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Pore-water advection and solute fluxes in permeable marine sediments (II): Benthic respiration at three sandy sites with different permeabilities (German Bight, North Sea)

Janssen, F., M. Huettel, U. Witte

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ABSTRACT: This contribution presents total oxygen uptake (TOU) rates and nutrient fluxes of organically poor permeable shelf sands of the German Bight. Measurements have been made in situ with the novel autonomous benthic chamber system *Sandy* under controlled conditions of advective pore-water exchange. Average oxygen consumption rates of 31.3 $\pm$ 18.2 mmol m^{-2} d^{-1} measured in this study were relatively high as compared with rates reported from shelf sediments with much higher organic contents. TOU of highly permeable medium and coarse grained sands was substantially enhanced in the presence of advection. This indicates that advective oxygen supply contributed significantly to respiration in these sediments and that advection has to be considered when assessing oxygen consumption and organic matter mineralization in shelf areas. In fine-grained, less permeable sands, no effect of advection could be measured. A lower advective oxygen supply in these sediments is in agreement with a release of ammonium instead of nitrate and a shallower oxygen penetration depth. Scaled up to the entire German Bight, the results imply that in 40% of the area an effect of advection on benthic oxygen uptake and other advectionrelated processes can be largely excluded, while in the remaining 60% significant pore-water advection potentially takes place. However, because permeabilities of the sediments investigated in this study were widely spaced, a significant effect on oxygen supply was only verified for highly permeable sands that are likely to cover approximately 3% of the area.

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