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Using seasonal hindcasts to understand the origin of the Pacific cold tongue bias in CGCMs and its impact on ENSO

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Seasonal forecasts (and more specifically '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 the long (at least multi-decadal) time series statistics needed to compute robust signals. Yet, this strategy cannot fully explain how the model's errors (in the mean state but also in the feedbacks) were generated in the first place. This is an issue as the initial model errors result in a balance (a new mean state and annual cycle) that then becomes difficult to link to particular model deficiencies (such as arising from model parameterizations). Since seasonal 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. With this sequence, we distinguish pre-existing errors from errors responding to initial ones. The present study focuses on the cold SST bias in the tropical Pacific, which is present in most of CMIP3 models and can severely affect ENSO representation. We applied the strategy described above to a set of five CGCMs (ENSEMBLES-FP6 project) and found that the zonal wind errors are likely to be the origin of the cold bias. To test this assumption, we carried out ocean only forced experiments, applying the CGCMs daily 10-meter wind as the forcing. In a case study we showed that this forcing is sufficient to reproduce the main SST patterns observed after one month of simulation in CGCMs further confirming the original hypothesis.