

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-709

Anonymous Referee #1

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Referee comment on "Quantification of oil and gas methane emissions in the Delaware and Marcellus basins using a network of continuous tower-based measurements" by Zachary Barkley et al., Atmos. Chem. Phys. Discuss.,  
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Overall the manuscript is very well written and gives thorough explanations of the model, the outputs and the errors, and provides important information currently beyond the abilities of satellite measurement. Quite often in the introductory sections I wrote comments only to remove them as I found the information somewhere later in the manuscript. It would be helpful to have some of this information earlier, such as the predominant winds and seasonal meteorological changes, and the inversion heights and diurnal cycles (with the associated SI figures coming much earlier) as this information is important when trying to understand the choice of tower location on the maps or the model input, rather than having to wait sometimes until the discussion for the information.

Otherwise my only other main point is that there are some SI figures that are not mentioned in the main text and others that do not appear in the order in which they are mentioned in the text, which makes for a lot of scrolling up and down when trying to consult both documents at the same time. Those figures and tables just mentioned in the SI text should be numbered after those in the main manuscript, as is Fig S21, but all should be mentioned somewhere in the text of either MS or SI.

### Detailed Points / Questions

Line 59 – No explanation as to why a 4-hour period in the afternoon is taken. If it is taken as the period of maximum vertical mixing of the boundary layer does this work even in the winter months (at least 1 hour prior to sunset)? If daily afternoon averages are used for analysis, how can you have 70 and 40 background observations used per month as stated later. Needs to be clearer that the 4-hour window is just the starting point for background selection. Explanation comes too late.

Line 64 – why did the Marcellus measurements stop at the end of 2016 as there is only 20 months to work with in the model?

Fig. 1 caption – using the phrase 3-km domain for the map is confusing. This is the model resolution rather than the area of the inset boxes, presumably those given in lines 70-71. Mention of the predominant wind directions would be useful given that it is stated earlier that the locations of the towers were chosen to be downwind of the O & G production areas, which one might presume meaning predominantly westerlies in the Delaware and easterlies in the Marcellus, but from looking at SI Figs 4 and 5 (not mentioned in the main text) this is clearly an incorrect assumption. Could refer to Fig S10 for the Delaware that highlights the seasonal differences.

Line 114 – It would be helpful to state the % of non-O&G sources in the Production-based inventory used in the Marcellus model. It must be much less than the 45% presumed from the PADEP, but if still 15-20% could errors in those emissions have implications for the model errors that should be mentioned in a discussion that is totally focussed on O&G?

Line 204 – boundary layers not previously mentioned. Refer to Fig S8 which could have highlighted on it the period of the afternoon data that is used, and Fig S9, which could have highlighted the time of day in UTC at which the radiosonde is profiling the boundary layer.

Fig. 2 – the observed enhancements are influenced by the boundary layer height, but how does the modelled excess, based on the inventory account for this? Not clear, but presume that the 3000m summer and 1000m winter heights are used to calculate the difference in excess produced by the different Delaware inventories.

## **Technical Corrections**

Line 115 – likely twice in 5 words.

Line 201-202 – open parentheses incorrectly positioned.

Line 454 – basins twice.

Typographical errors on lines 13 and 132 of the SI text.