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NATURAL FLOODPLAIN STORAGE CAPACITY - MODELLING APPROACH

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Abstract

The aim of this paper is to estimate the storage capacity of the natural river floodplain and to compare it with the condition of river valley, which has undergone changes in its structure. This study was done using the morphological and hydrological data of the Biebrza River lower basin, GIS ArcView and ArcInfo for their processing and UNET of HEC-RAS for simulation of unsteady river flow. The Biebrza River valley has been chosen due to its natural character. The flood phenomenon occurs regularly in this river system and is not constrained by any man-made structures. The DTM of the Lower Basin of the Biebrza River was generated by ArcInfo TOPOGRID method. Topographic maps and a land survey were a source of the dataset. Additional field measurements were processed to assess the hydraulic model: river channel cross-sections, valley cross-sections. The numerical model of flood flow through the floodplain was calibrated for the spring flood event in 2000 and verified by measurements of flood extent performed in the period from 17-19 March of 1999. During this period the data on water levels in different parts of the valley and the flood border localizations by GPS were collected and compared with the Landsat TM satellite image captured on 19th March 1999. As a result, the digital map of the flood was created. This map has been compared with the results of river flow numerical model. The drawn up model was verified for the flood-wave that lasted from March to June 1999. During the verification process the observed stages and discharges at Burzyn gauging station, closing the analyzed river stretch, were used. Moreover, the flood extent, generated by GIS and DTM for the calculated ordinates of water surface, was compared with the extent obtained by the analysis of satellite images. As regards the flood in 1999, for the obtained flood extents from the model, floodplain storage capacities have been calculated and their changes in time analyzed. Both the drawn up model and GIS techniques, estimating floodplain storage capacity, were used for the analysis of the influence that channel improvement (shortening of a river course) and its levees exert on the changes of discharge volume, rate field as well as discharge hydrograph. Simulations of these variants were also performed for the flood in 1999. The achieved results allow quantification of a natural river valley retaining capacity.