Atmos. Chem. Phys. Discuss., 10, C10653–C10654, 2010
www.atmos-chem-phys-discuss.net/10/C10653/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Understanding effective diameter and its application to terrestrial radiation in ice clouds" *by* D. L. Mitchell et al.

Anonymous Referee #1

Received and published: 2 December 2010

This study assesses the applicability of the effective diameter or radius in the specification of cloud optical properties. Overall, this paper is interesting and can be a useful contribution. Although the manuscript in its present form is well organized and clearly written, there are several technical points, which are suggested for the authors' consideration in the revision process.

Specific comments:

1). In Hansen and Travis (1974), it is shown that both the effective radius and effective variance are needed to fully specify the effect of the particle size distribution. In other words, one parameter, namely, the effective radius, is not sufficient for characterizing

the dependence of the bulk optical properties on the particle size distribution.

2). The subject addressed in this study seems to have no relation with photon tunneling. It is suggested that the context associated with the discussion of photon tunneling be removed in the revised manuscript.

3) On page 2, "MADA allows one to separate the photon tunneling process from other optical processes": this is an overstated statement. In the case of nonspherical particles, the parameters in the parametric photon tunneling terms in the MADA are determined from fitting the MADA results to rigorous electromagnetic calculations. The anomalous diffraction approximation (ADA) is a highly simplified approximation. The differences between ADA and the rigorous solutions cannot be fully attributed to the photon tunneling effect. A part of the differences are actually due to the ADA errors. In the parametric photon tunneling terms in MADA, can the ADA errors and the photon tunneling contribution be partitioned?

4) Classic references for photon tunneling are missing in the manuscript. Chapter 7 of "Scattering of Waves from Large Spheres" by W. T. Grandy comprehensively discusses scattering resonances.

5). In Nussenzveig and Wiscombe (1980), the above edge and the below edge terms are introduced to quantify the terms in the optical properties that cannot be explained by the classic ray-tracing technique. It is suggested that the reference be cited if the authors plan to include the discussion of the photon tunneling effect in the revised manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29405, 2010.