Verifying the Representation of Regional Climate Variability in a GCM using Object-based Methods

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Abstract:

Systematic model evaluation is an important contributor to the processes of using and improving climate prediction and projection systems. Traditionally, this step has relied on grid-based comparisons where each model point is matched to an observation point, producing measures such as the correlation coefficient, mean squared error, critical success index, or false alarm ratio. While these statistics can provide meaningful information about model performance over time, they lack important details needed to determine the cause of a good or poor score. Furthermore, they are also subject to the so-called "double-penalty" issue. For example, these statistics do not identify spatial displacements, timing issues, and size or orientation errors. Recently, new tools in weather forecast verification have been developed to alleviate some of these problems, provide additional diagnostic information about forecast performance, and to more richly characterize model projection comparisons. Here, these object-based tools have been adapted and applied to a 30-year simulation of the Community Earth System Model (CESM) large ensemble. Examples of several applications of these tools have been developed with a focus on climate processes (in contrast to weather forecast verification). They offer new approaches to examine and characterize spatial, temporal, and intensity differences in precipitation and temperature features as related to ENSO variability across the globe. Though developed for high-resolution weather forecasts, these tools can provide important new information applicable to climate research and model development and serve as flexible alternatives to simple difference maps ("eyeball comparisons") and correlations.