Shift from denitrification to anammox after inflow events in the central Baltic Sea

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ABSTRACT: Incubation experiments with ^{15}N-labeled compounds (NO_3^- and NH_4^+) were performed during three cruises (2002, 2004, and 2005) to study the loss of inorganic N as dinitrogen gas (N_2) via denitrification and anammox in the water column of the Gotland Deep (central Baltic Sea). ^{15}N incubations did not provide evidence for direct conversion of NO_3^- reduction to N_2 (heterotrophic denitrification) in the suboxic (O_2 < 10 µmol L^{-1}) sulfide-free waters. Substantial denitrification rates (up to 2.7 µmol L^{-1} d^{-1} N_2) were measured in water samples collected from the NO_3^--H2S interface (redoxcline) in 2002 and in water from the sulfidic zone in 2004, which indicates chemolithotrophic denitrification as the dominant N-loss process in both years. Massive inflows of oxygenated North Sea water from 2002 to 2003 caused a complete ventilation of the Baltic Sea with high oxygen concentrations in the Gotland Deep bottom water. After the reestablishment of the redoxcline in 2004, a newly formed suboxic zone above sulfidic waters[]with NO_3^-, NO_2^-, and NH_4^+ at the detection limit[]was observed in spring 2005. The development of this zone was associated with a several-fold increase in reduced and oxidized manganese and with a shift from denitrification to anammox as the main N-loss process. Fluorescence in situ hybridization analysis confirmed the presence of anammox bacteria and the number of anammox cells was consistent with the observed N_2 production rates in 2005.

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