Clim. Past Discuss.,
https://doi.org/10.5194/cp-2018-65-RC1, 2018

Climate of the Past Discussions

Interactive comment on "Ice core evidence for decoupling between mid-latitude atmospheric water cycle and Greenland temperature during the last deglaciation" *by* Amaëlle Landais et al.

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Received and published: 10 July 2018

Landais et al. discuss d-excess and 17O-excess records during Heinrich stadial 1, that provide additional evidence for a shift in atmospheric circulation and the mid-latitude hydrological cycle around 16.2 ka BP, as previously seen in e.g. atmospheric CH4, speleothems, Cariaco basin and North American lake levels. The authors emphasize the point that this event is not seen in Greenland d18O, suggesting a decoupling of Greenland climate from mid-latitude hydrology.

Their data and observations make a valuable contribution to the literature, and I broadly agree with their interpretation. The paper is well-written and easy to follow. I have a

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few comments and suggestions that I'd like to see addressed before final publication. After minor revision the paper will be suitable for publication.

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.

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).

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 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 (CH4 and CO2 from Antarctica, sediments and speleothems) are on independent chronologies. Why not just state that ice core dxs 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.

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

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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.

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

Line 101: INSTAAR (typo)

Line 156: "reflect" instead of "reflects"

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?

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

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

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?

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)?

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.

Line 283: Ice shelf destabilization by subsurface warming was suggested indepen-

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dently by (Marcott et al., 2011); please cite both.

Line 293: The apparent stability from 20-14.7ka is somewhat misleading, because we know Greenland must have warmed in response to CO2 and insolation. I think this is due to a masking effect; (summer) warming due to insolation and CO2 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.

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

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

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.

Line 585: Should this be Hodell et al. 2017?

Asmerom, Y., Polyak, V.J., Burns, S.J., 2010. Variable winter moisture in the southwestern United States linked to rapid glacial climate shifts. Nature Geosci 3, 114-117.

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Deplazes, G., Luckge, A., Peterson, L.C., Timmermann, A., Hamann, Y., Hughen, K.A., Rohl, U., Laj, C., Cane, M.A., Sigman, D.M., Haug, G.H., 2013. Links between tropical rainfall and North Atlantic climate during the last glacial period. Nature Geosci 6, 213-217.

Marcott, S.A., Clark, P.U., Padman, L., Klinkhammer, G.P., Springer, S.R., Liu, Z., Otto-Bliesner, B.L., Carlson, A.E., Ungerer, A., Padman, J., He, F., Cheng, J., Schmittner, A., 2011. Ice-shelf collapse from subsurface warming as a trigger for Heinrich events. Proc. Natl. Acad. Sci. U. S. A.

Rhodes, R.H., Brook, E.J., Chiang, J.C.H., Blunier, T., Maselli, O.J., McConnell, J.R., Romanini, D., Severinghaus, J.P., 2015. Enhanced tropical methane production in response to iceberg discharge in the North Atlantic. Science 348, 1016-1019.

Zhang, H., Griffiths, M.L., Huang, J., Cai, Y., Wang, C., Zhang, F., Cheng, H., Ning, Y., Hu, C., Xie, S., 2016. Antarctic link with East Asian summer monsoon variability during the Heinrich Stadial–Bølling interstadial transition. Earth Planet. Sci. Lett. 453, 243-251.

Zhang, W., Wu, J., Wang, Y., Wang, Y., Cheng, H., Kong, X., Duan, F., 2014. A detailed East Asian monsoon history surrounding the 'Mystery Interval'derived from three Chinese speleothem records. Quat. Res. 82, 154-163.

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