



Flood forecasting and flood inundation mapping system developed for Ukrainian parts of Prut and Siret river basins within EAST AVERT project

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Prut and Siret rivers are two neighbouring rivers the upper parts of which are located in south-western Ukraine on the eastern slopes of the Carpathian Mountains. The upper reaches of Prut are located in Ivano-Frankivsk and Chernivtsi oblast of Ukraine, while the middle and lower reaches of Prut river flow along the border between Moldova and Romania. Most of the Siret river basin is located in Romania and only a small portion of its upper part – in Chernivtsi oblast of Ukraine. Within EC funded project EAST AVERT “Prevention and flood protection in Siret and Prut river basins through the implementation of a modern monitoring system with automatic stations” in addition to the strengthening of the monitoring system in the basins there were plans for modernization of the flood forecasting system in all three countries of these transboundary basins, as well as the simulation of flood inundation zones.

The modelling system developed for the Ukrainian part of the Prut and Siret rivers is based on the chain of the following models.

1. The regional numerical weather prediction model, based on the customization of the open source mesoscale model WRF. The developed software system provides automatic computing of the up to 7 day weather forecast for the Prut and Siret basins in Ukraine four times per day with spatial resolution 3*3 km.
2. The distributed physically based “rainfall–runoff model” TOPKAPI-UKRAINE predicting the lateral inflow from watershed to river network. The parallel code of the model was developed on the basis of the equations of TOPKAPI model (Todini at al., 2000-2015).
3. The flood routing – river hydrodynamics 1– D model RIVTOX, deployed in the versions based on the full Saint Venant equations and its diffusive wave approximation.
4. The two dimensional model COASTOX_UN of the flow in the river channels and within the floodplains, based on the numerical solutions of the 2D shallow water equation on unstructured grids.

The specialized software shell HYDROS was developed in Java. Its functions include the coupling of the model chain, data retrieval from data bases of the monitoring systems, data transfer from 1D and 2D hydraulic models and GIS servers, graphical user interface for each module of the system.

Two dimensional model COASTOX_UN was used to simulate the flood zoning for the 12 sites of these rivers selected on the criteria of the highest risk for the population. These results of 2-D modelling were used for the calibration of 1-D model RIVTOX customised for whole length of the main river channels for flood forecasting and operational flood inundation mapping during the high floods.

The system is installed in the regional operational units of Ukrainian Hydrometeorological Service and in the regional branch of Water Management Agency of Ukraine for pilot operation and testing. The sources of uncertainties of system forecasting are analysed on the basis of the numerical results and monitoring data received in the initial period of the system use in operational mode and on the basis of the archive data/historical scenario consideration.