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Changes in structure and radiative impact of mesoscale convective systems with ENSO phase

Sylvia Sullivan and Pierre Gentine
Department of Earth and Environmental Engineering, Columbia University, New York, NY (sylvia.c.sullivan@gmail.com)

In the tropics, mesoscale convective systems (MCS) cause significant surface warming from their extensive anvils and heavy rainfall from their cores. But the adjustment of these radiative and hydrological impacts according to the phase of the El Niño Southern Oscillation remains unclear. We first construct tropical climatologies of MCS initiation location, propagation, and structure between 1983 and 2008 using the ISCCP convective tracking database and differentiating for El Niño-La Niña years. System growth is also quantified with the ratio of tendencies in convective cloud top height to those in horizontal extent. During El Niño years, systems are larger and more elongated with a higher number of associated mesoscale convective complexes.

Changes in MCS characteristics are then linked to the vertical and zonal energy budgets using collocated CERES top-of-atmosphere and ERA Interim eastward energy fluxes. We quantify the modification of diurnal flux cycles and monthly means with MCS extent, depth, and growth for one terrestrial (Amazon) and one oceanic (adjacent eastern Pacific) region. The link of MCS structure and radiation to ENSO phase is a first step toward more general synthesis of global-scale ENSO influences, for example on the Walker circulation, with regional ones, for example on precipitation.