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Interactive comment on "Organic aerosol and global climate modelling: a review" *by* M. Kanakidou et al.

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General comments: This manuscript describes current knowledge regarding the role of organic aerosols in the climate system and outlines the uncertainties and challenges associated with simulating their behavior in numerical models. The manuscript demonstrates both the considerable existing knowledge as well as the many critical gaps. This review is a major undertaking that is a useful contribution to the literature and will be read with interest by the scientific community. The manuscript is generally comprehensive but could be improved by including a few more topics:

1. Aerosol lifetimes: what is known, what needs to be known, what are expected values for various conditions (e.g. wet and dry).

2. Constraining aerosol production using ambient observations: what constraints can currently be placed on global annual SOA production and how does this compare with uncertainties associated with the bottom-up estimates? What is needed to reduce these uncertainties?

The following specific comments and technical corrections should be addressed before this manuscript is published:

Specific comments: Page 5858: the processes that need to be considered to account for OA include chemistry, physics AND biology.

Page 5863: Matsunaga et al. have observed isoprene oxidation products in aerosols that could be a larger contribution to global SOA than those described by Claeys et al.

Matsunaga, S., M. Mochida, and K. Kawamura, Growth of organic aerosols by biogenic semi-volatile carbonyls in the forestal atmosphere, Atmospheric environment, 37 (15), 6, 2003.

Page 5864. While short chained carbonyls may not be likely to contribute to SOA, there are reports of $>$C7 carbonyls that may be important contributors (e.g., see Matsunaga reference above). Current analytical methods may need to be improved before we can accurately quantify these compounds. Given the current uncertainties, I don't think they can be dismissed.

Page 5865. The SP2003 values given in Table 1 are not based on Guenther et al. 1995 since that manuscript does not give any break down for these compounds. It may be that Seinfeld and Pankow use the combination of Griffen et al and Guenther et al to get mass emissions but this is not what is shown in Table 1. It would be interesting to know what the Griffin et al. estimates of % contributions were based on.

Page 5865: the substantial uncertainties in BVOC emissions are discussed but not the uncertainties in anthropogenic emissions. The authors do not even indicate if they are significant.

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Interactive Comment

Page 5866 and table 2. Why not apply the .15 constant fraction (given in the text) and convert the BVOC emissions in table 2 to SOA so that it compares aerosol mass with aerosol mass (instead of gas emissions)?

Section 3.1, I suggest including some text on sesquiterpene aerosols yields. It is assumed to be 100% earlier in the manuscript but with no reference or discussion. A table showing the yields (or range) for each compound group would be useful.

Section 5.1, This section should include a discussion on the uncertainties associated with dry deposition (and the research needed to address them). The theory is described but not the experimental evidence needed to evaluate the models.

Technical corrections:

Page 5864. Isoprene is a hemi-terpene and so is one of the "terpenes". It is not correct to say that that mono-terpenes are 40-80% of the overall terpene emission since isoprene is a type of terpene.

Page 5864. The reference that should be used for GLOBEIS (rather than the website) is Guenther, A., B. Baugh, G. Brasseur, J. Greenberg, P. Harley, L. Klinger, D. Serca, and L. Vierling, Isoprene emission estimates and uncertainties for the Central African EXPRESSO study domain, Journal of Geophysical Research-Atmospheres, 104 (D23), 30625-30639, 1999. However, the most recent updates to Guenther et al. 1995 are MEGAN (instead of GLOBEIS as indicated in the text) which are available at https://cdp.ucar.edu

Page 5867, for uncertainty "c": do you really mean "phenomenology"? "phenology" would make more sense to me.

Page 5869, the sentence "Future studies . . . primary emissions invoke to integrate" is confusing.

Page 5887, the sentence "This method guarantees . . . requires to be carefully checked" is confusing.

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 5855, 2004.