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# Massive parameter-sweep warm bubble experiment on convective cloud environment

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Characteristics of convective clouds largely depend on thermodynamic and wind profiles of the environment. We qualitatively understand that higher temperature lapse rates, larger low-level moisture, and larger vertical wind shear increase the risk of severe convection producing heavy rainfall, tornadoes, and so on. However, we do not know quantitative dependence of convective cloud characteristics on variation in the environmental profile. Elucidation of quantitative relationships between convective cloud characteristics and the environment of cloud is necessary for accurately assessing the risk of severe weather from larger-scale atmospheric conditions. To investigate this, a massive parameter-sweep "warm bubble" experiment on the environment of convective cloud was performed. In the present study, SCALE-RM which is the non-hydrostatic atmospheric model developed at RIKEN was used. The size of the domain is 80 km x 80 km x 25 km. The horizontal grid spacing is 500 m. The vertical grid spacing is 20 m at the bottom, 480 m at the top, and gradually changes between them. The doubly periodic lateral boundary condition is applied. Seven parameters which control the environmental profile were swept: 4 surface temperature values Ts (21, 24, 27, and 30°C); 5 temperature lapse rates L (5.5, 6.0, 6.5, 7.0, and 7.5 K/km); 3 tropopause heights Ztrp (12, 14, and 16 km); 4 surface relative humidity values RHs (75, 80, 85, and 90%); 5 heights where relative humidity becomes zero Zrh0 (4, 6, 8, 10, and 12 km); 4 vertical wind shear magnitudes S (0, 1/1200, 1/600, and 1/400 #/s); 4 heights of the top of shear-layer Zs (3, 6, 9, and 12 km). Therefore, total 19200 (= 4 x 5 x 3 x 4 x 5 x 4 x 4) profiles were tested. Preliminary analysis clearly shows that strong-shear environment (S = 1/400 #/s) can increase the total 2-hour rainfall amount by an order of magnitude compared with no-shear environment (S = 0 #/s), when L and RHs are sufficiently large. Continuously generated convective systems which lead to heavy rainfall never occur under the conditions of L = 5.5 K/km or RHs = 75% even if Ts and S are large.