AlterEco cruise#7: Cruise report

RV Princess Royal 2ND December 2017

1. Project overview:

An Alternative Framework to Assess Marine Ecosystem Functioning in Shelf Seas (AlterEco)

The overarching aim of AlterEco is to develop a novel monitoring framework to deliver improved spatio-temporal understanding of key shelf sea ecosystem drivers. To achieve this, AlterEco will use marine autonomous vehicles to provide long-term, multi-variable ocean measurements that will help develop greater understanding of the physical and biogeochemical functioning of the continental shelf system. The project will enable a series of missions over a 14-month period with multiple vehicles on a region in the North Sea that undergoes considerable spatial and temporal variability.

The project has the following deliverables:

1. utilise the latest autonomous technology to provide sufficiently high temporal and spatial resolution of meso and sub-mesoscale processes to better understand the impacts of inter-annual variability on the functioning of the shelf sea ecosystem,
2. provide the tools necessary for informing operational forecast models of the stressors on and consequences of the environmental status of shelf seas,
3. provide a modular, integrated framework for an efficient, diagnostic monitoring regime for continental shelf seas that has global transferability.

2. Personnel on board:

Crew: Neil Armstrong (captain), Barry Pearson (engineer)

Science personnel (affiliation): Matthew Tobeman (PSO, SAMS), Estelle Dumont (SAMS) , Jan Witte (NOC).

3. Cruise objectives:

This is the 7th of 8 planned AlterEco deployment/recovery cruises. Cruise objectives were to,

1. Deploy 2 Slocum submarine gliders: 305 (Dolomite) and 331 (Coprolite).
2. Recover 2 Slocum submarine gliders: 444 (OMG-Kelvin) and 438 (Frazil).
3. Collect CTD profiles and discrete water samples for calibration of glider sensors following deployment and prior to recovery.

Unit 444 for recovery is a specialist glider and is longer and heavier than the standard Slocum glider; ~80kg in air and 2.1m long. This additional bulk is to accommodate an integrated ADCP and externally mounted microstructure package.

Deployment, recovery, transect and waypoint locations are shown in figure 1.

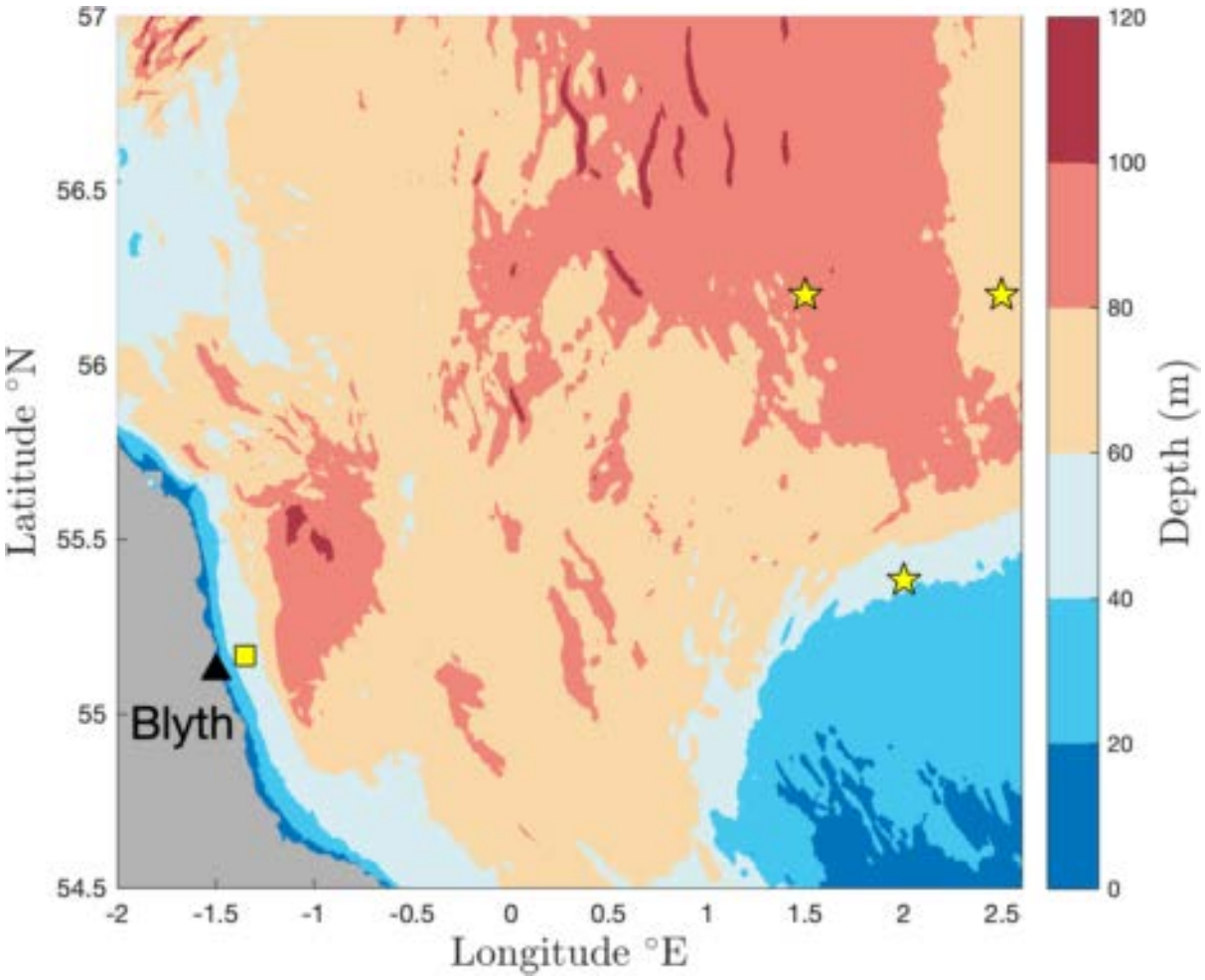

Figure 1: Nominal deployment/recovery site (yellow square) and planned survey location waypoints (yellow stars) for deployed gliders 305 (Dolomite) and 331 (Coprolite). Bathymetry (metres depth) indicates the coastline in black.

4. Cruise narrative (all times GMT 2018):

Friday 1rd December

Pre deployment checks were successfully completed for gliders 305 (Dolomite) and 331 (Coprolite).

The CTD hydrographic winch was not available as vessel was offshore so automatic firing was tested on the CTD unit and found to be successful in timed closure mode.

NOC Seabird 16+ stand alone CTD was attached to the Newcastle University CTD carousel.
It was deemed that the weather for Saturday the 2nd of December was unfavourable for deployment/recovery due to forecasted moderate to strong south easterly winds, with Sunday forecasted to have lighter winds out of the south west.

MARS was requested to direct gliders 444 (OMG-Kelvin) and 438 (Frazil), to recovery way point 6nm off the coast of Blyth at: 55°10' N , 1°21.00' W. (see figure 1) for 08:00 on Sunday.

Sunday 3rd December

Began Vessel loading ready for sailing at 06:30.

07:15 Departed Blyth harbour, sea state was relatively calm with ~0.5m swell, and light winds, however wind was forecast to pick up through the day so a decision was made to first recover gliders 444 (OMG-Kelvin) and 438 (Frazil), due to the need to use a winched recovery during the calmest time of the day, with the remaining deployment to be carried out from aft deck direct from the trolley a method less susceptible to wind and swell.

Event#1
08:00 438 (Frazil) sighted, request sent to MARS to release nose cone to allow for recovery. Nose line released via Iridium at 08:05.

Event#2
08:30 438 (Frazil) successfully recovered. Line grappled, attached to crane and glider lifted out of the water at 08:25 in position 55° 11.458' N, 1° 22.196' E. No visible damage on glider.

Event#3
08:30 (444) Kelvin sighted, request sent to MARS to release nose cone to allow for recovery. Nose line released via Iridium.

Event#4
08:55 (444) Kelvin successfully recovered. Line grappled, attached to crane and glider lifted out of the water at 08:25 in position 55° 11.440' N, 1° 21.544'.
No visible damage on glider.

Given the forecast for a worsening of the weather throughout the day a decision was made to deploy gliders 305 (Dolomite) and 331 (Coprolite) prior to conducting a CTD.

Event#5
09:10 Successfully Deployed 305 (Dolomite) from aft deck direct from the trolley at position 55° 11.320' N, 1° 21.351' E. Floating well

Event#6
09:30 Succesfuly Deployed 331 (Coprolite) from aft deck direct from the trolley at position 55° 11.250' N, 1° 21.419' E. Floating ok, possibly a slight tilt to port.

Event#6
09:55 CTD conducted at position 55° 11.052' N, 1° 21.36 ' W. Water depth approximately 50m.

CTD carousel programmed to fire 3 bottles at 5,6 and 7 minutes and 3 further bottles at 10,11 and 12 minutes. NOC Seabird 16+ stand alone CTD initiated to record T and S.

The CTD was left to acclimatise for 3 minutes at approximately 5m. CTD is then lowered to approximately 40m (based on wire length from winch). CTD remains at this depth for a further 5 minutes, then Is raised to approximately 5m for a further 8 minutes. CTD then brought back on board and water samples taken for both Salinity and Oxygen measurements, see tables 1 and 2 for details.

11:05 back alongside at Blyth. Demobilised and washed down gliders and CTD. Gliders 444 (OMG-Kelvin) and 438 (Frazil) packed into boxed and loaded for transport to NOC Southampton.

CTD Summary.

Figure 2 displays temperature and salinity profiles from both the calibrated SB16 CTD and uncalibrated SB19 CTD. There does appear to be some stable temperature and salinity stratification, however when compared to that of the previous ALTERECO cruise. Changes in temperature and salinity with depth are very small.

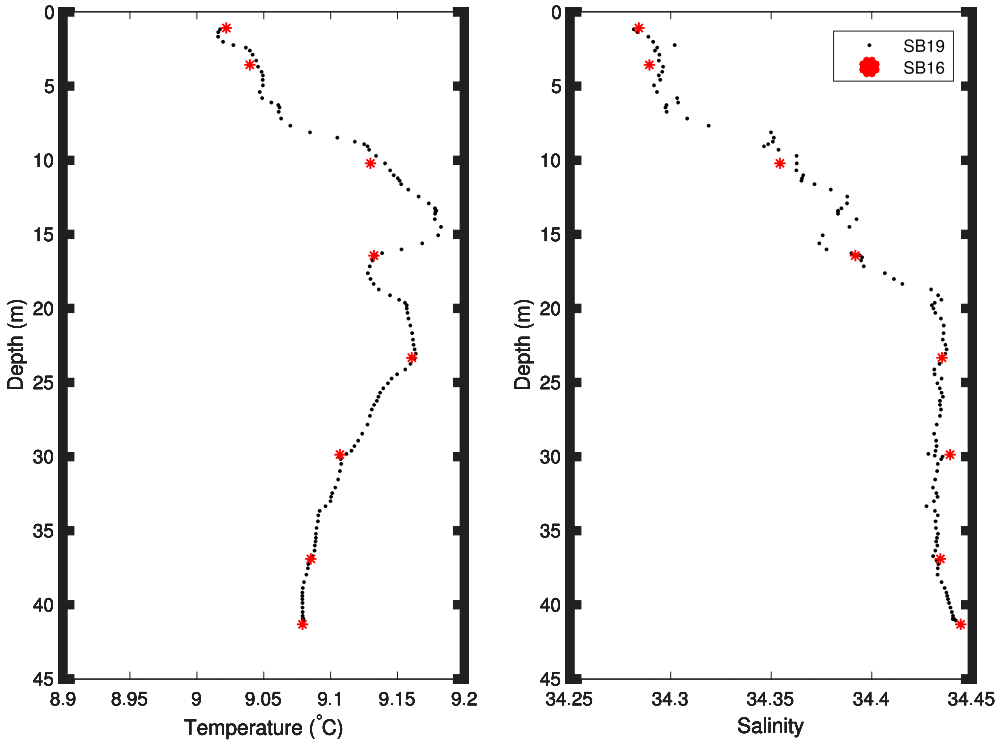

Figure 2: Temperature and salinity as a function of depth from the calibrated SB16 CTD (red stars) and uncalibrated SB19 CTD (black dots)

Figure 3 displays CTD depth as a function of time with the times of bottle firings shown, in order to confirm that the bottles were indeed fired at the required depth.

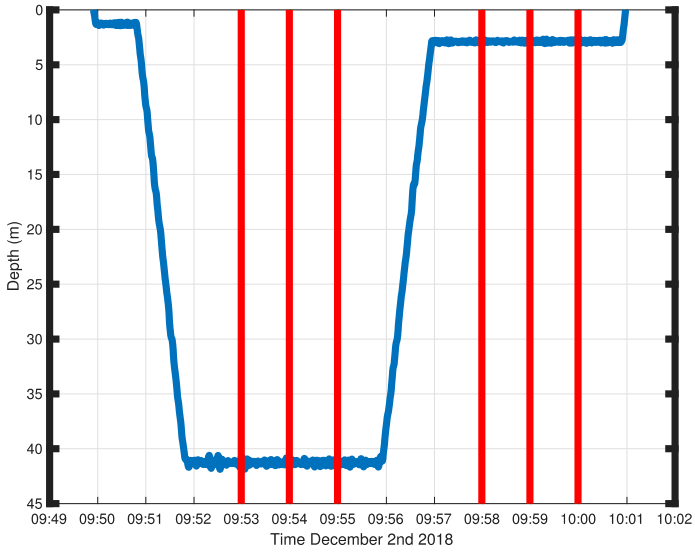

Figure 3 Depth as a function of depth for CTD carrousel with, Niskin bottle firing times shown as red lines.

Tables 1 and 2 detail the water sample bottle numbers and the corresponding water depths for oxygen and salinity measurements.

Oxygen

Bottle Number	Temperature at Fix (Deg)	Depth (m)
288	9.08	2.9
235	9.03	2.9
264	9.15	2.9
168	8.96	41
175	9.06	41
206	9.02	41

Table 1 Oxygen sample bottle numbers, fix temperature and depth from which water was taken.

Salinity

Bottle Number	Depth (m)
37	2.9
38	2.9
39	41
40	41

Table 2 Salinity sample bottle numbers and depth from which water was taken.

Micro-rider Probe Information

Table 3 contains the details of the shear and temperature probes installed on glider 444 (OMG-Kelvin).

Channel	Probe Number	Sensitivity (Volts m^{-2} s^2)
S1	M1080	0.0705
S2	M1078	0.0819
T1	T381	
T2	T837	

Table 3 Micro rider probe details.