

Decadal predictability and signal-to-noise

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WGCM has suggested that the CMIP5 experiment include decadal predictions by global climate models for the period 2005 to 2040. These runs will likely include changes in anthropogenic forcing factors ie ghgs and aerosols, specified ocean initial conditions to represent the observed climate state at the start of the simulations, and multiple members with varying atmospheric initial conditions to form an ensemble. Several issues for decadal predictability and evaluation of these runs were discussed, including estimation of internal climate variability from these runs, when is a forced climate change signal in an individual realization likely to emerge from the noise, and how long will any climate signal due to the specified initial conditions remain large relative to noise and a possible growing climate change signal.

A preliminary assessment of these issues was provided from analysis of two ensembles of simulations with the NCAR CCSM3, a large 30-member ensemble with the same ocean initial conditions but different atmospheric initial conditions and a smaller 8-member ensemble with varying ocean and atmospheric initial conditions. For estimates of internal climate noise, it was found that departures of individual runs from the ensemble mean provide a good estimate of the interannual variability of global and regional mean temperature and precipitation, provided a sufficiently large ensemble is available. The emergence of a forced climate change signal above the noise depends on the magnitude of the forced signal, and spatial and time averaging to reduce the noise. It was found that a forced climate change signal as the departure from values in 2000 could be identified in global mean annual temperature change and in low frequency regional temperature change by 2020. It was difficult to identify a strong signal from the initial conditions in global mean or regional mean temperature in many regions, and any signal was usually apparent only for the first period in the run i.e. in the first ten years for ten-year average changes.