ATS/CIRA Colloquium

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from ATS

Beyond Surface Fluxes: How Ocean Coupling Affects the Madden-Julian Oscillation

Hosted by David Randall

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ATS room 101
Discussion will begin at 11:15 a.m.
Refreshments will be served at 10:45 a.m. in the weather lab

The intraseasonal (30-70 day) Madden Julian oscillation (MJO) regulates cloudiness, rainfall, and winds throughout the Tropics. Its effects are communicated to higher latitudes via teleconnections where it influences the likelihood of extreme weather events. Simulation and prediction of the MJO remain an outstanding challenge for climate and forecast models. The organization of MJO convection and its eastward propagation across the Indo-Pacific Warm Pool are regulated by atmospheric processes: cloud radiative feedbacks and horizontal advection of mean state moisture, respectively. However, nearly two decades of modeling studies almost unanimously demonstrate improved MJO simulation when ocean feedbacks are considered.

In this talk, I will give an overview of Warm Pool ocean-atmosphere feedbacks associated with the MJO, and discuss how the ocean response to MJO forcing may feed back to MJO convection. Next, the effects of ocean coupling for the MJO are assessed with a suite of coupled and uncoupled model experiments using the super-parameterized Community Atmospheric Model (SPCAM). Daily SST time series from the coupled simulation, plus its 5- and 31-day running means, are prescribed in atmosphere-only simulations to assess the role of coupled feedbacks.

While the role of SST perturbations in MJO maintenance and propagation predictably decreases with increasing SST averaging period, an unexpected result—which is duplicated using other models—is that the horizontal gradients of mean state column water vapor also decrease with increasing SST averaging period. This suggests that relatively high-frequency ocean-atmosphere interactions rectify onto the mean state moisture distribution, and so influence MJO propagation through horizontal moisture advection. I will conclude my talk with some proposed strategies for understanding the processes responsible for this rectification.