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Interactive comment on "Sensitivities of Lagrangian modeling of mid-latitude cirrus clouds to trajectory data quality" *by* E. Kienast-Sjögren et al.

Anonymous Referee #3

Received and published: 28 April 2015

In this study the authors investigated the influence of input data uncertainties on the simulated cirrus cloud properties over Jungfraujoch using a microphysical trajectory box model. They looked at the impact of trajectory resolution, unresolved updraft velocities, and the assumed IN number concentration on the simulated accuracy. Not surprisingly, they found higher trajectory resolution and the addition of small scale temperature fluctuations helped to improve the agreement between model and observation. On the other hand, the higher sensitivity to the specified initial humidity than to the unsolved temperature fluctuation is interesting. My major comment is that the observational data (lidar retrievals) used to the evaluate the model result are too limited

in time (20min). This made the case study too specific and perhaps not applicable to other conditions.

In general, the paper is well written and easy to read. However, I agree with reviewer 2 that the information presented in figure 10 is not very clear and should be improved. Some of the figure indices are mismatched and need to be carefully checked before final publication.

Specific Comments:

P7536L18: Typo "bysignificantly"

P7537L11: Remove "in turn"

P7540L3: Would be better to note that the reported IN concentration in DeMott et al. (2010) is in per standard liter, not per liter under the ambient state. What's the unit (L-1 STP or L-1 under ambient state) used in the IN sensitivity simulations?

P7541L22: How does ZOMM represent the size distribution of ice particles?

P7542L16: Why only 20min's data were used? Why not using more lidar data and including more trajectories in the analysis?

P7544L24: If more trajectories were included, do you expect the result would change?

P7544L11: What is the number of solution droplets assumed in the model?

P7545L13: "according to the formulation of . . ." this part is a bit misleading.

P7545 section 2.3: more details of the ZOMM model are needed. For example, apart from the nucleation process, which other processes are considered in the model? How these processes are coupled? And what is the microphysical time step?

P7545L18: Offline trajectories are based BACKWARD calculation, while the online trajectories are based on FORWARD calculations. Will this make a difference in the box model simulations?

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P7545L19: Could you elaborate more about the sedimentation treatment? The current statement is not clear to me. Do you take the sedimentation flux from the host COSMO model? If so, do you consider the same ice particle size distribution in COSMO and in ZOMM?

P7555L7: Do you mean Fig.8 here?

P7555L12: Doesn't the green curve in fig8a indicate a cloud?

P7556L1: Do you mean Fig.8c?

P7556L24: Do you mean Fig.8a?

P7557L21-228: The discussion here is a bit hand-waving. Would be nice to plot the supersaturation (as figure 6 and 7) before and after the microphysical calculation and the ice crystal size to facilitate the discussion.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 7535, 2015.