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Maintenance of MJO Convection by Radiative Feedbacks

Eric Maloney and Wei-Ting Hsaio
Colorado State University, Atmospheric Science, Fort Collins, United States of America (eric.maloney@colostate.edu)

The maintenance mechanisms for the Madden-Julian oscillation (MJO) remain an area of active research, and may include a combination of radiative feedbacks, wind-evaporation feedbacks, and moistening produced by lower tropospheric convective heating. This presentation will revisit the importance of radiative feedbacks for supporting MJO convection with a new GPCP precipitation dataset and NASA CERES radiative heating profiles. Prior work by Adames and Kim with the GPCP v1.3 precipitation product and NOAA OLR indicated that radiative feedbacks are strongly supportive of MJO convection as viewed through the vertically integrated moist static energy budget, and provide a strong scale selection mechanism. This presentation uses the newer GPCP v3.2 product to show that while radiative feedbacks still provide a strong scale selection mechanism, the overall strength of radiative feedbacks are weaker than with GPCP1.3. This suggests that the relative role of other feedbacks such as wind-evaporation feedbacks for supporting MJO convection may be more important than once thought.

This presentation also uses NASA CERES radiation profiles in a vertically-resolved moisture budget framework that employs the tropical weak temperature gradient assumption to determine the impact of radiative feedbacks on the MJO moisture budget. It is shown that longwave cloud radiative feedbacks onto MJO moisture anomalies are enhanced in the Indian Ocean and southern Maritime Continent region compared to other parts of the tropics, suggesting stronger support for MJO convection there. This finding is consistent with prior work by Mayta and Adames suggesting that the MJO most closely resembles a moisture mode in that region. It is hypothesized that enhanced vertical shear in the Indian Ocean and southern Maritime Continent supports convective organization that fosters greater cloud-radiative feedbacks.