

***Interactive comment on* “Global contrail radiative forcing and the impact of diurnal variations of air traffic” by N. Stuber and P. Forster**

Anonymous Referee #3

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The paper analyses contrail radiative forcing and the effect of the diurnal cycle of contrail cover on the radiative forcing. As is commonly done, the authors restrict the analysis to the effect of persistent line-shaped contrails and model those using a variation of the standard approach. The authors assume a fixed optical depth of the contrails but fail to discuss the limitations and sensitivity of the results due to this choice. This assumption does not seem appropriate for calculating another ‘best estimate’ of contrail radiative forcing. Nevertheless, the discussion of the effect of the diurnal cycle of air traffic on the radiative forcing is certainly interesting (and should not depend on the assumptions about the optical depth) and can be seen as a global extension of the results published already in Nature. Therefore I recommend publishing the paper after major revisions.

Major comments:

1. Why was the optical depth or the variability of the optical depth not estimated using the ECMWF moisture or condensable water field?
2. The choice of the standard width and life time of 2km and 2hr should be better motivated and the sensitivity of the results to this choice should be discussed.
3. Contrail radiative forcing depends strongly on the optical depth of the contrails which is varying in time and space. The contrail optical depth should be much larger in the tropics than in the extratropics and varies regionally due to the supply of condensable water. It also depends on the synoptic situation, season and height. Fixing the optical depth can change the geographical field, seasonal variability and the global overall values of radiative forcing. I would doubt whether a study that uses a fixed optical depth could lend more credibility to the existing 'best estimates' of contrail radiative forcing.
4. What is the justification for simply scaling global mean radiative forcing to a different cloud cover and optical depth? Note that by scaling the Fichter et al. radiative forcing to the Marquart et al. cloud cover you obtain a radiative forcing that is too strong even though they used the same model. How can two radiative forcing values be judged to agree with each other or not.

Minor comments:

1. Please mention that by using the Bakan et al. results for tuning you assume that this tuning also holds for the rest of the world and discuss whether contrail covers observed in other parts of the world are reproduced.
2. Why were the results scaled by the monthly total column air traffic instead of the monthly air traffic at the respective levels? The latter choice would not have fixed the vertical profile to the June profile.
3. Please check if radiative forcing numbers of other studies are correctly cited and

specify which scenarios you are citing.

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