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Interactive comment on “Contribution of liquid, NAT and ice particles to chlorine activation and ozone depletion during Antarctic winter and spring” by O. Kirner et al.

Anonymous Referee #2

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This paper is a nice and important contribution investigating the role of liquid particles to chlorine activation. The study is based on a set of multi-year simulations performed with the chemistry-climate model EMAC. The foundation for this investigation is a so-called standard simulation (Standard) and a selection of three sensitivity simulations by changing the heterogeneous chemistry on PSC particles, i.e. switching on and off the chemistry on liquid, NAT and ice particles. Differences between these simulations are presented and discussed. It is a well-written paper including the quality of the figures. The abstract is clear and the introduction section provides a good overview of the open points. The results are described sufficiently. Although the paper is short, the message

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is clear. Nevertheless, I have three major points which must be clarified or considered before publication.

1. My major point is regarding the chosen model configuration. On the one hand side you are saying that the “nudging” technique helps to simulate realistic synoptic conditions, which is definitely the case. But on the other hand you are using a chemistry-climate model which allows feedback of chemical and dynamical processes. This means that the four simulations (the Standard and the three sensitivity studies), although used in a nudged mode, will be different in detail (regional) regarding the simulated dynamic conditions. The synoptic conditions in all four simulations are similar, but they are not identical! This means that you cannot directly determine the absolute effects of changes by subtracting the results of the sensitivity simulations from the Standard. Your model as used here is CTM-like, but it is not a CTM. To my understanding this may not impact your general conclusions but for me it raises the question about the reliability of the estimated numbers (absolute and relative values mentioned in your paper).

2. EMAC is a well-established model system. Nevertheless, an evaluation of the Standard results with observations or other model simulations is required. It is necessary to verify the skill of your model system, in particular regarding your study. It is the basis for your assessment and reliable conclusions.

3. A more detailed discussion and rating of the results would be essential, e.g., how they are in line with other studies. At the end it would be helpful to discuss possible uncertainties of your findings. Or are you sure that the results are “watertight”? If yes (which I believe) you should explain why.

Minor point:

I do not understand why you only show and discuss the results from 2005-2009 (figures 2 to 5), even though you have run the model until 2012 (see description in the beginning of Section 4)!? Please clarify.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 14833, 2014.

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