

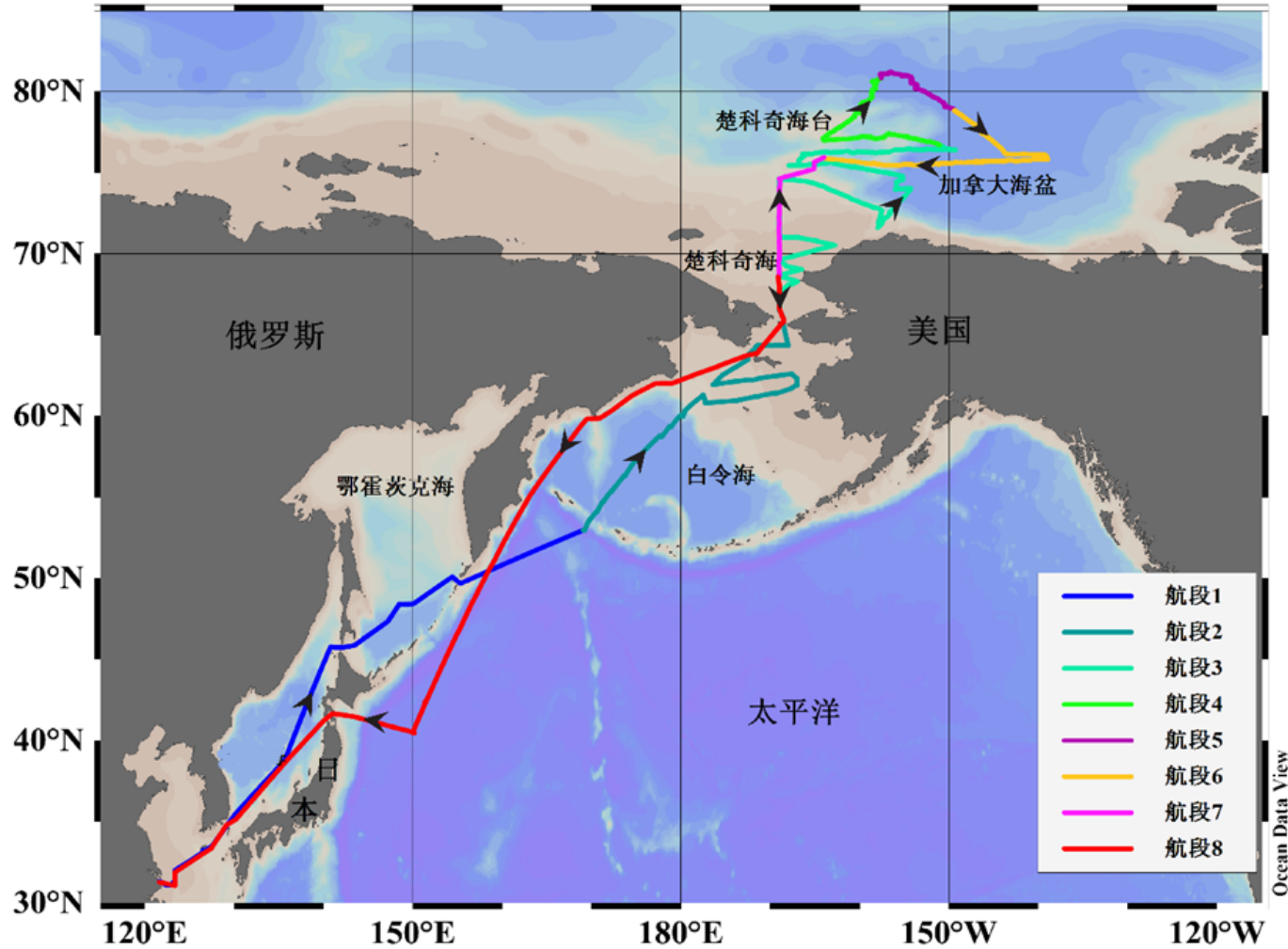


2014 Chinese Arctic Cruise

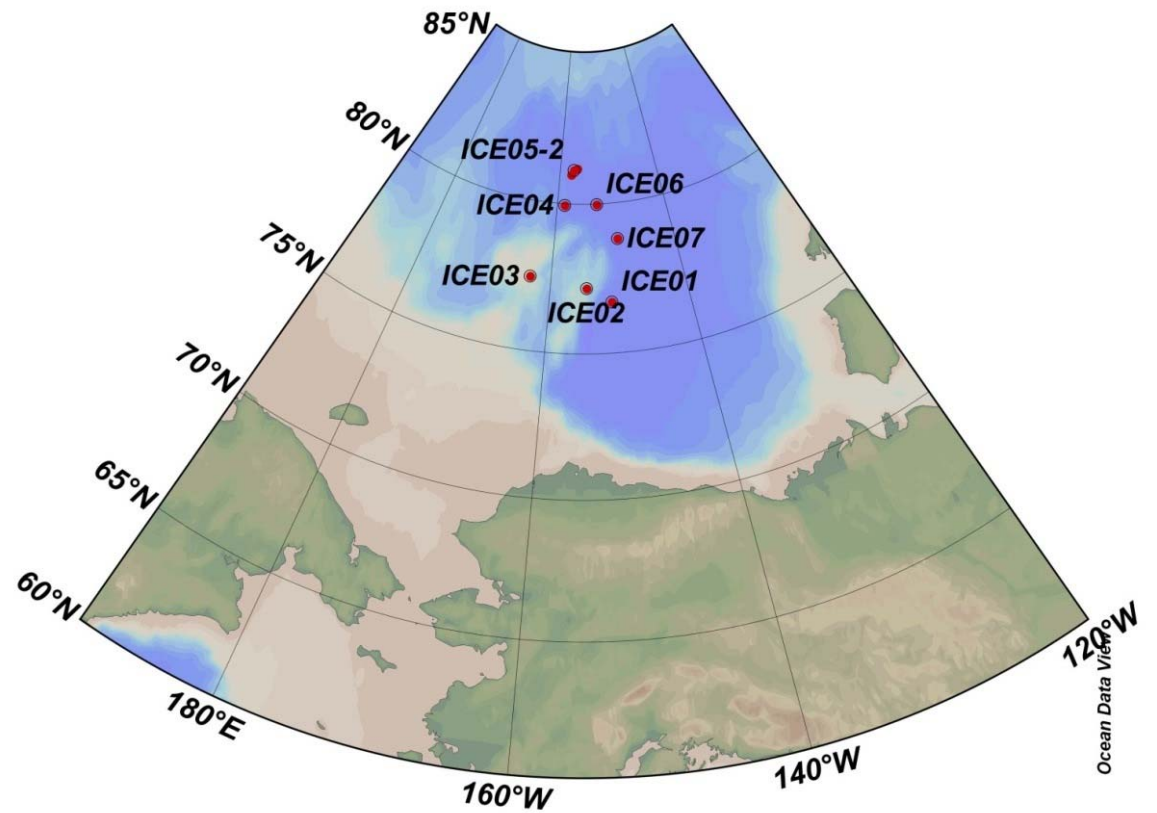
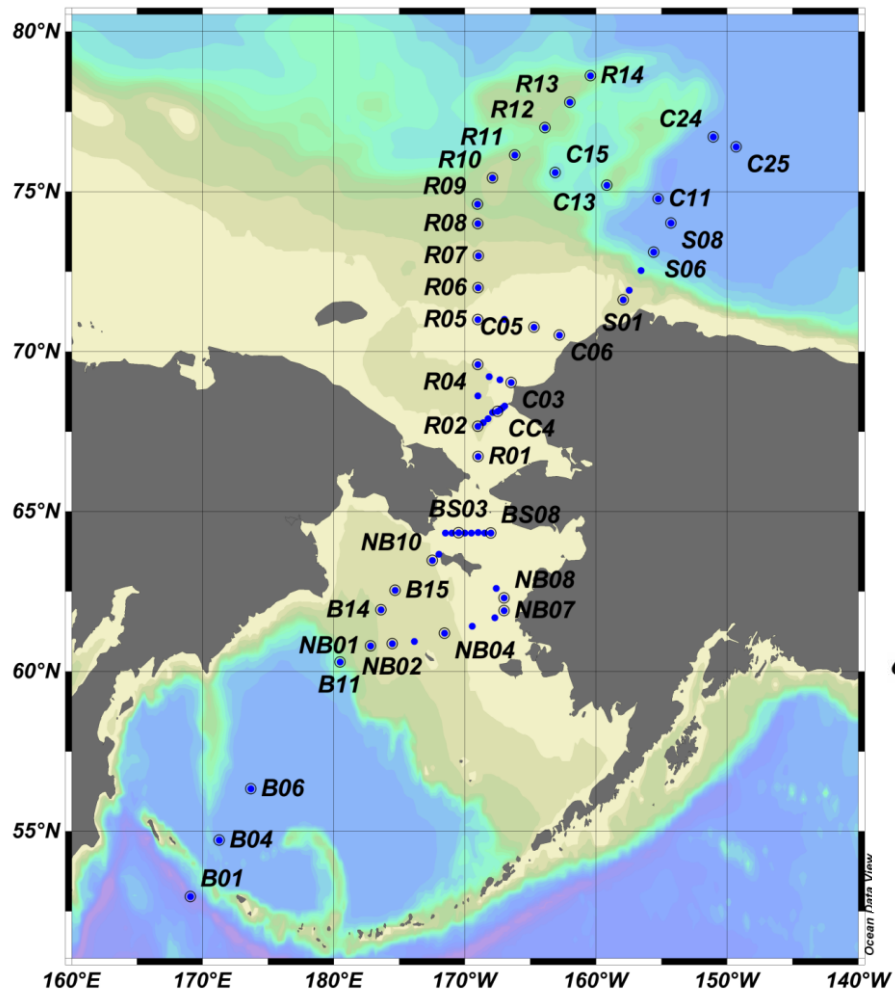
Jianfeng He
Polar Research Institute of China



CHINARE-6



- July 11—Sept. 24 (76 days)
- 128 persons, including :
 - 3 Americans,
 - 1 German,
 - 1 French,
 - 1 Russian.

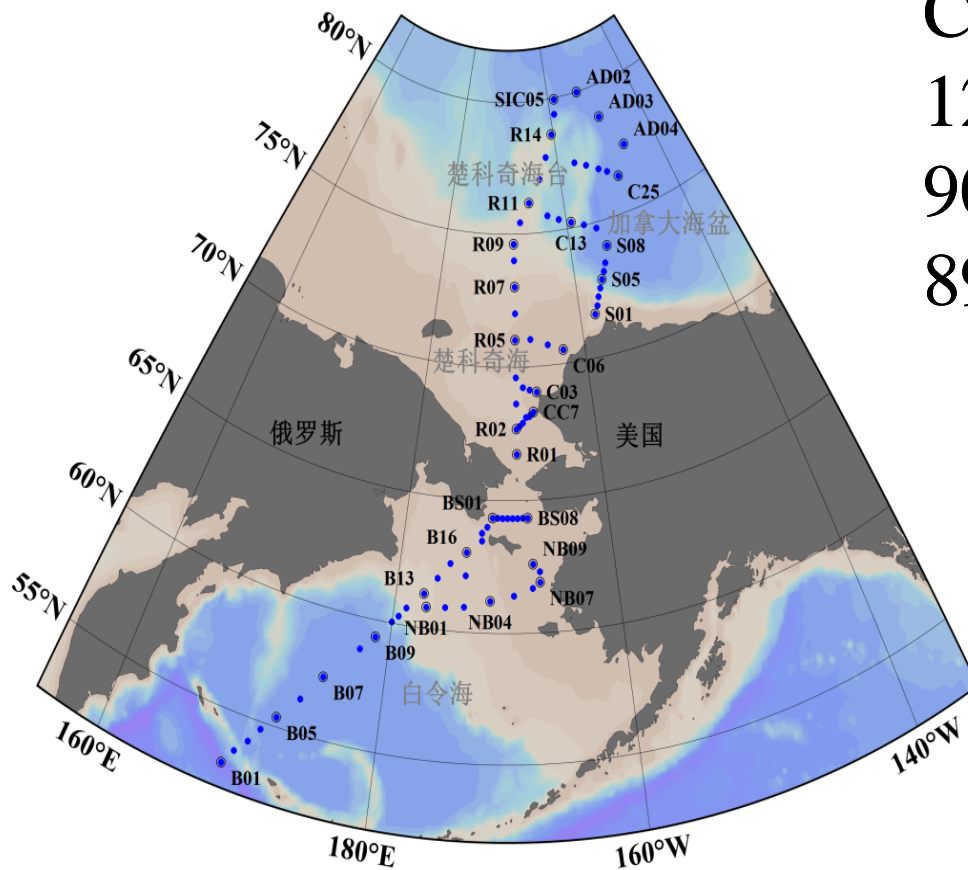


Oceanic and sea ice sampling stations during the CHINARE-6



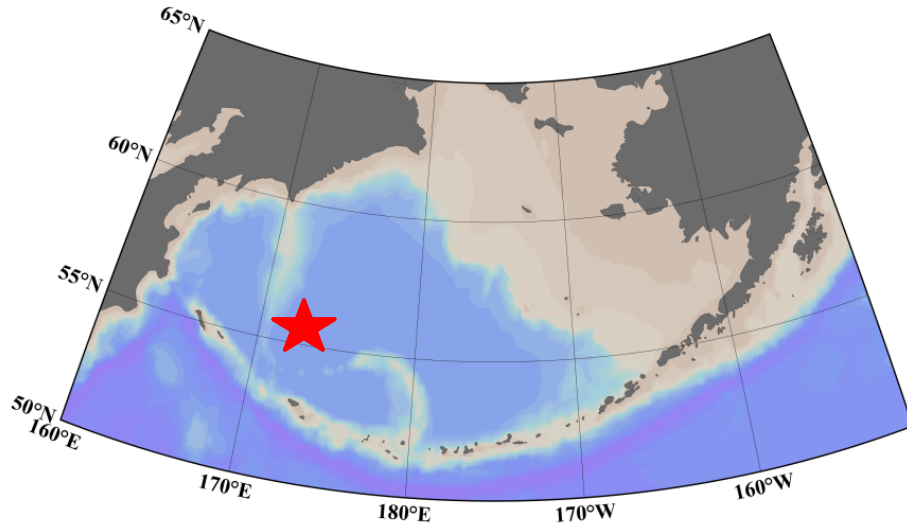
Physical Oceanography Investigation

CTD/LADCP investigations:
12 transects in total
90 stations for CTD investigations
89 stations for LADCP

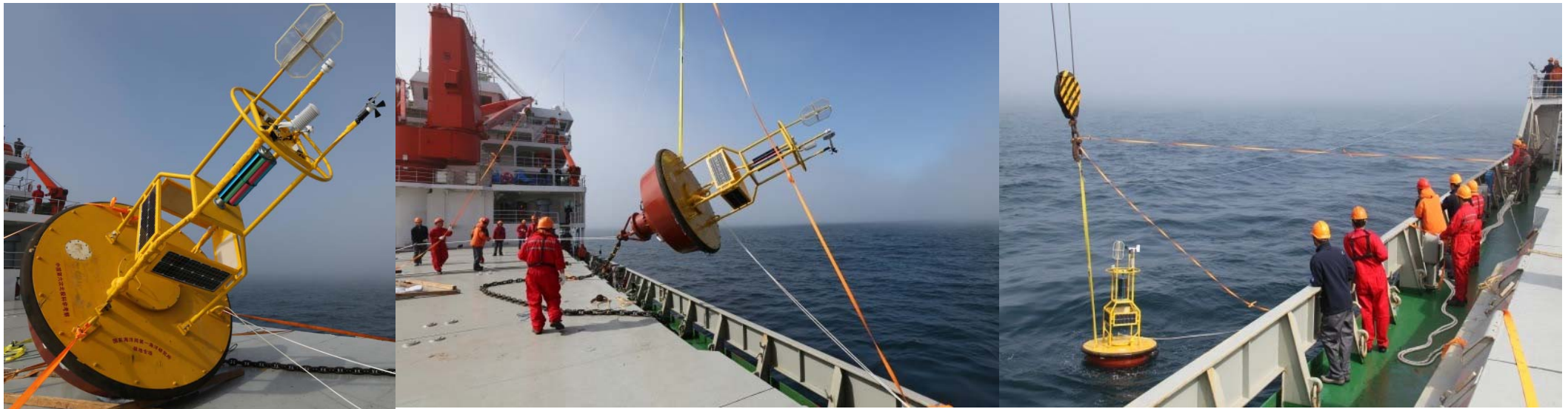


CTD/LADCP investigation stations

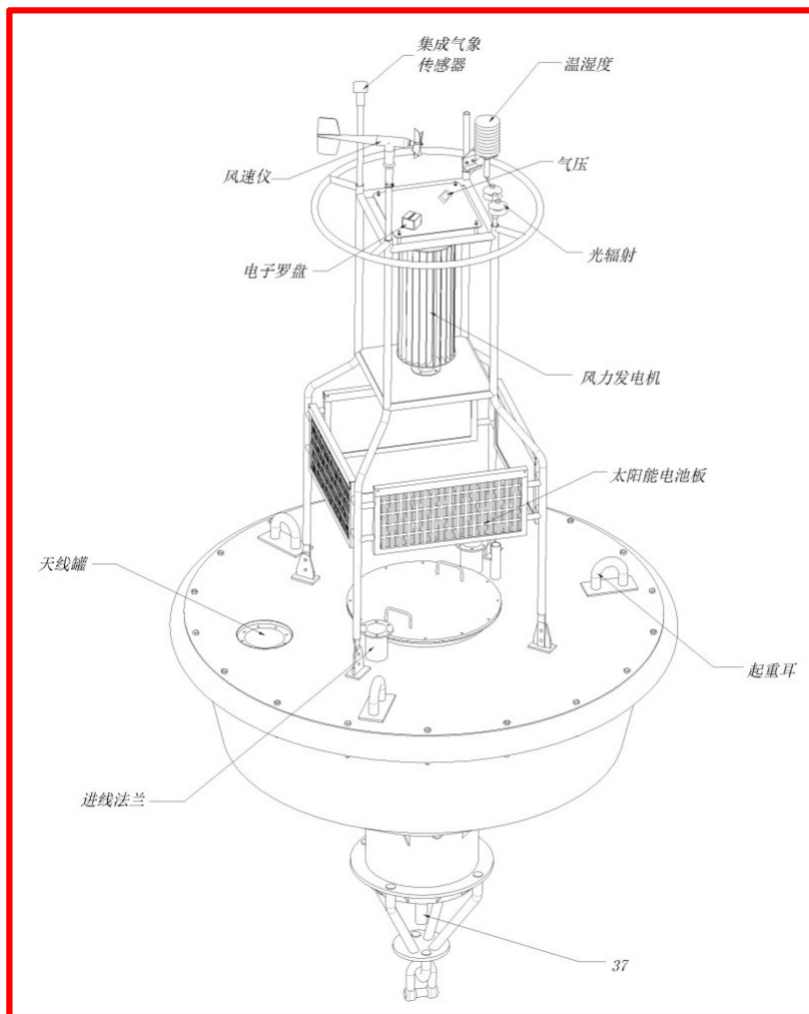




○ On 20th July, a ocean-atmosphere flux mooring system was deployed in Bering Basin area ($172^{\circ}36'E$, $55^{\circ}36'N$)



Deployment of the mooring

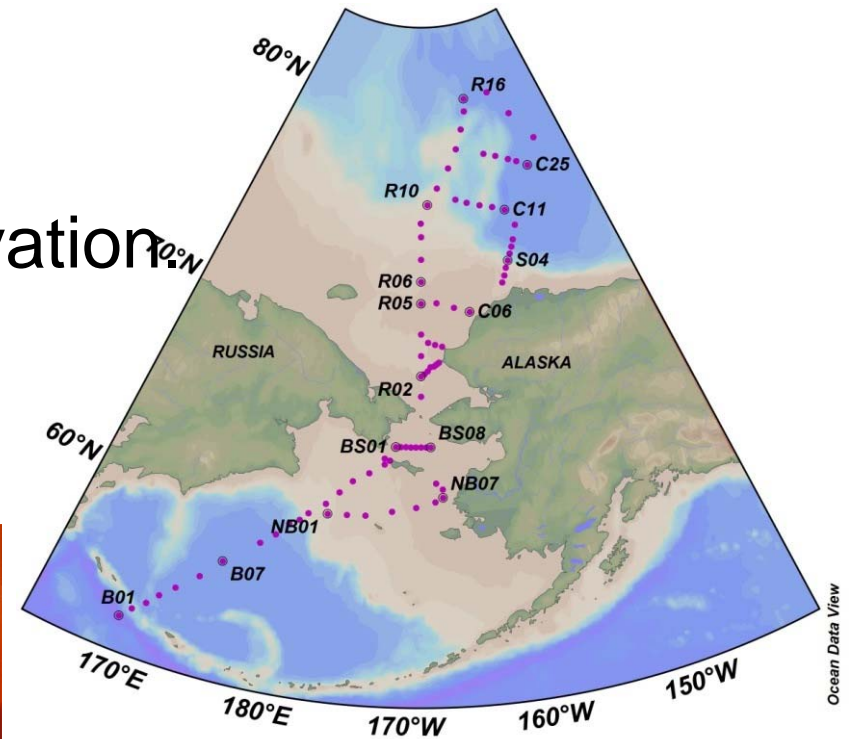


Main indexes of the mooring sensors

items	measurement range	accuracy
wind speed	0 ~ 75m/s	±0.3m/sec
wind direction	0°~360°	±0.25%
air temperature	-50~50°C	±0.5°C
air pressure	610~1100hPa	±0.5 hPa
humidity	0~100%	±1%
short-wave irradiance	305~2800 nm	±1%
long-wave irradiance	4500~50000 nm	±1%
water temperature	-5~40°C	±0.1°C
salinity	0~40	±0.03

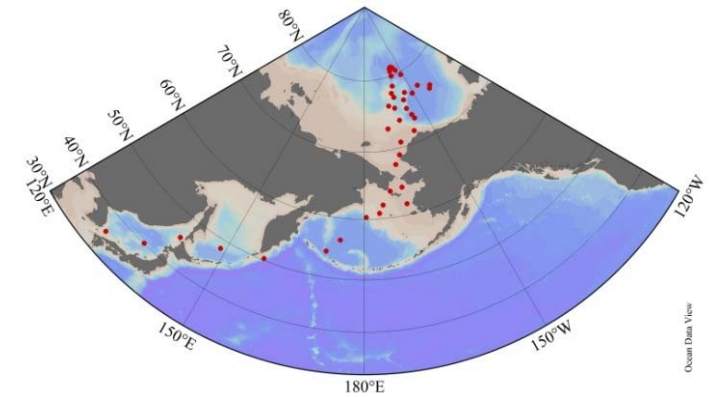
Marine Chemical Investigation

89 water sampling stations
40 stations for nitrate profile observation

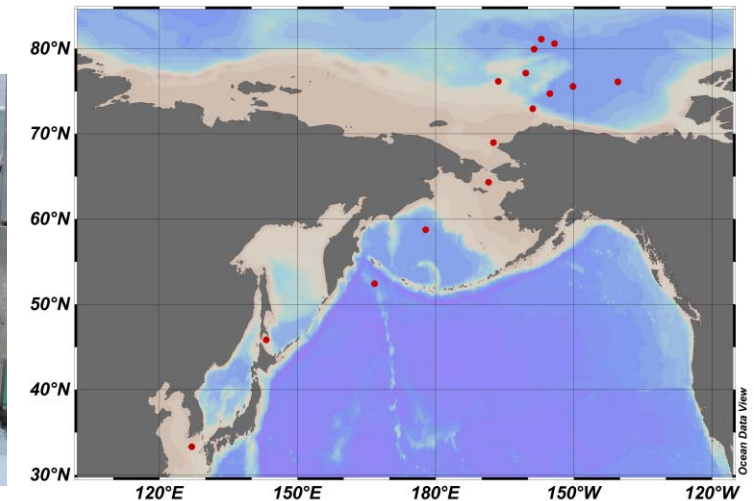




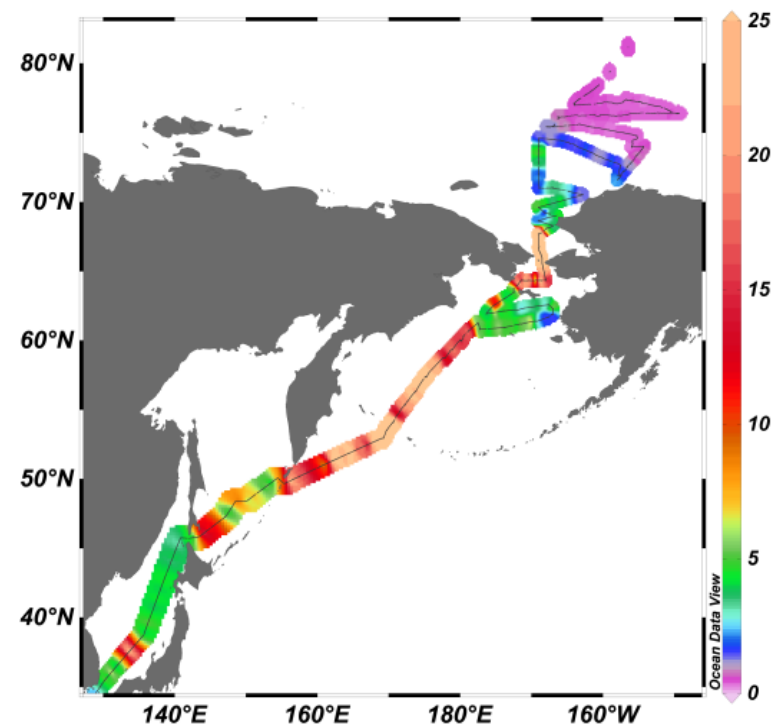
Atmosphere mercury online monitoring;
VOCs: 38 samples ;
TSP: 46 samples ;
N₂O/CH₄: 140 samples ;
Atmosphere POPs: 64 samples.



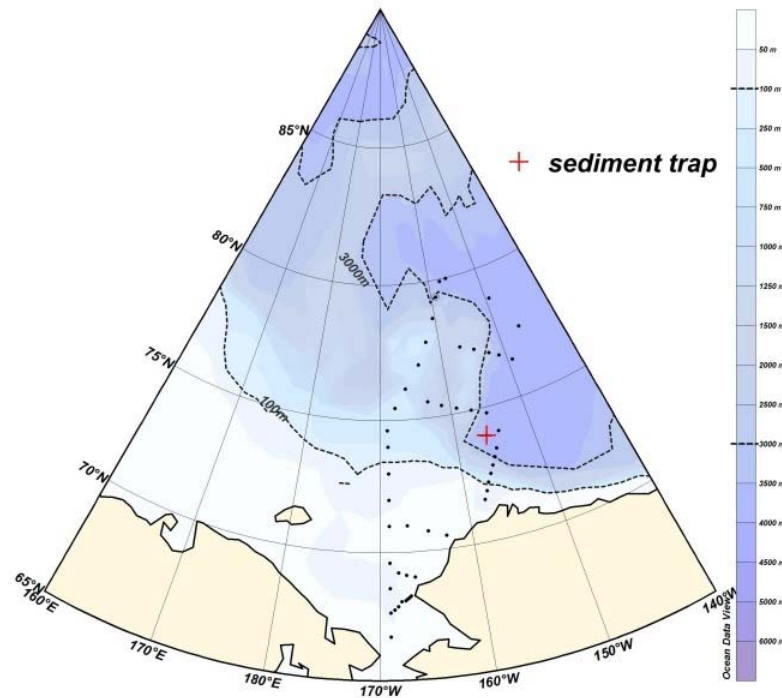
VOCs/TSP sampling stations



气溶胶TSP, POPs, IONs sampling stations

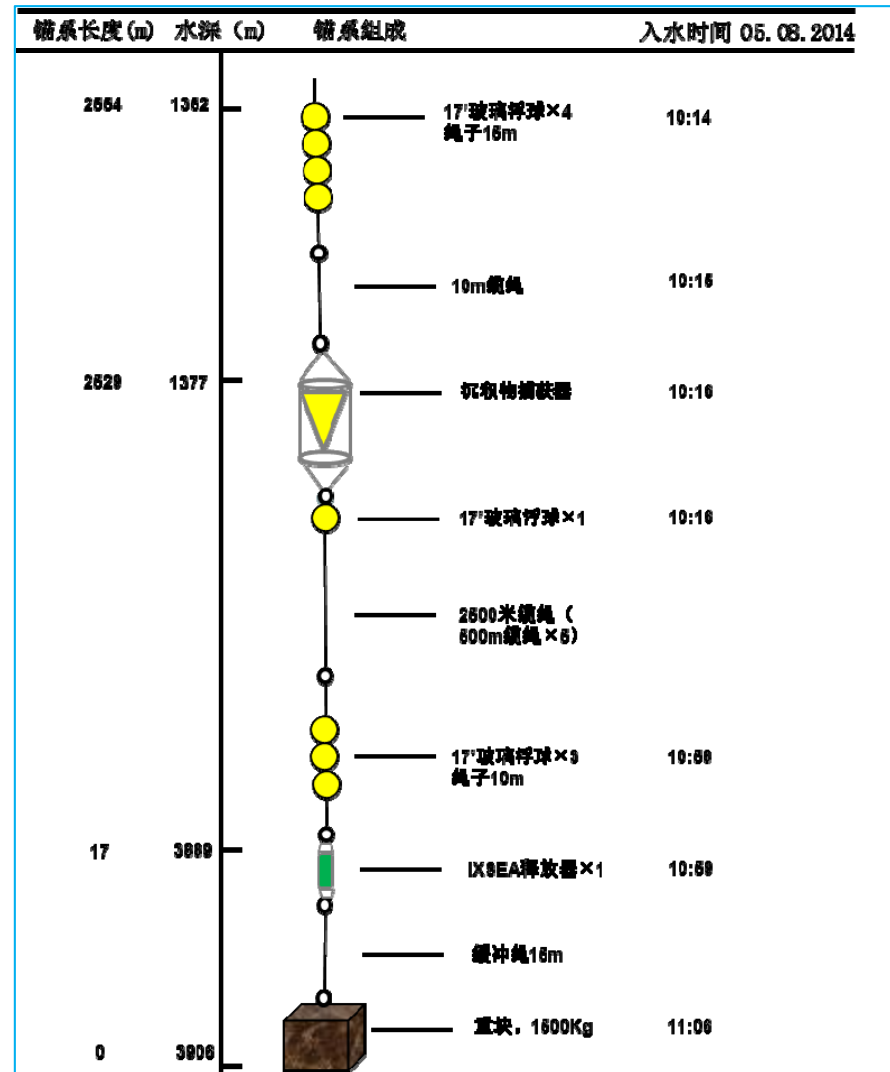


DMS, DMS flux, DMSPd and DMSPp measurement aboard



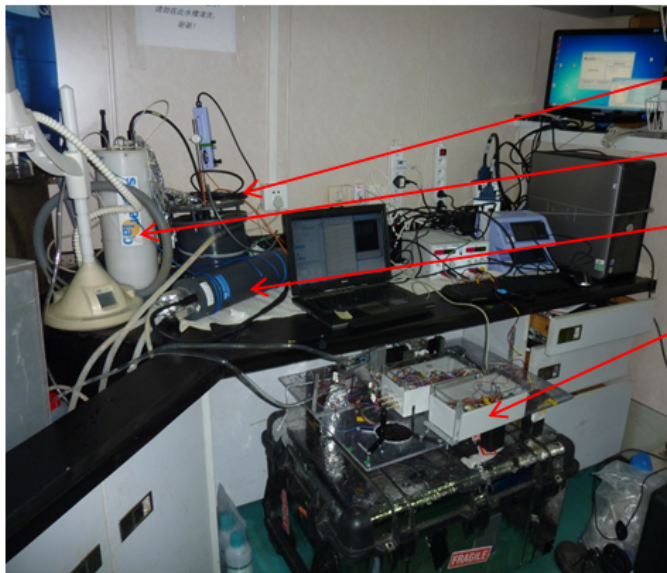
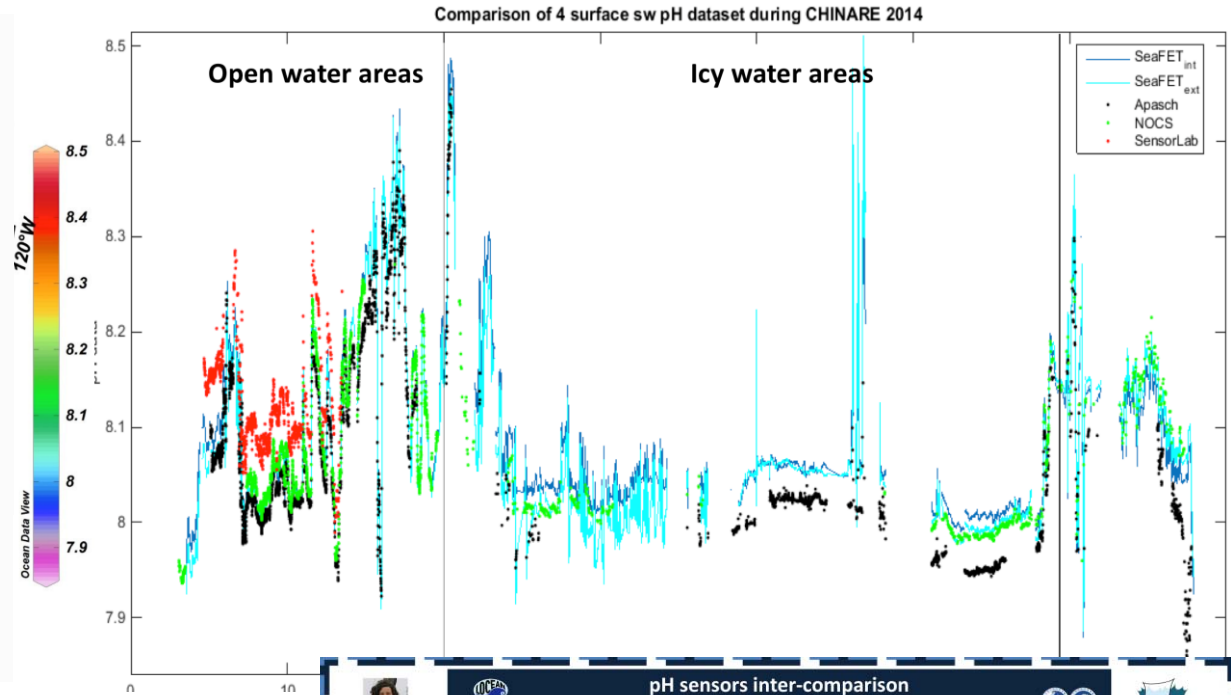
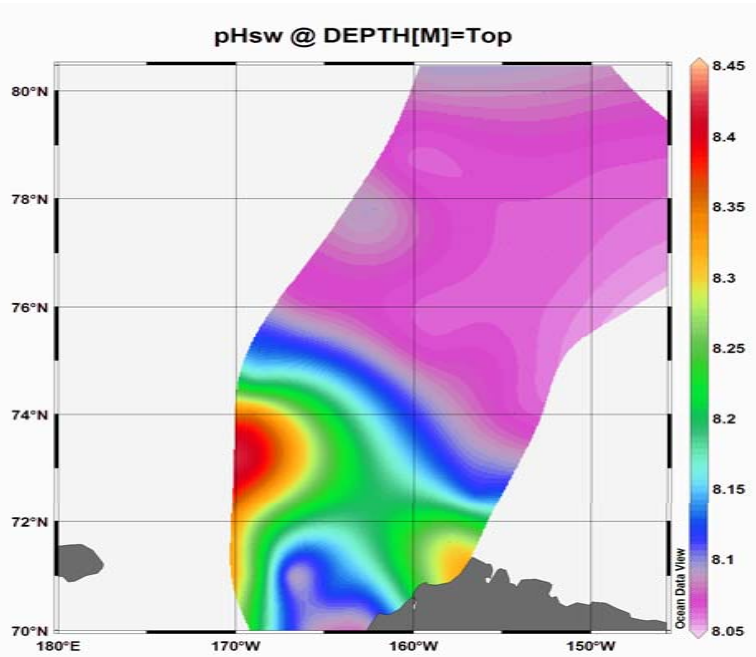
Site of the sediment traps deployment

(156°E ; 74°N)





Surface pH in Canada Basin (Cooperation with Paris Uni.)



- 1) Bench top analyser from NOCS (Southampton, UK) ←
- 2) SP200-SM *In situ* sensor from SensorLabs® (Gran Canaria) ←
- 3) SeaFET® *In situ* sensor from Satlantic® (USA) ←
- 4) APASCHsw Bench top analyser (LOCEAN/IPGP, Paris) ←

pH sensors inter-comparison during the 6th Chinese Arctic Research Expedition

Rérolle V.¹, Ruiz-Pino D.², Prévot F.², Loucaides, S.³, Mowlem, M.³, Provost C.¹, Chen, J.⁴

Why measure pH in the Arctic Ocean?
Arctic seawaters are experiencing a rapid acidification due to the absorption of carbon dioxide from the atmosphere and large inputs of freshwater from rivers and melting ice. The decrease of the summer ice extent could potentially increase the capacity of the Arctic to act as a sink of atmospheric carbon dioxide but also lead to significant acidification of the Arctic Ocean. As part of the Ice project, we aim at tackling the lack of observational carbonate data by deploying CO₂ sensors on the AOCOS platforms.

Measuring seawater pH
The quality of the pH data is critical for ocean acidification study but very challenging to obtain with an automated instrument. The challenge is to test pH sensors with the longevity, stability, reliability and robustness required for deployments in the Arctic.

The 4 pH sensors:

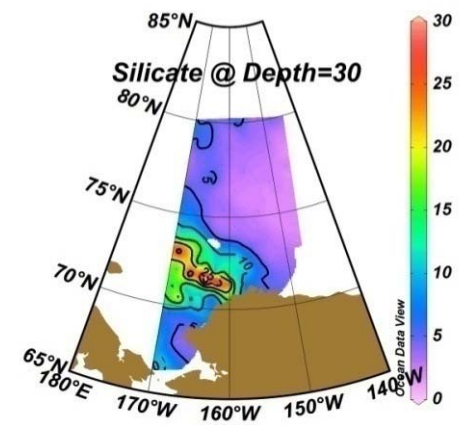
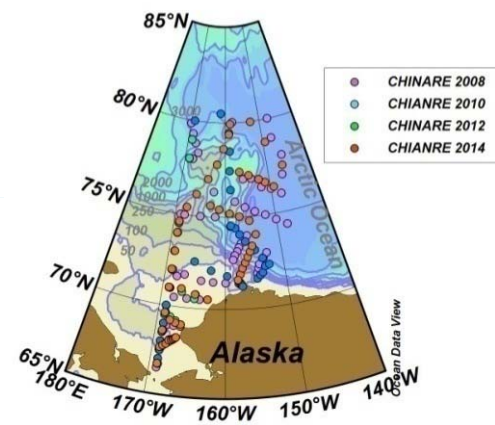
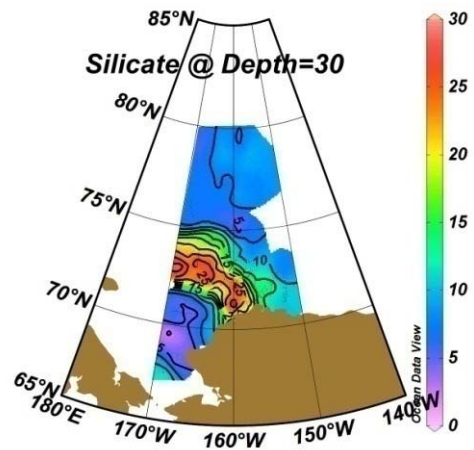
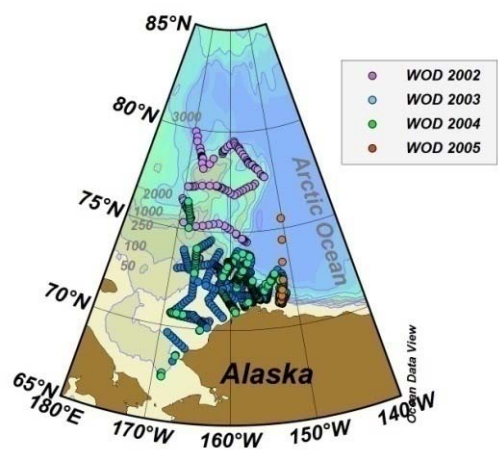
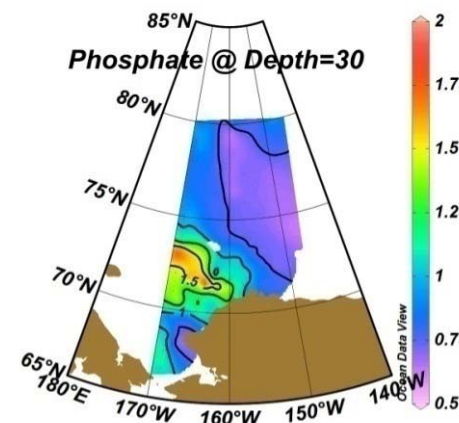
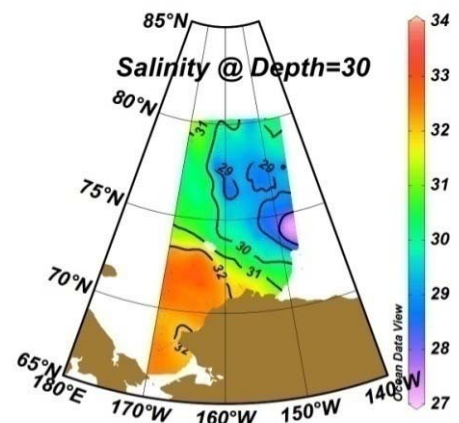
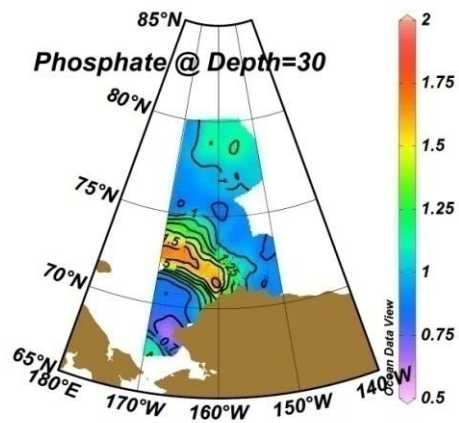
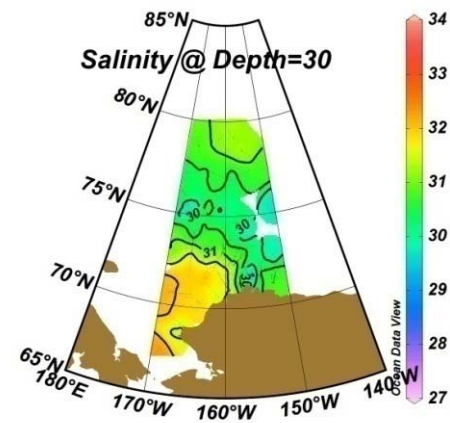
- Bench top colorimetric analyser from NOCS (Southampton, UK) used as reference. Prototype indicator-purified mCP, calibration=Lu et al., 2011
- SP200-SM *in situ* colorimetric analyser from SensorLabs® (Gran Canaria, Spain). Early prototype, indicator=unpurified mCP, not calibrated.
- SeaFET® *in situ* potentiometric sensor from Satlantic® (USA). Calibration from manufacturer. Temperature sensor issue and pump broke.
- APASCH Bench top colorimetric analyser from IPGP (Paris, France). Prototype, indicator=unpurified mCP, not calibrated.

Correlations between the pH datasets:

Open water areas (04/07/2014-01/07/2016)				Icy water areas (02/07/2014-01/07/2016)			
Sensors	Differences (pH)	Linear Regression (Prot/mCP)	R	Sensors	Differences (pH)	Linear Regression (Prot/mCP)	R
SeaFET vs SeaFET	-0.01	0.00	0.01	1.00	0.00	0.00	1.00
SeaFET vs SeaFET	-0.01	0.00	0.01	0.99	0.00	0.00	0.99
NOCS vs SeaFET	-0.02	0.00	0.01	0.99	0.00	0.00	0.99
NOCS vs SeaFET	-0.02	0.00	0.01	0.99	0.00	0.00	0.99
Apasch vs SeaFET	0.00	0.01	0.00	0.99	0.00	0.01	0.99
Apasch vs SeaFET	0.00	0.01	0.00	0.99	0.00	0.01	0.99
Apasch vs NOCS	0.00	0.01	0.00	0.99	0.00	0.01	0.99
SensorLab vs SeaFET	-0.01	0.01	0.01	0.99	0.00	0.01	0.99
SensorLab vs SeaFET	-0.01	0.01	0.01	0.99	0.00	0.01	0.99
SensorLab vs NOCS	-0.02	0.01	0.01	0.99	0.00	0.01	0.99
SensorLab vs Apasch	-0.02	0.01	0.01	0.99	0.00	0.01	0.99

Observations
Good correlation between all the sensors despite lack of calibration and/or issues encountered with some sensors. SeaFET: Sensor worked very well. Issues in high salinity/temperature gradient areas. Equilibration time required (here 3 days). Good accuracy in open water areas but needs recalibration at low temperature and low salinity. APASCH: Sensor worked well. Needs characterization of the mCP indicator for its optics. SP200-SM: issues with the temperature sensor and the pump broke after a week.

What's next?
Calibrate of SeaFET at low T and S and calibrate Apasch for its optics. Test colorimetric and potentiometric sensors *in situ* in the Arctic during winter 2015!

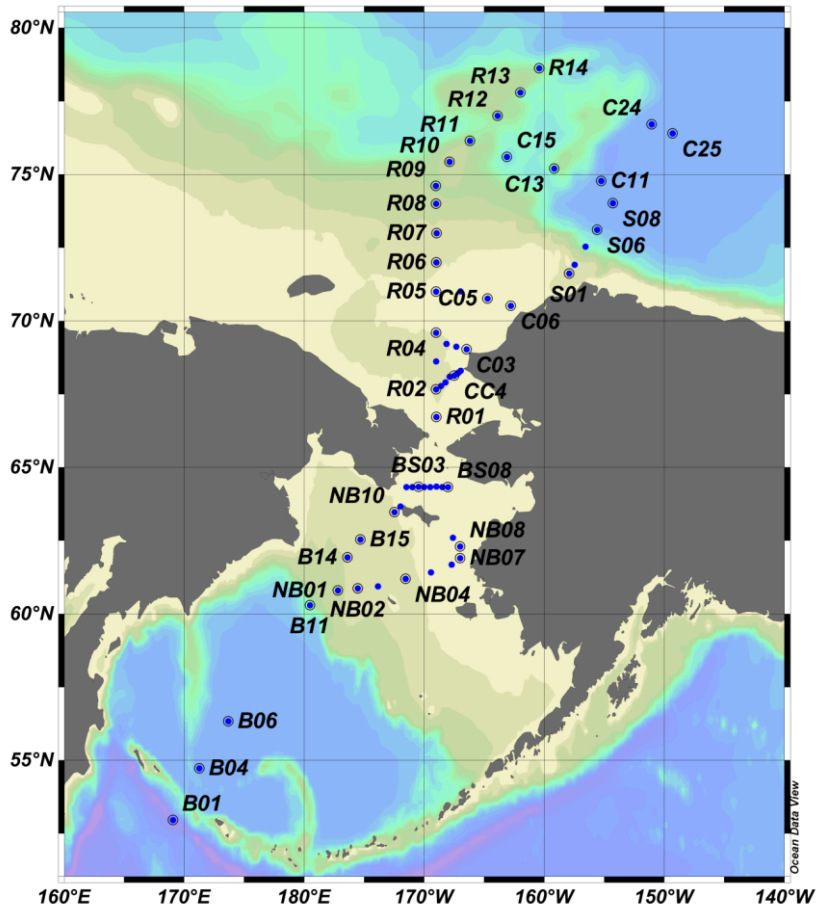


Nutrients in Northwestern Arctic Ocean
 2008-2014 (CHINARE) comparing with 2002-2005 (WOD)

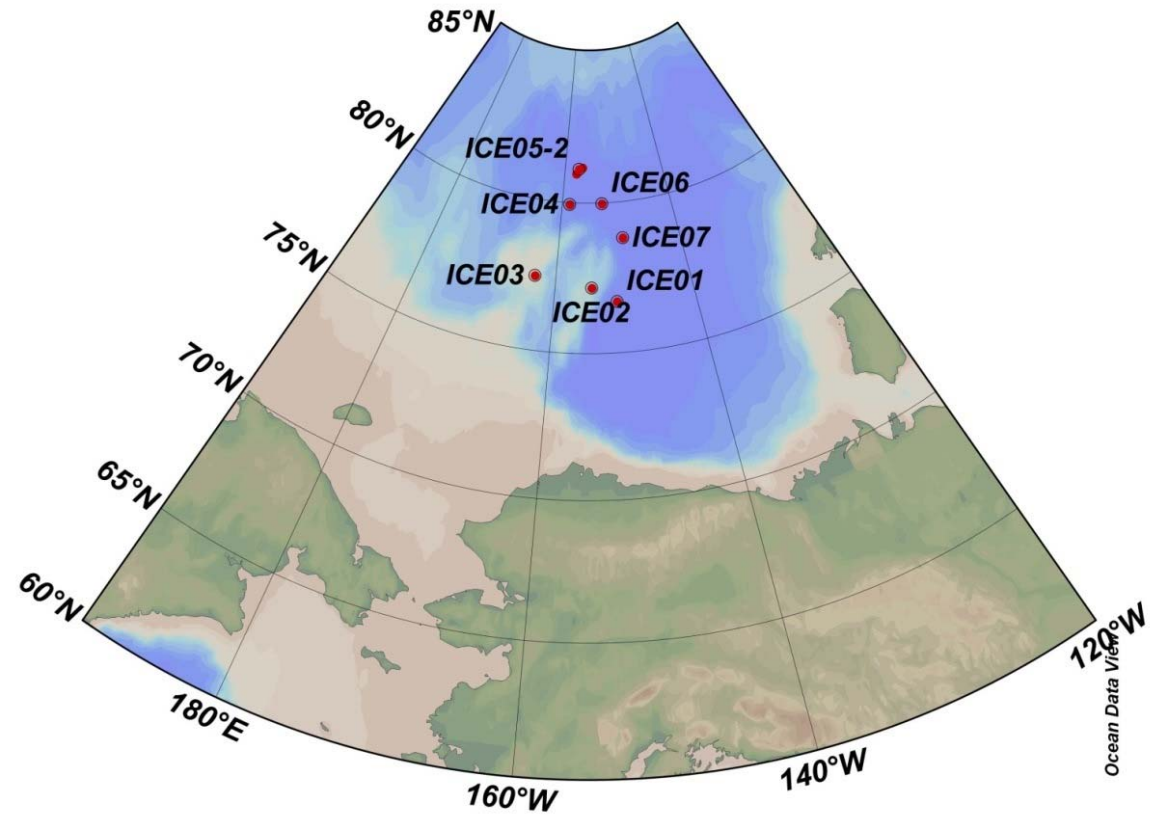
Unpublished data



Marine ecosystem Investigation



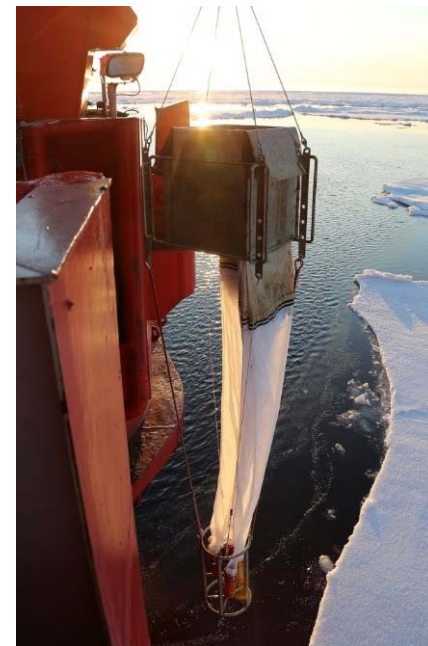
Oceanographic stations

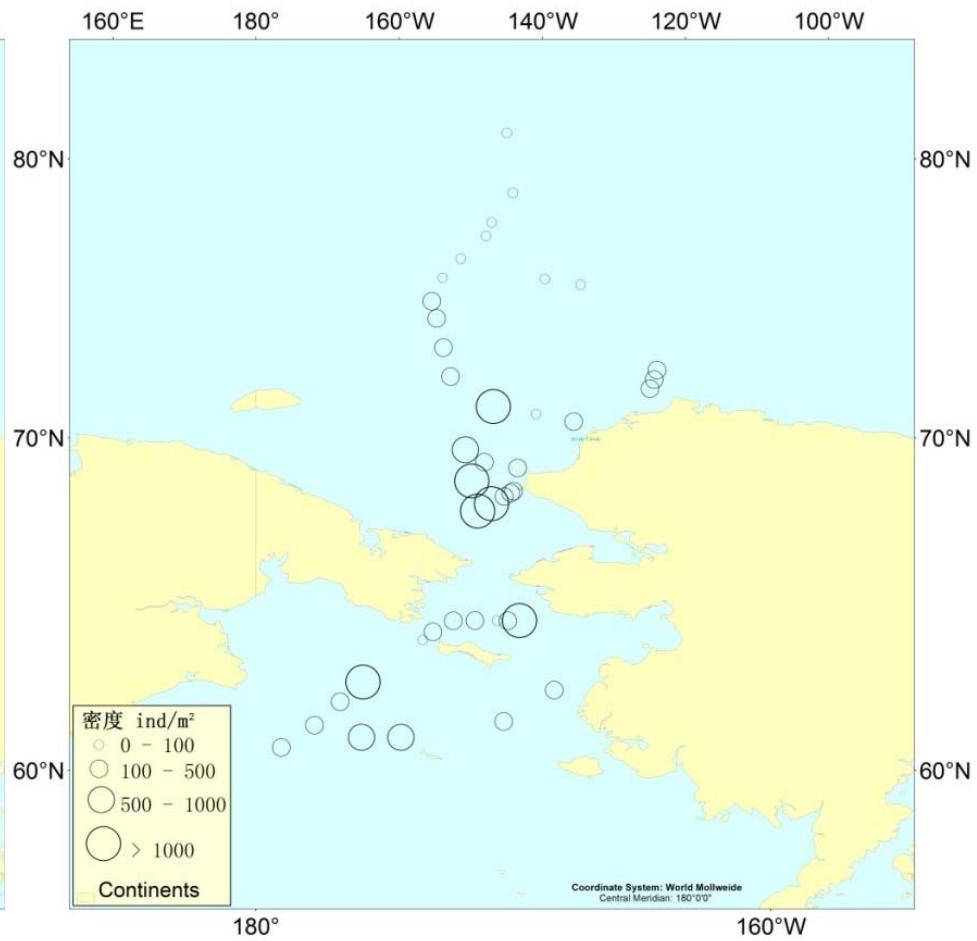
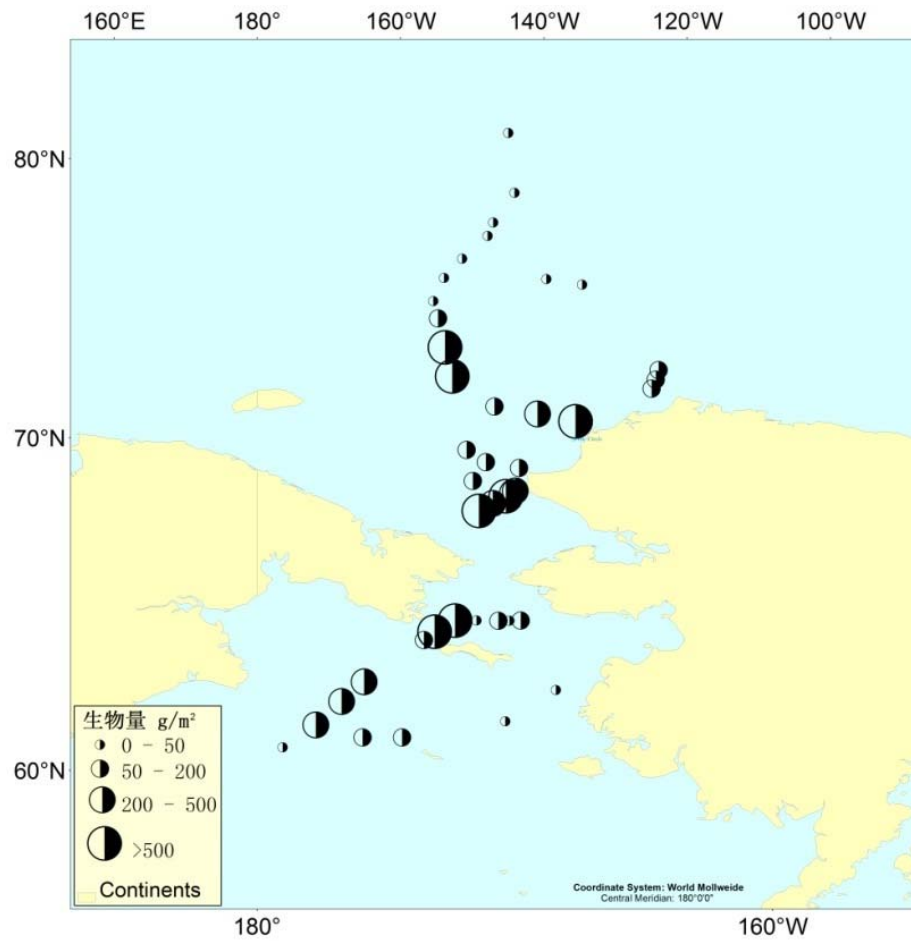


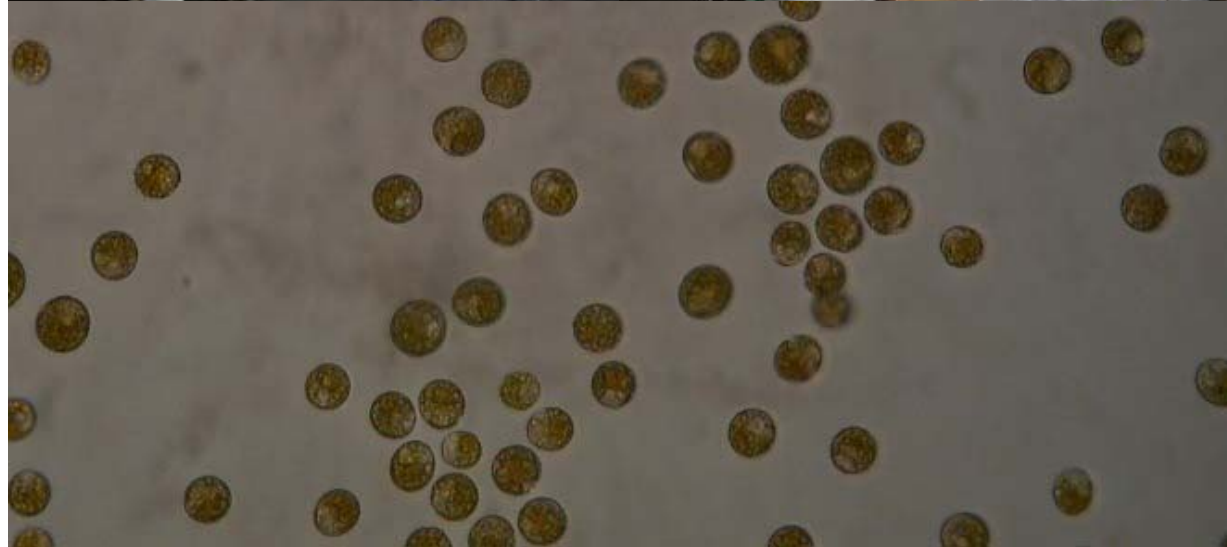
Ice stations



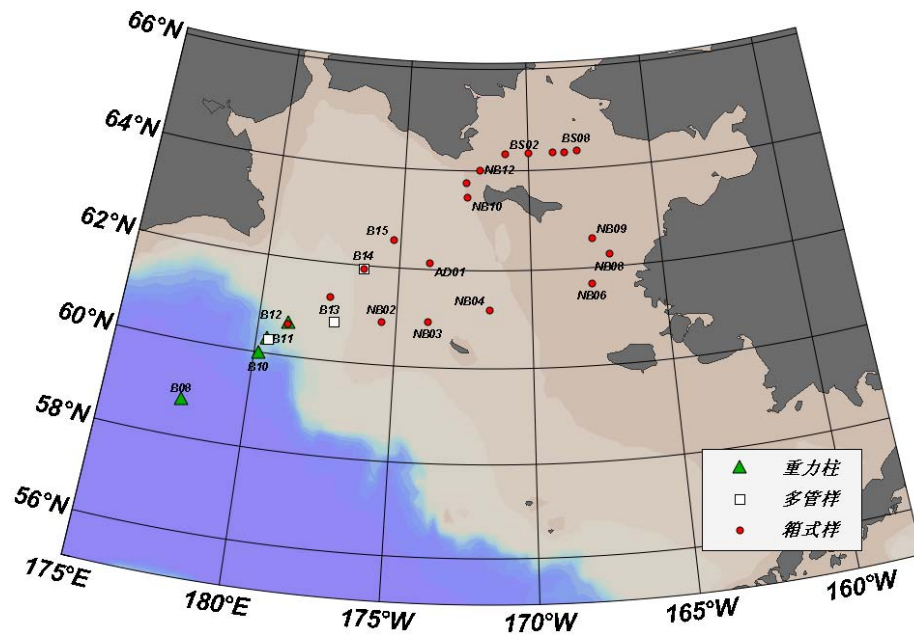
Chlorophyll: 80 stations;
PP: 17 stations;
Pico-/Nano-: 81 stations;
Vertical tow: 68 stations;
Multi-net tow: 4 stations;
Macro-benthic tow: 42
Micro-benthos: 30



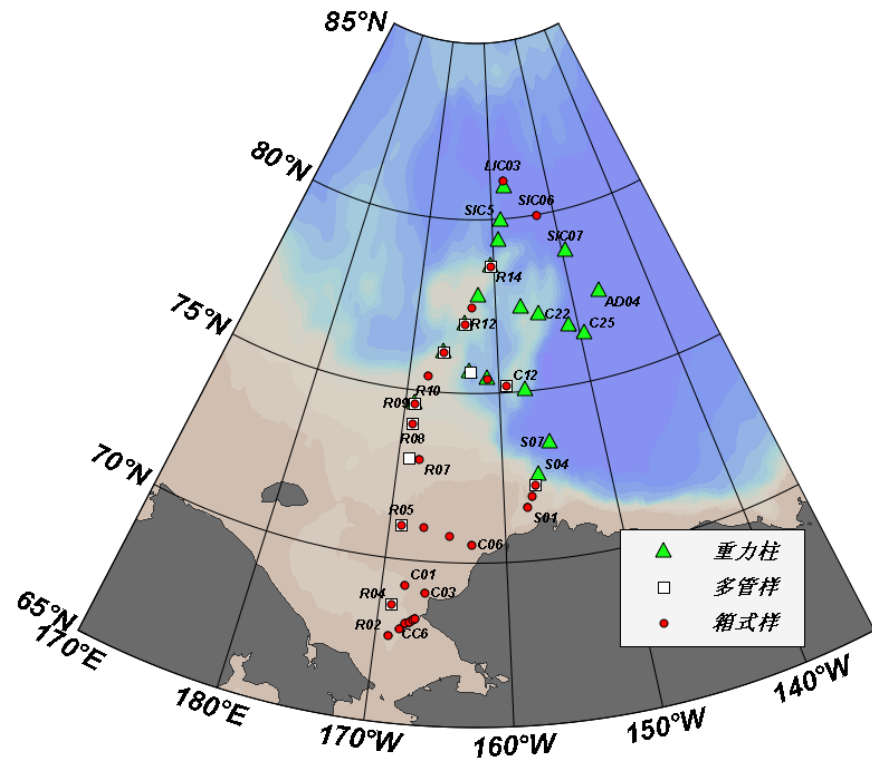




Marine geology Investigation



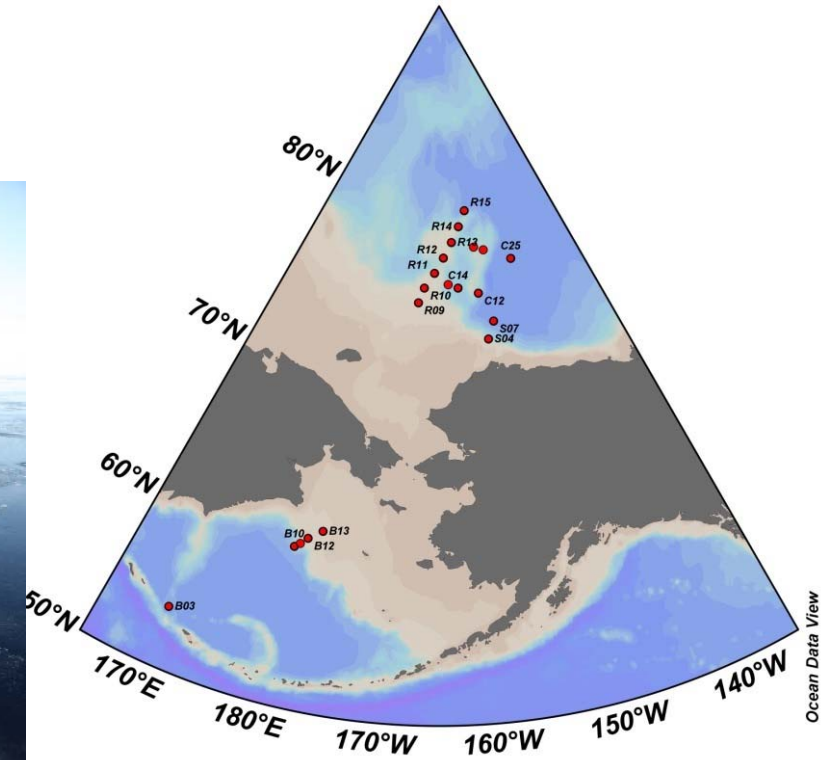
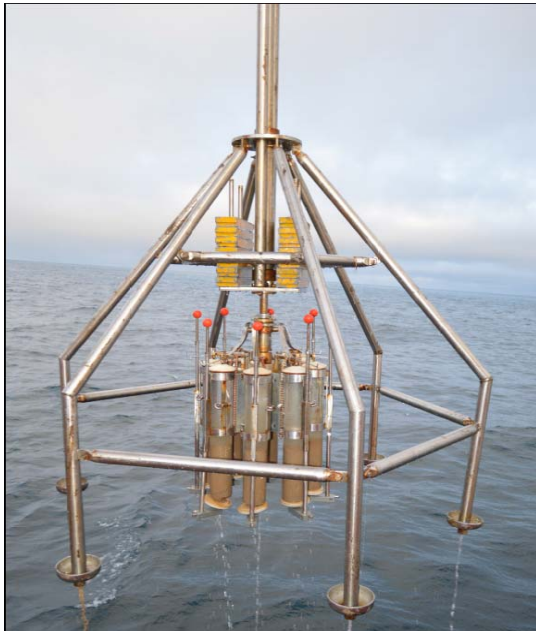
Sampling stations in Bering Sea (18)



Sampling stations in Arctic Ocean (28)



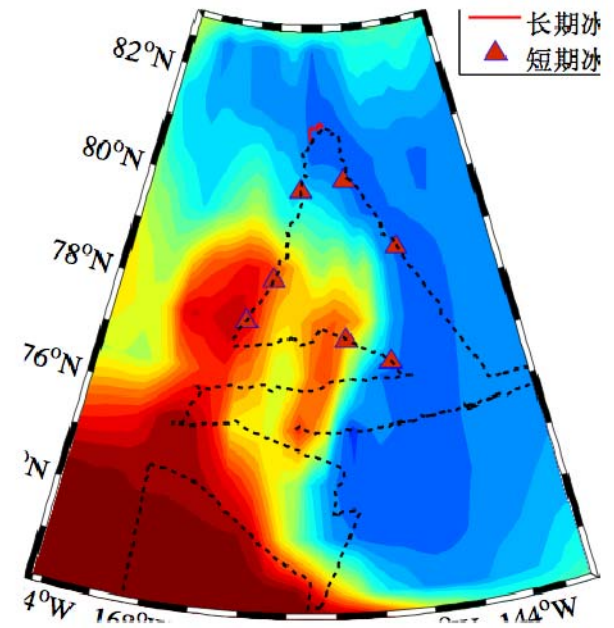
64 stations in total;
Surface sediment sample: 60
stations;
Sediment cores: 21 stations.



sediment core sampling stations



Sea ice Investigation

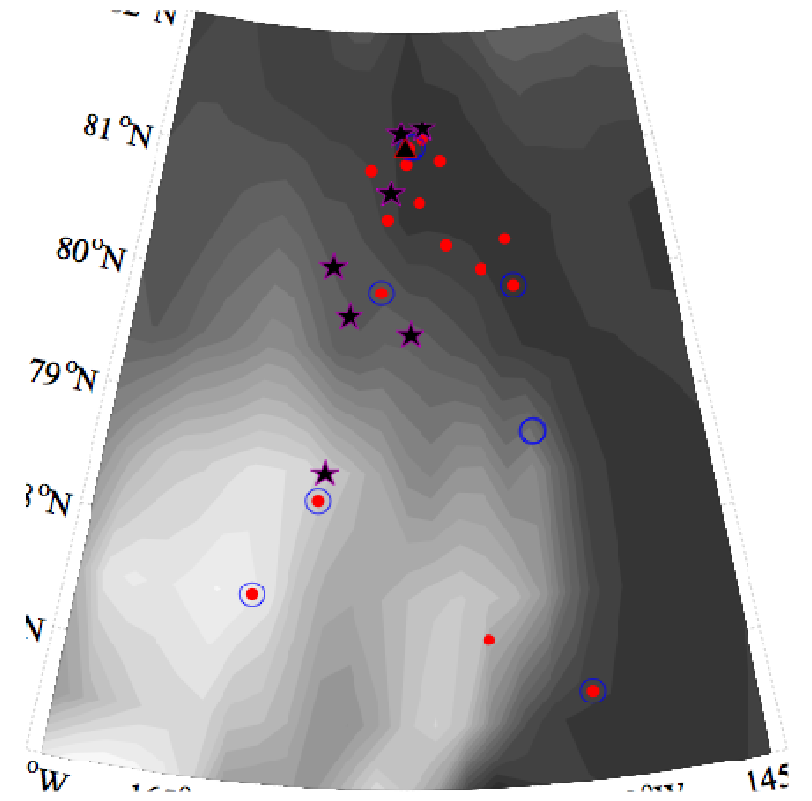


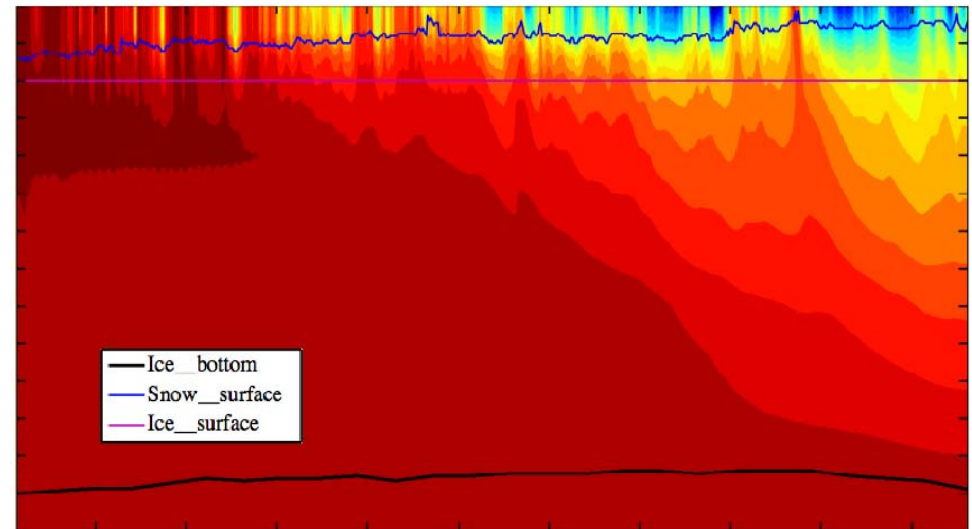
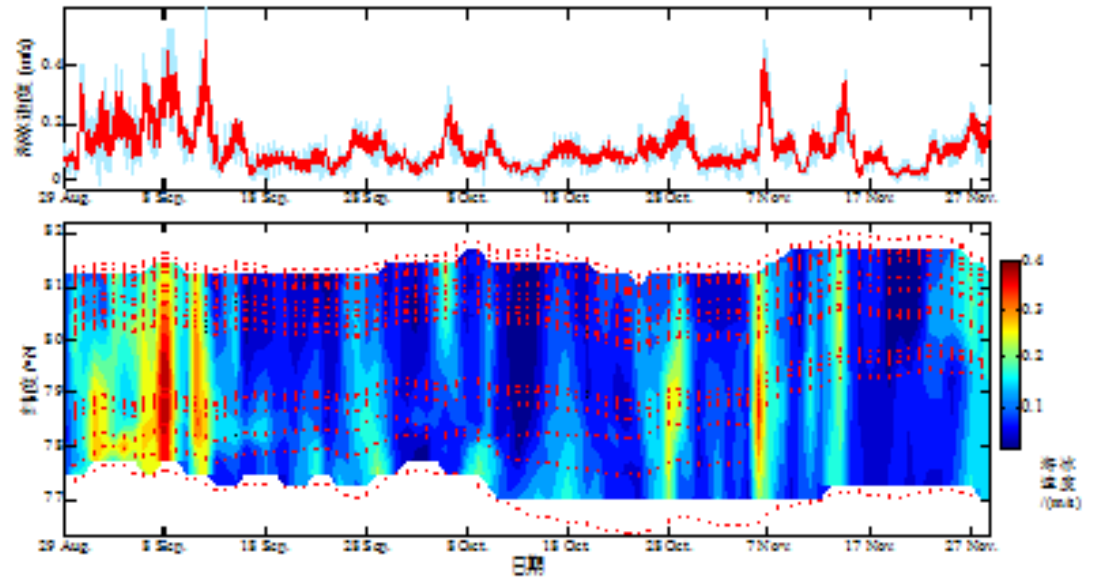
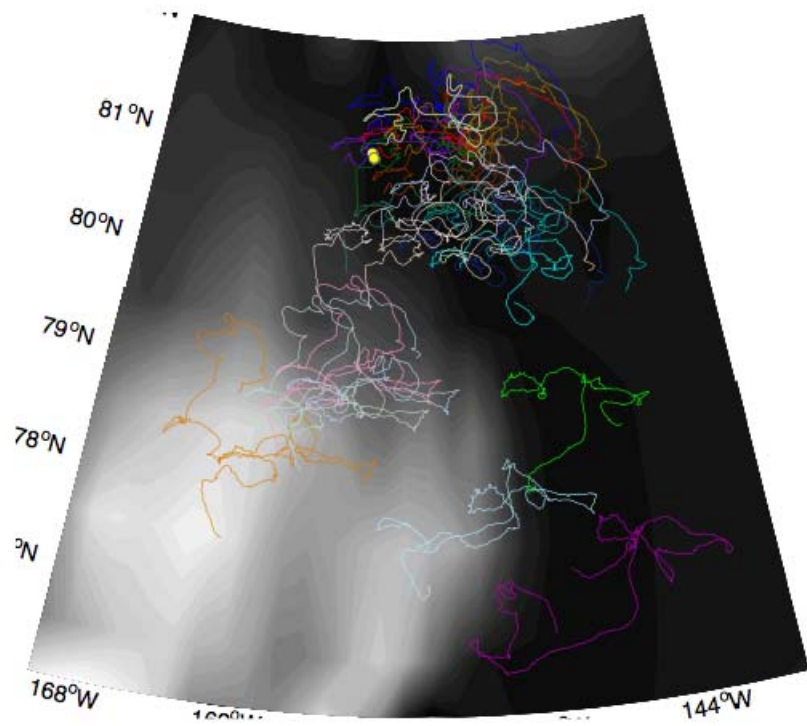
Location of ice stations

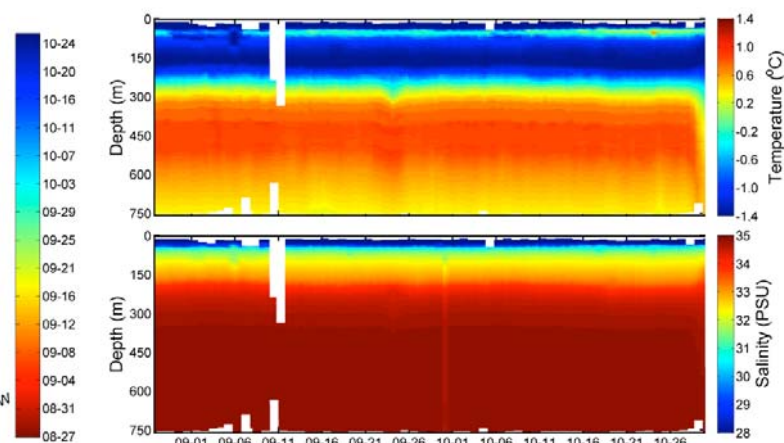
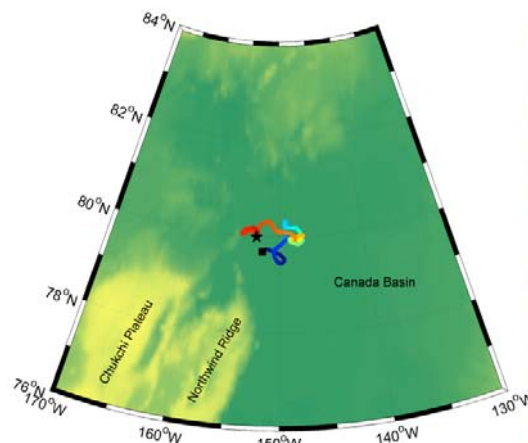
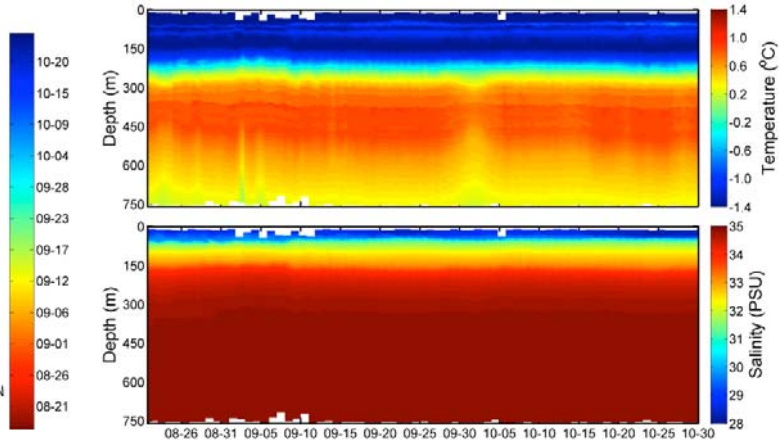
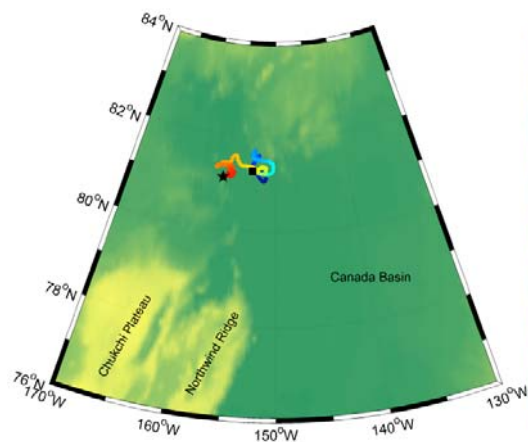
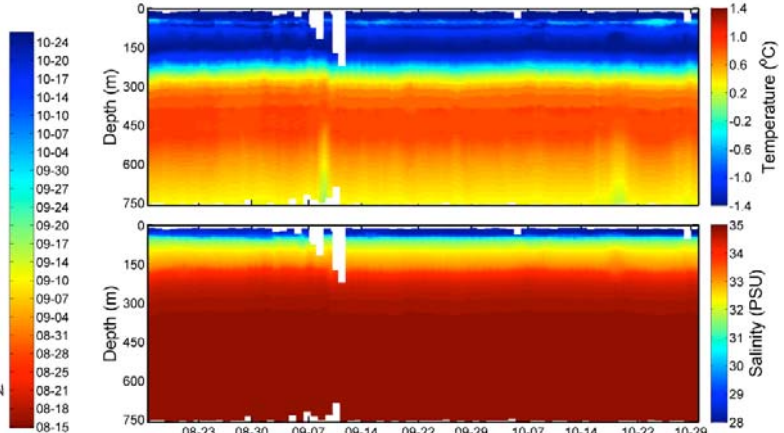
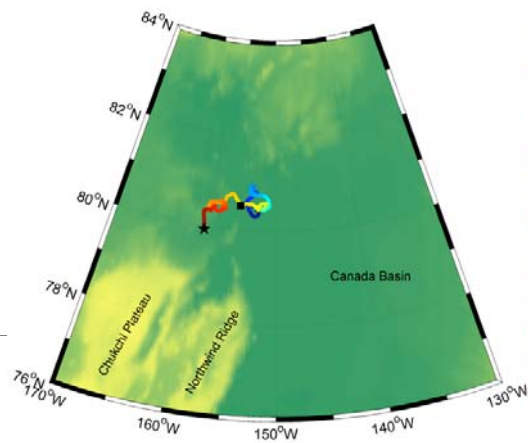
37 in total



ITP buoy deployment







THANKS!

