Dynamically meaningful metrics of ENSO in climate models

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Given the fundamental role that ENSO plays in the global climate, its accurate simulation by climate models is extremely important. Significant progress has been made in the identification of suitable metrics to assess the model performance in the simulation of key ENSO aspects, including amplitude, spatial patterns, spectral characteristics and some of the local ocean-atmosphere feedbacks. To make further progress, metrics should also be able to capture the evolving nature of ENSO as well as the non-locality of some of its key feedbacks. Lag-covariances characterize the persistence and evolution of the given field, and can thus provide fundamental insights in the model representation of the ENSO evolution. In this study, we first examine the sea surface temperature (SST) lag-covariances at different lags in observational data sets and in the Climate Model Intercomparison Project version 5 (CMIP5) archive. Linear Inverse Modeling (LIM) is then used to elucidate the origin of the model inaccuracies in the lag-covariance representation. In particular, the nature of the discrepancies, whether originating from local or remote feedbacks, is investigated.