PAG 2019 Fall Meeting, Hangzhou, China, October 14~16, 2019

SAS-Korea Research Plan: 2019 Update

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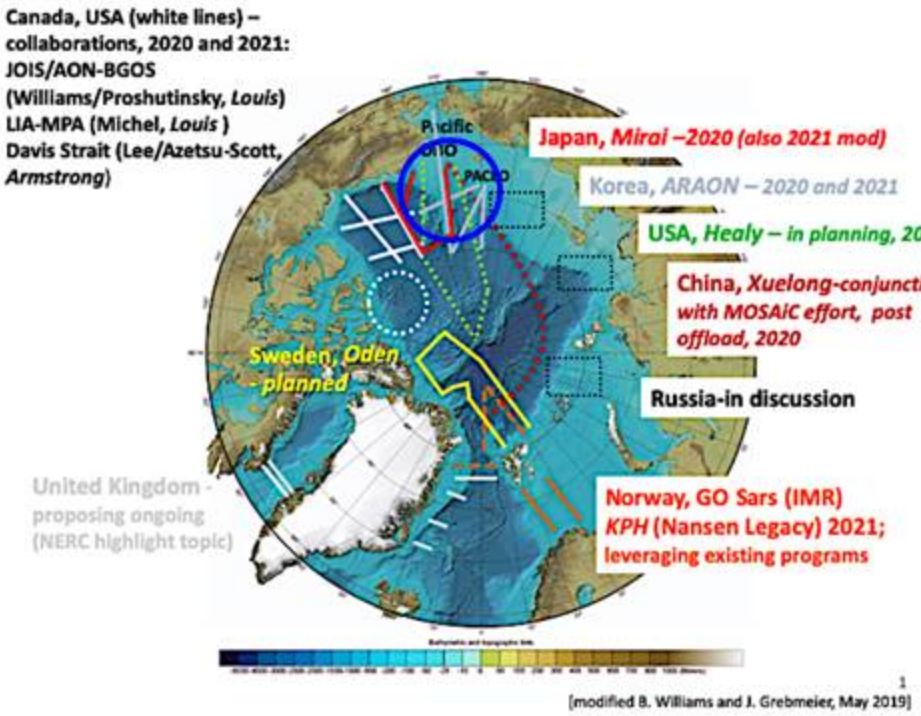
KOPRI
Korea Polar Research Institute, KIOST

Synoptic Arctic Survey

SAS-Korea area & members

Most recent map of planned SAS transects

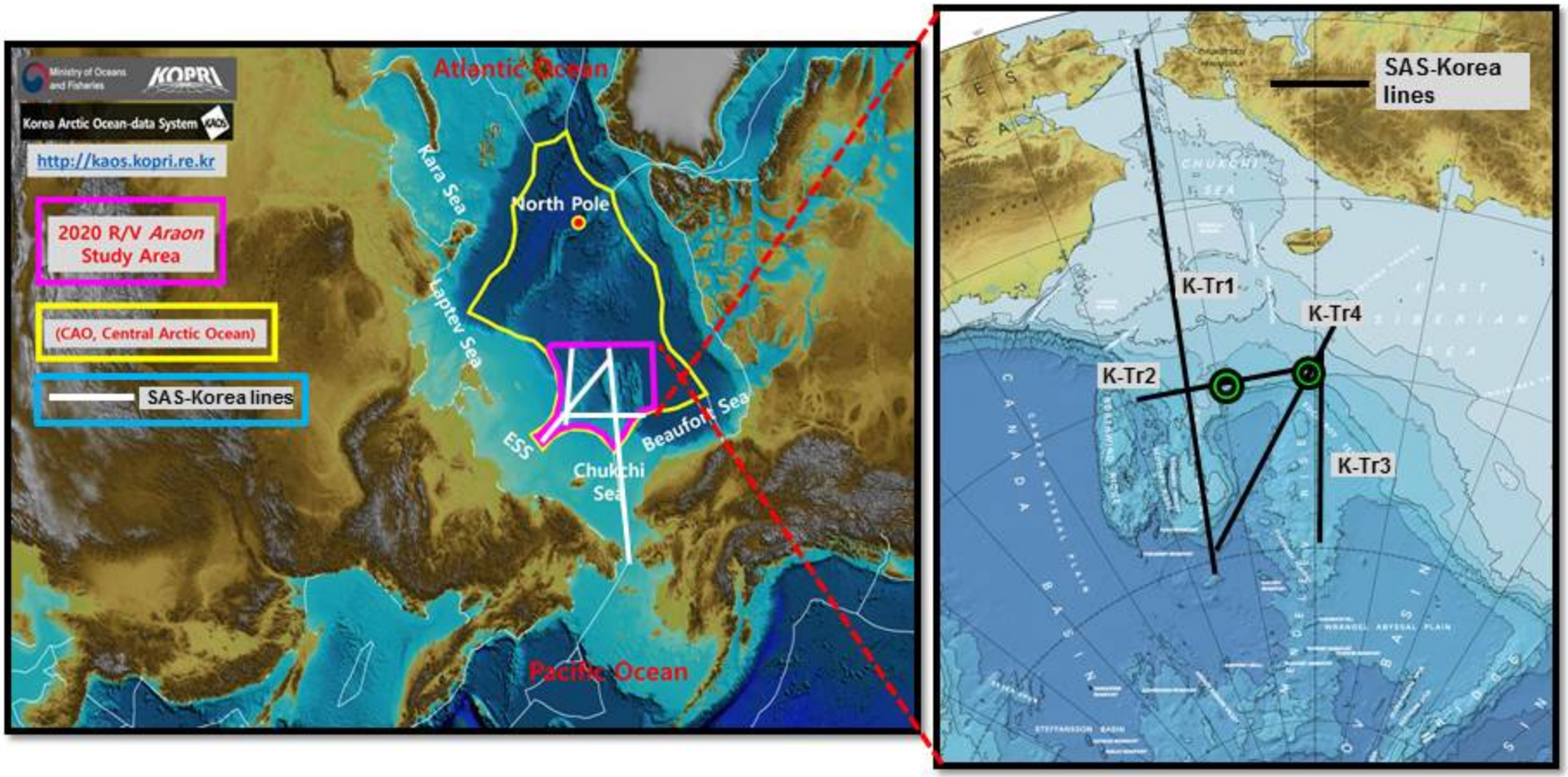


From the Report of 2019 SAS Workshop held in WHOI, May 15-16, 2019

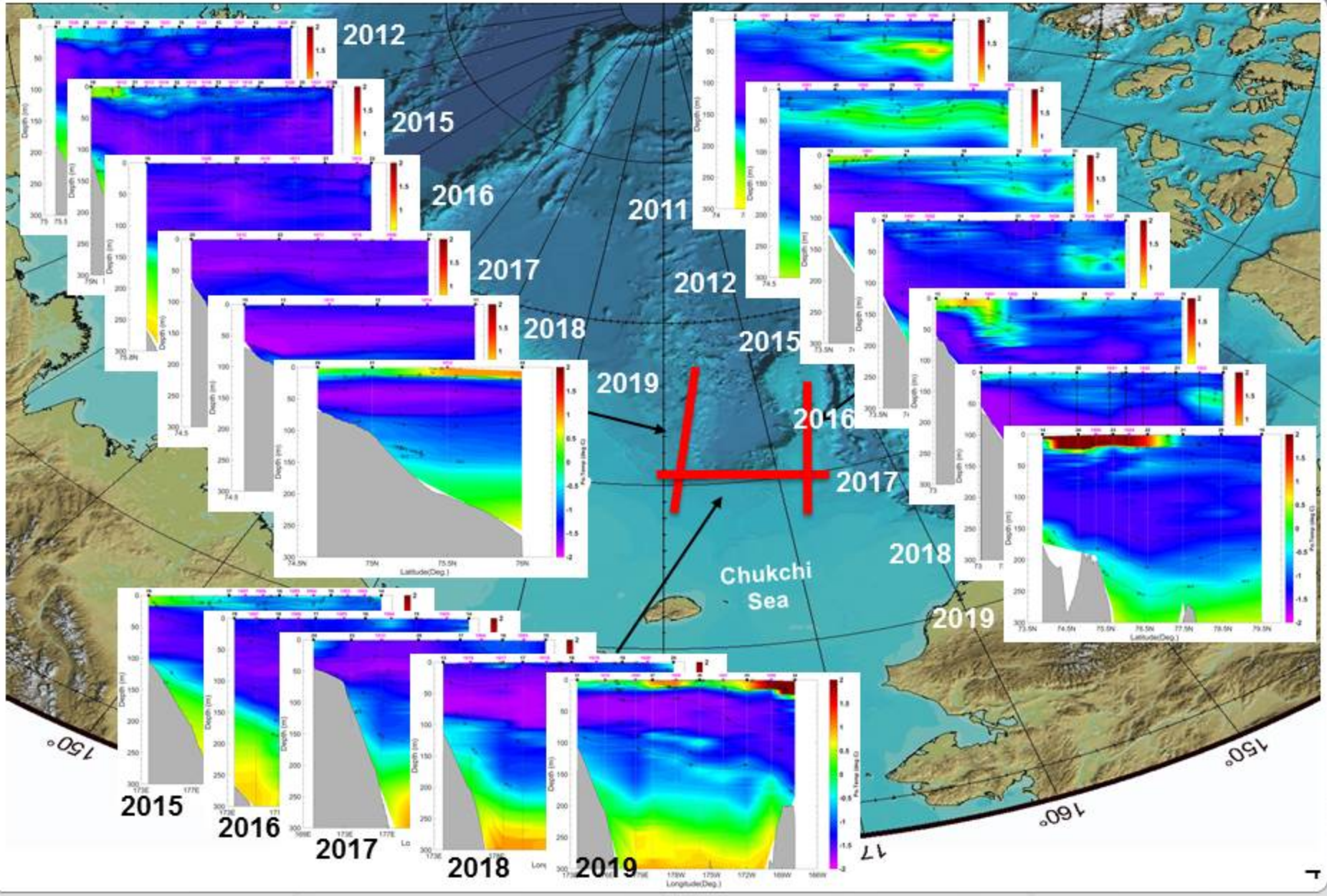
List of persons responsible for scientific variables during SAS-Korea 2020	
Put together by Kyoung-Ho Cho, July 5th, 2019	
Variable	Responsible
Chemistry and physics	
CTD (Pressure, Temperatire, Salinity)	Kyoung-Ho Cho
Inorganic chemistry (Oxygen, nutrients, DIC, Alkalinity, pH)	Jinyoung Jung
CFCs and SF_6	NA
$\delta^{18}O$ of H_2O	Jinyoung Jung
Organic chemistry (DOC, POC)	Jinyoung Jung
CO2 (atmosphere & sea surface)	Jinyoung Jung
Black Carbon	Jinyoung Jung
Water column ecosystem	
Phytoplankton and microzooplankton (composition including pigments	Eunjin Yang
Primary production & nitrogen uptake rates	Youngju Lee
Bacteria (composition and transformations)	NA
Virus	NA
Meso- and Macro zooplankton	Eunjin Yang
Ictyhyoplankton and Fish	NA
Marine mammals	NA
Transformation rates (grazing, sinking, respiration)	Eunjin Yang
Acustiucs	Hyoungsul La
Benthic ecosystem	
Meio- and macrofauna, epifauna	NA
Transformation rates (grazing, sinking, respiration)	NA
Phytoplankton resting spores	So-Young Kim
Ice studies and Epiontic communities	
Under ice imagies	NA
Ice cores/Floating ice (chemical and biological components)	Jinyoung Jung
Seabirds	NA
Modelling	Kyoung-Ho Cho

KOPRI 2020 Plan for SAS

- 2020 Araon Arctic Cruise
  - We proposed 4 transects for CTD casts

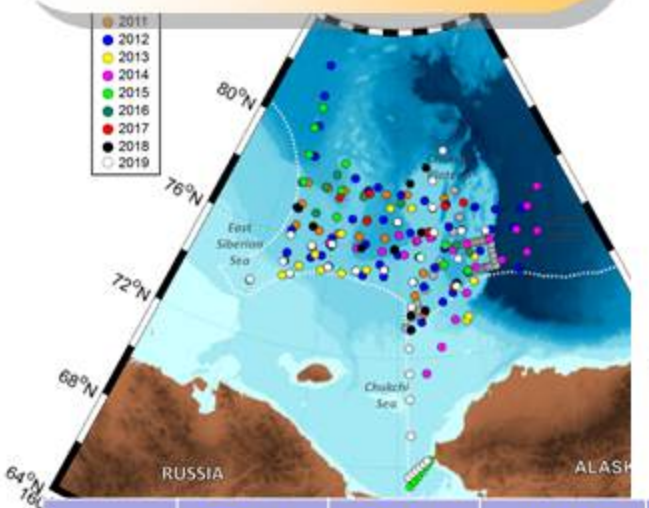


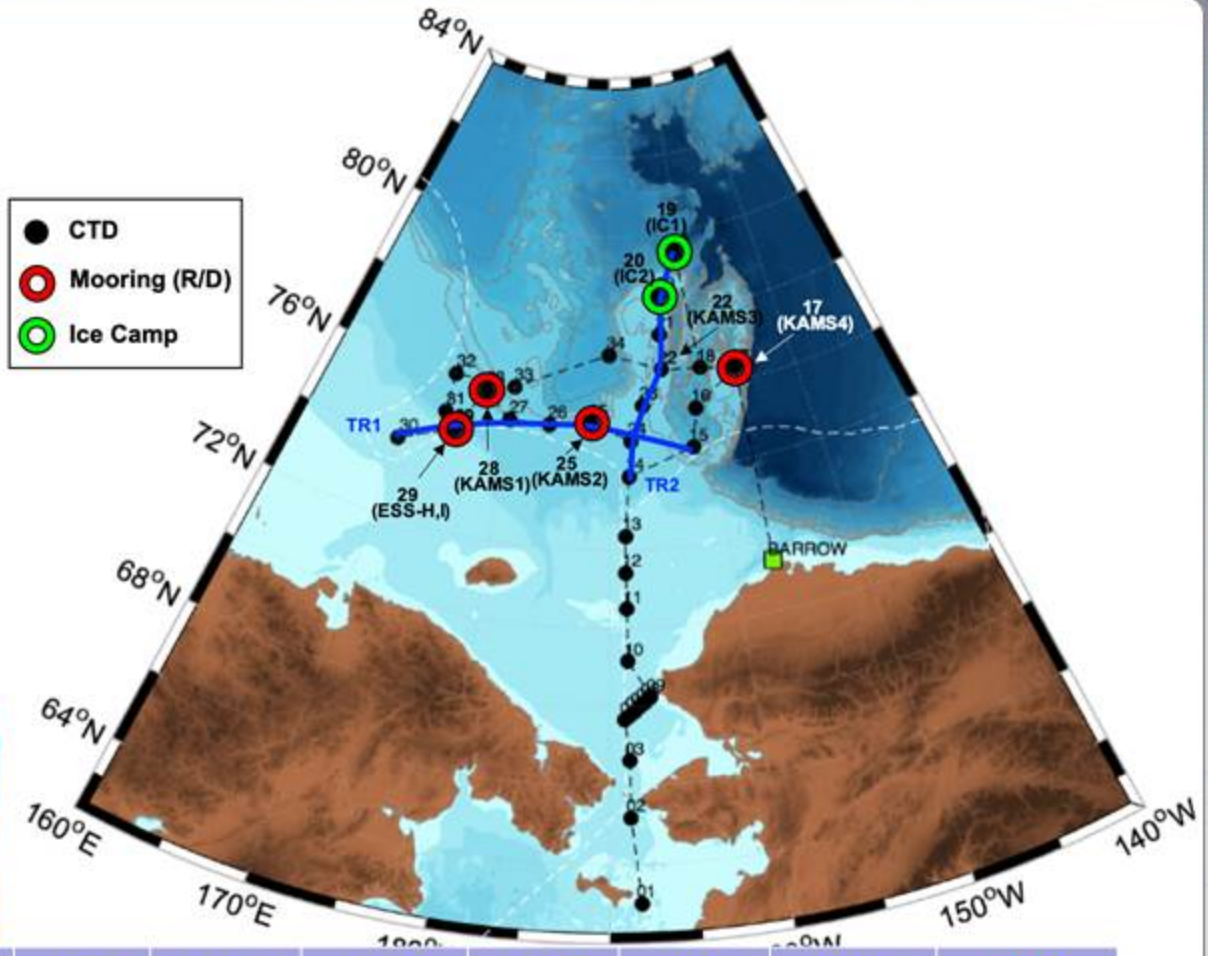
T & S distributions at 3 transects



IB R/V ARAON Arctic Cruise (2019)

- CTD: 34 stations
- XCTD: 22 stations
- Ocean Mooring:
  - Recovery: 5
  - Re-deployment: 5
- Sea ice camp: 2





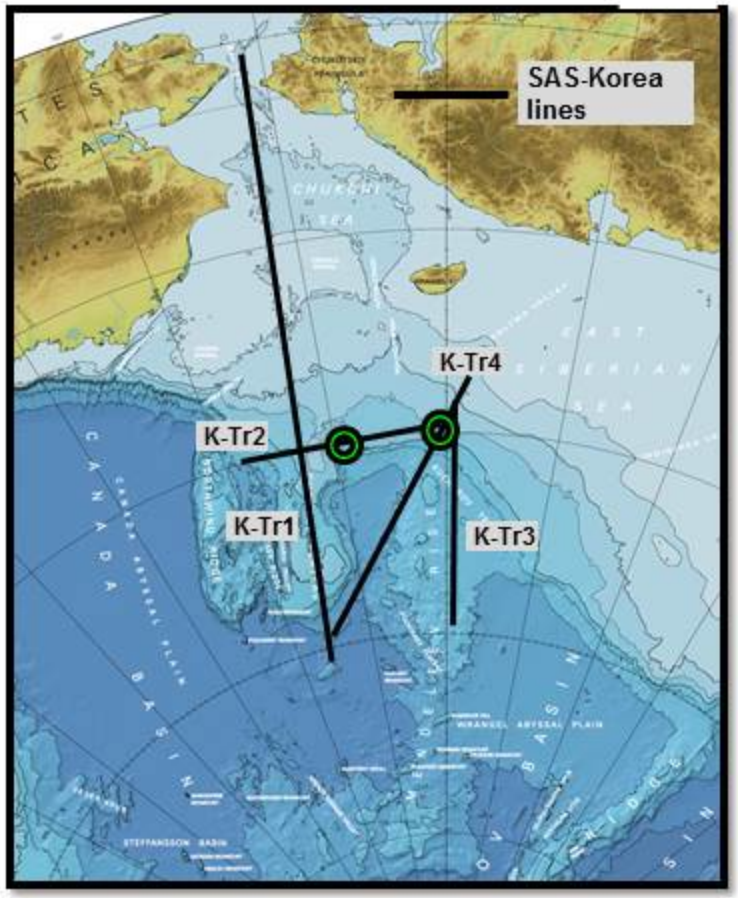
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CTD	38	18	44	16	32	42	34	35	27	34
XCTD	*	33	48	36	51	61	38	30	30	22
Period	07/20~ 08/10	08/02~ 08/16	08/04~ 09/06	08/24 ~ 09/01	08/01~ 08/23	08/01~ 08/21	08/05~ 08/21	08/06~ 08/24	08/04~ 08/25	08/03~ 08/26

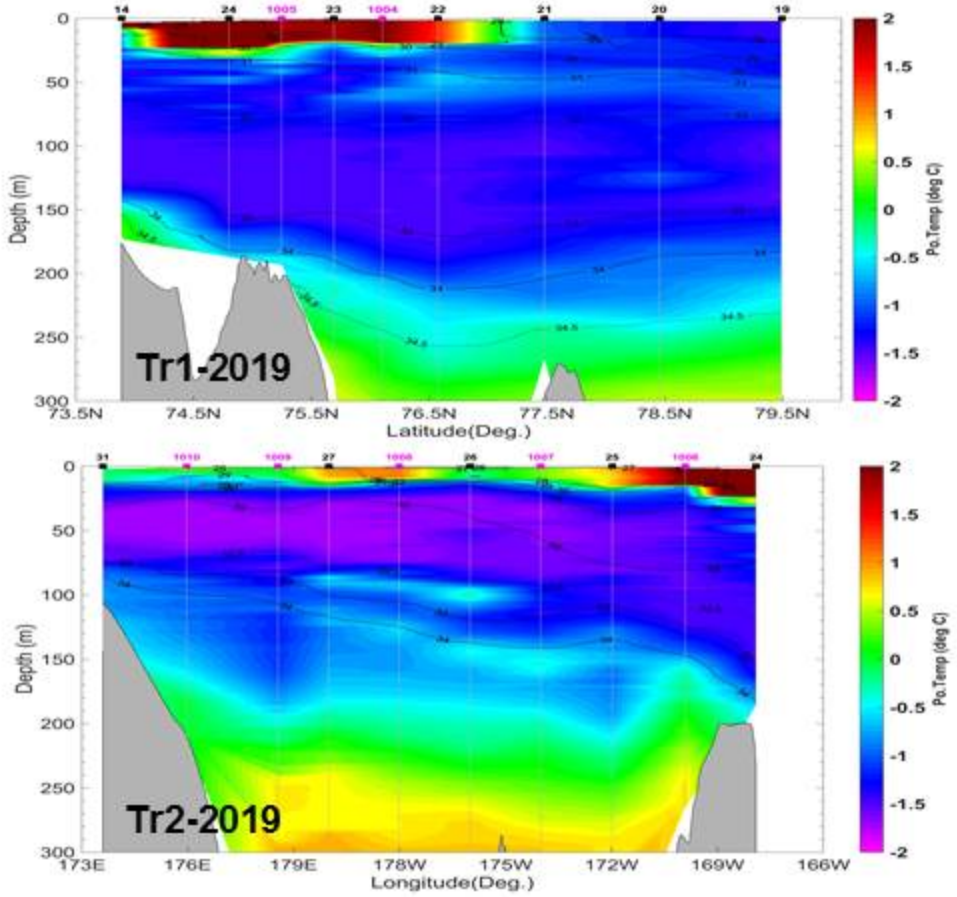
KOPRI 2020 Plan for SAS (physical)

◆ 2020 Araon Arctic Cruise

Leading Scientist: Kyoung-Ho Cho

- We proposed 4 transects for CTD casts (interval between stations will be determined later)
- At least 2 ocean moorings will be maintained until 2021 summer





◆ Classification of Water Masses in the study area

◆ Spatial/temporal distributions of the water masses and circulation patterns

◆ Quantification of heat transport and freshwater transport

KOPRI 2020 Plan for SAS (biological)

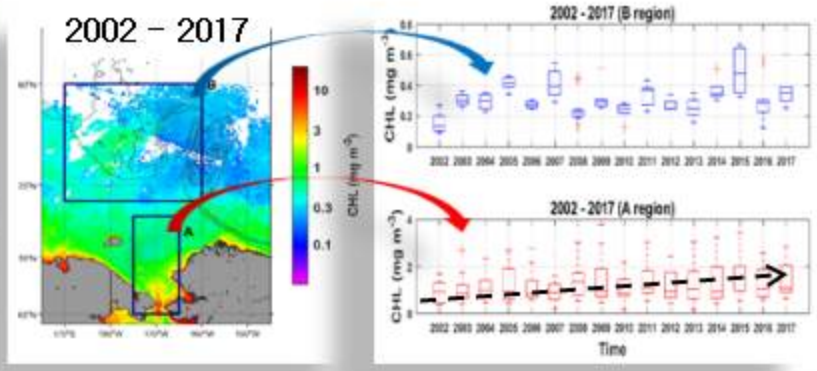
- **Phytoplankton** community structure, Physiology (F_v/F_m)
- **Microzooplankton** community structure and grazing impact
- **Mesozooplankton** population and community structure (Net and Accoustic)
- **Bacteria and virus** abundance
- Planktonic **food web** structure

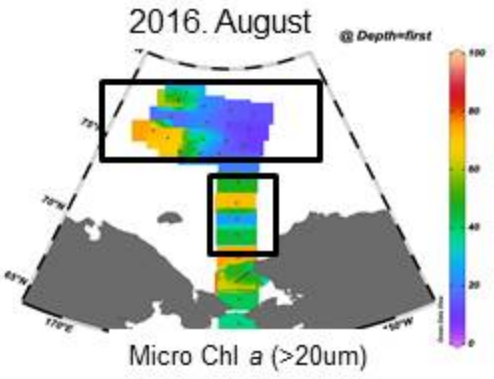
Leading Scientist: Eun Jin Yang

1. Autotrophy in the food web

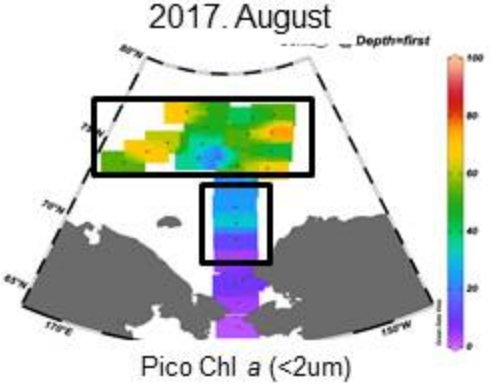
Phytoplankton community

- **Uncertain temporal variation of Chl *a* in NCS and NESS unlike the pattern in SCS**
- **Microplankton was dominant in the NESS in 2016 and Picoplankton was dominant in the NESS and NCS in 2017**





Micro Chl *a* (>20um)



Pico Chl *a* (<2um)

Phytoplankton physiology (F_v/F_m)

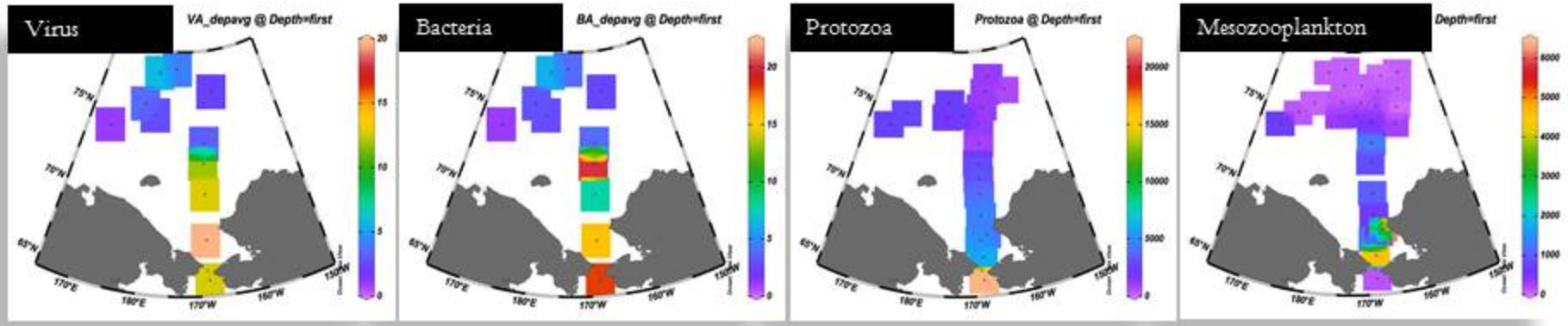
- **Photochemical efficiency was higher in SCS than NCS and NESS**
- **Phytoplankton community and nutrient supply might be the possible source.**

KOPRI 2020 Plan for SAS (biological)

Virus, bacteria, and zooplankton

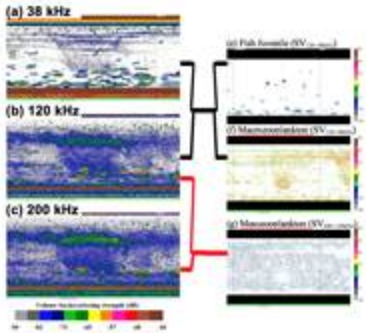
2. Heterotrophy in the food web

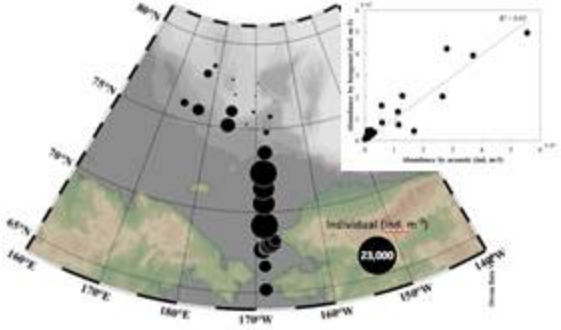
- Virus, bacteria, protozoa, and mesozooplankton were two times less abundant in NCS and NESS than SCS

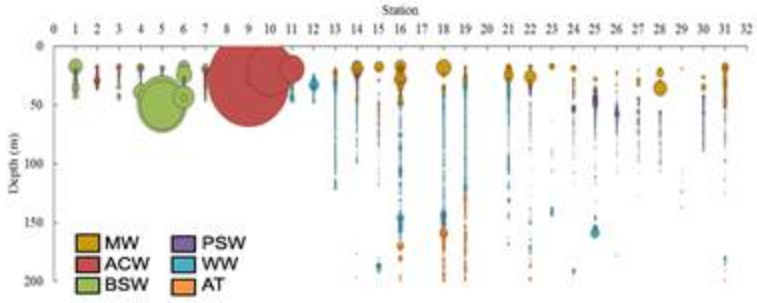


Copepod abundance

- Copepod abundance was tried to estimate with acoustic and net samples
- We expect to find a relationship between water masses and copepod habitats





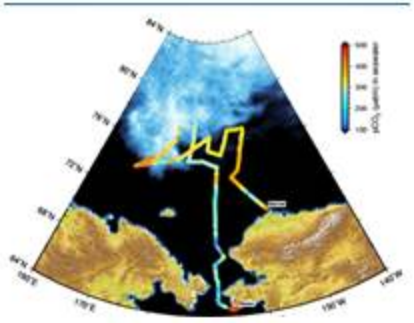


KOPRI 2020 Plan for SAS (chemical)

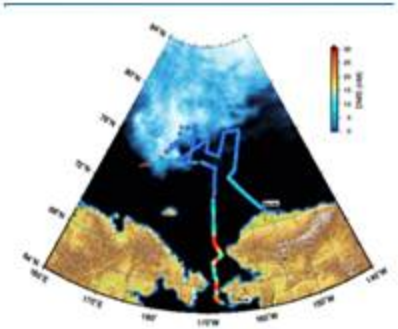
- Spatial and temporal variation of pCO_2 in the Arctic Ocean
- Characteristics of dissolved inorganic carbon (DIC)
- Net community production (NCP) using MIMS (Membrane-inlet Mass Spectrometry)

Leading Scientist: Jinyoung Jung

Continuous observation system of pCO_2



Dissolved pCO_2 along the track



Dissolved O2/Ar along the track

Continuous observation system (MMIS)

- Distributions of nutrients (NH_4, NO_2+NO_3, PO_4 and SiO_2)
- Characteristics of dissolved and particulate organic matters (DOM and POM)
- Distributions of river water and ice melt water
- Sinking particle flux

Seawater auto analyzer

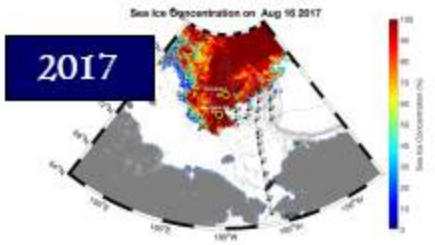
TOC-TN analyzer

CHN analyzer

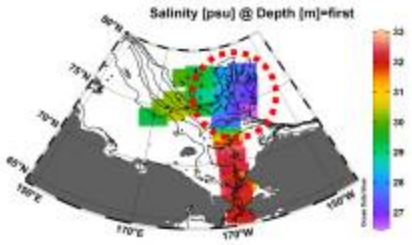
DOC sampler

Sediment trap

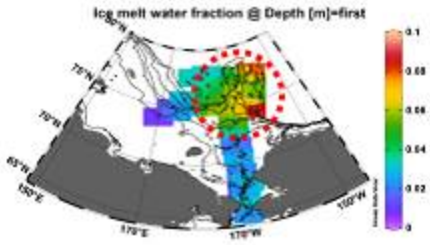
KOPRI 2020 Plan for SAS (chemical)



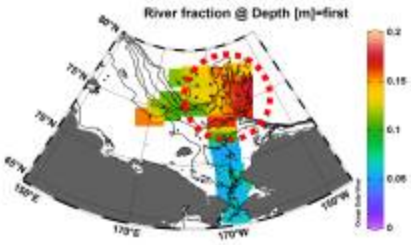
Sea ice concentration



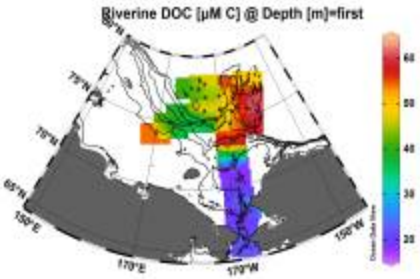
Salinity



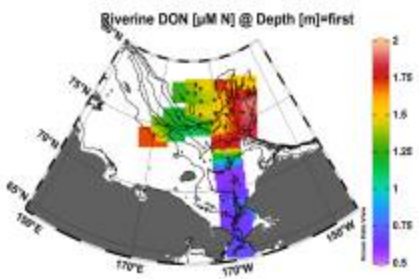
Ice melt water



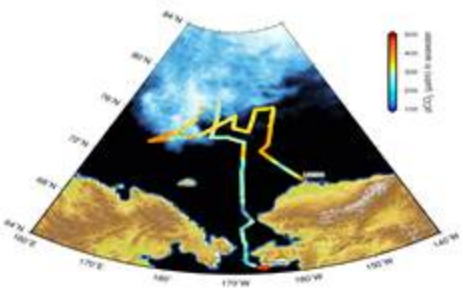
River water



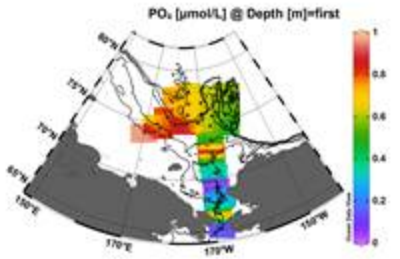
Riverine DOC



Riverine DON



pCO_2

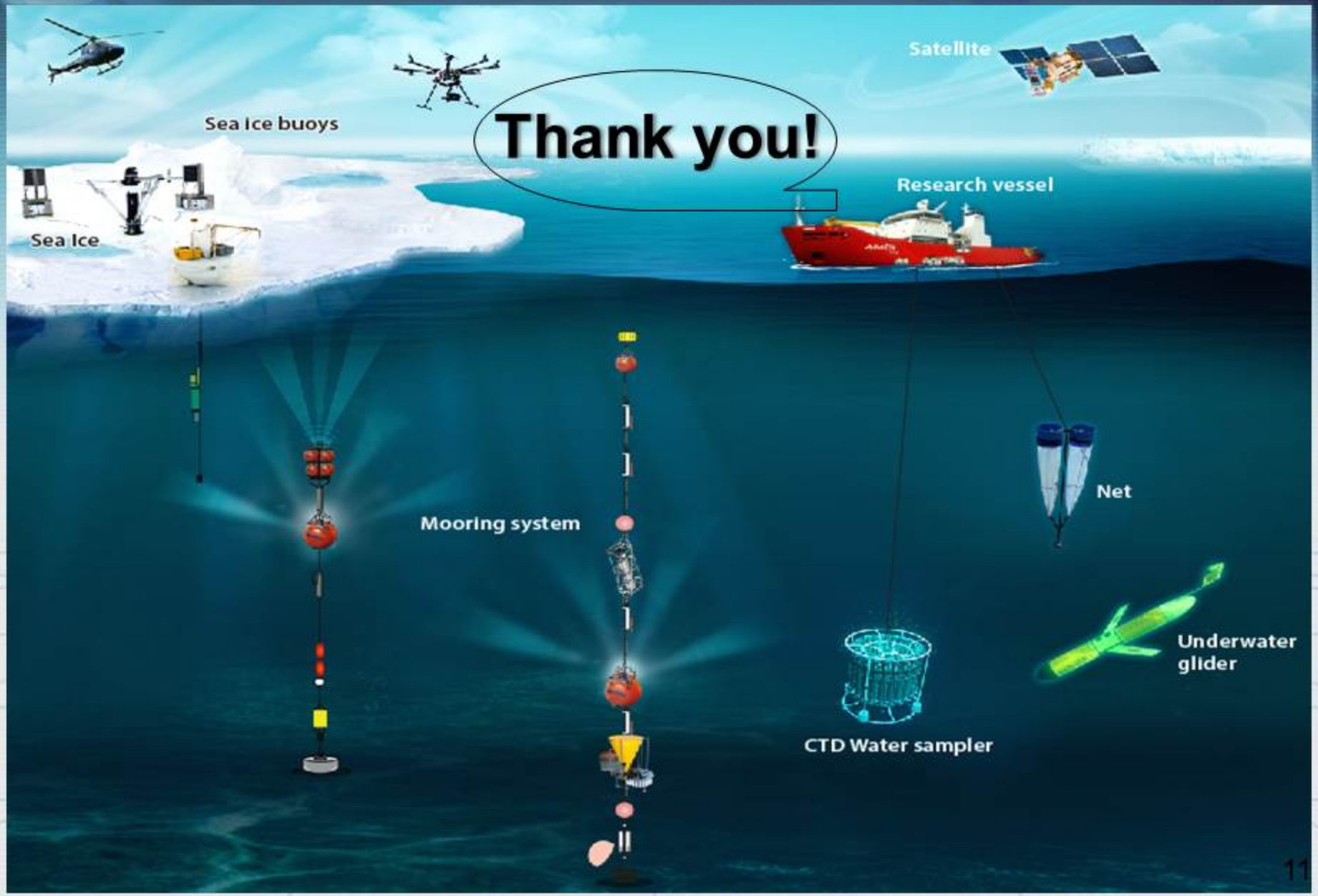


PO_4

In 2020, Korea Polar Research Institute (KOPRI) is going to measure carbon components as follows:

- pCO2
- Dissolved inorganic carbon (DIC)
- Nutrients
- d18O
- Dissolved organic carbon (DOC) [Marine DOC, Riverine DOC]
- Particulate organic carbon (POC)
- Sinking particle flux

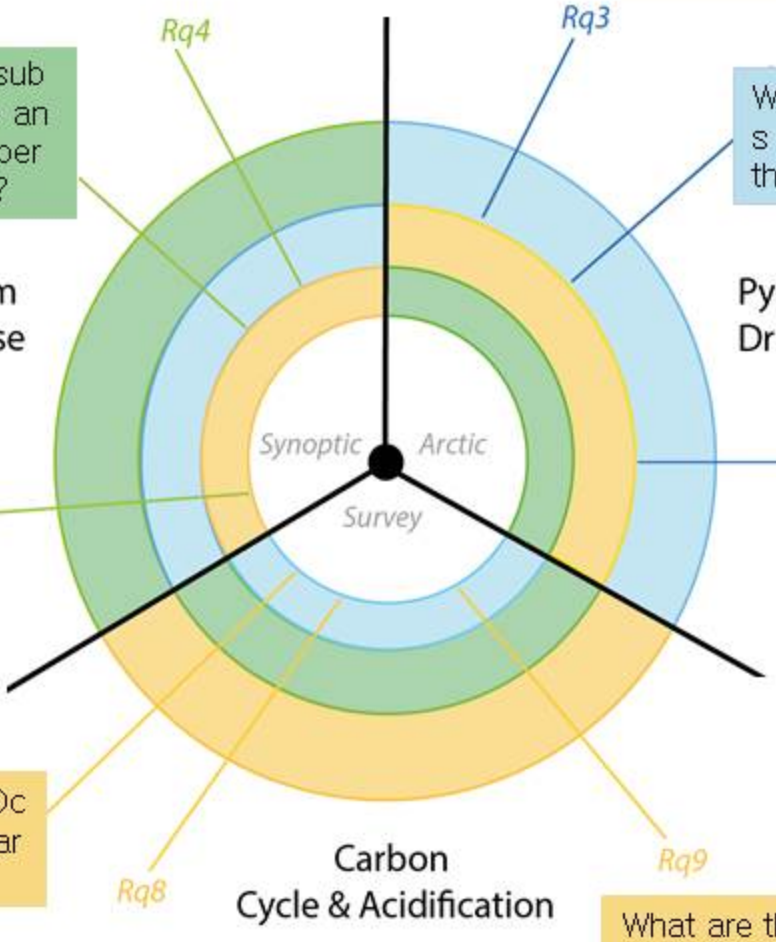
The chemical data set will be compared to biological (e.g., phytoplankton taxonomic structure and bacterial abundances) and physical (e.g., salinity and water masses) ones to improve our understanding of carbon cycle in the Pacific Central Arctic Ocean.


Satellite
Sea ice buoys
Thank you!
Research vessel
Sea Ice
Net
Mooring system
Underwater glider
CTD Water sampler

What are the present state and major ongoing transformations of the Arctic marine system?

How does primary production and associated availability of nutrients vary between Arctic regions?

What are the changes in w ater mass sources, sinks a nd transformations?



Does northward range expansion of sub arctic species vary regionally and are an y of these species likely to establish per manent populations in Arctic regions?

What are the states of, and change s in, heat and freshwater budgets in the Arctic regions?

How do trophic energy transfer s vary across ecosystems and regions in the Arctic?

How are Arctic Ocean water ma sses and circulation responding to changes in sea ice properties , and atmospheric, advective an d freshwater forcing?

What is the contribution of the Arctic Oc ean to maintaining the global ocean car bon dioxide reservoir and uptake?

What are the magnitude, drivers, and impacts of Ocean Acidification in the different regions of the Arctic Ocean?

What are the input and fate of terrestrial and subsea carbon to the Arctic Ocean?

(from Olsen's presentation in 2018)