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Interactive comment on "Centennial to millennial climate variability in the far northwestern Pacific (off Kamchatka) and its linkage to East Asian monsoon and North Atlantic from the Last Glacial Maximum to the Early Holocene" *by* Sergey A. Gorbarenko et al.

Anonymous Referee #1

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This study presents high-resolution proxy data derived from a marine sediment record of the Northwest Pacific. Based on lithophysical- and productivity proxies (e.g. magnetic properties, TOC content or chlorine measurements) the authors provide time-series of millennial- to centennial-scale North Pacific climate variability from the Last Glacial Maximum (LGM) into the Early Holocene (EH). Several short-term (centennial-scale) productivity changes/cycles have been identified from 20 to 8 ka and are compared to high-resolution records reflecting changes in the East Asian Monsoon (EAM)

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system as well as climate variability recorded Greenland- and Antarctic ice cores. The authors suggest a close relationship between changes in productivity in the northwestern Pacific, changes in EAM and Greenland/North Atlantic climate variability and further speculate about underlying mechanisms to explain North Atlantic - North Pacific climate synchronicity on centennial timescales.

General comments:

As there is currently quite some debate about the relationship of North Atlantic and North Pacific climate variability during the last glacial termination, the study of Gorbarenko et al. is a timely and relevant research topic. Unfortunately, problems regarding the English (grammar and usage) affect the clarity of the writing and sometimes it is quite difficult to follow authors' interpretations. Moreover, there are several issues that need to be discussed before the manuscript should be considered for publication in Climate of the Past. Please find below my recommendations to improve the quality of the manuscript:

I have some major complaints about the construction of the age model for core 41-2. The first serious concern is about the use of AMS 14C ages derived from benthic foraminifera (E.pacific and U.parvoc.) to establish age control points for core 41-2. More specifically, a constant offset of 1400 years between planktic and benthic foraminifera has been used to correct benthic ages for reservoir effects according to unpublished? and total regional results? of Max et al. (2014). However, looking into the original publication of Max et al. (2014) reveals that planktic – benthic age differences (BP ages) in core 12KL (used for correlation) varied substantially during the last glacial termination and the Holocene and are not constant through time. The variability in BP ages given in core 12KL is thus in conflict with age assumptions made on benthic foraminifers in this study. Moreover, there is some confusion about correlation of core 41-2 to neighbor core 12KL. Several AMS 14C ages have been transferred from core 12KL to 41-2 to improve the stratigraphy. However, it has been stated by the authors that one age dating from core 12KL was not transferred to 41-2 (16.53 ka at 695cm

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in core 12KL) but in the original age model of core 12KL the age in 695cm is 15.9 ka and not 16.53 ka! I feel that the current age model needs to be revised and further improved. To improve the age model, it would make sense to e.g. check for correlation to well-dated core SO202-7-6 (Serno et al., 2015). This core has an excellent age model consisting of > 40 AMS 14C ages that, in principle, could be transferred to core 41-2.

A major point that has been made is that the NW-Pacific experienced a sequence of millennial – centennial-scale productivity changes during the last 21ka. The authors further suggest an in-phase behavior between changes East Asian Summer Monsoon and to some extent links to Greenland sub-interstadials. I suggest adding another table, which should give the reader information about the occurrence and length of proposed events. I also recognized that cross-correlation has been done to compare time-series of the EAM and Greenland ice core data. What I'm missing here is cross correlation between 41-2 and Greenland and EAM records. I strongly recommend cross-correlation between 41-2 and Greenland and EAM records because this could, from a statistical point of view, strengthen the main conclusion of this study. Ideally, the time window for cross-correlation should be reduced (< 1000 years) according to the centennial-scale variability in 41-2 and other climate records.

Specific comments/Technical corrections:

Abstract:

Line 17: "The core age model" sounds strange. Better is "The age model of core 41-2 is. . .

Line 19: Please replace "SO-201-2-12KL" by "SO201-2-12KL"

Introduction:

Line 38-41: Some references (e.g. Kienast et al., 2001 or Seki et al., 2002) are related to studies in the Northeast Pacific. Accordingly, "NW Pacific" should be replaced by "North Pacific"

Line 42: A more proper citation would be Kühn et al. (2014)

Line 49: “atmospheric teleconnections” Please elaborate a little bit more in the Introduction the mechanisms behind atmospheric coupling.

Line 52: . . .Riethdorf et al. (2013) further suggest. . .

Line 57-61: This sentence is quite long and should be subdivided into two sentences.

Line 77: “With our methodologically robust age controls”. . .please see major complaint about the age model above. It is probably more accurate to say that the age model (in principle) allows to investigate centennial-millennial scale productivity. . .

Material and methods:

Line 87: Is there any citation (cruise report?) available???

Line 106: Please replace “computing” by “calculating”

Line 109-110: A better beginning of these sentence would be: “It has been shown that variability in color b*. . ..”

Line 112-124: Please see comments above regarding the robustness of the age model. Do you use the Intcal09 and Marine09 dataset as stated in Line 123-124 or Marine13 calibration curve as stated in Table 1???

Results:

Line 180-183: This sentence is confusing. Please clarify.

Line 200-225: This chapter (“Age model”) describes the correlation to neighbor core 12KL (please see major comments above) and EAM records. I think the whole chapter should be shifted to the beginning of the Results followed by the paragraph describing other parameter (productivity proxies, CF etc.) derived from sediments. At this point it would make sense to give ages (onset and duration) of the centennial-scale productivity events (e.g. by adding another Table; see main comments above)

Discussion:

Line 243-285: This chapter deals with centennial-scale NW-Pacific productivity events and linkages to EAM records and Greenland ice core data. Thus, I suggest to modify the name of this chapter from "N-S hemispheres climatic linkages of. . ." to "Northern Hemisphere climatic linkages. . .". However, studied records are also compared to EPICA data (from the beginning of line 286) and it would make sense to shift this information to another chapter named e.g. "Southern Hemisphere influence on centennial-millennial scale productivity. . ." There is also other proxy-data available from core 12KL (e.g. SST data; Max et al., 2012 or sea-ice variability data; Méheust et al., 2016), which should be discussed. Accordingly, it could make sense to add SST and/or sea-ice variability data from core 12KL to Figure 5, which serve as additional evidence for millennial-scale variability in the NW Pacific.

Line 259: missing citation (e.g. Ruth et al., 2007)

Line 278-279: "stronger winter monsoon supplies more dust to the loess plateau". Please clarify.

Line 355-410: These chapters deal with NW Pacific productivity trends over the LGM-HE1 and the Early Holocene. I suggest moving these chapters to the beginning of the Discussion, followed than by discussion of possible mechanisms to explain productivity events (e.g. one chapters describing links to Northern Hemisphere/Southern Hemisphere).

Line 379-384: How does enhanced intermediate water ventilation promotes more nutrients to the euphotic layer? Most studies in the NW Pacific found substantially reduced nutrients/productivity during HS1 (e.g. Riethdorf et al., 2013). The enhanced formation of intermediate water during HS1 has been related to strong expansion of sea-ice and brine rejection as main processes to intensify mid-depth ventilation (e.g. Rella et al., 2012).

Line 413-415: Millennial-scale climate events are also well known from the North Atlantic during the Holocene (Bond cycles; Bond et al., 1997). Is there any relationship to millennial-scale events in the North Atlantic?

Figure 1: The core locations are hardly visible in this figure. Please modify.

Figure 3:Please remove all datasets, which are not necessary for age model construction. Please blow up a little bit more the y-axis to help the reader identifying variability in the given records, which is hard to recognize in the current figure.

Figure 4: Please see comments to Figure 3.

Figure 5: It would make sense to implement one proxy dataset from core 41-2 (e.g. Si-bio) for comparison.

References:

Bond, G., W. Showers, M. Cheseby, R. Lotti, P. Almasi, P. deMenocal, P. Priore, H. Cullen, I. Hajdas, and G. Bonani (1997), A pervasive millennial-scale cycle in North Atlantic Holocene and glacial climates, Science, 278(5341), 1257-1266.

Max, L., L. Lembke-Jene, J. R. Riethdorf, R. Tiedemann, D. Nurnberg, H. Kuhn, and A. Mackensen (2014), Pulses of enhanced North Pacific Intermediate Water ventilation from the Okhotsk Sea and Bering Sea during the last deglaciation, Climate of the Past, 10(2), 591-605.

Meheust, M., R. Stein, K. Fahl, L. Max, and J. R. Riethdorf (2016), High-resolution IP25-based reconstruction of sea-ice variability in the western North Pacific and Bering Sea during the past 18,000 years, Geo-Mar Lett, 36(2), 101-111.

Rella, S. F., R. Tada, K. Nagashima, M. Ikehara, T. Itaki, K. Ohkushi, T. Sakamoto, N. Harada, and M. Uchida (2012), Abrupt changes of intermediate water properties on the northeastern slope of the Bering Sea during the last glacial and deglacial period, Paleoceanography, 27.

Ruth, U., M. Bigler, R. Rothlisberger, M. L. Siggaard-Andersen, S. Kipfstuhl, K. Goto-Azuma, M. E. Hansson, S. J. Johnsen, H. Y. Lu, and J. P. Steffensen (2007), Ice core evidence for a very tight link between North Atlantic and east Asian glacial climate, Geophysical Research Letters, 34(3).

Serno, S., G. Winckler, R. F. Anderson, E. Maier, H. J. Ren, R. Gersonde, and G. H. Haug (2015), Comparing dust flux records from the Subarctic North Pacific and Greenland: Implications for atmospheric transport to Greenland and for the application of dust as a chronostratigraphic tool, Paleoceanography, 30(6), 583-600.

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