Update of 2016 field activities & preliminary 2017 plans : Republic of Korea

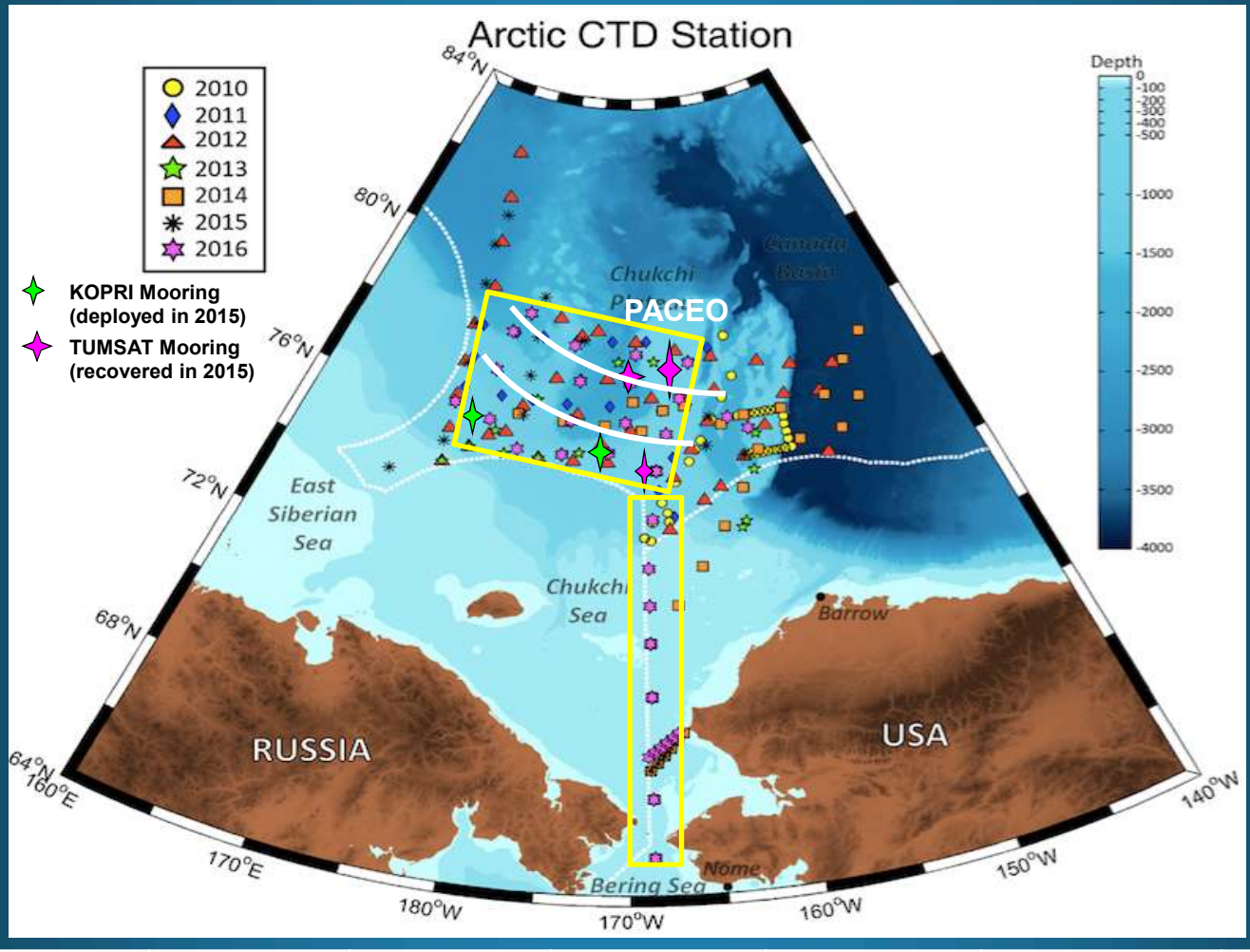
Eun Jin Yang and Sung-Ho Kang
Division of Polar Ocean Science
KOPRI

27 October 2016

Pacific Arctic Group Meeting, Qingdao

Korea Polar Research Institute

IB R/V ARAON Arctic Cruises (2010~2016)



	2010	2011	2012	2013	2014	2015	2016
CTD	38	18	44	16	32	42	34
XCTD	*	33	48	36	51	61	38
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	08/05-08/21

2016 KOPRI Arctic Research activity

First Leg: 2016. 8. 5 ~ 8. 21

Second Leg: 2016.8.24 ~ 9.10

2016 KOPRI Arctic Cruise (1st leg)

- Ocean-Sea Ice-Atmosphere study
- Aims of the cruise:
  - To identify key environmental parameters (physical and biogeochemcial) in rapid transition due to the sea-ice decrease in the western Arctic Ocean and predict environmental change patterns.
  - To understand sea ice dynamics and sea ice ecosystem
- Period: 2016. 8.5 - 8.21 (from Nome to Barrow)
- Chief Scientists: Dr. Eun Jin Yang
- Participating nations: Korea, China, Japan, France, Spain, UK, US

2016 Arctic survey (1st Leg)

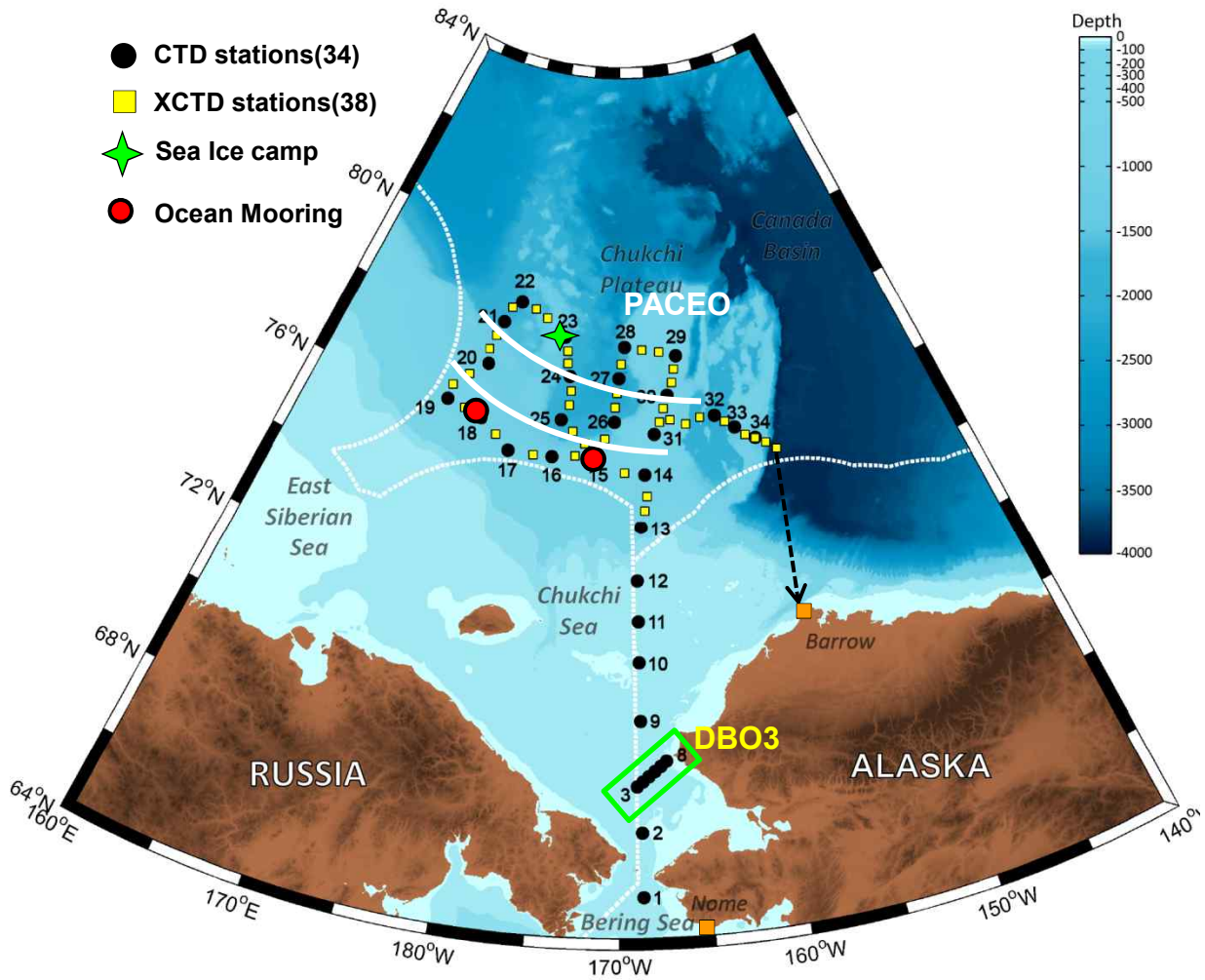
2015 Araon Arctic Cruise (ARA06B)
1 August ~ 22 August

KOPRI
ICM Institute of Marine Sciences
UPMC
KIOST
LATMOS
KRISO
UCI University of California, Irvine
British Antarctic Survey
UAF
인천대학교

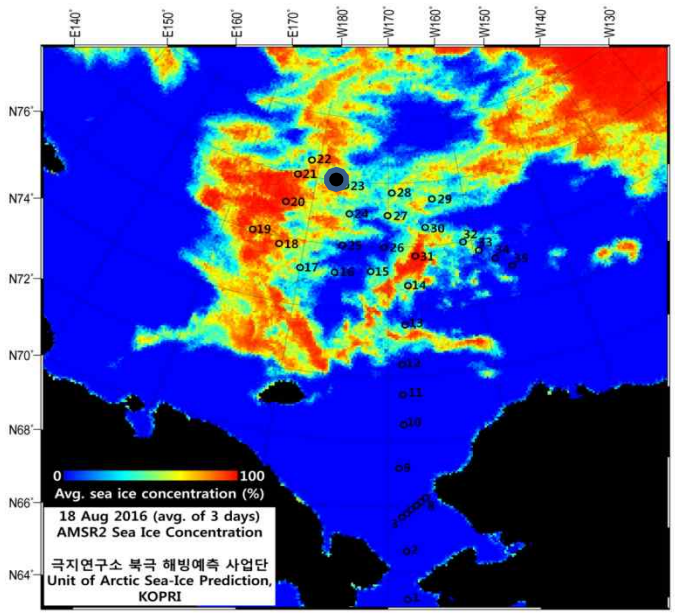
Total 7 counties, 84 participants

2016 Arctic Survey

1st Leg (ocean-sea ice-atmosphere)

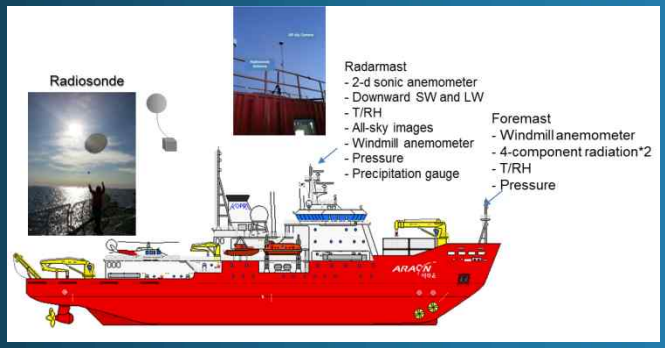


- North Bering Sea (DBO 3)
- Chukchi Sea
- East Siberian Sea & Mendeleev Ridge
- Sea Ice station



Atmospheric Observation

- Surface basic meteorological variable : physical understanding of weather events and prediction
- Claud radiative flux on surface , physical understanding of weather events
- Radiosonde balloon launch : temperature, humidity and wind



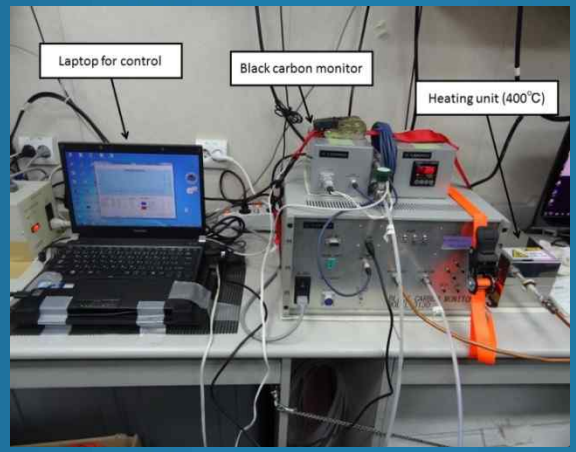
Radiosonde balloon

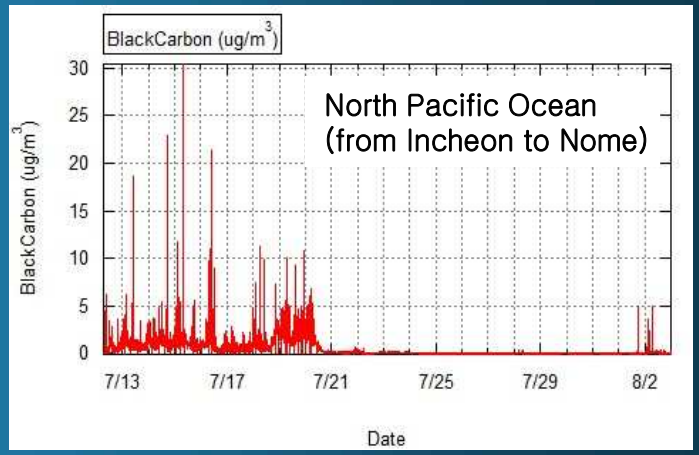
INMARSAT satellite

World Meteorological Organization

Global Telecommunication System (GTS)

- Direct measurement of Black carbon (BC)



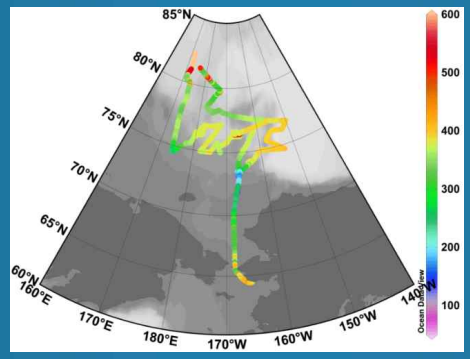


Preliminary result

Chemistry in water column

- Pursuing spatial and temporal variation of pCO_2 system in the Arctic Ocean
- Net community production(NCP) using EIMS(Equilibrator-inlet Mass Spectrometry)

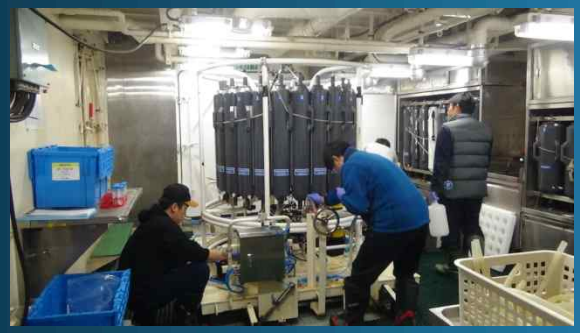
Continuous observation system of pCO_2



Dissolved pCO_2 along the track

Continuous observation system of NCP

- Behavior of nutrients (NH_4, NO_2+NO_3, PO_4 and SiO_2)
- Characteristics of dissolved and particulate organic matters (DOM and POM)
- UV-absorbing compounds (Mycosporine-like amino acids)

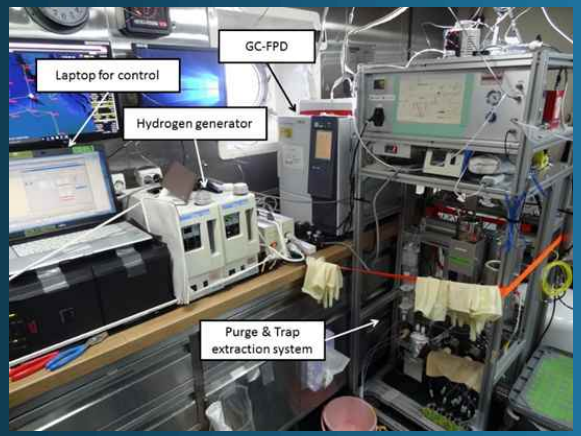


Analytical system for DIC and TA

TOC-TN analyzer

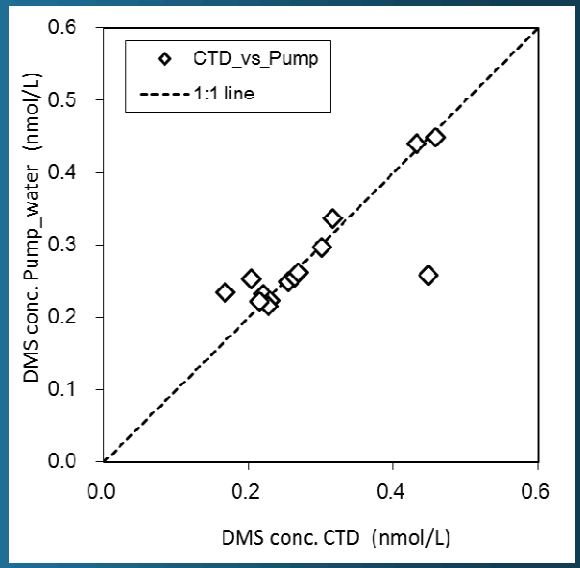
Dimethylsulfide (DMS) and DMSP

- **Distribution of DMS and dimethylsulphoniopropionate (DMSP) in water column and melting pond**
- **Quality check of pumped water from built-in pumping system for dissolved VOCs measurement by comparing with sample taken by CTD system**



Purge & Trap-GC-FPD system for DMS and DMSO measurement

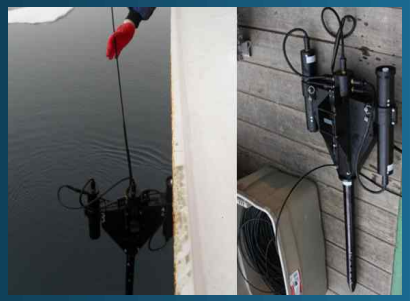
Membrane-Introduction Mass Spectrometry (MIMS) System for DMS measurement



Relationship between DMS concentrations of pumped water and CTD water sample

Satellite Remote Sensing

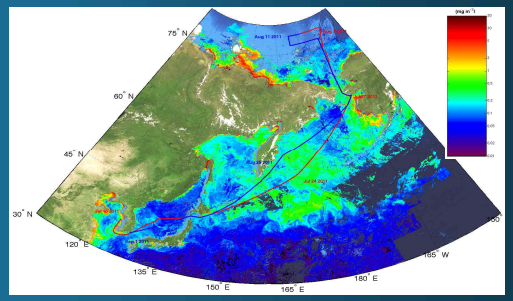
- Ocean Color Remote Sensing (Ocean Optics Measurement)



Hyper-spectroradiometer

Above water spectroradiometer

APC deployment



Hydrographic Survey

- Water mass distribution & characteristics

CTD & LADCP

XCTD

Ocean buoy (from OCU)

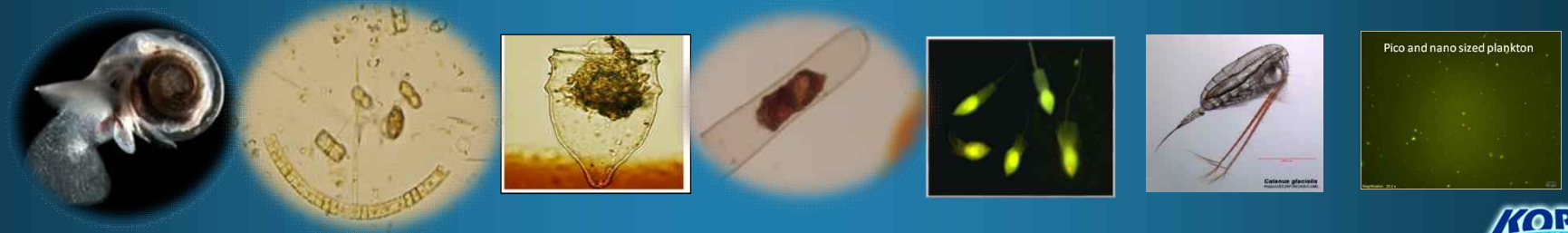
Plankton Ecology/Production

- 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
- Food web interaction between phytoplankton and zooplankton

Phytoplankton Net

Zooplankton Net

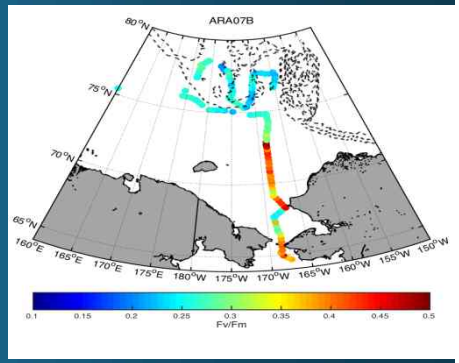
Deck Incubation



Phytoplankton physiology

- To understand the photosynthetic characteristics of phytoplankton
  -> Phytoplankton physiology (photochemisty) parameters using a Fluorescence Induction and Relaxation (FIRe II) system

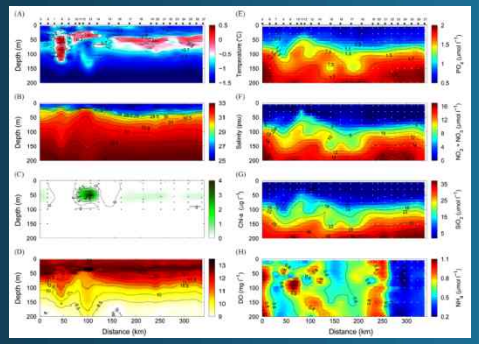
FIRe II system

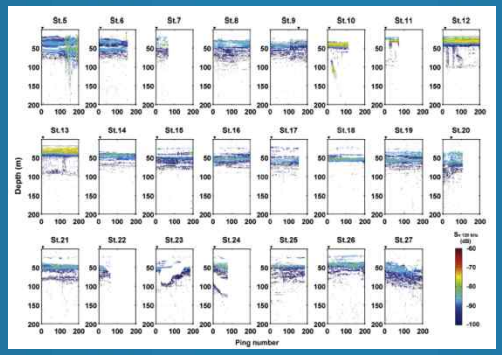


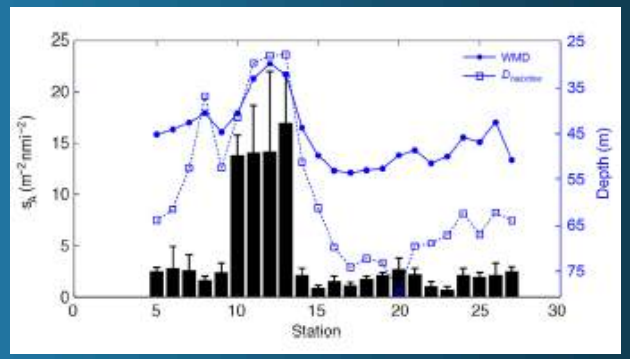
Fv/Fm value along the track

Bioacoustic surveys

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





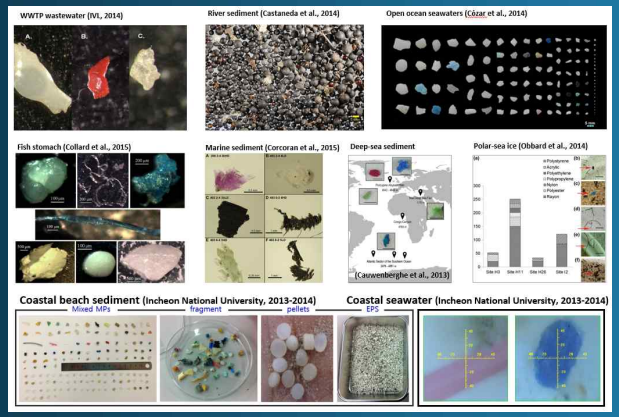


[Spatial variation of Arctic copepods over Northwind Ridge]

Microplastics (MPs) Study

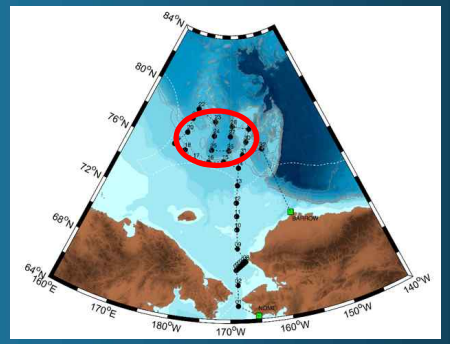
- **To investigate the abundance and distribution of MPs in Arctic region**
- **To identify possible transport pathway and source of MPs**
- To survey how MPs redistribute among various Arctic media/habitat
- To predict the effect of MPs on Arctic ecosystem and sea-ice melting/formation

MPs in environments

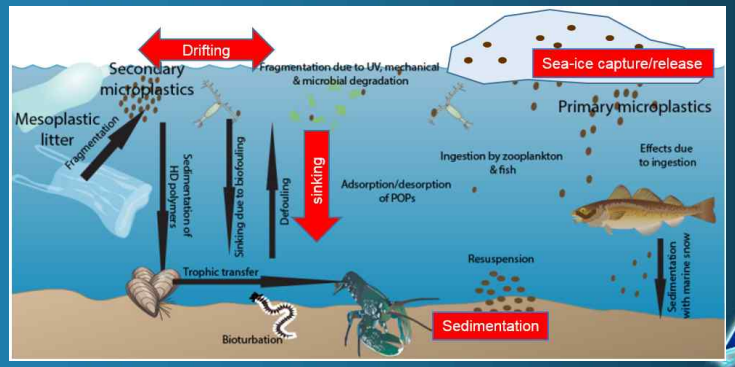


MPs monitoring

MPs pollution mapping



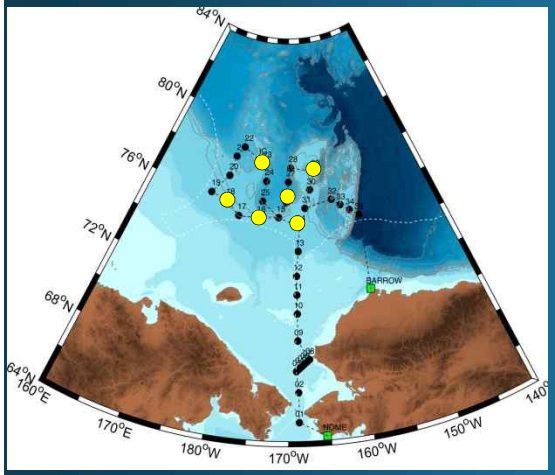
Effect of MPs on ecosystem/see-ice melting



- **Research issues;**
  - drifting MPs in surface/sub-surface waters
  - sinking & sedimentation of MPs
  - intake of MPs by Arctic organisms
  - sea-ice capturing mechanisms of MPs
  - effect on melting/formation of sea-ice
  - effect of MPs-associated pollutants

Sediment biogeochemisty

- To understand effects of environmental factors on spatio-temporal distributions of meofauna and resting stages of phytoplankton on seafloor sediments
- To investigate geochemical processes observed in seafloor sediments and pore waters



Box core station

Box core for sediment sample

Pore water extraction

Box core sediments for microfossil analysis

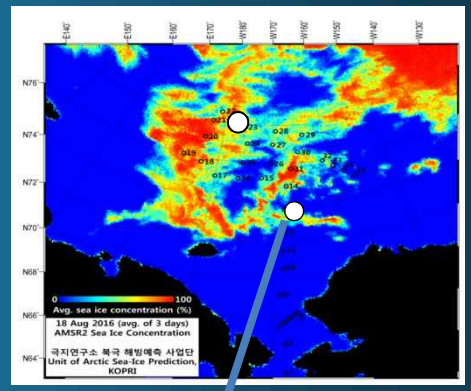
Sea ice dynamics

- International collaboration : KOPRI, UK(BAS), China(OCU), Spain, France
- 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

Melt pond Ice Mass Balance (IMB) with radiation sensors

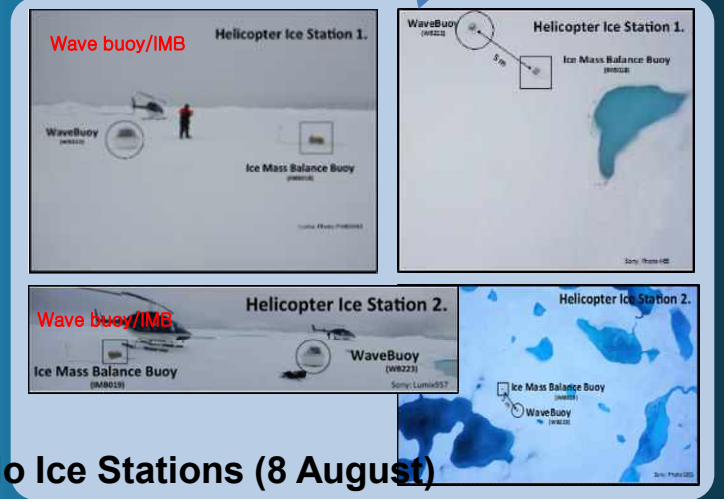
Smart Ice-Tethered Profilers (SITPs)

AWS



Wave buoy

IAOOS buoy

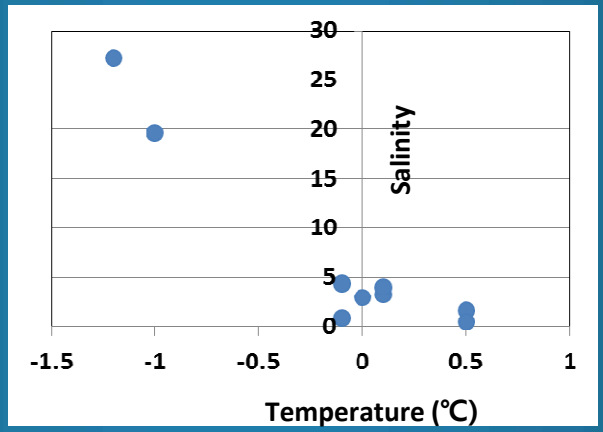


Helo Ice Stations (8 August)

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 western Arctic Ocean.

Melt pond study site from 2016



Temperature & Salinity

Melting pond study

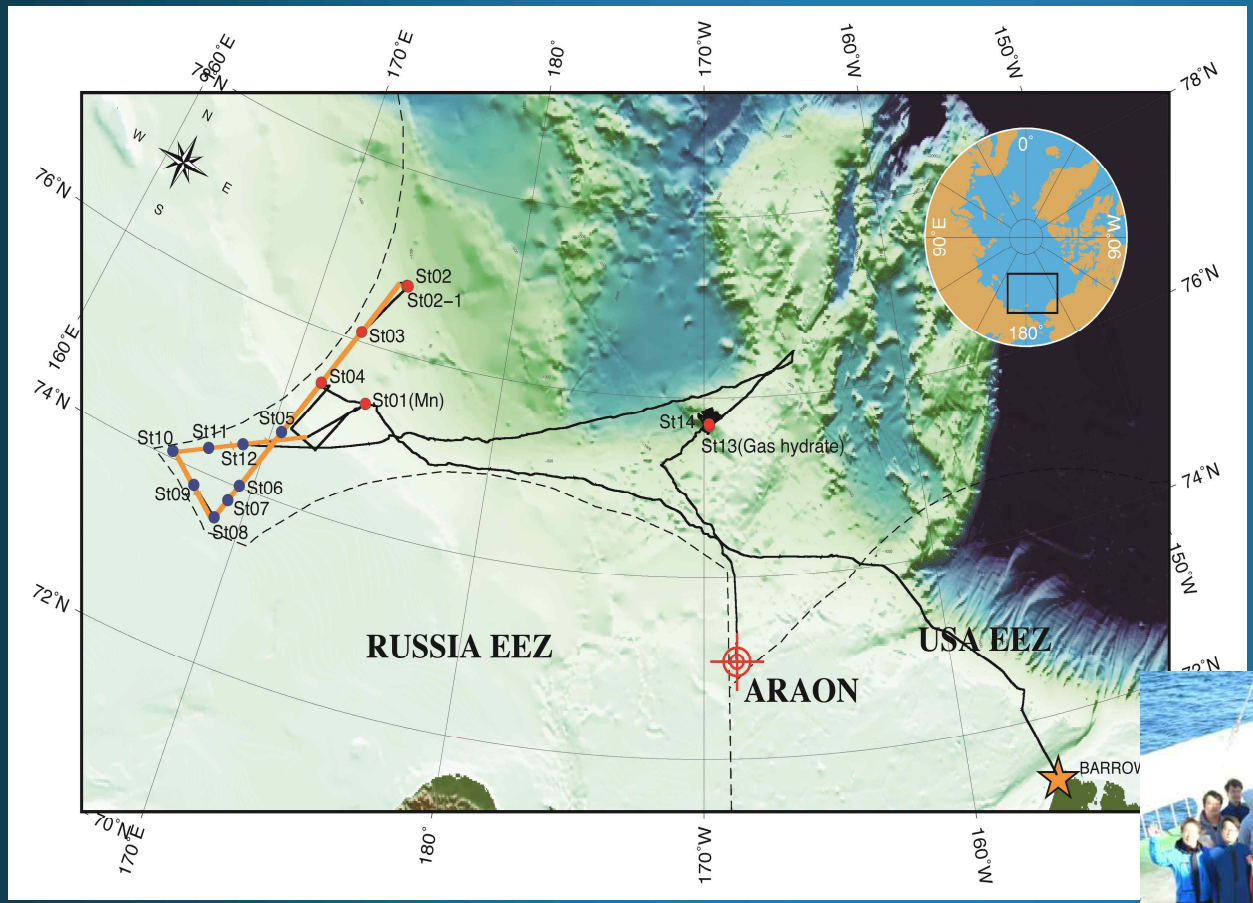
- Research components;
  - Plankton composition, diversity and physiology
  - Gas interaction between air and surface of ponds
  - Biochemical parameters (Carbon and Nitrogen …)

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 evaluate the interactions and linkages in terms of methane cycle
- **Period:** 2016. 8.25 - 9.9 (from Barrow to Nome)
- **Chief Scientists:** Dr. Young-Keun Jin
- **Participating nations:** Korea and Russia

2nd Leg

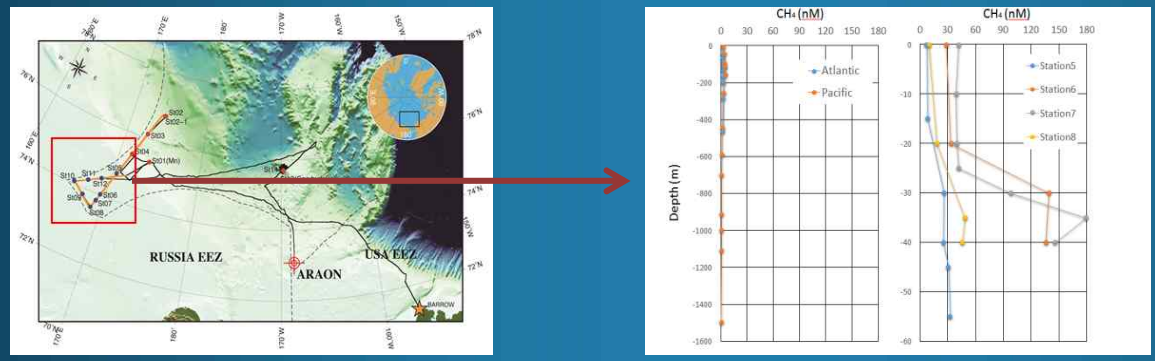
Arctic Marine Geoscience Expedition (AMAGE)



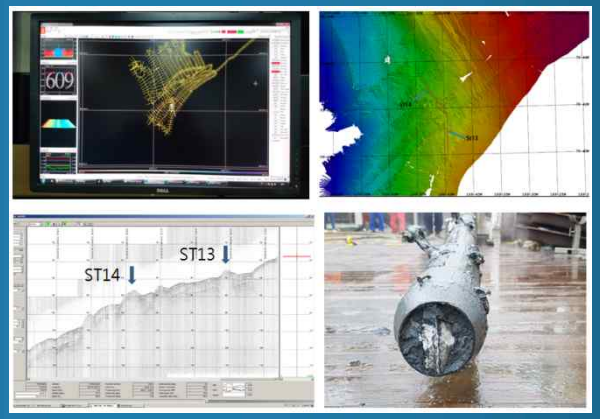
- **Research items;**
  - Seismic survey
  - Sub-bottom profiling
  - bathymetric mapping
  - Sediment coring
  - Heat flow measurements
  - Underway gravity survey
  - Water column study
  - Methane flux study
  - Microbiological study

Research highlight

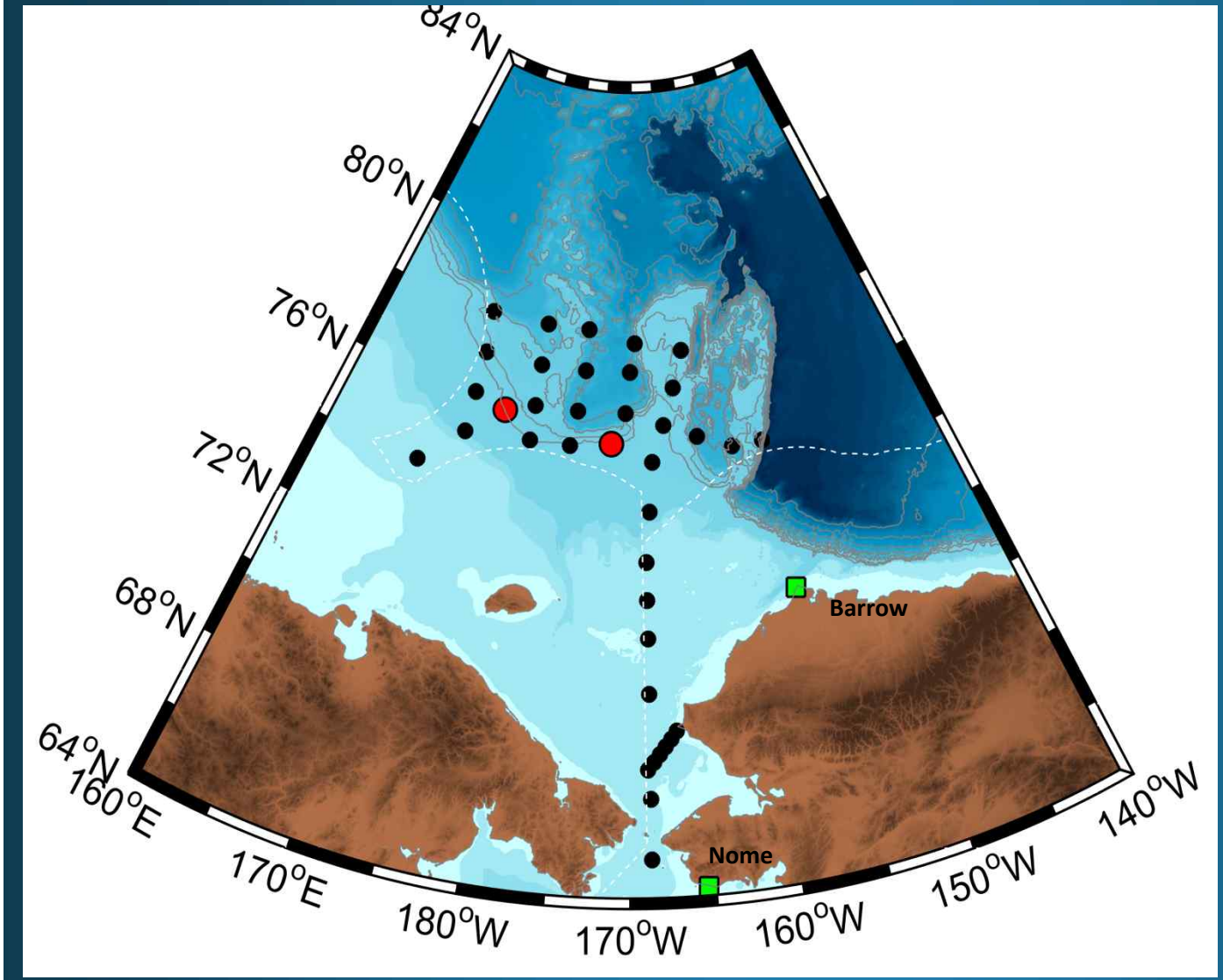
- **Extremely high dissolved methane concentration in the ESS shelf**



- **Gas hydrate and Manganese nodules in the ESS**



Preliminary Korean Arctic research plan (2017. 8)



- North Bering Sea (DBO 3)
- Chukchi Sea
- East Siberian Sea
- Cruise day : ca. 15 days

- Sea Ice station (5 days)
- Ocean mooring station
  new one KOPRI mooring


Thank you
KOPRI
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