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Framework Design for an Integrated Watershed Model for Climate Change Impact Assessment

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An international collaboration between the University Of Munich, Germany (LMU) and Ouranos, Canada (www.ouranos.ca) aims at the development of an advanced user oriented integrated watershed model. The process is driven by (i) the experience of LMU in integration of water related expert systems gathered in the GLOWA-Danube project (www.glowa-danube.de), (ii) the expertise of Ouranos in stakeholder involvement in climate change research and (iii) the approach of the integration of stakeholders in the development process. Key issues to be addressed by a future integrated watershed model were identified to be future discharge volumes, low flows, water quality and land use changes. The need for advanced diagnostic watershed tools in the wake of climate change was analyzed in case studies of the Ottawa and the Châteauguay watersheds in Canada and the Ammer watershed in Bavaria. An improvement of tools for the assessment of climate change impacts on watersheds, for decision support and the development of climate change adaptation strategies is of great interest to various players on watershed domains.

The approach to design a framework for an integrated watershed model includes the layout of the interrelations of stakeholders at various levels of involvement and the intensive use of the Unified Modeling Language (UML) as an industry standard communication tool. Visualizations of the model framework and layout as well as use cases of a future user oriented integrated watershed model are presented using UML diagrams. The approach showed to be highly effective in the identification of the exigencies of the projected model in terms of data requirements, necessary capabilities of the model,

desirable degree of complexity, experts to be incorporated in the development and the identification of fields for operational application. The process of involving stakeholders in the development effort resulted in the identification of use cases in various water management related fields such as future water supply and quality, hydro power generation and reservoir management, risk management and reinsurance as well as water use in the power industry.

A preliminary layout of the architecture of a new integrated watershed model was developed. Loose coupling of process describing modules and data models is achieved by the definition of interfaces between contributing model components. These include a database of IPCC future climate scenarios by Ouranos, a water quality component, a reservoir management model and a hydrological model at the core. The framework foresees to produce a user oriented, transferable and efficient model capable of addressing climate change issues by ensemble modeling and evaluation of decision alternatives. Although the approach for the framework design appears to have revealed most necessary requirements of the model, the framework remains open to include additional components.