

Reply to the editor's comments

Black text: editor's comments

Red text: our replies and modified parts

Public justification (visible to the public if the article is accepted and published):

Dear authors,

thank you for considering the remaining outstanding issues in your revised manuscript, which I have now accepted for publication subject to technical corrections.

Reply:

We, the authors, would like to thank the editor for his cooperation and judgement. We checked and corrected our manuscript accordingly. Please check if our collections are in line with the points.

Required corrections:

- Please make all figure and table caption self explanatory. They should clearly indicate the data displayed or reproduced and fully understandable without having to find the corresponding section in the main text.

Reply:

We modified our manuscript as suggested by the editor. Additionally, we corrected four points in the sentence as shown below. Please check.

In manuscript:

L150: "VIIR" changed to "VIIRS" .

L161: "hot spots" changed to "hot spots (points)".

L162: "spot number" changed to "points".

L346: "abias" changed to "a bias".

Additionally, with the caption corrections, "high BC mass concentration cases" in the text has been changed to "cases of high BC mass concentrations."

Captions:

Figure 1. A map that shows the location of the PFRR and other sites compared in Section 3.2 (Trapper Creek, Denali, and Toolik Lake Field Station). All hot spots

(larger than 0.3 MW in FRP) observed in the USA and Canada by VIIRS between 2016 and 2020 are shown in red colour.

Figure 2. Time series of (a) BC mass concentration and (b) CO mixing ratio observed at the PFRR from April 2016 to December 2020. Grey lines, blue filled circles, and red filled triangles in both (a) and (b) show hourly, daily, and monthly averages, respectively.

Table 2. Summary of locations for observation sites and the BC mass concentrations in the interior Alaska.

(footnotes)

^a Data were selected for the periods that all locations are available.

^b Observations started on 13 November 2018.

^c TRCR; Trapper Creek.

^d DENA; Denali.

^e TOOL; Toolik Lake Field Station.

^f Period of data used: 13 November 2018 – 2 December 2020.

Figure 3. Time series of (a) BC mass concentrations, (b) attribution of BC at the PFRR to source regions, and (c) to source sectors. Black open circles and red open triangles in (a) show the 6-hour average observations and 6-hourly simulations, respectively. Individual colour bars in (b) and (c) depict the estimated contributions from the source regions and sectors, respectively. The FLEXPART-WRF model was used for all simulations.

Figure 4. (a) Histogram of the observed hourly BC/ Δ CO ratio at the PFRR in cases of high BC mass concentrations (>98 percentile). Histograms of the simulated 6-hourly (b) fractions of BC mass concentrations from biomass burning to the total BC and (c) mean age of BC estimated by the FLEXPART-WRF model. Black and red bars in (b) and (c) show the cases of high BC mass concentrations and the other cases (<98 percentile), respectively.

Figure 5. A time series of the 6-hourly BC mass concentrations at the PFRR simulated by the FLEXPART-WRF model. Light grey bars show the total BC mass concentrations. Other individual colour bars (overlaid on the light grey bars) show the BC mass concentrations for biomass burning from each source region.

Figure 6. The scatter plot (black filled circles) between the hourly BC/ Δ CO ratio observed at the PFRR and the \sum FRP/point values in cases of high BC concentrations (>98 percentile). Data from June to September were analyzed. The \sum FRP/point values are the average FRP of the hot spots (points) present along the backward trajectories from the PFRR (see section 2.4). A red line indicates the result of a linear regression fit.