A statistical study on precipitation characteristics coupled with equatorial Kelvin waves and equatorial Rossby waves.

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Coupling structures between convection and equatorial waves are investigated using space-borne precipitation radar observation. Recent theoretical studies suggest that different equatorial wave modes can have different coupling mechanisms. However, observational studies on their precipitation characteristics are yet not enough. In order to tackle this issue, we quantitatively characterize precipitation coupled with equatorial Rossby waves (ERW) and equatorial Kelvin waves (EKW).
Based on wave phases determined with brightness temperature observed from the Geostationary Meteorological Satellites, composite analyses are conducted. TRMM 2A25 and 2H25 products are used to analyze precipitation characteristics. We prepare rainfall-area dataset by identifying areas of consecutive precipitating pixels. ERA-interim is used to obtain synoptic scale wave structures.
In the ERW, organized convective systems dominate directly following a shallow convection stage, without a developed convection stage. On the other hand, in the EKW, precipitation shows a tri-modal evolution: shallow convection, developed convection and organized convection stages. We also find a contrast in column water vapor (CWV) anomaly structures. With ERW, positive and negative CWV anomalies have similar amplitudes, while negative CWV anomaly in EKW is not clear.
As for the vertical structures, ERW has an upright structure, while EKW has a vertical tilt. The evolution of moisture field driven by wave disturbances may cause the contrast of the CWV anomaly.
These contrasts of convective evolution and moisture field suggest that these two equatorial waves have different unstable modes. ERW well correspond to ‘moisture mode’, which is driven by CWV anomaly. On the other hand, EKW well correspond to ‘gravity mode’, which is driven by buoyancy perturbation.
In order to clarify interaction between precipitation and wave disturbances in details, we further investigate energy and moisture budget.

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