Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-961-RC2, 2018

Atmospheric Chemistry and Physics Discussions

ACPD

Interactive comment

Interactive comment on "Improving Mobile Platform Gaussian-Derived Emission Estimates Using Hierarchical Sampling and Large Eddy Simulation" *by* Dana R. Caulton et al.

Anonymous Referee #2

Received and published: 23 January 2018

This manuscript presents a methodological and large-scale study of dispersion estimates, comparing Gaussian estimates to LES and tracer releases. A large dataset of wellpad emissions is analyzed, and a set of estensive measurements at a smaller number of sites provides better data for intercomparison. Methods are clearly described, and the results are formulated into recommendations so as to be most useful to the atmospheric measurement community. This important manuscript publishes a robust assessment of uncertainties that result from commonly-used Gaussian dispersion methods on mobile plume transect data.

I particularly appreciated the effort the authors went to to express uncertainties in the

Printer-friendly version

Discussion paper

95% confidence framework, with skewed bounds if needed, for best comparison to previous studies (e.g. section 6). These uncertainties are larger than previously measured, but the assessment is much more comprehensive, making them all the more worthy of publication. These uncertainties are a major result of the paper. I recommend including uncertainty bounds for SS gaussian, MS gaussian and MS LES in Table 1, as well as in the abstract.

I recommend publication after considering the minor comments listed here.

Main points:

1. Timescale

p. 3, Section 1.1: I think this section warrants a discussion of timescales of Gaussian simulations. There is a good deal of variation in what the the atmospheric modeling community determines to be the appropriate timescale for the A-D stability classes. The consensus seems to be on the order of 10-15 minutes. See Fritz et al. DOI:10.13031/2013.18501

A discussion of timescales is also relevant to Reviewer #1's second comment about averaging of plume transects vs the meandering plume.

2. Winds

p. 6, line 7: Explain why the choice was made to use downloaded interpolated hourly winds (3-hour interval data, originally) when there were presumably measured winds on-site for the intensive IGM sites? I am also concerned in how well this interpolated 1-hour met will work for determining stability parameters of quick transects. See also previous comment on timescale. How would results differ with measured met?

The mobile laboratory also presumably had a measurement of mobile wind, and yet this measurement has not been mentioned at all. Do these data exist? What problems were encountered with this wind (equipment failure, uncertainty in calculating true winds for moving vehicle, etc)? Depending on the conclusions, item 2 in the Recommendations

(p. 15) might be updated. Table 2 might also be updated.

3. Clarity in describing source data

In many parts of the manuscript, it was difficult to understand the nature of the underlying dataset, or equivalently, which hierarchical "level" of data was being used. For example:

p. 10, section 4.3: Are these tracer releases? Are they real emissions measured with high N and simulated with all methods?

Fig 11: Is this purely simulated data? If measured data is available, show a sample transect on the same scale.

4. Others

Table 1: Add a column to this table describing the the type of uncertainty noted (e.g. 95% CI, std dev, etc. See also previous comment about adding in results of this study.

p. 7, line 1: What is the purpose of allowing the simulation to use other point sources in order to best simulate the emissions? Are these other point sources input by the user based on observed equipment/sources, or are they automatically generated? What is the reasoning behind comparing multi-point LES to a single-point gaussian simulation at all (as described p. 9, line 10 and Fig 7)? If it is for ease/quickness of data processing, describe this.

p. 9, line 5: Did scientists have site-access or other means to verify this assumption? If tank batteries are present, tank emissions can often overwhelm wellhead emissions. Is this dealt with in the data somehow?

p. 13, line 9: A figure showing the distribution, where it is possible to note the mode and 95% confidence intervals, is needed to understand this skewed distribution and should be included as SI

Minor comments/ typos:

Table 3. Describe SS, MS and LES abbreviations in caption.

Table 5: It seems like the line for Source Location should differentiate between x, y and z directions, as done in the text, or at least include a range of uncertainties.

Table 6: reformat Sources of Uncertainty column (e.g. left-justify) for ease of reading.

Figure 2: Consider breaking up this graphic into more panels because it is impossible to compare individual traces as-is. Also homogenize the vertical scales. There is currently a 3 order of magnitude difference in the scales. Is this correct?

Figure 4: Make the bounds of Yindex the same in all graphs. Furthermore, it would be useful to produce a mixing ratio vs Y index graph (or Scalar vs Yindex) at a height of 3 m to show what hypothetical measured data would look like.

Figure 5: Is it possible to show uncertainties at 95% confidence on these graphs? This would be more useful than the 10-90th percentiles. Replace "50% percentile" and similar with "50th percentile" throughout the caption and text

Figure 7: expand SS, MS and LES in the graph, or note their meaning in the caption.

p. 4, line 13: "Additionally, implementing..." These last two sentences seem out of place in the paragraph discussing uncertainties. Elaborate or move.

p. 5, lines 1, 5, 9: LICOR is typically written as "Li-COR"

p. 7, line 31: briefly define percent difference - what is the "true" value used as denominator.

p. 8, lines 2-4 and Figure 5: renumber figure panels so that consecutive letters refer to the same transect interval. As it is, line 2 should read "(b & d)" instead of "(c-d)"

p. 8 lines 14-19: reference Figure 6 here somewhere

p. 10, line 14: which result shows no apparent bias?

p. 10, line 20 and Fig 10: When discussing Fig 10, the over/underestimate of results as they converge seems important to mention.

p. 11, Section 5.1: It would be interesting to express these comparisons in relative distances as well.

p. 12, line 1: reference Table 5 in this section.

p. 15, line 1: include range, e.g "...standard sampling uncertainty range of 0.05x - 6.0 x is greater..."

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-961, 2017.

Printer-friendly version

Discussion paper