

The influence of the length of projection periods on reliability of inundation area quantiles

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The impact of climate change on floods can have significant economic, social and environmental consequences. It is therefore important for society as a whole that the patterns of flood occurrence, both in today's and under a future climate are well understood. This will enable effective management of water resources under changing conditions. Estimation of an impact of climate changes on flood risk is usually performed under the assumption of stationarity of records (flow or rainfall). However this assumption might be not valid in future climate. It is a common practice in the impact change studies to apply short-term (usually 30-year) periods to estimate the projected changes of hydro-climatic indices between the future and the reference periods. The choice of the indices depends on the purpose of climate change assessment. When floods are concerned, the 1-in-200, or 1-in-500 flood quantiles are of interest. However, many studies show that 30-year period based approach gives very high uncertainty of the index change estimates and can be subject to errors related to the inter-decadal variability of climatic driving forces. This problem can be overcome by an application of a nonstationary flood frequency analysis to long time-series of flow projections (up to 130 years or longer).

This study's aim is to apply the non-stationary frequency analysis to 130 – year long time series of annual maximum inundation area projections for the Biala Tarnowska river near Tuchów. Biala Tarnowska catchment is situated in southern Poland. Future discharges at the input to a hydraulic model are obtained using the HBV model and climate projections obtained from the EURO-CORDEX project applied in the upper part of the catchment, at Ciężkowice gauging station. The maximum inundation maps are derived for the Ciężkowice-Koszyce reach using the flow routing models. The lump-parameter emulator of MIKE-11 is used to derive 130-year long time series of inundation area at the river reach near Tuchów. The reliability of projections of changes using the 30-year periods (so called near- and far-future periods, 2021-2050 and 2071-2100) and long-term simulations for the period 1971-2100 is assessed. The sensitivity studies are performed to estimate the reliability of the derived flood inundation quantiles for different recurrence periods, from 10 years to 200 years for both approaches. The results indicate that long-time simulation series provide more reliable flood inundation quantiles than 30-year periods for all the return periods considered.