Turbulence measurements suggest high rates of new production over the shelf edge in the northeastern North Sea during summer

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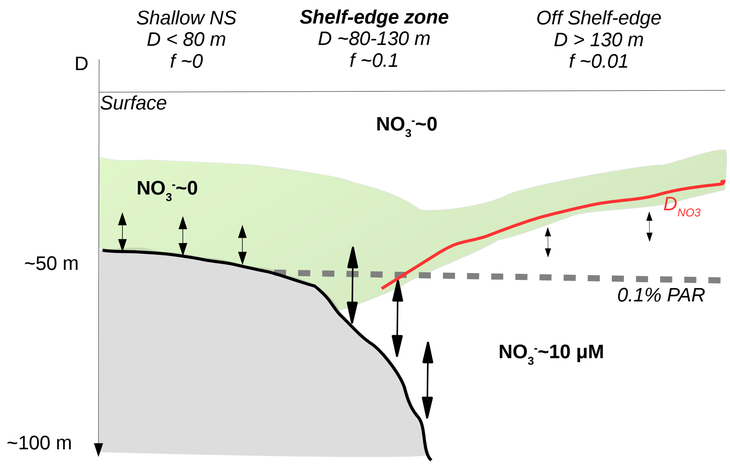
Summary

Significant new production was found along the shelf edge due to vertical turbulent nutrient transports

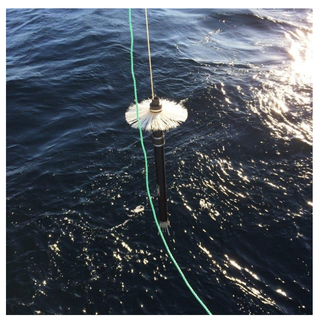


Conditions across the shelf edge zone during summer

- The nutricline (D_{NO3}) meets the bottom at the shelf edge
- Large vertical nitrate fluxes at the shelf edge
- Largest f-ratios are found above the shelf-edge zone

- **The shelf edge is a major nutrient supplier during the period of summer stratification**

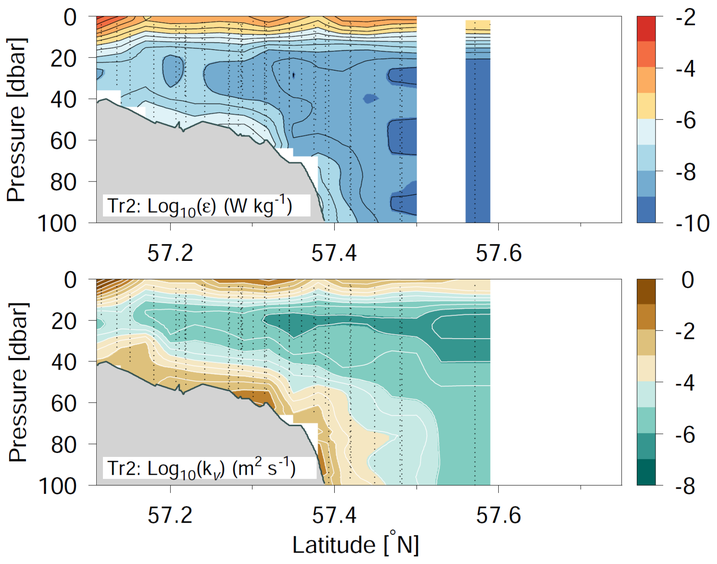
Turbulent nitrate fluxes



Deployment and retrieval of the turbulence profiler

- Dissipation of turbulent kinetic energy (ε) from profiler
- Vertical diffusion coefficients (k_v) can be calculated from ε
- Vertical nitrate fluxes are then calculated as:

$$F_{NO3} = -k_v \frac{\partial [NO_3^-]}{\partial z}$$

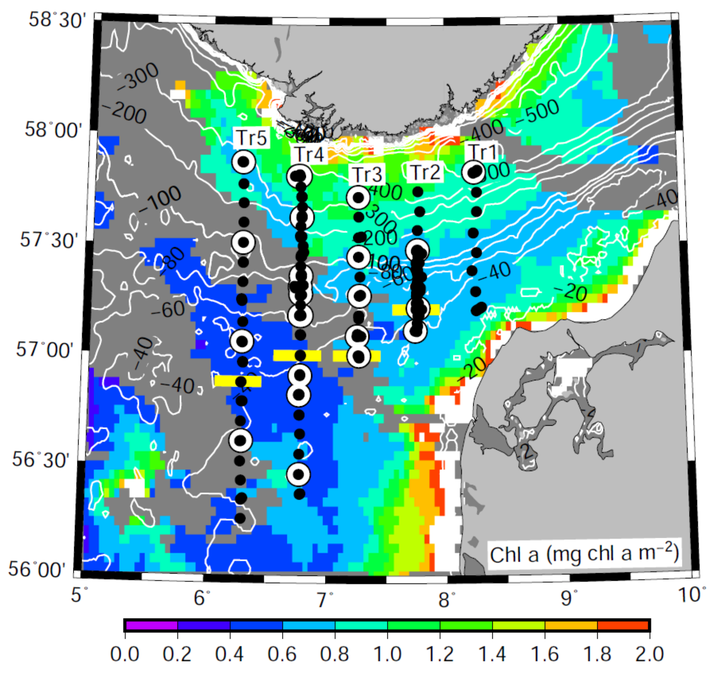


Turbulence measurements along Transect 2

- Log_{10} (ε) of dissipation of turbulent kinetic energy (W kg^{-1})
- Log_{10} (k_v) of vertical turbulent diffusion coefficient (m^2 s^{-1})

Introduction

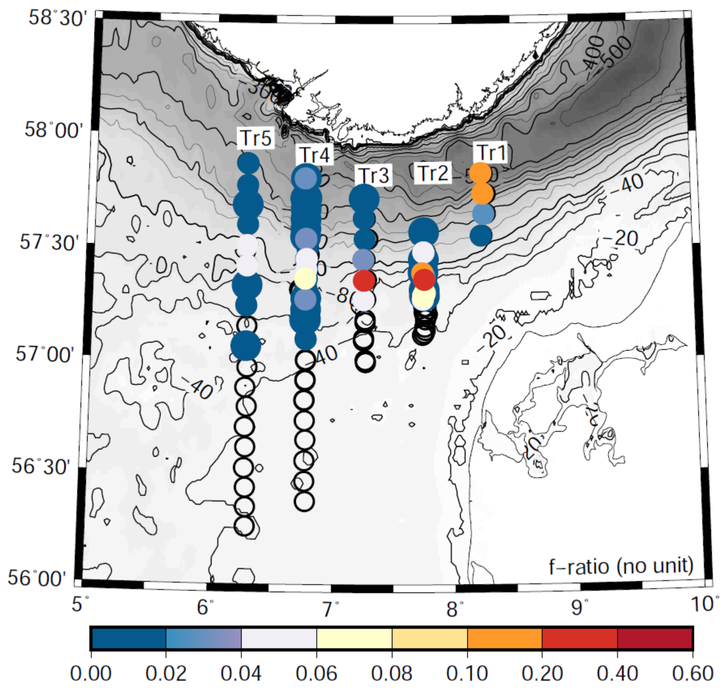
VERMIX investigated the role of mixing on biological productivity and ecosystem structure



Station map for the VERMIX cruise July 2016

- CTD's (black) and selected PP-stations (white)
- Border towards nitrate depleted area (yellow markers)
- Satellite derived chlorophyll a (clouds are gray)

Results



f-ratios for the euphotic zone

- Primary production (PP) is calculated from chl a and PAR
- New production (NP) is assumed to equal the nitrate flux into the euphotic zone
- The f-ratio is defined as:

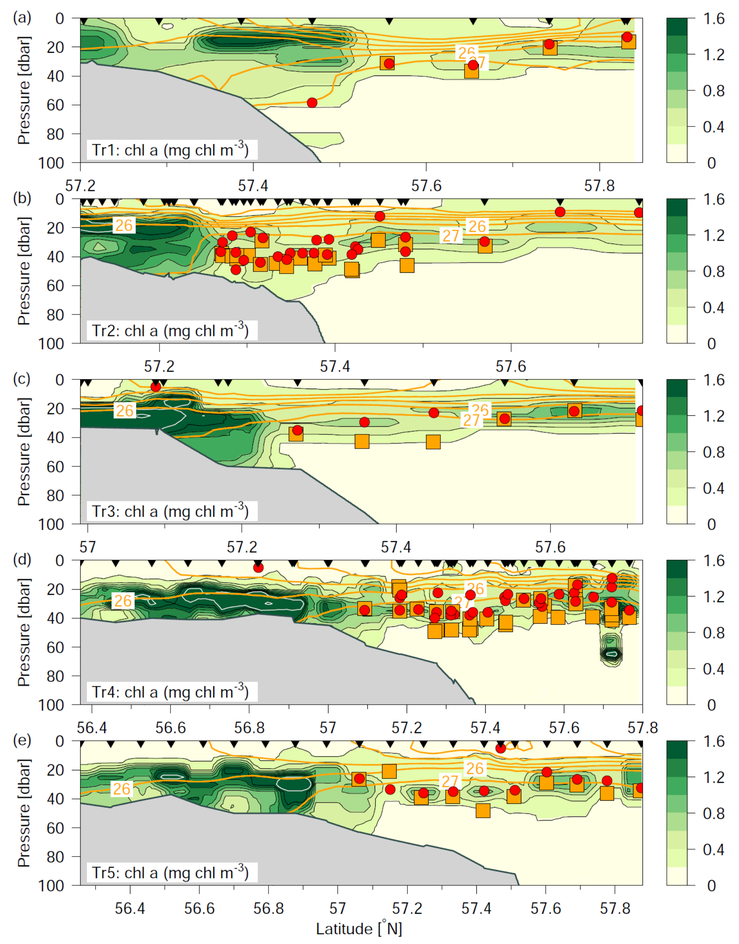
$$f = \frac{NP}{PP}$$

High f-ratios are seen along the shelf edge (white - red)

References

Bendtsen, J. and Richardson, K., Turbulence measure-ments suggest high rates of new production over the shelf edge in the northeastern North Sea during summer, Biogeosciences, 15, 7315--7332, 2018 (Open access).

Shelf edge processes



Chlorophyll a along transects 1 - 5

- Nutricline depths (red bullets)
- Depths with maximum nitrate flux into the euphotic zone (orange squares)
- Density anomalies (orange contours).

- **The nutricline is closely related to the pycnocline**
- **Dynamical changes, therefore, influence the depth of the nutricline, and, thereby, new production**

Shelf edge processes represent an important key to understand temporal variability of organisms, production, and ecosystem structure in this productive area.

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