IMOS Integrated Marine Observing System

Australian Animal Tagging and Monitoring System:

AATAMS phase 2, biologging

'time for us to grow up and share the data'

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MACQUARIE UNIVERSITY

sims sydney institute of marine science

Australian Animal Tagging and Monitoring System - AATAMS is part of Australia's Integrated Marine Observing System - IMOS

Australian Government
Department of Innovation Industry, Science and Research

- IMOS is a National, Collaborative, Research Infrastructure Program
- Joins Australian universities & publicly-funded research agencies in marine and climate science
- It funds them to deploy ocean observing equipment
- **it makes all of the data freely available to the whole community**
  - Ie the data streams are the 'research infrastructure

UTAS

CSIRO

Australian Institute of Marine Science

Australian Government Bureau of Meteorology

Australian Government Department of the Environment, Water, Heritage and the Arts Australian Antarctic Division

SARDI South Australian Research and Development Institute

sims sydney institute of marine science

Curtin University of Technology

James Cook University Australia

Australian Government Geoscience Australia

The University of Western Australia

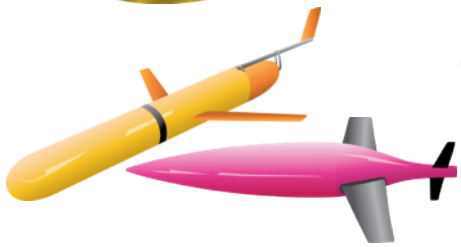
IMOS

Key Features of IMOS

- All data discoverable and accessible, for free
- Integrated from the open ocean, onto the continental shelf and into the coast
- Integrated across physics, chemistry and biology
- Linked to the Global Ocean Observing System
  - key role for Australia in the southern hemisphere
- National mandate
  - engages across Australian marine & climate science
- Funded from equipment purchase to data delivery
  - ‘data access’ vs ‘bricks and mortar’ view of infrastructure

IMOS

11 IMOS Facilities



1. Argo Floats
   - autonomous profiling floats-to 2000m
2. Ships of Opportunity
   - repeat underway observing on volunteer ships
   - physical, chemical and biological observations
3. Deepwater Moorings
   - existing: Southern Ocean Time Series (47^0S)
   - planned: Antarctic Coast (Adelie), Indonesian Through Flow, East Australian Current (26^0S)
4. Ocean Gliders
   - coastal and open ocean

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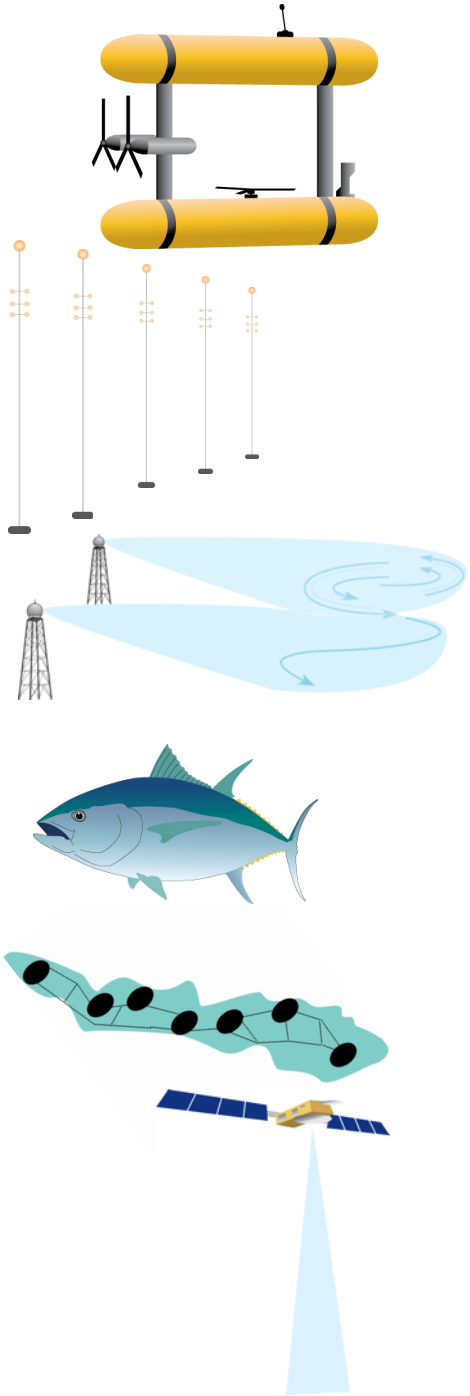
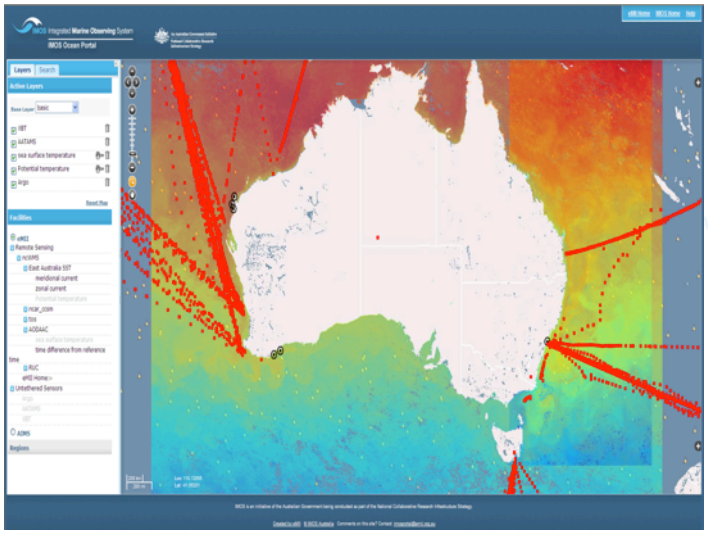
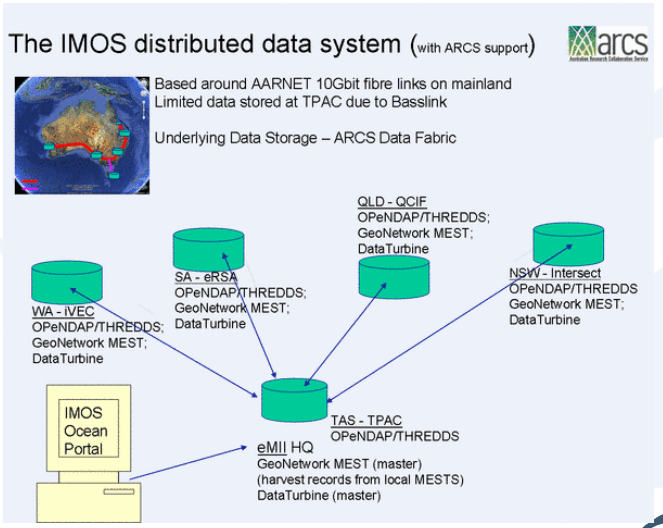


5. Autonomous Underwater Vehicle
   - benthic surveys
6. National Mooring Network
   - National Reference Stations (nine)
   - shelf moorings and arrays
7. Ocean Radar
   - phased array and direction finding
8. *Animal Tagging and Monitoring
   - Acoustic curtains and biologgers
9. Wireless Sensor Networks
   - Great Barrier Reef
10. Satellite Remote Sensing
    - SST, altimetry and ocean colour

11. electronic Marine Information Infrastructure (eMII)

- Facility responsible for creating and developing the information infrastructure
  - to make all data discoverable and accessible
  - via the IMOS Ocean Portal http://imos.aodn.org.au/webportal/
- Now creating *Australian Ocean Data Network* (AODN)
  - providing access to IMOS and non-IMOS data
    - '*publicly-funded data, publicly available*'





Has Australian biologging benefited from accepting the Oceanographer's mantra

'*publicly-funded data, publicly available*'

ie by

'sharing the data, share in the benefit'

National science plan has set priorities for ocean observing

Five major research themes:

1. *Multi-decadal ocean change
2. Climate variability and weather extremes
3. Major boundary currents and interbasin flows
4. *Continental shelf processes
5. *Ecosystem responses - productivity, abundance and distribution

* biologgers part of the grand scheme

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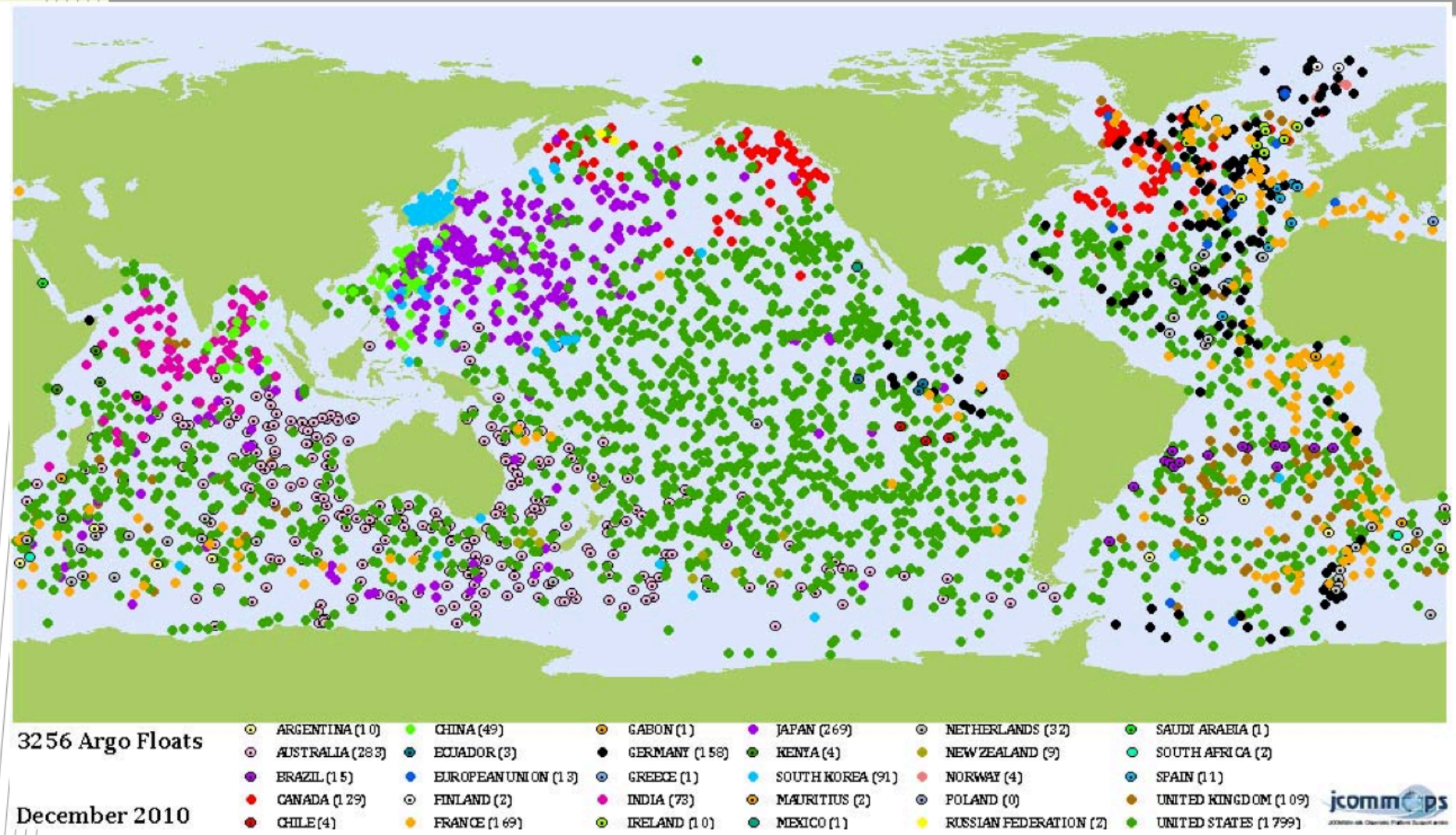
National science priorities:

TRACKING MULTIDECADAL OCEAN CHANGE

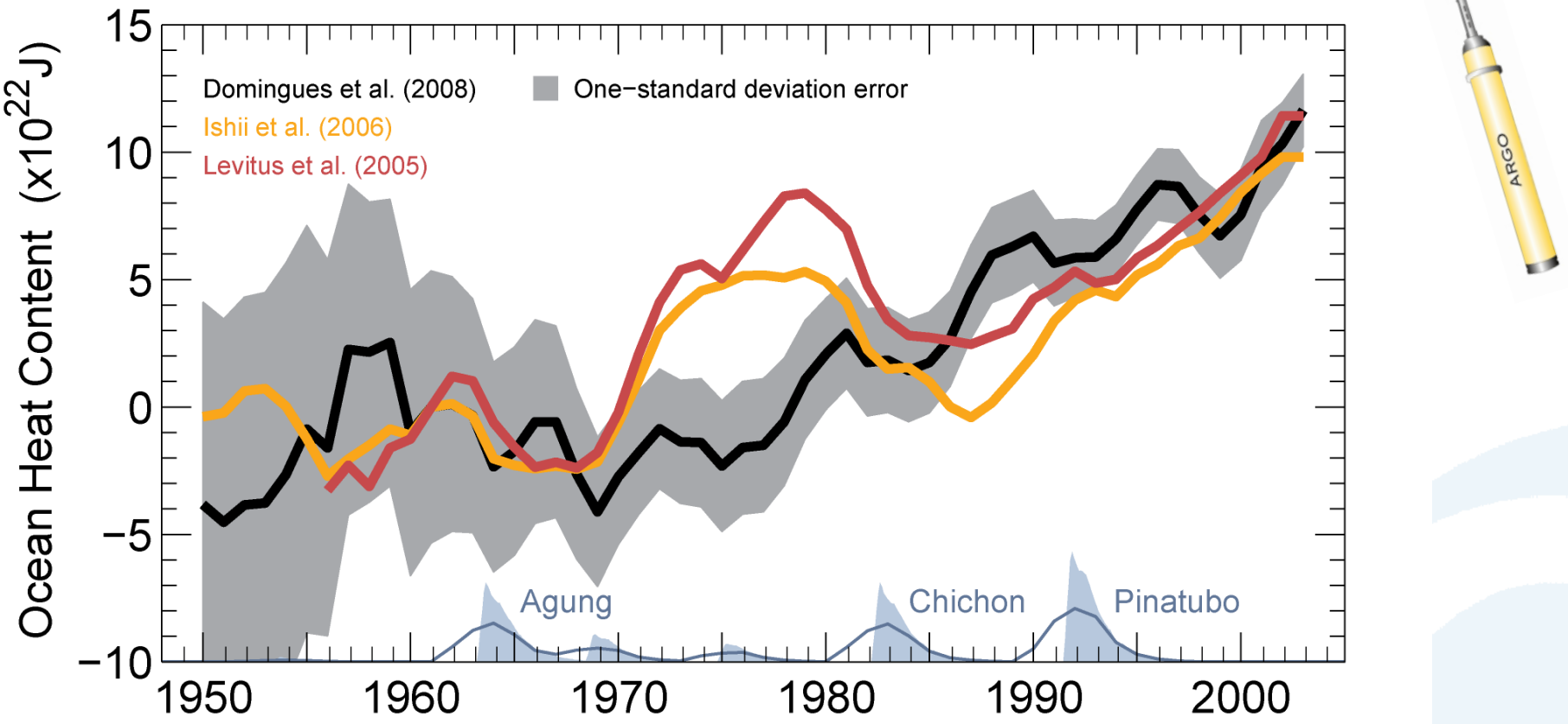
ARGO floats: sustaining established time series

Australia: 283 operating platforms in December 9%



CSIRO

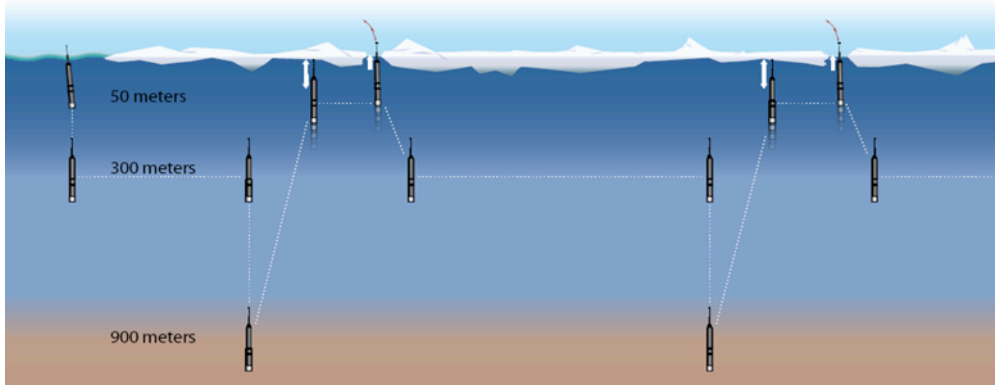
…for tracking Multi-decadal Ocean Changes



From: Catia Domingues and Susan Wijffels (Domingues et al., 2008)

IMOS

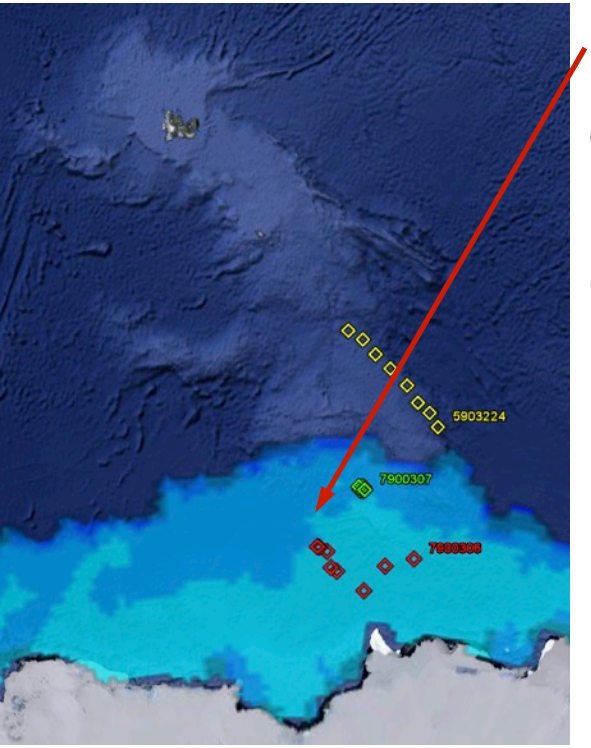
Expanding to high latitudes: Argo Under Ice.



Use ice avoidance algorithms.

Challenges:

- Limited deployment opportunities
- Exact position of under ice profiles not known:

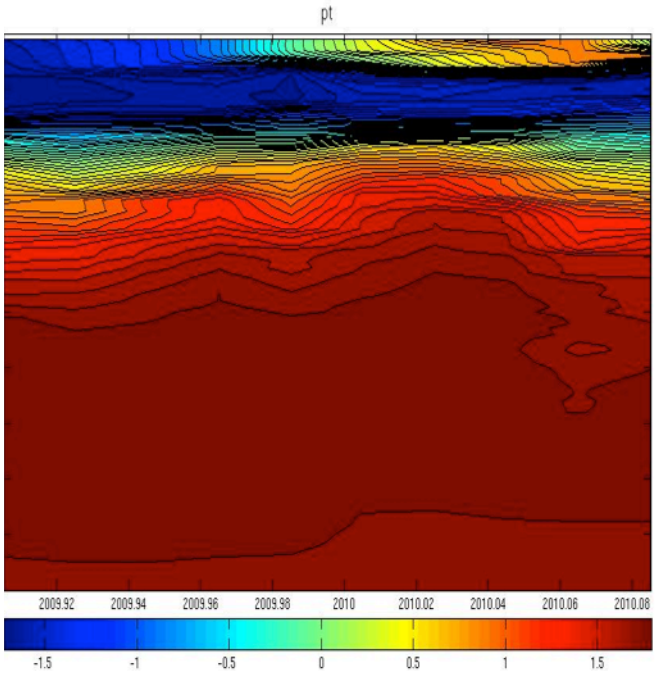


Float 7900306

deployed 26/11/2009, drifting eastward

8 profiles in Princess Elizabeth Trough

1st profile was completed under ice, stored and transmitted with the second profile

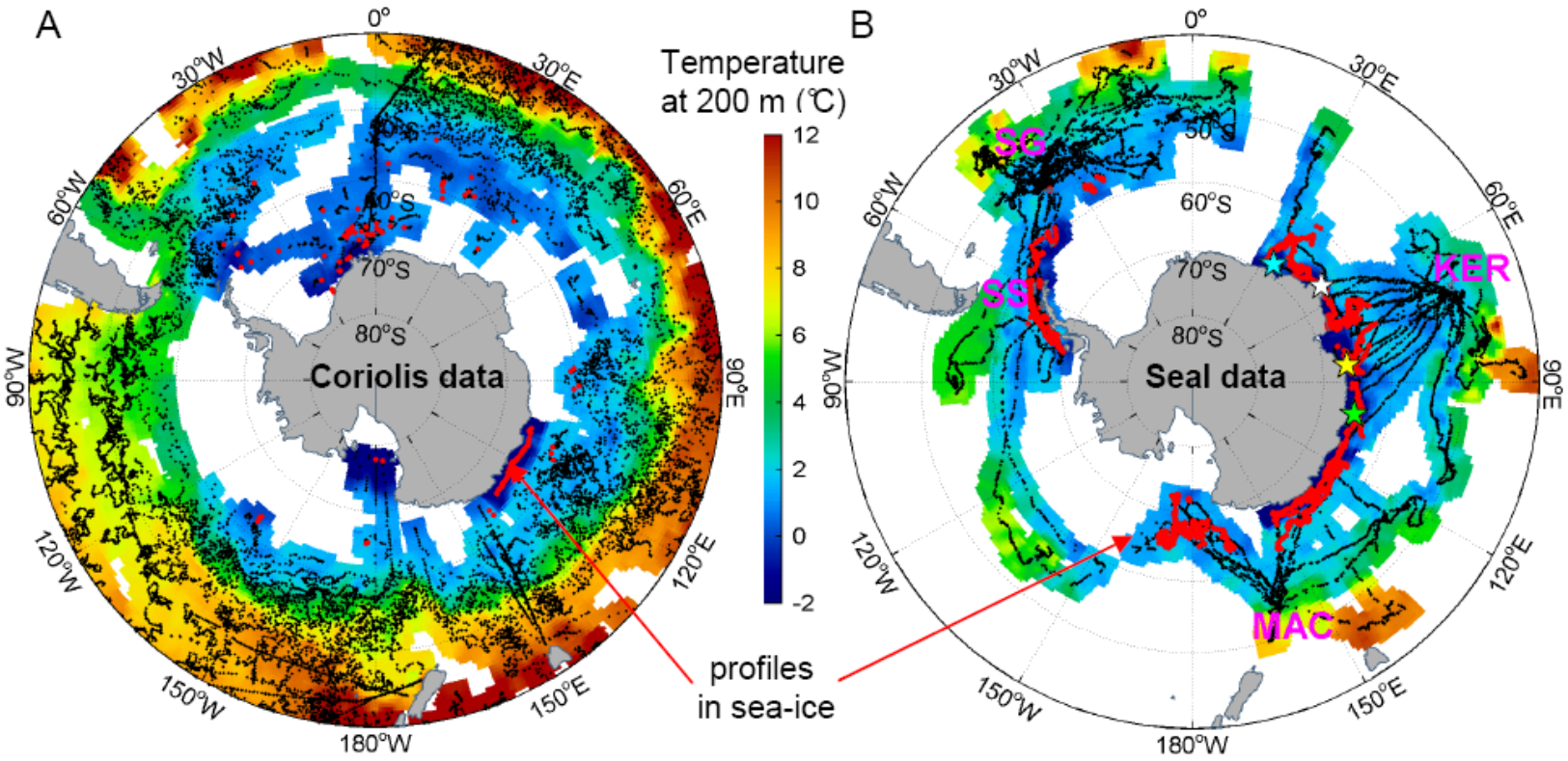


From: Susan Wijffels

IMOS

Case put to IMOS: immense potential for sustained obs using CTD Tags on seals Multi-decadal change?

- Mapping under the sea ice to complement Argo

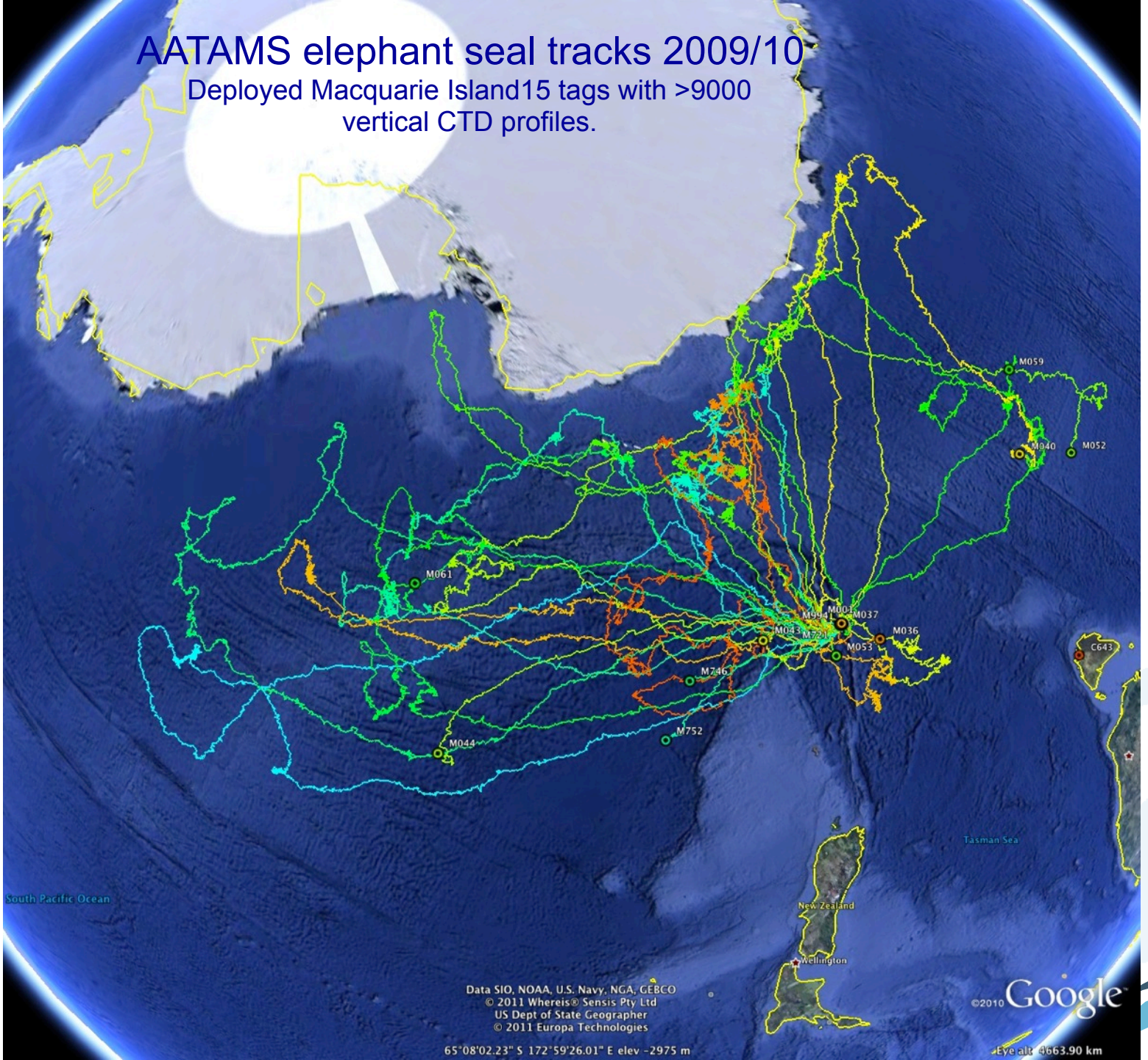


Charassin et al., PNAS, 2008

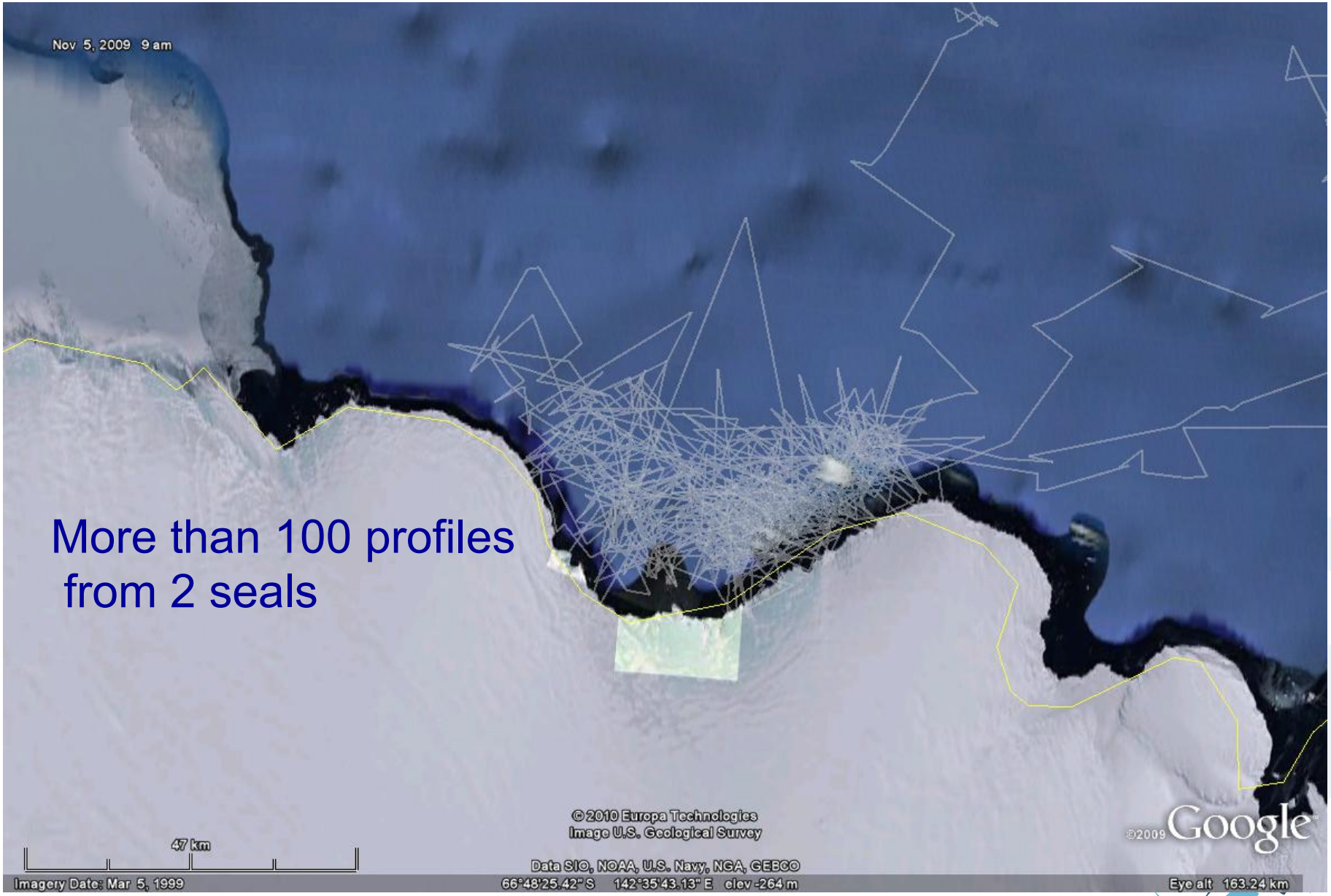
From Steve Rintoul (CSIRO)

AATAMS elephant seal tracks 2009/10

Deployed Macquarie Island15 tags with >9000 vertical CTD profiles.



Tracks 2009/10 Commonwealth Bay

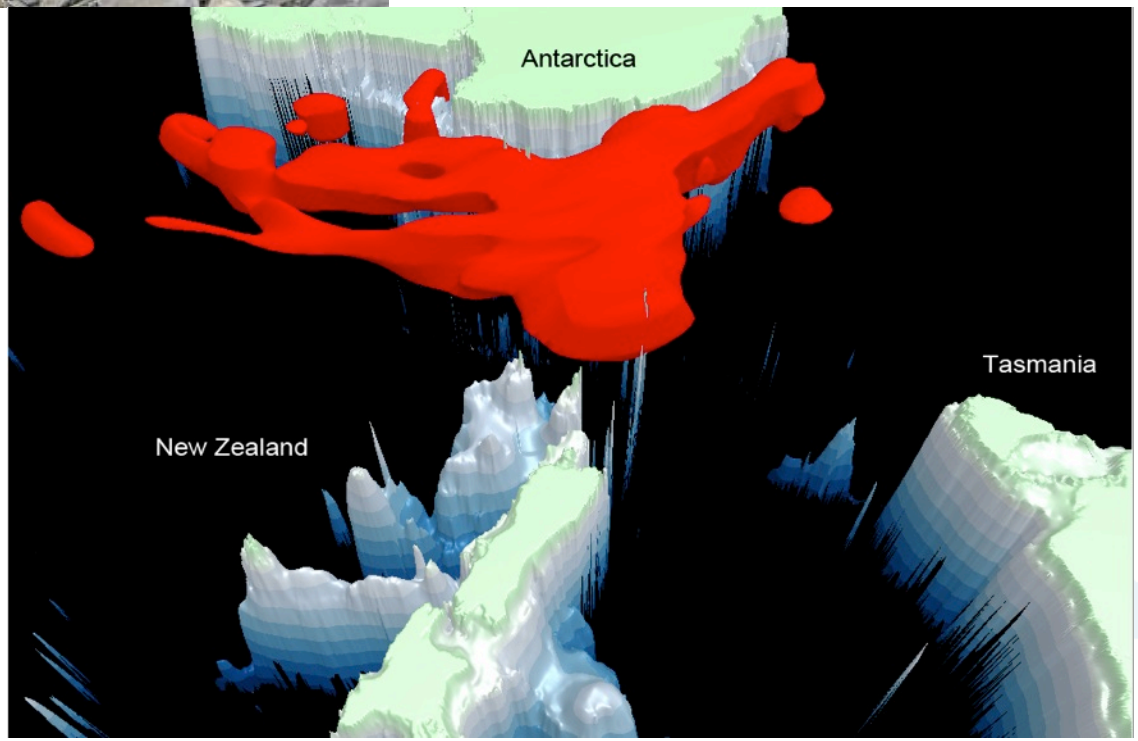


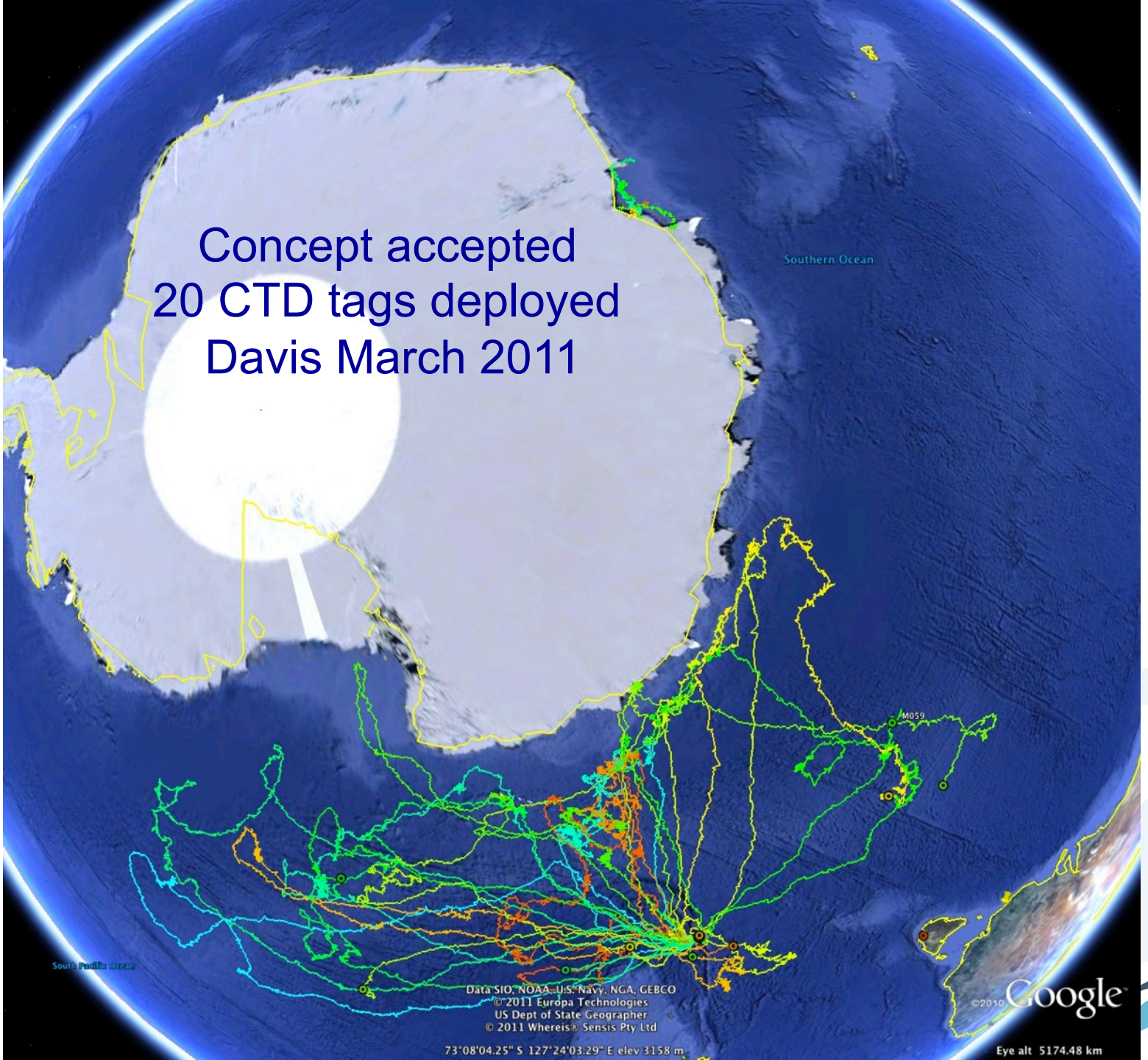
IMOS

Multi-decadal change from sustained obs using seal CTDs?

Outputs- interdisciplinary research eg

Williams, G. D., Hindell, M., Houssais, M.-N., Tamura, T, and Field I. C. 2010. Upper ocean stratification and sea ice growth rates during the summer-fall transition, as revealed by Elephant seal foraging in the Adélie Depression, East Antarctica *Ocean Sci. Discuss.*, 7, 1913-1951



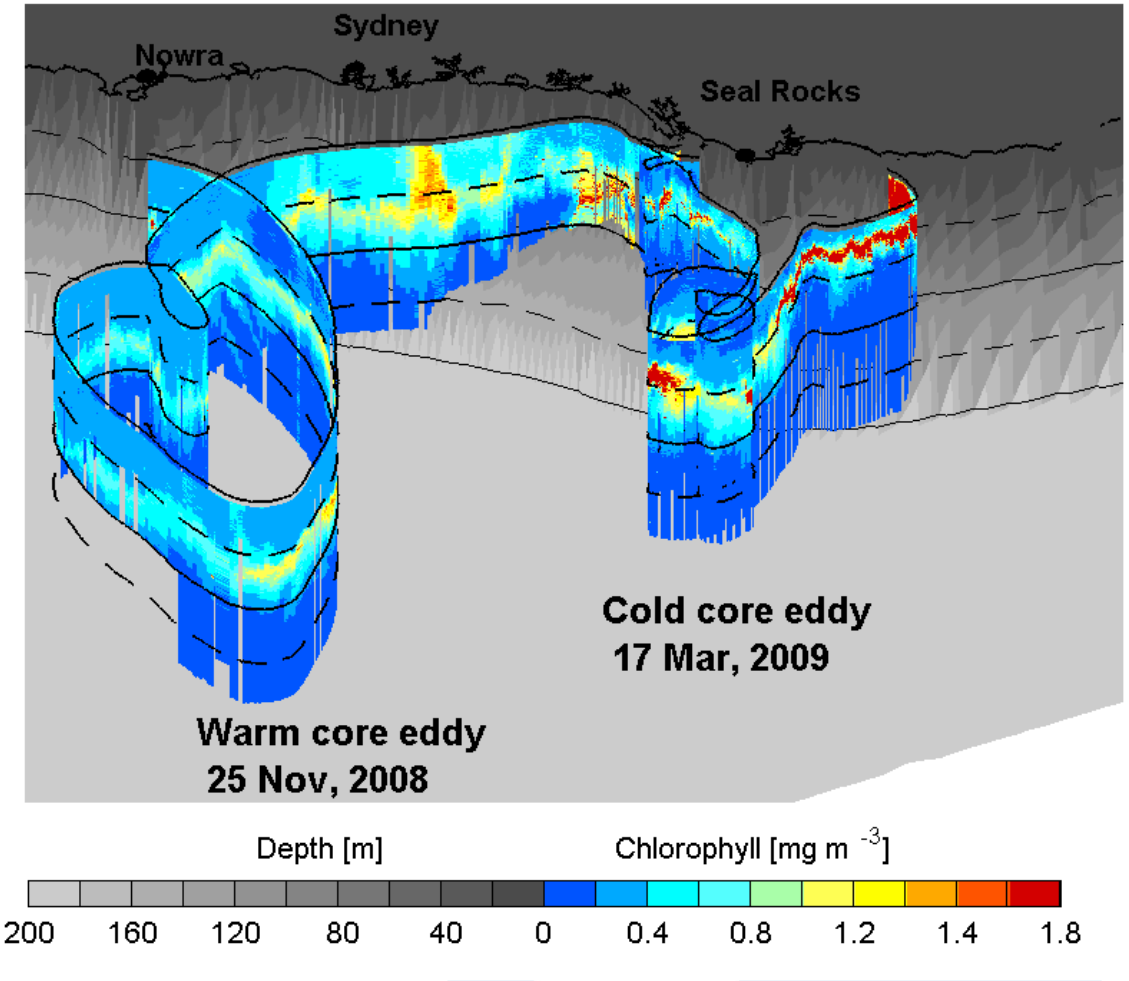

Concept accepted
20 CTD tags deployed
Davis March 2011
Southern Ocean
M059
South Pacific Ocean
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2011 Europa Technologies
US Dept of State Geographer
© 2011 Whereis® Sensis Pty Ltd
73°08'04.25" S 127°24'03.29" E elev 3158 m
©2010 Google
Eye alt 5174.48 km

National Science Priorities

CONTINENTAL SHELF PROCESSES

Biophysical integration: Ocean Gliders for monitoring eddy biophysical processes

- East Australian Current (EAC) dominated by Eddies, and therefore a challenge to observe.
- Chlorophyll concentration along the path of two gliders in the mesoscale eddy field off NSW.
- Both show a sub-surface chl maximum within the eddy and elevated surface chl on the shelf and shelf break.
- The sub-surface chl associated with the cold core is a factor of 2 higher than the warm-core

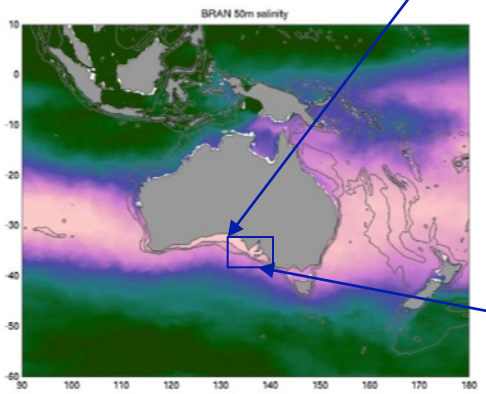


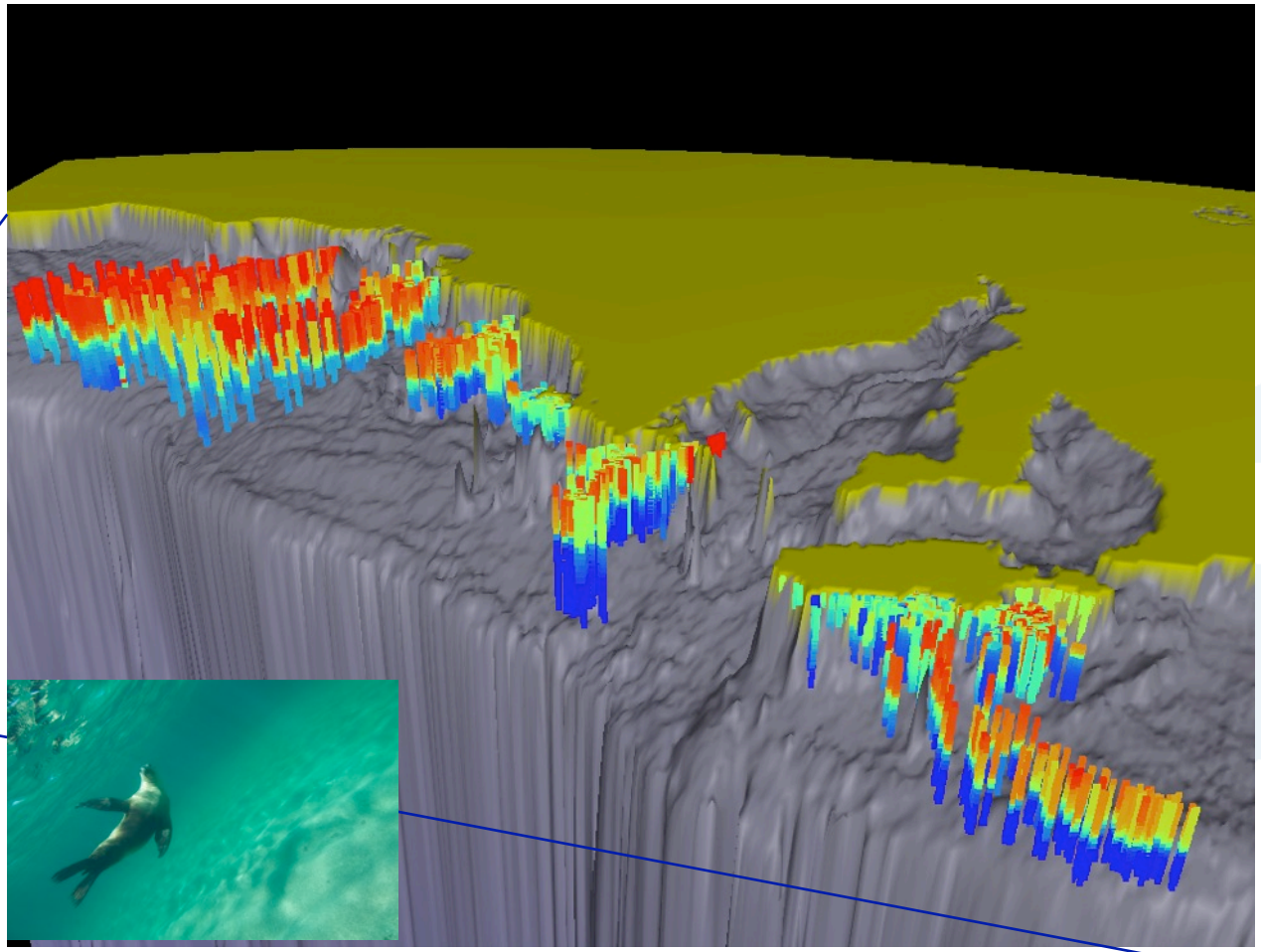
From Iain Suthers and Mark Baird (UNSW)

IMOS

Biologging and monitoring biophysical processes- male Australian sea lions

- 7 tags deployed on Australian sea lions produced cross-shelf transects with over 7000 vertical CTD Profiles November 2009 - May 2010
- 5 new deployments underway in Jan 2011





CI Simon Goldsworthy (SARDI)

National Science Priorities

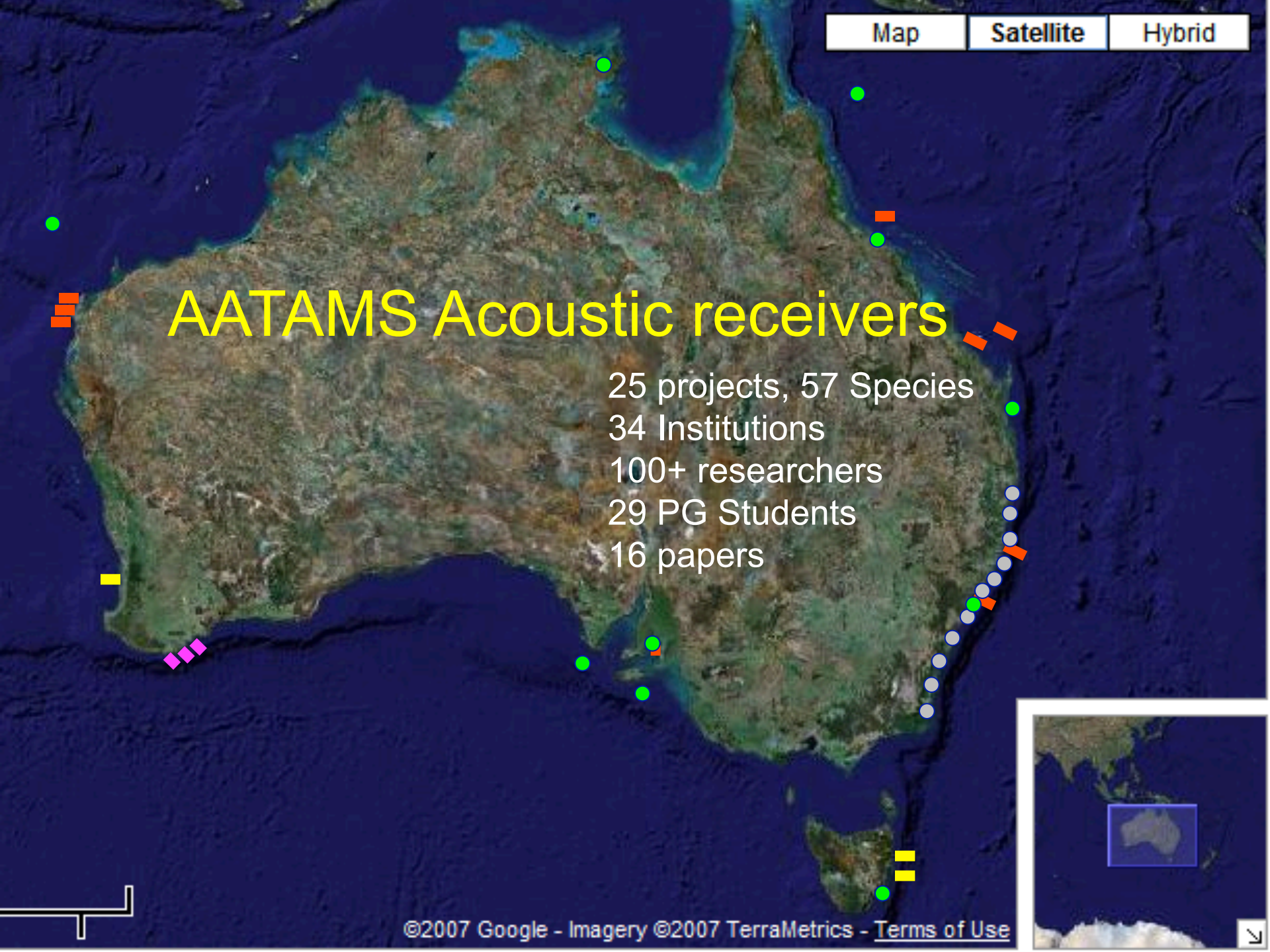
BIOLOGICAL RESPONSES

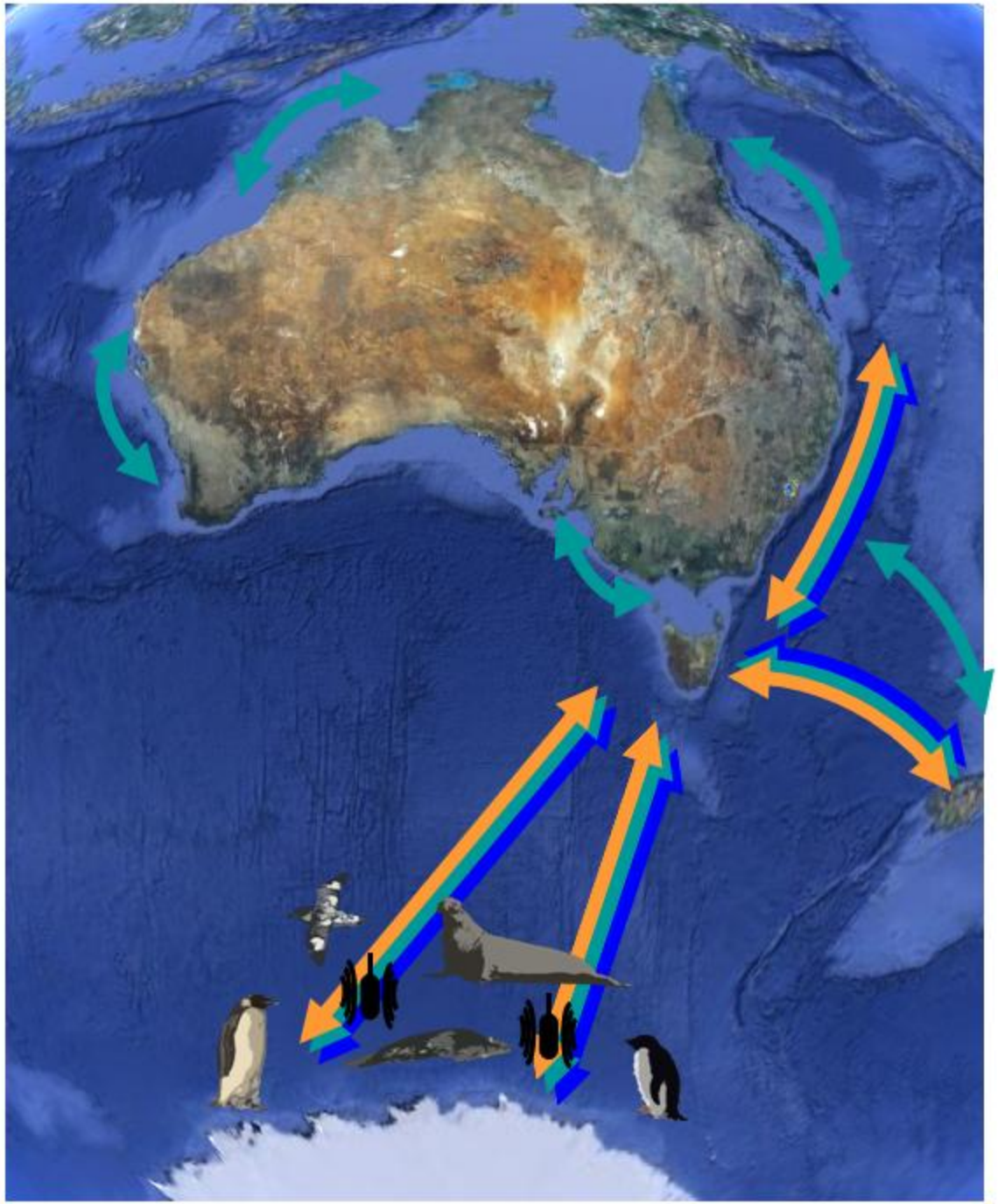
AATAMS1

Develop a national network for detecting changes in migratory movements and distribution of marine life by:

- Forming a national network of acoustic tracking researchers -nationally coordinated acoustic tag codes and data retrieval;
- Deploying and maintaining acoustic curtains or arrays
- Providing a pool of acoustic receivers to Australian research community
- Organising acoustic telemetry workshops
- Freely supply quality data via eMII

BUT- 3.5% of IMOS1


Map
Satellite
Hybrid
AATAMS Acoustic receivers
25 projects, 57 Species
34 Institutions
100+ researchers
29 PG Students
16 papers
©2007 Google - Imagery ©2007 TerraMetrics - Terms of Use



Enhanced Ecosystem Observations

Lower trophic levels

- Ocean and nutrients

- CRP

- Bio acoustics

Higher trophic levels

- SOSS

- MAPSO

- Passive Acoustics

IMOS-Apex predators and Areas of Ecological Significance

- Marine apex predators are sensitive to changes in the distribution and abundance of their prey, which in turn respond to changes in lower trophic levels and the physical environment.
- Pelagic apex predators forage in areas of relatively high food availability -areas of ecological significance (AES)
- Observing AESs provides information on the spatial and temporal variability of their prey and the influence of mesoscale features such as fronts and eddies
- Apex predators sensitive indicators of climatic perturbations in the Southern Ocean

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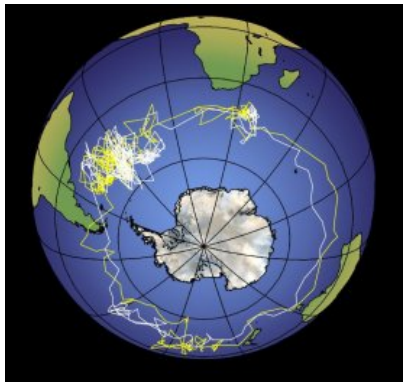
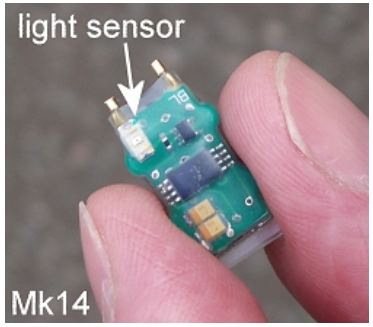
AATAMS 2-Monitoring Apex Predators of the Southern Ocean



Data loggers* or PTTs
- Temperature and
- Geo-location



	•2010/2011		
Species	*Davis*	*Casey*	*Mawson*
Southern Elephant seal	*10 (15)*	*15 (0)*	
Weddell Seal	*10 (20)*	*10 (0)*	
*Adelie Penguin**			*30 (0)*
Emperor Penguin	*12*		
*Snow Petrel**	50 (10 + 10)	50 (0)	25 (14 + 10)
*Cape Petrel**			
*Antarctic Petrel**			
*Antarctic Fulmar**			
*Short-tailed shearwater**	*40 (40- 22 now retrieved)*		
Total	*100 / 32*	*50/25*	*55*

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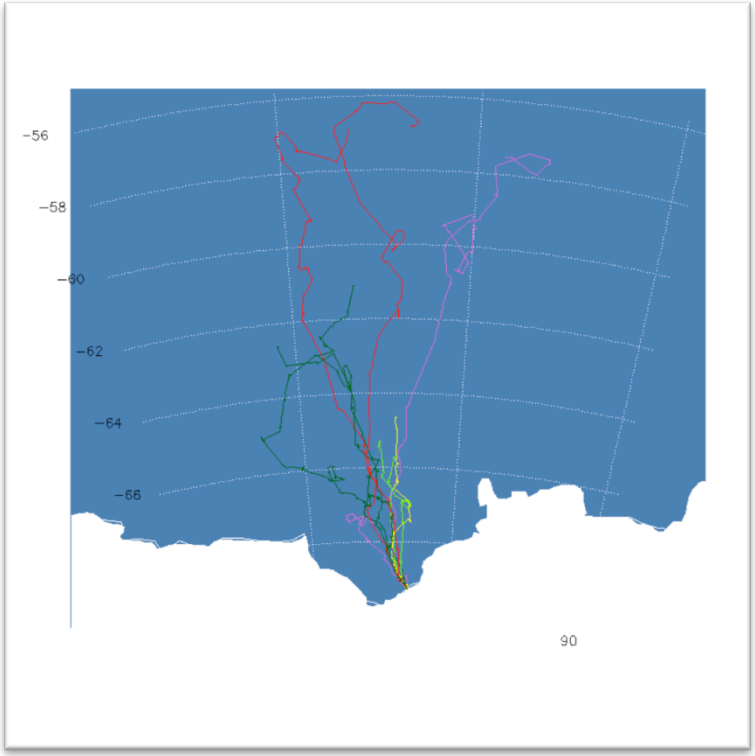
Monitoring Apex Predators of the Southern Ocean



Emporer tracks 2010/11

	•2011/2012		
Species	*Davis*	*Casey*	*Mawson*
Southern Elephant seal	*10*	*15*	
Weddell Seal	*10*	*10*	
*Adelie Penguin**	*50*	*50*	*50*
Emperor Penguin		*12*	12
*Snow Petrel**	50	50	50
*Cape Petrel**	50		
*Antarctic Petrel**	50	50	50
*Antarctic Fulmar**	50		
*Short-tailed shearwater**	*50*		
Total	*300/20*	*150/37*	*150/12*

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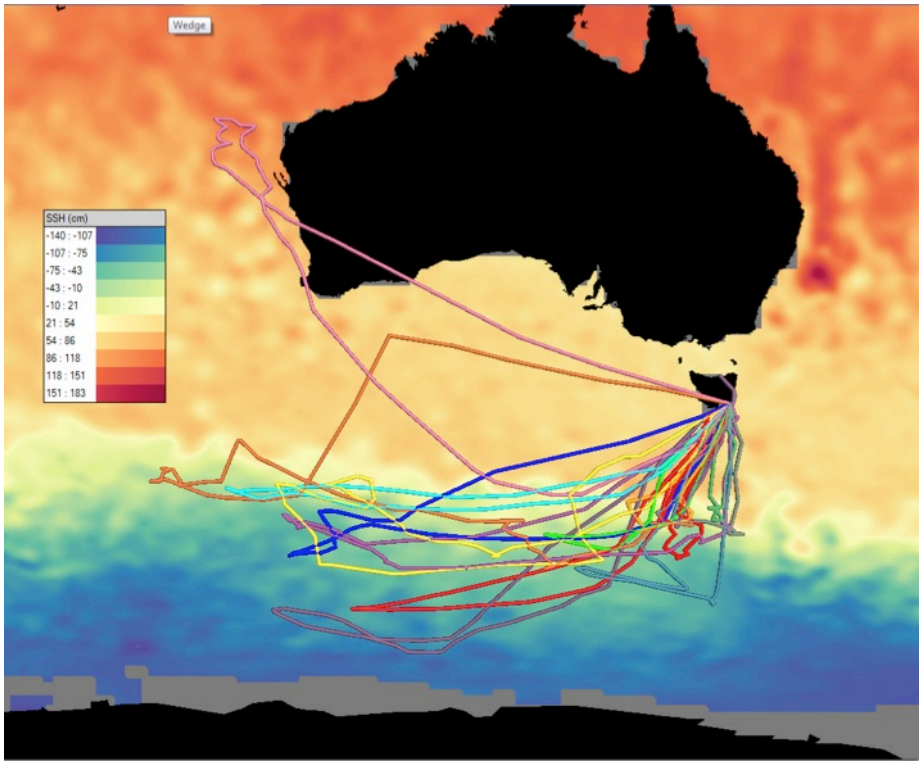
Monitoring Apex Predators of the Southern Ocean

- 12 SRDLs deployed on Emporer penguins, Jan 2011
- **50 geolocators deployed on short-tailed shearwaters, 35 retrieved downloaded and 22 redeployed**
- 24 geolocators deployed on snow petrels



Individual STSW pre-breeding migrations from the Wedge Island colony. Jaimie Cleeland (dev from SSH)

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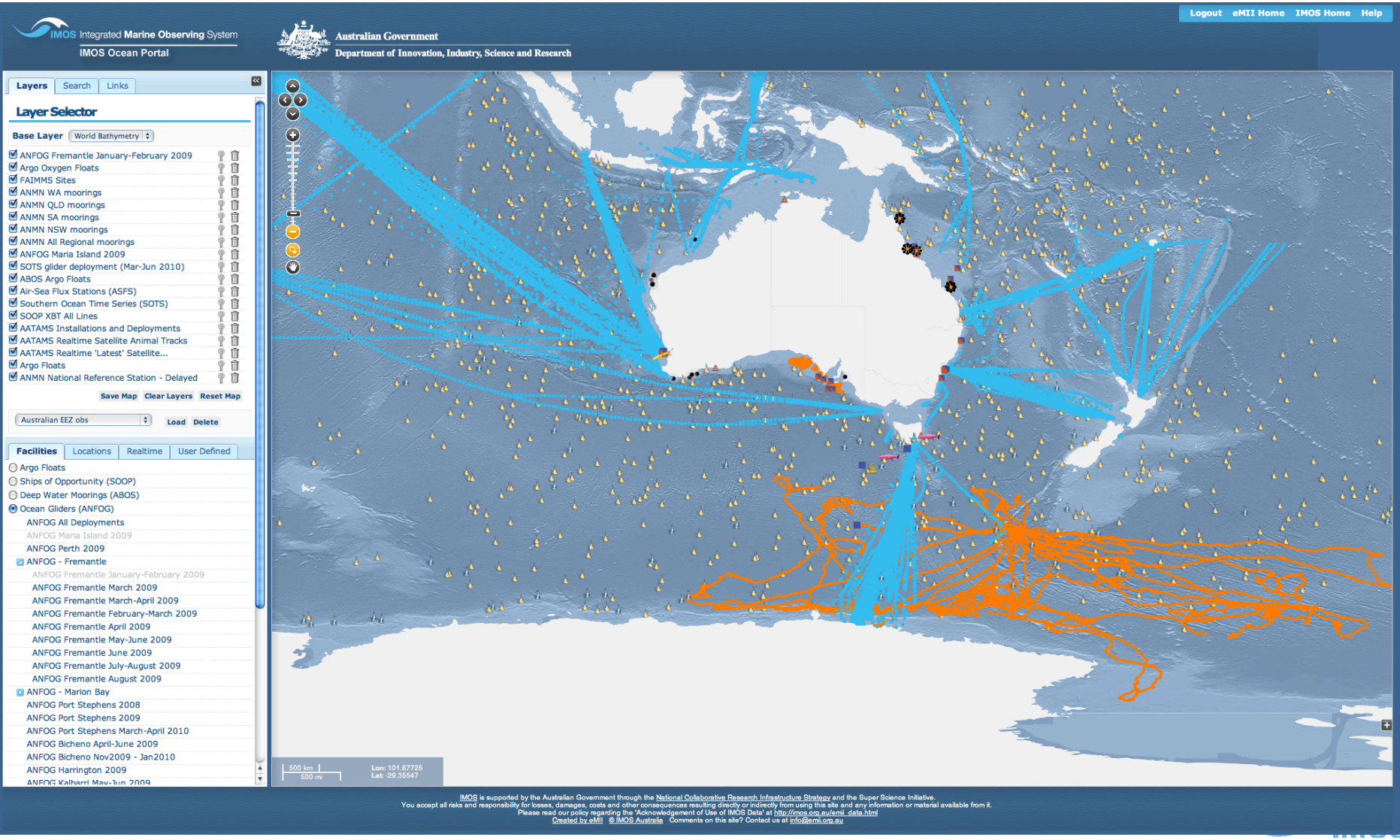
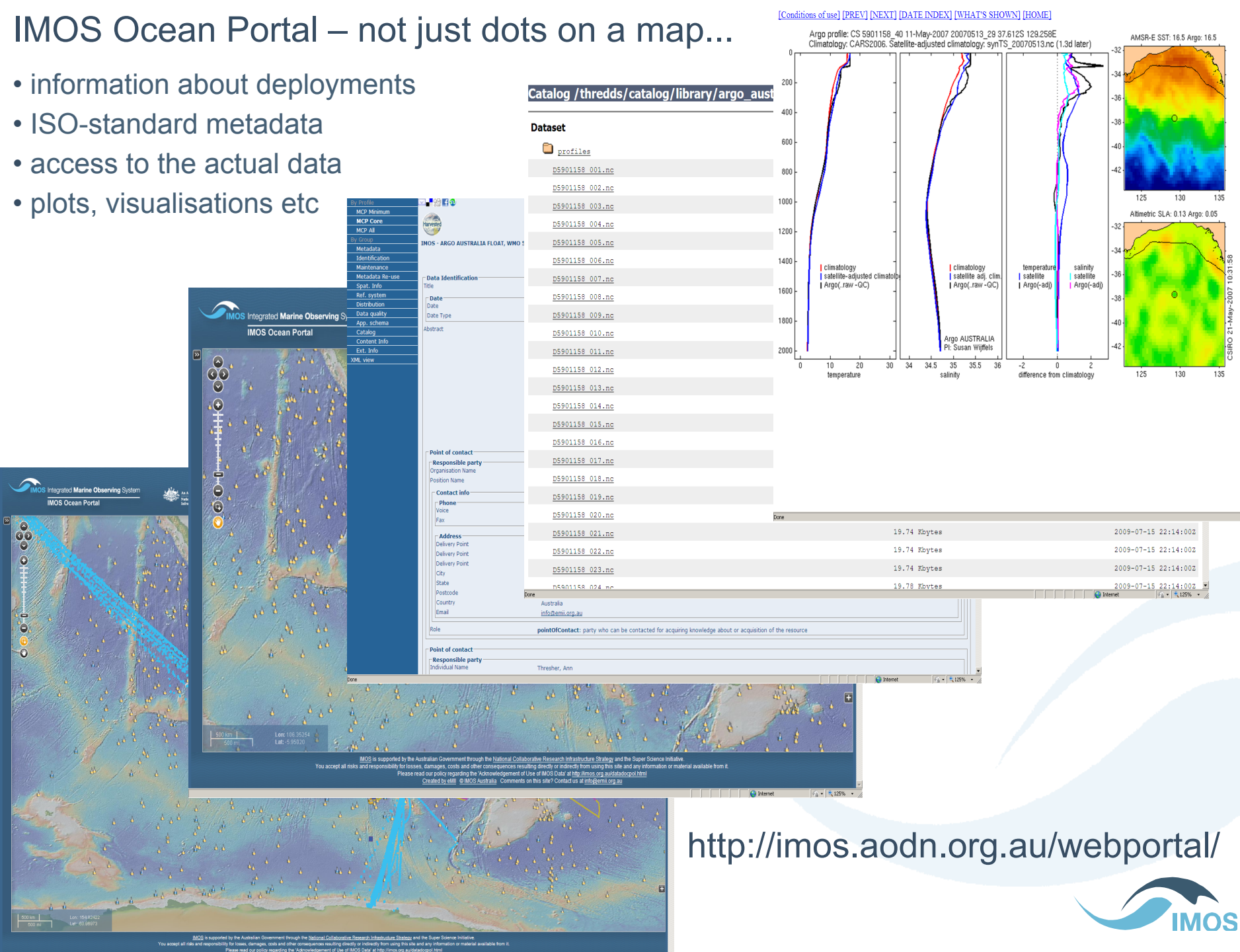
IMOS Portal- current deployments- strategic directions



IMOS Ocean Portal – not just dots on a map...

- information about deployments
- ISO-standard metadata
- access to the actual data
- plots, visualisations etc



The challenge:

Public data **is** public data

1) All IMOS data is available to anyone to use- this includes our close colleagues and those we are less close to…

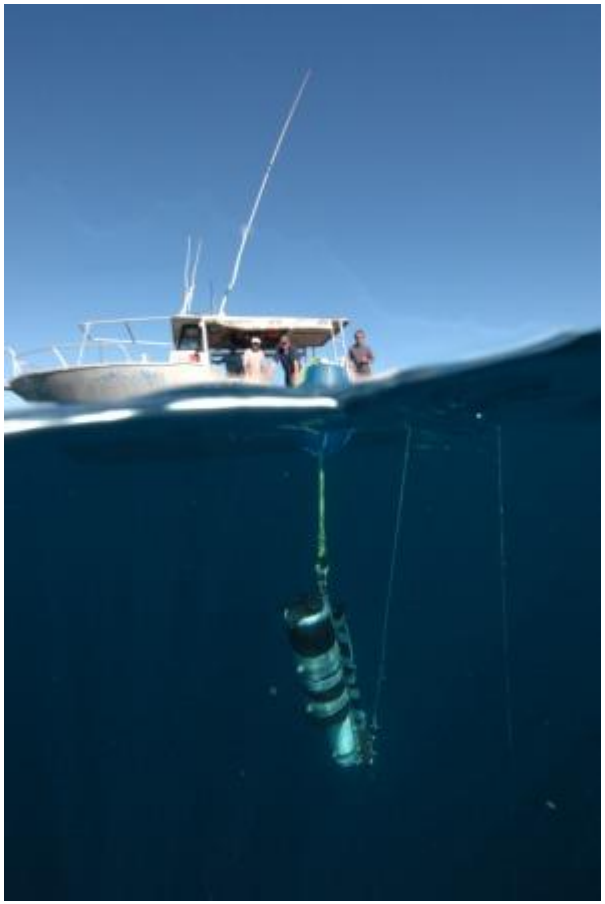
BUT

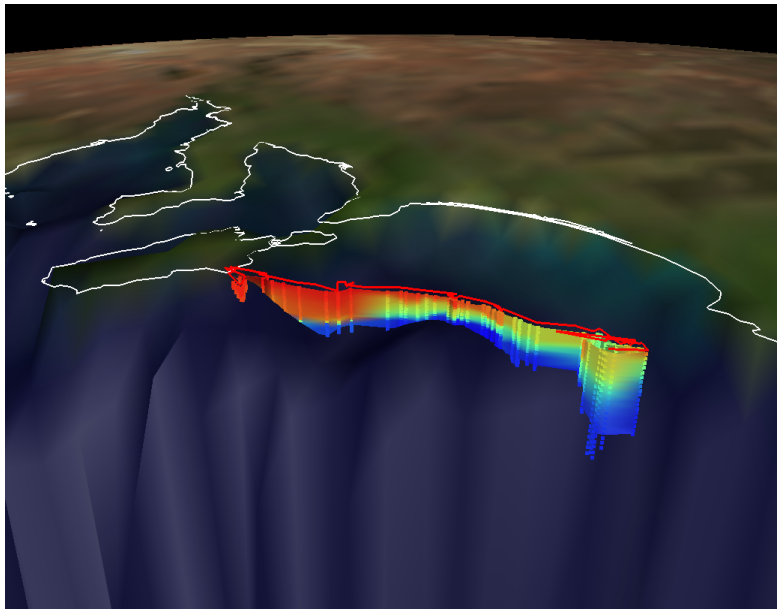
2) The net benefit to the community of sharing data is a demonstrable enhancement. IMOS has injected $102M into Australian marine observing, with co-investment this reaches $224M- the oceanographic community has embraced this and benefited from the lions share

We are starting to follow their lead, but with only 7% of the budget to date, we can only be advantaged by embracing that challenge….

SOOS…..

Questions?





IMOS Integrated **Marine Observing** System

Acknowledgments

- AATAMS Scientific Committee

- robert.harcourt@mq.edu.au

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An Australian Government Initiative

National Collaborative Research Infrastructure Strategy