

### Answer to Anonymous Referee #3

**We thank the reviewer for the kind words. We adopted the constructive suggestions and corrected the manuscript accordingly and will upload it when required from the editorial system. Please find the comments to the general and specific suggestions from Referee #3 below.**

This very interesting manuscript describes spatial and temporal variations in oxygen concentrations along the outer Western Crimean Shelf and the consequences for biota and a number of key biogeochemical processes. Using a wide range of state of the art measurement techniques that include in-situ methods, the authors show that, in this region of the Black Sea, substantial variations in oxygen concentrations in bottom waters occur over time scales of hours. Other conclusions are that oxidation of upward diffusing reduced compounds from porewaters play only a minor role in the diffusive uptake of oxygen by the sediment and that fauna, when present, contribute significantly to oxygen uptake.

This is a well-written paper and I have only very few comments.

#### **Referee #3:**

(1) It would be great if the authors could add organic C profiles to their geochemical C2624 data set. This could be used in their discussion of the fate of the organic matter reaching the sediment in the various redox zones in section 4.1. A more detailed discussion of the NH<sub>4</sub> profiles and production rates also would fit in this section.

**REPLY:** *We now include the organic carbon content in the first cm in the Methods, Results, Table 2 and the Discussion. Regarding the further discussion of the ammonium profiles, we have added a sentence to the Results that though some ammonium production is expected upon organic carbon degradation, production rates are low (Chapter 3.4. Sediment geochemistry).*

#### **Referee #3:**

(2) The paper would benefit from the addition of a short conclusion and/or implication section at the end. It is not strictly necessary, but it would likely increase its impact.

**REPLY:** *The authors have included a conclusion section at the end of the manuscript.*

#### **Minor comments:**

**Referee #3:**(1) page 6454. Porosity is missing in this equation.

**REPLY:** *In this case the flux was calculated in the diffusive boundary layer, i.e. in the water column. Porosity of water is 1 and in this case doesn't have to be included in the equation. See e.g. Glud, R. N.: Oxygen dynamics of marine sediments, Marine Biology Research, 4, 243–289, 2008.*

**Referee #3:** (2) page 6454, line 26. Change “was” to “were”

**REPLY:** *The authors rephrased “was” to “were”.*

**Referee #3:** (3) page 6455. It can be tricky to take pore water samples with rhizons at 1 cm resolution because of the risk of sampling from depths above and below the sampling depth targetted. It would be useful if the authors describe how this was avoided, e.g. by including how long the rhizons were deployed, what volume was extracted, etc.

**REPLY:** *We were taking care that we did not extract too much pore water, by using 2 drilled holes at opposite sides per depth interval in a core. With this we did extract less pore water than recommended by Seeberg-Elverfeldt 2005, et al. This is now explained in the Method section of the manuscript (2.6 Geochemical analyses of the sediments and sulfate reduction rates), including the length of the Rhizons, the explanation that we used 2 parallel Rhizons and the citation.*

**Referee #3:** (4) Page 6458. Section 3. Here the authors are describing the results of Fig. 6 before those of Fig. 3, 4 and 5. I would suggest to change the sequence of the figures to that in the text (Fig 6 => Fig. 3, Fig. 3 => Fig 4. etc.)

**REPLY:** *The authors changed the numbers of the figure in order of their appearance.*

**Referee #3:** (5) Page 6461: line 22. In figure 5 only rates are presented, not fluxes.

**REPLY:** *The authors agree that this should be corrected to “concentration profiles and volumetric production and consumption rates...”*

**Referee #3:** (6) Page 6463. 210Pb data: refer to the figures in the supplementary data file. It would be good if more information was provided on the calculation of the sedimentation rate from the 210Pb data. How did the authors account for the bioturbation at site 462?

**REPLY:** *We now refer to Figure S4 in the Supplement Data File. For the calculation of the sedimentation rates we used the method described in detail in a previous publication (Niggemann et al 2007) that is cited (P6456 L25). The bioturbation at St. 462 we accounted for by using only the undisturbed part of the profile as described in the method section (P6456 L23).*

**Referee #3:** (7) Page 6464. Line 22. Change to “macrofauna play”

**REPLY:** *Changed to “macrofauna can enhance”.*

**Referee #3:** (8) Page 6466. Line 11. Rephrase “in relation to bottom water oxygen concentration”.

**REPLY:** *Rephrased*