Objective: to improve our understanding of rain formation

Can detailed cloud modeling in a highly resolved 3D dynamical frame reproduce the observed features of a convective rain event?

The observational case chosen is the 12 August 2007 – a rain event characterized by small cells that were initiated along a crest line of the Vosges Mountains under medium high convective conditions.

In this model study special emphasis is put on:

- Observed and modeled rain drop spectra and radar reflectivities
- The role of atmospheric aerosol particles
- The horizontal extension of the modeled cells is estimated in the continental case but over-estimated in the clean case.
- The intensity of the core of the cells is quite well estimated in the clean case.
- The horizontal extension of the modeled cells is larger than the observed ones. This is most likely due to the coarse model resolution of 1km which poorly compares with the radar resolution of 60m.

Influence of the aerosol number

- The change of the number of aerosol particles modifies the intensity and the location of rain.
- Total surface rain increases in the clean case.
- Rain on-set is delayed in the continental case.

Conclusions

Reproduction of the observed event

The microphysical model is able to reproduce reasonably well the cloud field (see X-band radar observation) and its precipitation (see raindrop spectra) for a medium convective situation over the Vosges Mountains during the COPS campaign.

The role of the atm. aerosol particles

The differences between the raindrop spectra of the continental case and the clean case can be explained by the microphysics that modifies the vertical and horizontal structures of the cloud and rain water fields.

→ Indeed, the continental aerosol particle spectrum inhibits the formation of large drops while a clean aerosol particle spectrum increases it.

References:
