From Complex Models to Decision Making and Policy Support

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Summary Notes
16 June 2006

Context: Typical Players we have in mind.
Policy Maker: Stern Review, US EPA, US National Academy of Sciences Panel on Uncertainty
Decision Maker: EDF Natural Gas Trader (to burn); Wind Generator, Reinsurance
Complex Model: ECMWF 10 day ensemble weather forecast (EPS); UK Hadley Centre Climate Model (HCM3); UK Met Office 36 hour short range hi-res weather EPS.

Background Facts:
1) Policy driven science can result in poor policy support, especially when the best available answer to the policy relevant question is uninformative (but well defined).
2) Industrial users are hesitant to invest resource in expensive, unproven model output.
3) Decision makers do not require probability density functions.
4) Modellers cannot provide (policy relevant) probabilities from Complex Models.
5) Complex models are too complicated for exhaustive exploration of their variability.
6) It is useful to distinguish forecasts made to inform from those made to motivate (they can differ even at the experimental design stage).

Civil servants (say, Treasury) and Traders (Energy sector) can cope with probability free insights; they often prefer developing an intuitive feel for how to use the model. We need to develop (a) general communication skills and means of insight transfer and (b) realistic expectations and promises.

Story: The Ensemble and the Known Unknowns
Complex models contain uncertain starting values, parameter values, and mathematical structures.
The first two can be sampled, but the third (always) implies unknown unknowns, limiting the policy relevance of any "posterior probabilities" computed (and other model products). This does **not** destroy the utility of the model! (but does introduce interesting questions of resource allocation.)

Scenarios:
Weather-like questions: "One" model, many forecasts under similar conditions; repeated decisions.
Providing enough electricity next Friday; Chasing the forecast; Alerts to unreliable forecasts.
Climate-like questions: "One" decision (revisable), model lifetime less than forecast period!
Quantifying lower bounds on our uncertainty; Scenarios without likelihoods; model coherence.
Directs model improvement; and suggests critical observations.

Challenges:
How to interpret our model runs (if not as probabilities)?
How to effectively extract and communicate decision specific insights?
How to train the communicator, to train a collection of receivers?
How to disseminate information (Cost recovery or market penetration? Public good?)

Leverages: We only see climate through weather: stronger insights from environmental (ocean/atmosphere) models add value under all climate scenarios (unlike seawalls).

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