

Interactive comment on “Estuarine circulation reversals and related rapid changes in winter near-bottom oxygen conditions in the Gulf of Finland, Baltic Sea” by T. Liblik et al.

Anonymous Referee #1

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General Comment:

This manuscript shows that a relation between the amount of anoxic water mass in the Gulf of Finland and a reversal of the estuarine circulation exists. Two reversals of the estuarine circulation were observed during the winter months in 2011/2012. The reversal occurred during south-westerly winds, which increased the sea level in the Gulf of Finland, and caused an outflow in the thalweg of the Gulf of Finland. Since the anoxic water enters the gulf via the deeper layers, a reversal of the velocity means a stop of the advective transport of anoxic water into the gulf. The paper discusses that the advective transport caused by these wind is the dominant process in the observed vanish of stratification and the oxygenation of the deep layers.

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I do think that this paper is of general interest for the audience of Ocean Science Discussion and worth publishing. It focusses on the process of destratification and oxygenation of the deeper layers and can show with the combination of point velocity measurements, CTD transects along the thalweg of the Gulf of Finland, as well as wind measurements, that south-westerly winds can cause a reversal of the estuarine circulation. The paper is written in an understandable way and is good to read.

It also discusses an open question which can be nicely addressed in a following work: An upwind barotropic flow in the thalweg in combination with a raising sealevel, suggesting a downwind transport of water at the shores. A second question arises and is shortly discussed but could be formulated in a bit more detailed way: The quantification of mixing during the reversal events. The manuscript emphasizes the importance of advection. A discussion between the lack of vertical mixing, the advective transports and convective mixing during reversal periods would be informative.

Detailed Comments:

Page 728, Line 12, “... caused the vanishing of the stratification and oxygen concentrations that were almost ...”: Mention that the reversal caused the oxygen concentration to increase from 0 to 270 $\mu\text{mol/L}$.

Page 728, Line 15: Add the direction (along gulf) of the deep layer currents

Page 729, Line 19: “The relative weaker and deeper” → “A relative weaker and deeper”?

Page 730, Line 10-18: This is an important part of the introduction, add Elken 2003, who showed that vertical mixing alone cannot explain the observed changes of the vertical profiles.

Page 734, Line 8: What was the filter time?

Page 738, Line 8: Add the direction of the cumulative wind stress.

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Page 777, Line 15 and following: Please extent this part a bit more, discuss the origin of the anoxic waters and the consequences of estuarine circulation and reversals for estuaries ala the Tokyo Bay and the Gulf of Finland.

Page 747, Line 25: It was not shown, that convection caused the complete mixing of the water column. This is very likely but needs to be proofed. This should rephrased.

Fig. 1: Add a scale.

Fig.3: This is one of the most important figures, can be enlarged.

Fig. 2, Fig5, Fig6: it would be nice to have the reversal events shown in Fig.4 be marked as well.

Interactive comment on Ocean Sci. Discuss., 10, 727, 2013.