

CNES annual meeting, March 8, 2024

Alg-o-Nord & Takuvik activites

Algorithmes satellitaires des flux de
matières dans les eaux côtières arctiques

M. ARDYNA & K. NIETO, M. BABIN, D. DOXARAN, H. CLAUSTRÉ



UNIVERSITÉ
LAVAL



TAKUVIK

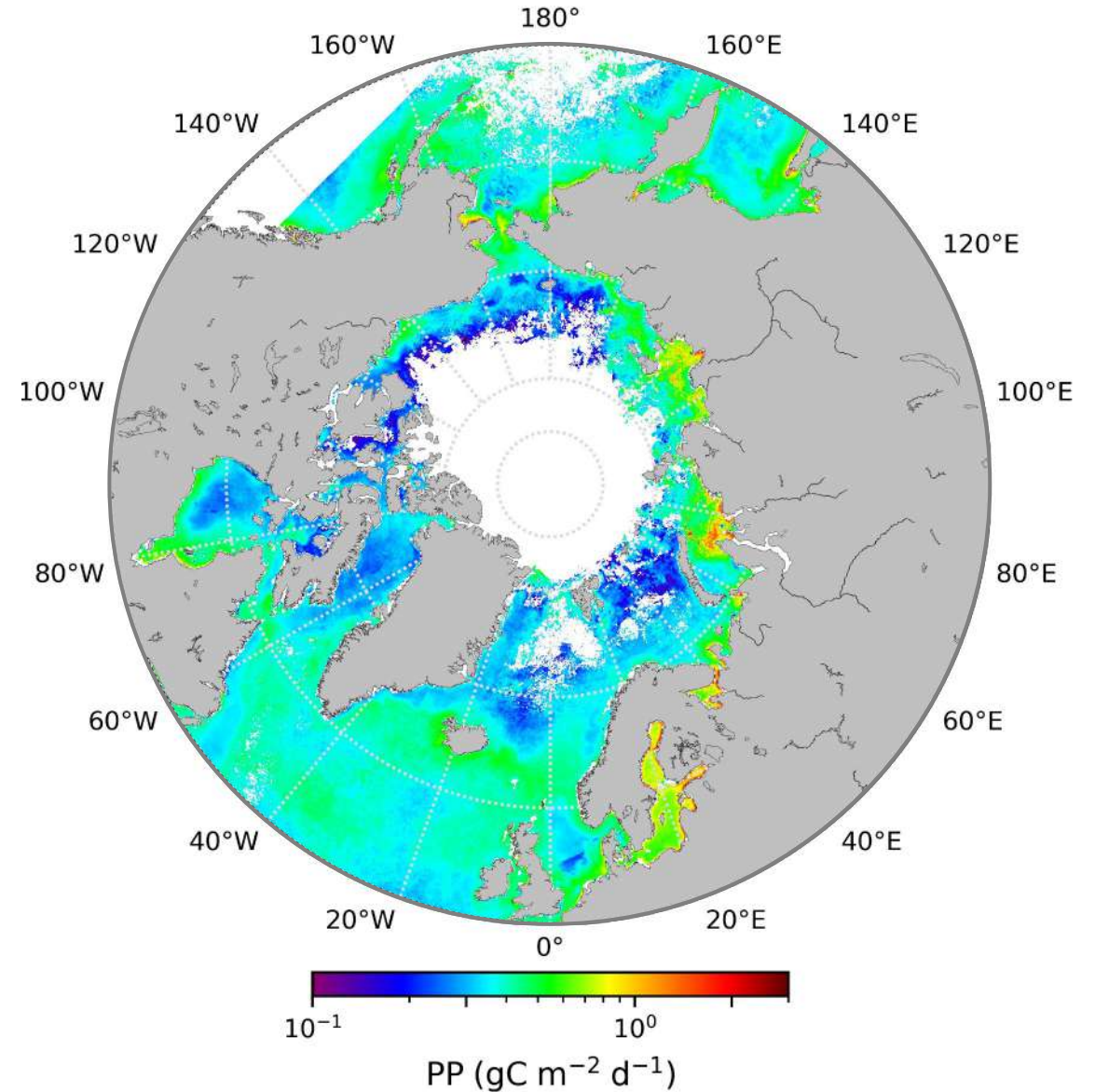


ArcticNet
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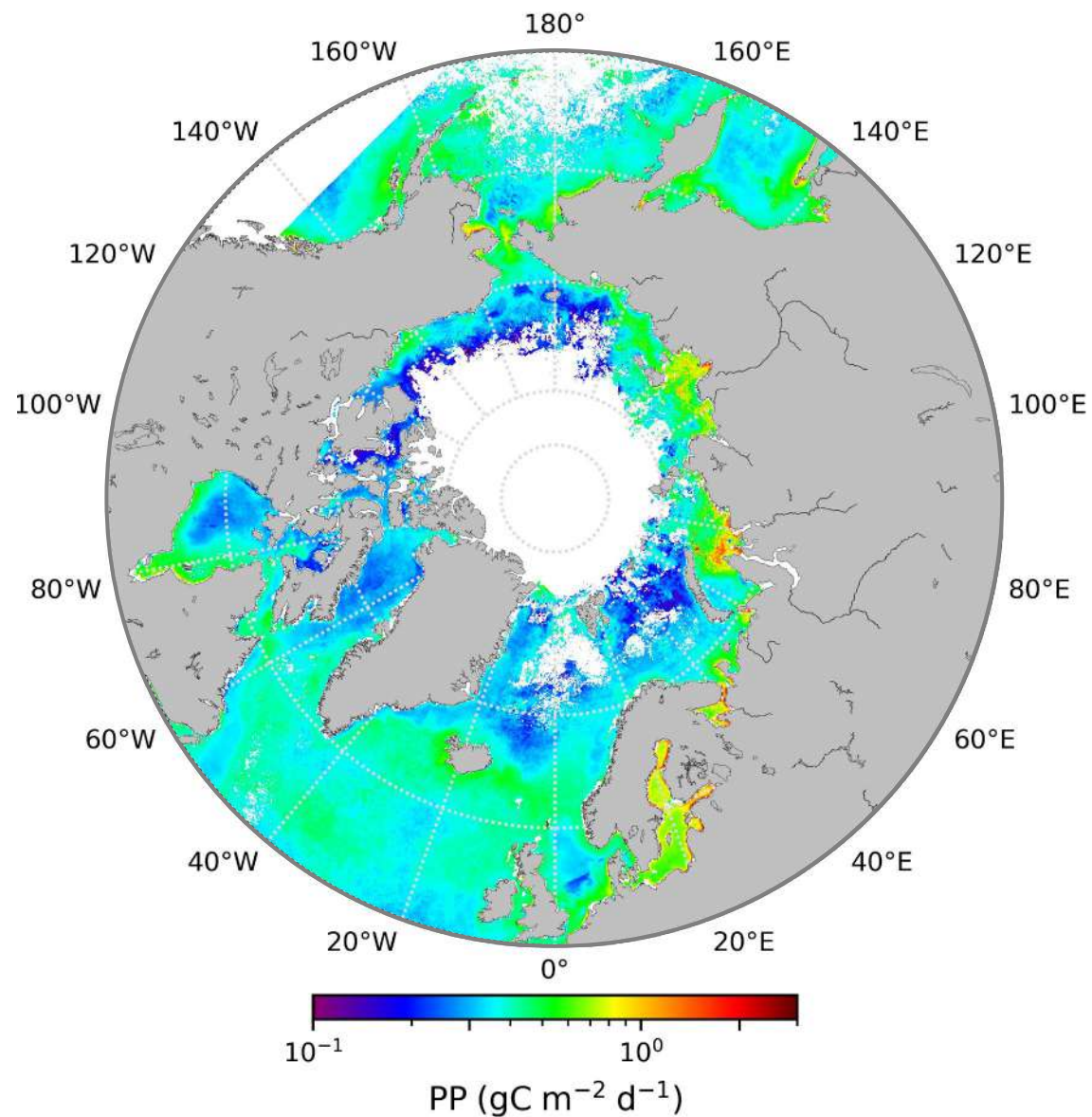
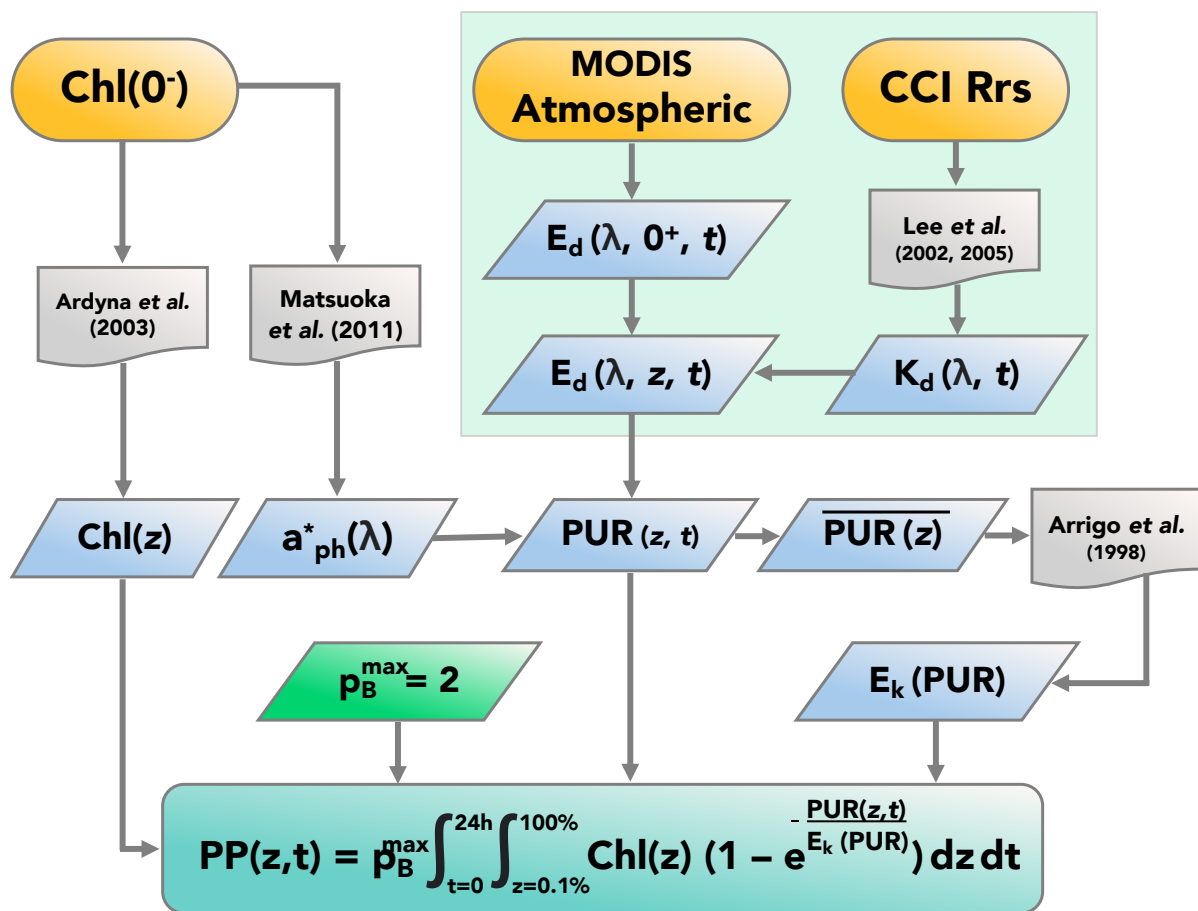
Alg-O-Nord main objective

The main objective of the Alg-o-Nord project is to improve our estimates and trends of primary production (PP), from the small scale to the pan-Arctic scale.

Better constrain CDOM, SPM, chlorophyll a dynamics



Takuvik Primary Production Model

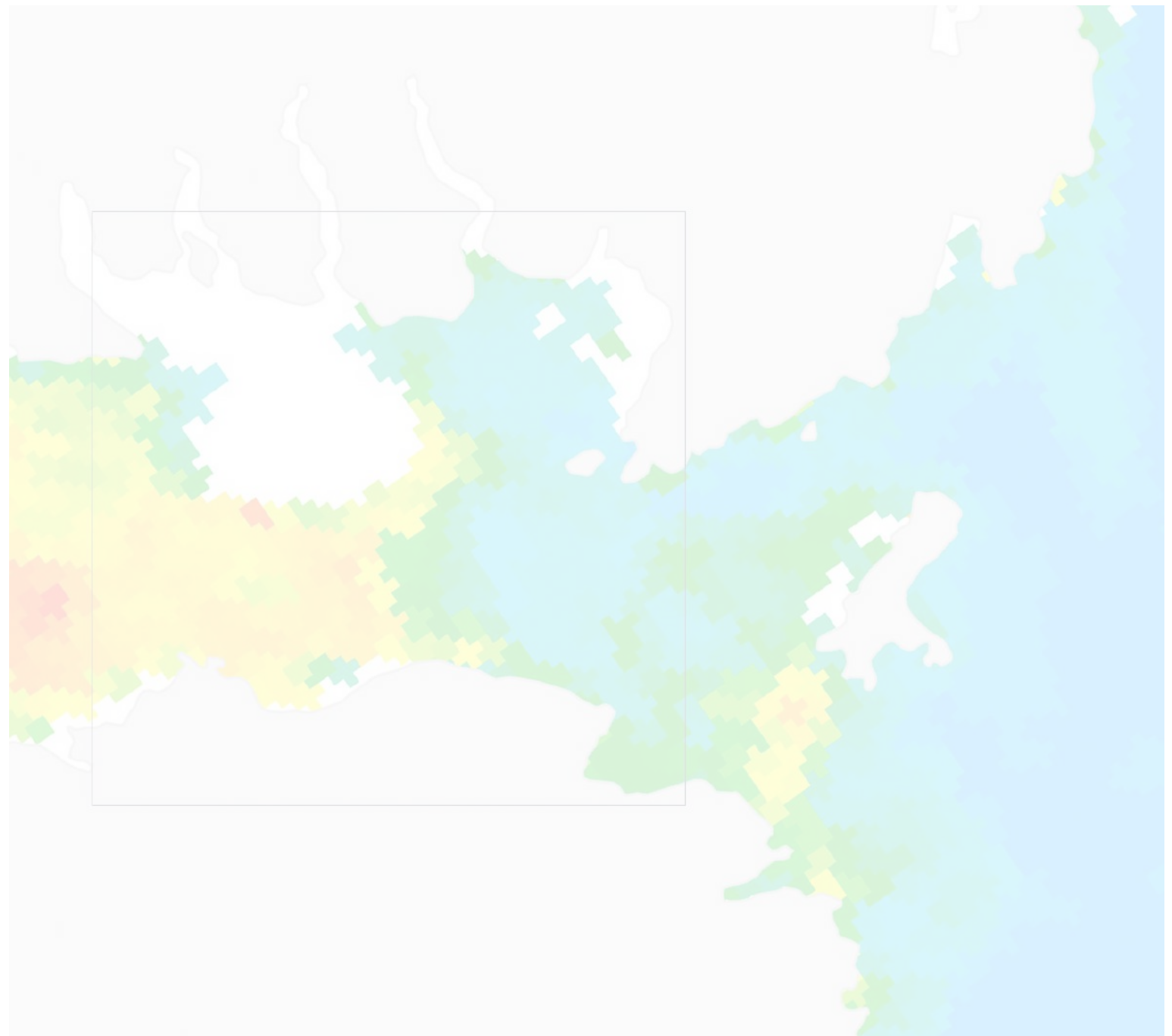
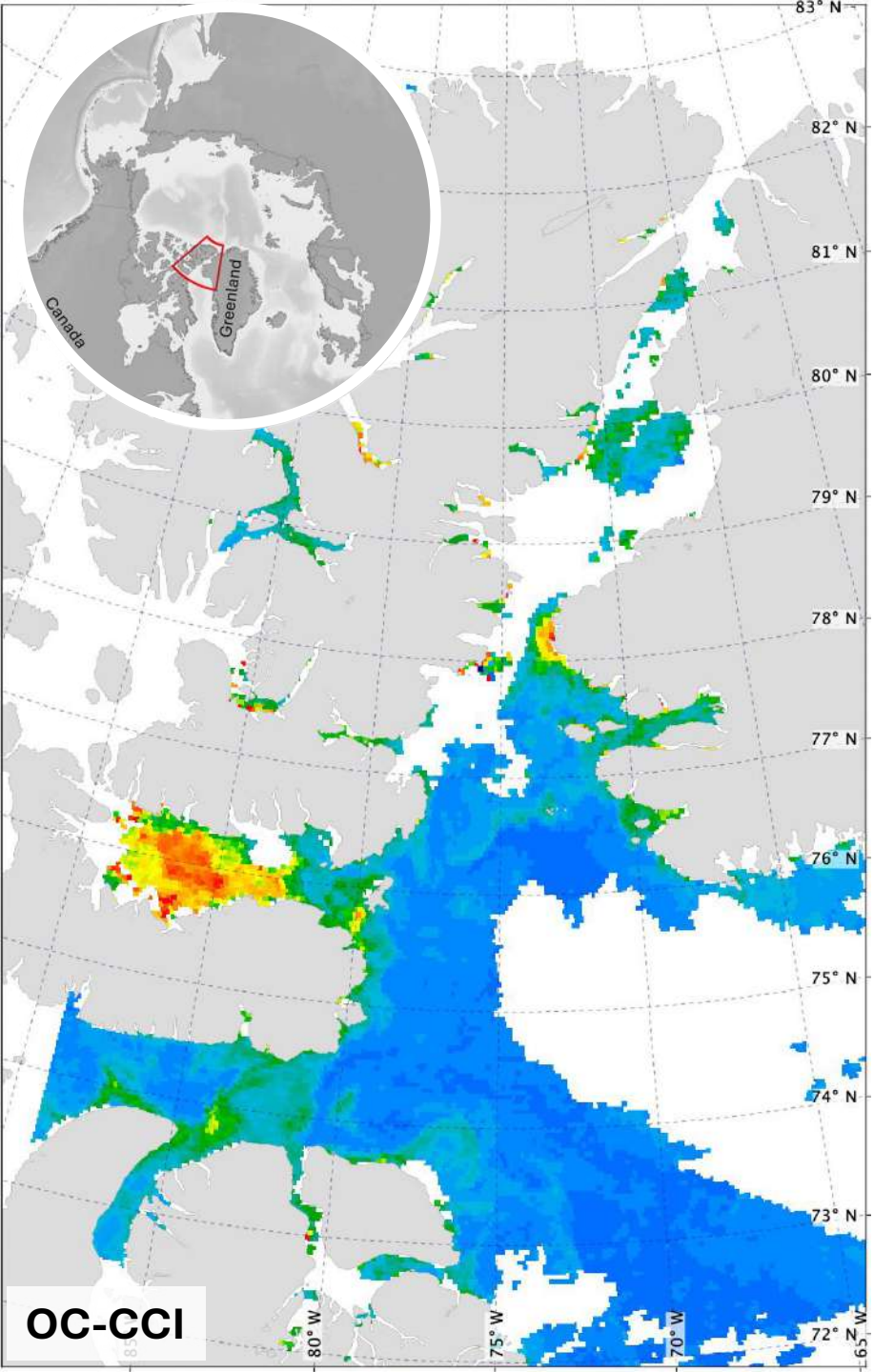


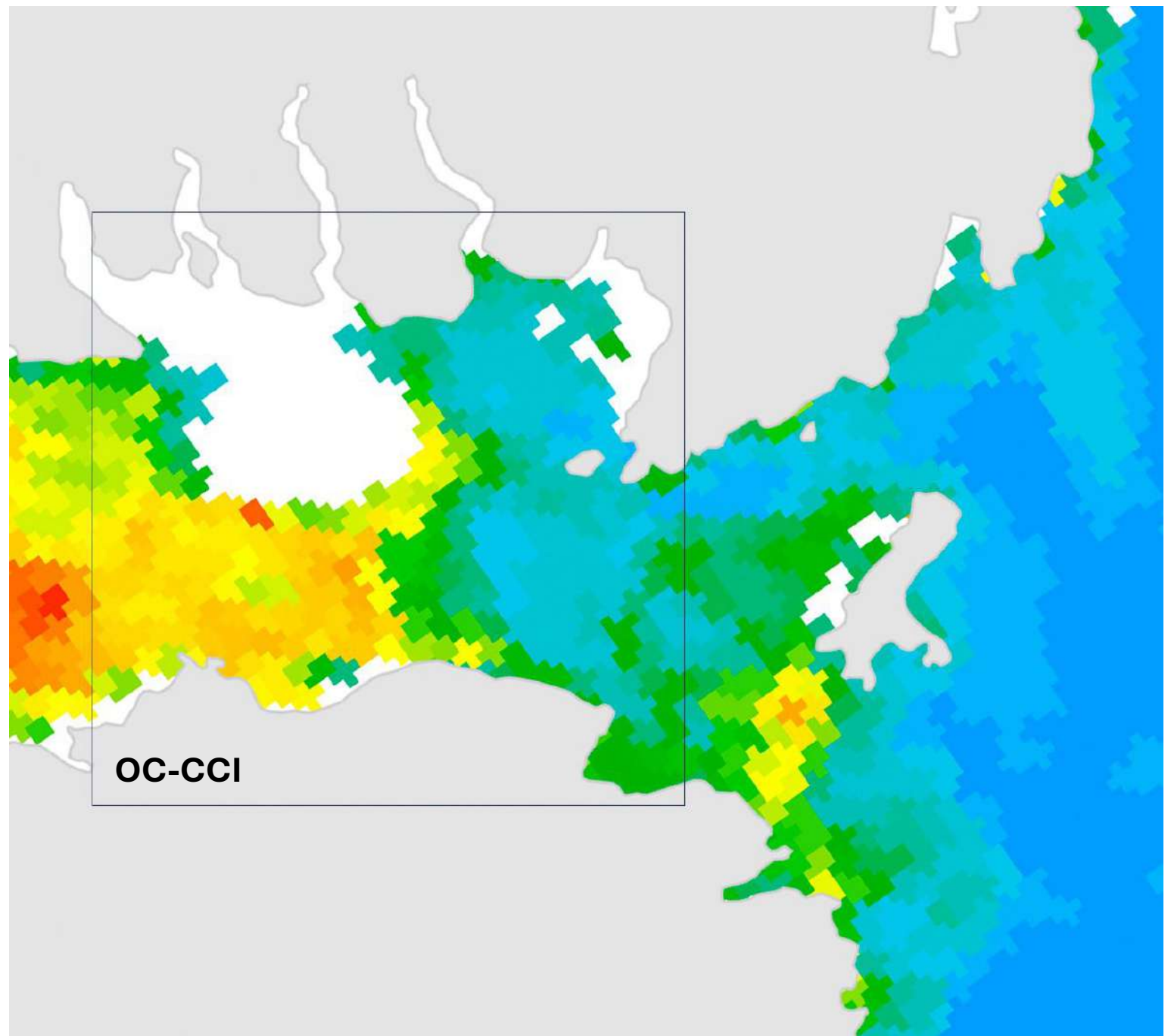
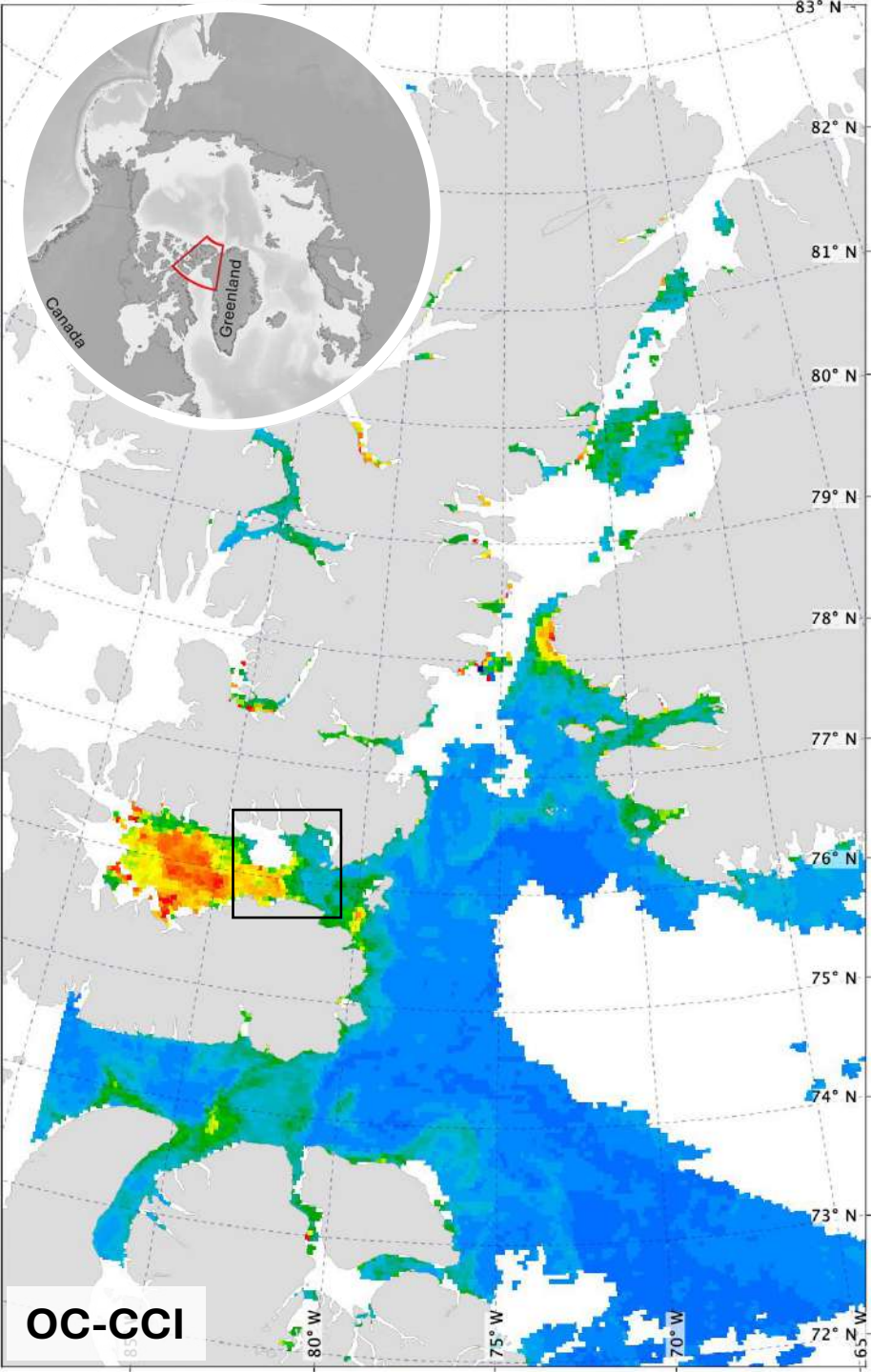
Chlorophyll algorithms

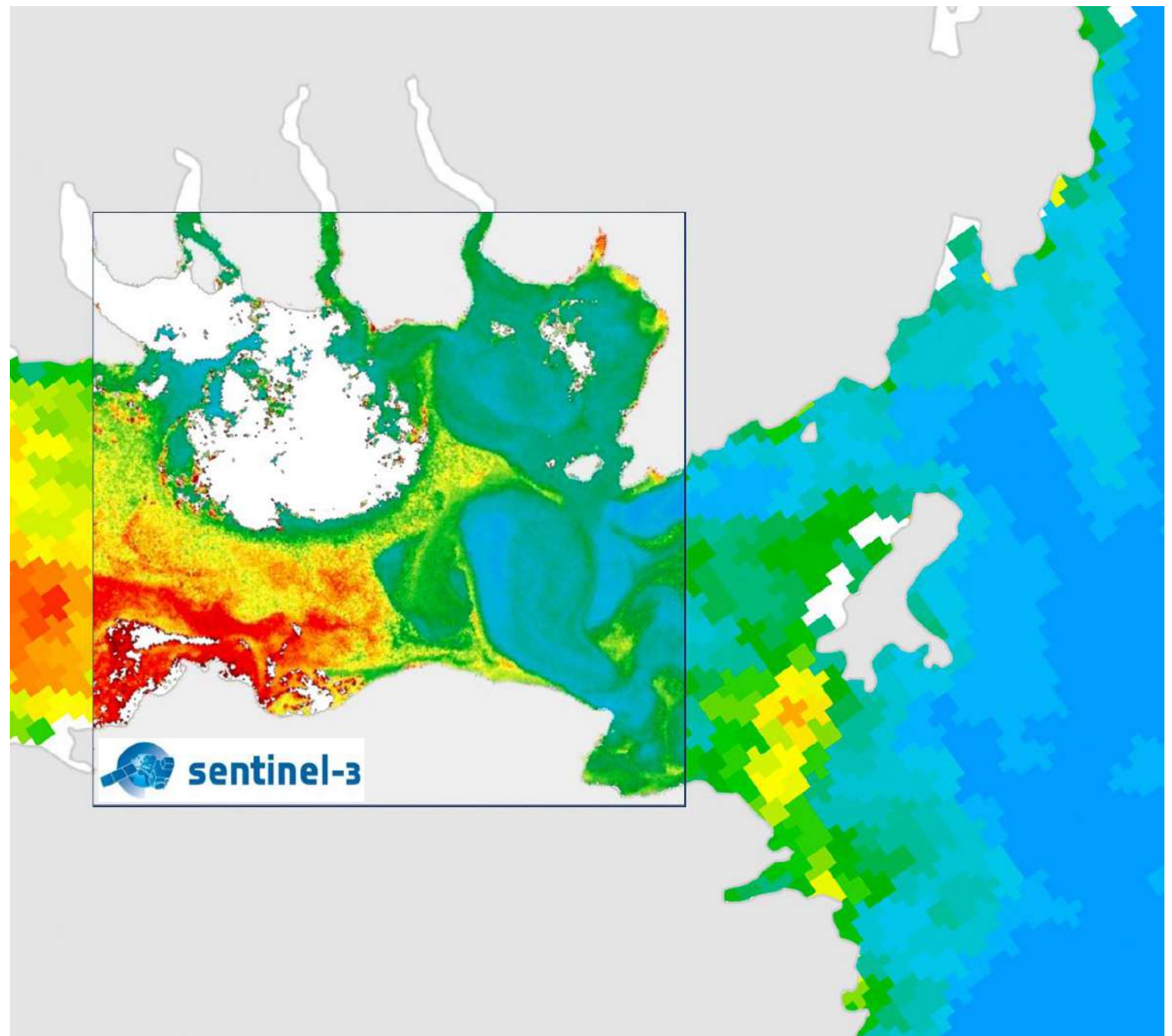
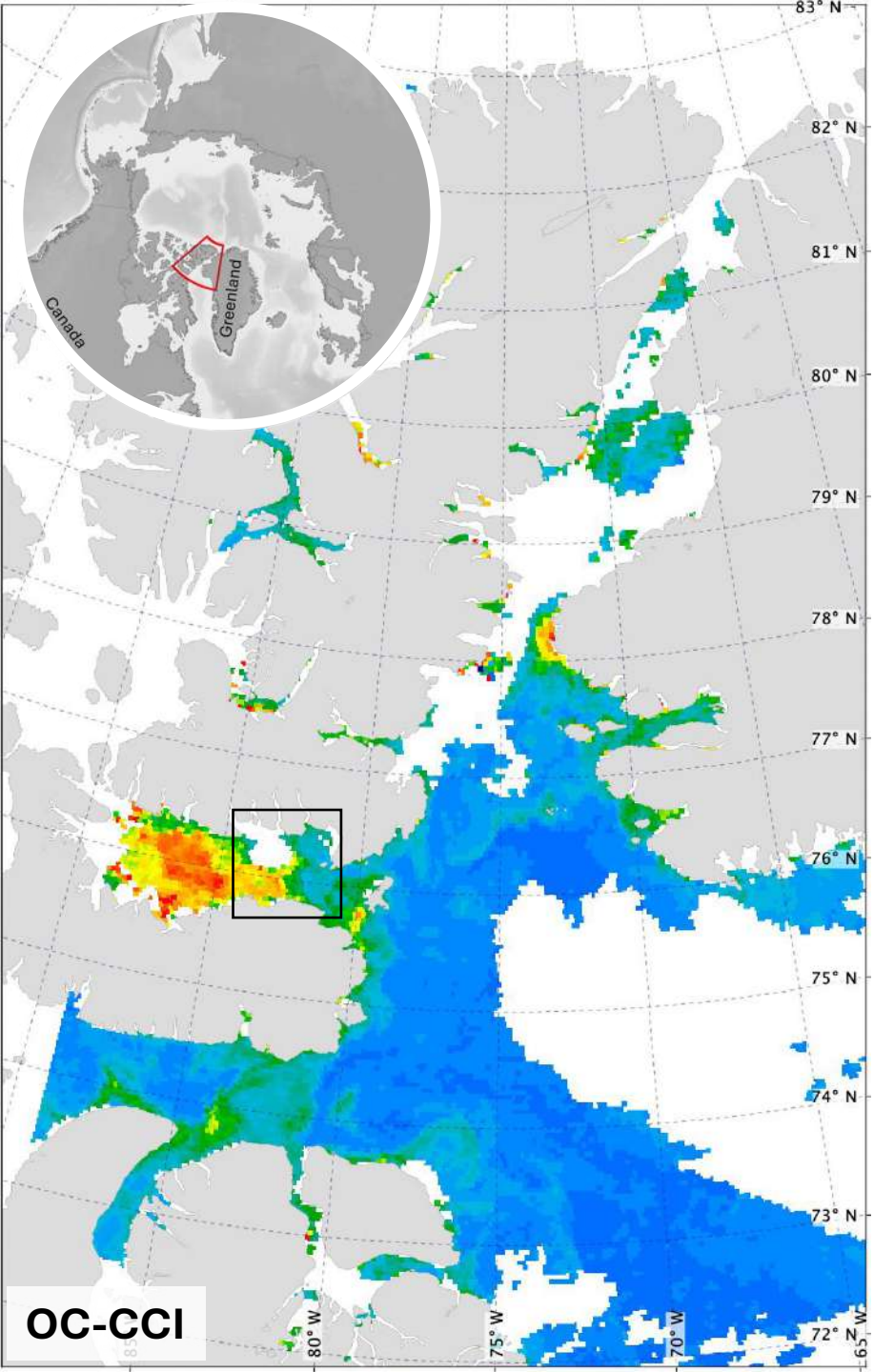
Chl(0')

| OC-CCI (4.4 km) | Sentinel 3 (300 m) |
|-------------------------------------|---|
| OCx (product OC-CCI) | NN / OC4Me (products S3) |
| AO Empiric (Lewis & Arrigo) | AO Empiric (Lewis & Arrigo) |
| GSM-Arctic (Juan Li <i>et al.</i>) | GSM-Arctic (Juan Li <i>et al.</i>) |
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Chlorophyll algorithms

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Research Article

Vol. 31, No. 23/6 Nov 2023 / Optics Express 38494

Optics EXPRESS

A tuned ocean color algorithm for the Arctic Ocean: a solution for waters with high CDM content

JUAN LI,^{1,2,3}  ATSUSHI MATSUOKA,⁴ STANFORD B. HOOKER,⁵ STÉPHANE MARITORENA,⁶ XIAOPING PANG,^{2,3}  AND MARCEL BABIN^{2,*}




remote sensing



Article

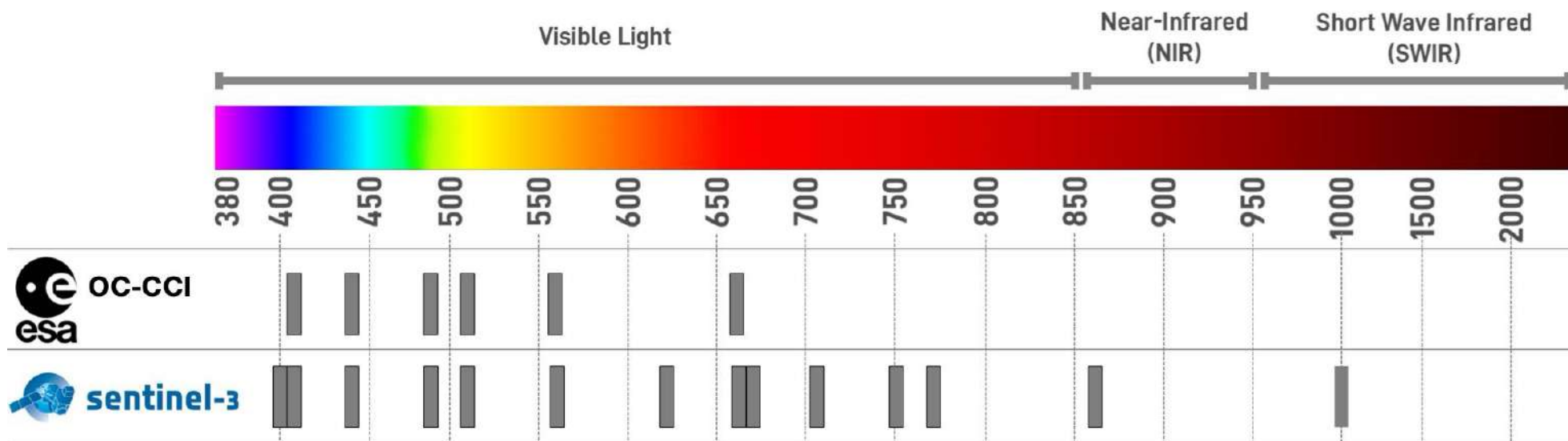
Performance of Algorithms for Retrieving Chlorophyll *a* Concentrations in the Arctic Ocean: Impact on Primary Production Estimates

Juan Li ^{1,2,3,4}, Atsushi Matsuoka ^{2,3,5}, Xiaoping Pang ^{1,4,*} , Philippe Massicotte ^{2,3} and Marcel Babin ^{2,3}

Chlorophyll algorithms

Chl(0^-)

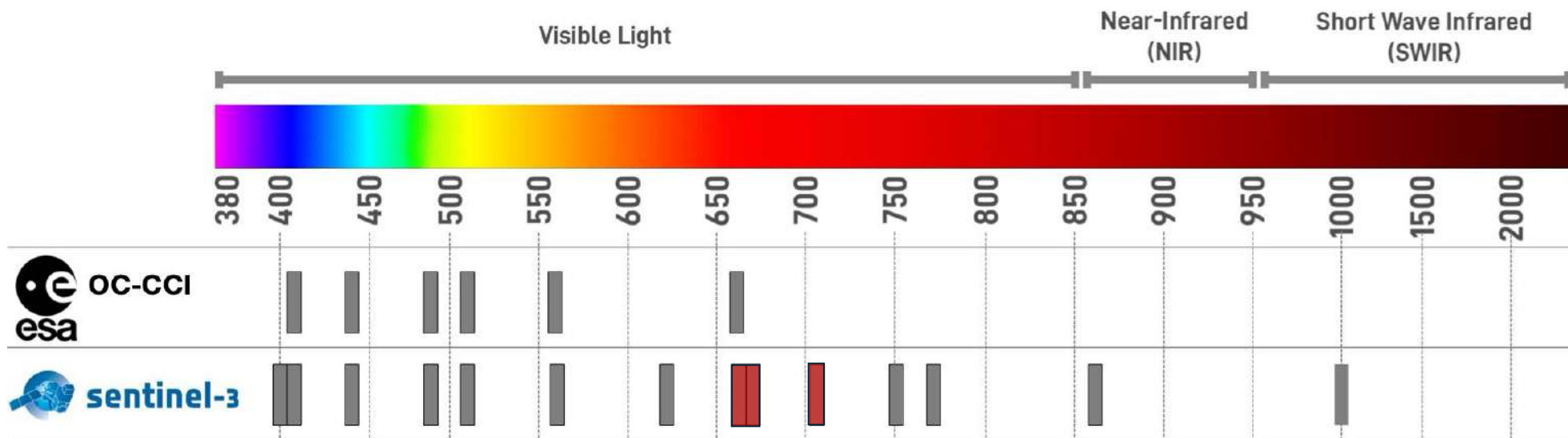
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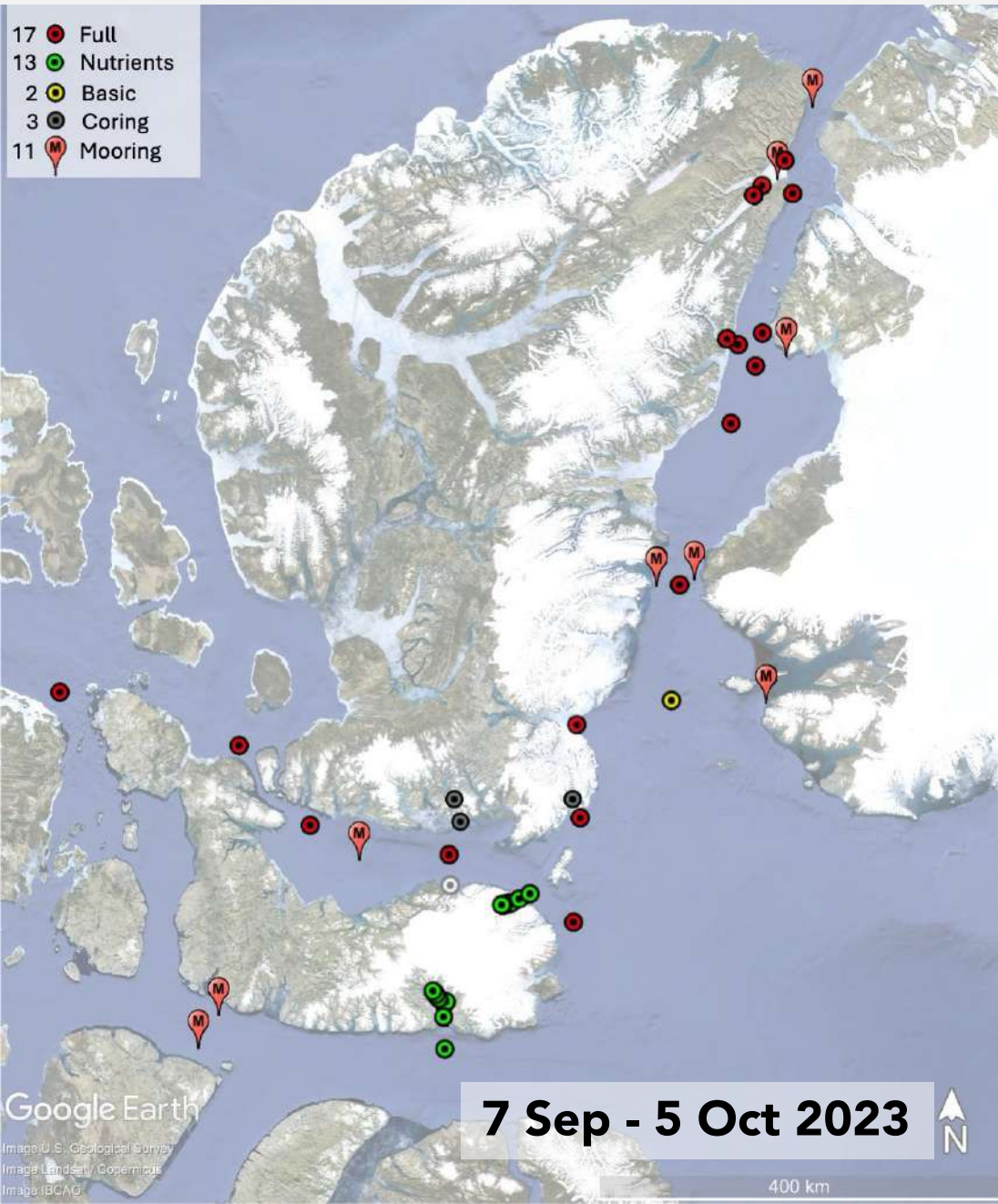
Chlorophyll algorithms

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2023 Leg 3 Amundsen



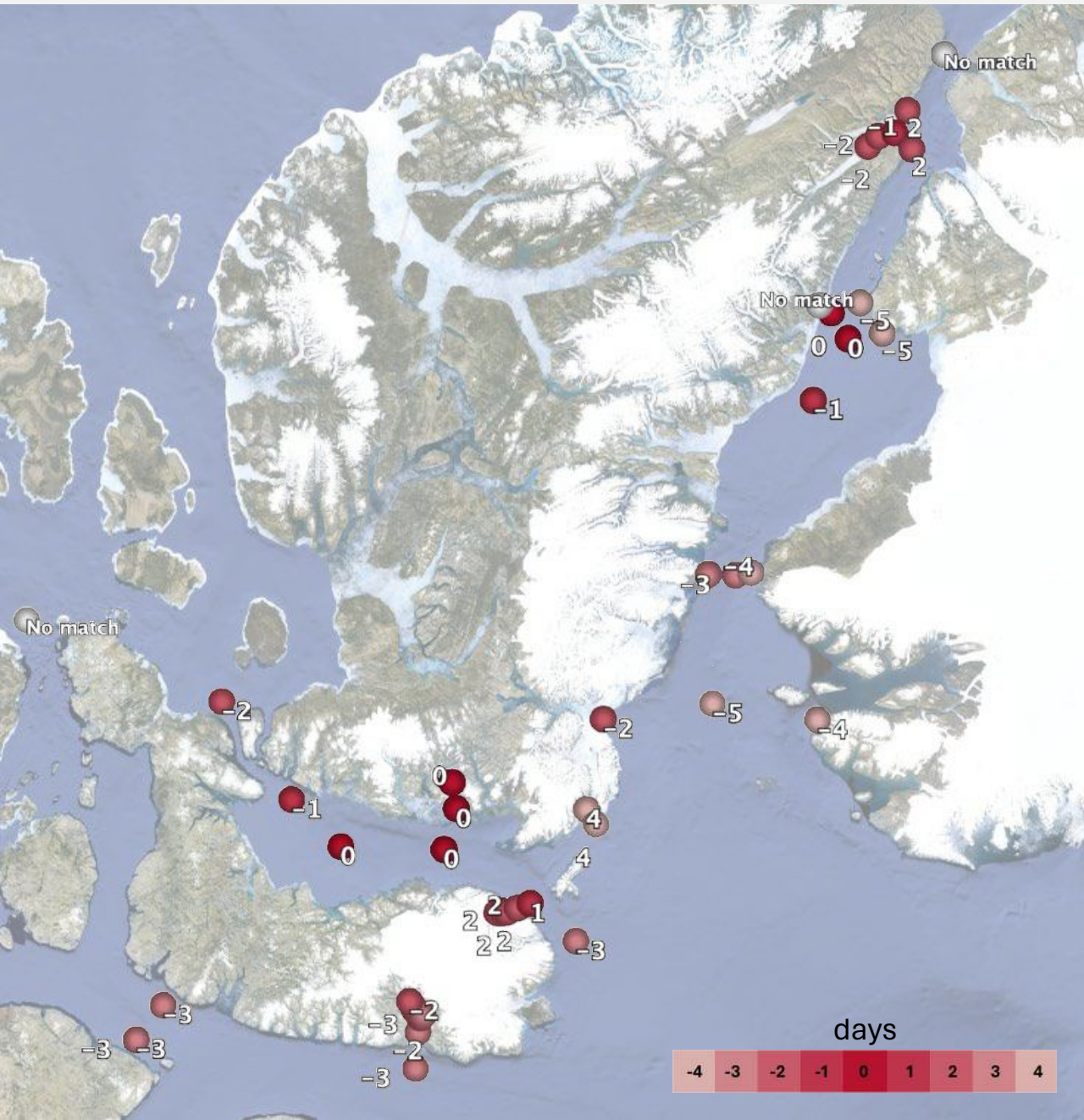
Variables couvertes:

- Mesures de réflectance de télédétection
- Absorption du CDOM
- Concentration du DOC
- Concentration de SPM et du POC
- Analyse des pigments.
- Cytométrie de flux
- Taxonomie du phytoplancton
- Courbes P-I

2023 Match station/satellite



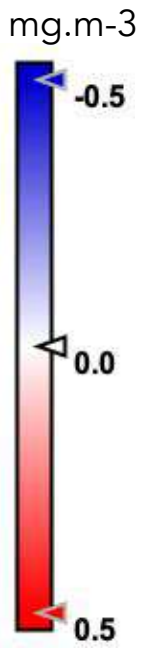
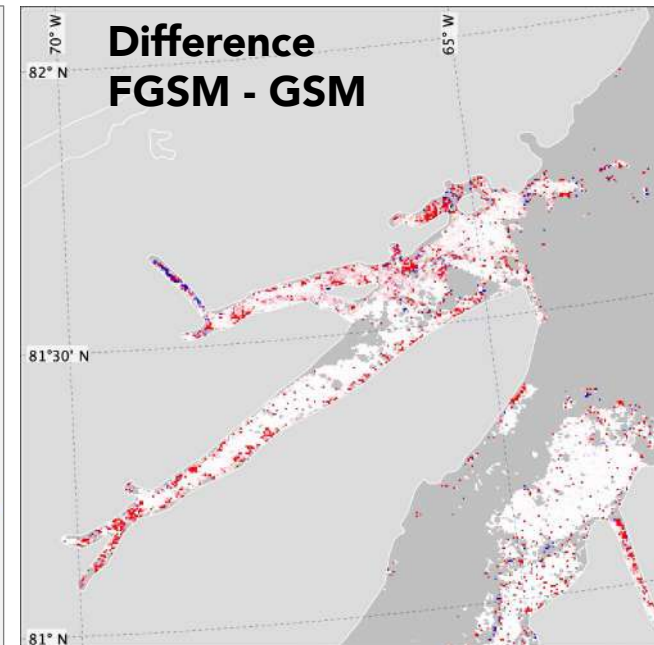
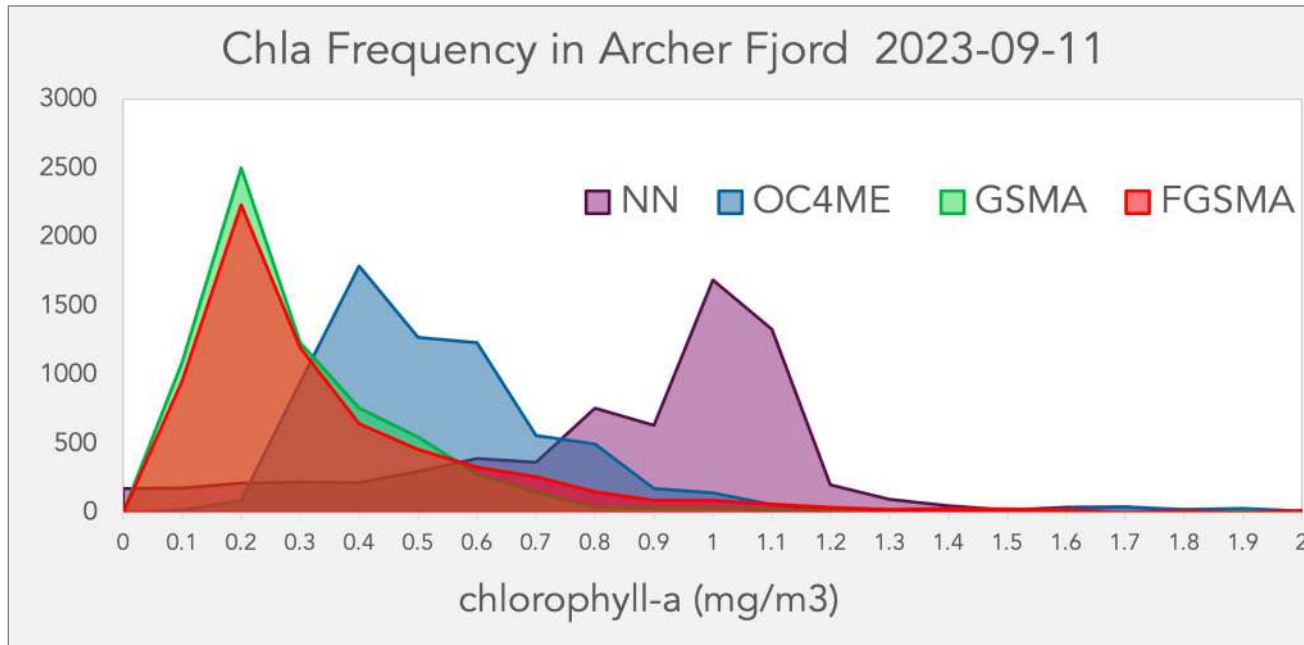
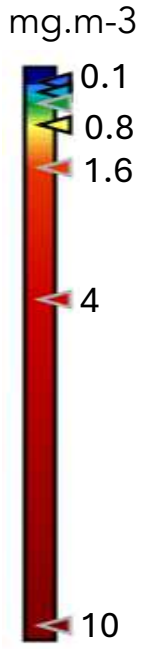
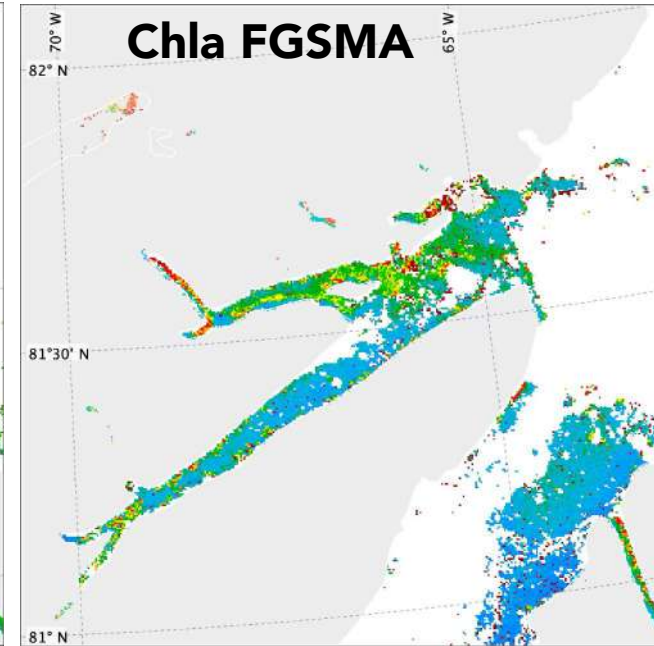
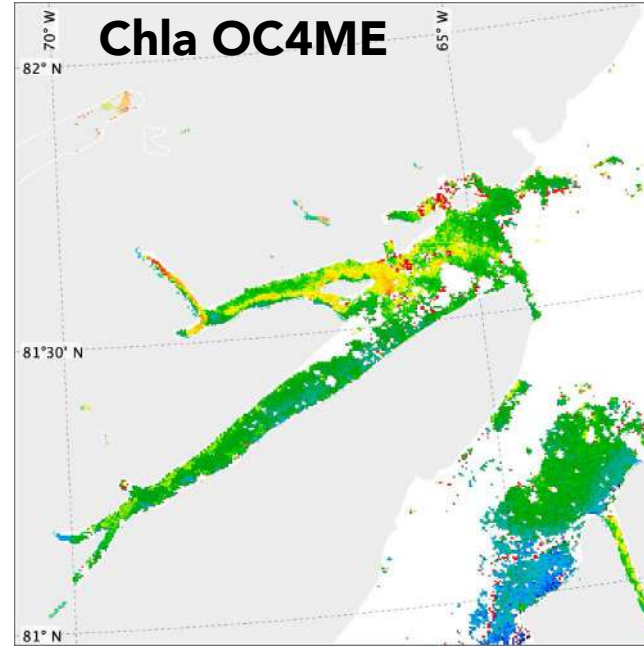
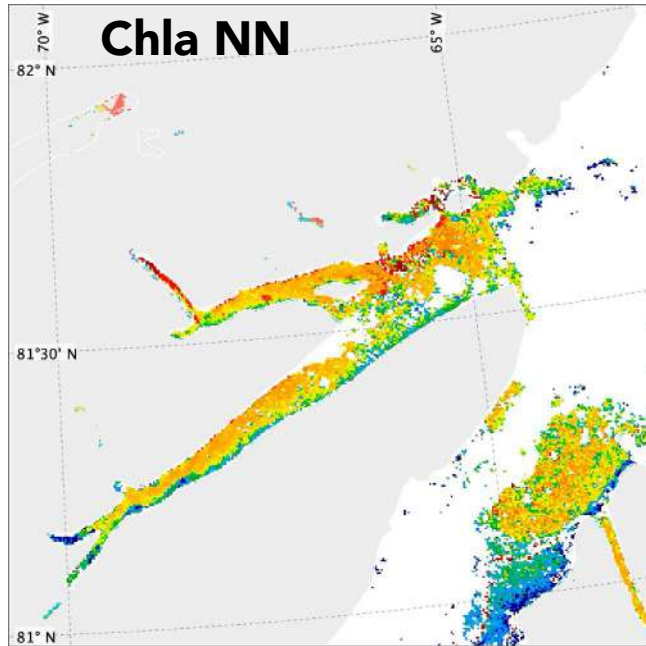
2023 Match station/satellite

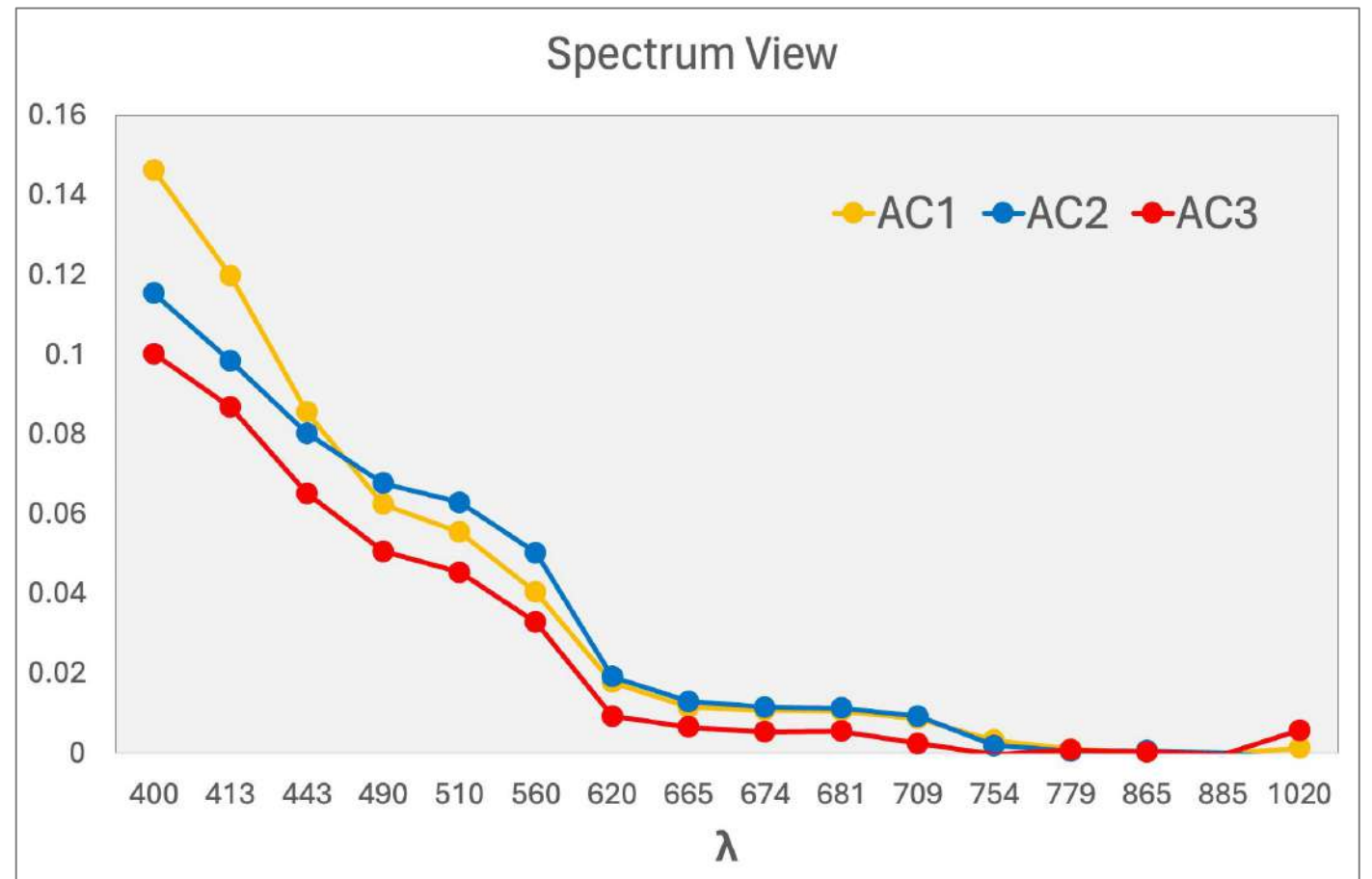
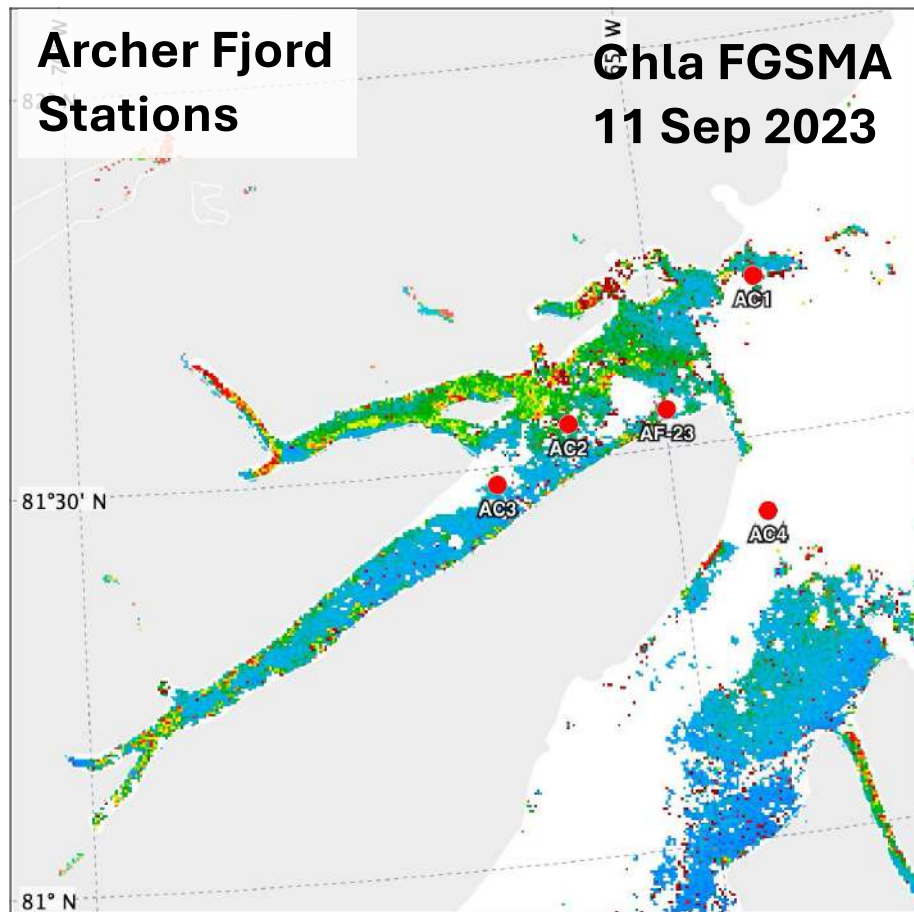


Archer Fjord stations



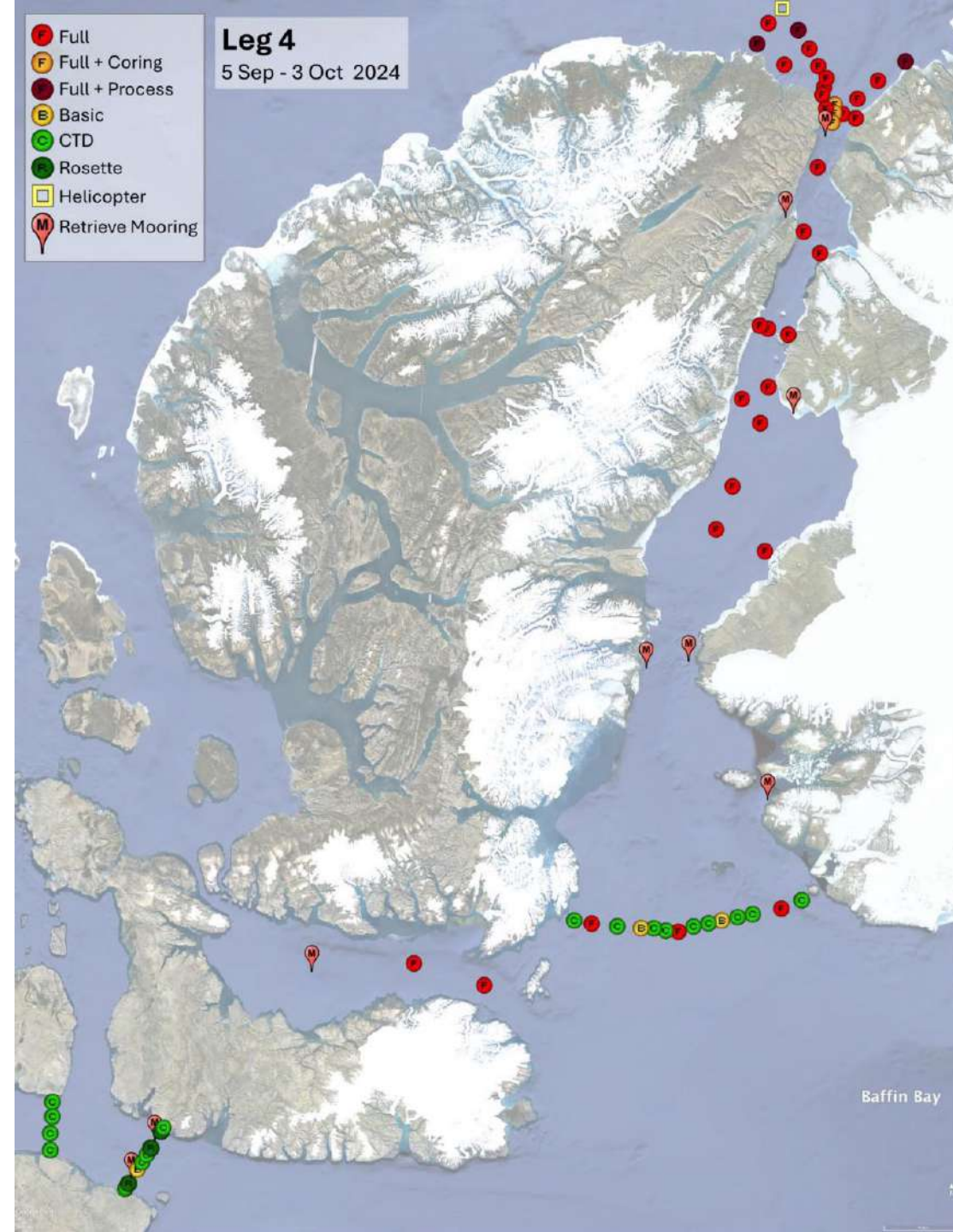
Archer Fjord 2023-09-11



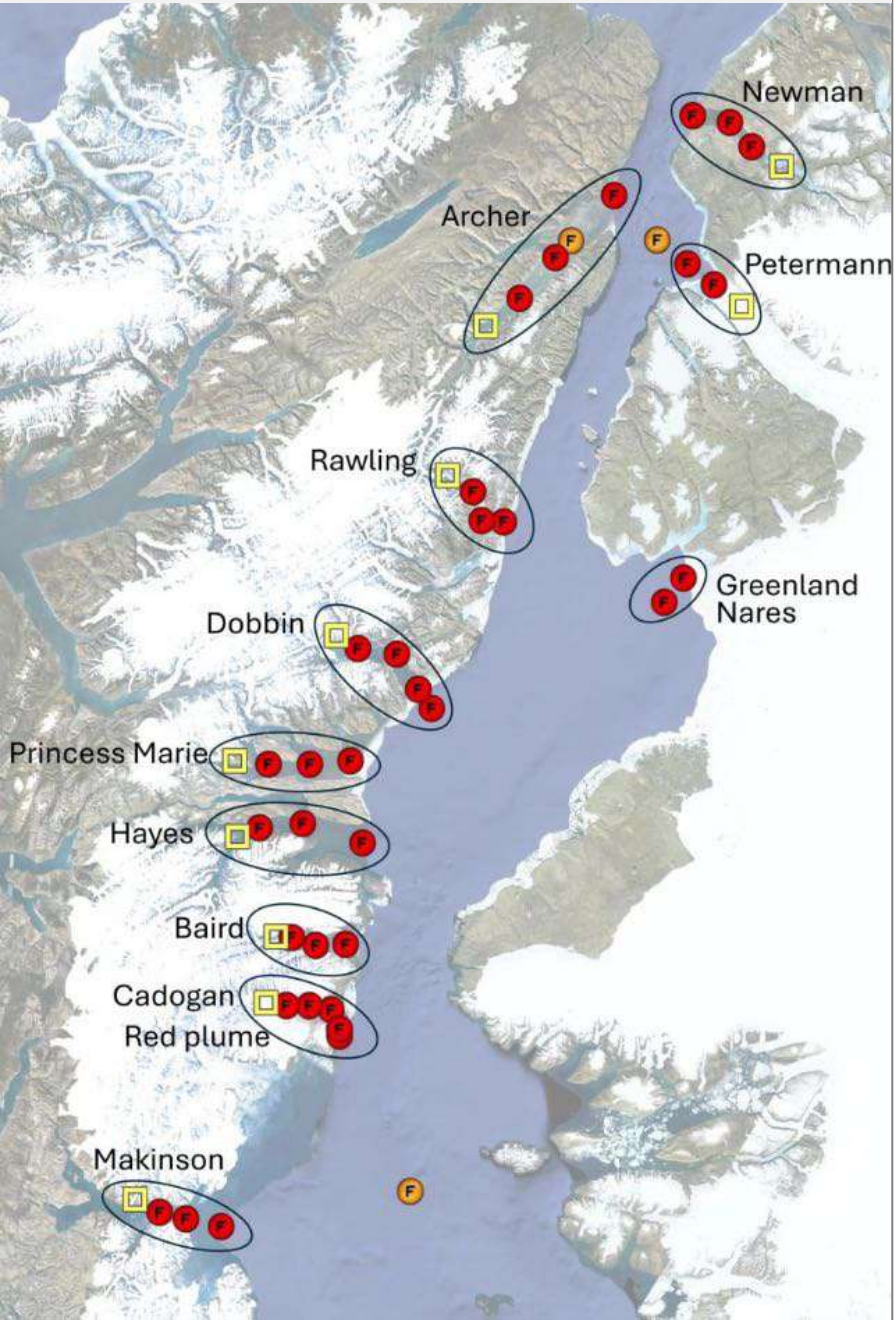


| Station | Total Suspended Matter (g.m-3) | Chla NN (mg.m-3) | Chla OC4ME (mg.m-3) | Chla GSMA (mg.m-3) | Chla FGSM (mg.m-3) |
|---------|--------------------------------|------------------|---------------------|--------------------|--------------------|
| AC3 | 2.79239 | 1.07522 | 0.52064 | 0.27855 | 0.27451 |
| AC2 | 5.00765 | 0.93004 | 0.83418 | 0.51641 | 0.52840 |
| AC1 | 1.11525 | 1.0369 | 0.46697 | 0.25476 | 0.28381 |

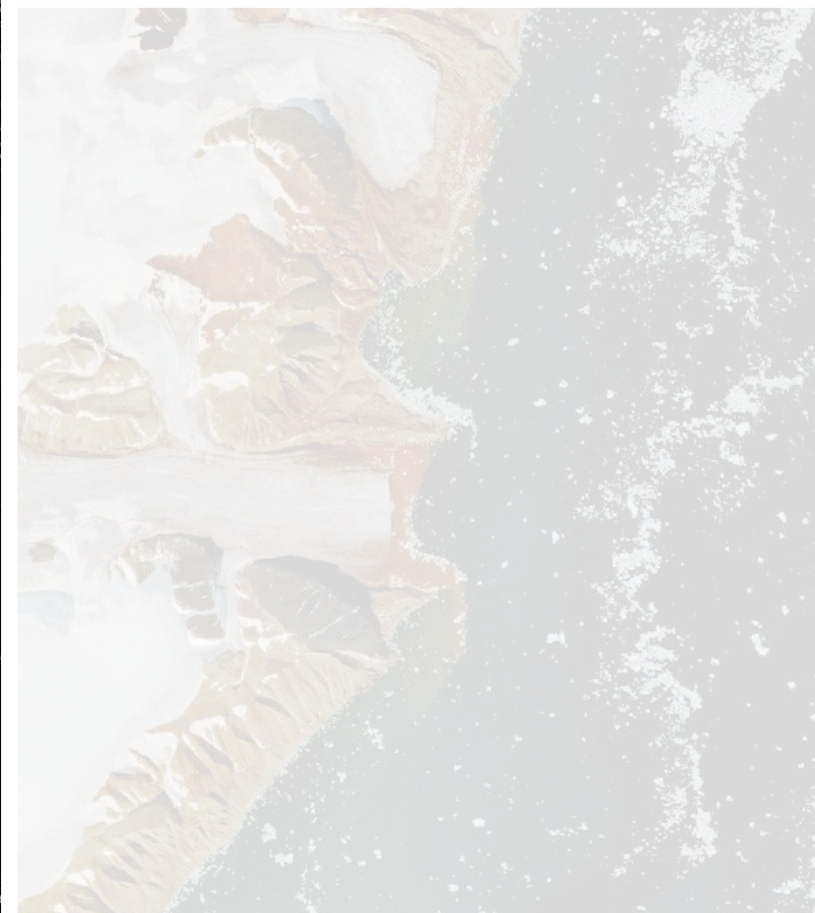
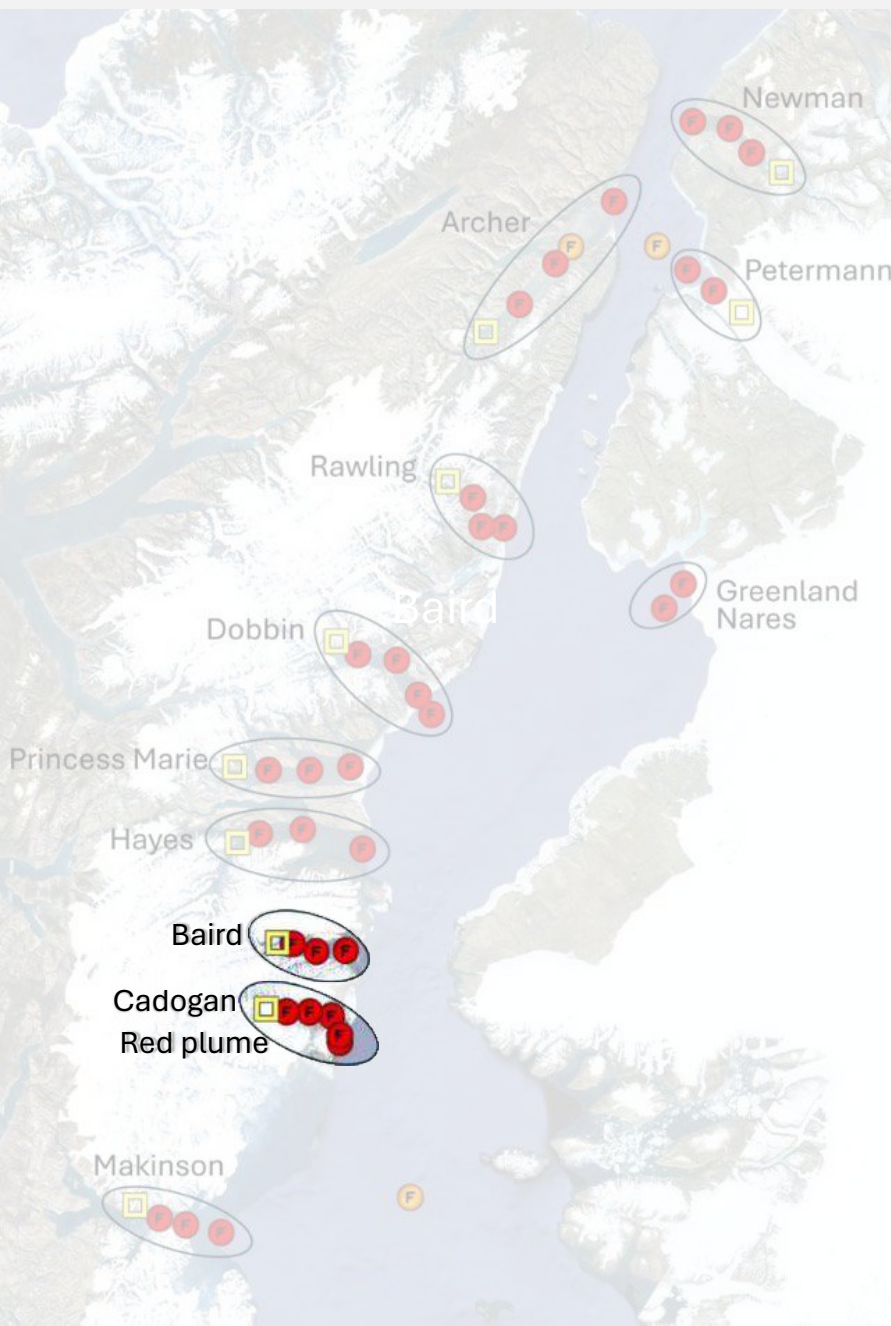
Amundsen Expedition 2024



2024 Amundsen Leg 3

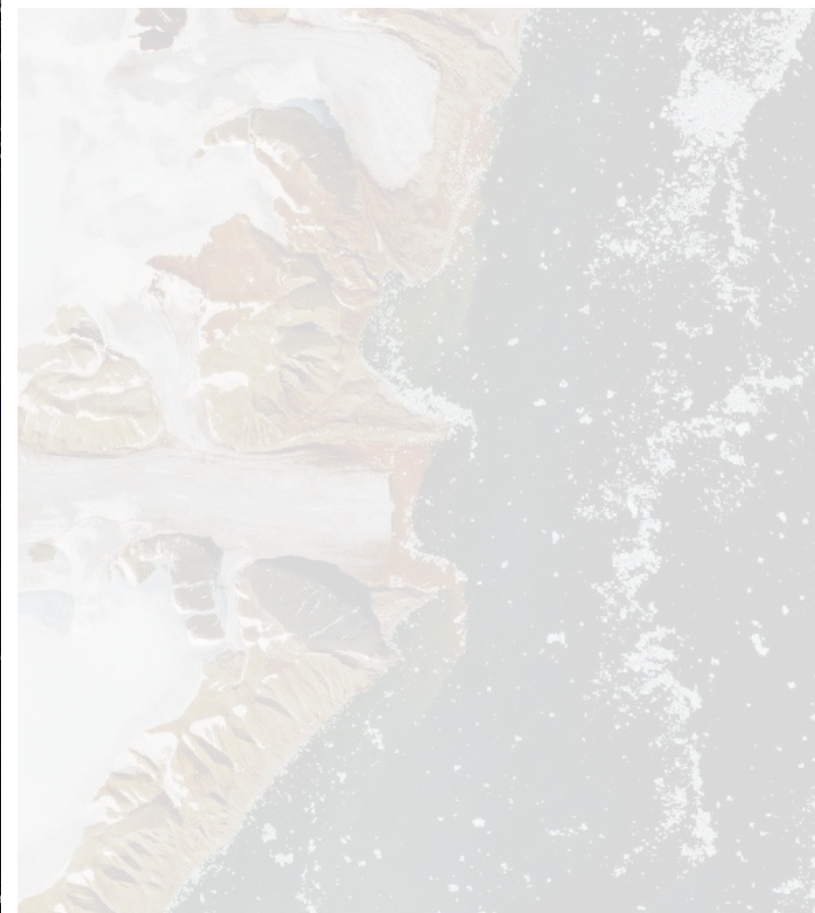
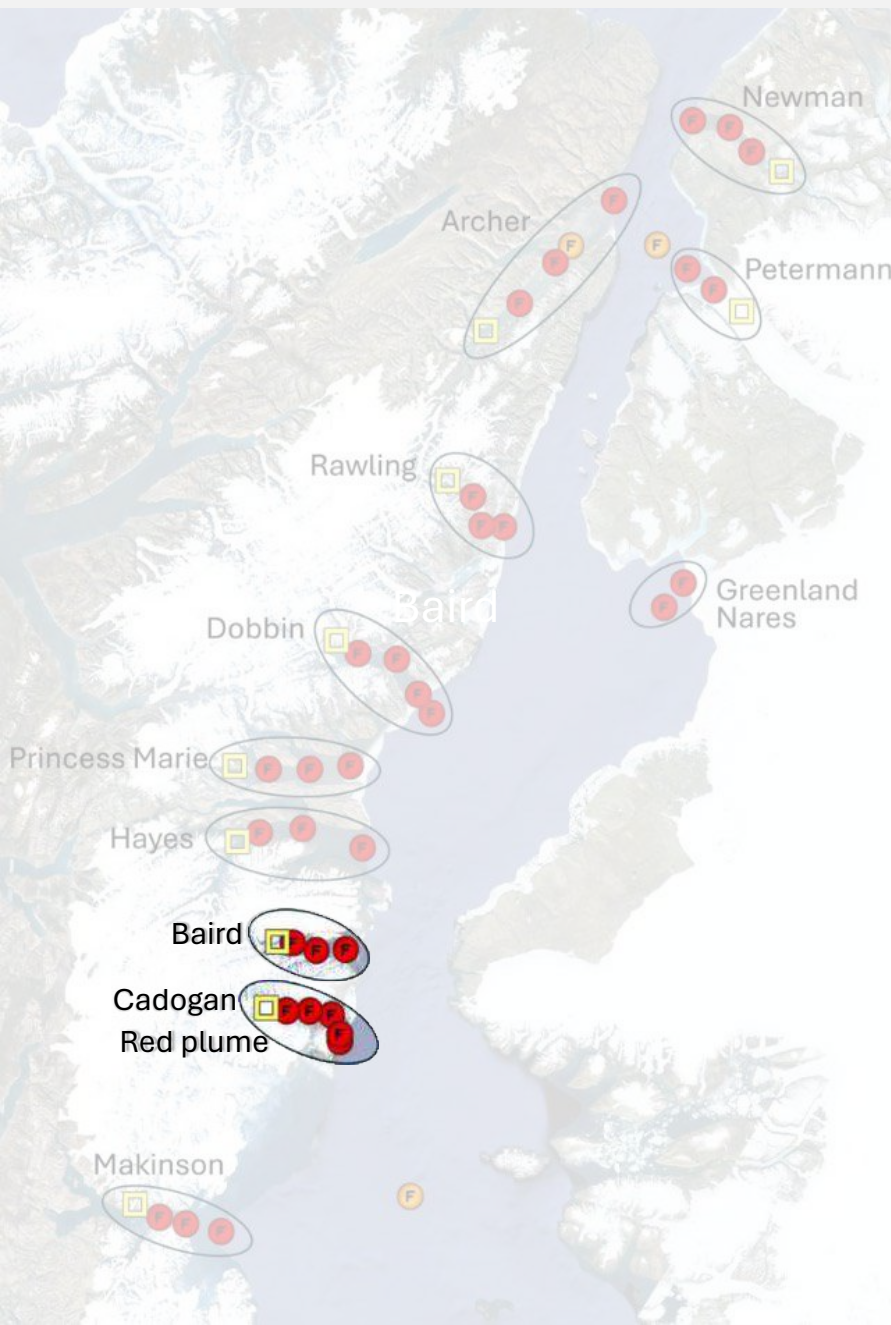


2024 Amundsen Leg 3

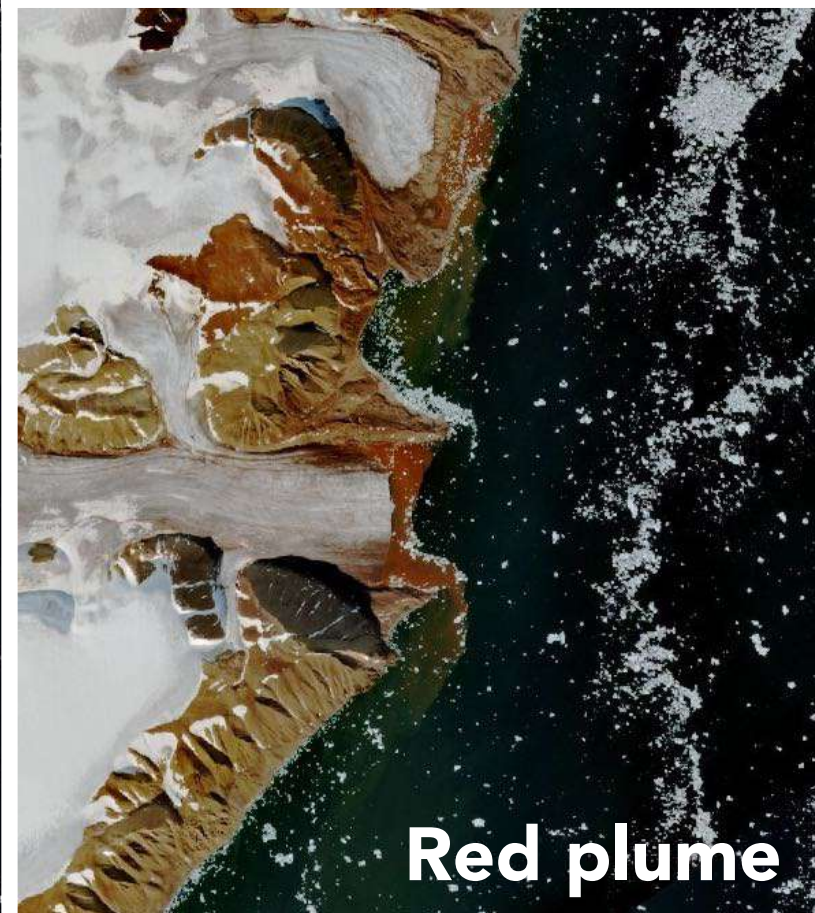
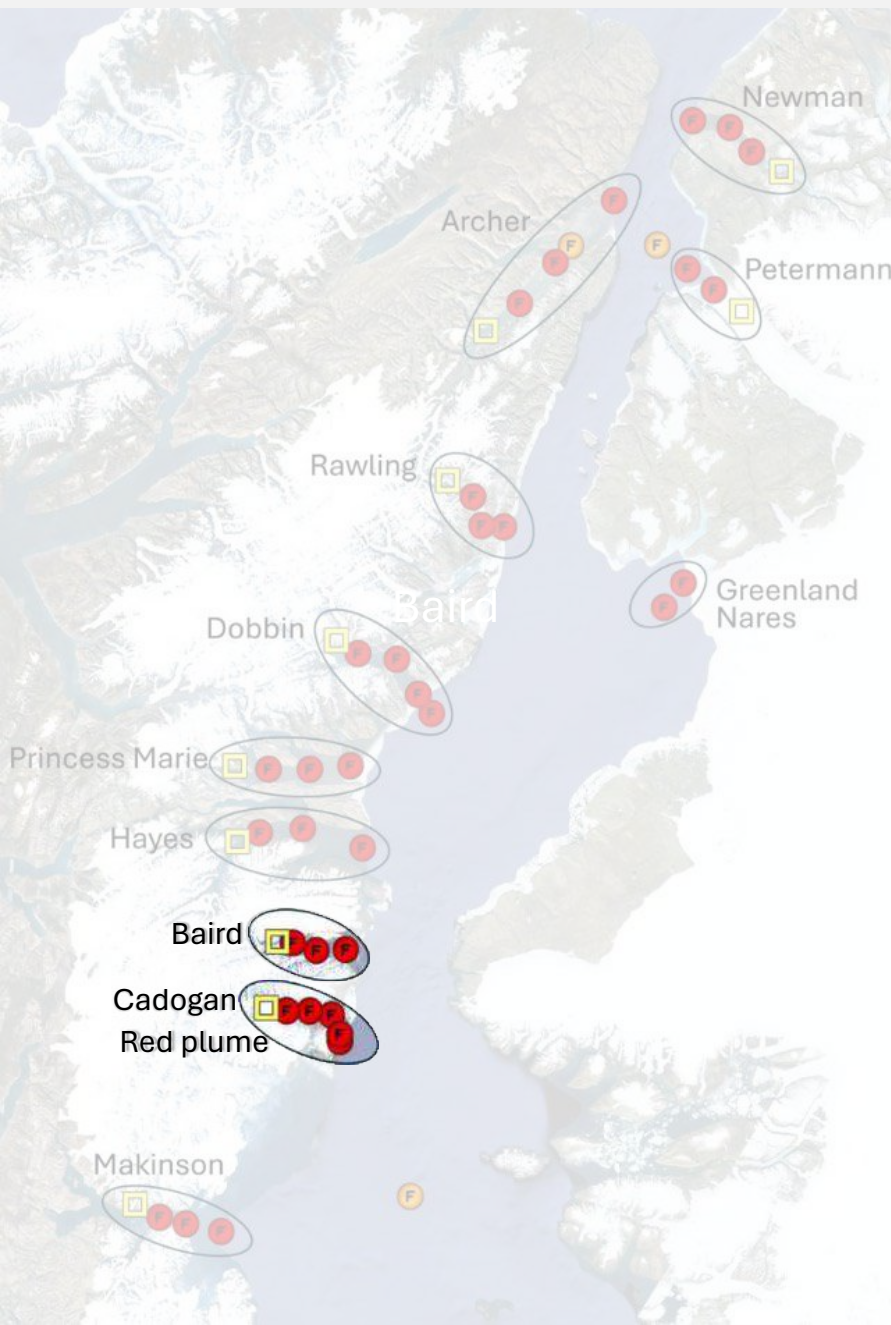


Credit: European Union, contains modified Copernicus Sentinel data 2024

2024 Amundsen Leg 3

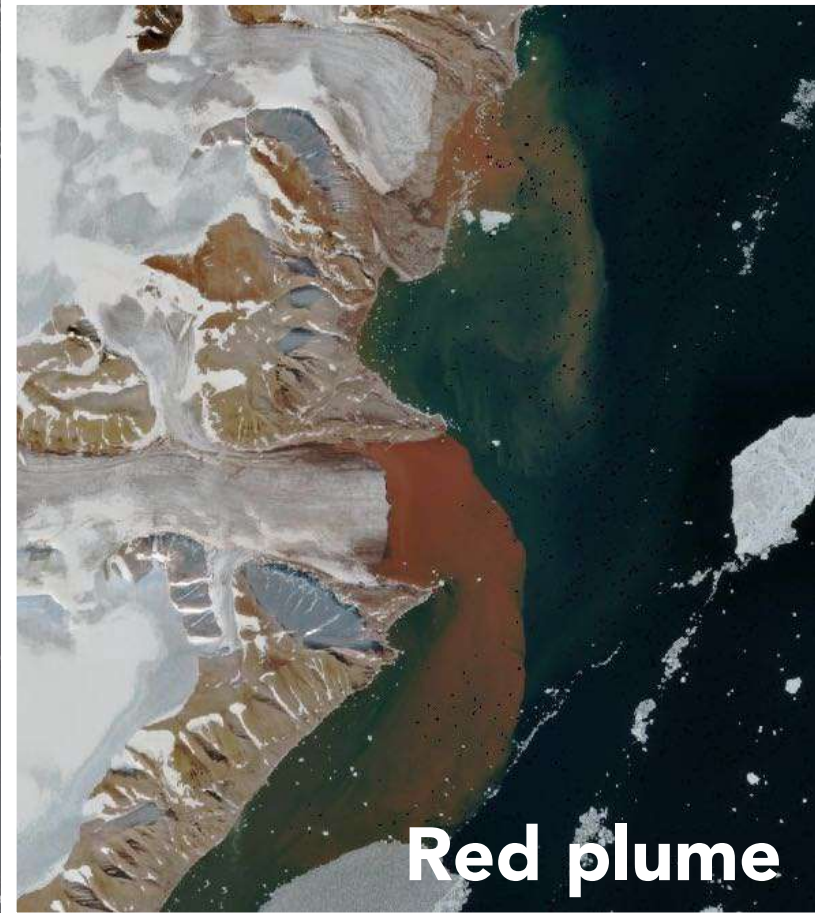
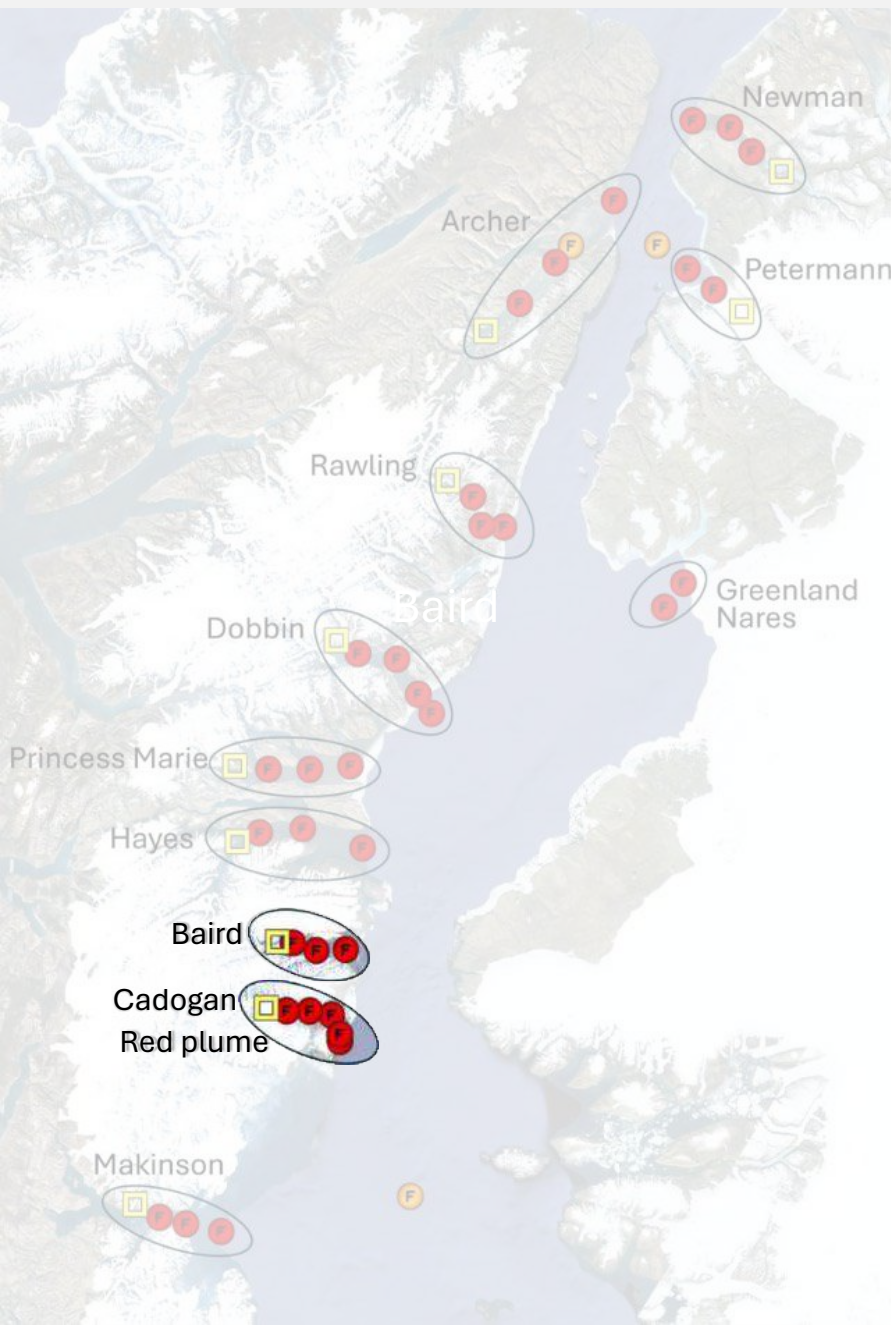


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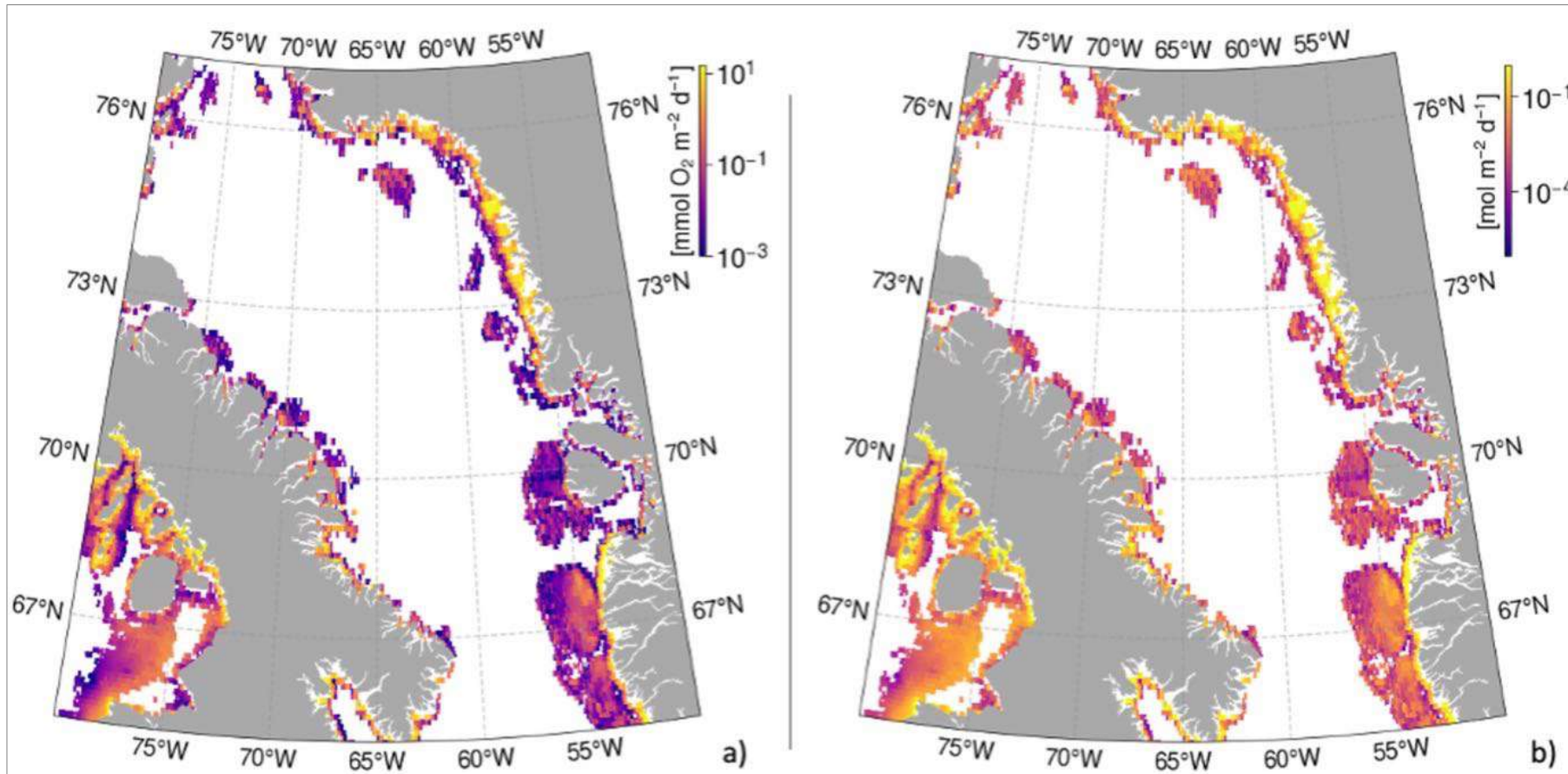
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2024 Amundsen Leg 3



New Activities

Determining benthic primary production by satellite (PhD Foucaut Tachon)



Map showing the BPP (a) derived from Sing *et al.* (2022) (a), and the PAR (b) at the seafloor for shallow waters (<100m) for August 2018 in the Baffin Bay.

Determining benthic primary production by satellite (PhD Foucaut Tachon)

PNAS

PERSPECTIVE



Seafloor primary production in a changing Arctic Ocean

Karl Attard^{a,b,c,1}, Rakesh Kumar Singh^{d,e}, Jean-Pierre Gattuso^{f,g}, Karen Filbee-Dexter^{c,h,i}, Dorte Krause-Jensen^{j,k}, Michael Kühl^l, Mikael K. Sejr^{j,k}, Philippe Archambault^{c,m}, Marcel Babin^c, Simon Bélanger^d, Peter Bergⁿ, Ronnie N. Glud^{a,b,o}, Kasper Hancke^p, Stefan Jänicke^q, Jing Qin^d, Søren Rysgaard^{k,r}, Esben B. Sørensen^d, Foucaut Tachon^c, Frank Wenzhöfer^{a,s,t}, and Mathieu Ardyna^c

Edited by James Elser, University of Montana Missoula, Polson, MT; received June 16, 2023; accepted January 16, 2024

Key findings:

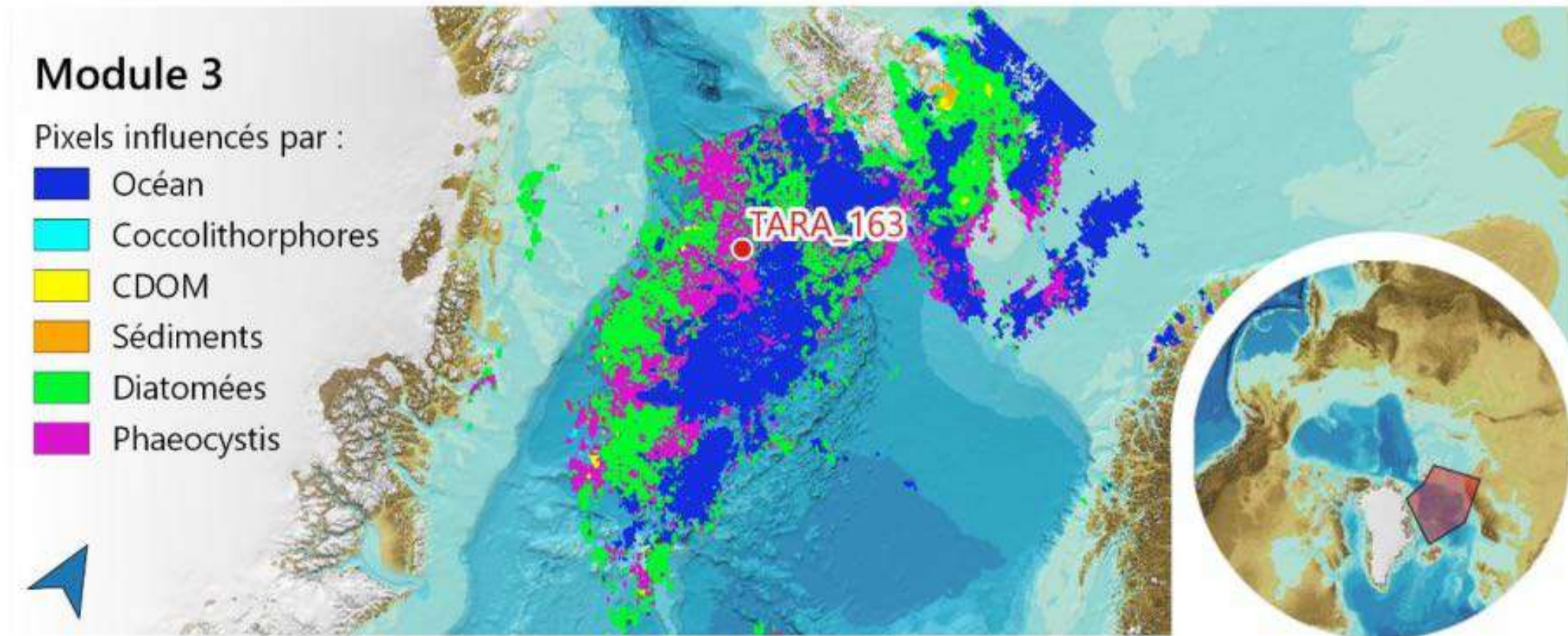
- Benthic primary production currently contribute $\sim 77 \text{ Tg C y}^{-1}$ of primary production to the Arctic, equivalent to ~ 20 to 35% of annual phytoplankton production

Since 2003, the Arctic seafloor area exposed to sunlight has increased by $\sim 47,000 \text{ km}^2 \text{ y}^{-1}$, expanding the realm of BPPs in a warming Arctic

Map showing the BPP (a) derived from Sing *et al.* (2022) (a), and the PAR (b) at the seafloor for shallow waters ($<100\text{m}$) for August 2018 in the Baffin Bay.

New Activities

Phytoplankton Functional Type algorithm (PhD Léna Bodiguel)

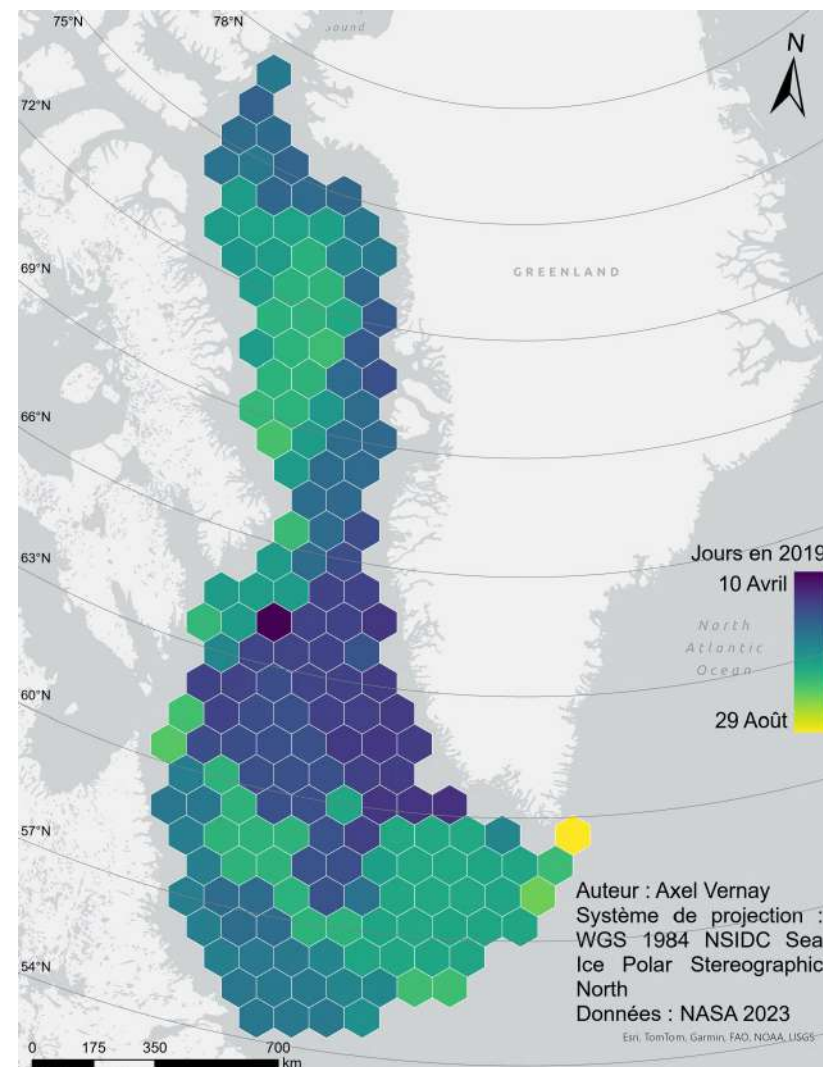
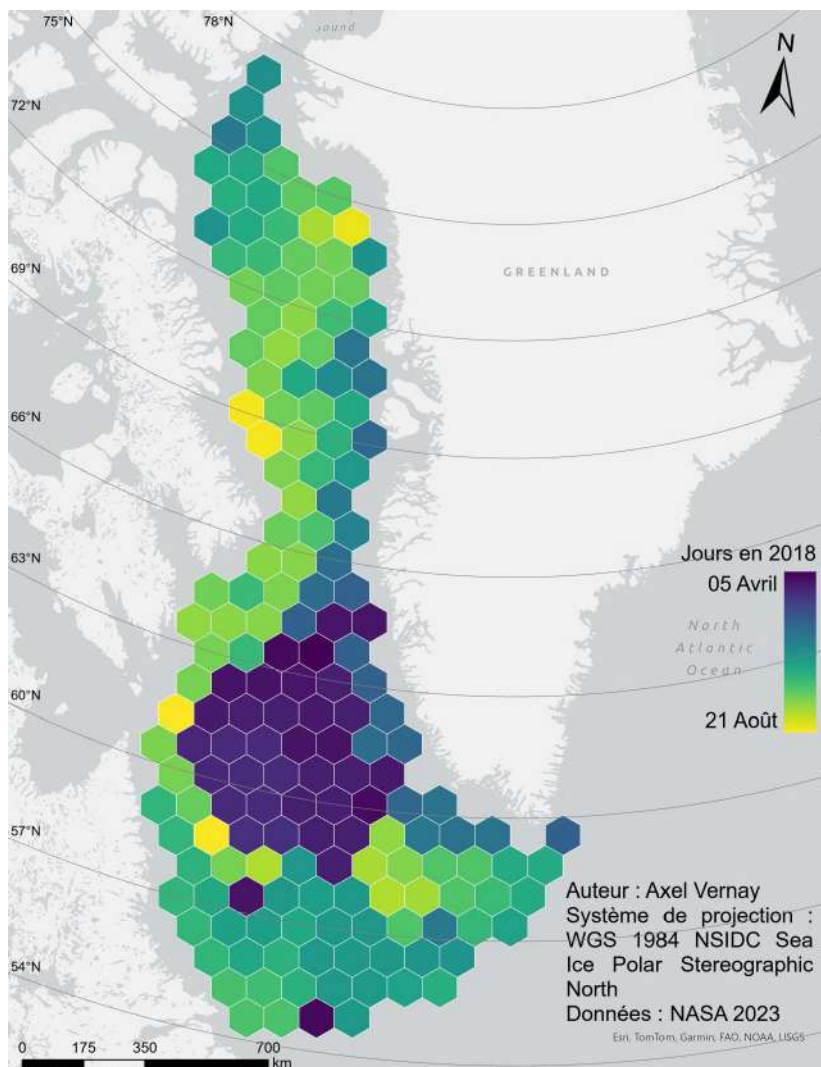


Source des données : MODIS-Aqua (2013/06/08)
Florence Ballot, d'après Orkney et al. (2020)

New Activities

Phytoplankton Functional Type algorithm (MSc Alex Vernay)

Bloom Timing



Conclusions & Perspectives

- Still some analysis to run from 2023 (HPLC, CDOM, SPM...).
- Preparing the next 56-day expedition in the Last Ice Area.
- Still some algorithm validation and implementation at high resolution (in particular for CDOM).
- Developing a new coupled benthic-pelagic high-resolution satellite-derived model (300 m).
- New activities fostered by CNES: benthic primary production, PFT algorithms, phenology, etc.

Questions?

Community Visit Grise Fiord (37 visitors)



REGARD SUR L'ARCTIQUE
CATEGORIES LONGS FORMATS BLOGUES REPORTAGES VIDÉOS EYE ON THE ARCTIC

Le brise-glace Amundsen atteint des latitudes inédites dans l'Arctique

La rompighiaccio Amundsen raggiunge latitudini senza precedenti nell'Artico
2 mesi ago Colombano Russo

ICI Québec

Le brise-glace Amundsen atteint des latitudes inédites dans l'Arctique

Le Canada obtiendra ainsi des données d'importance dans un contexte de changements climatiques.

