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Towards reconciling observational and modeling-informed views of precipitation-induced tropical oceanic cold pools

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The near-surface characteristics of convective cold pools over the equatorial Indian ocean are studied using surface meteorological measurements from the Dynamics of the MJO (DYNAMO) field campaign and constrained cloud-resolving simulations. The temperature drop at cold pool onset is almost always accompanied by a drying and a decrease in moist static energy, signifying transport of air from above the boundary layer through precipitation-induced downdrafts. The decrease in the surface water vapor mixing ratio is more pronounced for stronger temperature drops, which tend to be associated with deeper convection. At the cold pool onset edge, the observations reveal a slight enhancement in moisture (water vapor rings) accompanied by a slight enhancement in temperature (0.25 g kg^{-1} and 0.1K, respectively) in the composite mean. The slight enhancements prior to a gust of increased surface winds suggests the immediate source is wind convergence, rather than rain evaporation, for which the moist static energy would remain unchanged. The cloud-resolving simulations capture the drying in the inner core of the cold pool and realistically simulate the changes in surface winds (and thereby surface fluxes). Near the cold pool edge the evolution in the model near-surface moisture field can be unrealistic, however, with a decrease in the composite mean before a slower increase (before the central drop). We encourage careful evaluation of model fields against observations prior to using models to understand cold pool processes.