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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contrails and Their Impact on Shortwave Radiation and Photovoltaic Power Production – A Regional Model Study" *by* Simon Gruber et al.

Anonymous Referee #1

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This paper describes a parametrisation of contrails that is embedded in the two-moment cloud microphysics of the COSMO regional atmospheric model. It is followed by a case study including the impact of contrails and contrails-cirrus on short wave radiation and on possible PV production.

The paper presents interesting new results, but before being published the authors should address the following points.

General remarks:

- I was a bit surprised that the authors have chosen a model with a complete representation of atmospheric chemistry and aerosols (COSMO-ART) for this study. From the

description of the parametrisation in Section 2 it seems to me that changes by aircraft to atmospheric chemistry as well as soot emissions are not directly considered. Thus it seems that the usage of the COSMO model (without the computationally expensive ART modules) in conjunction with the 2-moment scheme of Seifert and Beheng (2006) are sufficient for the present study. If this is not the case it should be shown more clearly why the ART modules are needed.

- Whereas the case study in section 4 is well described, sections 2 and 3 are rather hard to read and understand and would profit from a rewrite. In section 2.1 it is very difficult to understand where the description of the standard cirrus class is ended and the description of the newly introduced contrail class starts. I would thus recommend separating by introducing a new section. Also this section would highly profit from a table explaining the differences between both classes as well as a schematics such as Fig 1 in Salzmann et al. (2010) to highlight the interactions of the newly introduced contrail ice class with the other ice classes. A Table is provided at the end of the paper explaining the differences, but is not referenced in the text. I would moreover suggest in Table 1 to distinguish more clearly between the cirrus and contrail ice class. Similarly in section 2.2 a Table would help to understand the differences between the interactions with radiation of both classes.

- It seems quite strange that a completely new scenario "bio fuels" is introduced in the last section of the paper. but referenced already in Fig 12. I would suggest to keep section 4.5 as sensitivity case study, and not introduce a new scenario here. As shown by Ferrone (2011) biofuels also have an impact on the Appleman-Schmidt criterion and this would need to be changed accordingly.

Specific remarks:

- in the last line of page 2, the resolution of Global Circulation Models (GCMs, the abbreviation is not introduced) are given as 250km, however most recent models have a resolution of 50 km or higher (IPCC, 2015).

- Caption of Figure 2: The abbreviation COSMO-DE is not introduced

- Figures 3, 4, 6 and 7 would become more interesting and easy to interpret if a difference plot between the middle and right column would be added.

- Figure 8 and 9: If I understood correctly, the black boxes should highlight the same areas but they are slightly shifted.

- In the list of abbreviations given on page 31 and 32 some Units are erroneous. Units such as kgˆ(-/mu), mˆ(-/mu); kgˆ(-b_vel); kg ˆk do not exists.

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