Science: Key topics to be addressed with gliders

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What do gliders bring to the science party?

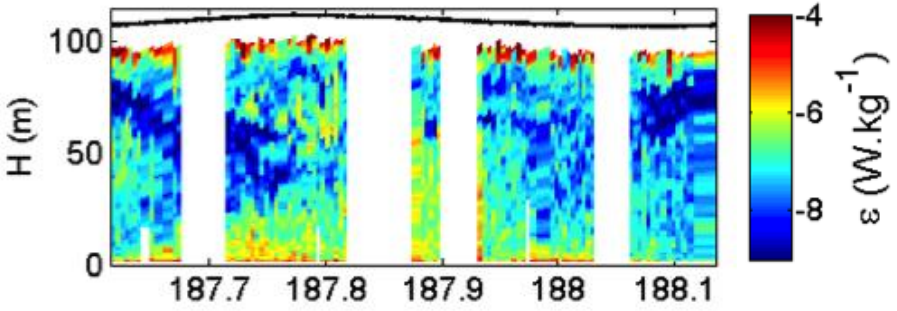
- New capability.
  - Long endurance platform
  - Low noise
  - High resolution
  - Remote, real-time mission control
  - Real time data delivery
  - Full depth profile
- Reduced cost
  - Cheap data points/£(€)
  - Remote deployment and recovery

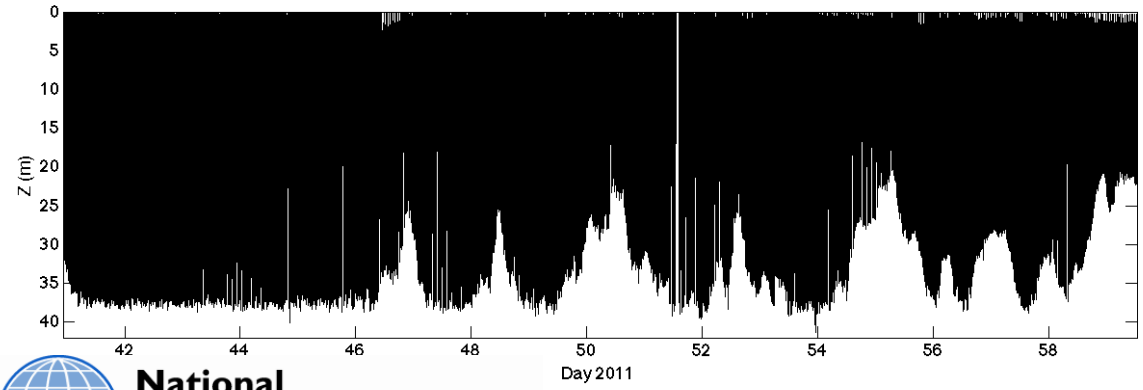
- Gliders must provide solutions
  - Limited accessibility
    - Storms/hurricanes
    - Dangerous environments
    - Heavy traffic?
    - Under ice?
  - Cost effective missions
    - Long term and/or long range
    - Limited 'wire time'
    - Small (or no) vessel deployments
  - Unique capability?
    - ARGO beating-
      - Shallow water capability
      - Mission control
    - Ideal platform for
      - Turbulence measurements
      - Passive acoustic monitoring
      - …

Providing a better platform
OMG: Ocean Microstructure Glider

Caveats to ship based profilers;

- Require ships and lots of people.
- Require continuous operation so high demand of ‘wire-time’.
- Short duration and weather dependent.
- No near surface measurements.





OMG includes Seabird CTD and retro-fitted microstructure (512Hz shear, temperature, conductivity +?)

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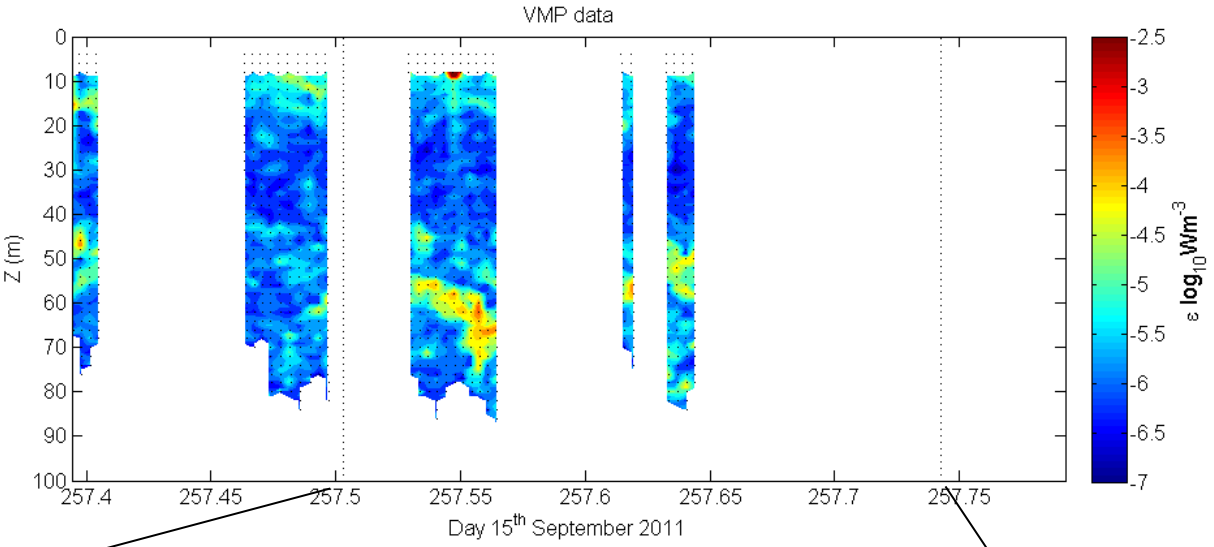
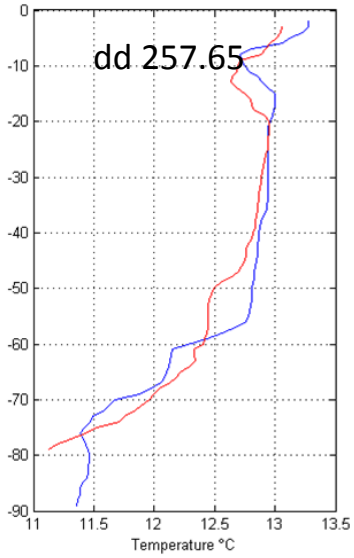
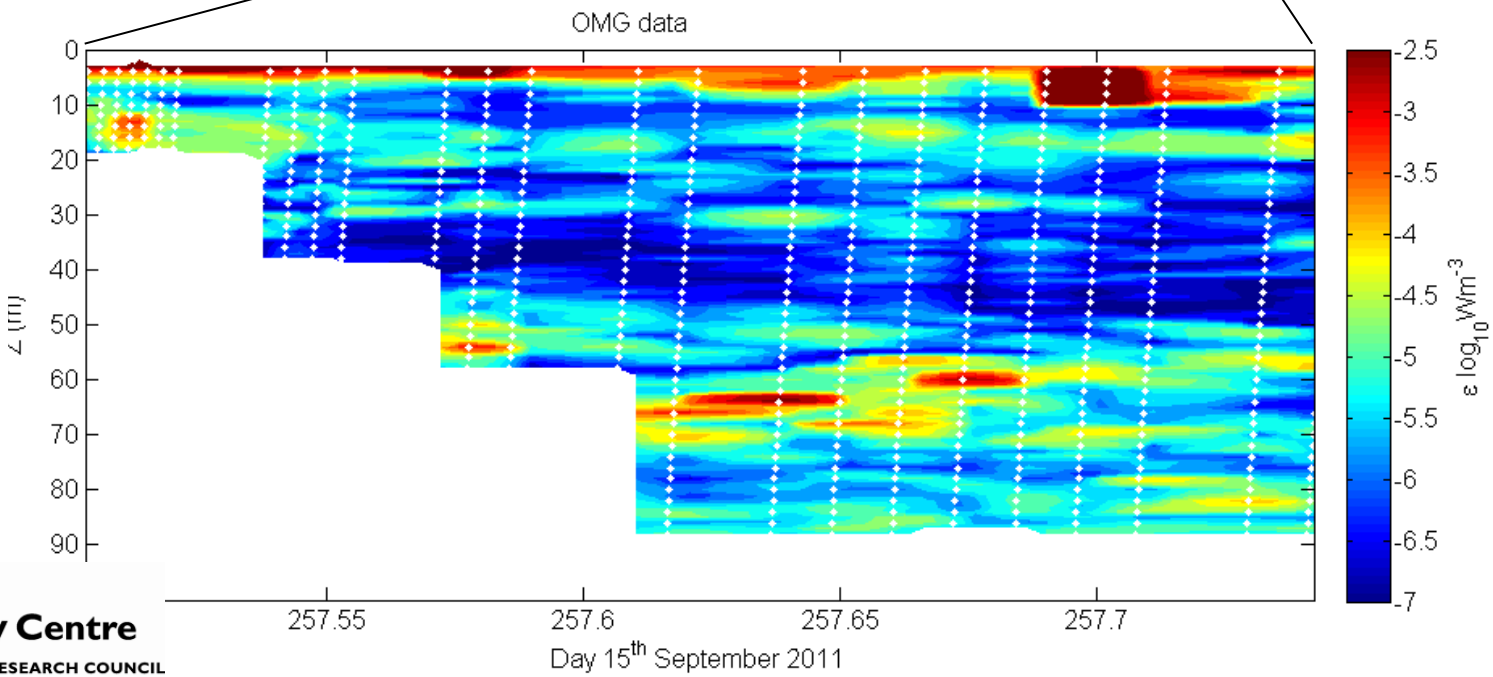
OSMOSIS trials Oct 2011:

- VMP provides higher temporal resolution but was patchy due to poor weather.
- Both instruments pick out a turbulent layer associated with a 50-70m deep thermocline.
- Only the OMG captures the turbulent surface layer.







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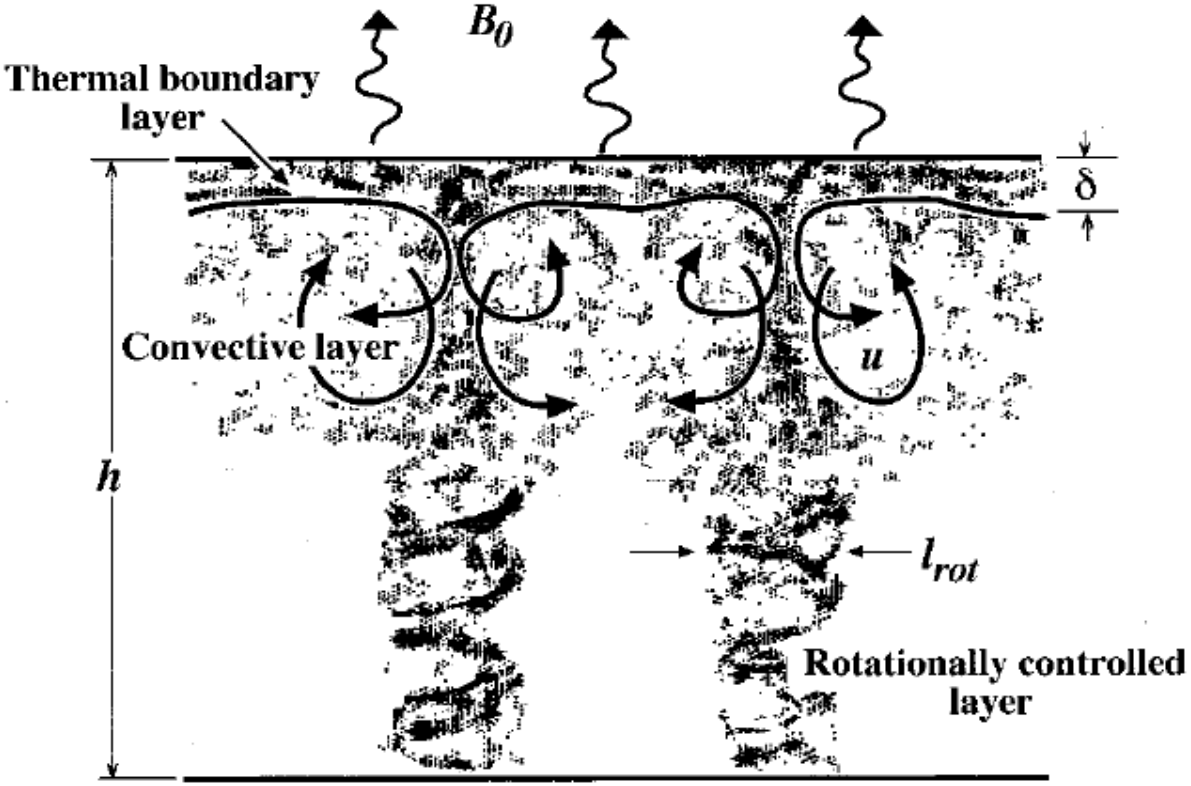
Near real time mission control:
Capturing episodic events -_Convective mixing

Objective: to measure vertical motion associated with convective plumes



(Marshall & Schott 1999)

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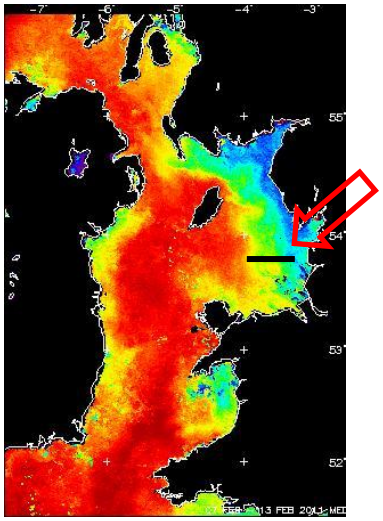
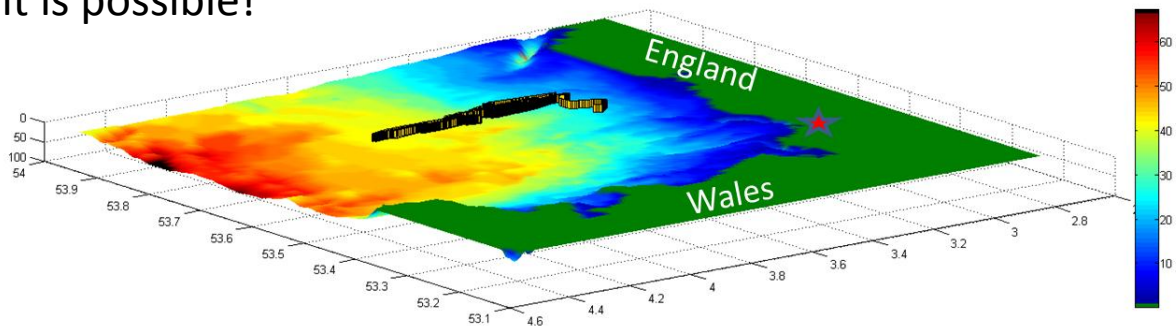
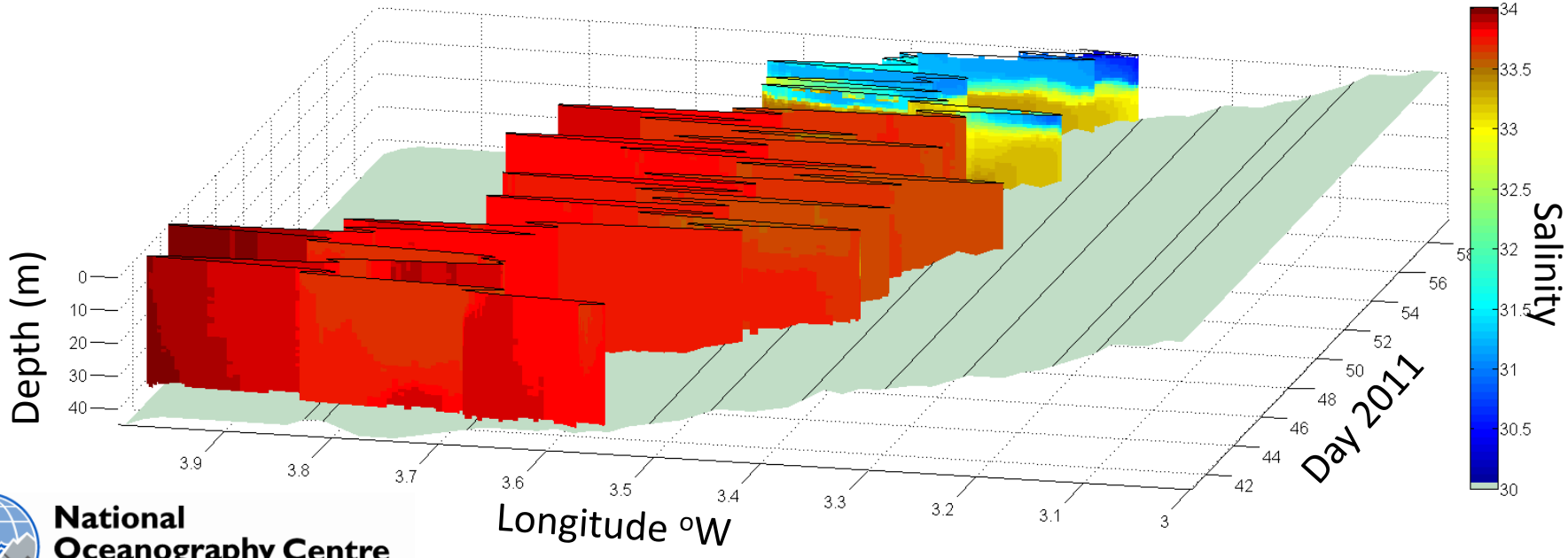
Working in extreme environments: Liverpool Bay, February 2011



Mission aims:

- To better understand freshwater pathways.
- Test coupled physical-ecosystem models capability.
- To see if it is possible!





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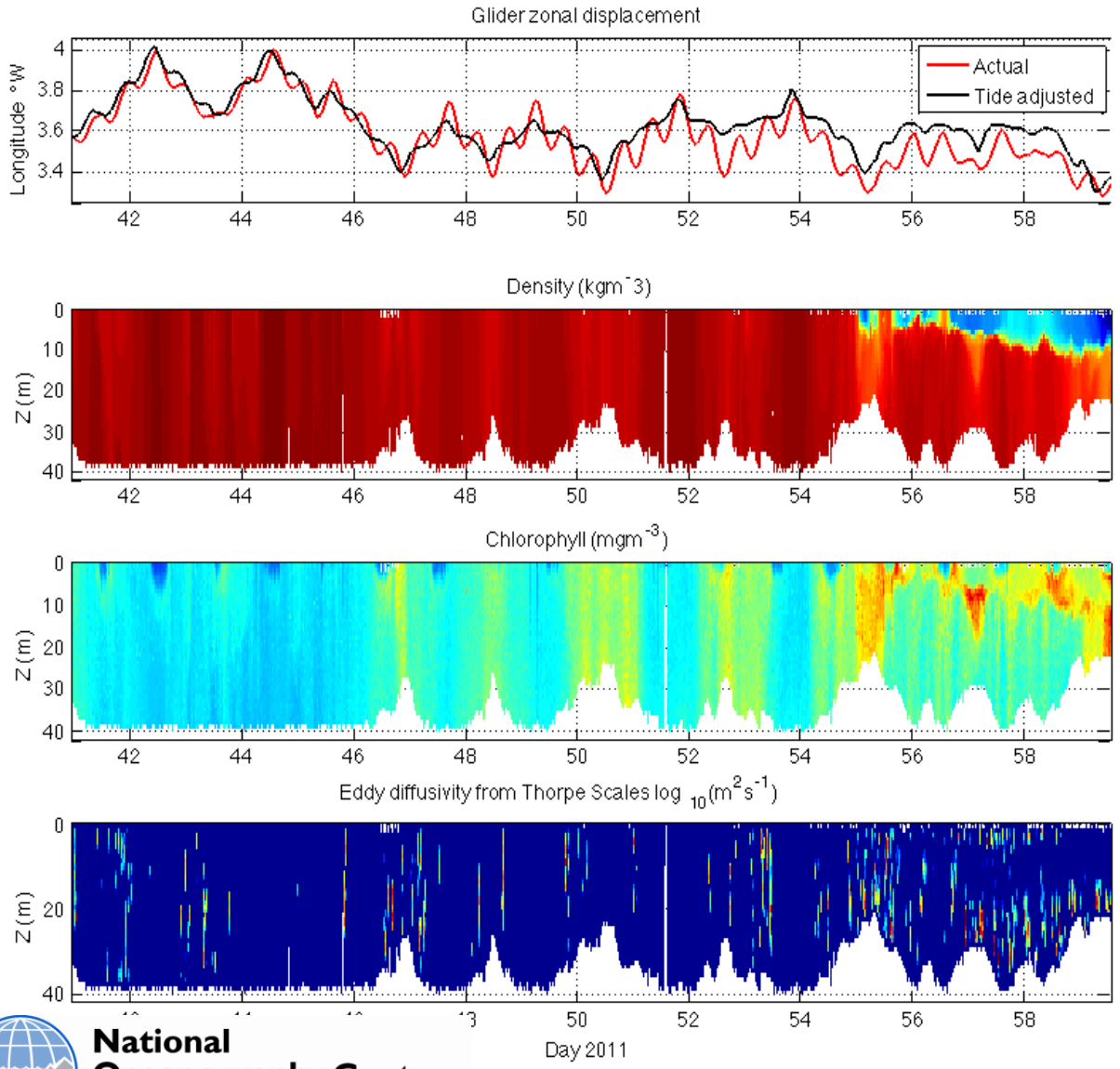
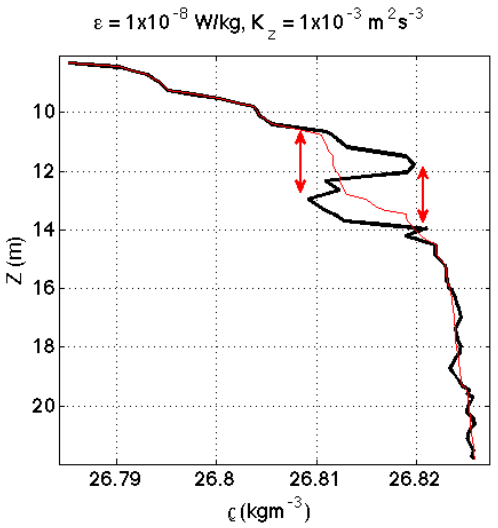
Liverpool Bay, Feb 2011



- Near shore increase in Chl evident prior to plume event.
- Two-fold increase in Chl density associated with the front and plume.
- Increased turbulent mixing is evident during the plume event.



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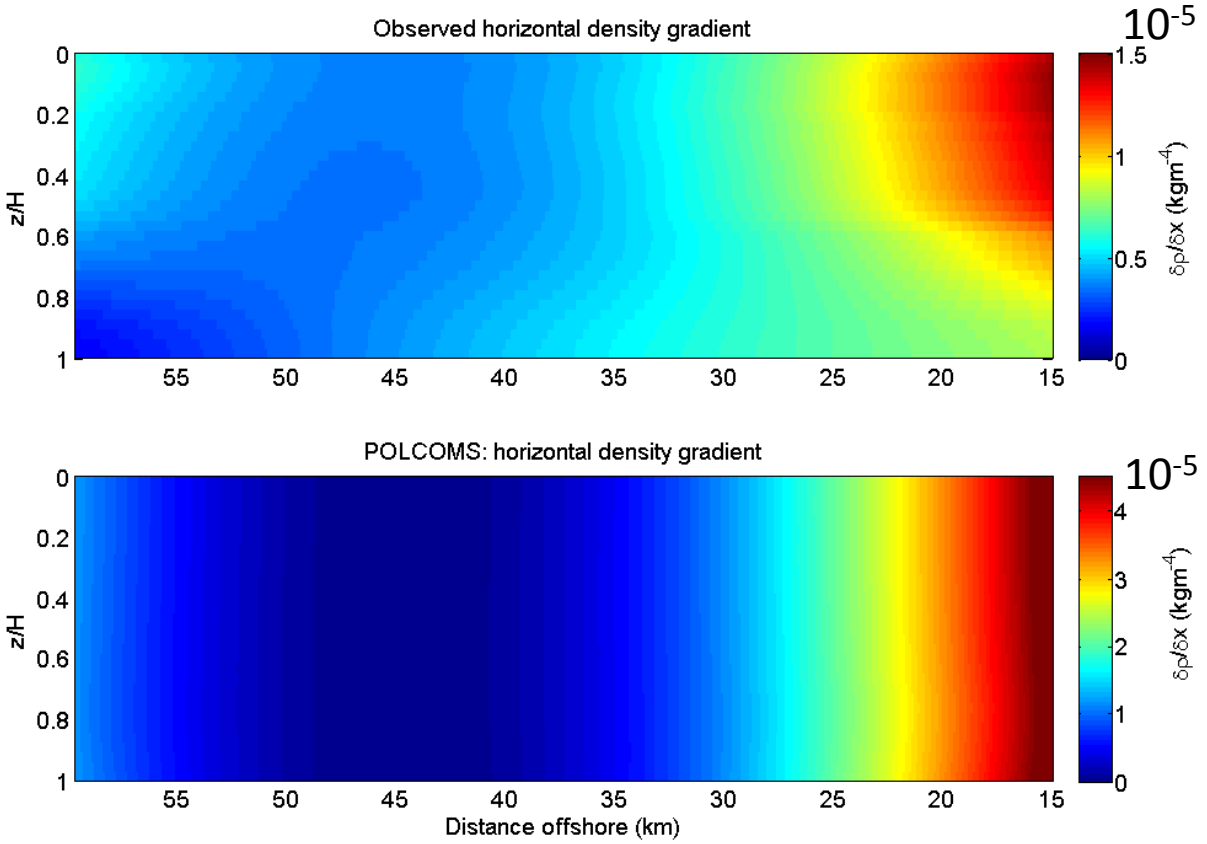
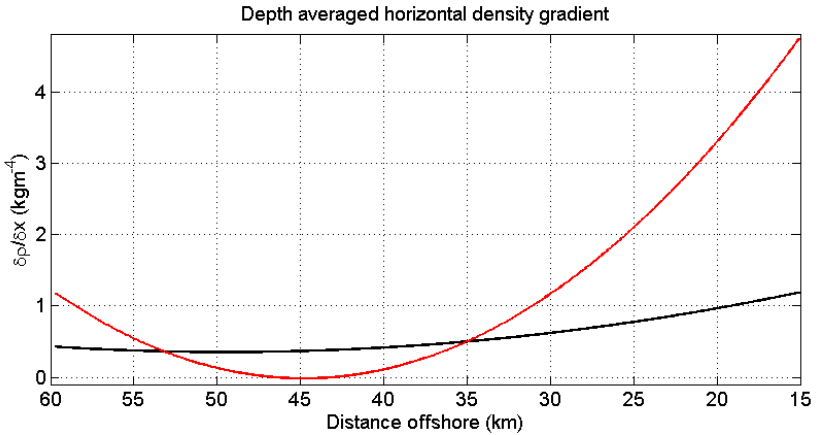
Testing ocean models:

- Glider data reveals a weak horizontal density gradient strongest close to the coast and variable with depth.
- *Average* $\Delta\rho/\Delta x$ = 0.5×10^{-5} kgm^{-4}.
- Model data dramatically overestimates horizontal gradients by up to 5 times.
- *Average* $\Delta\rho/\Delta x$ = 1.2×10^{-5} kgm^{-4}.
- This suggests lateral diffusion is poorly represented in the model.





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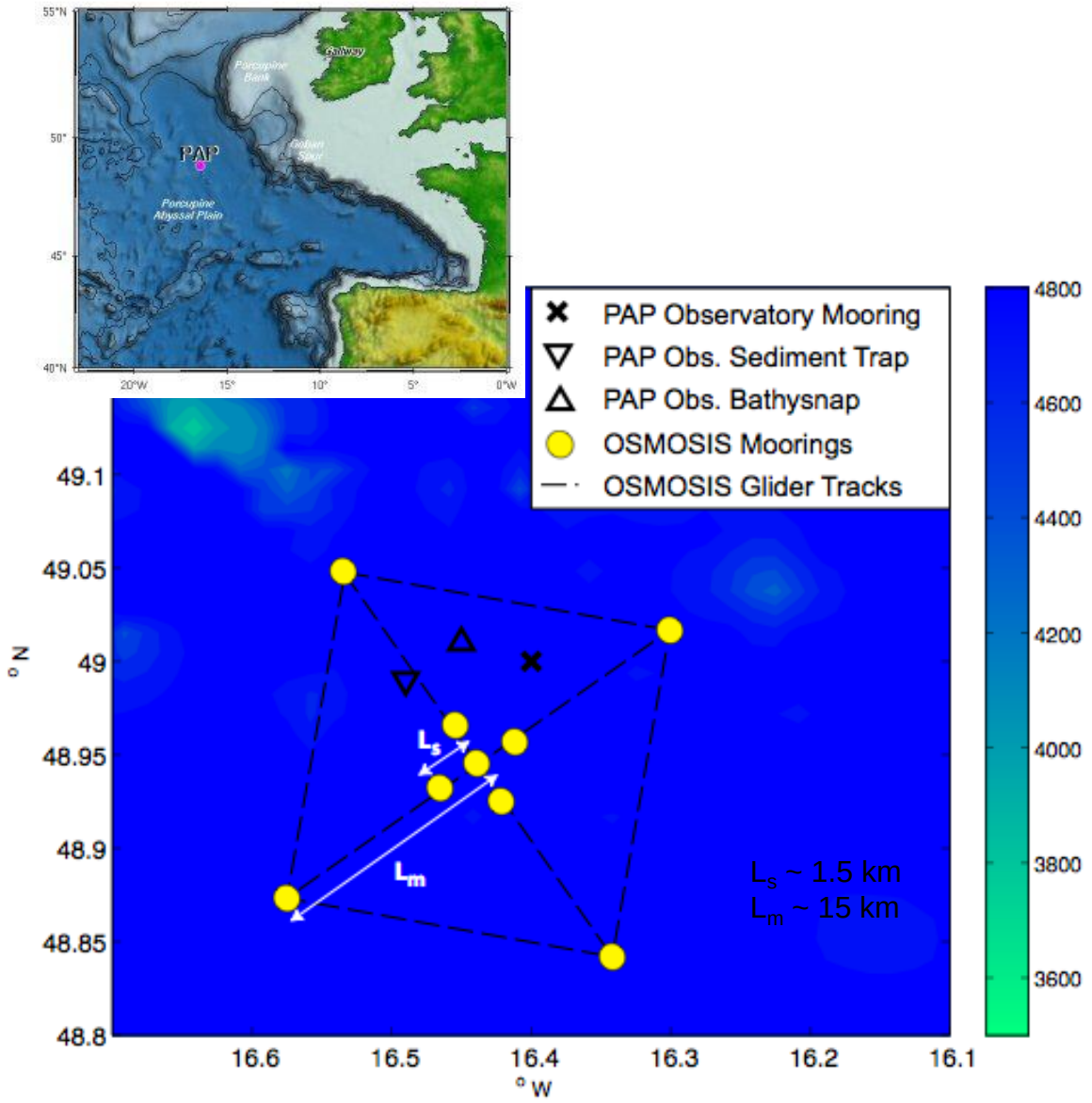
Filling the gaps in mooring data: OSMOSIS

Ocean Surface Mixing, Ocean Sub-mesoscale Interaction Study

To observe and quantify mesoscale and sub-mesoscale processes that determine the evolution of the surface boundary layer.

To develop improved parameterisations for ocean and climate models



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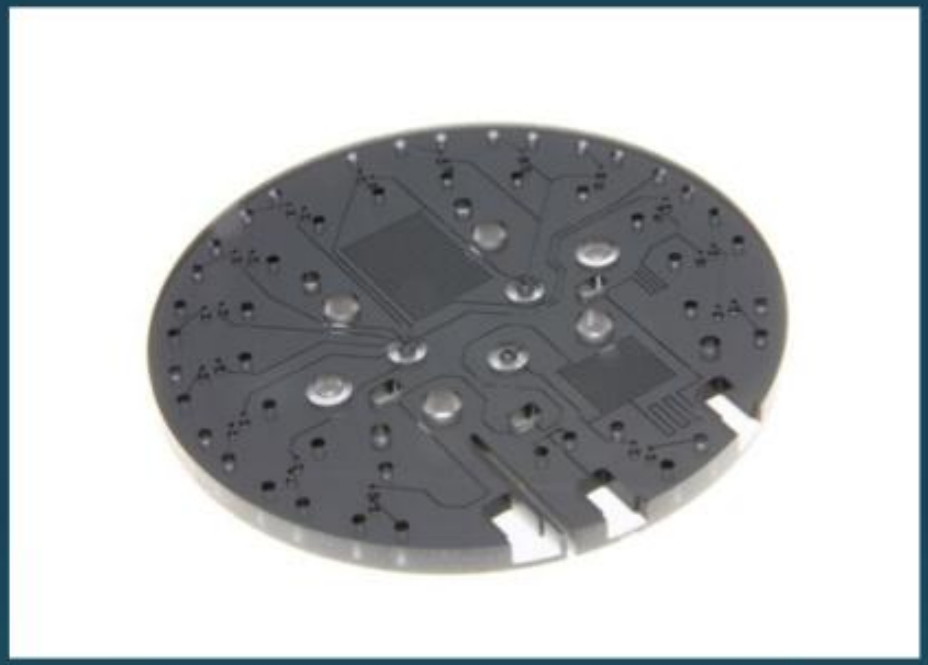
Providing a platform for new sensors



Ocean Technology Engineering: Sensors group

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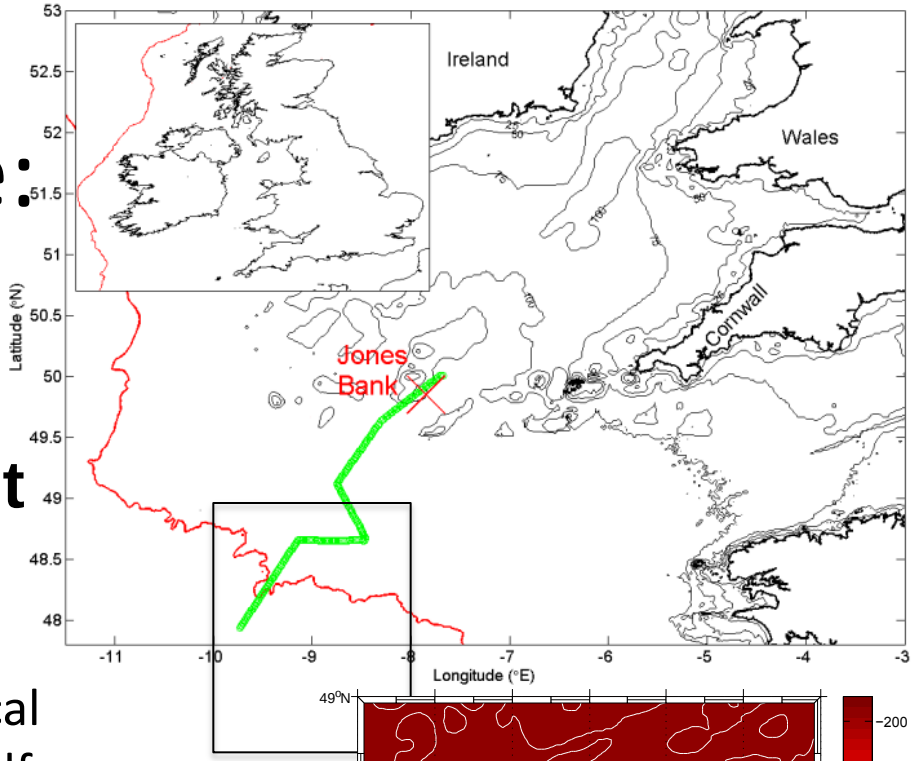
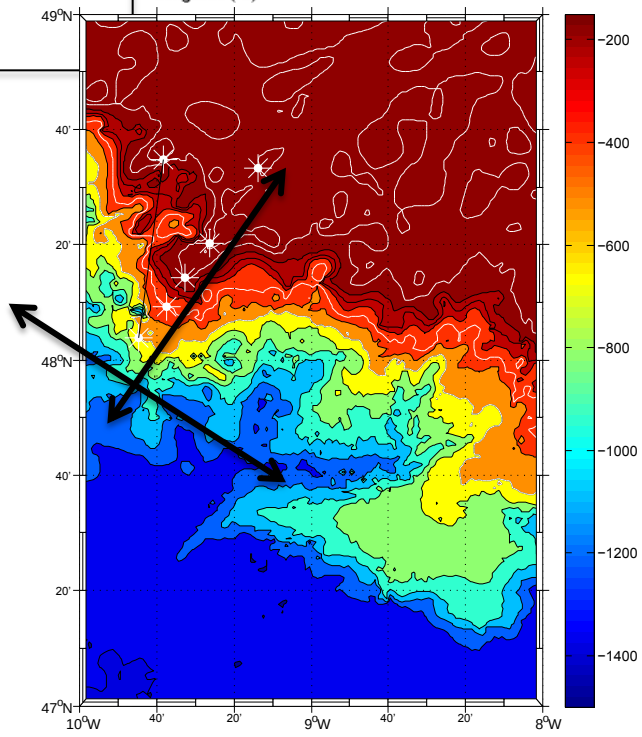
Key topics

Ocean shelf exchange: FASTNET

Fluxes Across the Sloping Topography of the North East Atlantic.





Objective:

To determine the seasonality of physical gradients and exchange across the shelf edge by deploying new observational technologies (Gliders, Autosub Long Range) and established techniques (long term moorings, drifters).

- 2 major cruises June 2012 (Celtic Sea) and August 2013 (Malin Sea).
- Includes integrated NOC sensors with seagliders

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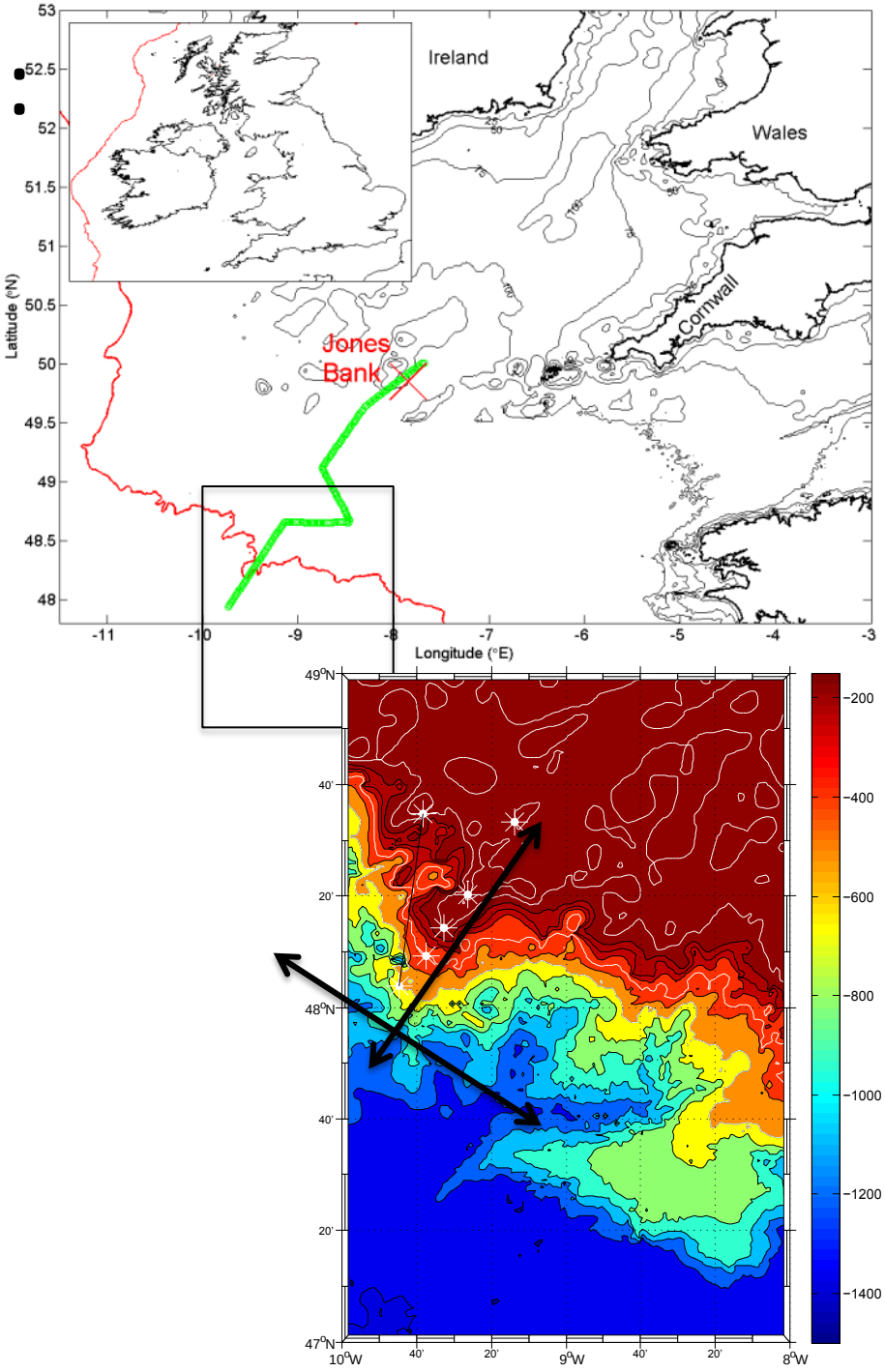
Ocean shelf exchange: FASTNET 2012

- 2 deep Slocum
  - Off shelf, along shelf break
  - Short scale
- 1 Shallow Slocum
  - On shelf
  - Between moorings
- 1 Slocum Microstructure
  - On shelf
  - Short scale
- 2 Seaglider
  - Off shelf, along shelf break
  - Long scale
- Including mooring arrays, microstructure profiler and some macronutrient measurements.



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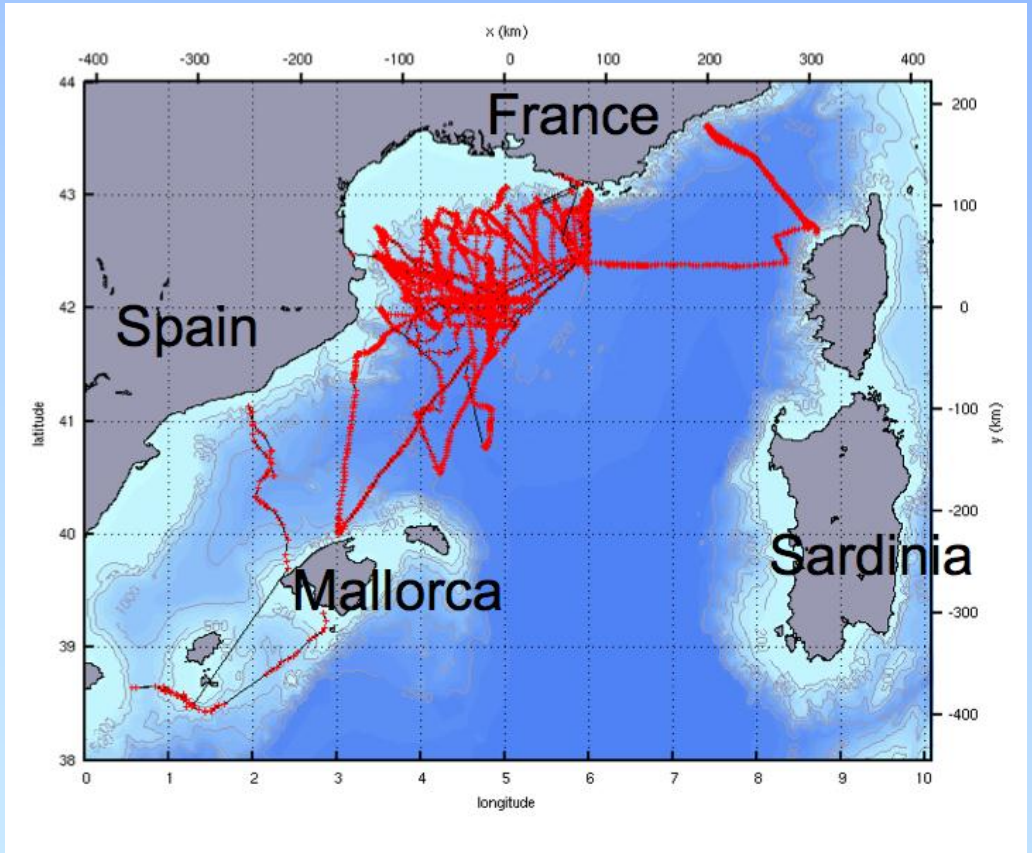
EGO glider deployments in Gulf of Lions 2008



Collaboration between UK, France, Spain and Germany deployed 11 gliders in winter.

New programme in 2012-2013

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What does the science community expect from gliders?

- Wish list: a go anywhere, measure everything, real-time delivery, intelligent instrument platform.
- The assumption is that the ocean glider platform **has** reached maturity.
  - Worldwide coverage
  - Capability is proven
  - Limits/risks are well understood
- Science requires
  - Multiple, complex sensor capability
    - Turbulence
    - Biogeochemistry
    - Passive acoustic
  - Multiple glider deployments
    - Redundancy and validation
    - Security
    - Broader coverage
  - Cost effective missions
  - Seasonal timescales
  - Open Access