Do salinity variations along the East Greenland shelf show imprints of increasing meltwater runoff?

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Summer NAO drives Greenland melt

Negative summer NAO (SNAO) phase, enhanced melting (2010 and 2012)[1] [2]

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Increased freshwater content constrained to the East Greenland shelf

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More melt events may result in increased freshwater into the interior via offshore transport

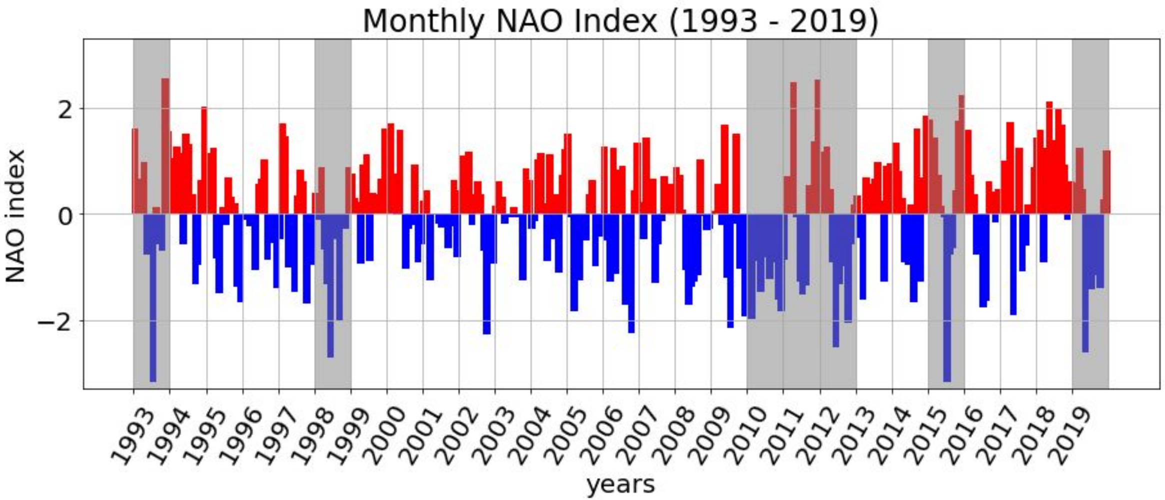

Fig 1. Monthly NAO index (1993 - 2019)[3]. Grey bars indicate strongly negative summer (JJAS) NAO years.

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Freshwater content, currents, and cross sections

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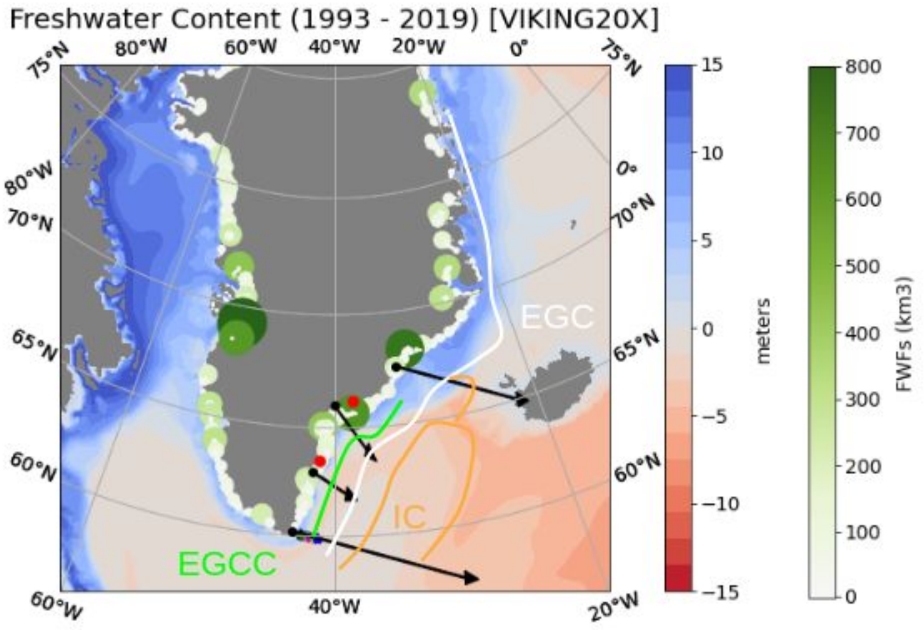

Fig 2. Mean FWC and Greenland runoff locations[4]

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Data and Methods

Greenland melt applied to model

Data:

- VIKING20X (1/20°, ocean only model)[5]
- GLORYS12V1 (1/12°)[6]
- OSNAP East CTD data[7]

Methods:

- Time-varying mask (S < 34.8 psu, V < 0 m/s)
- Composite analysis from summer NAO index

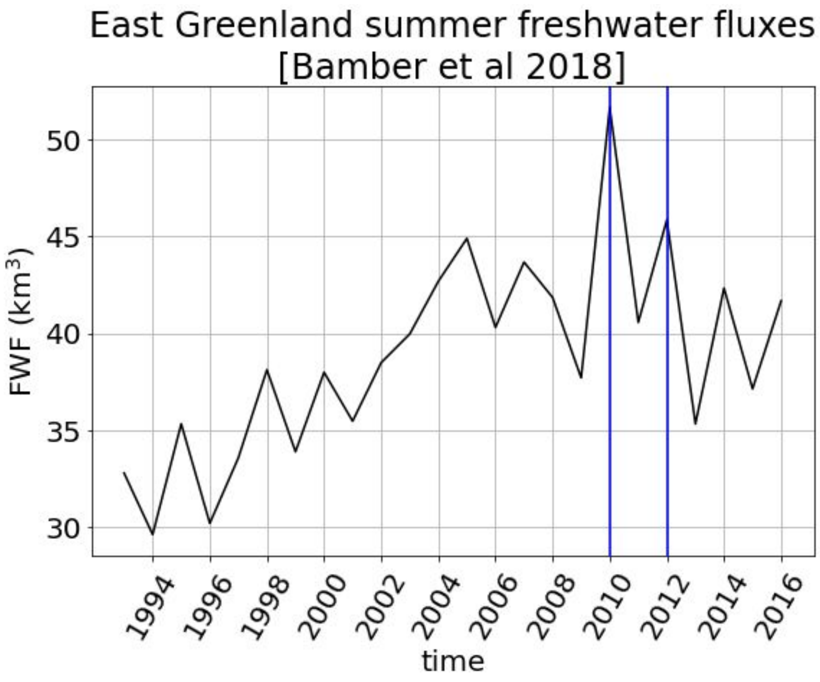

Figure 3. East Grnl FWFs[3]

Data and Methods

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East Grnl Coastal FWC

Data:

- VIKING20X (1/20°, ocean only model)[5]
- GLORYS12V1 (1/12°)[6]
- OSNAP East CTD data[7]

Methods:

- Time-varying mask (S < 34.8 psu, V < 0 m/s)
- Composite analysis from summer NAO index

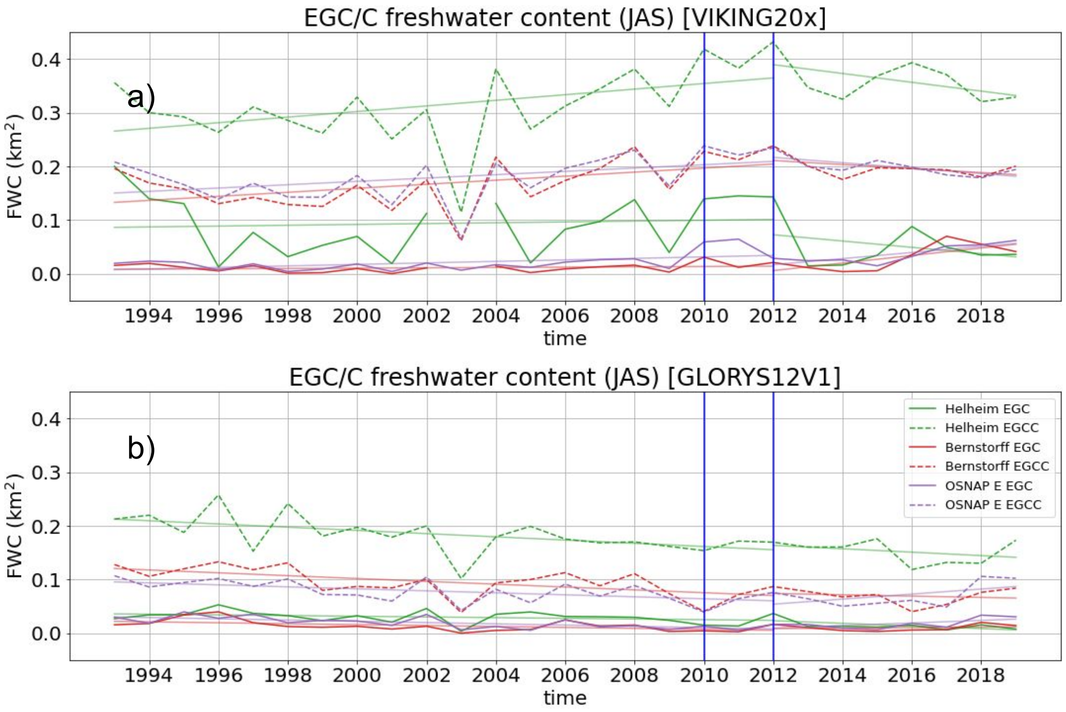

Figure 4. FWC cross sections along the EG shelf for VIKING20x and GLORYS12V1 (a,b)

OSNAP East Comparisons

Data:

- VIKING20X (1/20°, ocean only moc [5]
- GLORYS12V1 (1/12°)[6]
- OSNAP East CTD data[7]

Methods:

- Time-varying mask (S < 34.8 psu, V < 0 m/s)
- Composite analysis from summer NAO index

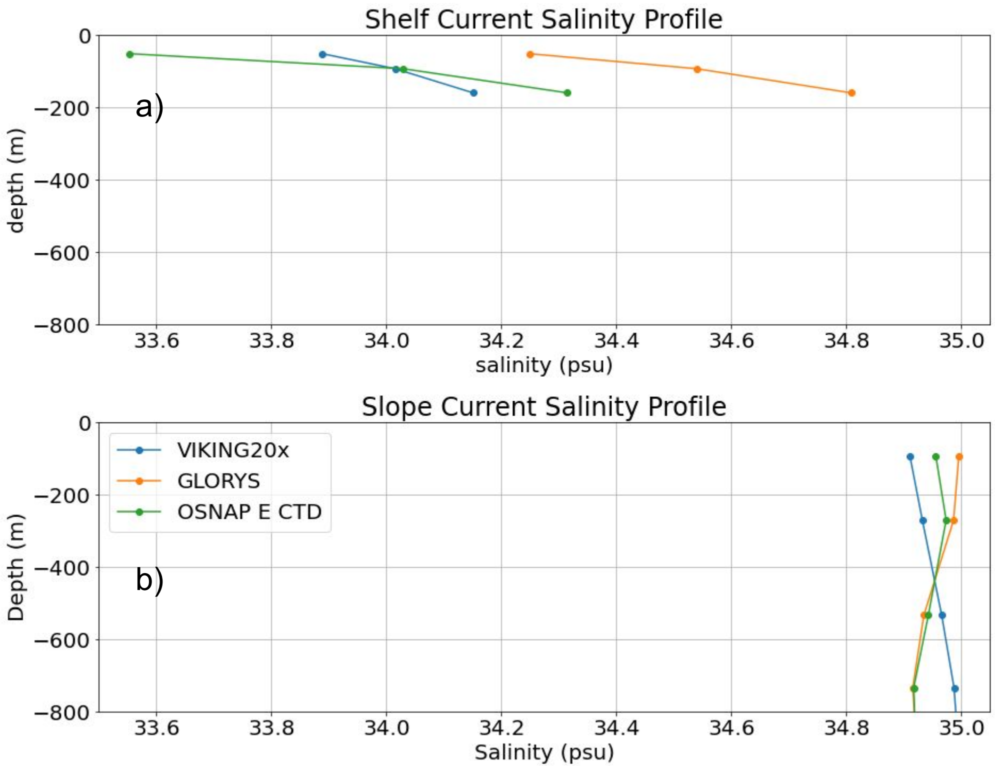

Figure 5. Salinity profiles of VIKING20x, GLORYS12V1, and OSNAP East along the shelf and slope current from summer 2014 - 2016 (a,b)

Results and main takeaways

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SNAO composite analysis

- January FWC and ONDJ Ekman transport anomalies
- Increased FWC during anomalously negative SNAO years

SNAO negative years induces enhanced Greenland melt

Intensified downwelling favorable winds along East Grnl during the succeeding fall/winter

Meltwater constrained to the East Grnl coastal current may be advected further offshore via upwelling along the West Grnl shelf

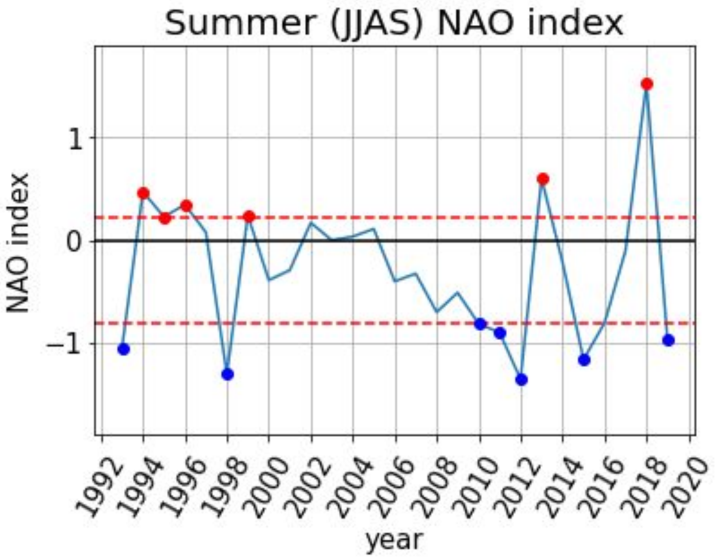

Fig. 6: Years of minimum and maximum summer NAO (JJAS) based on a 20th percentile.

Results and main takeaways

Enhanced FWC during negative SNAOs

- January FWC and ONDJ Ekman transport anomalies
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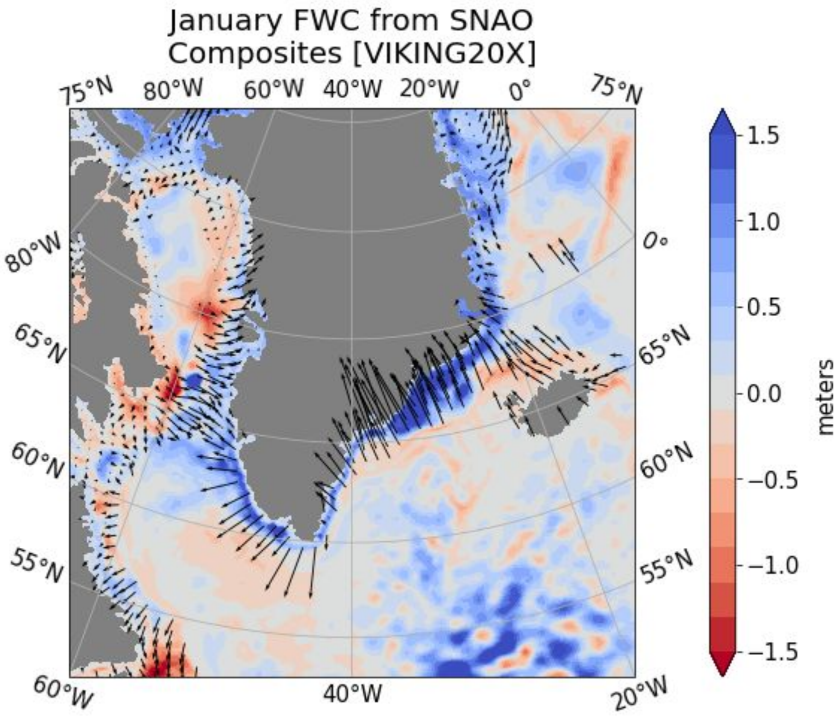

Fig. 7: Composite analysis from minimum minus maximum SNAO Years.

References

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