

Interactive comment on “Spatiotemporal variability of light attenuation and net ecosystem metabolism in a back-barrier estuary” by Neil K. Ganju et al.

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The diel method typically assumes that oxygen is well mixed throughout the boundary layer (hbl). Only when this is true can the time rate of change of oxygen be “corrected” for the surface flux (F_{surf}). Furthermore, the surface flux correction requires that there is no flux through the bottom of the mixed layer (or seabed in shallow water) so that the flux divergence can be estimated simply as F_{surf}/hbl . In shallow water, like the environments studied here, there could be benthic fluxes that would invalidate this estimation. When the diel method is applied and these assumptions are not valid, diel variations in the flux divergence term are not accurately accounted for, typically resulting in an

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over-estimate of community respiration. This often can result in an apparent first order balance between GPP and CR (like in figures 9 and 11), when in reality the flux divergence is much more important than assumed. In the absence of advection, $GPP+CR$ must be balanced by the time rate of change and the flux divergence. If the flux divergence term is poorly estimated by the bulk estimate, these errors will be included in the estimate of CR, resulting in a nearly 1:1 relationship between GPP and CR (like in figure 11). I think that the estimated flux divergence term should be shown so that the reader knows how big this term is compared to the estimated NEM. I would not be surprised if the errors associated with the estimated flux divergence are larger than the estimates of NEM. In my experience, diel methods provide useful estimates of GPP but are not accurate enough to resolve NEM. I think some comments should be added regarding whether or not vertical oxygen gradients develop and the potential role of benthic fluxes. In addition to these errors, there is considerable uncertainty in the piston velocity in these systems. I assume a wind-speed dependent formulation was used, but this should be discussed more explicitly, including a discussion of its applicability to a sheltered estuarine environment.

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