Clim. Past Discuss., 9, C2422–C2425, 2013
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Climate of the Past Discussions

Interactive comment on "Persistent millennial-scale link between Greenland climate and northern Pacific Oxygen Minimum Zone under interglacial conditions" *by* O. Cartapanis et al.

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Received and published: 28 October 2013

Andreas Schmittner points out that our interpretation of an atmospheric link between Greenland climate and oceanic processes in the eastern equatorial Pacific is not supported by model simulation. He suggests that the oceanic link between changes in the AMOC and changes in the productivity in the northeastern equatorial Pacific (by changes in the nutrient inventory) has already been demonstrated and quantified in his previous papers: Schmittner (2005, Nature) and Schmittner et al. (2007, Paleoceanography). We do not contest that there might be an oceanic link between northern Atlantic and Pacific, and we will address this mechanism in the revised version on our paper.

However, several points should be taken into account while considering our dataset.

First, we want to point out that MD02-2508 core was retrieved below a coastal upwelling system. Earth system model such as UVic (with a global resolution of 3.6° (zonal) by 1.8° (meridional)) might not be suitable to resolve complex and fine scale features such as variations of intensity of regional/local coastal upwelling. Dr. Schmittner is right in stating that the atmospheric mechanism we suggest was not assessed by models, but we argue that because of their coarse resolution, these models are not suitable to simulate such fine scale process. Then, the specificity of the studied period (interglacial period with high sea level stand) should be taken into account. Schmittner et al (2007) do not directly describe if the Bering Strait is open or closed in their experiment. Figure 8 of this paper shows a continuous continental mass between Alaska and eastern Russia, such as we can suspect that the Bering Strait is closed. In that case, it is not certain that mechanisms evidenced by Schmittner et al, 2007 study are relevant to our study on the past interglacial, when the Bering Strait was open, and knowing the potential effect of opening/closing the Bering Strait on teleconnection between northern Atlantic and northern Pacific (Hu et al., 2007; Okumura et al., 2009; Hu et al., 2010). Thus, if an oceanic process is implied, this process should be affected by Bering Strait status.

Several modeling studies (Broccoli et al., 2006; Krebs and Timmermann, 2007; Timmermann et al., 2007) suggested that changes in the atmospheric circulation affected the whole northern hemisphere, especially in shifting ITCZ, and storm track on millennial timescales during glacial, which is supported by many proxies. Changes in the atmospheric circulation could have impacted productivity and oxygenation in the studied area. However, we agree that no quantitative estimation of this can be provided with our dataset (it should noted that quantitative estimations of the productivity varaiations with sedimentary proxies are affected by strong uncertainties, while no reliable quantitative proxies for oxygenation exists by now). Finally, as quoted by Dr. Laetitia Pichevin (second reviewer), large change in the opal content and Si:Corg ratio in sed-

iments at millennial timescales during MIS5 points to the occurrence of transient Iron limitation in conditions of intense upwelling and high biological demand, which fits with our interpretation, even if it does not exclude changes in nutrient availability because of oceanic circulation modification. But we think that any oceanic linkage should have been, at least weakly, affected by changes in the water exchange between the Arctic and Pacific oceans.

To conclude, we agree that there is a possibility of an oceanic linkage between the northern Atlantic and northern Pacific through changes in the northern Pacific deep upwelling of nutrients. We will thus add some consideration on that topic in the part "5.3 Oceanic circulation impact on oxygenation and productivity". This alternative mechanism will be also addressed in the introduction and the conclusion of the paper.

In addition, the referee points out several minor issues:

Page 3927 line 22: The sentence was reformulated for more clarity.

Page 3929 line 1: We agree that the interpretation of d18O from speleothems isn't straightforward. However, we quote here the interpretation of theses records by their authors in the quoted reference. Revisiting the interpretation of speleothems records is beyond the scope of our paper.

3930 lines 10-13: Theses statement are too speculative, and we have now rephrased the conclusion.

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Interactive comment on Clim. Past Discuss., 9, 3919, 2013.