Climate model evaluation and models of natural variability

11th International Meeting on Statistical Climatology
Thursday - Poster Session 2

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Abstract

Nonlinearities in the climate system induce strong interactions among separated space and time scales. However, there is no climate model that encompasses all temporal and spatial scales, includes all the components and processes and therefore explains the climate phenomena at once. As a result Global climate models (GCM) often exhibit significantly lower variability. In general GCMs concentrate the modelling on a particular frequency band. Variables that evolve on slower timescales can be modelled as quasi-adiabatic parameters and variables evolving more rapidly can be modelled as random fluctuations. Therefore, when looking at climatic records we should ask which is the relevant frequency band, and which features of such a record are the ones a model of the behaviour within that band should capture. In this work we analyse these issues in the context of climate model evaluation. When validating climate models with observations the standard assumption is that fast variables can be described as uncorrelated random variables, neglecting strong correlations between different time-scales. Using the CMIP3 models and climateprediction.net perturbed physics ensemble, we investigate whether correlations between different time scales are relevant for the model runs' evaluation and the consequences of taking them into account in the metrics to evaluate models.

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