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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Potential impact of carbonaceous aerosols on the Upper Troposphere and Lower Stratosphere (UTLS) during Asian summer monsoon in a global model simulation" *by* Suvarna Fadnavis et al.

Anonymous Referee #1

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Fadnavis et al. studies the regional impact of carbonaceous aerosol in ASM region by doubling the Asian carbonaceous emissions. In general the topic is interesting and important. However I think the paper may overstate some of the significance and some information are missing/incomplete.

General comments:

1. I am a little bit confused here. The title suggested the paper is going to focus on UTLS region. Reading through the paper, I found little evidence from ECHAM6-HAM model supports a sounding impact of carbonaceous aerosols on UTLS. This study

shows a heating rate of +0.003-0.005K/day (Line 434) due to carbonaceous aerosols near the tropopause, and it is only 1 to 2% of total atmospheric heating rate (∼0.2 to 0.5 K/day). What is the uncertainness of the atmospheric heating rates at the UTLS? Gettelman et al. (2004, Figure 4) suggests that the uncertainties from different radiative transfer models is on the order of +-0.1 k/day, and spatial/temporal distribution of water, ozone, aerosol will add more uncertainties. Is the +0.003-0.005 K/day due to carbonaceous near the UTLS significant enough given the relative large uncertainties.

2. Paper shows one profile BC comparison with balloon sounding. It is hard to tell the concentration from the Figure in linear scale. Maybe a log scale is better for UTLS. In addition, it is necessary to show more model's validations of BC's vertical profile especially in UT since the conclusion relies heavily on modeled BC vertical profile. I know there is a SP2 campaign over Japan up to 9/10 km. You mentioned CARIBIC aerosols, how does your model simulation compared with CARIBIC data?

3. How you treat OC and BC? How much contribution comes from OC and BC separately?

4. Paper shows a warming core above TP, and a large temperature anomaly of 3K (Figure 4f) due to carbonaceous aerosol increase. I wonder is the 3K due to aerosol directly or water (through change in dynamics) or just model noise? The feature (spatial pattern) of 3K temperature anomaly in Figure 4f is different/inconsistent with heating rate/aerosol anomaly in Figure 4(b, d). In addition, your calculated heating rate due to aerosol (Figure 4d) shows some value less than 0.003 K/day, (very difficult to tell from the color scale) above 500 mb, while your 3K feature in Figure 4f is located at regions between 500 and 200 mb. Seems the heating rate (0.003 K/day) is too small to achieve a temperature difference of 3K.

5. Paper mentioned 2.6 W/m2 for the total forcing in Line

Some other suggestions:

a. Figure color scale is hard to tell

b. Line 302, explain why your forcing (+2.7 W/m2) is quite different from other studies from Babu (2002) for +28 W/m2, and Badarinatha and Latha (2006) +42 W/m2. Is that because of different spatial sampling? Please justify.

c. When you show how much vertical velocity or water vapor etc change with your experiment, please also provide % change.

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