Variability of Oxygen in Denmark Strait Overflow Water (DSOW) as Revealed by Moored Oxygen Sensors in the Irminger Basin

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1. Background and Objectives

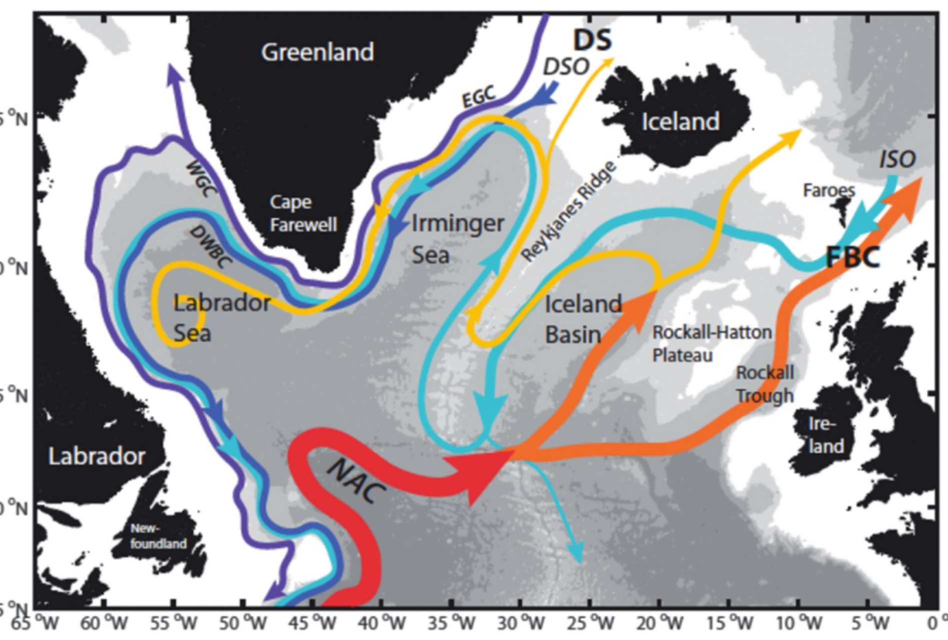
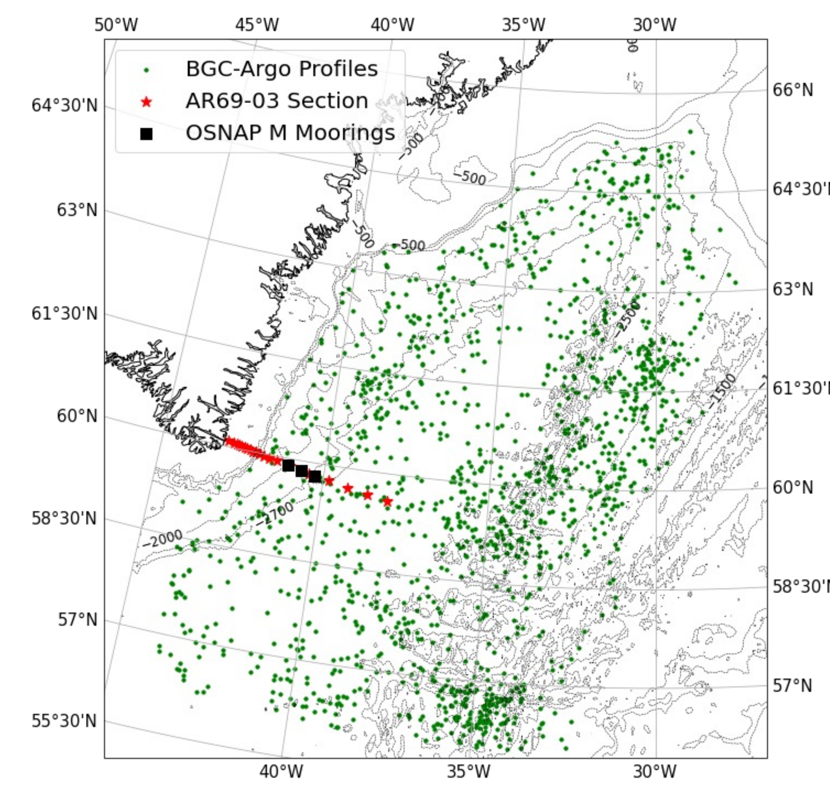


Figure 1: Key circulation features in the Subpolar North Atlantic. Red-to-yellow and cyan-to-purple lines denote the pathways of warm and cold waters respectively. The pathway of the Denmark Strait Overflow Water (DSOW) is represented in blue. Figure from Lozier et al. (2017).

- Denmark Strait Overflow Water (DSOW) is formed from deep convection in the Nordic Seas and is the densest component of the Deep Western Boundary Current (DWBC).
- In the Irminger Basin, DSOW properties change due to entrainment, which plays a critical role in the density structure of AMOC and oxygenation of the North Atlantic.
- Variability in biogeochemical properties of DSOW along the DWBC of the Irminger Basin and its relationship with entrainment remains an open question.

This study documents the variability in the oxygen content of DSOW in the DWBC near Cape Farewell and relates these observations to the fractions of water masses that the overflow plume entrains.

2. Data



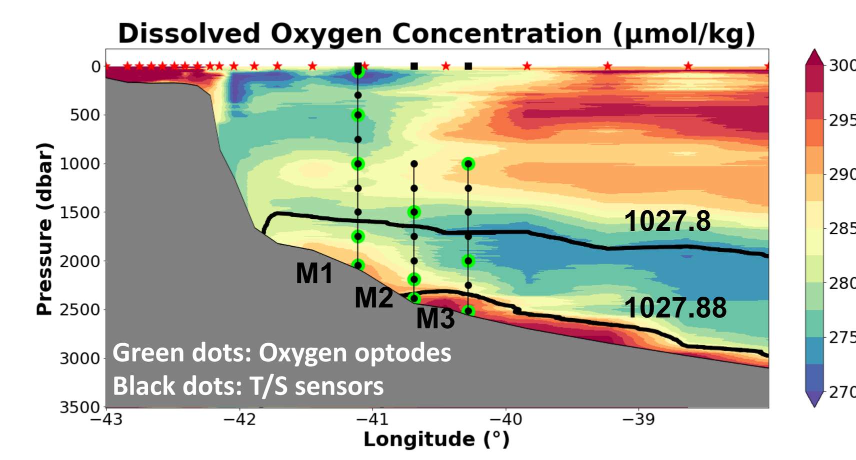
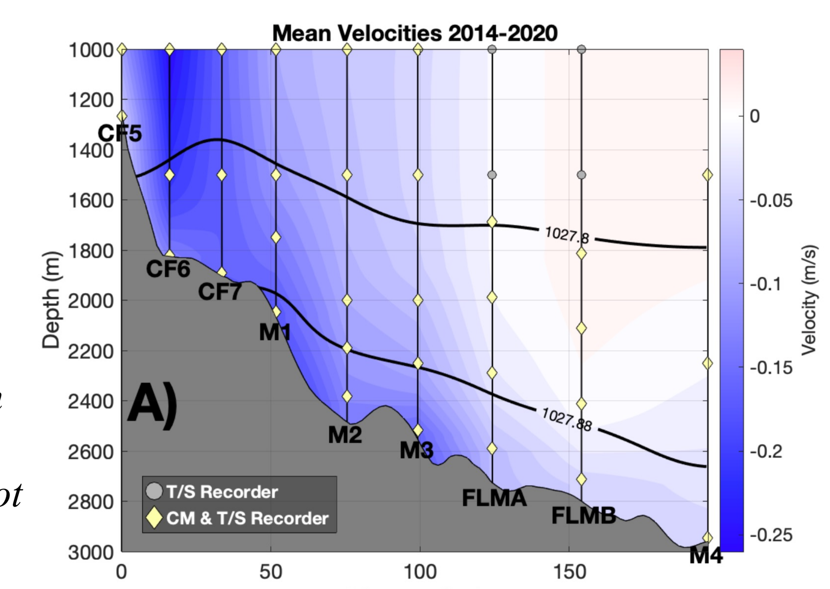


Figure 2: Above panel shows location of OSNAP M moorings (black squares) and BGC-Argo profiles (green dots) used in this study. Red stars denote CTD stations from AR69-03 cruise (Summer 2022) that are used to plot the hydrographic section of O_2 concentration in the upper-right hand panel. Lower-right hand panel shows mean velocity field over 2014-2020.



Koman et al. (2023)

3. Oxygen Cycle in DSOW from OSNAP M

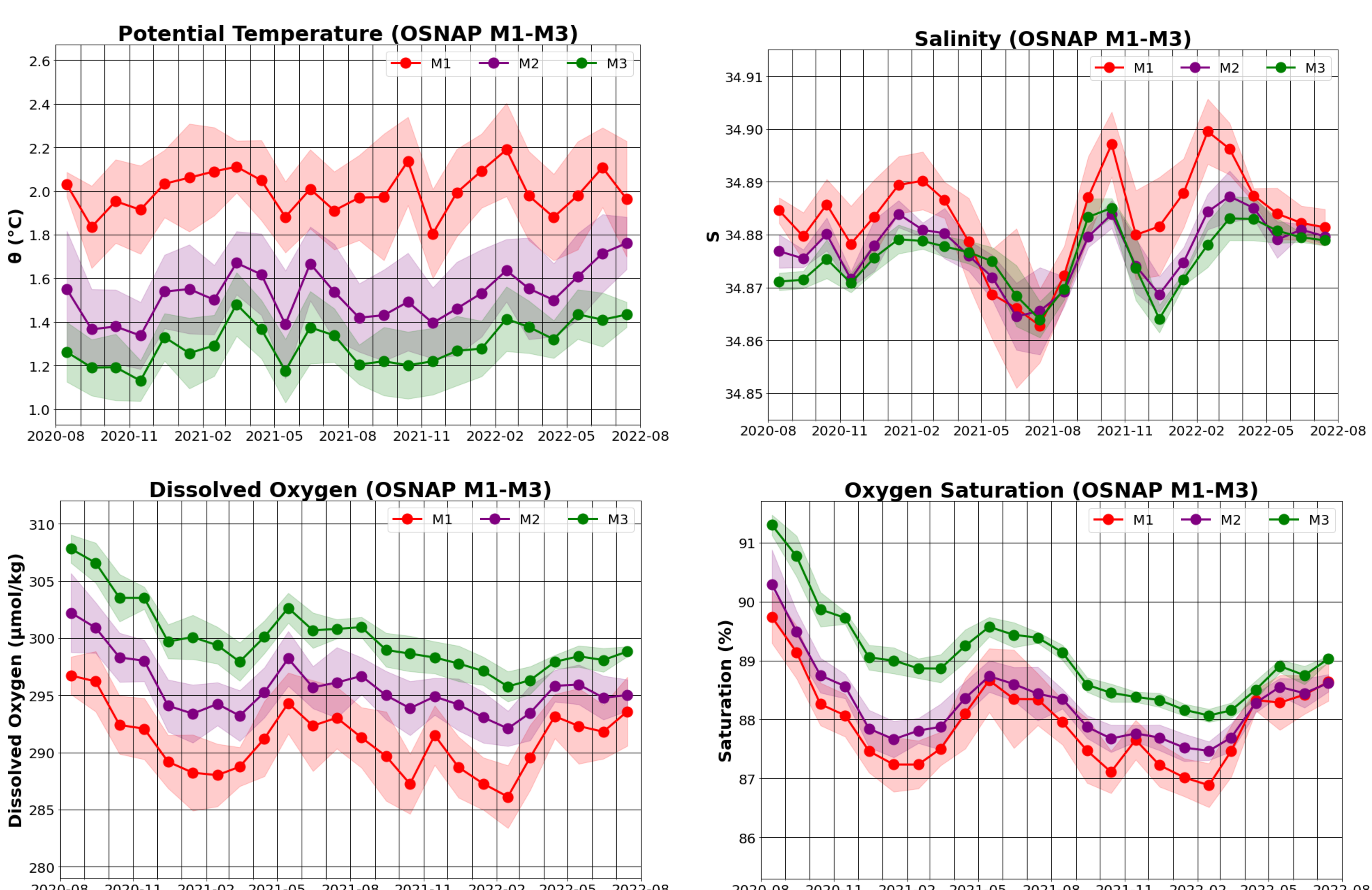


Figure 3: Monthly mean of the daily-averaged time series of temperature, salinity, O_2 concentration, and O_2 saturation. The error bands denote one standard deviation.

Dissolved oxygen concentration and saturation of DSOW increase over winter-spring (February to July) and decrease over summer-fall (August to January).

4. Water-Mass Composition of DSOW

The following source waters were defined: (1) Source Denmark Strait Overflow Water (sDSOW), (2) Northeast Atlantic Deep Water (NEADW), (3) Labrador Sea Water (LSW), and (4) Arctic Water (ArW). The water-mass decomposition reveals seasonality in % NEADW and % LSW.

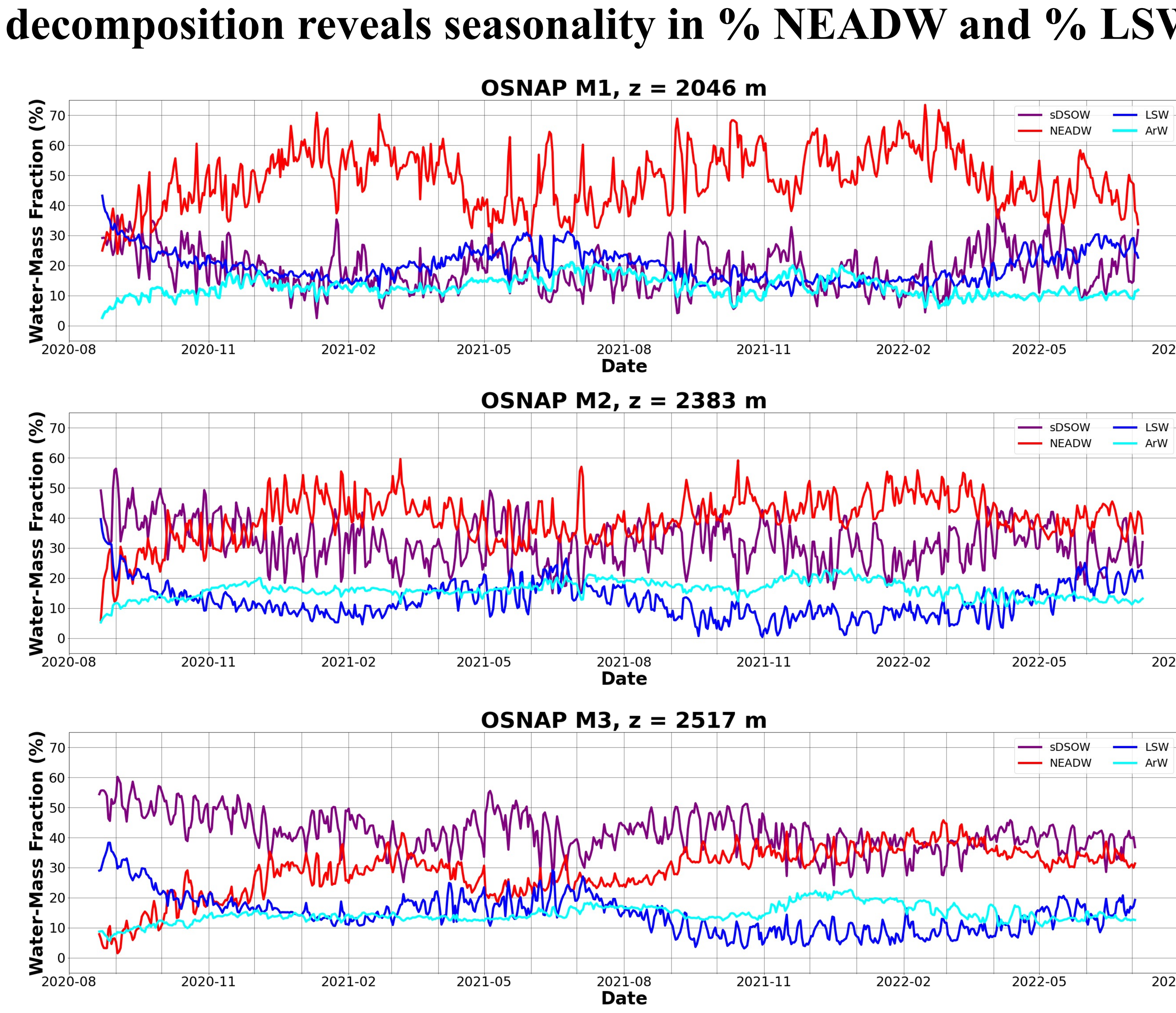


Figure 4: Time series of water-mass composition of DSOW as measured from the bottom-most instruments in OSNAP M1-M3.

5. Summary and Outlook

- **Moored oxygen sensors offshore of Cape Farewell, Greenland reveal for the first time that O_2 concentration and saturation of DSOW exhibits variability over seasonal timescales.**
- **Water-mass decomposition analysis suggests that the observed seasonality in the oxygen content of DSOW is linked to the entrainment of LSW and NEADW.**
- **We will apply Price and Baringer (1994)'s numerical model for entrainment mixing to test the extent to which variability in source overflow properties and entrainment processes influence the variability in DSOW properties observed in Cape Farewell.**