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Interactive comment on "Revisiting the contribution of land transport and shipping emissions to tropospheric ozone" *by* Mariano Mertens et al.

Anonymous Referee #2

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This paper offers a nice overview of the impact of shipping emissions on ozone through the use of two methodologies: the tagging methodology and the perturbation methodology. The paper is well written and extremely thorough with a clear comparison to previous studies.

Comments.

1. The authors state two goals in this study (p3, l4-6) in determining ozone from shipping emissions: to review previous studies and to give the results of the tagging method. The results from the authors use of the tagging methodology nicely complements estimates from the contribution method. I think the paper works as a review

paper. However, as written, I question whether the paper stands very well on its own as a new piece of research. There does not seem to be enough new. Part of the author's justification for this paper is that no one has investigated the ozone contributions from transportation using the tagging approach. Just because something has not been done does not mean it is scientifically interesting or worth pursuing. There are probably other emission sectors that have not been investigated using the tagging approach. It doesn't seem that there should be a new paper written for each of these sectors. I think the authors need to better justify their study than simply state it has not been done. Why do we need another paper on the emission contributions from transportation emissions given the uncertainty? Specifically, what new insights does the tagging approach give? (This needs to be better clarified, see below). What do we learn about the tagging approach here that we didn't know before?

2. Why does the present study use a 5% perturbation? The results are sensitive to this perturbation. Some justification is needed. It would be helpful for comparison purposes if the authors also gave their results for a 100% perturbation in their tables. To what extent does the discrepancy with the tagging method come from the assumed 5% reduction? It appears a 100% emission reduction gives similar results to the tagging method. Reporting on a 100% emission perturbation would also help compare with other studies.

3. Equation (3): Is a factor of 20 missing?

4. The definition of gamma needs to be clarified in more detail in the text. After looking in detail at the figure and reading the text the meaning of gamma became clear, but it should not have been this difficult. Please clarify the definition of gamma in the text explicitly stating what the y intercept is and stating that y is the average net ozone production rate in a particular region.

5. It is unclear why gamma is defined in terms of the intercept instead of the slope (dO3/dNOx). The intercept will be leveraged by the amount of the NOx emissions.

That is, the impact of the slope the will be amplified when the NOx emissions are large by changing the intercept to a greater extent than if the NOx emissions are small.

6. Figure 5 clearly demonstrates that the perturbation approach gives different estimates under different conditions. However, it does not show how the tagging approach differs. Some more work is needed here to better understand how these two approaches give different answers depending on ambient conditions and transportation emissions. From line 9 onwards (on page 9) the well-known dependence of ozone production on NOx is shown, with the well-known result that in regions of high NOx a decrease in emissions has little impact on the ozone concentration. There is not much new here. The text and figures don't explicitly show that the tagging approach gives a different answer than the perturbation approach. And isn't the discrepancy between the two methods well known. What is new?

7. The authors state: "Combining the tagging and the perturbation approach is therefore the best way to measure the success of a mitigation strategy." (p10, l19-20). The authors argue that the perturbation approach gives different answers depending on the current state. I suppose the tagging approach gives the same ozone reduction regardless of the mitigation pathway. This should be clearly stated. Nevertheless, it is unclear how one would use the tagging method to decide on mitigation issues. Perhaps a concrete example would be helpful here? This is important because it would provide a needed justification of the tagging approach. It is crucial that the paper clearly gets this across. It seems to me the tagging approach is useful in assigning blame: for example, if you want to apportion blame for an ozone pollution outbreak or for the radiative forcing due to ozone. It is not clear to me how one would use the tagging method practically in assessing mitigation options.

8. The loss rate of ozone is very dependent on how it is calculated (page 11). How are the losses calculated in the present study? Are they calculated in the same manner in the comparison studies?

9. P12, l 16: "We obtain. . .." Using which method?

10. The section on uncertainties should also discuss the uncertainties in the perturbation method. In particular this method is sensitive to the perturbation assumed.