

# Tools and Workflows in Geospatial Environmental Planning and Management ... or: *Environmental Models in the Web*

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# Context

- iEMSs (International Environmental Modelling and Software Society) wishes to advance (among other things)
  - automated but informed use of models, and
  - integrated modeling
- OGC manages a consensus process to develop publicly available geospatial standards
- iEMSs and OGC have signed a MoU
- OGC presented a Workshop on Model Interoperability for the Web at the iEMSs Biennial Congress in Ottawa, Canada, July this year

# Technological context

- Development of services and (interface) standards for communicating
  - Data,
  - Processing, and
  - Knowledge
  - to, from and of Modelsin the Internet (Web)

# Environmental models

- Tools for ...
  - examining components of and their interactions in
  - predicting outcomes of
  - revealing implications of assumptions in
  - enhancing communication among interest groups of
  - ...
- ... natural resources management
- Construction ► Testing ► Use

# Environmental models, categories

- Simulation models (dynamic simulation of state in time)
- Optimization models (the “best” set of parameters, or structure for a plan)
- Statistical models (e.g. random variables representing a state arranged in a structure)
- Decision models (or methods that aid decision making)
- ...
- Several other categorizations have been presented.

# Benefits to be expected

- Ready availability of data as standard services
  - Data feeds from sensors and sensor networks
  - Baseline data
- Improved meta data of (increasing trust in) models
  - Statements of assumptions
  - Reports of testing the whole model
  - Instructions how to use the model
  - Discussion of problems and issues
- Improved collaboration and communication possibilities

# Foreseen problem areas

- Lack of comprehensive definition of “an environmental model”
- Matching the temporal and spatial scale and other characteristics of available data to the requirements of the model
- Problems in how to systematically represent knowledge incorporated in models
- Lack of tools for supporting high level workflows required by model construction, testing and use



# Workflow of building of an environmental model

- (Jakeman et al.(2006) Ten iterative steps...)
  - Purpose ► Context ► Conceptualization ► Prior information ► Features ► Parameterization method ► Performance criteria ► Parameterization ► Verification ► Quantification of uncertainty ► Evaluation
  - Useful/required services include
    - Knowledge (also of the workflow itself)
    - Data (catalogs, browsing also to aid conceptualization)
    - Processing services (parameter estimation, model verification)
    - Documentation and meta data (upload)

# Integrated assessment and modeling (IAM)

- Coupling (integrated use) of models representing different components of natural and social systems
- Coupling (integrated use) of models representing processes at different spatial scales
- Tools for generating scenarios
- Stakeholder participation
  - Setting objectives
  - Designing management strategies
  - Setting preferences
  - Implementing plans
- Decision support
- Typical workflow: intelligence ► design ► choice ► action

# Benefits and problems regarding IAM

- Distributed control of information assets
- A stated goal of IAM is to adapt the model to the case with an IA process
- Can we improve the model validation?
- Communication
- Technical difficulties in setting up services
- No or very little work on analyzing and supporting formally workflows

# Case studies

- On-site environmental modeling and management
  - Topic of an ongoing FP7 research project HYDROSYS
  - Hydrological / environmental hydraulics models
  - Assessment of risks and pollution; management options
- Oil spill combating
  - Enhancing an existing operational system
  - Model of vulnerability of environmental values to oil spills
- Water quality management
  - At proposal stage
  - Analytical models of/for lake management

# Conclusions

- Several use cases for modeling
  - Required interaction and its kind varies a lot
  - A need to use data services in setting the context and conceptualization of modeling
- The optimal architecture?
  - Optimal combination of web – office – on-site
- Environmental model is much more than a processing service
- Stakeholders have no experience yet in asking for services of this kind

Thank you for your attention!

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