Understanding sea surface temperature forcing of precipitation variability in the tropics

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The great dependence of human society and natural ecosystems on rainfall makes precipitation variability an essential aspect of the earth’s climate. In the tropics, it is well accepted that the ocean plays a crucial role in precipitation variability through variations in sea surface temperatures (SSTs). Above normal SSTs often increase the boundary-layer moist static energy and induce anomalous convection. An important yet unresolved question is: how strong is the SST forcing? Observational studies have long suggested an intense SST forcing for base SSTs around 27.5°C but little forcing for very high base SSTs. In this seminar, I will show that simultaneous SST-rainfall relationships in any coupled system, including observations, are inadequate for quantifying the SST forcing. This is largely due to the two-way interplay between the atmosphere and ocean. Results from uncoupled simulations show that the SST forcing in fact becomes larger for higher base SSTs. The relationship between the SST forcing and base SST can be parameterized with the moist static energy model. Future endeavors to quantify feedbacks between the SST and hydrological cycle will be presented with the aim of improving model simulations of tropical air-sea interaction.

Keywords: tropical precipitation variability, SST forcing, air-sea relationship

