This paper addresses the question of unexpected high ice crystal number concentration measured at the High Altitude Research Station Jungfraujoch (JFJ). The comprehensive dataset of observations at this measurement site combined with kilometer scale model simulations is used to investigate different reasons that might cause the observed ice crystal concentration that could not be explained by measurements alone. As the meteorological conditions simulated agree well with observation station from Meteo Swiss they are suitable for a comparison study.
Simulations with different ice nucleation particle (INP) concentrations are conducted to test how large INP concentration need to be in order to explain such high ice crystal concentration. By increasing the INP concentration in the model by three orders of magnitude much better agreement between modelled and observed ice crystal concentration is reached while the LWC in the simulation disappears nearly completely. The increased INP concentration avoid MPC in the model as a consequence of the Wegener Bergaron Findeisen process (WBF). Therefore it is analysed based on theoretical studies from Korolev whether MPC are generally possible at JFJ with the chosen INP conditions.
Furthermore the influence of Hallett-Mossop ice multiplication is tested by implementing the process in the model. The calculation of ice multiplication is extended over a wider temperature range based on the argument of discrete model resolution. The comparisons show that this is a noticeable effect at certain times but not explaining the entire high ice crystal concentration.
Consideration of changing the thresholds between ice crystals and snow is also tested but could be excluded as contributing to the high ice crystal concentration essentially.
Contribution of hoar frost to the ice crystal concentration was identified as the most efficient process. The implementation of surface crystal fluxes is done following on parametrisations used for frost flowers. The included hoar frost enhances the ice crystal concentration but not depleting LWC too much so that a good agreement between observations and simulation could be reached.
Overall the the paper is very relevant and and advanced over knowledge on MPC and high ice crystal number concentration. Thus I recommend it after the following points have been addressed:

major comments and questions

- When INP concentration are increased to match the observed ice crystal concentration and the consequences for LWC is demonstrated pleas add what happens to the ice water content (IWC) in the model. If its possible please compare with observations of IWC.

- The comparison with the calculated required updrafts velocities that enable MPCs is not done consistently. On one hand the measured updrafts are compared with the required updrafts calculated from observation and conclusions of the existence of MPC are made. On the other hand modelled updrafts are compared with the

calculated updrafts base on modelled data for both simulations. But a comparison between the modelled and measured updrafts is missing. It should be done using the same linear axis including downdrafts.

- As already mentioned by the authors the implementation of surface flux is kept very simple so far. Please discuss the consequences of this simplifications.
- Explain why LWC is not completely depleted when increasing the ice crystal number concentration locally by surface flux processes but depleting when increasing by higher INP concentrations. Would the calculated updrafts as done for the study with increased INP allow MPC in the simulation with surface fluxes?
- Is the WRF model respective the cloud parametrization able to distinguish different freezing mechanism? If so is deposition nucleation the dominating freezing process in MPCs?

editorial comments

- Timeseries: axis, axis title and titles are hardly readable (too small)
- Do not use different axis for two comparable plots (figure 6)
- Label bar description (units) in Fig 12 can not be found easily. Placed somewhere in between the other plots.
- Better use INP instead of IN as suggested in http://www.atmos-chem-phys.net/15/10263/2015/acp-15-10263-2015.pdf
- Typing error: pp 25658 line 26: Bergeron-Findeisen (i is missing)