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Interactive comment on "The Roles of Resuspension, Diffusion and Biogeochemical Processes on Oxygen Dynamics Offshore of the Rhone River, France: A Numerical Modeling Study" *by* Julia M. Moriarty et al.

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Dear Reviewer #1,

We appreciate the very constructive and thorough feedback within your review. Although we plan to wait until the end of the discussion period before we fully address your comments, we did want to respond to your primary concern, that the reclassification (or 'repartitioning') of refractory and labile particulate organic matter (POM) upon resuspension may affect the estimates of seabed oxygen consumption. Here, we elab-

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orate on the rationale for this repartitioning, and show results from a model without this repartitioning.

As noted in the review, the model converts a fraction of resuspended refractory POM into labile POM upon entrainment from the seabed into the water column. This modeling approach is supported by laboratory experiments by Stahlberg et al. (2006) indicating that organic matter remineralization rates increased during and in the days following resuspension events, and that changes in remineralization rates were not only due to changes in oxygen availability. Literature pertaining to how resuspension affects the remineralization of particulate organic matter over days to weeks is limited, but we also considered related studies that focused on redox oscillations and remineralization (e.g. Gilbert et al., 2016; Sun et al., 2003; Caradec et al., 2004; Aller, 1994; Wakeham and Canuel, 2006; Arzayus and Canuel, 2004). Because guidance from this literature is inconclusive, we chose a parsimonious approach, i.e. 'repartitioning', for the partitioning of organic matter that mimics the changes in remineralization described in Stahlberg et al. (2006), and is consistent with field data from the Rhone River (see below).

Like the reviewer, we have admittedly been concerned about the model's sensitivity to this approach. With prompting from this review, we ran a "no-repartitioning" model run that was identical to the standard model run in the paper, except it did not repartition refractory and labile organic matter upon resuspension to the water column. Instead, any labile organic matter in the model was assumed to stay labile, and refractory organic matter in the model was assumed to stay refractory.

Overall, results from this no-repartitioning model run indicate that estimates of seabed oxygen consumption were sensitive to this repartitioning (see next paragraph), but estimates of water column oxygen consumption were not. In both the standard and the new "no-repartitioning" model runs, resuspension approximately doubled oxygen consumption in the bottom boundary layer when averaged over a two-month time period (see Figure R1 in supplement, please compare to Figure 4 in the submitted manuscript, reproduced here as Figure R2 in supplement). Since water column oxygen consumption is the dominant component of the total oxygen consumption, our overall results were insensitive to this parameterization.

However, as noted above, seabed oxygen consumption was sensitive to the repartitioning of organic matter. Compared to the standard model where resuspension increased seabed oxygen consumption by +20% (Fig. R2 in supplement), resuspension had a negligible effect on seabed oxygen consumption in the "no-repartitioning" model run over timescales of two-months (Fig. R1 in supplement). Note that this result from the "no-repartitioning" model is in conflict with observations from Toussaint et al. (2104; their Fig. 7), which do not show a decrease in seabed oxygen consumption following resuspension events like that seen in Figure R1 (see supplement). This implies that the model with repartitioning better describes the observations on the Rhone prodelta compared to the model without repartitioning.

We look forward to other input via the review process, after which a more complete response to reviews will be composed, including how the revision will incorporate these interesting new results. Thank you again for your review.

Best Regards,

Julia Moriarty

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Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2016-482/bg-2016-482-SC1-supplement.pdf

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