

High Arctic Polynyas in a changing climate

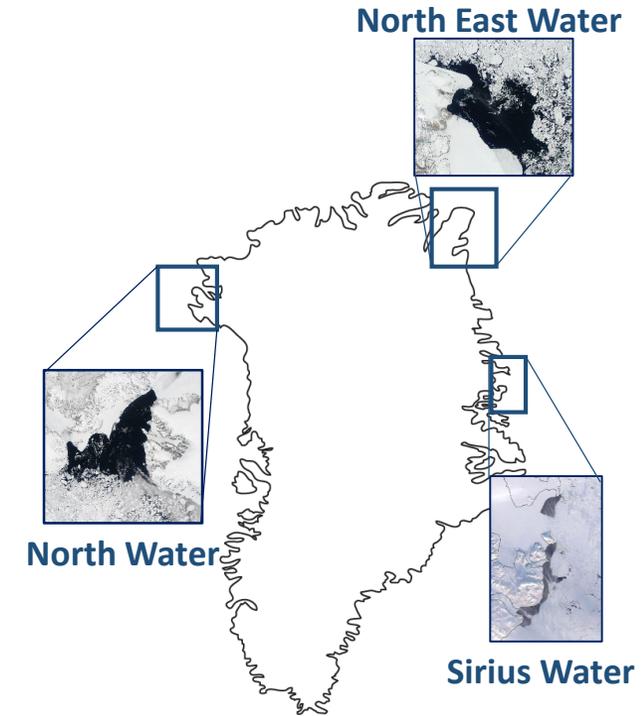
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High Arctic polynyas (areas of open water in otherwise sea-ice dominated environments) are **biological hotspots**, sites of **deepwater formation** and are of **cultural and historical significance** to indigenous communities. The North Water (NW Greenland) is the largest and most productive.

Yet, little is known of their past variability or future viability in a warming climate.

The Marie Curie Individual Fellowship (MSCA-IF) project 'POLARC' (2019-2021) will build on work in the North Water Polynya ([next slide](#)), applying a multi-proxy approach to marine sedimentary records to **reconstruct sea-ice, productivity and bottom water conditions in the Sirius and North Water polynyas and compare this with model simulations for key periods in the Holocene**, with a view to improve model forecasts and assess future viability of these phenomena.



Images from NASA Modis

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POLARC motivation: North Water Polynya (NOW) mediates Holocene ocean heat transport into northern Baffin Bay (Jackson et al., submitted)

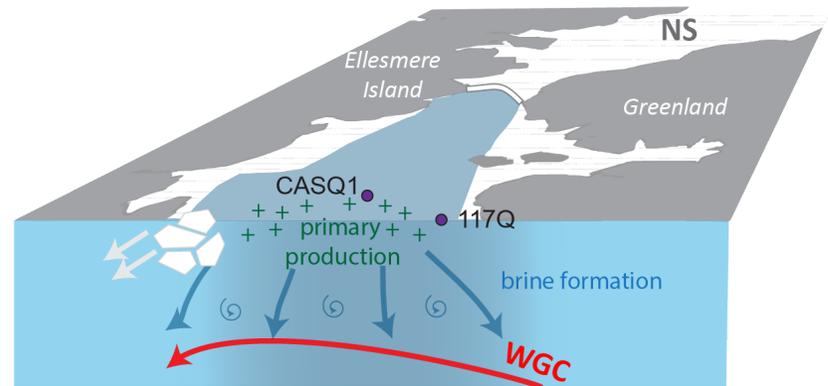
Polynya end members (reconstructed)

Time interval

Proxy evidence

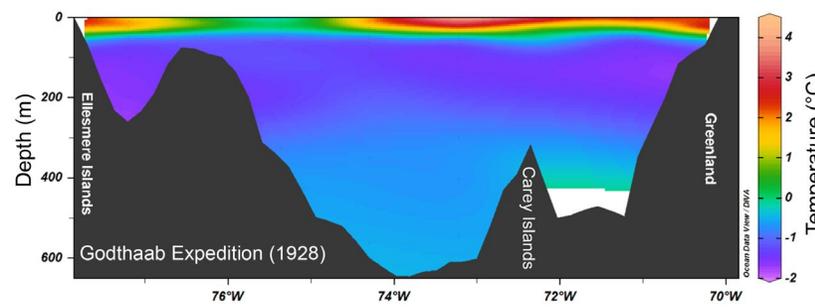
Observational-era polynya end members: CTD transects across the polynya region (76°N - 77°N)

Stable margin and recurrent polynya



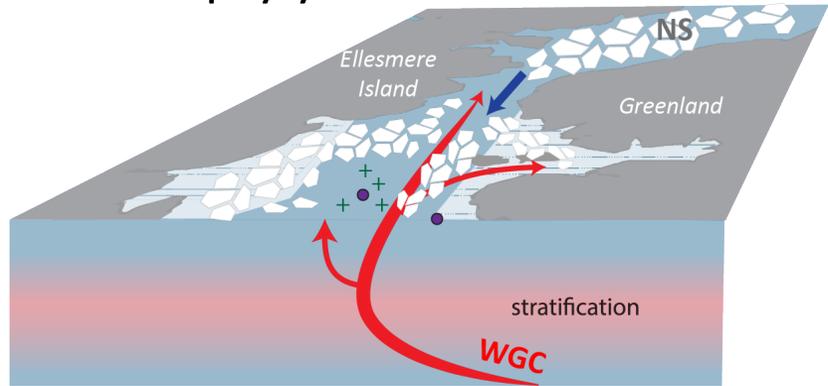
4500 – 2200 yrs BP (from the onset of neoglacial cooling)

High Primary Production
 ++ BSi fluxes ++ TOC
 Open water conditions
 -- HBI
 Extensive brine production
 ++ agglutinated benthic foraminifera species
 Limited Atlantic Water influence
 -- benthic foraminifera species associated with WGC



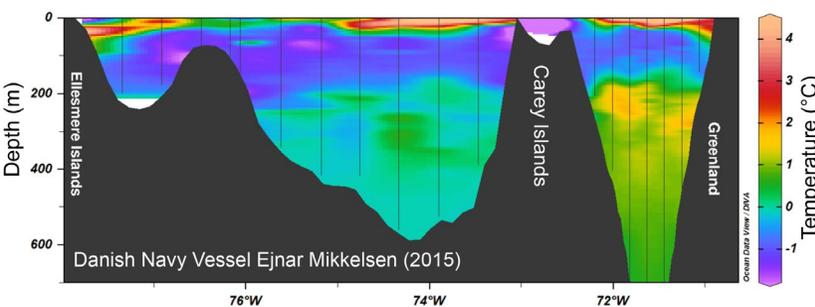
1928 (www.ices.dk)

Contracted polynya



2200 yrs BP onwards (especially during Rowan Warm Period)

Low Primary Production
 - BSi fluxes - TOC
 Marginal sea-ice zone
 ++ HBI
 Stratified water column
 ++ agglutinated benthic foraminifera species
 Strong Atlantic Water influence
 ++ benthic foraminifera species associated with WGC



2015 (Steffen M. Olsen (@DMI))

POLARC next steps and questions for the community

Paleo-Perspective



Future and fate of high Arctic polynyas



Are **other high Arctic polynyas** responding in the same way as the North Water to Holocene climatic change?



Sirius Polynya (NE Greenland) study underway



To what extent does brine formation and mixing in the North Water polynya **contribute to the Baffin Bay Deep Water mass**?



What can we use as a reliable **proxy for tracing paleo-redox/ventilation states** in areas where carbonate dissolution is prevalent?



Besides assemblages, can we utilise **agglutinated foraminifera** for other analyses?



Less Arctic multi-year sea ice may hinder ice arch stability and recurrent North Water Polynya formation -> less brine production/deepwater formation -> more Atlantic water influence in northern Baffin Bay....



...could the polynya be a buffer against potential **'Atlantification'** of northern Baffin Bay in the future?



For reconstruction/model simulation comparison we need to capture polynya configuration on a wider spatial scale for key climatic periods to project forward