Atmos. Chem. Phys. Discuss., 15, C4857–C4859, 2015
www.atmos-chem-phys-discuss.net/15/C4857/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of particle shape on the morphology of noctilucent clouds" *by* J. Kiliani et al.

Anonymous Referee #3

Received and published: 14 July 2015

General comments:

This article studies the effect of non-spherical (cylindrical) as compared to spherical particles in Noctilucent clouds (NLC), which is what models generally assume. The growth rate and the fall speed of the particles in the model (MIMAS, formely known as LIMA/ICE) as well as the optical properties of the particles are adjusted to account for cylindrical particles. The scattering properties of the modeled clouds are then compared to 3 color measurements by the ALOMAR RMR-Lidar. The best agreement is found when there is a mix of needle and disk shaped particles with an axis ratio of 2.8. This piece of work is important for the community and should definitely be published. However, I have one major comment that I believe the authors should address before publication.

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Interactive Discussion
Discussion Paper

I am missing a sensitivity study and discussion of if other cloud properties, i.e. apart from the shape, could be adjusted to give color ratios that agree better with the Lidar measurements. This is important, because the paper as it reads now, demonstrates that the particles in general are not spherical (at least not the majority of them). Before stating that I believe it is important to investigate if spherical particles could somehow "do the job". Especially since you have added two or three (?) more degrees of freedom when you add the axis ratio and the proportion of particles that have each axis ratio. By adding more degrees of freedom you can expect a somewhat better agreement to any result. Other properties that I can think of which may or may not affect the color ratios (apart from axis ratio) include the amount of water vapor, the temperature and vertical (and perhaps even horizontal) wind. Another property that in my view is very likely to be important, but that may be difficult to investigate, is the non-purity of the ice, such the mixture of meteoric material into the ice (see Hervig et al, The content and composition of meteoric smoke in mesospheric ice particles from SOFIE observations, JASTP, v 84-86, 2012, p1-6). Even if it is beyond the scope of the manuscript to properly investigate the effect of non-pure ice, it should be discussed.

As a more minor comment I further believe the model adjustments, while well described in parts, should be summarized better. What is actually adjusted to take the cylindrical particles into account? Is it only equation 1, 3 and the T matrix? If so please summarize that. Moreover, at the bottom of page 16023 it states that the standard version of MIMAS only calculates backscatter ratios for 532 nm. It does not say if this has been modified in the new version. I assume it has, because if not I do not see how you can calculate the color ratios. Please state this if it is the case.

Specific comments:

P 16023, line 21: 'scatters light' should probably be 'back scatters light', unless they scatter less efficiently in all directions. P 16029, line23: I assume beta_max in the maximum brightness, not the maximum column brightness.

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Figure 3: This figure needs to be improved. Are the gray/black lines referring to spherical particles only? Why do not all colored lines have two dashed, one solid and two dotted lines? I.e. one for each radius and disk shape. Moreover, describe in the caption what the colors are. I assume they are equivalent radius in nanometers.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 16019, 2015.