



# Progress and Perspectives of R/V Mirai Arctic Ocean observation

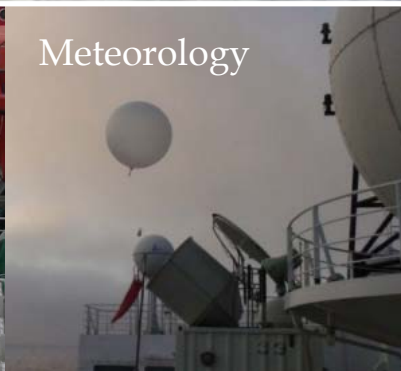
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With kind inputs from lots of my colleagues.



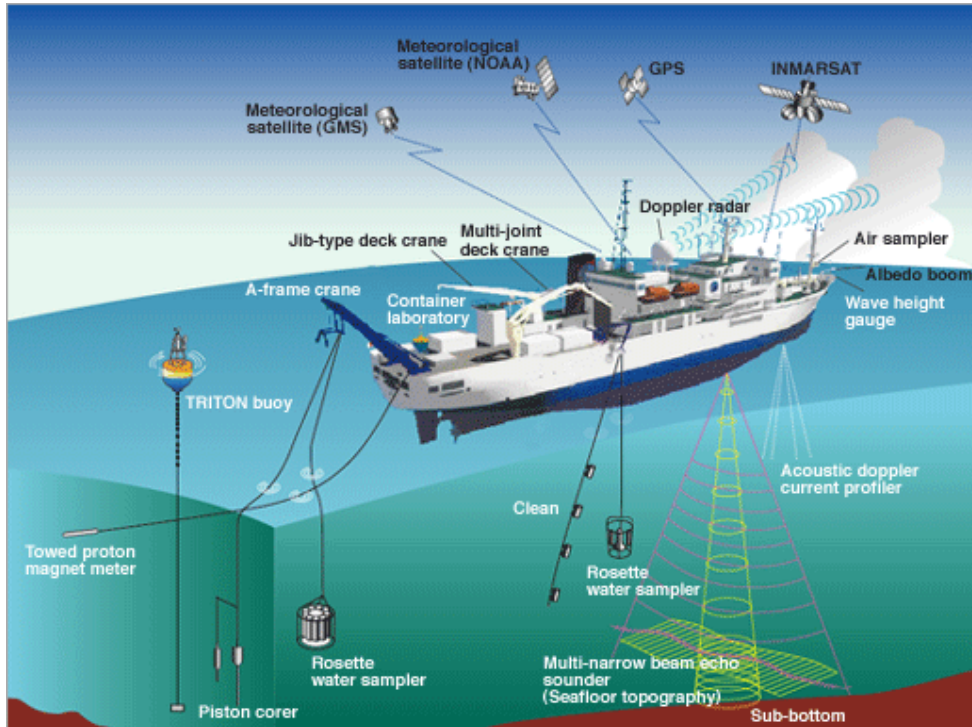
# To clarify the “on-going Arctic environmental change” and “its impact” for global climate and ecosystem



JAMSTEC Arctic Ocean and climate research  
in collaboration with national and international institutions/universities.

# JAMSTEC Activities in the Arctic Ocean using R/V Mirai

## *R/V Mirai (JAMSTEC)* Ice-strengthen ship (not ice-breaker)



*R/V Mirai* conducts large-area and long duration oceanic observations around the world. The large sturdy hull permits scientific observations to be made throughout summer ice sea and other rough sea state regions. The vessel has state-of-the-art oceanographic and meteorological equipment for gathering information to study global environment change, specifically climate change and global warming.

### Principal specifications

|                               |   |
|-------------------------------|---|
| <b>Length</b>                 | 128.5 m   |
| <b>Beam</b>                   | 19.0 m  |
| <b>Depth</b>                  | 10.5 m  |
| <b>Draft</b>                  | 6.9 m   |
| <b>Gross tonnage</b>          | 8,706 tons  |
| <b>Cruising speed</b>         | Approx. 16 knots  |
| <b>Range</b>                  | Approx. 12,000 nautical miles   |
| <b>Accommodation</b>          | 80 (34 crew, 46 research personnel)                                   |
| <b>Main propulsion system</b> | Diesel engines: 1,838kW × 4<br>Electric propulsion systems: 700kW × 2 |
| <b>Main propulsion method</b> | Controllable pitch propeller × 2                                      |



# JAMSTEC Activities in the Arctic Ocean using R/V Mirai

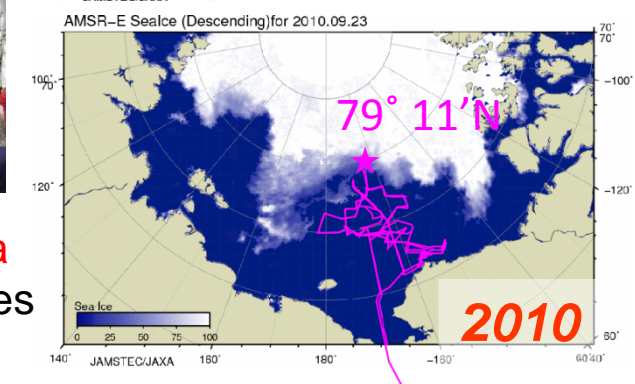
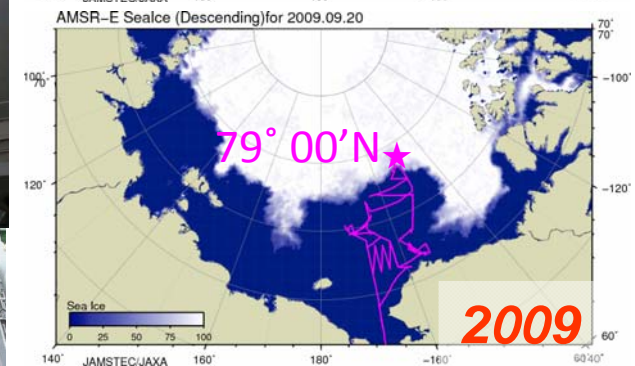
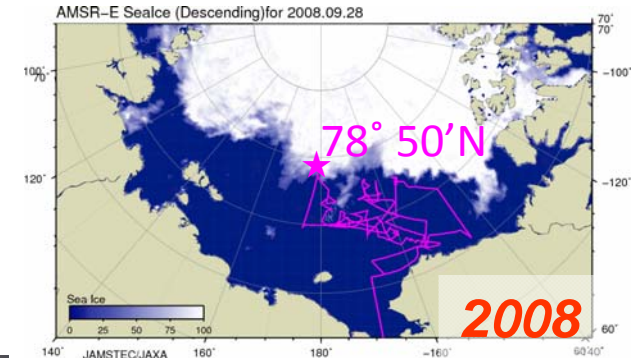
## ***R/V Mirai (JAMSTEC)*** Ice-strengthen ship (not ice-breaker)



In collaboration with Japanese research institutions & universities, JAMSTEC have been conducting R/V Mirai Arctic Ocean Cruise since 1998. (1998, 1999, 2000, 2002, 2004, 2006, 2008, 2009, 2010, 2012, 2013, 2014, 2015 and beyond)



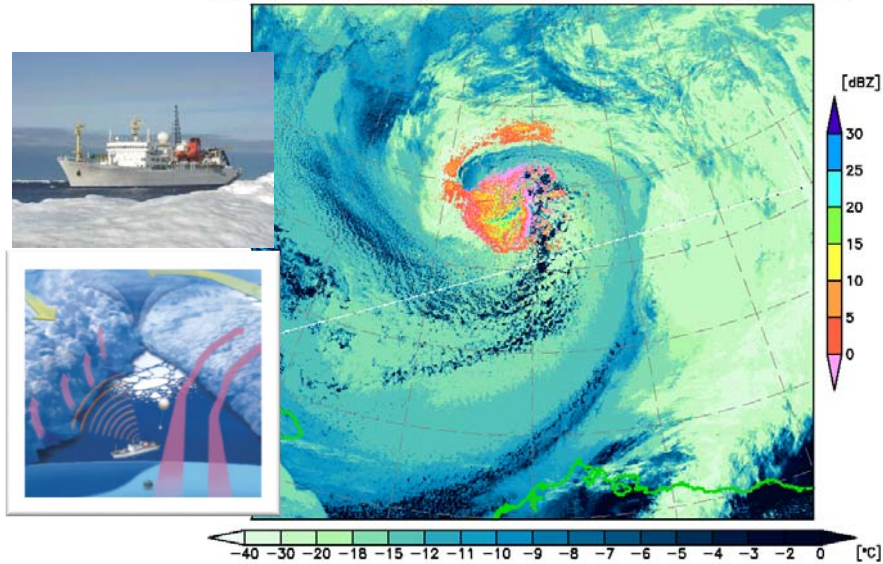
Based on the observational results in the **sea-ice reduction area** by R/V Mirai, we published lots of papers which shows evidences of Arctic environmental changes and the influences.



# Research topics using observational data from R/V Mirai Arctic cruise

## Arctic cyclogenesis

NOAA/AVHRR Ch.4, & Radar Ref. (23:29Z24SEP2010)

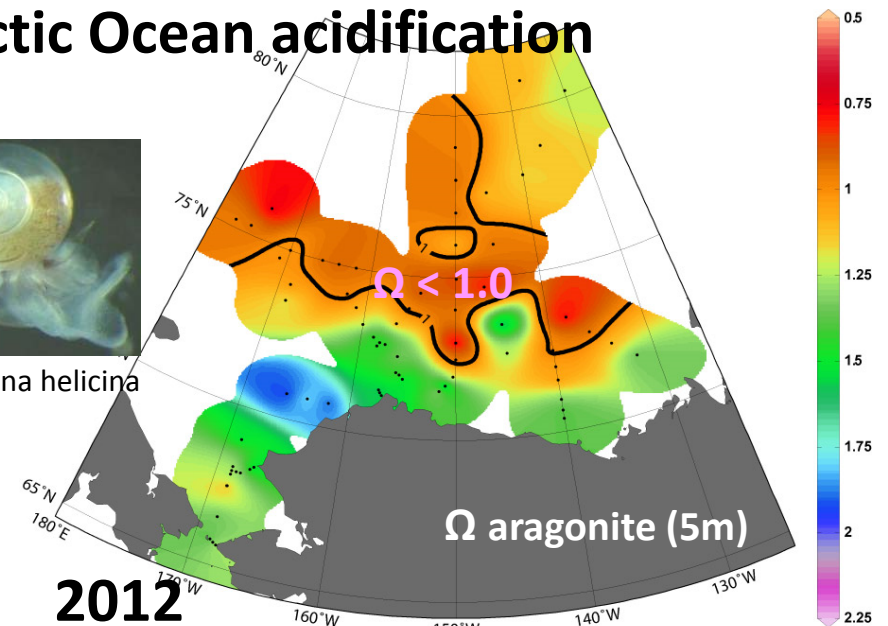


Inoue and Hori, *Geophys. Res. Lett.*, 2011.

## Arctic Ocean acidification

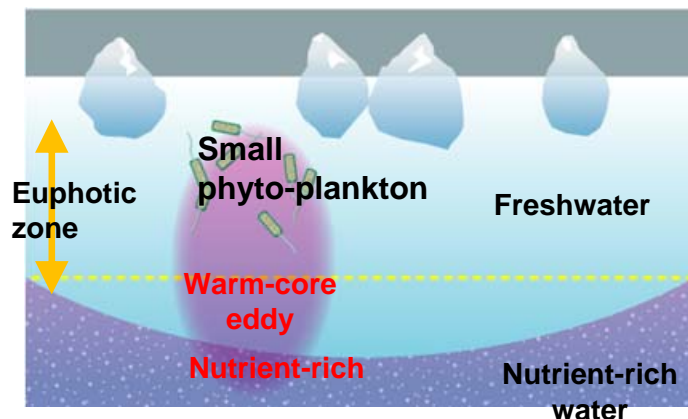


*Limacina helicina*



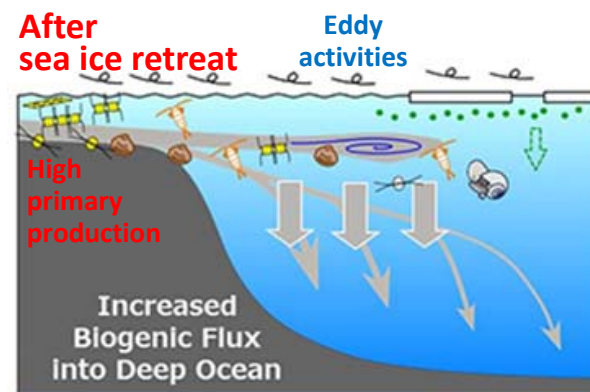
Courtesy from Dr. Yamamoto-Kawai (TUMSAT)

## Unusually large warm-core eddy



After Nishino et al., *Geophys. Res. Lett.*, 2010.

## Enhanced role of eddies on Arctic marine ecosystem

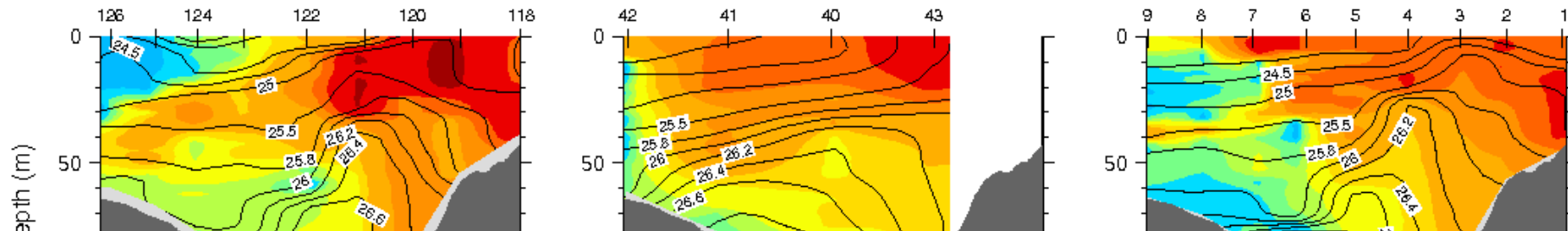


**Plankton Habitat is expanding along Eddy Pathway**

After Watanane, Onodera, et al., *Nature Comm.*, 2014.

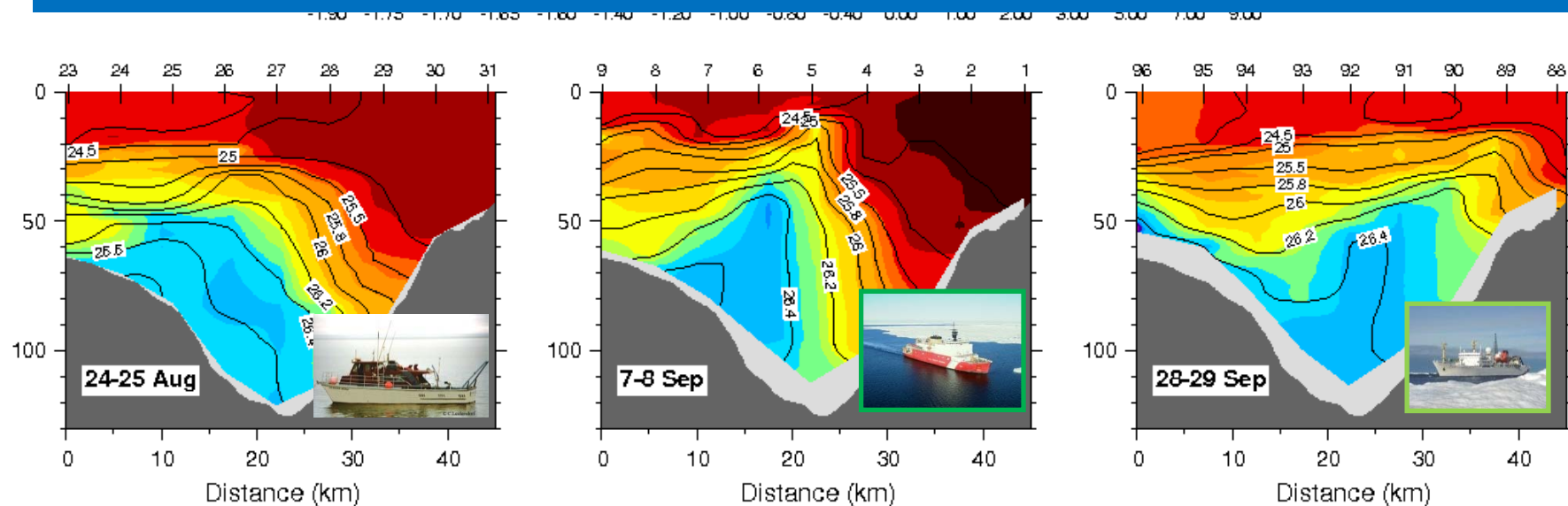
# Research topics using observational data from R/V Mirai Arctic cruise

## Distributed Biological Observatory (DBO) 6 occupations of Barrow Canyon transect in 2010

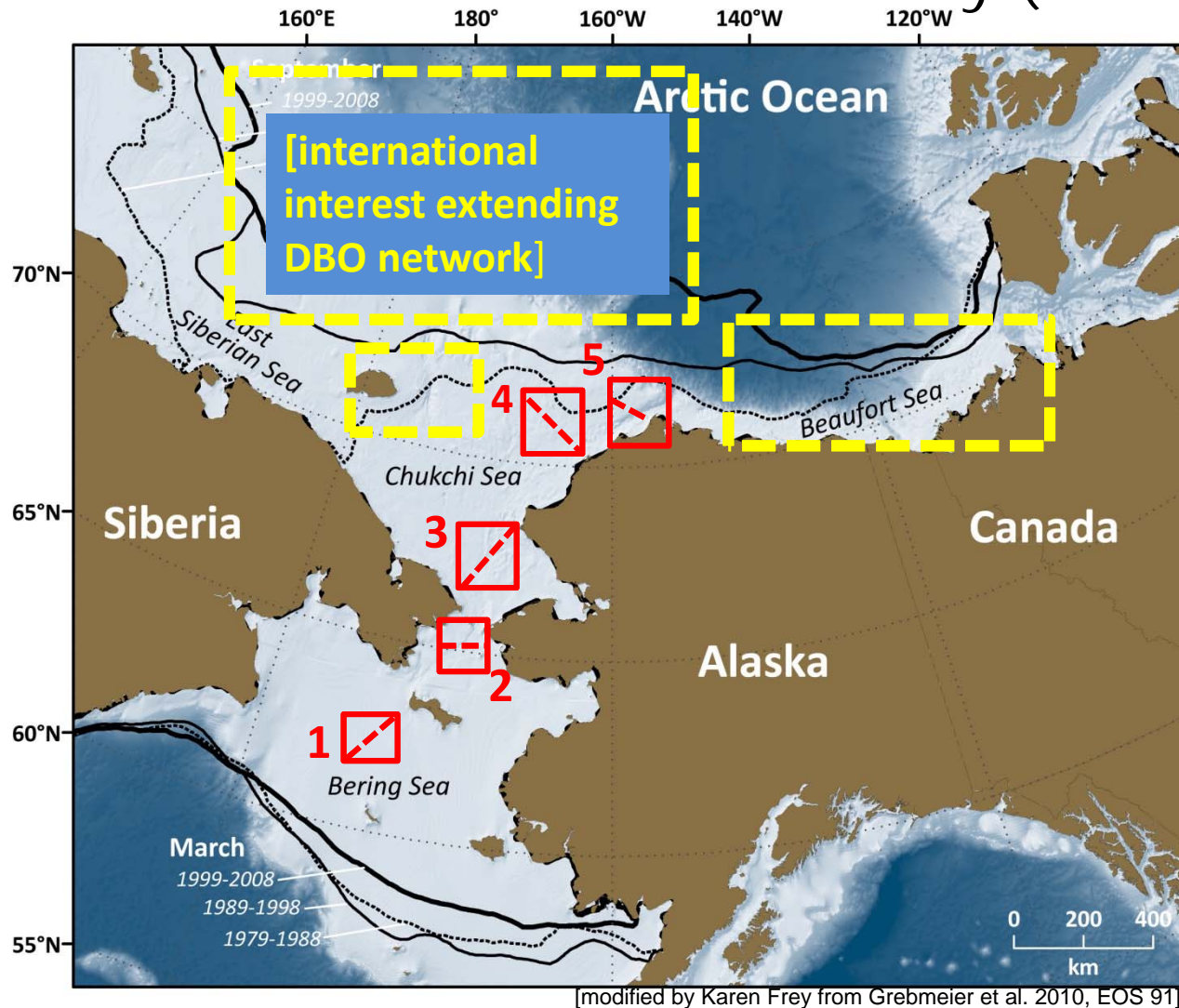


**Itoh, M.,** R. S. Pickart, T. Kikuchi, Y. Fukamachi, K. I. Ohshima, D. Simizu, K. R. Arrigo, S. Vagle, J. He, C. Ashjian, J. T. Mathis, S. Nishino, and C. Nobre (2015)

“Water properties, heat and volume fluxes of Pacific water in Barrow Canyon during summer 2010”, *Deep Sea Res. I*, Accepted on April 18, 2015



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



- 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 occupied by national and international entities with shared data plan

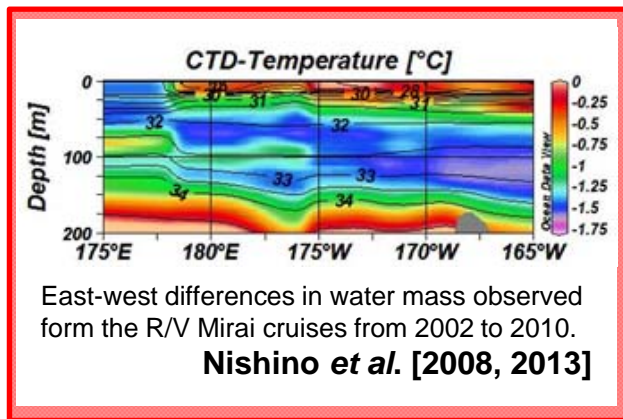




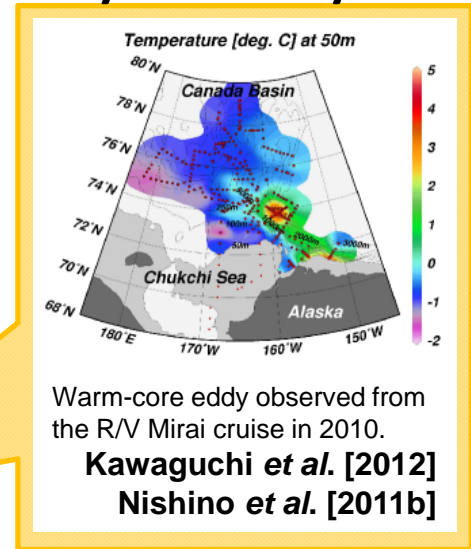
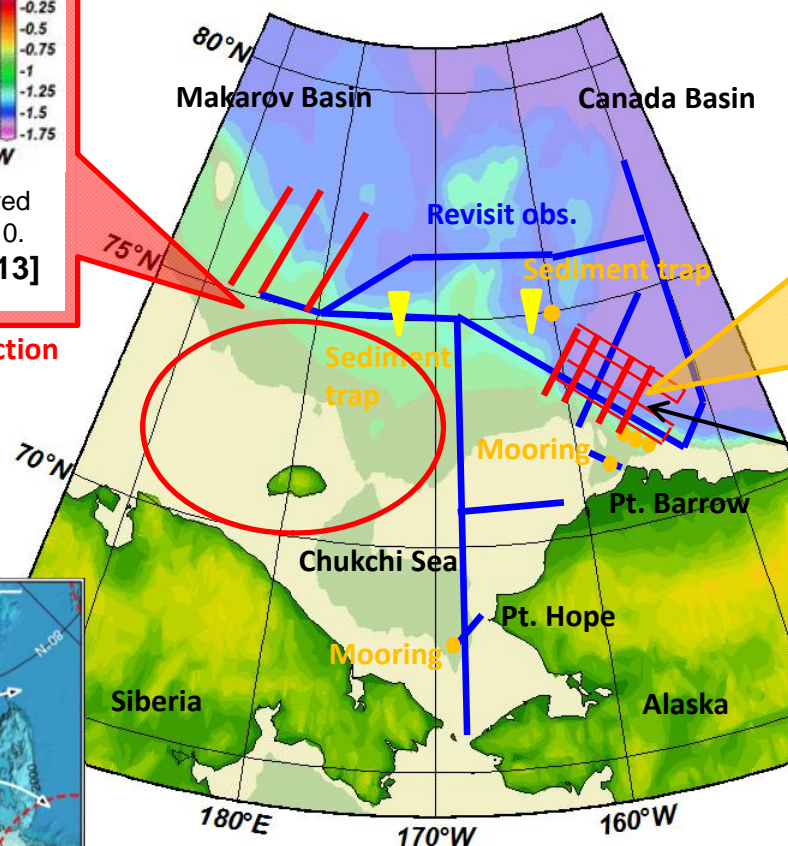
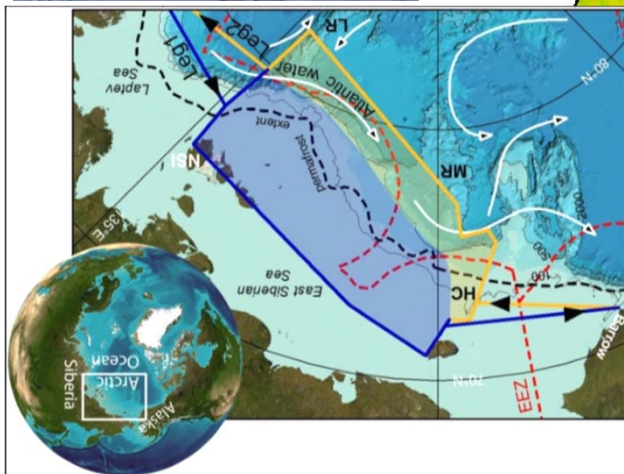
# JAMSTEC Future observation plan in the Arctic Ocean

## R/V Mirai Arctic cruise in September-October 2015

→ Oceanographic cruise focused on physics, bio-geochemistry and ecosystem



Siberian shelf-basin interaction



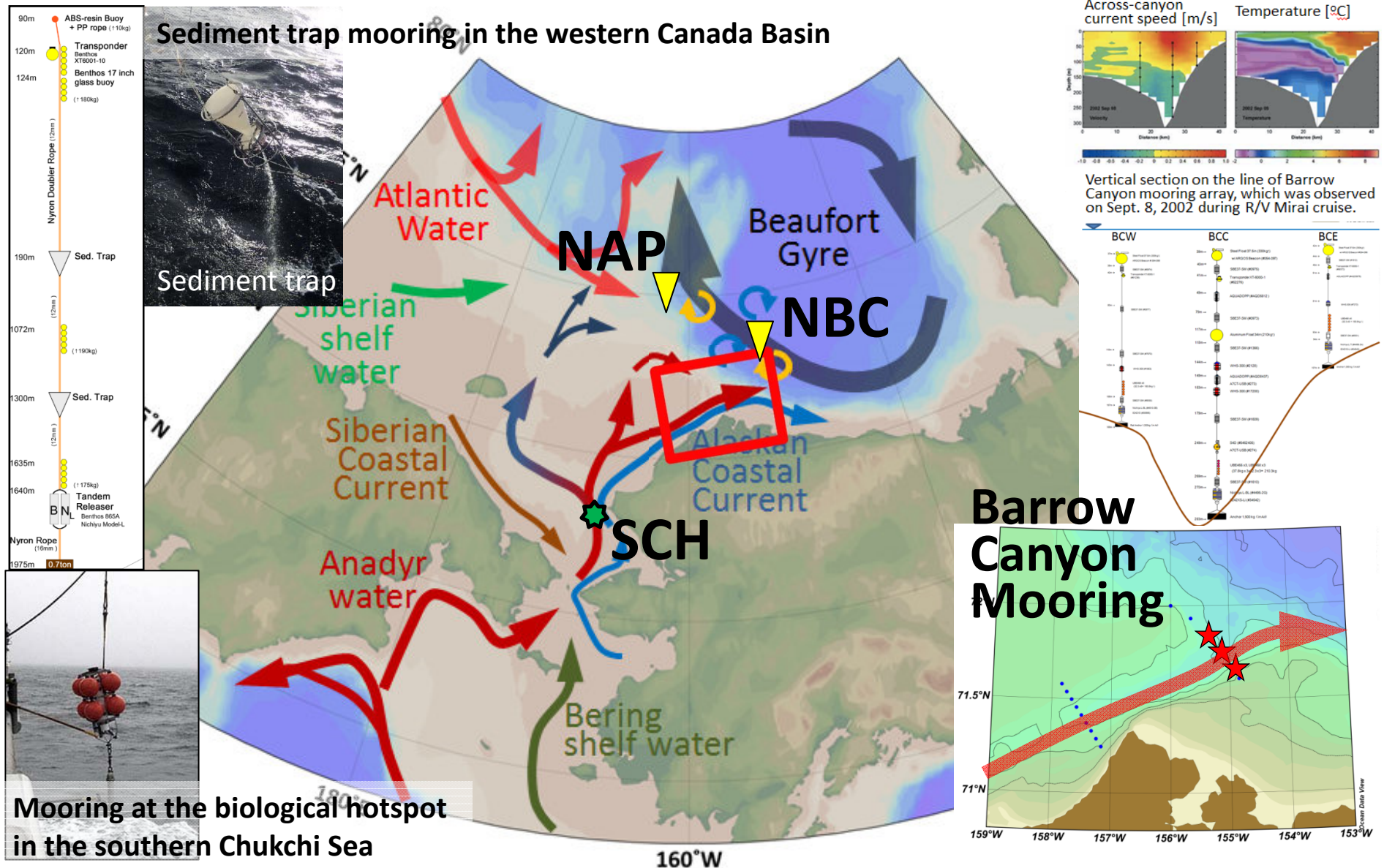
Intensive obs. of eddy & shelf-break jet by CTD/LADCP/water sampling and TurboMAP



Courtesy from Dr. Nishino (JAMSTEC)

# JAMSTEC Future observation plan in the Arctic Ocean

## Mooring observation in the Pacific sector of the Arctic Ocean





Thank you very much  
for your attention.

A photograph of a large, white ice floe floating in the Arctic sea. The word "JAMSTEC" is written in blue letters on the side of the ice. The background shows a vast, open sea under a clear blue sky.

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