Missions from MARS:

Marine Autonomous and Robotic Systems - current and future science applications

Dr Russell B Wynn (MARS Chief Scientist, Head of NOC Marine Geoscience)

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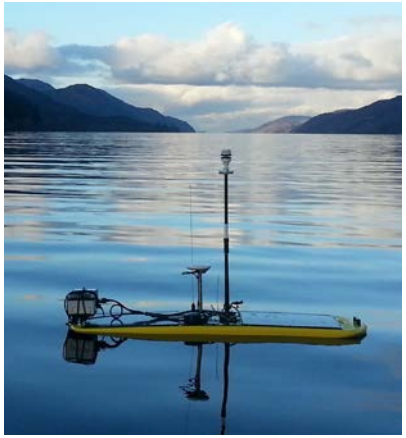
MAREMAP
Marine Environmental Mapping Programme

Marine Autonomous and Robotic Systems at NOC



1) Autonomous Underwater Vehicles (AUVs)

- Autosub3 (1600 m WD)
- Autosub6000 (6000 m WD)
- Autosub LR (6000 m WD)

2) Gliders (submarine and surface)

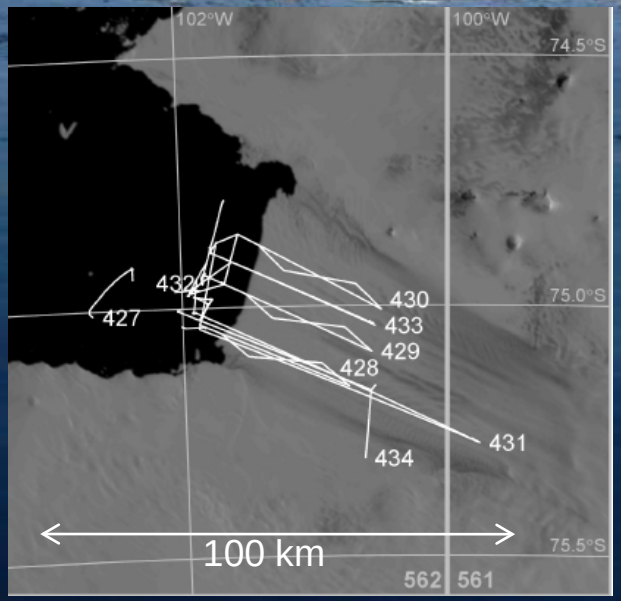
- 4 x Slocum 200 m
- 4 x Slocum 1000 m
- 4 x Seaglider 1000 m
- Liquid Robotics waveglider*

3) Remotely Operated Vehicles (ROVs)

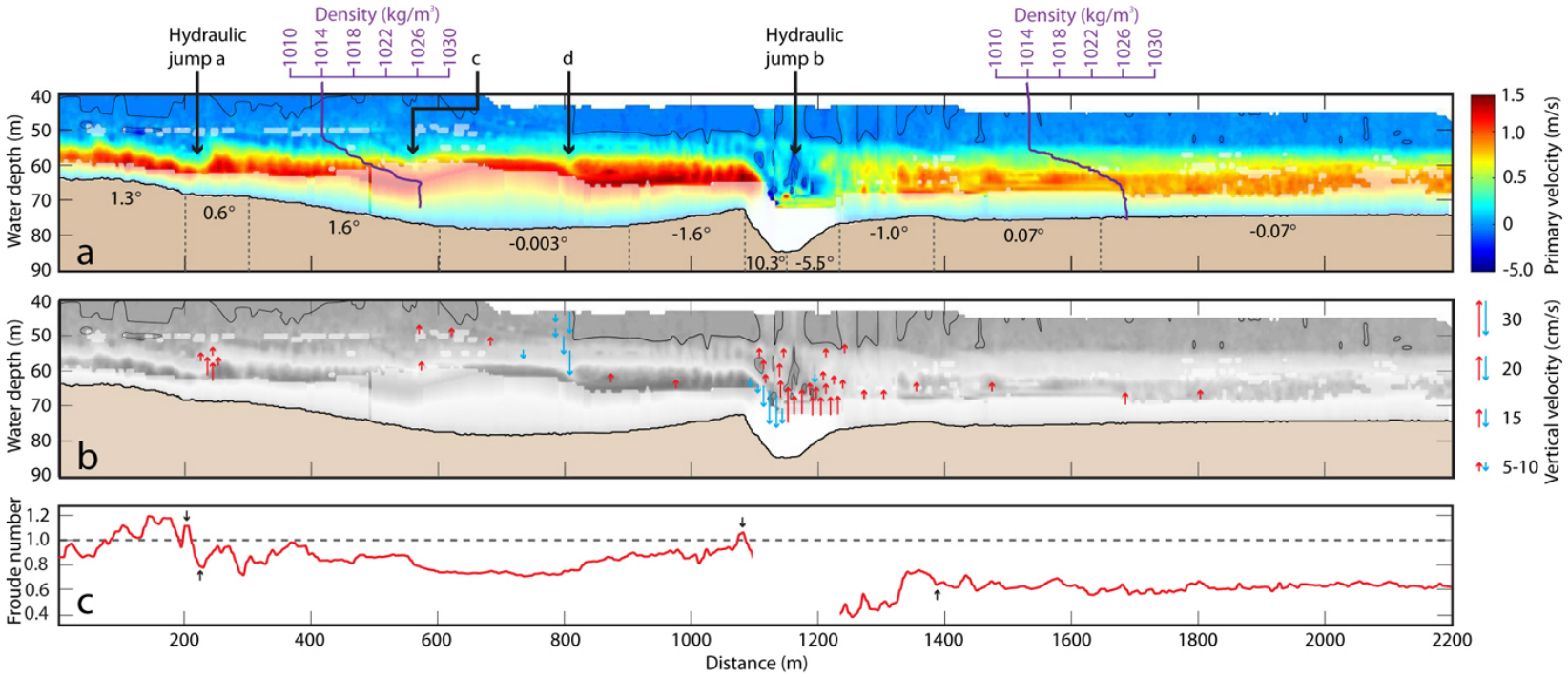
- ROV Isis
- HyBIS*

**not currently in MARS*

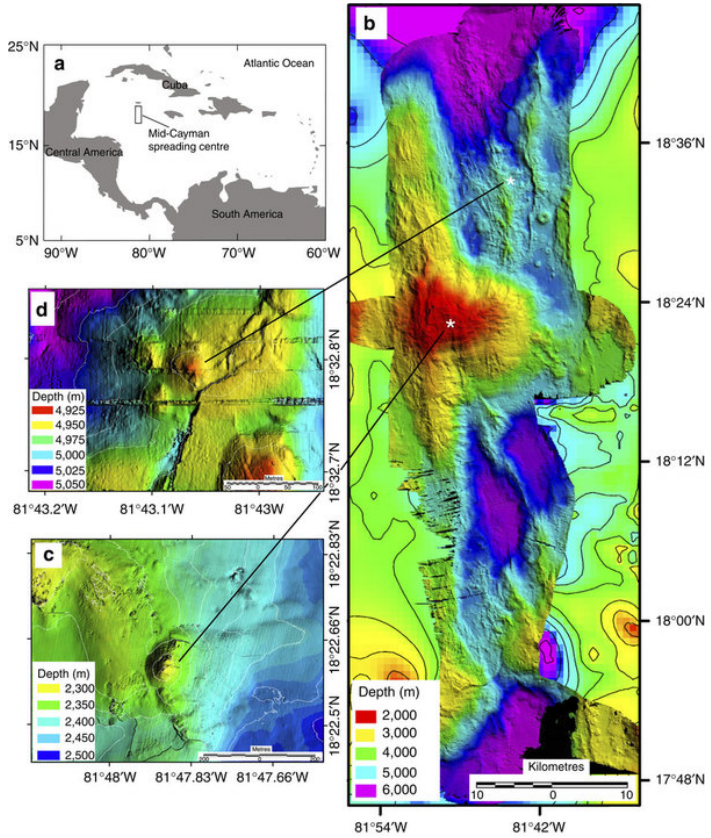
Autosub - first ever under-ice missions in Antarctica (Pine Island Glacier)

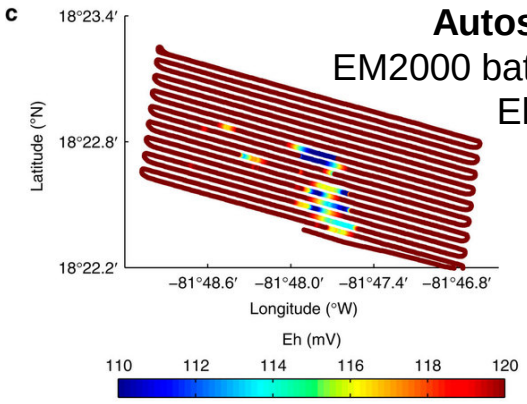


Autosub3 - Investigating hydraulic jumps in sediment-laden density flows



Autosub6000 - Discovery of the World's deepest and hottest hydrothermal vents





Autosub6000
EM2000 bathymetry
Eh sensor

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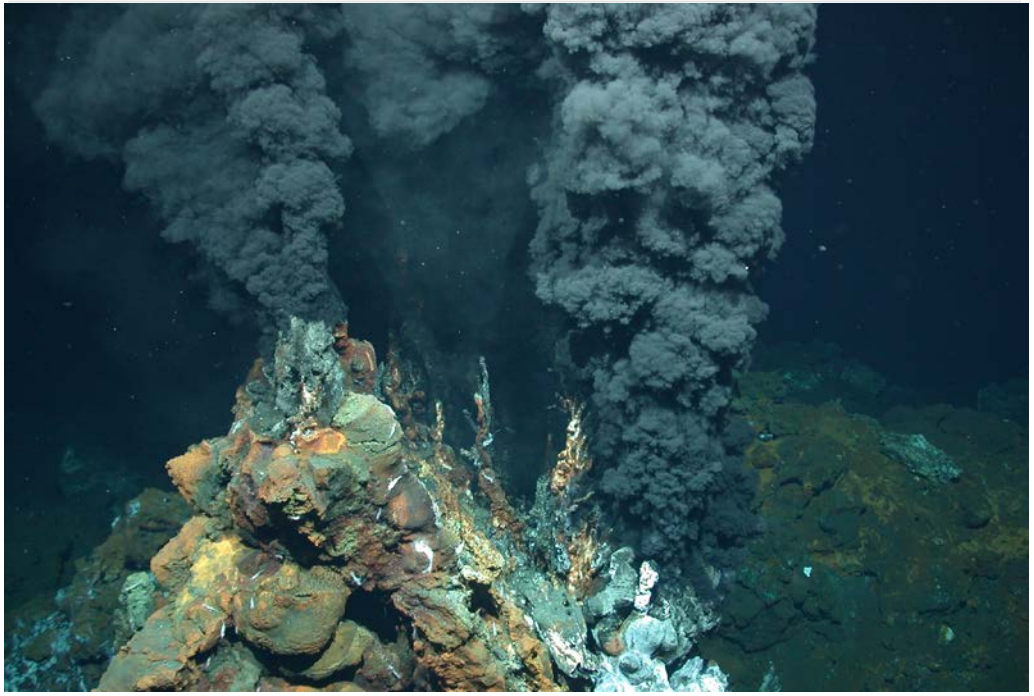
Deepest undersea vents discovered by UK team

By David Shukman
Science editor, BBC News

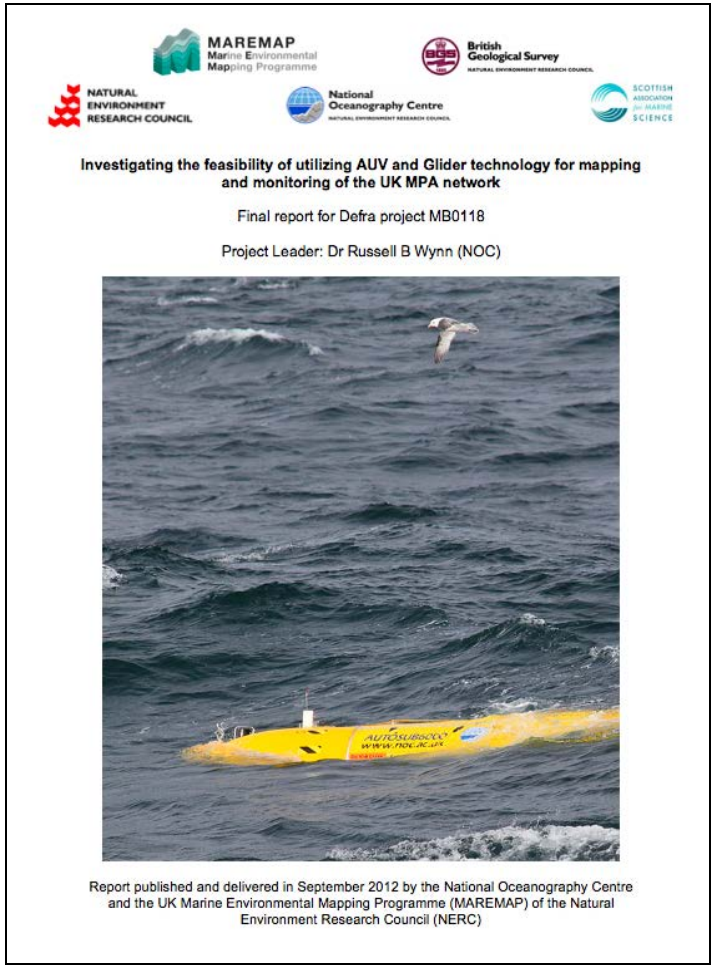


High-resolution photomosaics of the deep seafloor at 5000 m WD

- Autosub6000
- 500,000 individual images
- Largest continuous deep-sea photo

Application of MAS to seafloor mapping and monitoring

NERC-funded (MARS) technology development has potential to generate cost savings to Defra, and improve spatial and temporal resolution of data used for seafloor mapping and monitoring (e.g. MPAs)



MAREMAP Marine Environmental Mapping Programme

British Geological Survey

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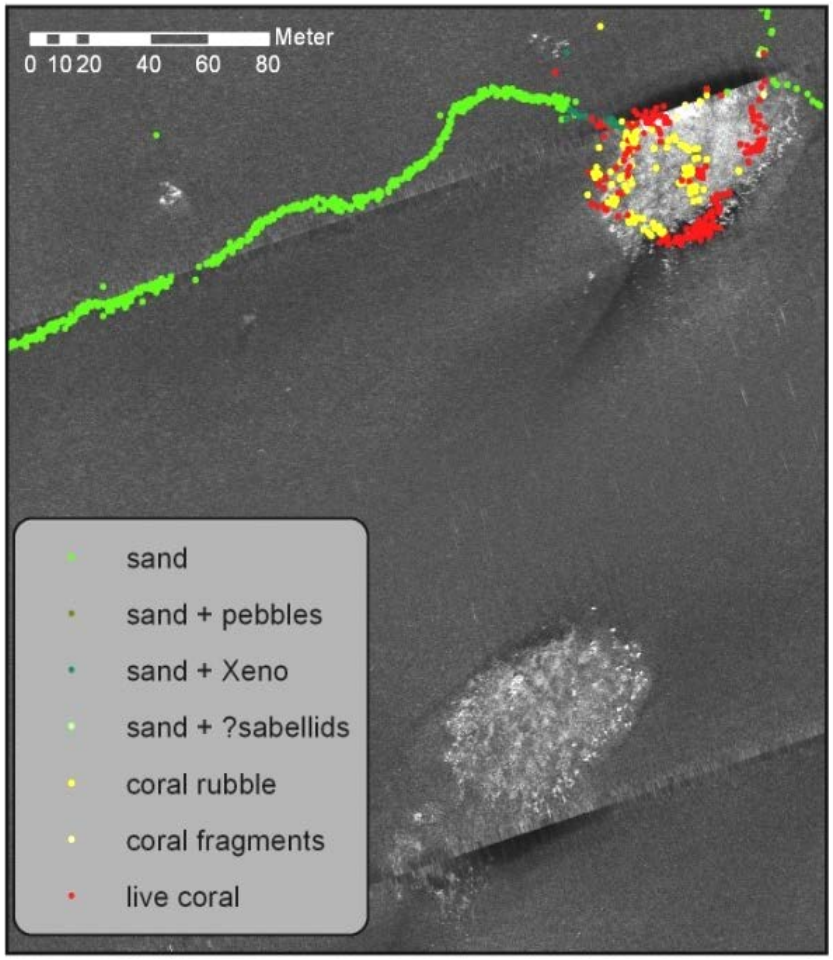
Investigating the feasibility of utilizing AUV and Glider technology for mapping and monitoring of the UK MPA network

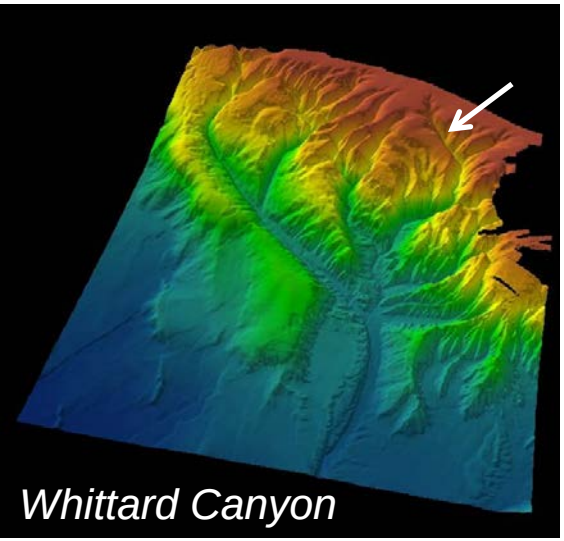
Final report for Defra project MB0118

Project Leader: Dr Russell B Wynn (NOC)

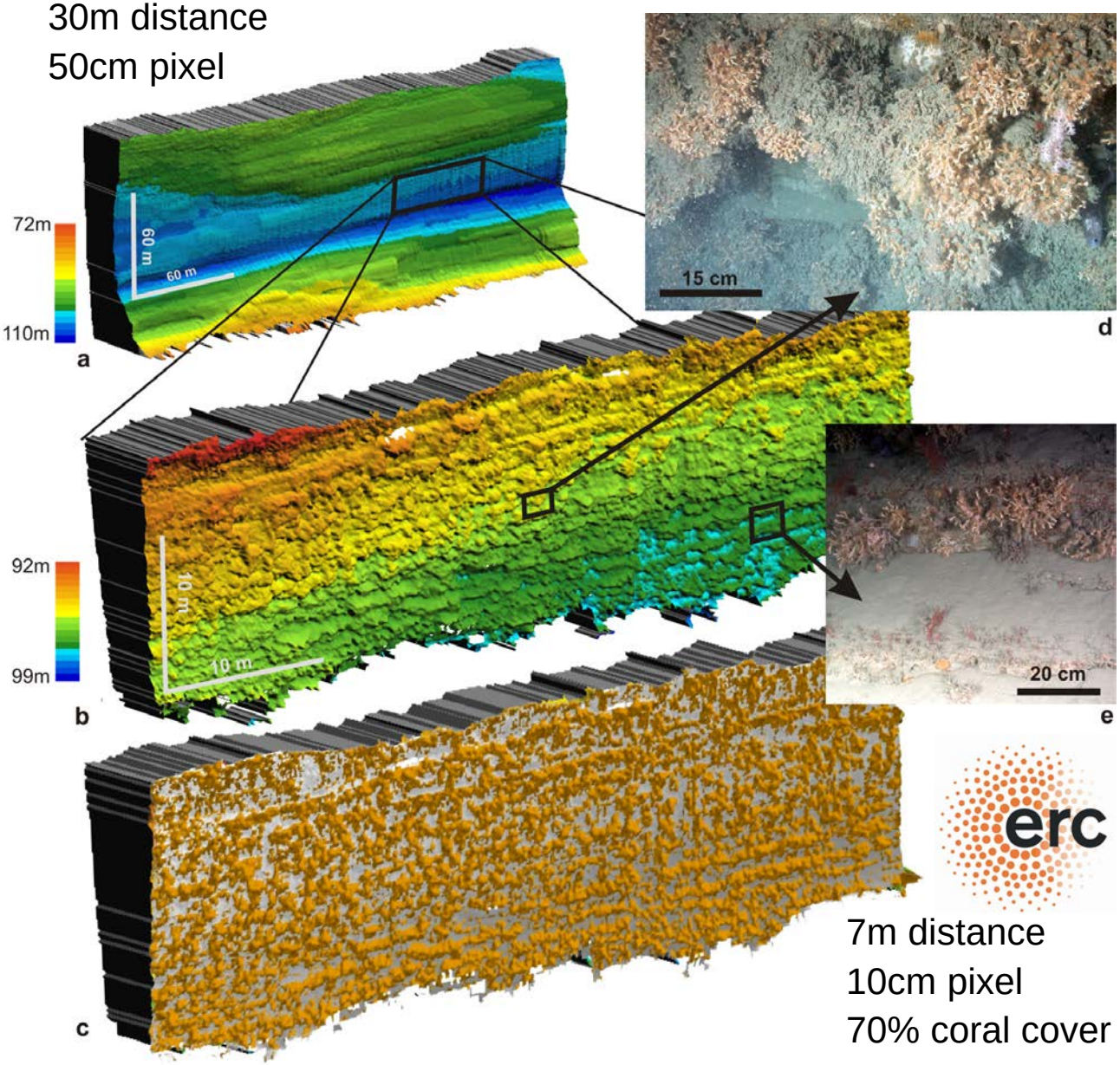
Report published and delivered in September 2012 by the National Oceanography Centre and the UK Marine Environmental Mapping Programme (MAREMAP) of the Natural Environment Research Council (NERC)



ROV Isis 3D swath mapping of cold-water coral communities in Whittard Canyon

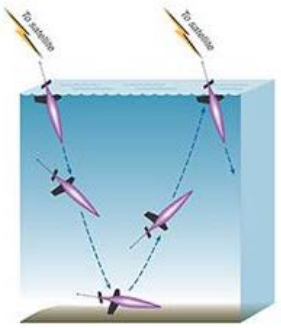


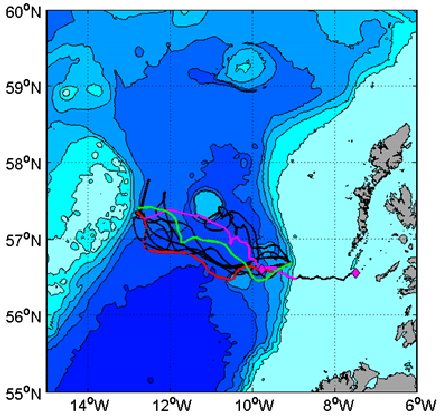
30m distance
50cm pixel

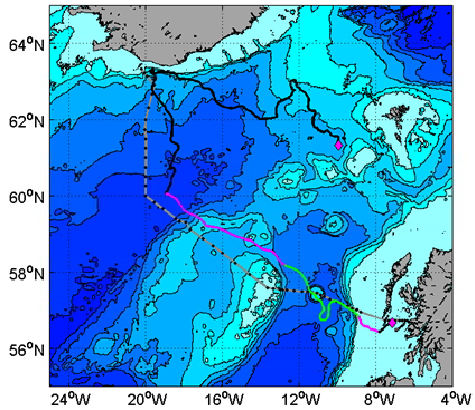


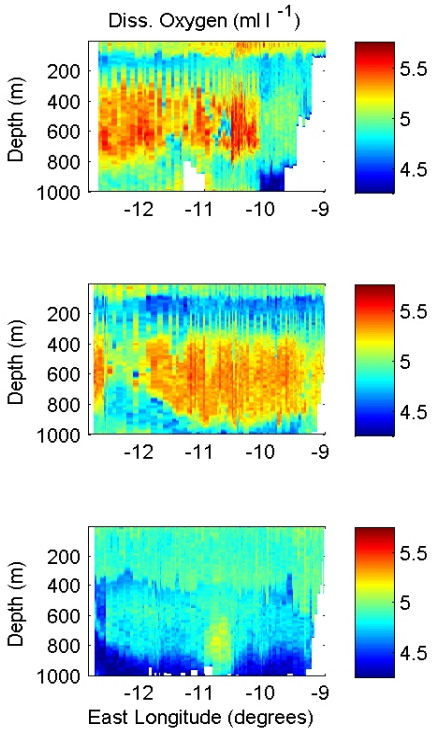
7m distance
10cm pixel
70% coral cover

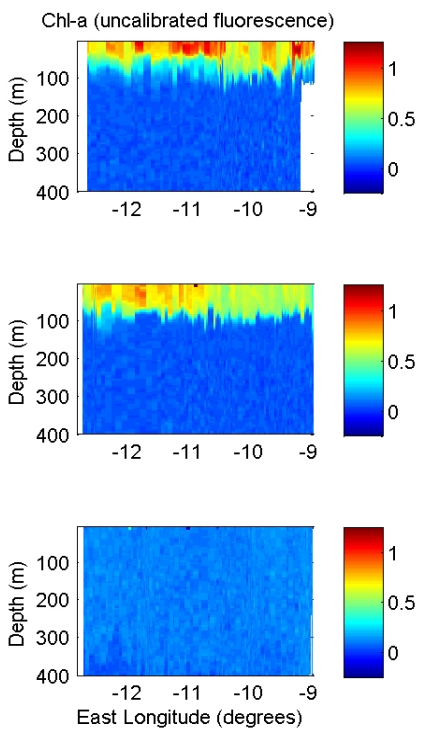
Deep-water multi-month oceanographic glider surveys across Rockall Trough











• This study included two deployments of the SAMS **Seaglider 'Talisker'** across the Rockall Trough off northwest UK, in order to collect oceanographic transect data to depths of up to 1000 m

• The glider collected **hundreds of vertical profiles** of temperature, salinity, dissolved oxygen, chlorophyll-a fluorescence, and optical backscatter, allowing characterisation of different water masses; both missions were successful, and underline the ability of gliders to collect data in **hostile conditions at high spatial and temporal resolution**

Autosub Long Range – a new AUV with ultra long range and endurance

6000 km, 6 months, 6000 m, 600 kg AUV

Across ocean basins, long persistence, seasonal hibernation

- First science mission scheduled for June 2013; recently completed sea trials in Canaries
- Shore deployment from northwest Ireland - oceanography at Malin Shelf down to 1500 m.

Future plans (supported by ~£13M of capital investment from 12/13 – 14/15)

• Purchase and development of new platforms (AUVs + gliders) and sensors, e.g. biogeochemistry (carbonate, nutrients, iron)

• Development of new techniques (e.g. multi-trophic-level measurements and sideways swath mapping) and mobile ocean observatories

• Development and testing of unmanned surface vehicles; potential use of Air Launched AUVs for rapid response (e.g. Arctic oil spills, HABs, volcanic eruptions)

• Development of a fit-for-purpose UK marine monitoring network, including AI systems and mission planning and control (in partnership with government and industry)

• Development of a MAS business cluster and hub at NOC-S, to aid UK SME development and innovation, and align industry and research priorities/resources (with SMMI and TSB/MILC)

Marine Autonomous and Robotic Systems (MARS)

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In 10 years the aspiration for MARS is to be able to 1) deploy MAS in any part of the world's ocean, at any depth, 2) use MAS to map and monitor a comprehensive range of marine parameters of importance to science, policy and industry, at the full range of spatial and temporal scales required, and 3) rapidly deploy MAS in response to any marine event requiring urgent monitoring