Reply on RC1
Patricia A. Cleary et al.

Author comment on "Observations of the lower atmosphere from the 2021 WiscoDISCO campaign" by Patricia A. Cleary et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-310-AC1, 2022

Response to Reviewer 1.

Thank you for your thorough and helpful review of this manuscript. With respect to the comments in the review, all line numbers given for the revised manuscript refer to lines in the tracked-changes manuscript.

General comments:

1/The goals for the field campaign and background understanding of the lake breeze effect have been added to the revised manuscript.

The goals of the campaign were to: a) characterize lake breeze characteristics of near shore circulation onset and vertical shape along the shoreline of Lake Michigan, b) capture the development or movement of convergence zones/fine scale circulations within the lake-breeze frontal region from offshore to onshore over time and c) monitor ozone gradients, characteristics of chemical circulation patterns within marine-influenced inversions at the shoreline at low altitudes. See P2 lines 39-51

2/Language to describe the utility of the dataset to the greater scientific community has been added to the revised manuscript. These data sets can be used in a variety of ways to better understand the meteorology and pollution episodes at the Lake Michigan shoreline. The Lidar WindPRO data and RAAVEN data provide complete coverage of the atmospheric dynamics of the marine layer such that it can be characterized and modeled (Wagner et al., 2022; Jozef et al., submitted); Those characterizations could be used to test the fidelity of operational meteorological models (such as HRRR) in modeling the stable boundary layer height. The data sets can also be used to test models for the roughness parameterizations in a shoreline environment using overwater and overland turbulences. The combination of ozone data with the meteorological data can be used to constrain air quality models for the chosen mixing volume for chemical processing in the atmosphere, using the FOAM model (Vermeuel et al., 2019) or testing vertical grid-scale sizing of nested high resolution models for their ability to reproduce the gradients in ozone as measured using UAS (Abdi-Oskouei et al., 2020). The lake breeze phenomenon is similar to bay breeze and sea breeze circulations that complicate modeling efforts in other shoreline locations impacted by poor air quality (Caicedo et al., 2021; Geddes et al.,...
2021) and model fidelity is crucial to the development of appropriate emissions controls in these environments. See P4 lines 111-124.

Specific comments:

1/ The selection of the time period for the campaign was dictated by capturing a combination of lake breeze and ozone events. We determined an acceptable window for operations from May 23-June 14 based on systems availability and the higher frequency of high ozone and lake breeze events occurring in this region during late spring/early summer (see Cleary 2022 Atmospheric Environment, SI for a list of high ozone events for the years 2013-2019 at Chiwaukee Prairie). Once the window was approaching, the team used the RAQMS forecast model and consulted with the Wisconsin Department of Natural Resources Air Quality Division’s meteorologist (who does internal ozone forecasting for the division) to decide on a “go time” to initiate deployment from all collaboration partners. The go time required evidence that synoptic flow would have a southerly component for a few days (normally brought about by a high-pressure system over the Ohio River Valley) with limited precipitation events. During the campaign, flight days were cancelled when operations would be in extreme weather or under conditions that were well outside of the goals (to capture lake breeze and to capture lake breeze with high ozone). See P 18 lines 304-313.

2/ Page 7 line 142 (Now P21 lines 339-340): The request is to report the saving frequencies for instrumentation. The saving frequency for instrumentation for the RAAVEN is given in lines 357-365 and the saving frequency for instrumentation on the M210 is given in lines 492-493 and units were changed from intervals in s to Hz.

3/ Section 3 has been moved. Please see revised manuscript.

4/ Thank you for this suggestion – we now have a separate section for interpreted results starting on Line 584 on P32.

P 32 lines 584-608 now include interpreted results.

Technical comments

1/ Page 2 line 38: please correct “on shoreline” by “on the shoreline”. Done

2/ Page 2 line 63: (now line 78) please correct “night time” by nighttime”. Done

3/ Page 3 line 68: (now line 83) Please correct “Incorporation” by “The incorporation”. Done

4/ Page 3 line 80: (now P4 line 95-96) Please correct “up to planetary boundary layer” by “up to the planetary boundary layer”. Done

5/ Page 4 line 104: (now P16 line 288-289) Please correct “near to the WiDNR” by “near the WiDNR”. Done

6/ Page 6 line 120: (now P 18 line 313) Please correct “cancelled” by “canceled”. Done