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Interactive comment on "Bulk density and its connection to other microphysical properties of snow as observed in Southern Finland" *by* Jussi Tiira et al.

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This study uses ground-based measurements from particle probes located in Finland to look at the relationship of a population-mean ice particle density to parameters of the corresponding particle size distributions and the relationship of particle terminal velocity to diameter. The measurement techniques and their accuracies are carefully and quite fully described and, overall, the article is clearly written.

My most major concern has to do with the near-absence of a discussion of what areas would most benefit from the results presented here. It is mentioned that the properties of ice particles are an area of continuing interest for ground, airborne, and satellite remote sensing retrievals. For example, which disciplines are interested in using the "vol-

ume equivalent diameter", or "the population-mean density"? I don't see these parameters being useful for weather forecast or climate modeling because a size-dependent density is needed for these studies. To address this question, I suggest that the authors look at the citations for the Brandes article and determine what type of studies are needing these parameters.

More could have been done to estimate the density of individual particles, at least as a reality check on the ensemble-bulk densities that they do derive. Crude estimates could have been made by using particle terminal velocities and approximate cross-sectional areas (viewed from the side) and Best Number-Reynolds Number relationships that are referred to (Bohm, etc). Also, would it have been possible to derive the fractal dimension of the particlesâĂŤfrom their cross-sectional areas and terminal velocities, such that the exponent in the mass-dimensional relationship could be estimate?

Also, if there are collocated radar observations, it would be interesting to use the PSDs and estimate densities to forward-model the radar reflectivity and compare against the meausurements.

My specific comments appear below.

1. Page 5, line 17: What was the motivation for using the equivalent area diameter?

2. Page 5, line 22: what is the approximate ratio of particle height to maximum particle width from your data set? It would be useful to show.

3. Page 7, Eq. (8). It would be good to mention here that rho is the population-mean average.

4. Page 7, line 6: "snow bulk density" to "mean snow bulk density or volume flux-weighted snow density"

5. Page 7, line 15: "used diameter" to "diameter used"

6. Page 8, line 8: From the definition of D, what would this relationship be used for?

Likewise, Page 8, Eqs. 11-13.

7. Page 10, line 12: 5...6 needs to be corrected.

8. Page 11, line 6. "induced" to "derived"

9. Page 11, Eq. (19): Eq. (19) assumes that the PSD goes from 0 to infinity. Will this assumption induce some error.

10. Page 12, line 20: consecutive winters.

11. Although you show the temperatures of the observations in Table 1, it would be good to me

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