P45 Dynamical and physical processes associated with orographic precipitation in a conditionally unstable uniform flow: Variation in basic wind speed and CAPE.

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A series of systematic two- and three-dimensional (2D and 3D) idealized numerical experiments were conducted to investigate the combined effects of dynamical and physical processes on orographic precipitation (OP) with varying incoming basic flow speed (U) and CAPE in a conditionally unstable uniform flow. It is found that (a) High resolution (e.g., Δx = 100 m) are required to resolve precipitation distribution and intensity for U higher than 30 m s-1, (b) Precipitation is nearly doubled at high wind speed low CAPE simulations compared to high CAPE results, and (c) Overall, in both 2D/3D high wind speed simulations, the pattern of the precipitation distribution resembles to the mountain profile. These findings may be applied to examine the performance of moist and turbulence parameterization schemes and have potential to simplify the parameterization of OP in terms of control parameters.

Similar conclusions are made using WRF simulations at low wind speeds. However, two main issues are encountered at high wind speeds: (1) the results are sensitive to the domain length in that unless a very large domain employed, spurious reflections from the lateral boundaries influence the precipitation distribution over the mountain, and (2) the model domain top is observed to drop by a few kilometers after a half day of integration, which might indicate a mass loss throughout the simulations. It is hypothesized that these findings have an impact on idealized and real-case simulations of tropical cyclones passing over mountains.