

## General comments

In their study, the authors focused on the fluorescence characteristics of water-soluble organic carbon (WSOC) in aerosol particles collected over the western Arctic Ocean during summer in 2016. Besides fluorescence excitation-emission matrix (EEM) coupled with parallel factor analysis (PARAFAC) of WSOC, they measured ionic species and WSOC, and marine biological parameters in surface seawaters. Two fluorescent components, humic-like C1 and protein-like C2, were identified in WSOC of fine-mode aerosols by the PARAFAC modeling. The two components varied regionally, with low fluorescent intensities in the coastal areas and high at the sea ice-covered areas.

The topic is important and actual. Although emphasize of this work is on the fluorescence characteristics of WSOC in summertime organic aerosols, a bigger part of section “Results and discussion” includes results on chemical composition of WSOC (ionic species, e.g.,  $\text{Na}^+$ ,  $\text{NO}_3^-$ , MSA,  $\text{nss-SO}_4^{2-}$ ). However, I am afraid that a reader will get lost among all the results if there is not a good connection between them. Besides, nothing about these components, their importance can be found in the conclusions.

The content of this manuscript is descriptive presenting the results with some discussion, but with no discussion in the last section, where atmospheric implications should be involved; i.e. in a way how your results contribute to the understanding of the state and behavior of the atmosphere. In addition, the introduction is rather modest.

Conditionally, the manuscript could be of adequate atmospheric interest to merit publication in *Atmospheric Chemistry and Physics* (maybe as a Measurement Report), but addressing the following comments and/or questions.

## Specific comments

### Introduction:

- Line 49: The sentence “thus, WSOC is one of the most important...” can be deleted.
- Line 50: Please, correct the sentence and add some newer references. Why “residual aromatic nuclei”?
- Lines 52-54: Statement: “these discrepancies regarding the chemical composition of atmospheric WSOC» is not good. What do you mean by discrepancies? At most, you can say that there are many open questions. Besides, it is well known now that HULIS is one of the most important classes of water-soluble organics in atmospheric aerosols, fog and cloud waters. Please, correct and add some more (newer) references on HULIS in WSOC (e.g., Zheng et al., Environ. Pollut. 2013; Salma et al., J. Aerosol Sci. 2013; Frka et al., Atmos. Environ. 2018).
- Lines 59/60: Not accurate statement. Using EEM-PARAFAC approach one can get information on chemical structures and photochemical properties of compounds in

WSOC (according to their fluorescence characteristics), and based on these information you can say something on their sources and/or formation processes.

- Line 72: "...seasonal marine primary production" of what?
- Lines 81-85: The objectives of the research has to be clearly defined. Please, rewrite this paragraph.

#### Methods:

- It would be helpful for later discussion if the sampling sites denoted in Fig.1 are at least shortly described (e.g. AR1-AR3: coastal area)
- Except for Milli-Q water and HCl, there is no information on other chemicals/standards used.
- Lines 97-99: Combine/shorten.
- Line 197: Unit for the resistivity is  $M\Omega \cdot cm$  (not  $M\Omega \cdot cm^{-1}$ ).
- Line 110: Which separation columns did you use?
- Since sample preparation is the same for both, ionic species and WSOC, Chapters 2.1.2. and 2.1.3. can be combined.
- Line 119: Delete "In the analytical system"
- Line 120/121: Decide what to use, WSOC or TDOC. Anyway, in both cases one has in mind all water-soluble organic carbon. The sentence "Thus, in this study..." can be deleted.
- Chapter 2.1.4: Since the focus of this study are fluorescence characteristics of WSOC, this part is too superficial and has to be updated with some more information on fluorescence measurements.
- Line 145: Pre-combusted glass ampules? Were they really combusted before the use? Usually, filters for sampling need to be pre-baked to remove organic contaminants.
- Chapter 2.2.: No need to separate into 2.2.1. and 2.2.2.

#### Results and discussion

- Line 169: Error. Coarse aerosol above  $0.5 \mu m$ ?
- 3.2. Better as: "WSOC in atmospheric aerosols"
- Line 232: Correct the first line as: "The total WSOC concentration of atmospheric aerosols (fine and coarse)" (or  $PM_{10}$ );
- "Bulk aerosol" is not a good choice.
- Line 245, 255, 270, etc: No need to use both, OC or OM. You have to specified, what you are talking about (organic carbon - C in organic matter or organic matter).
- Lines 275-280: Be careful in comparison. Is your ratio  $WSOC/Na^+$  comparable to the ratio  $OC/Na^+$  (line 278/279)? Is the second also only water-soluble OC or "all" organic carbon. If so then it is logical that the ratio  $OC/Na^+$  is lower than  $WSOC/Na^+$ .
- Lines from 335 on: Some newer references on HULIS from biomass burning and on secondary formation e.g., from phenolic precursors in multiphase reactions should be

added. Check for example: Frka et al., Atmos. Environ. 2018; Vidović et al., Environ. Sci. Technol. 2018.

Conclusions should involve atmospheric implications.

- Line 433: “One such characteristic...”? Which one?

Figure 2: Add missing information in the caption (i.e. short description of the sampling sites, e.g.: from R1 to R3: Coastal area, etc...).

Figure 4 can be moved to the Supplemental material.