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Effect of nonuniform vertical grid on the tropical cyclone simulations

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Effect of nonuniform vertical grid on the tropical cyclone simulations was investigated using the WRF model. For more accurate initial conditions of the simulations, the bogus vortex technique was incorporated, where the tropical cyclone in the observation was replaced by the analytic three-dimensional vortex structure. Various types of vertical grid-spacing were used. To get an insight on the nonuniformity of grid, two-dimensional transport equation was first examined numerically with a focus on the influence of nonuniformity of grid. Boundary condition of the model is set periodic in horizontal direction, while no-normal flow condition is used in the vertical direction: Considering these unequal boundary conditions, the nonuniformity is only given in the vertical direction in such a way that the grid interval monotonically increases toward the center of the vertical direction. Simple analysis of the nonuniformity effect of grid was carried out, and indicated that it brings about adverse diffusion depending on the convergence or divergence in the vertical direction. Taking this effect into consideration, the tropical cyclone simulations with WRF incorporated the increased or reduced grid nonuniformity than those most commonly used one. Tropical cyclone track and intensity error of the simulations with various grid-structure will be discussed.