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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric measurement of point source fossil fuel CO_2 emissions" *by* J. C. Turnbull et al.

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In this study, Turnbull et al., develop and test methodologies for determining top-down emissions estimates of large point sources of fossil fuel emissions. Three sampling methods for measuring CO_2 and $^{14}CO_2$ from a gas treatment plant were trialled, including 'snapshot' sampling from a Helikite, surface based flask sampling integrating over 15 minutes and grass samples acting as integrated samplers over a week. A short-range Lagrangian plume dispersion model (WindTrax) is used to disperse the reported (bottom-up) emissions from the gas plant and the modelled concentrations are compared to the observed values. Since the model assumes atmospheric equilibrium, as one might anticipate, the model shows relatively poor skill in reproducing the

'snapshot' observations from the Helikite sampling, with their high short-term variability. On the other hand, this modelling approach does quite well at reproducing the 15 minute and one week integrated samples. Using the grass samples, the authors obtain modelled results that agree with the observations within 30%. They are optimistic that improvements in their methods could further improve this agreement.

The work described in this paper is of high quality, bringing a range of established techniques to a new problem. The manuscript provides a thorough description of the techniques used and incorporates thoughtful and detailed interpretation of both the observations and model results. I recommend publication of this paper in ACP. The following are a couple of minor suggestions to improve the manuscript.

P29074, line 22ff. "The meteorological conditions during the grass sampling periods may more correctly match neutral to slightly unstable conditions, but we found that under these conditions, the model underestimates the observed plume dispersion." The reader is left wondering observed in what sense? This is discussed further in Section 4.2, and for clarity, I suggest adding, "See section 4.2." at the conclusion of the paragraph.

P29077, line 12ff. "In October, the winds were consistently from the west, resulting in larger enhancements to the east of the Kapuni plant than in the August samples, and no CO2ff detected in the northwest." Figure 6b does not show any data to the northwest of the site. If there were measurements made, as implied by this sentence, it would be good to indicate these on the map.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 29059, 2013.