eastern Europe, Asia and, to a lesser extent, the Pacific Ocean. Similarities between temporal variability of river flows and climatic factors were revealed. Results of the study are important for flood frequency analysis because a long observation period is necessary to capture clusters of high and low river flows.