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The Cryosphere Discussions

Interactive comment on "First Investigation of Perennial Ice in Winter Wonderland Cave, Uinta Mountains, Utah, USA" *by* Jeffrey S. Munroe

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Thank you Marc for the obvious time and consideration you put into reviewing this manuscript. I appreciate your effort and am encouraged that you find this site, and the dataset I have generated, worthy of publication. As the title of the manuscript makes clear, this is a 'first investigation' of this recently discovered cave; the paper is not intended to be a complete summary of every type of investigation that could be conducted in such an environment. Mass balance of the ice mass, for instance, was not a target of this initial study. And given that nothing was known about the ice deposit (age, origin, composition) in this cave before this work, it would have been premature to use this location as a testbed for evaluating or answering key questions associated with ice caves. That work can – and should – come next, but the key goals here (as stated in Lines 65-67) are documenting the extent and age of the ice, elucidating its origin, and evaluating its paleoclimate potential. All of these goals are met by the data collected and presented in this study. In my revisions I will add wording to emphasize these specific goals, while also highlighting the potential of this site as a place where questions about ice caves could be addressed by future work building off the foundation presented here.

The author presents a detailed description of a recently discovered mid-latitude/high altitude ice cave located in the Uinta Mts, Utah (USA). The preliminary results suggest the cave ice is rather young and likely associated with enhanced winter snow precipitation during the Little Ice Age. Recent ingress of liquid water hints towards partial thawing of this sporadic mountain permafrost which is consistent with the general warming trend observed regionally.

The paper is nicely written and presents original data supporting the site-specific dynamics of the system. Such documentation is critical to better understand the response of the subsurface cryosphere with respect to climate change and provides fundamental data on a largely under-explored environment. Yet, the paper contributes only marginally to a better understanding of the general processes controlling cave ice mass balances nor does it provide a significant paleoenvironmental record. Therefore, I strongly suggest to emphasize the significance of this site for the larger community by stressing out its specificity with respect e.g. to other ice caves and/or its significance for regional mountain permafrost. Similarly, the discussion identifies a range of tasks (§4.5) that could be undertaken during future field work. Rather, I'd recommend focusing/rephrasing this chapter on what should be done at this site to answer key questions associated with ice caves, mountain permafrost and/or paleoenvironmental reconstructions. Providing these few adjustments and some minor comments below, I fully support publication of this paper.

Detailed comments:

These comments are all very helpful and I plan to incorporate them into my revisions. Thanks for giving the text such a close reading.

L. 16: edit “Most values of δ18O and δD range plot subparallel” (delete "range")

L. 17: edit ”with a slope of 7.5 with and an intercept at 0.03‰´’ (delete "with")

L. 61-66: redundancy with l. 83-85.

L. 88: specify the location of the loggers

L. 90: what about the loggers’ calibration?

L. 115: specify the location of your samples, in particular with respect to a cave ice stratigraphy and location of the isotope samples

L. 160: did you mean r2? Check significant digits

L. 194: can you comment about the wave propagation speed?

L. 219: I am missing some info about the modern context. What is the temperature mean and range, resp. the isotope signature, in the outside environment?

L. 220: “both isotopes are notably depleted” I guess you mean that both isotope ratios are low, i.e. depleted in the heavy isotopes (?)

L. 221-222: check significant digits on the isotope values

L. 272 “drops notably below ~0°C” or below the cave air temperature? Fig. 8

check/remove unit of Mg/Ca

Table 1 I guess it is the sample mass and not the C-mass? Specify which calibration curve was used.

Table 2 check the significant digits; the precision is given at 0.2‰ and 1.0‰ for d18O and d2H, respectively (cf. l. 143)