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***Interactive comment on “A 500 year seasonally resolved  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$ , layer thickness and calcite fabric record from a speleothem deposited in equilibrium of the Han-sur-Lesse cave, Belgium” by M. Van Rampelbergh et al.***

**Anonymous Referee #2**

Received and published: 15 December 2014

General Comments: This is an interesting and quite detailed study of a 500 year seasonally resolved speleothem stable isotope record from Han-sur-Lesse cave, Belgium. My general impression is that the authors have completed a careful multi-proxy study and for the most part have matched their careful analytical work with thoughtful and well considered and supported interpretations. The U-series data are clearly problematic and I think that even less discussion should be given over to these data. It is finally stated near the top of page 4161 that the layer counting model is used to establish the chronology for the stalagmite; perhaps convey this information to the reader earlier

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in this section. My other main concern is that the manuscript is currently too long (c. 50 pages) and I would strongly recommend that the authors try to reduce the overall length of the text, paying particular attention to possible repetition in places. A more concise text will improve the readability of the manuscript and ultimately will improve the impact of the work.

In the interpretation/discussion section, changes in the NAO state are often invoked to explain the periods of anomalously high  $d_{18}O$  values (cold-dry periods. These are often linked to negative NAO periods in the reconstruction of Trouet et al. (2009). I would like to see the Trouet et al. curve plotted on the same diagrams (e.g. Figs. 4 and 5) so that the reader can more easily assess these putative links.

It should also be noted that negative NAO conditions are known to be associated with more easterly-derived moisture that typically has more lower  $d_{18}O$  values (e.g. Baldini et al., 2008, *Geophys. Res. Lett.* 35, GL032027 and Baldini et al. (2010) *Climate Dynamics* 35, 977-993). The point is that negative NAO conditions would be expected to produce lower rainfall  $d_{18}O$ . One would then have to argue that this effect is overwhelmed by the non-equilibrium effects that apparently give rise to higher  $d_{18}O$  and  $d_{13}C$  in the Prosperine stalagmite during these periods. I do not wish to claim that the authors' interpretation of a link to the NAO is incorrect, but the magnitude of the non-equilibrium effects on  $d_{18}O$  and  $d_{13}C$  would have to be quite large to produce the observed 'anomalies' (high values) if rainfall values for  $d_{18}O$  were lower than usual. Are there any particular ventilation effects that might make the cave particularly sensitive to NAO conditions (wind directions etc.)?

Given the absence of Mg/Ca and Sr/Ca data I think the authors should steer clear of making interpretations that include statements about prior calcite precipitation. In the absence of the trace element data, such interpretations are probably overly speculative.

In Table 1, the  $^{230}Th/^{232}Th$  ratios should be given as activity ratios, not atomic ratios.

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Most readers will be able to tell at a glance that many of these samples are contaminated by detrital thorium if these ratios are given as activity ratios (e.g. is the activity ratio < 100 etc). As presented in Table 1, these numbers are difficult to convert to activity ratios unless the reader happens to have a calculator to hand and he/she happens to know the ratio of the decay constants of  $^{230}\text{Th}$  and  $^{232}\text{Th}$ . Help the reader - convert these ratios to activity ratios.

Specific Comments and minor corrections: Abstract: The abstract is informative but is overly detailed and too long for an abstract. The purpose of the abstract is to convey the major findings of the study in a concise manner to the reader. Details of how the interpretations are supported can be omitted and discussed within the text of the manuscript itself. There are also a few typographical errors (e.g. upper case A is missing at the beginning of two sentences).

P. 4153, line 5: 'To allow reconstruction of' instead of 'To allow reconstructing'

P. 4154, line 3: 'in more detail', not 'more in detail'

P. 4156, line 19: I suggest you use 'number of counted layer couplets' rather than 'amount of counted layer couplets'

P. 4158, line 12: 'number of years' rather than 'amount of years'.

Similar comment on P. 4159, line 24.

P. 4163, lines 14 and 15: The 'amount effect' causes  $\delta^{18}\text{O}$  values to decrease during wetter periods, i.e. become more negative, (not increase as stated here).

P. 4163, line 27: 'smaller scale' not 'smaller scale'.

P. 4164, line 10: 'assuming' would be better than 'considering'. This is definitely an assumption.

P. 4165, line 4: 'large scale', not 'large scaled'.

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P. 4171, line 8: The possibility of a lit fire on the Prosperine stalagmite does indeed suggest dry conditions, but they may have been short-lived, perhaps a season or two? I'm not convinced that this is necessarily evidence for drier conditions on decadal timescales, as implied here.

P. 4174, line 22: 'measured' not 'measure'

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Interactive comment on Clim. Past Discuss., 10, 4149, 2014.

CPD

10, C2091–C2094, 2014

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