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OpenMI 2, an extended open standard for integrating models and tools

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Linking models from different domains so that they can complement each other and thereby provide comprehensive and balanced assessments requires both technical and semantic integration. This contribution will focus on the Open Modeling Interface OpenMI, an open standard that offers interfaces and tools for linking qualitative and quantitative models into modeling systems. It is being developed and maintained with the vision to become the accepted standard for model linking both in the hydrological and the broader environmental domain.

After the initial release of the OpenMI version 1 in 2005 the OpenMI-LIFE project demonstrated its usability at the operational level on real world scale problems. Several use cases of the river Scheldt rising in France and running through Belgium and the Netherlands will be shortly described as an example for an international and multi-disciplinary study. River, sewer, water quality and estuarine models have been linked together to different modeling networks according to the stakeholders' interests. Use of the OpenMI to integrate components outside of the hydrological domain will be illustrated with a description of the generic GEI reader capable of delivering meteorological wind fields into a three-dimensional estuarine modeling system, and a short section about the SEAMLESS project integrating agricultural and economical models from farm field to world scale.

The OpenMI is seeing a significant increase in the number of applications that leads to new requirements. For example integration of non-model components like the web-based hydrologic information system HydroDesktop or the decision support system AM-DSS was possible but required some effort. To improve the OpenMI and advance it to the next version several European research institutes bundled activities and, after a modeling community review period, released the OpenMI standard version 2 in December 2010.

Some of the key ideas of the new version that will be explained include:

- A geographical representation for exchanged data approaching the common representation in the GIS-world.
- The Use of adapters, e.g. interpolating in space or time, to transform data into a requested form and of series connections of several adapters offering a piping and filtering mechanism.
- Removal of the restriction to time step based models enabling the integration of new kinds of models, e.g. neuron networks, in the future.
- Setting and varying boundary conditions for individual models for running comparative simulations, simplifying the use of the OpenMI in DSSs and tools for calibration, optimisation and data assimilation.

The introduction of a set of mandatory base interfaces and sets of optional interfaces has the aim to make the OpenMI fit for future requirements of integrated modelling. The current edition includes the extension for time and space dependent components. Future extensions could support compliance with the standards of the Open Geospatial Consortium (OGC) or request and deliver data in terms of dictionaries or ontologies.

The OpenMI is available under the terms of the open source license LGPL with the aim of easier dissemination. It is implemented in C# and Java and offers ways for wrapping code from other languages. There are guidelines for migrating existing models to OpenMI compliancy in order to maintain approved legacy code.

With the results from operational use and the explanation of its extended feature set this contribution will show that the OpenMI is becoming a valuable tool for integrating models and related tools, both for single domain

applications or across domains supporting multi-disciplinary studies.