

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-618

Anonymous Referee #2

Referee comment on "Impacts of biomass burning and photochemical processing on the light absorption of brown carbon in the southeastern Tibetan Plateau" by Jie Tian et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-618-RC2>, 2022

General comments:

This manuscript presents a comprehensive analysis of light-absorbing aerosols, especially organic aerosol, in the southeastern margin of Tibetan Plateau during the pre-monsoon season. Authors found light absorption of BrC was mainly contributed by biomass burning and secondary formation. Furthermore, radiative effect of BrC was found to be non-negligible compared to that of BC. Generally, in view of the concern about the melting of plateau glaciers caused by global warming, it is of great significance to evaluate the optical properties, sources and formation processes of BrC in the TP. The results of this study provide valuable dataset and analysis to illustrate the importance of BrC on climate change in the TP, which will be helpful in model simulation of radiative effect of aerosols. Overall, this manuscript is well written and results are interesting with novelty. I recommend this manuscript should be accepted for publication after addressing the following issues.

Major comments:

- In this study, the mass spectra of po-OOA were characterized by high m/z 44 and low m/z 43. This indicated po-OOA was more-oxidized, which was similar to MO-OOA identified in AMS and ACSM studies. Generally, MO-OOA has lower MAC compared to primary OA due to photo-bleaching effect; however, in this study the estimated MAC of po-OOA was larger than that of BBOA. Could the authors explain it? On the other hand, I suggest authors could conduct the tests of collinearity and heteroscedasticity of independent variables considering the good correlation between BBOA and po-OOA, and this would guarantee the accuracy of multiple linear regression as shown in Eq. 5.

- The amount of solar energy absorbed by BrC relative to BC ($f_{\text{BrC/BC}}$) was used to evaluate the radiative effect of BrC. In this study, the $f_{\text{BrC/BC}}$ was calculated by “simple forcing efficiency” and mass concentration. In fact, there are many studies have been conducted by $f_{\text{BrC/BC}}$ calculation according to the method reported by Kirillova et al. (2014, JGR-A). Have the authors compared these two approaches? Furthermore, the uncertainties of $f_{\text{BrC/BC}}$ need to be discussed. The uncertainties can be caused by e.g., the errors of assumption parameter, MAC and mass concentration.

- From the results of this study, biomass burning emission and photochemical reactions both contributed to the formation of BrC. Since the intense photochemical environment is an inherent feature of the TP, it is difficult to control the photochemical production of BrC. Thus, effective control measures are to reduce the anthropogenic emissions of biomass burning. The authors should add some discussions at the end of the results to imply the significance of this work.

Specific Comments:

Line 12: Replace "as well as" with “compared to”.

Line 25: Replace “BrC from biomass burning emissions” with “BrC of biomass burning origin”.

Line 38-39: Add citation to the statement of “In particular, the atmospheric heating of BrC is greater than that of BC in the tropical mid and upper troposphere.”.

Line 66-67: Replace “plateau” with “TP”. Full name of TP is already mentioned in Line 56.

Line 182: Check the publication year of Draxler and Hess.

Line 216: Please consider to put Fig. S1 in the main figures of manuscript. Fig. S1 indicates the periods of high concentrations and b_{abs} that later discussed in this manuscript.

Line 256: Replace "as well as" with "similar to".

Line 261: Replace "affect most" with "strongly affect".

Line 283: How the $rb_{\text{abs-BrC}}$ was calculated? Is it reconstructed from the b_{abs} of BBOA and po-OOA? Have the authors compared the $rb_{\text{abs-BrC}}$ with the calculated $b_{\text{abs-BrC}}$ from Eq. 2?