

Response to review #2 of Ekeroth et al., Egusphere-2026-707

Our responses are in blue text and the reviewer comments in black text.

RC2: '[Comment on egusphere-2026-707](#)', Anonymous Referee #2, 17 Mar 2026

Ekeroth et al compiled 305 individual benthic DSi measurements in the Baltic Sea over the past two decades. This is a very much appreciated effort to refine today's Baltic Si budget. Given this dataset, it is clear that benthic BSi and LSi dissolution is properly the most important process supplying DSi to the Baltic Sea.

We thank the reviewer for this assessment.

However, it is a pity that the authors work hard to address the missing Si pool derived from land

This is one of the main messages of the manuscript: The autochthonous export production from the photic zone does not match the sum of the integrated benthic dSi flux and the reported bSi burial rate. So, a main finding of this manuscript is that rSi of terrestrial and groundwater origin ("the missing Si pool") makes an important contribution.

that they cannot provide any direct data/evidence from this study in terms of the mass balance (such as Fig 6),

We have presented strong indirect evidence that Si of terrestrial and groundwater origin makes an important contribution to the integrated benthic dSi flux and that this Si is reactive (dissolvable). Our aim in including Figure 6 was to illustrate the numbers we arrived at in the manuscript. Since this and the first reviewer seem to have misunderstood our intention with this Figure, we will remove it from the manuscript.

while there are some potential findings that requires more attention get lost in the discussion. Below are major suggestions.

1. It is great to see so many in situ DSi flux measurements across the Baltic. Meanwhile, these measurements also show large spatial heterogeneity that cannot be simply explained by seabed types. E.g., in Figure 2a, for the mud-muddy sand seabed, the DSi flux varies between 1-10 mmol/m²/day. Is this a natural variability or this is something to do with in situ technique from different years or the sampling locations (river mouth vs fjords vs shallow open sediments vs deep basins etc.) or with temporal periods (the peak of eutrophication to the post-eutrophication period). Anyway, I think there is a large potential to dig from this dataset, which is worthy more efforts and in turn improve the certainty of benthic DSi estimates.

Mud-muddy sand spans over large areas including transport bottoms, deep accumulation bottoms and this sediment type contains various degrees of sand and carbon content. It also covers the seafloor in all of the major Baltic Sea basins with various water depths, trophic states (mesotrophic to highly eutrophic) and hence a large range of vertical particle fluxes. So this sediment type encompasses the large natural spatial variability of the Baltic Sea. The in situ technique we used was the same during all years and it is described in Kononets et al. (2021; cited in the

manuscript). As far as seasonal variability is concerned, as mentioned in the response to reviewer 1, we performed our flux measurements during all months of the year except December and March (Table 1), so not only during the productive part of the annual cycle. We carried out our measurements between 2001 and 2021 (during two decades), so all degrees of eutrophication encountered in the Baltic Sea during this period are included.

2. I see the point that the total calculated benthic Dsi flux is much larger than BSi export from water column, but another uncertainty here is the accumulative effects of sedimentary BSi due to eutrophication. There was a clear increasing trend of BSi contents in the Baltic sediments before, so this older Bsi pool could continue dissolving as part of this benthic flux. This adds more uncertainty to estimates of LSi dissolution in this study.

Yes, we agree that older (legacy) bSi can contribute. We will add this possibility to the text. If dissolution of this old legacy bSi pool is important, the need for rSi from land, including groundwater, will be less to match the sum of the integrated benthic dSi flux and the reported bSi burial rate. However, we are not aware of any observations of a legacy bSi pool in Baltic sediments, nor the quantity of it or any change of this quantity. This is due to the fact that published data on solid phase bSi in Baltic sediments are scarce, and on other forms of particulate rSi are largely absent. For this reason, we assume that the contribution to the integrated benthic dSi flux from any legacy bSi pool is quantitatively of less importance.

3. There is no doubt LSi in seafloor is an important player, but some factors should be considered. (1) the rate of LSi dissolution and authigenic clay formation, usually these are much slower than BSi process. if the in situ measurements are running from hours to days, how much LSi dissolution signal it is really captured is a question.

Yes, the in situ measurements lasted from less than a day to about three days depending on the reactivity of the seafloor sediment. The porewater dSi is released as a benthic flux to the overlying bottom water due to the concentration gradient across the sediment-water interface. The porewater dSi is produced from the dissolution of all the different forms of particulate Si that exist in the sediment and is dissolvable (reactive). So how much dSi (contributing to the benthic flux) that originates from dissolution of one form of particulate Si (e.g. lsi) or another (e.g. bSi) is a function of the relative abundance of each of the reactive forms of particulate Si in the sediment and their respective dissolution rates. However, this cannot be resolved with the benthic flux measurements we performed. Determinations of the Si isotopic composition of the dSi in the benthic chambers may have helped to disentangle the origin of the dSi in the benthic flux, but this study did not include isotopic determinations.

(2) Si consumption by authigenic clay formation may can also be considered in the overall Si sink.

Correct, and we have never denied that. This process is removing some dSi from the porewater forming authigenic clays, which would make the benthic dSi flux lower. The influence of this process on the benthic dSi flux is included in the measurements we performed (since the fluxes we measure are net fluxes), and thus so also in the

integrated annual dSi flux we have presented. However, it is not the aim of this study to specifically quantify this process or to show evidence of its importance in the Baltic Sea.

4. Overall, both the introduction (almost one page) and discussion sections (4.1) start with the important role of riverine inputs, giving a feeling of a study about Si delivery by rivers, but the methods and results exclusively leans on benthic flux. I think it would be much better to focus more on discussing benthic flux variability that this study has solid evidence, and speculate to a lesser extent regarding the mass balance of Si in the Baltic, in which riverine and groundwater inputs and LSi dissolution, two major sources, are largely unconstrained.

We have strong indirect evidence that riverine and groundwater inputs of particulate reactive (dissolvable) lSi and aSi (including for example phytoliths and bSi from freshwater diatoms) to sediments of the Baltic Sea have a major influence on the magnitude of the integrated benthic dSi flux. These lines of evidence are already clearly presented in the manuscript. We agree that our strongest empirical evidence concerns benthic fluxes. Riverine and groundwater inputs are therefore discussed primarily as probable contributors rather than quantified sources. We have now also added the possibility that any legacy bSi pool in sediments may contribute to the integrated benthic dSi flux, albeit presumably to a lesser extent.