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A hydroinformatics tool for modelling of estuaries, rivers and subsurface water systems

N. Keshavarzi-Roonizi, N.S. Hanspal, R. Ghorashi, V. Nassehi

Department of Chemical Engineering, Loughborough University

Loughborough, LE11 3TU, United Kingdom

Email: n.keshavarzi-roonizi@lboro.ac.uk, Fax: +44-10509-223923, Phone: +44-1509-222539

Abstract

This paper deals with the description of a hydroinformatics system for the simulation of the behaviour of estuaries and non-tidal rivers as well as underground flow processes. The system consists of intelligent front and back end interfaces, an operator guide and modelling quality evaluation. It also has extra modules for controlling input and output data and model selection criteria. Therefore it provides an IT system which enables those operators who have minimal experience in hydro-environmental modelling to access and process information related to the behaviour of complex natural water systems. It should hence be regarded as a fast and flexible tool for the management of river and estuary networks. In particular it is very useful in dealing with critical events such as the monitoring of the aftermath of accidental spillage of pollutants and flood routing. Interactions between surface and subsurface water flow zones can also be handled using this tool. Basically, the developed hydroinformatics system consists of three components: a component for data organization and treatment (front-end), a component for simulation and quantitative analysis of water quality and hydrodynamics (number cruncher), and a component for analysing, visualizing and

editing of the results (back-end). Specific operations such as optimization of data used in hydrodynamic models are handled via utilizing genetic algorithms embedded within the number cruncher module. The modular approach adopted in the development of this system is an appropriate and versatile methodology for coping with lengthy and complicated decision support and quality monitoring processes related to tidal, non-tidal and subsurface water environments. The described system is used to generate simulations for realistic events in estuarine networks and underground flows, including combined free/porous flows and contaminants migration in heterogeneous underground domains and modelling of salt intrusion in the Upper-Milford Haven Estuary, South Wales, UK.