Clim. Past Discuss.,
https://doi.org/10.5194/cp-2018-37-RC2, 2018

Climate of the Past Discussions

Interactive comment on "Neoglacial Climate Anomalies and the Harappan Metamorphosis" *by* Liviu Giosan et al.

Anonymous Referee #2

Received and published: 3 August 2018

Interactive comment on "Neoglacial Climate Anomalies and the Harappan Metamorphosis" by Liviu Giosan et al.

The paper presents a reconstruction of the Indian winter monsoon in the Arabian Sea for the last 6000 years based on paleobiological records with different complexity. Based on the analysis of sedimentary paleo-DNA and planktonic foraminifers the authors show that stronger winter monsoons occurred between ca. 4,500 and 3'000 years ago. They call this period Early Neoglacial Anomaly (ENA) and argue that this climate reorganization may have helped trigger the well-known metamorphosis of the urban Harappan civilization into a rural society. As a dynamical climatologist I could principally review the climatological part of the paper. I was not able to evaluate the methodological part of the sediment core analysis.

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Overall the paper presents an interesting analysis on the activity of the Indian Winter Monsoon and its impacts on the Harappan civilization. I am personally cautious if a new term for a climate period is defined. Are the authors convinced the ENA is a global phenomenon with high significance? Is it not possible that similar climate periods marking the transition to the Neoglacial occurred even earlier and in other areas of the globe?

Specific comments:

Lines 34-36: Avoid creating the impression the Little Ice Age was not global. It was but, due to the inertial effect of the large ocean areas in the Southern Hemisphere, the cooling effect occurred later in this area (see Neukom et al., 2014, Nature Climate Change 4, 362-367).

Lines 48-49: If you call a climate period as an optimum, it has to be related to a certain state or process. Therefore, I recommend using the classical term “Holocene Thermal Maximum”.

Lines 67-73: The Indian Winter Monsoon is, simply said, driven by the thermal contrast between the cold Asian continent and the adjacent warm oceans (see e.g. Trenberth et al. al., 2006, in: The Asian Monsoon, Springer; Wang and Chen, 2014, J. Climate 27, 2361-2374; Yancheva et al., 2007, Nature 445, doi:10.1038/nature05431).

Line 116: Dimri et al., 2015?

Line 220: Pisias et al, 2013 is not in reference list.

Line 313: Böll et al., 2014.

Line 332 and lines 364-369: I do not recommend introducing a new term called Late Neoglacial Anomaly (LNA). First of all, this period consists of two cooler (Migration Period, Little Ice Age) and two warmer periods (Medieval Climate Anomaly and Modern Warming). Second, the dynamical background differs clearly from the so-called ENA: Orbital forcing set the stage, Grand Solar Minima, volcanic events

and GHG forcing played a key role and, likely, internal variability had a significant influence (see Bradley et al., 2016, The Medieval Quiet Period. The Holocene, doi:10.1177/0959683615622552). Line 376: Büntgen et al., 2016 Lines 380-383: I agree, but we should not forget mentioning internal variability! Lines 431-432, 437: You mention several local names. I ask me if you should also add a Figure with a local map?

Lines 480-485: This is a very important question. I am asking me whether or not literature about this phenomenon is available?

Figure 1: I am not happy with the direction of the arrow marking the Summer Monsoon. Look at you Figure 2 A or consult Figure 1 in Chen et al., 2008, Quaternary Science Reviews 27, 351-364. Why did you not insert an arrow for Winter Monsoon?

Figures 2-5: In my opinion, for a better oprientation, it would make sense to denominate the Figures 2-5 with letters A,B, C etc.

Abbreviations: The paper contains numerous abbreviations. It would possibly make sense adding a list of abbreviations at the end of the paper text.

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