

Jan04, 2017

Dear editor,

Thank you very much for your time and efforts regarding our manuscript (*tc-2017-111: Black carbon and mineral dust in snow cover on the Tibetan Plateau*). We have carefully revised the manuscript according to the comments. Detailed responses are in blue in the main text. We also included the revised version below with changes shown in blue. We hope that you find the revisions appropriate and adequate.

Yours sincerely,

Yulan ZHANG and Shichang KANG

Grammar or missing information:

1. Page 5 line 5: should read “density was measuring by weighing a specific volume of snow”

Answer: We have changed in the main text.

2. Page 6 line 31: “dose nor included biofuel use and trash burning” should read “does not include biofuel use or trash burning”

Answer: Done

3. Page 12 line 23: Remove “as these”

Answer: Done

4. Page 12 line 24-25: Replace sentence beginning with “However” with “It is difficult to sample during the ablation season due to poor accessibility” or some other grammatically correct sentence.

Answer: Done

5. Page 12 line 25-26: Is this true for all seasons or a specific season? Indicate which season(s).

Answer: In the study by Xu et al. (2017), the sentence “considerable heterogeneity in the topography and climate has led to complex spatial and temporal snow cover patterns” means for all seasons. Their results show a very weak negative trend for the snow depth and the number of snow-cover days in spring and winter from 1961 to 2010, but two different trends were found: an initial increase followed by a decrease; In summer and autumn, snow depth and the number of snow-cover days show a significant decreasing trend for most sites.

Here in our study, we want to indicate the snow cover across the Tibetan Plateau may be discontinuous during ablation season.

6. Page 12 lines 26-27: I think you mean “Discontinuous”, not “Discontinued”. Put “the” before “melting”. Replace “be a problem” with “also make it difficult”

Answer: Done

7. Page 12 lines 27-28: Remove this sentence. It doesn't make sense and it seems unnecessary.

Answer: Done

8. Page 12 line 31: Replace "tended to mix" with "is mixed"

Answer: Done

Responses:

1. My comment starting with "Page 7 lines 24-28". This paragraph should be added to the manuscript. Replace "consider" with "considered" and remove the last sentence.

[Comment: Page 7 lines 24-28: The lines in blue do not answer the reviewer's question. Did you assume uniform BC throughout the snow depth? It looks like that is the only option in the inputs. If so, what sort of error does this represent?]

Answer: From Flanner et al (2007, 2009)'s study and personal communication with Prof. Flanner, the SNICAR model online is only a single snow layer, so the BC concentration is necessarily uniform with depth. With the model code, and in the CLM model, however, multiple model layers are specified and hence vertically-heterogeneous BC concentrations can be specified or simulated. In this study, we assumed uniform BC throughout the snow depth. The error in not doing so depends entirely on the environmental conditions. In conditions of strong melt where hydrophobic impurities accumulated near the top, the concentrations can vary strongly with depth.

We have revised in the main text (Page7 Line29-32, and Page8, Line1-3).

References:

Flanner, M. G., Zender, C. S., Hess, P. G., Mahowald, N. M., Painter, T. H., Ramanathan, V., Rasch, P. J.: Springtime warming and reduced snow cover from carbonaceous particles, *Atmos. Chem. Phys.*, 9, 2481–2497, 2009.

Flanner, M. G., Zender, C. S., Randerson, J. T., Rasch, P. J.: Present-day climate forcing and response from black carbon in snow. *J. Geophys. Res.*, 112, D11202, 2007.

2. My comment starting with Page 8 line 8: I don't see any references on page 8 line 14.

[Comment: Page 8 line 8: Is the observed snow depth based on previous studies? If so reference them here.]

Answer: The observed snow depth used were from this study (supplementary Table S1) and previous studies (Che et al., 2012; Xu et al., 2017; Zhong et al., 2016). We have added the related references in the main text.

References:

Che, T., Dai, L., Wang, J., Zhao, K., Liu, Q.: Estimation of snow depth and snow water equivalent distribution using airborne microwave radiometry in the Binggou Watershed, the uppe reaches of the Heihe River basin, *Int. J. Appl. Earth Obs. Info.*, 17, 23–32, doi:10.1016/j.jag.2011.10.014, 2012.

Xu, W., Ma, L., Ma, M., Zhang, H., Yuan, W.: Spatial-Temporal variability of snow cover and depth in the Qinghai-Tibetan Plateau, *J. Clim.*, 30, 1521–1533, doi:10.1175/JCLI-D-15-0732.1, 2017.

Zhong, X., Zhang, T., Zheng, L., Hu, Y., Wang, H., Kang, S.: Spatiotemporal variability of snow depth across the Eurasian continent from 1966-2012. *Cryosphere Diss.*, doi:5194/tc-2016-182, 2016.

3. My comment starting with Page 9 line 20: I understood that half meant 50%. My question was how did you determine these percentages (50, 30, and 70%)?

Answer: I am so sorry for the misunderstanding. So shown in the Figure 5 in the main text, we calculated the different biomass contributions to the target site for different hours before they arrived at the site (Table R1). Considering the impact of air mass transportation, we calculated the average contributions based on 0, -24, and -48 hrs.

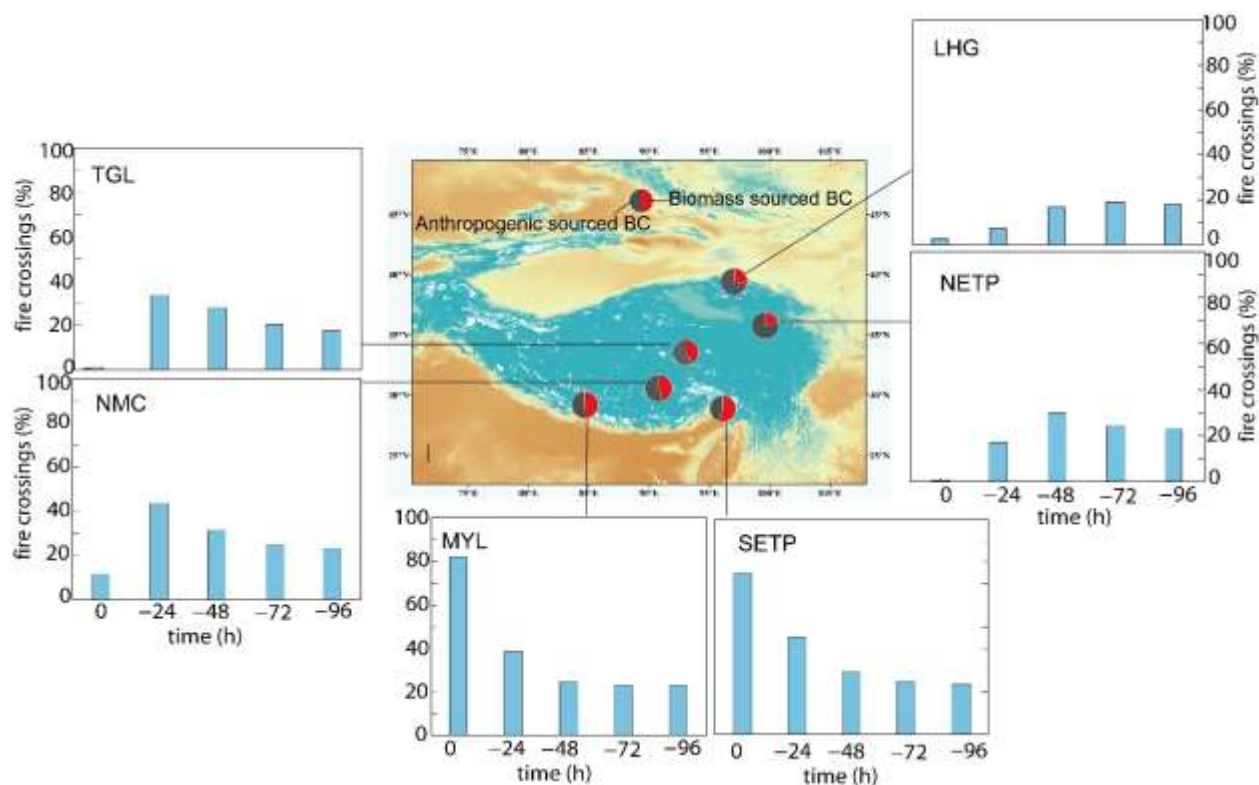


Fig. 5 Different source contributions to BC deposition on the snow cover across the Tibetan Plateau.

Table S1 Biomass contributions (%) of BC deposition to the target sites over the Tibetan Plateau.

Time (h)	MYL	SETP	NMC	TGL	NETP	LHG
0	83%	78%	17%	3%	2%	3%
-24	40%	50%	43%	37%	19%	18%
-48	27%	37%	33%	32%	32%	20%
Average contributions of biomass burning	50%	55%	31%	24%	18%	14%