Coupled Model Simulations of Boreal Summer Intraseasonal (30-50 day) Variability, Part 1: Systematic Errors and Caution on Use of Metrics

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Abstract

Boreal summer intraseasonal (30-50 day) variability (BSISV) over the Asian monsoon region is more complex than its boreal winter counterpart, the Madden-Julian Oscillation (MJO), since it also exhibits northward and northwestward propagating convective components near India and over the west Pacific. Here we analyze the BSISV in the CMIP3 and two CMIP2+ coupled ocean-atmosphere models. Though most models exhibit eastward propagation of convective anomalies over the Indian Ocean, difficulty remains in simulating the life cycle of the BSISV, as few represent its eastward extension into the western/central Pacific. As such, few models produce statistically significant anomalies that comprise the northwest to southeast tilted convection which results from the forced Rossby waves that are excited by the near-equatorial convective anomalies. Our results indicate that it is a necessary, but not sufficient condition, that the locations the time-mean monsoon heat sources be simulated correctly in order for the life cycle of the BSISV to be represented realistically. Compared to the regional rainfall variations, the models exhibit more fidelity at capturing the vertical windshear since this is an integrator of the monsoon heat source.

Extreme caution is needed when using metrics, such as the pattern correlation, for assessing the fidelity of model performance, as models with the most physically realistic BSISV do not necessarily exhibit the highest pattern correlations with observations. Furthermore, latitude-time plots to evaluate the northward propagation of convection from the equator to India and the Bay of Bengal also need to be used with caution. Here, incorrectly representing extratropical-tropical interactions can give rise to “apparent” northward propagation when none exists in association with the eastward propagating equatorial convection. It is necessary to use multiple cross-checking diagnostics to demonstrate the fidelity of the simulation of the BSISV.