

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 #1

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The focus of this manuscript is to synthesize key questions and research priorities regarding four main areas: 1) sources of organic aerosols (OA); 2) formation and transformation of OA; 3) physical and chemical state of OA; and 4) atmospheric modeling of OA. The paper is suitable for publication in ACP after clarifications of the issues shown below.

1) The other two reviewers have already made comments and I shall try not to repeat. Nevertheless, I believe the comments on the abstract and the uniqueness of this paper

compared to Kanakidou et al. (2005) are very important ones that it would be okay to re-emphasize again here. In particular, a very clear discussion of how the current paper is unique from Kanakidou et al. (2005) is needed.

2) Page 11735-11736, section 2.3 & 2.4: The reason for defining “primary and secondary aerosol particles” and “primary and secondary aerosol components” separately is not clear. My impression is that these two sections described something very similar.

3) Page 11735, section 2.4: “secondary components are substances formed in the atmosphere by chemical reaction of gaseous precursors”. The authors only consider the organic matters that formed via gas-phase chemical reactions as secondary aerosol components. However, secondary aerosol components can also be produced via heterogeneous and multiphase reactions of organic particles. They are aged components but it is not clear if they are considered primary or secondary. Furthermore, if primary aerosols can contain secondary components via gas phase condensation of reaction products, would it be simpler to include aged components as secondary too?

4) Page 11739, line 10-15: The authors already define “Primary and Secondary” in the previous section. Hence, there is no need to repeat this information.

5) Page 11739, Q1: The authors may want to elaborate on their choices of the proposed classification listed in Table 1. In addition, it would be useful to discuss what “Distinguishing Characteristics” are known and what are poorly understood in the literature. This may also help in relating Tables 1, 3, and 4 better.

6) Page 11740, line 22-29: The authors propose that class 1 and 6 can be potentially important for atmospheric aerosols. It would be useful to list any future research efforts to reduce their uncertainties in the “bottom up” estimates.

7) Page 11750-11751, “Open questions and research priorities for organic aerosol aging”: As the authors mentioned, the aging processes of organic aerosols can lead to modification of the physicochemical properties of organic aerosols. Hence, I suggest

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that more research efforts should be made to study the effect of the aging processes on the change of the physiochemical properties, such as hygroscopicity and CCN activity, of organic aerosols because these properties may greatly influence the direct and indirect radiative forcing of atmospheric aerosols.

8) Page 11755, While wettability is an important issue, recent studies have shown that the phase of organic aerosols before activation and the presence of trace amount of inorganic salts can also significantly alter the ability of organic aerosols to form cloud droplets (Bilde and Svenningsson, 2004).

Reference: Bilde, M., Svenningsson, B. (2004) CCN activation of slightly soluble organics: importance of state of mixing and particle humidity history. *Tellus*, 56B, 128-134.

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