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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The global impact of the transport sectors on atmospheric aerosol in 2030 – Part 2: Aviation" *by* M. Righi et al.

Anonymous Referee #2

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General comments

This paper estimates the impact of the aviation emissions on global atmospheric aerosol and climate in 2030. It is in the continuity of two previous papers on the global impact of land transport, shipping and aviation on climate. It uses the EMAC model (ECHAM/MESSy Atmospheric Chemistry) to quantify the impact of aviation on chemical species concentrations such as black carbon (BC), sulfate (SO4), nitrate (NO3) as well as on particle number concentration. The results are given for three main regions of the globe using the four Representative Concentration Pathways (RCPs), which allows covering a wide range of future emission scenarios.

The paper is structured, well written and pleasant to read. The results are clearly presented and illustrated by different figures. The originality of the study relies as

stated by the authors in the fact that it includes the representation of the aerosol indirect effect. However, I have a few remarks concerning mainly the aviation emission setup and the fact that some parts could be discussed further. After taking into account those remarks the paper should certainly be published in ACP.

Specific comments

Section 1-Model setup, emission inventories and model simulations

This part is crucial to understand which set up of the model and emission inventories have been used. To my view, it needs to be extended and restructured (may be by adding a section dedicated to emission). First, as the indirect effect of aerosol is activated, it is important to describe how it is implemented into EMAC. Secondly, the description of the aviation emissions from the RCPs is only done partially. It would be nice to have a more specific description of the data used for the aviation emission (e.g. assumption made for traffic growth, fuel efficiency) especially the ones coming from the RCP2.6. For example, the huge increase (2000-2030) for BC in RCP2.6 would need more explanations. Lines 16-23 p34042 need clarification, maybe by adding a table, summing up the actual data used.

Section 3- Aviation impact on aerosol in 2030

The figures associated to this part are nicely chosen but weakly commented. Rather than writing "the contribution of the aviation sector to the mass concentration changes remains small, as it is clear from the comparison of the left (all sources) and the right (non-aviation sources) columns", a full description and discussion of the aviation impact for sulfate and nitrate should be done including quoting the numbers.

Section 4- Aviation impacts on Earth's radiation budget

As well as decomposing the radiative forcing effect by RCP, I would suggest to do it for the direct and the indirect effect for each species and discuss it. Also, the role of sulphate into the cloud microphysics is described but the influence of the strong

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increase of BC is not discuss but should be.

Page 34047, L 10-14: I would suggest also to look at the data from Pitari., et al, 2015 to enhance the discussion about the direct and indirect radiative forcing.

Pitari G., Iachetti D., Di Genova G., De Luca N., Søvde O.A., Hodnebrog Ø., Lee D.S., Lim L.L., 2015: Impact of Coupled NOx/Aerosol Aircraft Emissions on Ozone Photochemistry and Radiative Forcing. Atmosphere 6, 751-782

Page 34048, L 10-12: I would temperate the statement "without the implementation of significant technological improvements to reduce the emissions" as ACARE has clear goals related to air pollution emissions including a reduction of CO2 (-75% per passenger kilometre) and NOx emissions (-90% per passenger kilometre) by 2050 relative to 2000.

Page 34049, L 8-11: I am not sure where this statement has been shown in the paper.

Technical corrections

Abstract: Define acronyms ECHAM, MESSy and RF.

Page 34042: Define all variables of the four equations.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 34035, 2015.