



National Oceanography Centre
National Marine Facilities
NMF

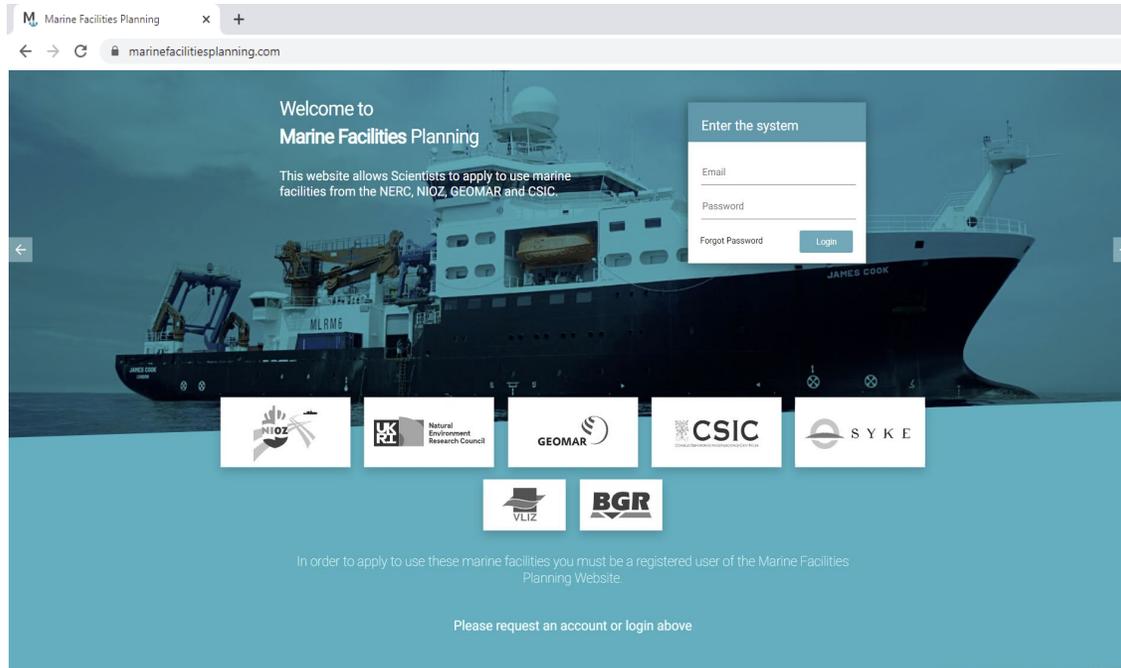
NET ZERO
OCEANOGRAPHIC
NZOC CAPABILITY



BIO-Carbon NZOC science mission – Update post submission of Nols

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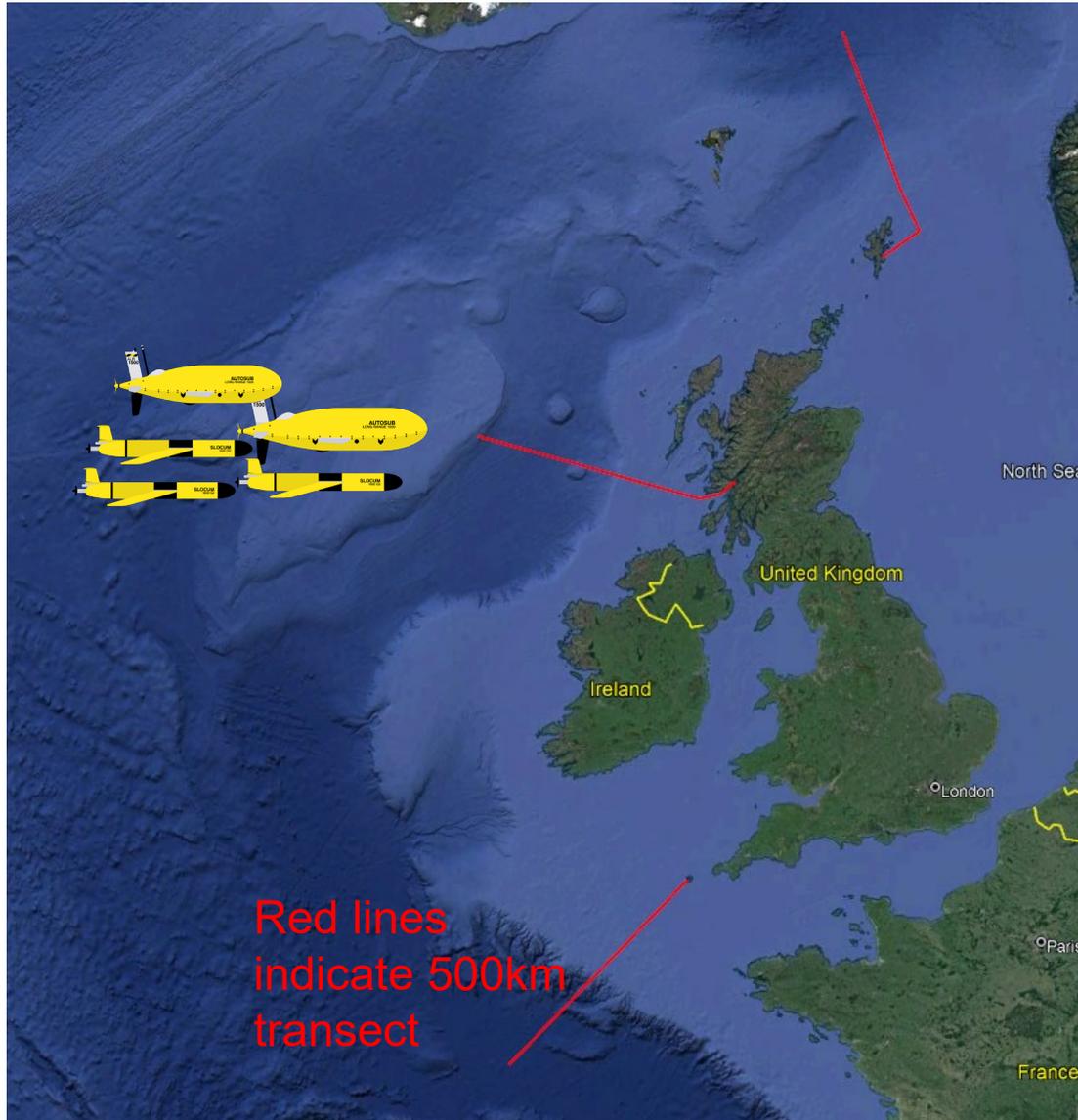




The BIO-Carbon NZOC science mission opportunity has an additional budget of £1M for access to NERC's marine facilities to support proposals submitted to the current £5.8M Biological influence on future ocean storage of carbon AO. This £1M budget is exclusively for use to cover costs associated with the shore launched autonomous deployments, including those associated with purchase or hire of additional sensors not available in the National Marine Equipment Pool (NMEP).

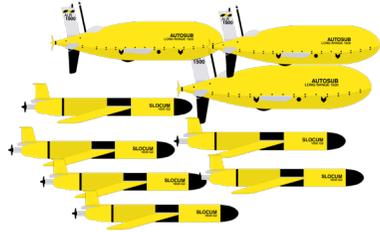
The final plan for the NZOC science mission deployments will need to efficiently accommodate all the aims of the awarded BIO-Carbon grants, within the £1 million funding available. In extreme instances, NERC may ask principal investigators to adjust science plans for the science missions so that an affordable plan can be agreed, and grants can be awarded.

For this BIO-Carbon call for proposals, (in a change from the standard process) completion of ADF for the science mission will be undertaken by the Bio-Carbon Champion not individual PIs.



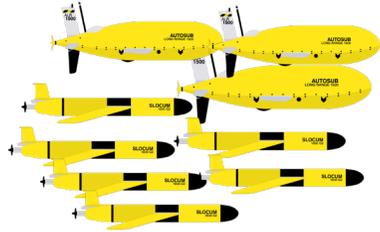
- NERC envisage the NZOC BIO-Carbon science mission deployments will occur in the 2024/2025 NERC Marine Facilities Programme to run alongside the BIO-Carbon SME. Note: **BIO-Carbon has provisionally been two cruises scheduled in 2024 one in Spring and one in Autumn in the NE Atlantic.**
- The original expectation was the NZOC BIO-Carbon Science Mission was expected to be undertaken in the NE Atlantic subpolar region over a maximum of a ~3 month period. **Some flexibility to run staggered or multiple campaigns subject to cost.**
- Original request was Marine Autonomous and Robotic Systems platforms will either be launched and recovered from a UK port (e.g. Plymouth, Oban or Lerwick) transiting to a primary work area within ~500km of the launch site (e.g. Rockall Trough, Faroe–Shetland Channel). Transiting times are included in the three-month period. **An exception to allow a transit from a UK port to a foreign port or vice versa has been agreed with NZOC.**

General Feedback on NZOC element of Nols



- Generally technically feasible
 - Some Nols were requesting launch very early in the calendar year and concerns raised over viability of a weather window
 - Some Nols were pushing endurance/range of the platforms
 - Some Nols were pushing the envelope in terms of number of sensors requested on a single Slocum
 - Lack of resilience in some of the experimental design
- Big variation in the magnitude of the requests – in terms of scale/cost
 - Most of the Nols pushing the envelop in terms of budget in isolation
- In some of the Nols it was difficult to unpick what activities were associated with standard ship based activities and what was NZOC science mission – because of the slightly different funding constraints this needs to be unpicked

Further Guidance on Constraints



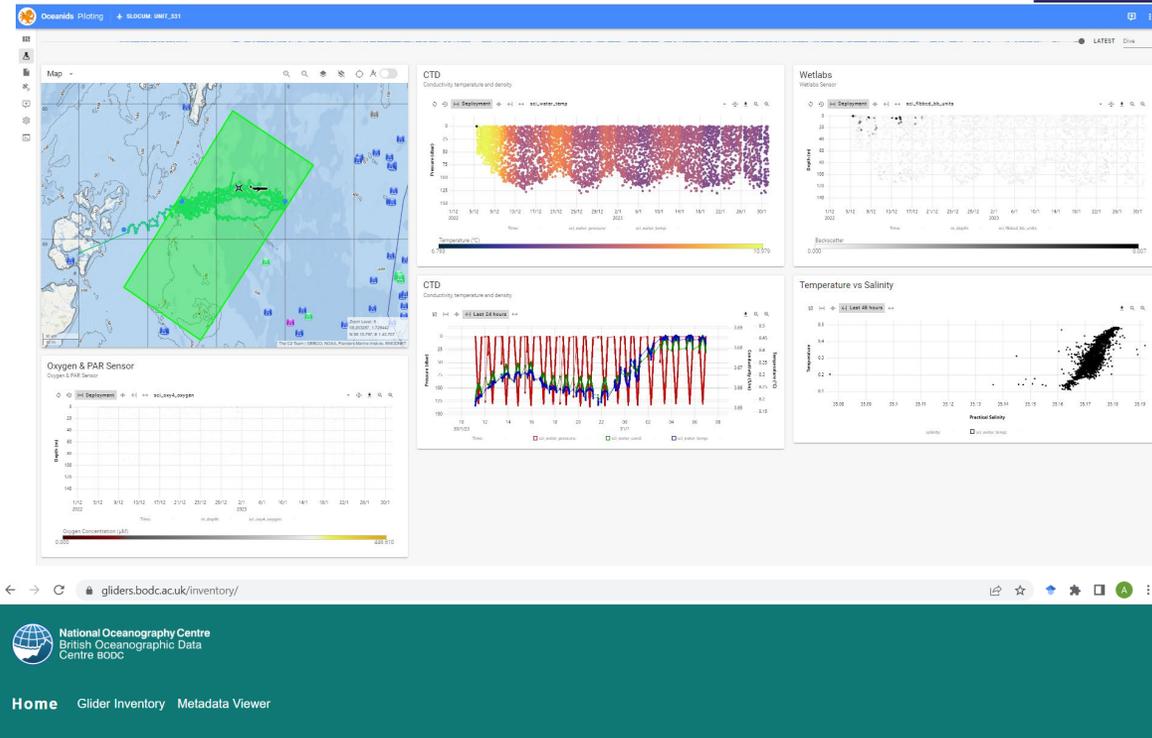
- Subject to confirmation of the 24/5 MFP MARS are expecting to be able to provide the following total number of platforms across both Ship Based and NZOC Activities:
 - 1 x ALR1500 (available April 24 onwards)
 - 1 x ALR1500 (available June 24 onwards)
 - 1 x ALR6000 (available April 24 onwards) – Reduced Endurance Appropriate for Ship Based Activities
 - 6 x Slocum gliders
- There are other funded activities with ALR which NERC may choose to programme in winter 24/25 period
- Reasonable expectation on number of non-standard NMEP sensors which may be available as part of the NZOC Science Mission (Treat with extreme caution!)
 - Up to 3 UvP6
 - Up to 6 LoC
 - 1 x RoCSI
- There is no ability to cover the cost of non-standard NMEP sensors from the BIO-Carbon £1M SME pot and thus these costs would need to be covered from the science grant(s)
- A Slocum glider is only able to carry 1 off LoC sensor / turbulence probe / UVP6
- For NZOC Science Mission interaction with the NERC vessels limited to cross calibration (if desired) and emergency recovery option (if appropriate)



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Questions?





BODC: Glider Inventory

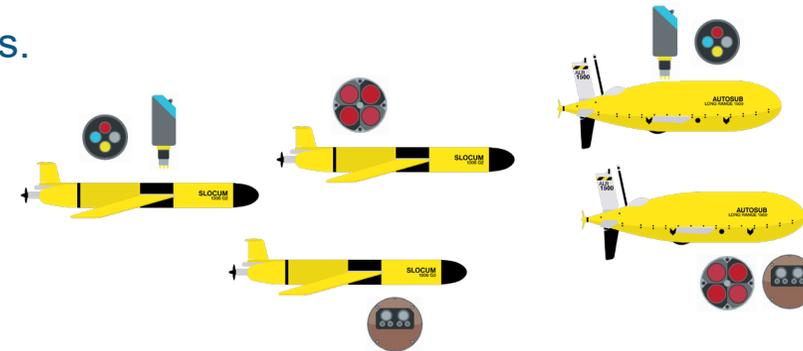
BODC is an OceanGliders Data Assembly Centre (DAC) for UK glider deployments. Information associated with glider deployments can be looked up by clicking on the "Glider inventory" in the menu above.

BODC kindly request that users of glider data available from this inventory provide full acknowledgement of data originators. The recommended acknowledgement is as follows: "This study uses data from [project/programme], provided by the British Oceanographic Data Centre, National Oceanography Centre and funded by the [funding body]". The data are provided under the UK Open Government Licence (OGL).

If you require information concerning a particular deployment or campaign not listed here, please contact a member of the BODC glider team for assistance. Copyright © British Oceanographic Data Centre 2023.

The heterogeneous fleet equipped with appropriate sensing is envisaged to comprise some or all of:

- 3 x Slocum underwater gliders
- 2 x 1500m depth rated Autosub Long Range (ALR1500) AUVs.



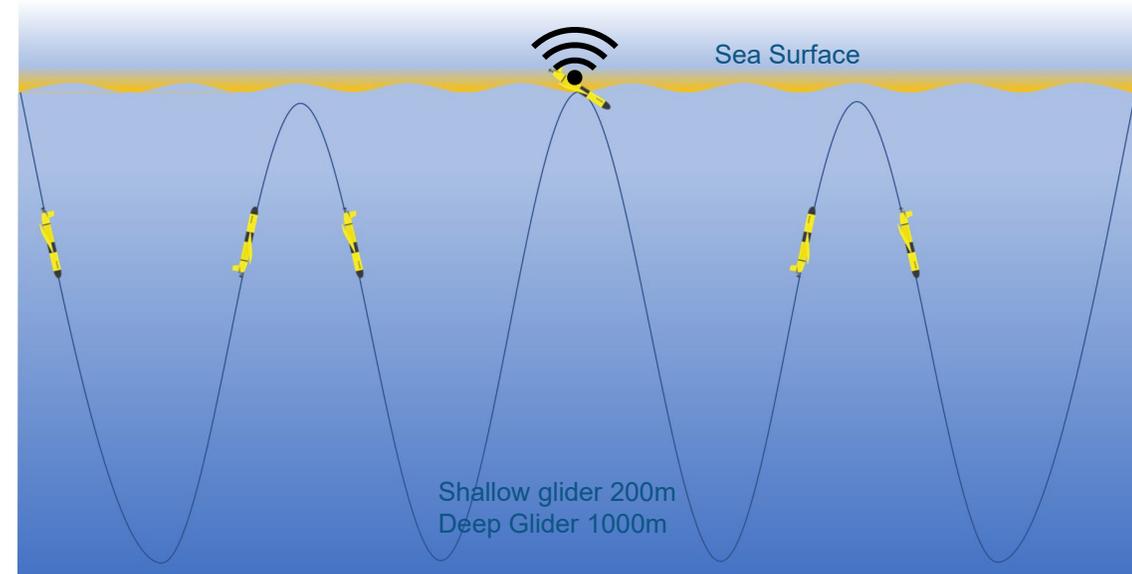
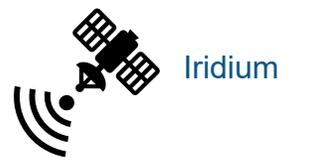
Vehicles will be piloted and near real time data visualised with the Oceanids C2 portal

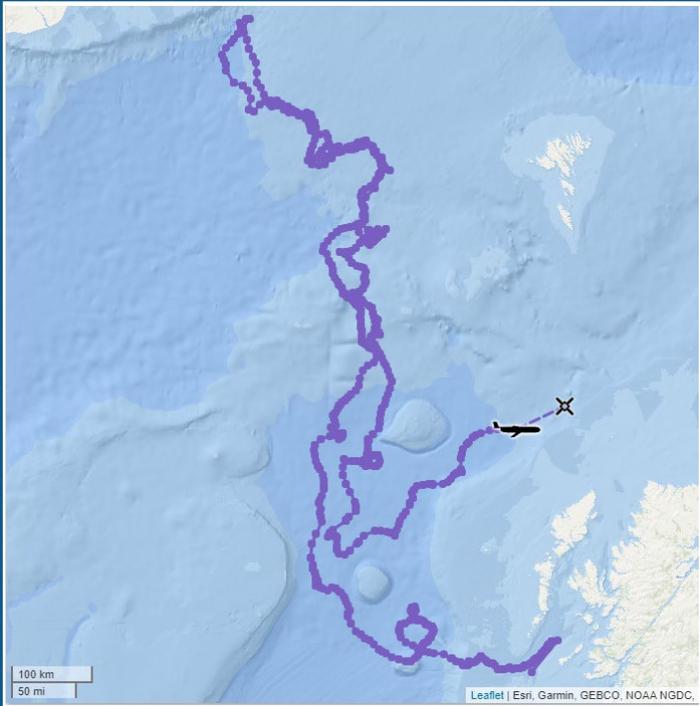
Near Real Time Data will be ingested and disseminated by BODC

Slocum Gliders

The Slocum glider is buoyancy driven robot capable of long range and duration remote water column observations

- Length: 1.5m
- Diameter: 22cm
- Mass: 55 – 70 kg
- Depth Rating: 200m or 1000m
- Range: 3000-13000km
- Endurance: 4 to 18 months



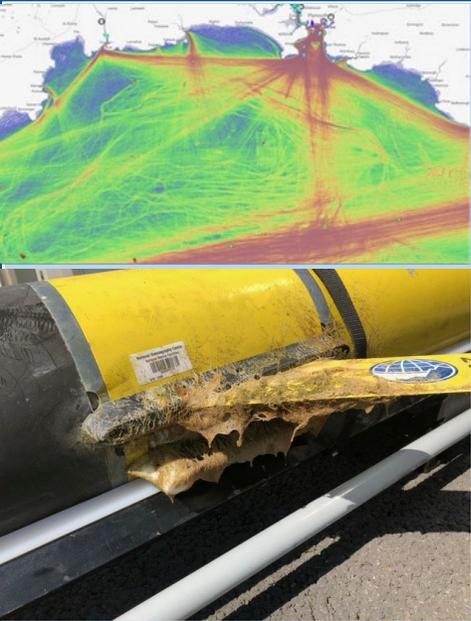


[dstl]



HECLA Faroes Glider Mission (April to Sept 2021)

- 6 month Deployment
- 2643km travelled.
- 1580 YO's
- 241MB transmitted



Natural Environment Research Council

- 3 month Deployment off Plymouth investigating Automated waypoint generation techniques to follow algal bloom.
- Area of high marine traffic, risk of grounding outside survey area - Risk mitigation was key
- Significant Marine growth



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Science & Environment

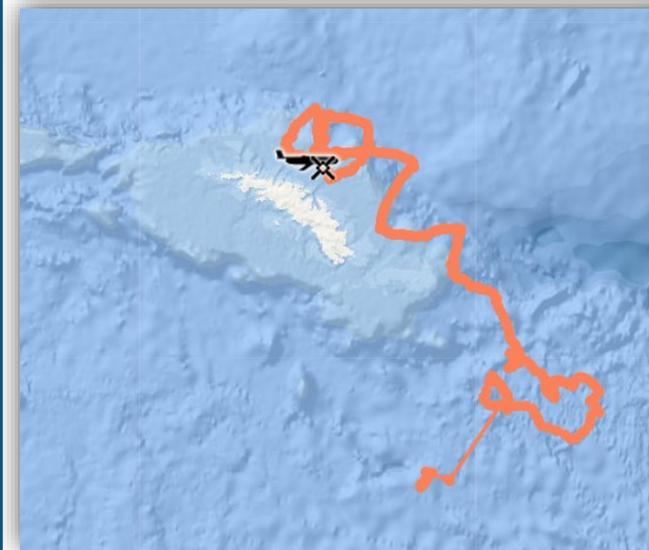
Robots deployed at A68A mega-iceberg remnants

Jonathan Amos
Science correspondent
@BBCAmos

6 days ago



A robotic glider goes over the side of the James Cook



- Persistent occupation of the JONASIS line by slocum gliders

3 x Autosub Long Range 6000 (ALR6000)

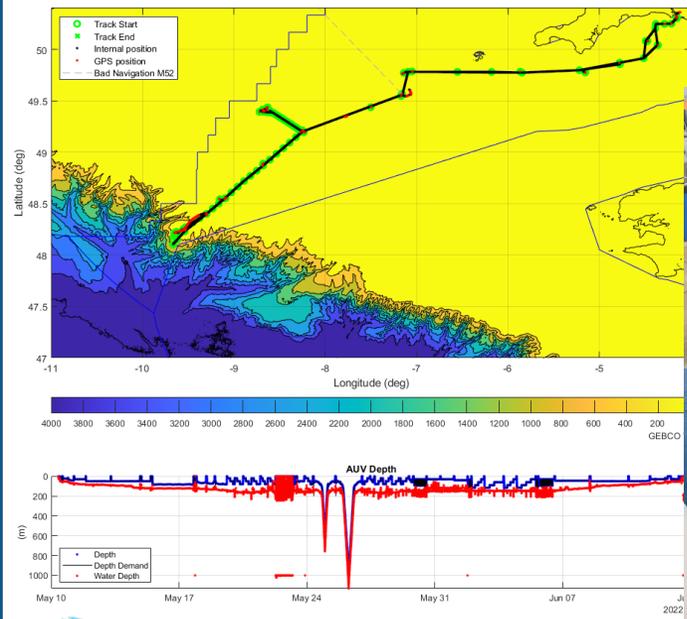
- 2 x Pressure Vessel
- 38kWhrs Primary LTC Batteries
- 6000m depth rating
- Mass \approx 800 kg
- Length \approx 3.5m
- Top Speed \approx 1m/s
- Max Range \approx 2000km



- 1 x Pressure vessel
- 95kWhrs Primary LTC batteries
- 1500m depth rated
- Mass \approx 800 kg
- Length \approx 3.5m
- Top Speed \approx 1m/s
- Max Range \approx 6000km

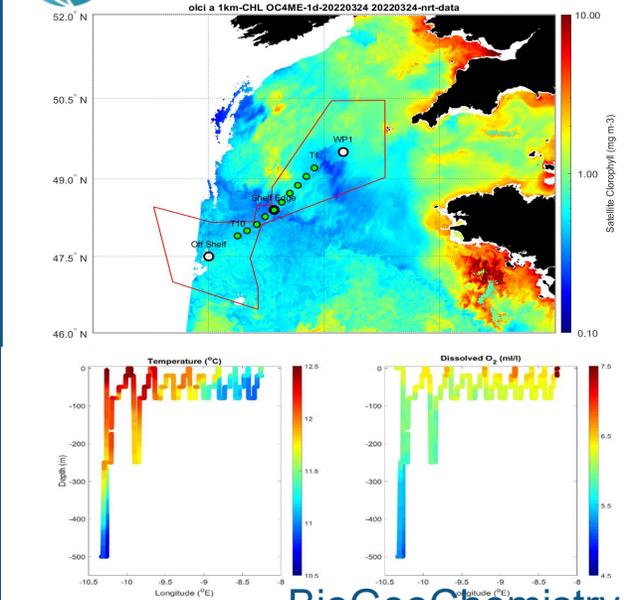
3 x Autosub Long Range 1500 (ALR1500)

Long Distance Proving Trial 2000km over 5 weeks

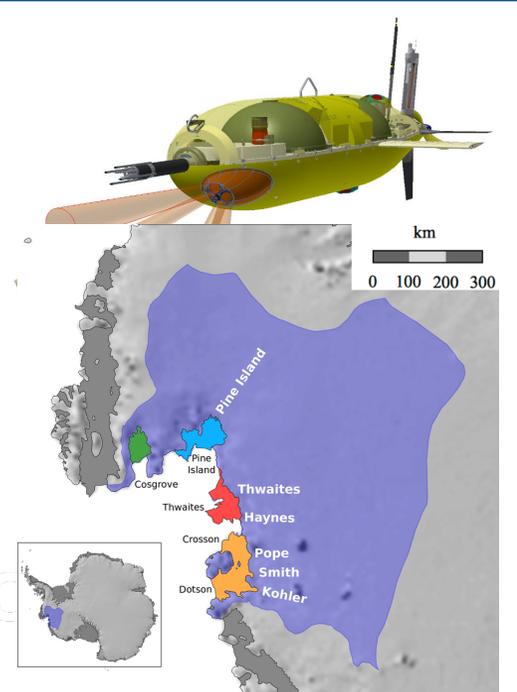
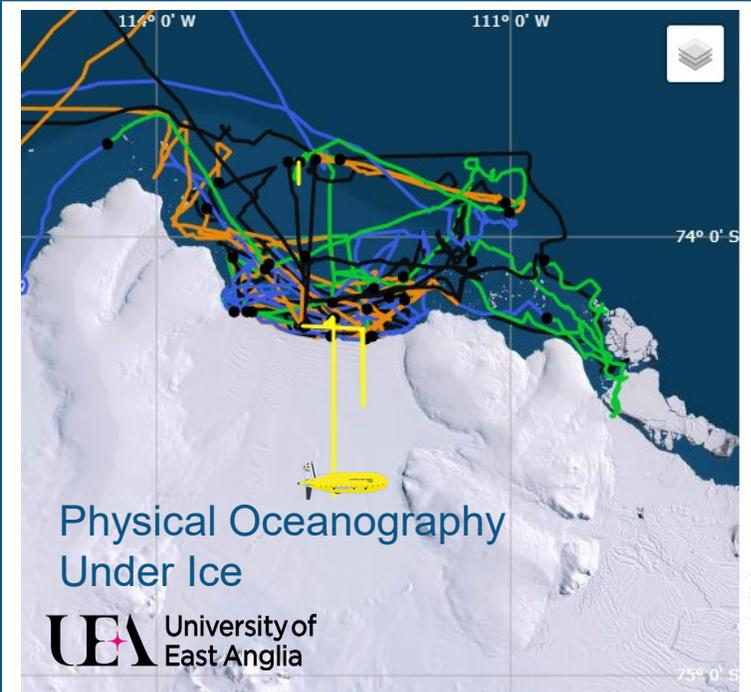
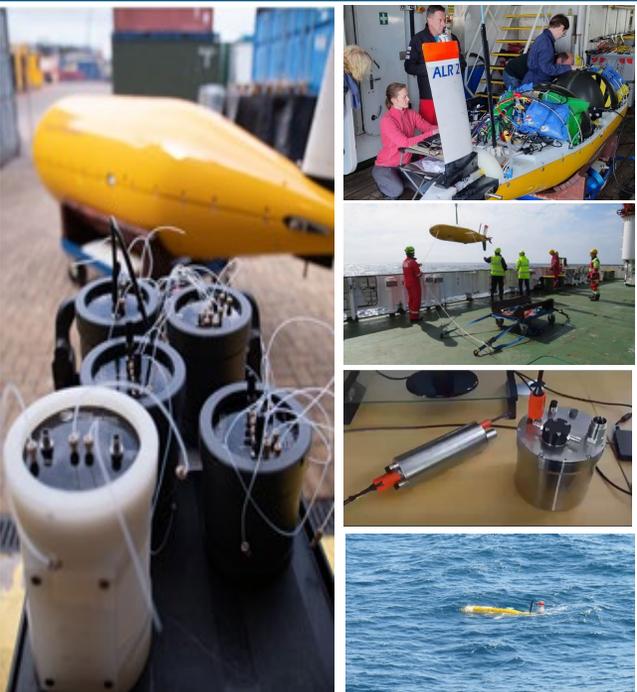


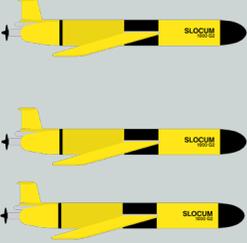
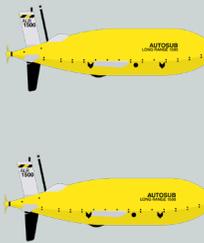
Shore Launch Benthic Survey

Diagram illustrating the Shore Launch & Recovery system for the Shetland Islands, Scotland. The system involves launching the AUV from a barge and recovering it from a decompressed subsea development site. The AUV is equipped with various sensors: Laser safety switch, Camera unit, Strobe x2, and Laser x2.



BioGeoChemistry from Autonomy
University of Southampton



	Slocums		ALR1500	
Standard sensors available within the NMEP		CTD Dissolved Oxygen ADCP MicroRider Turbulence Probe PAR Fluorescence		CTD Dissolved Oxygen ADCP (up/down) MicroRider Turbulence Probe Wetlabs ECO BBRTD - turbidity Wetlabs ECO FLCDRTD - CDOM Wetlabs ECO FLNTURTD – fluorescence and turbidity Wetlabs Triplet Puck
Additional non-standard sensors may be available		Lab on Chip <ul style="list-style-type: none"> • Total Alkalinity* • DIC* • pH • Nitrate/Nitrite • Phosphate • Silicate • Iron UVP6+ ... Your input required + NMF hoping to procure these sensors through other funding sources *These sensors will be provided by NOC's Ocean Technology Engineering Group (OTEG)		Scientific Echo sounder (EK80)+ UVP6+ RoCSI environmental sampler* (suitable for eDNA sampling) PAR Lab on Chip <ul style="list-style-type: none"> • Total Alkalinity* • DIC* • pH • Nitrate/Nitrite • Phosphate • Silicate* • Iron* Primary productivity ... Your input required

“Lab on a chip” sensors for in-situ chemical analysis



	Parameter	Method (S = spectrophotometric)	Availability
	Nitrate + nitrite	S, Griess assay	commercialised
	Phosphate	S, molybdate assay	commercialised
	Iron	S, ferrozine assay	commercialised
	Silicate	S, molybdate assay	commercialised
	pH	S, mCP dye	commercialised
	Total alkalinity	S, single-point titration	NOC
	Dissolved inorganic carbon	Conductometric	NOC

Why lab-on-chip sensors?

- Highly miniaturised instruments with low power & reagent use
- Pump in seawater & analyse using standard wet chemistry assays with well-known analytical performance
- Analytical reference materials on board allow regular re-calibration during use
- Real-time data provision to vehicle
- ~2 W while running
- 1-4 ml waste per measurement
- Rated to 6000 m deep

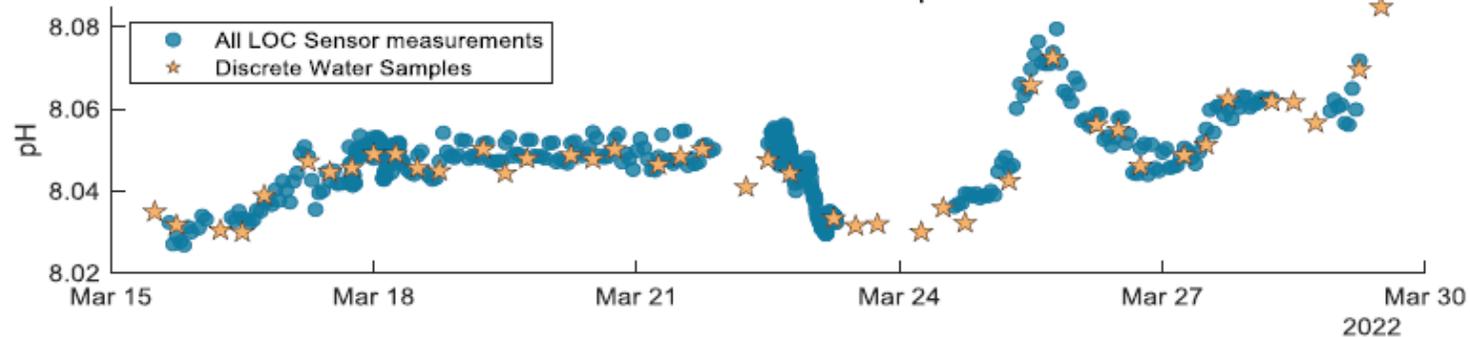
<https://noc.ac.uk/technology/technology-development/instruments-sensors>

Integration of sensors onto ALR for DY149

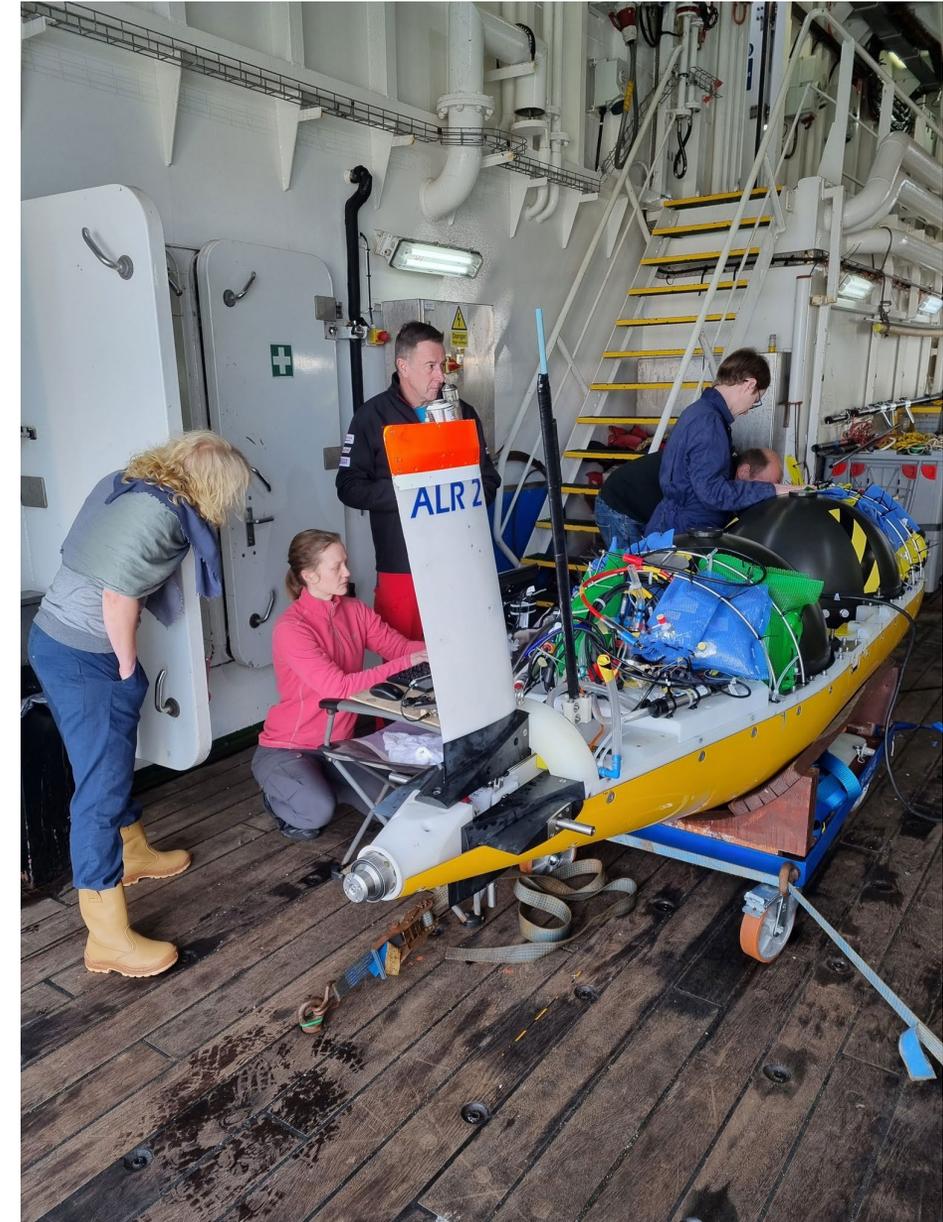
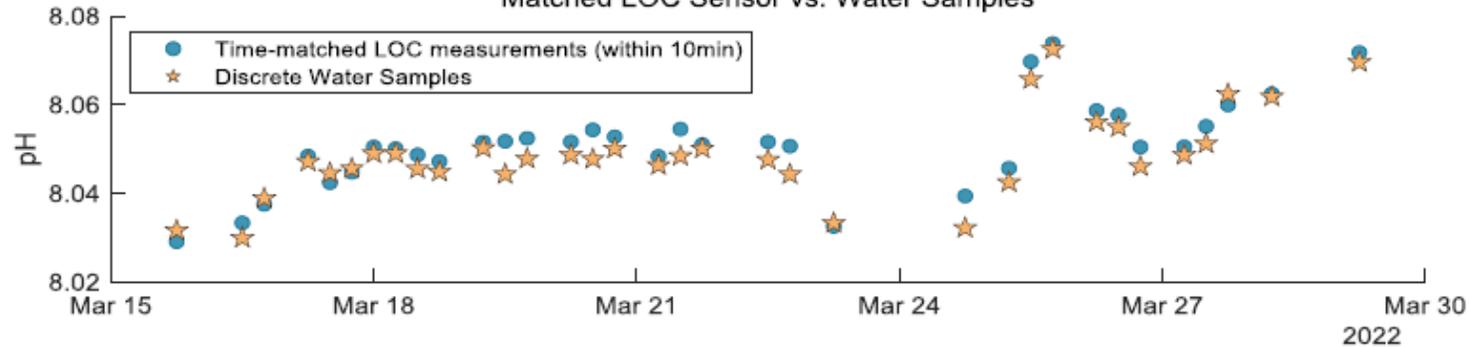
- 8 sensors integrated onto one vehicle (5 nutrients, 3 carbonate)
- Sensors receive power from vehicle
- Data provided back to vehicle for transmission & planning

DY149 Underway pH Observation

LOC Sensor vs. Water samples



Matched LOC Sensor vs. Water Samples



Current data workflows

Slocum

Near real time data flow

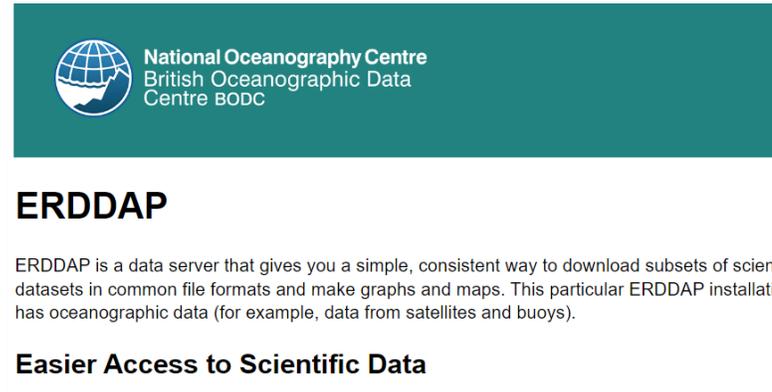
- Version 1 operational
 - Raw files and EGO NetCDF
 - 1-2 hour timeliness
 - Delivery to BODC website, ERDDAP, Met Office and OceanGliders
- Version 2 evaluation
 - Raw files and OceanGliders NetCDF
 - <30 minute timeliness
 - Delivery to BODC website, ERDDAP, Met Office and OceanGliders

Delayed mode

- Delayed mode curation & DOIs supplied

Autosub

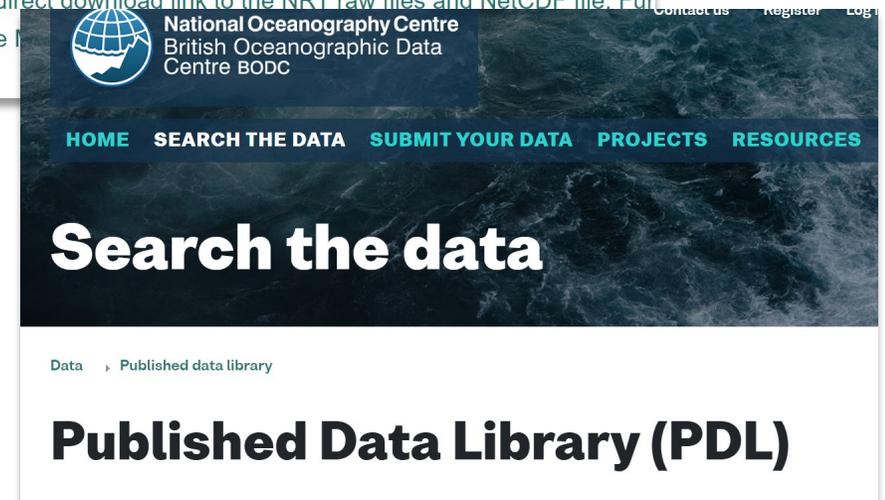
Near real time data flow under development
Delayed mode curation and DOIs supplied



The screenshot shows the top of the ERDDAP website. It features a dark teal header with the National Oceanography Centre logo and the text 'National Oceanography Centre British Oceanographic Data Centre BODC'. Below the header, the title 'ERDDAP' is displayed in a large, bold font. Underneath, there is a paragraph of text explaining that ERDDAP is a data server for downloading scientific datasets and creating visualizations. A sub-section titled 'Easier Access to Scientific Data' is also visible.



This screenshot shows the 'BODC: Glider Inventory' page. It has a dark teal header with the BODC logo and navigation links for 'Home', 'Glider Inventory', and 'Metadata Viewer'. The main content area is titled 'BODC: Glider Inventory' and contains text about campaign details. A navigation bar at the bottom of this section includes links for 'Contact us', 'Register', and 'Log in'.



The screenshot displays the 'Search the data' page. It features a dark teal header with the BODC logo and a navigation bar with links for 'HOME', 'SEARCH THE DATA', 'SUBMIT YOUR DATA', 'PROJECTS', and 'RESOURCES'. The main heading is 'Search the data' in a large, white font. Below this, there is a breadcrumb trail 'Data > Published data library' and a large, bold heading for 'Published Data Library (PDL)'.