S9-9741

Siliceous phytoplankton flux reflecting oceanographic variation in the southern Northwind Abyssal Plain

Jonaotaro **Onodera**, Eiji Watanabe and Naomi Harada
(Research & Development Center for Global Change, JAMSTEC)

Summer sea-ice decrease in the Arctic Ocean (Stroeve et al., 2012)
and change of hydrographic condition (i.e., Beaufort Gyre intensification (McPhee, 2013)

The impacts to
lower-trophic marine ecosystems,
material transportation such as lateral advection, and biological pump

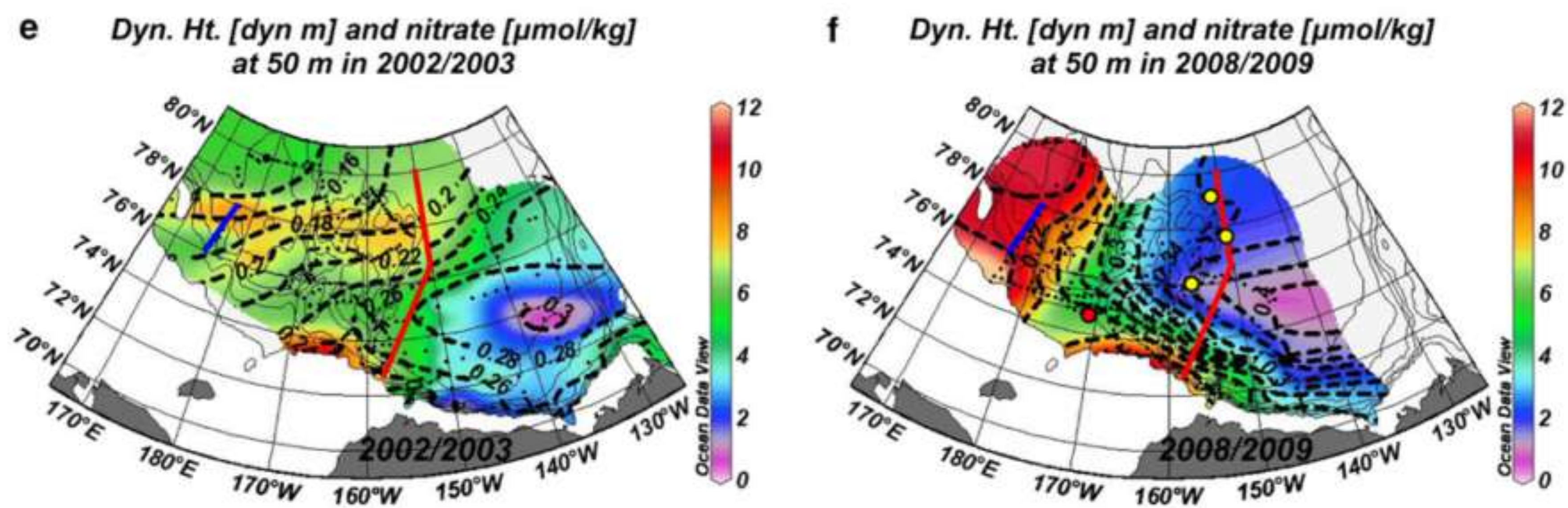
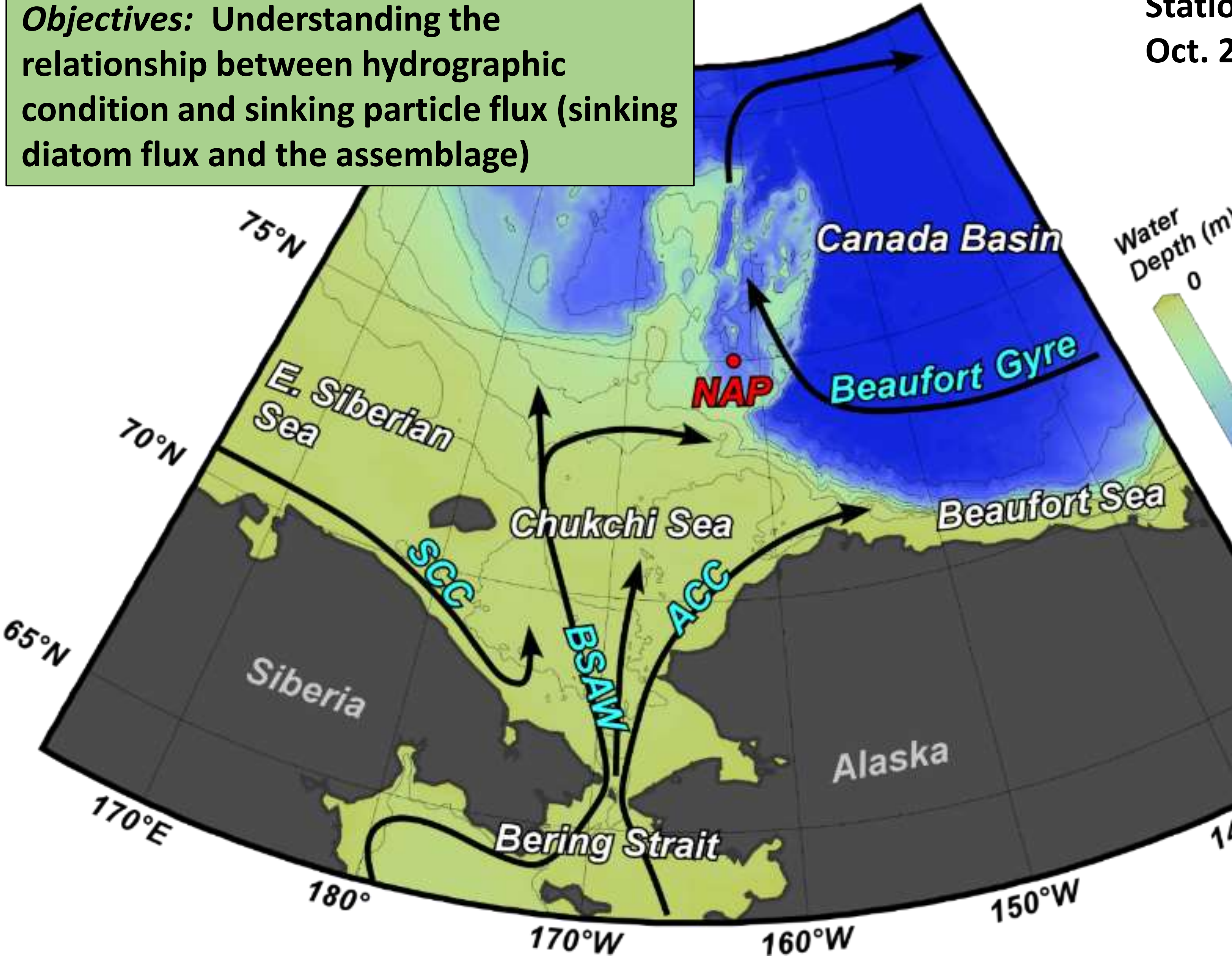


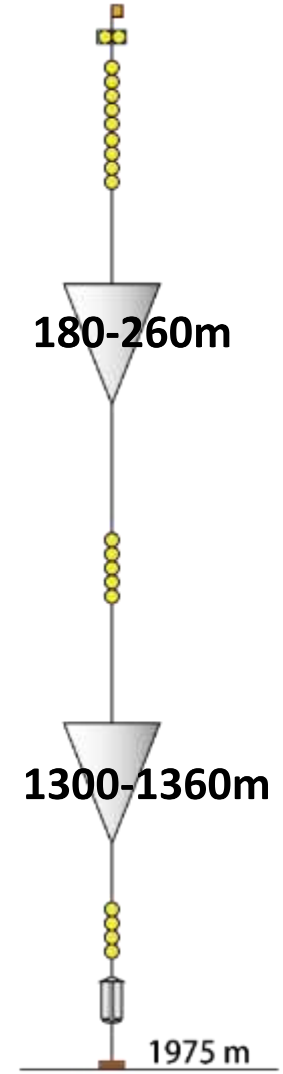
Fig. 2 Vertical sections of phytoplankton chlorophyll *a* (μg/L) in large-sized cells of >10 μm (*colors*) and salinity (*contours*) in **a** 2002/2003 and **b** 2008/2009, vertical sections of phytoplankton chlorophyll *a* (μg/L) in small size cells of <10 μm (*colors*) and salinity (*contours*) in **c** 2002/2003 and **d** 2008/2009, and dynamic height (dyn m) at 50 m relative to 250 db (*dashed contours*) and nitrate (μmol/kg) at 50 m (*colors*) in **e** 2002/2003 and **f** 2008/2009. The sections in **a**–**d** are illustrated along *red lines* in **e** and **f**. The *blue lines* in **e** and **f** show the sections of nitrate distributions in Figs. 4 and 5. *Red* and *yellow circles* in **f** indicate stations where nitrate uptake rates were measured in 2009 (Fig. 3). Data were obtained from cruises by the R/V Mirai in 2002, 2008, and 2009, USCGC Polar Star in 2002 (Woodgate et al. 2002), and CCGS Louis S. St-Laurent in 2003 (McLaughlin et al. 2010)

Nishino et al. (2011)

Objectives: **Understanding the relationship between hydrographic condition and sinking particle flux (sinking diatom flux and the assemblage)**

Station NAP
Oct. 2010-Sep. 2012





Schematic Current (Naidu et al. 2004, Danielson et al. 2011)

ACC: Alaskan Coastal Water; BSAW: Bering Shelf - Anadyr Water; SCC: Siberian Coastal Current

Methods - Diatom Analysis

1/10 sample <1mm particle size fraction

⇩

Splitting 1/100-1/1000

⇩

Filtering membrane filter, 0.45μm pore size

⇩ **SEM Observation**

⇩ **Mounting on slide glass** Canada Balsam

Valve Size Measurement

Diatom Valve Count >400 valves, Light Microscope (x600)

⇩

Diatom Valve Flux (Unit: number of valves $m^{-2}\ d^{-1}$)

⇩

carbon : cell volume
(Menden-Deuer & Lessard, 2000)

Diatom Carbon Flux (Unit: mg C $m^{-2}\ d^{-1}$)

Sea-ice Concentration, and shortwave radiation data from NCEP-CFSR (Saha et al. 2010)

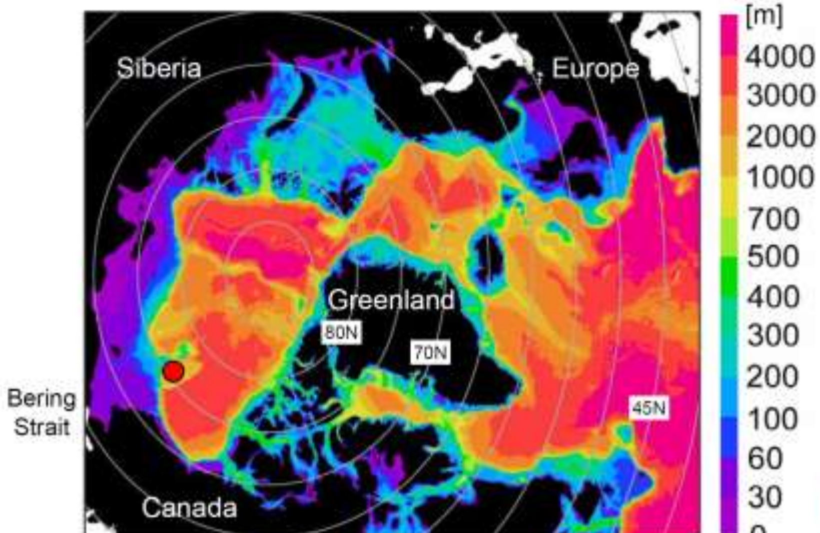
Methods – physical oceanographic model

Method

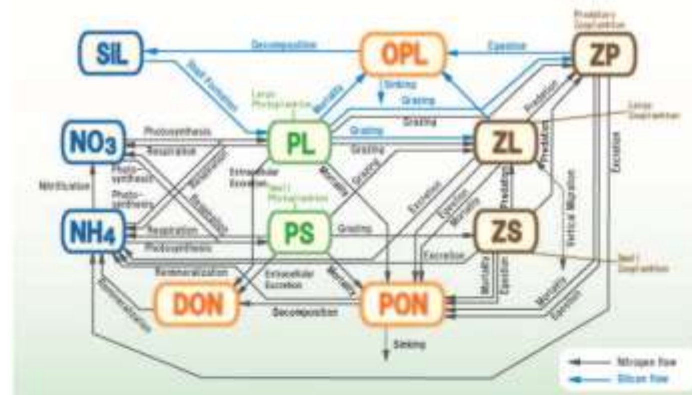
Pan-Arctic Ice-Ocean Model

Physical Part: COCO 4.9 [Hasumi, 2006]
(sea ice-ocean general circulation model)

Ecosystem Part: NEMURO [Kishi et al., 2007]
(lower-trophic marine ecosystem model)



● Station NAP



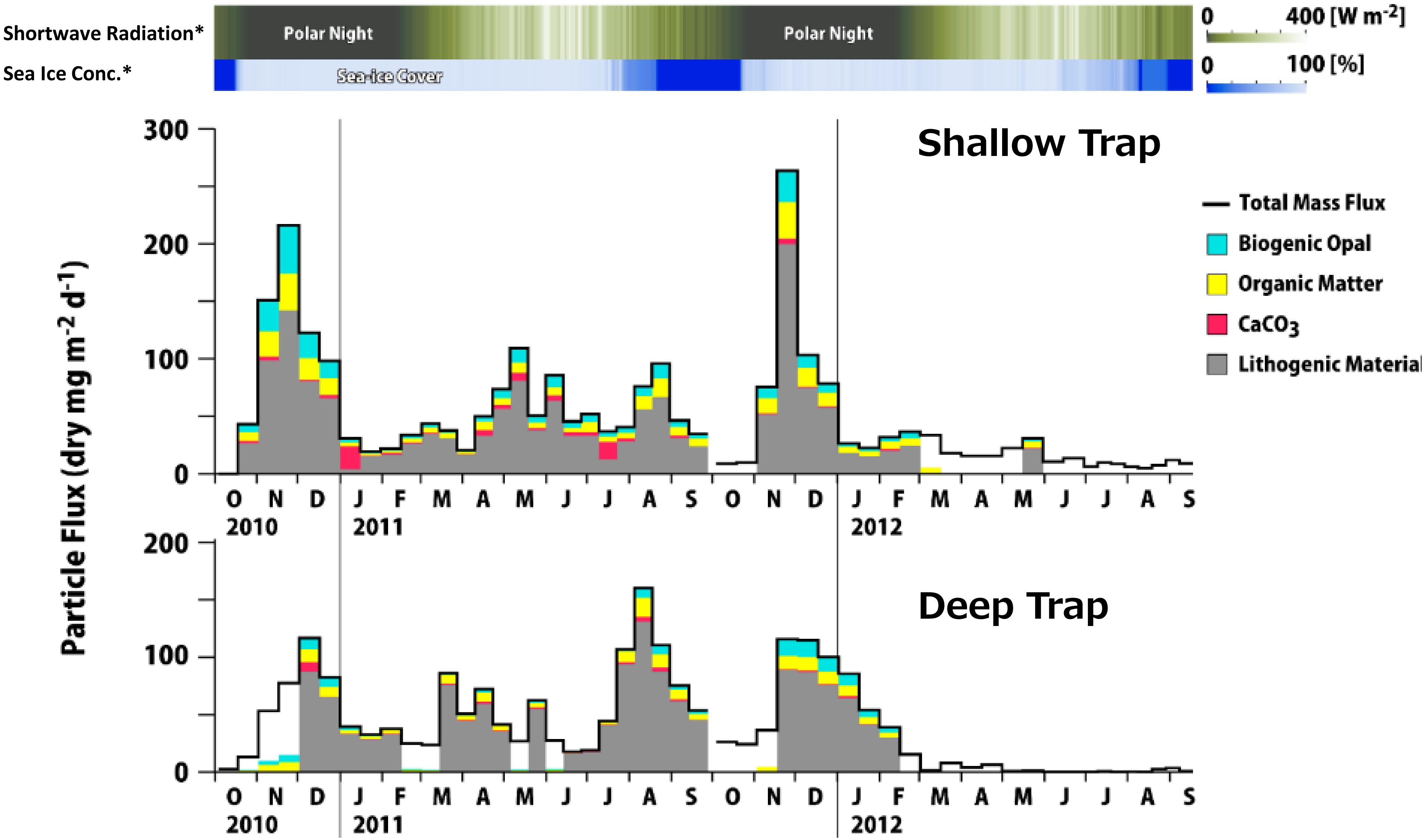
*No sea ice ecosystem (e.g., ice algae) yet

Spin up exp. — Decadal exp.
1979 forcing — 1979-2012
25km
280x200x28 grids

【2010M case】
Seasonal exp.
2010
5km
1400x1000x42 grids

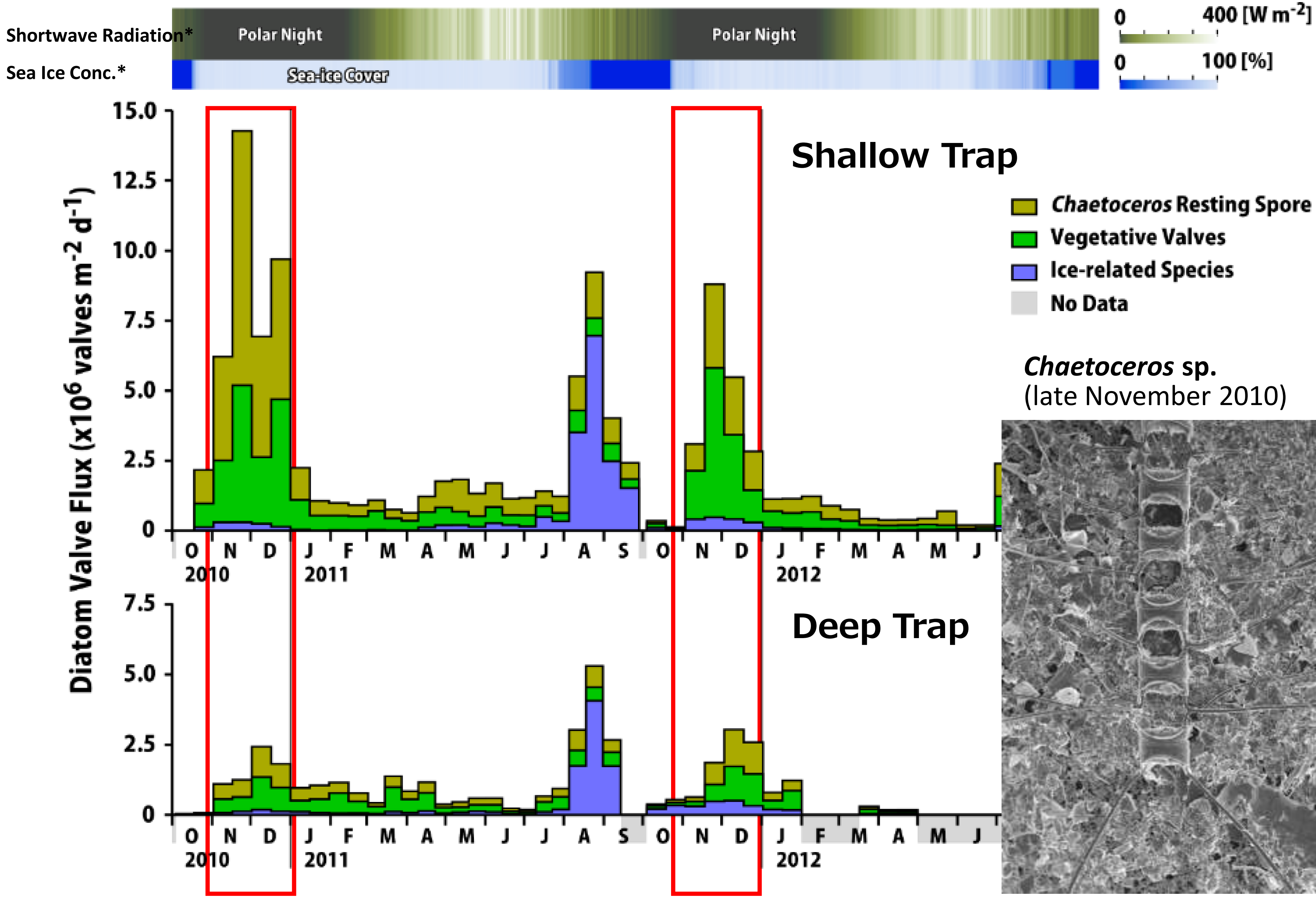
Experimental Design
- NCEP/CFSR atmospheric daily forcing
- AOMIP river water discharge
- Pacific water inflow at Bering Strait
- Integrated from PHC T/S, WOA09 NO3/SIL
- Nutrient input from sea bottom (NH4/DON/SIL)
- Sinking PON velocity increasing with depth

Total Mass Flux & Bulk Particle Components



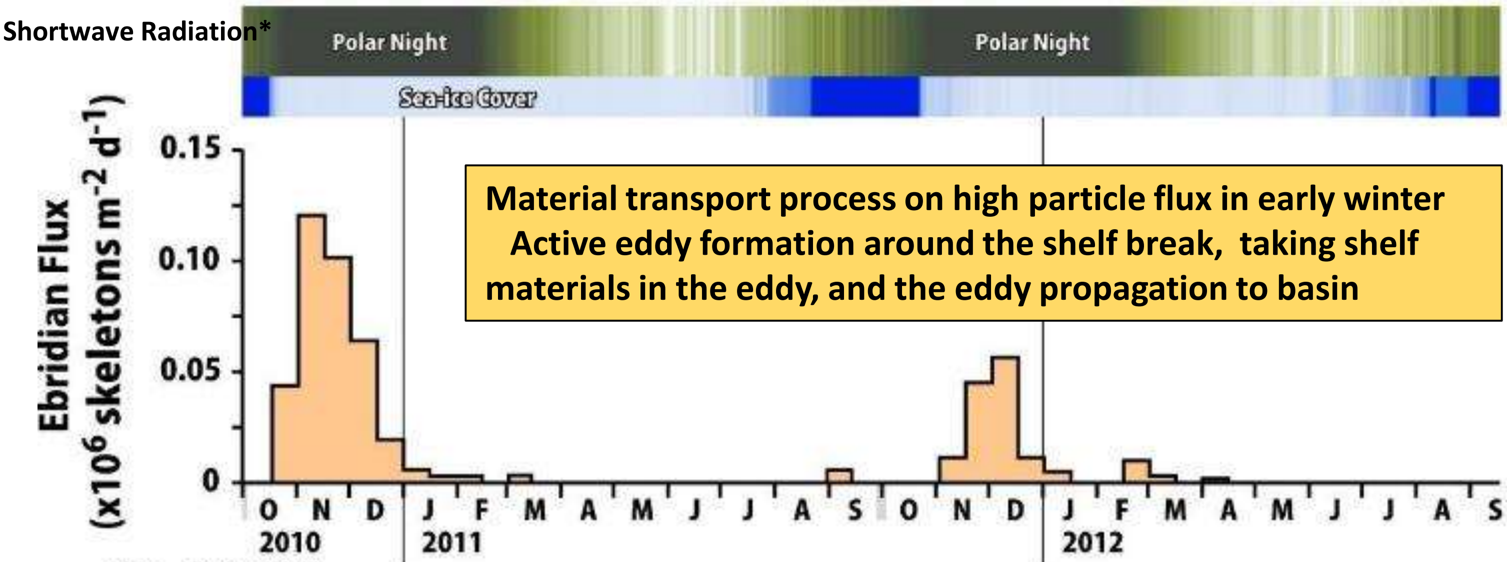
*: NCEP-CFSR (Saha et al. 2010)

Diatom Valve Flux in Nov.-Dec.

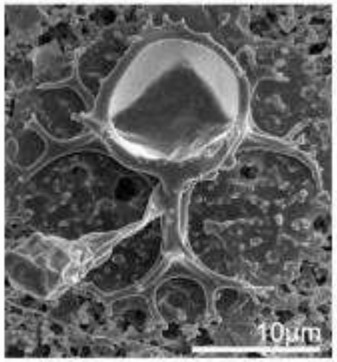


Chaetoceros sp.
(late November 2010)

Ebridian Skeleton Flux in Nov.-Dec.

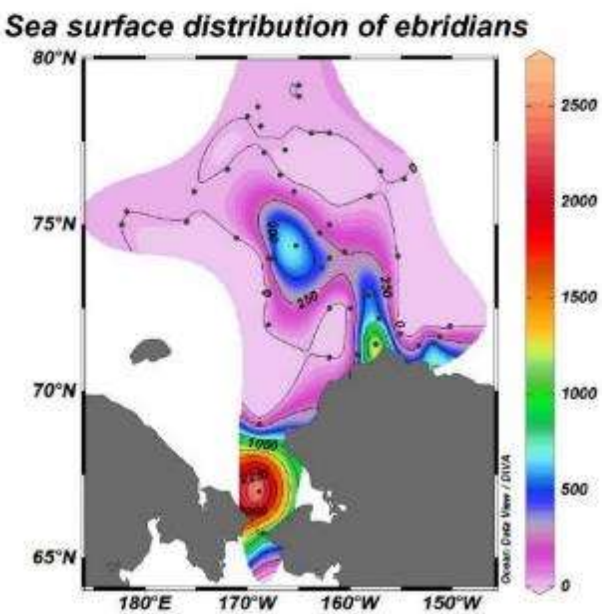


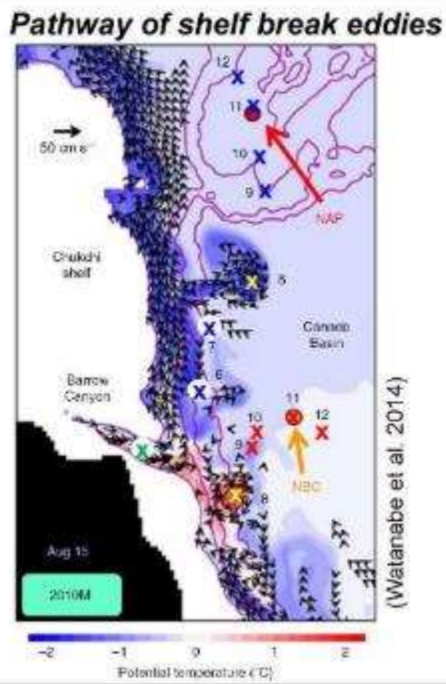
Material transport process on high particle flux in early winter
Active eddy formation around the shelf break, taking shelf materials in the eddy, and the eddy propagation to basin



Ebria tripartita skeleton

Sep.-Oct. 2010





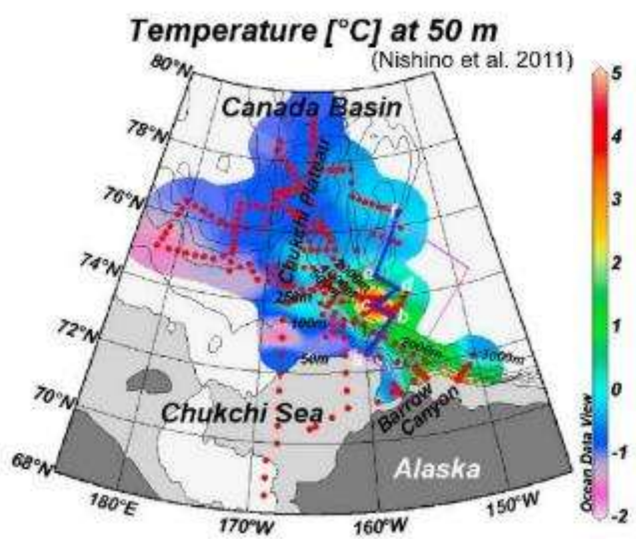
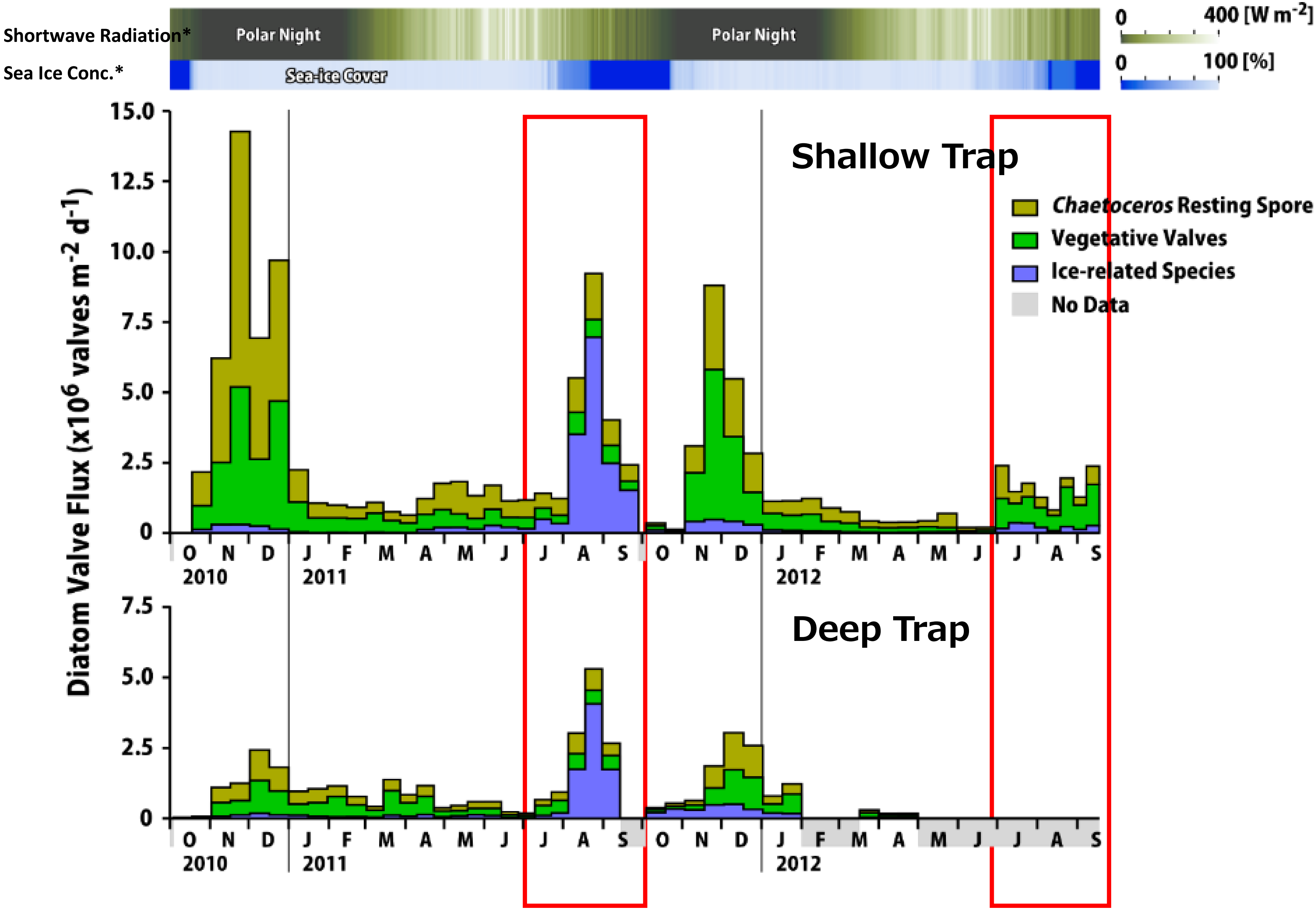


Figure 1. Hydrographic stations of CTD/water sampling and XCTD (red dots) of the R/V *Mirai* Arctic Ocean cruise in 2010 and temperature distribution at 50 m depth (color).

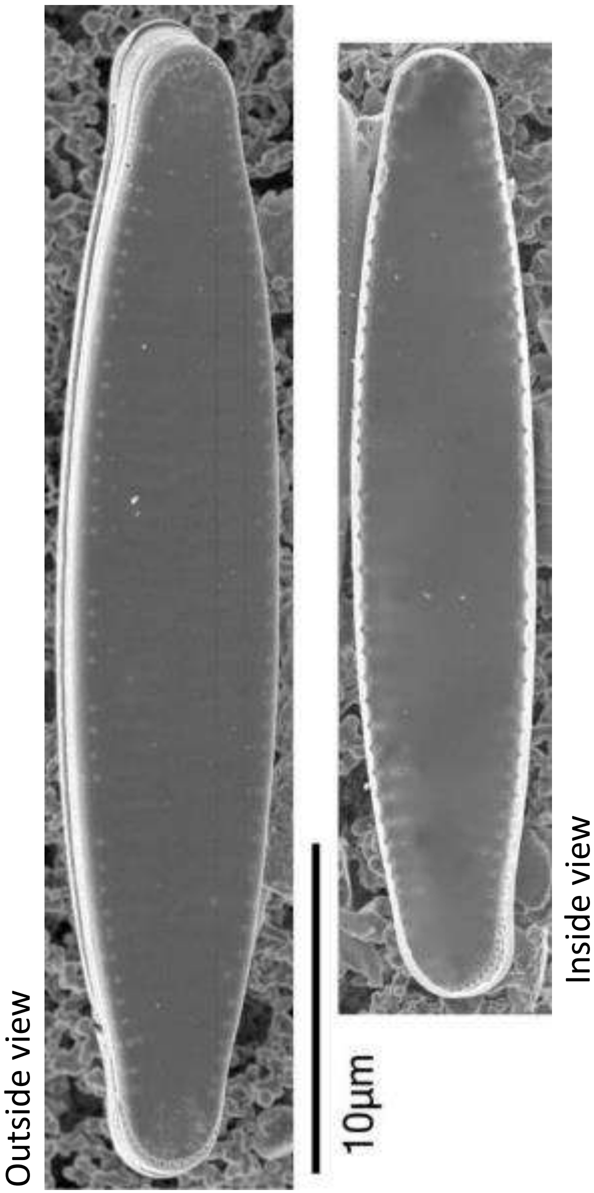
Diatom Valve Flux in July-Sept.



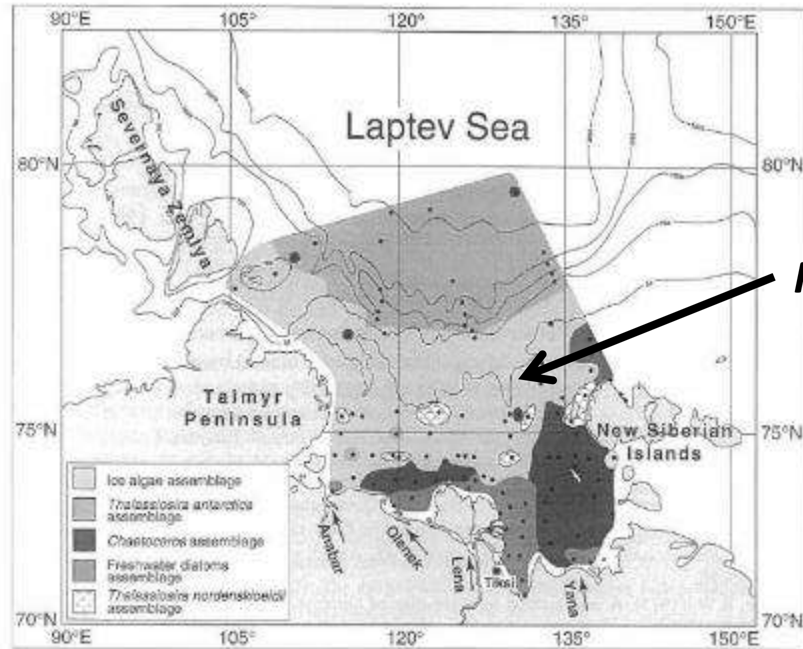
Fossula arctica

- Common in the shelf of Laptev and Chukchi Seas

-(Cremer 1998, Quifeldt et al. 2003)

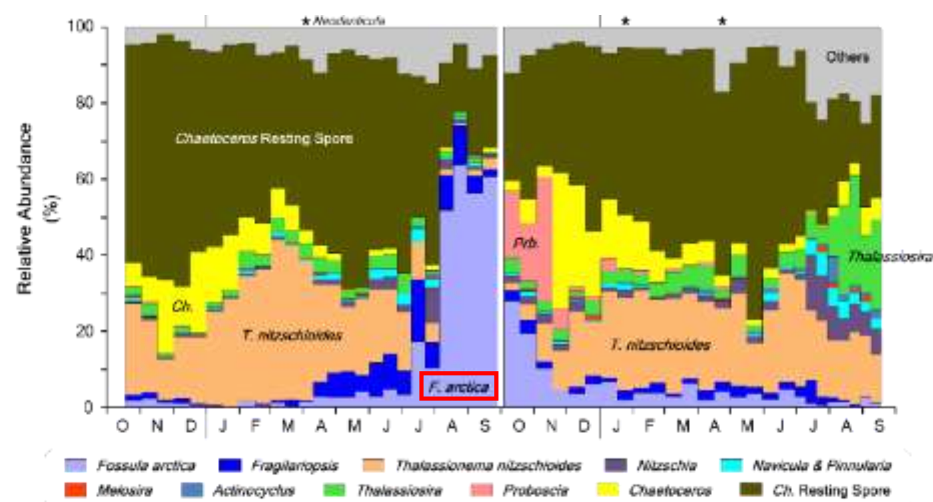


Sample NAP10t-180m #22 (July-Aug.2011)

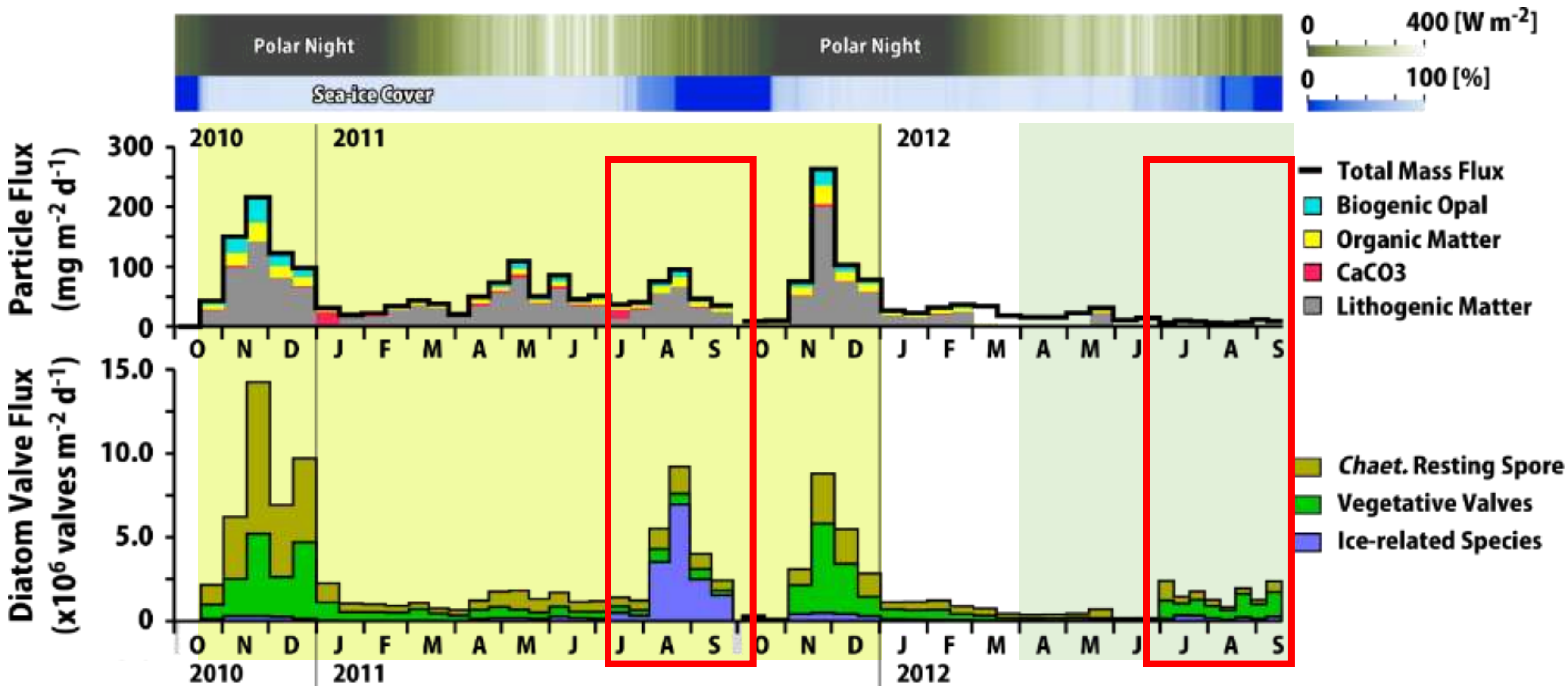


***Fossula* dominant**

Figure 5: Geographic distribution of diatom sediment assemblages in the Laptev Sea (after Cremer 1998, modified).



Particle Flux at Shallow Trap Depth



Influence of shelf waters

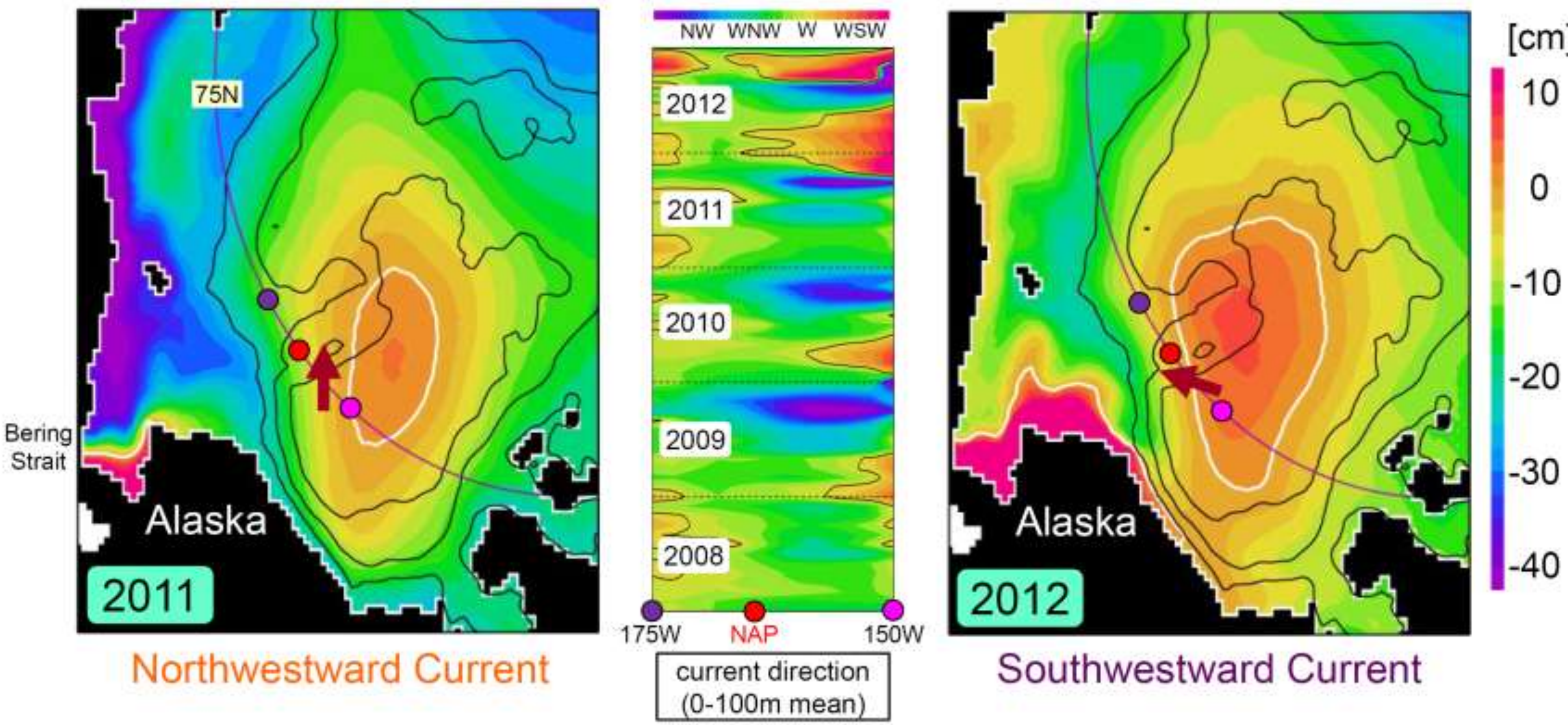
Oligotrophic waters

High particle flux
Abundant lithogenic matters
Coastal planktic diatoms and ice-algae

Low particle flux
Absence of summer flux maximum

Intensified Beaufort Gyre and oligotrophic water input to Station NAP in summer 2012

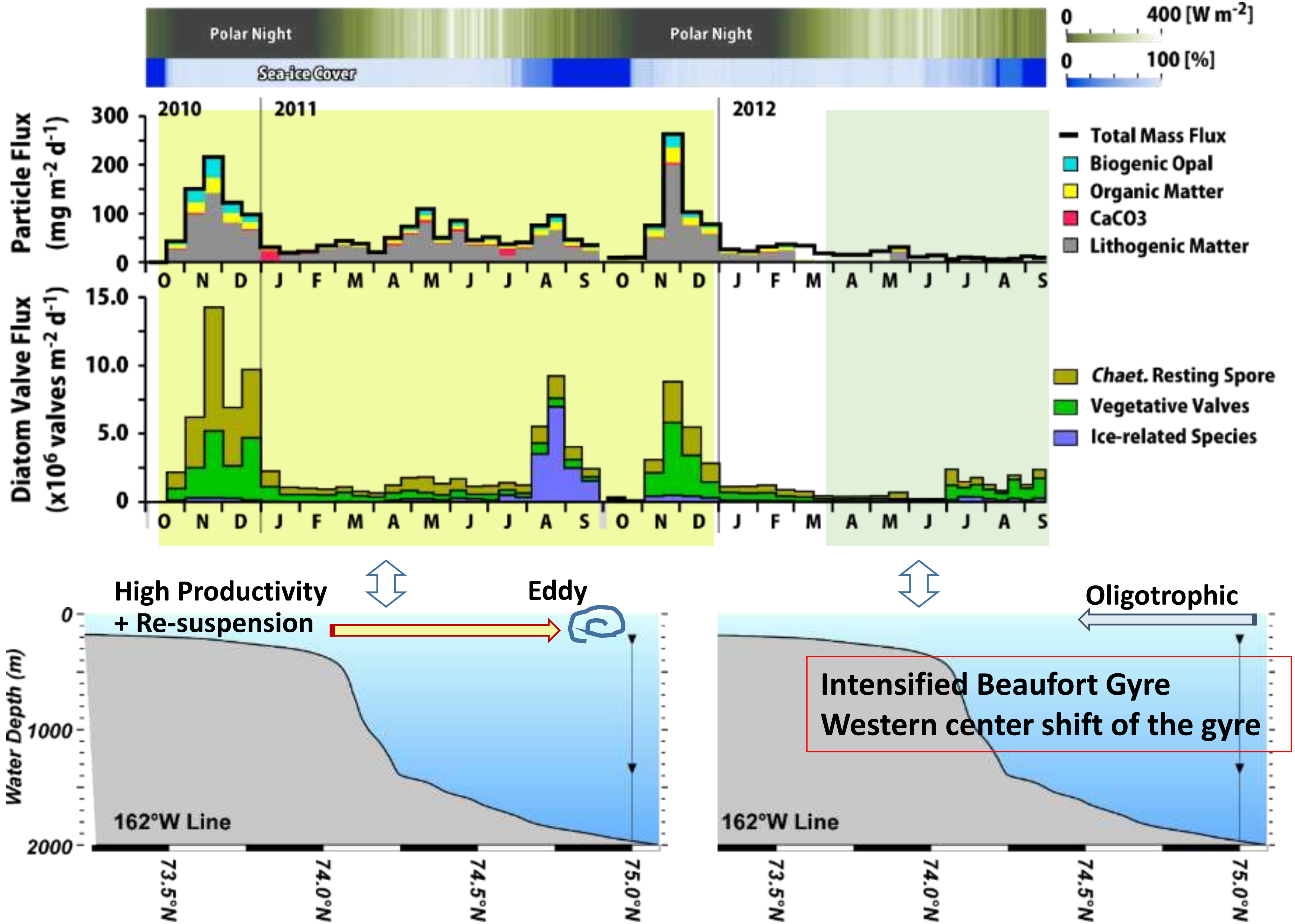
Sea surface height in the western Arctic (JJA mean, 25km exp.)



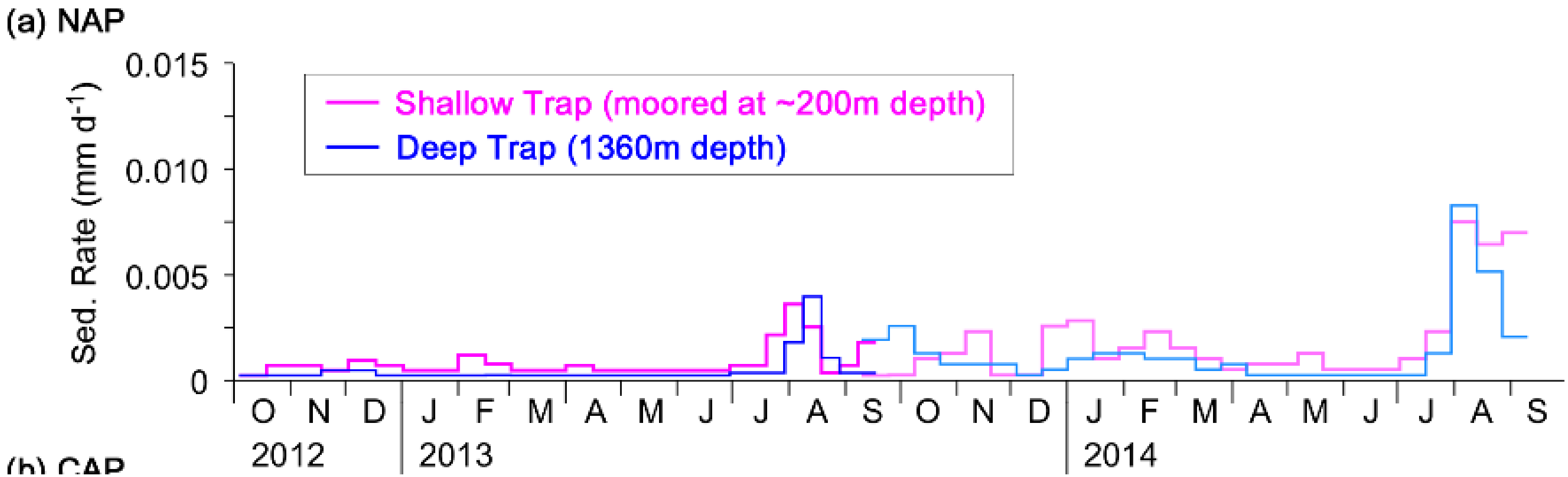
Northwestward Current

Southwestward Current

(Nutrient-poor) Canada Basin water was transported toward NAP in 2012


Polar Night
Sea-ice Cover
Polar Night
0
400 [W m-2]
0
100 [%]
2010
2011
2012
Particle Flux (mg m-2 d-1)
300
200
100
0
Total Mass Flux
Biogenic Opal
Organic Matter
CaCO3
Lithogenic Matter
O N D J F M A M J J A S O N D J F M A M J J A S
Diatom Valve Flux (x10^6 valves m-2 d-1)
15.0
10.0
5.0
0
Chaet. Resting Spore
Vegetative Valves
Ice-related Species
O N D J F M A M J J A S O N D J F M A M J J A S
High Productivity
+ Re-suspension
Eddy
Oligotrophic
Intensified Beaufort Gyre
Western center shift of the gyre
Water Depth (m)
0
1000
2000
162°W Line
162°W Line
73.5°N
74.0°N
74.5°N
75.0°N
73.5°N
74.0°N
74.5°N
75.0°N

Preliminary Data – Sedimentation Rate based on the sediment thickness in trap bottle



Future works

Data accumulation of sinking particle fluxes to find the interannual trend

Quantitative estimation on the significance of each transportation process

(effect of eddy formation and propagation,

(biological pump by major planktons such as diatoms, copepod)

Acknowledgement

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