

Anonymous Referee #2

The EMeRGe project and accompanying field campaigns have been a tremendous overall contribution to the field of atmospheric chemistry, providing extensive data and insights into how atmospheric pollutants are transported and transformed in the outflow of European and Asian megacities and other major population centers (MPCs). This overview paper brings together four distinct threads: 1) a review of the historical background and framing of the campaign; 2) the campaign setup, objectives and actual operations, along with the modeling and satellite observation contributions; 3) a presentation of the main observations; and 4) key scientific insights that can be gained from these observations. The quality of each of these individual components is very high. However, putting all of these together into one paper leads to an extremely long manuscript, which is nearly all on the same "level", with only a few very technical details being in the electronic supplement. There is nothing principally wrong with providing this extent of information to the community. However, having it all as one long, linear (as opposed to multi-level or hyperlinked) paper makes it quite a hindrance for readers to find the time to go through it adequately (especially not spreading it across various sittings over a week or more). This has contributed to the long delay in submitting this review; like the other referee, I sincerely apologize for this delay. Since this hindrance is likely to apply to other busy colleagues as well, leading to much less uptake than possible by the community of potentially interested readers, I provide suggestions for how to potentially improve this significantly. This manuscript should definitely be published, due to its excellent content. But prior to publication, it should be restructured in order to be appealing and directly useful to a much larger readership. Here I outline a suggested restructuring. This is not the only possible approach, and it is fine if the authors pursue a different strategy for restructuring, as long as it fulfills the same purposes of better distinguishing the four elements noted above, and bringing forth the highlights and putting the more mundane (albeit important) aspects on a "lower" level (e.g., the electronic supplement, an appendix, etc.).

The abstract is not going to be very appealing to many readers, starting off directly with the project/campaign name and setup/components, with only a short paragraph on the key scientific insights. I would suggest starting off with something like "Megacities and major population centers (MPCs) worldwide are major sources of air pollution, both locally as well as downwind. Characterizing this outflow has been XYZ... Here we provide an overview of the highlights of a major new contribution to the understanding of this issue, based on the data and analysis of the EMeRGe campaign...". Then follow the order of the four points noted above, moving the current last paragraph earlier and partly merging it, and expanding the current second-to-last paragraph to be a more appealing highlight description of the most interesting and important findings.

Answer: First of all, the authors are thankful for the encouraging suggestions of RC2 to improve the structure of the manuscript. It has now been made a considerable effort to present the manuscript in a more condensed form addressing the comments and suggestions of RC1 and RC2. Overall, the length of the manuscript has been reduced in 15 pages.

The abstract has been modified and re-structured according to the suggestions of RC2.

For the main text, I suggest the following: Introduction: Keep this short. Move the historical overview (lines 89-150) into section 2, and here just focus on the framing and introducing the EMeRGe campaign (without making that a subsection - it's a bit odd to have only section 1.1 and no 1.2).

Answer: This has been done

Section 2: make this a "Historical Review" section, combining the material from section 1 (lines 89-150) with Section 2.1. The present historical overviews in these two sections are very fitting and seemingly accurate, to my knowledge. Combining these sections will help consolidate the topic within the paper. Check for and reduce any redundancy. In this section, it would be good to be clearer about what are seen as the most important knowledge gaps (presently only a list of "Some examples are..." is given). These should then be connected back to in describing the most important findings, which should help to fill some of these gaps.

Answer: This has been done.

One minor point: MEGAPOLI was a project with largely modelling analysis at various scales, plus an embedded field campaign in Paris, so line 203 should read "The MEGAPOLI field campaign was conducted in Paris..."

Answer: This has been corrected.

Then sections 2.2-2.4 become the new section 3. To facilitate reading, I'd put the questions in 2.2 into a table, possibly with an extra column indicating where in the campaign or the overview paper each question is addressed (optional, but that would help the reader to orient and quickly track down the parts that are most interesting or relevant to them).

Answer: These sections have been combined to form section 3.

Most or even all of Section 2.4 could go into either the electronic supplement, or a "Methods" appendix. Only keep here what is really needed for understanding the campaign, which will interest most readers. (The specialists who are interested in the instrument details will know where to find that information in the supplement or appendix.)

Answer: Most of the section 2.4 (now 3.3) has been moved to the supplement.

Section 3 would become section 4. That's good for the first part, but the flight route descriptions (lines 514-599) can easily go into the electronic supplement for reference by those who are interested, and in the main text keep only what is really needed (if anything) to understand the main results and new findings in the later sections.

Answer: The authors think that the description of the flight routes is necessary for understanding the campaign as it provides a general overview of the coverage of the flights and the meteorological conditions. The flight routes are now included as section 3.6.

Section 3.4 is good as it stands.

Answer: The section 3.4. is now included as section 3.7.

From then on comes a larger restructuring: Sections 3.5 through Section 6 are all written in the form "Here's what we observed" –then described in great detail – followed by "...and this is what that means or tells us about the atmospheric outflow from the MPCs". While that's OK for a short (e.g., 5-10 page) paper, it honestly gets rather boring for a paper with 65 pages of text. The really exciting part is then bundled into bullet points in the "summary" in section 7. I would strongly recommend turning this all around: after the old section 3.4 (now 4.4.), start new sections 5 and 6 (and perhaps 7) which are structured along the lines of the key findings noted in Section 7, and only provide the observational evidence from the campaign that is needed to support those findings (then possibly putting further general description of observations which do not connect to the main findings into the conclusions).

Answer: The text has been completely re-structured according to the suggestions of the RC2. Now there is a new section focusing on the bullet points of the previous summary in section 7. The new section 4 (Transport and transformations of pollution plumes during the EMeRGe IOP in Europe) highlights the main findings of EMeRGe, which are sorted in six subsections: 4.1 Observations; 4.2 Identification, classification and characteristics of pollution plumes; 4.3 Identification of MPC outflows; 4.4 Mixing of MPC outflows with air masses of biogenic and natural origin: forest fires and dust; 4.5 Photochemical processing of polluted air masses during transport; and 4.6 Model simulation of EMeRGe observations.

Finally, instead of a summary at the end, provide a good outlook, describing how the knowledge gaps that have been filled contribute to our overall understanding, what is important for the community to focus on next, and suggestions of how to go about that. If it can be done without spoiling things, then providing a "teaser" of a highlight or two of what EMeRGe found to be different in Asia, garnering interest for the next paper, would fit well in the outlook section; otherwise the Asian campaign does not need to be noted here, since it was already discussed in the opening sections. Following those suggestions would make this a much more valuable, accessible and appealing result from a tremendous and successful effort of the large team involved.

Answer: A new section "5 Outlook" has been included at the end.

One final minor comment: Some of the references in the list are inconsistently formatted, with the date before the doi, whereas most have the date after the doi (when one is given).

Answer: This has been corrected.