Review of 'Impact of surface and near-surface processes on ice crystal concentrations measured at mountain-top research stations'

The authors present observations of near-surface ice crystal concentrations from the Sonnblick Observatory, Austria. The results are important in the context of recent measurements at mountain top sites that suggest high ice crystal (100s or 1000s L^{-1}) that cannot be explained by existing primary ice nucleation schemes and that are also hard to attribute to secondary ice production processes given our current understanding.

Although the dataset is limited I think the observations are important and worth publication given the revisions suggested.

Specific Comments

I think the microphysical processes relevant to the work presented should be more clearly described or expanded on in the introduction. Relevant references are included, but I think it would be good to briefly describe in a bit more detail some of the main secondary ice processes in free floating cloud e.g. mechanical break up, rime-splintering, drop shattering. This helps the reader understand some of the mechanisms that are already thought to enhance ice concentrations.

I'd like to see if it's possible to look at only pristine ice crystals or only irregular ice crystals vs wind speed are the dependencies different? I think you say that in general the ratio of irregular to regular ice crystals stays similar – but I don't think this is the case looking at the habit segregated figures of ICNC concentration vs altitude.

P6 L30 – This paragraph only really holds true with some pretty big assumptions, no irregular ice crystals are produced in cloud and are therefore only produced from the surface, and that pristine ice crystals are all produced in cloud with no contribution from the surface. Although still very early research I believe there's increasing evidence for pristine ice crystals generated from the surface – though the exact physical mechanisms and the optimum conditions for this to take place is still unclear. The paragraph is also confused by the previous statement that the SBO is out of cloud.

Are there any useful references to convergence zones as described in section 4.1.2? I think convergence zones and sedimenting ice crystal theories need a much more thorough discussion, possibly under their own sub section headings. In its current form I don't find the explanations very well backed up.

ICNCs could be added to the microphysical time series figures.

There's 2 different wind measurements – If possible I'd like to see a comparison between the two where available.

Were the clouds glaciated/mixed phase at the site? Is there any information on the liquid phase from the holography?

What were the reasons for the dataset being limited to 2 events?

English is generally good, but the manuscript should be carefully checked as there were several grammatical/spelling mistakes.

Technical Corrections/Further Comments

P1 L3-4 These all refer to secondary ice processes? It's worth stating this.

P1 L5 relevance with respect to which processes? Primary ice nucleation? Secondary ice processes? I think that you are correct - the measurements at these sites are definitely complicated by the potential for surface generated ice particles.

P1 L15 Agreed - they are not representative when compared with free floating clouds away from ice surfaces, but it is important to consider potential impacts of surface ice processes on clouds above these surface, whether in contact or close enough to be influenced.

P2 L2 distribution(s)

P2 L6 Precipitation?

P2 L7 The bergeron findiesen process should be stated here.

P2 L15 primary ice concentrations

P2 L20 'lack of large'

P3 L14 I think the other important conclusions from Farrington et al (2015) could be described here including the finding that secondary ice could not account for the concentrations in the model

P3 L23 subvisible

P5 L12 'northerly'

P8 L17 'Maintained their habits, because they don't reach the surface'

P8 L25 Has this been studied over ice/snow free surfaces?

P9 L12 – is curtain supposed to be curtail?

P10 L20 of should be 'off' the surface.

P11 L16-17 Sentence needs rephrasing

P11 L24 poor sentence with grammatical/spelling mistakes

P11 L28 particle should be 'particles'

Figure 7 – what are the different colours for shading? I assume it's regular, irregular and aggregates, but what is purple?