

Interactive comment on “Critical assessment of the current state of scientific knowledge, terminology, and research needs concerning the role of organic aerosols in the atmosphere, climate, and global change” by S. Fuzzi et al.

Anonymous Referee #3

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General Comments

This paper presents key scientific questions and research priorities regarding atmospheric organic aerosols, based on the discussion at the workshop organized by IGBP-IGAC/iLEAPS/SOLAS. The main topical areas are sources, formation and transformation, physical and chemical properties, and atmospheric modeling of organic aerosols. Further, the authors propose universally applicable terms and definitions to describe atmospheric organic aerosols. As described in this paper, extreme complexity of or-

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ganic aerosols makes it very difficult to clarify their role in the atmosphere. It is therefore important to discuss future research strategies from several different viewpoints as presented in this paper.

While individual scientific statements in this paper are sound and highly valuable, this manuscript needs revision from the following two points. First, this paper has not been edited sufficiently and thus the format and the construction are not well organized. For example, although the title of section 5.1 on page 11756 is “outstanding issues for future research,” the content on the page does not include any scientific statements, but it is merely an explanation of the current status of research and the current understandings. Further, identical subjects are explained repeatedly in different sections, which makes the manuscript wordy. For instance, importance of the assessment of sampling artifacts is stated at least five times, on p11746 lines 1-5, p11748 lines 15-16, p11751 lines 14-16, p11753 lines 8-12, and p11757 lines 1-2.

Second, there are several issues that are not addressed sufficiently in this paper. For example, in terms of the budget of organic aerosols, deposition processes must be as critical as emission/formation and transformation (as pointed out briefly in section 6.1), in particular on global scale. However, there is no discussion on depositions in sections 3 and 4. Another issue that may be worth emphasizing is mixing state of organics. Many organics in aerosols are internally mixed with inorganics, and it is related to most of the issues discussed in this paper. Research priorities regarding the mixing of organics and inorganics are worth addressing, for instance in section 5.

This manuscript is acceptable for publication in ACP if it is revised in terms of format, issues to list up, and balance between different sections, as pointed out above. More specific comments are as follows.

Specific Comments

Abstract: The initial half of the abstract is not explained in the main body of this paper. Further, I do not think that the last sentence in the abstract is necessary.

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Section 2.4: In molecular levels, it is often discussed if organic compounds are primarily emitted or secondary formed in the atmosphere. In this case, “secondary” does not always mean gas-to-particle formation but it potentially includes transformation of organics within the particles. It is not clear in this paragraph if these secondary organic compounds formed in the condensed phase are categorized as primary- or secondary aerosol components.

Section 2.6: As described above, many organic components are internally mixed with inorganics. For this reason organic and inorganic particles can not be separated in many cases, and the definition of terms “organic aerosols” and “organic aerosol particles” are not obvious. A brief explanation to this point may be necessary.

Section 2.6: This section only explains the assignment of carbon to OC and EC. I recommend adding an explanation on the difference between organic carbon and organic matter (related to Q7 on p11748); the latter involves oxygen, hydrogen and other heteroatoms as well as carbon atoms. In addition, some explanation on the detection of IC (carbonate carbon) by the carbon analyzer may be necessary.

Page 11739, lines 10-16: What the authors explain in this paragraph is not clear. On pages 11734 and 11735, authors distinguish primary organic aerosol “components” from primary organic aerosol “particles”. Is the issue explained in this paragraph is about only “components”, or both “components” and “particles”?

Page 11742, lines 25-26: It is not clear if this sentence is based on results from previous studies or on authors’ speculation.

Page 11746, line 12: What does OPM stand for?

Page 11755, lines 6-7: I read the paper by Cziczo et al. [2004] but I did not find a sentence explaining that less efficient water uptake by organics is the reason that organics were not efficient as ice nuclei.

Page 11756, lines 20-23: It is not clear if this sentence is based on results from previ-

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ous studies or on authors' speculation.

Page 11756, lines 23-26: Add references.

Page 11757, Research Priorities: Among R1-R5, R5 is the only suggestion that might relate to "physical" properties of organics aerosols. Aren't there any suggestions on studies of hygroscopicity and optical properties of organic aerosols, which the authors discuss in detail on pages 11753-11755?

Interactive comment by U. Pöschl: I basically agree the revision of Table 1. However, isn't it necessary to add other primary sources such as road dust and meat cooking [e.g., Schauer and Cass, 2000], which are not necessarily included in industrial POA in the revised table?

Technical corrections

Page 11740, line 22: Change "2 thorough 6" to "2 through 5".

Page 11745, lines 5-6: Replace a, b, and c with 1, 2 and 3, respectively.

References Schauer, J. J., and Cass, G. R.: Source apportionment of wintertime gas-phase and particle-phase air pollutants using organic compounds as tracers, *Environ. Sci. Technol.*, 34, 1821-1832, 2000.

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