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Role of interactive sea surface in the onset of convective clustering

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We present results of radiative convective equilibrium experiments using the WRF model coupled to an interactive slab ocean model, for which a relaxation term removes energy to constrain the domain mean sea surface temperature (SST) to a target value. Using an adjustment timescale of one minute, drift in the mean temperature is constrained and the impact of the slab ocean is only through the spatial heterogeneity in sea surface flux. We show how thin ocean mixed layers slow the onset of organization, and an analysis of the fluxes indicate that this is chiefly through the latent heat feedback. Once clustering starts, the surface feedback acts to promote organization, although the rate at which the system transitions to a clustered state is not impacted, indicating that this is set by a diffusional timescale as suggested in other recent work. An additional set of experiments that permit the mean surface temperature to undergo a diurnal adjustment show how diurnal variations in SST oppose the atmospheric radiative forcing and also act to prevent clustering onset. We show the mechanism could originate from the reduction of the diurnal variation of convective mass flux and the distance between updraft towers.

Authors: TOMPKINS, Adrian (ICTP); Dr SEMIE, Addisu (LMD)

Presenters: TOMPKINS, Adrian (ICTP); Dr SEMIE, Addisu (LMD)

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