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The sensitivity of flood hazard estimates to changes in future climate conditions

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The continuous simulation approach to assessing the impact of climate change on future flood hazards has been applied to Biala Tarnowska catchment, southern Poland. The study focusses on the variability of inundation extent areas and their sensitivity to changes in hydrological conditions in the catchment upstream. The chain of undertaken actions starts from the choice of the Global Climate Model GCM driven by an assumed CO_2 emission scenario, through the downscaling of climatic forcing to a catchment scale, an estimation of flow using a hydrological model, and subsequent derivation of flood hazard maps with the help of a flow routing model. Future climate projections of rainfall and temperature are used as inputs to the precipitation-runoff model simulating flow in part of the catchment upstream of a modelled river reach. An application of a lumped-parameter emulator instead of a distributed flow routing model, MIKE11, substantially lowers the required computation times. A comparison of maximum inundation maps derived using both flow routing models, MIKE11 and its lump-parameter emulator, shows very small differences, which supports the feasibility of the approach. The relationship derived between maximum annual inundation areas and flow upstream of the study reach is used to assess the floodplain extent response to future climate changes. The analysis shows that the relationship studied depends mainly on the river cross-section geometry and its sensitivity to changes decreases with the increase of the flow. In addition, the analysis shows large influence of the one-grid-storm error in climate projections on the return period of annual maximum inundation areas and their uncertainty bounds.

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