Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-25-RC2, 2018

Interactive comment on "A 1500-year multiproxy record of coastal hypoxia from the northern Baltic Sea indicates unprecedented deoxygenation over the 20th century" *by* Sami A. Jokinen et al.

Anonymous Referee #2

Received and published: 15 March 2018

General Comments: The paper by Joniken et al. is a multiproxy study of the development of coastal hypoxia in the Archipelago Sea, Northern Baltic Sea during the last millenium. It takes into consideration the natural changes in the basin geomorphology and sediment transport, driven by climate variability, with the anthropogenic inputs, as causes of the emergence of near-bottom hypoxia in the area. One of the main findings is that coastal hypoxia started to occur in the early 1900's, and not in the mid-twentieth century, as other studies have suggested. The authors state that natural variability and trends were the main drivers of the emergence of hypoxia in the 1900's, but that eutrophication was the key factor from the 1950's onwards. The paper is well-written, including many data in tables and figures. Perhaps alternative interpretations on the

studied record are missing, but, overall, he manuscript deserves to be accepted for publication. Minor revisions are suggested as follows.

Specific comments: 1) The'material and methods' section is too long and might be simplified. For example, subsection 4.4, could be summarized and the full text be moved to supplementary material.

2) p.22 The authors propose that Mo accumulation rate is a proxy for bottom water hypoxia in the MoWP, suggesting that this takes place mostly during summer. Nevertheless, Mo geochemistry depends on the suplhide concentration in the pore waters, which in turn also depends on the sedimentation rate of labile organic matter. As the authors recognize, the phytoplankton productive season extends during spring/summer. Thus Mo accumulation rate does not actually depend on bottom water hypoxia, rather the latter be a consequence of organic matter respiration in the surface sediments. This should be taken into account in the discussion. On other hand, in order to preclude any bias due to the changes in the sedimentation rate for the authigenic accumulation of Mo, it would be better to normalize the Mo content to Aluminum, and estimate the Mo enrichment factor (Scholz et al., 2013).

3) p.23 on causes of early 1900s deoxygenation: the authors include stratification and global warming as one of the factors precluding the bottom water ventilation and the deoxygenation trend. However, SST paleorecords (Figure 5), shows that the warming is significant (above that attained in the MCA) just around 1950, while laminations, increased d15N and increased organic carbon and Mo accumulation rates are recorded well before.

4) The attribution to 'warmer climate' for the early deoxygenation is also mentioned in the conclusions. Authors might reconsider this interpretation or provide more support to this conclusion.

5) p.20. On the role of the sewer network for the city which likely enhanced sewage loading to the Archipelago Sea, at the beginning of the twentieth century, the authors

indicate that it had a secondary role, because no significant changes in the organic matter source were detected. However this argument is not convincing, since the increases of MAR, OC MAR and d15N occurred just after the sewer construction, and a higher influence of marine organic matter was recorded later, driving the exacerbation of hypoxia. It would be possible that anthropogenic organic enrichment partly sustained the early increase of MAR and also contributed the increase of primary productivity in the area.

5) p.25 ('Implications'). The authors indicate that the δ15N record demonstrates increased anthropogenic nutrient input already at the beginning of the 20th century. It would be worth to analyze if the record is alsorelated to an increased denitrification in the bottom waters and surface sediments, which could result of an increasing anthropogenic/natural labile organic matter flux.

6) Figure 7. Though all the figures coincide in showing a negative trend of near-bottom water oxygenation; it would have been better to provide a climatology (or monthly/seasonal averages) of the water column dissolved oxygen concentration. The resolution of the time-series does not allow to observe the seasonal hypoxia.

Technical comment: The legend of Figure 2 (geochronologies) is missing (the text of the legend 1 was duplicated here).

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-25, 2018.