

Interactive comment on “Investigation of saline water intrusions into the Curonian Lagoon (Lithuania) and two-layer flow in the Klaipėda Strait using finite element hydrodynamic model” by P. Zemlys et al.

Anonymous Referee #1

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This manuscript, as in the title, is primarily a modelling study of salinity and layered (or not) flow in a strait between Curonian Lagoon and the wider Baltic, according to stratification and winds.

There is interest (for OS) in the relation between context and the layering, and the analysis of this relation in terms of non-dimensional quantities is a good idea. Conclusions are reached but would be of wider interest if there were a more systematic consideration of a fuller set of non-dimensional quantities (see detailed comments); this could help application (or testing of conclusions) in other locations. The present

C158

results are strictly for a simulation of the Curonian Lagoon and Klaipėda Strait, and in my opinion too focused on that location. Most potential readers will be more interested in somewhere else.

This is strictly a model simulation. Although the model has been used in several contexts as cited, not much evidence is given of how good it is here. The agreement with (only) four pairs (top and bottom) of salinity measurements at different times is good - how selective are these four times? The correlation between modelled and observed surface salinity time series at one location is fair (only). All the observations in these comparisons are about half way between S1 and S2, i.e. relatively close to the wider Baltic; no model test is shown for areas further towards or in the lagoon. The manuscript would be more convincing if the model were better validated for this context. The presentation is generally straightforward, valid and clear. There are a few obscurities of language (some detailed comments below). A few figures probably need type-sizing for any printed version.

Detailed comments.

Page 322 line 7. “one year” – 2009 might be mentioned.

Page 323 lines 7-8. This is one reason to study lagoons and their connection with wider seas. There are others!

Page 323 lines 16-22. These are other reasons to study lagoons in general. I suggest that much of this (modified) material be moved to the previous paragraph; it would add to the motivation in the first paragraph. Then the remainder of the second paragraph can be merged with the third and really be about the Curonian Lagoon.

Page 327 line 23. “without solving a linear system.” This is very vague: the reader might guess what this is about, but in that case they would probably understand the sentence without this phrase. Please either omit or say what is really meant.

Page 327 line 27. “. . . partially modified from the classic formulation. This approach . . .”

C159

Nothing here is defined.

Page 328 line 3. "With respect to the original formulation". I guess this refers to page 327 line 27 but as that is not defined it is no help. Perhaps something needs to be cited.

Page 328 lines 28-29. Much of this can be omitted because all is said starting with "the standard linear form . . ."

Page 329 line 25. "As mentioned in the text" Where? This is the text!

Page 331 lines 15-16, 17. It would help if there were explanation of why southward winds cause set-up over the open shelf and the opposite in the lagoon; especially the former is not obvious - does it relate to the bend in the Baltic and the Baltic's limited depth and extent further west? Does "modulation" mean "lowering"?

Page 333 lines 7, 8. I think that "velocities around 0.3 m/s" and "this area" both refer to the area seaward of S3. Anyway, please clarify.

Page 334 line 20. In principle there are more than these two governing dimensionless parameters. Another would be $(gh\Delta\rho/\rho)^{1/2}/(fb)$ where b is the width of Klaipeda Strait. Others might relate to the size of the lagoon (which surely controls the relative extent of intrusion into the lagoon proper) and the rate of freshwater input; however, conceivably these influences might be represented in the Strait by the "a posteriori" $\Delta\rho$.

Page 335 line 26. W is also a measure of stratification.

Page 337 lines 19-20. I think the intended meaning is ". . . with a decrease to the South." As written the trend varies with location.

Figure 1 caption. Is the "surface salinity continuous monitoring station" Klaipeda harbour as referred to in the text?

Figure 5 caption. Please say which time series are observed and which are modelled.

C160

Please be more precise about "northern part of the lagoon" (twice).

Several figures, notably 1, 4, 6 (arrows), 10 (wind rose): electronic versions can be magnified but in print various annotation is presently too small relative to figure size.

"Typos" etc.

Abstract line 21, page 333 line 27 and page 338 line 15. "85-100" does not quite agree with Figure 8 where the S_4 value is about 70.

Page 325 line 14. "z" not "zeta"?

Page 330 lines 7, 8; page 337 line 20; figure 4 caption (x3); figure 5 caption and possibly elsewhere. I think this should be "vertically-averaged" not "vertically integrated". The units seem to be parts per thousand (without multiplication by depth as would be implied by integration).

Page 338 line 16. Better ". . . cross-sections two-directional flow has longest duration, while . . ."

Page 338 line 22. Better "The analysis of (i) ratio . . . and (ii) the Wedderburn number . . ."

Figure 10 caption. Add "from" before "NN" to clarify the convention for wind direction.

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C161