Ecosystem perspectives on freshwater fluxes in Arctic fjords—results from the FACE-IT project

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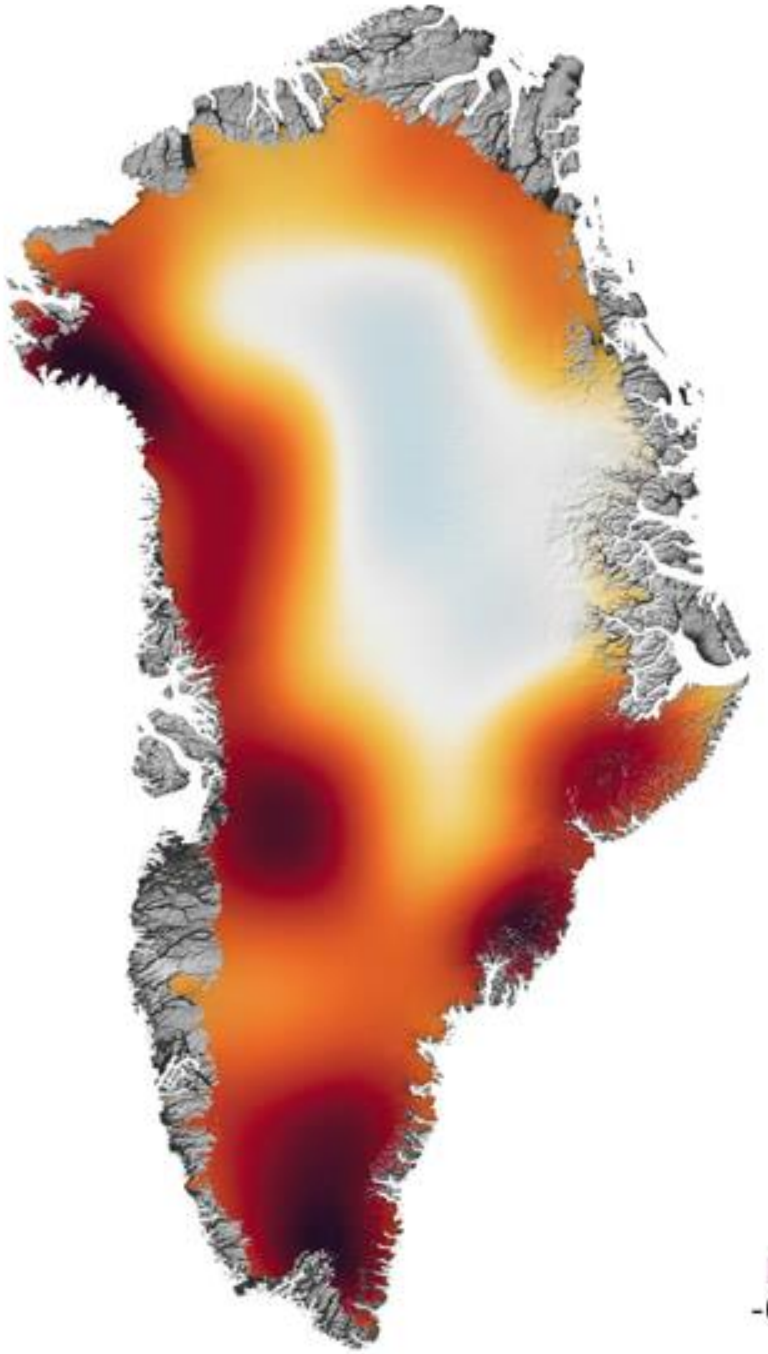
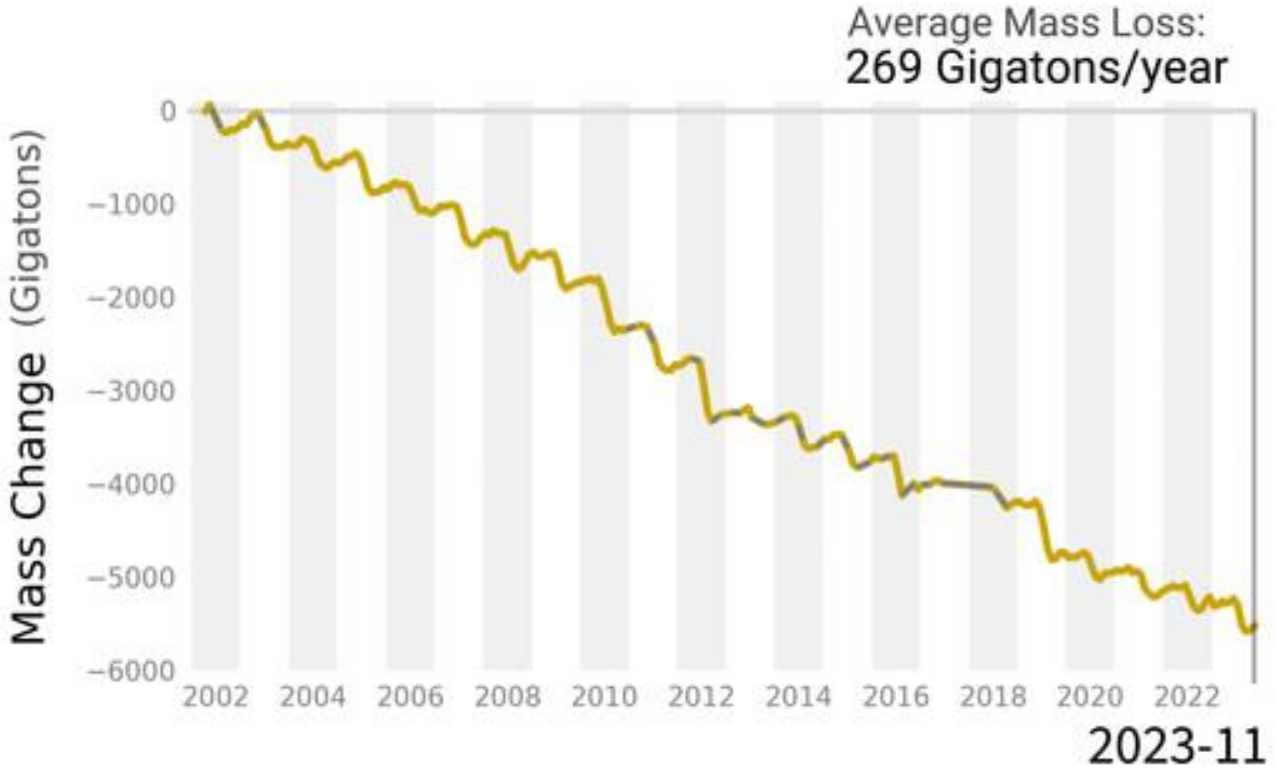
Aarhus University, Denmark

Polar Science Week
September 2024

2023-11

GRACE AND GRACE-FO
Observations OF Greenland Land Ice Mass Changes





~5000 Gigatons lost in the last 20 yrs

~0.8 mm sea level rise per year

Courtesy of NASA: https://svs.gsfc.nasa.gov/31156

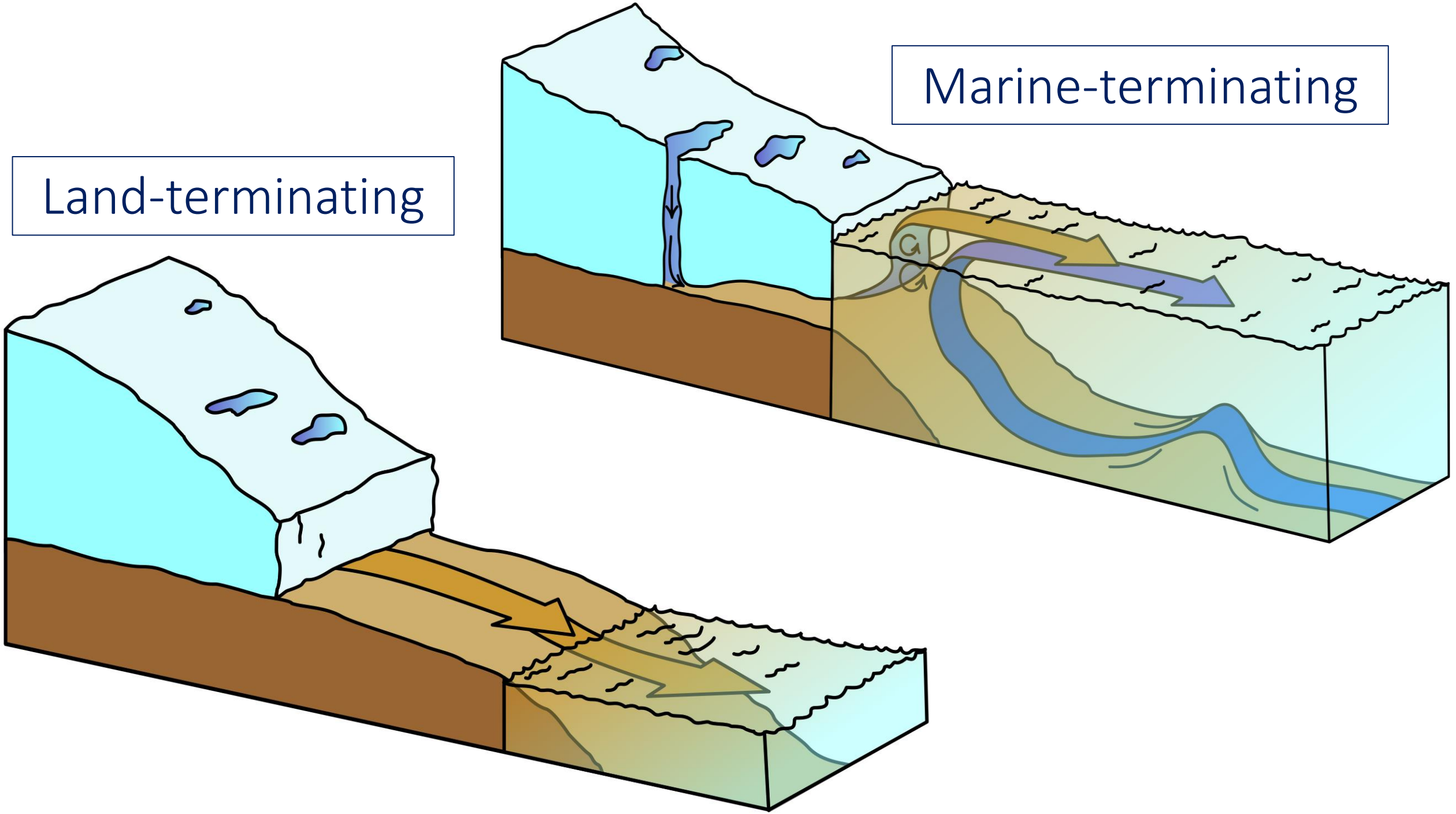
now you see it

Photo: Anders Bjørk, 1935


now you don’t
Photo: Anders Bjørk, 2013

Marine-terminating

Land-terminating



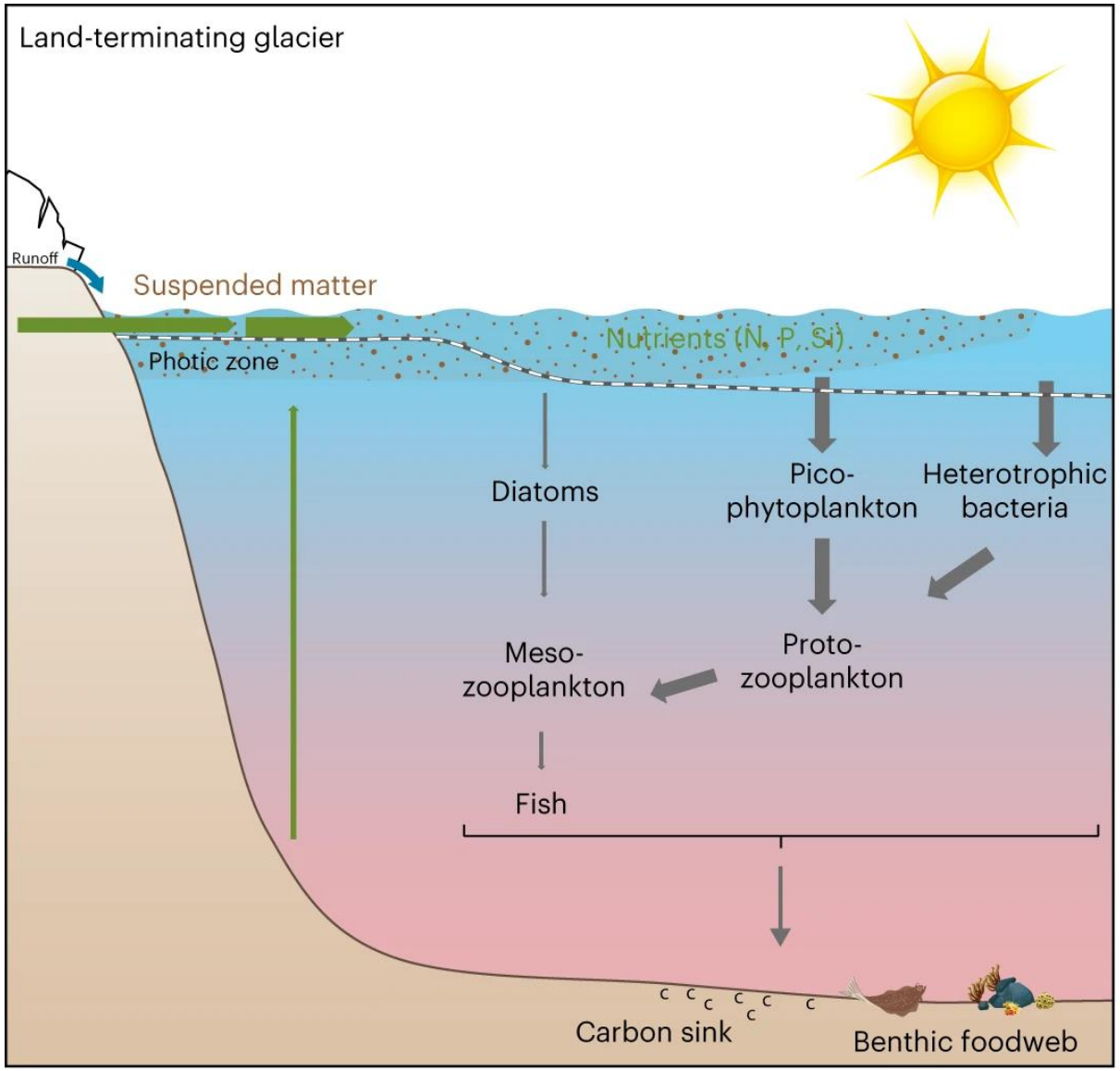
sub-glacial discharge

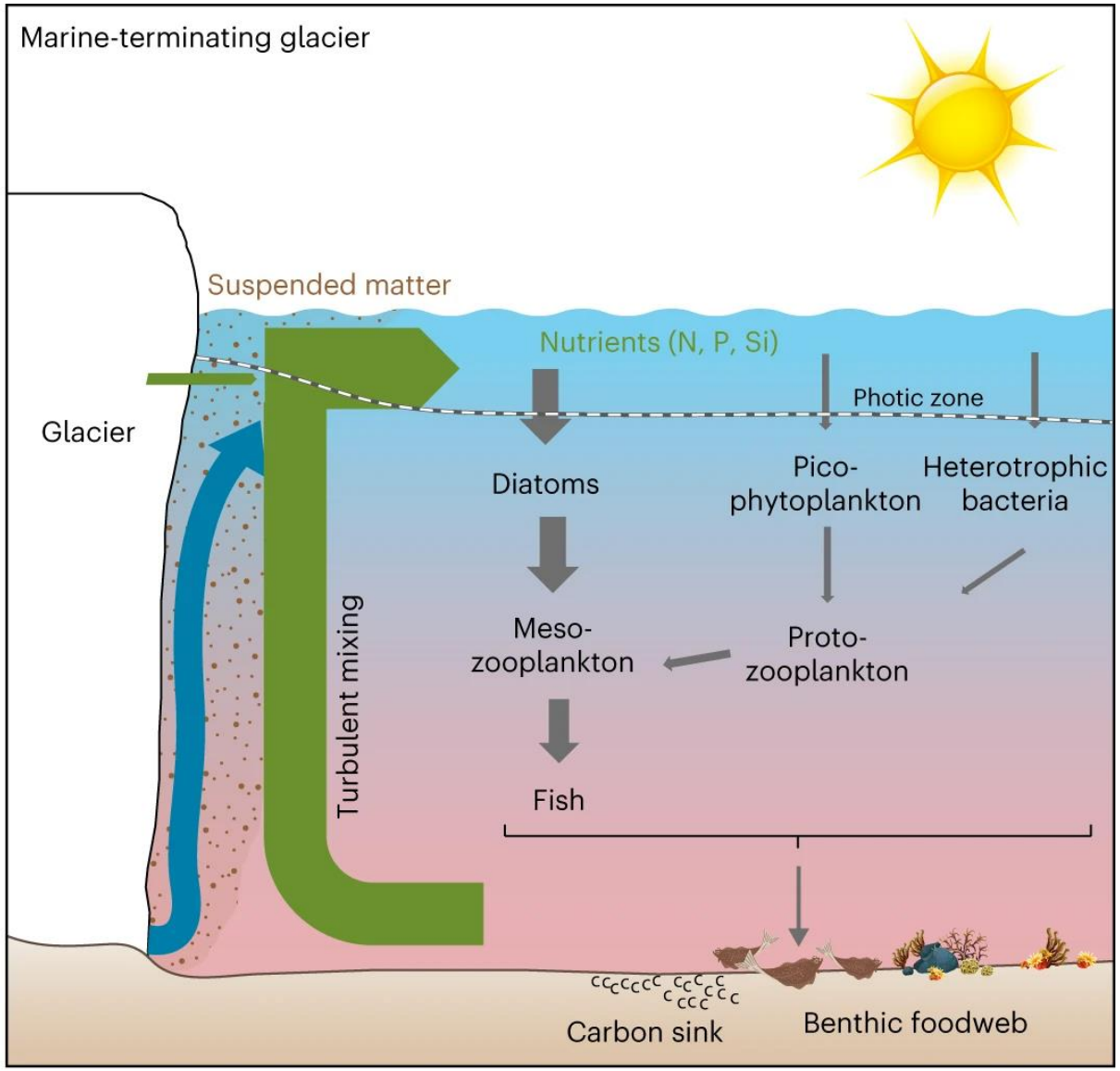
Video credit: ??


Photo: Mikael Sejr

Land-terminating

Marine-terminating

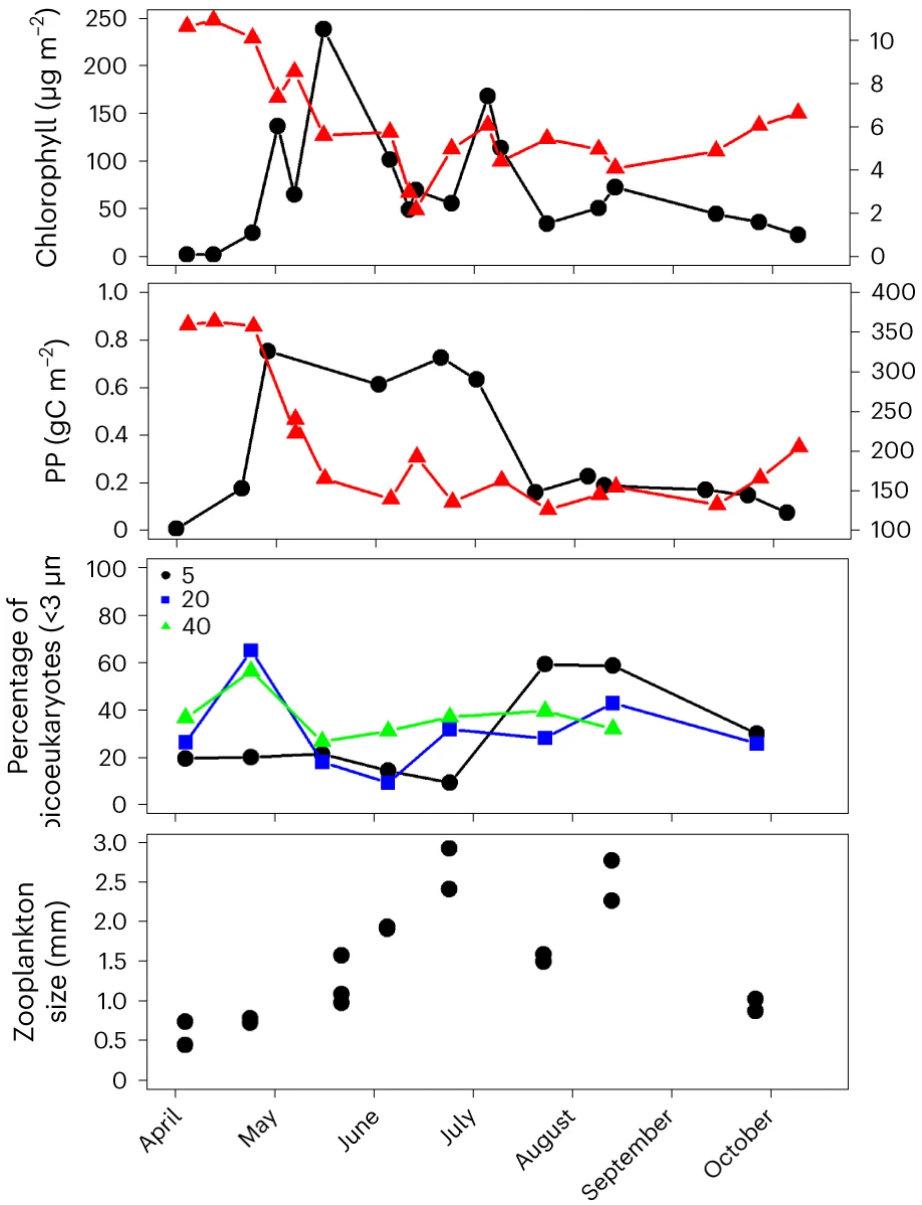


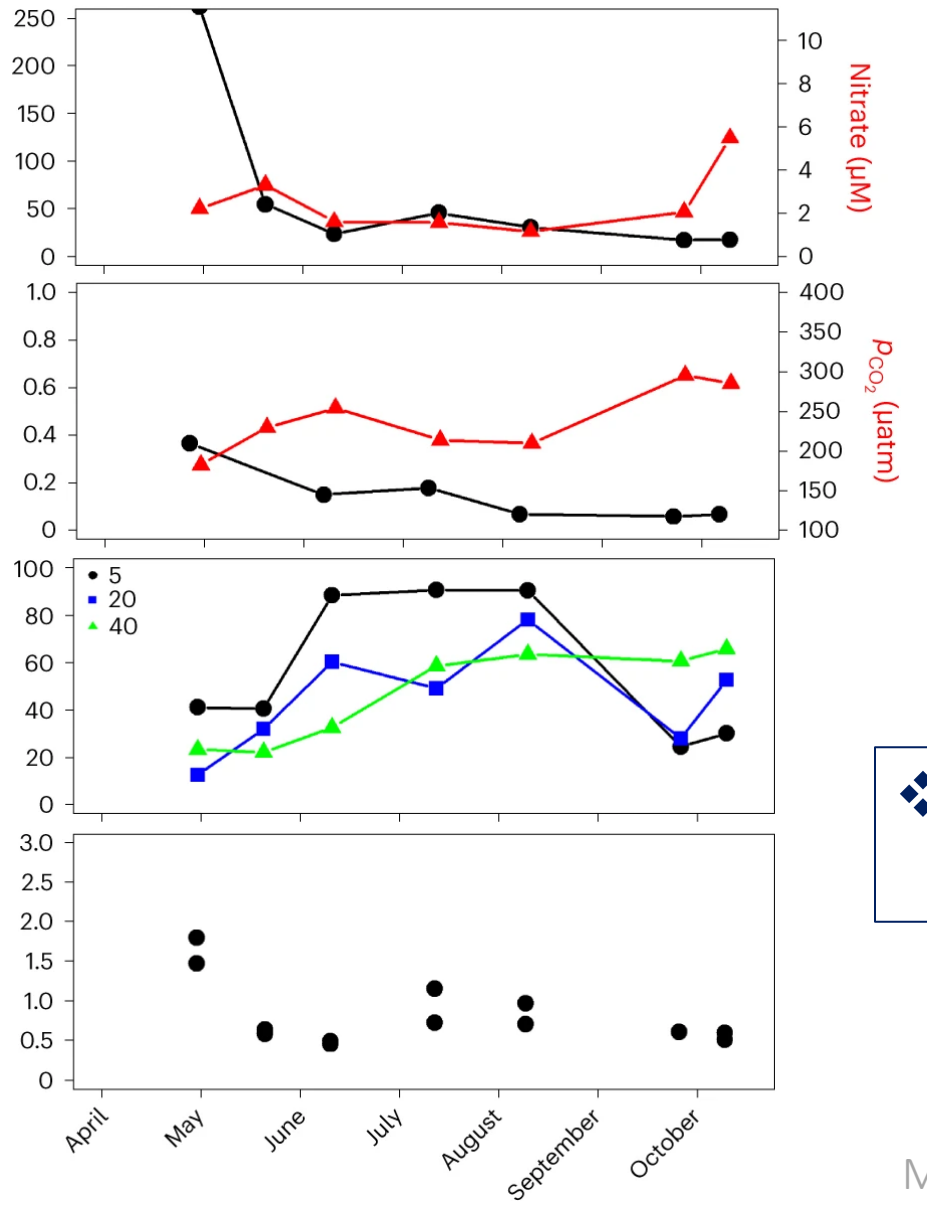


Meire *et al.* (2023), *Nature Geosci.*

Marine-terminating

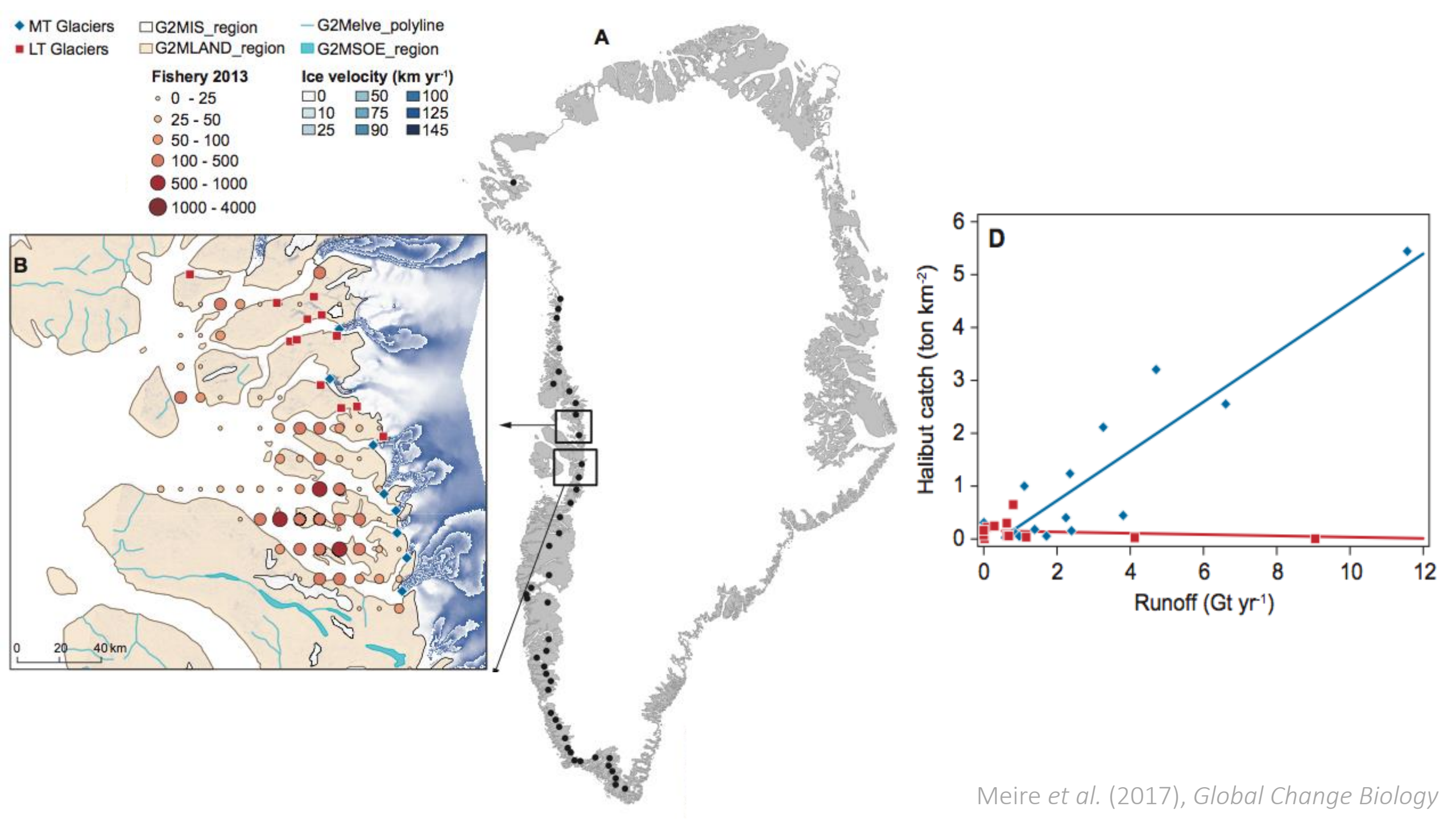
Land-terminating





- Higher Chl and PP in MTG
- Higher pCO_2 in LTG
- Smaller phyto- and zooplankton in LTG

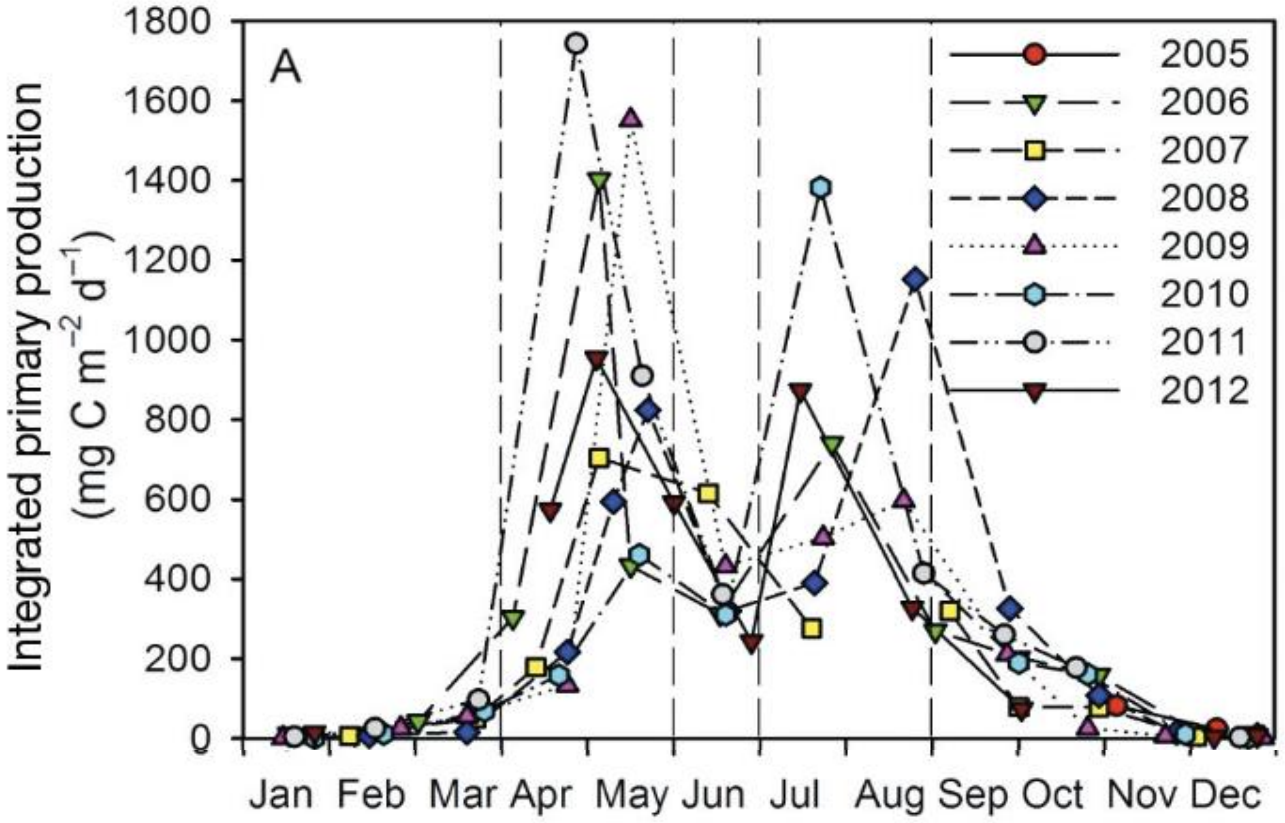
Meire *et al.* (2023), *Nature Geosci.*



Meire *et al.* (2017), *Global Change Biology*

Marine-terminating

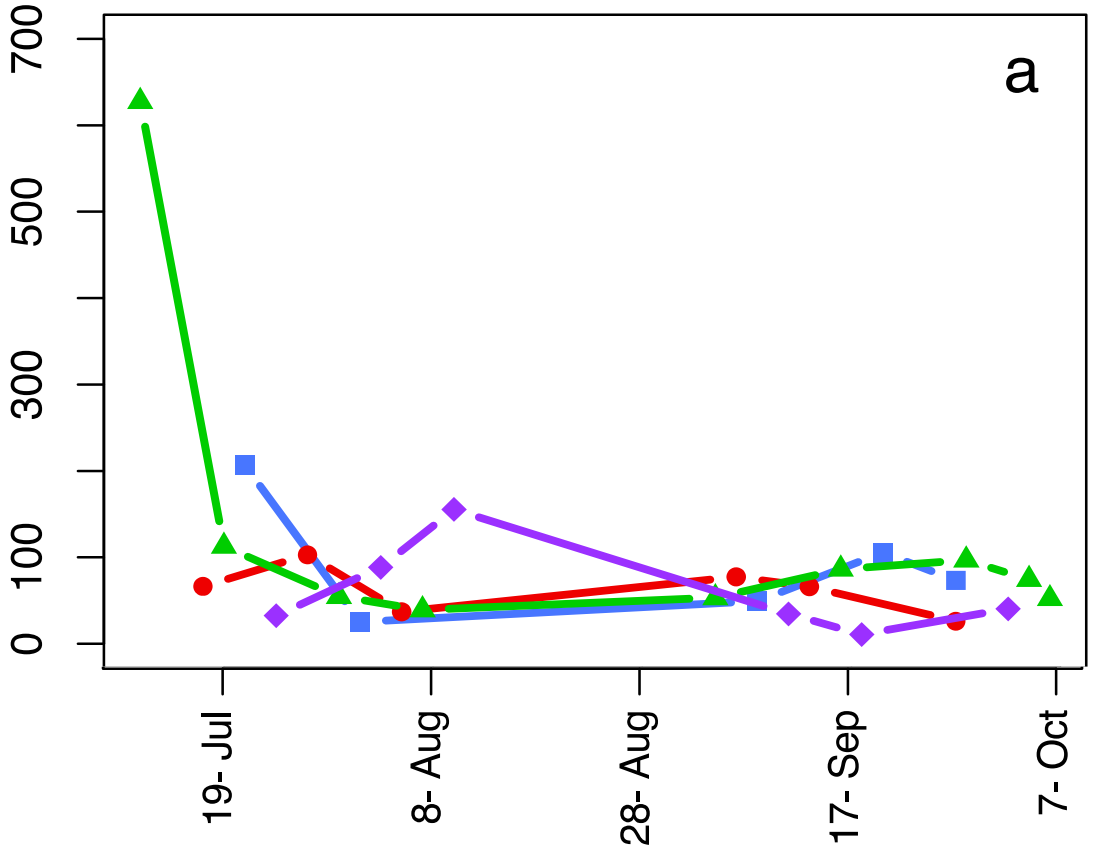
West Greenland



Juul-Pedersen *et al.* (2015) *Mar. Ecol. Prog. Ser.*

Land-terminating

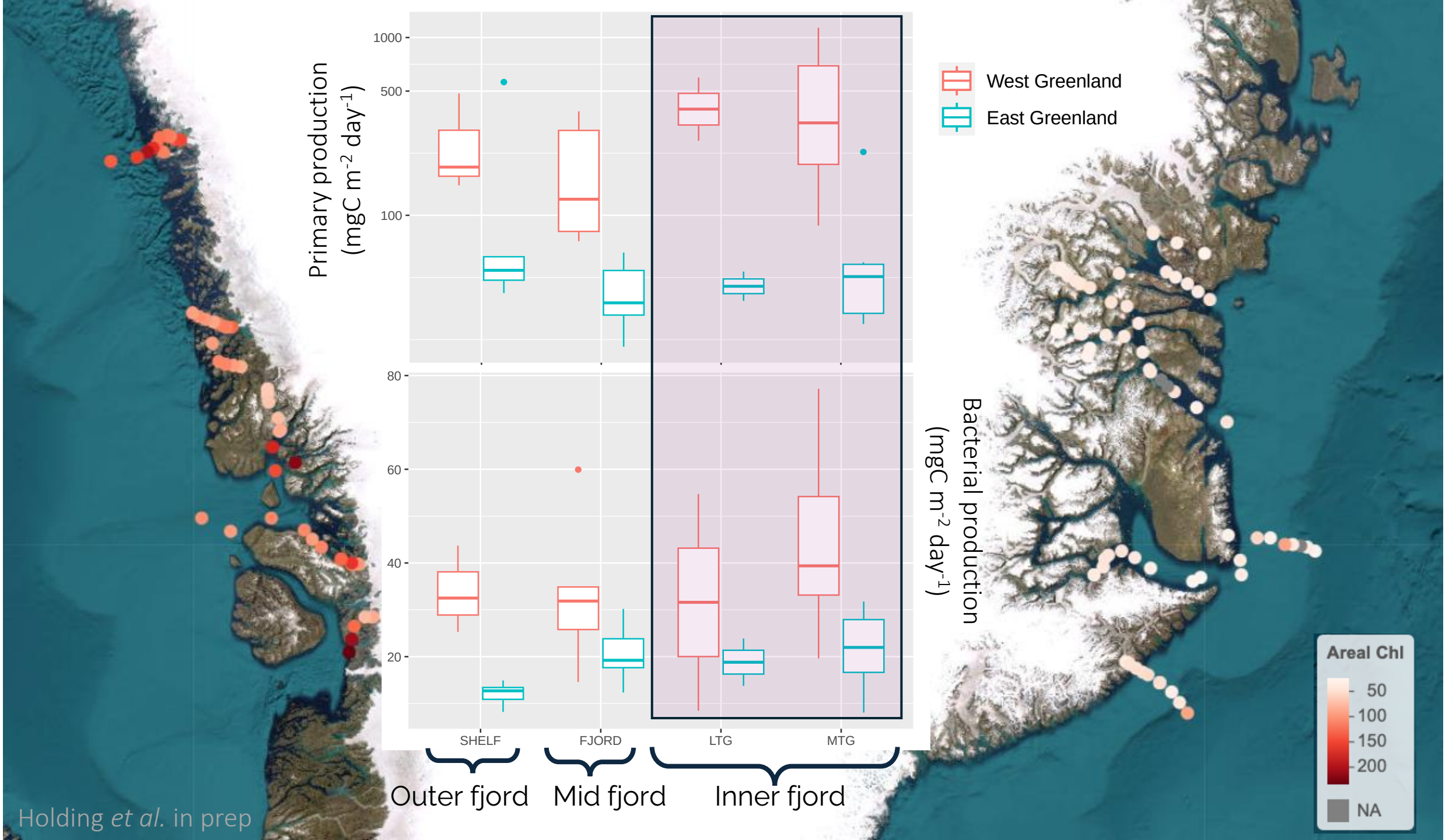
East Greenland



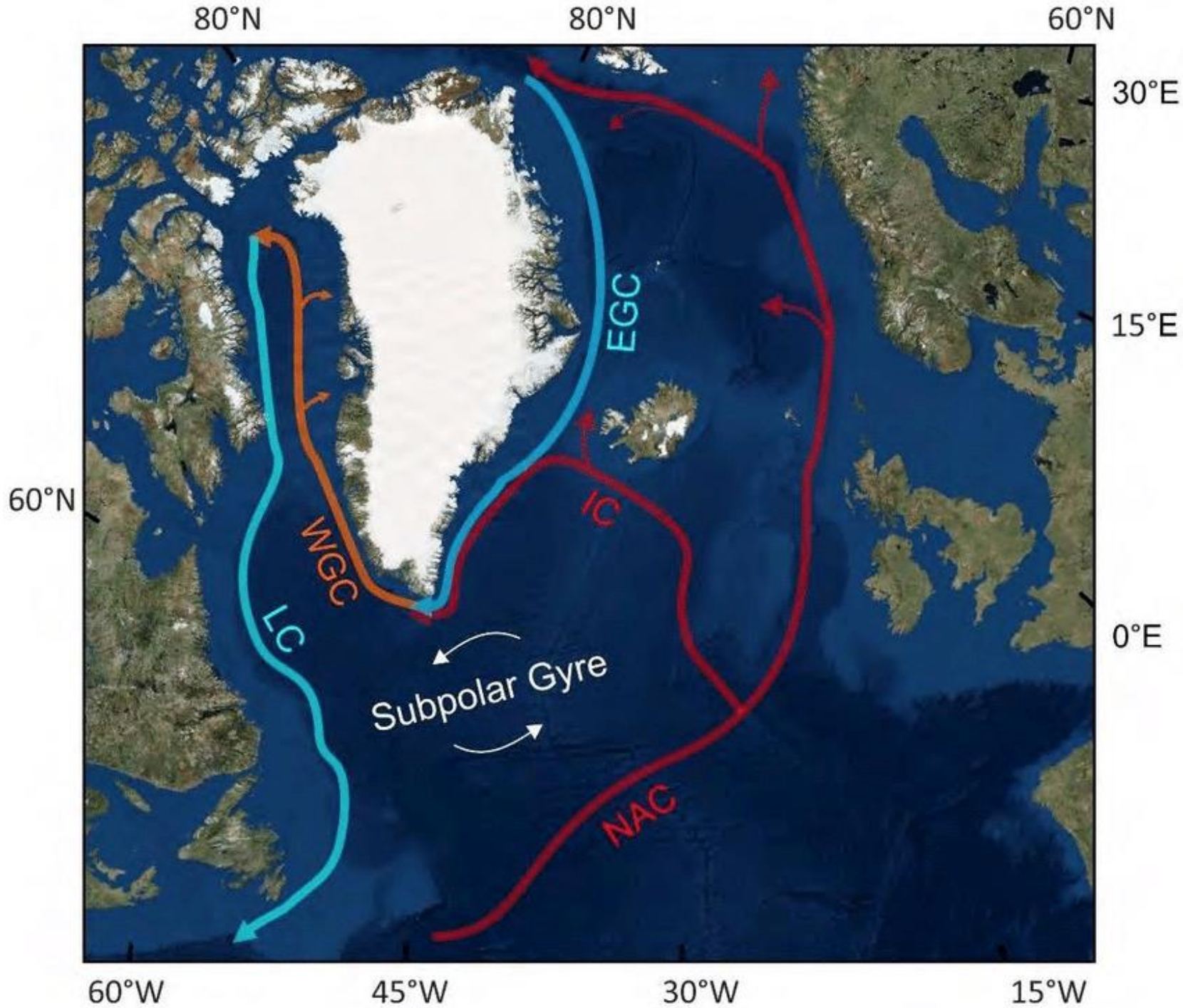
Holding *et al.* (2019) *Biogeosciences*

Are we comparing apples to oranges?

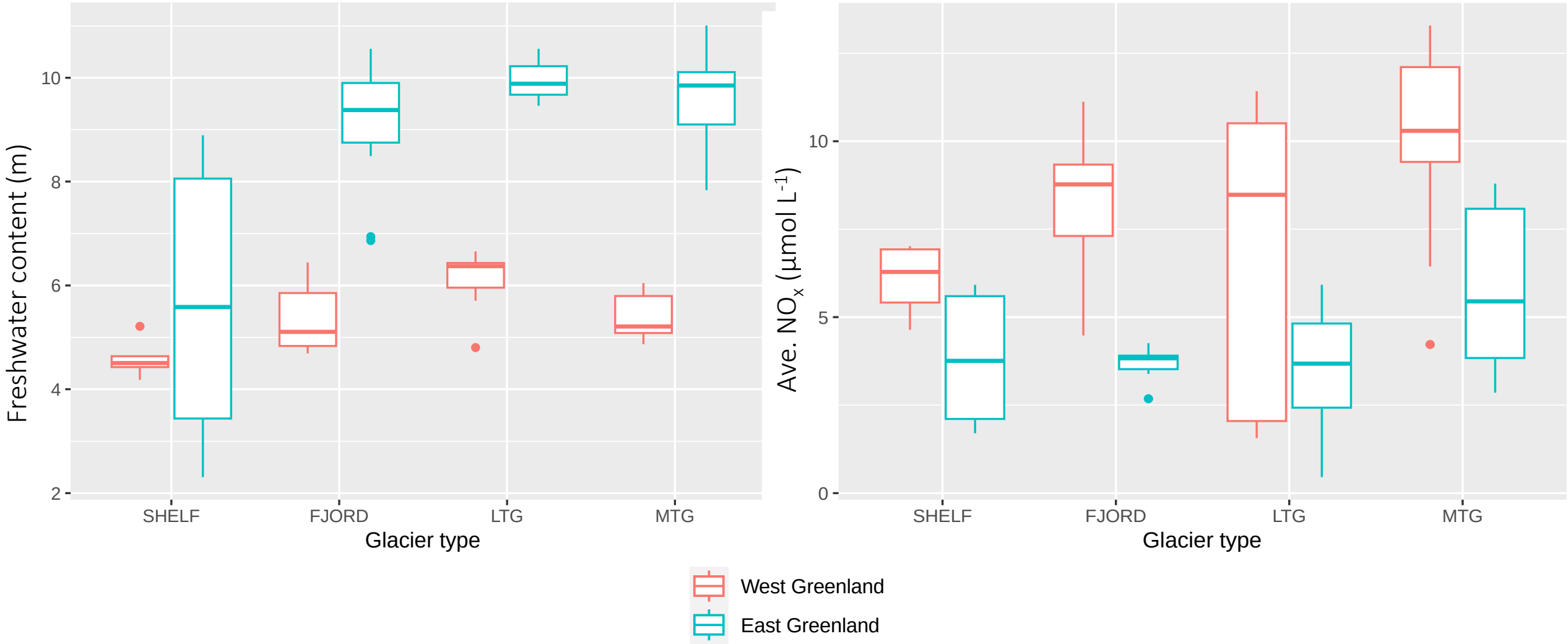
Holding *et al.* in prep



Holding *et al.* in prep

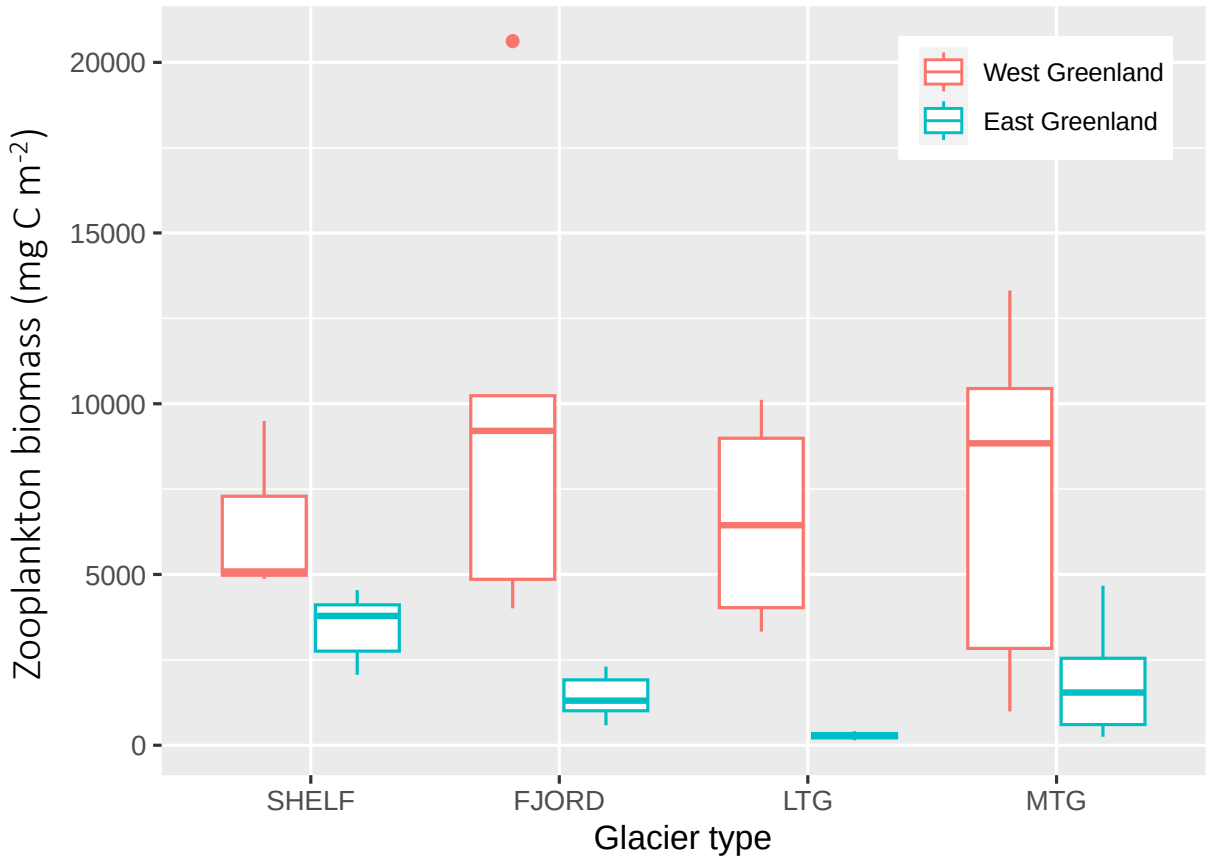

80°N
80°N
60°N
30°E
15°E
0°E
60°N
EGC
WGC
IC
LC
Subpolar Gyre
NAC
60°W
45°W
30°W
15°W

East Greenland: Fresher and more oligotrophic



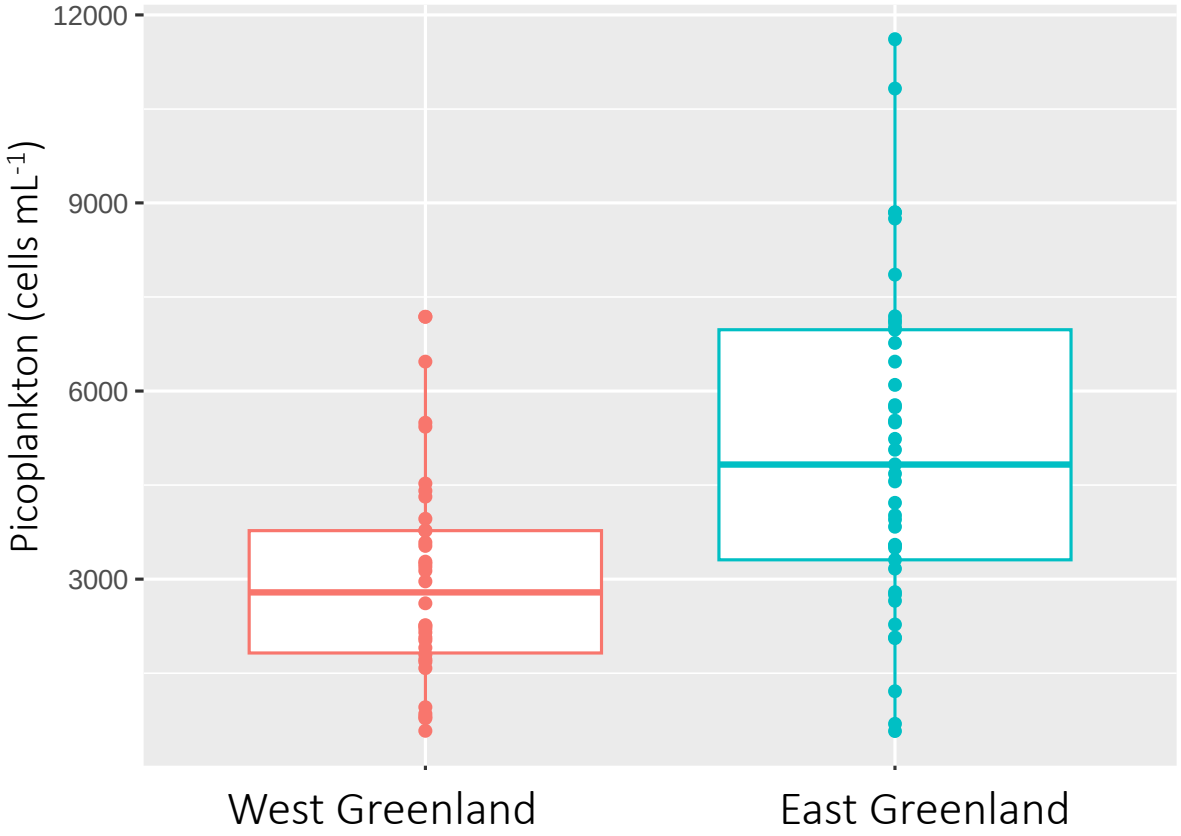
Holding *et al.* in prep

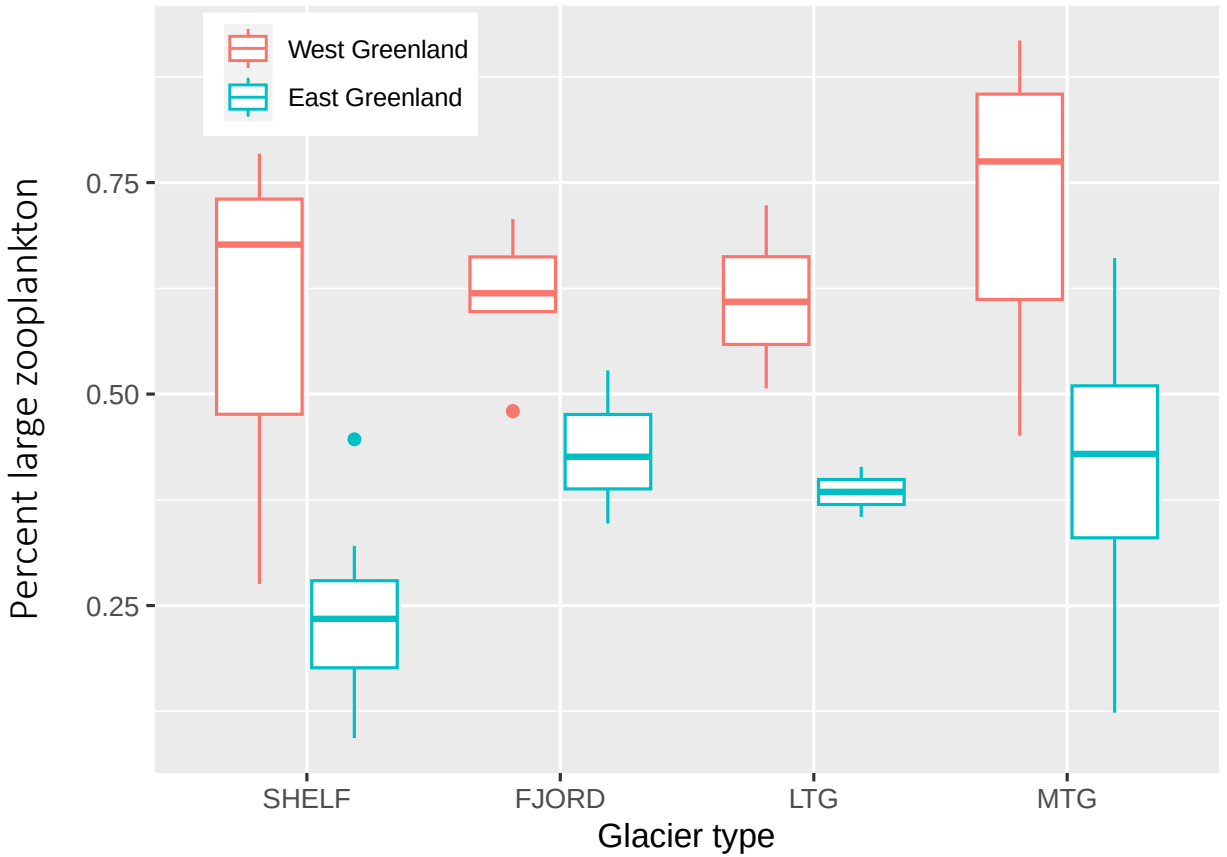
Foodweb and zooplankton biomass



Holding *et al.* in prep

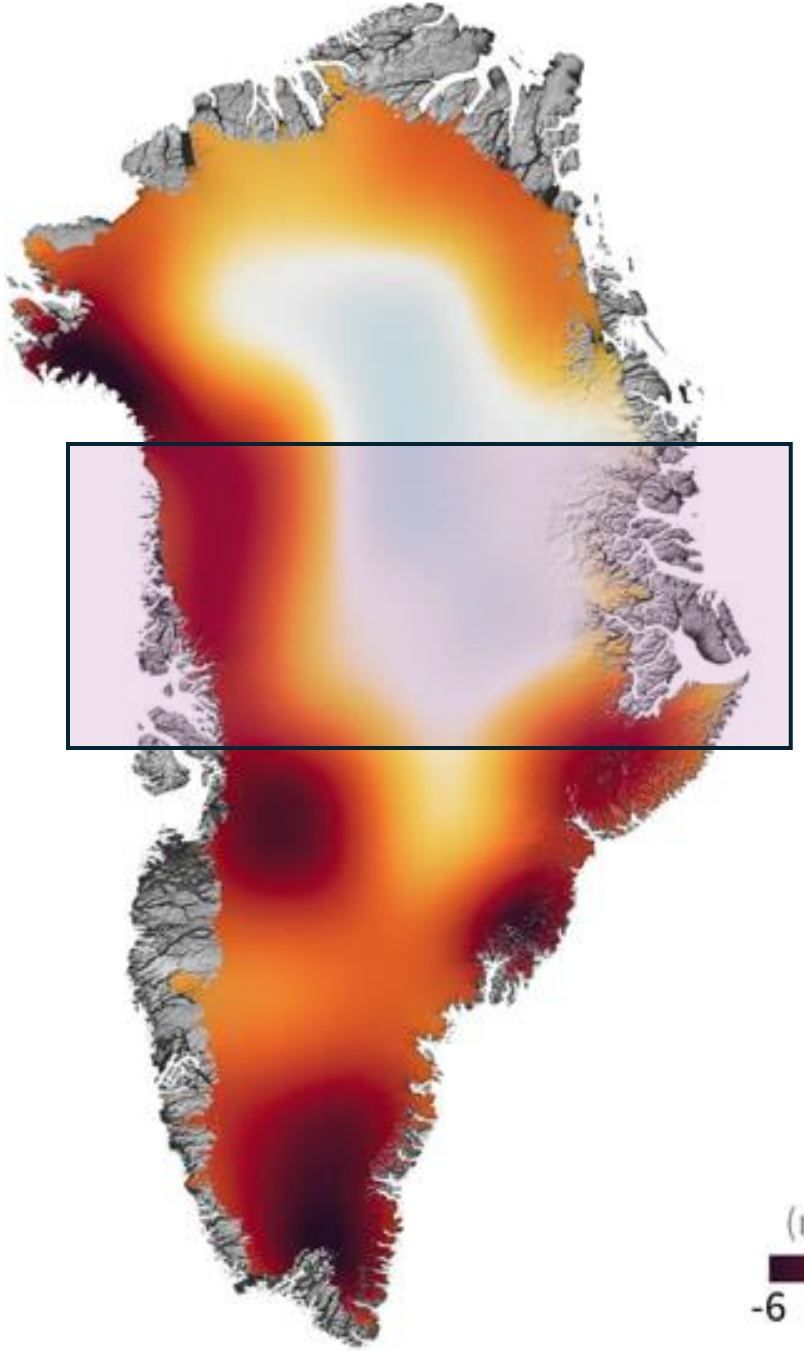
Foodweb and zooplankton biomass





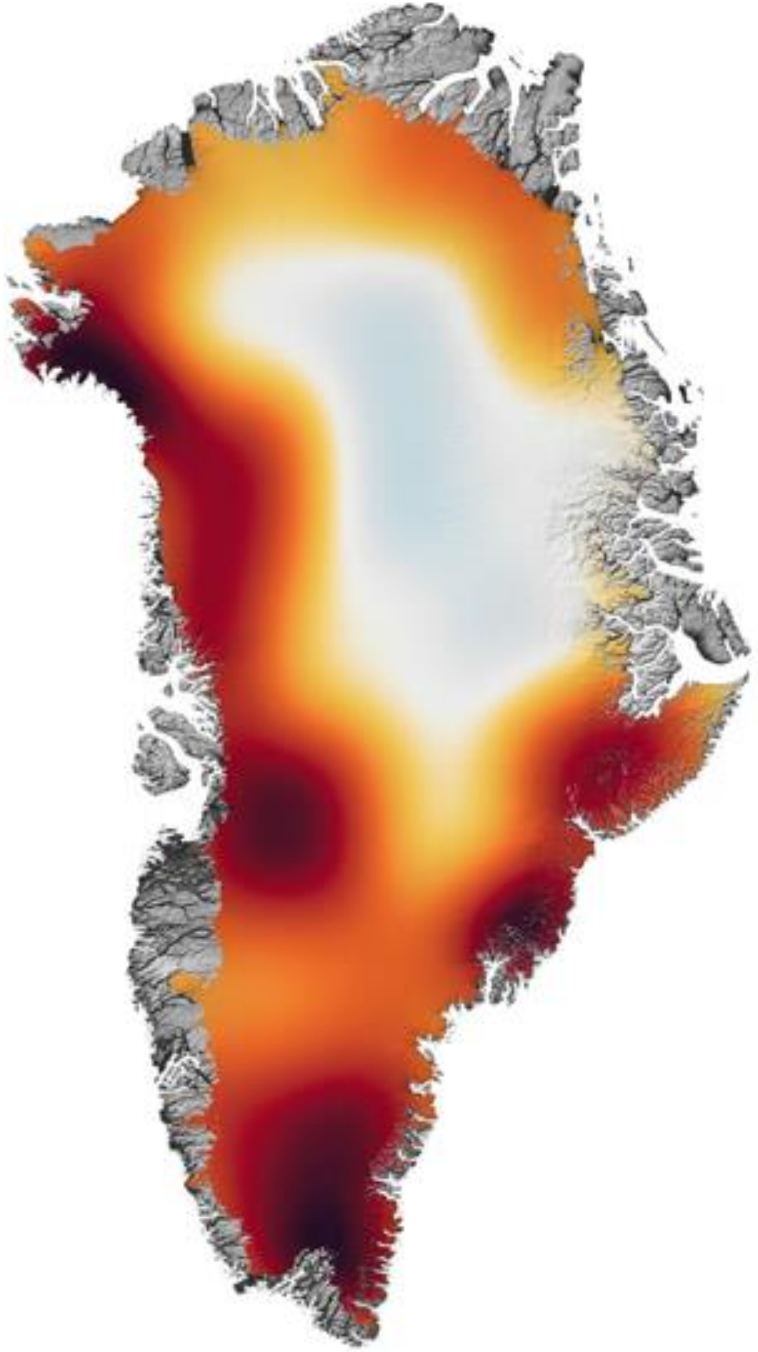
Holding *et al.* in prep

Discharge?

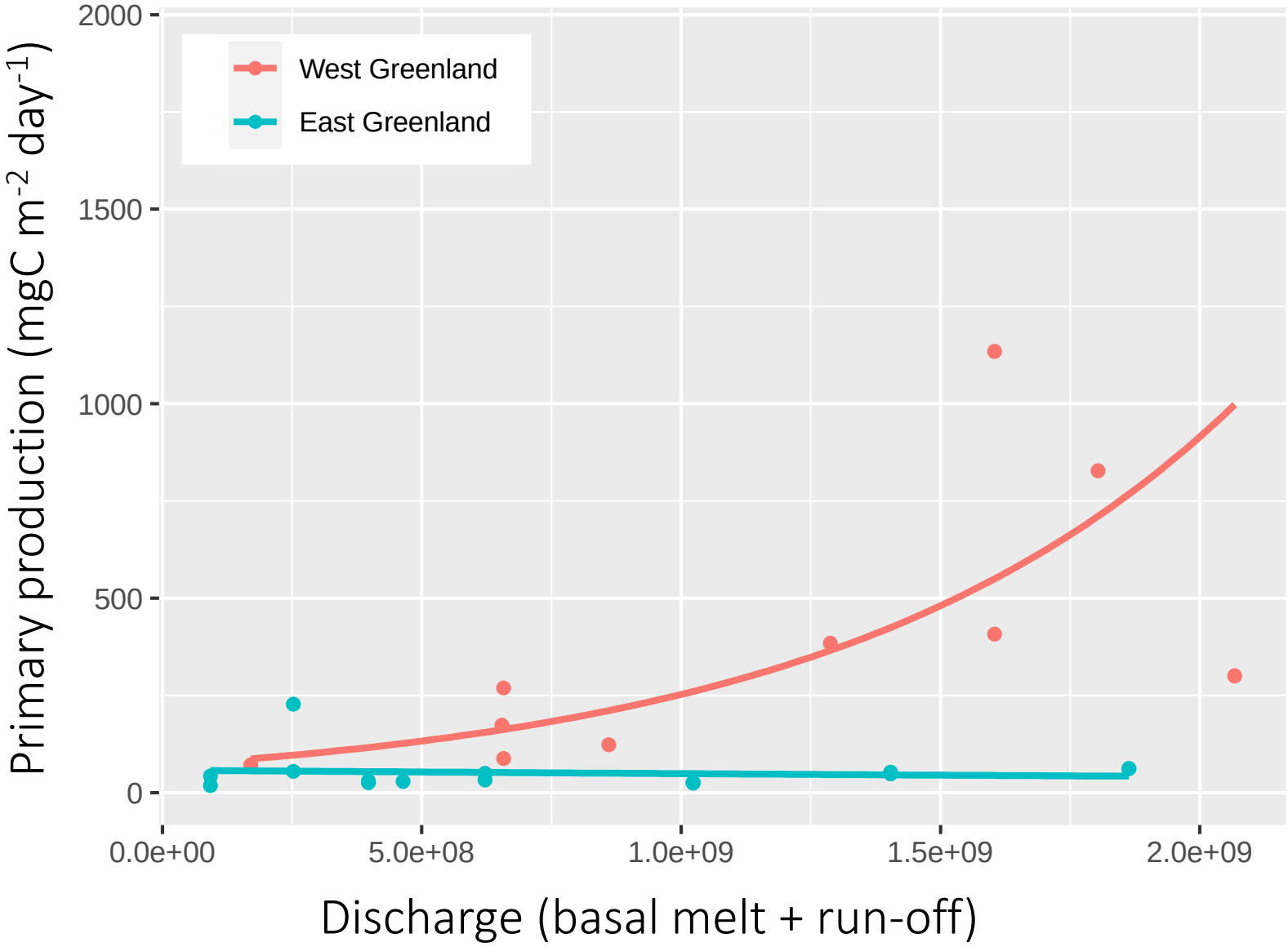


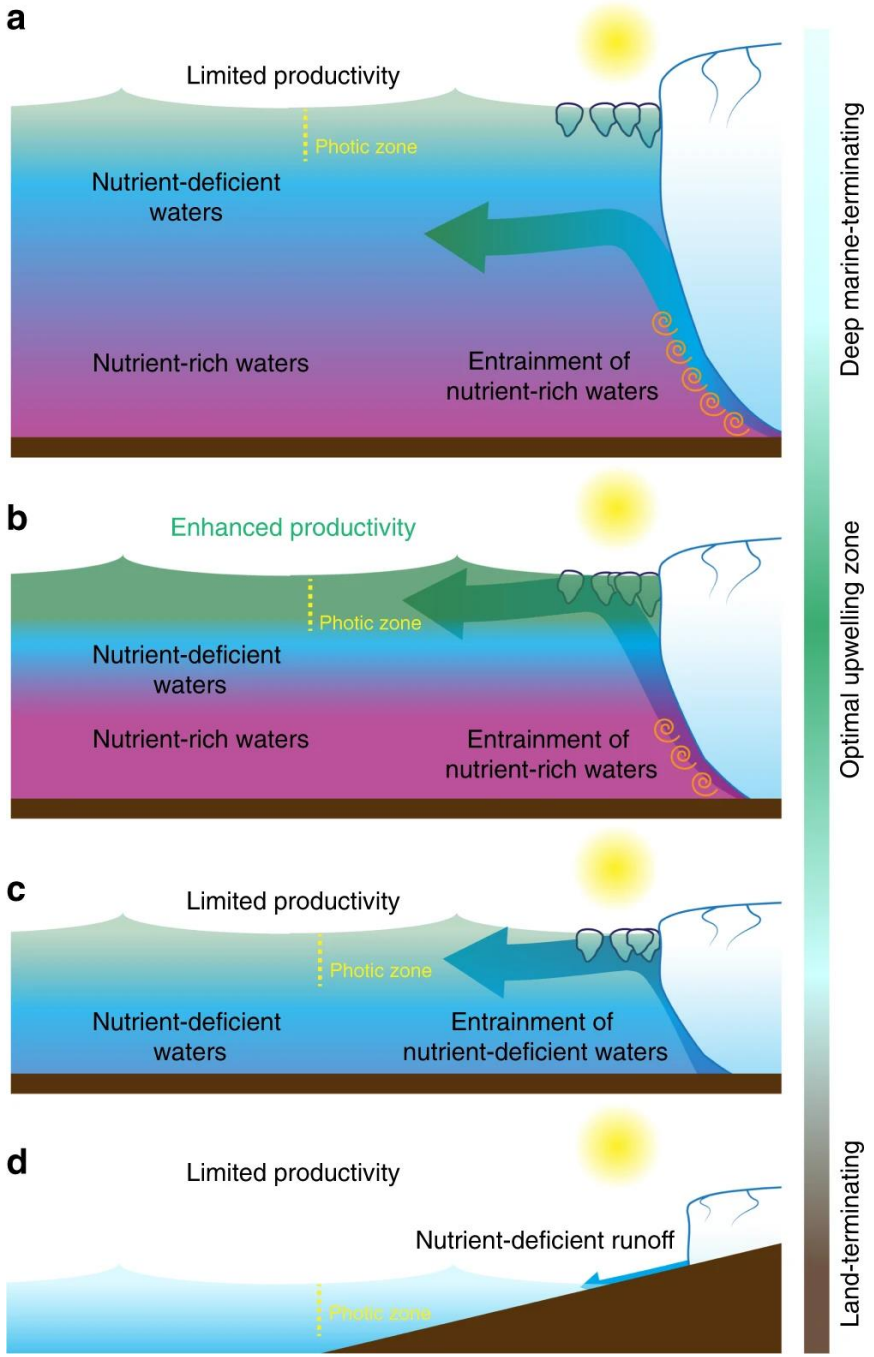
Courtesy of NASA: https://svs.gsfc.nasa.gov/31156

Discharge?



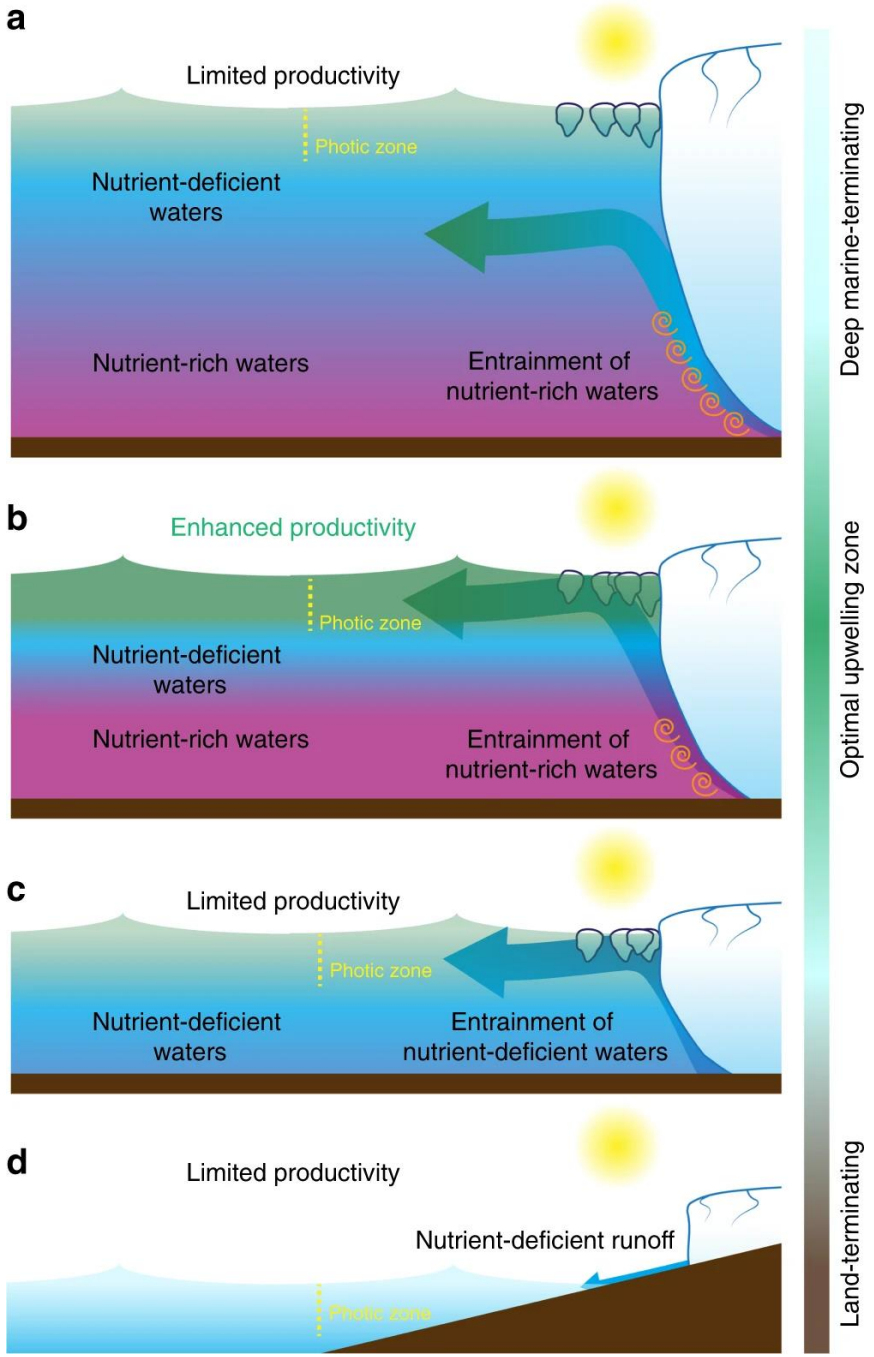
Courtesy of NASA: https://svs.gsfc.nasa.gov/31156





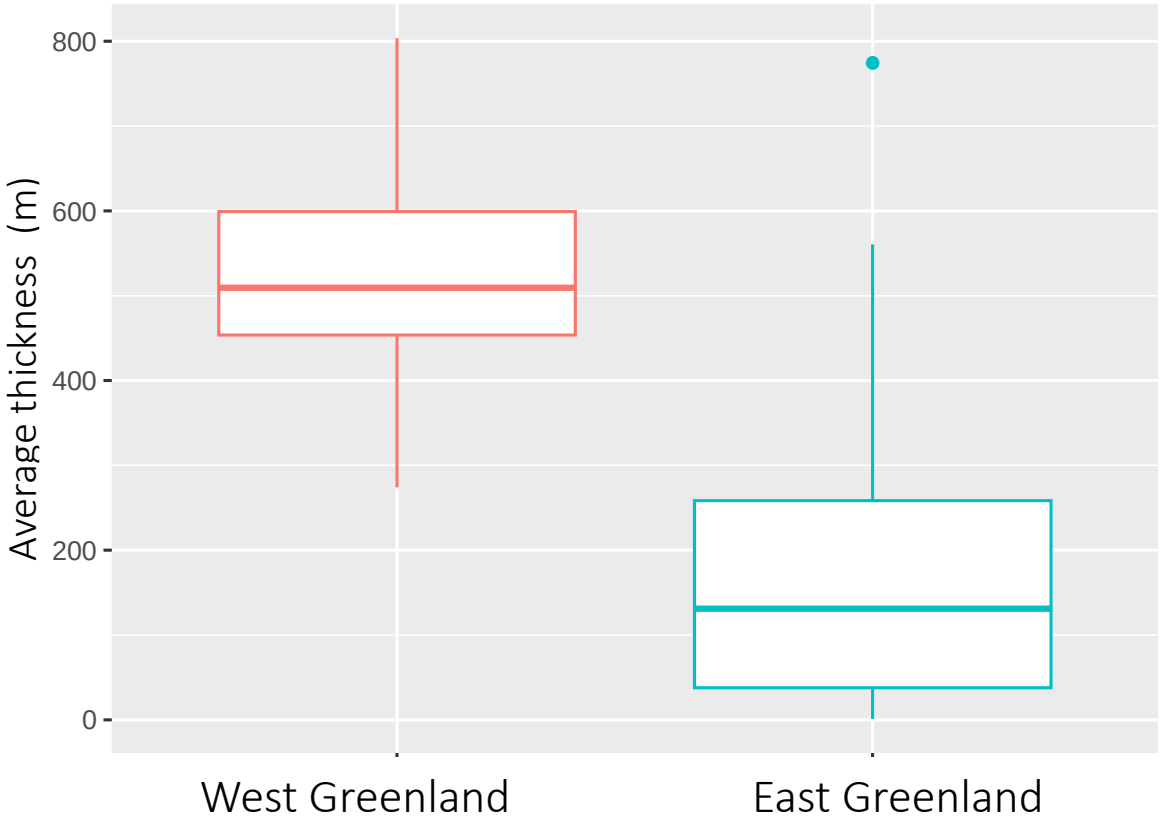
Glacier thickness/ grounding lines?

Hopwood *et al.* (2018) *Nature communications*

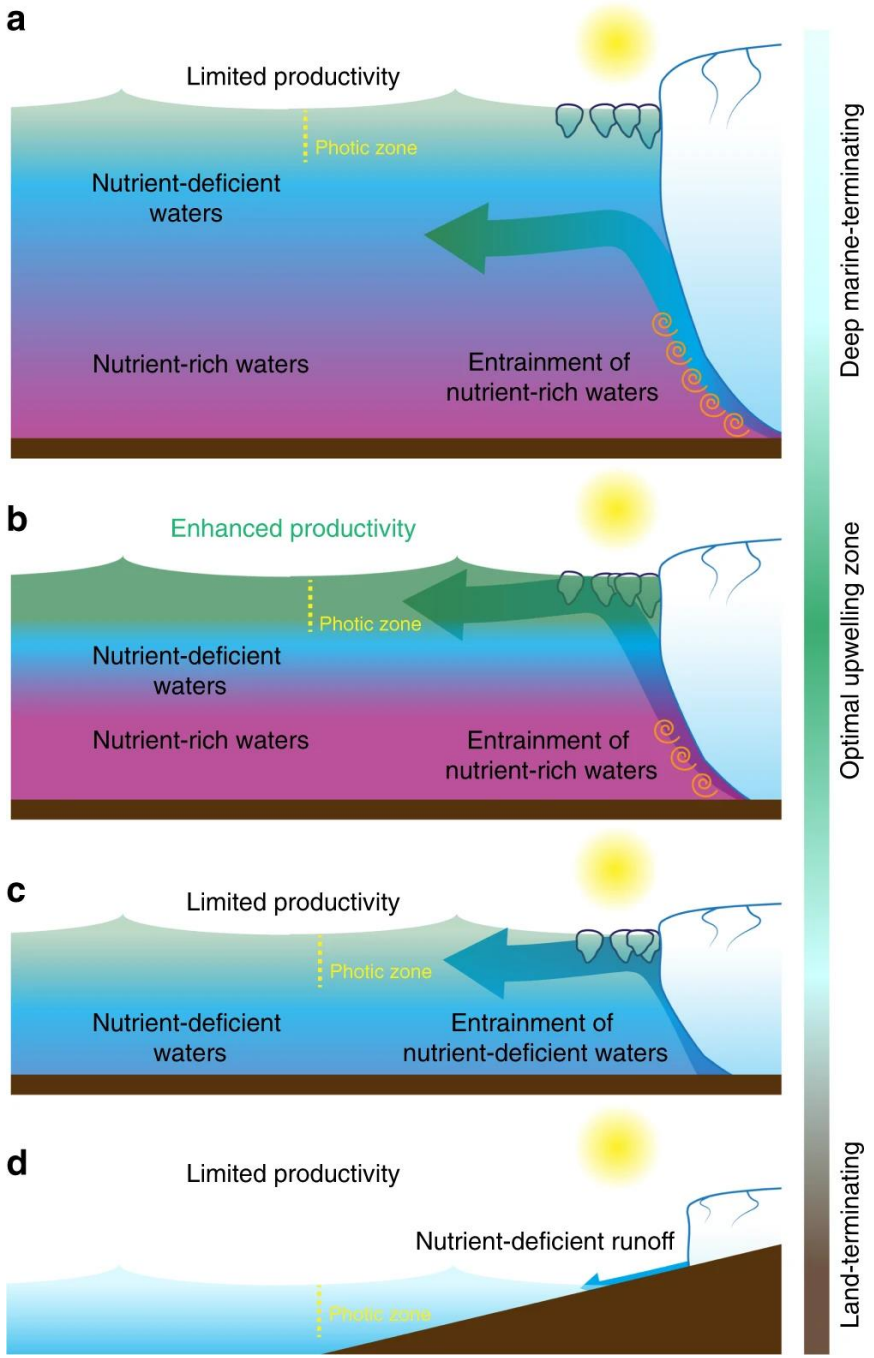


Hopwood *et al.* (2018) *Nature communications*

Glacier thickness/ grounding lines?

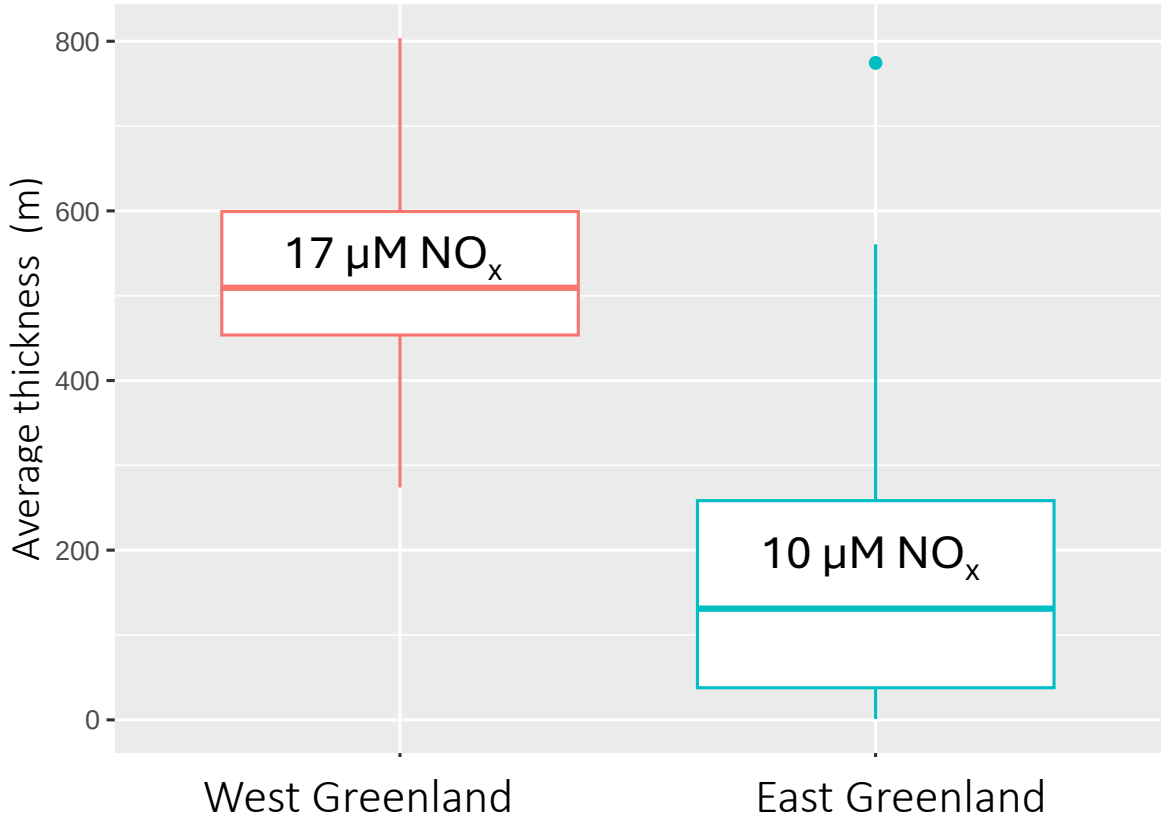


Holding *et al.* in prep



Hopwood *et al.* (2018) *Nature communications*

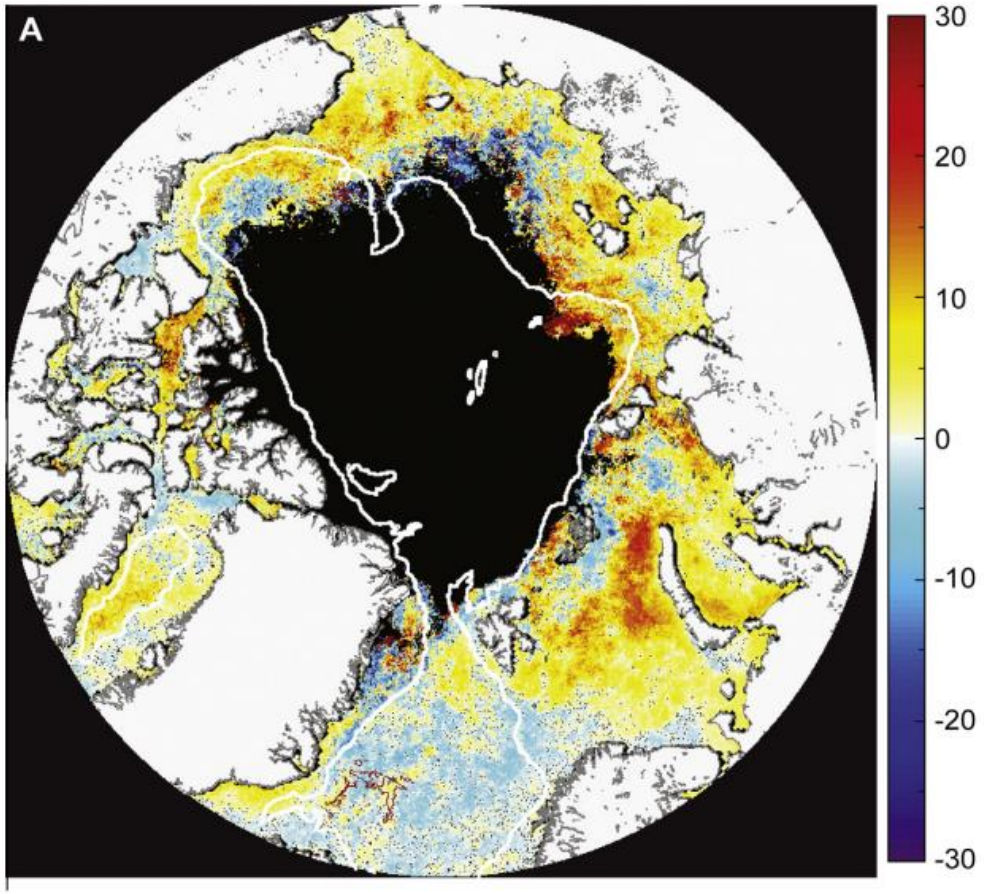
Glacier thickness/ grounding lines?

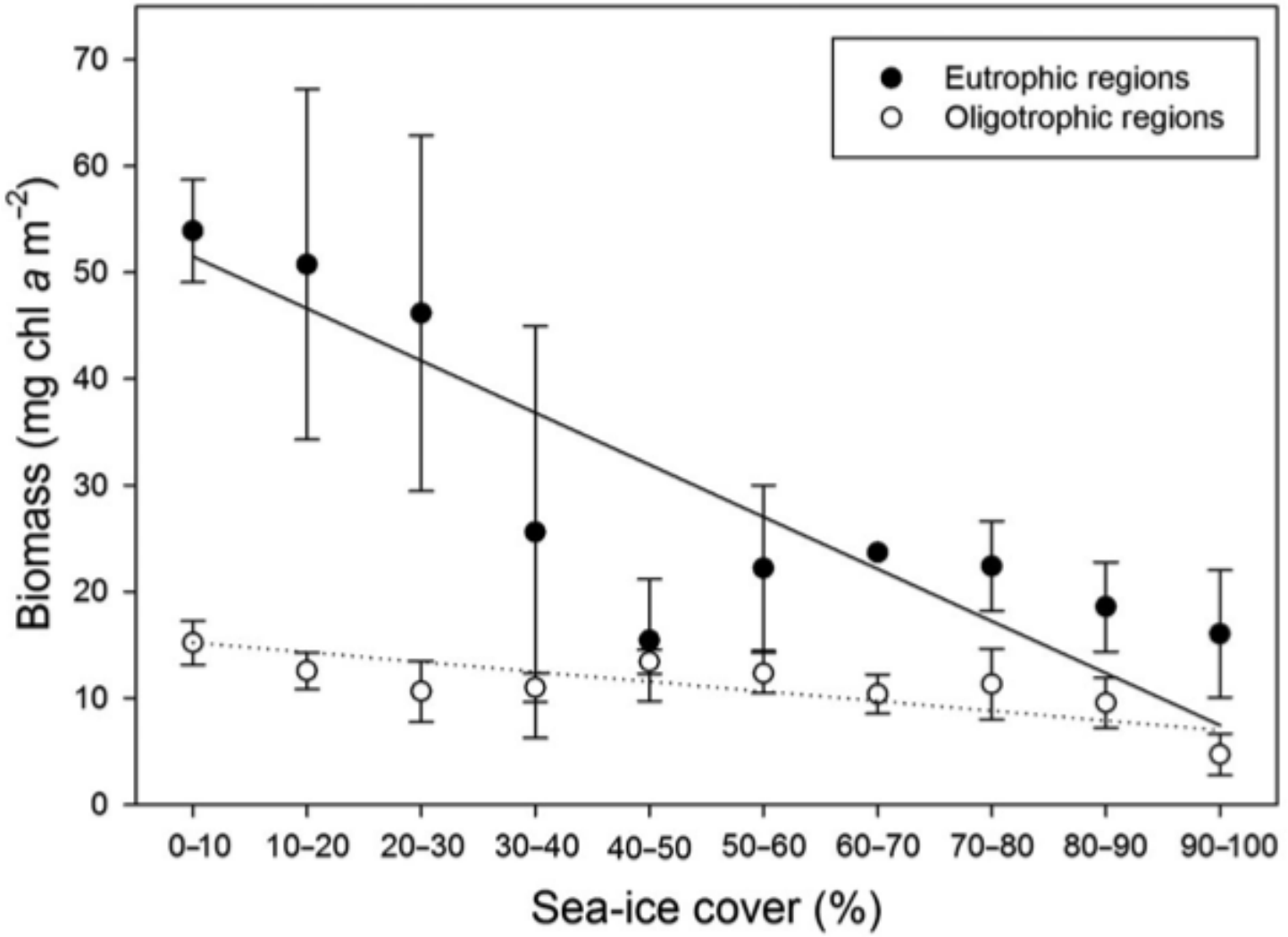


Holding *et al.* in prep

Primary production in Oligotrophic vs Eutrophic regions

Δ Net production (%)





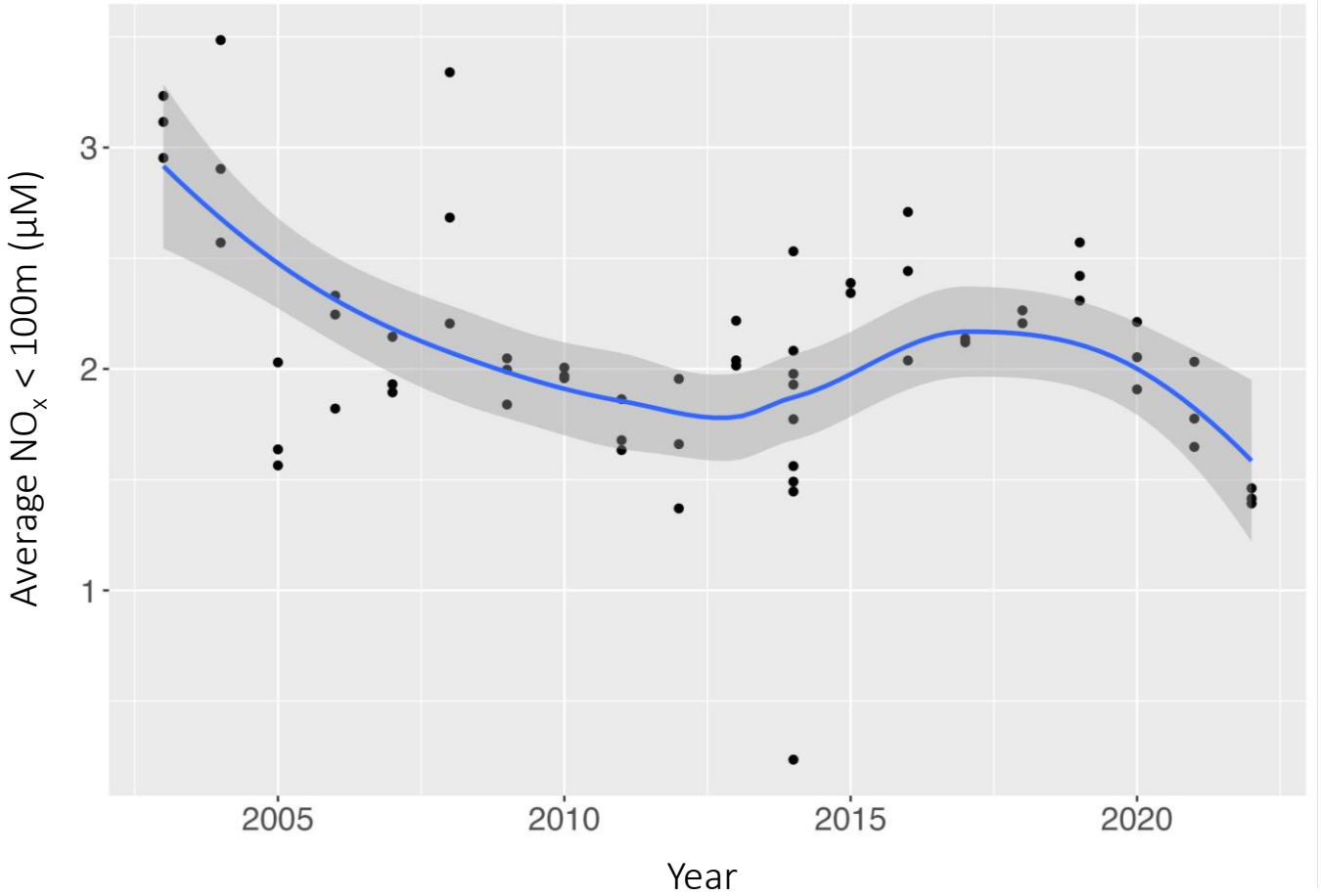
Arrigo & van Dijken. (2015) Prog. Oceanography

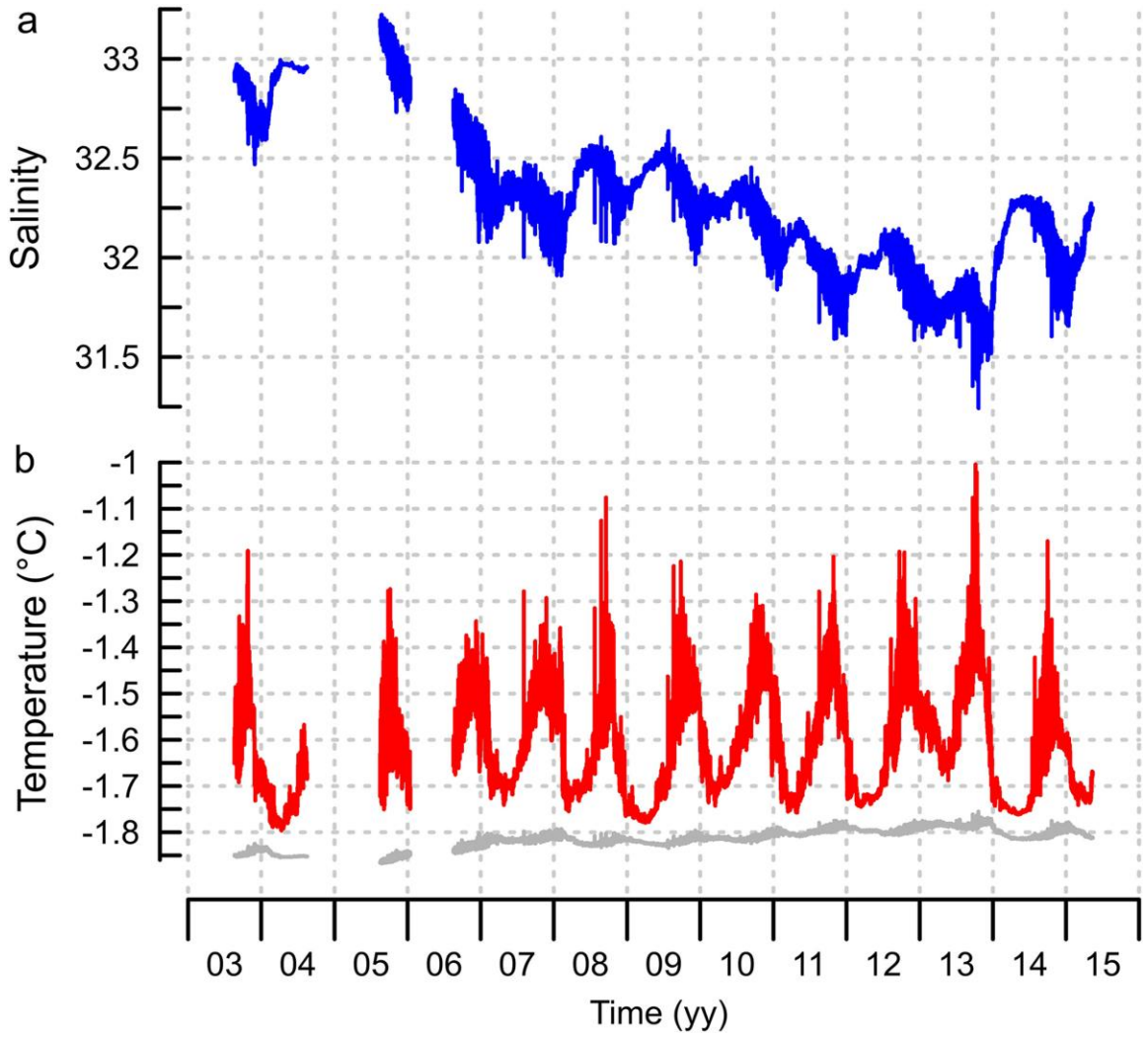
Ardyna *et al.* (2011) *Mar. Ecol. Prog. Series*

GEM

Greenland Ecosystem Monitoring

Oligotrophication of East Greenland?





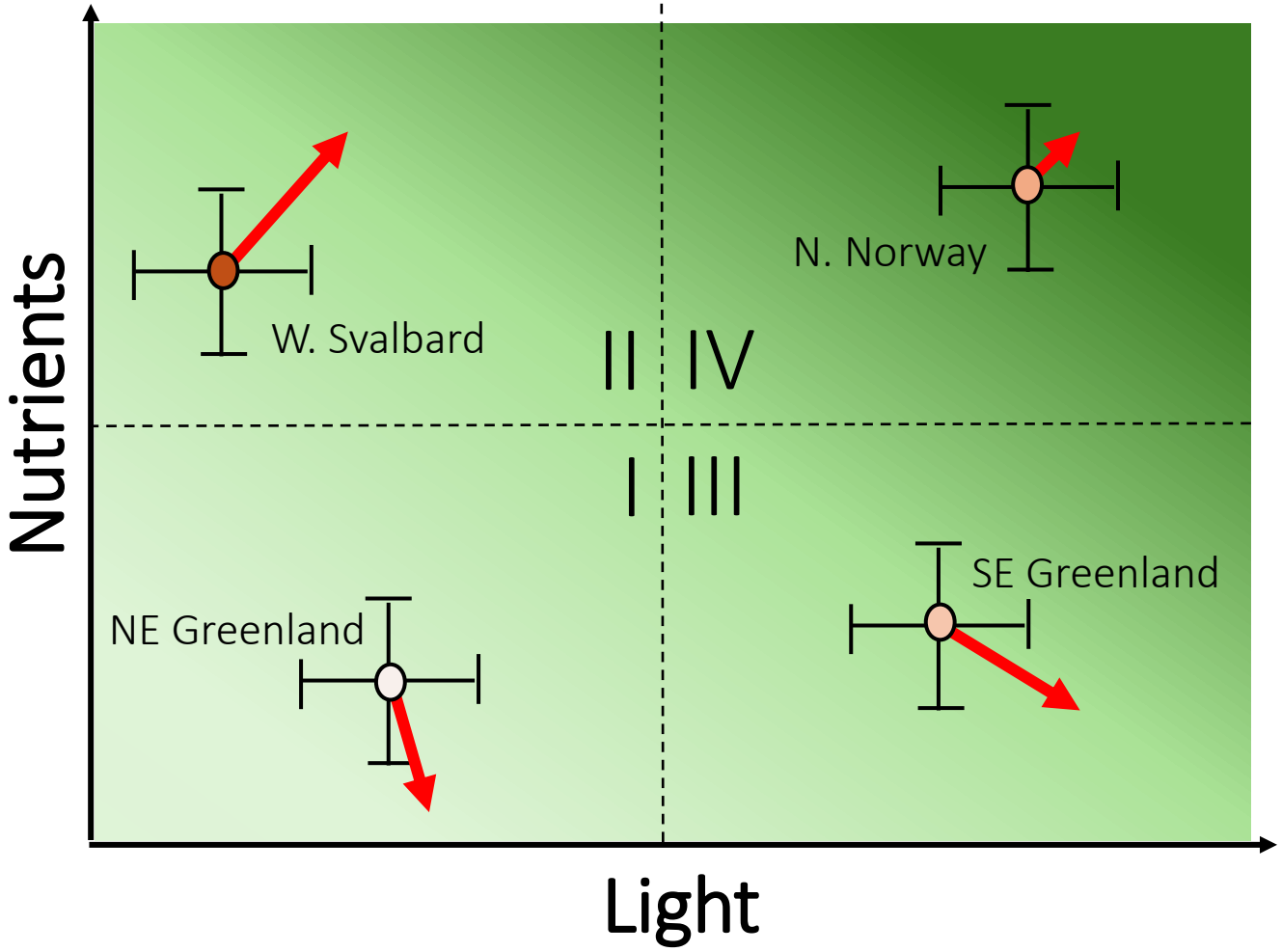
Unpublished data: Greenland Ecosystem Monitoring

Boone *et al.* (2018) Geophys. Research Lett.

Take aways

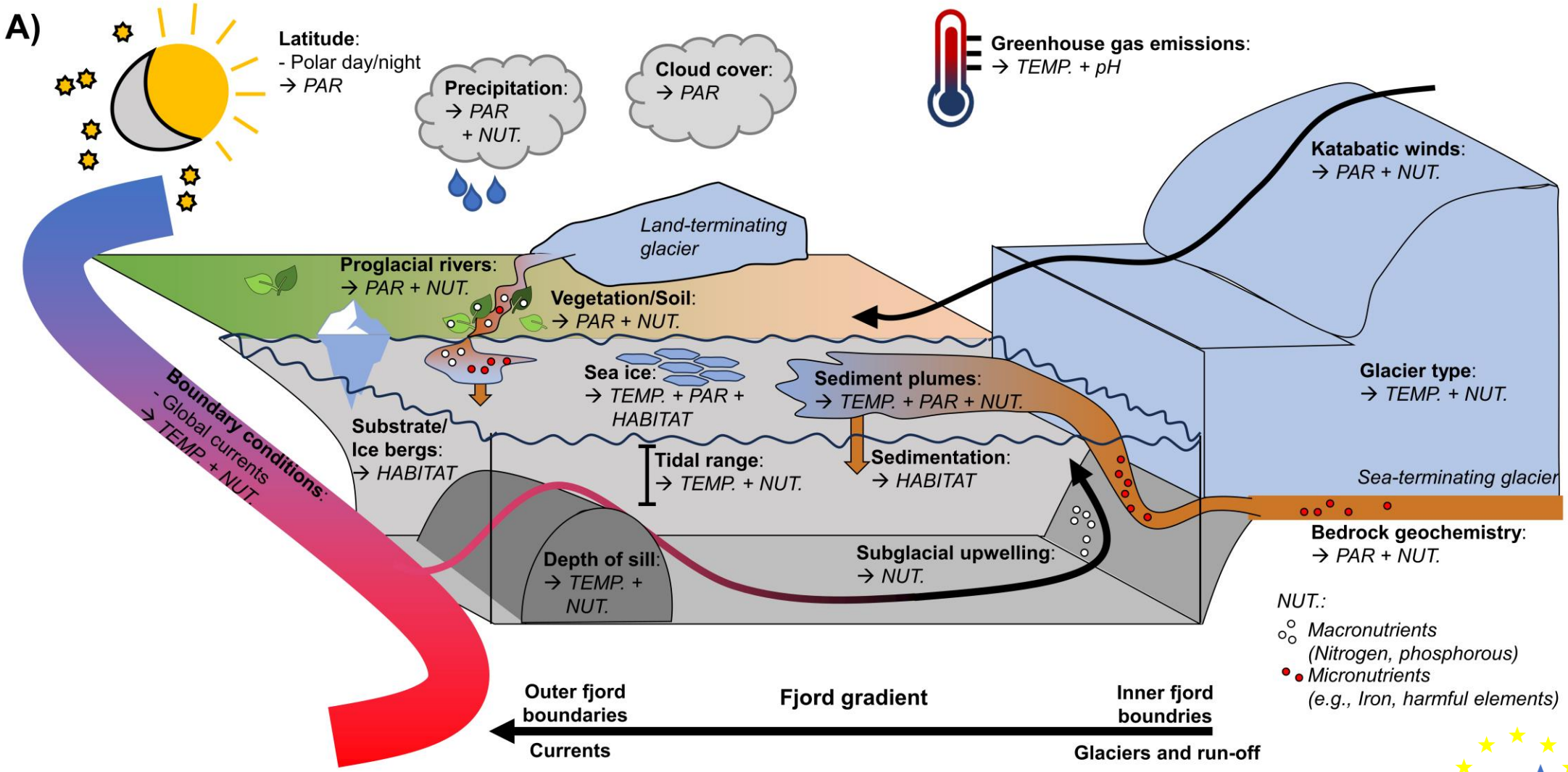
- Land vs. marine terminating glacier type is only ONE of the things that distinguish fjords from one another
- Boundary conditions are equally if not more important for determining trophic state and trajectory of future fjord ecosystem productivity
- Eutrophic vs. oligotrophic regions will respond to ice loss (sea & glacier) differently

Driver based approach



Niedzwiedz, Vonnahme, Lund-Hansen, Holding, *et al. in prep*

Revised conceptual model with A LOT more nuance



Niedzwiedz, Vonnahme, Lund-Hansen, Holding, *et al. in prep*

FACE-IT
Arctic Biodiversity & Livelihoods


Thank you!