Prince Madog OSMOSIS Cruise Report. 7th-18th September 2011

Aims and Objectives

Observation of deepening ocean surface boundary layer processes at a fetch limited site where the wave field is locally generated, fetch limited and aligned to the wind. We specifically aim to collect data to test the scaling hypotheses for Langmuir turbulence and shear spike.

To achieve our aim three specific objectives are defined:

1) Collection of time series data using moored instrumentation. For the first time we will aim to collect a time series of the rate of dissipation of TKE using an ADCP deployed on a mooring wire.
2) Collection of high resolution vertical profiles using a loosely tethered VMP microstructure profiler together with velocity profiles from the ships ADCP.
3) Collection of horizontal transect data, including dissipation of TKE and bubbles, from an AUV. OSMOSIS proposal required 3 separate missions in contrasting weather conditions.

A further objective was later defined in relation to developing the capacity for near surface dissipation measurements from a glider with a microstructure package.

7th September

11.00 GMT. Loading complete with the exception of the NOC-L Waverider buoy which we were informed was not available due to an instrument malfunction.

Decision was made to postpone sailing on account of poor weather conditions in the Irish Sea.

8th September

08.00 GMT. Depart Menai Bridge. Although initially moderate to rough sea conditions these improved as the journey progressed.

Scientific Compliment:

Bangor University: Tom Rippeth (PSO), Chris Old, Ben Lincoln, Ben Powell. (Ray Wilton was unable to join the ship on account of a back injury).

NOC-L: Terry Doyle and Ray Edun.

Received call for Chris B (NOCL) expressing concerns over Glider operation due to high levels of fishing activity in proposed mooring area. It was resolved that the Glider team should join the Prince Madog and deploy when Prince Madog was on site.

9th September

01.00. Anchor off by Holy Island, Clyde Sea, for the night.

06.00. Up anchor and make for mooring site. Sea state favourable for mooring deployments.

07.50. Arrive at mooring location and undertake survey to locate precise positions/ depths for the deployment of mooring arrays.

08.13. CTD profile #001 at moorings location. 55˚46.5'N 5˚12.25'W.

08.34. Deploy mooring M3: Instrumented with 150khz flowquest ADCP and Seabird CTD on a bed frame with an acoustic release.

09.06. Deploy mooring M2: A U-shape mooring with a Met Station and Seabird CTD on the toroid buoy and a wave recorder ADCP in a streamline float on the mooring rising line.

11.08: CTD profile #002 to test acoustic release.

12.08. Deploy mooring M1: A single line mooring with acoustic release instrumented with two ADCPs in inline frames setup up to record time series of dissipation using the structure function method and thermistors and Seabird CTDs. Also equipt with a SAMS acoustic pinger for AUV operation.

12.23 CTD profile #003 at moorings location.

14.00 Along side Tarbert East Pier.

10th September

08.00 NOCL Engineers Terry Doyle and Ray Edun left the ship.

SAMS AUV team Mark Inall, Tim Boyle, Bernard Hagan, Matt Toberman and Estelle Dumont joined the ship.

NOCL Glider team of Chris Balfour and Danny Mclaughlin joined the ship.

Ship made ready for AUV and Glider operations with meetings between relevant scientists and crew members to communicate protocol for deployment and recovery of the vehicles. Relevant transmitters fitted to the Monkey deck in consultation with the First Mate.

11.00 Depart Tarbert for mooring location.

11.56 CTD #004 at moorings location.

13.55 Deploy AUV using finger crane. A simple flight path was defined which saw the AUV undertake a transect through the mooring site returning via a dogleg to a location in the shelter of Inchmarnoch Island for recover.

15.43 AUV recovered using the RIB. Wind conditions, force 5, estimated to be at the upper limit for use of the RIB. RIB towed the AUV back to the ship and it was then lifted back on board through the A-frame, with the back deck doors open.

AUV data complete except for the failure of the bubble detector.

16.27 Glider deployed using the RIB as a platform off the back deck. This operation required the back deck doors to be open. Initial glider operation indicated it was performing very well.

17.30 Arrive Tarbert.

11th September

Departure delayed on account Glider malfunction overnight. A recurrent flood detection error was leading to dives being aborted. Two options were identified: (i) recovery of glider and (ii) rectification of error whilst the glider was still in the water. Initially option (ii) was pursued with CB in contact with Phil Knight (NOCL) and the Instrument manufacturers in the US.

08.30 Depart Tarbert.

09.35 CTD #005 at moorings location.

AUV mission cancelled on account of high winds (force 8) and worsening forecast (storm force 10 later) making RIB operations too hazardous. Decision made by a meeting between TPR, MEI, the Captain, the First Mate and Phil Jones (Boson and RIB driver).

10.20 RIB brought inboard on account worsening sea state. CB, in consultation with PK made the decision to recover the glider acknowledging some damage in the recovery.

11.53 Glider recovered on first attempt using a net system constructed by the boson. The captain and crew are to be commended for a remarkable bit of seamanship in the smooth recovery of the glider in very difficult conditions. Although some of the glider sensors were destroyed in recovery this damage is all recoverable in time for a second deployment later in the cruise.

12.00 Head to Troon on account of significantly worsening weather conditions.

16.00 Tie up in Troon.

12th September

Sit out “Hurricane Katia” in Troon.

13th September

Sit out “Hurricane Katia” in Troon.

14th September: *Weather: blowing 4 from the north-west. Visual evidence of Langmuir circulation.*

05.00 Depart Troon for Mooring site.

07.30 Arrive at mooring site. Mooring still appear intact.

Wind from the North ~ 12-15 ms^{-1}. Wind weakened and sea state dropped as day progressed.

07.33 CTD #006 at mooring location.

08.00 Deploy AUV north of Inchmarnock Island (as Saturday). AUV programmed for 1km sections at 3 depths (5m, 10m, 15m).

08.50 Return to AUV launch site after mission aborts. Successfully re-launch mission.

09.39 – 14.49: 48 VMP profiles along a 1 nm transect running approximately S to N. Several interruptions to avoid trawler and also meeting AUV.

15.09 Steam to pickup AUV. RIB deployed and AUV lifted back on deck using the A-frame.

16.57 Tie-up in Tarbert.

15th September. *Weather: calm with a float sea.*

06.00 Depart Tarbert.

07.10 Arrive on station.

07.15 CTD #007

08.01 AUV deployed to run L-shape track to the north of the Mooring site.

08.38 AUV mission aborted on account of the AUV not being able to dive. AUV recovered using RIB and A-frame.

09.26 – 15.25. Begin VMP series along a transect running approximately 500 m to the west of the AUV line. VMP interspersed with CTD/ ADCP profiles setup for S-function trials.

10.35 VMP/ CTD series interrupted to successfully redeploy the AUV.

16.30 AUV back on deck following recovery using the RIB and A-frame.

18.34 Tie up in Tarbert.

In parallel to the ship operation, the NOCL team achieved a series of Glider deployments on site from a dive boat.

16th September. *Weather: blowing 4-5 from South West and rising sea, swinging to the East ~ 13.00 and sea falling off.*

06.12 Depart Tarbert

07.19 On site to deploy AUV.

07.38 AUV in water

08.02 CTD #012

08.35 – 10.35 19 VMP profiles on a line running parallel to the bathymetry approx 500m to the west of the mooring site.

11.45 Recover the AUV.

13.00 Tarbert. Off SAMS team and equipment. Pick up NOC-L crew.

14.06 – 15.00. Back on mooring site to successfully recover all three moorings.

17th September

10.00 Back alongside Menai Bridge. Unload the ship

Summary of activity/ data return as per listed objectives.

1) *Collection of time series data using moored instrumentation. For the first time we will aim to collect a time series of the rate of dissipation of TKE using an ADCP deployed on a mooring wire.*

   Almost 100% success rate with moored instrumentation. 1 thermistor failed. There were also some problems with the wave-ADCP which may compromise the quality of the wave data.

   ADCP structure function data successfully collected, with initial analysis showing good agreement between dissipation estimates made using the moored h-f ADCP data and VMP profiles.

2) *Collection of high resolution vertical profiles using a loosely tethered VMP microstructure profiler together with velocity profiles from the ships ADCP.*
3) *Collection of horizontal transect data, including dissipation of TKE and bubbles, from an AUV. OSMOSIS proposal required 3 separate missions in contrasting weather conditions.*

   3 sets of data were collected which combined AUV and VMP measurements on the 14, 15, 16th September (corresponding to day numbers 257, 258 and 259). Each set of data was characterised by differing wind conditions.

A further objective was later defined in relation to developing the capacity for near surface dissipation measurements from a glider with a microstructure package.

Simultaneous glider, AUV and VMP data, including velocity microstructure dissipations, were collected over a six hour period on the 15th September. These will provide data (i) an assessment of glider use to make near surface microstructure measurements and (ii) validation of the ability of gliders to make microstructure measurements.

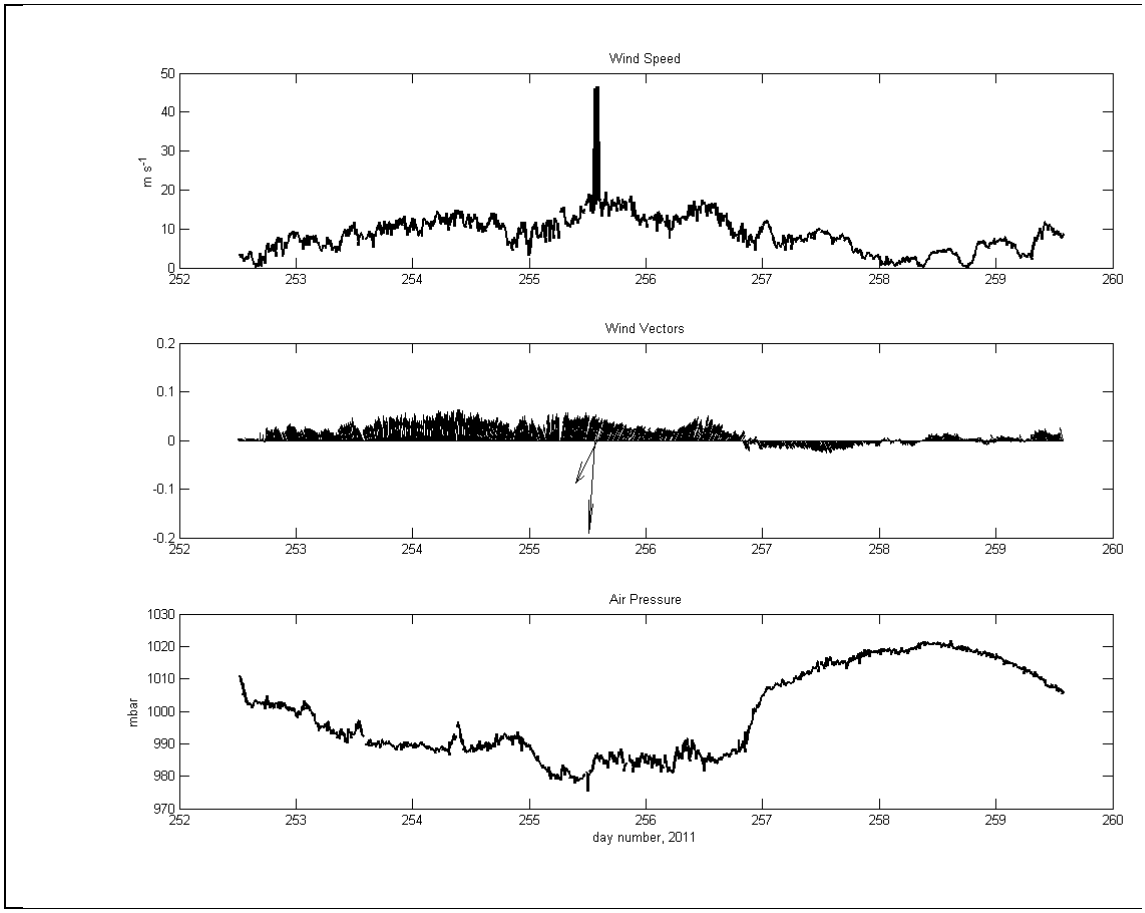

Figure 1: Data obtained from the Meteorological buoy. Panel 1 shows wind speed, panel 2 wind arrows and panel 3 atmospheric pressure.