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Interactive comment on "Total suspended matter derived from MERIS data as indicator for coastal processes in the Baltic Sea" *by* D. Kyryliuk and S. Kratzer

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Thank you David for your valuable comments and feedback! We found it to be relevant and on point.

To the first weakness of the paper we would like to respond as follows:

We agree that we have not really discussed the issue of mud banks, and we are now including this in the revision. Most of the mud banks are situated in the southern Baltic Sea and are rather close to the coast, so they can also be regarded as rather coastal features. During the ice age the glacial ice sheet went right across Scandinavia and reached also over most of the Baltic Sea, apart from the very south-eastern coastal

areas where we today find more sand banks. The rest of the Baltic Sea bottoms were swiped clear of muddy and sandy bottoms, so most of these features can still be found in the SW. But the origin of this matter is most likely also from coastal run-off and erosion. The suspended sediment is carried into the sea with river run-off can therefore be considered part of costal processes. Suspended matter also limits the light that penetrates the water, thus affecting primary production that in turn affects the ecology within coastal areas.

In the SE Baltic there seems to be a combination of both sediments brought in by river run-off which then is mixed up with sediment brought up from the sea bottom and carried away by wind and Coriolis force further offshore. If a muddy sea bed is situated close to the coast and thus contributing to the sediment loads through resuspension then it should also be natural to assume that they are part of 'coastal processes'. However, when looking at the SE part of the Baltic along the transect that we have extracted and evaluating the bathymetry (page 29, Figure 14) it is evident that there are no 'offshore mud banks' that may produce a surface signature. The sea bottom here is already rather deep close to the coast and gets even deeper when moving further off-shore into the open sea. There is presumably no way to distinguish from the satellite images whether suspended sediment was brought up from the bottom or if it is derived from run-off. That is why we refer to the bottom substrate map and bottom topography as a possible explanation why the extent of suspended matter is so wide in the SE Baltic. It is likely, though, that the sandy and muddy areas in the sediments also have been slowly built up over time by coastal run-off which is much stronger in the southern parts of the Baltic Sea than in the NW parts.

Second weakness: curve-fitting procedure

The initial bio-optical model described by Kratzer & Tett identifies the break between coastal and open sea at a point where SPM concentration reaches the threshold of about 0.6 ãĂŰgmãĂŮˆ(-3). Where the decay was best described by polynomial of 2nd order for SPM (first order polynomial for chl-a, and third order polynomial for CDOM).

This model was based on theory (diffusion is the driving force) and tested on in-situ optical measurements (see Box 1 and Figure 7 in Kratzer and Tett, 2009). So, we only considered 1st, 2nd and 3rd order polynomials but in general the 2nd order was the best polynomial description for SPM as found by Kratzer and Tett (2009). But we also found that in some cases a logarithmic described the trend better than any of the tested polynomials (especially in the south-eastern and southern Baltic). We concluded that this has to do with the stronger effects of wind-driven processes in the SE Baltic Sea, whereas in the NW Baltic diffusion may be assume to be the driving process for the distribution of particles. There are substantially more points extracted from a satellite image along a given transect than usually measured in situ. So, the degree of freedom is not really much affected by going from 2nd to a 3rd order polynomial. But in none of the cases the third order polynomial was chosen as it did not show a significantly improvement of the coefficient of determination.

The values from the MERIS transect has a rather high spatial resolution (300 m pixels) and highlights the features that would most likely have been missed by only using in situ transect data. The sudden sharp drops in values close to the shore can be indicators of processes that happen very close to the coast and are most likely closely linked to the water depth. When the water depth increases the values drop rapidly since there is no longer any contribution from the bottom and only a fraction of suspended sediments gets transported further away by wind or swell. It may well be that the depth profiles (see Figure 15) do not have the required spatial resolution to actually map the sea-floor correctly and include all information on coastal sand banks. A lot of this data counts as secrete military information and to date bottom maps with high resolution are not officially available.

Our rather generalized approach excluding obvious meso-scale features was required to be able to apply one model to different parts of the Baltic Sea so the results would be intercomparable and the overall coastal trends could be evaluated. So, when choosing transects for the trend analysis of the particle distribution we avoided large meso-scale

features on purpose, as the main goal was to evaluate the spatial extent of suspended particles rather than describing separate suspended features that may indicate certain oceanographic features such as large-scale eddies. In our choice of transects we thus assumed meso-scale features to be related to the internal circulation of the Baltic proper caused by the Coriolis force creating anti-clockwise currents in the Baltic proper basin, and thus not really directly indicating coastal features. But the images from the SW Baltic show that there is somewhat an overlap of the coastal sediment gradient with several of these features. The baroclinic Rossby radius varies between 1.5-10 km (Fennel et al., 1991; Alenius et al., 2003) and the costal upwelling is usually found at distances of 10-20 km offshore (Lehmann and Myberg, 2009). So, some of the features in the SW Baltic may also be caused by coastal upwelling moving suspended matter from the sea bottom up to the surface.

Yes, ‘the geographical extent of coastal processes’ would be more appropriate than only ‘physical extent’ as suggested by the referee.

We thought that chlorophyll maps should be brought up in the ‘Results’ section right next to the TSM composite from early June to highlight that chlorophyll patterns do not match those of the total suspended matter, therefore visually confirming that TSM concentration are of inorganic origin. Please see (page 6, Lines 17-25) where we additionally refer to Kahru & Elmgren (2014) who described the shift in the timing of cyanobacterial surface accumulations on average by 0.6 days per year, causing the peak of the summer bloom in recent years occurring 20 days earlier when compared to 1979.

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