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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On microphysical processes of noctilucent clouds (NLC): observations and modeling of mean and width of the particle size-distribution" *by* G. Baumgarten et al.

Anonymous Referee #2

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Reviewers Evaluation of MS No.: acp-2009-826 "On microphysical processes of noctilucent clouds (NLC): Observations and modeling of mean and width of the particle size-distribution" by G. Baumgarten et al.

General Comments This manuscript addresses a study of the size distribution of particles in noctilucent clouds (NLC). In particular it examines the relationship between the width of the distribution and the mean particle size. Three color lidar measurements from the ALOMAR site in Northern Norway show that the Gaussian width of the particle size distribution is proportional to its mean radius for mean particle sizes up to

40 nm. For larger particles, the width becomes independent of the mean particle size or decreases with increasing particle size, depending on how the measurements are analyzed, although there appears to be small subset of cases where the width of the distribution continues to increase with increasing mean radii beyond 40 nm. These measurements are consistent with microphysical modeling results with the CARMA model. The model results show that the width of the NLC particle size distribution is largely driven by the eddy diffusivity. This manuscript represents one of the first studies showing that the width of the NLC particle size distribution can related to the mean radius. My recommendation is that the manuscript be published subject to the authors addressing the detailed comments below.

Detailed Comments

1) Abstract, lines 5-10: Rather than simply saying that the width of particle distribution for particles larger than 40 nm deviates from the linear dependence observed for the smaller particles, you should indicate that the width of the distribution becomes independent or exhibits a slight decrease with mean size. While a slope of 0.39 +/- 0.03 is smaller than a slope of 0.42 +/- 0.02, it is not obvious the difference is either meaningful or statistically significant. Also you should make clear that this refers to the particles less than 40 nm.

2.) Page 3608, line 15-16: How are the 3 segments defined? Equal thirds of the cloud? Or does the "Peak" exceed some fraction of the maximum backscatter? Or do you use some other criteria? Also given in the rest of the Manuscript you refer to the Top, Peak, & Bottom, for consistency you should use Top & Bottom here instead of "Upper" & "Lower".

3) Page 3610, lines 26-27, and Table 1: Why show "all" cases separately from the "statistical", cases, if the latter are more statistically reliable and include $\sim$90% of all cases anyway. I recommend just showing the "statistical" results, or provide justification for showing both "all" and "statistical" cases separately.

4) Page 3611, lines 1-6: While it might be true the particles with r > 40 nm are disproportionally near the bottom of the cloud, both the cloud peak (-0.08 +/- 0.02) and the cloud top (-0.05 +/- 0.02) also have negative slopes for r > 40 nm. So you still need to explain why when all three parts of the cloud when looked at separately have negative slopes when you look at all parts of the cloud together (although with higher vertical resolution) you have zero slope.

5) Page 3611, lines 9-16, and Table 2: You should make the distinction between the slopes for r < 40 nm and for r > 40 nm here. While it appears that there is not statistically significant difference in the slopes for r < 40 nm, for r > 40 nm, at least for type "I" and for type "B" the slopes for the faint clouds are significantly different from those for the strong clouds.

6) Page 3612, lines 4-14, & Figure 4: There appears to be a small subset of size distributions where the width continues to increase with the mean radius up to particle sizes of 80 to 100. The lidar data (especially Figure 1), also appears to have a small population of cases where the width increases up to mean radii of ~60 nm.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3605, 2010.