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Upwelling characteristics in the Gulf of Finland (Baltic Sea) as revealed by Ferrybox measurements in 2007–2013

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Response to Anonymous Referee #2

This is a fairly straightforward descriptive paper, presenting surface temperature and salinity data and noting episodes of coastal upwelling. It deserves to be published, with minor revisions.

1. My primary recommendation: please try to improve the writing style throughout. Some of the issues involve poor English usage, but I think the primary problem is simply too many unnecessary words. A more concise style would really help the reader absorb the content without getting bogged down.

For example, the first sentence of section 3.2:

"The occurrence and intensity of upwelling events along the both coasts of the Gulf of Finland can be qualitatively identified from the temperature deviation maps presenting temperature deviations from the daily mean value along the transect between Tallinn and Helsinki (Fig. 5)." could be replaced with: "Upwelling events along both coasts of the Gulf of Finland can be identified by temperature deviation maps (Fig. 5)." with no loss of content. The phrase "occurrence and intensity" is unnecessary; this is obvious already, especially if the reader is this far into the paper. "qualitatively" is not needed. The "from the daily mean value" definition of what you mean by "deviation" is not needed, since you've explained this already in the methods section, plus the definition is repeated in the caption to Fig. 5. The phrase "Tallinn and Helsinki" is certainly not needed, given the previous mentions of the two cities and the caption to Fig. 5.

Many sentences throughout the paper could use this sort of "tightening up", leading to happy readers and more clarity.

Response: We tried to improve the text throughout the manuscript.

2. When I looked at Table 2, I immediately wanted to see some of the data here in the form of a plot. Specifically, I think plotting the cumulative upwelling intensity vs. the cumulative wind stress could be potentially useful scientifically. It would answer the question: what sort of wind stress produces what sort of upwelling event?

Response: A new figure (Fig. 6.) is added. It illustrates the dependence between the wind stress and cumulative upwelling index as well as the difference between the two coastal areas.

3. I do not think Fig. 2 adds much, and it could probably be skipped. Your description of the time shift correction in section 2.2 is clear enough by itself.

Response: We agree. Fig. 2 is removed.

4. I think Fig. 4 could be improved by highlighting the horizontal zero-line in all the panels. For example, you could make this a thin solid colored line. This would help a lot: without this, it is difficult at a glance to tell where the positive and negative deviations are.

Response: Done.

5. Regarding Fig. 8 and the discussion of it (bottom of p. 2884). First, I would prefer that discussions like this always use wind stress, rather than wind speed. Stress is what is really happening at the ocean surface, and since it involves the square of wind speed, it can look pretty different in a plot. I think it would help make your point: the difference between these two cases will be more obvious. Also, why not mention (referring to Table 2) that the 17-23 Aug 2010 event had a cumulative wind stress of 0.66, while the 5-10 Jul 2011 one had 0.38. Wouldn't this much larger cumulative wind stress also explain the fact that the temperature front was sharper?

Another idea that could help make sense of all this: on the new figure based on Table 2, perhaps you could plot the "sharp temperature front" events with one symbol and the "gradual" ones with another? That way, we could easily tell how often the sharp ones also have larger cumulative wind stress.

Response: We agree with the comment and revised the text and Fig. 8 as suggested. Types of upwelling events are marked in Table 2 and Fig. 6. Nevertheless, the cumulative wind stress is not the only factor that can be related to the development different types of upwelling events. In case of upwelling events near the northern coast several prominent upwelling events could be classified as the events with gradual temperature decrease towards the coast. See also the response below.

6. Regarding your conclusion that the important thing is the deviation of the wind from average forcing (rather than the absolute value of the wind). What might be the physical mechanism behind this? I would really appreciate some discussion of this.

Response: In general, the thermocline has a shallower position in the southern part of the gulf (Liblik and Lips, 2016). It is related to the prevailing south-westerly winds and freshwater inflow at the eastern end of the gulf. Thus, in cases of winds with the same strength from east and west the upwelling could be seen earlier (and could be more intense) along the southern coast than that along the northern coast. In addition, the south-westerly winds cause eastward transport and north-easterly westward transport in the surface layer of the gulf. Thus, southwesterly winds (although causing upwelling along the northern coast) in general could cause deepening of the thermocline in the gulf and therefore work against the upwelling development. We added relevant text in the revised manuscript.