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Interactive comment on "LIMA (v1.0): a two-moment microphysical scheme driven by a multimodal population of cloud condensation and ice freezing nuclei" *by* B. Vié et al.

Anonymous Referee #1

Abstract The paper by Vie at al describes the new Liquid Ice Multiple Aerosols (LIMA), which is implemented into the cloud-resolving mesoscale model Meso-NH. LIMA is a "hybrid" to moment microphysical scheme that use prognostic aerosols to activate cloud droplets and produce pristine ice. Further, two examples of sensitivity studies are presented to show that LIMA can capture the complex nature of aerosol-cloud interactions.

The development of microphysical schemes linked with aerosols is useful for the scientific community and I think this paper should be published. Below are my comments.

P7768, Line 1: Since the microphysical scheme is not 2-moment in snow and graupel,

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I suggest calling it a hybrid 2-moment scheme, or something to the similar effect.

Line 5: Suggest to rewrite: ......pristine ice crystals to form from aerosols." Then remove the next sentence.

Page 7769 There have recently been several studies regarding aerosol/cloud/precipitation studies. I suggest included some more references regarding this topic (The review by Tao et al 2012 is a great place to start)

Page 7770 Line 9. Use capital letters in The 2012 International Cloud Modeling Workshop, and I suggest included that it was funded by WMO.

Page 7771 There is a new paper out describing aerosols linked to the Thomspon et al (2008) microphysical scheme (Thompson and Eidhammer, 2014). They included 2 prognostic modes of aerosols (one category for droplet activation and on the ice nucleation. Only two categories were included for forecasting purposes). Activation of cloud droplets are similar to that of Saleby and van den Heever (2013) and based upon look-up tables, while heterogeneous ice nucleation based upon DeMott et al 2010. One major difference from Saleby and van den Heever is that a simple emission scheme of aerosols is included. I suggest adding a reference to Thompson and Eidhammer (2014)

Thompson, G. and Eidhammer, T., 2014: A Study of Aerosol Impacts on Clouds and Precipitation Development in a Large Winter Cyclone. J. Atmos. Sci., 71, 3636–3658. doi: http://dx.doi.org/10.1175/JAS-D-13-0305.1

Thompson, G, P. R. Field, R. M. Rasmussen, and W. D. Hall, 2008: Explicit forecasts of winter precipitation using an improved bulk microphysics scheme. Part II: Implementation of a new snow parameterization. Mon. Wea. Rev., 136, 5095–5115, doi:10.1175/2008MWR2387.1.

Page 7772 Line 2: I am not sure what is meant by "the resolution of the equation of the vertical motion". Perhaps remove "equation", and say: The resolution of the vertical

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motion?

Page 7776 Line 14. In " ...mode is fixed, and this effect..." Please be more specific about what "this effect" refers to in the sentence. (i.e. the effect of modifying particle size distribution?)

Page 7777 What does the apostrophe in Eq 5 stand for?

Page 7778 There are missing equation numbers here and later on.

Page 7779 Line 8: I suggest moving the sentence starting with "This means that . . .. . .". This sentence is a repetition from previous sentence.

Page 7784 Line 10. I do not agree with using the term CCN particles for describing homogeneous freezing. I suggest using "deliquescent aerosol instead.

Page 7787 Line 19. The placement of "as plotted in black" is awkward. I suggest rephrase the sentence.

Line 20. I think "hours" is missing after 8. Line 22. I suggest removing "CCN".

Page 7788 Line 13. Included a comma between "low levels" and "high" Line 20. I suggest rephrasing "It is recalled that both ...", to "Recall that both ...."

Page 7789 Line 13 to 15. That BC is more efficient nucleation agent ant organics is inherent in the Phillips parameterization.

Line 23. I would stress more that the IFN concentration/composition may have little impact for this specific case.

Page 7790 Line 8. Here and other places (before and later in the paper, and in Table2) I do not agree with the use of CCN. A CCN is a particle that activates at a given supersaturation. Thus when describing CCN concentrations, you must also define at what supersaturation. I therefore suggest replacing CCN with aerosols concentration where appropriate.

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