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Geoscientific Model Development Discussions

Interactive comment on "Development of a plume-in-grid model for industrial point and volume sources: application to power plant and refinery sources in the Paris region" *by* Y. Kim et al.

Anonymous Referee #2

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The authors added PM treatment and volume-source treatment to a plume-in-grid treatment for Polyphemus and apply it to two sources in the Paris region. The manuscript is well written and and the development is technically sound. The results sections had a few places where the text was confusing, but ultimately comprehensible. There are a few places where additional analysis would be ideal, or the paper would benefit from better textural characterization of the differences between this development and the previous PinG. These additions would help to demonstrate the value of the incremental development. The development of a new plume-in-grid treatments is a valuable

contribution to the community, and this paper is a good documentation of the tool.

1. The paper discusses only surface concentrations, but the changes in pollutants at all levels. The surface levels are clearly important for atmospheric exposure, but higher altitudes will affect wet-deposition. Have you characterized the affects on total column and/or total domain mass?

2. The article compares pure Eulerian results to the updated PinG model, but heavily references the previous PinG model. The updates developed in this paper are the PM treatment and the volume source. Given that only the VOC emissions use the volume-source update, many of the changes in gas concentrations (NOx and O3) likely have small incremental changes. Why would the base (no PinG) be a better reference case than the pre-existing PinG model? Given that this is a model development journal, it would be nice to characterize the contribution of the original development in this paper.

3. Page 5868-5869: The description of chemistry in the bullets was not clear without reading the citation. Either add more details here or simply cite the other document.

4. Page 5871, lines 11-13: There is a suggestion that size criteria gives better results for grids <25k and time criterion gives better results fro >50k grid cells. This is written as a universal truth, but your paper investigates the effect. Your results section suggests that there is negligible effect on performance of PinG at all. Thus, it seems that the injection criteria would not substantially affect performance evaluation. Can you clarify whether this is your result or previous literature findings?

5. PinG-injection was very confusing. Both plumes were "injected" into the grid. How about PinG-sizeonly? Further, I recommend that you give add more introduction of the criterion-sensitivity and resolution-sensitivity to the "Simulation setup" section. Adding light outlines to the figures would help with the zones, which are only clear after much discussion.

6. The Horizontal grid-sensitivity analysis needs clarity and potentially more analysis.

First, it is not clear if the PinG and Reference at 0.1 degrees are being compared to a 0.02 degree model with the same criterion (size-only) or with a different criterion (size-time). Second, it would be more useful if it more fully characterized the competing factors: small-cell-size induced injection and large-grid insensitivity. The analysis as presented shows a "high" value at 0.02 degrees ($\sim$1.5km) and "lower" response at 0.1 ($\sim$7km) degrees. The native WRF resolution of 0.0555 degrees might have shown some added value without diluting the total response.

7. In the conclusions, you state "The PinG modeling results presented here demonstrate that fugitive emissions need to be taken into account in addition to stack emissions for industrial sites treated at the subgrid scale." However, this has not been demonstrated. In this work, the fugitive PinG emissions are being compared to a no-PinG model. To truly demonstrate the need for fugitive emissions to be treated as PinG, the comparison would have been between the pre-existing PinG model and the updated PinG model. Was that comparison made? Comparing to the Karamchandani paper (in the conclusion) is less than ideal because it used a different host model with potentially different conditions. Either the comparison between Polyphemus PinG and updated PinG would be ideal, or it needs to be clearer how different the present model is from the previous Polyphemus PinG.

Interactive comment on Geosci. Model Dev. Discuss., 6, 5863, 2013.