

Interactive comment on “Black carbon variability since preindustrial times in Eastern part of Europe reconstructed from Mt Elbrus, Caucasus ice cores” by Saehee Lim et al.

Anonymous Referee #2

Received and published: 18 October 2016

This paper shows the rBC concentration profile retrieved from a long ice core and a shallow core drilled on Mt. Elbrus, Caucasus, covering the period 1825-2013. This rBC profile has, by far, the highest temporal resolution compared to the OC and EC profiles obtained from ice cores from the Western European Alps (Col du Dome, Colle Gnifetti and Fiescherhorn). The author compares the rBC profiles with the atmospheric BC load at the drilling site computed with the FLEXPART lagrangian particle dispersion model: the available European BC emission inventories and the BC potential sources areas are used to compute the estimated BC load. BC emissions from the Eastern Europe appeared to be the main source of BC for Mt. Elbrus. The differences between the measured BC profile and the estimated atmospheric load are suggested to be caused

C1

by an underestimation of the real emissions in the inventories; therefore, the author suggests that the retrieved rBC profile may be used as a new valuable constrain for the past Eastern European emission inventories. Mid-latitude ice cores are extraordinary environmental and climatic archives and this work represents a great step forward in the past atmospheric aerosols' reconstructions. The structure of the paper is clear and the modeling efforts contribute to the interpretation of the ice core based rBC profile. This paper is really well done and the argument is in accordance with the aim of the ACP Journal, therefore I suggest publishing it.

I have two comments, which the author might want to consider:

1) I agree with the comment of Referee #1 about the summer/winter layers subdivisions. If possible, I will recommend reinforcing the rBC-based annual layers determination with some other seasonally varying parameters, such as water stable isotopes, thus being in agreement with the other paper about the Elbrus ice core (Kozachek et al., CPD 2016).

2) I have found the rBC particles' MMD time series and the related interpretation very interesting and promising. I agree with all the interpretations but, however, the seasonality is not clear since the 1960s; particularly, during the 1980s the winter MMDs are even larger than the summer ones. I don't think that the difference between summer and winter is statistically significant in the period 1960-2010, can you please add some comments and interpretations about that? Or at least describe the MMD time series more in details.

Minor comments:

Line 37: it's better to write: “to be transported” instead of “to transport”.

Line 38: “In high-altitude or –latitude areas ”: missing word?

Line 39: “that may accelerate”: it's better to write, “in accelerating”.

Line 47: “proximity”: how much? It's better to specify for the sake of clarity.

C2

Line 50: please add a phrase regarding the BC/EC relation and write that there aren't other rBC records in this region.

Line 102: "Nd YAG laser": please write "Nd:YAG laser", with colon.

Line 123: "single rBC", I will add "particle".

Line 198: you may want to underline that the procedure is the same as for the entire atmospheric column.

Line 228: try to be clearer, e.g. "The highest rBC mass concentrations were observed..."

Line 236: substitute "consistent to..." with "consistent with..."

Line 259: if you write and compare the absolute values for the EC with your rBC analyses it will be better to write something about the conversion factor also in this part of the paper, or at least specify "how" to compare the values explicitly.

Line 293: please clarify why dry deposition is not playing a significant role in the rBC particles diameter changing.

Line 295: should surface snow melting modify the rBC size distribution? Explain and add references.

Line 332: can you exclude the surface snow melting effect in increasing the rBC MMD in the 2003 summer layer? Please explain.

Line 386: "BC depositing to snow": "BC depositing ON snow".

Line 462: "as new a proxy": write "as a new proxy".

For what concern the figures I would personally prefer having the deepest and the oldest parts always on the right or on the left (but this is up to you).

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-804, 2016.

C3