VLAAMSE OVERHEID

DEPARTEMENT MOBILITEIT EN OPENBARE WERKEN
WATERBOUWKUNDIG LABORATORIUM

Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing

Bestek 16EB/05/04



Deelrapport 2.12 : 13-uursmeting Sediview op 11/03/2008 tijdens springtij - Liefkenshoek (transect I)

Report 2.12 : Through Tide Measurement Sediview on 11/03/2008 during spring tide - Liefkenshoek (transect I)

30 June 2008
I/RA/11283/07.088/MSA

i.s.m.

en

International Marine and Dredging Consultants (IMDC)
Wilrijkstraat 37-45 Bus 4 - 2140 Antwerpen – België
tel: +32.3.270.92.95 - fax: +32.3.235.67.11
E-mail : info@imdc.be

Document Control Sheet

Document Identification

Title:	Deelrapport 2.12: 13-uursmeting Sediview op 11/03/2008 Liefkenshoek (transect I)
Project:	Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing
Client	Waterbouwkundig Laboratorium
File reference:	I/RA/11283/07.088/MSA
File name	K:\PROJECTS\11\11283 - Opvolging aanslibbing dgd\10-Rap\DGD2\2_12_RA07088_13h_ADCP_transectI_080311\2_12_RA0788_TransectI_080311_v10.doc

Revisions

Version	Date	Author	Description
1.0	30/06/08	JCA/YDK/MBO	Concept

Distribution List

Name	# ex.	Company/authorities	Position in reference to the project
Joris Vanlede	1 hard copy	Waterbouwkundig Laboratorium	Client
Frederik Roose	1 pdf-file	Afdeling Maritieme Toegang	Client

Approval

Version	Date	Author	Project manager	Commissioner
1.0	30/06/08	JCA/YDK/MBO	MBO	MSA

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1. THE ASSIGNMENT 1
1.2. PURPOSE OF THE STUDY 1
1.3. OVERVIEW OF THE STUDY 2
1.3.1. Reports 2
1.3.2. Measurement actions 3
1.4. STRUCTURE OF THE REPORT 4

2. THE MEASUREMENT CAMPAIGN 5

2.1. OVERVIEW OF THE PARAMETERS 5
2.2. DESCRIPTION OF THE MEASUREMENT CAMPAIGN 8
2.2.1. Purpose of the measurement campaign 8
2.2.2. Measurement procedure 9
2.3. THE EQUIPMENT 10
2.3.1. ADCP 10
2.3.2. OBS - CTD 10
2.3.3. Pump Sampler 10

3. COURSE OF THE MEASUREMENTS 11

3.1. MEASUREMENT PERIODS 11
3.2. HYDRO-METEOROLOGICAL CONDITIONS DURING THE MEASUREMENT CAMPAIGN 11
3.2.1. Vertical tide during the measurements 11
3.2.2. Meteorological data 12
3.3. NAVIGATION INFORMATION 12
3.4. REMARKS ON DATA 12

4. PROCESSING OF DATASETS 13

4.1. CALIBRATION OF THE OBS TURBIDITY SENSOR 13
4.2. METHODOLOGY OF PROCESSING OF THE ADCP DATA WITH SEDIVIEW 13
4.2.1. Acoustic backscatter theory 13
4.2.2. Water sampling and transect sailing 14
4.2.3. Calibration for suspended sediment concentration within Sediview 14
4.2.4. Sediview configuration 14
4.2.5. Output 17

5. PRELIMINARY ANALYSIS OF THE DATA 19

5.1. MARCH 11TH 2008 SURVEY 19
5.2. INTERCOMPARISON WITH EARLIER SURVEYS ON FEBRUARY 17TH 2005, MARCH 22ND 2006 AND SEPTEMBER 27TH 2006 19

6. REFERENCES 26

APPENDICES

APPENDIX A. OVERVIEW OF MEASUREMENT 32

A.1 OVERVIEW OF THE MEASUREMENT LOCATIONS FOR THE WHOLE HCBS2 AND DEURGANCKDOK MEASUREMENT CAMPAIGNS 33
A.2 OVERVIEW OF ALL MEASUREMENT LOCATIONS HCBS AND DEURGANCKDOK MEASUREMENT CAMPAIGNS37
A.3 MEASUREMENT OVERVIEW AT TRANSECT I ON 11/03/2008 38

APPENDIX B. TIDAL DATA 40

APPENDIX C. NAVIGATION INFORMATION AS RECORDED ON SITE..... 42

APPENDIX D. CALIBRATION GRAPH OF OBS3A TURBIDITY SENSOR..... 47

APPENDIX E. UNESCO PPS-78 FORMULA FOR CALCULATING SALINITY 49

APPENDIX F. OVERVIEW OF SEDIVIEW SETTINGS..... 51

APPENDIX G. CONTOURPLOTS OF FLOW VELOCITIES, SEDIMENT CONCENTRATION AND SEDIMENT FLUX PER SAILED TRANSECT 54

APPENDIX H. DISCHARGE, CONCENTRATION AND SEDIMENT FLUX FOR THE TOTAL CROSS-SECTION 126

APPENDIX I. AVERAGE SEDIMENT CONCENTRATION FOR THE TOTAL CROSS-SECTION 130

APPENDIX J. TEMPORAL VARIATION OF TOTAL FLUX, TOTAL DISCHARGE AND SUSPENDED SEDIMENT CONCENTRATION 132

APPENDIX K. OVERVIEW OF HCBS2 AND AANSLIBBING DEURGANCKDOK REPORTS136

LIST OF TABLES

TABLE 1-1: OVERVIEW OF DEURGANCKDOK REPORTS 2
TABLE 2-1:TRANSECT OF THE FLOW MEASUREMENTS ON 11TH OF MARCH 2008 (UTM31 ED50) 9
TABLE 2-2: POSITIONS OF THE CALIBRATION POINTS FOR 11TH OF MARCH 2008 DURING FLOOD AND EBB. 9
TABLE 2-3: MAIN CONFIGURATION SETTINGS OF ADCP 10
TABLE 3-1: HIGH AND LOW TIDE AT LIEFKENSHOEK ON 11/03/2008 11
TABLE 3-2: COMPARISON OF THE TIDAL CHARACTERISTICS OF 11/03/2008 WITH THE AVERAGE TIDE, THE AVERAGE NEAP TIDE AND THE AVERAGE SPRING TIDE OVER THE DECADE 1991-2000 FOR LIEFKENSHOEK. 12
TABLE 4-1: EXTRAPOLATION METHODS FOR TOP AND BOTTOM VARIABLES 16
TABLE 4-2: REFERENCE POINTS AT THE END OF THE MUD FLATS ON LEFT AND RIGHT BANK 17
TABLE 5-1: WATER VOLUME DURING EBB, FLOOD AND MEASUREMENT CAMPAIGN ON 17/02/2005 (NEAP TIDE), 22/03/2006 (NEAP TIDE), 27/09/2006 (AVERAGE TIDE) & 11/03/2008 (SPRING TIDE) 25
TABLE 5-2: SS MASS DURING EBB, FLOOD AND MEASUREMENT CAMPAIGN ON 17/02/2005 (NEAP TIDE), 22/03/2006 (NEAP TIDE), 27/09/2006 (AVERAGE TIDE)& 11/03/2008 (SPRING TIDE) 25

LIST OF FIGURES

FIGURE 2-1: ELEMENTS OF THE SEDIMENT BALANCE 5
FIGURE 2-2: DETERMINING A SEDIMENT BALANCE 6
FIGURE 2-3: TRANSPORT MECHANISMS 7
FIGURE 2-4: MAP OF SAILED TRANSECT AND CALIBRATION POINTS AT DEURGANCKDOK ON 11TH OF MARCH 2008. 8
FIGURE 4-1: UNMEASURED REGIONS IN THE CROSS SECTION (FROM RD INSTRUMENTS, 2003) 15
FIGURE 4-2: MEASURED AND ESTIMATED DISCHARGES AND SEDIMENT FLUXES WITHIN SEDIVIEW (DRL, 2005) .. 15
FIGURE 4-3: PRINCIPAL OF BOTTOM ESTIMATE OF THE SEDIMENT CONCENTRATION IN SEDIVIEW 16
FIGURE 5-1: FRESH WATER DISCHARGE 08 – 18 FEBRUARY OF 2005. 20
FIGURE 5-2: FRESH WATER DISCHARGE 15 – 25 MARCH OF 2006 20
FIGURE 5-3: FRESH WATER DISCHARGE 21 SEPTEMBER – 1 OCTOBER OF 2006 20
FIGURE 5-4: FRESH WATER DISCHARGE 3 MARCH - 13 MARCH OF 2008 21
FIGURE 5-5: MEAN FRESH WATER DISCHARGE 21
FIGURE 5-6: TOTAL FLUX ON 17/02/2005 (NEAP TIDE), 22/03/2006 (NEAP TIDE), 27/09/2006 (AVERAGE TIDE) & 11/03/2008 (SPRING TIDE) 22
FIGURE 5-7: TOTAL DISCHARGE ON 17/02/2005 (NEAP TIDE), 22/03/2006 (NEAP TIDE), 27/09/2006 (AVERAGE TIDE) & 11/03/2008 (SPRING TIDE) 23
FIGURE 5-8: SS CONCENTRATION 17/02/2005 (NEAP TIDE), 22/03/2006 (NEAP TIDE), 27/09/2006 (AVERAGE TIDE) & 11/03/2008 (SPRING TIDE) 24

1. INTRODUCTION

1.1. The assignment

This report is part of the set of reports describing the results of the long-term measurements This report is part of the set of reports describing the results of the long-term measurements conducted in Deurganckdok aiming at the monitoring and analysis of silt accretion. This measurement campaign is an extension of the study "Extension of the study about density currents in the Beneden Zeeschelde" as part of the Long Term Vision for the Scheldt estuary. It is complementary to the study 'Field measurements high-concentration benthic suspensions (HCBS 2)'.

The terms of reference for this study were prepared by the 'Departement Mobiliteit en Openbare Werken van de Vlaamse Overheid, Afdeling Waterbouwkundig Laboratorium' (16EB/05/04). The repetition of this study was awarded to International Marine and Dredging Consultants NV in association with WL|Delft Hydraulics and Gems International on 10/01/2006. The project term was prolonged with an extra year from April 2007 till March 2008.

Waterbouwkundig Laboratorium– Cel Hydrometrie Schelde provided data on discharge, tide, salinity and turbidity along the river Scheldt and provided survey vessels for the long term and through tide measurements. Afdeling Maritieme Toegang provided maintenance dredging data. Agentschap voor Maritieme Dienstverlening en Kust – Afdeling Kust and Port of Antwerp provided depth sounding measurements.

The execution of the study involves a twofold assignment:

- Part 1: Setting up a sediment balance of Deurganckdok covering a period of one year, i.e. 04/2007 – 03/2008
- Part 2: An analysis of the parameters contributing to siltation in Deurganckdok

1.2. Purpose of the study

The Lower Sea Scheldt (Beneden Zeeschelde) is the stretch of the Scheldt estuary between the Belgium-Dutch border and Rupelmonde, where the entrance channels to the Antwerp sea locks are located. The navigation channel has a sandy bed, whereas the shallower areas (intertidal areas, mud flats, salt marshes) consist of sandy clay or even pure mud sometimes. This part of the Scheldt is characterized by large horizontal salinity gradients and the presence of a turbidity maximum with depth-averaged concentrations ranging from 50 to 500 mg/l at grain sizes of 60 - 100 μm. The salinity gradients generate significant density currents between the river and the entrance channels to the locks, causing large siltation rates. It is to be expected that in the near future also the Deurganckdok will suffer from such large siltation rates, which may double the amount of dredging material to be dumped in the Lower Sea Scheldt.

Results from the study may be interpreted by comparison with results from the HCBS and HCBS2 studies covering the whole Lower Sea Scheldt. These studies included through-tide measurement campaigns in the vicinity of Deurganckdok and long term measurements of turbidity and salinity in and near Deurganckdok.

The first part of the study focuses on obtaining a sediment balance of Deurganckdok. Aside from natural sedimentation, the sediment balance is influenced by the maintenance and capital dredging works. This involves sediment influx from capital dredging works in the Deurganckdok, and internal relocation and removal of sediment by maintenance dredging works. To compute a sediment balance an inventory of bathymetric data (depth soundings), density measurements of the

deposited material and detailed information of capital and maintenance dredging works will be made up.

The second part of the study is to gain insight in the mechanisms causing siltation in Deurganckdok, it is important to follow the evolution of the parameters involved, and this on a long and short term basis (long term & through-tide measurements). Previous research has shown the importance of water exchange at the entrance of Deurganckdok is essential for understanding sediment transport between the dock and the river Scheldt.

1.3. Overview of the study

1.3.1. Reports

Reports of the project 'Opvolging aanslibbing Deurganckdok' between April 2007 till March 2008 are summarized in Table 1-1. An overview of the HCBS2 and 'Opvolging aanslibbing Deurganckdok' (between April 2006 till March 2007) reports are given in APPENDIX K.

This report 2.12, is one of a set of reports that gains insight in sediment and water transport between Deurganckdok and the river Scheldt, which belongs to the second part of this project.

Table 1-1: Overview of Deurganckdok Reports

Report	Description
Sediment Balance: Bathymetry surveys, Density measurements, Maintenance and construction dredging activities	
1.10	Sediment Balance: Three monthly report 1/4/2007 - 30/06/2007 (I/RA/11283/07.081/MSA)
1.11	Sediment Balance: Three monthly report 1/7/2007 – 30/09/2007 (I/RA/11283/07.082/MSA)
1.12	Sediment Balance: Three monthly report 1/10/2007 – 31/12/2007 (I/RA/11283/07.083/MSA)
1.13	Sediment Balance: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/07.084/MSA)
1.14	Annual Sediment Balance (I/RA/11283/07.085/MSA)
Factors contributing to salt and sediment distribution in Deurganckdok: Salt-Silt (OBS3A) & Frame measurements, Through tide measurements (SiltProfiling & ADCP) & Calibrations	
2.09	Calibration stationary equipment autumn (I/RA/11283/07.095/MSA)
2.10	Through tide measurement Siltprofiler 23 October 2007 (I/RA/11283/07.086/MSA)
2.11	Through tide measurement Salinity Profiling winter (I/RA/11283/07.087/MSA)
2.12	Through tide measurement Sediview winter 11 March 2008 Transect I (I/RA/11283/07.088/MSA)
2.13	Through tide measurement Sediview winter 11 March 2008 Transect K (I/RA/11283/07.089/MSA)
2.14	Through tide measurement Sediview winter 11 March 2008 Transect DGD (I/RA/11283/07.090/MSA)
2.15	Through tide measurement Siltprofiler 12 March 2008 (I/RA/11283/07.091/MSA)
2.16	Salt-Silt distribution Deurganckdok summer (21/6/2007 – 30/07/2007) (I/RA/11283/07.092/MSA)
2.17	Salt-Silt distribution & Frame Measurements Deurganckdok autumn (17/09/2007 - 10/12/2007) (I/RA/11283/07.093/MSA)

Report	Description
2.18	Salt-Silt distribution & Frame Measurements Deurganckdok winter (18/02/2008 - 31/3/2008) (I/RA/11283/07.094/MSA)
2.19	Calibration stationary & mobile equipment winter (I/RA/11283/07.096/MSA)
Boundary Conditions: Upriver Discharge, Salt concentration Scheldt, Bathymetric evolution in access channels, dredging activities in Lower Sea Scheldt and access channels	
3.10	Boundary conditions: Three monthly report 1/4/2007 – 30/06/2007 (I/RA/11283/07.097/MSA)
3.11	Boundary conditions: Three monthly report 1/7/2007 – 30/09/2007 (I/RA/11283/07.098/MSA)
3.12	Boundary conditions: Three monthly report 1/10/2007 – 31/12/2007 (I/RA/11283/07.099/MSA)
3.13	Boundary conditions: Three monthly report 1/1/2008 – 31/03/2008 (I/RA/11283/07.100/MSA)
3.14	Boundary conditions: Annual report (I/RA/11283/07.101/MSA)
Analysis	
4.10	Analysis of Siltation Processes and Factors (I/RA/11283/07.102/MSA)

1.3.2. Measurement actions

Following measurements have been carried out during the course of this project:

1. Monitoring upstream discharge in the Scheldt river
2. Monitoring Salt and sediment concentration in the Lower Sea Scheldt taken from on permanent data acquisition sites at Lillo, Oosterweel and up- and downstream of the Deurganckdok.
3. Long term measurement of salt distribution in Deurganckdok.
4. Long term measurement of sediment concentration in Deurganckdok
5. Monitoring near-bed processes in the central trench in the dock, near the entrance as well as near the landward end: near-bed turbidity, near-bed current velocity and bed elevation variations are measured from a fixed frame placed on the dock's bed.
6. Measurement of current, salt and sediment transport at the entrance of Deurganckdok for which ADCP backscatter intensity over a full cross section are calibrated with the Sediview procedure and vertical sediment and salt profiles are recorded with the SiltProfiler equipment
7. Through tide measurements of vertical sediment concentration profiles -including near bed highly concentrated suspensions- with the SiltProfiler equipment. Executed over a grid of points near the entrance of Deurganckdok.
8. Monitoring dredging activities at entrance channels towards the Kallo, Zandvliet and Berendrecht locks
9. Monitoring dredging and dumping activities in the Lower Sea Scheldt

In situ calibrations were conducted on several dates to calibrate all turbidity and conductivity sensors, a description can be found in IMDC (2006a; 2007a; 2008f; 2008o).

1.4. Structure of the report

This report is the factual data report of the through tide measurements upstream of Deurganckdok on the 11th of March 2008. The first chapter comprises an introduction. The second chapter describes the measurement campaign and the equipment. Chapter 3 describes the course of the actual measurements. The results and processed data are presented in Chapter 4, whereas chapter 5 gives a preliminary analysis of the data.

2. THE MEASUREMENT CAMPAIGN

2.1. Overview of the parameters

The first part of the study aims at determining a sediment balance of Deurganckdok and the net influx of sediment. The sediment balance comprises a number of sediment transport modes: deposition, influx from capital dredging works, internal replacement and removal of sediments due to maintenance dredging (Figure 2-1).

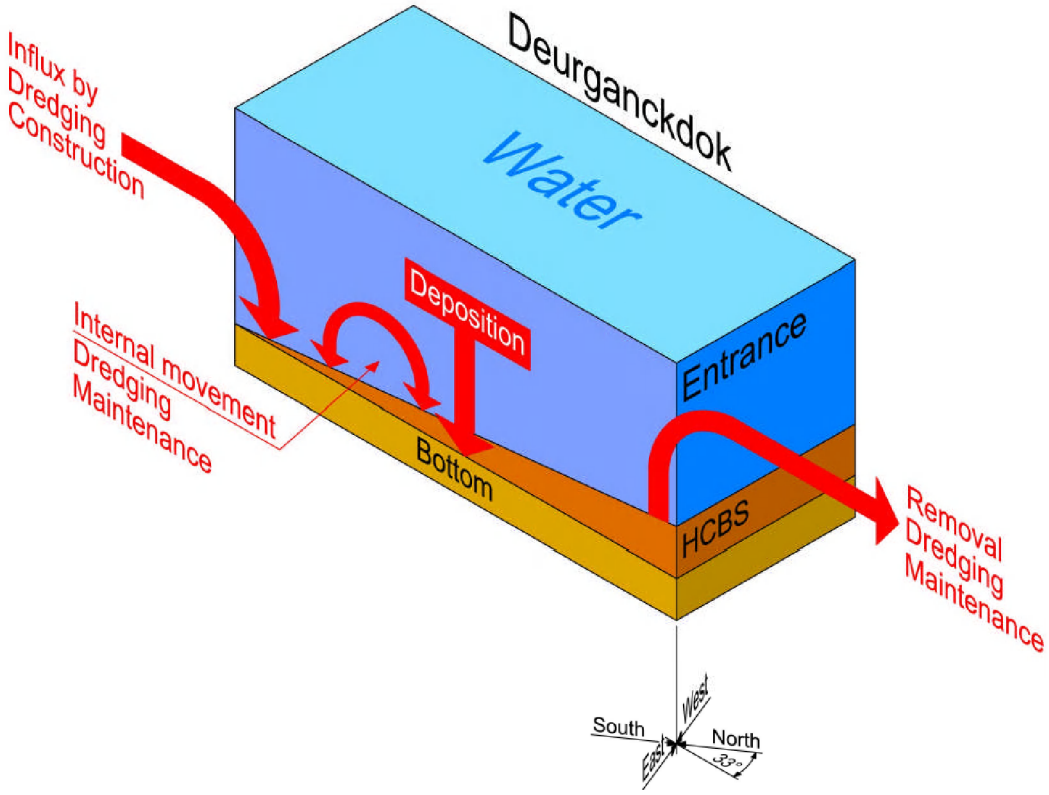


Figure 2-1: Elements of the sediment balance

A net deposition can be calculated from a comparison with a chosen initial condition t_0 (Figure 2-2). The mass of deposited sediment is determined from the integration of bed density profiles recorded at grid points covering the dock. Subtracting bed sediment mass at t_0 leads to the change in mass of sediments present in the dock (mass growth). Adding cumulated dry matter mass of dredged material removed since t_0 and subtracting any sediment influx due to capital dredging works leads to the total cumulated mass entered from the Scheldt river since t_0.

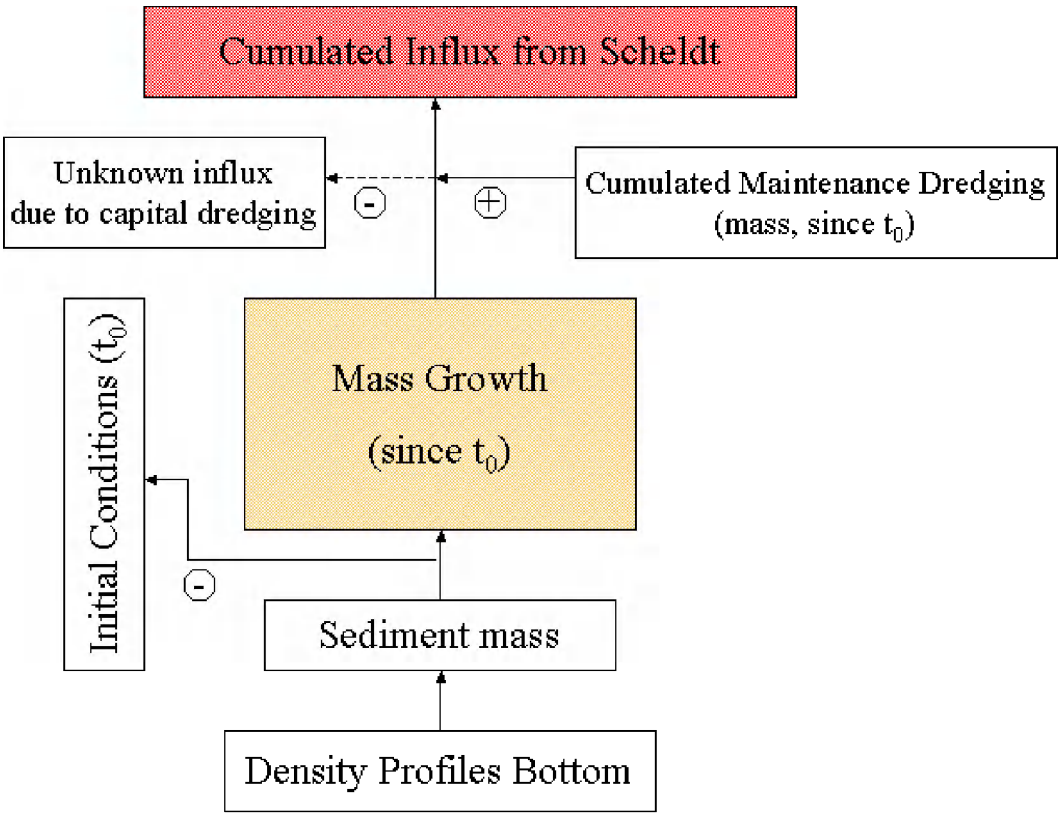


Figure 2-2: Determining a sediment balance

The main purpose of the second part of the study is to gain insight in the mechanisms causing siltation in Deurganckdok. The following mechanisms will be aimed at in this part of the study:

- Tidal prism, i.e. the extra volume in a water body due to high tide
- Vortex patterns due to passing tidal current
- Density currents due to salt gradient between the Scheldt river and the dock
- Density currents due to highly concentrated benthic suspensions

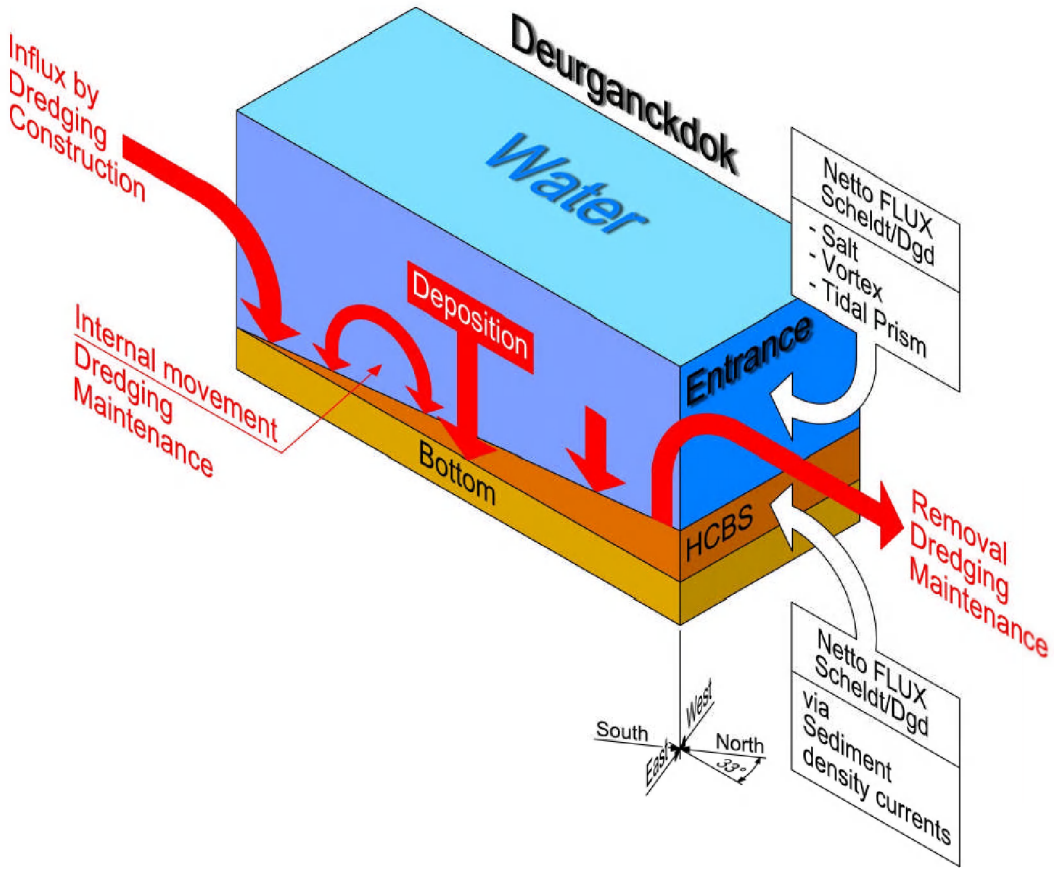


Figure 2-3: Transport mechanisms

These aspects of hydrodynamics and sediment transport have been landmark in determining the parameters to be measured during the project. Measurements will be focussed on three types of timescales: one tidal cycle, one neap-spring cycle and seasonal variation within one year.

Following data are being collected to understand these mechanisms:

- Monitoring the freshwater input (discharge) from the tributaries into the river Scheldt.
- Monitoring salinity and sediment concentration in the Lower Sea Scheldt at permanent measurement locations at Oosterweel, up- and downstream of the Deurganckdok.
- Long term measurement of salinity and suspended sediment distribution in Deurganckdok.
- Monitoring near-bed processes (current velocity, turbidity, and bed elevation variations) in the central trench in the dock, near the entrance as well as near the current deflecting wall location.
- Dynamic measurements of flow pattern, salinity and sediment transport at the entrance of Deurganckdok.
- Through tide measurements of vertical sediment concentration profiles -including near bed high concentrated benthic suspensions.
- Monitoring dredging activities at the entrance channels towards the Kallo, Zandvliet and Berendrecht locks as well as dredging and dumping activities in the Lower Sea Scheldt and Deurganckdok in particular.

In situ calibrations were conducted on several dates to calibrate all turbidity and conductivity sensors.

2.2. Description of the measurement campaign

2.2.1. Purpose of the measurement campaign

The purpose of the measurements was to determine the cross-section distribution of the suspended sediment concentration, sediment flux, flow velocity and water discharge over a sailed transect I during a complete tidal cycle. The finally purpose is to make a water and a sediment balance from the river Scheldt at Deurganckdok during a tidal cycle by integrating the water discharge and sediment flux.

To get up a water and sediment balance at Deurganckdok, 3 transects were sailed during the same tidal cycle on the 11th of March at the river Scheldt (Figure 2-4): at the entrance of Deurganckdok (transect DGD), upstream of Deurganckdok (transect I) and downstream of Deurganckdok (transect K). This report is focussed on the through tide measurements upstream of Deurganckdok (transect I) and the two others measurement campaigns are described in IMDC reports 2008j and 2008k.

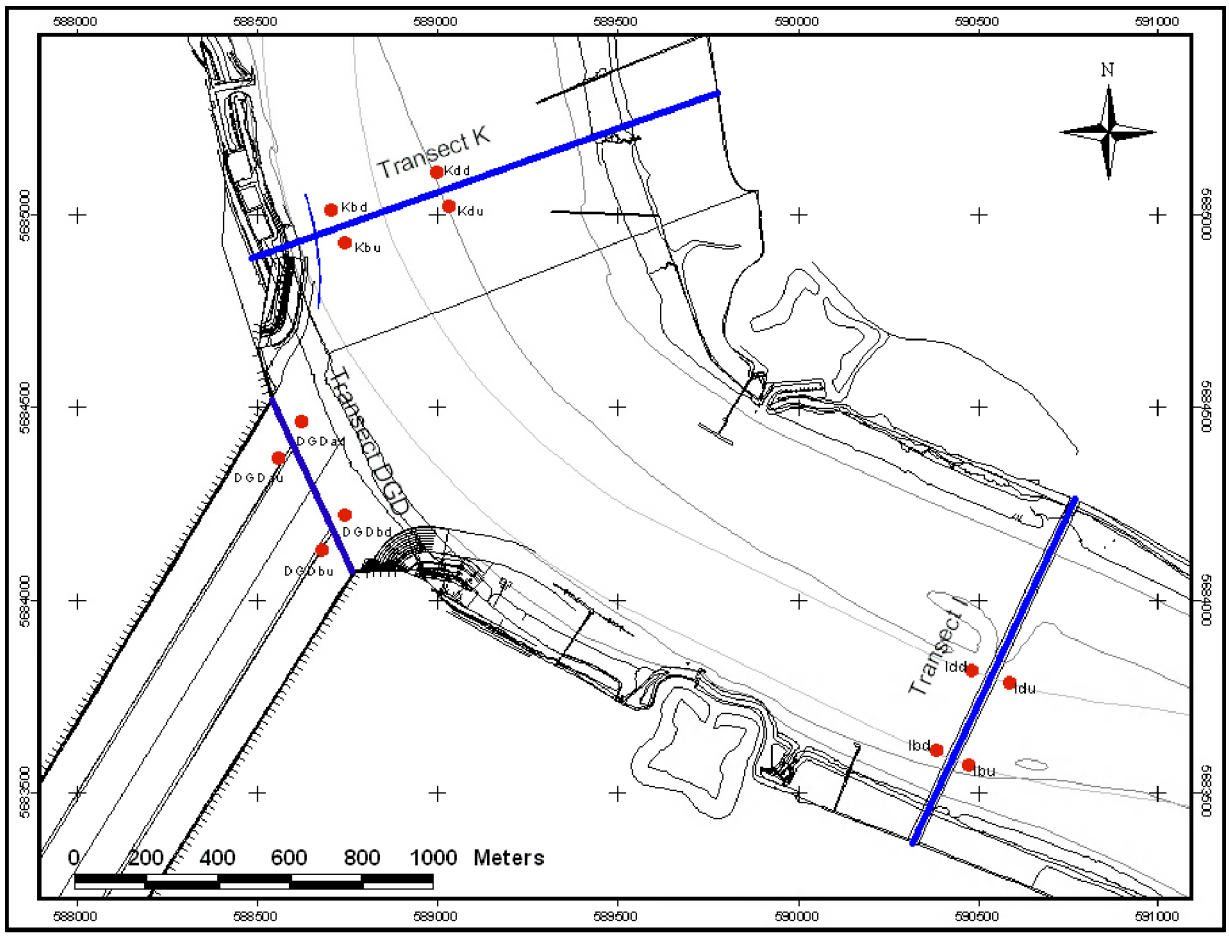


Figure 2-4: Map of sailed transect and calibration points at Deurganckdok on 11th of March 2008

2.2.2. Measurement procedure

Flow velocity, Turbidity, Salinity and Temperature measurements were conducted on the 11th of March from 7h00 MET until 20h00 MET. From the survey vessel Scheldewacht II a measurement cycle was completed every 30 minutes. The vessel with a mounted ADCP sailed a fixed transect from the right bank to the left bank and vice versa as a short backup transect (Table 2-1). Profiles were gathered to calibrate the ADCP transects for temperature, salinity and suspended sediment concentration to be used in Sediview.

Two calibration profiles were collected for each transect (Table 2-2):

- One before sailing the transect at the bank where the start of the transect was
- One after sailing the transect at the bank where the transect ended

During these calibrations, a fish with a CTD-OBS was lowered to the bottom. The downcast was interrupted at three depths, one in the upper half of the water column (between 4 and 7 m from the water surface), one at 4 meters above the bottom and the last one at the water bottom. At the two first depths samples were taken for calibration, and are used as 'ground truth' for all suspended sediment concentration measurements (OBS and Sediview). The turbidity measurement at the third depth is used to estimate the SS concentration at the bottom (see 4.2.4.1.2). The other instruments logged continuously during the downcast. Conductivity, Temperature and Depth was logged by the CTD-probe, while turbidity was recorded by the OBS.

Table 2-1:Transect of the Flow Measurements on 11th of March 2008 (UTM31 ED50)

Measurement location	Left Bank Easting	Left Bank Northing	Right Bank Easting	Right Bank Northing	Avg Length [m]	Avg Course [degr.]
Transect I	590 318	5 683 302	590 771	5 684 557	1057	25
Transect DGD	588 541	5 684 527	588 765	5 684 056	521	335
Transect K	588 484	5 684 924	589 775	5 685 384	1371	70

Table 2-2: Positions of the calibration points for 11th of March 2008 during flood and ebb.

Measurement point	Bank	Easting (UTM31 ED50)	Northing (UTM31 ED50)
Flood			
Ibu	Left	590476	5683514
Idu	Right	590589	5683744
DGDau	Left	588561	5684369
DGDbu	Right	588682	5684113
Kbu	Left	588746	5684965
Kdu	Right	589033	5685066
Ebb			
Ibd	Left	590384	5683557
Idd	Right	590485	5683778
DGDad	Left	588623	5684470
DGDbd	Right	588745	5684214
Kbd	Left	588706	5685055
Kdd	Right	588999	5685160

2.3. The equipment

2.3.1. ADCP

The current measurements were conducted using an RD Instruments ADCP 600 kHz Workhorse. For positioning the GPS onboard the vessel Scheldewacht II was used. For the measurement of the heading a gyrocompass was installed.

This 600 KHz ADCP system was mounted on a steel pole underneath the central axis of the vessel. The transducer set was looking vertically downwards to the bottom. Transceiver unit and computer system were connected to peripherals such as the differential GPS-receiver, the heave compensator and the gyrocompass.

During the measurements the ADCP constantly measured upstream from the vessel. The acquisition software of Winriver was used. The main settings are given in Table 2-3.

Table 2-3: Main Configuration Settings of ADCP

Main configuration settings of ADCP 600kHz Worhhorse:
Cell depth: 0.5 m
Number of cells: 50
Number of Water pings per ensemble: 2
Number of Bottom Track pings per ensemble: 2
Time between ensembles: 0
Averaging: None
Speed of Sound: Fixed 1500 m/s
Salinity 0 psu
3-beam solution: enabled

2.3.2. OBS - CTD

A D&A type OBS 3A was used to measure depth, conductivity, temperature and turbidity.

Measured parameters by the OBS 3A sensor: temperature (°C), conductivity (µS/cm), absolute pressure (m), turbidity (NTU).

On Scheldewacht II, the OBS 3A device was mounted on a tow fish. The resulting record is filled-up with GPS-time, sample number, and planimetric position of the GPS-receiver. Sampling frequency is 1 reading per second.

The technical details on the OBS 3A are given in the winter calibration Report of the HCBS 1 measurement campaign. (IMDC, 2006a)

2.3.3. Pump Sampler

A water sampler was attached nearby the turbidity sensor taking water samples. Samples were collected in 1 litre sampling bottles. The pumping speed of the water sampler was tested at the start of the measurement campaign on board. Dye was used to time the duration between the intake of the dye and exit at the sampling end of the sampler on board. The duration between intake and exit at the end was 22 seconds.

3. COURSE OF THE MEASUREMENTS

3.1. Measurement periods

At Deurganckdok ADCP tracks were sailed once every 15 minutes for 13 hours, in total 52 cross-sections.

Calibration profiles were taken at 2 locations (left bank, right bank). During every cycle, 1 calibration profile was taken serving as the second calibration of the previous transect and as the first calibration point of the current transect, resulting in a total of 52 profiles. APPENDIX A gives the start and end points of the tracks, the sailed length and the course.

3.2. Hydro-meteorological conditions during the measurement campaign

3.2.1. Vertical tide during the measurements

The vertical tide was measured at the Liefkenshoek tidal gauges. Graphs of the tide at Liefkenshoek on the 11th March of 2008 can be found in APPENDIX B. Table 3-1 gives the most important characteristics (high and low tide) of the tide at those gauges on the 11th of March 2008.

Table 3-1: High and low tide at Liefkenshoek on 11/03/2008

Liefkenshoek Tidal Gauge		
11 March 2008		
	Time [MET]	***Water level [m TAW]***
HW (1)	5:00	6.22
LW (2)	12:30	0.08
HW (3)	17:50	5.93

In Table 3-2 the tidal characteristics of the tide on the 11th of March 2008 are compared to the average tide over the decade 1991-2000 (AMT, 2003).

Table 3-2: Comparison of the tidal characteristics of 11/03/2008 with the average tide, the average neap tide and the average spring tide over the decade 1991-2000 for Liefkenshoek.

	Neap tide (1991 - 2000)	***Avg Tide (1991 - 2000)***	***Spring Tide (1991 - 2000)***	***Tide 11/03/2008***
Water level [m TAW]				
HW (1)	4.63	5.19	5.63	6.22
LW (2)	0.39	0.05	-0.18	0.08
HW (3)	-	-	-	5.93
Tidal difference [m]				
Falling (1 to 2)	4.24	5.14	5.81	6.14
Rising (2 to 3)	4.24	5.14	5.81	5.85
Duration [hh:mm]				
Falling (1 to 2)	6:40	6:50	7:02	7:30
Rising (2 to 3)	5:59	5:34	5:16	5:20
Tide (1 to 3)	12:39	12:24	12:18	12:50
Tidal coefficient				
Falling (1 to 2)	0.82	1.00	1.13	1.19
Rising (2 to 3)	0.82	1.00	1.13	1.14

The tidal coefficients from 1.14 up to 1.19 for the measured tide of the 11th of March 2008 indicate that this tide has a larger tidal range than the average tide for the decade of 1991-2000, and can be classified as spring tide.

3.2.2. Meteorological data

Meteorological data at Deurne was obtained from the Weather Underground website (Wunderground, 2008).

The weather on the 11th of March 2008 was stormy and the wind blew from the west at an average velocity of 22 km/h with maximal gust velocity of 67 km/h. The air temperature varied between 5 and 12°C. The sky was cloudy with precipitation.

3.3. Navigation information

An overview of the navigation at the measurement location is given in APPENDIX C.

3.4. Remarks on data

Shipwakes were removed from the data where possible. Fifteen transects are excluded for processing because they were too short to represent the hydro- and morphodynamics for the whole cross-section (transect I).

4. PROCESSING OF DATASETS

4.1. Calibration of the OBS turbidity sensor

A crucial aspect of the accuracy and reliability of the data concerns the calibration of the OBS turbidity sensor. The calibration of the OBS sensor is necessary to convert turbidity into Suspended Sediment Concentration (SSC). We use here an in situ calibration, which is more representative of the actual measurement conditions at that moment. At some depths water samples were taken by the pump sampler and were analysed by a laboratory for SSC. These SSC were used as 'ground truth' to calibrate the OBS turbidity sensor. The calibration curve can be found in APPENDIX D.

4.2. Methodology of processing of the ADCP data with Sediview

DRL Software's Sediview was used to process the ADCP data. Sediview is designed to derive estimates of suspended sediment concentration throughout the water column using acoustic backscatter data obtained by ADCPs manufactured by RD Instruments of San Diego, California.

4.2.1. Acoustic backscatter theory

The acoustic theory governing backscatter from particles suspended in the water column is complex, but the following simplified formula serves to introduce the main factors that are relevant:

$$E = SL + SV + Constant - 20\log(R) - 2\alpha_w R$$

Where:

- E = echo intensity,
- SL = transmitted power,
- SV = backscatter intensity due to the particles suspended in the water column,
- α_w = a coefficient describing the absorption of energy by the water,
- R = the distance from the transducer to the measurement bin.

The term 20log(R) is a simple geometric function which accounts for the spherical spreading of the beam. The constant is required because each ADCP has specific performance characteristics.

In order to measure the suspended sediment concentration in the water column it is necessary to relate the backscattered sound intensity to the mass concentration in the water. For the purposes of measuring solids concentration on site, it can be shown that the relationship is as follows (derived from Thorne and Campbell, 1992 and Hay, 1991 in DRL (2003)):

$$Log_{10}M_r = \{dB + 2r(\alpha_w + \alpha_s) - K_s\}S^{-1}$$

Where:

- $M(r)$ = mass concentration per unit volume at range, r
- S = relative backscatter coefficient
- K_s = site and instrument constant
- dB = the measured relative backscatter intensity (corrected for beam spreading)
- α_w = water attenuation coefficient
- α_s = sediment attenuation coefficient, which is a function of the effective particle size

In this expression there are four unknowns: *S*, *Ks*, α_w and α_s. These parameters are to be determined within Sediview (APPENDIX F).

4.2.2. Water sampling and transect sailing

To calibrate Sediview for suspended sediment concentration, two water samples are taken at the beginning and at the end of each transect (see 3.1). Both samples are taken within the range of reliable data of the ADCP. For the near-surface sample this means in bin 3 or 4, for the near-bed sample this means at about one or two meter above the sidelobe.

Water sampling is done together with CTD-OBS measurement in order to have two independent suspended sediment concentration measurements for each sample. OBS measurements were compared to the water samples and recalibrated as mentioned in § 4.1. The water samples were used for Sediview calibration, while cross-calibrated OBS measurements were used as a back up check. The salinity and temperature was used to compute the acoustic water absorption (water attenuation coefficient). All water samples were analysed as is described in 4.2.3.1.

4.2.3. Calibration for suspended sediment concentration within Sediview

4.2.3.1. Calibration workset

The calibration workset consists of ADCP-files, sampling times, sampling depths, SSC obtained from water samples and SSC, temperature and salinity obtained from CTD-OBS readings.

The suspended sediment concentration of the water samples was determined. One-litre samples were filtered over a preweighed desiccated 0.45 micron filter, after which the filter is dried in an oven at 105°C, cooled and weighted (NEN 6484).

4.2.3.2. SSC calibration per ensemble pair

In the Sediview calibration process the following parameters must be defined: the site and instrument constant (Ks), the relative backscatter coefficient (S) and the effective particle size per ensemble-pair (near-surface sample and near-bed sample) in order to fit the Sediview-estimate with the suspended sediment concentration of the water samples. These parameter sets may not differ too much from the previous parameter sets, as the environmental conditions will not change that much over a small time interval. To obtain a smooth progress in time of Ks, S and effective particle size an iterative approach is used.

4.2.4. Sediview configuration

4.2.4.1. Discharge and suspended sediment concentration estimates

The ADCP measures most of the water column from just in front of the ADCP to 6% above the bottom. The shallow layer of water near the bottom is not used to compute discharge and suspended sediment concentration due to side-lobe interference. When the ADCP sends out an acoustic pulse, a small amount of energy is transmitted in side lobes rather than in the direction of the ADCP beam. Side lobe reflection from the bottom can interfere with the water echoes and can give erroneous data. The thickness of the side lobe layer is 6% of the distance from the transducers to the bottom.

Near the banks the water depth is too shallow for the ADCP to profile.

For each of those unmeasured regions, Sediview will make an estimate of the discharges and suspended sediment concentration. The measured and unmeasured regions in the cross section are shown in Figure 4-1 and Figure 4-2.

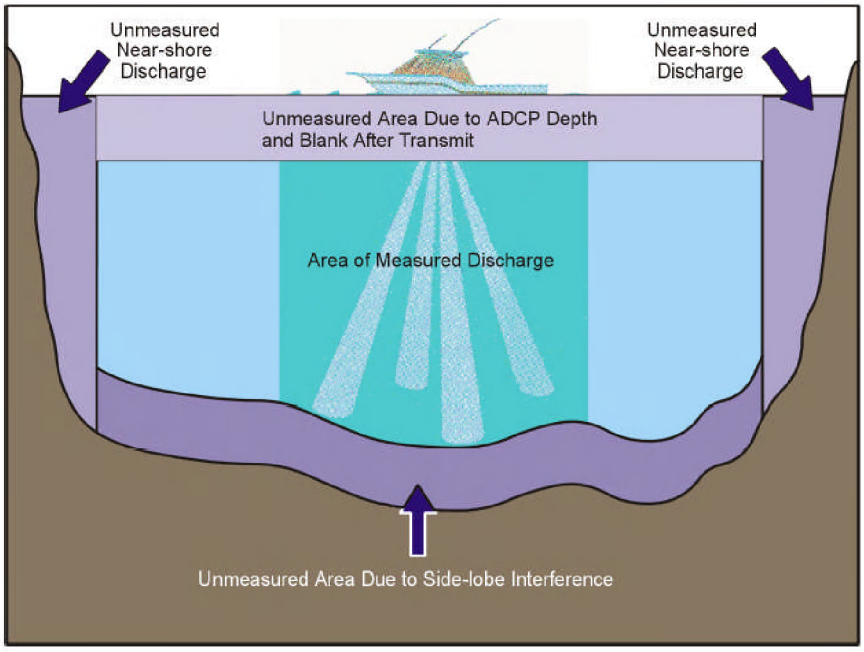


Figure 4-1: Unmeasured regions in the cross section (from RD Instruments, 2003)

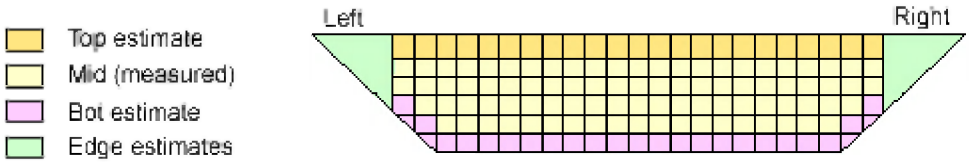


Figure 4-2: Measured and estimated discharges and sediment fluxes within Sediview (DRL, 2005)

4.2.4.1.1 Top/bottom estimates

The sediment concentration and discharge at the top of the water column is assumed to be the same as the concentration and discharge in the first measured bin.

The sediment concentration between the bottom and the lowest valid bin is assumed to be an increase of the lowest valid bin. The SSC increase between the lowest valid bin (position of the sidelobe) and the bottom is calculated from the CTD-OBS profile, which was lowered in the unmeasured sidelobe layer. The CTD-OBS profiles show that the bottom value of the SSC at the calibration points transect I vary during a tidal cycle between approximately 100 and 892 % of the SSC-value at the position of the sidelobe. As the concentration grows approximately linear from the lowest valid bin to the bottom, and as Sediview uses a constant concentration factor for these deepest bins, we use a concentration factor that varies between 99 and 496% (Figure 4-3). An overview of the used power concentration factor is given in APPENDIX F.

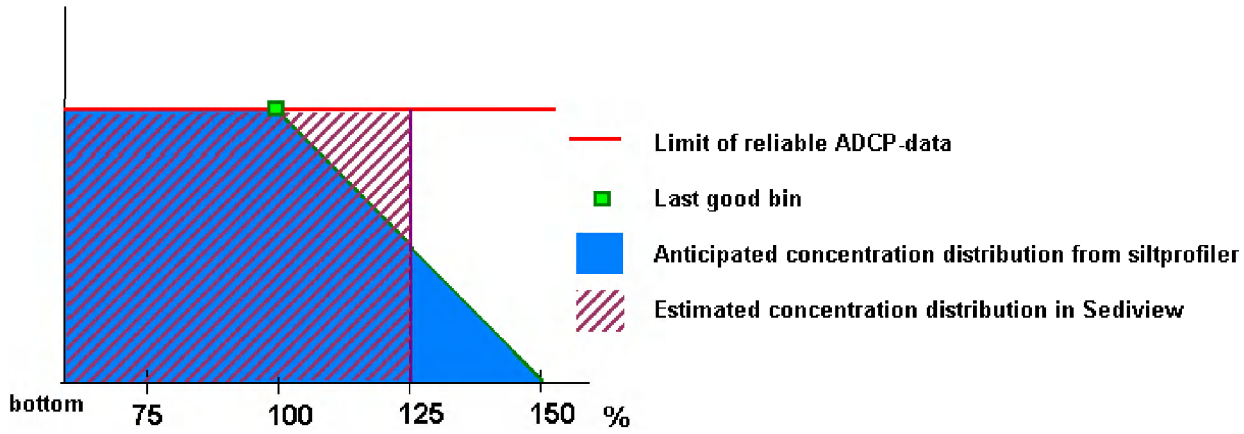


Figure 4-3: Principal of bottom estimate of the sediment concentration in Sediview

Table 4-1: Extrapolation methods for top and bottom variables

Variable	***Top***	***Bottom***
Discharge Method	Constant	Power
Concentration factor	100%	99-496%

The discharge for the bottom water layer is estimated by using the power method. Chen (1991) discusses the theory of power laws for flow resistance. Simpson and Oltmann (1990) discuss Chen's power law equivalent of Manning's formula for open channels (with b=1/6) (RD Instruments, 2003).

$$u / u^* = 9.5(z / z_0)^b$$

Where:

- z = Distance to the channel bed [m]
- u = Velocity at distance z from bed [m/s]
- u* = Shear velocity [m/s]
- z_0 = Bottom roughness height [m]
- b = Exponent (1/6)

4.2.4.1.2 Edge estimates

The shape of the edges of the cross section is assumed to be near triangular due to the banks of the river Scheldt. Five data ensembles are to be averaged to determine the left and right bank mean velocities used for calculation of edge estimates.

The distance from start- and endpoint to the bank is calculated from the theoretical start- and endpoint at the bank to the effective start- and endpoint. The theoretical points are taken at the banks.

Table 4-2: Reference points at the end of the mud flats on left and right bank

Coordinates (UTM31 ED50)	***Easting Left bank***	***Northing Left bank***	***Easting Right bank***	***Northing Right bank***
Transect I	590 318	5 683 302	590 771	5 684 557

The formula for determining the near shore discharge is:

$$Q_{shore} = CV_m Ld_m \text{ [m}^3\text{/s]}$$

Where:

C = Coefficient (0.35 for triangular, 0.91 for rectangular shape)

V_m = Mean water velocity in the first or the last segment [m/s]

L = Distance from the shore to the first or the last segment specified by the user [m]

d_m = Depth of the first or the last segment [m]

The coefficient (C) has been set to 0.35 (triangular shape of the banks).

4.2.4.2. Contour plots of the transects

All contour plots show perpendicular and parallel projected values on the straightened sailed transects. The heading of the straightened sailed transect is defined by picking 2 points in the straight part of the line after having corrected the heading of the ADCP compass. The compass offset is derived from a comparison of the ADCPs bottom track with the external GPS data.

4.2.5. Output

General transect information containing start-stop coordinates of each sailed transects with stop time, track length and heading is given in APPENDIX A.

In 0, four contourplots were generated for each transect showing the distribution of suspended sediment concentration & sediment flux as well as the flow velocity perpendicular and parallel to the transect. The following conventions were used:

- Distances on the X-axis were referenced to the starting point of the transect, the start of the sailed transect is always at distance equal to zero.
- Left bank is always shown left, right bank on the right side. For transect DGD, left bank was taken to be the western quay wall and the right bank to be the eastern quay wall considering the dock as being a tributuary to the Scheldt river.
- Perpendicular flow velocities and fluxes are positive for downstream flow (ebb, out of Deurganckdok), negative for upstream flow (flood, inbound).
- Parallel flow velocities are positive for flow going from the left bank to the right bank, and negative for flow going from the right bank to the left bank.
- Absolute Depth is given in meters above TAW.

Also a depth-averaged velocity plot was generated for the flow velocity perpendicular to the transect. (See APPENDIX G).

Tables in APPENDIX H give the values for discharges and sediment fluxes for the total cross-section and the average measured SSC is shown in APPENDIX I.

- Mid = measured part of the cross-section
- Top = top part of the cross-section
- Bottom = bottom part underneath the sidelobe
- Edge (left, right) = edge estimates to left & right bank
- Total = Mid+Top+Bottom+ Edge values

The graph in APPENDIX J gives the temporal variation of the total flux, total discharge and total measured SSC for the whole through tide measurement at Deurganckdok.

5. PRELIMINARY ANALYSIS OF THE DATA

5.1. March 11th 2008 survey

As it is on the river Scheldt, transect I near Liefkenshoek is under tidal influence, and it is subject to complex current fields. During slack water we see a current field with opposing current directions in the upper part of the water column compared to the lower part of the water column. For high water we see inflow (negative) at left bank near the bottom and outflow (positive) at right bank near the surface. This particular pattern is probably an example of the expected salt density currents. The same event is seen at low water when the dock contains waters of higher salinity than the river; here we see an outflow near the bottom and inflow near the surface.

From the backscatter interpretation into suspended sediment concentration we see in general a higher concentration during slack water and during rising tide compared to during ebb tide.

Considering the sediment fluxes APPENDIX J shows that incoming transport is dominating during flood while a residual outgoing sediment transport can be observed from HW until LW.

It appears from the recorded data that the highest water velocities occur near the navigation channel at about 1 hour before HW and 1 hour before LW in which velocities exceed 1.5 m/s. The total calculated discharge ranges between 13172 and -15940 m³/s.

The depth-averaged suspended sediment concentrations range from 191 mg/l up to 552 mg/l. The highest SS concentrations occur about 4h30 after HW.

Average cross-section SS concentrations vary from about 154 up to about 739 mg/l. The maximum calculated flux during ebb occurs 3h14 after HW and is about 5147 kg/s. During flood, the highest flux is about –5874 kg/s, 0h40 before HW.

5.2. Intercomparison with earlier surveys on February 17th 2005, March 22nd 2006 and September 27th 2006

On February 17th 2005, March 22nd 2006,September 27th 2006 and March 11th 2008 the same transect has been sailed during through tide measurements, a description is given by IMDC (2005d), IMDC (2006d) and IMDC (2006k).

In order to make a comparison possible all results were referred to HW. The previous HCBS-campaigns (HCBS1 & HCBS2-winter) show a comparable tidal amplitude (tidal coefficients about 0.75) corresponding to neap tide. The HCBS2-summer campaign (27/09/2006) on the other hand, has a tidal coefficient of about 1.02 and is more corresponding to an average tide. The current campaign has a tidal coefficient of 1.14-1.19 which is higher than the average spring tide.

It is important to underline that lower fresh water discharges from the tributaries were recorded during the earlier measurement campaigns (Figure 5-1, Figure 5-2, Figure 5-3 and Figure 5-4): on 17/02/2005 the discharges prior to the measurements were about 181 m³/s; on 22/10/2007 about 94 m³/s, on 27/09/2006 about 35 m³/s and on 11/03/2008 about 286 m³/s.

The results presented in Figure 5-5 are based on a long-term simulation over a period of 30 year (1971-2000) with the SIGMA-model for MKBA (IMDC, 2006g). The mean discharge is the annual average ten days' discharge, calculated with simulated long-term measurements. The high and low discharges are also annual average ten days' discharges, but with an absolute maximum of mean discharge $+2\sigma$ and an absolute minimum of mean discharge -2σ.

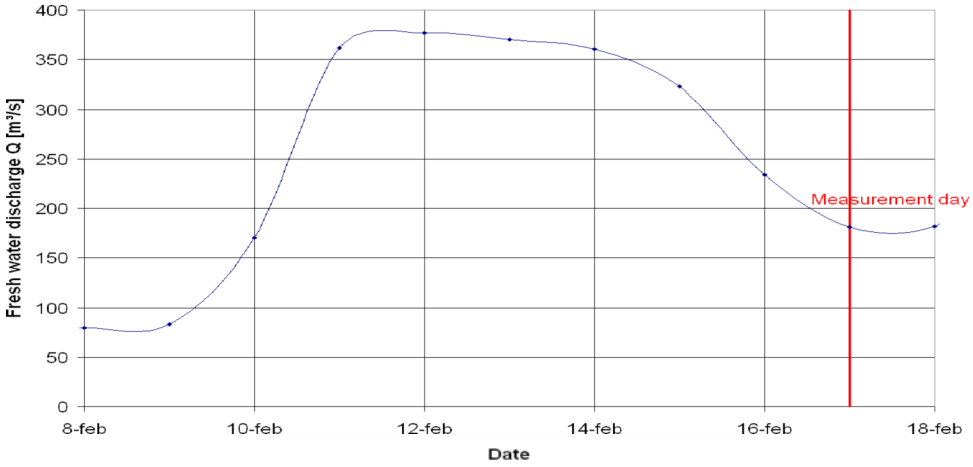


Figure 5-1: Fresh water discharge 08 – 18 February of 2005.

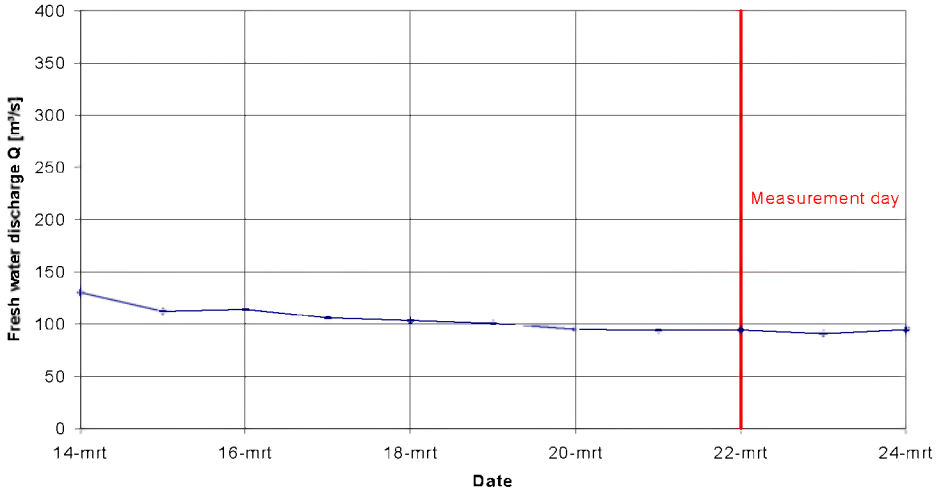


Figure 5-2: Fresh water discharge 15 – 25 March of 2006

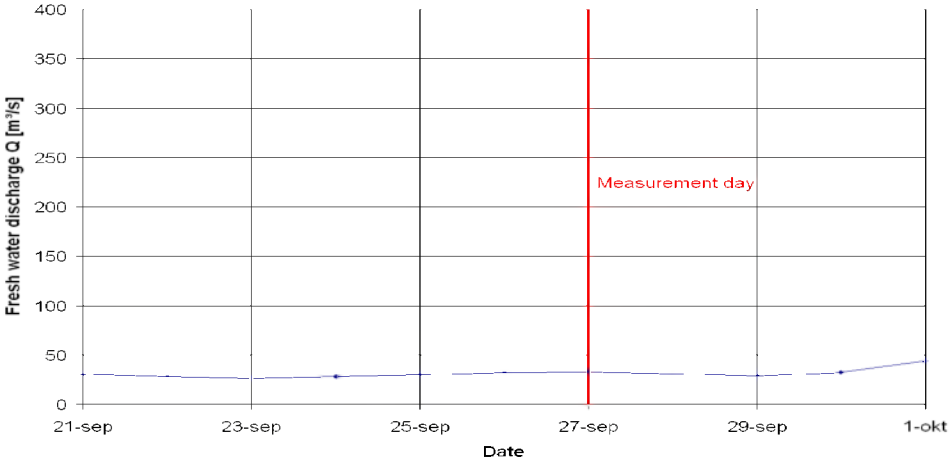


Figure 5-3: Fresh water discharge 21 September – 1 October of 2006

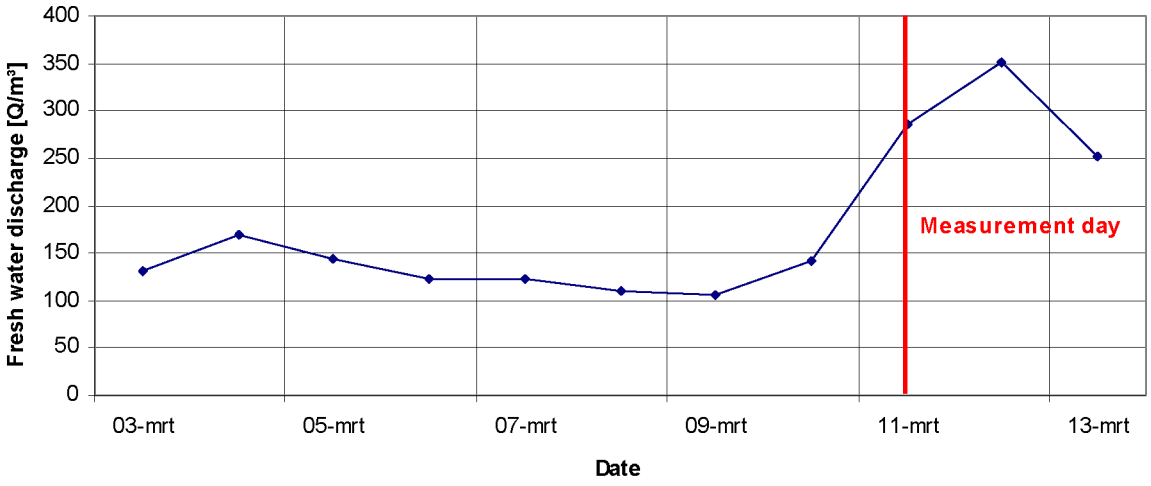


Figure 5-4: Fresh water discharge 3 March - 13 March of 2008

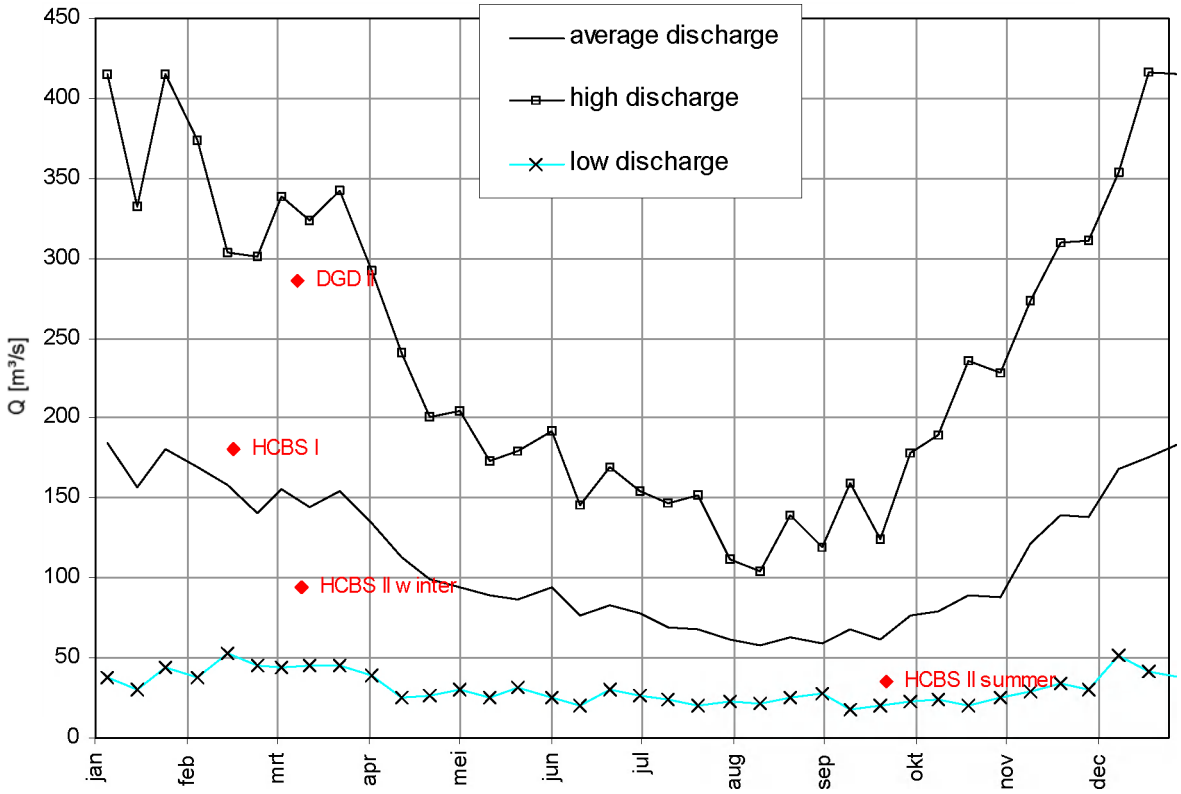


Figure 5-5: Mean fresh water discharge

The fluxes, total discharges and suspended sediment concentrations, of all measurement campaigns at Liefkenshoek are illustrated in Figure 5-6, Figure 5-7 and Figure 5-8. It can be seen that the discharges, fluxes and SS concentrations of this campaign are higher than the previous campaigns.

The volume of water, crossing transect I during flood or ebb on a measurement day, was calculated by integrating the discharge curve (Figure 5-7) during flood and ebb respectively. Table 5-1 shows the results. During flood on 11 March 2008, 154 033 000 m³ water crossed transect I and during ebb 189 392 000 m³. Theoretically, the net volume between flood and ebb is equal to the fresh water volume. The fresh water volume, crossing transect I during the tidal cycle (ebb and flood) on 27/09/2006, was estimated at 13 657 000m³ (based on data of 'Waterbouwkundig Laboratorium – Cel Hydrometrie Schelde') and is not similar to the net volume of 35 359 000m³ (based on ADCP measurements). There is not a straight explanation. Compared to the previous campaigns, volumes are rather high because the tide of this measurement campaign corresponds to spring tide, and that the flood values were composed partly out of two flood parts (before and after ebb). Also the meteorological conditions have influenced the water movement (West wind).

The mass of the suspended sediment, crossing transect I during flood or ebb on a measurement day, was calculated on a similar manner as the volume. The flux curve was integrated (Figure 5-6) and (Table 5-2) shows the results. During ebb on 11 March 2008, 68 531 tonnes SS crossed the transect and during flood 51 181 tonnes. Comparing with other campaigns, a net transport downstream of SS mass 17 350 tonnes is high (Table 5-2). Since flux is calculated with discharge and SS concentration, a similar overestimation and underestimation as the water volumes will appear in the calculated SS masses.

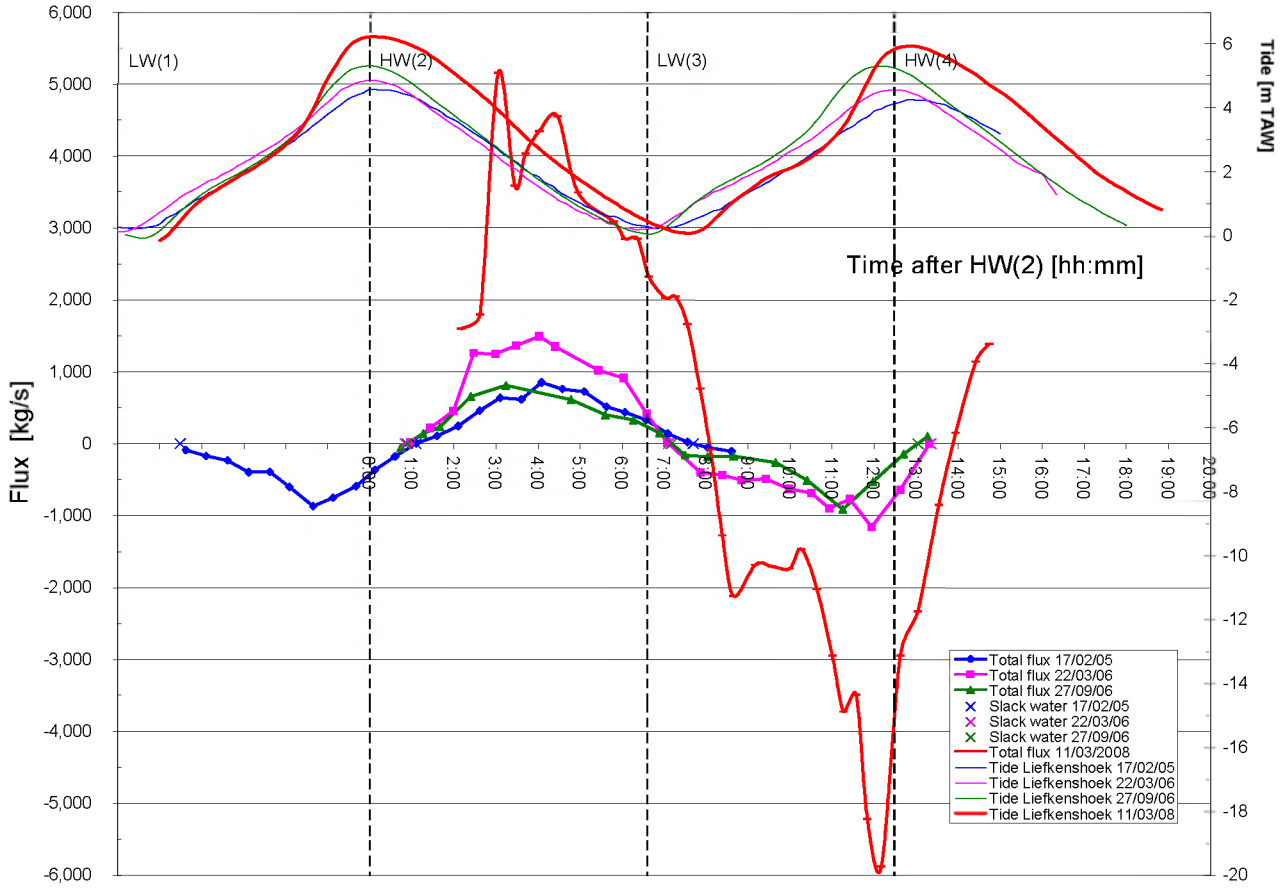


Figure 5-6: Total flux on 17/02/2005 (Neap tide), 22/03/2006 (Neap tide), 27/09/2006 (Average tide) & 11/03/2008 (Spring tide)

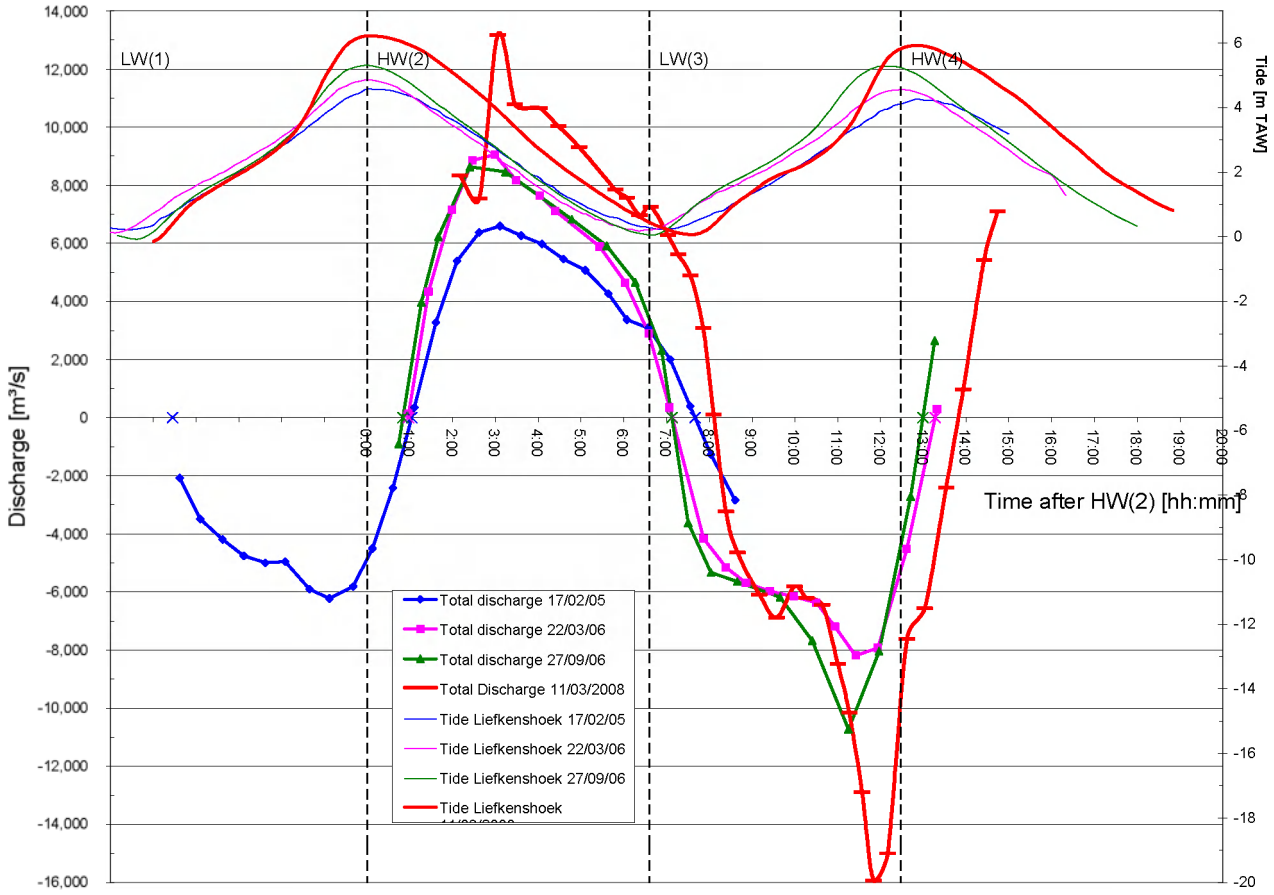


Figure 5-7: Total discharge on 17/02/2005 (Neap tide), 22/03/2006 (Neap tide), 27/09/2006 (Average tide) & 11/03/2008 (Spring tide)

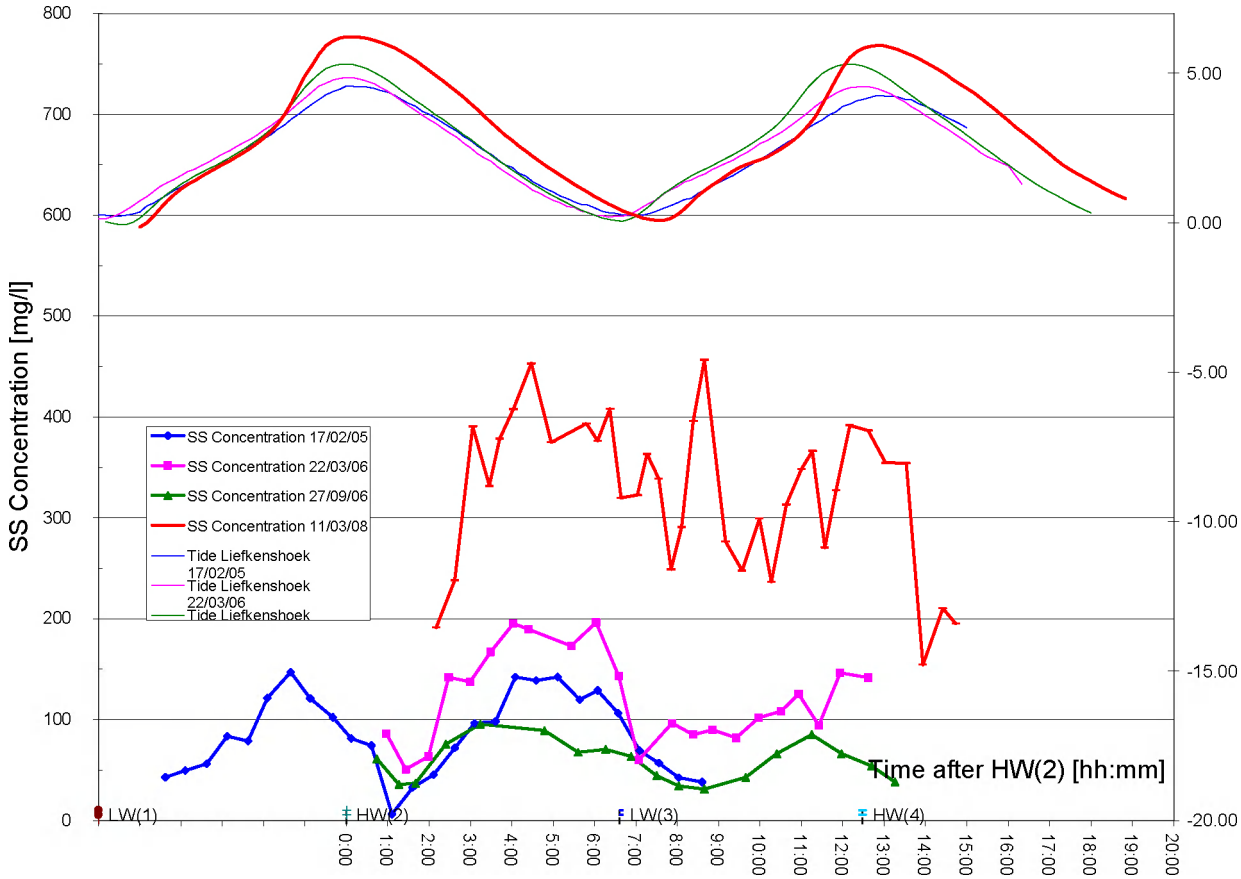


Figure 5-8: SS Concentration 17/02/2005 (Neap tide), 22/03/2006 (Neap tide), 27/09/2006 (Average tide) & 11/03/2008 (Spring tide)

Table 5-1: Water volume during ebb, flood and measurement campaign on 17/02/2005 (Neap tide), 22/03/2006 (Neap tide), 27/09/2006 (Average tide) & 11/03/2008 (Spring tide)

Measurement Day		***17/02/2005***	***22/03/2006***	***27/09/2006***	***11/03/2008***
Ebb	Volume [1000x m³]	103 080	132 405	138 430	189392
	Duration [HH:MM]	6:37	6:09	6:17	7:11
	Tidal Difference [m]	4.35	4.68	5.26	6.14
Flood	Volume [1000x m³]	-87 355	-118 936	-131 287	-154033
	Duration [HH:MM]	5:35	6:08	5:51	6:03
	Tidal Difference [m]	4.36	4.38	5.24	5.85
Net	Volume [1000x m³]	15 725	13 469	7 143	35359
	Duration [HH:MM]	12:12	12:18	12:09	13:15
	Discharge [m³/s]	358	304	163	741
Fresh water	Volume [1000x m³]	7 971	4 180	1 436	13657
	Duration [HH:MM]	12:12	12:18	12:09	13:15
	Discharge [m³/s]	181	94	33	286

Table 5-2: SS Mass during ebb, flood and measurement campaign on 17/02/2005 (Neap tide), 22/03/2006 (Neap tide), 27/09/2006 (Average tide)& 11/03/2008 (Spring tide)

Measurement Day		***17/02/2005***	***22/03/2006***	***27/09/2006***	***11/03/2008***
Ebb	SS Mass [Tonnes]	10 409	19 898	10 632	68531
	Duration [HH:MM]	6:35	6:16	6:17	7:11
	Tidal Difference [m]	4.35	4.68	5.26	6.14
Flood	SS Mass [Tonnes]	-8 349	-13 038	-7 687	-51181
	Duration [HH:MM]	5:36	6:14	5:51	6:03
	Tidal Difference [m]	4.36	4.38	5.24	5.85
Net	SS Mass [Tonnes]	2 060	6 860	2 945	17350
	Duration [HH:MM]	12:12	12:30	12:09	13:15

6. REFERENCES

AMT (2003). Intern rapport, Getij-informatie Scheldebekken 1991-2000.

IMDC (2002). Studie Densiteitsstroming in het kader van LTV Schelde, Stroom- en saliniteitsmeting t.h.v. Deurganckdok uitgevoerd op 12/06/202, I/RA/11216/02.042/CMA.

IMDC (2005a). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 1: Test survey 17/02/2005, I/RA/11265/05.008/MSA.

IMDC (2005b). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.1: Deurganckdok 17/02/2005, I/RA/11265/05.009/MSA.

IMDC (2005c). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.2: Zandvliet 17/02/2005, I/RA/11265/05.010/MSA.

IMDC (2005d). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.3: Liefkenshoek 17/02/2005, I/RA/11265/05.0011/MSA.

IMDC (2005e). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.4: Schelle 17/02/2005, I/RA/11265/05.0012/MSA.

IMDC (2005f). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.5: Deurganckdok 16/02/2005, I/RA/11265/05.013/MSA.

IMDC (2005g). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.6: Kallosluis 18/02/2005, I/RA/11265/05.014/MSA.

IMDC (2005h). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.7: Near bed continious monitoring: february 2005, I/RA/11265/05.015/MSA.

IMDC (2005i). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 3: Settling velocity INSSEV february 2005, I/RA/11265/05.016/MSA.

IMDC (2005j). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 4: Cohesive sediment properties february 2005, I/RA/11265/05.017/MSA

IMDC (2005k). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 5.1: Overview of ambient conditions in the river Scheldt January-June 2005, I/RA/11265/05.018/MSA.

IMDC (2005l). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 5.2: Overview of ambient conditions in the river Scheldt July-December 2005, I/RA/11265/05.019/MSA.

IMDC (2006a) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 6.1 Calibration Winter 15 March & 14 April 2006? I/RA/11291/06.092/MSA.

IMDC (2006b) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.1 21 March 2006 Scheldewacht – Deurganckdok, I/RA/11291/06.094/MSA.

IMDC (2006c) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.2 22 March 2006 Parel 2 – Deurganckdok (downstream), I/RA/11291/06.095/MSA.

IMDC (2006d) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.3 22 March 2006 Laure Marie – Liefkenshoek, I/RA/11291/06.096/MSA.

IMDC (2006e) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.4 23 March 2006 Parel 2 – Schelle, I/RA/11291/06.097/MSA.

IMDC (2006f) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.5 23 March 2006 Laure Marie – Deurganckdok (downstream), I/RA/11291/06.098/MSA.

IMDC (2006g) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 7.6 23 March 2006 Veremans – Waarde, I/RA/11291/06.099/MSA.

IMDC (2006h) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.1 Opmeting stroming en zout- en sedimentbeweging aan de ingang van het Deurganckdok (SiltProfiler), I/RA/11283/06.087/WGO.

IMDC (2006i) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.3. Opmeting stroming en zout-en sedimentbeweging aan de ingang van het Deurganckdok (ADCP), I/RA/11283/06.110/BDC

IMDC (2006j). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 8.1: Vaste meetopstelling in zake bodemgedrag, I/RA/11291/06.100/MSA.

IMDC (2006k) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.6 Zout en slibverdeling Deurganckdok 17/03/2006 – 23/05/2006, I/RA/11283/06.121/MSA.

IMDC (2006l) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 5.3 Overview of ambient conditions in the river Scheldt – January-June 2006 (I/RA/11291/06.089/MSA), in opdracht van AWZ.

IMDC (2006m): Studie van de stromingsvelden en sedimentuitwisseling aan de ingang van Deurganckdok. Current and Sediment flux measurements November 17th 2005 (I/RA/15030/06.021/BDC).

IMDC (2006n). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 9: Valsnelheid slib – INSSEV, I/RA/11291/06.102/MSA, in opdracht van AWZ.

IMDC (2006o). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 2.7: Silt distribution and frame measurements 15/07/2006 – 31/10/2006. (I/RA/11291/06.122/MSA).

IMDC (2006p) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 5.3 Overview of ambient conditions in the river Scheldt – Januari-June 2006 (I/RA/11291/06.089/MSA), in opdracht van AWZ.

IMDC (2007a) Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 6.2 Summer calibration and Final report, I/RA/11291/06.093/MSA.

IMDC (2007b). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 5.4 Overview of ambient conditions in the river Scheldt – July-December 2006 (I/RA/11291/06.089/MSA), in opdracht van AWZ.

IMDC (2007c). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.1 Through tide Measurement Sediview & Siltprofiler 27/9 Stream - Liefkenshoek (I/RA/11291/06.104/MSA), in opdracht van AWZ.

IMDC (2007d). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.2 Through tide Measurement Sediview 27/9 Veremans - Raai K (I/RA/11291/06.105/MSA), in opdracht van AWZ.

IMDC (2007e). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.3 Through tide Measurement Sediview & Siltprofiler 28/9 Stream - Raai K (I/RA/11291/06.106/MSA), in opdracht van AWZ.

IMDC (2007f). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.4 Through tide Measurement Sediview 28/9 Veremans - Waarde(I/RA/11291/06.107/MSA), in opdracht van AWZ.

IMDC (2007g). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.5 Through tide Measurement Sediview 28/9 Parel 2 - Schelle (I/RA/11291/06.108/MSA), in opdracht van AWZ.

IMDC (2007h). Uitbreiding studie densiteitsstromingen in de Beneden Zeeschelde in het kader van LTV Meetcampagne naar hooggeconcentreerde slibsuspensies Deelrapport 11.6 Through tide Measurement Salinity Distribution 26/9 Scheldewacht – Deurganckdok in opdracht van AWZ.

IMDC (2007i) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.1 Sediment Balance: Three monthly report 1/4/2006 – 30/06/2006 (I/RA/11283/06.113/MSA)

IMDC (2007j) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.2 Sediment Balance: Three monthly report 1/7/2006 – 30/09/2006 (I/RA/11283/06.114/MSA)

IMDC (2007k) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.3 Sediment Balance: Three monthly report 1/10/2006 – 31/12/2006 (I/RA/11283/06.115/MSA)

IMDC (2007l) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.4 Sediment Balance: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/06.116/MSA)

IMDC (2007m) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.5 Annual Sediment Balance (I/RA/11283/06.117/MSA)

IMDC (2007n) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.2 Through tide measurement SiltProfiler 26/09/2006 Stream (I/RA/11283/06.068/MSA)

IMDC (2007o) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.7 Salt-Silt distribution & Frame Measurements Deurganckdok 15/07/2006 – 31/10/2006 (I/RA/11283/06.122/MSA)

IMDC (2007p) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.8 Salt-Silt distribution & Frame Measurements Deurganckdok 15/01/2007 – 15/03/2007 (I/RA/11283/06.123/MSA)

IMDC (2007q) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.1 Boundary conditions: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/06.127/MSA)

IMDC (2007r) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.10: Sediment Balance: Three monthly report 1/4/2007 – 30/06/2007 (I/RA/11283/07.081/MSA)

IMDC (2007s) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.11: Sediment Balance: Three monthly report 1/7/2007 – 30/09/2007 (I/RA/11283/07.082/MSA)

IMDC (2007t) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.16: Salt-Silt distribution Deurganckdok summer (21/6/2007 – 30/07/2007) (I/RA/11283/07.092/MSA)

IMDC (2007v) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.10: Boundary conditions: Three monthly report 1/04/2007 – 30/06/2007 (I/RA/11283/07.097/MSA)

IMDC (2007w) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.11: Boundary conditions: Two monthly report 1/07/2007 – 30/09/2007 (I/RA/11283/07.098/MSA)

IMDC (2008a) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.5: Through tide measurement Sediview average tide 24/10/2007 (I/RA/11283/06.120/MSA)

IMDC (2008b) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 4.1: Analysis of siltation Processes and Factors (I/RA/11283/06.129/MSA)

IMDC (2008c) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.12: Sediment Balance: Four monthly report 1/9/2007 – 31/12/2007 (I/RA/11283/07.083/MSA)

IMDC (2008d) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.13: Sediment Balance: Four monthly report 1/01/2007 – 31/03/2007 (I/RA/11283/07.084/MSA)

IMDC (2008e) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 1.14: Annual Sediment Balance. (I/RA/11283/07.085/MSA)

IMDC (2008f) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.09: Calibration stationary equipment autumn (I/RA/11283/07.095/MSA)

IMDC (2008g) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.10: Through tide measurement SiltProfiler 23 October 2007 (I/RA/11283/07.086/MSA)

IMDC (2008h) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.11: Through tide measurement Salinity Profiling winter 12 March 2008 (I/RA/11283/07.087/MSA)

IMDC (2008i) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.12: Through tide measurement Sediview winter 11 March 2008 – Transect I (I/RA/11283/07.088/MSA)

IMDC (2008j) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.13: Through tide measurement Sediview winter 11 March 2008 – Transect K (I/RA/11283/07.089/MSA)

IMDC (2008k) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.14: Through tide measurement Sediview winter 11 March 2008 – Transect DGD (I/RA/11283/07.090/MSA)

IMDC (2008l) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.15: Through tide measurement SiltProfiler winter 12 March 2008 (I/RA/11283/07.091/MSA)

IMDC (2008m) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.17: Salt-Silt distribution & Frame Measurements Deurganckdok autumn (17/9/2007-10/12/2007) (I/RA/11283/07.093/MSA)

IMDC (2008n) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.18: Salt-Silt distribution & Frame Measurements Deurganckdok winter (18/02/2007-31/03/2008) (I/RA/11283/07.094/MSA)

IMDC (2008o) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.19: Calibration stationary & mobile equipment winter (I/RA/11283/07.096/MSA)

IMDC (2008p) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.12: Boundary conditions: Three monthly report 1/9/2007 – 31/12/2007 (I/RA/11283/07.099/MSA)

IMDC (2008q) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.13: Boundary conditions: Three monthly report 1/1/2008 – 31/3/2007 (I/RA/11283/07.100/MSA)

IMDC (2008r) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.14: Boundary conditions: Annual report (I/RA/11283/07.101/MSA)

IMDC (2008s) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 4.10: Analysis of siltation Processes and Factors (I/RA/11283/07.102/MSA)

TV SAM (2006a) Langdurige stationaire ADCP stroommetingen te Oosterweel dukdalf 01/2005-06/2005. 42SR S032PIB 2A.

TV SAM (2006b) Langdurige stationaire ADCP stroommetingen te Oosterweel dukdalf 07/2005-12/2005. 42SR S033PIB 2A.

TV SAM (2006c) Langdurige stationaire ADCP stroommetingen te Oosterweel dukdalf 01/2006-06/2006. 42SR S032PIB 2A.

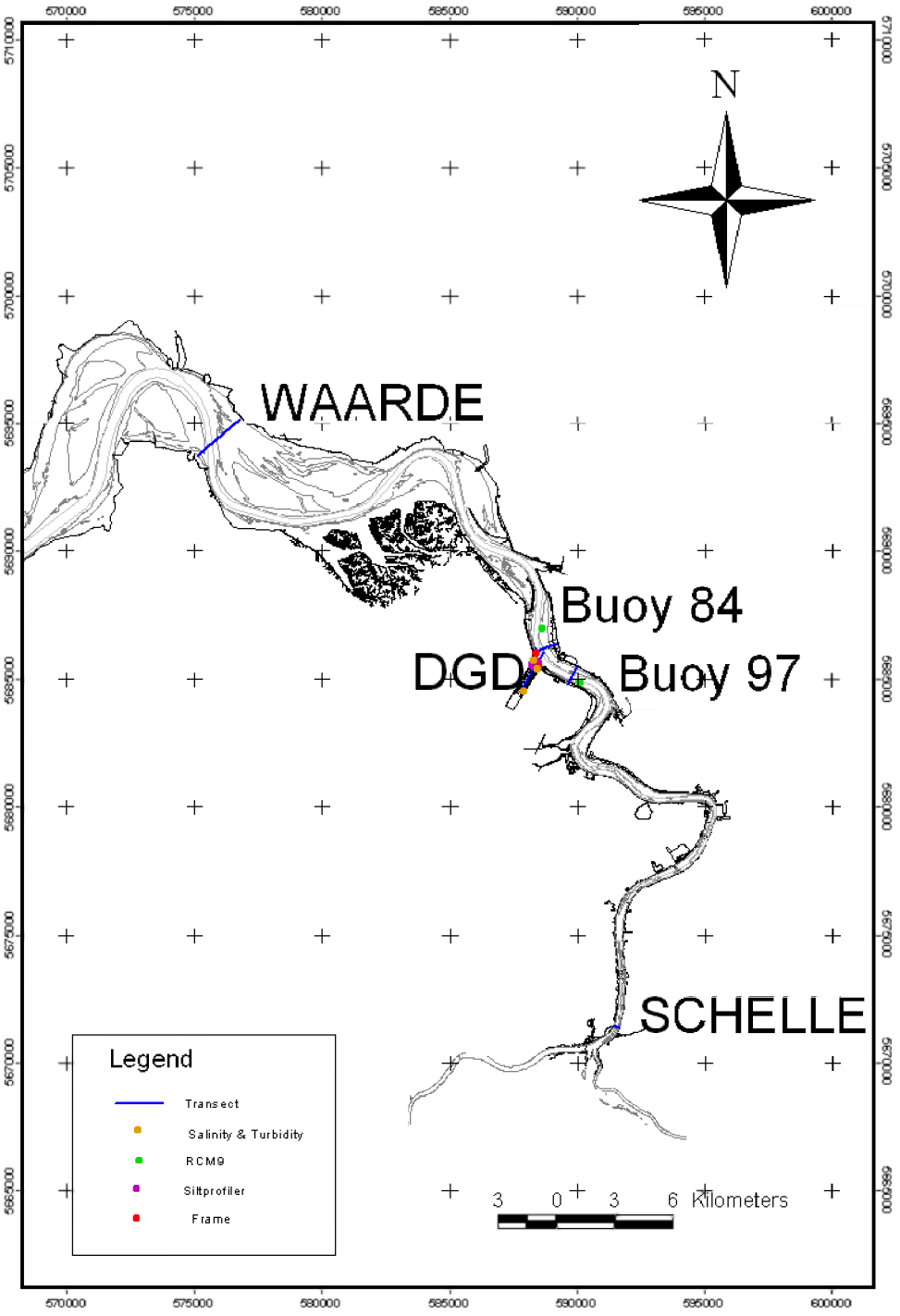
Unesco (1983). Algorithms for computation of fundamental properties of seawater, UNESCO Technical Papers in Marine Science, 44. UNESCO, France.

Wunderground (2008). Weather Underground: www.wunderground.com

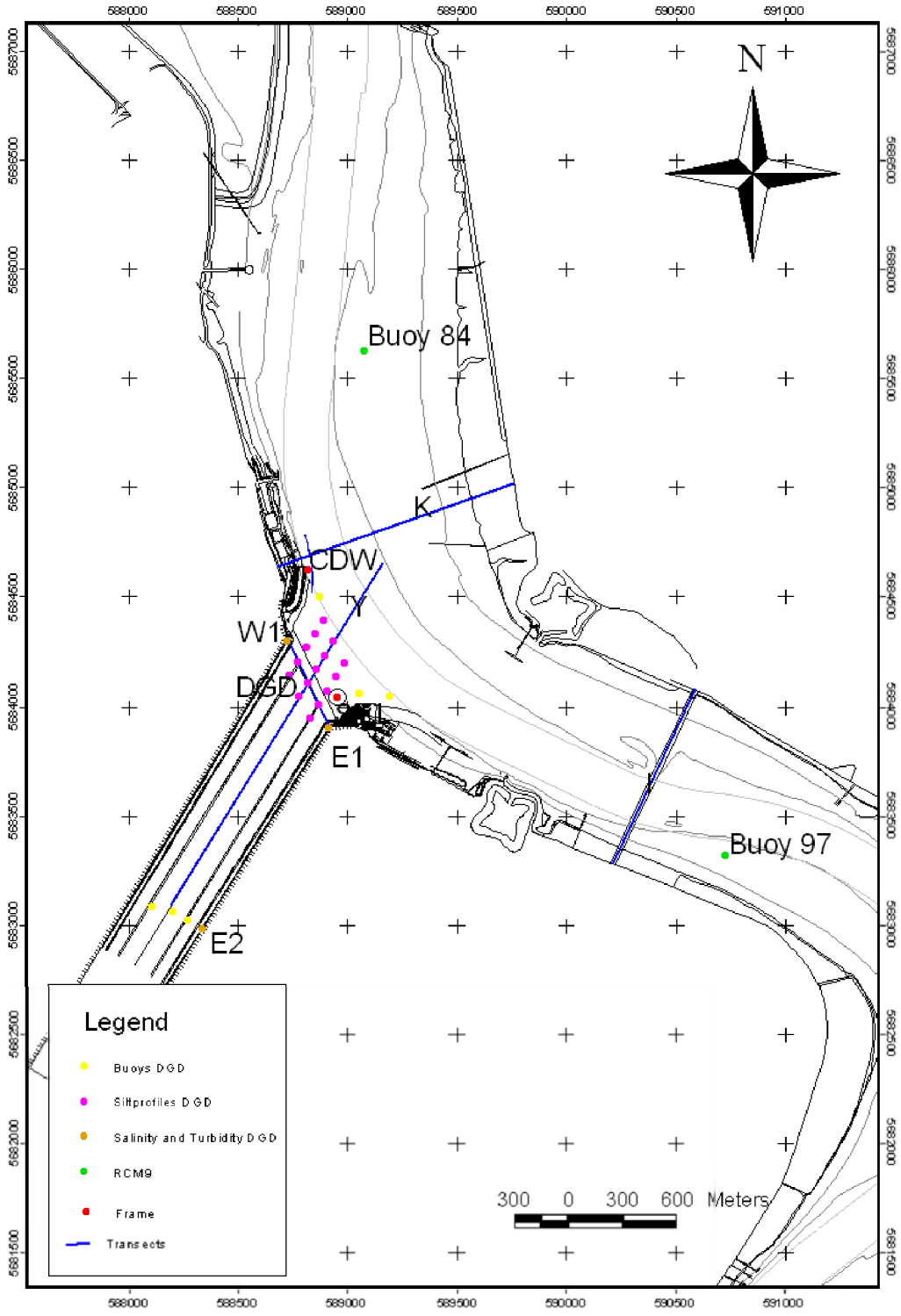
APPENDIX A.

OVERVIEW OF MEASUREMENT

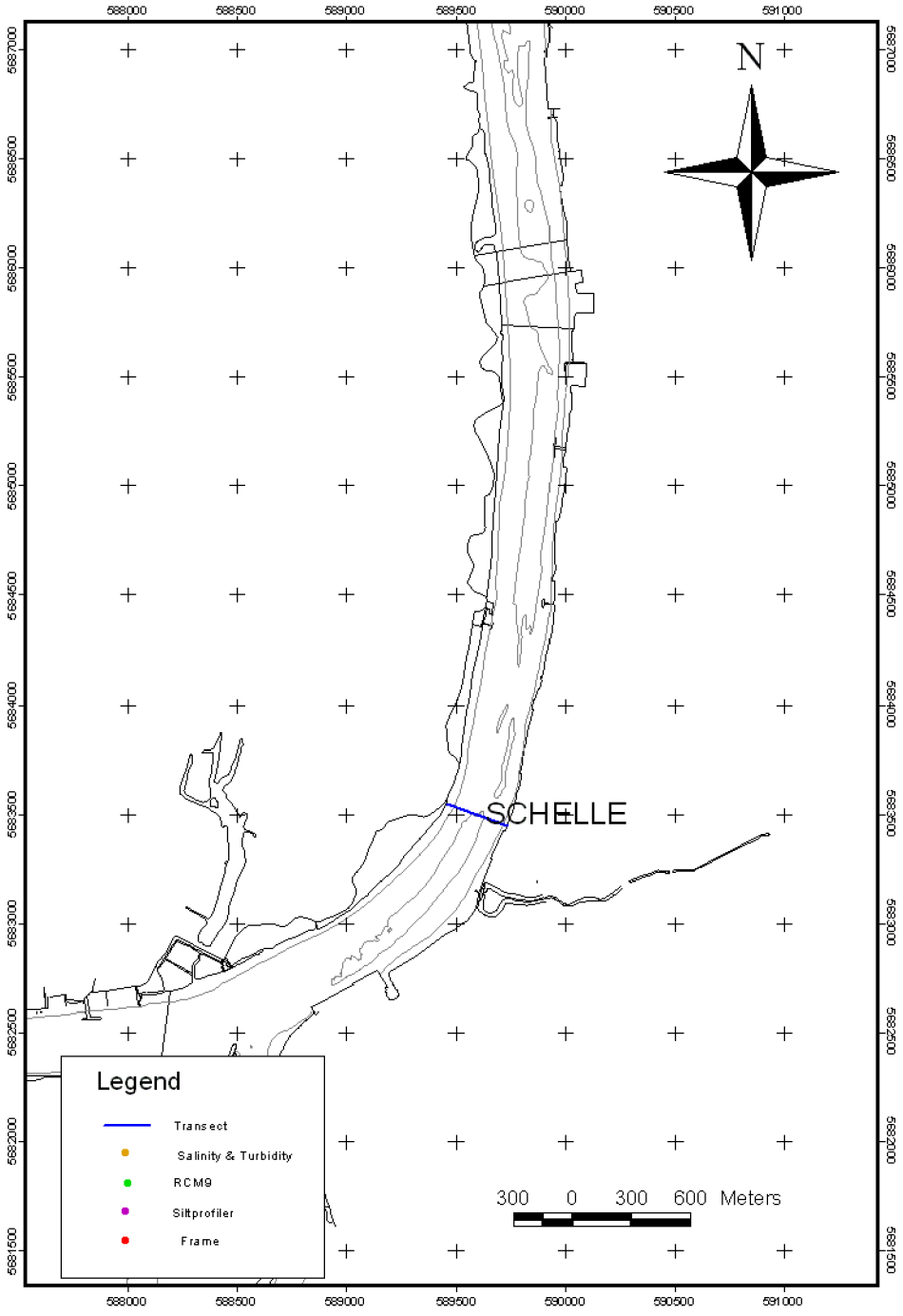
A.1 Overview of the measurement locations for the whole HCBS2 and Deurganckdok measurement campaigns



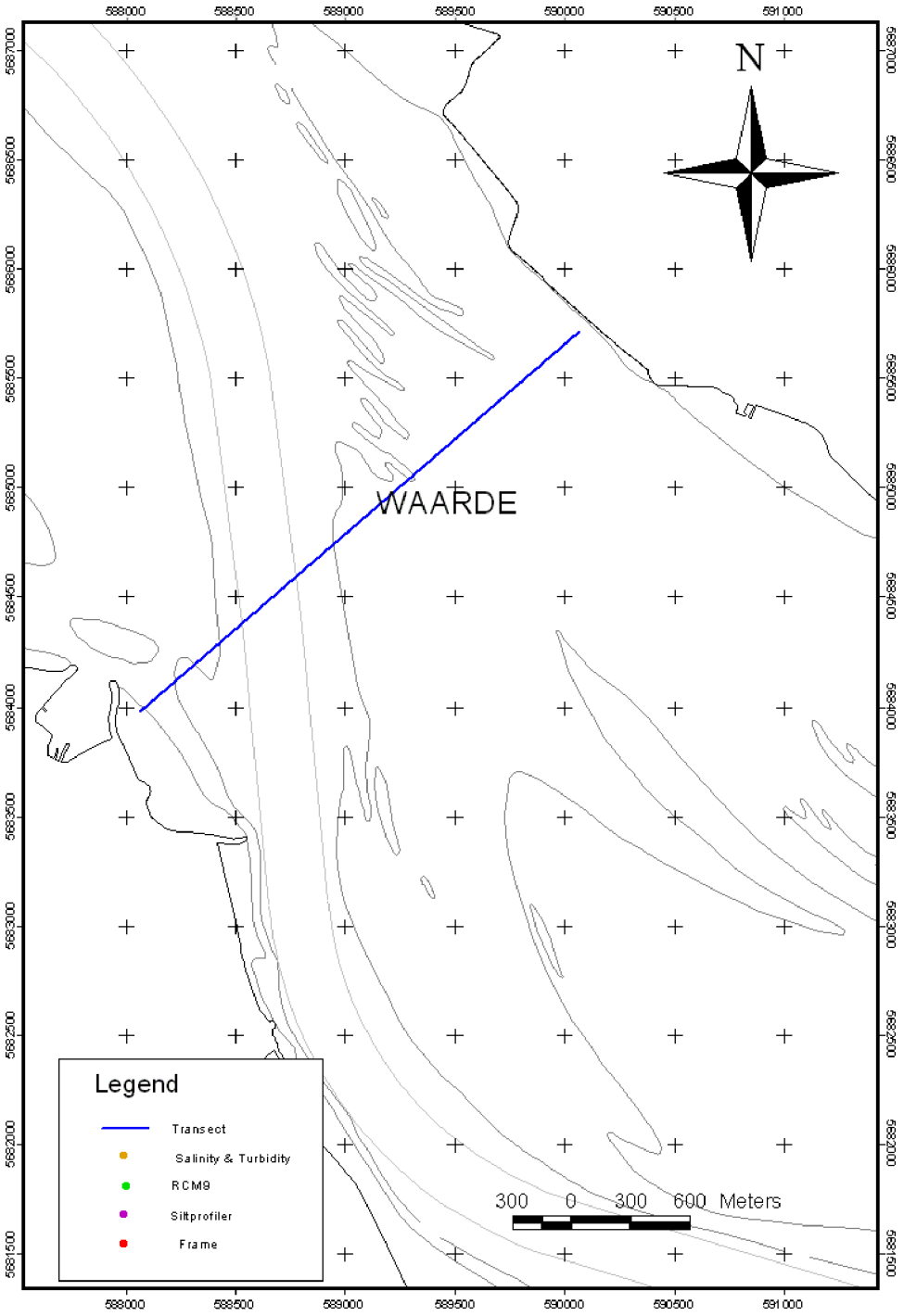
Annex Figure A-1: Overview of the measurement locations



Annex Figure A-2: Overview of the measurement locations at Deurganckdok



Annex Figure A-3: Transect S in Schelle



Annex Figure A-4: Transect W in Waarde

A.2 Overview of all measurement locations HCBS and Deurganckdok measurement campaigns

Annex Table A-1: coordinates of theoretical transects

Transect	Start Easting	Start Northing	End Easting	End Northing
I	590318.00	5683302.00	590771.00	5684257.00
K	588484.00	5684924.00	589775.00	5685384.00
SCHELLE	592645.07	5665794.06	592952.68	5665682.28
DGD	588764.88	5684056.49	588540.95	5684526.94
Y	589059.09	5684948.36	587898.76	5683076.56
WAARDE	573541.00	5696848.20	571318.00	5694932.90

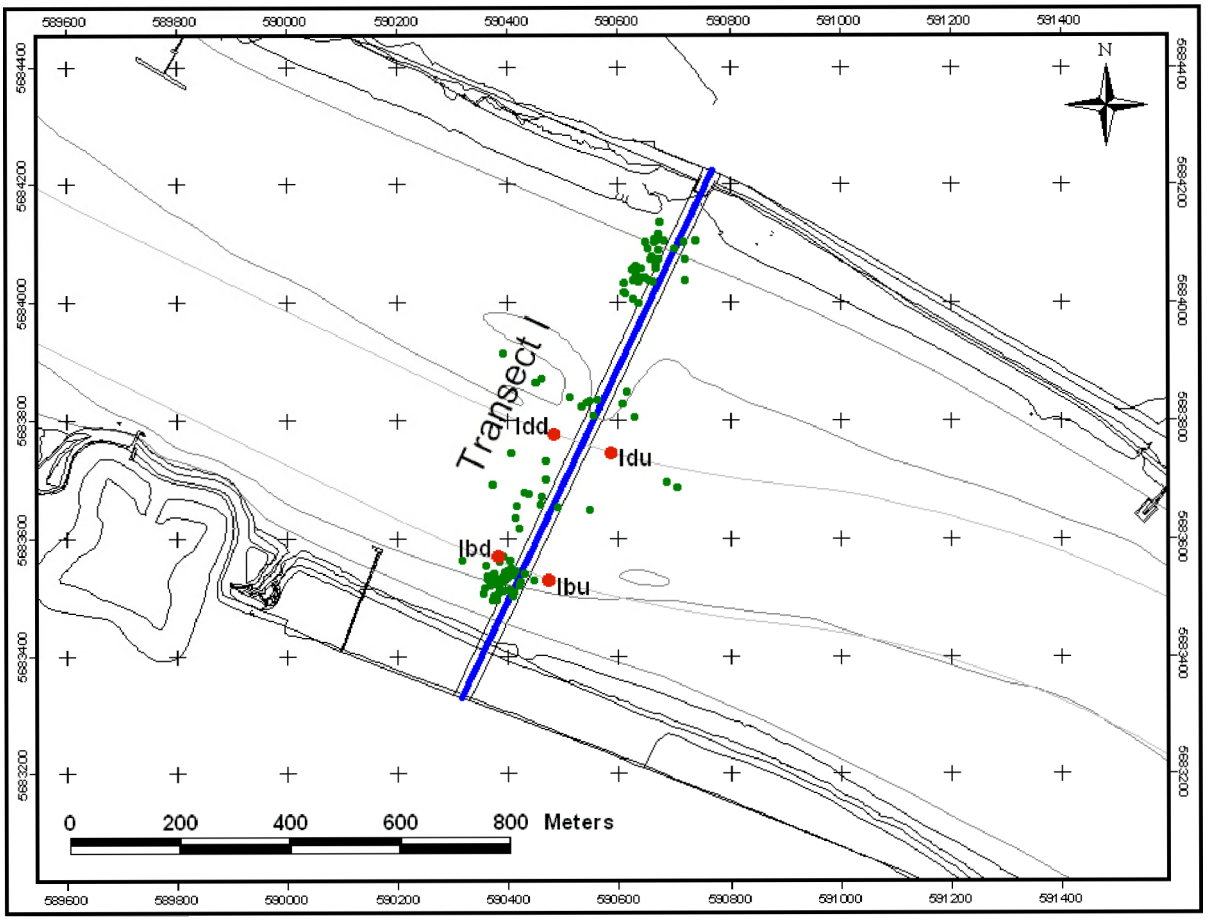
Annex Table A-2: coordinates of SiltProfiler gauging locations

SP	EASTING	NORTHING
1	588737	5684638
2	588690	5684562
3	588643	5684486
4	588596	5684411
5	588549	5684335
6	588606	5684217
7	588653	5684293
8	588700	5684368
9	588747	5684444
10	588793	5684520
11	588850	5684402
12	588803	5684326
13	588756	5684250
14	588709	5684174
15	588662	5684099

A.3 Measurement overview at Transect I on 11/03/2008

FileName	*End time [hh:mm MET]*	*Time of HW [hh:mm]*	*Easting Start (UTM31 ED50)*	*Northing Start (UTM31 ED50)*	*Easting Stop (UTM31 ED50)*	*Northing Stop (UTM31 ED50)*	*Transect length [m]*	*Transect heading [°]*
3002ltr_sub.csv	7:10	2:10	590686	5684129	590360	5683500	708	207
3004ltl_sub.csv	7:26	2:26	590408	5683744	590454	5683872	136	20
3006ltr_sub.csv	7:37	2:37	590669	5684127	590384	5683489	699	204
3008ltl_sub.csv	7:51	2:51	590415	5683628	590464	5683878	255	11
3010ltr_sub.csv	8:03	3:03	590615	5684033	590357	5683490	601	205
3012ltl_sub.csv	8:17	3:17	590375	5683687	590451	5683872	200	23
3014ltr_sub.csv	8:27	3:27	590668	5684131	590374	5683479	716	204
3016ltl_sub.csv	8:42	3:42	590377	5683485	590657	5684114	688	24
3018ltr_sub.csv	9:02	4:02	590664	5684101	590423	5683505	643	202
3020ltr_sub.csv	9:16	4:16	590395	5683924	590424	5683607	318	355
3022ltl_sub.csv	9:28	4:28	590450	5683515	590676	5684112	638	21
3024ltr_sub.csv	9:57	4:57	590676	5684096	590370	5683504	666	207
3026ltl_sub.csv	10:15	5:15	590412	5683486	590631	5684079	632	20
3028ltr_sub.csv	10:37	5:37	590472	5683698	590376	5683520	201	208
3030ltl_sub.csv	10:48	5:48	590402	5683520	590629	5684075	600	22
3032ltr_sub.csv	11:04	6:04	590645	5684061	590364	5683516	613	207
3034ltl_sub.csv	11:22	6:22	590393	5683518	590636	5684068	602	24
3036ltr_sub.csv	11:38	6:38	590630	5684057	590363	5683541	581	207
3038ltl_sub.csv	11:53	6:53	590464	5683666	590515	5683844	185	16
3040ltr_sub.csv	12:02	7:02	590613	5684051	590387	5683547	553	204
3042ltl_sub.csv	12:16	7:16	590416	5683530	590613	5684035	541	21
3044ltr_sub.csv	12:33	-5:17	590641	5684016	590400	5683531	541	207
3046ltl_sub.csv	12:51	-4:59	590378	5683527	590640	5684054	589	26
3048ltr_sub.csv	13:06	-4:44	590630	5684022	590412	5683523	545	204
3050ltl_sub.csv	13:23	-4:27	590395	5683558	590652	5684062	566	27
3052ltr_sub.csv	13:39	-4:11	590667	5684054	590392	5683519	601	207
3054ltl_sub.csv	13:59	-3:51	590433	5683674	590633	5683809	241	56
3056ltr_sub.csv	14:10	-3:40	590658	5684057	590405	5683498	613	204
3058lt_sub.csv	14:23	-3:27	590493	5683646	590610	5683833	220	32
3060ltr_sub.csv	14:34	-3:16	590672	5684079	590371	5683504	650	208
3062ltl_sub.csv	14:47	-3:03	590440	5683670	590617	5683854	255	44
3064ltr_sub.csv	14:59	-2:51	590636	5684082	590384	5683504	631	204
3066ltl_sub.csv	15:16	-2:34	590393	5683494	590645	5684077	636	23
3068ltr_sub.csv	15:38	-2:12	590723	5684057	590413	5683492	645	209
3070ltl_sub.csv	15:51	-1:59	590461	5683651	590558	5683810	186	31
3072ltr_sub.csv	16:00	-1:50	590662	5684096	590397	5683529	626	205
3074ltl_sub.csv	16:16	-1:34	590409	5683535	590702	5684114	649	27
3076ltr_sub.csv	16:34	-1:16	590723	5684094	590432	5683526	638	207
3078ltl_sub.csv	16:50	-1:00	590425	5683512	590742	5684128	693	27
3080ltr_sub.csv	17:10	-0:40	590671	5684088	590382	5683507	649	206

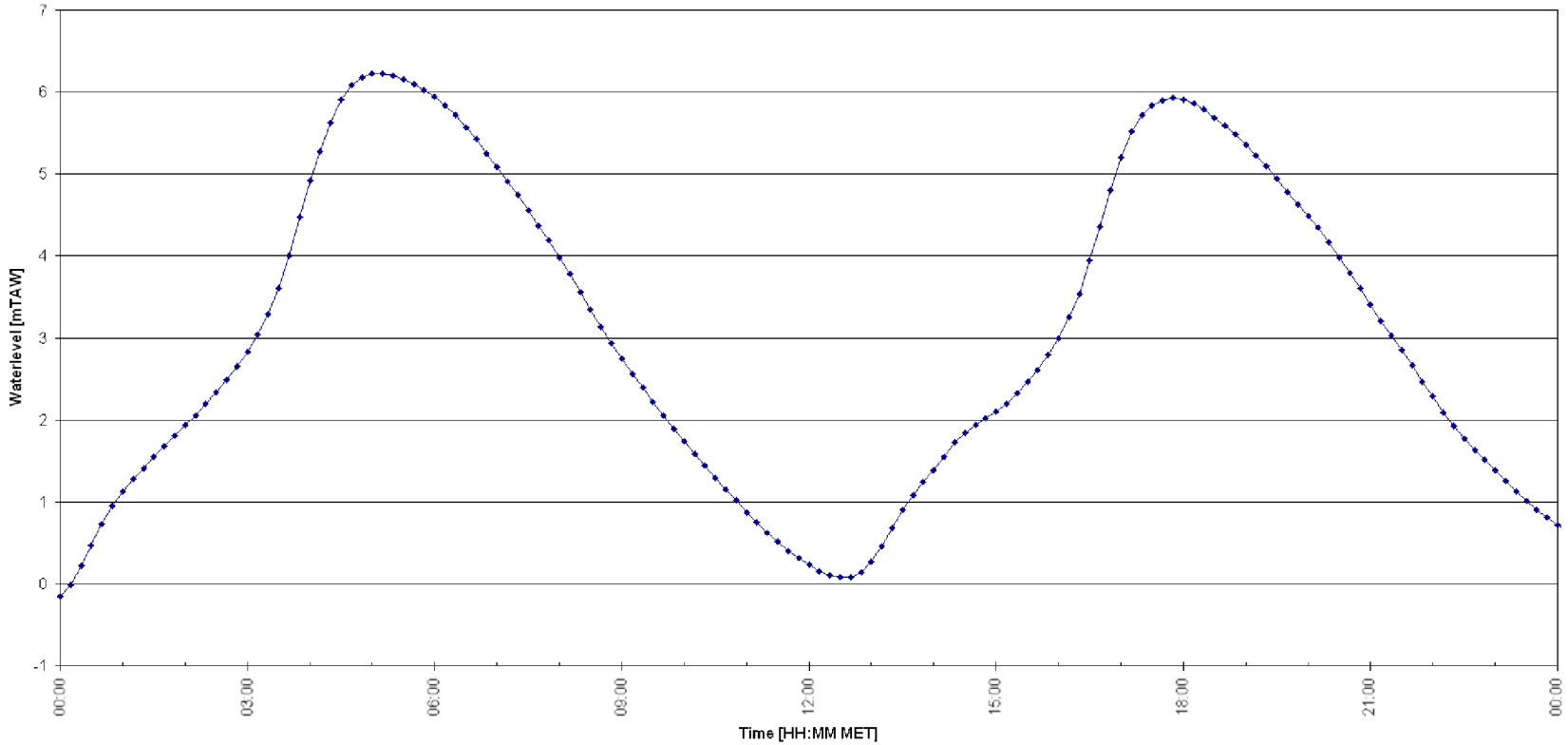
FileName	End time [hh:mm MET]	Time of HW [hh:mm]	Easting Start (UTM31 ED50)	Northing Start (UTM31 ED50)	Easting Stop (UTM31 ED50)	Northing Stop (UTM31 ED50)	Transect length [m]	Transect heading [°]
3082ltl_sub.csv	17:26	-0:24	590707	5683682	590565	5683839	212	318
3084ltr_sub.csv	17:37	-0:13	590676	5684140	590405	5683549	651	205
3086ltl_sub.csv	17:53	0:03	590690	5683692	590537	5683828	205	312
3088ltr_sub.csv	18:02	0:12	590679	5684163	590394	5683511	711	204
3090ltl_sub.csv	18:20	0:30	590550	5683643	590550	5683836	193	0
3092ltr_sub.csv	18:32	0:42	590720	5684127	590364	5683521	703	210
3094ltl_sub.csv	18:45	0:55	590471	5683729	590545	5683835	130	35
3096ltr_sub.csv	18:56	1:06	590678	5684130	590383	5683477	716	204
3098ltl_sub.csv	19:10	1:20	590422	5683506	590418	5683648	142	359
3100ltr_sub.csv	19:25	1:35	590676	5684140	590386	5683506	698	205
3102ltl_sub.csv	19:44	1:54	590320	5683551	590651	5684126	664	30



Annex Figure A-5: Location of start en end points of the sailed tracks

APPENDIX B. TIDAL DATA

11283 – March 2008 SURVEY



Measured tide on 11/03/2008 at Liefkenshoek

Location:	Date:
River Scheldt	11/03/2008

Data processed by: IMDC

In association with: WL | delft hydraulics, GEMS International

I/RA/11283/07.088/MSA

APPENDIX C.

NAVIGATION INFORMATION AS RECORDED ON SITE

Ship:		*Scheldewacht II*	
Location:		*Liefkenshoek (transect I)*	
Nr.	*Time (MET)*	*Type ship*	*Direction (Upstream, Downstream)*
1	7:33	Binnenschip Jean-Bart	Downstream
2	7:36	Binnenschip Friesland	Downstream
3	7:40	Zeeschip Zeus	Downstream
4	7:42	Binnenschip Stortwein	Upstream
5	8:05	Binnenschip Vopak Farhen	Upstream
6	8:07	Binnenschip Bonneventura	Upstream
7	8:15	Sleepboot Union 9	Upstream
8	8:17	peilvlot	Downstream
9	8:30	Binnenschip Donata	Upstream
10	8:35	Kuster Noest	Downstream
11	8:45	Zeevaart Sloman Neptun	Downstream
12	8:55	Duwkonvooi Vitaya	Upstream
13	9:00	Binnenvaart Antwerpen	Downstream
14	9:01	Binnenvaart Naamloos	Downstream
15	9:24	Kuster Verdi Halerna	Upstream
16	9:25	Binnenschip Wesley	Downstream
17	9:27	Sleepboot Union Emmerald	Downstream
18	9:40	Peilvaartuig Veremans langzij	
19	10:45	Alexander I	Upstream
20	10:45	Union 9	Upstream
21	10:45	Emerald	Upstream
22	10:10	Big-Ben	Downstream
23	10:55	Santos	Downstream
24	11:00	Zeeschip Normandia	Downstream
25	11:02	Binnenvaart Nyoma	Downstream
26	11:02	Binnenvaart Vaarwel	Upstream
27	11:05	Binnenvaart Fast Catherine	Downstream
28	11:06	Binnenvaart Riemus	Downstream
29	11:06	Binnenvaart Friendship	Downstream
30	11:07	Binnenvaart Geulstroom	Downstream
31	11:08	Binnenvaart Esberger	Upstream

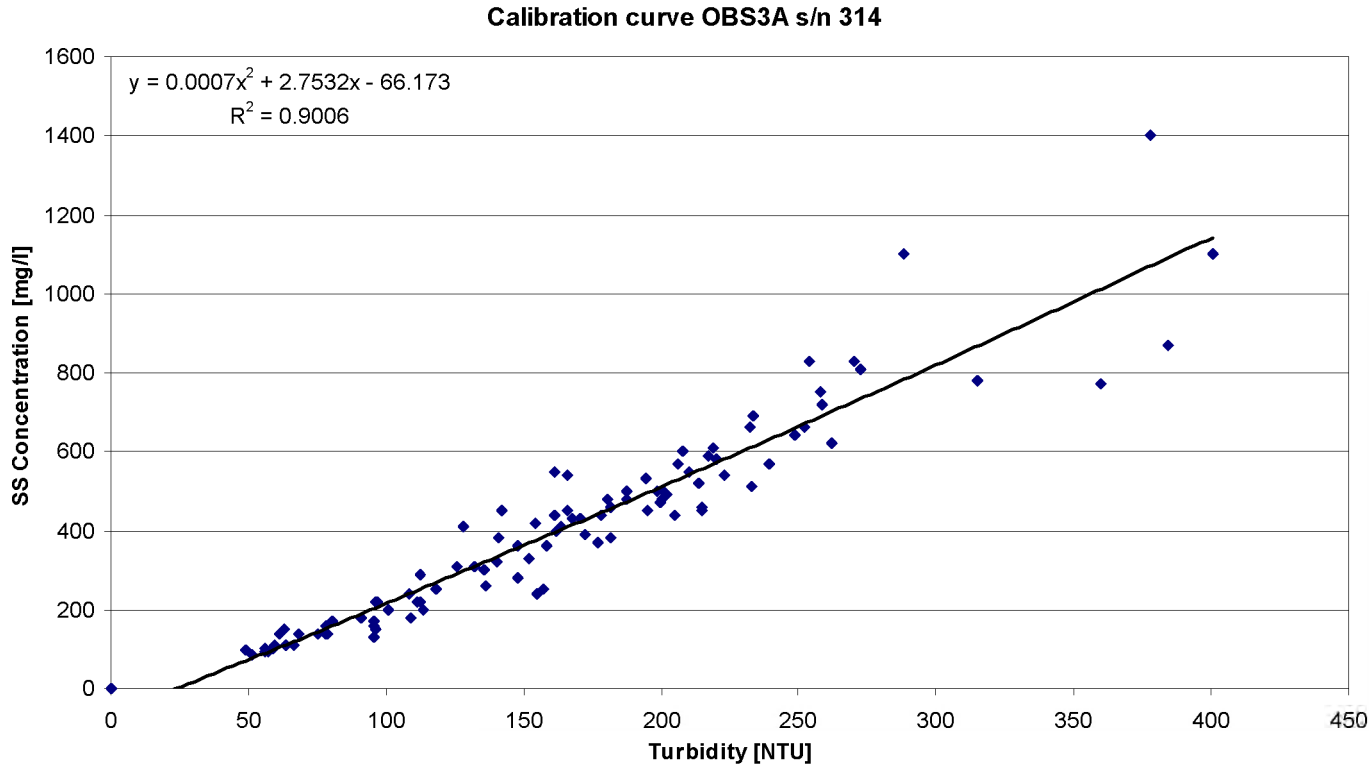
Ship:		*Scheldewacht II*	
Location:		*Liefkenshoek (transect I)*	
Nr.	*Time (MET)*	*Type ship*	*Direction (Upstream, Downstream)*
32	11:13	Zeeschip Tonsil Knuter	Downstream
33	11:20	Binnenvaart - Schelde	Downstream
34	11:15	Binnenschip Bach	Upstream
35	11:20	Binnenschip Annaconda	Downstream
36	11:23	Binnenvaart Jean-Bart	Upstream
37	11:35	Binnenvaart Vitaya	Upstream
38	11:40	Binnenschip Henny	Upstream
39	11:40	Pleziervaart Wilfried	Downstream
40	11:45	Binnenvaart El Blayo	Downstream
41	12:05	SPN 14	Downstream
42	12:15	Binnenvaart Vigo	Downstream
43	12:16	Binnenvaart Zijpe	Downstream
44	12:17	Binnenvaart Jaguar	Downstream
45	12:23	Binnenvaart Zandschip	Upstream
46	12:26	Kuster Betina	Downstream
47	12:27	Binnenvaart Amperes	Downstream
48	12:28	Kustvaart Rebeca Hamman	Downstream
49	12:53	Binnenvaart Polska	Upstream
50	13:00	Binnenvaart Aviso	Downstream
51	13:20	Sally	Upstream
52	13:25	Silos Oranjeboom	Upstream
53	13:28	Jade	Upstream
54	13:40	Binnenvaart Hustang	Upstream
55	13:43	Binnenvaart Jabo	Downstream
56	13:57	Zandschip Stelvio	Upstream
57	14:00	Binnenvaart Schelde	Upstream
58	14:12	Binnenvaart Goya	Downstream
59	14:15	Binnenvaart Delta	Downstream
60	14:16	Kustvaart Patriot	Downstream
61	14:18	Binnenvaart Veronique	Downstream
62	14:20	Binnenvaart Karina	Downstream
63	14:20	Binnenvaart Nautek	Downstream

Ship:		*Scheldewacht II*	
Location:		*Liefkenshoek (transect I)*	
Nr.	***Time (MET)***	***Type ship***	***Direction (Upstream, Downstream)***
64	14:23	Binnenvaart Renso	Downstream
65	14:24	Binnenvaart Rygo	Downstream
66	14:30	SPN 14	Upstream
67	14:31	Zeevaart Grimaldi	Downstream
68	14:32	Sleepboot Union Emerald	Downstream
69	14:35	Binnenvaart Diego	Downstream
70	15:30	Good Spuud	Upstream
71	15:40	Antwerpen	Upstream
72	15:35	Amalia	Downstream
73	15:40	Naamloos	Downstream
74	15:41	Thiacita	Upstream
75	15:45	Binnenvaart El Blayo	Upstream
76	15:50	Binnenvaart Antwerpen	Downstream
77	15:55	Kustvaart Grendon	Upstream
78	16:00	Scheldeland	Upstream
79	16:10	Guria	Upstream
80	16:12	Elisabeth	Upstream
81	16:15	Binnenvaart Costes	Upstream
82	16:16	Binnenvaart Bombastick	Upstream
83	16:25	Binnenvaart Vigo	Upstream
84	16:45	Zeevaart Stella Wega	Downstream
85	16:47	Pandion	Downstream
86	16:50	Marnix	Downstream
87	16:51	Arenda	Downstream
88	16:53	Elise	Upstream
89	16:54	Binnenvaart Marisa	Downstream
90	16:56	Lieve Gevaert	
91	16:53	Eeben-Hazee	Downstream
92	16:53	Kustvaart Germania	
93	16:52	Eemstroom	Downstream
94	17:00	Kurzene	Upstream
95	17:20	Union 9	
96	17:35	Union 7	

Ship:		***Scheldewacht II***	
Location:		***Liefkenshoek (transect I)***	
Nr.	***Time (MET)***	***Type ship***	***Direction (Upstream, Downstream)***
97	17:35	Union 9	
98	17:36	Zeevaart Amu Zemobia	Upstream
99	17:38	Zeevaart Cobalt	Upstream
100	17:42	Kustvaart Fokko Ukena	Downstream
101	17:44	Zeevaart Jittebres	Upstream
102	17:45	Union Ruby	
103	18:30	Binnenvaart Rembrand	Downstream
104	18:32	Binnenvaart Waterway	Downstream
105	18:55	Orida	Downstream

APPENDIX D. CALIBRATION GRAPH OF OBS3A TURBIDITY SENSOR

11283 – March 2008 SURVEY



Calibration Graph of OBS3A s/n 314

Location:	Date:
River Scheldt (Transect I)	11/03/2008

Data processed by: IMDC

In association with: WL | delft hydraulics, GEMS International

I/RA/11283/07.088/MSA

APPENDIX E.

UNESCO PPS-78 FORMULA FOR CALCULATING SALINITY

Practical Salinity Scale (PPS 78) Salinity in the range of 2 to 42

Constants from the 19th Edition of Standard Methods

R cond.ratio	0.0117	$R = \frac{C}{42.914 mS/cm}$	
C Cond at t	**0.5**		**Input conductivity in mS/cm of sample**
t deg. C	**22.00**		**Input temperature of sample solution**
P dBar	**20**		**Input pressure at which sample is measured in decibars**
Rp	1.0020845	$R_p = 1 + \frac{p(e_1 + e_2 p + e_3 p^2)}{1 + d_1 t + d_2 t^2 + (d_3 + d_4 t)R}$	
rt	1.1641102	$r_t = c_0 + c_1 t + c_2 t^2 + c_3 t^3 + c_4 t^4$	
Rt	0.0099879	$R_t = \frac{R}{R_p \times r_t}$	
Delta S	-0.0010	$\text{Delta S} = \frac{(t-15)}{1+k(t-15)}(b_0 + b_1 R_t^{1/2} + b_2 R_t + b_3 R_t^{3/2} + b_4 R_t^2 + b_5 R_t^{5/2})$	
S = Salinity	**0.257**	$S = a_0 + a_1 R_t^{1/2} + a_2 R_t + a_3 R_t^{3/2} + a_4 R_t^2 + a_5 R_t^{5/2} + \text{delta S}$	

a0	0.0080	b0	0.0005	c0	0.6766097	d1	3.426E-02	e1	2.070E-04
a1	-0.1692	b1	-0.0056	c1	2.00564E-02	d2	4.464E-04	e2	-6.370E-08
a2	25.3851	b2	-0.0066	c2	1.104259E-04	d3	4.215E-01	e3	3.989E-12
a3	14.0941	b3	-0.0375	c3	-6.9698E-07	d4	-3.107E-03		
a4	-7.0261	b4	0.0636	c4	1.0031E-09				
a5	2.7081	b5	-0.0144						
		k	0.0162						

R = ratio of measured conductivity to the conductivity of the Standard Seawater Solution

Conductivity Ratio R is a function of salinity, temperature, and hydraulic pressure. So that we can factor R into three parts i.e.

R = Rt x Rp x rt

R = C(S,t,p)/C(35,15,0)

C = 42.914 mS/cm at 15 deg C and 0 dbar pressure ie C(35,15,0) where 35 is the salinity

Ocean pressure is usually measured in decibars. 1 dbar = 10^-1 bar = 10^5 dyne/cm^2 = 10^4 Pascal.

APPENDIX F. OVERVIEW OF SEDIVIEW SETTINGS

Ship:		***Scheldewacht II***	
Location:		***Liefkenshoek (transect I)***	
Date		***11/03/2008***	
Parameters	***Value***	***Parameters***	***Value***
Inst. Depth (m)	1.8	*Compass offset (°)*	2.3
Force depth (m)	0	*Beam 3 misalignment (°)*	0
Velocity reference	BT	*Effective particle size (µm)*	20
Speed of sound algorithm	Urick	*Beam1 scale factor*	0.420
Error velocity	YES	*Beam2 scale factor*	0.413
External heading	NO	*Beam3 scale factor*	0.443
External Depth	NO	*Beam4 scale factor*	0.445
SSC factor top (%)	100	*Discharge factor top*	Constant
SSC factor bottom (%)	Variable	*Discharge factor bottom*	Power
Shape factor left bank	0.35	*Shape factor right bank*	0.35

Filename	***Calibration const (Ks)***	***Backscatter coefficient (S)***	***SSC factor bottom (%)***	***Distance to the left bank (m)***	***Distance to the right bank (m)***
3002ltr_sub.csv	46	20.25	113	197	152
3004ltl_sub.csv	46	20.50	134	438	483
3006ltr_sub.csv	46	20.00	145	197	161
3008ltl_sub.csv	46	19.10	141	336	474
3010ltr_sub.csv	46	18.35	185	187	269
3012ltl_sub.csv	46	18.50	163	373	485
3014ltr_sub.csv	46	18.85	108	184	158
3016ltl_sub.csv	46	18.80	111	191	178
3018ltr_sub.csv	46	18.70	115	229	186
3020ltl_sub.csv	46	18.35	123	321	462
3022ltr_sub.csv	46	18.40	118	249	172
3024ltr_sub.csv	46	18.65	108	205	187
3026ltl_sub.csv	46	18.35	107	207	221
3028ltr_sub.csv	46	18.25	105	136	698
3030ltl_sub.csv	46	18.50	105	233	225
3032ltr_sub.csv	46	18.40	103	213	231
3034ltl_sub.csv	46	18.30	117	227	228
3036ltr_sub.csv	46	18.65	106	235	241
3038ltl_sub.csv	46	18.75	102	391	483
3040ltr_sub.csv	46	18.65	116	251	253
3042ltl_sub.csv	46	18.80	116	248	269
3044ltr_sub.csv	46	18.80	108	242	274

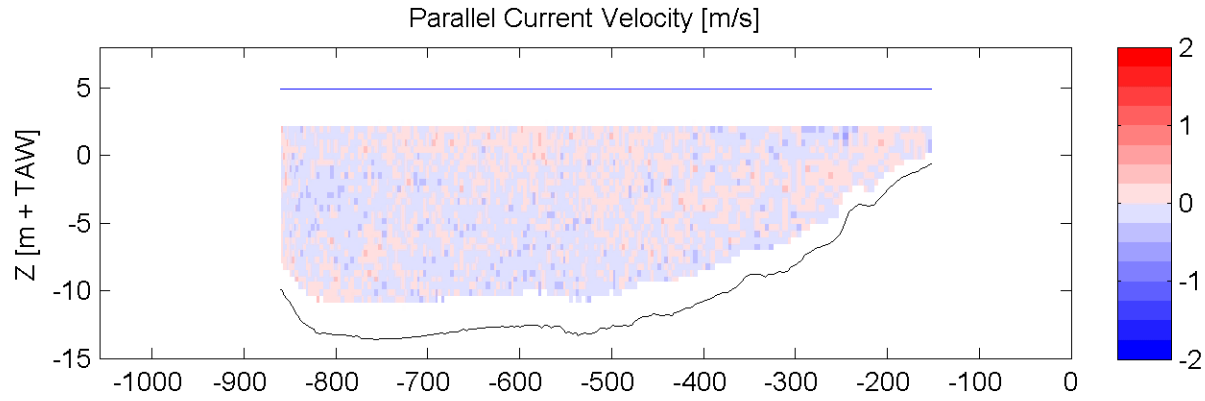
Filename	*Calibration const (Ks)*	*Backscatter coefficient (S)*	*SSC factor bottom (%)*	*Distance to the left bank (m)*	*Distance to the right bank (m)*
3046ltl_sub.csv	46	18.80	111	229	239
3048ltr_sub.csv	46	19.00	139	240	272
3050ltl_sub.csv	46	19.10	131	264	228
3052ltr_sub.csv	46	18.75	127	228	228
3054ltl_sub.csv	46	18.75	135	386	464
3056ltr_sub.csv	46	19.25	104	215	229
3058lt_sub.csv	46	19.50	109	386	452
3060ltr_sub.csv	46	19.25	176	205	203
3062ltl_sub.csv	46	18.85	175	385	430
3064ltr_sub.csv	46	18.85	206	210	216
3066ltl_sub.csv	46	18.85	219	205	217
3068ltr_sub.csv	46	18.85	152	212	201
3070ltl_sub.csv	46	18.55	134	377	495
3072ltr_sub.csv	46	18.50	300	239	192
3074ltl_sub.csv	46	18.50	301	249	159
3076ltr_sub.csv	46	18.70	114	251	168
3078ltl_sub.csv	46	18.75	118	236	129
3080ltr_sub.csv	46	18.60	107	213	196
3082ltl_sub.csv	46	18.10	100	510	466
3084ltr_sub.csv	46	18.10	106	260	146
3086ltl_sub.csv	46	18.20	113	512	488
3088ltr_sub.csv	46	18.75	111	221	125
3090ltl_sub.csv	46	19.30	108	407	475
3092ltr_sub.csv	46	19.40	109	217	139
3094ltl_sub.csv	46	19.60	111	451	478
3096ltr_sub.csv	46	20.10	121	186	155
3098ltl_sub.csv	46	20.50	140	242	823
3100ltr_sub.csv	46	20.70	202	213	146
3102ltl_sub.csv	46	20.45	192	226	169

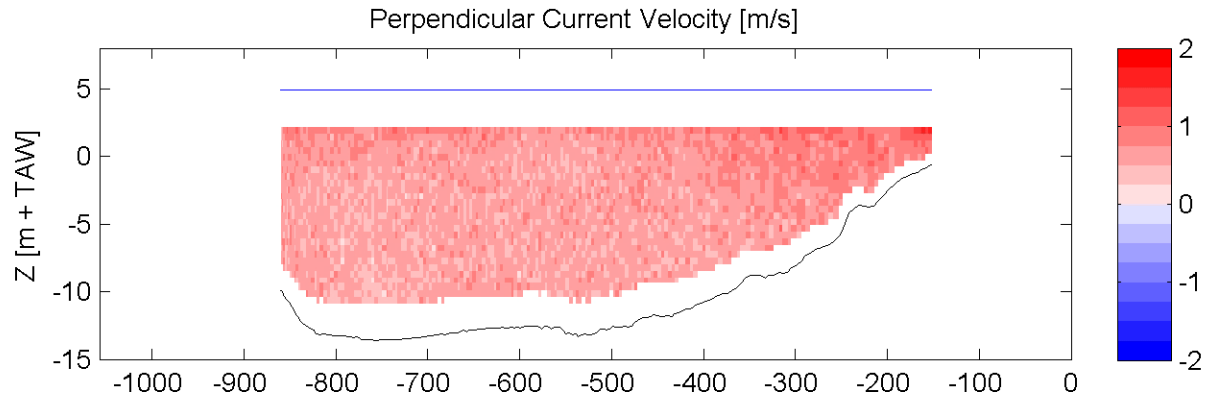
APPENDIX G. CONTOURPLOTS OF FLOW VELOCITIES, SEDIMENT CONCENTRATION AND SEDIMENT FLUX PER SAILED TRANSECT

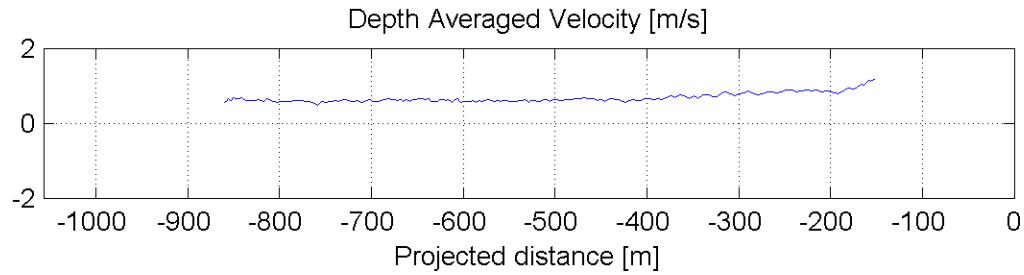
This page is intentionally left blank.

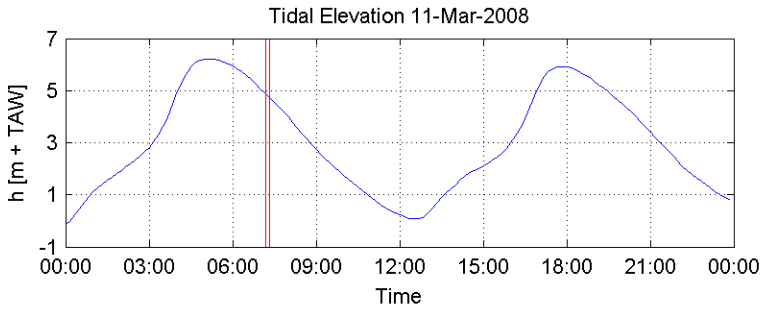
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3002ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

07:10 - 07:19

Time after HW [HH:MM]

2:15

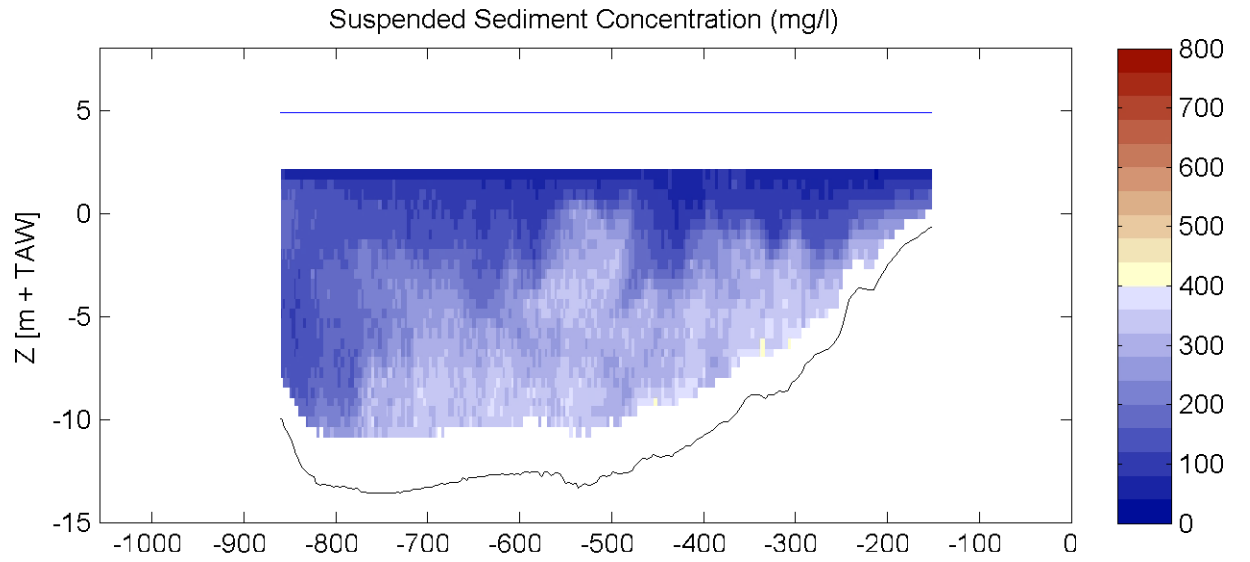
Data Processed by: IMDC

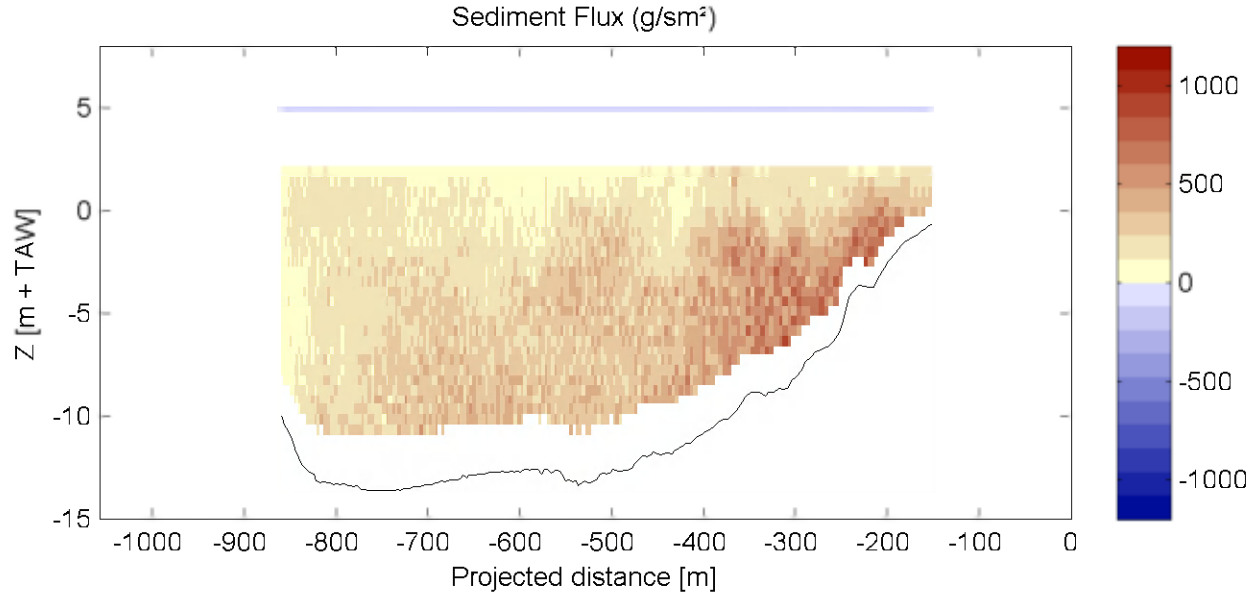
In association with : WL | delft hydraulics, GEMS International

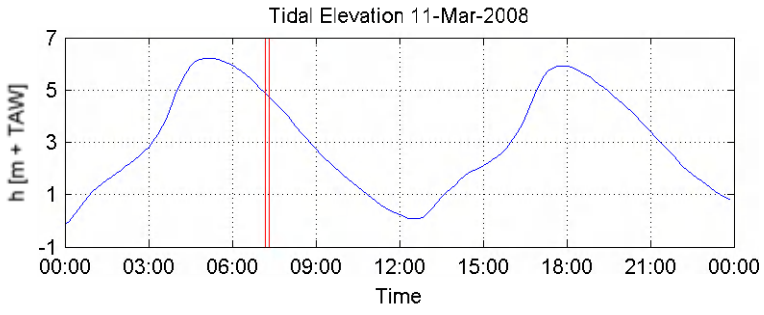
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3002ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
07:10 - 07:19

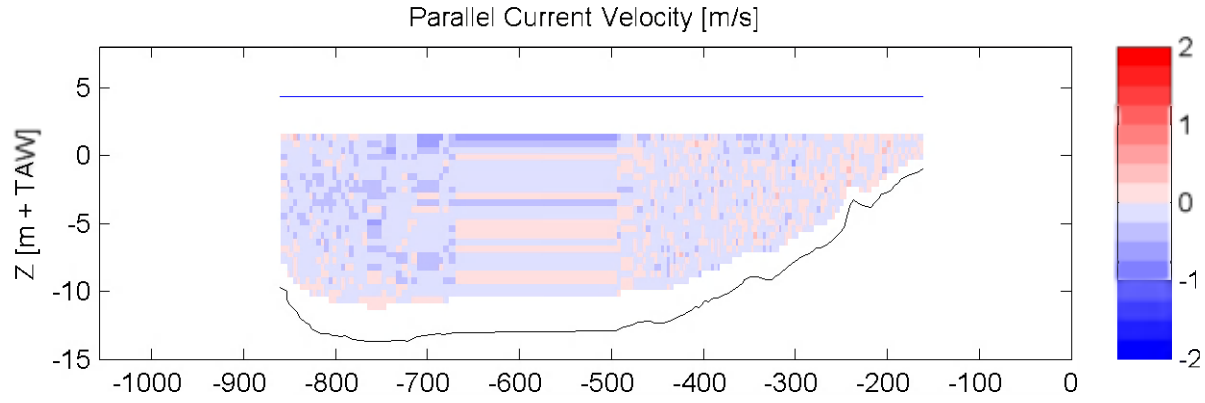
Time after HW [HH:MM]
2:15

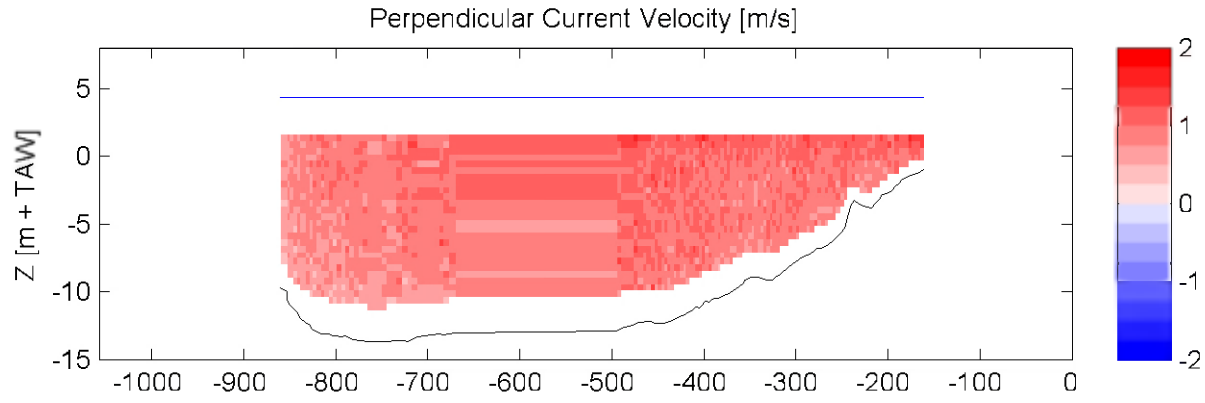
Data Processed by: IMDC
In association with :

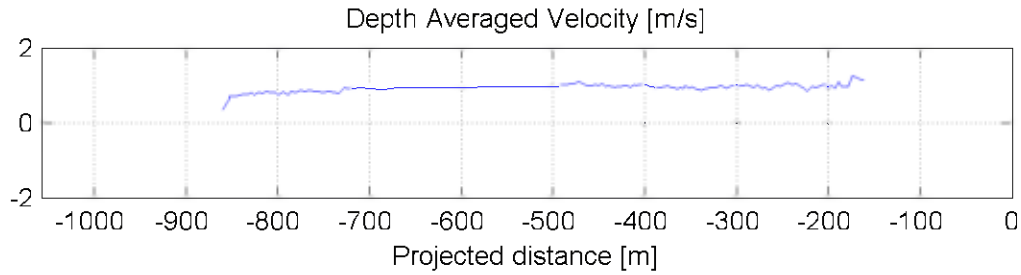
I/RA/11283/07.088/MSA

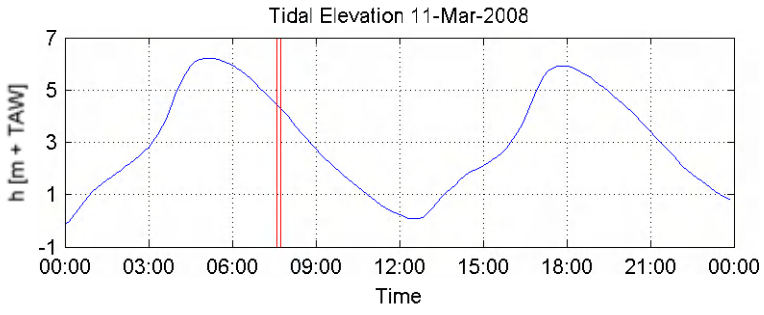
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3006ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
07:37 - 07:43

Time after HW [HH:MM]
2:40

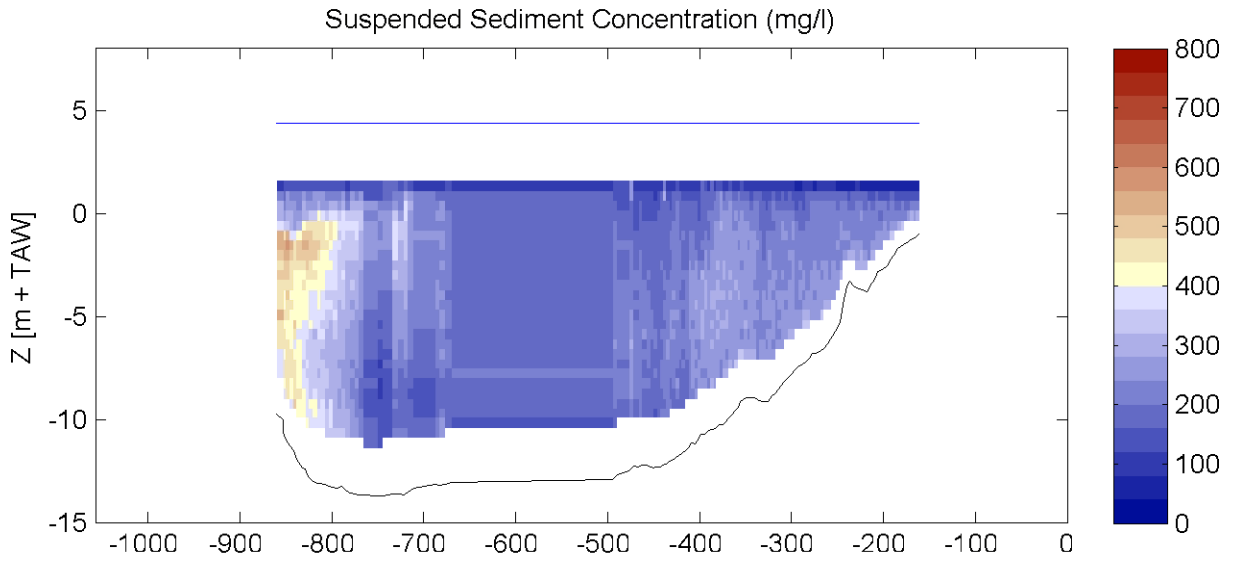
Data Processed by: IMDC

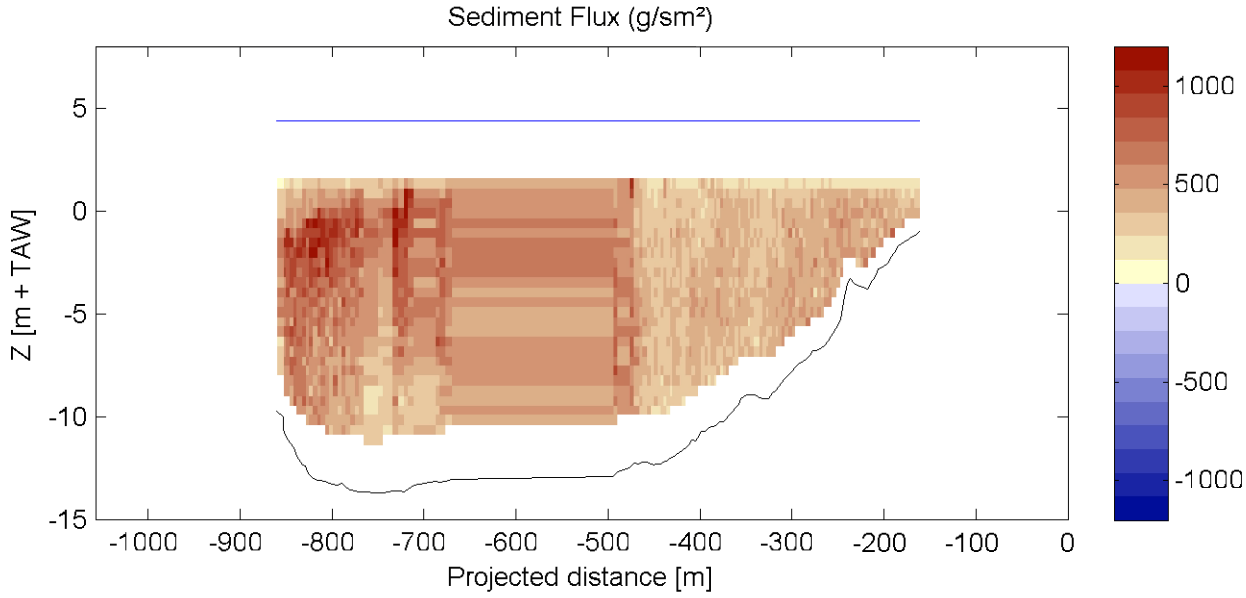
In association with :

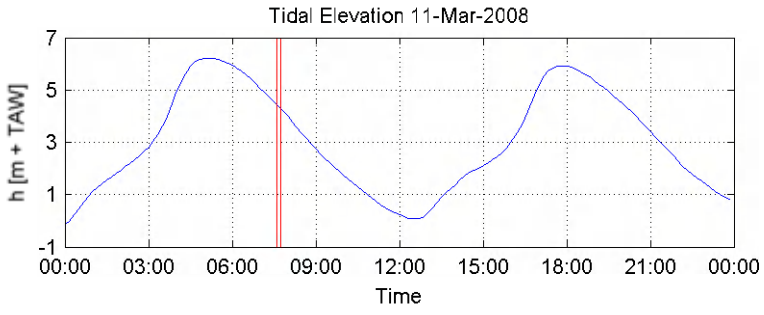
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3006ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
07:37 - 07:43

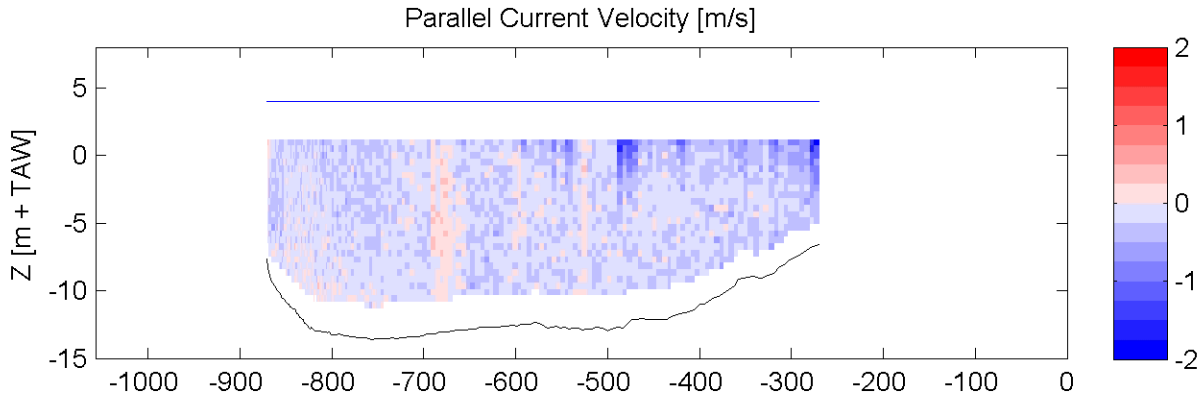
Time after HW [HH:MM]
2:40

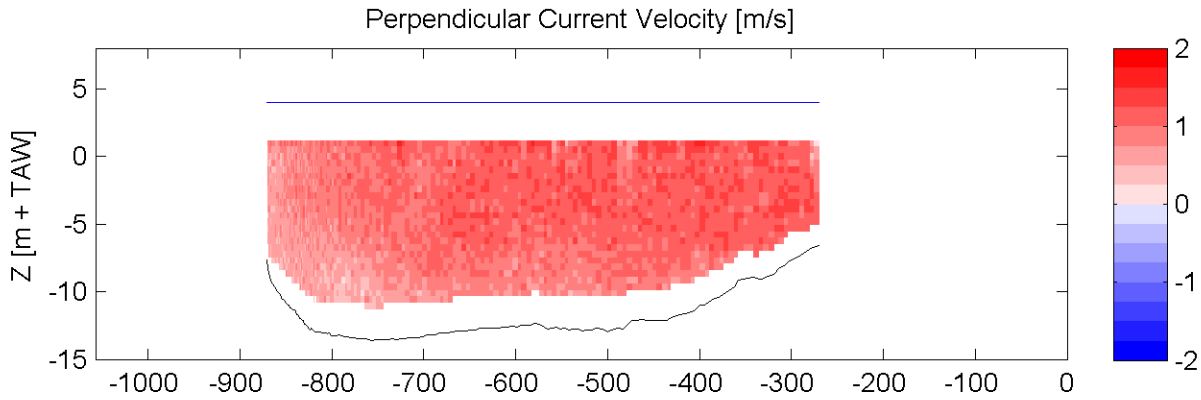
Data Processed by: IMDC
In association with :

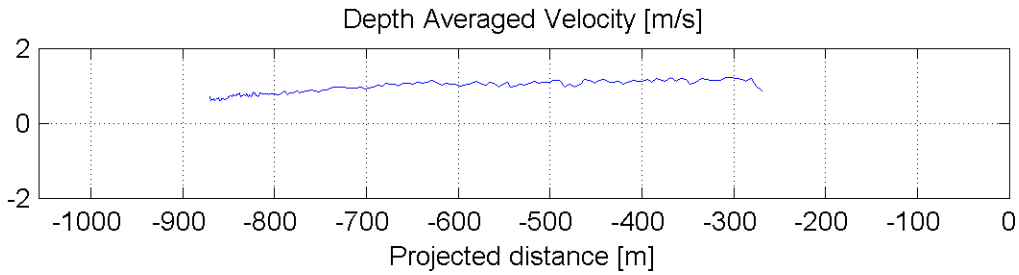
I/RA/11283/07.088/MSA

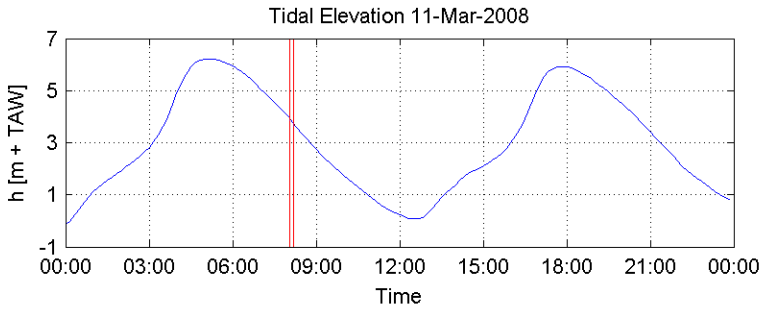
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3010ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

08:03 - 08:10

Time after HW [HH:MM]

3:07

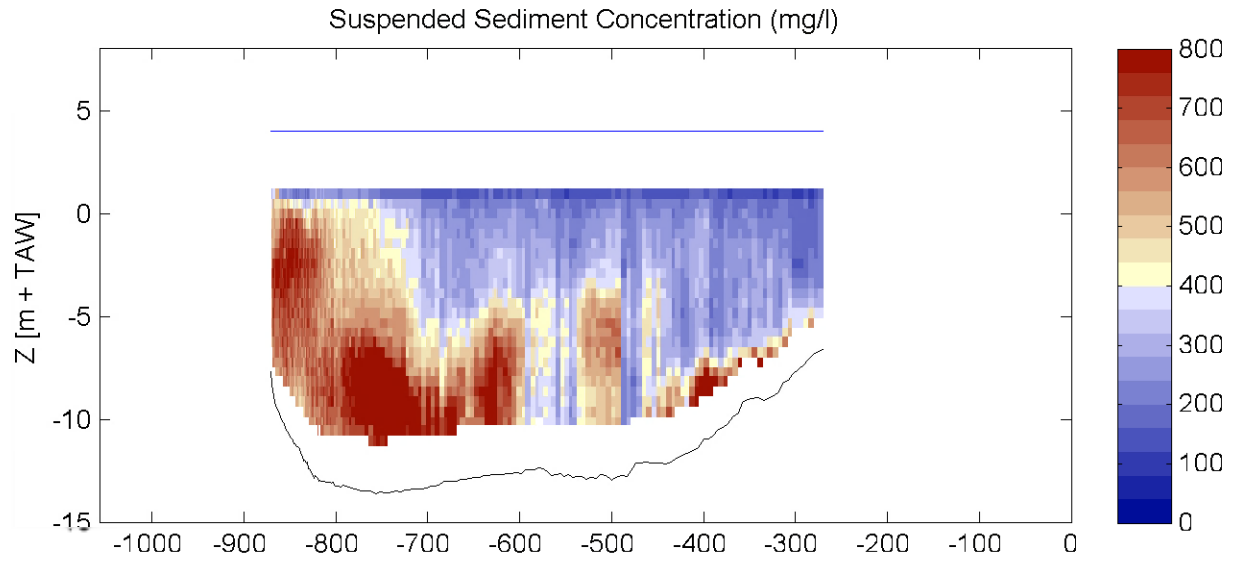
Data Processed by: IMDC

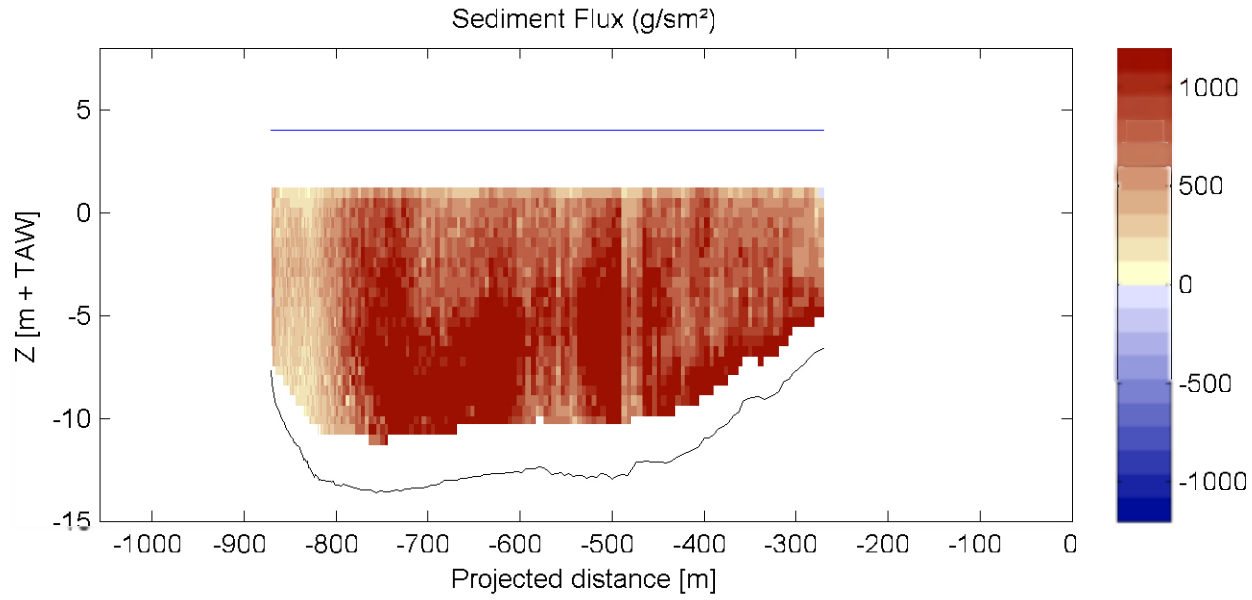
In association with : WL | delft hydraulics, GEMS International

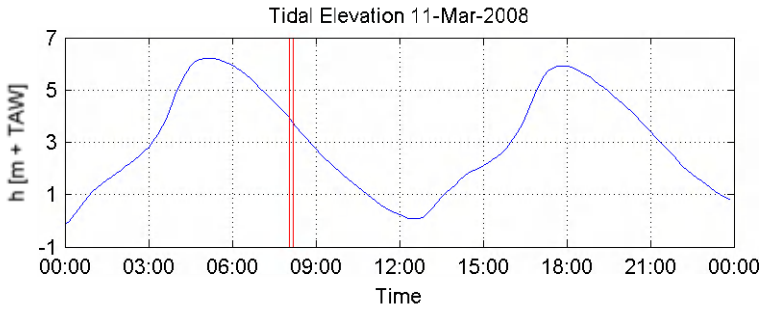
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3010ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

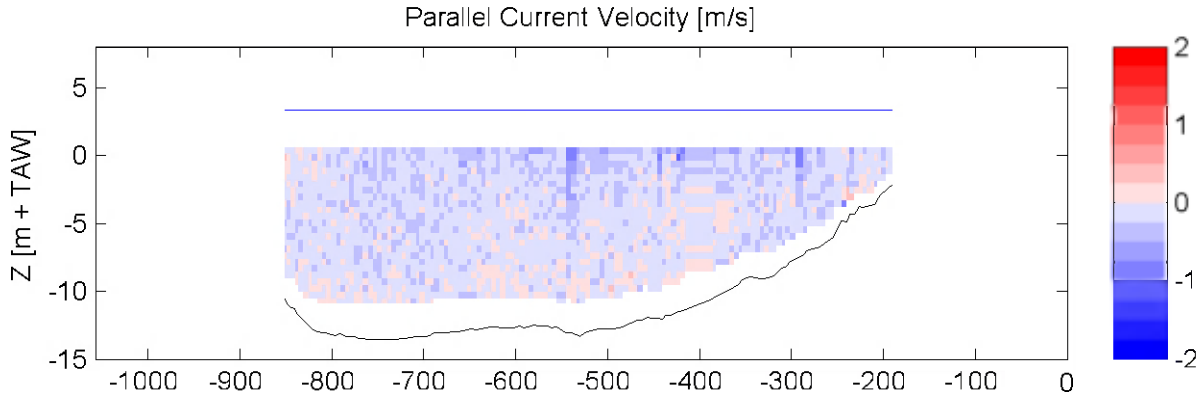
Date / Time [MET] :
11-Mar-2008
08:03 - 08:10

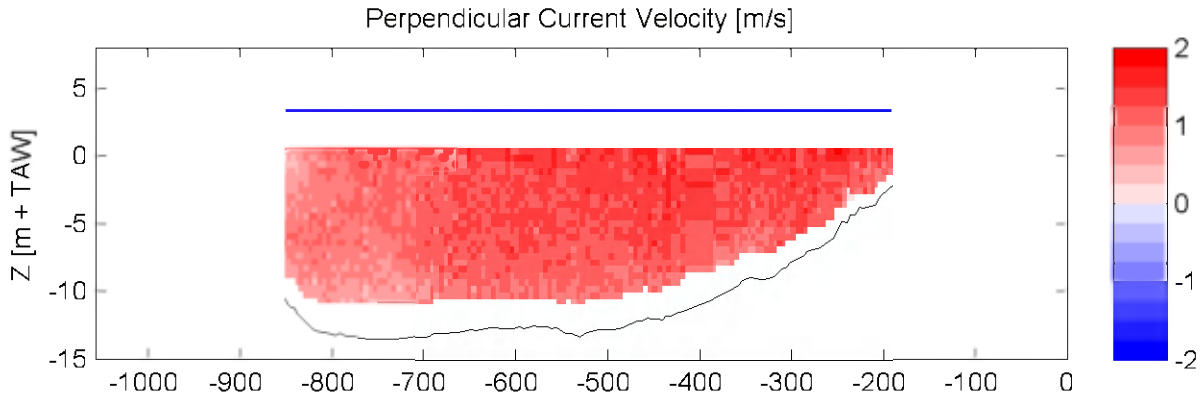
Time after HW [HH:MM]
3:07

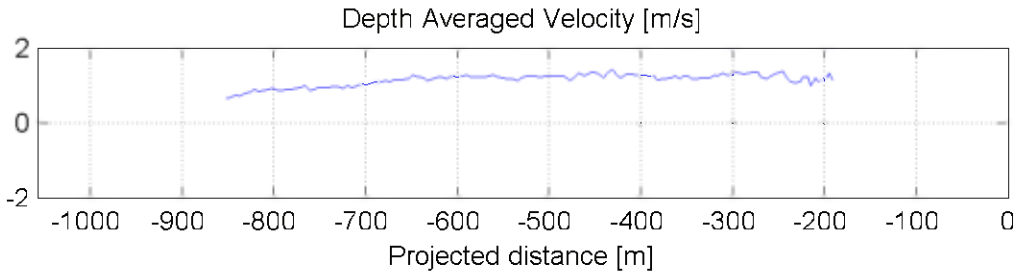
Data Processed by: IMDC
In association with : GEMS
I/RA/11283/07.088/MSA

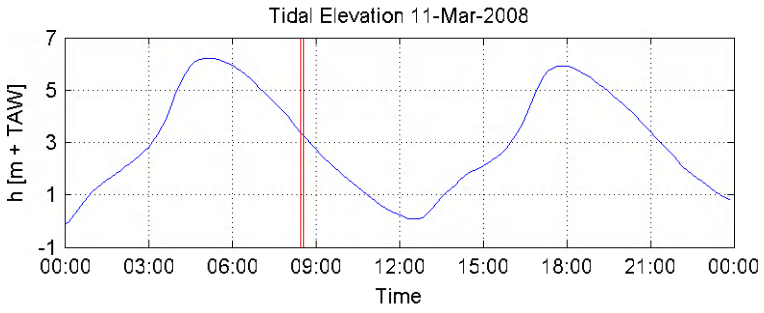
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3014ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
08:27 - 08:33

Time after HW [HH:MM]
3:30

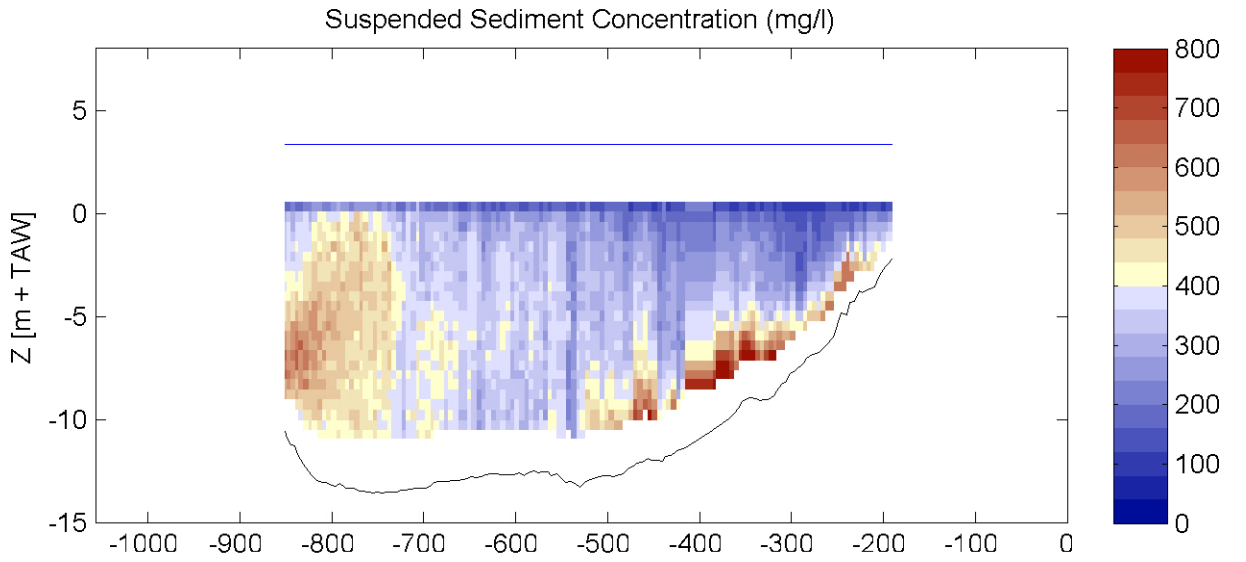
Data Processed by: IMDC

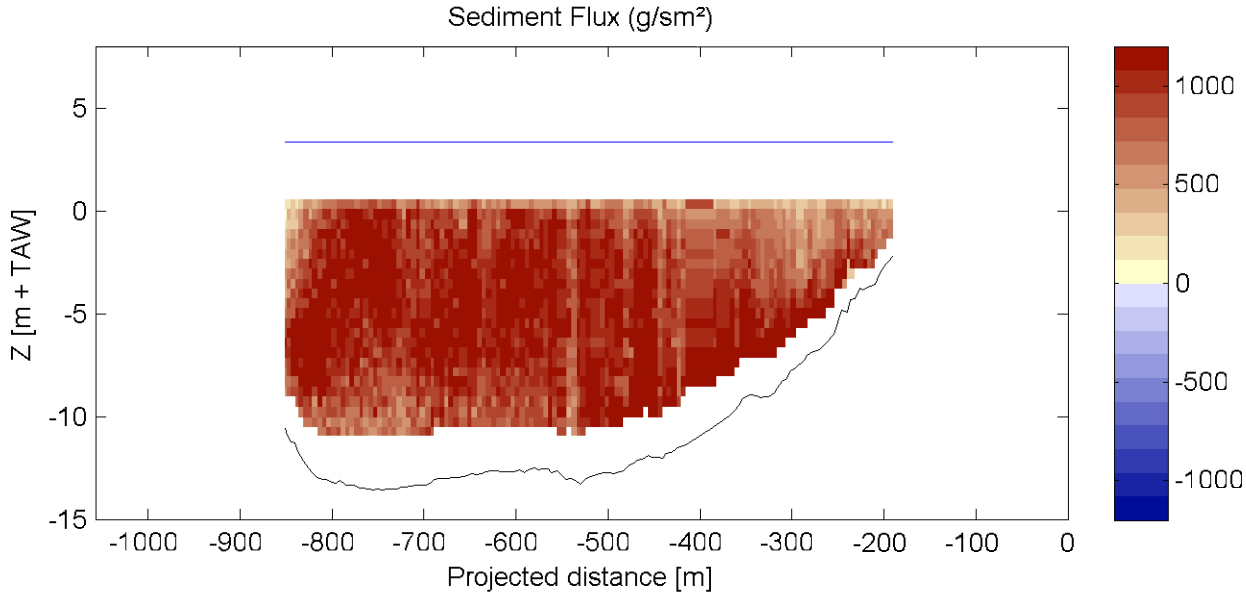
In association with :

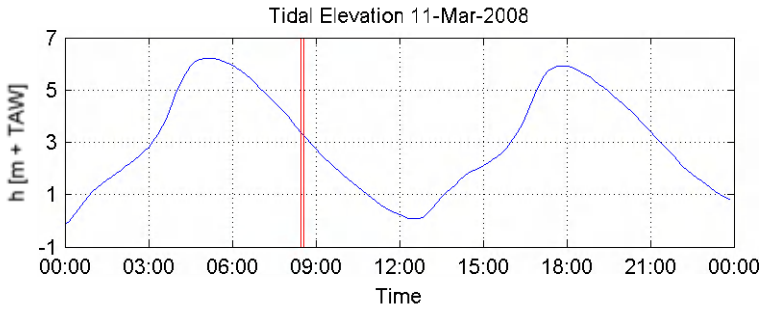
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3014ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
08:27 - 08:33

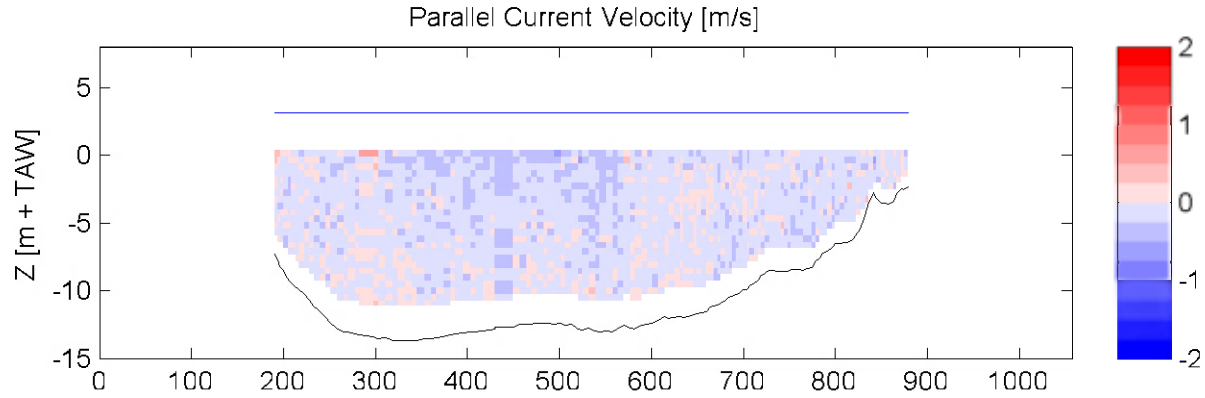
Time after HW [HH:MM]
3:30

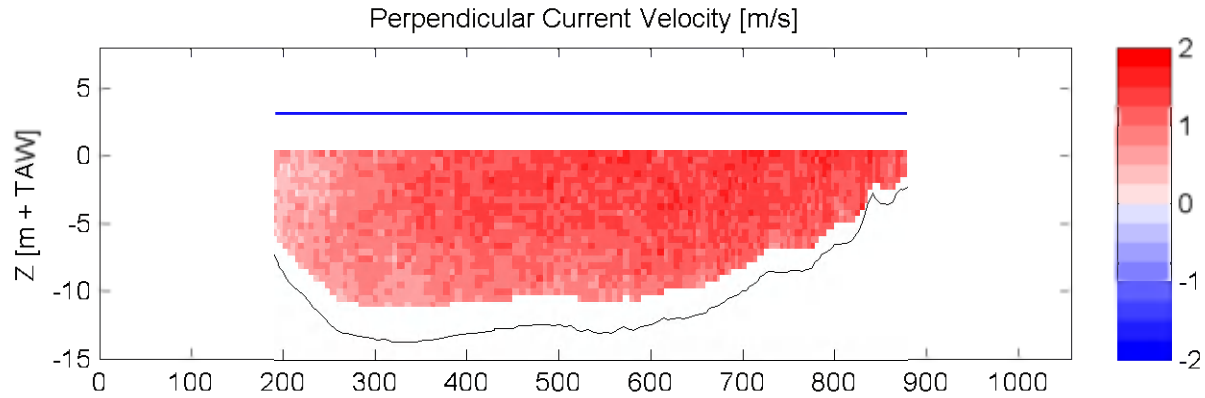
Data Processed by: IMDC
In association with :

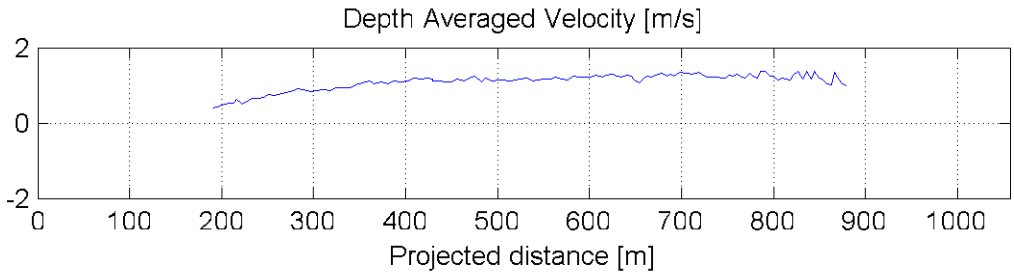
I/RA/11283/07.088/MSA

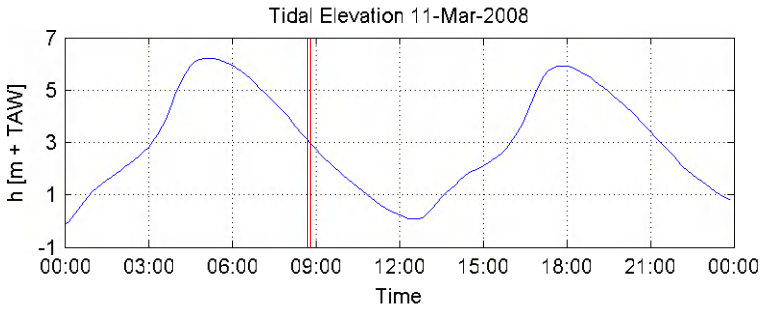
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3016ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
08:42 - 08:47

Time after HW [HH:MM]
3:44

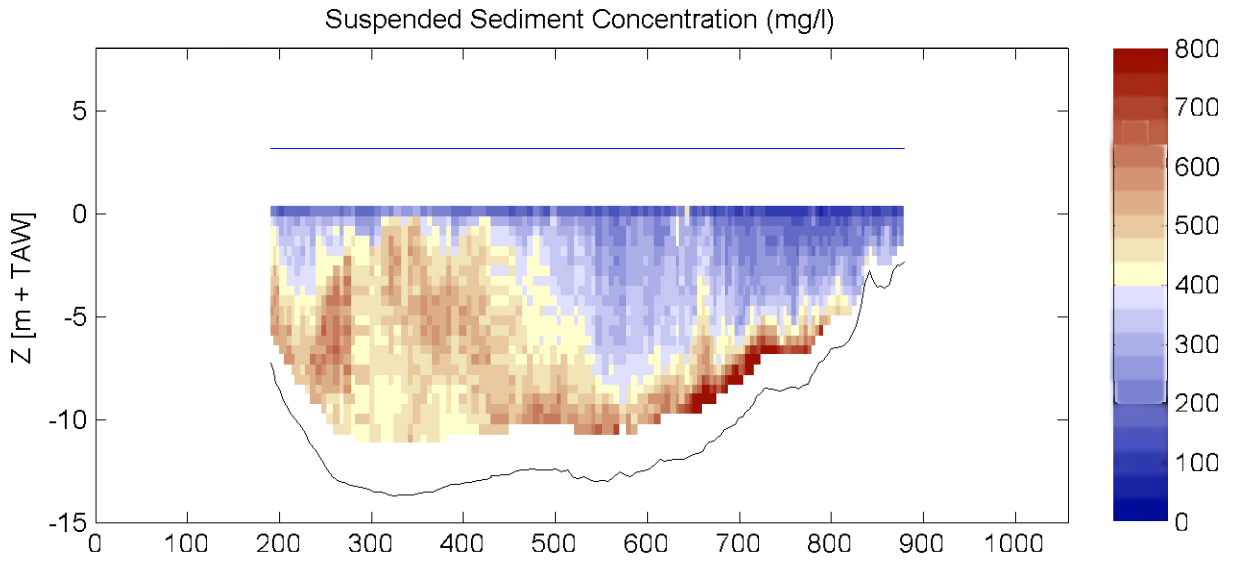
Data Processed by: IMDC

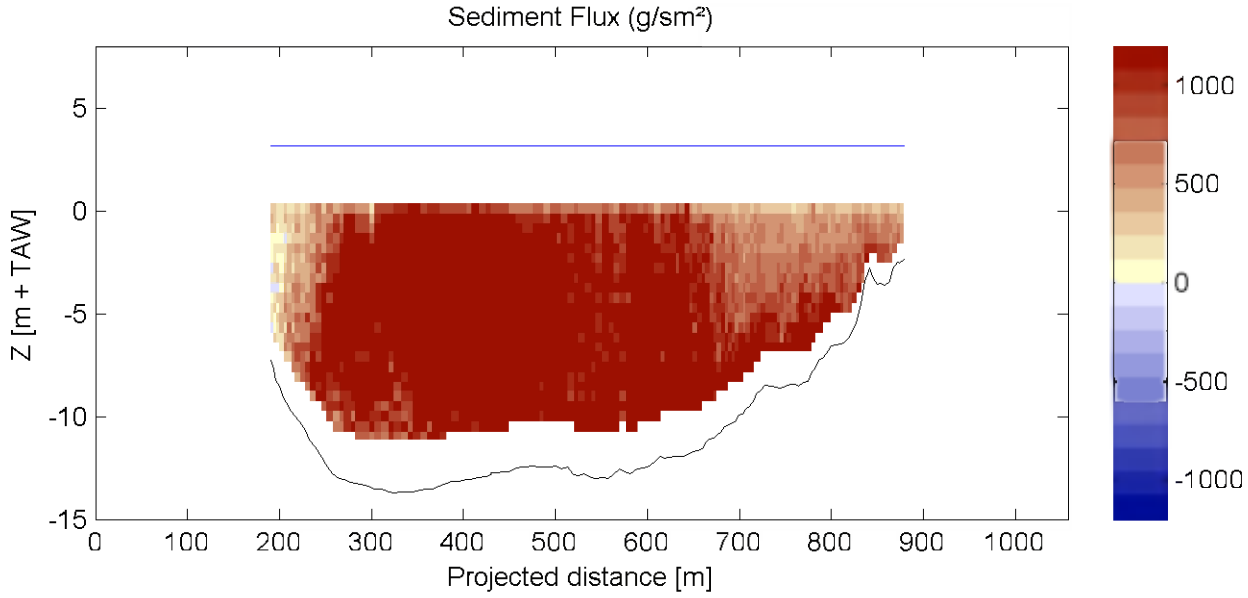
In association with :

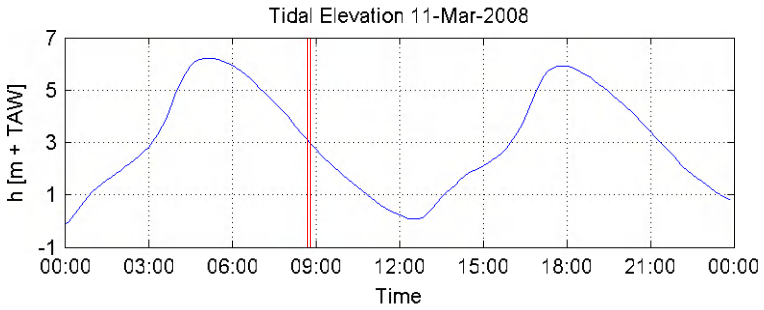
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3016ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
08:42 - 08:47

Time after HW [HH:MM]
3:44

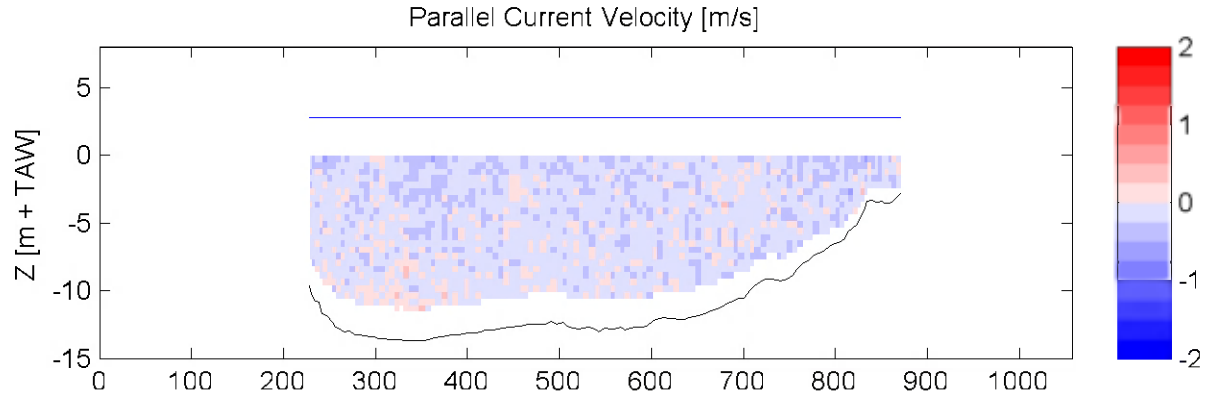
Data Processed by: IMDC

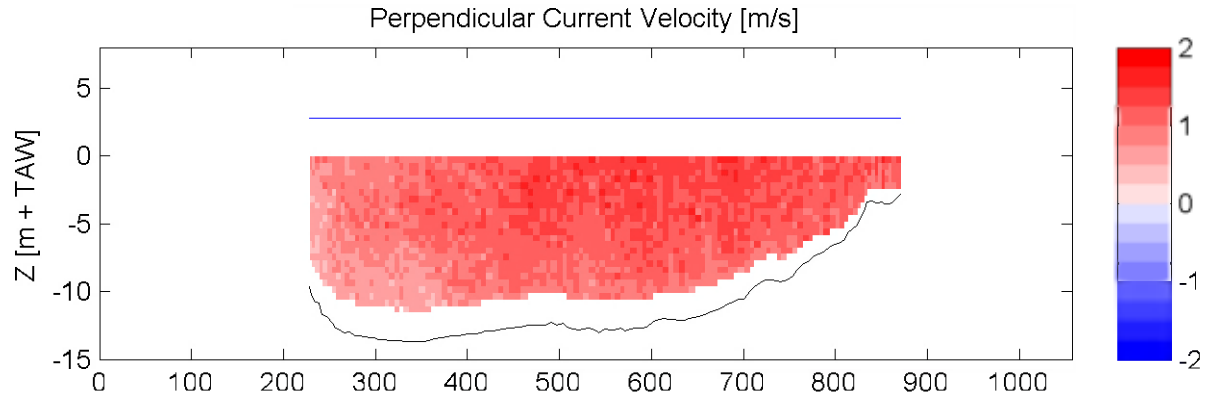
In association with :

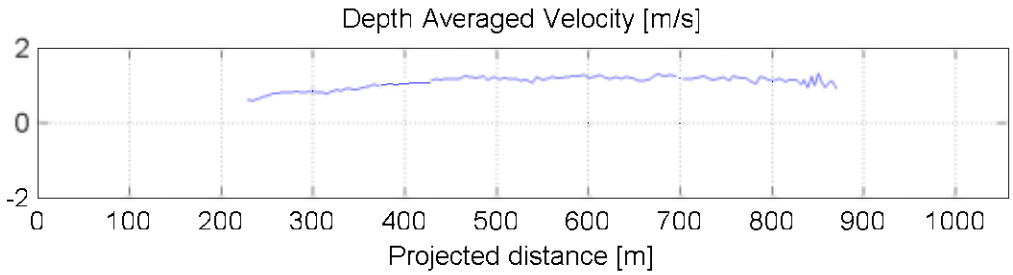
I/RA/11283/07.088/MSA

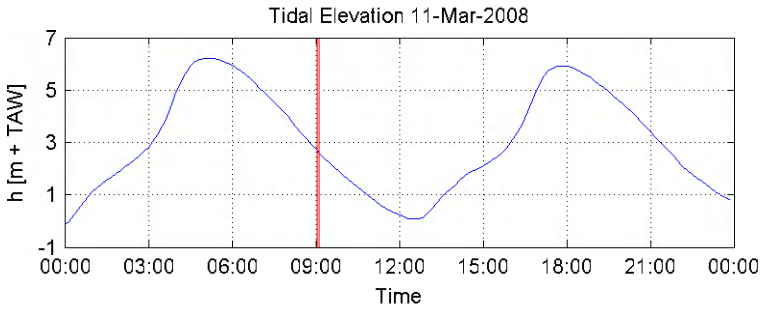
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3018ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
09:02 - 09:07

Time after HW [HH:MM]
4:05

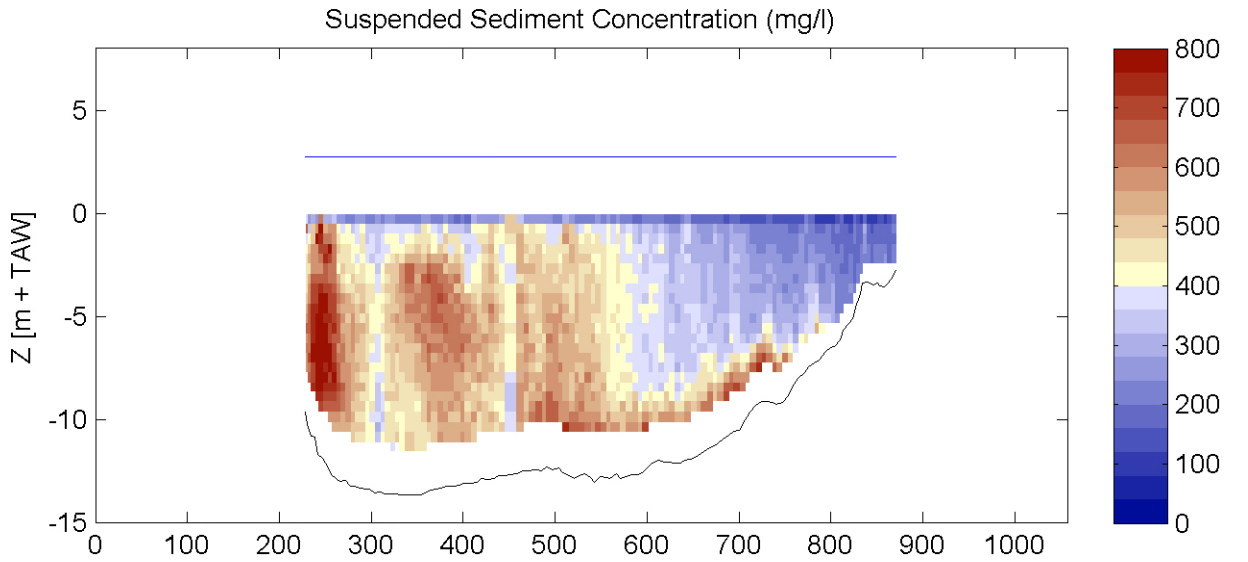
Data Processed by: IMDC

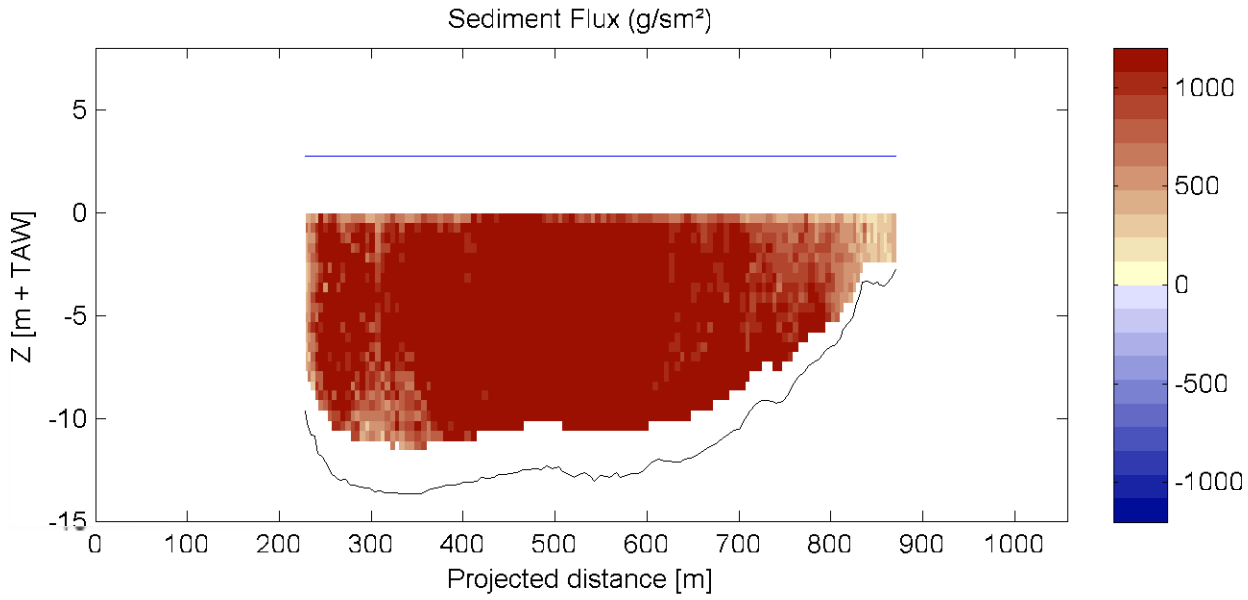
In association with :

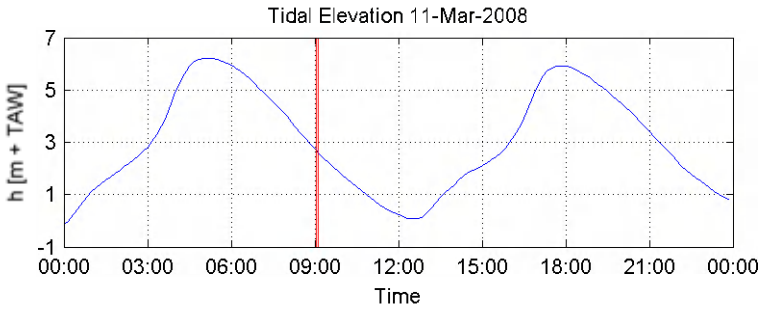
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3018ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
09:02 - 09:07

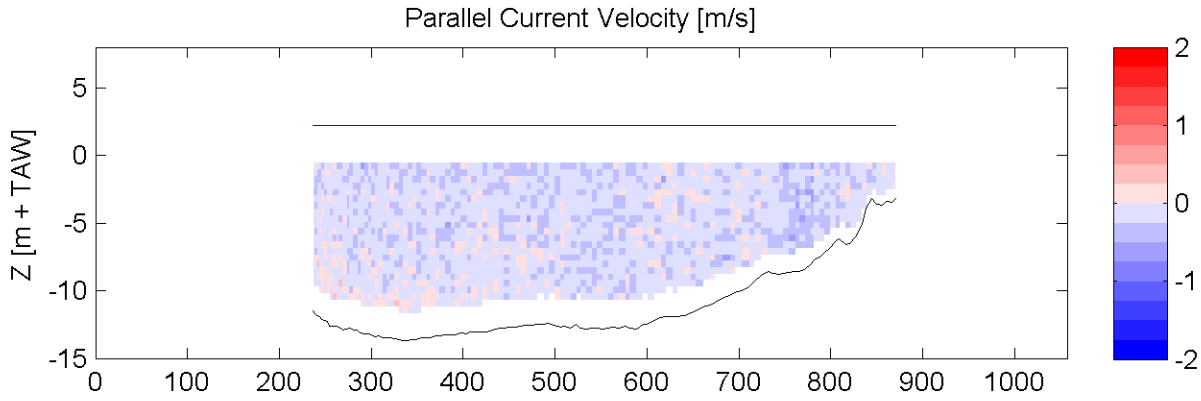
Time after HW [HH:MM]
4:05

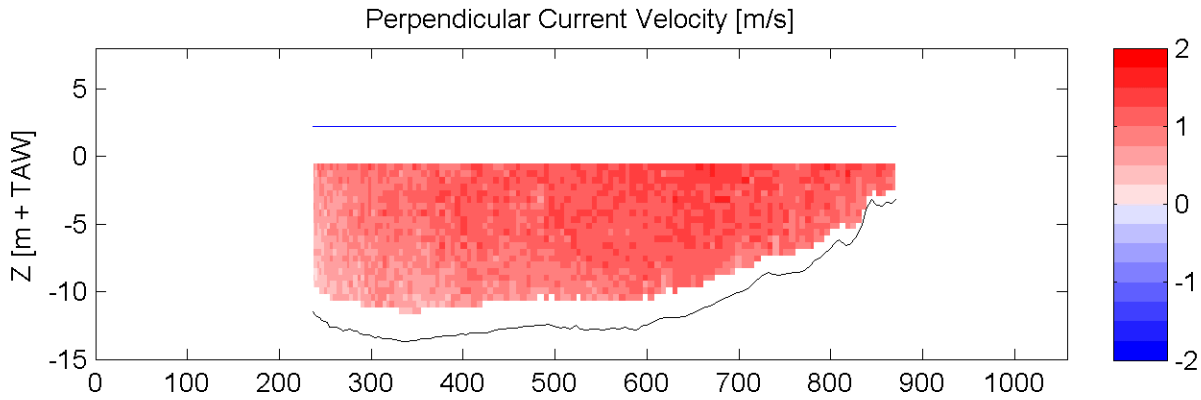
Data Processed by: IMDC
In association with : WL | Delft Hydraulics, GEMS International

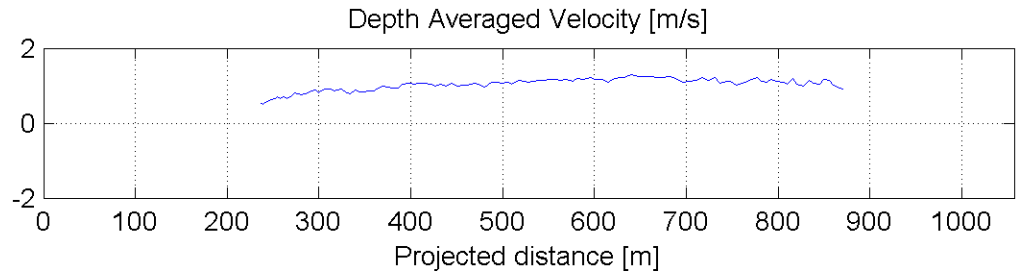
I/RA/11283/07.088/MSA

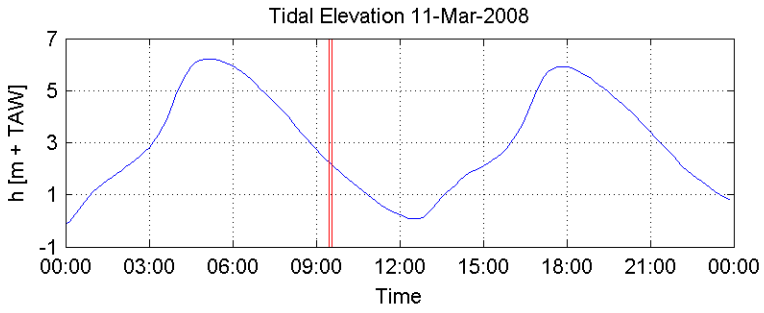
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3022ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

09:28 - 09:34

Time after HW [HH:MM]

4:31

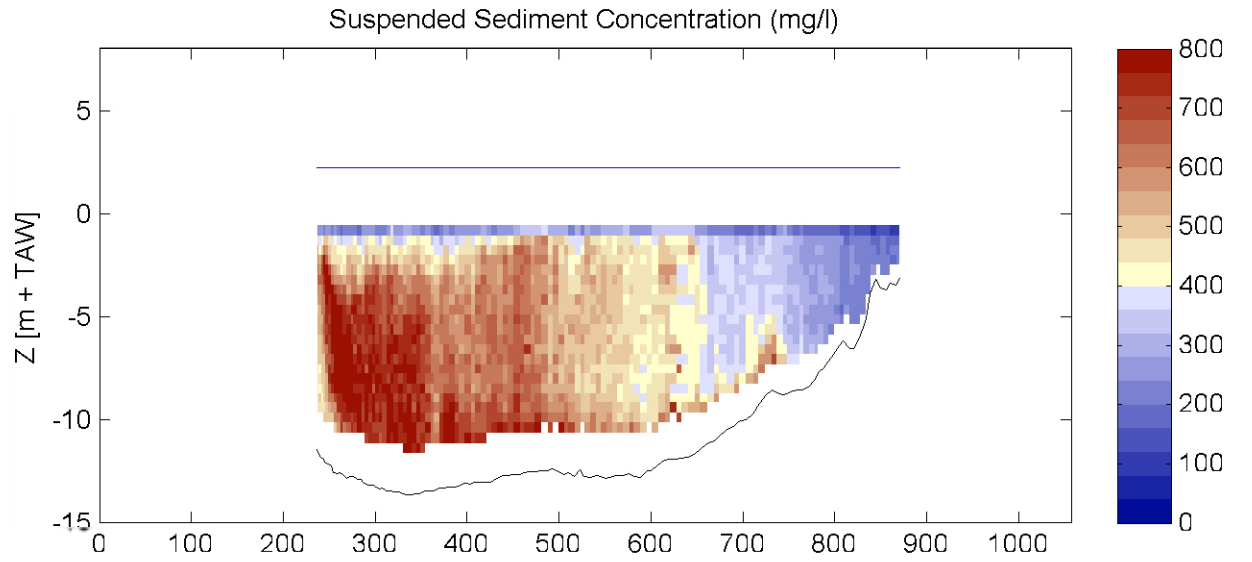
Data Processed by: IMDC

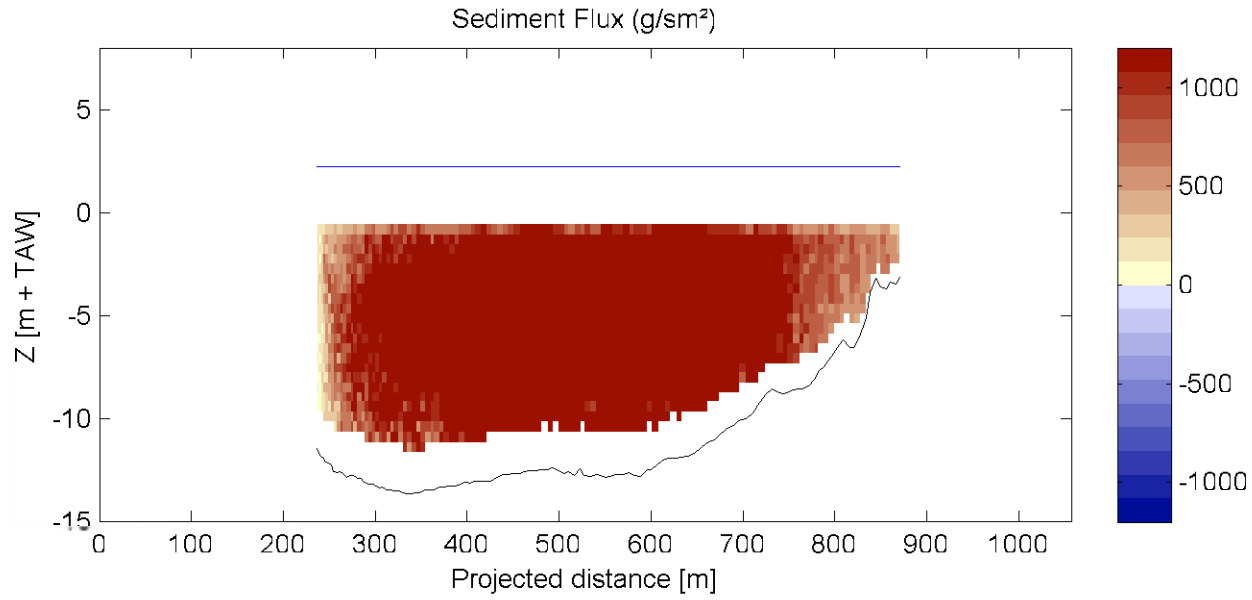
In association with : w.l | delft hydraulics, GEMS international

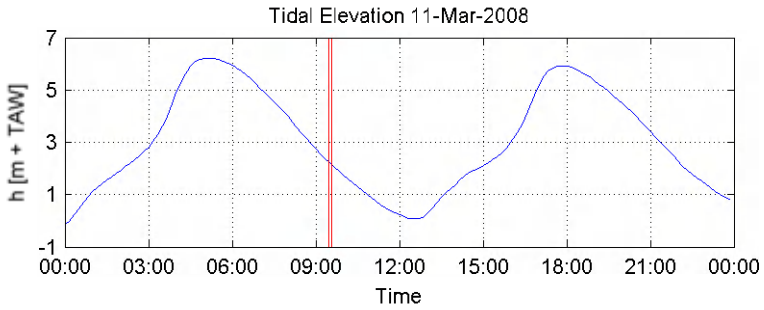
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3022ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

09:28 - 09:34

Time after HW [HH:MM]

4:31

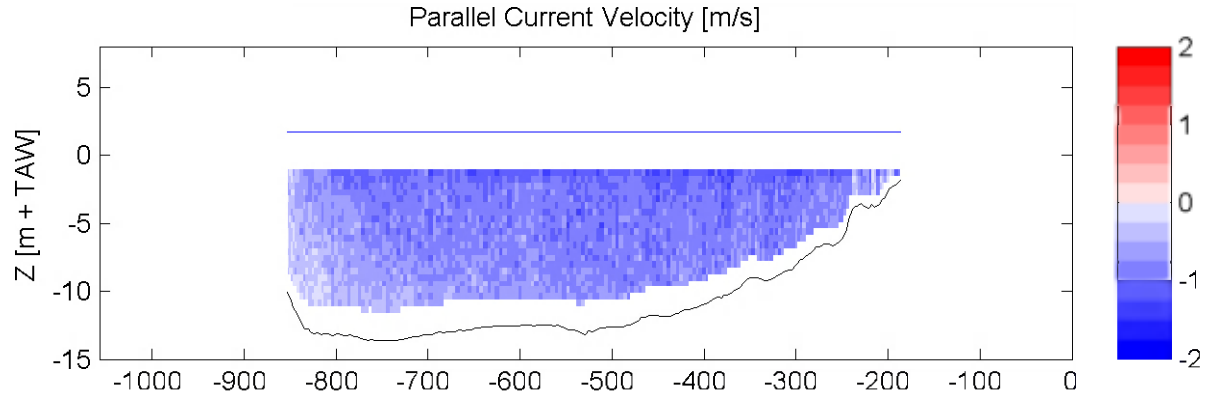
Data Processed by: IMDC

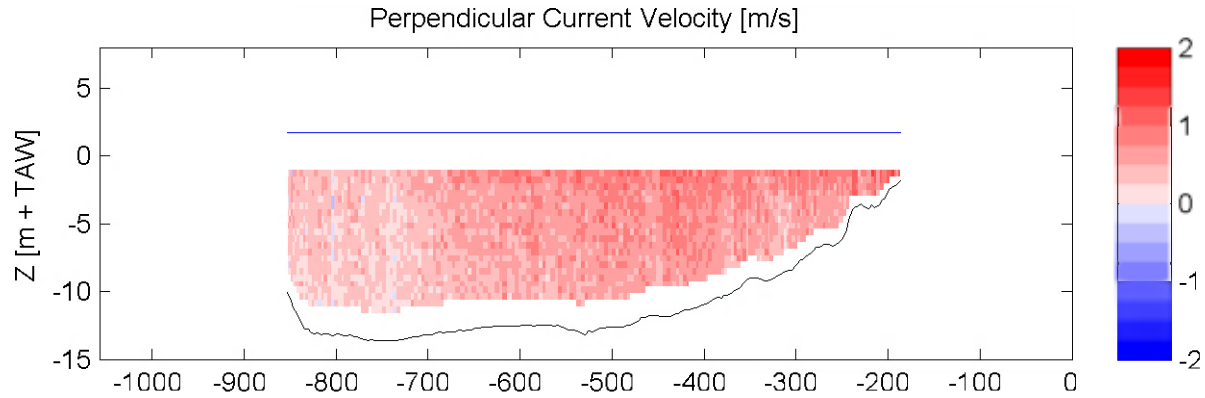
In association with : WL | Delft Hydraulics, GEMS

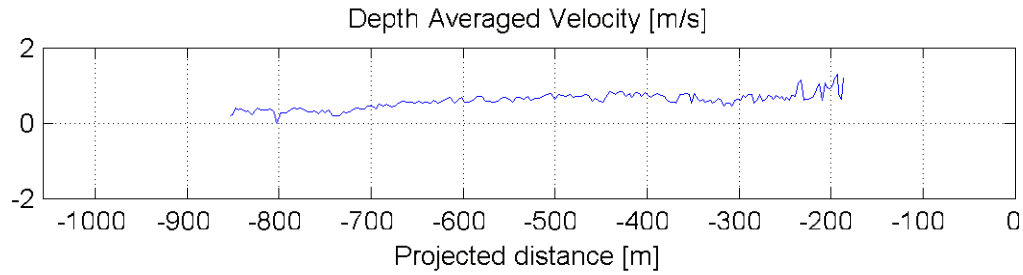
I/RA/11283/07.088/MSA

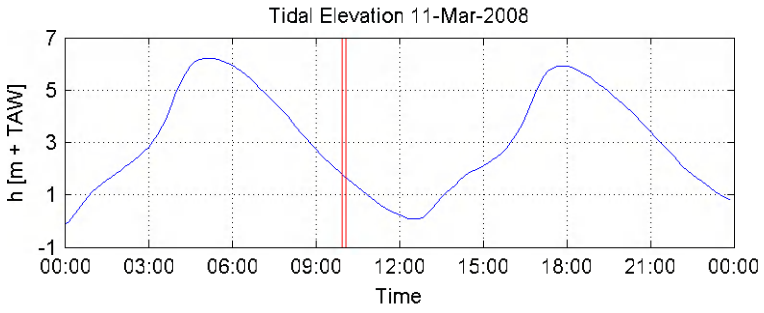
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3024ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
09:57 - 10:05

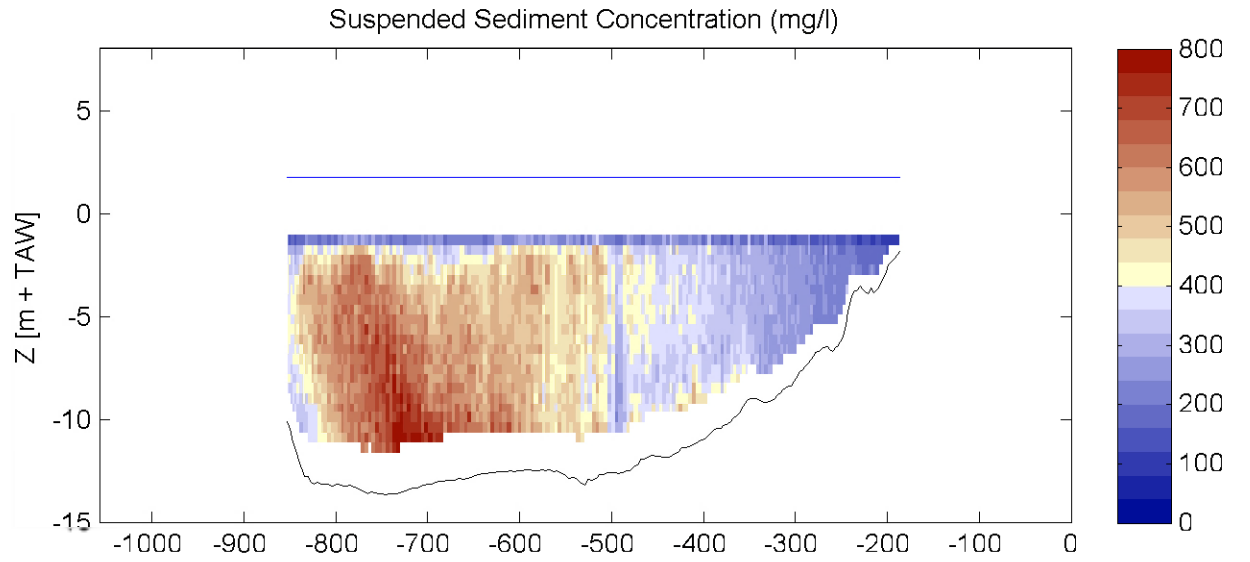
Time after HW [HH:MM]
5:01

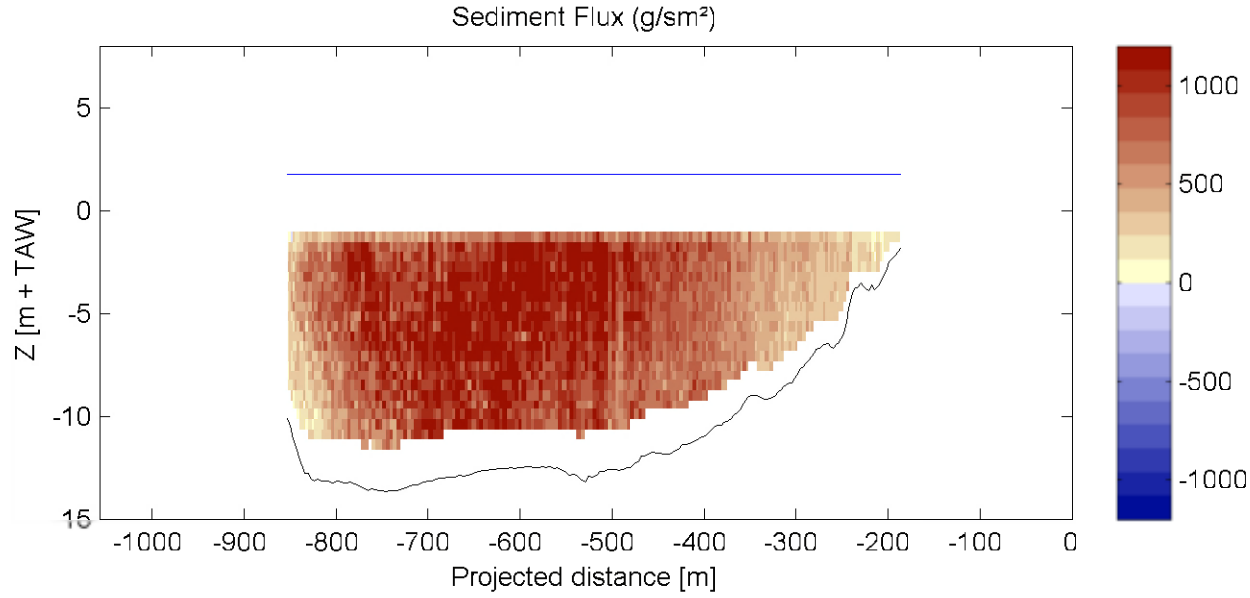
Data Processed by: IMDC
In association with :

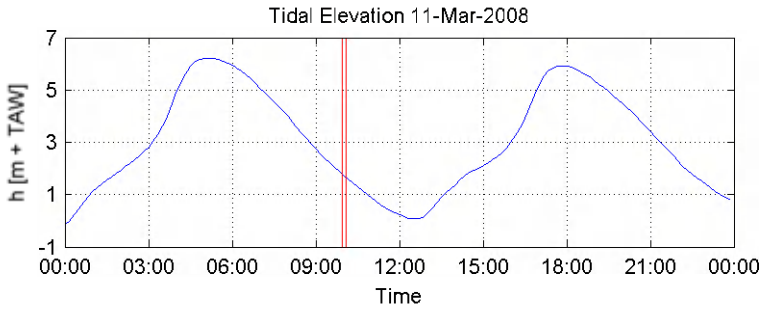
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3024ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
09:57 - 10:05

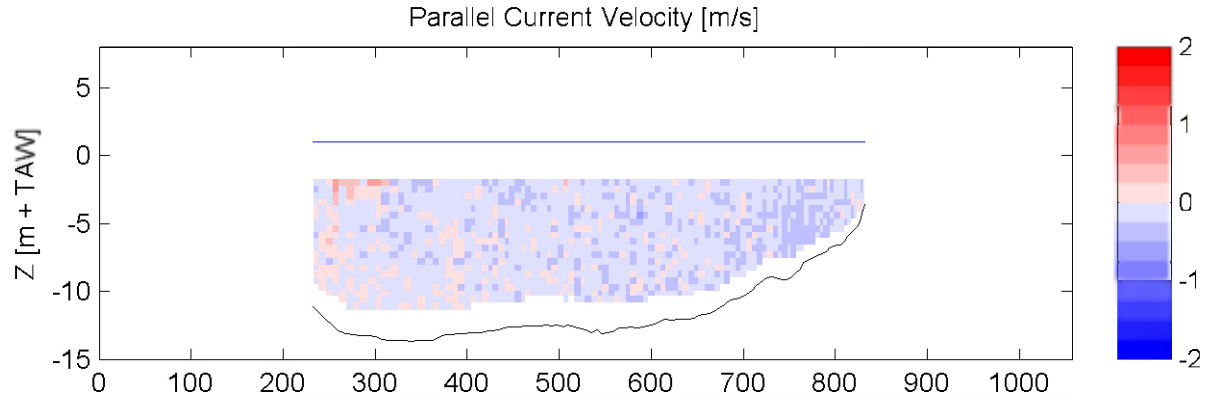
Time after HW [HH:MM]
5:01

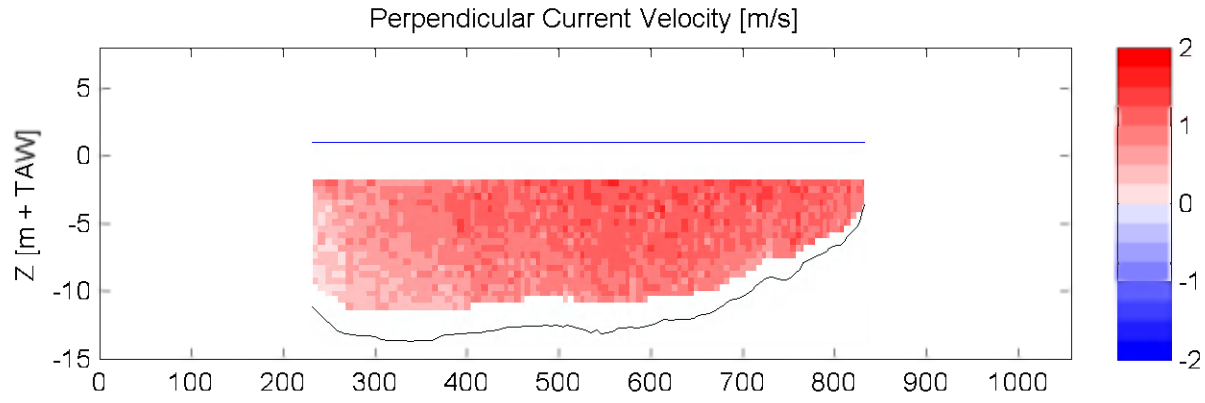
Data Processed by: IMDC
In association with :

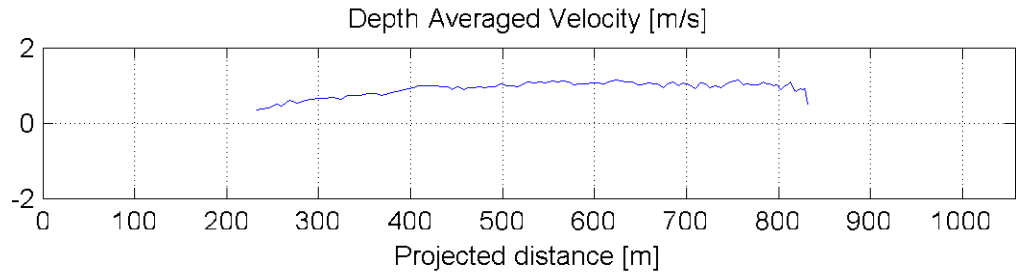
I/RA/11283/07.088/MSA

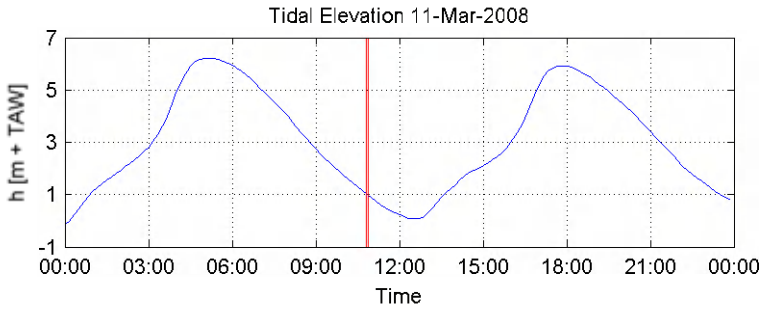
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3030ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
10:48 - 10:52

Time after HW [HH:MM]
5:50

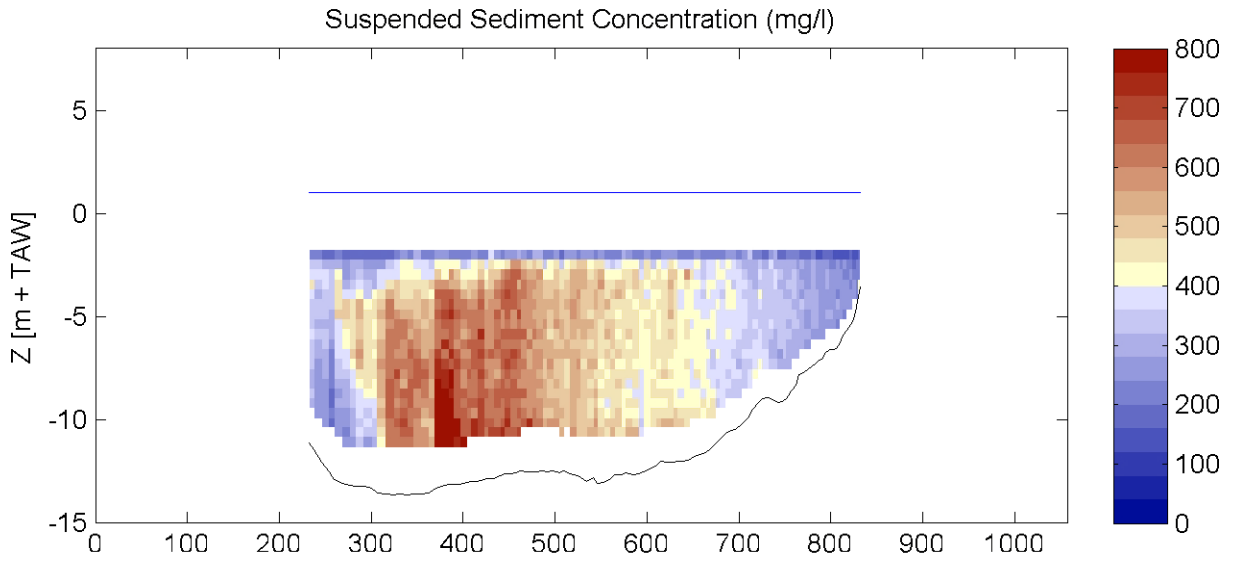
Data Processed by: IMDC

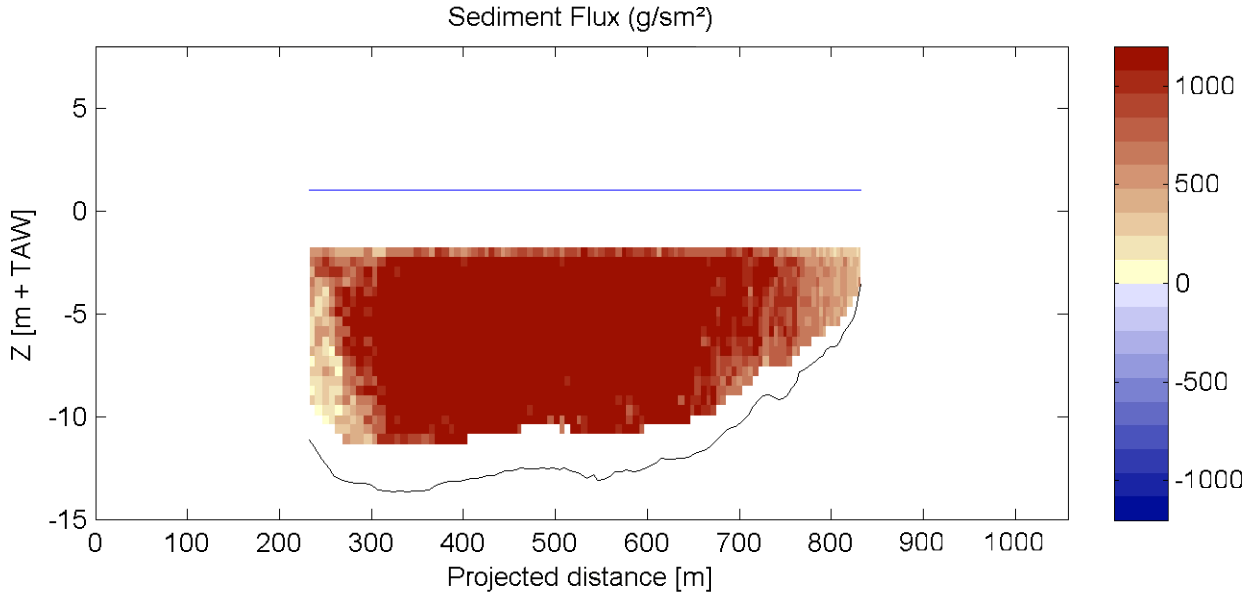
In association with :

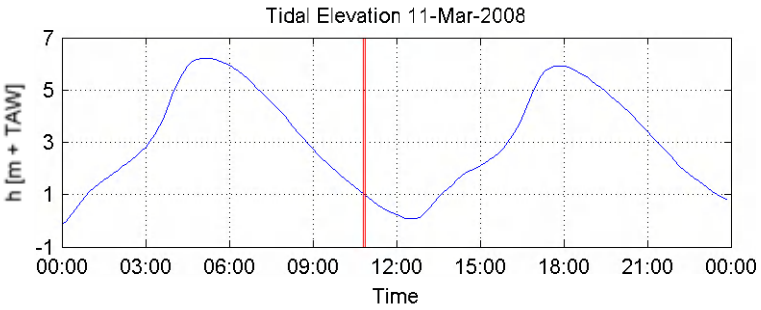
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3030ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
10:48 - 10:52

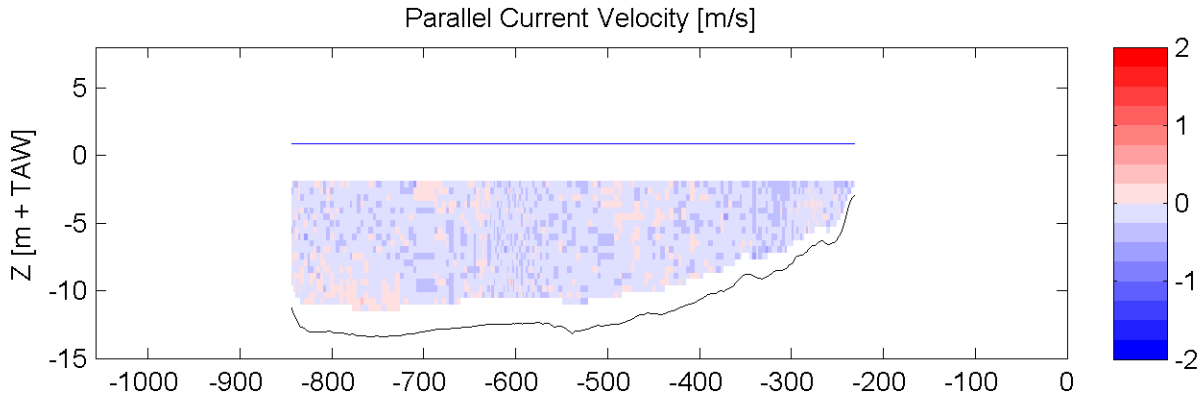
Time after HW [HH:MM]
5:50

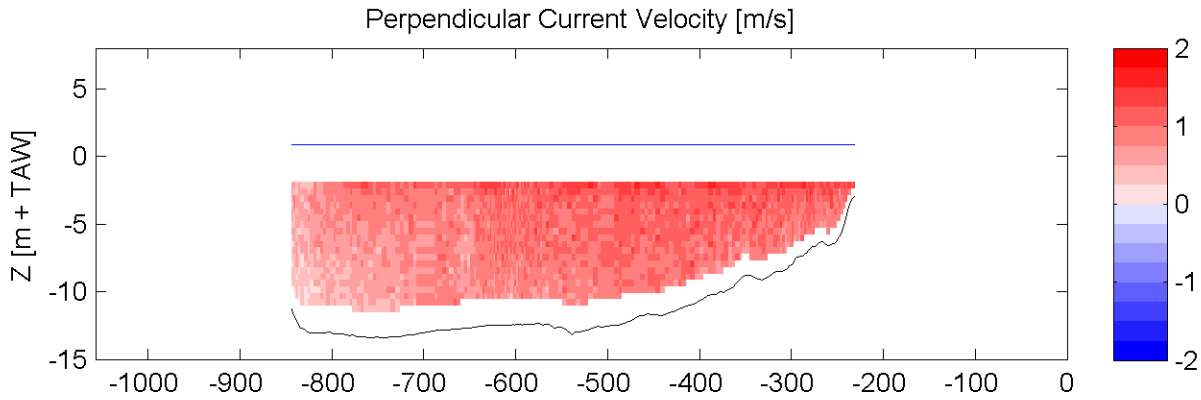
Data Processed by: IMDC
In association with :

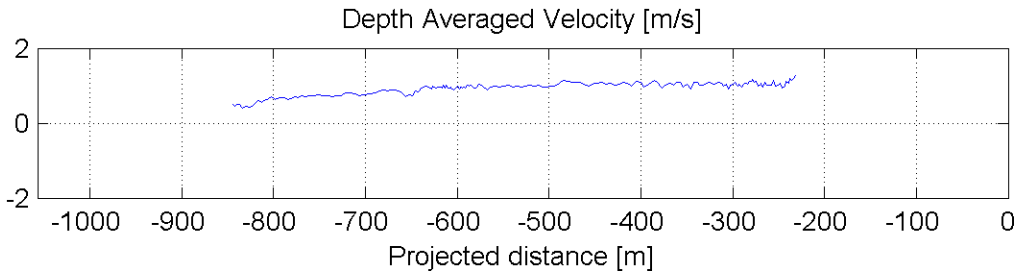
I/RA/11283/07.088/MSA

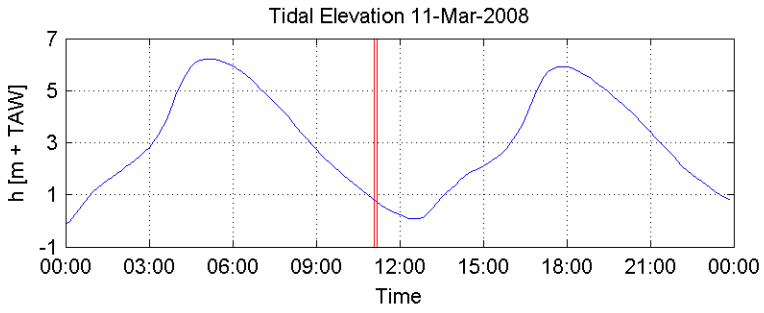
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3032ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

11:04 - 11:12

Time after HW [HH:MM]

6:08

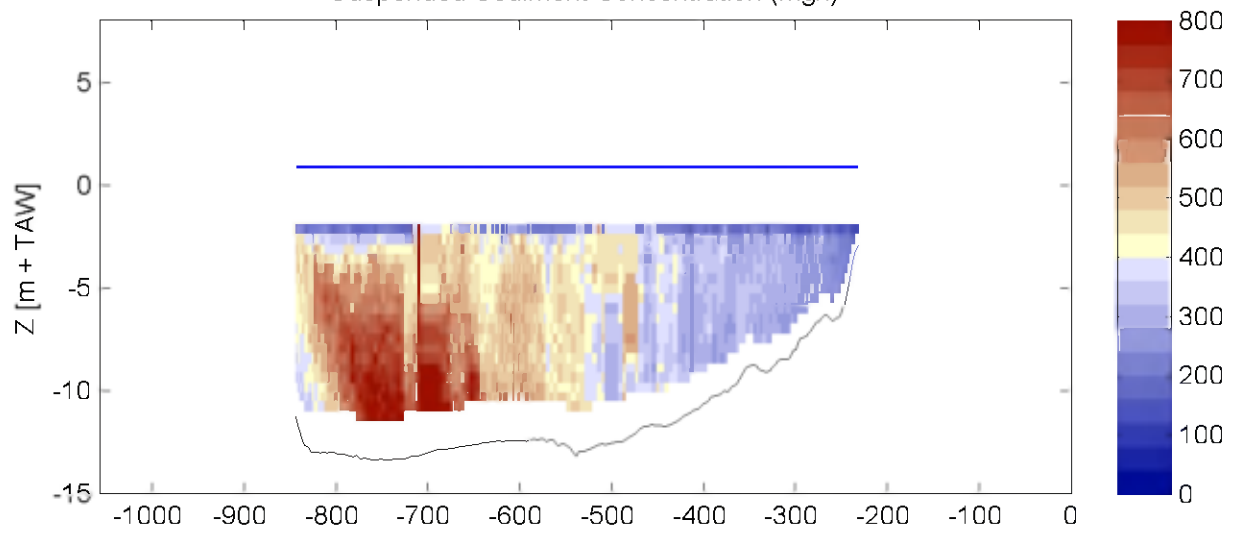
Data Processed by: IMDC

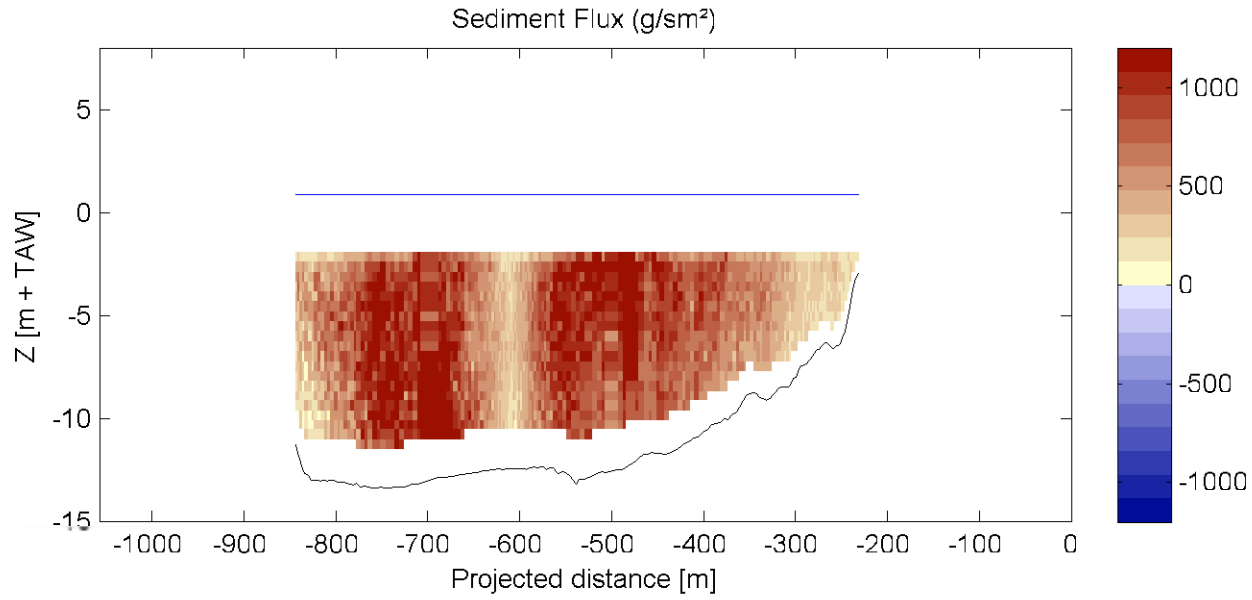
In association with : WL | delft hydraulics, GEMS International

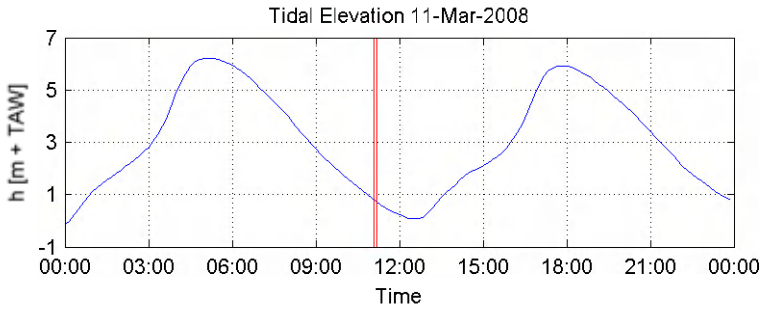
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3032ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
11:04 - 11:12

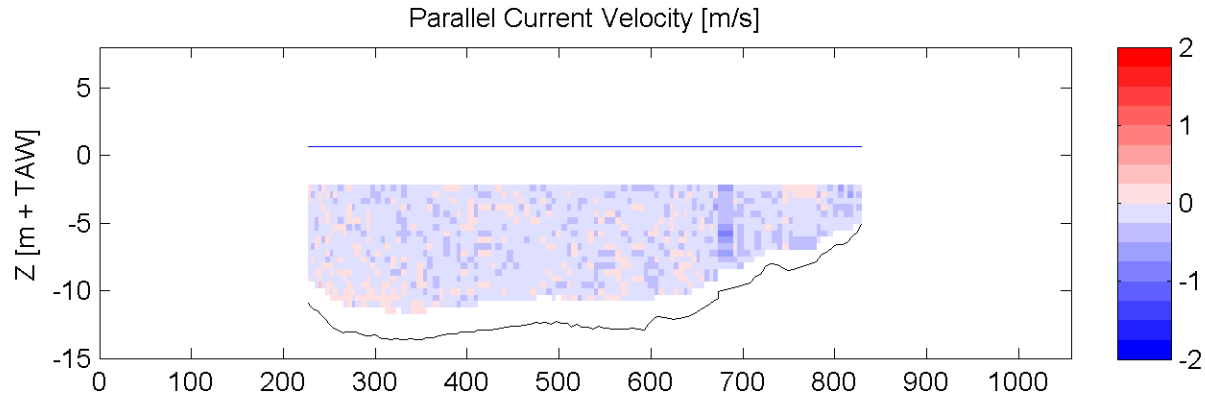
Time after HW [HH:MM]
6:08

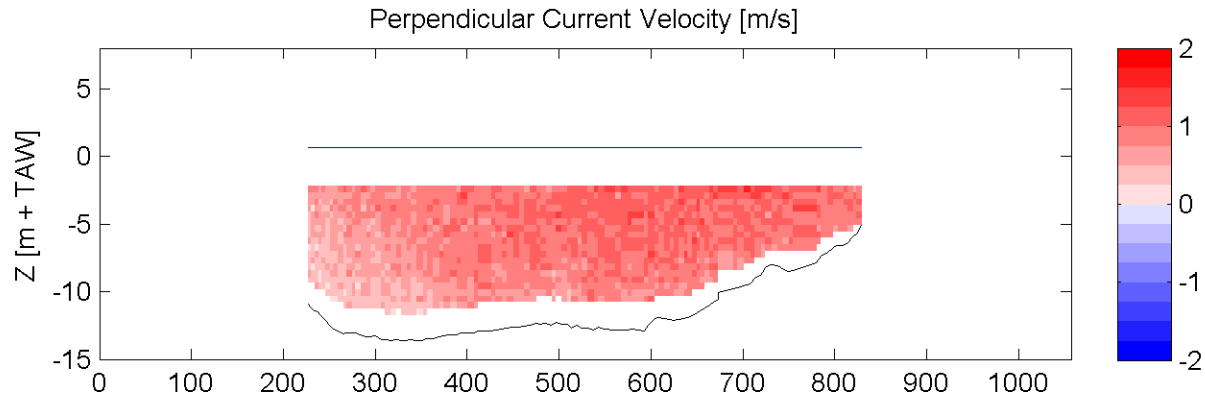
Data Processed by: IMDC
In association with : WL | Delft Hydraulics, GEMS

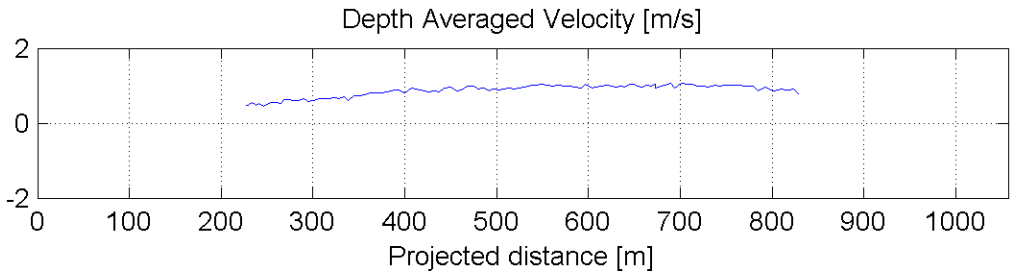
I/RA/11283/07.088/MSA

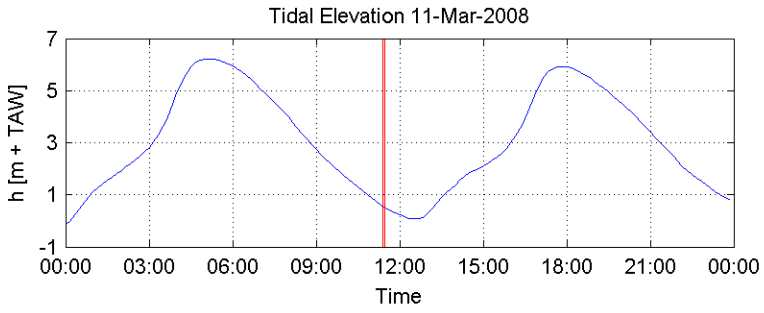
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3034ltl_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

11:22 - 11:27

Time after HW [HH:MM]

6:25

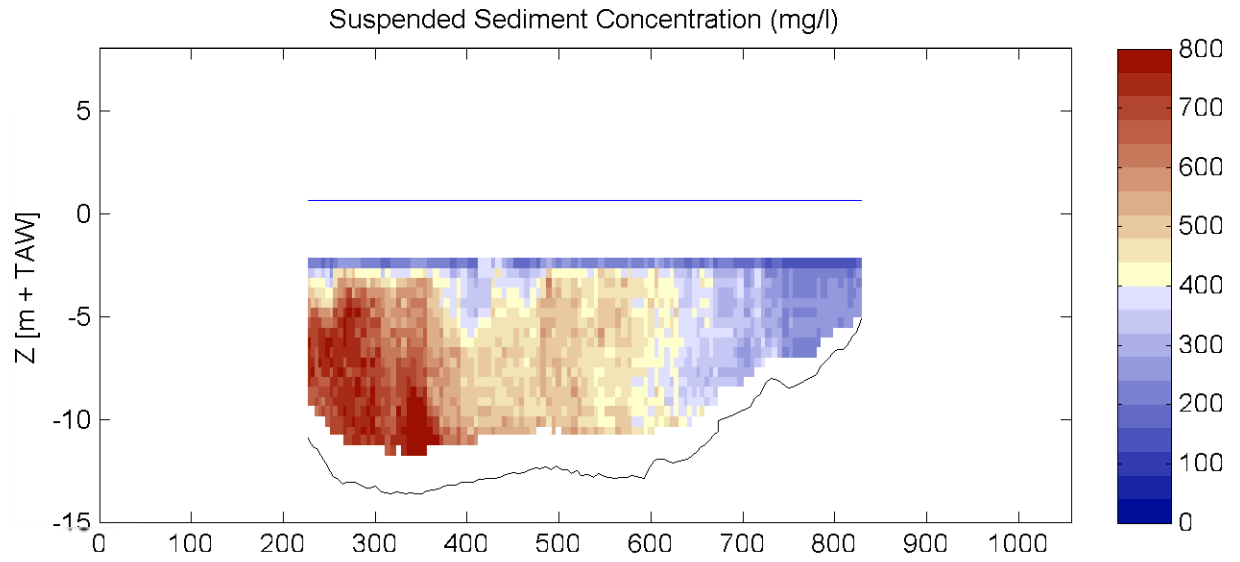
Data Processed by: IMDC

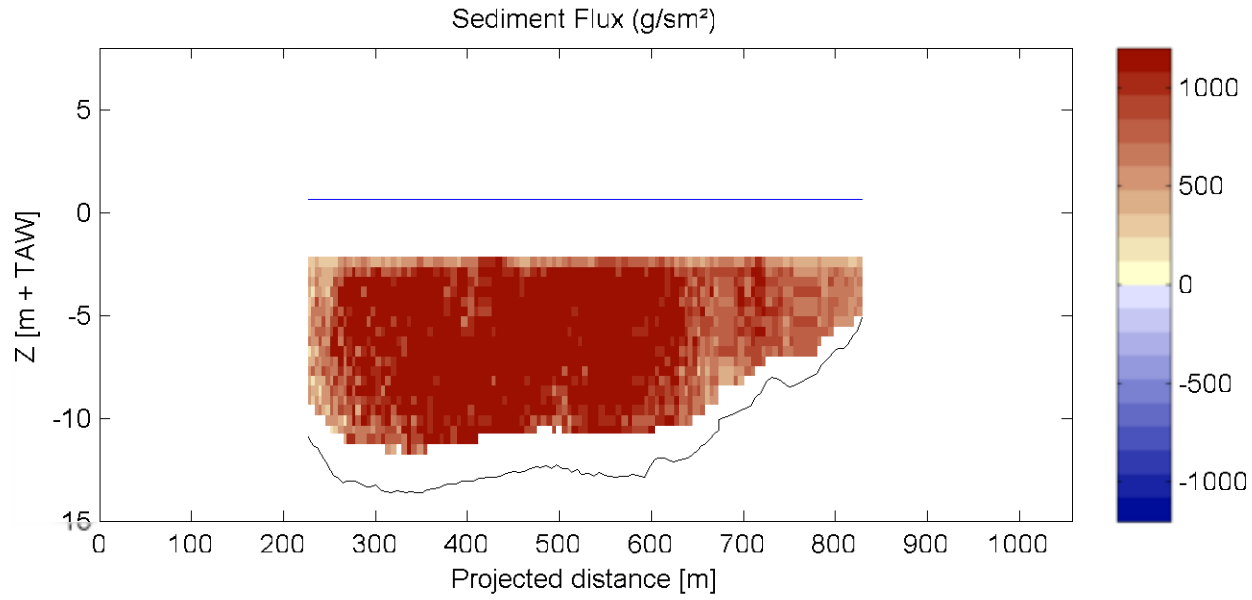
In association with : WL | delft hydraulics, GEMS International

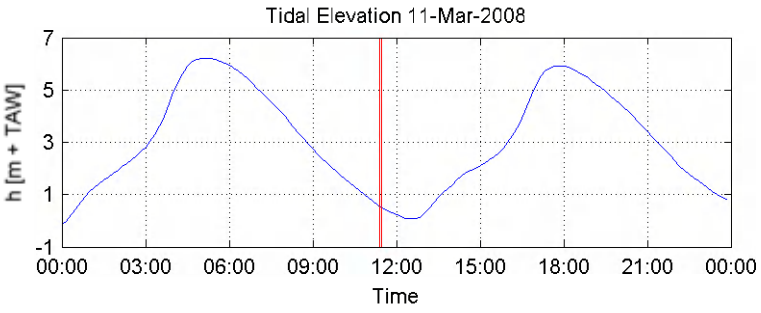
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3034ltl_sub.csv	Location: Transect I







HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

11:22 - 11:27

Time after HW [HH:MM]

6:25

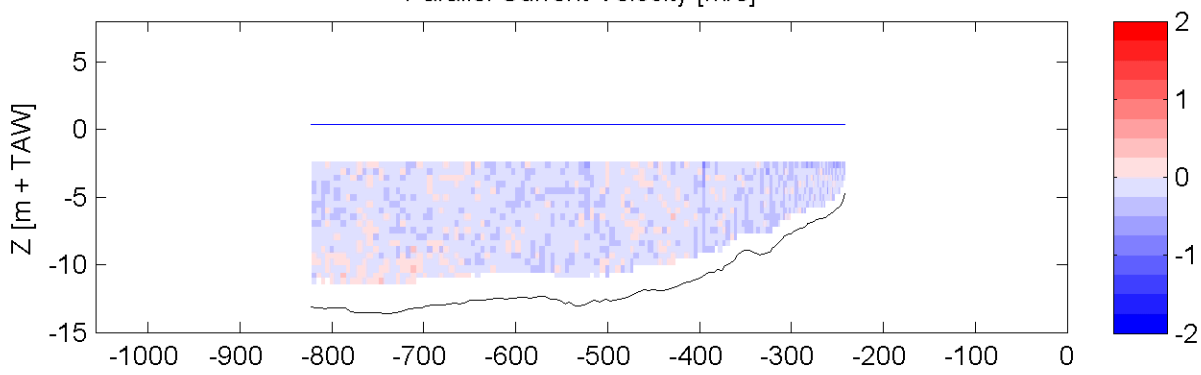
Data Processed by: IMDC

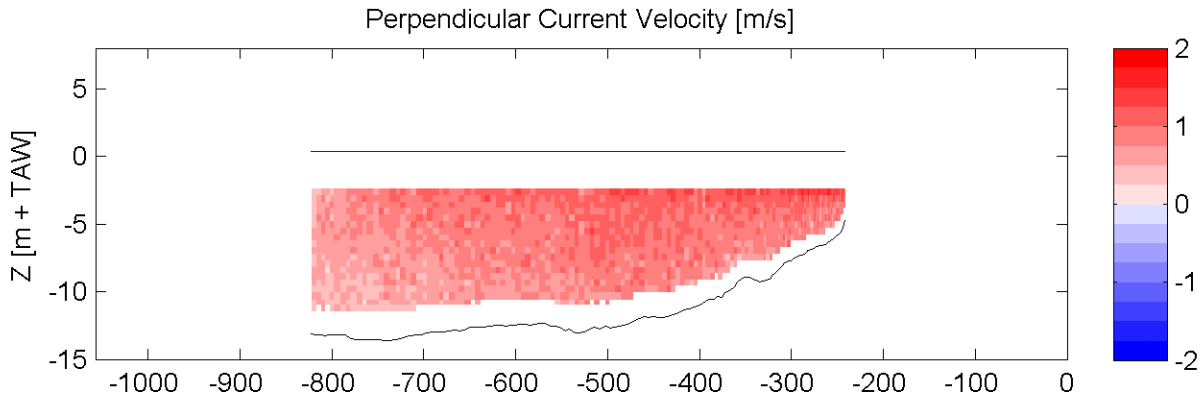
In association with :

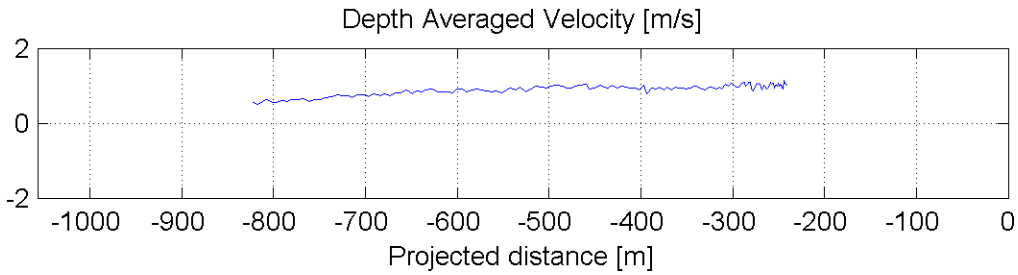
I/RA/11283/07.088/MSA

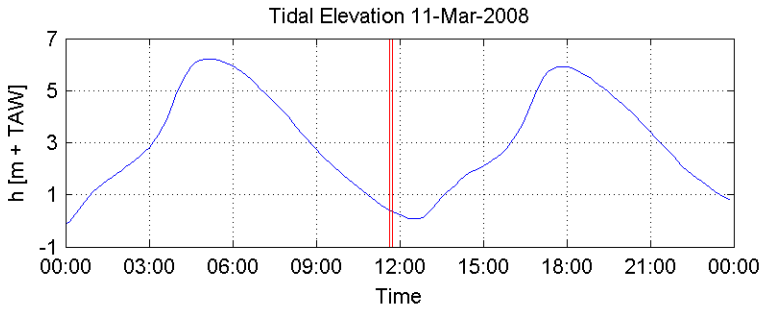
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3036ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

11:38 - 11:44

Time after HW [HH:MM]

6:41

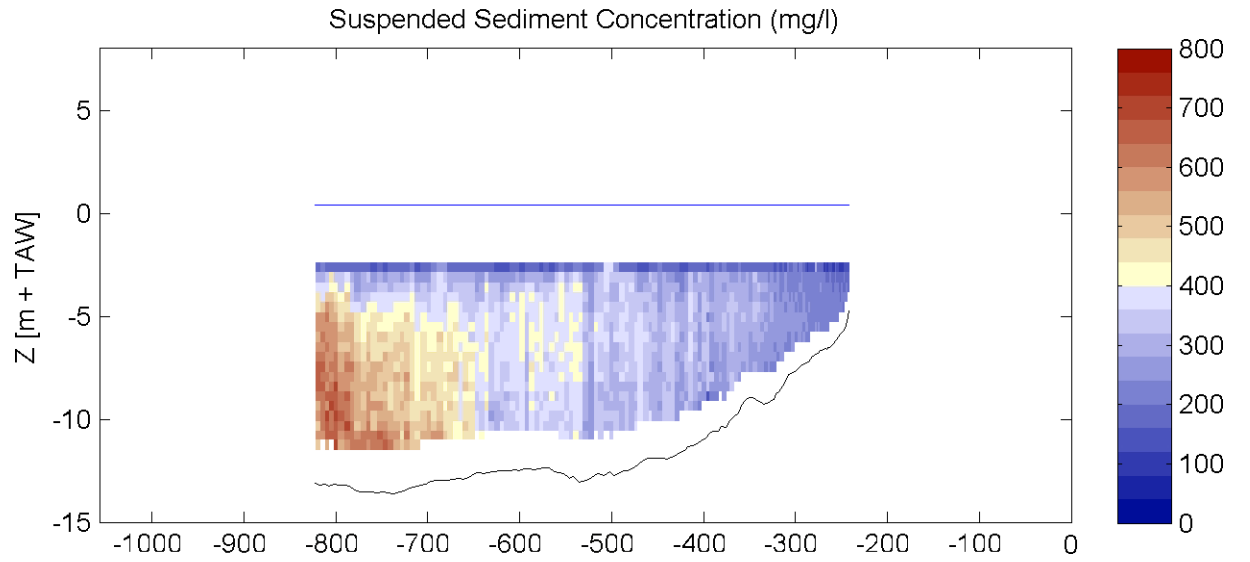
Data Processed by: IMDC

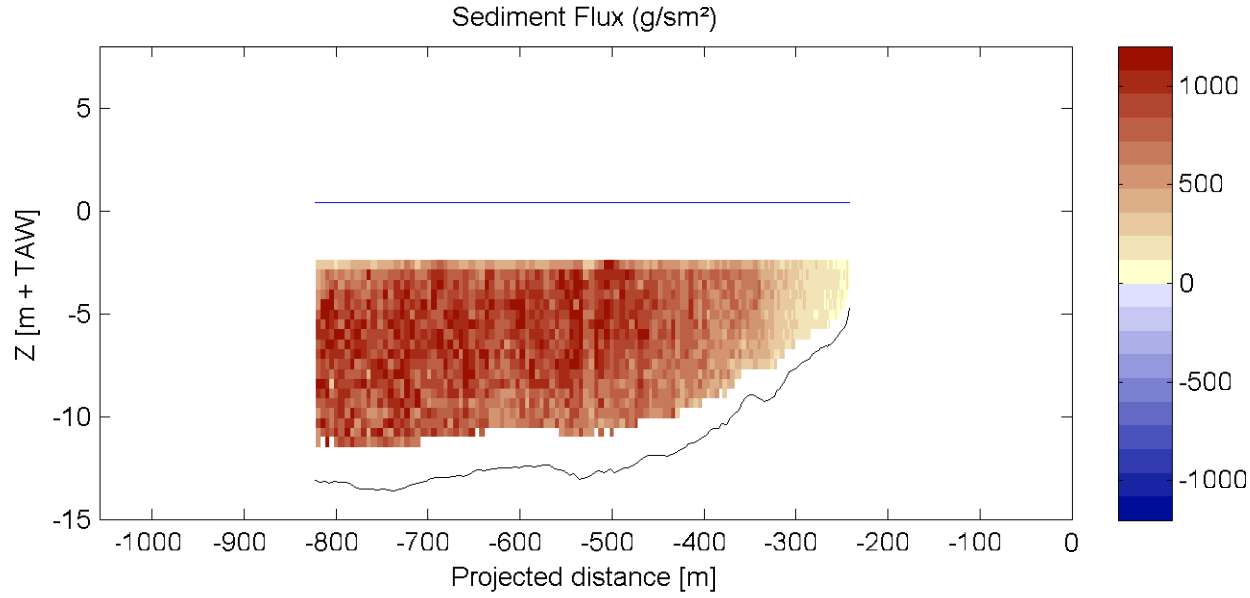
In association with : w.l | delft hydraulics, GEMS international

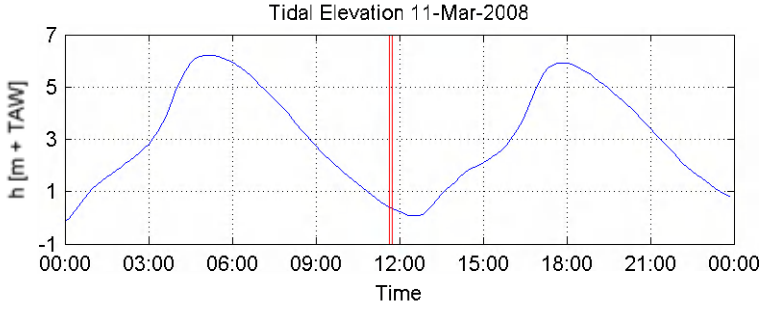
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3036ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
11:38 - 11:44

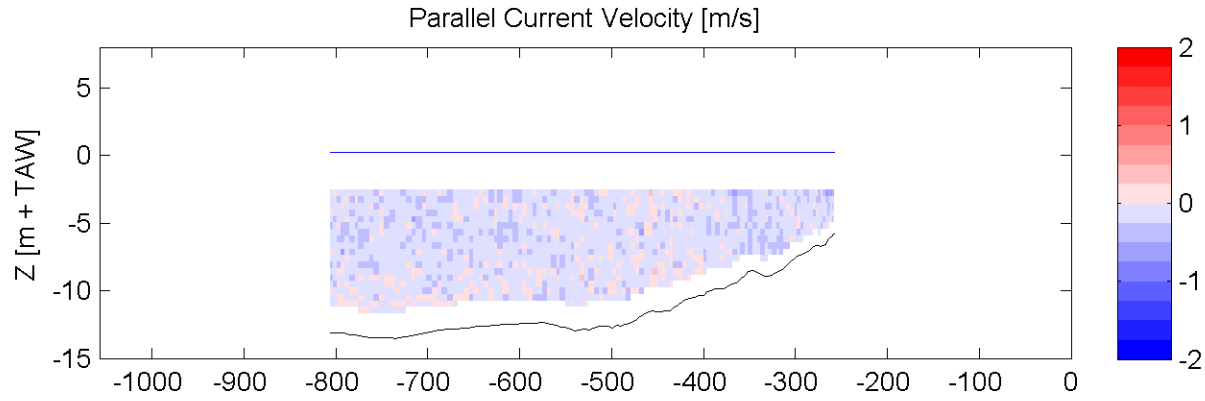
Time after HW [HH:MM]
6:41

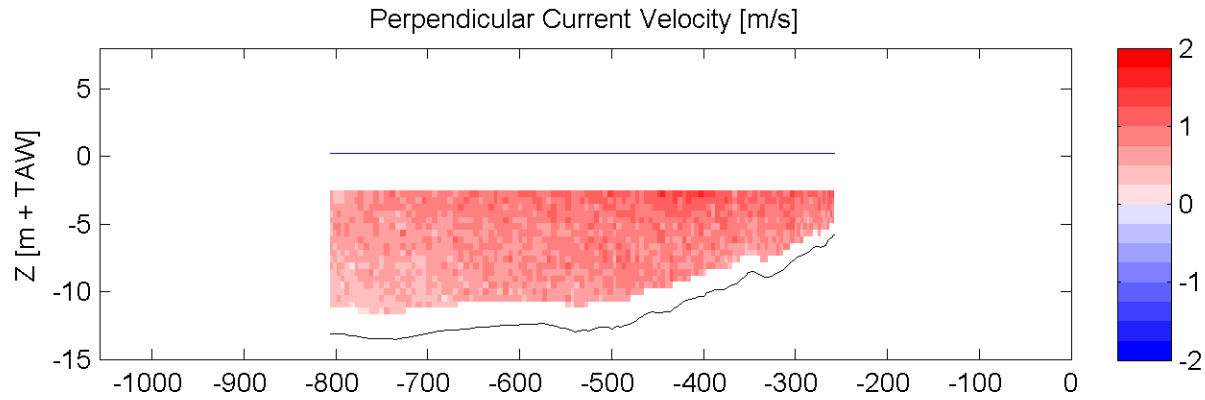
Data Processed by: IMDC
In association with :

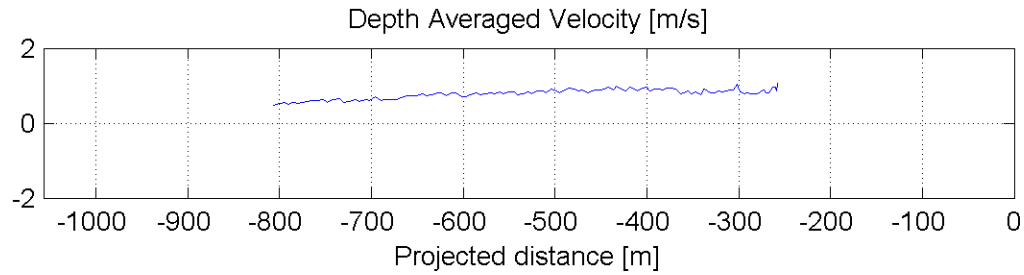
I/RA/11283/07.088/MSA

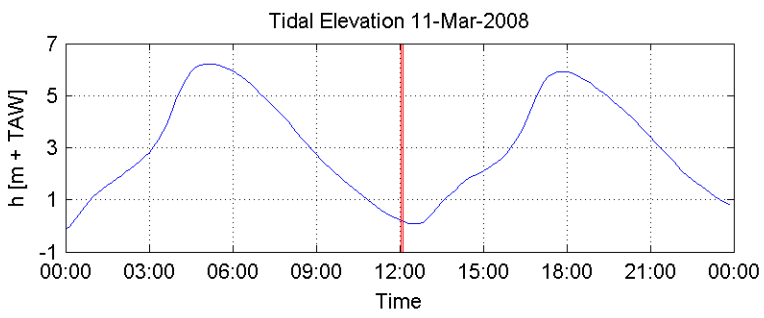
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3040ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:02 - 12:07

Time after HW [HH:MM]

7:04

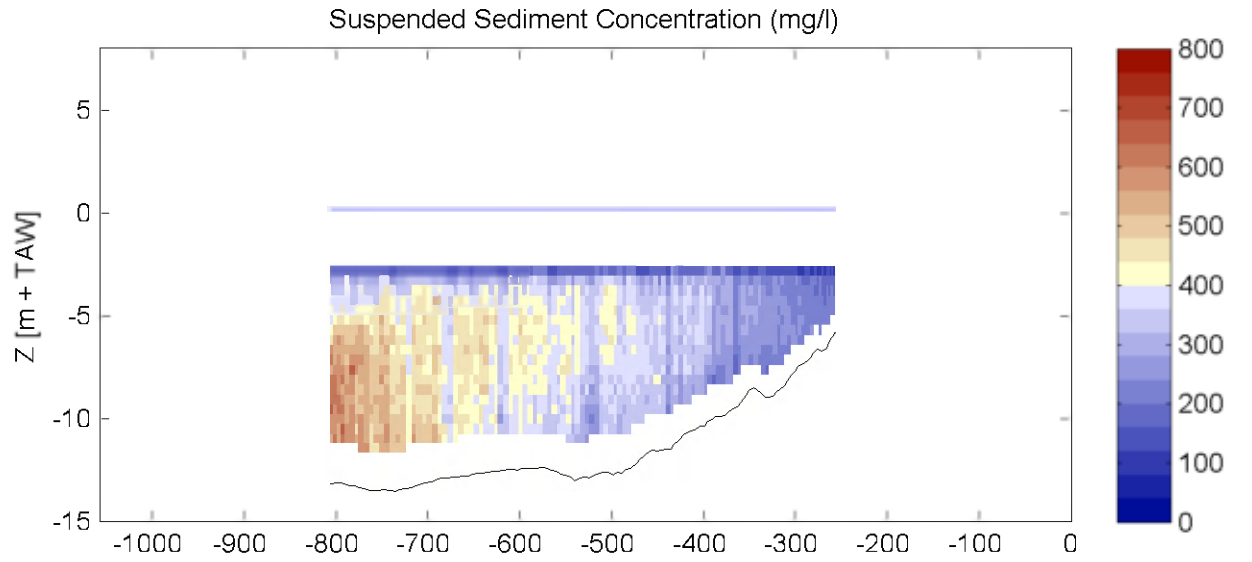
Data Processed by: IMDC

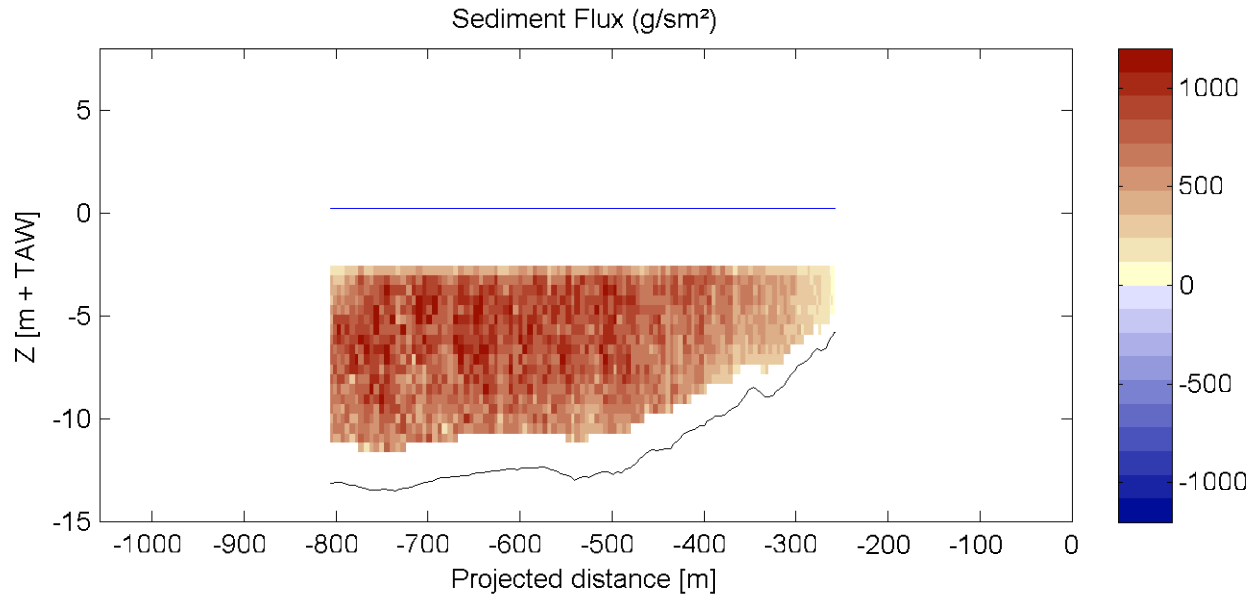
In association with : WL | delft hydraulics, GEMS International

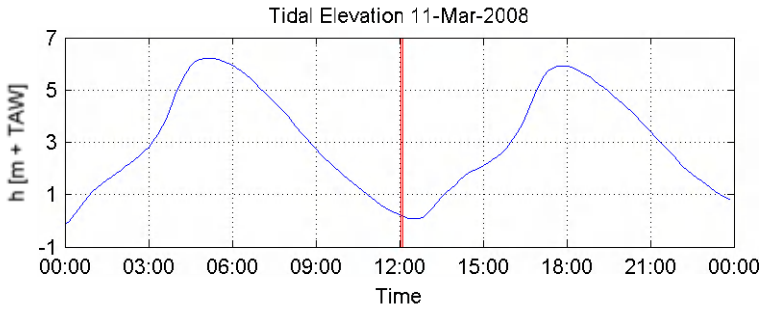
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3040ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
12:02 - 12:07

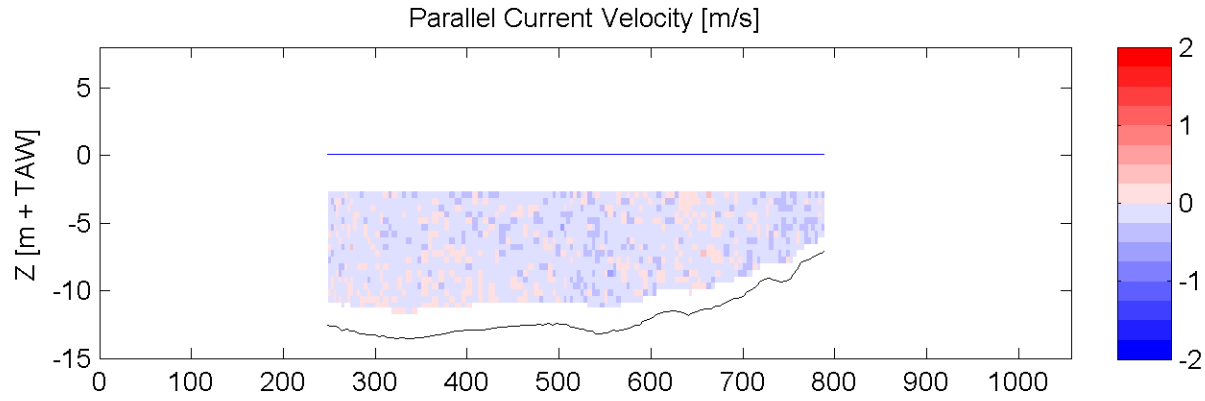
Time after HW [HH:MM]
7:04

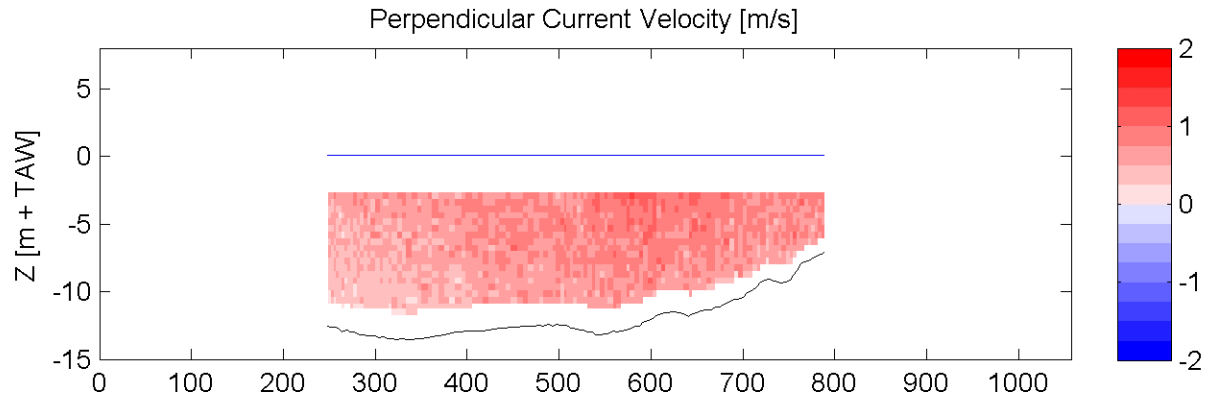
Data Processed by: IMDC
In association with :

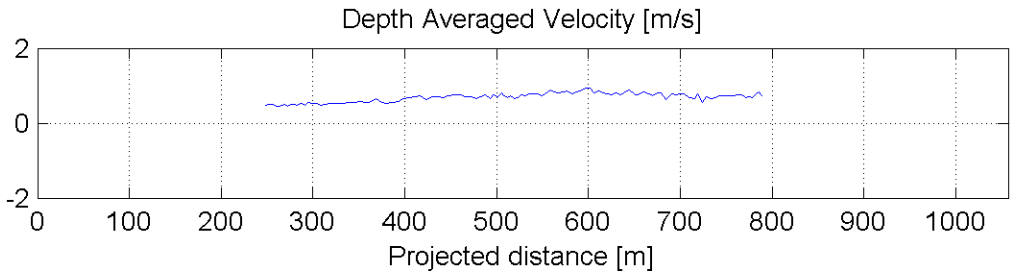
I/RA/11283/07.088/MSA

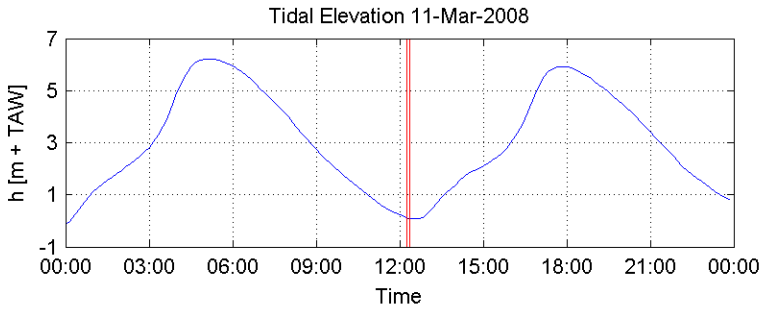
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3042ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:16 - 12:21

Time after HW [HH:MM]

7:18

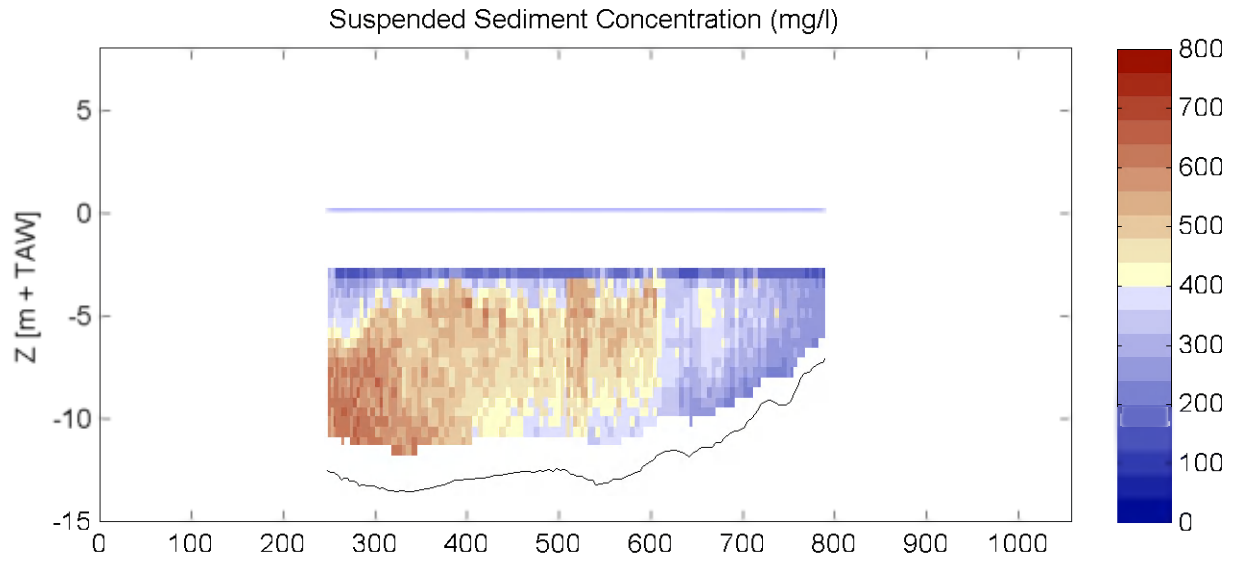
Data Processed by: IMDC

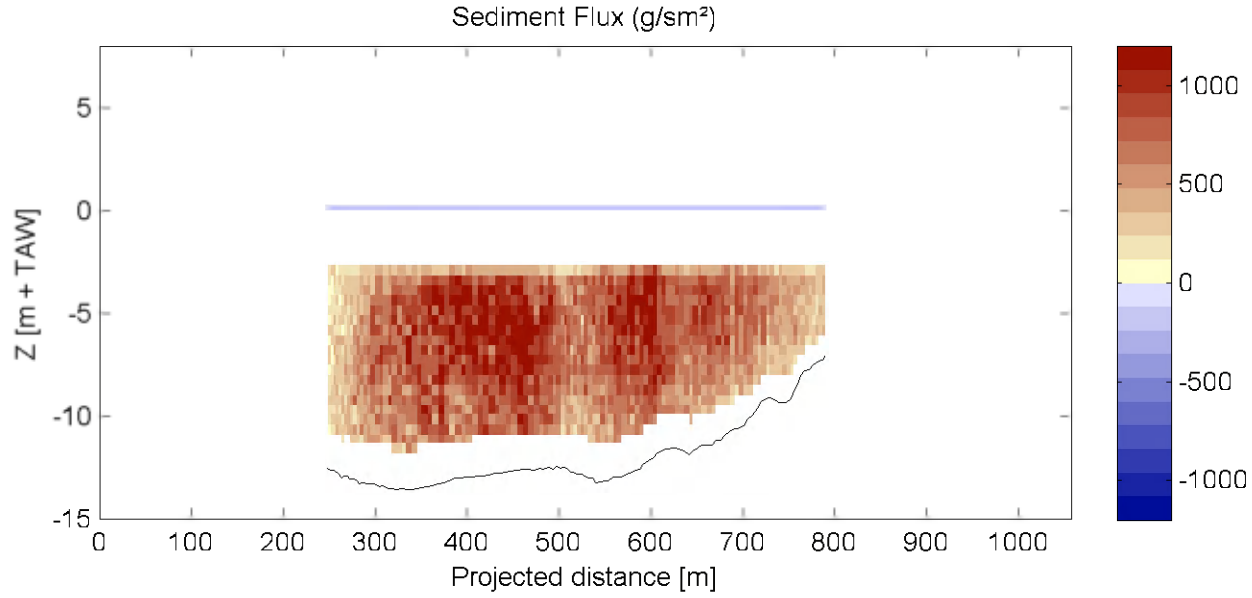
In association with : WL | delft hydraulics, GEMS International

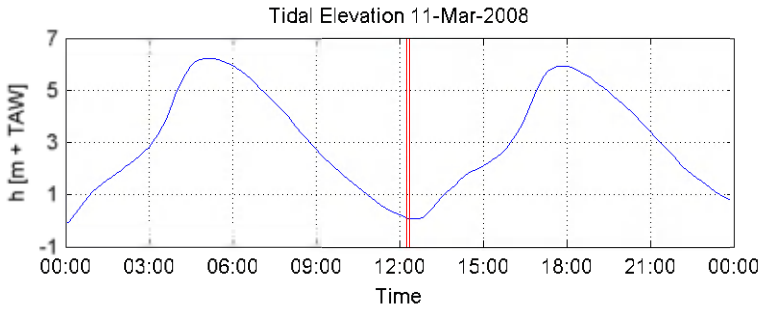
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3042ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:16 - 12:21

Time after HW [HH:MM]

7:18

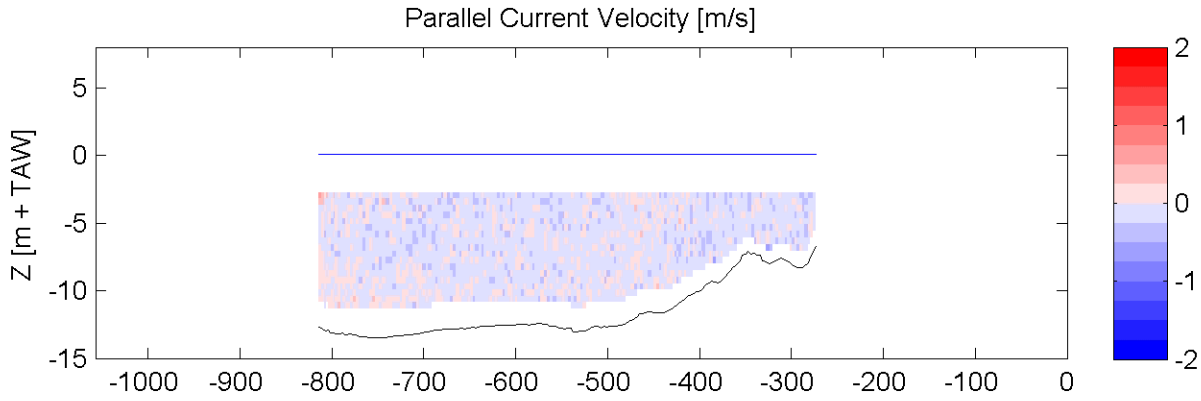
Data Processed by: IMDC

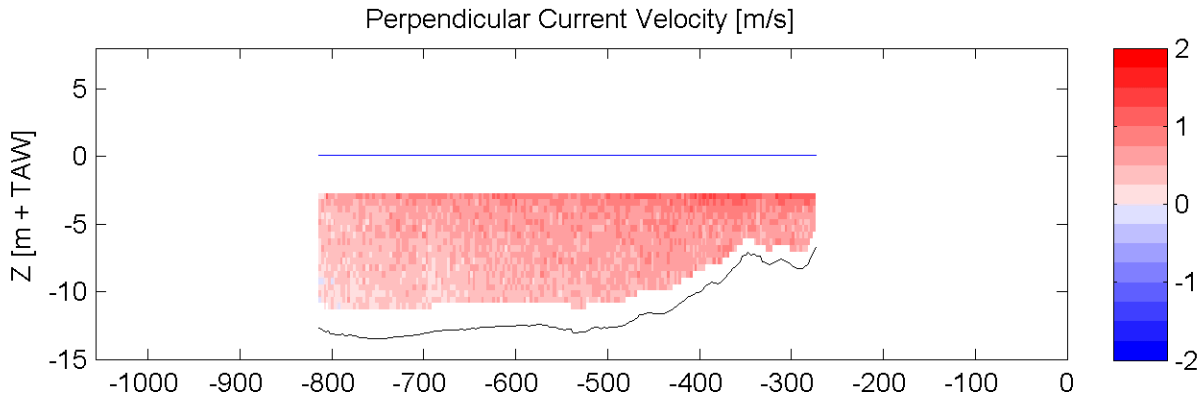
In association with :

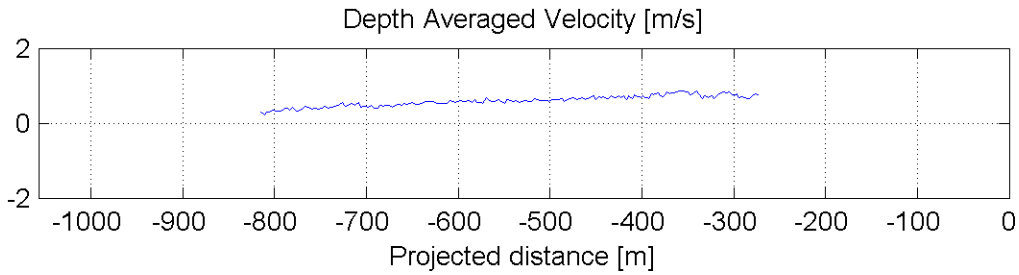
I/RA/11283/07.088/MSA

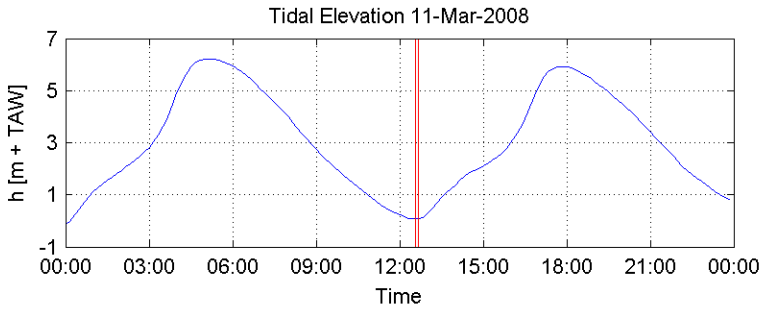
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3044ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:33 - 12:41

Time after HW [HH:MM]

-5:12

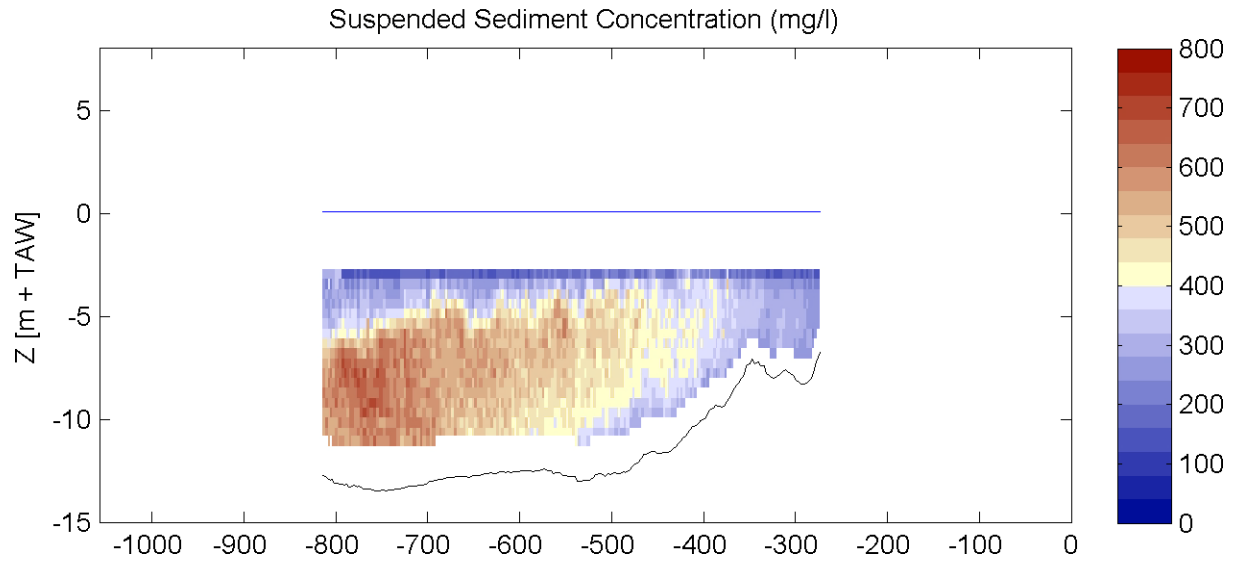
Data Processed by: IMDC

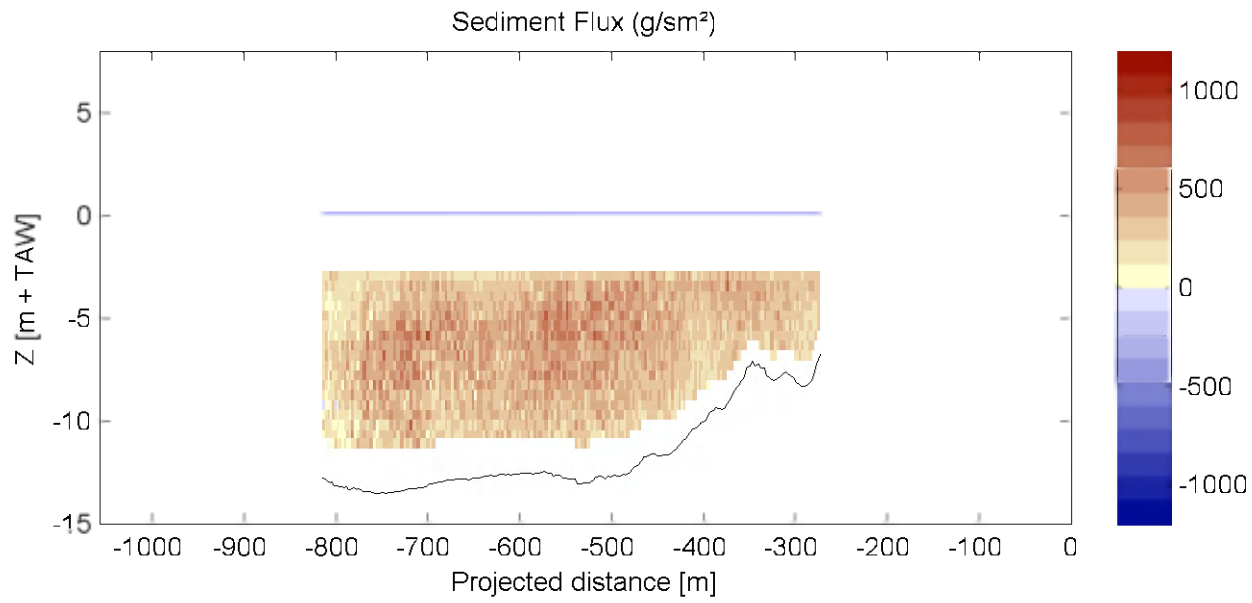
In association with : WL | delft hydraulics, GEMS International

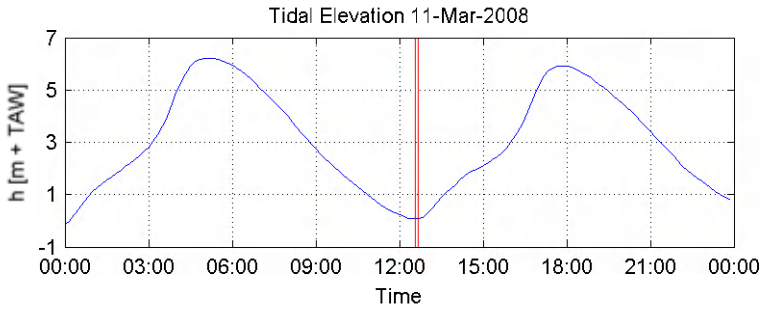
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3044ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
12:33 - 12:41

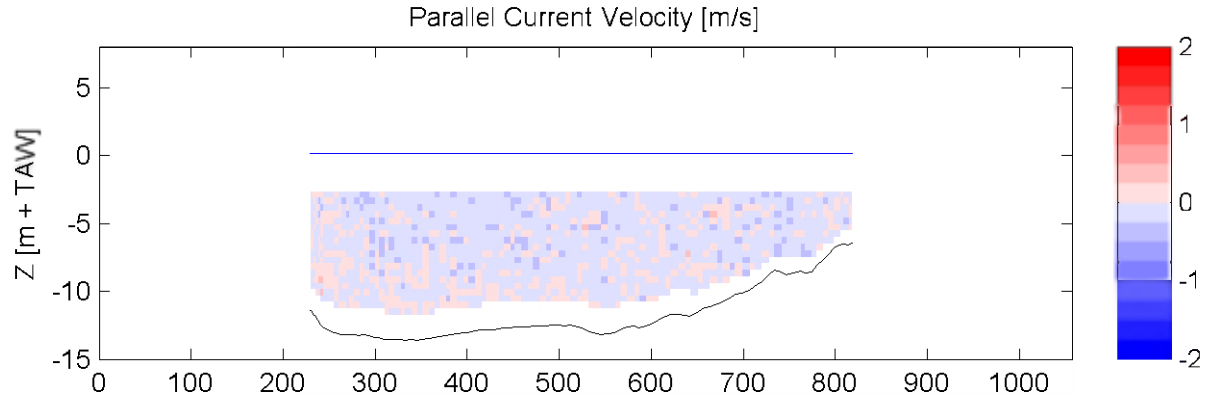
Time after HW [HH:MM]
-5:12

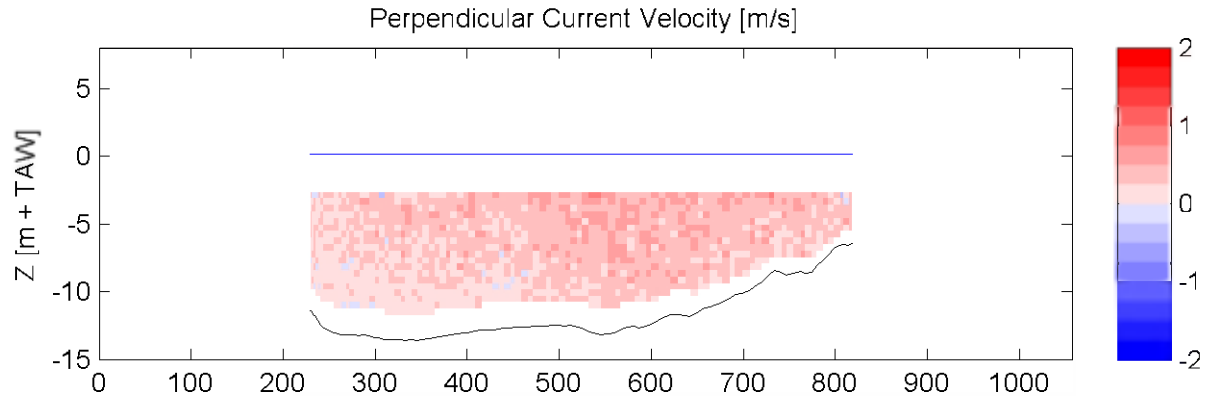
Data Processed by: IMDC
In association with : WL | Delft Hydraulics, GEMS

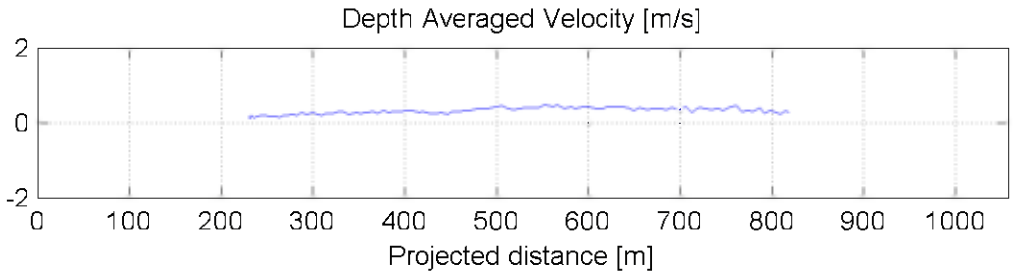
I/RA/11283/07.088/MSA

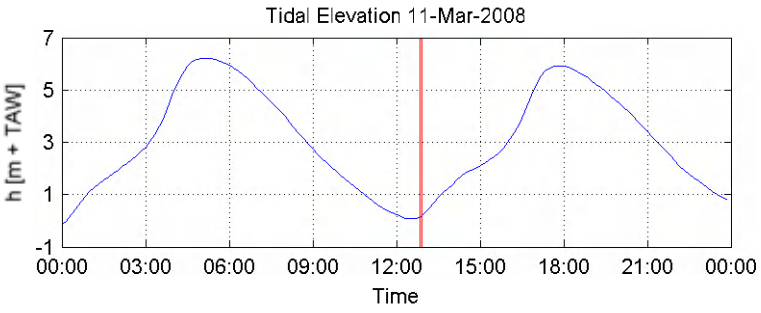
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3046ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:51 - 12:55

Time after HW [HH:MM]

-4:56

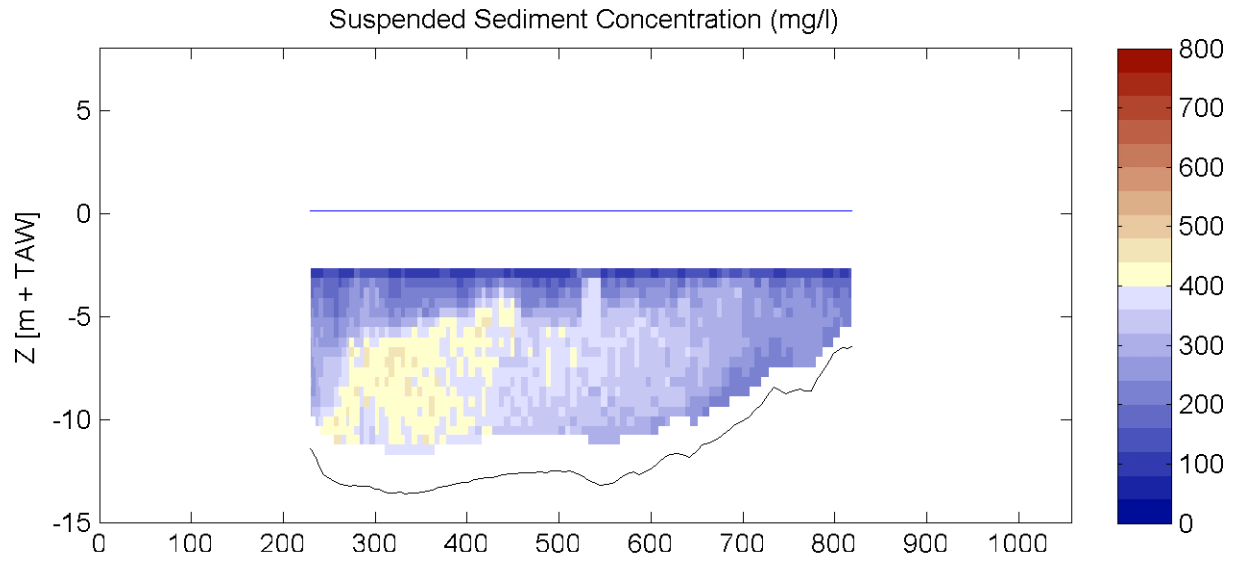
Data Processed by: IMDC

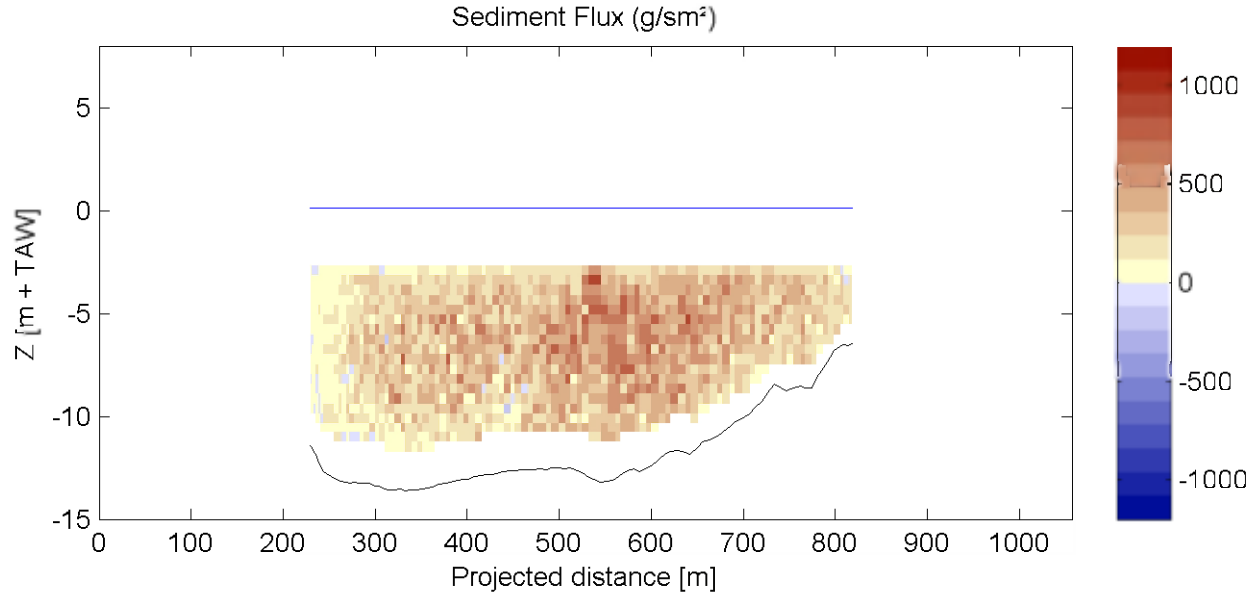
In association with :

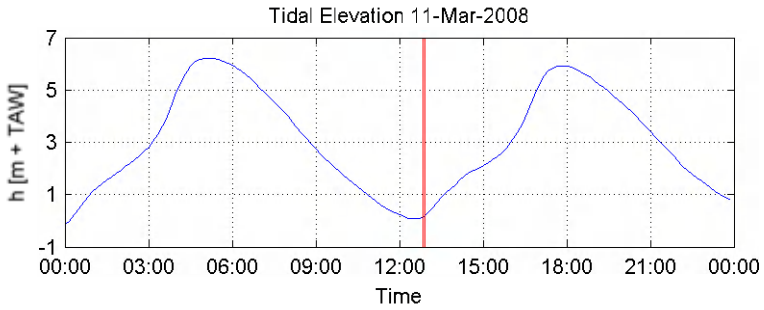
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3046ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

12:51 - 12:55

Time after HW [HH:MM]

-4:56

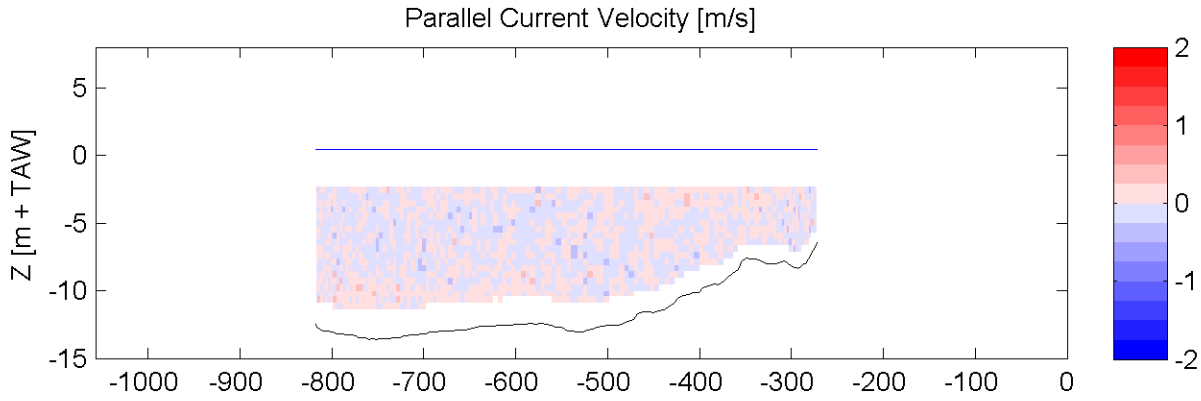
Data Processed by: IMDC

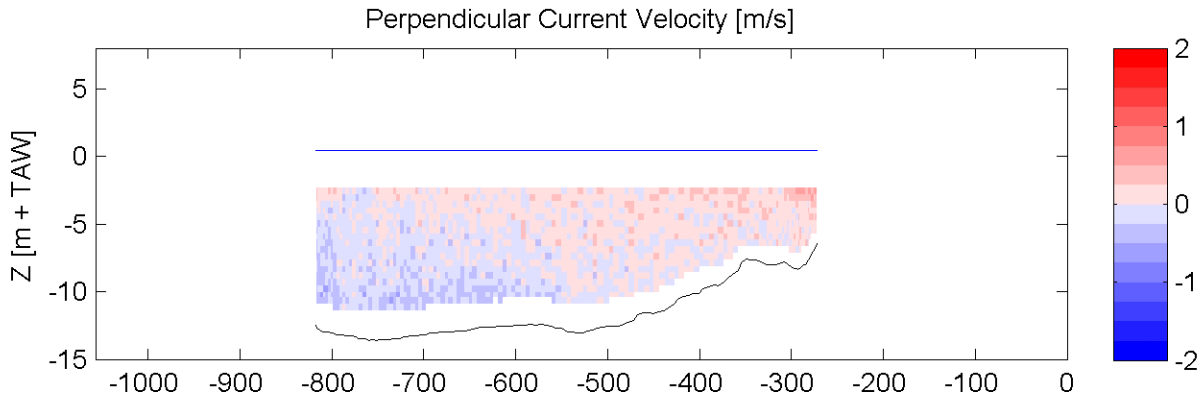
In association with :

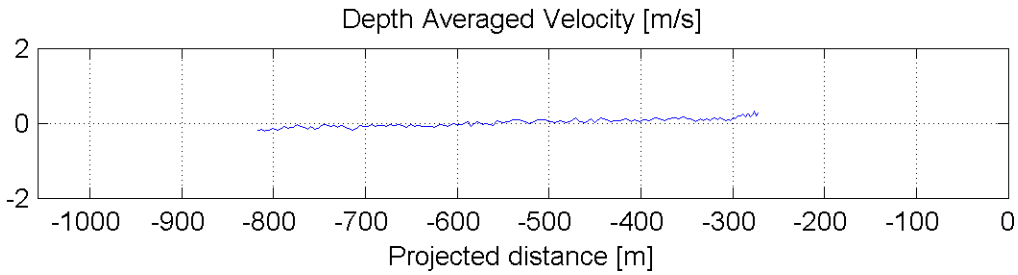
I/RA/11283/07.088/MSA

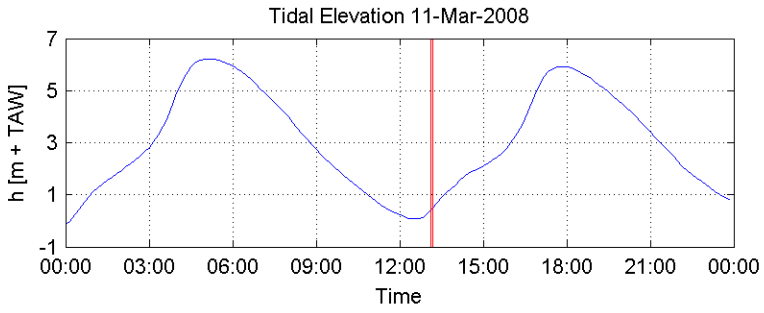
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3048ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

13:06 - 13:12

Time after HW [HH:MM]

-4:40

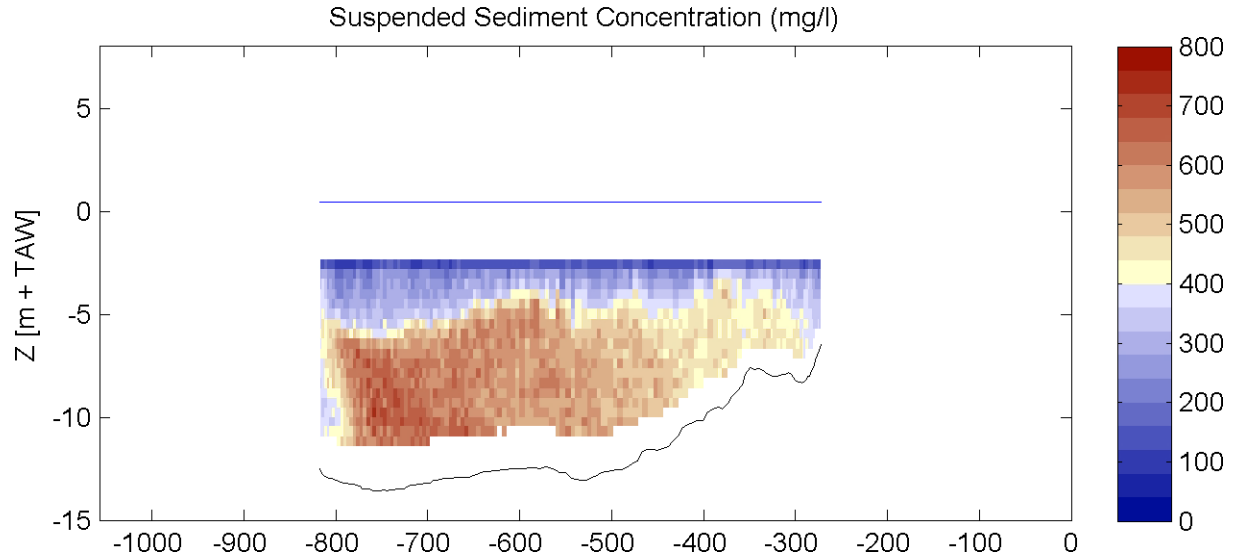
Data Processed by: IMDC

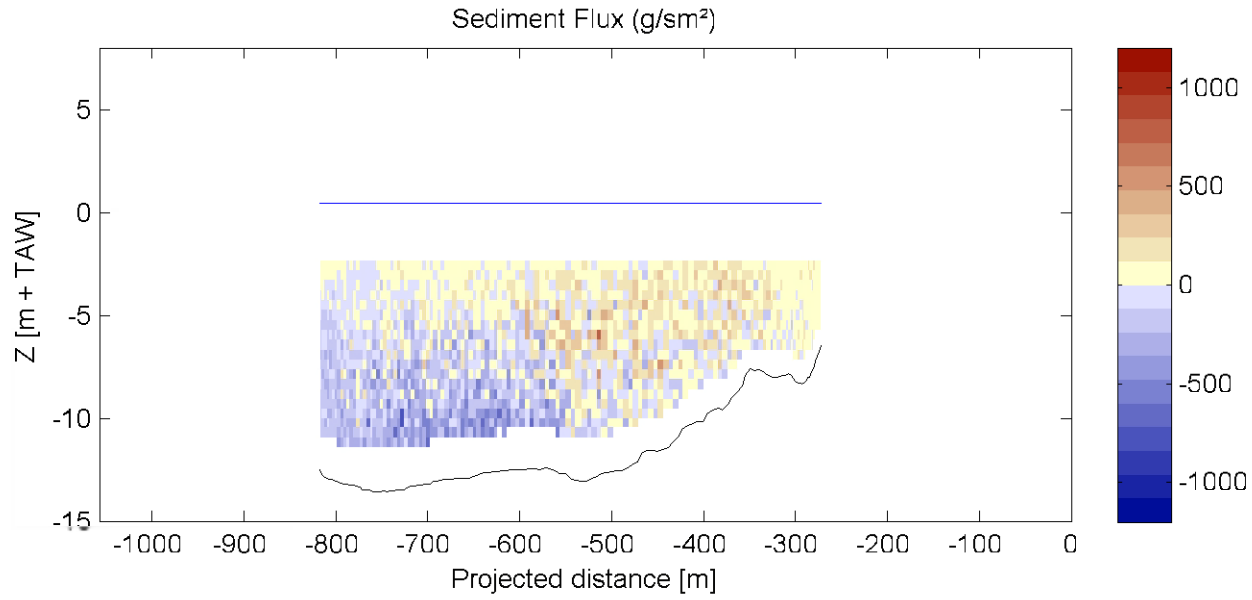
In association with : WL | delft hydraulics, GEMS International

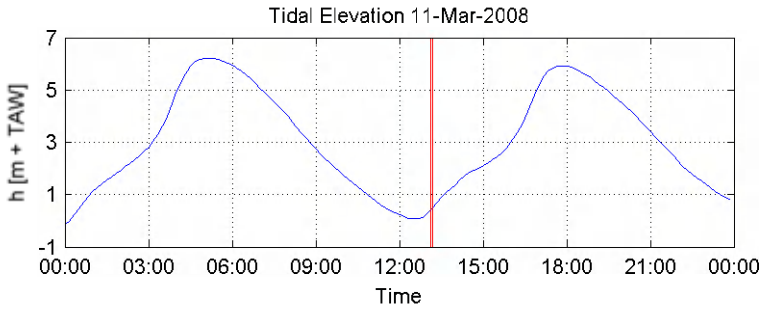
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3048ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
13:06 - 13:12

Time after HW [HH:MM]
-4:40

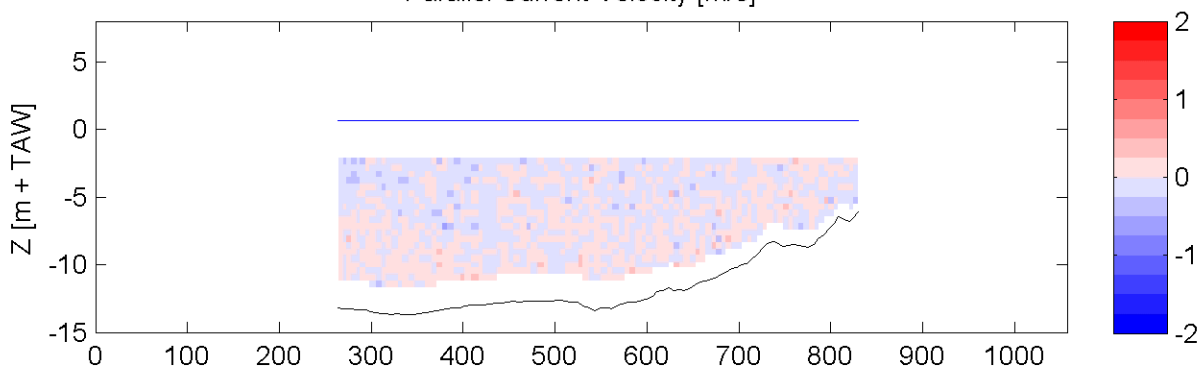
Data Processed by: IMDC
In association with : WL | delft hydraulics, GEMS

I/RA/11283/07.088/MSA

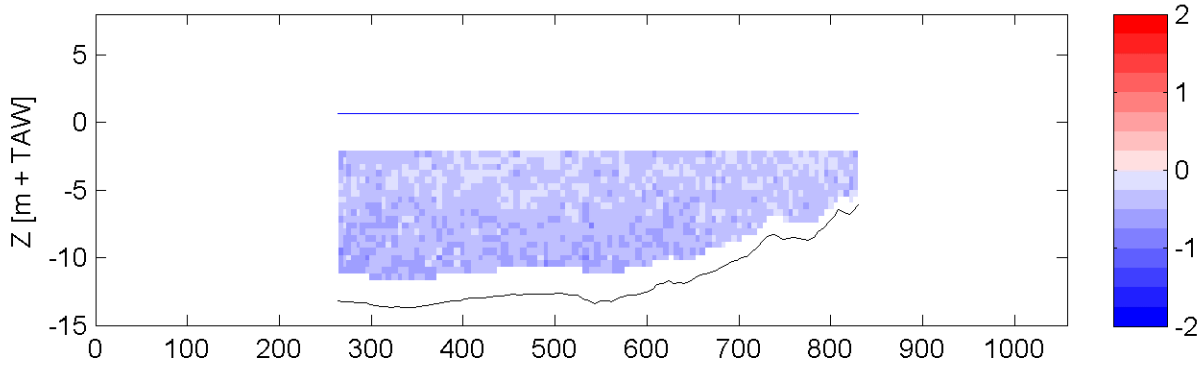
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3050ltl_sub.csv	Location: Transect I

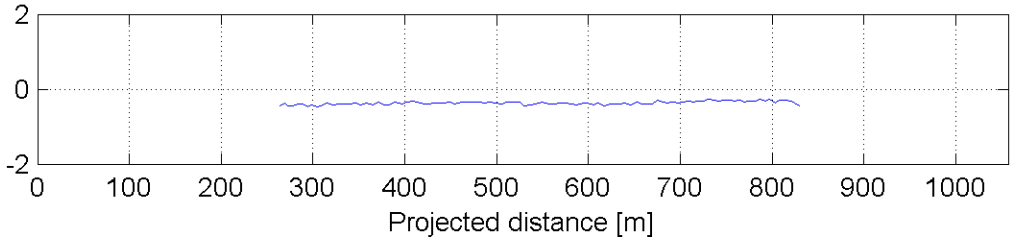
Parallel Current Velocity [m/s]



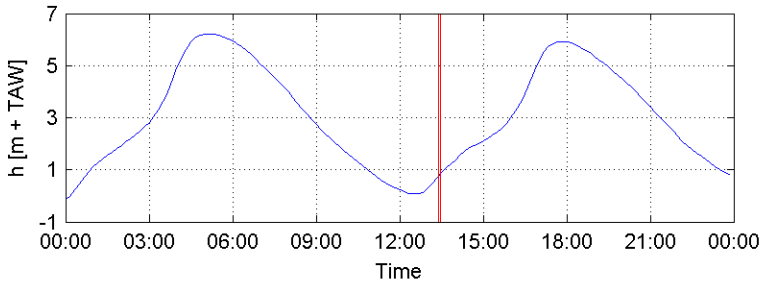
Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]



Tidal Elevation 11-Mar-2008



HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
13:23 - 13:27

Time after HW [HH:MM]
-4:24

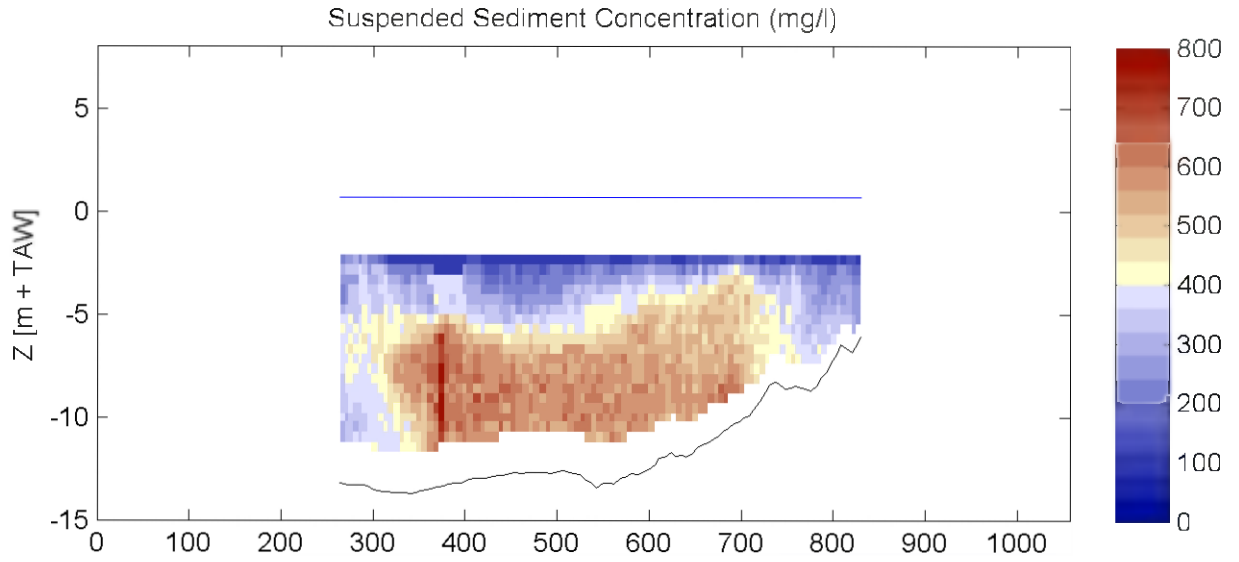
Data Processed by: IMDC

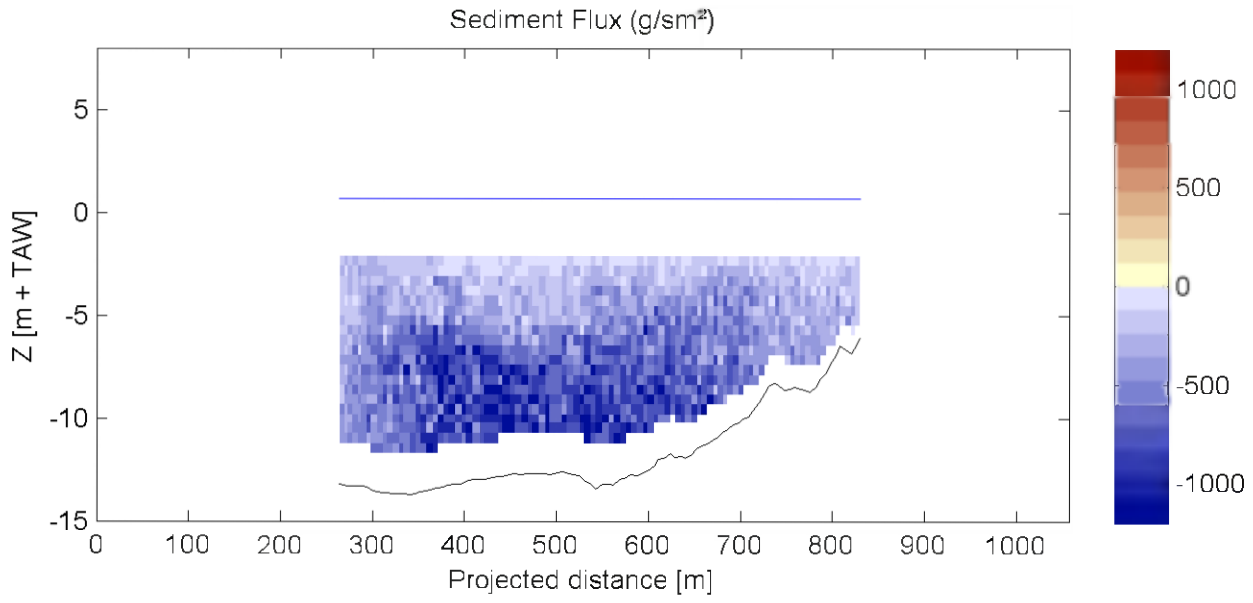
In association with : WL | delft hydraulics, GEMS International

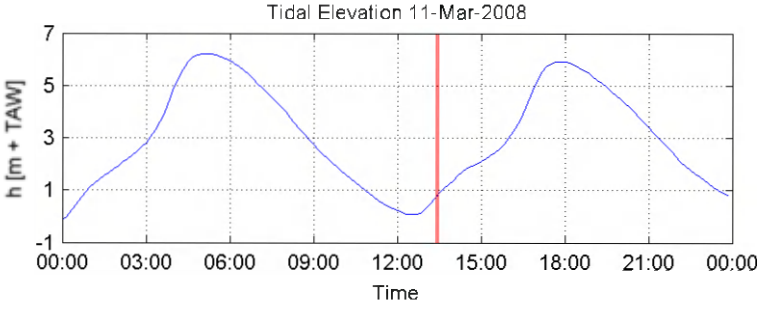
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3050ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

13:23 - 13:27

Time after HW [HH:MM]

-4:24

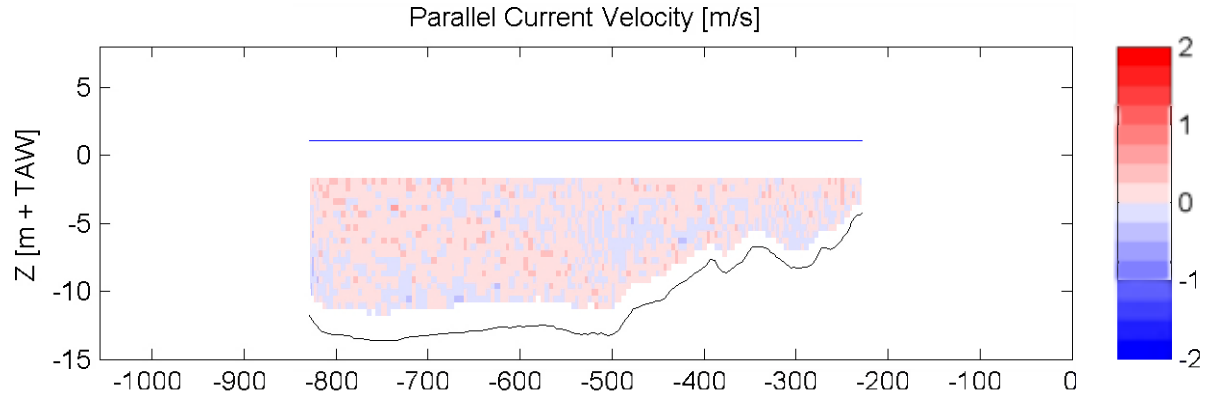
Data Processed by: IMDC

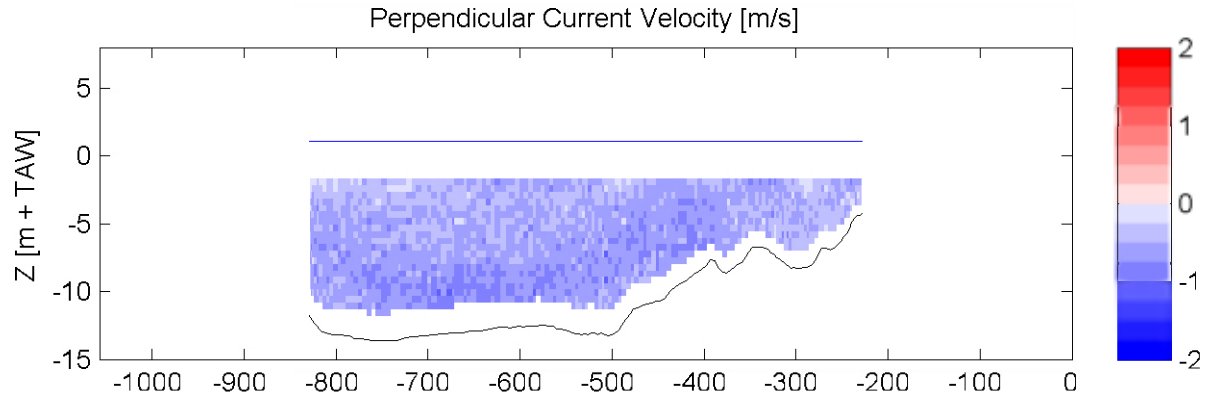
In association with : WL | Delft Hydraulics, GEMS

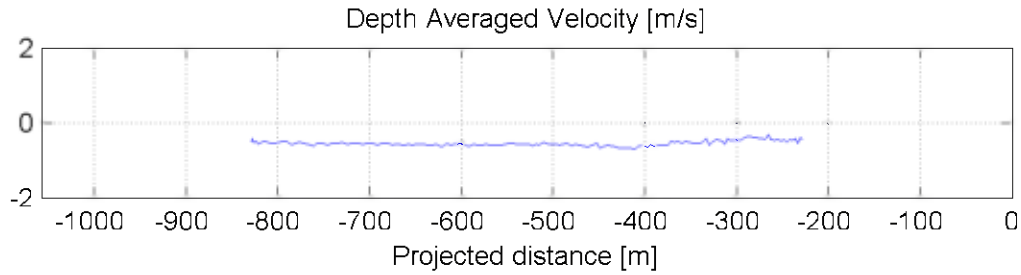
I/RA/11283/07.088/MSA

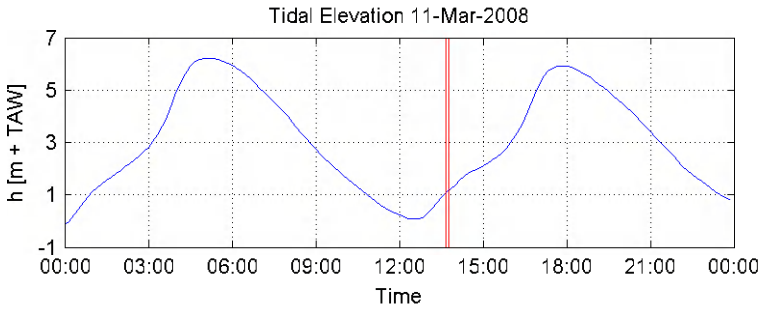
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3052ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
13:39 - 13:46

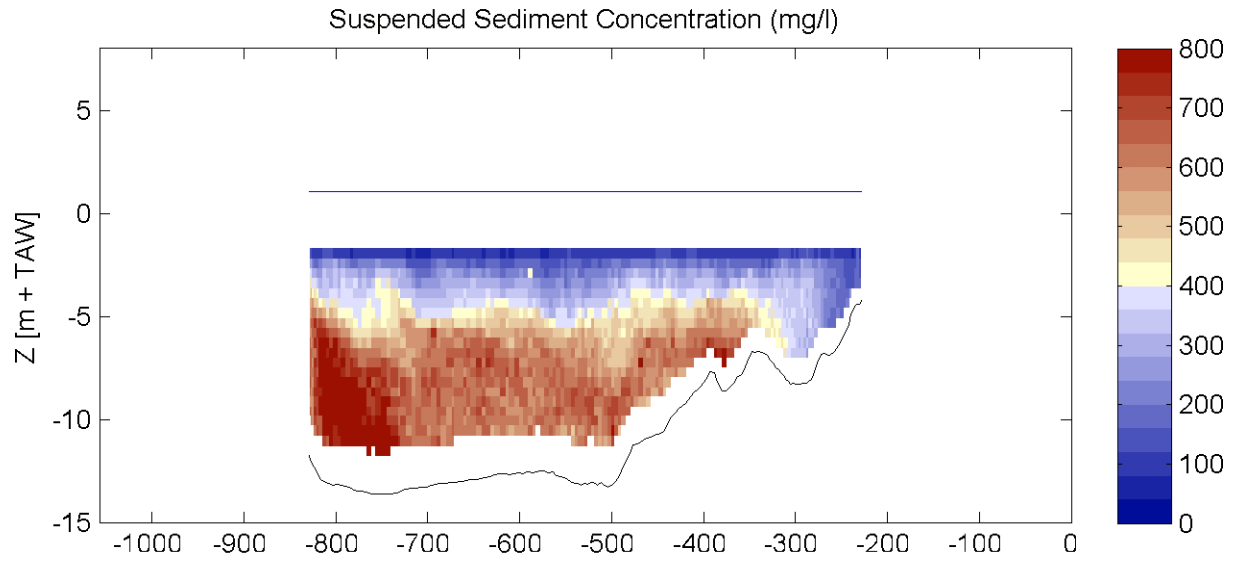
Time after HW [HH:MM]
-4:07

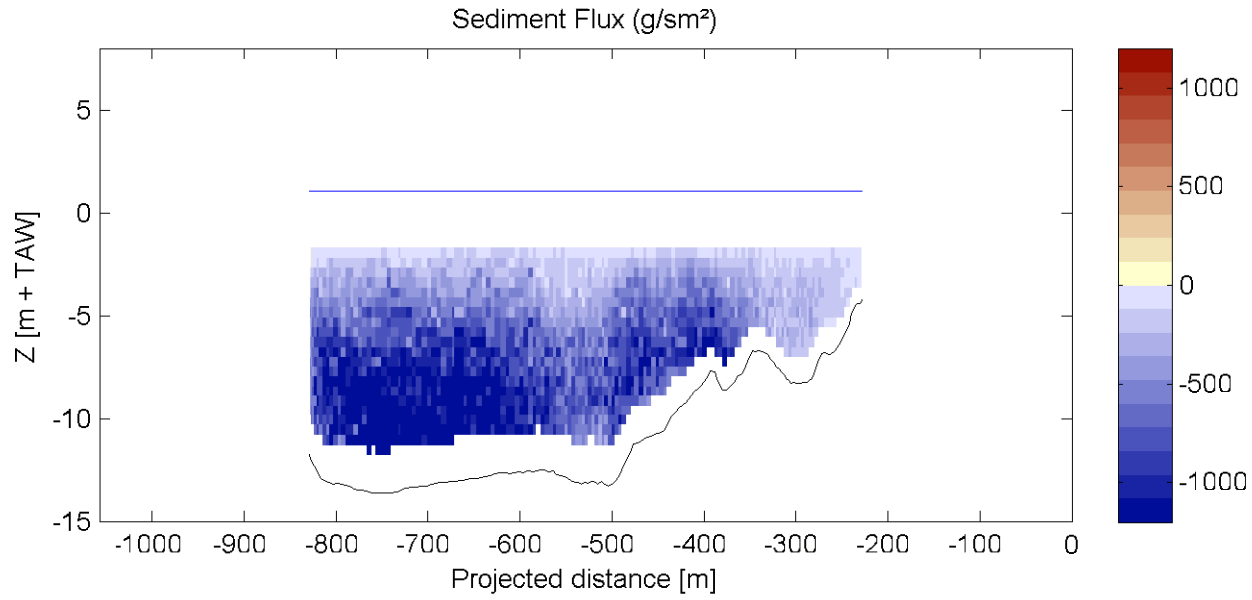
Data Processed by: IMDC
In association with :

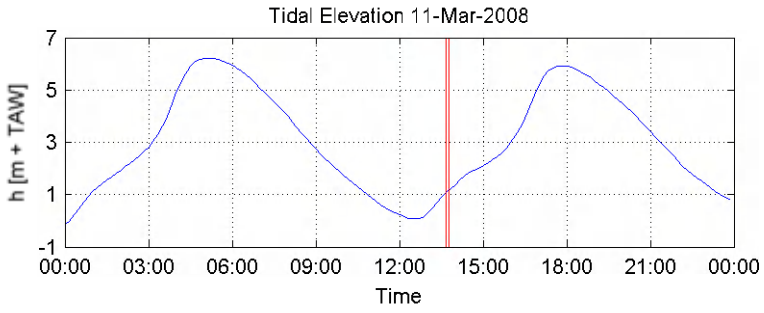
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3052ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
13:39 - 13:46

Time after HW [HH:MM]
-4:07

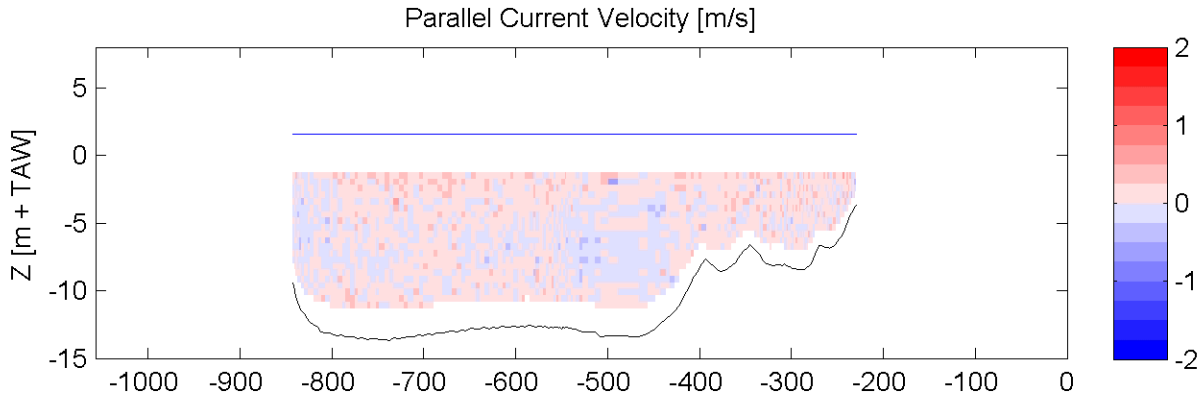
Data Processed by: IMDC

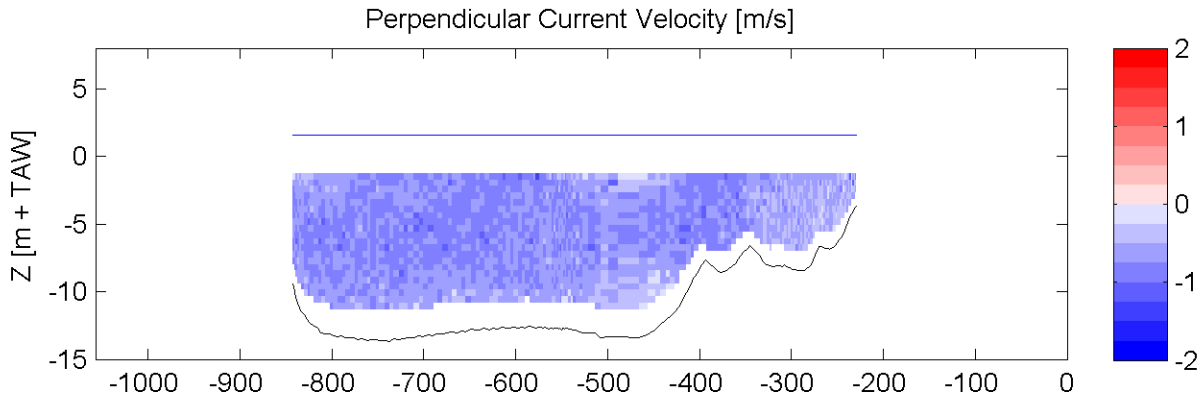
In association with :

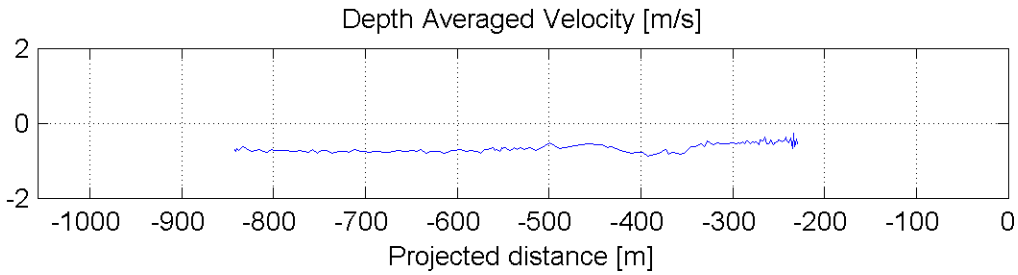
I/RA/11283/07.088/MSA

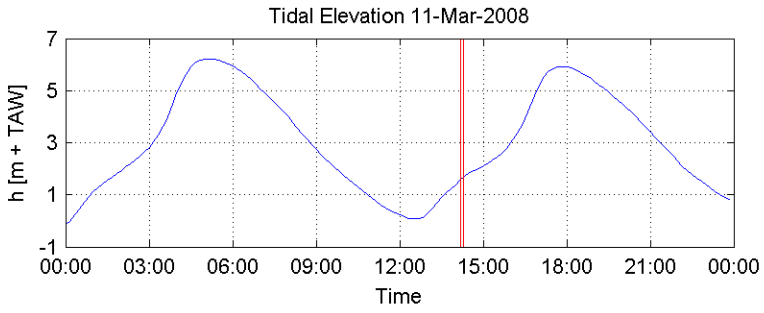
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3056ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

14:10 - 14:17

Time after HW [HH:MM]

-3:36

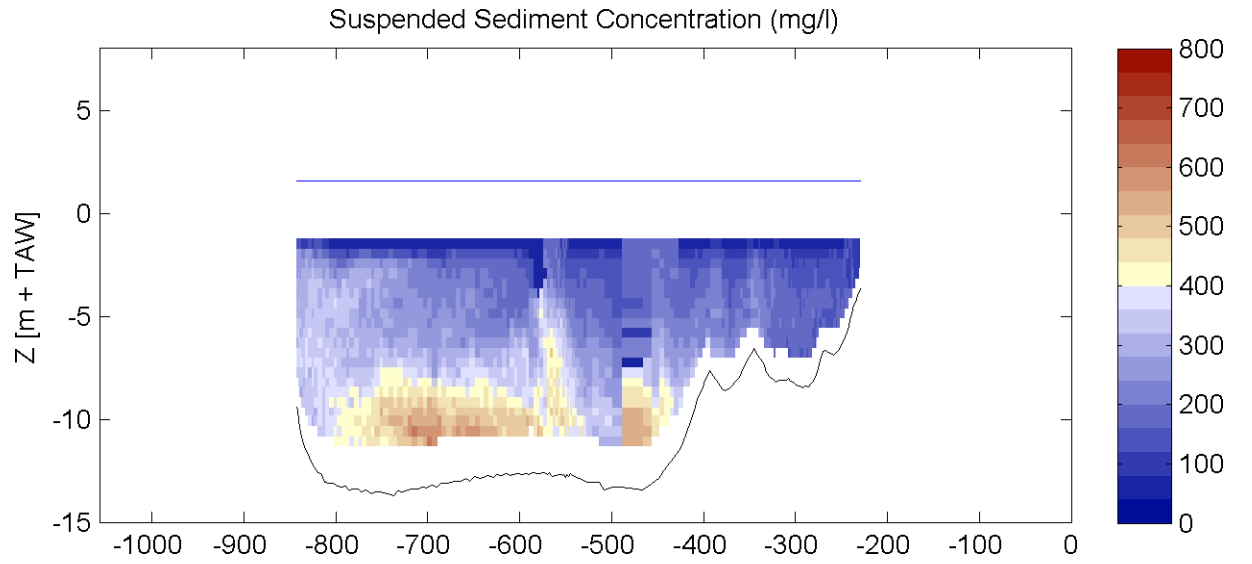
Data Processed by: IMDC

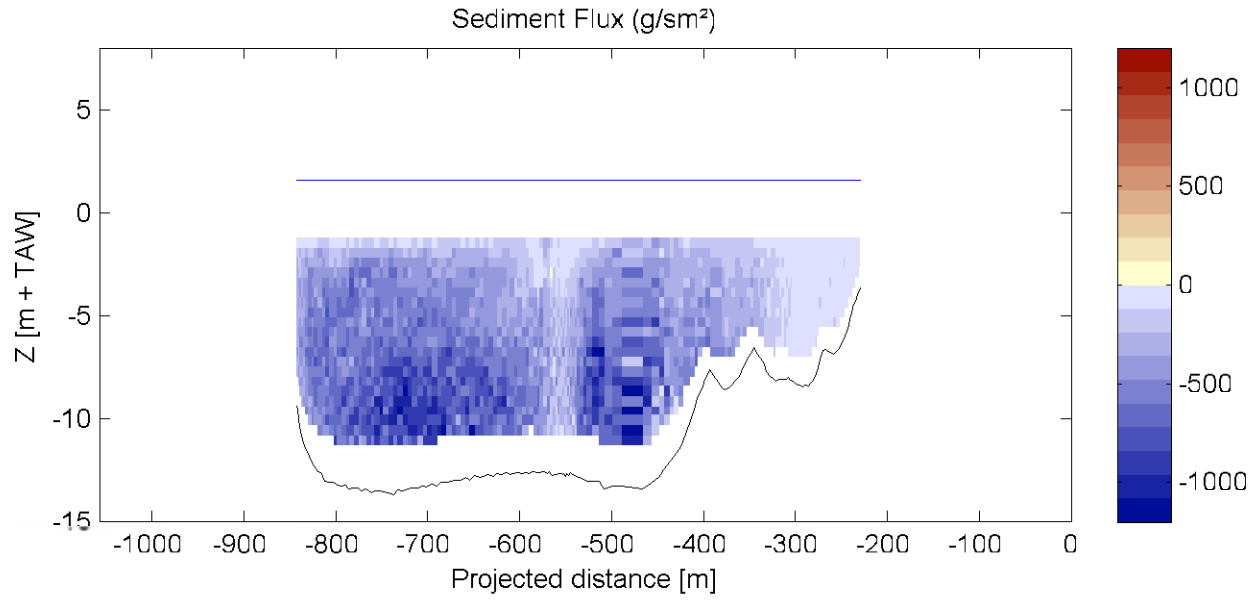
In association with : WL | delft hydraulics, GEMS International

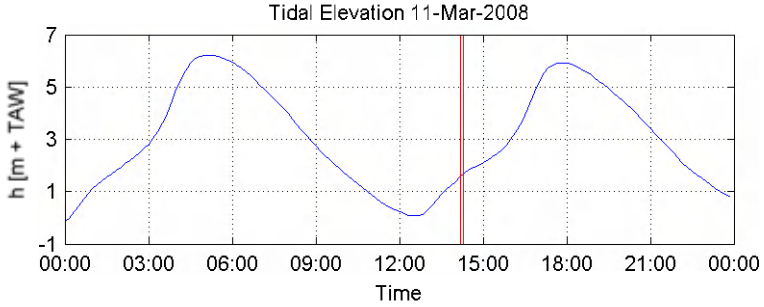
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3056ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
14:10 - 14:17

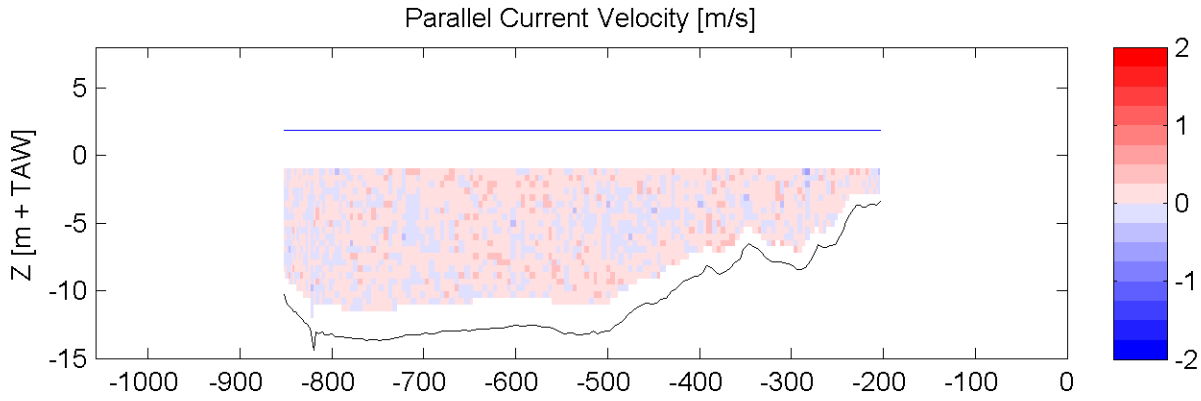
Time after HW [HH:MM]
-3:36

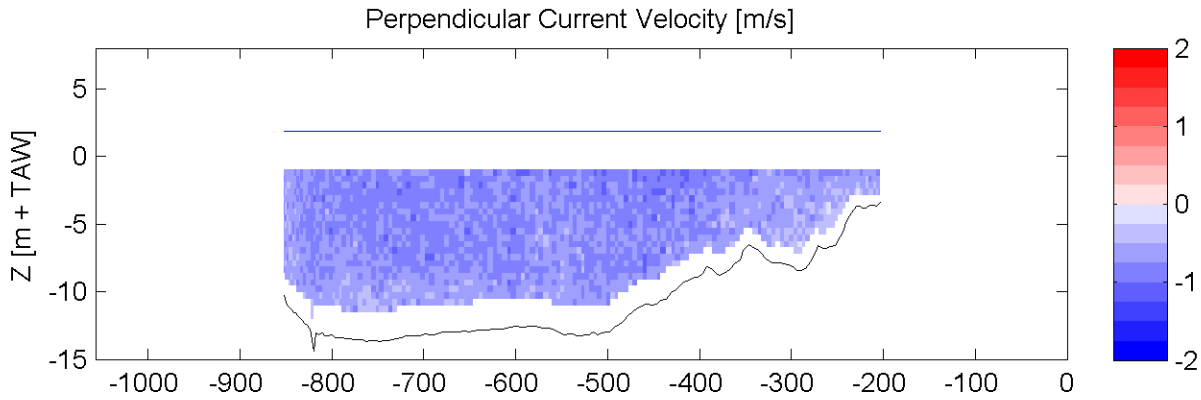
Data Processed by: IMDC
In association with :

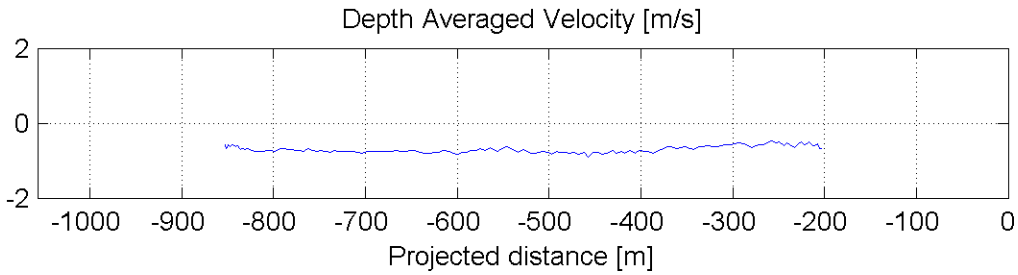
I/RA/11283/07.088/MSA

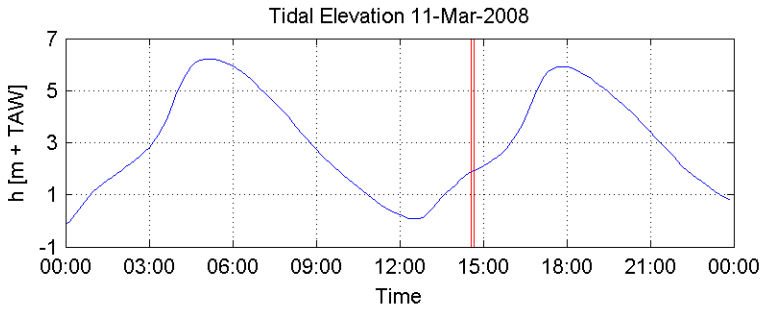
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3060ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

14:34 - 14:40

Time after HW [HH:MM]

-3:12

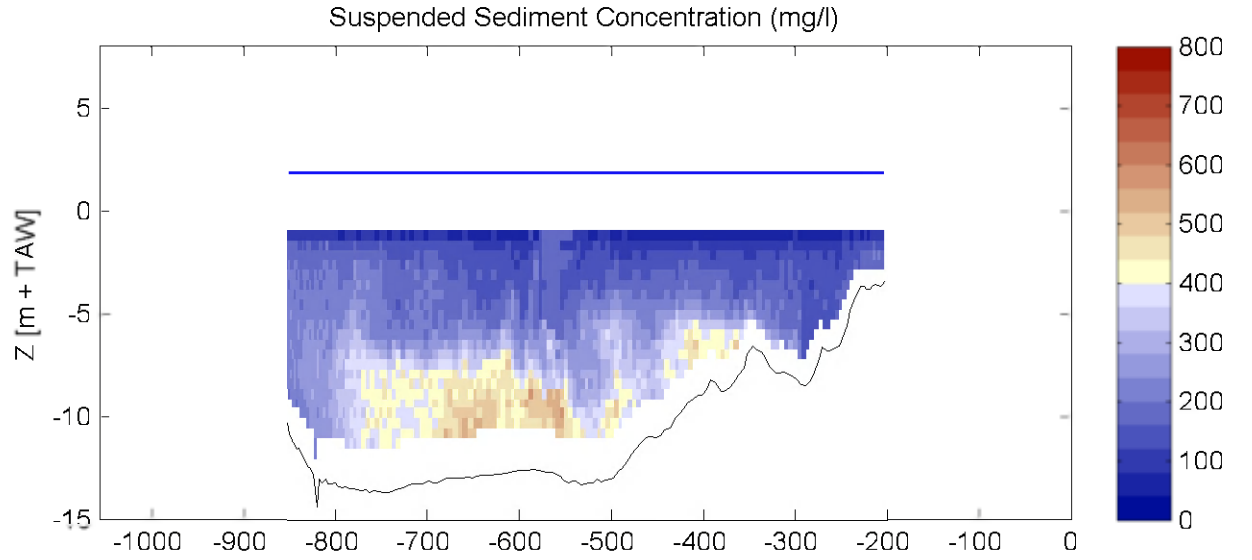
Data Processed by: IMDC

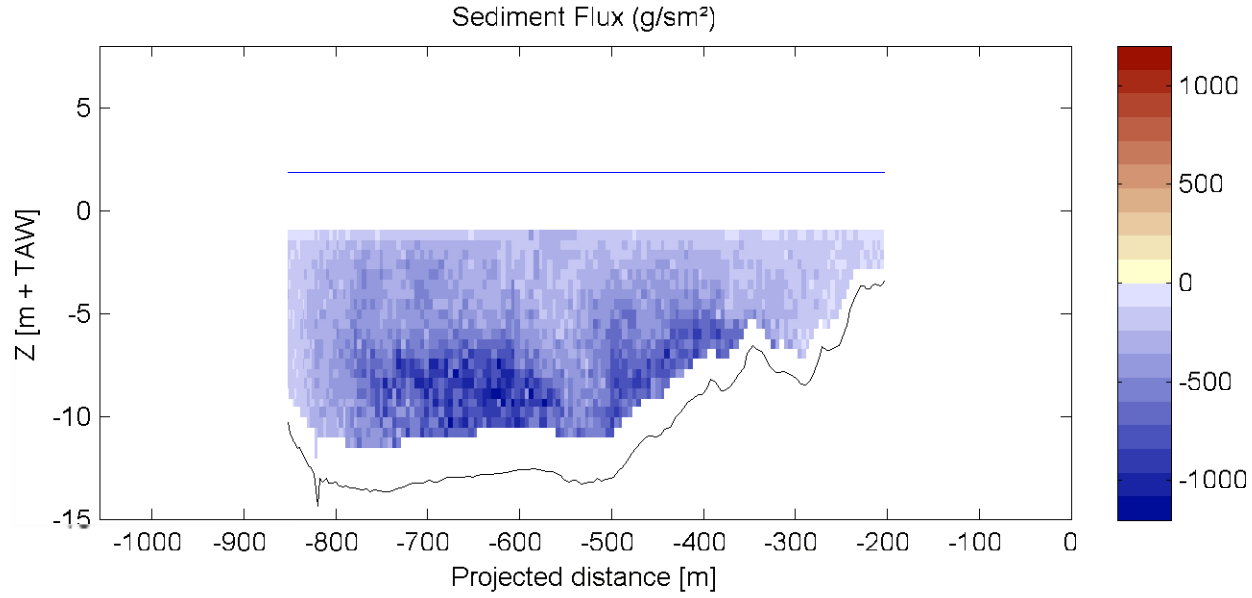
In association with : WL | delft hydraulics, GEMS International

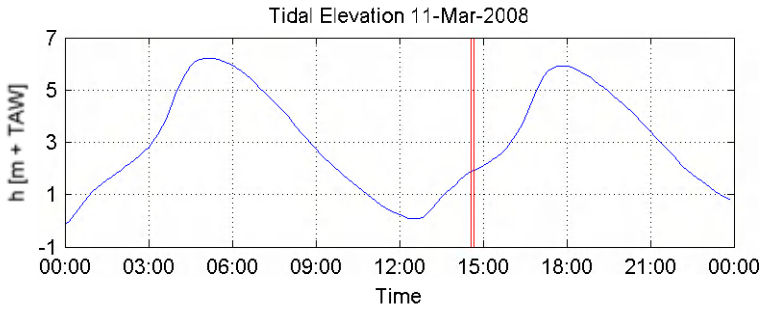
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3060ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
14:34 - 14:40

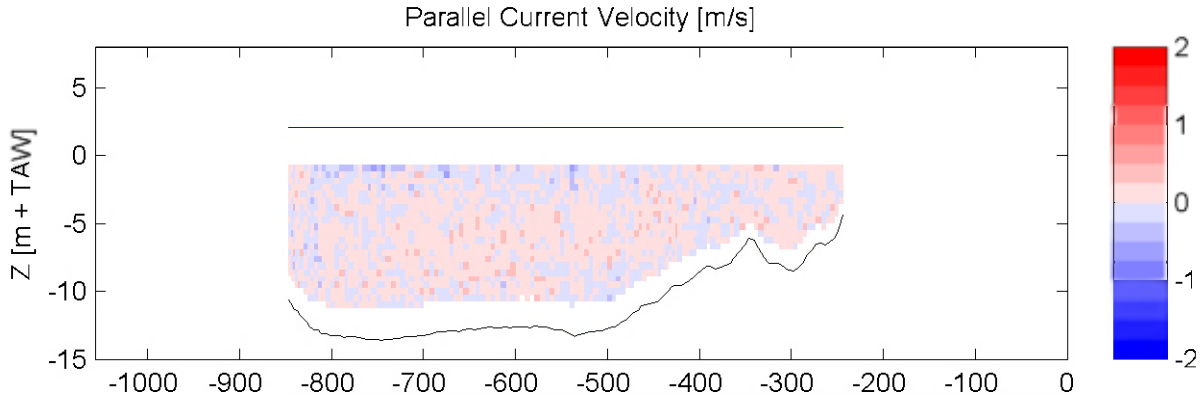
Time after HW [HH:MM]
-3:12

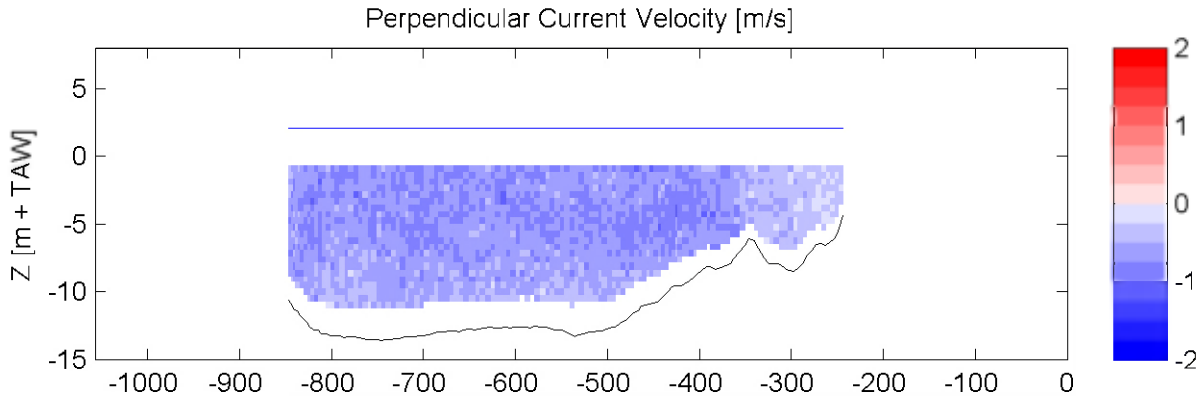
Data Processed by: IMDC
In association with : WL | Delft Hydraulics, GEMS

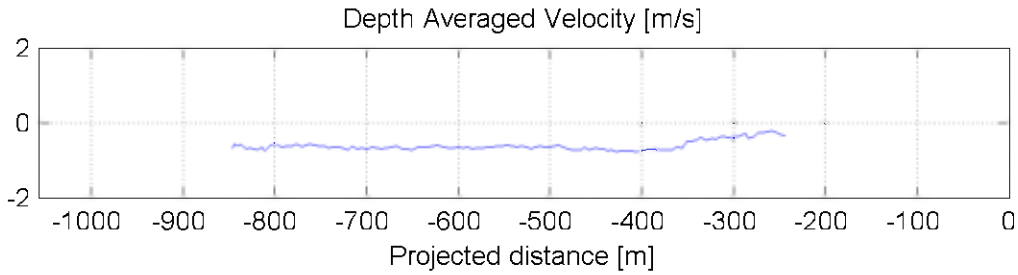
I/RA/11283/07.088/MSA

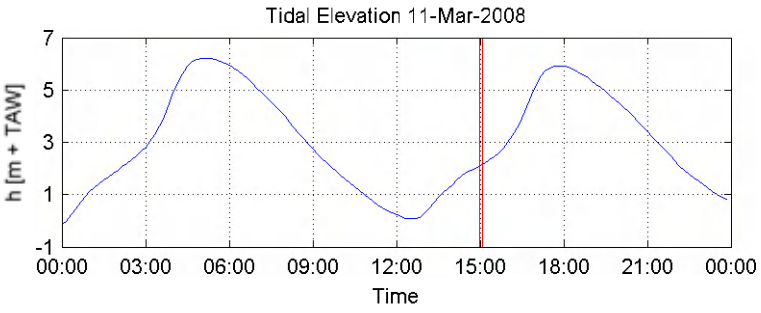
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3064ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

14:59 - 15:04

Time after HW [HH:MM]

-2:48

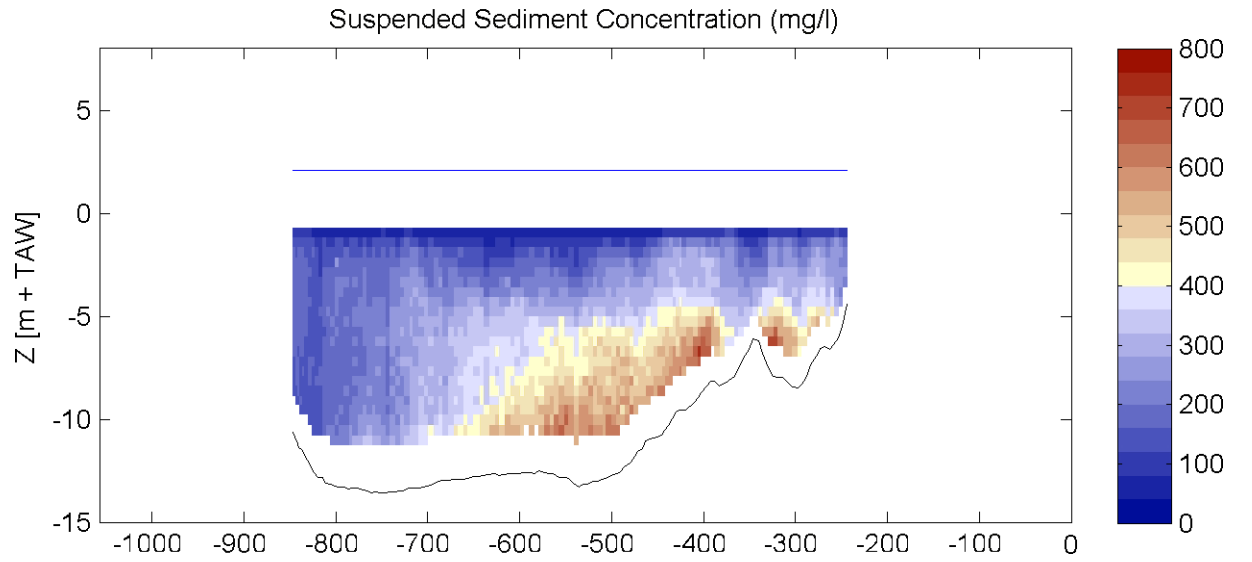
Data Processed by: IMDC

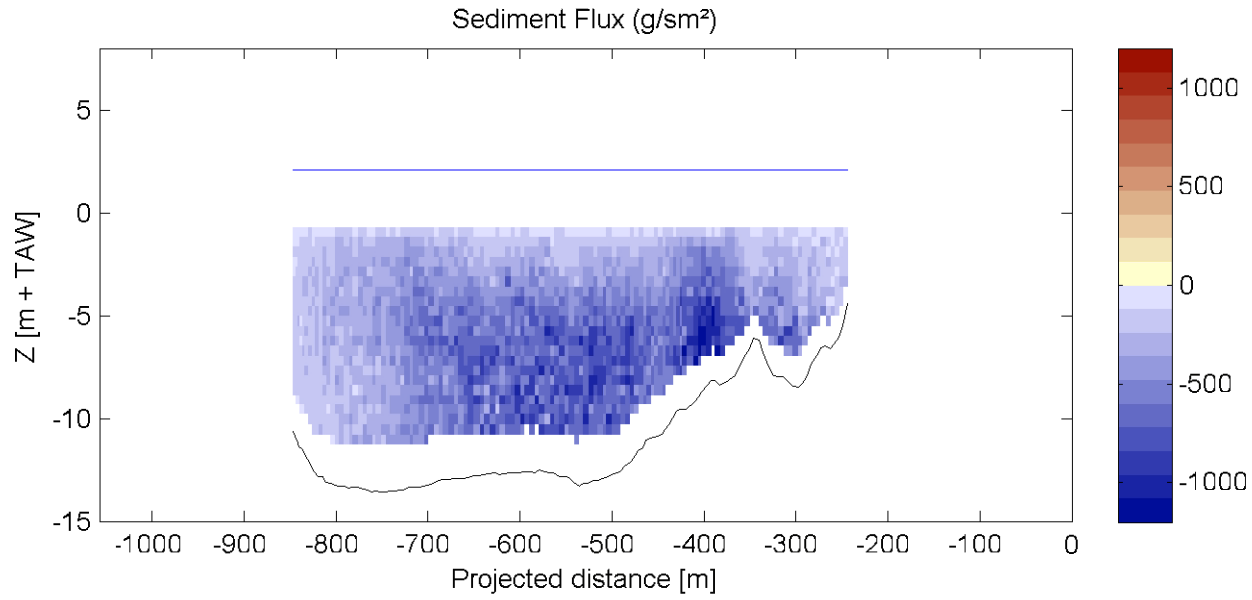
In association with :

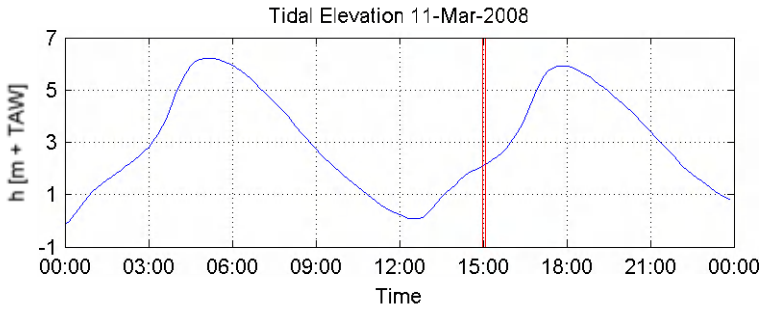
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3064ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
14:59 - 15:04

Time after HW [HH:MM]
-2:48

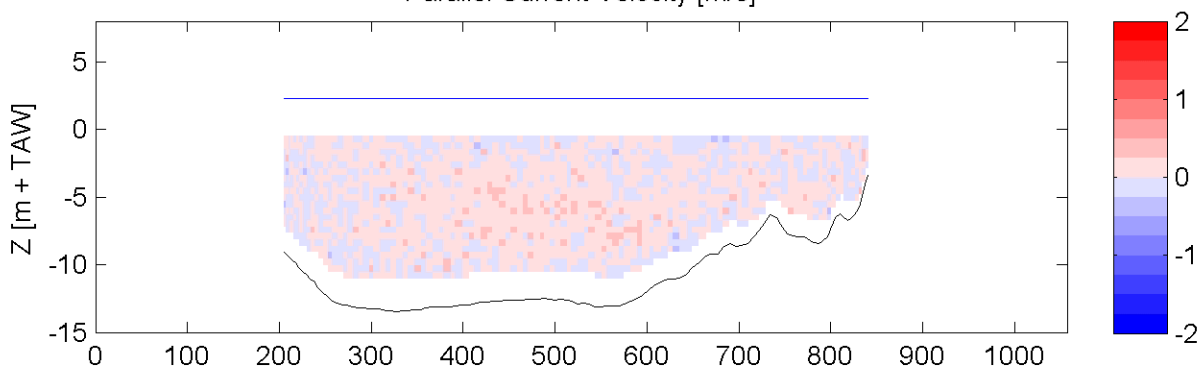
Data Processed by: IMDC
In association with :

I/RA/11283/07.088/MSA

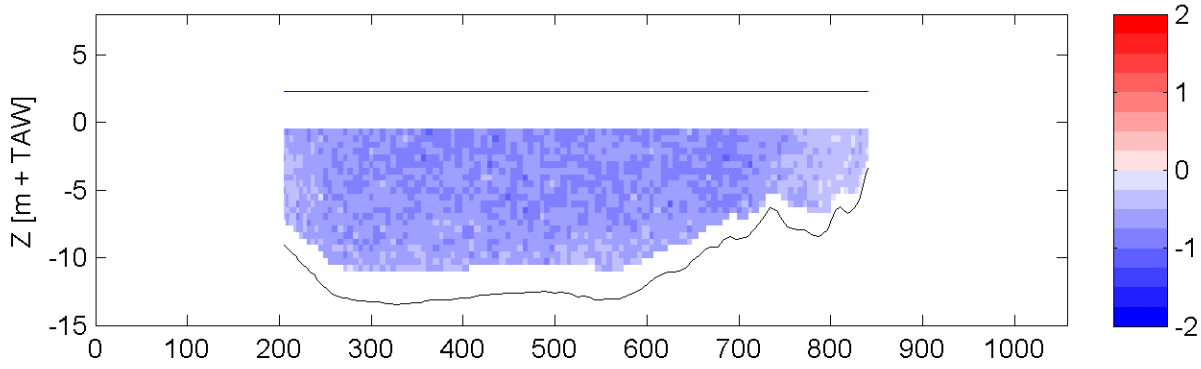
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3066ltl_sub.csv	Location: Transect I

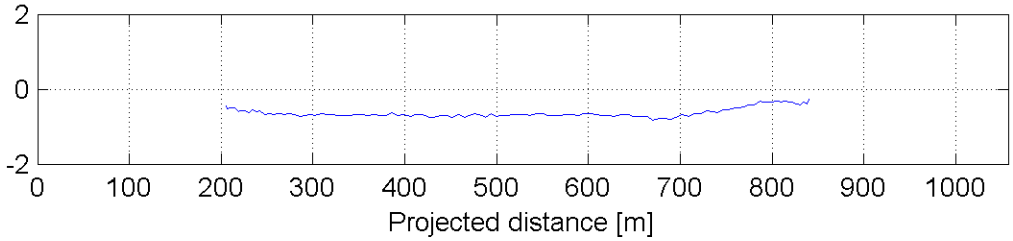
Parallel Current Velocity [m/s]



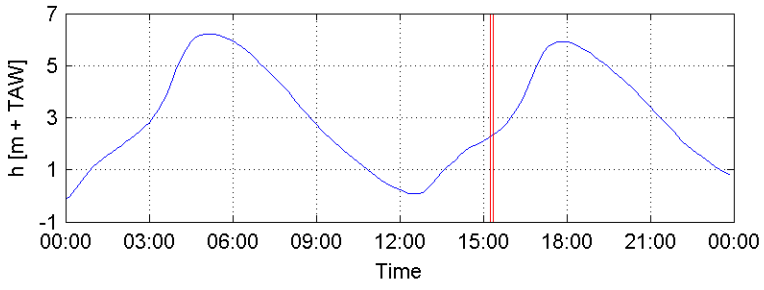
Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]



Tidal Elevation 11-Mar-2008



HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
15:16 - 15:20

Time after HW [HH:MM]
-2:31

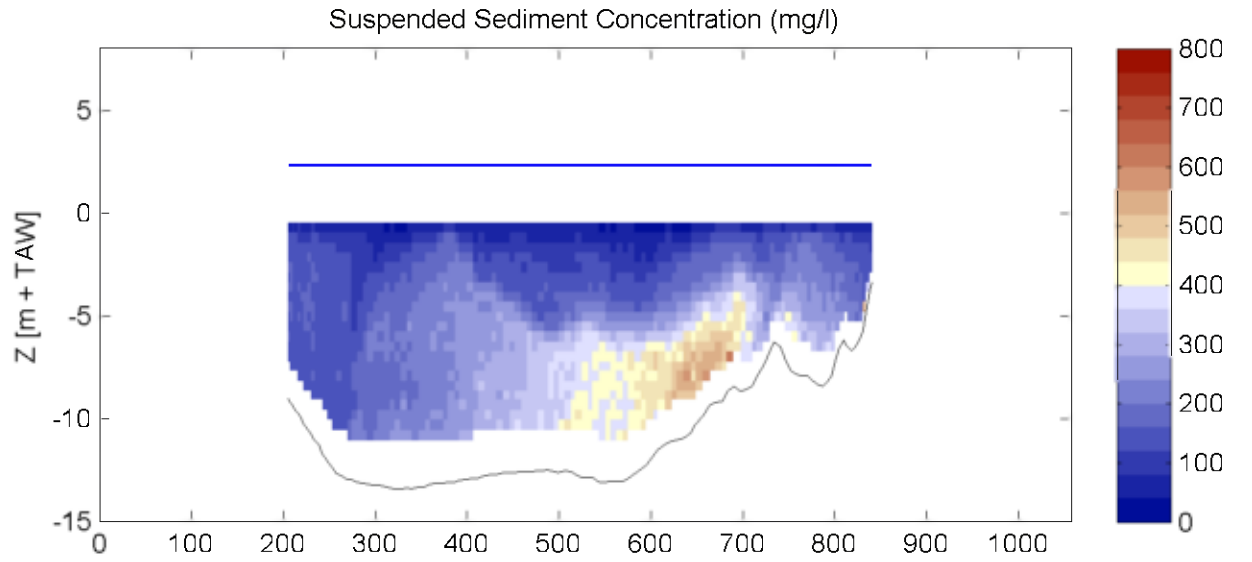
Data Processed by: IMDC

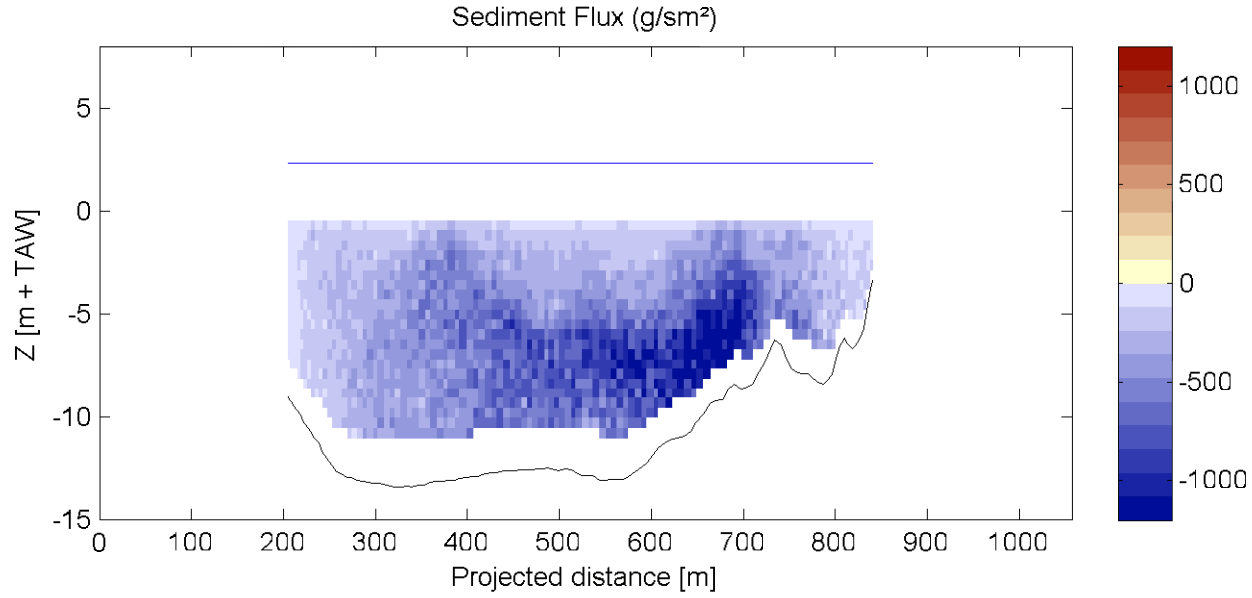
In association with : WL | delft hydraulics, GEMS International

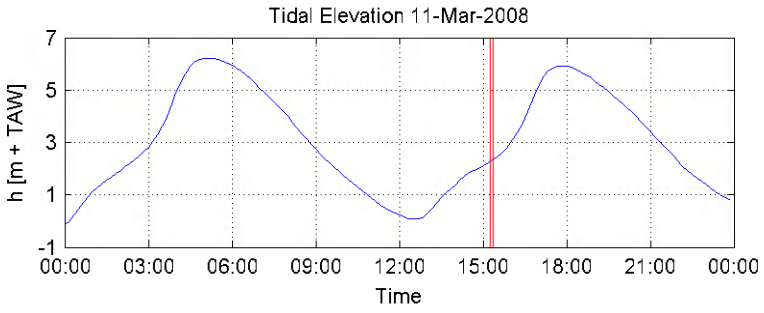
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3066ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

15:16 - 15:20

Time after HW [HH:MM]

-2:31

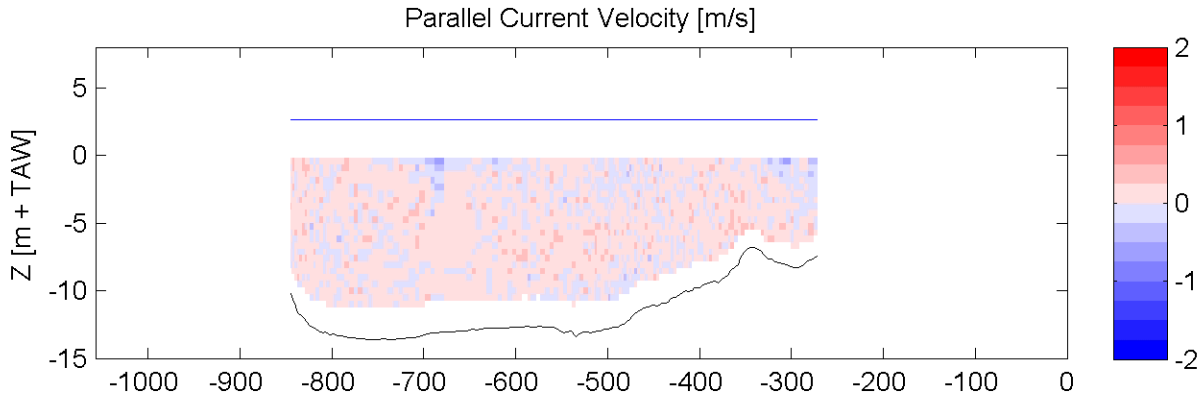
Data Processed by: IMDC

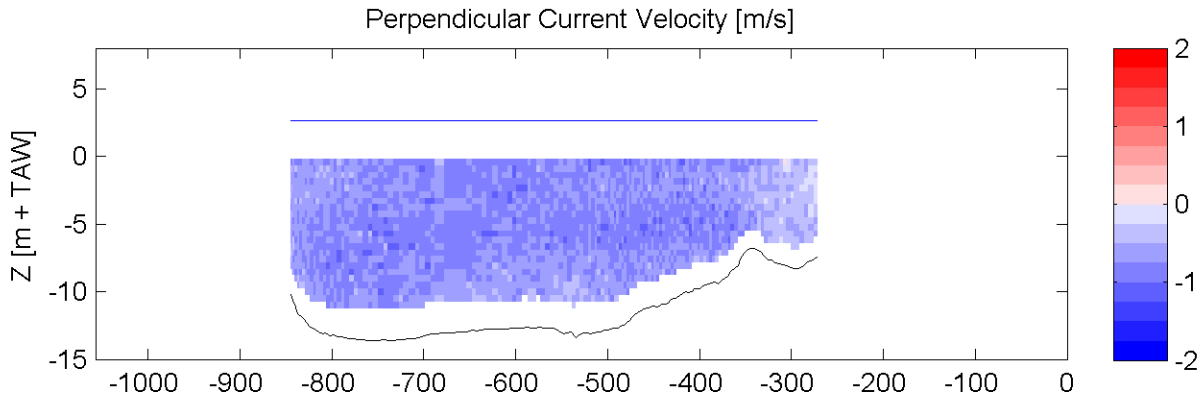
In association with :

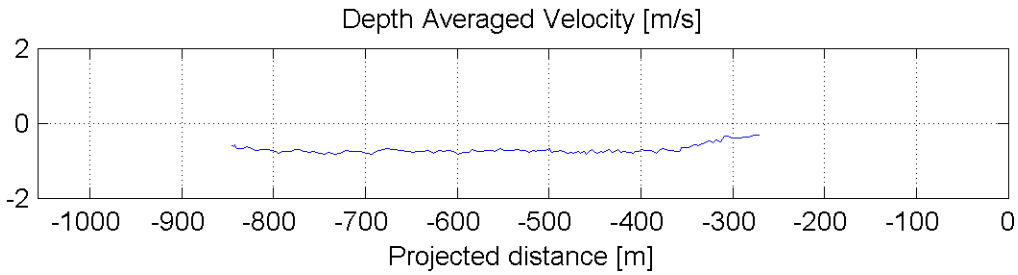
I/RA/11283/07.088/MSA

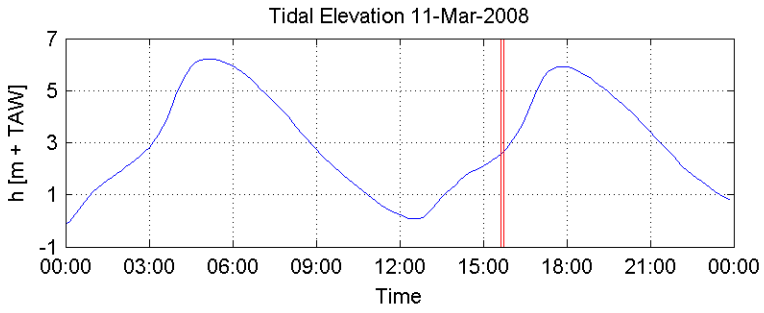
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3068ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

15:38 - 15:44

Time after HW [HH:MM]

-2:08

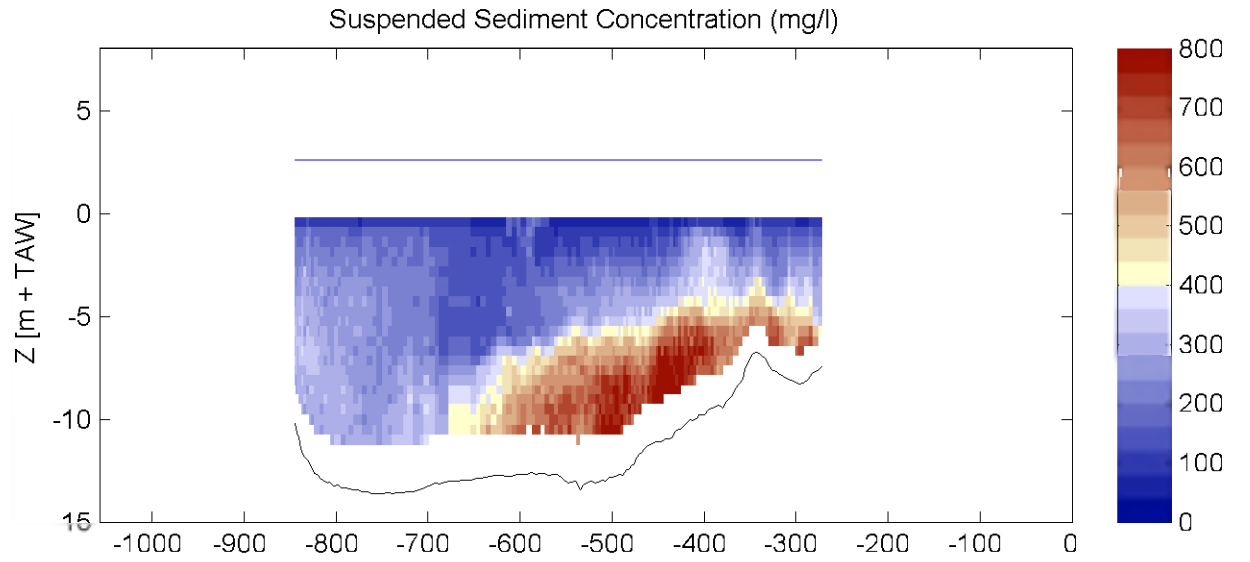
Data Processed by: IMDC

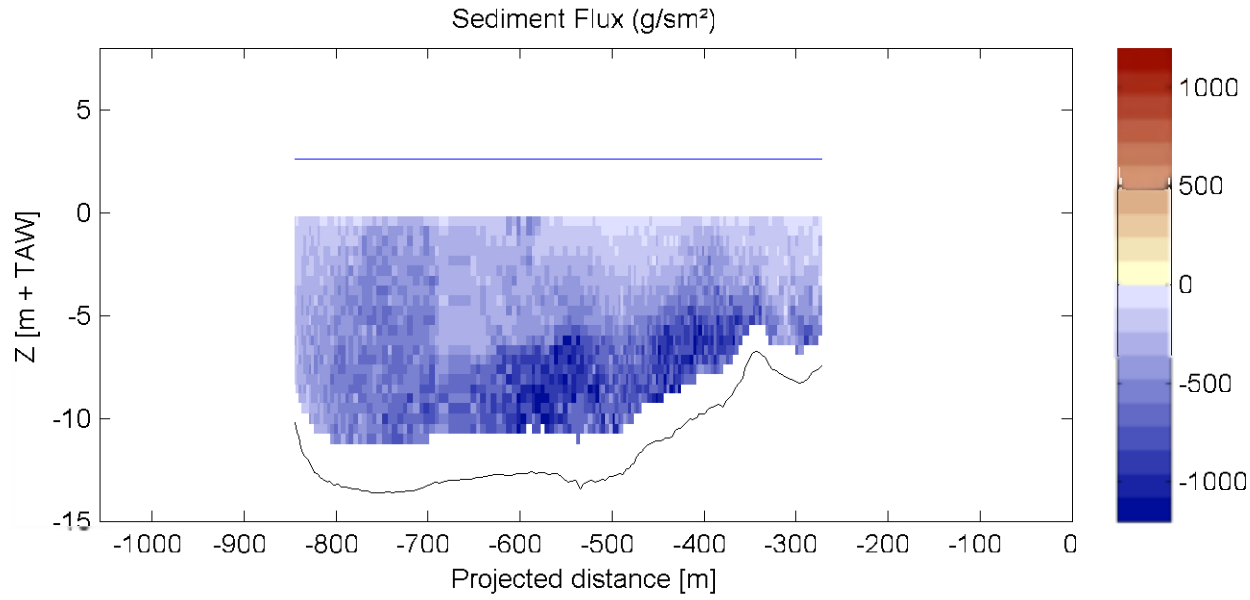
In association with : WL | delft hydraulics, GEMS International

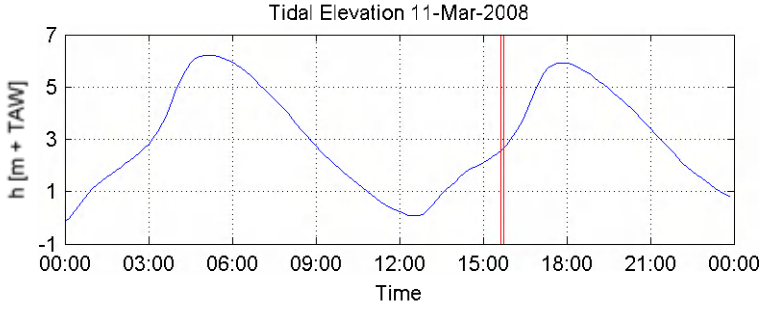
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3068ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
15:38 - 15:44

Time after HW [HH:MM]
-2:08

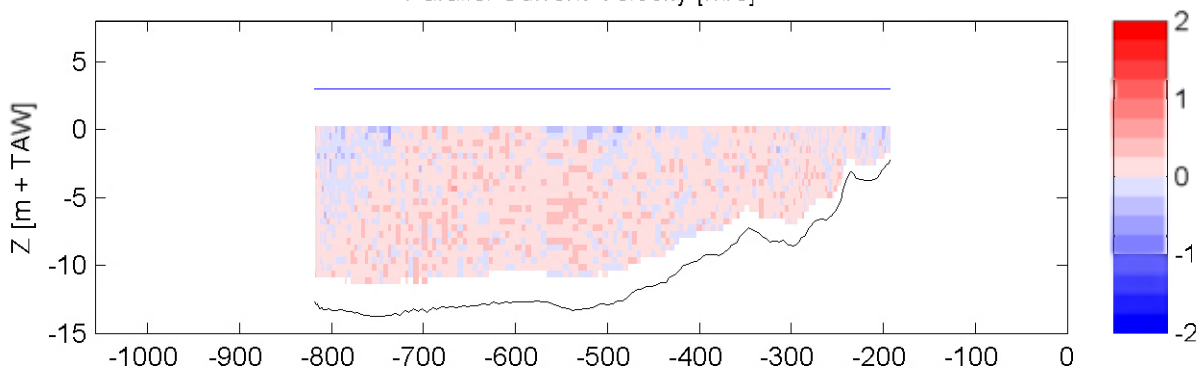
Data Processed by: IMDC
In association with :

I/RA/11283/07.088/MSA

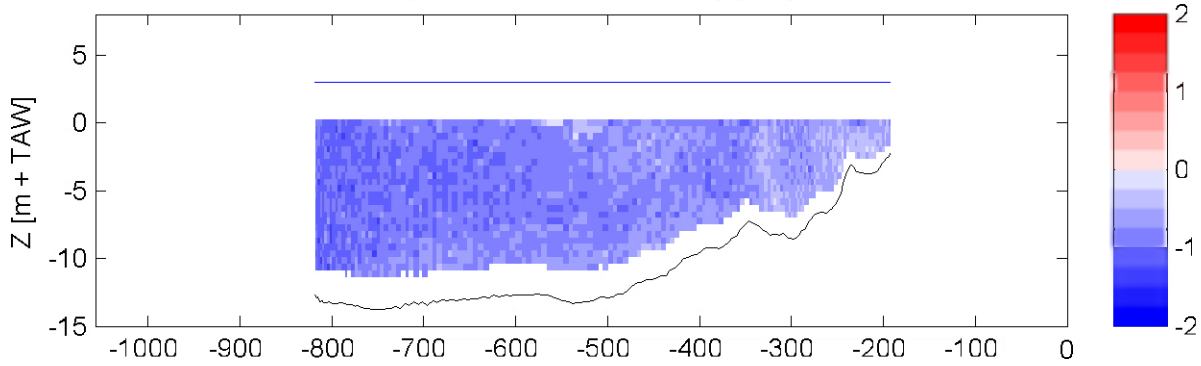
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3072ltr_sub.csv	Location: Transect I

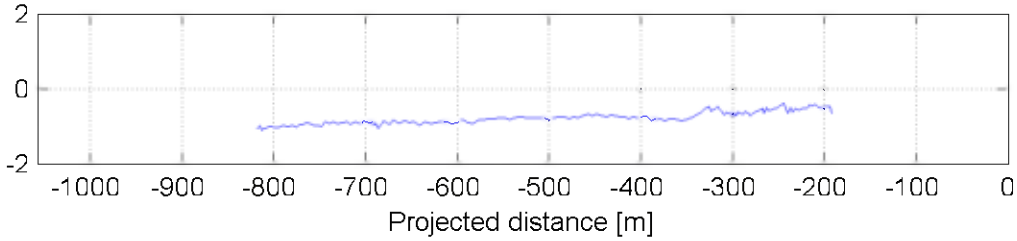
Parallel Current Velocity [m/s]

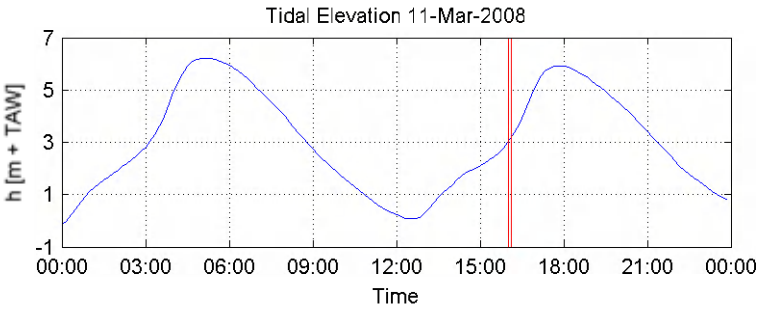


Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]





HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:00 - 16:06

Time after HW [HH:MM]
-1:46

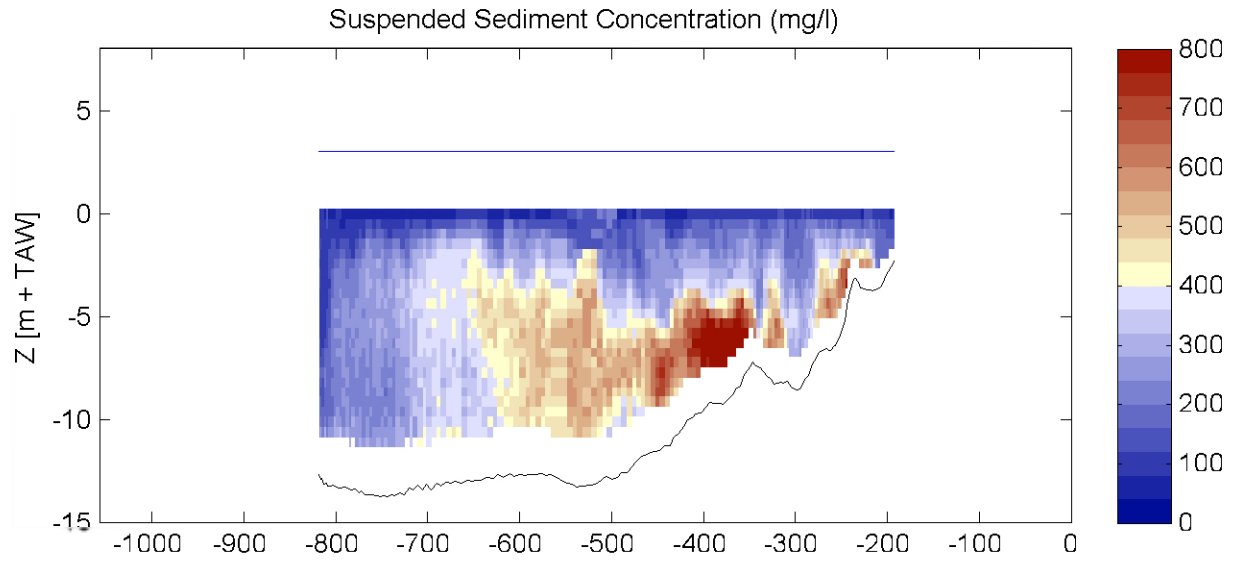
Data Processed by: IMDC

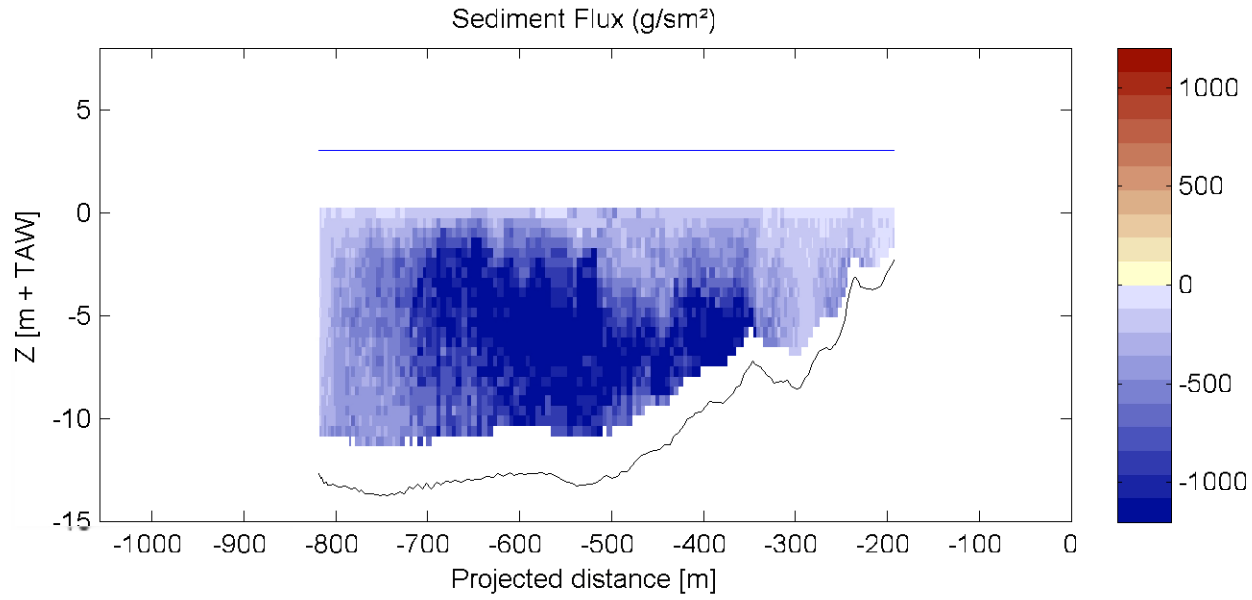
In association with :

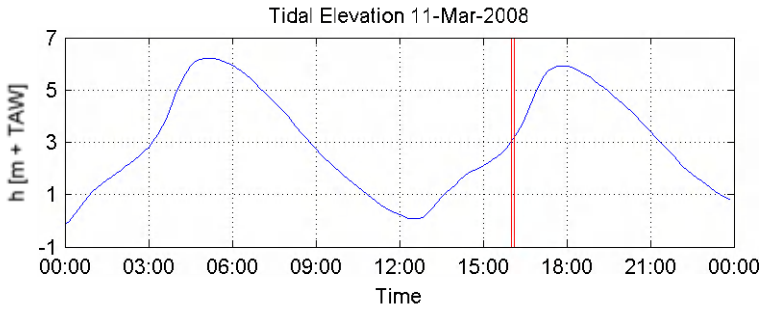
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3072ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:00 - 16:06

Time after HW [HH:MM]
-1:46

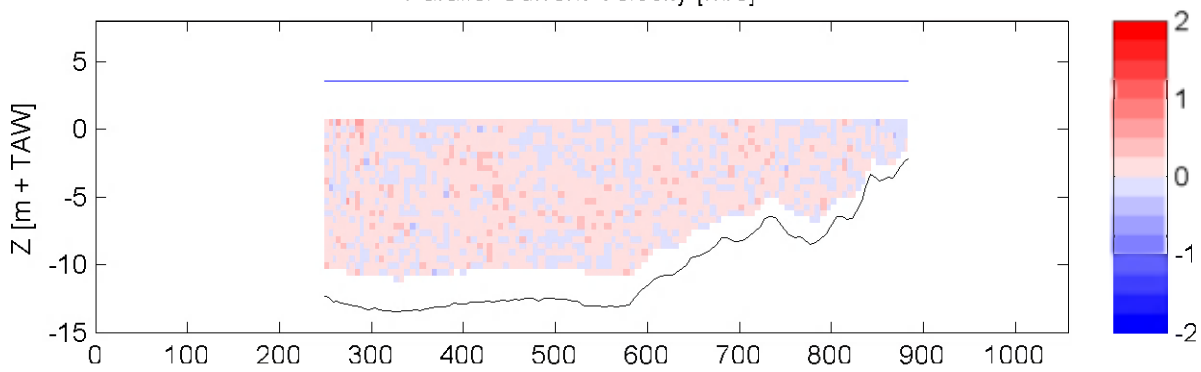
Data Processed by: IMDC
In association with :

I/RA/11283/07.088/MSA

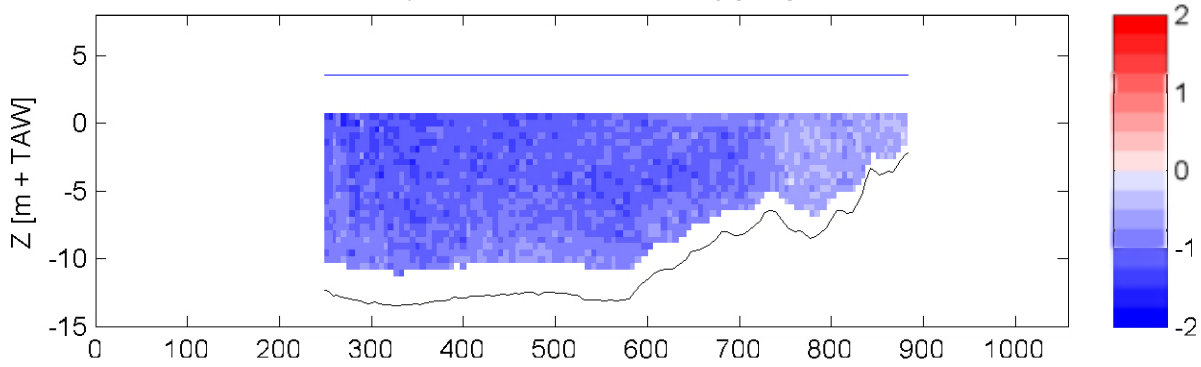
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3074ltl_sub.csv	Location: Transect I

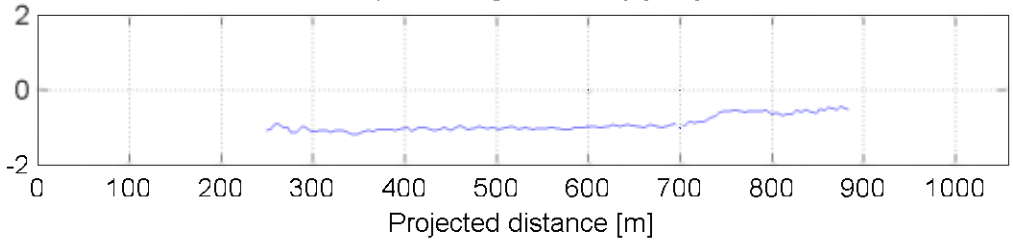
Parallel Current Velocity [m/s]



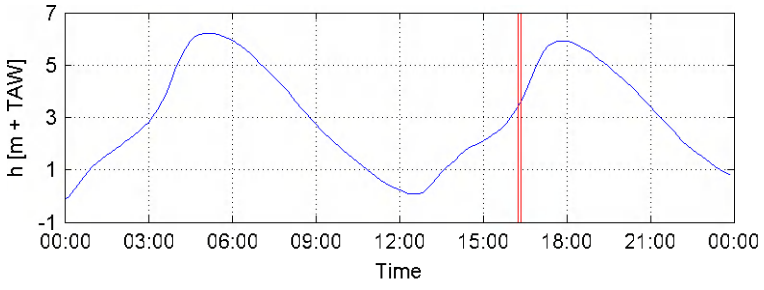
Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]



Tidal Elevation 11-Mar-2008



HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:16 - 16:20

Time after HW [HH:MM]
-1:31

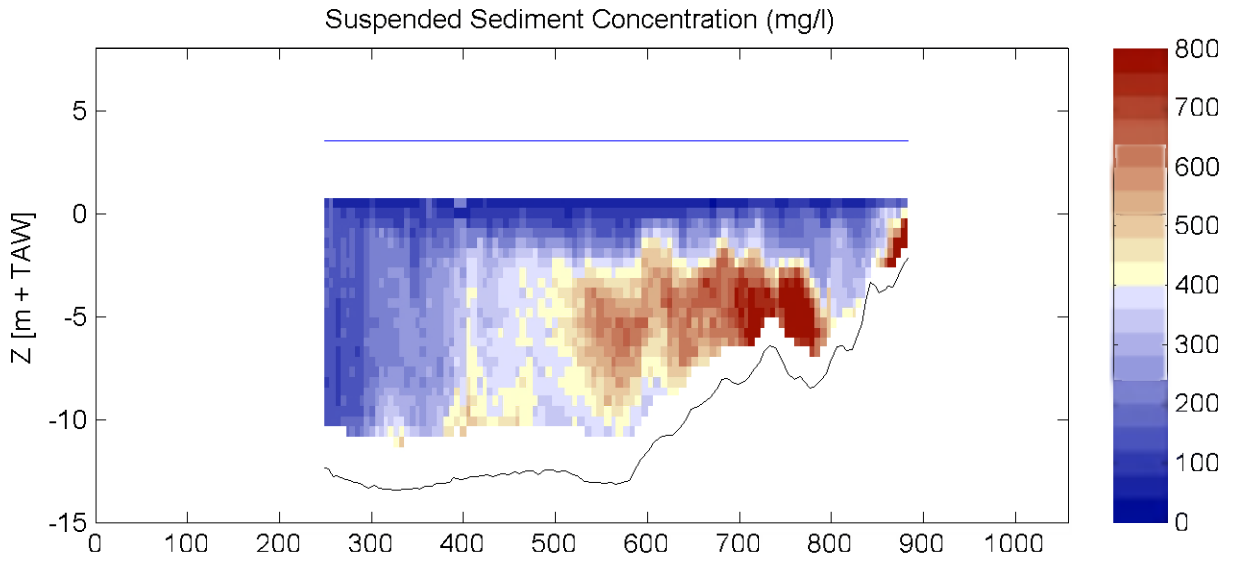
Data Processed by: IMDC

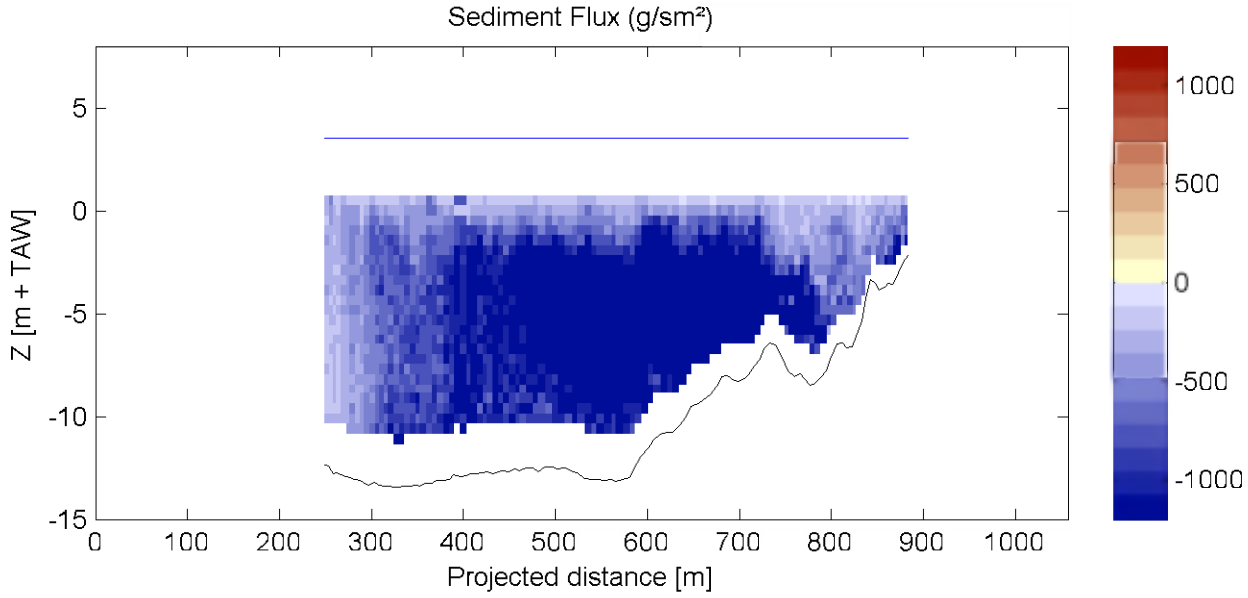
In association with :

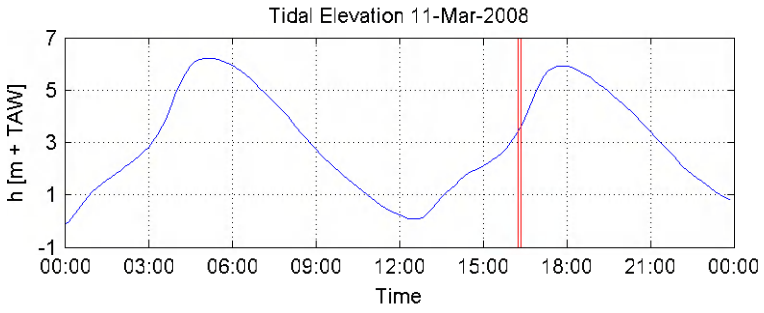
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3074ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:16 - 16:20

Time after HW [HH:MM]
-1:31

Data Processed by: IMDC

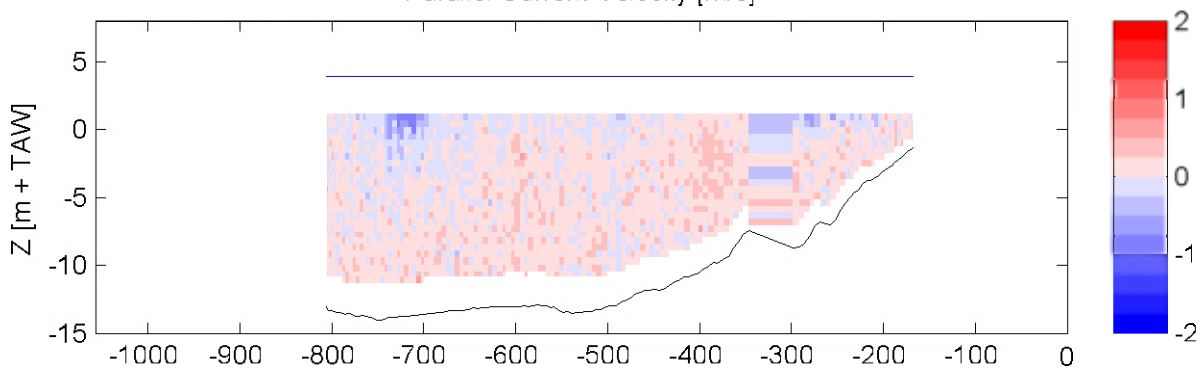
In association with :

I/RA/11283/07.088/MSA

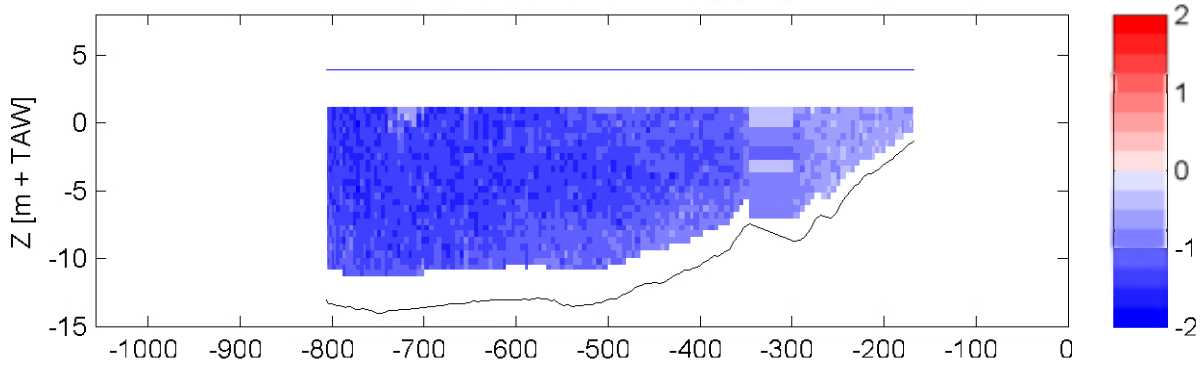
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3076ltr_sub.csv	Location: Transect I

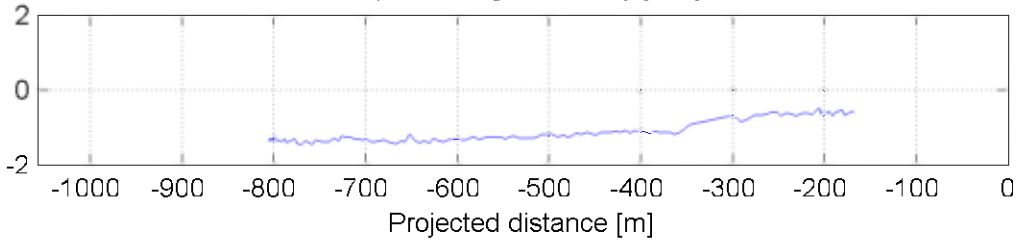
Parallel Current Velocity [m/s]

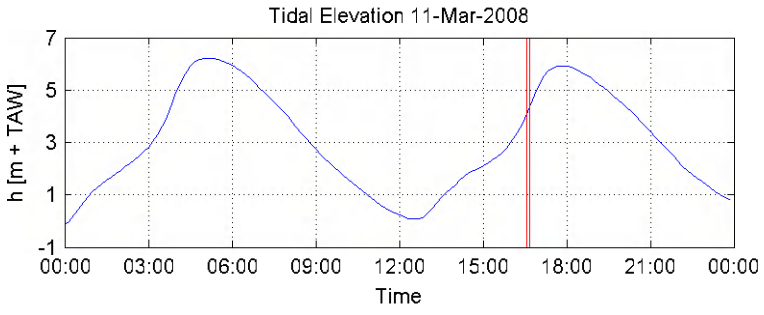


Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]





HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:34 - 16:40

Time after HW [HH:MM]
-1:12

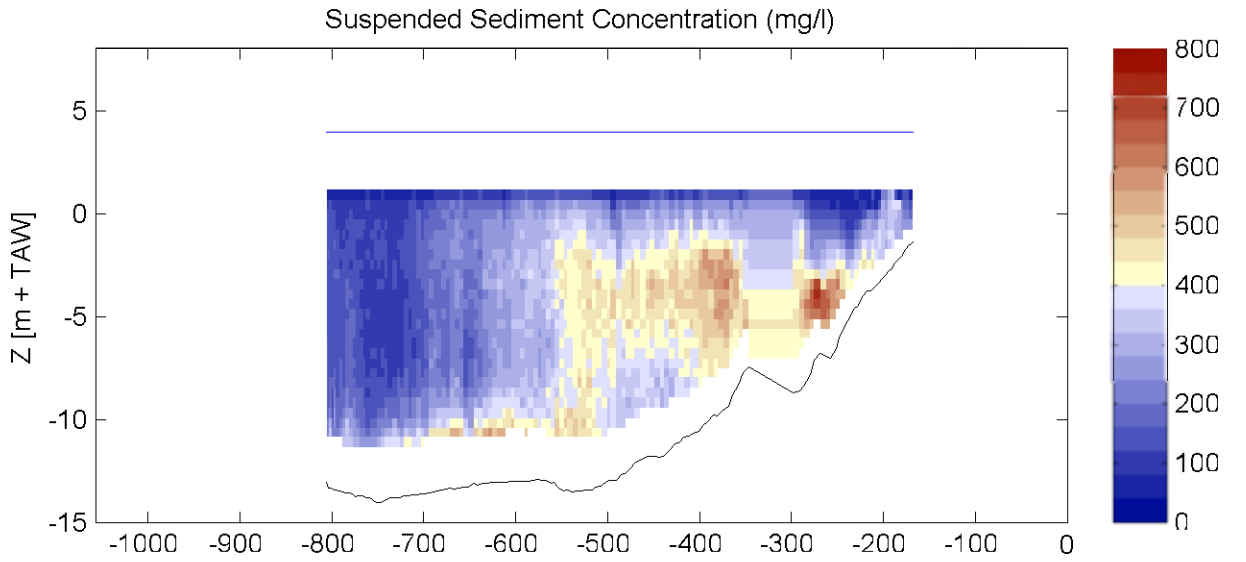
Data Processed by: IMDC

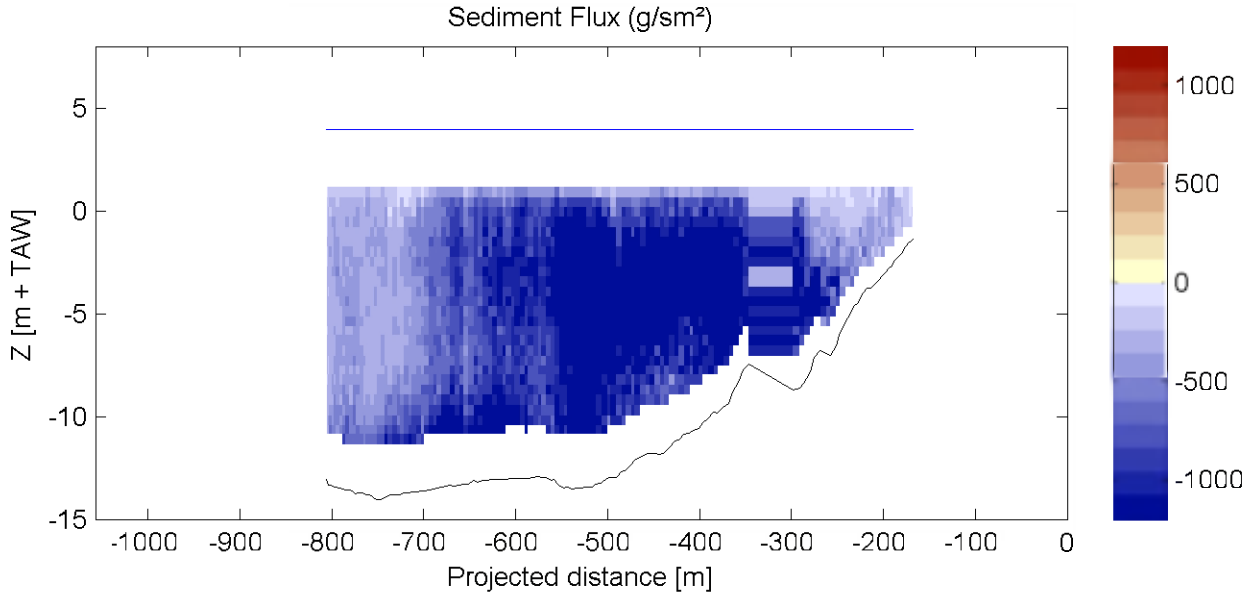
In association with :

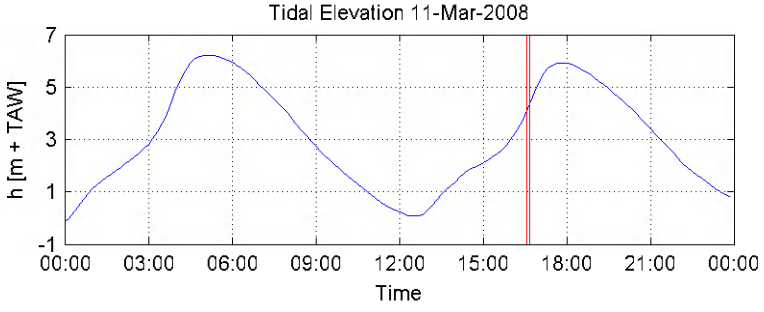
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3076ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:34 - 16:40

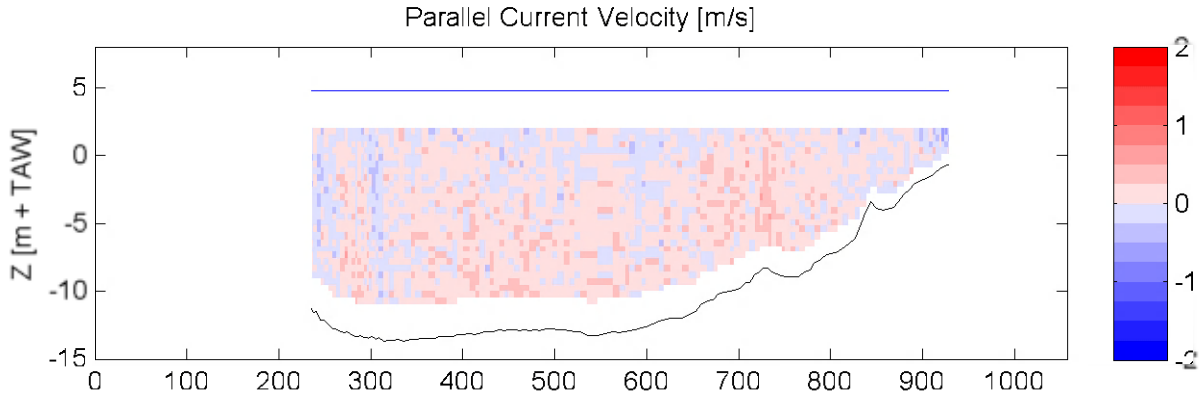
Time after HW [HH:MM]
-1:12

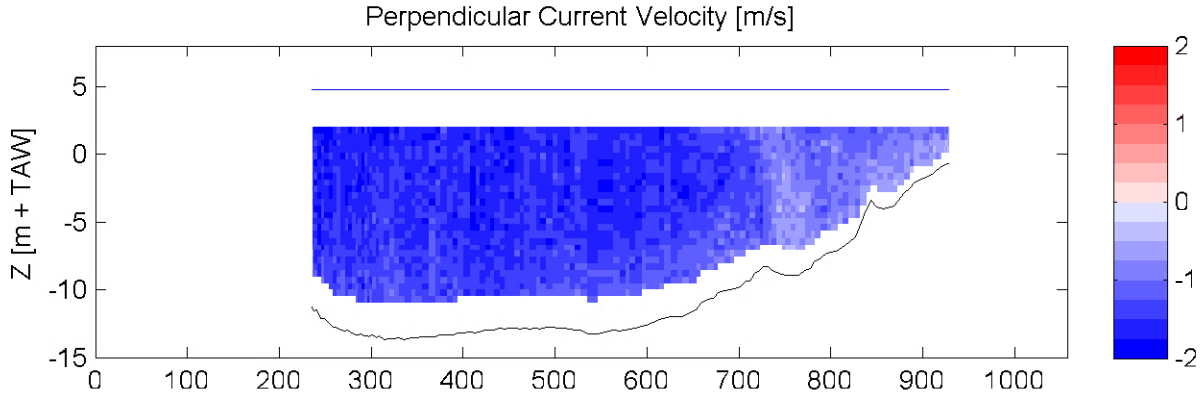
Data Processed by: IMDC
In association with :

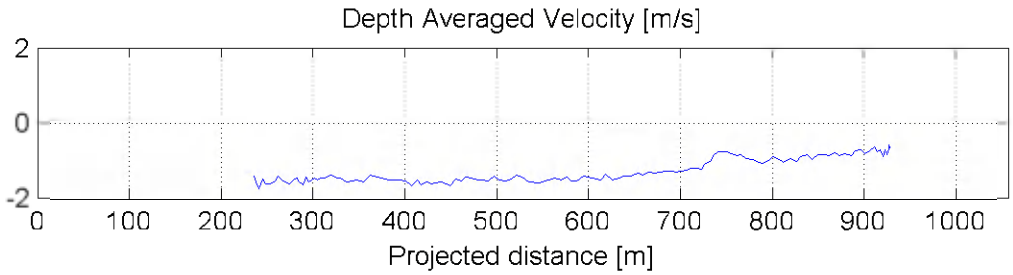
I/RA/11283/07.088/MSA

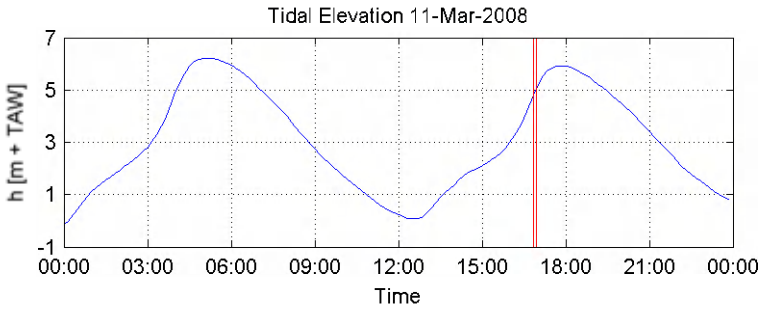
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3078ltl_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
16:50 - 16:56

Time after HW [HH:MM]
-0:56

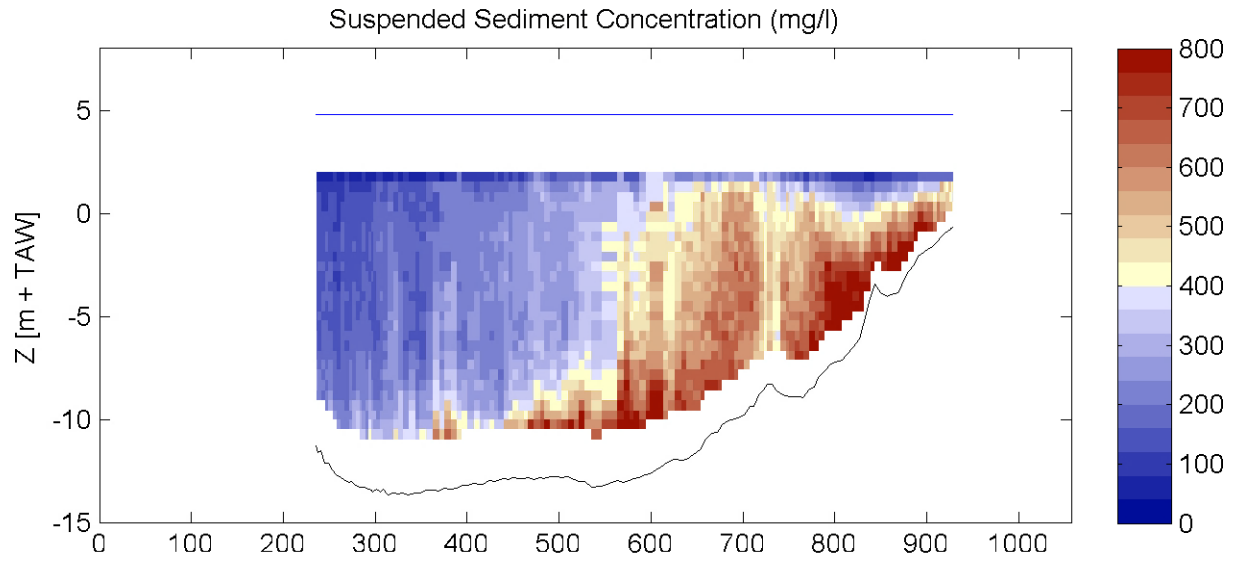
Data Processed by: IMDC

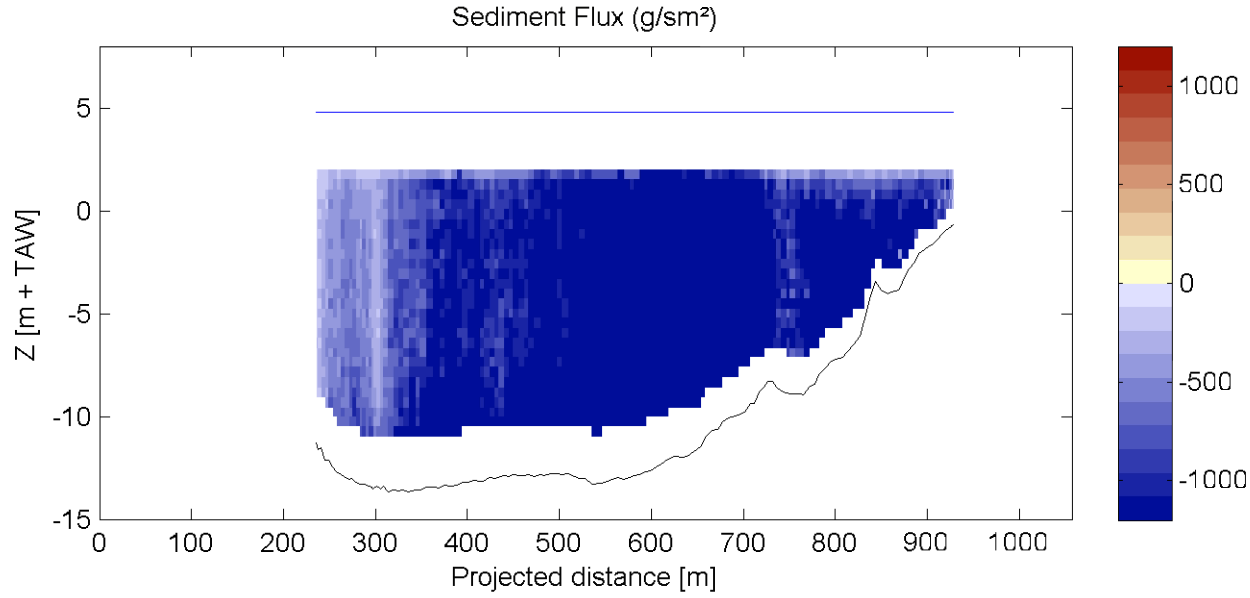
In association with : WL | delft hydraulics, GEMS

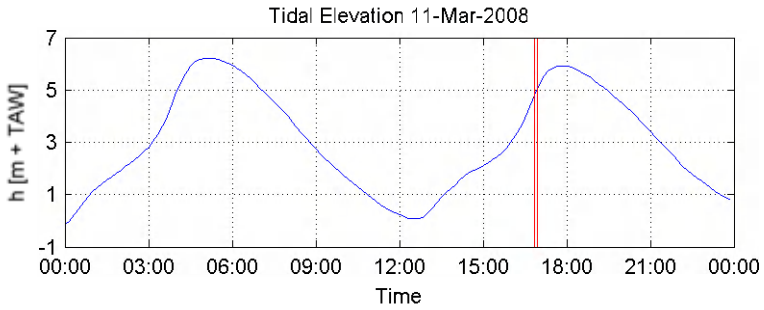
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3078ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

16:50 - 16:56

Time after HW [HH:MM]

-0:56

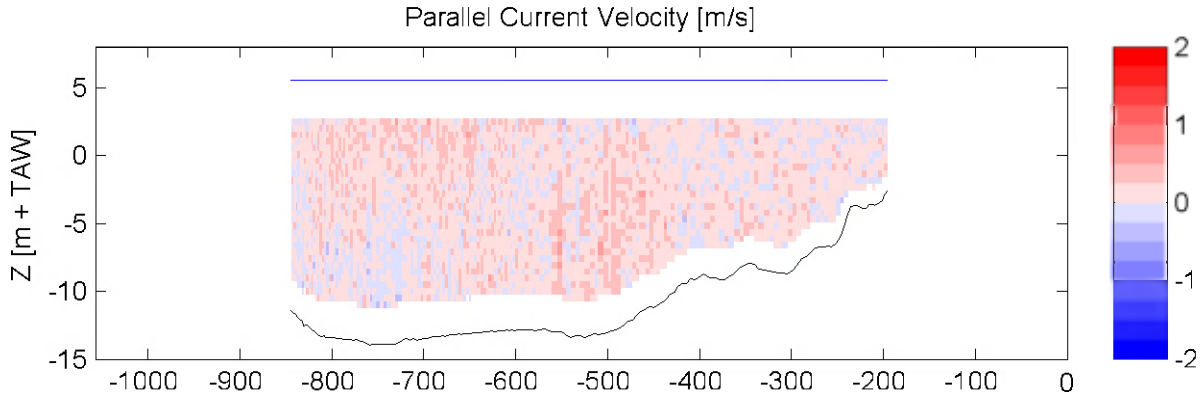
Data Processed by: IMDC

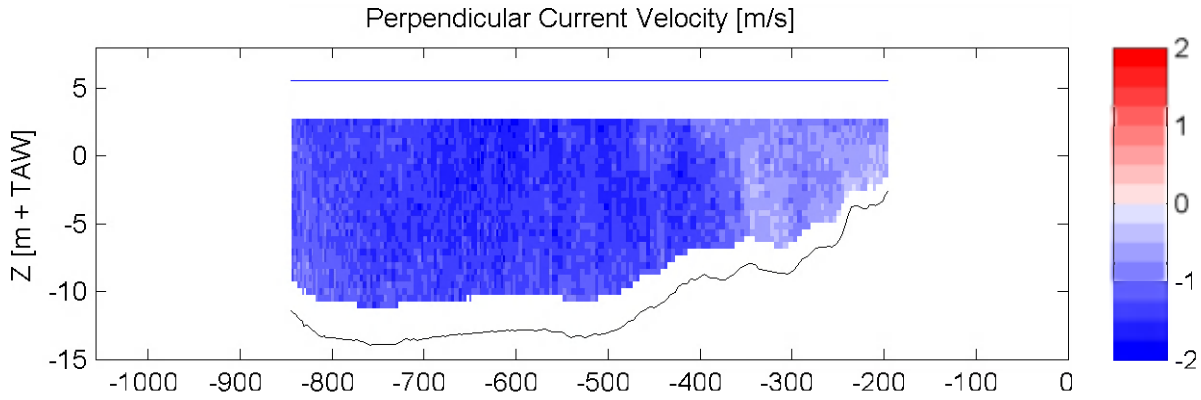
In association with :

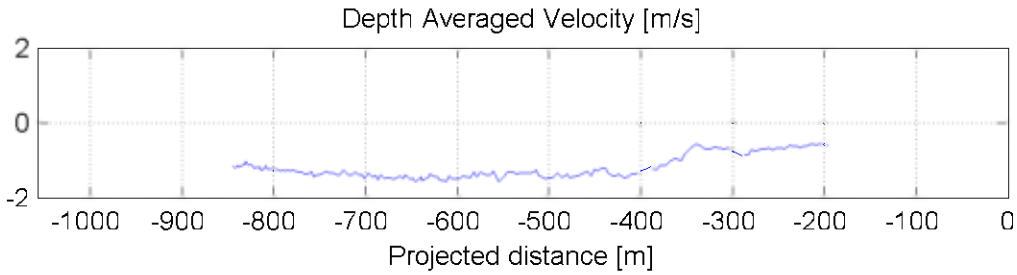
I/RA/11283/07.088/MSA

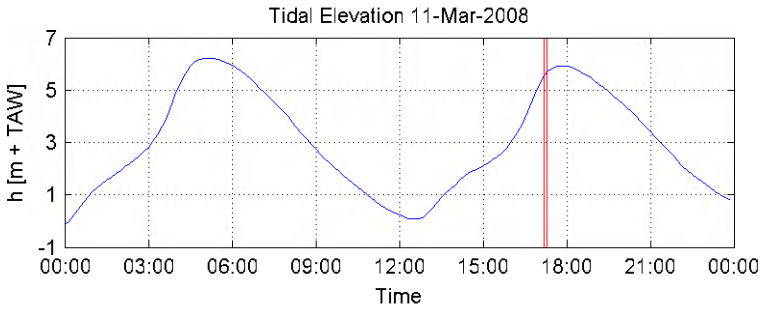
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3080ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
17:10 - 17:18

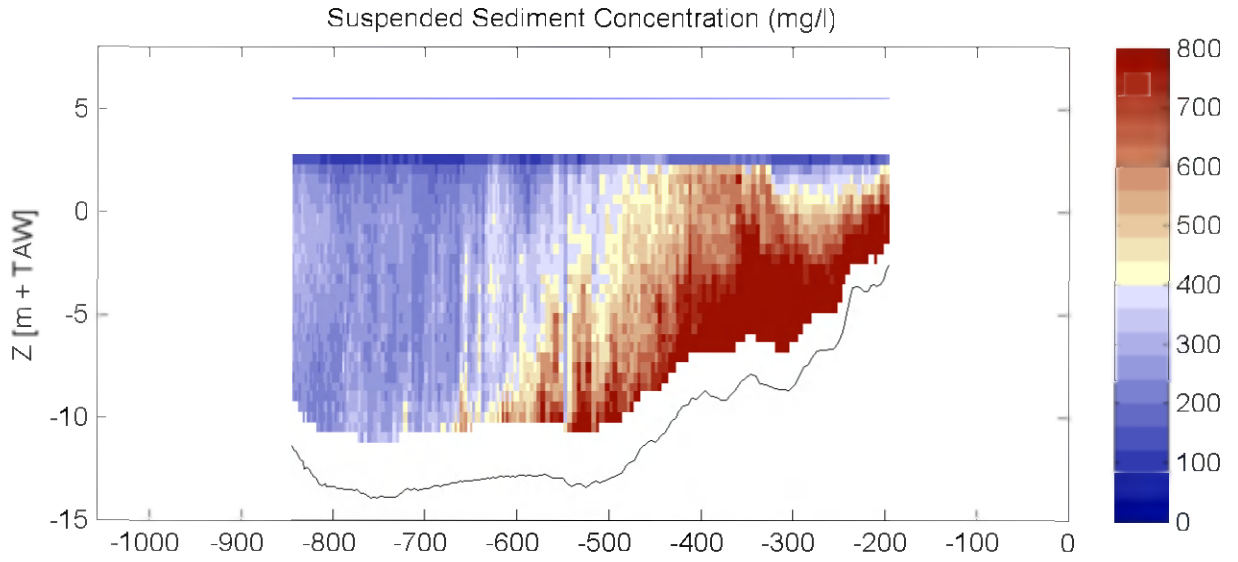
Time after HW [HH:MM]
-0:35

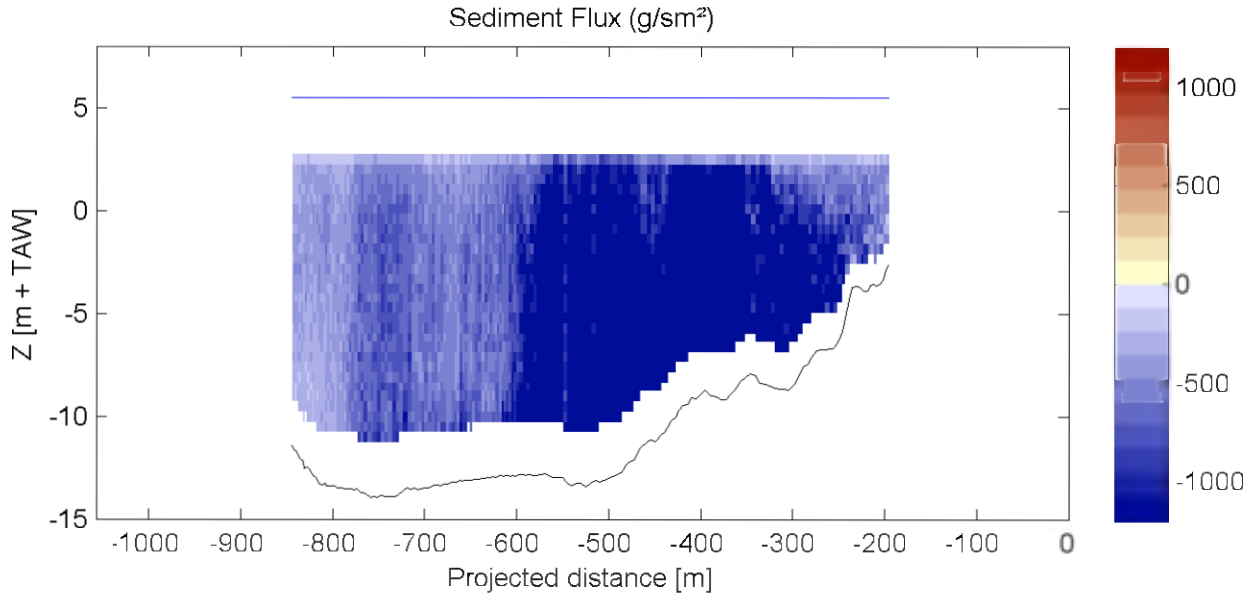
Data Processed by: IMDC
In association with :

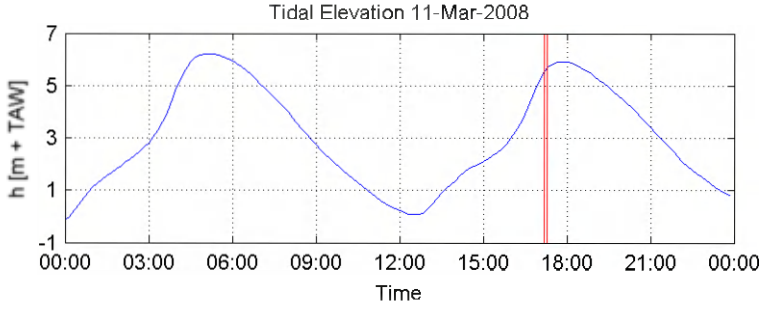
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3080ltr_sub.csv	Location: Transect I







HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

17:10 - 17:18

Time after HW [HH:MM]

-0:35

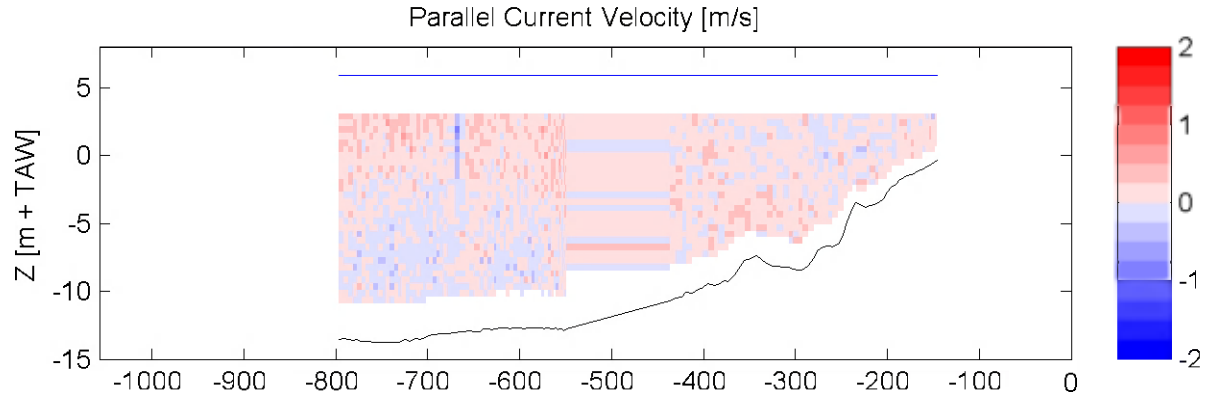
Data Processed by: IMDC

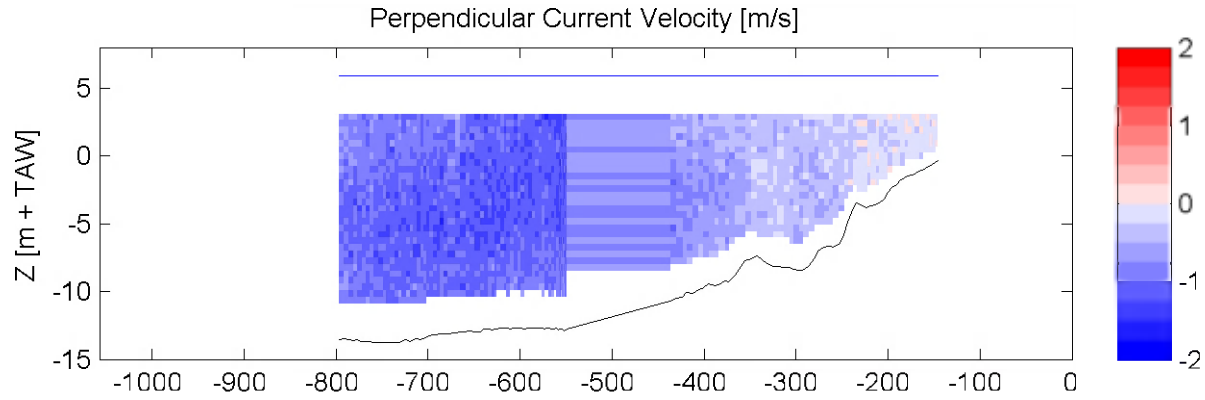
In association with :

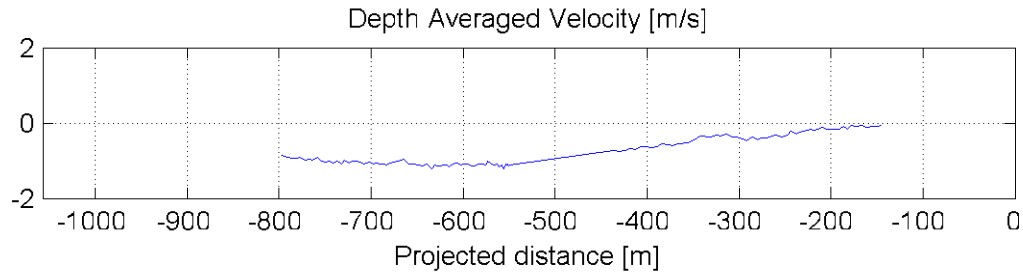
I/RA/11283/07.088/MSA

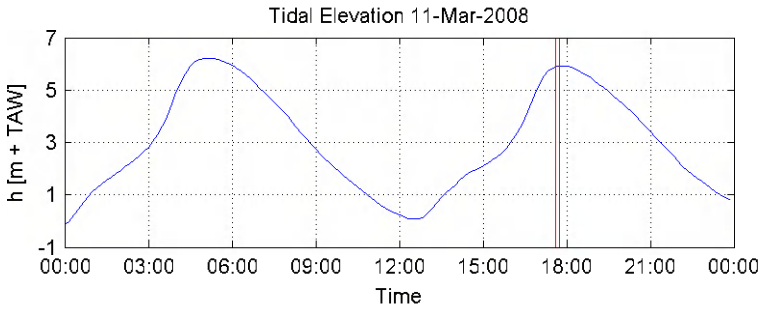
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3084ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
17:37 - 17:44

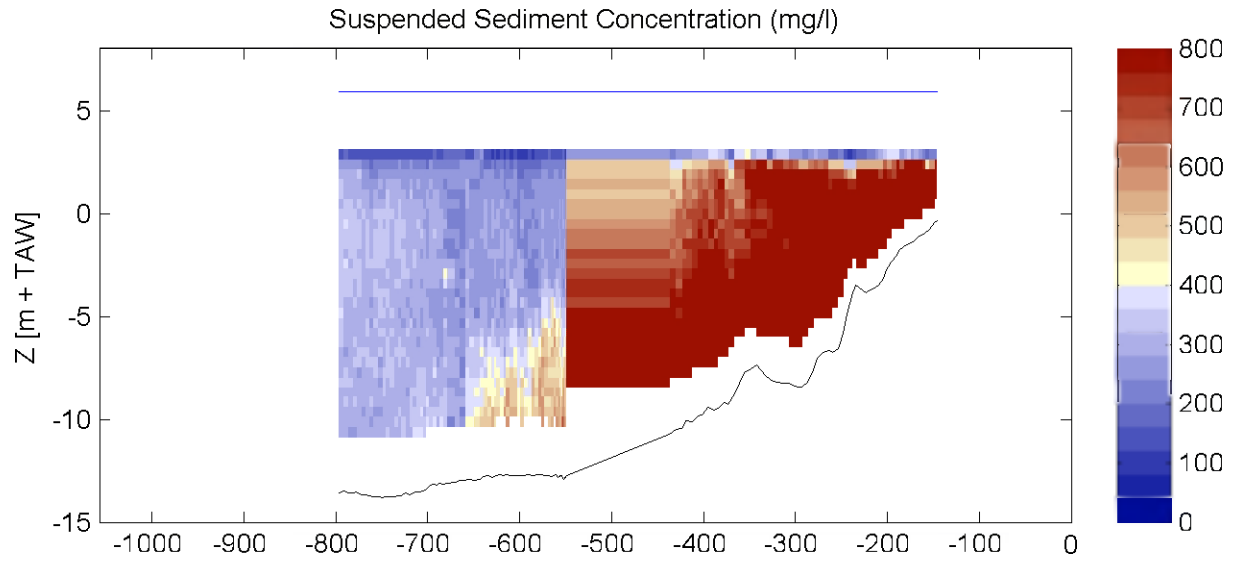
Time after HW [HH:MM]
-0:09

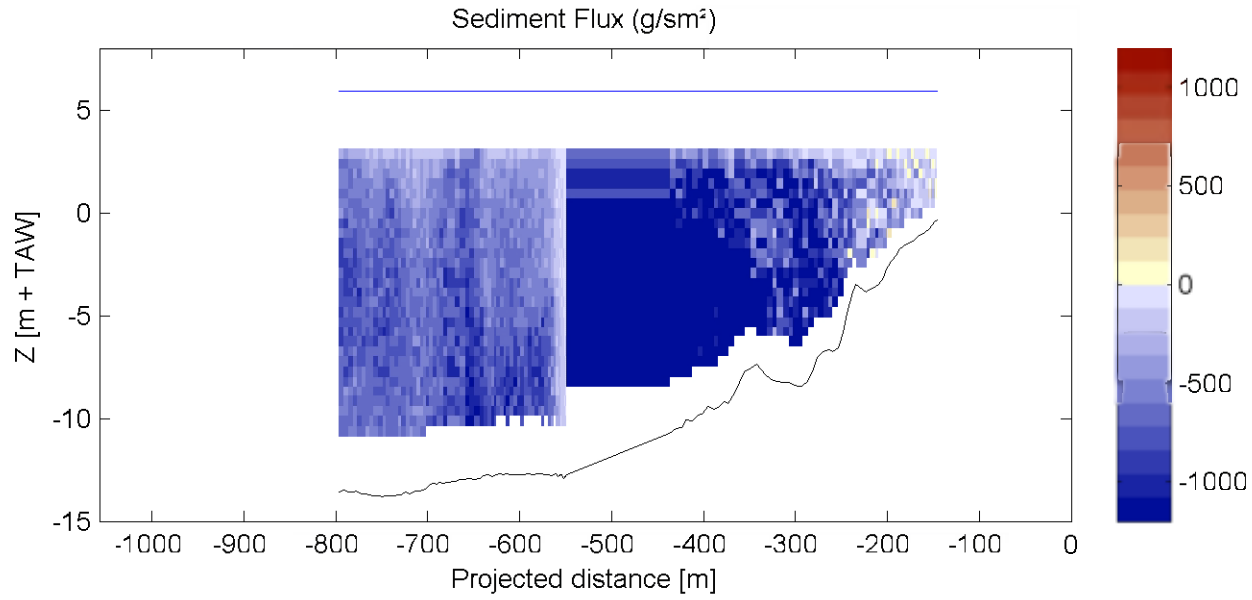
Data Processed by: IMDC
In association with :

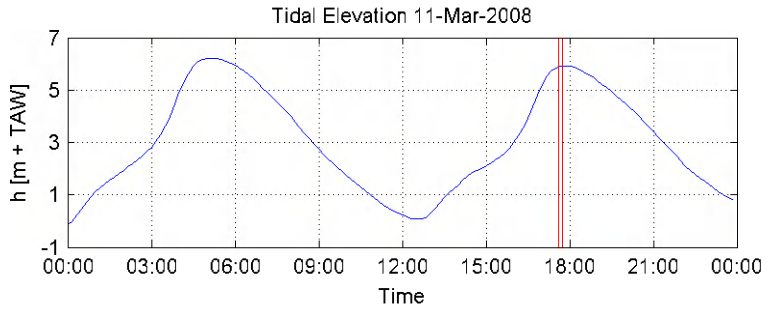
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3084ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
17:37 - 17:44

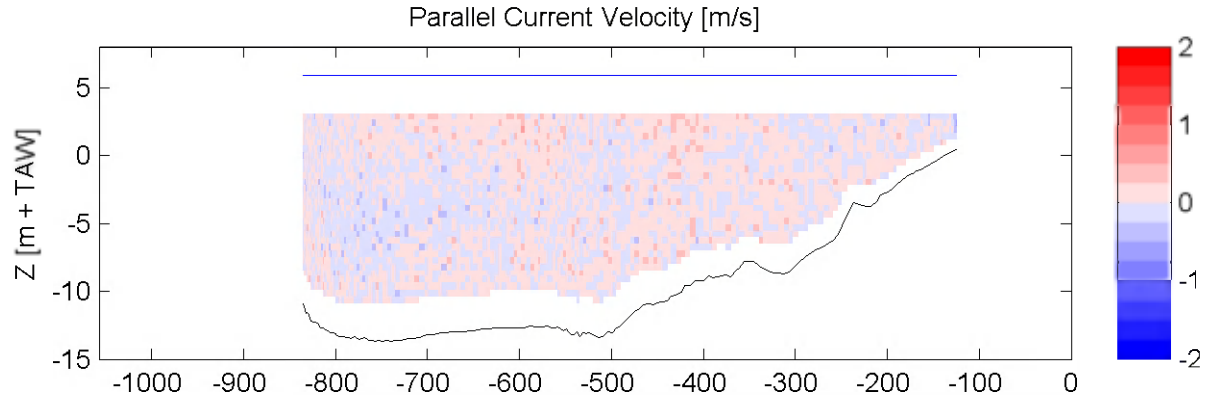
Time after HW [HH:MM]
-0:09

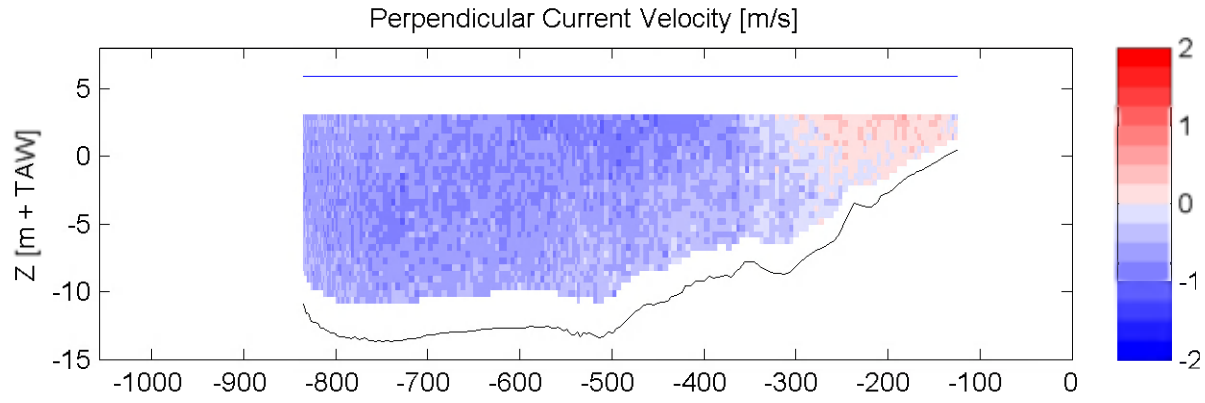
Data Processed by: IMDC
In association with :

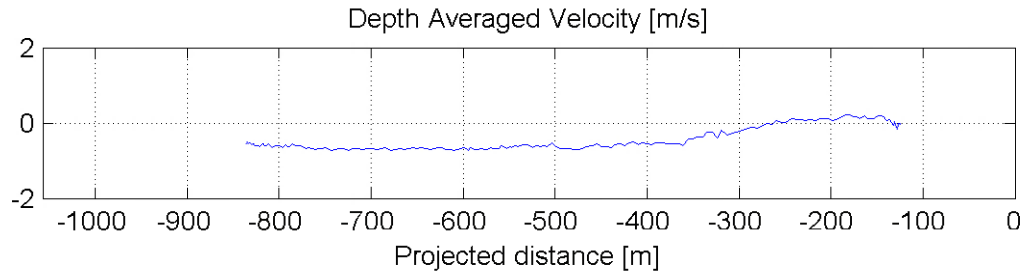
I/RA/11283/07.088/MSA

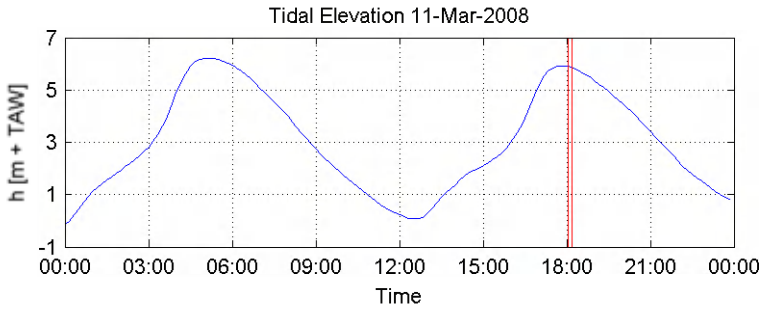
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3088ltr_sub.csv	Location: Transect I









HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

18:02 - 18:10

Time after HW [HH:MM]

0:16

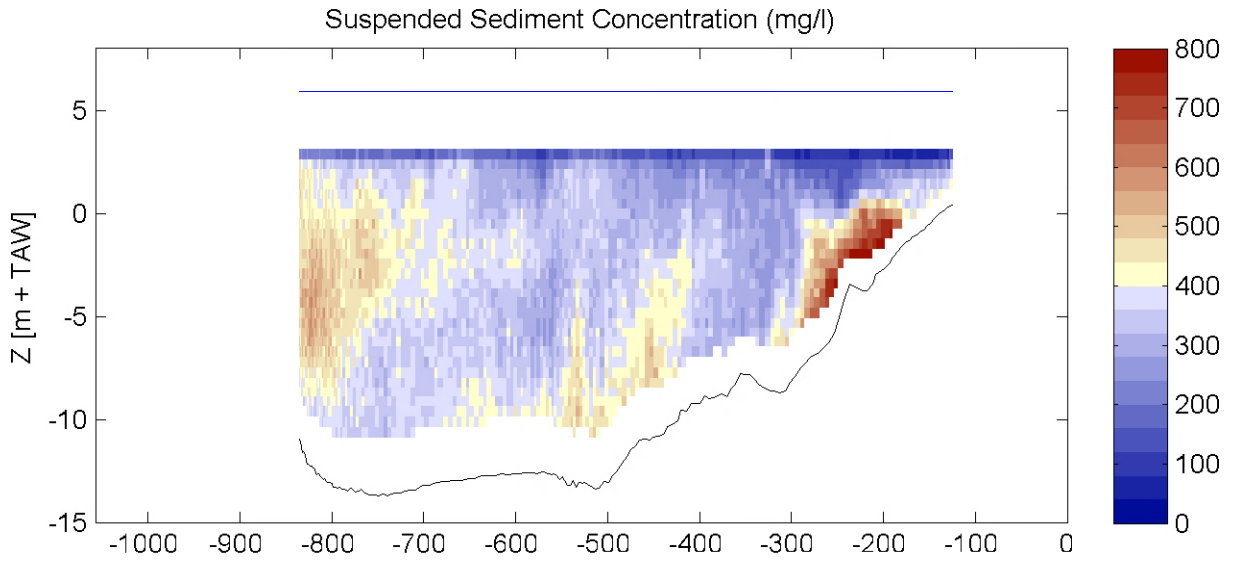
Data Processed by: IMDC

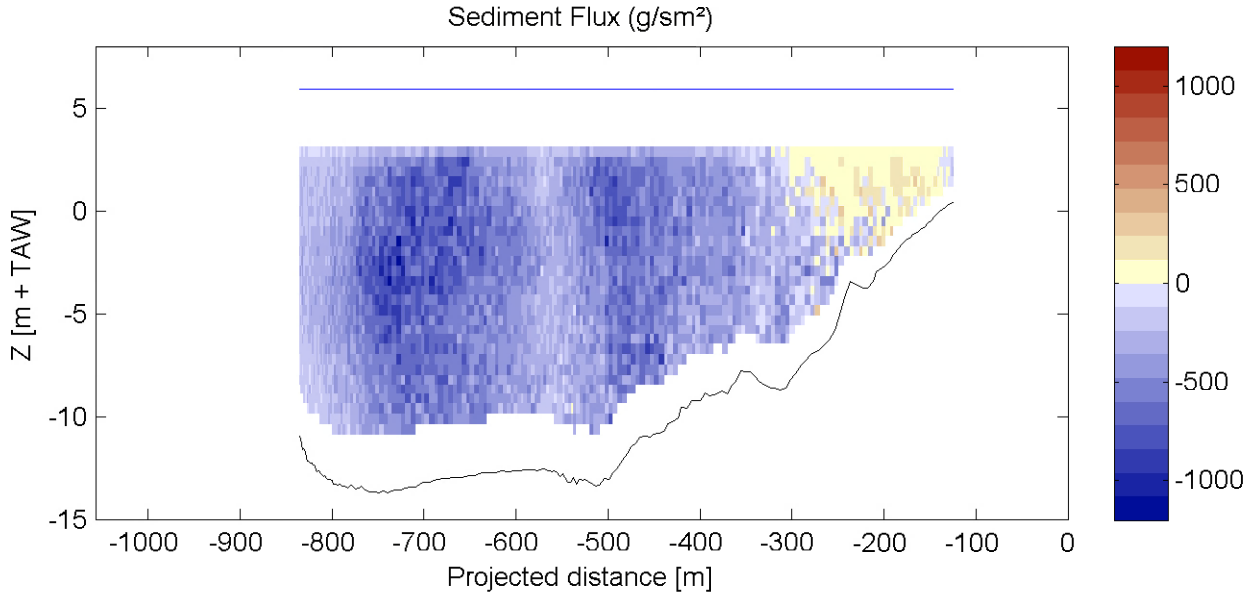
In association with :

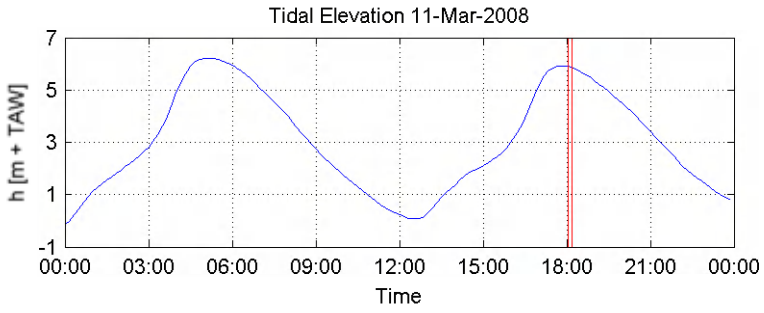
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3088ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

18:02 - 18:10

Time after HW [HH:MM]

0:16

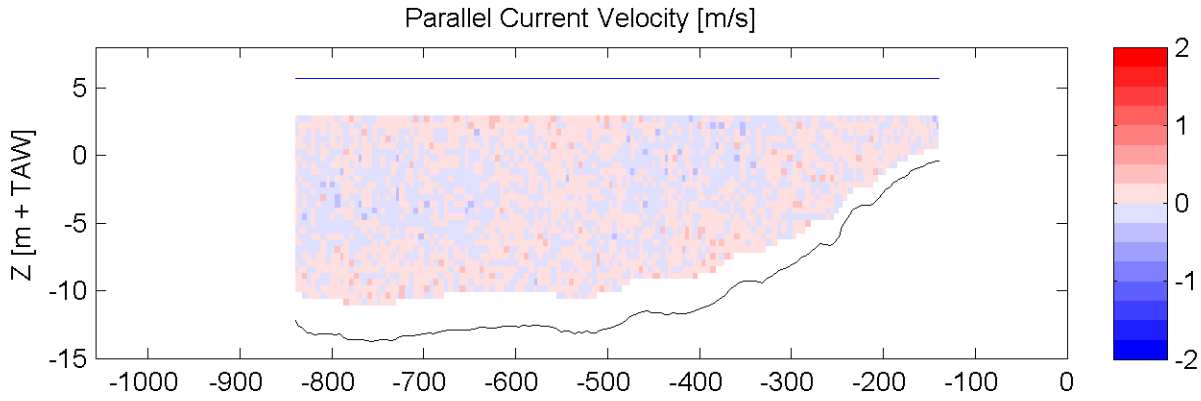
Data Processed by: IMDC

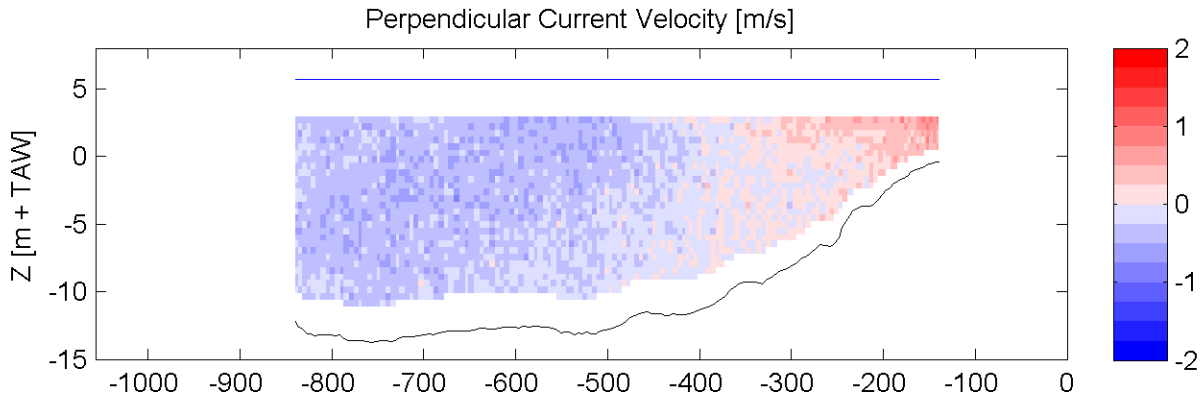
In association with :

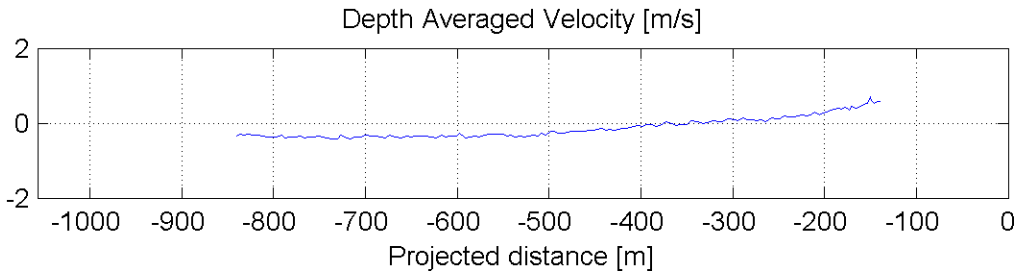
I/RA/11283/07.088/MSA

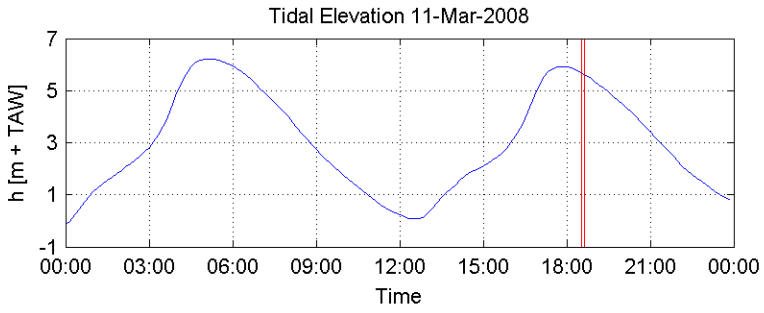
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3092ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

18:32 - 18:39

Time after HW [HH:MM]

0:45

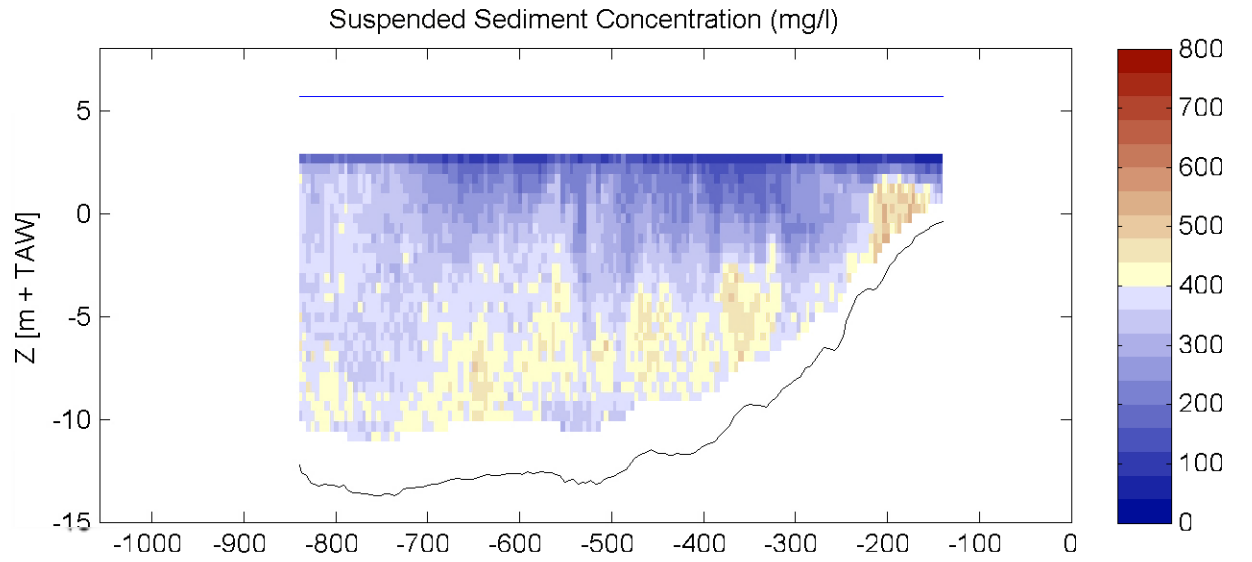
Data Processed by: IMDC

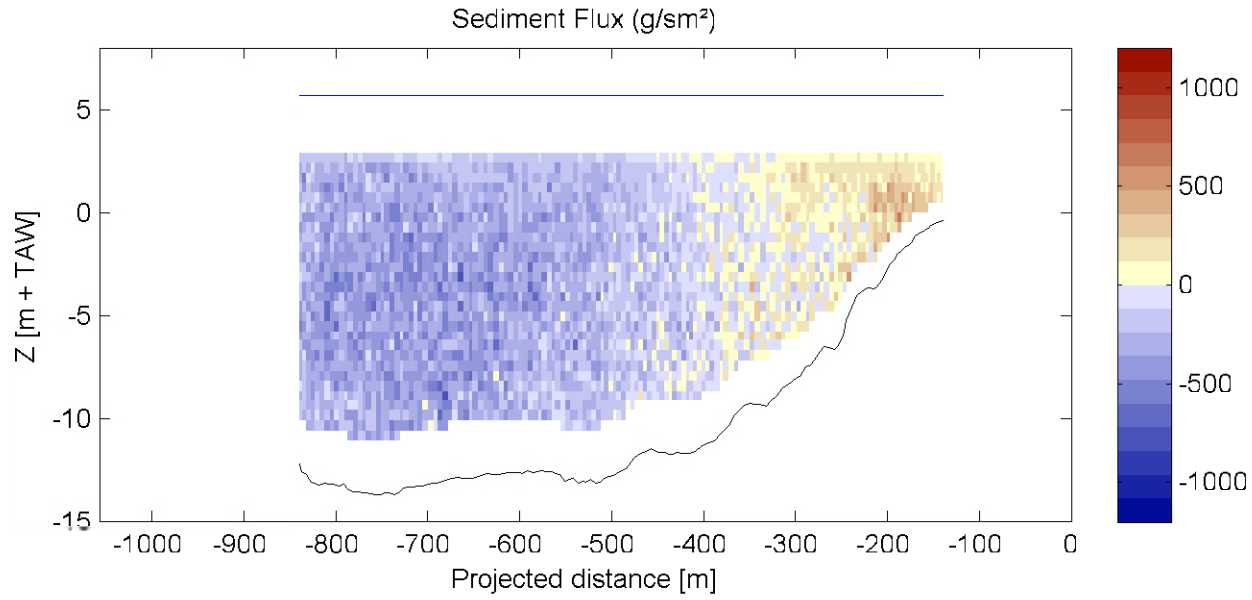
In association with : WL | delft hydraulics, GEMS International

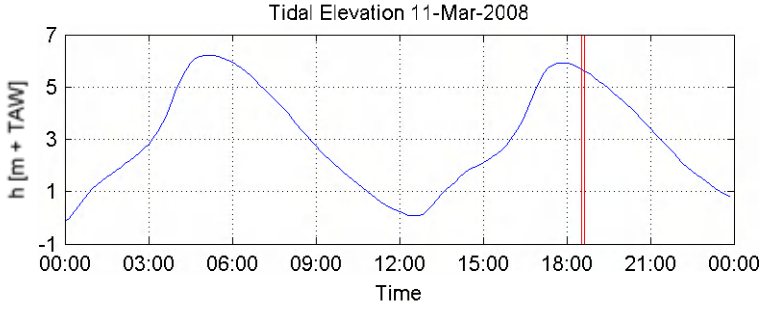
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3092ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
18:32 - 18:39

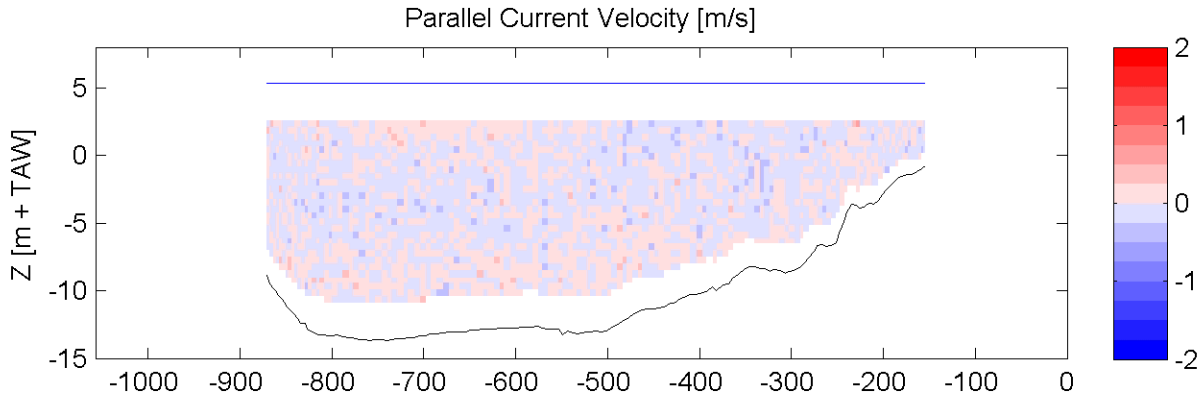
Time after HW [HH:MM]
0:45

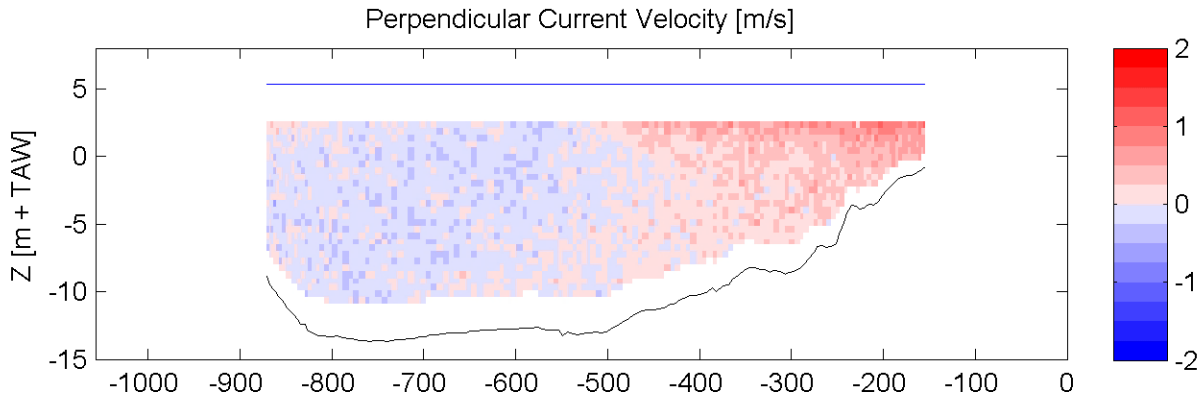
Data Processed by: IMDC
In association with : WL | Delft Hydraulics, GEMS

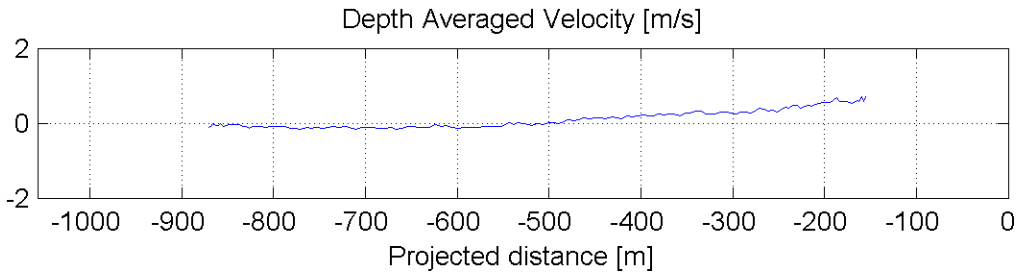
I/RA/11283/07.088/MSA

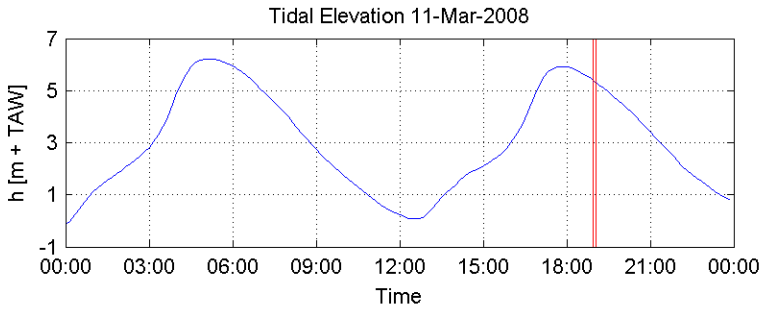
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3096ltr_sub.csv	Location: Transect I









HW/LW: 05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

18:56 - 19:02

Time after HW [HH:MM]

1:09

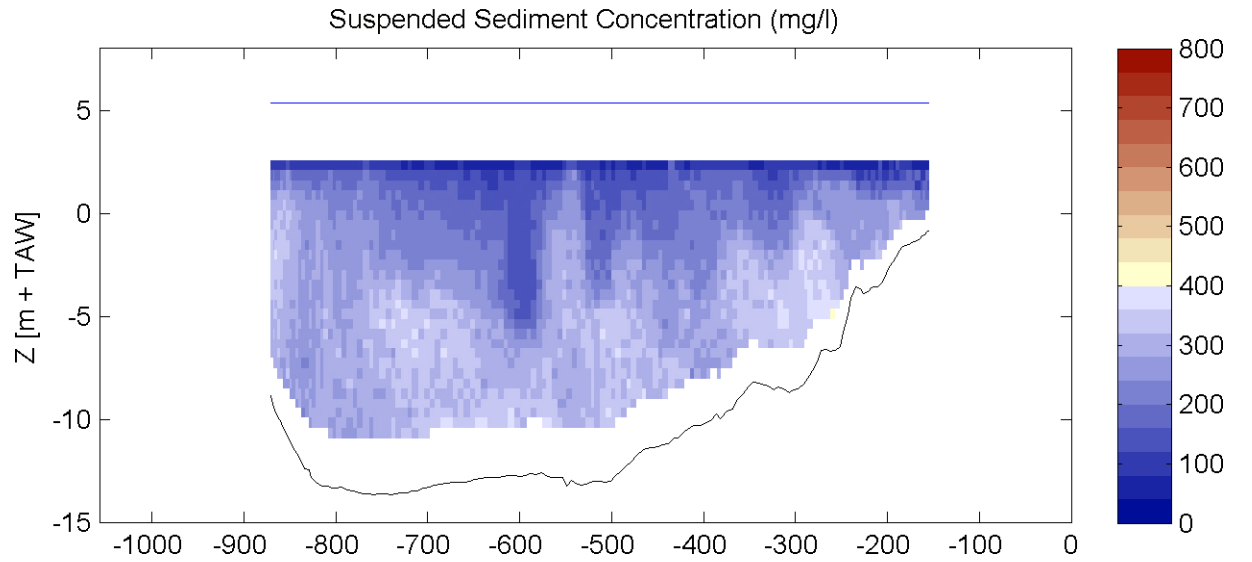
Data Processed by: IMDC

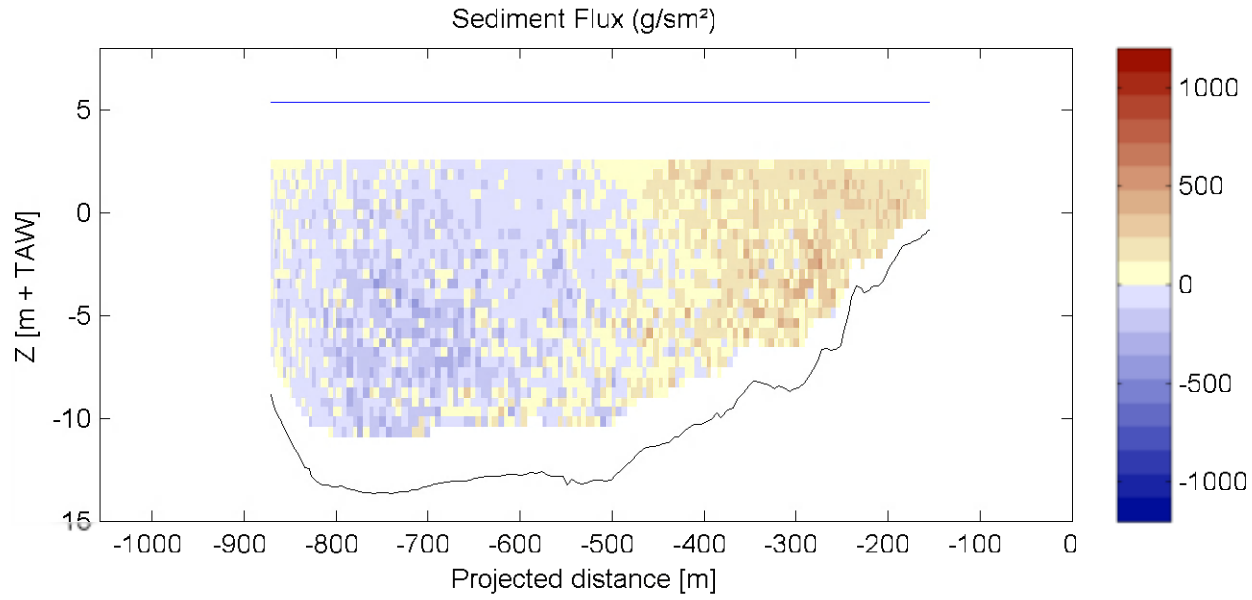
In association with : WL | delft hydraulics, GEMS International

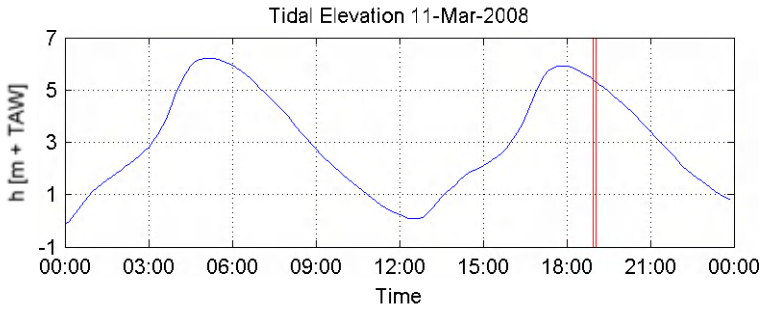
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3096ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
18:56 - 19:02

Time after HW [HH:MM]
1:09

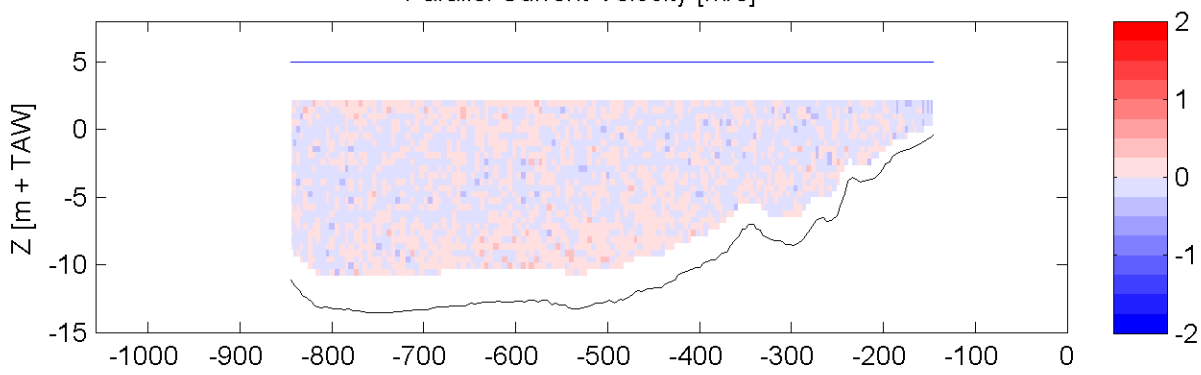
Data Processed by: IMDC
In association with :

I/RA/11283/07.088/MSA

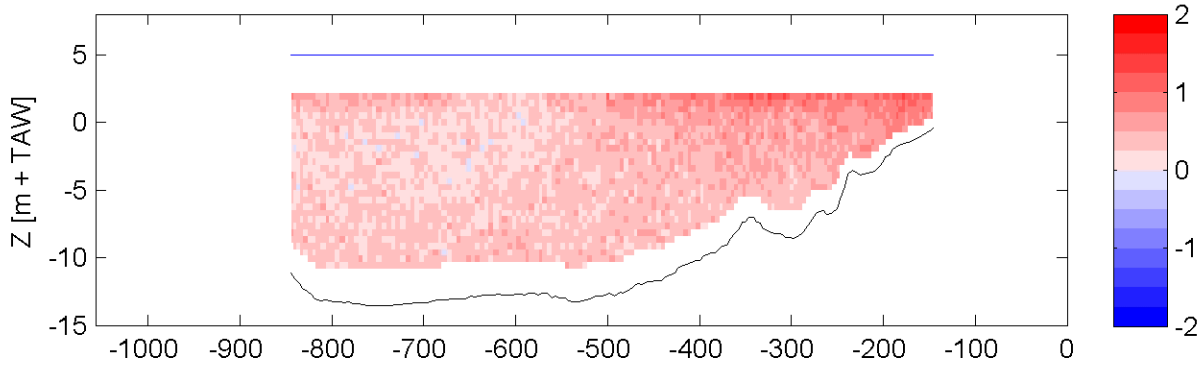
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3100ltr_sub.csv	Location: Transect I

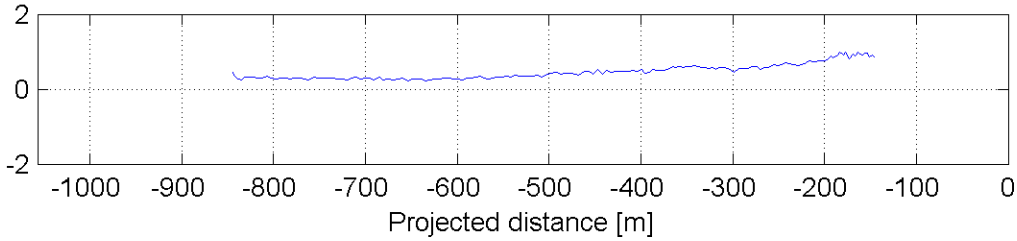
Parallel Current Velocity [m/s]



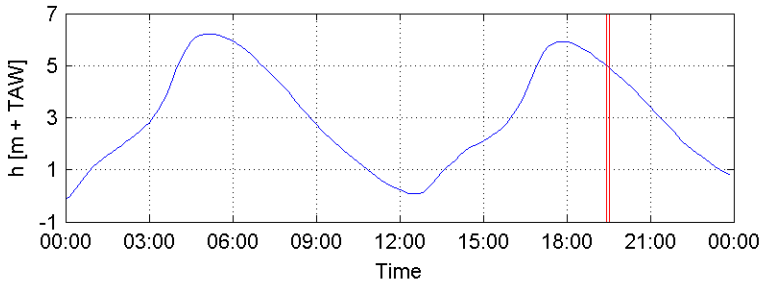
Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]



Tidal Elevation 11-Mar-2008



HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

19:25 - 19:31

Time after HW [HH:MM]

1:38

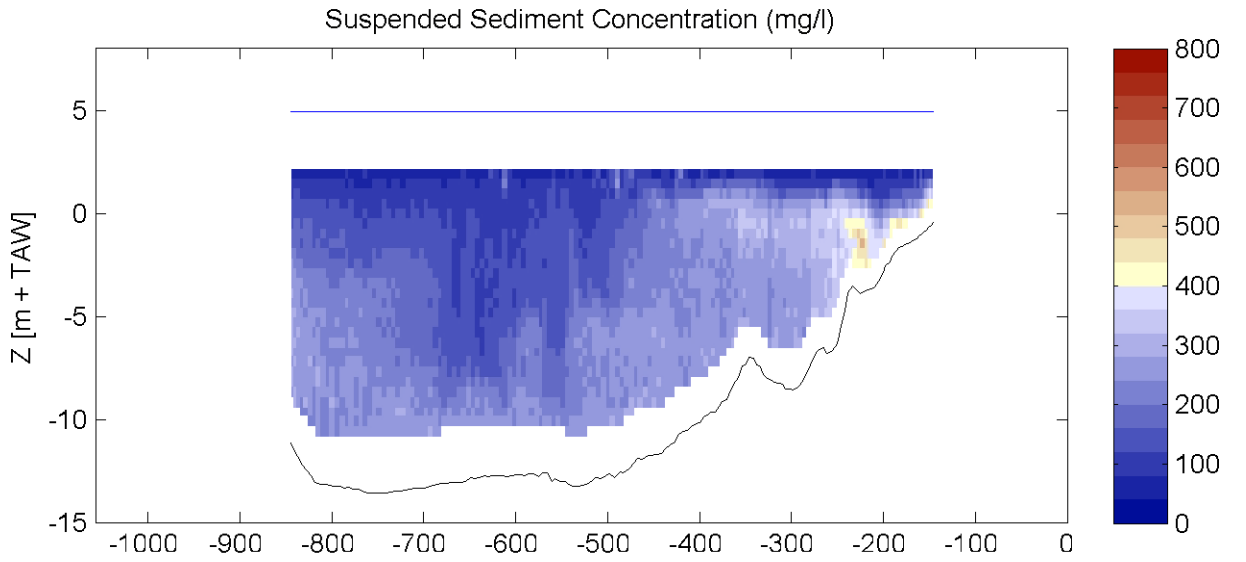
Data Processed by: IMDC

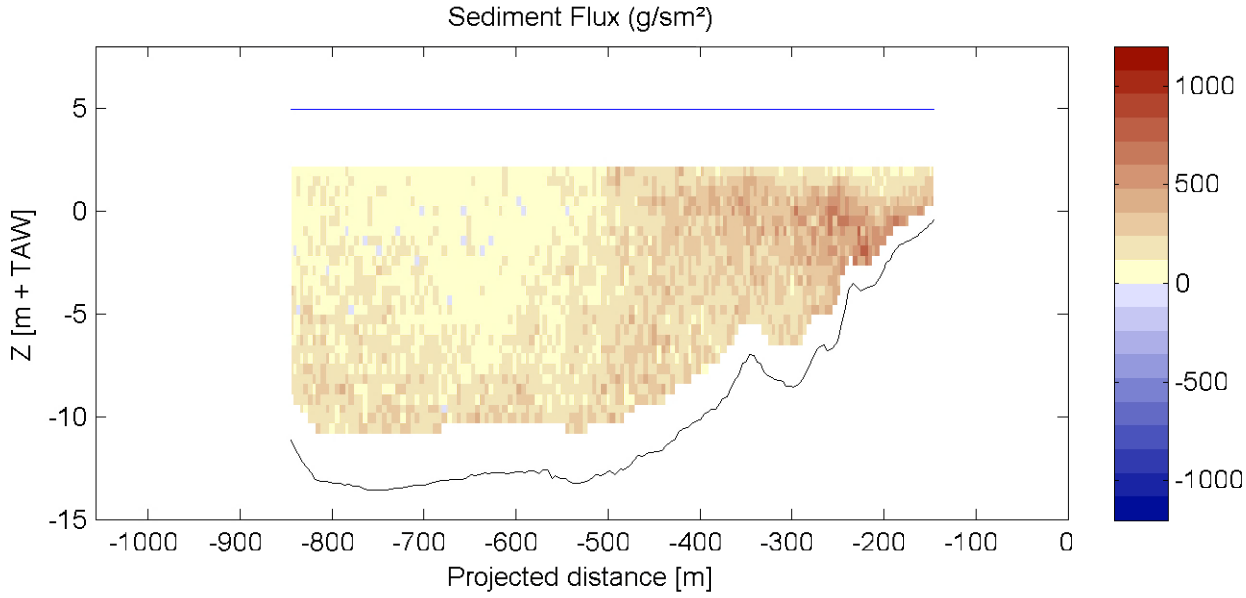
In association with : WL | delft hydraulics, GEMS International

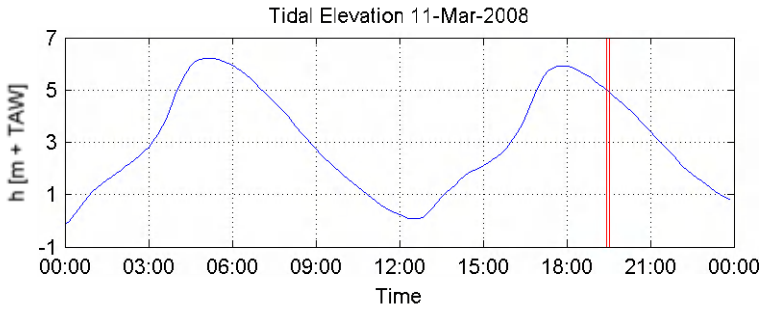
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3100ltr_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
19:25 - 19:31

Time after HW [HH:MM]
1:38

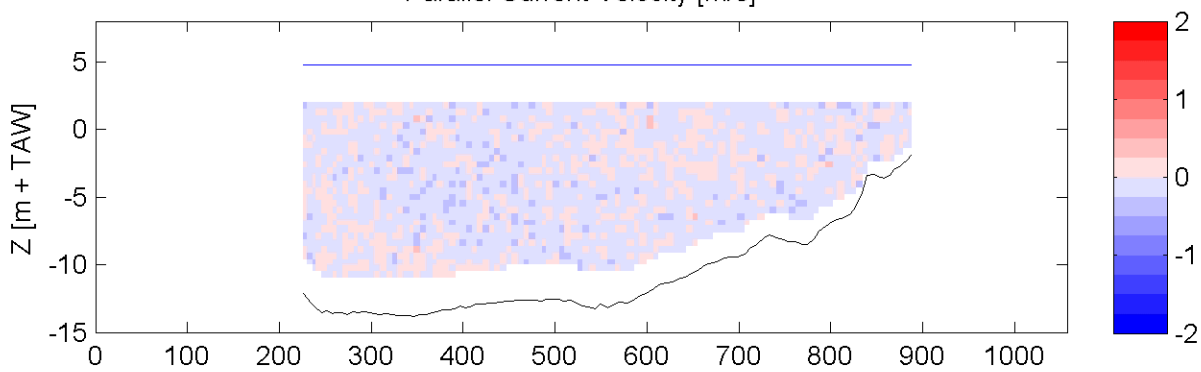
Data Processed by: IMDC
In association with :

I/RA/11283/07.088/MSA

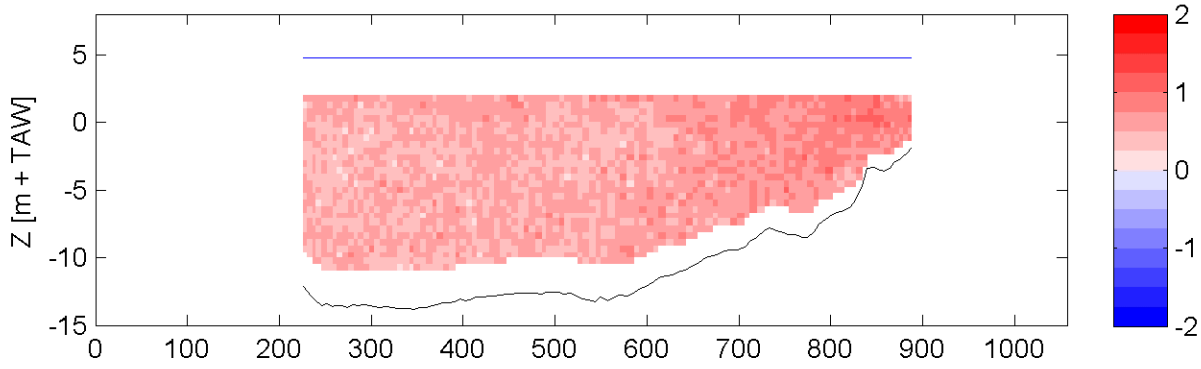
Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3102ltl_sub.csv	Location: Transect I

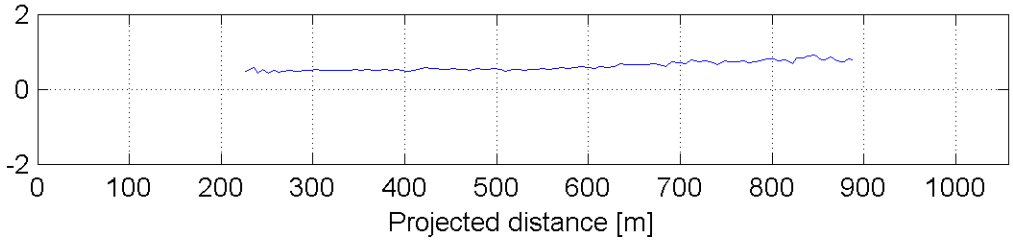
Parallel Current Velocity [m/s]



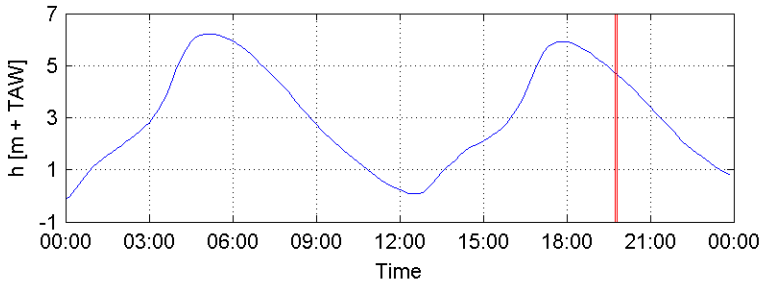
Perpendicular Current Velocity [m/s]



Depth Averaged Velocity [m/s]



Tidal Elevation 11-Mar-2008



HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :

11-Mar-2008

19:44 - 19:48

Time after HW [HH:MM]

1:56

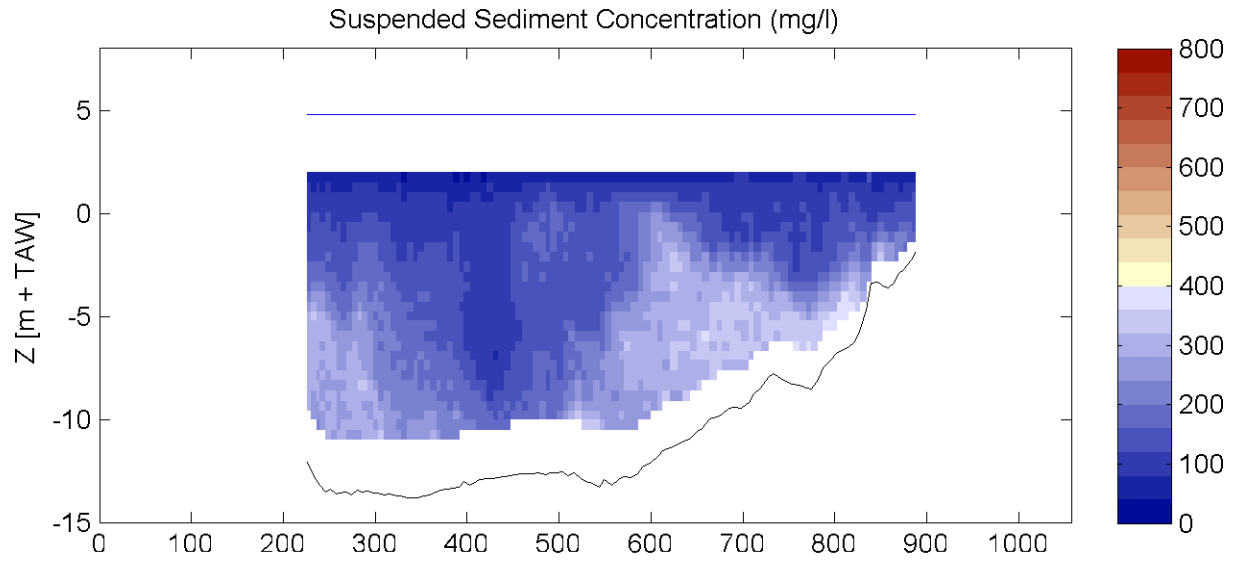
Data Processed by: IMDC

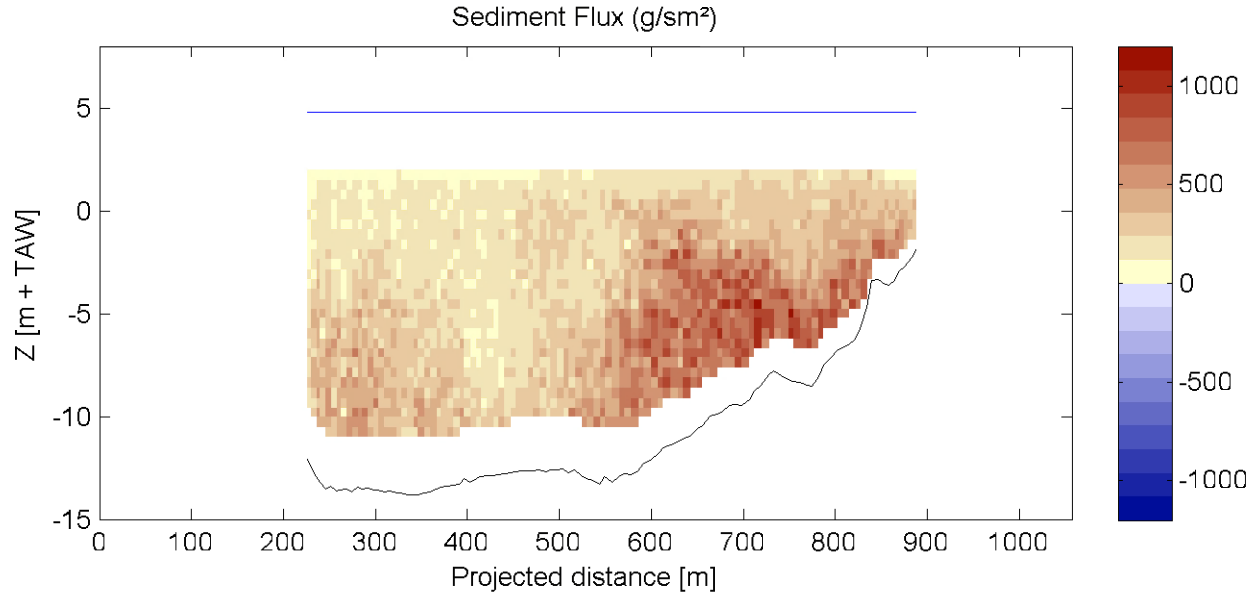
In association with : WL | delft hydraulics, GEMS International

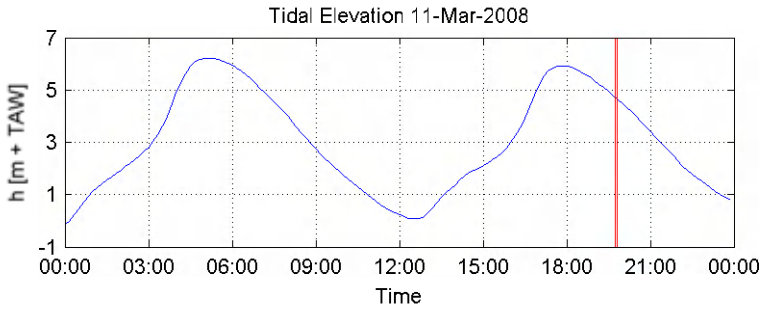
I/RA/11283/07.088/MSA

Through Tide Measurement Sediview on 11/03/2008 - Transect I

11283 - Aanslibbing Deurganckdok	Equipment(s): ADCP
Sourcefile: 3102ltl_sub.csv	Location: Transect I







HW/LW:
05:00: h = 6.22 m+TAW
12:30: h = 0.08 m+TAW
17:50: h = 5.93 m+TAW

Date / Time [MET] :
11-Mar-2008
19:44 - 19:48

Time after HW [HH:MM]
1:56

Data Processed by: IMDC

In association with :

I/RA/11283/07.088/MSA

APPENDIX H. DISCHARGE, CONCENTRATION AND SEDIMENT FLUX FOR THE TOTAL CROSS-SECTION

Discharge distribution over the cross section: positive is from dock to river

Filename	*Time to HW [hh:mm]*	*Qmid [m³/s]*	*Qtop [m³/s]*	*Qbottom [m³/s]*	*Qleft [m³/s]*	*Qright [m³/s]*	*Qtotal [m³/s]*
3002ltr_sub.csv	2:10	4903	1670	799	629	337	8337
3006ltr_sub.csv	2:37	4301	1437	729	690	374	7531
3010ltr_sub.csv	3:03	6771	1822	1080	304	3195	13172
3014ltr_sub.csv	3:27	6592	2068	1092	651	389	10792
3016ltl_sub.csv	3:42	6931	2192	1177	341	2	10643
3018ltr_sub.csv	4:02	6428	2052	1089	673	407	10648
3022ltl_sub.csv	4:28	5946	2032	1008	684	358	10027
3024ltr_sub.csv	4:57	5410	2246	945	401	308	9310
3030ltl_sub.csv	5:48	4556	1671	806	436	372	7840
3032ltr_sub.csv	6:04	4117	1824	747	453	423	7565
3034ltl_sub.csv	6:22	3840	1484	695	480	471	6971
3036ltr_sub.csv	6:38	3754	1666	701	640	489	7251
3040ltr_sub.csv	7:02	3173	1459	590	617	430	6269
3042ltl_sub.csv	7:16	2883	1143	519	541	530	5617
3044ltr_sub.csv	-5:17	2291	1324	434	314	531	4893
3046ltl_sub.csv	-4:59	1415	609	256	335	462	3077
3048ltr_sub.csv	-4:44	-58	226	-5	-221	168	109
3050ltl_sub.csv	-4:27	-1697	-487	-301	-548	-200	-3232
3052ltr_sub.csv	-4:11	-2675	-731	-470	-558	-208	-4643
3056ltr_sub.csv	-3:40	-3572	-1076	-618	-629	-194	-6089
3060ltr_sub.csv	-3:16	-3984	-1415	-698	-548	-238	-6882
3064ltr_sub.csv	-2:51	-3403	-1068	-571	-594	-177	-5813
3066ltl_sub.csv	-2:34	-3789	-1170	-637	-420	-194	-6210
3068ltr_sub.csv	-2:12	-3912	-1138	-637	-627	-133	-6446
3072ltr_sub.csv	-1:50	-4763	-1310	-798	-1410	-203	-8483
3074ltl_sub.csv	-1:34	-5884	-1668	-973	-1414	-226	-10165
3076ltr_sub.csv	-1:16	-7621	-1787	-1213	-2021	-257	-12899
3078ltl_sub.csv	-1:00	-9637	-2490	-1511	-2121	-179	-15940
3080ltr_sub.csv	-0:40	-9531	-2134	-1468	-1505	-363	-15001
3084ltr_sub.csv	-0:13	-4461	-810	-689	-1623	-43	-7626
3088ltr_sub.csv	0:12	-4285	-889	-645	-703	-45	-6568
3092ltr_sub.csv	0:42	-1720	-197	-237	-446	195	-2406
3096ltr_sub.csv	1:06	232	518	65	-69	220	966
3100ltr_sub.csv	1:35	2913	1331	490	409	268	5410
3102ltl_sub.csv	1:54	4180	1219	677	694	334	7105

Concentration distribution over the cross section.

Filename	*Time to HW [hh:mm]*	*Cmid [mg/l]*	*Ctop [mg/l]*	*Cbottom [mg/l]*	*Cleft [mg/l]*	*Cright [mg/l]*	*Ctotal [mg/l]*
3002ltr_sub.csv	2:10	210	59	364	202	135	191
3006ltr_sub.csv	2:37	243	111	379	363	168	238
3010ltr_sub.csv	3:03	402	166	1113	590	232	391
3014ltr_sub.csv	3:27	351	164	515	394	279	332
3016ltl_sub.csv	3:42	393	171	632	537	223	378
3018ltr_sub.csv	4:02	426	213	609	642	182	408
3022ltl_sub.csv	4:28	490	241	695	549	180	453
3024ltr_sub.csv	4:57	431	219	514	374	104	375
3030ltl_sub.csv	5:48	455	226	520	309	216	394
3032ltr_sub.csv	6:04	431	251	485	408	163	376
3034ltl_sub.csv	6:22	447	214	602	597	222	408
3036ltr_sub.csv	6:38	350	180	395	532	181	320
3040ltr_sub.csv	7:02	357	174	412	499	198	322
3042ltl_sub.csv	7:16	412	203	454	485	235	363
3044ltr_sub.csv	-5:17	404	197	437	472	248	338
3046ltl_sub.csv	-4:59	300	126	342	256	197	249
3048ltr_sub.csv	-4:44	1288	154	1485	370	291	739
3050ltl_sub.csv	-4:27	451	133	670	367	233	396
3052ltr_sub.csv	-4:11	500	101	787	548	150	457
3056ltr_sub.csv	-3:40	270	80	416	301	966	277
3060ltr_sub.csv	-3:16	244	83	666	206	157	248
3064ltr_sub.csv	-2:51	283	72	912	165	454	299
3066ltl_sub.csv	-2:34	223	58	738	143	138	237
3068ltr_sub.csv	-2:12	313	92	801	263	115	313
3072ltr_sub.csv	-1:50	332	90	1292	138	139	348
3074ltl_sub.csv	-1:34	337	74	1291	141	715	366
3076ltr_sub.csv	-1:16	283	106	462	151	1083	270
3078ltl_sub.csv	-1:00	346	158	676	159	713	327
3080ltr_sub.csv	-0:40	407	151	696	278	647	392
3084ltr_sub.csv	-0:13	416	179	575	313	1004	387
3088ltr_sub.csv	0:12	362	177	432	452	474	355
3092ltr_sub.csv	0:42	346	203	416	369	234	354
3096ltr_sub.csv	1:06	157	86	364	301	295	154
3100ltr_sub.csv	1:35	204	80	581	198	264	210
3102ltl_sub.csv	1:54	182	58	534	211	131	195

Sediment flux distribution over the cross section: positive is from dock to river

Filename	*Time to HW [hh:mm]*	*Fmid [kg/s]*	*Ftop [kg/s]*	*Fbottom [kg/s]*	*Fleft [kg/s]*	*Fright [kg/s]*	*Ftotal [kg/s]*
3002ltr_sub.csv	2:10	1031	99	291	127	46	1593
3006ltr_sub.csv	2:37	1044	159	276	250	63	1792
3010ltr_sub.csv	3:03	2723	303	1201	180	740	5147
3014ltr_sub.csv	3:27	2313	339	562	256	109	3580
3016ltl_sub.csv	3:42	2725	374	744	183	1	4026
3018ltr_sub.csv	4:02	2738	437	663	432	74	4343
3022ltl_sub.csv	4:28	2912	490	700	375	64	4543
3024ltr_sub.csv	4:57	2330	491	486	150	32	3489
3030ltl_sub.csv	5:48	2074	377	419	135	80	3085
3032ltr_sub.csv	6:04	1773	458	362	185	69	2847
3034ltl_sub.csv	6:22	1717	317	418	287	105	2844
3036ltr_sub.csv	6:38	1313	300	277	341	88	2319
3040ltr_sub.csv	7:02	1132	254	243	307	85	2022
3042ltl_sub.csv	7:16	1187	232	236	262	125	2041
3044ltr_sub.csv	-5:17	925	261	190	148	131	1656
3046ltl_sub.csv	-4:59	425	76	88	86	91	766
3048ltr_sub.csv	-4:44	-74	35	-8	-82	49	-81
3050ltl_sub.csv	-4:27	-765	-65	-202	-201	-47	-1279
3052ltr_sub.csv	-4:11	-1339	-74	-370	-306	-31	-2119
3056ltr_sub.csv	-3:40	-964	-86	-257	-189	-187	-1684
3060ltr_sub.csv	-3:16	-973	-117	-465	-113	-37	-1705
3064ltr_sub.csv	-2:51	-963	-77	-521	-98	-80	-1739
3066ltl_sub.csv	-2:34	-844	-68	-470	-60	-27	-1469
3068ltr_sub.csv	-2:12	-1225	-105	-510	-165	-15	-2020
3072ltr_sub.csv	-1:50	-1582	-118	-1031	-195	-28	-2954
3074ltl_sub.csv	-1:34	-1983	-123	-1257	-200	-161	-3723
3076ltr_sub.csv	-1:16	-2155	-190	-560	-305	-278	-3488
3078ltl_sub.csv	-1:00	-3337	-393	-1021	-338	-128	-5218
3080ltr_sub.csv	-0:40	-3876	-323	-1021	-419	-235	-5874
3084ltr_sub.csv	-0:13	-1856	-145	-396	-508	-43	-2948
3088ltr_sub.csv	0:12	-1553	-158	-279	-318	-21	-2329
3092ltr_sub.csv	0:42	-595	-40	-99	-164	46	-852
3096ltr_sub.csv	1:06	36	45	24	-21	65	149
3100ltr_sub.csv	1:35	594	107	284	81	71	1137
3102ltl_sub.csv	1:54	761	71	362	147	44	1385

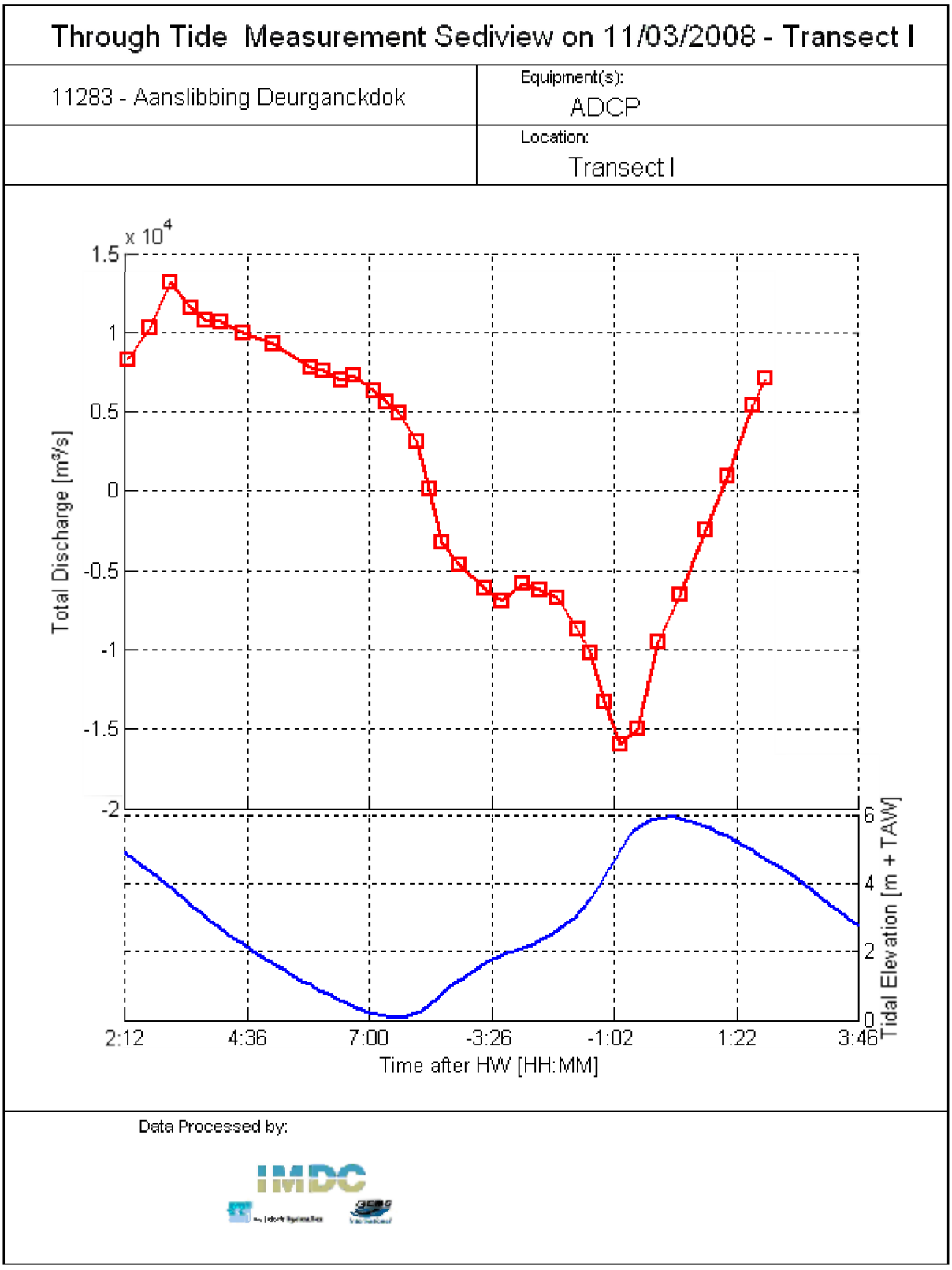
APPENDIX I. AVERAGE SEDIMENT CONCENTRATION FOR THE TOTAL CROSS-SECTION

Transect name	*Time [hh:mm MET]*	*Time after HW [hh:mm]*	*Average measured SS Concentration [mg/l]*
3002ltr_sub.csv	7:10	2:10	229
3006ltr_sub.csv	7:37	2:37	247
3010ltr_sub.csv	8:03	3:03	501
3014ltr_sub.csv	8:27	3:27	372
3016ltl_sub.csv	8:42	3:42	419
3018ltr_sub.csv	9:02	4:02	451
3022ltl_sub.csv	9:28	4:28	552
3024ltr_sub.csv	9:57	4:57	465
3030ltl_sub.csv	10:48	5:48	463
3032ltr_sub.csv	11:04	6:04	479
3034ltl_sub.csv	11:22	6:22	514
3036ltr_sub.csv	11:38	6:38	374
3040ltr_sub.csv	12:02	7:02	382
3042ltl_sub.csv	12:16	7:16	438
3044ltr_sub.csv	12:33	-5:17	441
3046ltl_sub.csv	12:51	-4:59	322
3048ltr_sub.csv	13:06	-4:44	469
3050ltl_sub.csv	13:23	-4:27	444
3052ltr_sub.csv	13:39	-4:11	529
3056ltr_sub.csv	14:10	-3:40	294
3060ltr_sub.csv	14:34	-3:16	271
3064ltr_sub.csv	14:59	-2:51	300
3066ltl_sub.csv	15:16	-2:34	233
3068ltr_sub.csv	15:38	-2:12	355
3072ltr_sub.csv	16:00	-1:50	333
3074ltl_sub.csv	16:16	-1:34	349
3076ltr_sub.csv	16:34	-1:16	286
3078ltl_sub.csv	16:50	-1:00	362
3080ltr_sub.csv	17:10	-0:40	403
3084ltr_sub.csv	17:37	-0:13	458
3088ltr_sub.csv	18:02	0:12	376
3092ltr_sub.csv	18:32	0:42	350
3096ltr_sub.csv	18:56	1:06	267
3100ltr_sub.csv	19:25	1:35	208
3102ltl_sub.csv	19:44	1:54	191

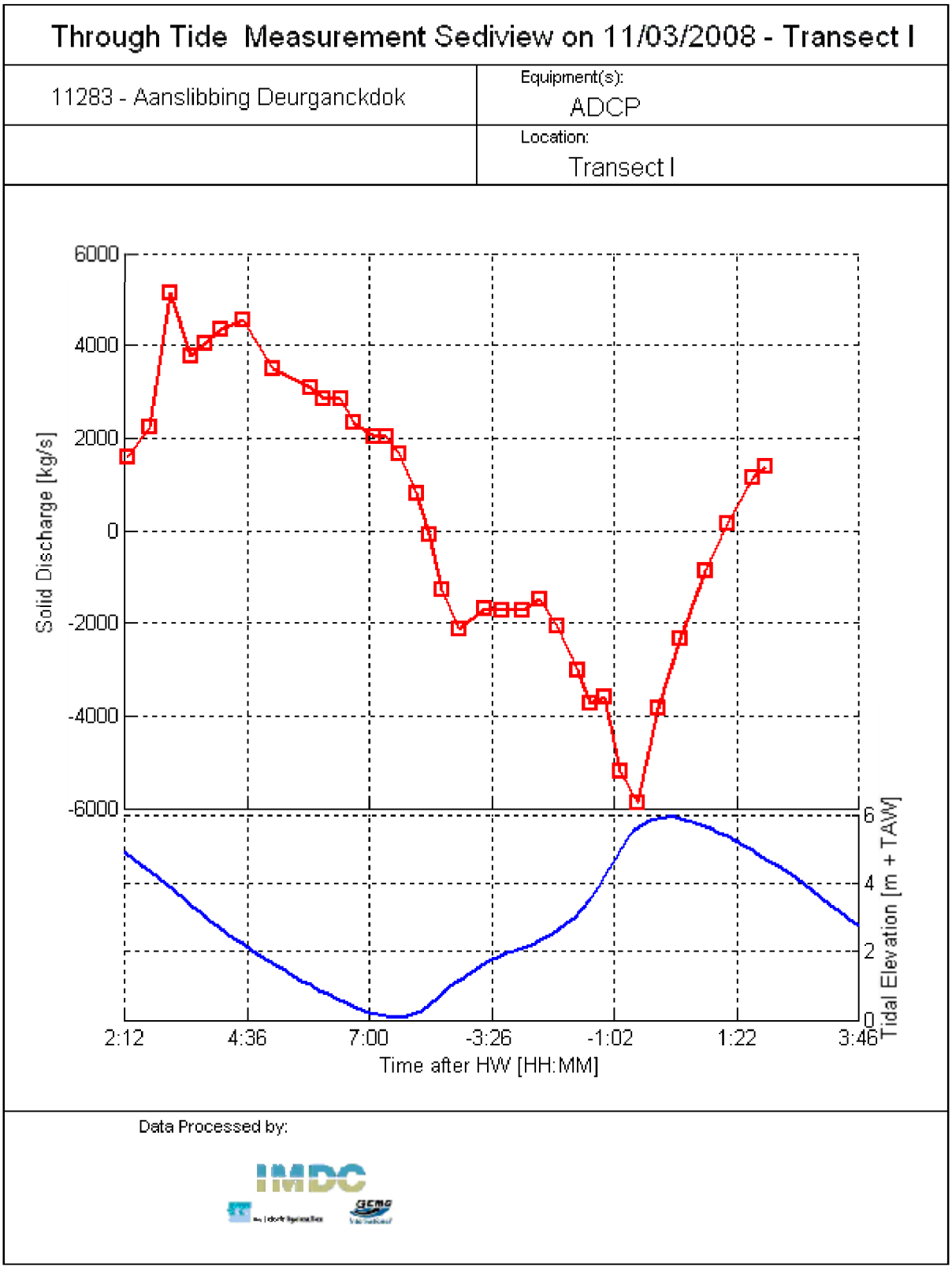
Tide	*Concentration [mg/l]*		
	Average	*Minimum*	*Maximum*
Ebb	383	191	552
Flood	366	233	529

APPENDIX J.

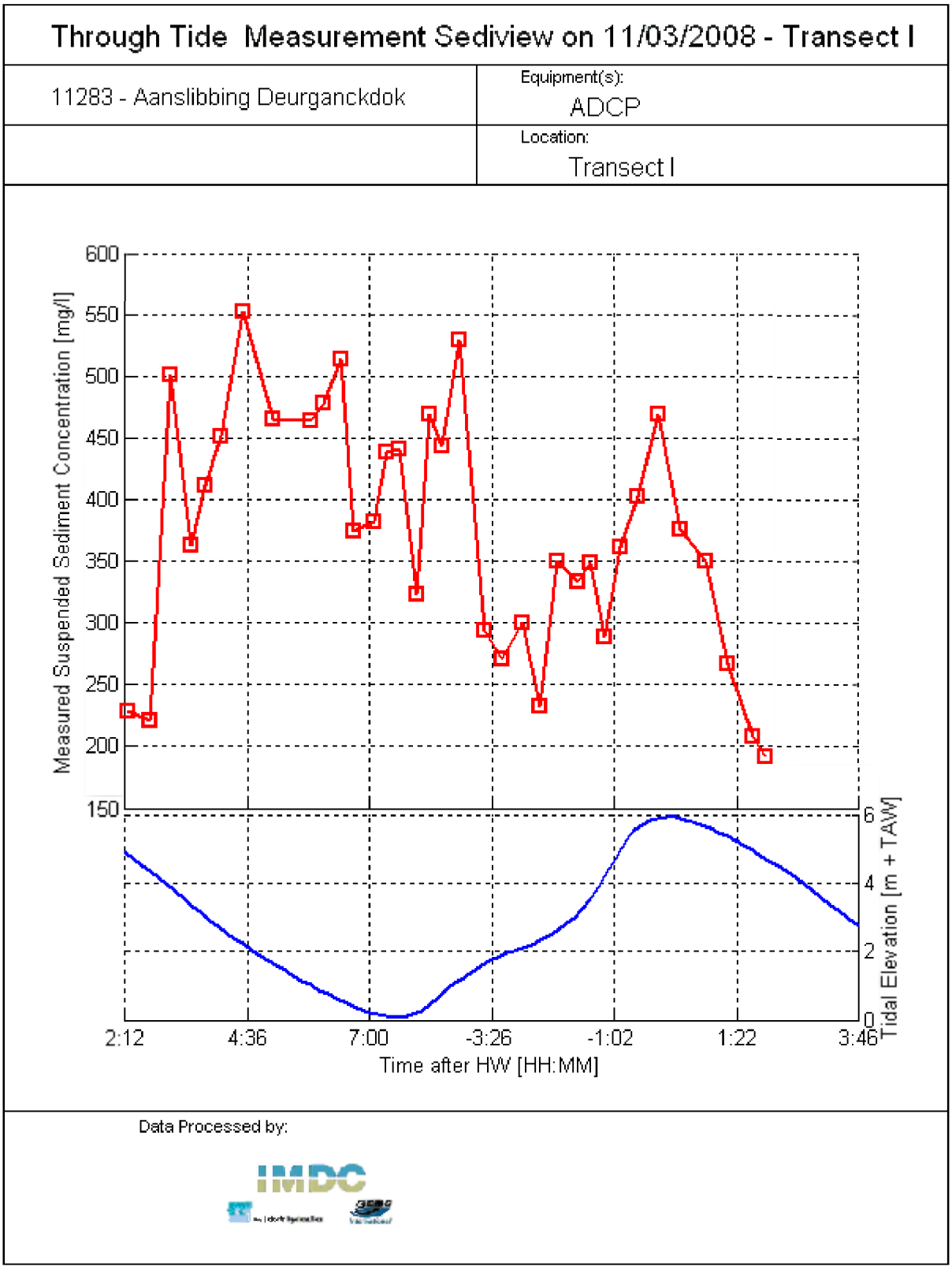
TEMPORAL VARIATION OF TOTAL FLUX, TOTAL DISCHARGE AND SUSPENDED SEDIMENT CONCENTRATION



Total discharge through the measured cross section, positive is from dock to river



Total flux through the measured cross section, positive is from dock to river



Suspended sediment concentration through the measured cross section

APPENDIX K.

OVERVIEW OF HCBS2 AND AANSLIBBING DEURGANCKDOK REPORTS

Report	Description of HCBS2
Ambient Conditions Lower Sea Scheldt	
5.3	Overview of ambient conditions in the river Scheldt – January-June 2006 (I/RA/11291/06.088/MSA)
5.4	Overview of ambient conditions in the river Scheldt – July-December 2006 (I/RA/11291/06.089/MSA)
5.5	Overview of ambient conditions in the river Scheldt : RCM-9 buoy 84 & 97 (1/1/2007 -31/3/2007) (I/RA/11291/06.090/MSA)
5.6	Analysis of ambient conditions during 2006 (I/RA/11291/06.091/MSA)
Calibration	
6.1	Winter Calibration (I/RA/11291/06.092/MSA)
6.2	Summer Calibration and Final Report (I/RA/11291/06.093/MSA)
Through tide Measurements Winter 2006	
7.1	21/3 Scheldewacht – Deurganckdok – Salinity Distribution (I/RA/11291/06.094/MSA)
7.2	22/3 Parel 2 – Deurganckdok (I/RA/11291/06.095/MSA)
7.3	22/3 Laure Marie – Liefkenshoek (I/RA/11291/06.096/MSA)
7.4	23/3 Parel 2 – Schelle (I/RA/11291/06.097/MSA)
7.5	23/3 Laure Marie – Deurganckdok (I/RA/11291/06.098/MSA)
7.6	23/3 Veremans Waarde (I/RA/11291/06.099/MSA)
HCBS Near bed continuous monitoring (Frames)	
8.1	Near bed continuous monitoring winter 2006 (I/RA/11291/06.100/MSA)
INSSEV	
9	Settling Velocity - INSSEV summer 2006 (I/RA/11291/06.102/MSA)
Cohesive Sediment	
10	Cohesive sediment properties summer 2006 (I/RA/11291/06.103/MSA)
Through tide Measurements Summer 2006	
11.1	Through Tide Measurement Sediview and Siltprofiler 27/9 Stream - Liefkenshoek (I/RA/11291/06.104/MSA)
11.2	Through Tide Measurement Sediview 27/9 Veremans - Raai K (I/RA/11291/06.105/MSA)
11.3	Through Tide Measurement Sediview and Siltprofiler 28/9 Stream - Raai K (I/RA/11291/06.106/MSA)
11.4	Through Tide Measurement Sediview 28/9 Veremans - Waarde(I/RA/11291/06.107/MSA)
11.5	Through Tide Measurements Sediview 28/9 Parel 2 - Schelle (I/RA/11291/06.108/MSA)
11.6	Through Tide measurement 26/9 Scheldewacht – Deurganckdok – Salinity Distribution (I/RA/11291/06.161/MSA)

Analysis	
12	Report concerning the presence of HCBS layers in the Scheldt river (I/RA/11291/06.109/MSA)

Report	Description of Opvolging aanslibbing Deurganckdok between April 2006 till March 2007
Sediment Balance: Bathymetry surveys, Density measurements, Maintenance and construction dredging activities	
1.1	Sediment Balance: Three monthly report 1/4/2006 – 30/06/2006 (I/RA/11283/06.113/MSA)
1.2	Sediment Balance: Three monthly report 1/7/2006 – 30/09/2006 (I/RA/11283/06.114/MSA)
1.3	Sediment Balance: Three monthly report 1/10/2006 – 31/12/2006 (I/RA/11283/06.115/MSA)
1.4	Sediment Balance: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/06.116/MSA)
1.5	Annual Sediment Balance (I/RA/11283/06.117/MSA)
1.6	Sediment balance Bathymetry: 2005 – 3/2006 (I/RA/11283/06.118/MSA)
Factors contributing to salt and sediment distribution in Deurganckdok: Salt-Silt (OBS3A) & Frame measurements, Through tide measurements (SiltProfiling & ADCP)	
2.1	Through tide measurement Siltprofiler 21/03/2006 Laure Marie (I/RA/11283/06.087/WGO)
2.2	Through tide measurement Siltprofiler 26/09/2006 Stream (I/RA/11283/06.068/MSA)
2.3	Through tide measurement Sediview spring tide 22/03/2006 Veremans (I/RA/11283/06.110/BDC)
2.4	Through tide measurement Sediview spring tide 27/09/2006 Parel 2 (I/RA/11283/06.119/MSA)
2.5	Through tide measurement Sediview average tide 24/10/2007 Parel 2 (I/RA/11283/06.120/MSA)
2.6	Salt-Silt distribution & Frame Measurements Deurganckdok 13/3/2006 – 31/05/2006 (I/RA/11283/06.121/MSA)
2.7	Salt-Silt distribution & Frame Measurements Deurganckdok 15/07/2006 – 31/10/2006 (I/RA/11283/06.122/MSA)
2.8	Salt-Silt distribution & Frame Measurements Deurganckdok 12/02/2007 – 18/04/2007 (I/RA/11283/06.123/MSA)
2.9	Calibration stationary equipment autumn (I/RA/11283/07.095/MSA)

Report	Description of Opvolging aanslibbing Deurganckdok between April 2006 till March 2007
Boundary Conditions: Upriver Discharge, Salt concentration Scheldt, Bathymetric evolution in access channels, dredging activities in Lower Sea Scheldt and access channels	
3.1	Boundary conditions: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/06.127/MSA) including HCBS 2 report 5.5
~~3.2~~	~~Boundary condtions: Annual report (I/RA/11283/06.128/MSA)~~[1]
Analysis	
4.1	Analysis of Siltation Processes and Factors (I/RA/11283/06.129/MSA)

[1] considered in report 5.6 'Analysis of ambient conditions during 2006' (I/RA/11291/06.091/MSA) in the framework of the study 'Extension of the study about density currents in the Beneden Zeeschelde'