Responses to comments from Reviewer 3

(page and line numbers refer to the original manuscript)

P7768 Line 2 : The behavior of the LIMA scheme was illustrated for 2D idealized cases. However LIMA was also used in 3D real-case simulations as shown by Vié et al. 2014 : https://ams.confex.com/ams/14CLOUD14ATRAD/webprogram/Paper249863.html
As other microphysics schemes, LIMA is not “dimensionally dependent”.

We changed the formulation to “the prognostic evolution of an aerosol population” which still keeps the idea of heterogeneous aerosol concentrations and properties as in the real world.

P7771 Lines 6-9 : References to Thompson and Eidhammer 2014 and Thompson et al. 2008 were added, following suggestion by reviewers 1 and 3.

P7780 Line 3 : In the discussion paper, we mentioned in the text before the equation for L we used kg/kg in LIMA, whereas Berry and Reinhardt (1974, BR74) used g/cm3. Same thing for rc in LIMA (kg/kg) and L2 in BR74 (g/cm3). Therefore, the air density was not necessary. Since this change of unit for L was confusing, we corected the manuscript to give L in kg/m3, and introduced the air density in the equation for L.

P7780 Lines 12-13 : This factor was suggested indirectly by Berry and Reinhardt (1974) scheme (hereafter BR74). These authors made the distinction between the time T_2 needed for a characteristic radius of the rain spectrum to reach the value of 50 μm (and thus to accumulate a rain mixing ratio of L) and the time $T_H \approx 1.2*T_2$ at which a hump shows up on the rain spectrum (with BR74 notations). During the T_2-T_H transition, the autoconversion rate (L/T_2) of BR74 is supposed to include spuriously cloud droplet accretion and raindrop self-collection. This is why the application of the explicit parameterizations of rain accretion and self-collection are delayed until a “well-formed” rain mixing ratio reaches as least $1.2*L$. At this point, the production rate of raindrop concentration by autoconversion is also modified as explained in Cohard and Pinty (2000a).

P7787 Lines 20-21 : The sentence was corrected. Simulations are 8-hour long, with a timestep of 4s. Results are time averaged for 1 hour, between 7 and 8 hours of simulation.

P7790 Line 14 : The background IFN mode for the squall-line simulations was composed of 60% of small dust particles, 1% of large dust particles, 33% of black carbon and 6% of organics. This precision was added to the manuscript.

P7792, Line 8-12 : There is a huge amount of modeling studies about mixed-phase clouds. Here we focused on a new microphysics scheme to emphasize the ability of aerosols to form droplets or pristine crystals depending on the properties of a heterogeneous population of aerosols. So the purpose of the study was not to show new mechanisms or to analyze the thermodyn.-dynamics interactions such as the critical role of the raindrop evaporation rate: an important process indeed for the strength and maintenance of a squall line.