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How Well can We Predict the Indian Ocean Dipole?

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Abstract

The Indian Ocean Dipole (IOD) has been recognized as a strong climate driver that not only significantly impacts the rainfall variability in the countries surrounding the Indian Ocean but also may influence the global climate beyond the El Niño-Southern Oscillation (ENSO). In this study, four state of the art coupled model forecast systems that routinely produce seasonal predictions in real time were used to access the current ability of the IOD predictive skill and its relationship to ENSO prediction. We compared predictions of the IOD, in particular the IOD events in September-October-November (SON), from the Bureau of Meteorology's dynamical season prediction model, Predictive Ocean Atmosphere Model for Australia (POAMA) with predictions from the ECMWF seasonal forecast System 3, the Frontier Research Center model (SINTEX-F), and the NCEP Climate Forecast System (NCEP-CFS). The IOD forecast skills of these four seasonal prediction systems were calculated from the retrospective ensemble runs initiated from all 12 calendar months for the period 1980-2006.

Our investigation show that the forecast skill of IOD is much less predictable than El Niño for all forecast systems, for instance, the skilful prediction of anomaly correlation coefficients ($\geq$0.6) of IOD in the austral spring season for all seasonal forecast systems is up to 3-4 months lead time in the boreal autumn season (the peak phase of the observed IOD). The corresponding hit rate for predicting the occurrence of IOD events drops to less than 50% after $\sim$2 months lead time (3 months for the best system and 1 month for the worst system). We show that predictive skill at longer lead time does not extend beyond the ability to predict ENSO and its relationship with the IOD, however the relationship between ENSO and the IOD is typically underdone in the forecast models as lead time increases. Hence, improvement in forecast skill can be achieved by an improved representation of the relationship between ENSO and the IOD in these models.