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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Development and application of a reactive plume-in-grid model: evaluation over Greater Paris" *by* I. Korsakissok and V. Mallet

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We thank the reviewer for his/her useful comments.

1 Specific comments

1) Section 2.2.1 – Scientific notation In order to make the paper clearer, we moved part 2.2.1 to an appendix (as suggested by the first reviewer). Concerning the notation in this part, Equation 1 gives the definition of the puff volume : it is defined as the ratio

of the puff's first moment (mass) squared, on the puff's second moment:

- First moment :

$$\langle c_A^\alpha \rangle = \int\int\int_{-\infty}^{\infty} c_A^\alpha \mathrm{dV}$$

- Second moment:

$$\langle {c_A^\alpha}^2 \rangle = \int\int\int_{-\infty}^{\infty} {c_A^\alpha}^2 \mathrm{dV}$$

- Volume :

$$V_\alpha = \frac{\langle c_A^\alpha \rangle^2}{\langle {c_A^\alpha}^2 \rangle}$$

This, of course, is only a definition since we have to use a finite volume in chemistry while in the case of Gaussian puffs, the "real" volume is infinite. However, the definitions used here are easily verified in the case of puffs with a finite volume and a uniform concentration. We added this explanation in the article.

2) Meteorological data The data come from ECMWF fields, of resolution $0.36°$. This is not a very fine resolution, and using MM5 or WRF models may have improved the dispersion results. However, it was considered sufficient since the Paris Basin is characterized by a non-hilly terrain and rather homogeneous fronts. The interpolation on the simulation grid is bilinear. We would like to point out that the aim of this study was to study the improvement brought by the subgrid-scale treatment of point sources, all other data being the same. Thus, we did not focus on improving the input data.

3) Plume rise parameterization Of the three plume rise parameterizations available in our model (Briggs, Concawe and Holland), Briggs' parameterization is the most physical one, which is why we prefer to use this one. The other two parameterizations are only simple empirical models based on the source heat rate, and do not depend on stability for instance. The choice of the plume rise scheme is probably of small importance in this case, considering the uncertainty in the plume rise parameters.

4) Dispersion parameterization We agree with the reviewer when he states that a more rural scenario would show a higher impact of the plume-in-grid model. The main issue would then be the lack of measurement stations near the sources. In the present study, several of the greatest point sources are in periurban or rural areas and we expected a higher impact for these plumes. This impact was seen on the concentration maps, but was not so important on stations which are mainly located in urban area and far from point sources. Concerning the dispersion parameterizations, similarity theory and Doury formulas seem well adapted to rural cases (as we studied in Korsakissok and Mallet (2009) for instance). We modified the Section 6.1 in order to add some comments on rural/urban diffusion in Gaussian models.

5) Colour scale We followed the reviewer's recommendation and changed the colour scale on Figure 9.

References

Korsakissok, I. and Mallet, V. (2009). Comparative study of Gaussian dispersion formulas within the Polyphemus platform: evaluation with Prairie Grass and Kincaid experiments. *J. Applied Meteor.*, 48(12):2459–2473.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 5091, 2010.