

Review of the paper: “*On the use of radon for quantifying the effects of atmospheric stability on urban emissions*”, by S.D. Chambers et al.

This is an innovative and relevant paper in the field of boundary layer pollution studies. The authors have focused on three specific points: (1) to demonstrate the possibility to use single-height radon measurements (as in the majority of cases), (2) to design a simple method to separate local and remotely advected components to the observed radon abundance, (3) to relate the radon observations to boundary layer stability conditions that can be applied to urban pollutants. The authors also demonstrate that the classical Pasquill-Gifford “stable PBL” category is less selective of the strongly stable nights than the radon-based scheme: this may have important implications on the management of air quality.

The study is successful on all the above points, with excellent scientific significance and good scientific and presentation quality. I recommend publication on ACP, after the following minor points are addressed.

*Minor points.*

- (1) Fig. 2-3 show a key analyses for point (2) listed above. In discussing Fig. 2, the authors say that back trajectories using the HYSPLIT model are used (but not shown) indicating that the increase in daily minimum (afternoon) radon concentrations from day 253 to day 255 is the result of an increasing land fetch over eastern Australia. On day 257, the abrupt reduction in radon concentration corresponds to a synoptic change in air mass fetch from terrestrial (south westerly) to oceanic (south easterly). I would suggest to be more explicit on this important aspect, by showing examples of back-trajectories for days 255 and 257. In addition, for Fig. 3, I would provide a quantitative correlation of the minimum radon concentration during afternoon hours (for all days reported in Fig. 3a) with the wind direction. This could be done by adding an extra-panel in Fig. 3.
- (2) The discussion on the stability effects on boundary layer pollutants (Fig. 8) is bit too short and compact, in my opinion. Links of boundary layer observations of ozone, radon, wind and temperature have been discussed in other papers in the literature and they may probably be cited in the discussion (see for example: Di Carlo et al., *J. Geophys. Res.*, 112, doi:10.1029/2006JD007900, 2007; Pitari et al., *Environ. Earth Sci.*, 71, doi:10.1007/s12665-013-2635-1, 2014).
- (3) As above for the references to the box model approach.