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## ***Interactive comment on “The submarine groundwater discharge as a carbon source to the Baltic Sea” by B. Szymczycha et al.***

### **Anonymous Referee #1**

Received and published: 25 March 2013

This manuscript reports dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) concentrations in groundwater discharging into the Bay of Puck within the southern Baltic Sea. The authors couple these carbon concentrations with previous reports of submarine groundwater discharge rates to calculate DIC and DOC fluxes to the Bay of Puck, the larger Baltic Sea, and the entire world's oceans. The topic of carbon fluxes from submarine groundwater discharge is a relatively under-represented area of concern, as several papers report quite significant fluxes of DIC and DOC to coastal systems from groundwater discharge. Much of the carbon flux is derived from the groundwater flowing through the diagenetic zone where organic matter is remineralized. In this regard, this manuscript offers additional data on this topic. However, I found this manuscript to be quite underwhelming. The lack of scientific rigor is remarkable, and lends large uncertainties in the results presented. See specific issues to

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follow below. Moreover, the attempt to scale up largely unverified results to the greater Baltic Sea system and even the entire world's oceans is incredibly premature for this work. I think that the authors would have been better suited preparing one complete and scientifically sound paper from their data on this project rather than dividing their data set up into a number of small papers as they seem to be doing. In my opinion, this dilutes the quality of each paper and therefore the impact they have on the scientific community. In this case, I just don't think there is enough in this manuscript (data or interpretations) to merit publication.

Specific Comments: 1. The authors MUST do a more complete job at demonstrating the representativeness of their data. Where were the seepage meters and groundwater lances deployed? These locations are not even shown in Figure 1, nor is there any discussion on position and depth of deployment relative to the beach/seepage face, etc. How well do these samples represent the greater area and region? Where is the subterranean estuary with respect to the lances? At what point in the tide were the lances sampled? Santos et al. (2008) demonstrate the spatial and temporal variability of groundwater DOC concentrations within the subterranean estuary. The authors offer no insight or justification into the representativeness of their samples in this regard. Until this is done with scientific rigor, the rest of the manuscript (comparison to other sources, upscaled fluxes, etc) is meaningless. 2. The authors make very little attempt to interpret their data. The data are presented and the numbers are listed in the text, but there is little attempt to discuss WHY the DIC and DOC concentrations are different during one sampling compared to another, or to put any context to their data. Could the increased DIC/DOC concentrations with depth be due simply to sediment compaction, thereby concentrating all dissolved solutes into a smaller volume? Instead, they simply take an average value of their data and calculate fluxes, which they then upscale to larger areas. 3. It is also not clear whether the authors are reporting DIC/DOC concentrations from the seepage meters, or just from the lances. One side effect of installing a seepage meter in the seabed is that the benthic autotrophs no longer receive sunlight and die, potentially enhancing bacterial remineralization of that organic matter. If DOC

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samples were collected from the seepage meter, they likely overestimate DOC concentrations due to this effect. 4. The authors cite a number of other studies for SGD rates to use in calculating fluxes. There needs to be a description of each study's methodology in determining SGD rates to determine whether they are truly comparable or not. 5. Scaling up to the entire world's ocean (section 4.3) is completely inappropriate in this case. Please remove this section entirely. 6. Figure 1 needs refinement. The regional base map is hard to read and hard to interpret land from sea. The area map must also include a better layout of the study site with respect to locations of seepage meters and groundwater lances. 7. Figure 2 is very hard to read. There is too much presented. I suggest breaking this up into individual figures.

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