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Design of Experiments (DoE)-Based Approach to Better Capture Uncertainty in Future Climate Projections

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We are living in the big data era. The amount of data created is enormous and we are still planning to generate even more data. We should stop and ask ourselves: Are we extracting all the information from the available data? Which data do we really need? The next frontier of climate modelling is not in producing more data, but in producing more information. The objective of this talk is to share how to mitigate future challenges associated with the exponential increase in climate data expected over the next decade. Our approach uses efficient design processes and methods to ensure effectiveness in data production and data analysis.

Numerical climate model simulations have become the largest and fastest growing source of climate data. This is largely due to societal demands for climate information that is both relevant and useful. To satisfy this demand, numerical models need to run large ensembles to quantify uncertainties. Traditionally, the simulations that constitute members of an ensemble are chosen in an ad hoc way leading to what is called an 'ensemble of opportunity'. The current 'ensemble of opportunity' approach is inefficient and incomplete, since only part of the parameter space is covered by the framework.

The main scientific question is: Can the 'ensemble of opportunity' be replaced by something better? Statistics is a useful tool in this regard. We provide an overview of a Design of Experiments (DoE)-based approach, grounded on statistical theory, which makes it possible to fully sample the uncertainty space, while saving computation cost.

Keywords

big data; climate change; experimental design

Classification

Mainly methodology

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