

## ***Interactive comment on “Simulated radiative forcing from contrails and contrail cirrus” by C.-C. Chen and A. Gettelman***

### **Anonymous Referee #1**

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I hurry to respond to the authors' reply as long as the interactive discussion is still open. I appreciate the additional work that has been provided with respect to illustrating diurnal cycle effects. This makes the results much more transparent and valuable. I will only refer to major points in this comment. As I expect review(s) from other referee(s) to come in at later stages, and as the authors might react to such potential comment(s) in a further revised version, I will go into minor and technical points only when the final revised version is available.

A) 2 hour based diurnal cycles presentation.

I realize that the solar zenith angle peaks at around 12 o'clock local time for the global mean, suggesting that locations all over the globe have been calibrated for noon at

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12 UTC. I would kindly ask the authors to confirm this for the text. What I miss in the Figures 2b, 2f, 2j is the specific diurnal signature of shortwave contrail forcing with 2 minima at sunrise and sunset, as reported in Meerkötter et al. (1999, their Figure 4) and Dietmüller et al. (2008, their Figure 1). This signature might get lost for short winter days when the sun remains low all over (e.g., the January panel in Dietmüller et al.), but is certainly realistic for a long day with high sun at noon. Other papers studying the dependence of the shortwave forcing on solar zenith angles (everything else constant) unequivocally confirm this finding (e.g. Myhre et al., 2009; Markowicz and Witek, 2011; Schumann et al., 2012; Forster et al., 2012). I would therefore expect to find this structure in Fig 2 of the present paper, too, in those cases where contrail properties are near-constant over the day (hourly/monthly emission specification). Has it been ensured that your radiation module actually gives lower forcing for low solar zenith angles than for high ones? This may also be important in view of the extremely low (or even negative?) net forcings you get for the summer months in the seasonal cycle (Figure 3), a finding that is also somewhat at odds with previous evidence (e.g. Rap et al., 2010, their Figure 9). I mention that the (possible) inconsistency might also been taken as a hint that you are in another optical depth regime (compared to previous work), given your assumptions on initial ice masses and particle sizes. It might be worthwhile to provide some values on your typical optical depth values, in order to either confirm or rule out this option.

B) Radiative forcing definition

This is referring to your reply rather than to the revised paper text. It is inconsistent to present net forcings that are not the sum of the shortwave and longwave component. I understand that  $RESTOM = FSNT + FLNT$ , so the contents of Figure 2 are fully consistent. In Table 1 you switch from FSNT to Delta\_SWCF and from FLNT to Delta\_LWCF, but remain with the same RESTOM (am I correct?); hence the additivity is no longer given also for the linear contrails, although this would not have been guessed from the number in the latter case. Nor is it necessary for the linear contrail case, as you

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could have given just the same numbers as basic to Figure 2. It is not clear to me why you do this switch. Did you expect the contrail-related radiative signal to show up in SWCF/LWCF rather than in FSNT/FLNT? Is it necessary, because Delta\_SWCF and Delta\_LWCF are less noisy than Delta\_FSNT and Delta\_FLNT? But then, why should Delta\_RESTOM be statistically significant, when the corresponding component changes (i.e., Delta\_FSNT and Delta\_FLNT) are not? I have a problem with this presentation of parameters that do not fit. From my view I would recommend to keep strict formal consistency, meaning that Table 1 should contain (for the shortwave, longwave, and net forcing) either values of Delta\_FSNT, Delta\_FLNT, and Delta\_RESTOM or of Delta\_SWCF, Delta\_LWCF, and (Delta\_SWCF + Delta\_LWCF). If you prefer to stick to the Table values as they are, I would request a convincing reasoning why you think this choice possible from theoretical and pragmatic reasons.

#### C) References

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