

We thank the reviewer for his/her constructive review and spelling recommendations. For convenience reasons, we add the original comment of the reviewer in bold font.

This is a well written and useful analytical study of the evolution of the exhaust from aircraft in the trailing vortex wake. New results are presented that will benefit both fundamental understanding and application of these results for use in related aircraft emissions modeling studies. I thought that the paper was particularly good at summarizing the results for possible use by other modeling work that would use simpler tools for the CFD to allow more extensive chemistry or microphysics. This indicates that the authors are both aware of a broader audience and of a need to help make their results useful to that audience.

I recommend publication after correction of the following technical issues.

1. Minor issue, but so prevalent that I must start off with this: Commas are very inexpensive. They should be used when appropriate. There are many, many sentences that open with a phrase that needs to be ended with a comma:

Abstract: Line 9 "Along the transversal [sic] direction COMMA the tracer ..."

Introduction: Line16 "From the wake-vortex dynamics point of view COMMA it is convenient ..."

Line 4 (next page) "When the organized vortices break up COMMA the exhaust .."

Line 27 "In the later stages COMMA the plume ..." And so forth

There are too many to list all these occurrences. Definitely check all sentences that start like "At n secs, ..." "In this or that ..." (like line 15 on page 30042 "In larger-scale models COMMA individual plumes ..", "During ...", "For ..." etc.

We went over the whole manuscript and followed your recommendations.

2. In the abstract, the phrase is used "for the first time" . I may be missing what is the first application, but it seems that the references to Paoli 2008 and Naiman 2011 use similar methods. Are not combined Lagrangian/LES methods used by those authors (one a coauthor on the present paper)?

It is true, that the two cited studies use a Lagrangian approach to study contrail microphysics. When we said "for the first time", we had in mind only studies dealing with the dispersion of a passive tracer. To avoid any misunderstandings we delete "for the first time".

3. Abstract line 6: "deceased" probably means "ceased".

Corrected.

4. Throughout the paper numerous times, but first in Abstract line 9 "transversal" probably means to use "transverse". (Transversal is a more specialized term which is a proper word, but means something different from transverse.)

We replaced "transversal" by "transverse" on all occasions.

5. Page 30041 line 10/11: "the time scale ... is too small". I think that the authors mean that the mixing is too small, or that the time scale is too large (or long).

Good point. We changed it to "large".

6. Page 30052, Eqns 6-8. This may be a detail, but it is confusing to me that the

different C 's defined here seem to have different units. At least they should all be the same units (double integrals in space normalized by the same number of length scales). On some level, it would be satisfying to have the subscripted C 's have the same dimensions as $C(x,y,z)$ and each double integral be scaled by two length scales, but perhaps that would be confusing for other reasons.

We are aware that this non-symmetry may look inconsistent at first glance. However, we think it is the best to do it this way. Note that even "total" quantities are usually given in terms of "material" per meter of flight path. So one always averages along flight direction, as the result would otherwise depend on the length of the simulation domain. Scaling along longitudinal direction is simply an averaging of the plume characteristics.

Introducing length scales for the transverse and vertical direction (i.e. width and depth of the plume) would have a different effect, as the definition would shift from "total quantities" (per meter of flight path) to "concentrations". This is not optimal for several reasons. Technically, this requires the definition of plume borders (thresholds must be introduced). Further, we are not interested in the distribution of concentrations in this study. The way the vertical profiles are displayed here, we answer the question how much material is transported upwards. Once the displayed quantity is divided by a height-dependent plume width, one could not answer such questions.

7. Figure 2: Why is it placed on its side? If it must be on its side (not sure why), shouldn't convention have the view be from the right, not left?

In the final ACP layout the figure may cover a full page. In this case, the figure should be placed on its side. We will discuss this issue with the type setting/layout team of the publisher in case of acceptance of the manuscript.

8. Page 30055 line 11. Would it be worth adding "final" to read "The final vertical plume structure may be approximated ..." since this is only done at 6 min and not the prior results?

Corrected.

9. Page 30055 line14: "altitude" not "alitude"

Corrected.

10. Page 30055 line21: suggest adding "multimodal" or similar to clarify that the result is not a simple "bell curve": "The profile tends to become "a multimodal" Gaussian ..."

In this paragraph we refer to the transverse distribution which is indeed unimodal.

11. Page 30055 line 26: Another comma, but not in the opening phrase "Hence it is "one" hundred times larger than the reference value COMMA which is at the lower end ..."

Corrected.

12. Page 30057 line 11 suggest adding "above" to read " ... even protrude "above" the original emission level."

Corrected.

13. Page 30065 line 15 "distribution" not "distribuiton"

Corrected.

14. Page 30065 line26 suggest adding "the" and drop "in" to read "is comparatively small within "the" first five ..."

Corrected.