Pacific Arctic Group:
Korean Arctic Ocean Research in 2016

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KOPRI

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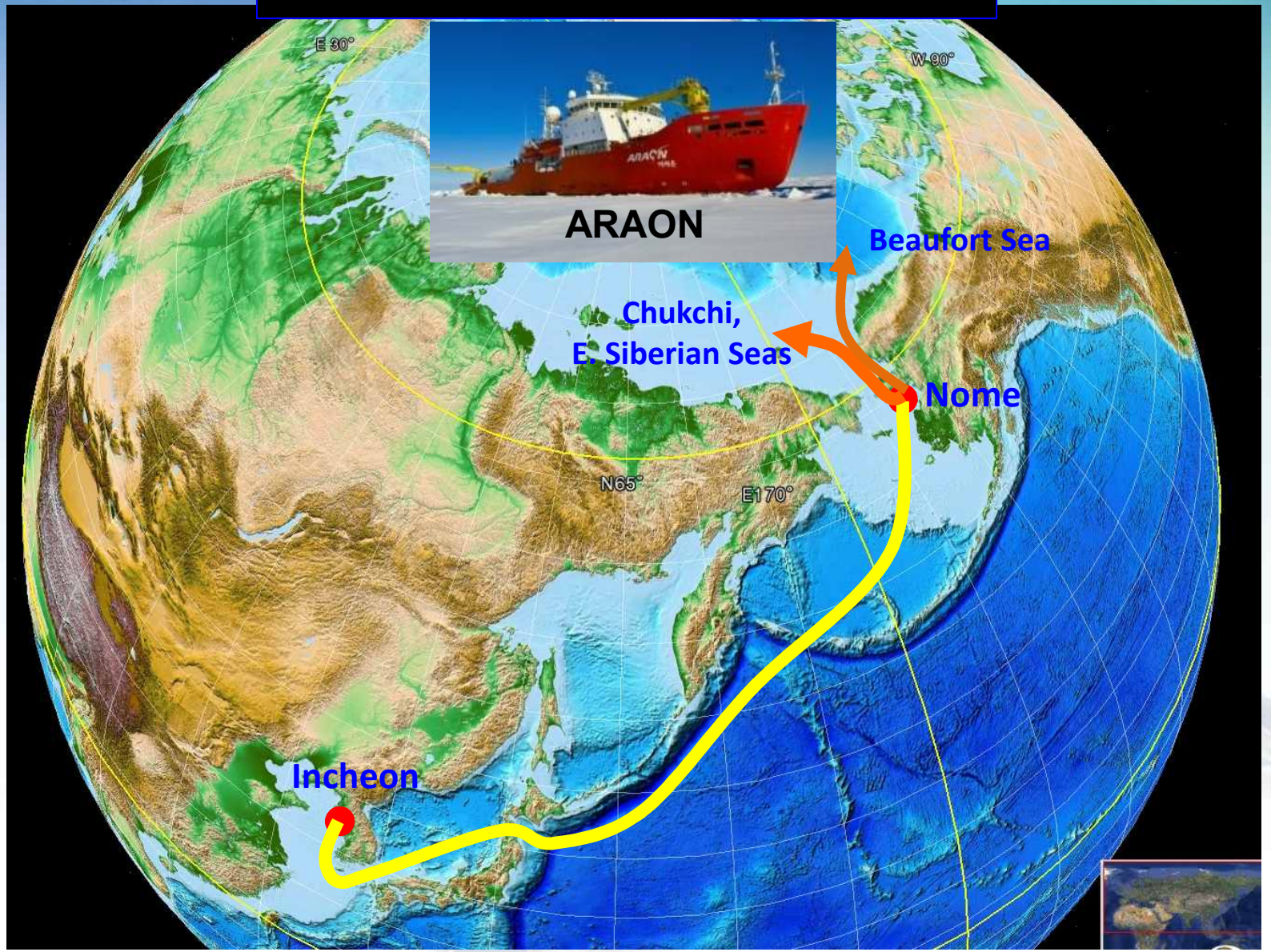
Pacific Arctic Group Meeting, Fairbanks

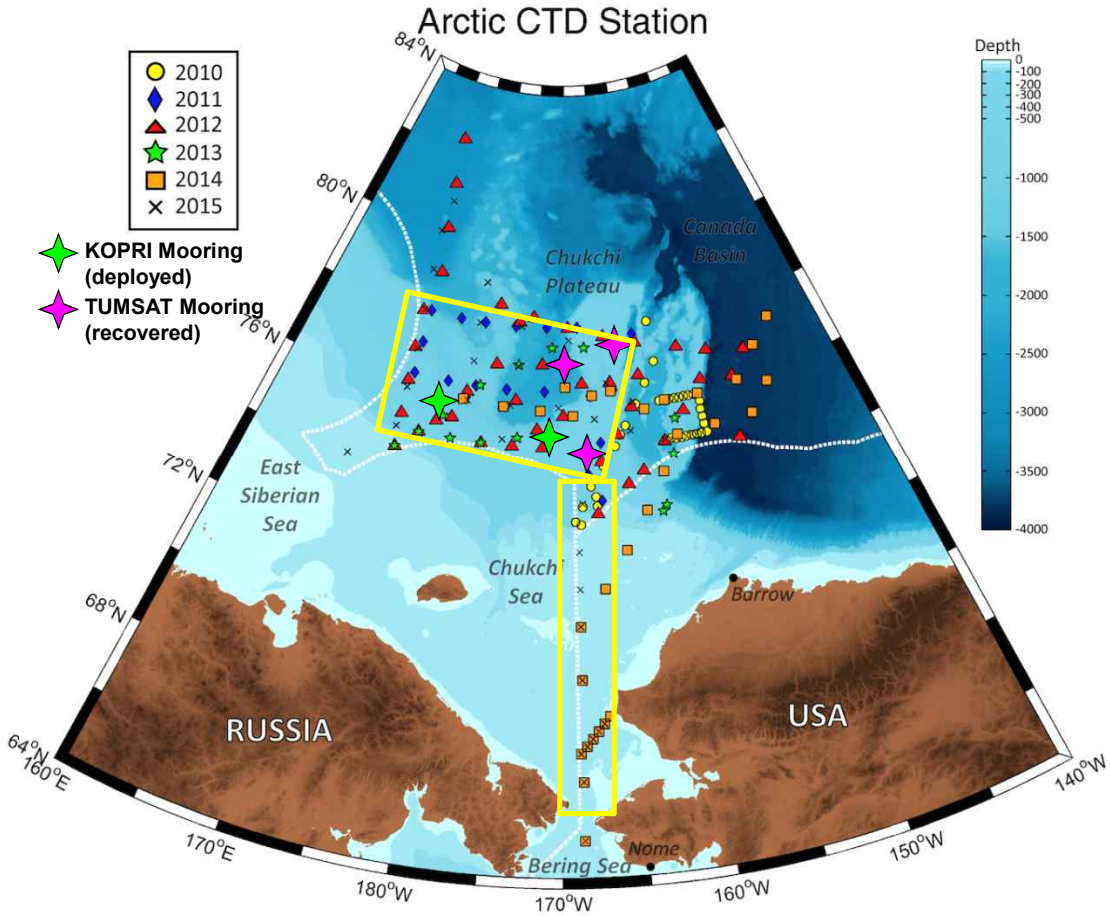
KOPRI
Korea Polar Research Institute

Korean Arctic Ocean Cruise track



Typical expedition periods: from the July to the end of September

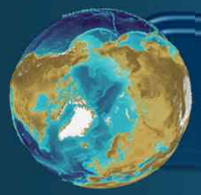
IB R/V ARAON Arctic Cruises (2010~2015)



	2010	2011	2012	2013	2014	2015
CTD	38	18	44	16	32	42
XCTD	*	33	48	36	51	61
Period	07/20~08/10	08/02~08/16	08/04~09/06	08/24~09/01	08/01~08/23	08/01~08/21

2016 KOPRI Arctic Research Plan

2016. 8. 5 ~ 9. 9



2016 KOPRI Arctic Cruise (1st leg)

- **Ocean study**
- **Aims of the cruise:**

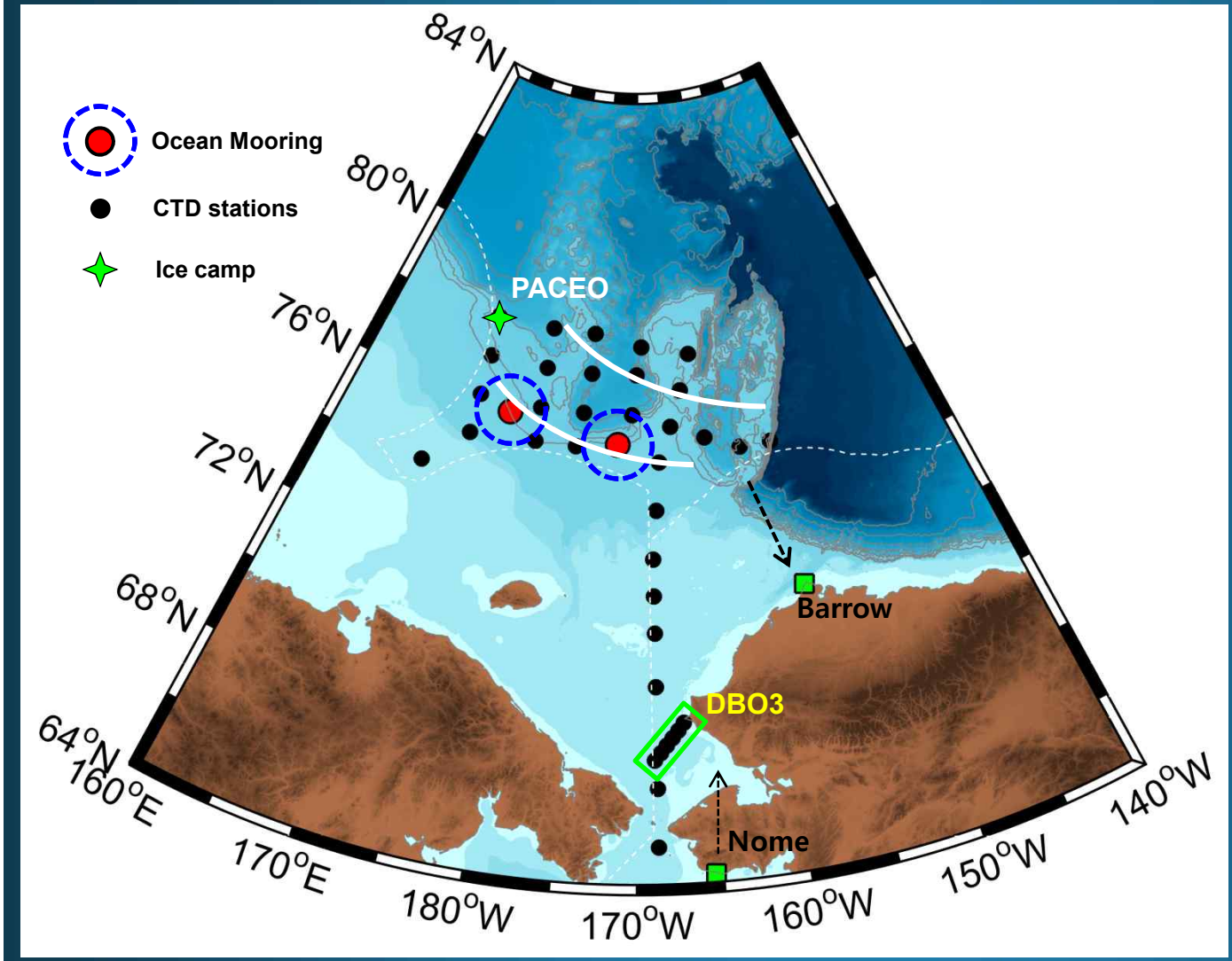
  - To investigate the structure and processes in the water column around the North Bering Sea, Chukchi Sea, and the North site of the East Siberian Sea in rapid transition

  - To understand sea ice dynamics and sea ice ecosystem

- **Period:** 2016. 8.5 - 8.23 (from Nome to Barrow)
- **Chief Scientists:** Dr. Eun Jin Yang
- **Participating nations:** Korea, US, Japan, China and UK

2016 Arctic Survey plan

1st Leg (ocean study)

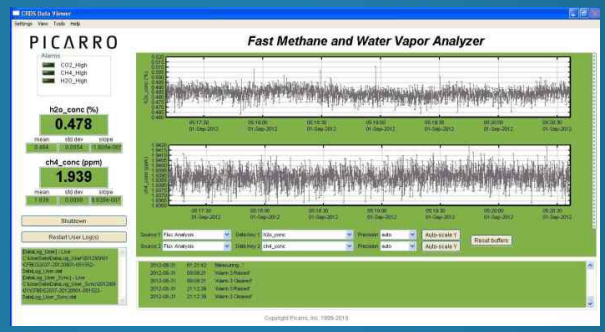


- North Bering Sea (DBO 3)
- Chukchi Sea
- East Siberian Sea & Mendeleev Ridge
- Sea Ice station
- Ocean mooring station

Atmospheric Observation

- Direct measurements of Air-Sea Greenhouse Gas Fluxes (CO_2 and CH_4)

Open-path eddy covariance at the foremast of ARAON

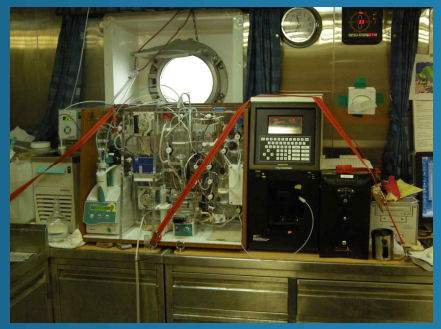


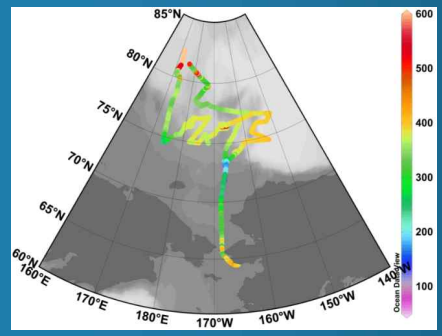
Real time variation of CH_4 and H_2O in flux mode

Chemistry in water column

- Pursuing spatial and temporal variation of CO_2 system in the Arctic Ocean
- Behavior of nutrients (NH_4, NO_2+NO_3, PO_4 and SiO_2)
- Characteristics of dissolved and particulate organic matters (DOM and POM)

Analytical system for DIC and TA





Dissolved pCO_2 along the track

TOC-TN analyzer

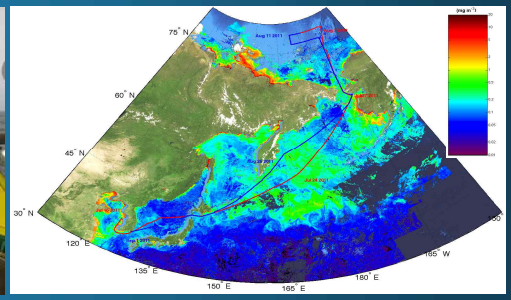
Satellite Remote Sensing

- Ocean Color Remote Sensing (Ocean Optics Measurement)

Hyper-spectroradiometer

Above water spectroradiometer

APC deployment



Hydrographic Survey

- Water mass distribution & characteristics

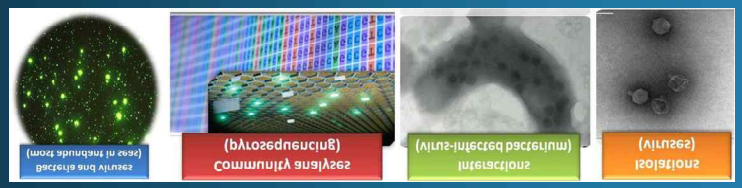
CTD & LADCP

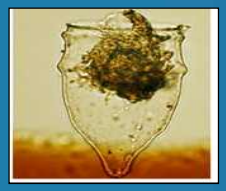
XCTD

Ocean Mooring

Plankton Ecology/Production

- Distribution of bacteria and virus and community structure
- Species compositions of phytoplankton and chlorophyll *a* concentration
- Abundance and community structure of heterotrophic protists
- Mesozooplankton community and grazing impacts on phytoplankton biomass
- Primary production and new production





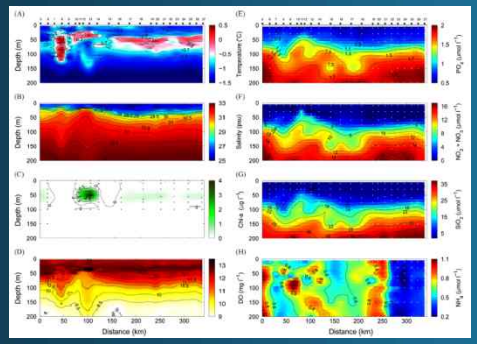
Phytoplankton physiology

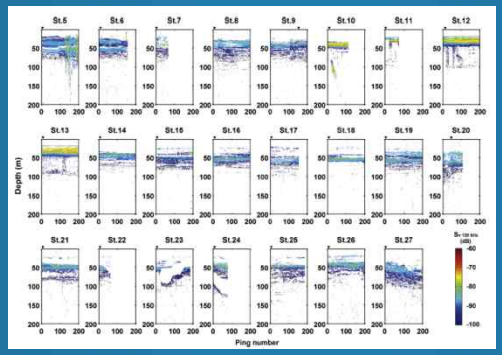
- To understand the photosynthetic characteristics of phytoplankton

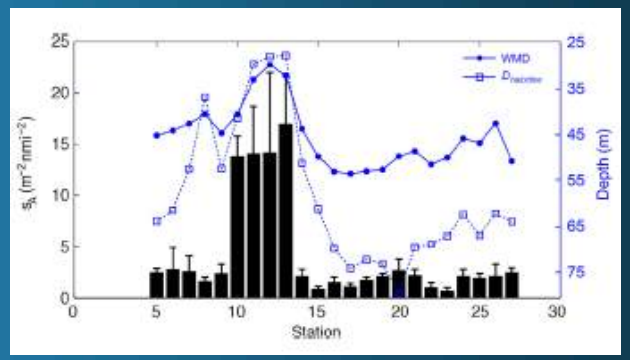
  -> Phytoplankton physiology (photochemisty) parameters using a Fluorescence Induction and Relaxation (FIRe II) system

Bioacoustic surveys

- Variations in the sound-scattering layer that were reflected from the mesozooplankton
- Spatial and vertical distribution of dominant mesozooplankton using EK 60





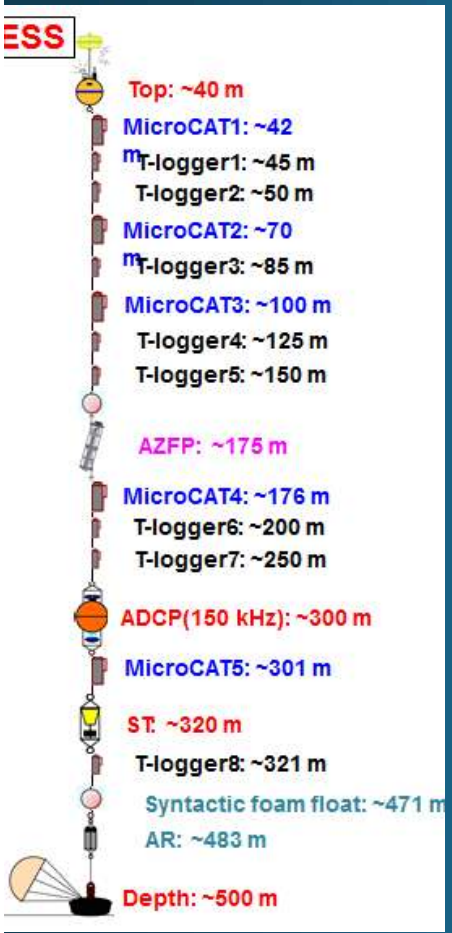


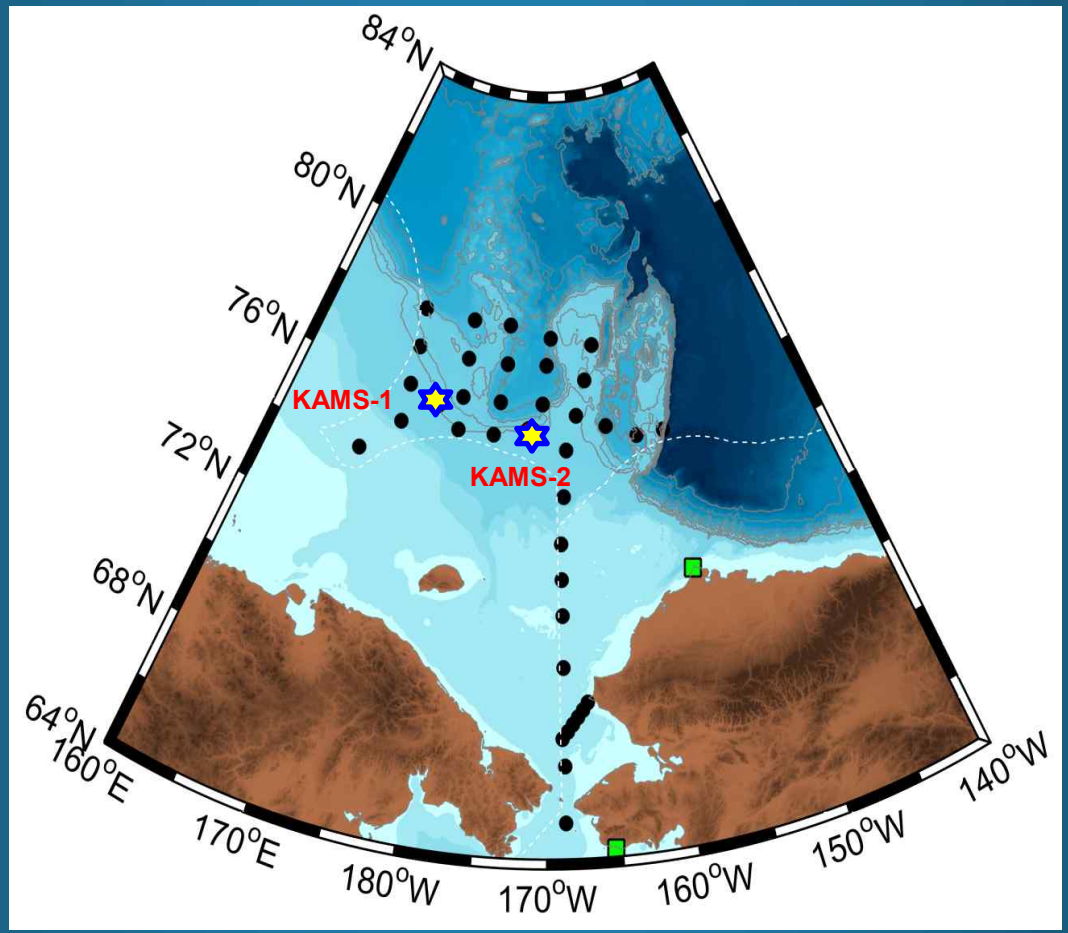
[Spatial variation of Arctic copepods over Northwind Ridge]

KOPRI ocean mooring system

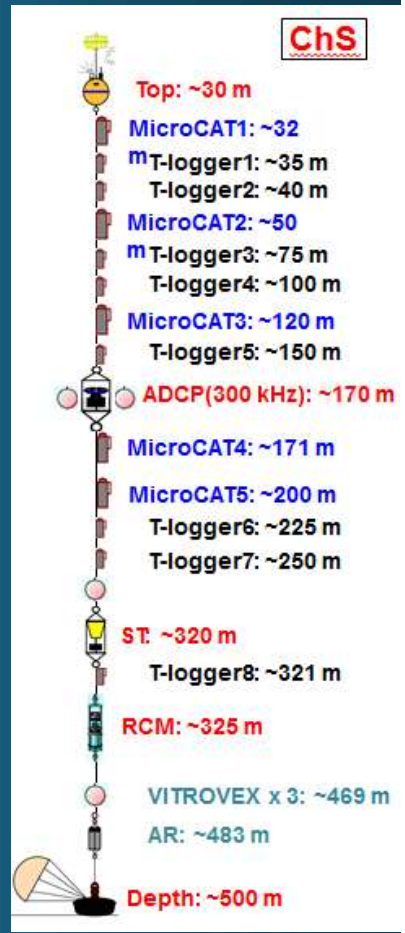
- **Chukchi Sea and East Siberian Sea**
- **ADCP, Microcat, Sediment trap, RCM, AZFP, Chla, PAR**

KAMS-1





KAMS-2



Sea ice dynamics

- International collaboration : KOPRI, SAMS, BAS, US, China, Japan
- Buoy deployments for physical observation
  - To measure in-situ physical parameters of atmosphere, ice and ocean autonomously
  - To study the energy balance at the atmosphere-ice-ocean interface

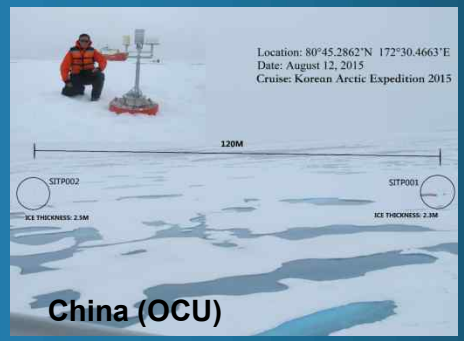
SAMS-type Ice Mass Balance Array (SIMBA)

KOPRI/SAMS(UK)

BAS-type IMB with radiation sensors

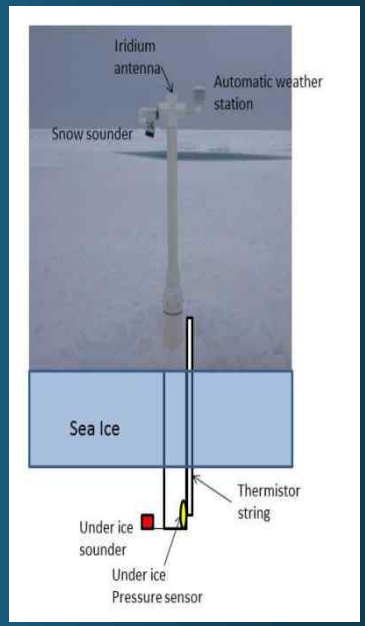
BAS(UK)/SAMS/KOPRI

Smart Ice-Tethered Profilers (SITPs)



China (OCU)

CRREL-type Seasonal IMB (SIMB)



CRREL(US)/SAMS/KOPRI

GPS drifter

KOPRI/SAMS

Wave buoy

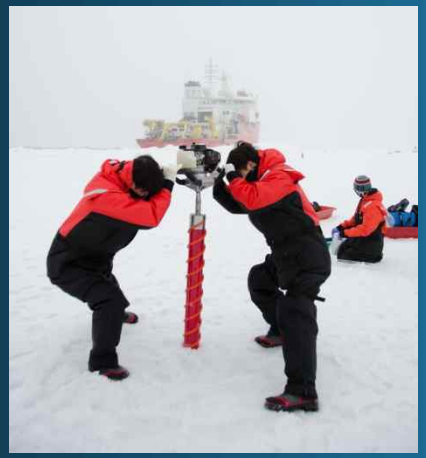
ONR(US)/BAS/SAMS

UpTempO

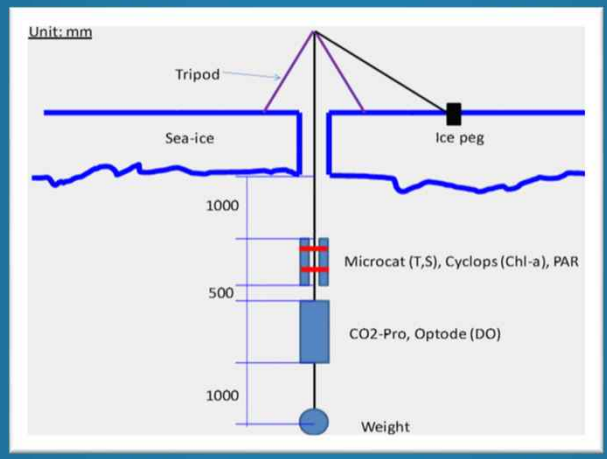
US(UW)

Sea Ice_Biochemical Study

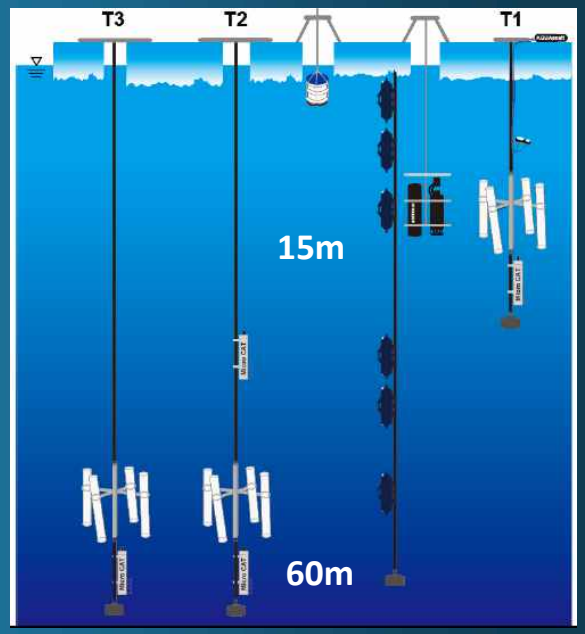
- The effect of changing sea-ice on Arctic marine ecosystem
- Species composition, abundance, and diversity associated with sea ice condition
- Carbon interaction between Sea Ice and water column
- Shor-term mooring under sea-ice (carbon flux and vertical distribution)



Ice core sampling



PCO_2 monitoring system



Small sediment trap,
Microcat, CTD,

- Research components;

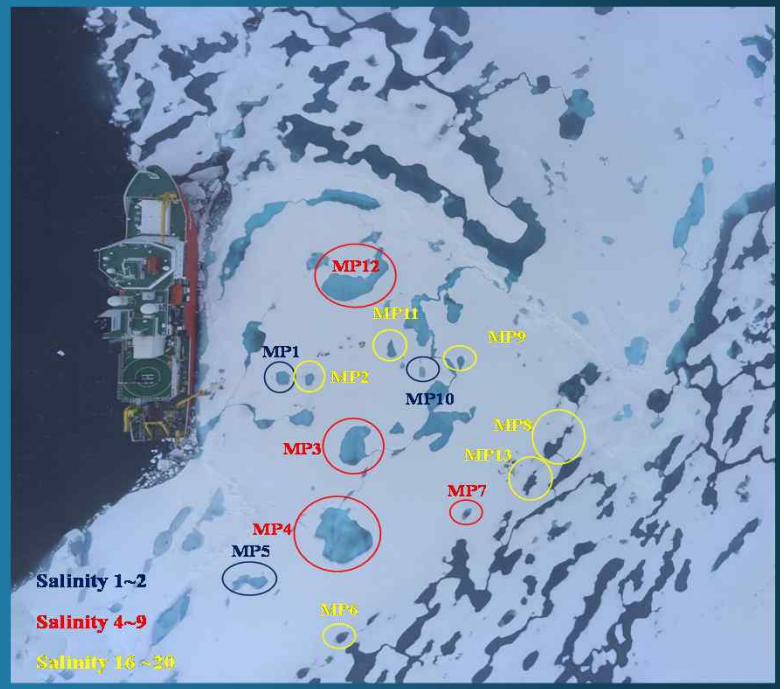
- Plankton composition and diversity
- Production and macromolecular of ice algae
- PCO_2 monitoring under sea ice
- Small sediment trap

Melt Pond study

- To define environmental characteristics of various melt ponds on sea ice floes in the Arctic Ocean
- To understand food web interaction associated with melt pond condition
- To estimate the carbon contribution of entire sea ice floes in the Arctic Ocean.

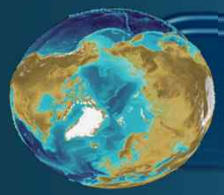
Melting pond study

Plankton netting



Melt pond study site from 2015 Arctic cruise

- Research components;
  - Plankton composition, diversity and physiology
  - Primary production and new production
  - Gas interaction between air and surface of ponds
  - Biochemical parameters (Carbon and Nitrogen …)

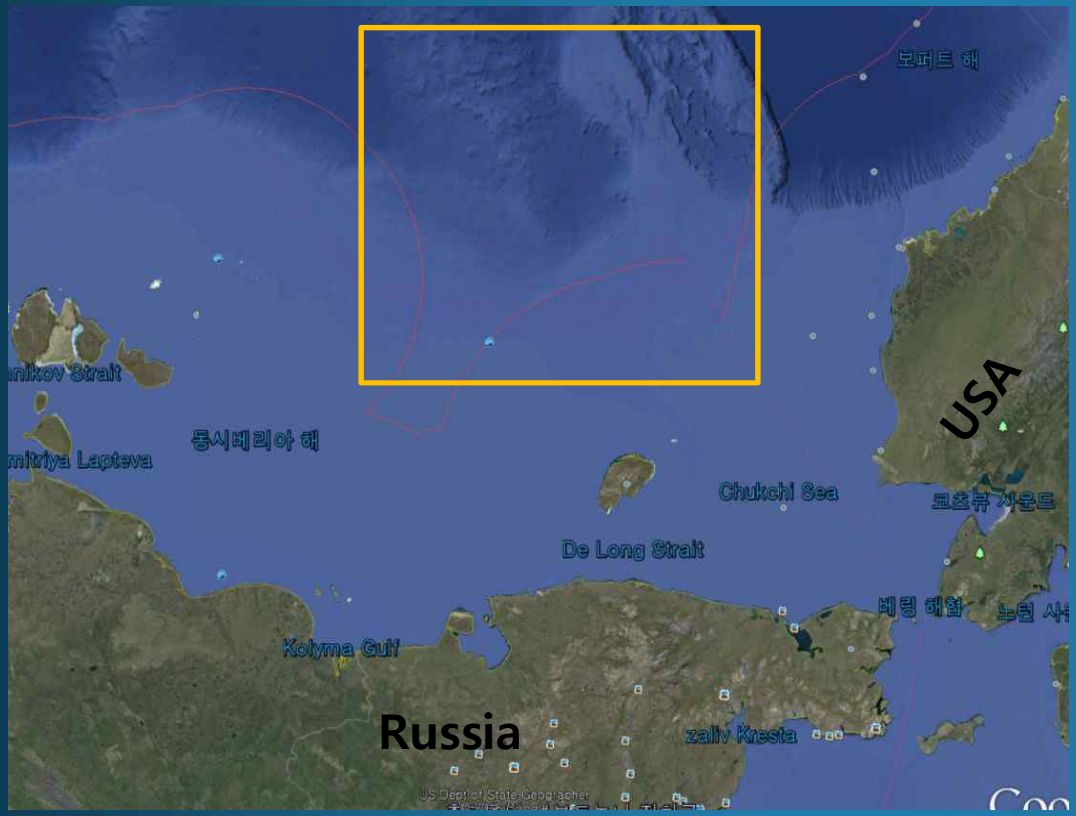


2016 KOPRI Arctic Cruise (2nd Leg)

- **Marine geology/geophysics (East Siberian Sea)**
- **Aims of the cruise:**
  - To map geological features/structures in the Arctic continental margin
  - To understand geological processes related to melting subsea permafrost and gas hydrate in the Arctic
  - To investigate CH^4 release and CH^4 cycle from the Arctic shelf
- **Period:** 2016. 8.23 - 9.9 (from Barrow to Nome)
- **Chief Scientists:** Dr. Young-Keun Jin
- **Participating nations:** Korea, US, Germany and Russia

2nd Leg

Marine Geological/Geophysical Survey @ the East Siberian Sea



- **Research items;**
  - Seismic survey
  - Sub-bottom profiling
  - bathymetric mapping
  - Sediment coring
  - Heat flow measurements
  - Underway gravity survey
  - Water column study
  - Methane flux study
  - Microbiological study


Thank you
KOPRI
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