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Ocean Science
Discussions

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 #2

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This paper studies the water exchange dynamics of the Curonian lagoon using a finite element numerical model, focussing on three different flow regimes at the outlet channel of the Curonian Lagoon: vertically mixed inflow/outflow and two layer exchange flow. After introducing the numerical model used and the governing equations, the model setup of the Curonian Lagoon is described, including bathymetry and boundary conditions. The main part of the paper deals with the generation mechanisms of the different flow regimes and a statistical analysis of the occurrence.

The intrusion of salt into the Curonian Lagoon, as an example of exchange processes

between lagoons and open seas, the distribution and the driving mechanisms of the salt are of interest for the readers and worth publishing.

Major points:

- It is not mentioned if temperature was calculated. A quantitative analysis of the temperature contribution to stratification would be informative. This is necessary to verify the sentences on e.g. page 330 -331 or on page 337 where it is stated that stratification is strongest at the Klaipeda strait and that stratification depends mainly on freshwater discharge. How strong is summer stratification due to temperature?

- Following the first point: How is the density in Eq. (1) and (2) calculated without temperature? Which density equation is used?

- Fig. 5C shows the water level inside the lagoon. Is there water elevation data available for validation, as e.g. in Ferrarin 2008? As said on page 332 wind and water level differences correlate well, validated water levels would support the performance and analysis of the model output.

- Validation of stratification is based on four measurements distributed over the whole year. Is there more vertically resolved data available? An overview of available data for validation would be informative. Some comments on the quality of the boundary conditions would be good.

- Ferrarin et al. 2008 report a statistical analysis of salinity and water level for 4 different station distributed over the lagoon using a depth integrated model. Since the model in this paper resolves the baroclinic processes including the interaction between density driven flows and vertical mixing without having to be parameterized by a horizontal eddy diffusivity, model results should have been improved. Is this so?

- The analysis of the "average relative magnitude" (Eq. 5) is not entire clear to me and the results based on the analysis are rather short. Please explain better or remove that part.

Minor points:

- As discussed through the paper, salt flux into the lagoon is either barotropic or due to a two layer flow. On page 332 a correlation between water level difference and salt flux is calculated and briefly discussed. The discussion lacks the influence of the two layer flow. If a correlation between water level difference and salt flux during barotropic inflow events is made, the correlation is probably much higher, leading to the question how much salt is actually transport by which process? Barotropic transport seems to dominate, this could be quantitized.

- It is often referred to a vertical integrated salinity but units are in promille, is vertically averaged salinity meant?

- Fig. 1 Add a scale

- Fig. 2 labels are not consistent

- Fig. 3 units are missing or not consistent

- Fig. 10 Add error for hb/H. Color scale between 0-0.1 and 0.1- 0.25 in Fig. 4D are hard to distinguish, this should be clearer.

Interactive comment on Ocean Sci. Discuss., 10, 321, 2013.