FluidEarth with OpenMI version 2.0 – Lowering the Barriers to Integrated Hydro-meteorological Modelling

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The discipline of modelling environmental processes is on the verge of a new era of innovation and creativity. This is being enabled by a set of emerging standards which allow practitioners more flexibility to study related environmental processes and ensure structured engagement with new technologies.

One such standard is OpenMI, now at version 2.0, which provides a standard interface allowing models (and other components) to exchange data with each other on a time-step by time-step basis as they run. The models may come from different suppliers, represent processes from different domains, be based on different concepts or have different spatial and temporal resolutions. Model components that comply with this standard can, without any programming, be configured to exchange data during computation (at run-time). This means that combined systems can be created, based on OpenMI-compliant models from different providers, enabling the modeller to use the models that are best suited to a particular project. The standard supports two-way links where the involved models mutually depend on calculation results from each other. Linked models may run asynchronously with respect to timesteps and data represented on different geometries (grids) can be exchanged seamlessly.

If such model integration is to become mainstream, then it is necessary to lower the barriers for entry for both model (and other component) developers and those assembling integrated compositions with the developed components. Indeed, uptake is considered to be directly related to the ease of use. To meet this requirement, HR Wallingford's FluidEarth initiative which brings together a community of specialists with the aim of researching and implementing integrated computer modelling approaches to environmental systems, has been made compliant with the new version 2.0 of OpenMI. Following on from work presented in 2011 this paper describes this upgraded functional and technical platform supported by its e-Infrastructure at http://fluidearth.net.

In particular, FluidEarth for OpenMI 2.0 includes a suite of tools to support both developer and modeller:

i) The FluidEarth Software Development Kit allows model developers to adapt their models for linking to other models and data services. It takes most of the complexity out of this process allowing easy creation of a new generation of environmental models which can be combined into compositions.

ii) Pipistrelle is a tool giving modellers the ability to easily create and run compositions of linked models. Everything is controlled through a simple user interface showing models as OpenMI components with data exchange along links.

iii) Compatible with the FluidEarth framework, Pyxis is a productivity tool allowing modellers to manage their compositions. This includes file housekeeping, audit, composition definition, uncertainty and repeat run control.

iv) Also compatible with FluidEarth, the visualisation toolkit allows modellers increased capability to view and present model results.

It is claimed that, with the FluidEarth toolset, it is possible to develop and run your first OpenMI integrated modelling composition within 2 hours.