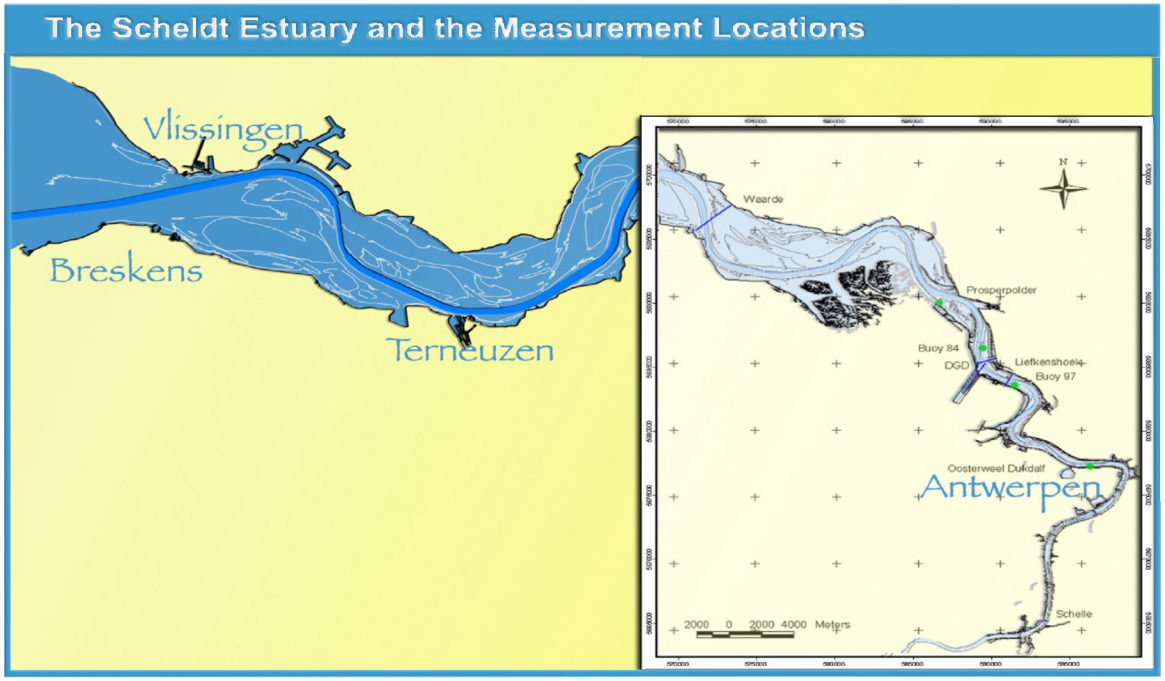
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WATERBOUWKUNDIG LABORATORIUM

Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing

Bestek 16EB/05/04



Deelrapport 3.12: Omgevingscondities in de rivier de Schelde oktober – december 2007

Report 3.12: Overview of boundary conditions in the river Scheldt October – December 2007

4 April 2008
I/RA/11283/07.099/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.

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

The execution of the study involves a twofold assignment:

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

1.2. Purpose of the study

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

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

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

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

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

1.3. Overview of the study

1.3.1. Reports

Reports of the project 'Opvolging aanslibbing Deurganckdok' between April 2007 till March 2008 are summarized in Table 1-1.

This report, report 3.12, is one of set of reports for understanding the sediment transport between Deurganckdok and the river Scheldt, which belongs to the second part of this project.

The report is also a continuation of the set of ambient conditions reports of HCBS2 (IMDC, 2005k; IMDC, 2005l; IMDC, 2006l; IMDC, 2006p) and 'Opvolging aanslibbing Deurganckdok' (IMDC, 2007b; IMDC, 2007u; IMDC, 2007w). This new ambient conditions report gives an overview of the ambient conditions from October till December 2007 in the river Scheldt. An overview of the HCBS2 and 'Opvolging aanslibbing Deurganckdok' (between April 2006 till March 2007) reports are given in APPENDIX A.

Table 1-1: Overview of Deurganckdok Reports

Report	Description
Sediment Balance: Bathymetry surveys, Density measurements, Maintenance and construction dredging activities	
1.10	Sediment Balance: Three monthly report 1/4/2007 - 30/06/2007 (I/RA/11283/07.081/MSA)
1.11	Sediment Balance: Three monthly report 1/7/2007 – 30/09/2007 (I/RA/11283/07.082/MSA)
1.12	Sediment Balance: Three monthly report 1/10/2007 – 31/12/2007 (I/RA/11283/07.083/MSA)
1.13	Sediment Balance: Three monthly report 1/1/2007 – 31/03/2007 (I/RA/11283/07.084/MSA)
1.14	Annual Sediment Balance (I/RA/11283/07.085/MSA)
Factors contributing to salt and sediment distribution in Deurganckdok: Salt-Silt (OBS3A) & Frame measurements, Through tide measurements (SiltProfiling & ADCP) & Calibrations	
2.09	Calibration stationary equipment autumn (I/RA/11283/07.095/MSA)
2.10	Through tide measurement Siltprofiler winter (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 (I/RA/11283/07.088/MSA)
2.13	Through tide measurement Sediview winter (I/RA/11283/07.089/MSA)
2.14	Through tide measurement Sediview winter (I/RA/11283/07.090/MSA)
2.15	Through tide measurement Siltprofiler (to be scheduled) (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)

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

1.3.2. Measurement actions

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

1. Monitoring upstream discharge in the river Scheldt.
2. Monitoring Salt and sediment concentration in the Lower Sea Scheldt taken from on permanent data acquisition sites at Oosterweel, Prosperpolder 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 and bulk densities 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 (IMDC, 2006a; IMDC, 2007a; IMDC, 2008c).

1.4. Structure of this report

This report is the factual data report for three measurement actions during the period between October and December 2007:

- Monitoring salinity and sediment concentration in the Lower Sea Scheldt taken from on permanent data acquisition sites at Oosterweel, Prosperpolder and up- (buoy 97) and downstream (buoy 84) of the Deurganckdok.
- Monitoring dredging and dumping activities in the Lower Sea Scheldt.
- Monitoring of horizontal and vertical bulk density distribution at entrance channels towards the Kallo, Zandvliet and Berendrecht locks. To complete the data set, the measurements in September 2007 are included as well.

Beside these actions, navigation and meteorological conditions are also reported.

The first chapter comprises an introduction. The second chapter describes the project. Chapter 3 summarizes the measurement campaign, while the ambient conditions are discussed in Chapter 4.

2. SEDIMENTATION IN DEURGANCKDOK

2.1. Project Area: Deurganckdok

Deurganckdok is a tidal dock situated at the left bank in the Lower Sea Scheldt, between Liefkenshoek and Doel. Deurganckdok has the following characteristics:

1. the dock has a total length of 2750 m and is 450 m wide at the Scheldt end and 400 m wide at the inward end of the dock
2. The bottom of Deurganckdok is provided at a depth of –17m TAW in the transition zones between the quay walls and the central trench and of –19m TAW in the central trench.
3. the quay walls reach up to +9m TAW

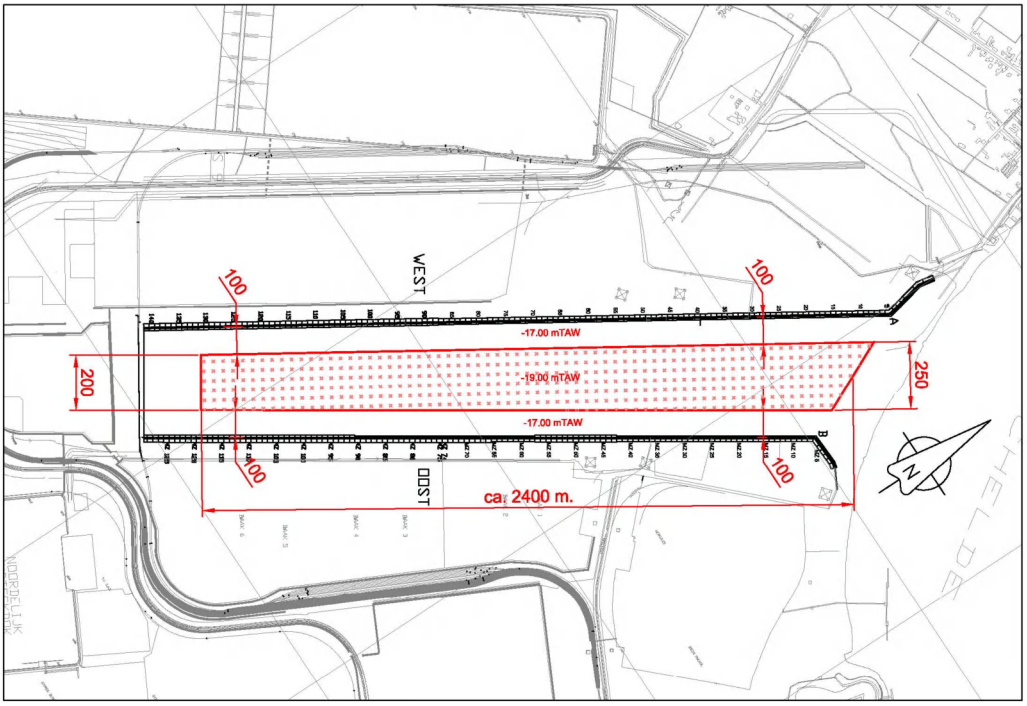


Figure 2-1: Overview of Deurganckdok

The dredging of the dock is performed in 3 phases. On 18 February 2005 the dike between the Scheldt and the Deurganckdok was breached. On 6 July 2005 Deurganckdok was officially opened. The second dredging phase was finalized a few weeks later. The first terminal operations have started since.

2.2. Overview of the studied 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 2-2).

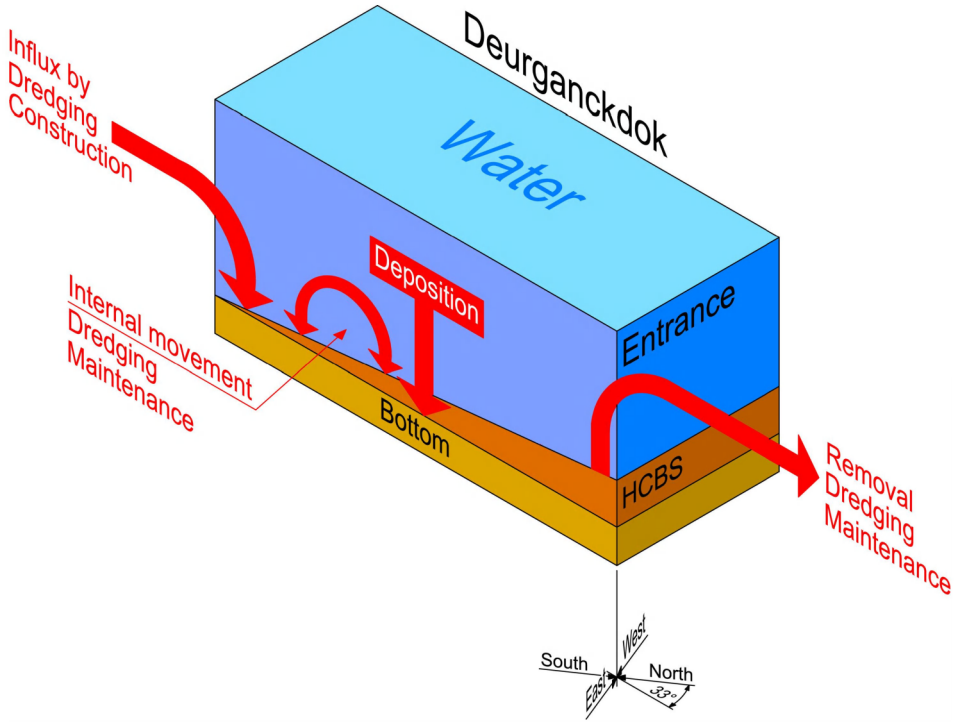


Figure 2-2: Elements of the sediment balance

A net deposition can be calculated from a comparison with a chosen initial condition t_0 (Figure 2-3). 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 river Scheldt since t_0.

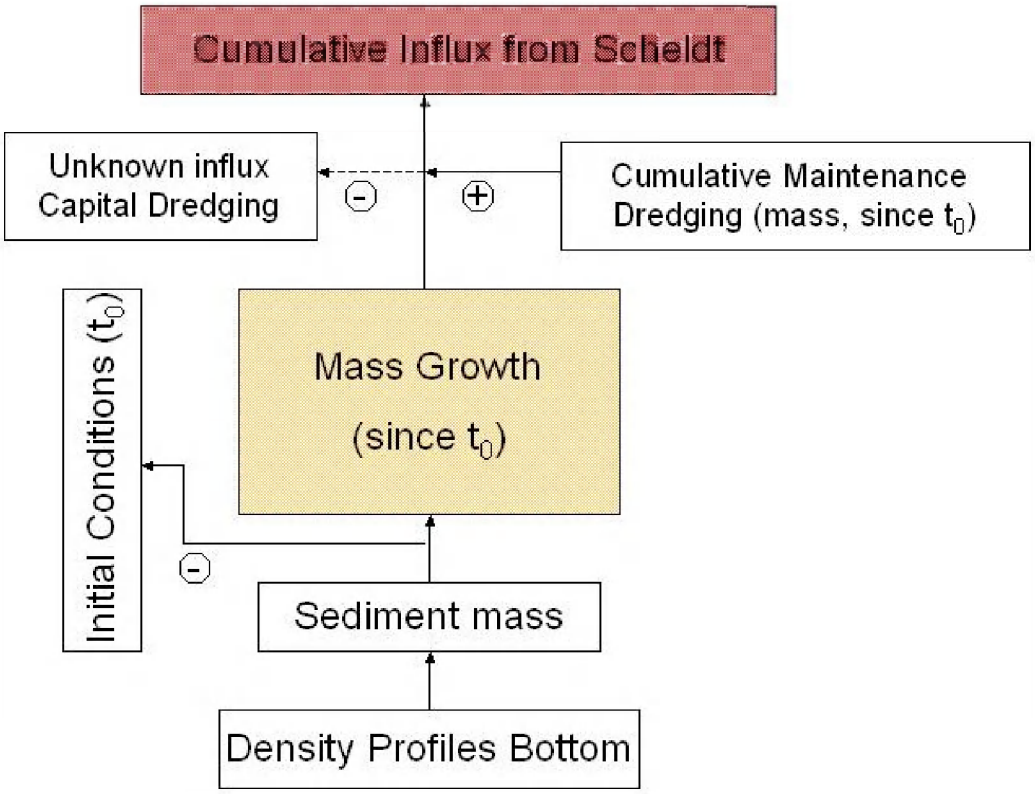


Figure 2-3: Determining a sediment balance

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

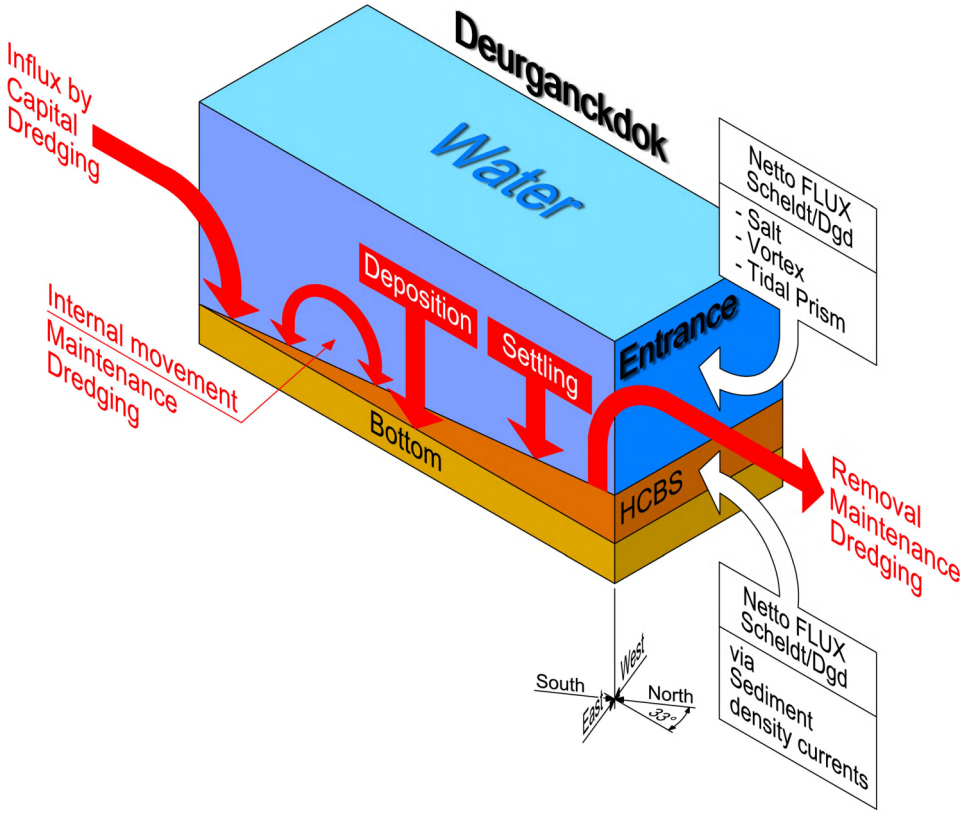


Figure 2-4: Transport mechanisms

These aspects of hydrodynamics and sediment transport have been landmark in determining the parameters to be measured during the project. Measurements will be focused 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 upstream discharge in the river Scheldt.
- Monitoring Salt and sediment concentration in the Lower Sea Scheldt at permanent measurement locations at Oosterweel, up- and downstream of the Deurganckdok.
- Long term measurement of salt 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 current, salt 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 and bulk densities at entrance channels towards the Kallo, Zandvliet and Berendrecht locks as well as dredging and dumping activities in the Lower Sea Scheldt.
- In situ calibrations were conducted on several dates to calibrate all turbidity and conductivity sensors.

2.3. Specific objectives of this report

The natural ambient conditions in the Scheldt estuary change from the mouth near Vlissingen to the upstream boundaries near Ghent and the tributaries. Furthermore navigation and dredging activities are important human activities in the Lower Sea Scheldt.

These natural and human conditions can help to gain insight in the mechanisms causing siltation in Deurganckdok. For this reason this report summarises the following data for the period between October and December 2007:

- Ambient characteristics in the Lower Sea Scheldt:
  - Tide
  - Current
  - Salinity
  - Temperature
  - Turbidity/Suspended sediment concentration
  - Salinity downstream
- Fresh water inflow from the tributaries
- Meteorological conditions
- Human activities
  - Dredging/dumping
  - Navigation
- Vertical and horizontal distribution of bulk densities in the access channels of the following locks: Zandvliet, Berendrecht, Kallo, Boudewijn and Cauwelaert. It also includes the sediment mass distribution of the concerned entrance channels.

3. THE MEASUREMENT CAMPAIGN

3.1. Overview of the measurement campaigns

Several measurement campaigns took place between the 1st of October and the 31st of December 2007. Near bed continuous monitoring took place at the entrance of Deurganckdok, through tide measurement campaign at transect DGD and entrance of Deurganckdok, long term salinity measurements at Deurganckdok and finally further long term measurements were executed near buoy 84 and buoy 97.

The long-term measurements at buoys 84 and 97 started the 21st, respectively the 20th of September 2005 and will be continued at least until the 31st of March 2008. In this period there were two short interruptions to calibrate the instruments: 13/04/2006 – 18/04/2006 and 05/09/2007 – 13/09/2007. Table 3-1 gives an overview of the coordinates of the measurement locations and the periods when data was gathered. Considering the through tide measurements coordinates are given for the sailed transects (i.e. left bank and right bank position). Figure 3-1 shows the Lower Sea Scheldt with the measurement locations. A sketch of each measurement campaign can be found from Figure 3-2 to Figure 3-14.

A detailed description of the near bed continuous monitoring during this reporting period can be found in IMDC (2008a). The factual data of the long-term measurements near buoy 84 and buoy 97 from October until December 2007 are given in this report.

Measurements of bulk densities were performed at the entrance channels of the Kallo, Zandvliet, Berendrecht, Boudewijn and Cauwelaert locks. These one-day campaigns took place on a monthly base and cover the months September-November 2007. An overview is given in Table 3-1.

Table 3-1:Measurement locations and periods for the HCBS2 and Deurganckdok measurements (01/01/2006 – 31/12/2007)

Through tide measurements: Transects					
Location	***Easting (UTM ED 50)***		***Northing (UTM ED 50)***		***Period***
Deurganckdok (in dock) (transect Y)	Left Bank	Right Bank	Left Bank	Right Bank	21/03/2006 & 26/09/2006
	589059	591298	5684948	5683077	
Liefkenshoek (transect I)	Left Bank	Right Bank	Left Bank	Right Bank	22/03/2006 & 27/09/2006
	590318	590771	5684257	5683302	
Deurganckdok (downstream) (transect K)	Left Bank	Right Bank	Left Bank	Right Bank	22 & 23/03/2006 & 27 & 28/09/2006
	588484	589775	5684924	5685384	
Deurganckdok (in dock) (transect DGD)	Left Bank	Right Bank	Left Bank	Right Bank	22/03/2006, 27/09/2006 & 24/10/2007
	588765	588541	5684056	5684527	
Schelle (transect S)	Left Bank	Right Bank	Left Bank	Right Bank	23/03/2006 & 28/09/2006
	592645	592953	5665794	5665682	
Waarde (transect W)	Left Bank	Right Bank	Left Bank	Right Bank	23/03/2006 & 28/09/2006
	573541	571318	5696848	5694933	

Through tide measurements: Siltprofiler gauging points			
Location	***Easting (UTM ED 50)***	***Northing (UTM ED 50)***	***Period***
Location 1: Xa	588549	5684335	21/03/2006, 26/09/2006 & 23/10/2007
Location 2: Xb	588596	5684411	
Location 3: Xc	588643	5684486	
Location 4: Xd	588690	5684562	
Location 5: Xe	588737	5684638	
Location 6: Ya	588606	5684217	
Location 7: Yb	588653	5684293	
Location 8: Yc	588700	5684368	
Location 9: Yd	588747	5684444	
Location 10: Ye	588793	5684520	
Location 11: Za	588662	5684099	
Location 12: Zb	588709	5684174	
Location 13: Zc	588756	5684250	
Location 14: Zd	588803	5684326	
Location 15: Ze	588850	5684402	
Near bed continuous monitoring			
Location	***Easting (UTM ED 50)***	***Northing (UTM ED 50)***	***Period***
Deurganckdok CDW	588653	5684906	14/03/2006 – 05/04/2006
Deurganckdok CDW	588685	5684880	19/04/2006 – 23/05/2006
Deurganckdok Sill	588805	5684170	19/04/2006 – 23/05/2006
Deurganckdok CDW	588685	5684880	18/07/2006 – 11/10/2006
Deurganckdok Sill	588805	5684170	19/07/2006 – 11/10/2006
Deurganckdok CDW	588685	5684880	15/03/2007 – 12/04/2007
Deurganckdok Sill	588805	5684170	09/02/2007 – 18/04/2007
Deurganckdok CDW	588685	5684880	26/09/2007 – 05/12/2007
Deurganckdok Sill	588805	5684170	10/10/2007 – 28/11/2007
Salt Silt measurements Deurganckdok			
Location	***Easting (UTM ED 50)***	***Northing (UTM ED 50)***	***Period***
P&O 1	588074	5682942	17/03/2006 – 28/04/2006
P&O 2	588767	5684045	17/03/2006 – 28/04/2006
PSA	588536	5684523	17/03/2006 – 28/04/2006
P&O 1	588074	5682942	20/07/2006 – 12/10/2006
P&O 2	588767	5684045	20/07/2006 – 12/10/2006
PSA	588536	5684523	20/07/2006 – 12/10/2006
P&O 1	588074	5682942	12/02/2007 – 27/03/2007
P&O 2	588767	5684045	12/02/2007 – 27/03/2007
PSA	588536	5684523	12/02/2007 – 27/03/2007
P&O 1	588074	5682942	20/06/2007 – 31/07/2007
P&O 2	588767	5684045	20/06/2007 – 31/07/2007
PSA	588536	5684523	20/06/2007 – 31/07/2007
P&O 1	588074	5682942	17/09/2007 – 10/12/2007
P&O 2	588767	5684045	17/09/2007 – 10/12/2007
PSA	588536	5684523	17/09/2007 – 10/12/2007

Settling velocity – INSSEV			
Location	***Easting (UTM ED 50)***	***Northing (UTM ED 50)***	***Period***
Deurganckdok CDW	588717	5684898	05/09/2006
Deurganckdok SILL	588800	5684250	06/09/2006
Deurganckdok Western quay wall	588452	5684355	07/09/2006

Bulk density - SILAS	
Entrance channel	***Date***
Kallo lock	04/09/2007
Zandvliet and Berendrecht locks	06/09/2007
Boudewijn and Cauwelaert locks	04/09/2007
Kallo lock	15/10/2007
Zandvliet and Berendrecht locks	17/10/2007
Boudewijn and Cauwelaert locks	15/10/2007
Zandvliet and Berendrecht locks	19/11/2007
Boudewijn and Cauwelaert locks	20/11/2007

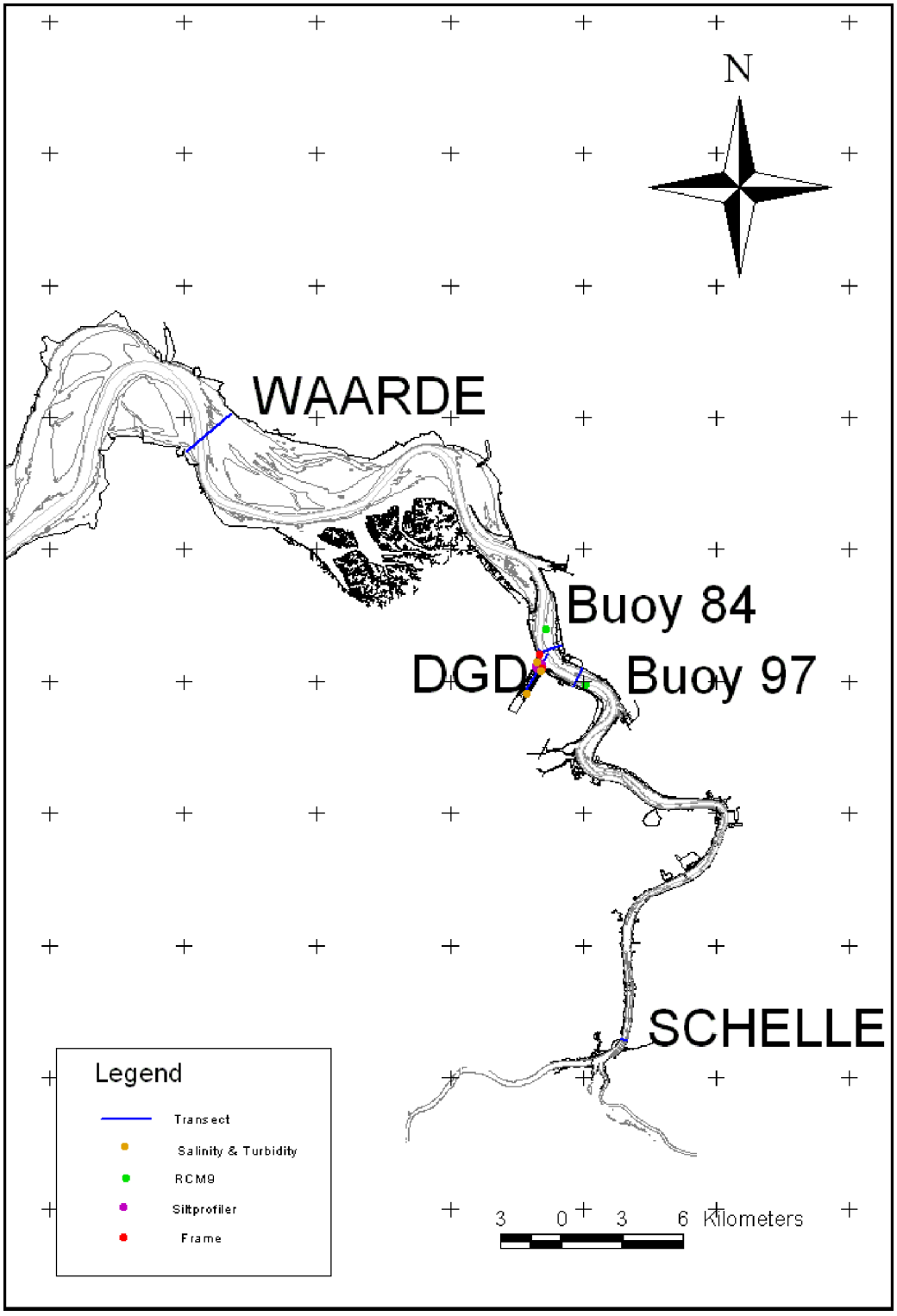


Figure 3-1: The measurement locations in the Lower Sea Scheldt and Deurganckdok (01/01/2006 – 31/12/2007)

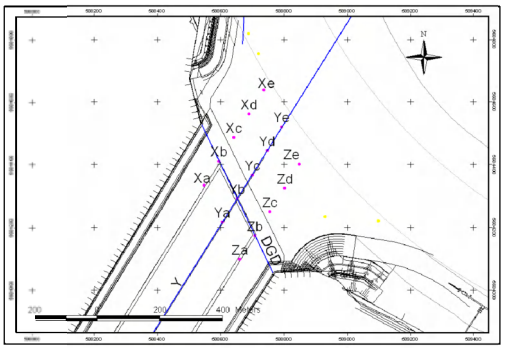


Figure 3-2: Through tide measurements - Deurganckdok 21/03/2006, 26/09/2006 & 23/10/2007 (Siltprofiler)

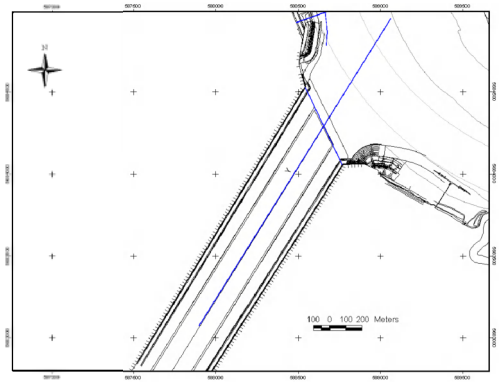


Figure 3-3: Through tide measurements – Deurganckdok 21/03/2006 & 26/09/2006 (salinity)

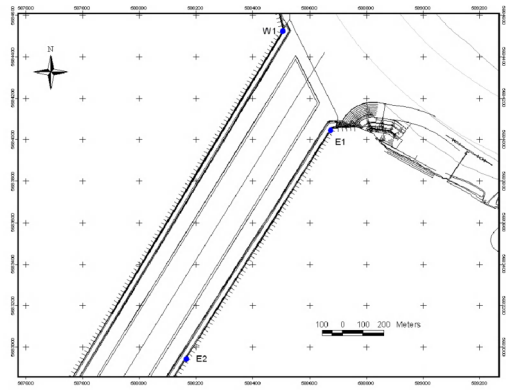


Figure 3-4: Long term salinity measurements Deurganckdok 17/03/2006 – 28/04/2006, 20/07/2006 – 12/10/2006 & 12/02/2007 – 27/03/2007

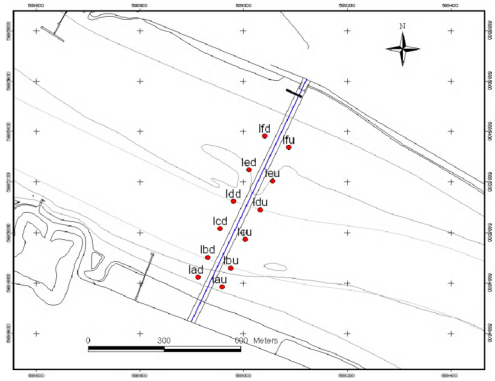


Figure 3-5:Through tide measurements - Liefkenshoek 22/03/2006 & 27/09/2006 (ADCP+SiltProfiler)

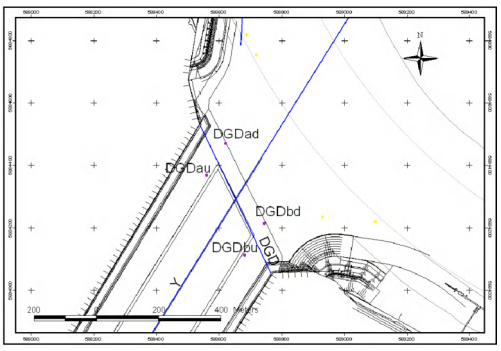


Figure 3-6: Through tide measurements - Deurganckdok 22/03/2006, 27/09/2006 & 24/10/2007 (ADCP)

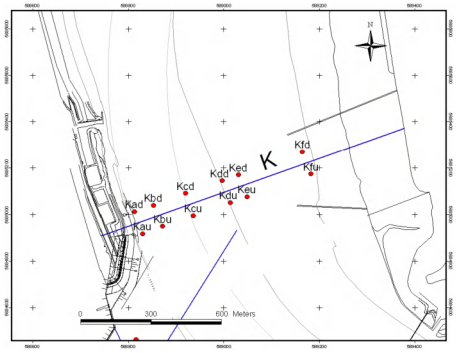


Figure 3-7: Through tide measurements - Deurganckdok 22/03/2006 & 27/09/2006 (ADCP); 23/03/2006 & 28/09/2006 (ADCP+SiltProfiler)

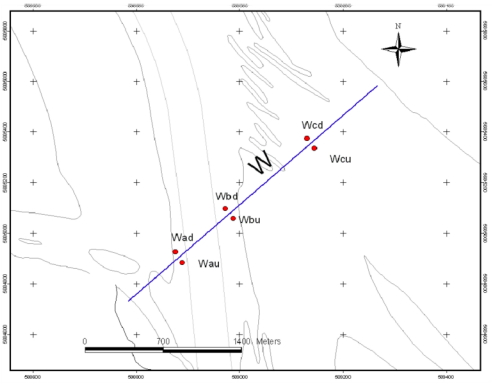


Figure 3-8: Through tide measurements - Waarde 23/03/2006 & 28/09/2006 (ADCP)

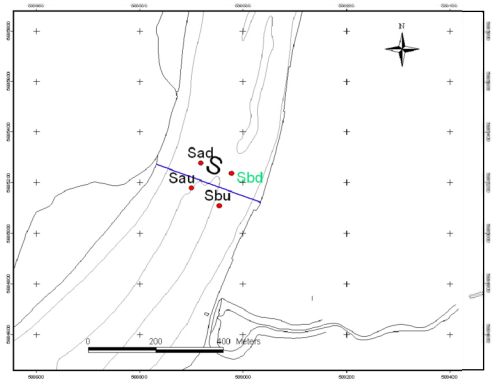


Figure 3-9: Through tide measurements - Schelle 23/03/2006 & 28/09/2006 (ADCP)

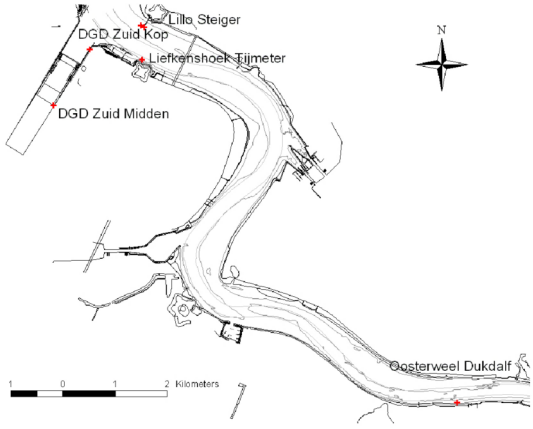


Figure 3-10: Calibration measurements - 15/03/2006 & 14/04/2006

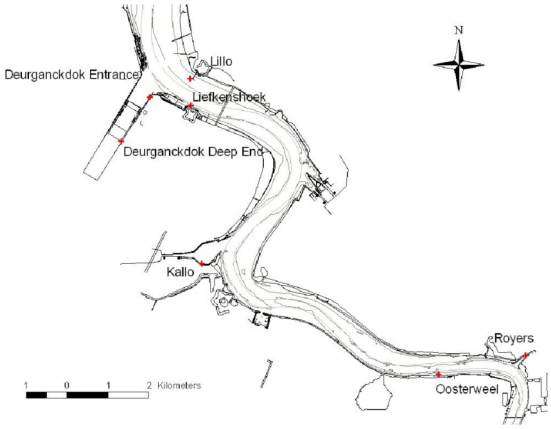


Figure 3-11: Calibration measurements – 23/06/2006 & 18/09/2006

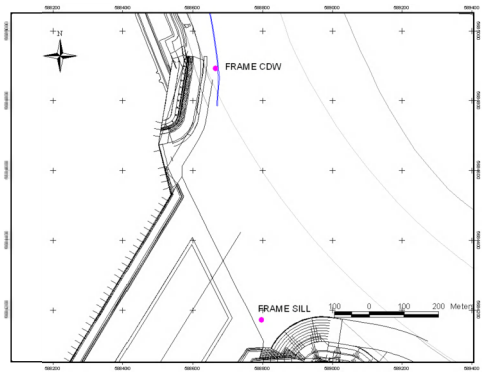


Figure 3-12:Near bed continuous monitoring
14/03/2006 – 23/05/2006
18/07/2006 – 11/10/2006
09/02/2007 – 18/04/2007
26/09/2007 – 05/12/2007

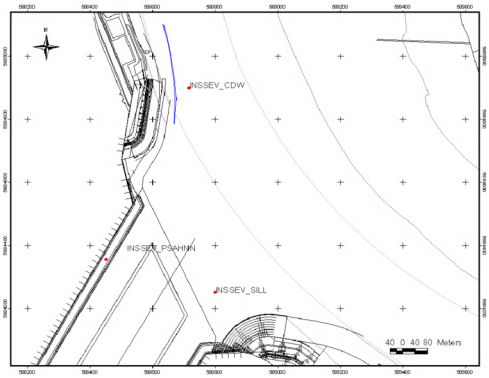


Figure 3-13: Settling velocity (INSSEV) 05/09/2006 – 07/09/2006

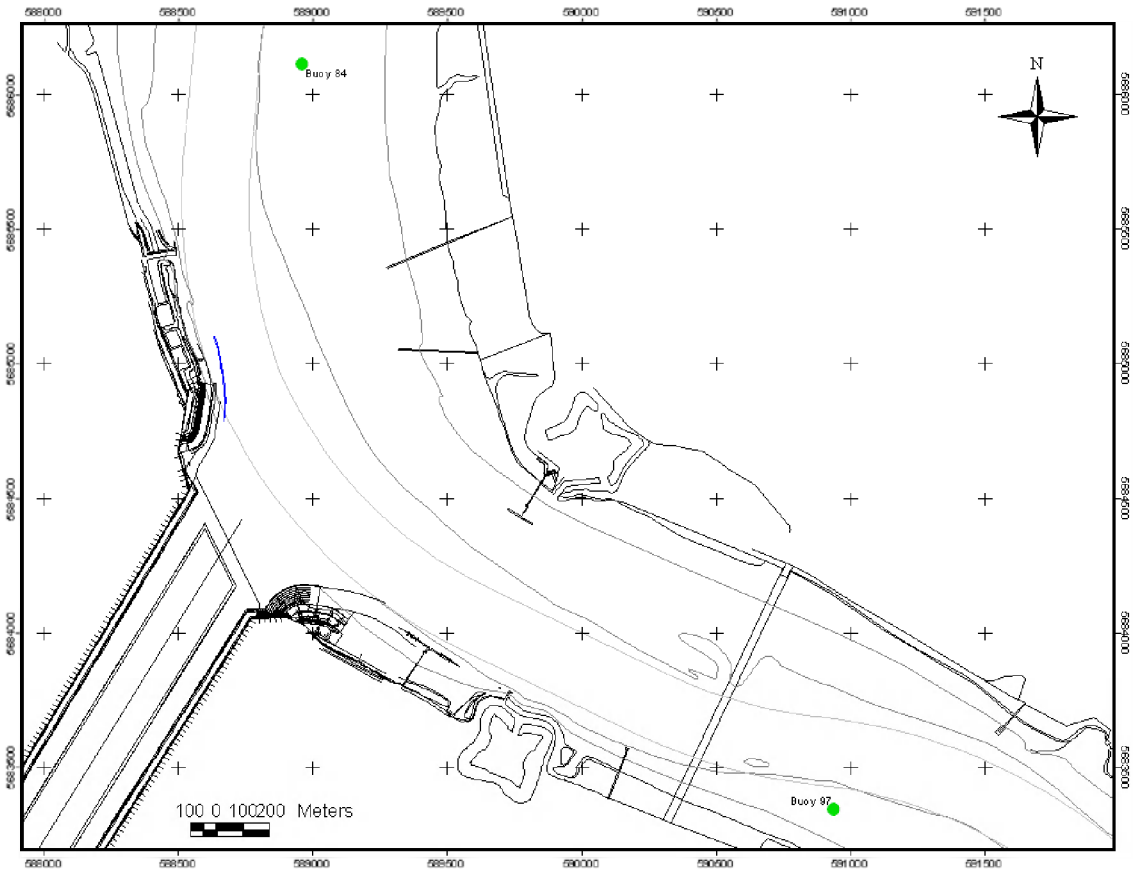


Figure 3-14: Long term measurements in the Lower Sea Scheldt

3.2. Description of the data

3.2.1. Parameters and equipment

The data gathered during the measurement campaign is current velocity, current direction, temperature, pressure and turbidity. For the through tide measurements also data about depth and position of the hard and soft bottom is collected. To report the results in most cases current velocity, current direction, temperature, salinity and suspended sediment concentration is used.

A detailed description of the data acquisition can be found in IMDC (2006b – 2006l; 2007a-2007q).

During the long term stationary at buoy 97 and buoy 84 measurements current, temperature, salinity and turbidity where measured using Aanderaa RCM-9's. A fixed set up was used in which a steel frame was placed on the bottom, with two RCM-9s suspended and held upright by subsurface buoys (Figure 3-15). The lower RCM-9 was placed at 0.80 m above the bottom, while the upper one was placed at a distance of 2.5 m above the lower one. To collect data, check and clean the instruments the instruments were surfaced on regular bases.
The owner of the instruments differs per location, the measurement instruments on buoy 84 belong to WL – Cel Hydrometrie Schelde and the instruments on buoy 97 to IMDC.

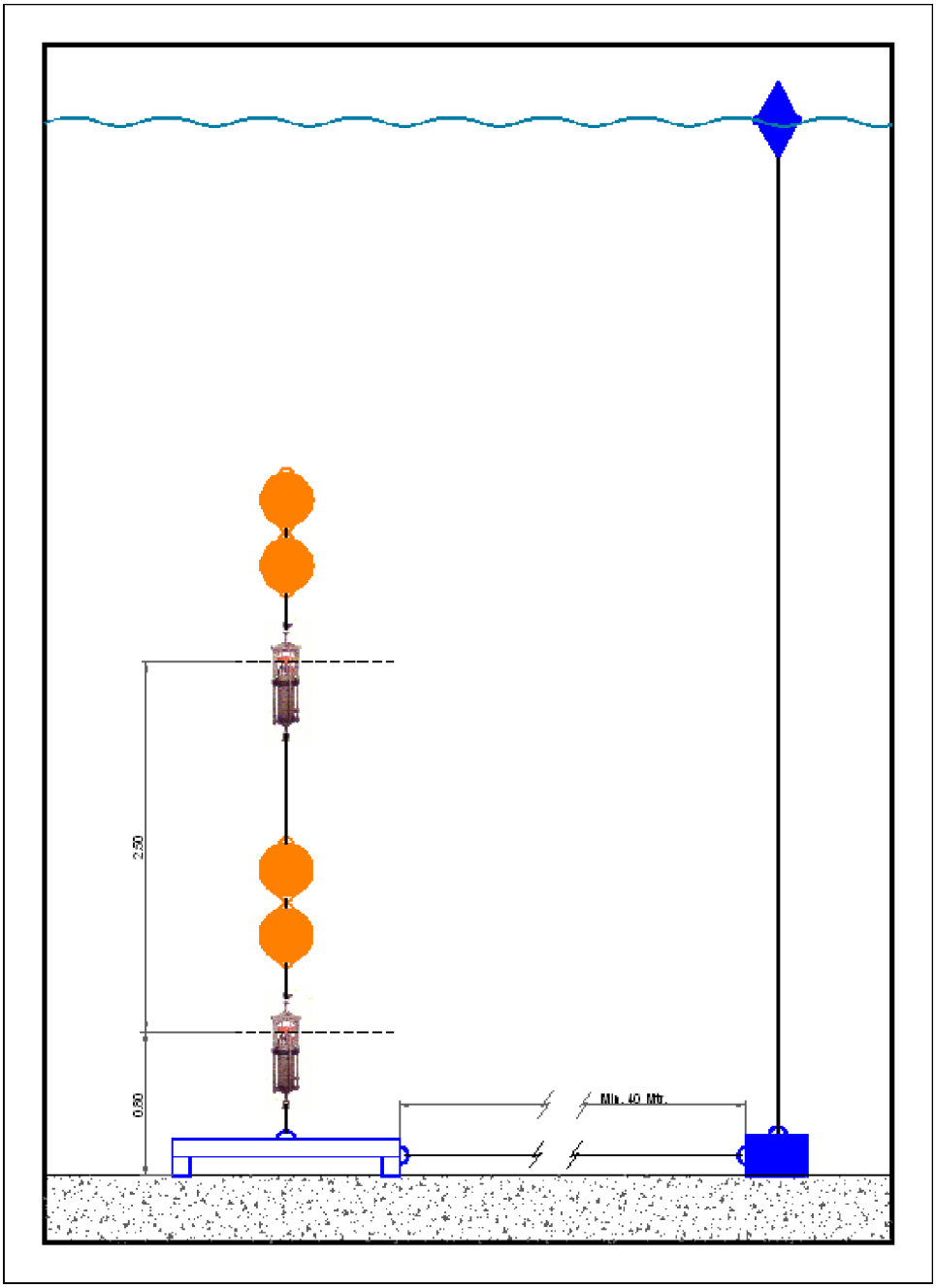


Figure 3-15: Fixed set-up for two RCM9 units with subsurface buoys (orange)

The instruments were set up to measure every 10 minutes. All sensors (temperature, pressure, conductivity, turbidity, tilting) except the Doppler Current Sensor were set to record once every 10 minutes. The Doppler Current Sensor sent 600 pings during every 10 minute-interval and calculated the average value for current speed and direction over this interval. Data storage units

in the instruments logged all the measured values. A picture of the set-up is shown in Figure 3-16. More information about the Aanderaa RCM-9 can be found in IMDC (2005l).



Figure 3-16: Set-up of two RCM-9 units

Table 3-2 gives an overview of the measured parameters during the long term measurements and the depth at which these were registered.

Table 3-2: The equipment and measured parameters per location (01/01/2006 – 31/12/2007)

Through tide measurements									
Location	***Period***	***Instrument***	***Velocity***	***Direction***	***Temperature***	***Pressure***	***Conductivity***	***Turbidity***	***Depth***
Deurganckdok (in dock, transect Y	21/03/06 & 26/09/06	SiltProfiler			X	X	X	X	
		Echosounder							X
		Aanderaa RCM 9			X	X	X		
		CTD			X	X	X		
Liefkenshoek (transect I)	22/03/06 & 27/09/06	ADCP	X	X					
		OBS			X	X	X	X	
		CTD			X	X	X		
		Pump Sampler							
		SiltProfiler			X	X	X	X	
		Echosounder							X
Deurganckdok (transect K & in dock transect DGD)	22/03/06 & 27/09/06	ADCP	X	X					
		OBS			X	X	X	X	
		CTD			X	X	X		
		Pump Sampler							
Deurganckdok (transect K)	23/03/06 & 28/09/06	SiltProfiler			X	X	X	X	
		Echosounder							X
Schelle (transect S)	23/03/06 & 28/09/06	ADCP	X	X					
		OBS			X	X	X	X	
		CTD			X	X	X		
		Pump Sampler							
Waarde (Transect W)	23/03/06 & 28/09/06	Same as Schelle (transect S)							

Near bed continuous monitoring									
Location	***Period***	***Instrument***	***Velocity***	***Direction***	***Temperature***	***Pressure***	***Conductivity***	***Turbidity***	***Depth***
Deurganckdok CDW	14/03/2006 – 05/04/2006	Valeport MIDAS OBS3+	X	X	X	X	X	X	
		Aanderaa RCM9	X	X	X	X	X	X	
		ALTUS							X
		ARGUS			X	X	X	X	
Deurganckdok CDW	19/04/2006 – 23/05/2006	Idem	Idem						
Deurganckdok Sill	19/04/2006 – 23/05/2006	Idem	Idem						
Deurganckdok CDW	18/07/2006 – 11/10/2006	Idem	Idem						
Deurganckdok Sill	19/07/2006 – 11/10/2006	Idem	Idem						
Deurganckdok CDW	15/03/2007 – 12/04/2007	Idem	Idem						
Deurganckdok Sill	09/02/2007 – 18/04/2007	Idem	Idem						
Deurganckdok CDW	26/09/2007 – 05/12/2007	Idem	Idem						
Deurganckdok Sill	10/10/2007 – 28/11/2007	Idem	Idem						

Long-term salinity measurements								
Location	***Period***	***Instrument***	***Velocity***	***Direction***	***Temperature***	***Pressure***	***Conductivity***	***Turbidity***
Deurganckdok (Quay wall)	17/03/2006 – 28/04/2006	Aanderaa RCM9	X	X	X	X	X	X
		OBS 3A			X	X	X	X
Deurganckdok (Quay wall)	20/07/2006 – 12/10/2006	OBS 3A			X	X	X	X
Deurganckdok (Quay wall)	12/02/2007 – 27/03/2007	OBS 3A			X	X	X	X
Deurganckdok (Quay wall)	20/06/2007 – 31/07/2007	OBS 3A			X	X	X	X
Deurganckdok (Quay wall)	19/09/2007 – 10/12/2007	OBS 3A			X	X	X	X

Long-term measurements			
Location	***Period***	***Instrument***	***Depth sensor***
Buoy 84	01/01/2006 – 30/06/2006	Aanderaa RCM 9	-5.6m TAW
		Aanderaa RCM 9	-8.1m TAW
Buoy 97	01/01/2006 – 30/06/2006	Aanderaa RCM 9	-5.3m TAW
		Aanderaa RCM 9	-7.8m TAW
Buoy 84	01/07/2006 – 31/12/2006	Aanderaa RCM 9	-5.6m TAW
		Aanderaa RCM 9	-8.1m TAW
Buoy 97	01/07/2006 – 31/12/2006	Aanderaa RCM 9	-5.3m TAW
		Aanderaa RCM 9	-7.8m TAW
Buoy 84	01/01/2007 – 31/03/2007	Aanderaa RCM 9	-5.6m TAW
		Aanderaa RCM 9	-8.1m TAW
Buoy 97	01/01/2007 – 31/03/2007	Aanderaa RCM 9	-5.3m TAW
		Aanderaa RCM 9	-7.8m TAW
Buoy 84	01/04/2007 – 30/06/2007	Aanderaa RCM 9	-5.6m TAW
		Aanderaa RCM 9	-8.1m TAW
Buoy 97	01/04/2007 – 30/06/2007	Aanderaa RCM 9	-5.3m TAW
		Aanderaa RCM 9	-7.8m TAW
Buoy 84	01/07/2007 – 30/09/2007	Aanderaa RCM 9	-5.6m TAW
		Aanderaa RCM 9	-8.1m TAW
Buoy 97	01/07/2007 – 30/09/2007	Aanderaa RCM 9	-5.3m TAW
		Aanderaa RCM 9	-7.8m TAW
Buoy 84	01/10/2007 – 31/12/2007	Aanderaa RCM 9	-5.9m TAW
		Aanderaa RCM 9	-8.2m TAW
Buoy 97	01/10/2007 – 31/12/2007	Aanderaa RCM 9	-4.4m TAW
		Aanderaa RCM 9	-6.9m TAW

3.2.2. Overview of the data acquisition (measurements buoy 84 & buoy 97)

A chronological overview of the measurements, per location and per instrument, is given in Table 3-3 as well as an explanation for missing and faulty data.

Table 3-3: Chronological overview of the RCM-9 measurements

Buoy 84 top – 3.3 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
20/09/2005				Start measurement period
01/10/2007	0579			Start reporting period
31/12/2007	0579			End reporting period
Buoy 84 bottom – 0.8 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
20/09/2005				Start measurement period
01/10/2007	1153			Start reporting period
01/10/2007 – 10/10/2007	1153	X		Low battery
10/10/2007 – 23/10/2007	1153		X	Bad conductivity data
27/10/2007 – 21/11/2007	1153		X	Bad conductivity data
24/11/2007 – 16/12/2007	1153		X	Bad conductivity data
22/12/2007 – 31/12/2007	1153		X	Bad conductivity data
31/12/2007	1153			End reporting period
Buoy 97 top – 3.3 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
21/09/2005				Start measurement period
01/10/2007	1225			Start reporting period
05/11/2007 – 10/11/2007	1225		X	Bad current direction and velocity data
19/11/2007 – 05/12/2007	1225		X	Bad current direction and velocity data
31/12/2007	1220			End reporting period

Buoy 97 bottom – 0.8 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
21/09/2005				Start measurement period
01/10/2007	1229			Start reporting period
31/12/2007	1229			End reporting period

3.2.3. Bulk density measurements at entrance channels

The bulk density measurements were performed by an Echotrac MKIII echo sounder in combination with the SILAS software (Stema-Surveys bv) to determine horizons of equal density. The echo sounder transmits an acoustic signal of 33 and 210 kHz. The echo of the 33 kHz signal is automatically interpreted by the SILAS software and identifies various reflections horizons or layers with corresponding density levels.
In order to relate the echo signal to the local density, calibration data is needed. In this exercise, the Navitracker data set was used for this.

The Navitracker device (Figure 3-17) is a patented system to measure the density of fluid mud suspensions, by means of a gamma-density meter. It has been used by the Flemish authorities for more than 20 years to determine the nautical bed of the port of Zeebrugge.
The Navitracker system can be operated by a computer-controlled winch to tow it through the mud (horizontal mode). The Navitracker is equipped with the following sensors:

- the Gamma-ray density sensor, mounted on a fork-like tow fish, returning density information.
- the depth sensor gives information on the depth of the sensor.
- the position of the fish is calculated out of the length of the winch cable. Together with the position of the tow fish, following the density level, a dual frequency echo sounder is used to map the hard bottom and the top of the mud. With a speed of 2 to 3 knots, large areas can be covered.

For these measurements the Navitracker was used in a vertical profiling mode though, with the probe in vertical position in order to penetrate the soft bottom.

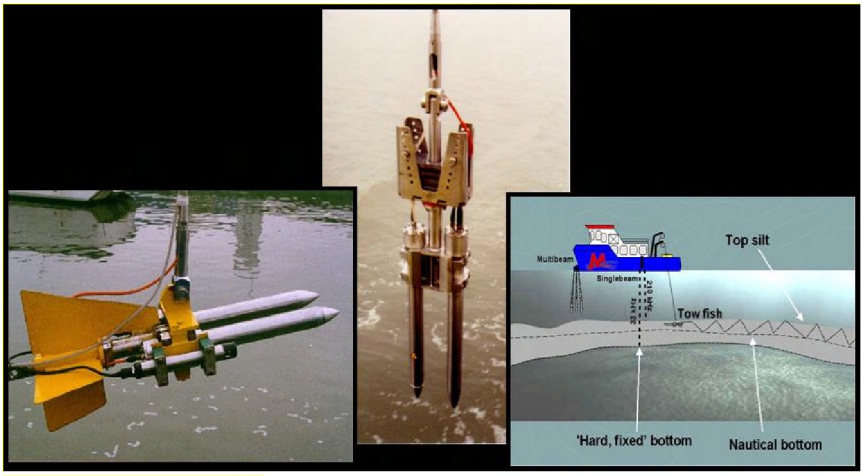


Figure 3-17: Navitracker

For each echosounder / SILAS measurement, both in time and space, a calibration data set was collected by means of the Navitracker. The different sampling locations can be found in APPENDIX B.

3.3. Processing of datasets

3.3.1. Data collected in river Scheldt

3.3.1.1. Methodology of Processing

The collected data was validated and outliers were removed. Erroneous measurements because of malfunction of sensors, growth on sensors, instrument failure were also removed from the dataset and are documented in 3.2.2.

Salinity was calculated using the temperature, conductivity and pressure in the pps-78 formula (Unesco, 1991 & IMDC, 2002).

Turbidity values were converted to suspended sediment concentration using the equation of the calibration curve. By submerging each turbidity sensor in clean water at almost every redeployment, the bias of the turbidity sensors was tested.

The calibration procedure and calibration graphs can be found in IMDC (2006a, 2007a and 2008c).

3.3.1.2. Results (weekly)

Measurements are visualized per instrument, location and per week in APPENDIX C.

- The title shows the week number followed by the year
- The first graph shows the current velocity and the current direction. The direction is scaled from 0 to 360
- The second graph depicts the salinity and temperature
- The third and last graph shows the waterlevel at the nearest tidal gauge and the suspended sediment concentration

All times are given in MET.

3.3.1.3. Results (monthly)

Monthly results are reported in APPENDIX C. The minimum, maximum and average value for velocity magnitude, temperature and suspended sediment concentration is given for every month. For salinity the minimum, maximum and mean are calculated for both high water slack and low water slack.

3.3.1.4. Results (deployment period)

An overview of the evolution of the monthly minimum, maximum and average values for velocity magnitude, temperature and suspended sediment concentration is given in APPENDIX C. For salinity the minimum, maximum and mean are given for both high water slack and low water slack. The graphs are given for the whole deployment period (September 2005 – December 2007).

3.3.1.5. Total results (October 2007 – December 2007)

The results for the whole deployment period are also given in APPENDIX C. The minimum, maximum and average value for velocity magnitude, temperature and suspended sediment concentration is given for the period from October 2007 till December 2007. For salinity the

minimum, maximum and mean are calculated for both high water slack and low water slack is given.

3.3.2. Data collected at the entrance channel of locks

From the measured bulk density profiles, depth maps of equal density layers are created. Also the vertical and horizontal distribution of sediment concentration is computed from the data. The technique adopted in this work consists of the following steps:

- calibration of SILAS by Navitracker measurements;
- create grids with depth of equal density plane: 1010, 1050, 1100, 1150, 1200 and 1250. These planes are shown in APPENDIX I for the different entrance locks and measurement dates;
- SILAS returns good SN-ratio until density of 1250; below this plane an average density based on available Navitracker data is used to calculate the mass. The obtained average bottom densities below the equal density plane of 1.25 tons/m³ for the different measurements can be found in Table 3-4, Table 3-5 and Table 3-6;
- Calculation of mass in each layer based on the difference of plane depths and average layer density. No mass is calculated when a layer density is locally missing or when subsequent depth planes of different densities locally cross each other (i.e. when a plane of higher density lies above one of a lower density).

Table 3-4: Averaged bottom densities (tons/m³) below the density plane of 1.25 tons/m³ as measured by the Navitracker near the van Cauwelaert and Boudewijn locks

date	van Cauwelaert lock	Boudewijn lock
04/09/2007	1.2944	1.2804
15/10/2007	1.2898	1.2772
20/11/2007	1.3146	1.2976

Table 3-5: Averaged bottom densities (tons/m³) below the density plane of 1.25 tons/m³ as measured by the Navitracker near the Kallo lock

	Kallo lock		
date	entrance channel	southern bank	northern bank
04/09/2007	1.2743	1.2796	1.2714
15/10/2007	1.2776	1.2641	1.2365

Table 3-6: Averaged bottom densities (tons/m³) below the density plane of 1.25 tons/m³ as measured by the Navitracker near the Berendrecht and Zandvliet locks

date	Berendrecht lock	Zandvliet lock
09/09/2007	1.3161	1.2796
17/10/2007	1.3002	1.2597
19/11/2007	1.3225	1.2713

To calculate the total sediment mass, it is necessary to adopt a lower boundary for the vertical sediment concentration profile. Above this depth, the accumulated mass is computed. Here, the maintenance dredging depth for the different entrance channels is used as threshold:

- Kallo lock's entrance channel: -14 m TAW
- Boudewijn and van Cauwelaert locks' entrance channel: -12.5 m TAW

- Zandvliet and Berendrecht locks' entrance channel: -16 m TAW

The calculated distribution of sediment mass in the entrance channels is shown in APPENDIX J.

The total sediment mass will be determined for the entrance channels. Their delineation is shown in Figure 3-18, Figure 3-19 and Figure 3-20 for the Kallo lock, Boudewijn and Cauwelaert locks, and Zandvliet and Berendrecht locks respectively.

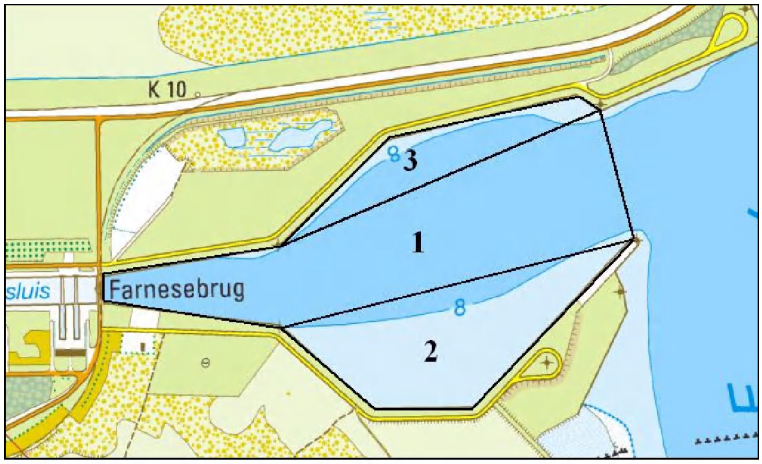


Figure 3-18: Adopted zones for the Kallo lock's entrance channel



Figure 3-19: Adopted zones for the Boudewijn and Cauwelaert locks' entrance channel

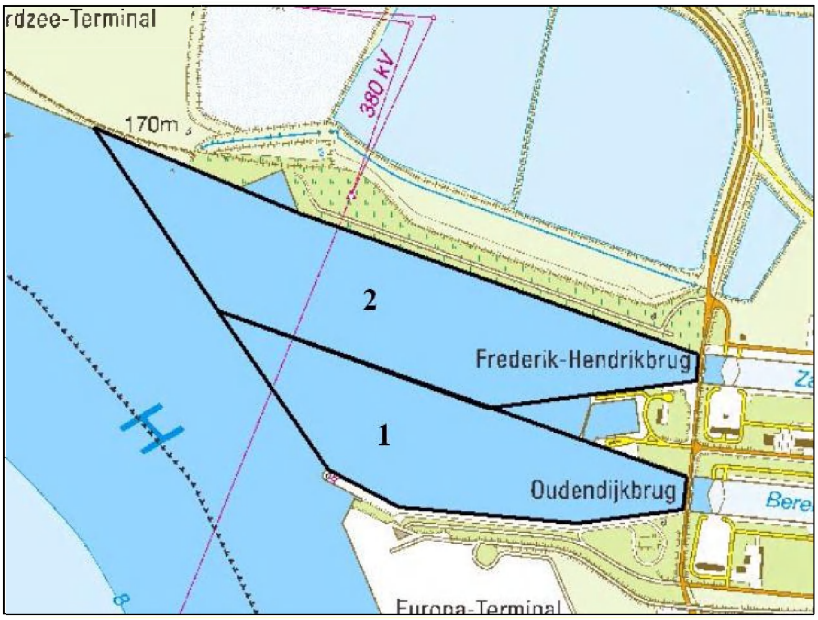


Figure 3-20: Adopted zones for the Zandvliet and Berendrecht locks' entrance channel

4. AMBIENT CONDITIONS

4.1. Environmental characteristics in the Lower Sea Scheldt

4.1.1. Other measurement campaigns

Beside the RCM-9 measurements at buoy 97 and 84 also other long-term measurements were executed in the Lower Sea Scheldt. At Oosterweel left bank (or Dukdalf), current, temperature, salinity and turbidity measurements were conducted using 2 Aanderaa RCM-9 units. Another RCM-9 unit was also used at Prosperpolder, where only temperature and salinity measurements were conducted. These instruments were suspended from a mooring post at fixed distances from the bottom. These measurements were set up and maintained by WL – Cel Hydrometrie Schelde. Figure 4-1 shows an overview of all the measurement locations (including locations of HCBS2 measurements).

The data of these measurements was processed by IMDC and is presented in APPENDIX D. Calibration of the turbidity sensors was executed by IMDC during the summer calibration of 2006. Further details of this calibration can be found in IMDC (2007a).

Table 4-1: Measurement locations and periods at Oosterweel (left bank) & Prosperpolder .

Location	***Depth sensor***	***Easting (UTM ED 50)***	***Northing (UTM ED 50)***	***Period***
Oosterweel (left bank)	4.5m above bottom (-2.3m TAW)	595574	5677278	01/10/2007 – 31/12/2007
Oosterweel (left bank)	1m above bottom (-5.8m TAW)	595574	5677278	01/10/2007– 31/12/2007
Prosperpolder	2.5m above bottom (-1.5m TAW)	586307	5689501	01/10/2007– 31/12/2007

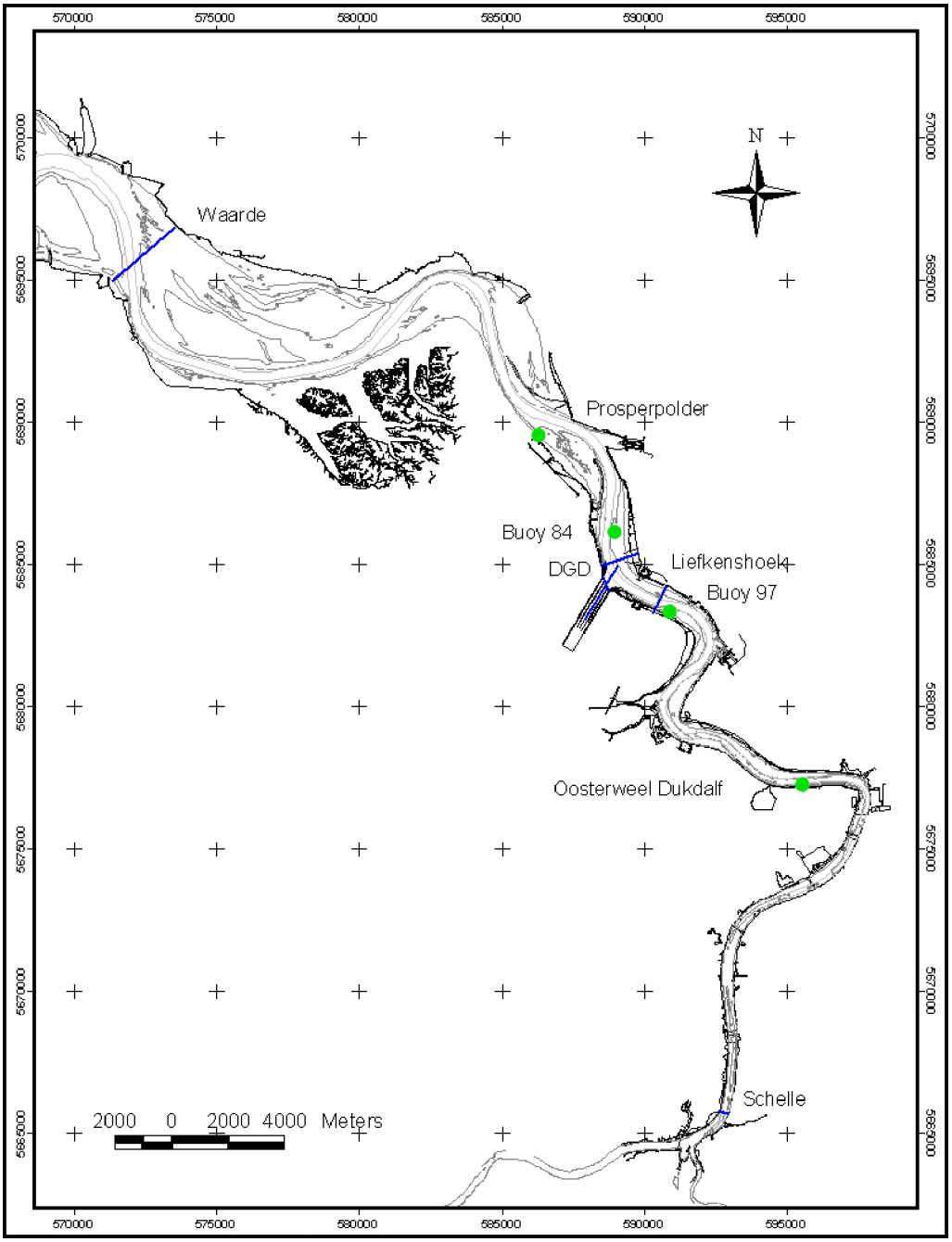


Figure 4-1: All measurement locations 01/2007 – 12/2007

The data gathered during these long-term measurements is current velocity, current direction, temperature, pressure and turbidity. In APPENDIX D the processed data is visualized per instrument, location and per week for October until December 2007.

  - The title shows the week number followed by the year
- The first graph shows the current velocity and the current direction. The direction is scaled from 0 to 360.
- The second graph depicts the salinity and temperature
- The third and last graph shows the water level at the nearest tidal gauge and the suspended sediment concentration

All times are given in MET.

To convert the turbidity values to suspended sediment concentration the equation of the calibration curve was used. The calibration procedure and calibration graphs can be found in IMDC (2007a).

An overview of the measurements and an explanation of missing and faulty data for the whole period is given in Table 4-2.

Table 4-2: Chronological overview of the long-term measurements at Oosterweel& Prosperpolder (01/10/2007 - 31/12/2007)

Oosterweel left bank – 4.5 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
01/07/2004				Start measurement period
01/10/2007	0152			Start reporting period
01/10/2007 – 04/10/2007	0152	X		Data not delivered
21/10/2007 – 23/10/2007	0152		X	Problem with the time
23/10/2007 – 14/11/2007	0152	X		Data not delivered
31/12/2007	0152			End reporting period
Oosterweel left bank – 1 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
01/07/2004				Start measurement period
01/102007	0149			Start reporting period
01/10/2007 – 06/12/2007	0149	X		Data not delivered
19/12/2007 – 31/12/2007	0149	X		Data not delivered
31/12/2007	0149			End reporting period

Prosperpolder – 2.5 m above bottom				
Period	***Sensor***	***No data***	***Faulty data***	***Comment***
15/06/2006	0117			Start measurement period
01/10/2007	0117			Start reporting period
19/12/2007 – 31/12/2007		X		Data not delivered
31/12/2007	0117			End reporting period

Monthly results (minimum, maximum and average) are shown in APPENDIX D. The minimum, maximum and average value for velocity magnitude, temperature and suspended sediment concentration is given for every month. For salinity the minimum, maximum and mean are calculated for both high water slack and low water slack. Also an overview of the evolution of the monthly minimum, maximum and average values of these parameters is given in APPENDIX D for the whole reporting period (July 2007 – December 2007). Notice that for the suspended sediment concentration the graphs are only given since 2006. In the previous reports turbidity was presented because there was no calibration available for the turbidity sensors.

The results for the whole measurement period are also given in APPENDIX D. The minimum, maximum and average value for velocity magnitude, temperature and suspended sediment concentration is given for the period from October 2007 till December 2007. For salinity the minimum, maximum and mean are calculated for both high water slack and low water slack is given.

4.1.2. Vertical tide

Tidal data was delivered for the period from 01/10/2007 till 31/12/2007 by Waterbouwkundig Laboratorium – Cel Hydrometrie Schelde. It is reported together with the processed data of the long-term measurement campaigns and those at Oosterweel and Prosperpolder in APPENDIX C respectively APPENDIX D.

4.1.3. Salinity downstream

Salinity data of Baalhoek and Hoofdplaat was collected from the Hydro Meteo Centrum Zeeland (HMCZ, 2008) and processed by IMDC. Outliers were screened and removed. Monthly results (minimum, maximum and average values for salinity) are reported in APPENDIX E.

4.2. Fresh water inflow from the tributaries

The fresh water discharge of the Kleine Nete (Grobbendonk), the Grote Nete (Hulshout), the Dijle (Wijgmaal), The Demer (Wilsele), the Dender (Dendermonde), the Zenne (Eppegem) and the Bovenschelde (Melle) are provided by the Hydrologische Informatie Centrum of the Ministerie van de Vlaamse Gemeenschap – Departement Leefmilieu en Infrastructuur Afdeling Waterbouwkundig Laboratorium. The gauging stations are not influenced by the tide. The calculated discharges at the gauging stations are converted to discharges at the mouth of the tributaries and then to a total fresh water discharge at Schelle. This 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.

In APPENDIX F a graph of the evolution of the fresh water discharge is given just as a table with the decade averages of the fresh water discharge. Also the monthly averages are compared to the

expected discharges in a graph. Notice that the given values are only temporary since no influence of possible growth is taken in to account yet. This will be done at the end of the year by the Hydrologische Informatie Centrum of the Ministerie van Mobiliteit en Openbare Werken - Departement Mobiliteit en Openbare Werken - Afdeling Waterbouwkundig Laboratorium.

4.3. Meteorological data

The meteorological conditions for the measurement station Deurne for the period 01/10/2007-31/12/2007 cannot be reported. This data should have been obtained from the KMI (Royal Meteorological Institute of Belgium) but due to problems at the institute the requested data is not published yet.

4.4. Human Activities

4.4.1. Dredging activities

Afdeling Maritieme Toegang provided information about the dates, times, volumes and locations of dredging activities. In APPENDIX G an overview is given of all the dredging activities from 01/10/2007 till 31/12/2007. Weekly volumes are given per location.

4.4.2. Navigation

Weekly data of navigation was delivered by Afdeling Scheepvaartbegeleiding – Schelde Rader Keten for the period of 01/10/2007 till 31/12/2007. To order the data a splitting up of the Beneden Zeeschelde was done in 4 areas. The first area is from de Belgian border up to locks of Zandvliet – Berendrecht (sluizencomplex Zandvliet – Berendrecht), the second goes from this point forward up to Deurganckdok. The third area is from Deurganckdok up to the lock of Kallo (Kallosluis) and finally the fourth goes up to the lock of Royers (Royerssluis). A more detailed description of the areas can be found in APPENDIX H. Also a distinction is made between the draughts. In APPENDIX H a total number is given which refers to the total of passing ships registered by Afdeling Scheepvaartbegeleiding - Schelde Radar Keten. In addition a difference was made between inland navigation and seagoing ships, just as between arrival and departure. Notice that for a certain area and certain draught, the total may deviate from the sum of inland navigation and seagoing. This can be explained by the presence of ships like dredgers, which were only counted in the column ‘total’. Also a difference may occur between the total number and the sum of the arrival and departure number. This is due to vessels that have the same entry and exit point.

Finally it should be mentioned that not all inland shipping is observed by the system, which means that the actual number of inland shipping will be higher.

5. SEDIMENT DENSITIES AND MASSES IN ENTRANCE CHANNELS OF DIFFERENT LOCKS

Measured equal density planes for the different entrance channels are shown in APPENDIX I. From the plots it is clear that the entrance channels to the van Cauwelaert and Boudewijn locks were deepest in October when looking at the nautical depth corresponding to a bulk density of 1.25 tons/m^3. The entrance channel showed a bed elevation of –10 to –11 m TAW for the van Cauwelaert lock, whereas the Boudewijn lock was connected to the Scheldt navigation channel by an entrance channel of –11 to –12 m TAW. The latter however showed a moderate sill near the Scheldt. Other measurements returned higher bed elevations indicating siltation.

With respect to the Kallo lock, only two density measurements were available, i.e. September and October 2007. In September, the density threshold of 1.25 tons/m^3 could be found at –10 to –12 m TAW in the entrance channel. This bed elevation increased to –9 to –10 m TAW by the month October. The severe siltation could also be observed near the small coves at both sides of the entrance channel. There, 1-2 metres of siltation were measured over the period of one month.

The deepest entrance channels were to be found towards the Zandvliet and Berendrecht locks. The density measurement in September 2007 indicated a nautical depth (cf. 1.25 tons/m^3) of up to –14 m TAW for the entire channel. In October, the channel close to the locks was characterized with a bed level of up to –15 m TAW. Further away from the locks, the channel was less deep and could be attributed to local dredging operations that disturbed the bed. By mid-November, the entrance channel had again a bed level of –14 m TAW; the difference with September was the narrower channel for the Berendrecht lock in November. The same counted for the Zandvliet lock. In addition, a moderate sill was observed near the Scheldt navigation channel at –13 m TAW.

Table 5-1 gives the temporal evolution of the total sediment mass in the different entrance channels. It is based on the sediment mass distribution data as covered in APPENDIX J. The vertical distribution in time of the mass is covered in the table as well. In order to ease the interpretation of the data, the months in which dredging occurred are included. Note that the density measurement at the Zandvliet and Berendrecht locks of 17 October 2007 are not considered because of dredging operations at the time of performing the measurements. Further on, special care should be taken during data analysis because the (SILAS) data uncertainty increases with density (see IMDC, 2008f). Hence, data should be looked at with the necessary criticism.

Table 5-1 indicates that the largest sediment mass could be found in the entrance channel of the Kallo lock, i.e. the channel covered slightly more than 400 10^3 TDS. Instead, the smallest sediment reservoir was determined at the van Cauwelaert lock and measured less than 100 10^3 TDS.

Periods of dredging are revealed by the temporal evolution of the sediment mass. In October 2007, dredging occurred in the entrance channel of the Boudewijn and van Cauwelaert locks. As a result, the total sediment mass decreased by 5 and 21% for the Boudewijn and van Cauwelaert locks respectively in comparison with the September measurement. After this withdrawal, the sediment accumulated again as can be observed in the table. With respect to the Berendrecht and Zandvliet locks, dredging happened in both September and October 2007. Here, the impact was not reflected by a decrease in total mass. The effect can however be observed in the upper density layers where less mass was stored compared to September. Although the upper layers covered a smaller fraction of the total mass, the deeper and denser layers continued to grow and accumulate sediments.

Table 5-1: Total sediment mass and its vertical distribution in the different entrance channels

		solids dry mass (TDS)						total mass (TDS)	total mass (%)	dredging
		density 1.01 - 1.05	density 1.05 - 1.10	density 1.10 - 1.15	density 1.15 - 1.20	density 1.20 - 1.25	density >1.25			
Boudewijnsluis	*04/09/2007*	809	1676	1492	2355	4920	78820	90074	100	
	15/10/2007	337	997	1610	1948	11050	69958	85900	95	x
	20/11/2007	394	1314	2229	2721	4229	104883	115770	129	
van Cauwelaertsluis	*04/09/2007*	314	990	716	1103	2611	82810	88544	100	
	15/10/2007	183	455	702	866	4759	62575	69539	79	x
	20/11/2007	229	526	863	1359	3040	92246	98263	111	
Zandvlietsluis	*06/09/2007*	2359	10535	13261	11125	19733	189233	246247	100	x
	19/11/2007	1024	3381	9200	14034	38833	243880	310351	126	
Berendrechtsluis	*06/09/2007*	1089	3831	6686	7843	16228	152578	188255	100	x
	19/11/2007	460	1496	3419	4901	15588	213779	239642	127	
Kallosluis	*04/09/2007*	2464	7808	6202	10546	18263	242372	287654	100	x
	15/10/2007	186	878	1718	2782	13256	382622	401442	140	x

6. REFERENCES

AZ (1974). Debieten van het Scheldebekken periode 1959 – 1972. *Ministerie van Openbare werken, Antwerpse Zeehavendienst.*

HMCZ (2008). Hydro Meteo Centrum Zeeland. Tijdsreeksen uit de WTZ – database. Consulted on 20 March 2008, at http://www.hmcz.nl.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IMDC (2007r) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing 2. Deelrapport 1.10: Sediment Balance: Three monthly report 1/4/2007 – 30/06/2007 (I/RA/11283/07.081/MSA)

IMDC (2007s) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing 2. Deelrapport 1.11: Sediment Balance: Three monthly report 1/7/2007 – 30/09/2007 (I/RA/11283/07.082/MSA)

IMDC (2007t) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing 2. Deelrapport 2.16: Salt-Silt distribution Deurganckdok summer (21/6/2007 – 30/07/2007) (I/RA/11283/07.092/MSA)

IMDC (2007v) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing 2. Deelrapport 3.10: Boundary conditions: Three monthly report 1/04/2007 – 30/06/2007 (I/RA/11283/07.097/MSA)

IMDC (2007w) Langdurige metingen Deurganckdok: Opvolging en analyse aanslibbing 2. Deelrapport 3.11: Boundary conditions: Three monthly report 1/07/2007 – 30/09/2007 (I/RA/11283/07.098/MSA)

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

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

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

IMDC (2008e) 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 (2008f). Feasibility study of echo sounding to determine fluid mud density profiles. Nota (I/NO/11283/08.001/BOB).

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.

APPENDIX A.

OVERVIEW OF HCBS2 AND OPVOLGING 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)~~[1]
5.6	Analysis of ambient conditions 21/09/05 - 31/3/2007 (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)

[1] The data, foreseen for Report 5.5 is reported in report 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 (Deurganckdok).

Report	Description of HCBS2
Ambient Conditions Lower Sea Scheldt	
11.5	Through Tide Measurements Sediview 28/9 Parel 2 - Schelle (I/RA/11291/06.108/MSA)
11.6	Through Tide measurement Longitudinal Salinity Distribution 26/9 Scheldewacht – Deurganckdok (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)

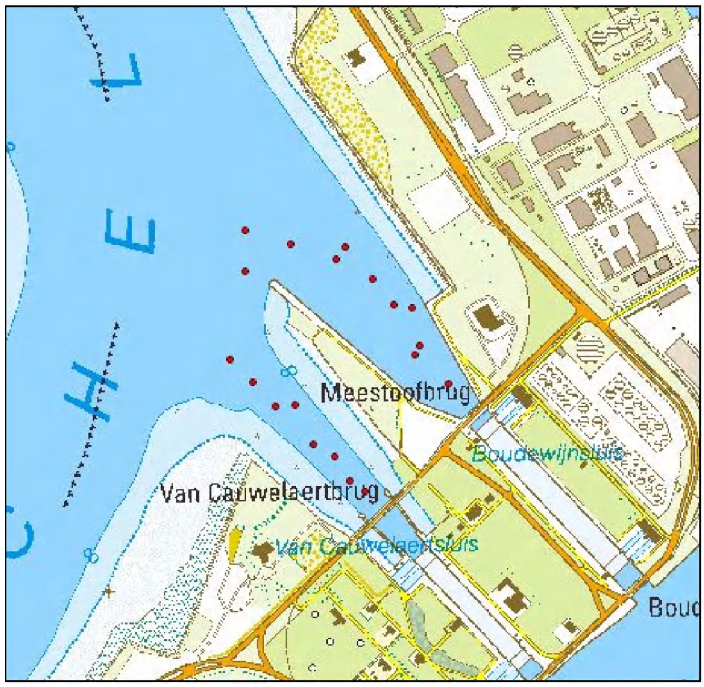
Report	Description of Opvolging aanslibbing Deurganckdok between April 2006 till March 2007
Sediment Balance: Bathymetry surveys, Density measurements, Maintenance and construction dredging activities	
1.1	Sediment Balance: Three monthly report 1/4/2006 – 30/06/2006 (I/RA/11283/06.113/MSA)
1.2	Sediment 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 average 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

Report	Description of Opvolging aanslibbing Deurganckdok between April 2006 till March 2007
	(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)
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)~~[2]
Analysis	
4.1	Analysis of Siltation Processes and Factors (I/RA/11283/06.129/MSA)

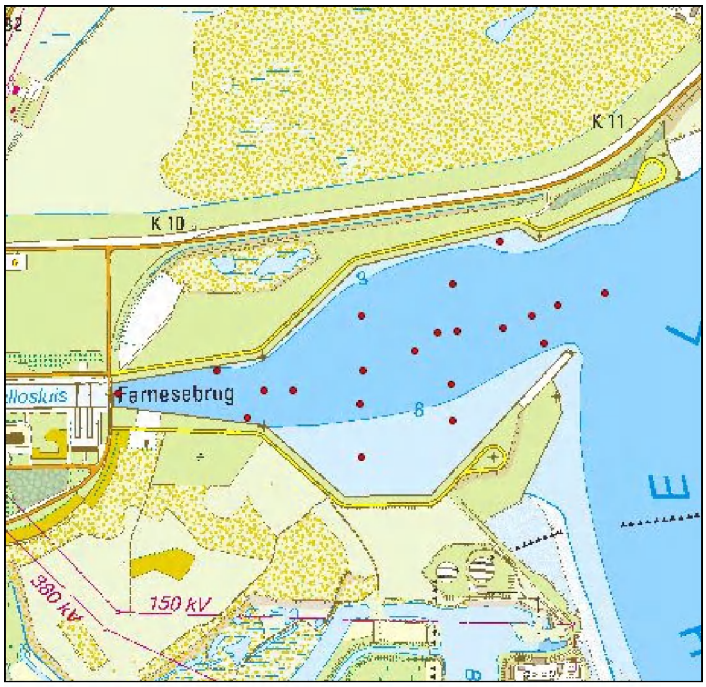
[2] considered in report 5.6 'Analysis of ambient conditions during 2006' (I/RA/11291/06.091/MSA) in the framework of the study 'Extension of the study about density currents in the Beneden Zeeschelde'

APPENDIX B.

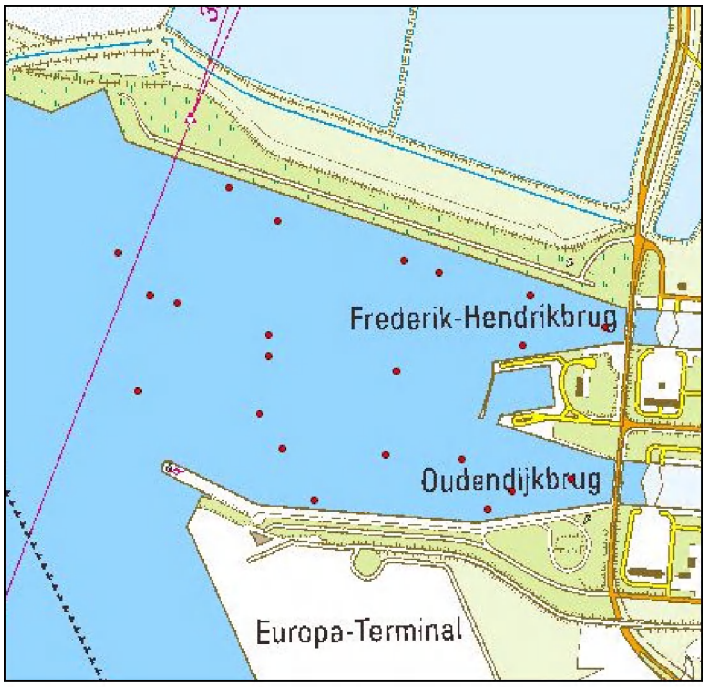
NAVITRACKER MEASUREMENT LOCATIONS



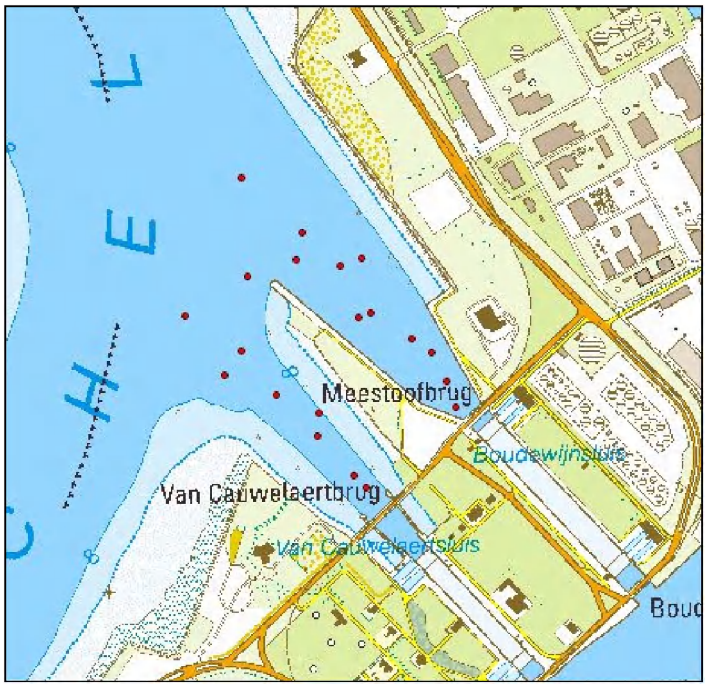
4 September 2007: Boudewijn and van Cauwelaert locks



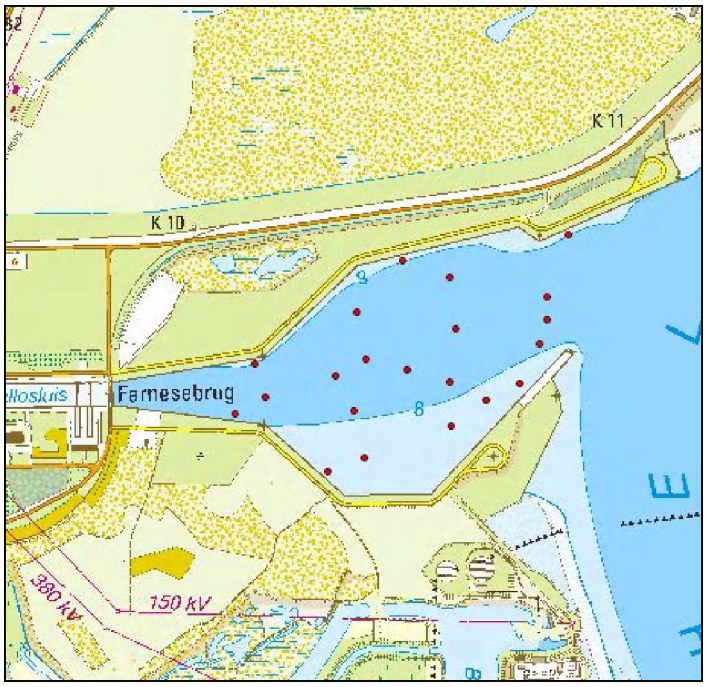
4 September 2007: Kallo lock



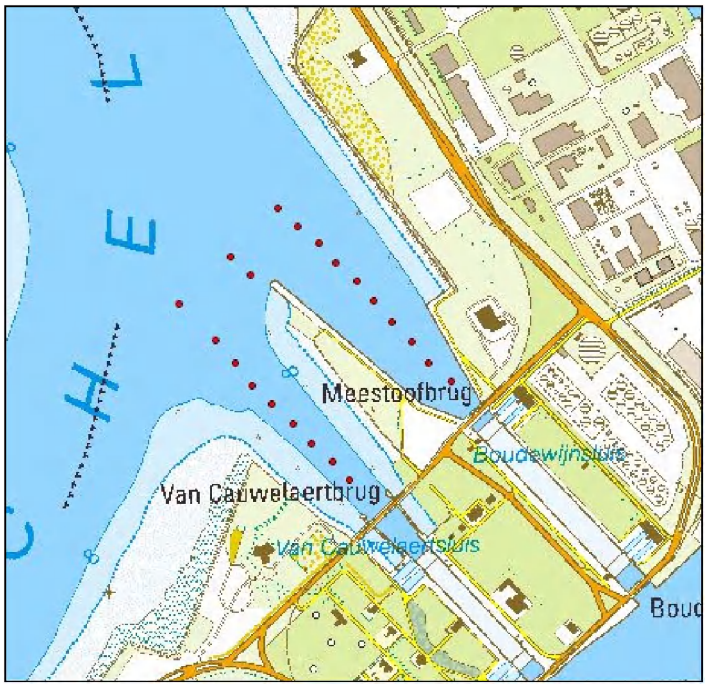
6 September 2007: Zandvliet and Berendrecht locks



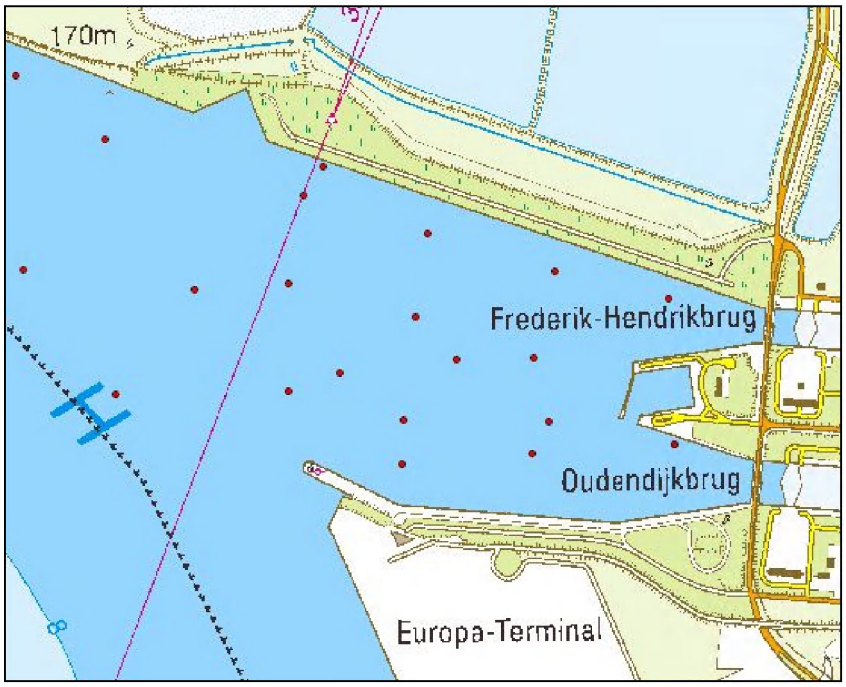
15 October 2007: Boudewijn and van Cauwelaert locks



15 October 2007: Kallo lock



22 November 20072007: Boudewijn and van Cauwelaert locks



19 November 2007: Zandvliet and Berendrecht locks

APPENDIX C.

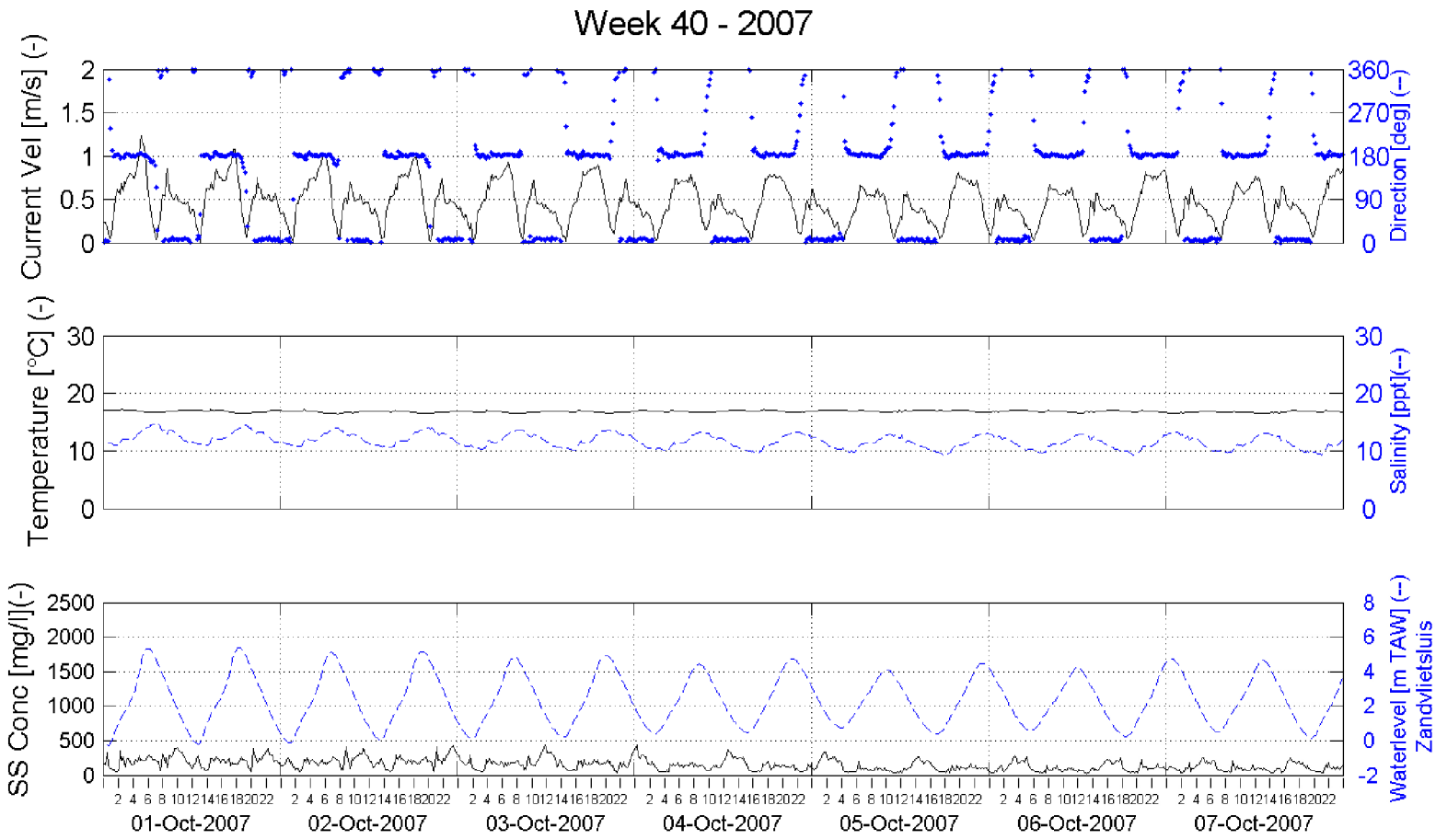
LONG-TERM MEASUREMENTS

DATASHEETS WEEKSERIES

Datasheet order

Nr	Location	Depth of Instrument		Sensor	Period
		[m] above bottom	[m TAW]		
1	Buoy 84	3.3	-5.6	Aanderaa 0579	01/10/2007 – 31/12/2007
2	Buoy 84	0.8	-8.1	Aanderaa 1153	01/10/2007 – 31/12/2007
3	Buoy 97	3.3	-5.3	Aanderaa 1225	01/10/2007 – 05/12/2007
				Aanderaa 1220	05/12/2007 – 31/12/2007
4	Buoy 97	0.8	-7.8	Aanderaa 1229	01/10/2007 – 31/12/2007

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

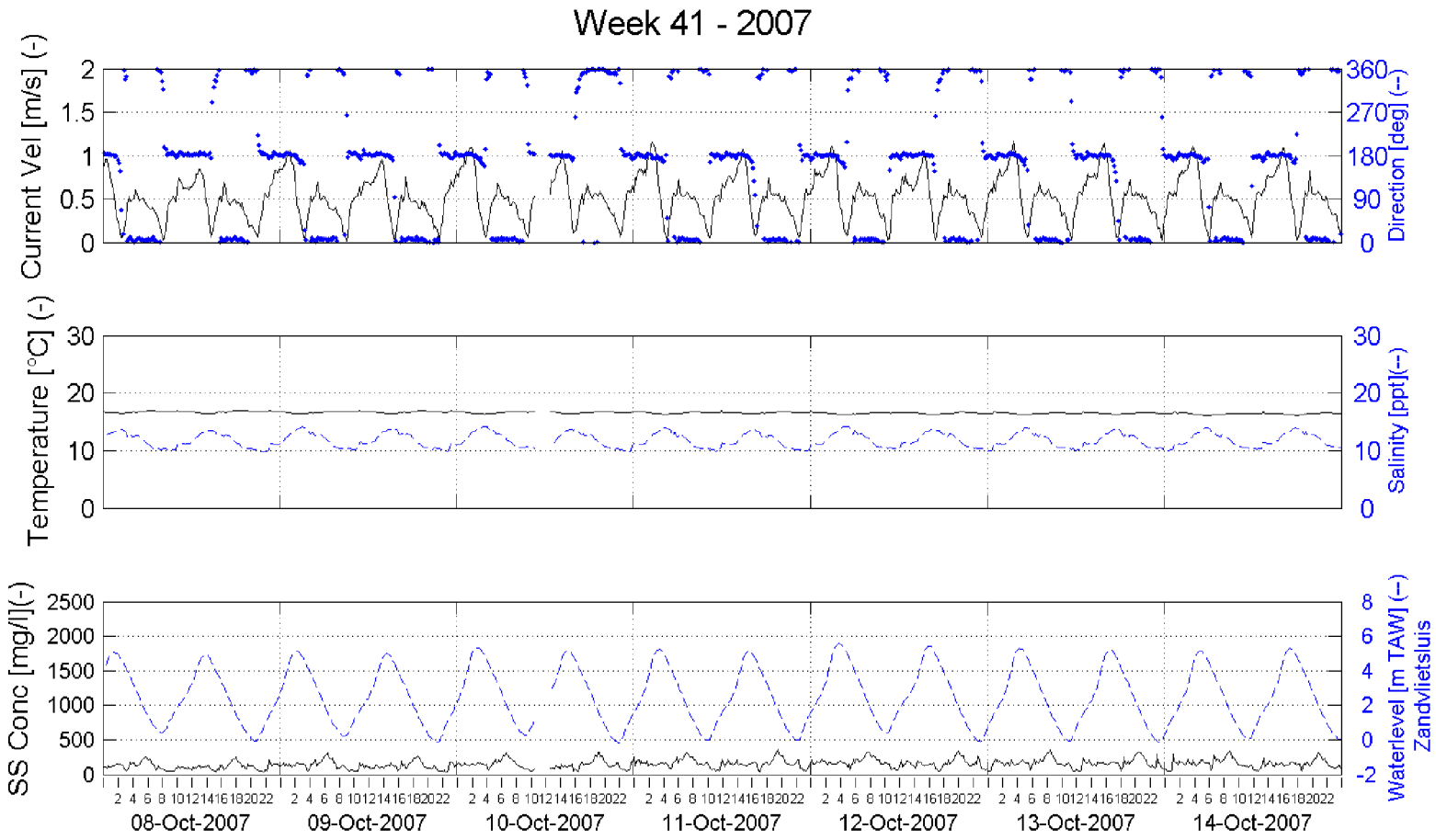
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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Processed by:

IMDC

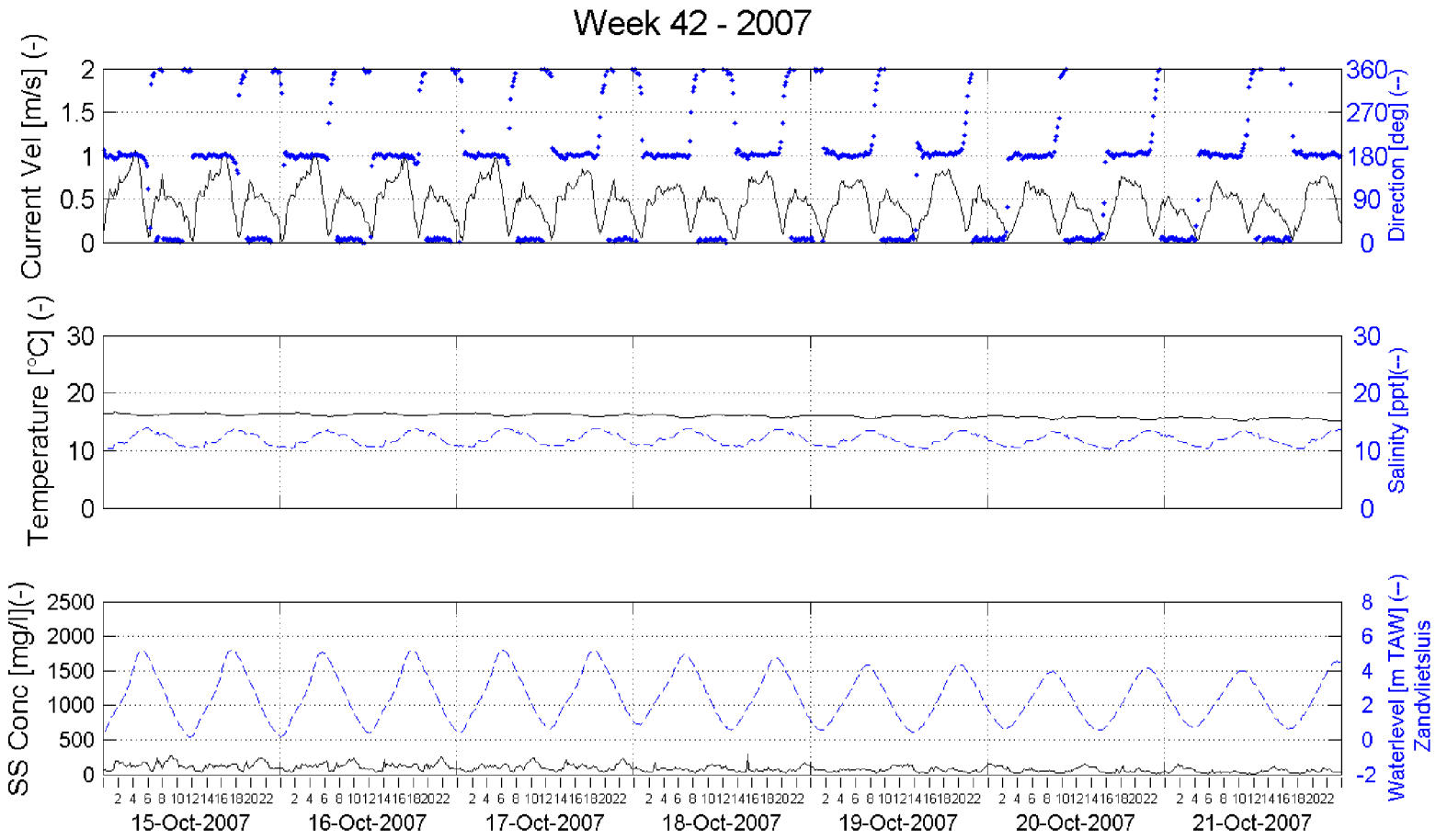
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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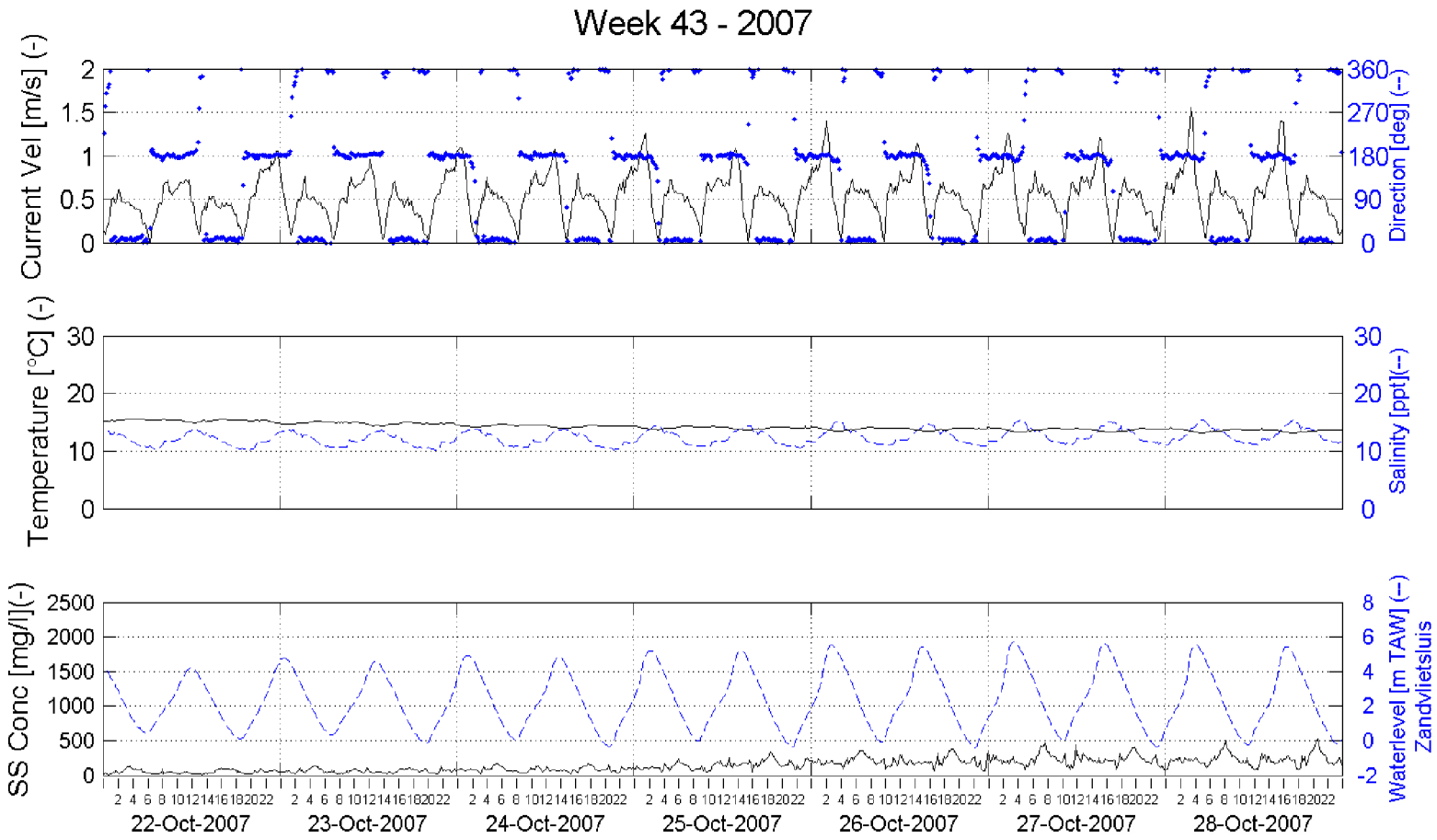
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

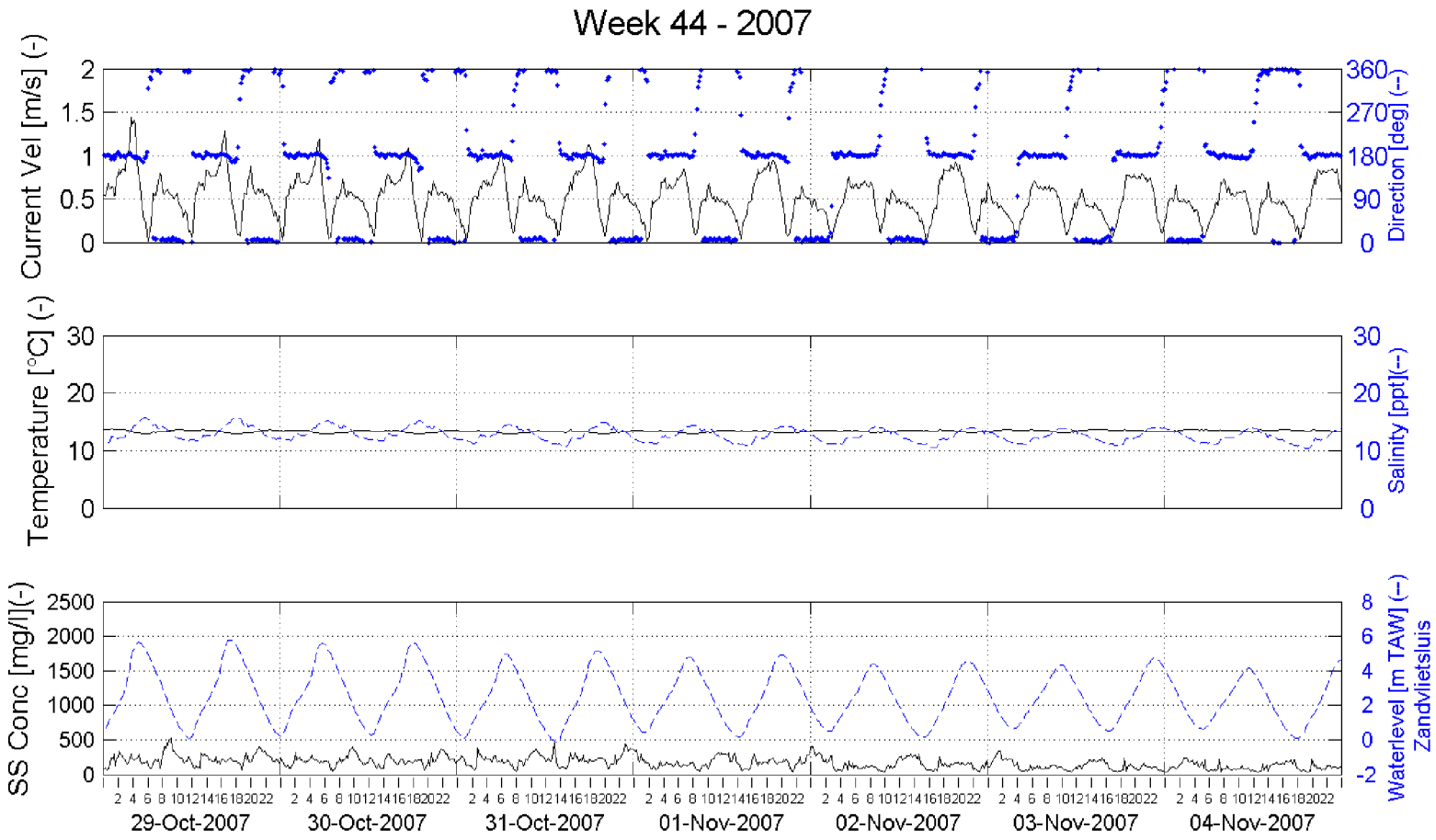
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

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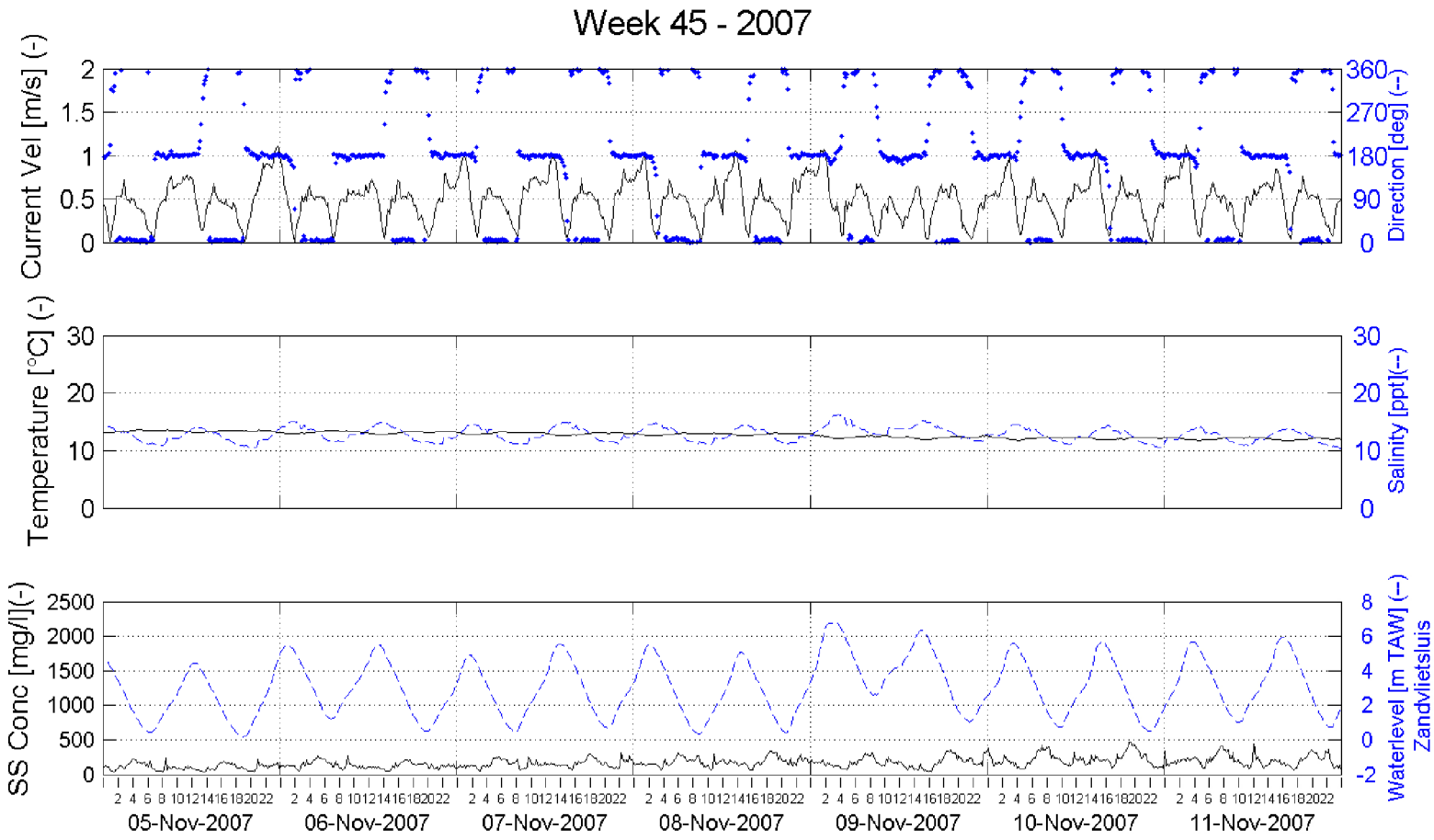
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

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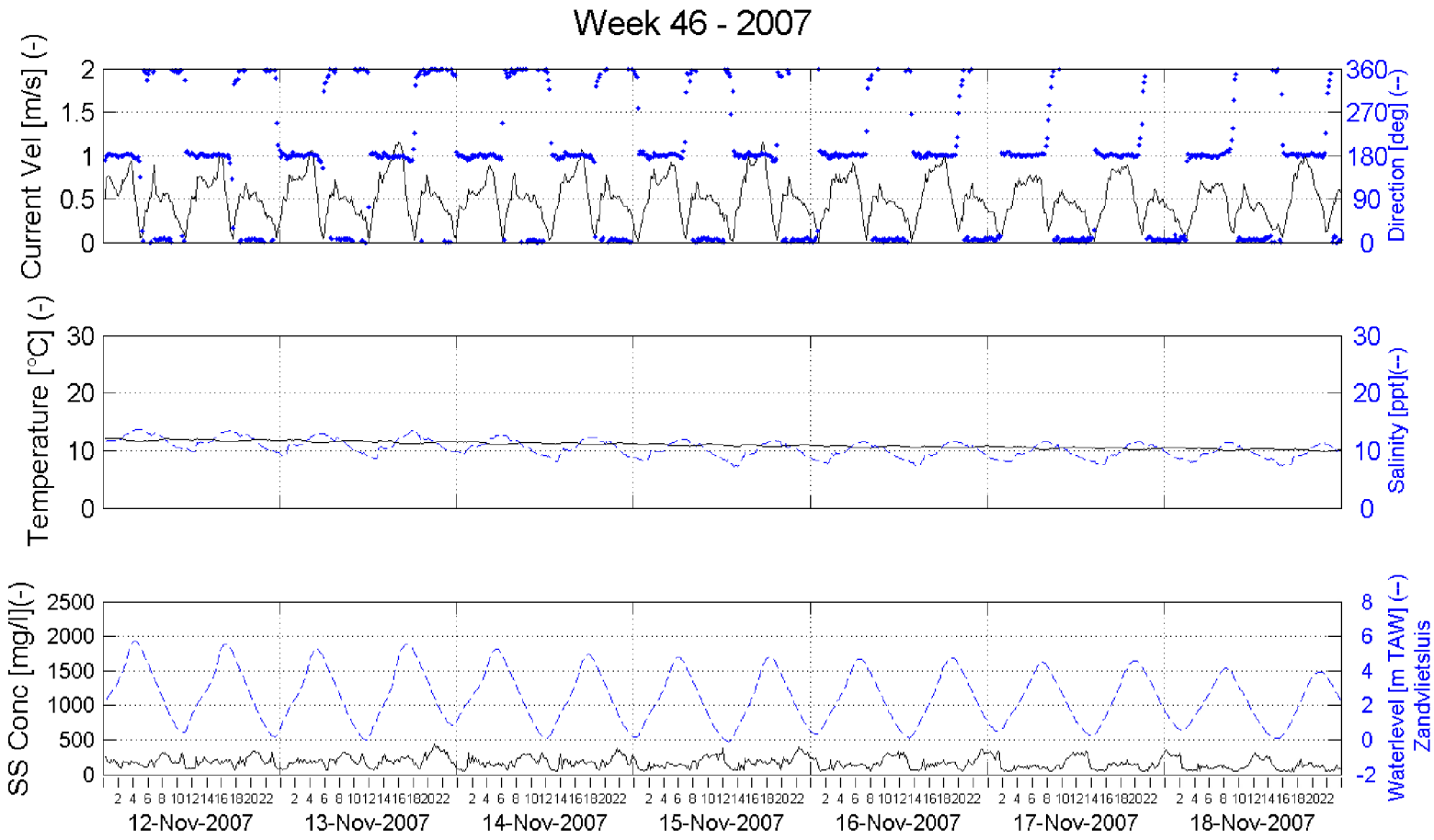
In Association with:

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GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

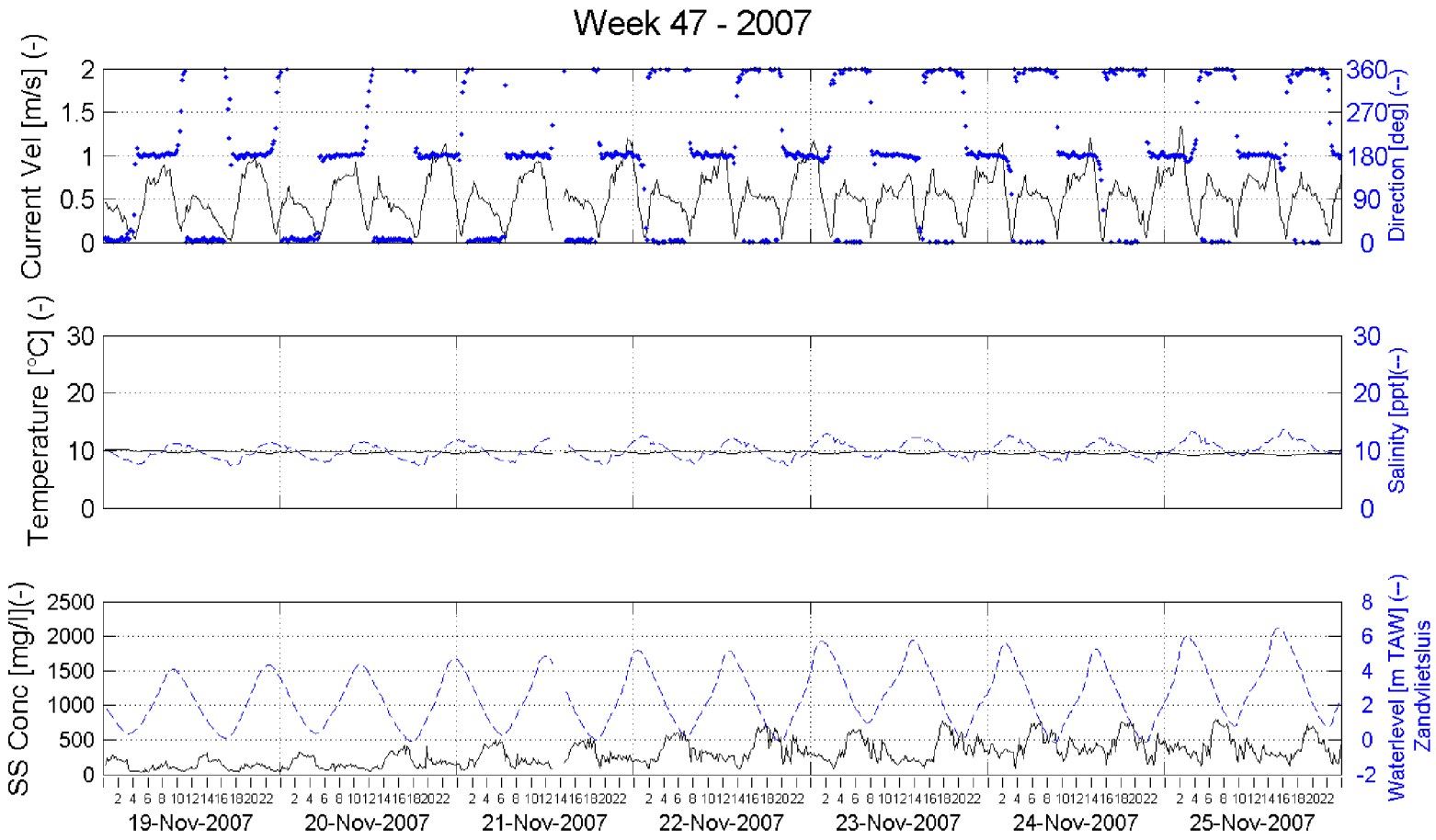
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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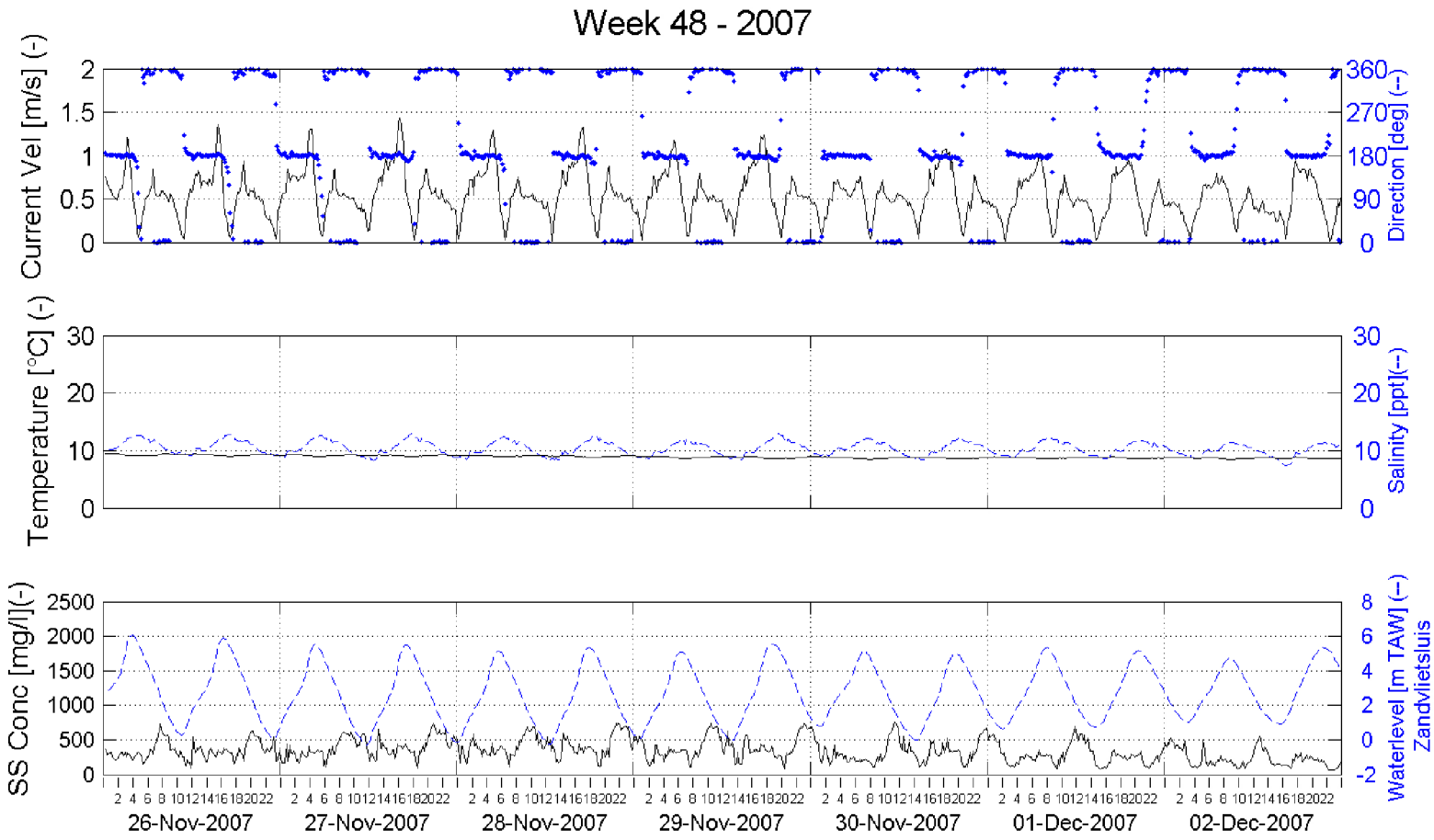
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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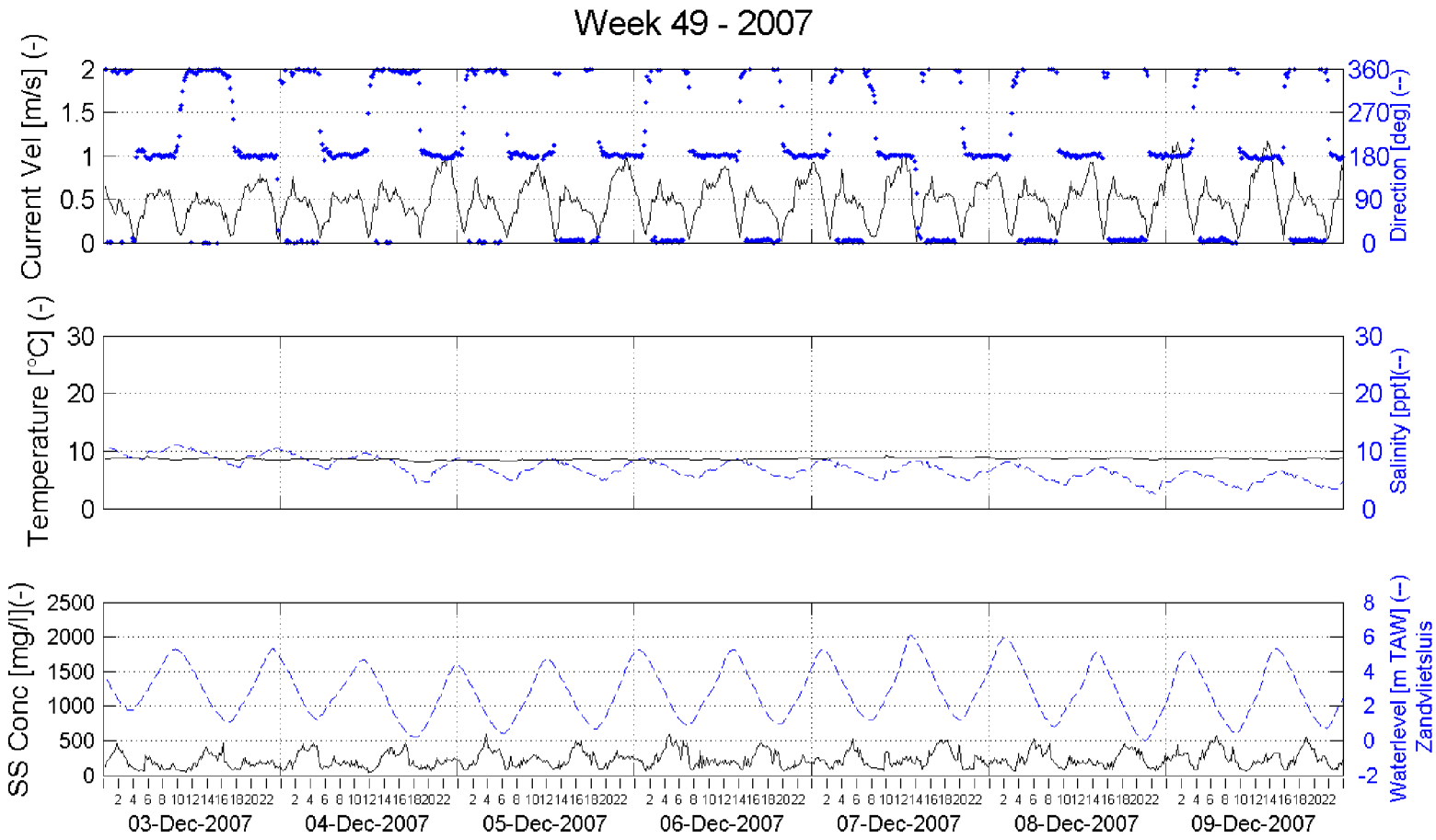
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I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

Processed by:

IMDC

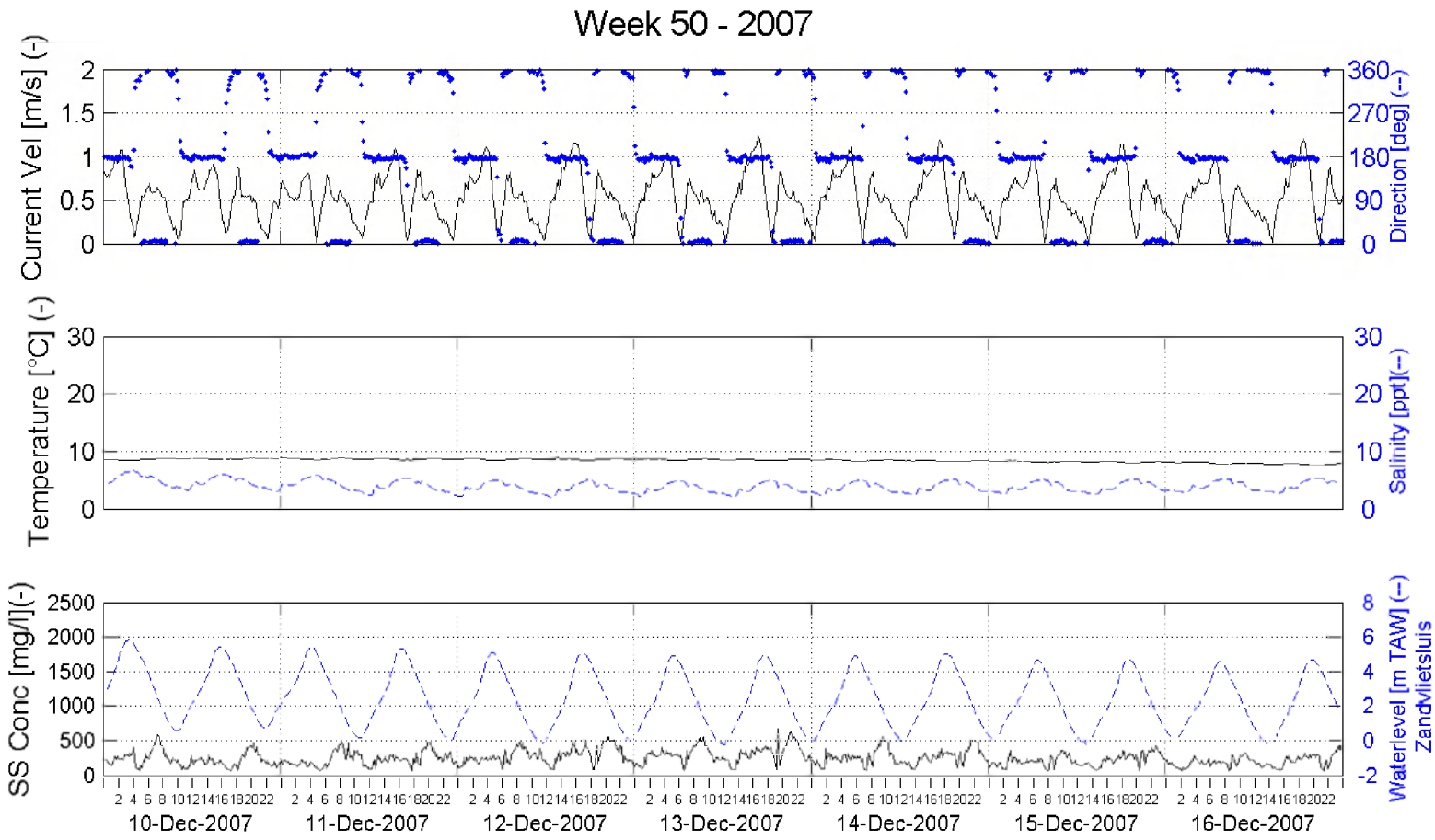
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

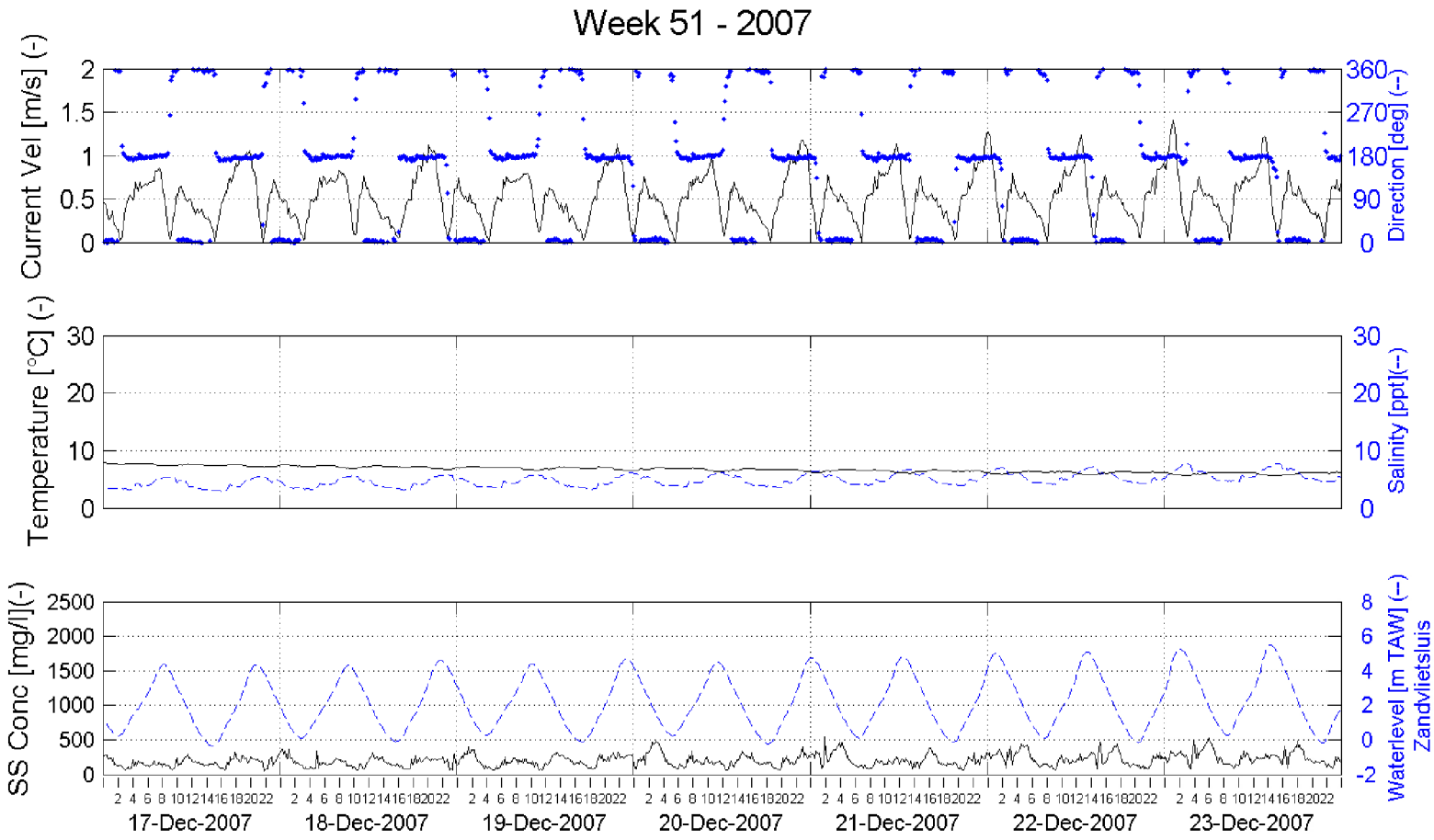
Buoy 84 top - 3.3m above bottom (-5.6m TAW)

Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

Processed by:

IMDC

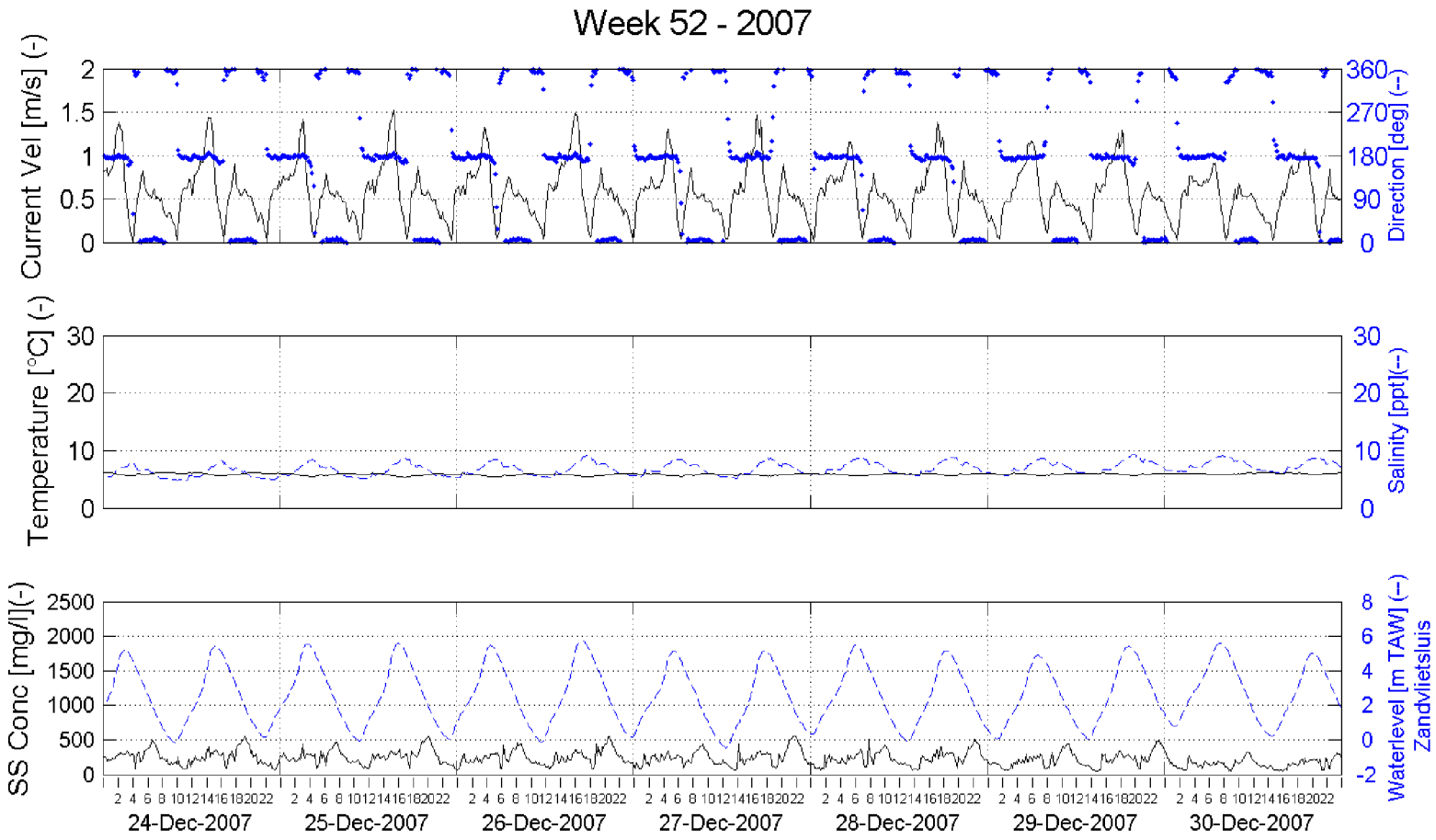
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 top - 3.3m above bottom (-5.6m TAW)

Processed by:

IMDC

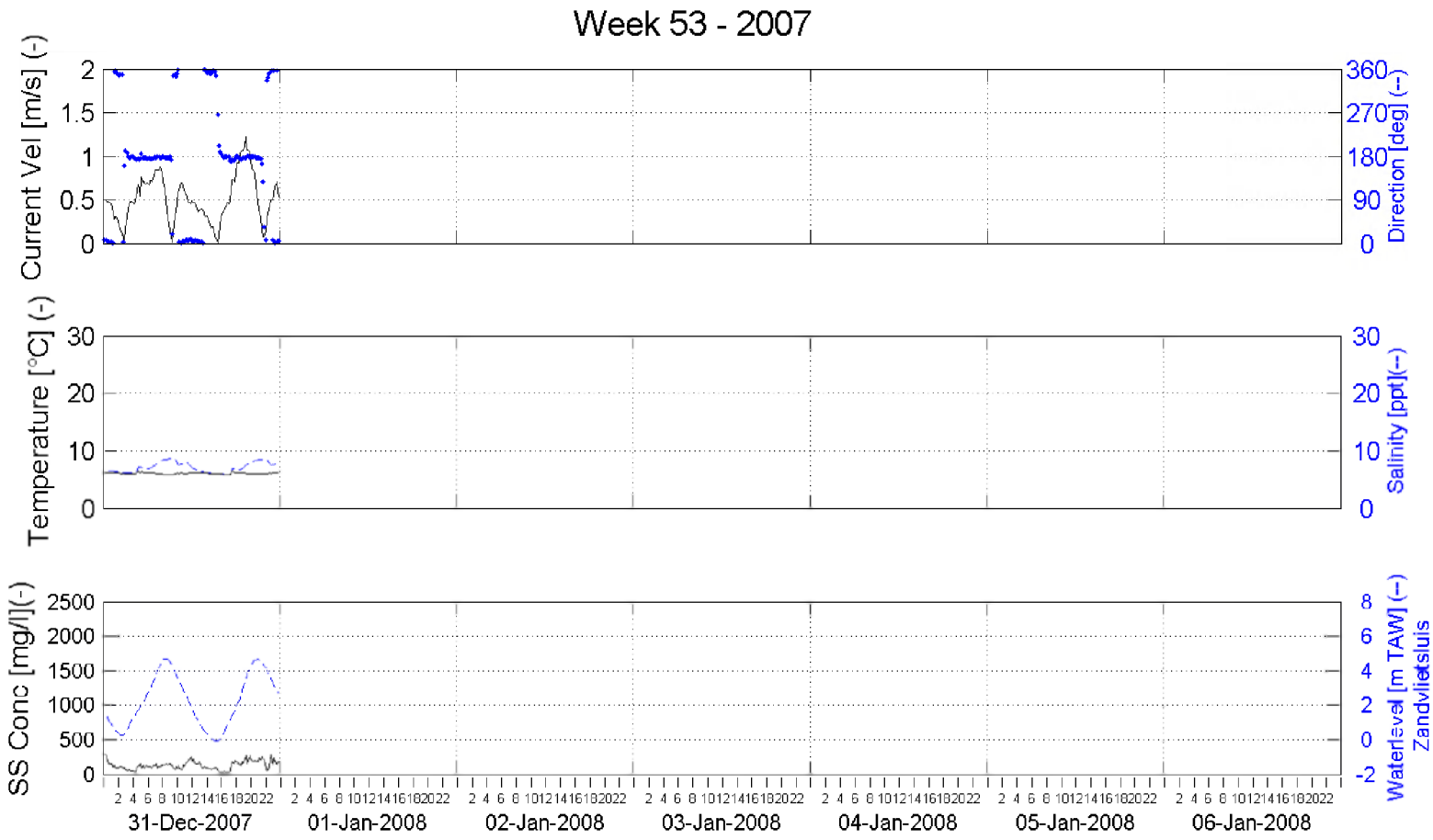
In Association with:

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GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

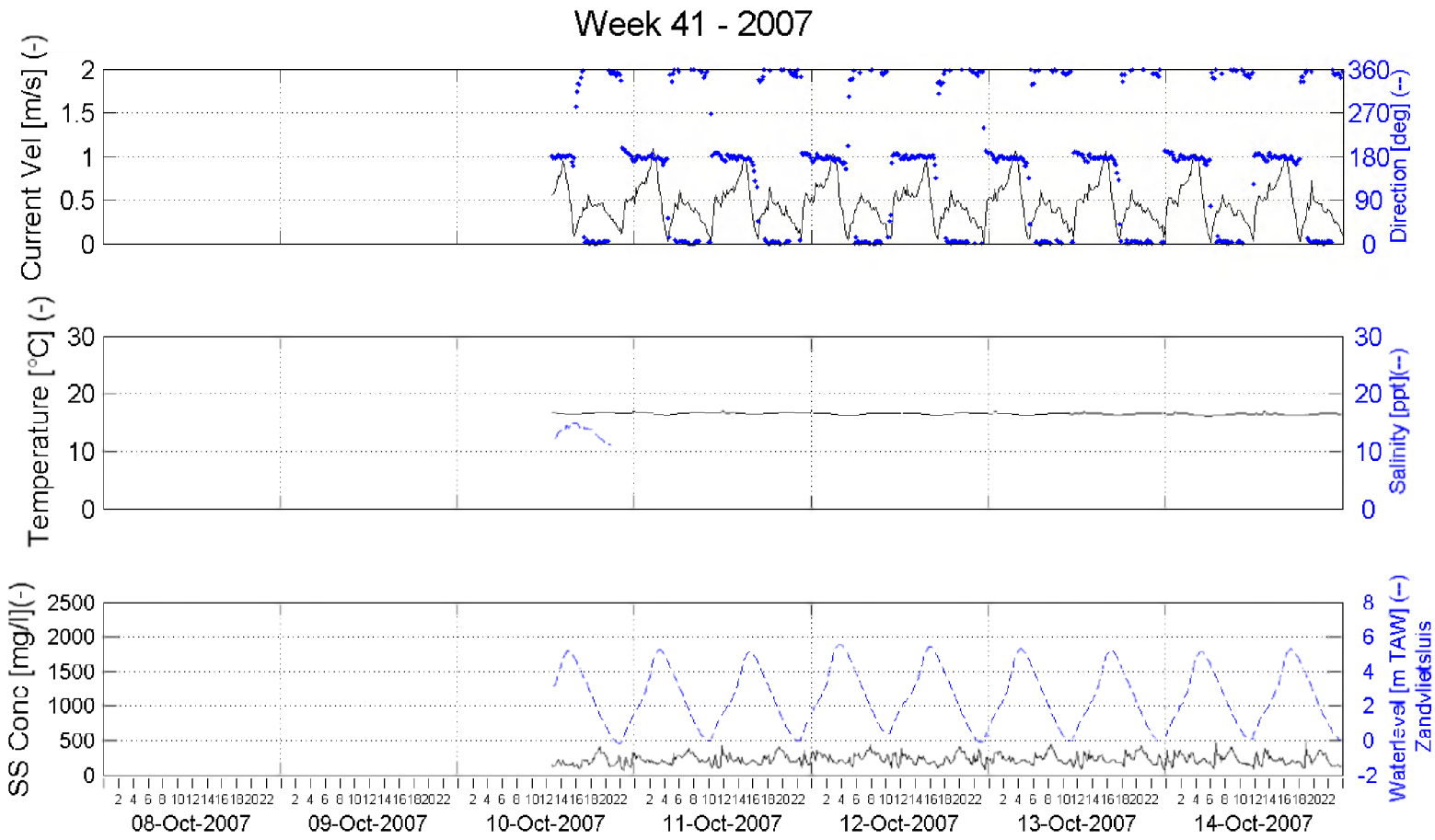
Buoy 84 top - 3.3m above bottom (-5.6m TAW)

Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

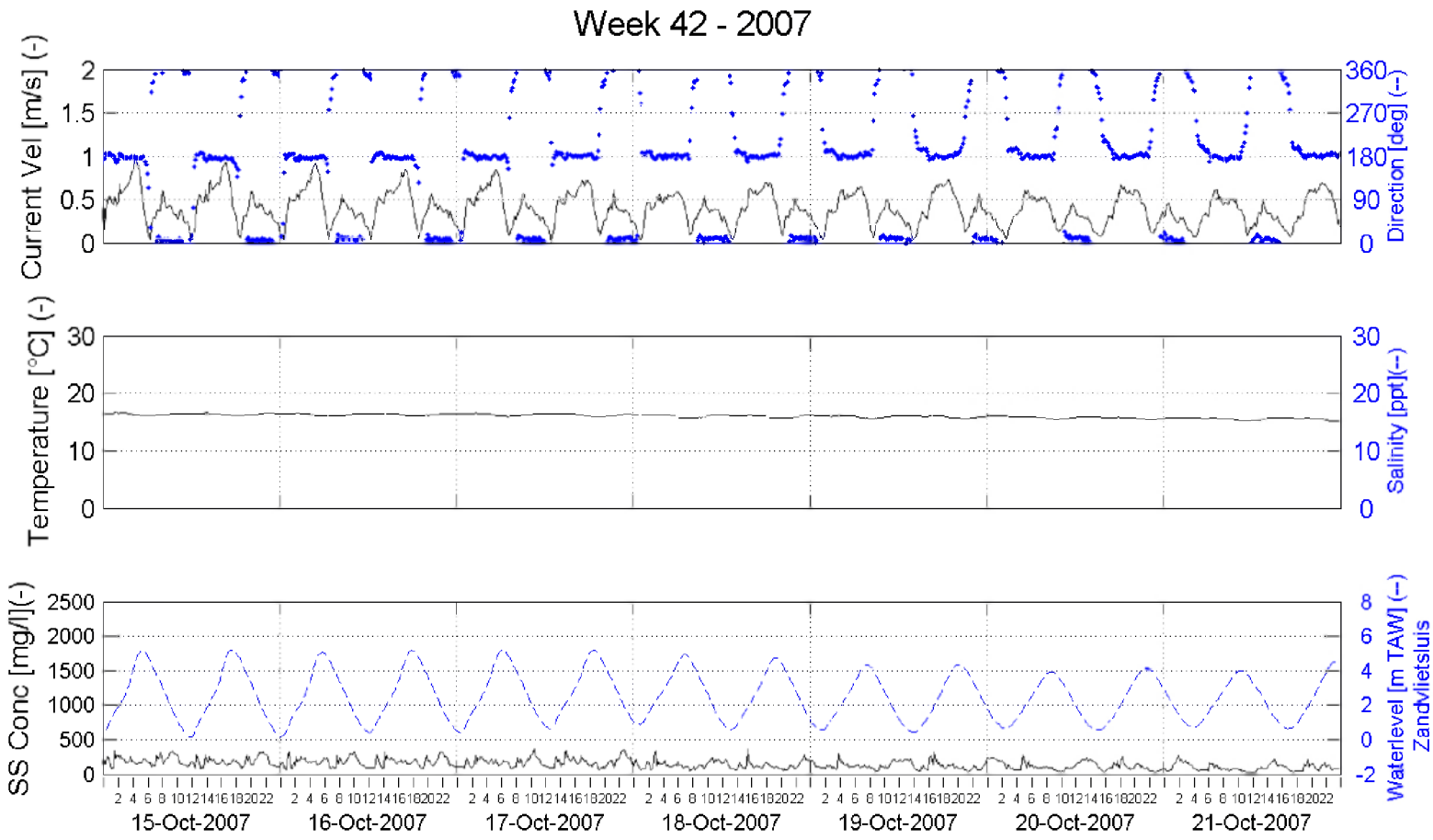
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

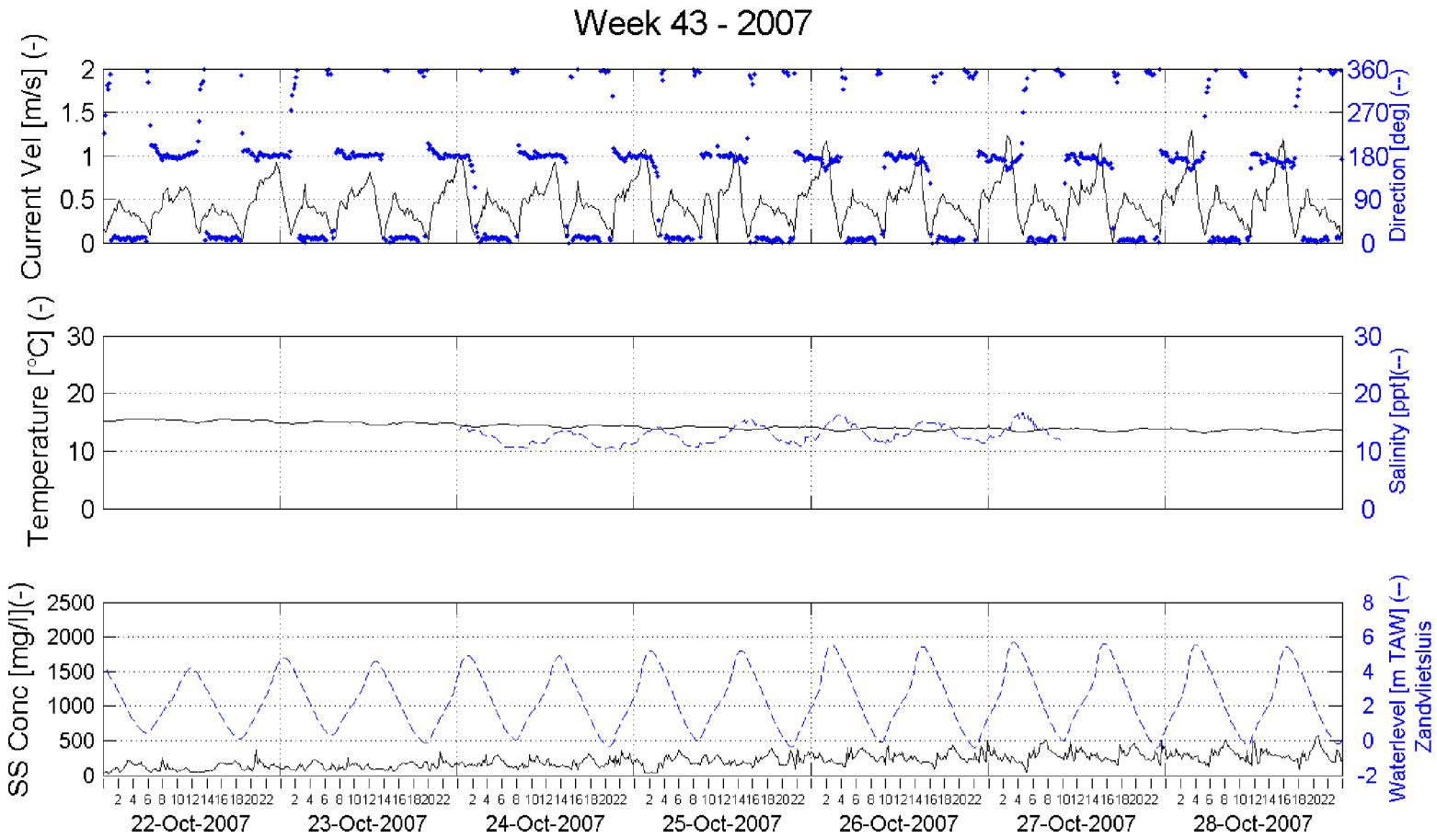
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Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

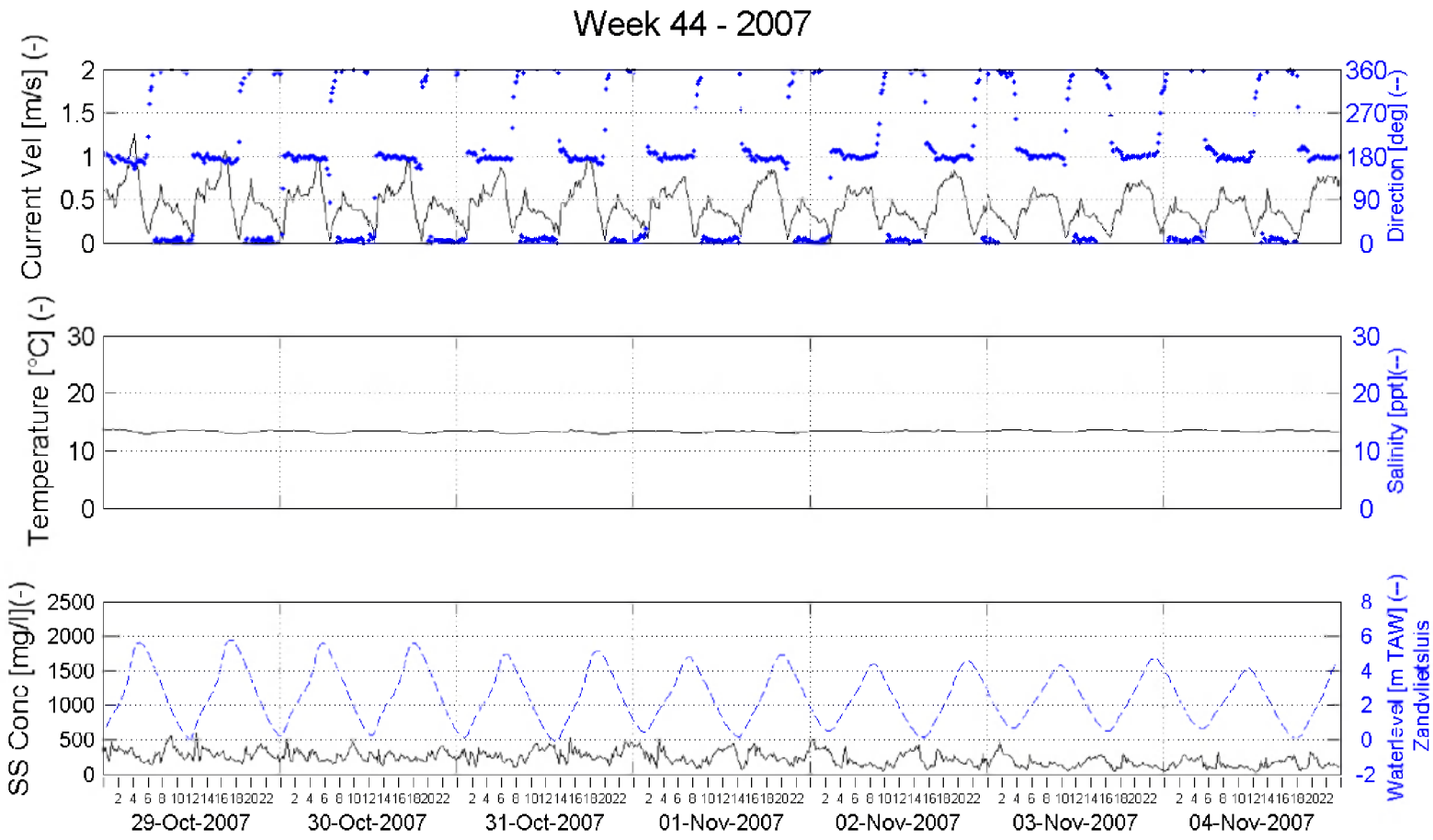
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IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

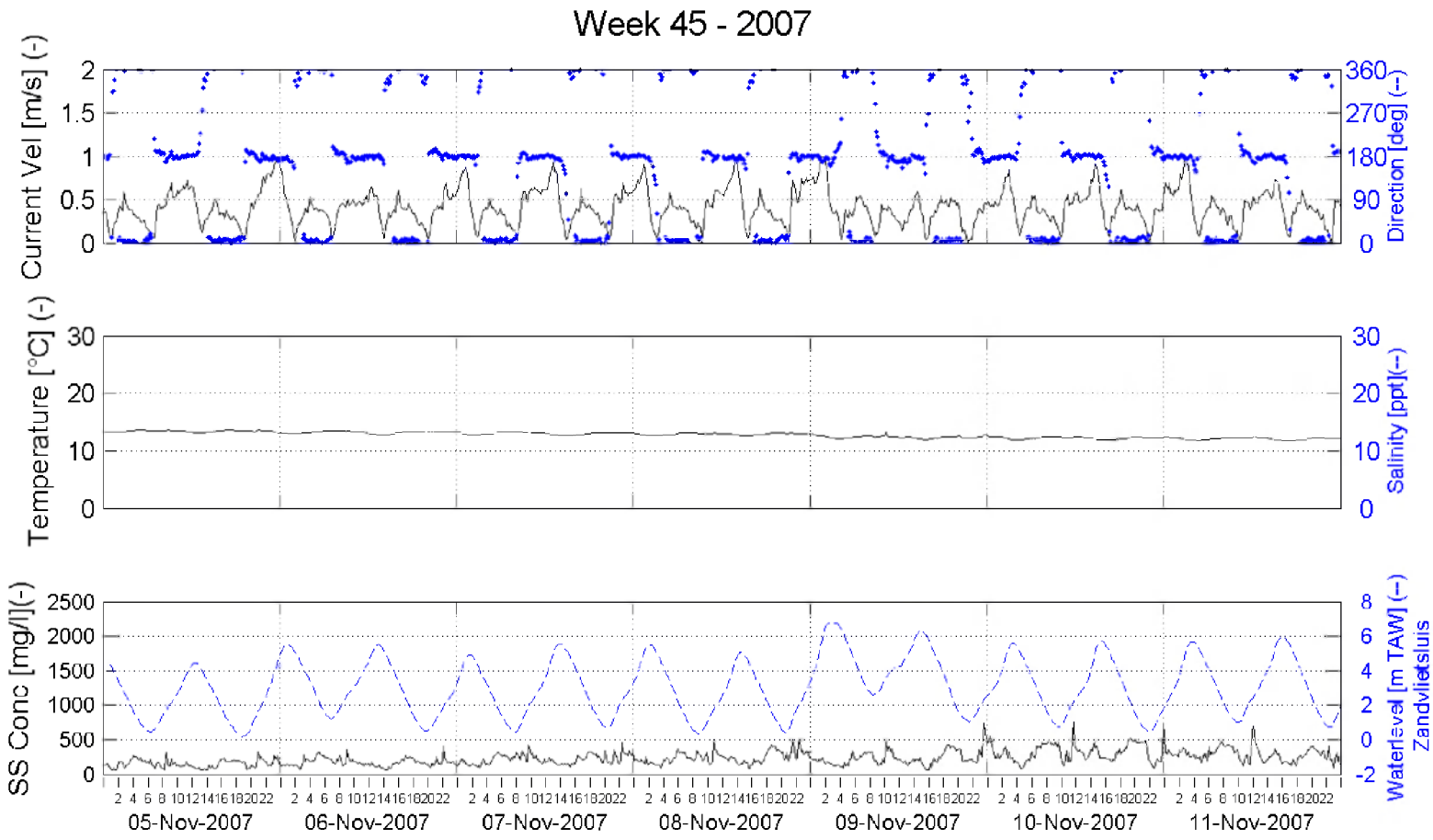
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IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

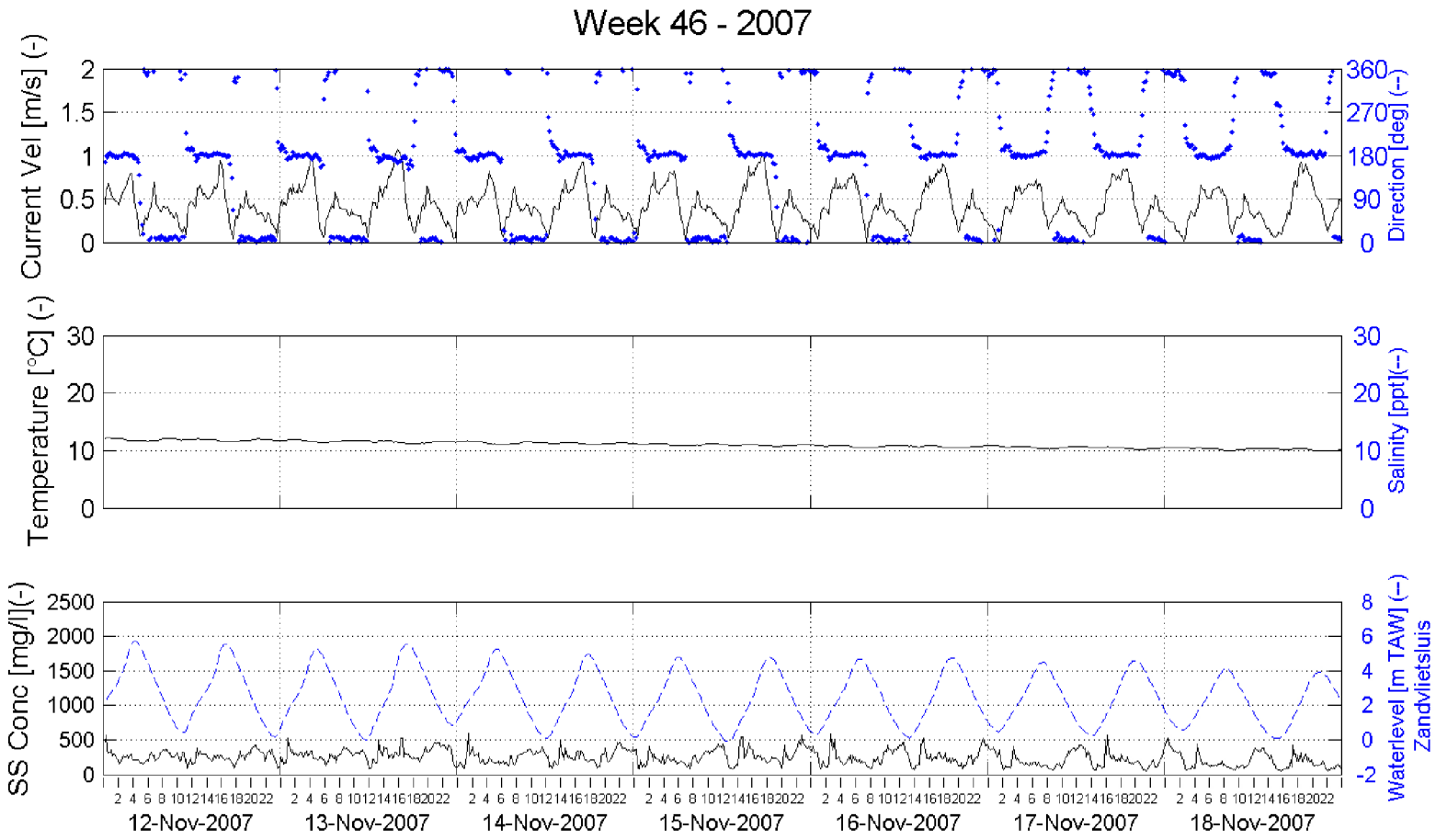
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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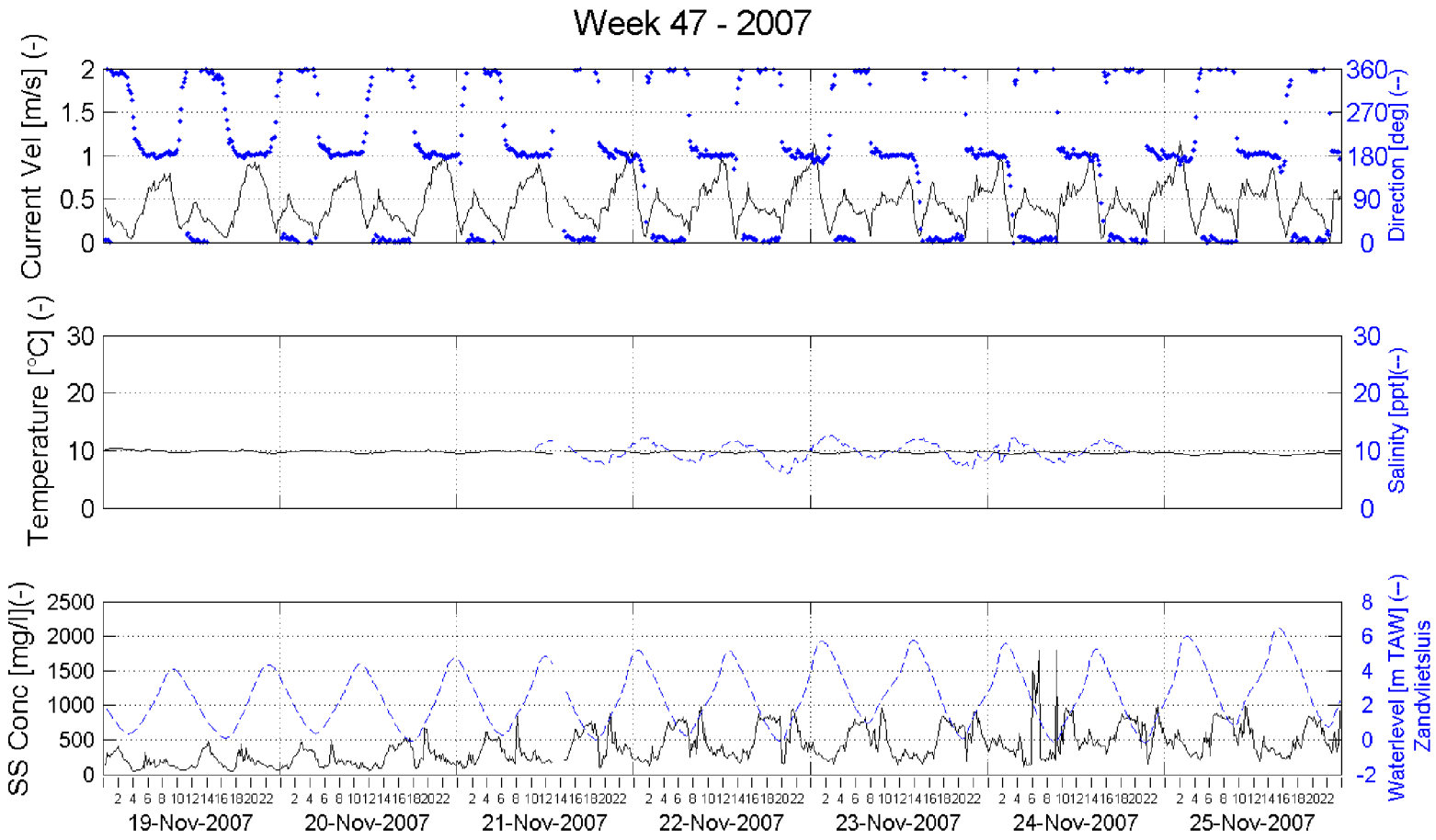
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In Association with:

GEMS

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

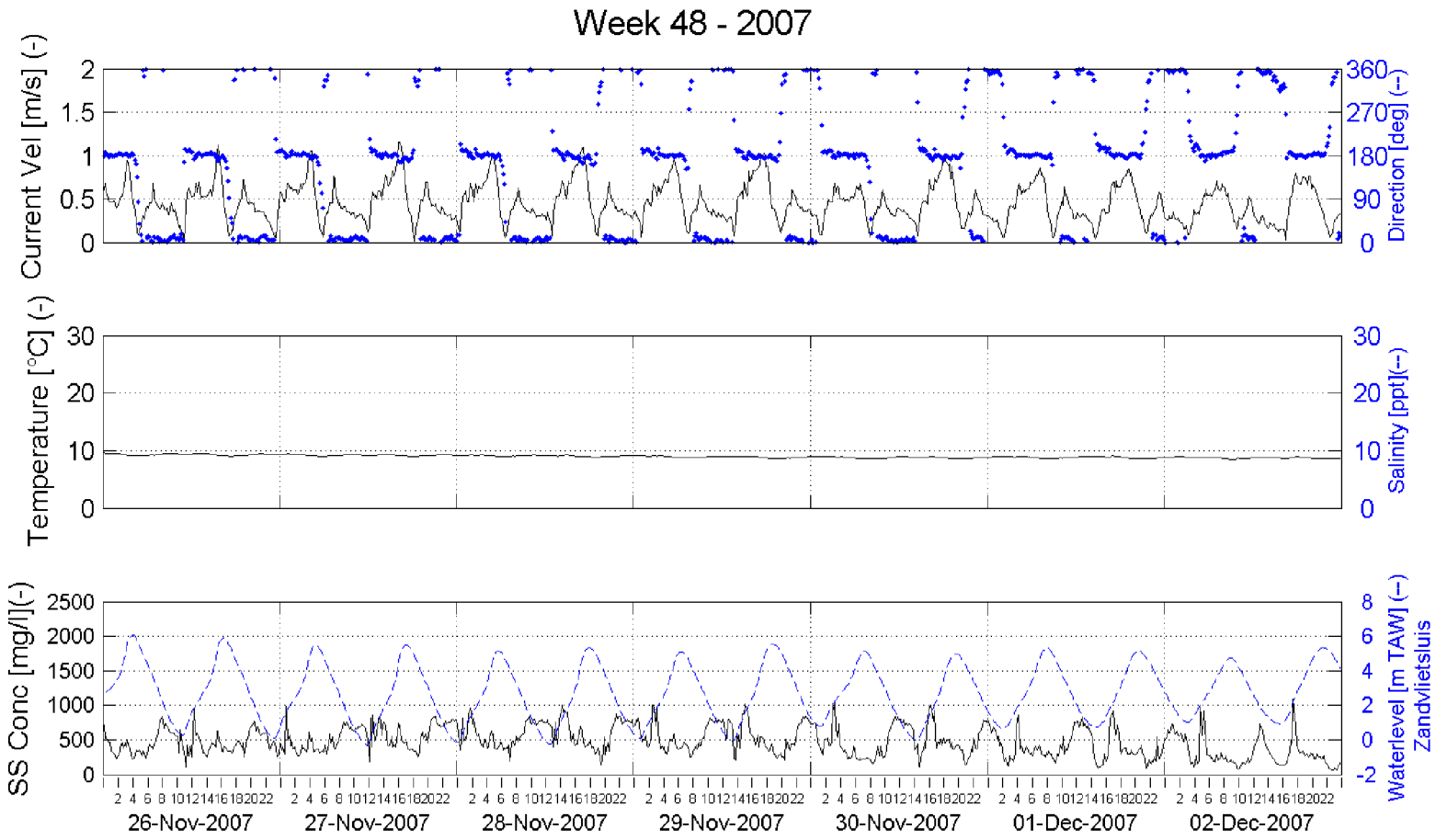
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IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 84 bottom - 0.8m above bottom (-8.1m TAW)

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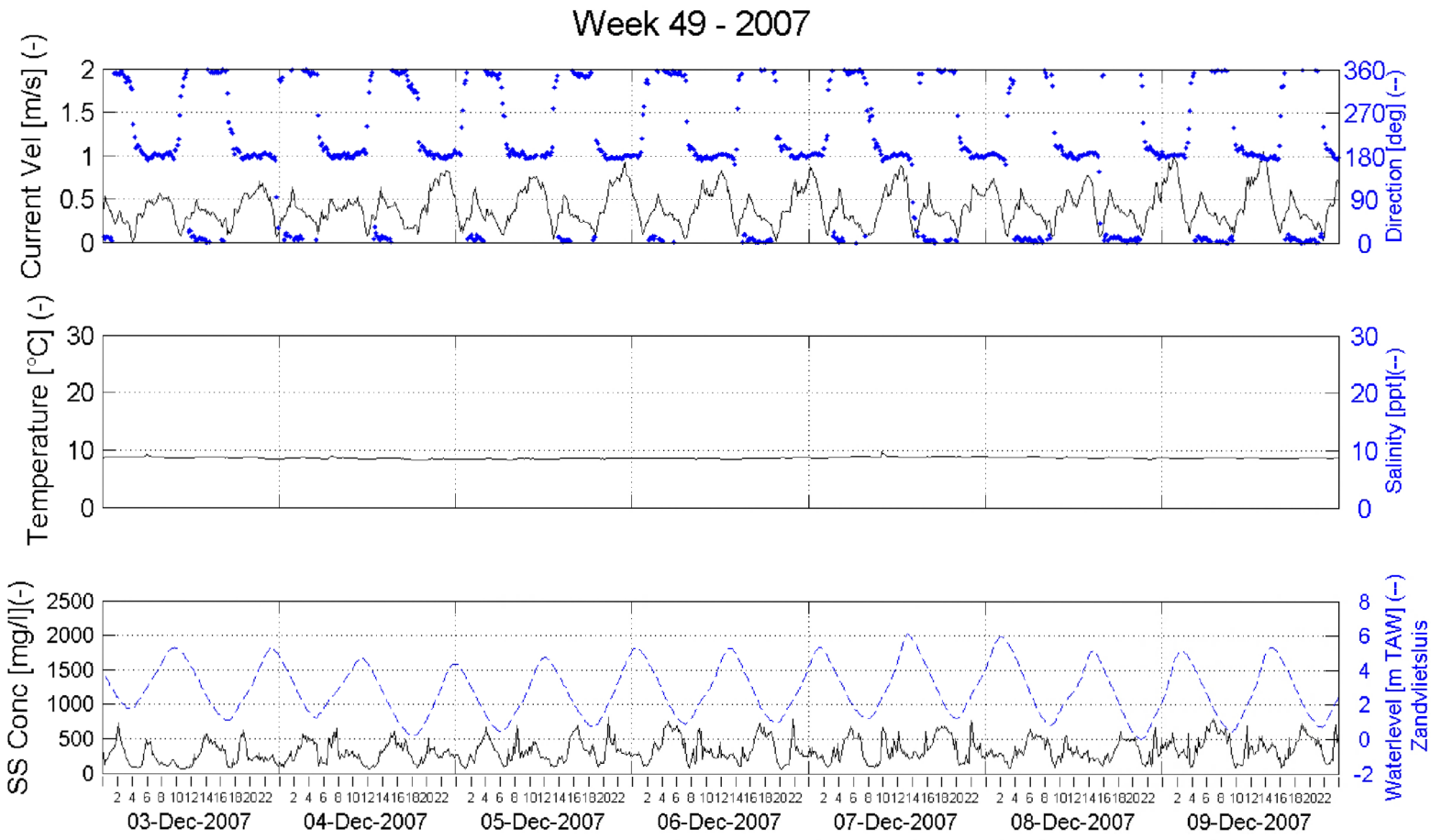
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In Association with:

GEMS

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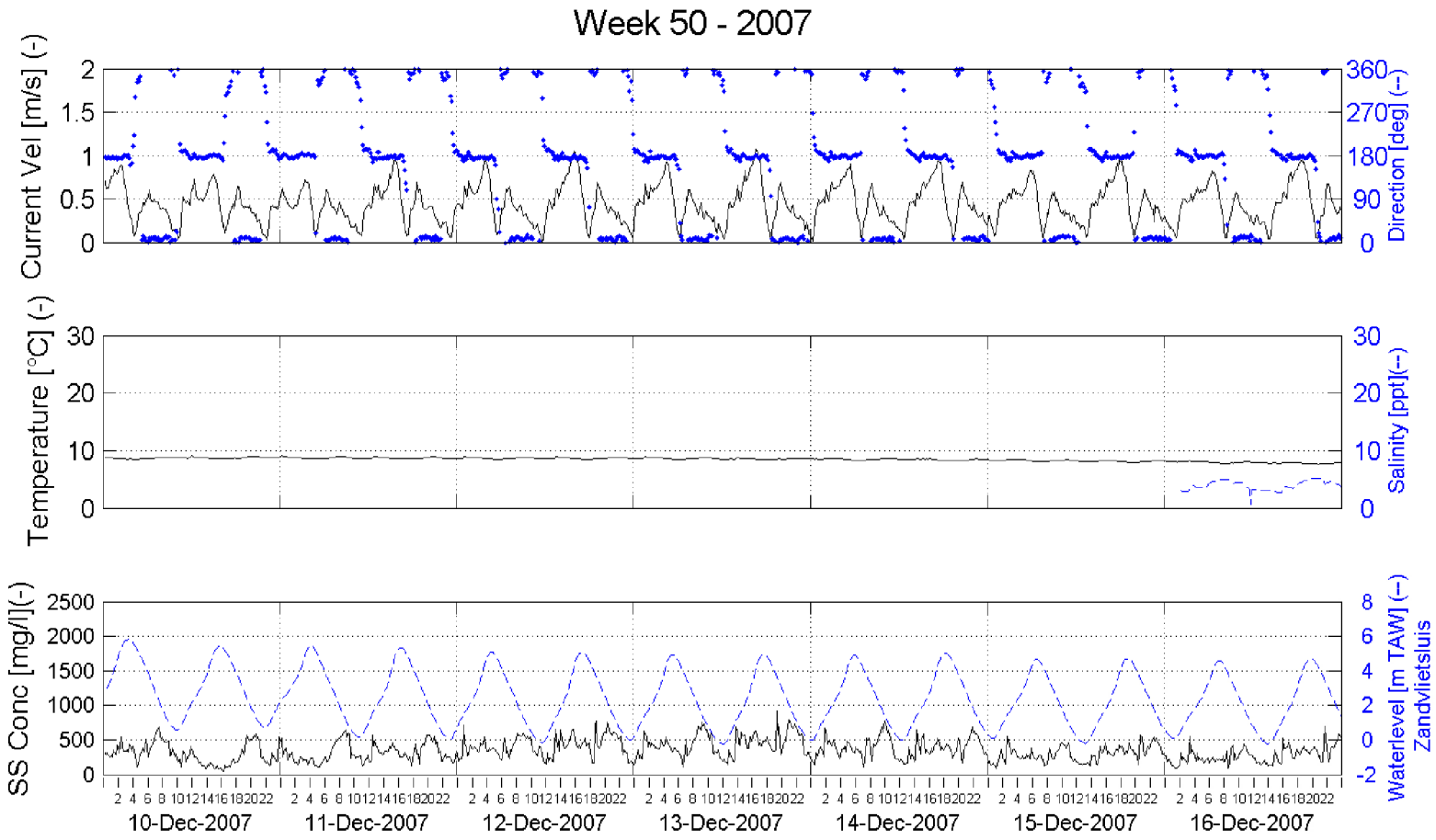
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In Association with:

GEMS

I/RA/11283/07.099/MSA

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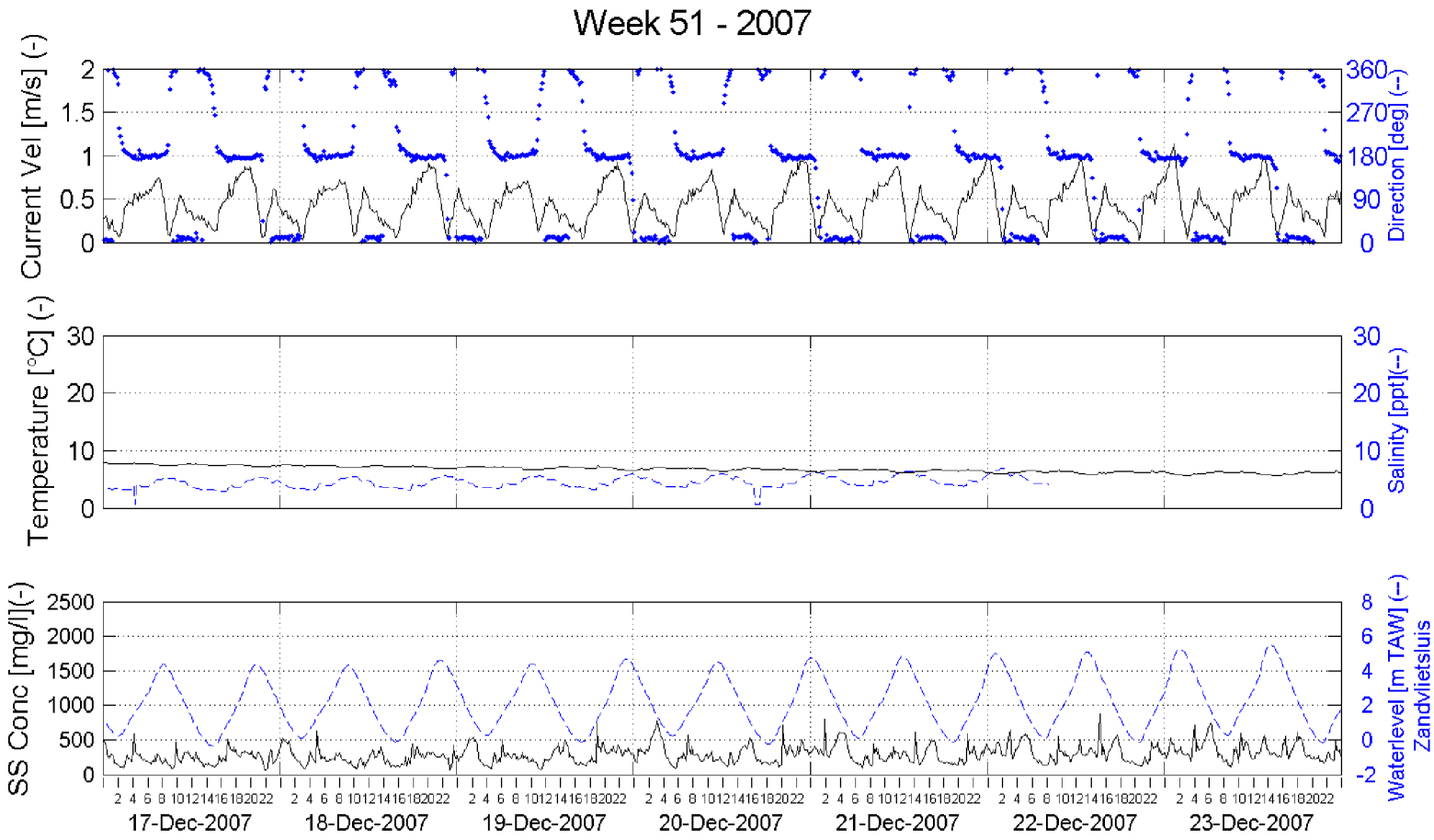
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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Processed by:

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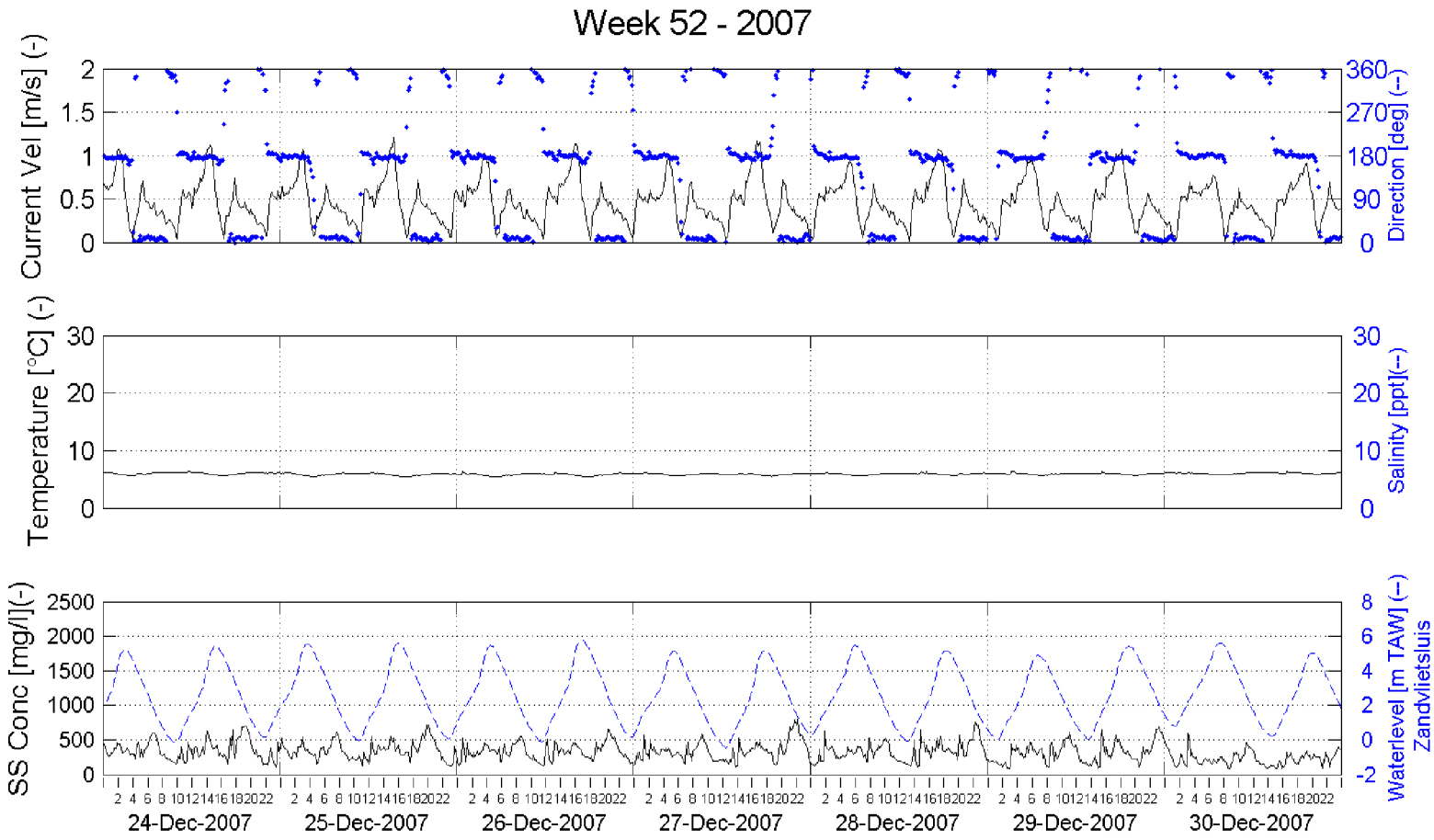
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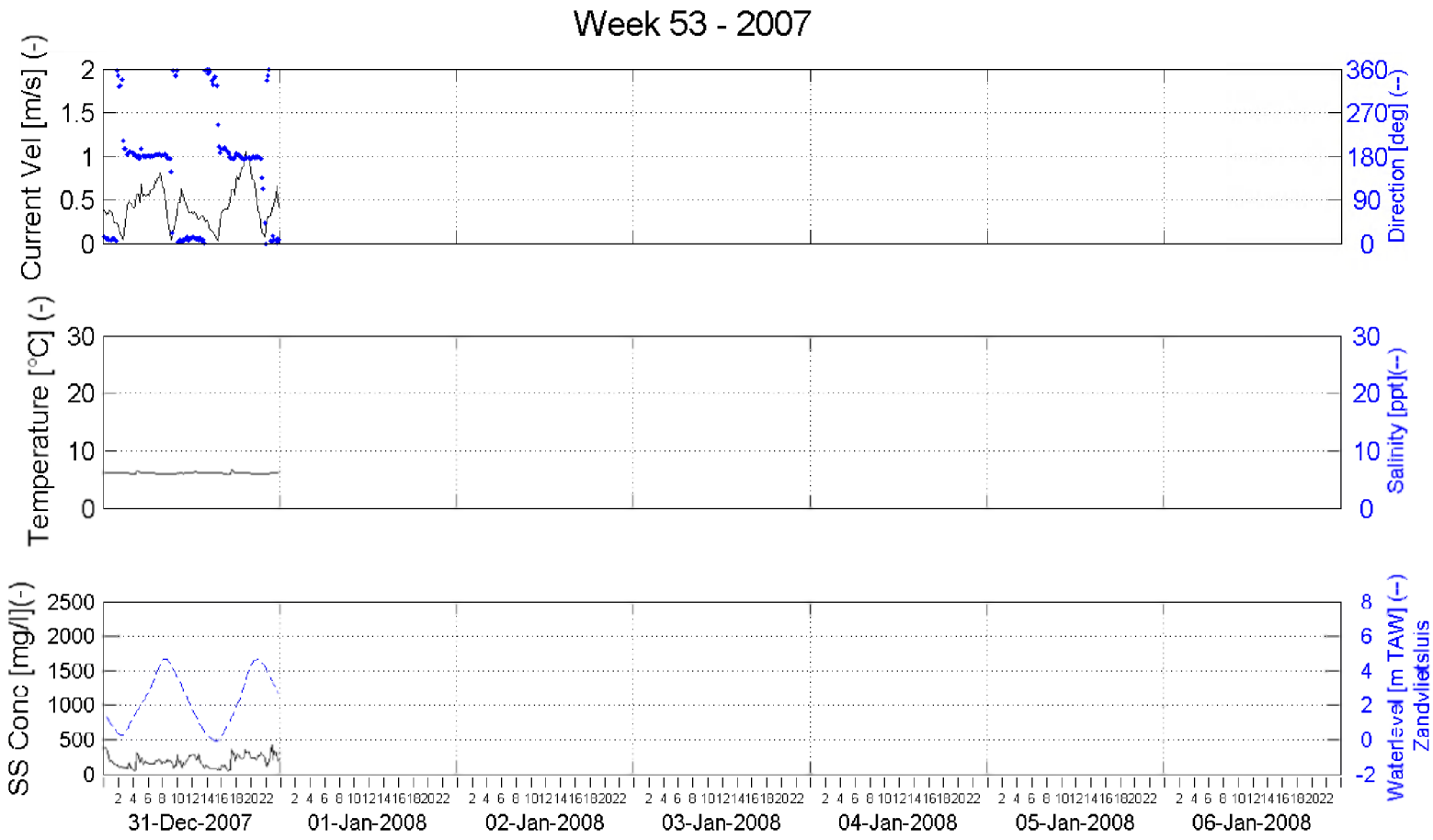
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In Association with:

GEMS

I/RA/11283/07.099/MSA

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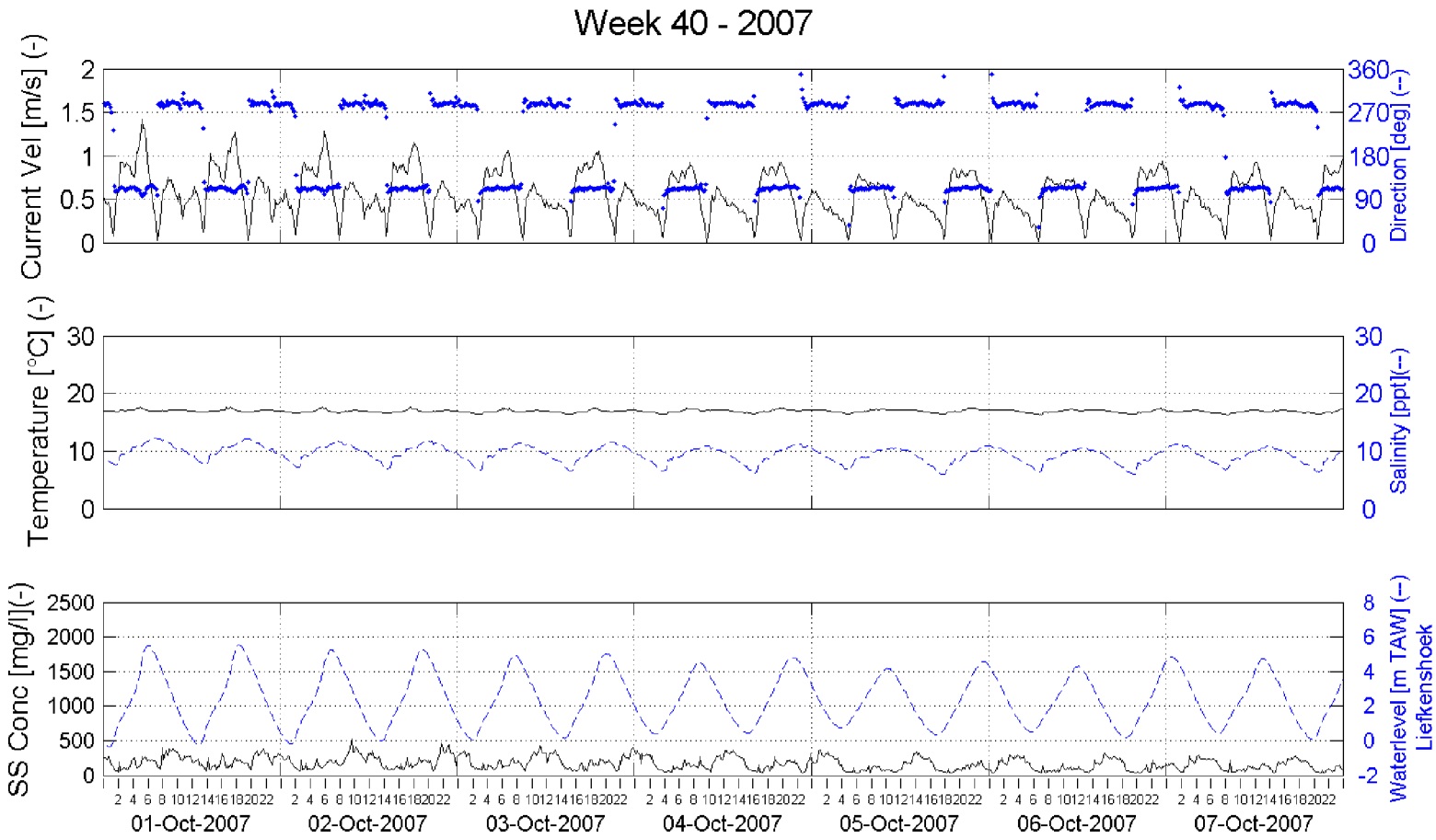
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 top - 3.3m above bottom (-5.3m TAW)

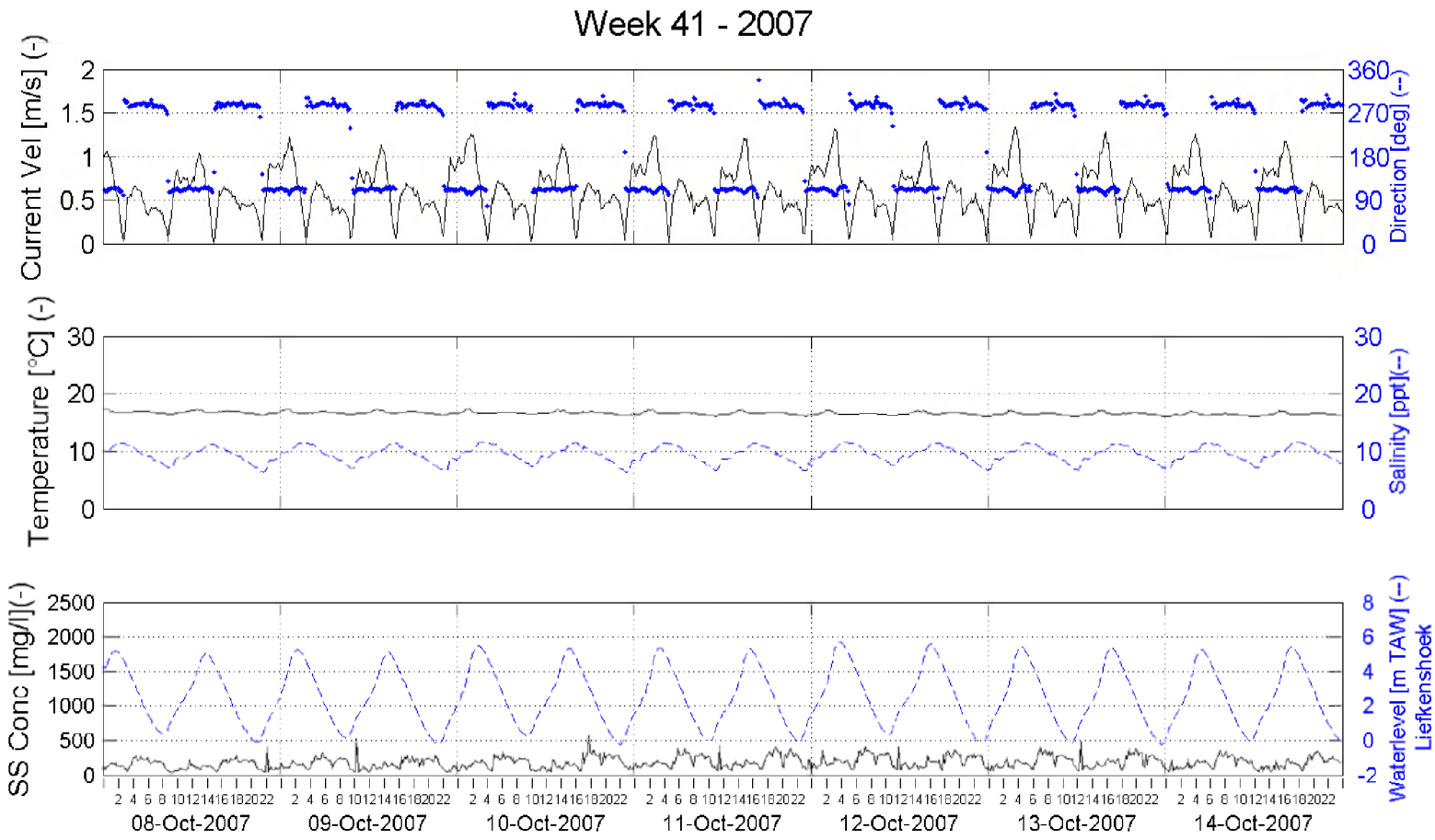
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Location:

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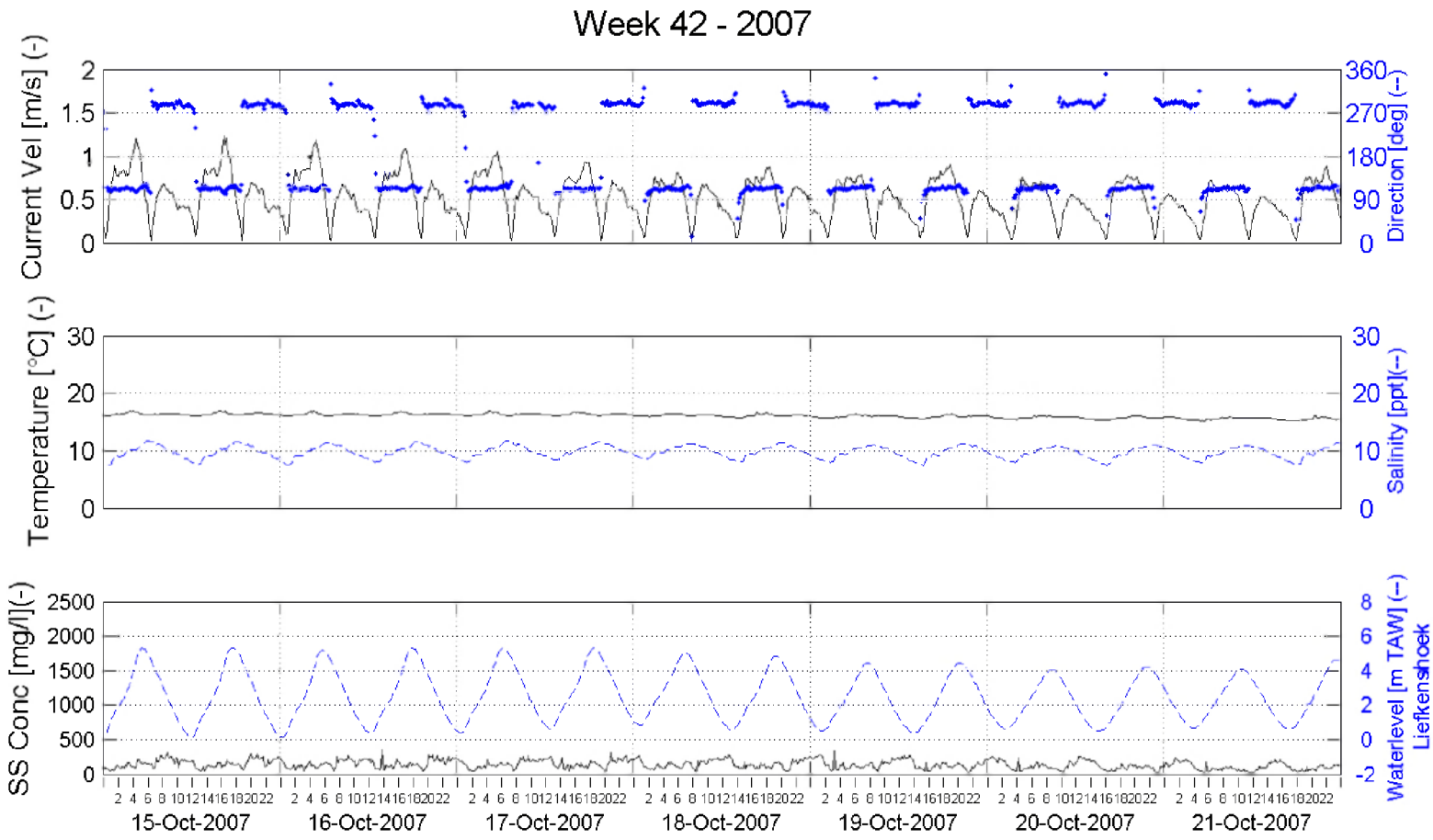
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In Association with:

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Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

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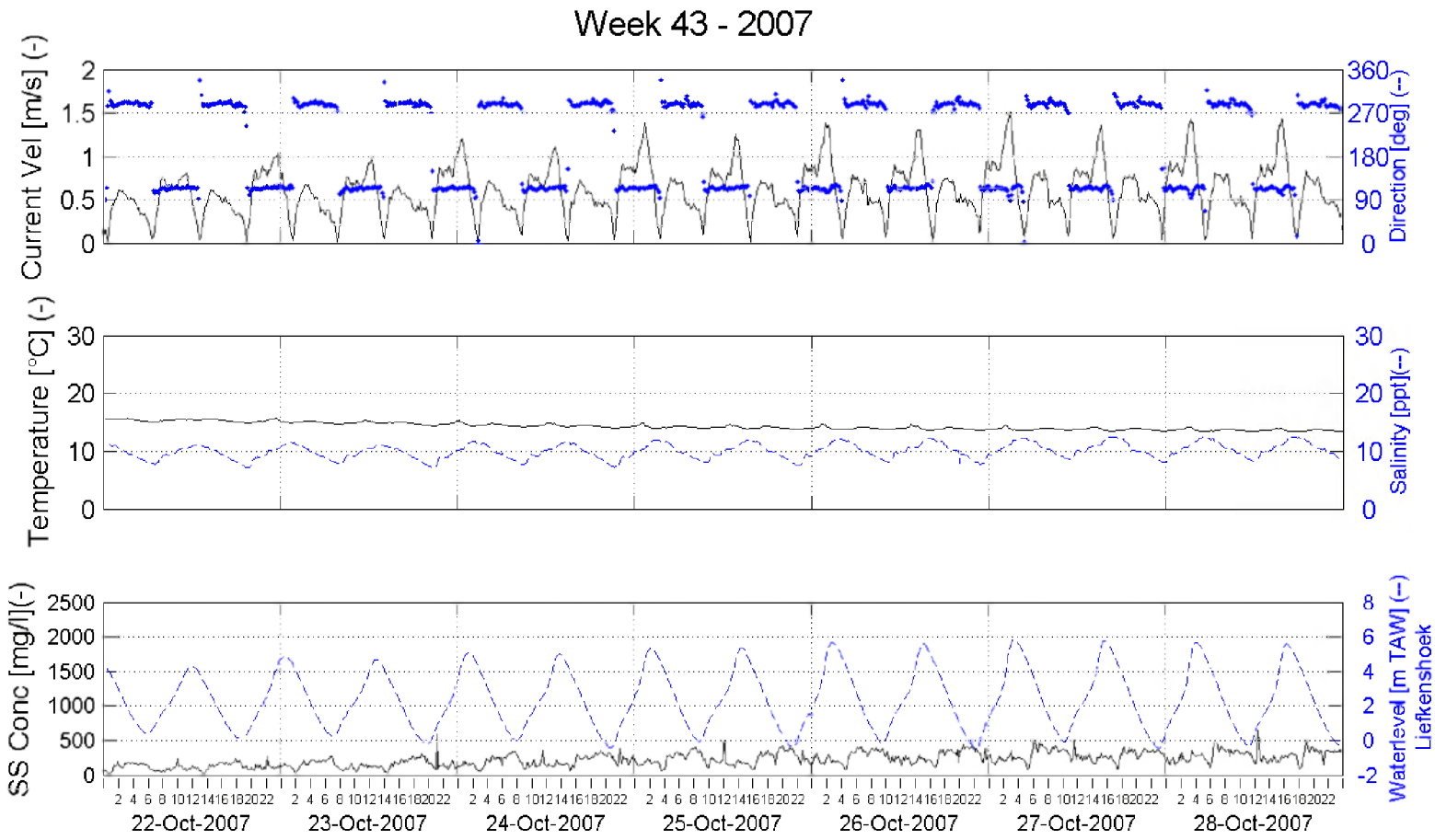
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

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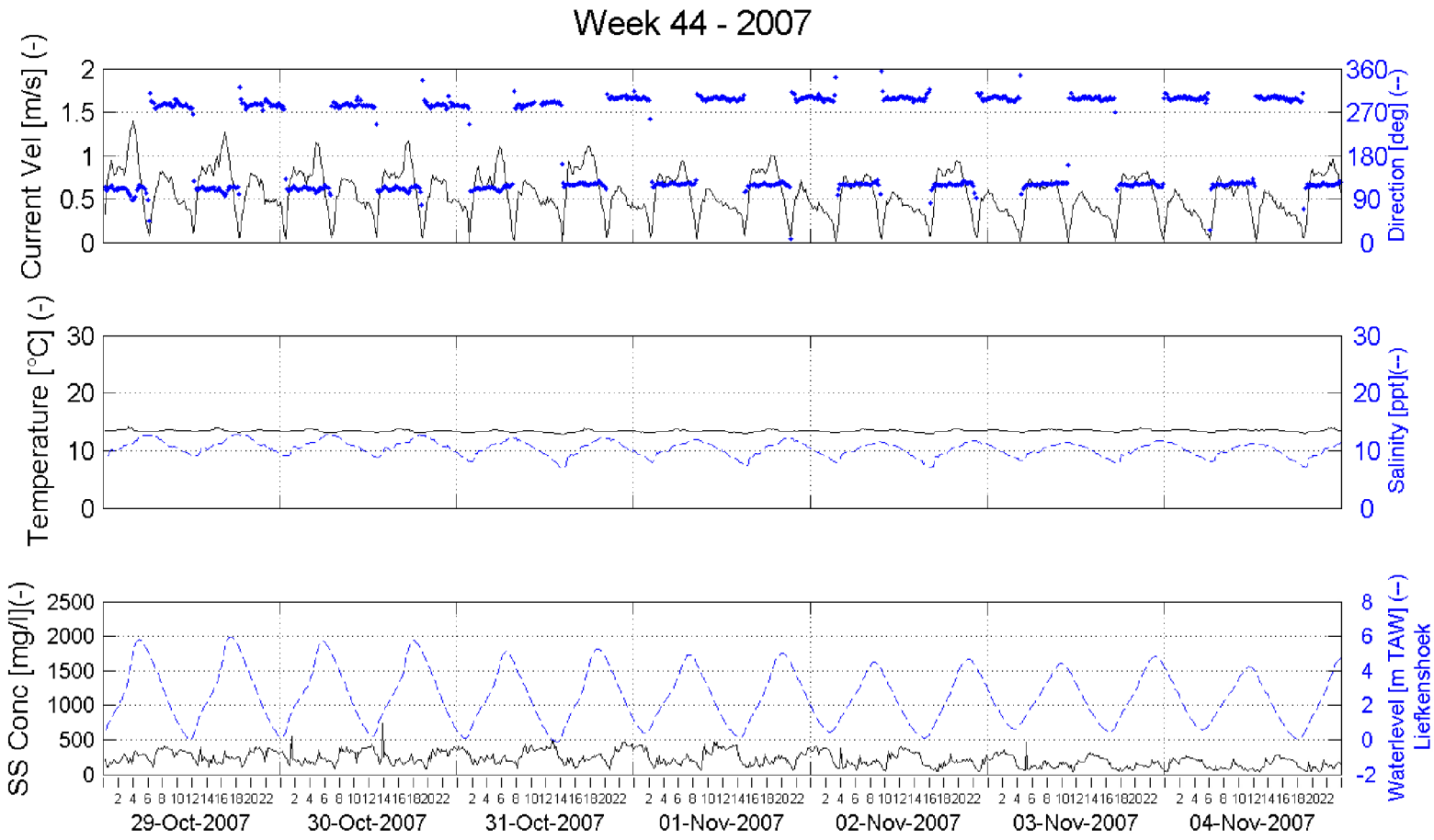
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Processed by:

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I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



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Location:

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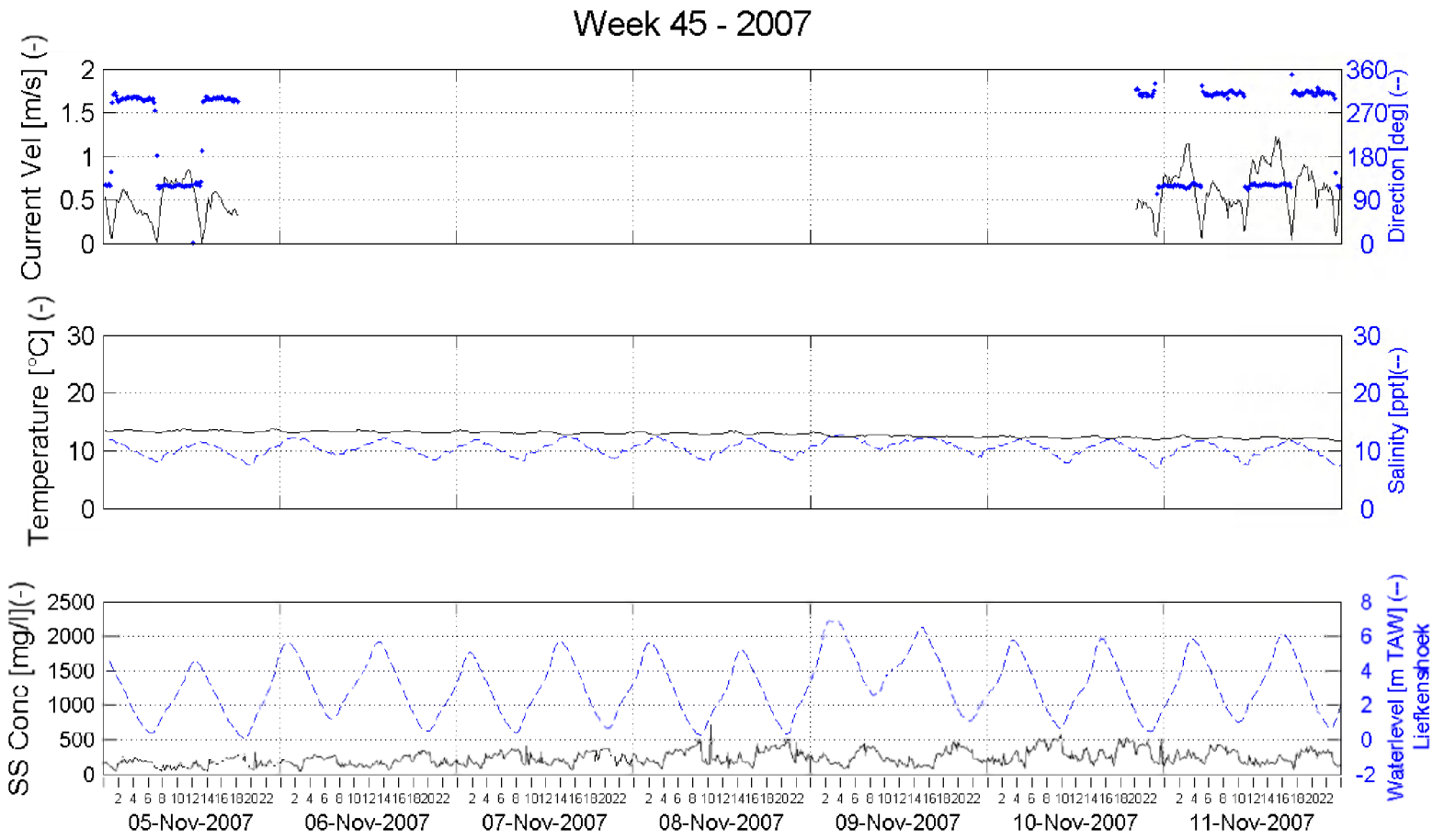
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

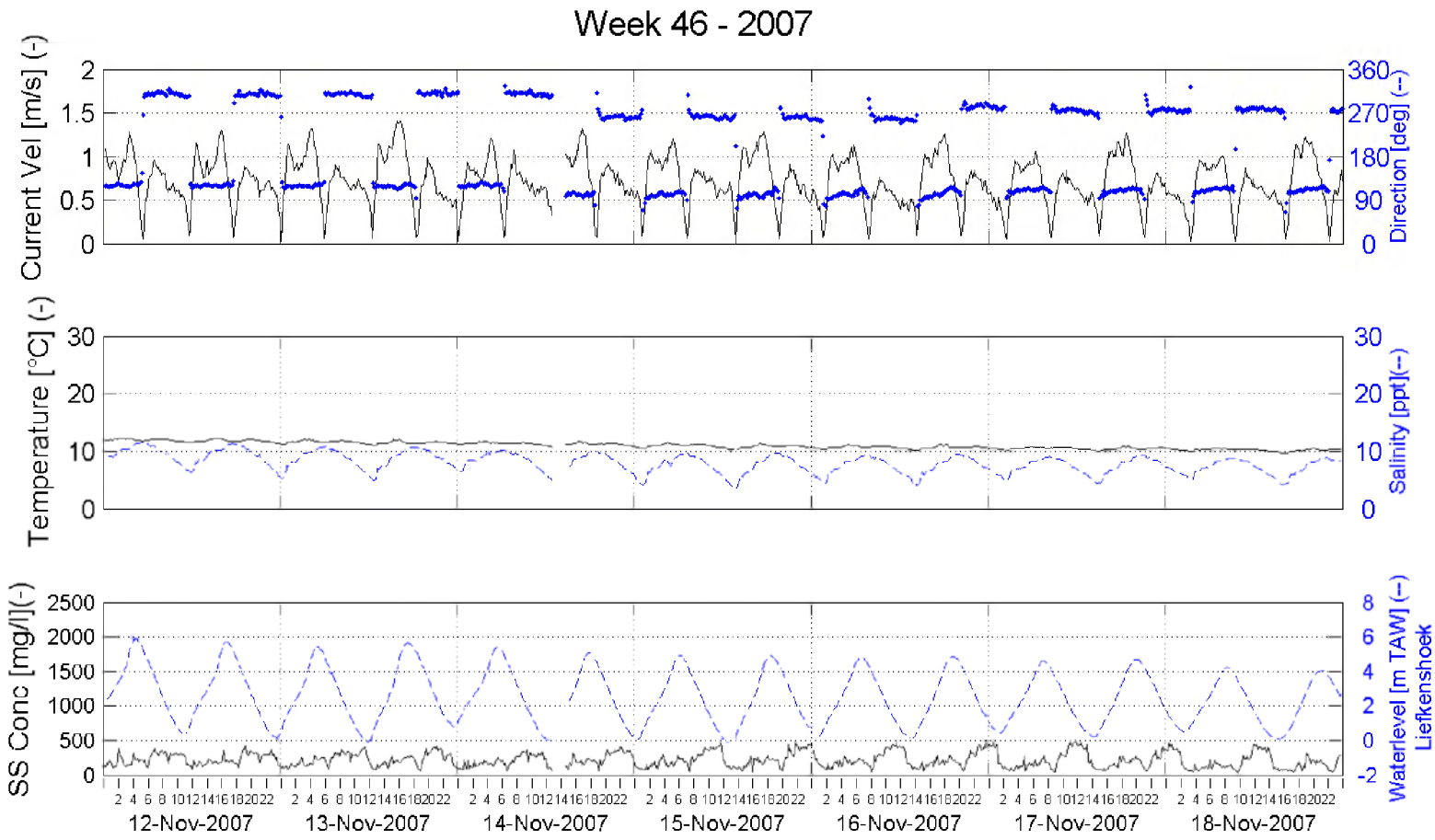
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In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

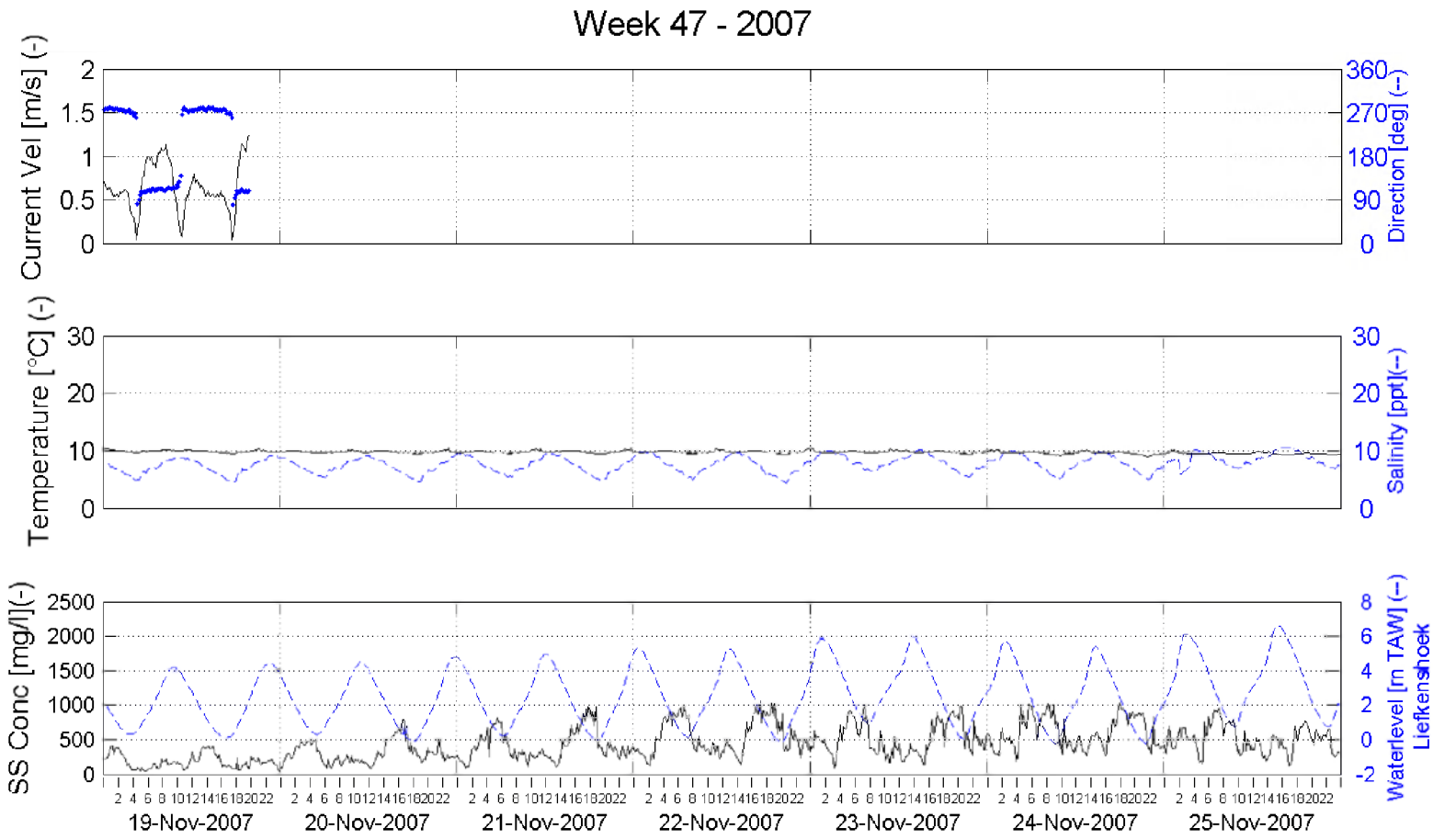
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In Association with:

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Location:

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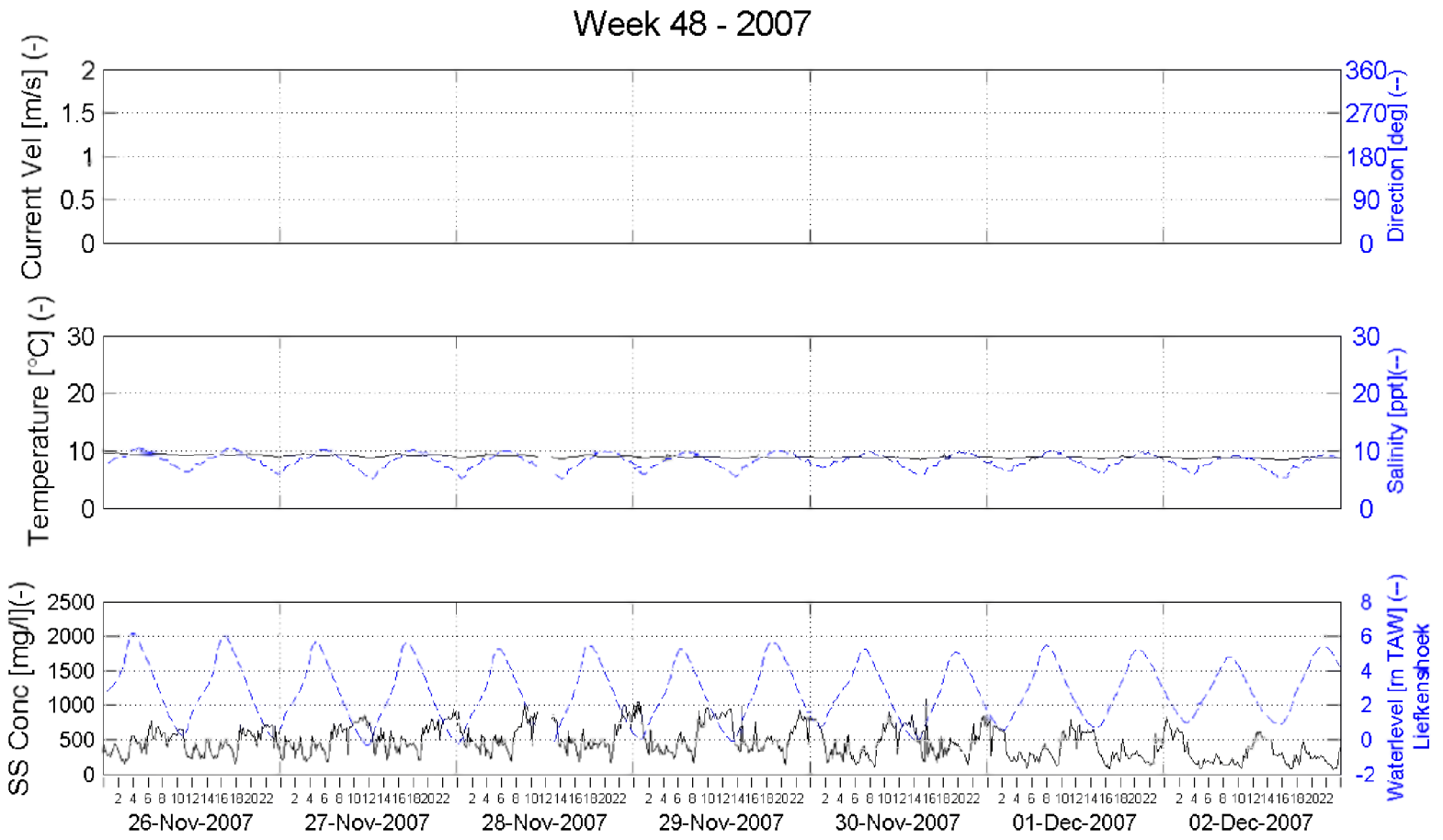
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Location:

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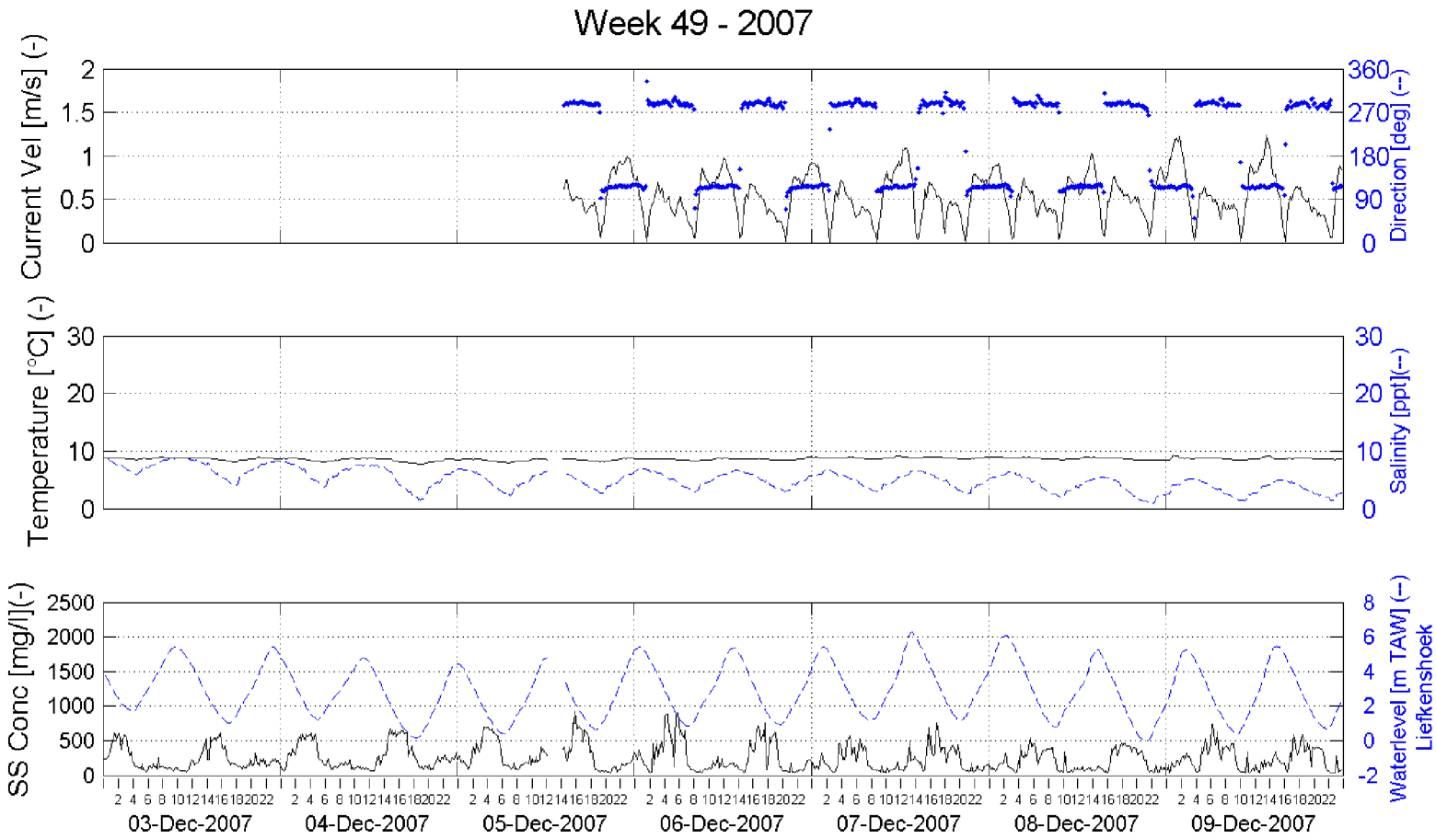
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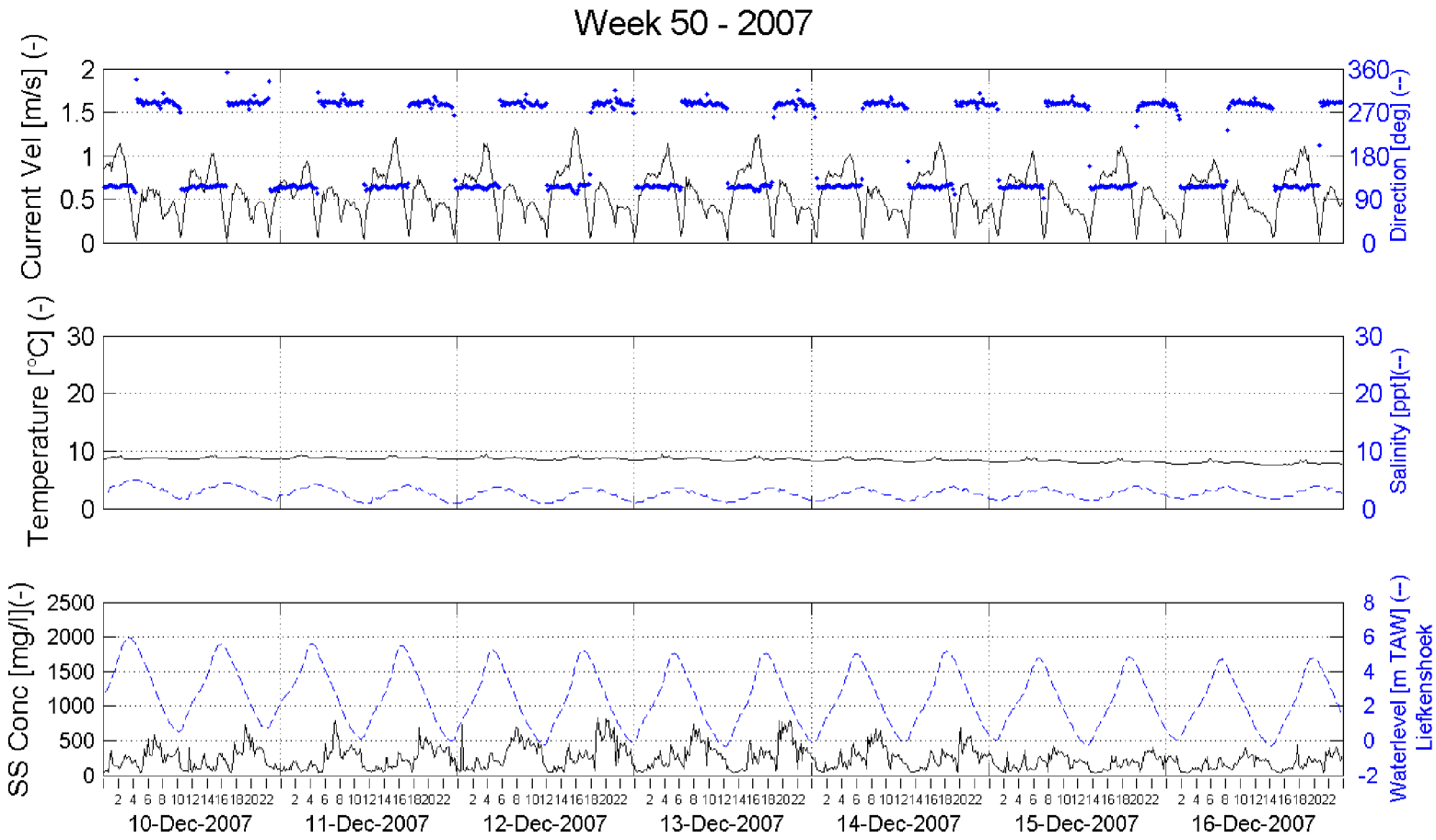
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Buoy 97 top - 3.3m above bottom (-5.3m TAW)

Processed by:

IMDC

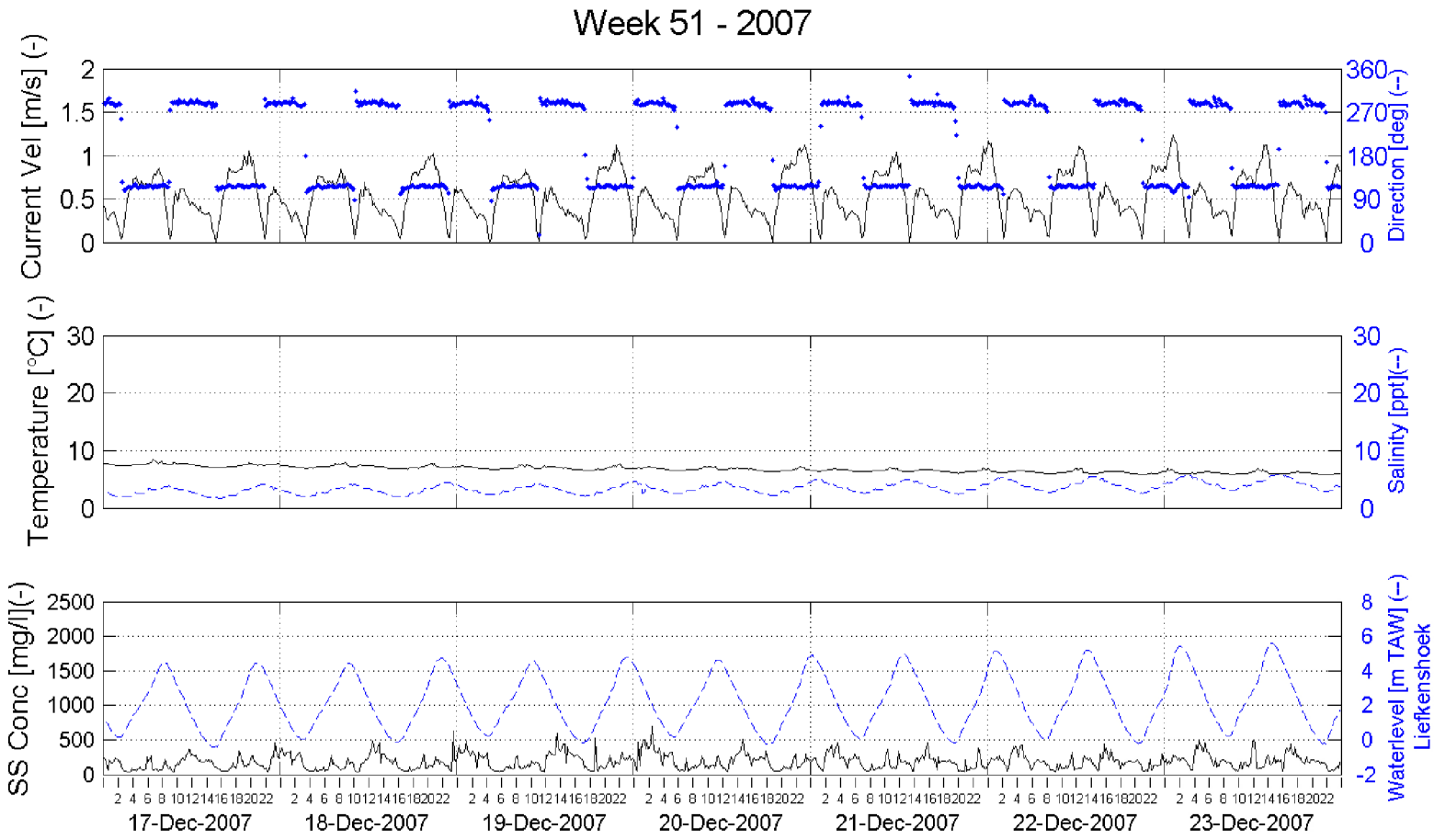
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 top - 3.3m above bottom (-5.3m TAW)

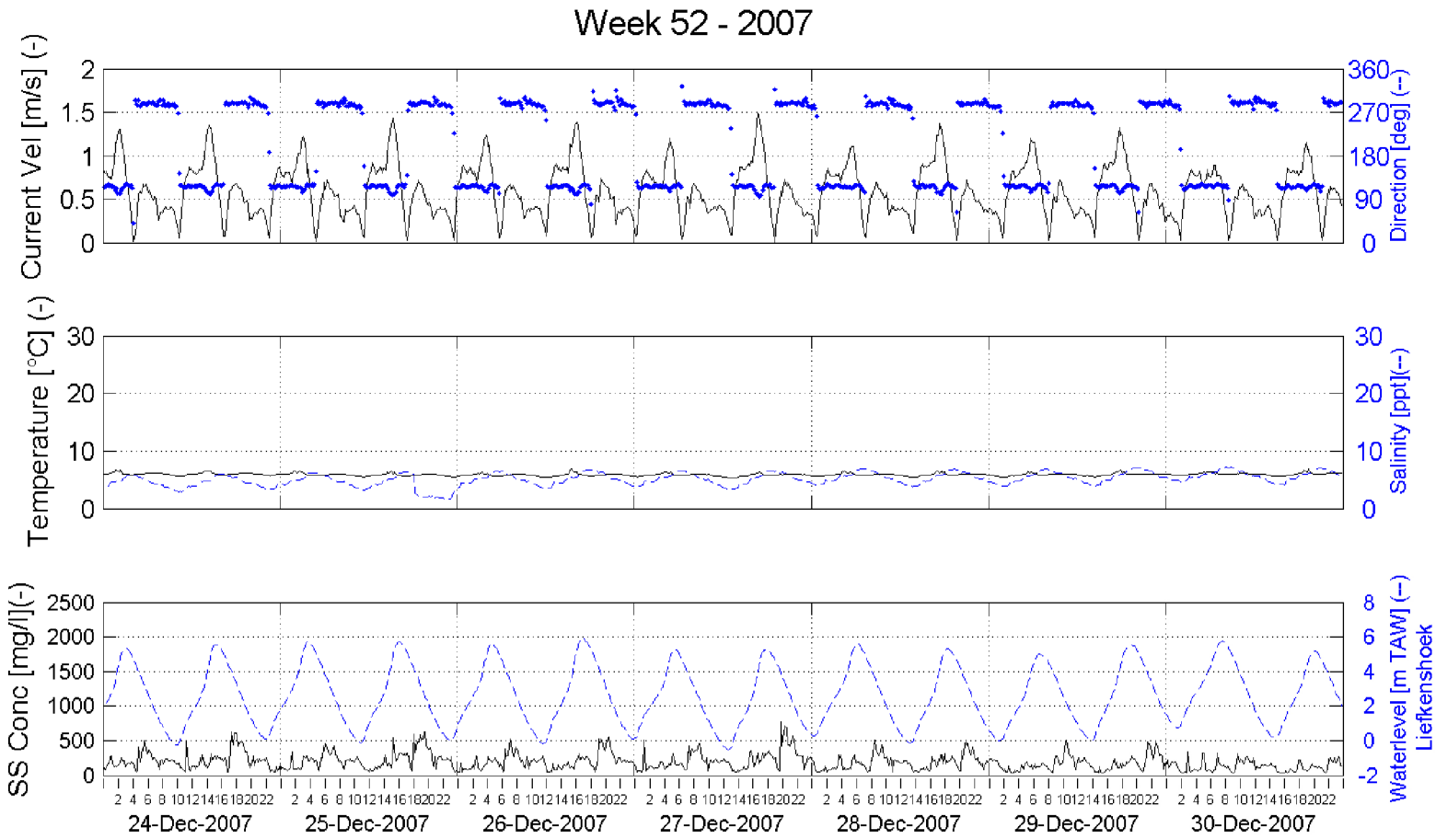
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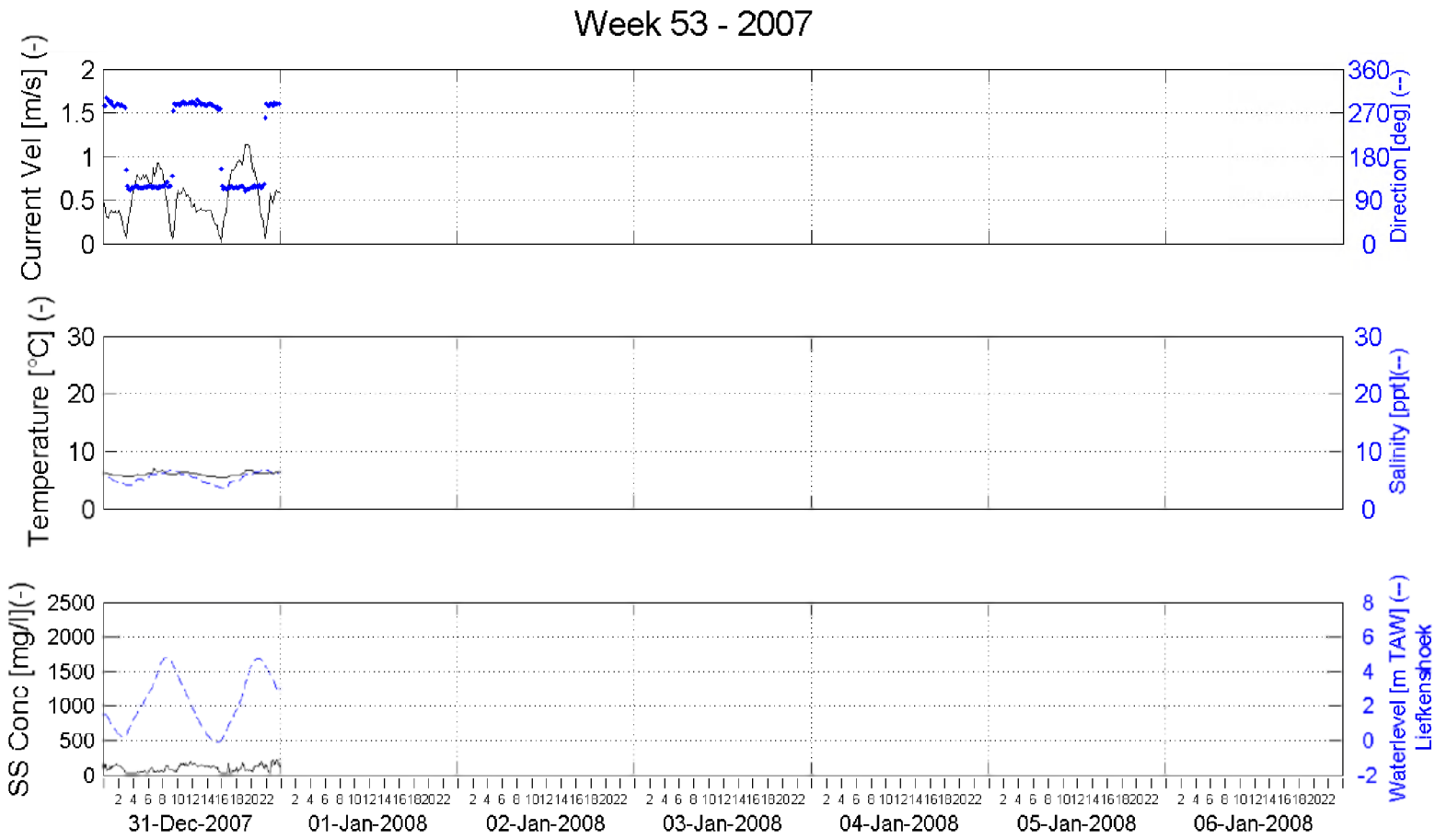
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Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

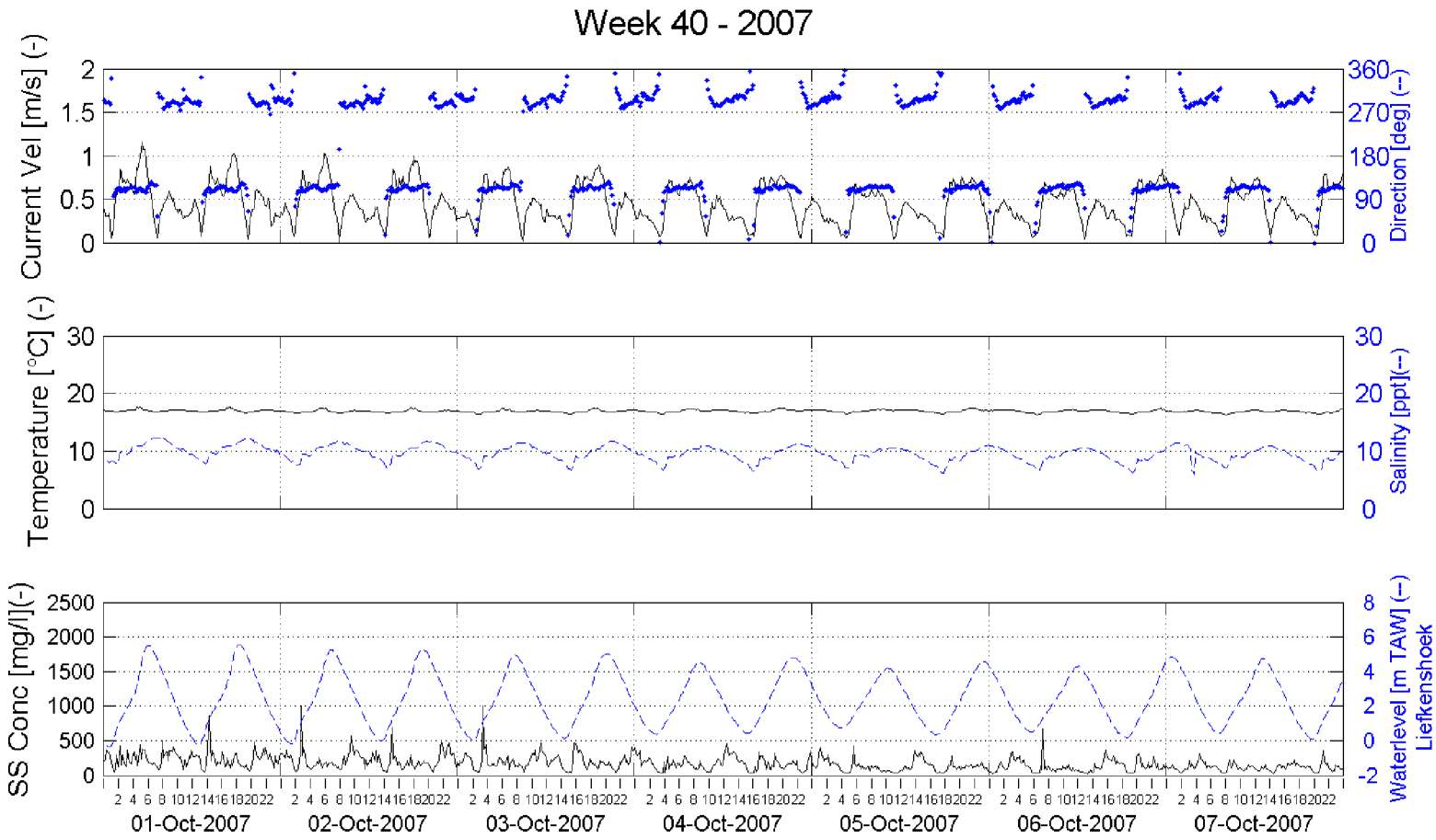
Buoy 97 top - 3.3m above bottom (-5.3m TAW)

Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

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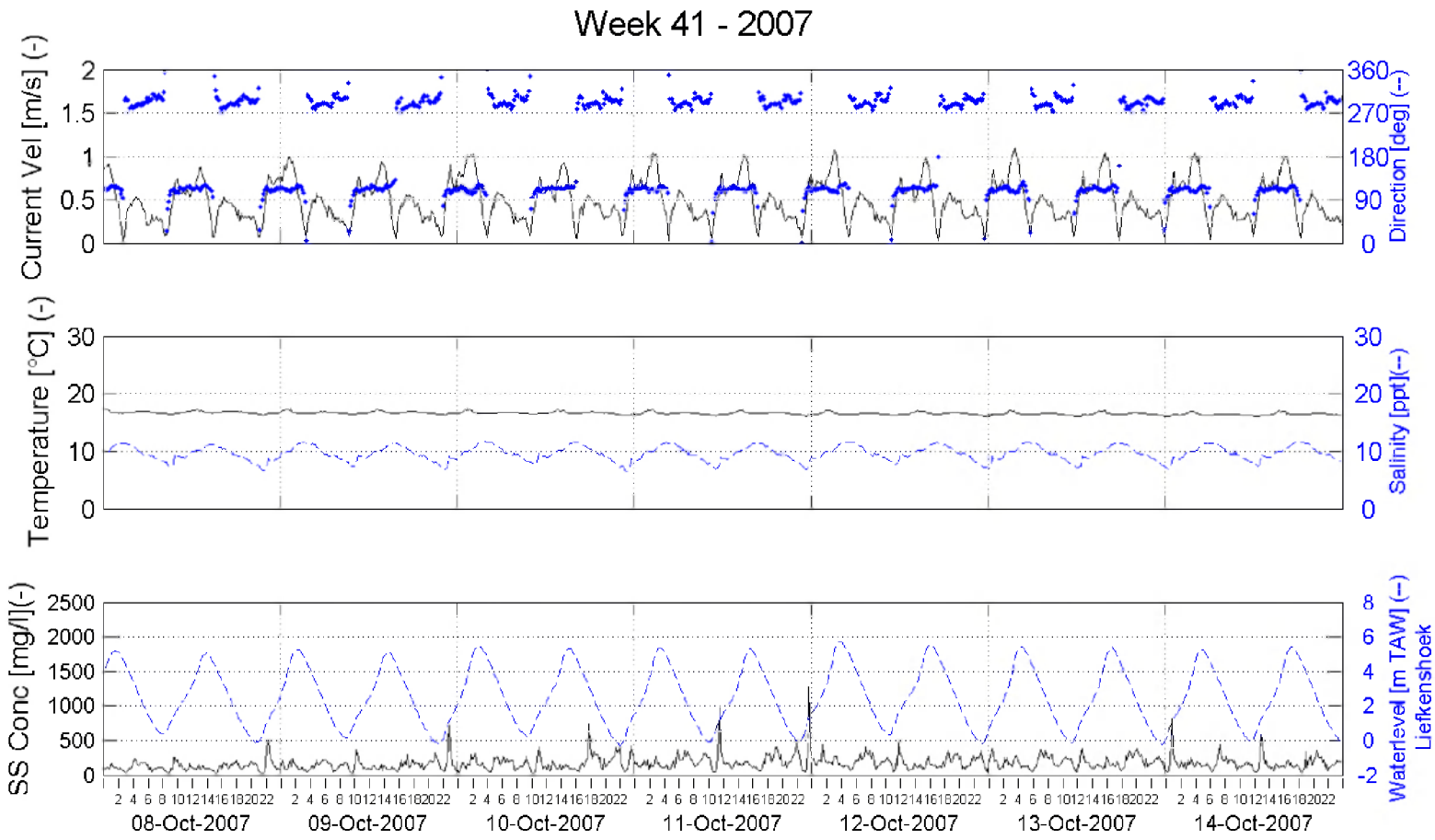
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Location:

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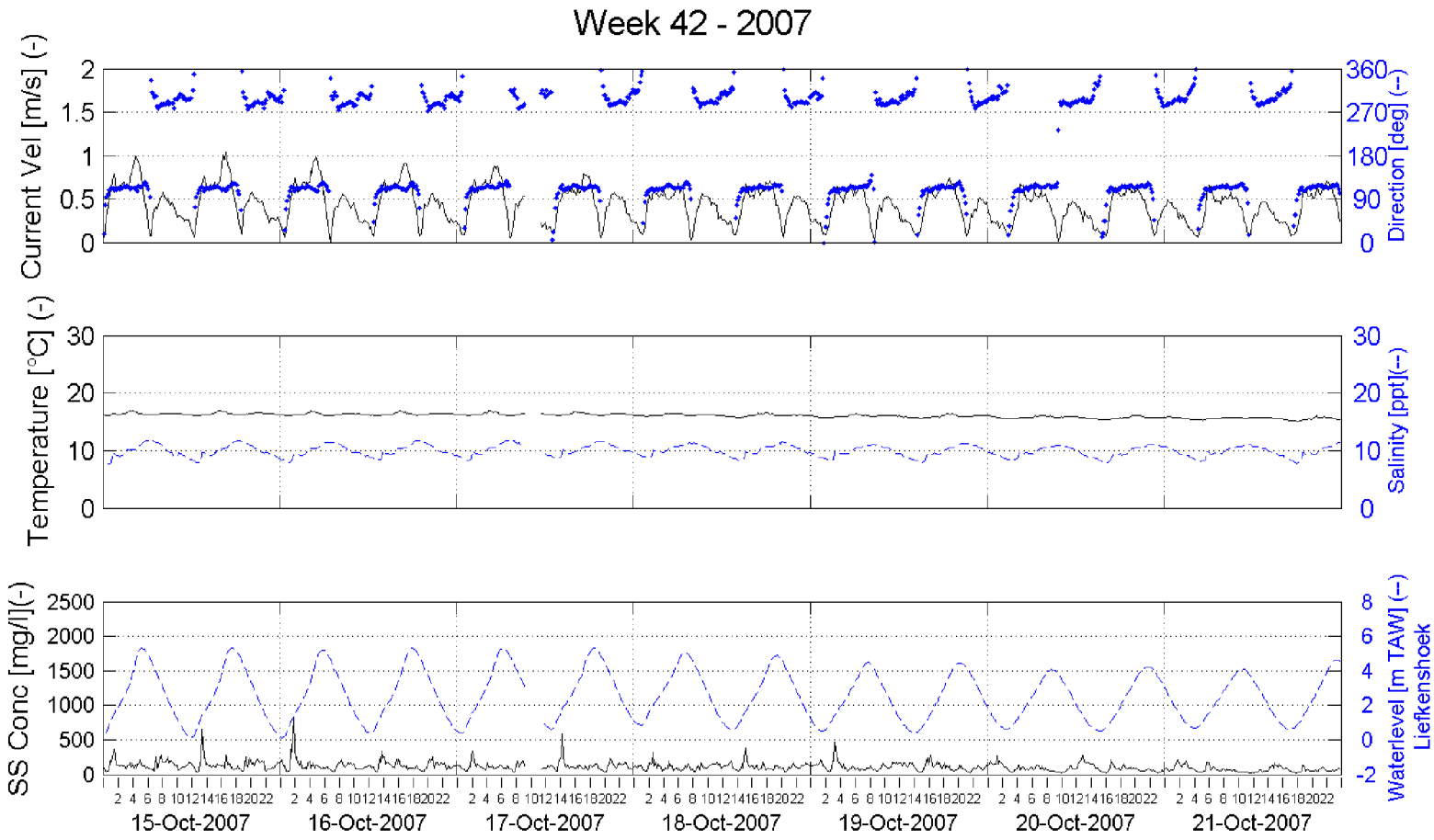
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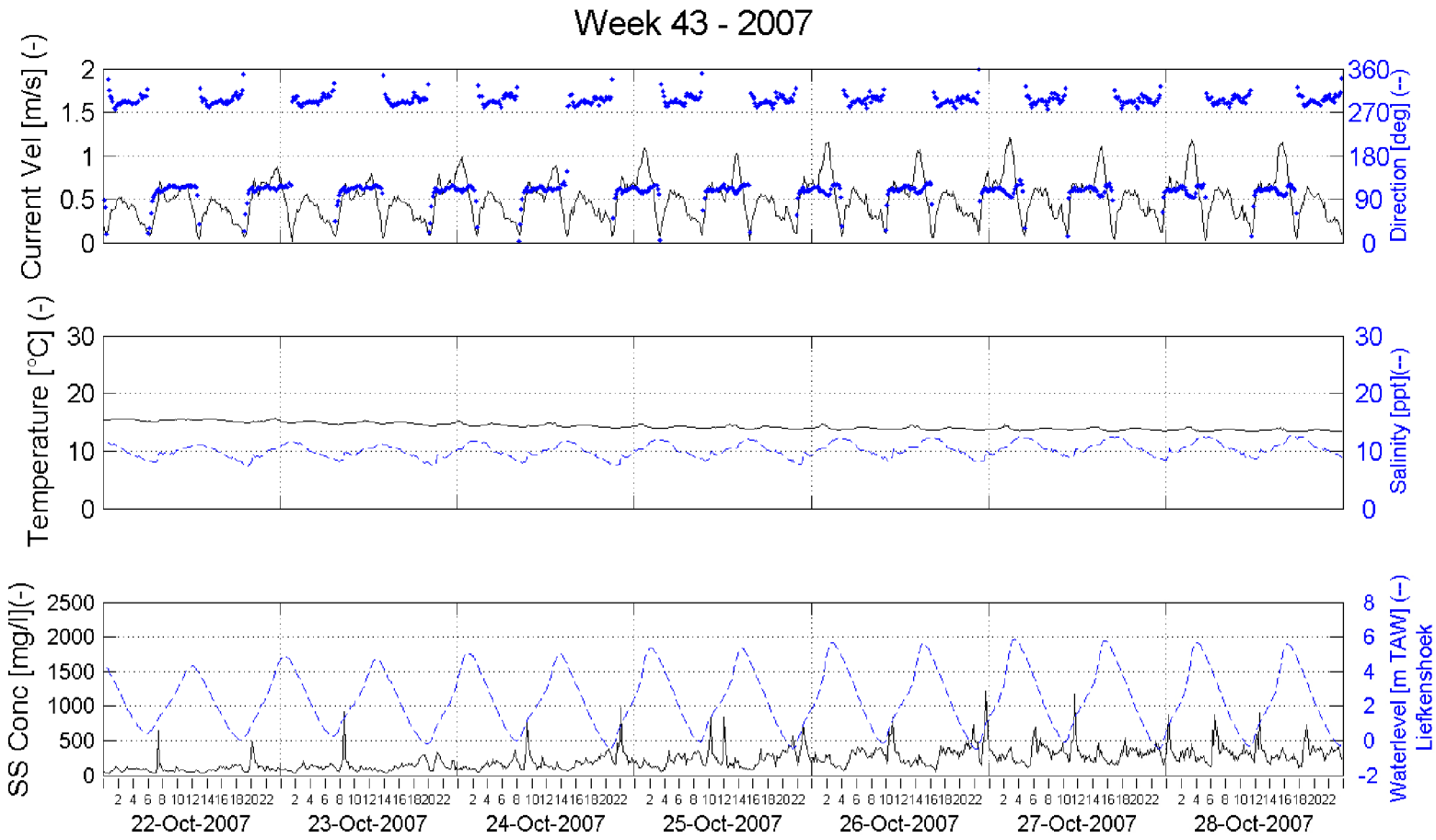
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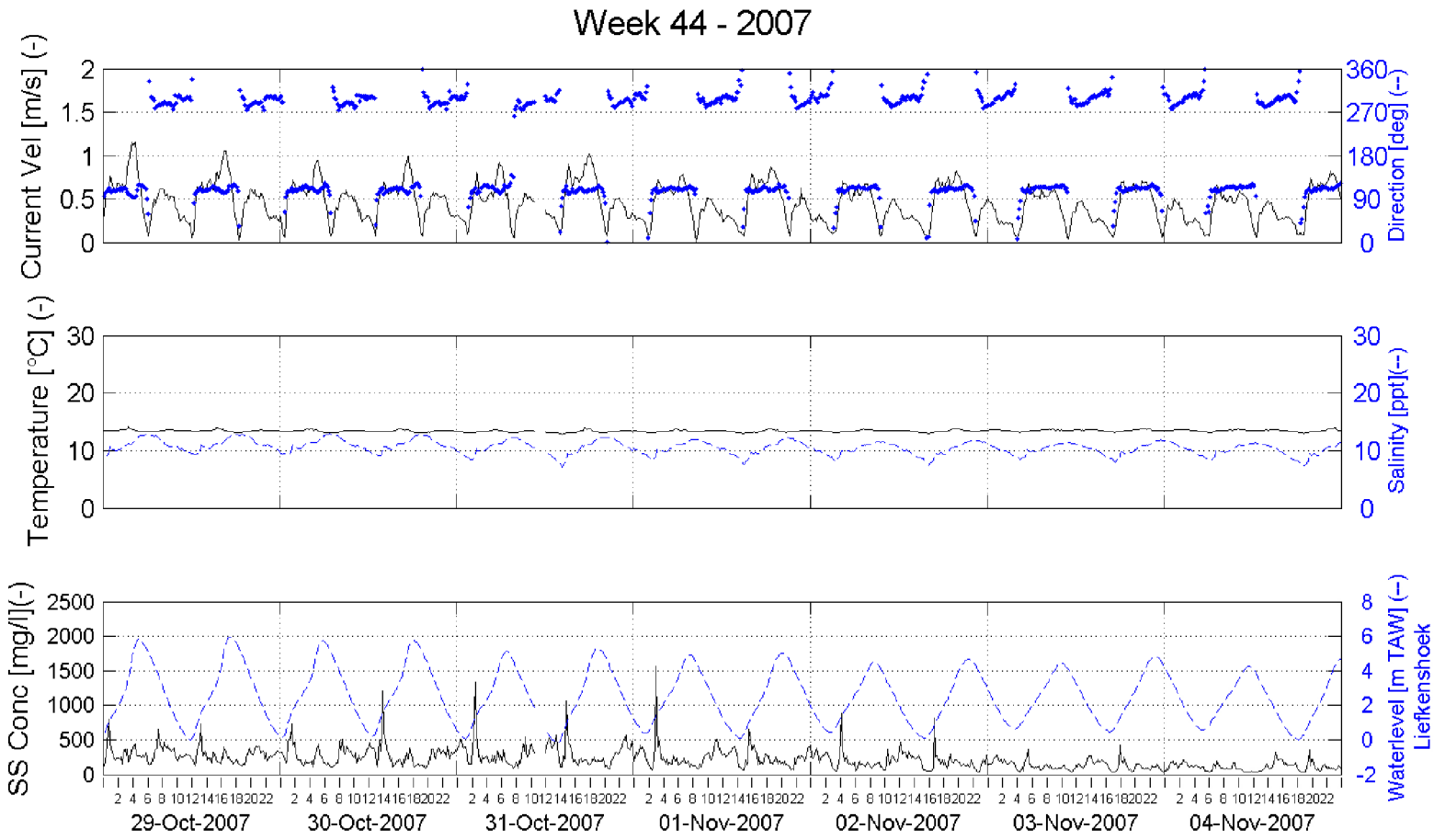
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Location:

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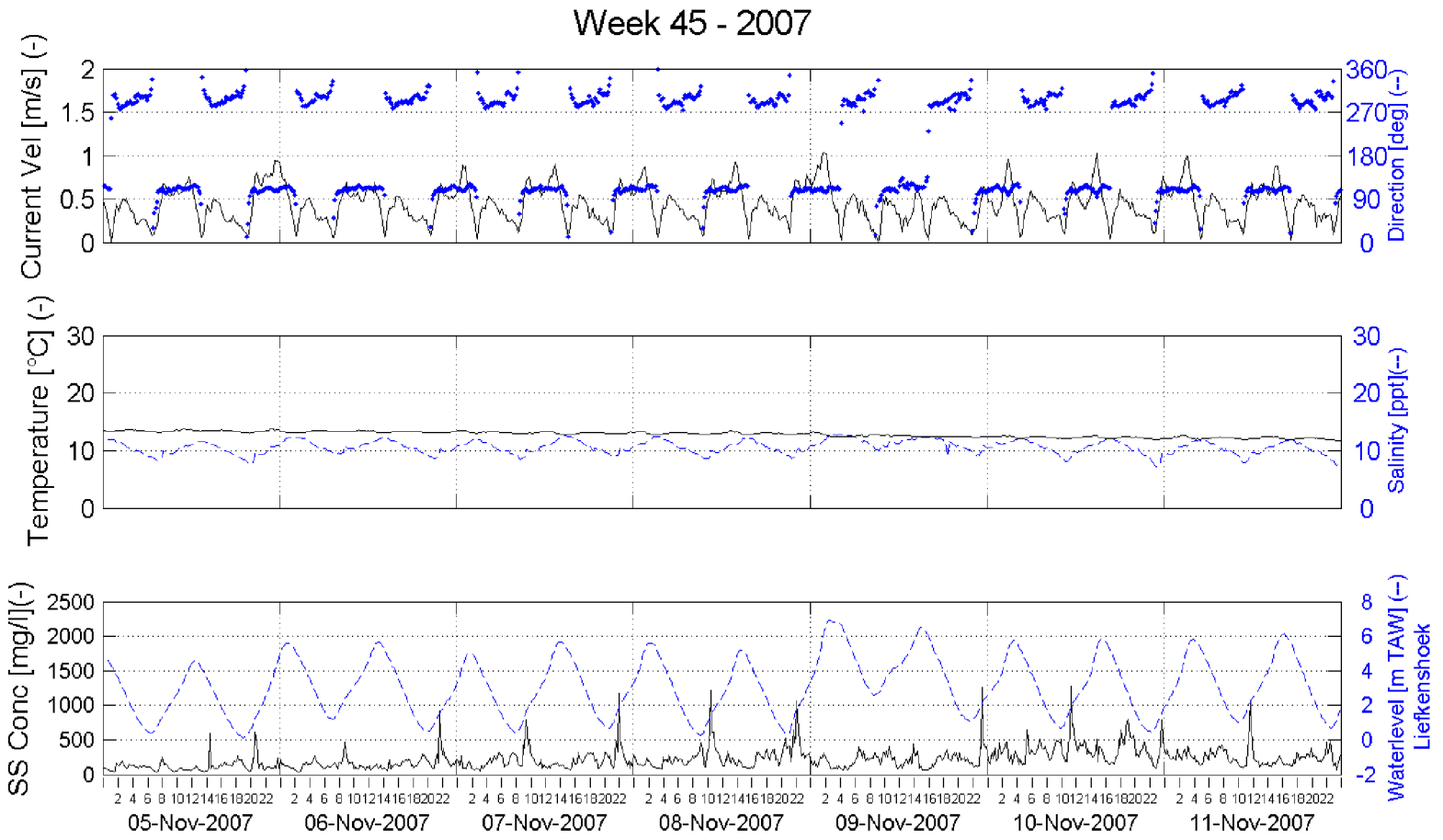
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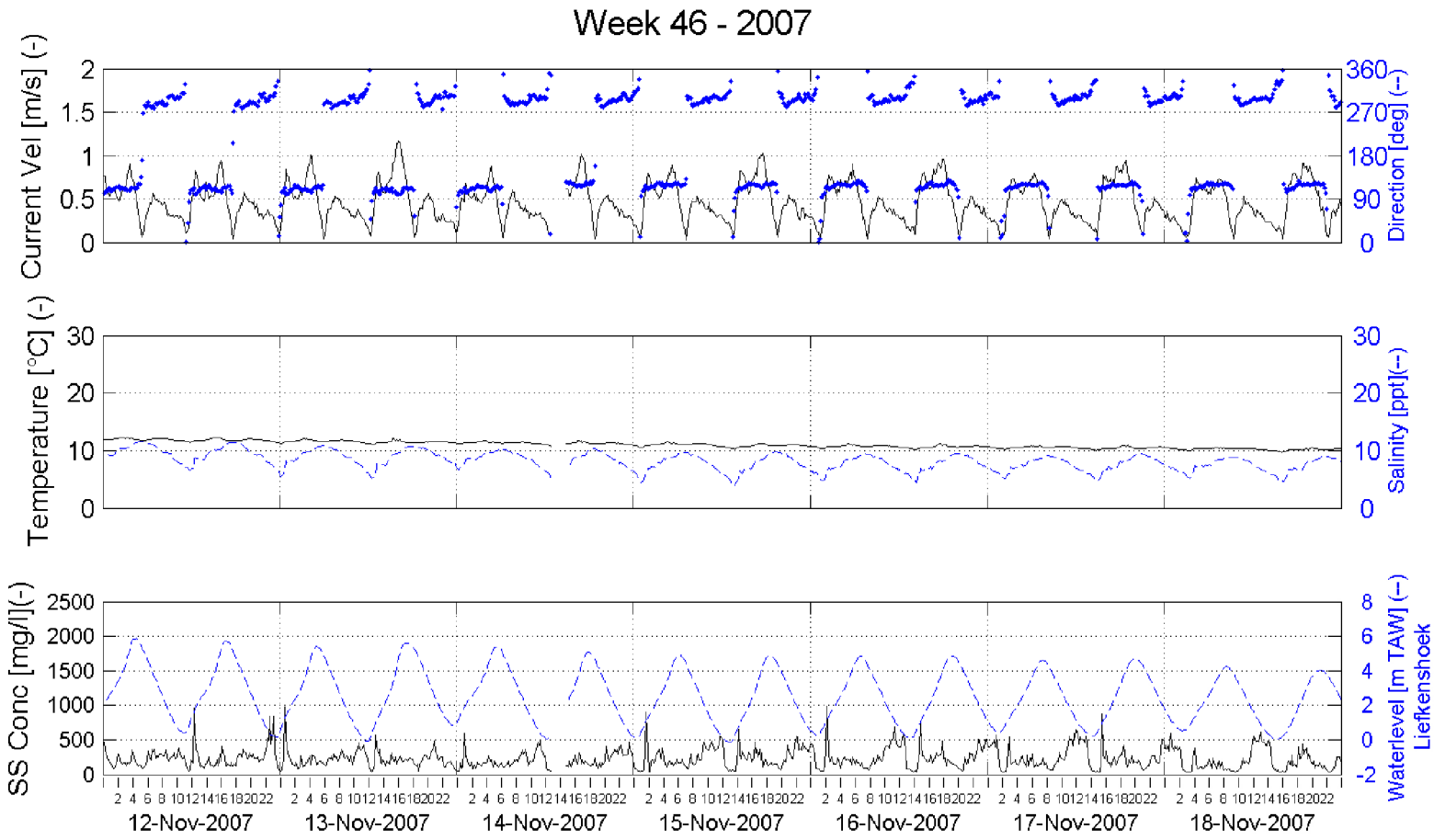
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I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

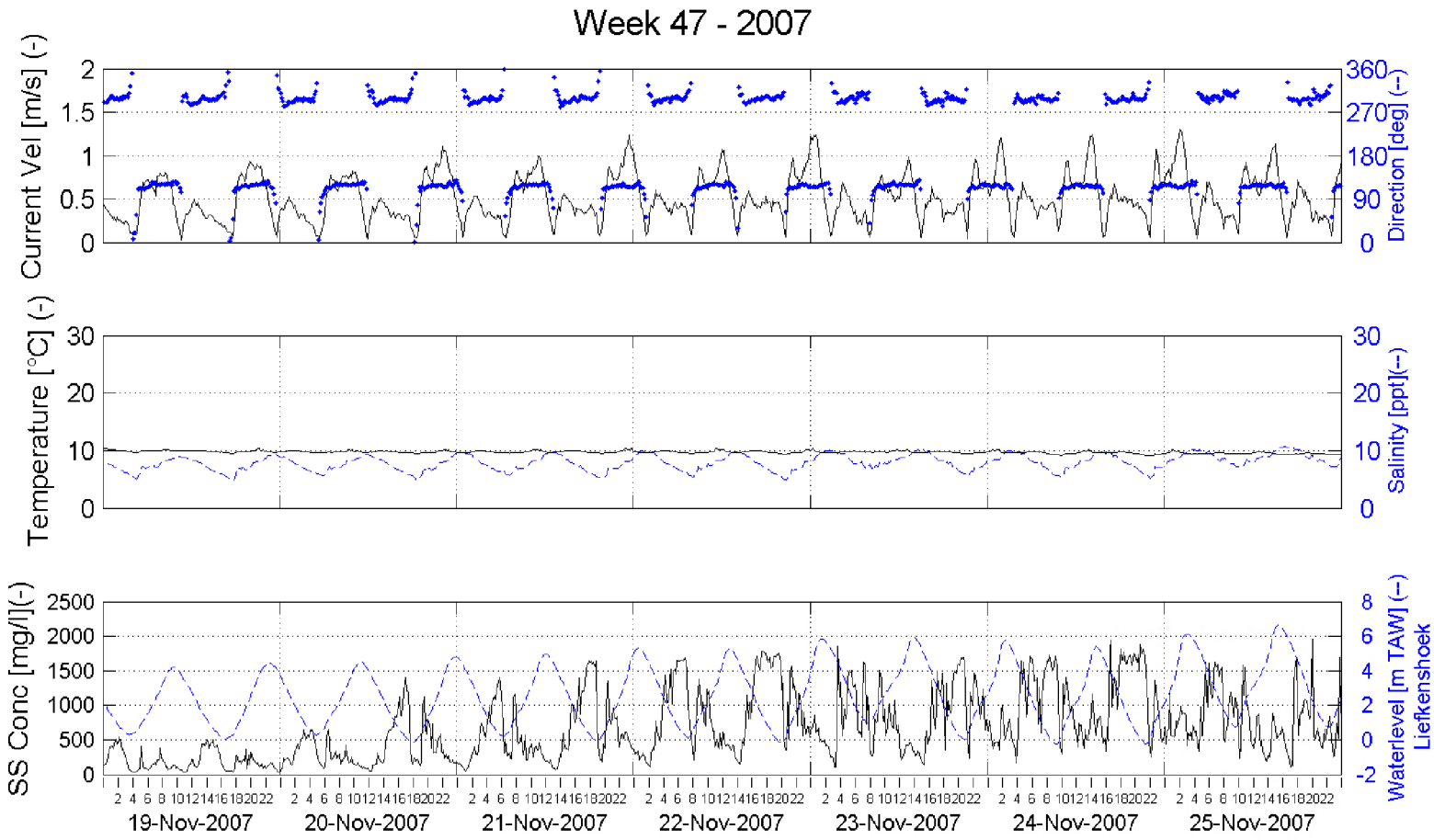
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

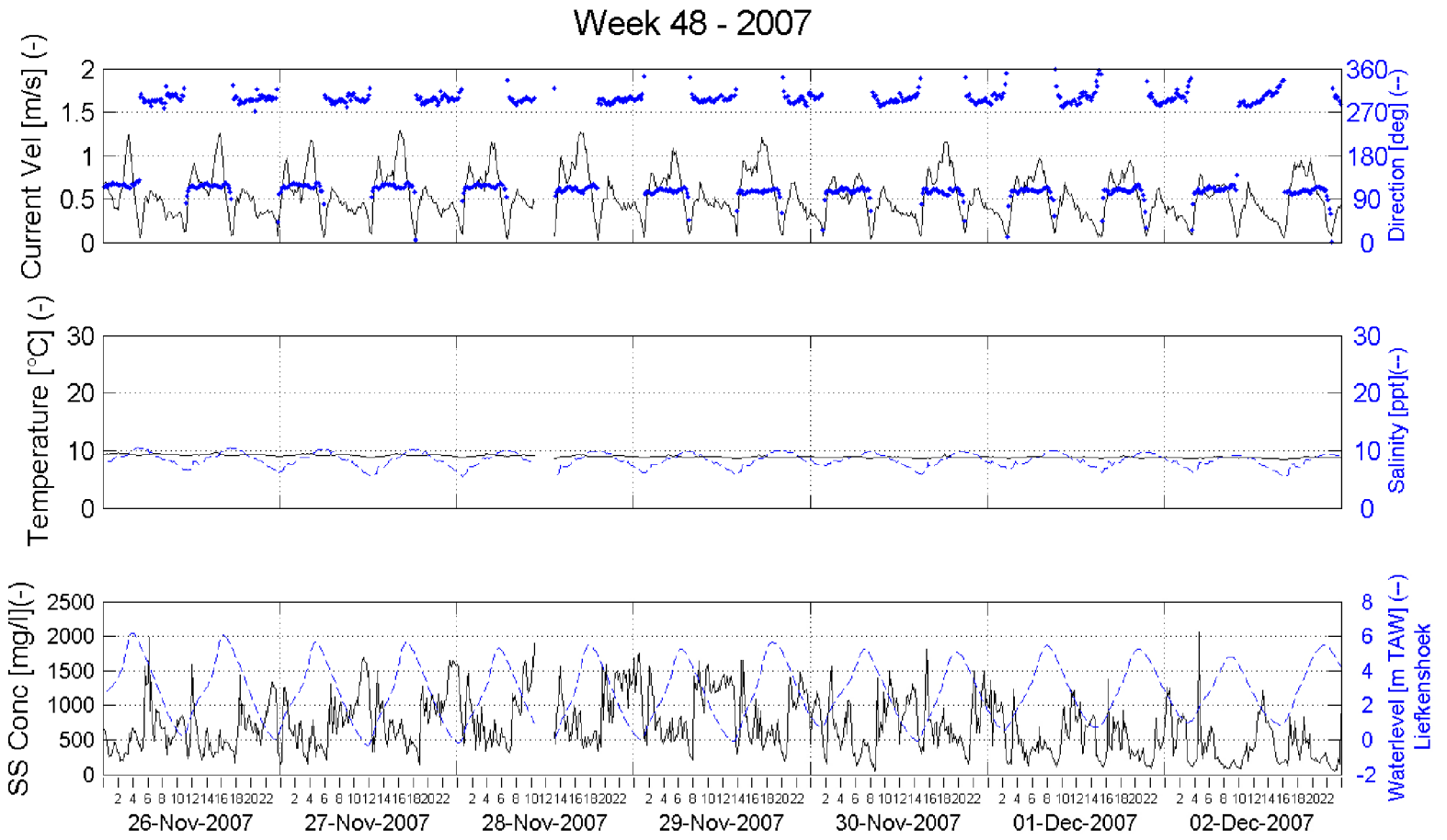
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

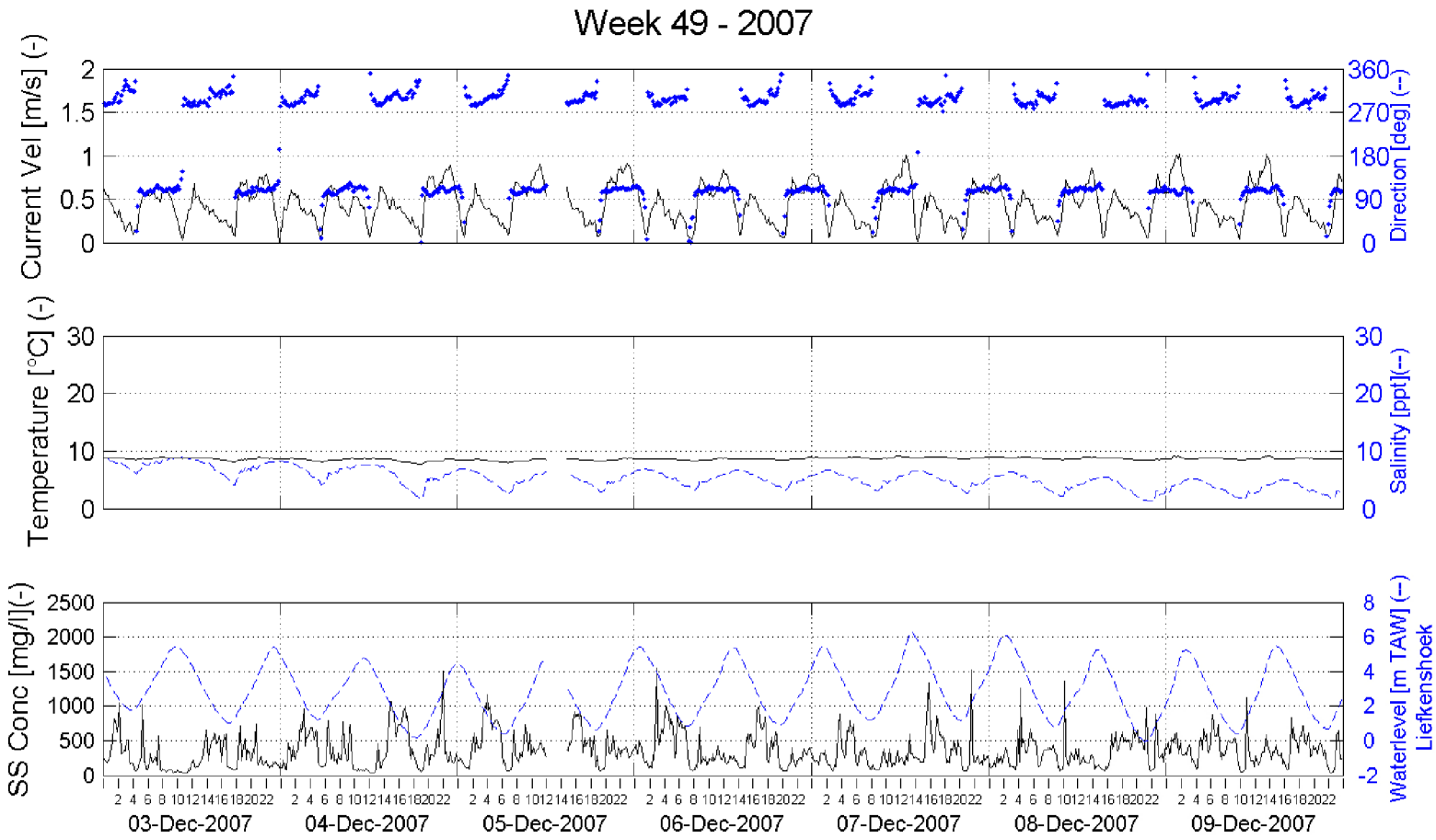
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

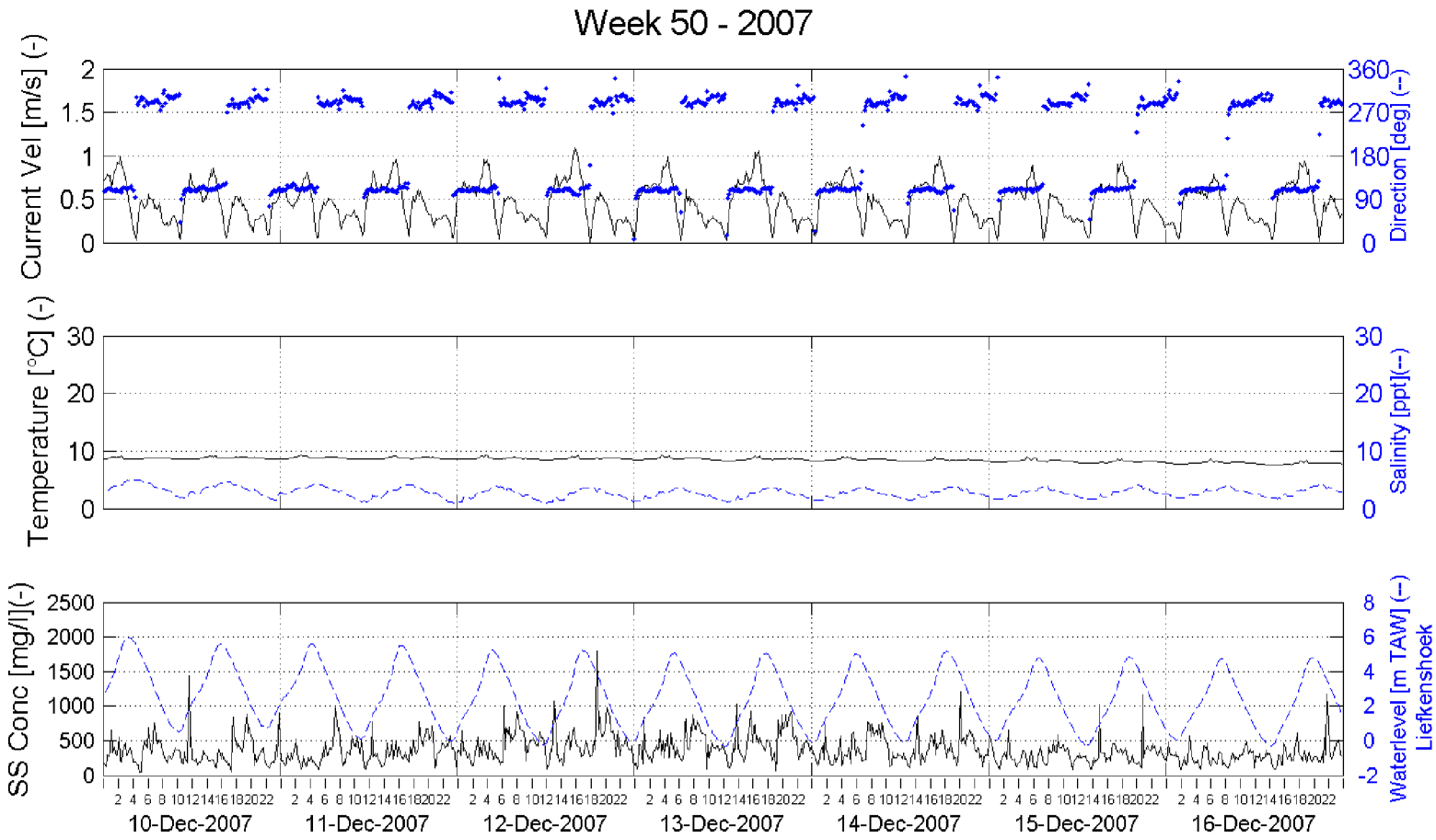
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

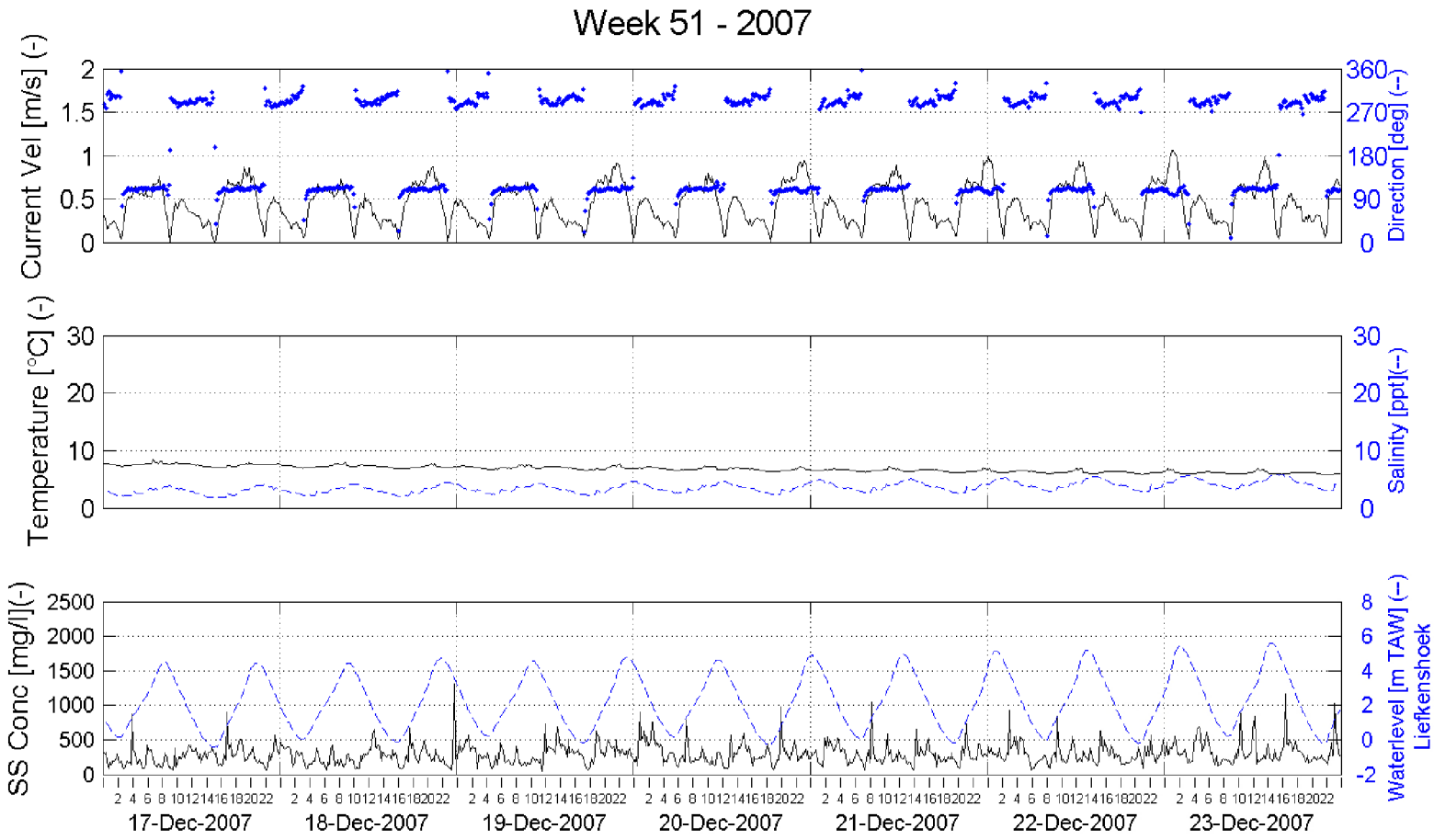
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

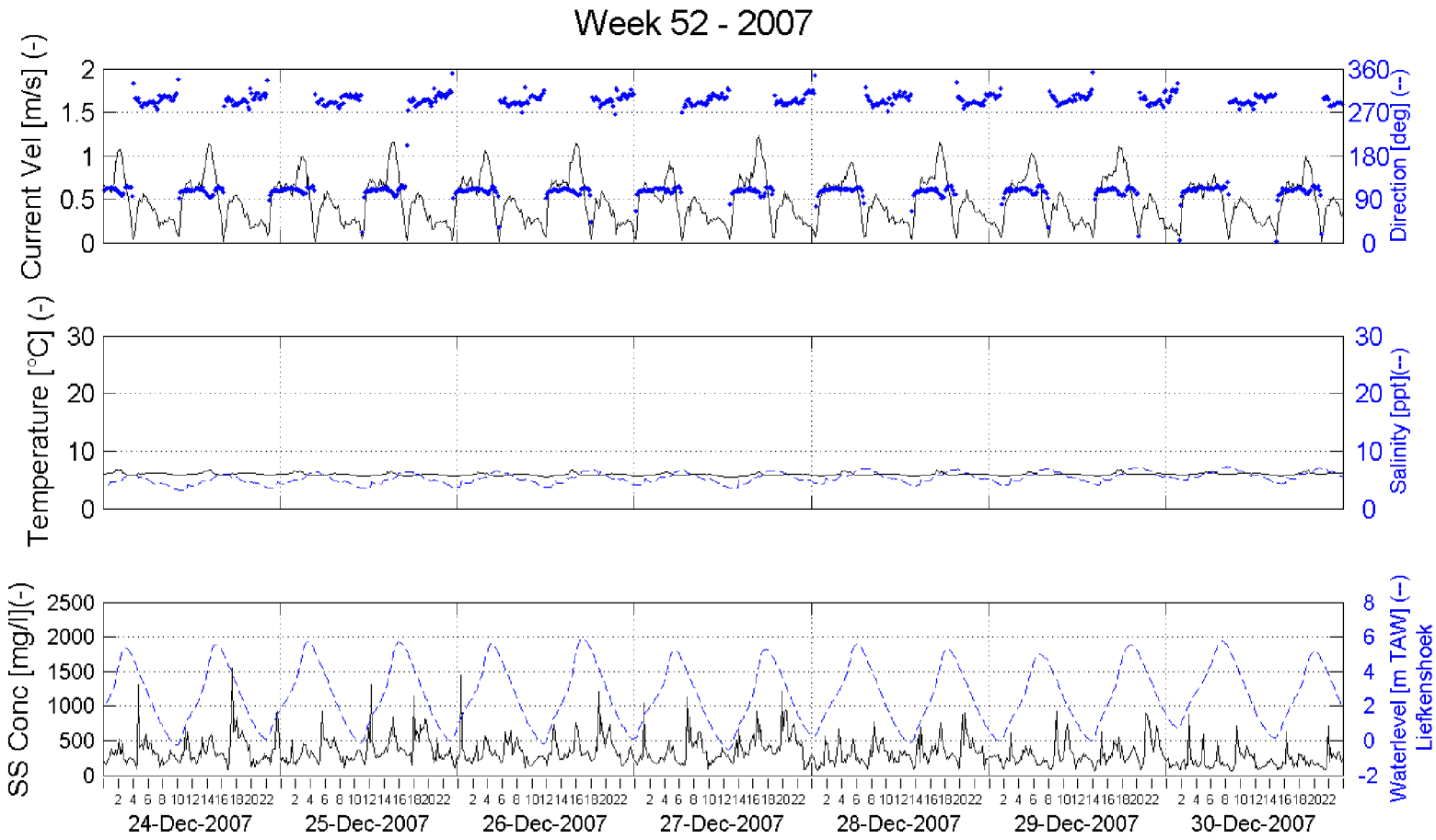
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

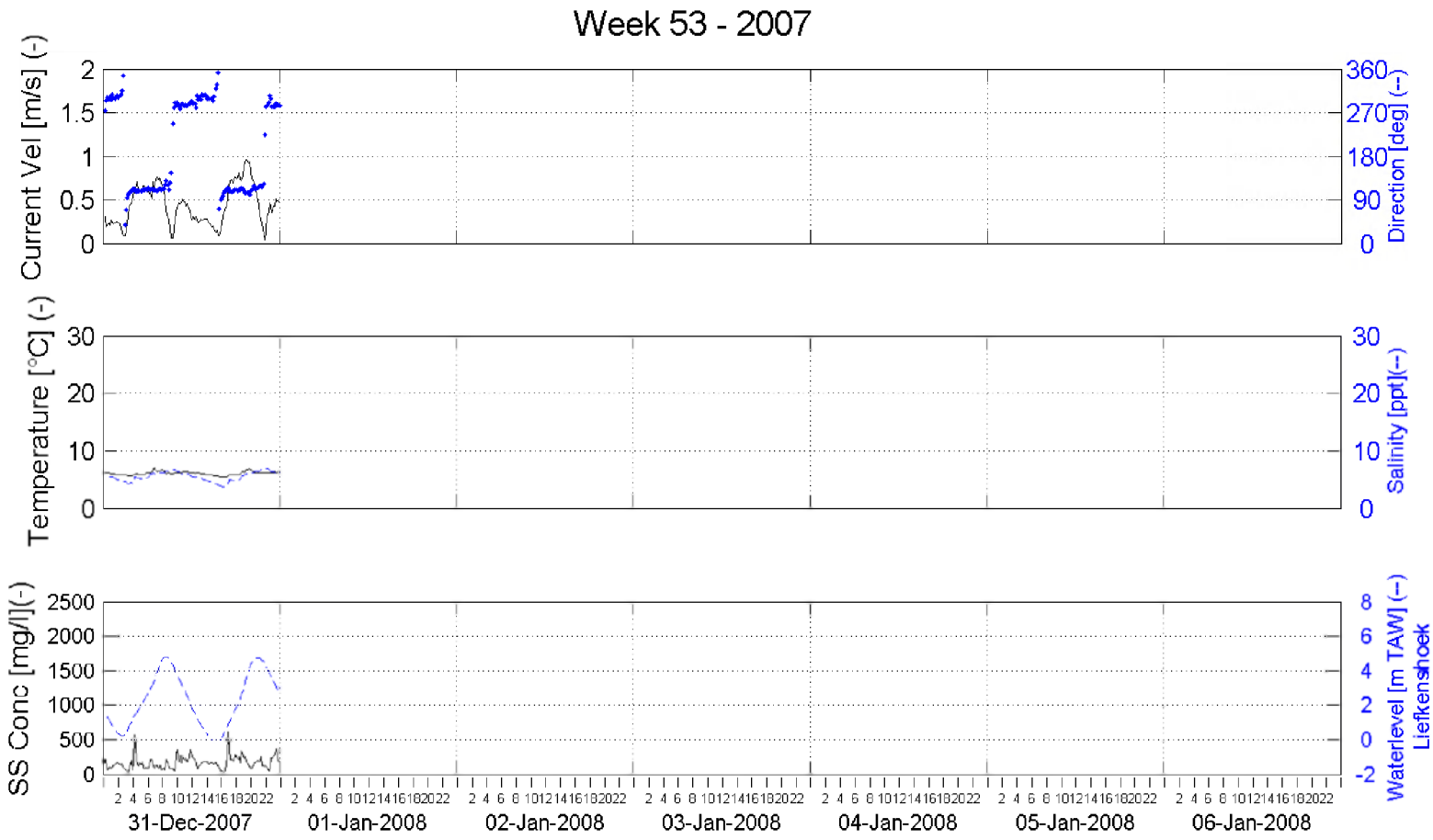
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Buoy 97 bottom - 0.8m above bottom (-7.8m TAW)

Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

C.1 Monthly results minimum, maximum and average of velocity magnitude, temperature, salinity and suspended sediment concentration

Location: Buoy 84
3.3 meter above bottom [-5.6 m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	0.01	1.42	0.51
February 2007	0.00	1.45	0.52
March 2007	0.01	1.47	0.54
April 2007	0.01*	1.28*	0.56*
May 2007	0.00	1.26	0.53
June 2007	0.00	1.27	0.52
July 2007	0.01	1.19	0.52
August 2007	0.00	1.27	0.50
September 2007	0.00	1.34	0.49
October 2007	0.00	1.56	0.5
November 2007	0.00	1.43	0.51
December 2007	0.01	1.52	0.53
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	7.4	9.9	8.4
February 2007	7.1	9.2	8.0
March 2007	8.5	10.6	9.6
April 2007	10.1*	12.8*	11.1*
May 2007	16.0	18.6	17.2
June 2007	17.5	21.6	20.1
July 2007	18.5	21.0	19.8
August 2007	19.5	21.4	20.4
September 2007	16.6	20.3	18.5
October 2007	12.87	17.29	15.63
November 2007	8.48	13.66	11.05
December 2007	5.37	9.34	7.43

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	4.6	2.6	9.3	6.4	6.3	4.1
February 2007	4.8	3.0	7.2	4.8	6.1	4.0
March 2007	2.3	1.4	6.0	3.7	3.9	2.2
April 2007	6.0*	3.7*	7.6*	5.6*	7.1*	4.8*
May 2007	11.4	8.8	12.7	9.8	12.1	9.3
June 2007	11.1	8.5	13.7	10.5	12.5	9.6
July 2007	9.8	6.8	12.8	9.7	11.2	8.5
August 2007	6.3	8.1	12.9	9.4	11.6	8.7
September 2007	11.5	9.2	15.1	11.7	13.5	10.7
October 2007	12.5	9.9	15.6	11.9	13.9	10.7
November 2007	11.0	7.5	15.9	12.4	12.9	9.7
December 2007	4.8	2.4	12	9.1	7.4	4.8

Suspended sediment concentration [mg/l]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	22	2941	173
February 2007	23	3008	334
March 2007	25	1435	205
April 2007	28*	1055*	243*
May 2007	12	494	122
June 2007	2	377	101
July 2007	9	408	122
August 2007	15	846	190
September 2007	12	850	174
October 2007	8	532	142
November 2007	29	803	231
December 2007	33	695	226

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Location: Buoy 84
0.8 meter above bottom [-8.1 m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	0.01	1.07	0.41
February 2007	0.01	1.31	0.46
March 2007	0.01	1.37	0.45
April 2007	0.01*	1.00*	0.46*
May 2007	0.01	1.20	0.46
June 2007	0.00	1.08	0.45
July 2007	0.01	1.19	0.46
August 2007	0.01	1.18	0.44
September 2007	-	-	-
October 2007	0.01*	1.29*	0.44*
November 2007	0.01	1.17	0.44
December 2007	0.01	1.21	0.44
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	7.5	9.4	8.3
February 2007	7.1	9.8	7.9
March 2007	8.5	10.7	9.6
April 2007	10.0*	12.8*	11.1*
May 2007	16.0	18.6	17.2
June 2007	17.6	21.7	20.1
July 2007	18.6	21.1	19.9
August 2007	19.5	21.4	20.4
September 2007	-	-	-
October 2007	12.9*	17.0*	15.1*
November 2007	8.5	13.7	11.1
December 2007	5.4	9.8	7.5

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	4.8	3.0	9.6	6.9	6.8	4.5
February 2007	4.6	2.6	7.4	5.0	6.0	3.9
March 2007	2.5	1.4	6.0	4.0	4.0	2.3
April 2007	5.9*	3.9*	8.0*	5.6*	7.3*	4.9*
May 2007	11.7*	9.2*	14.2*	10.0*	12.8*	9.7*
June 2007	11.3	8.3	15.4	11.2	13.1	10.1
July 2007	9.9	6.8	15.0	11.2	12.3	9.1
August 2007	10.2	6.9	14.4	9.9	11.4	8.5
September 2007	-	-	-	-	-	-
October 2007	-	-	-	-	-	-
November 2007	-	-	-	-	-	-
December 2007	-	-	-	-	-	-

Suspended sediment concentration [mg/l]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	25	1643	259
February 2007	29	2311	615
March 2007	29	2311	448
April 2007	31*	1889*	463*
May 2007	14	852	209
June 2007	1	808	170
July 2007	30	1540	200
August 2007	33	802	272
September 2007	-	-	-
October 2007	22*	596*	204*
November 2007	30	1798	320
December 2007	44	1093	321

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Location: Buoy 97
3.3 meter above bottom [-5.3 m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	0.01	1.38	0.53
February 2007	0.01*	1.37*	0.56*
March 2007	0.01*	1.73*	0.56*
April 2007	0.01	1.45	0.61
May 2007	0.01	1.35	0.60
June 2007	0.01	1.32	0.59
July 2007	0.00	1.45	0.59
August 2007	0.00	1.46	0.59
September 2007	0.00	1.68	0.58
October 2007	0.00	1.51	0.58
November 2007	0.01*	1.41*	0.63*
December 2007	0.00	1.49	0.56
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	7.1	10.1	8.5
February 2007	6.7*	8.9*	7.8*
March 2007	9.0*	11.0*	9.7*
April 2007	10.0	17.7	14.3
May 2007	16.3	18.7	17.3
June 2007	17.7	21.9	20.2
July 2007	18.7	21.2	20.0
August 2007	19.6	21.5	20.5
September 2007	16.9	20.7	18.6
October 2007	12.8	17.6	15.7
November 2007	8.5	14.0	11.1
December 2007	5.3	9.4	7.5

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	4.2	1.4	7.4	5.2	5.5	2.9
February 2007	4.7*	1.5*	6.4*	4.3*	5.7*	3.1*
March 2007	4.0*	1.4*	5.2*	3.0*	4.4*	2.2*
April 2007	5.3	2.4	10.0	7.0	8.2	5.3
May 2007	10.2	6.5	11.3	8.6	10.8	7.4
June 2007	10.5	5.3	12.3	8.7	11.4	7.5
July 2007	8.2	4.2	11.4	7.8	9.9	6.3
August 2007	8.1	4.1	10.5	7.4	9.4	6.0
September 2007	10.2	6.7	12.4	9.2	11.3	8.2
October 2007	10.4	5.9	12.7	9.1	11.5	7.5
November 2007	8.5	3.6	12	8.8	10.5	6.2
December 2007	3.6	0.8	7.1	4.6	5.3	2.5

Suspended sediment concentration [mg/l]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	24	1449	238
February 2007	30*	1354*	356*
March 2007	34*	1252*	305*
April 2007	24	1616	243
May 2007	23	980	154
June 2007	22	540	98
July 2007	33	1970	170
August 2007	25	900	260
September 2007	18	848	219
October 2007	21	744	188
November 2007	34	1084	321
December 2007	30	937	221

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Location: Buoy 97
0.8 meter above bottom [-7.8m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	-	-	-
February 2007	0.01	1.22	0.46
March 2007	0.00	1.61	0.46
April 2007	0.01	1.29	0.50
May 2007	0.00	1.23	0.49
June 2007	0.01	1.18	0.47
July 2007	0.00	1.32	0.48
August 2007	0.00	1.25	0.47
September 2007	0.01	1.23	0.47
October 2007	0.01	1.21	0.47
November 2007	0.01	1.3	0.48
December 2007	0.01	1.24	0.46
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	-	-	-
February 2007	6.8	9.3	7.9
March 2007	8.6	11.2	9.6
April 2007	10.0	17.7	14.3
May 2007	16.3	18.7	17.3
June 2007	17.7	21.9	20.2
July 2007	18.7	21.1	19.8
August 2007	19.6	21.5	20.5
September 2007	16.8	20.5	18.6
October 2007	12.8	17.6	15.7
November 2007	8.5	13.9	11.1
December 2007	5.4	9.4	7.5

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

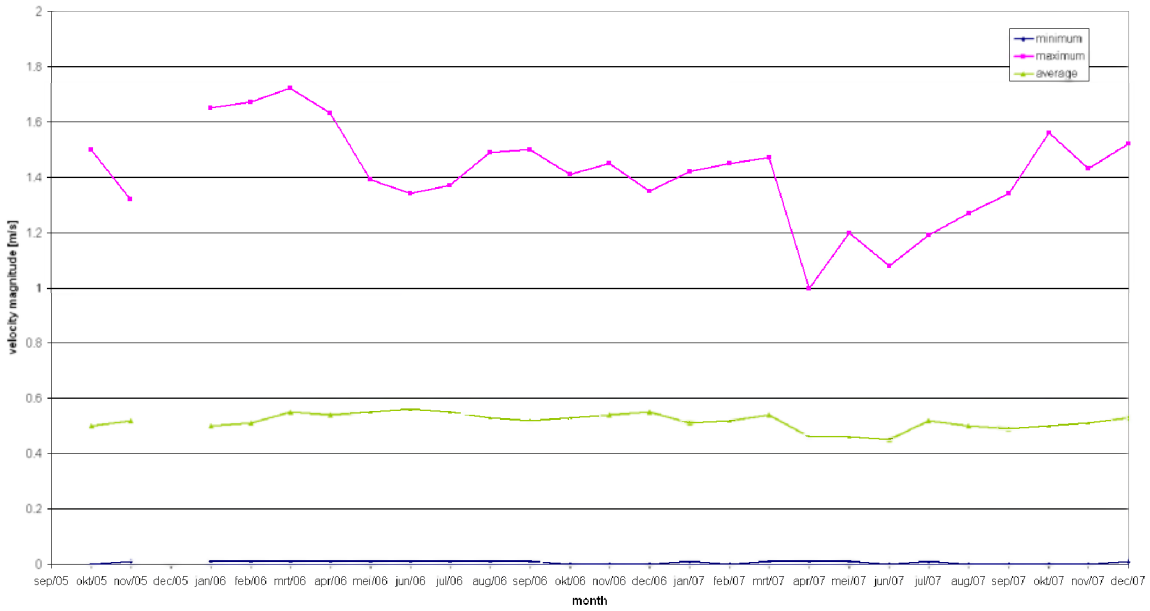
Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	-	-	-	-	-	-
February 2007	3.8	1.2	5.5	4.1	4.8	2.7
March 2007	1.9	0.7	5.2	3.1	3.3	1.7
April 2007	5.2	2.8	10.2	7.5	8.3	5.7
May 2007	10.3	7.0	11.4	9.1	10.9	8.0
June 2007	10.4	6.8	12.4	9.3	11.5	8.2
July 2007	7.3	4.6	11.5	8.2	9.9	6.9
August 2007	7.6	5.0	10.5	8.1	9.5	6.5
September 2007	10.2	7.2	12.5	9.5	11.4	8.7
October 2007	10.5	6.7	12.8	9.4	11.5	8.2
November 2007	8.8	4.2	12.8	10.7	10.6	7.0
December 2007	3.6	1.0	10.0	6.7	5.8	3.2

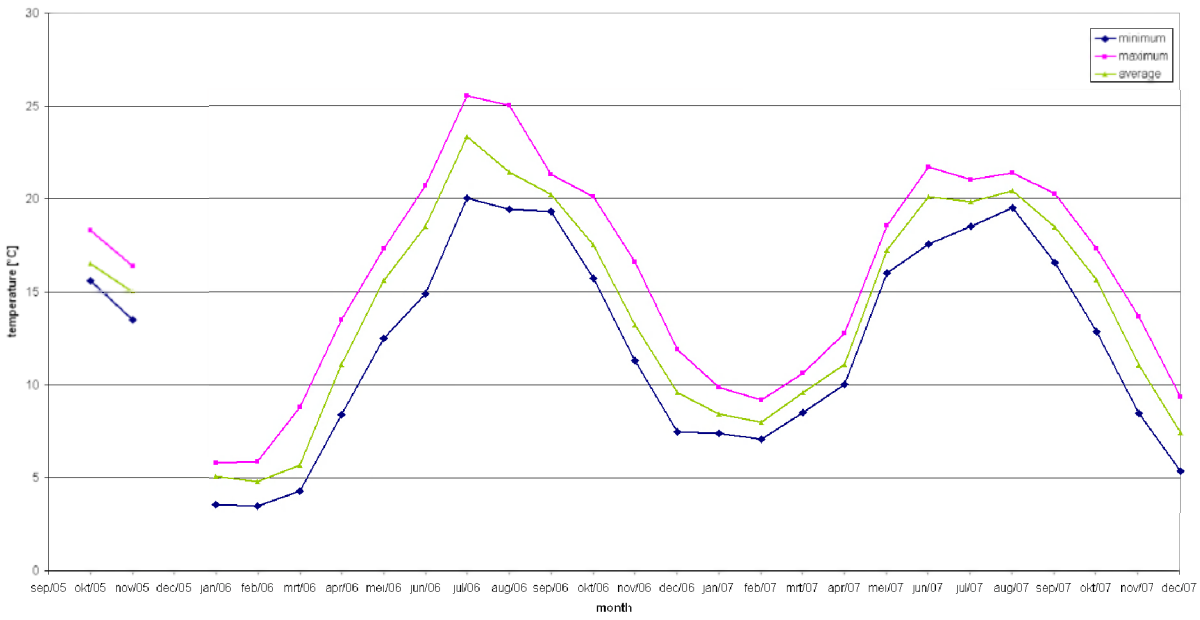
Suspended sediment concentration [mg/l]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	-	-	-
February 2007	29	2076	565
March 2007	31	1843	398
April 2007	31	1852	444
May 2007	22	1880	368
June 2007	22	2502	211
July 2007	25	1108	173
August 2007	25	2042	360
September 2007	22	2091	300
October 2007	25	1337	182
November 2007	29	1983	417
December 2007	31	2061	337

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

C.2 Graphs monthly results for the whole deployment period

Velocity magnitude & temperature





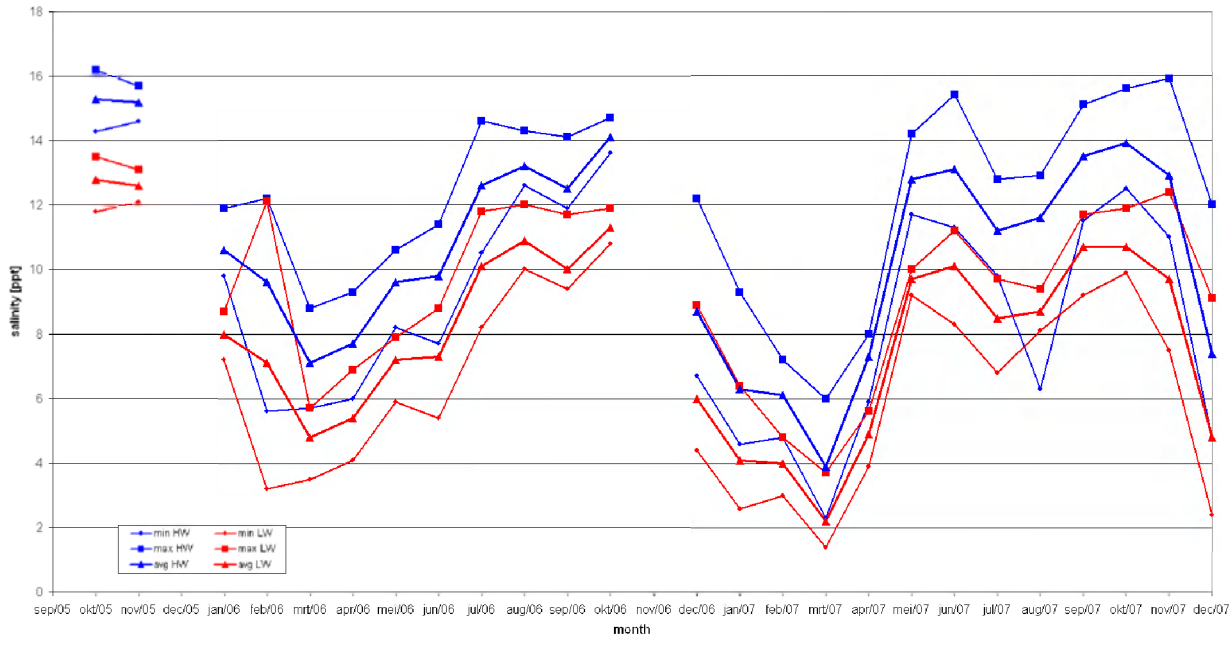
Buoy 84
3.3 m above bottom (-5.6 m TAW)

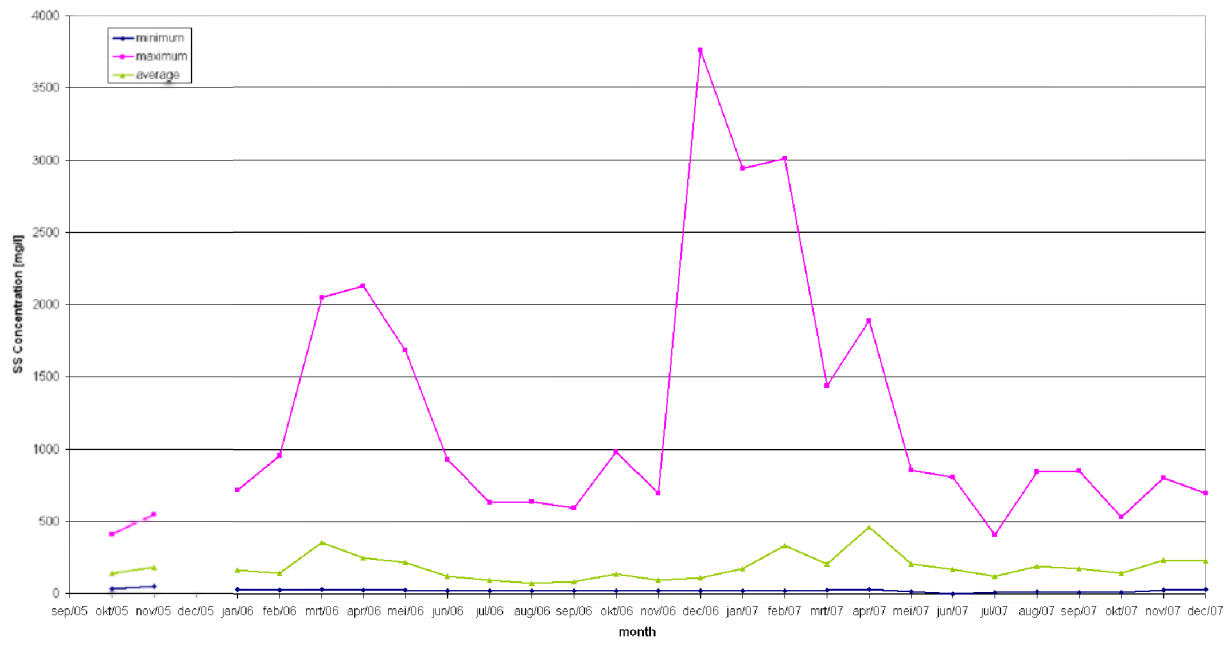
Data processed by: IMDC

In association with: WL | delft hydraulics, GEMS International

I/RA/11283/07.099/MSA

Salinity & SS Concentration





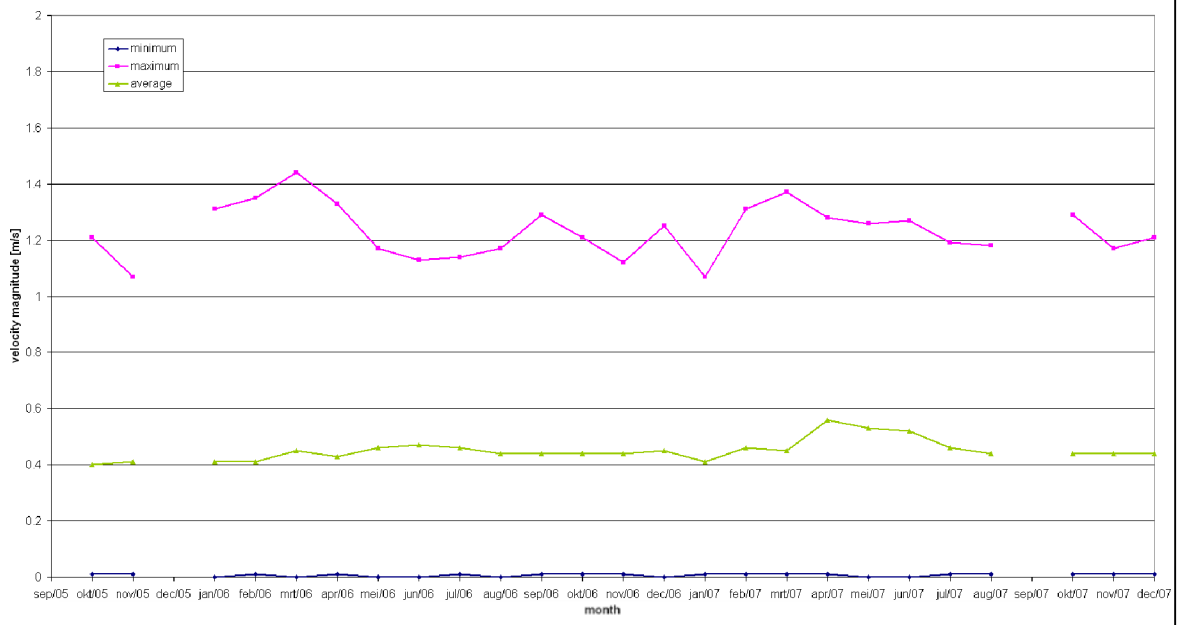
Buoy 84
3.3m above bottom (-5.6m TAW)

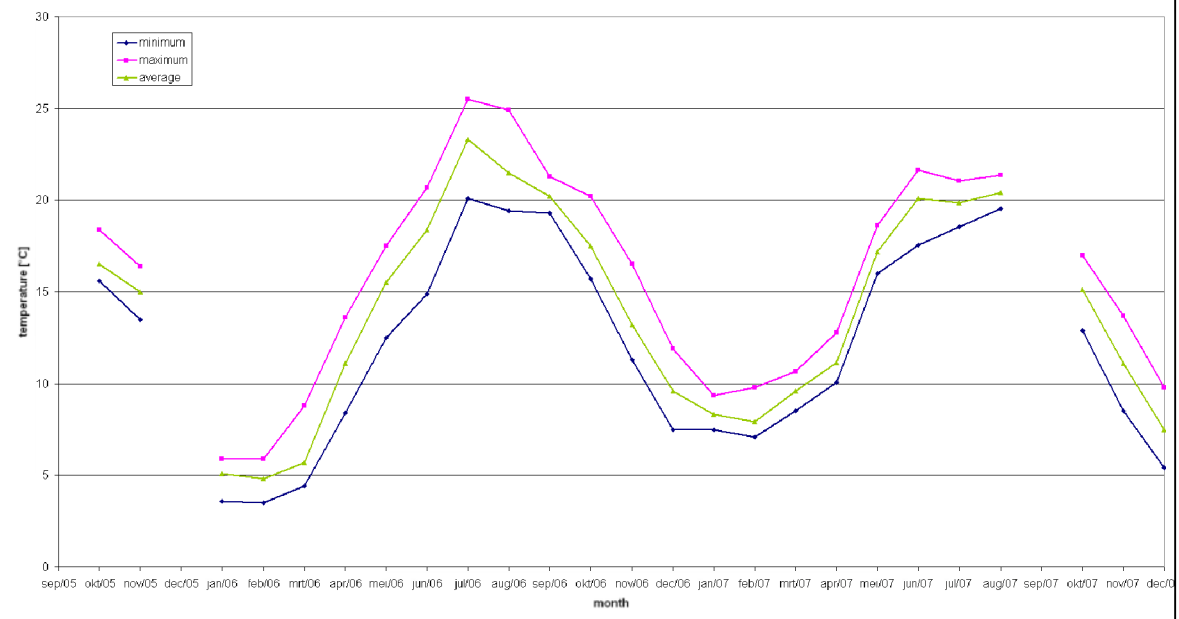
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Velocity magnitude & temperature





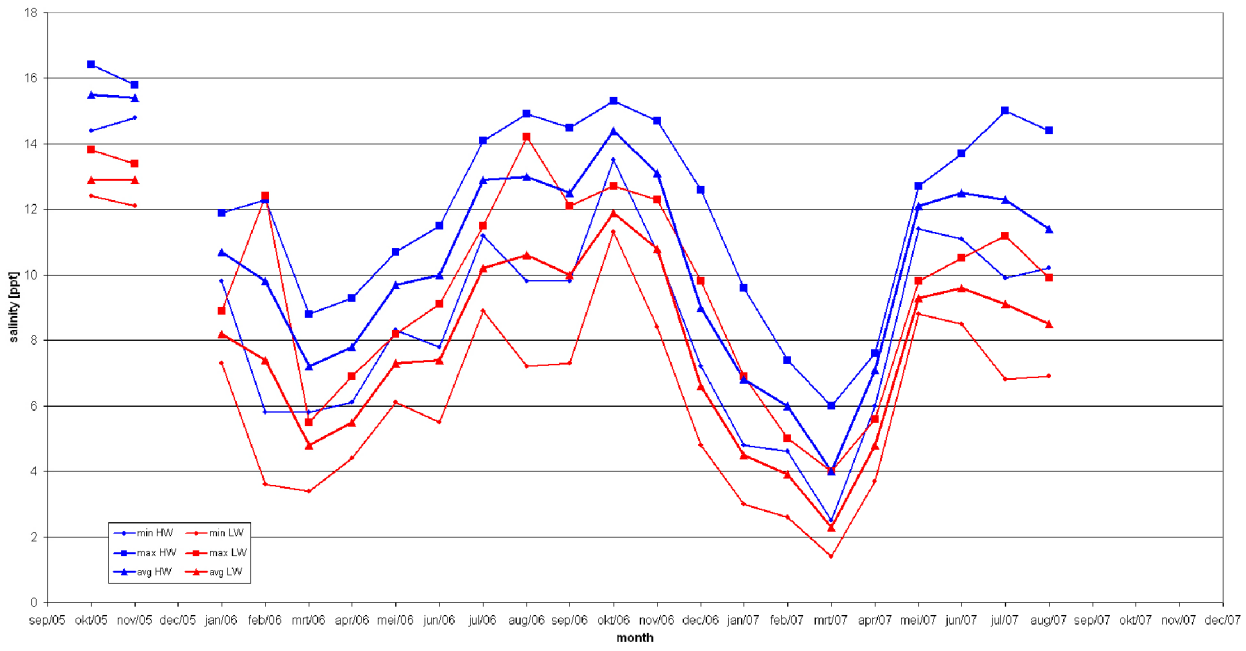
Buoy 84
0.8m above bottom (-8.1m TAW)

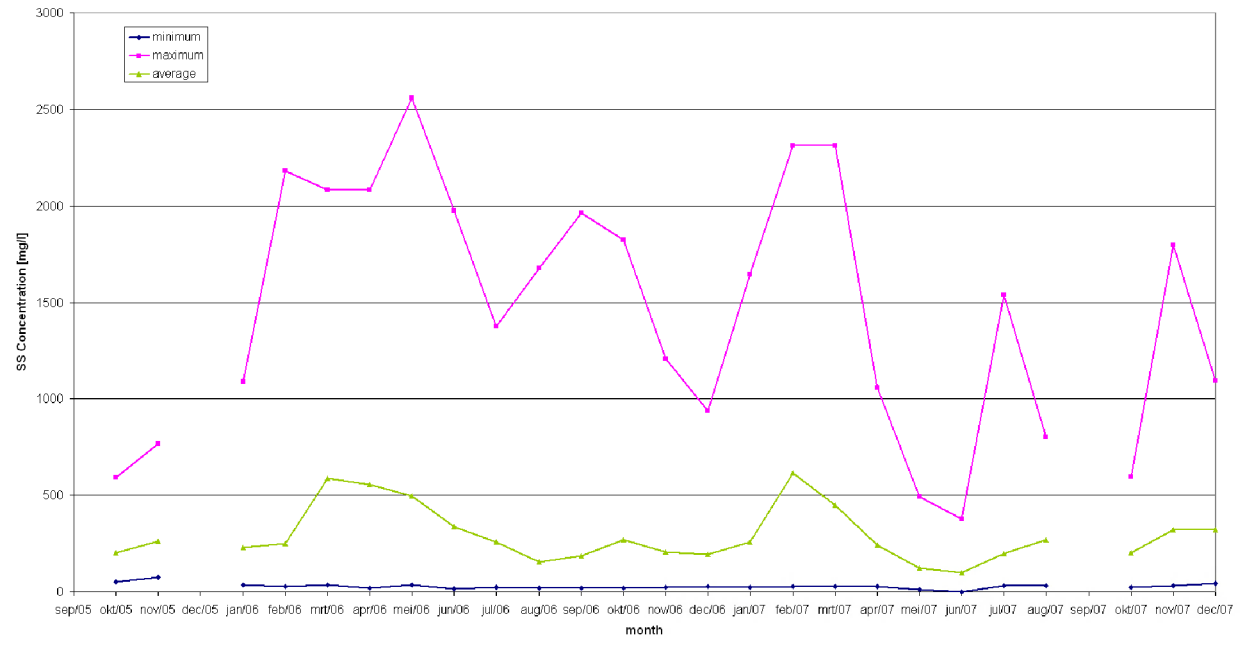
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Salinity & SS Concentration





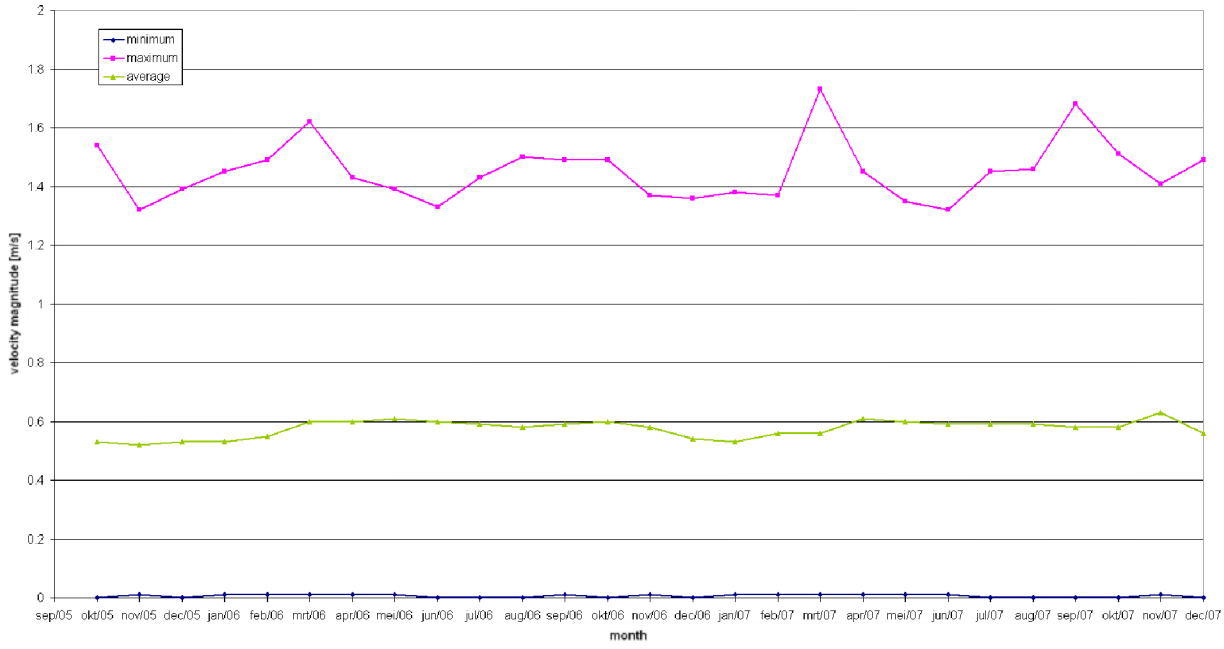
Buoy 84
0.8m above bottom (-8.1m TAW)

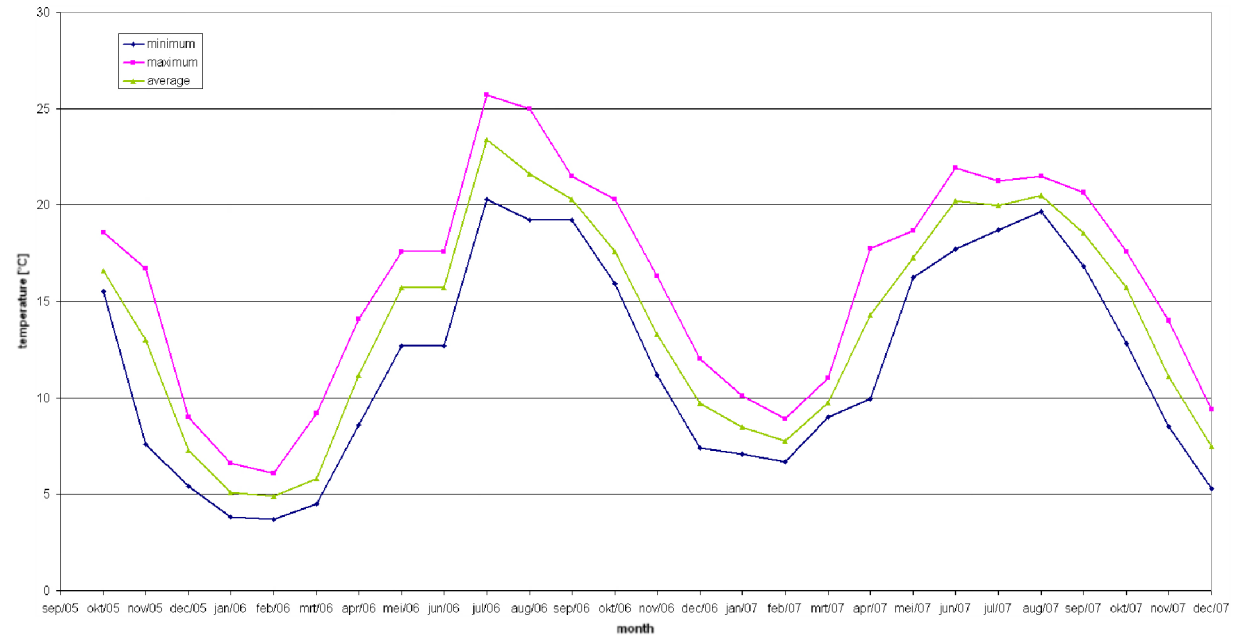
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Velocity magnitude & temperature





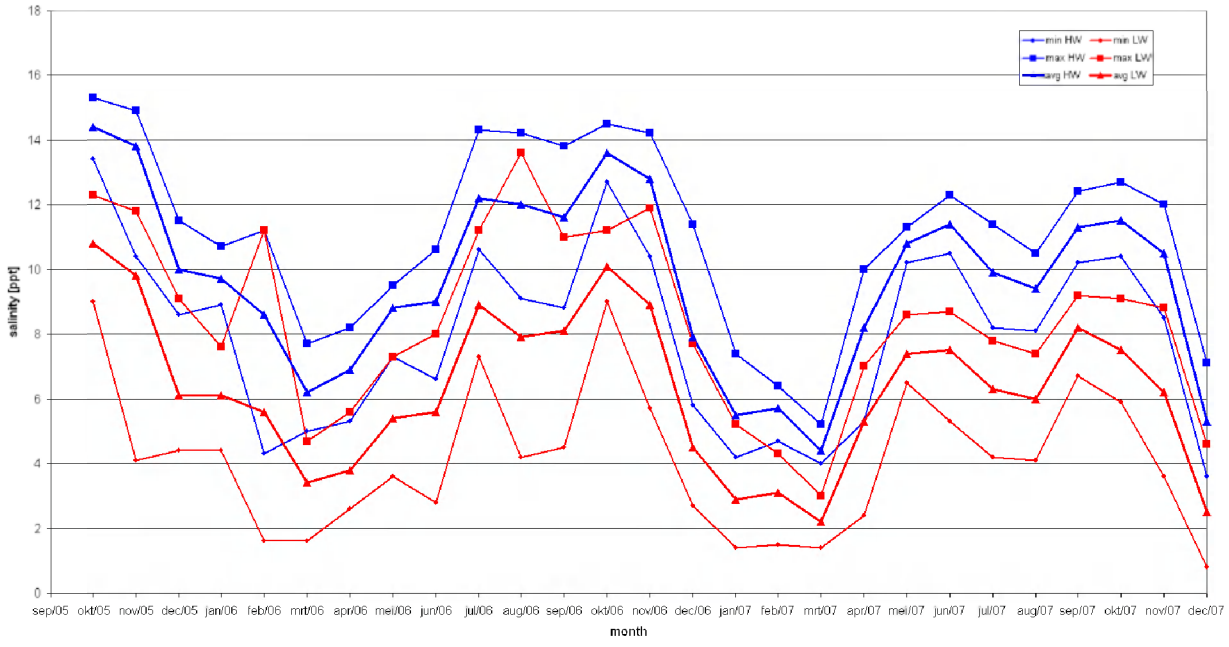
Buoy 97
3.3m above bottom (-5.3m TAW)

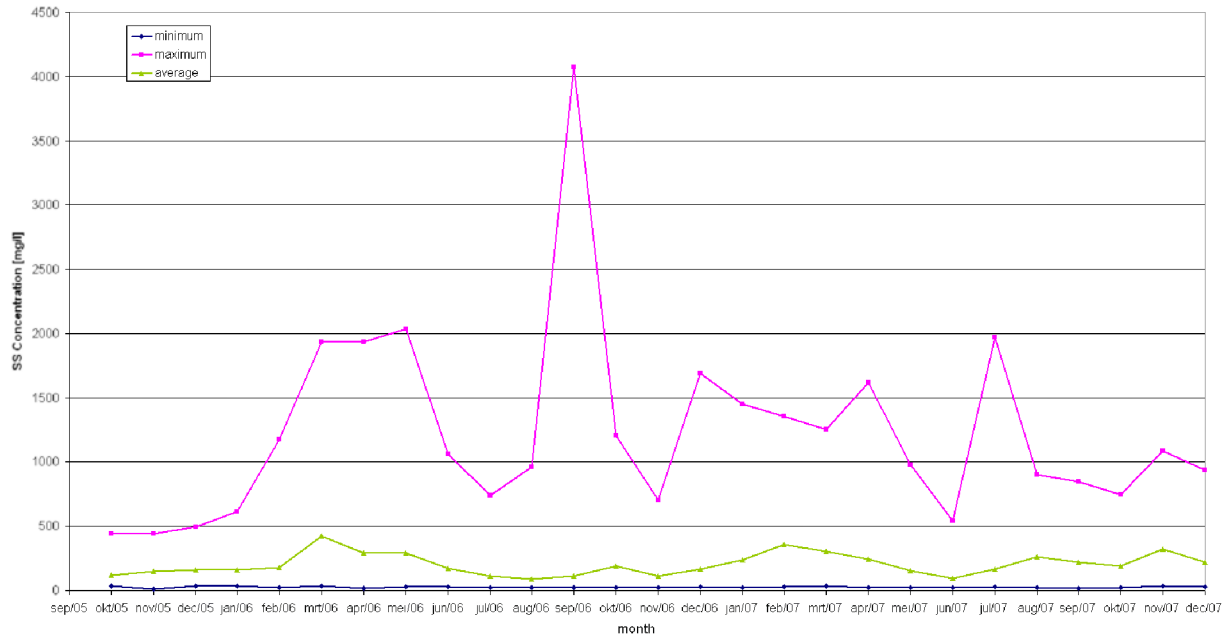
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Salinity & SS Concentration





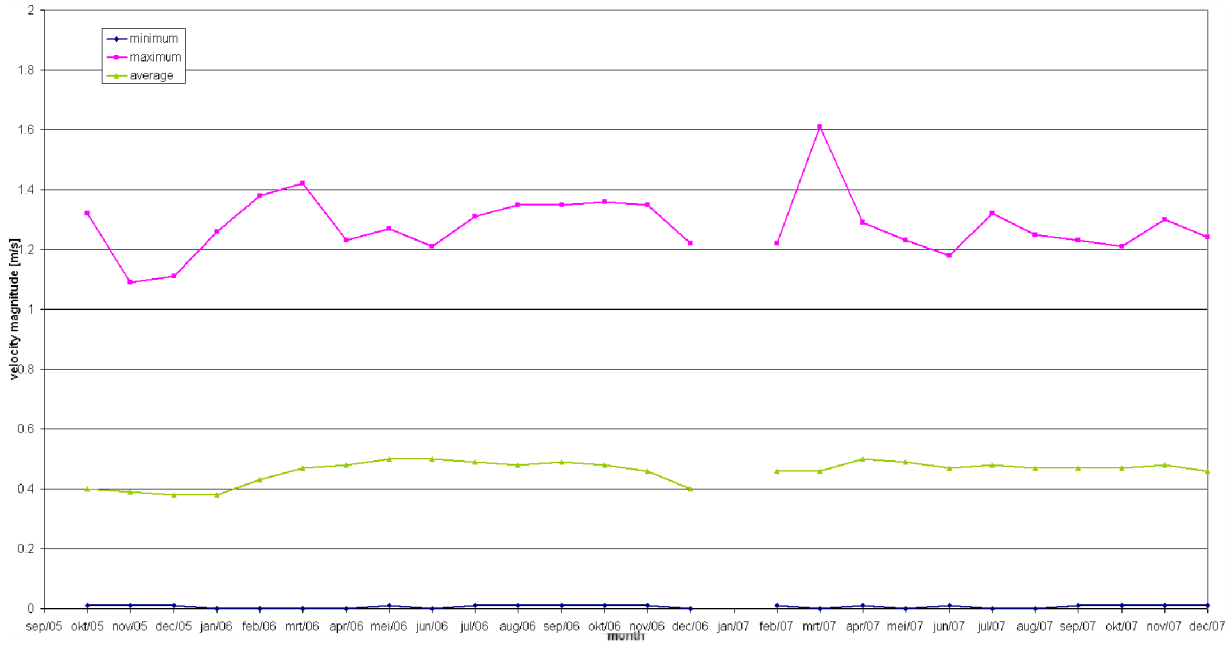
Buoy 97
3.3m above bottom (-5.3m TAW)

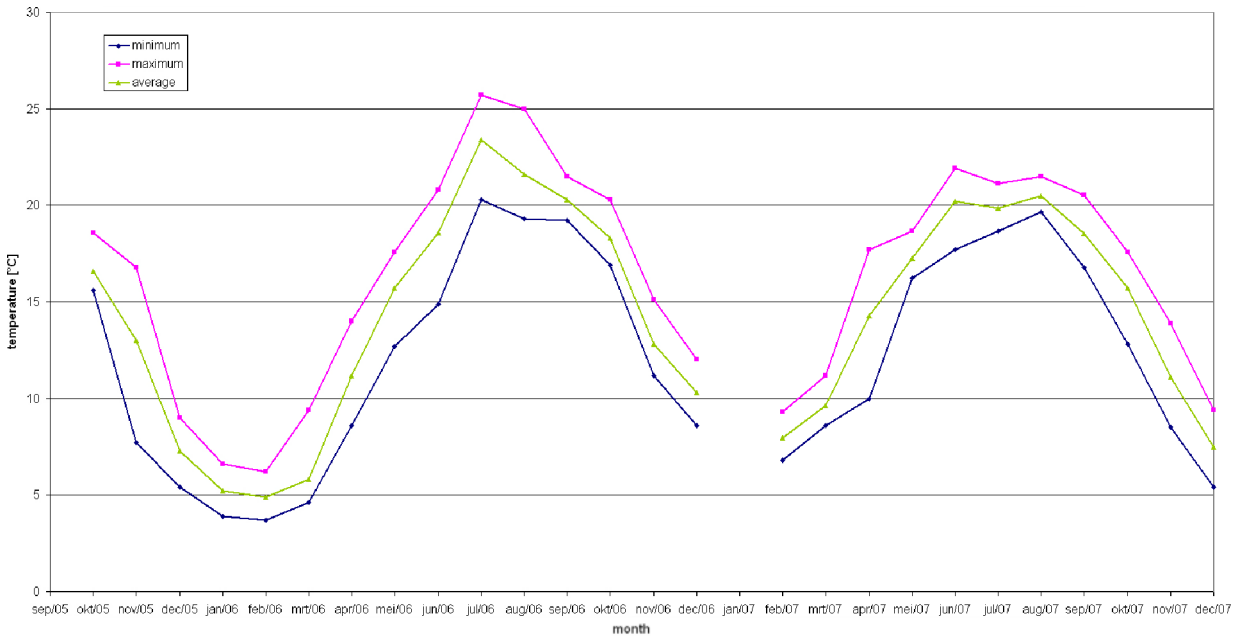
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Velocity magnitude & temperature





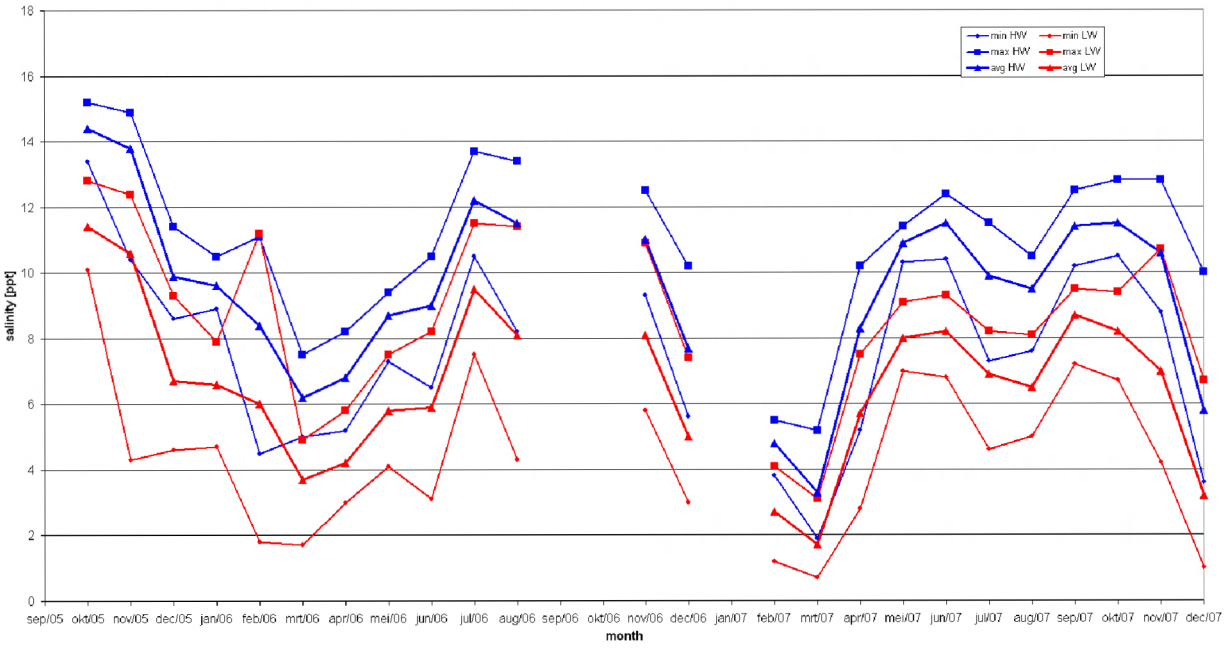
Buoy 97
0.8m above bottom (-7.8m TAW)

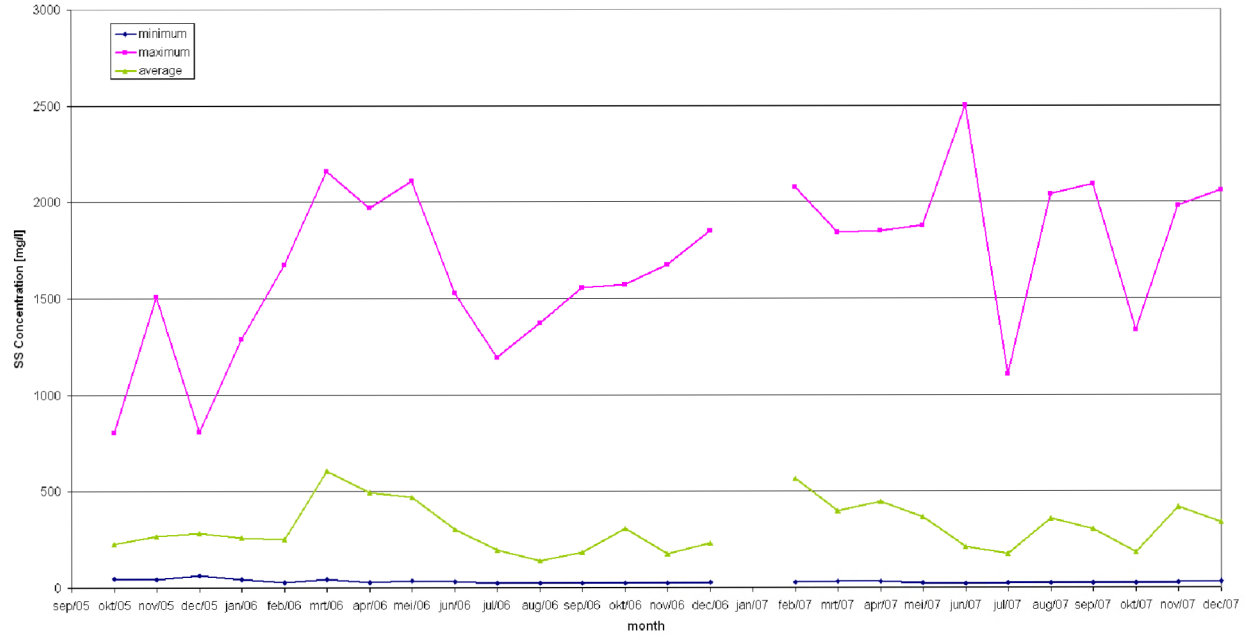
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Salinity & SS Concentration





Buoy 97
0.8m above bottom (-7.8m TAW)

Data processed by: IMDC

In association with: WL | delft hydraulics, GEMS International

I/RA/11283/07.099/MSA

C.3 Total result from October 2007 till December 2007 of velocity magnitude, temperature, salinity and suspended sediment concentration

Averages for the whole deployment period of each instrument [October 2007 – December 2007]

Location	Depth [m TAW]	Velocity [m/s]			Temperature [°C]			SS concentration [mg/l]		
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Buoy 84	-5.6	0.00	1.56	0.52	5.4	17.3	11.4	8	803	199
Buoy 84	-8.1	0.01	1.29	0.44	5.4	17.0	10.8	22	1798	290
Buoy 97	-5.3	0.00	1.51	0.58	5.3	17.6	11.4	21	1084	242
Buoy 97	-7.8	0.01	1.30	0.47	5.4	17.6	11.4	25	2061	311

Salinity [ppt]

Location	Depth [m TAW]	Minimum		Maximum		Average	
		Slack HW	Slack LW	Slack HW	Slack LW	Slack HW	Slack LW
Buoy 84	-5.6	4.8	2.4	15.9	12.4	11.4	8.4
Buoy 84	-8.1	-	-	-	-	-	-
Buoy 97	-5.3	3.6	0.8	12.7	9.1	9.0	5.4
Buoy 97	-7.8	3.6	1.0	12.8	10.7	9.3	6.1

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

APPENDIX D.

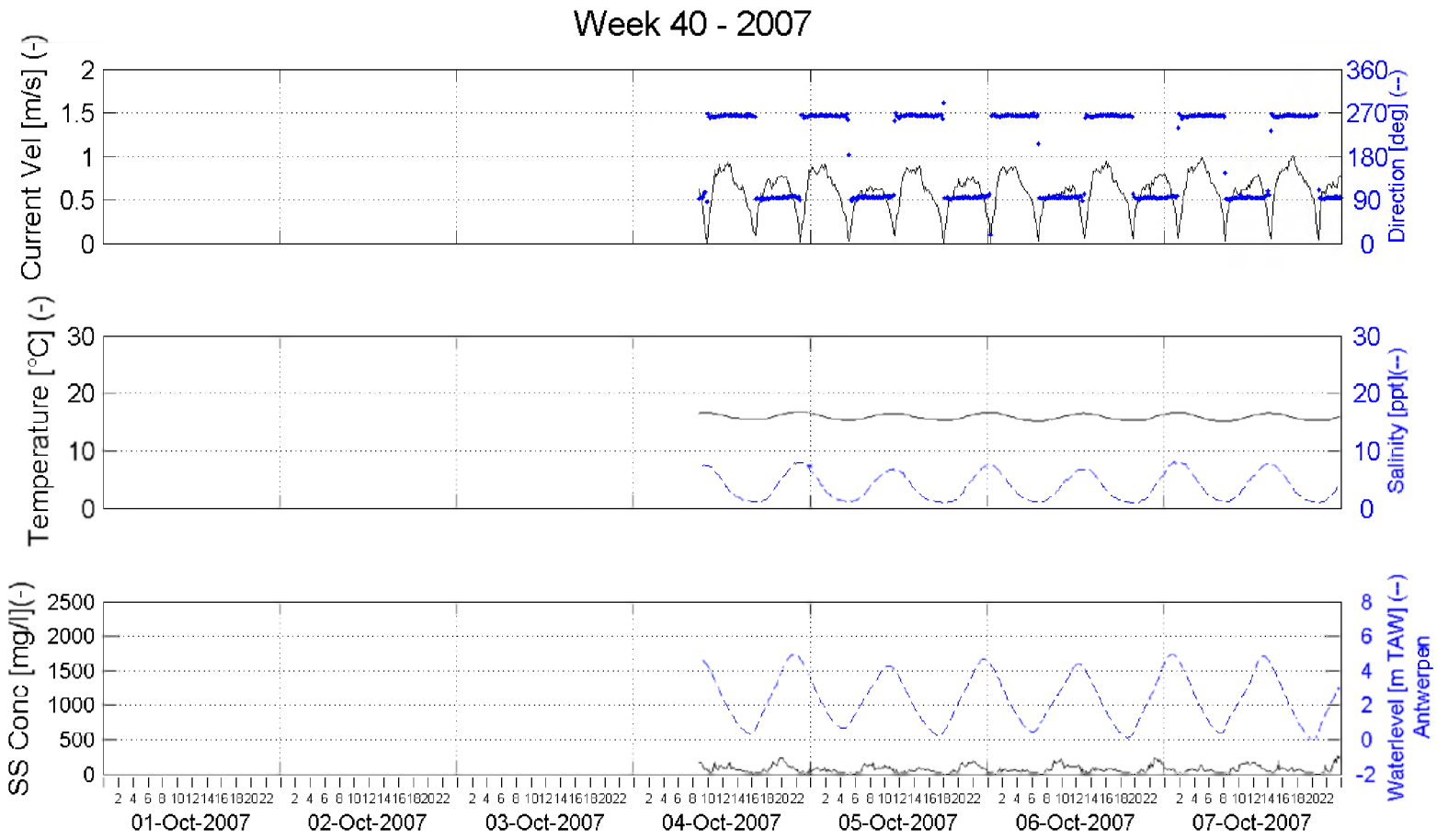
LONG-TERM MEASUREMENTS AT OOSTERWEEL AND PROSPERPOLDER (WL – CEL HYDROMETRIE)

D.1 Datasheets week series

Datasheet order

Nr	*Location*	*Depth of Instrument*		*Sensor*	*Period*
		[m] above bottom	*[m TAW]*		
1	Oosterweel left bank	4.5	-2.3	Aanderaa 0152	01/10/2007 – 31/12/2007
2	Oosterweel left bank	1.0	-5.8	Aanderaa 0149	01/10/2007 – 31/12/2007
3	Prosperpolder	2.5	-1.5	Aanderaa 0117	01/10/2007 – 31/12/2007

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

IMDC

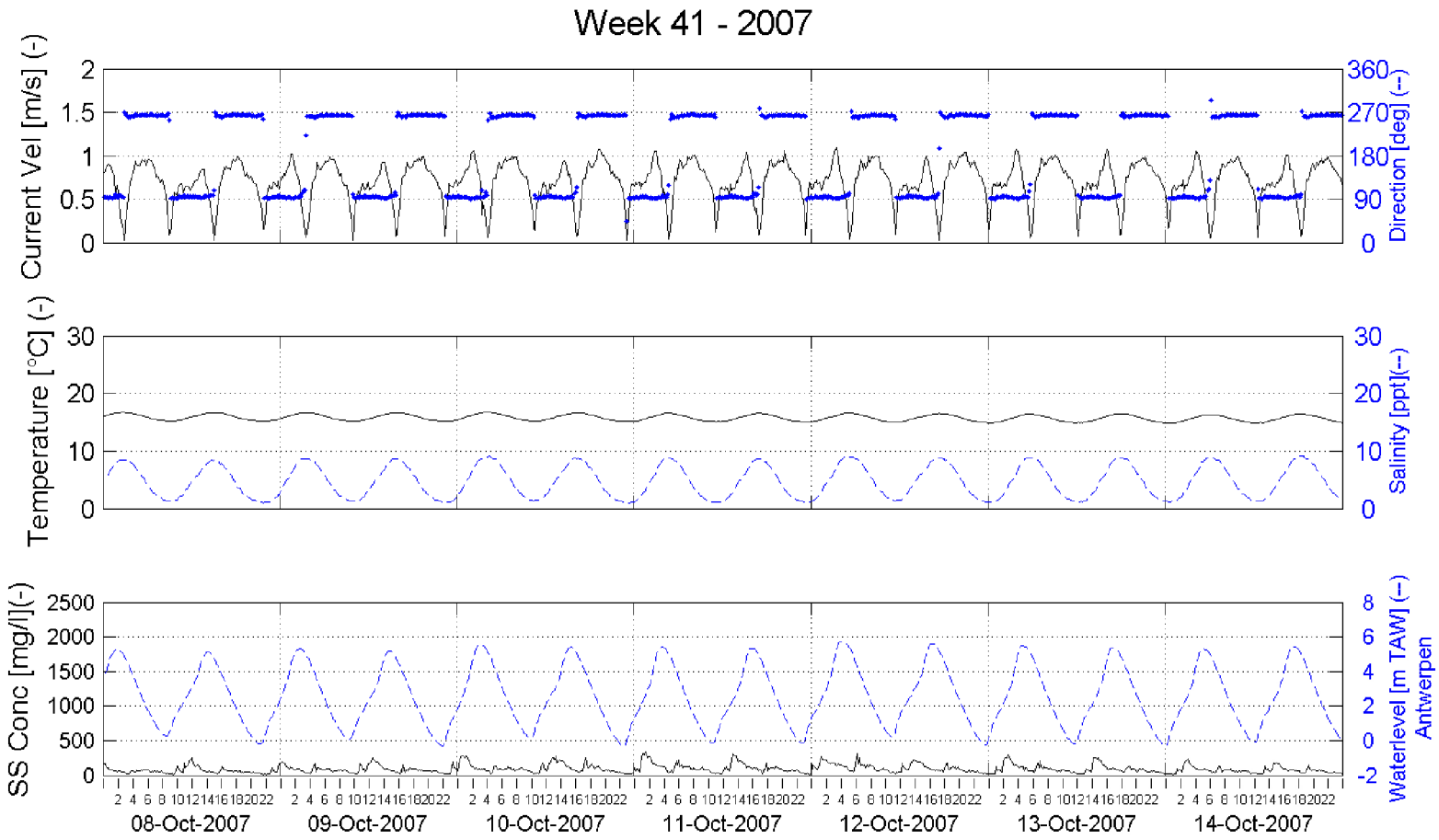
In Association with:

WL | delft hydraulics

GENS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

IMDC

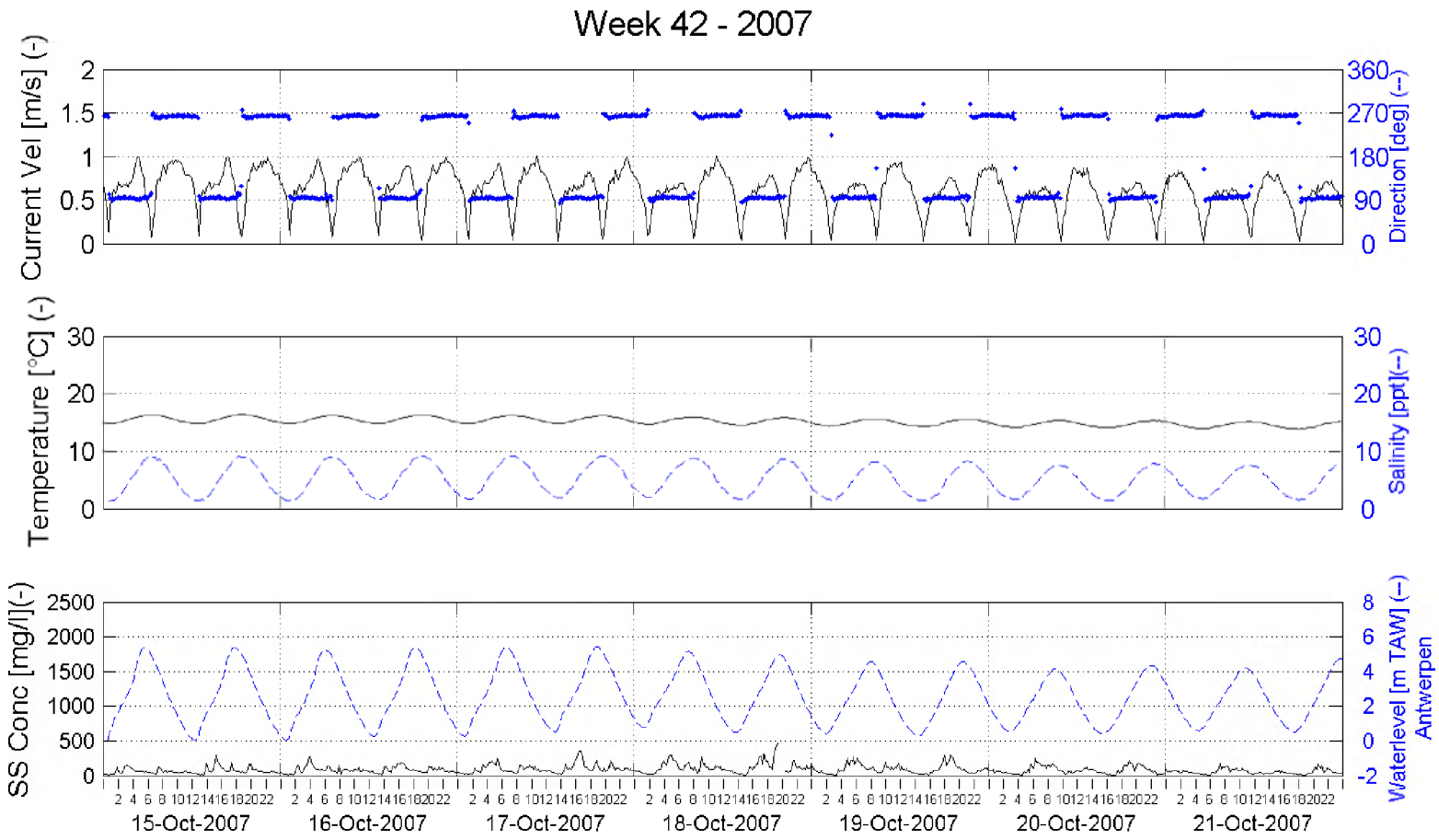
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

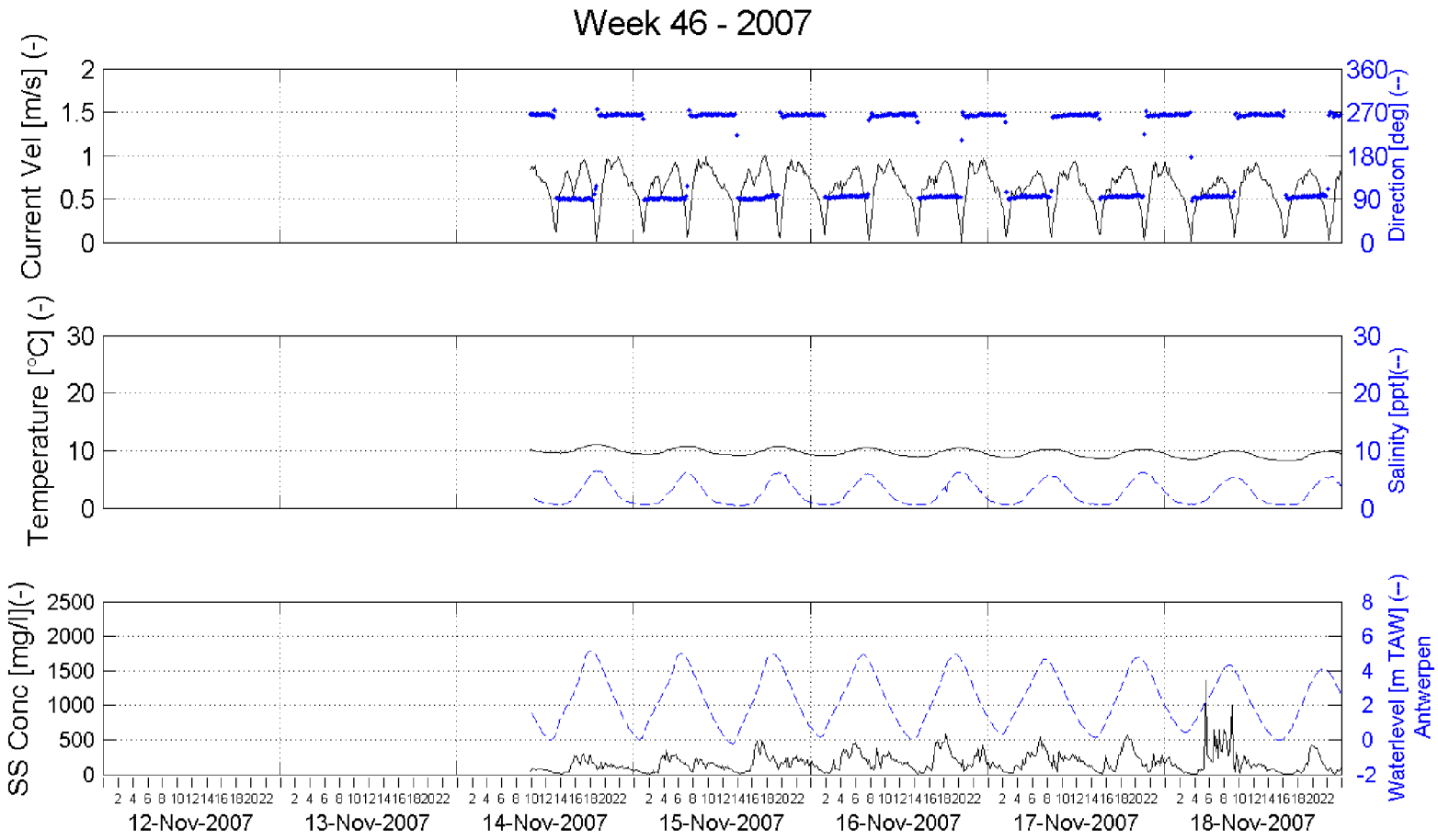
Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

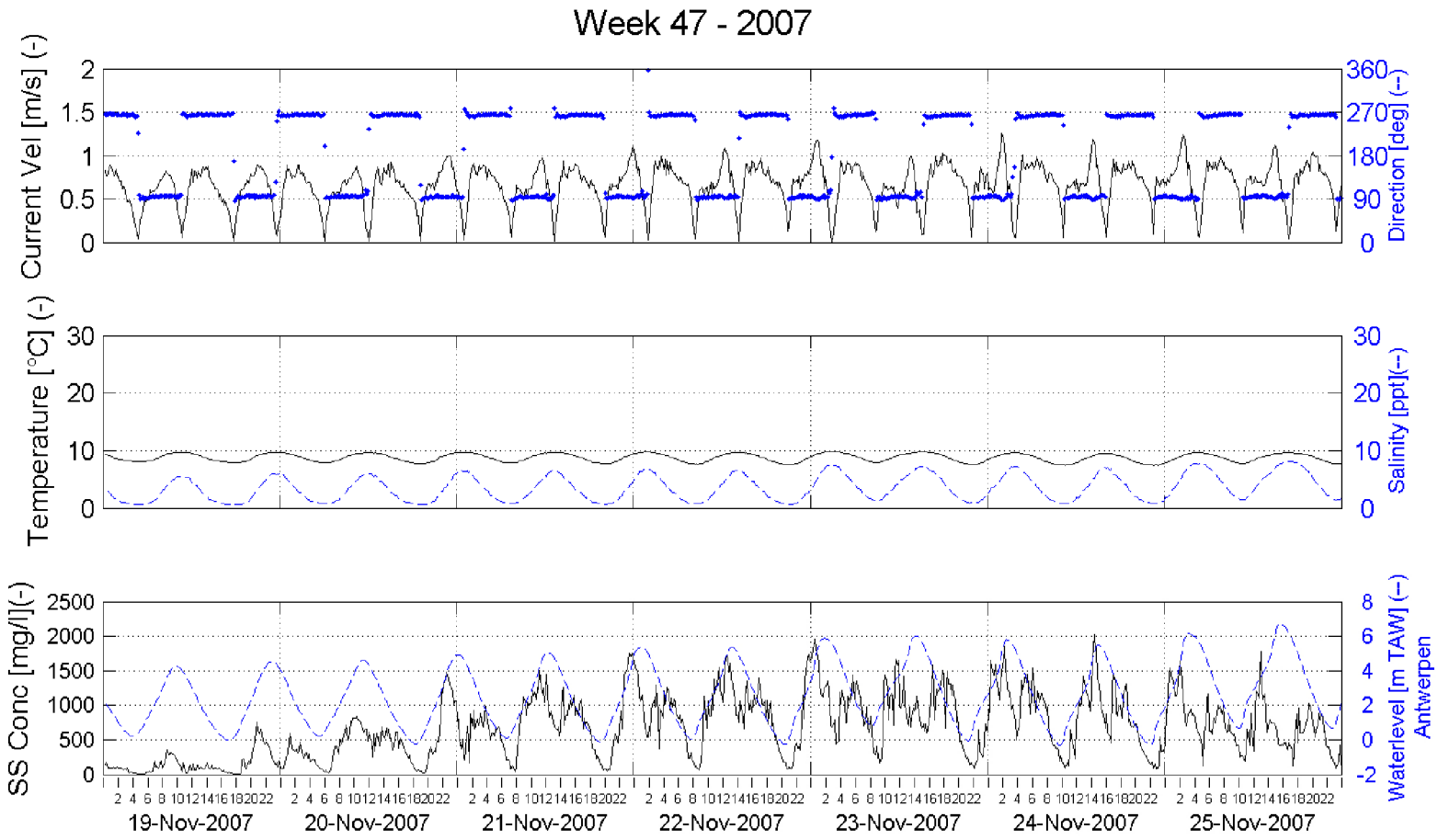
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

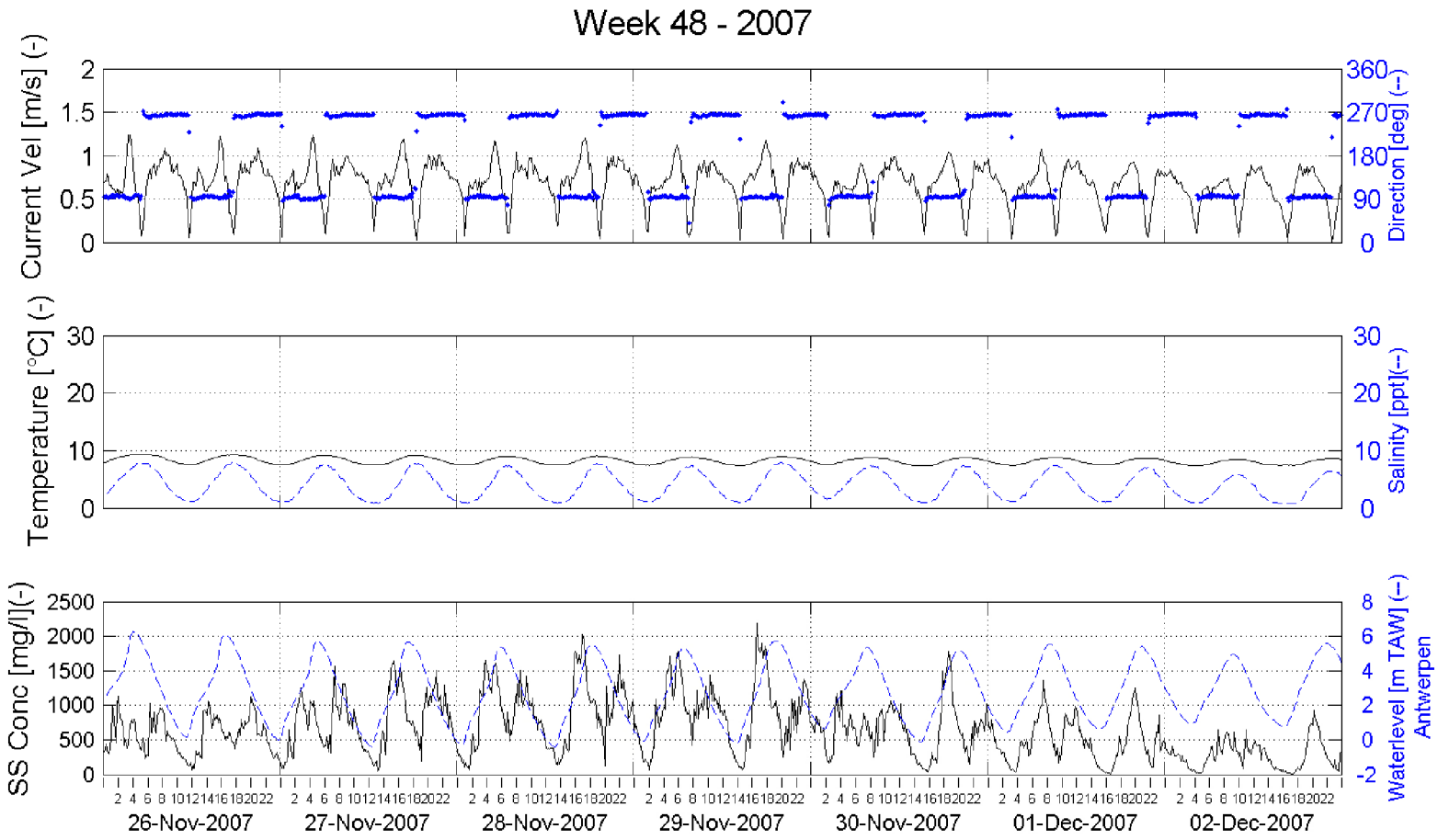
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

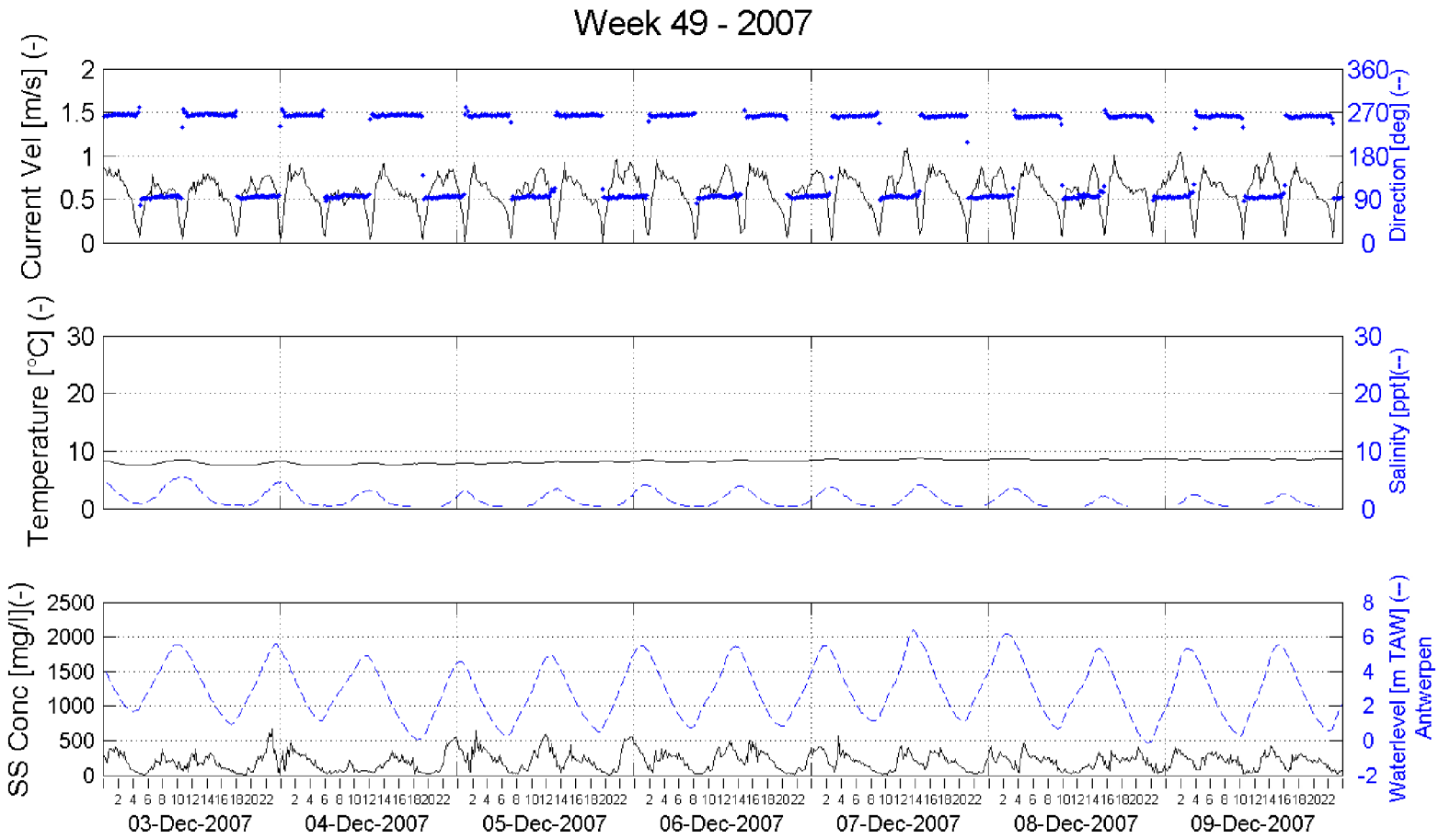
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

IMDC

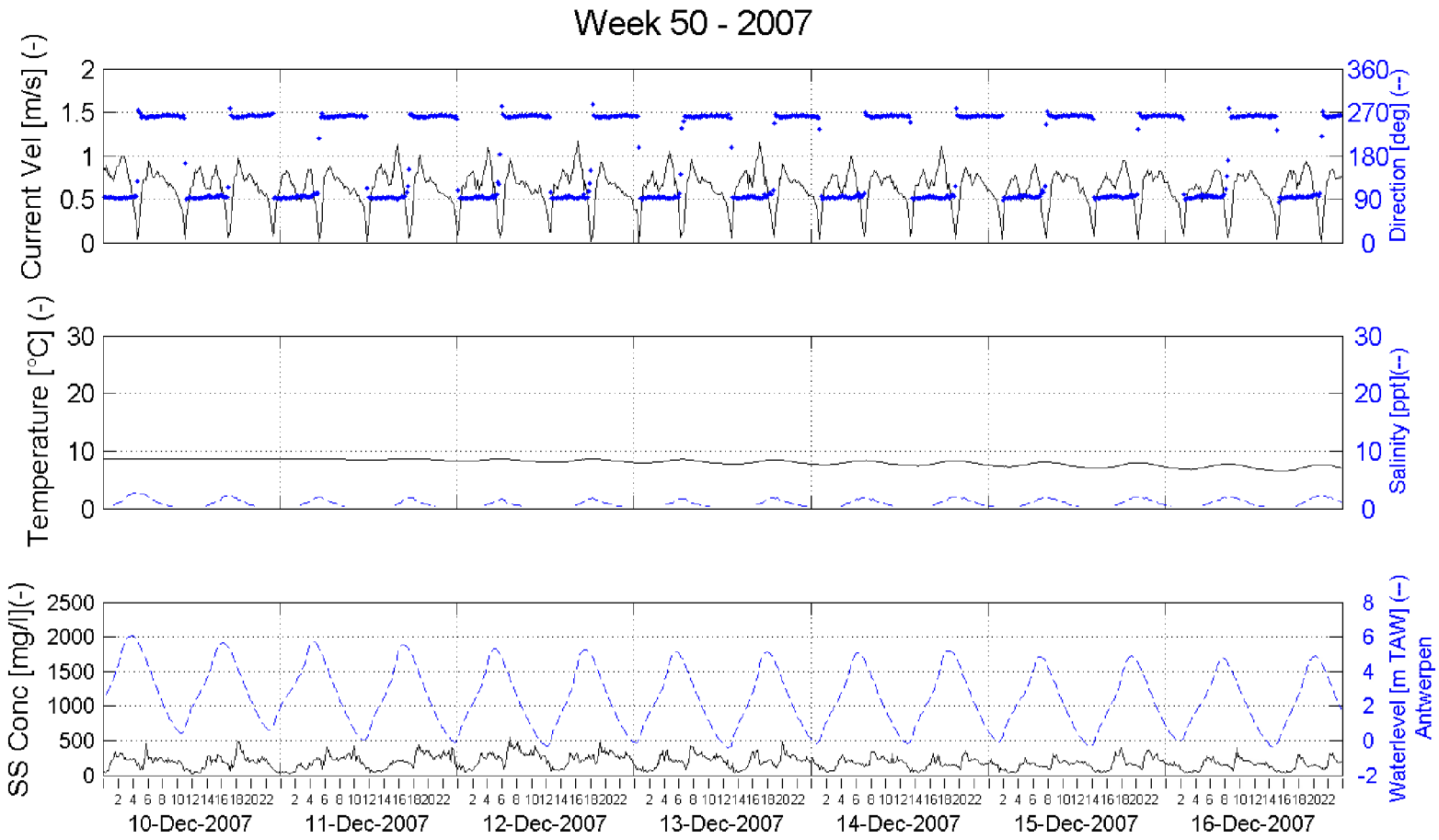
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

IMDC

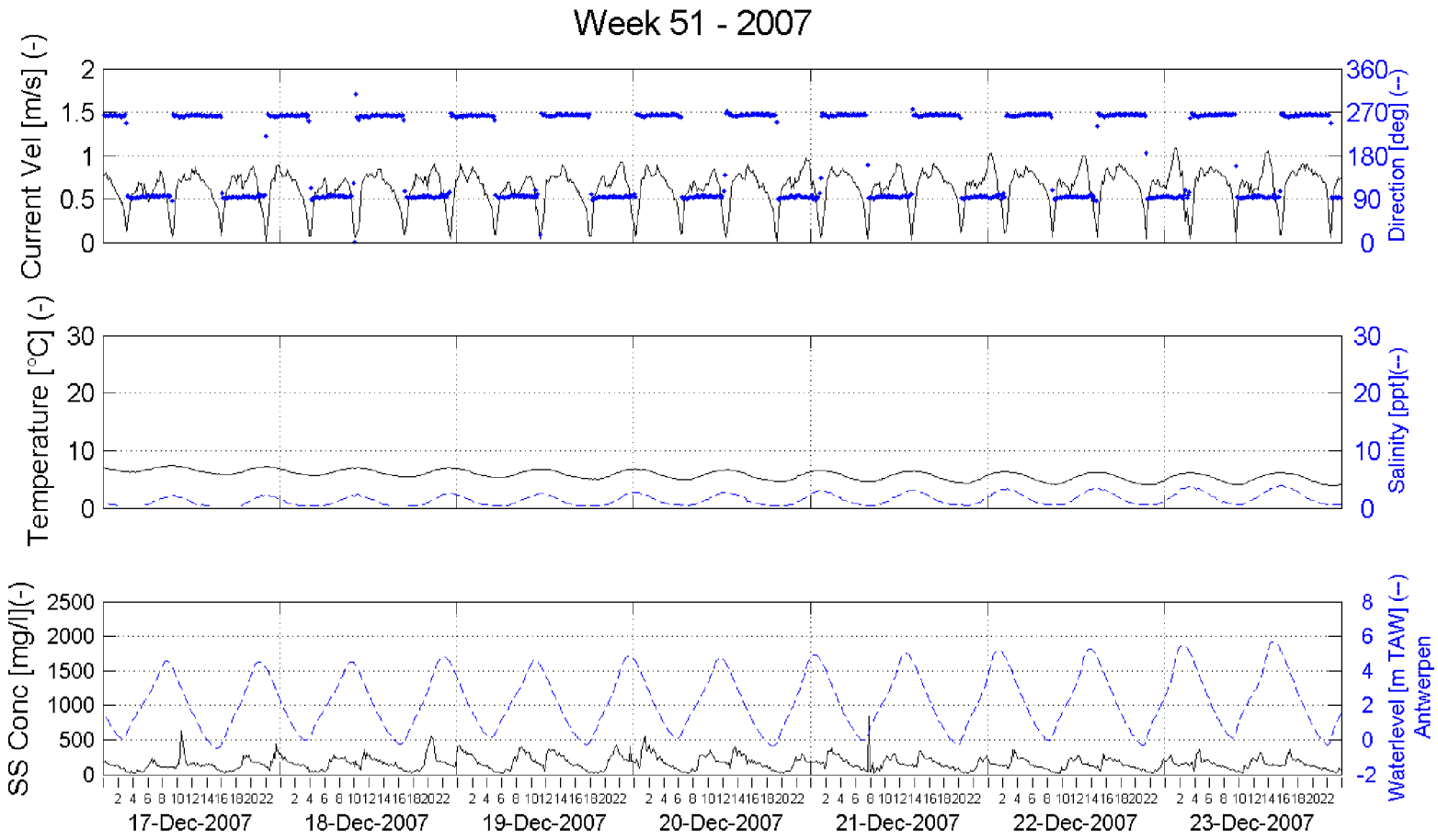
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

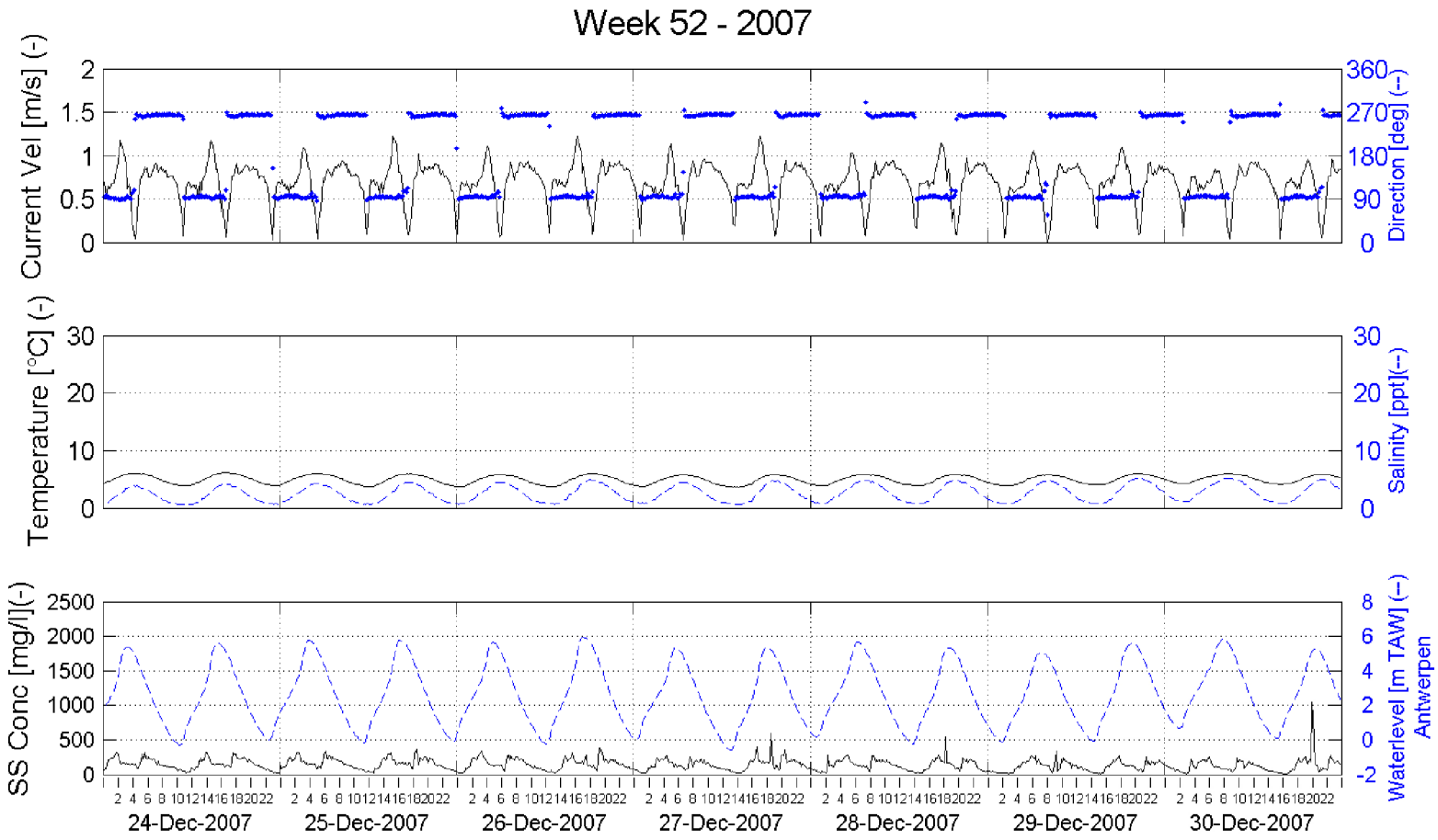
IMDC

In Association with:

GEMS

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

IMDC

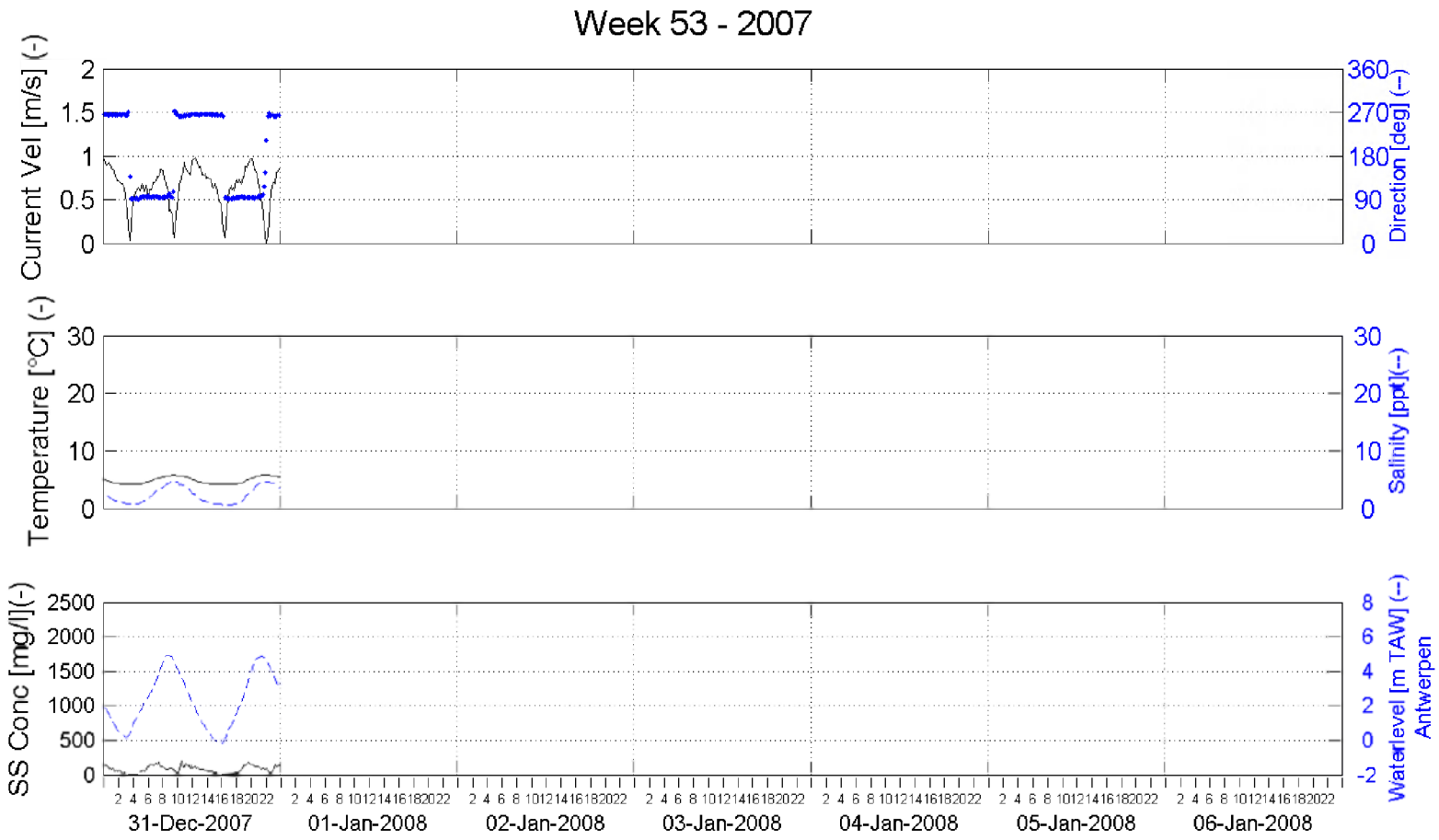
In Association with:

WL | delft hydraulics

GEMS International

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 4.5m above bottom (-2m TAW)

Processed by:

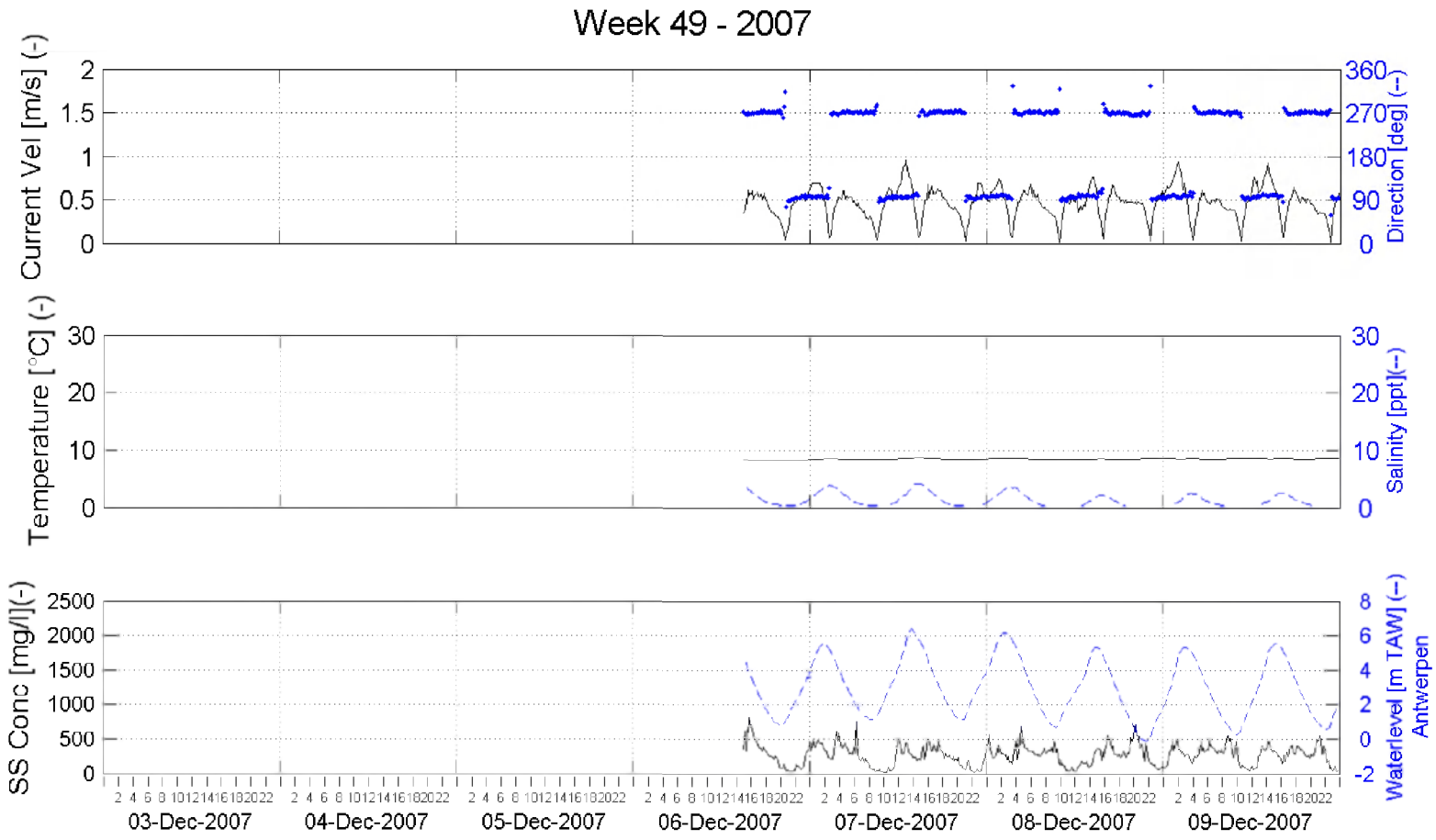
IMDC

In Association with:

WL | delft hydraulics

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 1m above bottom (-5.74m TAW)

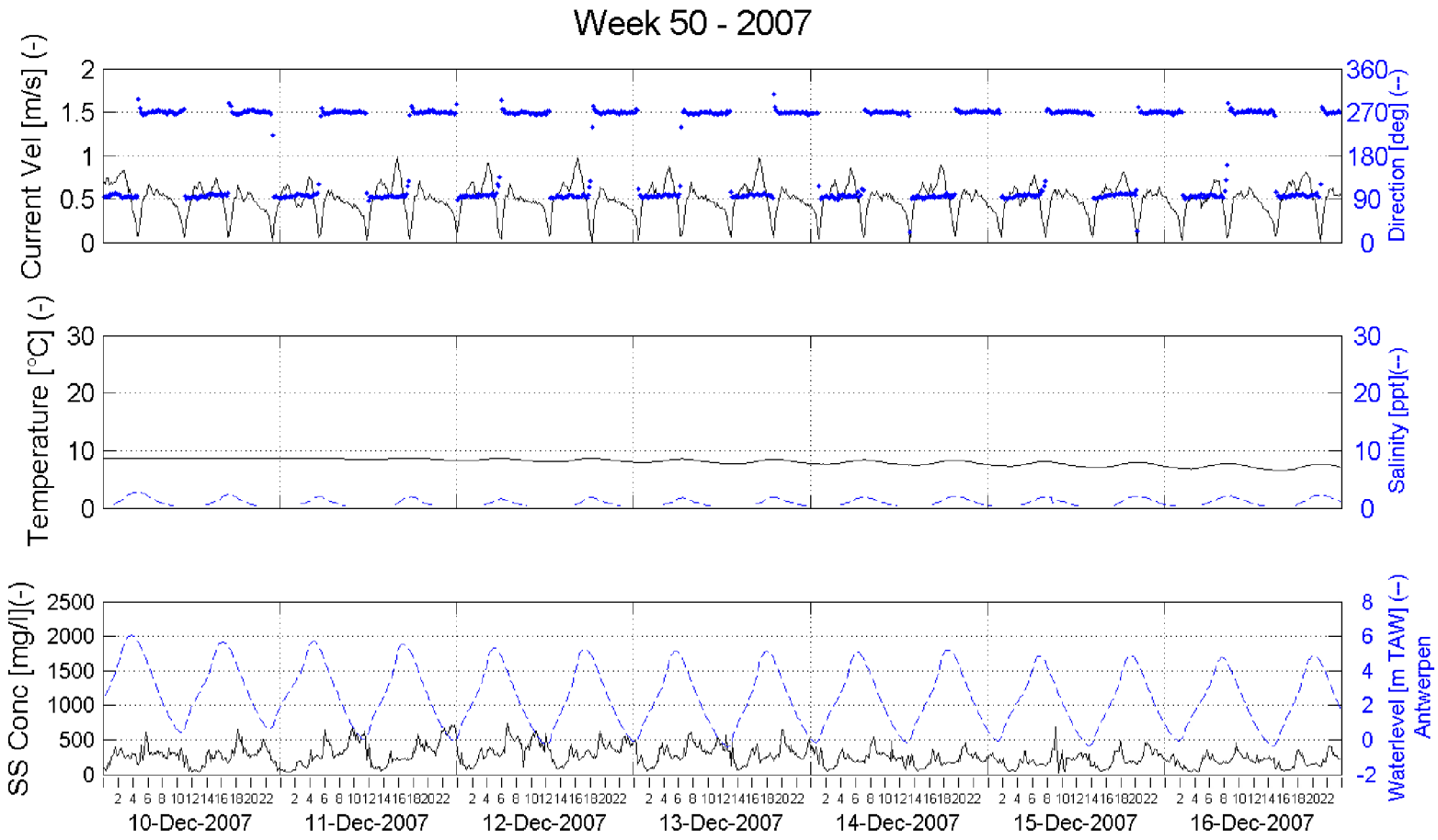
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 1m above bottom (-5.74m TAW)

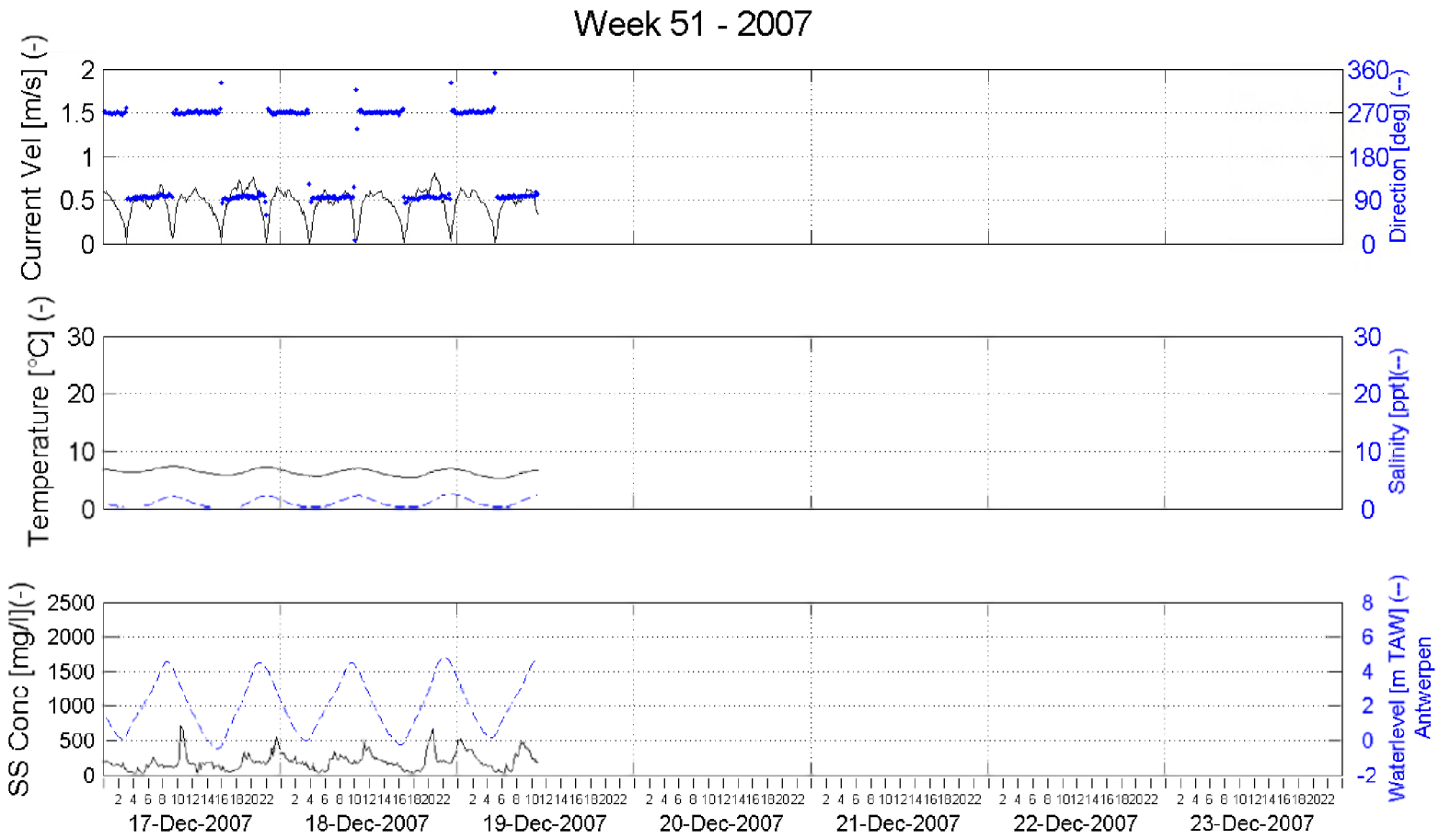
Processed by:

IMDC

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007



Week series Current Velocity, Current Direction, Temperature, Salinity, SS Concentration and Tide

Location:

Oosterweel (left bank) - 1m above bottom (-5.74m TAW)

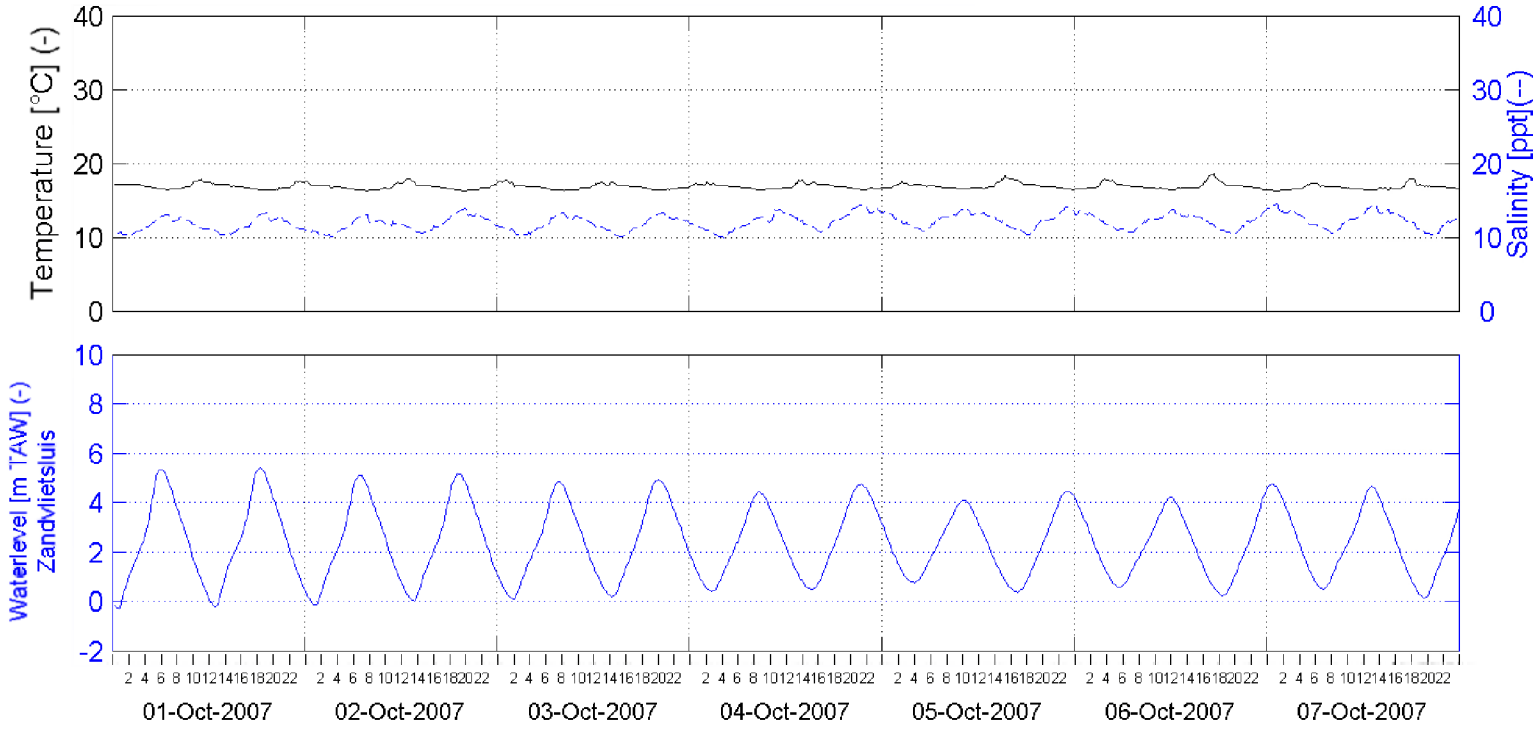
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 40 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

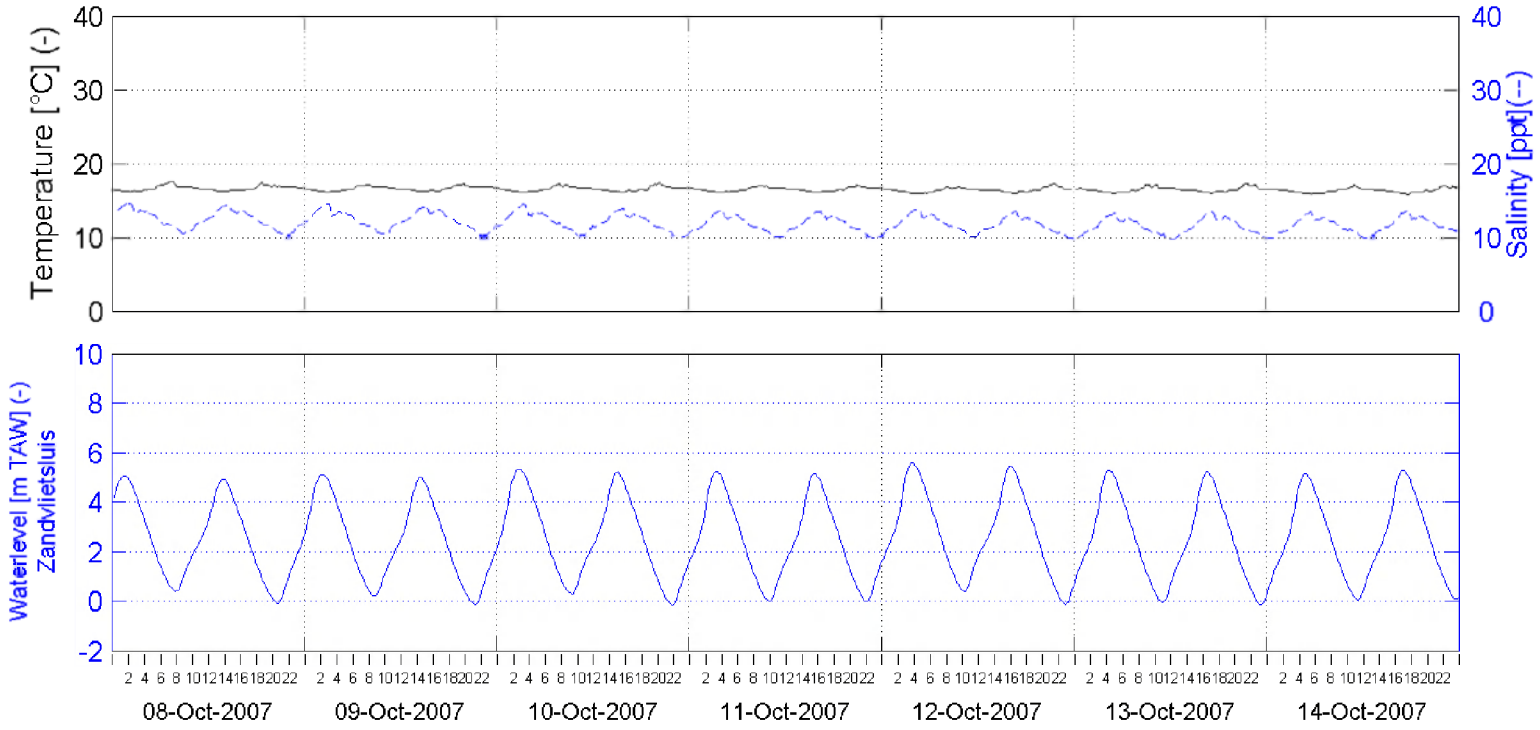
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 41 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

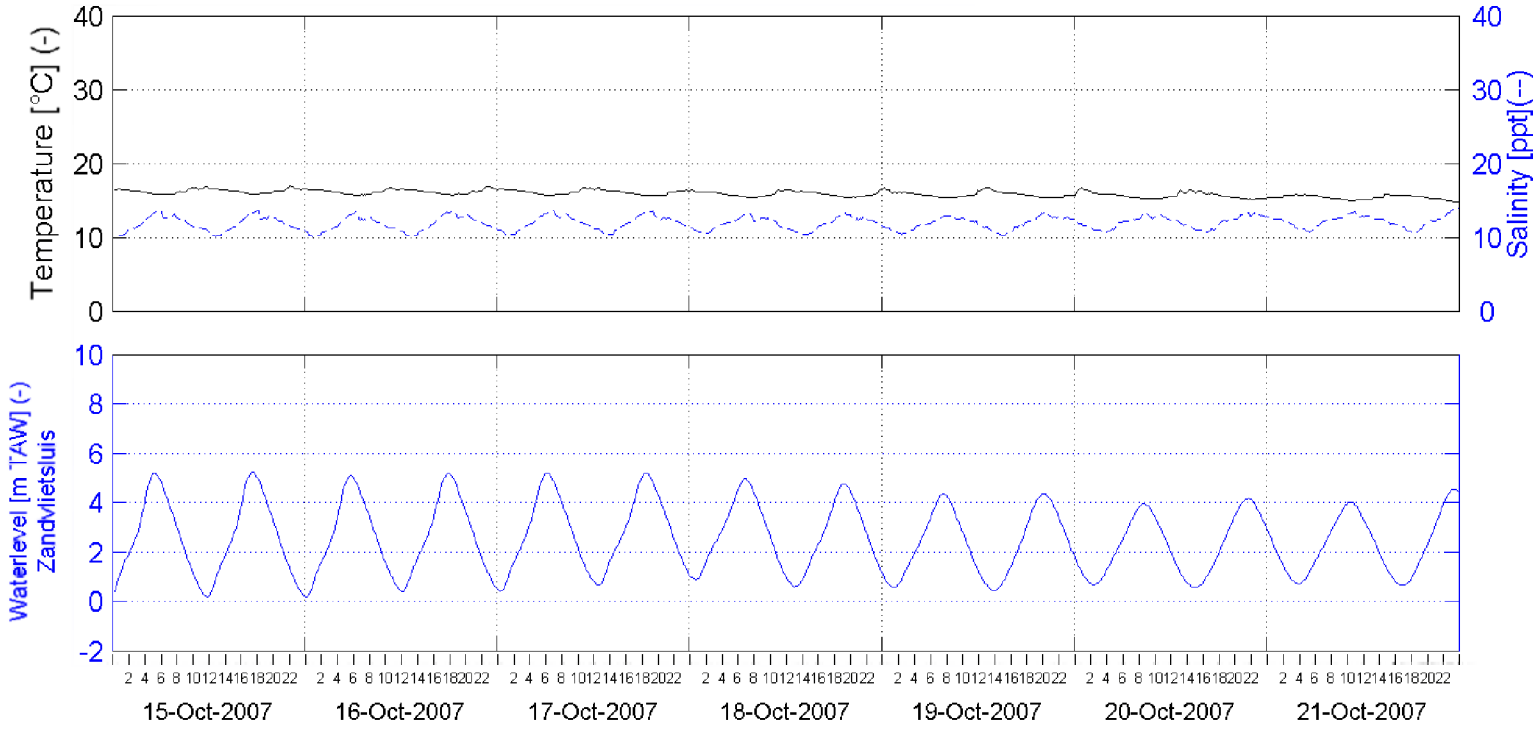
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 42 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

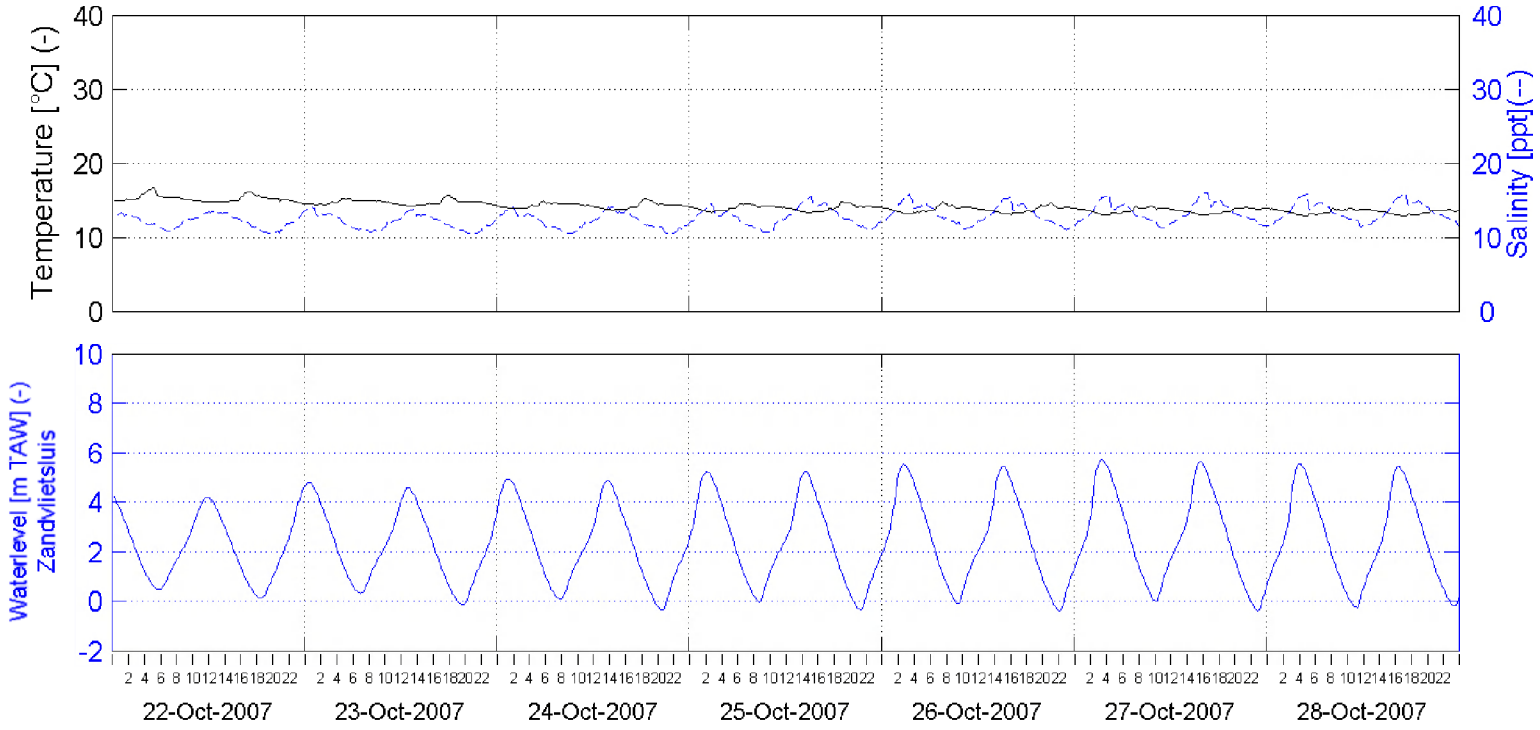
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 43 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

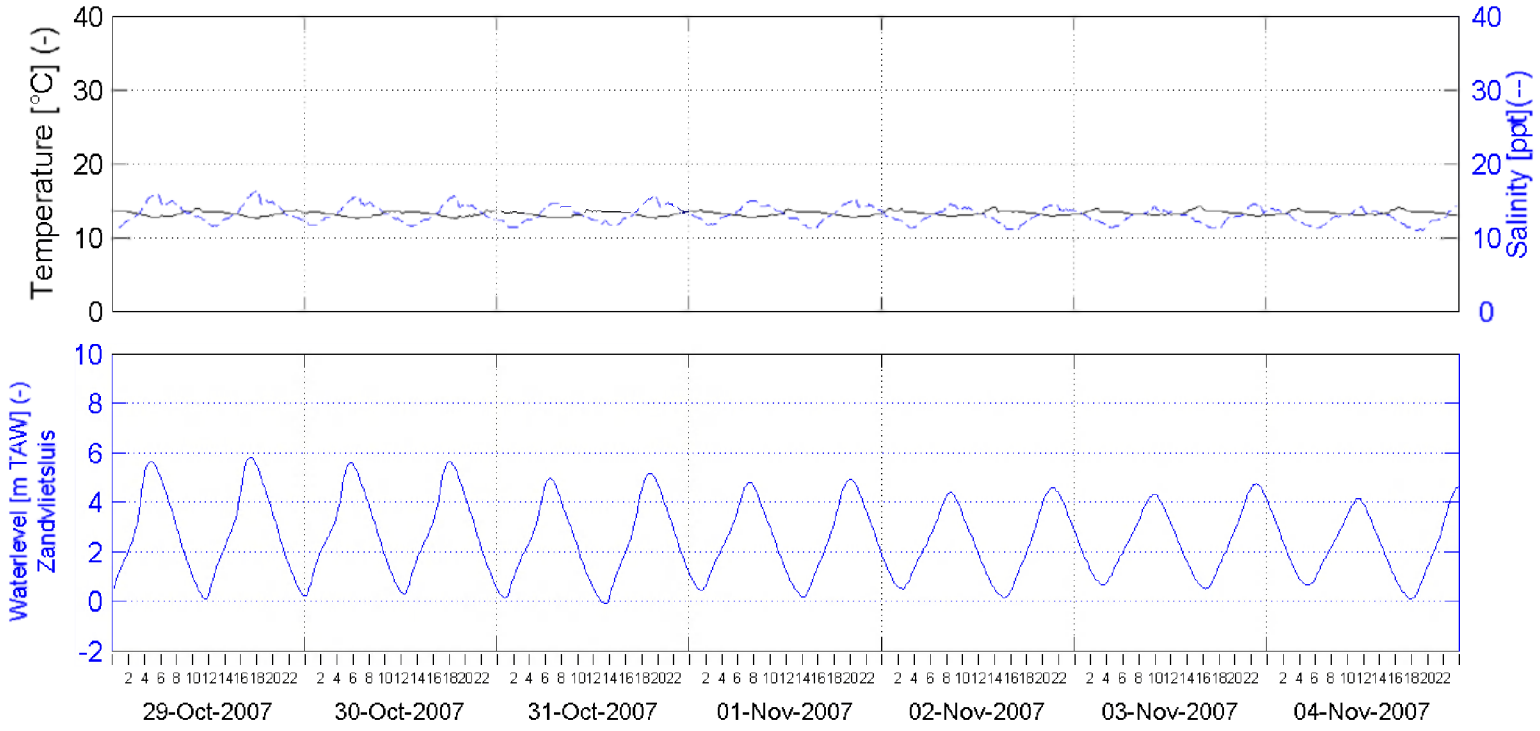
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 44 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

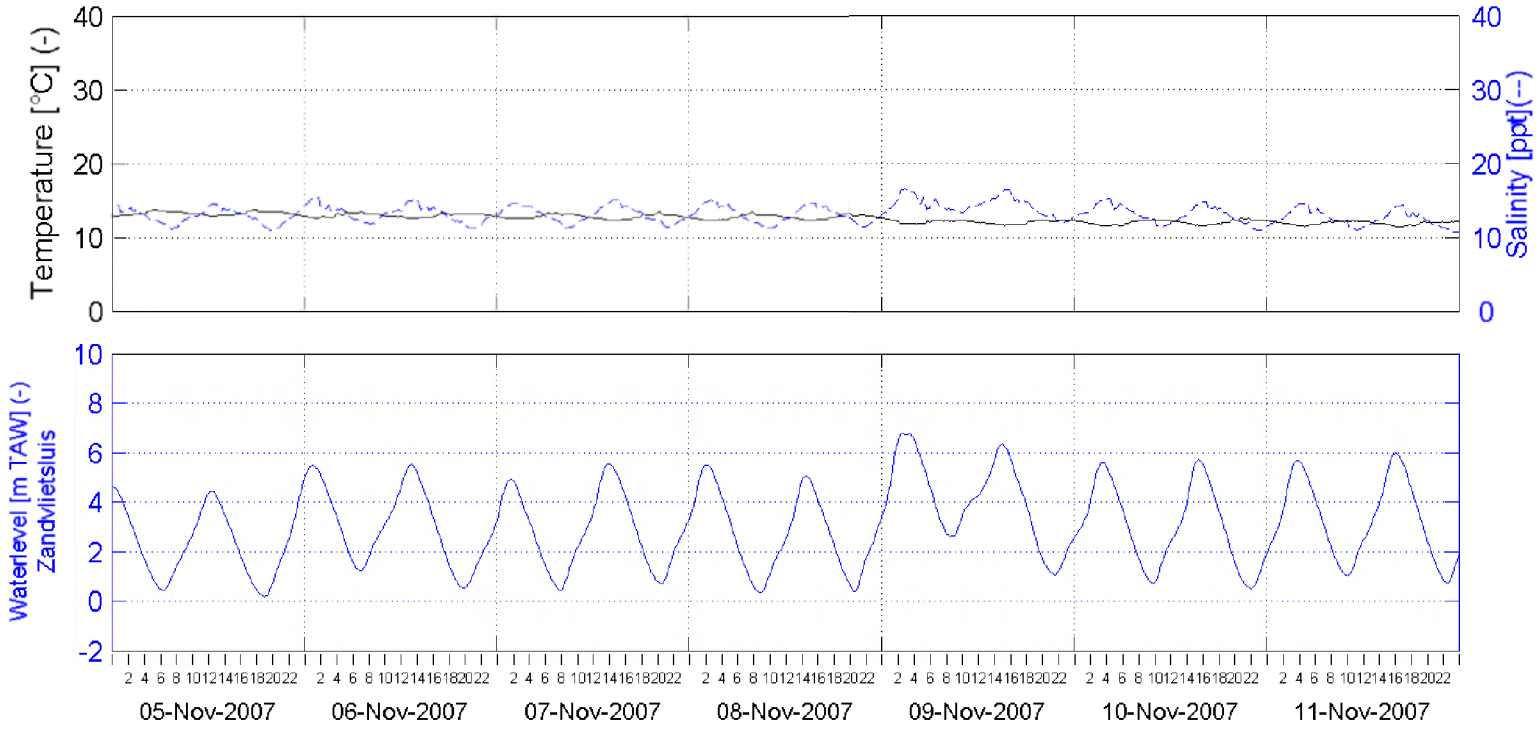
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 45 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

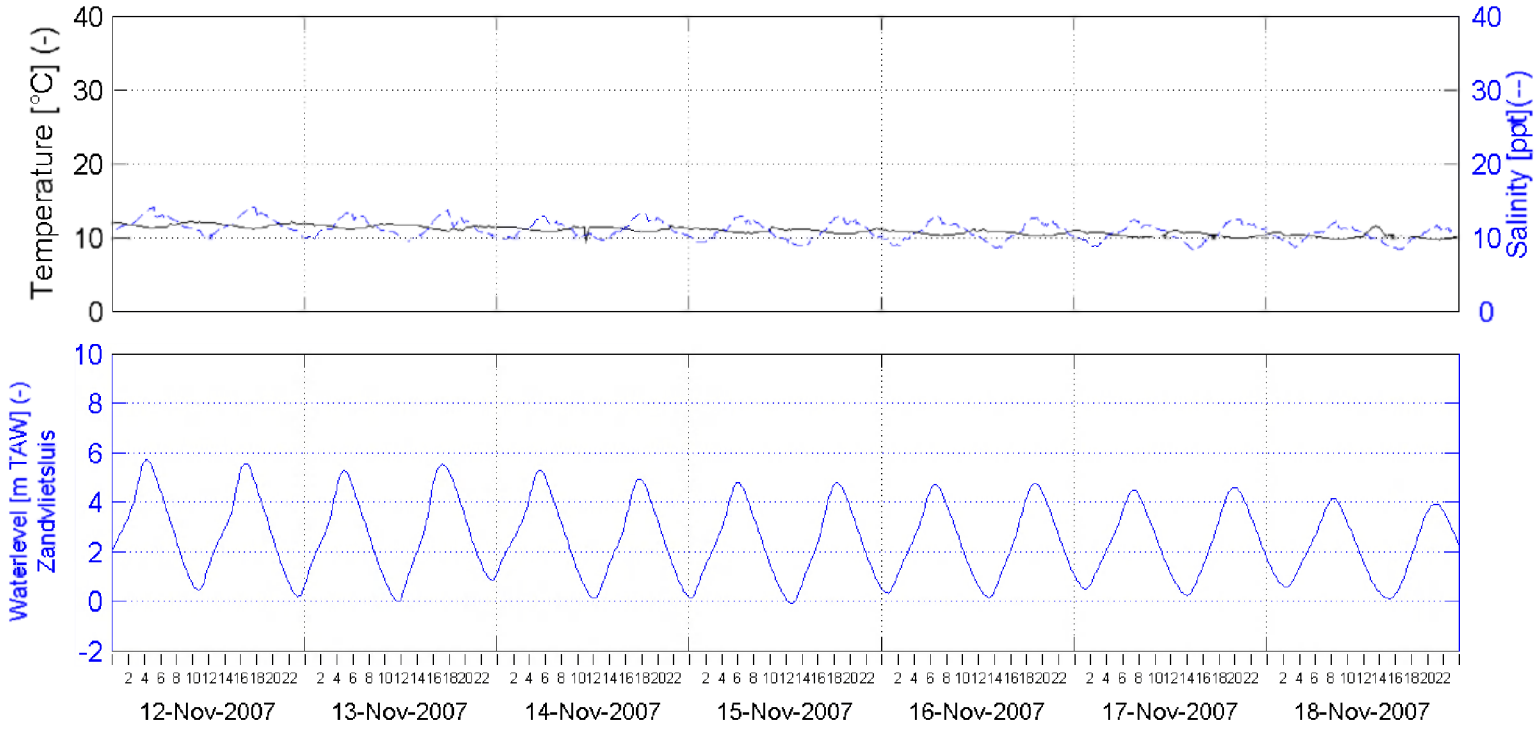
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 46 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

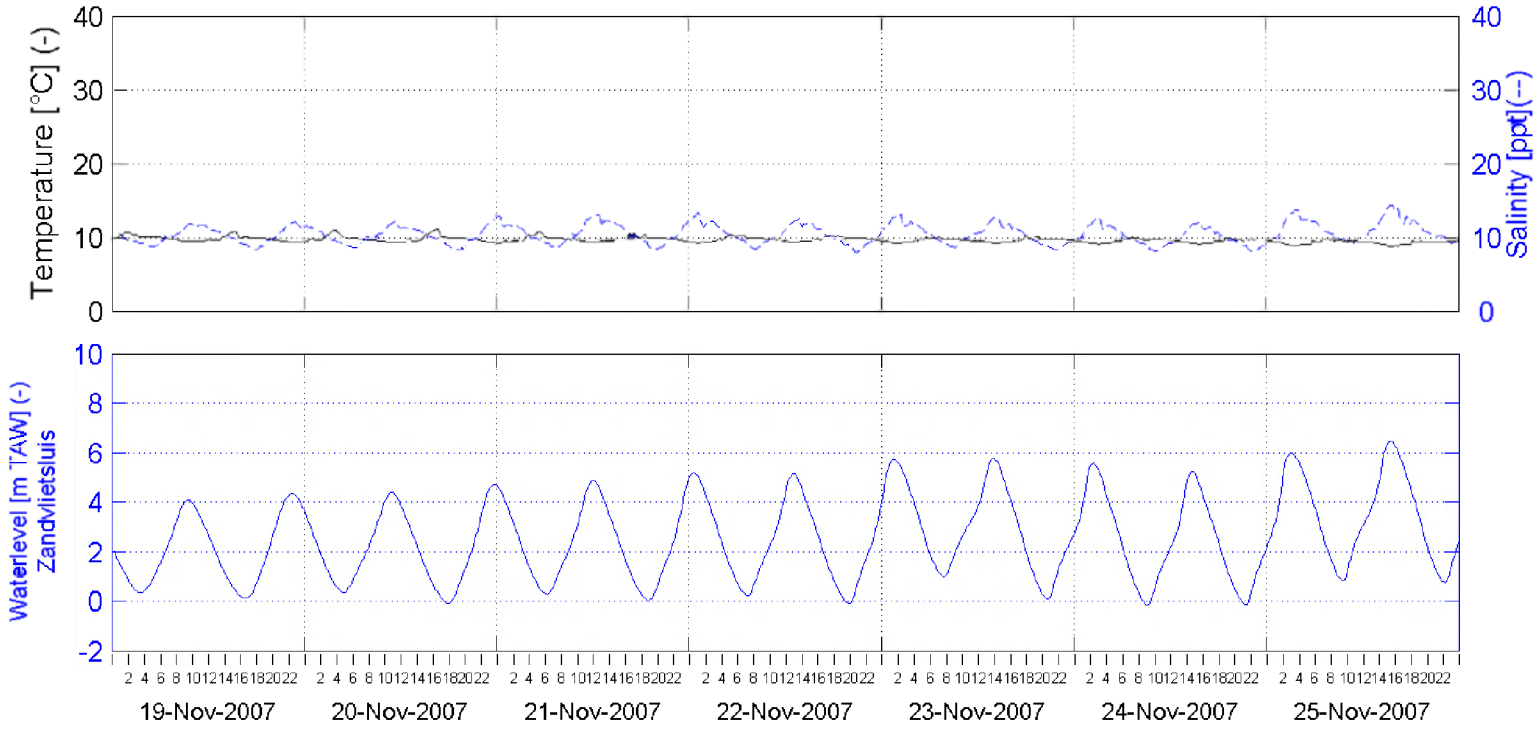
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 47 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

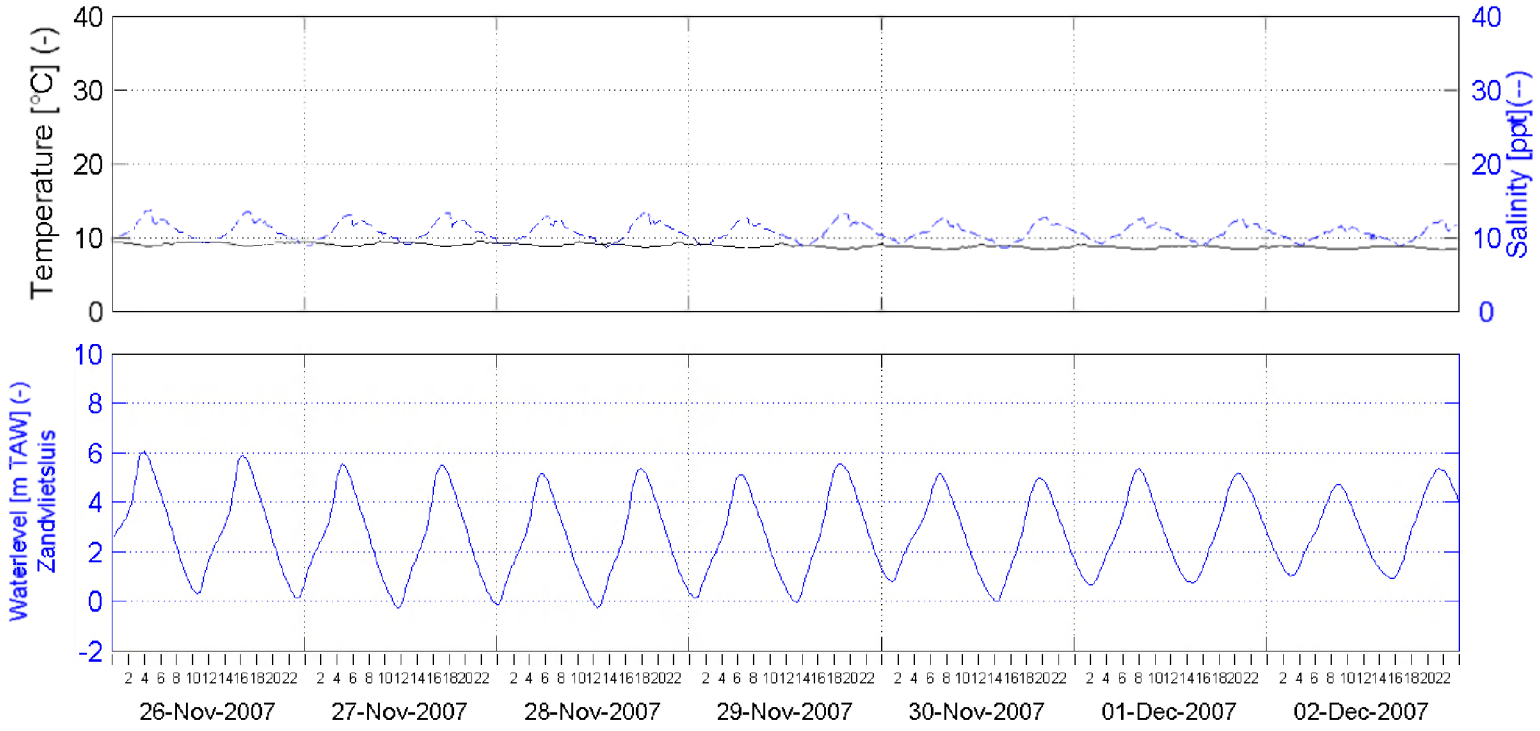
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 48 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

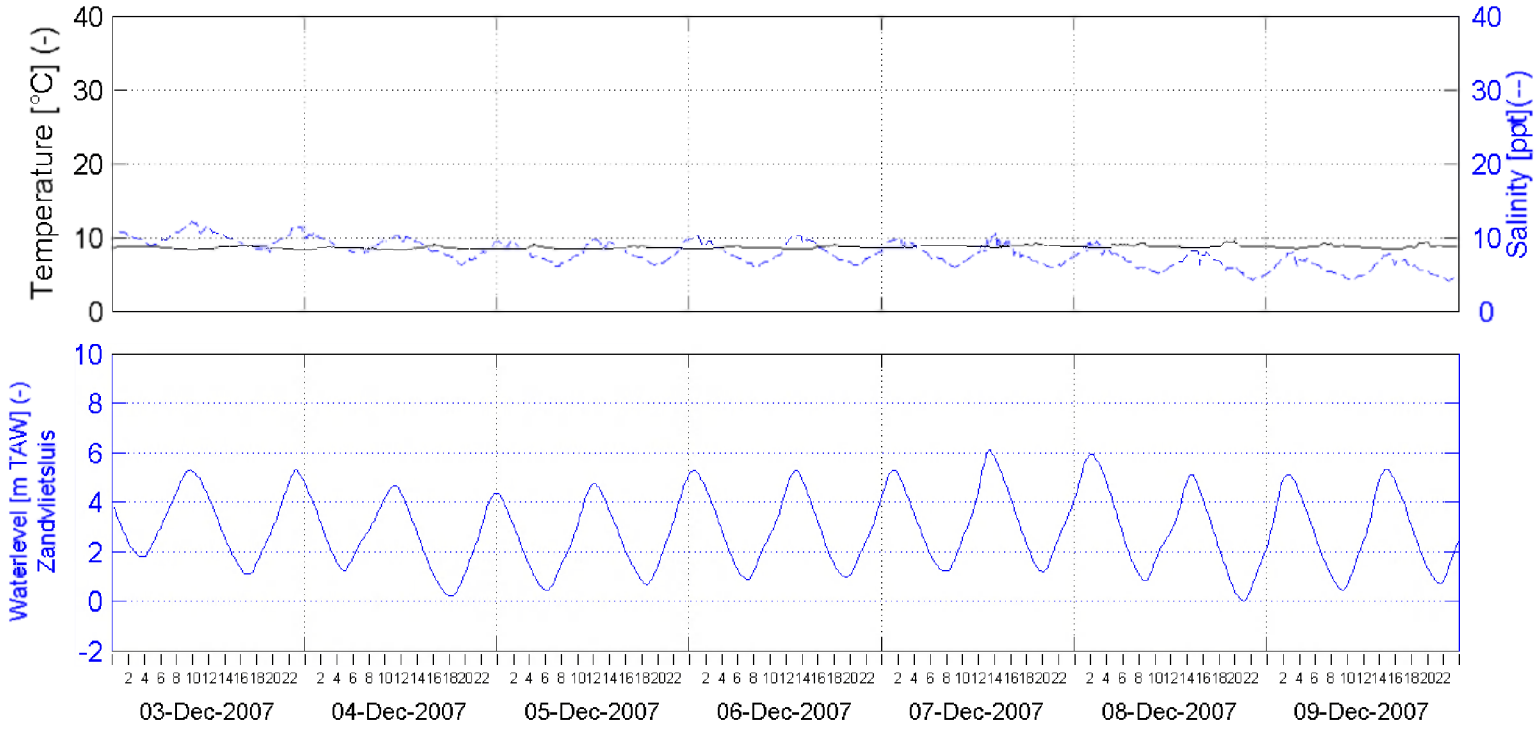
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 49 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

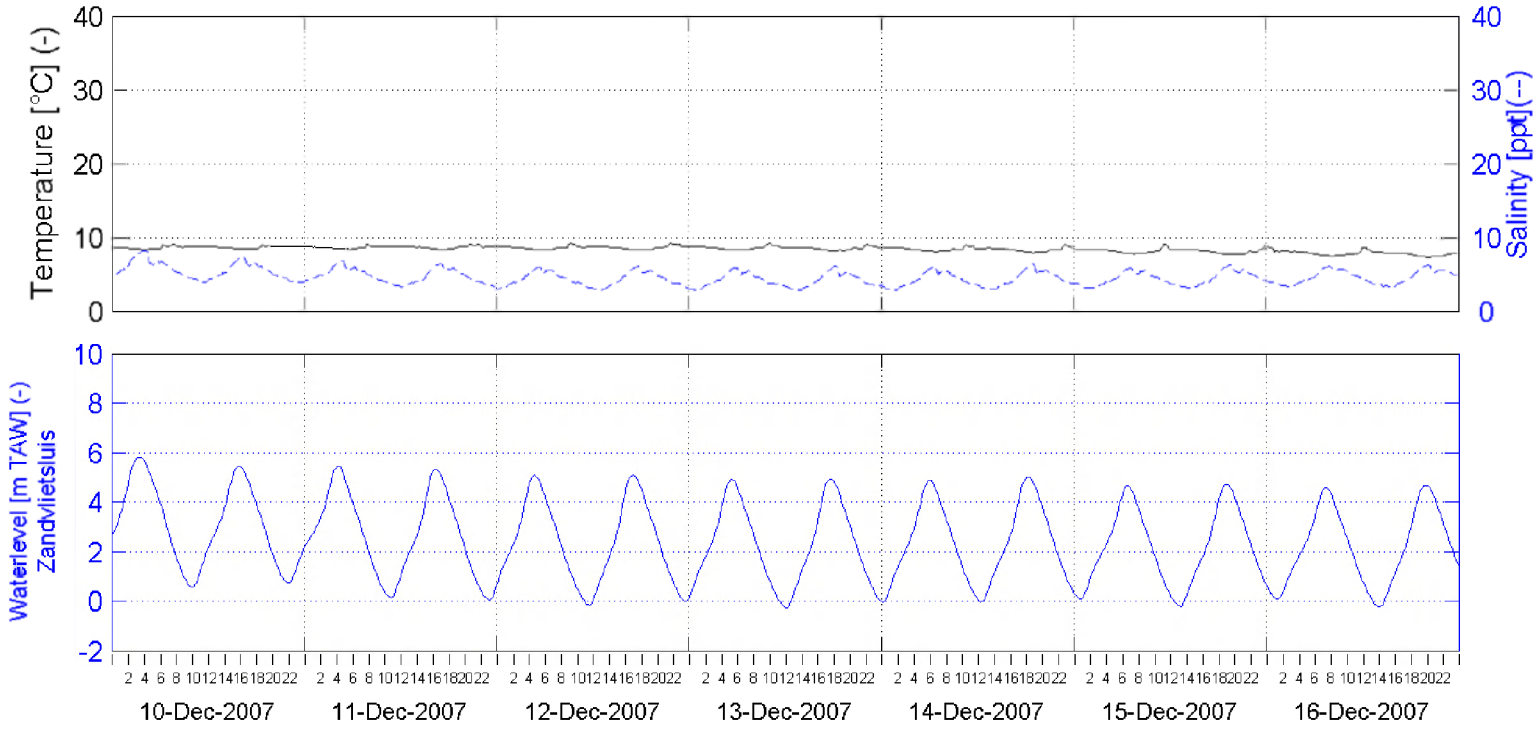
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 50 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

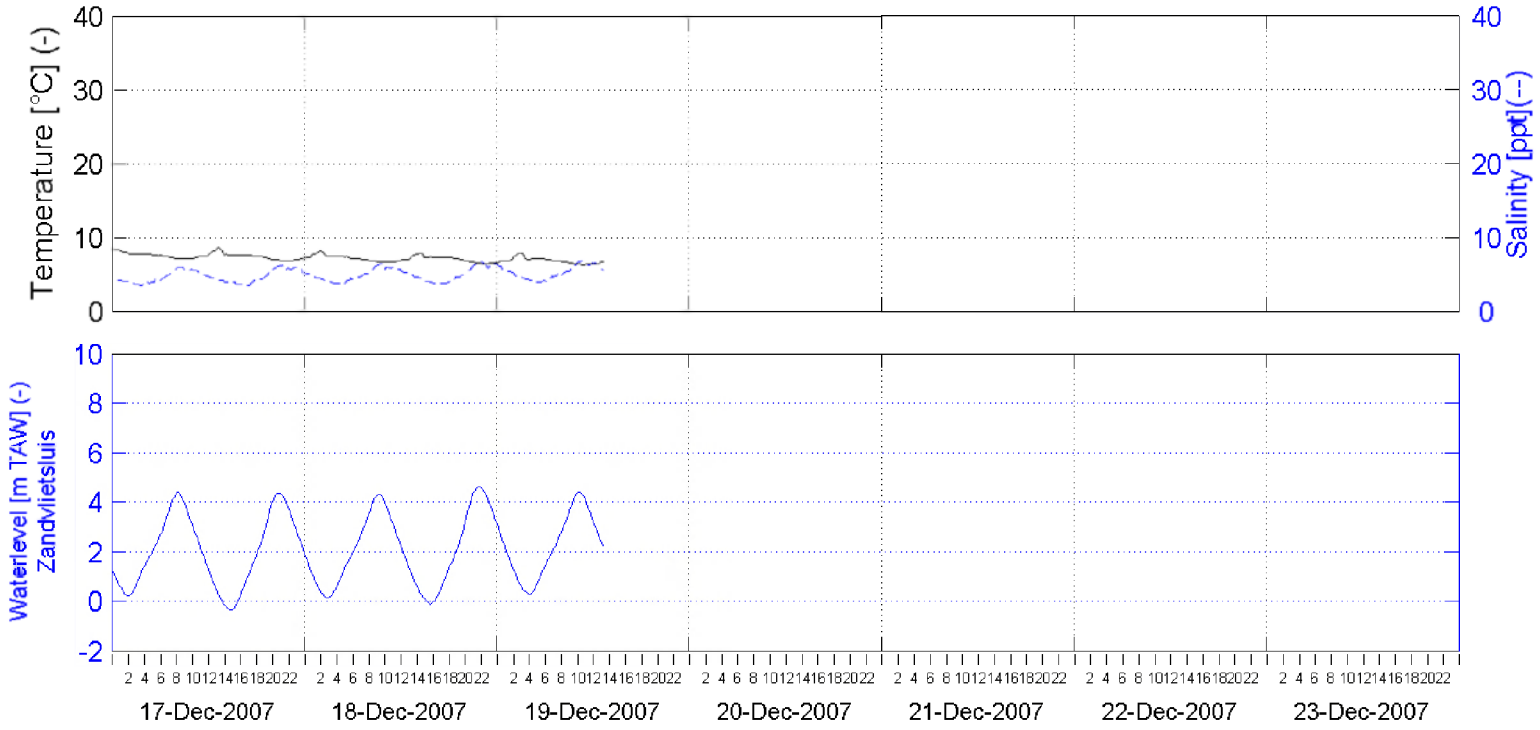
Processed by:

In Association with:

I/RA/11283/07.099/MSA

Boundary conditions: Three monthly report 01/10/2007 – 31/12/2007

Week 51 - 2007



Week series of Temperature, Salinity and Tide

Location:

Prosperpolder 2.5m above bottom (-1.5m TAW)

Processed by:

In Association with:

I/RA/11283/07.099/MSA

D.2 Monthly results Minimum, Maximum and Average Velocity Magnitude, Temperature, Salinity & Suspended Sediment Concentration

Location: Oosterweel left bank
4.5 meter above bottom [-2.3 m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	0.00	1.34	0.67
February 2007	0.01*	1.36*	0.66*
March 2007	0.01*	1.13*	0.55*
April 2007	0.00	1.18	0.60
May 2007	0.01*	1.10*	0.64*
June 2007	0.01*	1.03*	0.63*
July 2007	0.00*	1.22*	0.69*
August 2007	0.01*	1.35*	0.66*
September 2007	0.00	1.47	0.65
October 2007	0.01*	1.10*	0.65*
November 2007	0.01*	1.26*	0.67*
December 2007	0.01	1.22	0.64
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	6.1	9.4	7.9
February 2007	6.2*	8.2*	7.0*
March 2007	8.9*	10.5*	9.5*
April 2007	9.6	16.1	12.7
May 2007	16.1*	17.6*	16.8*
June 2007	19.5*	21.5*	20.6*
July 2007	18.6*	20.7*	19.5*
August 2007	19.2*	20.9*	20.2*
September 2007	16.0	20.1	18.3
October 2007	13.9*	16.7*	15.5*
November 2007	7.3*	11.0*	8.8*
December 2007	3.6	8.8	6.7

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	-	-	-	-	-	-
February 2007	-	-	-	-	-	-
March 2007	1.0*	0.5*	2.8*	0.8*	1.7*	0.6*
April 2007	3.6	0.8	7.7	2.2	5.8	1.3
May 2007	8.3*	1.7*	9.4*	3.2*	8.8*	2.4*
June 2007	8.3*	1.1*	9.0*	2.0*	8.7*	1.4*
July 2007	7.3*	0.9*	9.2*	1.6*	8.2*	1.2*
August 2007	5.9*	0.9*	8.5*	2.0*	7.4*	1.4*
September 2007	7.8	1.6	10.2	3.2	9.0	2.4
October 2007	6.6*	1.0*	9.1*	1.9*	8.3*	1.3*
November 2007	5.2*	0.5*	8.1*	1.6*	6.7*	0.8*
December 2007	1.5	0.4	7.4	1.1	3.5	0.7

Suspended sediment concentration [mg/l]			
Month	**Minimum**	**Maximum**	**Average**
January 2007	5	430	187
February 2007	33*	427*	254*
March 2007	16*	415*	153*
April 2007	23	508	212
May 2007	9*	958*	240*
June 2007	-	-	-
July 2007	0*	423*	64*
August 2007	9*	1372*	226*
September 2007	4	1434	205
October 2007	7*	474*	88*
November 2007	3*	2184*	559*
December 2007	4	1364	184

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Location: Oosterweel left bank
1.0 meter above bottom [-5.8 m TAW]

Velocity magnitude [m/s]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	0.01	1.13	0.53
February 2007	0.01*	1.40*	0.53*
March 2007	0.00	1.36	0.52
April 2007	0.00	1.27	0.52
May 2007	-	-	-
June 2007	-	-	-
July 2007	0.01*	0.99*	0.53*
August 2007	0.01	1.21	0.52
September 2007	0.01	1.25	0.52
October 2007	-	-	-
November 2007	-	-	-
December 2007	0.00*	0.99*	0.48*
Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	6.4	9.4	8.1
February 2007	6.9*	8.7*	7.9*
March 2007	8.4	10.5	9.3
April 2007	9.7	16.1	12.8
May 2007	-	-	-
June 2007	-	-	-
July 2007	18.7*	20.9*	20.1*
August 2007	19.2	21.1	20.2
September 2007	16.0	20.1	18.3
October 2007	-	-	-
November 2007	-	-	-
December 2007	5.2*	8.7*	7.8*

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	-	-	-	-	-	-
February 2007	-	-	-	-	-	-
March 2007	-	-	-	-	-	-
April 2007	-	-	-	-	-	-
May 2007	-	-	-	-	-	-
June 2007	-	-	-	-	-	-
July 2007	5.3*	0.6*	8.4*	1.7*	7.2*	1.1*
August 2007	5.5	0.6	8.3	2.1	7.1	1.3
September 2007	7.8	1.8	10.2	3.3	9.0	2.5
October 2007	-	-	-	-	-	-
November 2007	-	-	-	-	-	-
December 2007	-	-	-	-	-	-

Suspended sediment concentration [mg/l]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	13	1793	197
February 2007	36*	788*	343*
March 2007	23	579	229
April 2007	7	612	255
May 2007	-	-	-
June 2007	-	-	-
July 2007	3*	817*	66*
August 2007	1	1610	293
September 2007	7	1636	264
October 2007	-	-	-
November 2007	-	-	-
December 2007	23*	822*	255*

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

Location: Prosperpolder[3]
2.5 meter above bottom [-1.5 m TAW]

Temperature [°C]			
Month	***Minimum***	***Maximum***	***Average***
January 2007	7.2	10.1	8.5
February 2007	6.9	9.6	7.9
March 2007	8.4	12.3	9.6
April 2007	9.9	18.5	13.4
May 2007	15.7*	18.4*	16.7*
June 2007	17.4	22.3	20.0
July 2007	18.4	22.4	19.8
August 2007	19.4	22.2	20.4
September 2007	16.4	20.5	18.6
October 2007	12.6	18.6	15.6
November 2007	8.4	14.2	11.0
December 2007	6.3*	9.5*	8.4*

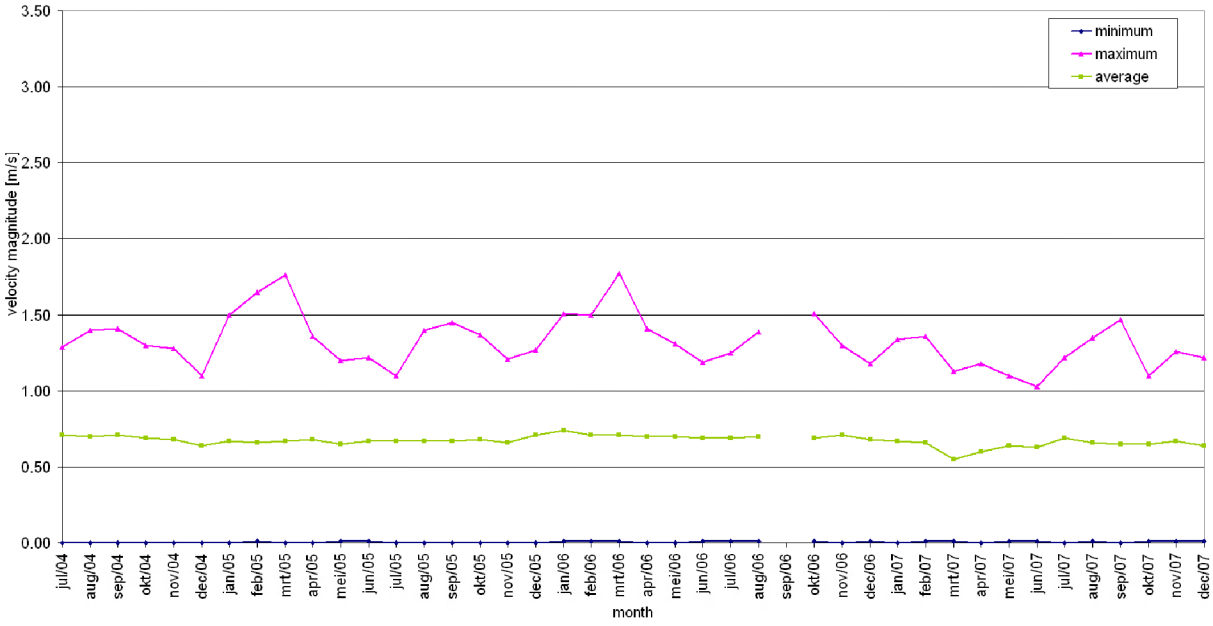
Salinity [ppt]						
Month	***Minimum***		***Maximum***		***Average***	
	HW	***LW***	***HW***	***LW***	***HW***	***LW***
January 2007	6.4	3.6	11.8	8.3	8.6	5.4
February 2007	6.4	3.2	9.4	6.5	8.0	4.7
March 2007	3.2	1.9	8.0	4.5	5.6	2.9
April 2007	7.7	4.8	12.2	9	10.2	7.2
May 2007	9.7*	8.5*	14.3*	10.4*	11.2*	9.1*
June 2007	12.8	10.2	15	12.1	13.6	10.8
July 2007	10.4*	8.2*	13.8*	11.1*	12.3*	9.6*
August 2007	9.3	7.0	13.8	10.0	11.0	8.6
September 2007	11.6	9.4	14.9	12.2	13.5	10.9
October 2007	12.6	10.3	15.9	12.3	13.9	11.1
November 2007	11.4	8.6	16.4	13.8	13.4	10.4
December 2007	5.6*	3.2*	12.5*	9.8*	8.0*	5.6*

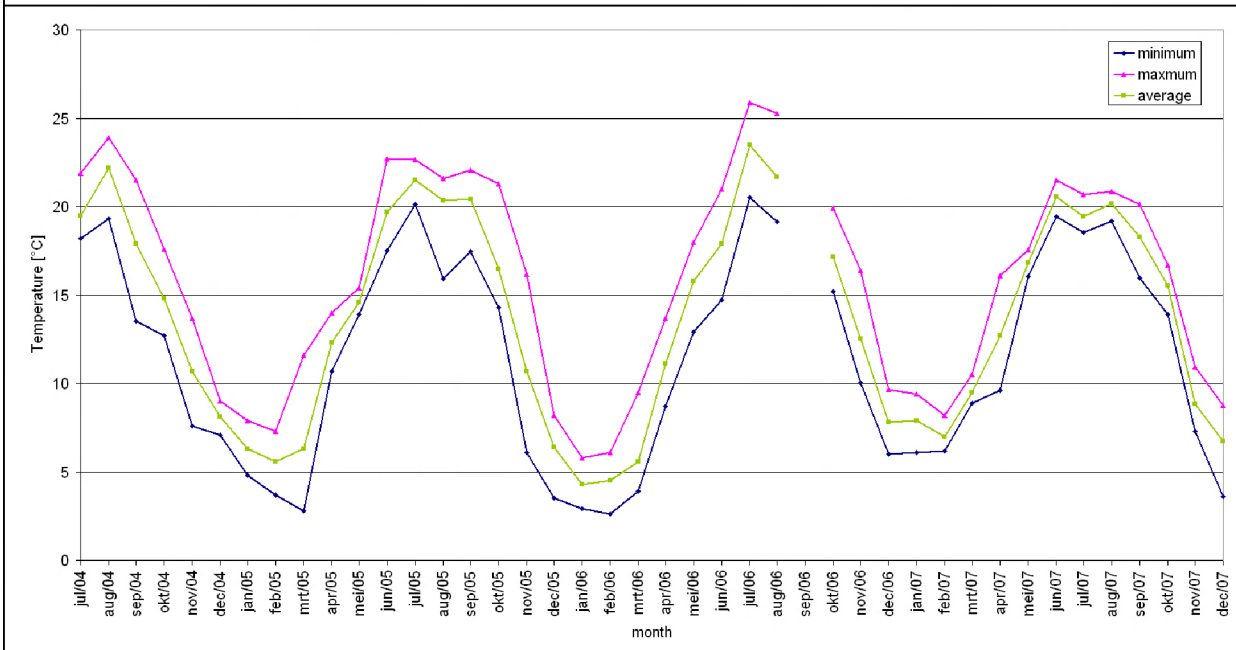
-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

[3] Current velocity and suspended sediment were not measured at Prosperpolder.

D.3 Graphs monthly results for the whole deployment period

Velocity magnitude & temperature

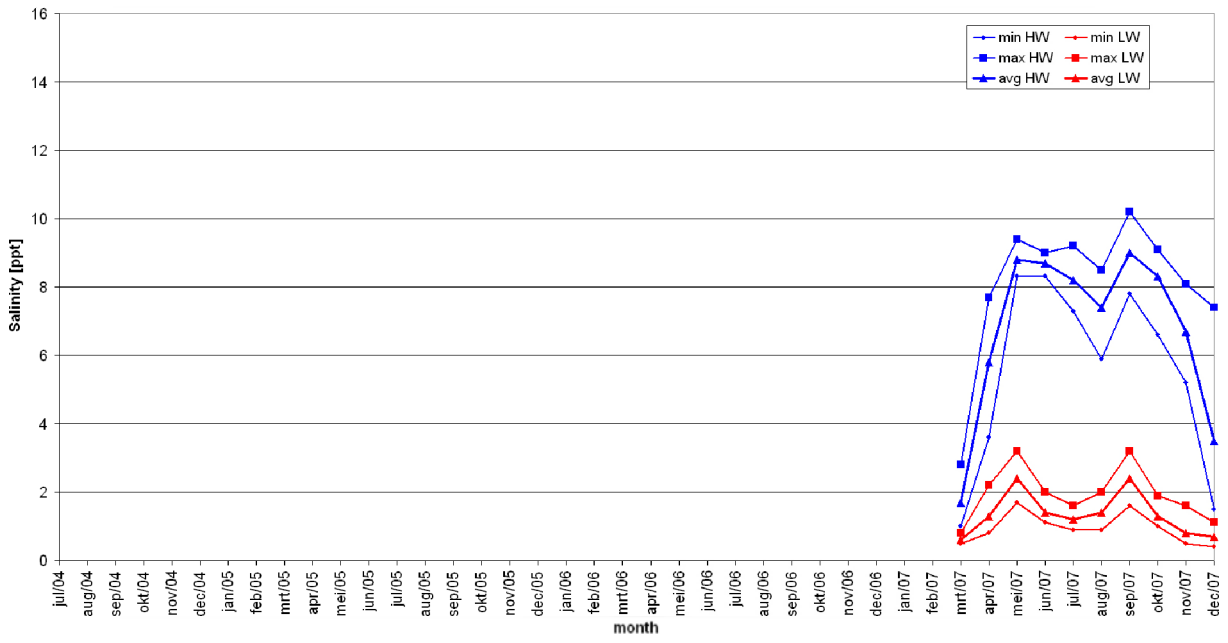


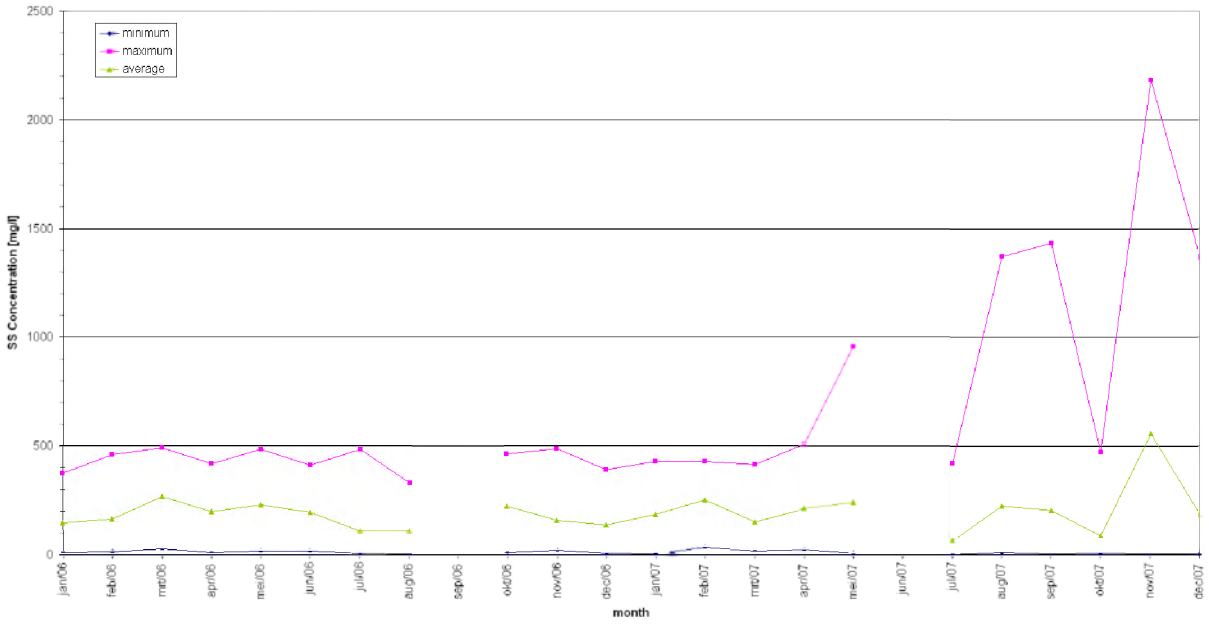


Oosterweel left bank **4.5m above bottom (-2.3m TAW)**	*Data processed by:* *In association with:*

I/RA/11283/07.099/MSA

Salinity & SS Concentration





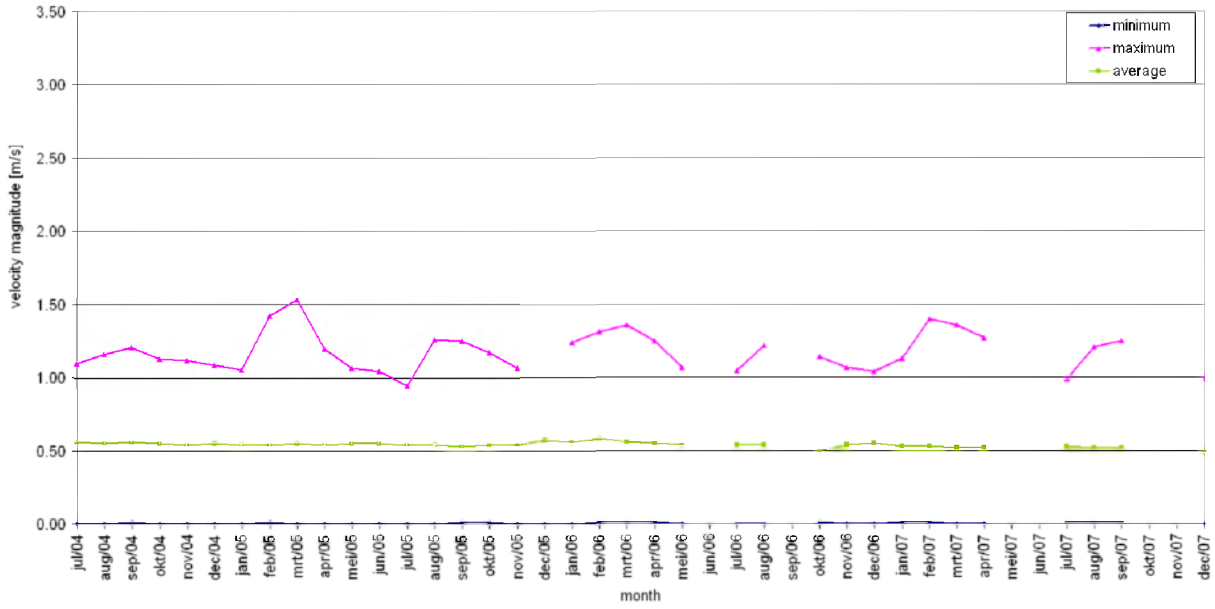
Oosterweel left bank
4.5m above bottom (-2.3m TAW)

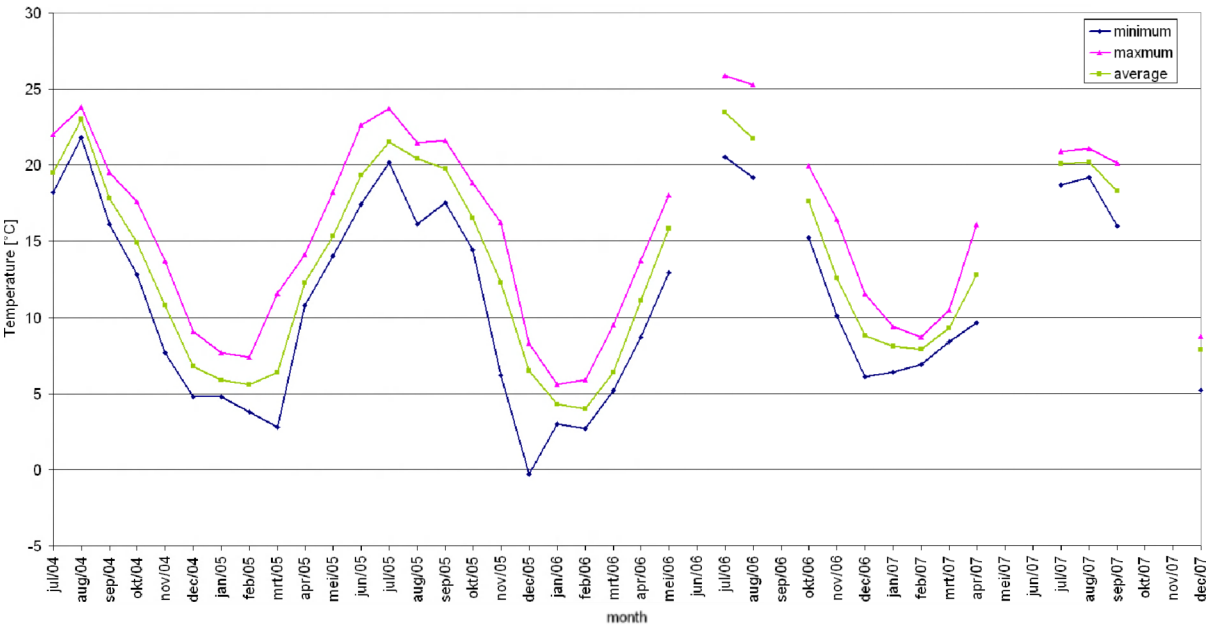
Data processed by:

In association with:

I/RA/11283/07.099/MSA

Velocity magnitude & temperature





Oosterweel left bank
1m above bottom (-5.8m TAW)

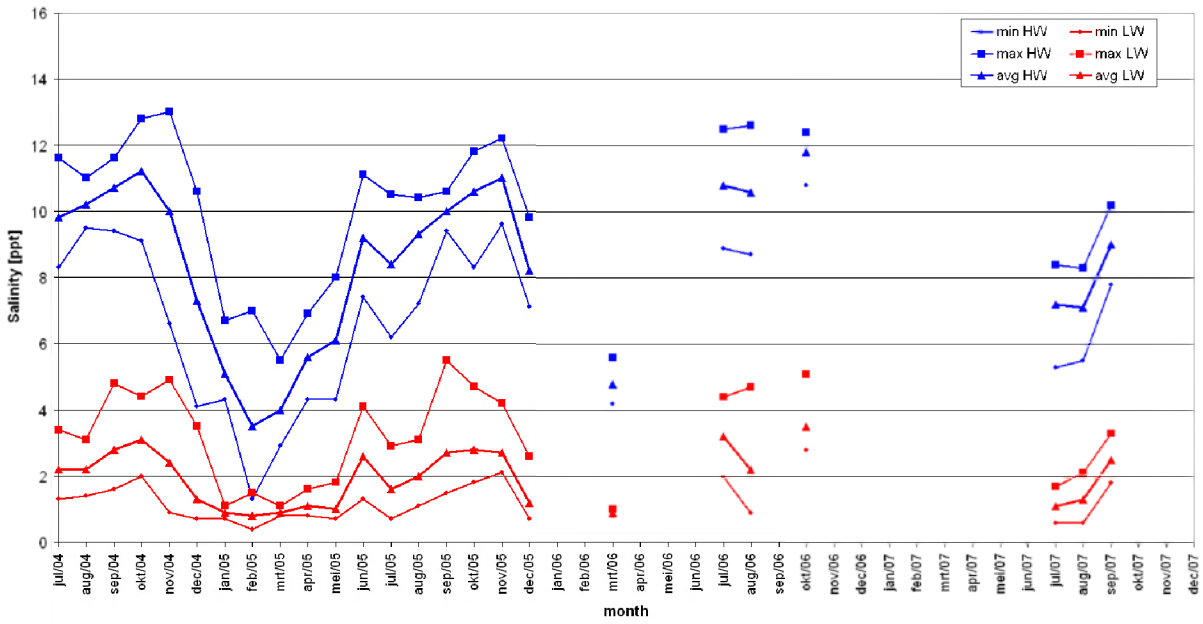
Data processed by:

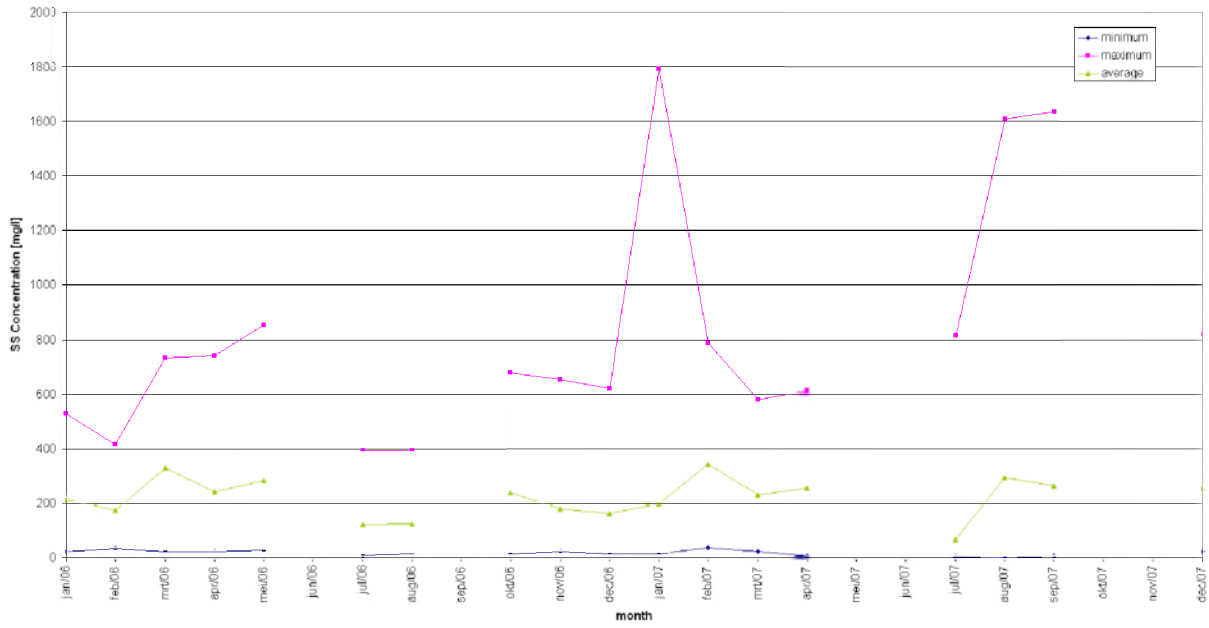
In association with:

IMDC
WL | delft hydraulics
GEMS International

I/RA/11283/07.099/MSA

Salinity & SS Concentration





Oosterweel left bank
1m above bottom (-5.8m TAW)

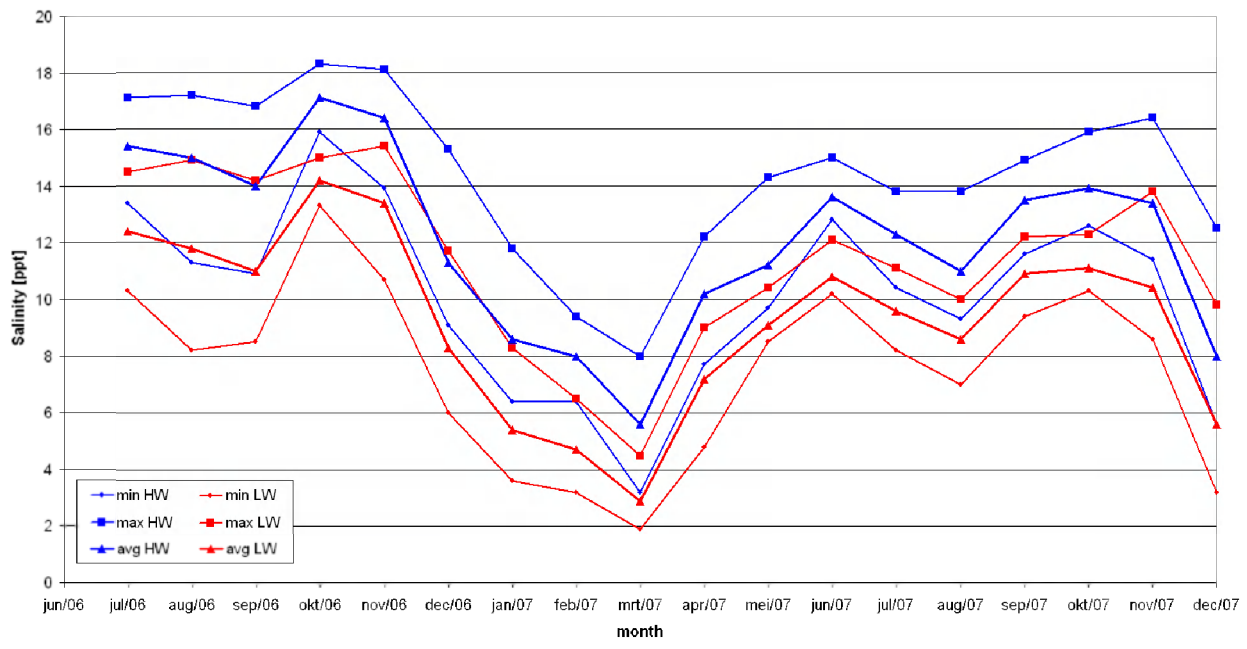
Data processed by: IMDC

In association with: wl | delft hydraulics, GEMS international

I/RA/11283/07.099/MSA

Temperature & Salinity





Propsperpolder
2.5m above bottom (-1.5m TAW)

Data processed by: IMDC

In association with: WL | delft hydraulics, GEMS International

I/RA/11283/07.099/MSA

D.4 Total result from October 2007 till December 2007 of velocity magnitude, temperature, salinity and suspended sediment concentration

Averages for the whole deployment period of each instrument [October 2007 – December 2007]

Location	*Depth [m TAW]*	*Velocity [m/s]*			*Temperature [°C]*			*SS concentration [mg/l]*		
		Min	*Max*	*Avg*	*Min*	*Max*	*Avg*	*Min*	*Max*	*Avg*
Oosterweel left bank	-2.3	0.01	1.26	0.65	3.6	16.7	9.7	3	2184	253
Oosterweel left bank	-5.8	-	-	-	-	-	-	-	-	-
Prosperpolder	-1.5	-	-	-	6.3	18.6	12.2	-	-	-

Salinity [ppt]							
Location	**Depth [m TAW]**	**Minimum**		**Maximum**		**Average**	
		Slack HW	*Slack LW*	*Slack HW*	*Slack LW*	*Slack HW*	*Slack LW*
Oosterweel left bank	-2.3	1.5*	0.4*	9.1*	1.9*	5.6*	0.9*
Oosterweel left bank	-5.8	-	-	-	-	-	-
Prosperpolder	-1.5	5.6	3.2	16.4	13.8	12.3	9.6

-: No data or less than 30% of the monthly data available.
*: Less than 70% of the monthly data available.

APPENDIX E.

MONTLY RESULTS: MINIMUM, MAXIMUM AND AVERAGE SALINITY AT BAALHOEK AND HOOFDPLAAT FOR THE PERIOD 01/01/2007 – 31/12/2007

Location: Baalhoek

Upper cell: floating at water surface
Lower cell: 4.7 meter above bottom [-3.1m TAW]

Salinity [ppt] (upper cell)			
Month	***Minimum***	***Maximum***	***Average***
January	5.9	17.1	10.8
February	5.2	14.7	9.9
March	3.3	13.6	7.6
April	7.1	17.8	12.3
May	5.9	20.1	15.9
June	11.2	20.4	16.4
July	7.8	19.6	14.7
Augustus	9.7	19.4	14.5
September	12.1	20.8	16.5
October	12.0	20.6	16.1
November	10.2	21.0	15.5
December	5.3	18.2	10.6
Salinity [ppt] (lower cell)			
Month	***Minimum***	***Maximum***	***Average***
January	5.7	17.6	11.4
February	5.7	15.7	10.5
March	3.0	14.2	8.2
April	7.0	18.4	12.9
May	12.0	20.6	16.5
June	12.4	21.1	17.0
July	9.9	19.7	15.0
Augustus	10.2	20.7	15.3
September	12.1	21.0	16.6
October	13.1	20.8	16.7
November	11.7	21.8	16.1
December	5.3	18.6	11.3

-: No data or less than 30% of monthly data available
*: Less than 70% of monthly data

Location: Hoofdplaat

Floating at water surface

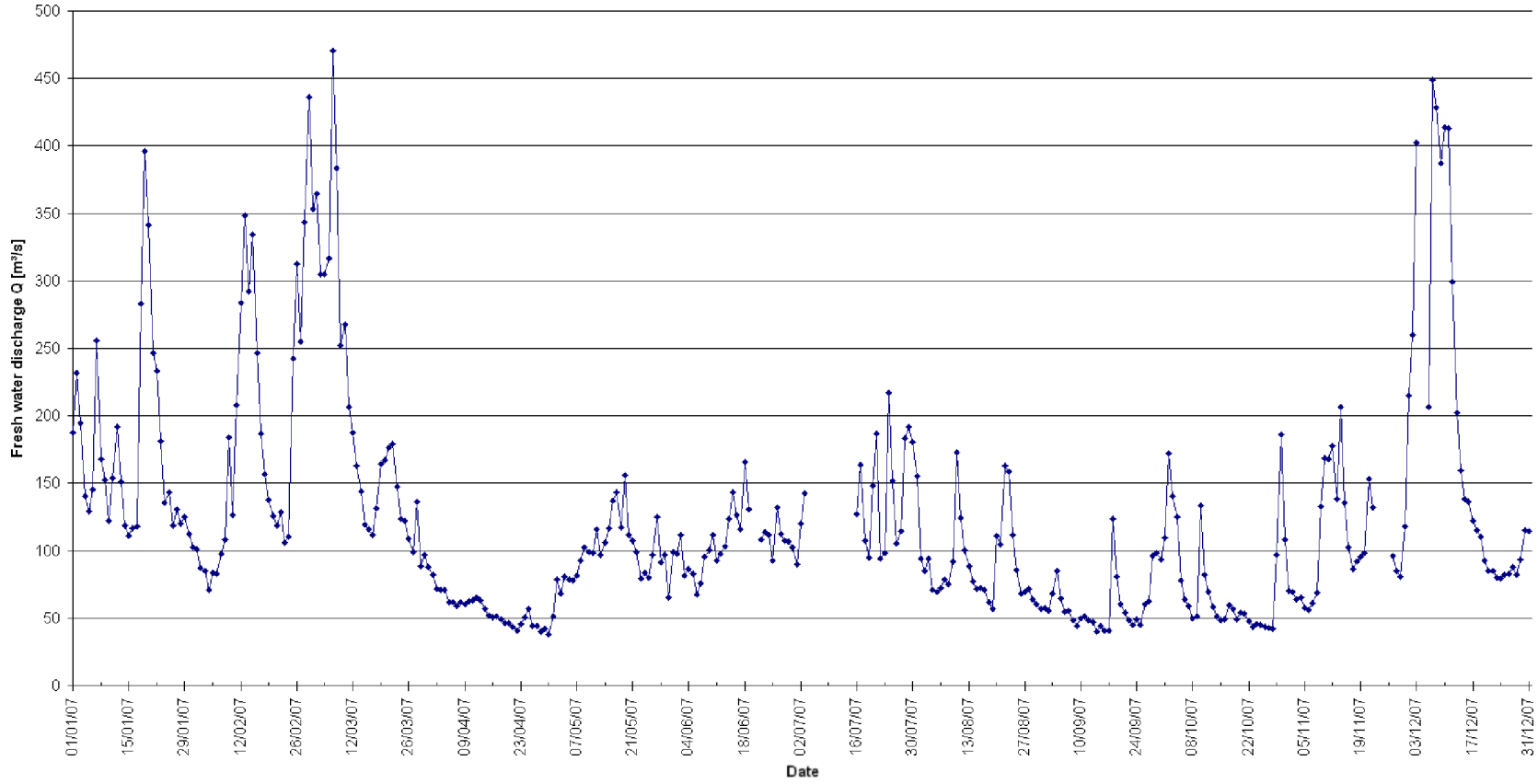
Salinity [ppt]			
Month	***Minimum***	***Maximum***	***Average***
January	18.2	28.7	25.4
February	17.5	28.4	24.4
March	18.9	34.6	23.3
April	15.9	28.0	24.9
May	25.2	32.9	29.4
June	24.7	31.5	28.1
July	22.5	29.5	27.1
Augustus	-	-	-
September	-	-	-
October	-	-	-
November	-	-	-
December	-	-	-

-: No data or less than 30% of monthly data available
*: Less than 70% of monthly data

APPENDIX F.

FRESH WATER DISCHARGE

11283 Opvolging aanslibbing Deurganckdok – Omgevingscondities Oktober - December 2007



Fresh water discharge

Location:	Date:
Schelle	01/01/2007 – 31/12/2007

Data processed by: IMDC

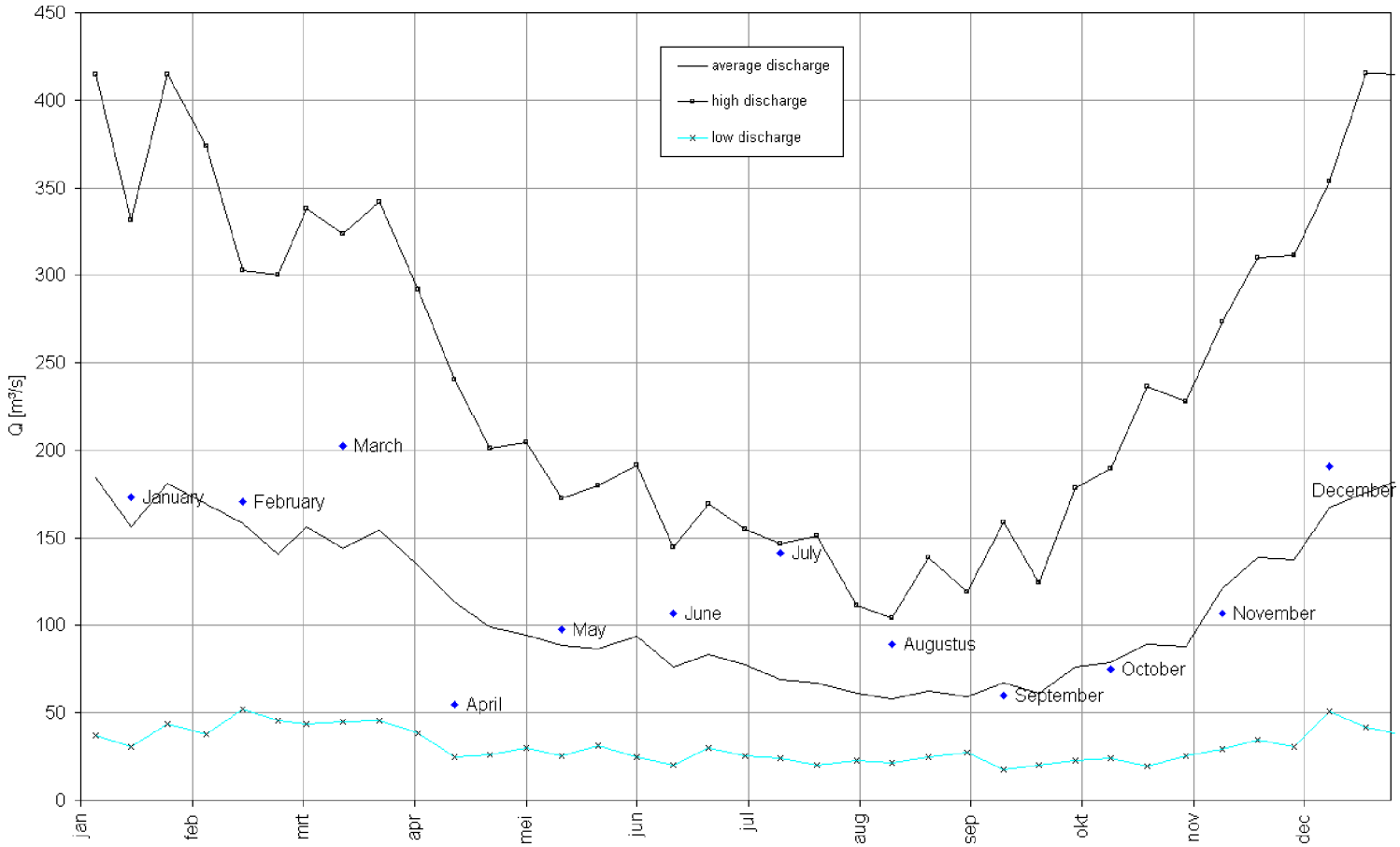
In association with: WL | delft hydraulics, GEMS International

I/RA/112831/07.099/MSA

Decade averages of the fresh water discharge [m^3/s] of the Scheldt at Schelle (January 2007 – December 2007)

	First Decade	*Second Decade*	*Third Decade*
January 2007	173	198	150
February 2007	103	219	202
March 2007	345	151	121
April 2007	67	54	45
May 2007	81	120	93
June 2007	91	122	110
July 2007	130	126	153
Augustus 2007	96	87	95
September 2007	62	58	65
October 2007	98	58	64
November 2007	82	130	109
December 2007	345	179	90

Average monthly discharge of 2007 compared to the long-term discharge curve (based on a long-term simulation over a period of 30 year; 1971-2000)



APPENDIX G.

OVERVIEW OF MAINTENANCE -DREDGING ACTIVITIES

01/10/2007 – 31/12/2007

Dredging and dumping volumes [10^3 m^3]

Dredging locations									
	Week 40	*Week 41*	*Week 42*	*Week 43*	*Week 44*	*Week 45*	*Week 46*	*Week 47*	*Week 48*
Drempel van Borssele	-	-	-	-	-	-	-	-	-
Pas van Terneuzen	-	-	83.32	-	-	-	-	-	-
Put van Terneuzen	-	-	-	-	-	-	-	7.30	-
Gat van Ossensisse	-	-	-	-	-	-	-	-	-
Drempel van Walsoorden	-	-	-	-	-	-	-	-	-
Overloop Hansweert	-	-	-	-	-	-	-	-	-
Drempel van Hansweert	-	-	-	-	87.58	-	-	-	109.71
Overloop van Valkenisse (B 56-62)	25.46	28.20	-	21.19	5.55	19.91	44.88	39.73	15.27
Drempel van Valkenisse	22.62	23.45	-	50.78	-	31.02	18.68	25.18	20.35
Drempel van Bath	36.01	31.62	-	-	-	-	-	-	-
Nauw van Bath (B 75)	25.50	22.56	-	-	-	-	-	-	-
Vaarwater Bath (B72-76)	2.71	-	-	-	-	-	-	-	-
Noordzeeterminal	-	-	19.26	4.25	-	-	-	-	-
Containerkaai noord	-	-	-	-	-	-	-	-	-
Containerkaai zuid	-	-	-	-	-	-	-	-	-
Vaarwater Oudendijk	-	-	-	-	2.98	-	-	-	-
Drempel van Zandvliet	-	-	-	-	28.73	-	-	-	-
Zandvliet+Berendrecht sluis	-	-	-	-	-	-	-	-	-
Drempel van Frederik	-	-	-	-	-	-	-	2.80	-
Drempel van Lillo	-	-	-	-	-	-	-	-	-
Lillo vaarwater plaat	-	-	-	-	-	-	-	-	-
Toeg Boud+Calew sluis	-	-	-	16.70	3.69	-	-	-	-
Deurganckdok	-	-	-	-	-	-	-	104.77	66.13
De Parel	-	-	-	-	-	-	-	-	-
Ketelplaat	-	-	-	-	-	-	-	-	-
Kallo sluis	-	-	-	-	13.96	35.67	18.33	20.99	-
Krankeloon	-	-	-	-	-	-	-	-	-
Kaaien 23-27	-	-	-	-	-	-	-	-	-

Dumping locations									
	Week 40	*Week 41*	*Week 42*	*Week 43*	*Week 44*	*Week 45*	*Week 46*	*Week 47*	*Week 48*
Spijkerplaat	-	-	83.32	-	-	-	-	3.59	-
Everingen	-	-	-	-	-	-	-	3.71	-
Ellewoutsdijk	16.55	21.44	-	15.85	16.87	-	-	-	34.05
Biezelingse Ham	20.06	2.45	-	18.67	24.29	-	-	-	20.60
Schaar van Waarde	75.70	81.94	-	37.45	51.97	50.93	63.55	64.91	90.69
Schaar Ouden Doel	-	-	-	-	31.71	-	-	-	-
Opspuitingen Deurganckdok	-	-	-	-	-	-	-	-	-
Oosterweel	-	-	8.52	9.36	9.94	15.72	18.33	66.01	29.45
Plaat van Boomke	-	-	10.75	11.60	7.71	19.95	-	-	-
Punt van Melsele	-	-	-	-	-	-	-	62.54	36.68
Opspuitingen Kruibeke	-	-	-	-	-	-	-	-	-

Dredging locations									
	Week 49	*Week 50*	*Week 51*	*Week 52*					
Drempel van Borssele	-	22.64	33.44	-					
Pas van Terneuzen	-	-	-	-					
Put van Terneuzen	5.88	-	-	-					
Gat van Ossensisse	-	20.35	-	-					
Drempel van Walsoorden	-	61.12	-	-					
Overloop Hansweert	-	-	-	-					
Drempel van Hansweert	37.41	-	-	-					
Overloop van Valkenisse (B 56-62)	-	-	14.54	-					
Drempel van Valkenisse	-	-	-	-					
Drempel van Bath	-	-	-	-					
Nauw van Bath (B 75)	-	-	-	-					
Vaarwater Bath (B72-76)	-	-	-	-					
Noordzeeterminal	-	-	-	-					
Containerkaai noord	-	-	-	-					
Containerkaai zuid	-	-	-	-					
Vaarwater Oudendijk	-	-	-	-					
Drempel van Zandvliet	-	-	46.30	-					
Zandvliet+Berendrecht sluis	-	-	-	-					
Drempel van Frederik	125.42	-	-	-					
Drempel van Lillo	-	-	-	-					
Lillo vaarwater plaat	-	-	-	-					
Toeg Boud+Calew sluis	-	-	-	-					
Deurganckdok	-	-	-	-					
De Parel	-	-	-	-					
Ketelplaat	-	-	-	-					
Kallo sluis	-	-	-	-					
Krankeloon	-	-	-	-					
Kaaien 23-27	-	-	-	-					

Dumping locations									
	Week 49	*Week 50*	*Week 51*	*Week 52*					
Spijkerplaat	2.38	11.07	16.45	-					
Everingen	3.50	11.56	16.99	-					
Ellewoutsdijk	-	-	-	-					
Biezelingse Ham	37.41	81.47	14.54	-					
Schaar van Waarde	-	-	-	-					
Schaar Ouden Doel	58.93	-	46.30	-					
Opspuitingen Deurganckdok	-	-	-	-					
Oosterweel	30.65	-	-	-					
Plaat van Boomke	-	-	-	-					
Punt van Melsele	35.84	-	-	-					
Opspuitingen Kruibeke	-	-	-	-					

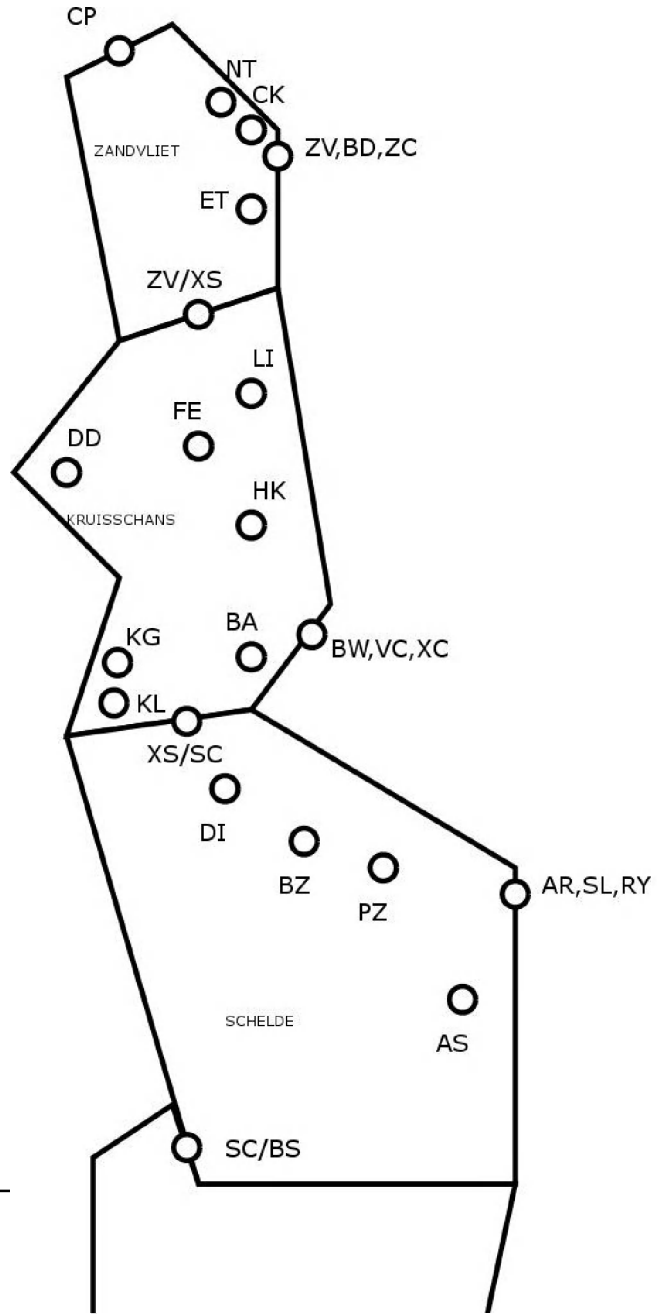
APPENDIX H.

NAVIGATION

H.1 Description of the areas

Area	*Global description*	*Detailed description*
1	Belgian border → Locks of Zandvliet – Berendrecht	Transit point CP → exit/entry point ZC, BD, ZV, NT, CK, ET or transit point ZV/XS
2	Locks of Zandvliet – Berendrecht → Deurganckdok	Transit point CP or entry/exit point ZC, BD, ZV, NT, CK, ET → transit point ZV/XS
3	Deurganckdok → Lock of Kallo	Transit point ZV/XS or entry/exit point DD → exit/entry point BA, BW, FE, HK, KG, KL, LI, VC, XC or transit point XS/SC
4	Lock of Kallo → Lock of Royers	Transit point XS/SC or entry/exit point DD, BA, BW, FE, HK, KG, KL, LI, VC, XC → entry/exit point AR, AS, BZ, DI, KT, PZ, RY, SL or transit point SC/BS

	CID	MEANING	TYPE
GA	GEBIED ANTWERPEN		
SA	Saeftinge		
	CP	Coordinatiepunt (blokgrens SA/ZV)	P
	CP2	Coordinatiepunt (blokgrens SA/ZV)	P
SC	Schelde		
	AR	Antwerpen Rede	E
	AS	Antwerpen Scheldekade/steiger	E
	AX	Antwerpen zonder detaillering	E
	BZ	BP Zwijndrecht	E
	DI	Haven Dredging International	E
	PZ	Polysar Zwijndrecht	E
	RY	Royerssluis	E
	SC/BS	Blokgrens SC/BS (boveneinde rede Antwerpen)	P
	SL	Sluizen Antwerpen Rechteroever	E
XS	Kruisschans		
	BA	Bayer Kallo	E
	BW	Boudewijnsluis	E
	DD	Deurganckdok	E
	FE	Steiger Fenol	E
	HK	Steiger Haltermann	E
	KG	Kallo geul	E
	KL	Kallosluis	E
	LI	Steiger Lillo	E
	VC	Van Cauwelaertsluis	E
	XC	Kruisschanssluiscomplex	E
	XS/SC	Blokgrens Kruisschans / Schelde	P
	XS/SC2	Blokgrens Kruisschans / Schelde	P
ZV	Zandvliet		
	BD	Berendrechtsluis	E
	CK	Containerkade Antwerpen	E
	ET	Europaterminal	E
	NT	Noordzeeterminal	E
	ZC	Zandvliet / Berendrecht sluiszencomplex	E
	ZV	Zandvliet sluis	E
	ZV/XS	Blokgrens Zandvliet / Kruisschans	P
	ZV/XS2	Blokgrens Zandvliet / Kruisschans	P


CP
NT
CK
ZV,BD,ZC
ZANDVLIET
ET
ZV/XS
LI
FE
DD
HK
KRUISSCHANS
KG
BA
BW,VC,XC
KL
XS/SC
DI
BZ
PZ
AR,SL,RY
SCHELDE
AS
SC/BS

Sketch of the different areas of navigation

H.2 Weekly data

Week 40 (01/10/2007 – 07/10/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	127	120	7	17	106
	0 – 8 m	880	446	433	428	449
	8 – 12 m	228	0	228	70	158
	> 12 m	30	0	30	5	25
2	Unknown	147	139	8	37	106
	0 – 8 m	632	383	248	345	284
	8 – 12 m	87	0	87	42	45
	> 12 m	8	0	8	3	5
3	Unknown	155	146	9	29	122
	0 – 8 m	584	362	221	320	260
	8 – 12 m	56	0	56	27	29
	> 12 m	0	0	0	0	0
4	Unknown	40	35	5	24	16
	0 – 8 m	144	108	35	101	43
	8 – 12 m	0	0	0	0	0
	> 12 m	0	0	0	0	0
Week 41 (08/10/2007 – 14/10/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	113	105	8	21	88
	0 – 8 m	940	499	439	419	520
	8 – 12 m	218	1	217	67	151
	> 12 m	33	1	32	3	30
2	Unknown	139	128	11	42	93
	0 – 8 m	692	423	267	355	336
	8 – 12 m	83	1	82	41	42
	> 12 m	6	1	5	3	3
3	Unknown	134	124	10	29	100
	0 – 8 m	643	400	241	328	314

	8 – 12 m	51	1	50	25	26
	> 12 m	2	1	1	2	0
4	Unknown	29	27	2	15	14
	0 – 8 m	160	108	52	108	52
	8 – 12 m	1	0	1	0	1
	> 12 m	0	0	0	0	0

Week 42 (15/10/2007 – 21/10/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	103	100	3	17	84
	0 – 8 m	906	473	433	407	493
	8 – 12 m	203	0	203	62	141
	> 12 m	23	0	23	5	18
2	Unknown	121	117	4	41	78
	0 – 8 m	659	420	239	341	312
	8 – 12 m	81	0	81	43	38
	> 12 m	4	0	4	2	2
3	Unknown	123	119	4	30	90
	0 – 8 m	612	400	212	316	290
	8 – 12 m	47	0	47	27	20
	> 12 m	0	0	0	0	0
4	Unknown	36	35	1	26	10
	0 – 8 m	138	97	41	90	48
	8 – 12 m	0	0	0	0	0
	> 12 m	0	0	0	0	0
Week 43 (22/10/2007 – 28/10/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	92	91	1	18	73
	0 – 8 m	917	452	464	416	497
	8 – 12 m	205	0	205	62	143
	> 12 m	31	1	30	5	26
2	Unknown	121	116	5	40	80
	0 – 8 m	646	378	267	337	308
	8 – 12 m	85	0	85	41	44
	> 12 m	9	1	8	3	6
3	Unknown	121	120	1	33	85
	0 – 8 m	601	355	245	311	289
	8 – 12 m	52	0	52	25	27
	> 12 m	1	1	0	0	1
4	Unknown	26	24	2	15	9
	0 – 8 m	140	86	53	106	34

	8 – 12 m	0	0	0	0	0
	> 12 m	0	0	0	0	0

Week 44 (29/10/2007 – 04/11/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	103	96	7	14	87
	0 – 8 m	817	387	427	377	437
	8 – 12 m	212	0	212	73	139
	> 12 m	30	1	29	4	26
2	Unknown	119	110	9	26	91
	0 – 8 m	563	322	239	311	249
	8 – 12 m	71	0	71	41	30
	> 12 m	5	1	4	1	4
3	Unknown	112	107	5	16	93
	0 – 8 m	528	307	219	291	234
	8 – 12 m	42	0	42	25	17
	> 12 m	1	1	0	1	0
4	Unknown	27	27	0	11	16
	0 – 8 m	134	94	39	102	32
	8 – 12 m	3	0	3	1	2
	> 12 m	0	0	0	0	0
Week 45 (05/11/2007 – 11/11/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	89	80	8	8	79
	0 – 8 m	737	381	355	334	399
	8 – 12 m	188	0	188	46	142
	> 12 m	33	1	32	9	24
2	Unknown	103	93	9	21	80
	0 – 8 m	503	316	186	267	232
	8 – 12 m	74	0	74	30	44
	> 12 m	11	1	10	7	4
3	Unknown	97	87	9	13	82
	0 – 8 m	477	306	170	253	219
	8 – 12 m	39	0	39	12	27
	> 12 m	5	1	4	4	1
4	Unknown	21	21	0	13	8
	0 – 8 m	120	80	40	88	32

	8 – 12 m	1	0	1	0	1
	> 12 m	0	0	0	0	0

Week 46 (12/11/2007 – 18/11/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	103	97	6	23	77
	0 – 8 m	926	475	449	410	509
	8 – 12 m	228	0	228	71	157
	> 12 m	27	0	27	6	21
2	Unknown	118	109	9	37	79
	0 – 8 m	670	408	260	343	321
	8 – 12 m	87	0	87	41	46
	> 12 m	8	0	8	4	4
3	Unknown	118	110	8	28	88
	0 – 8 m	629	397	231	321	302
	8 – 12 m	57	0	57	29	28
	> 12 m	1	0	1	1	0
4	Unknown	34	32	2	18	16
	0 – 8 m	152	103	49	95	55
	8 – 12 m	2	0	2	1	1
	> 12 m	0	0	0	0	0
Week 47 (19/11/2007 – 25/11/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	154	149	5	14	138
	0 – 8 m	921	500	417	461	455
	8 – 12 m	222	0	222	71	151
	> 12 m	31	0	31	6	25
2	Unknown	152	146	6	30	120
	0 – 8 m	680	417	259	391	284
	8 – 12 m	95	0	95	47	48
	> 12 m	8	0	8	3	5
3	Unknown	139	133	6	15	122
	0 – 8 m	617	381	232	355	257
	8 – 12 m	61	0	61	29	32
	> 12 m	3	0	3	2	1
4	Unknown	30	29	1	12	18
	0 – 8 m	166	109	56	116	49

	8 – 12 m	2	0	2	1	1
	> 12 m	0	0	0	0	0

Week 48 (26/11/2007 – 02/12/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	94	90	4	21	73
	0 – 8 m	870	448	422	408	460
	8 – 12 m	210	0	210	70	140
	> 12 m	25	0	25	3	22
2	Unknown	104	98	6	32	72
	0 – 8 m	647	386	261	344	301
	8 – 12 m	78	0	78	39	39
	> 12 m	9	0	9	3	6
3	Unknown	100	94	6	25	74
	0 – 8 m	595	365	230	311	282
	8 – 12 m	47	0	47	21	26
	> 12 m	1	0	1	0	1
4	Unknown	22	21	1	16	6
	0 – 8 m	141	92	49	102	39
	8 – 12 m	1	0	1	1	0
	> 12 m	0	0	0	0	0
Week 49 (03/12/2007 – 09/12/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	78	73	5	13	63
	0 – 8 m	770	404	365	343	424
	8 – 12 m	210	0	210	57	153
	> 12 m	26	0	26	4	22
2	Unknown	83	78	5	21	60
	0 – 8 m	567	345	221	295	270
	8 – 12 m	82	0	82	34	48
	> 12 m	4	0	4	2	2
3	Unknown	82	76	6	19	61
	0 – 8 m	528	329	198	272	254
	8 – 12 m	45	0	45	15	30
	> 12 m	0	0	0	0	0
4	Unknown	25	23	2	14	11
	0 – 8 m	139	90	48	99	40

	8 – 12 m	0	0	0	0	0
	> 12 m	0	0	0	0	0

Week 50 (10/12/2007 – 16/12/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	127	124	3	23	102
	0 – 8 m	919	446	472	418	500
	8 – 12 m	224	0	224	70	154
	> 12 m	34	0	34	5	29
2	Unknown	130	122	8	32	96
	0 – 8 m	664	375	288	360	303
	8 – 12 m	84	0	84	42	42
	> 12 m	7	0	7	3	4
3	Unknown	123	118	5	27	93
	0 – 8 m	618	356	261	338	279
	8 – 12 m	49	0	49	24	25
	> 12 m	1	0	1	1	0
4	Unknown	40	37	3	19	20
	0 – 8 m	149	95	54	97	52
	8 – 12 m	1	0	1	0	1
	> 12 m	0	0	0	0	0
Week 51 (17/12/2007 – 23/12/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	114	109	3	29	85
	0 – 8 m	866	428	436	409	454
	8 – 12 m	207	0	207	59	148
	> 12 m	27	0	27	4	23
2	Unknown	124	116	6	38	86
	0 – 8 m	615	351	262	341	272
	8 – 12 m	80	0	80	41	39
	> 12 m	6	0	6	1	5
3	Unknown	122	114	6	34	87
	0 – 8 m	559	329	228	314	243
	8 – 12 m	42	0	42	21	21
	> 12 m	0	0	0	0	0
4	Unknown	36	33	1	17	18
	0 – 8 m	147	92	55	104	43

	8 – 12 m	1	0	1	0	1
	> 12 m	0	0	0	0	0

Week 52 (24/12/2007 – 30/12/2007)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	51	49	2	16	34
	0 – 8 m	604	262	342	268	335
	8 – 12 m	203	0	203	69	134
	> 12 m	28	0	28	4	24
2	Unknown	59	55	4	24	34
	0 – 8 m	390	195	195	206	183
	8 – 12 m	83	0	83	41	42
	> 12 m	7	0	7	3	4
3	Unknown	67	64	3	15	51
	0 – 8 m	365	185	180	194	170
	8 – 12 m	48	0	48	23	25
	> 12 m	1	0	1	1	0
4	Unknown	24	21	3	13	11
	0 – 8 m	99	62	37	67	32
	8 – 12 m	1	0	1	0	1
	> 12 m	0	0	0	0	0
Week 01 (31/12/2007 – 6/01/2008)						
Area	***Draught***	***Total***	***Inland navigation***	***Seagoing***	***Arrival***	***Departure***
1	Unknown	53	51	0	15	38
	0 – 8 m	606	267	338	282	324
	8 – 12 m	172	0	172	49	123
	> 12 m	11	0	11	3	8
2	Unknown	61	55	4	26	35
	0 – 8 m	404	212	192	221	183
	8 – 12 m	58	0	58	25	33
	> 12 m	1	0	1	0	1
3	Unknown	54	50	2	17	37
	0 – 8 m	378	202	176	208	170
	8 – 12 m	29	0	29	12	17
	> 12 m	0	0	0	0	0
4	Unknown	15	14	1	9	6
	0 – 8 m	113	76	37	81	32

	8 – 12 m	0	0	0	0	0
	> 12 m	0	0	0	0	0

APPENDIX I.

EQUAL DENSITY PLANES FOR ENTRANCE CHANNELS OF DIFFERENT LOCKS

I.1 Kallo lock

I.1.1. 4 September 2007

I.1.2. 15 October 2007

I.2 Boudewijn and van Cauwelaert locks

I.2.1. 4 September 2007

I.2.2. 15 October 2007

I.2.3. 22 November 2007

I.3 Zandvliet and Berendrecht locks

I.3.1. 6 September 2007

I.3.2. 17 October 2007

I.3.3. 19 November 2007

APPENDIX J.

SEDIMENT MASS DISTRIBUTION IN THE ENTRANCE CHANNELS OF DIFFERENT LOCKS

J.1 Tabular results

J.1.1. Kallo lock

4 September 2007

**Volumes per layer(m3)

Layer 1:	87897.6
Layer 2:	1892.6
Layer 3:	459026
Layer 4:	54223.8
Layer 5:	59291.2
Layer 6:	837980.7

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	64817.1	1088.6	268916	37522.5	41454.5	550166.3
Zone 2:	14871.3	0	120160.4	8250.5	8982.4	185013.6
Zone 3:	5605.6	0	50152.1	5833.3	5309.1	102800.9

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	3123	131.1	53986.9	10546.1	18262.5	242371.6
Zone 2:	716.5	0	24123.1	2318.9	4033.6	83081.2
Zone 3:	270.1	0	10068.4	1639.5	2314.2	44809.3

**Total mass per layer(TDS)

Layer 1:	4109.6
Layer 2:	131.1
Layer 3:	88178.5
Layer 4:	14504.5
Layer 5:	24610.2
Layer 6:	370262.1

15 October 2007

**Volumes per layer(m3)

Layer 1:	8549.8
Layer 2:	13733.5
Layer 3:	15188.9
Layer 4:	16962
Layer 5:	49252.5
Layer 6:	1315523

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	3852.1	7291	8557	9898.3	29732.2	858200.5
Zone 2:	1869.1	3493	4002.1	4567.8	14459.4	287854
Zone 3:	726.3	1628.6	1651.5	1638.8	3781.4	169468.9

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	185.6	878.2	1717.9	2782	13255.9	382622.2
Zone 2:	90.1	420.7	803.5	1283.8	6133.1	122096.3
Zone 3:	35	196.2	331.5	460.6	1436.3	64369.9

**Total mass per layer(TDS)

Layer 1:	310.7
Layer 2:	1495.2
Layer 3:	2852.9
Layer 4:	4526.4
Layer 5:	20825.3
Layer 6:	569088.4

J.1.2. Boudewijn and van Cauwelaert locks

4 September 2007

**Volumes per layer(m3)

Layer 1:	29333
Layer 2:	27212.9
Layer 3:	14776.8
Layer 4:	17003
Layer 5:	23008.5
Layer 6:	350162.3

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	6515.8	8217.7	3566.1	3925.4	5521.9	175138.3
Zone 2:	16797.4	13915.9	7433.2	8379.8	10926.1	175024

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	313.9	989.9	715.9	1103.3	2610.9	82809.6
Zone 2:	809.3	1676.2	1492.3	2355.2	4920.4	78820.2

**Total mass per layer(TDS)

Layer 1:	1123.3
Layer 2:	2666.1
Layer 3:	2208.2
Layer 4:	3458.5
Layer 5:	7531.3
Layer 6:	161629.8

15 October 2007

**Volumes per layer(m3)

Layer 1:	15786.8
Layer 2:	15184
Layer 3:	14208
Layer 4:	12594.9
Layer 5:	42827.6
Layer 6:	291580

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	3802.5	3772.9	3496.5	3081	10224.3	134442.7
Zone 2:	6996.6	8277.4	8021.5	6931.7	24820.5	157137.3

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	183.2	454.5	701.9	865.9	4758.8	62574.5
Zone 2:	337.1	997.1	1610.4	1948.2	11050.1	69957.5

**Total mass per layer(TDS)

Layer 1:	520.3
Layer 2:	1451.5
Layer 3:	2312.3
Layer 4:	2814.2
Layer 5:	15808.9
Layer 6:	132532

22 November 2007

**Volumes per layer(m3)

Layer 1:	19966.2
Layer 2:	20653.4
Layer 3:	19774.4
Layer 4:	18587.7
Layer 5:	18582.1
Layer 6:	402006

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	4744.2	4365.3	4299.2	4836.1	6016.8	182569.4
Zone 2:	8185	10910.2	11101.4	9681.9	8848	219436.7

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	228.6	525.8	863.1	1359.2	3040.1	92246.2
Zone 2:	394.4	1314.2	2228.7	2721.2	4229	104882.7

**Total mass per layer(TDS)

Layer 1:	623
Layer 2:	1840
Layer 3:	3091.8
Layer 4:	4080.4
Layer 5:	7269.1
Layer 6:	197129

J.1.3. Zandvliet and Berendrecht locks

6 September 2007

**Volumes per layer(m3)

Layer 1:	84886.1
Layer 2:	133268.7
Layer 3:	111935.5
Layer 4:	78990.9
Layer 5:	91219.7
Layer 6:	721945

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	22610.3	31805.1	33302.6	27903.7	31965.9	300541.9
Zone 2:	48959.5	87458.9	66056.8	39582.6	43944.1	421403.1

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	1089.4	3831.1	6685.7	7842.6	16228.3	152577.8
Zone 2:	2359	10534.8	13261.4	11125.1	19733.3	189233

**Total mass per layer(TDS)

Layer 1:	3448.4
Layer 2:	14365.9
Layer 3:	19947.1
Layer 4:	18967.7
Layer 5:	35961.6
Layer 6:	341810.8

19 November 2007

**Volumes per layer(m3)

Layer 1:	41910.8
Layer 2:	47823.4
Layer 3:	72991.9
Layer 4:	75976.8
Layer 5:	132109.3
Layer 6:	972448.1

**Volumes per zone(m3)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	9544.6	12418.7	17029.9	17435.6	30095.9	412736.2
Zone 2:	21242.1	28065.4	45824.5	49932.6	89123.6	559711.9

**Total mass per zone(TDS)

	Layer1	Layer2	Layer3	Layer4	Layer5	Layer6
Zone 1:	459.9	1495.9	3418.9	4900.5	15588.3	213778.6
Zone 2:	1023.5	3380.6	9199.6	14034.1	38833.3	243880.1

**Total mass per layer(TDS)

Layer 1:	1483.4
Layer 2:	4876.5
Layer 3:	12618.5
Layer 4:	18934.5
Layer 5:	54421.7
Layer 6:	457658.7

J.2 Figures

J.2.1. Kallo lock

4 September 2007

15 October 2007

J.2.2. Boudewijn and van Cauwelaert locks

4 September 2007

15 October 2007

22 November 2007

J.2.3. Zandvliet and Berendrecht locks

6 September 2007

19 November 2007