

Responses to F. Dominé

First of all, we would like to thank the reviewer for the useful comments and suggestions.

1. A new section 4: Discussion and comparison to earlier results has been included into the revised paper where the reasons for the different retention coefficients in previous and our present studies have been discussed in detail taking into account the various conditions during the experiments such as liquid water content, ventilation, shape of the collectors, droplet sizes.
2. To develop a kinetic model of riming processes is far out of the scope of the present project which has been the base of the paper. It has been an experimental study where the techniques to investigate riming under conditions as near as possible to the realistic case were developed and performed. Modeling of this process might be a future project but so far we present our measured values and set them into comparison to other measured values and theoretical estimations.

In their theoretical model of chemical retention during hydrometeor freezing Stuart and Jacobson (2003; 2004) calculated a retention indicator of 1 for H_2O_2 which matched with the result of Iribarne and Physnov (1990) but was not validated by Snider et al. and Snider and Huang (1992; 1998) and the present experiments. However, Stuart and Jacobson themselves mentioned that the effective Henry's law constant which accounts for dissociation also (and not only for solubility as the Henry's law constant does) should be an important forcing factor. 100% retention under all conditions could be expected only for species with high effective Henry's law constants such as HNO_3 and HCl while for species with lower effective Henry's law constants other factors such as drop sizes, ventilation, and temperature become important. Thus, for H_2O_2 with an effective Henry's law constant of 1.5×10^7 , i.e. orders of magnitudes lower than the ones of HNO_3 and HCl , 100% retention are to be expected only under particular conditions which were obviously fulfilled in the Iribarne and Physnov (1990) experiments but are not necessarily representative for atmospheric clouds. This discussion has been added to the revised manuscript.

3. The fact that three experimental investigations of H_2O_2 retention resulted in values ranging from 5% to even 100% justifies new studies where the conditions have been selected such a way that the riming process proceeded as similar as possible as in atmospheric clouds, e.g., freely floating conditions, shape of the collector, realistic ventilation and heat transfer, typical liquid water contents, temperatures, droplet sizes, and liquid phase concentrations. By comparing the different conditions of all experiments two main factors are important: the liquid water content and the ventilation. The Iribarne and Physnov (1990) laboratory experiments were characterized

by high liquid water contents (5 g m^{-3}) and no ventilation of the ice surface both leading to high retention. The Snider field experiments (1992; 1998) indicated low liquid water contents in the orographic clouds (less than 0.4 g m^{-3}) and strong ventilation on the mountain top both affecting low retention. During the present experiments, the liquid water content was 1 to 1.5 g m^{-3} which is a typical value for mixed-phase clouds where riming will proceed rather than in orographic clouds. The ventilation during the experiments was due to ice particles floating in atmospheric clouds. Thus, one might conclude that this result represents a value of realistic conditions in atmospheric mixed-phase clouds.

Minor comments

1. p. 17451, l. 5: Schemes and details of the wind tunnel have been published elsewhere as for example in the review articles of Szakáll et al. (2010) and Diehl et al. (2011), as written in the manuscript.
2. p. 17451, l. 14: The adaption time of the droplet temperature was calculated according to Pruppacher and Klett (1997), Chapter 13, p. 545.
3. p. 17452: The mentioned expression has been changed in the revised paper.
4. p. 17454: The dendritic ice crystals had 6 mm length, their shape was like needles.
5. p. 17455, l. 19: The number has been changed.
6. p. 17455: The mentioned part has been re-written.
7. p. 17456: *R* has been mentioned in the text.
8. p. 17458, l. 21: The suggested replacement has been made.
9. p. 17458, l. 29: The errors of I & P (1990) have been given in the revised manuscript (section 4.1).
10. p. 17459, l. 29: The reviewer is right; however, the mentioned statement has not been omitted but weakened.
11. p. 17459, 17460, l. 2, 8, and 10: The mentioned issues have been discussed in detail in the new section 4.2.
12. p. 17460, l. 23: Generally all experiments were performed in the dry growth regime as mentioned. The tendency of changes of the ice surface at warmer temperatures was just an

observation which was explained by the assumption that the conditions were moving towards wet growth.

13. p. 17461, l. 16: A statement has been added in section 3.2 as mentioned by the reviewer.

14. p. 17461, l. 20: The mentioned expression has been replaced.

15. Tables 1 and 2: The concentration of the tracers in the droplets has been in the micro-molar range and we assume that in such a diluted solution there will be no effects.