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Predictability of Convective Amplification and Decay on the Gross Moist Stability Plane

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Column integrated moist static energy (MSE) and dry static energy (DSE) are useful to investigate convective amplification/decay mechanisms in the deep tropics. Utilizing the ERA-interim datasets, we examined the gross moist stability (GMS), which represents the efficiency of MSE export by large-scale circulations associated with moist convection; and we proposed a new diagnostic framework called the "GMS plane". The GMS plane is a plane whose x-axis and y-axis are, respectively, column-DSE-flux-divergence and column-MSE-flux-divergence. On this place, we can elegantly compute the predictability of convective amplification/decay: On this place, convection in the amplifying phase most likely appears below a critical line, which we called the critical GMS line, while convection in the decaying phase most likely appears above the critical GMS line.

The variability of column MSE is due to horizontal advection, vertical advection, and diabatic sources of MSE. In the GMS place analyses, we found that the variability of column MSE is primarily due to the horizontal advection of MSE, and furthermore, the predictability of convective amplification/decay also mainly comes from the horizontal advection. This might suggest that convective amplification/decay is primarily driven by horizontally moving moisture envelopes, instead of vertical MSE advection or diabatic source terms.