

Listen to the ocean

Bio-Argo: a new frontier for understanding ocean biology and biogeochemistry

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**National Centre for
Earth Observation**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Acknowledgements

J. Turton: UK MetOffice

C. Ellis-Evans: NERC Arctic RP

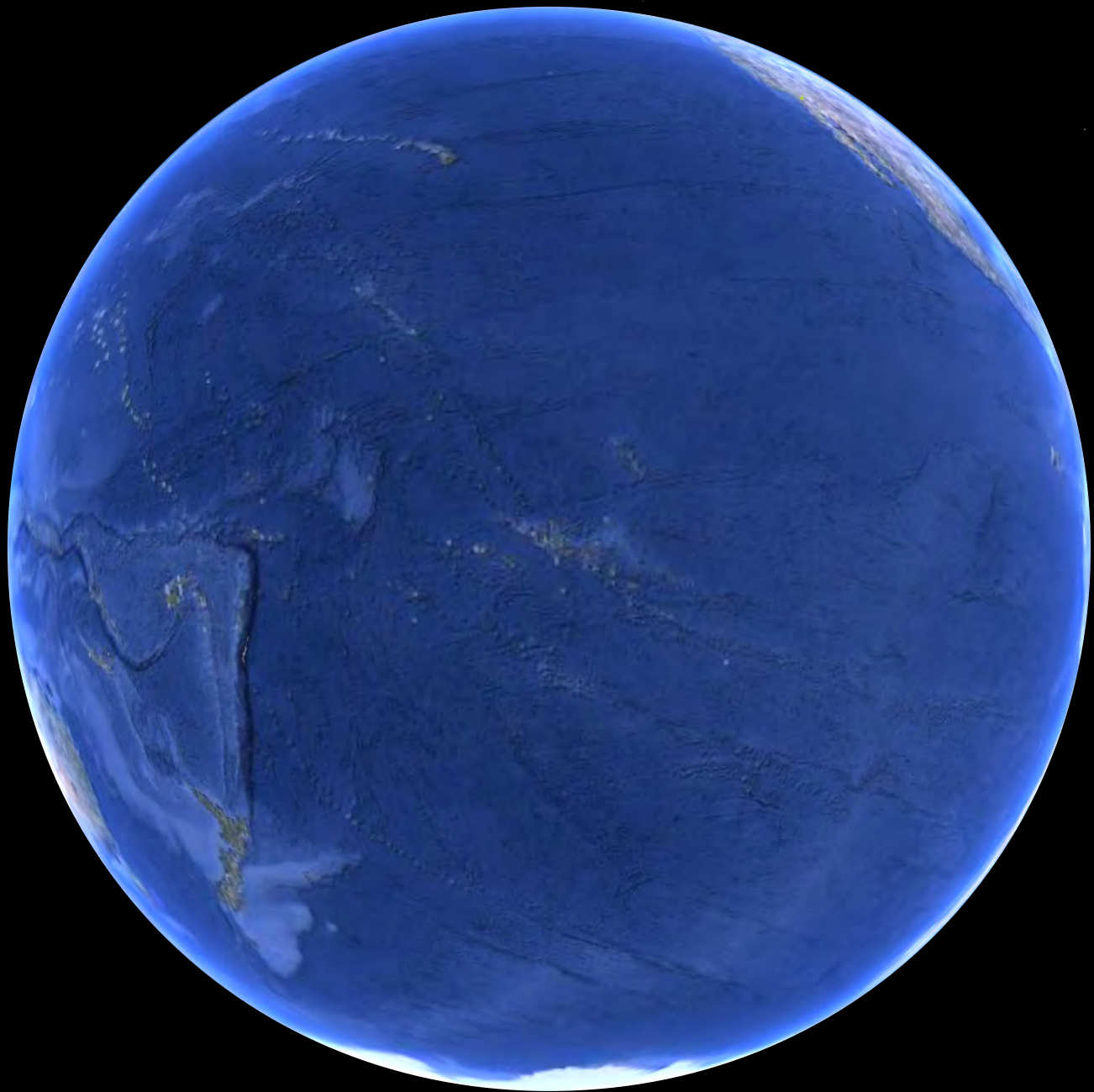
J. Buck: BODC

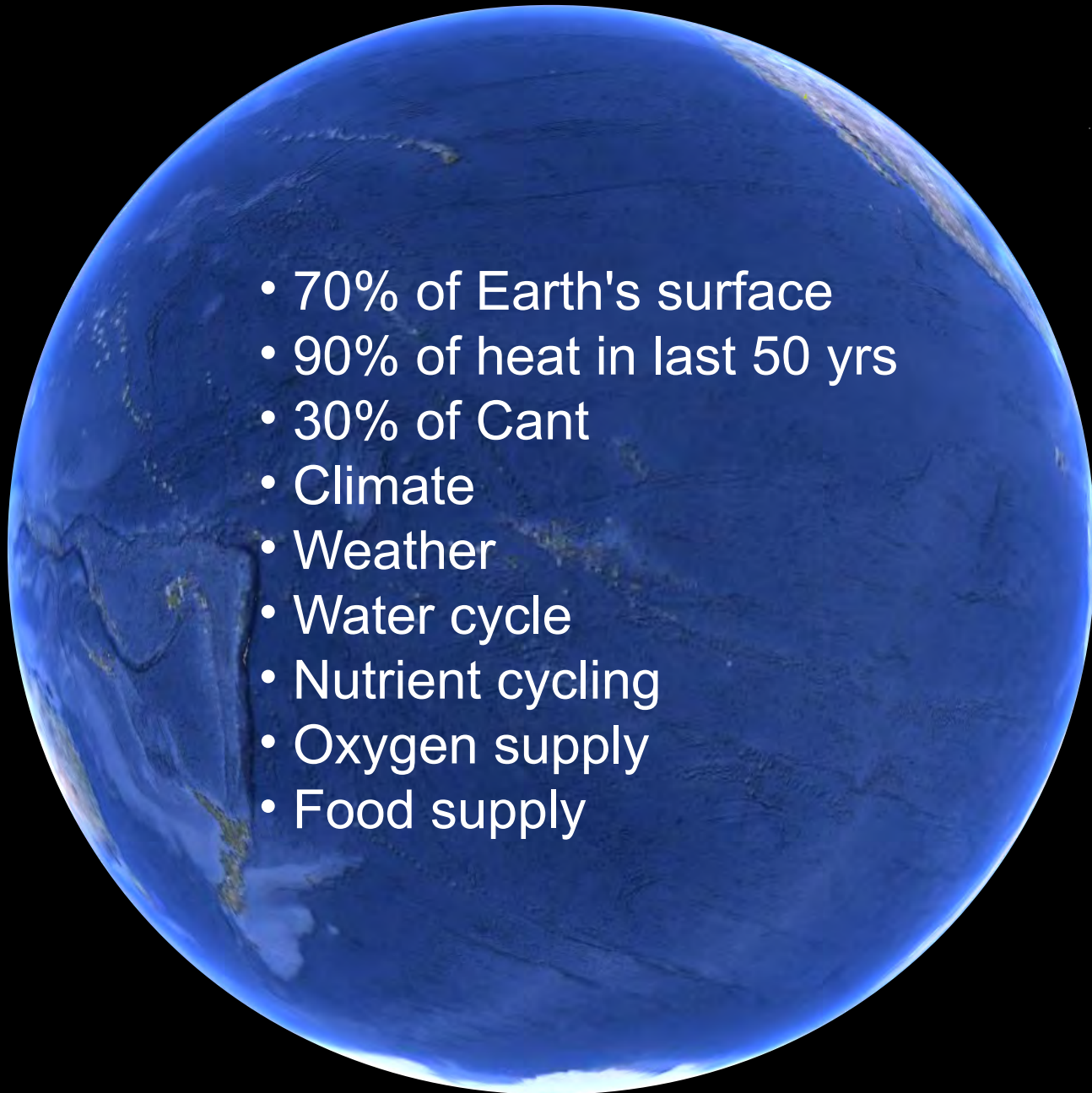
B. King: NOC-S

H. Claustre: LOV, France

E. Boss: U. Maine, USA

Ocean: why care?



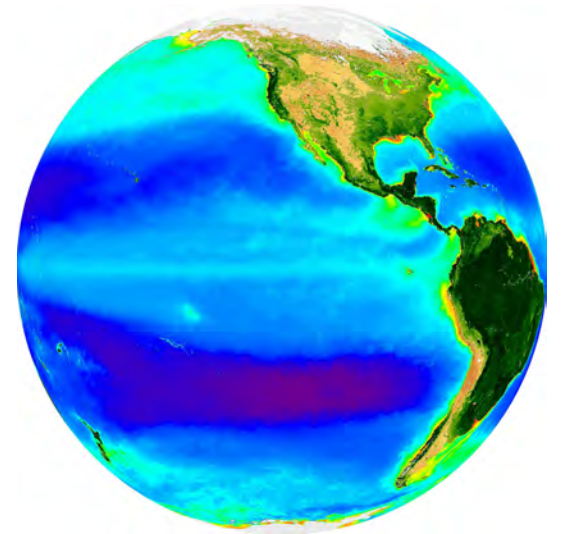
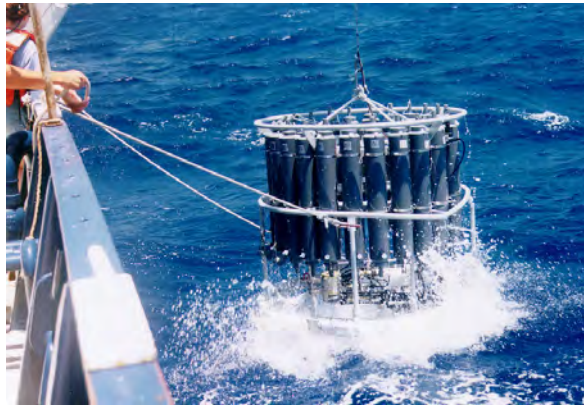


- 70% of Earth's surface
- 90% of heat in last 50 yrs
- 30% of Cant
- Climate
- Weather
- Water cycle
- Nutrient cycling
- Oxygen supply
- Food supply

Ocean observations

Current observations are limited

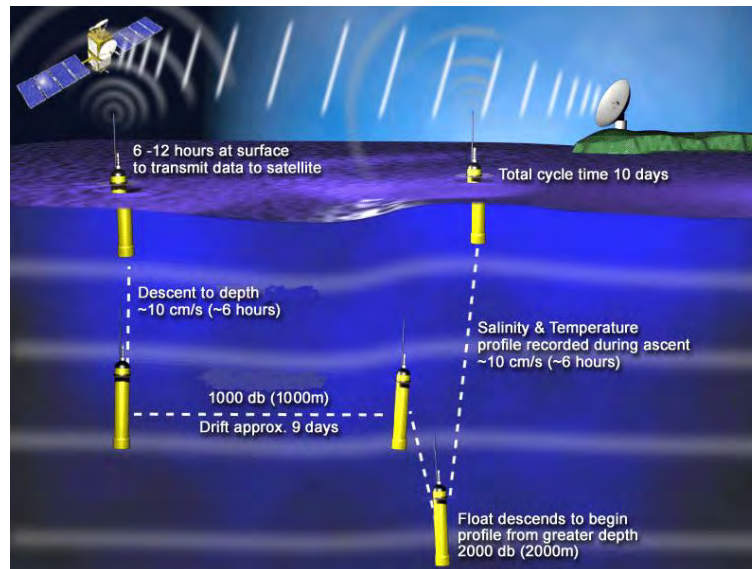
- Ship-based: limited in space and time
- Satellites: few variables, only surface



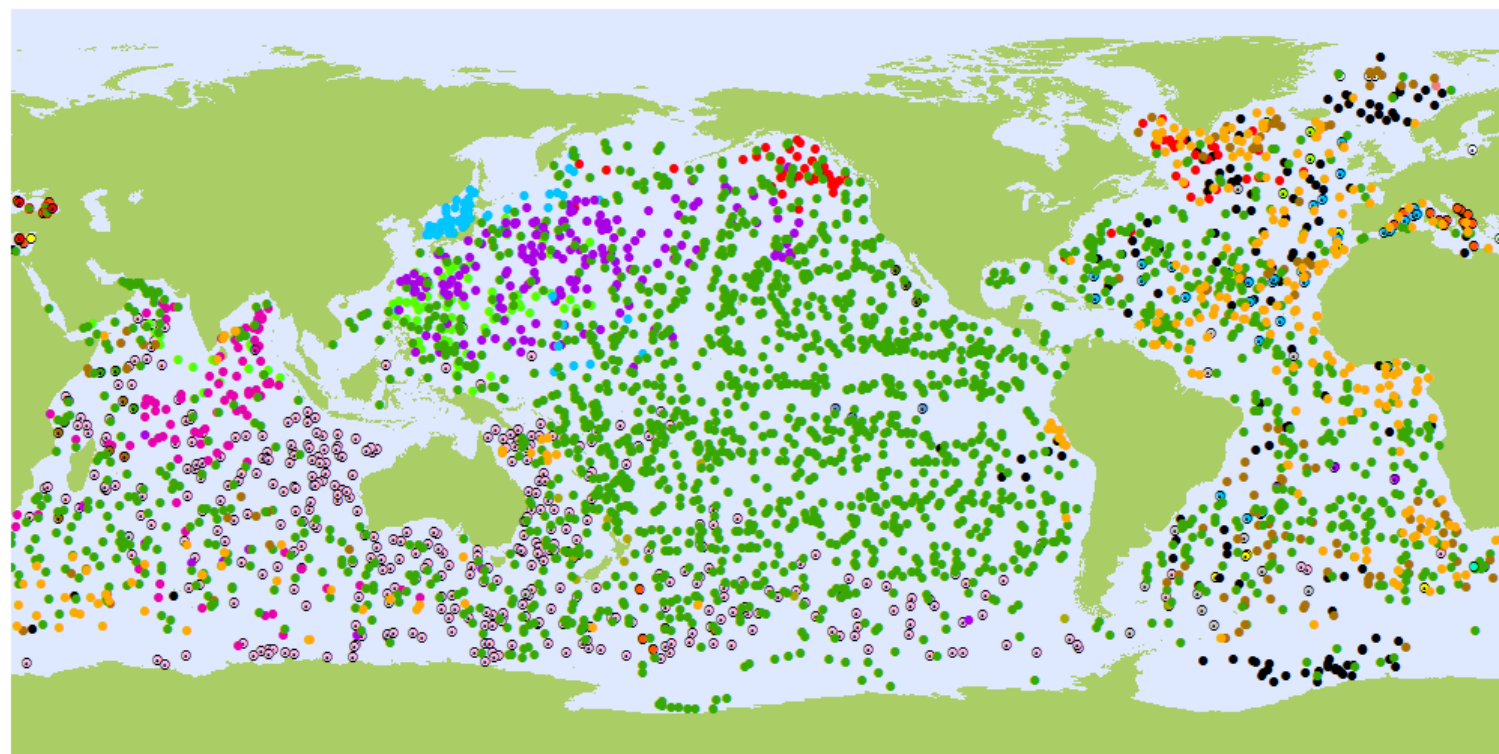
The Argo programme

Argo float

- Autonomous platform
- Can regulate its buoyancy
- Measures T, S and depth



Core-Argo array



3561
Floats

ARGENTINA (4)	CANADA (72)	FRANCE (258)	INDIA (98)	KENYA (3)	MEXICO (3)	SOUTH AFRICA (2)	UNITED KINGDOM (128)
AUSTRALIA (388)	CHINA (89)	GABON (1)	IRELAND (7)	SOUTH KOREA (74)	NETHERLANDS (17)	SPAIN (30)	UNITED STATES (2 000)
BRAZIL (3)	ECUADOR (3)	GERMANY (140)	ITALY (26)	LEBANON (1)	NEW ZEALAND (11)	SRI LANKA (1)	
BULGARIA (3)	FINLAND (4)	GREECE (2)	JAPAN (187)	MAURITIUS (5)	NORWAY (1)	TURKEY (4)	

February 2014

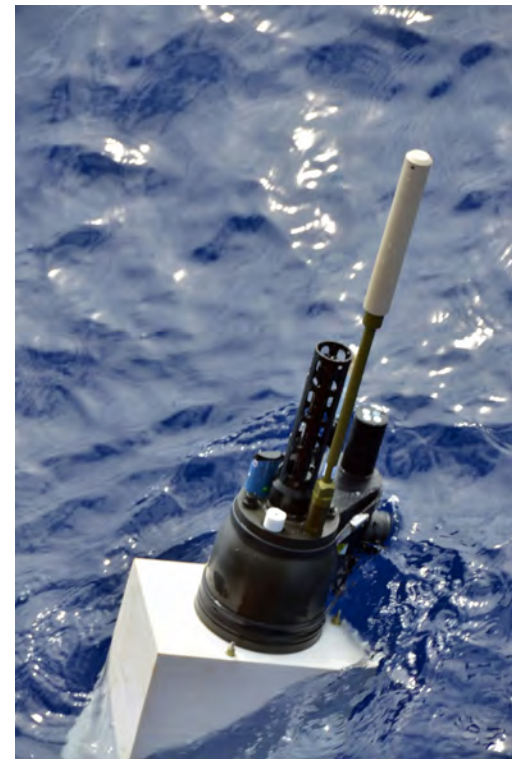


First Argo floats: late 1999
November 2012: 1M profiles
Total before 0.5M

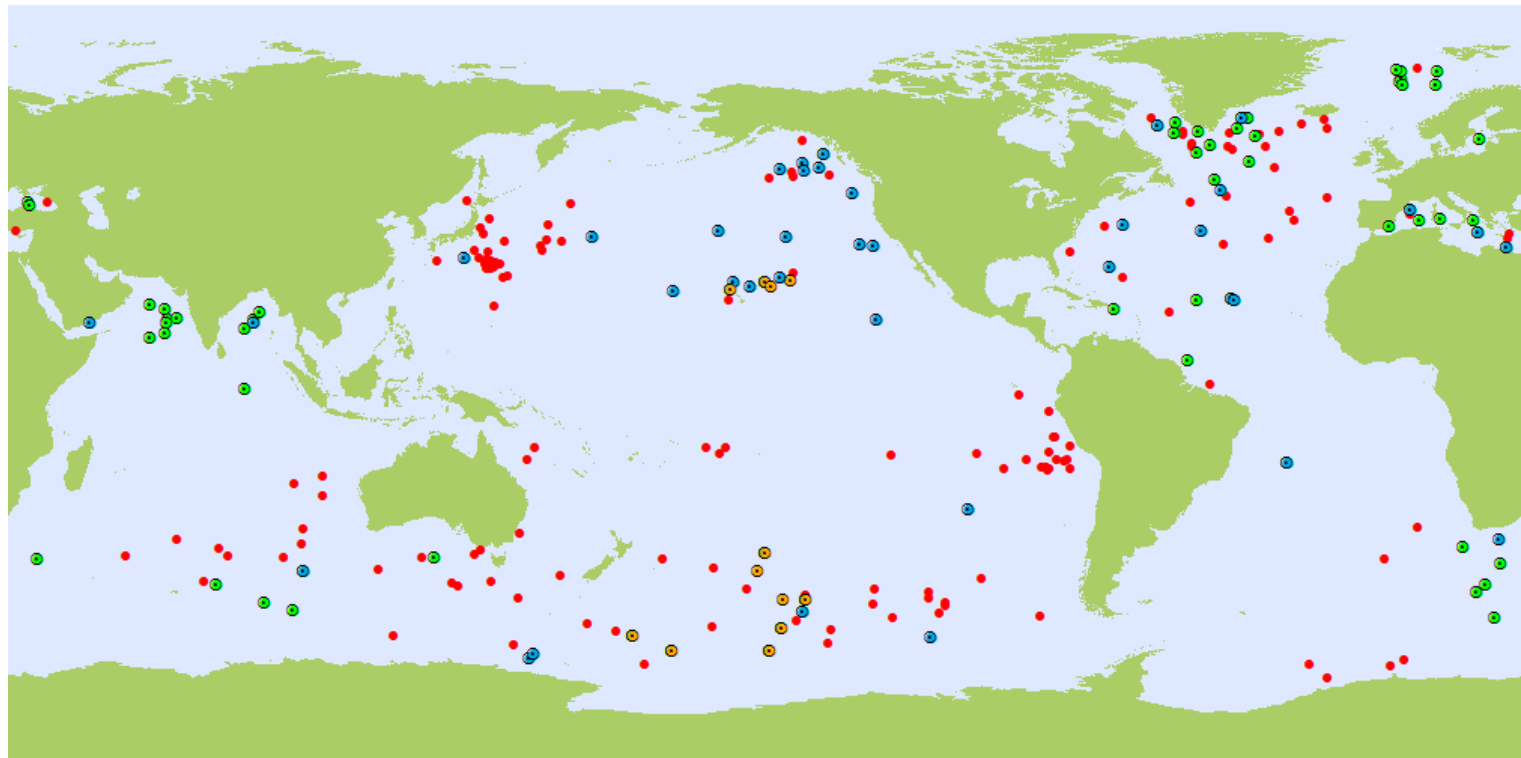
Bio-Argo

Which variables?

- Focus on Biology and Biogeochemistry
- Variables
 - Oxygen
 - Chlorophyll
 - Spectral optical scattering (particles)
 - Nutrients (NO_3)
 - Spectral downward irradiance
 - pH
 - passive acoustics
 - ...



Where/how many?



Bio-Argo (246)

• Dissolved Oxygen (232)

• Bio-optics (66)

• Nitrate (46)

• pH (12)

May 2014

How much?

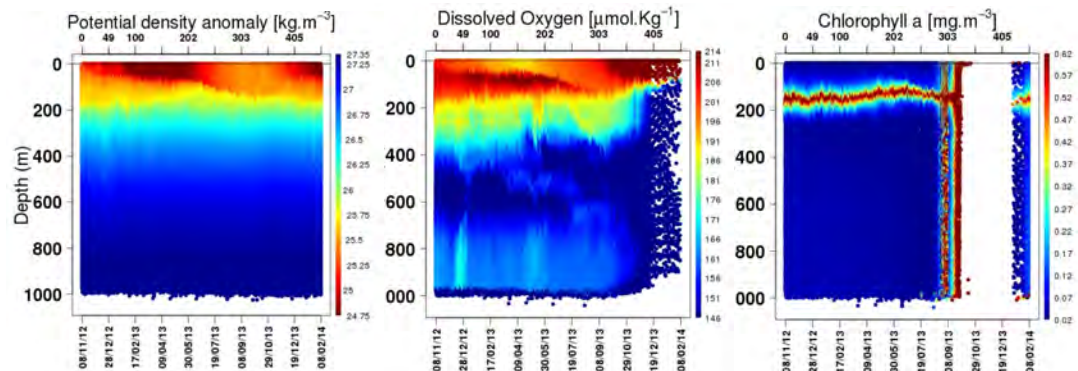
• Float with CTD:		£19k	
• Oxygen sensor:	+	£6k	
• Bio-optics (Chl, b_{bp} , E_d):	+	£22k	£47k
• pH:	+	£4k	£51k
• NO_3 :	+	£15k	£66k

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How long?

- 300 profiles (0 – 1000 m)
- 4 years for a 5-day cycle
- Max: 454 1-day profiles



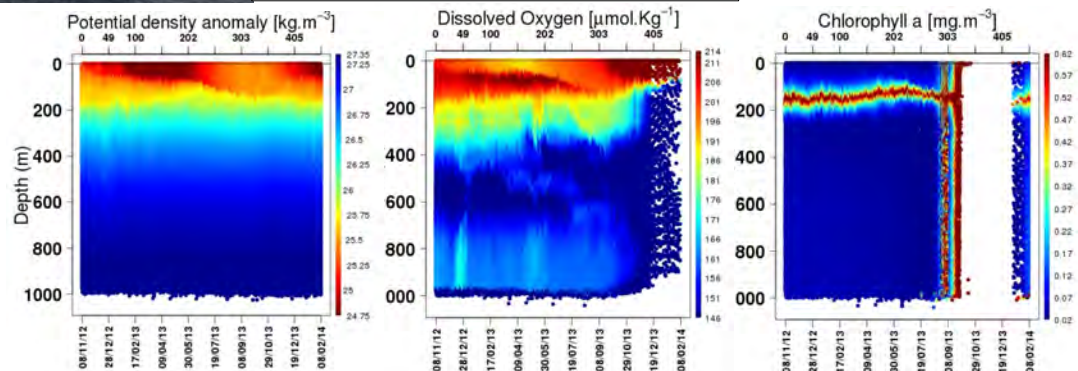
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~£30k/day

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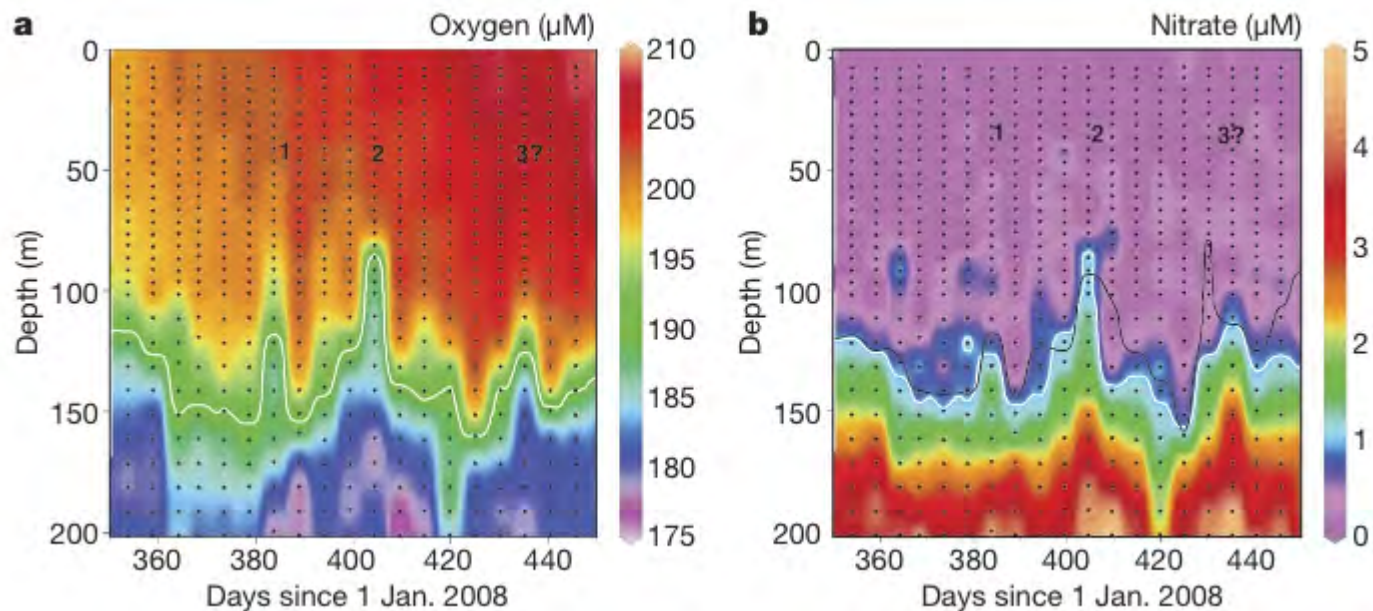
How?

Open-data policy



New research questions

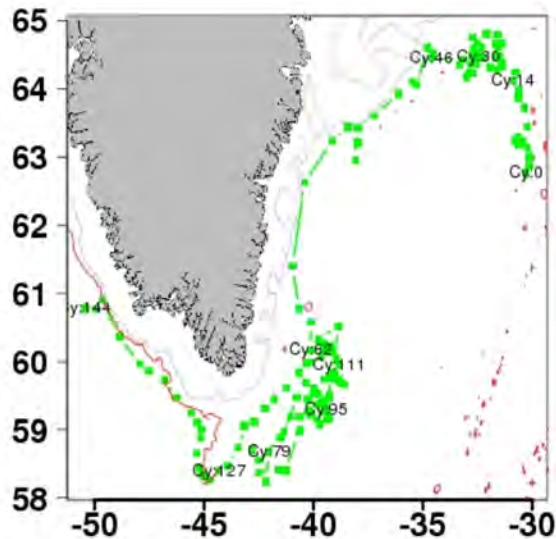
Ocean metabolism



[Johnson et al., 2010]

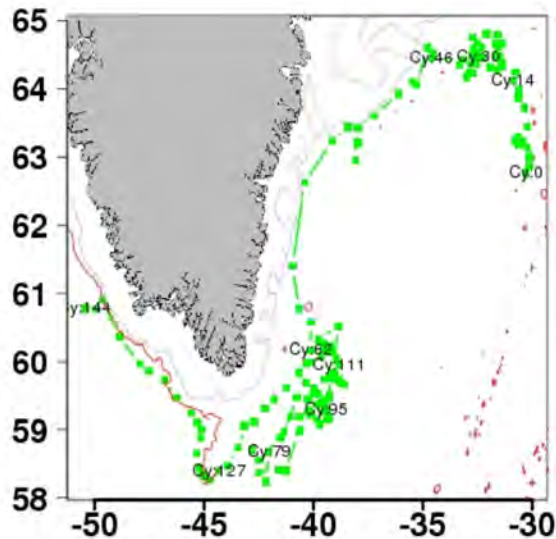
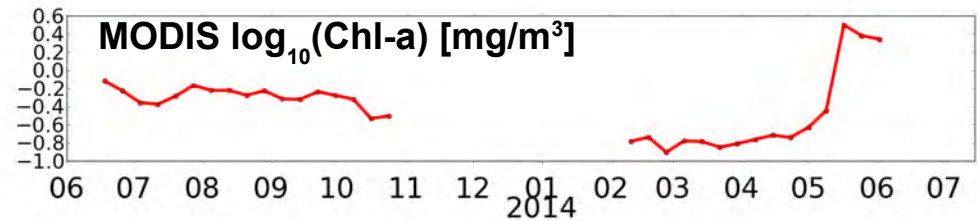
New research questions

Physical-biological interactions



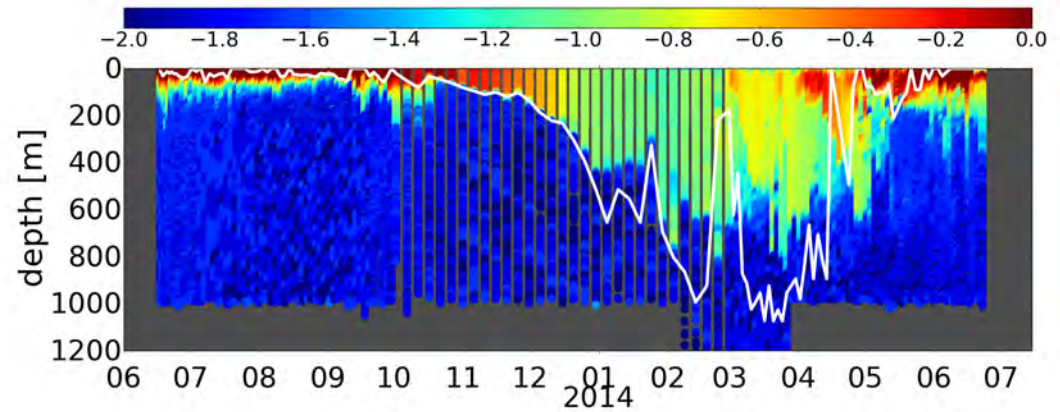
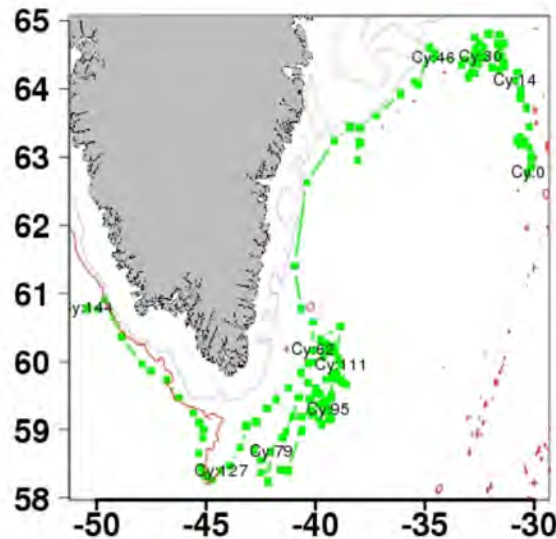
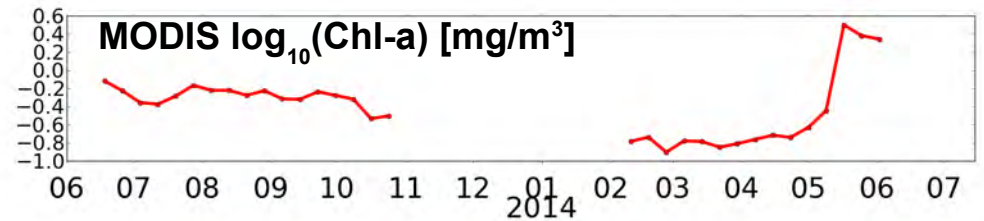
New research questions

Physical-biological interactions



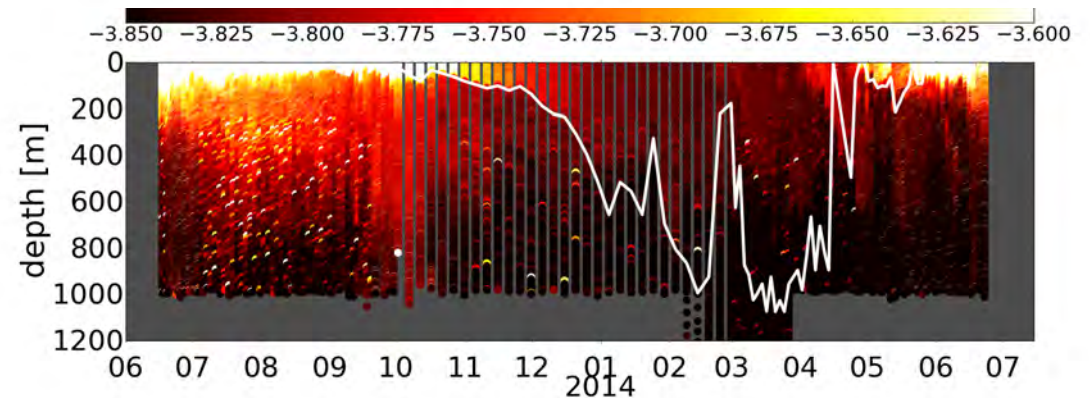
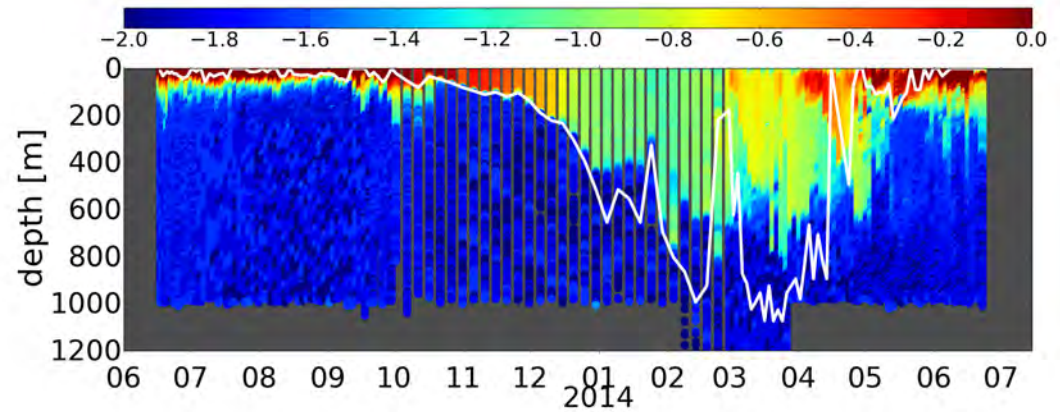
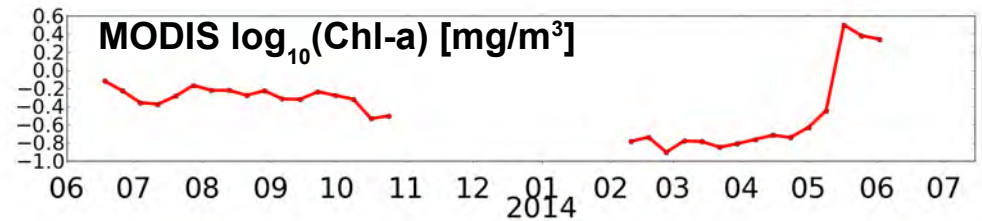
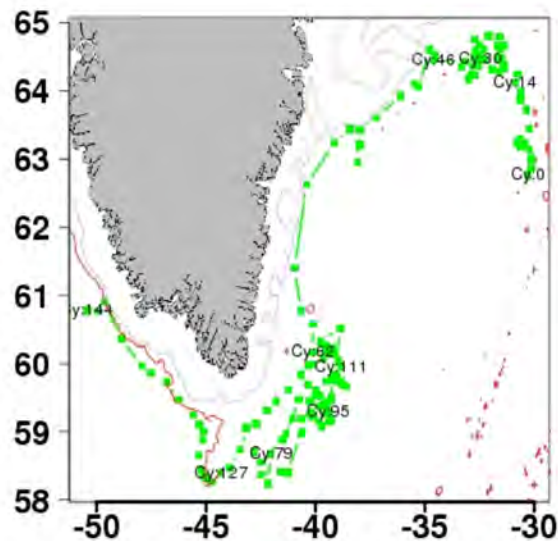
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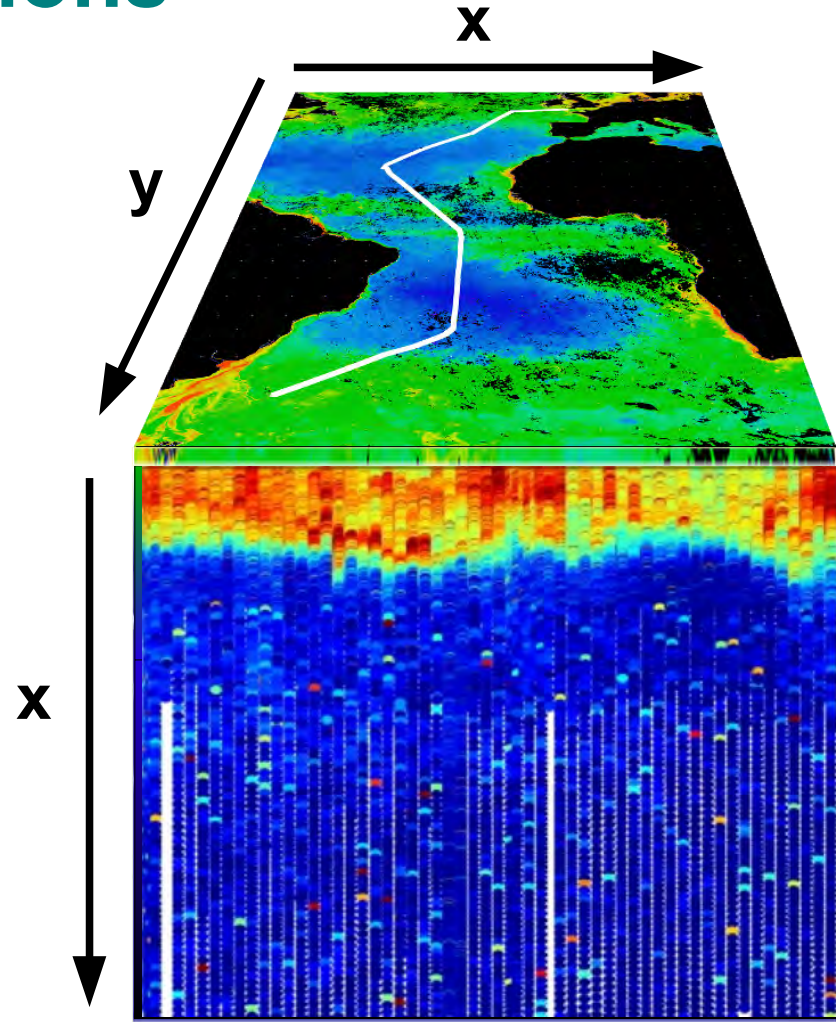
New research questions

Vertical processes



New research questions

Synergy with satellite data
and models



Quality control

- Independently biased and drifting sensors
 - Real Time
 - Delayed Mode
- IOPs are not biogeochemical properties

- Bio-Argo: new Earth Observation tool
 - Vertical resolution
 - New variables
- Synergy with satellite data and models

Conclusions

- Bio-Argo: new Earth Observation tool
 - Vertical resolution
 - New variables
- Synergy with satellite data and models

A satellite view of a large, irregularly shaped ice floe floating in the ocean. The ice is white and appears to be melting, with some water visible around its edges. A yellow buoy with a black base is attached to the ice. The surrounding water is a deep blue with visible ripples and waves. The text "Thank you!" is overlaid in the bottom right corner.

Thank you!

Where/how many?

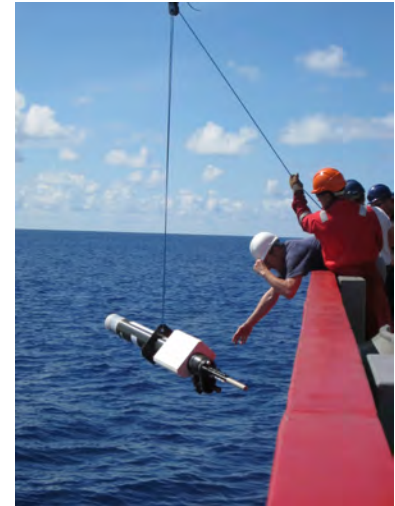
- Australia 11 Southern and Indian Ocean
- Bulgaria 2 Black Sea
- Canada 24 Labrador Sea, Baffin bay
- China 2 South China Sea
- France 70 Atlantic, Med. Sea, Southern Ocean
- India 50 Arabian Sea, Indian Ocean
- Italy 7 Mediterranean Sea
- Japan 3 Western Pacific
- Norway 2 Nordic Seas
- South-Africa 3 Southern Ocean
- UK 21 North & South Atlantic + Nordic Seas
- USA 90 Global (+ SOCOM)

UK Bio-Argo

PML + Met Office + NERC Arctic Programme:
4 floats in the Nordic Seas

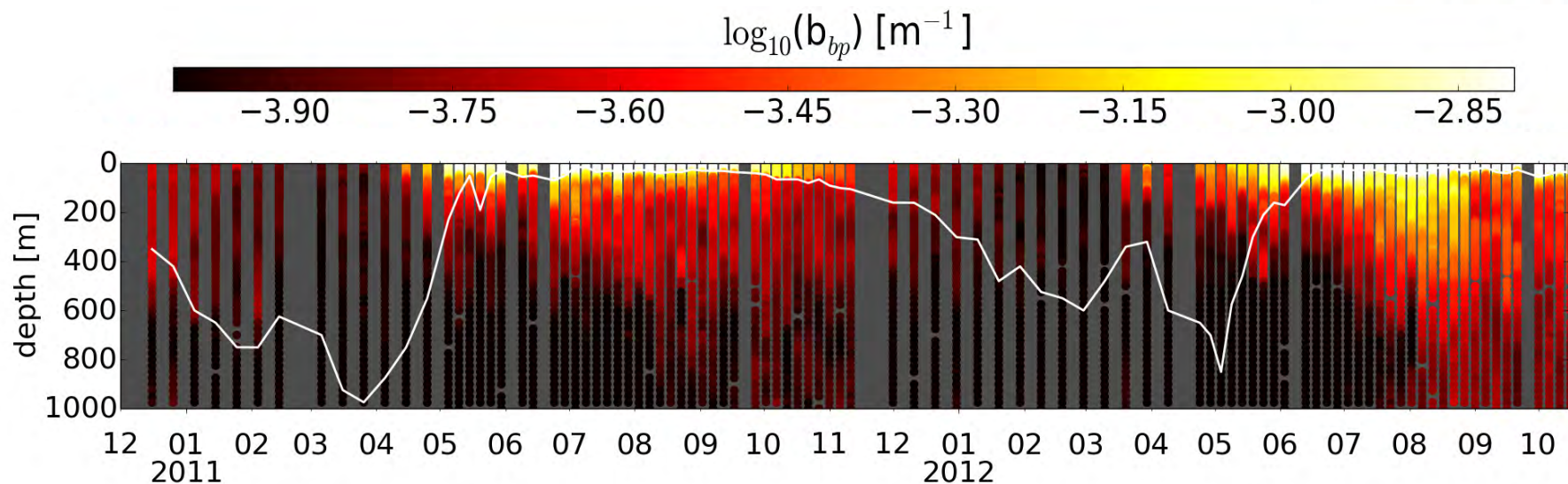
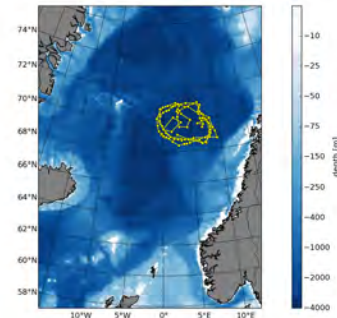
FP7 E-AIMS: 2 PML floats in the NASG

PML + BODC + MetOffice + NOC-S:
NERC Big Data: 11 floats



New research questions

Vertical processes (e.g., export flux)



[Dall'Olmo and Mork, GRL 2014]

Who?

- Single investigators: open-data policy
- May 2014: Euro-Argo European Research Infrastructure Consortium (to coordinate procurement, deployment and monitoring of EU floats): 9 countries

