Geophysical Research Abstracts
Vol. 14, EGU2012-1821-1, 2012
EGU General Assembly 2012

RTC-Tools: Open source software for reactive and predictive control of water resources systems

D. Schwanenberg (1,2), B. Becker (1), M. Xu (1), and J. Talsma (1)

(1) Operational Water Management, Deltares, Delft, The Netherlands (info@deltares.nl), (2) Institute of Hydraulic Engineering and Water Resources Management, University of Duisburg-Essen, Germany

Operational water management, in particular flood and draught forecasting systems, has achieved growing interest in recent years. Most of these systems include hydraulic structures such as reservoirs with operated dams, weirs or flood detention basins whose operating rules needs to be represented. Furthermore, advanced decision support or supervisory control may be required in forecasting mode for advising on optimal control strategies for safe flood mitigation or balanced, cost-effective water distribution.
Since operating rules and control strategies in water resources are very diverse and typically not supported directly in standard software packages, many dedicated software tools have been developed at Deltares over the years connecting to standard software via Application Programming Interfaces (APIs). Since these dedicated tools tend to be hard to maintain, difficult to adapt by somebody else than the developer, rarely fully tested, and not generic to be applied somewhere else, Deltares and partners recently integrated many of these tools in an open source software package called Real-Time Control Tools (RTC-Tools) for reactive and predictive control.
RTC-Tools (http://oss.deltares.nl/web/rtctools) is implemented in ANSI C++ and released as open source software under the GNU General Public License, version 2 (GPL2). It covers a wide selection of configurable feedback control rules. In application to Model Predictive Control (MPC), it includes the embedded optimizer IPOPT and a suite of internal MPC models, e.g. a combined kinematic / diffusive wave model with explicit and implicit time stepping or a neural network. The package has interfaces to the open forecasting platform Delft-FEWS, Matlab, OpenDA (http://www.openda.org/) for conducting data assimilation and OpenMI (http://www.openmi.org/) for model coupling. APIs enable its easy extension by new rules, controllers, or internal MPC models. Applications of the software so far include the simulation of control, decision support and supervisory control of diverse water systems. We present a hydraulic model of the Rhine River between Basel and Maxau along the German-French boarder in SOBEK and RTC-Tools which has been coupled via OpenMI. As a second application, we present the large-scale managament of water extractions from the Dutch river network within the framework of the National Hydrological Instrument (NHI).