Review for HESS-2019-647: "Pacific climate reflected in Waipuna Cave dripwater hydrochemistry "

by Nava-Fernández et al.

Overall:

This manuscript aims at evaluating the hydrochemical response of the Waipuna Cave, using a 3-yr monitoring data, as a sensor of external environmental variability and, subsequently, calibrating environmentally-sensitive proxies from speleothem archives. It also attempts to put into context the cave response to ENSO influences on some relevant proxies. Overall, the work is well-written (although several punctuations are not correctly used), and well-structured (otherwise indicated in my detailed comments below). The goal is clear and the methods are adequate. Figures are nicely presented. I congratulate the authors for putting such efforts in this manuscript.

Here I provide two types of comments: (1) more of conceptual comments that may help the author provide better grounds on the main concept they want to convey, and (2) technical comments, that mainly address lines per lines comments as I found idea or expressions requiring corrections or clarifications.

Comment type 1:

1. **Linkage to ENSO**: I understand that you have been referring to the last three years to interpret the ENSO relationship, but to make your point more convincing, I do suggest adding a general time series with climatology (e.g., from https://climexp.knmi.nl/start.cgi) since at least 1950 along with the SO index using either Nino 1+2, Nino 3, Nino 3.4 or Nino 4 (providing a rational for why one or the other is chosen). This could potentially demonstrate the strong climate linkage of your site to ENSO (with this time series, you can indicate with color code the El Nino Event vs. La Nina Event).

2. **Classification of drip water based on flow paths:** the authors use different terminology in the classification of the drip flow throughout the text, which is quite confusing (as some terms mean the same, others are climatic based and bedrock based). It would be nicer if the authors define the nature of the flow at the beginning of their paper, provide a general classification (e.g., Type 1, Type 2, and Type 3), group the relevant literature (already in the text) to match with their own classification, and finally assign the classification with only one name: such as in line 35. This could definitely keep consistence of terminology usage throughout your work.

3. **Proxies not shown in the main text figure:** d17O (17Oexcess) is among proxies listed in the abstract and the main text, but I was surprised that it does not appear in none of the figures of the main text. If you think this could play an important role in your study, please add it in the main figure, otherwise, it should be removed from the abstract because it is a bit misleading.

Comments type 2:

Line 29: remove "," after CO_2

Line 29-30: Please indicate directly which of these measurements were continuous and which are spot measurements (so that the use of "and" in line 29 and "and/or" in line 30 are less confusing).

Line 35: diffuse, fracture, and combined (this order makes more sense, please re-order)

Line 36: how about "small" variability

Line 37: remove "to" after testifying

Line 50: The effects of both "of" these

Line 53: please replace "reacts" with "responds"

Lines 53-56: For the case of la Niña, you specified NE New Zealand, but for El Nino, you didn't. Please keep it parallel.

Line 55: La Nina events "bring" stronger ….

Lines 56: please replace "costs" with "impacts"

Line 57: Please replace ";" with "." And start "For example" as a new sentence.

Note: When I read the first paragraph of the introduction, it gave me the impression that the paper will provide longer-term records, but this is not the case. I suggest to rewrite it better to reflect well what is intended to be conveyed in the paper.

Line 73: your reference "see section 3.5 for definition" is not correct

Line 75: use "reflects" instead of "depends"

Line 79: Some of the key parameters…

Line 81: Analysis of the latter allows to "distinguish between" the processes….soil dynamics) "and the processes"….

Lines 85-90: I thought conduits flow group fracture and fissure flows, as primary porosity and fracture/fissure flow both reflect the nature and quality of the bedrock. If I am wrong in my understanding here, please elaborate a little bit about the conduit flow, thank you

Line 91: There should be a dot after variability (you may also need to explain further around this section the drip flow classification, if necessary, as it seems to play a role in your paper)

Line 98-99: PCP serves as a proxy system for moisture availability (Magiera et al., 2019), and affects a range of trace elements, which may either become more concentrated (increasing X/Ca) or diluted in solution (decreasing X/Ca) with increasing PCP –I am not sure I follow this sentence well. Please re-write. I think you confuse how to interpret a ratio vs. how to interpret elemental concentration.

Line 113: we hypothesize "that"….

Line 113-115: this statement is one of the reasons I suggested to the authors to add the climatology + ENSO index (as I feel that they jump the gun too quickly). Also see my comments further below..

Line 117: you are listing d17O here, but no data is shown in the main manuscript, but only in the supplementary. May be it is good to add such data in the main text, and provide some convincing arguments

Line 133-136: I think this climate information is outdated, and it is not clear from which time period is the data being reported. I suggest visiting this site (https://climexp.knmi.nl/start.cgi) and download the relevant data using the monthly observation. From that, you can make your own climatology plot. In addition, as you'd be keen to include ENSO, I suggest plotting these climatology data with the SO index using either Nino 1+2, Nino 3, Nino 3.4 or Nino 4 (providing a rational for why one or the other is chosen).

Line 154: Spot cave air pCO2 were measured

Line 155: 10% REALLY ??(your pCO2 values are in ppm and your equipment uncertainty is 10%, something is wrong here)

Line 161: Ten drip sites, along with the cave stream …..

Line 162: if you are not going to report any results from this core at this stage, I suggest not mentioning this at all here. In fact, if you will publish it in your future work, then this paper needs to be cited. That's more logical to me

Line 164: terrace may not be an appropriate term here (how about platform?)

Line 164: Water from the cave stream was collected during each cave visit. How about rewriting this as "additional water samples from the cave stream were also collected (please indicate how many?)"

Line 167: when you said "previously demonstrated" would there be any reference for this?

Line 170: please remove the words in parenthesis

Line 169-171: I have suggestions for re-writing: "Drip rates at the monitored sites were determined using two independent methods. First, spot measurements were performed at all drip sites. The number of drips per minute were counted during each visit using a stop watch and counting at least 10 drips (normally at least three one-minute duration counts for the fast drip points). Second, continuous measurements were done at four drip sites (……) using automatic acoustic ….."

Line 173-174: cross correlation between local cumulative ….. discharge response to rainfall

Line 174-175: This is a single sentence paragraph; did you mean to have at least one more sentence here?

Lines 186: before and after a set of measurements of 10 to 12 samples

Lines 192: would like to know more about the calibration of the 17Oexcess in water, how the samples were prepared, and run?

Line 195: when you say "oxygen", do you refer to 18O or 17O or both, since you've been using three machines, please be specific. (if I understand well, some of the machines did not analyze 17O).

Line 196: "every 6 samples" earlier you said every 10-12 samples, did I miss something?

Line 201: Ca and Mg are major elements, how precise were the measurements using ICP MS vs ICP-OES? (did you test this?)

Line 215: Please add a coma after "Glenbrook"

Line 216: whe**n** overlapp**ed**

Line 218: I am not sure if you are interpreting a daily rainfall or cumulative monthly rainfall here, please be specific

Line 223: replace illustrated with "shown"

Line 235: seepage flow, fracture flow etc… you are using different terminology in the classification of the drip flow (earlier, the classification is different), can you please provide a common classification Type 1, Type 2, Type 3, and define each and keep this consistent throughout your work?

Line 239: Cluster analysis using manual and logger data reveals three main groups of …

Line 240: Please replace the sentence "drip site…others" with "The first group isolates drip site WP-2".

Line 240: " A second cluster groups sites WP1-3…."

Line 241&242: please remove the words inside the parentheses

Line 258: please use "small" instead of "low" before variability

also for the values in () you should've used the stdev of the values to make sure your statements with the analytical error are parallel.

Line 268: use small "l' for liters unit
it would be better to write 1000Mg/Ca and 1000Sr/Ca so it's clear (the ratios are unitless)
Line 278: ..chamber "recorded" between…
Line 293-294: I don't think it is a good idea to anticipate this statement in this paper as there is almost no data presented from that core in here.
Line 297: "free draining" -- what do you mean by this? and in which aspect?
Line 299-303: The use of seasonal flow vs. seepage flow in classifying the types of flow sounds a bit technically incorrect. One seems to relate to the nature of the overlying bedrock, the other to climate, which is like comparing oranges and apples. Please refer to my comments earlier (also if you'd like to include climatic classification, you could say "fracture flows are more seasonal than seepage flows", for example).
Line 299-318: Again, you are using a lot of technical terms to describe the nature of the flow. I'd suggest to define the nature of the flow at the beginning of your paper and assign it to only one name per category.
Line 324-326: please explain a bit the mechanism with regard to the light and heavy isotopes
Line 328-329: how could you quickly infer that?
Line 337: remove "(" before multi
Line 349: "boundary layer", what layer?
Line 365-368: wouldn't this reflect the amount effect?
Line 385: please make sure to follow the journal guidelines in using in-text citation
Line 406: Section 5.5: is this reference correct?
Line 428: please provide a subtitle that is more scientific (the current subtitle could be better for lay-audience readers, e.g., for blogs)
Line 700: with lag days between 11 and 16 days to
Line 745: there are two data points of the Feb-Aug dataset that merge with the orange data sets. Don't these data points change the linear fit? Why they are there?
Figure S1: what is the climatic difference between seepage flow and seasonal flow (see my comments above). I would expect that all the WPs (WP1-1, WP1-2, WP1-3, WP1-4, WP-1A, WP1B) in figure 2b should belong to one category (based on how I understand the figure 2b)
Figure S8: the blue diamonds seem to show a bimodal distribution: one that seems to be parallel with the orange plot, and the other detached from it. Does this represent something else?