Needed: An Intellectual Structure for Assessing Appropriate Model-Complexity

Environmental modellers, those who buy or sell models, and those who regulate using models, must decide on an almost everyday basis whether a model's complexity is appropriate for the decision-support imperatives that it must serve. More often than not, the decision hinges on whether a model is "defensible". Definition of decision-support modelling metrics is thus left to others, or to no-one in particular. The result is a bias towards model complexity. This is because a complex model is easier to defend than a simple model. The defence is simple. A complex model is more "realistic" than a simple model; the numbers that it calculates are therefore more correct.

Choice of a particular level of model complexity has many repercussions. Some are technical and some are social. Complex models often have a short shelf-life. In some circumstances (particularly in countries where water-related problems are dire, but where skills are short) their construction can disempower those whom modelling is meant to serve. In other circumstances, a complex model may be capable of making complex predictions, but may possesses little ability to evaluate the credibility of those predictions.

Conceptually, it should be possible to gauge optimum model complexity by solving a context-specific optimisation problem wherein the benefits and drawbacks of complexity are itemized and traded off against each other. Definition of "benefits" and "drawbacks" require metrics. Unfortunately, metrics for decision-support environmental modelling are neither clearly defined nor widely agreed upon.

In this talk, I address how modelling can best support environmental decision-making. I note that simulation should not be considered as an end in itself. Rather, simulation creates receptacles for information – information that modelling (if done properly) can harvest. Access to information is the cornerstone of good decision-making. However, just as fundamental to good decision-making is a capacity to evaluate the repercussions of information insufficiency, particularly as they pertain to an assessment of what can go wrong if a certain course of management action is adopted.

Once the importance of information is accepted, a chain of logic can be developed that can suggest an appropriate level of model complexity at a particular site. This can take account of data availability, local skill levels, the cost of a wrong decision, and early detectability of unwanted surprises once a decision has been taken.

There is no "right" way to model, because no model is "right". However there are strategies that, if adopted, can reduce the chances of a bad decision being made.