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## ***Interactive comment on “Are simulated aerosol-induced effects on deep convective clouds strongly dependent on saturation adjustment?” by Z. J. Lebo et al.***

**Anonymous Referee #2**

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### **1 General comments**

The paper investigates the use of saturation adjustment in bulk schemes as being the potential reason for differences to bin model results for aerosol effects on convective development and cumulative precipitation formation. With a more realistic treatment of supersaturation for both droplet growth and activation, the authors find little effect on cumulative precipitation (and the activation of new droplets), but an improvement is found for the convective mass flux. Scientifically, the topic is of large interest and significance, as it shows the importance of considering the system as a whole, where a large number of processes act and feed back onto each other.

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The paper is well structured and comprehensively presents the results, which focus on the treatment of supersaturation in bulk schemes and its effects compared to bin model results. In terms of future work, the authors correctly point out the treatment of sedimentation and ice particle growth, which seems to be an important link towards improving the response of surface precipitation to aerosol effects. The explicit treatment of supersaturation constitutes the first step towards this goal.

## 2 Specific comments

As the paper is already very clean and no major corrections are needed, there is only a remark concerning Section 2 which could be made. Depending on the treatment of the ice formation processes, especially in view of aerosols effects, this can have a large influence on the resulting amount of cumulative precipitation as is pointed out with the differences in graupel sizes. Although this is beyond the scope of the work presented, this could be emphasized.

## 3 Technical corrections

In the following only corrections concerning grammar or orthography are suggested. The page (p.) and the line (l.) are specified before giving the suggested correction.

- p. 10064, l. 22: The references should be in brackets ('citep' instead of 'citet').
- p. 10064, l. 26: "... convective strength where ...", not " ... convective strength with ...".
- p. 10064, l. 28: References expected to be in brackets (again 'citep' instead of 'citet').

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- p. 10068, l. 16: "and 6, where the latter reviews the ..." is proposed.
- p. 10070, l. 2: Eq.(2) should have commas in the first and last line too for consistency.
- p. 10072, l. 21: The sentence is very long. The following is proposed: "... model time step. Activation is treated ...".
- p. 10076, l. 26: "... for completeness, profiles up to 15 km are shown."
- p. 10076, l. 28: "graupel" instead of "grapple".
- p. 10076, l. 29: There should be a point at the end of the sentence; "... at the high levels.) ...".
- p. 10077, l. 23: Inverted commas are missing for Semi-Polluted.
- p. 10079, l. 18 - 20: The sentence " These changes ..." refers to Fig. 11 before reference to Fig. 10 is made. Hence replacing the sentence by the following is proposed: "... bulk-original models, of which a more thorough analysis will follow below. Independent of ...". Or something similar.
- p. 10081, l. 7: It should be "horizontally-averaged", not "horizontally-average".
- p. 10087, l. 13: "Thus, the net error ..." is proposed.
- p. 10103, caption: "... Here, the sum of  $q_{tot}$  at ...", the subscript "tot" is in large font.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 10059, 2012.

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