Development and sensitivity test of a new WRF bin microphysics scheme

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A new cloud bin microphysics scheme for the WRF model has been developed during the last 10 years and was described in detail by Geresdi and Rasmussen (2005) and by Rasmussen et al. (2002). This scheme uses the spectral method of moments (Tzivion et al. 1987) in order to calculate the evolution of the size and mass spectrum of the different cloud particles for each time step of the simulation. The use of this numerical approach assures the conservation of the masses of the different cloud particle species while it accurately calculates the evolution of the size distribution.

This bin microphysics scheme is a very powerful and valuable tool for investigating microphysical processes inside clouds. In order to demonstrate this detailed scheme's capability, we coupled this scheme into the WRFV3 model and carried out two sets of ideal simulations. Two ideal 2D-squall line cases with clean and polluted aerosol concentrations were simulated to illustrate how the coupled model handles strong convective systems. Two ideal LES simulations (clean and polluted) have also been carried out to see how the model deals with shallow convective clouds. The results not only show that pollution suppresses and delays the onset of warm-rain processes but also validate the recently proposed concept that high concentration of aerosols can strengthen convection and generate more ice-phase precipitation.