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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of mixed layer heights from airborne high spectral resolution lidar, ground-based measurements, and the WRF-Chem model during CalNex and CARES" *by* A. J. Scarino et al.

Anonymous Referee #1

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The discussion paper presents measurements of "mixed layer height" from an airborne lidar and compares them to various other measurements. In general the paper is well-written and makes good use of the available data. The references are incomplete. Use of some terms should be rethought. The statistical treatment and its interpretation need attention.

Comments:

1. An important reference to lidar mixing height work has been missed: S.C.

Tucker et al., 2009: Doppler Lidar Estimation of Mixing Height Using Turbulence, Shear, and Aerosol Profiles. J. Atmos. Oceanic Technol., 26, 673–688. doi: http://dx.doi.org/10.1175/2008JTECHA1157.1 The Tucker paper particularly addresses the difference between aerosol layer height and turbulent mixing height, an important issue in the discussion paper.

2. Another important reference to the determination of PBL height: M. LeMone et al., 2012: Objectively Determined Fair-Weather CBL Depths in the ARW-WRF Model and Their Comparison to CASES-97 Observations. Monthly Weather Review, vol. 141, pp.30-54.

3. The authors attempt to redefine commonly used terms (around line 10 of p.13728). This cannot be allowed. While the existing terms are loosely defined and inconsistently used, these authors should not further contribute to the confusion. The mixed layer height and the PBL height are semantically similar properties of the atmosphere. For properties of the measured profiles, I recommend choosing terms from the references above. One possible choice would be to refer to what the lidar measures as "aerosol layer height" and what the sonde measures as "sonde BL height" or "thermodynamic BL height."

4. Fig. 9 and discussion pertaining to it: The RMS difference is about 50% of the mean. On what basis is this considered "reasonable agreement?" In cases like this where both axes have large uncertainties, it is important to use an orthgonal fit (see C.A. Cantrell, 2008: Technical note: Review of methods for linear least-squares fitting of data and application to atmospheric chemistry problems. Atmos. Chem. Phys., 8, 5477-5487), since a simple one-sided fit will produce misleading results. Was this done? Should some obvious outliers be removed?

5. Fig. 15 and its discussion: See previous comment. In addition, what about the proportionally very large bias?

6. p. 13740, line 20: In what way were the model settings adjusted?

7. Fig. 17 and its discussion: See comments 4 and 5 above.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 13721, 2013.