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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiocarbon analysis in an Alpine ice core: record of anthropogenic and biogenic contributions to carbonaceous aerosols in the past (1650–1940)" *by* T. M. Jenk et al.

T. M. Jenk et al.

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First of all we thank the reviewer for the careful reading of our manuscript. The critical comments provided were helpful to improve our manuscript and clarify some specific aspects.

R. This is a useful paper that contributes to the databank concerning elemental and organic carbon concentrations. An additional feature of the paper is a partition of carbon into biogenic and fossil fuel burning components. It looks that trying to explain each minor feature of the data carried the authors away. With a few measurements available often any single feature depends on one measurement and thus may be the results of an error in procedure, contamination during the process, or as you say "the presence

of mineral dust". The results should be accepted as an input into the global data bank without a need to explain each minor feature; with the future increase of data points in global, regional and local carbon inventory the significance of individual measurements will be judged in the future.

A. We do not agree with the reviewer that we should just present a data set without a lot of discussion. We agree that single measurements may be affected by errors in the procedure or contamination during process. However, because we present in this study a new technique which was applied for the first time on ice samples, we think a careful discussion is essential. Nevertheless, we realized that the discussion of mineral dust influence received too much attention and therefore the according section will be condensed and changed. We will add tables for OC and EC summarizing our results.

Specific Comments:

R. p. 5906 Please don't claim "We present a first long-term record ...". The following should be sufficient "We present a long-term record ...".

A. To our knowledge this is the first ice core record allowing an apportionment of OC and EC into biogenic and fossil fuel burning components.

R. p. 5907 When you discuss which aerosol will warm or cool it would be nice to give credit to the original paper that attacked the problem (Science 183, 75-77, 1974).

A. Thank you for the comment, the according reference will be included.

R. p. 5911 Multiplying the results by a factor of 2 looks suspicious. The need of that should be more clearly explained. Can the loss of carbon and the need of multiplication be prevented?

A. A thermal method as it was applied in our study is commonly used for the analysis of OC and EC concentration. However, our focus was not the concentration analysis, but on the determination of the 14C/12C ratio. Already very small amounts of remaining OC could result in a large artefact of the EC 14C/12C ratio. A complete separation

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of OC was therefore necessary and for this we had to perform an additional thermal elimination step of OC (4 h at 375°C), which unfortunately resulted in a loss of EC. Using several aerosol samples from different locations we determined the amount of lost/not measurable EC (factor 2). This is the best we could achieve and resulted in the given high uncertainties for the EC concentrations. We will change the text accordingly to clarify this fact.

R. p. 5914 The average error of 4% and 18% for OC and EC seems to be quite low. Is this a total error or just repeatability of the procedure?

A. What is exactly meant by "total error"? The error of the individual samples was propagated by consideration of the uncertainties of the applied devices and the applied blank correction. The reproducibility was tested and was within this error. The errors of the individual samples for OC and EC were in the range 2-29% and 15-84%, respectively. The lowermost sample had the highest error for OC and EC (about a factor 5 higher than the rest, see error bars in Fig. 2). The given error of 4% and 18% for OC and EC is the average of the errors of the individual samples.

R. p. 5914, 5916, 5917 Blaming the Sahara dust seems suspicious. Did you detect some brownish spots on filters after heating them to 650 deg C? If not, the dust should not be blamed and there might be some other reason for disagreement. I don't think it is fair to blame an unknown amount of dust for each point of the data that does not agree with your expectation.

A. As mentioned above, we realized that the discussion of mineral dust influence received too much attention and therefore the according section will be condensed and changed.

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