Statistical simulation of climate time series for hypothesis testing

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Abstract

Motivated by hypothesis testing problems in climate science, we propose a simulation strategy for creating ensembles of statistical replicates of time series. The replicates are obtained by partitioning a time series into signal and noise components using wavelets, and applying a parametric bootstrap to create pseudo-realizations of the noise sequences. By customizing the signal-noise decomposition, the bootstrapping procedure, and the test statistic, we can enforce various conditions corresponding to the null distributions required for testing hypotheses. We describe how we use this method to test hypotheses about the similarities between time series of observations and those of CMIP5 model simulations for global average surface temperature, as an example. We hope to illicit feedback from the community on how the implied definition of "internal variability" as time series noise, relates to internal variability represented by data from the Large Ensembles project, and if/how our method might contribute to analysis of those data.