The Cryosphere Discussions

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Comment on tc-2022-67

Anonymous Referee #1

Referee comment on "Multi-annual temperature evolution and implications for cave ice development in a sag-type ice cave in the Austrian Alps" by Maria Wind et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-67-RC1, 2022

GENERAL COMMENTS

Dear Editor,

I've read the manuscript "Multi-annual temperature evolution and implications for cave ice development in a sag-type ice cave in the Austrian Alps" by Wind et al.

I found the manuscript an interesting submission describing fully and comprehensively the microclimate of a sag-type ice cave. The manuscript fits with the purpose of the journal TC.

The manuscript reports significant information generally poorly or not addressed in the existing literature and it is, therefore, a valuable work.

Although pointed out several times and accurately described, the only "weakness" of the work relates to the lack of data calculating the impact of visitors in the cave, which is indeed something hard to quantify. This is not something that affects the quality of the paper itself but makes the findings a bit less important than what could have been achieved in a non-touristic cave.

Besides such general comments and the specific comments below, I suggest the manuscript can be published after minor revision.

SPECIFIC COMMENTS

P 2 L 30-35: as I agree with the statement "it is crucial to assess and understand the microclimatic and glaciological conditions inside ice caves and their coupling to the outside atmosphere" I suggest the innovative CFD model approach proposed by Bertozzi et al., (2019) "*On the interactions between airflow and ice melting in ice caves: A novel methodology based on computational fluid dynamics modelling" https://doi.org/10.1016/j.scitotenv.2019.03.074, 2019* is mentioned in this section.

Figure 1: for more clarity, I suggest adding the location of the stakes even in the elevation view (lower panel)

P 5 L 106 (also related to **P20 L 416-419**): I understood that, as you mentioned, it is really hard to quantify the effects of artificial snow input inside the cave, but can you be more specific about this process? I see that some information is retrievable from Fig. 8 and some are explained in the discussions but maybe you can add some more if known. For example: is the snow input affecting all the areas homogeneously or just near the entrances, how often does it happen usually, just in late winter? Has the artificial snow input ever been quantified at least in snow thickness at a stake to have a vague idea of its impact (maybe referring to some of the Figure 8 values)? Is the shovelling process documented every time or the listed markers are just some of them?

P21 L 430-437: I feel that having a range of values from other stakes and T sensors would enrich the discussions of this work and improve the eventual future comparisons with other studies using this methodology in different caves. I understand that stake B and T29 were used as references for deriving the DDF as they are more robust. Is there a chance that some other T sensors and stakes are used for calculation of shorter DDF periods and then compared with the reference values that you already mentioned? If stake B is affected by the artificial snow input, are there other stakes that can be less affected by snow shovelling and therefore can provide additional data in the discussion of DDF findings?