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A comparison of volumetric radar and disdrometer measurements with rain and ice crystal spectra simulated by a 3D bin resolved cloud model during intense precipitation events over the Cévennes' foothills

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Continuous observations with a volumetric C band radar at Bollène (southern France) as well rain gauge and disdrometer measurements were performed in fall 2004 during a period of intense precipitation (Chapon, 2006).

A three-dimensional cloud model with a size resolved description for cloud and rain drops as well as ice crystals and graupel is used to reproduce rain, observed radar reflectivities and disdrometer measurements, and to investigate the role of the ice phase and the aerosol particles spectrum for the formation of precipitation.

The model couples the dynamics of the NCAR *Clark-Hall cloud scale model* (Clark et al., 1996) with the detailed scavenging model (*DESCAM*) of Flossmann and Pruppacher (1987) and the ice phase module of Leroy et al. (2007). The microphysics follows the evolution of aerosol particles, drop and ice crystals spectra each with 39 bins. Using a 3D grid resolution of 1km in horizontal and 250m in vertical, this model, called *DESCAM-3D*, is able to simulate a realistic cloud field with a rain accumulation up to 20 mm during 3 hours of integration. Surface rain drop diameters are around 1mm which is in agreement with the measurements from the disdrometer. Vertical profiles of observed and simulated reflectivities also compare quite well in terms of vertical extension and the location of the Z_R maxima.

The role of the ice phase for this event has been studied by turning off the cold microphysical package in a second simulation. The omission of the ice phase is found to enhance rain formation together with the vertical extent of the cloud field. Consequently, radar reflectivities are greater in the upper levels of cloud. Moreover, the onset of rain takes place significantly earlier when ice phase processes are ignored. The impact of pollution in terms of the initial aerosol particle number has also been investigated. An increase in the initial number of aerosol particles modifies both the intensity and location of rain.