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Virtual Hydrologic Environment (VHE) - Design and implementation of a GIS data model for the integration with hydrologic modeling and its application to Meijiang watershed area in East China

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Virtual Hydrologic Environment (VHE) is an integrated approach where two major data systems are included: integration of different types of GIS and water resources data, integration of data and modeling. The Unified Modeling Language (UML) facilitates the design of GIS based relational database model GeoHydro/DataBase(GH/DB) and is used to create a specialized set of geo- and hydro-objects from both surface and subsurface hydrology in a consistent manner. Feather classes were created to store spatial data, such as sub-catchments and steam network. Tables were created to store time series and other parameters. Relationship classes were developed to link related objects. Furthermore, a graphical user interface is implemented as a link between object- and process-oriented numerical model GeoSys/RockFlow and GH/DB for the pre- and post-processing of model data and parameters. This VHE concept is applied to the Meijiang watershed area which belongs to the Poyang lake basin, the biggest freshwater drainage area in East China. A coupled regional hydrologic soil model is developed for the understanding of surface/subsurface water interaction. The GH/DB has been populated with data from the Meijiang site. The soil compartment is directly coupled to the atmosphere via the land surface and to the aquifers. The high-resolution modeling is achieved by parallel computation techniques. VHE as a bridge between surface and subsurface hydrology can improve our understanding of the hydrologic cycle, the interactions between water, earth, ecosystems and man and its role in the context of climate change. The integration of databases and modeling by the use of methods from scientific computing and information technology leads to a comprehensive and consistent representation of the VHE and thus enhances our understanding about the interactions and coupling processes between the different compartments of the hydrologic system.