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Understanding coupled model errors in the tropical Pacific using hindcasts

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Seasonal and decadal hindcasts of the last decades can provide a powerful test to understand the development of biases in IPCC-class CGCMs. The classical analysis of ENSO in IPCC-type integrations (either basic statistics or more advanced evaluation of feedbacks) usually concentrates on long (at least multi-decadal) stabilized time series statistics needed to compute robust signals. Yet, this strategy cannot fully explain how the model's errors were generated in the first place. Since seasonal and decadal forecasts are initialized closed to observation, and their errors grows up with integration, they offer an ideal framework to study the sequence of biases apparition.

This strategy was applied to IPSLCM5A coupled model, which exhibits in the tropical Pacific two main structures of SST biases that are largely shared by the other CMIP3/5 coupled models : a warm bias in the south east Pacific and a cold bias at the equator. It has been shown that the warm bias took approximately 6 months to develop whereas it takes at least 30 years for the cold tongue bias to adjust.
Leadtime analysis further helps to demonstrate that the fast-adjusting warm SST bias is the first in a sequence of several biases leading to wrong ENSO phase-locking. The warm bias modifies the surface wind circulation in the east Pacific and is responsible for the development of a spurious upwelling in spring. The interannual modulation of this upwelling may in turn explain why SST interannual variability peaks in spring.