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Further development and implementation of the DIWA distributed hydrological model-based integrated hydroinformatics system in the Danube River Basin for supporting decision making in water management

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Today, the most significant mission of the decision makers on integrated water management issues is to carry out sustainable management for sharing the resources between a variety of users and the environment under conditions of considerable uncertainty (such as climate/land use/population/etc. change) conditions. In light of this increasing water management complexity, we consider that the most pressing needs is to develop and implement up-to-date Spatial Decision Support Systems (SDSS) for aiding decision-making processes to improve water management. One of the most important parts of such an SDSS is a distributed hydrologic model-based integrated hydroinformatics system to analyze the different scenarios. The less successful statistical and/or empirical model-experiments of earlier decades have highlighted the importance of paradigm shift in hydrological modelling approach towards the physically based distributed models, to better describe the complex hydrological processes even on catchments of more ten thousands of square km.

Answers to questions like what are the effects of human actions in the catchment area (e. g. forestation or deforestation) or the changing of climate/land use on the flood, drought, or water scarcity, or what is the optimal strategy for planning and/or operating reservoirs, have become increasingly important. Nowadays the answers to this kind of questions can be provided more easily than before. The progress of applied mathematical methods, the advanced state of computer technology as well as the development of remote sensing and meteorological radar technology have accelerated the research capable of answering these questions using well-designed integrated hydroinformatics systems.

With most emphasis on the recent years of extensive scientific and computational development **HYDROInform UnLtd** developed a distributed hydrological model-based integrated hydroinformatics system for supporting the various decisions in water management. Our developed integrated model has two basic pillars: the **DIWA** (**DI**stributed **WA**tershed) hydrologic, and the well-known **HEC-RAS** hydraulic models.

The **DIWA** is a dynamic water-balance model that distributed both in space and its parameters, and which was developed along combined principles but its mostly based on physical foundations. According to the philosophy of the distributed model approach the catchment is divided into basic elements, cells where the basin characteristics, parameters, physical properties, and the boundary conditions are applied in the centre of the cell, and the cell is supposed to be homogenous between the block boundaries. The neighbouring cells are connected to each other according to runoff hierarchy (local drain direction). Applying the hydrological mass balance and the adequate dynamic equations to these cells, the result is a distributed hydrological model on a continuous, 3D gridded domain.

For calculating the water level as well the **HEC-RASS** hydraulic model has been embedded into **DIWA** model. In this integration the **DIWA** model provides the upper boundary conditions for **HEC-RAS**, and then **HEC-RAS** provides the water levels along the lowland parts of the river-network.

In this presentation, our recently developed integrated hydroinformatics system and its implementation for the middle–upper part of the Danube River Basin will be reported. Following an outline of the backgrounds, an overview on the **DIWA** and the integrated model-system will be given.

The implementation of this integrated hydroinformatics system in the Danube River Basin will also be presented, including a summary of the developed 1km resolution geo-dataset for the modelling. Then some demonstrative results of the use of the pre-calibrated system will be discussed. Finally, an outline of the future steps of the development will be discussed.