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Long-term monitoring observation in the Amundsen Sea: KOPRI's status and plan

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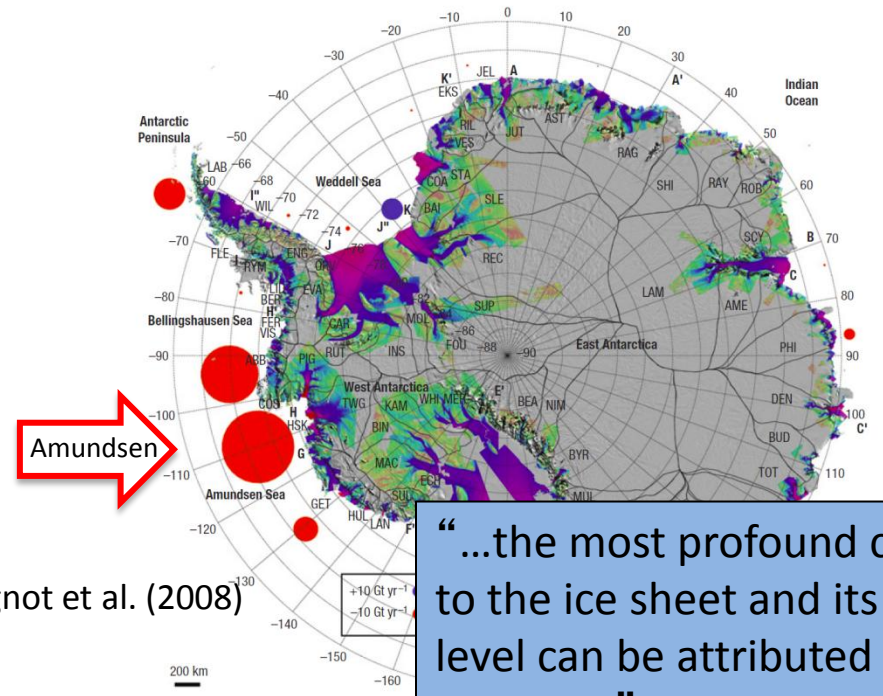
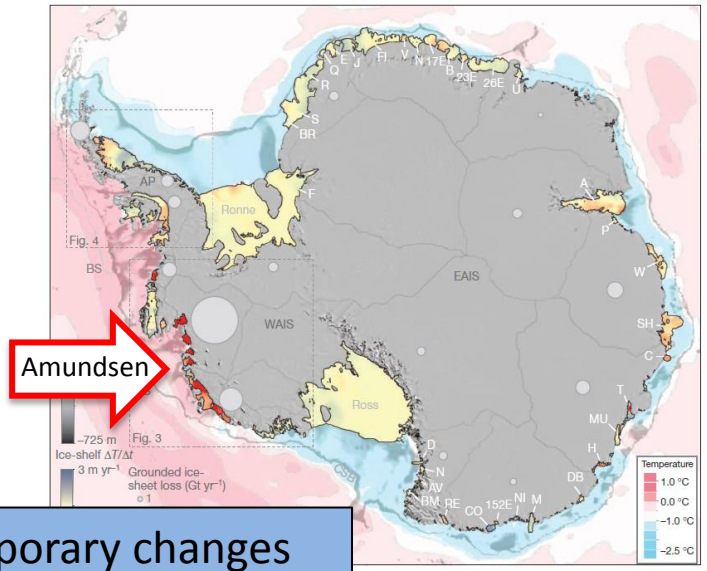
British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

Motivation: Why Amundsen?



Rignot et al. (2008)



Pritchard et al. (2012)

"…the most profound contemporary changes to the ice sheet and its contribution to sea level can be attributed to ocean thermal forcing …"

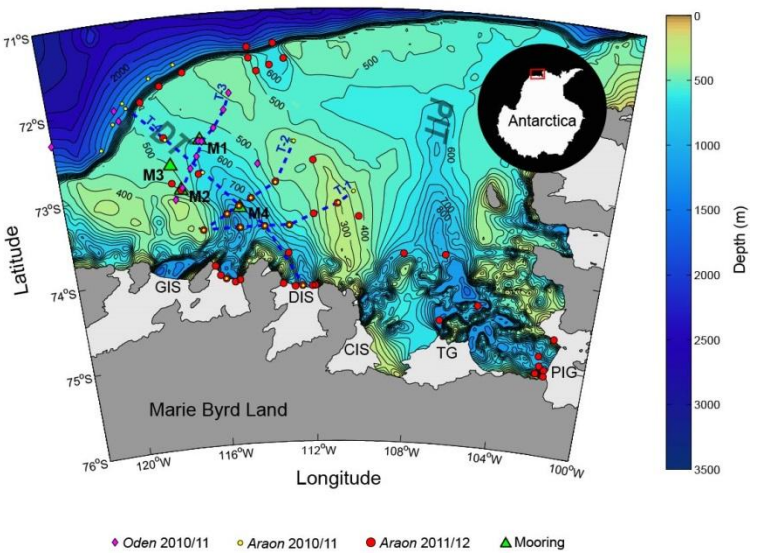
- Mass loss
- Mass gain

- Mass loss/gain of ice sheet is strongly regional.
- Amundsen/Bellingshausen Seas are the most rapidly melting region in the Antarctic Ocean.
- Ice melting is fuelled by intrusions of warm circumpolar deep water (CDW) onto the continental shelf.

Register in OceanSITES?

- …OceanSITES only deals with long-term and open-ocean timeseries (coastal/shallower sites may be considered when the conditions they measure really are representative of the open ocean)…

- Amundsen Sea
  - Pros:
    - Hot spot responding to climate change
    - Time series of fixed-point moorings
    - Intent to sustain
    - Multi-disciplinary project
  - Cons:
    - Not open ocean
    - Shallow depth



KOPRI Amundsen Project

Main research components

- **Physics**
  - current & circulation (CDW, ACC), heat/mass balance
  - sea-ice change, remote sensing

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

- **Ecosystem**
  - photosynthesis & parameters, processes & rates
  - producers, consumers, energy and material flow in the food web

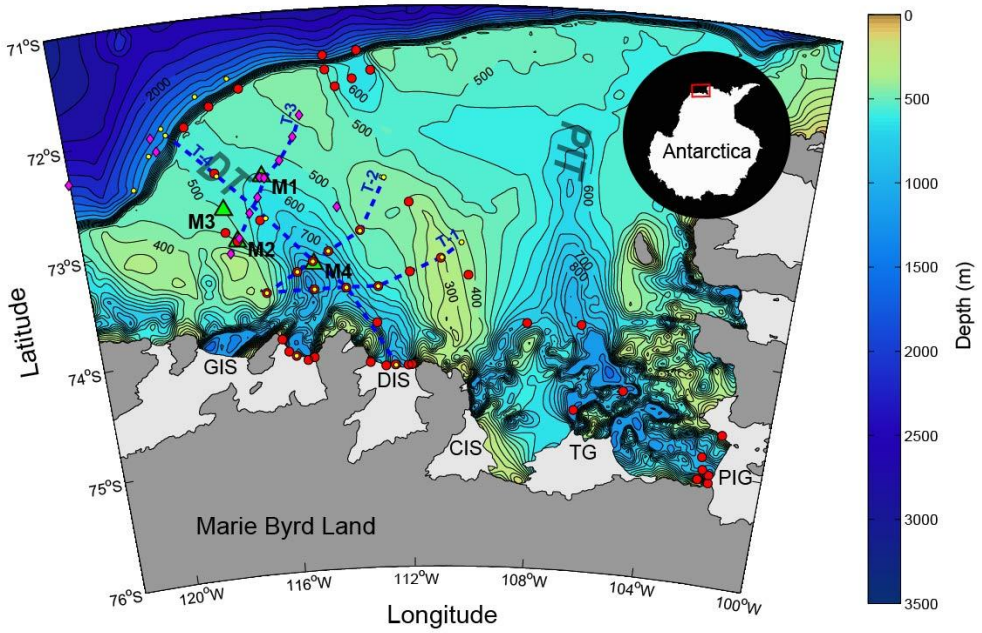
KOPRI Amundsen Project

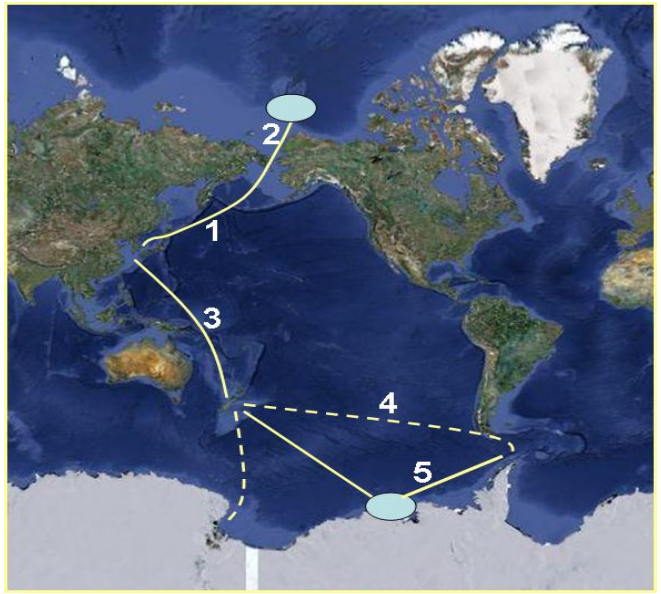
Features

- Multi-disciplinary
- Multi-Level : Satellite – Air – Ocean – Ocean Floor (sed trap & core)
- Multi-PI's: 3 National Research Inst, 9 Domestic Universities
- Multi-nationals:

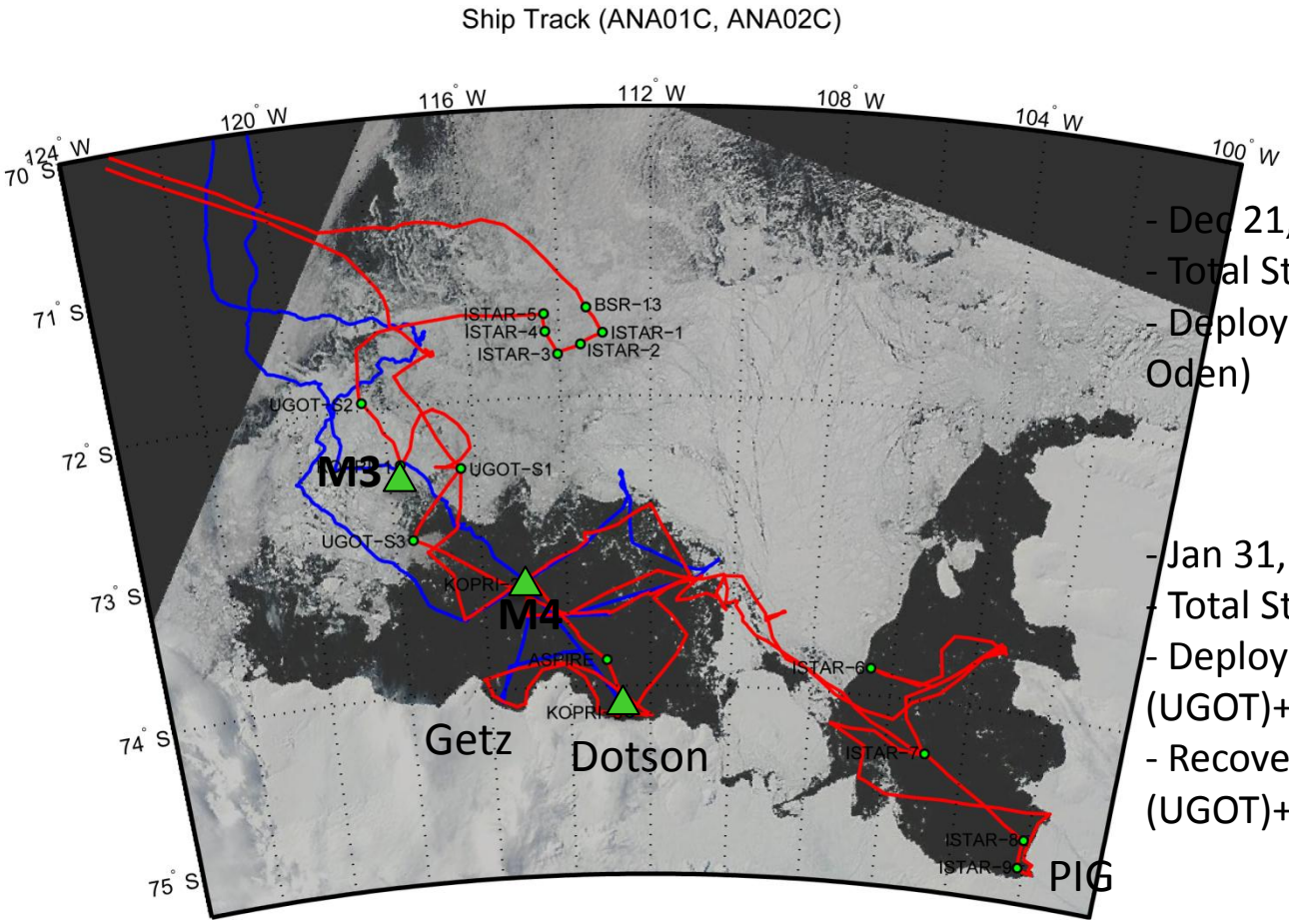
  US ASPIRE, Rutgers, MBL, UK BAS, Sweden Gothenburg Univ.
- Multi-sites: from sea-ice margin, sea ice, polynya, to ice-shelf edge

  \+ Underway observations along the ship track





2 Field Expeditions



2010/2011

- Dec 21, 2010 – Jan. 23, 2011 (34 days)
- Total Stations: 30 (CTD+LADCP)
- Deployed Moorings: 2 (KOPRI)+2 (UGOT-Oden)

2011/2012

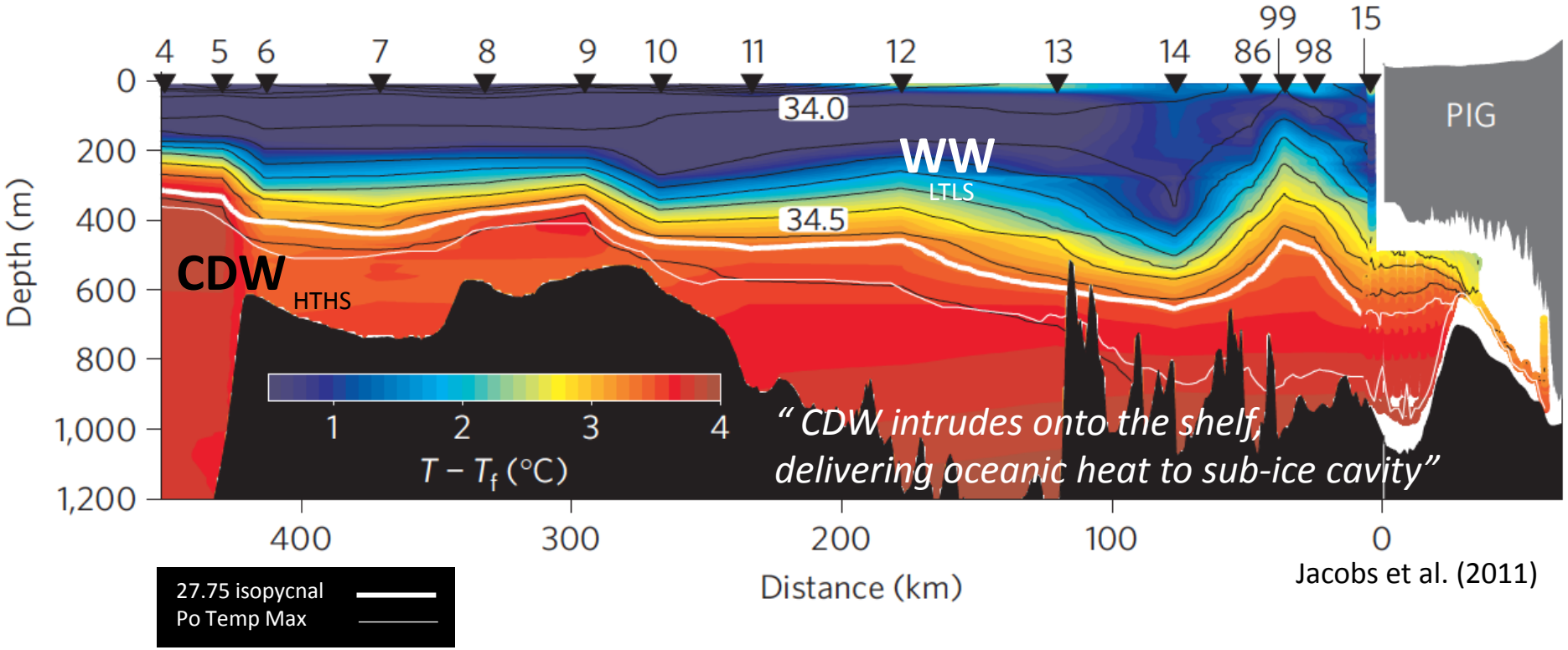
- Jan 31, 2012 – March 20, 2012 (50 days)
- Total Stations: 52 (CTD+LADCP)
- Deployed Moorings: 3 (KOPRI)+3 (UGOT)+9 (BAS) = 15
- Recovered Moorings: 2 (KOPRI)+2 (UGOT)+1 (BAS)+1 (US) = 6

ANA01C (2010/2011)
ANA02C (2011/2012)

KOPRI

BAS, UGOT

Circumpolar Deep Water (CDW)



Jacobs et al. (2011)

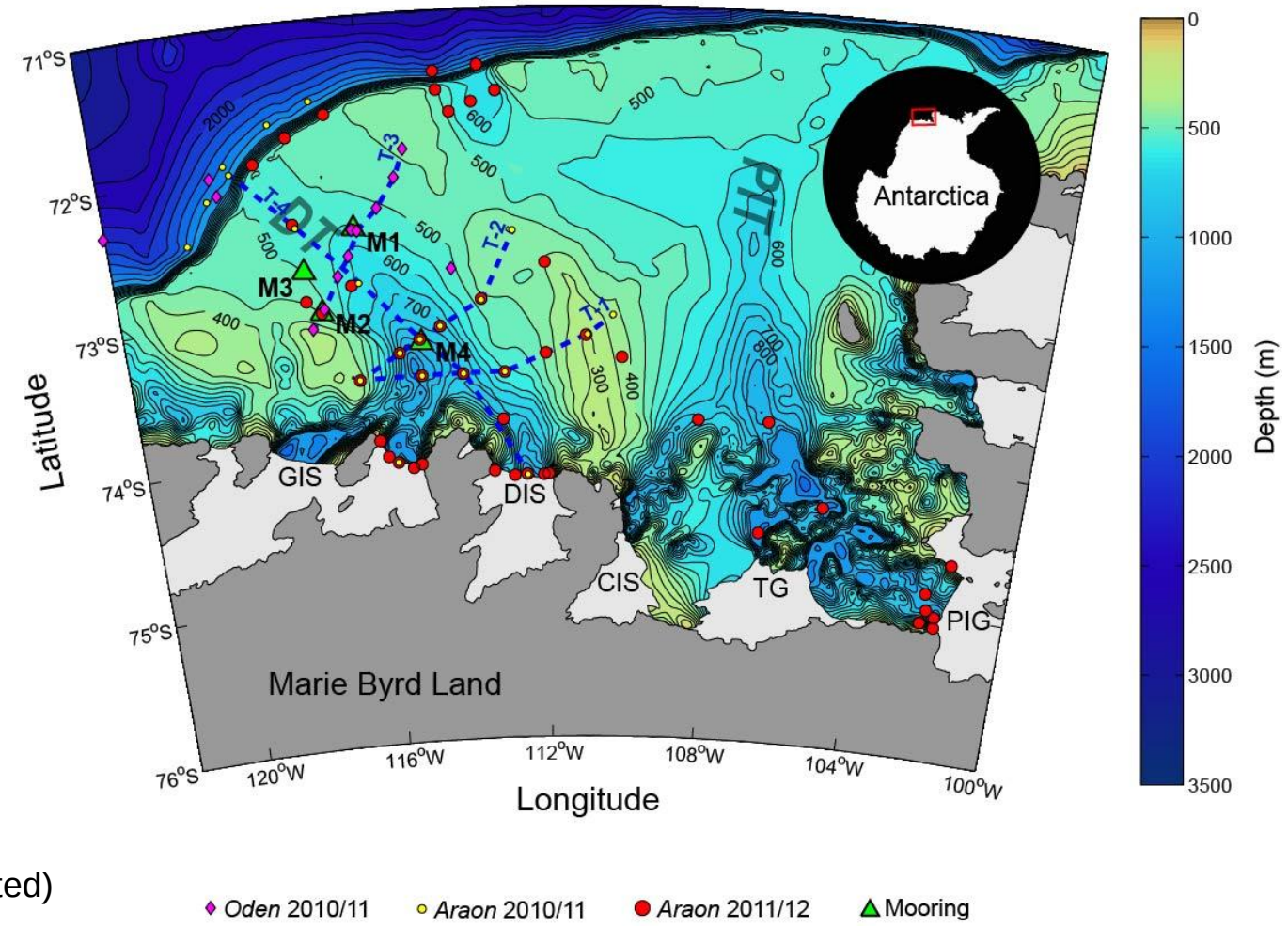
Knowledge gaps in the Amundsen Shelf

- CDW's circulation pattern
- CDW's seasonal variation
- Heat budgets
- Role of external forcings (wind and sea ice)

Study area

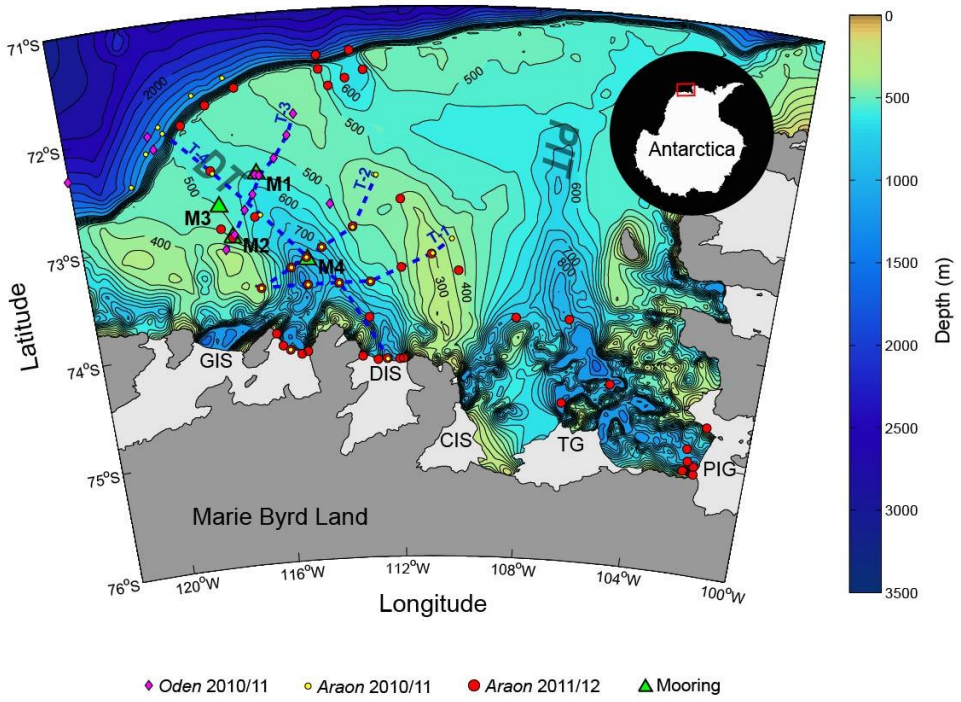
To understand the circulation of warm deep water

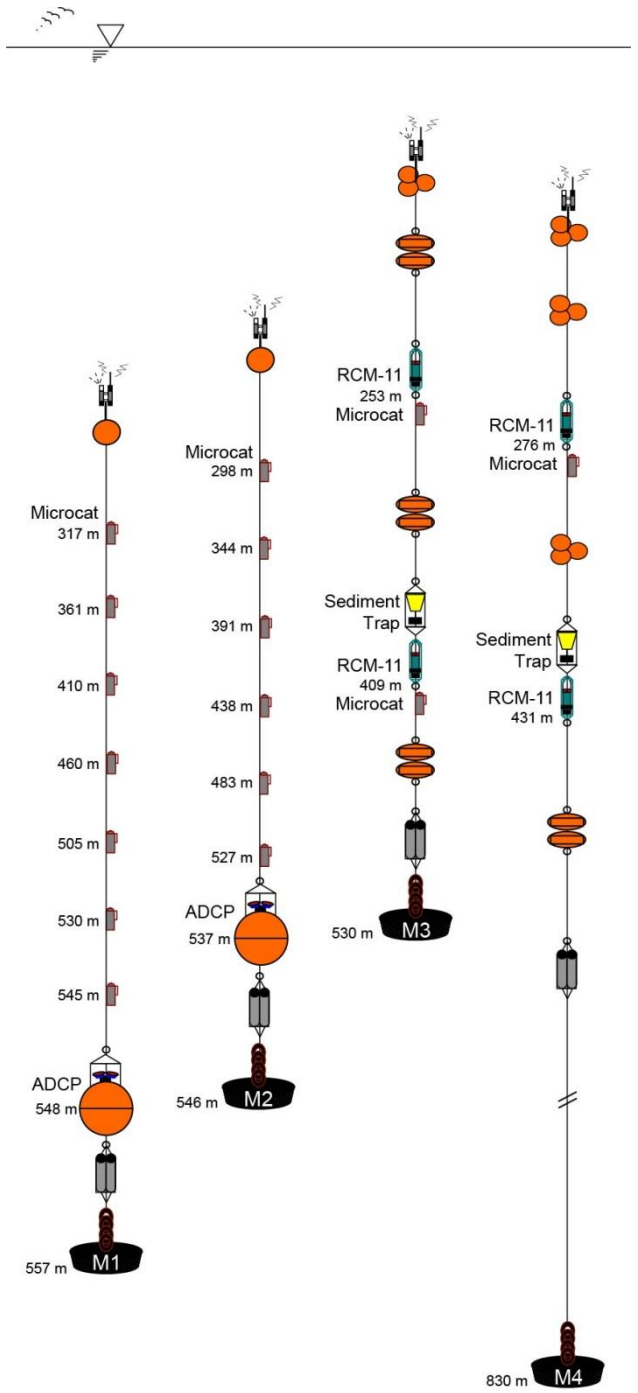
- M1: Eastern flank of Dotson Trough (DT)
- M2/M3: Western flank
- M4: Center



Ha & Wåhlin et al. (submitted)

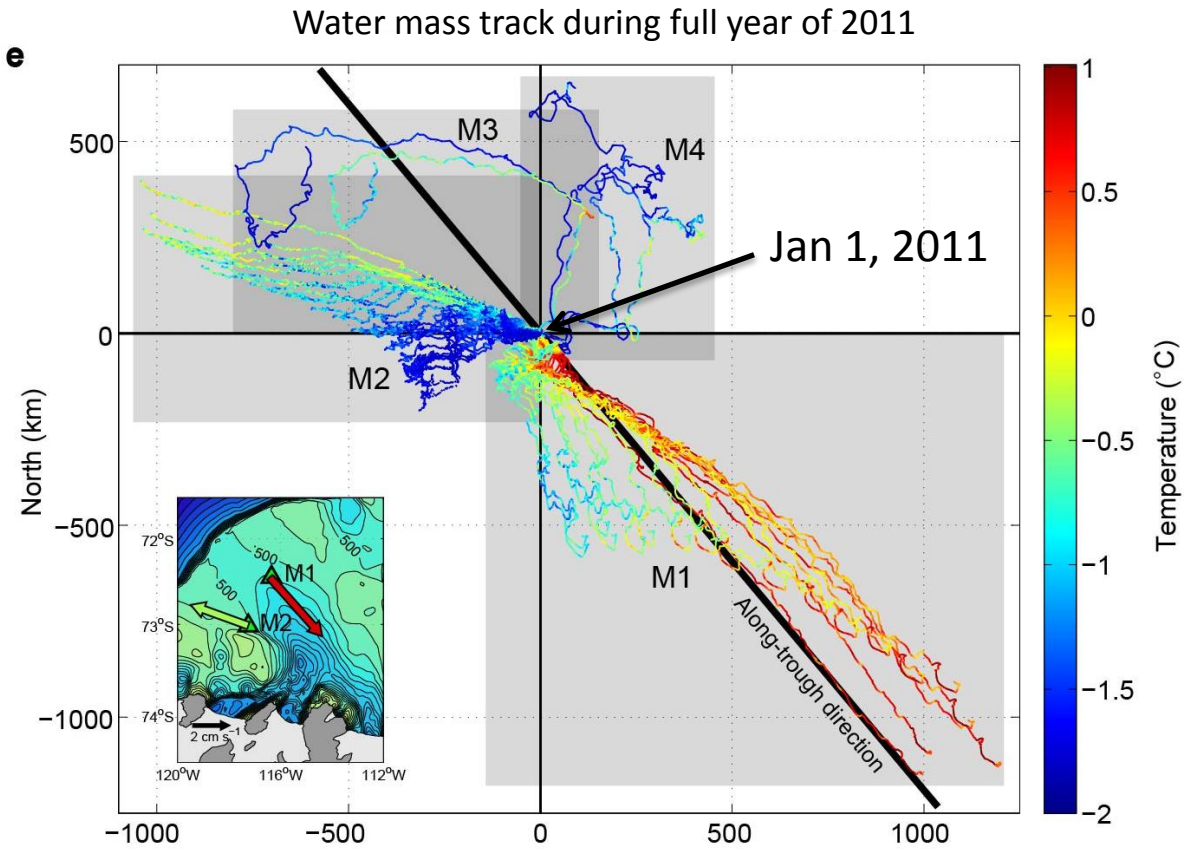
Four subsurface moorings





Ha & Wåhlin et al. (submitted)

Progressive vector

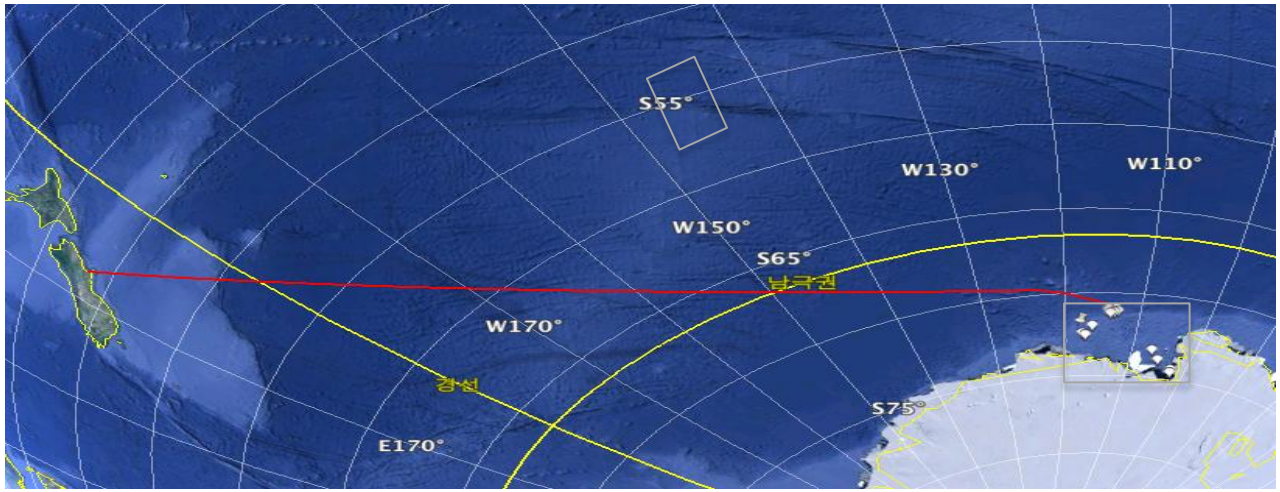


- Eastern flank (M1): Persistent inflow of warm deep water (avg. 0.8°C)
- Western flank (M2/M3): Persistent outflow; cooler and fresher version of CDW (avg. -0.4°C)
- Near-bottom flow is nearly parallel to the local bathymetry for both inflow and outflow.

Ha & Wåhlin et al. (submitted)

Future plans

Constructions at TNB



1. UGOT, BAS iSTAR, US ASPIRE
2. Rutgers Gliders (os)
3. French L'Ocean (cp) & KIOST (jhl) – ACC over Udintsev zone
4. UMB (mz) – drifters to Eastern Ross Sea
5. WHOI & SAMS (itp), UT (sa)
6. EU consortium
7. SOOS program
8. Circum-Antarctic CO2 monitoring

2013/2014 Araon schedule (tentative)

- Araon will depart at Incheon, Sep 2013
- Amundsen project: 20 days (Amundsen: Jan 10-30, 2014) + transit

University of Bergen (Norway): Willing to join project, input 6 moorings in 2014/2015, leave for 1-2 years

➔ Good coverage of inflow and outflow of CDW, width etc.

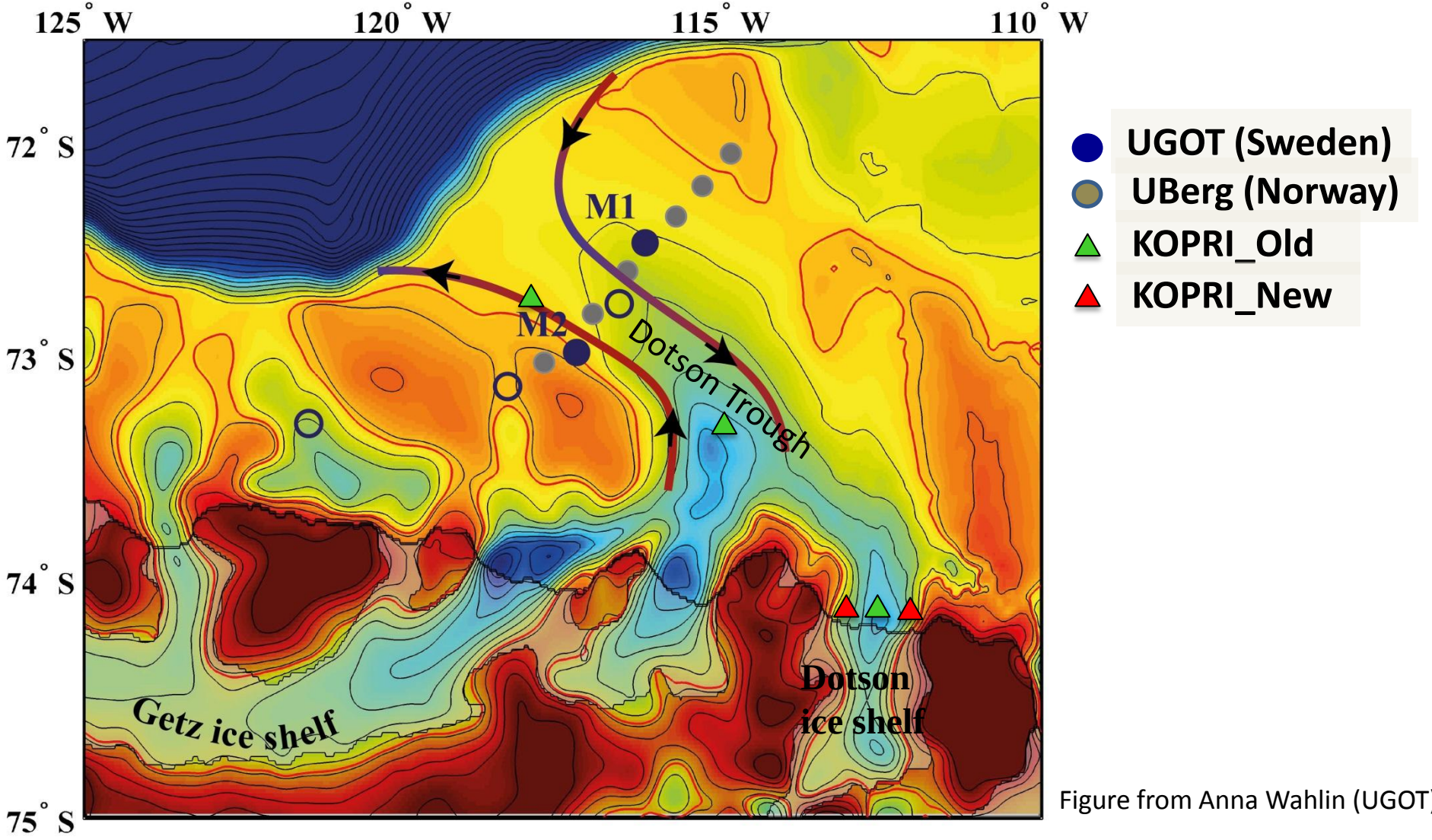
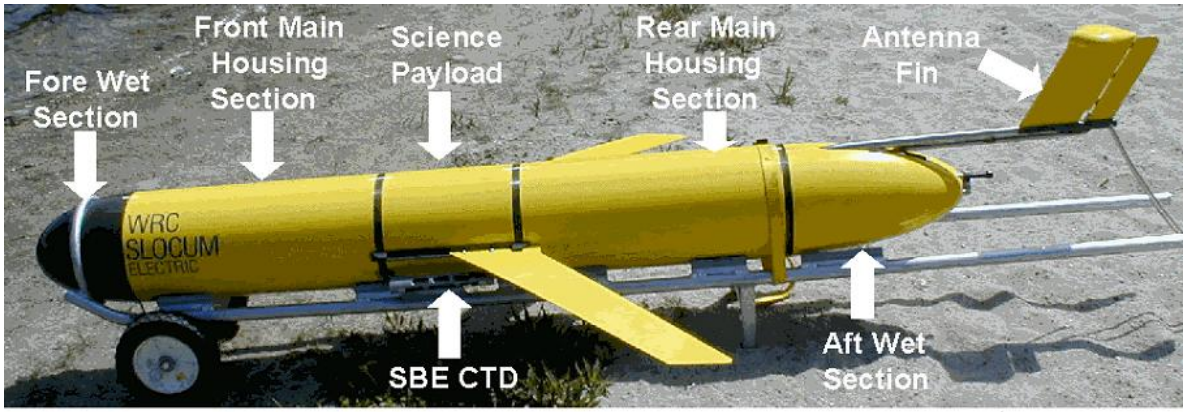


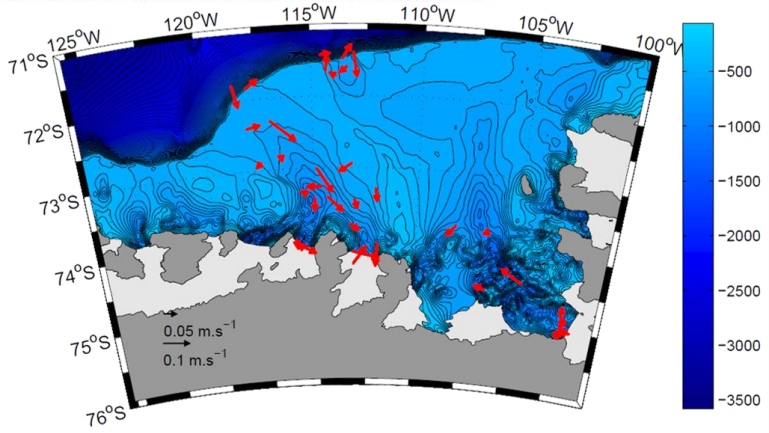
Figure from Anna Wahlin (UGOT)

New approach

- Big data gap in front of (or under) the ice shelf



Collaboration with Rutgers University (Oscar Schofield)

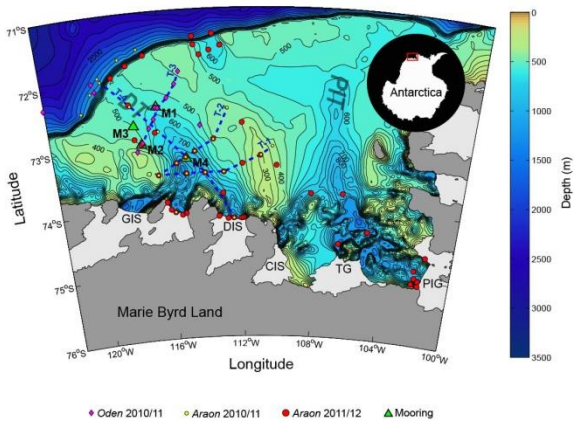


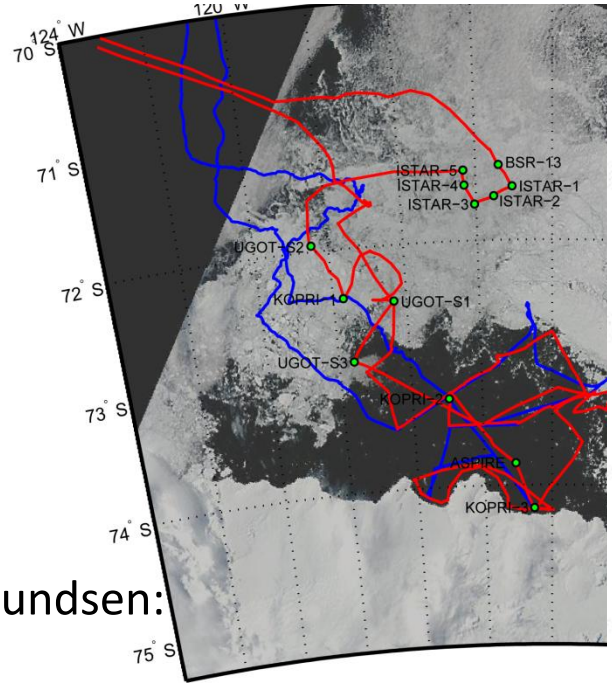
Potential target area: Getz or Dotson Ice Shelf

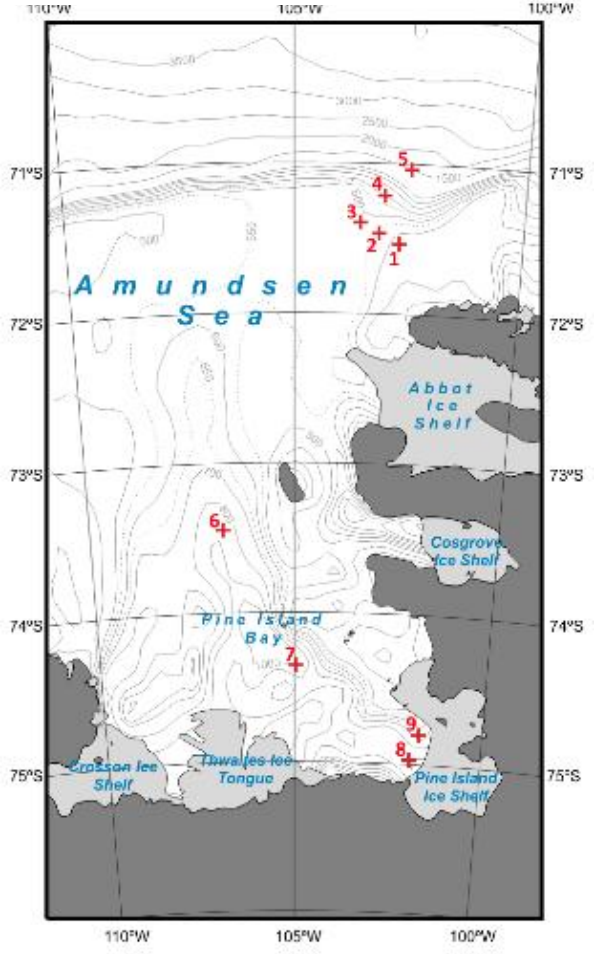
http://rucool.marine.rutgers.edu/

Contribution to SOOS

Southern Ocean Observing System







- Current partnership in the Amundsen:
  KOPRI-BAS-UGOT,
  Any other groups? (Rutgers, NYU, UBerg, UT, UEA,, …)
- In the future?
  - Recover all moorings in 2013/2014 (by Araon and/or JCR) and possibly maintain them.
  - Develop the international collaboration in the western Antarctic Ocean for sharing the platform, data s

SOOS SOUTHERN OCEAN OBSERVING SYSTEM

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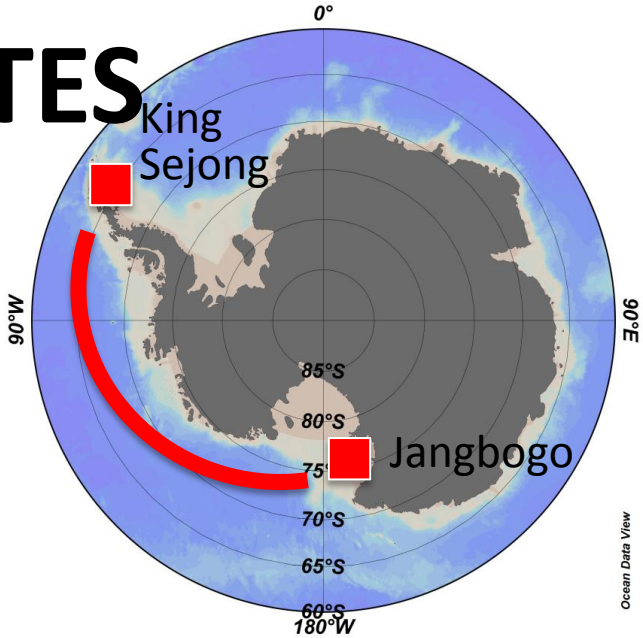
Contribution to OceanSITES



- Regular traffic between Jangbogo – King Sejong after 2014
- Amundsen/Bellingshausen/Ross Seas
- Any contribution to OceanSITES?

Thank you!

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