



Numerical Modeling for Flood Mapping under Climate Change Impacts: Transboundary Dniester River Study

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The Dniester river is shared by Ukraine and Moldova. Ukraine being both upstream and downstream of Moldova. The basin is especially suffering from heavy floods, often with transboundary impacts: in Ukraine, disastrous floods in July 2008, which were possibly partly caused or exacerbated by climate change. Within the UNECE I ENVSEC project "Reducing vulnerability to extreme floods and climate change in the Dniester river basin" the numerical flood risks mapping for several "hot spots" along the Dniester river was initiated

Two transboundary sites: "Mohyliv Podylskiy- Ataki" and "Dubossary HPP-, Mayaki" (in the delta zone) were chosen for flood risk modelling/mapping. . Floodplain inundation at Mohyliv Podylskiy- Ataki during historical and projected extreme floods scenarios is simulated by 2D model COASTOX –UN based on the numerical solution of shallow water equations on unstructured grid. The scenario of extreme flood, July 2008 that caused hazardous flooding of the riverside areas of Mohyliv Podylskiy has been used for model verification and calibration. The floodmarks of the inundated in 2008 streets have been collected and GIS processed to be used together with the data from the city's water gage station for model testing. The comparison of the simulated dynamics of floodplain inundation during 2008 flood with the observed data show good accuracy of the model. The technologies of the flood modeling and GIS based risk assessments verified for this site are implemented for analyses of the vulnerability to extreme floods for $Q=7600$ m³ / sec inflow to Dniester reservoir (1% flood for contemporary climate assessment) and for $Q=8700$ m³ / sec. that is considered as projection of 1% flood maximum for XXI century The detailed flood mapping was provided for all cases and was shown that 13% increase in water elevation for future extreme flood scenario will provide at 20% increasing of flooded areas in Mohilev Podolsky.

For the site Dubossary NPP in Moldova downstream till Mayaki (Ukraine) the river crosssection data including the elevation of the crests of the flood protection dikes data for the that are required for the 1-D model implementation are collecting in Republic of Moldova. The 1D model based on the numerical solution of the Saint Venant equations was implemented for this site, calibrated and successfully tested on the basis of the data of 2008 and 2010 high floods. It was shown that the developed technology can simulate with the reasonable accuracy the amount of the water overtopping the dikes on the different parts of the river. The surface elevation in the river channel and amount of water overtopping the flood projection dikes was simulated in this area with good accuracy from Dubossary to Lower Dniester – are of Turunchuk- branch and mouth of Dniester river. It was concluded that for Lower Dniester the required accuracy can be achieved only on the basis of the distributed 2D model the same as for Mohilev-Podolsky on the basis of the detailed topographical- bathymetry data that should be the prioritized task of future flood risk studies in this river basin.