

## ***Interactive comment on “Northern Hemisphere Contrail Properties Derived from Terra and Aqua MODIS Data for 2006 and 2012” by David P. Duda et al.***

### **Anonymous Referee #2**

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The study involves a very relevant comparison of satellite contrail retrieval outputs by contrasting annual averages from two years in terms of differences in traffic, coverage, optical depth, and particle size. Nevertheless, this comparison is confounded by differences in altitude, meteorology and background characterisation techniques. I would strongly suggest that all comparisons in the study are performed separately for each variable, while keeping all others constant. I believe that this should be easily done with the data already available in the study, as this would greatly expand the applicability of the results to a wider community.

The title of the article should reflect the fact that this is a comparison of two years of

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contrail retrievals with respect to variables not necessarily linked to “interannual variability”, as it is the case for traffic and altitude changes between the two years. I would make the following specific suggestions:

a) Provide an estimate of the uncertainties and differences in the calculated potential contrail coverage between the ECMWF and MERRA data. This will allow modellers to inform their choice of data base and help to quantify the uncertainties linked to the calculated contrail coverage. It would be useful to give these differences in PPCF from the ECMWF and MERRA as maps and latitudinal and global averages. Depending on the temporal pattern of the differences, the results might need to be presented as seasonal or monthly averages.

b) It would be useful to complement Table 2 with maps of temperature and PPCF, but in this case contrasting the differences between 2006 and 2012. This will make it easier to understand the latitudinal dependence of PPCF on temperature changes and validate them by screened CC retrievals. The maps, again, should probably correspond to representative seasons or months, depending on their variability between the two years.

c) In order to explain the differences between the two years in terms of the change in altitude, it should be easy with your available data to perform PPCF calculations using the actual altitudes and present them in a map together with traffic differences and their resulting CC. This will provide an observational measure of the relative dependence of CC on altitude. The comparisons will require to first keep traffic volume constant in order to assess the altitude dependence only, and then assess the contribution from traffic volume differences.

I believe that this altitude-dependence assessment will provide extremely useful information to link model outputs and climatological data on how the optical depth and  $D_e$  can be prescribed in terms of ambient temperature, please do not exclude this section from the manuscript.

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d) It is not clear to me how contrail radiative forcing was calculated, this should be appropriately described in the manuscript.

e) The suggested analyses should provide a way to discriminate the sources of the differences in retrieved CC between the two years. For these analyses the background characterisation must therefore be somehow be kept constant so it does not affect the conclusions.

I believe that with these additions the paper will make a much more significant contribution to the way in which we understand contrail retrievals from satellites and guide the use of retrieved atmospheric and contrail data in contrail models.

Pg 2 ln 28, delete “and”

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-993>, 2018.

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