Distributed Biological Observatory (DBO)
Data meeting
Feb.27-Mar.1, 2013
PMEL/NOAA, Seattle

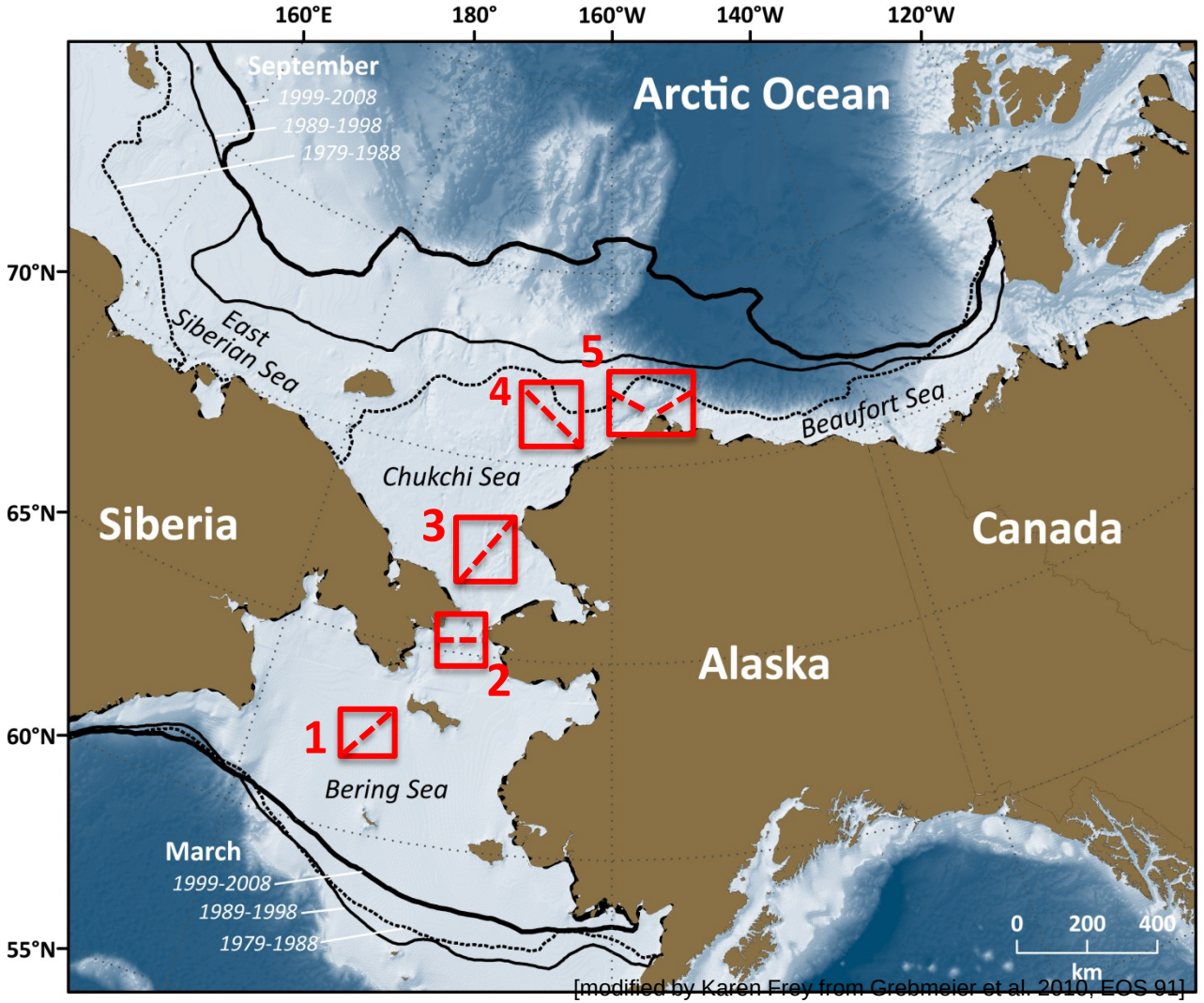
DBO pilot program data result:

Japanese topic

Physical oceanographic result and mooring observation

Takashi Kikuchi (JAMSTEC)
with inputs from other Japanese Scientists

Linking Physics to Biology: the Distributed Biological Observatory (DBO)



[modified by Karen Frey from Grebmeier et al. 2010, EOS 91]

- **DBO sites (red boxes) are regional "hotspot" transect lines and stations located along a latitudinal gradient**
- **DBO sites are considered to exhibit high productivity, biodiversity, and overall rates of change**
- **DBO sites will serve as a change detection array for the identification and consistent monitoring of biophysical responses**
- **Sites occuppied by national and international entities with shared data plan**

Distributed Biological Observatory: Linking Physics to Biology

Core standardized ship-based sampling:

- CTD
- Chlorophyll
- Nutrients
- Ice algae/Phytoplankton (size, biomass and composition)
- Zooplankton (size, biomass and composition)
- Benthos (size, biomass and composition)
- Seabird (standard transects, no additional shiptime)
- Marine mammal observations (no additional ship time)

"Change detection array" – same measurements every year, process information in near real time <6 mos; detect regime shifts in rapid changes

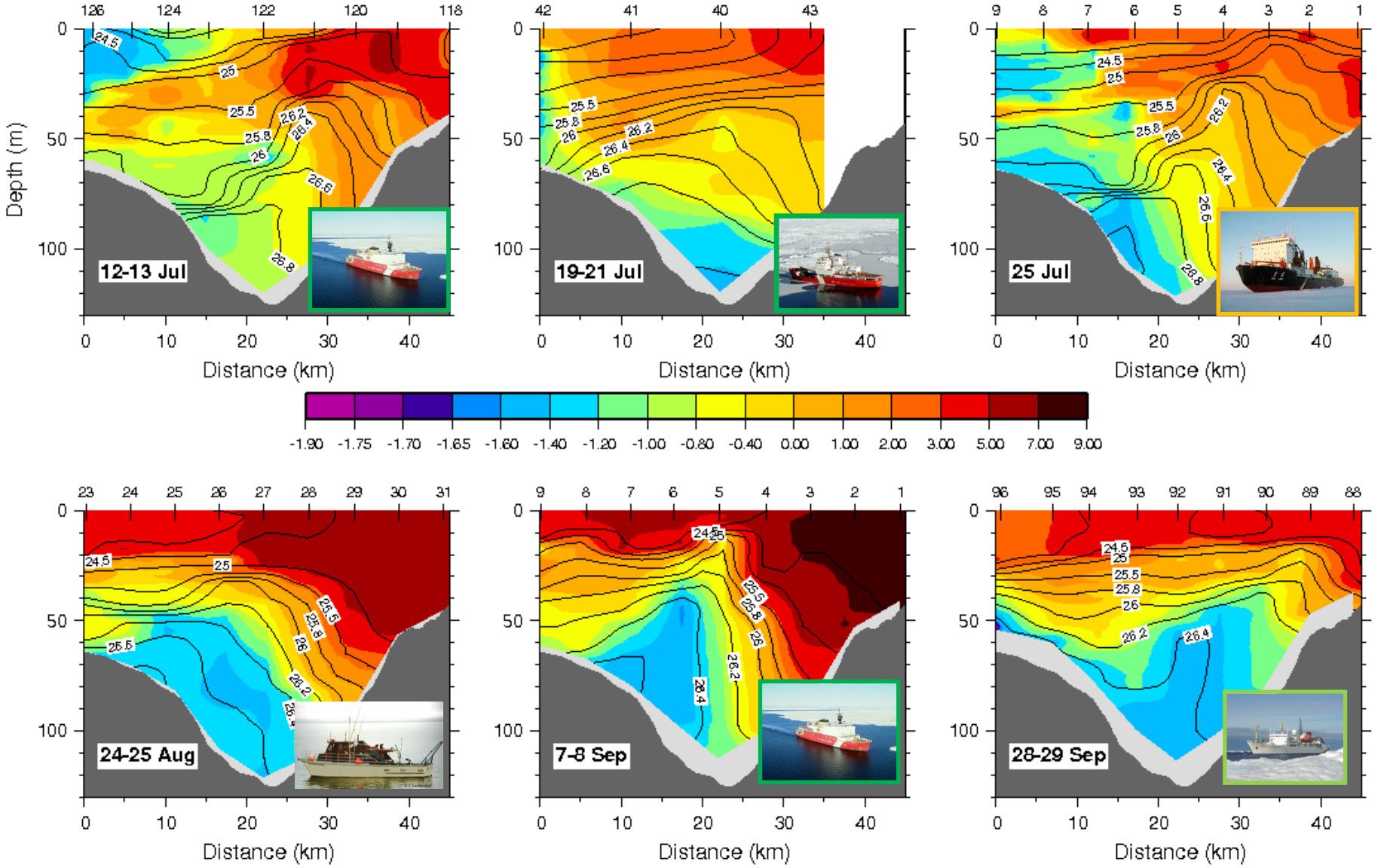
Second tier ship-based sampling:

- Fishery acoustics (less effort than standardized bottom trawling)
- Bottom trawling (every 3-5 years)

DBO occupations by national and international science programs

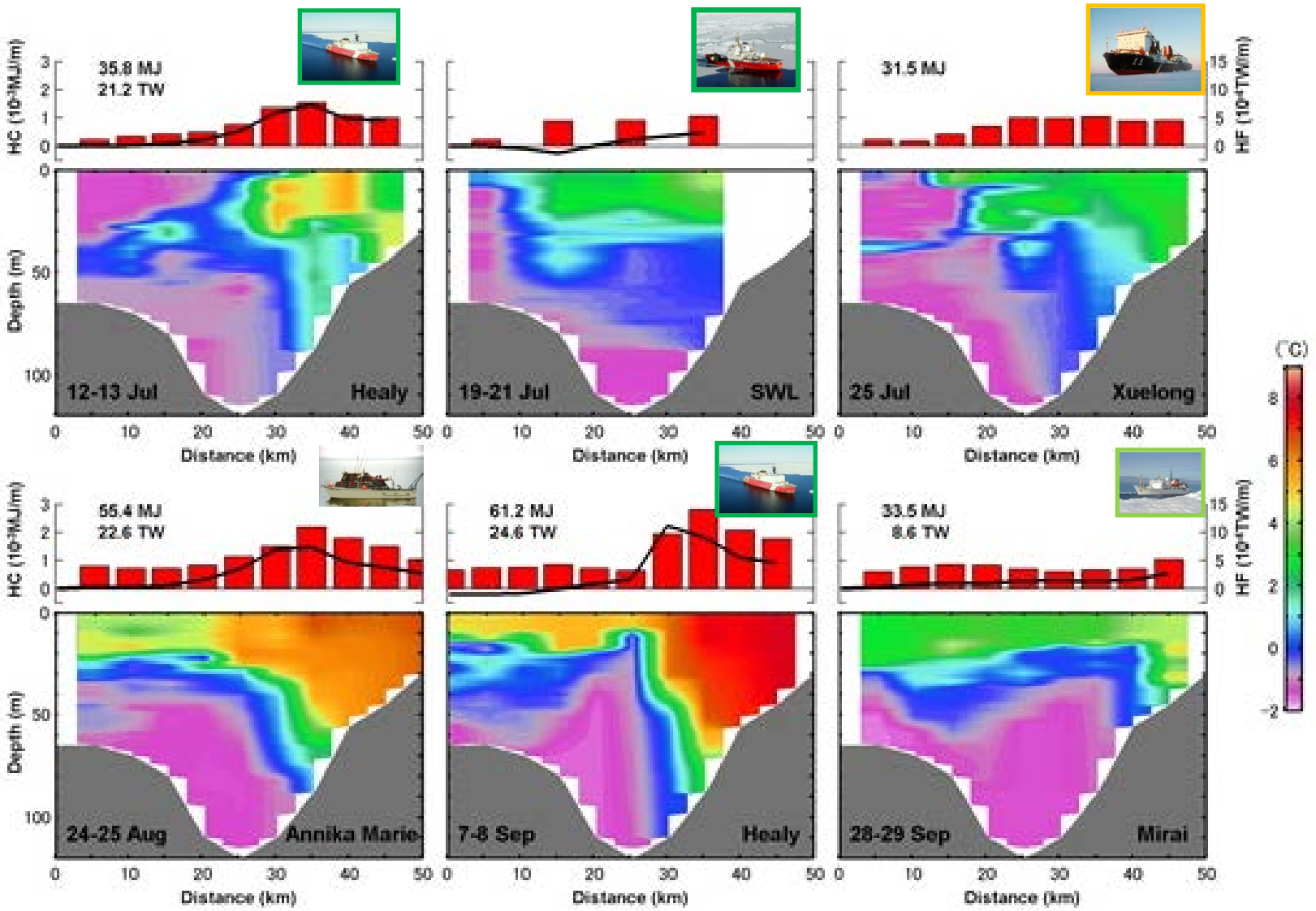
Linking Physics to Biology: the Distributed Biological Observatory (DBO)

6 occupations of Barrow Canyon transect in 2010



Linking Physics to Biology: the Distributed Biological Observatory (DBO)

6 occupations of Barrow Canyon transect in 2010



Arctic Report card: Update for 2012

Arctic Report Card

www.arctic.noaa.gov/reportcard

ブックマーク

Arctic Report Card: *Update*

Tracking recent environmental change

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Lemmings
Arctic Fox
Caribou & Reindeer
TERRESTRIAL CRYOSPHERE
Snow
Glaciers & Ice Caps
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Permafrost

What's new in

New records se
extent, sea ice
sheet surface m
air temperatures
melting - being u
relative to the las

Multiple observati
strong evidence
sustained change
environmental sy
state.

Highlights

Record low s
sea ice exten
and September

Growing seas
increasing alo
greenness and
biomass. Below
high permafro
occurred in nor

http://www.arctic.noaa.gov/reportcard, Arctic Report Card ...

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Arctic Report Card: *Update for 2012*

Tracking recent environmental changes

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Greenland Ice Sheet
Permafrost

Ecosystem Observations in Barrow Canyon: A Focus for the International Distributed Biological Observatory (DBO)

J. Grebmeier[1], R. Pickart[2], C. Ashjian[2], L. Cooper[1], K. Frey[3], J. He[4], M. Itoh[5], M. Kedra[1], T. Kikuchi[5], S. Moore[6], J. Nelson[7], S. Vagle[7]

[1]University of Maryland Center for Environmental Science, Solomons, MD, USA
[2]Woods Hole Oceanographic Institution, Woods Hole, MA, USA
[3]Graduate School of Geography. Clark University, Worchester, MA, USA
[4]Polar Research Institute of China, Shanghai, People's Republic of China
[5]Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Japan
[6]NOAA/Fisheries, Office of Science & Technology, Seattle, WA, USA
[7]Institute of Ocean Sciences, Dept. Fisheries and Oceans, Sidney, BC, Canada

November 11, 2012

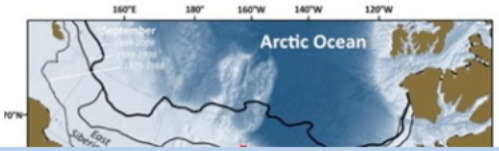
Highlights

- Since 1980, sea ice persistence in the Barrow Canyon (BC) region of the Distributed Biological Observatory (DBO) has declined by ~3 days per year.
- Heat flux during the 2010 DBO BC section was 3 times higher compared to that in 1993; heat flux was particularly high in the Alaska Coastal Water. The ACW was warmer in July 2011 than July 2010, suggesting a continued warming trend.
- Zooplankton and benthic species composition vary by water mass type in BC; total zooplankton abundance was greater in 2011 than in 2010.

Introduction

The Chukchi Sea continental shelf in the Pacific Arctic region (**Fig 3.5**) is influenced by the northward transport of nutrient-rich Pacific water via the Bering Strait (see the *Ocean* essay for more information about Pacific Water flow through the Bering Strait), which supports areas of high water column and benthic production on the southeast and northeast portions of the shelf (citations in Grebmeier, 2012). Dramatic, broad temporal and spatial variation in chlorophyll biomass in the Chukchi Sea has coincided with seasonal sea ice retreat and increases in seawater temperatures. One of the key uncertainties in this region is how the marine ecosystem will respond to seasonal shifts in the timing of sea ice retreat and/or delays in fall sea ice formation.

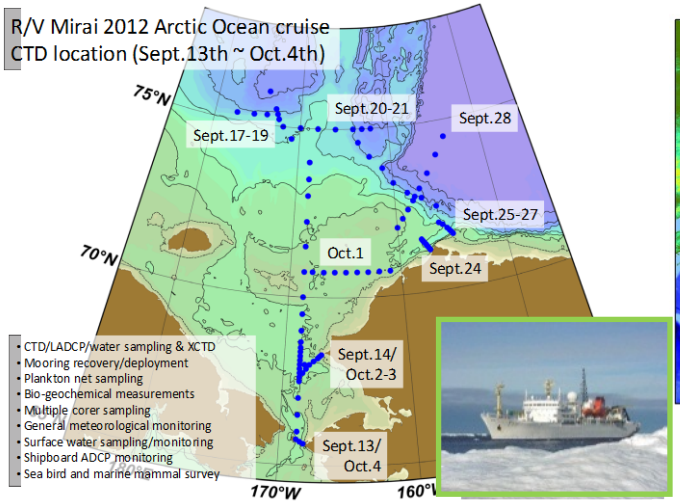
The Distributed Biological Observatory (DBO; **Fig. 3.5**) is being developed by an international consortium of scientists in the Pacific Arctic as a change detection array to systematically track the broad biological response to sea ice retreat and associated environmental change that is occurring (Grebmeier et al., 2010). The DBO relies on coordinated, international sampling by a network of ships from Canada, China, Korea, Japan, Russia and the United States. Specific high productivity locations in the Bering and Chukchi seas are sampled on a repeated basis as research vessels transit the Pacific sector of the Arctic. Additional measurements by satellite and moorings at the designated sites are providing important time series data to develop an early detection system for biological and ecosystem response to climate warming. The following report highlights specific findings at the DBO Barrow Canyon site (**Fig. 3.5**).



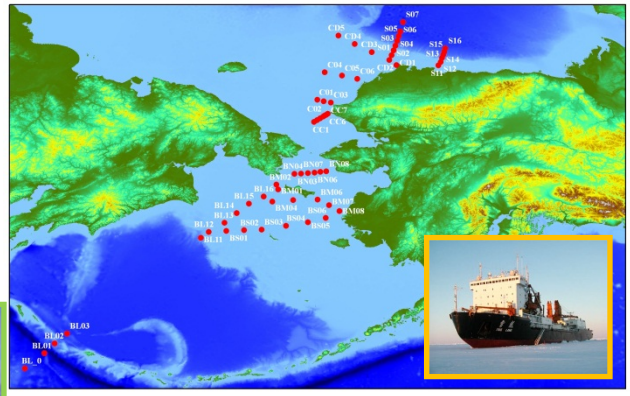
http://www.arctic.noaa.gov/reportcard/

Some 2012 PAG research cruises in Pacific Arctic Region

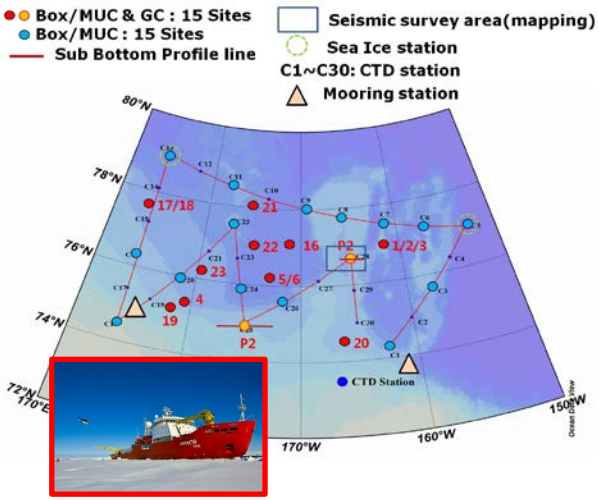
Japan: RV Mirai



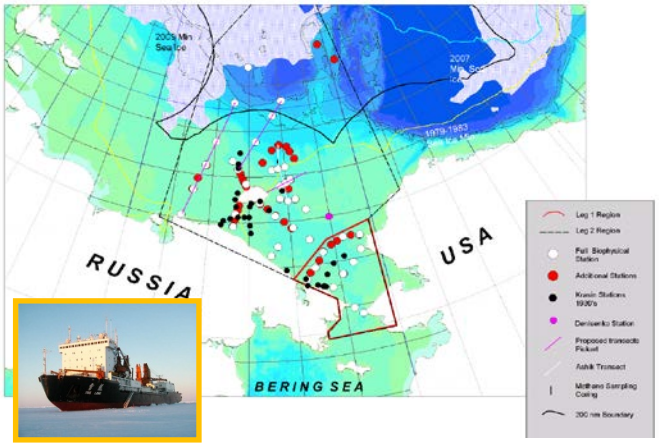
China: RV Xuelong



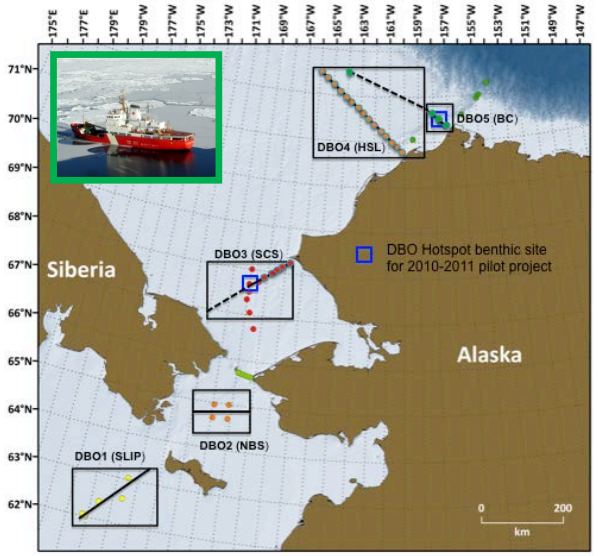
Korea: IBRV Araon



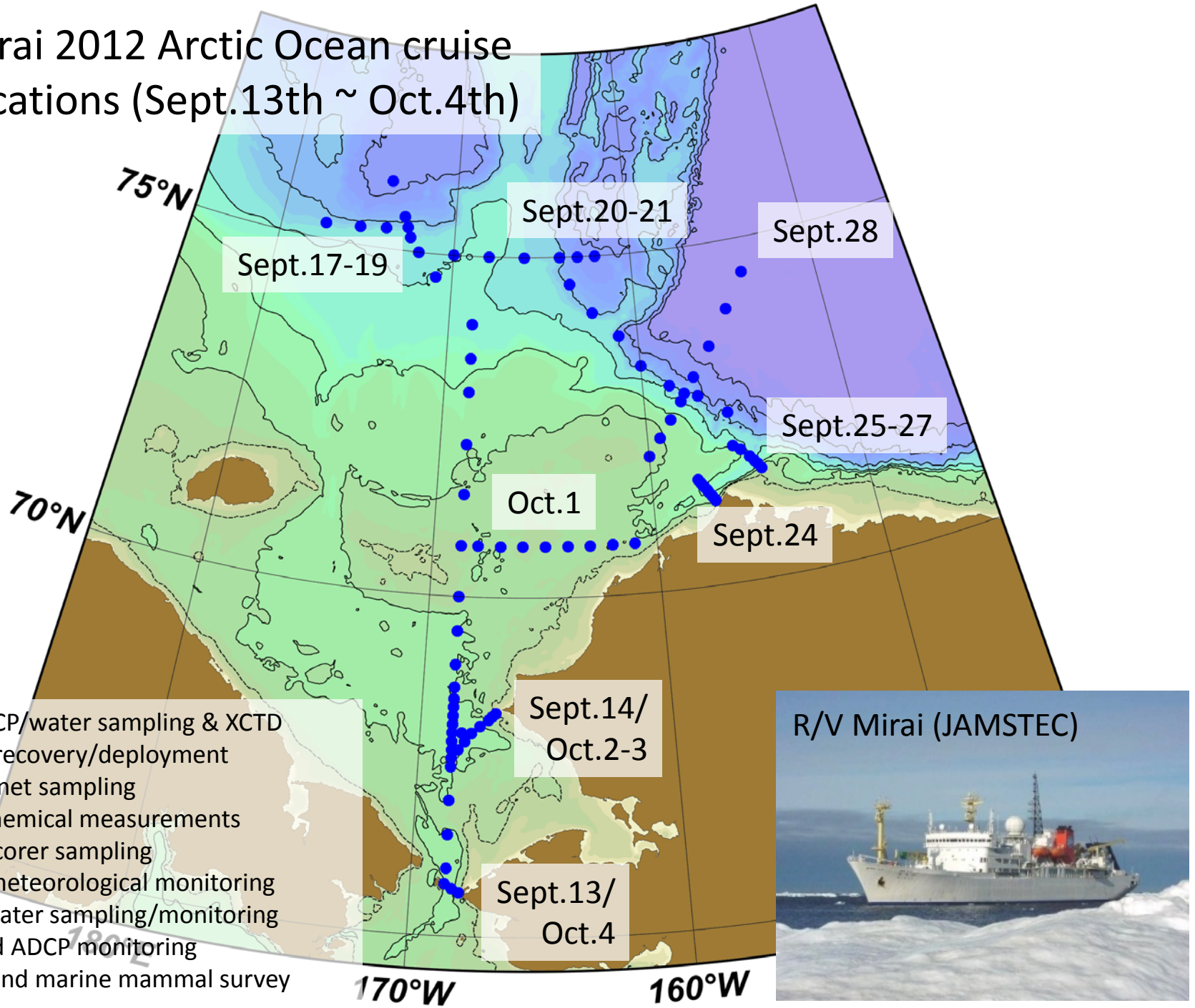
Russia-USA: RV Khromov



Canada-USA: CCGS Sir Wilfrid Laurier (DBO 1-3, 5 and RV Westward Wind DBO4)

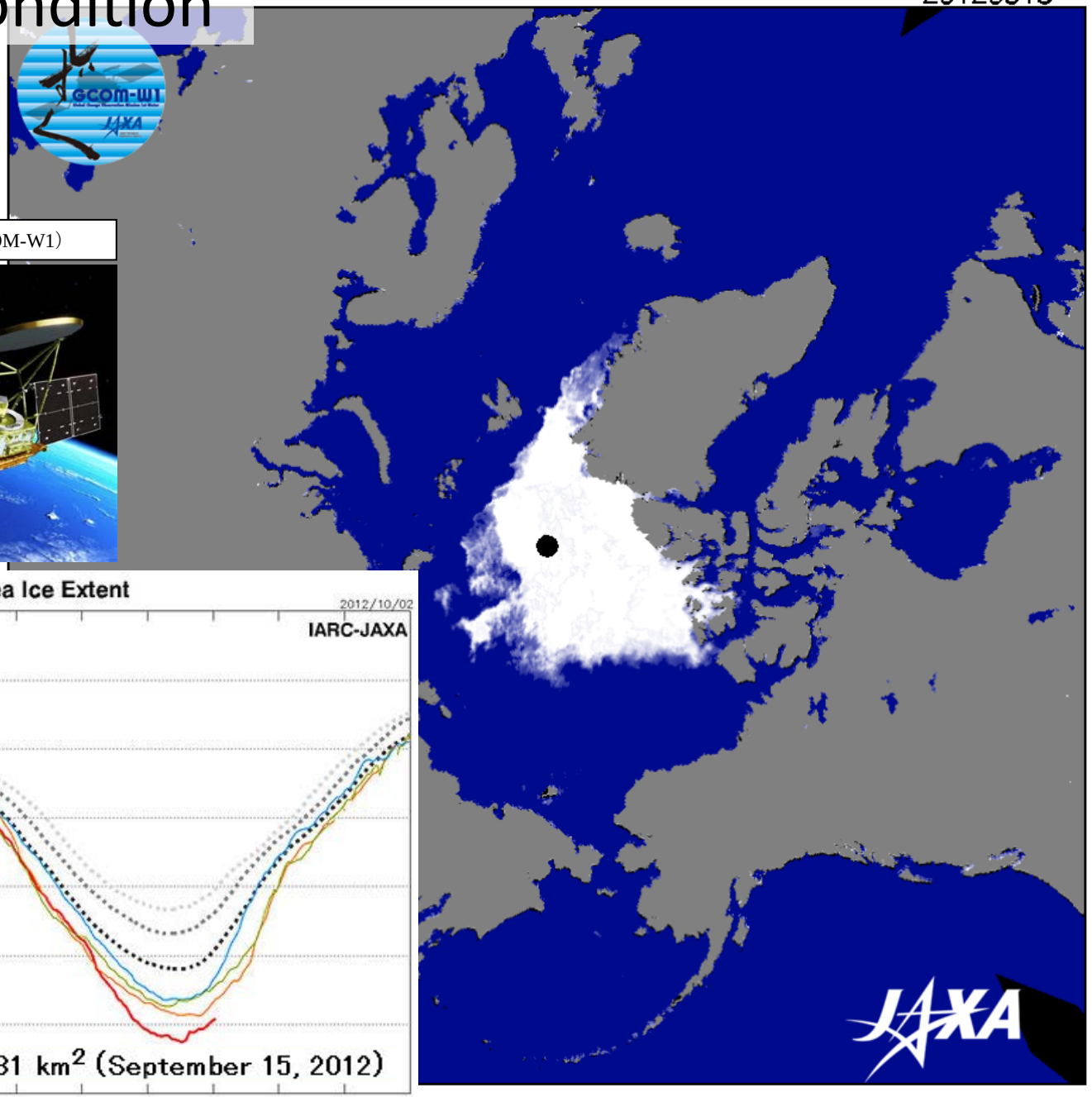


R/V Mirai 2012 Arctic Ocean cruise
CTD locations (Sept.13th ~ Oct.4th)

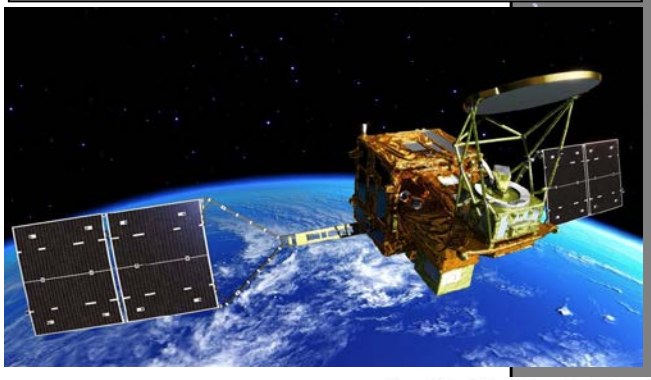


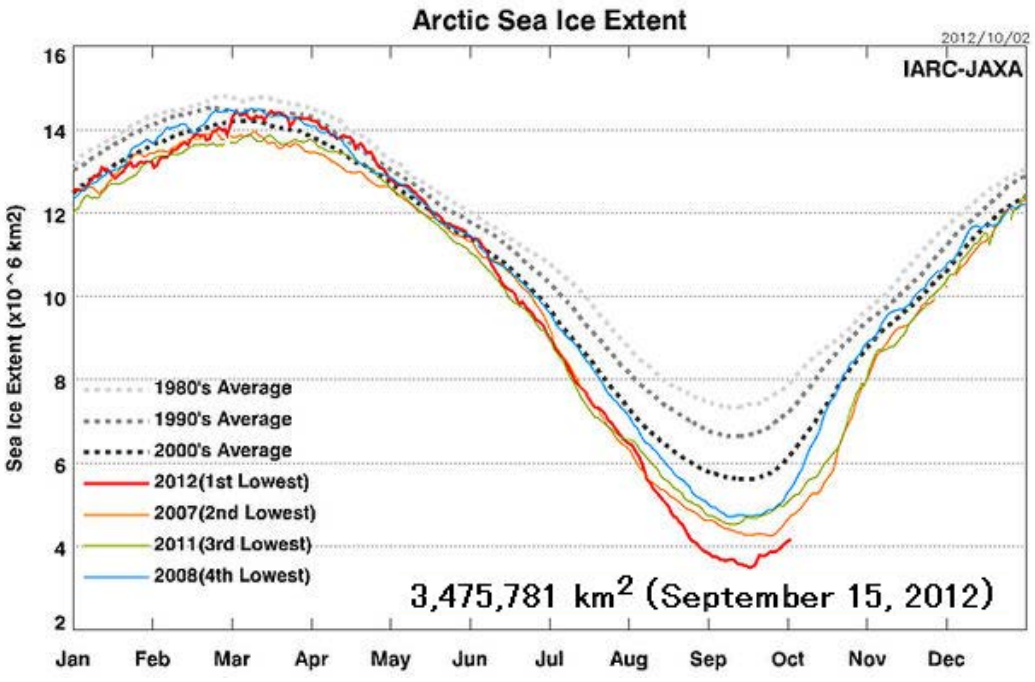
- CTD/LADCP/water sampling & XCTD
- Mooring recovery/deployment
- Plankton net sampling
- Bio-geochemical measurements
- Multiple corer sampling
- General meteorological monitoring
- Surface water sampling/monitoring
- Shipboard ADCP monitoring
- Sea bird and marine mammal survey

2012 Sea ice condition

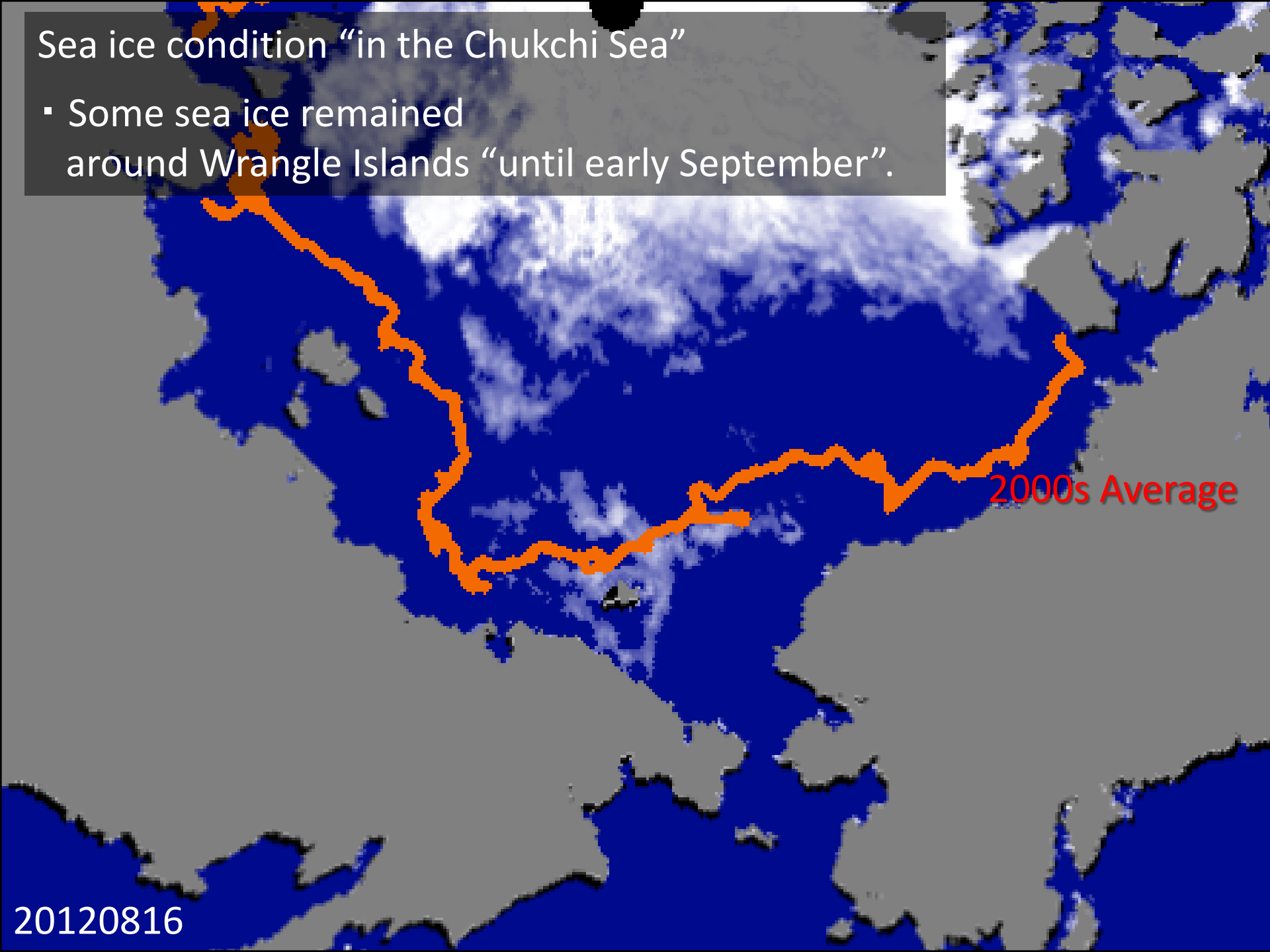


第一期水循環変動観測衛星「しずく」(GCOM-W1)

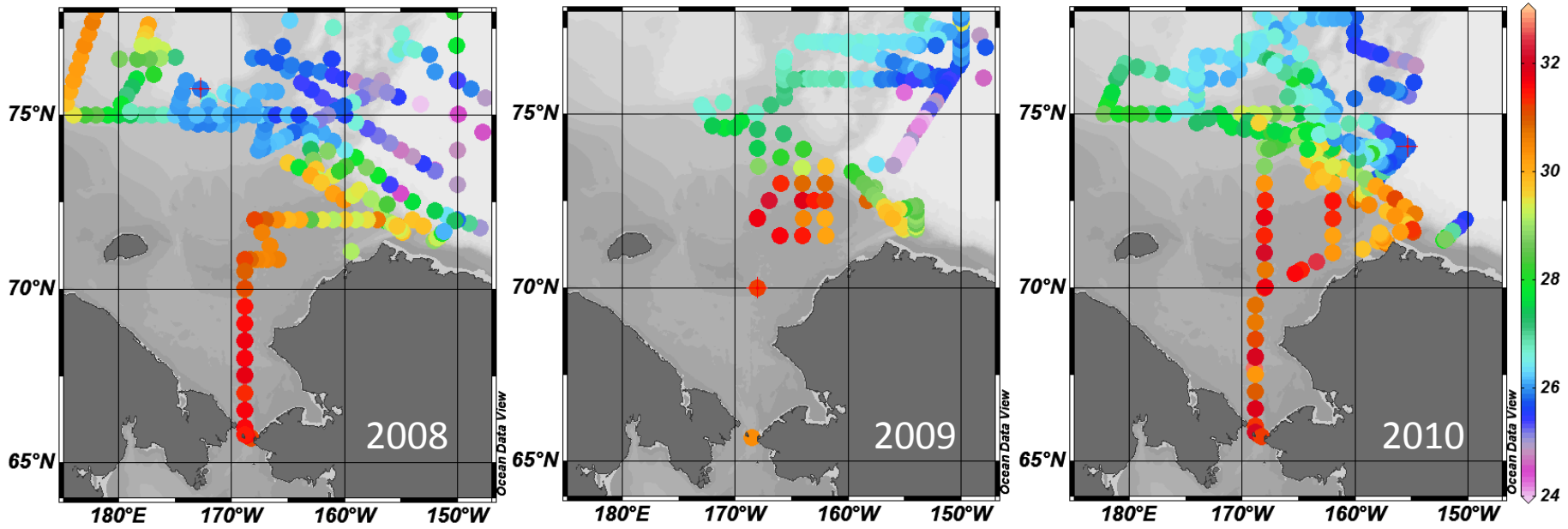


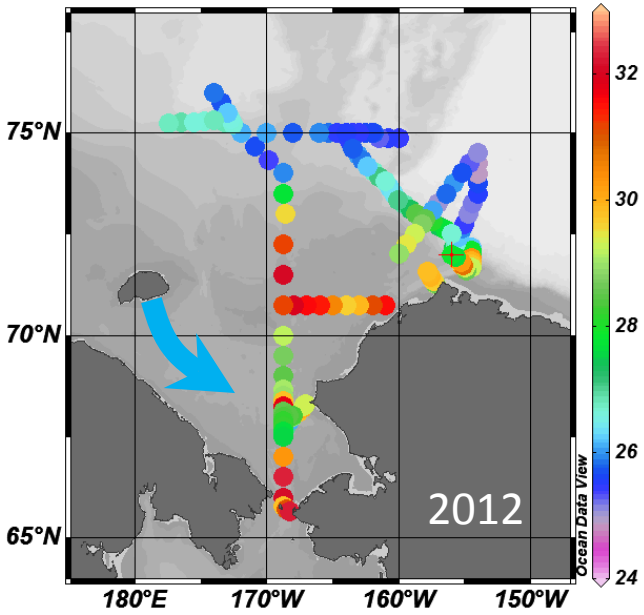


ay change after the validation process in future.


Sea ice condition “in the Chukchi Sea”
・Some sea ice remained
around Wrangle Islands “until early September”.
2000s Average
20120816

Comparison of surface salinity in 2012 with those in 2008, 2009, & 2010



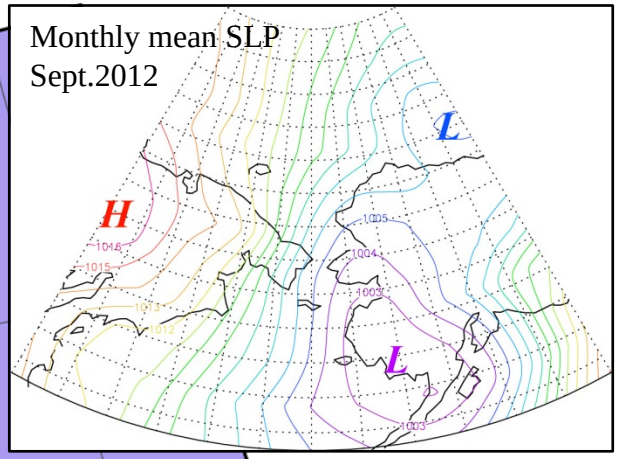


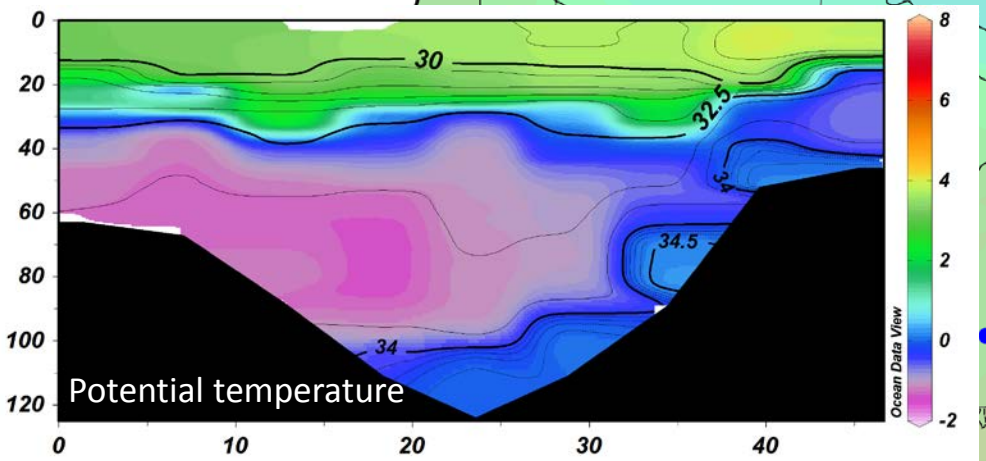
Sea ice condition in the Chukchi Sea.

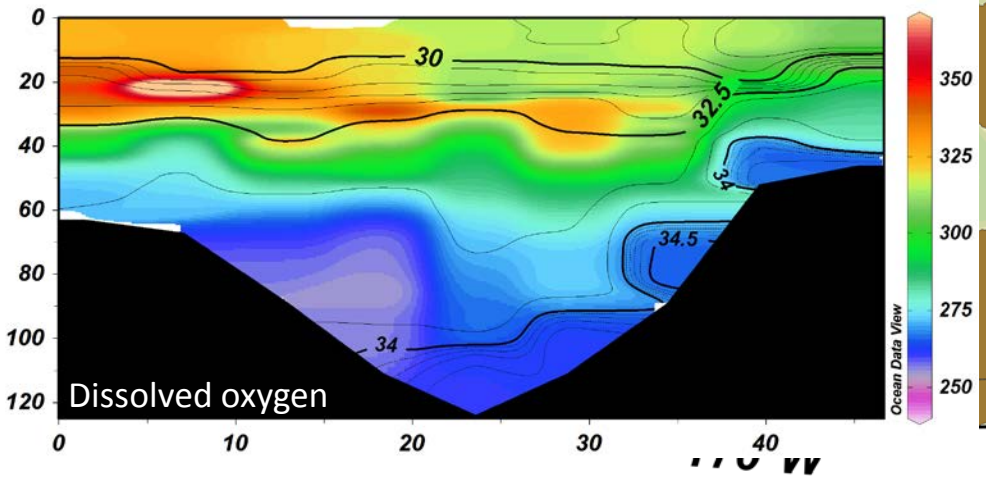
・Some sea ice remained
Around Wrangle Islands until early Sept.

It caused low salinity condition
around the Hope Valley in autumn 2012.

R/V Mirai 2012 Arctic Ocean cruise
CTD location (Sept.13th ~ Oct.4th)





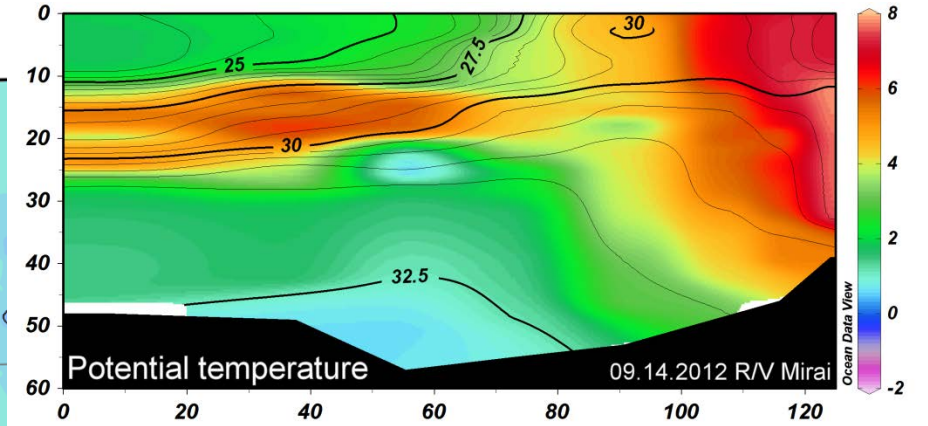


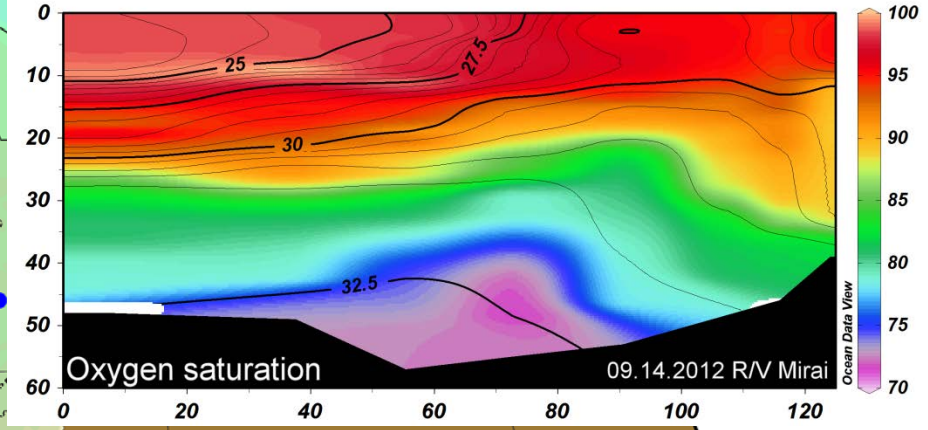
75°N

160°W

Sept.24

R/V Mirai 2012 Arctic Ocean cruise
CTD location (Sept.13th ~ Oct.4th)





75°N

70°N

170°W

160°W

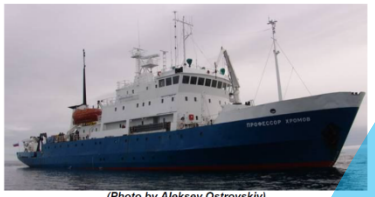
150°W

Ocean Data View

Sept.14

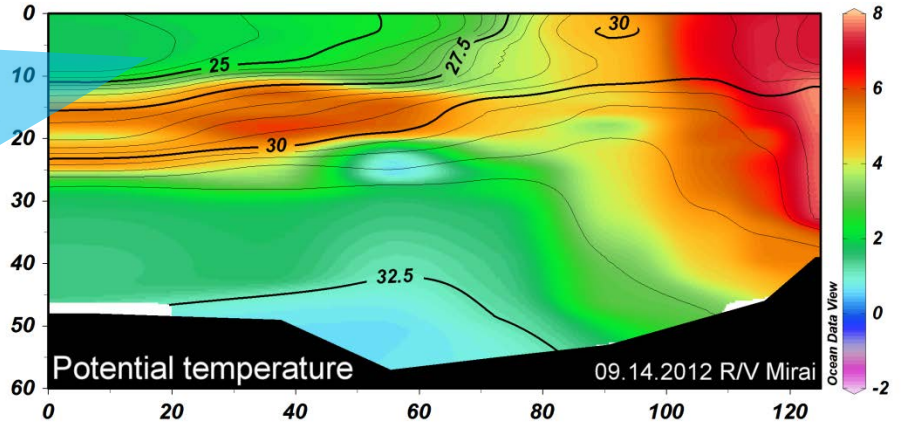
R/V Mirai 2012 Arctic Ocean cruise
CTD location (Sept.13th ~ Oct.4th)

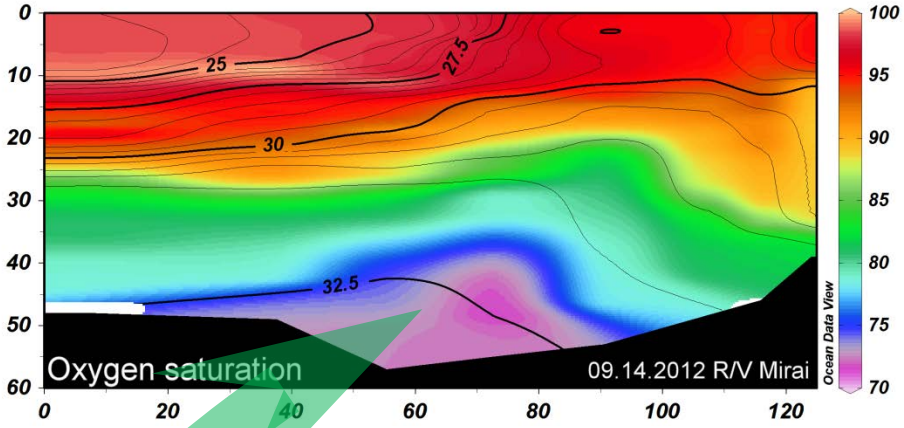
RUSALCA - BERING STRAIT AON 2012 MOORING CRUISE REPORT
Russian Research Vessel Professor Khromov (also called Spirit of Enderby)
Nome, 10th July 2012 – Nome, 20th July 2012
Rebecca Woodgate, University of Washington (UW), *woodgate@apl.washington.edu*
and the RUSALCA 2012 Science Team
Funding from NOAA RUSALCA Program and NSF Arctic Observing Network Program ARC-0855748 and NSF ARC – 1023264 (OSU)



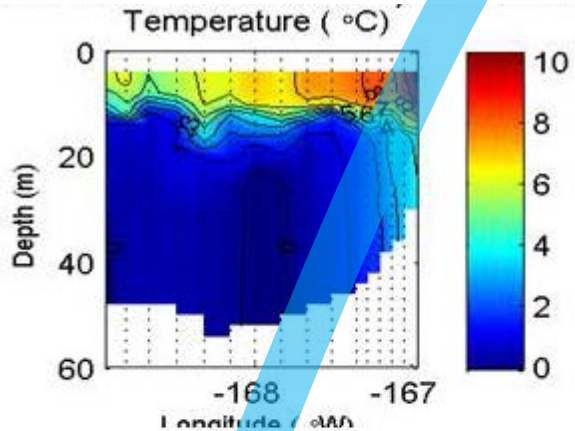
(Photo by Aleksey Ostrovskiy)

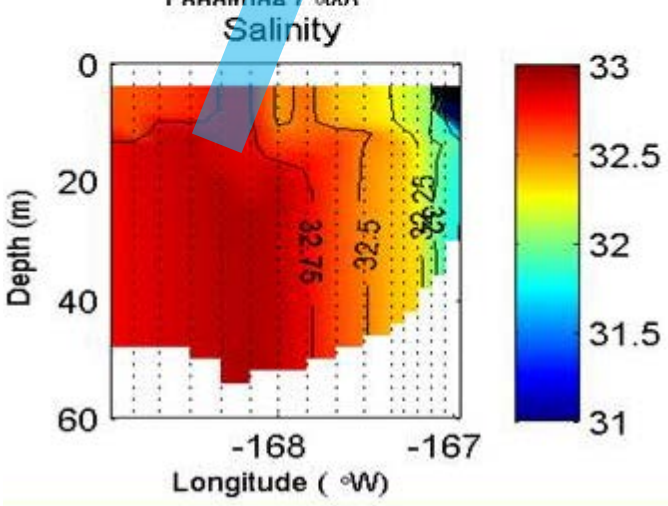
Freshening

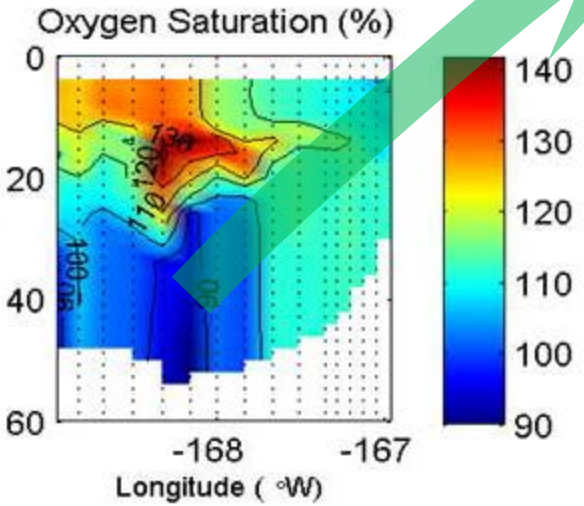




Decreasing



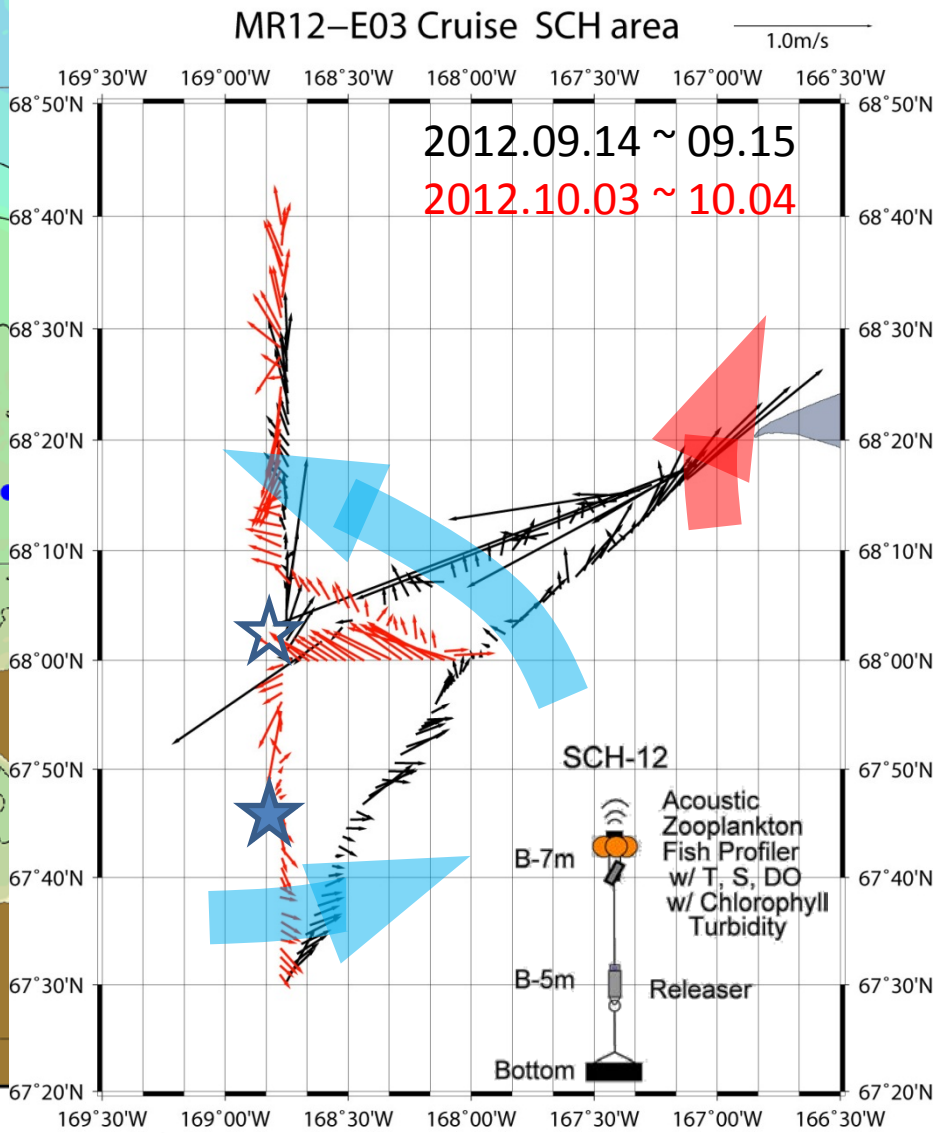




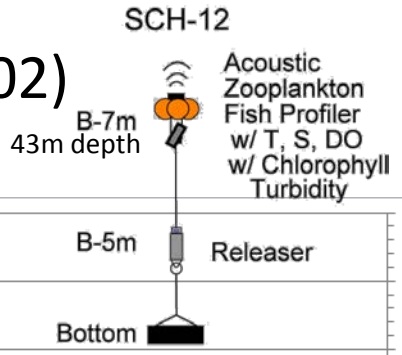
R/V Mirai (JAMSTEC)

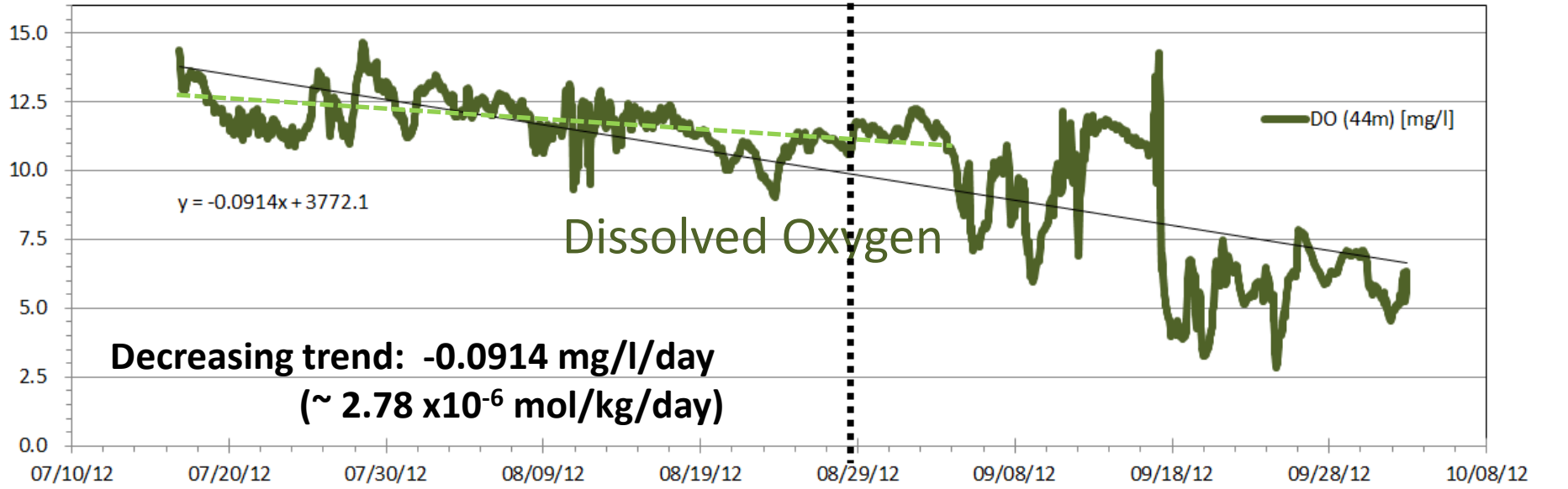
R/V Mirai 2012 Arctic Ocean cruise
CTD location (Sept.13th ~ Oct.4th)

Sept.14-15
/Oct. 3-4



Preliminary results from SCH-12 (July 16 to October 02)



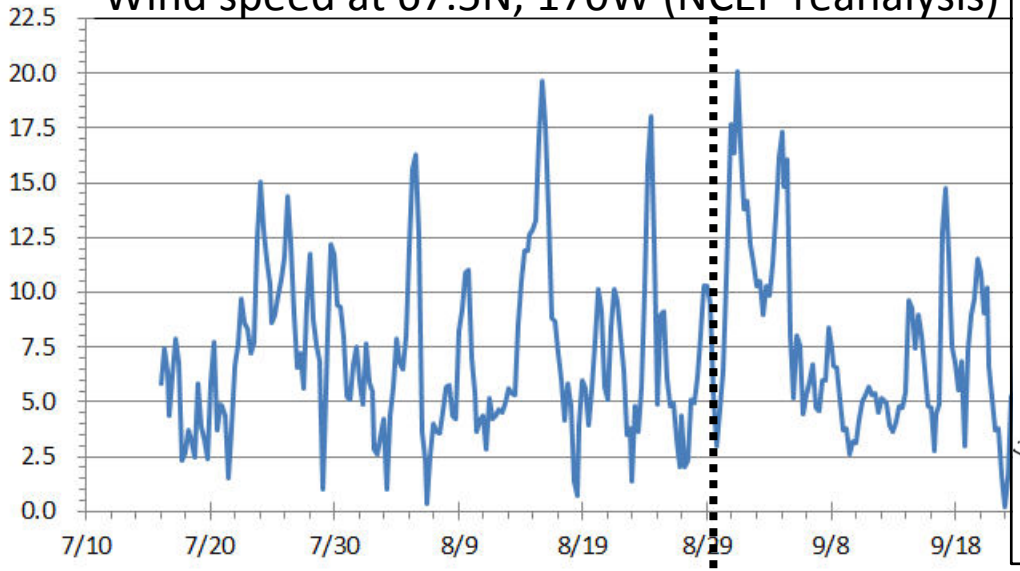


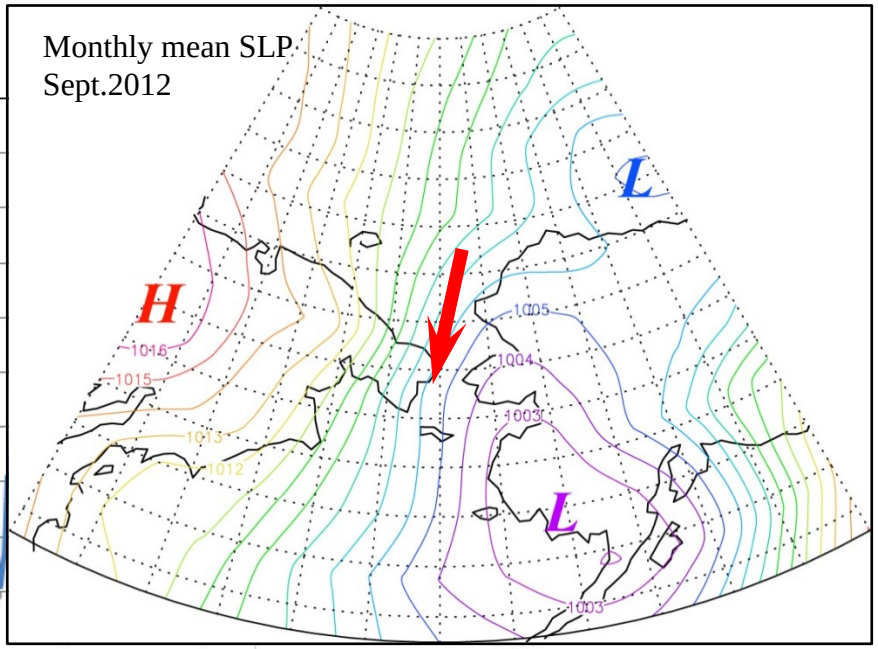
Decreasing trend: -0.0914 mg/l/day

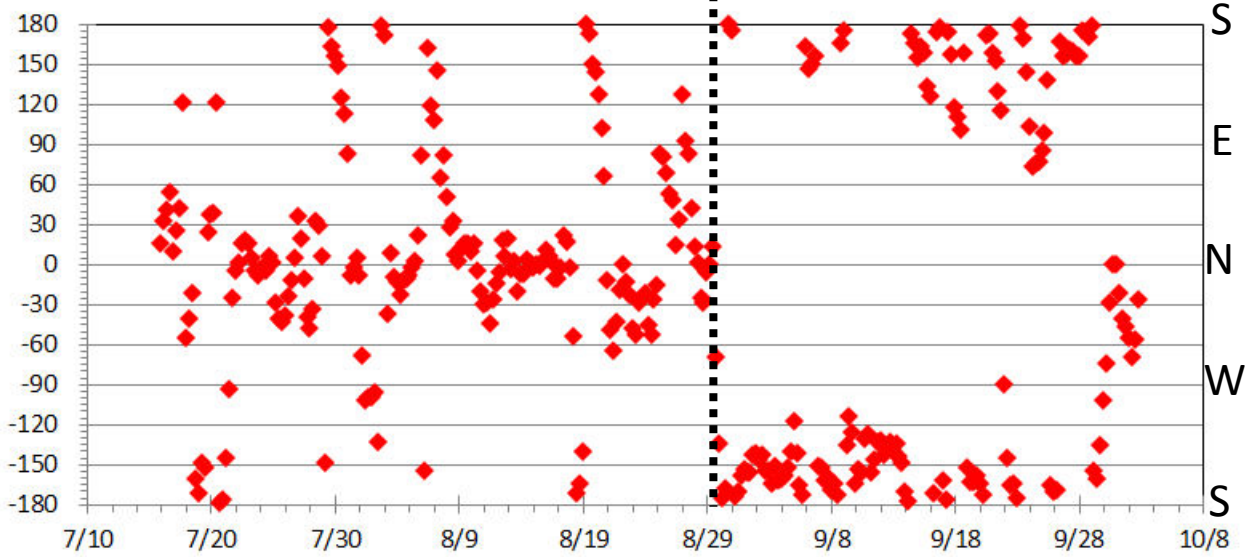
(~ 2.78 x10^{-6} mol/kg/day)

Preliminary results from SCH-12 (July 16 to October 02)

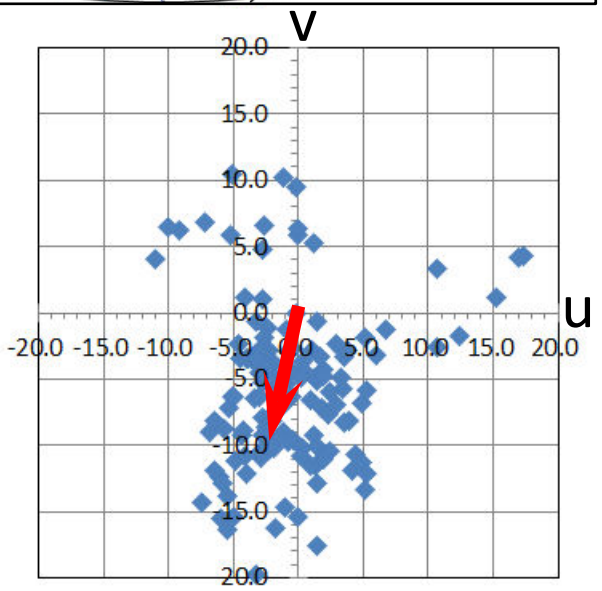
Wind speed at 67.5N, 170W (NCEP reanalysis)







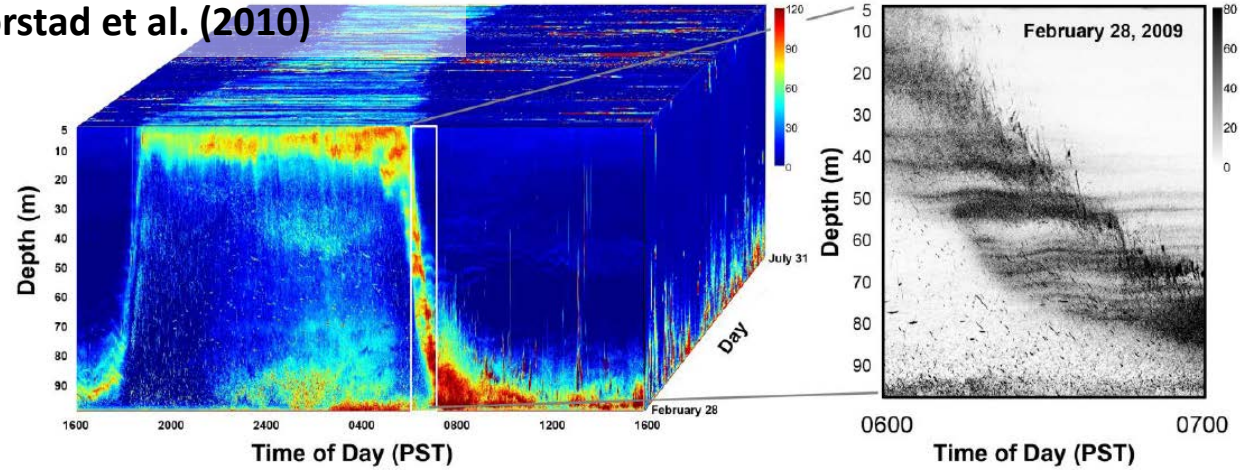
Wind direction at 67.5N, 170W (NCEP reanalysis)



Wind vector (8/29~10/02)

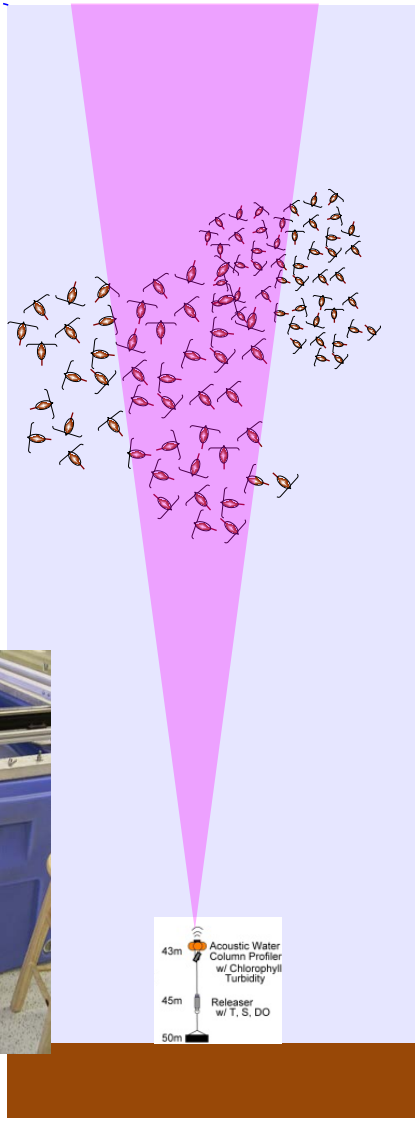
Multi-frequency Acoustic Zooplankton Fish Profiler (ASL Env. Sci.)

Borstad et al. (2010)



Instrument Frequency (kHz)	Approximate Minimum Particle Size Detected (mm)		Representative Organisms	Estimated effective Range (m)
775	2		small copepods, nauplii	50
460	6		mysids, larval euphausiids	100
200	16		larval fish, euphausiids	200
125	20		adult euphausiids, mysids, amphipods	250
70	30		small fish	Est 275
38	75		larger fish	Est 325

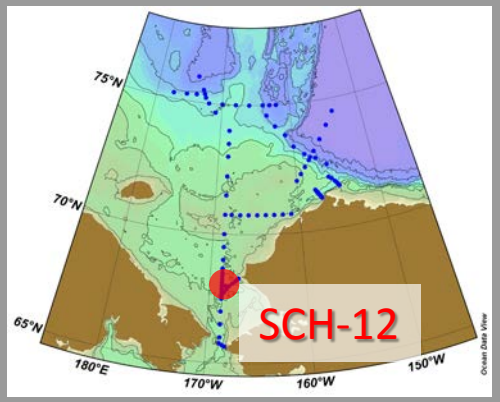
hich acoustic profiles
e series extending in
and 0700 PST on

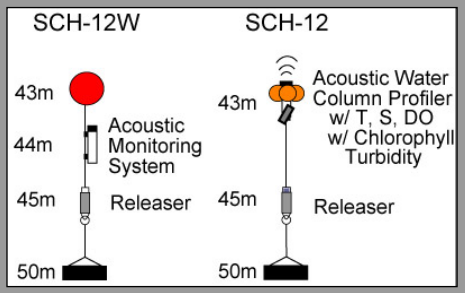


ASL Environmental Sciences

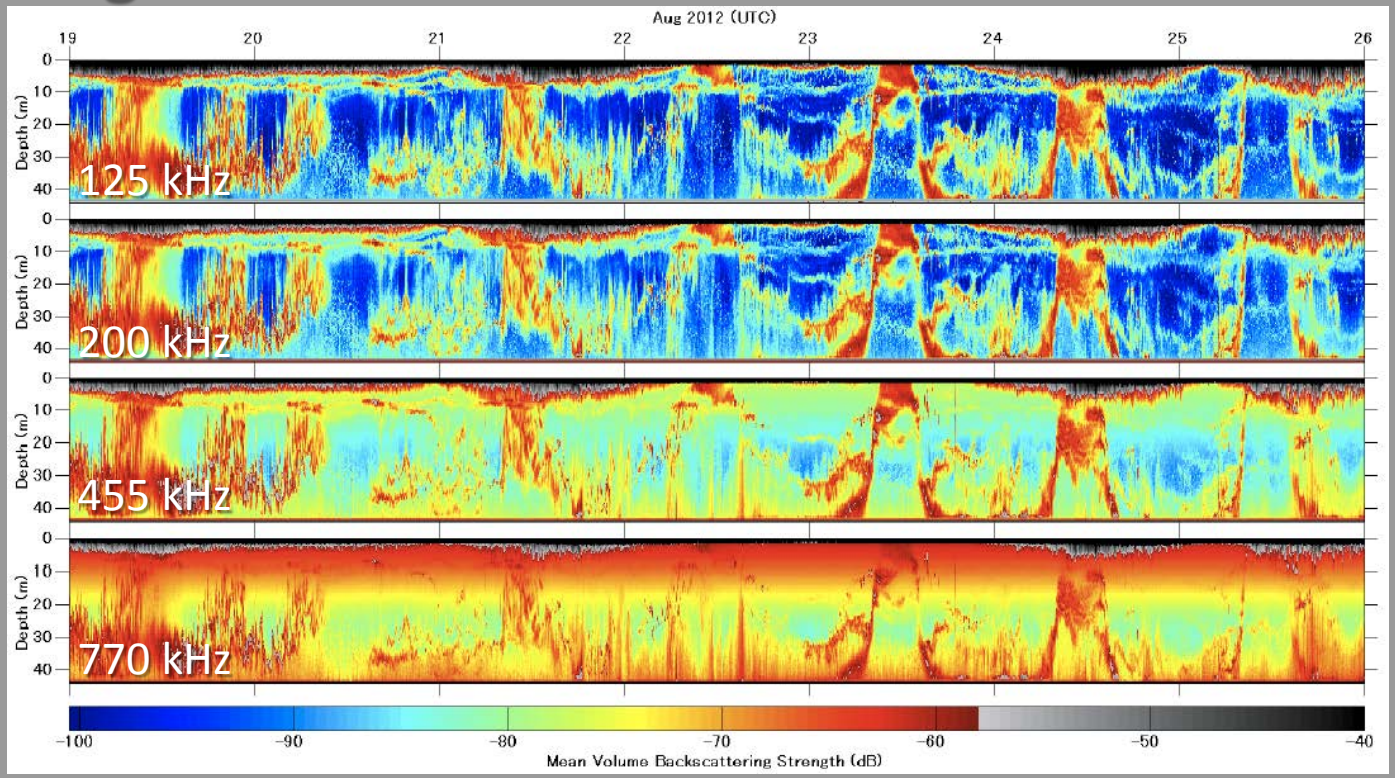
Preliminary results of 2012 field experiments

Mooring observation at biological “hot spot”
AZFP measurement in the southern Chukchi sea (SCH)





Aug. 19 - 26

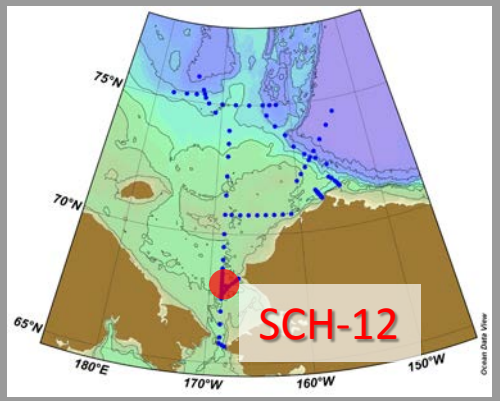


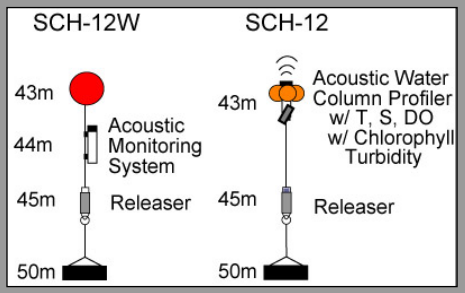
One week echogram from Acoustic Zooplankton Fish Profiler (AZFP) attached on SCH-12 between August 19 and 26, 2012
(Courtesy from Dr. Amakasu (Tokyo University of Marine Science and Technology))

Preliminary results of 2012 field experiments

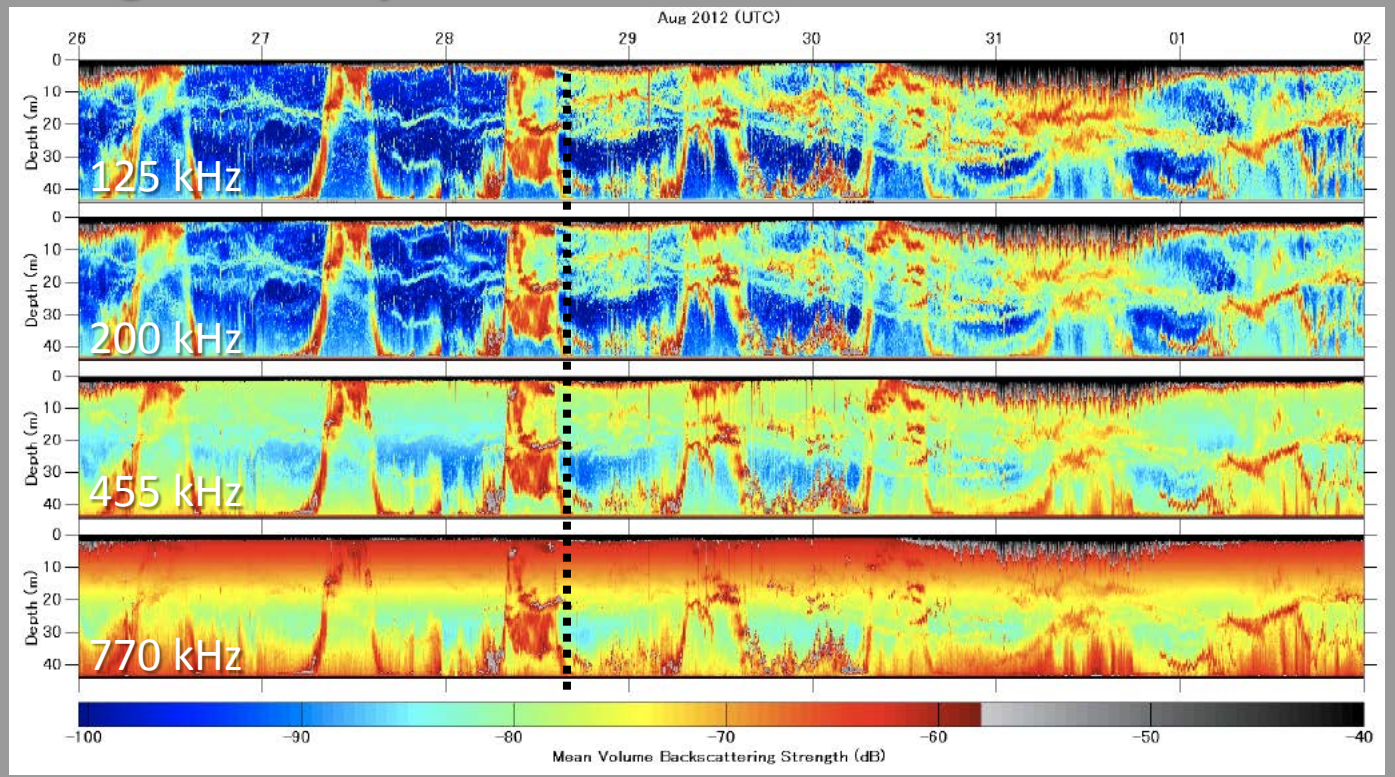
Mooring observation at biological “hot spot”

AZFP measurement in the southern Chukchi sea (SCH)





Aug.26 - Sept. 2

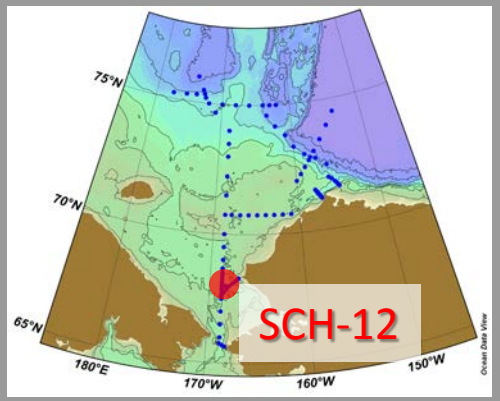


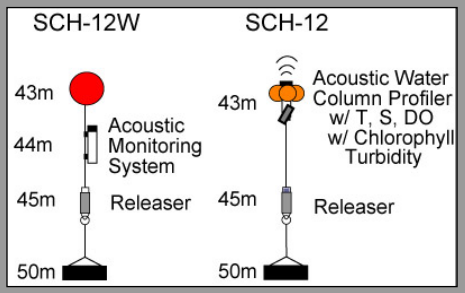
One week echogram from Acoustic Zooplankton Fish Profiler (AZFP) attached on SCH-12 between August 26 and September 2, 2012 (Courtesy from Dr. Amakasu (Tokyo University of Marine Science and Technology))

Preliminary results of 2012 field experiments

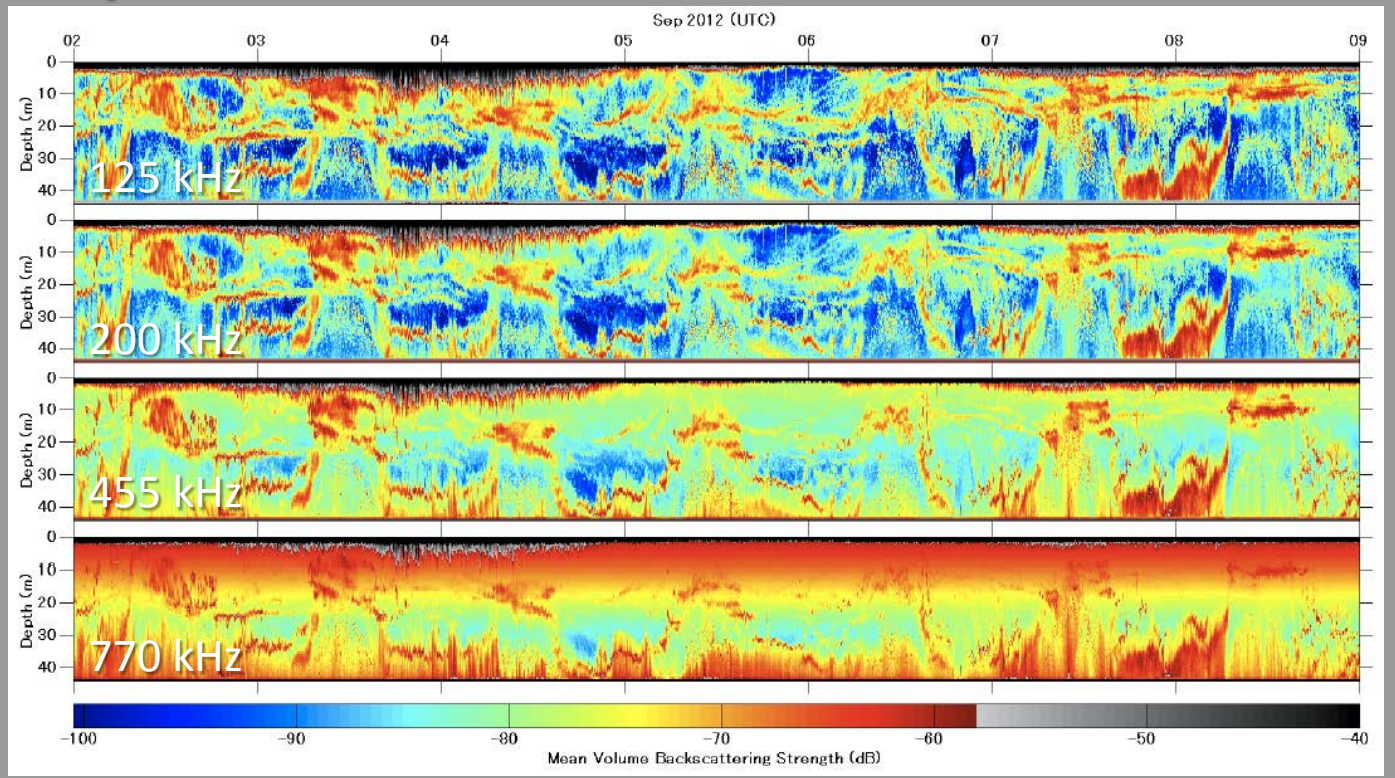
Mooring observation at biological “hot spot”

AZFP measurement in the southern Chukchi sea (SCH)





Sept. 2 - 9

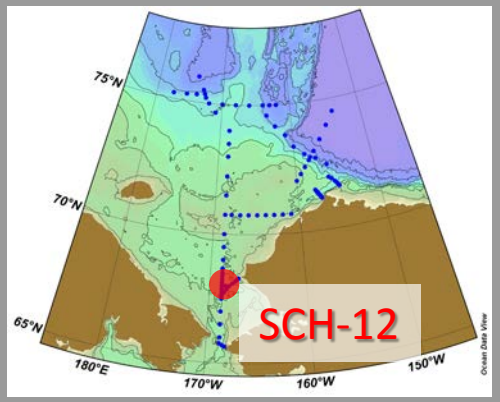


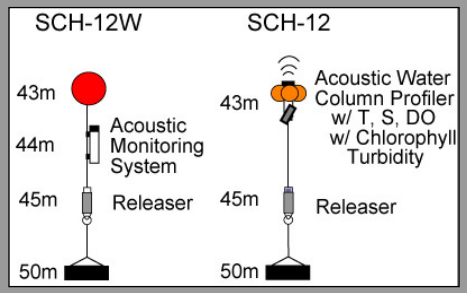
One week echogram from Acoustic Zooplankton Fish Profiler (AZFP) attached on SCH-12 between September 2 and 09, 2012
(Courtesy from Dr. Amakasu (Tokyo University of Marine Science and Technology))

Preliminary results of 2012 field experiments

Mooring observation at biological “hot spot”

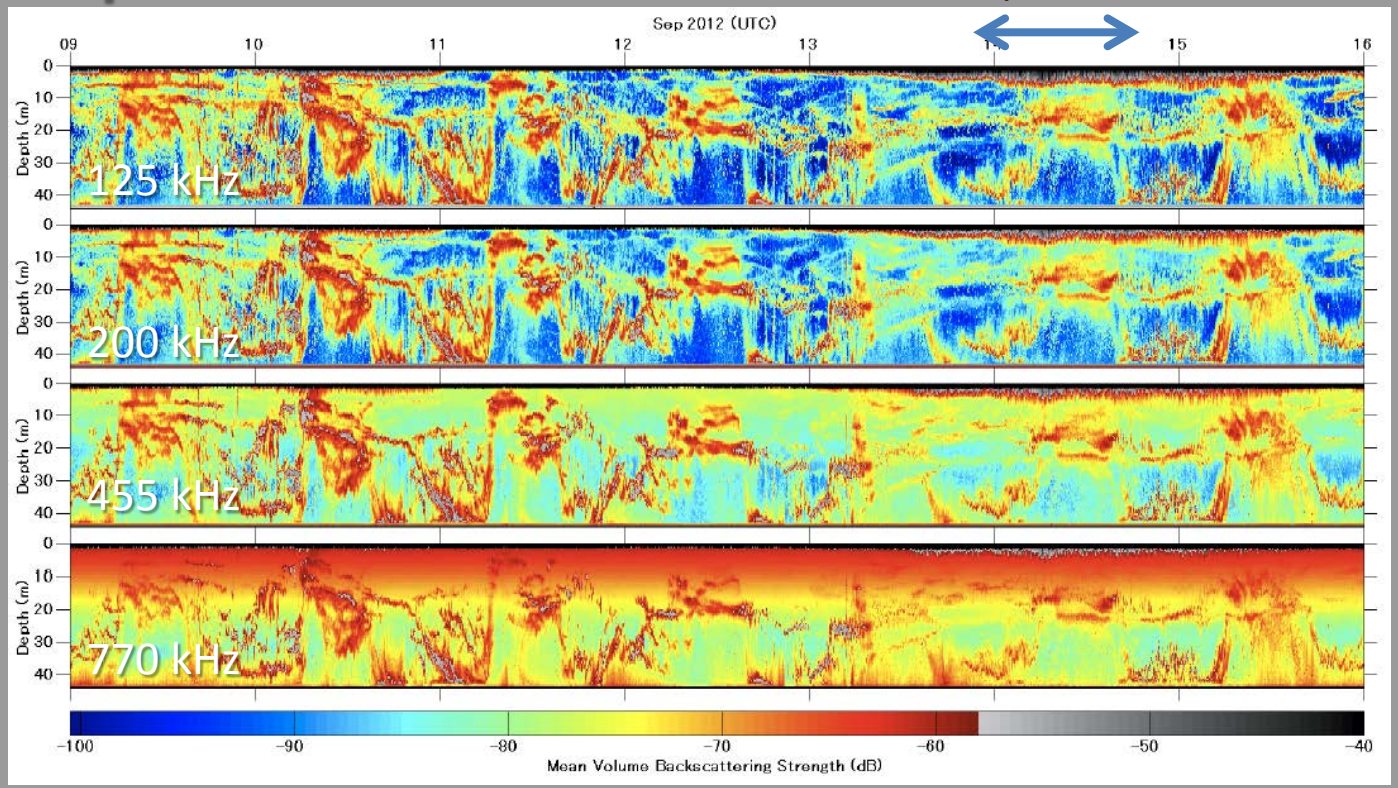
AZFP measurement in the southern Chukchi sea (SCH)





Sept. 9 - 16

R/V Mirai



One week echogram from Acoustic Zooplankton Fish Profiler (AZFP) attached on SCH-12 between September 9 and 16, 2012
(Courtesy from Dr. Amakasu (Tokyo University of Marine Science and Technology))

R/V Mirai 2012 Arctic Ocean cruise
Deployed mooring locations

NAP-12t
(Sed.Trap)

CAP-12t
(Sed.Trap)

SCH-12
SCH-12w

BCW-12
BCC-12
BCE-12

BCH-12
BCH-12w

75°N
70°N
170°W
72°N
71.5°N
71°N
159°W
158°W
157°W
156°W
155°W
154°W
153°W
Ocean Data View