

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## **Comment on acp-2022-158**

Anonymous Referee #2

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Referee comment on "Experimental development of a lake spray source function and its model implementation for Great Lakes surface emissions" by Charbel Harb and Hosein Foroutan, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-158-RC2>, 2022

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ACP Review "Experimental development of a lake spray source function and its

model implementation for Great Lakes surface emissions"

Summary: This manuscript describes the development of a new source function focused on aerosol emissions from freshwater lakes. The work builds from measurements of size and number concentration in an aerosol reference tank to develop a function that it applies in the CMAQ model to look at regional impacts. The function is primarily applied to the Great Lakes due to their size, particularly their fetch. Overall the work is detailed, considers the prior literature, and generally provides a useful function for use when considering freshwater emissions in models. There are some minor issues to fix related to aerosol nomenclature and some minor questions to be addressed, but overall is solid, detailed work and should be publishable after revision.

Specific Points:

- The authors in the abstract describe results with respect to fine aerosol ( $r < 0.2 \mu\text{m}$ ) and coarse aerosol ( $r \sim 1\text{-}2 \mu\text{m}$ ). Aerosol are usually defined in terms of diameter, not radius, so it would be helpful to readers to provide this in contact of diameter.
- In the abstract as written it could be interpreted that the authors looked just 1-2 and  $< 0.2 \mu\text{m}$ , which would imply that 0.2-1  $\mu\text{m}$  was not a part of the calculations. That size range has considerable amounts of LSA, so it would be helpful to clarify this point.
- Coarse aerosol is typically defined, at least by EPA, as 2.5-10  $\mu\text{m}$ . Calling 1-2  $\mu\text{m}$  coarse, could be confusing as this would fall in the fine PM ( $\text{PM}_{2.5}$ ) classification often used. IT would be helpful to explain and clarify this.
- Line 30: A common comment regarding aerosolization of bacteria/cyanobacteria is that it is components of the biological species that are typically aerosolized, not an intact bacterium. Please modify wording to reflect that the most prominent LSA sizes there would not be intact bacteria.
- The issue of low organic material in the simulated lake water and possibly from Claytor Lake is noted, it would be good to mention again in the conclusions as there is potential for fairly different emissions when more organics are present as is common across the Great Lakes, particularly in summertime.
- A key issue in the method section is that the authors refer to "mobility diameter" when they mean "electrical mobility diameter". Mobility diameter in the aerosol world has a different definition not related to an aerosol's movement in an electric field (see Ch. 3 and 5 of Hinds Aerosol Textbook). To avoid confusion for readers this should be referred to as  $d_{em}$ .
- Stitching together of SMPS and APS data would be preferable using the approach detailed in Khylstov 2004 AS&T, as opposed to removing that data. The sharp transition on Figure 2 at the SMPS/APS transition is notable and could be fixed by this approach.
- The wet versus dry size distributions are interesting. Could an inset or additional panel be included to make it easier to see the wet freshwater distribution in Figure 2a, it is almost impossible to see with how big the wet saltwater is.
- In a similar vein, for Figure 3 could the red size distributions (S and V) for 3c, 3d, 3e, and 3f be placed on the right axis or an inset provided? They are very difficult to distinguish from the baseline.
- Page 13, Line 315-316: please fix the sig figs for the numbers on these two lines. Error should not be listed with more than one digit (i.e. 21722 +/- 1964 should be 22000 +/- 2000).
- In the simulations for Figures 6-9, are larger particles even more enhanced (e.g. 3, 4, 5  $\mu\text{m}$ ?) in the more traditional coarse definition?
- Figure 10, why in the lake case is there so much aerosol over the Atlantic Ocean? Particularly for the  $\text{PM}_{2.5}$ ?