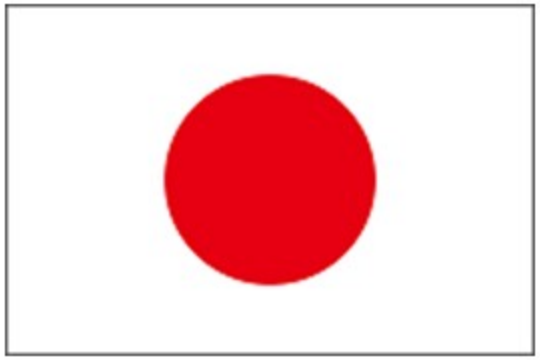
Pacific Arctic Group 2020 Spring Meeting
March 30, 2020
Zoom Information: https://eu01web.zoom.us/j/730805803

Country report: Update plans for 2020 field season with results for DBO and CAO

JAPAN



Shigeto Nishino

Japanese Arctic cruise in 2020

- R/V *Mirai* (MR20-05C)

  29 Aug (Shimizu, Japan) – 28 Oct (Sekinehama, Japan)

  PI: Shigeto Nishino, JAMSTEC

This cruise will be conducted under a new national project, ArCS II (JFY2020-2024) that is funded by Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan.

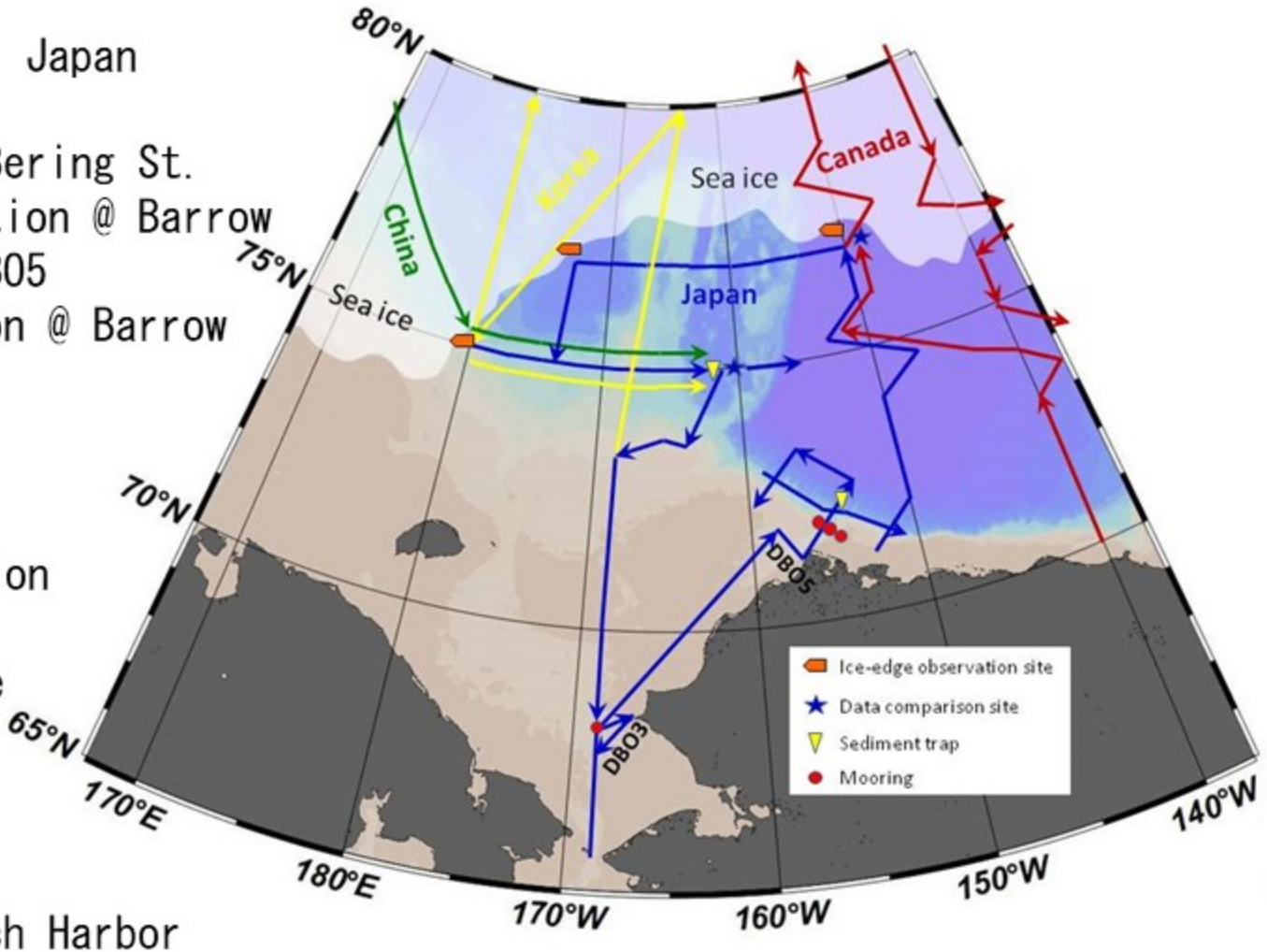
Cruise Plan: R/V Mirai Arctic cruise in 2020

Schedule (Tentative)

29 Aug: Leave Shimizu, Japan
7 Sep: Off Nome
8 Sep: Pass through Bering St.
11 Sep: Start observation @ Barrow
Moorings, DBO5
15 Sep: End observation @ Barrow

Canada Basin
150W Line
Joint with LSSL
Ice edge observation
Chukchi Borderland
Ice edge, 75N Line
Makarov Basin?
Chukchi Sea
168W Line, DBO3

11 Oct: Arrive in Dutch Harbor
14 Oct: Leave Dutch Harbor
27 Oct: In and out Hachinohe, Japan
28 Oct: Arrive in Mutsu Inst., JAMSTEC



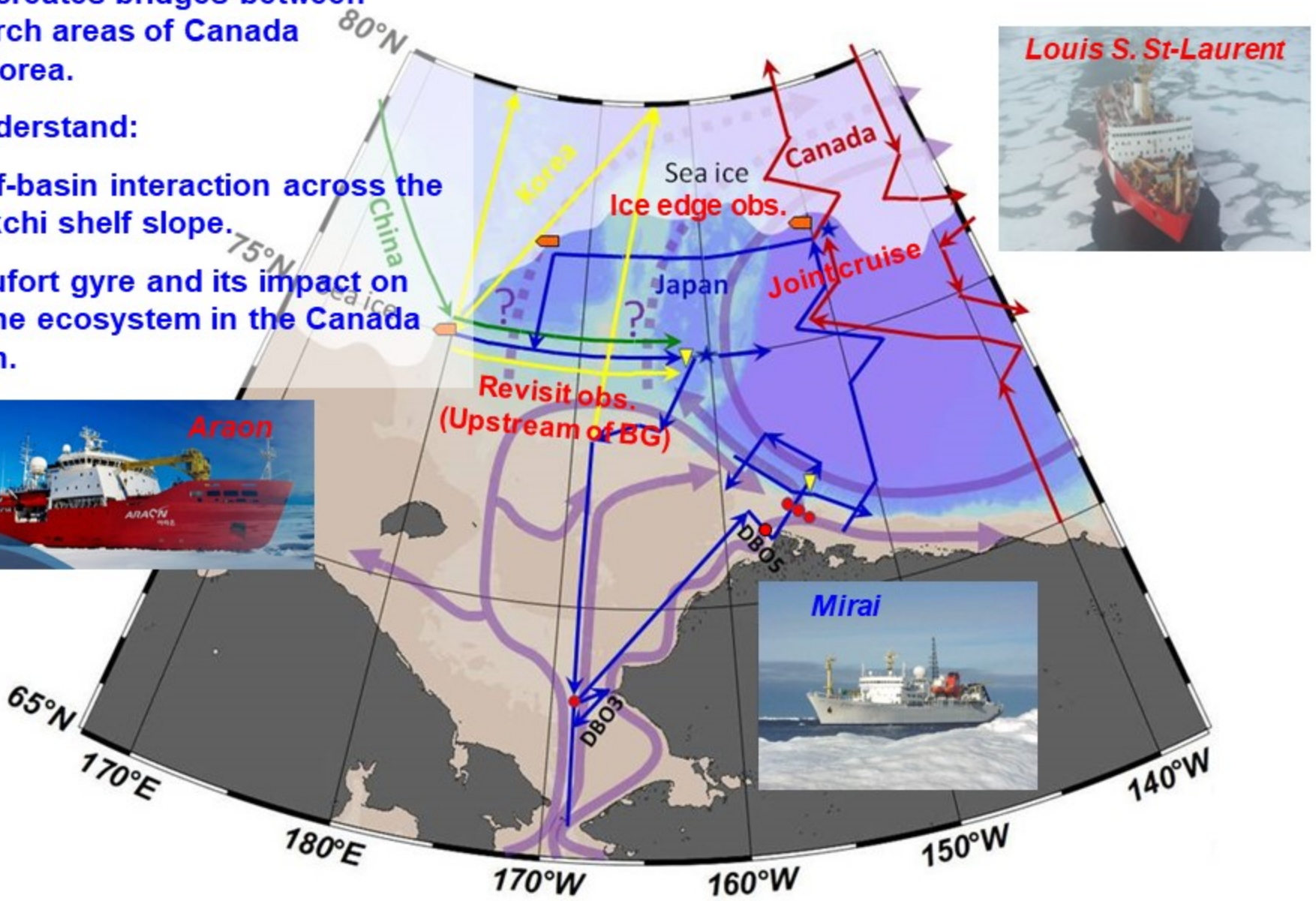
R/V Mirai cruise plan in 2020

Cruise Plan: R/V Mirai Arctic cruise in 2020

***Mirai* creates bridges between research areas of Canada and Korea.**

To understand:

- **Shelf-basin interaction across the Chukchi shelf slope.**
- **Beaufort gyre and its impact on marine ecosystem in the Canada Basin.**

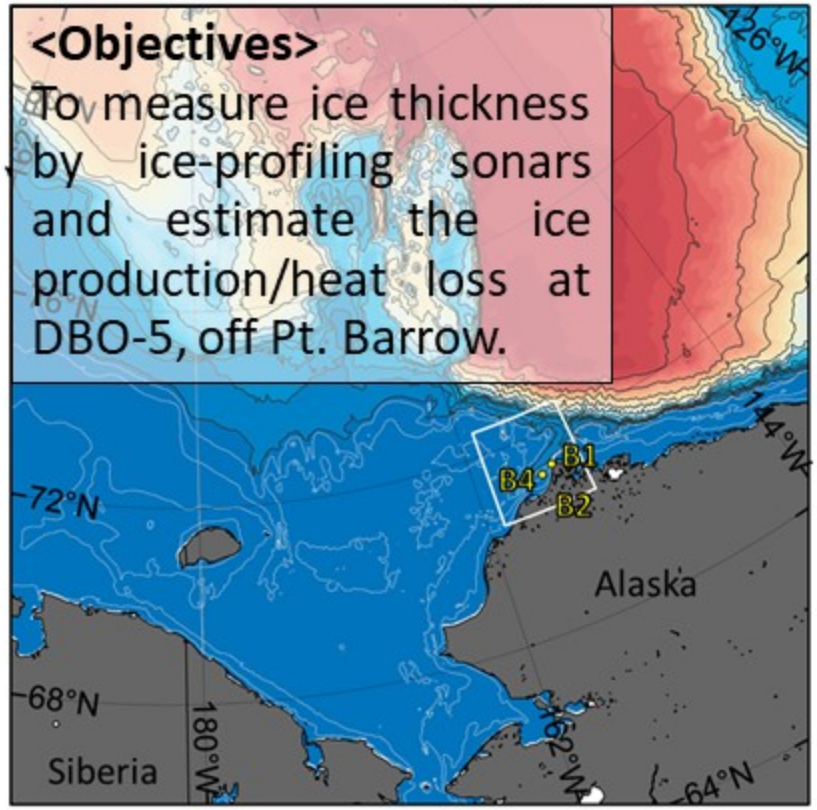


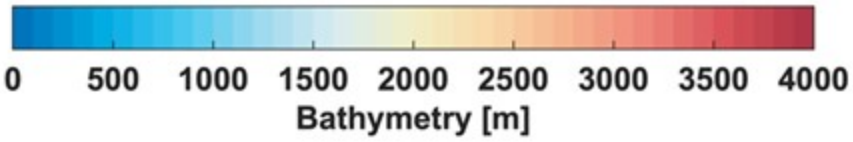
Sea-ice and oceanographic mooring operations by Hokkaido Univ. and UAF since 2009

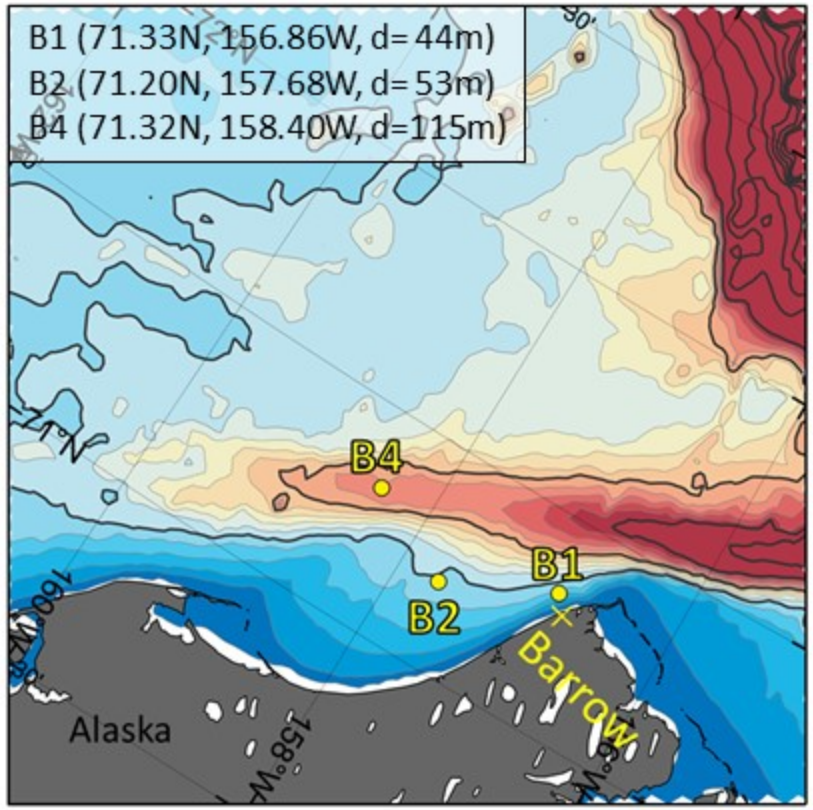
Hokkaido Univ.: Y. Fukamachi, K. I. Ohshima, D. Hirano, and M. Ito
UAF: A. R. Mahoney, H. Eicken, and J. Jones

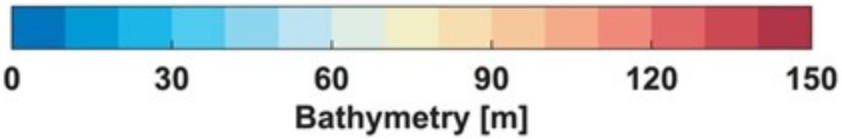
Mooring recoveries/deployments off Pt. Barrow

<Objectives>
To measure ice thickness by ice-profiling sonars and estimate the ice production/heat loss at DBO-5, off Pt. Barrow.



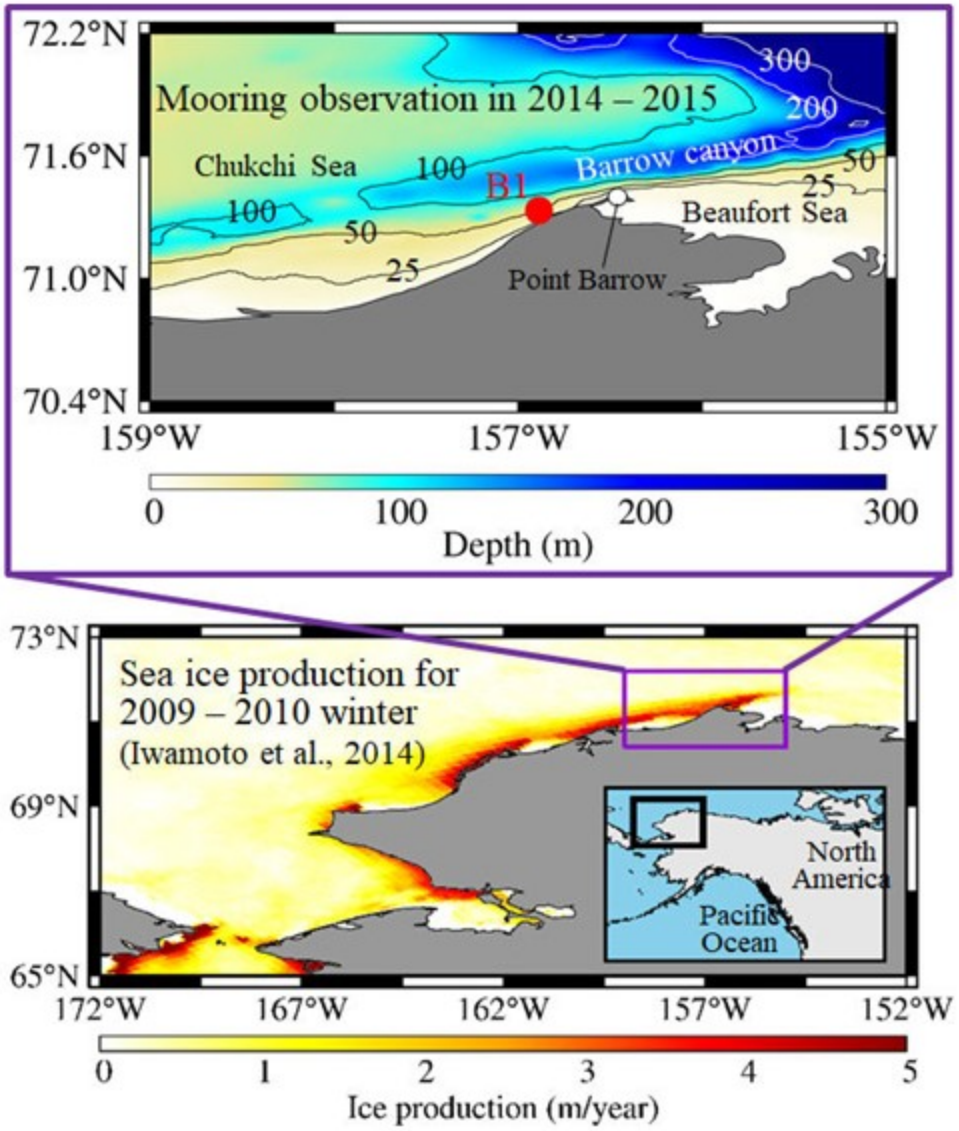


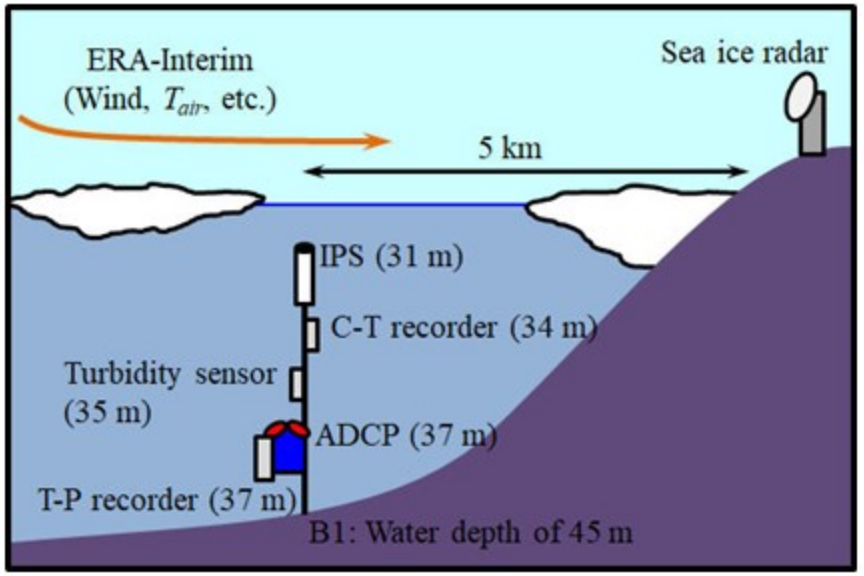


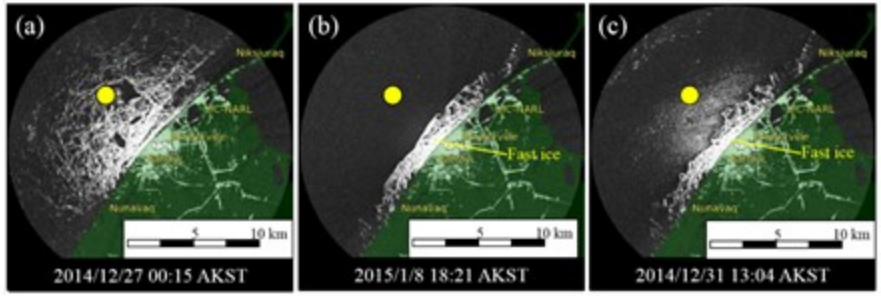


Favorable conditions for suspension freezing in an Arctic coastal polynya - Interaction between frazil ice and resuspended sediment -

Ito *et al.* [2019, *JGR Oceans*]



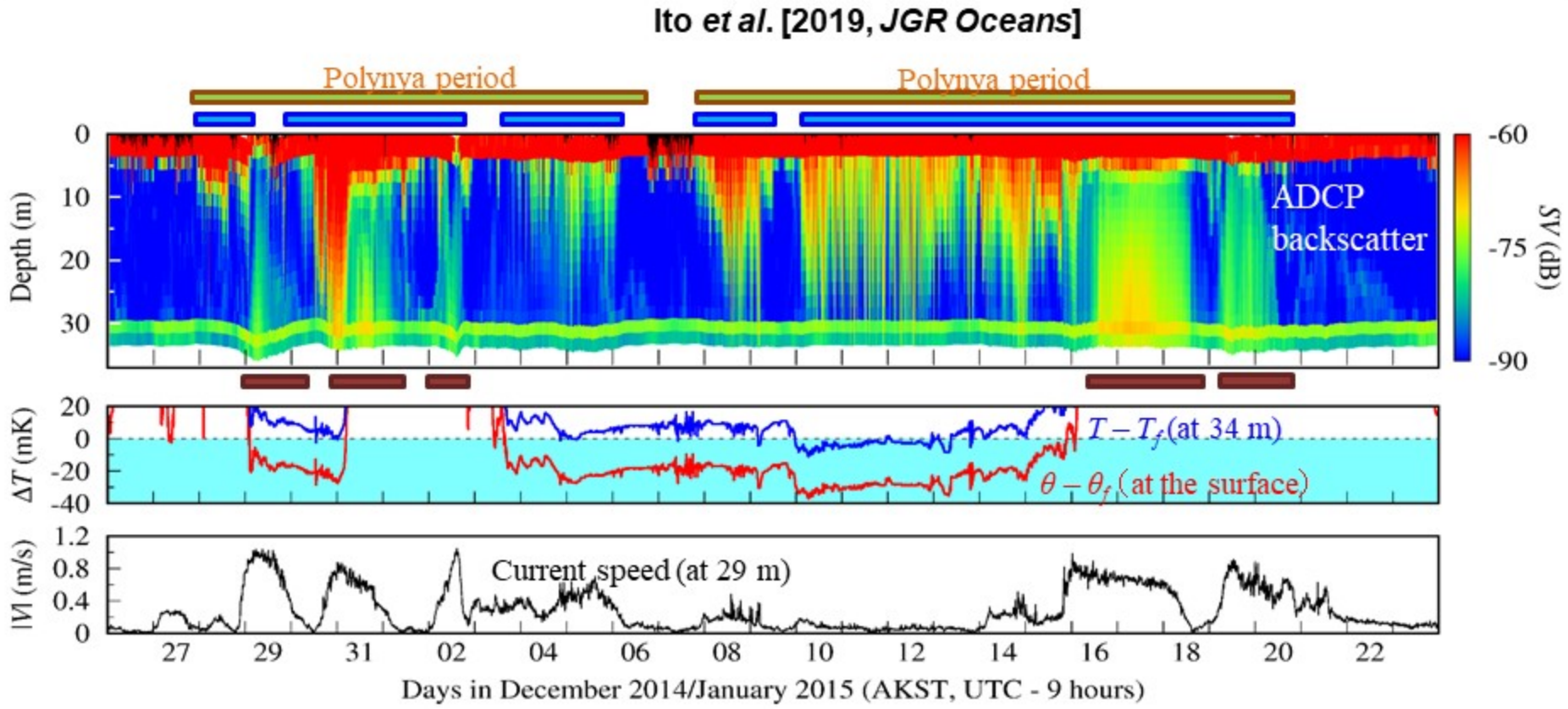


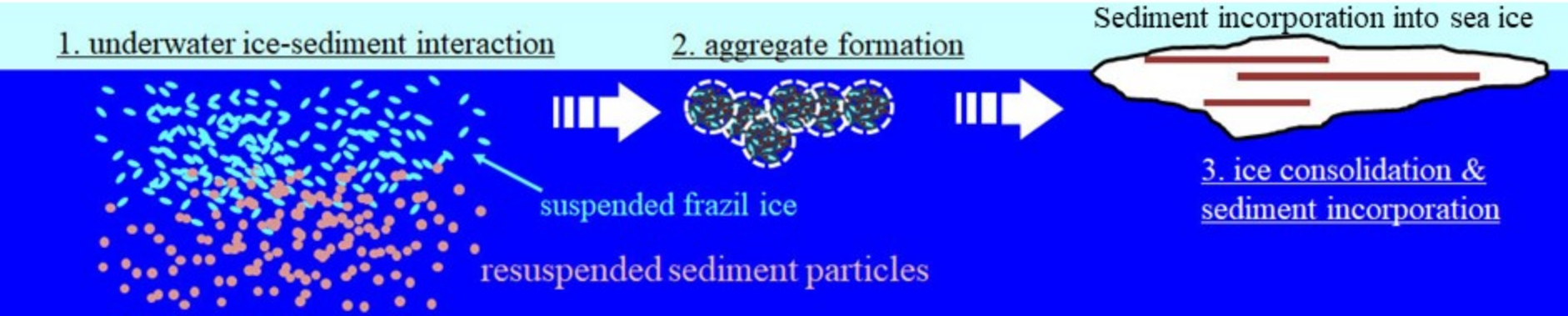


Sea ice radar imagery

- examine the sea ice condition around the mooring site (polynya presence, ice type such as frail/level ice)

Favorable conditions for suspension freezing in an Arctic coastal polynya
- Interaction between frazil ice and resuspended sediment -



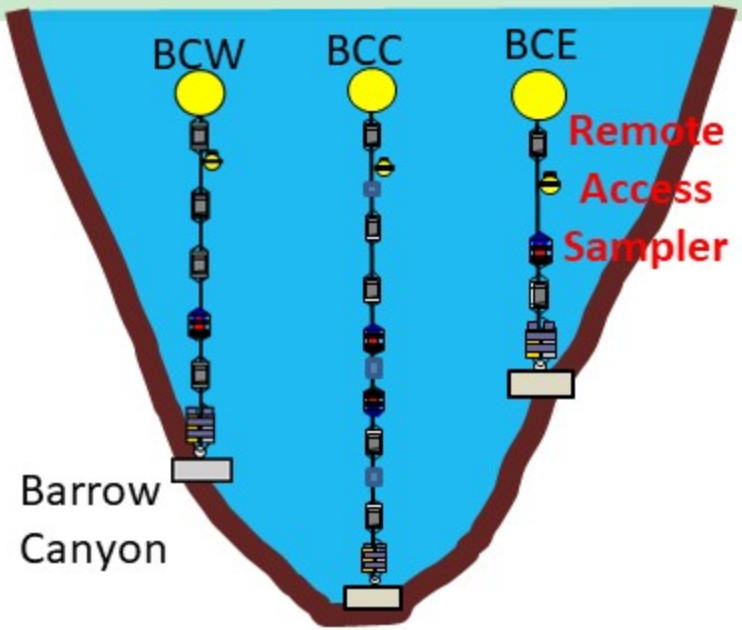


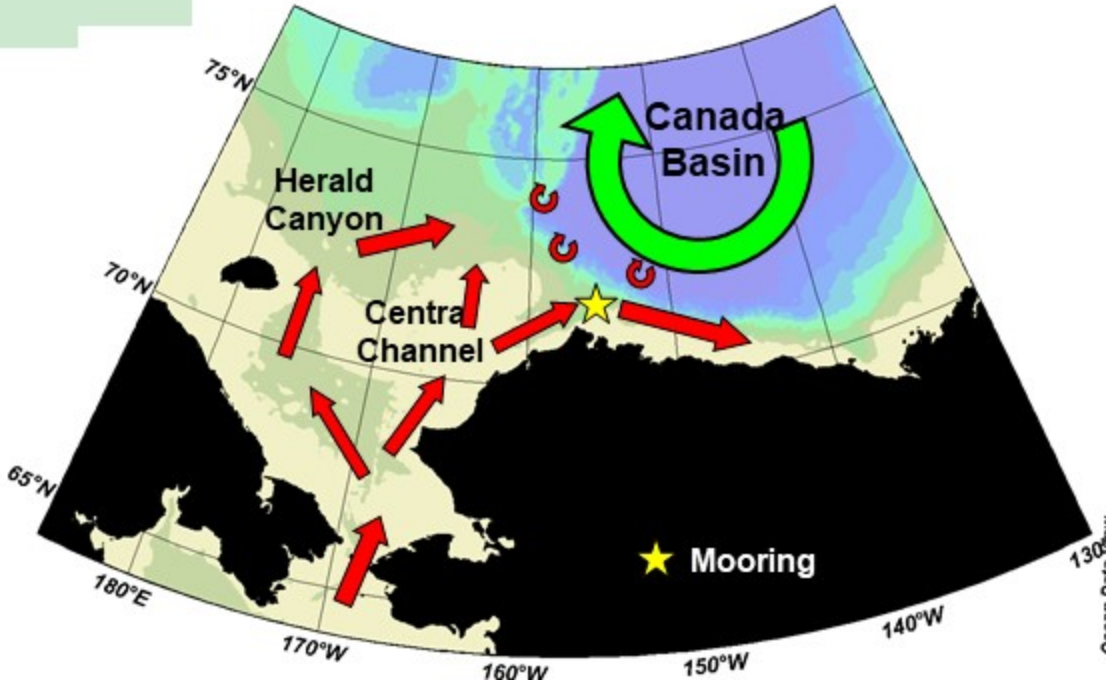
JAMSTEC mooring activities in the Barrow Canyon

R/V Mirai

<Objectives>

The goal of the monitoring efforts is to detect and quantify on-going changes in flows, water temperature, salinity, DO, nutrients, phyto- and zooplanktons from the Pacific to the Arctic Ocean.



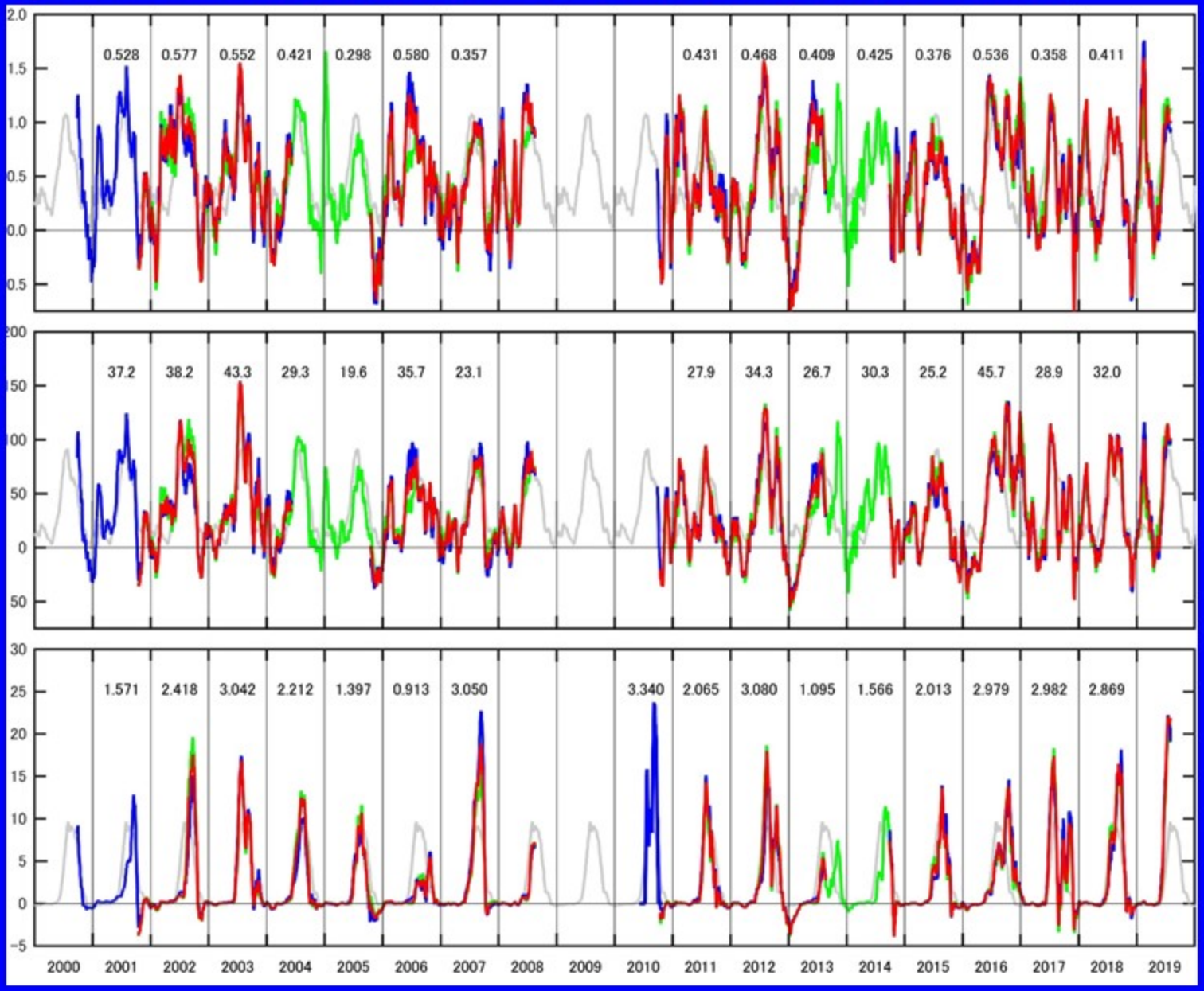


Barrow Canyon volume, fresh water and heat fluxes

Volume flux
0.46 Sv
(error 13%)

Freshwater flux
(ref. sal = 34.8)
33 mSv
(error 19%)

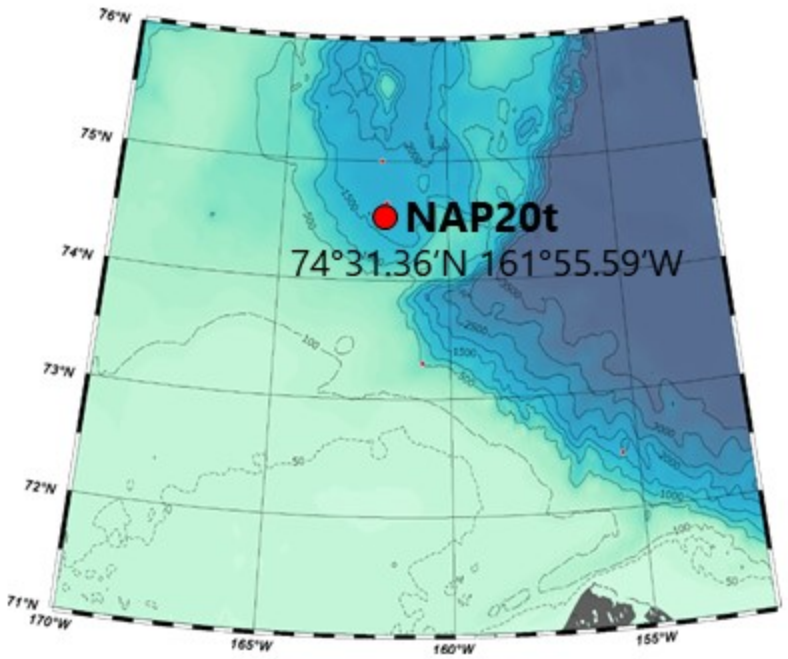
Heat flux
(ref. freezing temp)
2.39 TW
(error 8%)



+ Nutrient flux since 2020

Updated from Itoh et al., (JGR, 2013) and Itoh et al., (DSR I, 2015)

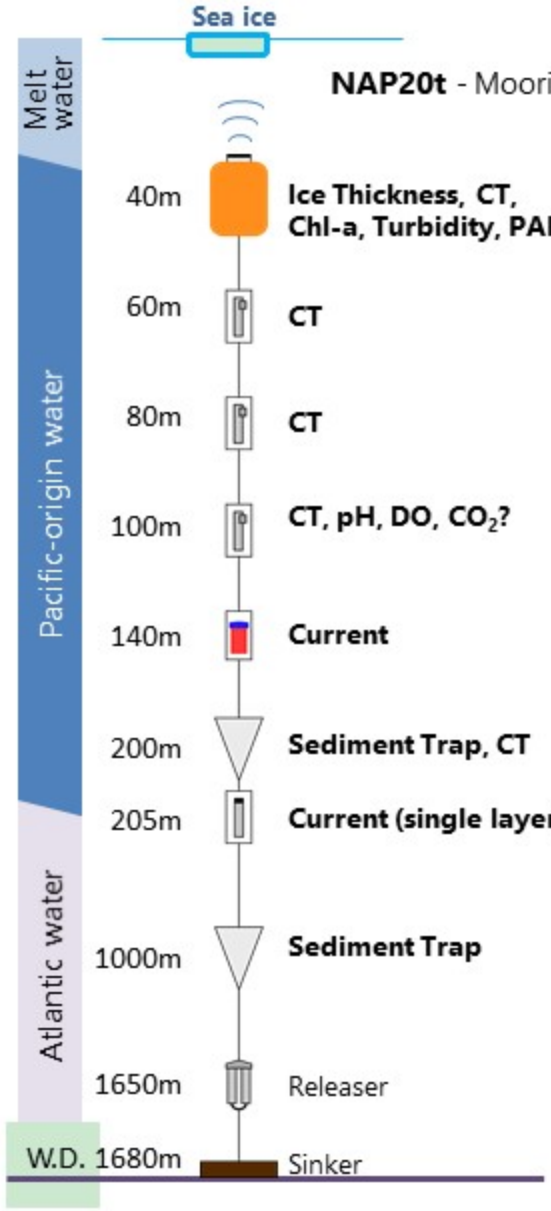
Deployment of one sediment-trap mooring



Redeployment at the same position as NAP13t
(Sep. 2013- Sep. 2014)

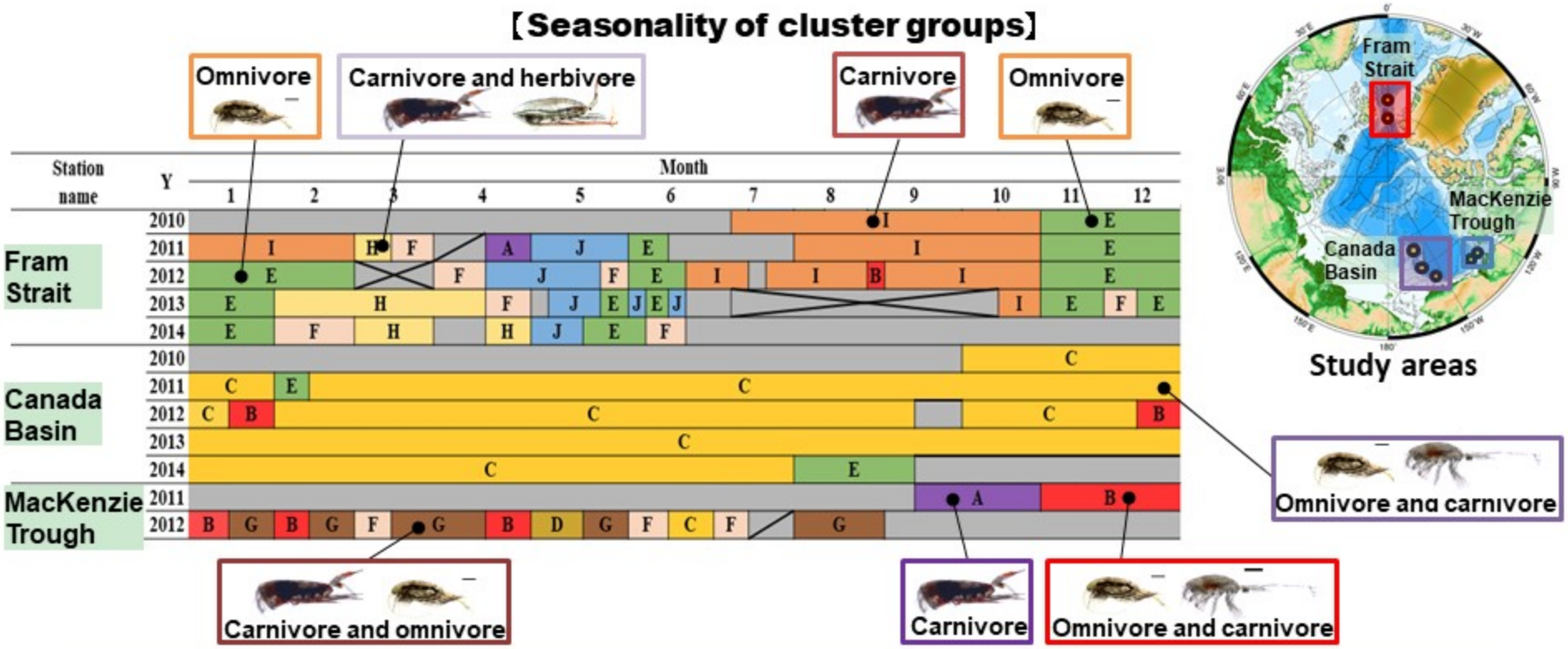
Monitoring of sea ice condition, hydrographic condition of Pacific-origin water layer, and settling particles.

For
- Physical oceanographic study
- Study on vertical and lateral transportation of settling particles.
- Study on plankton and ice-algae communities based on sediment trap samples.



Regional comparison of seasonal changes on copepod community structure in the Arctic Ocean

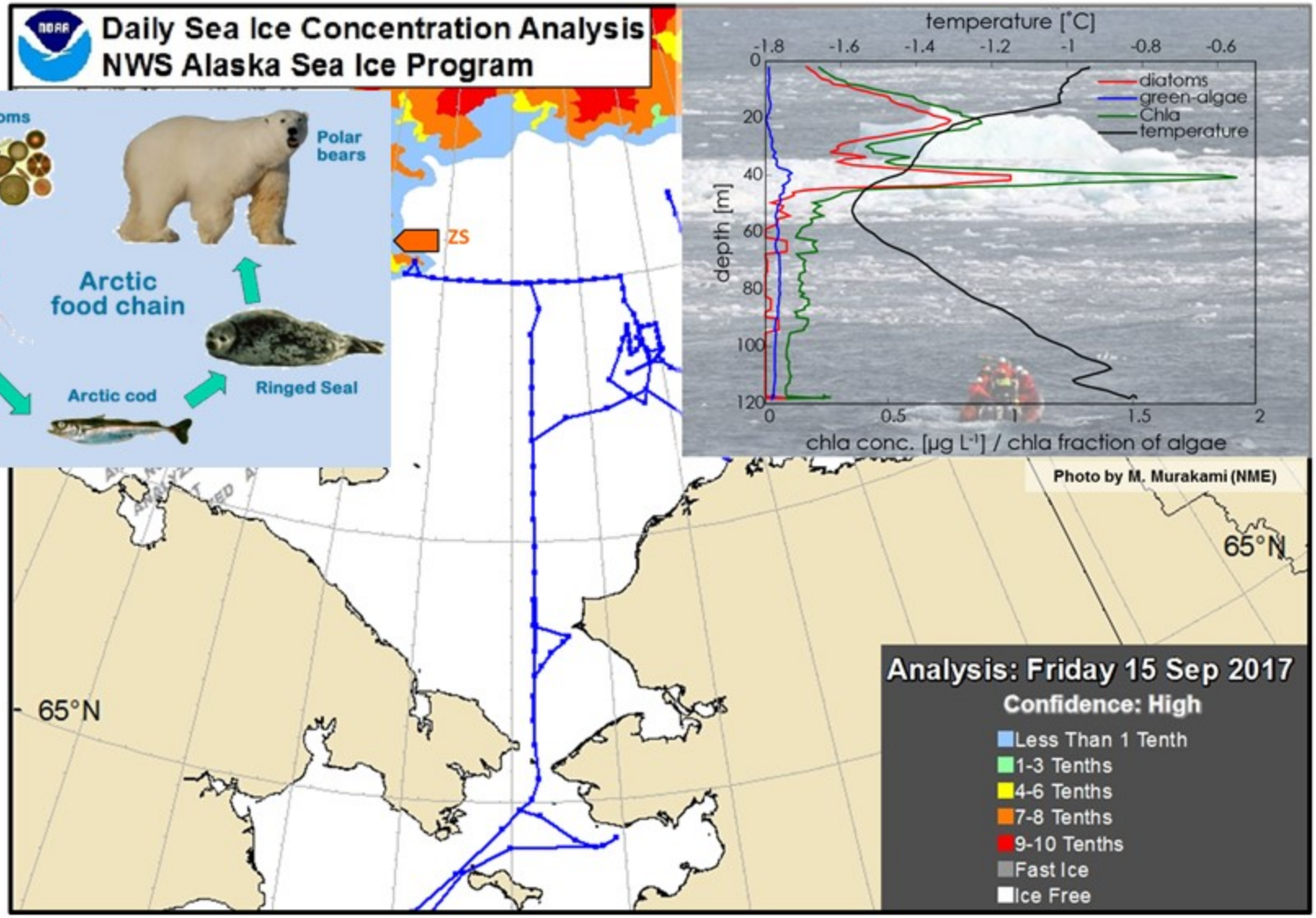
Tokuhiro *et al*, [2020, Polar Science]



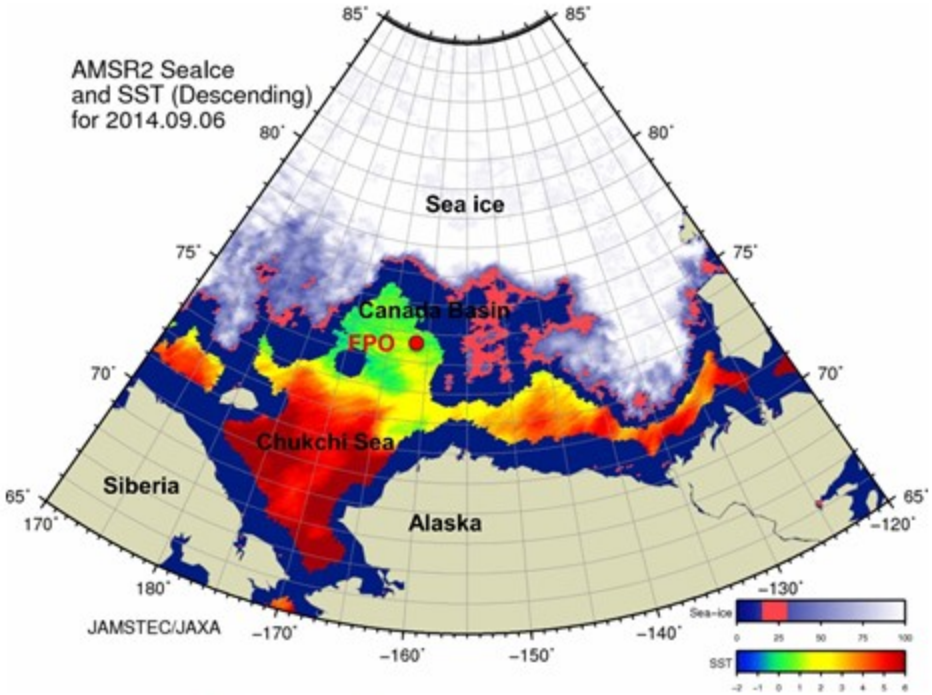
- ✓ Seasonality of copepods community structure collected by sediment trap were compared by region within Arctic Ocean
- ✓ Remarkable seasonality in Fram Strait, no seasonality in Canada Basin and short-term change in MacKenzie Trough at 200 m depth
- ✓ It was thought to be caused by various factors, not only sea ice seasonality but also in currents patterns, endemic species and magnitude of primary production.

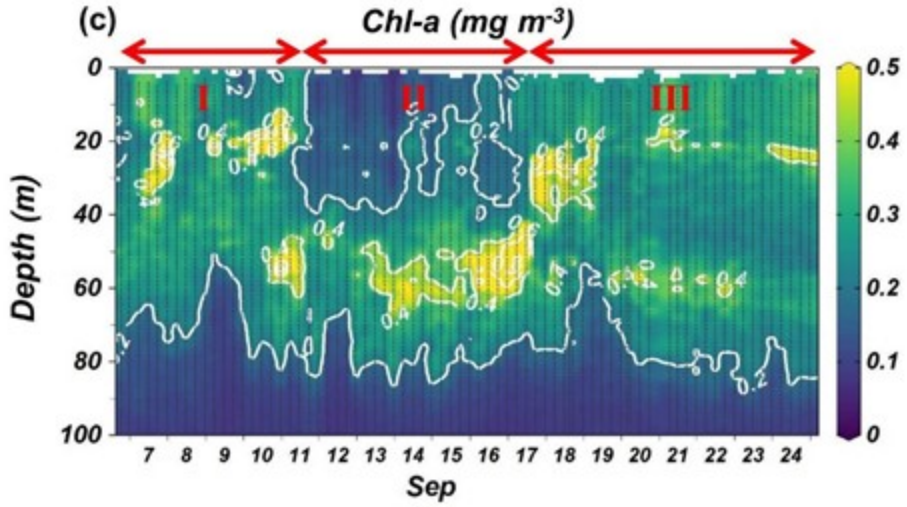
Results from the R/V Mirai Arctic Ocean cruise in 2017

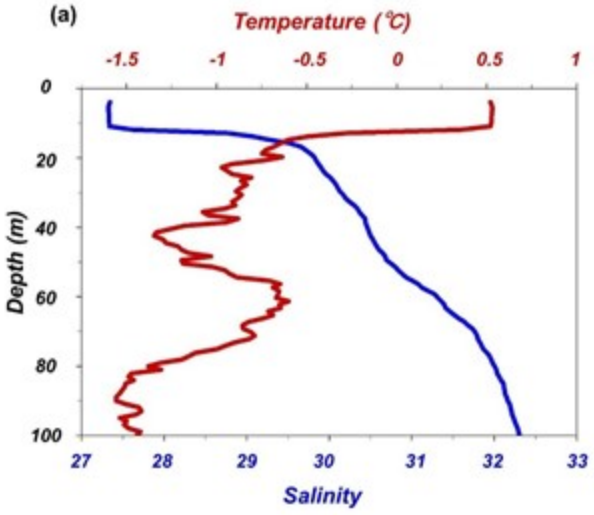
Zodiac boat survey in an ice-edge area

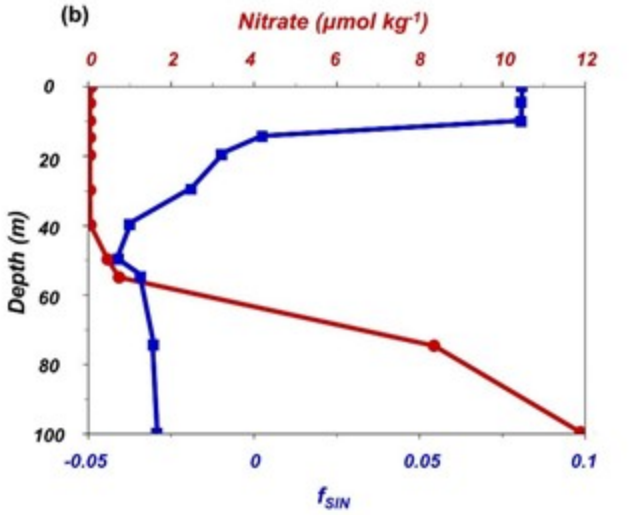


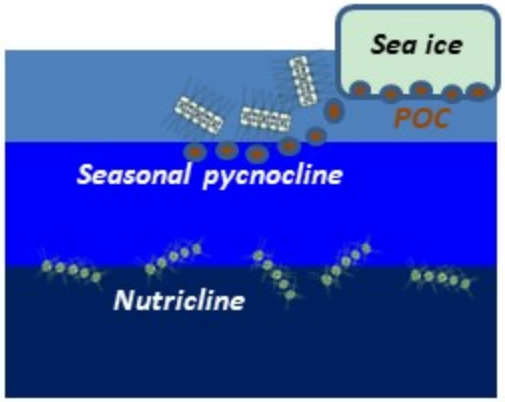
Results from the R/V Mirai Arctic Ocean cruise in 2014





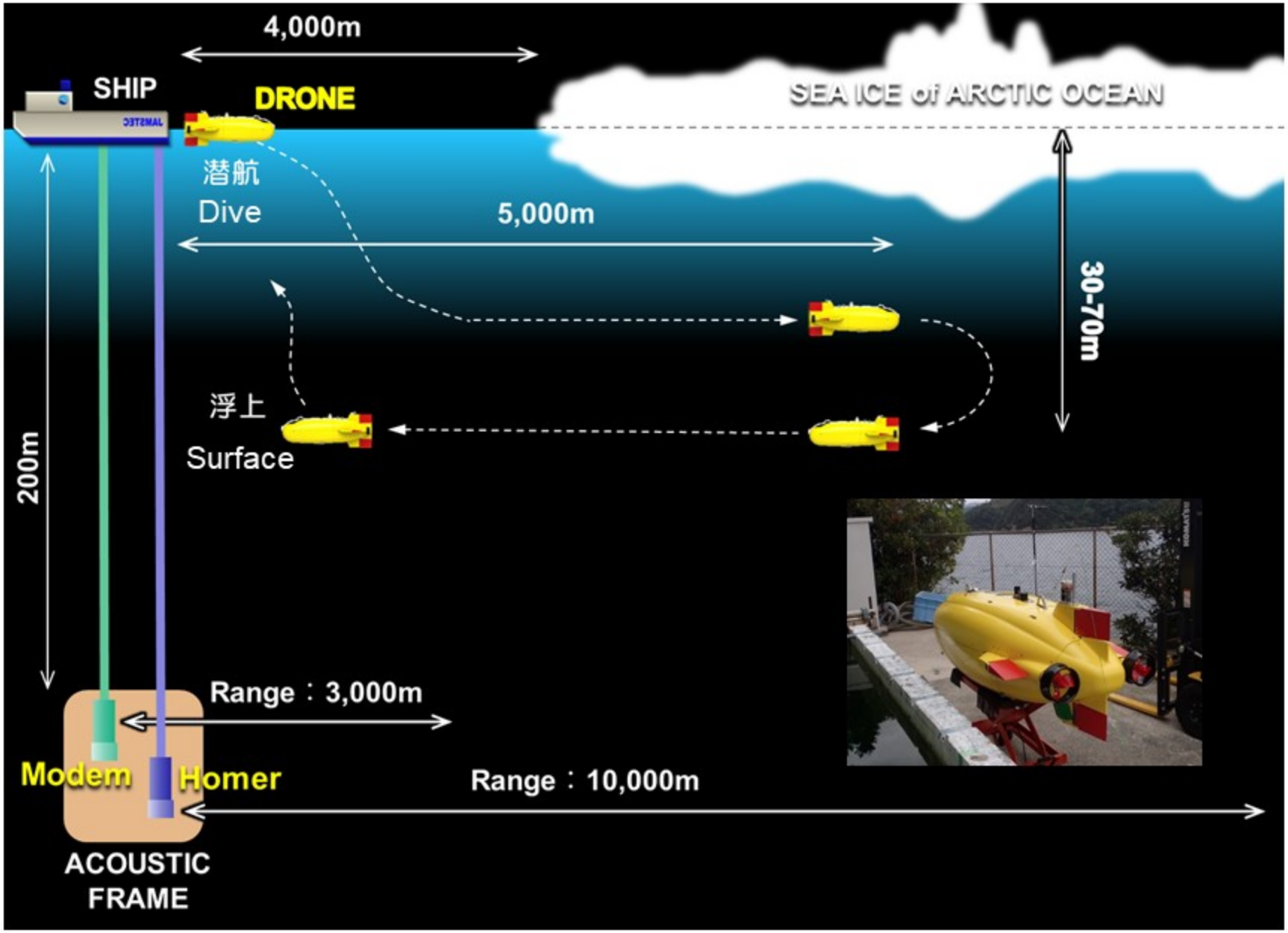






Nishino *et al.* [2020; JGR]

Sea trials in the Arctic Ocean for an Underwater Smart Drone (USDA)



Other activities

CCGS Sir Wilfrid Laurier
Photo: K.MacGregor - CG 979

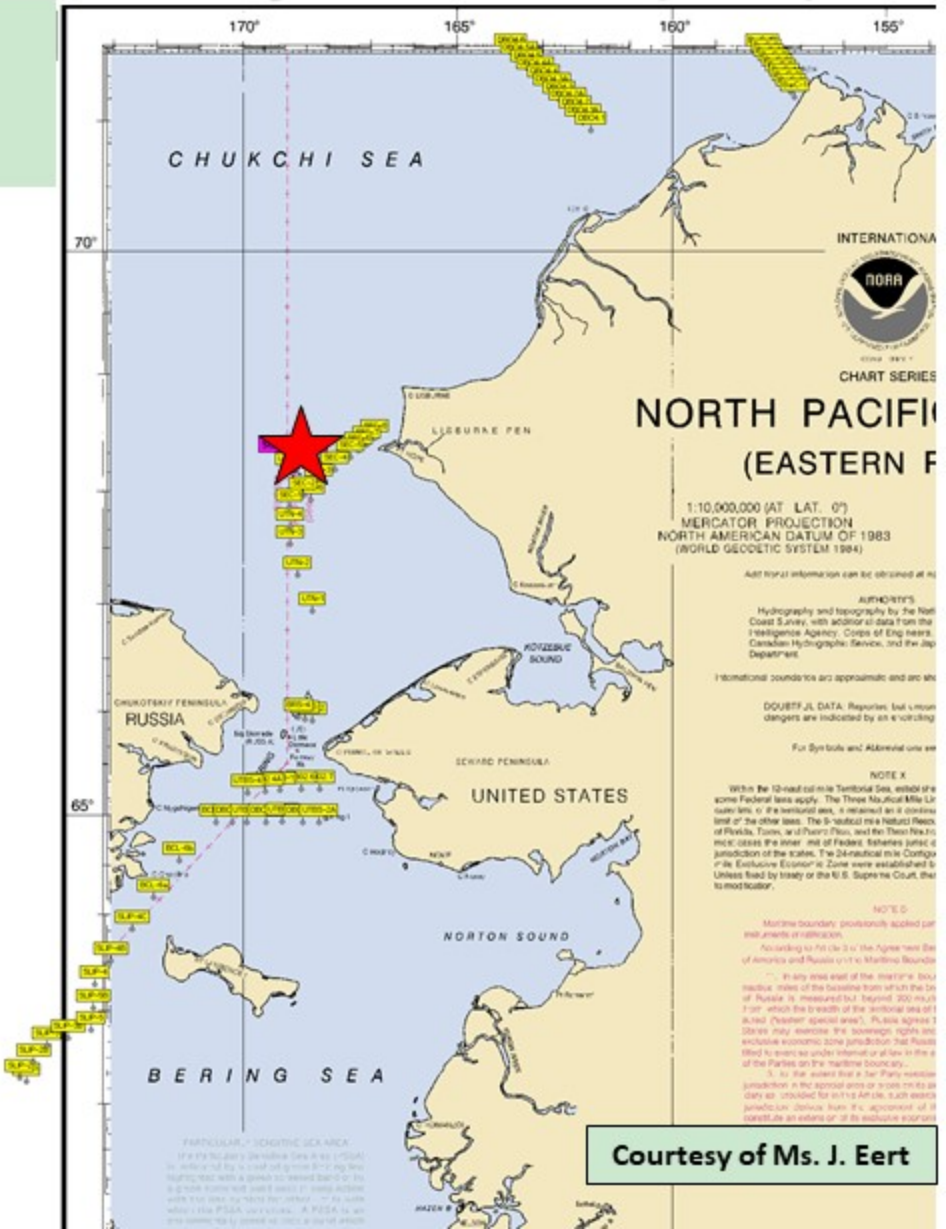
JAMSTEC mooring activities by Canadian Coast Guard Ship *Sir Wilfred Laurier* (SWL)

CCGS *Sir Wilfrid Laurier*

CCGS Sir Wilfrid Laurier
Photo: K.MacGregor - CO 579

Chief Scientist:
Jane Eert (IOS, Canada)
Participant:
Motoyo Itoh (JAMSTEC)
Period:
July 2nd – July 24th, Victoria to Barrow

★ **Recover one mooring at DBO3 hotspot off Pt. Hope.**



Courtesy of Ms. J. Eert

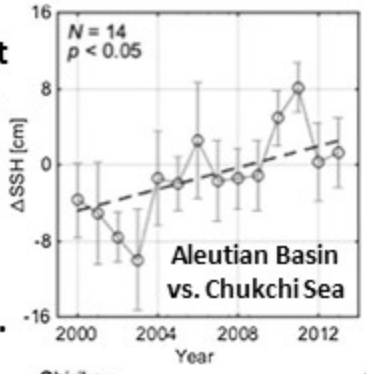
Recent change in benthic macrofaunal community composition in relation to physical forcing in the Pacific Arctic

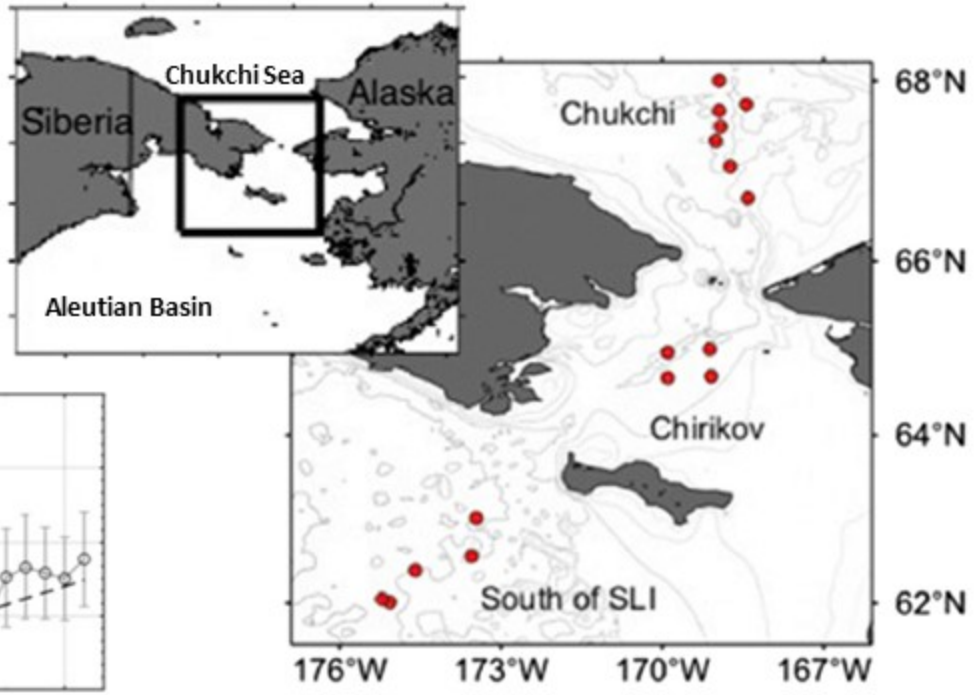
Waga *et al.* [2020, *Polar Biol.*]

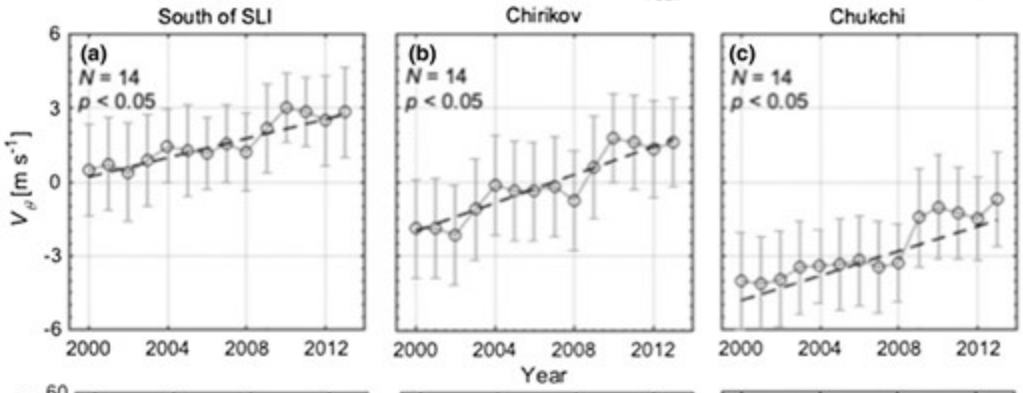
Increasing trends in the meridional sea level gradient (right panel) and local winds (a-c) over the 2000–2013 time period.

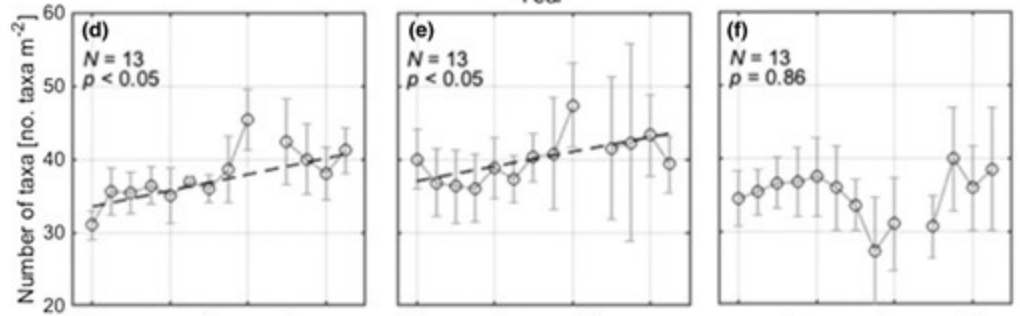
↓

Increased northward seawater volume transports.









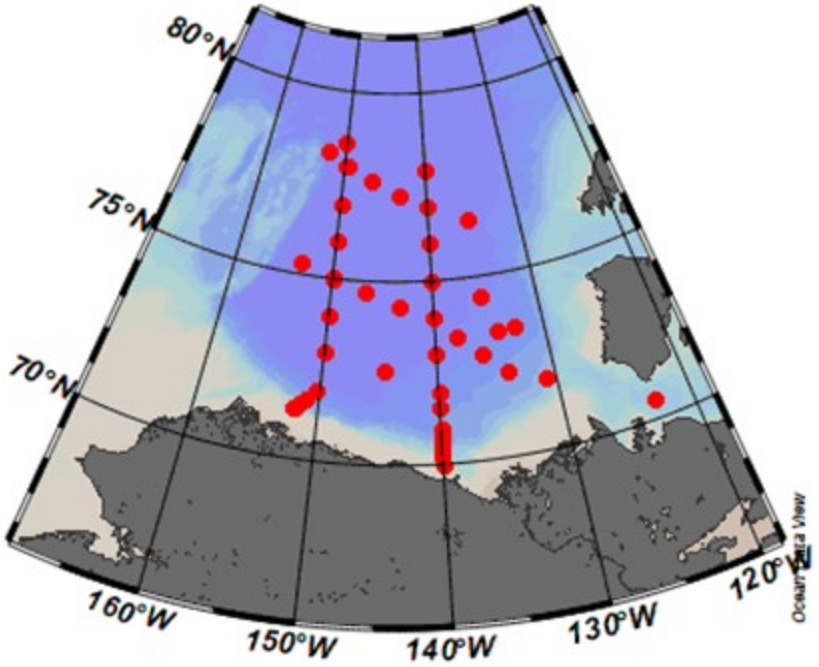
The number of macrofaunal taxa has increased significantly south of St. Lawrence Island and in the Chirikov Basin (d-f).

Our data suggest an increase in macrofaunal taxa type with increasing current transport northward into the Pacific Arctic region that could have a strong influence in restructuring the benthic ecosystem in this region in the future.

TUMSAT (Tokyo University of Marine Science and Technology) activities by Canadian Coast Guard Ship Louis S. St-Laurent (LSSL)

Water sampling ($\delta^{18}O$, DIC, TA) for monitoring of **freshwater content** and **Ω**

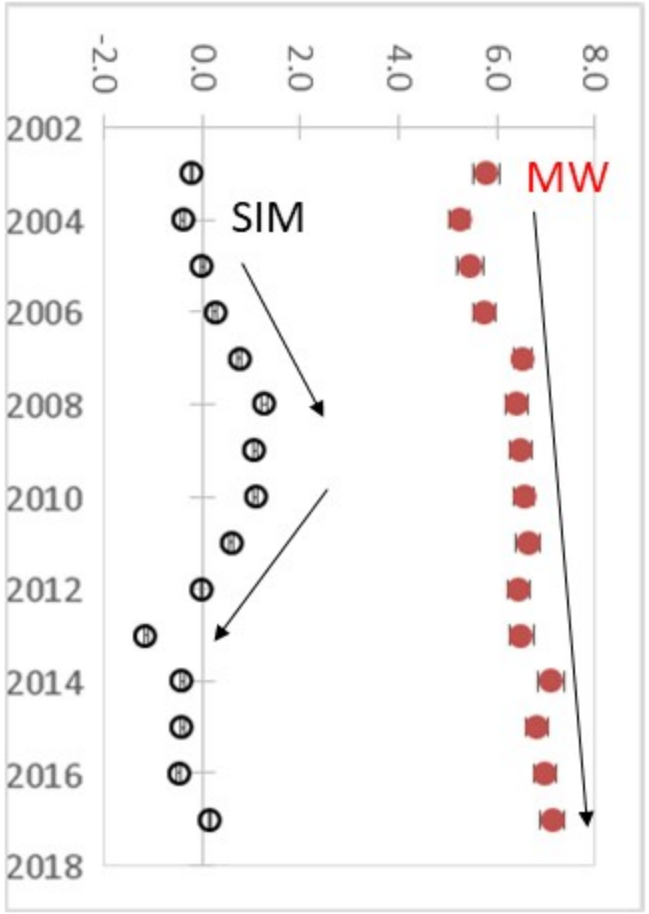
CCGS Louis S. St-Laurent



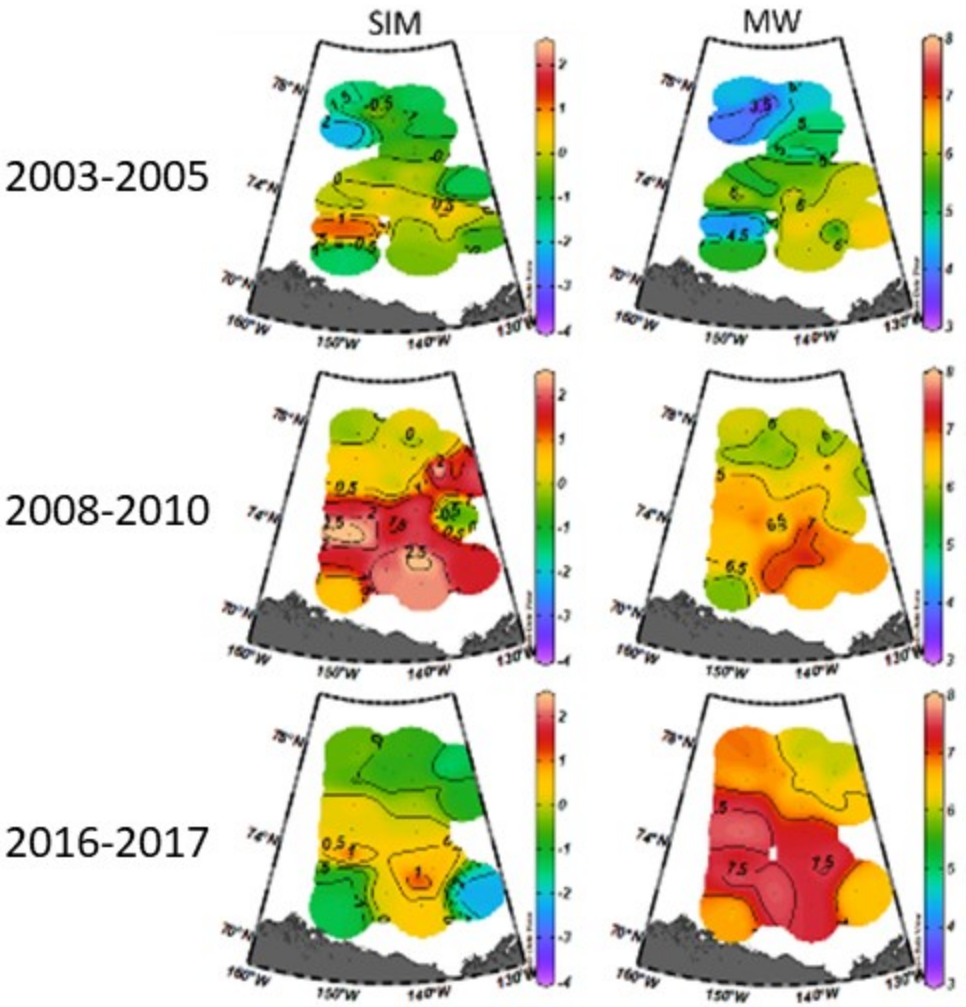
Chief Scientist:
Bill Williams (IOS, Canada)
Participant:
Michiyo Yamamoto-Kawai (TUMSAT)

Freshwater content in 0-50 m layer

FW inventory (m)

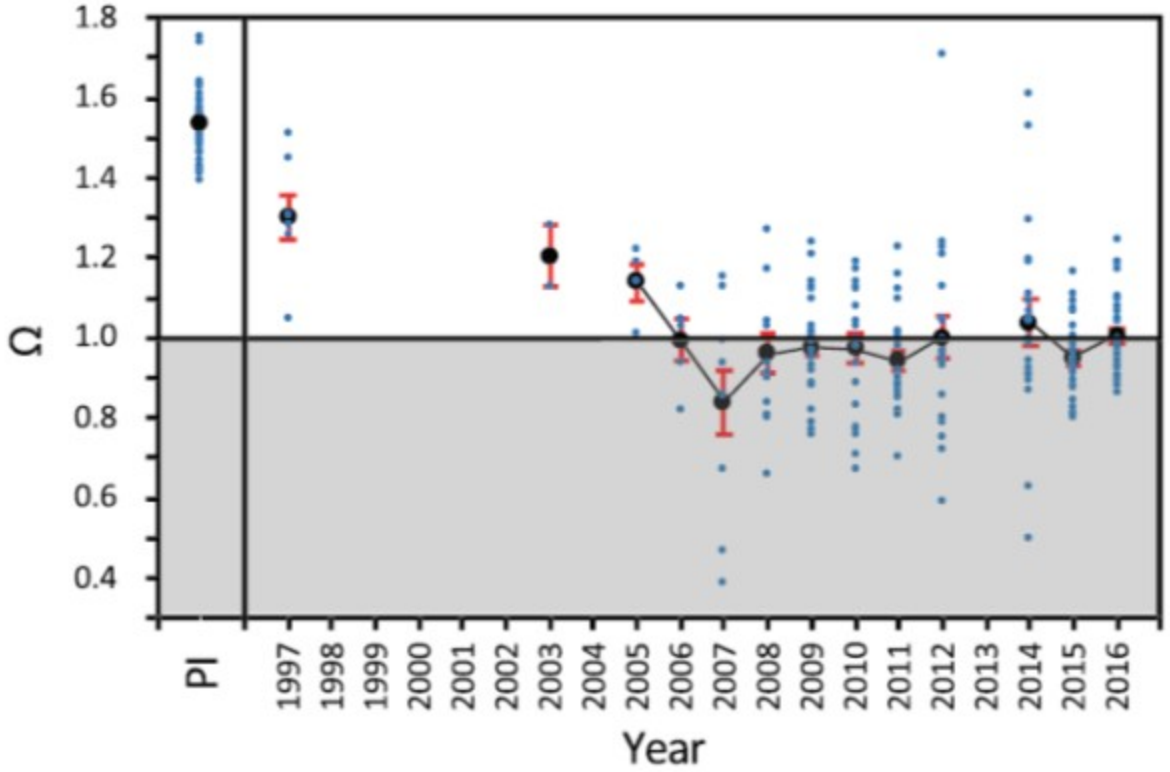


FW inventory (m)



Yamamoto-Kawai *et al.* [Pers. Comm.]

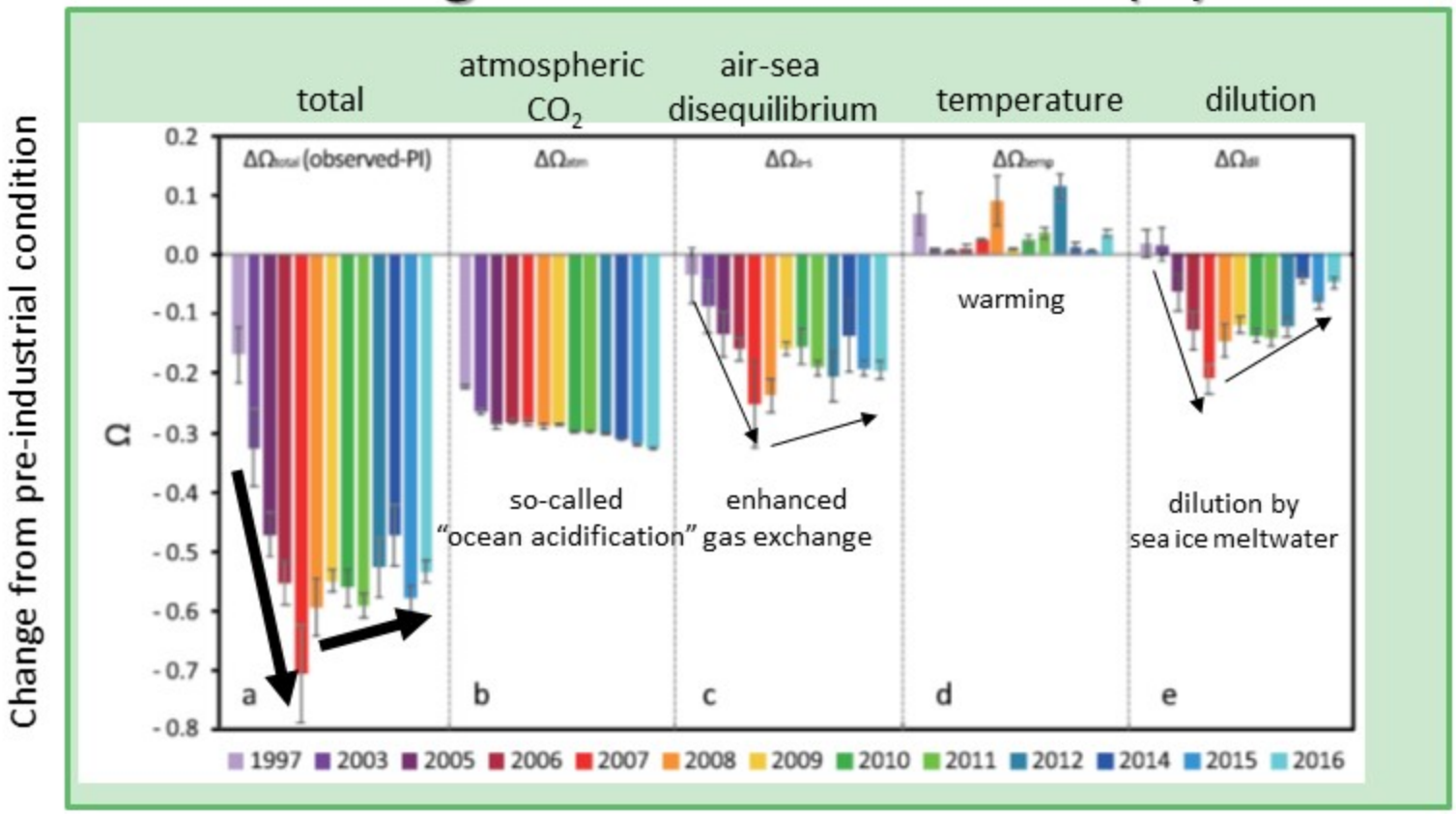
Aragonite saturation state (Ω)



$\Omega_{aragonite}$<1
for more than 10 years

Zhang *et al*. [2020; GRL]

Aragonite saturation state (Ω)



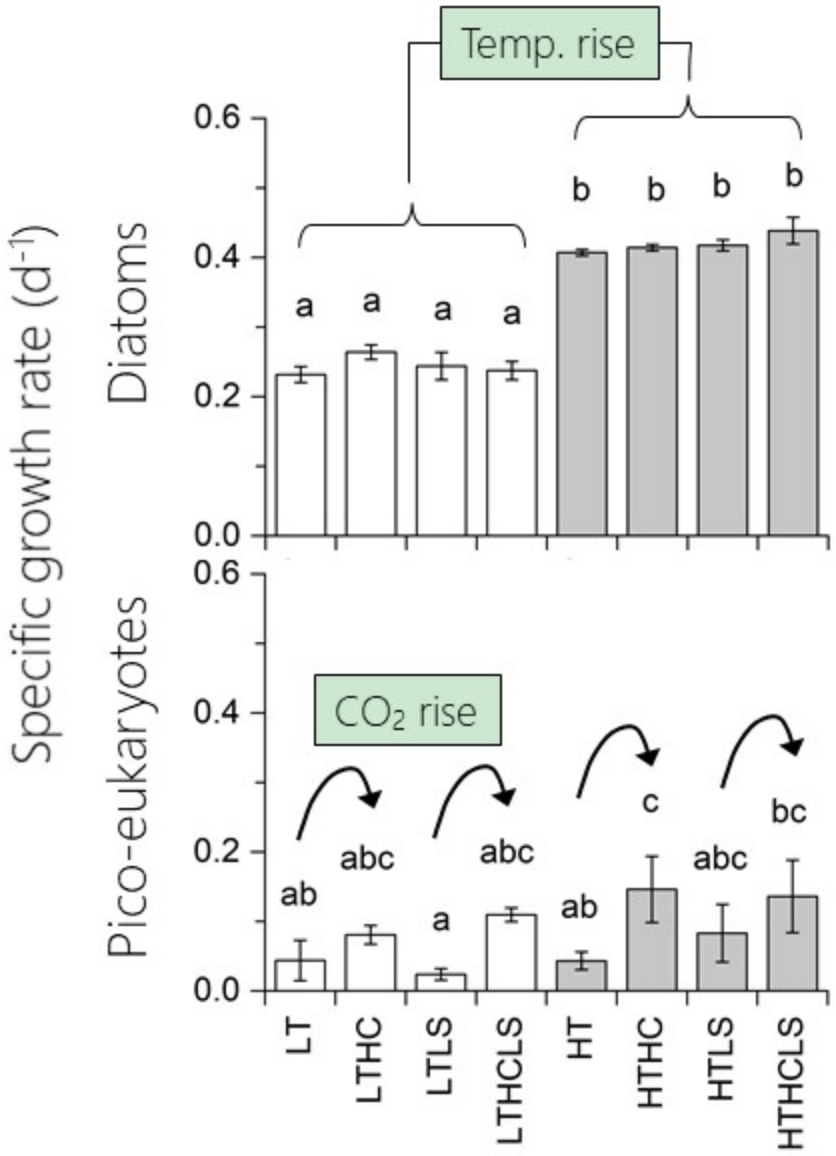
From 2003 to 2007: Decreased @ −0.09 year^{-1} (10 times faster than other oceans!!)

After 2007: Stabilized---due to decrease of sea ice meltwater & stabilization of the air-sea CO_2 disequilibrium state

Zhang *et al.* [2020; GRL]

Impacts of temperature, CO_2, and salinity on phytoplankton community composition in the western Arctic Ocean

Sugie *et al.*, [2020, *Front. Mar. Sci.*]
doi:10.3389/fmars.2019.00821



Growth enhancement factors

Diatoms (large size): high temp.

Pico-euk (very small): high temp. and high CO_2

Smaller phytoplankton tended to dominate in the western Arctic Ocean under multiple environmental stressors.

TREATMENTS

LT: control LTHC: high CO_2

LTLS: low salinity

LTHCLS: high CO_2 and low sal.

HT: higher temp. HTHC: HT and high CO_2

HTLS: HT and low sal.

HTHCLS: HT, high CO_2 and low sal.

Impacts of temperature, CO_2, and salinity on phytoplankton community composition in the western Arctic Ocean

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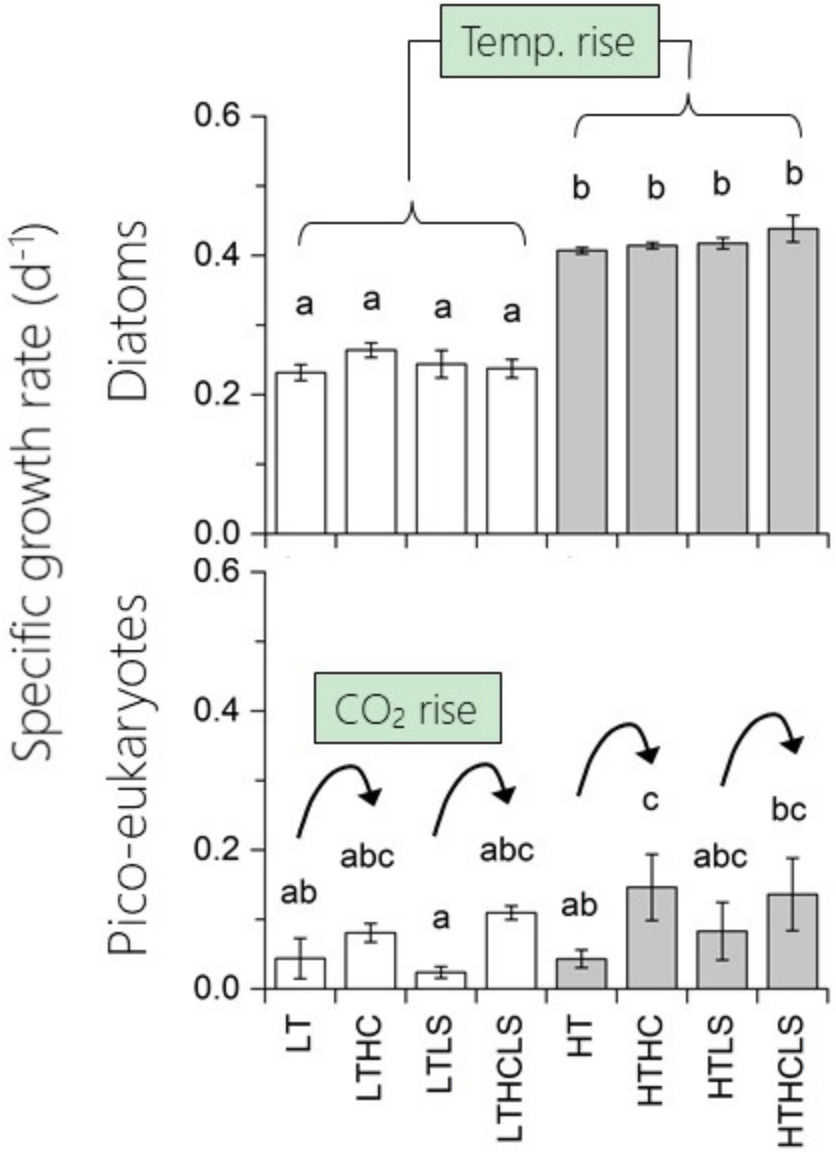

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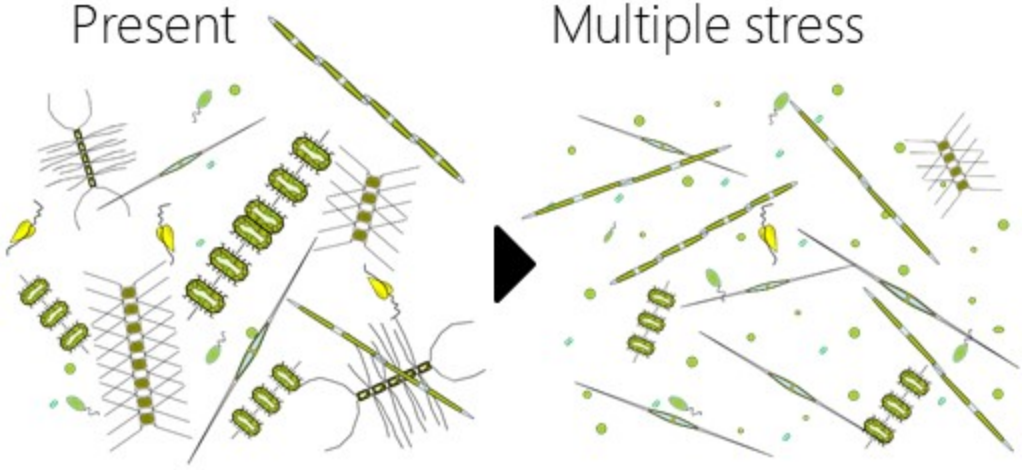

Thank you.