

## ***Interactive comment on “Concentration, temporal variation and sources of black carbon in the Mount Everest region retrieved by real-time observation and simulation” by Xintong Chen et al.***

### **Anonymous Referee #2**

Received and published: 18 April 2018

The authors conducted a detailed analysis of the BC concentration measurements at the Qomolangma station. The measurement, with a high temporal resolution and a relatively long period, provides very valuable information for the understanding of BC sources and transport to the Himalayas. The authors further combined observations with model simulations to investigate the BC transport mechanism. The analysis is comprehensive and the manuscript is generally well written. Before it can be considered for publication, I have a few comments and suggestions.

1. Section 2.2: Since different measurement methods may lead to quite different BC or EC concentrations, I suggest adding some discussions in this section on the possible

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difference in measured BC concentrations between the AE-33 used in this study and some widely-used methods from previous studies (e.g., thermal-optics method, SP2, etc.).

2. Section 3.4: The authors did a detailed analysis on possible BC sources and transport mechanisms for four pollution events, which is great. However, the evaluation of WRF-Chem model simulation seems missing here. Without knowing the model performance, it is difficult to be convinced by the source and transport analysis of model results. At least, the authors could compare modeled BC concentrations at this site with their observations. If possible, the modeled wind and precipitation can be also evaluated against some reanalysis or satellite products. If this takes too much time, the authors could also cite and discuss some previous studies where the WRF-Chem simulations have been evaluated in the TP and surrounding regions.

3. Line 15: "... concentrations were significantly greater from mid-night to noon. . ." This sentence is a little confusing. Do you mean "concentrations increased from mid-night to noon"?

4. Line 16: "... , implying the potential contribution from the long-range transport." It is not very straightforward for readers to understand why such diurnal variation implies the contribution from the long-range transport. Could you please rephrase the sentence and clarify the point?

5. Line 40: For the authors' information, a recent study (Lee et al., 2017) investigated BC deposition effects on reducing snow albedo over the Tibetan plateau based on satellite observation analysis. This study can be cited here.

Lee, W. L., et al. (2017): Impact of absorbing aerosol deposition on snow albedo reduction over the southern Tibetan plateau based on satellite observations, *Theor. Appl. Climatol.*, 129, 1373-1382, doi:10.1007/s00704-016-1860-4

6. Line 57: For the authors' information, a recent study (He et al., 2014b) has also

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used a global CTM to investigate the sources of BC over the Tibetan Plateau based on a tag-tracer technique, which can be cited here.

He, C., et al. (2014b): Black Carbon Radiative Forcing over the Tibetan Plateau. *Geophys. Res. Lett.*, 41, 7806–7813, doi:10.1002/2014GL062191

7. Lines 102–112: It would be more informative if the authors could provide the uncertainty/accuracy associated with this algorithm for BC concentration calculation.

8. Section 2.3 “Model simulation”: A number of studies (e.g., Flanner et al., 2007; Liou et al., 2014; He et al., 2017) have shown significant effects from BC in snow on albedo simulations. This albedo effect and feedback may exert an important impact on model simulations. Did the authors include such “dirty snow” effect in the WRF-Chem simulations? I suggest adding a brief discussion on this issue.

Flanner, M. G., et al. (2007), Present-day climate forcing and response from black carbon in snow, *J. Geophys. Res.*, 112, D11202, doi:10.1029/2006JD008003

He, C., et al. (2017): Impact of Snow Grain Shape and Black Carbon-Snow Internal Mixing on Snow Optical Properties: Parameterizations for climate models, *J. Climate*, 30(24), 10019-10036, doi:10.1175/JCLI-D-17-0300.1

Liou, K. N., et al. (2014), Stochastic parameterization for light absorption by internally mixed BC/dust in snow grains for application to climate models, *J. Geophys. Res.-Atmos.*, 119, 7616–7632, doi:10.1002/2014JD021665

9. Line 183: “. . ., which might be owing to the surrounding local emissions.” Is there any reference/observation showing surrounding emissions? Is there any populated city or town around the observational site? More information would better convince readers.

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