Benthic-pelagic coupling in the East Siberian Sea from nitrate isotopes

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Over the East Siberian Sea and common to the western Arctic Ocean, a subsurface nutrient maximum is reported in the halocline, and generally attributed to both nutrient-rich Pacific inflow and intensive remineralization in shelf bottom waters being advected into the central Arctic basin. We report nitrogen and oxygen isotopic measurement of nitrate in the water column. A large decoupling between nitrate $\delta^{15}N$ and $\delta^{18}O$ is reported, increasing and decreasing upward from the Atlantic T°C maximum into the halocline, respectively. Nitrate $\delta^{18}O$ follows the decrease in water $\delta^{18}O$, harboring low-$\delta^{18}O$ from large Arctic river discharge. This imprint is transmitted with nitrification to the ambient nitrate $\delta^{18}O$, suggesting that most of the nitrate being supplied into the Arctic Ocean has been reprocessed at least once within the Arctic. The associated increase in nitrate $\delta^{15}N$, correlated with the fixed N deficit, indicates that a significant share of benthic denitrification is supplied from nitrate produced by partial nitrification in the reactive sediment layer. Following an imbalance between remineralization and nitrification, the residual high-$\delta^{15}N$ ammonium is accumulated in pore waters and diffuses into shelf bottom waters to be ultimately nitrified. Following the advection into the central basin, this processes could explain both the nutrient maximum, with high-$\delta^{15}N$ and low-$\delta^{18}O$ nitrate, and the accentuated fixed N deficit in the western Arctic halocline in comparison to the Pacific inflow. A sedimentary isotope effect is reported for benthic denitrification, 2.3-3.1‰, in the middle range given in the literature.