

# ***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.***

## **Anonymous Referee #1**

Received and published: 18 January 2021

This manuscript presents and discusses results from a valuable long-term study of carbonaceous aerosol for the Birkenes Observatory in Southern Norway. A thorough data analysis was performed and the results are of substantial interest to the aerosol community. Unfortunately, as indicated below, the manuscript suffers from several shortcomings. Major revision is certainly needed before it can be published in ACP.

### Major comments:

1. Previous long-term aerosol studies at the study site deserve to be referenced to. I am thinking of Amundsen et al., Atmos. Environ. A, 26 (1992) 1209-1324 and especially of Maenhaut, Nucl. Instrum. Methods B, 417 (2018) 133-138. In the latter

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study, the PM mass, BC (which can serve as a proxy for EC) and 21 elements were determined in PM<sub>2</sub> samples over a 5-year period (1991-1996) and the results were subjected to PMF analysis, using EPA PM<sub>5</sub>, and 8 factors were extracted, with one of them being wood burning, which accounted for 14% of the PM<sub>2</sub> mass. It would be of interest to see a comparison of the PM mass and PMF data from that study with the corresponding data for the PM<sub>2.5</sub> aerosol fraction of the current study. For one thing, biomass burning (BB) accounts for 17% of the PM<sub>2.5</sub> OC (Figure 8); from Table S 7, one can derive that the OC/PM<sub>2.5</sub> ratio is around 0.2, so that BB accounts for only 3.5% of the PM<sub>2.5</sub> mass; this percentage is very much lower than the 14% in the study of Maenhaut (2018). Is there any sensible explanation for this large discrepancy?

2. Abbreviations and acronyms should be defined (written full-out) when first used in the Main text or the Supplement, and they should only be defined once. This applies to the following:

Line 79: BSOA; it is only defined in lines 659-660;

Line 187: PMF; it is already defined in line 124;

Line 228: BB; it is only defined in lines 419 and 660;

Line 303: SS; it is only defined in lines 320, 419-420, and 661;

Line 319: LRT; it is already defined in lines 217-218;

Line 395: CI;

Supplement, line 44: LOD.

3. The manuscript is on some occasions unclear and/or confusing.

In line 134 the authors mention the coordinates of the Birkenes Observatory, but then in line 175 they talk about the old and new Birkenes sites. This is confusing; both sites should be mentioned in line 134, it should be indicated what the distance between both sites was and in which year the measurements in the new site were started. According

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to a NILU Website, the observatory was moved to a new building in 2009.

It should be clearly indicated in sections 2.4 and S4 that the PMF on the aerosol data was carried out on the data set of 2016-2018 and I suggest that the number of samples (apparently 151, Table S 3) is indicated in both sections. Furthermore, a literature reference for the PMF approach is needed; I presume that use was made of EPA PMF5.

It seems that the PM mass data were not included in the PMF analysis. Why not? Including them would allow to assess the contribution of the different factors to it, which is very useful information.

It is unclear what the difference is between the base factor profiles and the black square markers in Figure 2a.

The legend of Figure S 3 should be extended. I suggest inserting "on the filter data" between "solution" and "presented". Also the headings of Tables S 3 and S 4 should be extended; it should be indicated that they are for the filter data. I also suggest to indicate in the legend and in the two captions that the filter data set of 2016-2018 was used.

4. The manuscript needs to be better organized. Section 2.4.1 does not belong in 2. Methodology, it should be moved to 3. Results and discussion. Also, is it not possible to combine this section and section 3.2 into one single section?

5. The manuscript has several grammatical errors; often the subject is in plural and the verb in singular (or vice versa).

6. There are major problems with the references, both in the Main text and in the Supplement.

The initials of the authors should be consistently after the authors' last names.

Titles of journal articles should be in lower case, not in Title Case.

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Abbreviated journal names are needed throughout.

The publication year should be at the end of each reference and it should not be in parentheses.

For the Main Text:

"Denier van der Gon" should be replaced by "van der Gon" both in the text and in the Reference list, and the reference should be moved down in the reference list.

Line 707: First names of the authors should be replaced by initials.

Lines 959-968: "Myhre and Samset, 2015" should come before "Myhre et al., 2013"

Lines 1067-1070 should be deleted.

The following references of the text are missing in the Reference list:

Line 67: Pio et al., 2007;

Line 108: Sillanpää et al., 2006; there is "Sillanpää et al., 2005" in the Reference list, but there is not referred to this within the text.

Line 109: Genberg et al., 2013;

Line 176: Mann, 1945;

Line 177: Kendall, 1975;

Lines 177 and 178: Gilbert, 1987;

Line 178: Theil, 1958; perhaps this should be "1950" instead of "1958, see below;

Line 178: Sen, 1968;

Line 215: Polissar et al., 1998;

Line 215: Norris et al., 2014;

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Line 241: Pacyna et al., 1996;

Line 305: Stumm and Mogan, 1995; there is "Stumm and Morgan, 1996" in the Reference list, but there is not referred to this within the text.

Line 620: Spracklen et al., 2011.

There is no reference made in the Main text to the following references that are in the Reference list:

Aas et al., 2019;

Birch and Cary, 1996;

Cattiaux et al, 2010;

Fine et al, 2001; 2002a, 2002b, 2004;

Hu et al, 2018;

Jordan and Seen, 2005;

Long et al., 2013;

Putaud et al, 2010;

Schmidl et al, 2008;

Theobald et al. 2019;

Turpin and Lim; 2001;

Tørseth et al, 2000;

Winiwarter et al. 1999.

For the Supplement:

References that are mentioned in its text should also be included in the Reference list,

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even if they are already in the Reference list of the Main text.

Line 230: The title of the journal article should be included.

Lines 233 and 254: Is it Backman or Backmann? In lines 116 and 118 there is Backmann, but in line 154 Backman.

The following references of the text are missing in the Reference list:

Line 7: Yttri et al., 2007a;

Line 10: Yttri et al., 2011; also, this should either be 2011a or 2011b or even 2011c;

Lines 10-11: Yttri et al., 2019;

Line 18: Cavalli et al., 2010;

Line 23: Subramanian et al., 2006; there is "Subramanian et al., 2004" in the Reference list, but there is not referred to this within the text

Line 57: Theil, 1958; There is "Theil, 1950" in the Reference list, and it looks that this is the correct year.

Line 60: Tørseth et al, 2012;

Line 61: Aas et al. 2019;

Line 125: Sandradewi et al., 2008;

Line 137: Paatero et al., 1994; there is "Paatero and Tapper, 1994" in the Reference list, but there is not referred to this within the text.

Line 206: Zotter et al., 2014;

Line 221: Bauer et al., 2008a (incidentally, the "a" should be removed);

Line 221: Yttri et al., 2007a;

Lines 221-222: Yttri et al., 2011a,b.

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There is no reference made in the text to the following reference that is in the Reference list:

Pio et al., 2007.

Minor comments and corrections for the Main Text:

Line 21: Replace "organic-" by "organic".

Line 23: Replace "-at the" by "at the".

Lines 27-30: It says "six" in line 27, but then in the remainder of the sentence, 7 components are listed. This is confusing. In lines 415-417 it is stated that only 6 out of the 7 components were associated with significant amounts of carbonaceous aerosol.

Line 72: Replace "and fungus" by "and fungi".

Line 90: Replace "biogenic," by "biogenic;".

Line 118: Replace "have developed" by "has developed".

Line 170: Replace "monosaccharides anhydrides" by "monosaccharide anhydrides".

Line 182: Replace "Scientific" by "Scientific)".

Line 184: Replace "in which" by "which".

Line 209: Replace "principal" by "principle".

Line 217: Replace "is via" by "are via".

Line 292: Replace "also favours" by "also favour".

Line 305: Replace "resembles these" by "resemble these".

Line 334: Replace "EC, (Sect. 3.1.2) but" by "EC (Sect. 3.1.2), but".

Line 349: Replace "Table S 8" by "Table S 8)".

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Line 363: The reference to Table S 4 here is unclear; I presume that reference should be made to another Table.

Lines 395-396: The data listed here apparently relate to PM<sub>2.5</sub> and PM<sub>10</sub>; it should be specified which ones are for which size fraction. Also in line 396, replace "-1.8, CI" by "-1.8%, CI".

Line 455: Replace "et al.," by "et al.".

Line 472: Replace "airmasses" by "air masses".

Line 530: Replace "2003)" by "2003".

Line 605: Replace "points to" by "point to".

Line 619: Replace "(2012) but" by "(2012), but".

Line 634: Replace "likely differ" by "likely differs".

Line 698: Replace "i.e." by "i.e.".

Line 714: Replace "Sci Rep" by "Sci. Rep.".

Line 786: Replace "organicaerosols" by "organic aerosols".

Line 904: Replace "5," by "5, 5065,".

Line 970: Replace "O'dowd" by "O'Dowd".

Line 1019: Replace "Sioutas" by "and Sioutas".

Line 1106: Replace "B.J., Lim" by "B. J. and Lim" in case this reference is retained.

Line 1120: Replace "www.atmos-chem-phys.net/12/5447/2012/doi:10.5194/acp-12-5447-2012," by "https://doi.org/10.5194/ acp-12-5447-2012,".

Line 1139: Replace "pri-mary" by "primary".

Line 1187: Replace "Atmos. Chem. Phys. Discuss., 14, pp. 15591-15643," by "Atmos.

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Chem. Phys., 14, 13551-13570, <https://doi.org/10.5194/acp-14-13551-2014>,

Lines 1192-1193: Replace "[www.atmos-chem-phys.net/17/4229/2017/doi:10.5194/acp-17-4229-2017](http://www.atmos-chem-phys.net/17/4229/2017/doi:10.5194/acp-17-4229-2017)," by "<https://doi.org/10.5194/acp-17-4229-2017>,".

Line 1215: Replace "); CA" by "; CA".

Line 1251, within Table 2: Replace twice "Zotter et al. 2017" by "Zotter et al., 2017".

Minor corrections for the Supplement:

Line 41: Replace "is text not" by "text are not".

Line 64: Replace "often deviates" by "often deviate".

Line 83: Replace "was applied" by "were applied".

Line 116: Replace "by of" by "by".

Line 117: Replace "adapt the" by "adopt the".

Line 194: Replace "then then" by "then".

Line 214: Replace ") , and" by ") , and".

Line 240: Replace "2013" by "2013.".

Line 343: Replace "1389.https" by "1389, https".

Line 394: Replace "bar (Figure S 2)" by "bar".

Line 396: Replace "were only" by "was only".

Line 404: Replace "for their identification" by "for identification".

Line 404, within Table S 1: Replace "Methylerythritol" by "Methyleytritol".

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-1165>, 2020.

