

The impact of initial conditions in climate modelling

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The significance of using a variety of initial conditions in climate modelling experiments is frequently debated. By examining initial condition ensembles, under the same model and the same parameter values, impacts on both regional and global scales can be assessed. Results based on the climateprediction.net experiment show that these variations are non-trivial in the Hadley Centre's HADSM3 model. This has important implications both for decision making and our understanding of the internal variability of climate models. Variability within initial condition ensembles can help decision makers place a lower bound on the uncertainty in model results. Some common statistical approaches fail to distinguish between this initial condition variability, a consequence of the nature of state variables, and other types of uncertainty that affect the model's dynamics, such as parametric uncertainty. One difficulty arises when the state variables are mixing in a sense that the parameter values are not, another lies in the definition (or perhaps even the existence) of decision-relevant priors when the model is not even arguably empirically adequate. These difficulties will be clarified in simple conceptual models where they can be easily understood; their implications are then illustrated, where possible, with state-of-the-art climate models.