Tools and Workflows in Geospatial Environmental Planning and Management

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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
  - Models
  - Knowledge

  in the Internet

Environmental modeling

- 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
  - Assessment of environmental values
  - Support for combating operations

Experience/conclusions so far

- Web data integration is sometimes (often?) seen as "plumbing", i.e., little or interest in conceptualization or data modeling
    - The GSN software
- Environmental model is much more than a processing service
    - We've been working on exposing a environmental hydraulics model as a WPS
- Stakeholders have no experience yet in asking for services of this kind

Thank You!

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