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Earth Surface Dynamics Discussions

# *Interactive comment on* "Long-term coastal openness variation and its impact on sediment grain-size distribution: a case study from the Baltic Sea" *by* Wenxin Ning et al.

**Wenxin Ning et al.**

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Reviewer 2's comments:

I would like to see a few more notes about the setting: are there only rocky coasts, or are there also patches of sandy shores? And what about shallow waters? All rocks? Some notes are found in 3.2, but more notes could be added to 2.1.

I also wonder how sand is transported to the core site. Does it happen during storms as storm sand layers? Is sand blown out on the sea ice during cold winters? Is sand transported by drifting sea weed or by drifting sea ice?

I would also like to see a few notes on the chronology of the core, at least a reference



to Ning et al. (2016).

The main control on grain size distribution is distance to the shore, but this is apparently not mentioned. The closer to the shore – the more coarse-grained sediments. In Gåsfjärden, however, the sediments become more and more fine-grained as the core site moves closer to the shore. This is not surprising, because the core site at the same time becomes more and more protected. The authors have developed a novel GIS-based approach that allows them to quantify down-core changes in grain size distributions in relation to changing fetch.

Author's Reply:

Thanks for the great comments. We will first give our replies to each asked question and then list all corresponding changes have made in the revised manuscript.

The shallow waters and the shore are characterized with rocky coasts and some sandy patches based on observation. Inside the inlet, there is so far no data about spatial distribution of sediment grain size. The sand content in the inlet are supposed to be relatively low, due to lack of large rivers draining into the inlet and erodible soil as well as its enclosed setting.

The sand content is generally lower than 1% in our coring site. During periods with relatively high openness, storm events would most likely transport large amount of sand and silt into the coring site which is shown in Figure 8. Sand can also be transported to the coring site through sea ice and/or drifting sea weeds, although the impacts are hard to estimate.

A description on the chronology of the core has been added.

Thanks for pointing out the underlying impacts of distances on grain size distributions. We have now addressed in the revised version.

Changes in the manuscript:

Page 3, line 15: The following descriptions have been added in the revised version. “In the shallow waters of the inlet, sandy patches and rocky coast can be found. In general, there is a lack of erodible soils and therefore subsequent sediment transportation into the inlet. The accumulated sediment in the inlet is expected to originate mostly from the terrestrial setting, compared with sediment transportation from the open Baltic Sea. Sediment accumulation rate over the last 1 ka is generally less than 1.5 mm per year in the deep basin (Ning et al., 2016).”

Page 3, line 16: “Grain-size analysis” is changed to “Chronology and grain-size analysis”.

Page 3, line 18: “Age-depth model of the sediment sequence was established through a combination of 210Pb and 14C dating methods (Ning et al., 2016).” is added after “A 6 m sediment sequence was obtained covering the last 5.4 ka (Ning et al., 2016)”.

Page 5, line 20: “In general, the closer to the shore, the more coarse-grained sediments will be deposited. In Gåsfjärden, however, the sediments become more and more fine-grained as the core site moves closer to the shore. This is because the core site at the same time becomes more and more protected as shown from the openness indices.” is added after “We have. . .openness variations.”

Page 6, line 4: “Coarse grains such as sand can also be transported to the coring site through storm events, winter sea ice or drifting sea weed, although their impacts are difficult to estimate.” is added after the sentence “Coarse grains such. . .are difficult to estimate.”.

Reference:

Ning, W., Ghosh, A., Jilbert, T., Slomp, C. P., Khan, M., Nyberg, J., Conley, D. J., and Filipsson, H. L.: Evolving coastal character of a Baltic Sea inlet during the Holocene shoreline regression: impact on coastal zone hypoxia, J Paleolimnol, 55, 319-338, 10.1007/s10933-016-9882-6, 2016.



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