

Exploring the Genesis and Predictability of Intraseasonal Variability

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Abstract

Empirical prediction schemes have shown that there exists considerable predictability on intraseasonal time scales as evidenced in models using Bayesian statistics. For example, regional South Asian rainfall (strongly to the summer Madden-Julian Oscillation: MJO) appears predictable at 20-25 day horizons. We accept the basic premise that if empirical studies can generate statistically significant forecasts then coupled ocean-atmosphere models, that supposedly replicate the large-scale behavior of the climate system, should also possess similar skill.

However, using sets of serial integrations (models run in ensemble form with successive 30+ day forecasts starting on successive days) of both coupled and uncoupled models show that numerical forecasts appear to show less skill than empirical schemes. One of the virtues of serial integrations is that the model is initialized at different periods of the MJO cycle and it is found, for example, that skill varies depending on the phase of the MJO in which the model is initialized suggesting problems associated with convective parameterizations. Serial integrations also show that skill is very sensitive to the degree to which the atmosphere is coupled to the ocean suggesting perhaps that the oceans need to be handled with more care. We discuss these two modeling issues and suggest that hybrid empirical-numerical configurations may increase predictability.

Finally, we discuss some enduring elemental problems that have existed since the classical Madden-Julian papers. What excites an MJO and why does it seem to reside in wavenumber-frequency space at locations that do not match normal modes? Why does it seem to form in the Indian Ocean, a common feature of both diagnostic studies and modeling results? We explore recent research that suggests that the MJO is a form of relaxation of a gross-scale instability and that the unique oceanographic, atmospheric and coupled ocean-atmospheric nature of the Indian Ocean provides a region suitable for the genesis of a low-frequency coupled mode.