On quantifying the local climate response in observations and models

David Stainforth

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Abstract

Traditionally the response of the climate system to increasing atmospheric greenhouses gases has been quantified in terms of changes in global mean surface temperature and encapsulated in concepts such as equilibrium climate sensitivity, transient climate sensitivity and earth system sensitivity. More recently the focus has shifted to how we quantify regional and local changes; changes which relate to individuals' experiences and decision-relevant impacts. On these spatial scales climate variability both limits our ability to quantify climatic changes from observations, and fundamentally impacts how we should design modelling experiments to understand future responses to climate perturbations. This talk will demonstrate how the timescales of climatic perturbations associated with anthropogenic climate change provide intrinsic limits to the quantification of local change. Despite such limits, it is nevertheless sometimes possible to identify changes in distribution; this will be illustrated with an exploration of local temperature and precipitation changes across Europe. The same intrinsic limits require us to use initial condition ensembles when exploring the climate response to potential future greenhouse gas concentration scenarios within complicated global climate models. The design of such ensembles is, however, far from trivial. How the design influences the probabilistic accuracy one can expect and the role of what has been termed macro c.f. micro initial condition uncertainty in the experimental setup will be illustrated.

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