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DEPARTEMENT MOBILITEIT EN OPENBARE WERKEN
WATERBOUWKUNDIG LABORATORIUM

# Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing

Bestek 16EB/05/04

## Deelrapport 2.24 : 13-uursmeting Sediview op 02/12/2008 tijdens springtij - Deurganckdok (transect DGD)

## Report 2.24 : Through Tide Measurement Sediview on 02/12/2008 during spring tide - Deurganckdok (transect DGD)

15 July 2009

I/RA/11283/08.085/MSA

i.s.m.

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# Document Control Sheet

## Document Identification

| | |
|---|---|
| **Title:** | Deelrapport 2.24 : 13-uursmeting Sediview op 02/12/2008 tijdens springtij - Deurganckdok (transect DGD) |
| **Project:** | Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing |
| **Client** | Waterbouwkundig Laboratorium |
| **File reference:** | I/RA/11283/08.085/MSA |
| **File name** | K:\PROJECTS\11\11283 - Opvolging aanslibbing dgd\10-Rap\DGD3\2.24_RA08085_sediview_neaptide_2008-12-02\2.24_RA08085_TransectDGD_081202_v2.0.docx |

## Revisions

| Version | Date | Author | Description |
|---|---|---|---|
| 2.0 | 15/07/09 | YDK | Final report |
| 1.0 | 9/3/09 | YDK | Concept |
| | | | |

## Distribution List

| Name | # ex. | Company/authorities | Position in reference to the project |
|---|---|---|---|
| Joris Vanlede | 7 | Waterbouwkundig Laboratorium | Client |
| Frederik Roose | 3 | Afdeling Maritieme Toegang | Client |
| | | | |

## Approval

| Version | Date | Author | Project manager | Commissioner |
|---|---|---|---|---|
| 2.0 | 15/07/09 | YDK | JME | MSA |
| 1.0 | 9/03/09 | YDK | JME | MSA |
| | | | | |

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# 1. INTRODUCTION

## 1.1. The assignment

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 and a second time prolonged with one extra year from April 2008 till March 2009.

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 two years, i.e. 04/2007 – 03/2009
- 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 $\mu$m. 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 2008 till March 2009 are summarized in Table 1-1. An overview of the HCBS2 and 'Opvolging aanslibbing Deurganckdok' (between April 2006 till March 2008) reports are given in APPENDIX I.

This report 2.24, 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** | |
| 1.20 | Sediment Balance: Three monthly report 1/4/2008 - 30/6/2008 (I/RA/11283/08.076/MSA) |
| 1.21 | Sediment Balance: Three monthly report 1/7/2008 – 30/9/2008 (I/RA/11283/08.077/MSA) |
| 1.22 | Sediment Balance: Three monthly report 1/10/2008 – 31/12/2008 (I/RA/11283/08.078/MSA) |
| 1.23 | Sediment Balance: Three monthly report 1/1/2009 – 31/03/2009 (I/RA/11283/08.079/MSA) |
| 1.24 | Annual Sediment Balance (I/RA/11283/08,080/MSA) |
| **Factors contributing to salt and sediment distribution in Deurganckdok: Salt-Silt (OBS3A) & Frame measurements, Through tide measurements (SiltProfiling & ADCP) & Calibrations** | |
| 2.20 | Through tide measurement Sediview DGD during average tide Spring 2008 – 19 June 2008 (I/RA/11283/08.081/MSA) |
| 2.21 | Through tide measurement Sediview DGD during average tide Spring 2008 –26 June 2008 (I/RA/11283/08.082/MSA) |
| 2.22 | Through tide measurement Sediview DGD during neap tide Summer 2008 – 24 September 2008 (I/RA/11283/08.083/MSA) |
| 2.23 | Through tide measurement Sediview DGD during spring tide Summer 2008 – 30 September 2008 (I/RA/11283/08.084/MSA) |
| 2.24 | Through tide measurement Sediview DGD during neap tide Autumn 2008 (I/RA/11283/08.085/MSA) |
| 2.25 | Through tide measurement Sediview DGD during spring tide Autumn 2008 (I/RA/11283/08.086/MSA) |
| 2.26 | Through tide measurement Sediview DGD during neap tide Winter 2009 (I/RA/11283/08.087/MSA) |
| 2.27 | Through tide measurement Sediview DGD during spring tide Winter 2009 (I/RA/11283/08.088/MSA) |

| Report | Description |
|---|---|
| 2.28 | Through tide measurement ADCP eddy DGD Summer 2008 – 1 October 2008 (I/RA/11283/08.089/MSA) |
| 2.29 | Through tide measurement Siltprofiler DGD Summer 2008 – 29 September 2008 (I/RA/11283/08.090/MSA) |
| 2.30 | Through tide measurement Siltprofiler DGD Winter 2009 (I/RA/11283/08.091/MSA) |
| 2.31 | Through tide measurement Salinity Profiling DGD Winter 2009 (I/RA/11283/08.092/MSA) |
| 2.32 | Salt-Silt distribution Deurganckdok: Six monthly report 1/4/2008 - 30/9/2008 (I/RA/11283/08.093/MSA) |
| 2.33 | Salt-Silt distribution Deurganckdok: Six monthly report 1/10/2008 – 31/3/2009 (I/RA/11283/08.094/MSA) |
| 2.34 | Calibration stationary & mobile equipment Autumn 2008 (I/RA/11283/08.095/MSA) |
| **Boundary Conditions: Upriver Discharge, Salt concentration Scheldt, Bathymetric evolution in access channels, dredging activities in Lower Sea Scheldt and access channels** | |
| 3.20 | Boundary conditions: Six monthly report 1/4/2008 – 30/09/2008 (I/RA/11283/08.096/MSA) |
| 3.21 | Boundary conditions: Six monthly report 1/10/2008 – 31/03/2009 (I/RA/11283/08.097/MSA) |
| **Analysis** | |
| 4.20 | Analysis of Siltation Processes and Factors 4/'06 – 3/'09 (I/RA/11283/08.098/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 at the entrance of Deurganckdok on the 2nd of December 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).

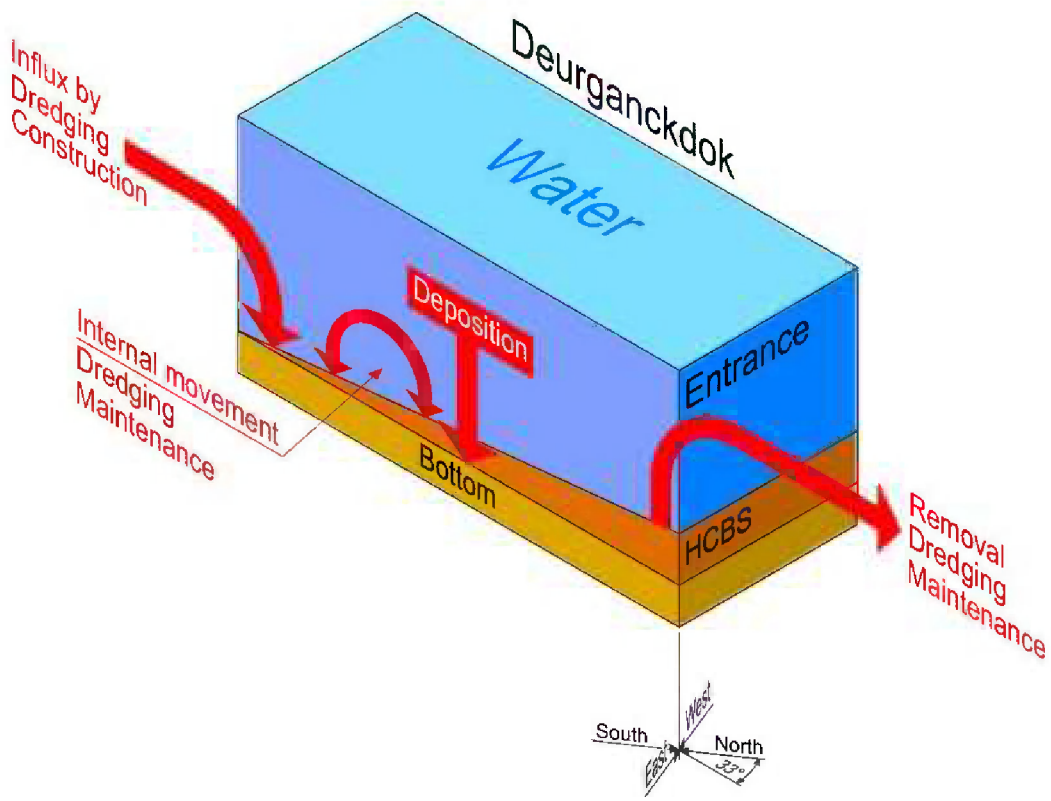



*Figure 2-1: Elements of the sediment balance*

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 $t_0$.

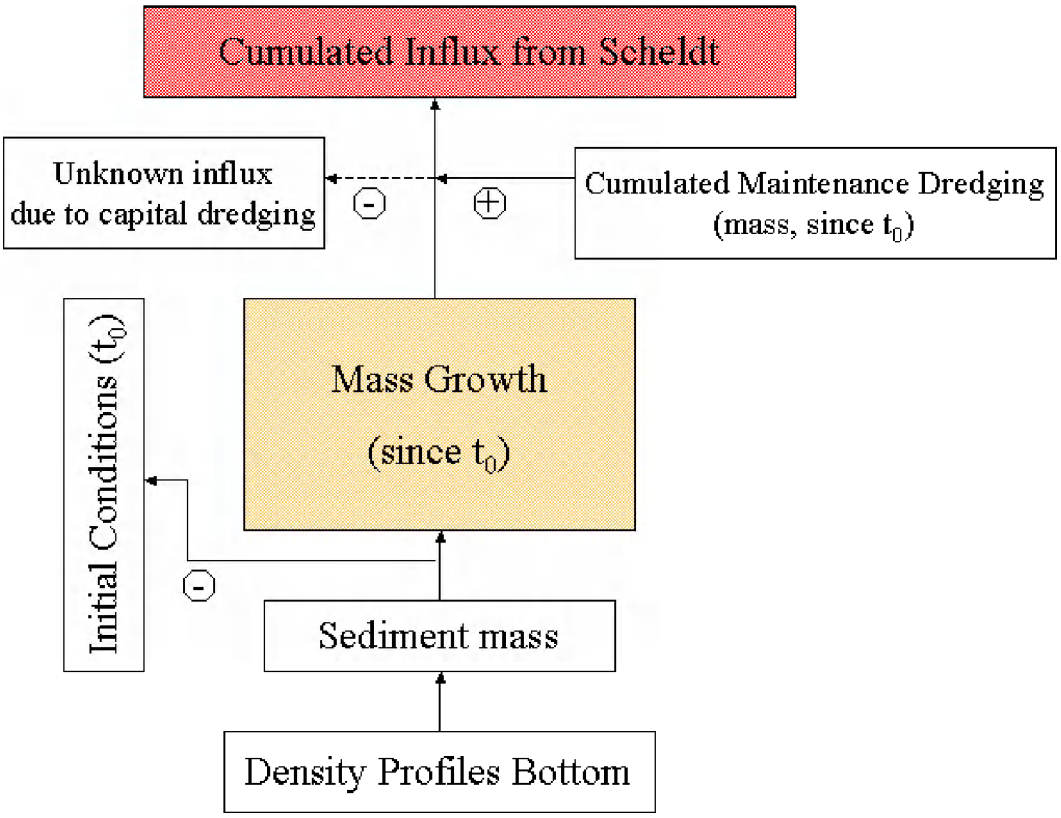



*Figure 2-2: Determining a sediment balance*

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

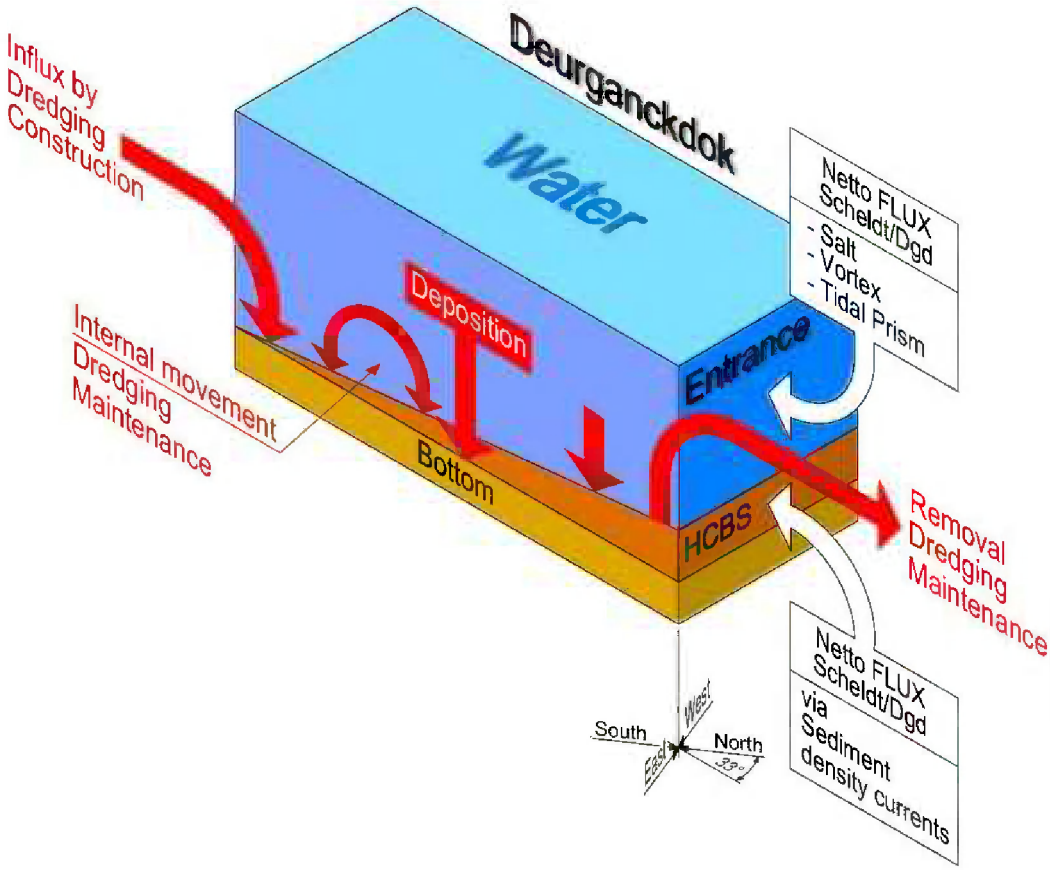



*Figure 2-3: Transport mechanisms*

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, the sediment flux and flow velocity during a complete tidal cycle.

Measurements were undertaken on the DGD transect (Figure 2-4), being the cross section between the river Scheldt and the dock itself.

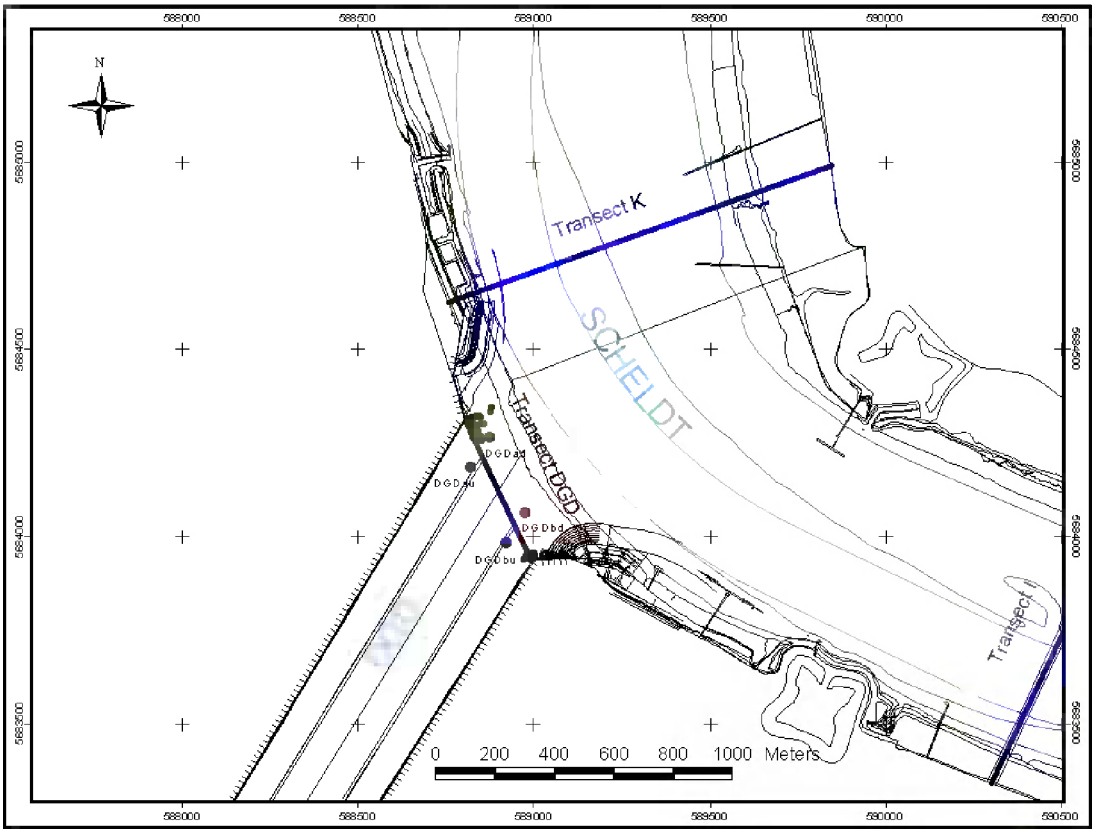



*Figure 2-4: Map of sailed transect DGD, calibration points (red) and start- and end points (green) at Deurganckdok (DGD) on 2nd of December 2008.*

### 2.2.2. Measurement procedure

Flow velocity, Turbidity, Salinity and Temperature measurements were conducted on the 2nd of December from 6h05 MET until 18h48 MET. From the survey vessel Scheldewacht II a measurement cycle was completed every 29 minutes. The vessel with a mounted ADCP sailed a fixed transect from the right bank to the left bank and vice versa as a 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 two depths, one in the upper half of the water column (around 4 meters from the water surface) and one at 4 meters above the bottom and the last one at the water bottom (about 10 meters above water surface). 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 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 2nd of December 2008 (UTM31 ED50)*

| Measurement location | Left Bank Easting | Left Bank Northing | Right Bank Easting | Right Bank Northing | Avg Length [m] | Avg Course [degr.] |
|---|---|---|---|---|---|---|
| Transect DGD | 588 541 | 5 684 527 | 588 765 | 5 684 056 | 521 | 335 |

*Table 2-2: Positions of the calibration points for 2nd of December 2008 during flood and ebb.*

| Measurement point | Bank | Easting (UTM31 ED50) | Northing (UTM31 ED50) |
|---|---|---|---|
| **Flood** | | | |
| DGDau | Left | 588561 | 5684369 |
| DGDbu | Right | 588682 | 5684113 |
| **Ebb** | | | |
| DGDad | Left | 588623 | 5684470 |
| DGDbd | Right | 588745 | 5684214 |

## 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 |

| ***Main configuration settings of ADCP 600kHz Worhhorse:*** |
|---|
| Salinity 0 psu |
| 3-beam solution: enabled |
| Beam angle: 30° |

### 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 15 seconds.

# 3. COURSE OF THE MEASUREMENTS

## 3.1. Measurement periods

At Deurganckdok ADCP tracks were sailed about every 14 minutes for 13 hours, in total 51 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 51 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 2nd of December 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 2nd of December 2008.

*Table 3-1: High and low tide at Liefkenshoek on 02/12/2008*

| ***Liefkenshoek Tidal Gauge*** | | |
|---|---|---|
| ***2/12/2008*** | | |
| | ***Time [MET]*** | ***Water level [m TAW]*** |
| **HW (1)** | 5:50 | 5.31 |
| **LW (2)** | 12:30 | 0.20 |
| **HW (3)** | 18:00 | 5.21 |

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

*Table 3-2: Comparison of the tidal characteristics of 02/12/2008 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 2/12/2008*** |
|---|---|---|---|---|
| **Water level [m TAW]** | | | | |
| HW (1) | 4.63 | 5.19 | 5.63 | 5.31 |
| LW (2) | 0.39 | 0.05 | -0.18 | 0.20 |
| HW (3) | - | - | - | 5.21 |
| **Tidal difference [m]** | | | | |
| Falling (1 to 2) | 4.24 | 5.14 | 5.81 | 5.11 |
| Rising (2 to 3) | 4.24 | 5.14 | 5.81 | 5.01 |
| **Duration [hh:mm]** | | | | |
| Falling (1 to 2) | 6:40 | 6:50 | 7:02 | 6:40 |
| Rising (2 to 3) | 5:59 | 5:34 | 5:16 | 5:30 |
| Tide (1 to 3) | 12:39 | 12:24 | 12:18 | 12:10 |
| **Tidal coefficient** | | | | |
| Falling (1 to 2) | 0.82 | 1.00 | 1.13 | 0.99 |
| Rising (2 to 3) | 0.82 | 1.00 | 1.13 | 0.97 |

The tidal coefficients from 0.97 up to 0.99 for the measured tide of the 2nd of December 2008 indicate that this tide has a tidal range equal as the average tide for the decade of 1991-2000 and can be classified as an average tide.

### 3.2.2. Meteorological data

Meteorological data at Woensdrecht (NL) was obtained from the website of the Royal Dutch Weather Institute (KNMI, 2008).

The weather on the 2nd of December 2008 was cold but dry. The wind blew from the south west at an average velocity of 4 km/h (3 Bft) with maximal gust velocity of 12 km/h. The air temperature varied between 1 and 6°C. The sky was cloudy without 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. Transects 1008 was excluded for processing because too many boats or bubbles interfered.

# 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). An in situ calibration of the OBS3A was performed. 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 report 2.34 (IMDC, 2009c).

## 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 ADCP's 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,
- $\alpha_w$ = 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 that 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)):

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

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)
- $\alpha_w$ = water attenuation coefficient
- $\alpha_s$ = sediment attenuation coefficient, which is a function of the effective particle size

In this expression there are four unknowns: $S$, $Ks$, $\alpha_w$ and $\alpha_s$. These parameters are to be determined within Sediview (APPENDIX E).

### 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 when the beam angle is 20° and to 12% above the bottom when the beam angle is 30°. 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 for the ADCP used during this campaign is 12% 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, an estimate of the discharges and suspended sediment concentration is made. The measured and unmeasured regions in the cross section are shown in Figure 4-1 and Figure 4-2.

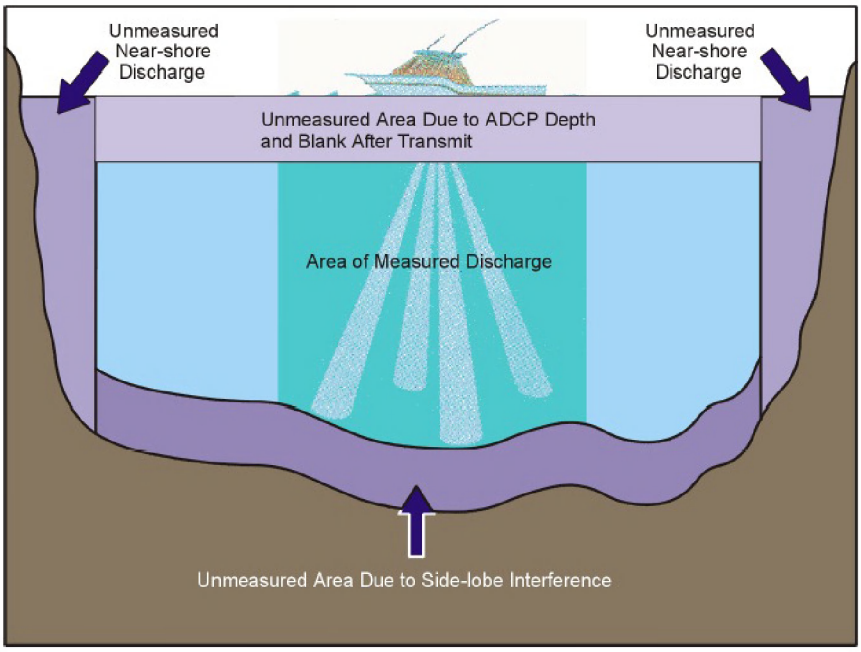



*Figure 4-1: Unmeasured regions in the cross section (from RD Instruments, 2003)*

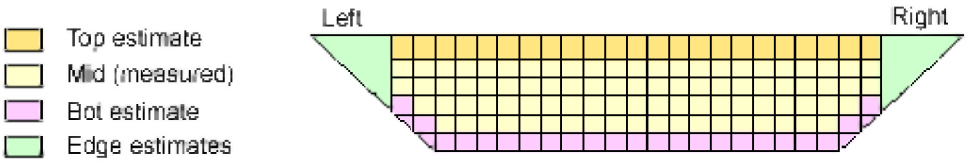



*Figure 4-2: Measured and estimated discharges and sediment fluxes within Sediview (DRL, 2005)*

#### 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. As the concentration grows approximately linear from the lowest valid bin to the bottom, and as Sediview/Matlab uses a constant concentration factor for these deepest bins, we use a concentration factor of 125% (Figure 4-3). An overview of the used power concentration factor is given in APPENDIX E.

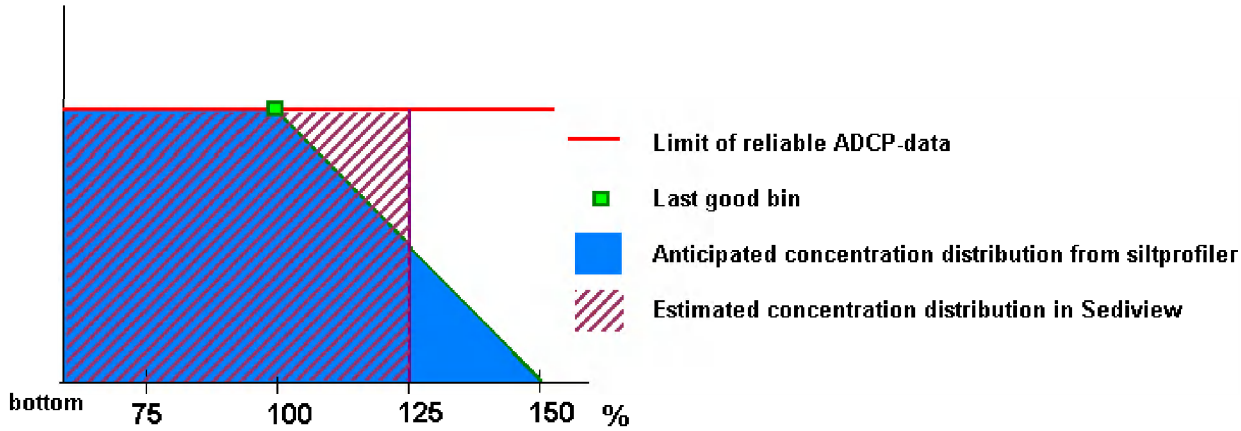



*Figure 4-3: Principal of bottom estimate of the sediment concentration in Sediview*

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

| ***Variable*** | ***Top*** | ***Bottom*** |
|---|---|---|
| Discharge Method | Constant | Power |
| Concentration factor | 100% | 125% |

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 DGD | 588 541 | 5 684 527 | 588 765 | 5 684 056 |

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 0.91 (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 APPENDIX F, 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 F).

Tables in APPENDIX G give the values for discharges, sediment fluxes and the average measured SSC for the total cross-section.

- 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 H 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. The survey of December 2nd 2008

As Deurganckdok is situated along the part of the river Scheldt under tidal influence, it is subject to complex current fields near its entrance. The measured current field shows a vortex pattern depending on the tidal phase. During ebbing tide the vortex at the entrance of the dock is a counter-clockwise one and during rising tide it is a clockwise one. This is shown in the contour plots by inflow (negative) on the western side (left) and outflow on the eastern side of the entrance during ebbing tide and vice versa for flooding tide. (APPENDIX F).

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, there is an inflow (negative) near the bottom and outflow (positive) near the surface. This particular pattern is probably an example of the expected salt density currents occurring near the entrance of Deurganckdok. 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, one can notice in general a higher concentration during high water and during rising tide compared to during ebb tide. The highest SS concentrations (incoming and outgoing) occur around HW.

It can also be noticed that during the complete measurement cycle the incoming water has a higher SSC than the outgoing water (see Table 5-1, Figure 5-1 and Figure 5-2). The incoming averaged suspended sediment concentrations range from 27 mg/l up to 232 mg/l during ebb and from 74 mg/l to 174 mg/l during flood, whereas the outgoing concentrations range from 23 to 182 mg/l during ebb and from 35 to 177 mg/l during flood.

*Table 5-1 Average SSC's over the sailed transect*

| | Concentration [mg/l] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | overall SSC | | | incoming SSC | | | outgoing SSC | | |
| **Tide** | **min** | **average** | **max** | **min** | **average** | **max** | **min** | **average** | **max** |
| Ebb | 25 | 76 | 201 | 27 | 102 | 232 | 23 | 57 | 182 |
| Flood | 55 | 115 | 174 | 74 | 117 | 174 | 35 | 112 | 177 |

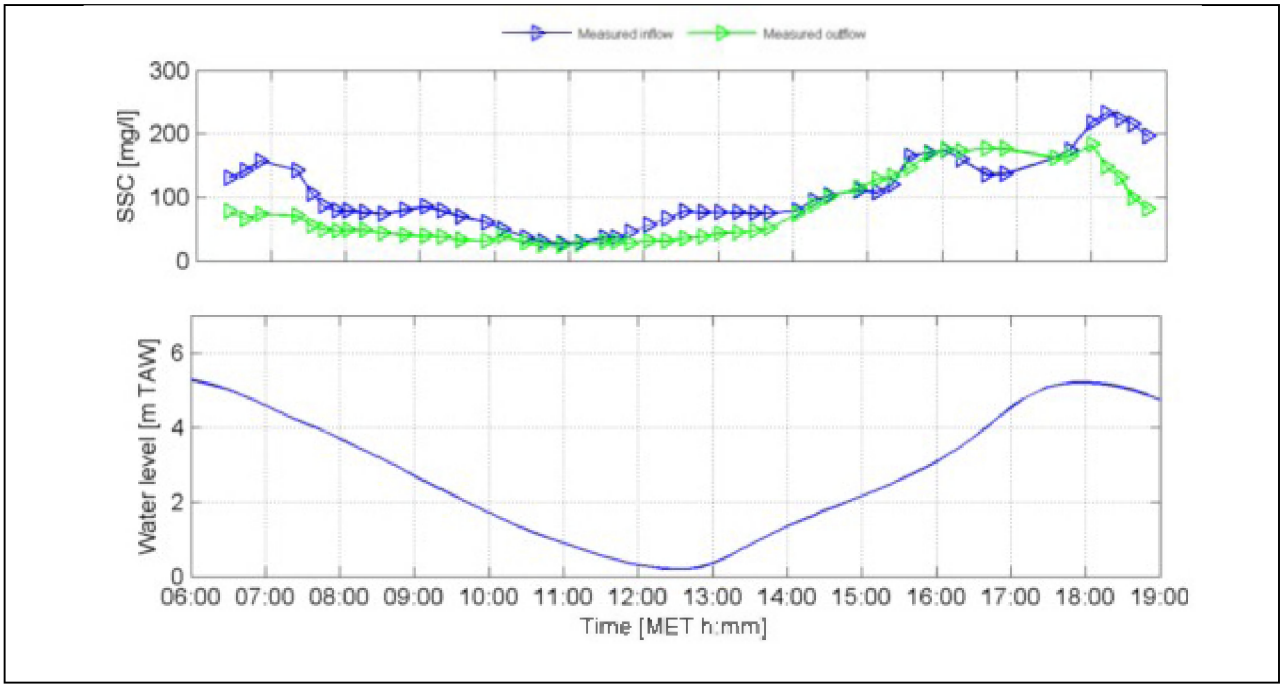



*Figure 5-1 Average incoming and outgoing SSC over a complete tidal cycle on 02/12/2008*

Considering the sediment fluxes, Figure 5-2-a shows that residual incoming transport is dominating during flood and lasts until approximately 2 hour after HW. Almost no residual outgoing sediment transport can be observed during the measurement campaign. In the first hour after high water there is a residual incoming sediment flux even though the resulting discharge is outgoing at that moment (see Figure 5-2-b ). To visualize in- and outflow, the absolute values of the inflow have been used. If the measured total line is negative, it means that measured inflow is greater than measured outflow. Or a negative measured total value means a total inflow/influx, a positive measured total value means a total outflow/outflux.

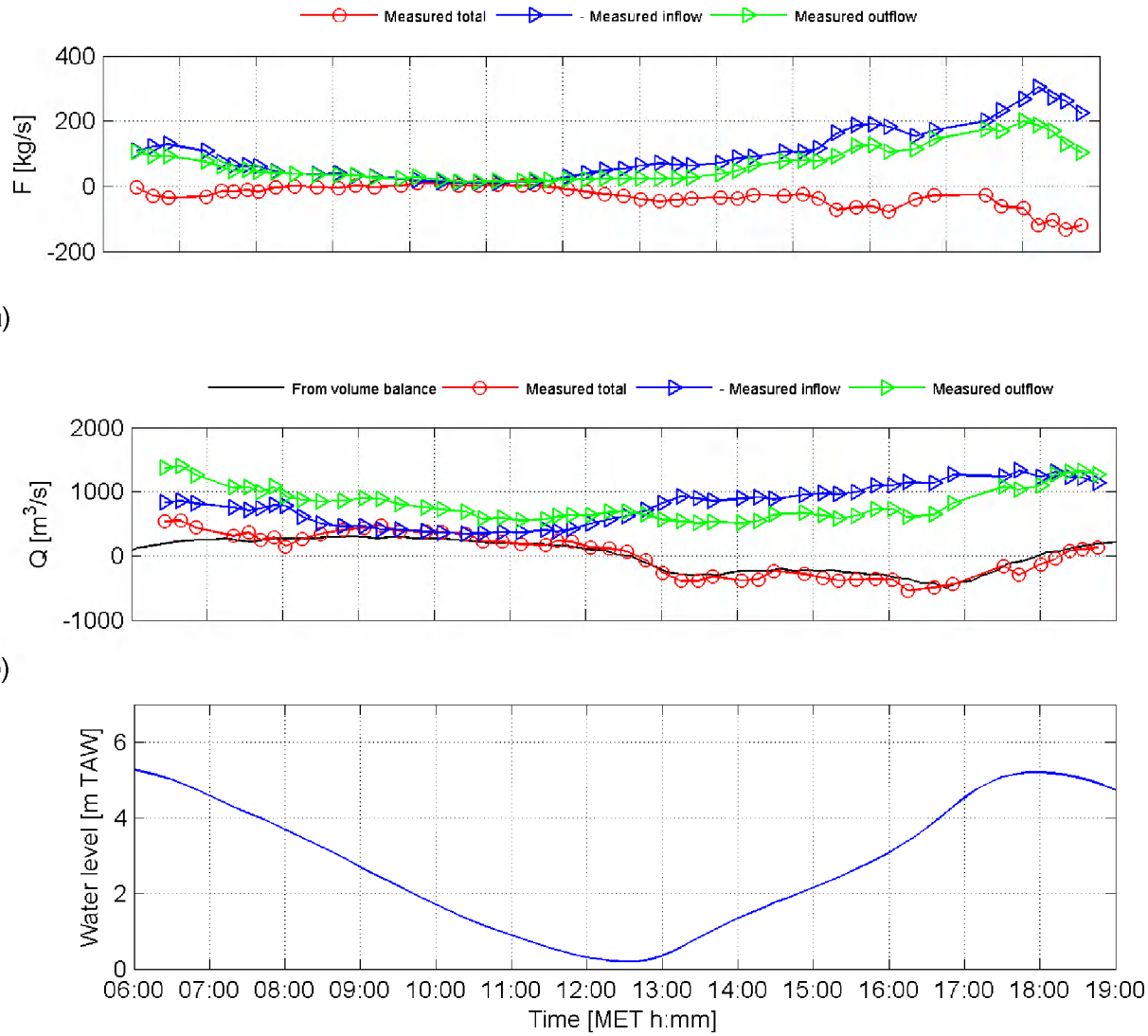



*Figure 5-2 Total in/out/net flux a) and in/out/net discharge b) at DGD on December 2nd 2008.*

During flood the outflow is approximately twice as high (+-1400 m³/s) as during ebb (see Figure 5-2-b ). Incoming density currents near the bottom due to a higher salinity in the river than in the dock reach their maximum around slack tide on the Scheldt at approximately 1 hour after high water (see Figure 5-7).

## 5.2. Intercomparison with earlier surveys at DGD

Since 2005, IMDC has executed several through tide measurement campaigns at the entrance of Deurganckdok. The course and results of the campaigns were described in IMDC rapports and are listed in Table 5-2. Table 5-2 gives also an overview of the tidal phase during the campaigns. Conditions near the entrance of Deurganckdok have been simulated in Delft3D and processed by IMDC (2006n) in order to compare simulation with observed data.

### 5.2.1. Fresh water discharge

The fresh water discharges at Schelle were calculated from the tributaries, which were recorded during the measurement campaigns. The calculation procedure is described in AZ (1974) and is based on the use of correction coefficients that take in account the surface of the hydrological basins. The daily fresh water discharges at Schelle are listed in Table 5-2. The evolutions of the fresh water discharge at Schelle for all former campaigns are shown in Figure 5-3.

*Table 5-2: Hydrological conditions during through tide ADCP measurements at the entrance of DGD*

| ***Tidal Coefficient at tidal gauge: Liefkenshoek*** | | | | |
|---|---|---|---|---|
| ***PROJECT (DESCRIPTION)*** | ***Date*** | ***Tidal coefficient*** | ***Tidal phase*** | ***Daily fresh water discharge at Schelle [m³/s]*** |
| Stroming & sediment aan ingang DGD(IMDC, 2006m) | 17/11/2005 | 1.10 | Spring | 91 |
| HCBS 2 (IMDC, 2006c) | 22/03/2006 | 0.97 | Average | 94 |
| HCBS 2 (IMDC, 2007o) | 27/09/2006 | 1.03 | Average | 33 |
| DGD 1 (IMDC, 2008a) | 24/10/2007 | 1.02 | Average | 46 |
| DGD 2 (IMDC, 2008k) | 11/03/2008 | 1.17 | Spring | 286 |
| DGD 3 (IMDC, 2008u) | 19/06/2008 | 1.15 | Spring | 93 |
| DGD 3 (IMDC, 2008v) | 26/06/2008 | 0.97 | Average | 69 |
| DGD3 (IMDC 2008x) | 24/09/2008 | 0.81 | Neap | 75 |
| DGD 3 (IMDC, 2009a) | 30/09/2008 | 1.08 | Spring | 82 |
| DGD 3 (IMDC, 2009) | 02/12/2008 | 0.98 | Average | 154 |

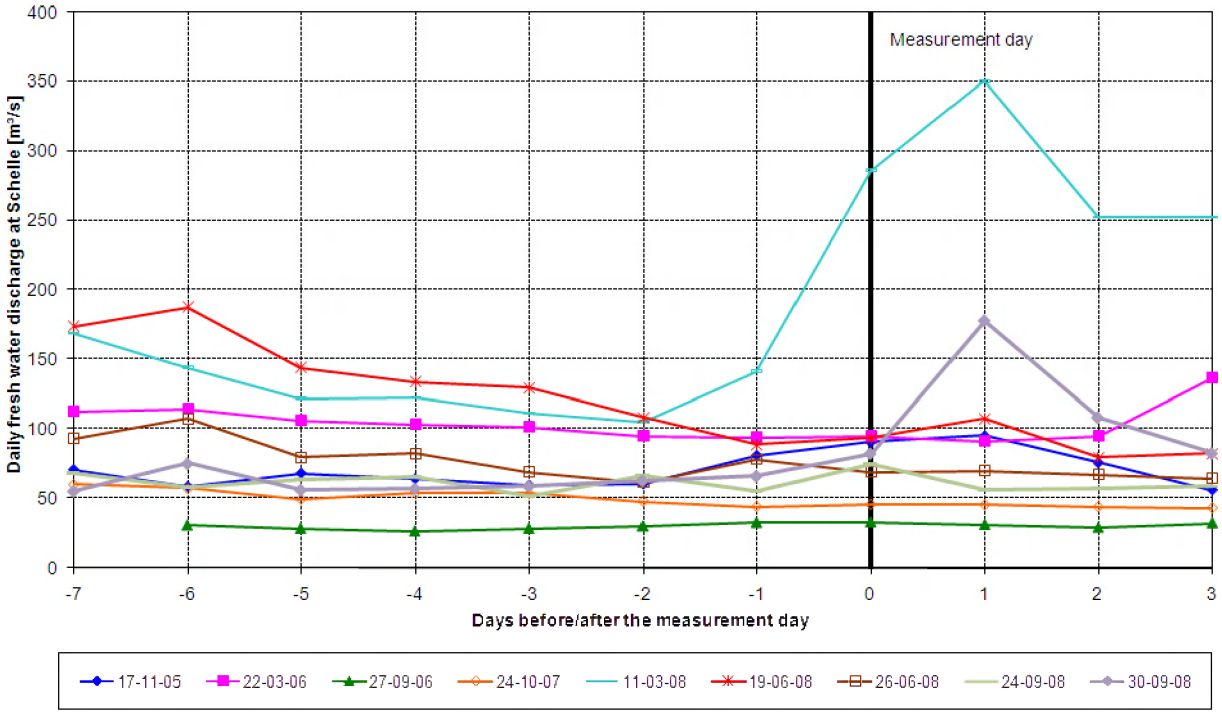



*Figure 5-3: The daily fresh water discharge evolution at Schelle before and after a measurement day.*

The results presented in Figure 5-4 are based on a long-term simulation over a period of 30 year (1971-2000) with the SIGMA-model for MKBA (IMDC, 2006r). The mean discharge is the annual average ten days' discharge, calculated with simulated long-term measurements. The high and low discharges are also annual ten days' discharges, and are calculated as mean discharge +2$\sigma$ and mean discharge -2$\sigma$.

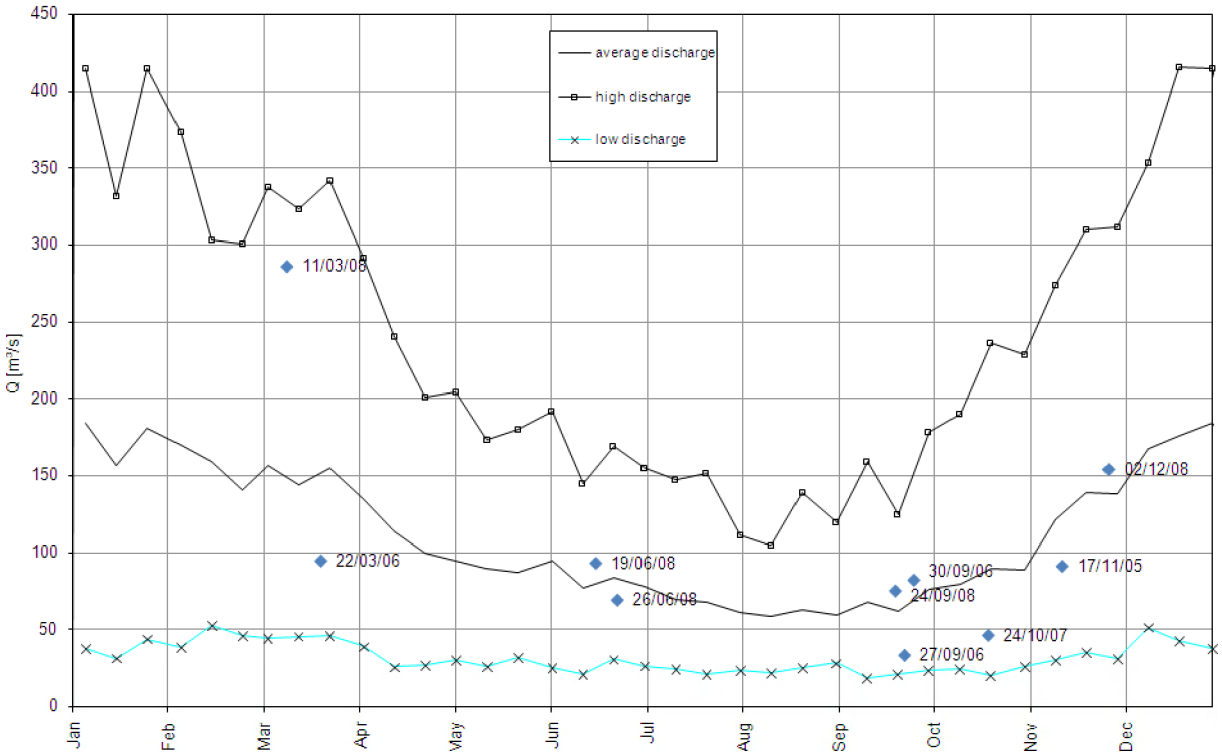



*Figure 5-4: Mean fresh water discharge over a period of 30 year (1971-2000)*

### 5.2.2. Sediment distributions and current pattern around HW

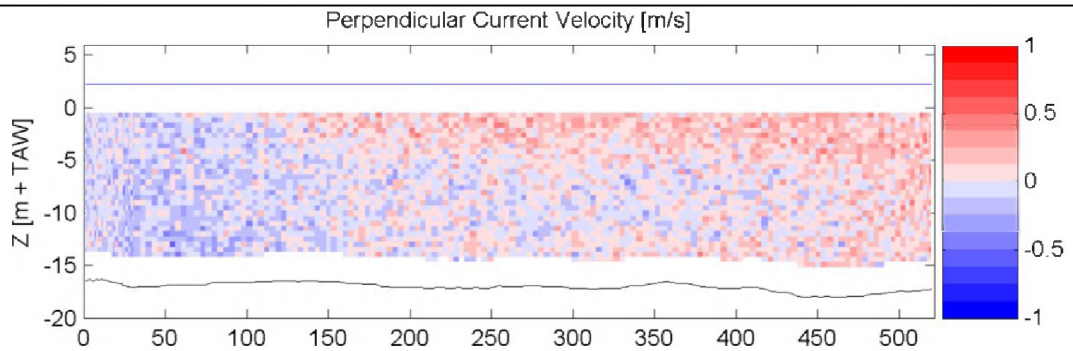
In Figure 5-5 and Figure 5-6 the 10 different measurement campaigns have been compared for about 3 hours after high water. Sediment distributions as well as current pattern in the cross section are similar for all campaigns. The western side of the dock is situated at the left of these figures, the eastern side at the right. The sediment distribution and current pattern of this neap tide measurement is less pronounced than the patterns during average and spring tide measurements.

In Figure 5-7 and Figure 5-8 the circulation pattern and sediment concentration have been compared for the same days but at about 1h after high water. Again the current pattern is almost identical between the different days with a salt wedge intruding near the bottom of the dock and compensatory outflow of fresher water near the surface. Except for the measurements at 11/03/2008, the sediment distributions are very similar between the different campaigns.

The measurements around HW on 11/03/2008 show a very different sediment distribution compared to the other measurement days. The sediment concentrations are considerably higher and this almost throughout the whole water column. These high concentrations can also be seen on the other transects on 11/03/2008, so it is very unlikely these concentrations can be attributed to a shipwake.

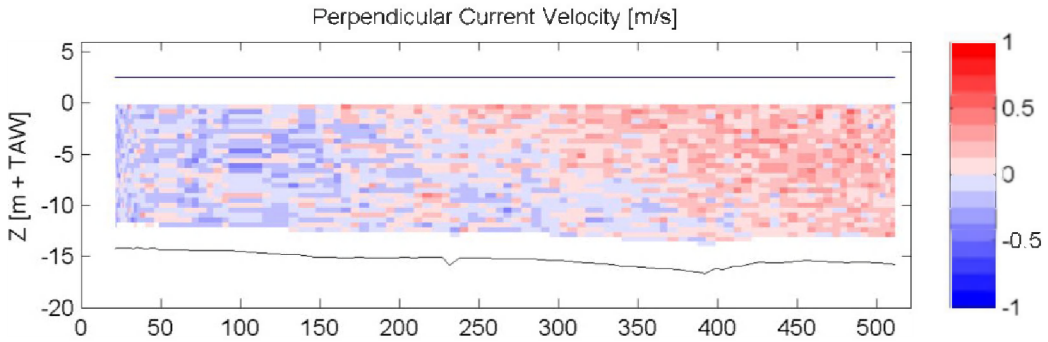
These high concentrations may partly be attributed to the high fresh water discharges, recorded on 11/03/2008 near Schelle (see Figure 5-4), but most particular to the extreme spring tide and stormy weather on that day. Compared with the other tides, the waterlevel at 11/03/2008 increases slower during the first hours of the flood. As a result, there is a huge intake of water during the second part of the flood phase. It is during these last hours of the flood, that those high concentrations were measured.

a)



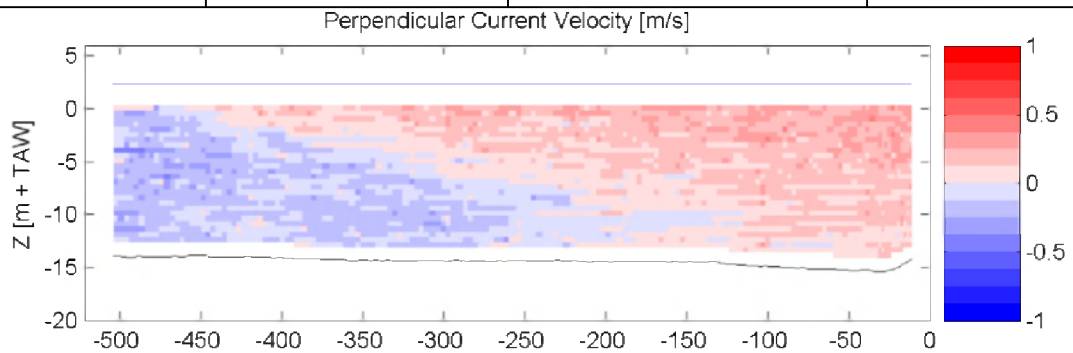

| | | | |
|---|---|---|---|
| 17/11/2005 | 3 hrs after HW | Tidal coefficient: 1.10 | Fresh water: 91 m³/s |

b)



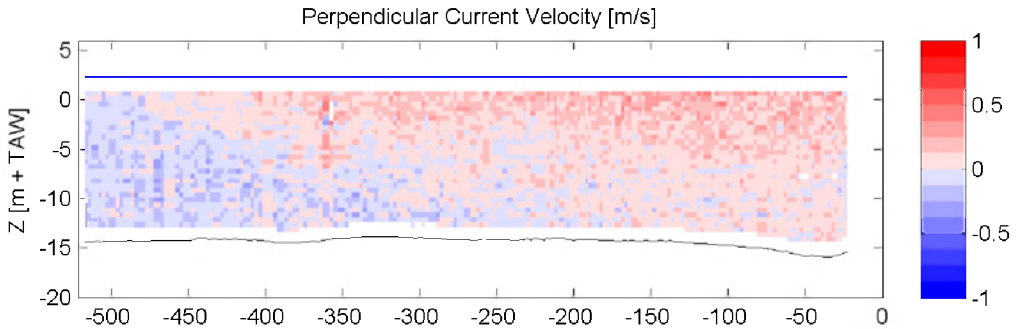

| | | | |
|---|---|---|---|
| 22/03/2006 | 3 hrs after HW | Tidal coefficient: 0.97 | Fresh water: 94 m³/s |

c)



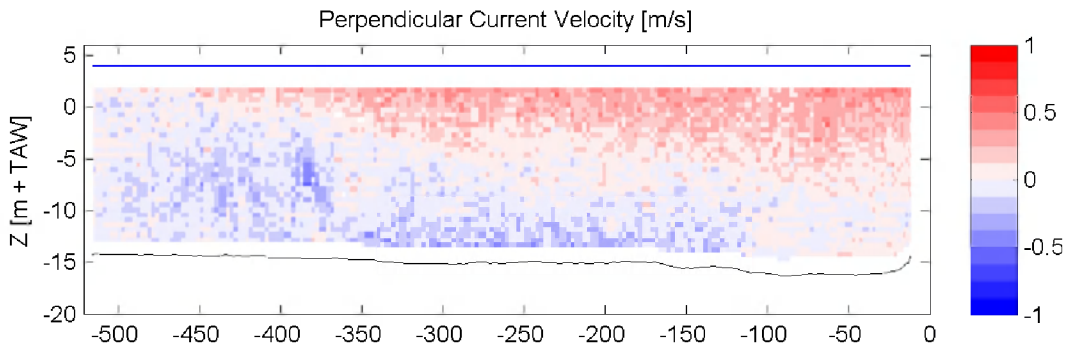

| | | | |
|---|---|---|---|
| 27/09/2006 | 3 hrs after HW | Tidal coefficient: 1.03 | Fresh water: 33 m³/s |

d)



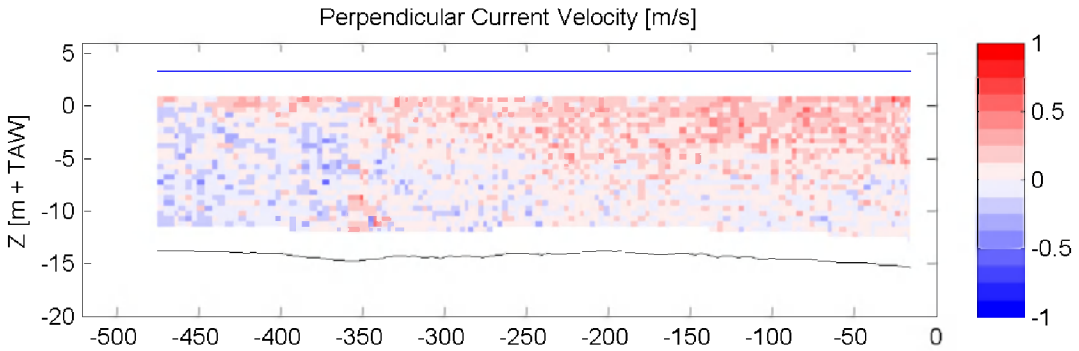

| | | | |
|---|---|---|---|
| 24/10/2007 | 3 hrs after HW | Tidal coefficient: 1.02 | Fresh water: 46 m³/s |

e)



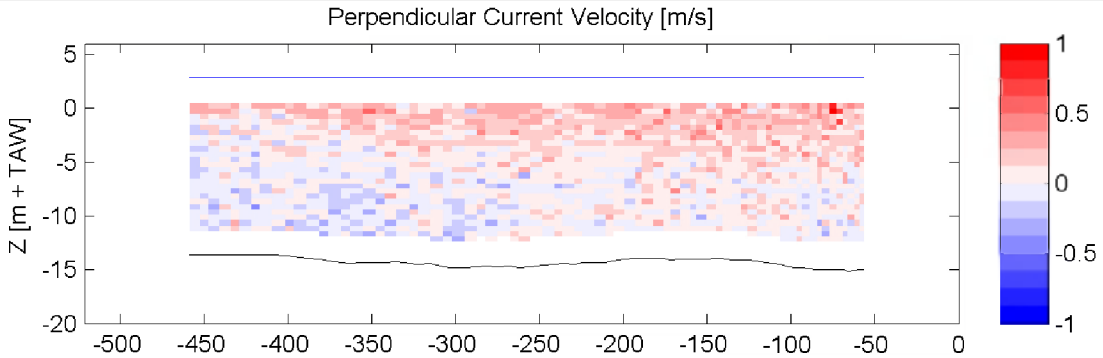

| | | | |
|---|---|---|---|
| 11/03/2008 | 3 hrs after HW | Tidal coefficient: 1.17 | Fresh water: 286 m³/s |

f)



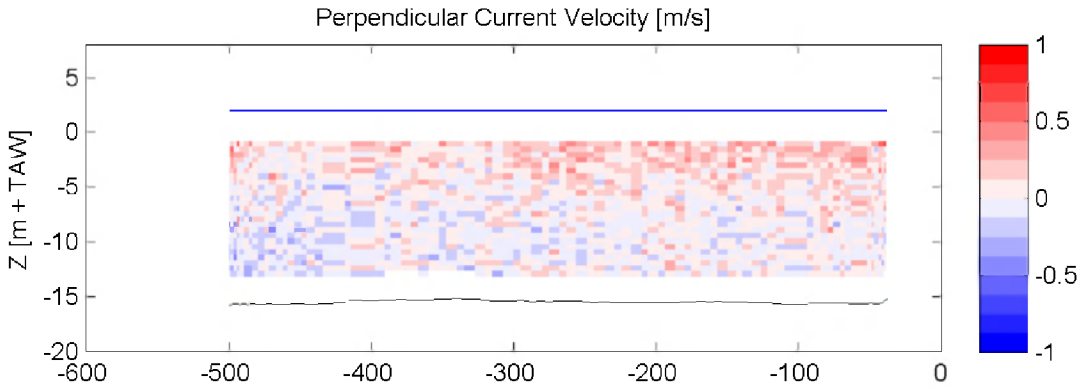

| | | | |
|---|---|---|---|
| 19/06/2008 | 3 hrs after HW | Tidal coefficient: 1.15 | Fresh water: 93 m³/s |

g)



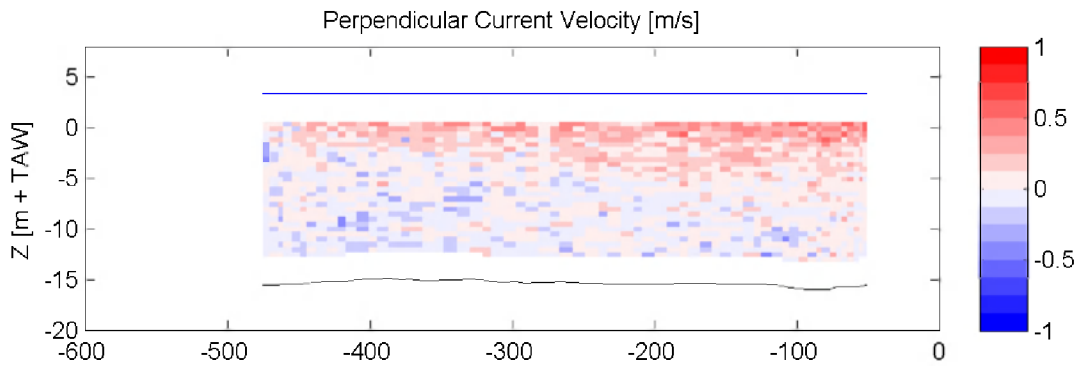

| | | | |
|---|---|---|---|
| 26/06/2008 | 3 hrs after HW | Tidal coefficient: 0.97 | Fresh water: 69 m³/s |

h)



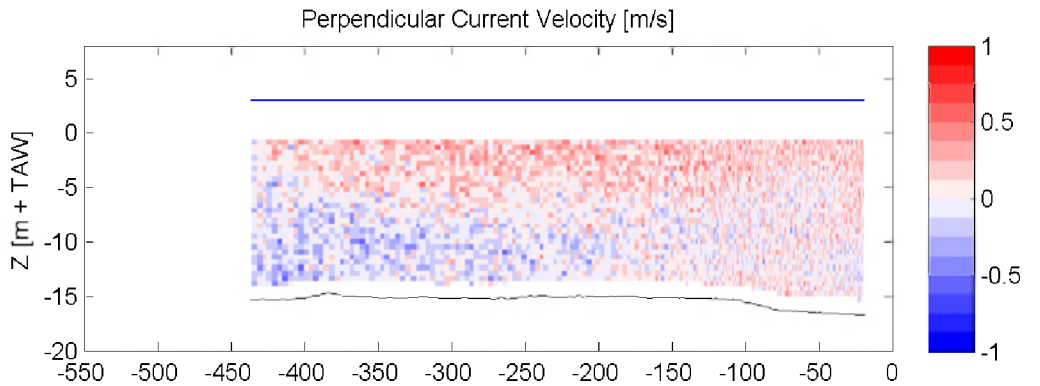

| | | | |
|---|---|---|---|
| 24/09/2008 | 3 hrs after HW | Tidal coefficient: 0.81 | Fresh water: 75 m³/s |

i)




| | | | |
|---|---|---|---|
| 30/09/2008 | 3 hrs after HW | Tidal coefficient: 1.08 | Fresh water: 82 m³/s |

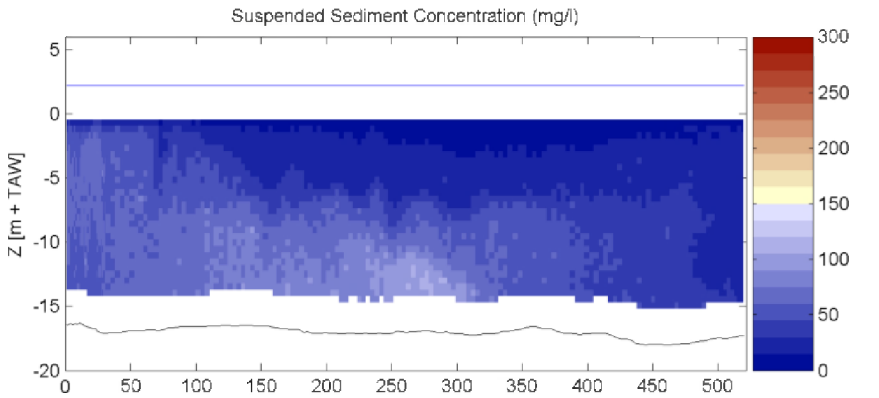
j)




| | | | |
|---|---|---|---|
| 02/12/2008 | 3 hrs after HW | Tidal coefficient: 0.98 | Fresh water: 154 m³/s |

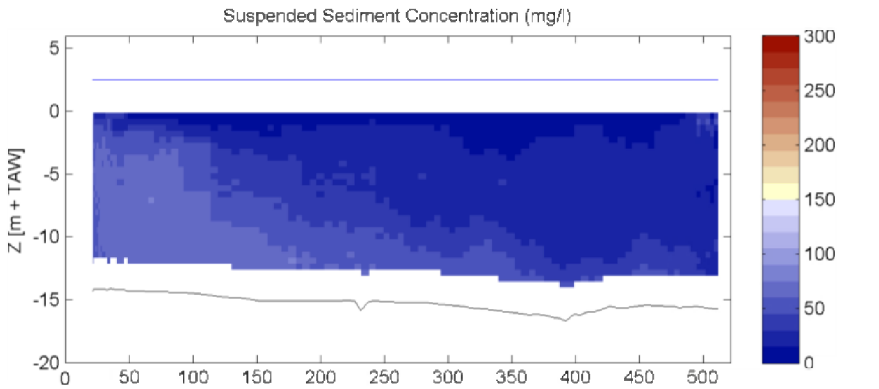
*Figure 5-5: a) Perpendicular current velocity on 17/11/2005, b) on 22/03/2006, c) on 27/09/2006, d) on 24/10/2007, e) on 11/03/2008, f) on 19/06/2008, g) on 26/06/2008 h) 24/09/2008, i) on 30/09/2008 and j) on 02/12/2008 at 3h after high water*

a)



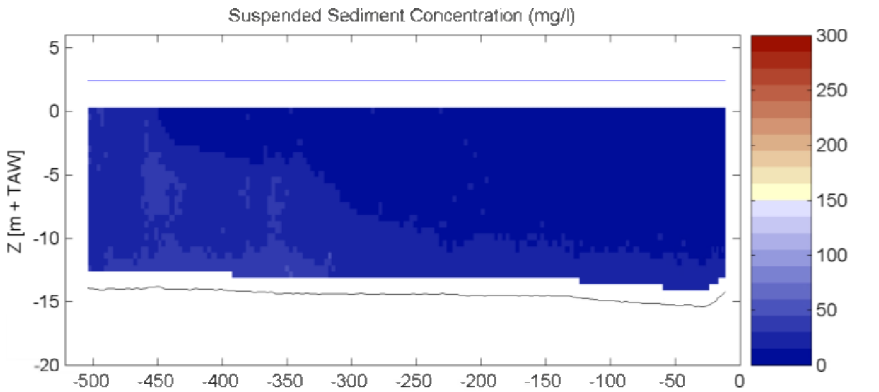

| | | | |
|---|---|---|---|
| 17/11/2005 | 3 hrs after HW | Tidal coefficient: 1.10 | Fresh water: 91 m³/s |

b)



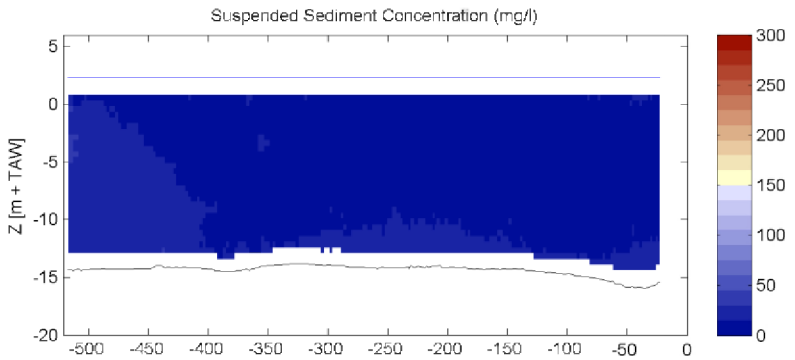

| | | | |
|---|---|---|---|
| 22/03/2006 | 3 hrs after HW | Tidal coefficient: 0.97 | Fresh water: 94 m³/s |

c)



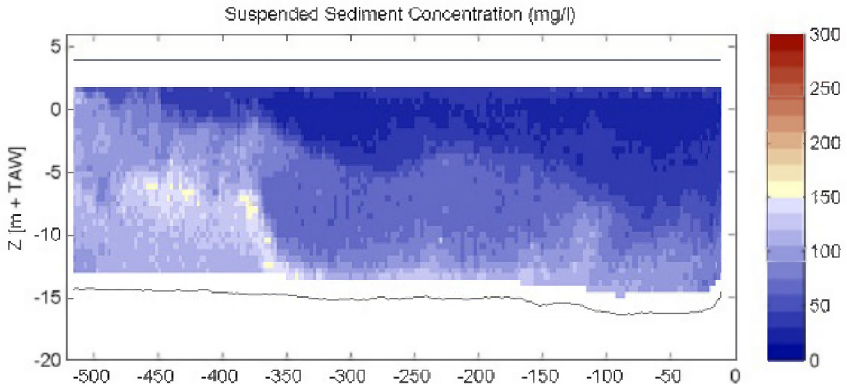

| | | | |
|---|---|---|---|
| 27/09/2006 | 3 hrs after HW | Tidal coefficient: 1.03 | Fresh water: 33 m³/s |

d)



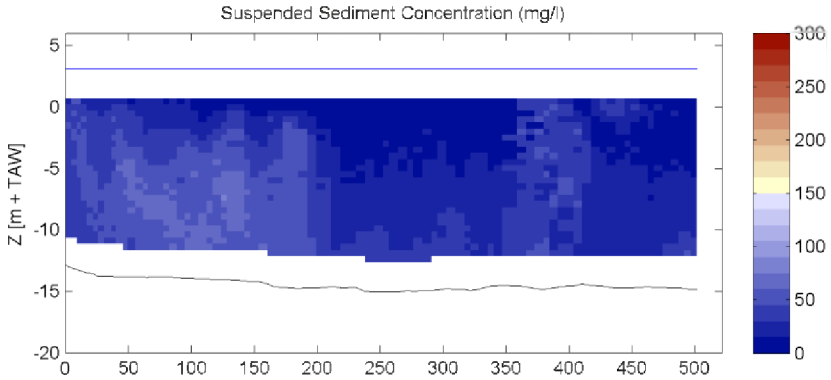

| | | | |
|---|---|---|---|
| 24/10/2007 | 3 hrs after HW | Tidal coefficient: 1.02 | Fresh water: 46 m³/s |

e)



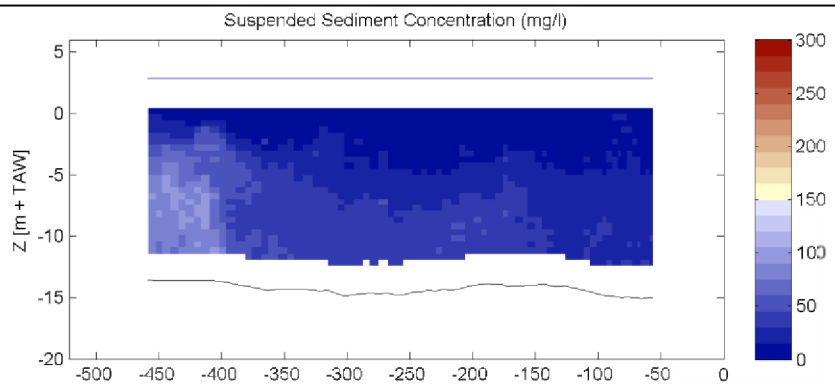

| | | | |
|---|---|---|---|
| 11/03/2008 | 3 hrs after HW | Tidal coefficient: 1.17 | Fresh water: 286 m³/s |

f)



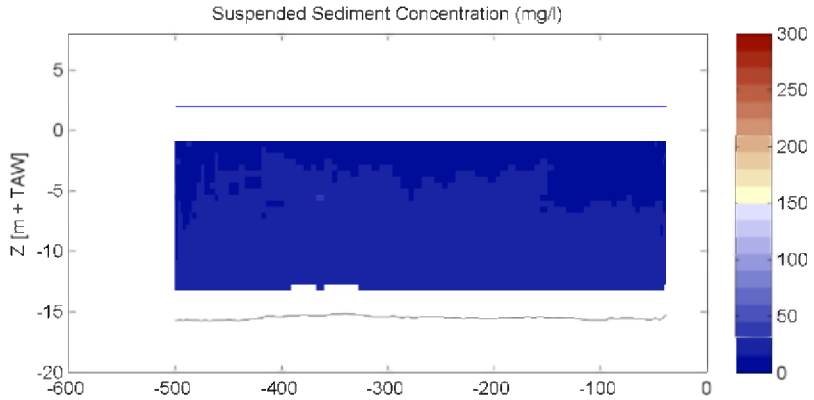

| | | | |
|---|---|---|---|
| 19/06/2008 | 3 hrs after HW | Tidal coefficient: 1.15 | Fresh water: 93 m³/s |

g)



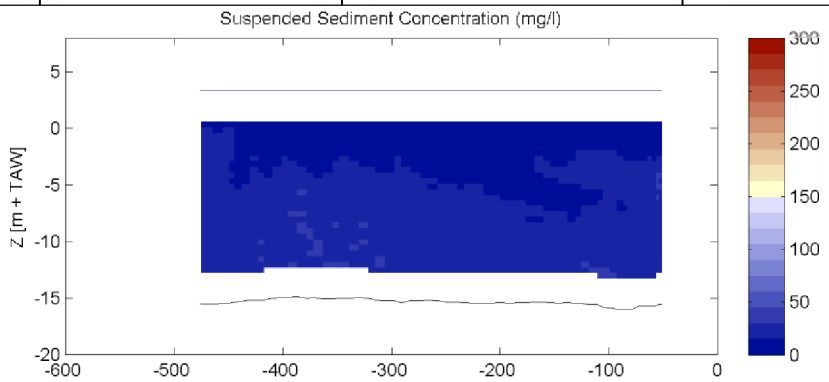

| | | | |
|---|---|---|---|
| 26/06/2008 | 3 hrs after HW | Tidal coefficient: 0.97 | Fresh water: 69 m³/s |

h)



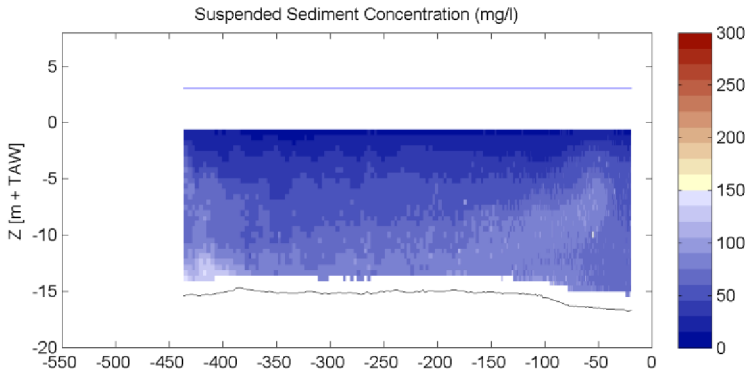

| | | | |
|---|---|---|---|
| 24/09/2008 | 3 hrs after HW | Tidal coefficient: 0.81 | Fresh water: 75 m³/s |

i)




| | | | |
|---|---|---|---|
| 30/09/2008 | 3 hrs after HW | Tidal coefficient: 1.08 | Fresh water: 82 m³/s |

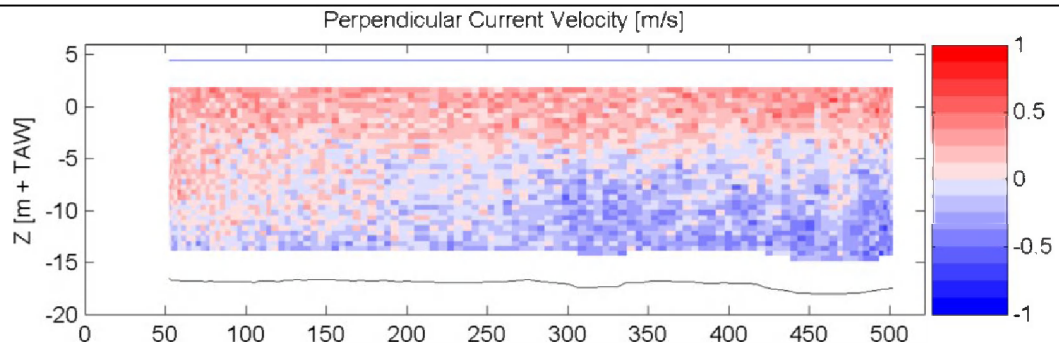
j)




| | | | |
|---|---|---|---|
| 02/12/2008 | 3 hrs after HW | Tidal coefficient: 0.98 | Fresh water: 154 m³/s |

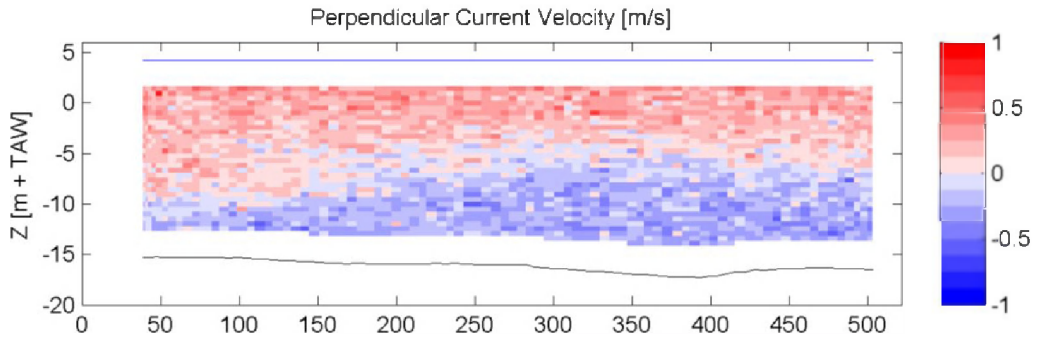
*Figure 5-6: a) Suspended sediment concentration on 17/11/2005, b) on 22/03/2006, c) on 27/09/2006, d) on 24/10/2007, e) on 11/03/2008, f) on 19/06/2008, g) on 26/06/2008, on 24/09/2008, i) 30/09/2008 and j) 02/12/2008 at 3h after high water*

a)



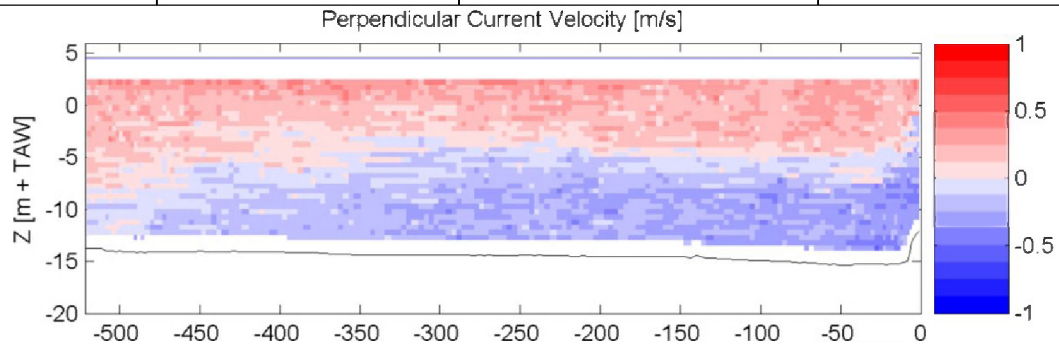

| | | | |
|---|---|---|---|
| 17/11/2005 | 1 hr after HW | Tidal coefficient: 1.10 | Fresh water: 91 m³/s |

b)



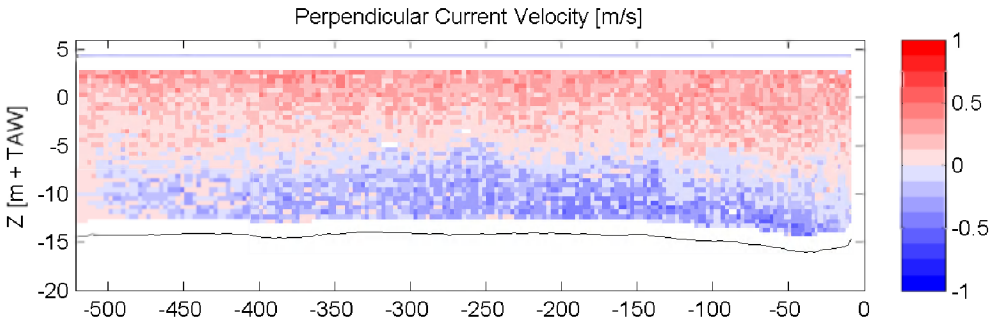

| | | | |
|---|---|---|---|
| 22/03/2006 | 1 hr after HW | Tidal coefficient: 0.97 | Fresh water: 94 m³/s |

c)



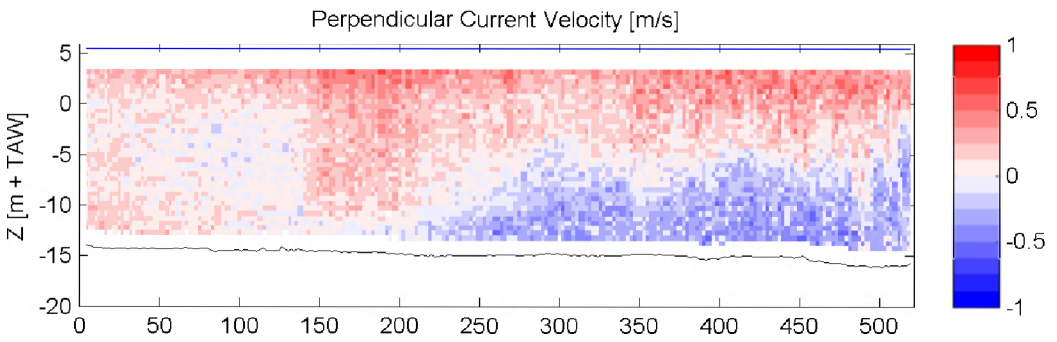

| | | | |
|---|---|---|---|
| 27/09/2006 | 1 hr after HW | Tidal coefficient: 1.03 | Fresh water: 33 m³/s |

d)



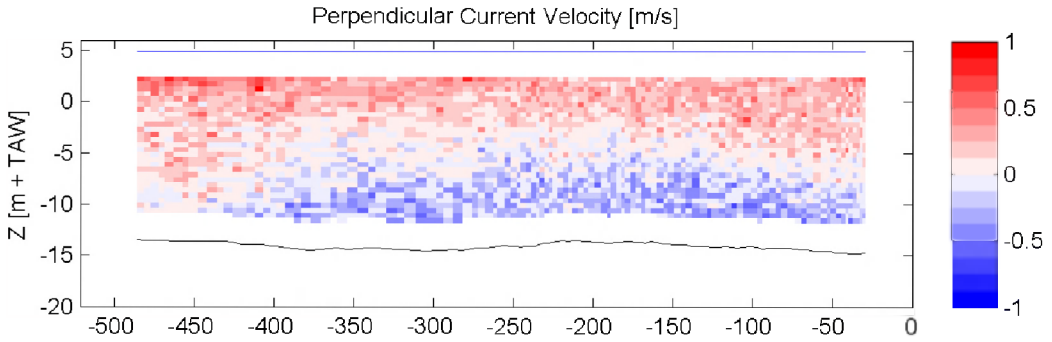

| | | | |
|---|---|---|---|
| 24/10/2007 | 1 hr after HW | Tidal coefficient: 1.02 | Fresh water: 46 m³/s |

e)



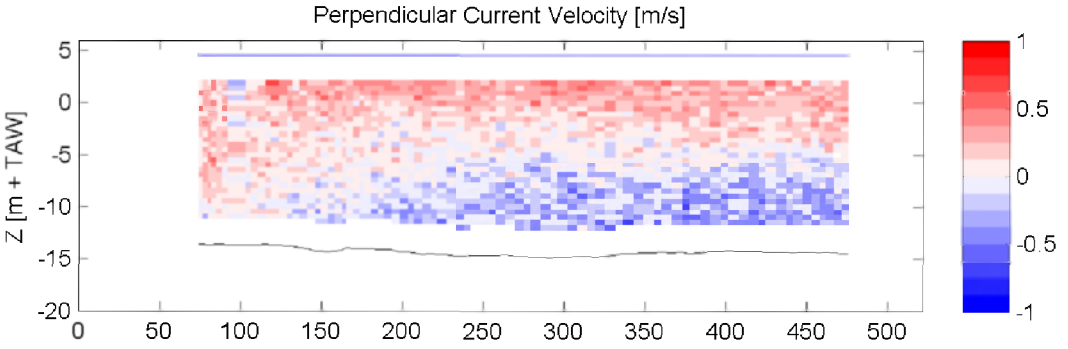

| | | | |
|---|---|---|---|
| 11/03/2008 | 1 hr after HW | Tidal coefficient: 1.17 | Fresh water: 286 m³/s |

f)




| | | | |
|---|---|---|---|
| 19/06/2008 | 1 hr after HW | Tidal coefficient: 1.15 | Fresh water: 93 m³/s |

g)




| | | | |
|---|---|---|---|
| 26/06/2008 | 1 hr after HW | Tidal coefficient: 0.97 | Fresh water: 69 m³/s |

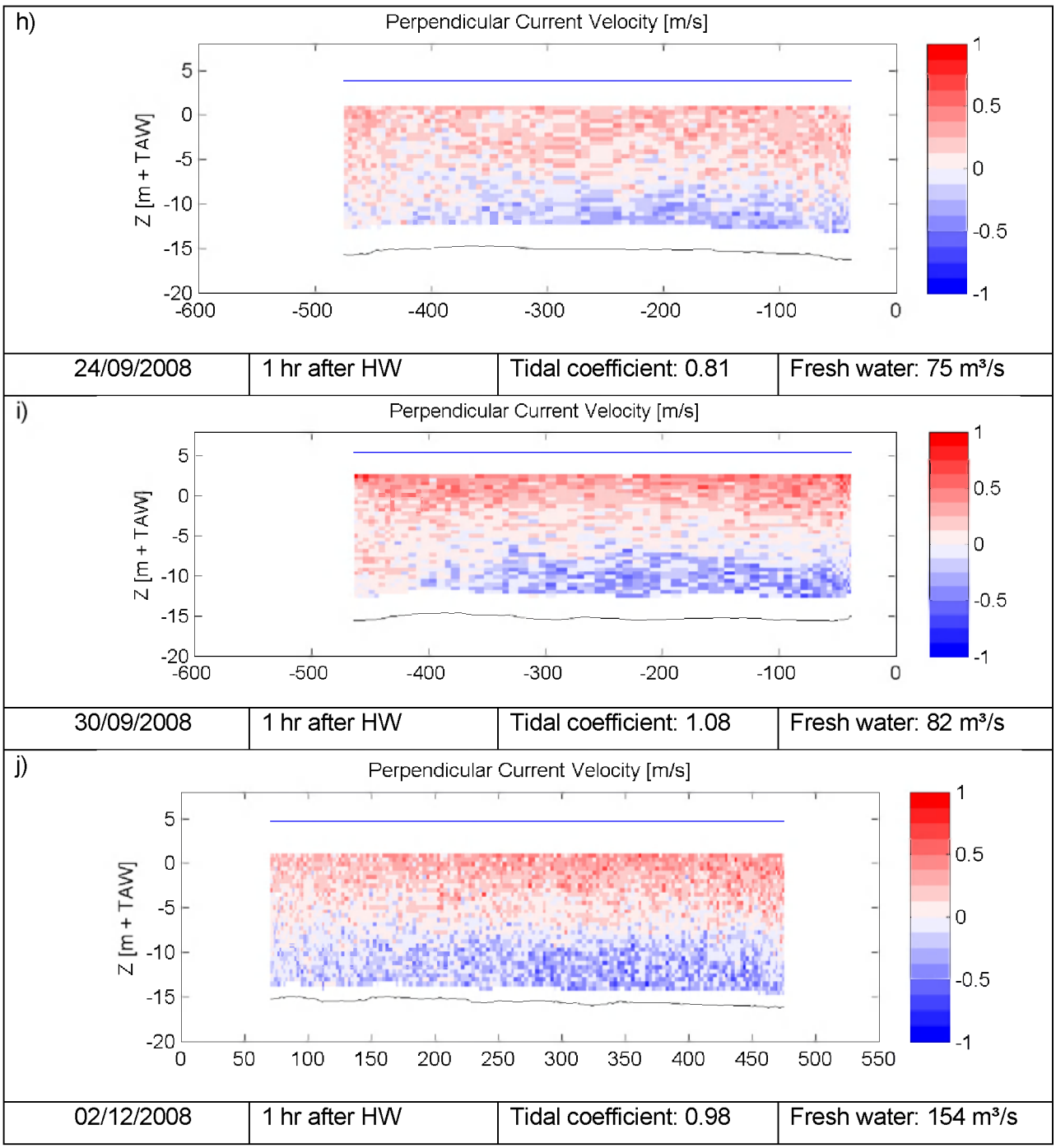
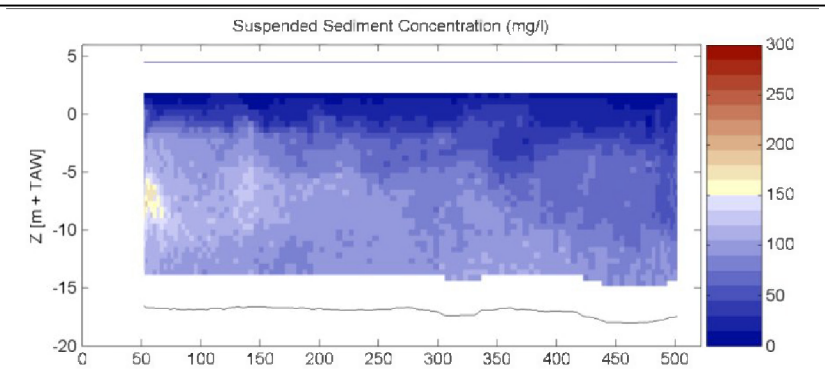


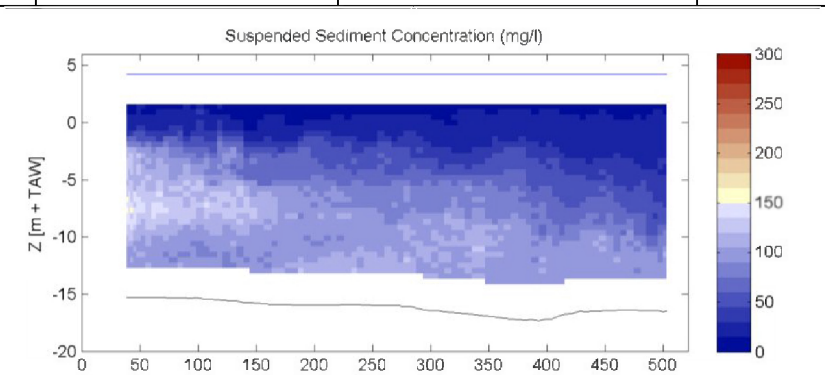

*Figure 5-7: a) Perpendicular current velocity on 17/11/2005, b) on 22/03/2006 , c) on 27/09/2006, d) on 24/10/2007, e) on 11/03/2008, f) on 19/06/2008, g) on 26/06/2008, on h) 24/09/2008, on i) 30/09/2008 and j) on 02/12/2008 at 1h after high water*

a)



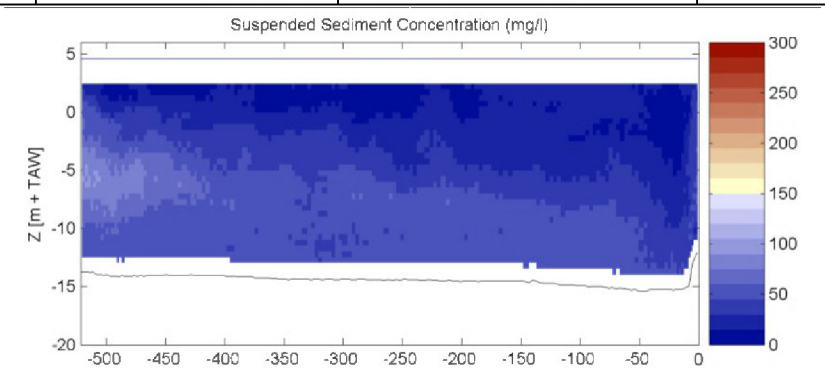

| | | | |
|---|---|---|---|
| 17/11/2005 | 1 hr after HW | Tidal coefficient: 1.10 | Fresh water: 91 m³/s |

b)



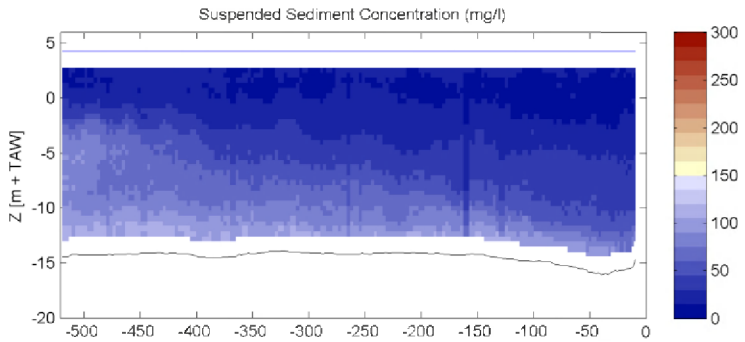

| | | | |
|---|---|---|---|
| 22/03/2006 | 1 hr after HW | Tidal coefficient: 0.97 | Fresh water: 94 m³/s |

c)



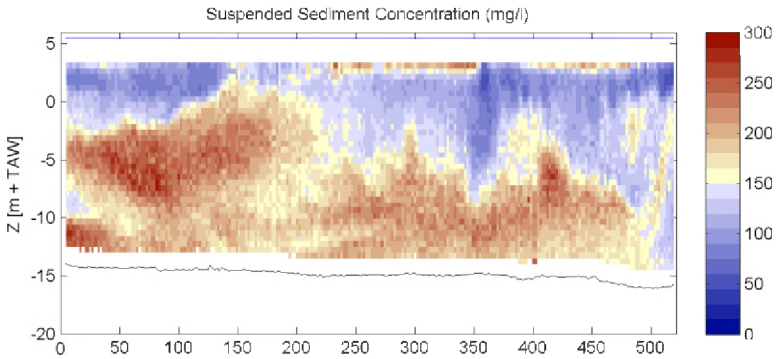

| | | | |
|---|---|---|---|
| 27/09/2006 | 1 hr after HW | Tidal coefficient: 1.03 | Fresh water: 33 m³/s |

d)



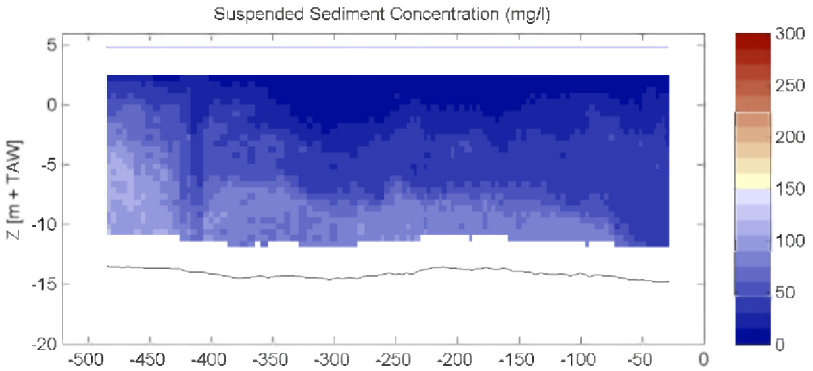

| | | | |
|---|---|---|---|
| 24/10/2007 | 1 hr after HW | Tidal coefficient: 1.02 | Fresh water: 46 m³/s |

e)



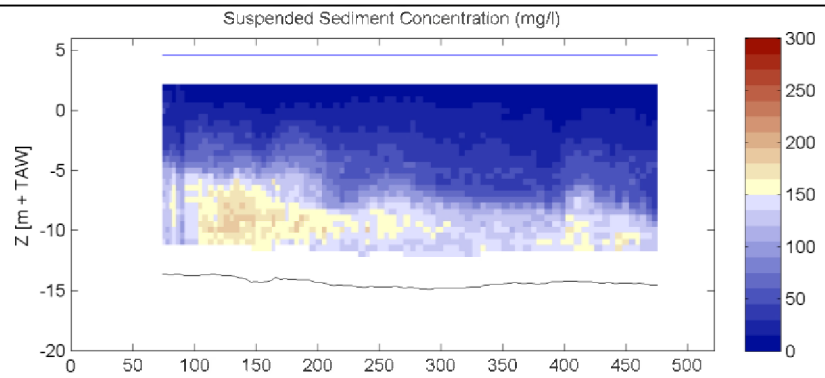

| | | | |
|---|---|---|---|
| 11/03/2008 | 1 hr after HW | Tidal coefficient: 1.17 | Fresh water: 286 m³/s |

f)



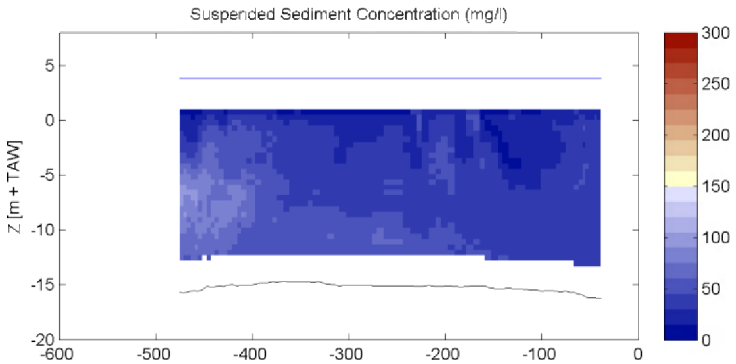

| | | | |
|---|---|---|---|
| 19/06/2008 | 1 hr after HW | Tidal coefficient: 1.15 | Fresh water: 93 m³/s |

g)



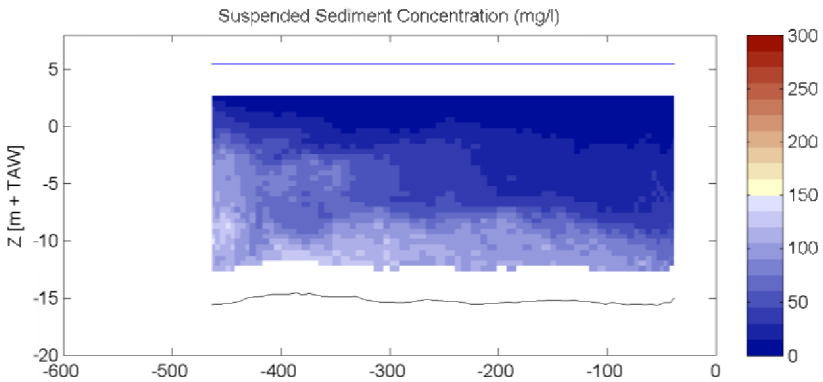

| | | | |
|---|---|---|---|
| 26/06/2008 | 1 hr after HW | Tidal coefficient: 0.97 | Fresh water: 69 m³/s |

h)

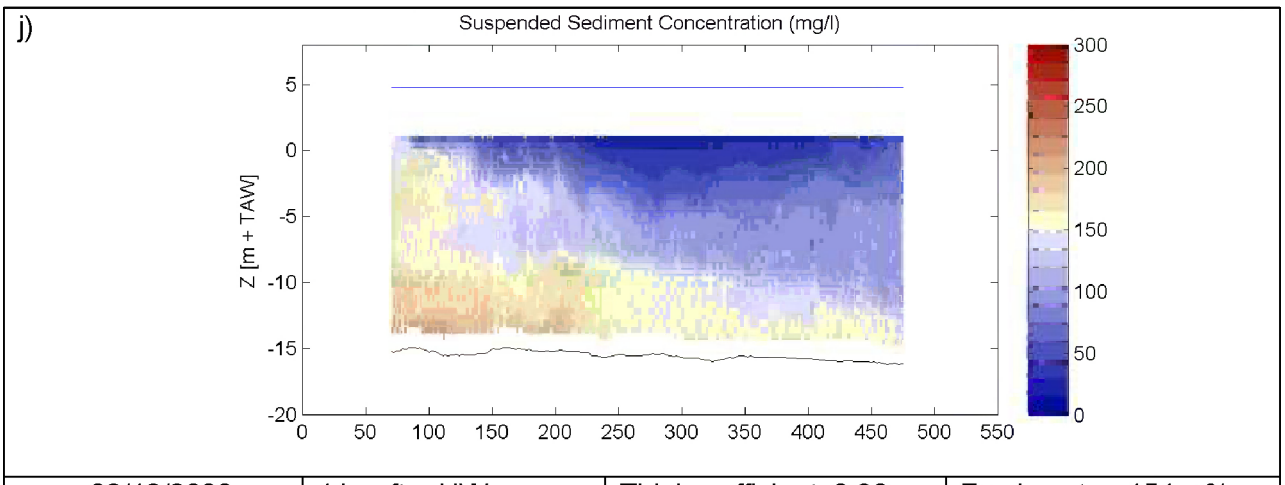



| | | | |
|---|---|---|---|
| 24/09/2008 | 1 hr after HW | Tidal coefficient: 0.81 | Fresh water: 75 m³/s |

i)




| | | | |
|---|---|---|---|
| 30/09/2008 | 1 hr after HW | Tidal coefficient: 1.08 | Fresh water: 82 m³/s |




| | | | |
|---|---|---|---|
| 02/12/2008 | 1 hr after HW | Tidal coefficient: 0.98 | Fresh water: 154 m³/s |

*Figure 5-8: a) Suspended sediment concentration on 17/11/2005, b) on 22/03/2006 , c) on 27/09/2006, d) on 24/10/2007, e) on 11/03/2008, f) on 19/06/2008, g) on 26/06/2008, on h) 24/09/2008, on i) 30/09/2008 and j) on 02/12/2008 at 1h after high water*

### 5.2.3. Water balance

The volume of water, crossing the dock's entrance during the complete measurement day was calculated by integrating respectively total incoming and total outgoing discharge. The absolute values of both volumes were added up to know the total water exchange through the transect on the 2nd of December 2008. Flood and ebb total water exchange were calculated with the same technique.

Next to the measured total water exchange, the theoretical exchanged water volume due to tidal filling was calculated by integrating tidal difference over time multiplied by the surface area of Deurganckdok.

*Table 5-3 Total water exchange compared to tidal filling water exchange at transect DGD during ebb, flood and the complete measurement day*

| | ***Q Exchanged [m^3]*** | ***source*** |
|---|---|---|
| Measured Total Ebb | 36 715 558 | ADCP measurement |
| Tidal Emptying | 5 225 432 | Volume balance |
| Measured Total Flood | 33 852 955 | ADCP measurement |
| Tidal Filling | 5 090 483 | Volume balance |
| Measured Total | 70 568 513 | ADCP measurement |
| Tidal Filling/Emptying Total | 10 315 915 | Volume balance |

During flood on the 2nd of December 2008, 33.9 million m³ water crossed the entrance and during ebb 36.7 million m³ (see Figure 5-9). In total 70.6 million m³ water crossed the docks entrance, of which only 15% (5 million m³) can be contributed to tidal filling of Deurganckdok (see Figure 5-10). The other 85 % of water displacement at the entrance must be caused by density and eddy currents.

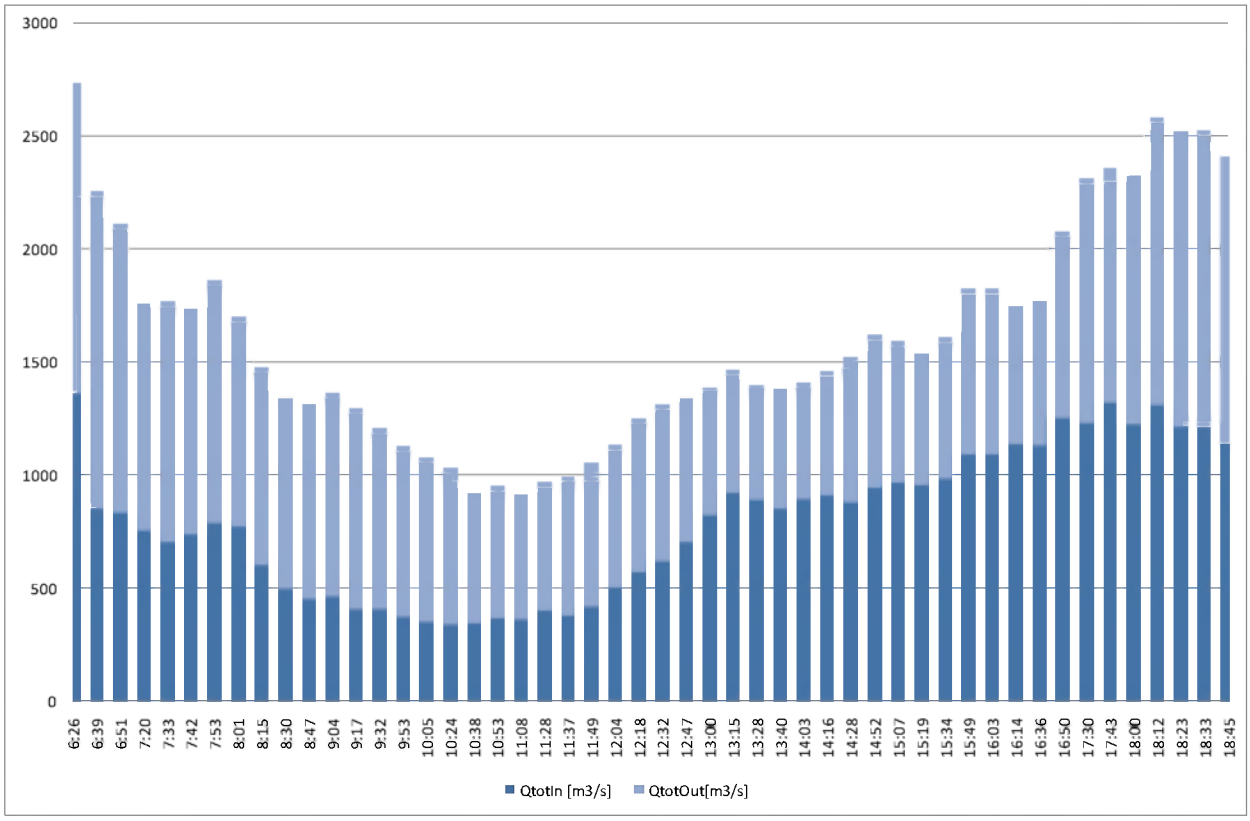



*Figure 5-9 Total incoming and outgoing discharge at DGD on 02/12/2008*

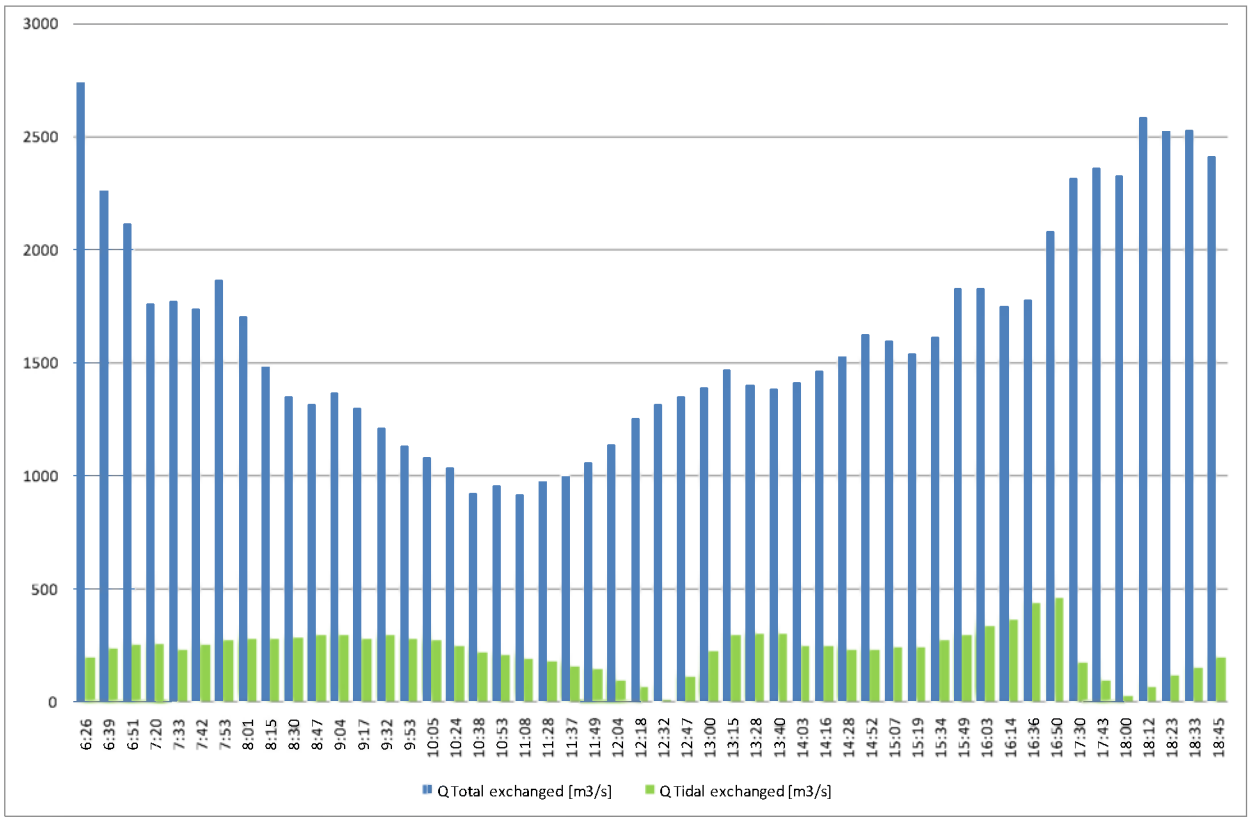



*Figure 5-10 Total exchanged discharge versus exchanged discharge due to tidal filling at DGD on 02/12/2008*

The measurements on the 2nd of December show comparable results to the mathematical modelling results for Deurganckdok (IMDC, 1998). This 3-D model was used to analyse the different exchange mechanisms between the river and the dock. By comparing the total amount of water leaving or entering the dock with the tidal volume, it was possible to identify that horizontal water exchange, due to density currents and eddy formation, is the dominant factor. The analysis led to the following conclusions :

- During an average tide ebb or flood the water exchange due to tidal filling is $7x10^6$ $m^3$, due to eddy effects about $6\text{-}12x10^6$ $m^3$ depending on the section and due to density effects about $29x10^6$ $m^3$. With density currents the total water exchange is thus about $42\text{-}48x10^6$ $m^3$. Without density effects the exchange would reduce to about $13\text{-}19x10^6$ $m^3$.
- Tidal filling and eddy effects are each responsible for ± 20% of the total water exchange.
- Density currents are responsible for ± 60-67% of the total water exchange.

Unlike previous campaigns, the water balance matches approximately, as the measured emptying of the dock is 0.5 million m³ over a period where tidal emptying is 0.1 million m³ (see Table 5-4). The emptying of the dock is thus overestimated by the measurements with 0.4 million cubic metres.

In comparison to the 10 million m³ of water exchanged by tidal filling/emptying, this overestimation of 0.4 million m³ seem rather low (see Figure 5-11), and compared to the 71 million cubes, the overestimation error is negligible (only 0.5% of the total exchanged volume (see Figure 5-12)).

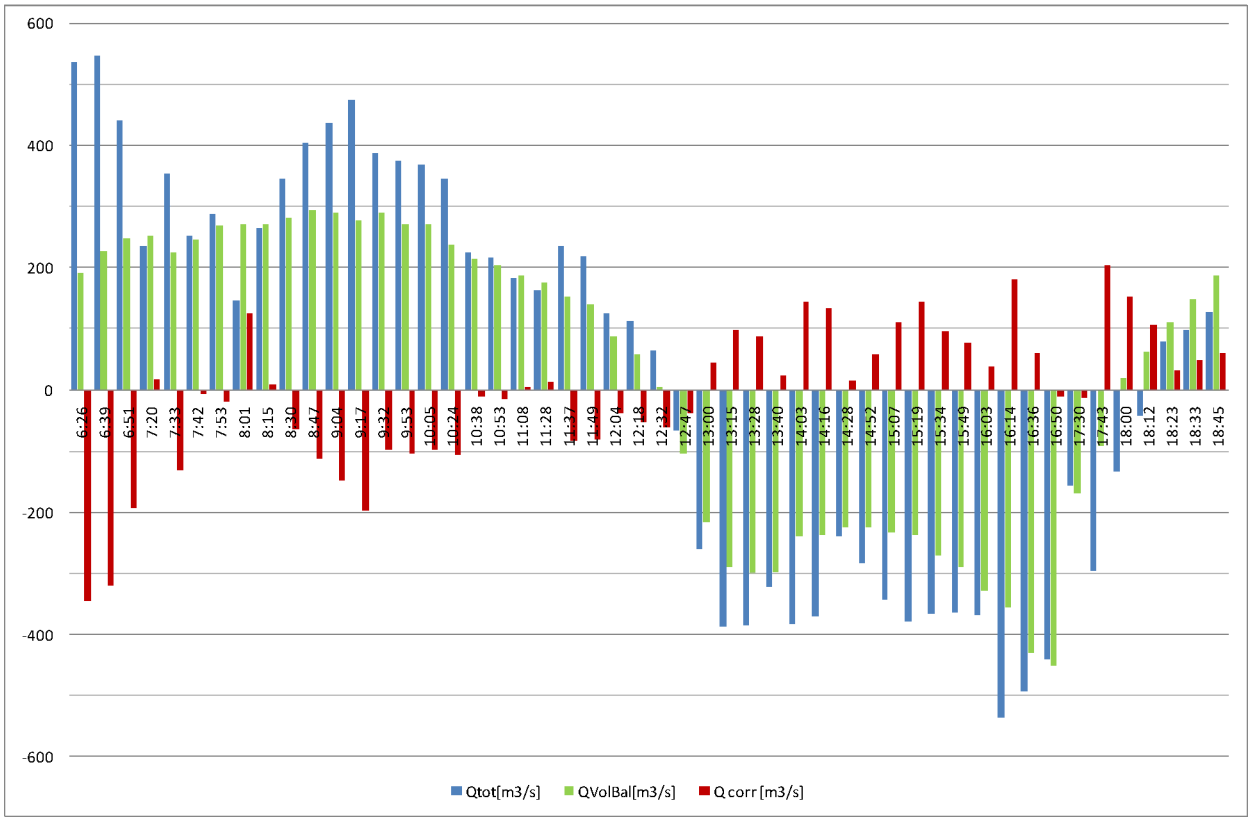



*Figure 5-11 Measured residual discharge (Qtot) versus theoretical residual discharge (QVolBal) and correction offset (Qcorr) at DGD on 02/12/08 (negative values represent incoming water)*

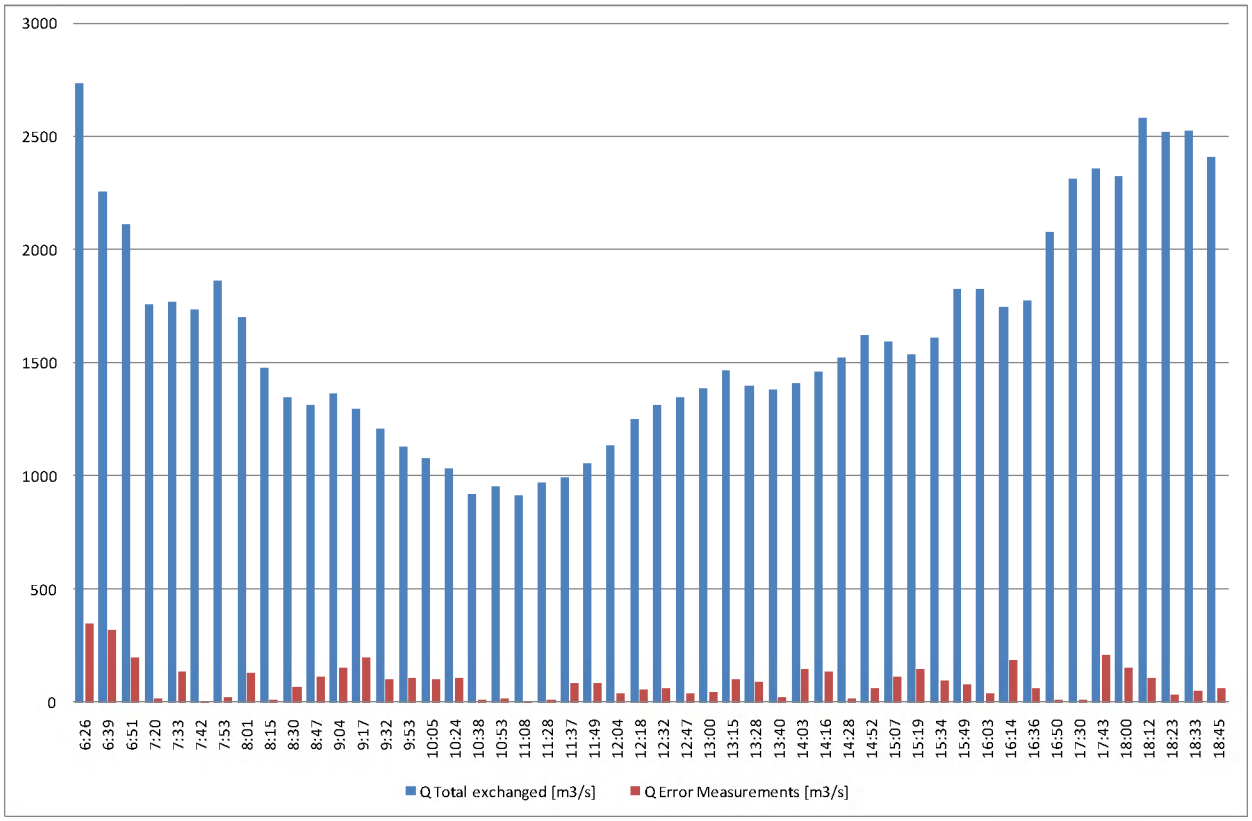



*Figure 5-12 Absolute error in total water exchange versus total water exchange at DGD on 02/12/2008*

*Table 5-4 Total residual, incoming and outgoing water volumes in Deurganckdok during the measurement campaign of 02/12/08 compared to tidal filling/emptying volumes.*

| | ***Q Total Net [m^3]*** | ***Q Total In [m^3]*** | ***Q Total Out [m^3]*** |
|---|---|---|---|
| Measured Ebb | 6 807 701 | 14 953 928 | 21 761 630 |
| Tidal Emptying | 5 225 432 | - | - |
| Measured Flood | 6 345 046 | 20 099 000 | 13 753 955 |
| Tidal Filling | 5 090 483 | - | - |
| Measured Net | 462 656 | 35 052 929 | 35 515 584 |
| Tidal Emptying Net | 134 948 | - | - |

One of the reasons of the overestimation can be found in the estimations of the unmeasured regions (the bottom, top and edge estimations). An ADCP cannot measure a complete cross section. Near the banks, near the bottom and near the water surface, no measurements can be executed and the discharges in these unmeasured areas needs to be estimated (see 4.2.4.1).

The errors caused by estimations can be minimised if a good vessel setup and appropriate ADCP and measurement protocol is chosen.

Compared to former campaigns, the effect of the top, bottom and edge estimates seems to be larger. This can be partly explained as a result of the boat setup and the used ADCP.

The uncertainty on the top estimated values has increased since the transducer depth of the ADCP was lowered from 1.4 meter (setup on the Parel II) to 1.8 meter (setup ADCP on the Scheldewacht II).

The uncertainty on the bottom estimated values for the measurements of 17/11/2005, 22/03/2006, 19/06/2008, 26/06/2008, 24/09/200 and 30/09/2008 was twice as big because of the beam angle of the used ADCP. In these measurements, the beam angle of the ADCP was 30°, therefore, the area near the bottom that is not be measured is 12% (see 4.2.4.1). During the other measurements, including this measurement, the ADCP had a beam angle of 20°, which implements a much smaller unmeasured area of 6%.

Compared to the first measurement campaigns the effect of estimations caused by interpolating between 2 successive transects is now minimized because the latest measurements were executed at a higher frequency, 5 to 6 measurements per hour, than the first measurements (2 measurements per hour).

As a conclusion, it appears that the water balance fit quite well (see Figure 5-11). The main cause for the unbalanced balance is the uncertainty/accuracy of the estimations and the fact that the total exchanged volume of water at the entrance of DGD is approximately five times bigger than the known resulting volume entering and leaving the dock, i.e. the tidal volume (see Figure 5-10).

In the future, it is important on one hand to minimize these estimates as much as possible by starting and ending the transects close to the quay walls, by minimising the transducer depth and by using an ADCP with a beam angle of 20° instead of 30°. On the second hand, it is important to maintain the high frequency of sailed transects.

### 5.2.4. Sediment balance

The mass of the suspended sediment, crossing dock's entrance during flood or ebb on a measurement day, was calculated on a similar manner as the volume.

From Figure 5-14 it can be concluded that the residual sediment flux is less than a fifth of the total sediment exchange at the entrance of Deurganckdok and from Figure 5-13 it can be seen that incoming and outgoing flux are always in the same order of magnitude. If these two conclusions are considered together one can see that the water balance has to fit before the sediment balance can be acceptable. An overestimation of outgoing discharge will always lead to an underestimation of the incoming sediment mass.

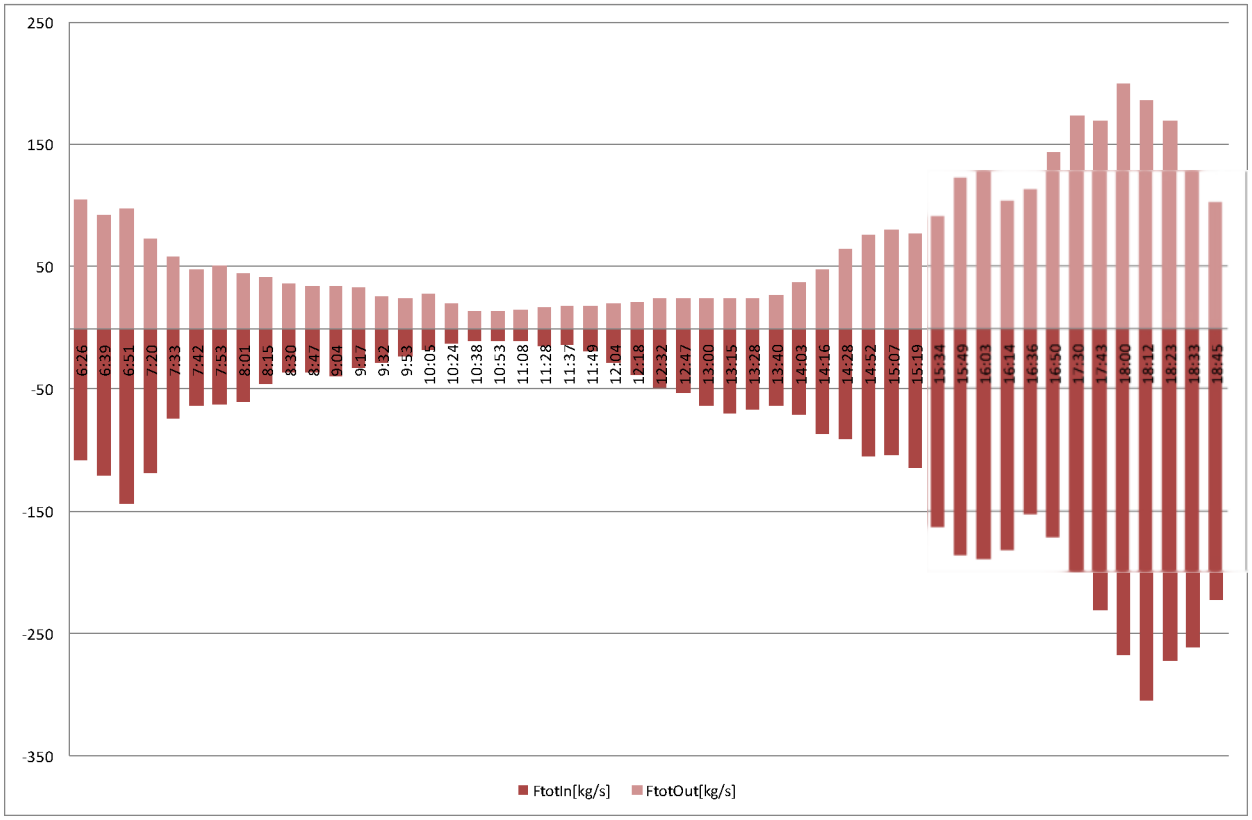



*Figure 5-13 Total incoming and outgoing sediment flux at DGD on 2/12/2008 (negative values represent incoming sediment)*

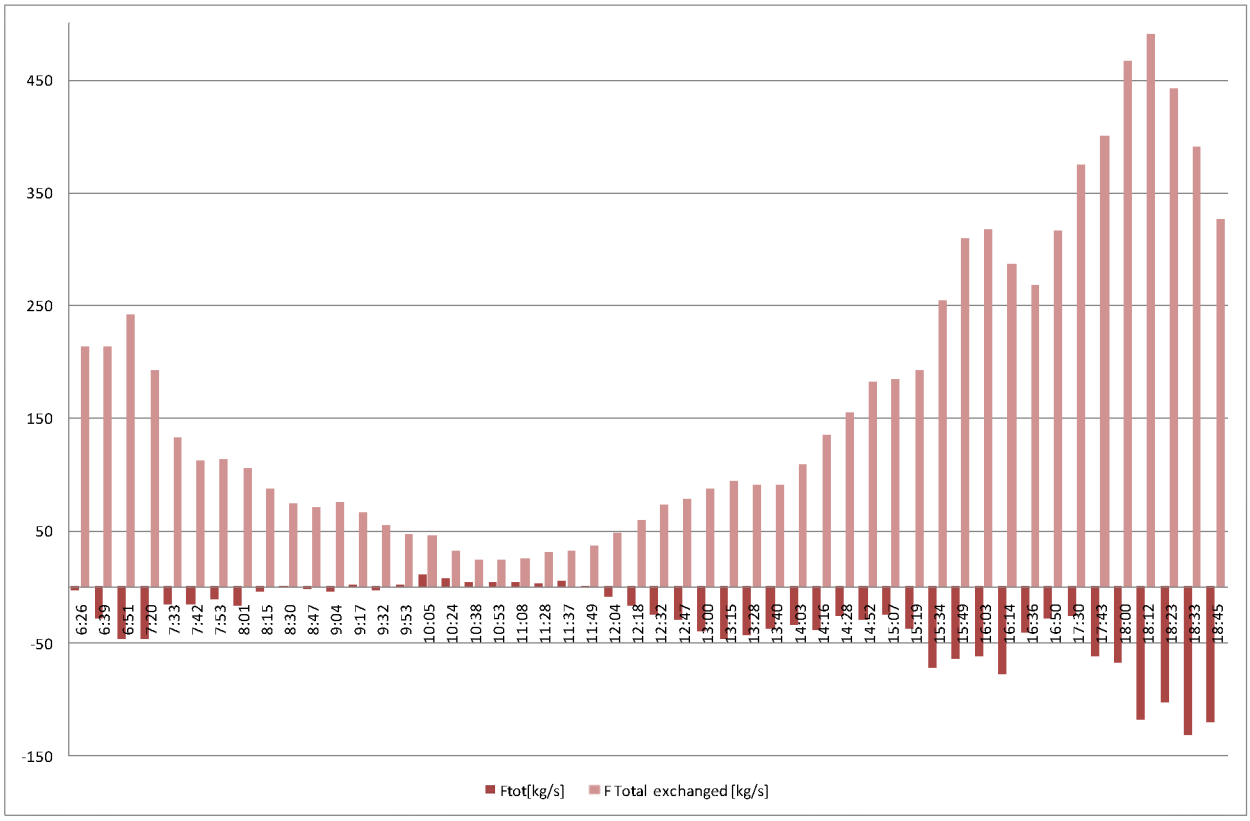



*Figure 5-14 Total sediment flux versus total sediment exchange at DGD on 2/12/2008 (negative values represent incoming sediment)*

As the error in water discharge is known (difference between total residual discharge and discharge due to tidal filling of the dock), one can try to correct discharges in order to calculate a more realistic sediment deposition in DGD over a tidal cycle. For the correction of the total discharge the following methods were used; in the first case the total incoming measured discharge was retained and the total outgoing discharge was reduced with 0.4 million $m^3$, in the second case the total outgoing discharge was retained and the total incoming discharge was raised with 0.4 million $m^3$. In both cases the total settled sediment mass increased. The settled sediment mass calculated with corrected discharges was estimated between 1167 and 1233 tonnes over the measurement cycle. During ebb approximately 2900 tonnes of sediment passed the entrance of which 589 to 519 stayed into the dock; during flood approximately 4300 tonnes passed the entrance of which 644 to 648 stayed into the dock.

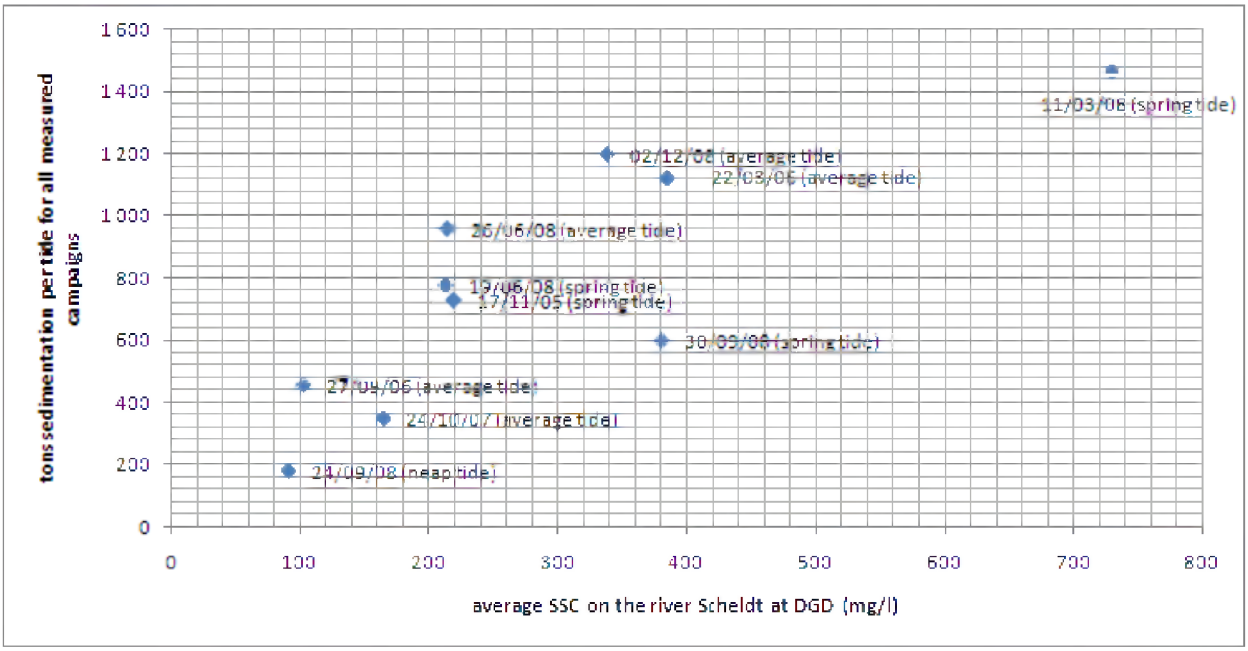



*Figure 5-15 Overview of measured sediment deposition in Deurganckdock per tide by means of Sediview technique*

In comparison to 3D simulations that were made to analyse the mud deposition in the dock (IMDC, 1998), model results from the empirical model described in report 4.10 (IMDC, 2008s) and former measurement campaigns at transect DGD, this resulting deposition during average tide is rather high. The model results from the empirical model described in report 4.10 (IMDC, 2008s) show net siltation rates from 400 to 2000 tonnes per tide, with a yearly average of 1000 tonnes per tide. The model results of the 3D model (IMDC, 1998) simulated siltation rates of ±1200 tonnes during a neap tide and ±1700 tonnes during a spring tide.

*Table 5-5: Water volumes during ebb, flood and measurement campaign on 17/11/2005 (Spring tide), 22/03/2006 (Average tide), 27/09/2006 (Average tide) and 24/10/2007 (Average tide), including theoretical expected volumes. The durations are based on ADCP measurement. Tidal data of gauge Liefkenshoek was used.*

| ***Measurement Day*** | | ***17/11/2005*** | ***22/03/2006*** | ***27/09/2006*** | ***24/10/2007*** |
|---|---|---|---|---|---|
| DGD surface area [$10^3$ m²] | | 750 | 750 | 750 | 1 019 |
| Tidal coefficient | | 1.1 | 0.97 | 1.03 | 1.02 |
| Duration of measurement [hh:mm] | | 10:57 | 12:52 | 12:42 | 12:24 |
| Daily fresh water discharge at Schelle [m³/s] | | 91 | 94 | 33 | 46 |
| Ebb | exchanged volume | 34 136 616 | 33 830 522 | 33 338 727 | 23 297 626 |
| | incoming volume | 18 436 105 | 14 715 880 | 14 974 087 | 8 579 394 |
| | outgoing volume | 15 700 511 | 19 114 642 | 18 364 640 | 14 718 232 |
| | residual outgoing volume | -2 735 594 | 4 398 762 | 3 390 553 | 6 138 838 |
| | residual tidal emptying = theoretical residual outgoing volume | 2 485 404 | 3 758 065 | 4 226 908 | 5 479 043 |
| | overestimed outgoing volume | -5 220 998 | 640 696 | -836 355 | 659 795 |
| Flood | exchanged volume | 24 304 195 | 28 058 426 | 24 938 855 | 19 611 830 |
| | incoming volume | 12 564 681 | 14 965 302 | 14 236 036 | 10 590 072 |
| | outgoing volume | 11 739 513 | 13 093 124 | 10 702 819 | 9 021 758 |
| | residual incoming volume | 825 168 | 1 872 179 | 3 533 217 | 1 568 313 |
| | residual tidal filling = theoretical residual incoming volume | 3 370 067 | 3 261 295 | 3 913 928 | 5 133 774 |
| | underestimated incoming volume | 2 544 898 | 1 389 116 | 380 711 | 3 565 461 |
| Total | exchanged volume | 58 440 811 | 61 888 948 | 58 277 582 | 42 909 456 |
| | incoming volume | 31 000 787 | 29 681 183 | 29 210 123 | 19 169 465 |
| | outgoing volume | 27 440 024 | 32 207 765 | 29 067 459 | 23 739 990 |
| | residual outgoing volume | -3 560 763 | 2 526 583 | -142 664 | 4 570 525 |
| | residual tidal emptying = theoretical residual outgoing volume | -884 663 | 496 771 | 312 980 | 345 269 |
| | overestimed outgoing volume | -2 676 100 | 2 029 812 | -455 644 | 4 225 255 |

*Table 5-6: Water volumes during ebb, flood and measurement campaign on 11/03/2008 (Spring tide), 19/06/2008 (Spring tide), 26/06/2008 Average tide, 24/09/2008 (neap tide), 30/09/2008 (Spring tide) & 2/12/2008 (average tide), including theoretical expected volumes. The durations are based on ADCP measurement. Tidal data of gauge Liefkenshoek was used.*

| ***Measurement Day*** | | ***11/03/2008*** | ***19/06/2008*** | ***26/06/2008*** | ***24/09/2008*** | ***29/09/2008*** | ***02/12/2008*** |
|---|---|---|---|---|---|---|---|
| DGD surface area [$10^3$ m²] | | 1 019 | 1 019 | 1 019 | 1 019 | 1 019 | 1 019 |
| Tidal coefficient | | 1.17 | 1.15 | 0.97 | 0.81 | 1.08 | 0.98 |
| Duration of measurement [hh:mm] | | 12:23 | 12:32 | 12:20 | 12:38 | 12:49 | 12:19 |
| Daily fresh water discharge at Schelle [m³/s] | | 286 | 93 | 69 | 75 | 82 | 154 |
| Ebb | exchanged volume | 30 605 480 | 29 862 615 | 25 668 407 | 25 792 421 | 32 789 767 | 36 715 558 |
| | incoming volume | 10 263 013 | 10 501 491 | 8 246 217 | 9 556 269 | 10 949 298 | 14 953 928 |
| | outgoing volume | 20 342 466 | 19 361 124 | 17 422 189 | 16 236 153 | 21 840 470 | 21 761 630 |
| | residual outgoing volume | 10 061 934 | 8 859 633 | 9 175 972 | 6 679 884 | 10 891 172 | 6 807 701 |
| | residual tidal emptying = theoretical residual outgoing volume | 5 957 334 | 5 456 121 | 4 805 274 | 4 099 889 | 6 208 764 | 5 225 432 |
| | overestimated outgoing volume | 4 104 600 | 3 403 512 | 4 370 698 | 2 579 995 | 4 682 408 | 1 582 269 |
| Flood | exchanged volume | 22 983 058 | 26 368 812 | 24 109 880 | 26 619 095 | 25 215 597 | 33 852 955 |
| | incoming volume | 14 477 186 | 14 602 453 | 11 817 853 | 14 615 500 | 14 186 274 | 20 099 000 |
| | outgoing volume | 8 505 873 | 11 766 360 | 12 292 027 | 12 003 595 | 11 029 323 | 13 753 955 |
| | residual incoming volume | 5 965 867 | 2 836 093 | 474 174 | 2 611 905 | 3 156 951 | 6 345 046 |
| | residual tidal filling = theoretical residual incoming volume | 5 941 019 | 5 390 972 | 5 211 112 | 3 620 075 | 5 767 856 | 5 090 483 |
| | underestimated incoming volume | -24 848 | 2 554 879 | 4 736 938 | 1 008 169 | 2 610 905 | -1 254 562 |
| Total | exchanged volume | 53 588 538 | 56 231 427 | 49 778 287 | 52 411 517 | 58 005 364 | 70 568 513 |
| | incoming volume | 24 740 199 | 25 103 943 | 20 064 071 | 24 171 769 | 25 135 572 | 35 515 584 |
| | outgoing volume | 28 848 339 | 31 127 483 | 29 714 217 | 28 239 748 | 32 869 792 | 35 052 929 |
| | residual outgoing volume | 4 096 067 | 6 023 540 | 9 650 146 | 4 067 979 | 7 734 220 | 462 656 |
| | residual tidal emptying = theoretical residual outgoing volume | 16 315 | 65 148 | -405 838 | 479 814 | 440 908 | 134 948 |
| | overestimated outgoing volume | 4 079 752 | 5 958 392 | 10 055 984 | 3 588 164 | 7 293 313 | 327 707 |

*Table 5-7 Range of sediment deposition during ebb, flood and measurement campaign on 17/11/2005 (Spring tide), 22/03/2006 (Average tide) and 27/09/2006 (Average tide), calculated with forced fitting water balances for those days. The duration is based on ADCP measurements.*

| ***Measurement Day*** | | ***17/11/2005*** | | ***22/03/2006*** | | ***27/09/2006*** | |
|---|---|---|---|---|---|---|---|
| DGD surface area [10³ m²] | | | 750 | | 750 | | 750 |
| Tidal coefficient | | | 1.1 | | 0.97 | | 1.03 |
| Duration of measurement [hh:mm] | | | 10:57 | | 12:52 | | 12:42 |
| Daily fresh water discharge at Schelle [m³/s] | | | 91 | | 94 | | 33 |
| Ebb | exchanged mass [kg] | 1 703 926 | 2 367 275 | 1 780 460 | 1 867 483 | 1 056 448 | 1 090 019 |
| | incoming mass [kg] | 1 087 233 | 1 488 674 | 1 160 142 | 1 217 874 | 635 375 | 656 454 |
| | outgoing mass [kg] | 616 692 | 878 601 | 620 317 | 649 609 | 421 074 | 433 565 |
| | residual incoming mass [kg] | 470 541 | 610 073 | 539 825 | 568 265 | 214 301 | 222 890 |
| Flood | exchanged mass [kg] | 1 804 593 | 1 498 429 | 2 092 190 | 2 328 688 | 683 915 | 663 551 |
| | incoming mass [kg] | 999 502 | 841 383 | 1 319 543 | 1 459 070 | 462 843 | 448 383 |
| | outgoing mass [kg] | 805 091 | 657 046 | 772 648 | 869 618 | 221 073 | 215 168 |
| | residual incoming mass [kg] | 194 411 | 184 337 | 546 895 | 589 452 | 241 770 | 233 215 |
| Total | exchanged mass [kg] | 3 508 519 | 3 865 704 | 3 872 650 | 4 196 170 | 1 740 364 | 1 753 570 |
| | incoming mass [kg] | 2 086 735 | 2 330 057 | 2 479 685 | 2 676 943 | 1 098 217 | 1 104 837 |
| | outgoing mass [kg] | 1 421 783 | 1 535 647 | 1 392 965 | 1 519 227 | 642 146 | 648 733 |
| | residual incoming mass [kg] | 664 952 | 794 410 | 1 086 720 | 1 157 717 | 456 071 | 456 105 |

*Table 5-8 Range of sediment deposition during ebb, flood and measurement campaign on 24/10/2007 (Average tide), 11/03/2008 (Spring tide), 19/06/2008 (Spring tide) and 26/06/2008 (Average tide), calculated with forced fitting water balances for those days. The duration is based on ADCP measurements.*

| ***Measurement Day*** | | ***24/10/2007*** | | ***11/03/2008*** | | ***19/06/2008*** | | ***26/06/2008*** | |
|---|---|---|---|---|---|---|---|---|---|
| DGD surface area [$10^3$ m²] | | | 1 019 | | 1 019 | | 1 019 | | 1 019 |
| Tidal coefficient | | | 1.02 | | 1.17 | | 1.15 | | 0.97 |
| Duration of measurement [hh:mm] | | | 12:24 | | 12:23 | | 12:32 | | 12:20 |
| Daily fresh water discharge at Schelle [m³/s] | | | 46 | | 286 | | 93 | | 69 |
| Ebb | exchanged mass [kg] | 619 806 | 584 893 | 2 589 128 | 3 641 521 | 1 087 599 | 1 375 505 | 1 040 509 | 1 471 199 |
| | incoming mass [kg] | 335 783 | 316 828 | 1 387 950 | 1 989 942 | 668 861 | 865 152 | 694 822 | 1 008 047 |
| | outgoing mass [kg] | 284 023 | 268 065 | 1 201 178 | 1 651 579 | 418 737 | 510 353 | 345 687 | 463 151 |
| | residual incoming mass [kg] | 51 760 | 48 763 | 186 772 | 338 362 | 250 124 | 354 799 | 349 135 | 544 896 |
| Flood | exchanged mass [kg] | 1 015 320 | 714 273 | 2 928 327 | 2 956 105 | 1 710 175 | 2 039 419 | 1 173 483 | 1 884 440 |
| | incoming mass [kg] | 661 872 | 500 923 | 2 058 036 | 2 086 840 | 1 087 813 | 1 262 679 | 815 210 | 1 226 949 |
| | outgoing mass [kg] | 353 448 | 213 350 | 870 291 | 869 265 | 622 362 | 776 740 | 358 272 | 657 490 |
| | residual incoming mass [kg] | 308 424 | 287 573 | 1 187 745 | 1 217 575 | 465 450 | 485 939 | 456 938 | 569 459 |
| Total | exchanged mass [kg] | 1 635 126 | 1 299 166 | 5 517 455 | 6 597 625 | 2 797 774 | 3 414 924 | 2 213 992 | 3 355 639 |
| | incoming mass [kg] | 997 655 | 817 751 | 3 445 986 | 4 076 781 | 1 756 674 | 2 127 831 | 1 510 032 | 2 234 997 |
| | outgoing mass [kg] | 637 470 | 481 415 | 2 071 469 | 2 520 844 | 1 041 100 | 1 287 093 | 703 960 | 1 120 642 |
| | residual incoming mass [kg] | 360 185 | 336 337 | 1 374 517 | 1 555 937 | 715 574 | 840 738 | 806 073 | 1 114 355 |

*Table 5-9 Range of sediment deposition during ebb, flood and measurement campaign on 24/09/2008 (neap tide) & 30/09/2008 (Spring tide) and 2/12/2008 (Average tide), calculated with forced fitting water balances for those days. The duration is based on ADCP measurements.*

| ***Measurement Day*** | | ***24/09/2008*** | | ***30/09/2008*** | | ***02/12/2008*** | |
|---|---|---|---|---|---|---|---|
| DGD surface area [10³ m²] | | 1 019 | | 1 019 | | 1 019 | |
| Tidal coefficient | | 0.81 | | 1.08 | | 0.98 | |
| Duration of measurement [hh:mm] | | 12:38 | | 12:49 | | 12:19 | |
| Daily fresh water discharge at Schelle [m³/s] | | 75 | | 82 | | 154 | |
| Ebb | exchanged mass [kg] | 701 869 | 674 344 | 915 211 | 1 205 171 | 3 118 503 | 2 928 522 |
| | incoming mass [kg] | 402 477 | 316 469 | 558 775 | 768 792 | 1 853 641 | 1 723 816 |
| | outgoing mass [kg] | 299 392 | 357 875 | 356 437 | 436 379 | 1 264 862 | 1 204 706 |
| | residual incoming mass [kg] | 17 077 | 44 602 | 202 338 | 332 413 | 588 780 | 519 110 |
| Flood | exchanged mass [kg] | 993 459 | 991 306 | 1 135 260 | 1 341 907 | 4 151 712 | 4 500 008 |
| | incoming mass [kg] | 590 065 | 550 302 | 726 957 | 843 357 | 2 398 108 | 2 573 951 |
| | outgoing mass [kg] | 403 394 | 441 004 | 408 303 | 498 550 | 1 753 604 | 1 926 057 |
| | residual incoming mass [kg] | 146 908 | 149 061 | 318 655 | 344 807 | 644 504 | 647 894 |
| Total | exchanged mass [kg] | 1 695 328 | 1 665 650 | 2 050 471 | 2 547 078 | 7 270 216 | 7 428 530 |
| | incoming mass [kg] | 992 542 | 866 771 | 1 285 732 | 1 612 149 | 4 251 750 | 4 297 767 |
| | outgoing mass [kg] | 702 786 | 798 879 | 764 739 | 934 929 | 3 018 466 | 3 130 763 |
| | residual incoming mass [kg] | 163 986 | 193 663 | 520 993 | 677 220 | 1 233 284 | 1 167 004 |

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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): Studie van de stromingsvelden en sedimentuitwisseling aan de ingang van Deurganckdok. Additional processing of ADCP and salinity data 17/11/2005 and 28/11/2005 (I/RA/15030/06.040/BDC).

IMDC (2006o). 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 (2006p). 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 (2006q) 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 (2006r) Mer verruiming Westerschelde, Nota Bovenafvoer Scheldebekken, I/NO/11282/06.104/FPE.

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 2.4 Through tide measurement Sediview spring tide 27/09/2006 Parel 2 (I/RA/11283/06.119/MSA)

IMDC (2007p) 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 (2007q) 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 (2007r) 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 (2007s) 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 (2007t) 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 (2007v) 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 (2007w) 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 (2007u) 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)

IMDC (2008t) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.20: Sediment Balance: Three monthly report 1/4/2008 – 30/06/2008 (I/RA/11283/08.076/MSA)

IMDC (2008u) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.20: Through tide measurement Sediview during average tide Spring 2008 – 19 June 2008 (I/RA/11283/08.081/MSA)

IMDC (2008v) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.21: Through tide measurement Sediview during average tide Spring 2008 – 26 June 2008 (I/RA/11283/08.082/MSA)

IMDC (2008w) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.21: Sediment Balance: Three monthly report 1/7/2008 – 30/09/2008 (I/RA/11283/08.077/MSA)

IMDC (2008x) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.22: Through tide measurement Sediview during neap tide Summer 2008 – 24 September 2008 (I/RA/11283/08.083/MSA)

IMDC (2008y) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.28: Through tide measurement ADCP eddy Summer 2008 – 1 October 2008 (I/RA/11283/08.089/MSA)

IMDC (2008z) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.32: Salt-Silt distribution Deurganckdok: six monthly report 1/4/2008 – 30/9/2008 (I/RA/11283/08.093/MSA)

IMDC (2008aa) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.20: Boundary conditions: Six monthly report 1/4/2008 – 30/09/2008 (I/RA/11283/08.096/MSA)

IMDC (2009a) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.23: Through tide measurement Sediview during spring tide Summer 2008 – 30 September 2008 (I/RA/11283/08.084/MSA)

IMDC (2009b) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.29: Through tide measurement SiltProfiler summer 2008 – 29 September 2008 (I/RA/11283/07.090/MSA)

IMDC (2009c) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.34: Calibration stationary & mobile equipment autumn 2008 (I/RA/11283/08.095/MSA)

IMDC (2009d) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.22: Sediment Balance: Three monthly report 1/10/2008 – 31/12/2008 (I/RA/11283/08.078/MSA)

IMDC (2009e) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.24: Through tide measurement Sediview during neap tide Autumn 2008 (I/RA/11283/08.085/MSA)

IMDC (2009f) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.25: Through tide measurement Sediview during spring tide Autumn 2008 (I/RA/11283/08.086/MSA)

IMDC (2009g) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.23: Sediment Balance: Three monthly report 1/01/2009 – 31/03/2009 (I/RA/11283/08.079/MSA)

IMDC (2009h) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing Deelrapport 1.24: Annual Sediment Balance (I/RA/11283/08.080/MSA)

IMDC (2009i) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.26: Through tide measurement Sediview during neap tide Winter 2009 (I/RA/11283/08.087/MSA)

IMDC (2009j) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.30: Through tide measurement SiltProfiler winter 2009 (I/RA/11283/08.091/MSA)

IMDC (2009k) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.31: Through tide measurement Salinity Profiling winter 2009 (I/RA/11283/08.092/MSA)

IMDC (2009l) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.33: Salt-Silt distribution Deurganckdok: six monthly report 1/10/2008 – 31/3/2009 (I/RA/11283/08.094/MSA)

IMDC (2009m) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 3.21: Boundary conditions: Six monthly report 1/10/2008 – 31/03/2009 (I/RA/11283/08.097/MSA)

IMDC (2009n) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 2.27: Through tide measurement Sediview during spring tide Winter 2009 (I/RA/11283/08.088/MSA)

IMDC (2009o) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing. Deelrapport 4.20: Analysis of siltation Processes and Factors (I/RA/11283/08.098/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.

Van Maren DS (2006) 3D Mud transport model Zeeschelde, Scenario 4, Effect CDW on sedimentation Deurganckdok, WL Delft Hydraulics, Report Z3824, November 2006.

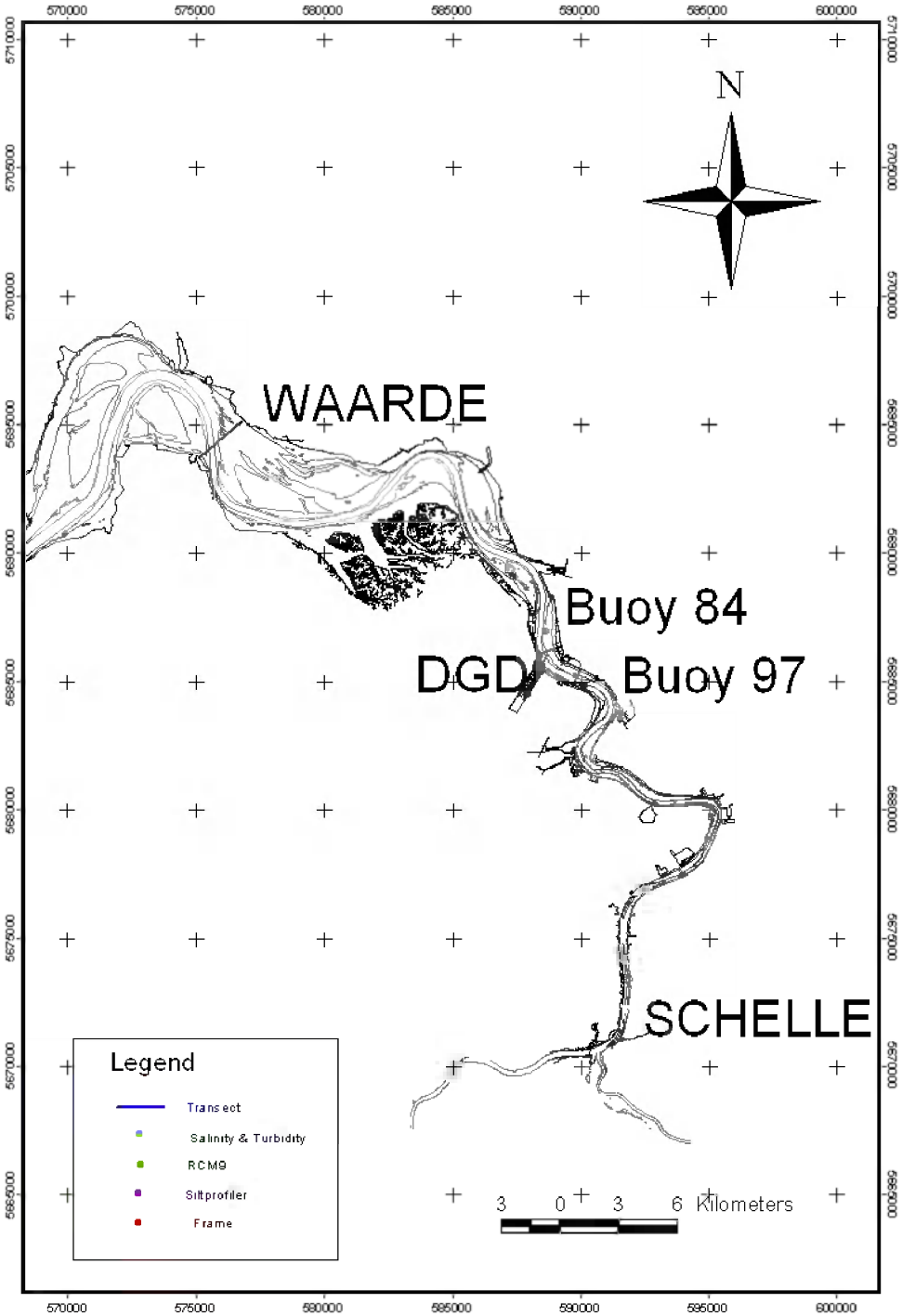
KNMI (2008) Royal Dutch Meteorological Institute www.knmi.nl

HMCZ (2008) Hydro Meteo Centrum Zeeland: www.hmcz.nl

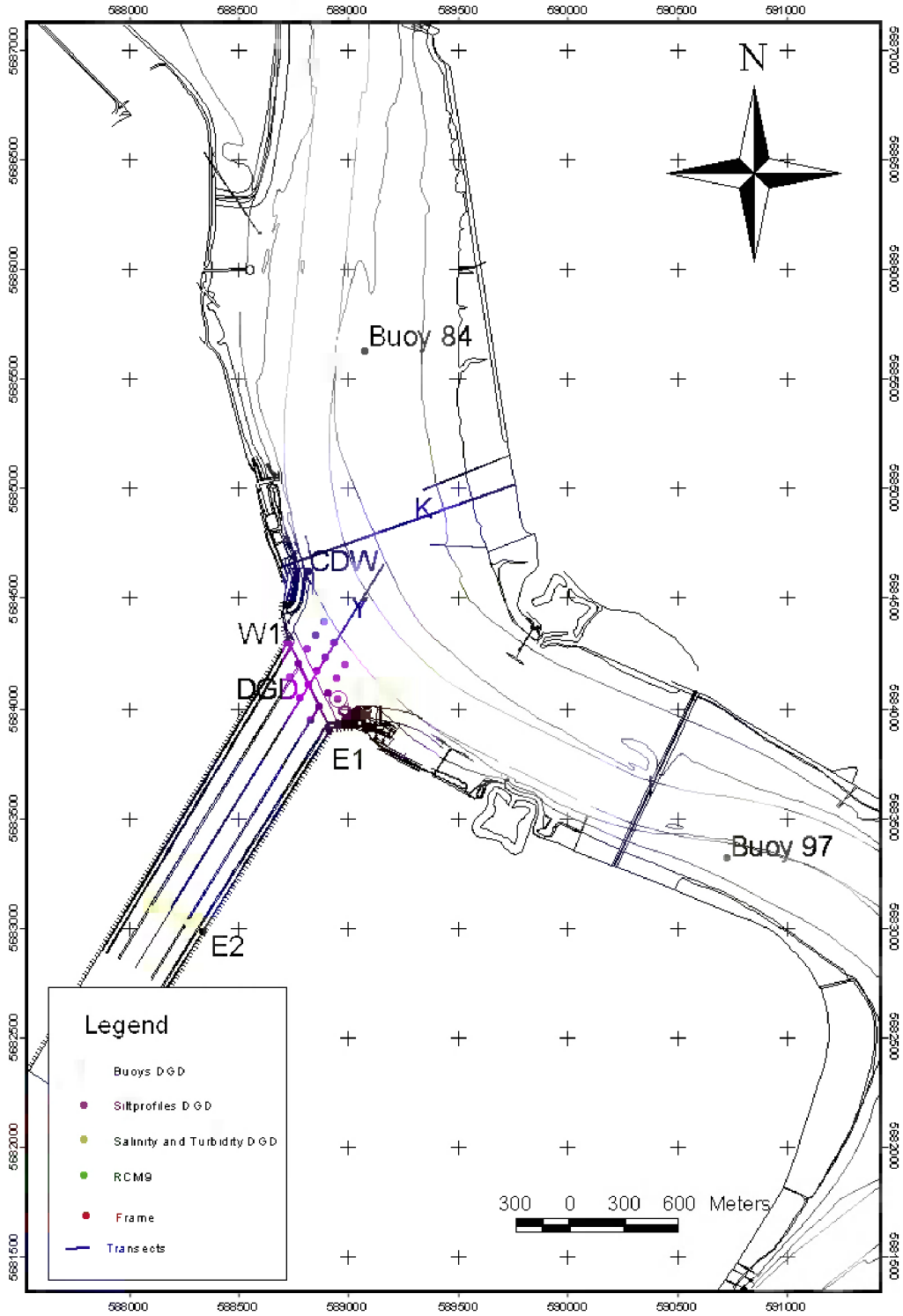
# APPENDIX A.

# OVERVIEW OF MEASUREMENT

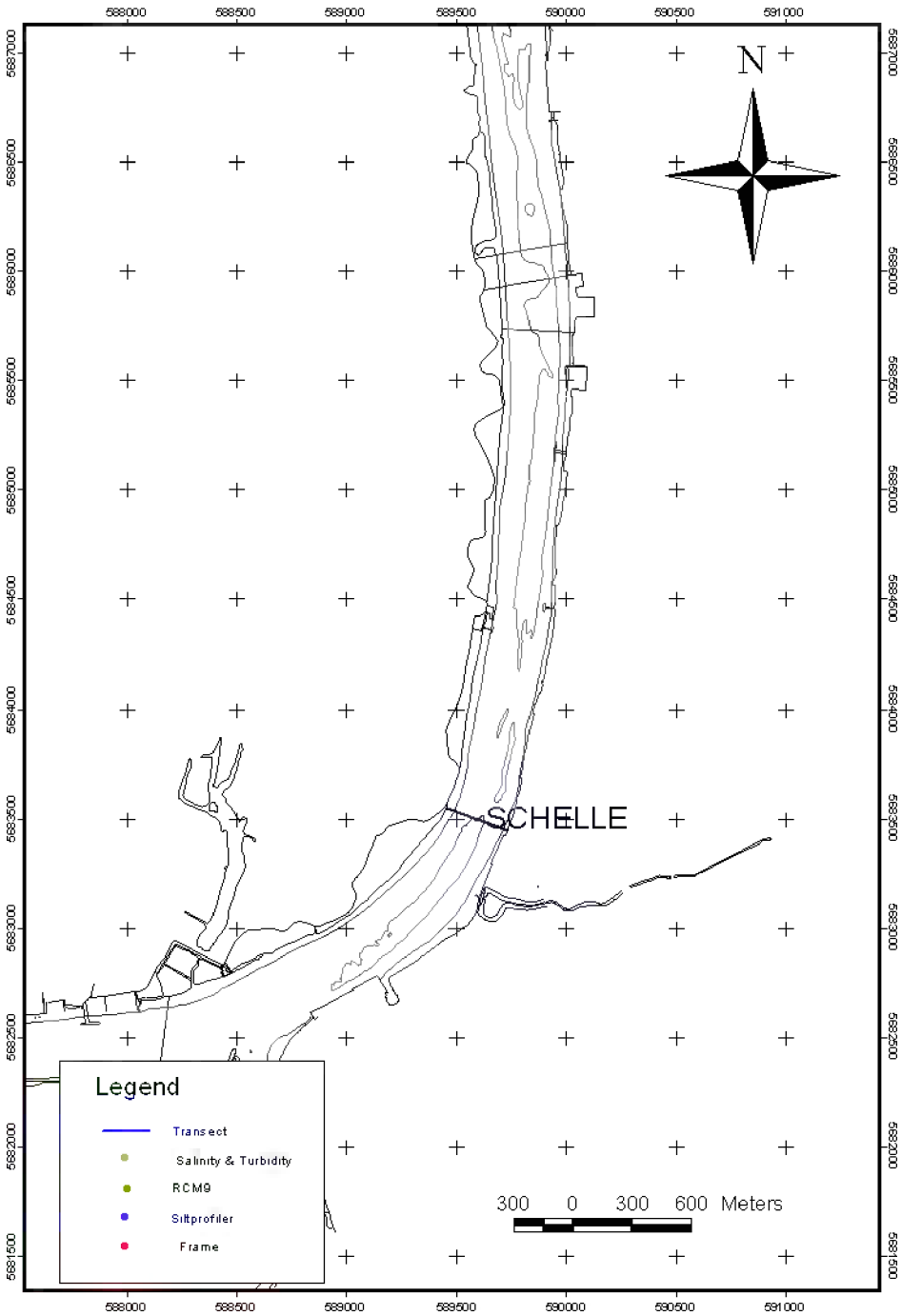
## A.1 Overview of the measurement locations for the whole HCBS2 and Deurganckdok measurement campaigns



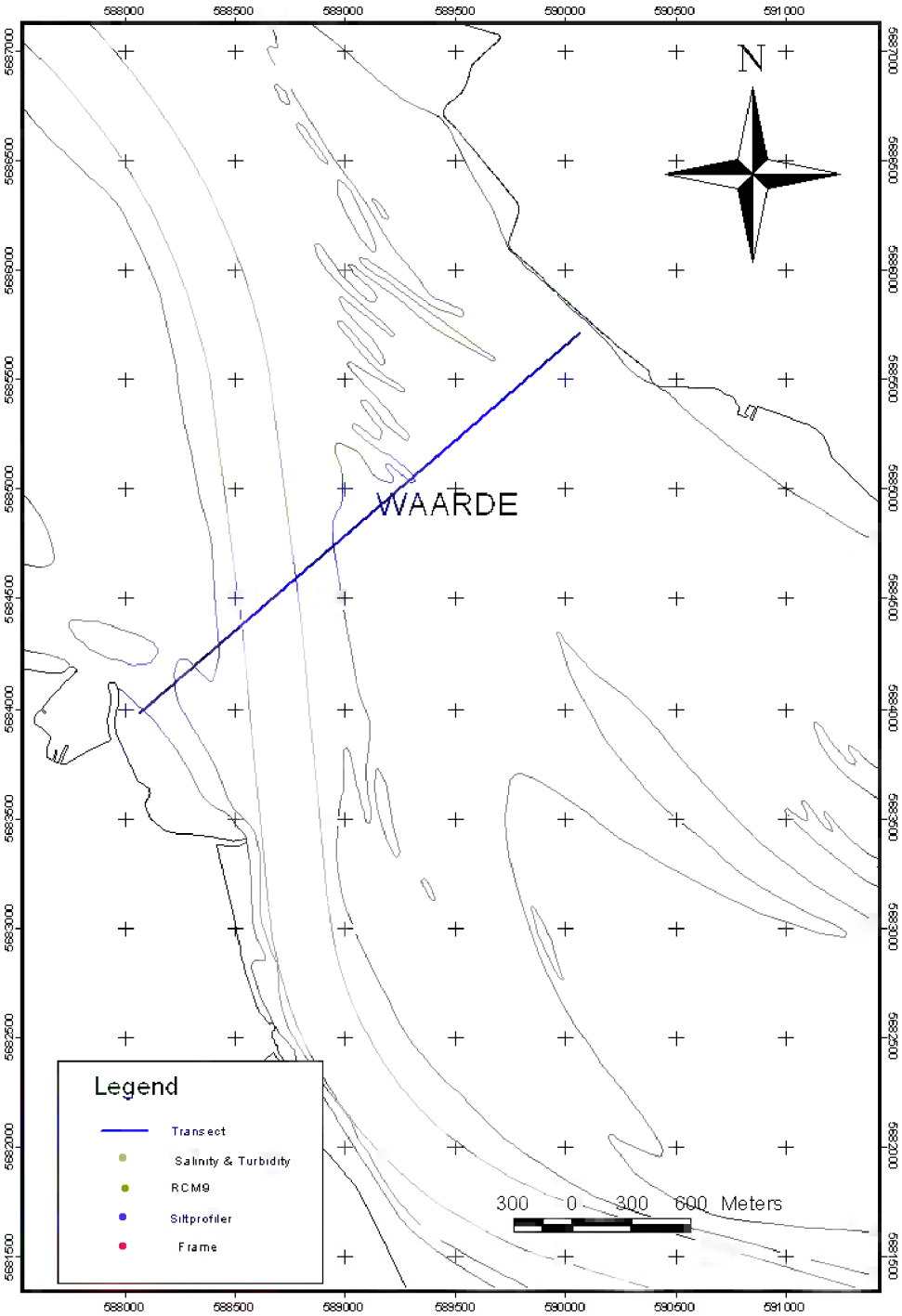

*Annex Figure A-1: Overview of the measurement locations*




*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 |

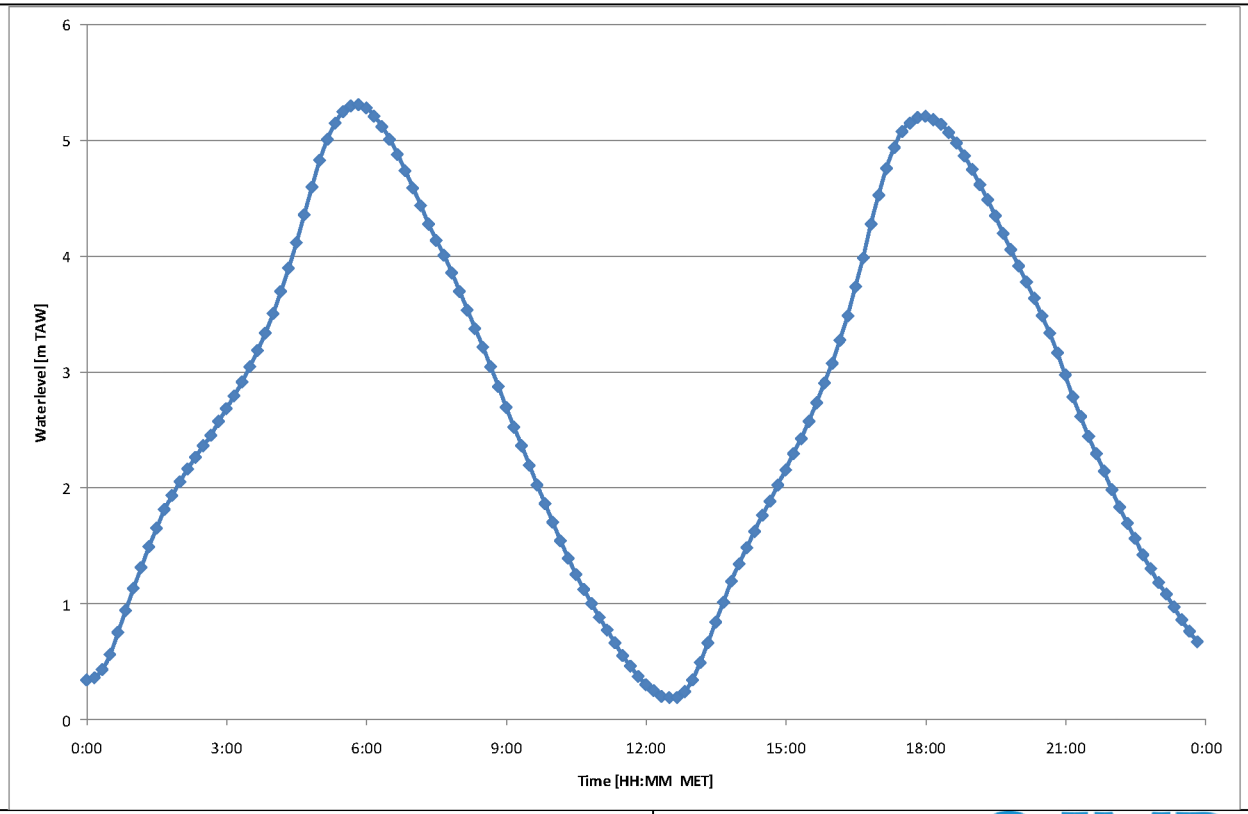
## A.3 Measurement overview at Transect DGD on 02/12/2008

| FileName | End time [hh:mm MET] | Time after HW [hh:mm] | Easting Start (UTM31 ED50) | Northing Start (UTM31 ED50) | Easting Stop (UTM31 ED50) | Northing Stop (UTM31 ED50) | Transect length [m] | Transect heading [°] |
|---|---|---|---|---|---|---|---|---|
| 1002TDGDlr_sub.csv | 6:26 | 0:36 | 588559.84 | 5684534.64 | 588740.26 | 5684071.39 | 497 | 159 |
| 1004TDGDrl_sub.csv | 6:39 | 0:49 | 588592.89 | 5684461.4 | 588736.21 | 5684069.8 | 417 | 340 |
| 1006TDGDlr_sub.csv | 6:51 | 1:01 | 588593.22 | 5684474.32 | 588755.23 | 5684102.47 | 406 | 156 |
| 1010TDGDlr_sub.csv | 7:20 | 1:30 | 588573.84 | 5684472.34 | 588739.39 | 5684102.01 | 406 | 156 |
| 1012TDGDrl_sub.csv | 7:33 | 1:43 | 588566.89 | 5684469.11 | 588735.6 | 5684101.35 | 405 | 335 |
| 1014TDGDlr_sub.csv | 7:42 | 1:52 | 588596.55 | 5684460.12 | 588735.69 | 5684096.43 | 389 | 159 |
| 1016TDGDrl_sub.csv | 7:53 | 2:03 | 588577.63 | 5684461.16 | 588715.65 | 5684113.52 | 374 | 338 |
| 1018TDGDlr_sub.csv | 8:01 | 2:11 | 588577.91 | 5684470.26 | 588765.58 | 5684093.99 | 420 | 153 |
| 1020TDGDrl_sub.csv | 8:15 | 2:25 | 588556.41 | 5684519.8 | 588738.35 | 5684080.88 | 475 | 337 |
| 1022TDGDlr_sub.csv | 8:30 | 2:40 | 588606.16 | 5684514.66 | 588750.83 | 5684071.85 | 466 | 162 |
| 1024TDGDrl_sub.csv | 8:47 | 2:57 | 588591.94 | 5684457.41 | 588751.62 | 5684070.94 | 418 | 338 |
| 1026TDGDlr.csv | 9:04 | 3:14 | 588573.54 | 5684515.34 | 588754.03 | 5684102.47 | 451 | 156 |
| 1028TDGDrl_sub.csv | 9:17 | 3:27 | 588555.77 | 5684515.06 | 588749.15 | 5684092.14 | 465 | 335 |
| 1030TDGDlr_sub.csv | 9:32 | 3:42 | 588579.35 | 5684468.98 | 588739.1 | 5684103.45 | 399 | 156 |
| 1032TDGDrl_sub.csv | 9:53 | 4:03 | 588566.28 | 5684495.97 | 588740.81 | 5684094.03 | 438 | 337 |
| 1034TDGDlr_sub.csv | 10:05 | 4:15 | 588593.57 | 5684516.39 | 588742.68 | 5684045.46 | 494 | 162 |
| 1036TDGDrl_sub.csv | 10:24 | 4:34 | 588554.99 | 5684531.66 | 588730.82 | 5684072.16 | 492 | 339 |
| 1038TDGDlr.csv | 10:38 | 4:48 | 588577.63 | 5684483.67 | 588762.94 | 5684070.87 | 452 | 156 |
| 1040TDGDrl_sub.csv | 10:53 | 5:03 | 588554.49 | 5684532.26 | 588726.35 | 5684061.46 | 501 | 340 |
| 1042TDGDlr_sub.csv | 11:08 | 5:18 | 588567.18 | 5684494.25 | 588779.89 | 5684101.2 | 447 | 152 |
| 1044TDGDrl.csv | 11:28 | 5:38 | 588563.09 | 5684497.75 | 588741.21 | 5684057.77 | 475 | 338 |
| 1046TDGDlr.csv | 11:37 | 5:47 | 588584.34 | 5684498.85 | 588759.03 | 5684091.29 | 443 | 157 |
| 1048TDGDrl_sub.csv | 11:49 | 5:59 | 588560.07 | 5684493.94 | 588750.16 | 5684083.71 | 452 | 335 |
| 1050TDGDlr_sub.csv | 12:04 | 6:14 | 588564.98 | 5684536.18 | 588770.02 | 5684086.93 | 494 | 155 |
| 1052TDGDrl_sub.csv | 12:18 | 6:28 | 588558.83 | 5684533.59 | 588755.03 | 5684061.69 | 511 | 337 |
| 1054TDGDlr.csv | 12:32 | -5:27 | 588565.38 | 5684538.06 | 588750.94 | 5684068.17 | 505 | 158 |
| 1056TDGDrl_sub.csv | 12:47 | -5:12 | 588566.48 | 5684530.15 | 588712.32 | 5684031.5 | 520 | 344 |
| 1058TDGDlr.csv | 13:00 | -4:59 | 588559.44 | 5684535.39 | 588748.96 | 5684081.12 | 492 | 157 |
| 1060TDGDrl_sub.csv | 13:15 | -4:44 | 588554.57 | 5684519.96 | 588719.3 | 5684081.12 | 469 | 339 |
| 1062TDGDlr_sub.csv | 13:28 | -4:31 | 588564.06 | 5684512.53 | 588740.19 | 5684070.51 | 476 | 158 |
| 1064TDGDrl.csv | 13:40 | -4:19 | 588560.08 | 5684509.02 | 588725.13 | 5684038.01 | 499 | 341 |
| 1066TDGDlr_sub.csv | 14:03 | -3:56 | 588590.38 | 5684541.87 | 588744.31 | 5684060.72 | 505 | 162 |
| 1068TDGDrl_sub.csv | 14:16 | -3:43 | 588557.76 | 5684529.59 | 588745.8 | 5684055.66 | 510 | 338 |
| 1070TDGDlr.csv | 14:28 | -3:31 | 588566.29 | 5684525 | 588735.88 | 5684059.78 | 495 | 160 |
| 1072TDGDrl_sub.csv | 14:52 | -3:7 | 588555.85 | 5684531.98 | 588744.42 | 5684051.35 | 516 | 339 |
| 1074TDGDlr_sub.csv | 15:07 | -2:52 | 588567.65 | 5684526.2 | 588740.44 | 5684051.21 | 505 | 160 |
| 1076TDGDrl_sub.csv | 15:19 | -2:40 | 588563.09 | 5684524.13 | 588731.94 | 5684095.37 | 461 | 339 |
| 1078TDGDlr.csv | 15:34 | -2:25 | 588565 | 5684533.9 | 588740.25 | 5684072.99 | 493 | 159 |
| 1080TDGDrl_sub.csv | 15:49 | -2:10 | 588560.97 | 5684499.1 | 588725.09 | 5684086.32 | 444 | 338 |
| 1082TDGDlr_sub.csv | 16:03 | -1:56 | 588628.67 | 5684556.87 | 588730.64 | 5684069.28 | 498 | 168 |

| FileName | End time [hh:mm MET] | Time after HW [hh:mm] | Easting Start (UTM31 ED50) | Northing Start (UTM31 ED50) | Easting Stop (UTM31 ED50) | Northing Stop (UTM31 ED50) | Transect length [m] | Transect heading [°] |
|---|---|---|---|---|---|---|---|---|
| 1084TDGDrl_sub.csv | 16:14 | -1:45 | 588561.02 | 5684533.58 | 588726.34 | 5684054.24 | 507 | 341 |
| 1086TDGDlr_sub.csv | 16:36 | -1:23 | 588630.37 | 5684569.47 | 588733.59 | 5684041.73 | 538 | 169 |
| 1088TDGDrl_sub.csv | 16:50 | -1:9 | 588556.85 | 5684532.21 | 588750.78 | 5684074.14 | 497 | 337 |
| 1090TDGDlr_sub.csv | 17:30 | -0:29 | 588578.93 | 5684542.89 | 588720.97 | 5684073.01 | 491 | 163 |
| 1092TDGDrl_sub.csv | 17:43 | -0:16 | 588573.8 | 5684506.33 | 588728.05 | 5684090.19 | 444 | 340 |
| 1094TDGDlr_sub.csv | 18:00 | 0:00 | 588585.11 | 5684537.83 | 588744.6 | 5684115.87 | 451 | 159 |
| 1096TDGDrl_sub.csv | 18:12 | 0:12 | 588577.47 | 5684508.52 | 588753.64 | 5684107.62 | 438 | 336 |
| 1098TDGDl_sub.csv | 18:23 | 0:23 | 588578.16 | 5684503.88 | 588739.48 | 5684118.49 | 418 | 157 |
| 1100TDGDrl_sub.csv | 18:33 | 0:33 | 588585.65 | 5684490.46 | 588759.19 | 5684113.56 | 415 | 335 |
| 1102TDGDlr.csv | 18:45 | 0:45 | 588594.54 | 5684535.97 | 588746.93 | 5684101.04 | 461 | 161 |

# APPENDIX B. TIDAL DATA

# 11283 – Autumn 2008 SURVEY




## Measured tide 02/12/2008 at Liefkenshoek

| Location: | Date: |
|---|---|
| River Scheldt | 02/12/2008 |

*Data processed by:* IMDC International Marine & Dredging Consultants

*In association with:* WL | delft hydraulics

I/RA/11283/08.085/MSA

# APPENDIX C.

# NAVIGATION INFORMATION AS RECORDED ON SITE

| Ship: Scheldewacht II | | | Date: 2/12/2008 |
|---|---|---|---|
| Location: Deurganckdok (transect DGD) | | | |
| Nr. | Time (MET) | Type ship | Direction (Inbound, Outbound) |
| 1 | 7:13 | Container duwvaart | Inbound |
| 2 | 7:18 | Container Maersk | Outbound |
| 3 | 8:12 | Container Oxford | Inbound |
| 4 | 8:12 | Container duwvaart | Inbound |
| 5 | 8:15 | Van Hombolt bagger | Inbound |
| 6 | 8:22 | Sleper | Outbound |
| 7 | 8:25 | Lichter | Outbound |
| 8 | 8:33 | Tanker lichter | Inbound |
| 9 | 8:45 | Container lichter | Inbound |
| 10 | 8:49 | Container | Inbound |
| 11 | 9:15 | Karin | Inbound |
| 12 | 9:38 | Nirvana lichter | Outbound |
| 13 | 10:09 | Lichter | Inbound |
| 14 | 10:16 | Dommel duwvaart | Outbound |
| 15 | 10:21 | Lichter Independent | Inbound |
| 16 | 10:27 | Lichter Cetus | Outbound |
| 17 | 10:29 | Kuster container Elugive | Outbound |
| 18 | 10:34 | Duwvaart Antigoon | Outbound |
| 19 | 11:00 | Lichter container Covano | Inbound |
| 20 | 11:01 | Lichter container Nova Zembla | Outbound |
| 21 | 11:04 | Lichter bak Laurens Laurent | Inbound |
| 22 | 11:09 | Kuster container Reggeborg | Inbound |
| 23 | 12:23 | Kuster container Castleyn | Inbound |
| 24 | 12:23 | Lichter Oxford | Outbound |
| 25 | 12:24 | DN61 slepertje | Inbound |
| 26 | 12:35 | Lichter | Outbound |
| 27 | 13:09 | Lichter Sailinghome | Inbound |
| 28 | 13:44 | Sleper Lieven Gevaert | Inbound |
| 29 | 13:49 | Camaro 4 duwbakken | Inbound |
| 30 | 14:03 | Lichter Traviata | Inbound |
| 31 | 14:04 | Lichter bak Laurens | Outbound |

| Ship: Scheldewacht II | | | Date: 2/12/2008 |
|---|---|---|---|
| Location: Deurganckdok (transect DGD) | | | |
| Nr. | Time (MET) | Type ship | Direction (Inbound, Outbound) |
| | | Laurent | |
| 32 | 14:08 | Lichter Willem sr | Inbound |
| 33 | 14:12 | Lichter Sailinghome | Outbound |
| 34 | 14:14 | Lichter Covano | Outbound |
| 35 | 14:36 | Lichter Traviata | Outbound |
| 36 | 14:36 | Lichter El Blajo | Outbound |
| 37 | 14:37 | Lichter Maloma | Outbound |
| 38 | 14:44 | Sleper Union Ruby | Inbound |
| 39 | 15:21 | Duwbak | Inbound |
| 40 | 15:21 | Sleper | Outbound |
| 41 | 15:23 | Lichter container invendo | Inbound |
| 42 | 15:26 | Kuster Reggeborg | Outbound |
| 43 | 15:35 | Sleper Union Ruby | Outbound |
| 44 | 15:38 | Container Harbourbridge 366m | Outbound |
| 45 | 15:48 | Container Union Kodiak | Outbound |
| 46 | 17:00 | Lichter Skyline | Inbound |
| 47 | 17:26 | Kuster JRS Castor | Outbound |
| 48 | 17:36 | Lichter El Blajo | Outbound |
| 49 | 18:07 | Kuster K-Ocean | Inbound |
| 50 | 18:39 | Lichter | Inbound |
| 51 | 18:45 | Lichter | Inbound |
| 52 | 18:55 | Lichter + 3 bakken | Outbound |

# APPENDIX D.

# UNESCO PSS-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 E. OVERVIEW OF SEDIVIEW SETTINGS

| ***Ship:*** | | ***Scheldewacht II*** | |
|---|---|---|---|
| ***Location:*** | | ***Deurganckdok (transect DGD)*** | |
| ***Date*** | | ***30/09/2008*** | |
| ***Parameters*** | ***Value*** | ***Parameters*** | ***Value*** |
| *Inst. Depth (m)* | 2.62 | *Compass offset (°)* | -2.1 |
| *Force depth (m)* | 0 | *Beam 3 misalignment (°)* | 45 |
| *Velocity reference* | BT | *Effective particle size (µm)* | 20 |
| *Speed of sound algorithm* | Urick | *Beam1 scale factor* | 0.445 |
| *Error velocity* | YES | *Beam2 scale factor* | 0.430 |
| *External heading* | NO | *Beam3 scale factor* | 0.420 |
| *External Depth* | NO | *Beam4 scale factor* | 0.425 |
| *SSC factor top (%)* | 100 | *Discharge factor top* | Constant |
| *SSC factor bottom (%)* | 125 | *Discharge factor bottom* | Power |
| *Shape factor left bank* | 0.91 | *Shape factor right bank* | 0.91 |

| ***Filename*** | ***Calibration const (Ks)*** | ***Backscatter coefficient (S)*** | ***Distance to the left bank (m)*** | ***Distance to the right bank (m)*** |
|---|---|---|---|---|
| 1002TDGDlr_sub.csv | 55 | 20.75 | 1 | 25 |
| 1004TDGDrl_sub.csv | 55 | 20.50 | 82 | 25 |
| 1006TDGDlr_sub.csv | 55 | 19.75 | 70 | 46 |
| 1010TDGDlr_sub.csv | 55 | 19.00 | 63 | 53 |
| 1012TDGDrl_sub.csv | 55 | 19.00 | 63 | 54 |
| 1014TDGDlr_sub.csv | 55 | 19.75 | 84 | 49 |
| 1016TDGDrl_sub.csv | 55 | 20.25 | 75 | 73 |
| 1018TDGDlr_sub.csv | 55 | 20.25 | 67 | 34 |
| 1020TDGDrl_sub.csv | 55 | 20.00 | 13 | 34 |
| 1022TDGDlr_sub.csv | 55 | 19.75 | 39 | 20 |
| 1024TDGDrl_sub.csv | 55 | 20.00 | 85 | 19 |
| 1026TDGDlr.csv | 55 | 20.00 | 25 | 47 |
| 1028TDGDrl_sub.csv | 55 | 20.00 | 17 | 39 |
| 1030TDGDlr_sub.csv | 55 | 20.50 | 69 | 54 |
| 1032TDGDrl_sub.csv | 55 | 21.00 | 39 | 45 |
| 1034TDGDlr_sub.csv | 55 | 20.75 | 32 | 0 |
| 1036TDGDrl_sub.csv | 55 | 21.00 | 2 | 29 |
| 1038TDGDlr.csv | 55 | 21.50 | 55 | 14 |
| 1040TDGDrl_sub.csv | 55 | 21.50 | 1 | 22 |
| 1042TDGDlr_sub.csv | 55 | 21.75 | 41 | 34 |
| 1044TDGDrl.csv | 55 | 21.50 | 36 | 12 |
| 1046TDGDlr.csv | 55 | 21.25 | 44 | 34 |

| *Filename* | *Calibration const (Ks)* | *Backscatter coefficient (S)* | *Distance to the left bank (m)* | *Distance to the right bank (m)* |
|---|---|---|---|---|
| 1048TDGDrl_sub.csv | 55 | 21.75 | 38 | 31 |
| 1050TDGDlr_sub.csv | 55 | 21.75 | 2 | 26 |
| 1052TDGDrl_sub.csv | 55 | 21.25 | 2 | 9 |
| 1054TDGDlr.csv | 55 | 21.50 | 0 | 17 |
| 1056TDGDrl_sub.csv | 55 | 21.50 | 8 | 1 |
| 1058TDGDlr.csv | 55 | 21.50 | 0 | 30 |
| 1060TDGDrl_sub.csv | 55 | 21.50 | 12 | 42 |
| 1062TDGDlr_sub.csv | 55 | 21.50 | 23 | 24 |
| 1064TDGDrl.csv | 55 | 22.00 | 24 | 1 |
| 1066TDGDlr_sub.csv | 55 | 22.50 | 8 | 13 |
| 1068TDGDrl_sub.csv | 55 | 22.00 | 5 | 8 |
| 1070TDGDlr.csv | 55 | 21.25 | 13 | 16 |
| 1072TDGDrl_sub.csv | 55 | 20.75 | 2 | 5 |
| 1074TDGDlr_sub.csv | 55 | 20.25 | 12 | 6 |
| 1076TDGDrl_sub.csv | 55 | 20.00 | 12 | 50 |
| 1078TDGDlr.csv | 55 | 19.75 | 4 | 26 |
| 1080TDGDrl_sub.csv | 55 | 19.50 | 34 | 45 |
| 1082TDGDlr_sub.csv | 55 | 19.50 | 11 | 27 |
| 1084TDGDrl_sub.csv | 55 | 19.50 | 3 | 15 |
| 1086TDGDlr_sub.csv | 55 | 19.75 | 0 | 1 |
| 1088TDGDrl_sub.csv | 55 | 19.75 | 2 | 22 |
| 1090TDGDlr_sub.csv | 55 | 19.25 | 2 | 34 |
| 1092TDGDrl_sub.csv | 55 | 19.00 | 33 | 47 |
| 1094TDGDlr_sub.csv | 55 | 19.25 | 9 | 63 |
| 1096TDGDrl_sub.csv | 55 | 19.00 | 32 | 51 |
| 1098TDGDl_sub.csv | 55 | 19.00 | 37 | 67 |
| 1100TDGDrl_sub.csv | 55 | 19.00 | 52 | 54 |
| 1102TDGDlr.csv | 55 | 19.00 | 15 | 48 |

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

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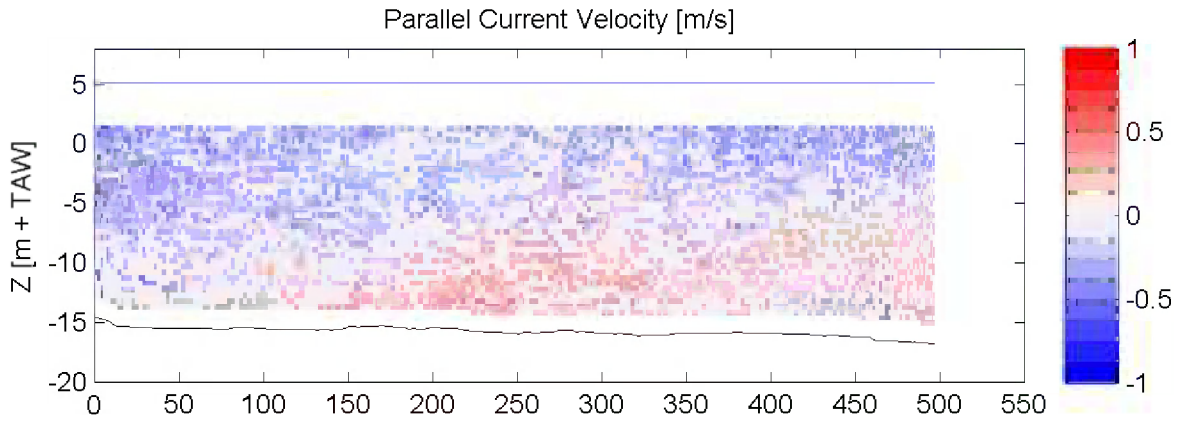
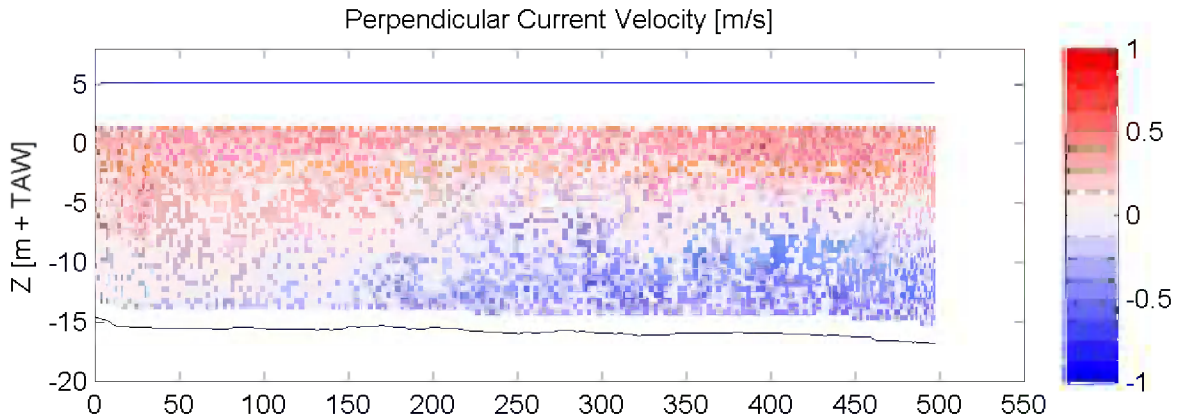
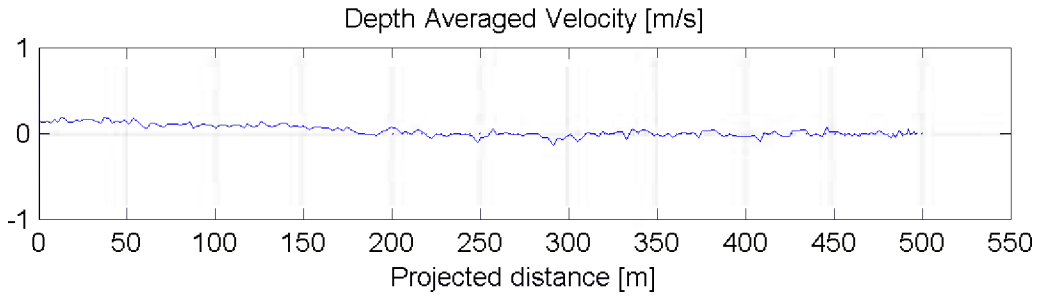
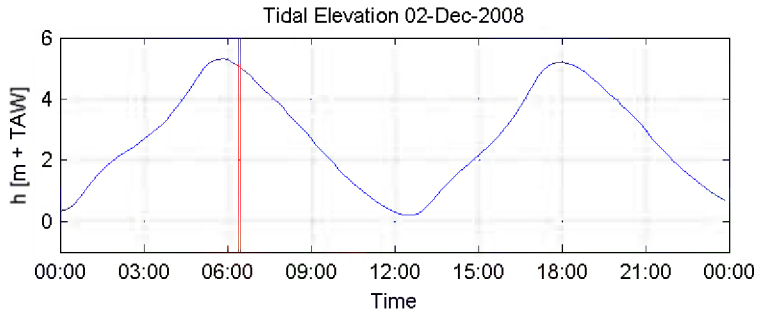
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1002TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:23 - 06:28

Time after HW [HH:MM]

0:36

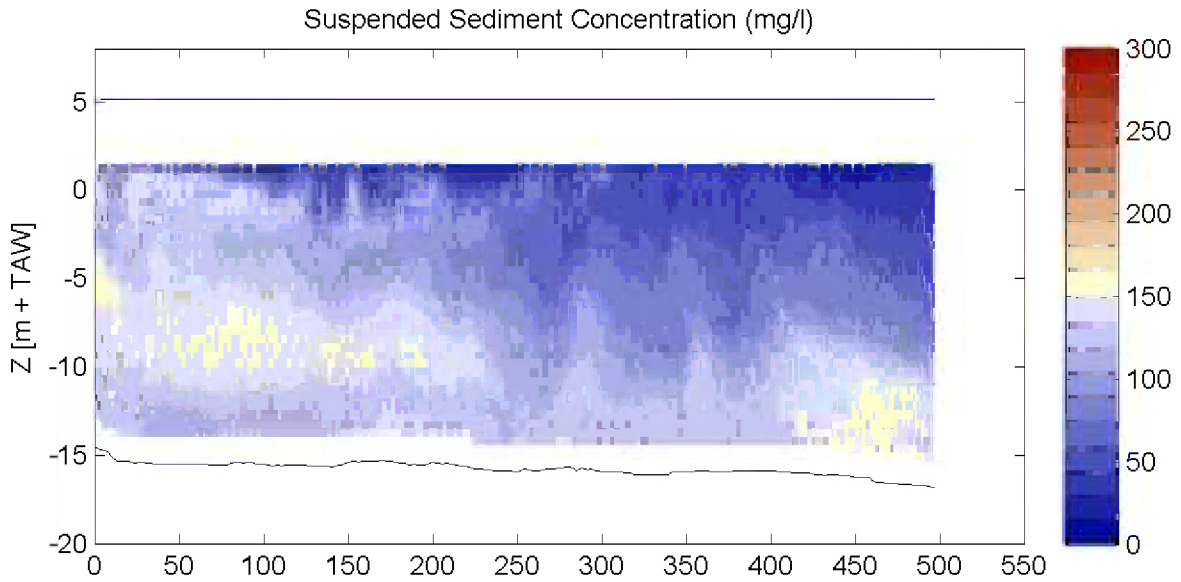
Data Processed by:

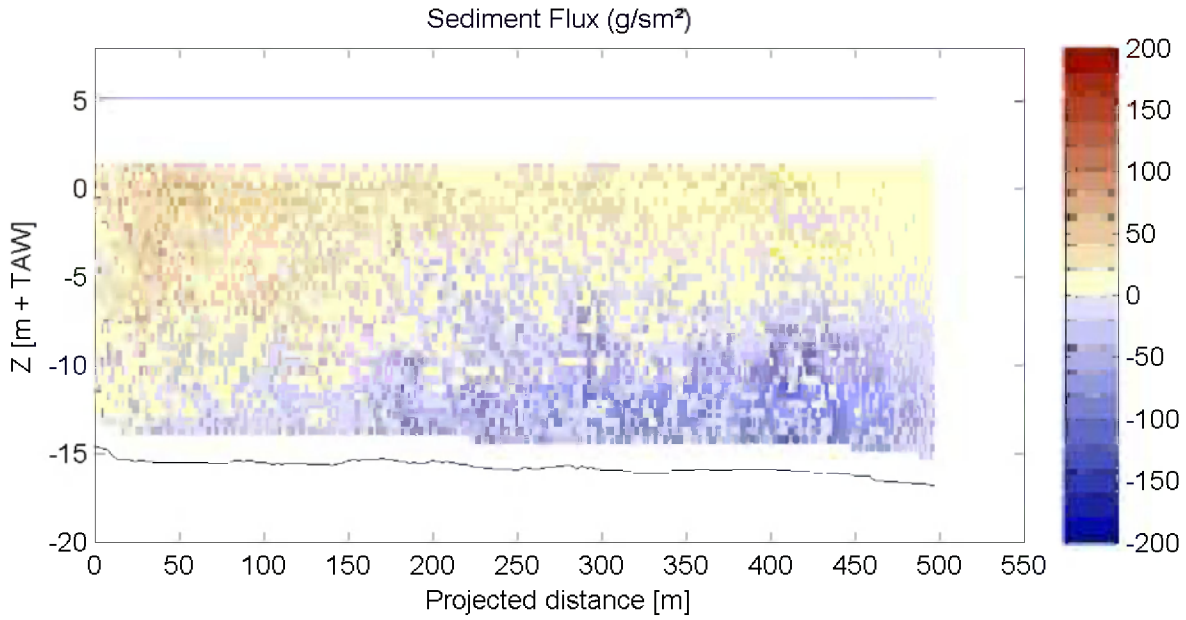
In association with :

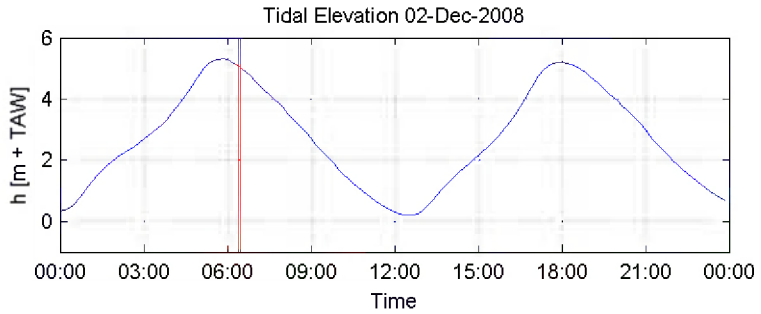
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1002TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:23 - 06:28

Time after HW [HH:MM]

0:36

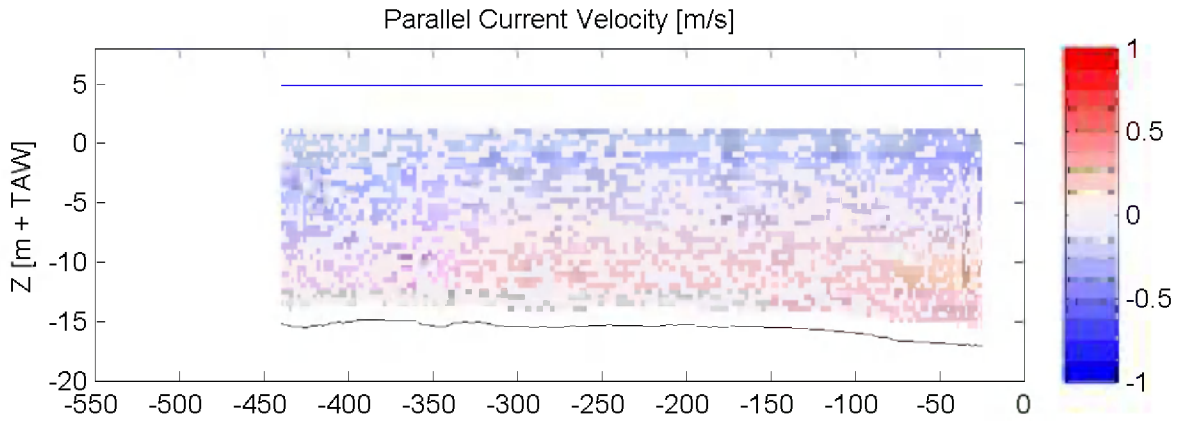
Data Processed by:

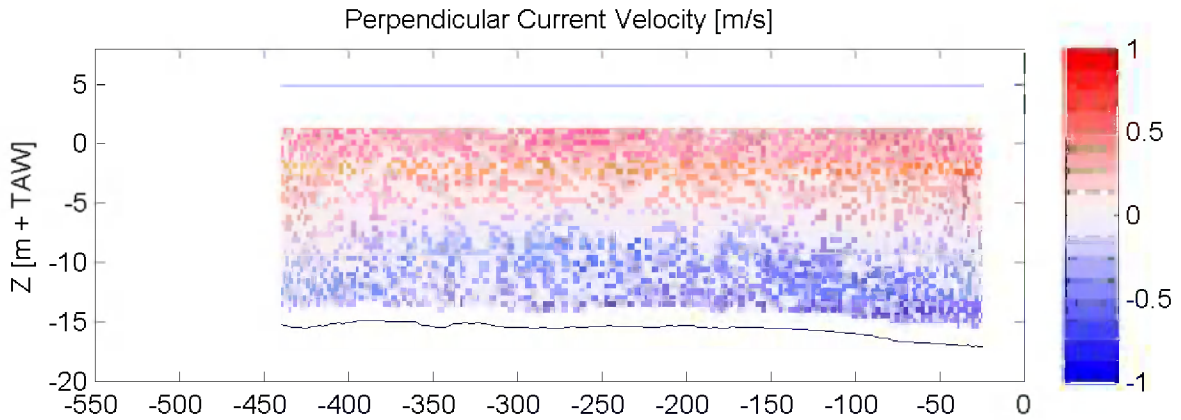
In association with :

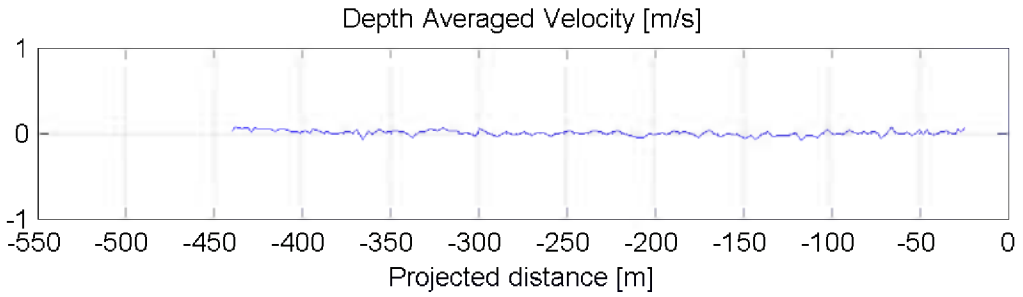
I/RA/11283/08.084/MSA

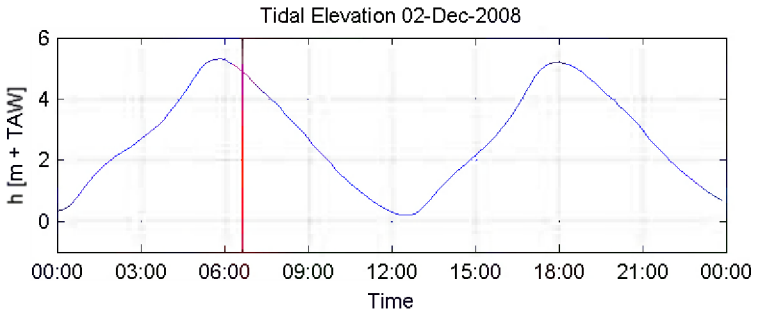
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1004TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:37 - 06:40

Time after HW [HH:MM]

0:49

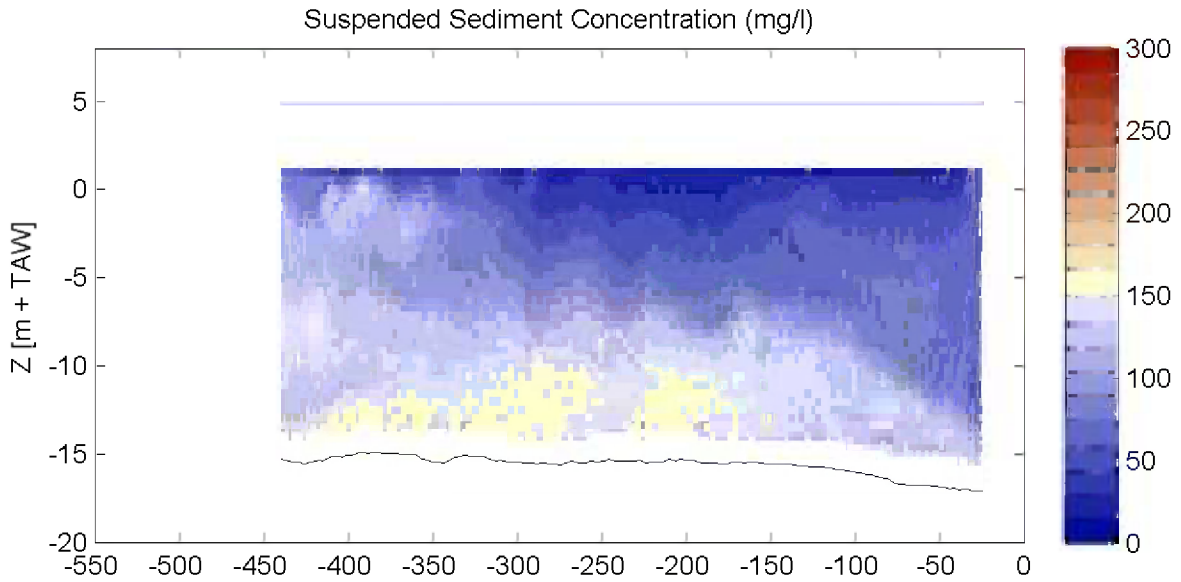
Data Processed by:

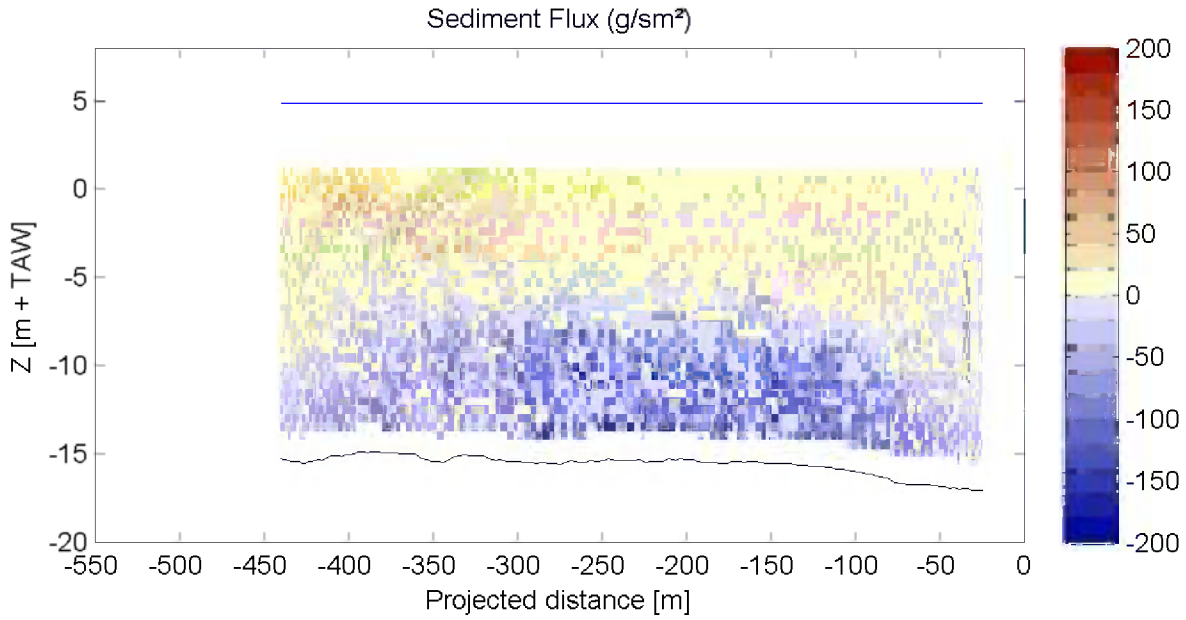
In association with :

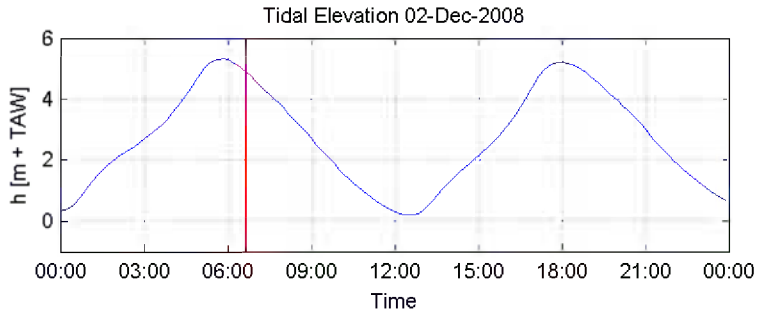
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1004TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:37 - 06:40

Time after HW [HH:MM]

0:49

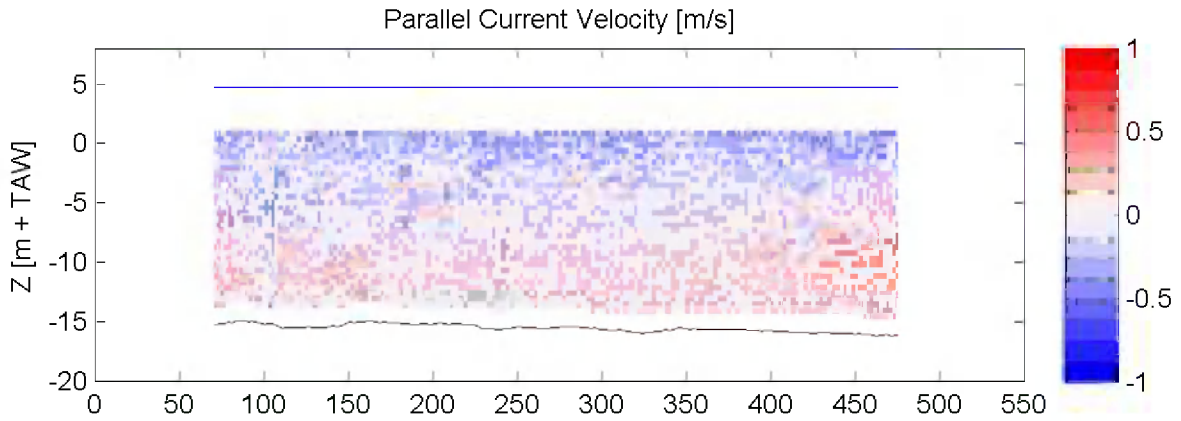
Data Processed by:

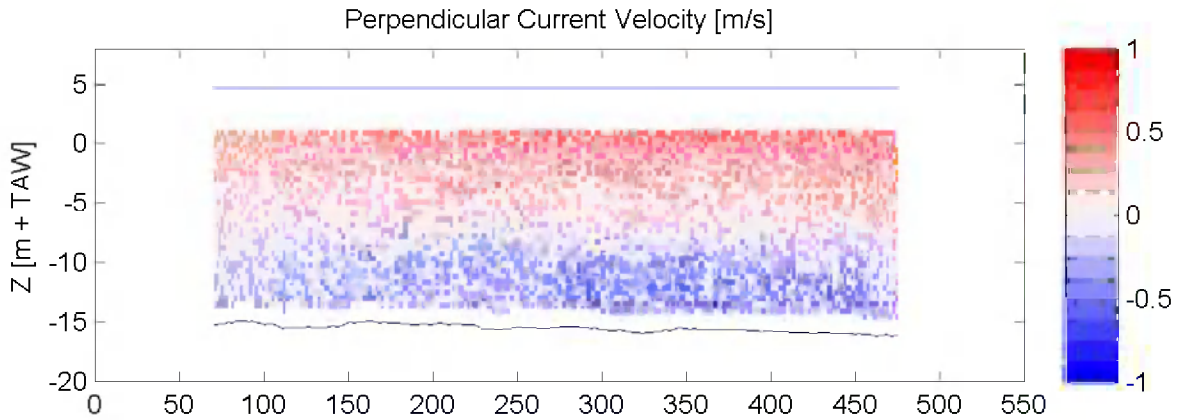
In association with :

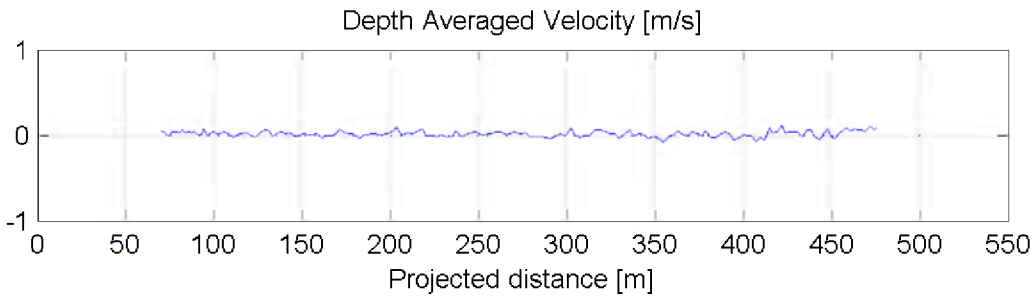
I/RA/11283/08.084/MSA

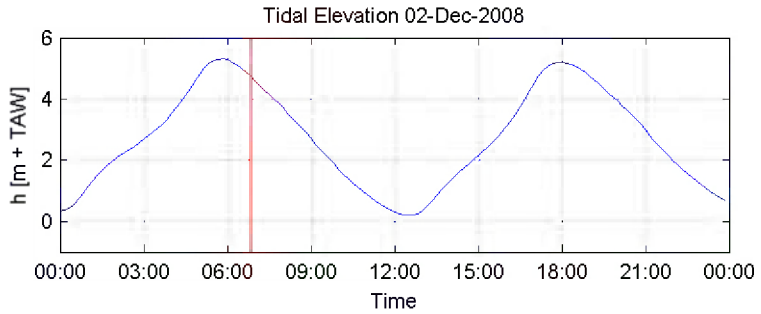
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1006TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:49 - 06:53

Time after HW [HH:MM]

1:01

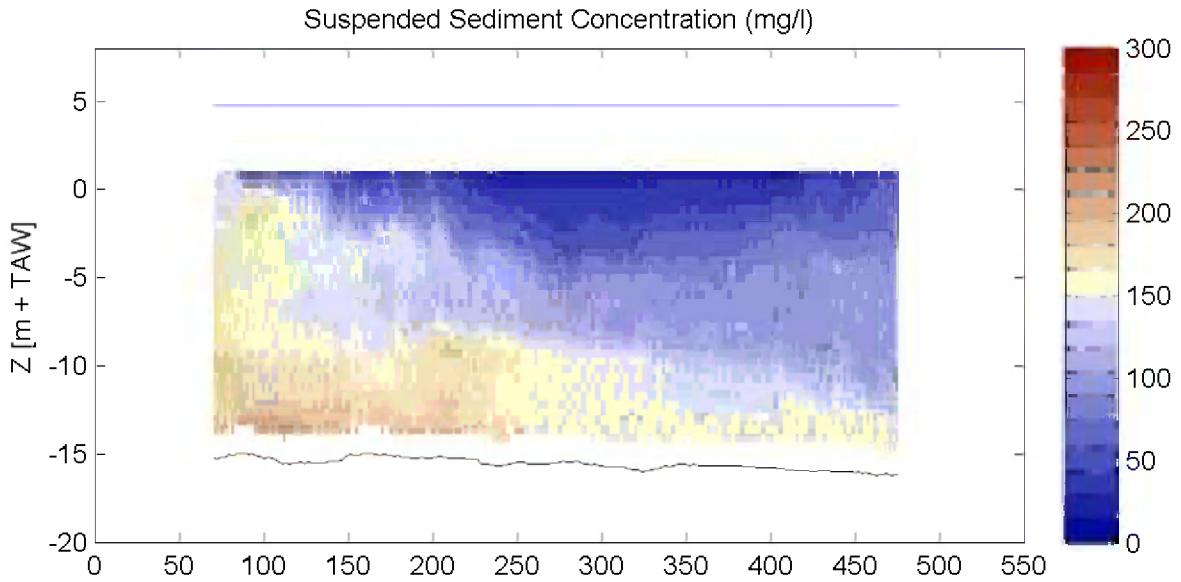
Data Processed by:

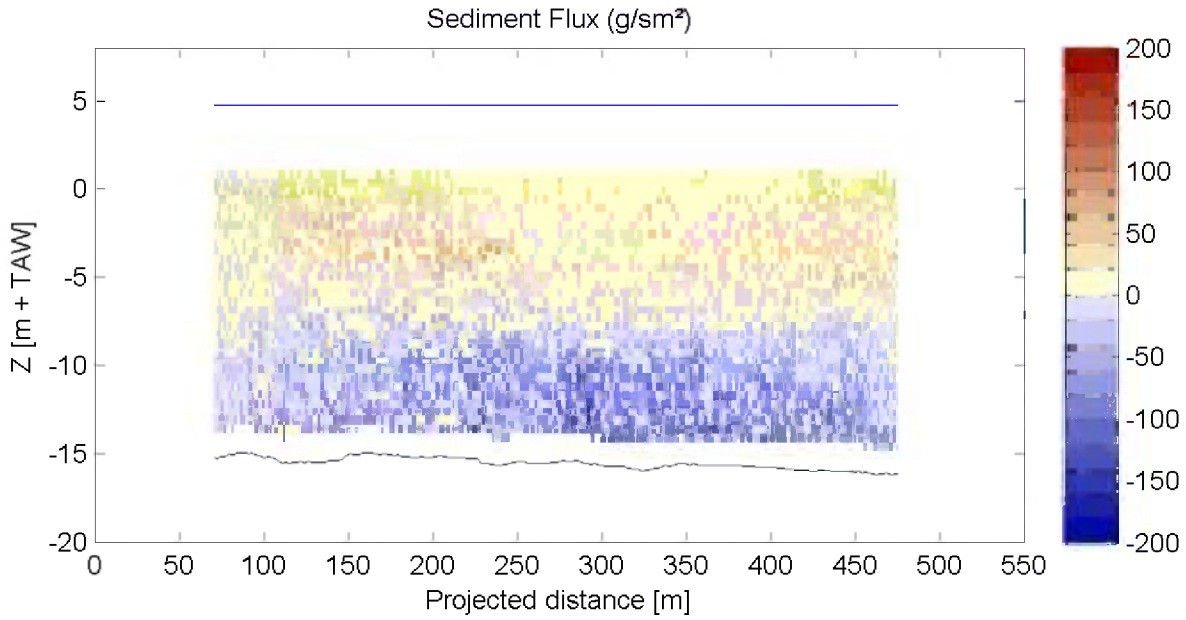
In association with :

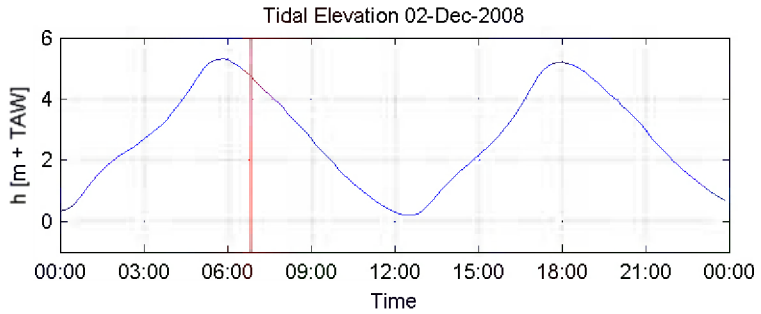
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1006TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

06:49 - 06:53

Time after HW [HH:MM]

1:01

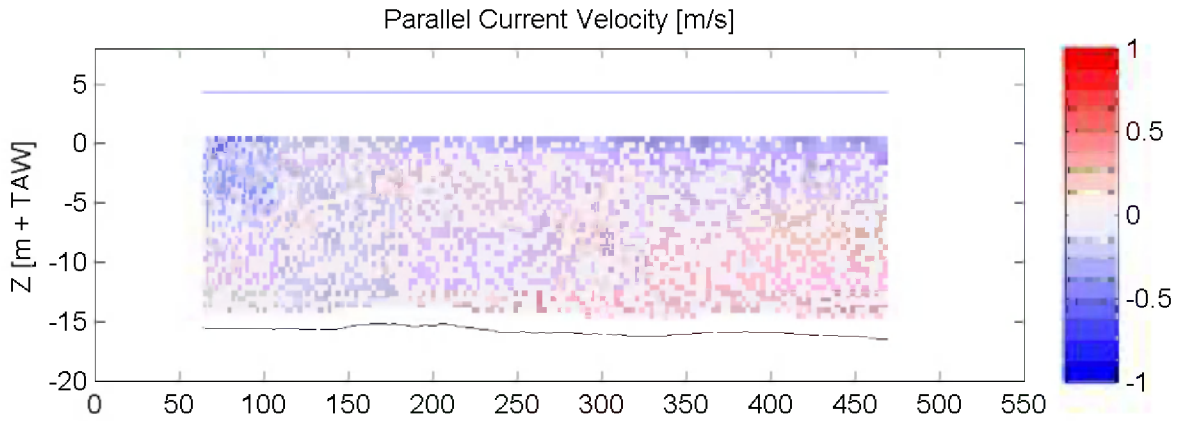
Data Processed by:

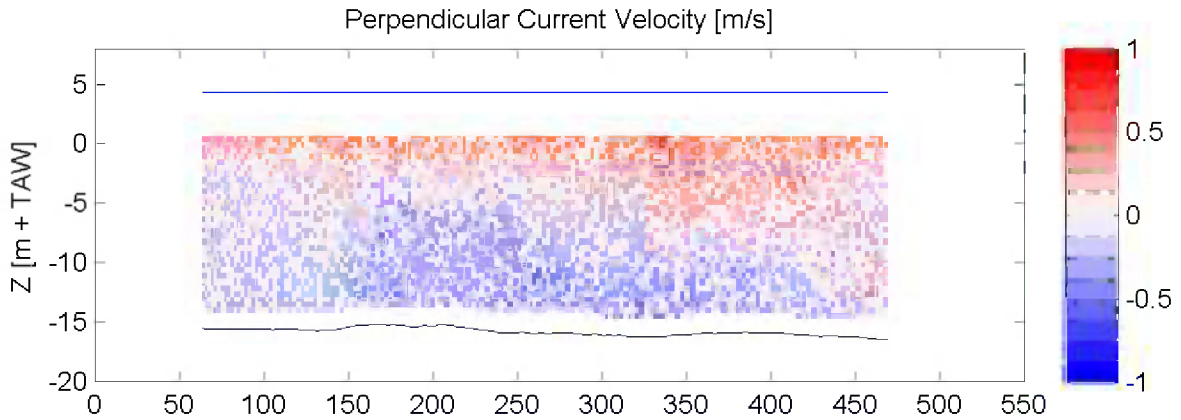
In association with :

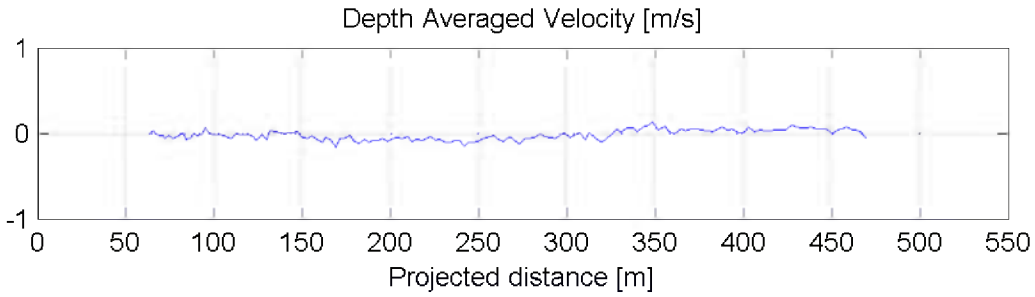
I/RA/11283/08.084/MSA

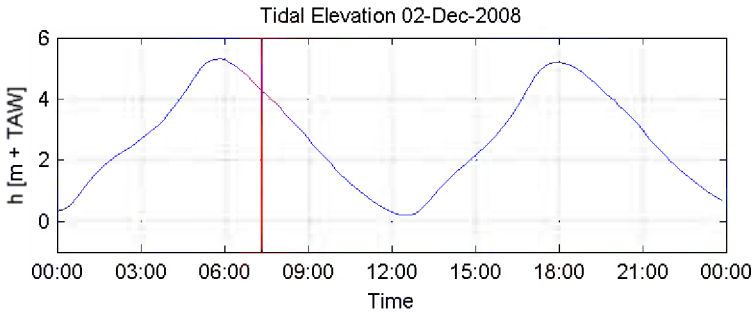
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1010TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:18 - 07:22

Time after HW [HH:MM]

1:30

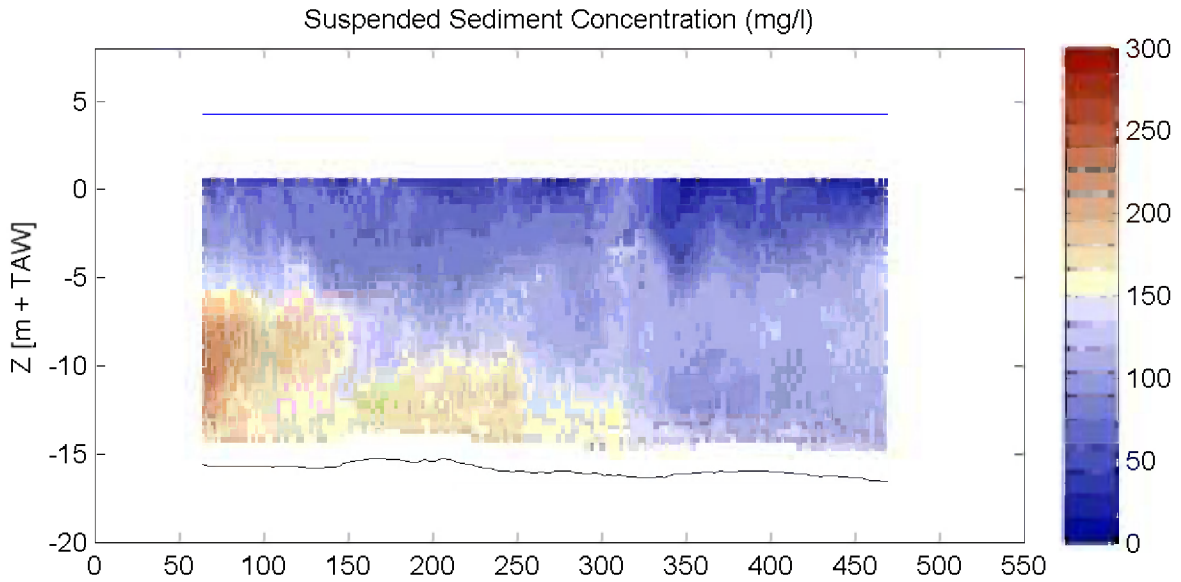
Data Processed by:

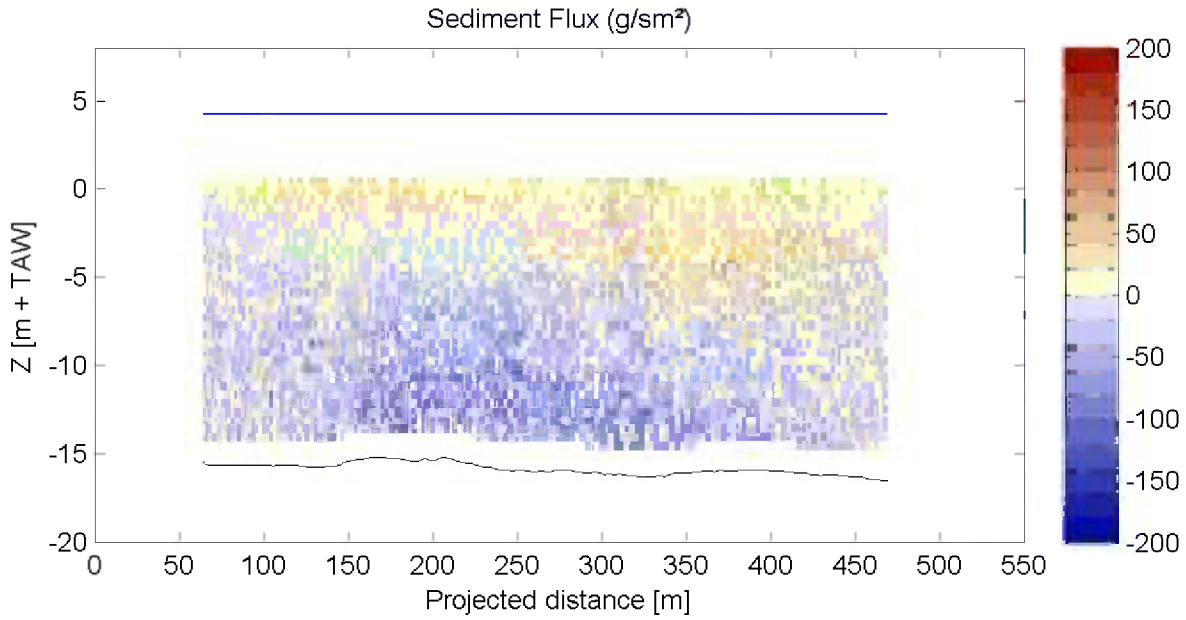
In association with :

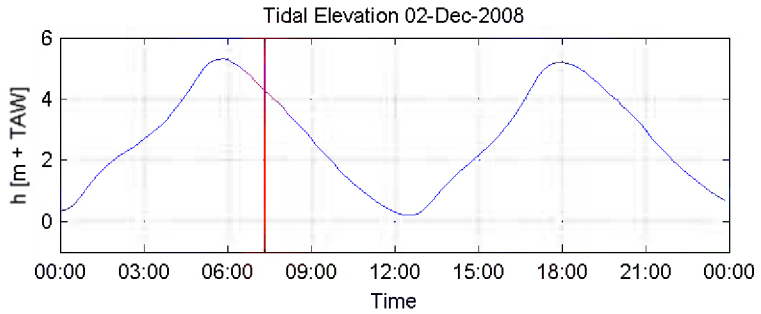
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1010TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:18 - 07:22

Time after HW [HH:MM]

1:30

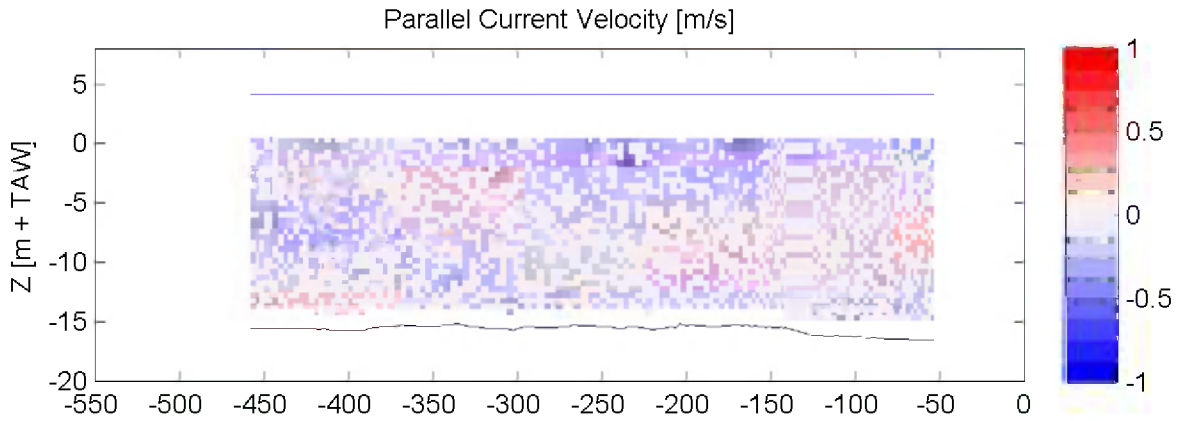
Data Processed by:

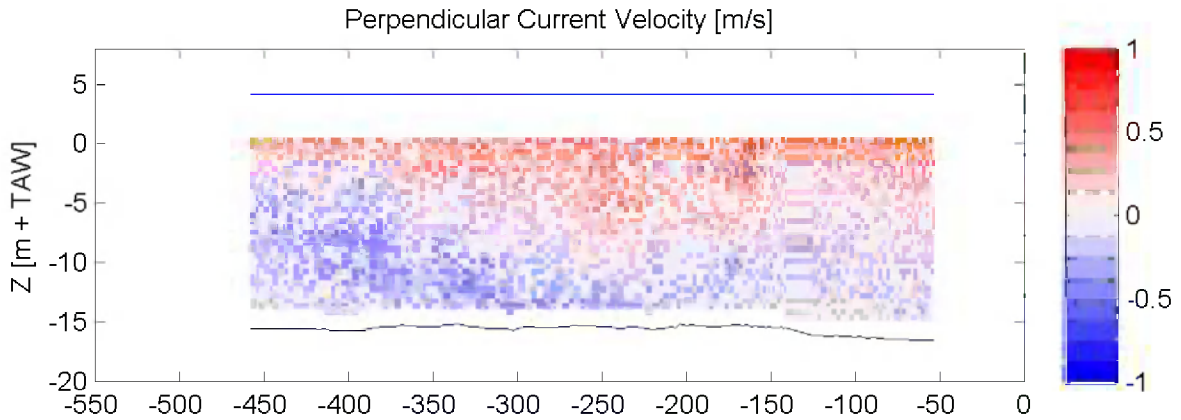
In association with :

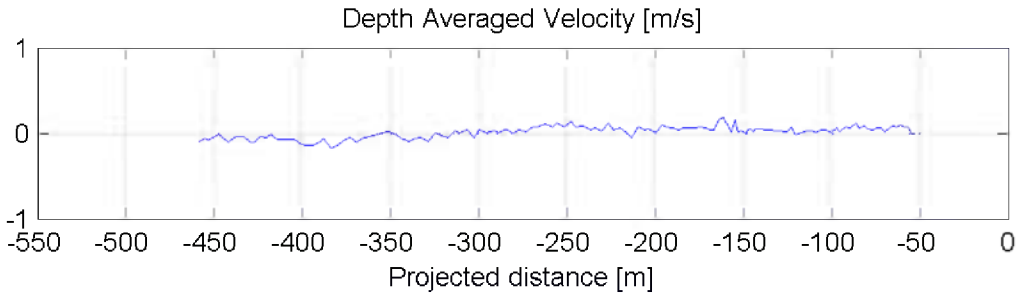
I/RA/11283/08.084/MSA

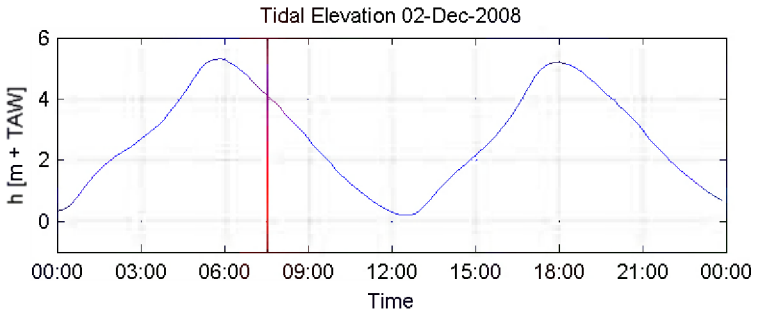
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1012TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:31 - 07:34

Time after HW [HH:MM]

1:43

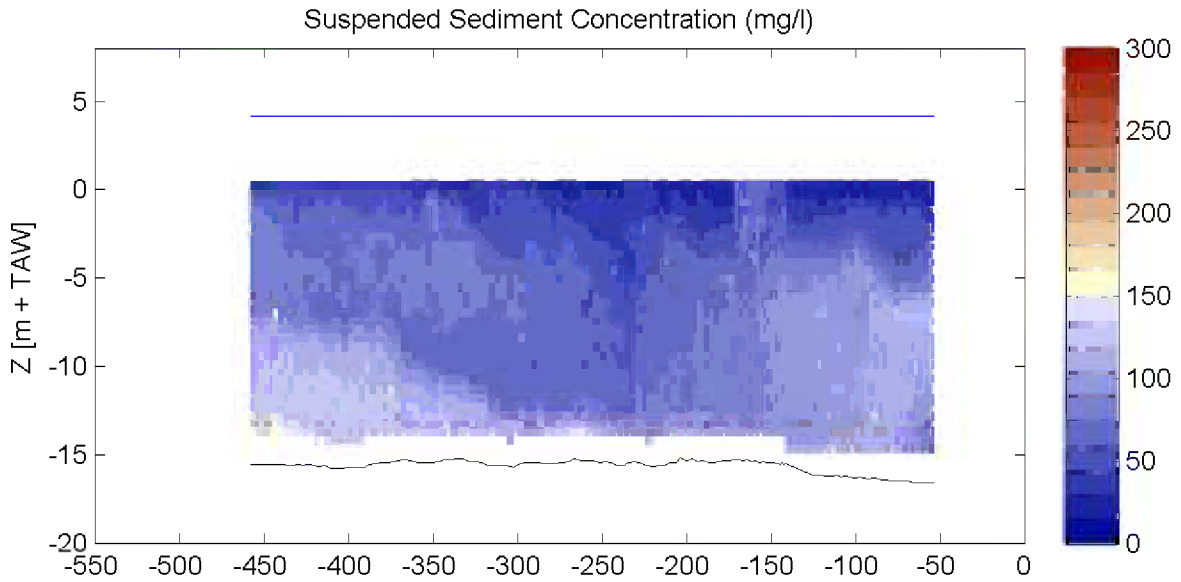
Data Processed by:

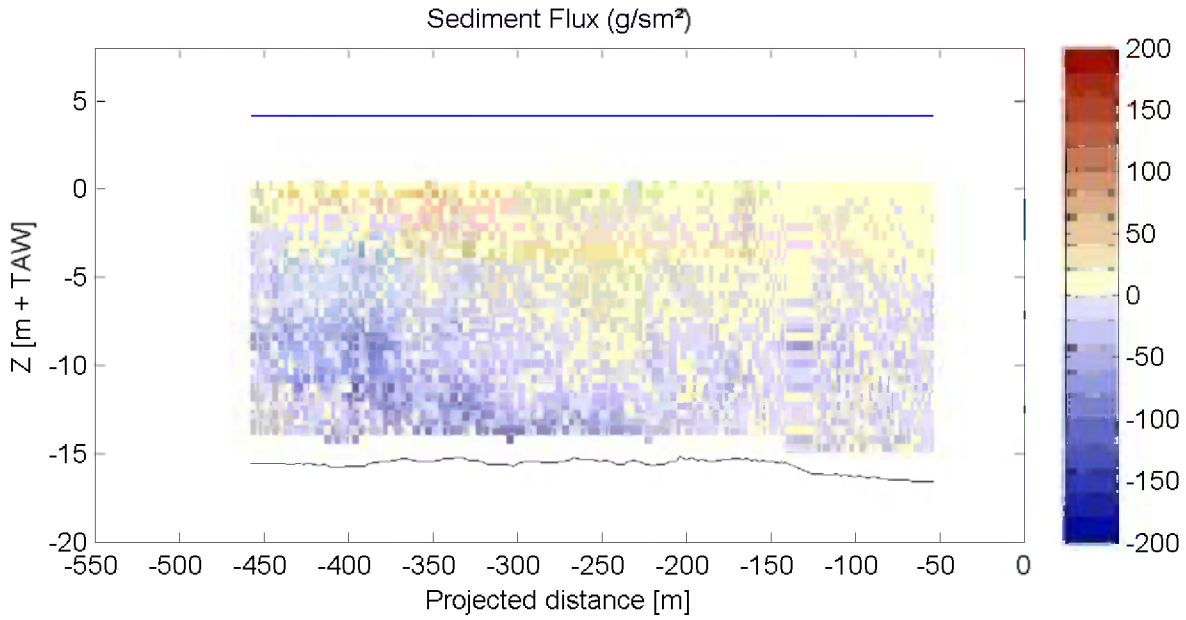
In association with :

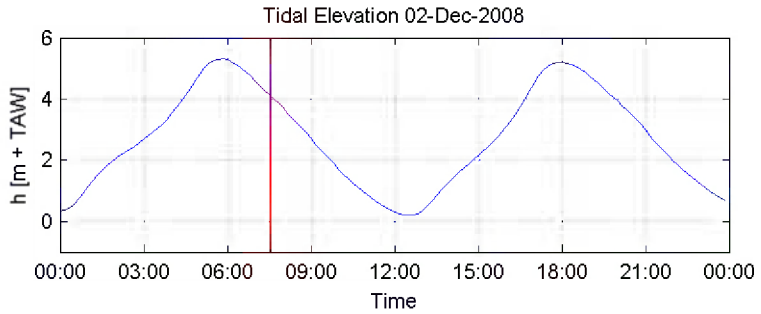
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1012TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:31 - 07:34

Time after HW [HH:MM]

1:43

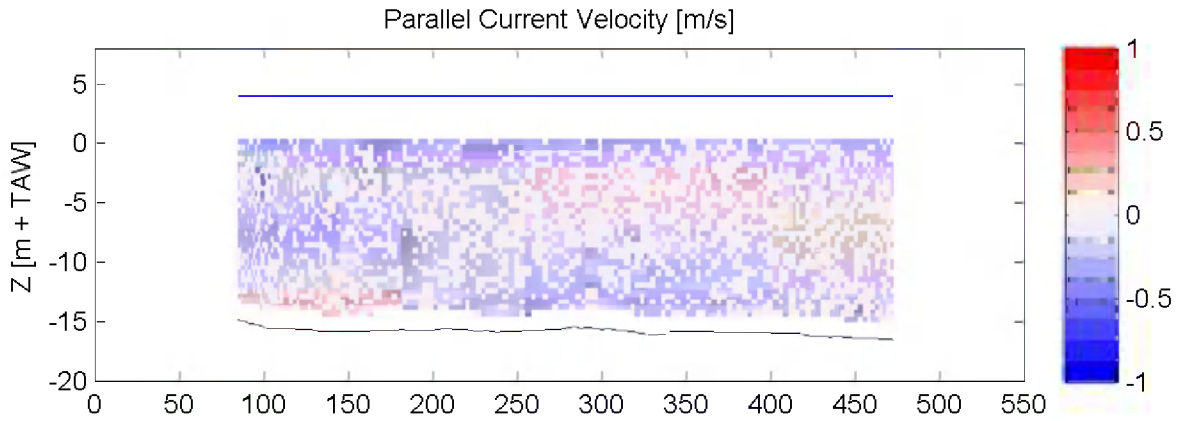
Data Processed by:

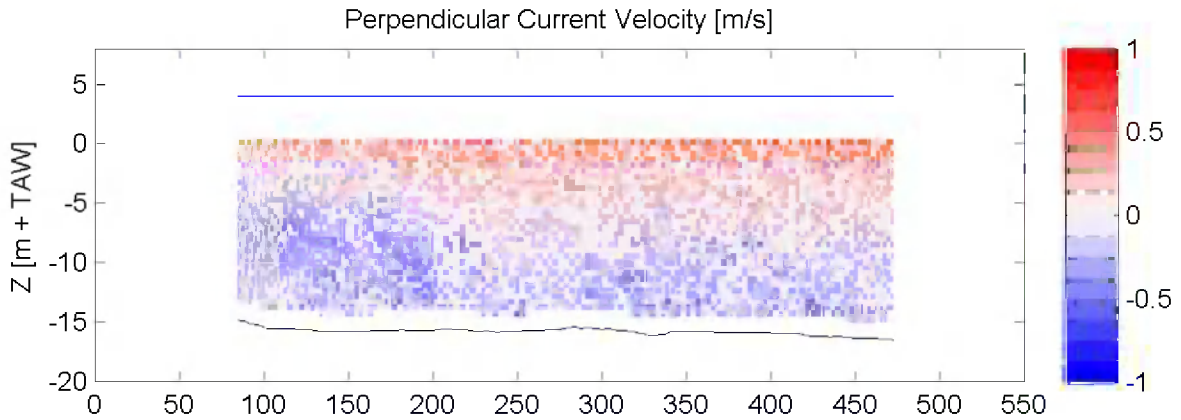
In association with :

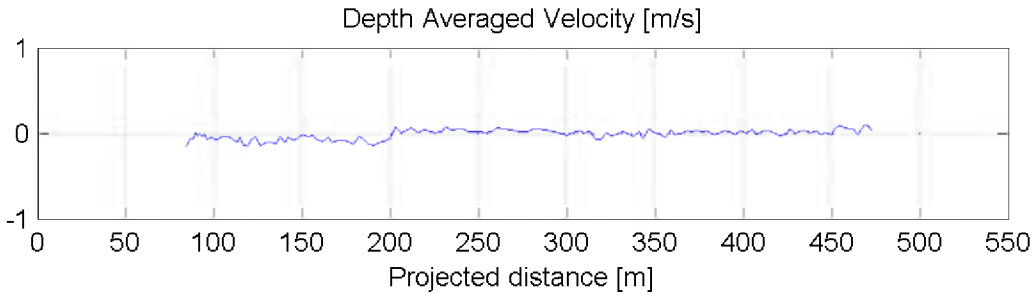
I/RA/11283/08.084/MSA

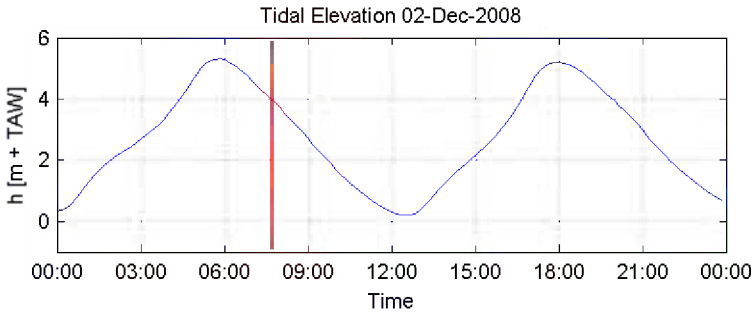
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1014TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:40 - 07:43

Time after HW [HH:MM]

1:52

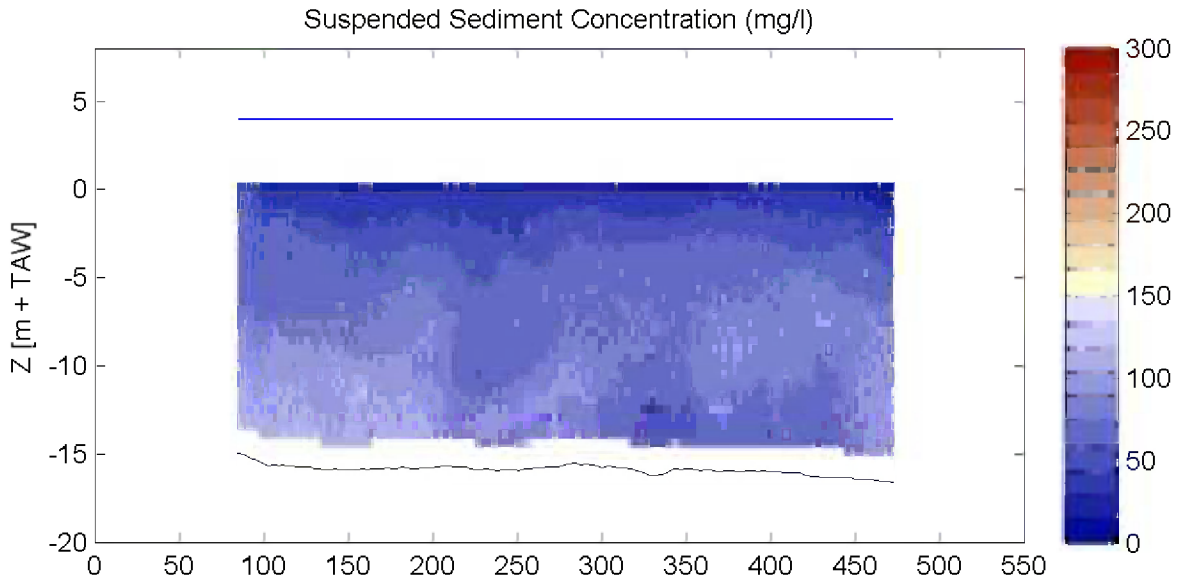
Data Processed by:

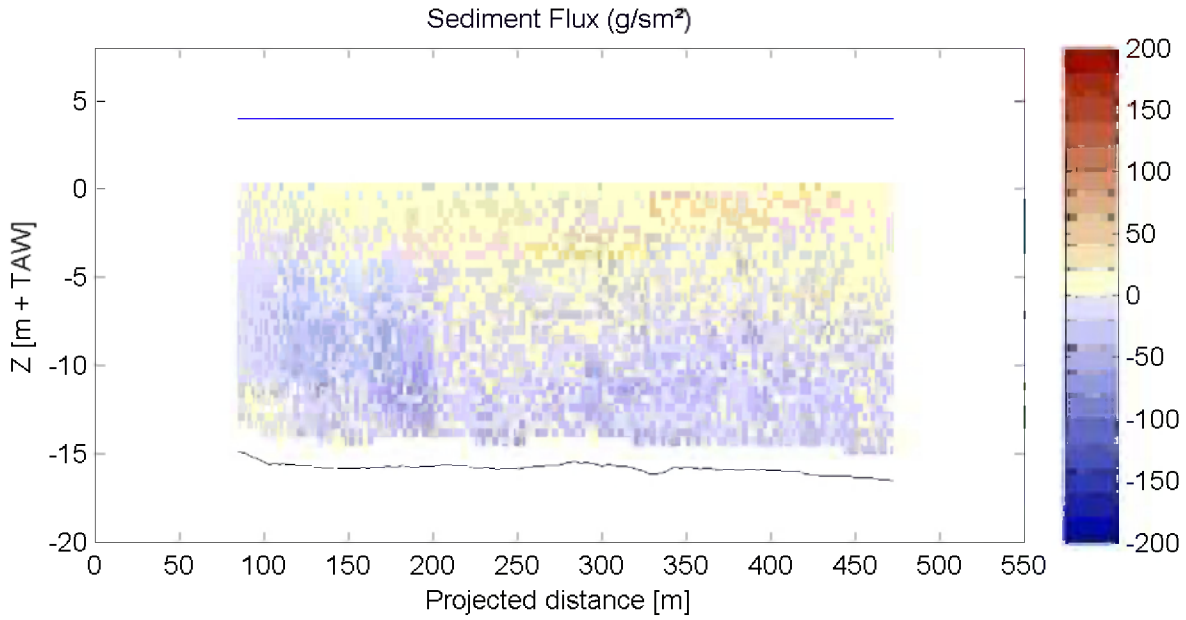
In association with :

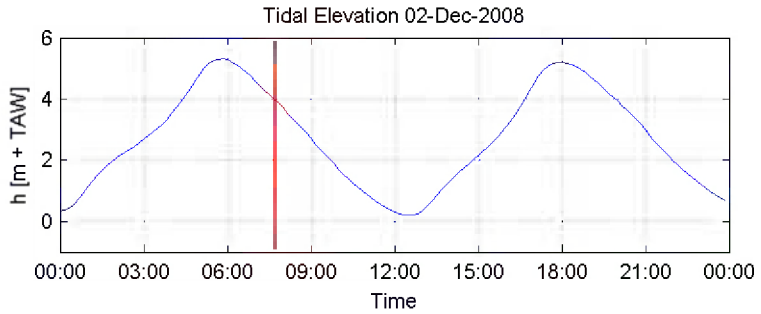
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1014TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:40 - 07:43

Time after HW [HH:MM]

1:52

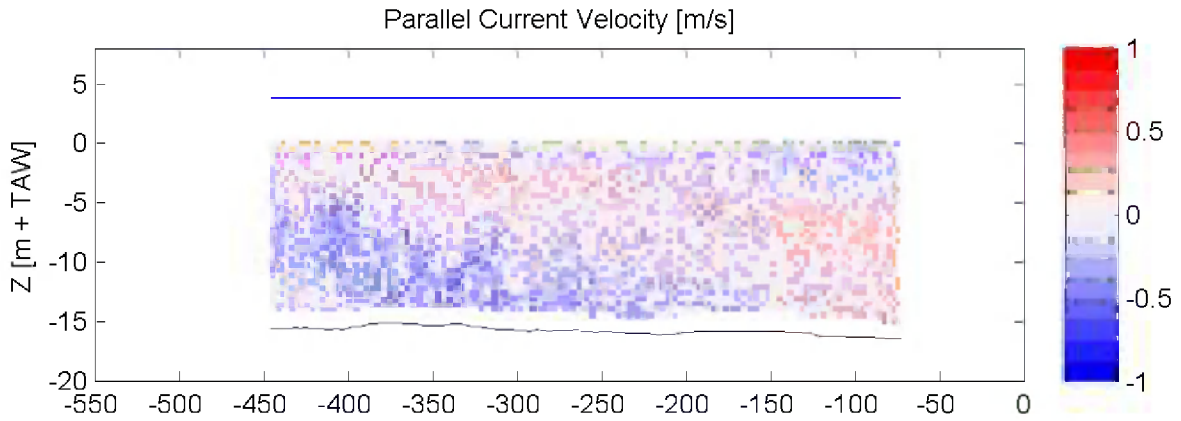
Data Processed by:

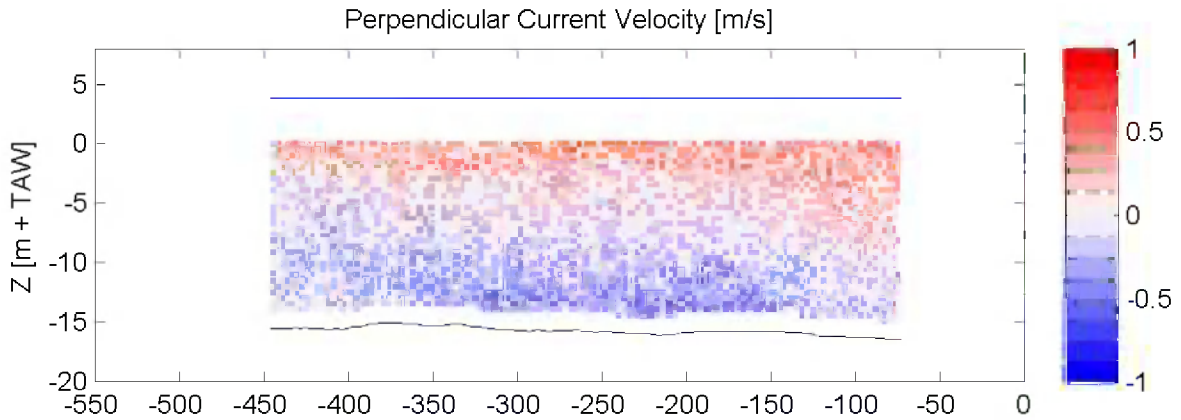
In association with :

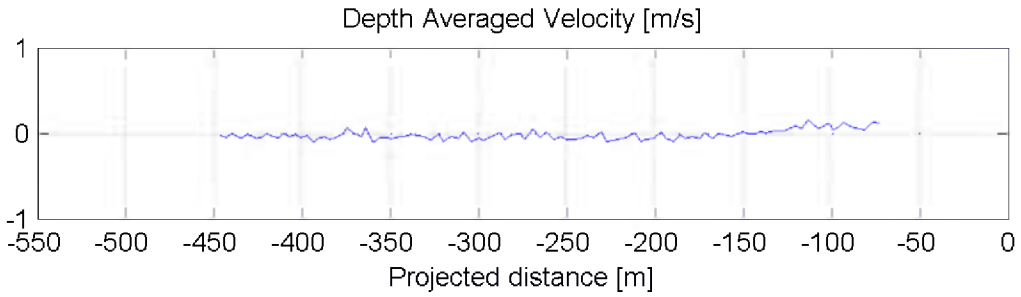
I/RA/11283/08.084/MSA

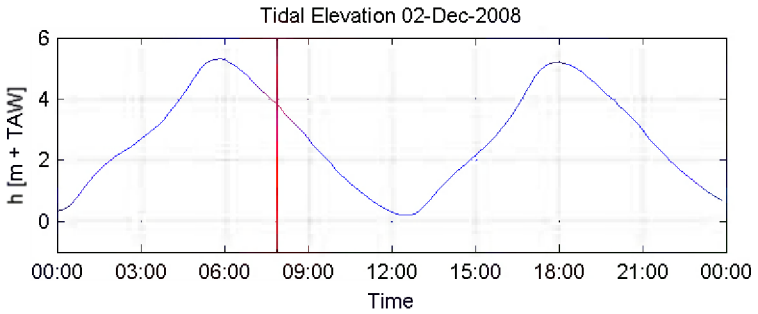
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1016TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:51 - 07:54

Time after HW [HH:MM]

2:03

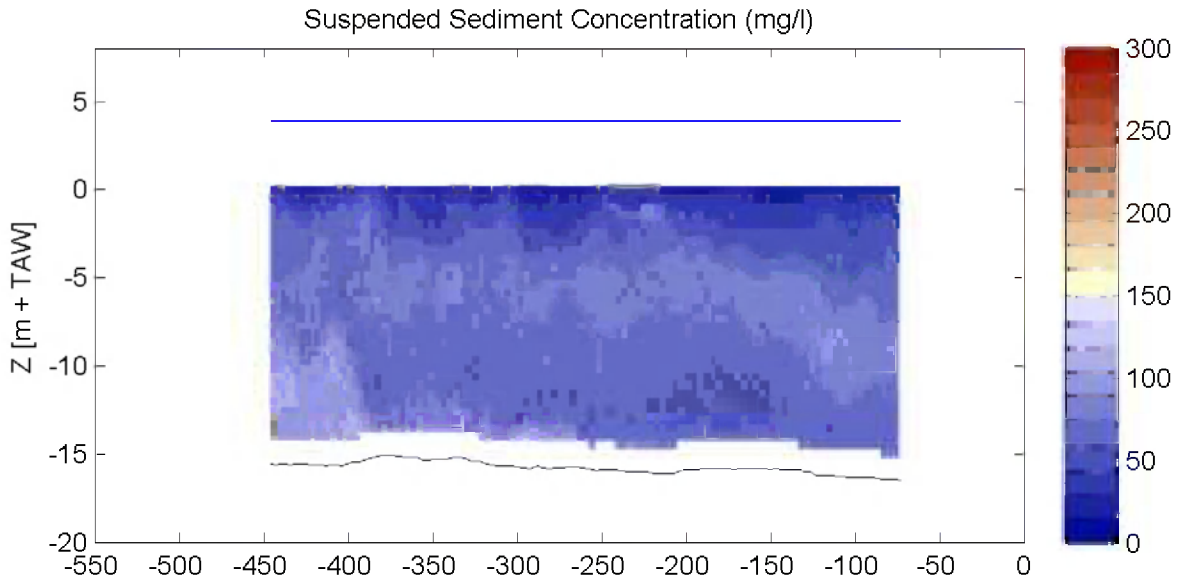
Data Processed by:

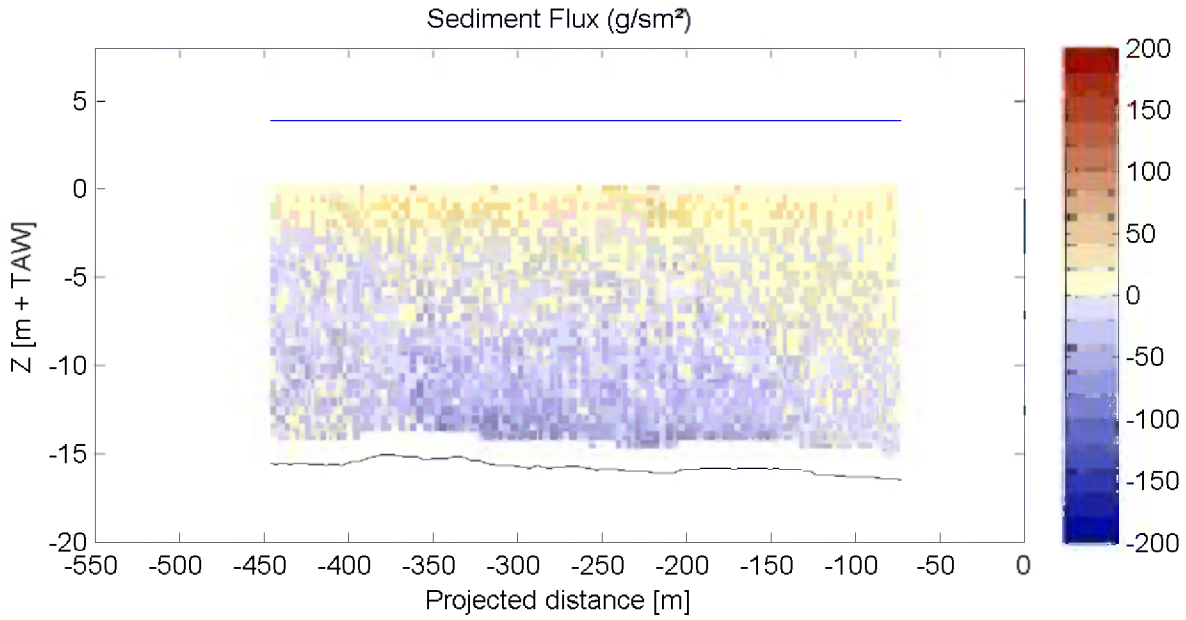
In association with :

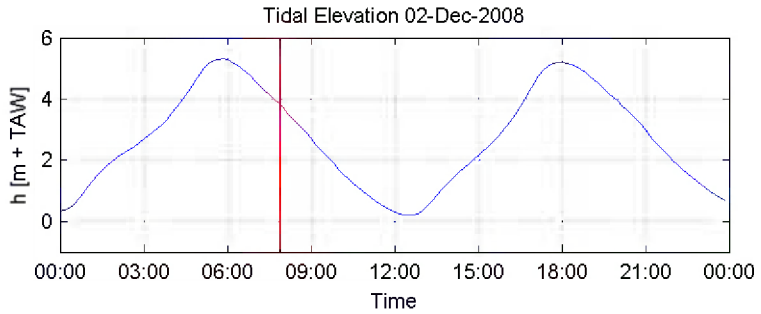
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1016TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

07:51 - 07:54

Time after HW [HH:MM]

2:03

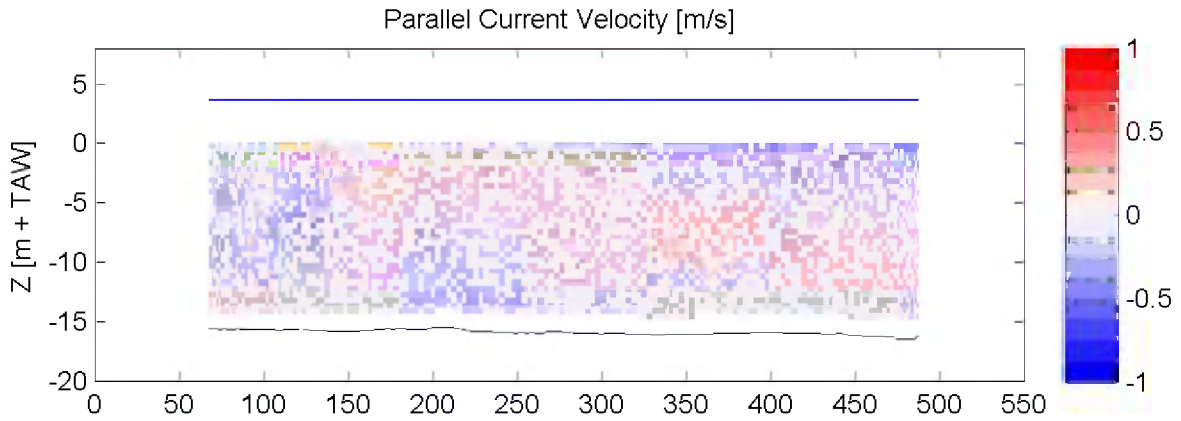
Data Processed by:

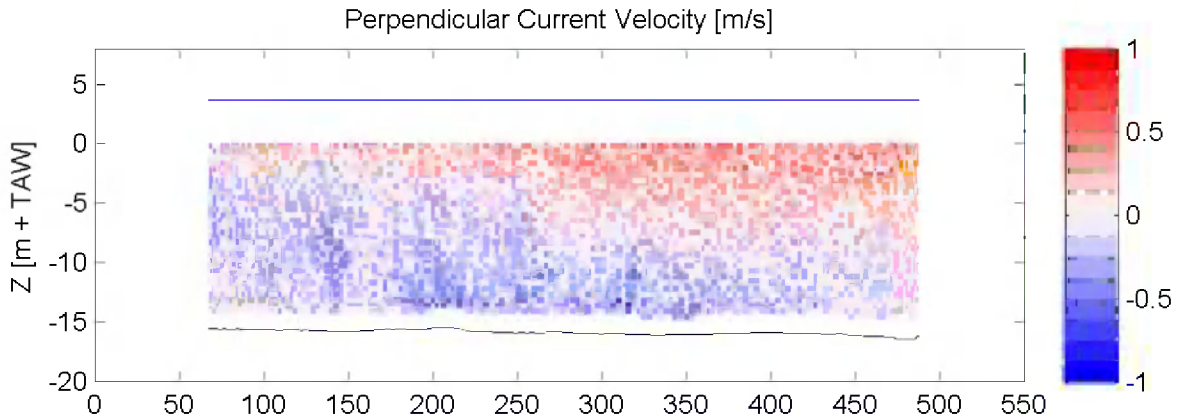
In association with :

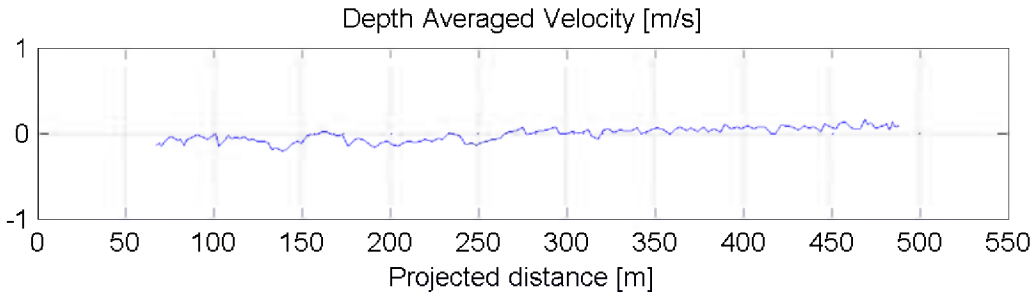
I/RA/11283/08.084/MSA

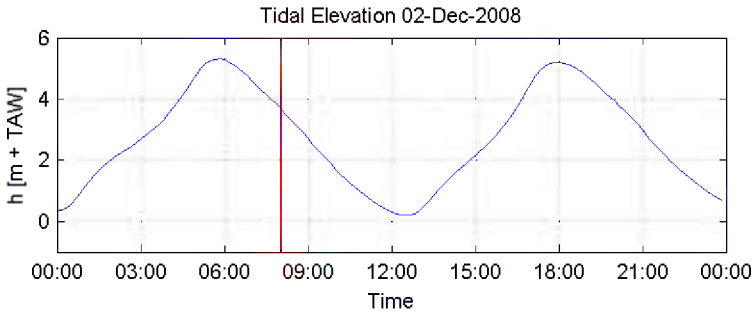
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1018TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:00 - 08:03

Time after HW [HH:MM]

2:11

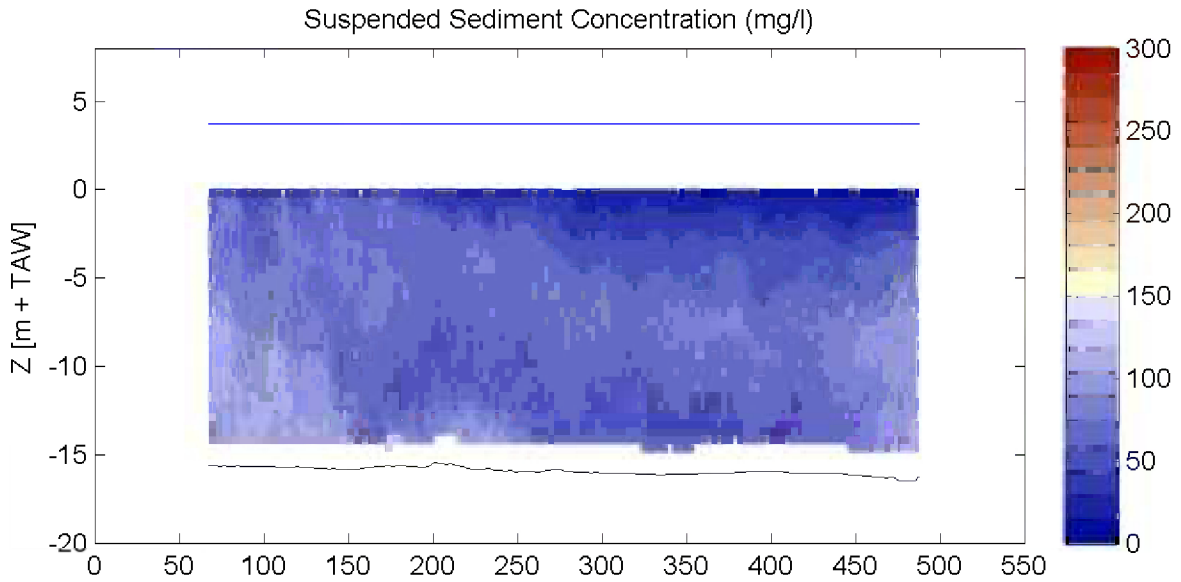
Data Processed by:

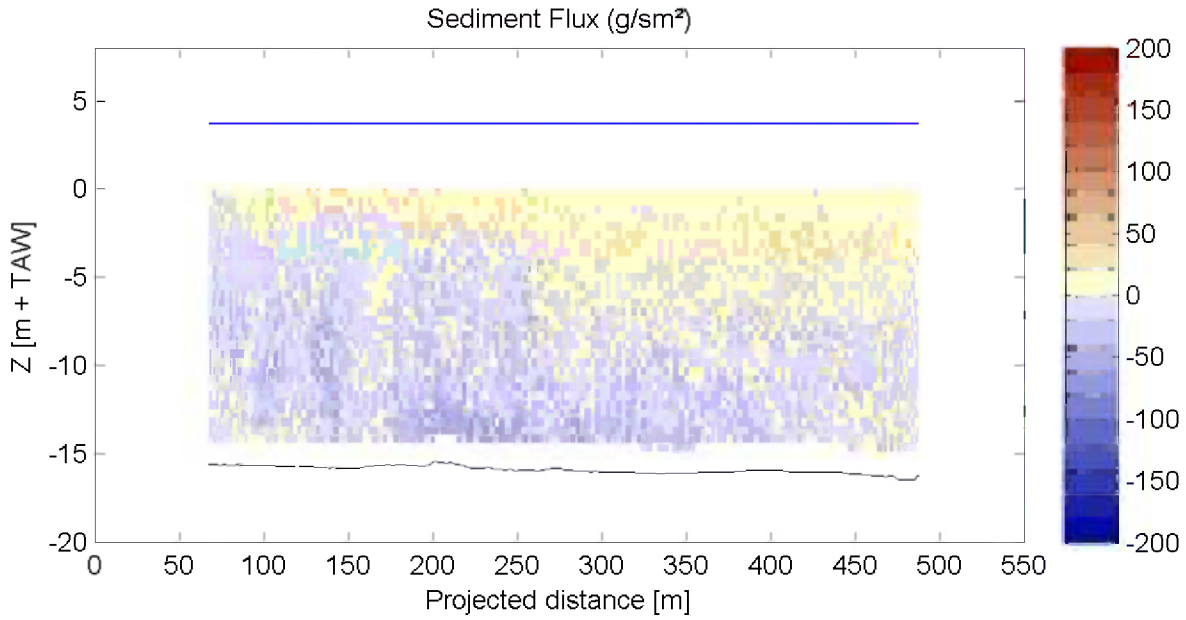
In association with :

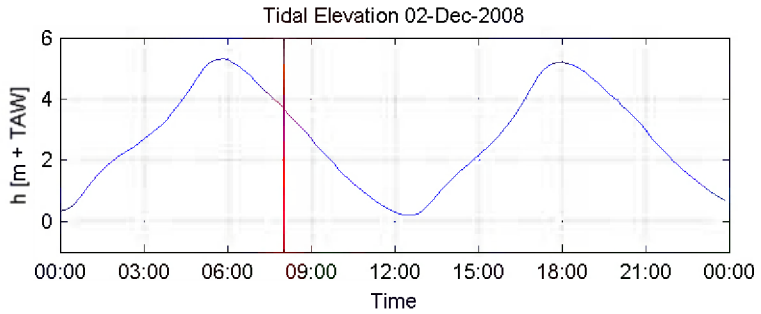
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1018TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:00 - 08:03

Time after HW [HH:MM]

2:11

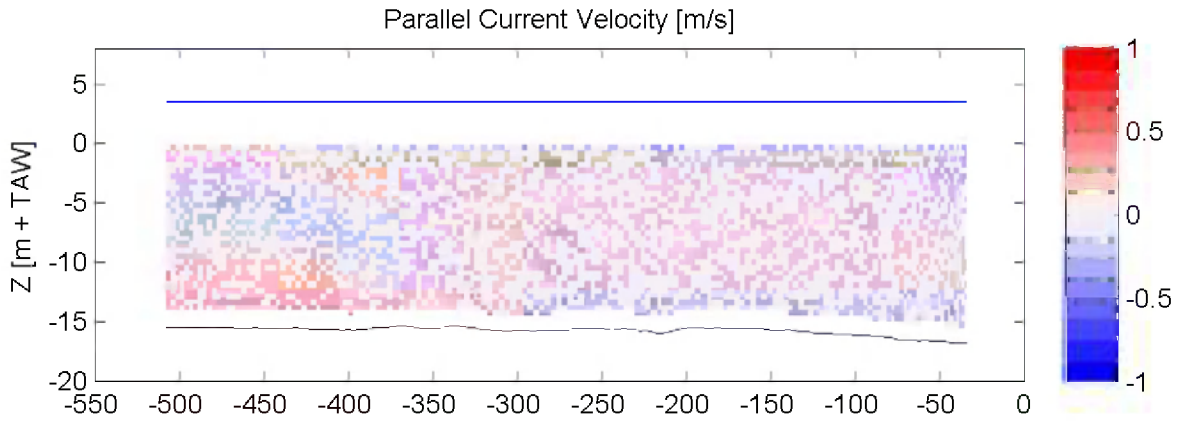
Data Processed by:

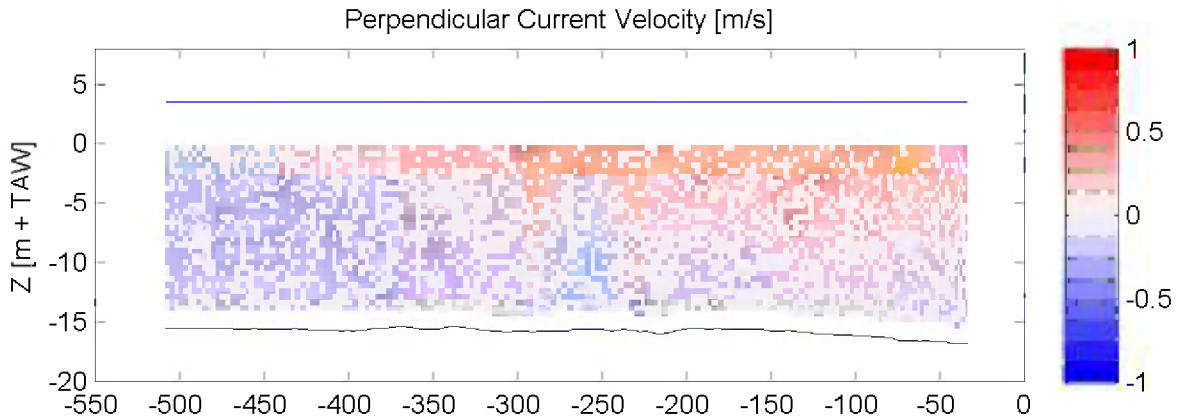
In association with :

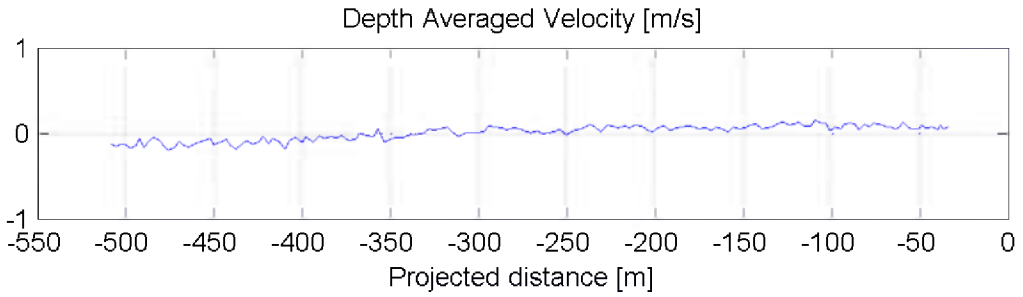
I/RA/11283/08.084/MSA

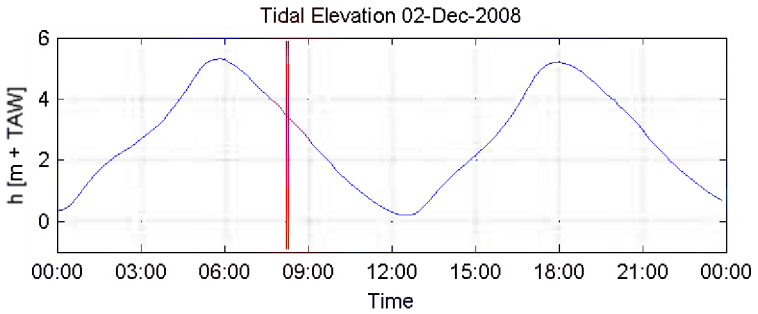
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1020TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:13 - 08:17

Time after HW [HH:MM]

2:25

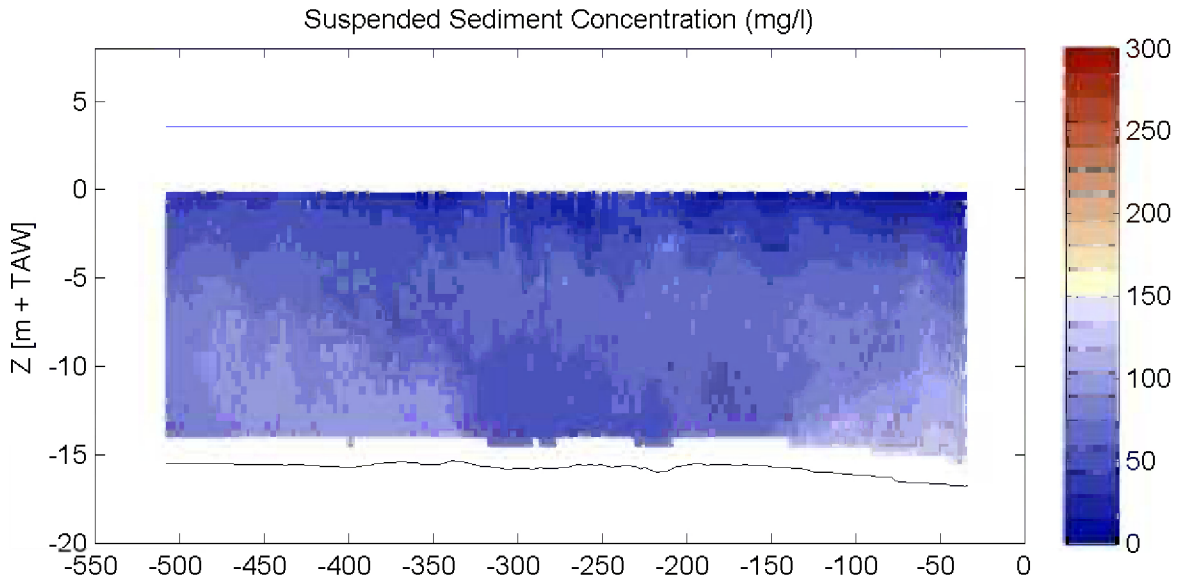
Data Processed by:

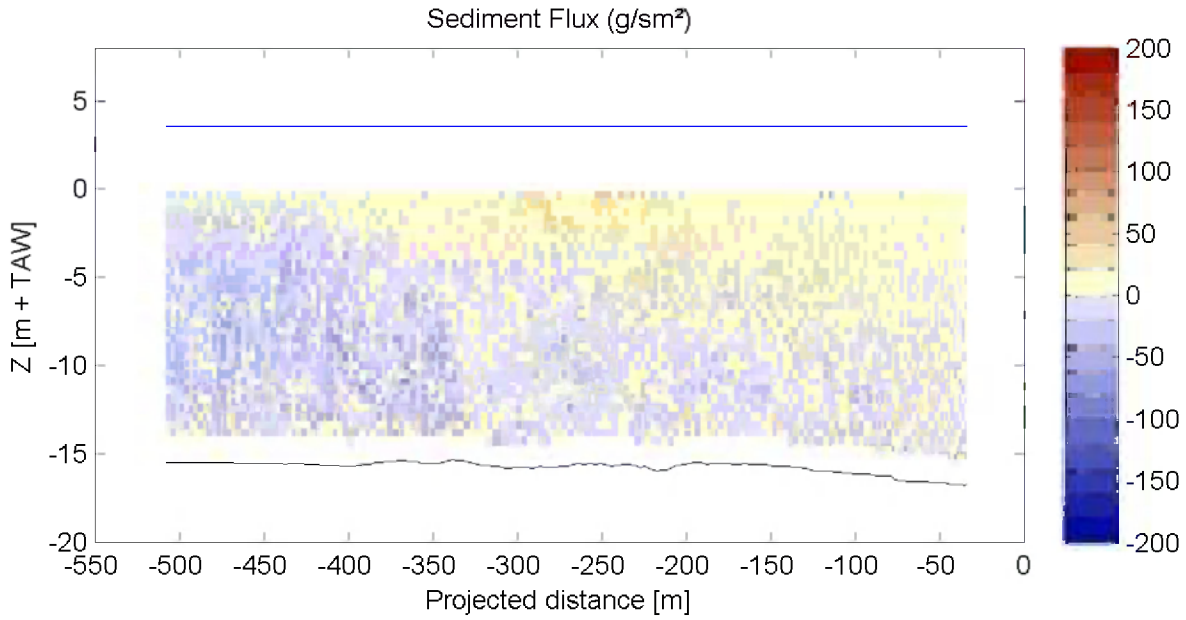
In association with :

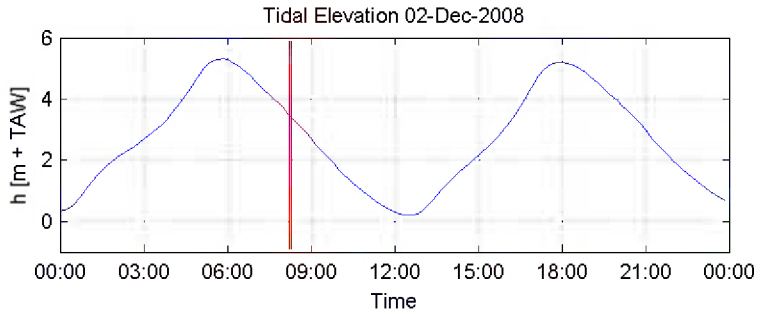
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1020TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:13 - 08:17

Time after HW [HH:MM]

2:25

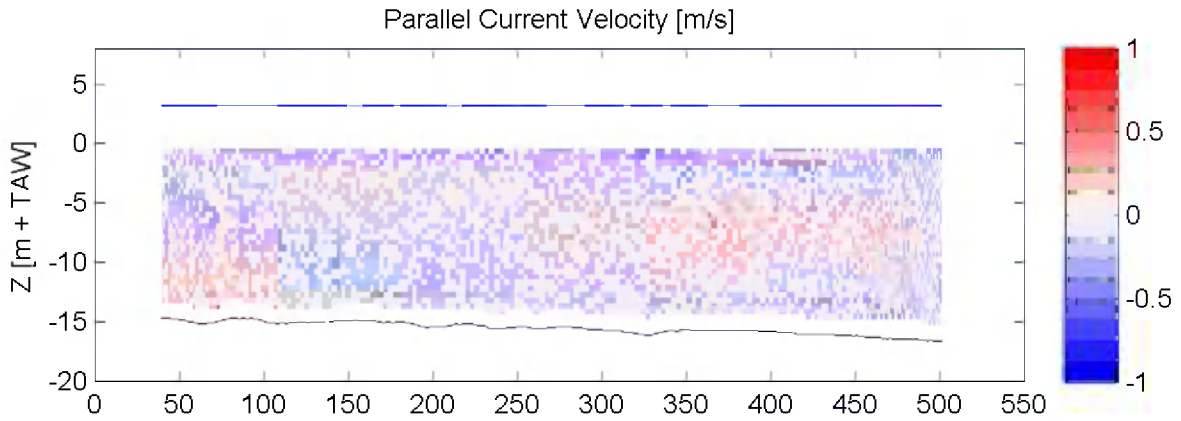
Data Processed by:

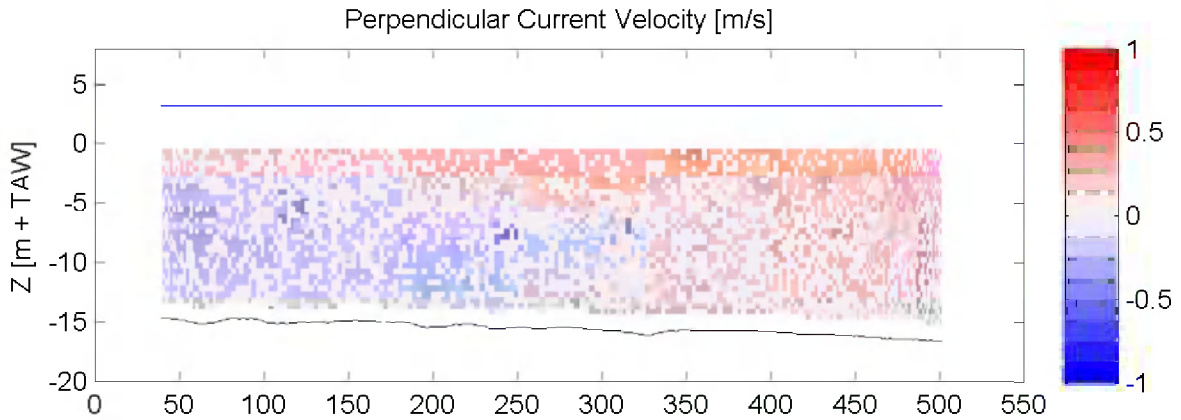
In association with :

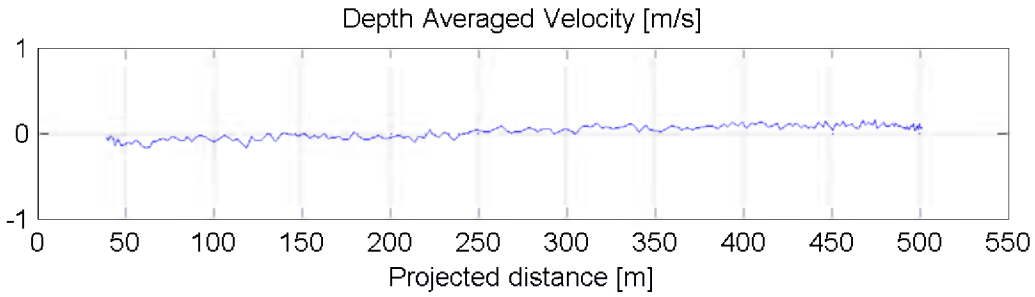
I/RA/11283/08.084/MSA

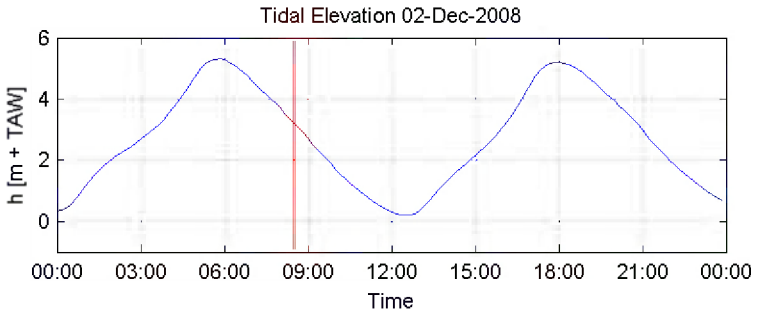
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1022TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:27 - 08:32

Time after HW [HH:MM]

2:40

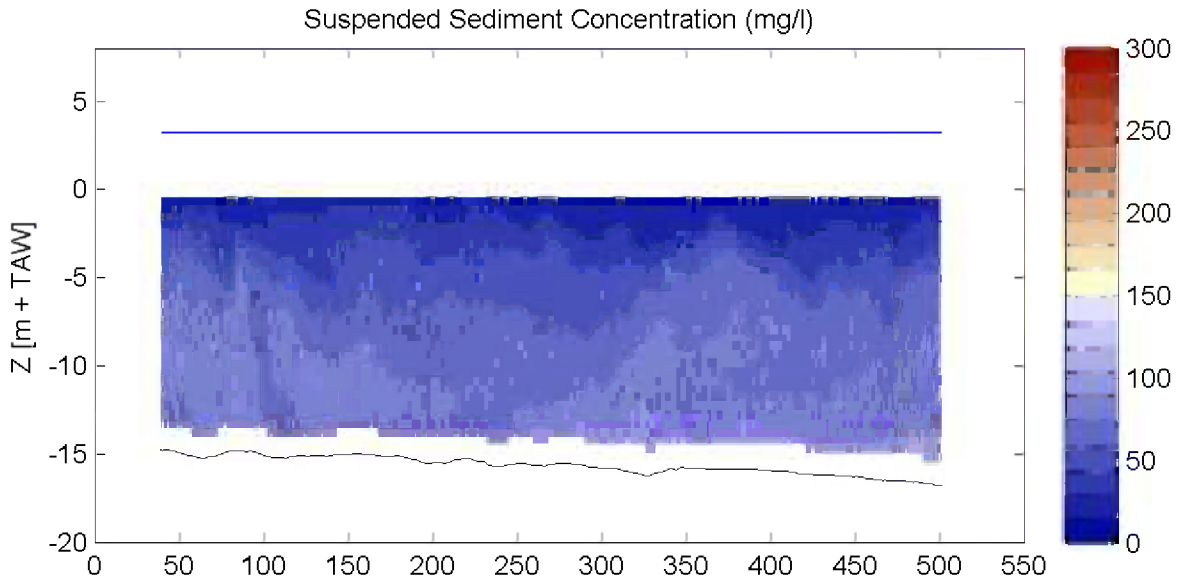
Data Processed by:

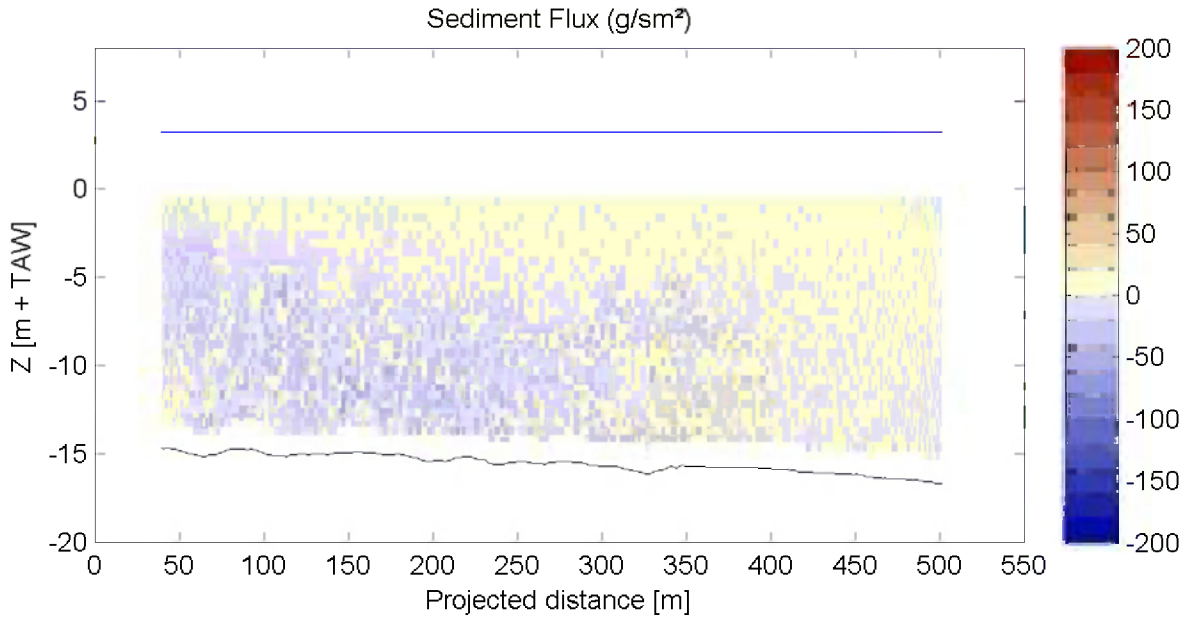
In association with :

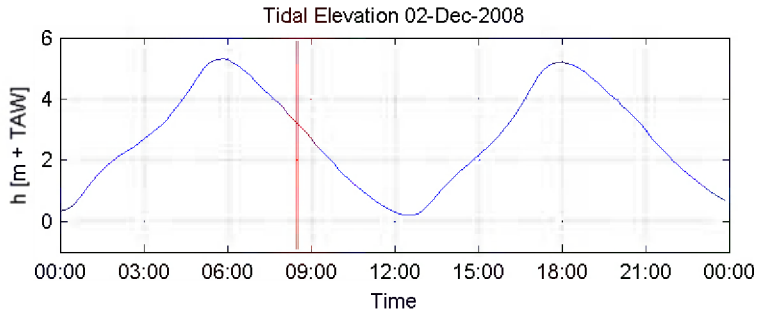
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1022TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:27 - 08:32

Time after HW [HH:MM]

2:40

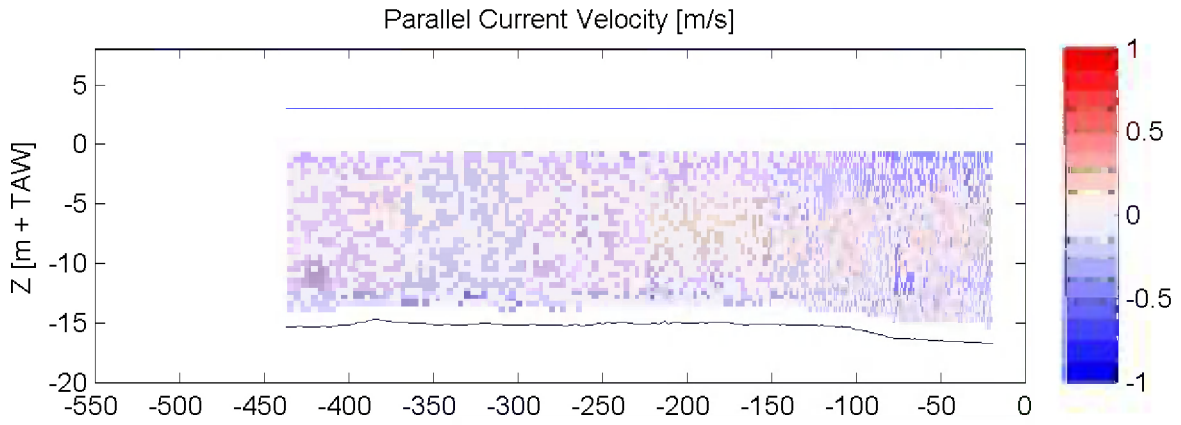
Data Processed by:

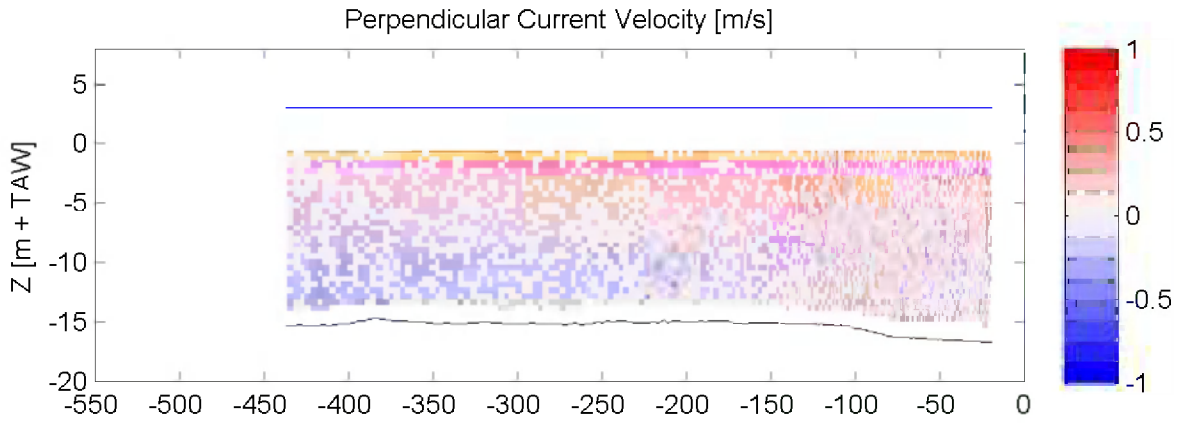
In association with :

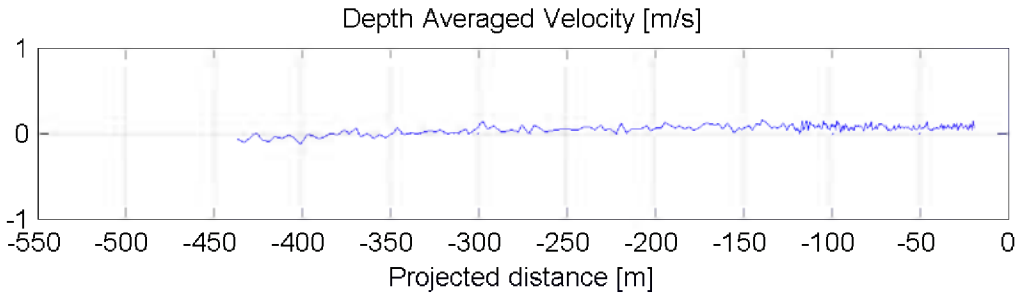
I/RA/11283/08.084/MSA

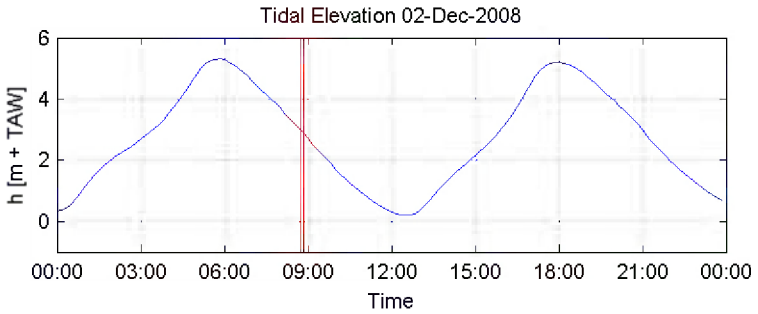
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1024TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:44 - 08:50

Time after HW [HH:MM]

2:57

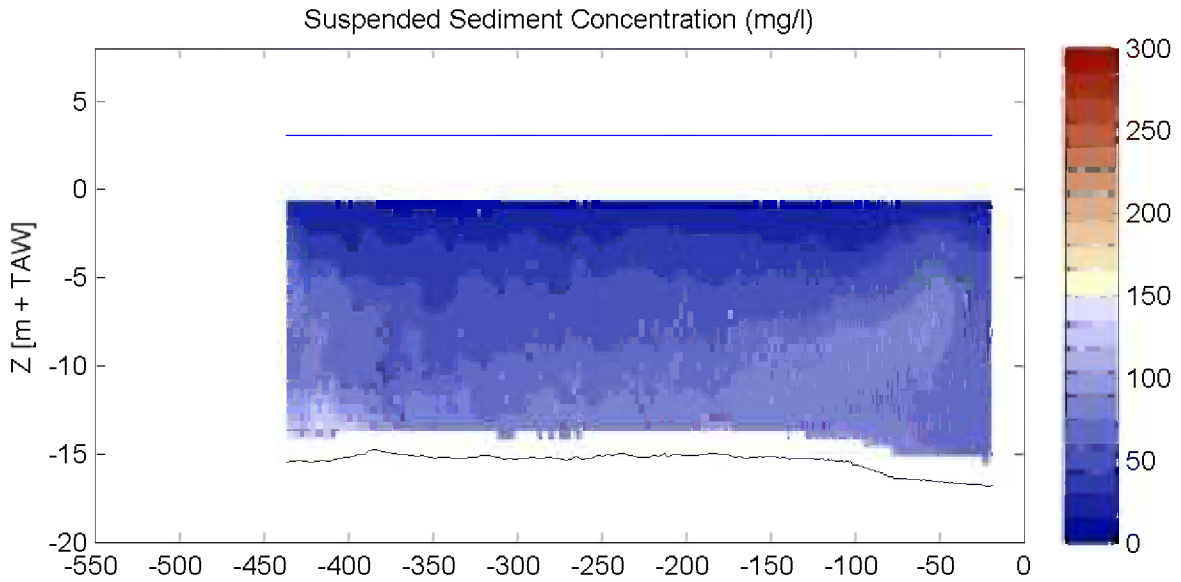
Data Processed by:

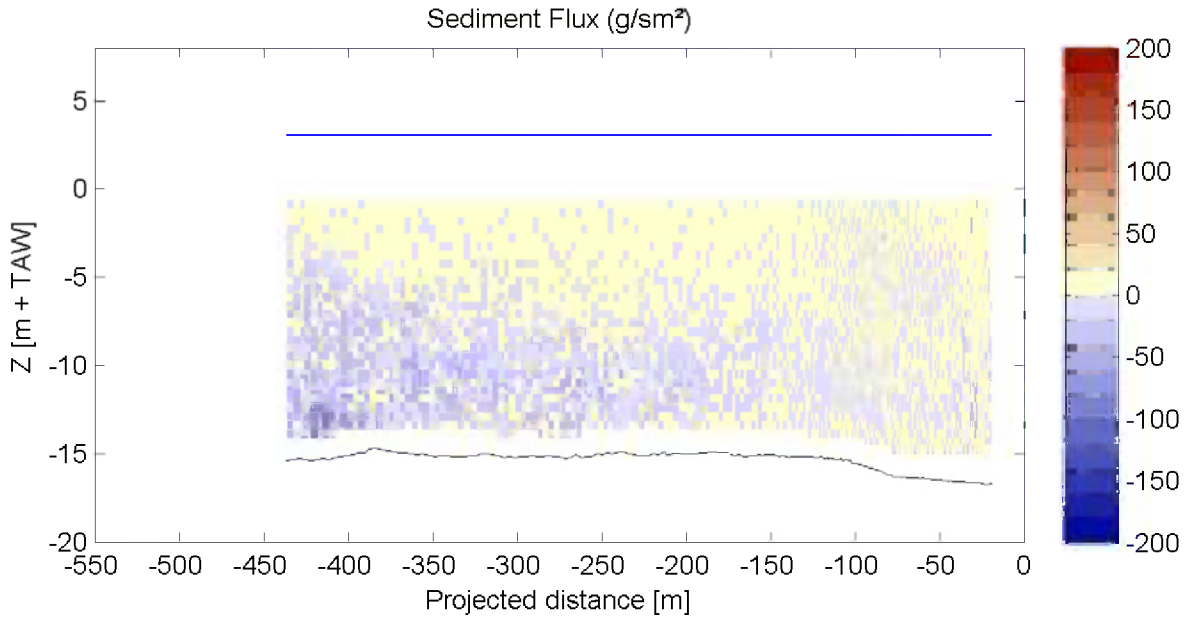
In association with :

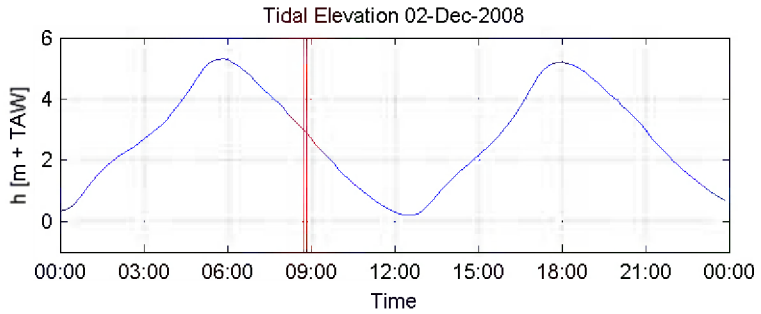
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1024TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

08:44 - 08:50

Time after HW [HH:MM]

2:57

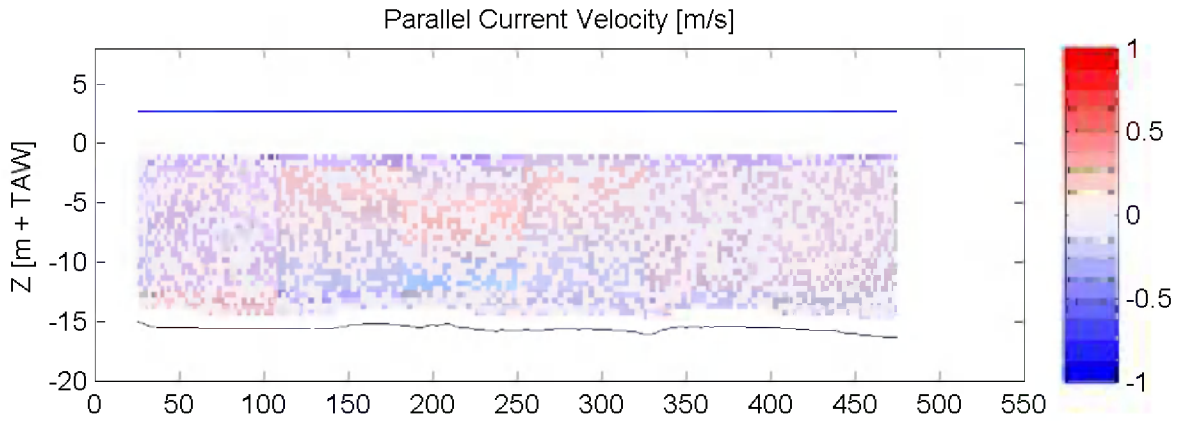
Data Processed by:

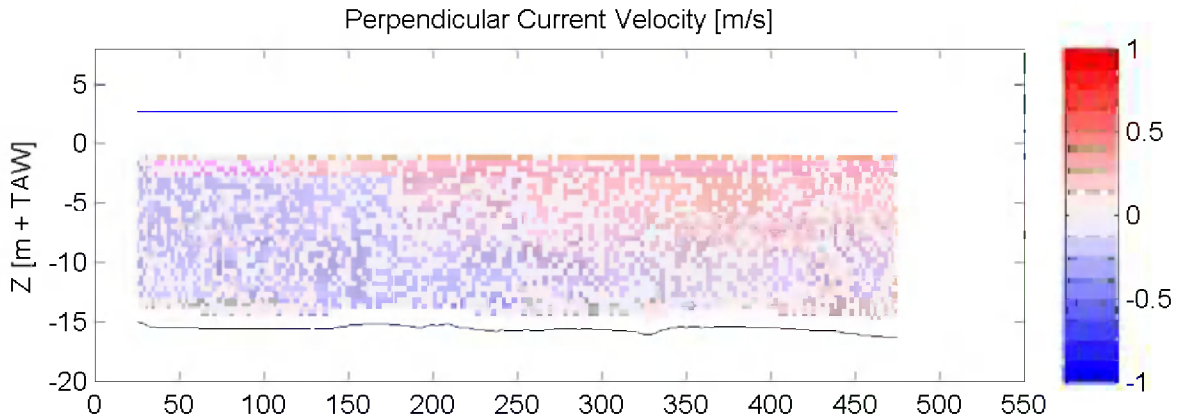
In association with :

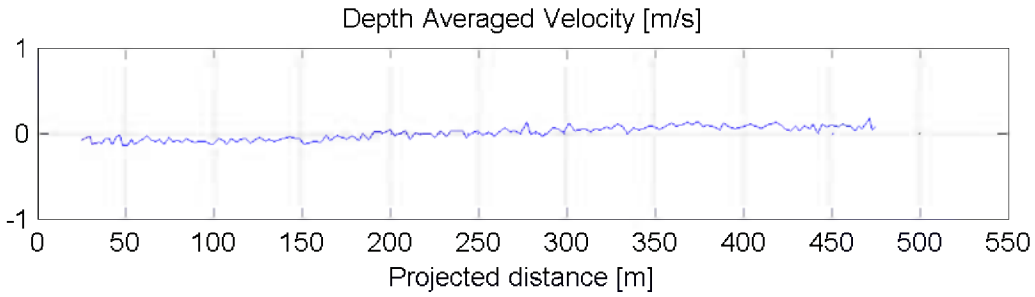
I/RA/11283/08.084/MSA

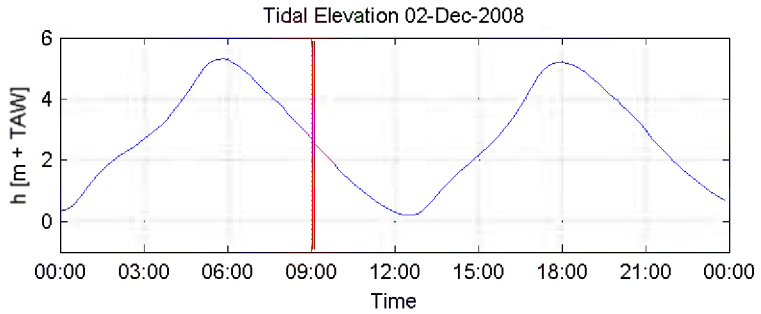
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1026TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:02 - 09:06

Time after HW [HH:MM]

3:14

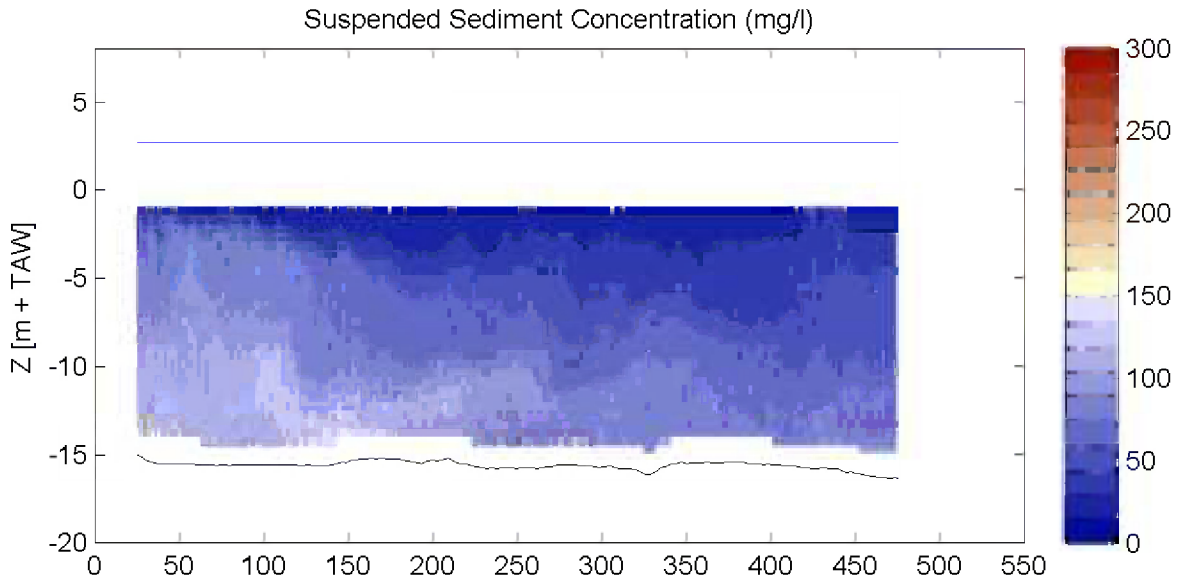
Data Processed by:

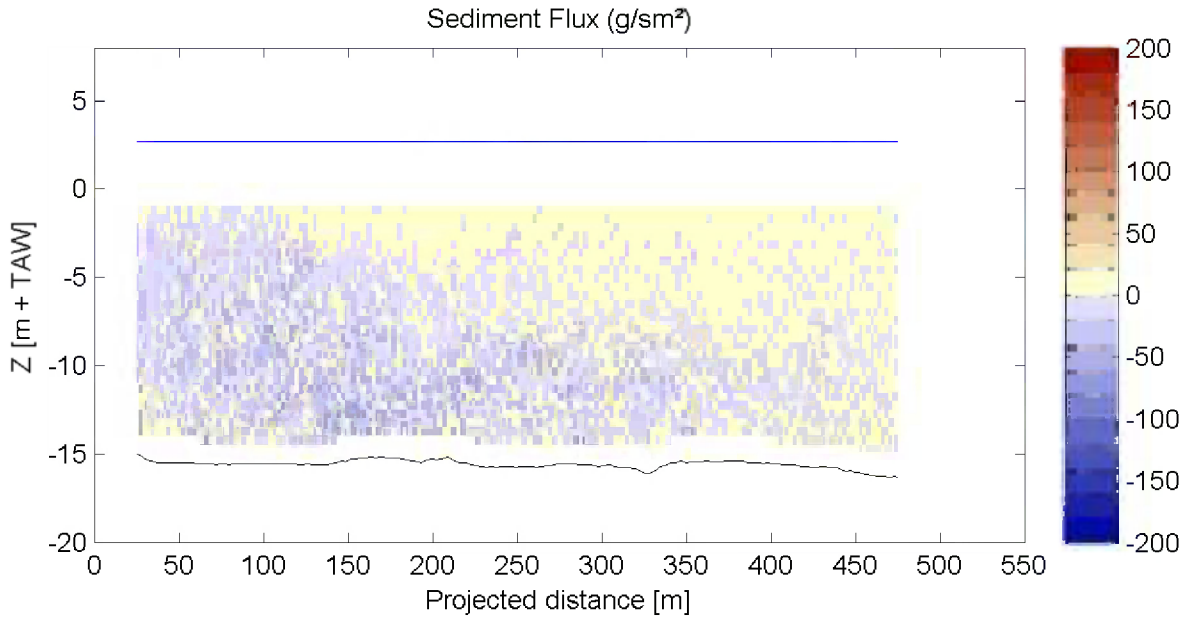
In association with :

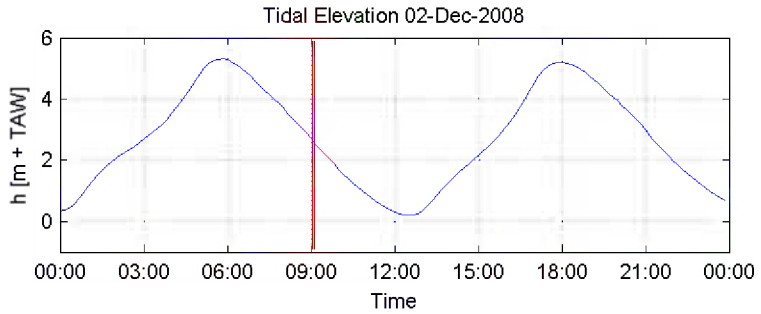
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1026TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:02 - 09:06

Time after HW [HH:MM]

3:14

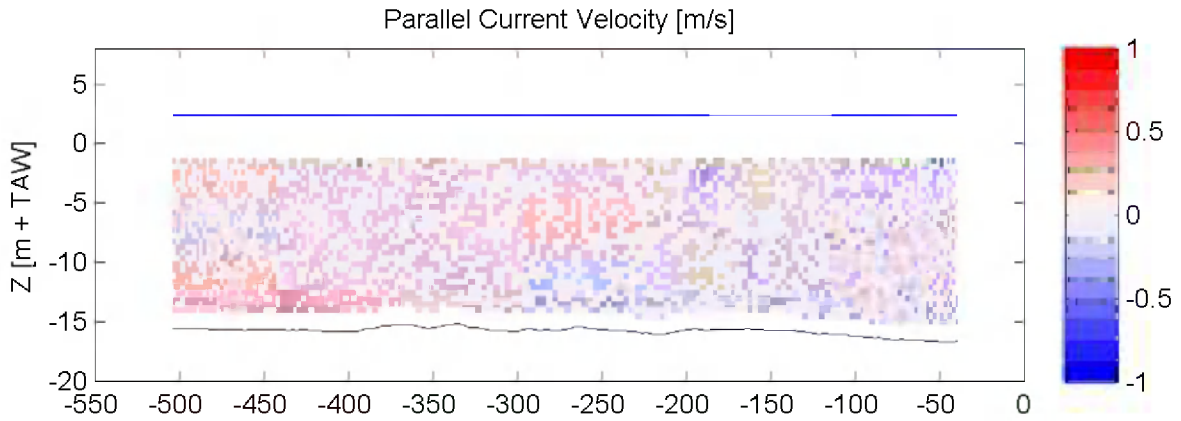
Data Processed by:

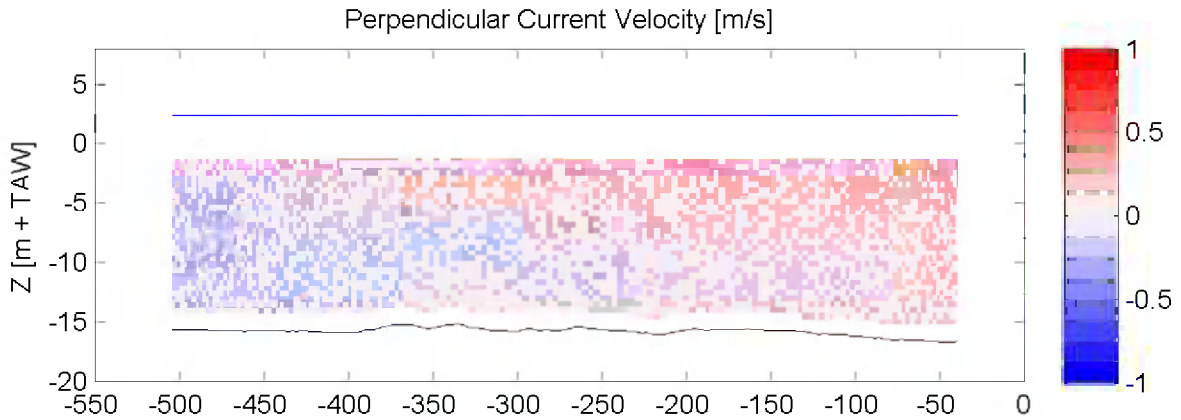
In association with :

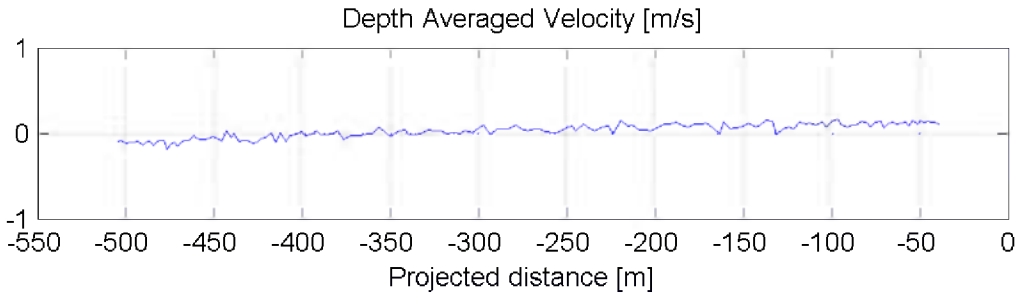
I/RA/11283/08.084/MSA

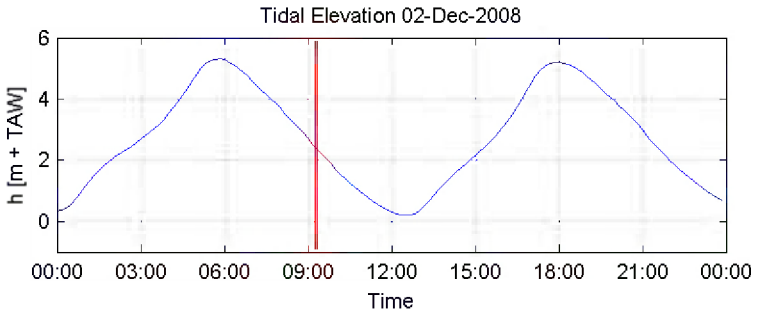
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1028TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:16 - 09:19

Time after HW [HH:MM]

3:27

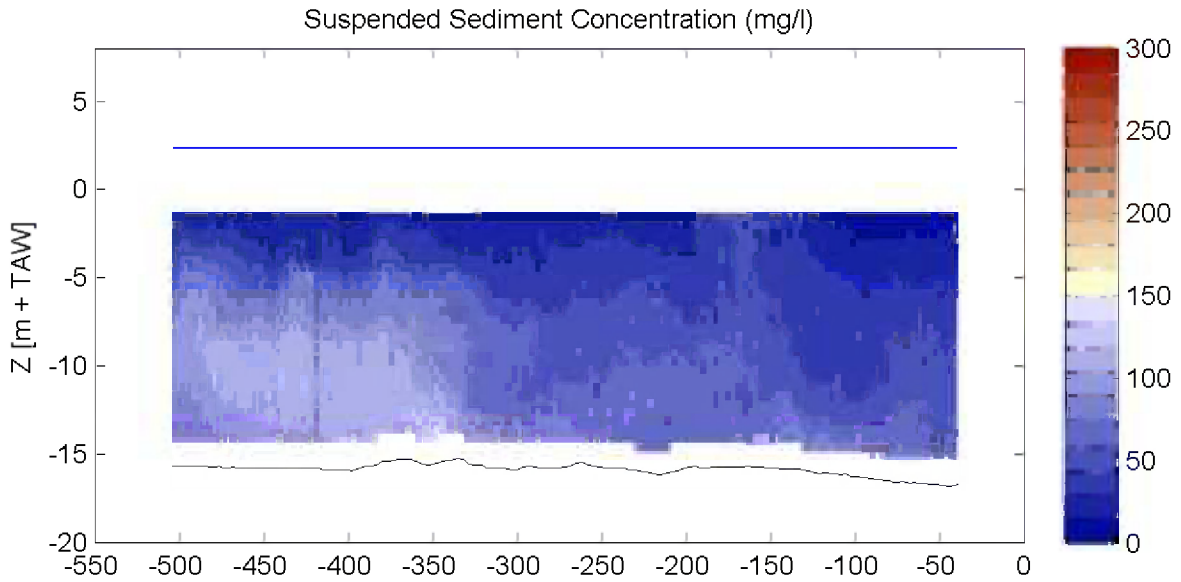
Data Processed by:

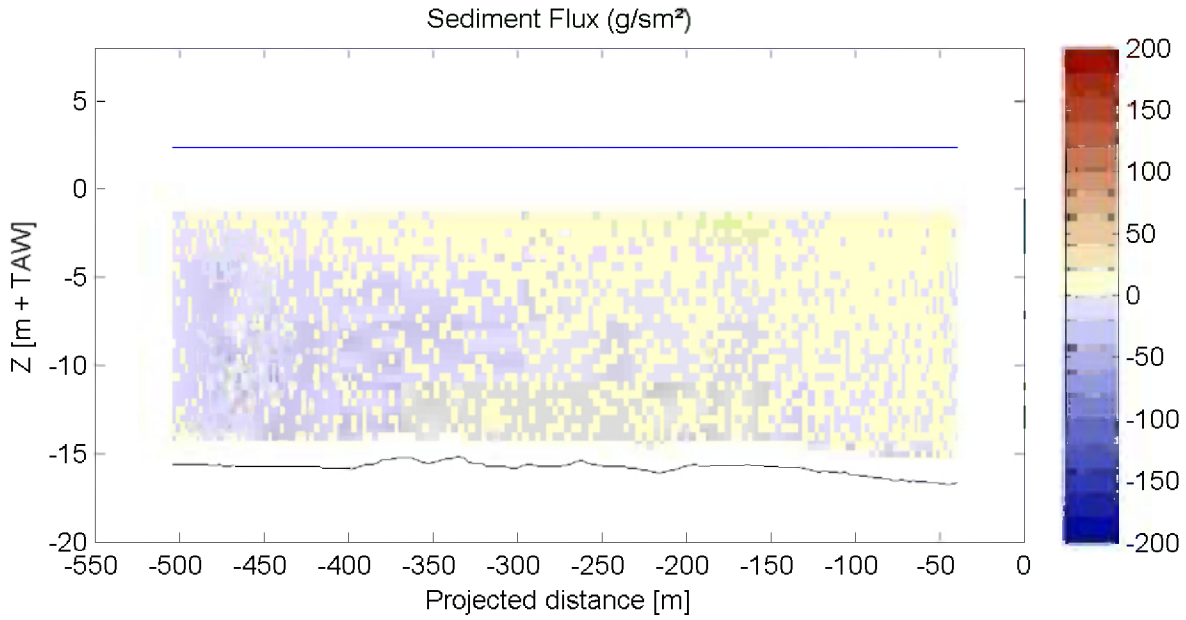
In association with :

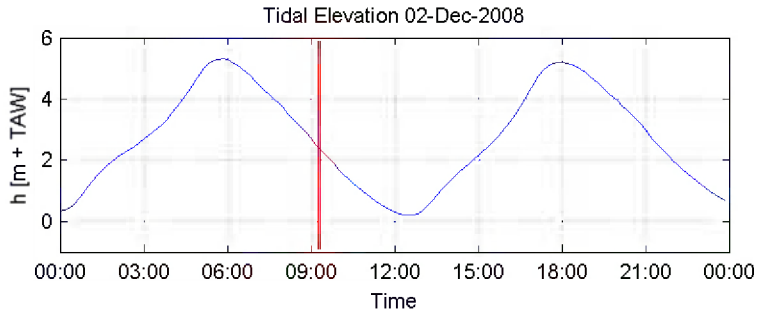
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1028TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:16 - 09:19

Time after HW [HH:MM]

3:27

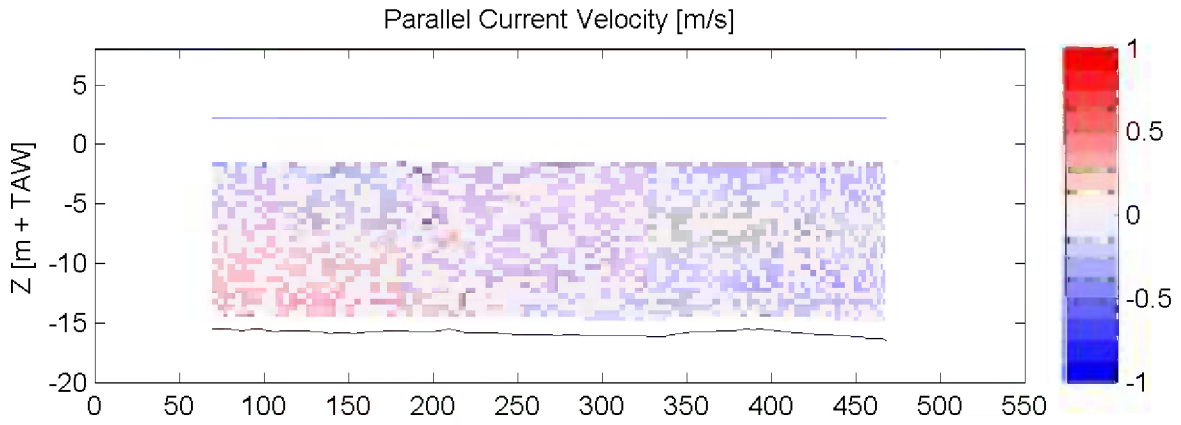
Data Processed by:

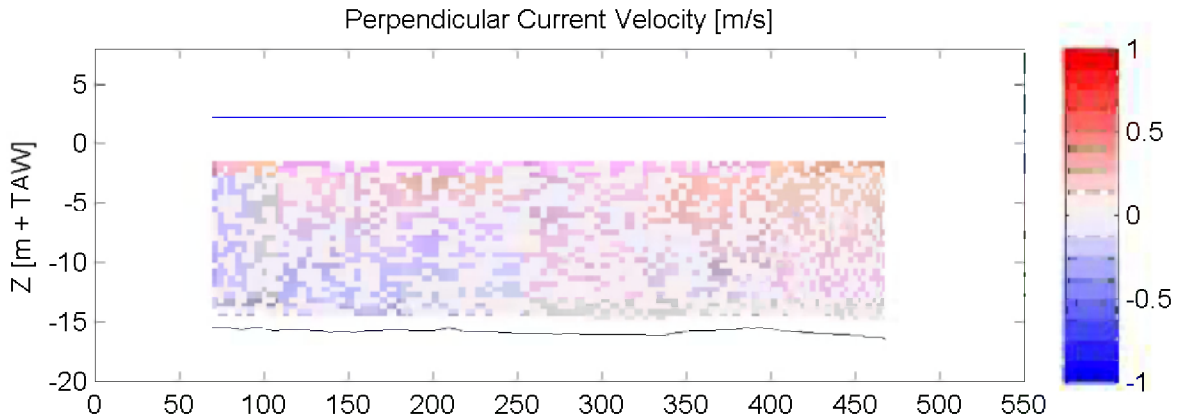
In association with :

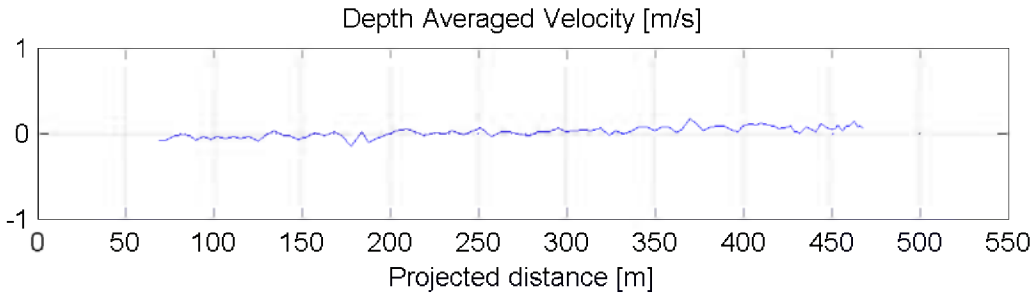
I/RA/11283/08.084/MSA

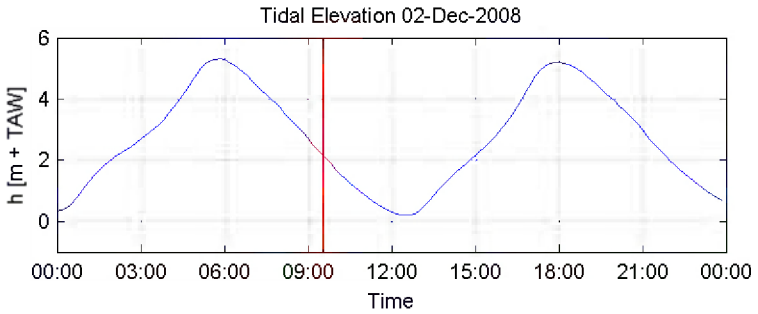
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1030TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:31 - 09:33

Time after HW [HH:MM]

3:42

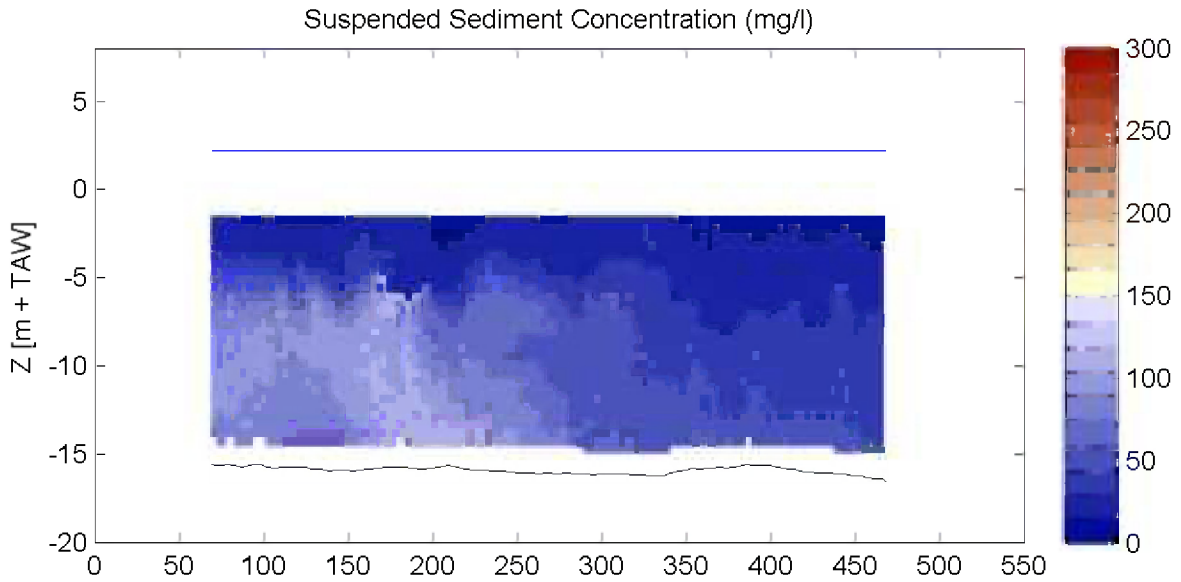
Data Processed by:

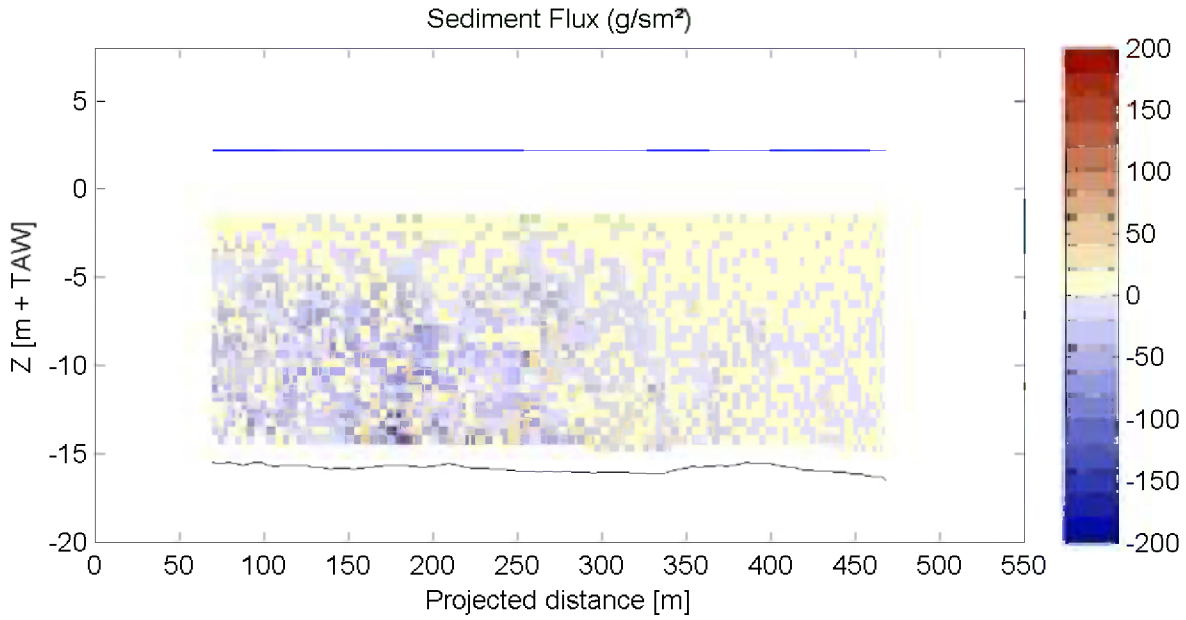
In association with :

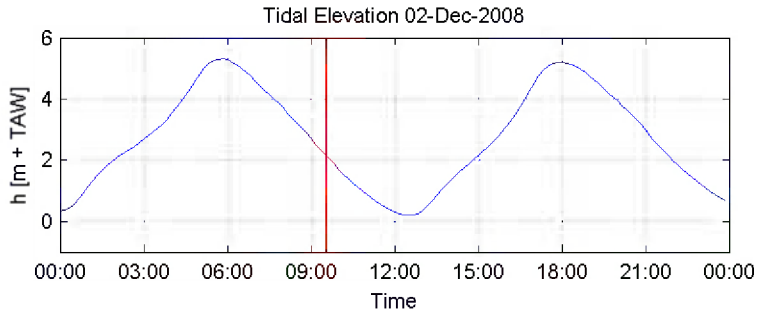
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1030TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:31 - 09:33

Time after HW [HH:MM]

3:42

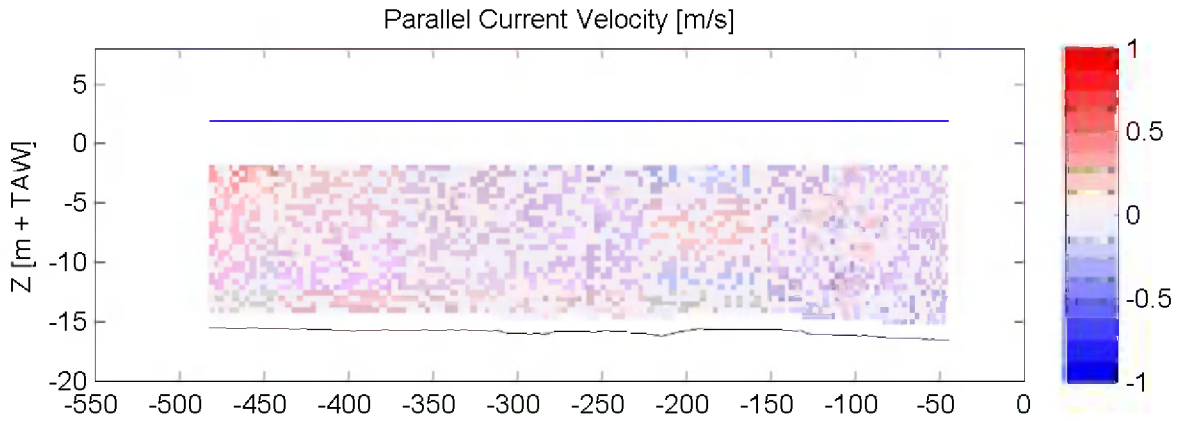
Data Processed by:

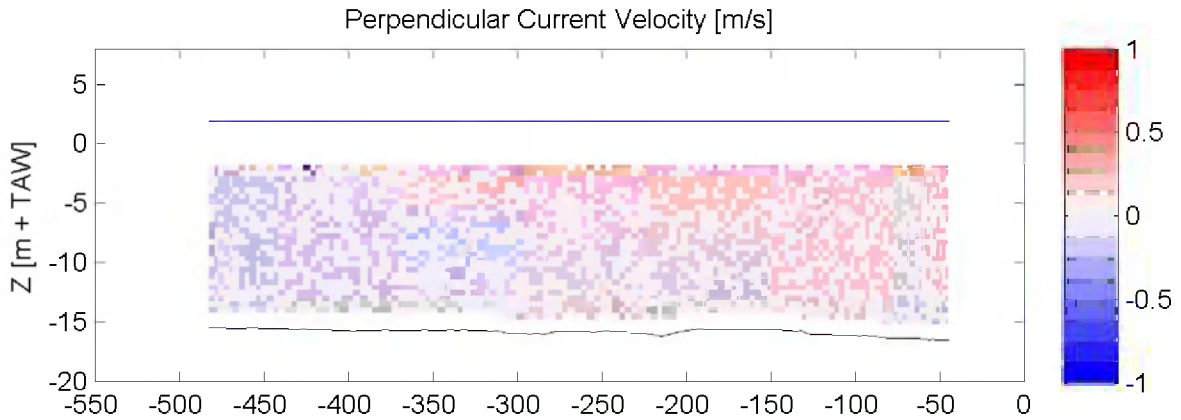
In association with :

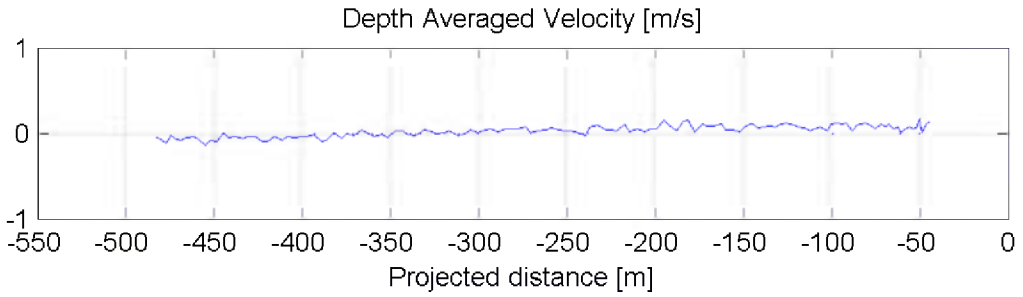
I/RA/11283/08.084/MSA

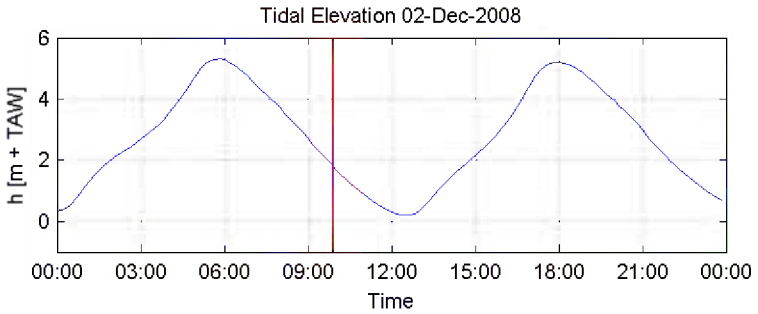
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1032TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:51 - 09:54

Time after HW [HH:MM]

4:03

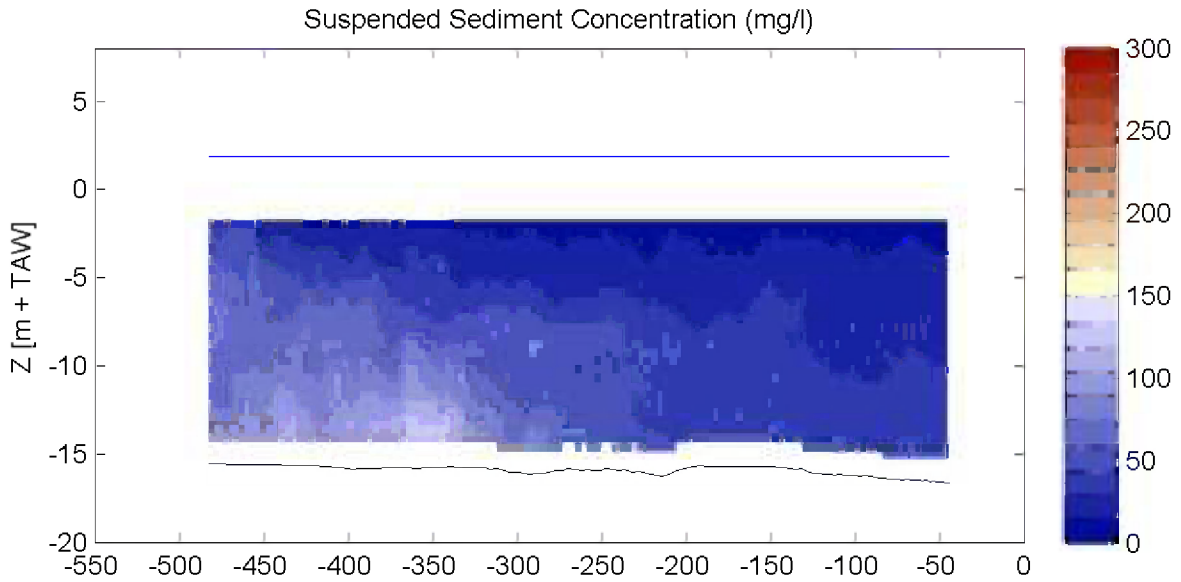
Data Processed by:

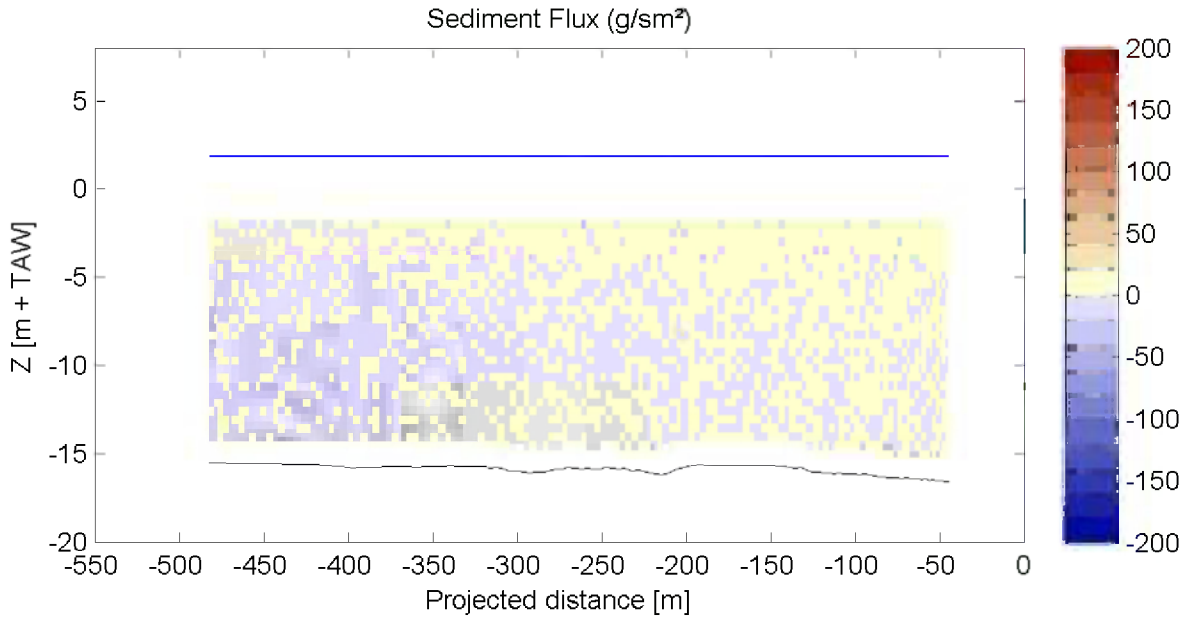
In association with :

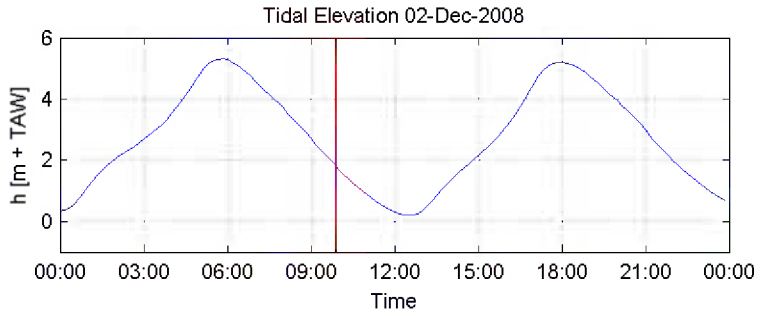
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1032TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

09:51 - 09:54

Time after HW [HH:MM]

4:03

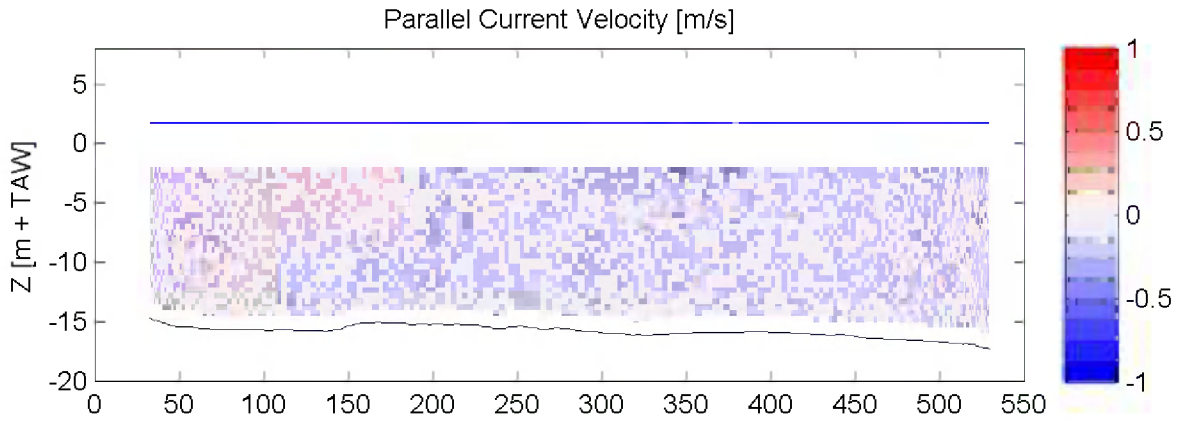
Data Processed by:

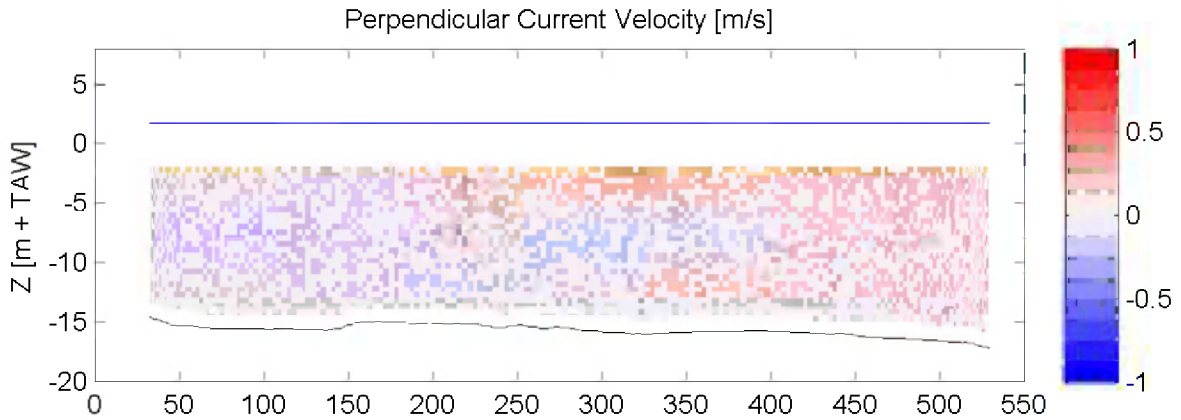
In association with :

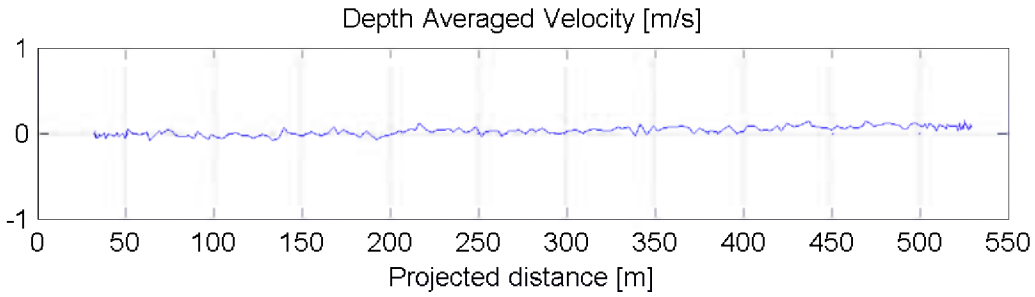
I/RA/11283/08.084/MSA

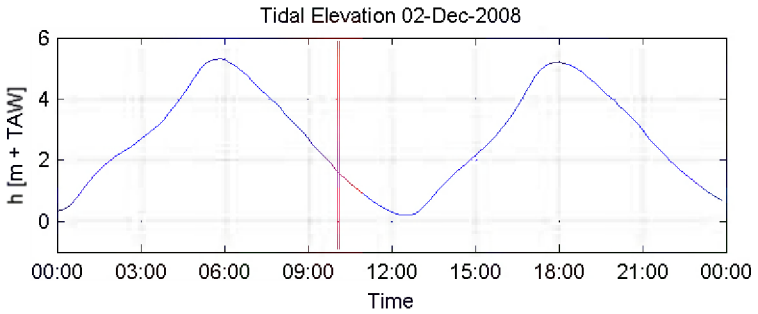
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1034TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:03 - 10:08

Time after HW [HH:MM]

4:15

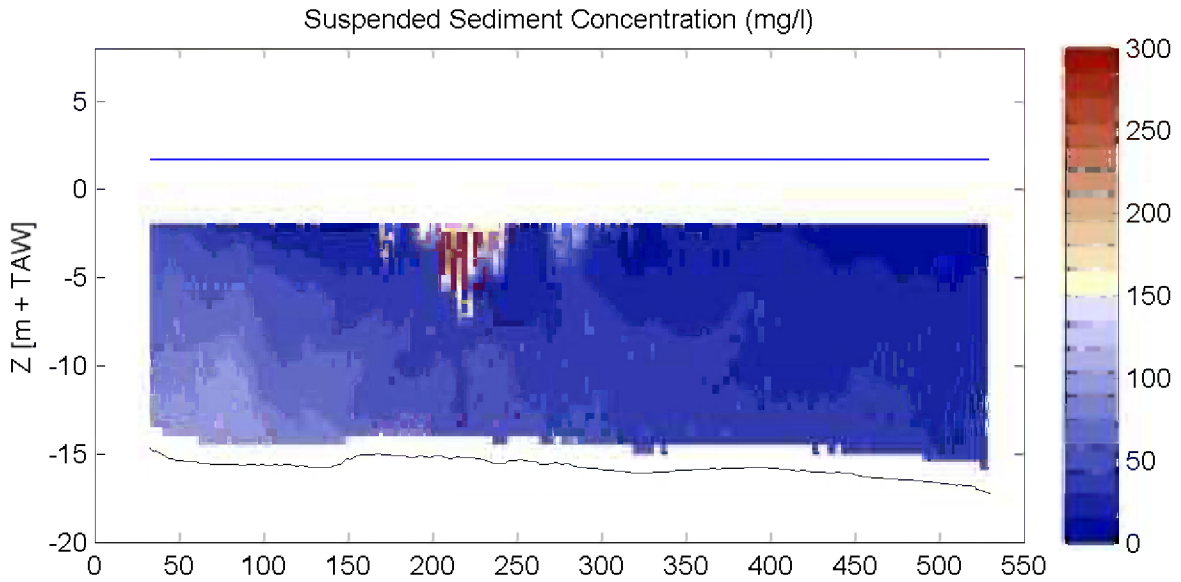
Data Processed by:

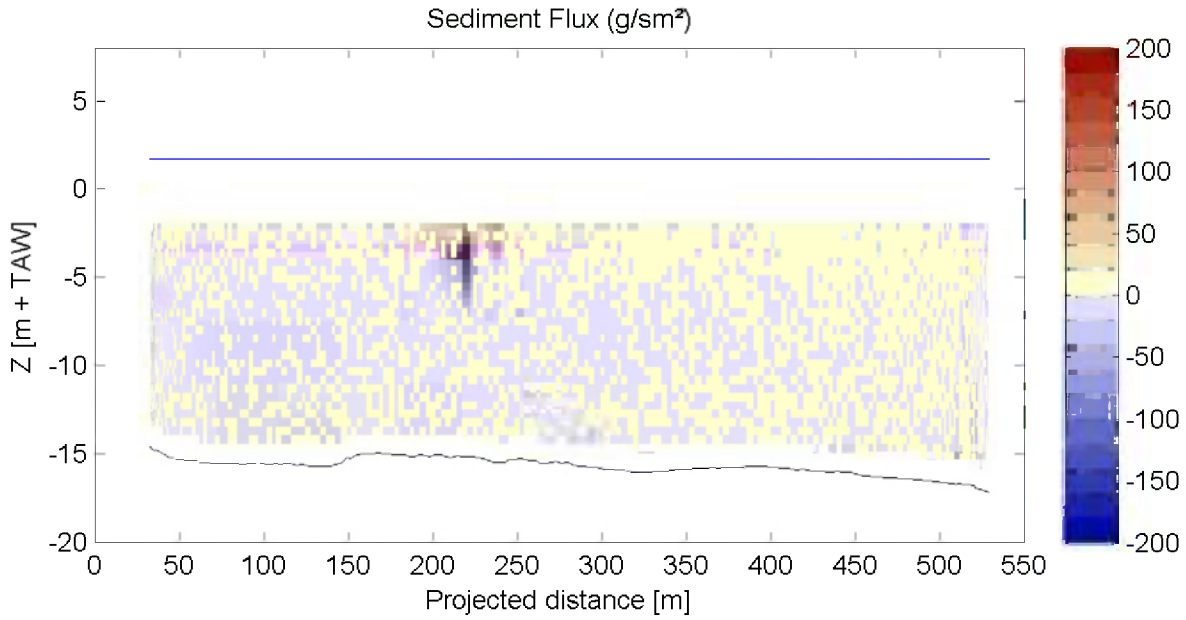
In association with :

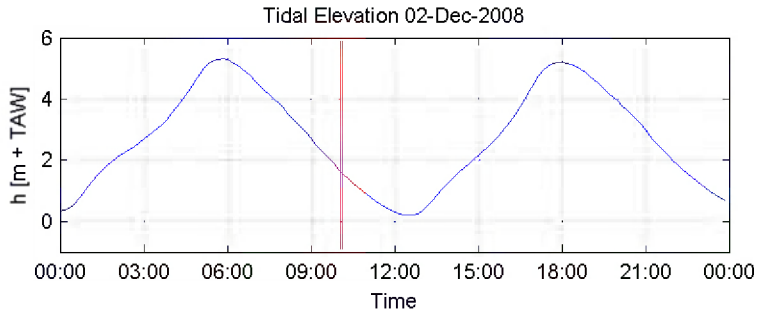
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1034TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:03 - 10:08

Time after HW [HH:MM]

4:15

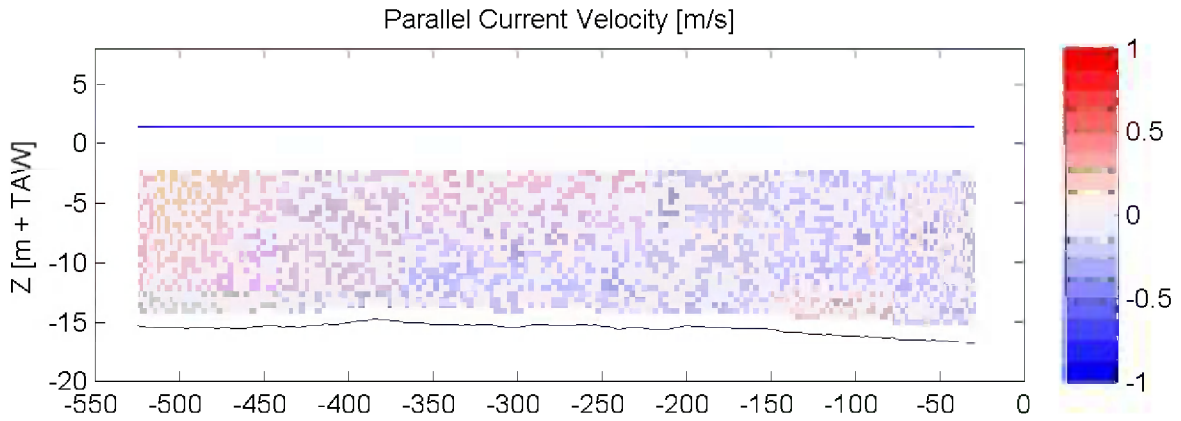
Data Processed by:

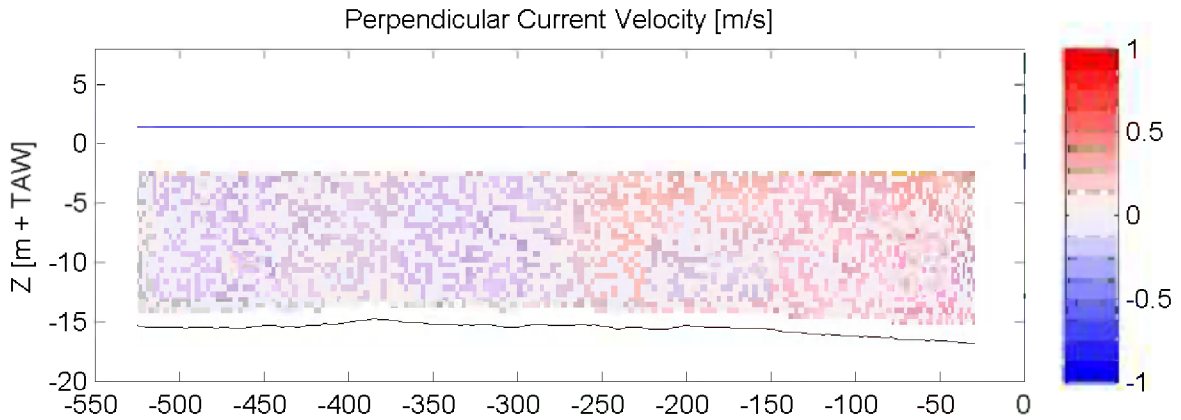
In association with :

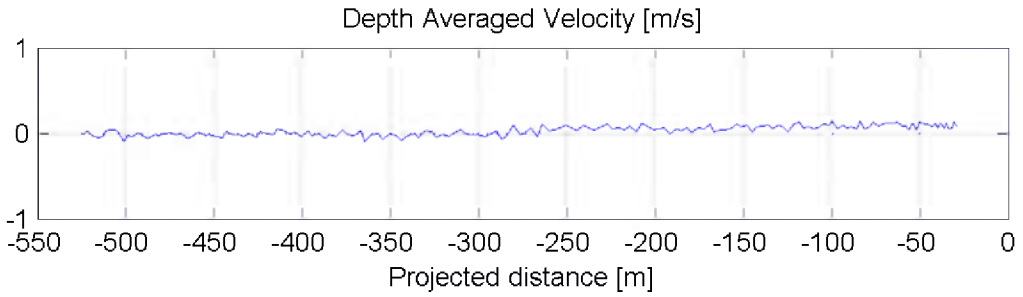
I/RA/11283/08.084/MSA

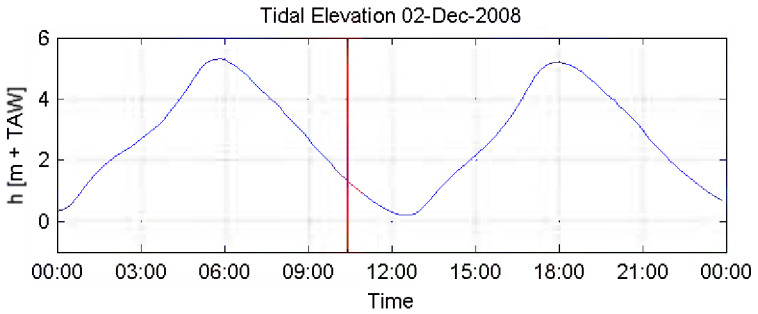
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1036TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:22 - 10:26

Time after HW [HH:MM]

4:34

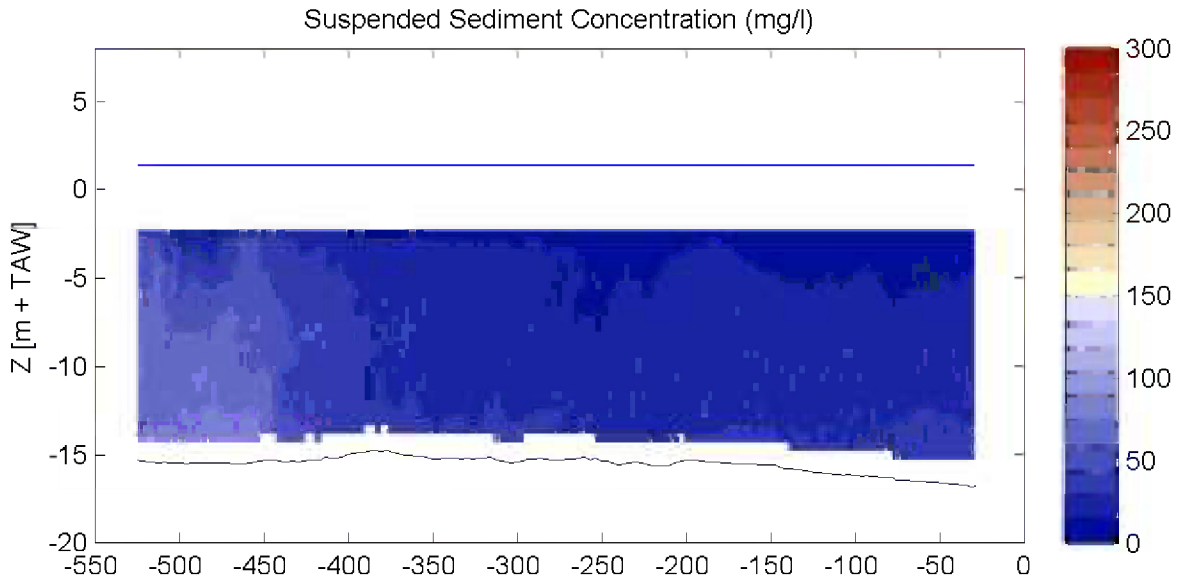
Data Processed by:

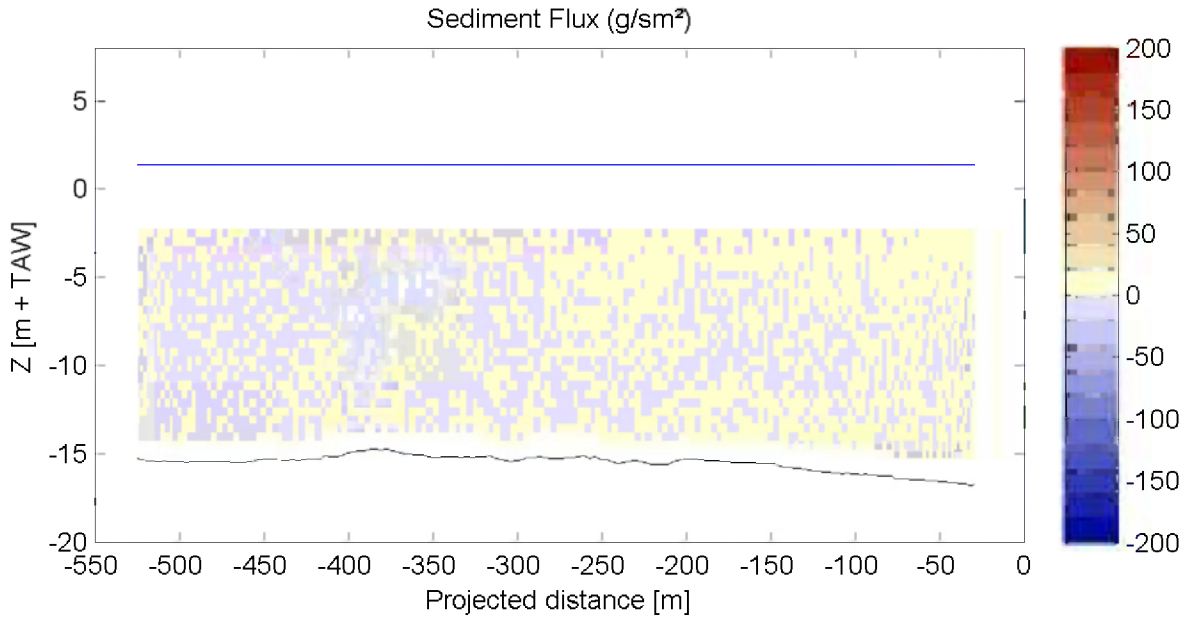
In association with :

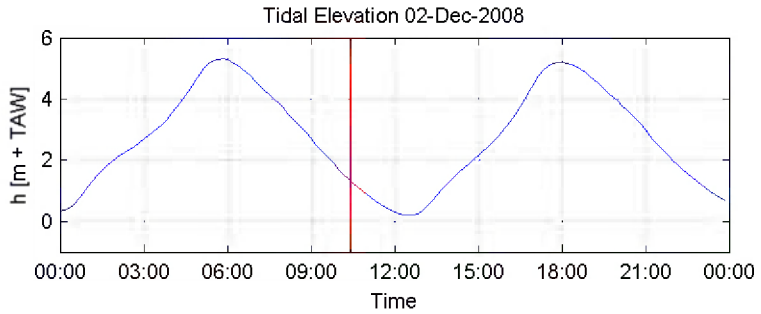
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1036TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:22 - 10:26

Time after HW [HH:MM]

4:34

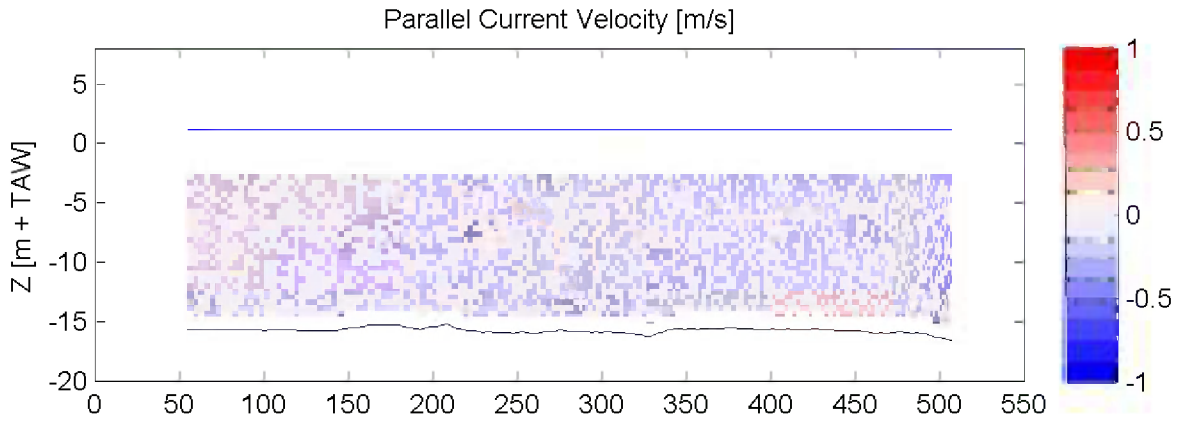
Data Processed by:

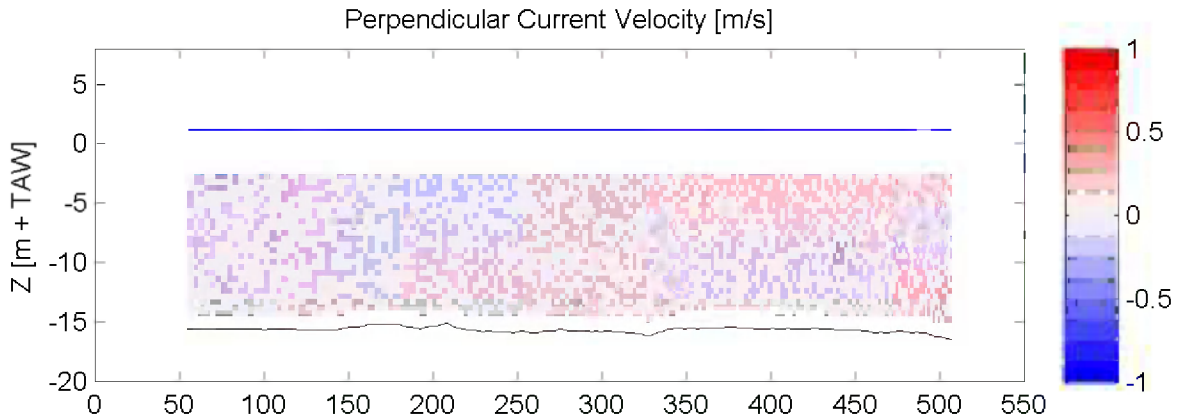
In association with :

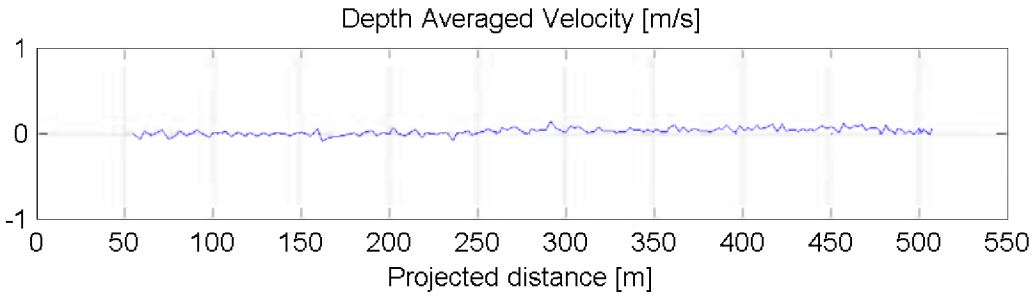
I/RA/11283/08.084/MSA

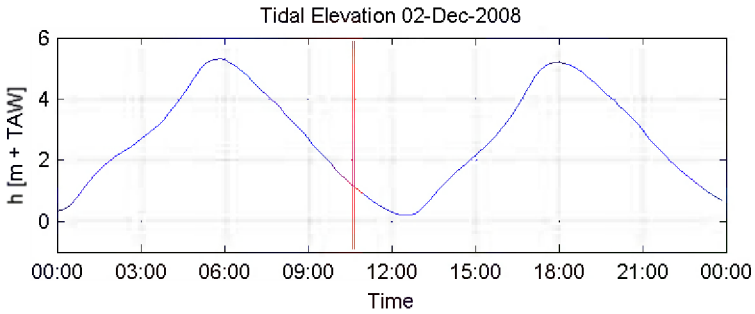
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1038TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:36 - 10:40

Time after HW [HH:MM]

4:48

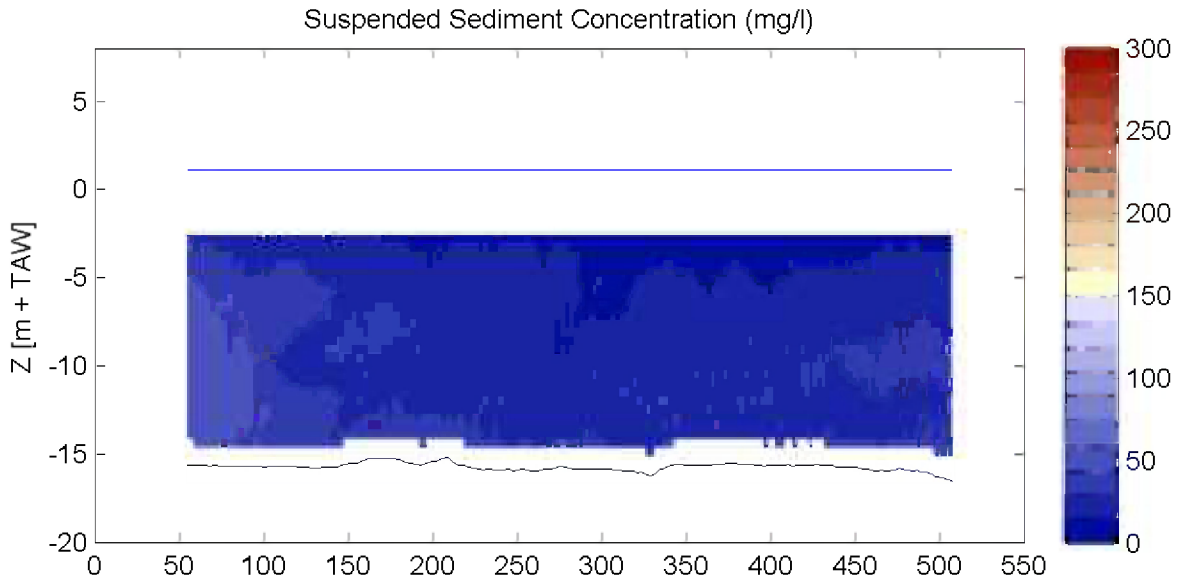
Data Processed by:

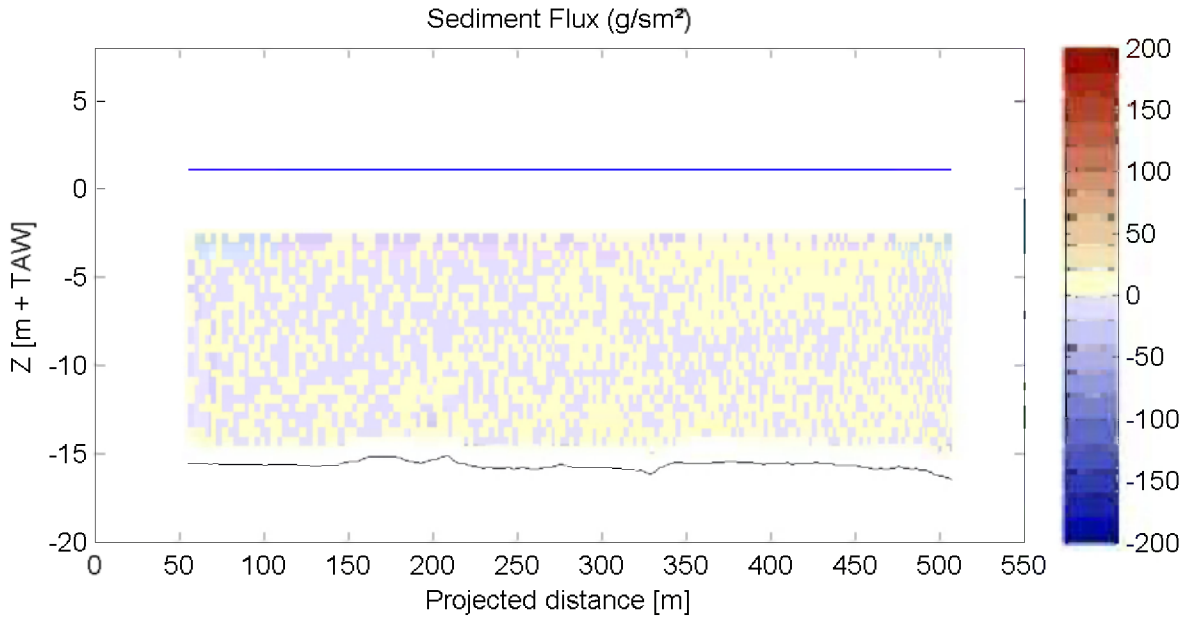
In association with :

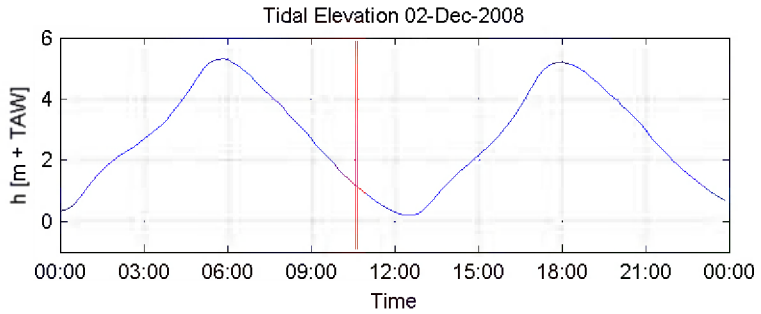
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1038TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:36 - 10:40

Time after HW [HH:MM]

4:48

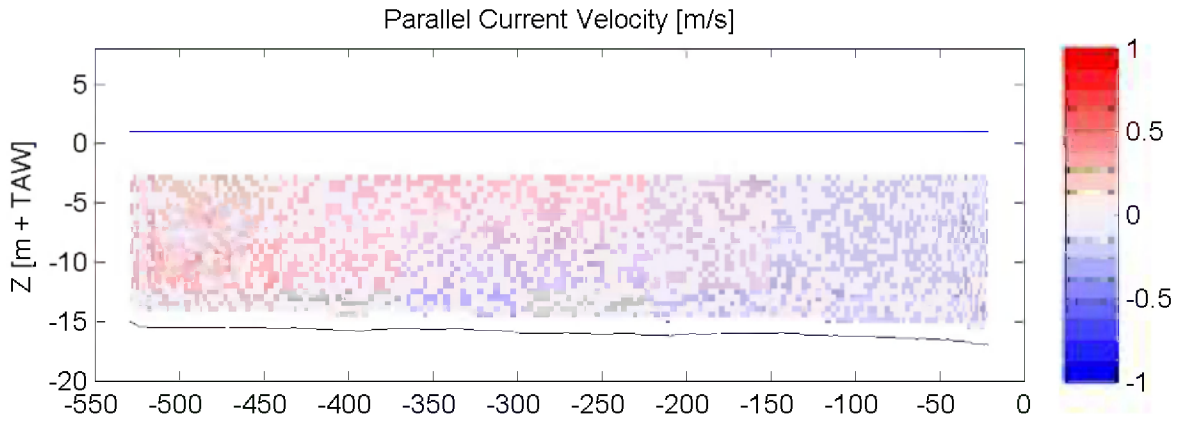
Data Processed by:

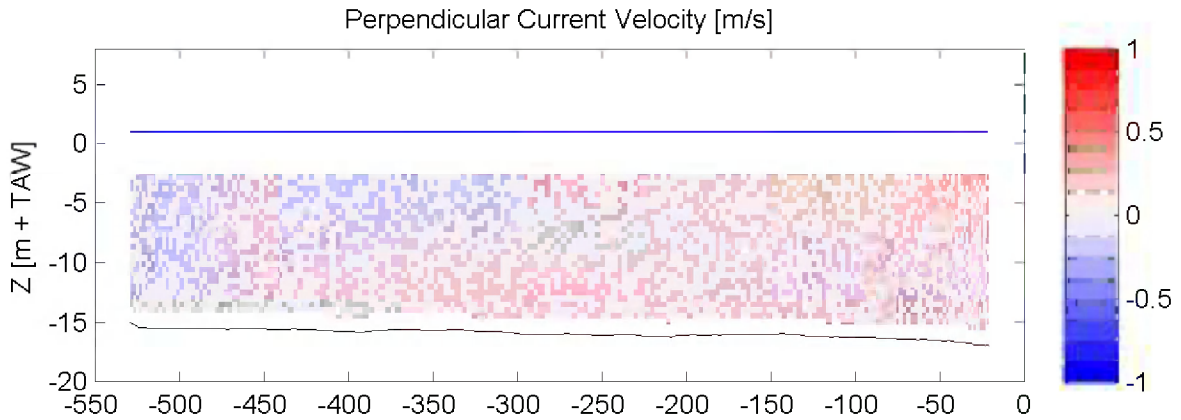
In association with :

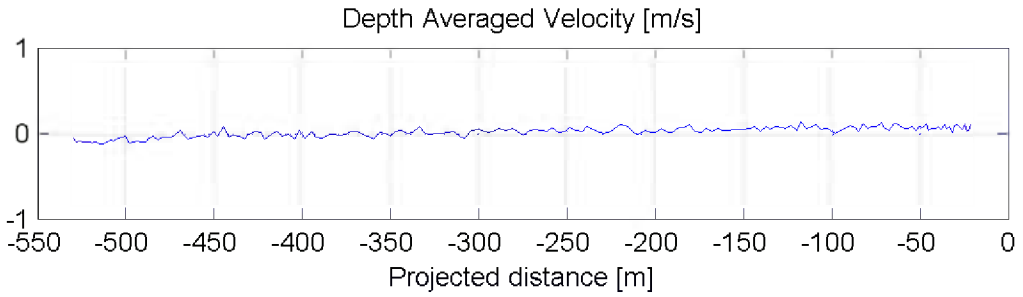
I/RA/11283/08.084/MSA

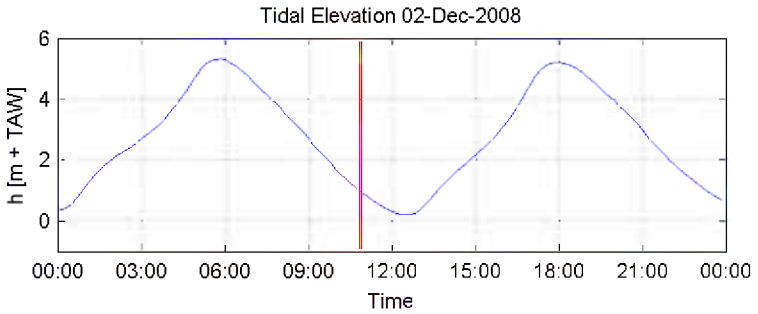
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1040TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:51 - 10:55

Time after HW [HH:MM]

5:03

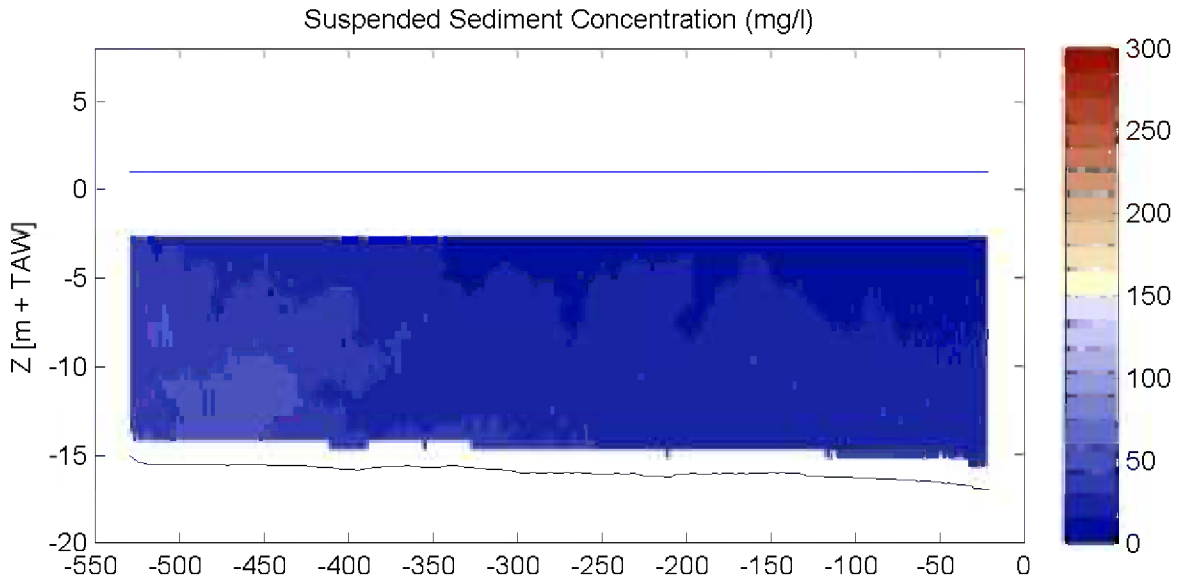
Data Processed by:

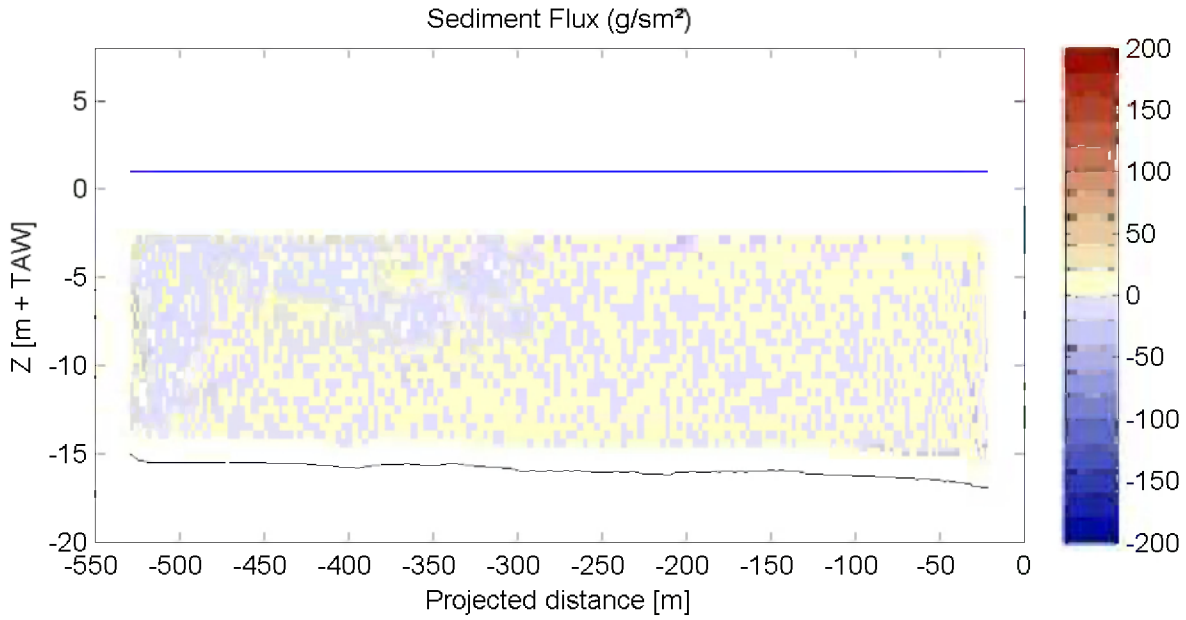
In association with :

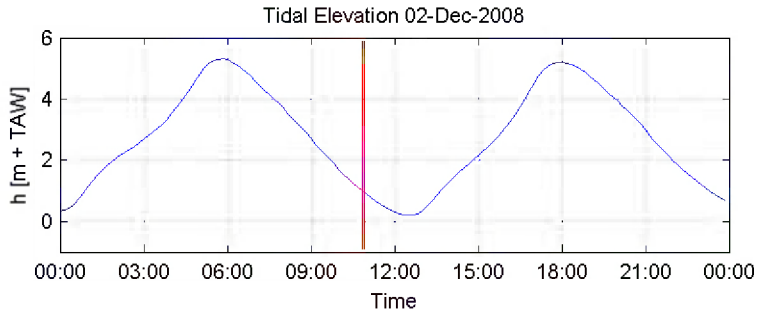
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1040TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

10:51 - 10:55

Time after HW [HH:MM]

5:03

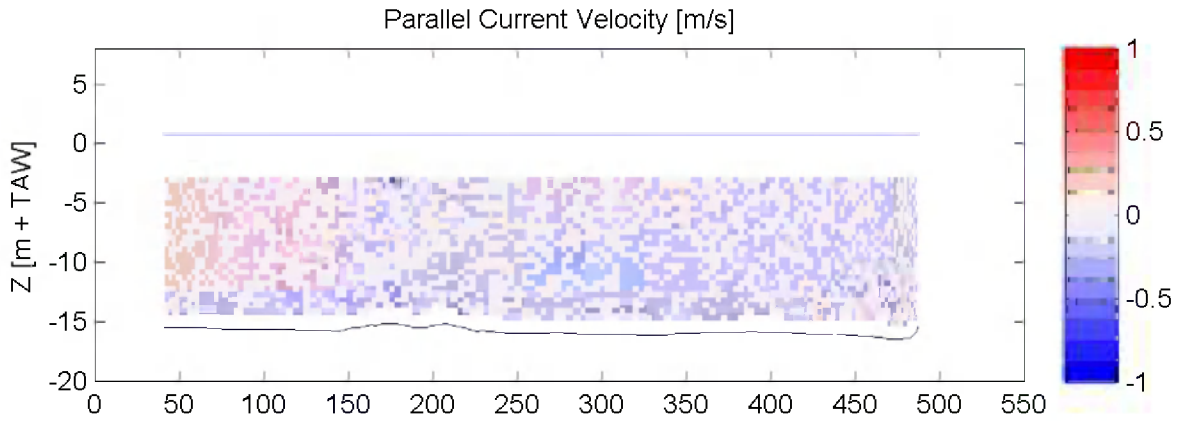
Data Processed by:

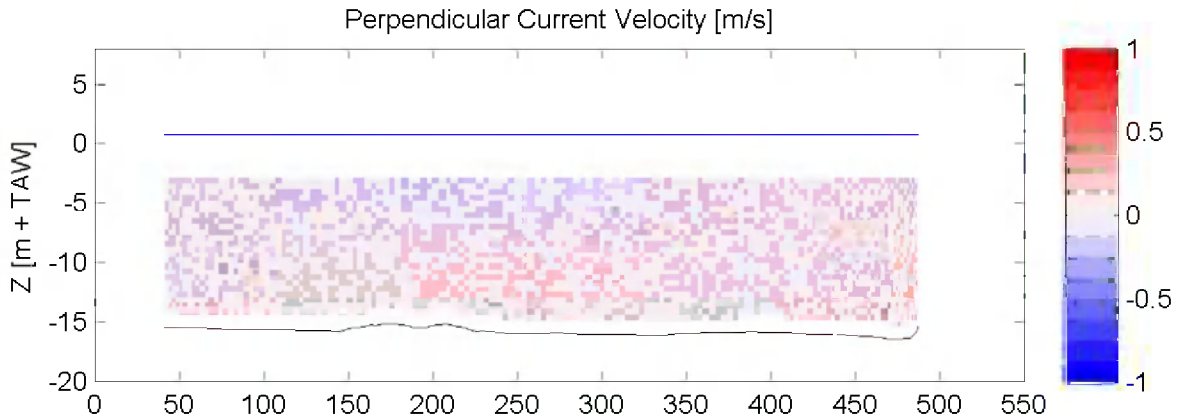
In association with :

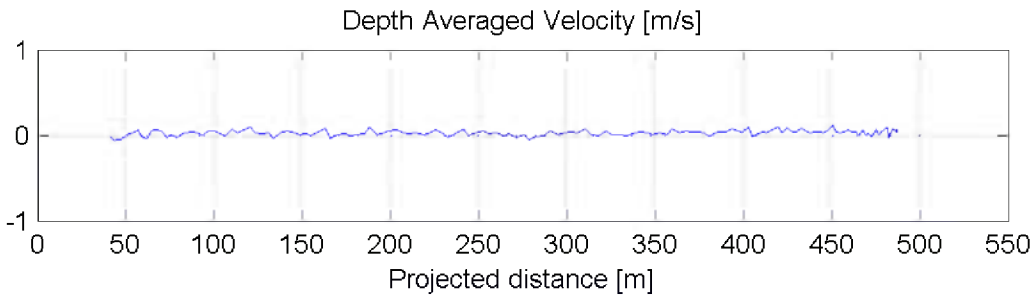
I/RA/11283/08.084/MSA

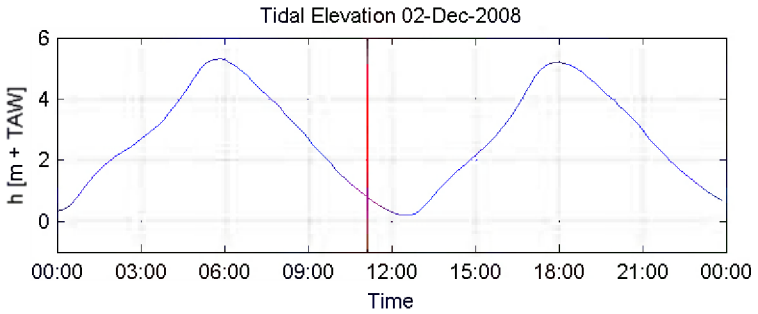
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1042TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:06 - 11:10

Time after HW [HH:MM]

5:18

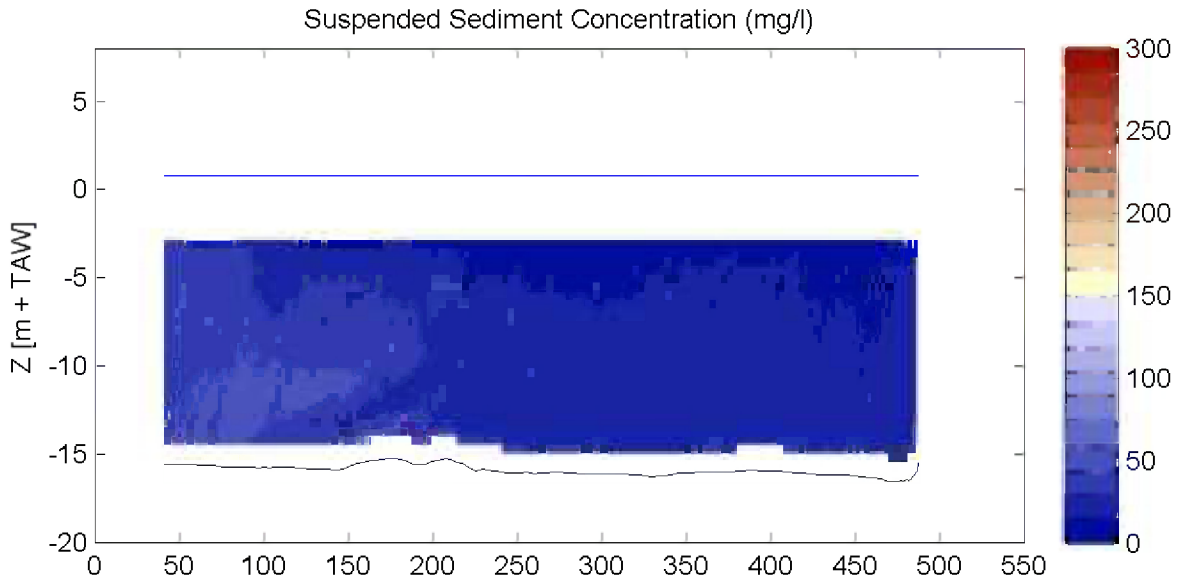
Data Processed by:

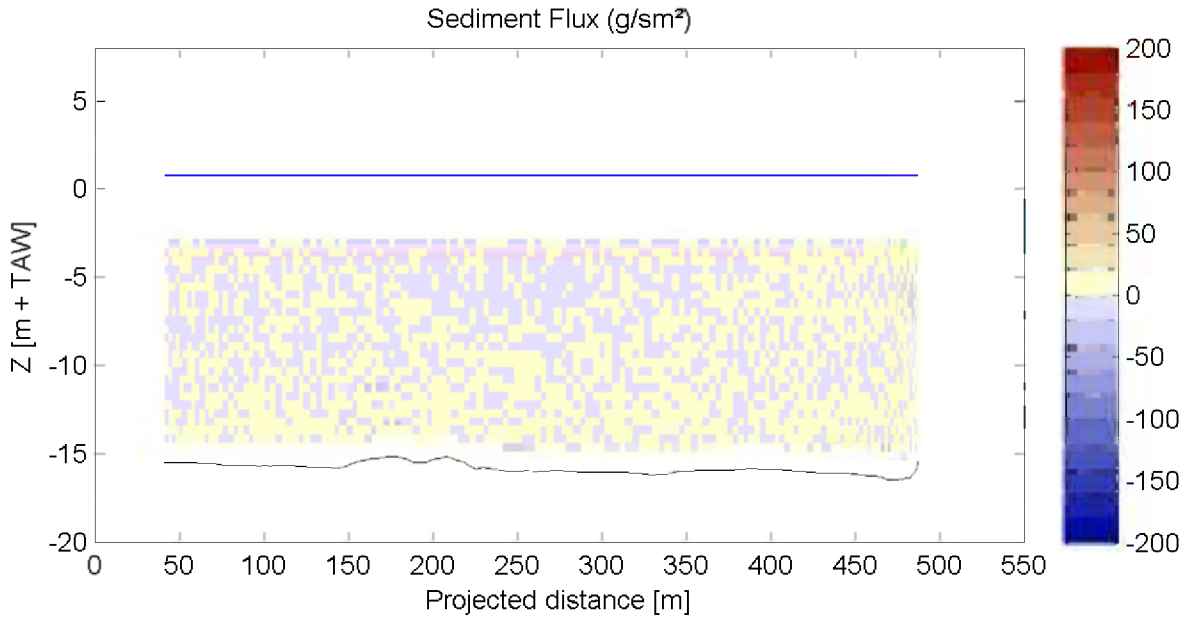
In association with :

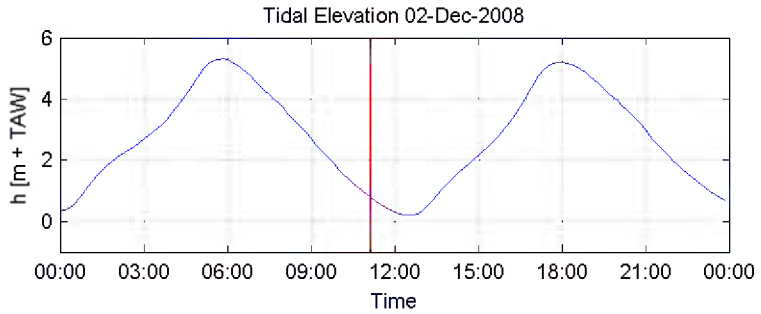
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1042TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:06 - 11:10

Time after HW [HH:MM]

5:18

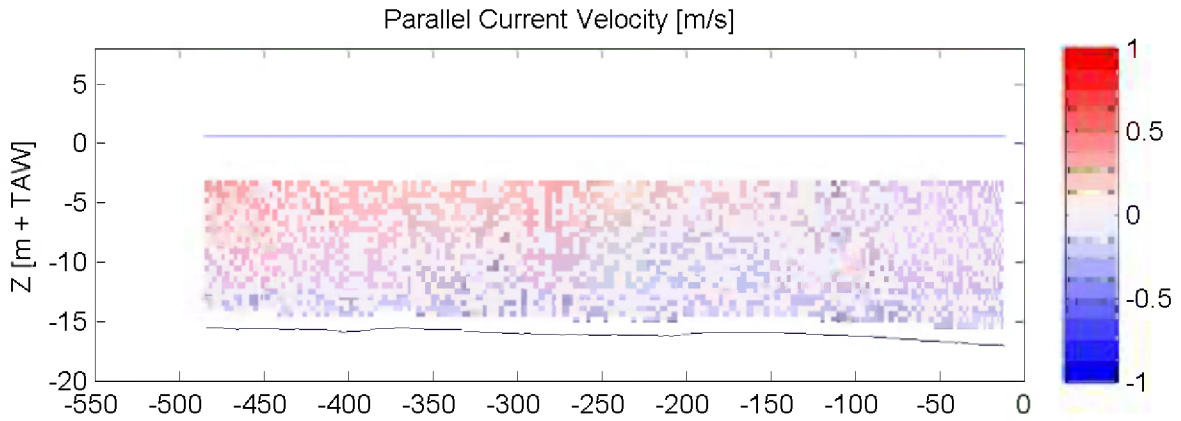
Data Processed by:

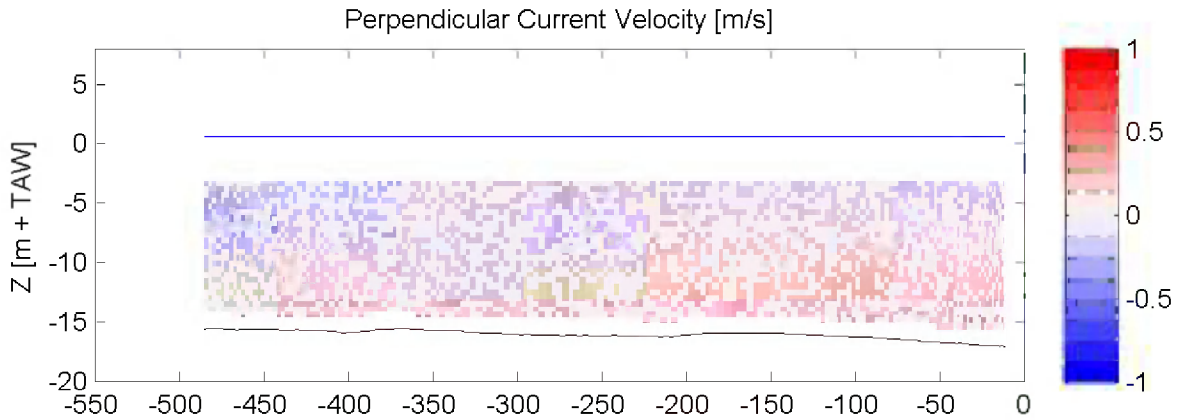
In association with :

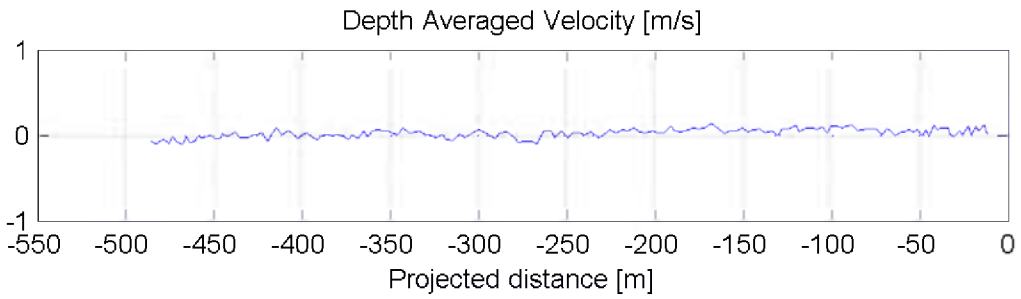
I/RA/11283/08.084/MSA

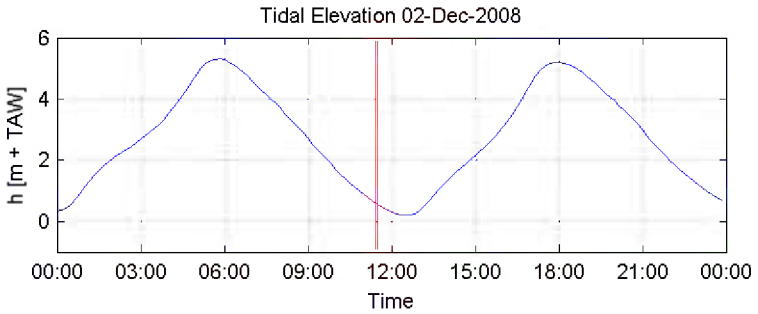
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1044TDGDrlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:26 - 11:30

Time after HW [HH:MM]

5:38

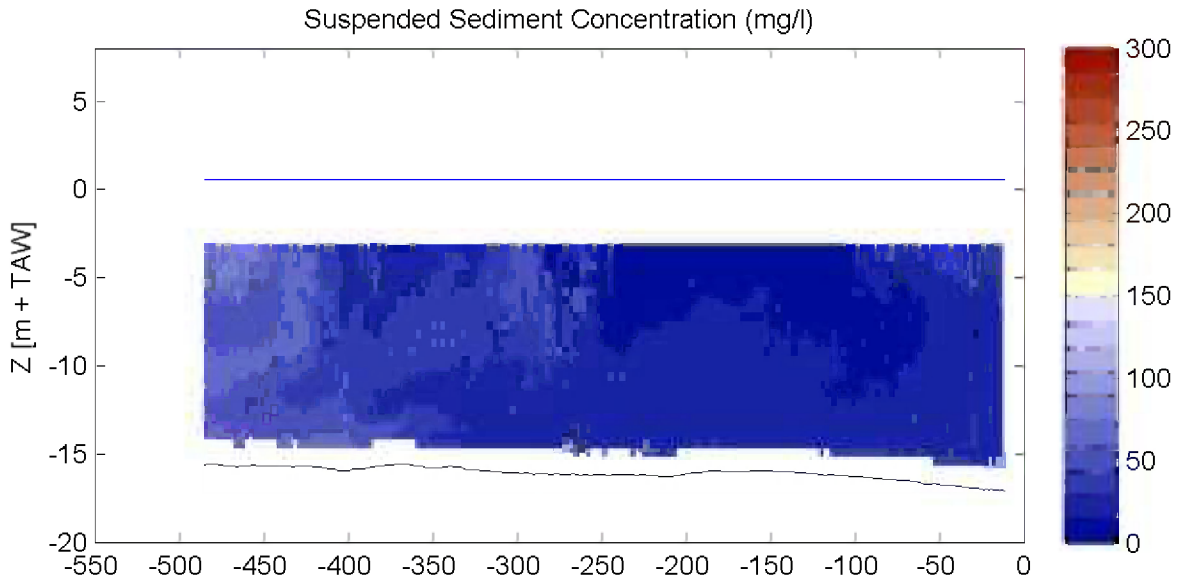
Data Processed by:

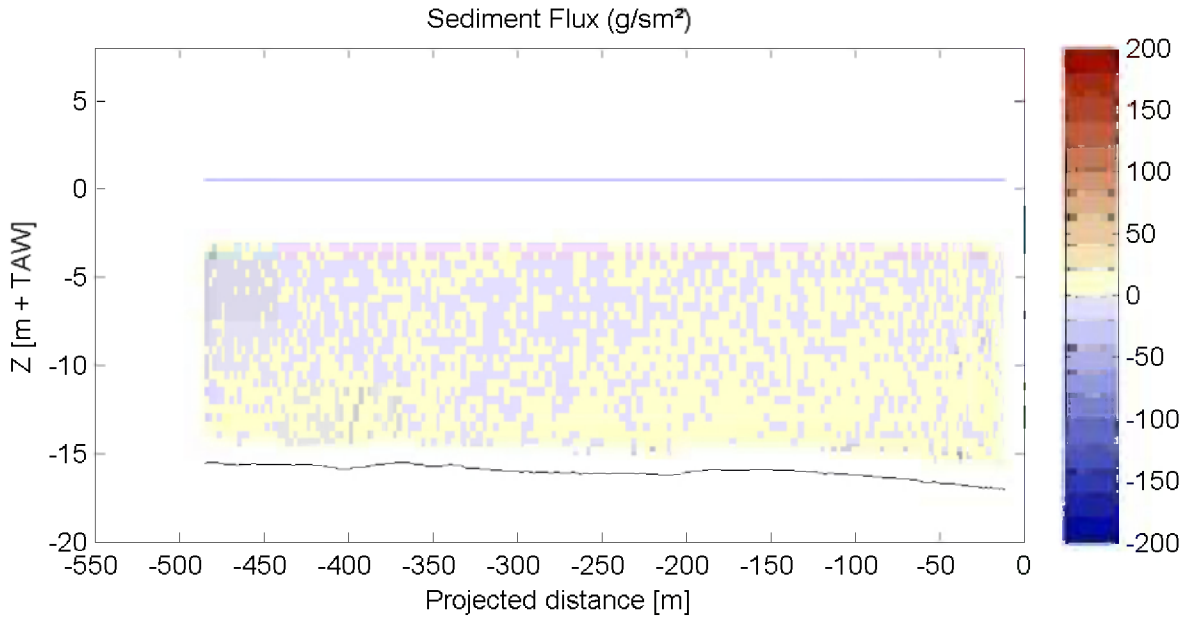
In association with :

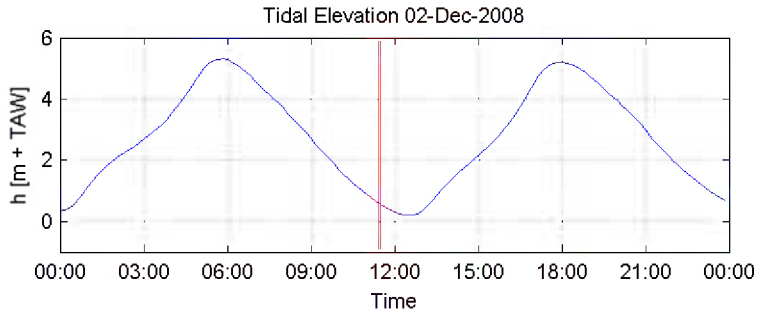
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1044TDGDrlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:26 - 11:30

Time after HW [HH:MM]

5:38

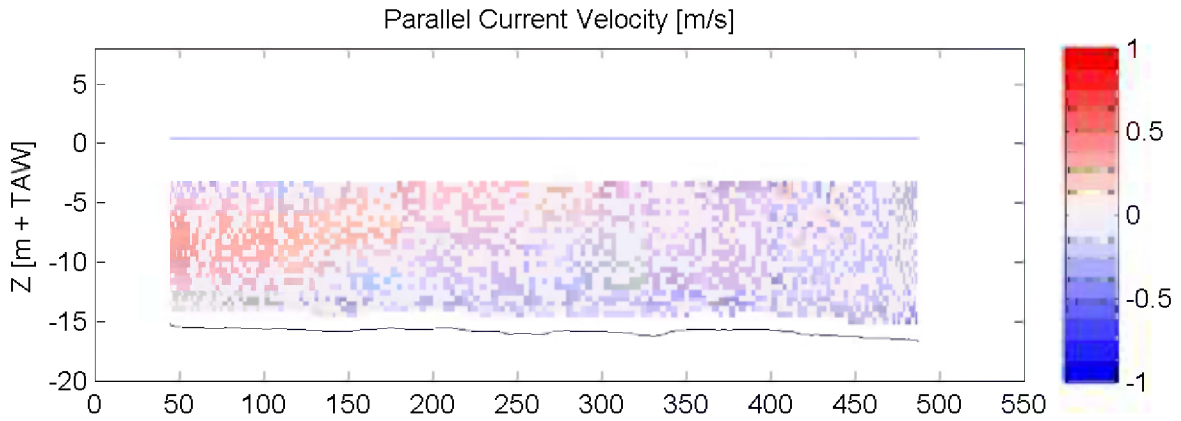
Data Processed by:

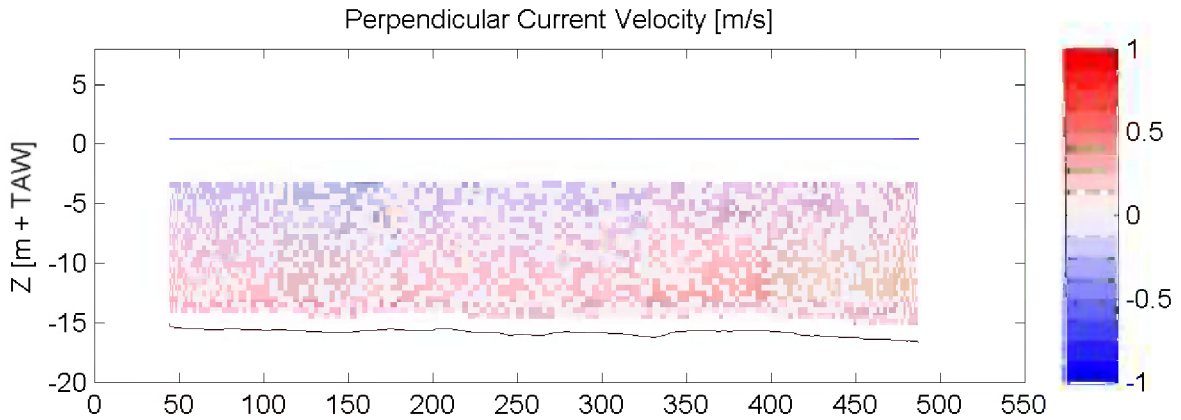
In association with :

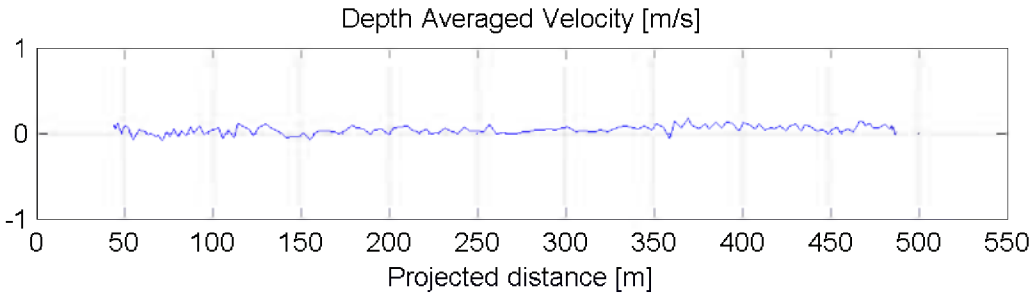
I/RA/11283/08.084/MSA

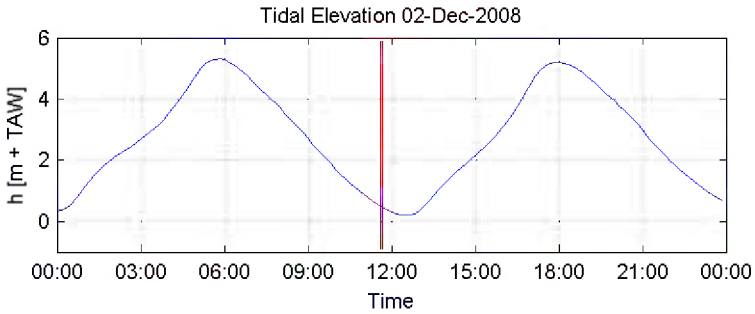
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1046TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:35 - 11:39

Time after HW [HH:MM]

5:47

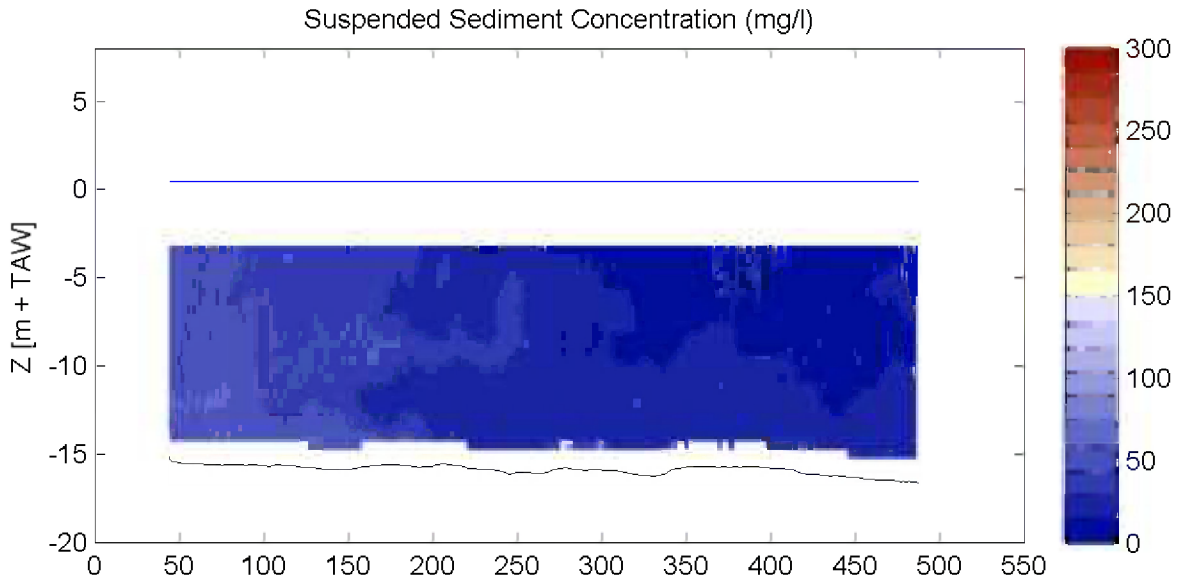
Data Processed by:

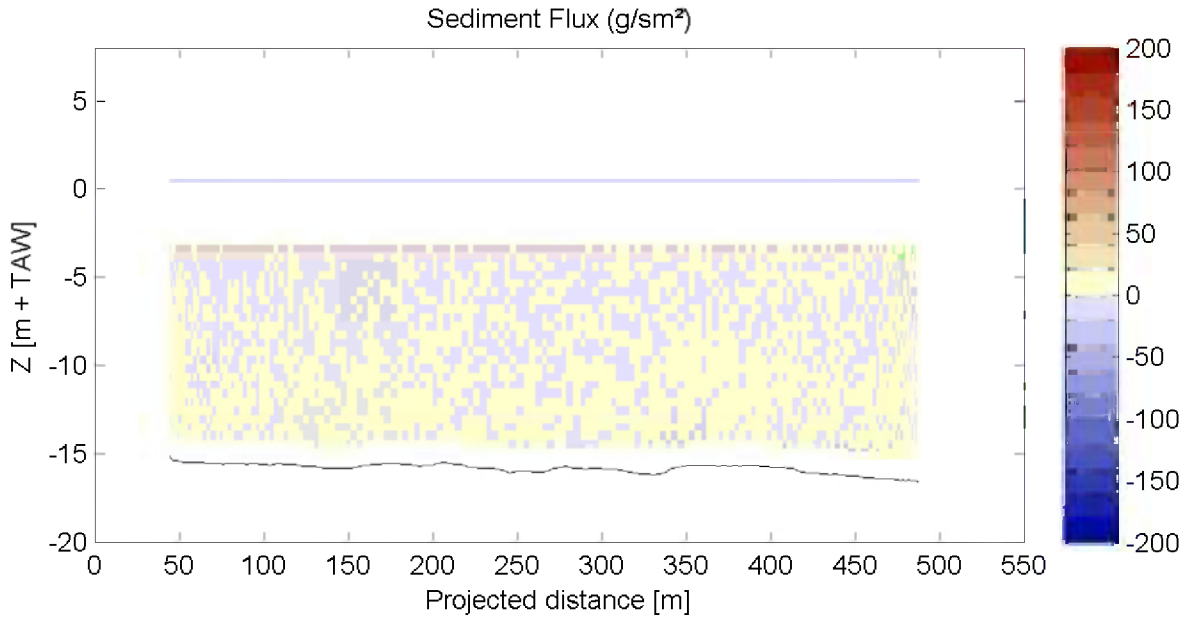
In association with :

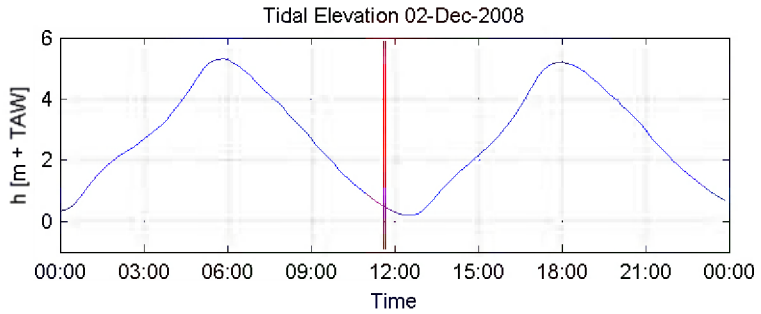
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1046TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:35 - 11:39

Time after HW [HH:MM]

5:47

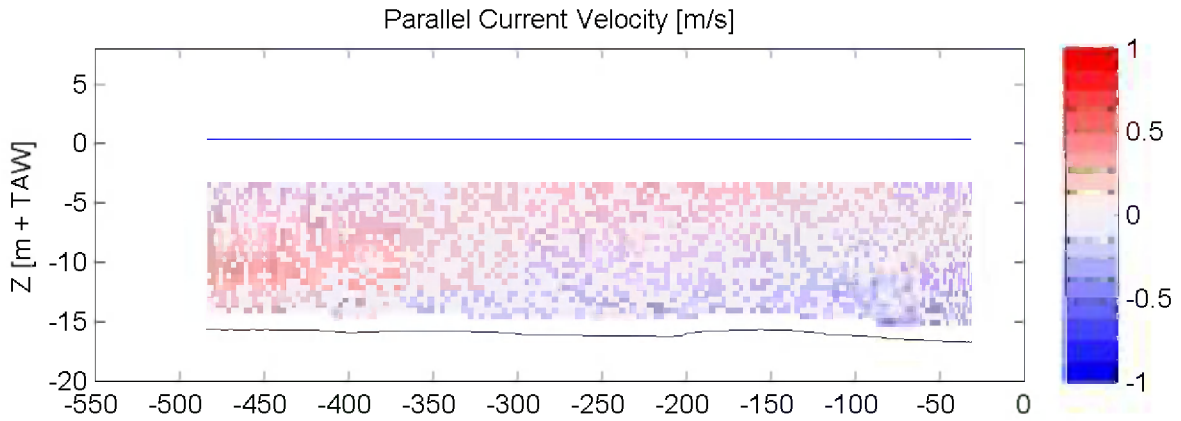
Data Processed by:

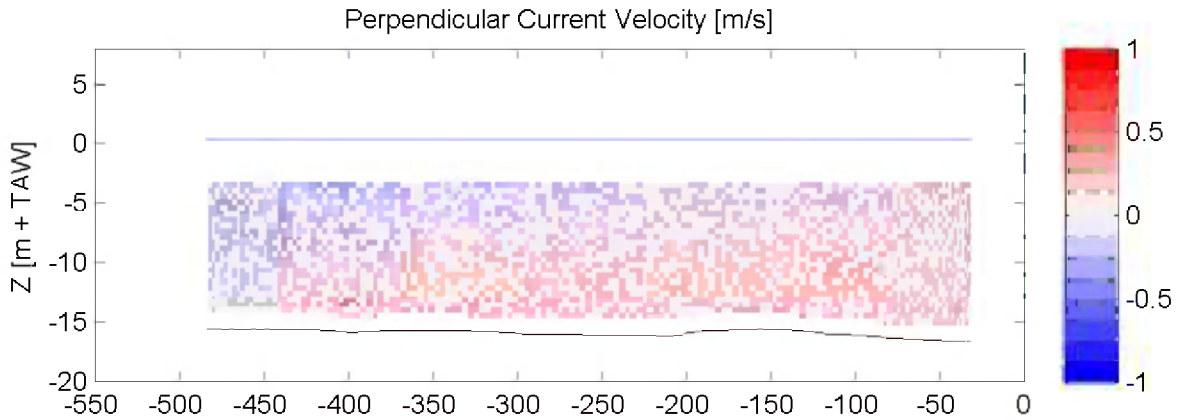
In association with :

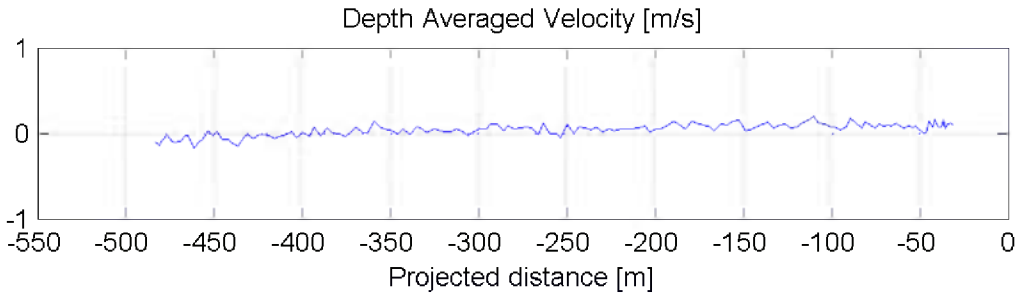
I/RA/11283/08.084/MSA

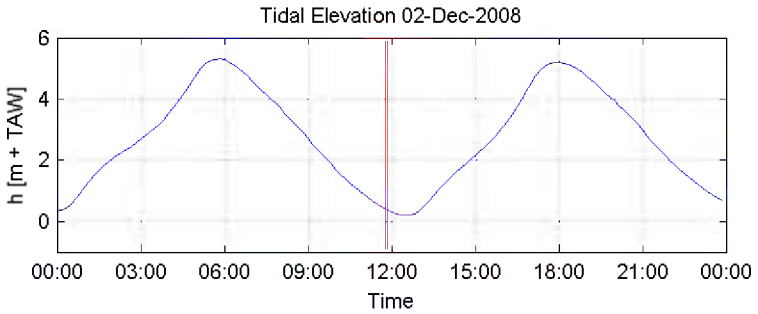
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1048TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:47 - 11:50

Time after HW [HH:MM]

5:59

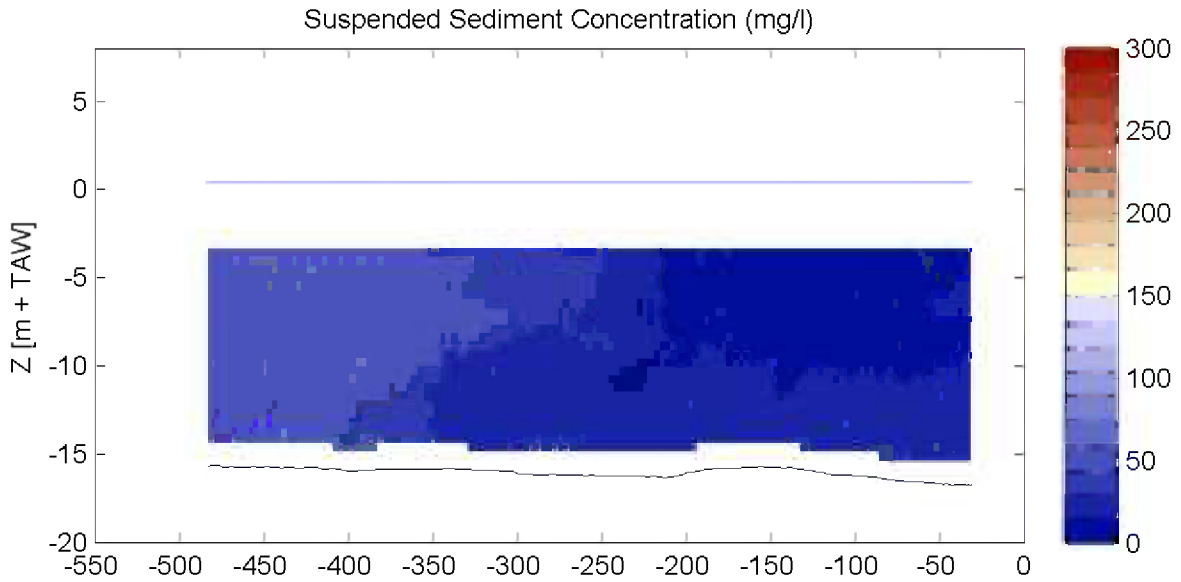
Data Processed by:

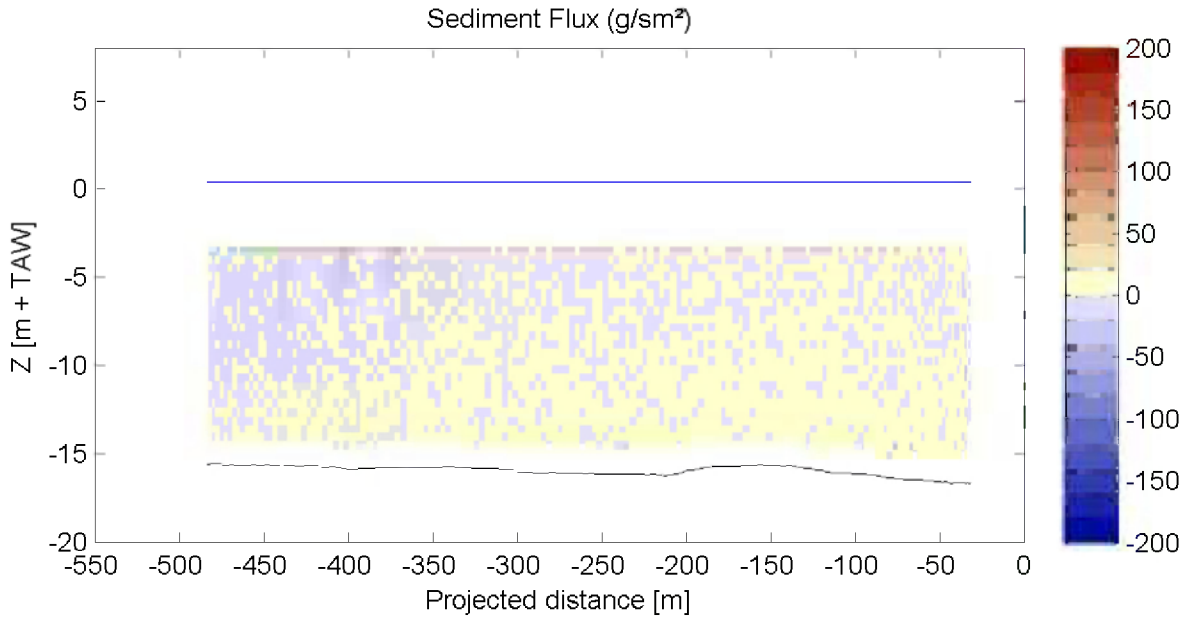
In association with :

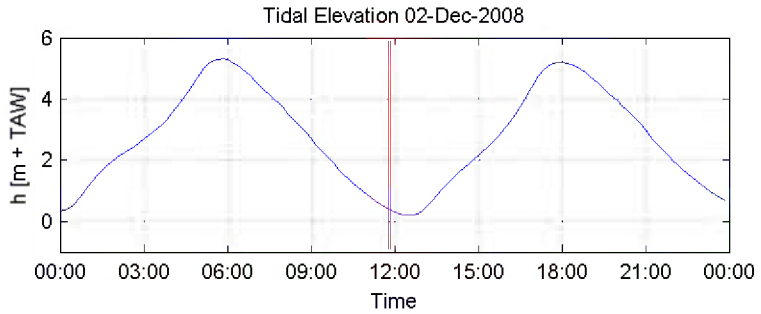
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1048TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

11:47 - 11:50

Time after HW [HH:MM]

5:59

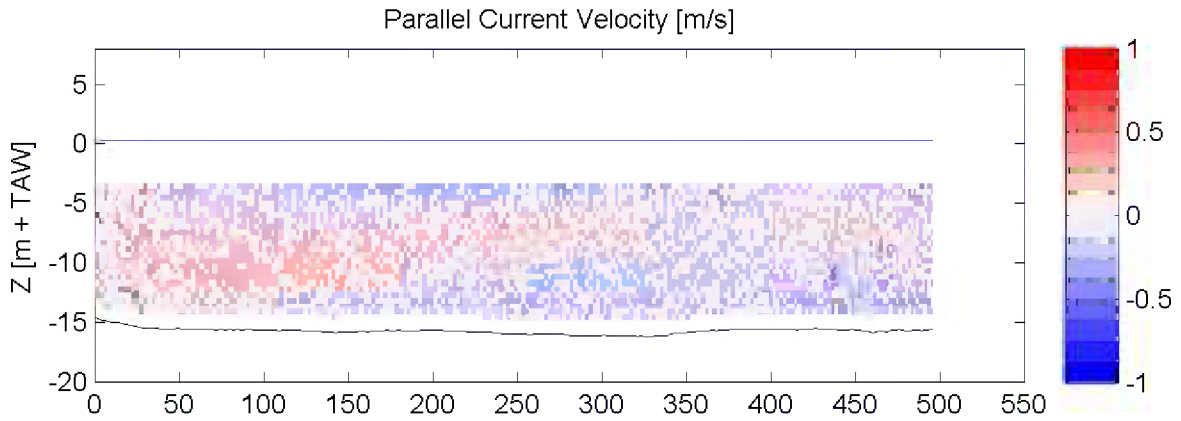
Data Processed by:

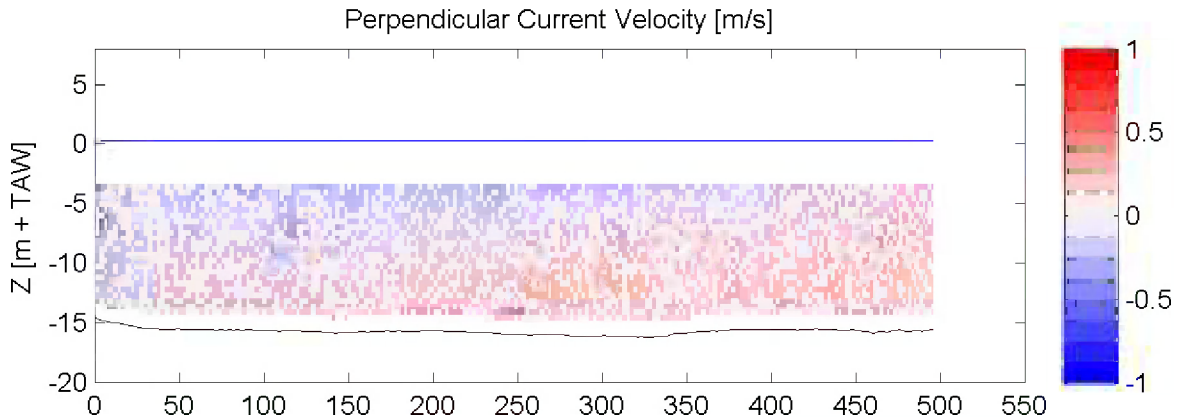
In association with :

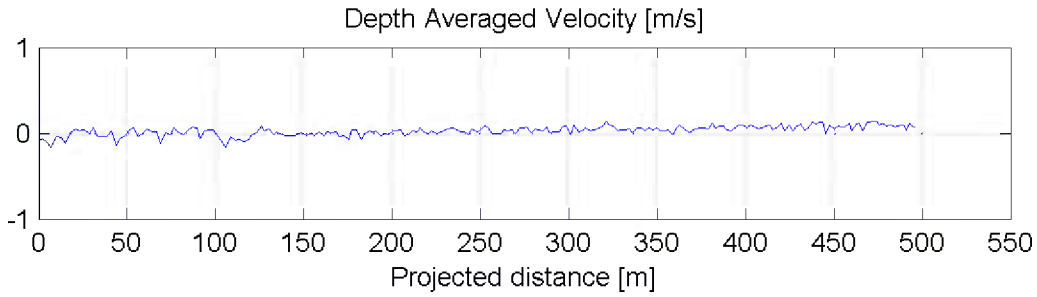
I/RA/11283/08.084/MSA

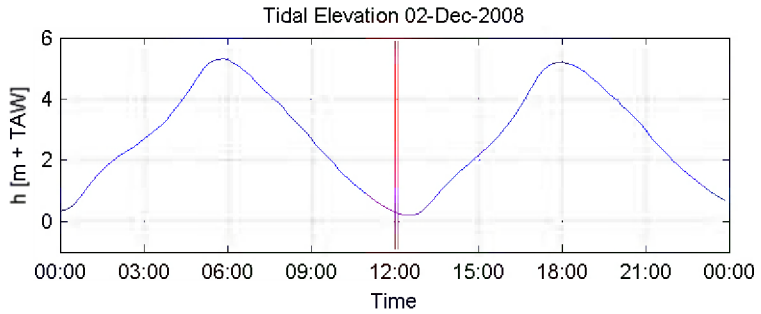
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1050TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:01 - 12:06

Time after HW [HH:MM]

6:14

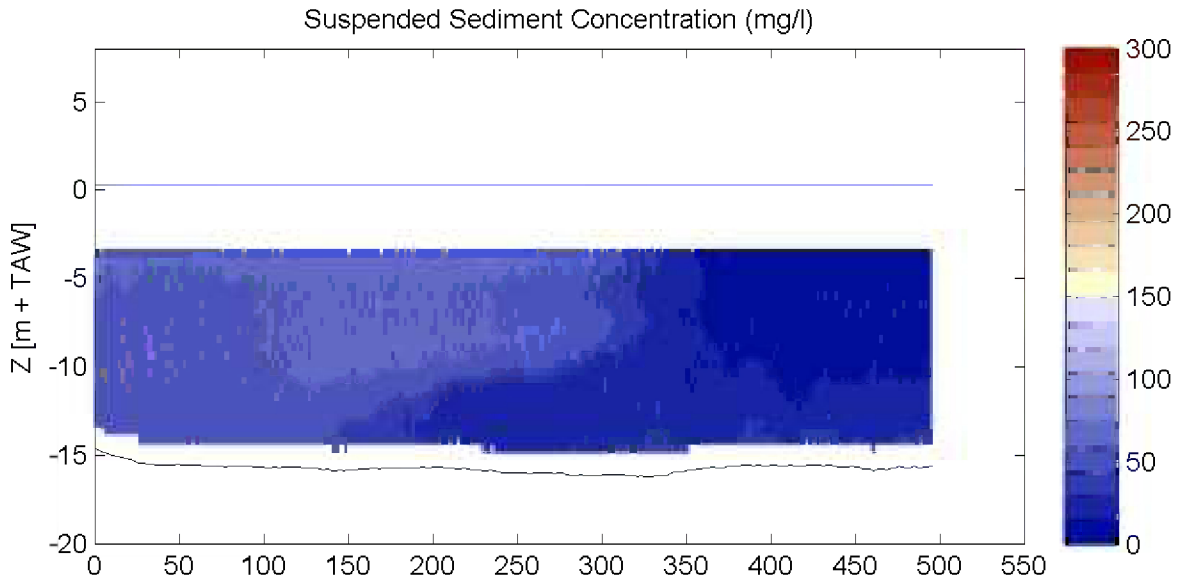
Data Processed by:

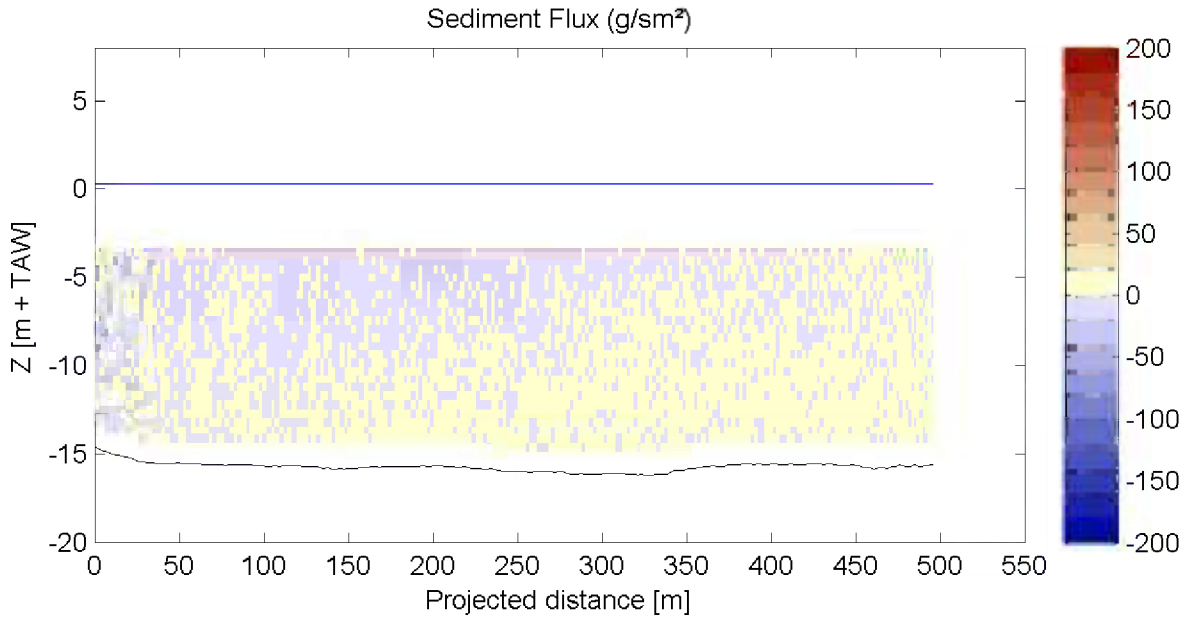
In association with :

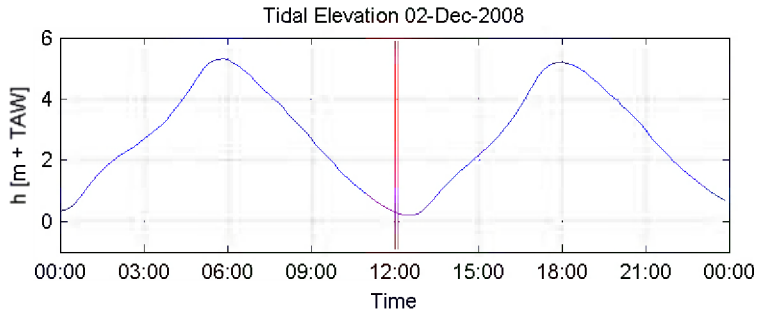
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1050TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:01 - 12:06

Time after HW [HH:MM]

6:14

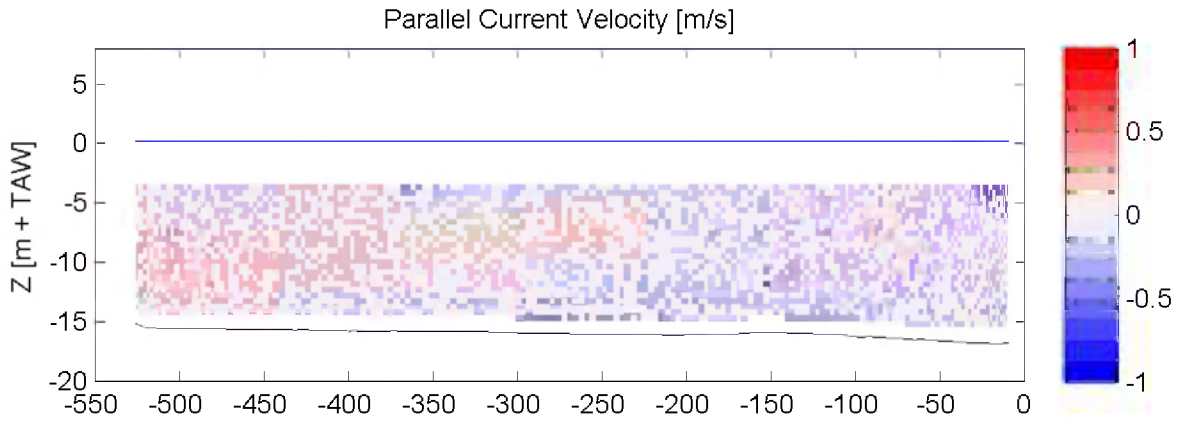
Data Processed by:

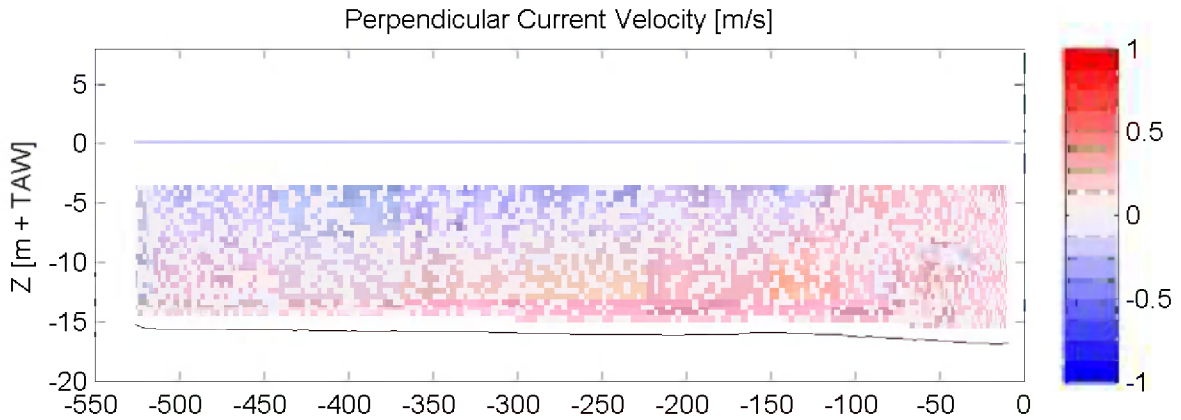
In association with :

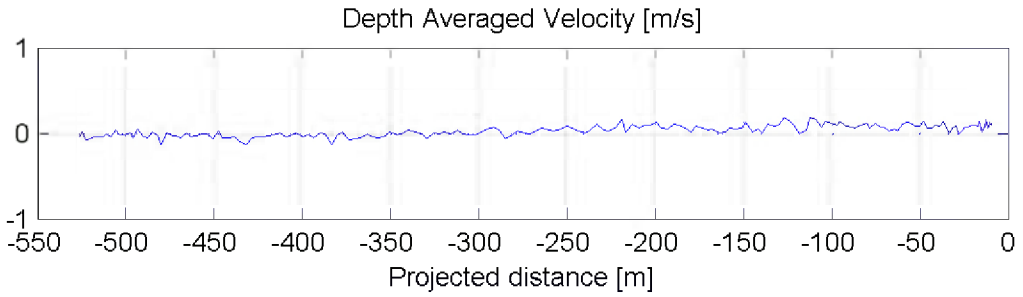
I/RA/11283/08.084/MSA

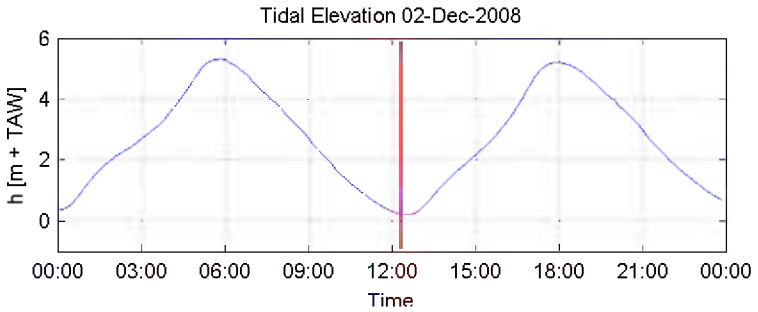
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1052TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:16 - 12:20

Time after HW [HH:MM]

6:28

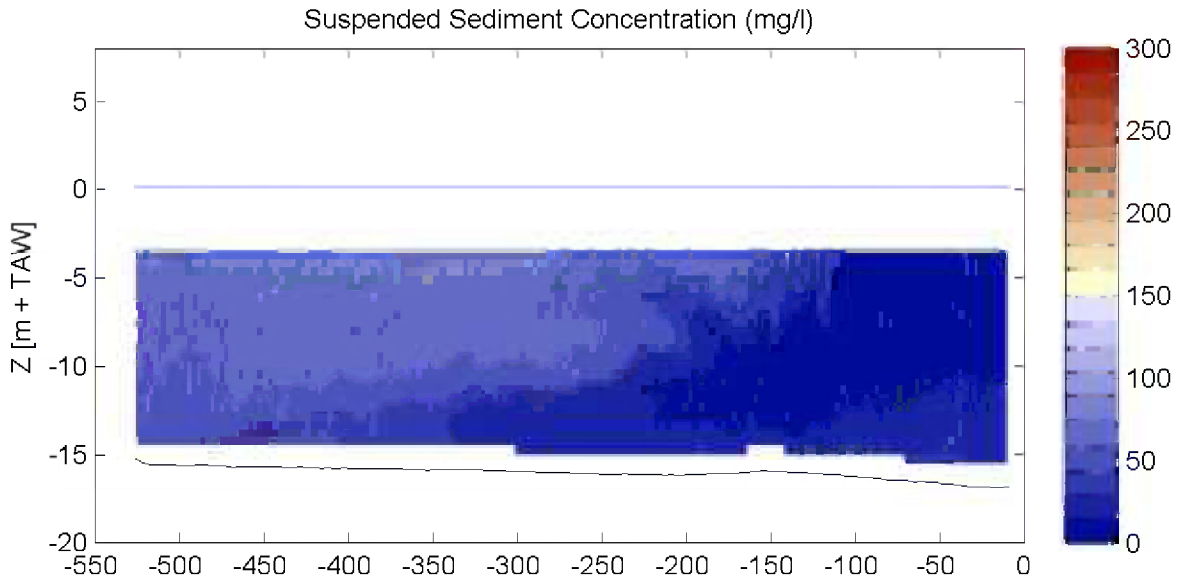
Data Processed by:

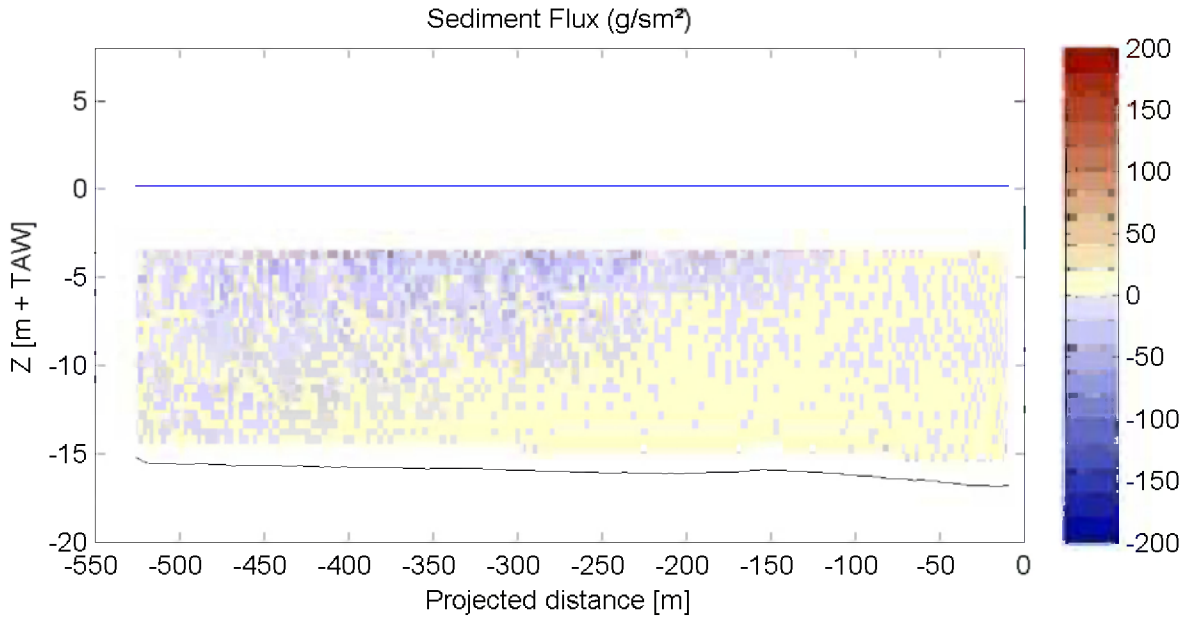
In association with :

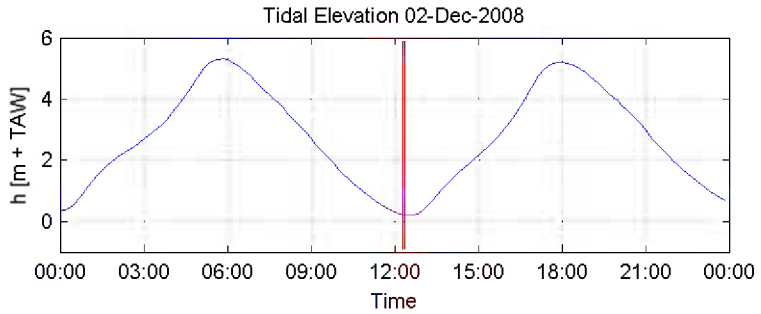
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1052TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:16 - 12:20

Time after HW [HH:MM]

6:28

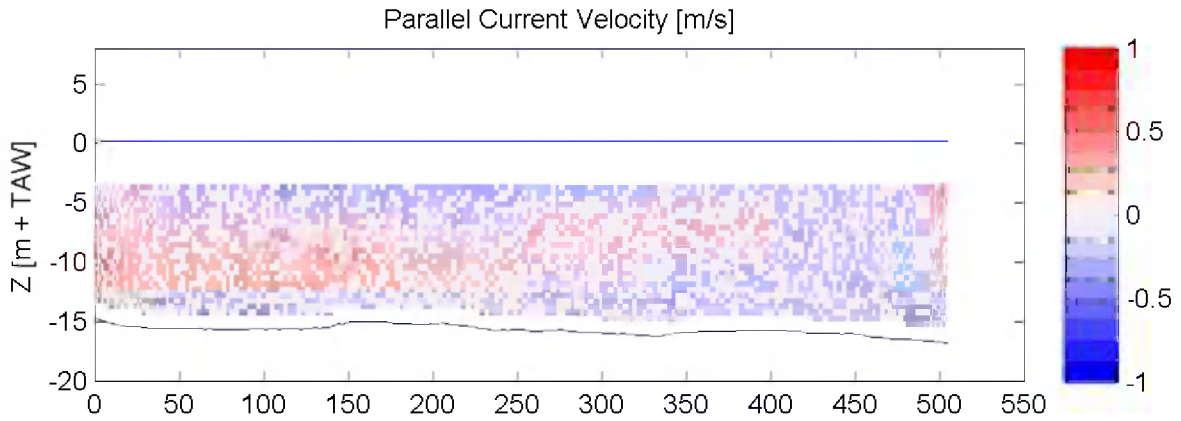
Data Processed by:

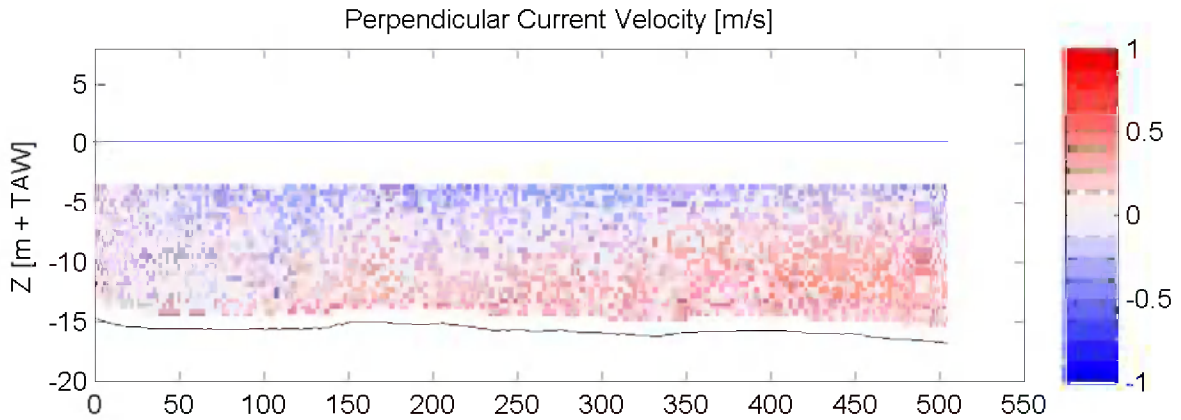
In association with :

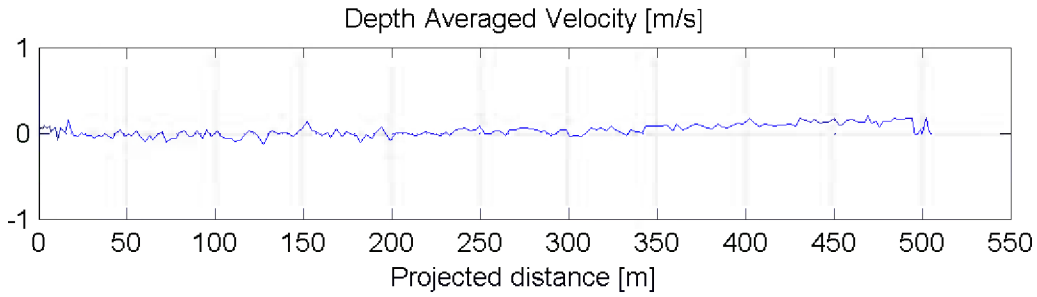
I/RA/11283/08.084/MSA

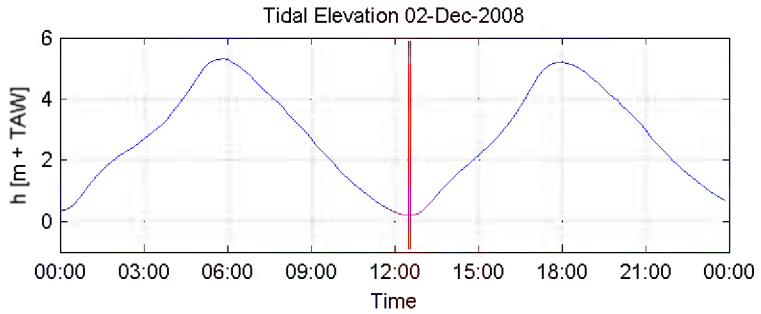
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1054TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:30 - 12:34

Time after HW [HH:MM]

-5:27

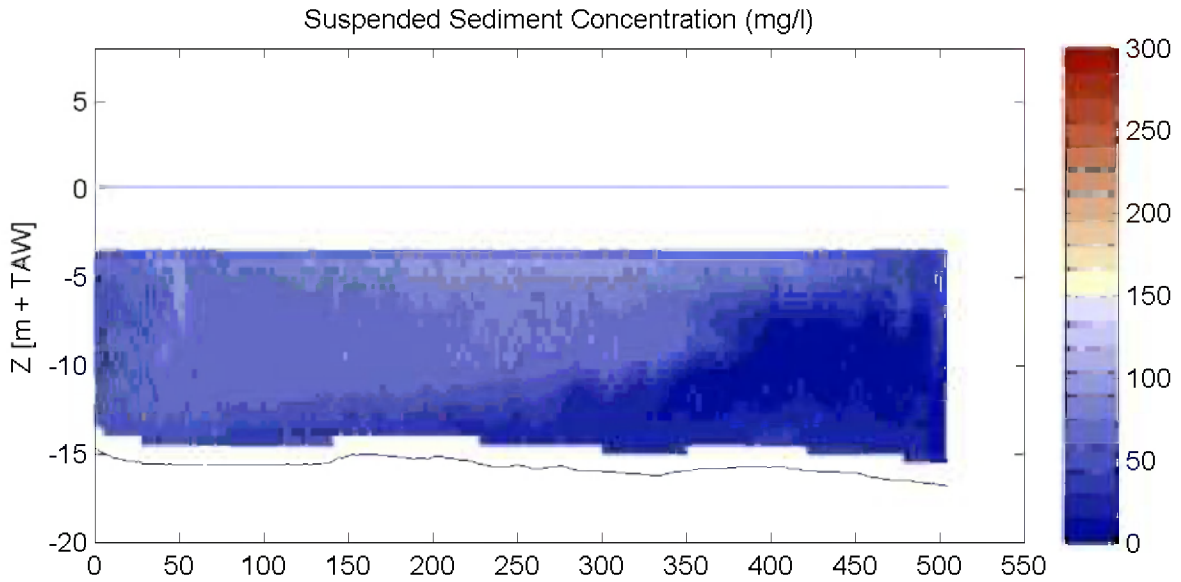
Data Processed by:

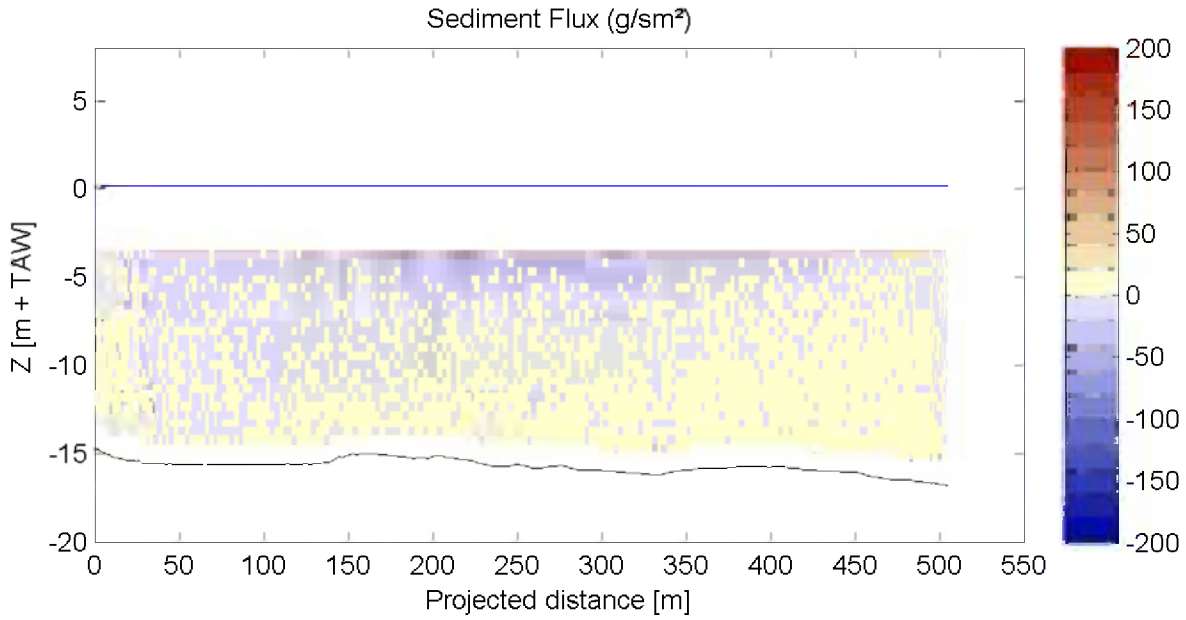
In association with :

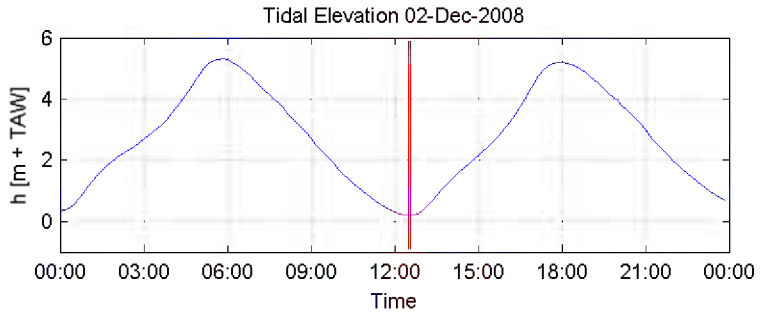
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1054TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:30 - 12:34

Time after HW [HH:MM]

-5:27

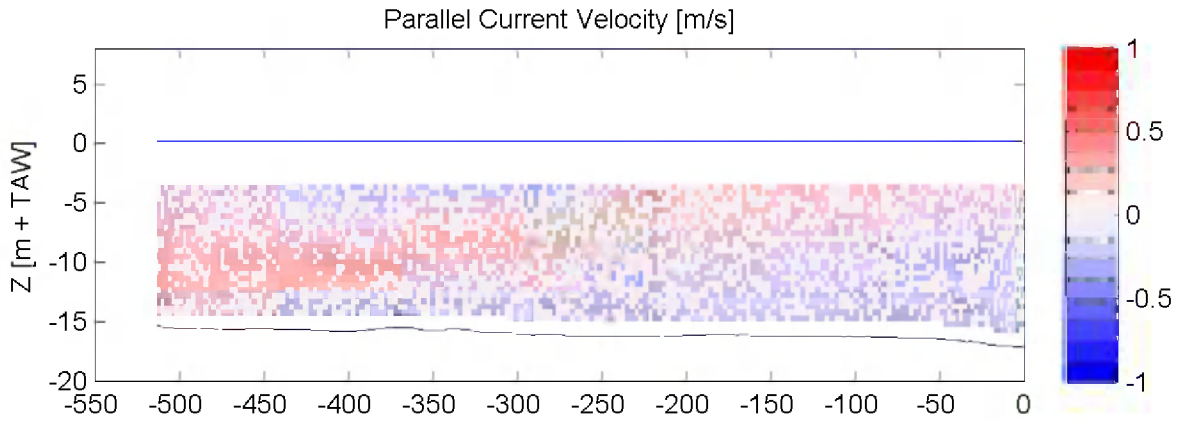
Data Processed by:

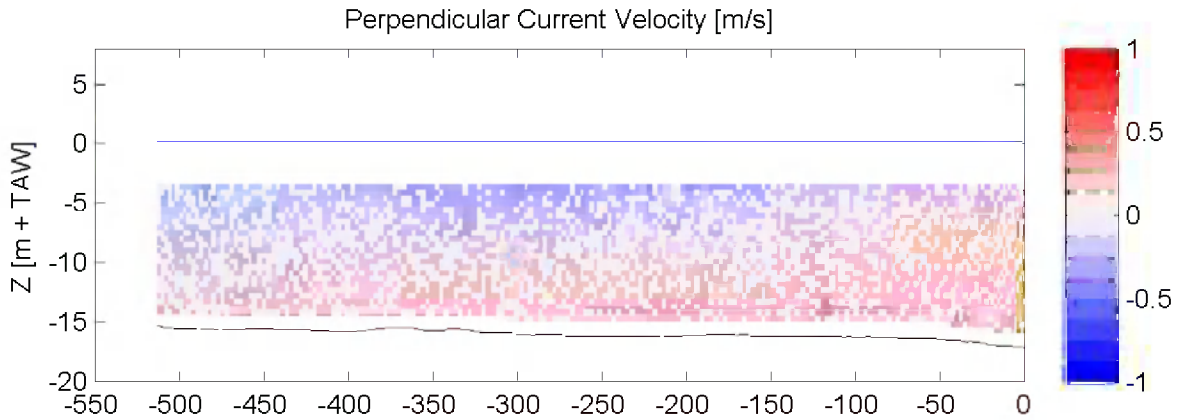
In association with :

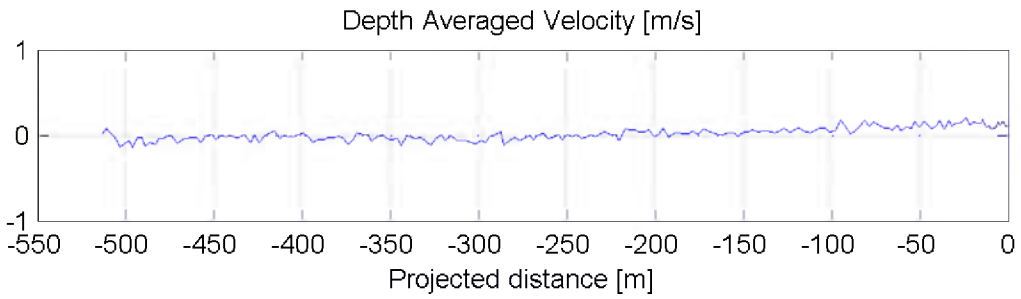
I/RA/11283/08.084/MSA

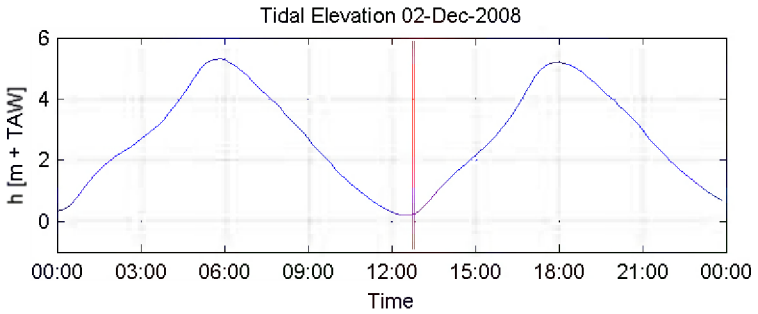
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1056TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:44 - 12:49

Time after HW [HH:MM]

-5:12

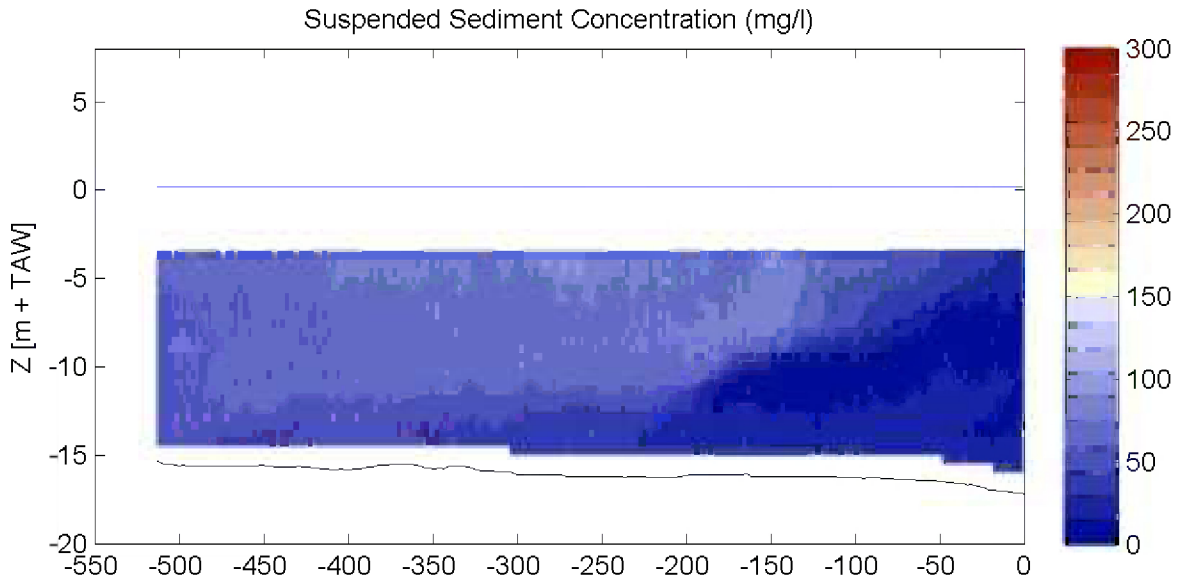
Data Processed by:

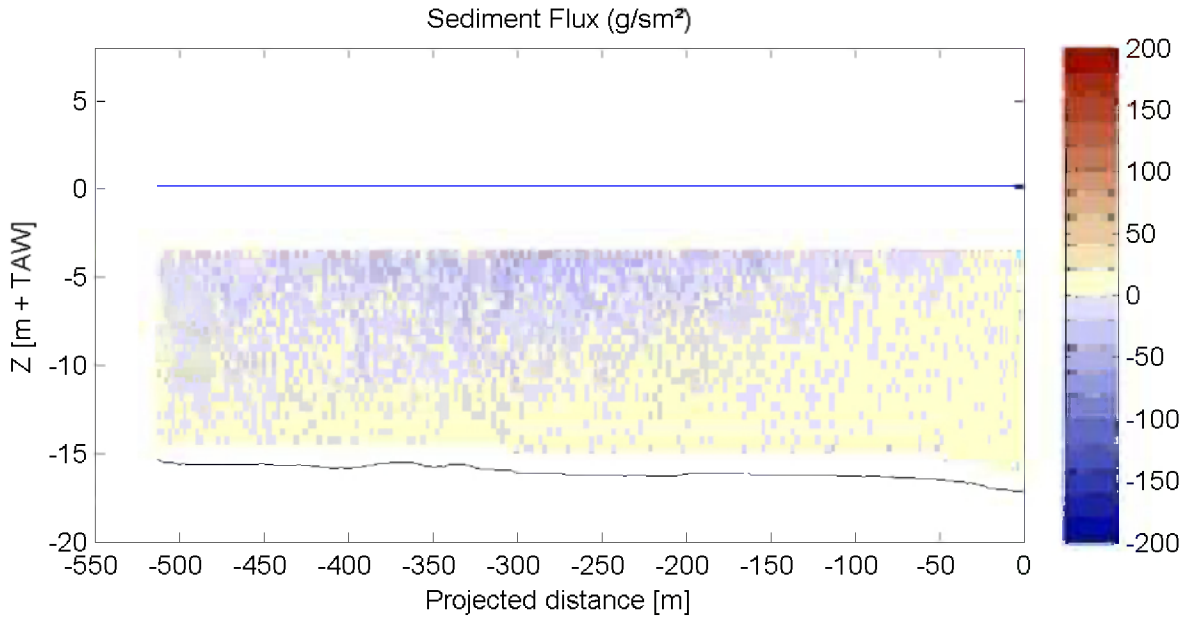
In association with :

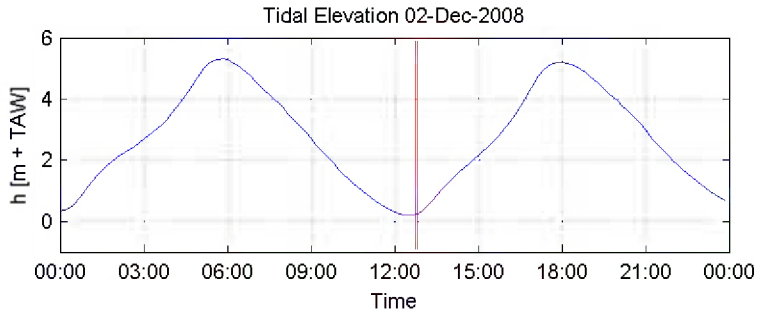
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1056TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:44 - 12:49

Time after HW [HH:MM]

-5:12

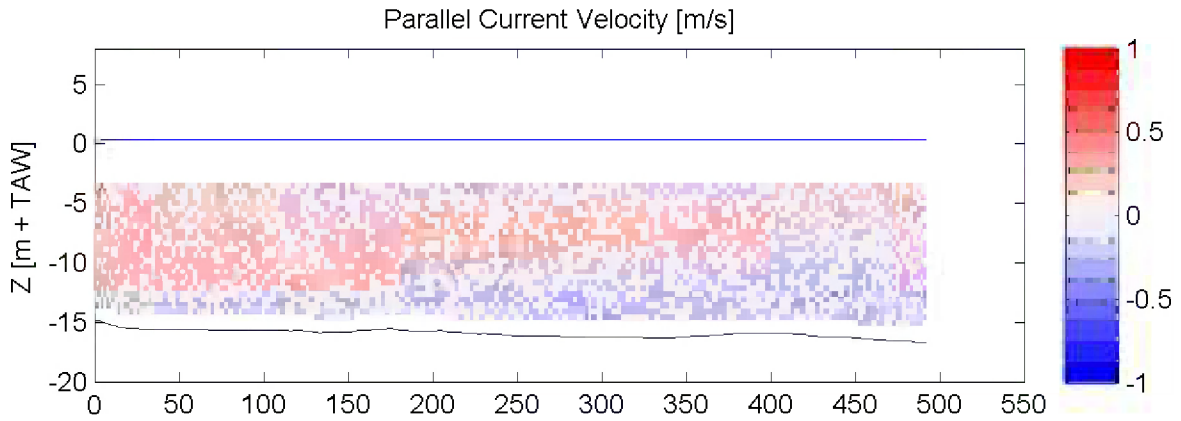
Data Processed by:

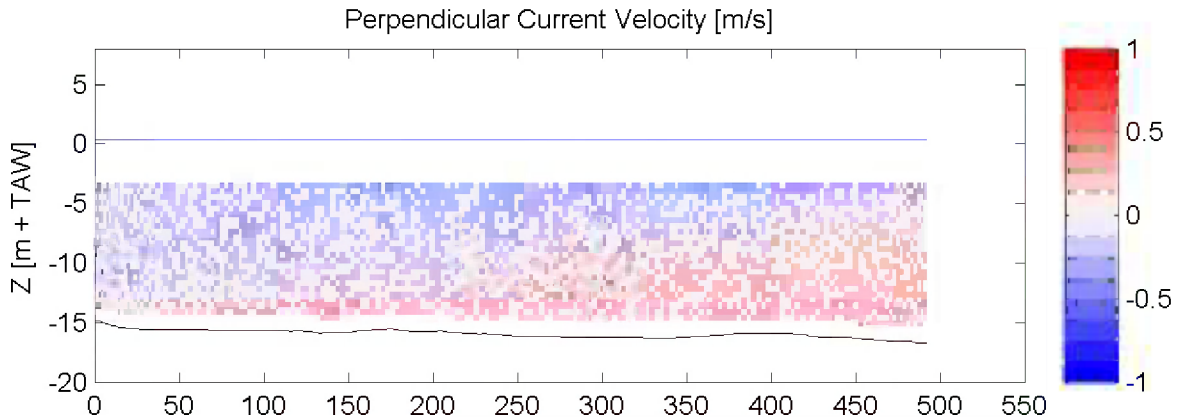
In association with :

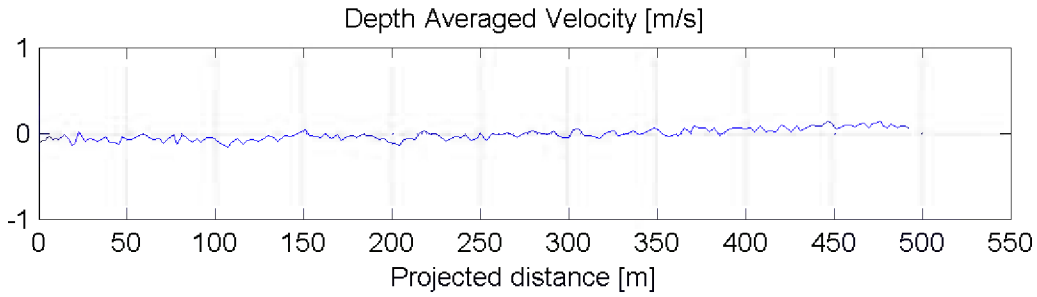
I/RA/11283/08.084/MSA

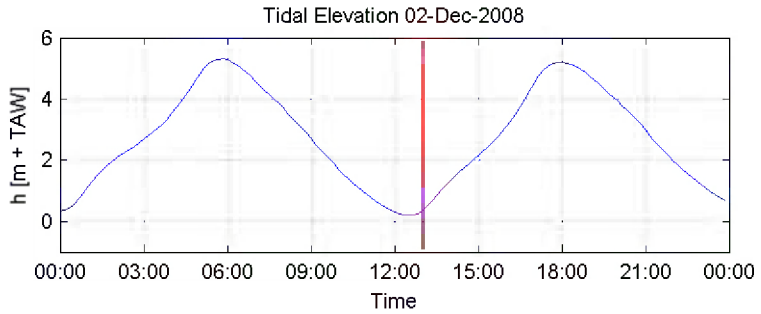
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1058TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:58 - 13:02

Time after HW [HH:MM]

-4:59

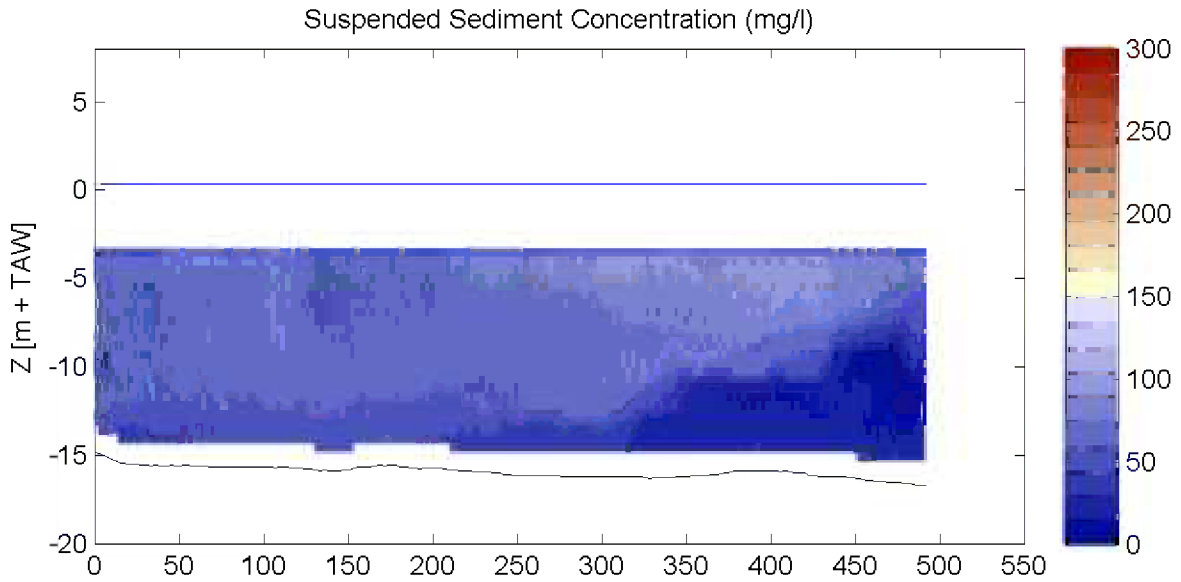
Data Processed by:

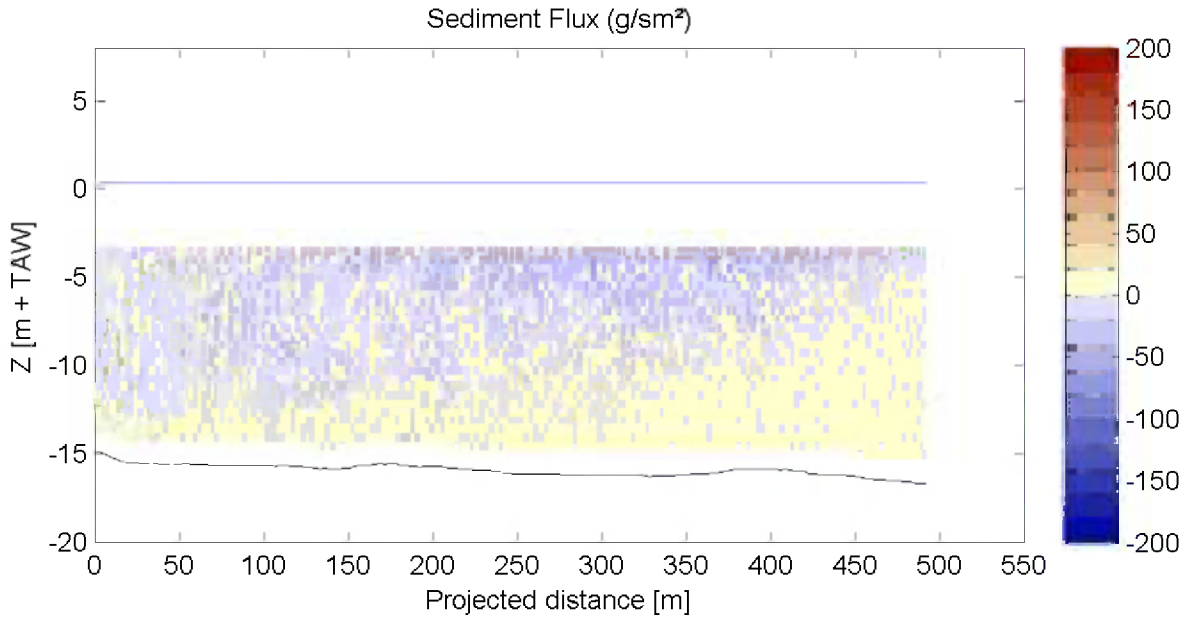
In association with :

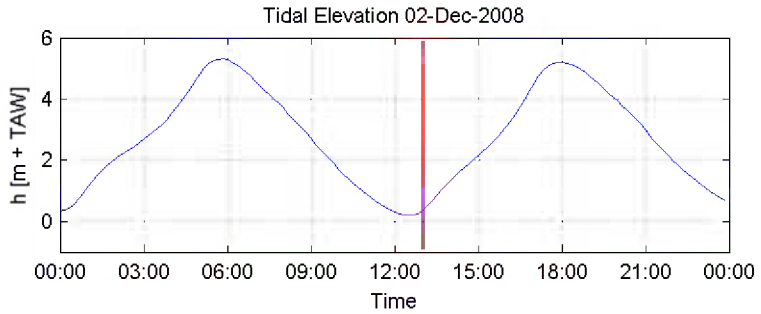
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1058TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

12:58 - 13:02

Time after HW [HH:MM]

-4:59

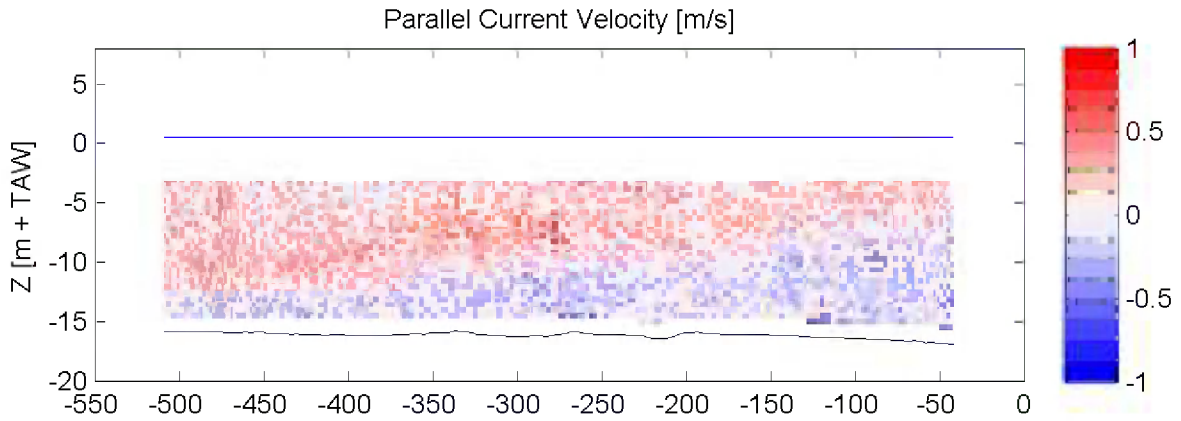
Data Processed by:

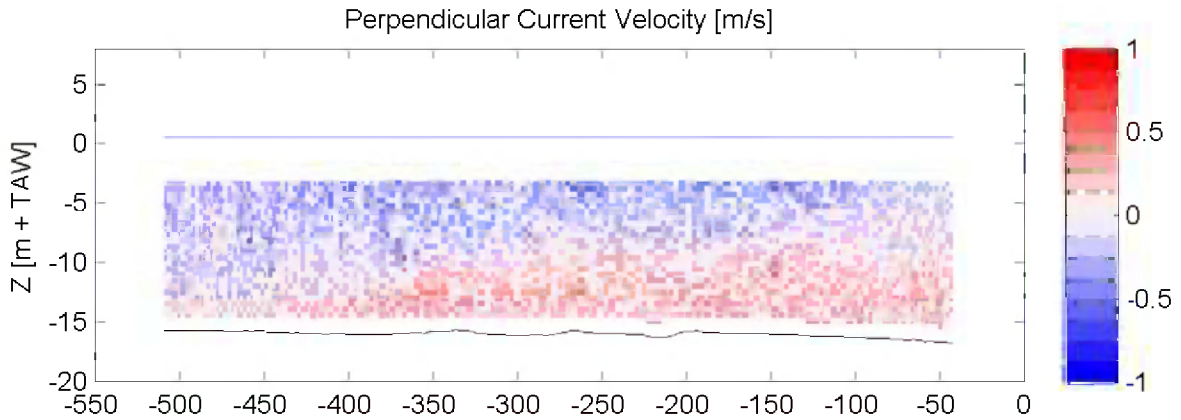
In association with :

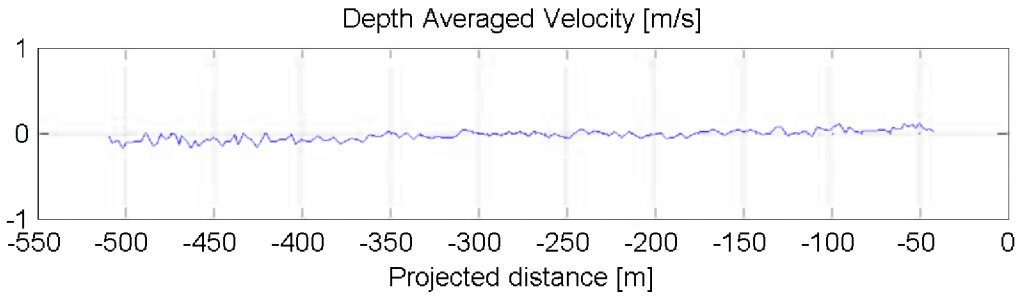
I/RA/11283/08.084/MSA

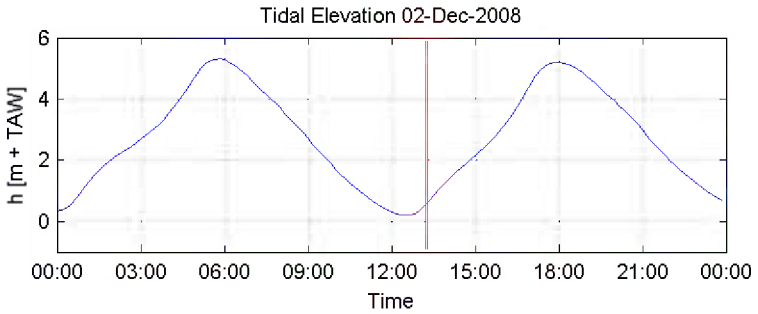
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1060TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:13 - 13:17

Time after HW [HH:MM]

-4:44

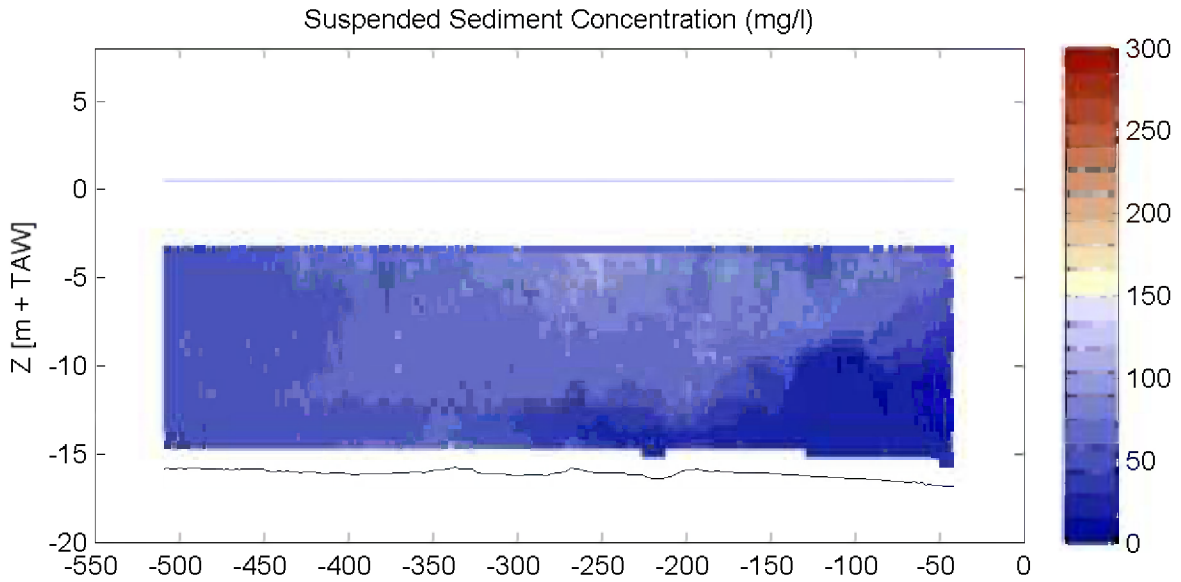
Data Processed by:

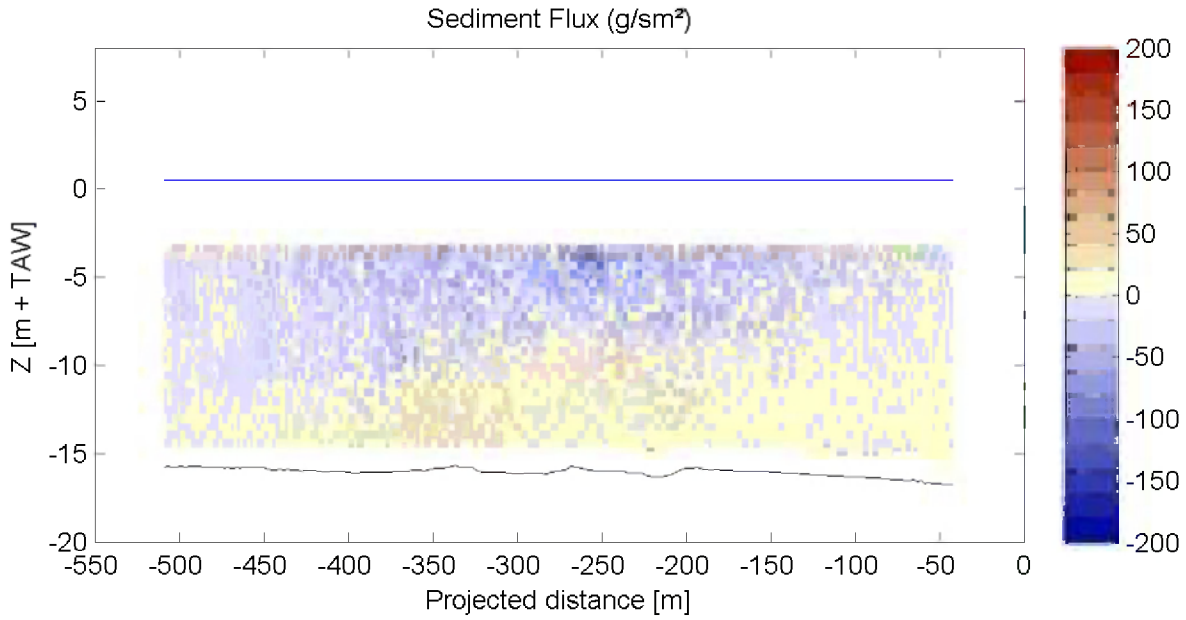
In association with :

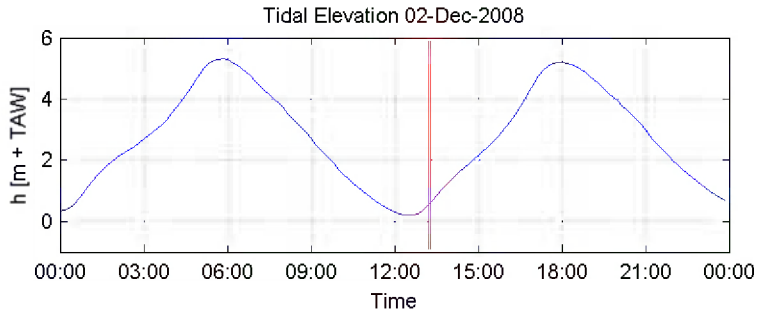
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1060TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:13 - 13:17

Time after HW [HH:MM]

-4:44

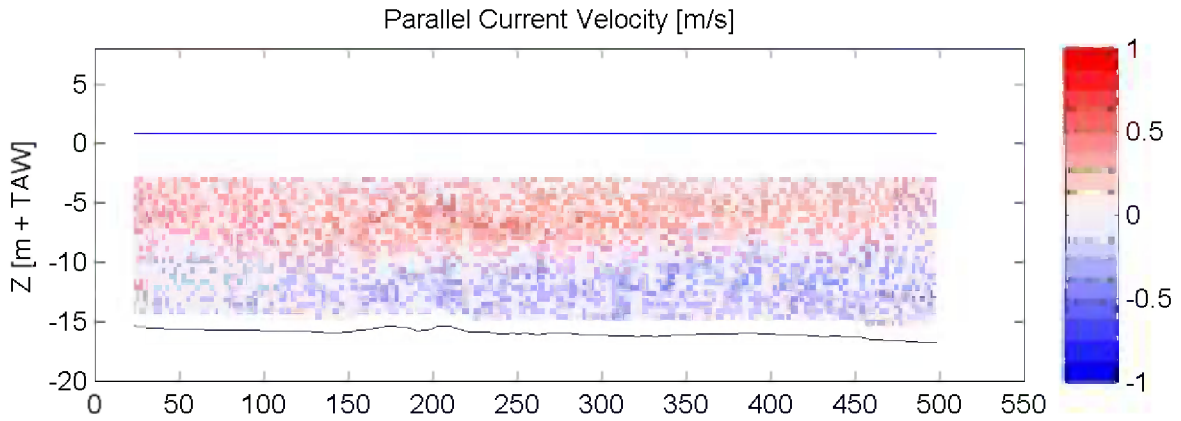
Data Processed by:

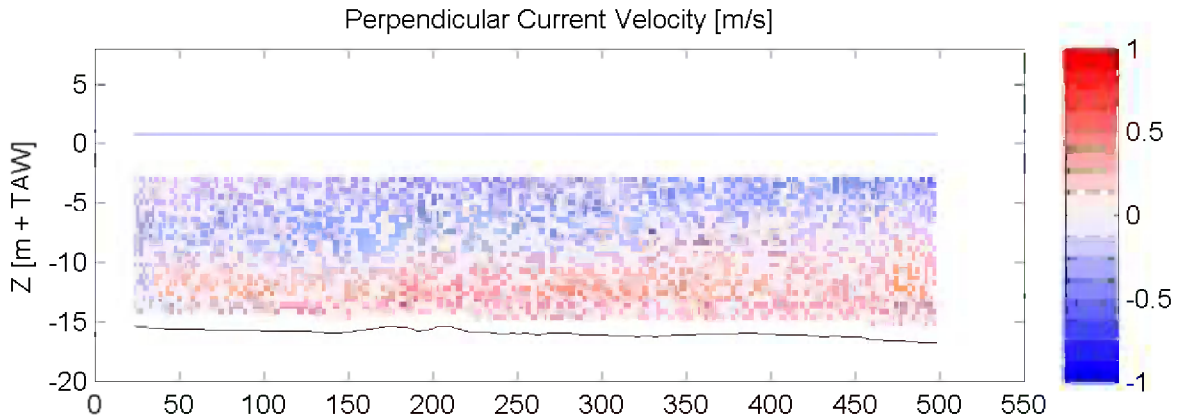
In association with :

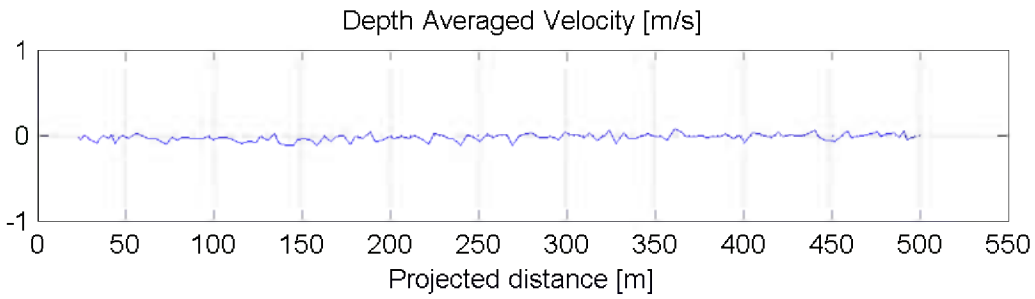
I/RA/11283/08.084/MSA

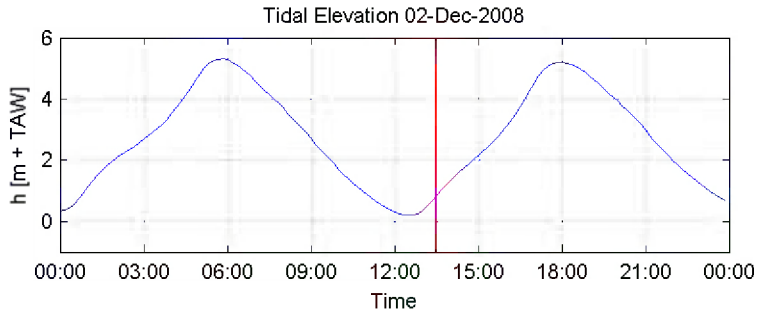
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1062TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:27 - 13:30

Time after HW [HH:MM]

-4:31

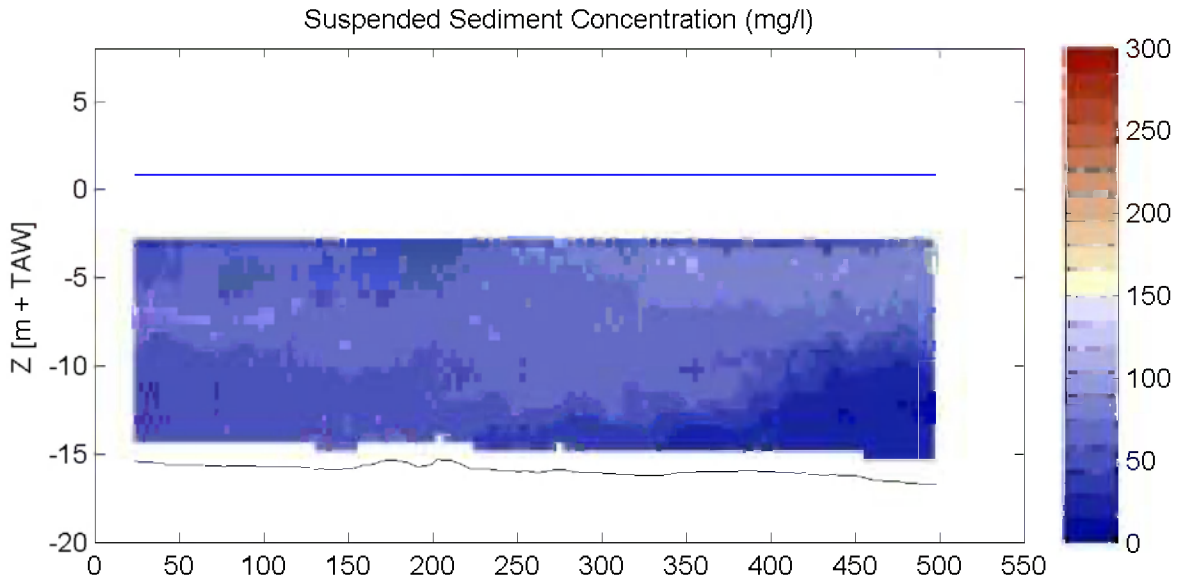
Data Processed by:

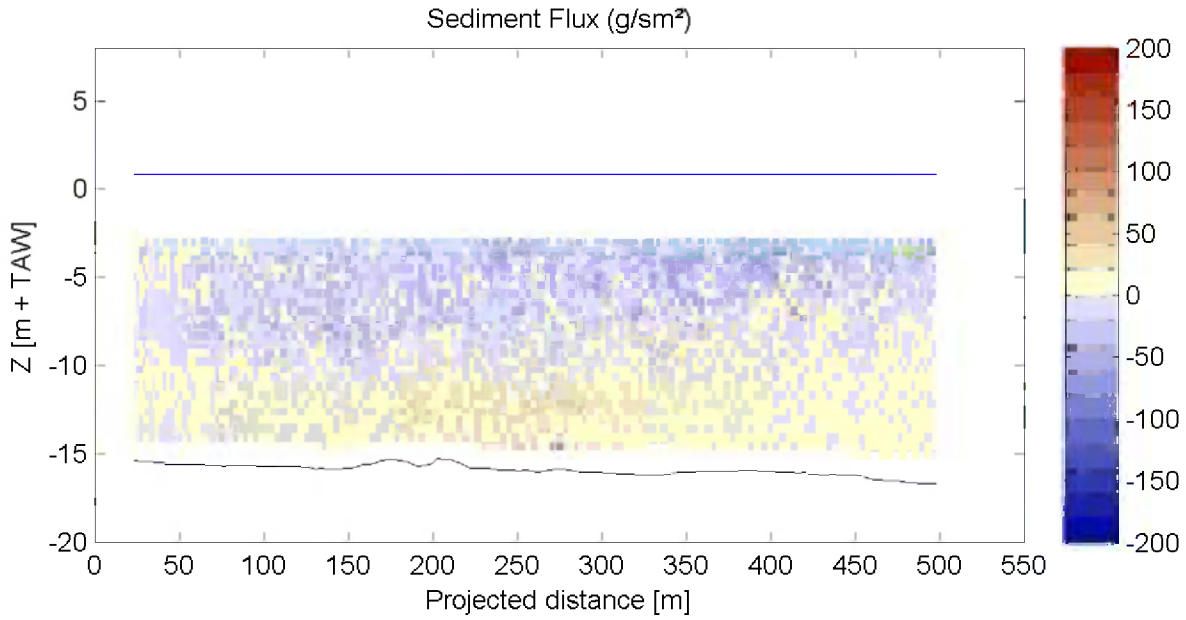
In association with :

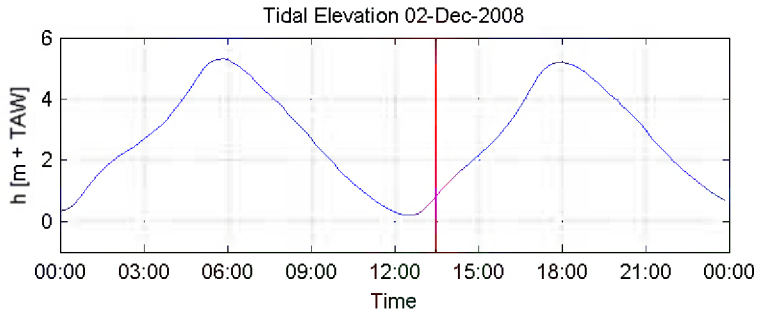
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1062TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:27 - 13:30

Time after HW [HH:MM]

-4:31

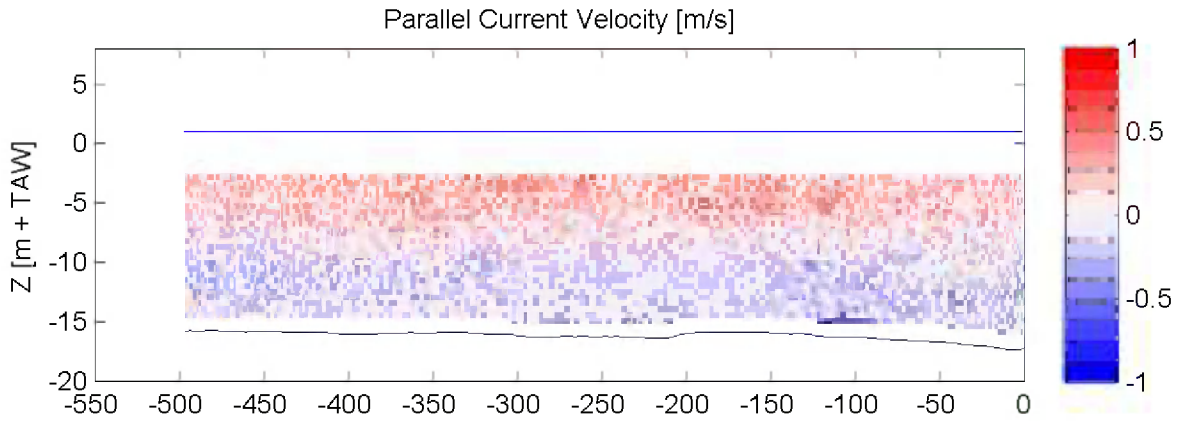
Data Processed by:

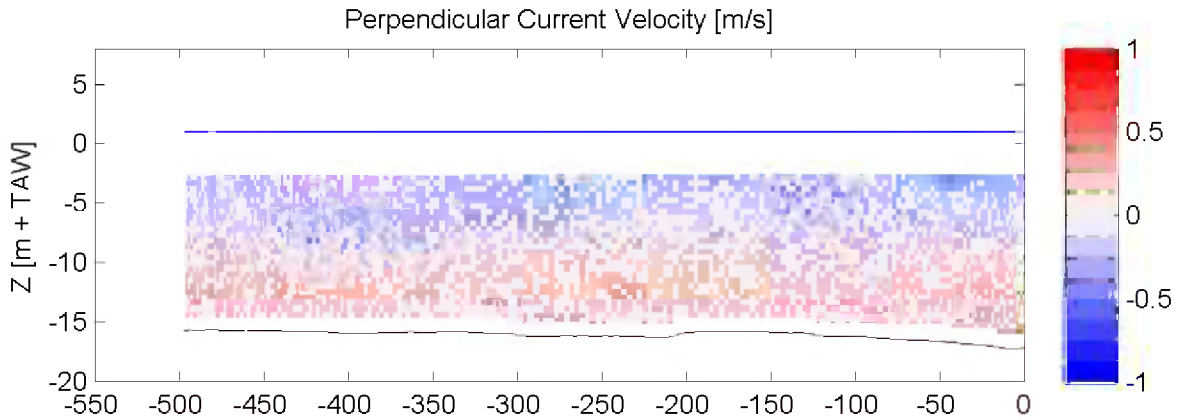
In association with :

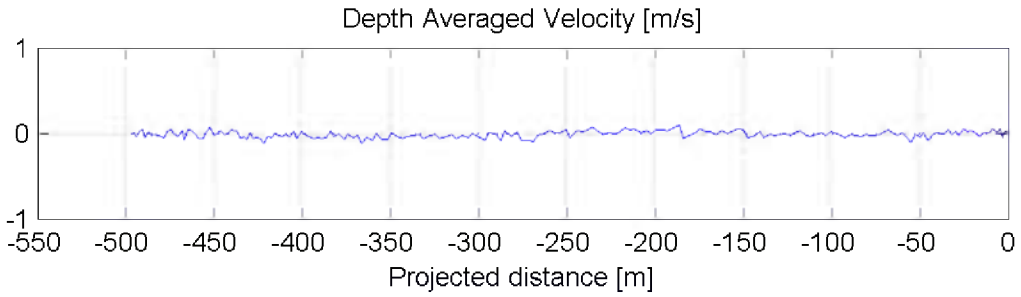
I/RA/11283/08.084/MSA

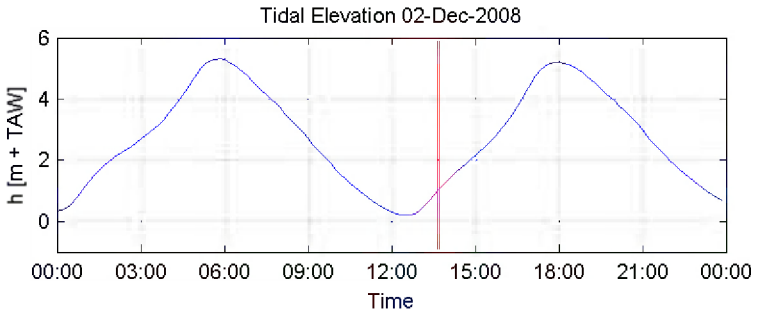
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1064TDGDrl.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:38 - 13:43

Time after HW [HH:MM]

-4:19

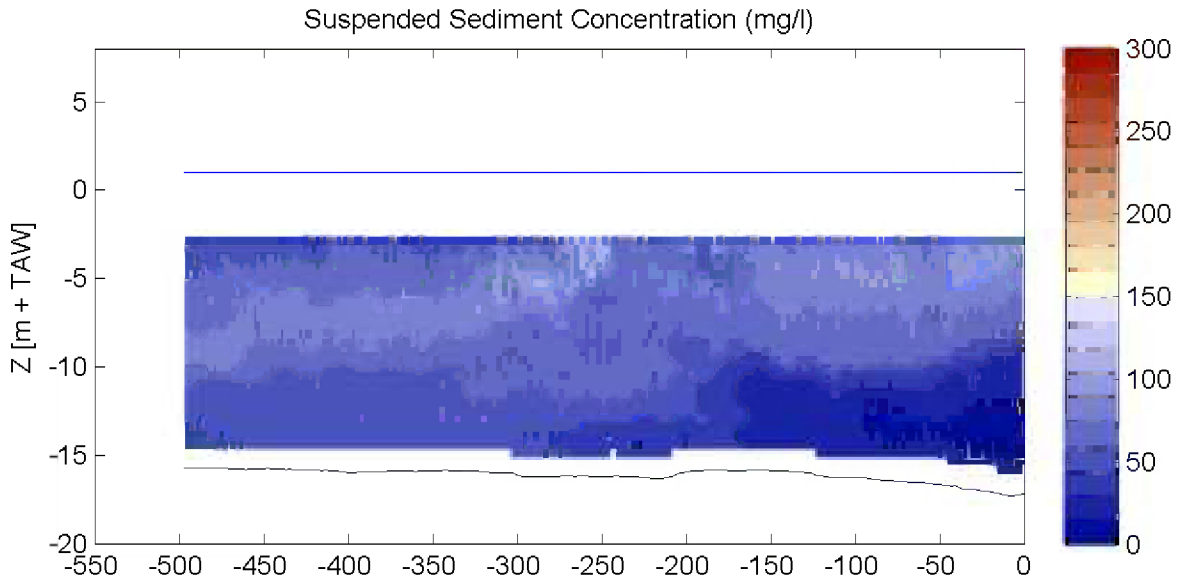
Data Processed by:

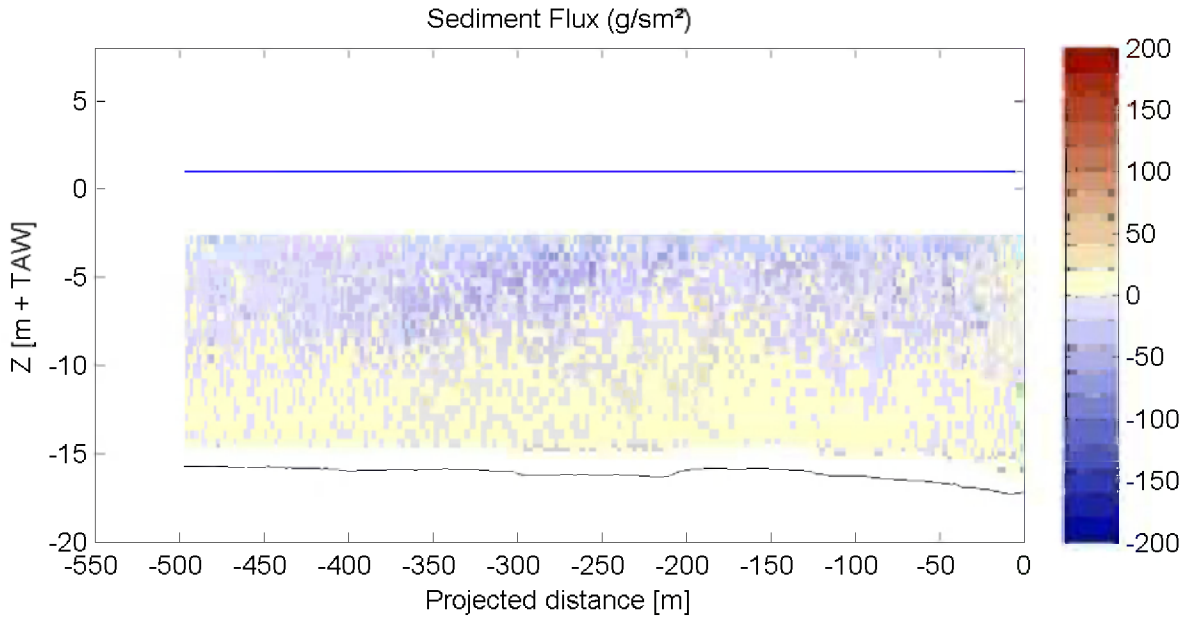
In association with :

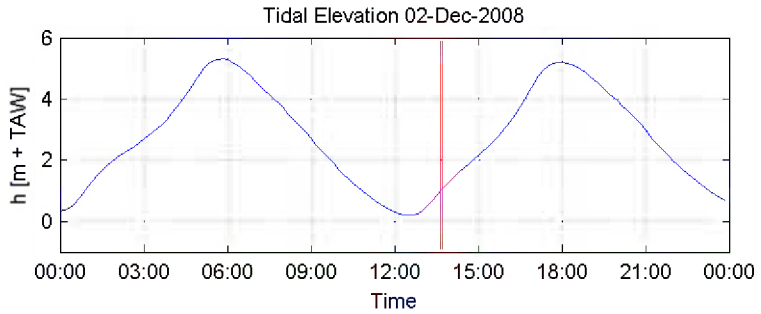
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1064TDGDrl.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

13:38 - 13:43

Time after HW [HH:MM]

-4:19

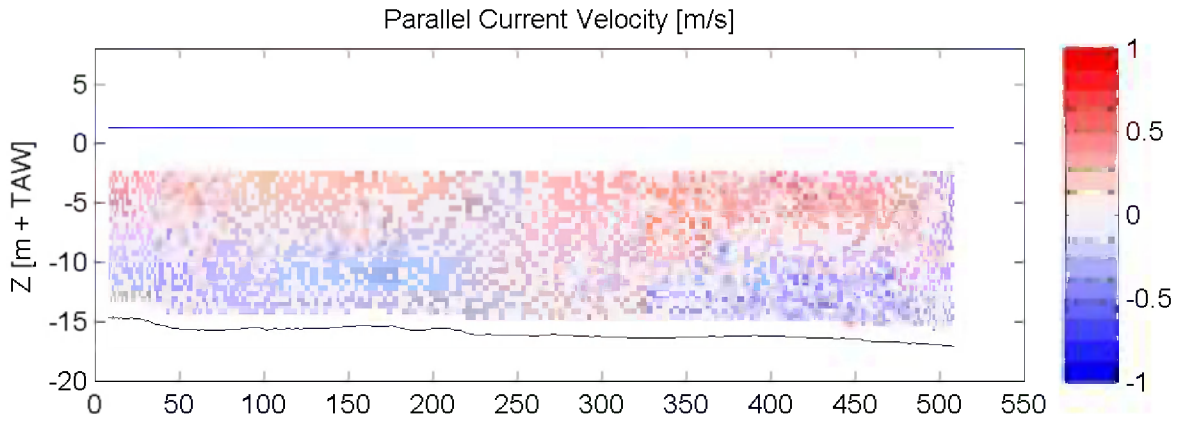
Data Processed by:

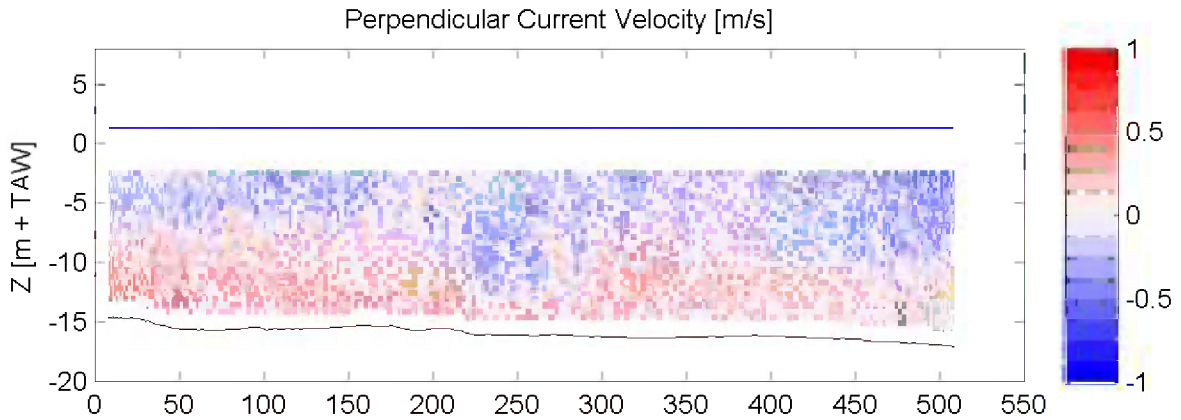
In association with :

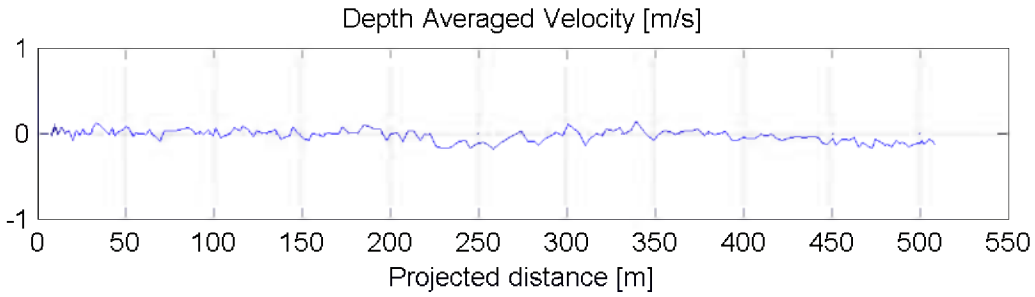
I/RA/11283/08.084/MSA

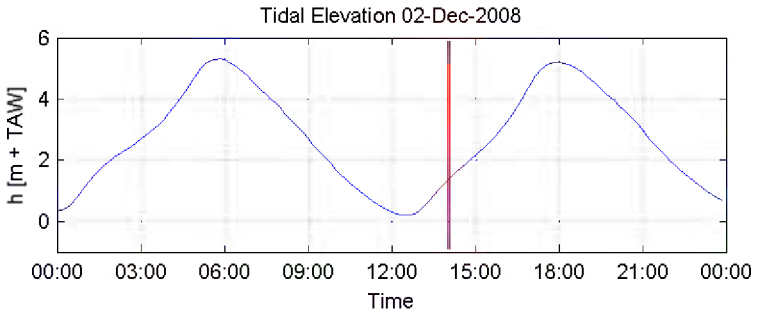
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1066TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:01 - 14:05

Time after HW [HH:MM]

-3:56

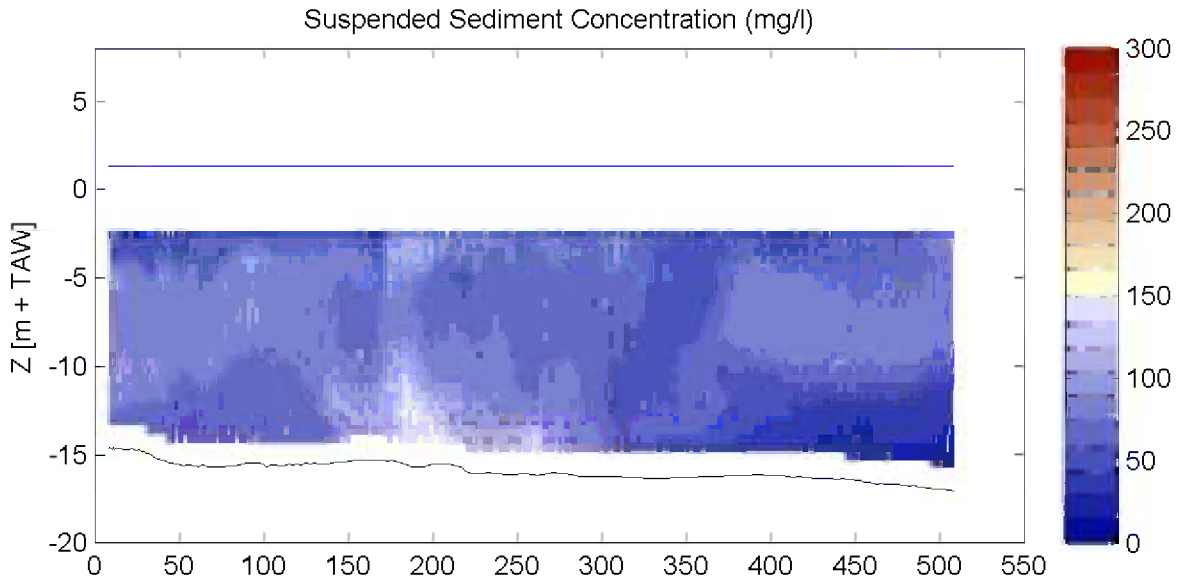
Data Processed by:

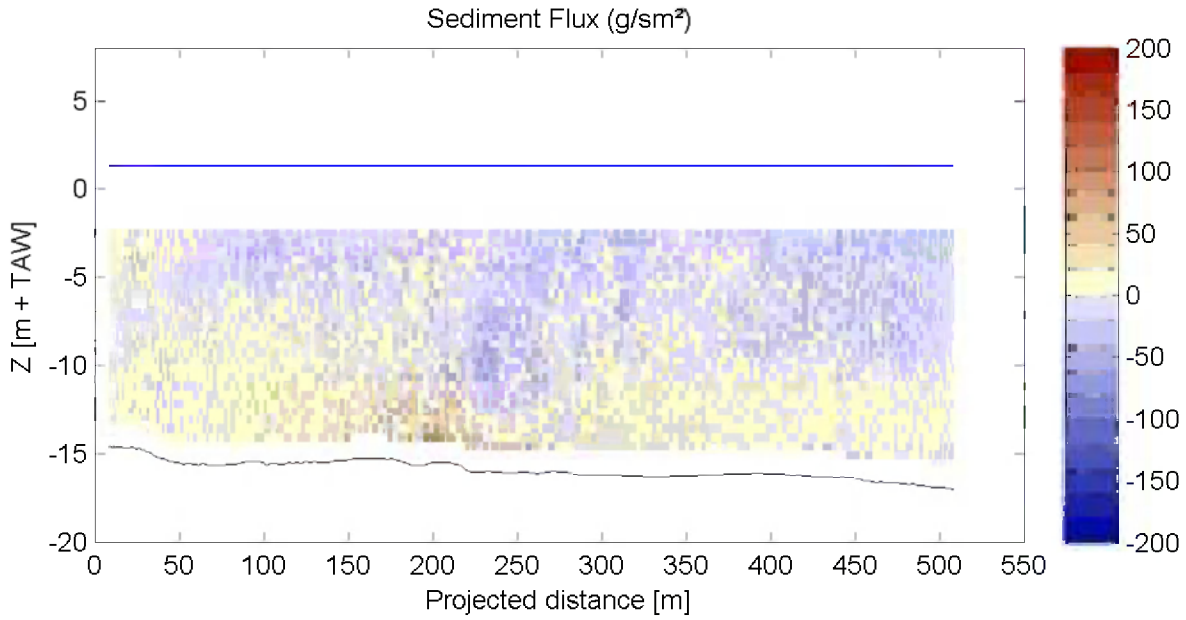
In association with :

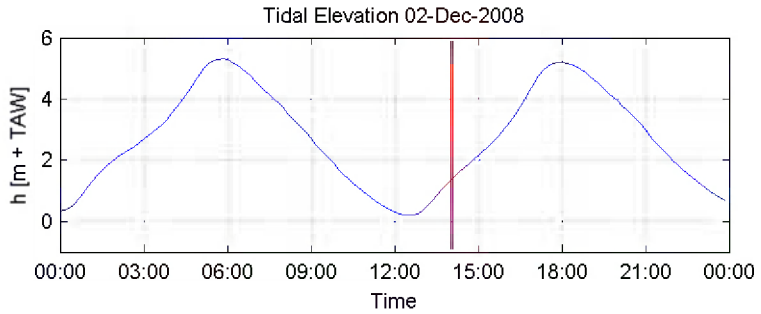
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1066TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:01 - 14:05

Time after HW [HH:MM]

-3:56

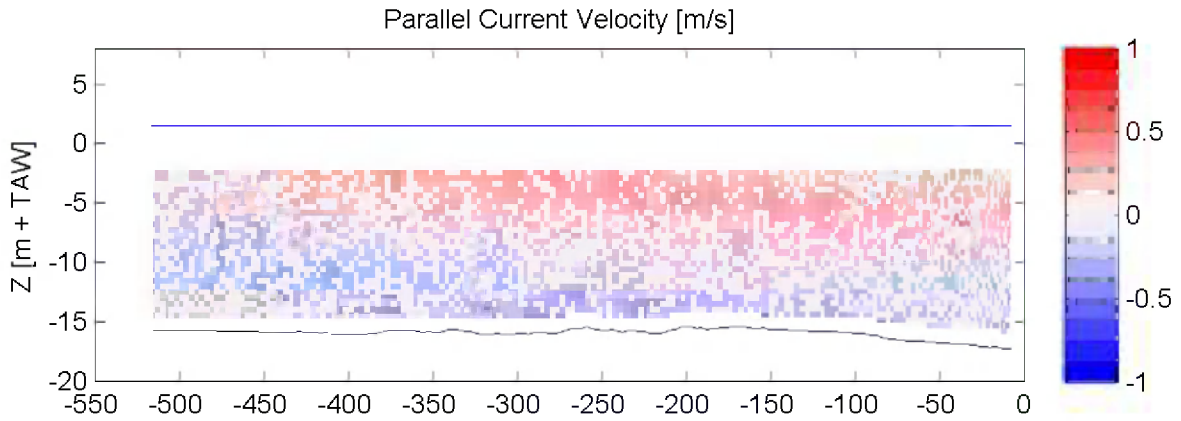
Data Processed by:

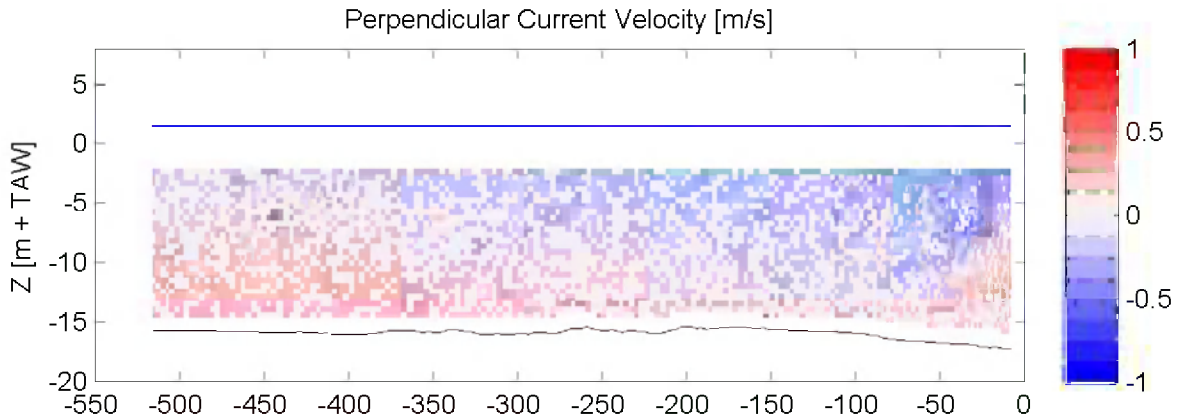
In association with :

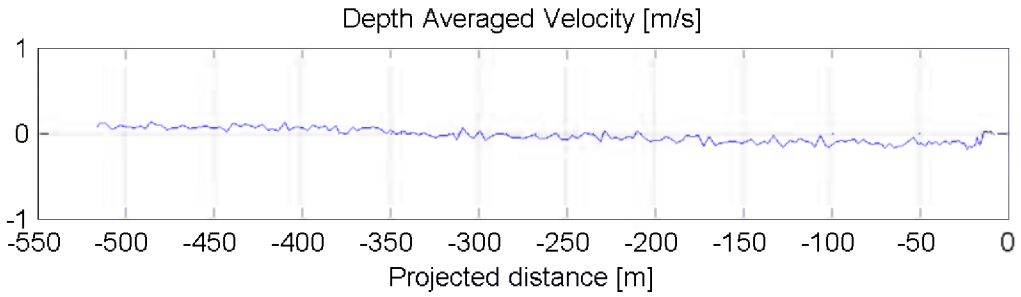
I/RA/11283/08.084/MSA

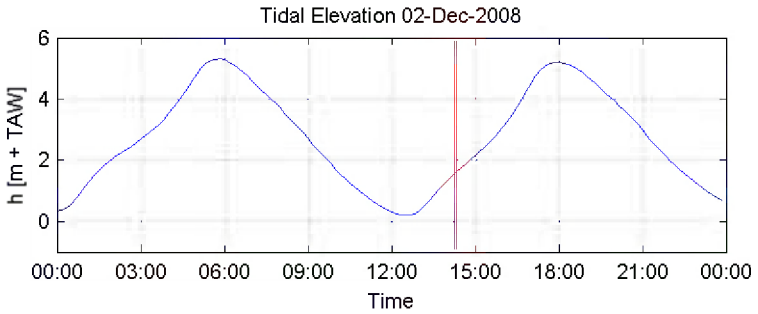
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1068TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:14 - 14:18

Time after HW [HH:MM]

-3:43

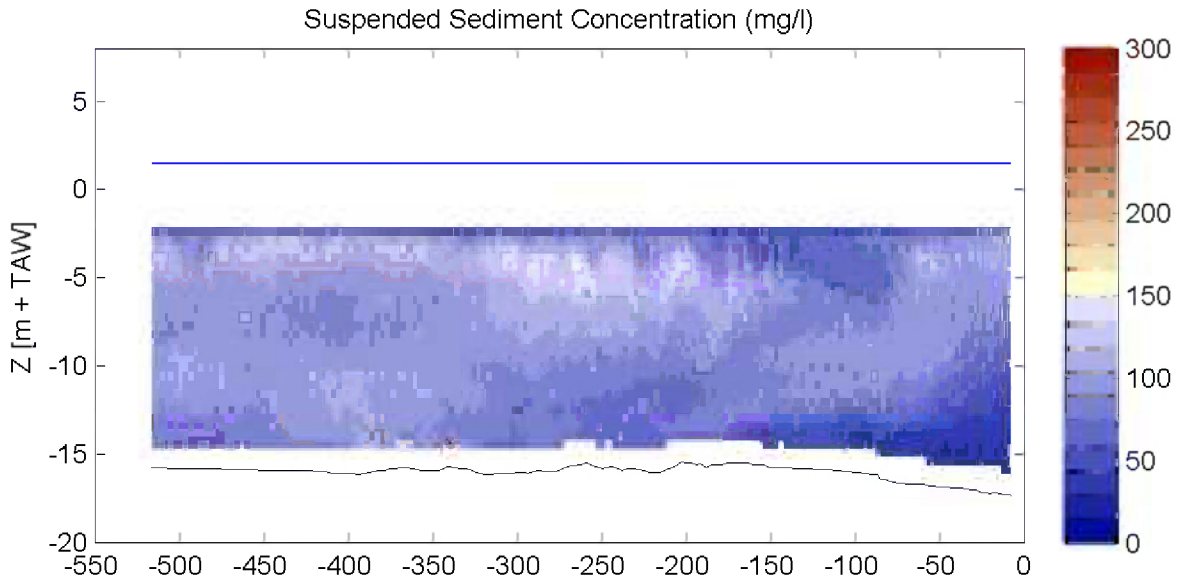
Data Processed by:

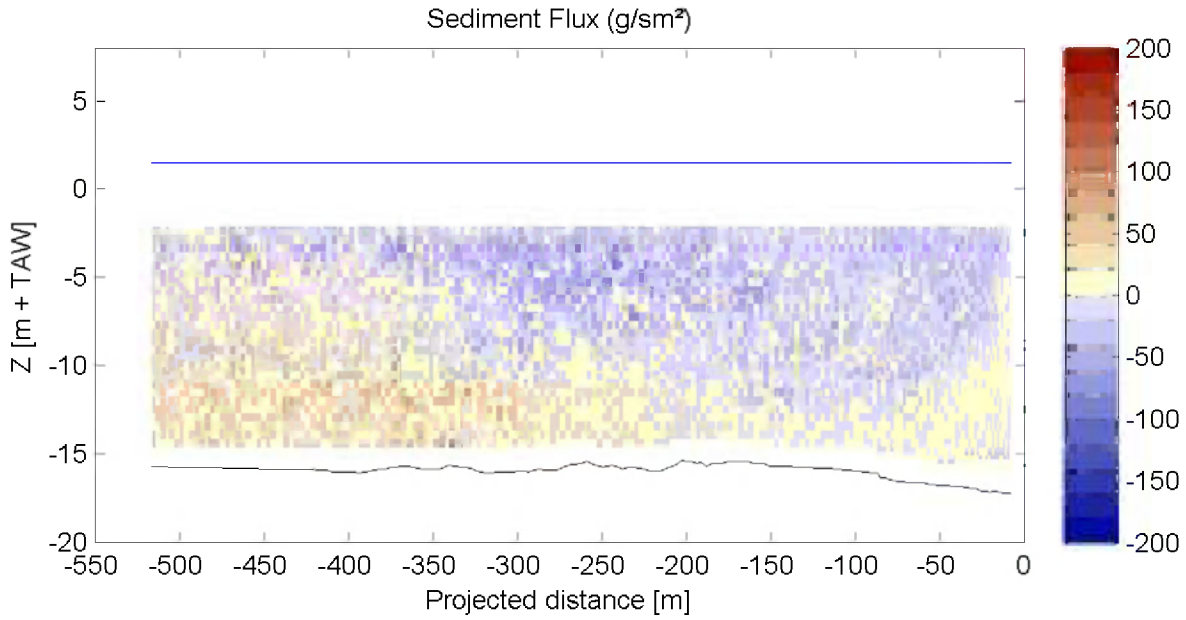
In association with :

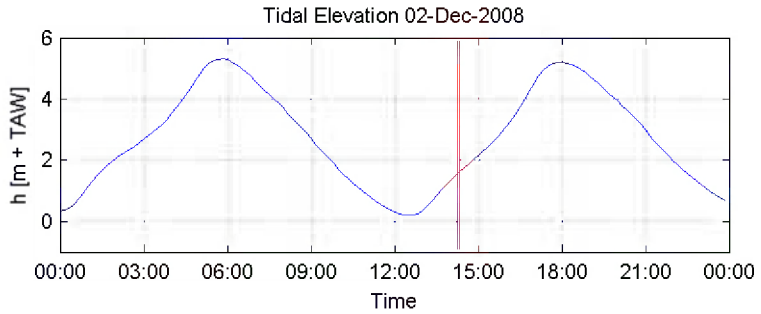
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1068TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:14 - 14:18

Time after HW [HH:MM]

-3:43

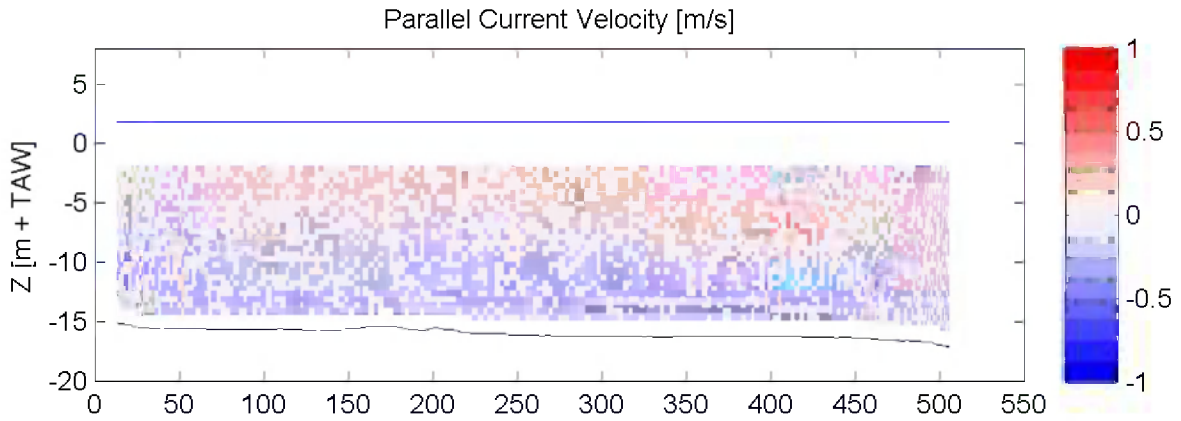
Data Processed by:

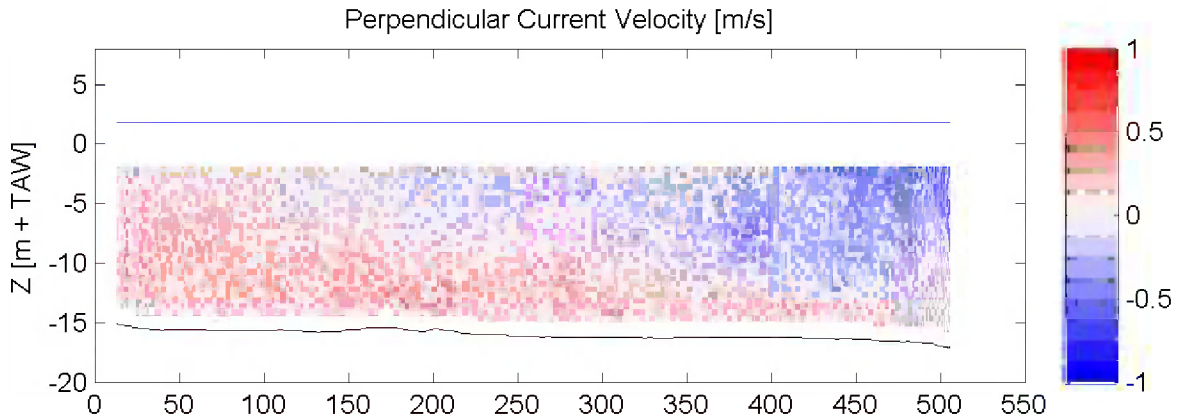
In association with :

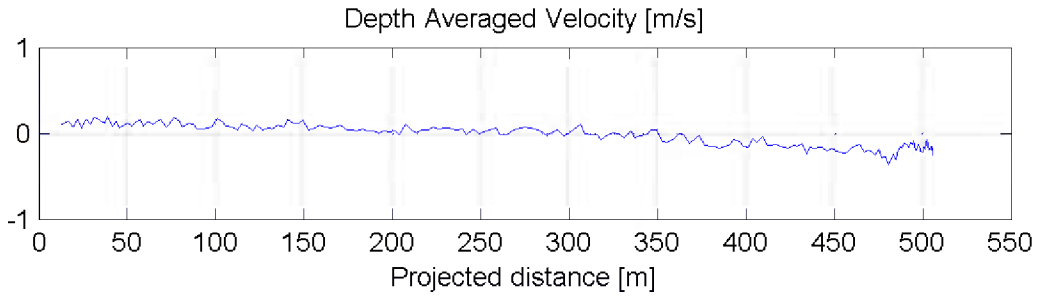
I/RA/11283/08.084/MSA

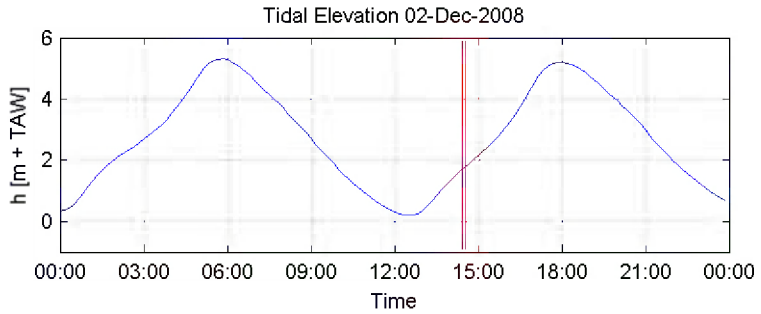
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1070TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:26 - 14:31

Time after HW [HH:MM]

-3:31

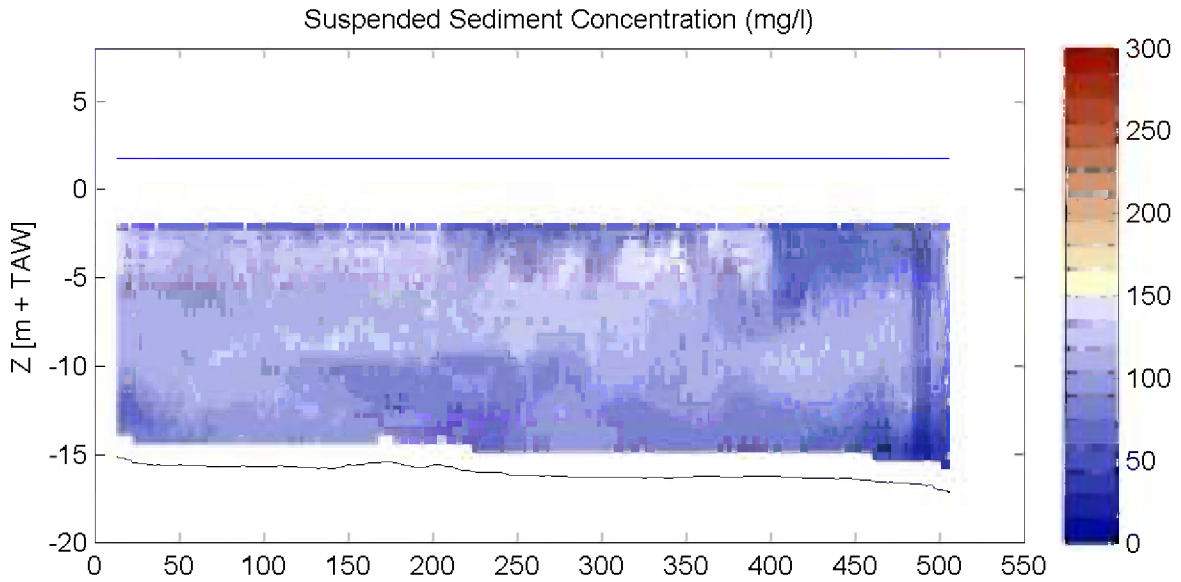
Data Processed by:

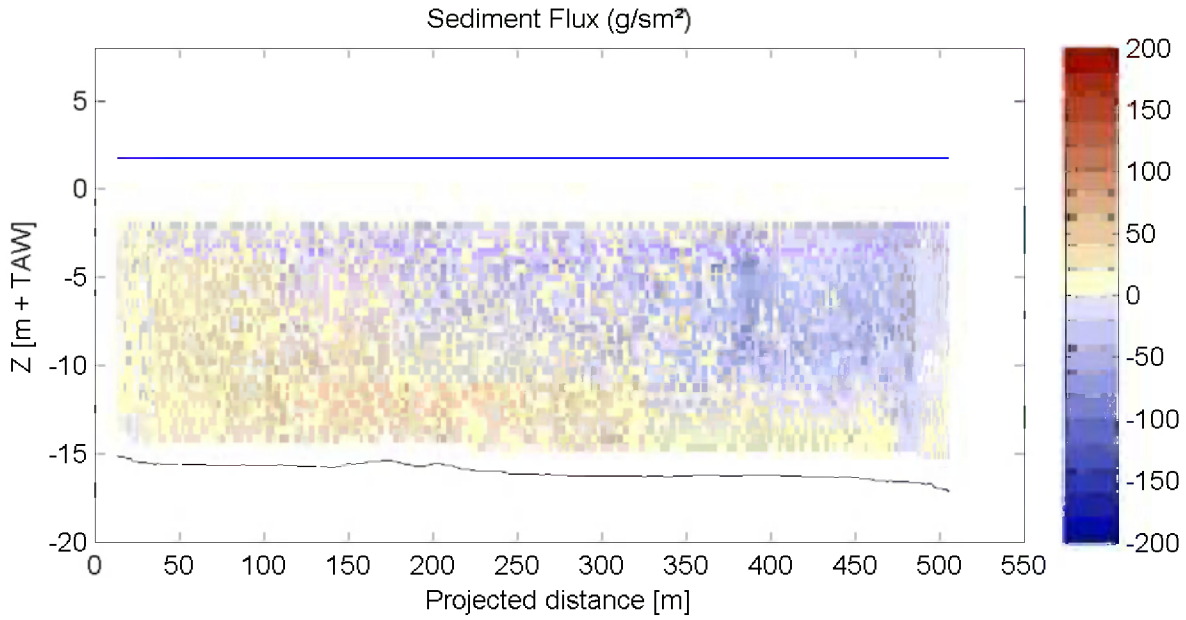
In association with :

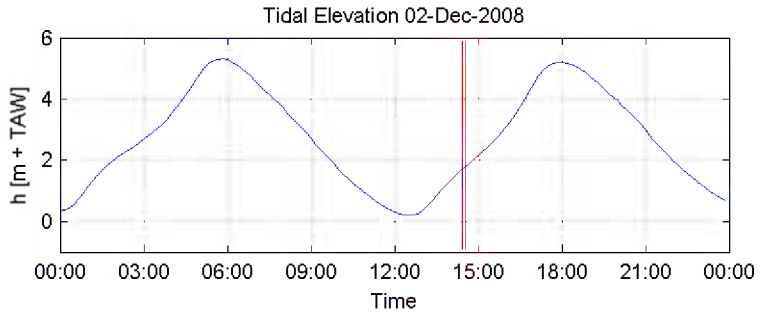
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1070TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:26 - 14:31

Time after HW [HH:MM]

-3:31

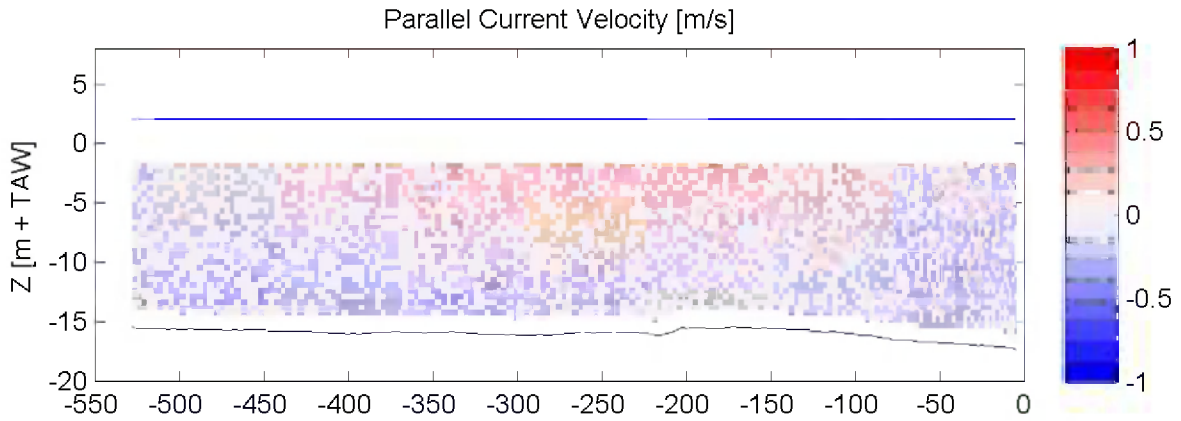
Data Processed by:

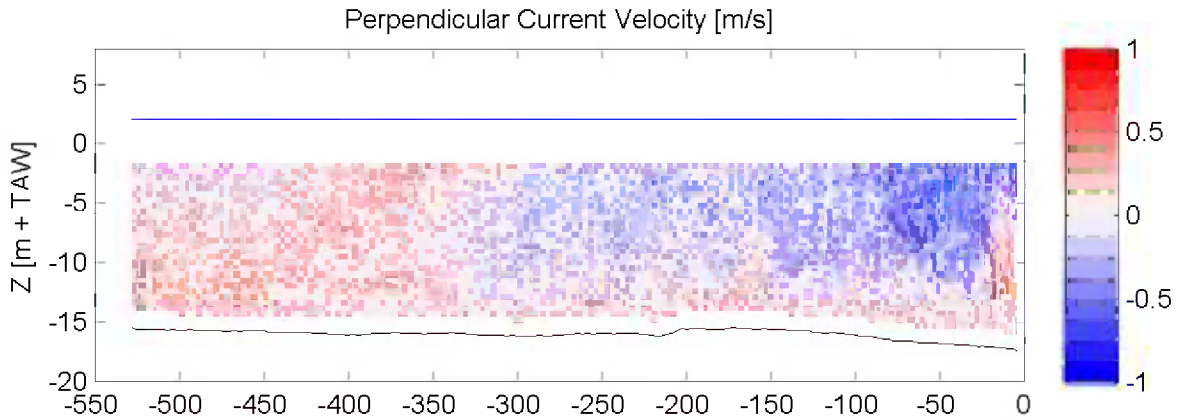
In association with :

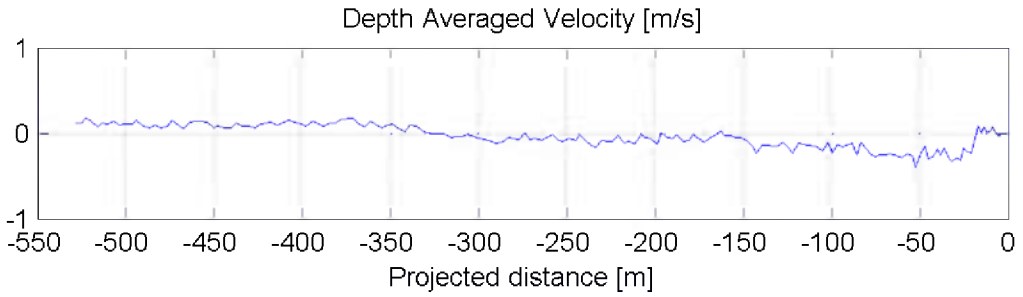
I/RA/11283/08.084/MSA

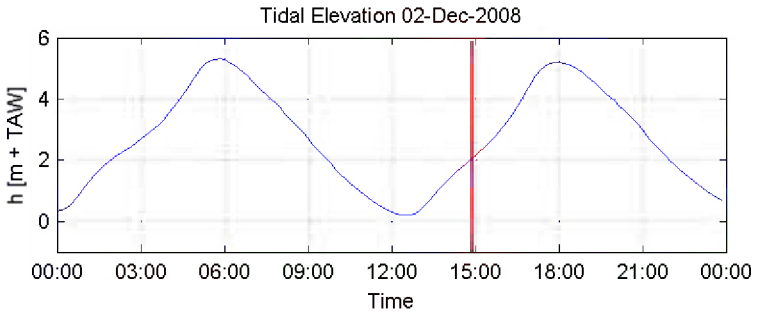
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1072TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:50 - 14:54

Time after HW [HH:MM]

-3:07

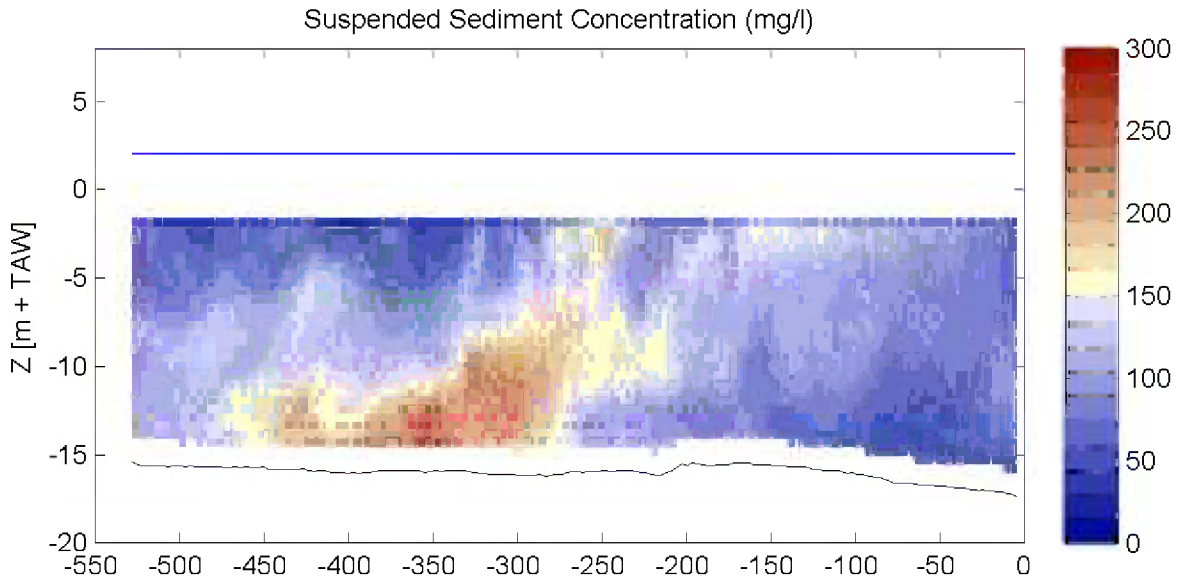
Data Processed by:

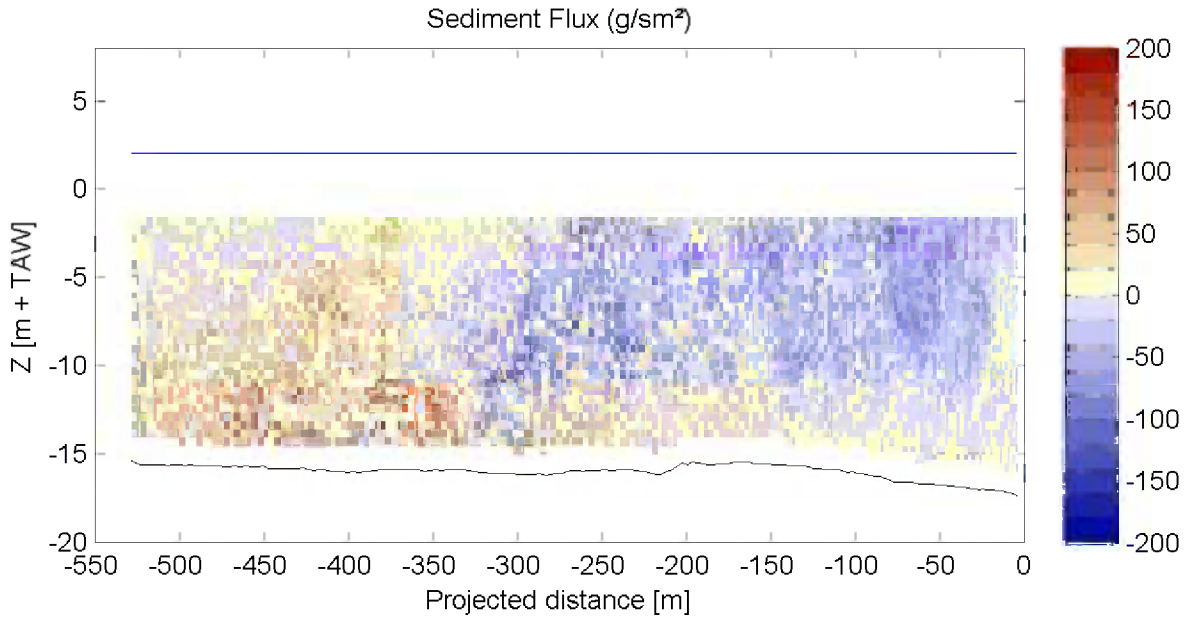
In association with :

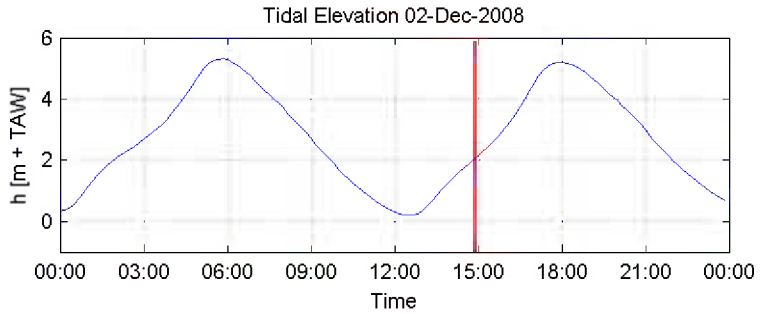
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1072TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

14:50 - 14:54

Time after HW [HH:MM]

-3:07

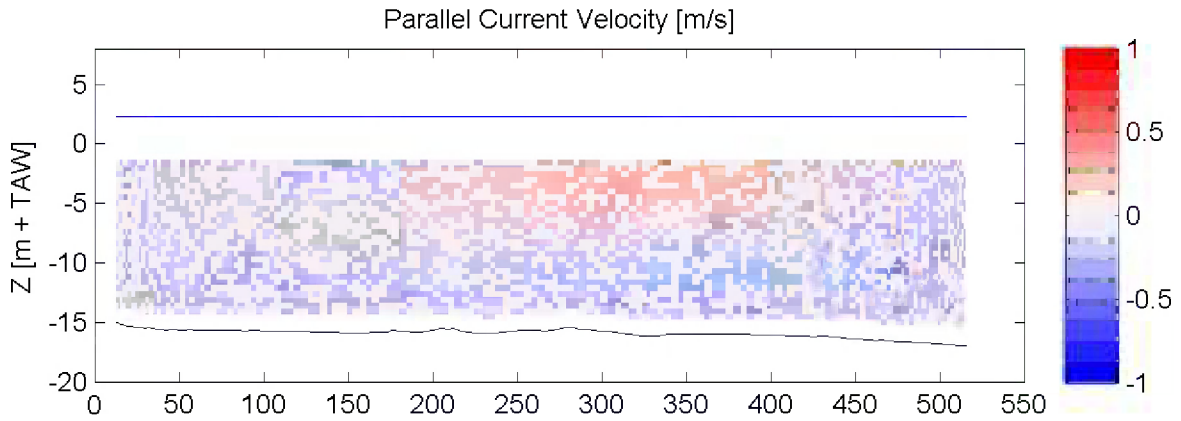
Data Processed by:

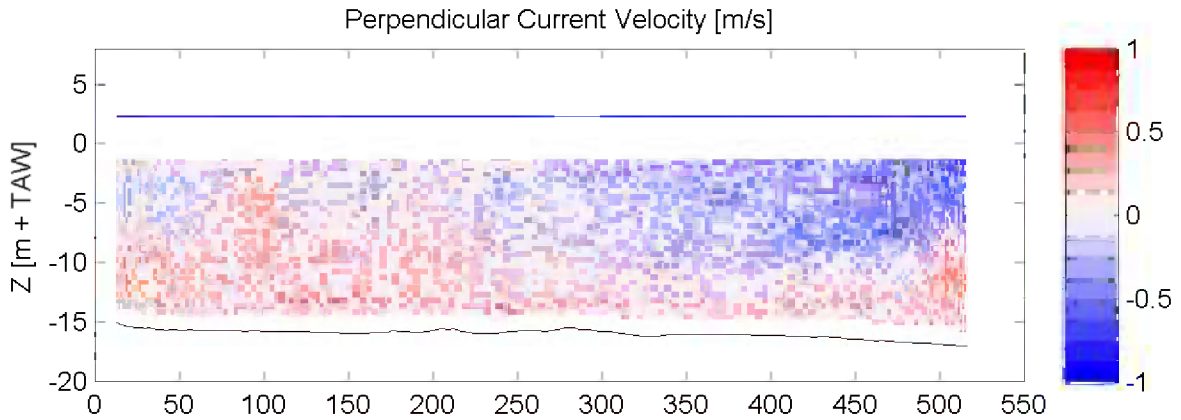
In association with :

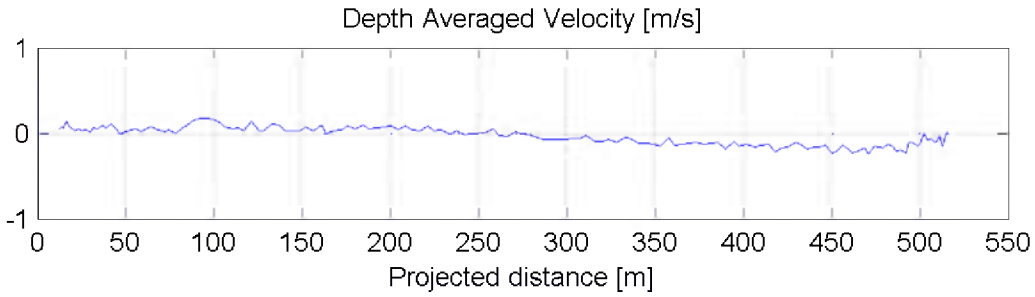
I/RA/11283/08.084/MSA

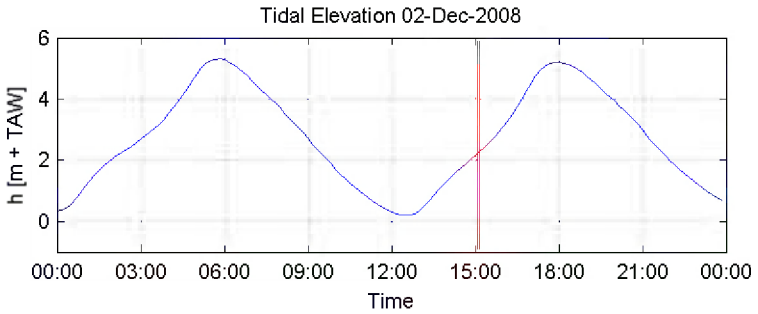
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1074TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:06 - 15:09

Time after HW [HH:MM]

-2:52

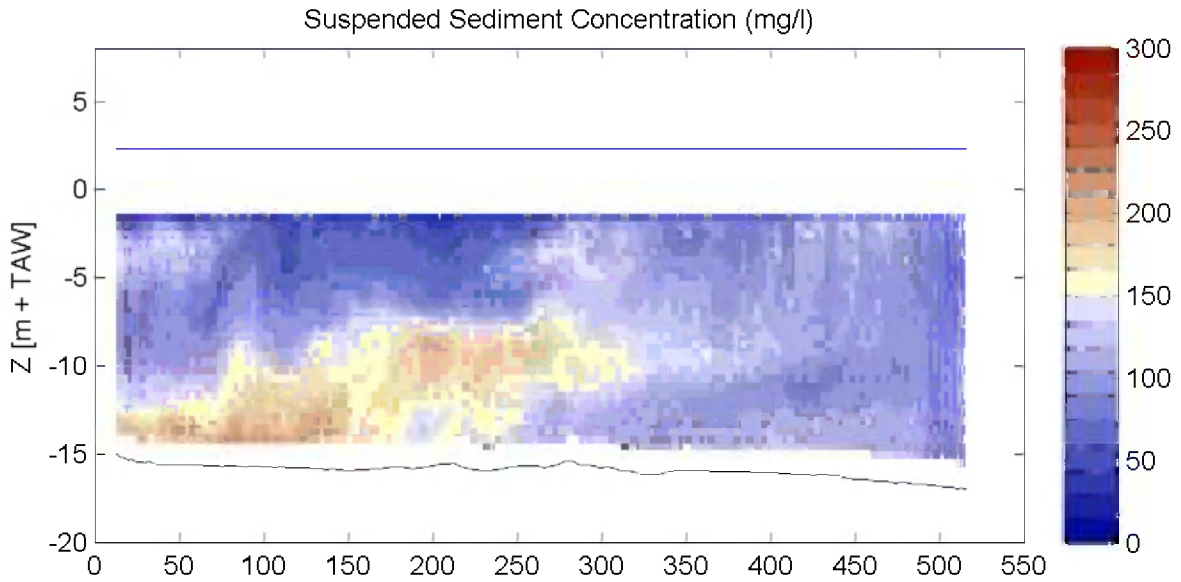
Data Processed by:

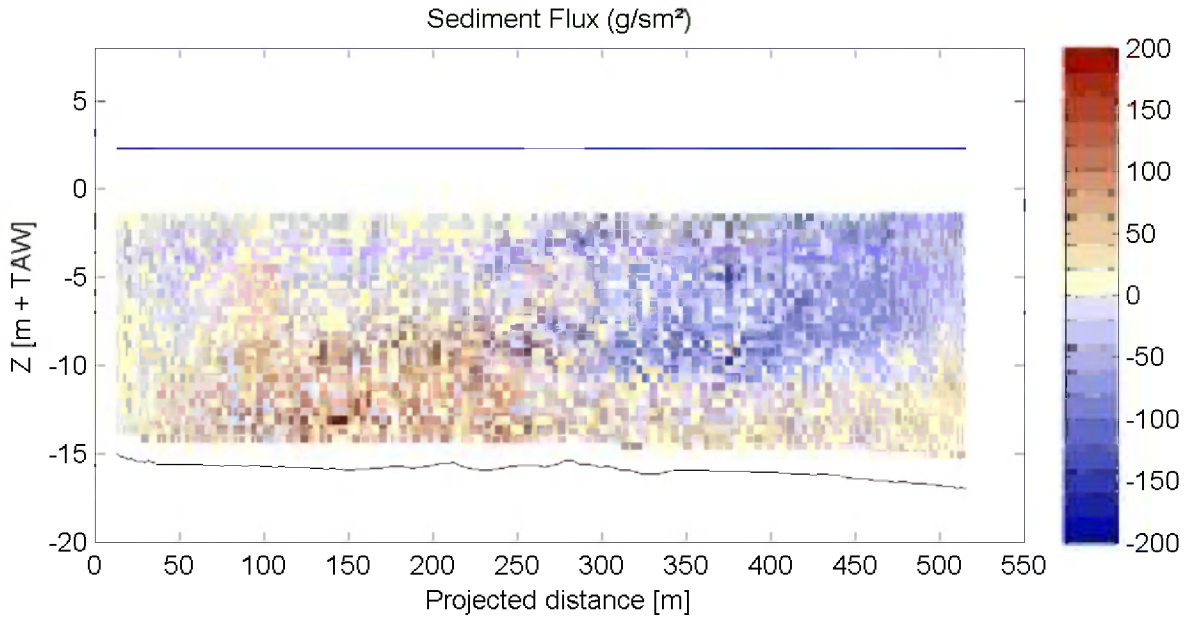
In association with :

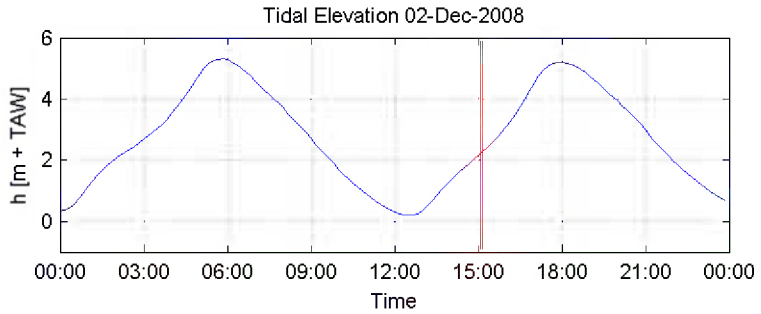
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1074TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:06 - 15:09

Time after HW [HH:MM]

-2:52

Data Processed by:

In association with :

I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
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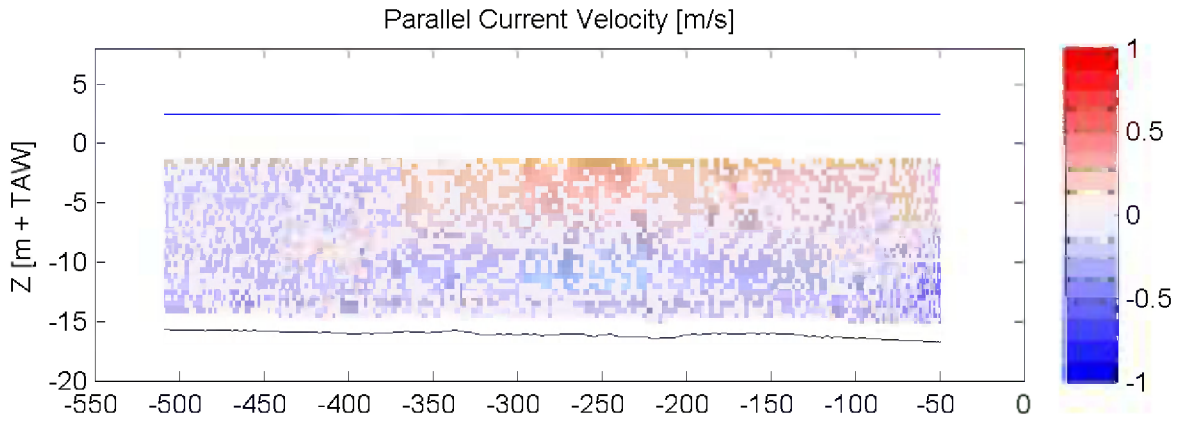
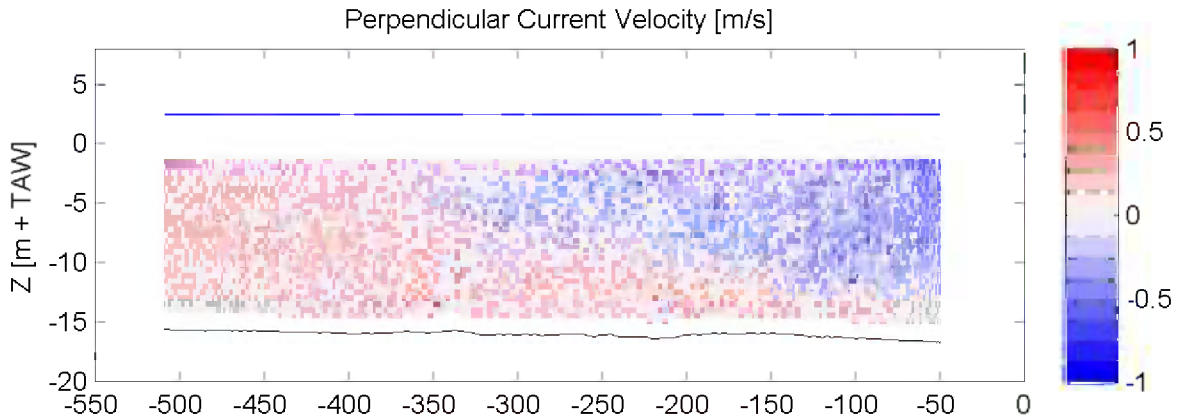
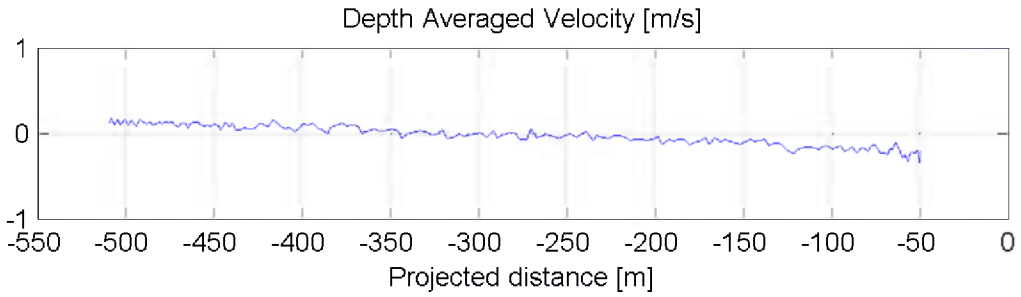
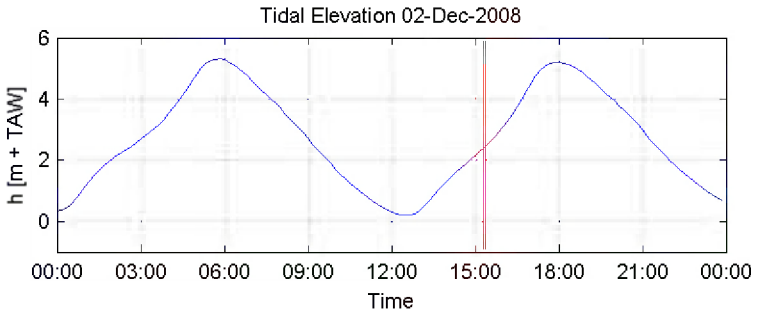
| Sourcefile: 1076TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:17 - 15:21

Time after HW [HH:MM]

-2:40

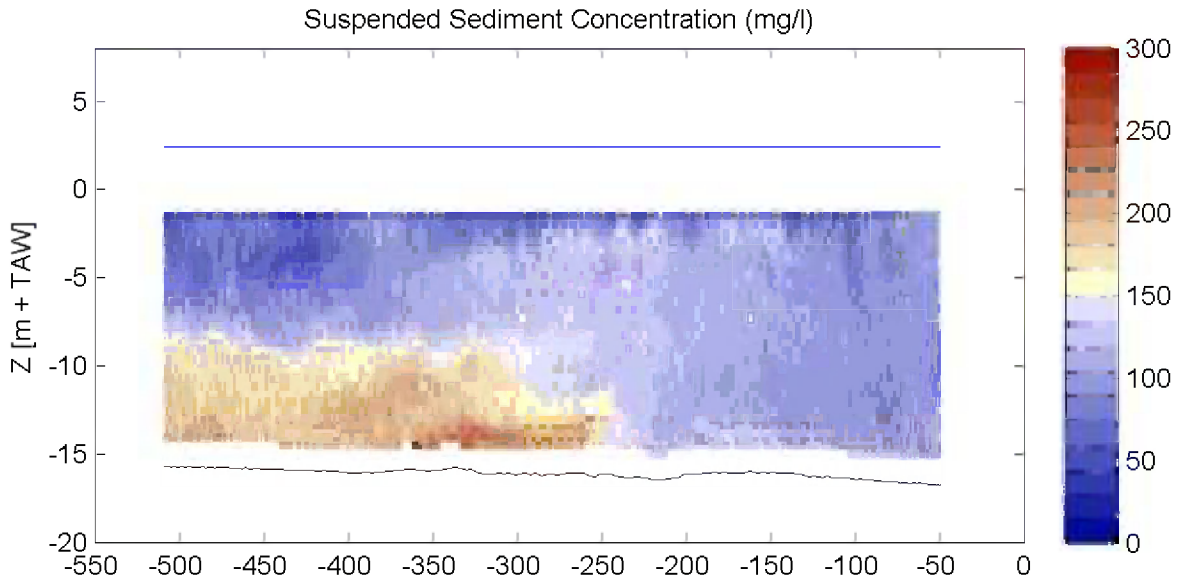
Data Processed by:

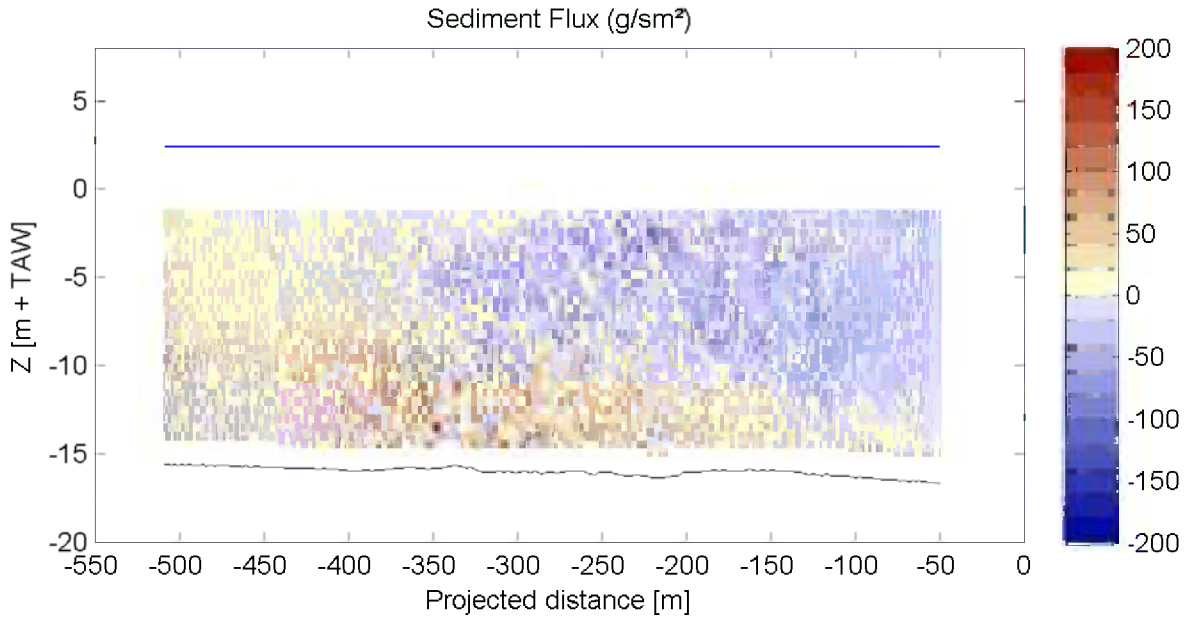
In association with :

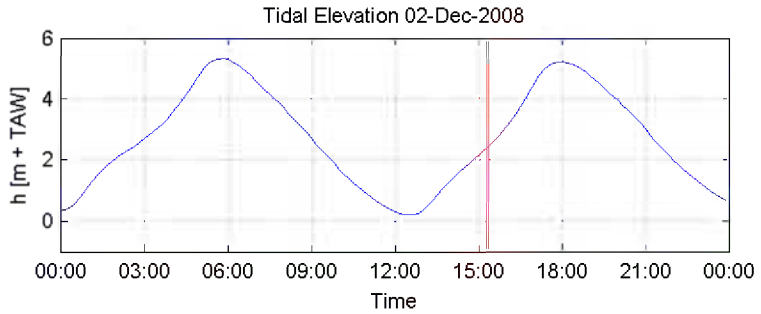
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1076TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:17 - 15:21

Time after HW [HH:MM]

-2:40

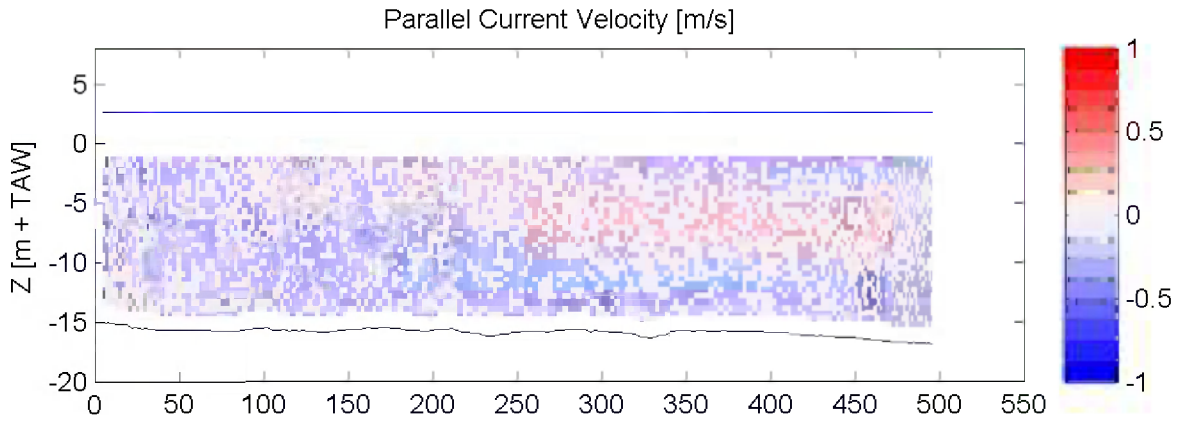
Data Processed by:

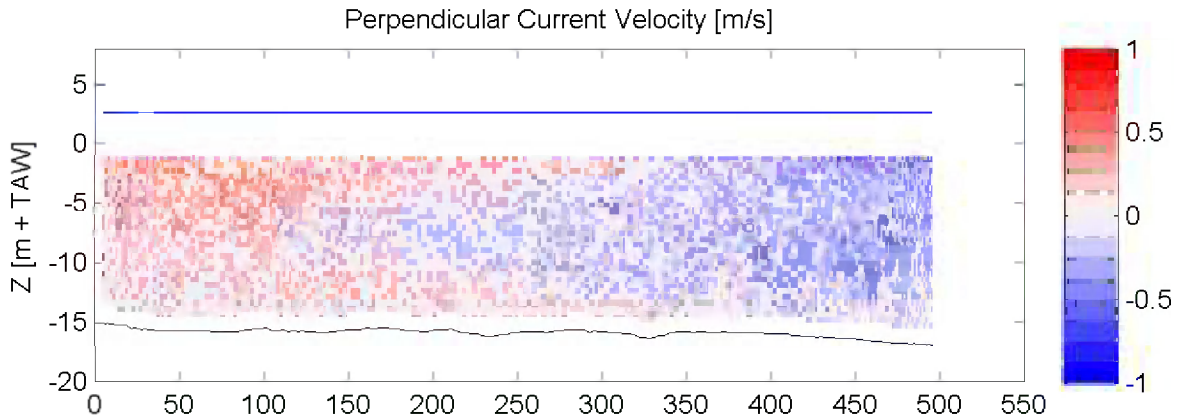
In association with :

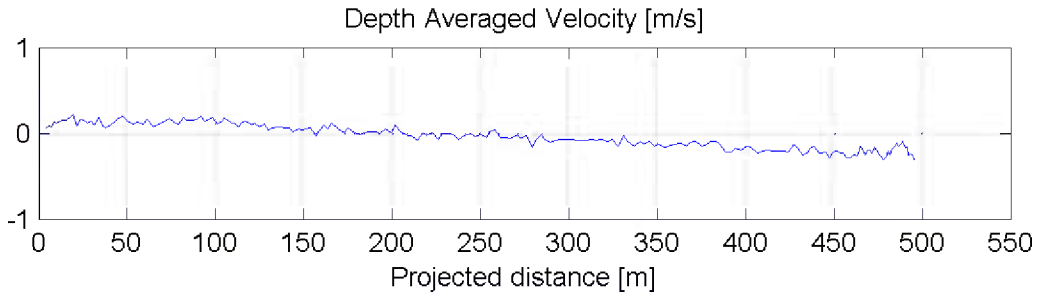
I/RA/11283/08.084/MSA

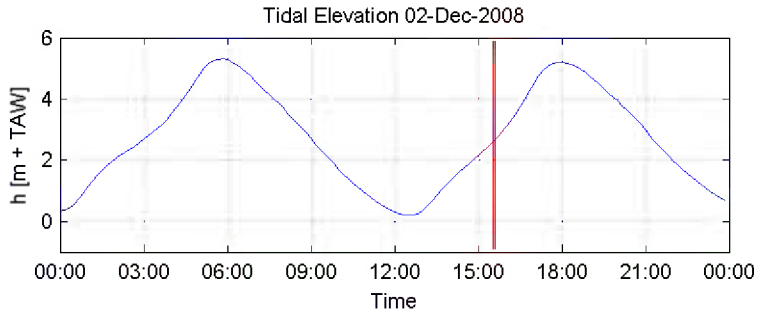
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1078TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:31 - 15:36

Time after HW [HH:MM]

-2:25

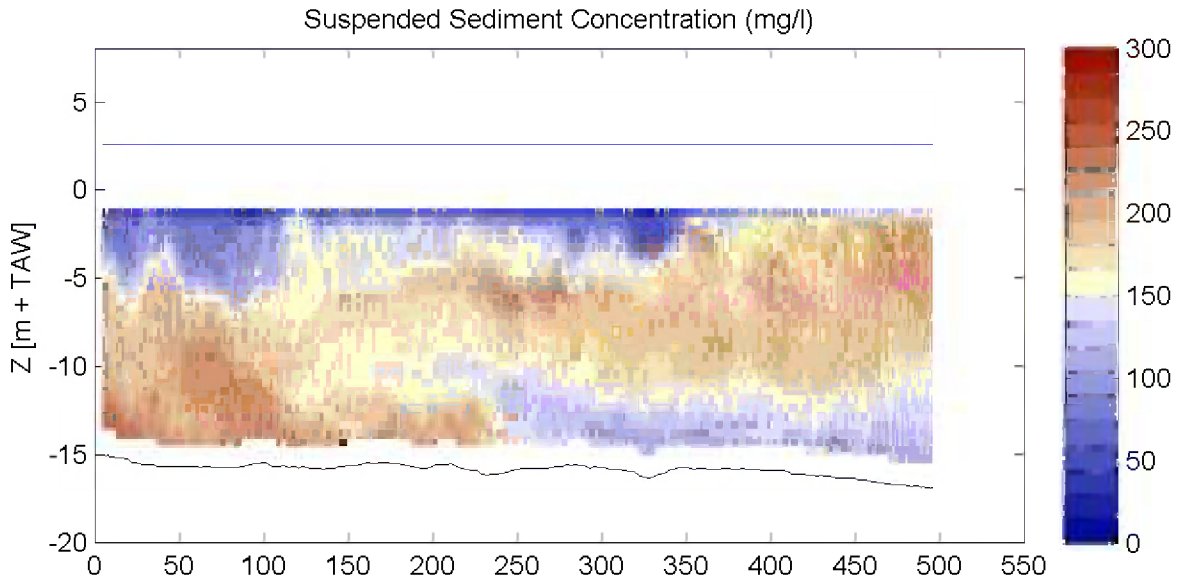
Data Processed by:

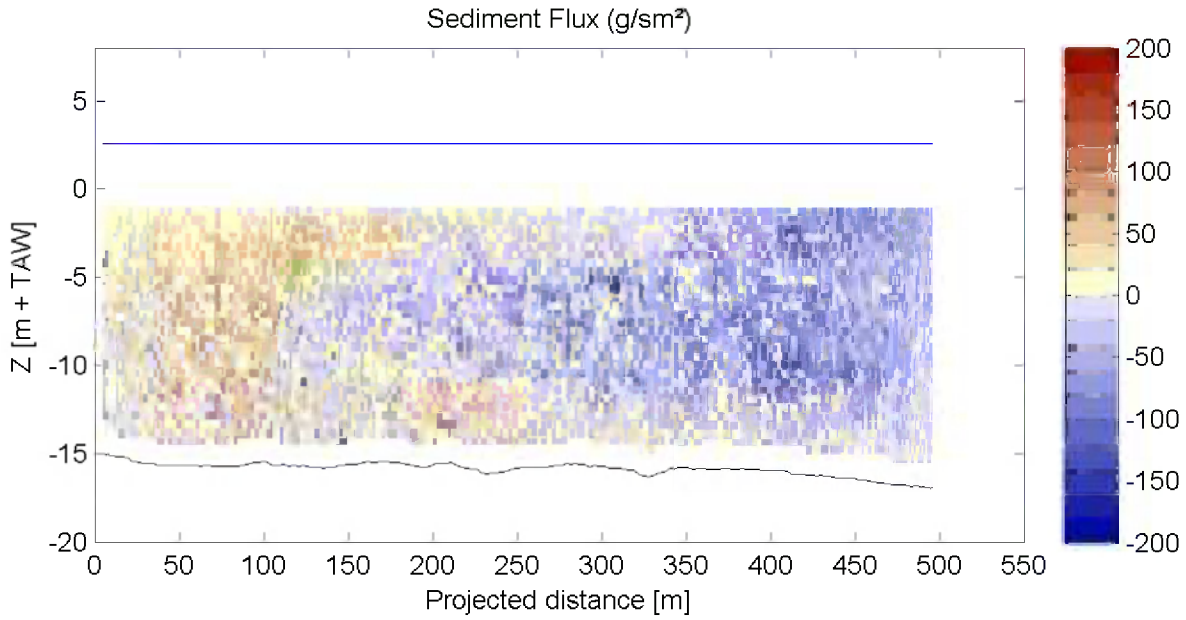
In association with :

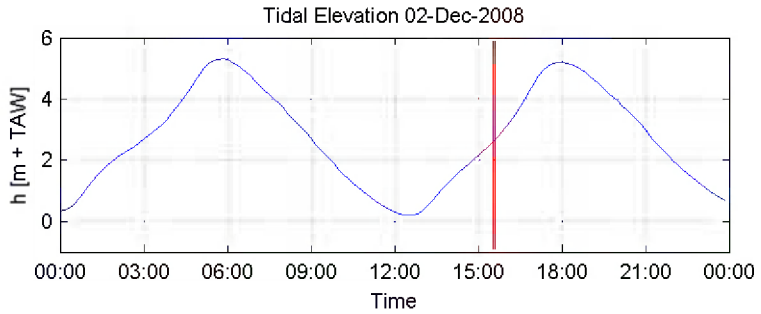
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1078TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:31 - 15:36

Time after HW [HH:MM]

-2:25

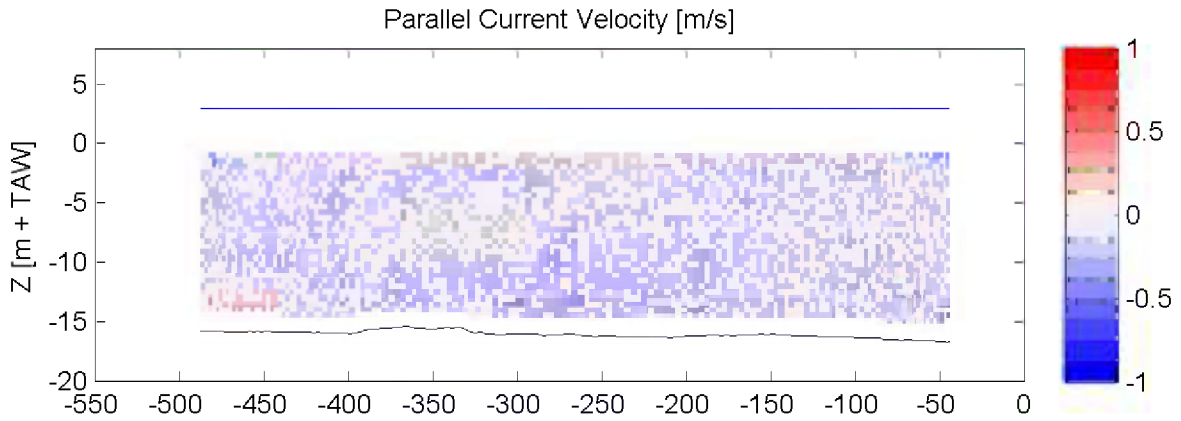
Data Processed by:

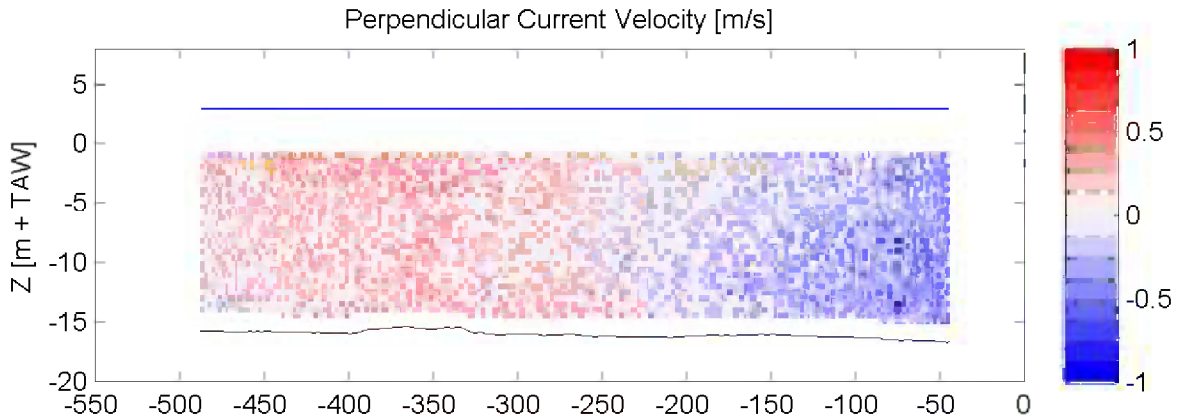
In association with :

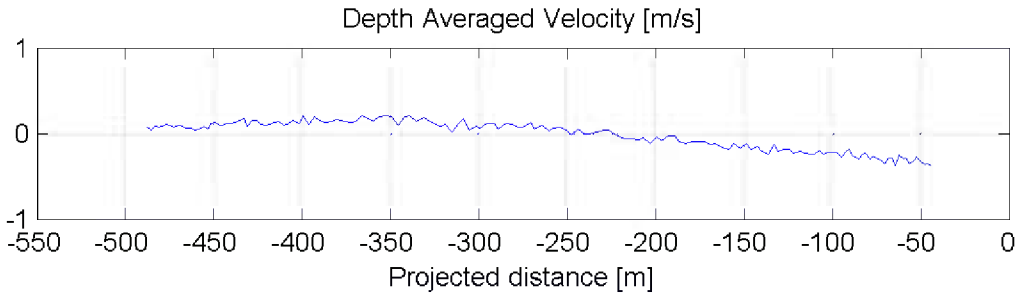
I/RA/11283/08.084/MSA

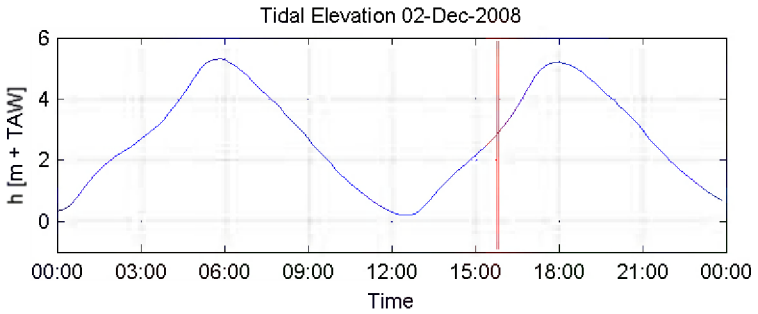
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1080TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:47 - 15:51

Time after HW [HH:MM]

-2:10

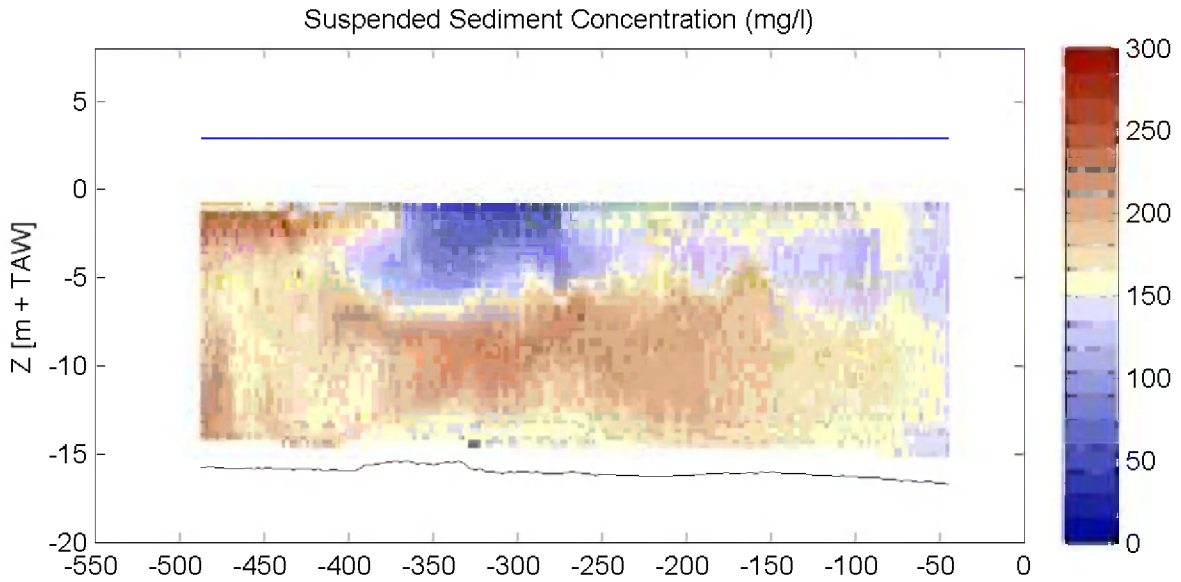
Data Processed by:

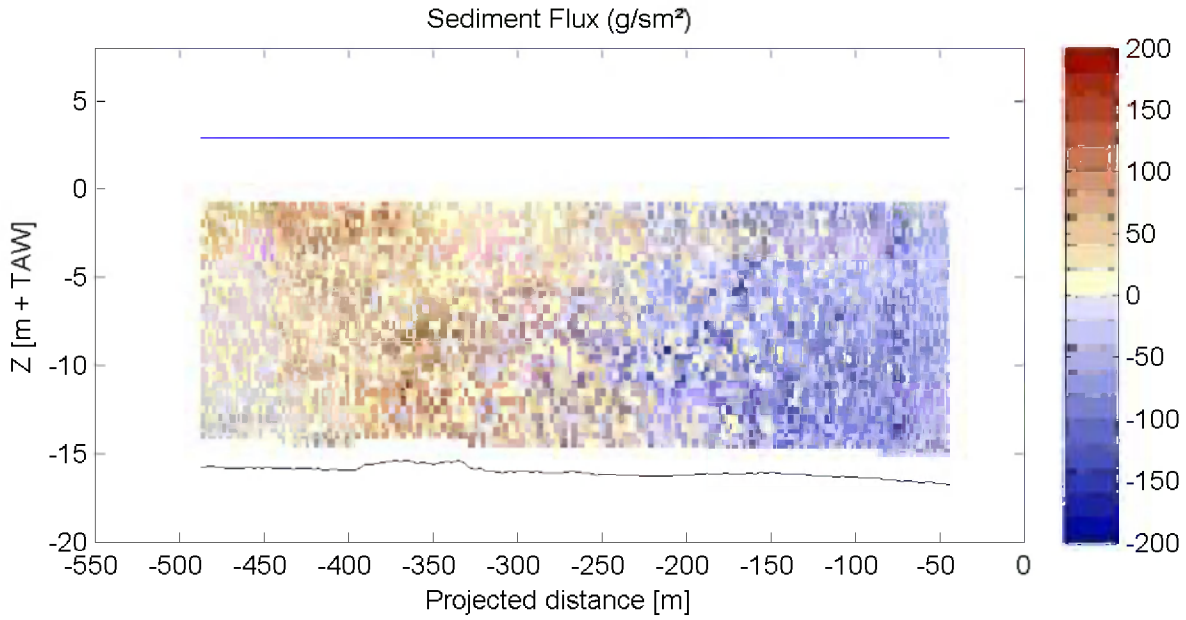
In association with :

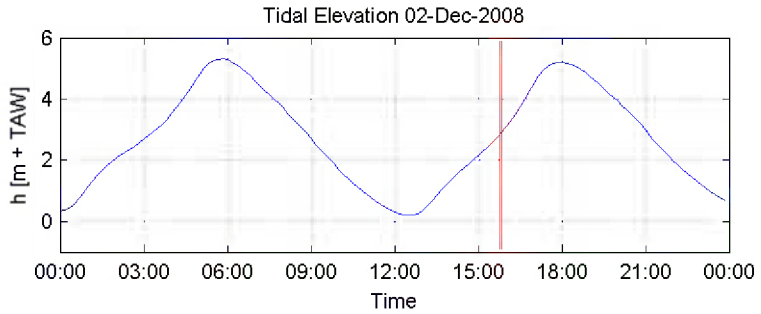
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1080TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

15:47 - 15:51

Time after HW [HH:MM]

-2:10

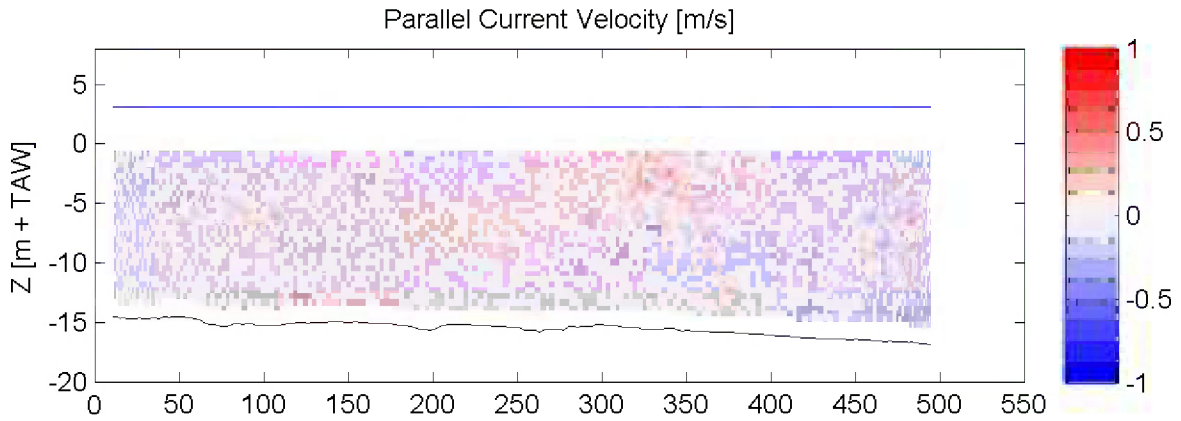
Data Processed by:

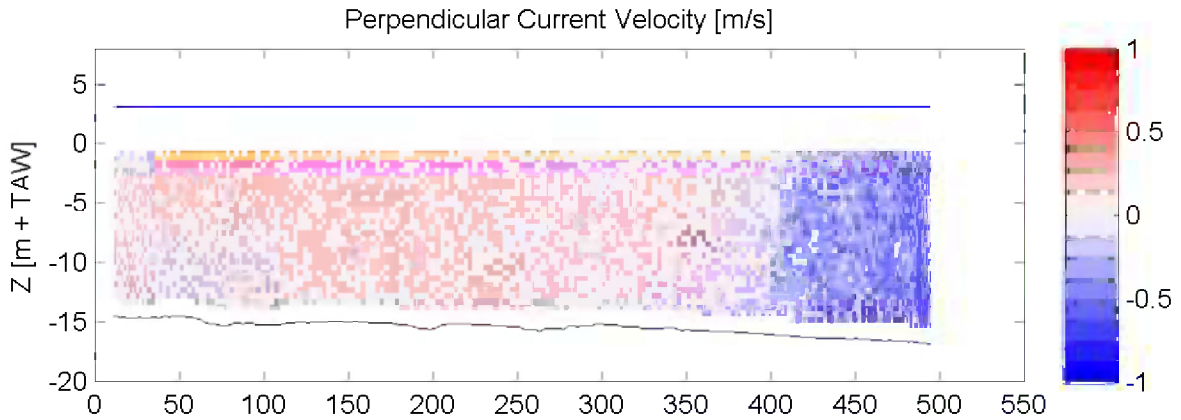
In association with :

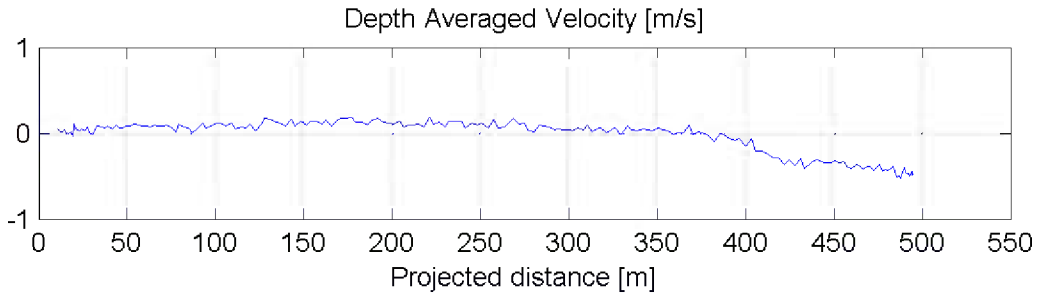
I/RA/11283/08.084/MSA

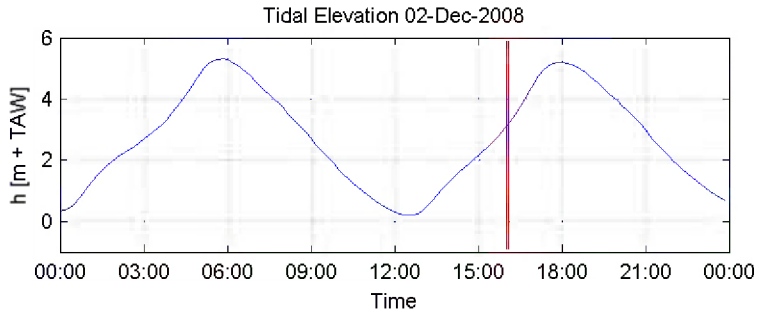
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1082TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:00 - 16:05

Time after HW [HH:MM]

-1:56

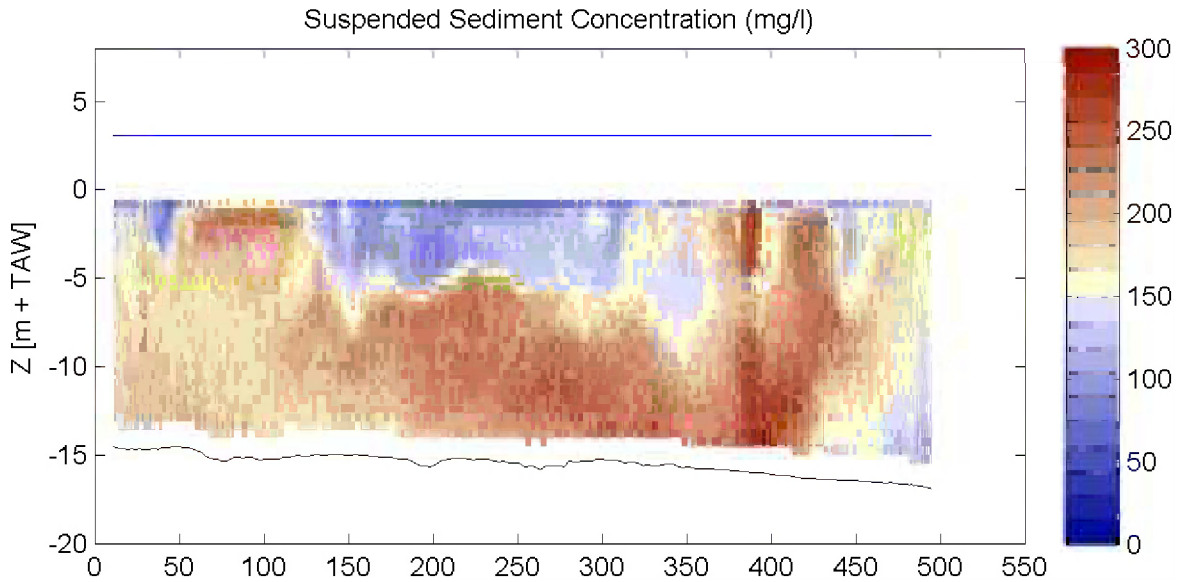
Data Processed by:

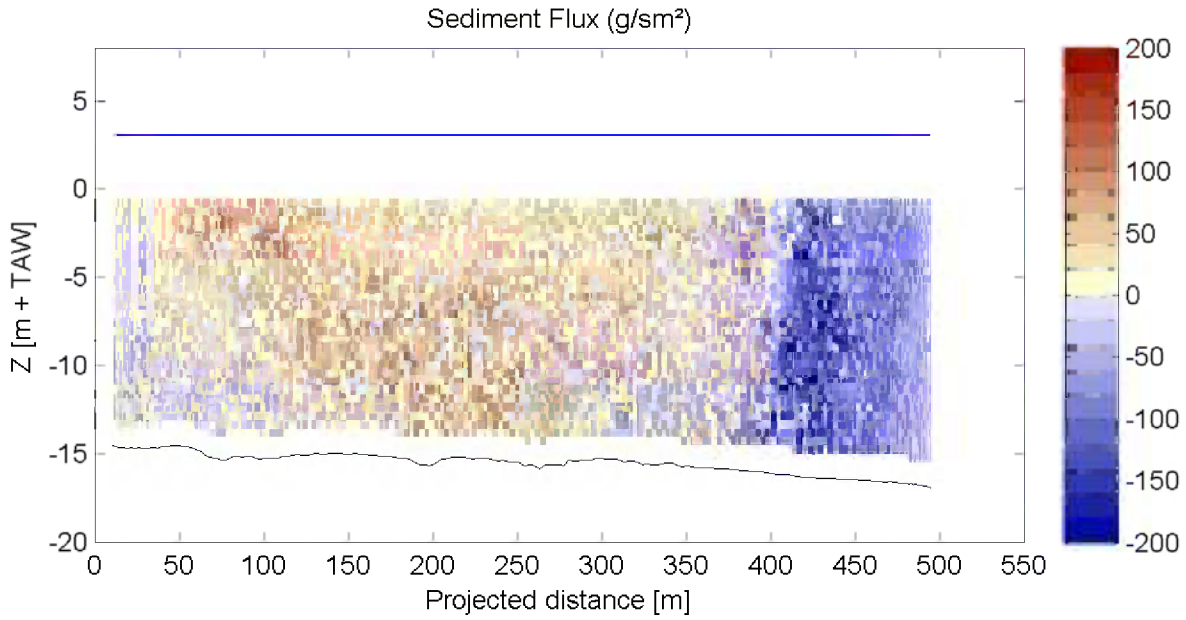
In association with :

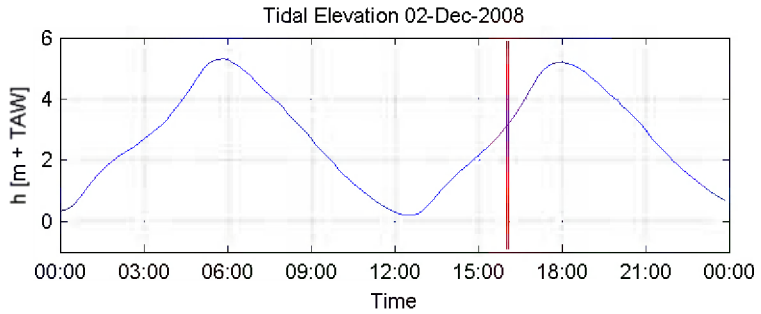
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1082TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:00 - 16:05

Time after HW [HH:MM]

-1:56

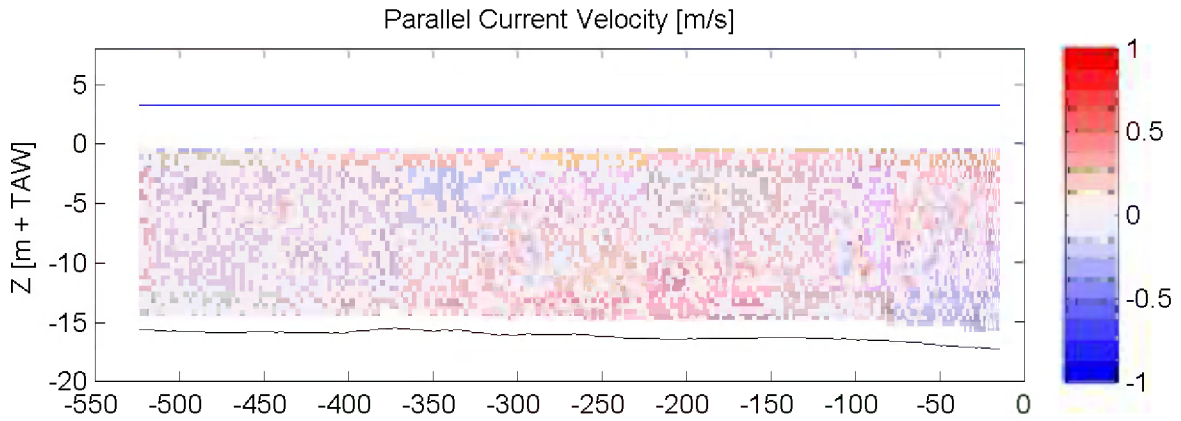
Data Processed by:

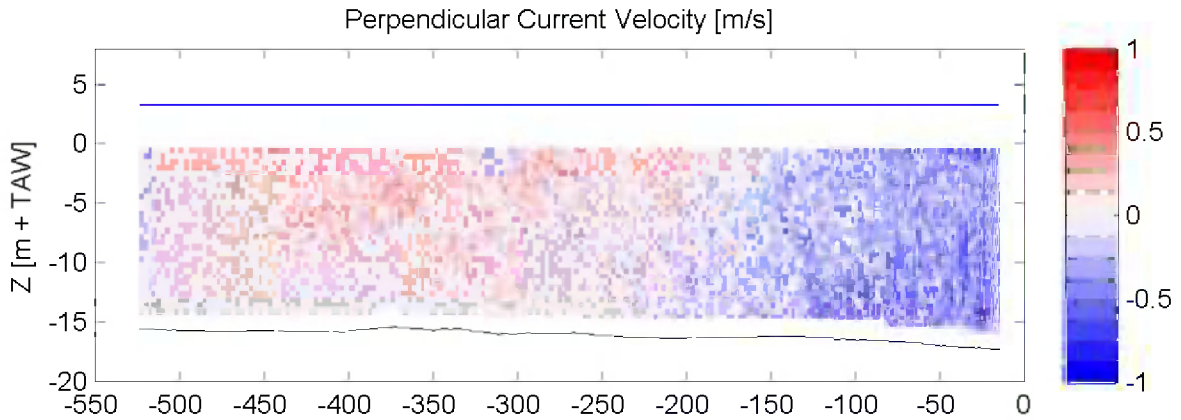
In association with :

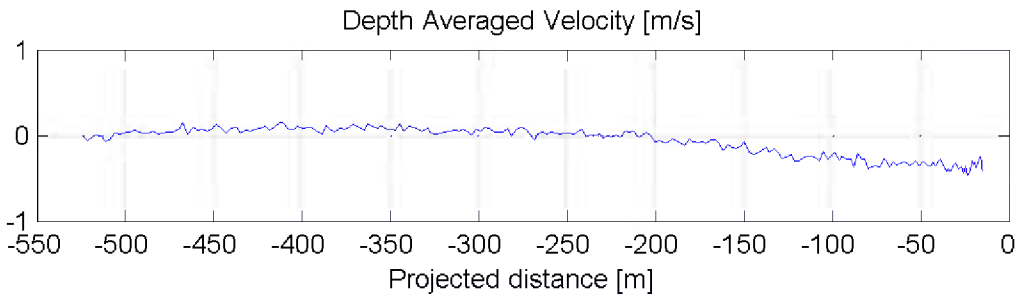
I/RA/11283/08.084/MSA

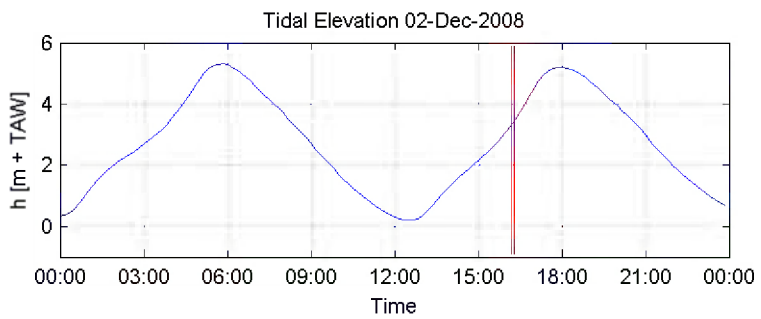
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1084TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:12 - 16:17

Time after HW [HH:MM]

-1:45

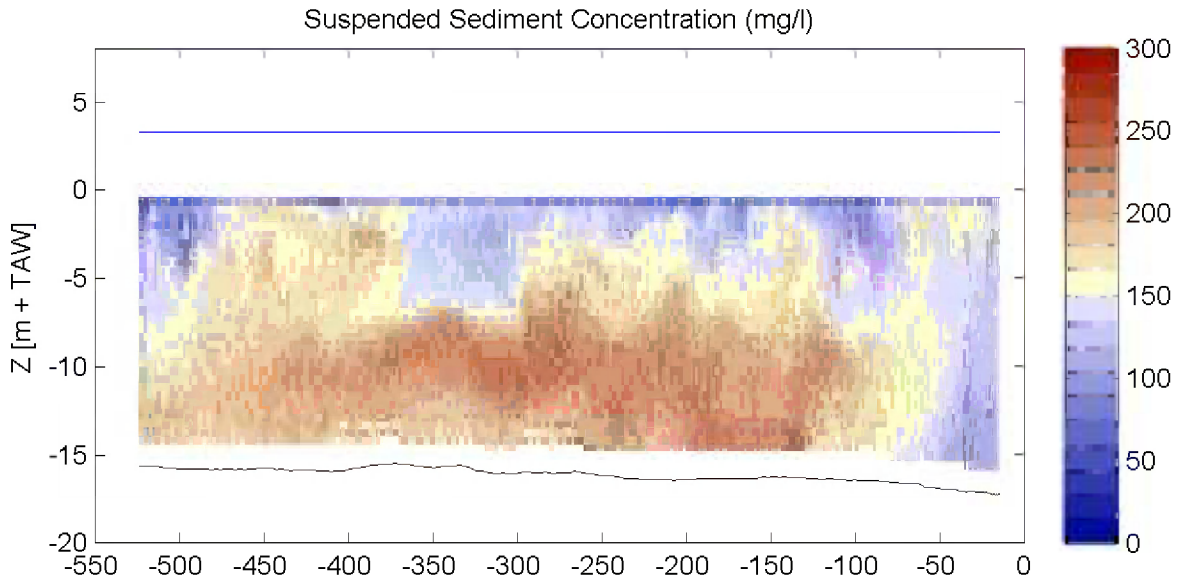
Data Processed by:

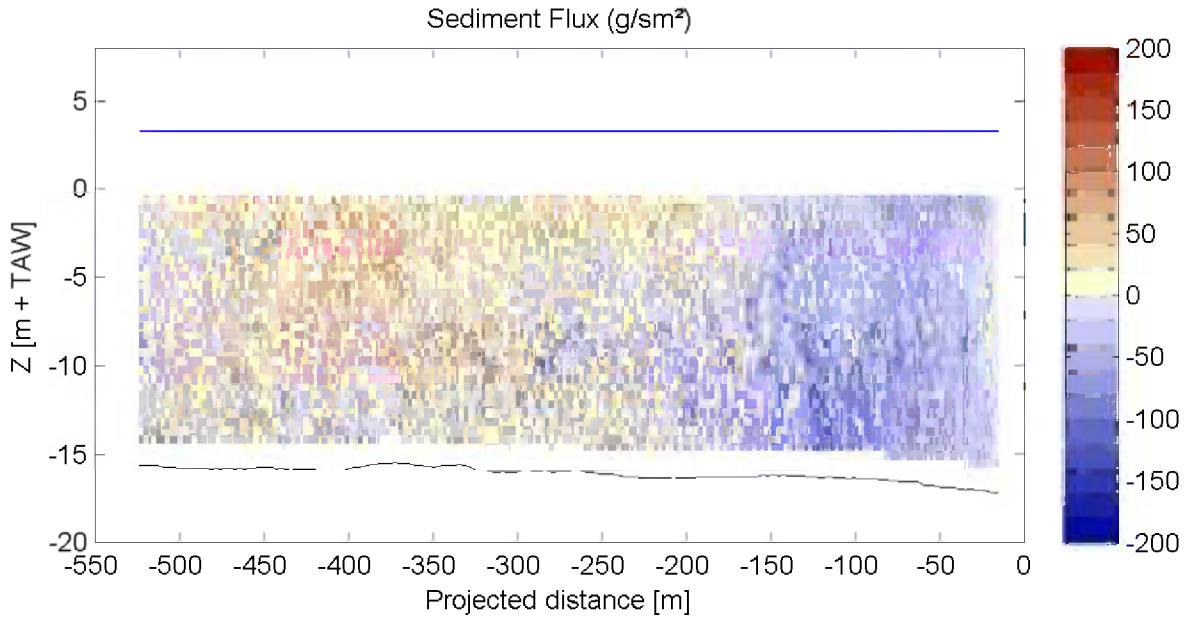
In association with :

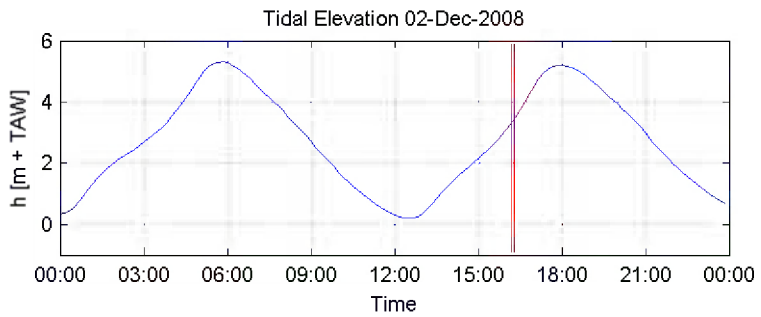
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1084TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:12 - 16:17

Time after HW [HH:MM]

-1:45

Data Processed by:

In association with :

I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
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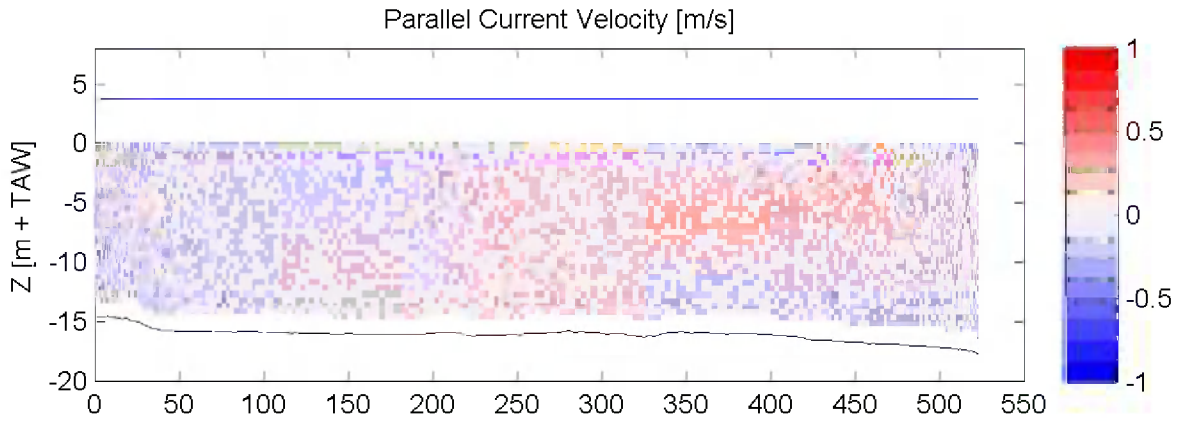
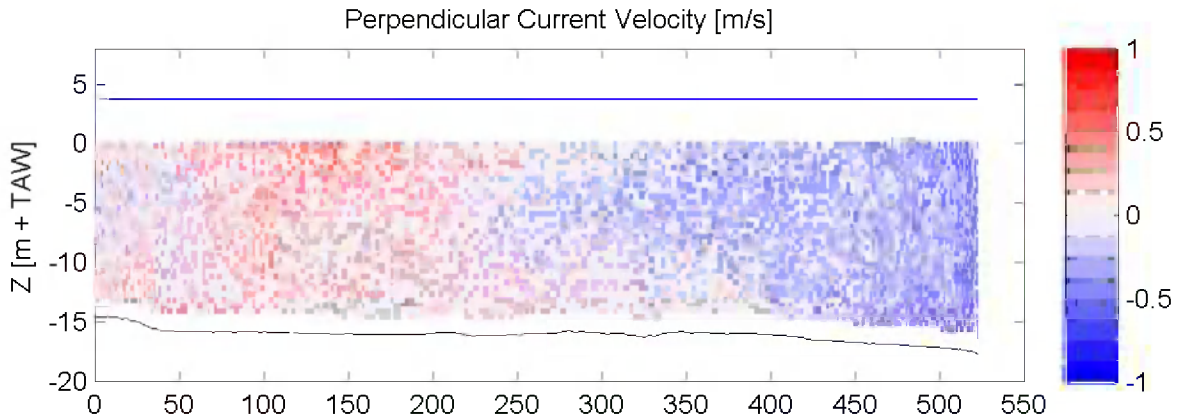
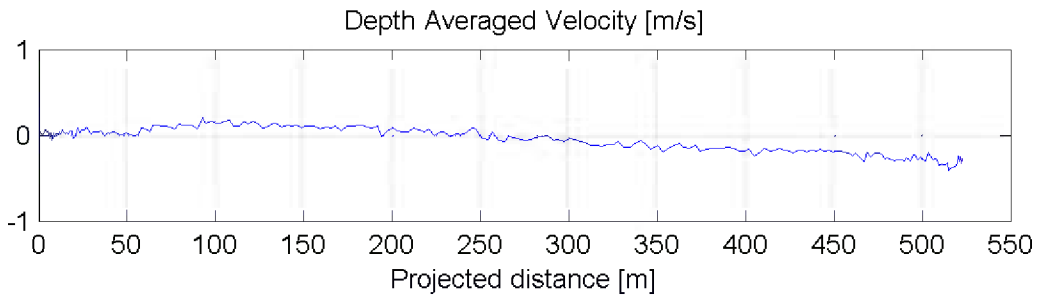
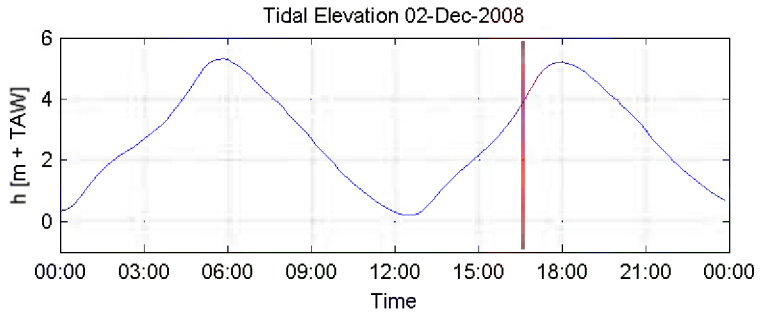
| Sourcefile: 1086TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:33 - 16:39

Time after HW [HH:MM]

-1:23

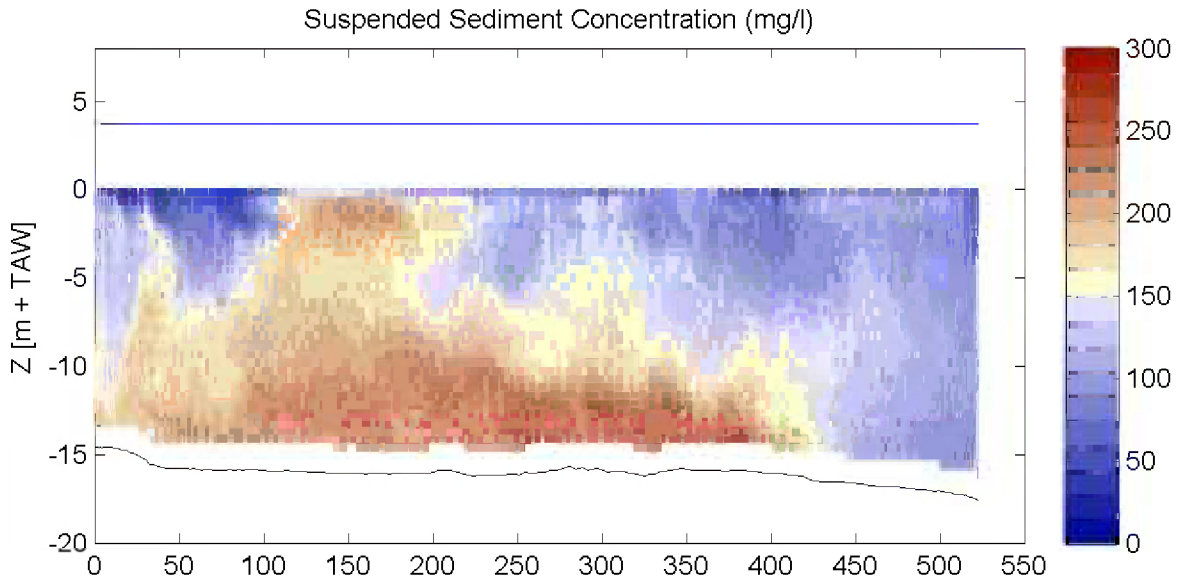
Data Processed by:

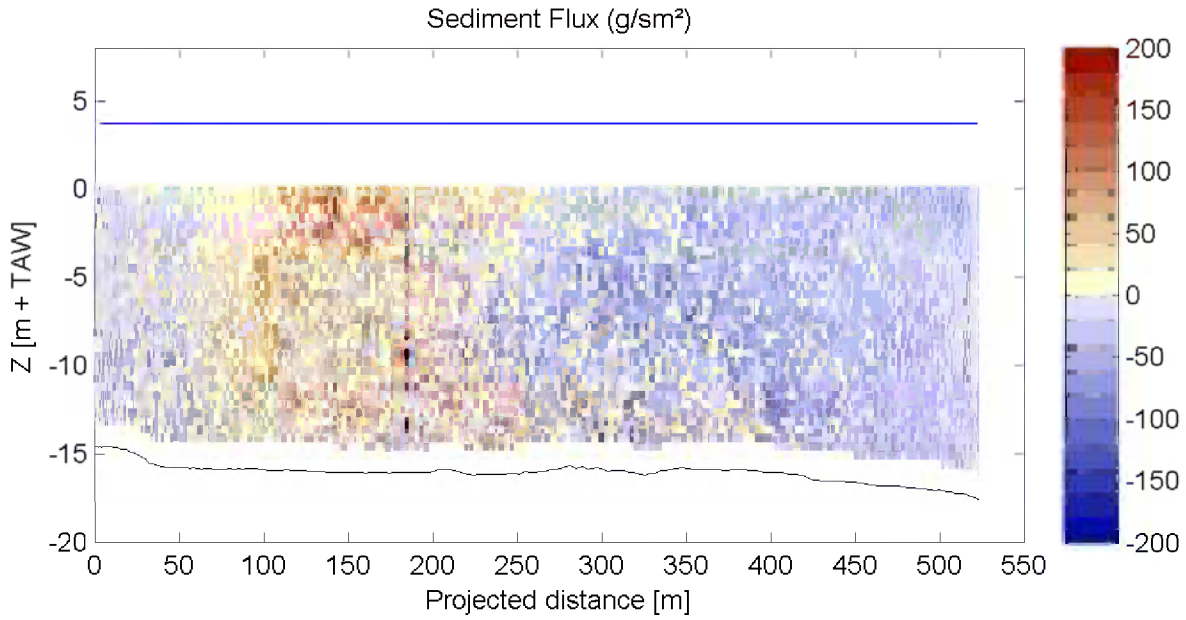
In association with :

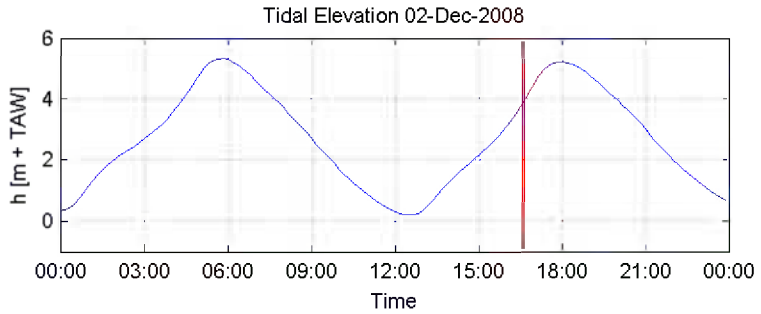
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1086TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:33 - 16:39

Time after HW [HH:MM]

-1:23

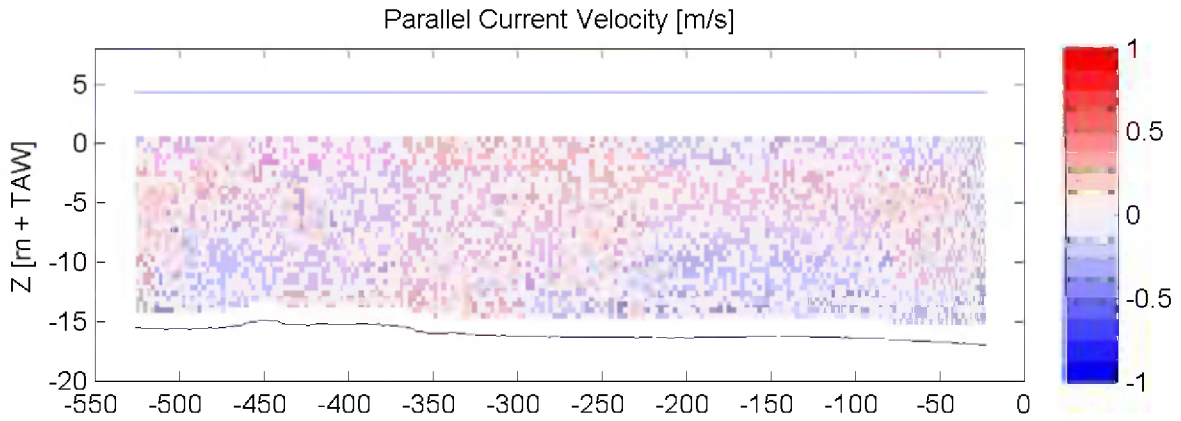
Data Processed by:

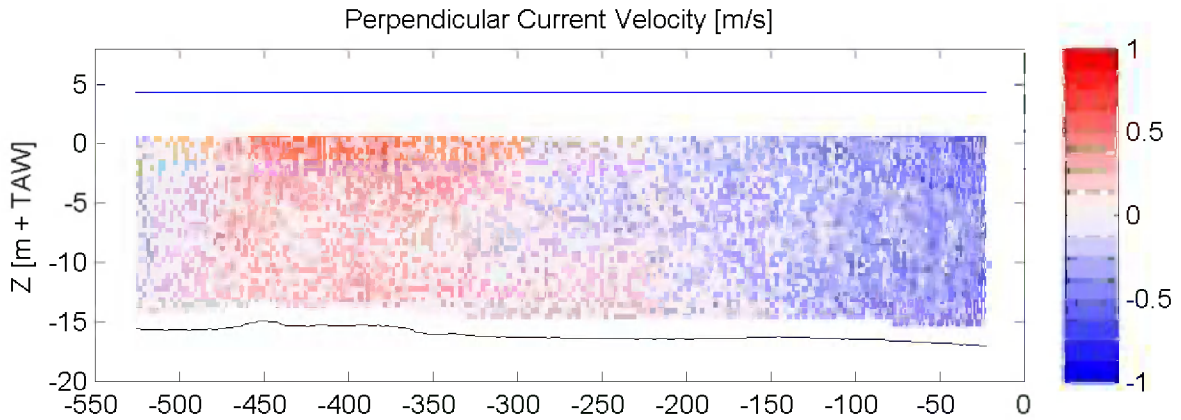
In association with :

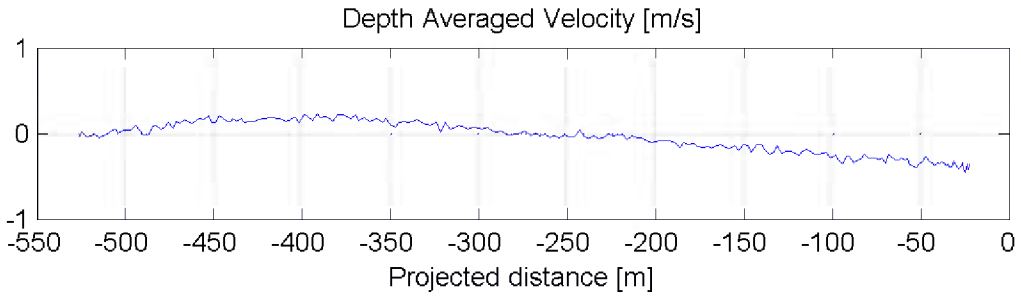
I/RA/11283/08.084/MSA

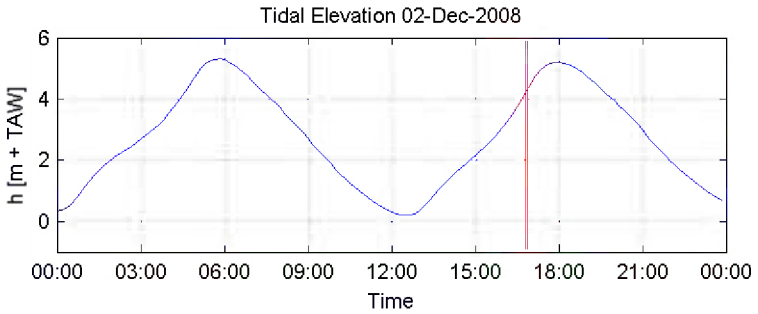
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1088TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:48 - 16:53

Time after HW [HH:MM]

-1:09

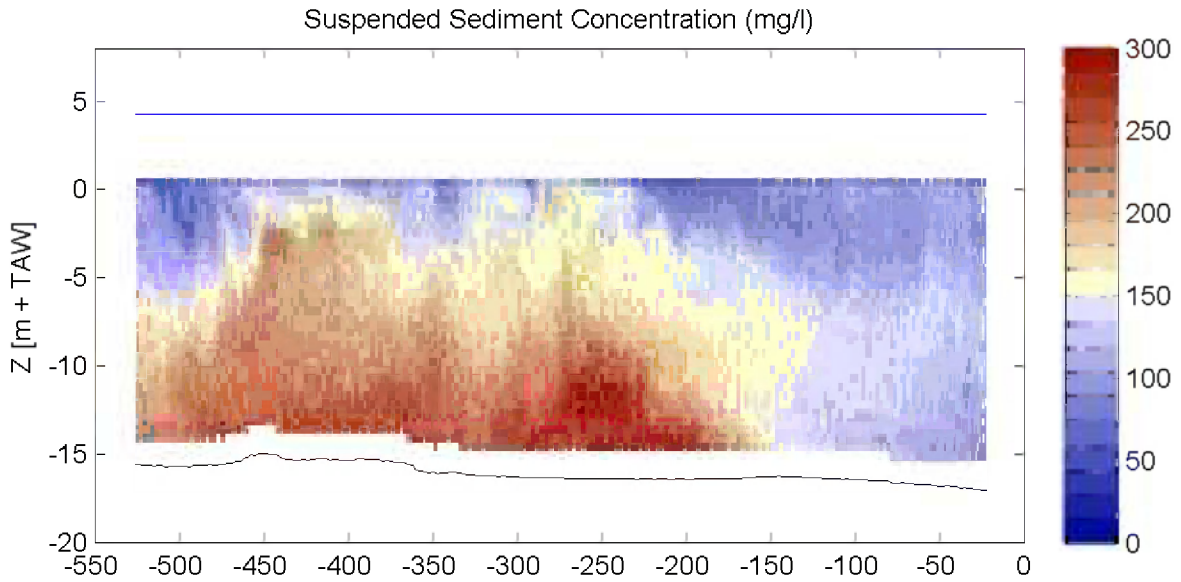
Data Processed by:

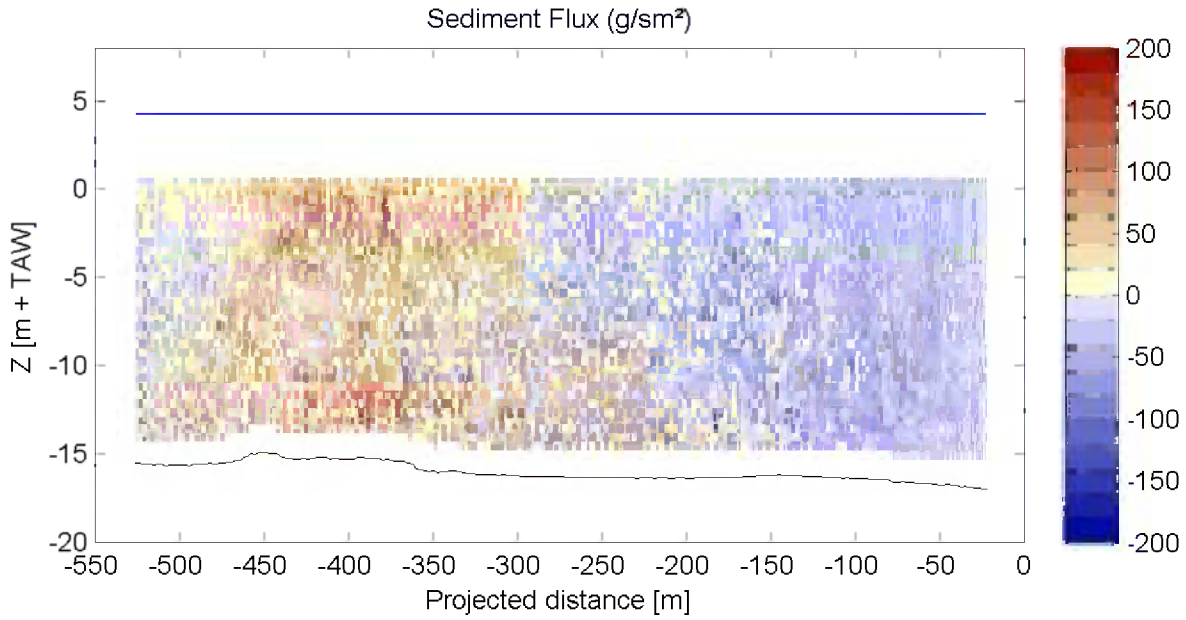
In association with :

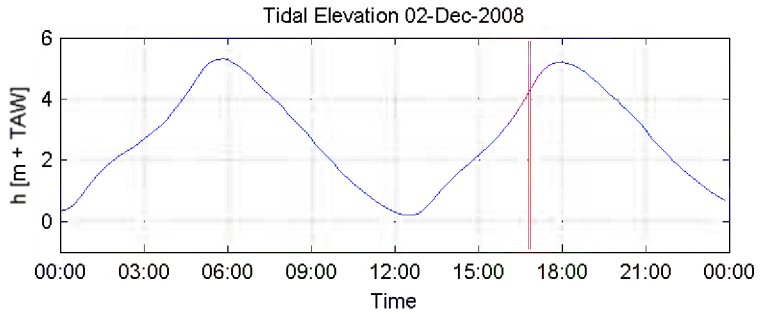
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1088TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

16:48 - 16:53

Time after HW [HH:MM]

-1:09

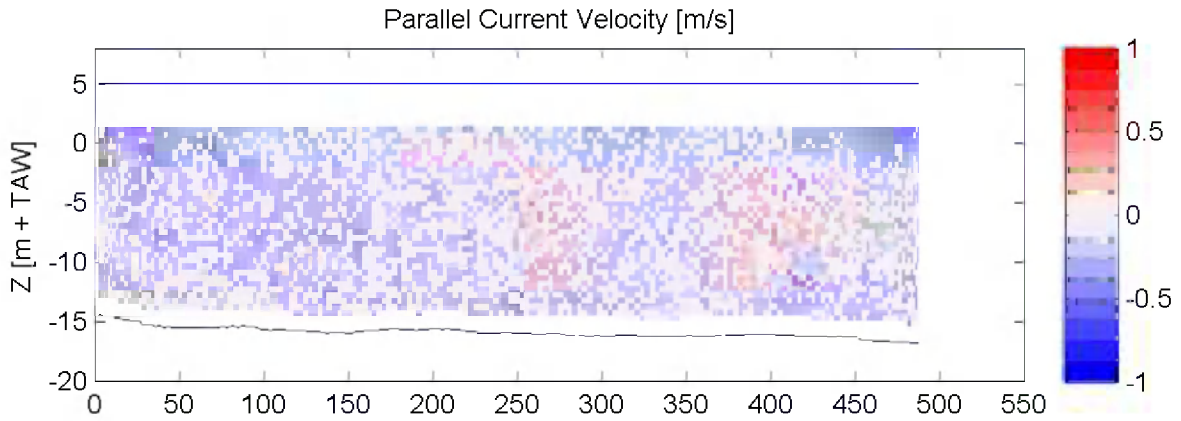
Data Processed by:

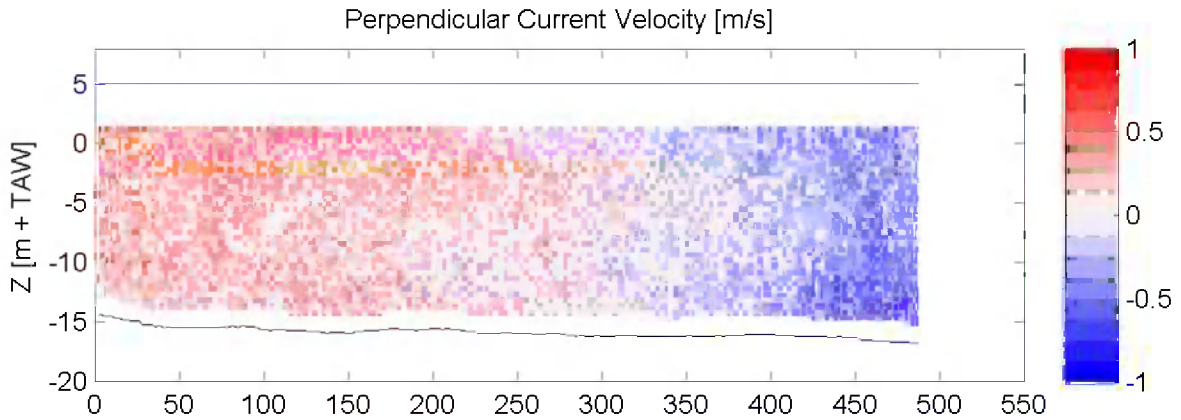
In association with :

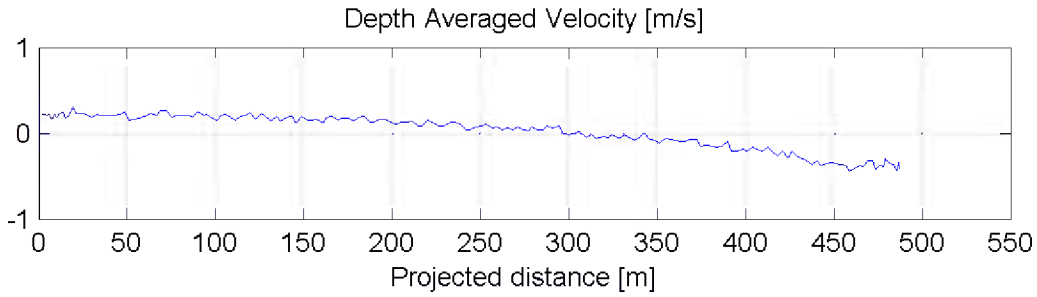
I/RA/11283/08.084/MSA

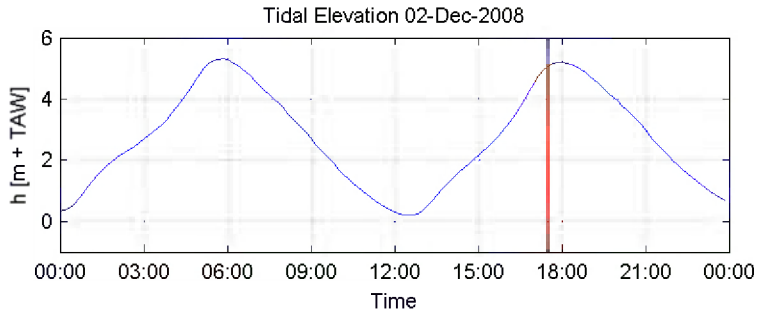
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1090TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:28 - 17:32

Time after HW [HH:MM]

-0:29

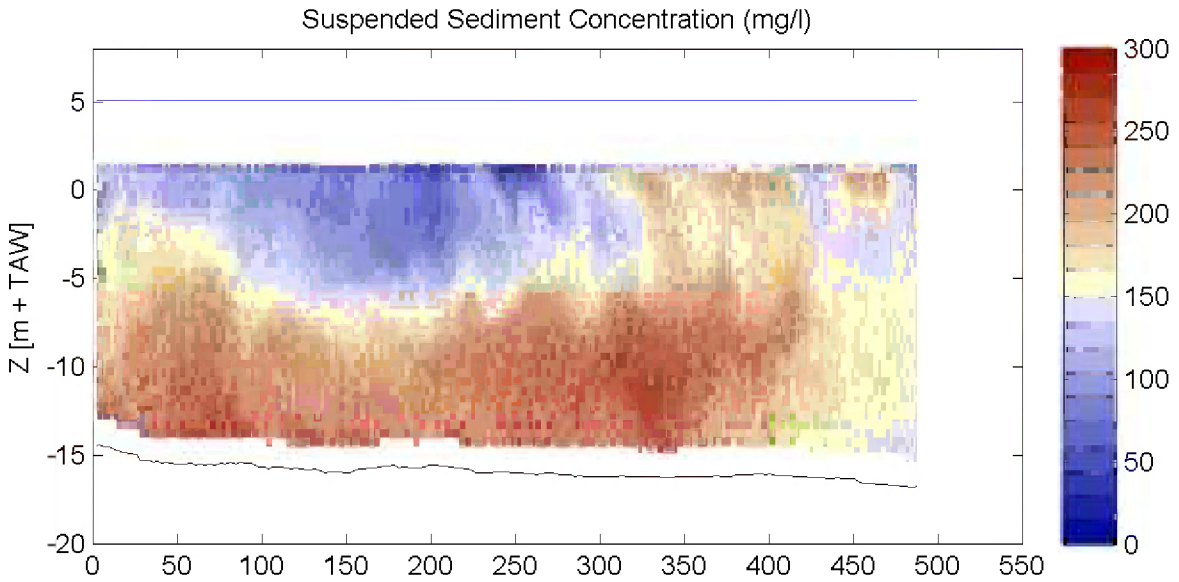
Data Processed by:

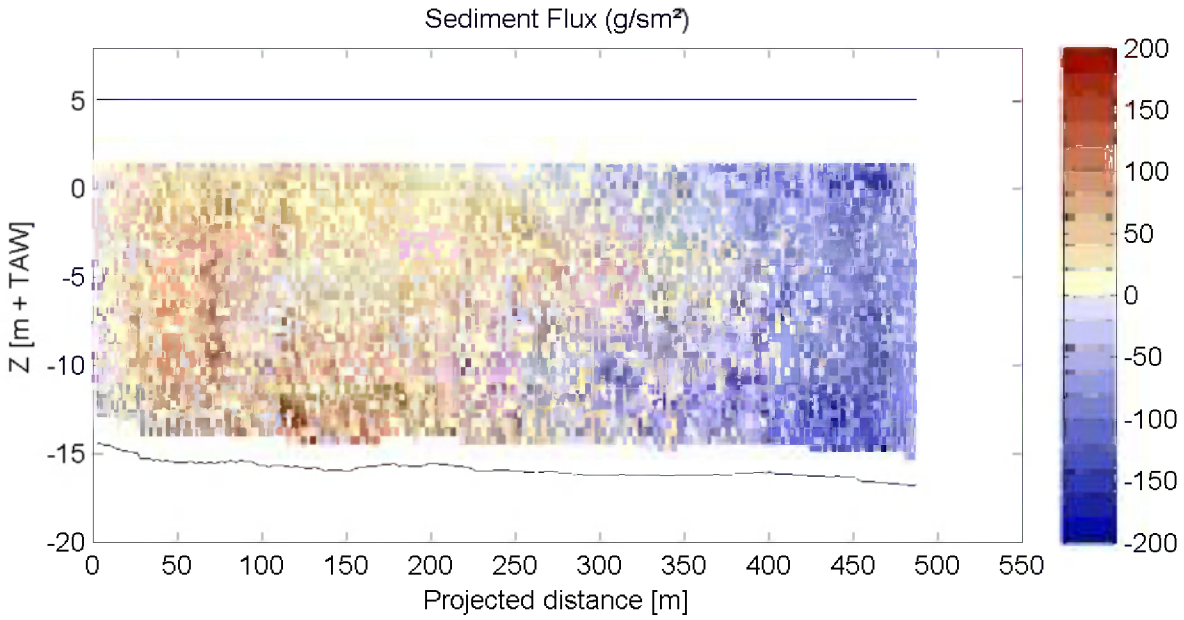
In association with :

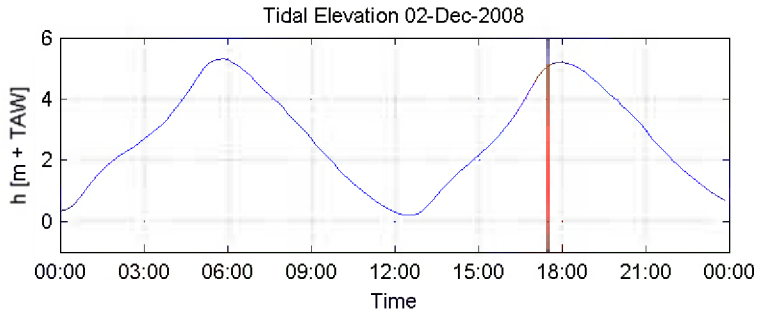
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1090TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:28 - 17:32

Time after HW [HH:MM]

-0:29

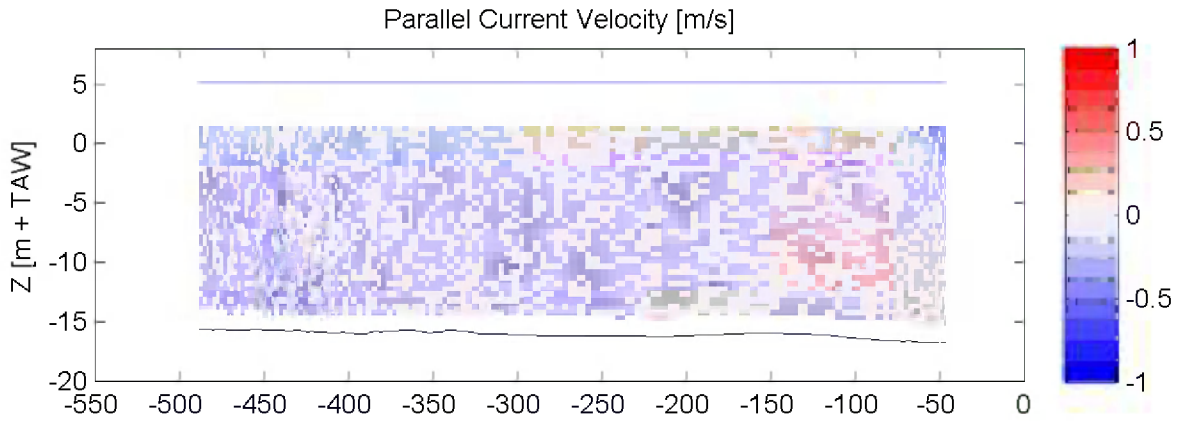
Data Processed by:

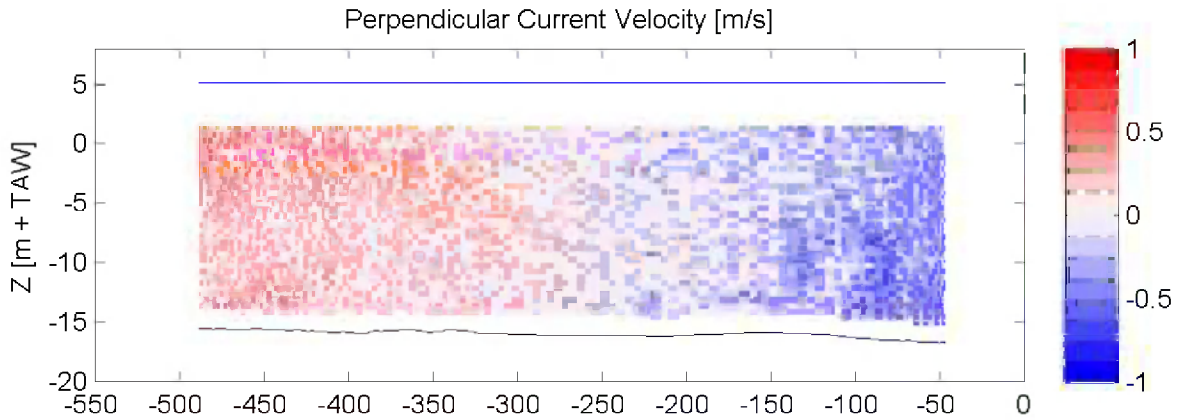
In association with :

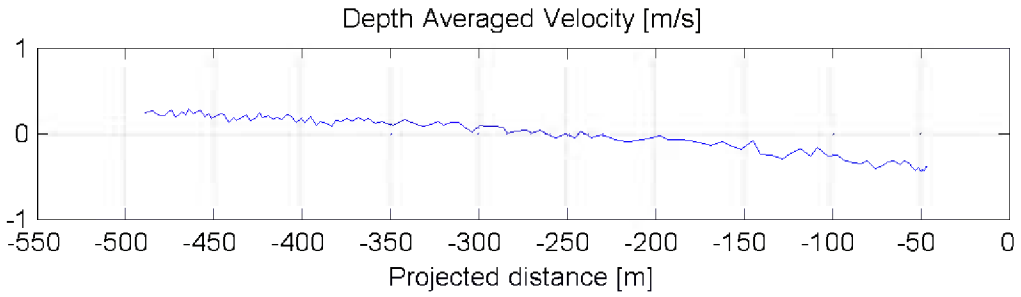
I/RA/11283/08.084/MSA

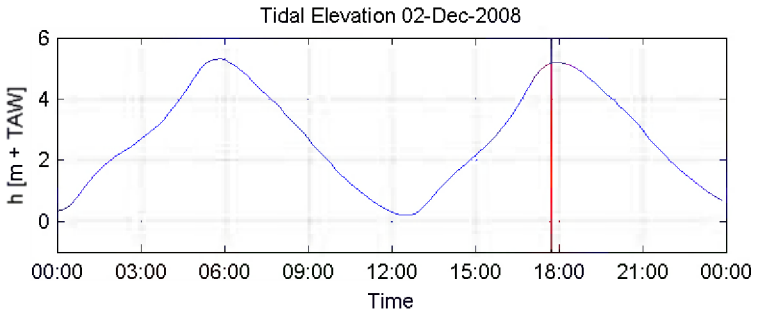
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1092TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:41 - 17:44

Time after HW [HH:MM]

-0:16

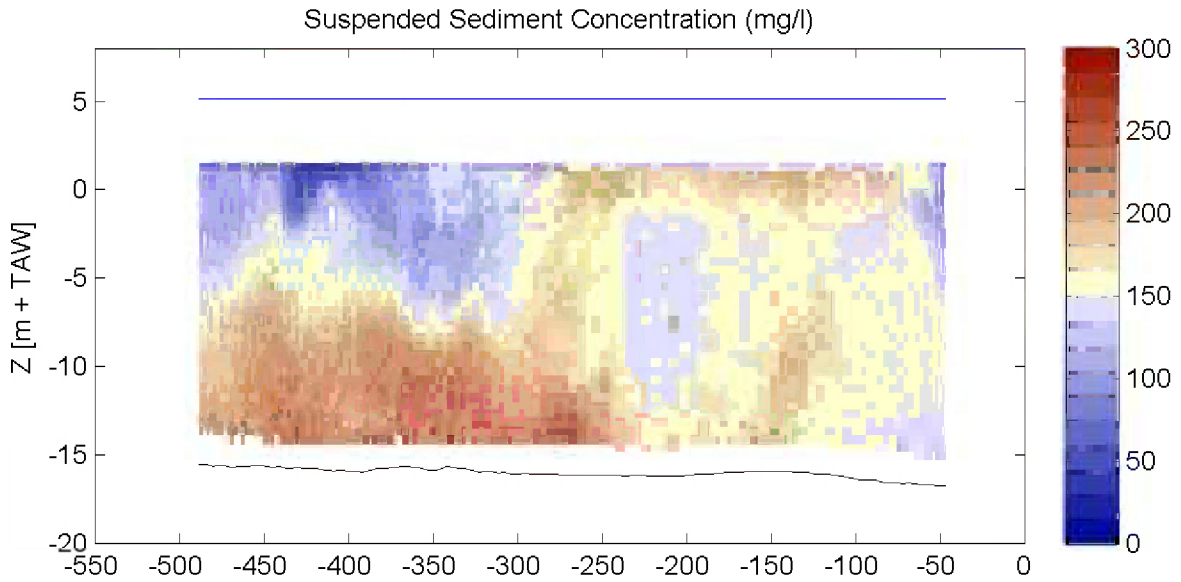
Data Processed by:

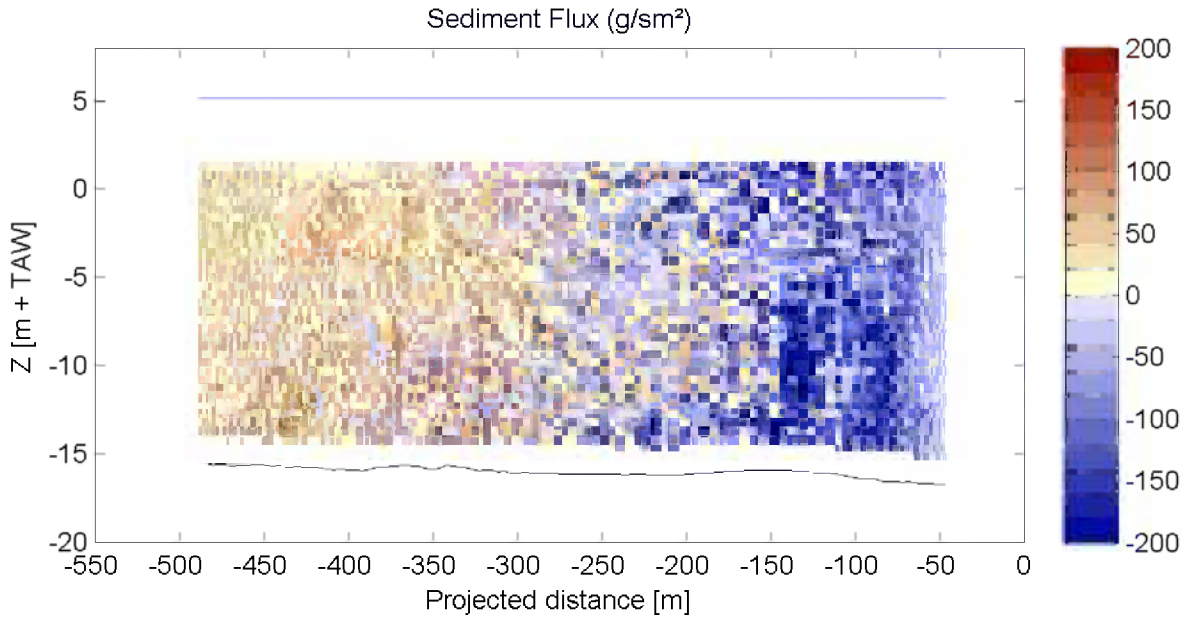
In association with :

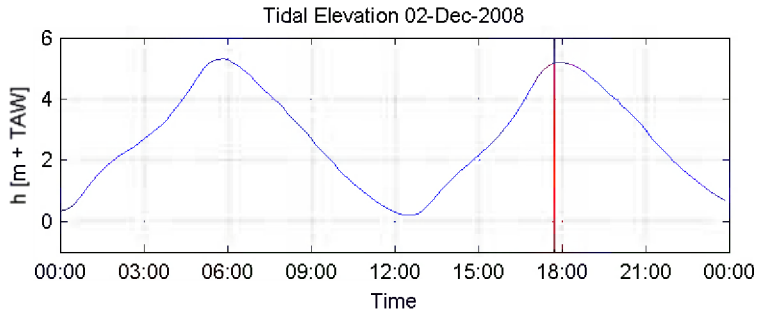
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1092TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:41 - 17:44

Time after HW [HH:MM]

-0:16

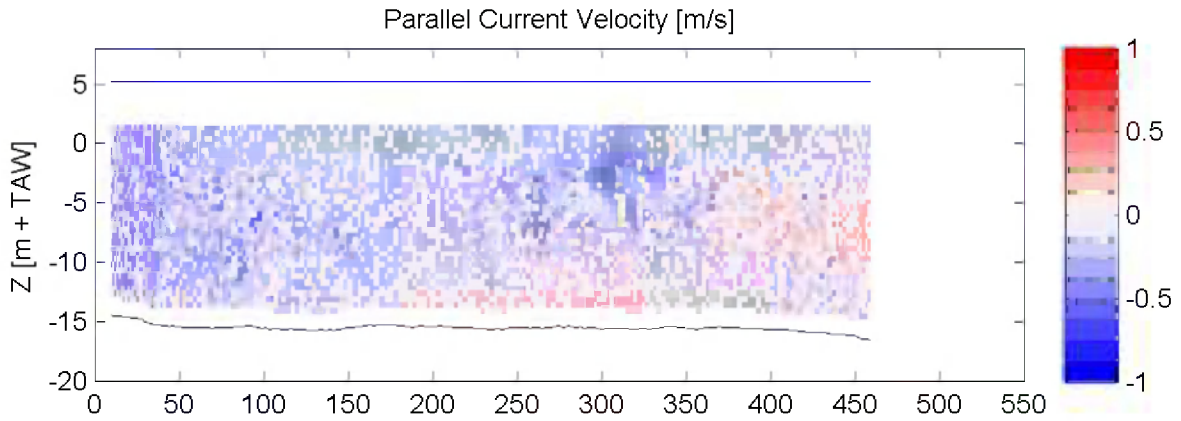
Data Processed by:

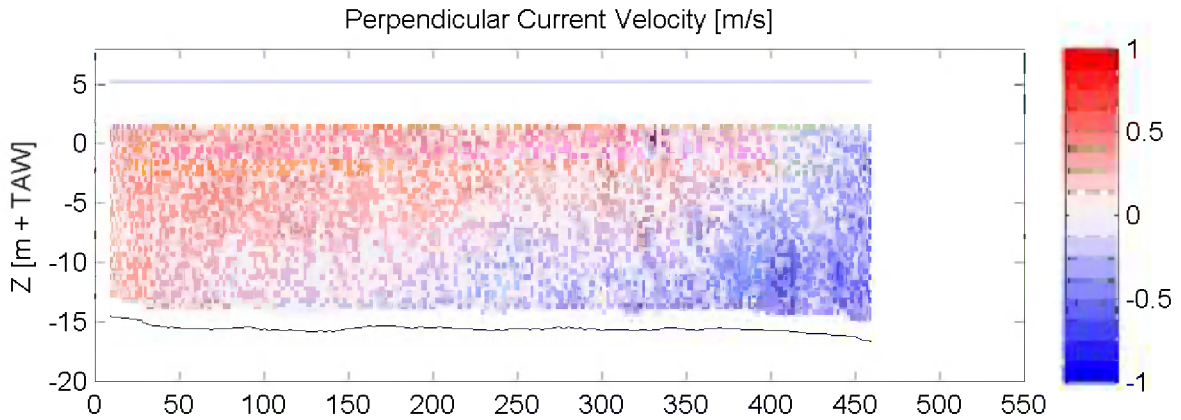
In association with :

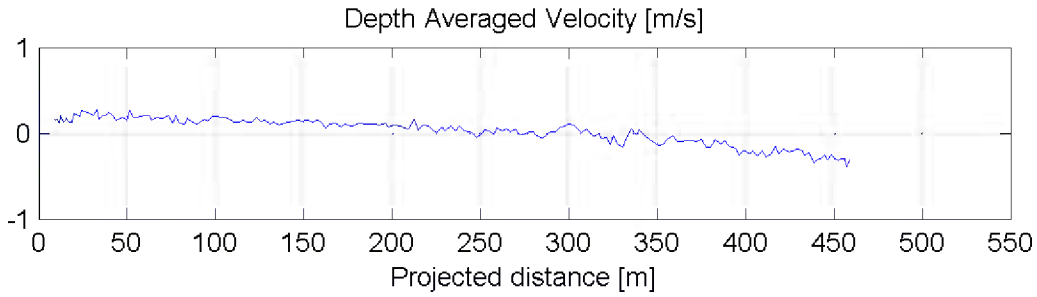
I/RA/11283/08.084/MSA

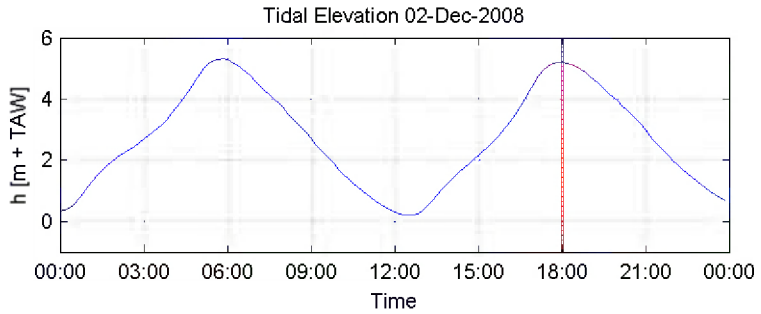
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1094TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:58 - 18:02

Time after HW [HH:MM]

0:00

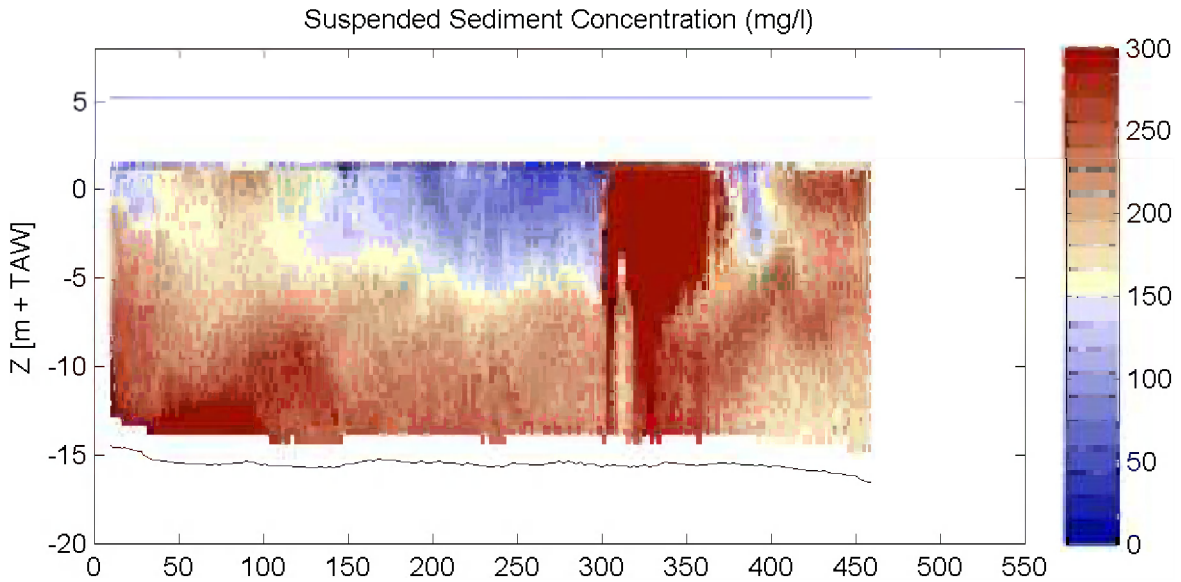
Data Processed by:

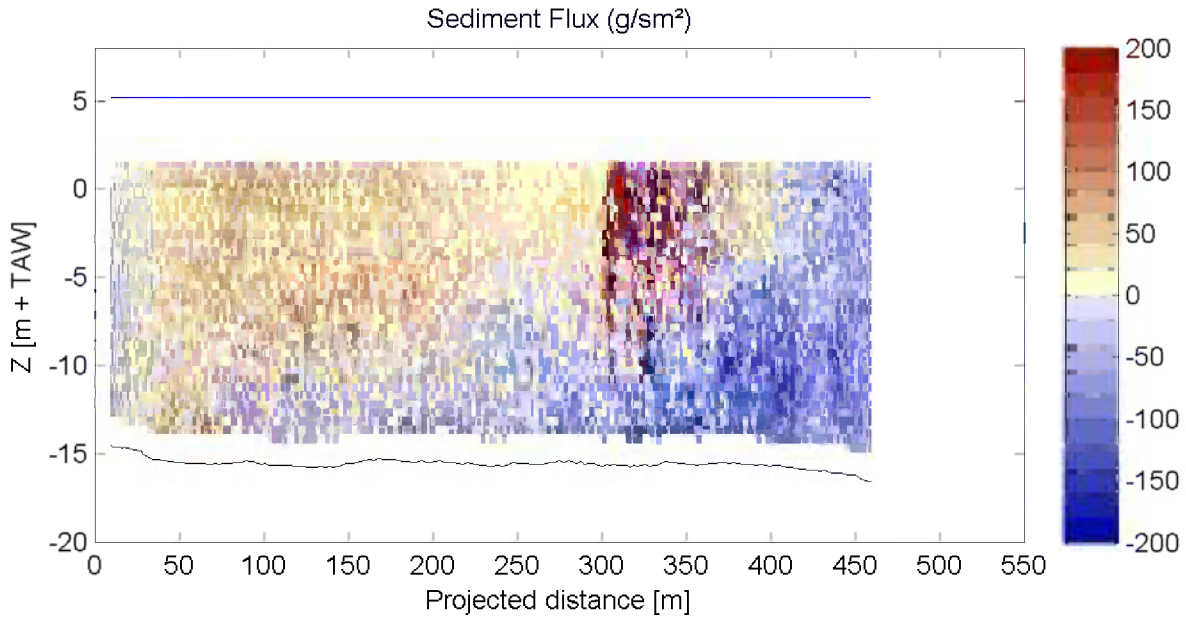
In association with :

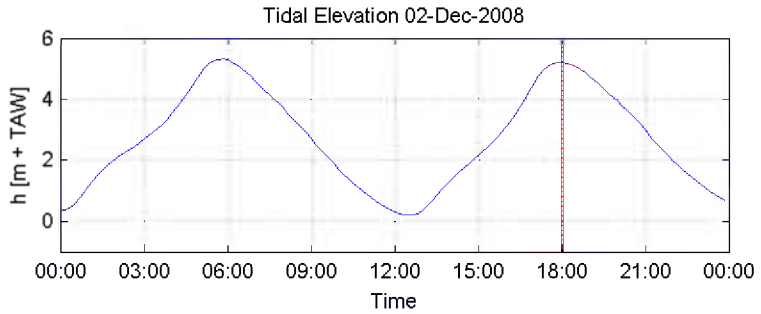
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1094TDGDlr_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

17:58 - 18:02

Time after HW [HH:MM]

0:00

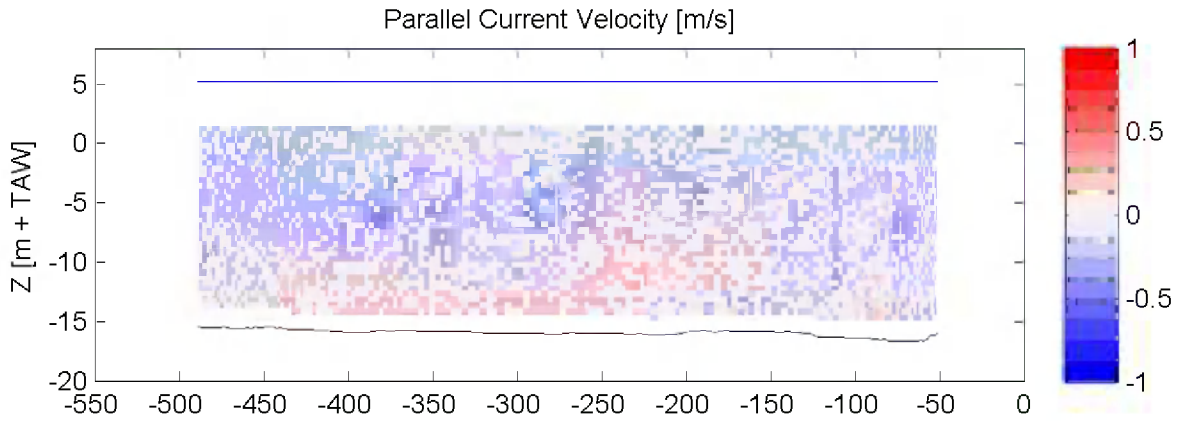
Data Processed by:

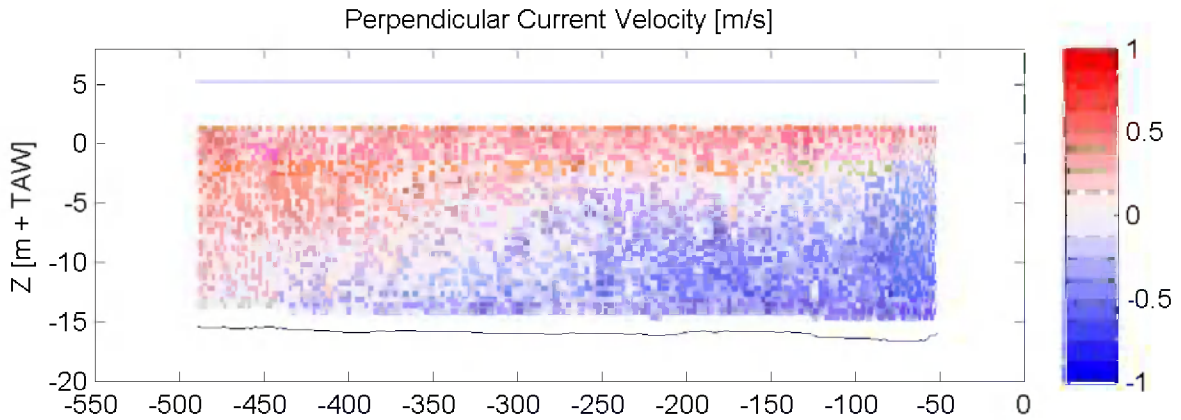
In association with :

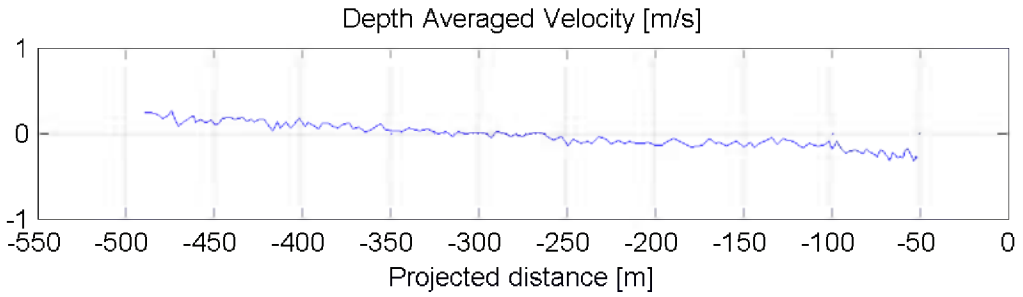
I/RA/11283/08.084/MSA

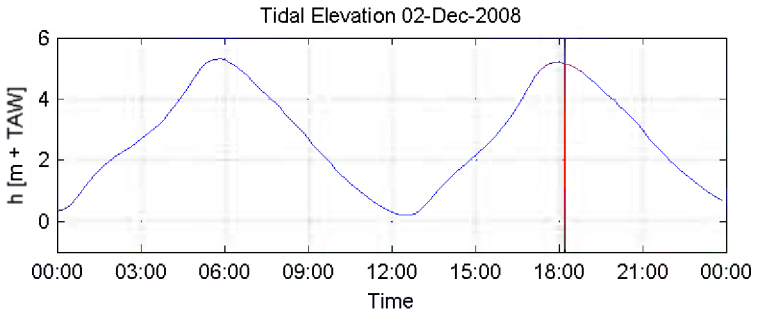
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1096TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:10 - 18:14

Time after HW [HH:MM]

0:12

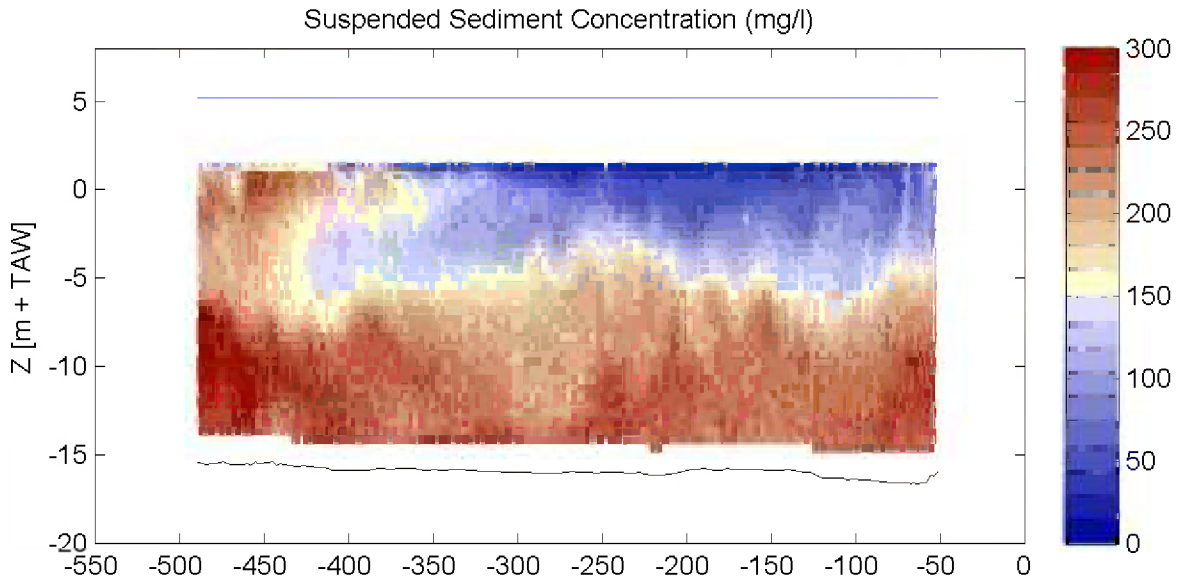
Data Processed by:

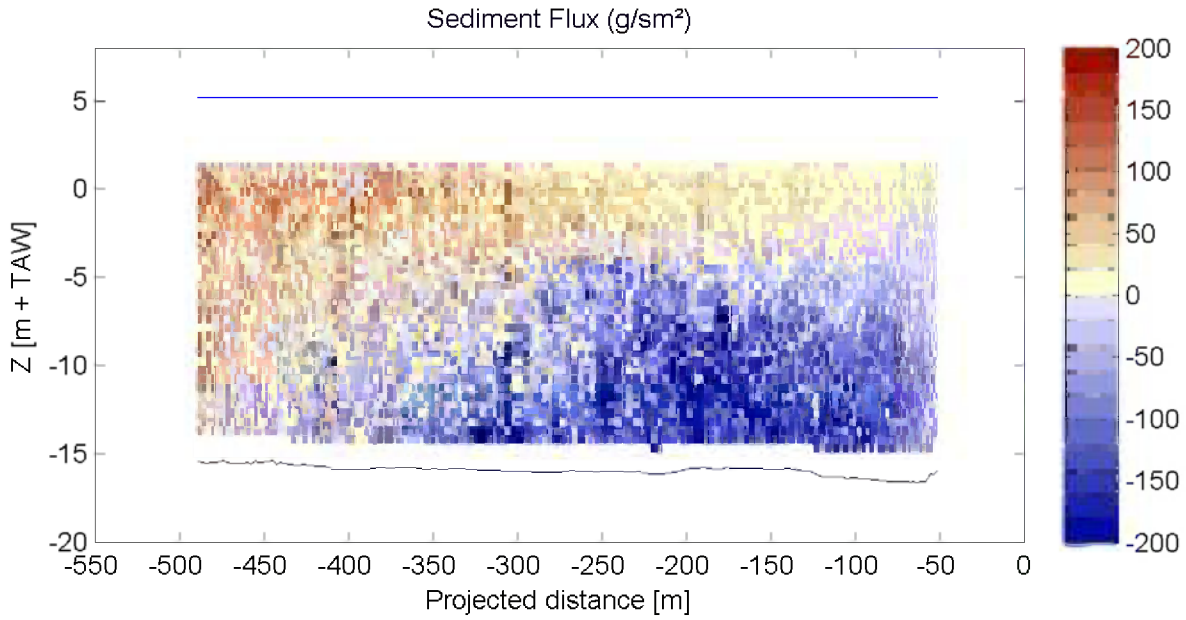
In association with :

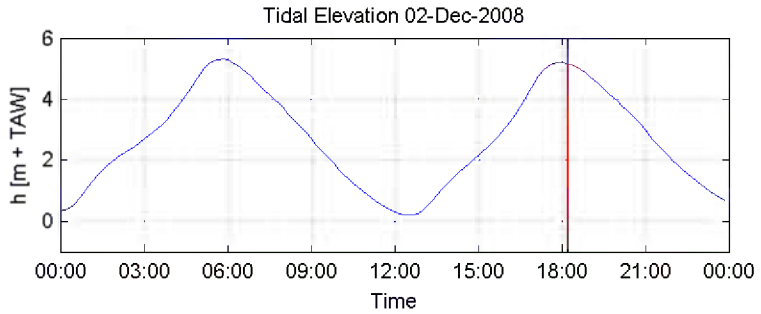
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1096TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:10 - 18:14

Time after HW [HH:MM]

0:12

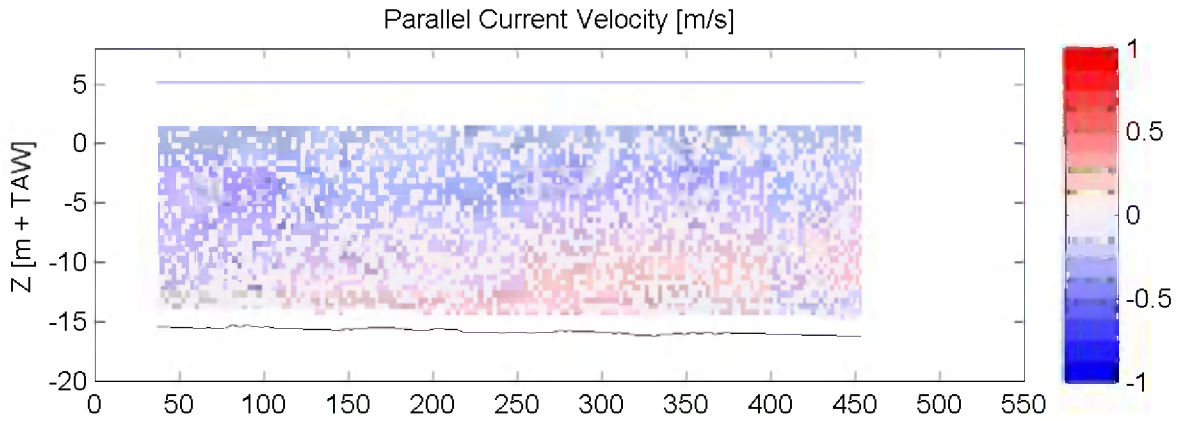
Data Processed by:

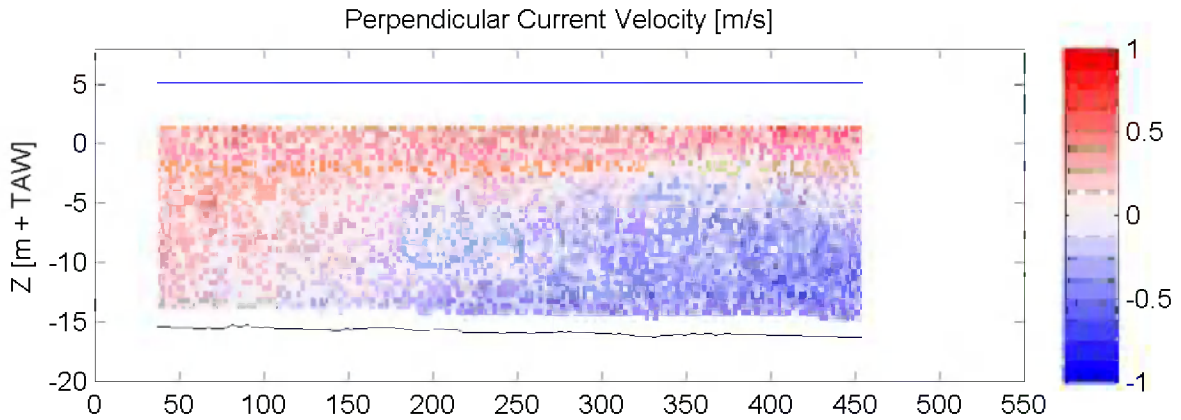
In association with :

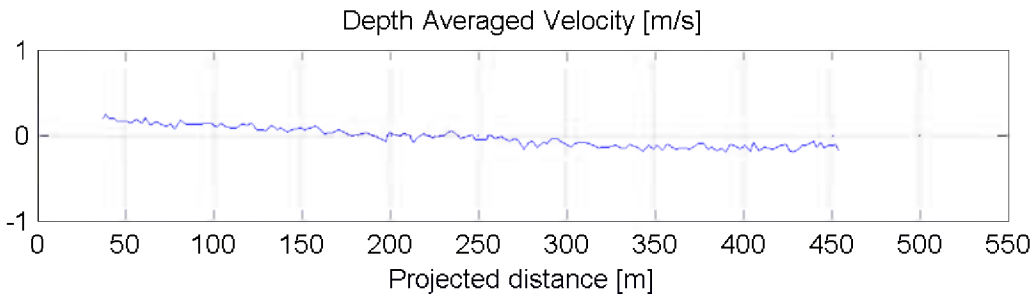
I/RA/11283/08.084/MSA

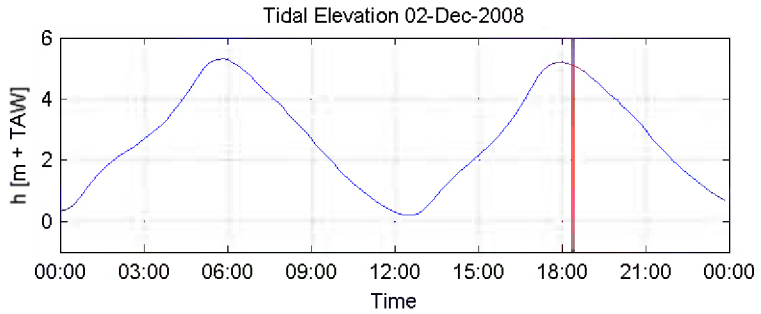
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1098TDGDI_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:21 - 18:24

Time after HW [HH:MM]

0:23

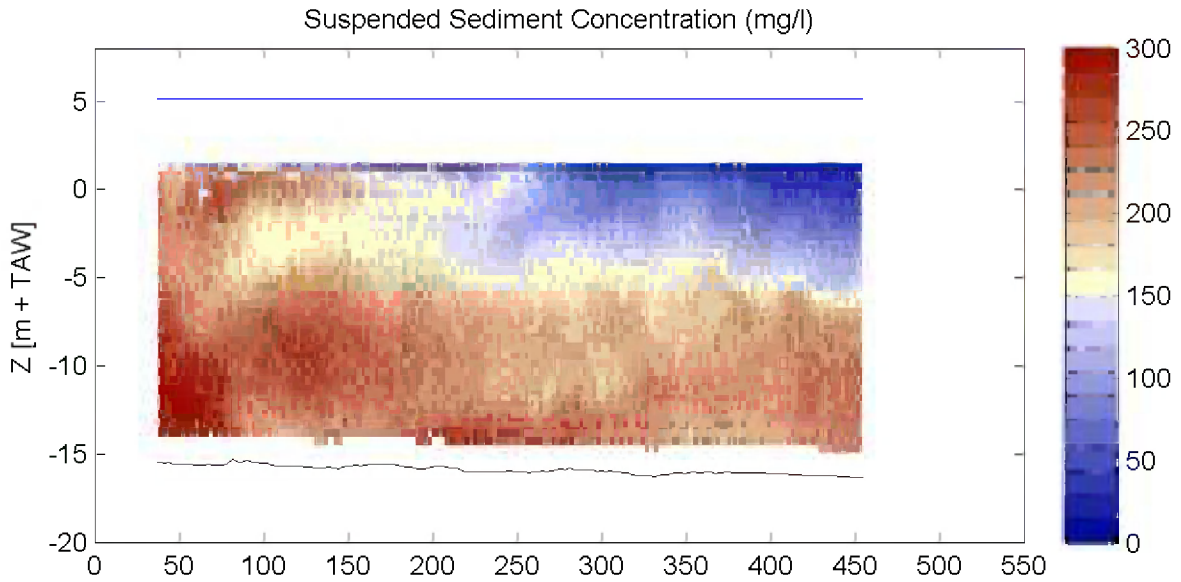
Data Processed by:

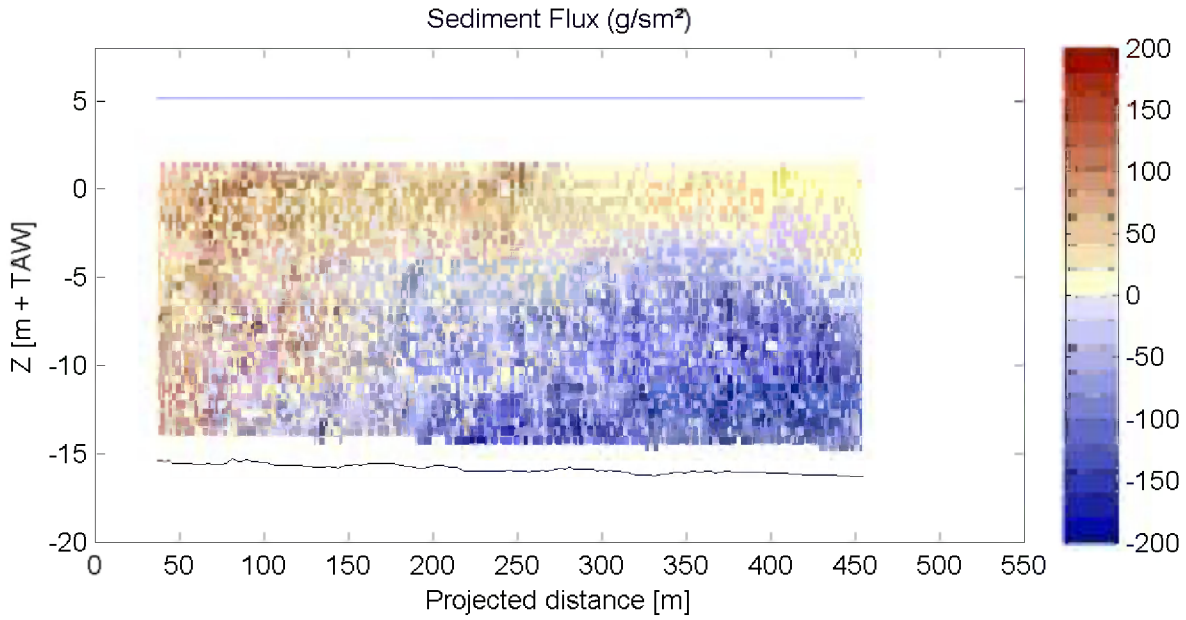
In association with :

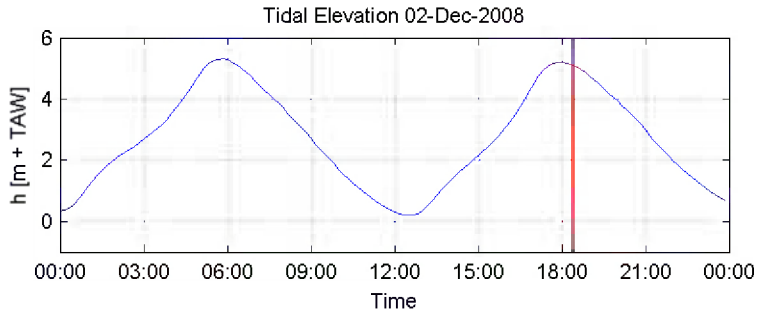
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1098TDGDI_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:21 - 18:24

Time after HW [HH:MM]

0:23

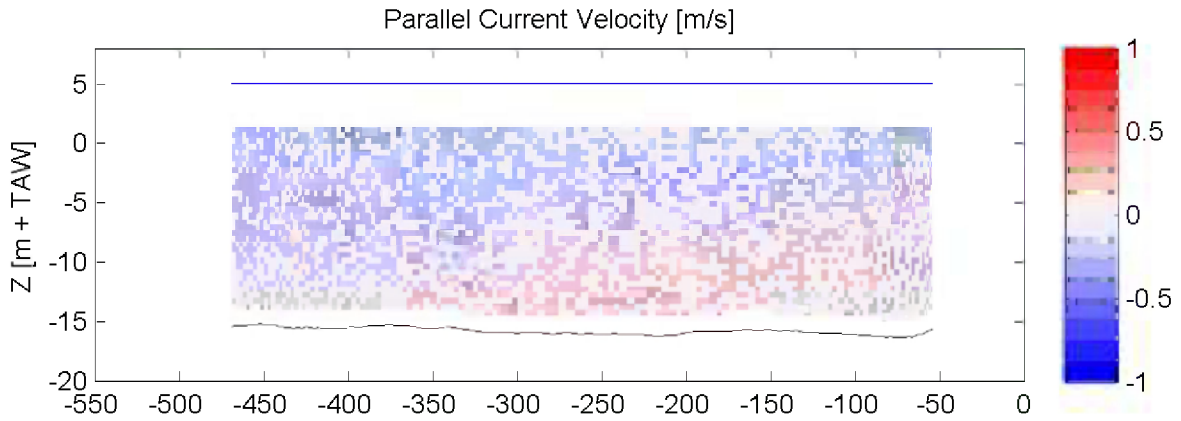
Data Processed by:

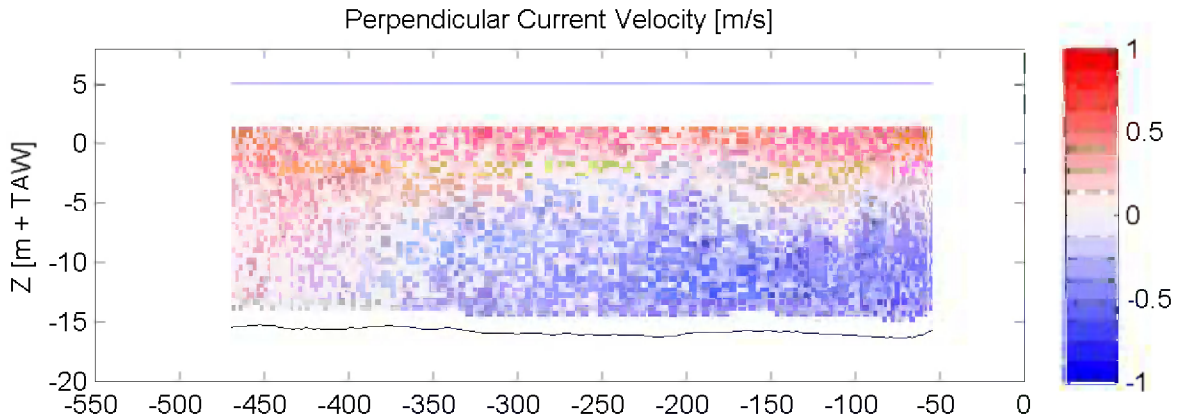
In association with :

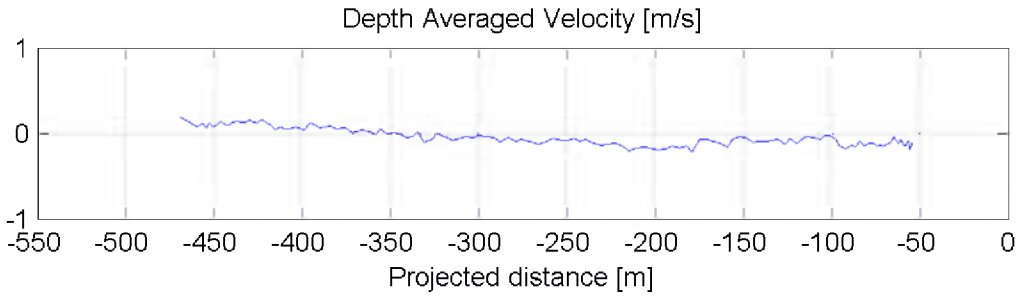
I/RA/11283/08.084/MSA

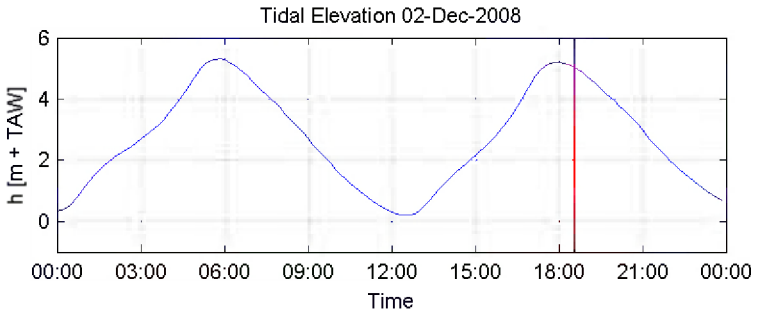
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1100TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:31 - 18:34

Time after HW [HH:MM]

0:33

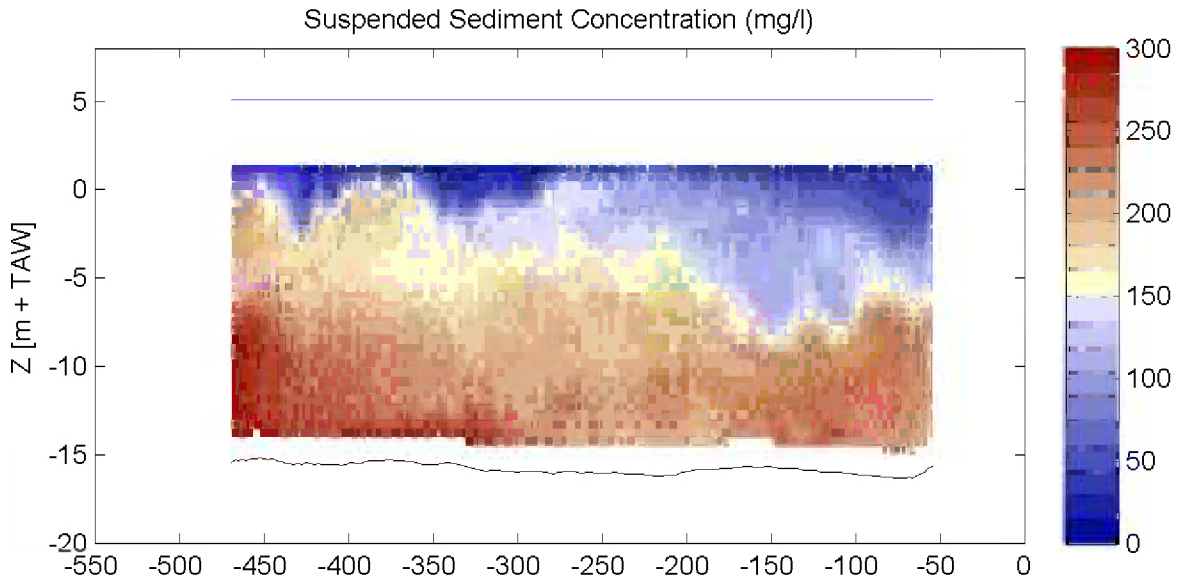
Data Processed by:

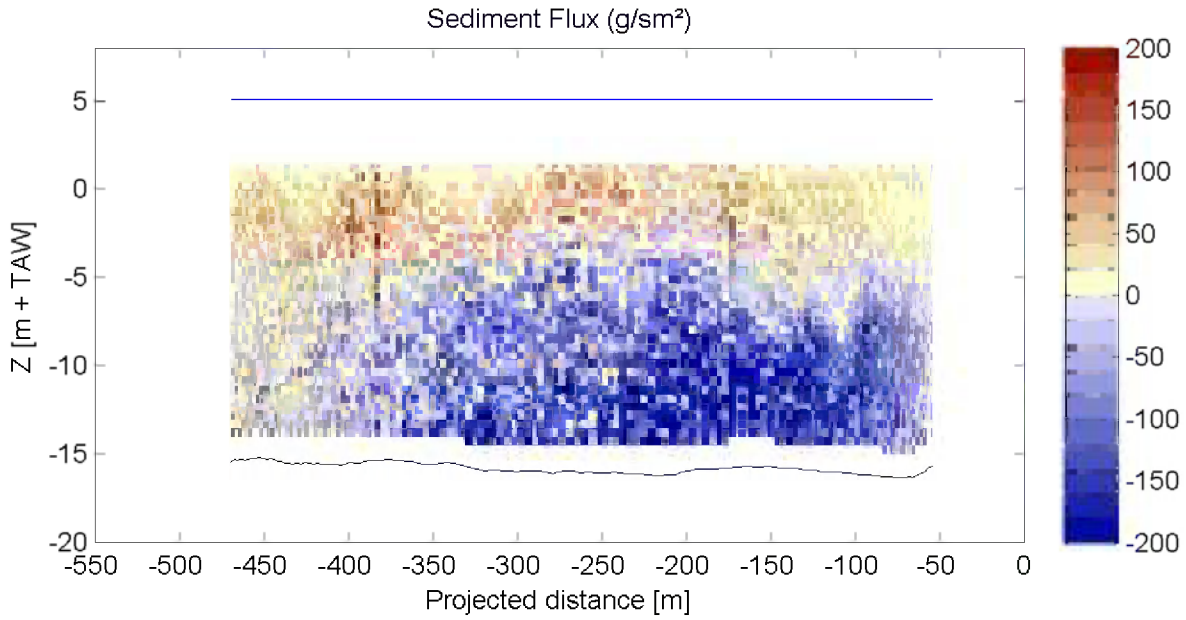
In association with :

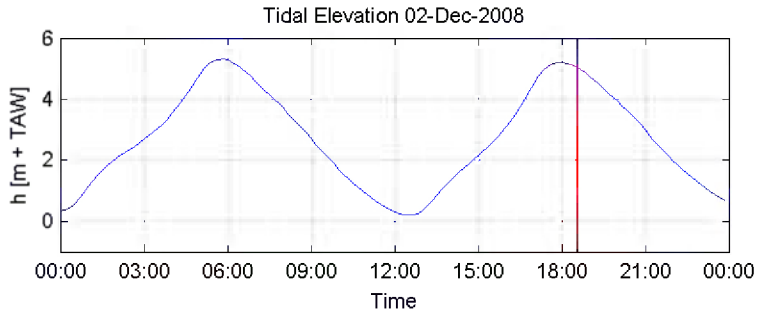
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1100TDGDrl_sub.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:31 - 18:34

Time after HW [HH:MM]

0:33

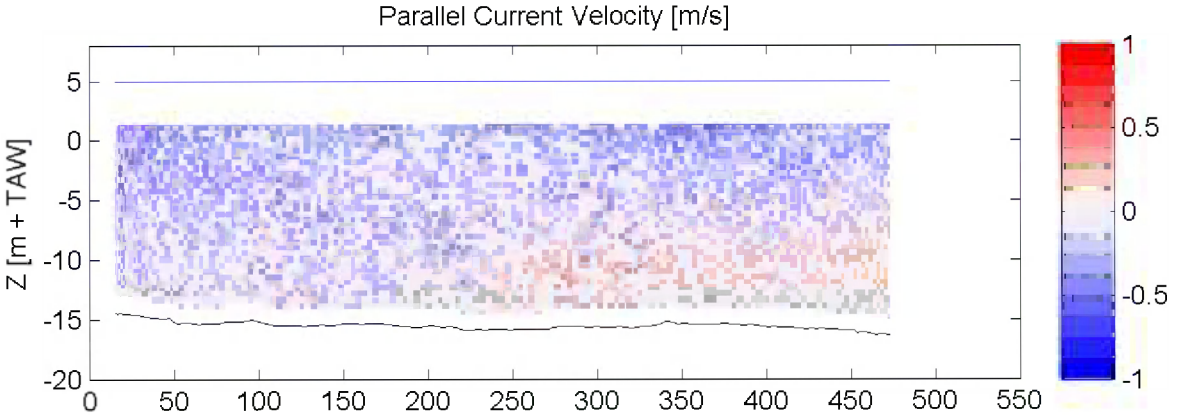
Data Processed by:

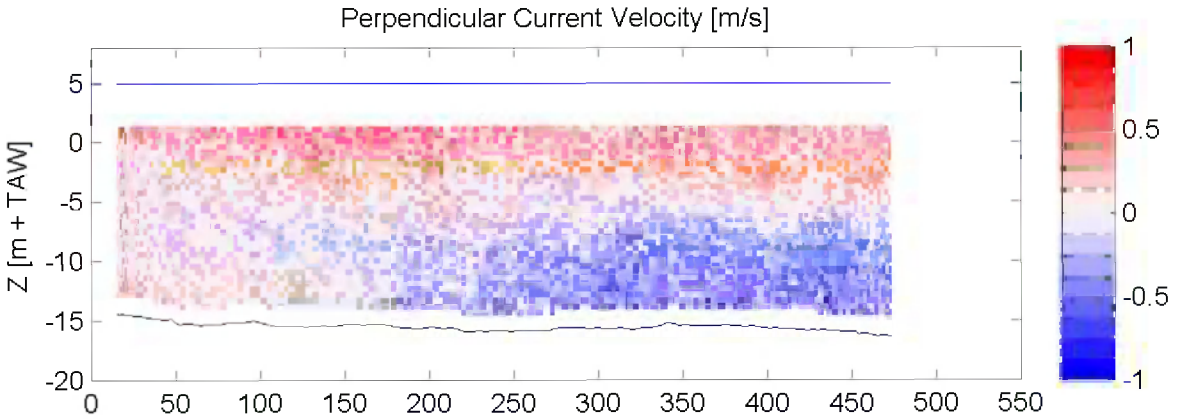
In association with :

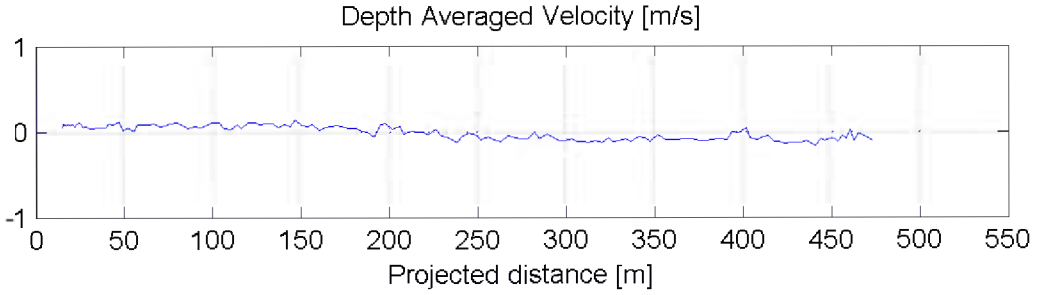
I/RA/11283/08.084/MSA

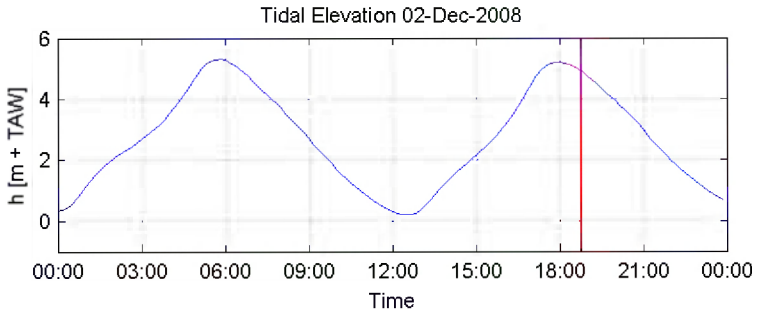
# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1102TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:43 - 18:47

Time after HW [HH:MM]

0:45

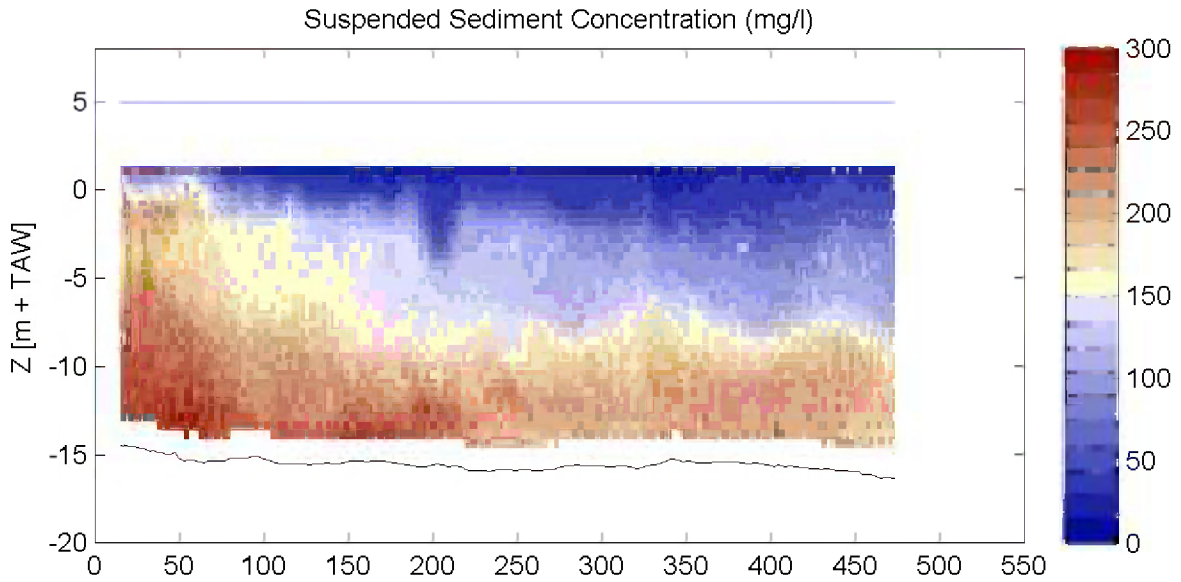
Data Processed by:

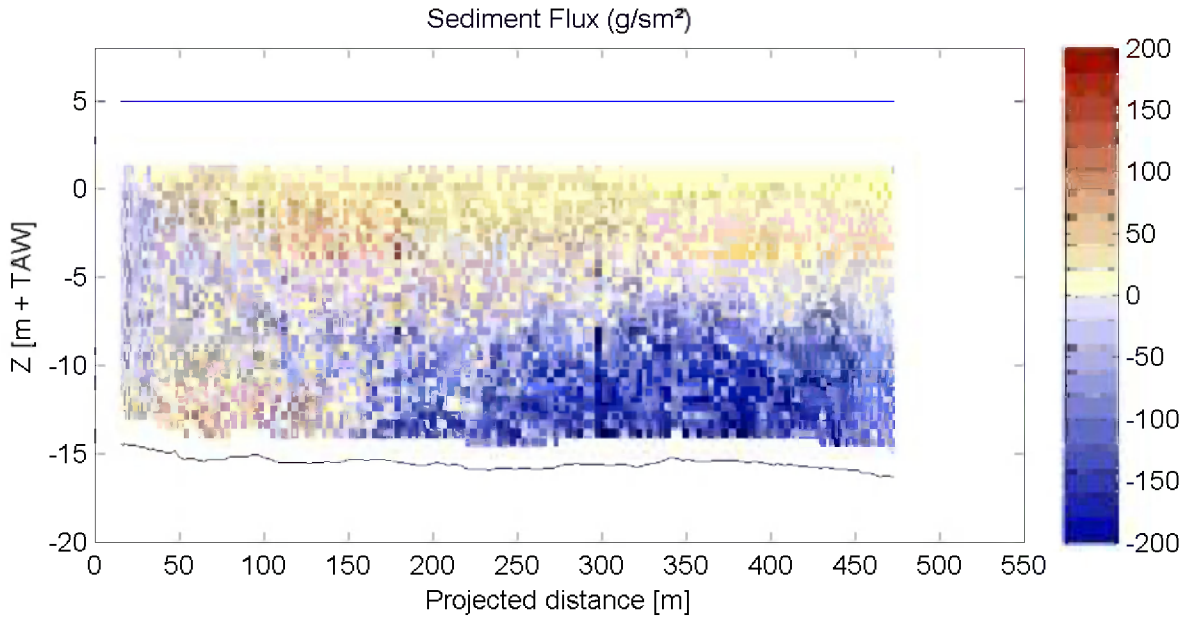
In association with :

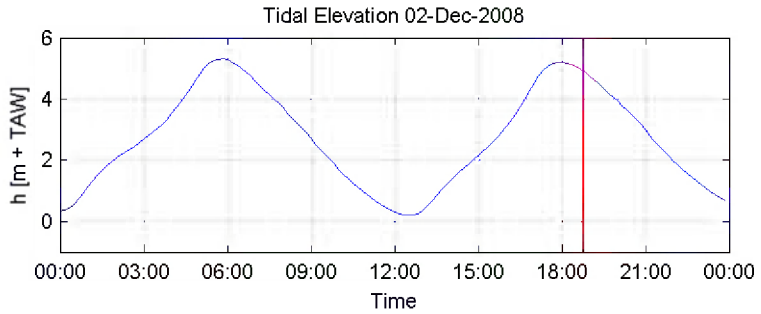
I/RA/11283/08.084/MSA

# Opvolging aanslibbing DGD

| | |
|---|---|
| 11283 | Equipment(s): ADCP |
| Sourcefile: 1102TDGDlr.csv | Location: Deurganckdok |




HW/LW: 05:50: h = 5.31 m+TAW
12:30: h = 0.2 m+TAW
18:00: h = 5.21 m+TAW

Date / Time [MET] :

02-Dec-2008

18:43 - 18:47

Time after HW [HH:MM]

0:45

Data Processed by:

In association with :

I/RA/11283/08.084/MSA

# APPENDIX G. DISCHARGE, SEDIMENT FLUX AND AVERAGE SEDIMENT CONCENTRATION FOR THE TOTAL CROSS-SECTION

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

| Filename | Time after HW [hh:mm] | Time [hh:mm] | Qmid [m3/s] | Qtop [m3/s] | Qbot [m3/s] | Qleft [m3/s] | Qright [m3/s] | Qtot [m3/s] | QVolBal [m3/s] |
|---|---|---|---|---|---|---|---|---|---|
| 1002TDGDlr | 0:36 | 6:26 | 225 | 452 | -167 | 4 | 24 | 537 | 191 |
| 1004TDGDrl | 0:49 | 6:39 | 23 | 385 | -33 | 174 | 25 | 548 | 228 |
| 1006TDGDlr | 1:01 | 6:51 | 92 | 396 | -164 | 57 | 75 | 441 | 249 |
| 1010TDGDlr | 1:30 | 7:20 | -105 | 306 | -84 | 32 | 94 | 312 | 253 |
| 1012TDGDrl | 1:43 | 7:33 | 51 | 326 | -38 | 20 | 85 | 365 | 224 |
| 1014TDGDlr | 1:52 | 7:42 | -61 | 292 | -96 | -48 | 86 | 252 | 245 |
| 1016TDGDrl | 2:03 | 7:53 | -97 | 295 | -63 | 64 | 177 | 288 | 268 |
| 1018TDGDlr | 2:11 | 8:01 | -74 | 291 | -123 | -105 | 62 | 146 | 272 |
| 1020TDGDrl | 2:25 | 8:15 | 44 | 259 | -34 | -30 | 59 | 264 | 272 |
| 1022TDGDlr | 2:40 | 8:30 | 98 | 260 | -20 | -26 | 28 | 346 | 280 |
| 1024TDGDrl | 2:57 | 8:47 | 217 | 245 | -18 | -63 | 37 | 405 | 293 |
| 1026TDGDlr | 3:14 | 9:04 | 18 | 210 | 122 | -22 | 94 | 437 | 289 |
| 1028TDGDrl | 3:27 | 9:17 | 180 | 237 | 18 | -14 | 97 | 475 | 277 |
| 1030TDGDlr | 3:42 | 9:32 | 72 | 156 | 27 | -3 | 102 | 387 | 289 |
| 1032TDGDrl | 4:03 | 9:53 | 132 | 191 | 3 | -36 | 95 | 376 | 272 |
| 1034TDGDlr | 4:15 | 10:05 | 184 | 172 | 11 | -7 | 0 | 368 | 270 |
| 1036TDGDrl | 4:34 | 10:24 | 166 | 116 | 41 | 1 | 59 | 345 | 238 |
| 1038TDGDlr | 4:48 | 10:38 | 108 | 56 | 29 | -17 | 9 | 226 | 215 |
| 1040TDGDrl | 5:03 | 10:53 | 134 | 30 | 41 | -1 | 31 | 217 | 204 |
| 1042TDGDlr | 5:18 | 11:08 | 146 | 11 | 15 | -15 | 25 | 183 | 187 |
| 1044TDGDrlr | 5:38 | 11:28 | 134 | -43 | 69 | -38 | 13 | 163 | 176 |
| 1046TDGDlr | 5:47 | 11:37 | 204 | -66 | 72 | 41 | 10 | 236 | 153 |
| 1048TDGDrl | 5:59 | 11:49 | 213 | -74 | 85 | -38 | 54 | 220 | 139 |

| Filename | Time after HW [hh:mm] | Time [hh:mm] | Qmid [m3/s] | Qtop [m3/s] | Qbot [m3/s] | Qleft [m3/s] | Qright [m3/s] | Qtot [m3/s] | QVolBal [m3/s] |
|---|---|---|---|---|---|---|---|---|---|
| 1050TDGDlr | 6:14 | 12:04 | 137 | -139 | 76 | -1 | 25 | 126 | 88 |
| 1052TDGDrl | 6:28 | 12:18 | 160 | -173 | 118 | -1 | 20 | 112 | 59 |
| 1054TDGDlr | -5:27 | 12:32 | 198 | -257 | 114 | 0 | 23 | 64 | 4 |
| 1056TDGDrl | -5:12 | 12:47 | 90 | -263 | 122 | 0 | 1 | -66 | -103 |
| 1058TDGDlr | -4:59 | 13:00 | -86 | -299 | 105 | 0 | 4 | -260 | -217 |
| 1060TDGDrl | -4:44 | 13:15 | -124 | -322 | 41 | -26 | 19 | -388 | -289 |
| 1062TDGDlr | -4:31 | 13:28 | -139 | -284 | 62 | -5 | -39 | -386 | -299 |
| 1064TDGDrl | -4:19 | 13:40 | -83 | -281 | 80 | 3 | 0 | -322 | -298 |
| 1066TDGDlr | -3:56 | 14:03 | -193 | -262 | 81 | 3 | -32 | -384 | -240 |
| 1068TDGDrl | -3:43 | 14:16 | -157 | -291 | 45 | 1 | -9 | -371 | -238 |
| 1070TDGDlr | -3:31 | 14:28 | -53 | -185 | 97 | 21 | -65 | -240 | -224 |
| 1072TDGDrl | -3:7 | 14:52 | -218 | -142 | 72 | 2 | -6 | -283 | -224 |
| 1074TDGDlr | -2:52 | 15:07 | -223 | -229 | 105 | 16 | -14 | -344 | -233 |
| 1076TDGDrl | -2:40 | 15:19 | -164 | -97 | 45 | 33 | -213 | -380 | -237 |
| 1078TDGDlr | -2:25 | 15:34 | -247 | -16 | 19 | 7 | -117 | -366 | -270 |
| 1080TDGDrl | -2:10 | 15:49 | -82 | 62 | -104 | 27 | -286 | -365 | -289 |
| 1082TDGDlr | -1:56 | 16:03 | -98 | 71 | -45 | 6 | -234 | -368 | -330 |
| 1084TDGDrl | -1:45 | 16:14 | -409 | -26 | -90 | -1 | -94 | -538 | -356 |
| 1086TDGDlr | -1:23 | 16:36 | -386 | -39 | -18 | 0 | -3 | -493 | -432 |
| 1088TDGDrl | -1:9 | 16:50 | -307 | 4 | -70 | -1 | -181 | -442 | -452 |
| 1090TDGDlr | -0:29 | 17:30 | 125 | 75 | 43 | 7 | -240 | -157 | -169 |
| 1092TDGDrl | -0:16 | 17:43 | -79 | 23 | -144 | 130 | -358 | -295 | -91 |
| 1094TDGDlr | 0:00 | 18:00 | 142 | 230 | -101 | 31 | -376 | -133 | 19 |
| 1096TDGDrl | 0:12 | 18:12 | -176 | 390 | -199 | 141 | -231 | -42 | 63 |
| 1098TDGDl | 0:23 | 18:23 | -164 | 361 | -154 | 141 | -69 | 79 | 110 |

| Filename | Time after HW [hh:mm] | Time [hh:mm] | Qmid [m3/s] | Qtop [m3/s] | Qbot [m3/s] | Qleft [m3/s] | Qright [m3/s] | Qtot [m3/s] | QVolBal [m3/s] |
|---|---|---|---|---|---|---|---|---|---|
| 1100TDGDrl | 0:33 | 18:33 | -298 | 378 | -107 | 211 | -97 | 99 | 147 |
| 1102TDGDlr | 0:45 | 18:45 | -132 | 415 | -164 | 28 | -19 | 128 | 188 |

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

| Filename | Time to HW [hh:mm] | Time [hh:mm] | Fmid [kg/s] | Ftop [kg/s] | Fbot [kg/s] | Fleft [kg/s] | Fright [kg/s] | Ftot [kg/s] |
|---|---|---|---|---|---|---|---|---|
| 1002TDGDlr | 0:36 | 6:26 | -4 | 31 | -27 | 0 | -4 | -4 |
| 1004TDGDrl | 0:49 | 6:39 | -39 | 20 | -25 | 12 | -1 | -29 |
| 1006TDGDlr | 1:01 | 6:51 | -32 | 23 | -34 | 7 | 1 | -35 |
| 1010TDGDlr | 1:30 | 7:20 | -40 | 20 | -19 | -3 | 5 | -32 |
| 1012TDGDrl | 1:43 | 7:33 | -13 | 16 | -9 | -2 | 1 | -15 |
| 1014TDGDlr | 1:52 | 7:42 | -17 | 12 | -10 | -6 | 1 | -15 |
| 1016TDGDrl | 2:03 | 7:53 | -14 | 13 | -10 | -1 | 6 | -11 |
| 1018TDGDlr | 2:11 | 8:01 | -15 | 11 | -11 | -10 | 2 | -16 |
| 1020TDGDrl | 2:25 | 8:15 | -6 | 10 | -3 | -2 | 1 | -4 |
| 1022TDGDlr | 2:40 | 8:30 | -4 | 7 | -2 | -3 | 1 | 0 |
| 1024TDGDrl | 2:57 | 8:47 | 2 | 6 | -2 | -7 | 1 | -2 |
| 1026TDGDlr | 3:14 | 9:04 | -14 | 5 | 0 | -2 | 3 | -4 |
| 1028TDGDrl | 3:27 | 9:17 | -3 | 7 | 0 | -2 | 3 | 1 |
| 1030TDGDlr | 3:42 | 9:32 | -5 | 3 | -1 | -5 | 2 | -3 |
| 1032TDGDrl | 4:03 | 9:53 | -2 | 3 | -1 | -3 | 1 | 1 |
| 1034TDGDlr | 4:15 | 10:05 | 5 | 9 | 1 | 0 | 0 | 10 |
| 1036TDGDrl | 4:34 | 10:24 | 2 | 2 | 1 | 0 | 1 | 7 |
| 1038TDGDlr | 4:48 | 10:38 | 2 | 0 | 1 | -1 | 0 | 3 |
| 1040TDGDrl | 5:03 | 10:53 | 1 | 0 | 1 | 0 | 0 | 3 |
| 1042TDGDlr | 5:18 | 11:08 | 4 | 0 | 1 | -1 | 1 | 4 |
| 1044TDGDrlr | 5:38 | 11:28 | 2 | -2 | 3 | -3 | 0 | 2 |
| 1046TDGDlr | 5:47 | 11:37 | 5 | -3 | 3 | 2 | 0 | 4 |
| 1048TDGDrl | 5:59 | 11:49 | 2 | -6 | 3 | -2 | 1 | -2 |
| 1050TDGDlr | 6:14 | 12:04 | -1 | -10 | 3 | 0 | 1 | -9 |
| 1052TDGDrl | 6:28 | 12:18 | -5 | -17 | 4 | 0 | 0 | -17 |
| 1054TDGDlr | -5:27 | 12:32 | -4 | -26 | 4 | 0 | 0 | -24 |
| 1056TDGDrl | -5:12 | 12:47 | -9 | -23 | 5 | 0 | 0 | -29 |
| 1058TDGDlr | -4:59 | 13:00 | -15 | -28 | 4 | 0 | -1 | -39 |
| 1060TDGDrl | -4:44 | 13:15 | -16 | -28 | -2 | -1 | 0 | -46 |
| 1062TDGDlr | -4:31 | 13:28 | -16 | -24 | 3 | -1 | -4 | -42 |
| 1064TDGDrl | -4:19 | 13:40 | -17 | -24 | 3 | 0 | 0 | -37 |
| 1066TDGDlr | -3:56 | 14:03 | -14 | -21 | 8 | 0 | -3 | -34 |
| 1068TDGDrl | -3:43 | 14:16 | -18 | -31 | 5 | 0 | -1 | -39 |
| 1070TDGDlr | -3:31 | 14:28 | -6 | -19 | 10 | 2 | -7 | -26 |
| 1072TDGDrl | -3:7 | 14:52 | -22 | -23 | 12 | 0 | 0 | -29 |
| 1074TDGDlr | -2:52 | 15:07 | -13 | -27 | 18 | 2 | -1 | -24 |
| 1076TDGDrl | -2:40 | 15:19 | -9 | -12 | 9 | 3 | -20 | -37 |
| 1078TDGDlr | -2:25 | 15:34 | -55 | -14 | 4 | 1 | -21 | -72 |
| 1080TDGDrl | -2:10 | 15:49 | -15 | 9 | -22 | 6 | -40 | -64 |
| 1082TDGDlr | -1:56 | 16:03 | -22 | 10 | -9 | 1 | -34 | -62 |
| 1084TDGDrl | -1:45 | 16:14 | -63 | -5 | -18 | 0 | -11 | -78 |

| Filename | Time to HW [hh:mm] | Time [hh:mm] | Fmid [kg/s] | Ftop [kg/s] | Fbot [kg/s] | Fleft [kg/s] | Fright [kg/s] | Ftot [kg/s] |
|---|---|---|---|---|---|---|---|---|
| 1086TDGDlr | -1:23 | 16:36 | -29 | 0 | 1 | 0 | 0 | -40 |
| 1088TDGDrl | -1:9 | 16:50 | -15 | 5 | -3 | 0 | -19 | -28 |
| 1090TDGDlr | -0:29 | 17:30 | 11 | -2 | 10 | 1 | -31 | -26 |
| 1092TDGDrl | -0:16 | 17:43 | -14 | -6 | -25 | 17 | -50 | -62 |
| 1094TDGDlr | 0:00 | 18:00 | 11 | 37 | -25 | 6 | -74 | -67 |
| 1096TDGDrl | 0:12 | 18:12 | -96 | 44 | -62 | 31 | -62 | -118 |
| 1098TDGDl | 0:23 | 18:23 | -70 | 44 | -43 | 33 | -44 | -103 |
| 1100TDGDrl | 0:33 | 18:33 | -113 | 26 | -46 | 21 | -36 | -132 |
| 1102TDGDlr | 0:45 | 18:45 | -87 | 21 | -41 | 5 | -18 | -120 |

Sediment concentration distribution over the cross section

| Transect name | Time [hh:mm MET] | Time after HW [hh:mm] | Average measured SS Concentration [mg/l] | Average measured incoming SS Concentration [mg/l] | Average measured outgoing SS Concentration [mg/l] |
|---|---|---|---|---|---|
| 1002TDGDlr | 0:36 | 6:26 | 97 | 131 | 77 |
| 1004TDGDrl | 0:49 | 6:39 | 95 | 142 | 66 |
| 1006TDGDlr | 1:01 | 6:51 | 114 | 172 | 76 |
| 1010TDGDlr | 1:30 | 7:20 | 109 | 156 | 73 |
| 1012TDGDrl | 1:43 | 7:33 | 75 | 104 | 55 |
| 1014TDGDlr | 1:52 | 7:42 | 65 | 86 | 49 |
| 1016TDGDrl | 2:03 | 7:53 | 60 | 79 | 47 |
| 1018TDGDlr | 2:11 | 8:01 | 62 | 78 | 48 |
| 1020TDGDrl | 2:25 | 8:15 | 59 | 75 | 48 |
| 1022TDGDlr | 2:40 | 8:30 | 55 | 74 | 43 |
| 1024TDGDrl | 2:57 | 8:47 | 53 | 79 | 40 |
| 1026TDGDlr | 3:14 | 9:04 | 54 | 85 | 39 |
| 1028TDGDrl | 3:27 | 9:17 | 51 | 78 | 38 |
| 1030TDGDlr | 3:42 | 9:32 | 45 | 69 | 32 |
| 1032TDGDrl | 4:03 | 9:53 | 41 | 60 | 31 |
| 1034TDGDlr | 4:15 | 10:05 | 42 | 50 | 38 |
| 1036TDGDrl | 4:34 | 10:24 | 31 | 36 | 28 |
| 1038TDGDlr | 4:48 | 10:38 | 26 | 29 | 24 |
| 1040TDGDrl | 5:03 | 10:53 | 25 | 27 | 23 |
| 1042TDGDlr | 5:18 | 11:08 | 27 | 29 | 26 |
| 1044TDGDrlr | 5:38 | 11:28 | 32 | 36 | 29 |
| 1046TDGDlr | 5:47 | 11:37 | 32 | 36 | 29 |
| 1048TDGDrl | 5:59 | 11:49 | 35 | 46 | 27 |
| 1050TDGDlr | 6:14 | 12:04 | 42 | 56 | 31 |
| 1052TDGDrl | 6:28 | 12:18 | 47 | 67 | 31 |
| 1054TDGDlr | -5:27 | 12:32 | 55 | 78 | 35 |
| 1056TDGDrl | -5:12 | 12:47 | 58 | 76 | 38 |
| 1058TDGDlr | -4:59 | 13:00 | 63 | 77 | 43 |
| 1060TDGDrl | -4:44 | 13:15 | 64 | 76 | 45 |
| 1062TDGDlr | -4:31 | 13:28 | 64 | 74 | 47 |
| 1064TDGDrl | -4:19 | 13:40 | 66 | 75 | 51 |
| 1066TDGDlr | -3:56 | 14:03 | 77 | 79 | 73 |
| 1068TDGDrl | -3:43 | 14:16 | 92 | 95 | 88 |
| 1070TDGDlr | -3:31 | 14:28 | 102 | 103 | 100 |
| 1072TDGDrl | -3:7 | 14:52 | 112 | 111 | 114 |
| 1074TDGDlr | -2:52 | 15:07 | 115 | 108 | 128 |
| 1076TDGDrl | -2:40 | 15:19 | 124 | 119 | 133 |
| 1078TDGDlr | -2:25 | 15:34 | 158 | 165 | 147 |
| 1080TDGDrl | -2:10 | 15:49 | 169 | 170 | 168 |
| 1082TDGDlr | -1:56 | 16:03 | 174 | 173 | 175 |

| Transect name | Time [hh:mm MET] | Time after HW [hh:mm] | Average measured SS Concentration [mg/l] | Average measured incoming SS Concentration [mg/l] | Average measured outgoing SS Concentration [mg/l] |
|---|---|---|---|---|---|
| 1084TDGDrl | -1:45 | 16:14 | 164 | 160 | 173 |
| 1086TDGDlr | -1:23 | 16:36 | 150 | 135 | 177 |
| 1088TDGDrl | -1:9 | 16:50 | 152 | 137 | 176 |
| 1090TDGDlr | -0:29 | 17:30 | 162 | 162 | 162 |
| 1092TDGDrl | -0:16 | 17:43 | 170 | 174 | 164 |
| 1094TDGDlr | 0:00 | 18:00 | 201 | 218 | 182 |
| 1096TDGDrl | 0:12 | 18:12 | 190 | 232 | 147 |
| 1098TDGDl | 0:23 | 18:23 | 175 | 223 | 130 |
| 1100TDGDrl | 0:33 | 18:33 | 154 | 215 | 98 |
| 1102TDGDlr | 0:45 | 18:45 | 135 | 196 | 81 |

| Tide | Concentration [mg/l] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | overall SSC | | | incoming SSC | | | outgoing SSC | | |
| | min | average | max | min | average | max | min | average | max |
| Ebb | 25 | 74 | 201 | 27 | 99 | 232 | 23 | 56 | 182 |
| Flood | 55 | 115 | 174 | 74 | 117 | 174 | 35 | 112 | 177 |

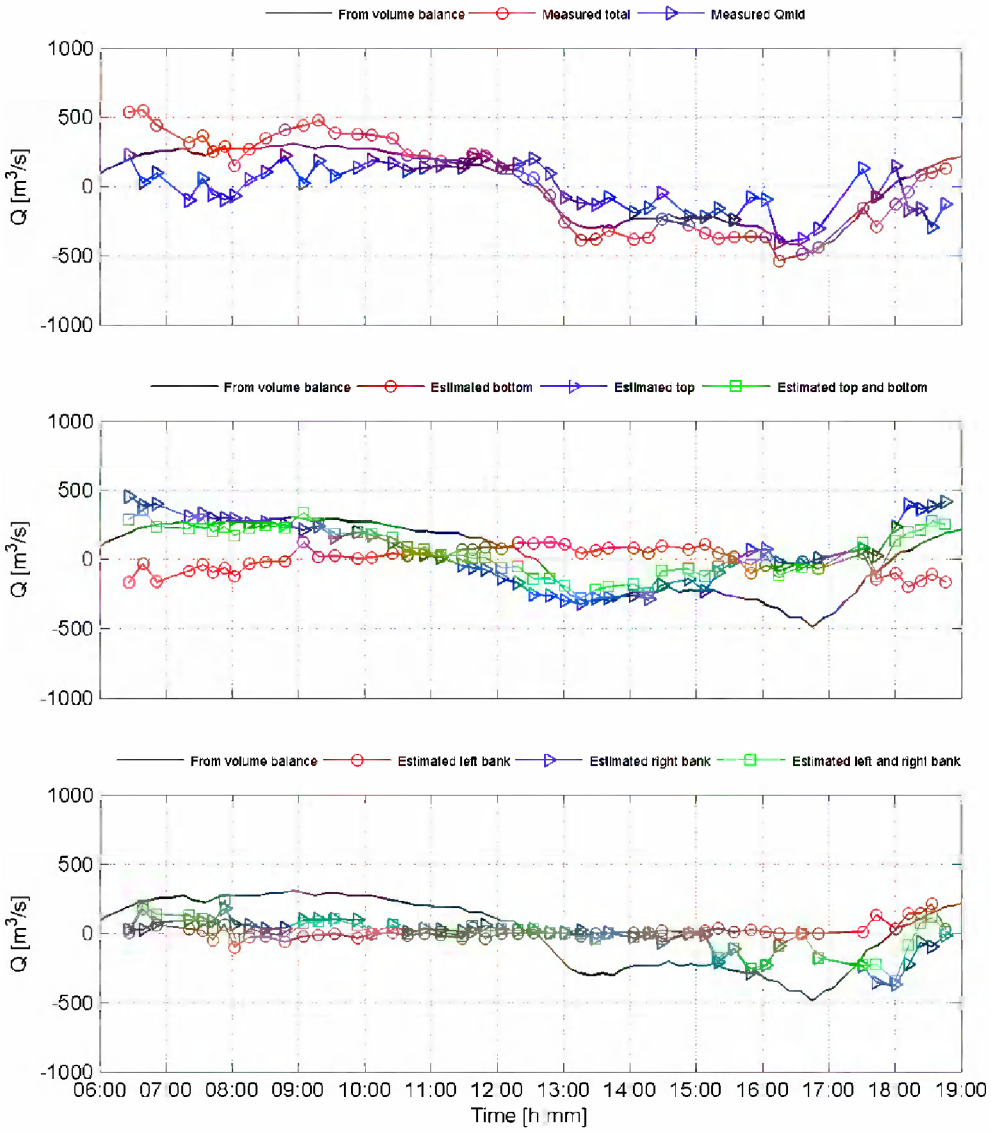
# APPENDIX H.

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

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

11283: Opvolging aanslibbing DGD

| | |
|---|---|
| | Equipment(s): ADCP |
| Sourcefile(s): 1004TDGDrl_sub.csv 1102TDGDlr.csv | Location: Deurganckdok |

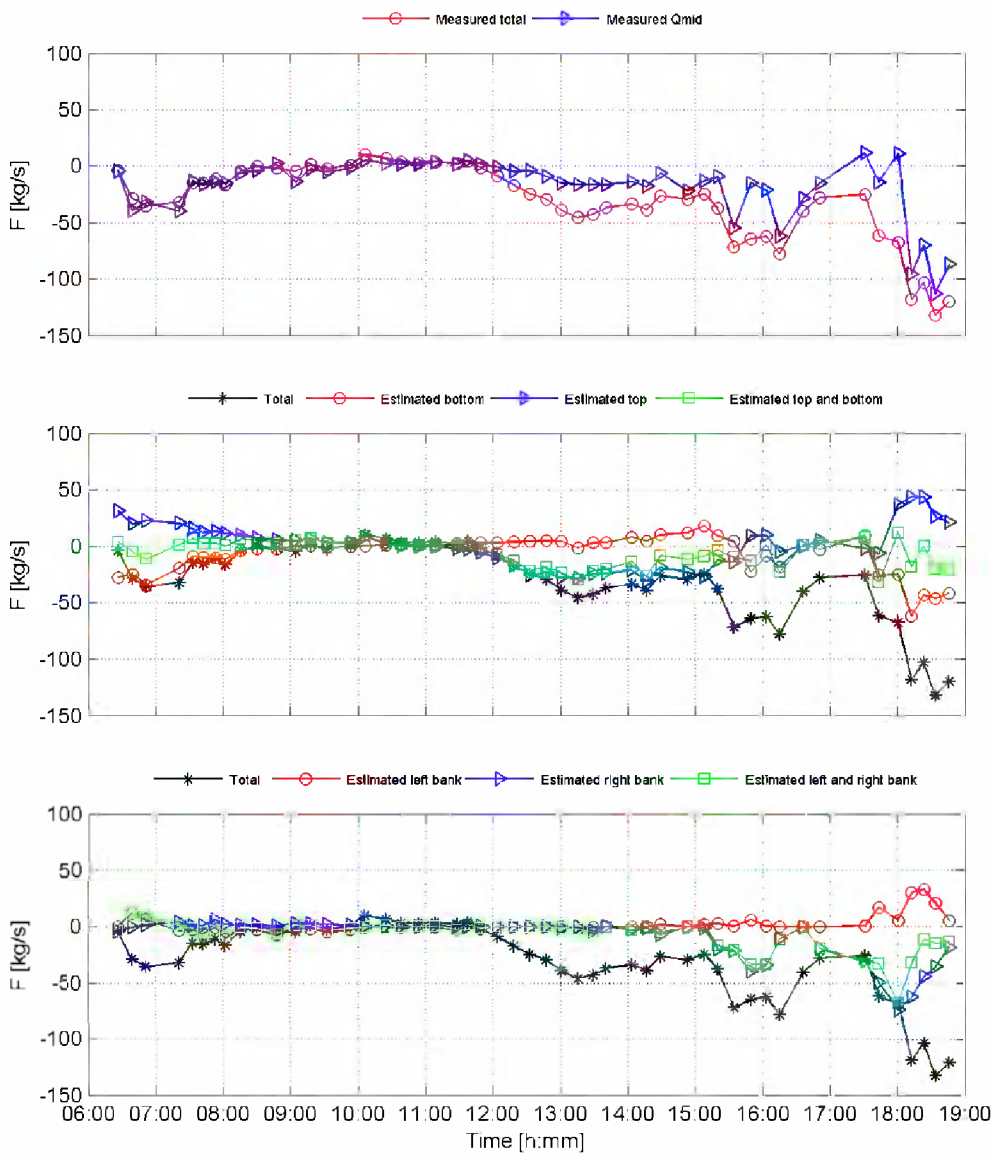



| | |
|---|---|
| Date: 02-Dec-2008 | Data Processed by: IMDC<br>In association with: WL \| delft hydraulics |

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

11283: Opvolging aanslibbing DGD

| | |
|---|---|
| | Equipment(s): ADCP |
| Sourcefile(s): 1004TDGDrl_sub.csv 1102TDGDlr.csv | Location: Deurganckdok |




Date :

02-Dec-2008

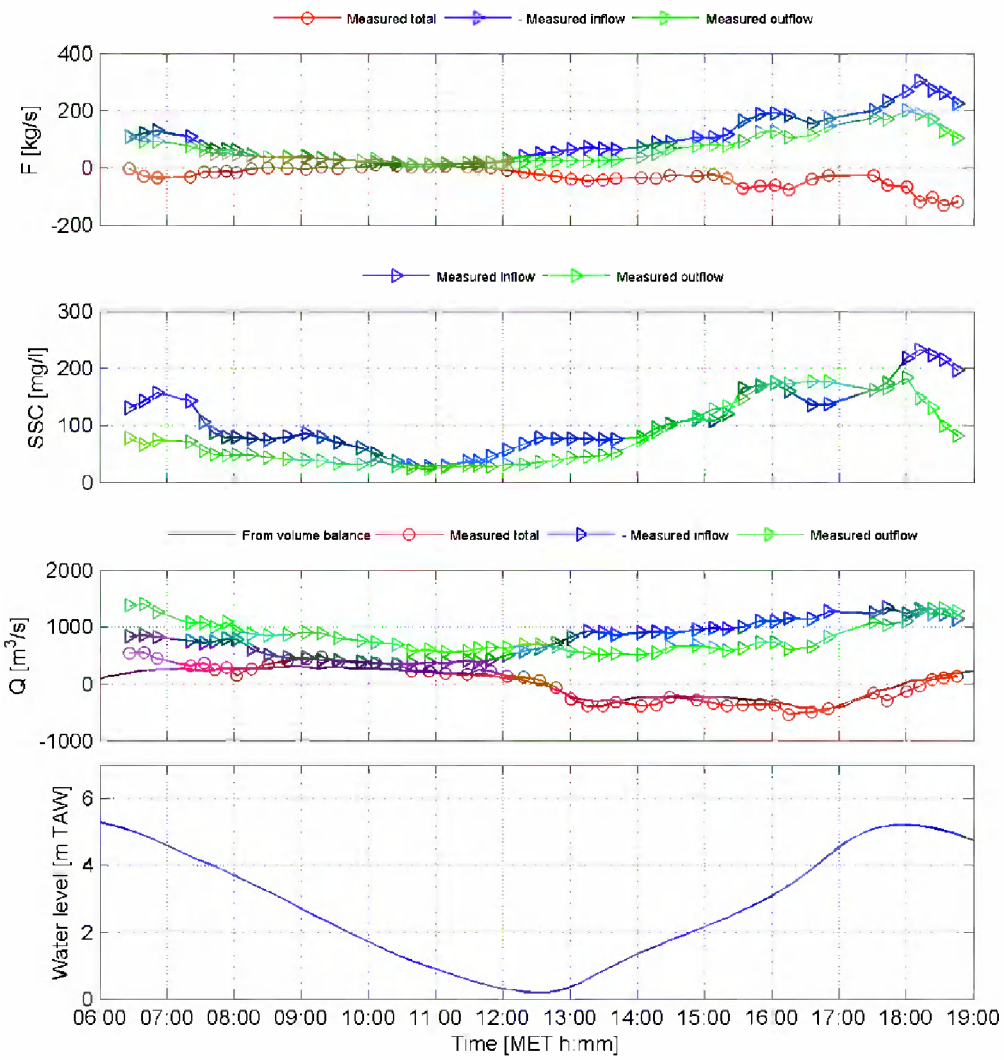
Data Processed by: IMDC

In association with : WL | delft hydraulics

## Suspended sediment concentration through the measured cross section

11283: Opvolging aanslibbing DGD

| | |
|---|---|
| | Equipment(s): ADCP |
| Sourcefile(s): 1004TDGDrl_sub.csv 1102TDGDlr.csv | Location: Deurganckdok |




Date :

02-Dec-2008

Data Processed by IMDC

In association with : WL | delft hydraulics

# APPENDIX I.

# 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 4/'06 – 3/'07 (I/RA/11283/06.129/MSA) |

| Report | Description of Opvolging aanslibbing Deurganckdok between April 2007 till March 2008 |
|---|---|
| **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) |
| 2.18 | Salt-Silt distribution & Frame Measurements Deurganckdok winter (18/02/2008 - 31/3/2008) (I/RA/11283/07.094/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'

| Report | Description of Opvolging aanslibbing Deurganckdok between April 2007 till March 2008 |
|---|---|
| 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 4/'07 – 3/'08 (I/RA/11283/07.102/MSA) |