

Ocean dynamic persistence provides significant predictability for sea surface temperature variation associated with El Niño and La Niña

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El Niño-Southern Oscillation (ENSO) predictions have significant socioeconomic implications. The skill of ENSO predictions using coupled models is contributed by the accuracy of the initial ocean state and by coupled model fidelity in represent post-initialization ocean-atmosphere coupling. Coupled-model initialization shock can suppress the positive contribution of the initial ocean state to prediction skill. How much predictability the initial ocean state provides without considering subsequent ocean-atmosphere coupling has not been quantified. We address this question by performing 12-month hindcasts of the three-dimensional ocean state using a global ocean model forced by climatological atmospheric forcings but initialized monthly during the altimetry era from Estimating the Circulation and Climate of the Ocean (ECCO) ocean state estimates. Non-seasonal anomalies in the hindcasts reflect dynamic evolution of the initial ocean state without subsequent ocean-atmosphere coupling, coined as ocean dynamic persistence (ODP). ODP shows better skills in predicting Niño3.4 sea surface temperature anomaly than the damped (statistical) persistence, a common baseline metric for evaluating predictions. ODP outperforms most real-time ENSO forecast models assessed by Barnston et al. (2012). Taken together, ODP provides a more stringent metric for evaluating ENSO prediction skill than damped persistence. The significant predictability offered by ODP also underscores the importance of reducing coupled model initialization shock to maximize the positive contribution of initial ocean state to ENSO prediction skill. The ODP method is a general approach that is applicable to predictability studies for other phenomena and time scales.