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Title: Simulating the Actual Climate of the 20th Century with a Coupled GCM

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Abstract

A method has been developed which can be used to retrospectively simulate and understand the evolution of surface temperature using reanalysis surface fluxes and a coupled GCM. The method has two parts: 1) weather noise surface fluxes are extracted from the reanalysis surface fluxes by removing the ensemble mean response of an AGCM ensemble to the observed surface temperature evolution; 2) an interactive ensemble (IE) CGCM (an ensemble of atmospheric models coupled to a single OGCM) is then forced by this noise. The IE CGCM will reproduce the observed surface temperature evolution up to errors in the model, the reanalysis surface fluxes, and the ocean initial state given certain conditions. These conditions are that there is no internal ocean “weather noise” or coupled instabilities. External forcing must also be taken into account properly.

The method is illustrated in the perfect model/perfect data context of the Barsugli and Battisti (2000) simple model and with synthetic observations from a CGCM simulation. It is then illustrated using forcing data from the NCEP reanalysis 1951-2000.