Response to Interactive comment on "Application of the ECT9 protocol for radiocarbon-based source apportionment of carbonaceous aerosols"

By Anonymous **Reviewer #2** (*Received and published: 18 November 2020*)

We thank the editor for coordinating the review and the reviewer for the constructive feedback. Here, we answer the questions and address the concerns raised by the reviewer#2 point by point in the format of "reviewer's comments/ author's responses".

1. Does the paper address relevant scientific questions within the scope of AMT?
   The manuscript fits perfectly within the scope of the journal Atmospheric Measurement Technique. It proposes the use of ECT9 protocol to separate OC and EC for radiocarbon analysis. Tis protocol is normally used for concentration and stable isotope measurement on OC and EC fractions, but this time the application is extended for ^{14}C based source apportionment of carbonaceous aerosols.
2. Does the paper present novel concepts, ideas, tools, or data?
   The manuscript proposes the use of the ECT9 protocol to physically separate OC from EC in carbonaceous aerosols. The ^{13}C composition of the fractions obtained with the method was also determined to assure that the fractions were well separated.
3. Are substantial conclusions reached?
   Yes, the effectiveness of the ECT9 to physically separate OC and EC from aerosol samples for ^{13}C and ^{14}C analysis is demonstrated.
4. Are the scientific methods and assumptions valid and clearly outlined?
   Yes
5. Are the results sufficient to support the interpretations and conclusions?
   Yes.
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?
   Yes, the authors used a number of materials containing only OC or EC as well as mixtures of them. The experiments are clearly described. The tests to establish accuracy, precision and background are well described.
   We appreciate the reviewer's support of our work

   However, I would suggest some minor additions:
   Concerning the sample preparation protocol:
   In section 2.3 isolating of OC, EC or TC

   Line 150: Please give more details on how the filter are treated after an OC material dissolved in water is loaded onto a pre-cleaned quartz filter.
   This issue was also raised by reviewer #1 and we have amended the text.
   Before the OC solution (i.e., OC material dissolved in water) is loaded onto the pre-cleaned quartz filter, the filter punch has already been put on a quartz boat at the position in the analyzer. A vial of OC solution is brought to beside the analyzer. A syringe is used to obtain a known volume of OC solution (5-10 µl), then the OC solution is very carefully applied to the filter surface. After the injection, the quartz boat is pushed into the analyzer at the right position. After purging the filter for about 20 minutes ensuring the water is gone, the filter is ready for analysis via ECT9 protocol.
   The volume of OC solution used does not saturate the filter, but merely moistens the surface.

   Line 151: Please explain in a more detailed way how the filter punch is loaded and manipulated to avoid losing material during ECT9 protocol.

Soluble (OC) materials are loaded onto filters as described above. Insoluble (EC) materials are loaded in form of solids (powders). A punch of pre-cleaned quartz filter is loaded with powder and weighed directly, via a 6 or 7 digit balance, before and after analysis. The mass of the powder is calculated by difference. The quartz punch with the power is carefully carried within a glass petri dish with cover to the analyzer for analysis via ECT9 protocol.

Concerning the comparison of $FM^{14}C$ obtained values vs. $FM^{14}C$ accepted values:
Line 245: It is mentioned that $FM^{14}C$ values of pure modern and fossil reference materials agreed with their accepted $FM^{14}C$ values within approx. 5% uncertainty. Please indicate the individual uncertainties that resulted in less than 5% in average.
We thank the reviewer for the careful examination of our work!

The 5% uncertainty mentioned in the paper is based on that the overall agreements of all individual pure (Table S6) and mixed reference materials (Table S7, excluding the OC data from adipic acid + bulk rice char) are within 2±3% of their corresponding consensus values (Table 2). For samples containing > 10 μg C the agreements are within 1±1%, whereas samples containing between > 5 μg C and < 10 μg C they are around 7±5% in average, respectively. The mean values of $F^{14}C$ for individual mixed OC and EC measurements have been added in Table S7. We have included the following content in the revised version.

*" The $F^{14}C$ values of the pure modern or fossil reference materials generally agreed with their accepted $F^{14}C$ values for both OC and EC fractions (**within approximately 5% uncertainty on average, Fig. 3 and Table 2, Tables S6, S7**) after applying a constant amount C_{ex} correction in $F^{14}C$ determination. Specifically, the overall agreements for all individual pure (Table S6) and mixed reference materials (Table S7) are within 2±3% of their corresponding consensus value (Table 2). On average, for samples containing > 10 μg C the agreements are within 1±1%, whereas samples containing between > 5 μg C and < 10 μg C they are around 7±5%, respectively."*

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?
   Yes, the cited references are adequate.
8. Does the title clearly reflect the contents of the paper?
   Yes, the title fully reflects the objective and the expected results.
9. Does the abstract provide a concise and complete summary?
   Yes.
10. Is the overall presentation well-structured and clear?
    Yes.
11. Is the language fluent and precise?
    The language is very appropriate.
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?
    Yes.
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
    The organization of the manuscript is adequate. The selected materials for testing the protocol are adequate; the description of methodology is in general clearly explained; except that a more detailed description on the filter loading. Validation of the protocol applied to ^{14}C analysis is rigorous.
14. Are the number and quality of references appropriate?

Yes.

15. Is the amount and quality of supplementary material appropriate?
    Yes.

Thank you for the constructive comments.