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Variability of maximum river flow quantiles in the Upper Vistula river basin, Poland

A. RUTKOWSKA[1], P. WILLEMS[2], C. ONYUTHA[2], W. MŁOCEK[1]

[1] Department of Applied Mathematics, University of Agriculture in Kraków,
Balicka 253C, 30-198 Kraków, Poland
email: rmrutkow@cyf-kr.edu.pl

[2] Department of Civil Engineering, KU Leuven,
Kasteelpark Arenberg 40, B-3001 Leuven, Belgium

ABSTRACT

Temporal pattern of annual and seasonal maximum river flow quantiles in 41 catchments in the Upper Vistula River basin was studied using the Quantile Perturbation Method (QPM). In the QPM, anomalies are calculated through comparison between quantiles of subseries with quantiles of baseline series while the subseries is shifted along the baseline series. Using the Hilbert-Huang Transform method, the decomposition of the anomalies was conducted to enable recognition of slowly and rapidly varying components and residuals, and to compute oscillatory characteristics: period, the part of explained variance and the part of unexplained variance. Results showed an oscillating pattern in temporal occurrence of maximum river 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. Spatial diversity of the oscillatory characteristics was revealed because the variability of summer maximum river flow quantiles was explained by the slowly varying, interdecadal component in a higher degree in the left-bank part than in the right-bank part of the Upper Vistula basin. Moreover, the highest values of the part of unexplained variance in summer season was observed in the southern and southwestern mountainous catchments which proves the highest level of noise-to-signal ratio in this part of the basin. The annual anomalies 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 of climatic variables were found.