

Model Selection, Decision Making, and Normative Pluralism: Theory and Climate Science Application

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In this talk I focus on computational models. While the results are intended to be more general, particular attention will be given to climate models.

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- Bayesian: Probability of the model based on the evidence
- Falsifiability: Degree of corroboration of the model
- Severe Testing: Degree of severity of the statistical tests that the model has passed

Model Selection in Science

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“An important concept in climate system modelling is that of a spectrum of models of differing levels of complexity, each being optimum for answering specific questions. It is not meaningful to judge one level as being better or worse than another independently of the context of analysis.” (4th Intergovernmental Panel on Climate Change, Working Group 1)

Two Types of Climate Models

AOGCMs: Atmospheric and Oceanic General Circulation Models

EMICs: Earth-system Models of Intermediate Complexity

Two Types of Climate Models

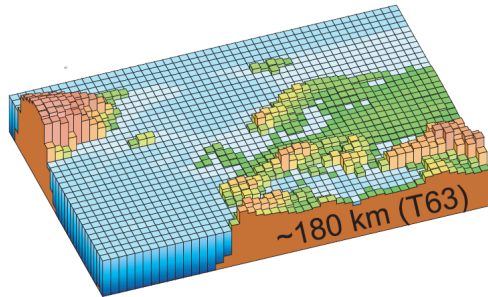


Figure : AOGCM representation of the geography of northern Europe circa 2001 (IPCC Working Group 1, 4th Assessment Report)

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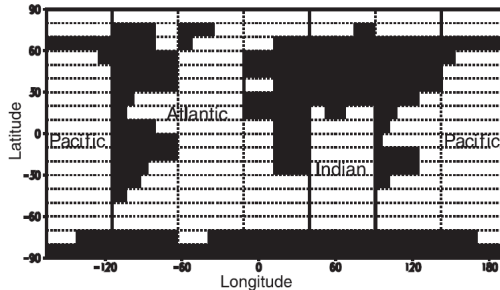


Figure : EMIC representation of the geography of the world circa 2000 (Petoukhov et al., 2000).

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Epistemic accounts consider how accurately a model is Of the phenomenon.

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Model Success

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$$S(M, d) = B_S(M, d) - RC_S(M, d) - DC_S(M, d) \quad (1)$$

Benefit

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- Subjective probability of being true model

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- Cost of human labor

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Instead, the compositional form of (1) can be used to identify and justify *ceteris paribus* heuristics that indicate which model to select.

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If S is a success criterion, d is a given data set, and M_1 and M_2 are models satisfying

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If the *ceteris paribus* clause in the Simplicity heuristic is satisfied, S will be dominated by RC_S , which will be lower for the simpler model.

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- If RC_S and DC_S are very small for all considered models, then focus on maximizing B_S .

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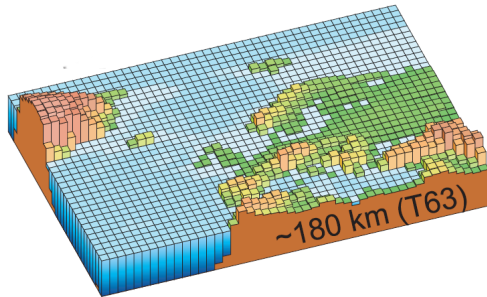


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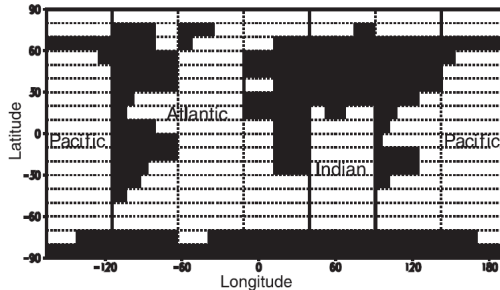


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Thanks for listening!