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On the role of internal atmospheric processes in interannual equatorial variability

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Major modes of tropical variability, such as El Nino-Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD), or the Atlantic zonal mode, have been found to arise from coupled air-sea interaction. An often invoked mechanism in this context is the Bjerknes feedback, in which equatorial zonal winds respond to sea-surface temperature (SST) anomalies in such a way as to reinforce the original anomaly. Recent studies, however, have reexamined the role of coupled feedbacks and found that they might be less important than previously thought. Here we examine the issue by focusing on equatorial surface winds, which undoubtedly play an important role in driving oceanic variability in the equatorial region. We compare fully coupled general circulation models (GCMs) from the Coupled Model Intercomparison Project Phase 5 (CMIP5) with an experiment in which the atmospheric component is forced with the climatological seasonal cycle of SST. For the equatorial Atlantic, the analysis reveals that surface wind variability decreases by only about 25% when climatological SSTs are prescribed. This suggests that a large portion of equatorial Atlantic surface wind variability is due to internal atmospheric processes. In the equatorial Pacific and Indian Ocean, on the other hand, surface wind variability reduces substantially when climatological SSTs are prescribed, indicating the importance of coupled feedbacks. Even there, however, the intrinsic atmospheric component can be quite large depending on the season and is subject to a large inter-model spread. Potential reasons for the model spread will be discussed.

キーワード: equatorial variability, ENSO, IOD, Atlantic Nino, predictability, surface winds
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