

## ***Interactive comment on “Seasonal, Spring-Neap and Tidal Variation of Hydrodynamics and Water Constituents in the Mouth of the Elbe Estuary, Germany” by Jens Kappenberg et al.***

**Anonymous Referee #2**

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### Summary

In this manuscript the authors present measurement data from three different long term deployments, ranging from spring 2012 to fall 2013 in the mouth of the Elbe estuary. These point measurements include CTD, velocity, turbidity and oxygen, as well as near by meteorological data. In addition nine along estuary helicopter transects are presented, with surface measurements of the same quantities as recorded at the fixed stations. Those transects provide snapshots of the along channel distribution.

Most of the analysis focuses on station HPA-Elbe1. The other two stations are primarily shown for comparison to provide an idea about the spatial variability.

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The authors investigate the changes on different time scales, ranging from inter-tidal to seasonal variabilities. A special focus is put on an extraordinary strong discharge event in summer 2013.

### General Comments

The authors present a very nice long term dataset, which taken by itself seems already worth publishing this manuscript. The language is mostly clear and the data are presented in a comprehensible manner. Unfortunately, the manuscript remains very descriptive based on a rather shallow data analysis. I understand that there is a trade off between showing such a large dataset as a whole and focusing on particular processes in detail. However, it would nice if there would be some further attempts to understand some of the underlying processes.

The authors claim in the first sentence of the discussion section, 'Long-term measurements at fixed positions can be a crucial contribution to the understanding of estuarine processes.' Although, I completely agree with that statement, I am not quite sure how the manuscript helps to improve our understanding of estuarine processes, since it only stays on a phenomenological level, barely touching any underlying processes and mechanisms. This is also reflected in the discussion section, which contains mainly general reflections on the usage of such long term data, without being able to provide any specific conclusion drawn from the actual observations. The discussion section should really focus more on the actual findings of paper rather than on general statements about the usability of long term point measurements.

The authors say that 'A desirable extension of the investigations would be a comparison with results of numerical models.' However it remains unclear what kind of questions the authors would like to address with a model that they can not investigate with this dataset.

I believe that the manuscript would benefit a lot from focusing on at least one of the observed phenomena in detail. For instance, you could focus a bit more on the high

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discharge event, and how it effects the position of the ETM and the salinity gradient. While talking about the event you raise many questions that remain open. Why does it take so long to reestablish a 'fully developed ETM'? What does it mean that you have a relative 'quick recovery of turbidity' after the event, but it takes much longer for the ETM to come back to its normal state? What are the potential mechanisms that cause the hysteresis you observe in the salinity associated to the peak discharge event?

In general I think that the manuscript would be worth publishing after some major revisions.

Special Comments.

Section 4.1 and following. It is quite confusing to the reader to refer to the high discharge event as flood, especially in the context of inter tidal variability. Maybe you should try to avoid the term flood when referring to the river discharge.

142-143 'At the location of the station in the outer estuary, one would expect a more symmetrical tide and the asymmetry is probably due to influence of the branch (Medem Rinne) to the Northwest of HPA-Elbe 1.' Why would you expect a more symmetrical tide? Could you try to briefly discuss how the influence of the side branch could cause this asymmetry?

Almost all the figures show two different quantities in each panel (gray and black). It is a bit annoying to switch forth and back between figure and caption to be able to tell which quantity belongs to which color. It would be nice if you add a legend or a color coding to the labels off each panel.

257-259 The section title says 'Measurements at the MPM Otterndorf station', but here you only talk about LZ2.

296 Here you describe how the tidal asymmetry in turbidity changes with the Neap-Spring rhythm. However you do not try to explain what is the reason for the asymmetry in the first place. If I understand figure 13 correctly, positive values correspond to larger

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peak flood than ebb values. This seems consistent with figure 5, however inconsistent with figure 16, where you find comparable peak values between ebb and flood. Am I missing something here? Furthermore, it seems surprising that you generally find larger peak values during flood than during ebb, given the fact that the site is clearly ebb-dominated with significantly larger peak ebb than flood current velocities. I feel this fact deserves some further discussion.

364 'Turbidity at HW slack is lower than at LW slack, which might be attributed to weaker turbulence at this site...' Why do you believe the turbulence should be weaker at this site? This is not obvious at all.

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