

Review of Lolli et al. manuscript

This is a relevant short study pointing out (to my knowledge the first time) the single-layer cirrus cloud radiative effect differences between the Fu-Liou-Gu radiative transfer model (FLG) calculations and the simplified Corti and Peter (CP) model, published in the Corti and Peter 2009 paper (CP2009).

Due to its simplicity and supposedly quite accurate results, the CP model has in recent years been used in several studies (e.g. Bourgeois et al., 2016, Kienast-Sjörgren et al., 2016).

Lolli et al.'s manuscript take data from 2 years of lidar dataset from Singapur and calculate considerably larger differences between the more advanced FLG and CP radiative models compared to what reported in CP2009.

In general, I am missing a more detailed discussion on the bias sources by the CP model and a more careful comparison with CP2009 (day only vs daily mean conditions).

The manuscript would increase its scientific significance if a midlatitude dataset, for instance the one published in Campbell et al., 2016, would be added to the analysis (or at least discussed the possible implications for regions outside the tropics, where CP model has also been used).

In general, I find this technical note valuable, however, the authors need to address the listed comments/questions before the paper is published in ACP.

General comments/questions:

1.)

Is the Singapore lidar site representative for the tropics?

(being an urban site, in a polluted region, etc.)

Would the main conclusion change, for instance, when applying the radiative transfer model calculations to other tropical measurement locations of the MPLN network e.g. the Bermudas, Cabo Verde, Doi Ang Khang (Thailand), Douliu (Taiwan), EPA-NCU (Taiwan), Kanpur (India), Ragged Point (Barbados), etc.?

2.)

Please add/estimate the uncertainty of both your absolute cloud radiative effect calculations as well as its deviations from the CP model.

3a.)

I miss a more detailed discussion of differences between CP and FLG models. Lines 183-185 and 207-209 need to be expanded.

Can you somehow test this speculation? Could you remove the longwave absorption above clouds from FLG model (or add this calculation to the CP model) and confirm the hypothesis?

Please add or at least comment on the uncertainty estimates of the radiative calculations (see also a related specific comment 7).

3b.)

Did you explain the reasons for significantly different intercepts in figures 5 and 6?

lines 175-185: I don't understand the interpretation of the different intercept parameter. Please rephrase. Are the lines 183-185 referring in general (that is – not only intercept parameter) to differences

between CP and FLG models or do they refer to the intercept parameter only?

4.)

CP2009 uses the daily mean conditions to assess their radiative transfer model. Would taking into account both day and night data decrease the bias/bring your results closer to the bias of up to 20% as stated in CP2009?

Consequently, can you comment/calculate how would differences between CP and FLG radiative model calculations behave during night?

5.)

What is the additional information we gain by always having 2 years of data shown in Figures 1-4 in separate panels?

One figure where both years are shown separately can be to my quick judgment followed by a combined histograms for both years.

Please also comment whether 2 years of data are enough to get a reasonable “climatological” values?

Why the authors didn't use the whole available Singapore lidar dataset?

Specific comments:

1. Please state your definition of cirrus clouds in a condensed form for the convenience of the reader
2. line 50: 1 W m^{-2}
3. line 67: Bourgeois et al., 2016 does not appear in reference list
4. line 110: How much can GEOS-5 biases influence the results?
5. line 157: “*This is particularly evident over ocean at 20sr...*” Why?
6. line 203: *in in*
7. line 214: “*...given lower computational demands...*” Can you quantify that?
8. lines 218-219: this is a strong statement for a study that analyzes only 1 site!

9. Please expand figures 1-4 in y-direction, so that one can better read out the values
10. Use a reasonable number of digits after the dot for the NET RE value in figures 1-4, and use them consistently with those stated in text.
11. Figure 1: top and bottom panel do not have the same upper y-axis limit
12. Could you briefly comment on the net negative daytime TOA CRF cooling effect for the thinnest cirrus clouds as observed in Campbell et al. 2016? Why you do not/cannot see that from your dataset?

References:

Corti and Peter, 2009: A simple model for cloud radiative forcing

Bourgeois et al., 2016: Ubiquity and impact of thin mid-level clouds in the tropics

Kienast-Sjörgren et al., 2016: Climatological and radiative properties of midlatitude cirrus clouds derived by automatic evaluation of lidar measurements

Campbell et al., 2016: Daytime Cirrus Cloud Top-of-the-Atmosphere Radiative Forcing Properties at a Midlatitude Site and Their Global Consequences