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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne observations of a subvisible midlevel Arctic ice cloud: microphysical and radiative characterization" *by* A. Lampert et al.

Anonymous Referee #1

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General comments

The paper presents a case study of an optically subvisible cirrus cloud, at a mid-level altitude (3 km) near 76°N. Multiple observations (in-situ, active and passive remote sensing) are compared with model simulations to provide a complete picture of the cloud microphysical and radiative properties. The authors estimate the radiative impact of this subvisible cirrus, and suggest ways to derive the global population of similar clouds over the Arctic, which is still unknown.

In this study, the authors follow a sound methodology, combining multiple observations and models in a very exhaustive way to reach coherent conclusions. As far as I know,

the subject of the study (subvisible mid-level ice clouds in the Arctic) has not been extensively studied in the litterature, so the results provide significant scientific value. In this regard, the conclusions regarding the microphysical and radiative properties of this cloud are informative and appear well-supported. The paper is well-written and clear, and I encountered only a single typo (see Technical corrections).

Specific comments

In the paper, the authors derive three different values of lidar ratio. First, the authors reproduce in-situ nephelometer observations of scattering using a model, the best agreement is found for small spherical particles and rough hexagonal crystals leading to a lidar ratio of 27 sr (Sect. 3.2). Then, a value of 21 sr (standard for cirrus clouds) is used to perform radiative transfer simulations (Sect. 4.1); since results of the simulation agree well with observations the authors conclude it is an accurate estimate. Finally, solving the Klett equation (Sect. 4.2) leads to a lidar ratio of 15 (+/- 10). In the end, the authors conclude the overall lidar ratio of the subvisible cirrus cloud is 21 (+/- 6). While I appreciate the efforts the authors went through to retrieve this parameter, I don't understand 1) why the authors did not use the value retrieved in the first step as input for the radiative transfer simulations of the second step, and 2) how the final value and its uncertainty were derived from the three values?

I was also unfamiliar with the following abbreviations: LR for lidar ratio (I would expect S, as in e.g. Chen et al. 2002), BSR for the backscattering ratio (according to the definition of Eq. 1, it is the value I've known as Scattering Ratio or SR).

Technical corrections

- p. 597, l.17: "solar zenith angels"

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 595, 2009.

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Interactive Comment