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Interactive comment on “The global impact of the transport sectors on atmospheric aerosol: simulations for year 2000 emissions” by M. Righi et al.

Anonymous Referee #1

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This paper uses the EMAC-MADE global aerosol model to study the impact of transport emissions on global aerosol loads. A series of sensitivity experiments is testing number emissions, and uncertainties. The paper finds land transport to be the most important source of black carbon pollution in the USA, Europe and Arabian Peninsula, shipping to strongly contribute to aerosol sulfate concentrations along the most-traveled routes of the northern Atlantic and northern Pacific oceans, with a significant impact along the coastlines, and the effect of aviation to be mostly confined to the upper-troposphere. This is a very good paper that will be of interest to a wide community. The details given in this paper will be of interest to other aerosol researchers, but the policy aspect of this

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paper will attract a wider audience. Therefore it is especially important that the results are presented clearly. This paper is very long, and it is structured systematically into subsections of experiments and sectors. However like this it becomes very repetitive (and too long) and the reader gets lost in too many details. The authors should think about their main message and streamline the paper around that message. Many figures could be combined into summary figures. E.g. give one figure per experiment that shows the results of all sectors for all species, like that it will be easier to compare them to each other. The radiative forcing numbers should be presented together with the sector experiments. This will help to put the results into perspective and shorten the paper. E.g. sometimes its hard to judge if the discussed difference between two experiments would really matter. This would also help the paper to concentrate on the bigger picture instead of discussing too many details. The paper fails to puts its findings into perspective. I recommend to rewrite the paper. Allover this is a very nice study that will be of interest to many readers.

Minor comments:

P 13122 L1: The abstract needs to be more quantitative. Only the importance of emissions from the transportation sector is stressed, but the abstract needs to provide numbers, forcings/loads, or quantitative statements in comparison to other emission sectors.

P 13122 L 8: 'resulting in change of radiation' please be more quantitative.

P 13122 L 12: Are the premature death calculated globally?

P 13122 L15: Transport emissions cause of main air pollution? Does this consider the effect of biofuel cooking?

P 13126 L 18: How is the aerosol mixing state taken into account when calculating radiative forcings?

P 13126 L 19: The radiation scheme is decoupled from the model chemistry, what

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does this mean?

P 13126 L10: Does the new emission inventory perform better or worse than the old one? What is the difference between the inventories? (There is a section on emissions later, so maybe just remove the emission part in 2.2)

Fig3/4: Fig 4 shows the importance of Nitrate, why not include nitrate in Fig3?

Section 5: Why only show SO₄ and BC, why not show all aerosol distributions? As differences are shown later it would be nice to see the reference concentrations. There is not much explanation needed, section 5 could be skipped, simply show the distributions when you discuss the impacts.

Fig4. Why is the effect of emissions per sector on mass is only calculated for certain levels? That's not a quantitative comparison. The size distribution assignment for transportation is simply split over different size distributions. Would it make sense to make the emission size distribution source dependent?

Table 5: Can this table be presented as figure?

P 13153 L1: Why are aerosols above clouds are not considered in this study? This should be included automatically when running a climate model?

P 13155 L10: Section 8.3 is the most important part for understanding the relevance of this study. Would it be possible to summarize these results visually? It is difficult to just read through all the forcing numbers. Eventually the net result, including GHG, of emission sources and uncertainties is what we need to understand.

P13157 Section 9, effects of non-linearities should be cut from the paper. The paper is already too long and this section adds very little information to this study.

Discussion: Similar to the abstract (and keep in mind many people will only read the abstract and the discussion) the discussion should be more quantitative. As an example 'Land transport and shipping are most relevant on continents and oceans.' this

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result doesn't carry a quantitative message. And that applies to discussion points 1 – 6. Similar to the paper the discussion highlights individual results instead of connecting this study to its climate relevance. The discussion should explain the relevance of the transportation sectors, including all co-emitted species and in relation to other anthropogenic sources.

The paper lacks any discussion on uncertainties introduced by the host model and microphysical schemes.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 13119, 2013.

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