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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.

Anonymous Referee #2

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General comments ==========

The paper addresses a topic (organic aerosols, their sources) is of the highest relevance, since their climatic forcing is a major source of uncertainty in climate modelling. Many related papers have been published in ACP. The use of sub-tropic glaciers as an archive of past aerosols is a promising new method. By pushing the limits of radiocarbon determination with AMS towards lower sample sizes, the authors have for the first time obtained a record covering the industrial era, with a reasonable time-resolution.

The authors present a thorough interpretation, and also freely discuss the shortcomings, which naturally occur for this first series: limits in resolution and precision, and

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gaps in the data. Thus, the interpretation must remain partly vague, still it is valuable, since it might guide the interpretation of future measurements. After identification of local events, the trends in the data are in reasonable agreement with expectations. The paper convinces the reader that the method is suitable to investigate historic aerosols. A major finding which does not agree with expectations is why EC does not approach fM = 1 for samples before 1800. Future investigations will show whether this is related to a methodical problem or whether this is a surprising property of natural EC aerosol.

A disadvantage for the understanding is that the technical description, in a complementary publication submitted to Nuclear Instruments and Methods in in Phys. Res. B, is not yet available. This is, however, not the fault of the authors or the present paper.

The paper is well structured and clear. The authors have compiled a comprehensive bibliography, which is valuable by itself.

A table of the 33 samples showing total mass, OC/EC concentrations, fM, and delta13C should be added, maybe in the supporting online material.

Considering the scientific potential, I expect that this is only the first such record of a whole series.

Specific comments ==========

* Abstract, line 16: "Before 1800, OC was of pure biogenic origin...": I do not understand why the number 1800 is given. Figure 3 suggests a biogenic origin till year 1870.

* Abstract, line 17: "21+/-2 μg/kgˆ-1": The error of the mean provides little information. The standard deviation should be given, since the variability is a relevant climatic information: " 21 μg/kgˆ-1 with a standard deviation of ? ..."

* Abstract, line 20: Why do you show especially mention 1940? This year is rather untypical, since it has the highest EC and 2nd highest OC in the whole record.

* Page 5912, line 5: for what amount of ice are these process blanks valid? The blank

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will probably depend on that.

* Page 5912, line 22: The formula pMC = fM * 100 is either wrong, or fM is used in the paper different from this definition. As far as I understand, fM in the paper indicates the 14C content of a sample relative to the 14C content of a purely biogenic sample from the same year. Thus, fM is both normalized to the calibration curve, and corrected for decay. If I'm right, "... and can easily ...Polach (1977)" should be deleted.

* Page 5914, line 11: "EC and OC ar nor correlated": If I judge this statement from Figure 2 by eye, I think that there is a correlation between EC and OC. If a statistical analysis shows that this impression is not true, the result of the statistical analysis should be given.

* Page 5914, line 12: "... concentration trend obvious for EC.": In this case I see no "obvious" trend in Figure 2. The trend is only detectable considering the following discussion (there, the higher values are attributed to mineral dust events). The word "obvious" should be omitted.

* Page 5915, line 6: "A significant contribution of anthropogenic (fossil) sources after around 1870 can be clearly identified in both fractions...": for me, this is only clear for OC in Figure 3. In EC, the small number of points with large uncertainties do not justify the attribute "clearly".

* Page 5915, line 6: see Abstract, line 16.

* Page 5916, line 19: Quite a few samples seem affected! The authors should comment how many samples affected and unaffected by Sahara dust exist.

* Page 5918, line 8: "No correlation between OCb and ECb was found. This seems reasonable ..". I do not understand the argument. There should be a partial correlation since biomass burning contributes to both OCb and ECb?

* Page 5918, line 12: What is the "natural background level" and how was it determined?

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* Page 5918, line 16: "The OCf peak in the 1840s can be assumed as an artefact derived from the very high OC concentration in the according sample." - So you mean this increased OCf is not real? This would suggest a cross-talk OCb -> OCf !? Please explain how this can happen (maybe in the methodical section).

* Page 5919, line 4: I had difficulties to undertand this sentence. What I understand is: "For the OC/EC ratio we observe a base line value of 1.5 +/- 0.3 (1 sigma). This value is significantly higher in the 1670s ...". Is this true?

* Page 5920, line 1: "The decreased consumption of fossil fuels during the 1920s due to the world economic crisis is clearly visible in ECf, ...": Formulated like that, this is in contradiction to the next sentence. Probably you mean: "At the time of decreased consumption of fossil fuels during the 1920s due to the world economic crisis, a decrease is clearly visible in ECf., whereas ... ".

* Table 1: From where is the "natural background" taken?

* Table 1: See Abstract, line 20: Why do you show especially year 1940?

Technical corrections ==========

* Abstract, line 4: "in the past": should be more specific to indicate the time range. e.g. "before 19??"

* Abstract, line 7: The first part of the sentence "The combination of ... CP allows .." repeats the statement of the previous sentence. Should be modified e.g. "This allows a distinction and quantification ..."

* Introduction, line 8: explanatory insert "... negative aerosol forcing (cooling) ..." suggested.

* Page 5908, line 14: "effect on" ? "response to" ?

* Page 5910, Footnote: why is this a footnote, and not a Reference? - However, this might be ACP style for yet unpublished manuscripts.

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* Page 5913, line 12: Replace "Failure" by "The failure rate".

* Page 5914, line 26: "... concentrations were measured significantly higher ..." means for me that the concentrations were not actually higher, but just measured higher. The authors probably mean "... concentrations measured were significantly higher ..."

* Page 5922, line 32: paper Lavanchy et al. 1999b is not referenced in the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5905, 2006.

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