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Surface moisture exchange and its influence of self-aggregation in RCEMIP simulations.

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Under radiative-convective equilibrium (RCE) surface moisture fluxes drive convection, while convection-driven winds regulate surface fluxes. Most simulations of RCE do not resolve the boundary-layer turbulence that drives near-surface winds due to too coarse grid spacing and instead parameterize its effects by enforcing a minimum wind speed in the computation of the ocean-atmosphere exchange. We show from RCE simulations with fully resolved boundary-layer turbulence that capturing wind dynamics at low speeds impacts the spatially averaged surface moisture flux, as well as its spatial distribution. A minimum wind speed constraint of only 1 m s−1 leads to ~10% increase in spatially averaged surface flux in the evolution towards RCE and reduces the surface flux differences between windy and calm regions with more than a factor of two. Hence, the ability of simulations to let wind vanish is key in representing the wind-induced surface heat exchange feedback and is potentially important in convective self-aggregation for two reasons. First, surface fluxes reduce moisture gradients between moist and dry regions. Second, surface fluxes drive the convection that is the spatial distributor of moisture and therefore potentially play a role in setting the spatial scales at which self-aggregation happens.

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