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Interactive Comment

Interactive comment on "Modeling and computation of effective emissions: a position paper" *by* R. Paoli et al.

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General comments

1. The theme of this paper is actual nowadays not only due to transport intensification in the air and sea. Also the detailed model description of physico-chemical processes in and out of the stack effluent plumes of the numerous factories and power plants is the classic problem. The world air and sea transports seem to be the widely discussed due to global scale of their pollutant dispersion and to their probable significant impact on the atmospheric composition and energy flows. In a position paper on the rather new modeling topic not only the results but some questions may be posed also.

Among the new atmospheric processes which deserve improving in their modeling the formation of the aerosol layer in the stratosphere from the sulfur containing gases dispersed from the highflying aircrafts for the reduction of solar radiation fluxes entering into the lower atmosphere and the Earth surface is a new one. This action now called "geoengineering" is rather intensively discussed by climatic scientists as a probably efficient instrument against the current global climate warming (e.g. see Robock et al. Benefits, risks, and costs of stratospheric geoengineering, Geoph. Res. Lett., v. 36, L19703, 2009).

Most of geoengineering impacts on the atmosphere, on the Earth surface and on climate factors are studied now and modeled in details using the big volcanic eruptions as examples, but the process of aerosol layer formation from the plumes of separate aircraft exhausts is still non studied. Would this layer be patchy or homogeneous and how it will intercept the solar radiation?

2. The problem of ship exhaust impacts on the atmospheric boundary layer is much less studied in comparison to air transport and this is evident from the manuscript. This is also due to more complicated exhaust composition: mixed gas and aerosol effluents and their interaction with clouds, rain, and drizzle in the lower atmosphere. The problem of plume interactions from the separate ships along the intensive routes is more actual here than in the air transport due to more short distance in general between ships than between aircrafts. These peculiarities for the marine transport should be better presented or at least indicated in the paper.

3. The important items of plume process parameterization in the flight and ship corridor conditions are presented and discussed in the paper insufficiently, especially for the flight corridor. The Fig. 7 scheme is to be presented and explained in more details for better understanding the flight corridor composition formation. Estimations of these corridor conditions influence at Fig. 16 for aircrafts and of ship routes at Fig. 23 show the importance of such consideration.

4. The comparison of model results with relevant measurements is a focal and difficult

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point in all model studies. There is no mentioning of this aspect in the manuscript and also no indication of it in all the reviewed papers in it. This is the one of main deficiencies in this area of research. It is really difficult to find the possibility to check some of the model results (maybe for some special model constructions) by direct or indirect measurements in the “field”. An indication of some movement in this direction is highly desirable.

5. One of the general qualitative results of the considered refinement in modeling of the local effluent behavior in the plume with its following interaction with the gas (and maybe aerosol) composition in the large scale is the reduction of the total effect in comparison to the effect of direct introduction of emitted NOX in the large scale model without the account of processes in the plume (see Figs. 19-23). This is the one more illustration of the well known “Le Chatelier principle” in natural processes: the total effect of a complicated natural phenomenon as the result of its component interactions is usually lower than the effects of separate components. This is due to partial compensation of component effects in their interactions and this feature is worth to be indicated in the position paper.

Specific comments

1. Would be highly desirable to compare the emission indexes considered in this paper for some simple cases. The EEI and ECF sketches at Fig. 8 and Fig. 12 respectively are examples of initial movements in this direction. Some points of this comparison are expressed also in conclusions at p. 164.

2. The general introduction (section 2, pp. 141-142) in the paper seems to gain from its reduction. Some of equations (1) – (12) may be omitted. They are poorly connected with Figs. 1-3 presenting plume models. A very important note about the consistency of gas chemical processes in the plume and in the background atmosphere and not for the heterogeneous chemistry is to be better placed from the end of the paper at p. 164 to its beginning. The list of numerous used abbreviations posed also in this place

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would help the reader considerably.

3. Only two misprints are noticed in the text: at p. 141, line 20: “see” instead of “sea” and at p. 164, line 22: “EER” instead of “ERR”.

Final conclusion: This position paper with suggested additions and few corrections is a substantial contribution in the considered section of atmospheric modeling and is to be recommended for publication.

This comment is to be signed by Prof. Igor Karol and Ph. D. Yuri Ozolin 18 March 2011.

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