Nutrient cycling in the Barents Sea: Insights from nitrate isotope measurements (ARISE project)

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The Arctic Ocean is warming at twice the rate of the global average, leading to sea ice loss and changes to primary productivity and food web dynamics. In the Barents Sea, warm Atlantic Water (AW) transits northwards and enters the Eurasian basin of the Arctic Ocean. In this shelf environment, the physical processes are already changing as a result of climate change and have the potential to alter the nutrient characteristics of exported AW to the wider Arctic basin.

We present measurements of nitrate isotopes (δ^{15}N-NO3 and δ^{18}O-NO3) from fieldwork in the Barents Sea in summer 2017, which are used to determine the modification of AW nutrients during transit though the Barents Sea. Preformed AW nitrate has a high δ^{18}O-NO3 signature, a result of partial nitrate assimilation and nitrification occurring in transit from the North Atlantic. As waters cool and freshen in the Barents Sea, δ^{18}O-NO3 decreases indicating that nitrate in the Arctic Waters (ArW) has been nitrified since entrainment onto the shelf. In contrast, there is no significant change to δ^{15}N-NO3 or N* in ArW, suggesting that benthic denitrification does not impart an isotopic imprint on pelagic nitrate in this Arctic shelf region. In the surface waters δ^{15}N-NO3 and δ^{18}O-NO3 increase with the onset of nitrate uptake by phytoplankton (ε=5‰). Nitrate is fully consumed in surface waters and particulate nitrogen (δ^{15}N-PN) reflects the isotopic source of AW. Our results suggest that following stratification in summer months, Barents Sea primary production becomes N limited. We discuss how current warming trends may affect the Barents Sea nutrient inventory and productivity, and the implications to Arctic intermediate water formation.