

We thank the two reviewers for their time and valuable comments that were taken into account as detailed in the following.

#### Comments from Christo Buizert.

- Could you speculate on the physical mechanisms for the decoupling? In other words, why are H-events not recorded in Greenland temperature records? My sense has always been that Greenland temperatures are “saturated”. Once the winter sea ice edge is far enough south (say 45N), driving it further south by additional AMOC weakening will not cool Greenland any further. Other explanations are also possible of course. Since the decoupling is the main topic of the paper, it would be appropriate to have some discussion on what could cause such a decoupling.

>> We propose to add the following text: “Uniformly cold conditions are generally observed during Heinrich Stadials of the last glacial period with temperature and  $\delta^{18}\text{O}$  levels that are not significantly lower than temperature levels observed during Greenland Stadials (Kindler et al., 2014; Guillevic et al., 2014). Because Greenland is surrounded by large sea ice extent during Greenland Stadials and Heinrich Stadials (Hoff et al., 2016), an explanation may be that central Greenland temperatures are saturated during cold periods so that AMOC modifications occurring south of the sea ice edge are not influencing significantly Greenland temperatures.”

- Line 63-64: The 16.2 ka event is also seen very beautifully in Cariaco basin reflectance (Deplazes et al., 2013). Since Cariaco is such an iconic record, it would be worth mentioning this (or even showing it in one of the figures).

>> We propose to add this reference in the following sentence: “At low latitudes, an ITCZ shift at 16.2 ka is clearly expressed through a weak monsoon interval in East Asian speleothem records and through change in hydrology in the low-latitude Pacific region, Cariaco Basin and Brazil (Partin et al., 2007; Deplazes et al., 2013; Russell et al., 2014; Strikis et al., 2015).”

- Another paper that should be referenced here is (Zhang et al., 2016). They argue for stronger links to Antarctica than to Greenland, as also proposed here. The decoupling between Greenland and mid-latitude hydrology had been noted explicitly by others also, which could be acknowledged more clearly (Rhodes et al., 2015; Zhang et al., 2016; Zhang et al., 2014).

>> The reference to the work of Zhang et al. (2016) has been added (see below) and we propose to modify the present conclusion by adding: “These new measurements hence confirm the previous studies of Zhang et al. (2014, 2016) and Rhodes et al. (2015).”

- The motivation on line 70-76 for using ice cores is not very strong, in my view. Since there is no H-event signal in Greenland temperature records anyway, there is no benefit in having a hydrological record on the same time scale! All the other records (CH<sub>4</sub> and CO<sub>2</sub> from Antarctica, sediments and speleothems) are on independent chronologies. Why not just state that ice core d<sub>x</sub>s and 17O can provide additional evidence to supplement what we know already from sediments and speleothems? That is a strong enough motivation in my view.

>> What we want to compare is the Greenland temperature record (high latitude) with lower latitude hydrological changes on a common timescale. In this sense, measuring d<sub>18</sub>O (+ d<sub>15</sub>N of air), d-excess and 17O-excess on the same ice core has really a sense and it is much better than comparing speleothem or sediment records with a Greenland ice core record. Such common measurements become increasingly important when going back in

time as larger uncertainties become associated to the record chronologies. We would thus like to keep this motivation for our work.

- Line 81: Please just call it Maximum Counting Error, and leave out the 1 sigma. I know that it is often advertised in terms of standard deviations, but I think it's incorrect. A 200 yr MCE means that GICC05 encountered 400 uncertain layers (each counted as half a year, representing a 50-50 chance the layer is real). So the 200 yr error is an extreme case where 400 coin flips all landed face-up. Not exactly a 1 sigma event.

>> Indeed, this was a mistake to call it a 1 sigma uncertainty. It will be corrected.

Line 86: "using a PICARRO laser cavity: : ." (change word order)

>> done

Line 101: INSTAAR (typo)

>> done

Line 156: "reflect" instead of "reflects"

>> done

Line 194: "the same timescale". Same timescale as what? As the Greenland records? Did you plot the Rhodes et al. record on its original timescale, or a different one? The caption to Fig. 2 suggests records are on the GICC05/AICC2012 time scale. How did you convert the WAIS Divide records to GICC05?

>> Actually, we kept the original timescales for the two cores but did a translation since the WAIS timescale (WD2014) is referred to year 1950 and GICC05 to year 2000. So, the conversion is only to refer both timescales to year 2000. We propose to remove "presented on the same timescale" to prevent any confusion and say that the WAIS results are presented on the WP2014 timescale referred to year 2000.

Line 195: "hypothesized to reflect" instead of "understood to reflect".

>> done

Line 199: ": : carbon fluxes and/or enhanced air-sea: : ." Both could be true.

>> Yes, that was the aim when writing "and/or"

Line 247: A southward shift of source regions is also what I would expect. This could explain the apparent SST increase of the source. However, increasing both RH and SST is hard to do through meridional shifts in atmospheric circulation. SST decreases with latitude, but RH increases. So at lower latitude, RH should be lower, actually. Any thoughts on what circulation change could cause both signatures?

>> A possibility here would be that we have mixed contributions of continental and marine sources for precipitation in Greenland at that period in agreement with the modeling study of Werner et al. (2001). Continental sources are from North America and we have a transition from a big dry to a big wet in that region at 16.2 ka. A contribution from the big wet North America from 16.2 ka would thus explain an increase of relative humidity from that period.

This idea was probably not expressed clearly enough in the present manuscript and we now propose the following text: "The Greenland signal of source humidity increase may at least partly explained by wetter conditions in the continental North America evaporative source regions, which are known to partly affect Greenland moisture today in addition to the main source in Northern Atlantic (Werner et al., 2001; Langen and Vinther, 2009)."

Line 254: how does the "big wet" transition fit in dynamically? Presumably the storm tracks and polar jet stream over N-America shift southward (Asmerom et al., 2010)?

>> This is indeed a possibility, this was added. Thanks.

"This transition to a big wet period can be explained by a southward shift of the storm tracks and polar jet stream over North America shift during this period (Asmerom et al., 2010)."

Line 260: The Pa/Th discussion is hard to follow without seeing the data. Please remind the reader that more positive values mean weakened circulation. I am no expert on this proxy, but my understanding is that Pa/Th integrates over the water column via particle scavenging. So I am not sure one can interpret the depth of the site as the depth to which the AMOC was affected. Of course AMOC changes at the surface and at depth are linked. The Pa/Th discussion should be clarified or left out.

>> The simplest is probably indeed to remove this discussion which is not needed for our conclusion

Line 283: Ice shelf destabilization by subsurface warming was suggested independently by (Marcott et al., 2011); please cite both.

>> This was added.

Line 293: The apparent stability from 20-14.7ka is somewhat misleading, because we know Greenland must have warmed in response to CO<sub>2</sub> and insolation. I think this is due to a masking effect; (summer) warming due to insolation and CO<sub>2</sub> rise is masked in Greenland temperature records by winter cooling during HS1 driven by AMOC weakening (Buizert et al., 2018). That explains why Greenland and the Laurentide retreat significantly prior to 14.7ka, while it appears there is no warming in Greenland records.

>> A reference was added to this work:

"During Heinrich 1 occurring during the last deglaciation, the story may be more complicated because of the CO<sub>2</sub> concentration and insolation increases. In this case, the occurrence of Heinrich Stadial 1 may counteract the increase in Greenland temperature records induced by CO<sub>2</sub> and insolation forcing through winter cooling driven by AMOC weakening as suggested by Buizert et al. (2018)."

Line 296: the link to EDML had also been suggested by Zhang et al. (2016), and possibly others?

>> The reference to Zhang et al. (2016) has been added:

"a link between EDML  $\delta^{18}\text{O}$  record and low latitude signal over Heinrich Stadial 1 has already been suggested by Zhang et al. (2016)."

Line 299: consider removing "their coherent chronology". I don't think this adds to much new insight, personally.

>> Done

Figures: Please add panel labels 1a, 1b, 1c etc, which will make it easier to look up in

the caption, and refer to specific records in the text.

>> This will be done in the revised version.

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