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Aerobic denitrification in permeable intertidal sediments from the Wadden Sea

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Sandy sediments dominate the intertidal region of the Wadden Sea but so far little is known about their role in the coastal N-cycle. We investigated the potential N-loss rates at a sandflat (Janssand) in the central German Wadden Sea by using a modified version of the whole core incubation technique used for fine-grained sediments. In view of the high permeability and strong pore water advection in these sediments, the percolation method better represents the *in situ* conditions than the conventional diffusive flux technique. Denitrification assays with those permeable sediments incubated with $^{15}NO_3^-$ indicate immediate $^{29}N_2$ and $^{30}N_2$ production. In contrast to the conventional views, our preliminary results show that permeable Janssand sediments are characterized by some of the highest denitrification rates in the marine environment. Moreover, our results from gas-tight bag incubations indicate that denitrification immediately occurs even under aerobic conditions, with rates of 2.03$\pm$0.06 at 0-2 cm and 2.30$\pm$0.09 mmol m^{-3} h^{-1} at 2-4 cm of the sediments with the starting O_2concentrations of 90 and 30 μmol L^{-1}, respectively. Additional evidence for denitrification in the presence of free oxygen was obtained by simultaneous O_2 and NO_x measurements with microsensors in percolated cores and Membrane Inlet Mass Spectrometer measurements. We speculate that the observed high denitrification rates in the presence of free oxygen might be an adaptation of the denitrifying bacteria to recurrent tidally-induced oscillations in pore water oxygen concentrations in the permeable sediments of Janssand.