OBSERVING SYSTEM UPDATE: DRAKE PASSAGE

SR1b
LMG
cDrake
SOCCOM

Teresa Chereskin
SAMOC VI
New Orleans 2016
SR1b

- Occupied summer 1993/1994 to 2015/2016, next cruise planned for Jan 2017
- 21 complete T, S sections (plus velocity, underway measurements)

- Data available from BODC, CCHDO
ACC transport through SR1b
- Cunningham et al. (2003), Cunningham et al. (2007)
- Update:
  - Trend in transport not significant
  - PF tending to a more northward position

Heat content and water mass properties on SR1b
- Multiple studies including Naveira Garabato (2009), Jullion et al. (2010), Close et al. (2013), Jullion et al. (2013), Evans et al. (2014)
- Small decreasing trend in deep temperature due to water mass property changes; strong variability associated with movements of ACC fronts (Firing et al., in prep)
Continuous monitoring in Drake Passage

- Bottom pressure recorders at 1000 m on southern and northern continental slopes 1992-present
  - Overlapping 2-year deployments to reduce effect of pressure drift
  - Now outfitted with microcats to measure T,S
  - Additional BPR at 2000 m on north slope since 2012
- Data available from PSMSL

- Multiple studies including Hughes et al. (1999), Hughes et al. (2003), Meredith et al. (2004), Bergmann and Dobslaw (2012), Meijers et al. (in prep)
High-Resolution Underway Air-Sea Observations in Drake Passage for Climate Science

PIs: Teresa Chereskin, Janet Sprintall, Colm Sweeney, Britt Stephens

ARSV L. M. Gould

- all season data
- temperature (XBT/XCTD 1996-present)
  6-7 sections annually
  5-15 km resolution

Other parameters recorded continuously on all crossings (22 sections annually):

- currents (NB150 ADCP, 1999-present; OS38 ADCP, 2004-present)
- ocean carbon (pCO₂, 2002-present)
- atmospheric O₂ and CO₂ (2012-present)

Funded through 2016 by NSF (ANT-1341431) NSF proposals pending to continue through 2019
ADCP backscatter south of the ACC front as a proxy for biomass shows decline and recovery of Antarctic krill.

Pilot program of net sampling across Drake Passage in 2014/2015 (PIs Valerie Loeb and Jarrod Santora).

Continuation to be proposed (April, 2016) to sample 2x/annually, spring and fall.
“cDrake” -- Drake Passage Dynamics and Transport of the ACC

Local dynamics array:
- mesoscale resolution; eddy heat and buoyancy fluxes; momentum and vorticity balance

Transport line:
- 800 km; time-varying structure.

4 years; 12/2007 - 12/2011

co-Pl’s: T. Chereskin, K. Donohue, R. Watts
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Data publicly available at NODC
Lots of work submitted/in progress:

Topographic form stress: Masich et al., JGR, 2015

SSH variability in Drake Passage: Donohue et al., JAOT, accepted 2016

Polar Front structure: Foppert et al., JGR, accepted 2016

Vorticity balance: Firing et al., JGR submitted, 2016


Transport and variability of the ACC.: Donohue et al., in prep.
Specific Objectives

- **Objective 1 - observe:** To develop a new observing system for carbon, nutrients, and oxygen based on ~200 biogeochem floats

- **Objective 2 - model:** To produce an unprecedented 3-dimensional space and time resolved estimate of Southern Ocean biogeochemistry based on SOSE (Southern Ocean State Estimate).
Deep-Sea DuraFET pH sensor (Ion Sensitive FET transistor)

ISUS (or SUNA) optical nitrate sensor

Aanderaa or SBE 63 oxygen optode & WETLabs FLBB or MCOM
Our Year 2 deployments:
- 7 cruises:
  - 2 GO-SHIP (we augment only optical measurements)
  - 5 non GO-SHIP: (we augment some chemistry depending on cruise – oxygen, nutrients, pH, alkalinity, HPLC, POC – a different subset for every cruise)
Map: opportunities identified as of June 2015, and trajectories of floats in June 2015.
Table: in flux, as future year cruise schedules and opportunities are changing.