

Survey report week 46, 2006
Survey site: Brown Bank
13 -17 November 2006
(TvD, 5 Dec 2006)



Figure 1: RV Arca of the Dutch Ministry of Transport, Public Works and Water Management (RWS).

Vessel: RV Arca (RWS)

Investigators and crew:

TNO: Thaiënne van Dijk (PI); Pieter Doornenbal

RWS: Rob Cupédo (PI); Bert Kulk

Crew: Royal Boskalis Westminster NV

Apparatus details: Positioning: dGPS, DP
EdgeTech 4300 MP-X Sidescan Sonar, 410 kHz
Simrad EM 3000 multibeam, 300 kHz
Odom 210 kHz singlebeam
Mors Tide meter
Cylindrical box corer
Portable pH-, EC- and thermometer (lab UU)

Journal

Mon 13.11.2006	All day	Stayed in harbour due to wave height >> 2 m; loading vessel
Tue 14.11.2006 11:15 WSW 5-6 Bft. 15:30 W 3-4 21:45 WSW 6-7	08:00	Repairs of 'panic button' RWS
	12:00	Sailing to BNB site; predicted wave height 2.3 m (for coastal site Zandvoort same wave height, so decided to go to BNB)
	15:00	Arrival BNB; start MBES only (waveheight to large for SSS)
	21:30	End of MBES measurements (5 tracks; 50 m distance in between)
Wed 15.11.2006 WSW 6-7 Bft.	08:00	Placement of tide meter (until 09:00)
	09:00	Sailing back to BNB study site (1 hour's sailing)
	10:00	Start MBES measurements; 4 tracks of SSS in the afternoon.
Thu 16.11.2006 00:00 SSW 7-8 Bft. 12:00 SSW 7-8 17:55 NW 3-4 22:30 WNW 4	All day	Box coring (sometimes problems with locating on DP)
Fri 17.11.2006 00:00 WSW 3 Bft. 07:10 SW 6	08:00	Start box coring; stopped after 2 box cores
		Collection of tide meter (before the waveheight would have increased; prediction 3 to 4 m wave height)
	10:15	Return to Scheveningen
		Arrival Scheveningen; unloading vessel and loading truck

Table 1: Survey journal and specifics.

MBES, SSS and tide meter

Despite the severe surface-wave conditions, multibeam echo soundings were recorded along 12 east-west running tracks and 4 north-south running tracks, normal and parallel to the Brown Bank's axis, respectively (Figure 2). The across-bank tracks were 12.5 km long and covered both the bank and its adjacent swales. The bank-parallel tracks were 11.5 km long and were both along the crest (3 tracks), crossing a large number of sand waves superimposed on the Brown Bank, and in the eastern trough (1 track), partly in a sand extraction zone. The tracks were sailed 50 m apart, so that the data is full-coverage.

The quality of the MBES data will have to be judged after processing. During acquisition, occasional stripes of no-data were visible on the screen, probably due to the occurrence of air around the hull-mounted multibeam.

The backscatter data of the multibeam soundings were not recorded, because the necessary software was not operational (Rob Cupédo verified this with the PDS-software provider).

Nevertheless, raw .all files, from which the backscatter normally may be compiled, were created, but we had no options to insert the absorption coefficient into a MBES menu. The portable pH and EC meter remained unused; NB. the temperature and salinity are measured by the multibeam apparatus as well. Recording of the MBES backscatter will have to be applied for earlier with RWS next time, and for this purpose the MS Zirfaea would be preferred. Certainly when SSS is not collected, it would be valuable to collect backscatter data with the MBES.

Track lines were plotted on board in ArcGIS, directly from the vessel's dGPS receiver into Arc GPS-log files (Figure 2). Check whether the offset is taken into account in this case.

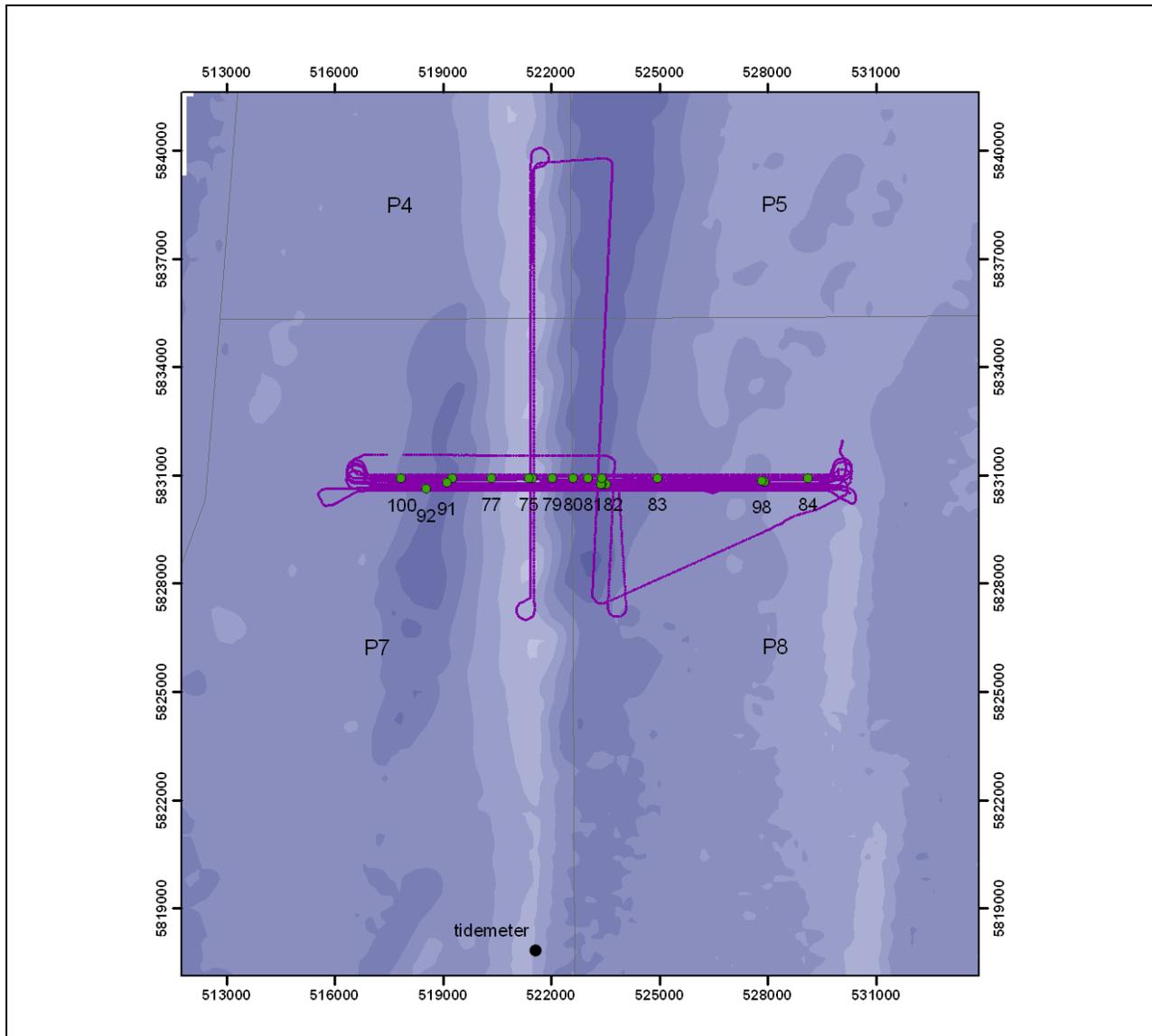


Figure 2: Sailed tracks, location of the tide meter and locations of the box core samples.

On only four of the 12 E-W directed MBES tracks, sidescan sonar was measured simultaneously. Due to the large wave heights, it was decided not to use the sidescan sonar on Tuesday and the Wednesday morning, because of the risk of snapping of the cable. Moreover, the sidescan sonar data was expected to be of poor quality and thus not suitable for the QTC classification. The distance between sonar tracks was 100 m, so that the sonograms overlap. In general, the sailing speed was 4.7 knots when the sidescan sonar was in use and 7 knots when merely the MBES was used (e.g. during later infill of the tracks). During hard winds, the speed had to be kept at 5.5 to 6 knots, to keep the vessel navigable. In order to keep the fish height above the bed constant, the cable length was crudely adjusted to the large-scaled morphology of the bank. It is important to keep this in mind with the interpretation, because some changes occur exactly at times of an opposite morphological change or with no morphological change at all. Here, the altitude of the fish above the bed was also changed over sand waves, which is not desirable, because then the water depth cannot be read from the undulations in the nadir.

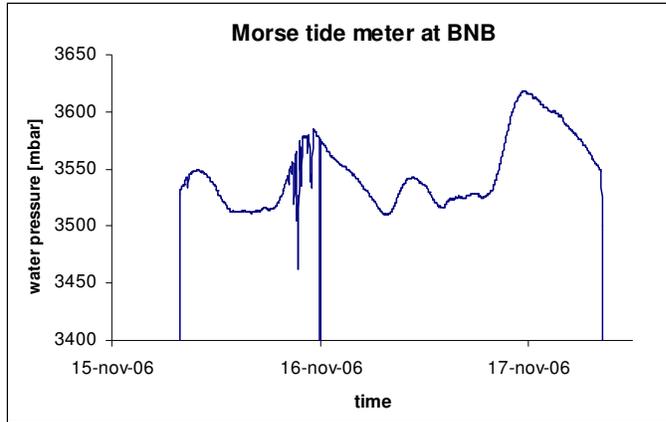


Figure 3: Tide meter measurements.

Because the tide is not being monitored near the Brown Bank in existing monitoring programmes, a Morse tide meter was placed at the bed close to the nearest buoy (cardinal buoy C9; UTM X = 521575; UTM Y = 5817825; UTM zone 31N ED50), for more accurate correction of the multibeam soundings. Water pressure was recorded every 5 minutes for 48 hours (Figure 3) (minimum measuring time is 39 hours).

Box coring



In order to test the diagnostic value of acoustic facies, 19 ground-truth samples were taken, using a cylindrical box corer of RWS (Figure 4). Box core locations were selected immediately after the acquisition of MBES and SSS data, and selection was based upon the large-scale morphological units across the Brown Bank as well as acoustic facies. At least one sample was taken in each morphological element (see Figure 2). To be able to link the associated benthos and grain sizes to sand wave mobility, samples were planned on the crests and in the troughs of 4 sand waves, but time and the weather permitted only 1 sand wave to be sampled. Due to wave heights of 3.5 m, it sometimes took a long time to put the vessel in place with the DP.

Figure 4: cylindrical box corer of RWS.

The box corer penetrates into the seabed by a weight of lead when the tension on the cable is released, upon hitting the bed. Being pulled up, a pin is removed by the tension of the cable and the knife cuts underneath the box corer. Two box cores were taken at the same location: one entirely for benthos analysis, from the other, a sediment core was sub-sampled with a plastic tube with a diameter of 100 mm. Photos were made of each benthos sample in the sieve (Figure 5). The benthos samples were sieved on a 1 mm sieve, and kept and transported in buckets or plastic jars while covered with formaldehyde. Intended algae samples for the link to mobility were not taken (seemed not useful in mobile sands and extremely coarse material).



Figure 5: example of a box core benthos sample (sample 80).

In general, the sediments over the Brown Bank were highly variable, ranging from extremely coarse (cobbles (11 cm) and large shells (<10 cm)) to well-sorted fine sand and sand on clay. Both box cores in a sand wave (crest and trough) on the top of the Brown Bank consisted of fine sand (<1 mm; all through sieve) with very little macrobenthos. Some samples contained more benthos, such as 5 urchins at depth in sample 99 (sandy sediments) and a large number of worms in sample 95 (gravel) in on-board observations. Sample 82 (also gravel) contained a less often found Shore Sea Urchin, *Psammechinus miliaris* (Figure 6).



Figure 6: *Psammechinus miliaris*, the Green or Shore Sea Urchin, normally found intertidally on rocky shores under stones, boulders and seaweeds; also found subtidally in seagrass beds or on mixed coarse bottoms such as muddy [sand](#) and gravel (e.g. www.marlin.ac.uk). Here in benthos sample 82 in the sieve, found in unvegetated, muddy coarse material offshore at large depth.

Details on the box cores, such as co-ordinates, penetration depth and measured water depth, are listed in the RWS plot list (TNO local network location: U:\d3\j5\p35156\Testing protocols\2006 survey week 46 BNB\results\plotlijsten RWS). NB. co-ordinates listed in the plot list are exact coordinates of the box core locations (thus already corrected for the offset between the dGPS receiver and the corer on the deck).

Results already received from RWS (on board):

- All plot lists (both digitally and printed)
- Raw MBES data (.all files)
- Digital SSS data on DVD
- Morse tide meter measurements

Processing plan and actions:

- Box core samples and box core sampling materials were collected by and stored at TNO in Utrecht.
- Offsets and measurements RV Arca can be acquired from Piet Pronk.
- Sediment cores of the box core samples will be described and sub-sampled for grain size analyses by TNO. Grain size analyses will be done at the joint TNO-University of Utrecht laboratory.
- Benthos samples will be analysed by TNO-IMARES.
- MBES digital data will be corrected at RWS for tides and be made available to TNO on CD/DVD (together with the metadata). Contact at RWS: Michel Hofsteede or Aad de Ruiter.