



Effect of initial uncertainties of sea temperature in Indian Ocean on the spring predictability barrier for El Niño events

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Using the CESM1.0.3 (Community Earth System Model), a fully coupled global climate model, we demonstrate that the initial errors of sea temperature in India Ocean can easily induce spring predictability barrier (SPB) for El Niño when predicting El Niño in tropical Pacific Ocean starts in the season before the boreal spring. Furthermore, we find that two types of initial errors are much likely to cause a SPB for El Niño events. One type consists of a positive IOD-like sea temperature pattern, with positive/negative sea temperature anomaly in the western/eastern Indian Ocean, while the other type has a negative IOD-like sea temperature structure which is nearly opposite to the former. For a weak El Niño event, the first type of initial errors causes the El Niño to be under-predicted, while the latter type tends to cause the event to be over-predicted. But for a strong El Niño, both types of initial errors are inclined to cause the event to be under-predicted. These may because strong El Niño events are affected by stronger nonlinearities than weak ones. In addition, these two types of initial errors may provide information regarding the “sensitive area” of ENSO predictions, and if data assimilation or adaptive observations can filter them, the ENSO forecast skill may be improved.