

Interactive comment on “Reconstructing seasonality through stable isotope and trace element analysis of the Proserpine stalagmite, Han-sur-Lesse Cave, Belgium: indications for climate-driven changes during the last 400 years” by Stef Vansteenberge et al.

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This is an excellent paper which pushes speleothem science forward in a significant way. The last paragraph of the conclusions in particular is an absolutely key insight which all speleothem scientists should bear in mind going forward.

In addition to vital considerations of the challenges in interpreting records within a stalagmite where the underlying cause (or causes) shift in importance through time,

C1

the authors also present useful information about historical climate variations in central Europe.

I recommend that this manuscript should be published, and only have a few (hopefully constructive) minor comments and tweaks which I would suggest are made by the authors:

In section 2.1 (lines 92-101) the modern climate is summarised and reference made to calculated evapotranspiration effects. This information is essential, and is further discussed later on in section 5.3 where further calculations and a figure are included. However, no figure is shown here to summarise the data. This could be fixed with a reference to the subsequent figure (Figure 8, currently).

Additionally in this section, average (mean?) values are given for both rainfall and temperature. Given the main thrust of this paper is about seasonality and variability it would seem important that some discussion of the variability is also included (SDs on means, some kind of measure of mean ranges?).

Line 107: "Drip Water" within the cave is discussed. It would be useful to indicate whether this is a general cave value, or specific to the drip site where the stal in question was collected, as with flow path variations these may be different.

Line 108: Average pCO₂ is given, but no clear indicator of the range. If dissolution or non-deposition are a threat to speleothem growth the maximum value is key.

Line 234: Typo, missing the word "of" at the end of the line

Line 241: (This is very nitpicky of me, and I do apologise). "the median is used instead of the average" is an odd phrasing, since the median is a form of average. I assume here that "average" refers to the mean. Here and throughout the rest of the manuscript I would ensure that either "mean" or "median" are used in the relevant places to avoid any confusion.

Line 371: Typo, "chances" should read "changes"

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Section 5.3: I like this section in general, but I find the idea that a speleothem "switches" between two transfer functions to be a little simplistic. My way of thinking about it (as expressed, perhaps poorly in my 2016 paper which is cited in this manuscript) is to view correct transfer functions as a compound function with multiple terms where the weighting changes. PCP and IDD are both taking place the entire time, but the weighting shifts to make one or the other more dominant. This is perfectly compatible with the results, interpretation and conclusions drawn in this paper. The point stands that one can't simply assume a transfer function based on very short-term monitoring, because there may be a currently low weighted additional term in that function which becomes significant in other time periods. Rather than abrupt switches from one to the other (such as may sometimes be the case, e.g. with flowpath activation) the more common result may be a gradual transition. The author's shouldn't feel that this comment requires a change to the text, I just think they should consider this as an alternative way of describing the phenomena.

Line 450: Supp. Mat. Fig. 1 is referred to. Incorrect? S1 is a set of frequency analysis plots.

Figure 5: In Figure 5 the P16 section of the record appears to undergo a transition at the 9mm mark where the magnitude of multiple trace element cycles markedly alters. Y, Zn and Mg all seem to increase in cycle maximum magnitude by almost double. This sub-sub-section variability isn't discussed in the text. It probably should be at least mentioned in the results section.

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