Replies to Co-Editor's comments

We thank Co-Editor for careful reading and suggestions. We have incorporated all the suggestions given by the Co-Editor. Changes are marked in red colour and corresponding line numbers are indicated below.

(1). I am still not convinced by the discussion on the temperature anomalycore in figure 4f.

The authors do not show sufficient discussion. Simple sentence in the paper"This warm core extends to mid-high latitudes. It is related to BC emissionfrom regions of China, Mongolia, Russia" is not sufficient. I don't see anyaerosol enhancement that is consistent with this feature in mid-highlatitude. Please investigate more on the cause, how black carbon leads tothe warming pattern and how robust it is.

Reply(1): Thank you for the suggestion. For our sensitivity simulations, we have increased both BC and OC over the South East Asian region (10°S - 50°N; 65°E - 155°E). This region includes China, Mongolia, and Russia etc. There is transport from these countries to the upper troposphere. We have provided a supplementary figure (Fig. S4) showing transport of black carbon, from regions of China, Mongolia, and southern Russia, from surface to 200 hPa, extending to mid-latitudes.

To show warming over the Tibetan plateau due to enhanced carbonaceous aerosols, we have shown latitude-pressure cross section (80°E -110°E) in figure 4f. This figure also shows wariming over 40-48°N from surface to ~200 hPa. This warming is related to upward and northward transport of BC from China, Mongolia, and southern Russia to mid latitudes as shown in supplementary figure (Fig. S4). Figure 8b shows negative water vapour anomalies in the same region. In the UTLS water vapour causes cooling and thus a decreased radiative cooling, this might have partially contributed towards the warming. It is now mentioned in the revised manuscript (Page 17-18, line Nos.378-383).

We have tried to plot BC distribution from CTRL simulations and BC anomalies from DBConly-CTRL simulations (Figure 1a-b shown below). Figure 1a shows upward and northward transport from regions of China, Mongolia, and southern Russia to the mid-latitude upper troposphere. However, this transport is not very clear near 350-200 hPa in DBConly-CTRL since differences are not linear along the path way. This may be due to non-linear heating due to doubling of BC. Hence we have shown figure 1a as supplementary figure S4.

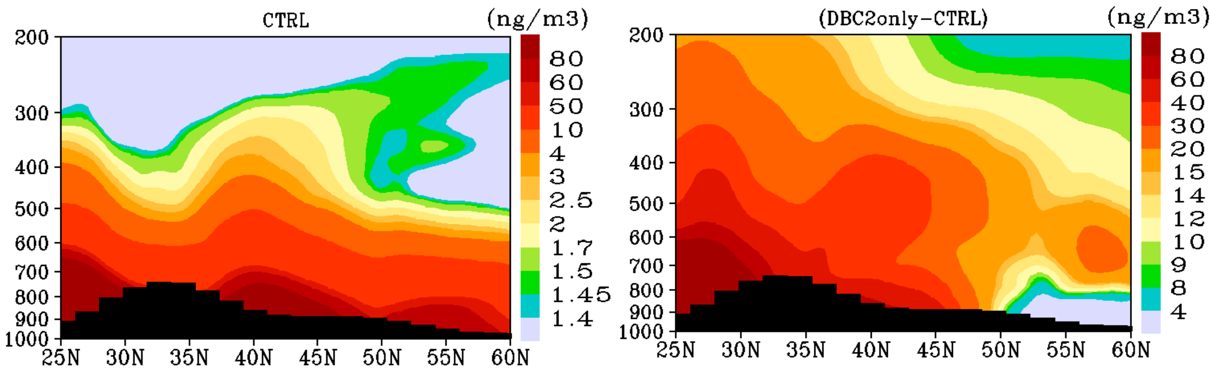

Figure 1: Latitude pressure cross section averaged for (80°E -110°E) and for the monsoon season for (a) BC aerosols (ng m^{-3}) from CTRL simulations and (b) anomalies of BC aerosols (ng m^{-3}) from DBConly-CTRL simulations.

(2). Abstract: “This increases precipitation amounts over India and northeast China.” By how much? Confidence level?

Reply(2): Thank you for the suggestion. The quantitative estimates are now provided in the abstract and confidence level is also mentioned (Page 2, line Nos.29-30).

(3). Abstract: “Doubling of emissions of BC and OC aerosols, each, over theSouth East Asia (10°S - 50°N; 65°E - 155°E) show that lofted aerosolsenhance radiative heating rates (0.02-0.03 K/day) near the tropopause,produce significant warming (1K), and instability in the mid/uppertroposphere.” Warming of 1K? where (lat, lon, tropopause?)? I see 0.5-1Kwarming 0-10N tropopause, is it what you claimed here? How robust is it?

Reply(3): As suggested above sentence is re-written (Page 1, line No. 20). We have shown 99% confidence levels in most the figures (Figs. 4 - 8). This indicates that the results are robust.