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Pathway to Encapsulate Water Quality Models as Cloud Computing Services and Couple with Environmental DSS for Managing Urban River Water Quality

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In the era of smart city, developing environmental decision support system (EDSS) integrated with monitoring, modelling, planning and control for smart management of urban river water quality has been widely accepted and implemented around the world. Construction and coupling localized water quality models, such as popular WASP and EFDC by USEPA, to meet different management requirements are fundamental for the surface water EDSS development. However, few reported the technique coupling the advanced version of WASP program with EDSS platform.

Traditional pathway of EDSS integrations or model coupling, e.g. database-oriented interaction, are non-modular, with low efficiency of share and reuse, and difficult for system updating. With the development of cloud computing and web services, the service-oriented design are the future trends of model coupling.

In this paper, a generic interface/module interacting with WASP V7.5 program is developed and the technical route of tightly coupling is proposed. The web service encapsulation of localized WASP models and advanced cloud computing services are implemented with the help of OpenGMS framework and SaaS (software as services) pattern. To meet the basic requirements of urban water quality management, the water assimilative capacity allocation and pollution load reduction planning are work out by the cloud computing services, which achieves operational running of EDSS.

The study area is located in Maozhou River Basin, an urban river in Shenzhen, China. According to the national water environment code and regulations, COD (chemical oxygen demand) and NH₃-N (ammonia nitrogen) are set as the ending point for supervision and the corresponding WASP model of Maozhou River is constructed and calibrated by historical field data. The computing components and web-services are integrated into the comprehensive water quality management

platform of Maozhou River through the model configuration and controlling data parameterization. One version of the Maozhou River EDSS has been deployed and is online on the Shenzhen ecological and environmental intelligent management and control center since January, 2021.

Along with WASP, service-oriented encapsulating of EFDC and SWMM based computing components for particular management purposes are also implemented based on the same technique route since both of them are developed by USEPA with similar inputs and outputs. The technology of model coupling and platform integration mentioned in this paper provides a valuable paradigm for linking other environment models into specific management business. Under the proposed technical pathway, the interaction of model interface between computation engine and system business layer can be easily updated along with the changes of management requirements. It provides the merits of rapidly development, easily deployment and maintenance.