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Interactive comment on “A plume-in-grid approach to characterize air quality impacts of aircraft emissions at the Hartsfield-Jackson Atlanta International Airport” by J. Rissman et al.

Anonymous Referee #2

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1 General comments

This manuscript presents a modeling study of the impact on $PM_{2.5}$ concentrations of aircraft emissions during LTO cycle for a major airport in the United States. Two modeling approaches for the dispersion and the chemical aging of aircraft emissions are compared. The first one consist in the use of a "classical" Eulerian chemistry transport model, the second one rely on the use of a plume-in-grid model to follow the aircraft emissions.

This paper is generally very clear and the study is certainly of interest for ACP. However

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some points should be addressed to improve it before publication.

2 Specific comments

p 1093 - l 2: The context is different, but it seems to me the work of Kraabøl et al. (2000 and 2002) could correspond to "use a plume-in-grid model to represent moving, elevated sources". This references could be mentioned in the section 2.3

p 1101 - l 24 and p 1102 - l 11: To explain why they use 2005 data to generate the aviation emissions the authors mention that no data detailed by engine were available for flights in 2002. However they do not discuss the impact of this temporal inconsistency. For instance, from the data of the Airports Council International it appears that the global traffic, quantified in number of movements, increase of 11% between 2002 and 2005. This evolution probably introduce a bias in the inventory assessment. Could it be possible to have an idea of the inter-annual variability of the engine distribution? If this variability is low, why not apply this distribution to the number of flights in 2002 (or scale the inventory through the ratio of the number of flights)? If this variability is high, are the emissions for 2005 representative for the year 2002?

p 1106 - section 4.3: A discussion of the origins of the differences between the inventories seems to me mandatory. It seems a considerable work was made to generate a new inventory of aircraft emissions. This new inventory apparently differs noticeably from the one used in the previous study of the authors for the same period, but the differences are not really discussed. Comments and explanations (or at least potential explanations) concerning the differences between the emissions inventories would be useful.

p 1109 - line 17 and line 26: I am not confident that an increased coagulation leading to an increased deposition would be the main process that could explain a decrease of the EC concentrations. Does the authors have any evidence for this? The sec-

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ond explanation, invoking differences in transport, appears to me much more credible. Moreover I do not understand why the authors apparently restrict this possibility to the case of increasing concentrations?

p 1110 - section 5.4: Are all the puffs shown on the figure 5 really located in the first vertical layer of the model? As mentioned by the authors most of the puffs seems to be blown Northward with a slight deviation toward the east. Some puffs however appear to be deviated rather toward the west. How this could be explained?

p 1114 - line 3-4: cf. my previous comment "p 1109 - line 17 and line 26"

Conclusion: The study described in this paper cover a summer period. It would be interesting to consider a similar study for a winter period with probably very different average dispersion, chemical and thermodynamical conditions. Even if the aviation emissions are less in winter, their impact on $PM_{2.5}$ concentrations could be more significant.

3 Technical correction

p 1107 - line 3: "All four test cases ..." should be replaced by "All three test cases..." I guess?

p 1109 - line 3: To avoid potential confusion I suggest to replace "puffs are added to the model" by "puff are emitted in the modeled domain".

p 1111 - line 24: "The highest concentrations both within puffs and grid cells typically occur within the 12 x 12 km domain". I suggest to mention here the figure 7.

Figure 3, 4 & 5: The units displayed on the figures are not consistent with the units mentioned in the captions.

Figure 5: I don't think that panels are centered on the airport.

Figure 6: I guess "inter-quantile" should rather be "inter-quartile".

References mentioned

A. G. Kraabøl, F. Flatøy, F. Stordal Impact of NO_x emissions from subsonic aircraft: Inclusion of plume processes in a three-dimensional model covering Europe, North America, and the North Atlantic Journal of Geophysical Research: Atmospheres (1984-2012) Volume 105, Issue D3, 16 February 2000, Pages: 3573-3581

Anne Gunn Kraabøl, Terje K. Berntsen, Jostein K. Sundet and Frode Stordal Impacts of NO_x emissions from subsonic aircraft in a global three-dimensional chemistry transport model including plume processes Journal of Geophysical Research: Atmospheres (1984-2012) Volume 107, Issue D22, 27 November 2002, Pages: ACH 22-1-ACH 22-13

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