Status and Outlook for Polar Argo

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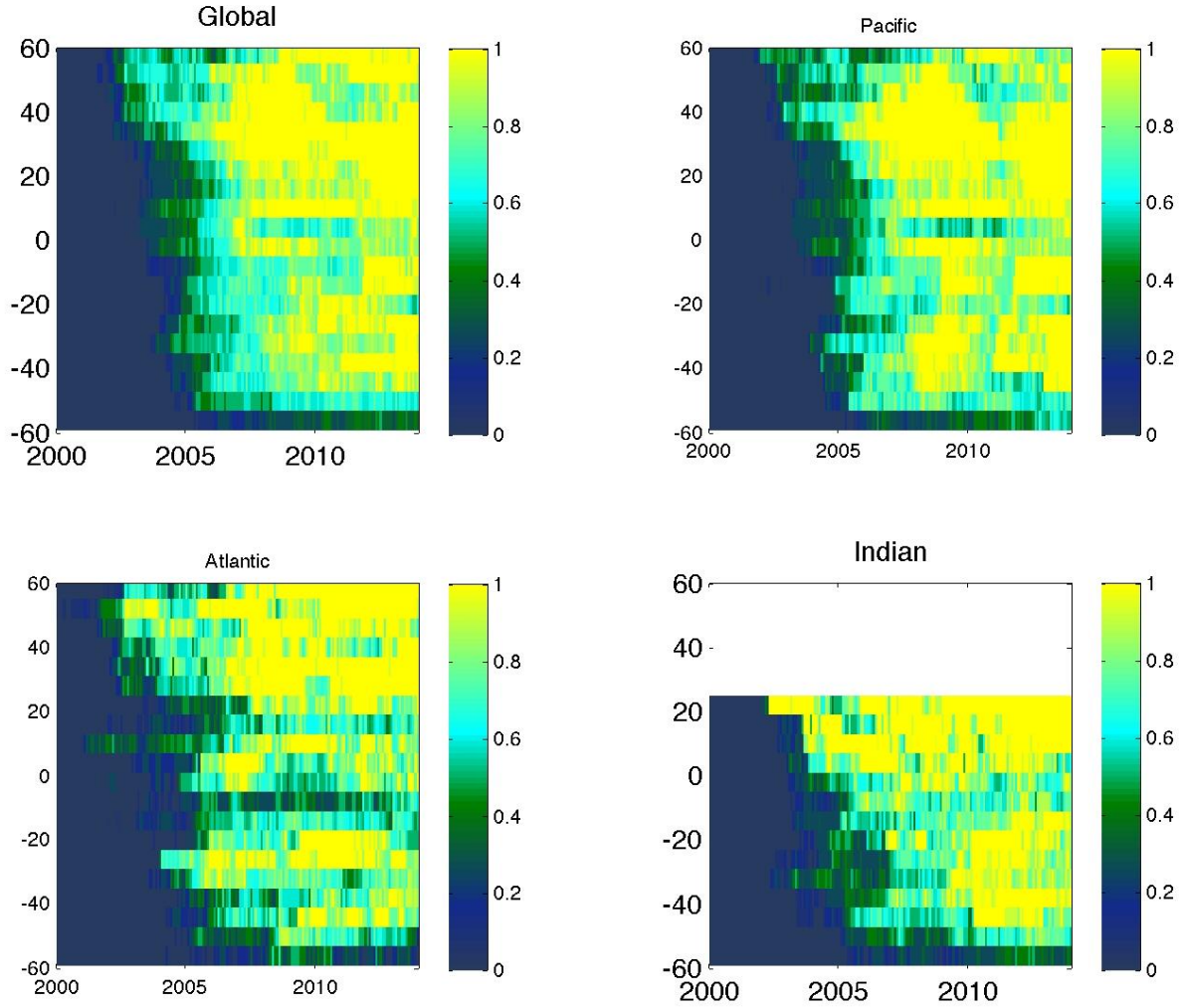
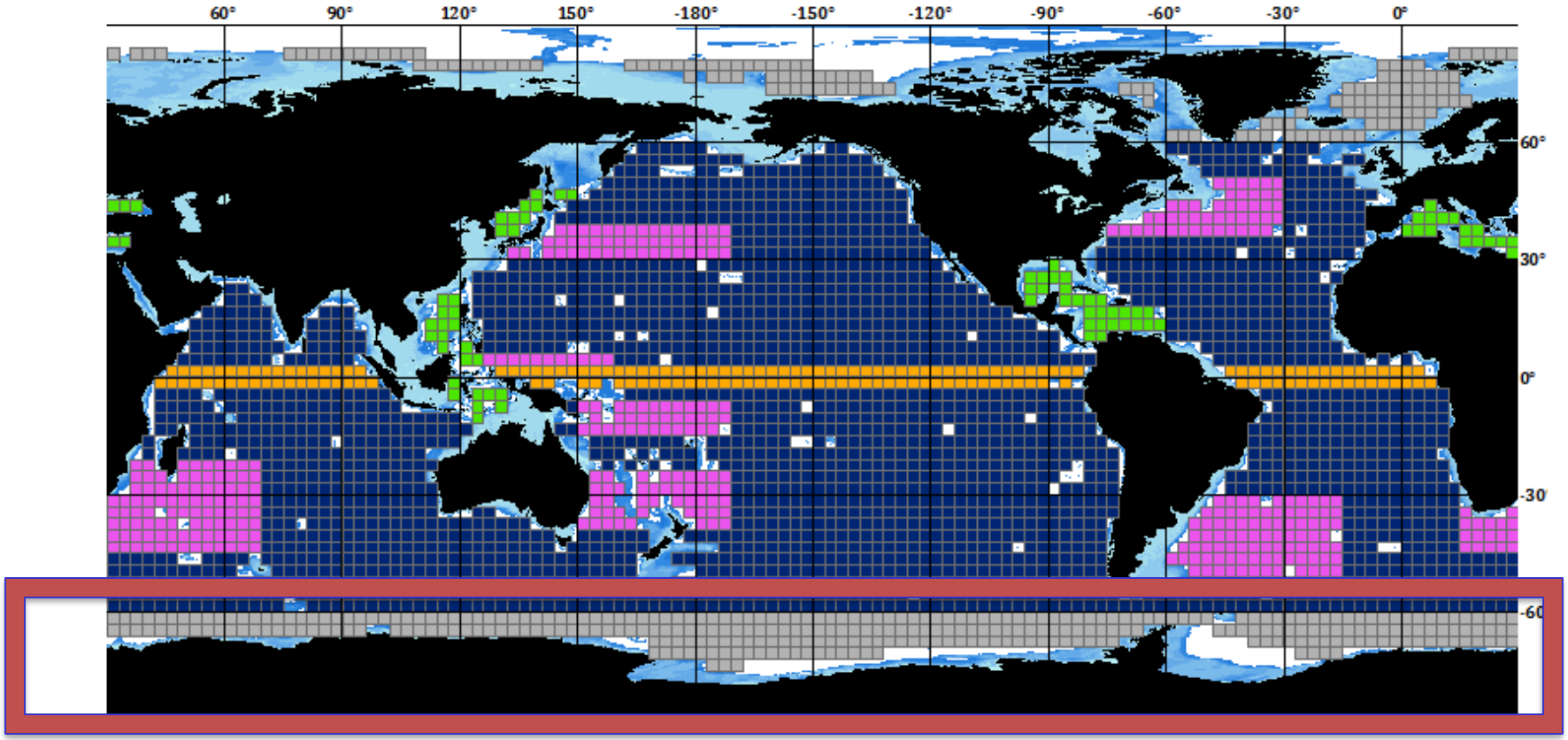
Core Argo: a 7 year build up to meet our goal



Coverage poleward of 50°S remains low

A Global Design
Spatial Extensions to Core Argo



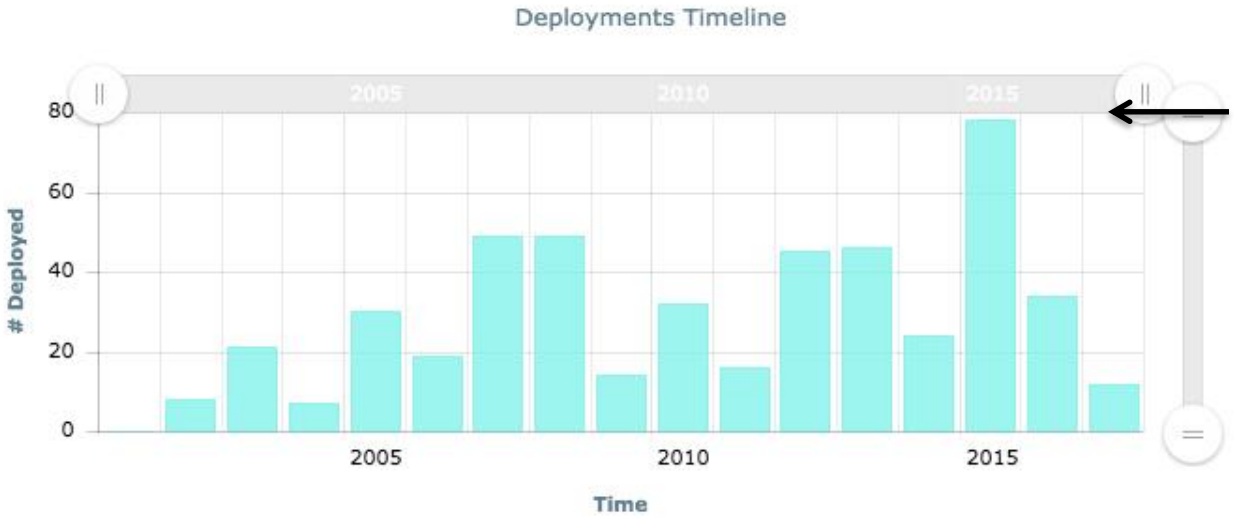
- Same mission – tracking the slow manifold - more spatially complete and better signal to noise
- Double sampling in WBCs and equatorial regions
- Marginal Seas: enhanced sampling - determined by regional partnerships

Seasonal Ice zone: x1 Target = 360-380 Floats south of 60 S, ~ 80-100 floats in the Weddell Gyre

Status of Polar Argo

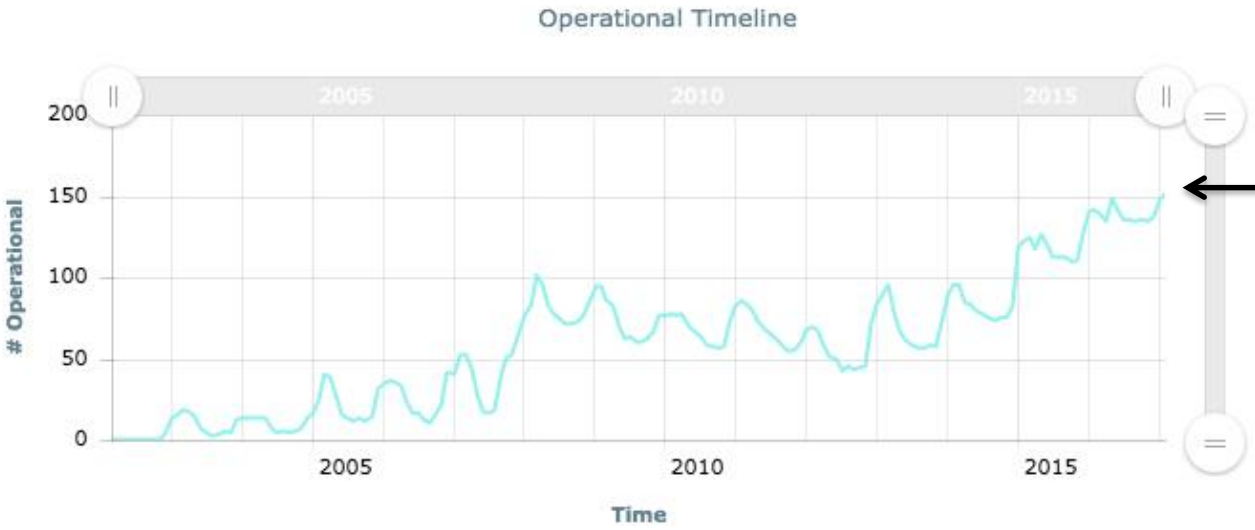
Southern Ocean Floats

Deployments
~ 500 floats
deployed
since 2002



Sustained deployments of 80 floats per year needed to maintain target

Active floats

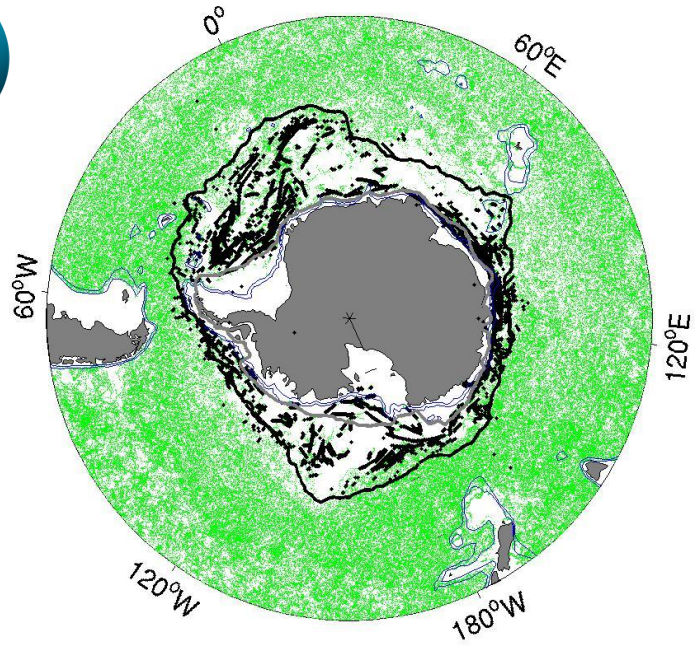


159 active

at 45% of design goal (360)

Southern Ocean Observations

< 40 °S



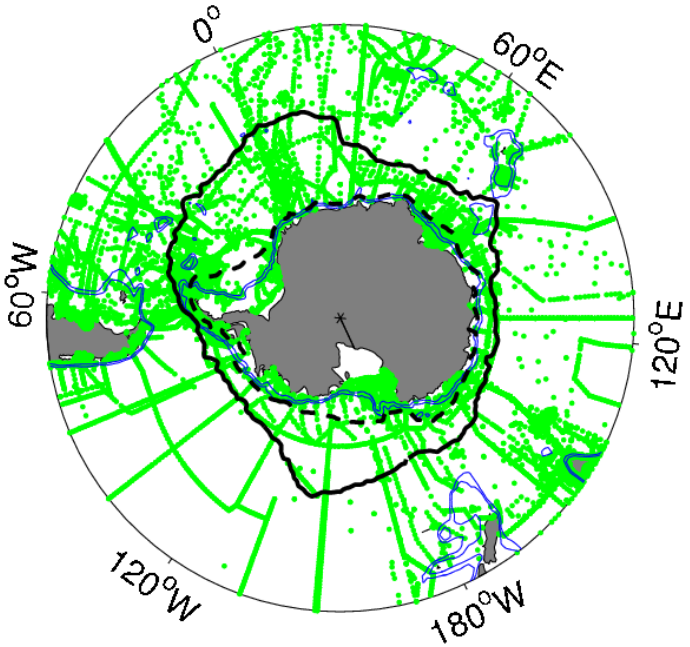
ARGO:

Total profiles = > 330,000

Summer = 170,000

Winter = 160,000

Under ice = ~ 10,000

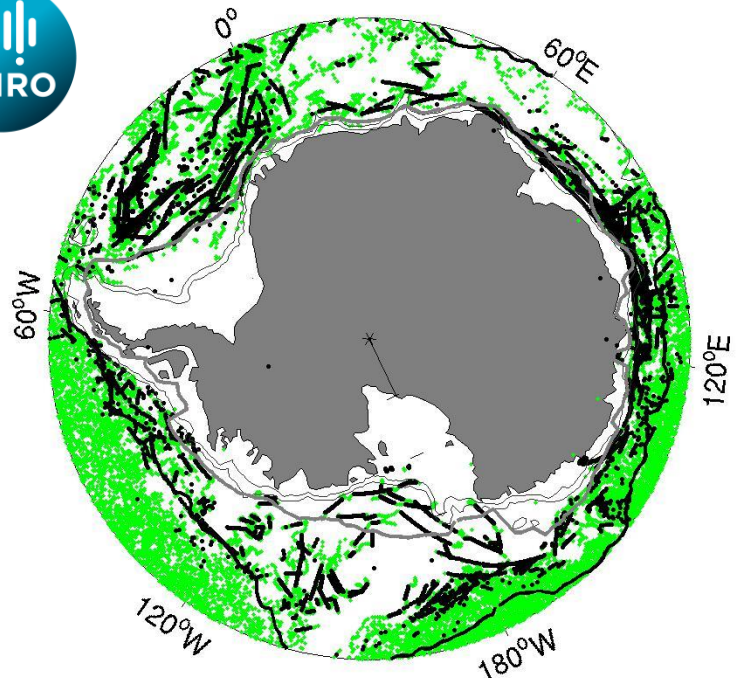


CTD:

Total profiles = 37,000

Summer = 28,000

Winter = 9,000



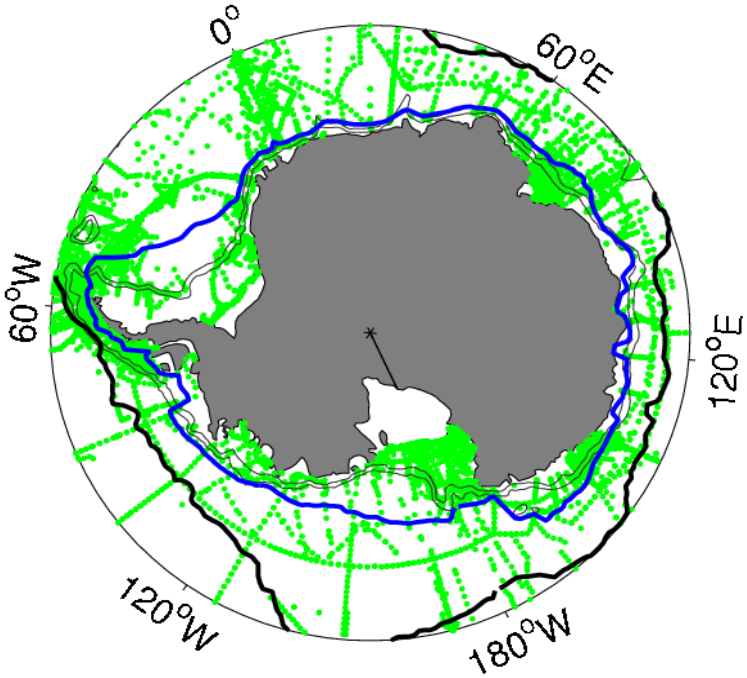
ARGO < 60˚S

Total profiles = ~ 47,000

Summer = 26,000

Winter = 21,000

7 x winter data from Argo



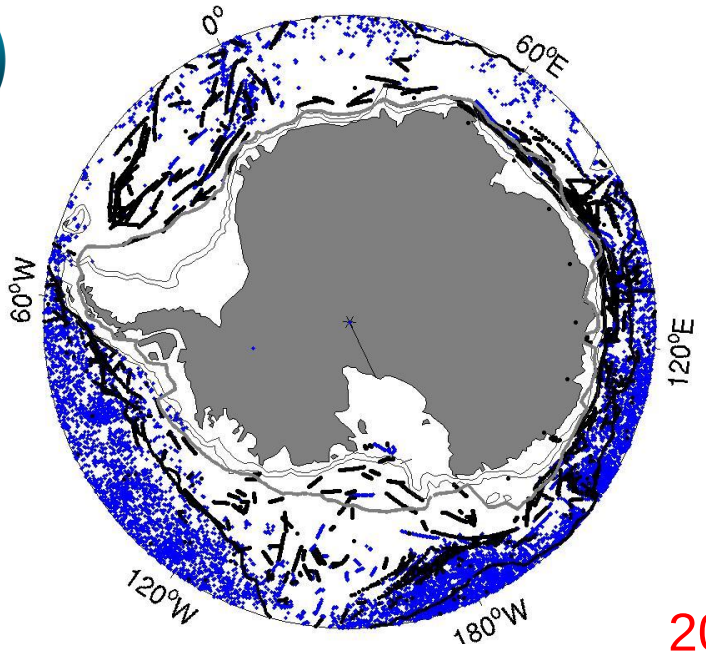
CTD < 60˚S

Total profiles = ~ 14,000

Summer = 11,000

Winter = 3,000

ARGO < 60˚S 2000 - 2017



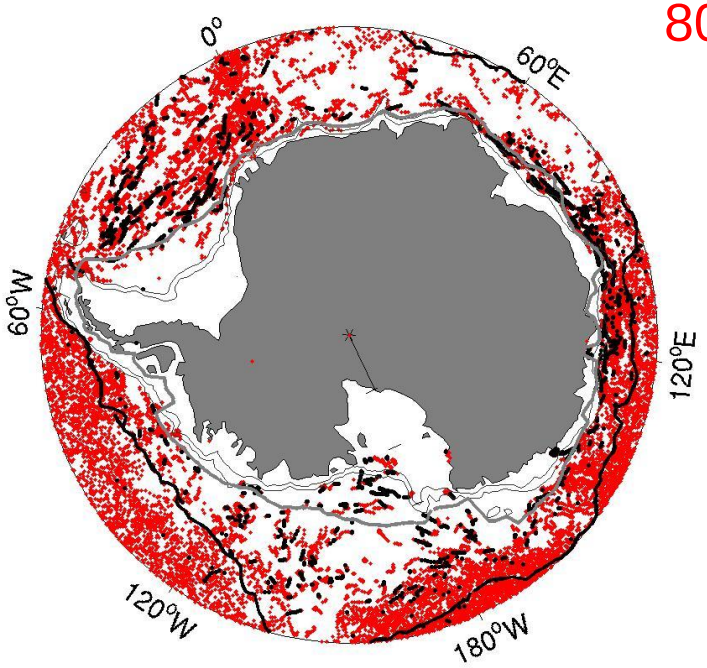
WINTER

21,000 profiles (45%)

Under ice = 7,000 (31%)

Open water 14,000 = (69%)

20 % of profiles < 60 ˚S are under ice
80 % open water + contributing to core Argo



SUMMER

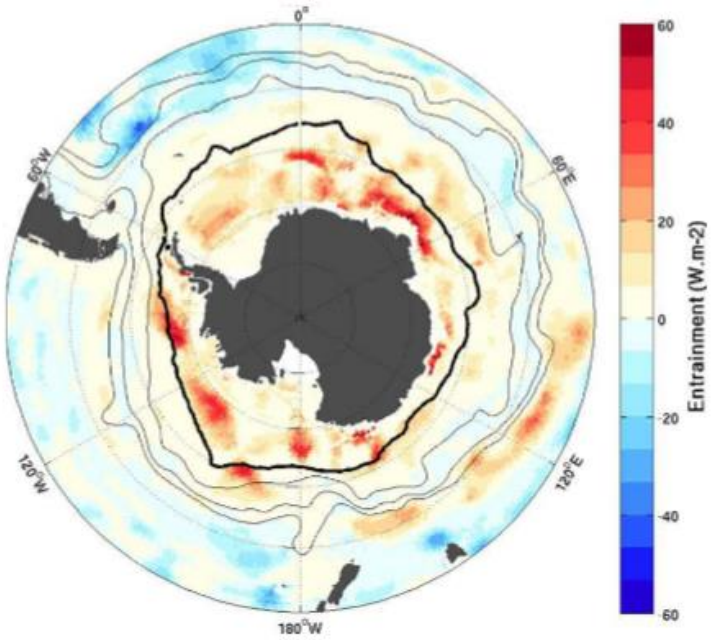
26,000 profiles (55%)

Under ice = 3,000 (12%)

Open water = 23,000 (88%)

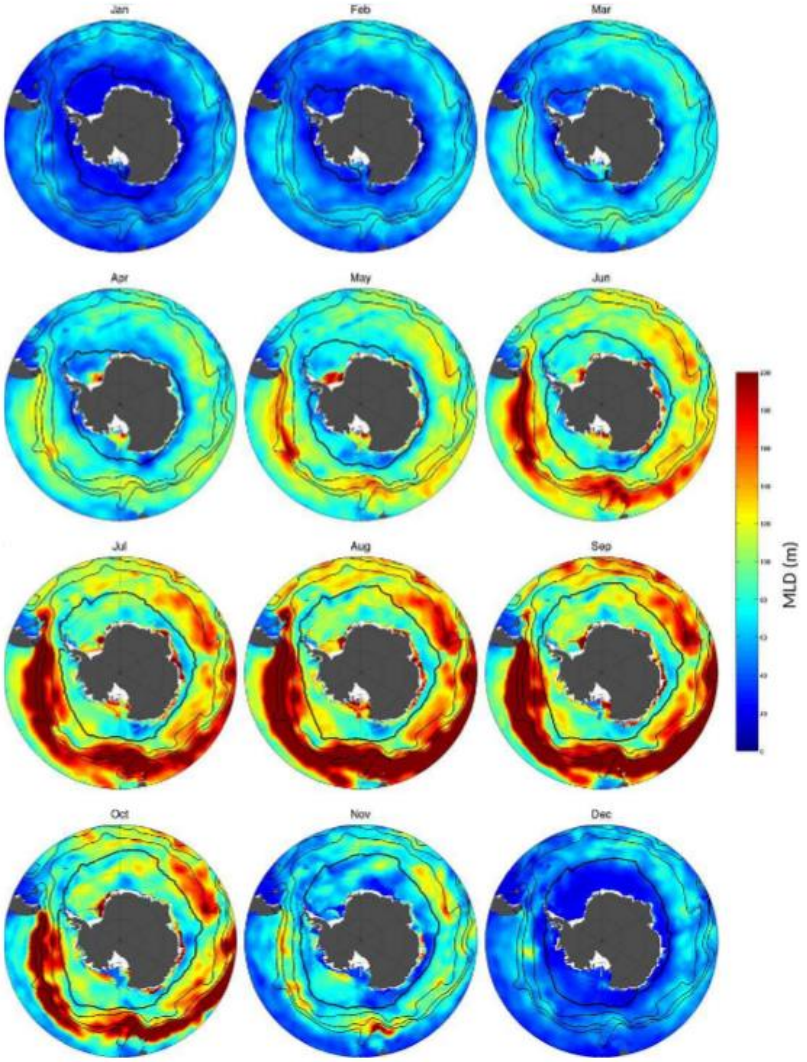
Southern Ocean Mixed Layer Seasonal Cycles

Pellichero, V. et al. 2016 The ocean mixed layer under Southern Ocean sea-ice: Seasonal cycle and forcing JGR, 122, doi:10.1002/2016JC011970.



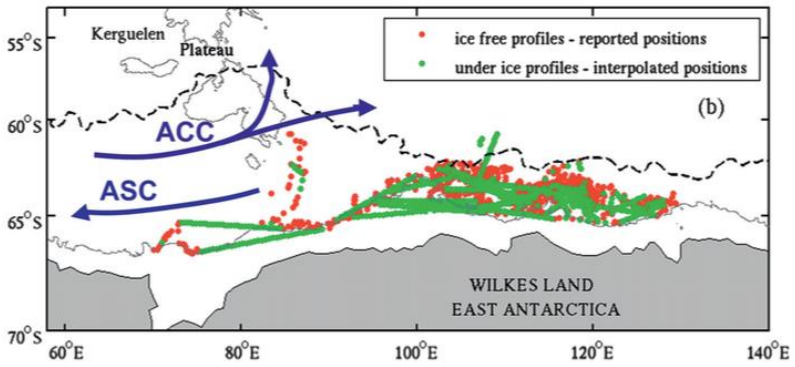
Circumpolar entrainment of heat in W m-2

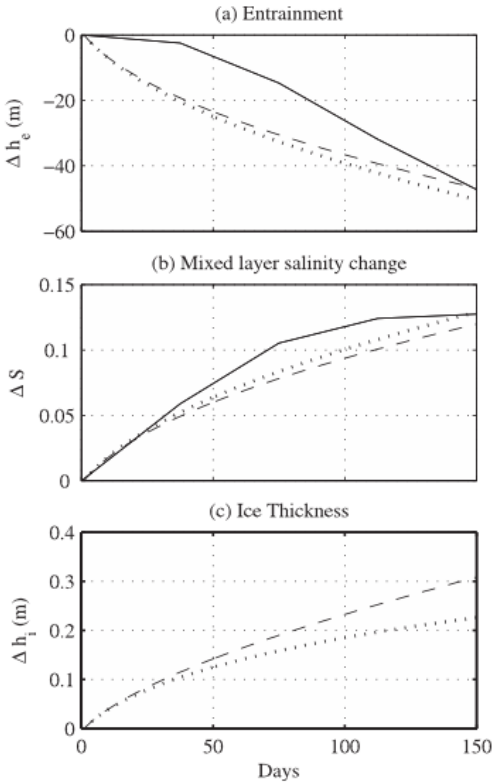
Evolution of mixed layer depth in the Southern Ocean

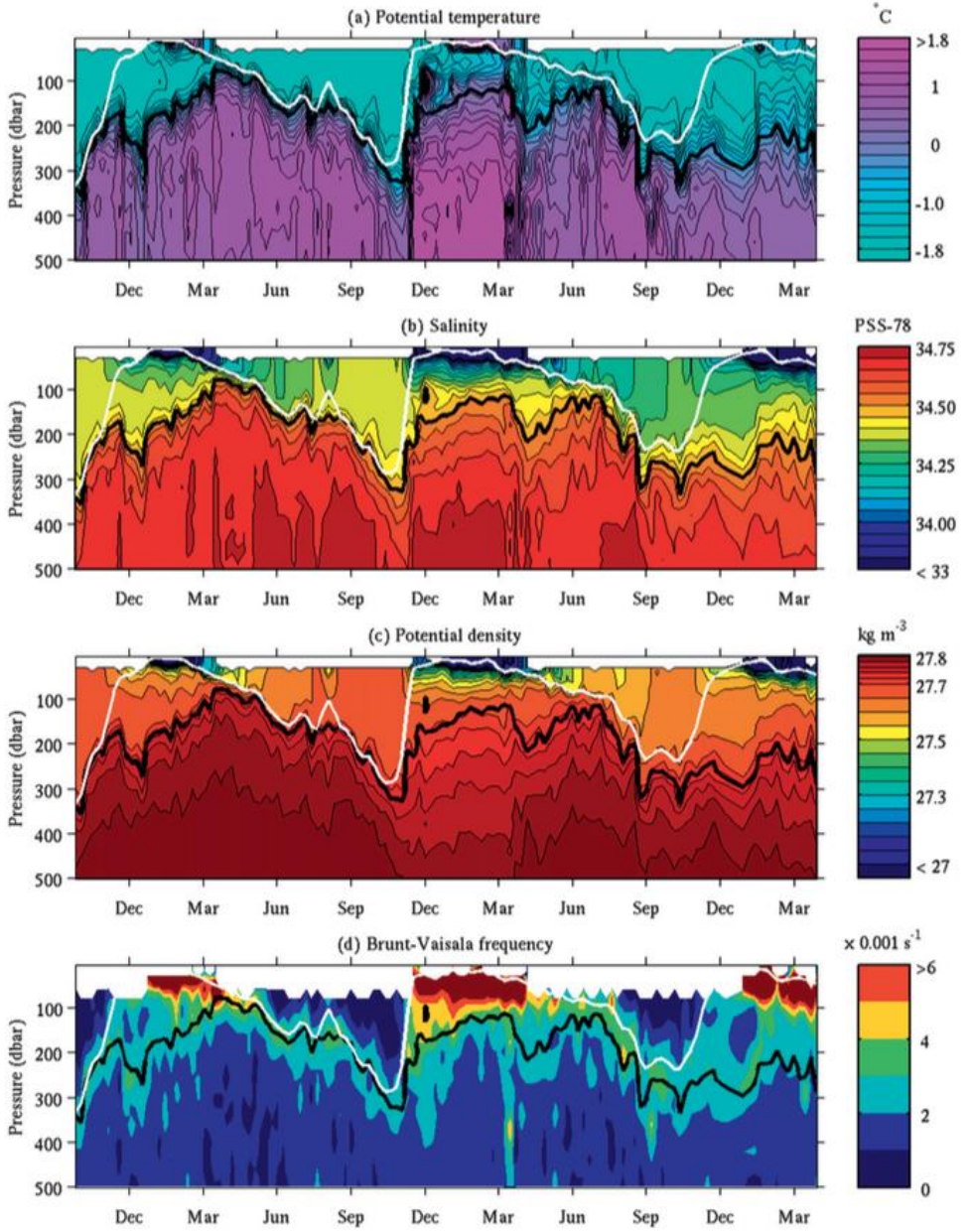


Under-Ice Pilot Studies

Wong and Riser, 2011,







Summary:

- Ice float capability is proven, 80% profiles are contributing to the core array
- Lifetimes of 3-6 years – comparable to regular Argo
- Retention in deployment regions south of 60° S is high
- Cost is the same as a regular float – ISA algorithm is free (RAFOS more expensive + maintain sound source array)

If we had a full strength under-Ice Argo array – what could we expect to know after 10 years?

  - Circumpolar seasonal climatology
  - 1 dimensional budgets of heat content/flux, sea ice production
  - Observations of cross-slope/shelf exchange of warm water onto the continental shelves and distribution of ISW/DSW
  - Year round observations to constrain and validate models

Challenges and Outlook:

- Increasing complexity of float software/new sensors.
- Ice floats in heavy sea ice or on the shelf will likely have higher failure rates.
- Position estimation remains a challenge for under ice profiles but groups are making progress (see Paul Chamberlain's talk on Fri).
- Limited deployment opportunities in polar regions.
- Several major contributors (U.S., Aust., Japan) will see significant declines in deployments due to flat (below inflation) or decreased funding. Growth by Europe and China will not likely compensate for this.
- Deployments are declining
  - 45% of the required number (360 floats).
  - need sustained deployments of ~80 floats per year.
  - require an additional 40-50 floats per year = 800k – 1 million.
- Real potential for the degradation of array densities over the next few years, with the Southern Ocean particularly at risk (despite SOCCOM).