

2020 Korean Arctic Ocean Research Activity



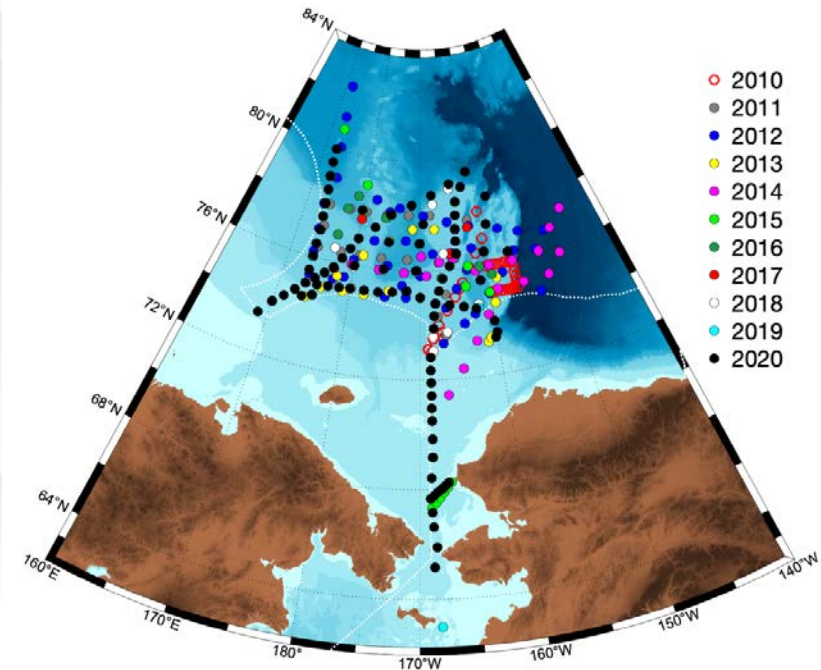
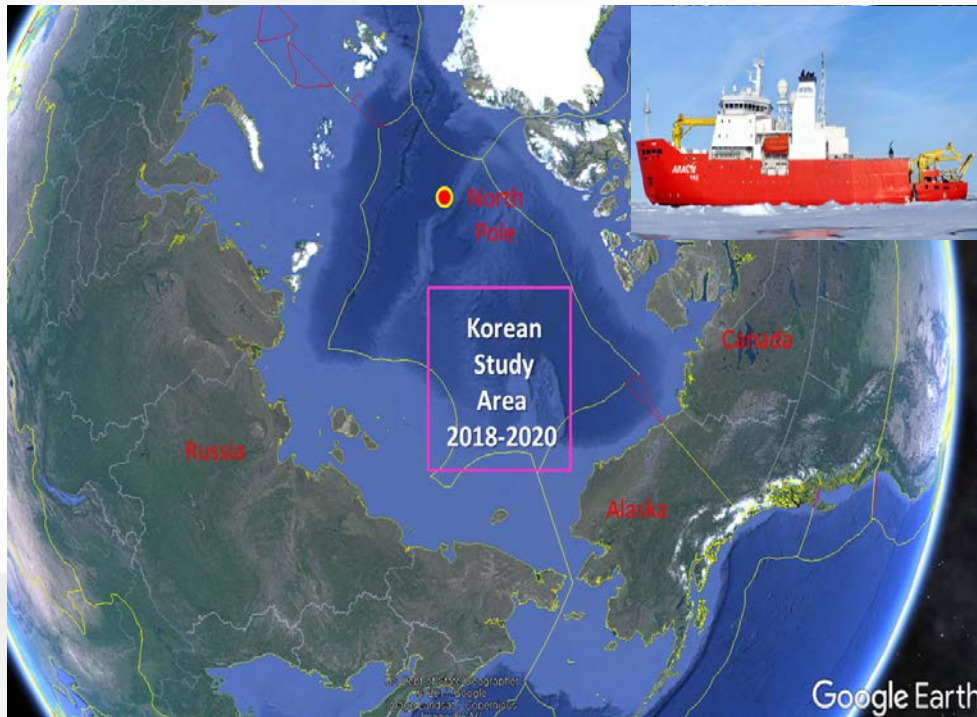
Eun-Jin Yang & Sung Ho Kang

Korea Polar Research Institute (KOPRI), Incheon, Korea

Pacific Arctic Group Fall Meeting, November 25-26, 2020

IB R/V ARAON Arctic Survey (2010~2020)

Long-term Observation Hot spot of Sea Ice Loss, Warming Atmosphere, and Changing Ecosystems in Pacific Arctic Region

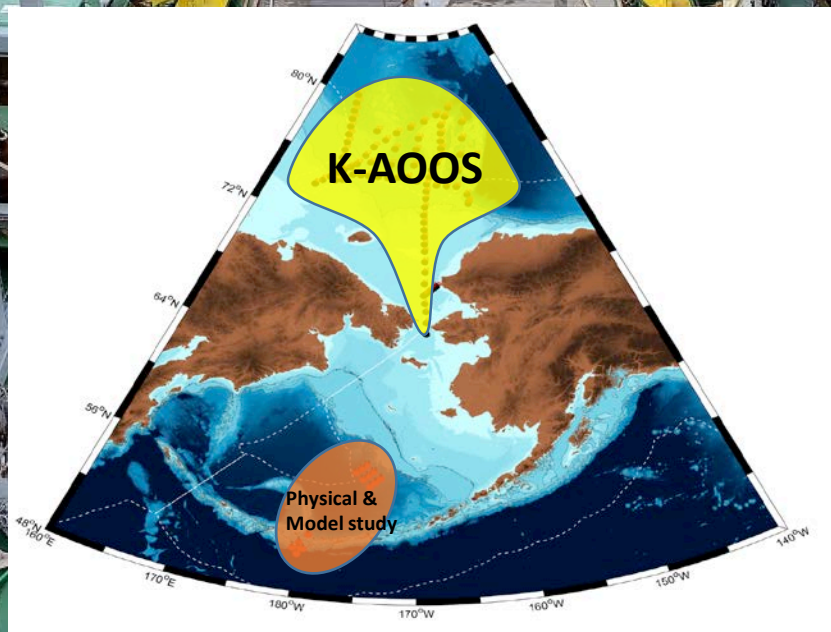


We are collaborating closely with our partners in Pacific Arctic Group (PAG) to find synergies and joint activities to avoid overlapping efforts.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CTD	38	18	44	16	32	42	34	35	25	34	88
XCTD	*	33	48	36	51	61	38	30	30	20	16
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	08/04~08/31

2020 KOPRI Arctic Research activity

K-AOOS : 2020. 8. 4 ~ 8. 31



2020 KOPRI Arctic Ocean Expedition

● Ocean-Sea Ice-Atmosphere Integrated Observations (Bering strait, Chukchi/East Siberian Seas of Pacific CAO)

- Korea Arctic Ocean Observing System (K-AOOS)

● Aims of the cruise:

- To identify key environmental parameters (physical and biogeochemical) in rapid transition due to the sea-ice decrease in the Pacific Central Arctic Ocean (CAO) and predict environmental change patterns.

- To development of satellite-based sea ice change observation system

● **Period:** 2020. 8.4 - 8.31 (from Bering strait to Chukchi Sea)

2020. 7.17 - 9.15 (from Korea to Korea)

● **Chief Scientists:** Kyoung-Ho Cho (kcho@kopri.re.kr)

● **Participating nations:** Korea

2020 ARAON Arctic Expedition

- Testing of COVID 19 two weeks before on board
- Self-quarantine 4 days before on board
- Testing of COVID 19 again one day before on board
- During 75 days, sailing from Korea to Korea with non-stop

COVID 19 testing lab



Lab interior

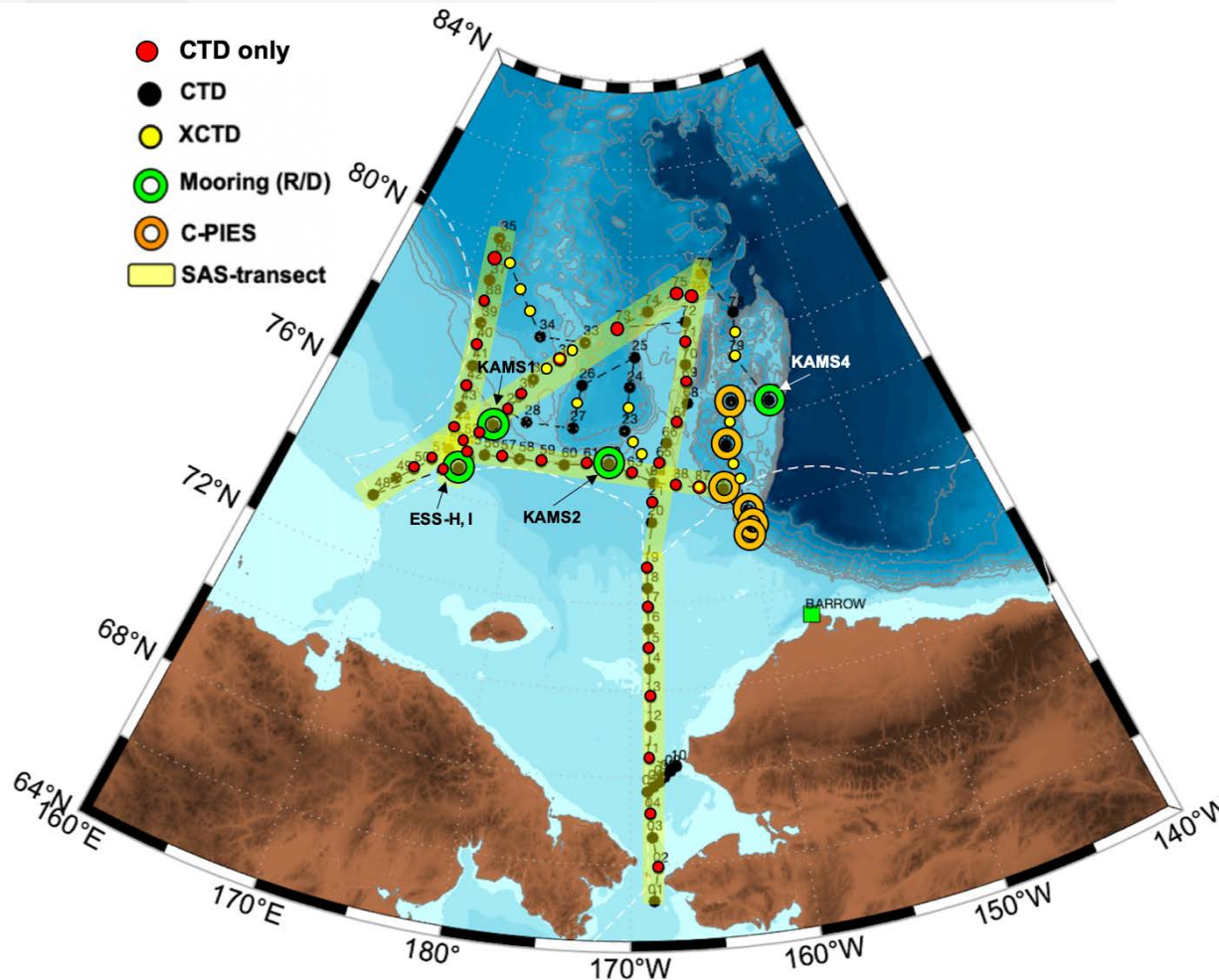


KOPRI 2020 ARAON ARCTIC CRUISE
ARA11A,B (17TH JULY- 15TH SEPTEMBER)

 최성호 국지연구소	 박덕호 국지연구소	 박시현 내오씨텍	 박명규 한국해양과학기술원	 남형순 국지연구소	 정인엽 국지연구소
 유재필 국지연구소	 박현민 한국해양과학기술원	 김지훈 국지연구소	 손우주 국지연구소, UST	 김수환 국지연구소	 노주현 한국해양과학기술원
 문국 국지연구소	 이보연 국지연구소	 김장곤 한국해양과학기술원	 박주국 한국해양과학기술원	 심동순 국지연구소	 구래영 인화대학교
 김창현 국지연구소, UST	 임미혜 국지연구소, 부경대학교	 이항수 포항대학교	 김소연 부산대학교		



2020 Arctic Ocean Expedition

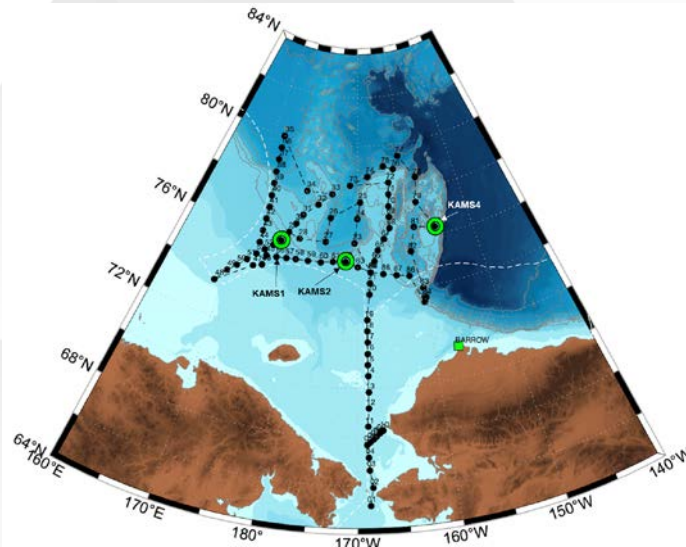


- ◆ 4 transects proposed:
88 CTD stations
(39 bio stations)
- ◆ 4 moorings
(recovery/deployment)
- ◆ 6 C-PIESs (recovery)
- ◆ 16 expendable CTD (X
CTD) probes were depl
oyed in transit
- ◆ No ice camp

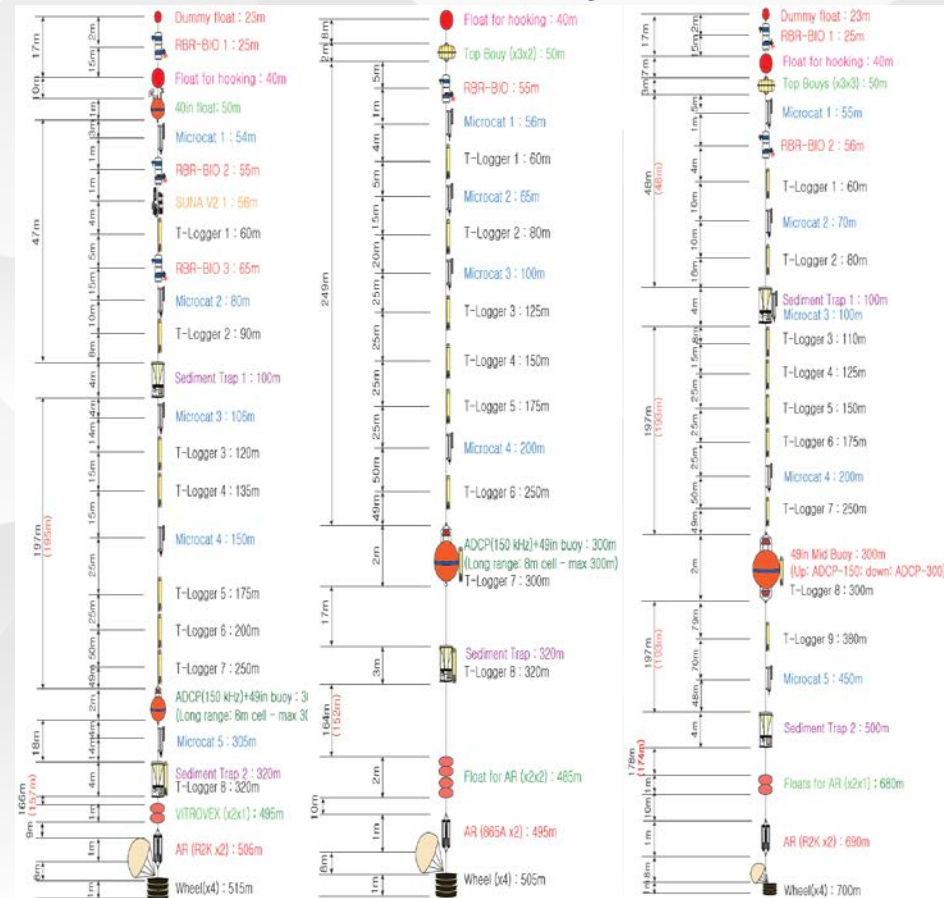
Physical Oceanography

- Objective: to identify the variation of water mass distribution and structure, circulation pattern in the regional of interest
- Equipment: CTD, XCTD, Lowered ADCP, ocean mooring system
- Ocean mooring system: ADCP, microCAT , temperature logger, sediment trap, AZFP, nitrate sensor (SUNA V2), Fluorescence & PAR sensors

2020 Arctic Ocean Mooring



2020 Deployment

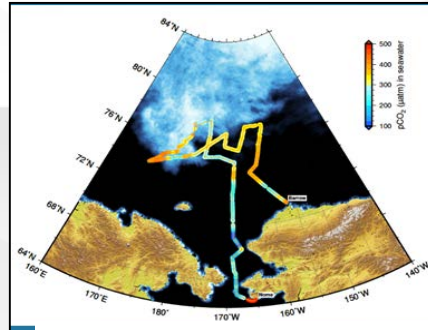


Chemical Oceanography

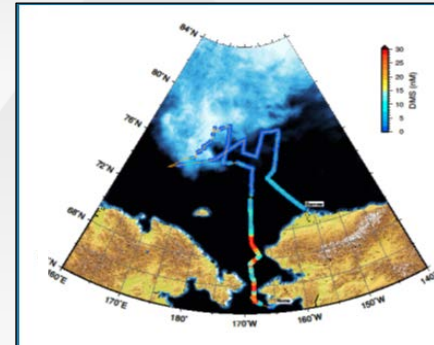
- Spatial and temporal variations of $p\text{CO}_2$ in the Arctic Ocean
- Characteristic of dissolved inorganic carbon (DIC) & Total Alkalinity
- Net community production (NCP) using an equilibrator-inlet mass spectrometry (EIMS)



Continuous observation system of $p\text{CO}_2$



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



Dissolved O_2/Ar along the track



Continuous observation system (EIMS)

- Distributions of nutrients (NH_4 , NO_2+NO_3 , PO_4 and SiO_2)
- Characteristics of dissolved and particulate organic carbon (DOC and POC)
- Distributions of river run-off water and ice melt water using Oxygen isotope ratios ($\delta^{18}\text{O}$)
- Sinking particle flux using the sediment trap



Seawater auto analyzer



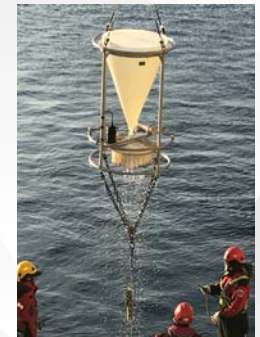
TOC-TN analyzer



CHN analyzer



DOC sampler



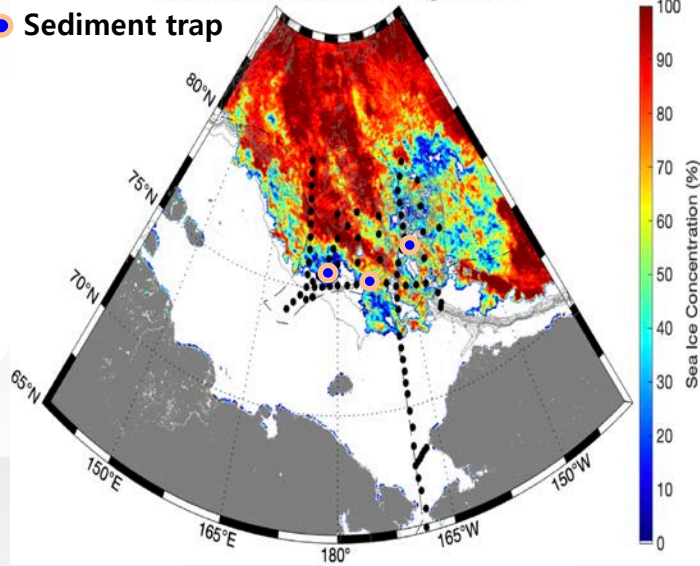
Sediment trap

Seasonal variation of Particle flux

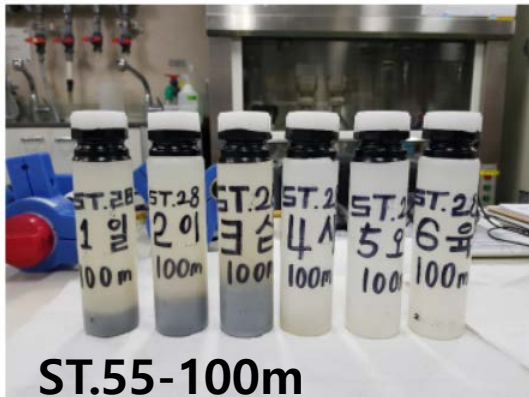
Sediment trap is the most powerful tool for investigating the carbon cycle changes in the Arctic Ocean

Sea Ice Concentration on Aug 09 2020

● Sediment trap

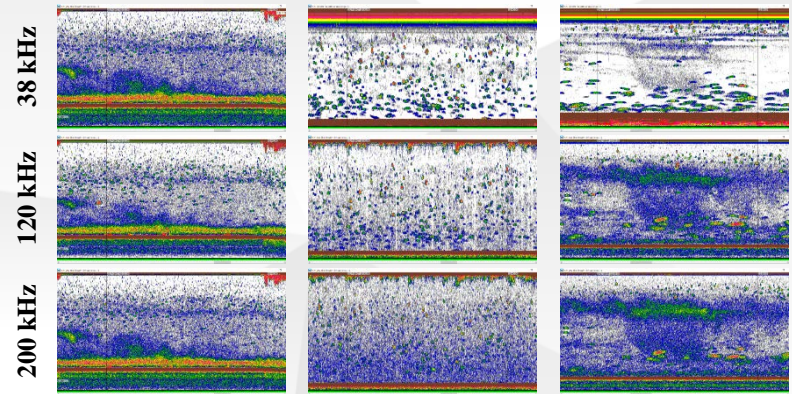


- ✓ East Siberian Sea
-100m & 320m (St.55)
- ✓ Southern Chukchi Sea
-100m (St. 91)
- ✓ Chukchi Borderland
-100m & 500m
(St. 80_failed)

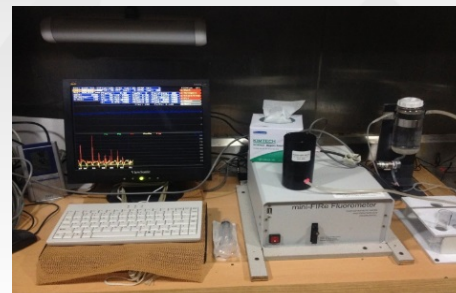
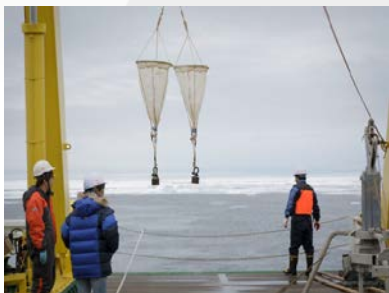


Biological Oceanography

- **Phytoplankton** community structure, Production, Physiology (F_v/F_m)
- **Microzooplankton** community structure and grazing impact
- **Mesozooplankton** population and community structure (biomass and acoustic)
- **Bacterial** abundance
- **Ichthyoplankton** composition and eDNA
- Planktonic **food web structure**



[Vertical variation of acoustic backscatter]



- **Title : Korea- Arctic ocean WARming & Ecosystem study (K-AWARE)**
- **Purpose :** The project aims to elucidate ongoing ecosystem change in the rapid transition due to unprecedented Sea ice loss, and to predict their impact on Arctic Ocean
- **Periods :** 2021. 4 ~ 2026.12
- **Budget :** USD 17 million for 6 years
- **Principal Investigator :** Eun-Jin Yang
- **Target study regions :** Chukchi Sea & East Siberian Sea

