Dynamics of nitrous oxide (N_2O) in the Arctic Siberian shelves of the North Kara Sea during summer 2021

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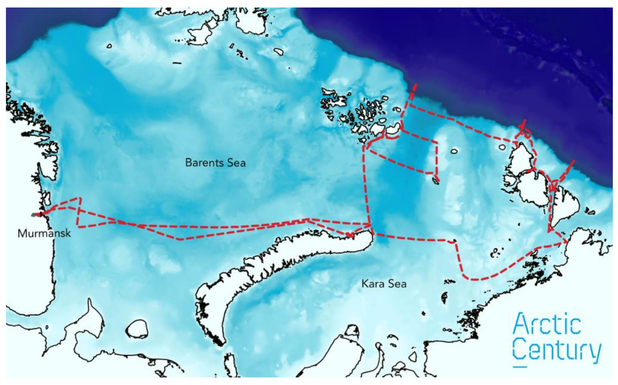
Arctic Century

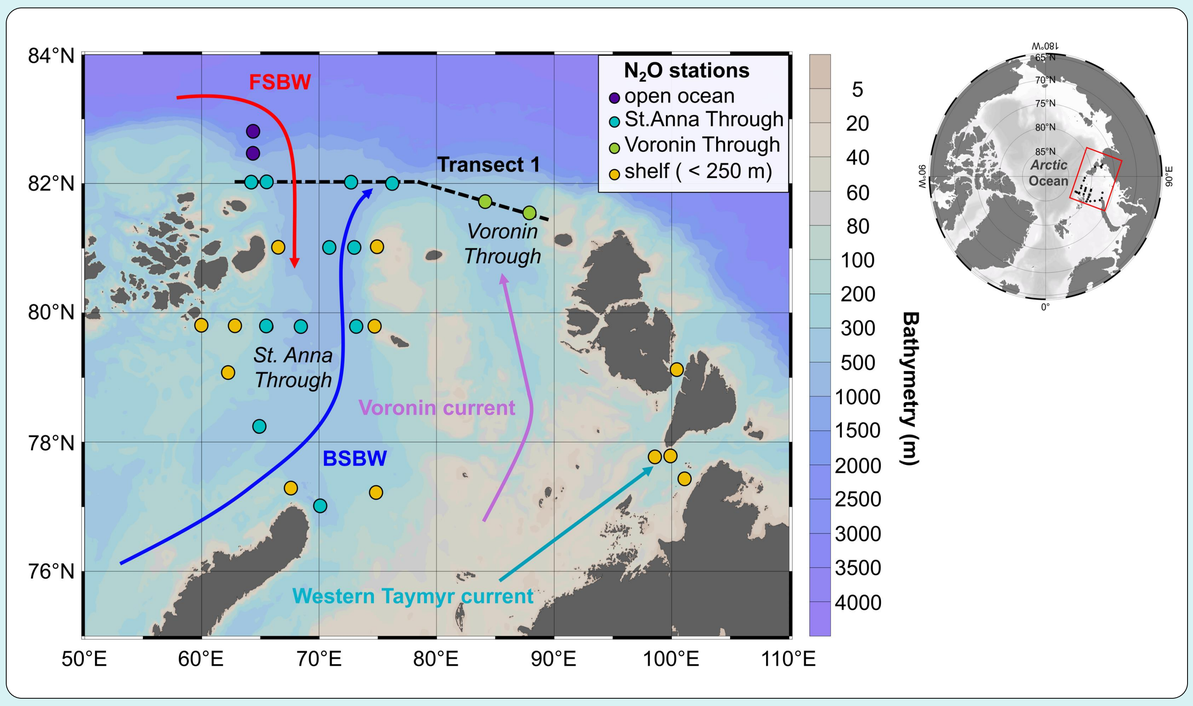


1. Introduction

- Previous studies documented N_2O accumulation across productive and shallow continental shelves (<100m) in the western Arctic.[1,2,3]
- High productivity on shallow shelves leads to increased carbon export, benthic carbon supply, and remineralization, resulting in intensified biogeochemical cycling, including nitrification and benthic denitrification.
- The eastern Arctic shelves are understudied compared to the western Arctic.

2. Sampling and Methodology

- Samples collected during summer 2021 as part of the Arctic Century Expedition, aboard the research vessel *Akademik Tryoshnikov*.
- N_2O concentration measured using the headspace technique described by Weiss (1981)[4] and Upstill-Goddard et al. (1996)[5].
- N^* is an indicator of denitrification (lower N^* = higher denitrification).



3. Results and Discussion

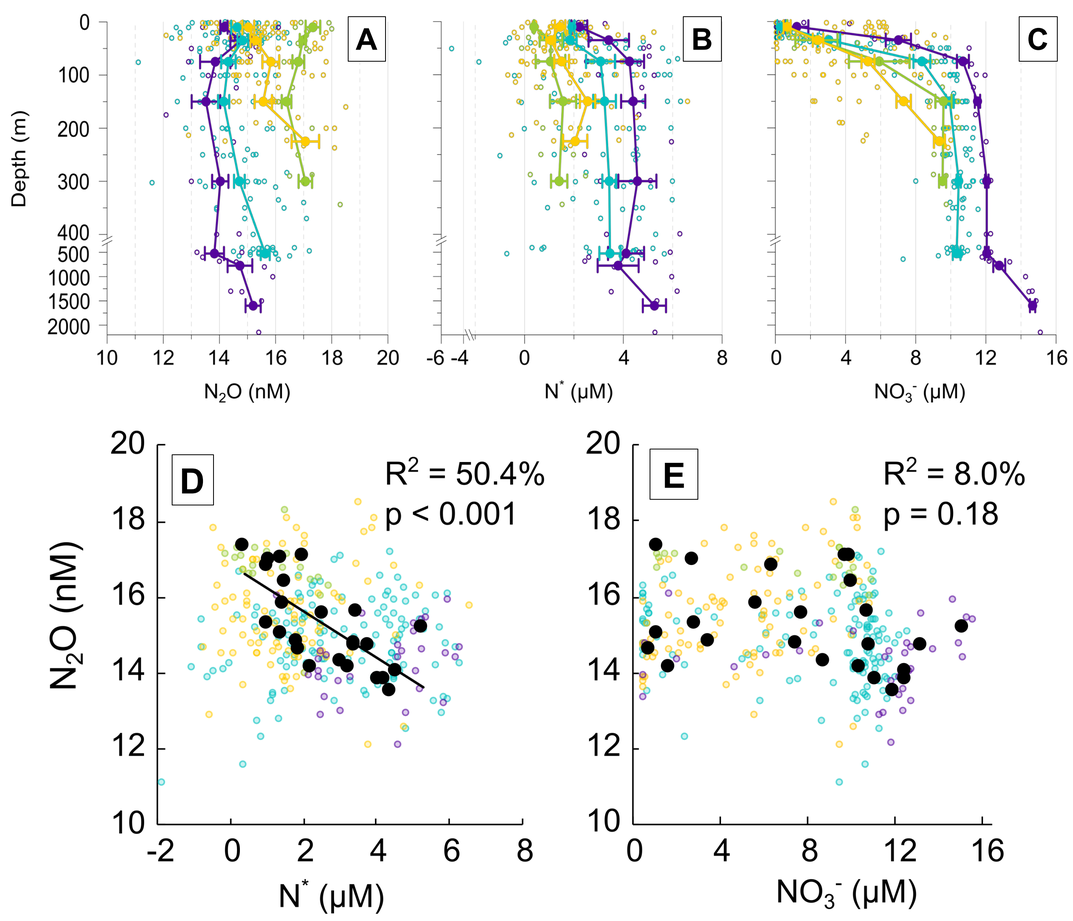
I. Continental shelf waters are enriched in N_2O

- N_2O concentration increases with depth.

II. N_2O production is likely linked to benthic denitrification

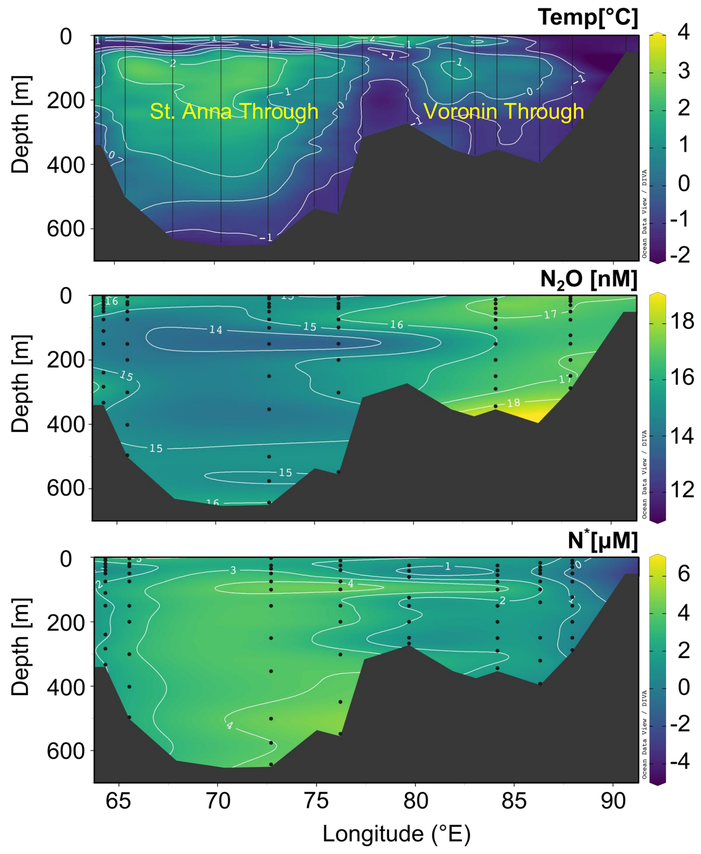
- N_2O exhibits significant relationship with N^* and not with nitrates.

Individual samples are represented by the small dots with no fill (Fig. A, B, C, D, E), the mean concentration of each category is represented by the lines with the filled points (Fig. A, B, C) and the black filled dots (Fig. D, E).

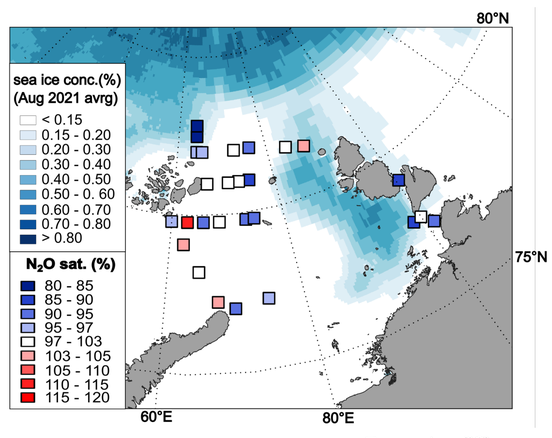


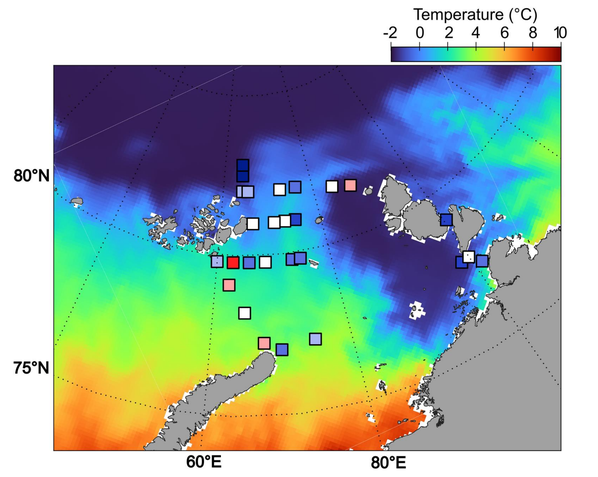
III. Impact of the water mass origin and depth

- The Voronin Through is N_2O-enriched with a stronger N^* deficit in contrast to the St. Anna Through.
- The Voronin Through is shallower and receives shelf water originating from the South Kara Sea in contrast to the deeper St. Anna Through that is under an open ocean influence.



IV. Surface water is near equilibrium with atmosphere





- Surface waters are in average at equilibrium with the atmosphere and may function as a minor sink (95 ± 6 %).
- Significant N_2O undersaturations at the open ocean (~ 80%) stations, due to rapid cooling of North Atlantic water and limited air-sea exchange by the presence of sea ice cover, during their transport towards the Kara Sea.

4. Conclusions

- Higher N_2O concentrations are found in bottom waters of shallow shelves compared to the open ocean.
- Benthic denitrification drive N_2O production.
- Temperature is the main controlling factor of N_2O concentration in surface waters.

References

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