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

Yuhi Nakamura*[1], Yukari N. Takayabu[1]

1 Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan

Coupling structures between convection and equatorial waves are investigated using space-borne precipitation radar observation. Recent theoretical studies suggested that different equatorial wave modes can have different coupling mechanisms. However, investigations on precipitation characteristics based on observation is still not enough. In order to shed light on this problem, we quantify precipitation and its characteristics coupled with equatorial Kelvin wave and equatorial Rossby wave, and compare their structures.

Based on the wave phase determined with brightness temperature observed from the Geostationary Meteorological Satellites, a composite analysis is conducted. TRMM 2A25 and 2H25 products are used for analysis of precipitation characteristics and we prepare rainfall-area dataset that is the area of consecutive precipitating pixels. ERA-interim dataset is used for analysis of synoptic scale wave structures.

In Rossby wave case, organized convective systems dominate following shallow convection without a developing convection phase. This evolution may be caused by the upright vertical structure of the wave disturbance. The cyclonic circulation triggers shallow convection, and successive deep upward velocity and moisture support that convections organize. On the other hand, in Kelvin waves, precipitation shows a tri-modal evolution: shallow convection, developed convection, organized convective systems. The vertical tilting structure of the Kelvin wave disturbance, so-called boomerang shaped, for moisture and vertical velocity fields corresponds to this evolution of precipitation characteristics.

We found a contrast of column water vapor (CWV) anomaly from climatology between Rossby and Kelvin waves. In case of Rossby waves, positive and negative anomalies of CWV have similar amplitudes. However, negative CWV anomaly in Kelvin waves is not clear.This contrast may cause differences in coupling processes between convection and wave disturbances. We are now investigating this point further in details.

These differences of precipitation characteristics and an asymmetry between Rossby and Kelvin waves in the relationship between moisture and precipitation imply the differences in their coupling processes. As further work, we will investigate precipitation characteristics comparing to snapshot and transient of wave phase.

Key words: Equatorial waves, moist convection, precipitation characteristics