



At the bottom of Earth
Sea ice, polynya, oceanography
in Amundsen Sea

A Team, Korea Polar Research Institute

ASPECT, SCAR 2012, 13 July 2012

2011



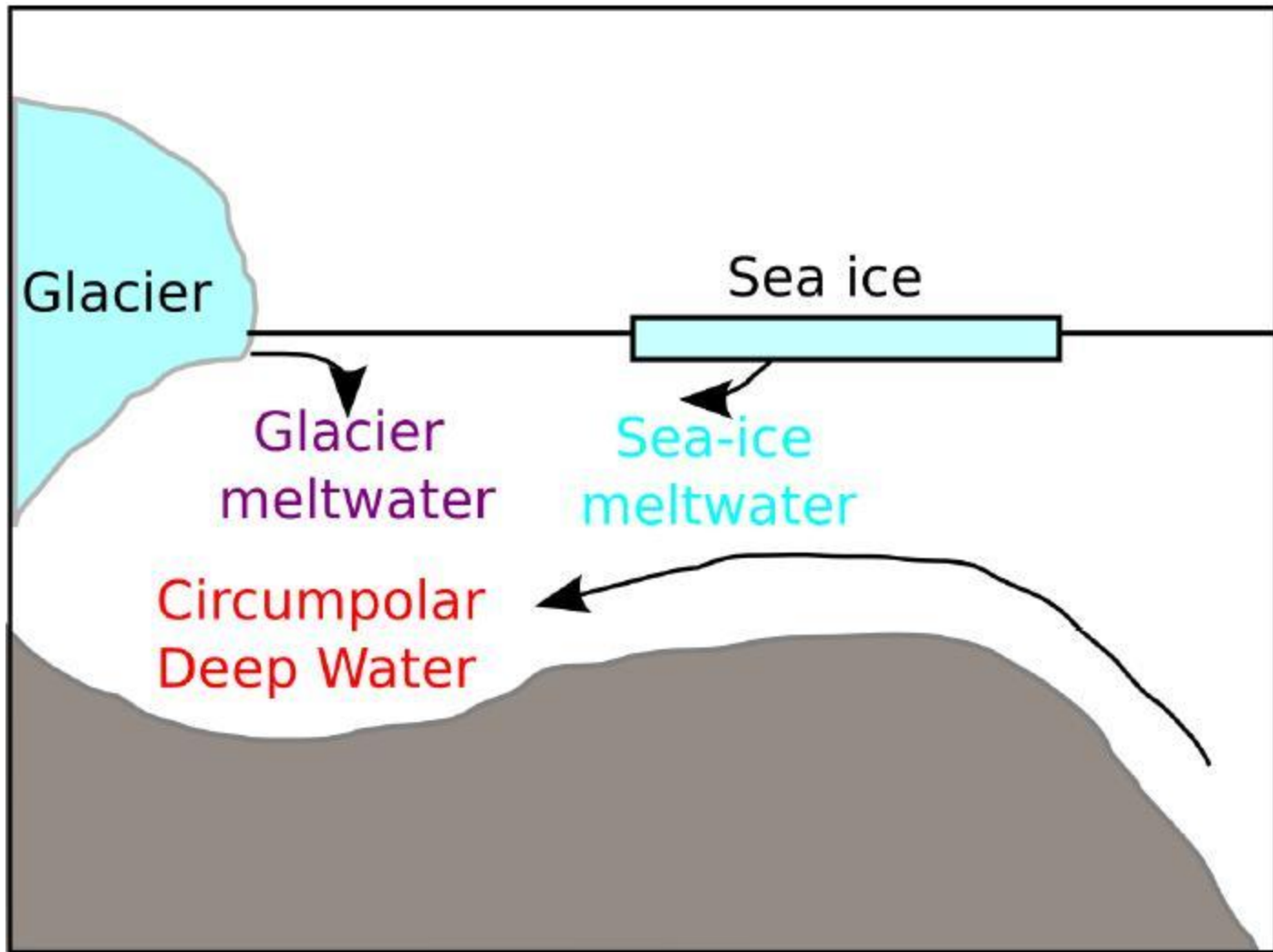
Why Amundsen Sea?

Rapid warming & melting

Polynya presence and high productivity

Topography (basin, sill, depression)

Chartering the unchartered



KOPRI Amundsen Project

Research Goal

1. To understand why & how the western Antarctic warms up
2. To assess the consequences & impacts of the warming on the environments & ecosystem

Major Study Area

1. ocean physics

current & circulation, heat/mass balance (CTD & mooring), sea-ice change, remote sensing

2. Environments

air/gas chemistry: trace gases, greenhouse gases, air-sea interaction
seawater chemistry: dissolved gases, C, N, nutrients, pigments,
biogeochemistry: C flow & flux (sediment trap)

3. Life science & Ecosystem

photosynthesis & parameters, consumers & food web

4. Misc: climatology, glaciology, paleoclimate, sea-ice physics

KOPRI Amundsen Project

Features

Cross-cutting of

Multidisciplinary studies

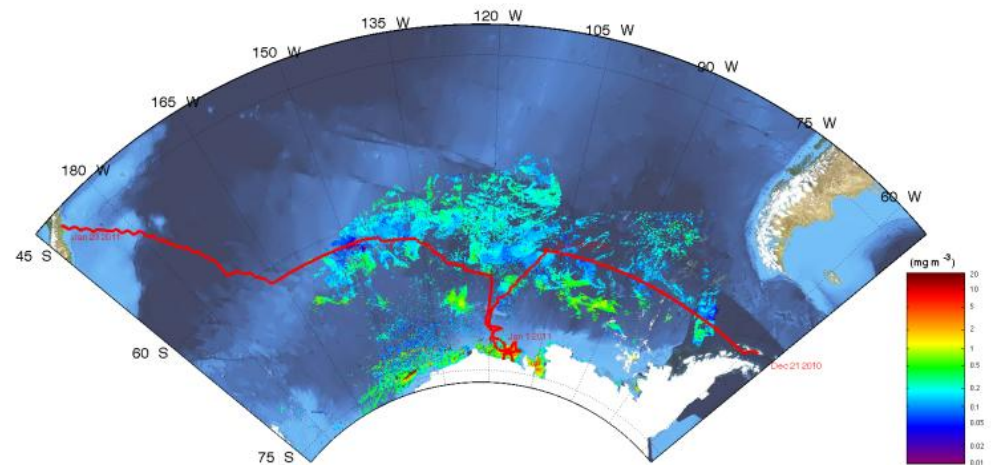
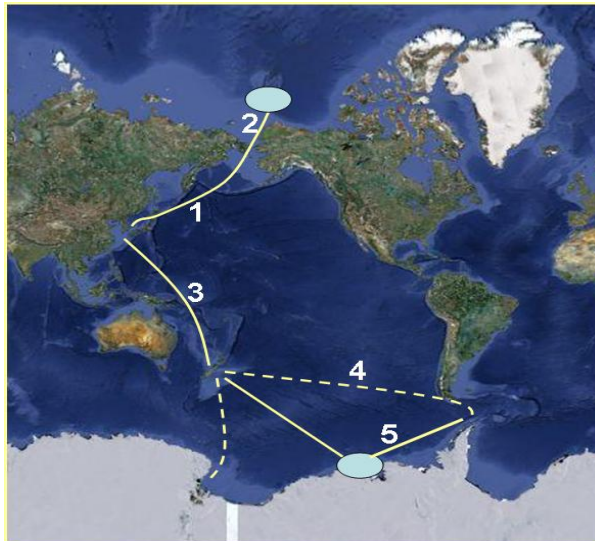
Multi- sites: from sea-ice margin, via sea ice, polynya, to ice-shelf edge

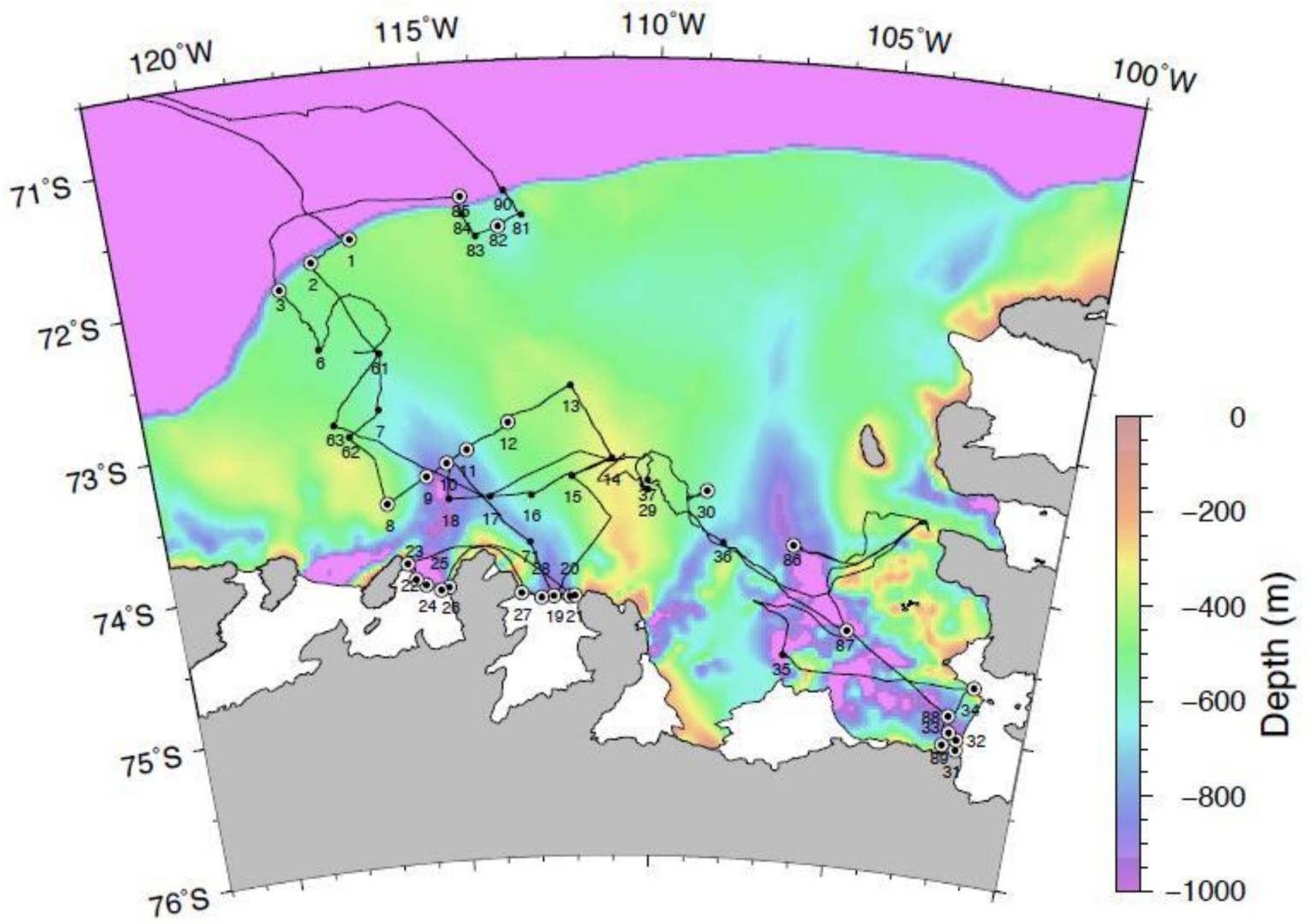
PLUS Underway Measurement from 38N to 75S

Multi-Level : Satellite – Air – Ocean – Ocean Floor (sed trap & core)

Multi-PI: 3 National Res Inst, 9 Domestic Universities

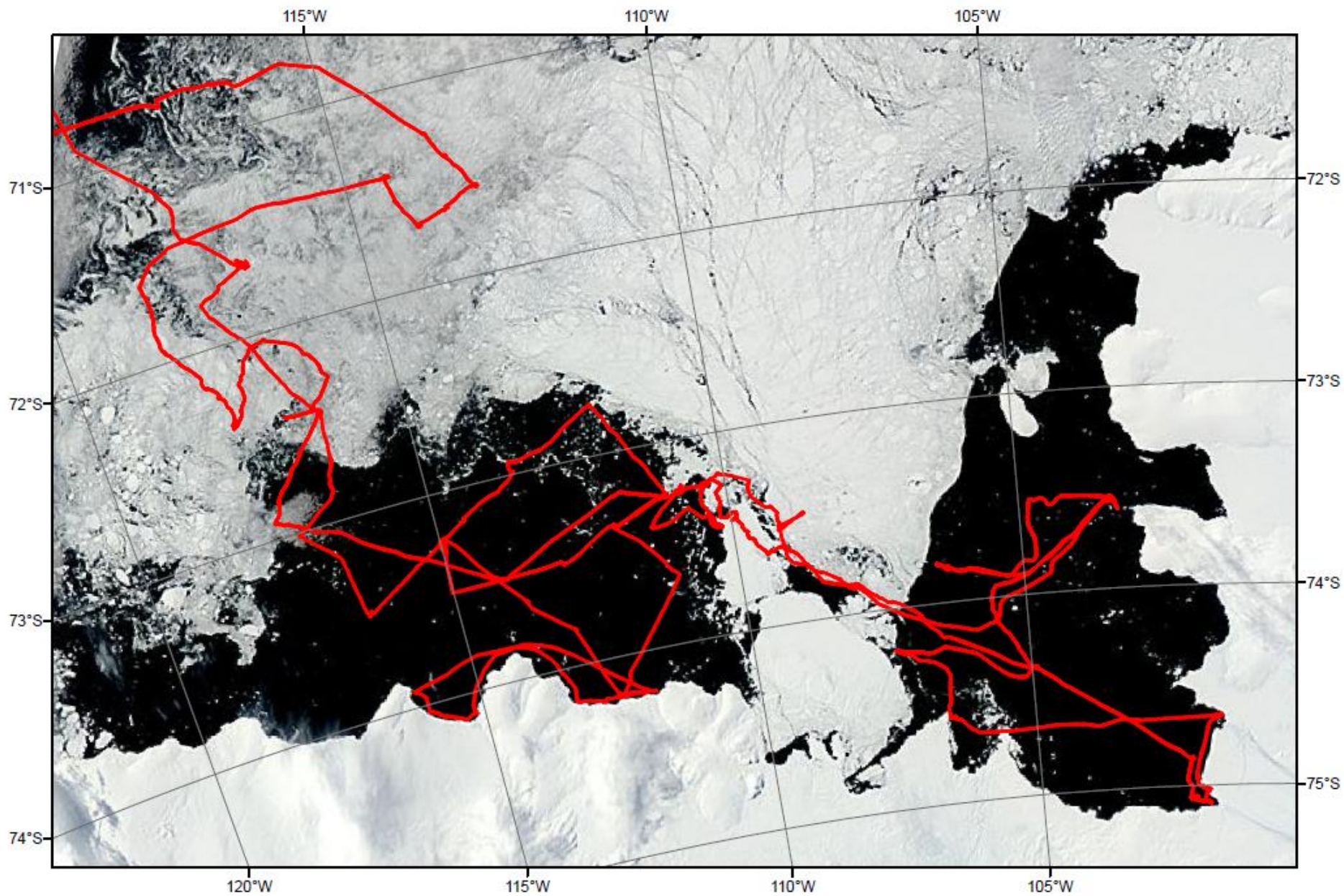
Multi-national: *US Rutgers, MBL, UK BAS, Sweden Gothenburg Univ.*

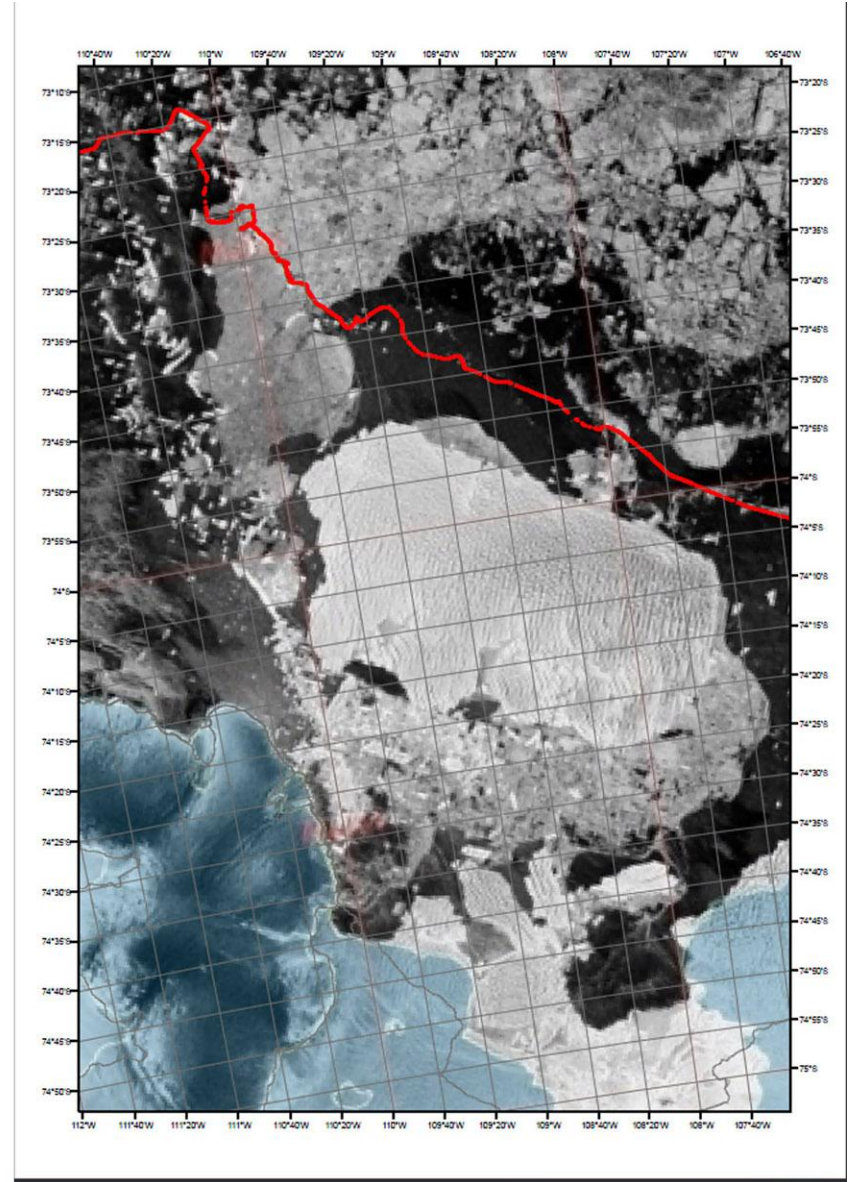
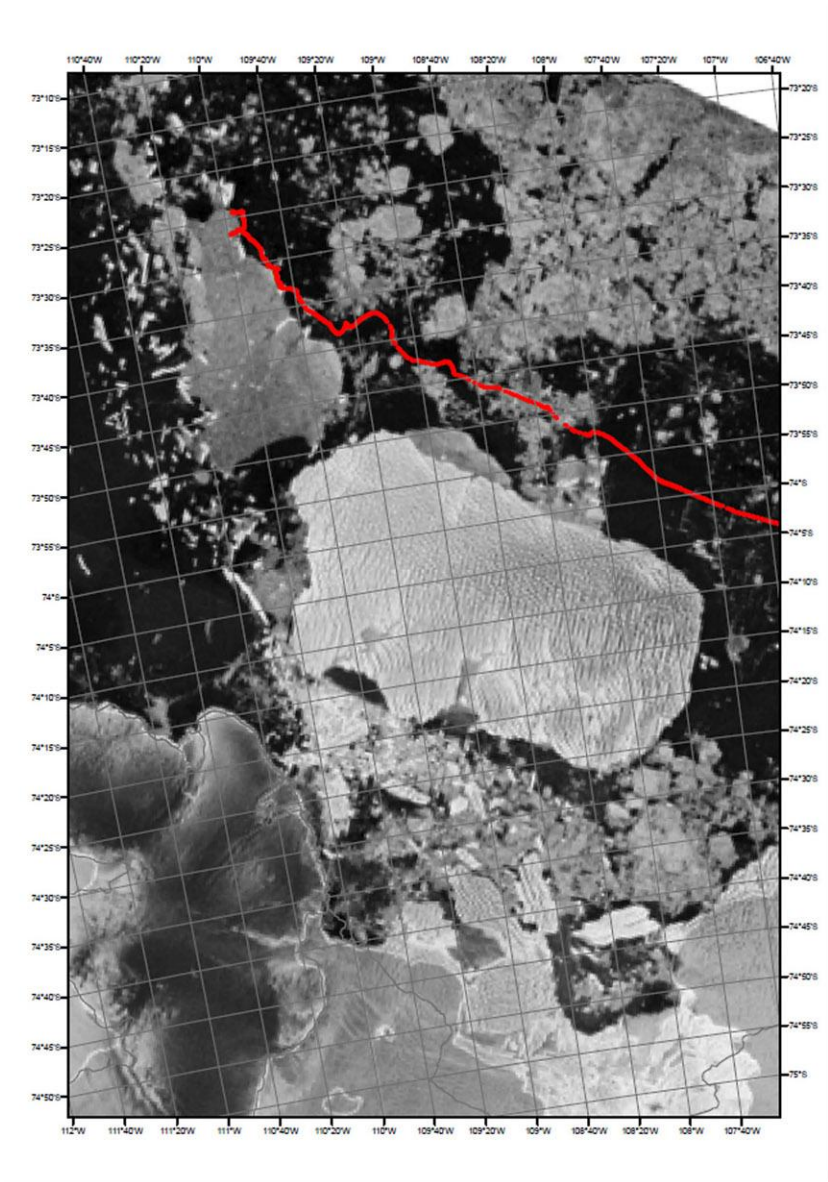




Just past field season, 2012 Feb to March

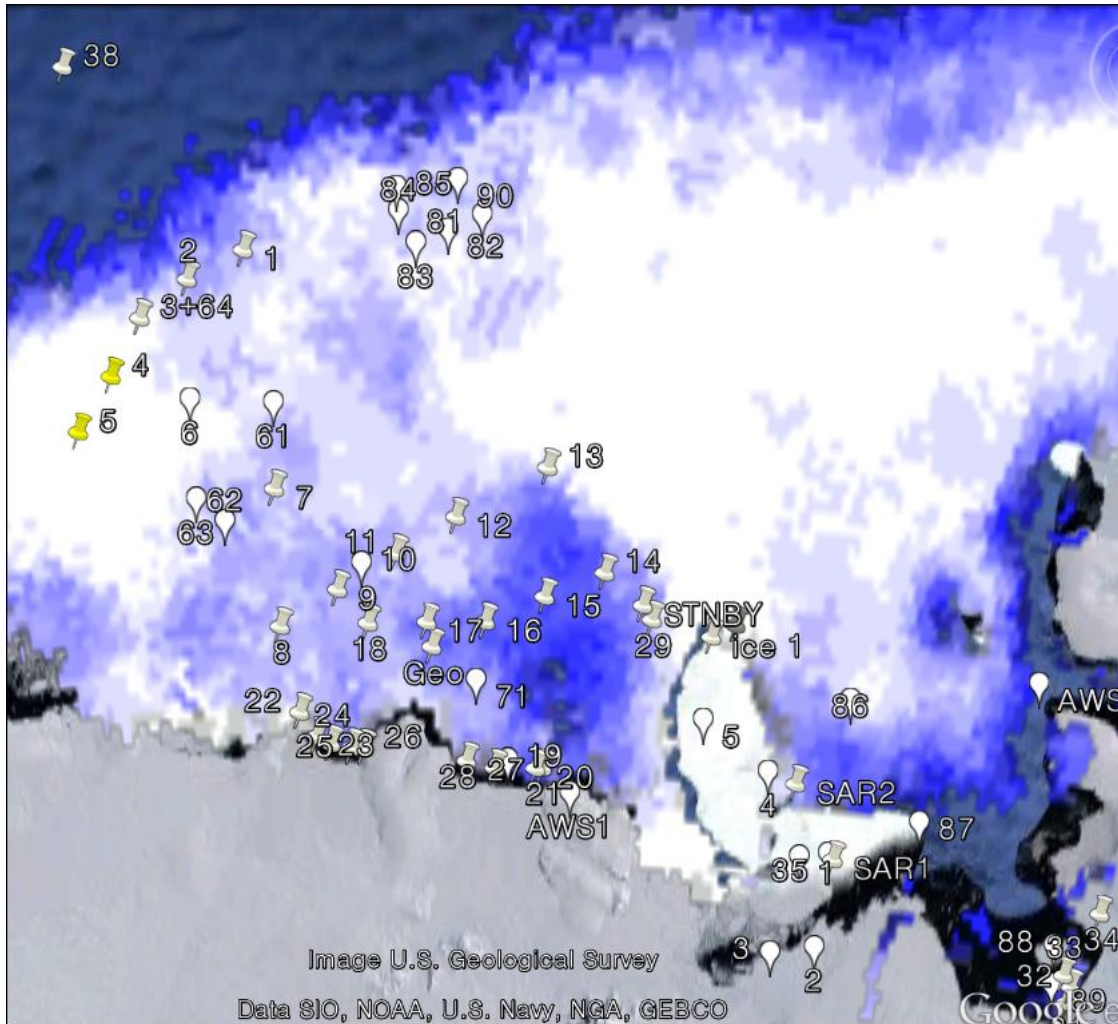
2012 Araon ship track in Amundsen





24 hours apart

2012 Field Stations



52+ CTD Stations

Profiles & Processes

5 Moorings Recovered

2 KOPRI (+trap)

2 Swedish

1 BAS BSR ser

1 US ASPIRE (MBL, +trap)

15 Moorings Deployed

3 KOPRI

3 Swedish

9 BAS iSTAR ser

1 Sea-ice stations

Core profiles & water beneath

4 Geo (box & piston coring)

3 AWS

1 Glacier (Thwaites SAR)

Underway Measurement

from Korea to Amundsen

2012. 1. 30 – 3. 20 (30 d at site)

Only 2 seasons on a new ship

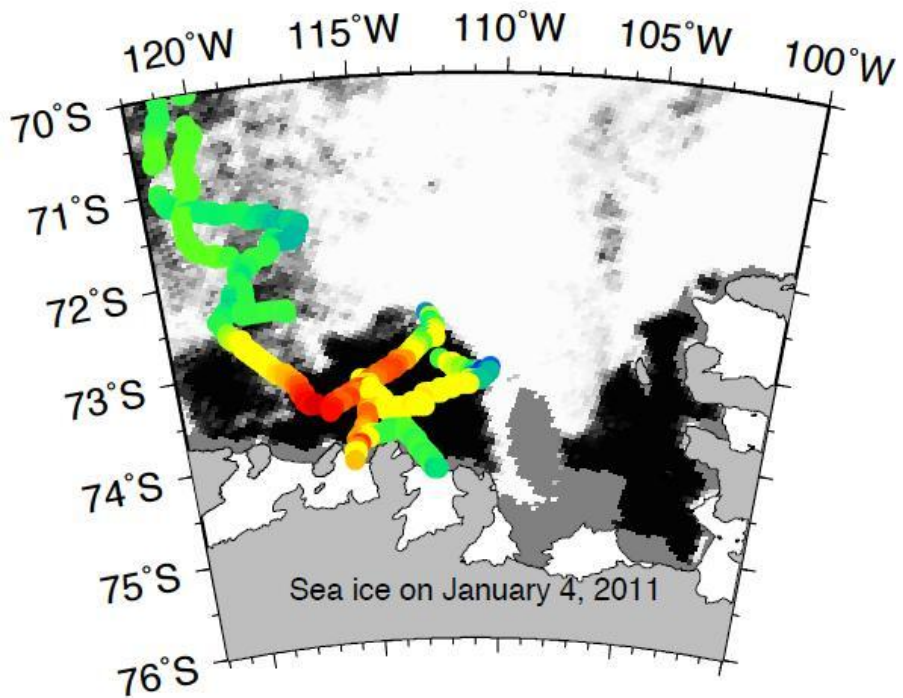
Brief overview

2011 Jan; 18 day campaign

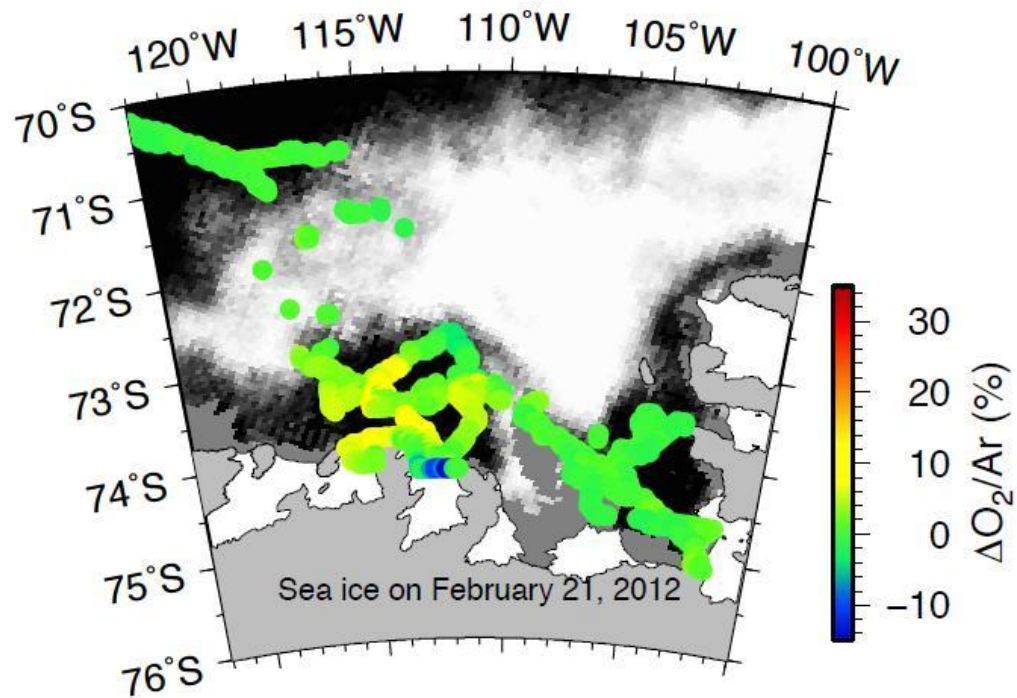
2012 Feb-Mar; 30 day campaign

Oceanographic survey with some
on-site sea ice studies

15 moorings deployed, 5 recovered

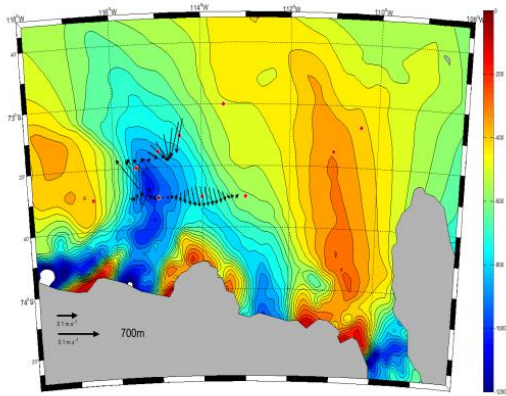


2011 January

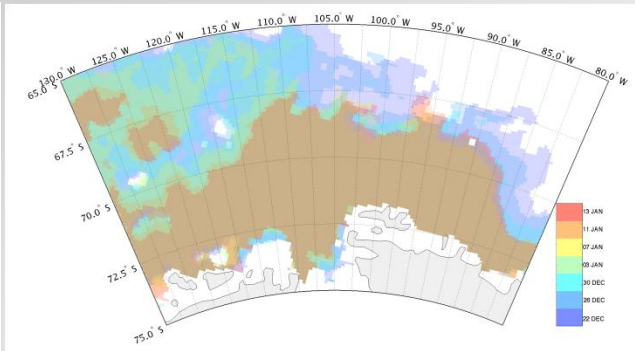


2012 February

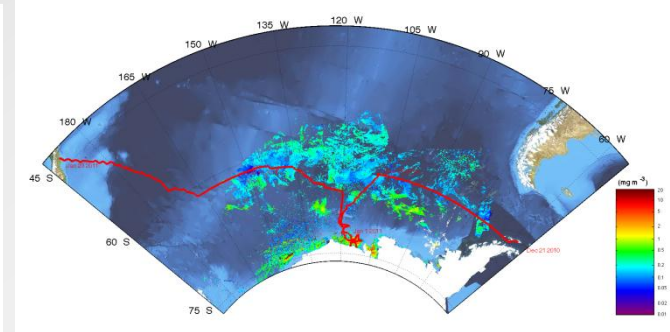
Currents by ADCP



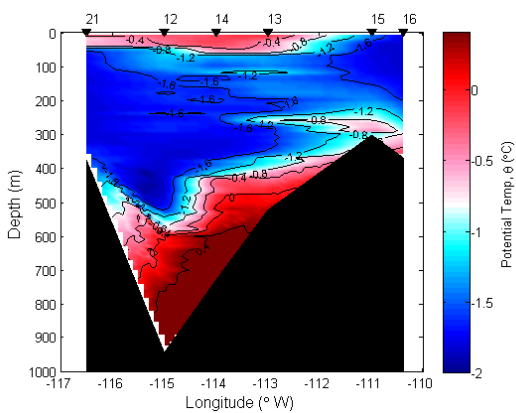
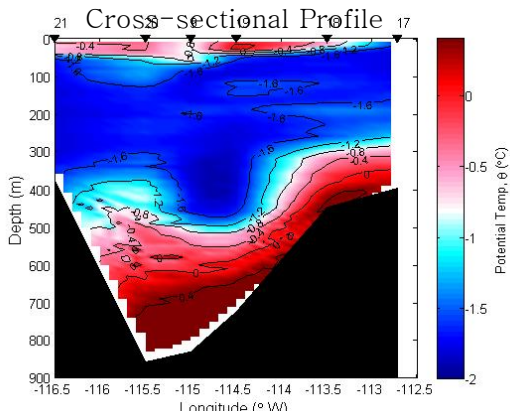
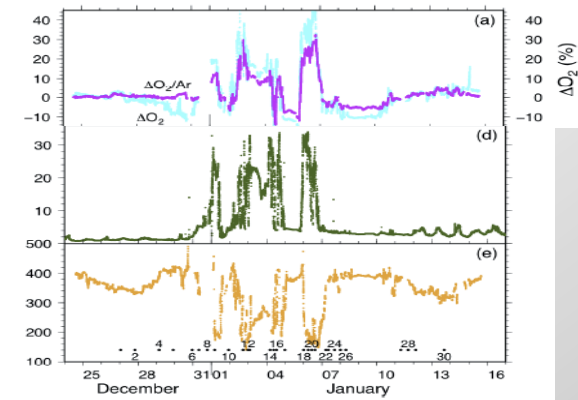
Daily SeaIce by Satellite



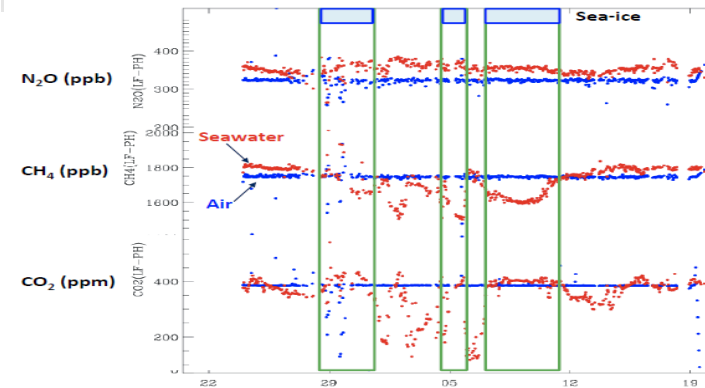
Satellite Ocean Color & Araon Track



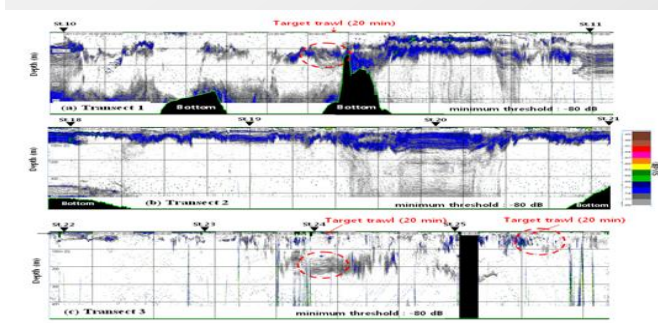
Excess O2 by Stable Isotope



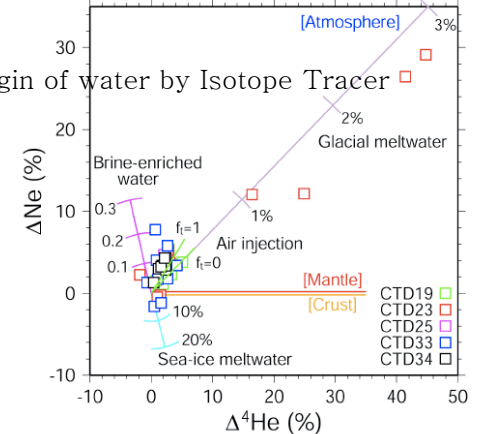
Greenhouse Gases

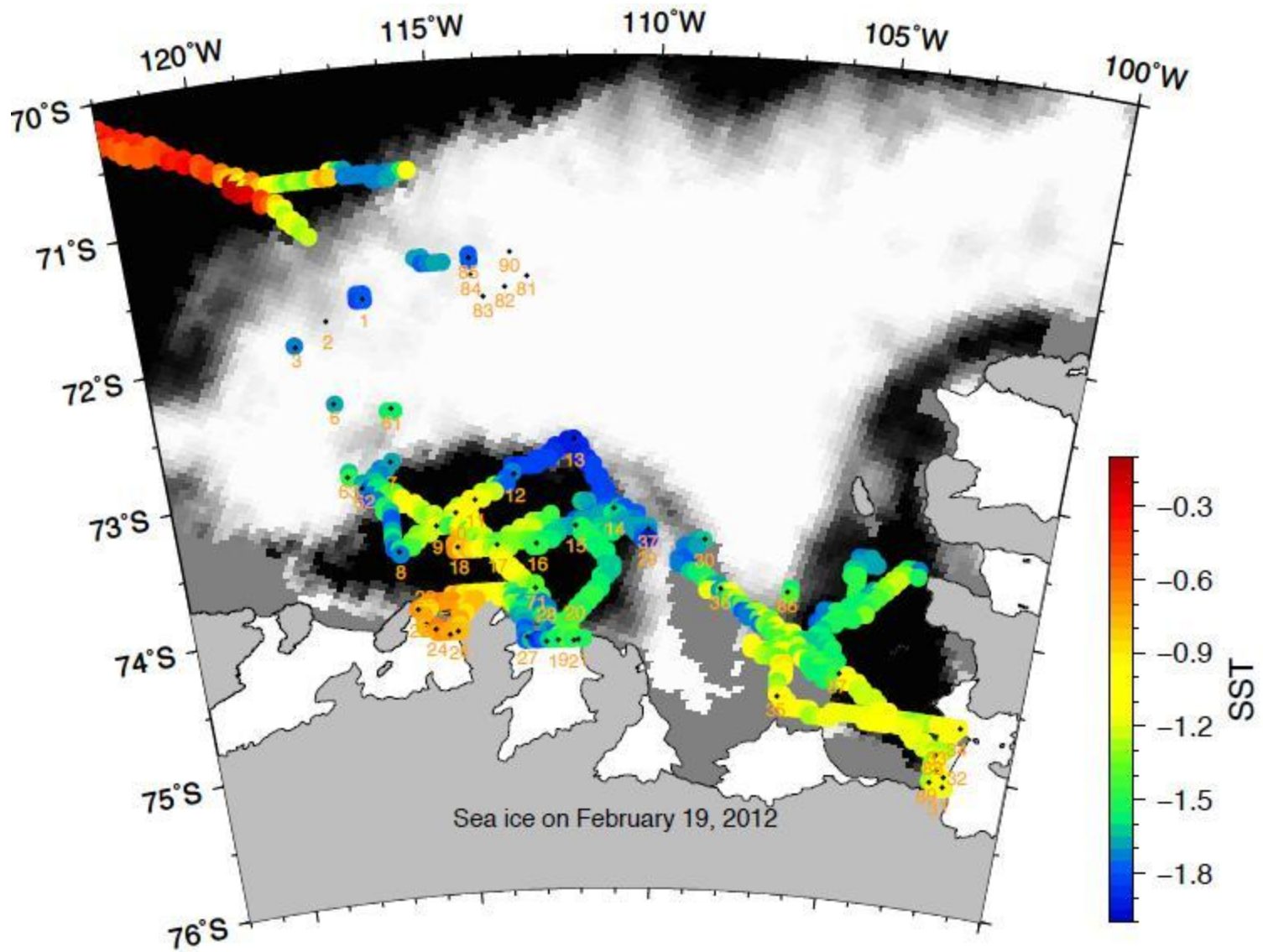


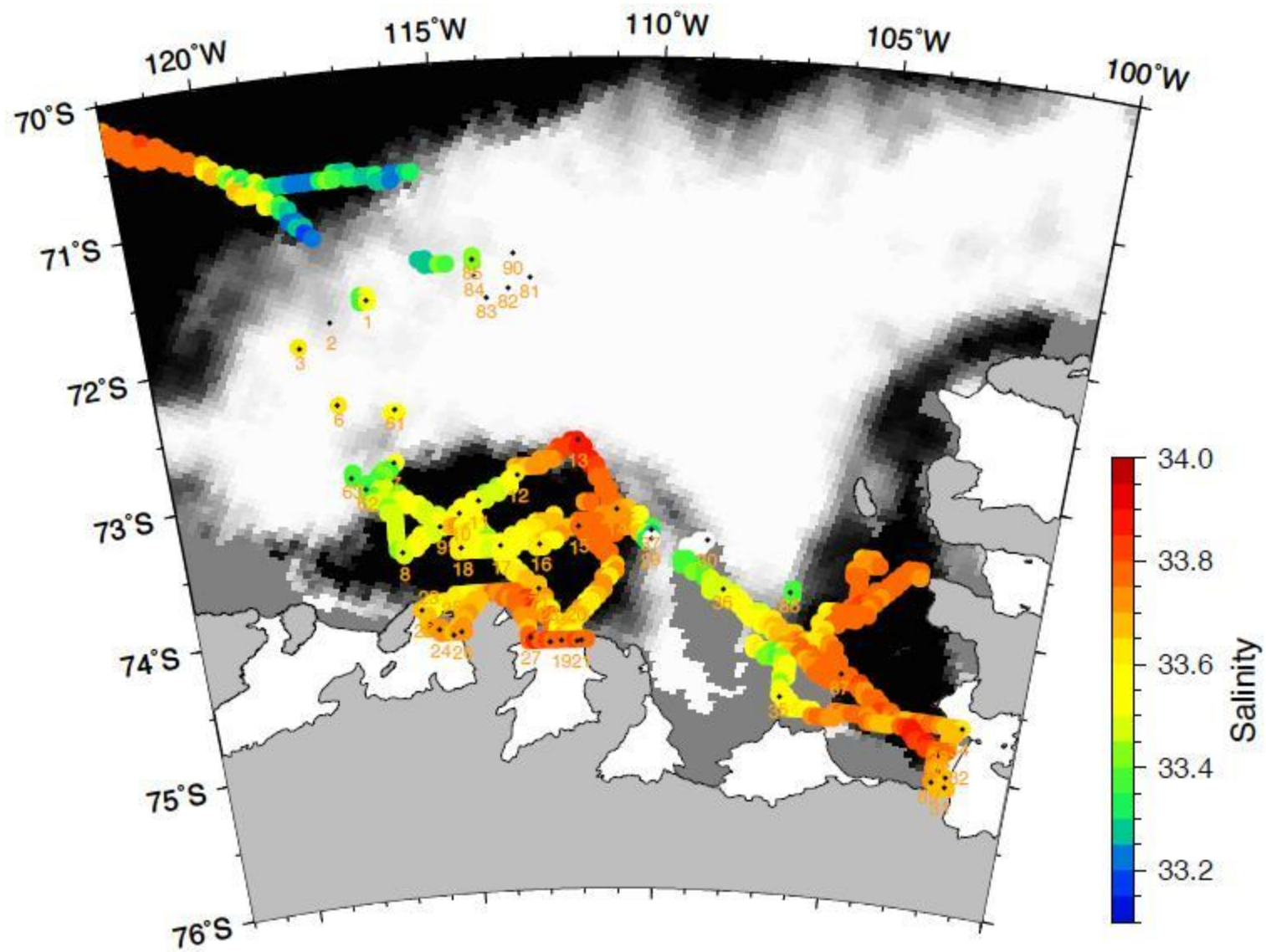
Acoustic Krill Biology

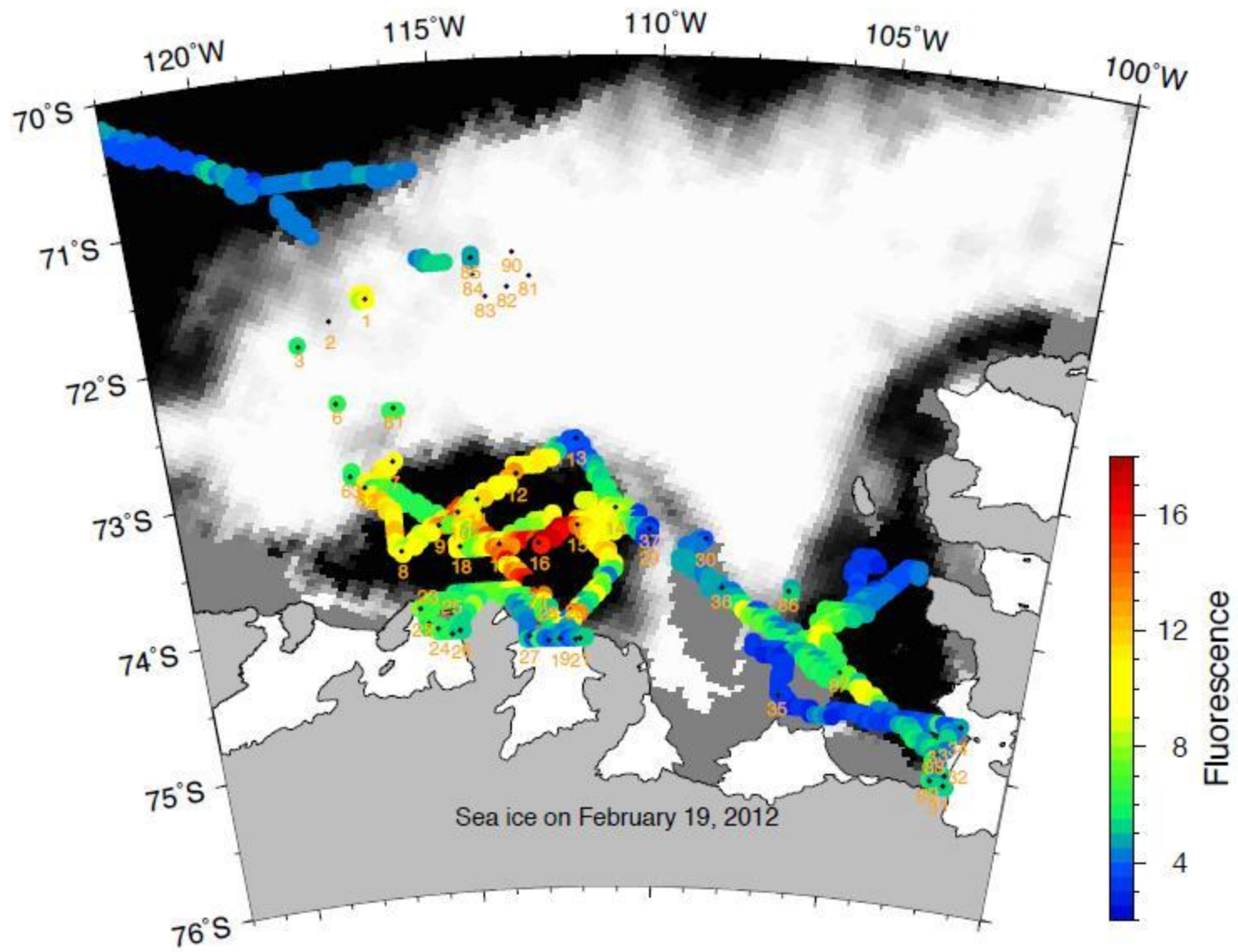


Origin of water by Isotope Tracer









Examples of key results

Polynya; highly productive, even more so early in the season

Sign of CDW, penetration dynamics

Sink of GHG (CO_2 , CH_4)

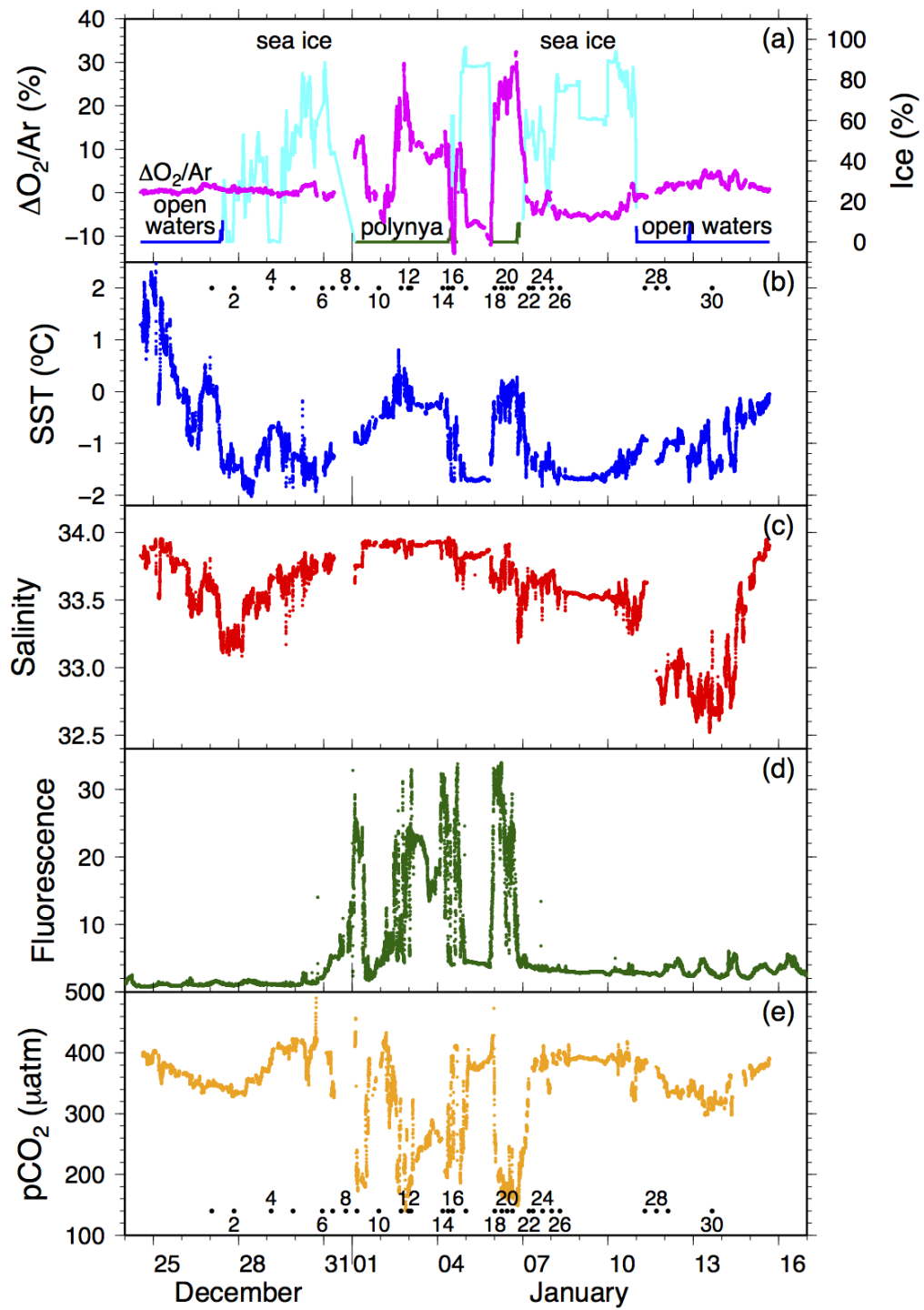
Algal bloom of limited species diversity, dominance of ice krill in polynya

Major findings

Distinction between open water, sea ice, and polynya

Polynya is the most dominant feature

Sea ice as a shielding interface



Data to be worked up

Vertical profile of DIC and other GHG

Water mass distribution and seasonal variability

Sea ice physical properties

Microbial diversity under ice habitat

noble gas contents in water; glacier water or sea ice water

Outcomes

Role of polynya; GHG dynamics

Across sea ice; heat, gases

Role of circulation (with combination of sea ice variability) on a number of aspects

Projections for Future Directions

2012/13 & 2013/14 Cruise Plan

Floating

- 100 days for the 2nd base construction each season
- Requested 20 days for the Amundsen program in 13/14 season

Amundsen Program

1. Evaluation of the 1st stage

2. Evolution toward better science

- what to study: topics & themes
- methodology involved

3. Expansion of International Network & Collaboration

- seek joint work that can be started in near future
- link to international program for longer-term & larger-scope studies

4. Spin-off

- resource, manpower, logistics-ship time