We thank the Reviewer #1 for evaluating our paper, both here, and at the technical level. The reviewer's comments, and our replies/revisions, are in red and black, respectively.

Page 26594

line 15: change 'in' to 'on'

Author's Change to Manuscript: Second, we use our measurement to derive a temperature- and aerosol-dependent fit of N_{IC} based on Eq. (1).

line 24: 'heterogeneous ice generation can be distinguished …' : Please be more specific in how they can be distinguished

Author's Change to Manuscript: The foundations of our investigation are the cold-season middle-tropospheric wave cloud studies of Cooper and Vali (1981), Cotton and Field (2002), Eidhammer et al. (2010) and Field et al. (2012). The prior research demonstrated that an assessment of wave cloud kinematics can be used to distinguish heterogeneous nucleation from homogeneous ice nucleation and that crystal production occurs primarily via the previously-mentioned freezing nucleation pathways. Further, no compelling evidence for secondary ice production was reported in those prior studies.

Page 26596

line 25 ff.: to readers who are not familiar with FSSP, PCASP and 2DC measurements it might not be clear from the description that evaporation is intended or may be a problem of the instrument. Please be more explicit here.

Author's Response: We feel that the manuscript makes it clear that evaporation, due to heating of the sample stream, is an issue for measurements made with the PCASP (haze particles and cloud droplets), but not for measurements made with the FSSP (cloud droplets) or with the 2DC (ice crystals). Further, we used the words "evaporate" and "evaporation" in our description of the PCASP measurement (bottom of p. 26596). Finally, we also stated that the PCASP measurements used to evaluate $n_{0.5}$ were acquired outside of cloud (Sections 3.3 and 3.4) where neither our work (Snider and Petters, 2006), or the work of Strapp et al. (1992), reveals a "problem of the instrument." To emphasize this point, we modified the sentence on Page 26602, Line 11.

Author's Change to Manuscript: These were averaged outside of cloud during the five-second time windows used for thermodynamic-property averaging (Sect. 3.1).

Page 26600

line 7: ‘This is shown, for the example,..’: delete ‘the’

Author’s Change to Manuscript: An example of this is shown in Fig. 1d.

Page 26602

line 6: Please describe more explicit the effect you observe of ice nucleation on cloud properties which is evident in Figure 1.

Author’s Change to Manuscript: The effect of ice development on cloud properties is evident at the downwind track-streamline intersection in Figs. 1 and 2. Most noticeable are the enhanced lidar depolarization ratios seen at $x \geq 15$ km in Fig. 1c and the enhanced diameter-integrated crystal concentrations seen at $x \geq 15$ km in Fig. 2d.

Page 26604

line 7: A short description of D10's three-step procedure would help the reader to follow the method described in this manuscript.

L5-L6, P26604 was modified to this:

Author's Change to Manuscript: ...using the three-step procedure described in D10. We refer to the latter as method #2 and describe our implementation of that method in Appendix B (attached below).

Page 26605

line 4 ff.: Is the fraction of the measured crystal concentrations that plot within a factor of two of the fit still significantly different if the error of the measured ice crystal concentrations is taken into account?

Author's Response: In the table shown below, we evaluate the effect of the Poisson sampling error on the fractions. Regardless of how the comparison is made the conclusion is the same: More points plot within a factor-of-two when using Eq. (1) with our Method #1 coefficients.

Fraction of N_{IC} Measurements within a Factor of two of the Fit

	Eq. (1) with Method #1 Fit Coefficients	Eq. (1) with D10 Fit Coefficients
Manuscript L. 4 / P. 26605	0.69	0.66
Measurements Increased by Poisson Sampling Error	0.74	0.72
Measurements Decreased by Poisson Sampling Error	0.65	0.52

Page 26606

line 11 ff.: Is should be stressed more that already the original D10 equation fits well to the measured data. This is of high value because of the very different measurement methods.

Author's Change to Manuscript: The result we present in Tab. 2, with fit coefficients generally consistent, in a statistical sense, with those reported by D10, is important because it validates D10's approach using different methodology.

Page 26606

line 20: insert 'ice' before 'nuclei'

Author's Change to Manuscript: We also probed the conjecture that the duration of ice nuclei exposure to water-saturated conditions is a determinant of IC concentration.

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Appendix B

Here we describe how we fitted our 80 measurements of the set $\{N_{IC}, n_{0.5}, T_{low}\}$ using the three step procedure developed by D10 (herein method #2). In the first step, the data were binned into four $(273.16 - T_{low})$ subsets; the number of samples in the four subsets is provided in Table 3. In the second step, values of $ln(p_i)$ and q_i were derived for each subset by regression. Here "i" indicates the temperature subset and the form of the fitted equation is

$$ln(N_{IN,i}) = ln(p_i) + q_i \cdot ln(n_{0.5,i}) \quad \text{(B1)}$$

In the third step, the values of $ln(p_i)$ were regressed vs. $ln(273.16 - T_{low,i})$, and also, the values of q_i were regressed vs. $T_{low,i}$. In these regressions the $T_{low,i}$ is the average of the subset. The slopes and intercepts of these regressions define the coefficients $ln(a)$, b, c and d for method #2.

$$ln(a) = \text{intercept}\left(ln(p_i)\ vs.\ ln(273.16 - T_{low,i})\right) \quad \text{(B2)}$$

$$b = \text{slope}\left(ln(p_i)\ vs.\ ln(273.16 - T_{low,i})\right) \quad \text{(B3)}$$

$$c = \text{slope}\left(q_i\ vs.\ (273.16 - T_{low,i})\right) \quad \text{(B4)}$$

$$d = \text{intercept}\left(q_i\ vs.\ (273.16 - T_{low,i})\right) \quad \text{(B5)}$$