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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The lacustrine-water vapor isotope inventory experiment L-WAIVE" *by* Patrick Chazette et al.

Anonymous Referee #1

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Summary: The authors of this manuscript describe a set of measurements from a 2-week field campaign investigating atmospheric water vapor and environmental conditions above a high-altitude lake in the French Alpes. They used a combination of many different sensors from ground-based lidar to observe atmospheric water vapor structure, cloud properties, and aerosols to ultra-light airborne platforms equipped with lidar, solar flux sensors, and water vapor isotope analyzer. Additional water isotope measurements were made from collections of cloud water and lake water at various depths, including the surface layer. It is a diverse dataset with potential to inform studies of lake evaporation and atmospheric mixing processes and perhaps provide validation for satellite measurements.

General comments: While the potential of this dataset is very promising, the current

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Discussion paper

manuscript does not deliver much interpretation. The authors do characterize vertical profiles of water vapor isotopes, but they do not comment on their interactions with clouds and aerosols. Nor do they discuss lake evaporation and atmospheric advection processes. It is clear that the data interpretation work is underway and planned for a future publication. This manuscript appears to be mainly the dataset description of many different types of observations during an intensive field campaign and presents observed ranges of isotopic values for vapor and liquid samples.

Having said that, this reviewer is not sure whether it meets the scope of ACP. "The journal scope is focused on studies with general implications for atmospheric science rather than investigations that are primarily of local or technical interest." Perhaps this would be more appropriately published as a dataset rather than a research paper? I will defer to the journal editor on this particular question.

If this limited interpretation is within the scope of ACP, here are some suggestions for making the value more apparent to the readers. 1. Why is the water vapor field in mountainous regions important to study? Societal importance? Local moisture recycling? 2. The authors could highlight their analysis linking large scale circulation from ERA to local wind patterns rather than declaring the aim of this manuscript to "gain understanding on the vertical structure of atmospheric water vapour above mountain lakes and to assess the respective influence of evaporation and advection processes" which they do not deliver in this particular manuscript. 3. "The influence of the lake evaporation was mainly detected in the first 500 m of the atmosphere." What data did the authors use to support this conclusion? 4. "A CRDS water vapour isotope analyser performed measurements during one day at the end of the experiment just above the lake surface in parallel with the lake water sampling." Was this data omitted?

Specific comments: Line 63 – See also this paper on tall tower measurements: Griffis, Timothy J, Jeffrey D Wood, John M Baker, Xuhui Lee, Ke Xiao, Zichong Chen, Lisa R Welp, et al. "Investigating the Source, Transport, and Isotope Composition of Water Vapor in the Planetary Boundary Layer." Atmospheric Chemistry and Physics 16, no.

8 (2016): 5139–57. https://doi.org/10.5194/acp-16-5139-2016-supplement.

Line 115 – Is the cloud water sampler discrete or passive (integrating the entire flight)? I think later it's mentioned that the collector opens while in the clouds only. Line 150 – the ULA's flew to 4 km amsl! That's amazing! Do pilots need O2? Line 181 – what is ALiAS? Line 190 – flux instead of flow? Line 205 – more details about the particle sizer inlet? Line 215 – were calibration functions designed specifically for this instrument? How do they change with cell pressure? Did cell pressure change with altitude? Line 228 – Appears an accompanying data report is panned with further details of the data processing and calibration procedure. Lines 246-250 are repetitive Line 245 – plastic other than HDPE? Specify material. Line 325 – surface microlayer sampling was interesting. Is this method previously published? Line 329 – was the cross section within the lake (liquid) or above the lake (vapor)? Line 348 – cite IAEA recommendations Line 434 -WL? Line 451 - The influence of the lake is thus seen mainly up to altitudes between ∼1 and 2 km a.m.s.l. during the day and significantly lower the rest of the time (âL'š 0.5 km a.m.s.l.). How do the authors make that conclusion? Line 525 – Nice validation description, but Fig 18 shows large differences on Aug 20 and no vapor on Aug 21? Line 559 – Would it make more sense to calculate vapor in equilibrium with the lake water? To show kinetic evap influence? Line 591 – Actual values for Lake Superior is a strange comparison here given it's in a completely different location.

Fig 13 and 14 - Why does the lidar data availability with altitude change over time?

Fig 15 – not easy to compare the 2 ULA platforms. Different plot needed to compare. I'm not sure these figures show the profiles very well. The authors could consider plotting altitude vs WVMR for individual times with 2 ULAs and Lidar measurements as separate lines/colors.

Fig 18 – 2m deep samples are heavier than 10-20 cm deep? Why such tight values at 10-20 cm?

2020.