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OpenDanubia - An integrated, modular simulation system to support regional water resource management

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The already completed, multi-disciplinary research project GLOWA-Danube has developed a regional scale, integrated modeling system, which was successfully applied on the 77,000 km2 Upper Danube basin to investigate the impact of Global Change on both the natural and anthropogenic water cycle. At the end of the last project phase, the integrated modeling system was transferred into the open source project OpenDanubia, which now provides both the core system as well as all major model components to the general public. First, this will enable decision makers from government, business and management to use OpenDanubia as a tool for proactive management of water resources in the context of global change. Secondly, the model framework to support integrated simulations and all simulation models developed for OpenDanubia in the scope of GLOWA-Danube are further available for future developments and research questions. OpenDanubia allows for the investigation of water-related scenarios considering different ecological and economic aspects to support both scientists and policy makers to design policies for sustainable environmental management.
OpenDanubia is designed as a framework-based, distributed system. The model system couples spatially distributed physical and socio-economic process during run-time, taking into account their mutual influence. To simulate the potential future impacts of Global Change on agriculture, industrial production, water supply, households and tourism businesses, so-called deep actor models are implemented in OpenDanubia. All important water-related fluxes and storages in the natural environment are implemented in OpenDanubia as spatially explicit, process-based modules. This includes the land surface water and energy balance, dynamic plant water uptake, ground water recharge and flow as well as river routing and reservoirs. Although the complete system is relatively demanding on data requirements and hardware requirements, the modular structure and the generic core system (Core Framework, Actor Framework) allows the application in new regions and the selection of a reduced number of modules for simulation.
As part of the Open Source Initiative in GLOWA-Danube (opendanubia.glowa-danube.de) a comprehensive documentation for the system installation was created and both the program code of the framework and of all major components is licensed under the GNU General Public License. In addition, some helpful programs and scripts necessary for the operation and processing of input and result data sets are provided.