Interactive comment on “Modeling global radiative effect of brown carbon: A larger heating source in the tropical free troposphere than black carbon” by Aoxing Zhang et al.

Aoxing Zhang et al.
azhang76@gatech.edu

Received and published: 30 July 2019

Dear Dr. Taylor,

Thank you for your helpful questions and comments.

1. The BC MAE values used in this study are 10 and 8.1 m2/g for 345-442 nm and 442-625 nm, respectively (Knox et al., 2009; Bond and Bergstrom, 2006). We will add this information in the revision.

2. We don’t have a solid physical explanation about BrC convective transports, but observations in SEAC4RS and DC-3 clearly show evidence for the process. There are some mechanisms related to the further transport of BrC. Zhang et al. (2017) showed BrC relative to BC enhancements for smoke plumes undergoing convection and suggested that in-cloud heterogeneous processing may produce BrC. Browne et al. (2019) also suggested that a fraction of BrC produced from heterogeneous oxidation by ozone is free from the bleaching effect and BrC produced from heterogeneous oxidation of OH has a longer lifetime. In addition, hydrophobic OC, such as humic-like substances (HULIS), is more likely to have high light-absorption compared to hydrophilic OC (Hoffer et al., 2006). BrC with high molecular weight dominates the aged biomass burning plume (Wong et al., 2017, Wong et al., 2019). Since higher molecular weight compounds have weaker hygroscopicity (Dinar et al., 2007), and it is harder to activate hydrophobic OC in cloud, less BrC is removed in deep convection.

We simulated that BrC DRE can be larger than BC DRE over strong deep convection regions such as the remote tropics. We expect this to be a real feature, and future measurements over the remote tropics will provide some evidence about the remote upper troposphere BrC.

3. Table. 2 in the manuscript describes the differences among the sensitivity runs (NCNB, ICNB, NCB, ICBB, ICB).

References


Geophysical Research: Atmospheres, 112(D5).


