Clim. Past Discuss.,
https://doi.org/10.5194/cp-2017-91-SC1, 2017

Climate of the Past Discussions

Interactive comment on "Does Belgian Holocene speleothem records solar forcing and cold events?" *by* Mohammed Allan et al.

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Received and published: 19 August 2017

The manuscript by Allan et al. under review constitutes a very valuable contribution to an important discussion regarding climate evolution during the Holocene, that could greatly benefit from some improvements. It is exclusively with that aim that I write this commentary.

The paleoclimatology field is undergoing an interesting controversy over the existence of Holocene climatic oscillations or quasi-cycles for which no clear mechanism has been identified. For some authors this type of periodicities are likely to emerge from the noise generated by a chaotic climate system (Turner et al., 2016). To other authors the climatic periodicities are real even if the forcings responsible are unclear at present

(Khider et al., 2014). This manuscript is an important contribution towards cementing the correlation between some of these climate periodicities and solar variability periodicities as recorded by cosmogenic isotopes records. The hydrological nature of the evidence makes it particularly valuable.

The good resolution of the speleothem ($\sim$ 20 years on average), and the high correlation between the different trace elements analyzed make this proxy a very good data source to reconstruct the centennial and millennial climatic changes underlying the differential deposition of the elements.

The article would benefit greatly from a discussion of known hydrological changes during the period analyzed with a special emphasis on how they could affect Père Noël cave hydrology and trace element deposition.

Modeling (Shindell et al., 2001), climate data (Kodera, 2002), and proxy reconstructions (Rimbu et al., 2004) have implicated North Atlantic Oscillation variability as an important element in the climate response to variable solar forcing. Modes of NAO variability are responsible for wind strength and moisture delivery to Europe (Smith et al., 2016). During the periods of lower than average solar forcing discussed in the manuscript, dominant NAO negative conditions caused a southward displacement of moisture delivery to Europe, and are associated with increased humidity in Central and Southern Europe (Smith et al., 2016; Magny, 2004), and decreased humidity in non-coastal Northern Europe (Deininger et al., 2016; Harrison et al., 2002).

The hydrology of the Belgian region, as inferred from the Père Noël cave speleothem record, should be compared to the hydrological groups defined by Harrison et al., 2002, based on lake levels, where it probably belongs to group 5. Even more relevant is the comparison to European speleothem δ18O records presented by Deininger et al., 2016, as it is the same type of proxy based on a different chemical species. Bunker cave, located in Germany (51°N, 8°W; Fohlmeister et al. 2012) is close enough to merit a comparison that could allow to draw some conclusions on the similitude of

hydrological conditions.

It is also my opinion that the title of the manuscript has been poorly chosen. Speleothems record essentially hydrological changes, and the data presented does not allow any inference towards temperature changes. The paper should concentrate mainly on hydrological changes during the Holocene. There are plenty of papers on Holocene temperatures while papers on hydrology are not so abundant.

I hope my modest contribution is useful both to the authors and the editor of this manuscript.

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