Responses to Reviewer 2

First of all, we would like to thank the reviewer for suggestions which help to improve the new version of the manuscript.

Major comments:

Previously (e.g. Ervens and Feingold, ACP, 2012; also from the same group Ervens and Feingold, GRL, 2013; Kulkarni et al., ACP, 2012, Fan et al., JGR, 2010 and references therein in these papers) also explored the role of temperature, IN size, nucleation schemes on cloud properties. This previous work in the context of present work should be discussed in the section 1 and 4.

Previous papers as suggested by the reviewer have been included in Section 1. In Section 4, a new sub-section has been added including comparisons of the present results to the outcome of previous model simulations.

Sensitivity studies are very helpful, but these would be more meaningful if some results are compared against observations (remote sensing for example or laboratory measurements). Constraining against observations would help to understand the influence of microphysical processes, and also dynamics to certain extent. Previous lab data can be plotted in Figure 12a and discussed.

The new sub-section 4.4 includes also comparisons of present results to atmospheric measurements. A comparison to previous laboratory data as suggested by the reviewer seems not to make much sense as the parameterizations themselves are based on laboratory results. Also we think that Figure 12 is already too busy to add further data.

Minor comments:

Section 2.3.2: *It is not clear how eqn. 16 is used in the model. Is it used after the ice is nucleated? Deposition ice nucleation parameterization gives number of ice particles that meet the r* criteria. No additional r* tests are required.*

The reviewer is right that the parameterization implicitly includes the r* criteria. Nevertheless, it was used before ice nucleation to exclude from the first any calculations with too small particles. This is explained in the revised manuscript.

Section 4.1.3: *Any references that define the strength of weak and strong convection. It is assumed that for weak convection the dT is 1.5K, but one can argue that it can be classified as a strong convection or mild convection based on the location.*

We agree that the classification of the strength of convection is dependent on the location. In the revised manuscript, the distinction of weak or strong convection has been avoided. We now mention only the used temperature differences (i.e., dT=1.5K, 2K, 3K) and the corresponding final temperatures after the ascent of the air parcel (i.e., -24.5, -29, and-40°C).

Section 5: *I suggest clearly mark a paragraph to aid the reader to read the conclusions. Currently, both summary and conclusion are somewhat difficult to separate.*

Following the reviewer's suggestion, this section has been completely rewritten so that the reader can clearly separate summary and conclusions.

Figures 1, 4: *Can you compare to laboratory data.*

The parameterizations given in these figures are directly based on laboratory results. Partly they were derived by the experimentators themselves and included in the references, e.g. immersion freezing by kaolinite particles from Murray et al. (2011), by feldspar particles from Atkinson et al. (2013). The authors decided to avoid showing also all the laboratory data in the figures because this would be too much information in the figures. We would like to avoid additional figures because there are already many tables and figures included. Readers might take a look at the given references to see the data points from the measurements.
In Figure 5 the laboratory data were included because they have not been published yet and the authors had received them by personal communication.

Figure 11: *Any particular reason why immersion + deposition is not considered. Also combination of feldspar and montmorillonite.*

Our intention was to restrict ourselves to some meaningful cases so that the paper would not be too long. The combination contact and immersion mode was selected as both interact with supercooled drops, the combination contact and deposition freezing as both interact with dry particles. So the competition between these freezing modes was investigated. The combination immersion and deposition was studied but not included in the paper in detail.
The combination feldspar (immersion) + montmorillonite (contact) as suggested by the reviewer did not lead to any meaningful results as immersion freezing with feldspar is anyway dominant. The combination kaolinite (immersion) + feldspar (contact) was selected as here contact freezing was similarly effective as immersion freezing.
Some sentences to explain this have been added to the revised manuscript.

Figure 12: *Is busy plot. If possible simplify it further or divide it.*

The authors agree that this plot is rather busy but we cannot find a possibility to simplify them. To divide the plots would make the comparisons even more difficult. Therefore, the authors decided to leave Figure 12 as it is although the reader has to take some time for it. We have added more detailed explanations in the revised text to help the reader.