



Interactive comment on “Trends, composition, and sources of carbonaceous aerosol in the last 18 years at the Birkenes Observatory, Northern Europe” by Karl Espen Yttri et al.

Karl Espen Yttri et al.

key@nilu.no

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Comment by Michael Schulz:

The work by Yttri et al. presents a great, valuable summary of 18 years of organic aerosol measurements. The absent organic carbon (OC) trend is most interesting to me. I believe this could be highlighted even more in abstract and conclusions. What do other OC trends show in Europe? Is this the only work attempting to calculate OC trends at European sites? Could the present work be put a bit more in a European context? More references? A side question: What influence has the change of the OC

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measurement protocol in the middle of the period on the OC trend? In what direction can this have influenced the trend?

We would like to thank Dr Schulz for his interest in our manuscript!

Dr Schulz states that: “The absent organic carbon (OC) trend is most interesting to me. I believe this could be highlighted even more in abstract and conclusions”.

a) We agree that the lack of a statistically significant downward trend in the OC concentration is an interesting finding. One would expect a reduction of anthropogenic OC that reflects that of EC, at least for primary OC, but probably also SOA from anthropogenic precursors. In our manuscript, we argue that this reduction is not visible, as OC is dominated by emissions from natural sources (Biogenic SOA and PBAP). Note though that OCPM_{2.5}, which has a larger fraction of anthropogenic OC compared to PM_{10-2.5} and PM₁₀, has a minor downward “trend” (-0.8% yr⁻¹), although not statistically significant.

In the abstract we have included the following sentence to meet the request from Michael Schulz.

“Dominating biogenic sources explain why there was no downward trend for OC.”

In our conclusions, line 652 – 657 focus on biogenic sources as an explanation to why no decreasing trend was observed for OC. We have added the following sentence to underpin the importance of such long time series for carbonaceous aerosol:

“We emphasize the importance of establishing long lasting, high quality carbonaceous aerosol and organic tracers time series at several sites across Europe for this purpose.”

“What do other OC trends show in Europe? Is this the only work attempting to calculate OC trends at European sites? Could the present work be put a bit more in a European context? More references?”

b) To our knowledge there are no other studies performing trend analysis of OC in

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Europe based on measurements; the present study is the first one. We expect that within a few years, time series of equal length as that of Birkenes at present will be available for 1-2 southern European sites. Consequently, there are no other studies to compare with, and hence not possible to put our results into a European context by comparing with other time-series. Towards the end of the introduction (line 124 - 125), we emphasize that the Birkenes Observatory is well suited to monitor air pollution from Continental Europe, and in the third line of the abstract (line 23-24) we state that Birkenes is a site representative of the Northern European region, thus the connection to the greater Europe is established.

What influence has the change of the OC measurement protocol in the middle of the period on the OC trend? In what direction can this have influenced the trend?

c) In the Suppl., line 35-42 we write the following:

A comparison of the two temperature programmes (denoted “protocol” by Michael Schulz) used for the Birkenes time series was performed for PM_{2.5} filter samples collected at Birkenes in 2014, using temperature calibrated versions of both Quartz and EUSAAR-2. There was a good agreement between the two temperature programs for TC and OC, i.e., close to the expected uncertainty associated with analysis and sampling, whereas for EC the difference was pronounced (Table S 17), although in close correspondence with that previously reported by Panteliadis et al. (2015). Note that OC and EC data for the period 2001–2007 discussed in the main is text not corrected according to Eq. (S 18–20) (Table S 17), except for the purpose of trend calculations.

Hence, the (minor) difference in OC obtained by the Quartz and EUSAAR-2 temperature programmes (See Table S 17, Eq. S 18-20) is accounted for in the trend calculations that are performed.

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