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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improved mixing height monitoring through a combination of lidar and radon measurements" *by* A. D. Griffiths et al.

A. D. Griffiths et al.

alan.griffiths@ansto.gov.au

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We thank the reviewer for their helpful comments an will address them all in a revised version. Our responses to the specific comments are given below.

1. The lower limit of the instrument depends on the overlap between the detector and emission optics. For a region with incomplete overlap, but $\gtrsim 0.6$, the optics are stable enough to correct the signal. Our lidar had an overlap of 0.65 at a range of 120 m or a height of 60 m above ground level (since the beam was tilted 60° from vertical). We inadvertently omitted this from the submitted version and will include this information in a revision.

   The reviewer also comments that a ceilometer would have been able to measure nearer the ground, and we agree that this is worth mentioning. In spite of this, we doubt that a ceilometer would have been able to routinely detect the very shallow (tens of meters) nocturnal boundary layer which was typically observed during this campaign. Our measurements were performed in an undeveloped rural area without significant surface aerosol sources at night. With the exception of foggy periods, there is no mechanism to sustain a sharp change in aerosol concentration at the top of the nocturnal boundary layer.
   In any case, we did not have access to a ceilometer to test this hypothesis but note that previous studies have found routine boundary-layer measurements to be impossible below 140 m (Eresmaa et al. 2006), even at a site near the coast using a single-lens ceilometer.

2. The caption for Fig. 5 will be expanded for clarity. The "candidate" points are three heights from each time step, where the magnitude of the 2-D gradient reached a local maximum. These were: (1) where the magnitude of the gradient was largest, (2) second-largest, and (3) the closest local maximum to the surface. The "best match" points are selected from the candidate points, one from each time step, by choosing those which agree best with the radon-derived mixing height.

3. We shall introduce the box model earlier in the revised version.

4. We appreciate having our attention drawn to these papers and will include them, along with a short discussion, in the revised literature review.

Eresmaa, N., Karppinen, A., Joffre, S. M., Räsänen, J., and Talvitie, H.: Mixing height determination by ceilometer, Atmos. Chem. Phys., 6, 1485–1493, doi:10.5194/acp-6-1485-2006, 2006.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 6835, 2012.