Effects of cold microphysical processes on the surface precipitation variability of non-squall tropical oceanic convection

Abstract

The influence of cold microphysical processes on surface precipitation variability is investigated for a non-squall cluster and a scattered convective event that occurred over the tropical Pacific Ocean during the KWAJEX Experiment period. The MM5 model high resolution simulations of surface rainfall and ice concentrations are validated with available data from the experiment in terms of the ability to reproduce the character of variability. The validated model is then used to perform a number of sensitivity analyses pertaining to the dependence of simulated surface precipitation on various microphysical factors associated with cold microphysical processes. It is found that the graupel-related processes in the model microphysics scheme modify both the magnitude and the spatial variability of surface precipitation. The maximum precipitation simulated by the warm rain scheme is double the one simulated by including ice microphysics. The sizes of mean convective precipitation cells in the warm rain simulation are 48% and 41% larger than those in the ice microphysics simulation for the non-squall and scattered convective events, respectively. Further investigation points to the different treatment of supercooled raindrops in these two microphysics schemes being responsible for significant differences in the simulated maximum precipitation and spatial variability for the two rain events. Dividing the simulated precipitation into convective and stratiform portions based on simulated radar reflectivity shows that the non-squall cluster produces more convective rainfall (68%) than the scattering convection event (46%). A microphysical diagnosis of the causes is performed for each event. The findings have significant implications for the vertical profiles of atmospheric heating in the tropics.

The figure below shows simulated temporal change of mean areal hourly rain rate for the control experiment (full microphysics), *"warm rain", "cold rain", and "rain melted from snow" scenario. The full article is published in the Journal of Geophysical Research.*

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