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Multiplicative MJO forcing of ENSO

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The role of sea surface temperature (SST) feedback to the Madden-Julian Oscillation (MJO) in its influences on El Niño—Southern Oscillation (ENSO) is studied using a coupled ocean-atmosphere model of intermediate complexity. Zonal surface wind of the MJO is expressed in terms of few basic parameters, such as amplitude, zonal extent, interval between two adjacent MJO events, and zonal propagating speed. Each MJO parameter includes a most probable value, a degree of stochasticity, and SST feedback. Simulations of two 100-member ensembles were generated: one without SST feedback (additive) and one with SST-feedback (multiplicative). ENSO statistics are compared between the two ensembles, and between the ensembles and observations. Nearly all ENSO properties are found to be sensitive to the most-probable value, stochasticity, and SST feedback of some MJO parameters. When MJO's zonal propagation speed is reduced to zero, ENSO signal vanishes. ENSO variance increases with both stochasticity and SST feedback to MJO amplitude, non-linearly dependent on SST feedback to zonal-extent of MJO, but is insensitive to stochasticity in other MJO parameters. Ensemble comparisons between additive and multiplicative MJO forcing reveal that at least in the stable regime, SST feedback to the MJO can be responsible for the observed variance of ENSO SSTs. ENSO under the multiplicative MJO forcing has larger ensemble spread, suggesting a larger interdecadal variability, than under the additive forcing.