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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Lidar and radar measurements of the melting layer in the frame of the Convective and Orographically-induced Precipitation Study: observations of dark and bright band phenomena" *by* P. Di Girolamo et al.

Anonymous Referee #2

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This paper summarizes multi-wavelength active remote sensing observations, in-situ measurements and theoretical light-scattering model calculations for the melting layer in precipitating clouds. The transition between melting snowflakes and liquid water droplets has long been studied and conceptualized for the anomalous bright/dark band phenomena observed from radar/lidar datasets.

The authors present a detailed and well-written study of their field observations and modeling calculations. In this review, I'm returning a copy of the paper that includes my comments and some basic technical editing/thoughts. For the most part, the paper is

clear, coherent and figures are appropriate for publication.

That said, I must be critical in this review for these primary reasons.

1.) What is the hypothesis of this paper?

2.) How does this paper improve upon the model described by Sassen et al. (2005)?

Because I cannot clearly answer these questions, and I do not believe that the authors make a compelling case that they have them answered either, I cannot recommend this paper for publication in its present form.

With respect to point 1, there is discussion and context of previous dark/bright band observations, thus establishing some relevance for these new observations. However, aside from the description of new/ancillary measurements being available, its not established where/how this paper fits within our existing understanding or where improvements to any physical model of the melting layer are being manifested. Modeling and in-situ observations aren't described in the introduction, nor how they enhance the motivation. The objectives of the study are weakly motivated.

With respect to point 2, the authors have shown no evidence that disagrees with the conceptual model of the melting layer and EM scattering presented by Sassen et al. (2005) . They do provide new and compelling measurements for lidar/radar depolarization and in-situ profiling of droplet size within the melting layer. However, the former reinforce Ken's model, and the latter are artifacts of precipitation efficiencies that Ken argued in his conclusions would be relative to the inherent dynamics causing precipitation for a given event.

In the introduction, Sassen et al. (2005) is described as a similarly comprehensive field study of dark/bright band phenomenon. However, there is more that goes to this paper, including a conceptual characterization of snowflake/raindrop transition and EM scattering effects at visible and microwave wavelengths. The paper builds off of and is mindful of previous attempts toward developing such a model (Sassen and Chen,

1995; Roy and Bissonnette, 2001; Lhermitte, 2002). The context of the current paper is presently ambivalent to this chronology and model linearge. Reading this paper, you wouldn't know that a model for the melting layer really existed. Most frustrating of all, however, is that the first author himself contributed greatly to this work (Di Girolamo et al., 2003)!

As written, the reader would believe that there was no general agreement within the community on the microphysics of what is occurring in these scenarios. For this reason alone, this paper can not be advocated for publication presently without a contextual rewrite.

Doppler velocities relative to measured particle sizes and the effects of depolarization thus relating asphericity to both the dark/bright band phenomena represent important measurements that merit publication and further these previous efforts. I encourage the authors to reconsider the context of this discussion to present their findings in a more consistent manner, and within the framework of our present understanding of light-scattering phenomena within the melting layer that they themselves have greatly contributed.

At that stage, I would gladly endorse this paper for publication. For now, I advise the editor that this manuscript requires a rewrite for consistency, relevance and merit.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C14207/2012/acpd-11-C14207-2012-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 30949, 2011.