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Biogeosciences Discussions

Interactive comment on "Quantitative reconstruction of sea-surface conditions over the last ~150 yr in the Beaufort Sea based on dinoflagellate cyst assemblages: the role of large-scale atmospheric circulation patterns" *by* L. Durantou et al.

L. Durantou et al.

lise.durantou@gmail.com

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Thanks to considering our manuscript, please find below specific responses to the comments.

Introduction

In the description of the study area, the addition of Doxaran et al. (this issue) is perti-

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Interactive Discussion

Discussion Paper

nent. It will therefore considerate, as the finer precisions about sediment supply distribution over the Mackenzie shelf.

"The core is located in the progradation of the modern delta zone (Hill et al., 1996), lower slope largest distributaries channels of the Mackenzie River in the Mackenzie Trough where highest sedimentation rates can be observed (e.g. Scott et al., 2009)."

Method

Sea-ice data used in comparison of the reconstituted sea ice cover duration data are get from 1953-1990 mean data of the National Snow and Ice Data Center (number of months per year with >50% of sea ice cover), that it called "modern value". Indeed, in this case it is not sufficient. That is the raison we compared our data to more precise data from satellite and historical data (HADISST, 1900-today). We did not present these data as we did for the annual discharge of the Mackenzie River because here are not is the same units (% covered surface) that can be disturbing.

Results and discussion

Along the discussion, discussed data are slightly modified (see below), most of all the interval period. This is in order to stand back with the data and be more objective. The principal error was to not publish data of datation. The progression of the cited article (Ledu et al.) is suspended momentarily so we need to share data 210Pb and 137Cs used, which are presented in the results, in the figure presented below.

"210Pb and 137Cs revealed high sedimentation rates (0.22 to 0.32 cm.yr-1) directly linked to high sediment discharge from the Mackenzie River. Even if neighboring studies using 210Pb and 137Cs datation in the Mackenzie Through gave away lower sedimentation rates (Bringué et al., 2012; Richerol et al., 2008a), the MA680BC core datation results are similar than other cores situated in the middle point of the slope between the Mackenzie Trough and the Amundsen Gulf (Scott et al 2009). Furthermore, sedimentation rates in the Mackenzie Trough are heterogeneous, following the

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dominant eastward transport of sediment in the suspended sediment plume (Hill et al., 1991) that reflects the possibility of finding of such high sedimentation rates along the MA680BC core."

As it mentioned by Referee 1: "according to figure 4, the only correlation that it can be significant is between 1979 and 1990s. The others as discussed in the text are not convincing at all. In fact, for some periods, there is an anti-correlation. To convince the reader, a spectral coherence could have been performed, as the authors seem to have confidence in their age model. I was not convinced about the impact of the oscillations on the sea-surface conditions in the Beaufort Sea based on these data."

That is also true, but spectral analysis is not possible on only 36 point data set. In consequence, we moderate our interpretation in the discussion.

Indeed, results from transfer functions are not systematically associated with PDO variations along the studied period. The comparison of atmospheric and paleoceanographic reconstructions is thus difficult to interpret and we cannot demonstrate with certainly that the PDO fully controls up-welling conditions and sea-surface parameters in the Mackenzie Shelf area. However, some of the reconstructed sea-surface parameters are synchronous with certain positive phases of the PDO, suggesting the probable effect of wind on sea-surface parameters and productivity at a decadal scale.

"The short ∼1915-1925 period, which is characterized by a negative PDO index, is not marked by higher reconstructed SIC, but by a slight decrease in reconstructed values of SSS and SST. With respect to modern values, reconstructed SIC indicate lower values during positive PDO phases ∼1900-1910 ; ∼1925-1940 and ∼1980-1990, but any higher values are observable during the negative period ∼1915-1925. Likewise, lower duration of SIC during periods not characterized by up-welling conditions is not systematically observable. During the older period (∼1860-1900) the link between reconstructed parameters with the large scale PDO is difficult to establish. Against atmospheric reconstructions (NOAA, ERSST v3,

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http://www.ncdc.noaa.gov/ersst/ersst_version.php), this period may be synchronous to a slightly negative PDO phase but reconstructed parameters display typical values of positive PDO phases in the SIC, SSS and SST reconstructed conditions and low sea-surface productivity. Therefore, results from transfer functions are not systematically associated with PDO variations along the studied period. The comparison of atmospheric and paleoceanographic reconstructions is thus difficult to interpret and we cannot demonstrate with certainly that the PDO fully controls up-welling conditions and sea-surface parameters in the Mackenzie Shelf area. However, some of the reconstructed sea-surface parameters are synchronous with certain positive phases of the PDO, suggesting the probable effect of wind on sea-surface parameters and productivity at a decadal scale."

Next, the suggestion of sea ice melt during the period 1855-1900 as commented: "The minimum values of freshwater palynomorph fluxes in our 25 record during AD 1855–1900 (around 30 specimens cm− 2 yr− 1), coupled with the relatively high sea surface temperature reconstructions during AD 1855–1890 (up to 3 celsius degrees above the modern value) correlate very well with these records and strongly suggest that the Mackenzie River discharge was at a minimum level during the 150 yr of our record." It is true that lower dinocysts concentration are recorded during higher SST, SSS and lower SIC, but the question could be further resolved using other paleo tools, as highly branched isoprenoid (organic geochemical biomarker produced by some Arctic sea ice diatoms called IP25) data. During this period, the IP25 is not displaying any diminution, that it may dismiss the hypothesis of sea ice melt, at least for the spring sea ice presence.

The final comment was concerning freshwater palynomorphs comparison with instrumental data of annual discharge of the Mackenzie River.

"Freshwater palynomorphs were used to infer the evolution of local freshwater inputs, which showed three distinct phases, a dry phase in the late 19th century, and intermediate phase 5 from AD 1900 to around 1976 and the maximum Mackenzie River

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discharge phase which peaked around 1990."

The recorded maximum annual discharge is around 1940 while the maximum freshwater palynomorphs recorded is around 1990. Long term change of exported route is very probable and realistic giving the elements controlling the surface transport. Some hypothesis about the exportation of freshwater palynomorphs could be formulated, but we do not dispose (for the moment) long-term data to verify. It probably be done when the results of MA680CASQ core will be available.

Interactive comment on Biogeosciences Discuss., 9, 7257, 2012.

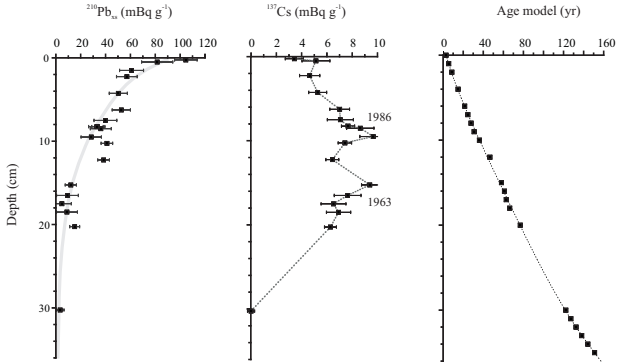

Fig. 1.

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Interactive Comment