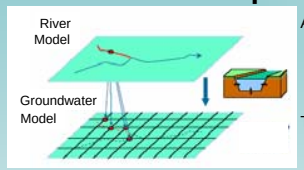
Bringing the OpenMI to *Life*

Open Modelling Interface

What is the OpenMI?



An **interface standard** which:
- **Allows** existing or developing models, databases and tools (of any dimension or domain) to **exchange data at runtime** across the links that the modeller defines

Thus
- **Improves the ability to simulate** real-life interactions

- OpenMI Source Code and documentation are publicly available via the Internet
- Any existing model can be modified to become OpenMI compliant
  - *Protects* a huge investment in model development
  - *Provides* flexibility to try alternative models of individuals processes
- The easiest way to make a model OpenMI compliant is to contain it in a suitable wrapper
  - The wrapper controls the runtime activity of pulling data across links
  - Smart wrappers are provided in the OpenMI Environment to handle most of the tasks

Why Apply OpenMI in the Environmental Studies?

Competition for **scarce resources**

Need for **decision support**

Call for **integrated modelling**

Requirement for **model linking**

OpenMI supports improved model linking

Current Status of the OpenMI

For the next 3 years
- Funded through the OpenMI-LIFE project (2006-2009)
- Maintained and updated by the OpenMI Association

About the OpenMI Source Code
- Version 1.2 released and documented for .Net
  - Available under 'Open Source' licence on Source Forge and on the official OpenMI website www.openmi.org
- Version 1.4 expected to be released on September 2007

About the OpenMI Association
- Became a legal entity under the Dutch Law on June 4th 2007
- Membership is open to organisations and all people over 18 who have an interest in the use and development of OpenMI

OpenMI Compliant Models

Organisation	Models
Delft Hydraulics Software	Sobek Channel Flow, Delft3D and DelftFEWS
PCRaster	PCRaster
RIZA	Sobek-RE, Mozart, NwSim, Agricom, DemNat and DistrConnector
Hydrologic Engineering Center	HEC-RAS
Waterloo Hydrologic Institute	Visual Modflow
WRc Plc	STOAT
DHI Software	Mike11, Mike-She, Mike Basin and Mike Urban
Wallingford Software	Infoworks RS and Infoworks CS
HR Wallingford	Sulis(3D)
CEH Wallingford	CLASSIC
NTUA	RMM-NTUA

OpenMI – LIFE Project

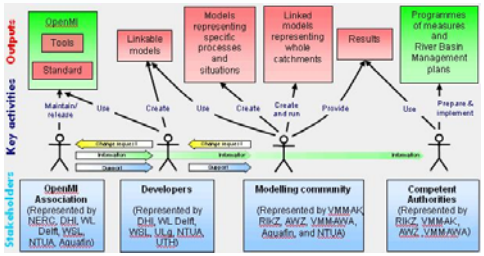
Objectives of OpenMI-LIFE

Transform the Open Modelling Interface and Environment from a **research output** to an **operational supported standard**
- Build Capacity
- Demonstrate and evaluate
  - The use of the OpenMI in integrated water management/modelling
    - The Scheldt (Belgium)
    - The Pinios (Greece)
  - The support organisation (The OpenMI Association)
- Disseminate Information

Deliverables

- Training
- Demonstrations of Scheldt and Pinios Use Cases
- Support
  - OpenMI Association
  - New releases of the OpenMI
  - Support evaluation report
- Dissemination
  - Best practice manual; Papers and Journals; Press articles; Conference presentations; OpenMI-Life web site (multi-lingual); Workshops; Associate with existing newsletters; Posters; Leaflets (multi-lingual); Layman's report; Reports to the Commission

Demonstration of the OpenMI Support Organisation



Consortium

NERC	Natural Enviroment Research Council	UK
DHI	DHI - Water and Environment	DK
WLDelft	Delft Hydraulics	NL
WSL	Wallingford Software Ltd	UK
NTUA	National Techical University of Athens	GR
UTH	University of Thessaly	GR
Aquafin	Aquafin NV	BE
VMM-AK	Vlaamse Milieumaatschappij	BE
FH	Flanders Hydraulic Research	BE
VMM-AWA	Vlaamse Milieumaatschappij	BE
ULG	CEME Environmental Modelling Centre	BE
RIKZ	National Institute for Coastal and Marine Management	NL

Use Cases (on-going modelling effort)

Demonstration of the OpenMI implementation in Scheldt river modelling (BE) *

Use Case A: Linking a sewer model (InfoWorksCS) to a river model (Infoworks RS)

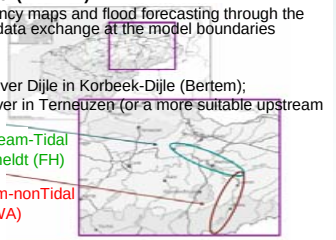
Objective: Optimize the investments and operational strategies of sewer and river managers
Partners: Aquafin and VMM-AWA
Study Area: The Dijle river basin around the town of Leuven

Some Challenges:
- Flow and level exchange at appropriate links
- Flood exchange
- Incorporate flow links in river calibration
- Conceptual/Procedural Issues

	Sewer Model	River Model
Scope	Design Model	Operational Model
Rainfall	Design	Event episodes
Time Step	60 seconds	Variable

Use Case B: Linking an upstream non-tidal river model (Infoworks RS) to a downstream tidal river model (MIKE-11)

Objective: Enhanced flood frequency maps and flood forecasting through the improvement of the dynamic data exchange at the model boundaries
Partners: Flanders Hydraulic Research and VMM-AWA
Study Area: Upstream part= the river Dijle in Korbeek-Dijle (Bertem); Downstream part= the Scheldt river in Terneuzen (or a more suitable upstream location)



Some Challenges:
- Assess the feasibility (data handling, simulation times) of large scale model linking
- Find appropriate historical events which address various combinations of high/low flows for the non-tidal part and high/low tides for the tidal section
- Try to link the models in remote way (a useful application for forecasting)

Use Case C: Linking river flow models (Infoworks RS and MIKE11) to a river quality model (Pegase)

Objective: Improved modelled interactions between different related water domains (hydrologic, hydraulic, quality) supporting Integrated Water Policy scenarios
Partners: Flanders Hydraulic Research, VMM-AWA, VMM-AK and ULG-CEME
Area: The Dijle river basin in the Belgian Flemish region

Some Challenges:
- The models are applied on different spatial and temporarily domains so appropriate links and exchange time steps should be selected
- The discretisation differs from one model to the other

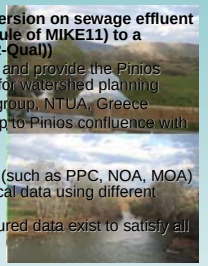
Use Case D: Linking a 1-D river model (MIKE11) to a more dimensional estuary model (Waqua and Delft3D)

Objective: Help Competent Authorities to address Integrated Management, by allowing the communication between models of different extent and detail
Partners:RIKZ, WLDelft and Flanders Hydraulic Research
Area:From the Flemish part of the river Dender to the Western Scheldt estuary
Some Challenges:
- Evaluate whether the output of the stand alone model runs and the linked model runs are comparable and how precision is affected
- Translate the 1-D discharge (river) to 2-D or 3-D discharge and vice-versa for the water levels

*Contact person for the Scheldt Use Cases: Yves Ronse (y.ronse@vmm.be)

Demonstration of the OpenMI implementation in Pinios river modelling (GR) **

Use Case A: The effect of advection-dispersion on sewage effluent discharge (link a hydrologic (RR module of MIKE11) to a hydraulic (RISH) to a quality model (R-Qual))



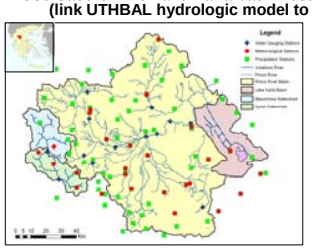
Objective: Improve the model performances and provide the Pinios Competent Authorities with input useful for watershed planning
Partners: Applied Hydraulic group and CHI group, NTUA, Greece
Study Area: Upstream part of Pinios basin up to Pinios confluence with Enipeas
Some Challenges:
- Data availability: Different organisations (such as PPC, NOA, MOA) collect and handle the necessary historical data using different methods
- Different time periods of available measured data exist to satisfy all models (especially the quality model)

Use Case B: Impact of Climate Change scenarios on the reliability of a reservoir (link a hydrologic model (RR module of MIKE11) to a Reservoir Water Management Model (RMM))

Objective: Optimum design of a reservoir to satisfy the need for integrated water management in the Thessaly area
Partners : ITIA research group and CHI research group, NTUA (GR)
Study Area: The basin upstream of the Smokovo reservoir

Some Challenges:
- Time steps and time horizon of the two models
- Lack of historical flow records at critical locations (the reservoir construction was recently finished -2002)

Use Case C: The Lake Karla basin restoration, Thessaly, Greece (link UTHBAL hydrologic model to Visual Modflow GW model)



Objective: To improve the evaluation of surface and groundwater resources before and after the restoration of Lake Karla and promote integrated watershed management
Partners: UTH, Greece
Study Area: Pinios river basin and Lake Karla basin

Some Challenges:
- Different discretisation of the models: select appropriate links to exchange information
- Limited monitoring stations with adequate reliable data records

** Contact person for the Pinios Use Cases: Ria Safiolea (safiolea@chi.civil.ntua.gr)

Further Information

Visit the **OpenMI-Life website at** www.openmi-life.org to get more information about the use cases and the project's progress

Find helpful documentation on OpenMI at the **OpenMI Association website** at www.openmi.org . Learn today how to apply the OpenMI technology to your own models and studies

Acknowledgements: This project has been made possible with the contribution of the LIFE financial instrument of the European Community.