

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-158

Anonymous Referee #1

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-RC1>, 2022

In this article, Harb and Foroutan describe a measurement and complementary modeling study of lake spray emissions focused on the Great Lakes region. The measurement section of the article describes the development of a lake spray source function using a marine aerosol reference tank, while the modeling section uses the Community Multiscale Air Quality model to simulate the lake spray impacts on aerosol number and mass concentrations during a period of strong winds. Generally, I find the measurement section of the article a useful development in the field of lake spray emissions but find the modeling section incomplete. Please see the specific comments below.

Major Comments:

1) CMAQ model: Despite being a widely-used model for research and policy, I don't believe that CMAQ is the appropriate tool to simulate the potential cloud impacts from lake spray aerosols. The lack of aerosol-cloud interactions in the version of CMAQ used in this study means that the simulations are limited to the prediction of aerosol number concentrations without any information on the associated changes of cloud condensation nuclei or ice nuclei on cloud properties. Quantifying the impacts on this aerosol source on cloud properties requires an online-coupled model.

2) CMAQ model configuration: I found little benefit from the SEA simulation to the study, and was surprised that it was included after the description of the lake spray source function having substantially lower emission fluxes than the sea spray source function. If CMAQ continues to be used in this study (see comment above), I'd strongly suggest that the SEA simulation be replaced with a simulation incorporating chemical speciation of the lake spray aerosol so that the impacts to regional atmospheric chemistry be quantified.

3) CMAQ model evaluation: When discussing the model results, it's unclear whether including this emission source improves model performance. I'd suggest that PM2.5 and PM10 observations from regulatory and IMPROVE sites in the region be compared to the model simulations. If chemical speciation of the lake spray aerosol is included (see comment above), I'd also suggest that PM2.5 speciation from the IMPROVE and CSN sites in the region be used in the evaluation.

4) Typos:

Page 2, line 49: Should be "These distinct..."

Page 16, line 371: Should be "as shown in Fig. 4b..."

Figure 8 caption: Should be "concentrations"

Figure 9 caption: Should be "concentrations"

Figure 10 caption: Should be "concentrations"

Page 22, line 470: Should be "Great Lakes..."

Page 22, lines 478-479: Should be "further north or south..."

Figure 11 caption: Should be "from north to south..."

Page 25, line 514: Should be "impacts of these emissions..."