

HyARC Seminar (HyARC Seminar#183)

Date: June 10 (Wednesday) 15:00-

Room: The meeting room (#617) of Research Institutes Building.

Speaker: Mr. Kuniaki Inoue (University of Wisconsin-Madison)

Title: Gross moist stability assessment during TOGA COARE:
Various interpretations of gross moist stability

Abstract:

We analyze daily averaged TOGA COARE data to investigate the mechanisms of convective amplification and decay. The gross moist stability (GMS) which represents moist static energy (MSE) export efficiency by the convection and large-scale circulations is studied, together with two quantities, the effective GMS, and the critical GMS (the ratio of diabatic forcing to the convective intensity) which we coined. Our analyses reveal that convection is amplified/dissipated via negative/positive effective GMS (i.e., sub-critical/super-critical GMS).

We illustrate that variability of the effective GMS during the convective amplification phase is predominantly due to the vertical MSE advection (or vertical GMS) which imports MSE via a bottom-heavy vertical velocity profile (which is associated with negative vertical GMS) and eventually starts exporting MSE via a top-heavy profile (which is associated with positive vertical GMS). The variability of the effective GMS during the decaying phase is, in contrast, due to the horizontal MSE advection (thus the horizontal GMS), which efficiently exports MSE in the decaying phase. The critical GMS, efficiency of moistening due to the diabatic forcing, is broadly constant throughout the convective life-cycle, indicating that the diabatic forcing always tends to destabilize the convective system in a constant manner.

We propose various ways of computing constant "characteristic GMS", and demonstrate that all of them are equivalent and can be interpreted as i) the critical GMS, ii) the GMS at the maximum precipitation, and iii) the combination of feedback constants between the radiation, the evaporation, and the convection. If the GMS is less/greater than that characteristic GMS, the convection is amplified/dissipated. We suggest usefulness of the characteristic GMS as a diagnostic quantity for investigating a wide range of tropical convective disturbances.

(given in Japanese or English)