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Disentangling the Drivers of Benthic Oxygen and Dissolved Carbon Fluxes in the Coastal Zone of the Southern Baltic Sea

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Abstract:

Benthic fluxes of oxygen and carbon in coastal zones are poorly resolved in mechanistic models due to the lack of understanding of the diverse interactions among the physical, chemical, and biological drivers of biogeochemical fluxes. To inform modelling efforts we used ex-situ incubation experiments to identify spatial and seasonal patterns of oxygen and dissolved inorganic and organic carbon (DIC and DOC) fluxes in the coastal southern Baltic Sea. We used boosted regression trees to identify important drivers of the studied fluxes. Our results demonstrate that benthic communities, in addition to sediment parameters, played a dominant role in shaping oxygen and DIC fluxes, while neither benthic community, environment, season, nor sampling location could account for the highly variable DOC fluxes. DIC fluxes were partly decoupled from oxygen fluxes, since carbonate dissolution, anaerobic respiration, and submarine groundwater discharge affected DIC fluxes in the study region. Boosted regression trees proved to be a useful tool to study drivers of biogeochemical fluxes as it allowed to identify non-linear effects of biological and environmental variables on benthic fluxes.

Keywords: DIC, DOC, respiration, benthic fauna, southern Baltic Sea, biogeochemical cycles