How to improve the quality and usefulness of model simulations for RBM plans?

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Models

Models can range from:

simple -> complicated
applied only -> developed & applied
empirical -> process-based
easy -> time demanding
freeware -> commercial
field -> via river basin -> to the sea
physics -> ecology
widely used -> personal
well-docum. -> poor-documented

=hundreds of different possible combinations

Advantages of models

Models ~ contain the essential features of the nature's complicated systems ($\Rightarrow$ simplification)

Models ~ data and scientific theory wrapped in a compact package

Models can be used to:

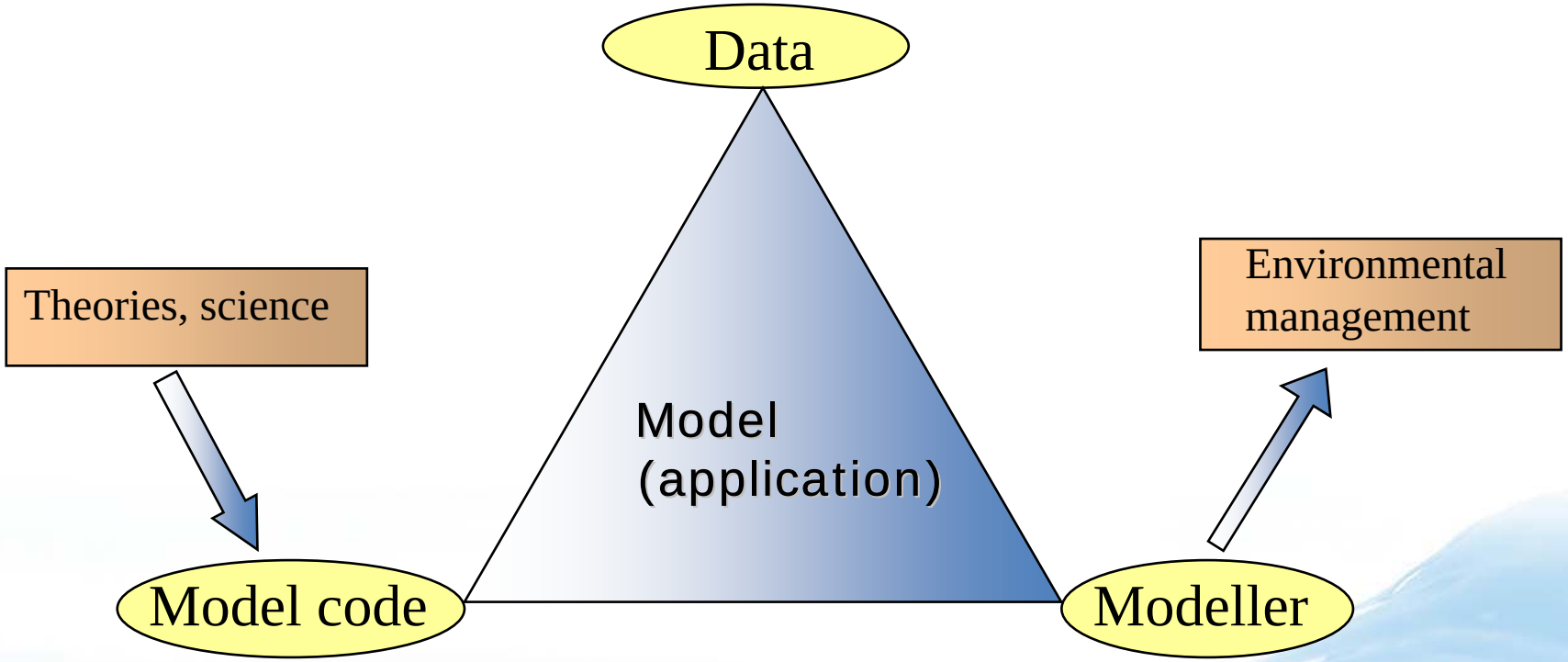
- *Predict the future (or past)*
- *Simulate what-if scenarios*
- *Gain a better insight into nature's complicated systems*

Thus, models can give easy, scientific, reproducible & holistic knowledge input to environmental management

...

Modelling

...if good model code, modeller, and data for modelling are available.



How to improve quality & usefulness - present state

manager:

(1) Get advice to select the best model codes and modellers available.

modeller:

(2) Apply model analysis techniques to optimise model performance.

How to improve quality & usefulness - present state

(*1) Select the best model codes and modellers available.*

But how?

⇒ Different *criteria for good quality models* have been developed

(see e.g. Saloranta et al. 2003, *Environmental Management*).

Optimally, a modeller should apply a model code which:

- focuses on the right water quality standard/variables
- is well-tested and consistent with the scientific theory
- is appropriate to the complexity of the situation
- is consistent with the amount of data available

How to improve quality & usefulness - present state

(*1) Select the best model codes and modellers available.*

Moreover, the modeller's model code should allow:

+ application of model analysis techniques
+ flexibility for updates and improvements
+ modelling with acceptable costs

How to improve quality & usefulness - present state

(2) Apply model analysis techniques to optimise model performance.

Why model analysis?

A transparent model,

with prediction uncertainties properly analysed and reported,

increases usefulness, quality and credibility of model results in environmental management.

How to improve quality & usefulness - present state

(2) Apply model analysis techniques to optimise model performance.

Sensitivity analysis
- shows which factors mean most for model output.
- increases model transparency (”X-raying the model”).

Uncertainty analysis (probability attached to results)
- increases model credibility (more ”honest” results).
- essential in risk-based management (probability × consequence).

”Automatic” calibration
- essential to explore all plausible model configurations.

Barriers

Barriers (1):

A model is often more an established method than just a ”tool” for a modeller

- Modellers and model codes often go hand-in-hand (which one is more important?)
- Familiarity is a strong argument in model selection
- Learning to use new models takes time

Barriers (2):

Model analysis techniques not supported by many models and modellers.

- They often require more computer power and advanced mathematical and coding skills.

Thanks!