Response to Referee #2

We wish to thank the anonymous Referee #2 for his/her very helpful and constructive suggestions. Detailed response is given below.

Similarly to Referee #1, the major criticism by Referee #2 is related to paper structure and overall readability. We tried to improve on this side by moving some of the sections to the appendix and restructuring some others (see reply to Referee #1 for more details). This should improve the overall paper readability and reduce the amount of details that could have confused some readers in the previous version.

Firstly, there are ten sections in this paper, isn't it necessary to separate a paper in ten sections? If merge some of them (such as section5, 6 and 7), maybe it will be easier for the discussion.
We agree with the reviewer's suggestion and reduced the number of sections, by moving model description and evaluation to the appendix. Furthermore, the results section about mass, number and radiative forcing are now structured in the same way (general remarks, land transport, shipping and aviation). This should help the reader to follow the discussion. We would like to keep the presentation of results separated by topic (mass, number and size, radiative forcing) to allow "quick readers" to read only the parts they are interested in.

Whether section 9 – effects of non-linearities is only for radiative forcing effects? If so, it can be merged into section 8.
We understand reviewer's comment here, but we believe that this Section should be separated from the rest, since the primary effect of the non-linearities is on aerosol mass and number distribution. This of course translates also in a radiative forcing effect, but only as a secondary effect. Having a separate section for the non-linearities should make the cause-effect relationship clearer.

Secondly, this paper is difficult to be read for the first time, particularly for Section 3. It takes time to work out the difference between each model experiment and particle size distribution. As table 4 given the list of the experiment performed in this study, one or two paragraph needed to explain the relations to Table 2 and Table 3 and pointed out what the main difference among those parameters.
We agree with the reviewer and tried to improve this by providing only the essential details about the sensitivity experiments with the different size distributions. We moved the details about size distributions (former sections 3.2.1-3.2.3) to Appendix B. Moreover, we use now different notations to identify the experiments (capital letters) and the corresponding size distributions (lower case letters, italic). Unfortunately, the model study presented in this paper required a large number of model experiments, which have to be discussed in detail for the sake of reproducibility.

Personally, I think if move section 4 model simulations before section 3 (or merged into section 2 EMAC-MADE model), it will be easier to read. I would suggest the authors make some effort to improve the manuscript and make this paper is valuable to different level of the scientists.
We thank the reviewer for this suggestion. We restructuted this part of the manuscript and moved most the details to the appendix. Model simulations and corresponding size distribution assumptions are now discussed together in Section 3.

There are two R11 in Table 2: R11 AGED1 and R11 AGED2, but in the later discussion section, a few place only use 'R11'. It needs to clarify whether R11 means both of them.
The reviewer is right, there was an ambiguity since R11 referred to both the Righi et al. (2011) paper and to the size distribution discussed in that paper and adopted for this study. We corrected this, by renaming the two size distributions to "AGED1" and "AGED2".

In page 13140, line 25, what is ECHAM4.L39(DLR)?
It is a different model used by Köhler et al. (2001) to perform a similar analysis in a previous study.

In page 13142, line 15, ICOADS need to explain. As there are so many abbreviations used in this paper, a list as appendix might be helpful.
Thanks for this very good suggestion. We added an acronym list in Appendix D.