

Update of 2014 field activities & preliminary 2015 plans : Republic of Korea



Sung-Ho Kang
Division of Polar Ocean Sciences
KOPRI

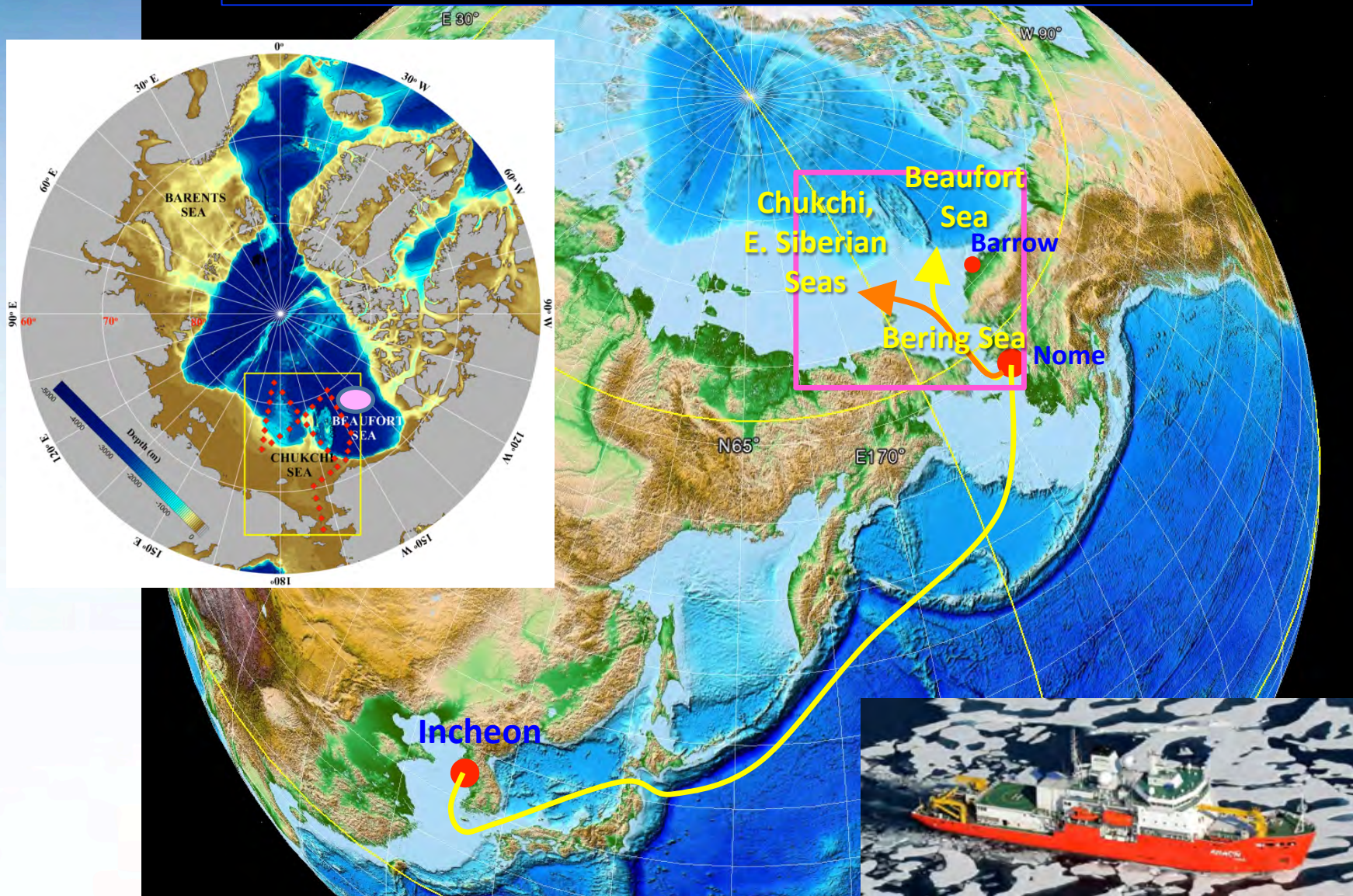
28-29 Oct. 2014

Pacific Marine Environmental Laboratory (PMEL), NOAA
Pacific Arctic Group Fall Meeting

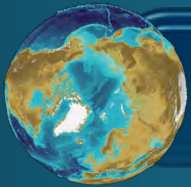


Korea Polar Research Institute

2014 RV ARAON cruise track, study area, period



2014. 7. 16 ~ 10.03 (Total 79 days) ♪



2014 KOPRI Arctic Cruise

● Aims of the cruise:

- To investigate the structure and processes in the water column and subsurface (sediment) around the northern Bering Sea, Chukchi/East Siberian/Beaufort Seas in rapid transition
- To understand the sea ice dynamics and sea ice ecosystem

● Period: - Leg 1: 2014. 7.31 ~ 8.25 -> Water column and Sea ice

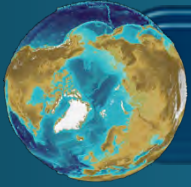
(Nome to Barrow)

- Leg 2: 2014. 8.27 ~ 9.19 -> Marine geophysics

(Barrow to Nome)

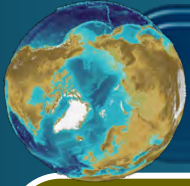
● Chief Scientists: 1st leg: Dr. Sung-Ho Kang,

2nd leg: Dr. Young Keun Jin



Leg 1

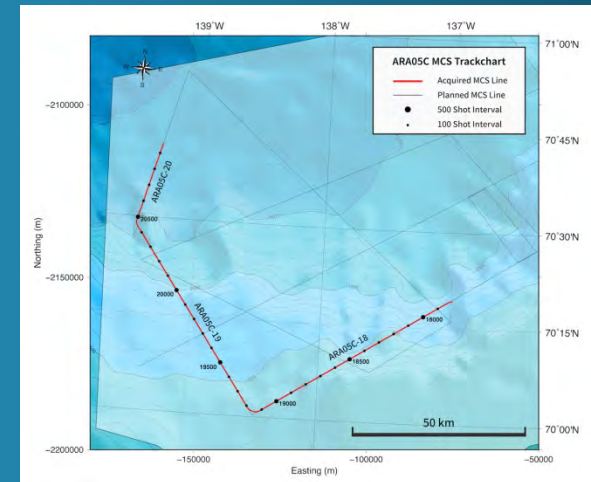
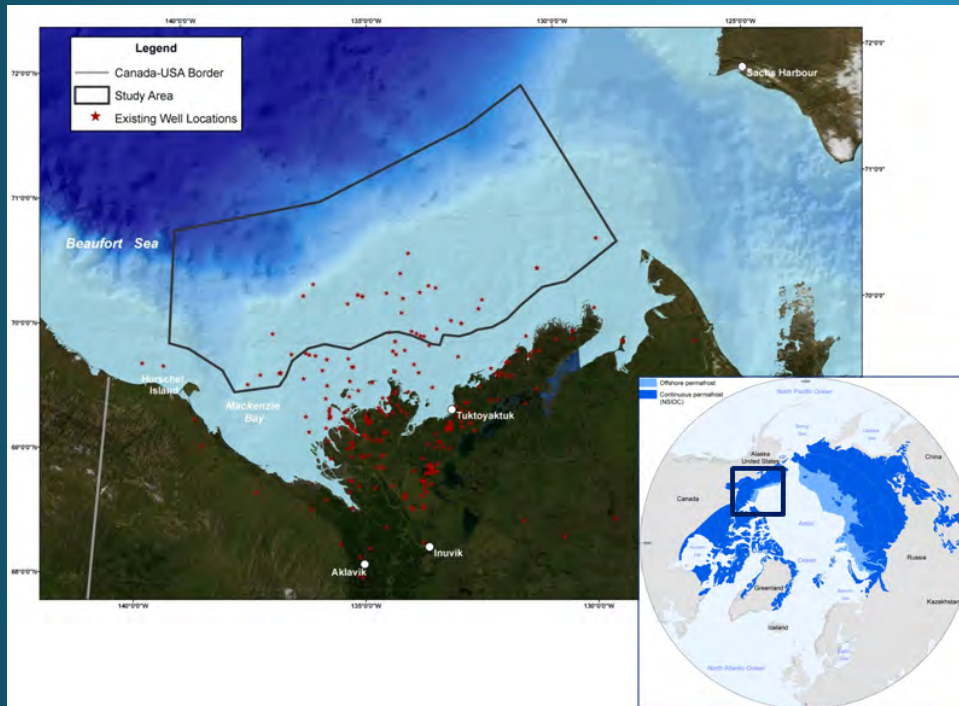
- **Period:** 2014. 07.31 ~ 08.25 (Nome to Barrow)
- **PI:** Dr. Sung-Ho Kang (KOPRI, shkang@kopri.re.kr)
- **Participating nations:** Korea, USA, UK, France, Finland, Japan, China, Canada, Russia, India
- **Research fields:**
 - Atmospheric observation
 - CO₂ systems in water column
 - Satellite Remote Sensing
 - Hydrographic survey
 - Microbes & Plankton ecology
 - Sea ice study
 - Melt pond (ice algae) study
 - Marine Geology and Seismic survey



Leg 2

Beaufort Sea : Geophysics & Gas hydrate study

- To study on geological structures of the permafrost and gas bearing layers
- To understand geohazard by gas hydrates
- Korea/Canada/US Joint Program



- **Research items;**
 - Multichannel seismic
 - Sub-bottom profiling
 - Hydroacoustic monitoring
 - Sediment coring



2014 **ARAON** ARCTIC CRUISE
ARA05B (31ST JULY - 25TH AUGUST)



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 Jin Oh MIN KOPRI jomin@kopri.ac.kr	 Chun Young GANG KOPRI cyounggang@kopri.ac.kr	 Myoung In KIM KOPRI minkim@kopri.ac.kr	 Map of the Arctic region showing ice concentration. The map includes latitude and longitude markers (60°N, 70°N, 80°N, 90°N, 120°W, 130°W, 140°W, 150°W, 160°W, 170°W, 180°W, 170°E, 160°E, 150°E, 140°E, 130°E, 120°E, 110°E, 100°E, 90°E, 80°E, 70°E, 60°E, 50°E, 40°E, 30°E, 20°E, 10°E, 0°). A color scale at the bottom indicates ice concentration from 0% to 100%.	 Seokhyoung CHOI Daejeon schoi@krips.ac.kr	 Howard BEED Maritime Helicopter hbeed@maritimehelicopters.com			
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- The Scottish Association for Marine Science (SAMS)
- Korea Polar Research Institute
- Hanyang University
- Pusan National University
- Korea Maritime & Ocean University
- Pohang Institute of Science and Technology
- Hankyong University of Foreign Studies
- Inha University
- Ocean University of China (OUC), China
- University of Maine
- Finnish Meteorological Institute
- Laboratoire d'Océanographie de Villefranche, France
- Naval Postgraduate School
- Louisiana State University
- Woods Hole Institute of Oceanography (WHOI)
- Russia (Ice Pilots)
- US Helicopter pilots
- Scientists from Canada, India, UK Nationality

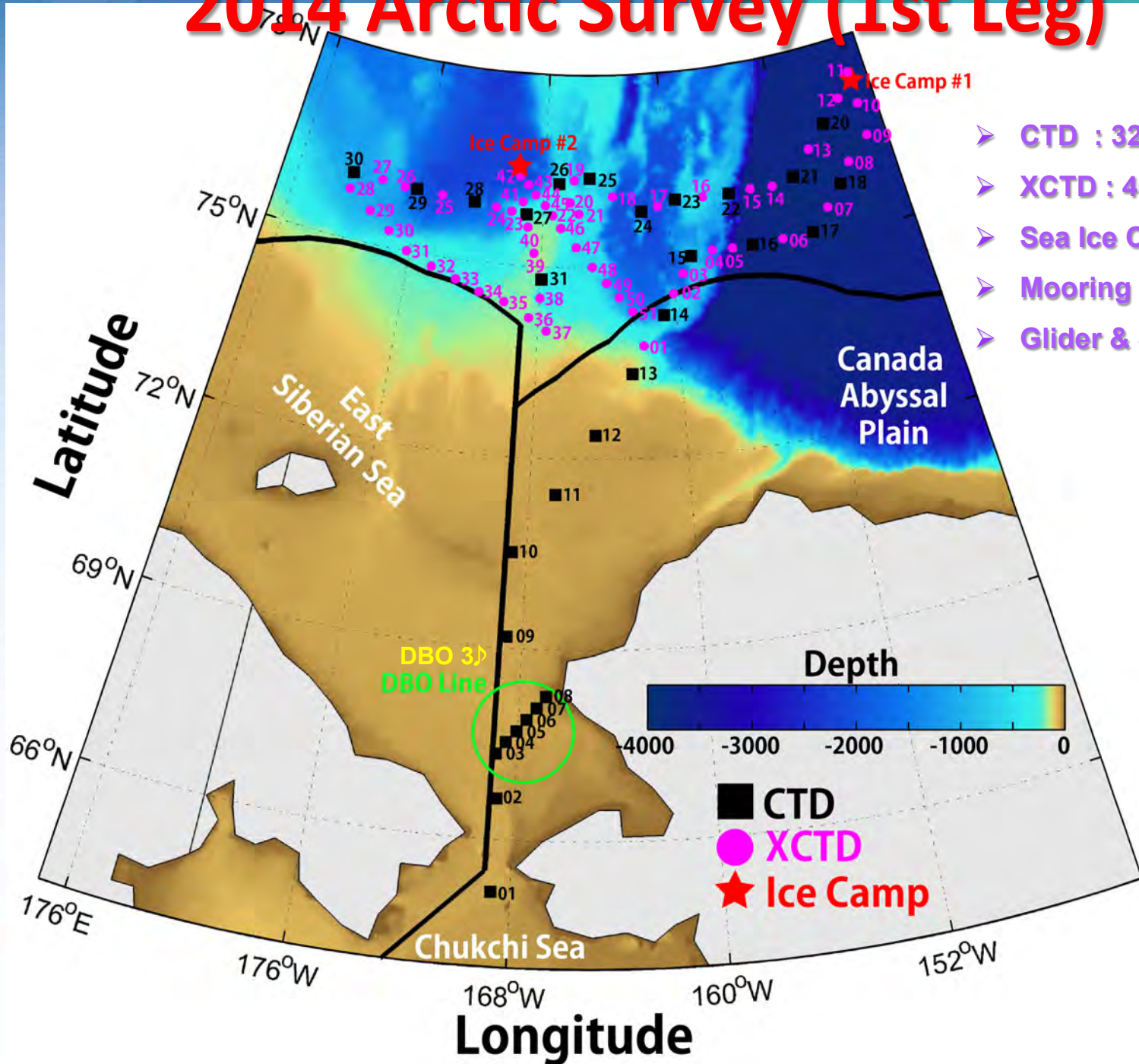




FINNISH METEOROLOGICAL INSTITUTE

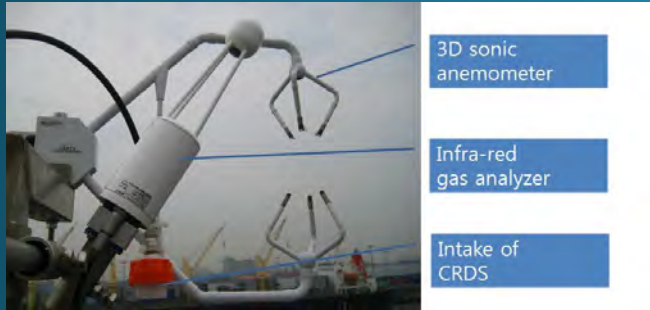


2014 Arctic Survey (1st Leg)



Atmospheric Observation

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

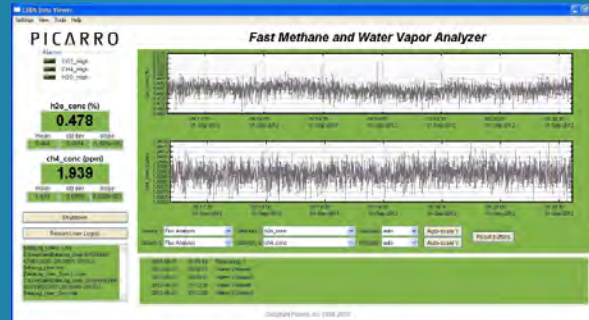


3D sonic anemometer

Infra-red gas analyzer

Intake of CRDS

Open-path eddy covariance at the foremast of ARAON



Real time variation of CH_4 and H_2O in flux mode

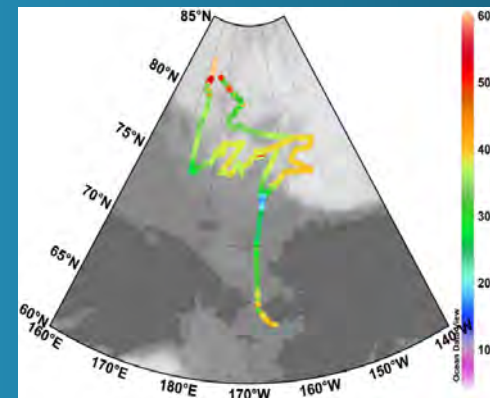


CO_2 system in water column

Pursuing spatial and temporal variation of CO_2 system in the Arctic Ocean



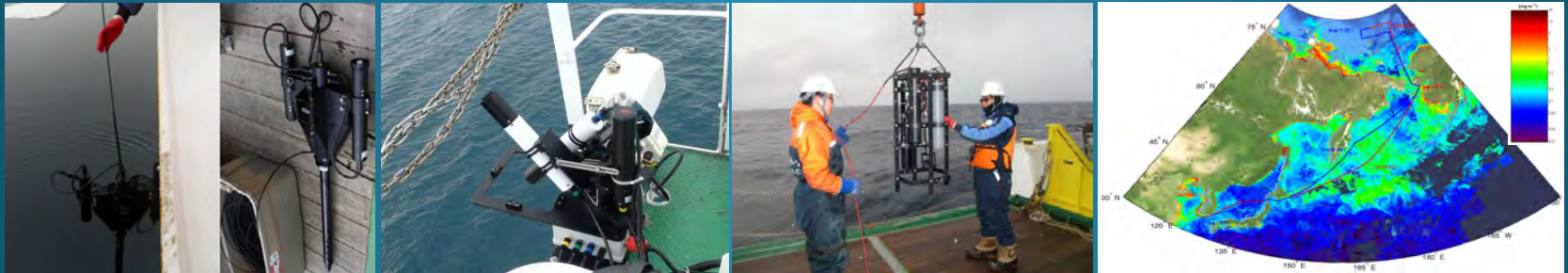
Analytical system for DIC and TA



Dissolved $p\text{CO}_2$ along the track

Satellite Remote Sensing

● Ocean Color Remote Sensing (Ocean Optics Measurement)



Hyper-spectroradiometer | Above water spectroradiometer | APC deployment

Hydrographic Survey

● Water mass distribution & characteristics



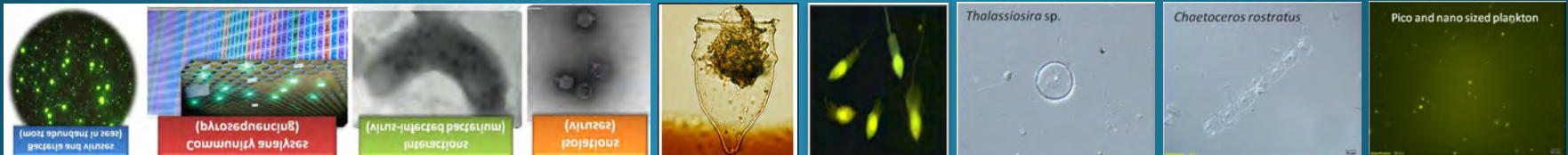
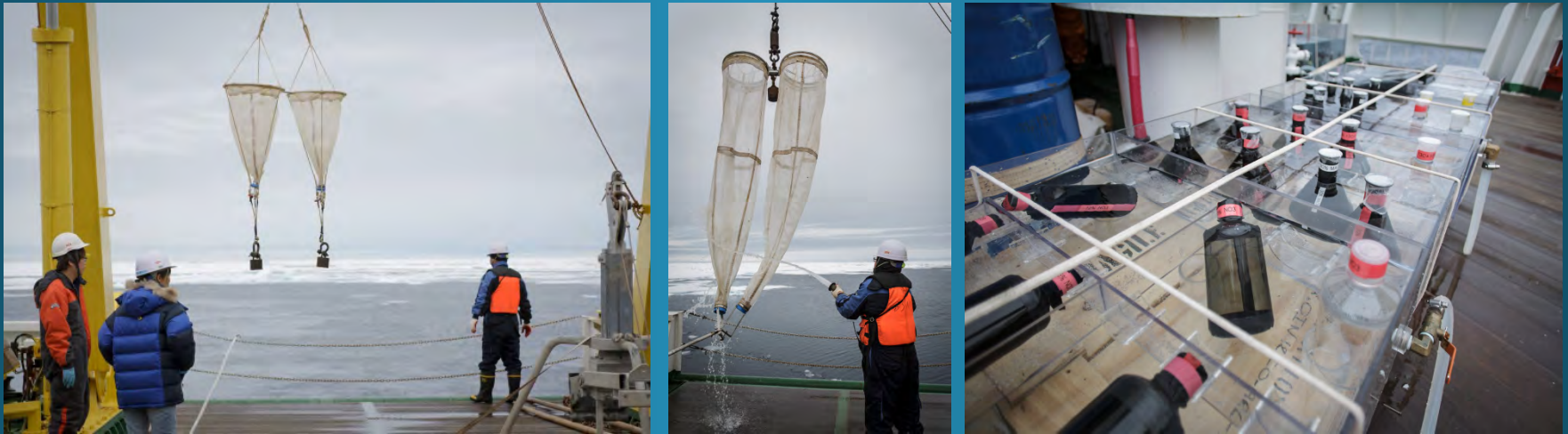
CTD & ADCP

XCTD

Ocean Mooring

Micobes/Plankton Ecology

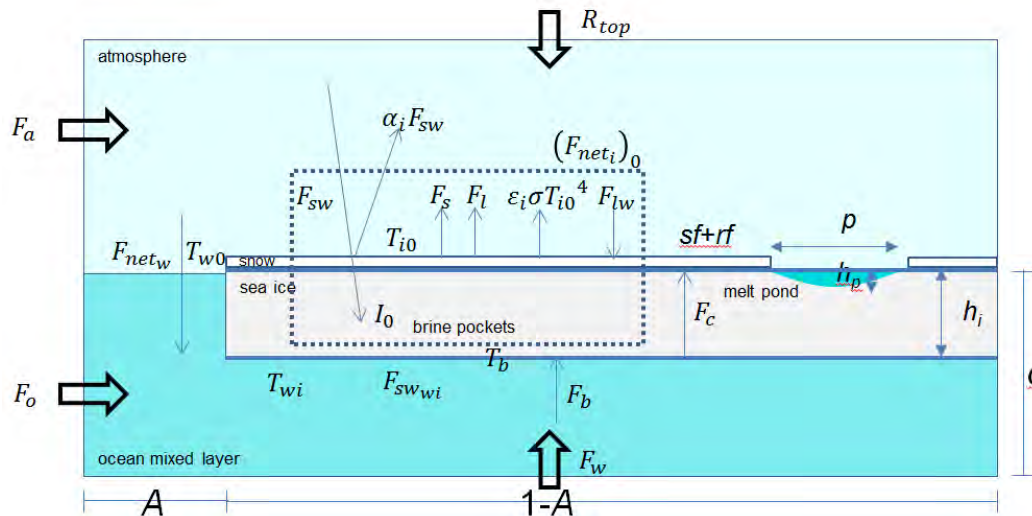
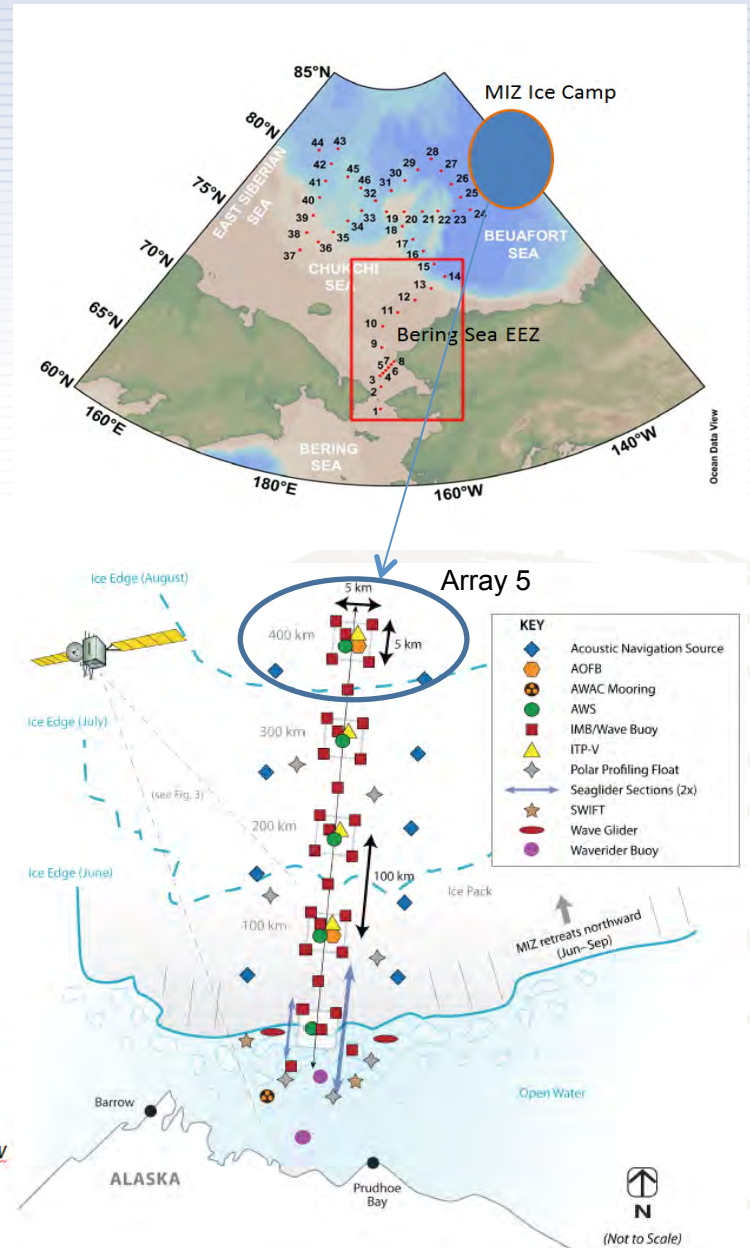
- Distribution of bacteria and virus and community structure
- Species compositions of phytoplankton , chlorophyll *a* concentration and primary production
- Abundance and community structure of heterotrophic protists
- Mesozooplankton community and grazing impacts on phytoplankton biomass

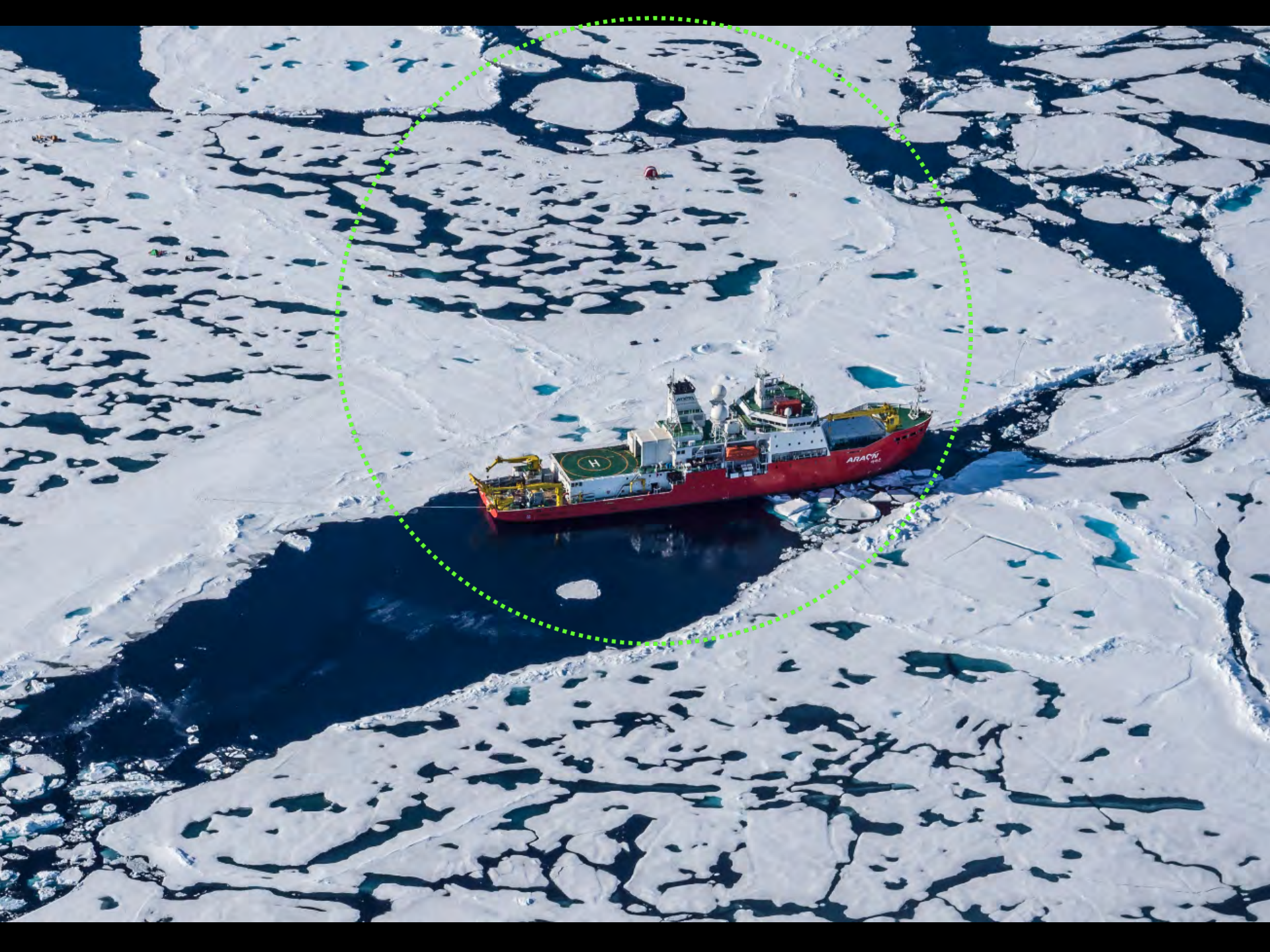


Marginal Ice Zone (MIZ) Field Activities

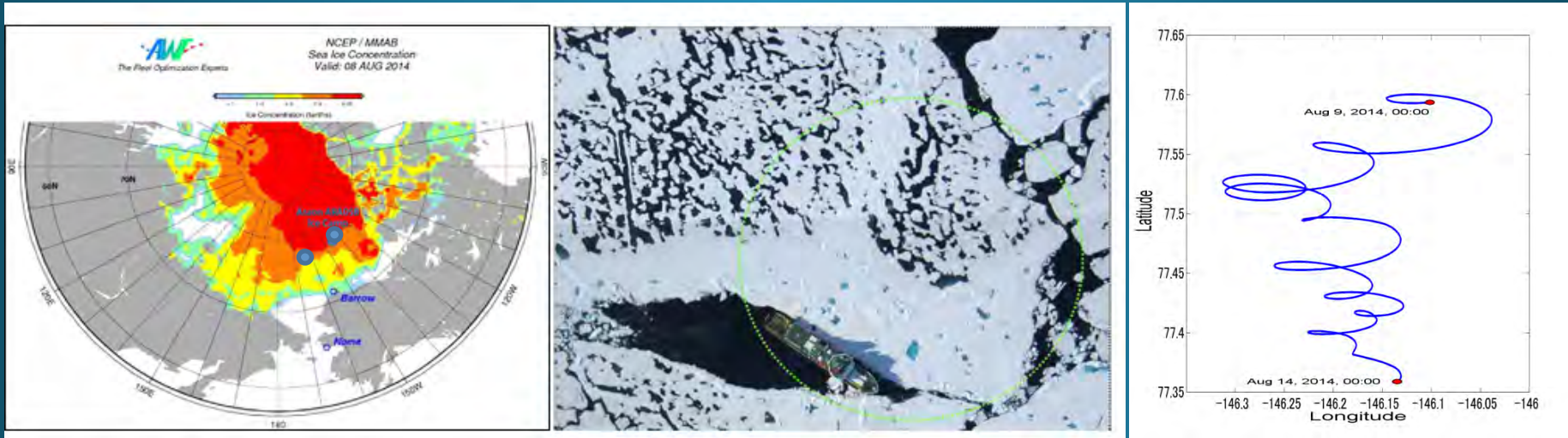
2014 "ARAON" Arctic Cruise (Leg I)

- "ARAON": MIZ Ice Camp 2014
 - Observations
 - Ocean-to-ice heat fluxes
 - Meteorological variables
 - Radiative heat fluxes
 - Snow and ice thickness, ice temperature
 - Research subjects
 - Ice energy budget and thickness evolution
 - Sea ice energy budget
 - Sea ice model to simulate ice thickness evolution
 - Ice-albedo feedback?





Sea Ice Camp (2 sites)



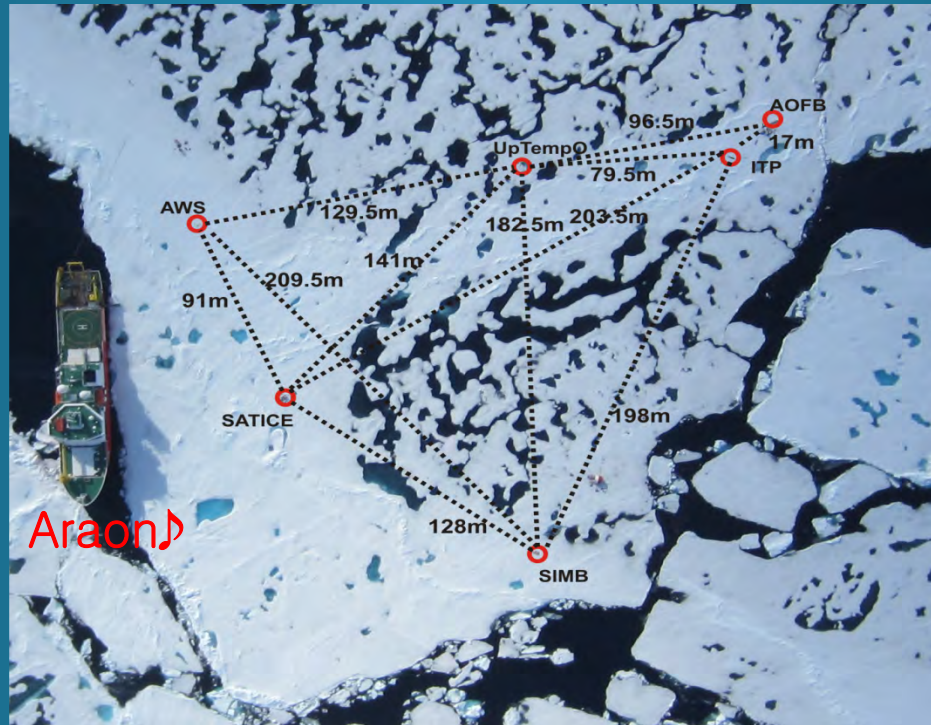
- Location : 1st Ice camp (76° 36.11`N, 146°03.78`W) -> 7 days
2nd Ice camp (76 °30.52`N , 169 °43.52`W) -> 2 days
- Buoy deployment and helicopter survey (KOPRI-ONR MIZ)
- Physical study under sea ice
- Biogeochemical study under sea ice
- Melt pond environments and ecosystem

Sea ice dynamics

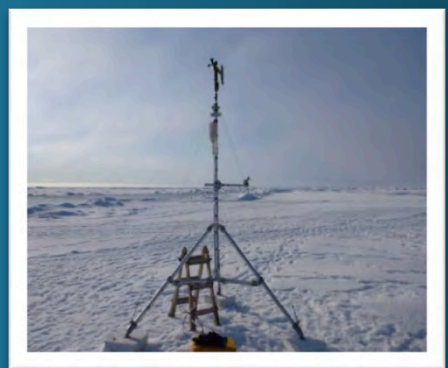
- Buoy deployment and helicopter survey (1st Ice camp : KOPRI-ONR MIZ)



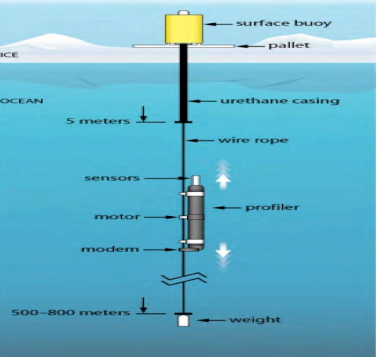
SATICE buoy



Araon



AWS05



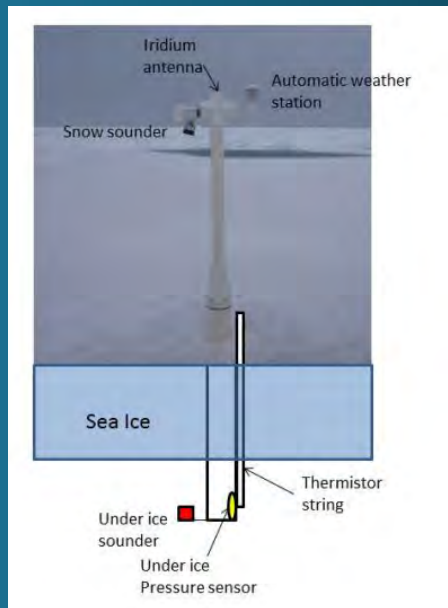
ITP buoy



UpTempO



SIESTA 5640



CRREL SIMB buoy

Physical study under Sea Ice

- To understand the condition for substantial heat release from the ocean
- To examine temporal variation of halocline structure in the upper ocean (up to 500 m depth)
- To study the mixing produced by ice drag stress and stratification.
- **Research instruments**
 - CTD, ADCT, Microcat, LADCP



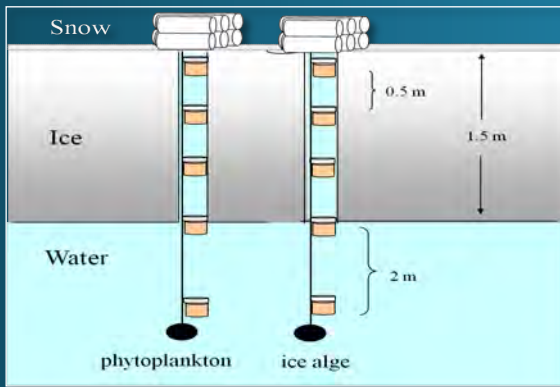
CTD operation (by OCU)♪



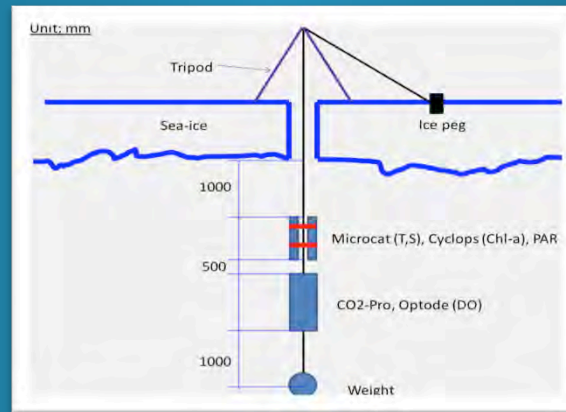
CTD, ADCP, LADCP operation (by TUMSAT)♪

Biogeochemical Study Sea Ice

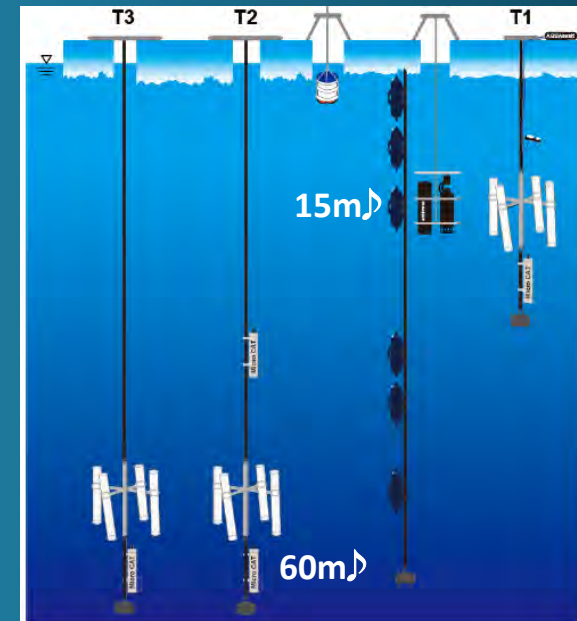
- The effect of changing sea-ice on Arctic marine ecosystem
- Species composition, abundance, and diversity associated with sea ice condition
- Carbon interaction between Sea Ice and water column
- Particle flux and vertical distribution under the sea ice



Incubation for production ↴



PCO₂ monitoring system ↴



Sediment trap, LISST- holo, AQUAscat, Microcat ↴

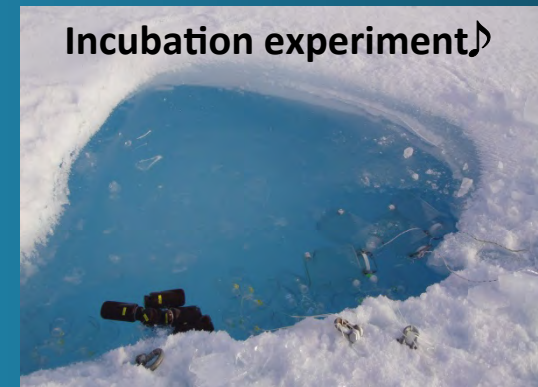
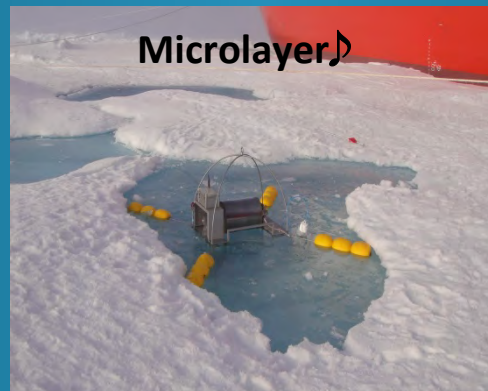
● Research components;

- Plankton composition and diversity
- Production and macromolecular of ice algae
- PCO₂ monitoring under sea ice
- Sediment trap & LISST Holo

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 environmental variation
- To estimate the carbon contribution of entire sea ice floes in the Arctic Ocean.

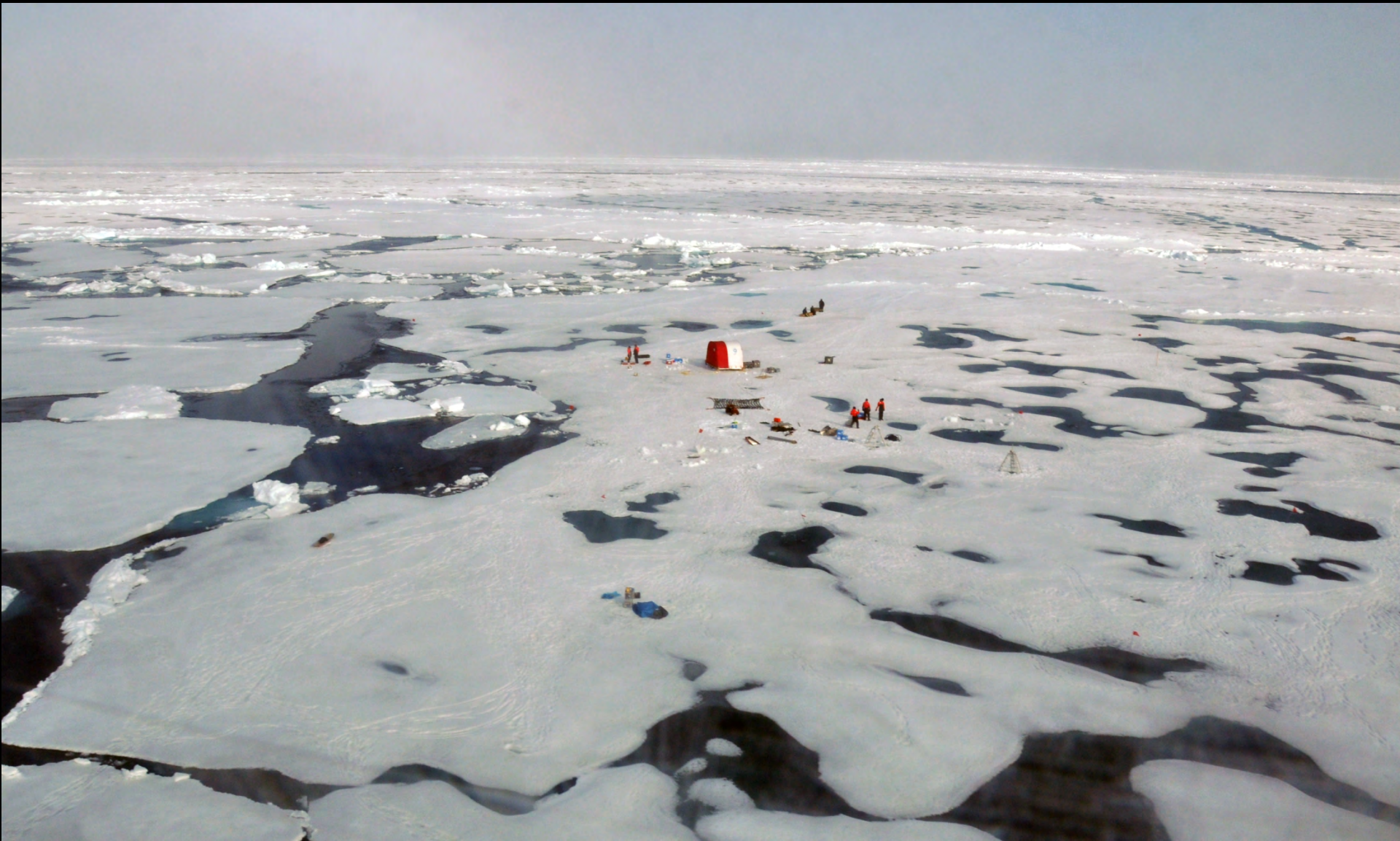
Total 32 stations : Salinity range (0 - 32 psu)



● Research components;

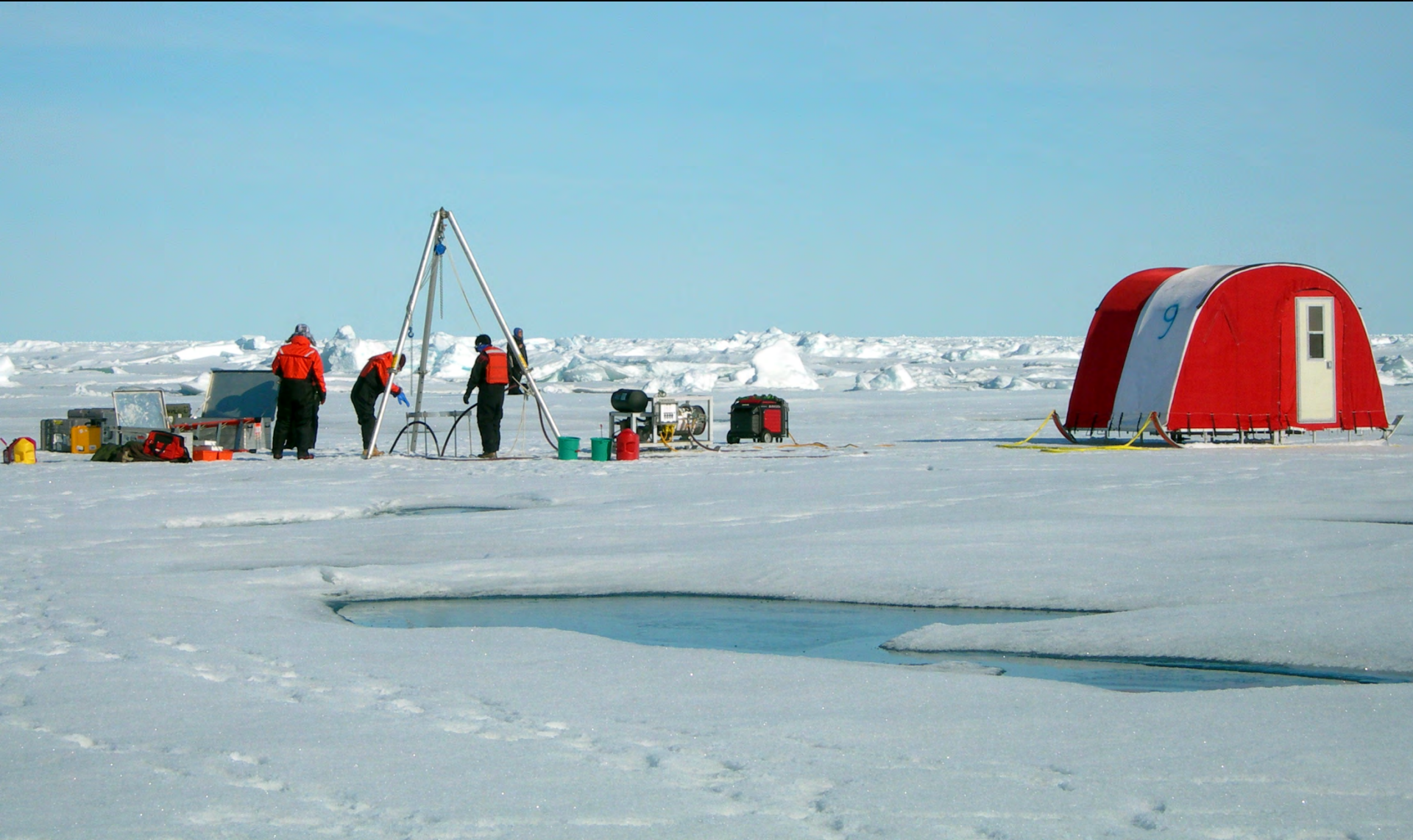
- Plankton composition and diversity
- Production and respiration of plankton
- Gas interaction between air and surface of ponds
- Biogeochemical parameters (Carbon, Nitrogen and DMS...)
- Spectral observation

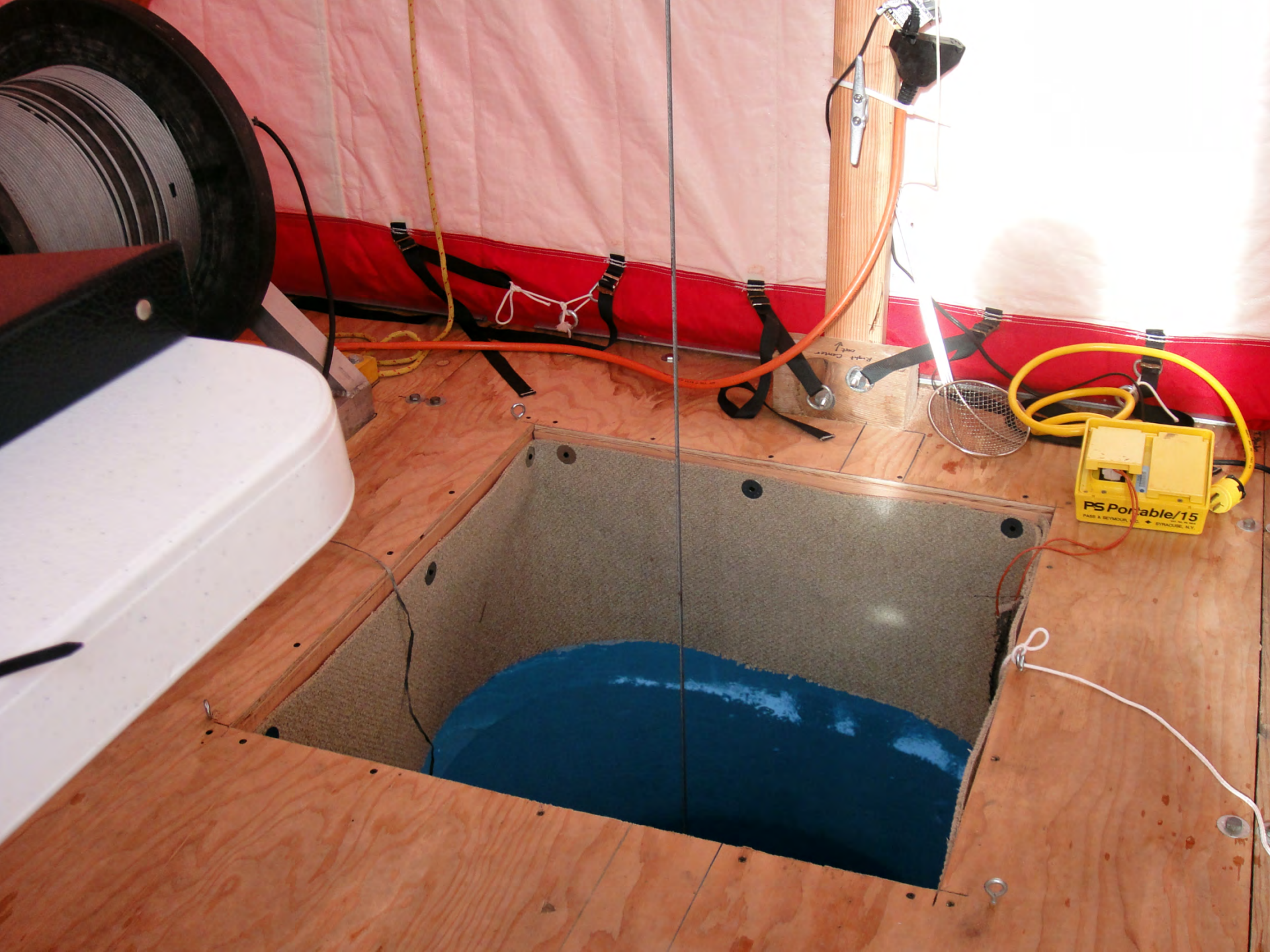














ARAON

INCHEON
IMO 9481525











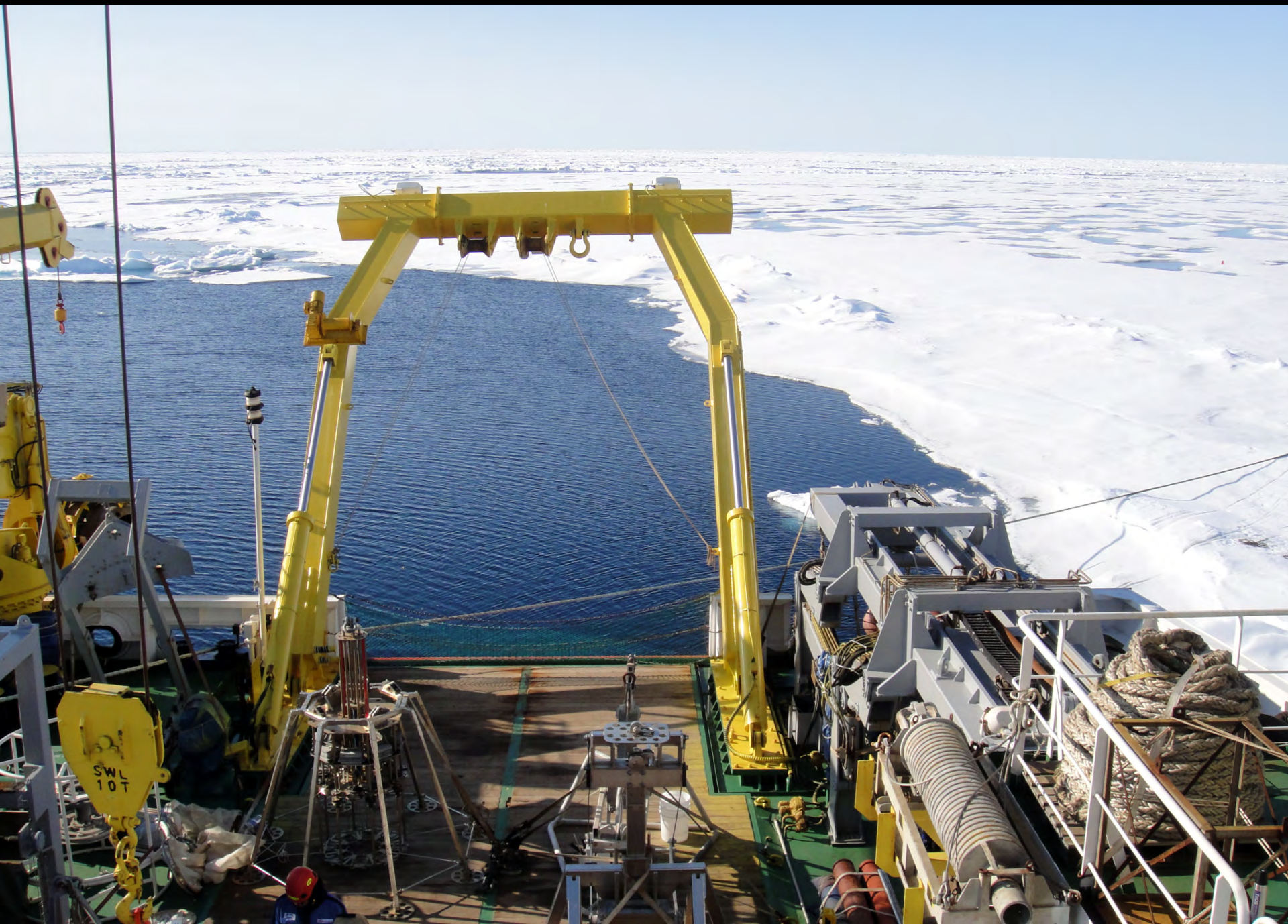
Hull	Anodized aluminum
Power	14 VDC, Alkaline or Lithium D cell packs
Weight	30 kg in air
Dimensions	1.25 m draft, 1.0 m mast, 0.35 m diameter
Shipping crate	1.65 m length, 0.5 m width, 0.5 m depth
Endurance	20 days (Alkaline), 60 days (Lithium)
Tracking (RF)	Garmin Astro DC40 collars (10 km range)
Tracking (Iridium)	Geoforce GT1 (global)
Telemetry	Iridium SBD
Processor	Sutron Xpert
Profiler	2 MHz Nortek Aquadopp HR
Met	Airmar PB200
IMU	Microstrain 3DM-GX3-35
CT	Aanderaa 4319
Camera	serial uCAM
Light	Yellow 1s flasher



Seaglider and (right) SWIFT.





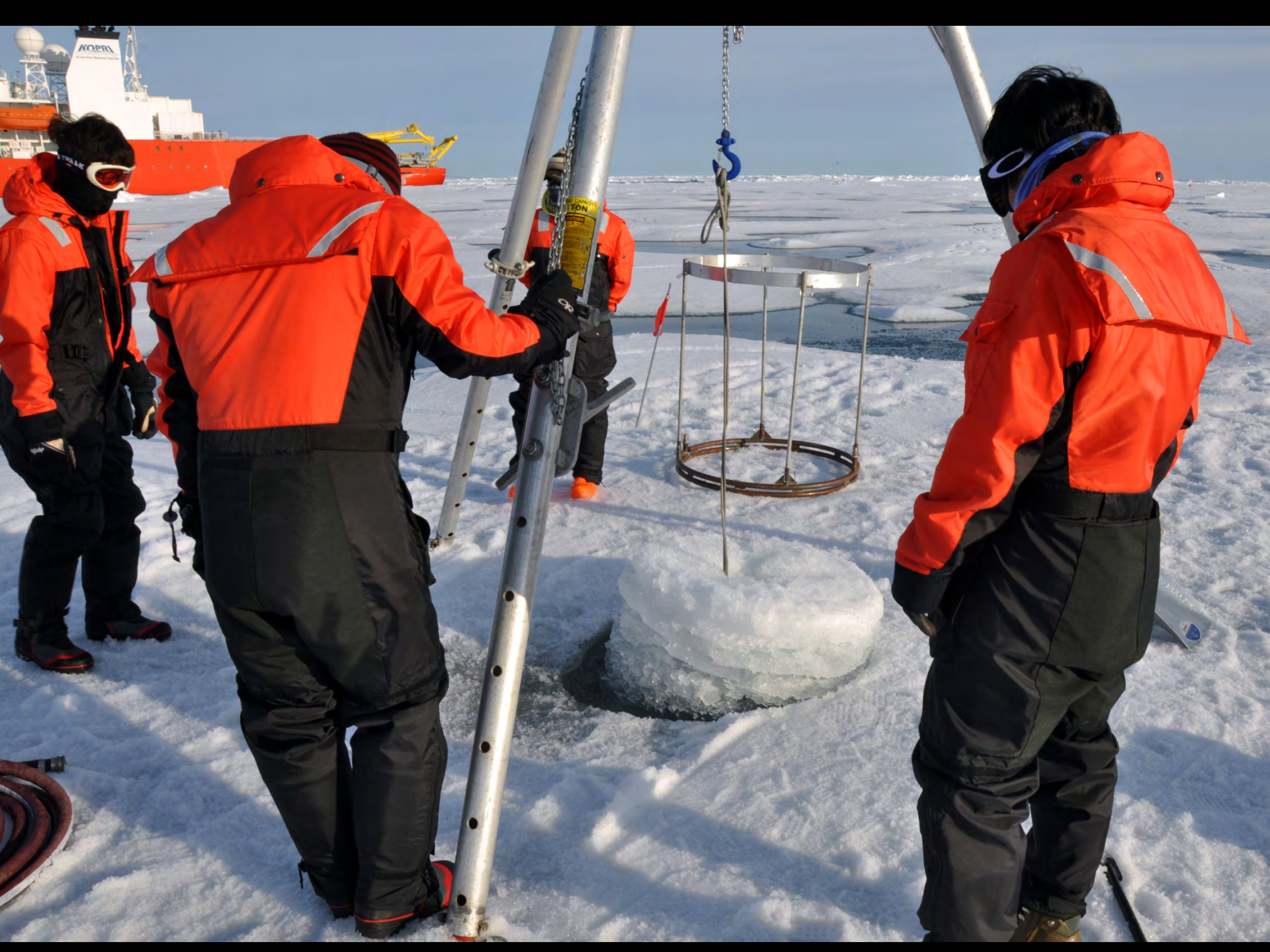






NOTE: INSTRUCTIONS FOR THE
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ALUMINUM

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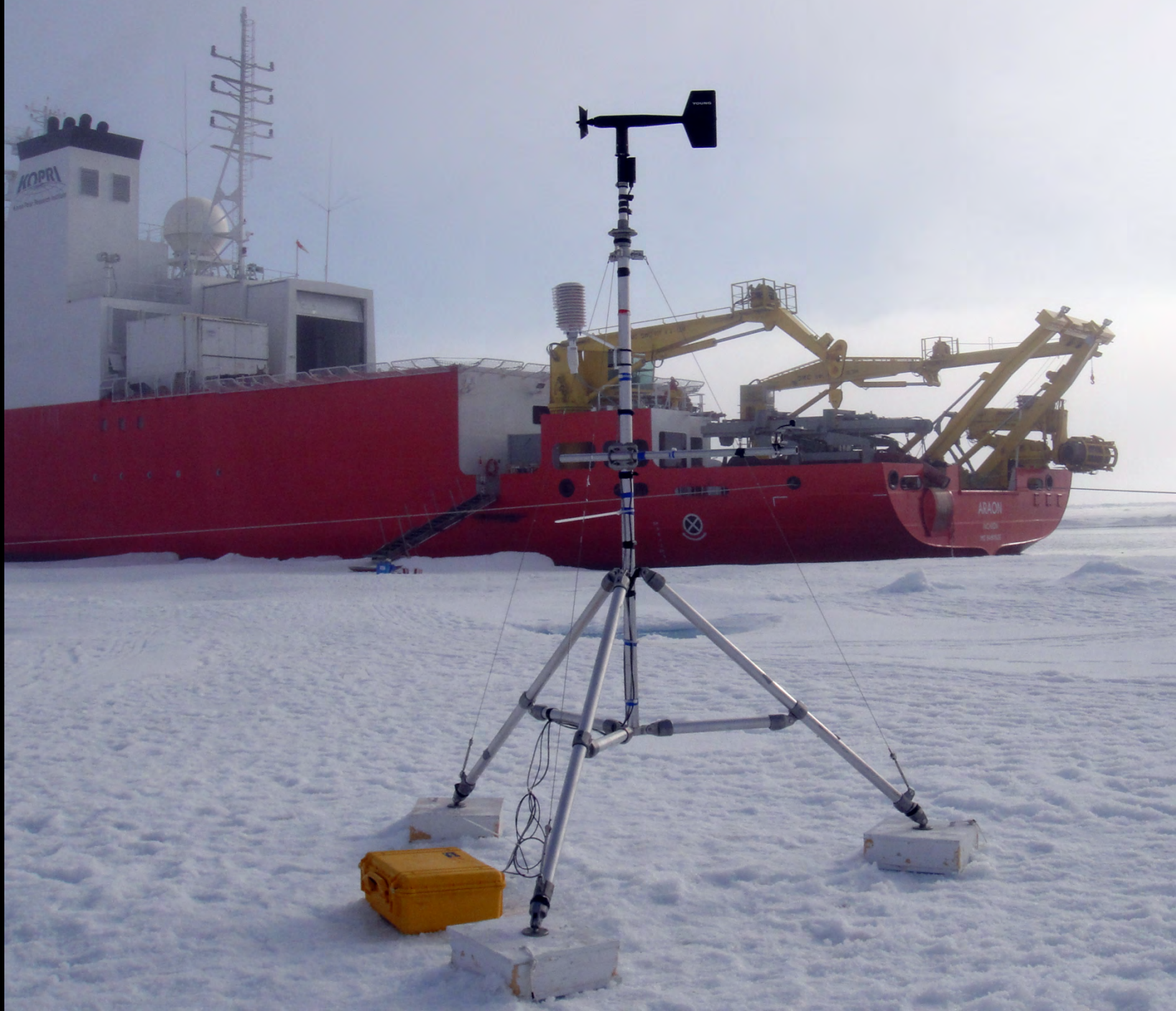
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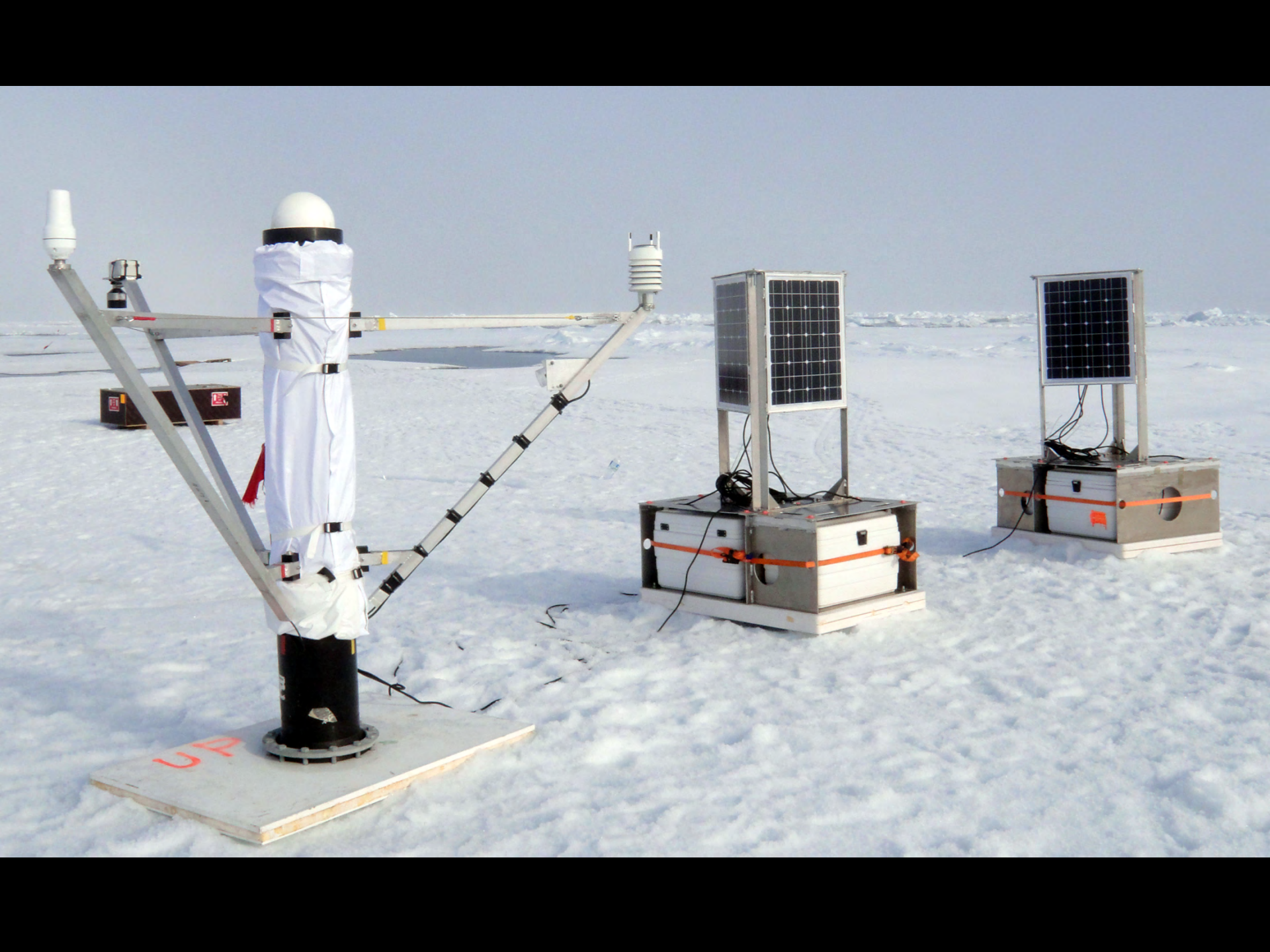
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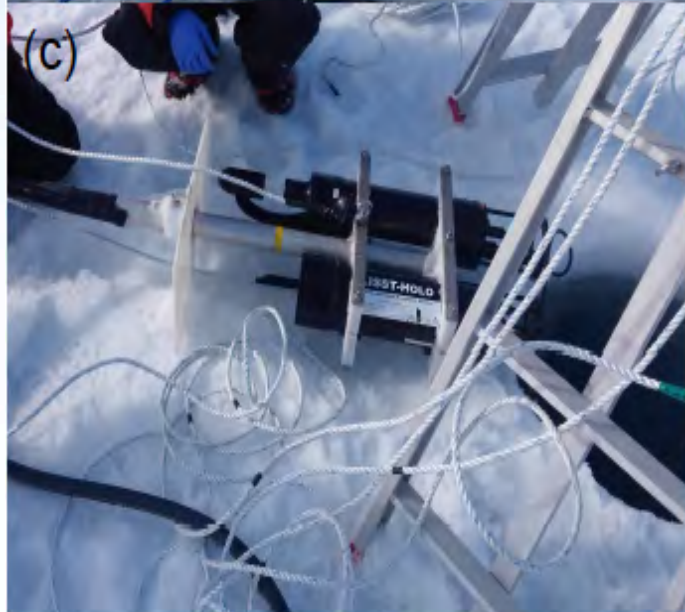
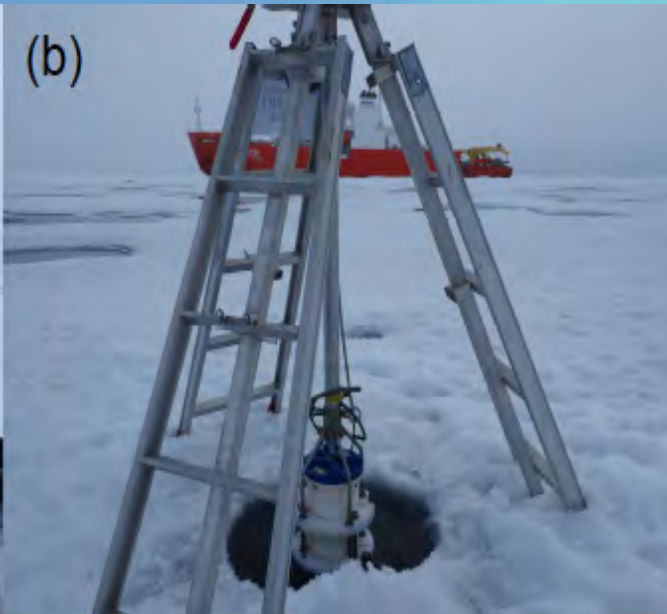




ARACON
아라온

OPRA
OCEAN POLAR RESEARCH VESSEL

AOFB 21
Naval Postgraduate School
Monterey, CA 93943
831-656-3111



Holographic and acoustic sensors: (a) Sediment trap, (b) ADCP, (c) LISST-Holo and (d) AQUAScatt 1000R/S.♪











Cruise Report:

IBRV *Araon* ARA05B, July30-August25, 2014

Bering Sea US EEZ, Chukchi/Beaufort/East

Siberian Seas, MIZ Ice Camp

Sung-Ho Kang, Chief Scientist

Korea Polar Research Institute (KOPRI)



Korea Polar Research Institute

Report Editors:

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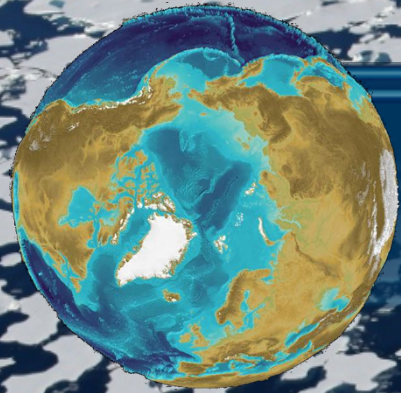
Korea Polar Research Institute (KOPRI)

Songdo Miraero 26, Yeonsu-gu

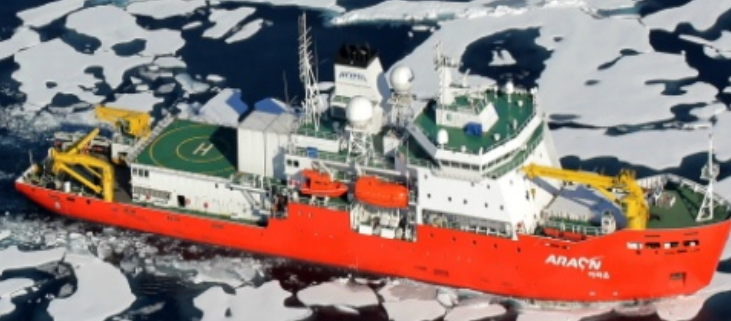
Incheon 406-840

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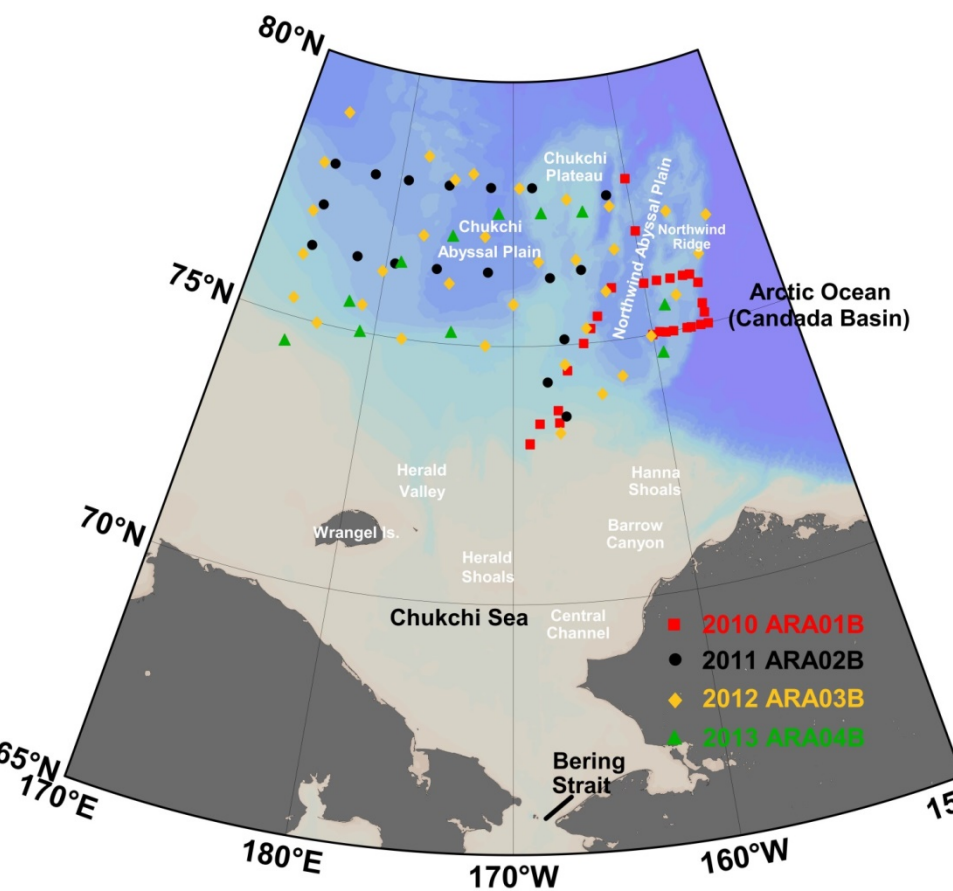
Preliminary 2015 Araon Plan



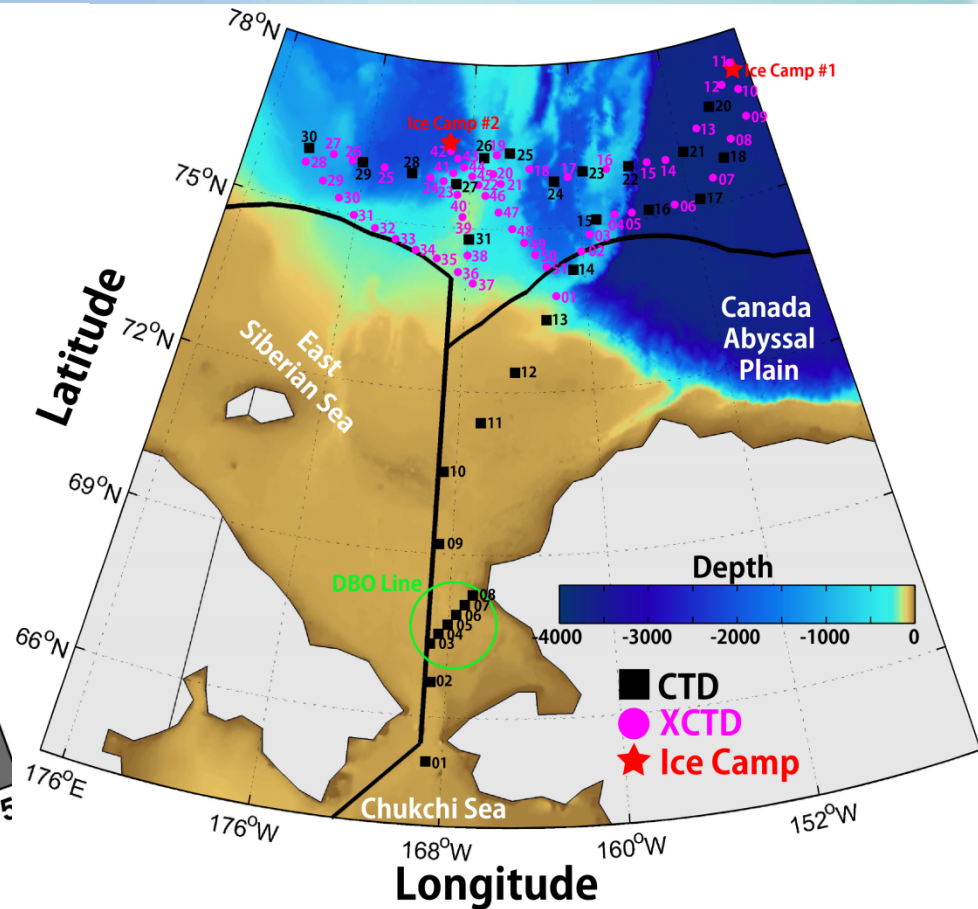
2015 Arctic cruise plan (Tentative)

- **Study area** : Bering Sea (DBO line3), Chukchi Borderland
East Siberian Sea & Mendeleev Ridge
- **Period**: 2015. 8.15 ~ 9.10 (ca. 25 days)
- **Chief Scientist**: Sung-Ho Kang
- **Participating nations**: Korea, USA, Japan, China,
Canada, Russia, Germany,....
- **Research fields**: 
 - Atmospheric observation
 - Satellite remote sensing
 - Microbes & plankton ecology
 - Sea ice dynamics & ecosystem
 - Paleocoenography (Sediment coring)
 - CO₂ systems in water column
 - Hydrographic survey
 - Marine geophysics
 - KOPRI mooring stations (2 sites)

Past Araon Research Stations



2010~2013



2014

Plan of 2015 Araon Arctic Cruise

Target areas

1. Northern Bering strait
→ DBO line3
2. Chukchi Borderland
→ 2 TUMST Moorings
→ 1 KOPRI Mooring
3. East Siberian Sea & Mendeleev Ridge
→ 1 KOPRI Mooring
→ Sea ice dynamics
→ Sediment coring

