

**AN ONTOLOGY-BASED APPROACH TO SIMULATION  
OF HYDROLOGICAL PROCESSES IN HEIHE BASIN, CHINA**

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**Abstract** - Today, there is a huge amount of hydrological models, either empirical simulation or physical process-based modeling, which were designed for distinct purpose and applied in various place of the world. Heihe river basin, which located in the arid and half-arid region of China, consists of complex hydrological process, and its hydrological condition has great significance to the local economy and people's life. Thus, hydrological modeling has become a hot topic in this area.

However, there are two problems among these models when user applied them in this area. On one hand, these models represent hydrological process in different ways, or the points of emphasis are dissimilar. What the model simulates might not adapt to Heihe river basin. On the other hand, these models have limits on their monolithic structure. It is difficult to use only parts of a model, and decompose or share the function of one model.

Ontology is a theory that uses a set of vocabularies and a hierarchy to describe concepts and their relations of a complex system in the real world. As the convincing instrument on establishing the conceptual model, and its latent advantages in solving the heterogeneity of various models, interoperability and integration, ontology has held scientists' interests internationally.

For the purpose of developing an interoperable hydrological model for Heihe river basin, this paper takes advantage of ontology to solve these above-mentioned problems from the conceptual perspective. Firstly, the application of various modeling approaches in the Heihe river basin was reviewed, and their simulation effects were taken into account respectively.

Secondly, the hydrological processes which were derived from these models, and local ontologies(application ontologies) were build. Hydrological processes in Heihe river basin were analyzed in order to build a standard ontology (upper-level ontology). Then, ontology mapping projects the local ontologies to the standard ontology. From this, the heterogeneous models have unitive presentation for the hydrological simulation. Based on the ontological representation, semantic problems for interoperable hydrological model were resolved. This information, which was derived from ontology, will be very useful for designing hydrological model components, adopting algorithms from existing models, and developing interoperable model in our future work. The main contribution of the paper are as follows: 1) For the first time taking the ontology-based modeling approach into practice in Heihe river basin, building its standard hydrological ontology and local hydrological ontologies. 2) Solving heterogeneity of various models used in this area, providing consistent presentation for the modeling practitioners. 3) Designing a framework for the interoperable hydrological model on the conceptual aspect.

**Key word** - Hydrological model; Ontology Construction; Ontology Mapping; Interoperability

### **Reference**

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