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Climate of the Past Discussions

Interactive comment on "Climate Induced Speleothem Radiocarbon Variability on Socotra Island from the Last Glacial Maximum to the Younger Dryas" *by* Steffen Therre et al.

Anonymous Referee #1

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General comments: Therre and co-authors present a new 14C record from Socotra Island, spanning the last deglaciation. They find very high and variable DCF values during the late glacial, which can only be explained by a combination of closed system dissolution regime and a high contribution of pre-aged soil organic matter. Through a multi-proxy approach, the authors can interpret changes in DCF with respect to synchronously occurring changes in infiltration and rainfall amount. This has important implications for the use of stalagmites for extending the 14C calibration curve, which as this and other studies show must occur on a case by case basis and is highly dependent on local climate and soil/vegetation dynamics. On the other hand, records such as this can provide novel and highly timely insights into soil carbon dynamics over time,

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and their sensitivity to climatic change.

I enjoyed reading this paper, which I think is well within the scope of Climate of the Past. The scientific approach and methods are valid and outlined in great detail. The results are discussed appropriately, considering previous related research. The quality of the paper is already high, it is overall well written, with clear and concise presentation of results and conclusion and nice figures. I therefore recommend publication after minor revisions.

Specific comments: Page 7, lines 205-207: I'm not sure I follow the conclusions of the authors that temperature drives the stalagmite width change. If higher drip rates and higher temperatures cause a larger width of stalagmites, then how can it be explained that the width of the stalagmite decreased when temperatures increased after the glacial? There might be a typo in the above sentence explaining the mechanism. . .

Page 9, discussion of causes for high DCF values. I agree with the authors that the proposed scenario (closed system dissolution and an old SOM pool contributing carbon on top of that) is likely the only process that can explain the observed DCF values in this case, but I would like to see a bit more discussion of the soil/karst system at Moomi cave. I assume that there have not been any investigations on the soil, which is unfortunate. However, it would still be nice to see a couple of sentences discussing how likely the presence of pre-aged organic matter is in the soil or karst above the cave (how thick is the soil and what type of soil is it, what kind of vegetation covers the cave, is there any chance that there is a reservoir of ground air that could contribute pre-aged CO2 to the drip water?).

Page 10, discussion of d18O and d13C signal over glacial termination. The authors suggest that the slight differences between d18O and d13C during the deglaciation, in particular the gradual decrease in d13C and more sudden termination in d18O are related to d18O registering the amount of precipitation (amount effect), while d13C is affected by vegetation changes. While this is one possibility to explain these different

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trends, it strikes me that the long-term trend in d13C is also reflected in the other hydrology proxies, in particular in Mg/Ca. Is it possible that d18O and d13C reflect a decoupling of regional moisture dynamics and local infiltration, as suggested for other Asian monsoon records (e.g., Myers et al., 2015, GRL, Cheng et al., 2016, Sci. Rep.)?

Technical comments: Page 6, lines 172-173 (14C results): I had to read this sentence several times, as to me it reads as if the 14C ages of the stalagmite were younger than the atmosphere. Would it be possible to rephrase to "the 14C ages of the stalagmite are significantly older than. . ."?

Page 10, line 298: I find the references to the Griffiths 2012 and Lechleitner 2016 papers here out of place, as these are both from tropical cave systems and therefore not from temperate environments. Maybe it would be worth rephrasing to "more humid" compared to Socotra?

Page 11, line 332: Would it be possible to provide a p value as well for the correlation between DCF and Mg/Ca? Also, note that in the text the authors refer to r2, while in the figure caption for figure 8 they use r.

Figure 3: It's quite hard to distinguish the ages from this study from the previous Shakun ages. Maybe the new ages could be highlighted by colouring the inside of the circles in grey? This would also help distinguish them from the omitted ages.

Figure 5: Please explain in the caption what D1 and D2 stand for.

Figure 6: "treerings" on the top of the figure should be "tree rings"

Figure 7: What do the different symbols for d234U stand for? Please explain in the caption or with a legend in the figure.

Figure 8: I would move the description of the YD (grey area) to the end of the first sentence in the caption, because as it is now it reads a bit confusingly (it seems like the grey box says something about soil dynamics).

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