



LONG-TERM MORPHOLOGY OF THE EASTERN SCHELDT



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Appendices

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Appendix A: Grids

Appendix A1: Measurement methods of the bathymetric data

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Appendix A1: Measurement methods of the bathymetric data

In the Netherlands location of the coast and the seabed are periodically determined within the framework of the Monitoring of the Water Situation of the Country (MWTL). A distinction in monitoring is made between coastal measurements and field soundings.

The coastal measurements are carried out once a year and consist of depth measurements and height measurements. The measurements are carried out along imaginary lines perpendicular to the coast. These so-called direction lines are at a distance from one another of 200 to 250 m and stretch out about one km into the sea.

The depth measurements are carried out from ships using an automatic sounding system combined with a computerised positioning system.

The height measurements for the beach and dunes are collected with laser altimetry. The surface of the earth is scanned from an aircraft using a laser beam. The underlying terrain is recorded in three dimensions using this method. The height along the direction lines is determined from this digital height model. Before this method photogrammetry was used to determine the height. The surface of the earth was photographed from three different directions. With the use of 3D photo interpretation the height along the direction lines were determined.

Field measurements begin where coastal measurements leave off and continue to the toe of the underwater bank, what lies at the level of NAP -20 m. The measurements are carried out at multiple sections (figure A2.1). The frequency of recording of the separate sections depend on the dynamics of the area and is once a year to once in six years. The complicated seabed topography with banks and channel systems, the outer delta's and estuaries are sailed almost everywhere with a distance between direction lines of 200 m. The direction lines are aimed perpendicular to the channels axes. The shallow areas of the flats are measured by a shallow draught vessel during high tide.

The direction line measurements are converted to a grid using interpolation techniques over a defined area.

Appendix A2: Available bathymetric data

Figure A2.1: The field sounding sections

Table A2.1: Available bathymetric data.

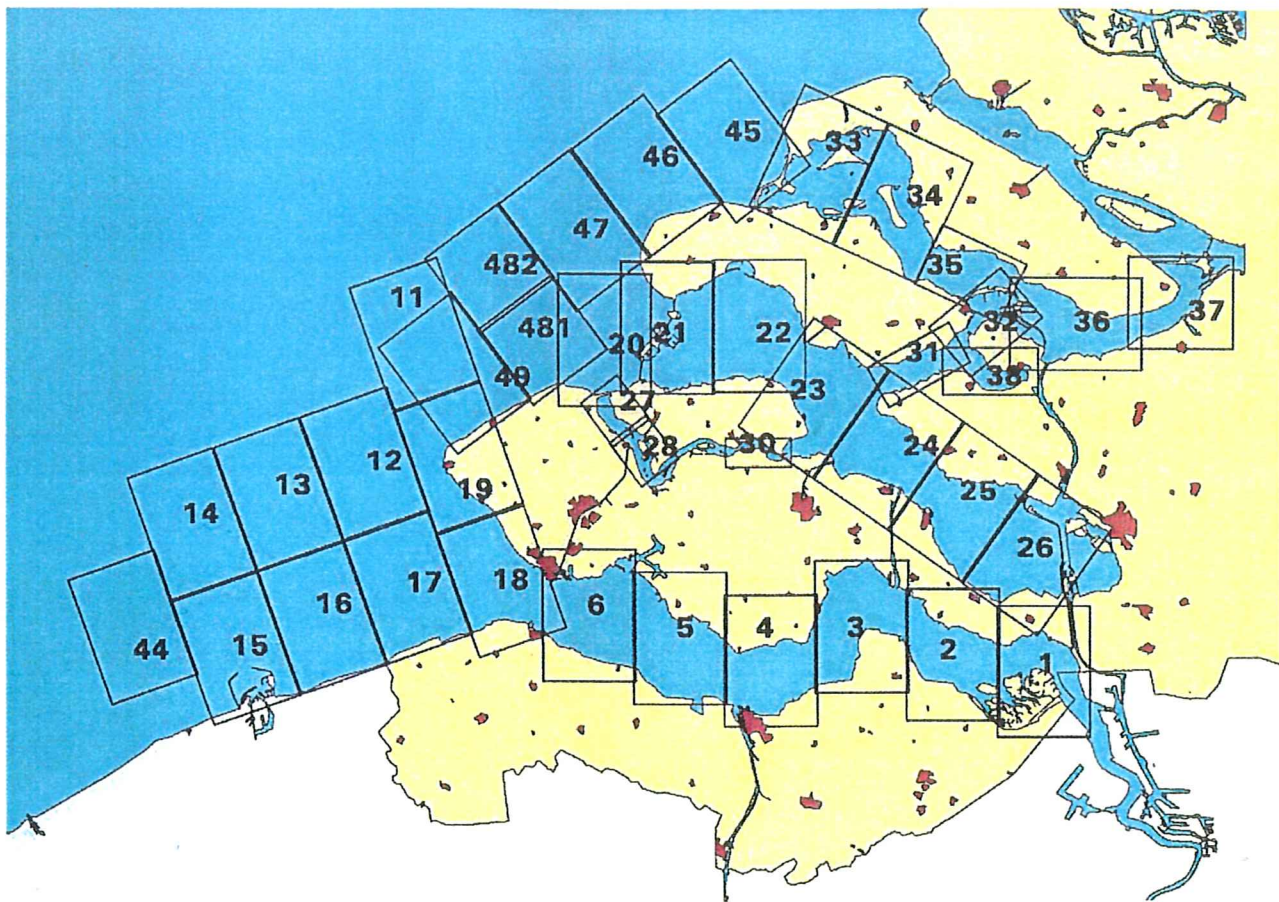


Figure A2.1: The field sounding sections

Table A2.1: Available bathymetric data with the column numbers corresponding to the section numbers indicated in figure A.2.1.

	outer delta							basin						
	46	47	481	482	49	20	21	22	23	24	25	26	31	32
1956														
1957														
1958														
1959														
1960														
1961														
1962														
1963														
1964														
1965														
1966														
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1968														
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1991														
1992														
1993														
1994														
1995														
1996														
1997														
1998														
1999														
2000														
2001														

	= not measured
	= available as map
	= available as digital grid

Appendix A3: Construction of the grids

Table A3.1: Table A3.1: Available field sounding data of the outer tidal delta of the Eastern Scheldt and the year of the section fill up.

Table A3.2: The fill of the remaining gaps in the grids.

Section s	20	21	46	47	481	482	49
1960	x	x	x	x	x	ND, digitised later	x
1964	x	x	x	x	x	x	x
1968	x	x	x	x	x	x	x
1972	x	x	x	x	x	ND, 1973	x
1976	x	x	x	x	x	x	x
1980	x	x	x	x	x	x	x
1984	x	x	x	x	x	x	NM, 1983
1988	x	x	x	NM, average of 1987 and 1989	x	x	x
1992	x	x	x	x	x	x	x
1995	x	NM, 1994	x	x	x	x	x
1998	x	NM, 1997	NM, 1995	x	x	x	x

Table A3.1: Available field sounding data of the outer tidal delta of the Eastern Scheldt (with x = available as digital grid, ND = not digitally available, NM = not measured) and the year of the section fill up.

	large gaps filled up with	edge mismatch filled up with	interpolation, search radius in m
1960	-	-	5
1964	-	-	5
1968	-	-	5
1972	section 20, average of 1968 and 1976		10
1976	-	-	5
1980	section 481, average of 1976 and 1984	-	10
1984	section 20, 1986	section 49, average of 1980 and 1988	20
1988	section 20, average of 1987 and 1989	section 47, average of 1984 and 1992	20
1992	-	-	10
1995	section 20, average of 1992 and 1998	-	5
1998	-	-	5

Table A3.2: The fill of the remaining gaps in the grids.

Construction of the grids of the outer delta and inlet

To derive grids covering the area of the outer delta, different field sounding sections and coastal measurements have to be combined. The yearly coastal measurements are carried out at the coast of Schouwen since 1966, at the coast of Walcheren since 1967 and at the coast of Noord-Beveland since 1965.

At first the field soundings and the coastal measurements for every year of interest are merged. Since the coastal measurement data of 1960 and 1964 is missing, it is substituted by the coastal measurement data of 1966 (Schouwen), 1967 (Walcheren) and 1965 (Noord-Beveland).

After merging the field soundings with the coastal measurements large gaps appear, due to missing grids of field sounding sections. The missing sections are filled up with sections of other available years (Table A3.1). Especially for this study section 482 of 1960 and 1973 has been digitised. Section 482 of 1973 was digitised to replace this section of the year 1972, because only half of this section was measured in 1972.

After filling up the section gaps, large gaps are still present. These gaps are also filled up with sections of other years. After filling up gaps with sections from other years, the small gaps remaining are filled up using interpolation techniques. (Table A3.2)

Construction of the grids of the basin

As can be seen in table A2.1 no grids are available covering the Eastern Scheldt basin before 1986. After 1986 digital data is available, it is possible to make a covering grid for the years 1986, 1987 and 1989 and also for 1993-1995. These grids do not cover the entire basin, because no measurements are done above NAP +0 m. These grids are usable to calculate the volume of the basin below NAP +0 m.

Another source of bathymetry data is the input of sea bottoms in computer assimilations. The influence of the Delta Works to the hydrodynamics of the Eastern Scheldt was determined with the use of computer assimilations. Bathymetric profiles of 1968 and 1983 were used in these computer models and are still available at RIKZ in Middelburg. The bathymetry of 1968 is available as a text file with x-y-z-values. This can be interpolated and transformed into a usable grid. The remaining gaps are also filled up by interpolation. The bathymetry of 1983 is available as grid usable in GIS.

A grid of the Eastern Scheldt is also used in a computer model to predict the wave run up. This grid is available as ASCII-file and can be easily transformed into a grid. This grid contains the soundings of the years 1993, 1994 and 1995 (table A2.1). The gaps at the locations of the shallow areas were filled up with data from 1991 and 1992. The remaining gaps are filled up with data of 1983. The process of constructing this grid is described by van der Vegt (1998).

Grids with bathymetric data covering the whole basin area is thus only available for the years 1968, 1983 and 1994. Grids with data below NAP +0 m is available for the years 1986, 1987 and 1989.

Appendix A4: Error

Measurement error

Several factors can cause errors. The measurement process is affected by: the squat of the ship, the determination of the co-ordinates of the ship location and the correction of measurements with reference to tide and NAP. These are all systematic errors. Random errors can be caused by human mistakes such as reading and writing errors. The standard deviation caused by all these factors can vary between 17 and 23 cm (Louters et al, 1996). The digitising and interpolation procedure also introduces errors.

Maps however are composed of many measurements. In this way errors are averaged. In this study the error is estimated at 10 cm. This error was used in previous studies (Tönis et al, 2001)

Appendix B: Tidal volume

Appendix B1: Measurement and calculation methods of the tidal volumes

Appendix B2: Tidal volumes

Appendix B3: Storage locations of the tidal volume data

Appendix B4: Errors

Appendix B1: Measurement and calculation methods of the tidal volume

The tidal volume is calculated by multiplying the velocity of a channel with the cross-sectional area of the channel. To get a more accurate result the velocities should be measured simultaneously at several different locations and depths in the channel and multiplied by a representative part of the cross-sectional area.

The current velocities in a channel are measured with an “Ott-molen” and the current direction with an Elmar-flowdirection meter. The gathered data was entered into a computer and saved on a tape on the ship. The Ott-molen was already used in 1960 and is still used for velocity measurements.

Since 1996 the tidal volume is measured by sailing direction lines and meanwhile measuring the velocities using an Acoustic Doppler Current Profiler (ADCP). The location of the ship is determined using the DGPS-location system.

Table B2.1: The ebb and flood volumes of the separate channels and the total inlet in 10^8 m^3 .

	Schaar		Hammen		Roompot		Geul		Total inlet	
date	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood
01-01-33										
01-01-59										
01-06-65	4.68	5.16 (Schaar & Hammen)			6.91	6.44	0.94	1.57	12.56	13.20
02-06-65	4.93	5.35 (Schaar & Hammen)			6.94	6.48	1.08	1.57	12.87	13.26
27-06-67									11.85	10.73
28-06-67									10.97	9.52
27-08-68	2.14	1.80	2.38	2.60	6.32	6.07	0.55	0.78	11.38	11.25
28-08-68	2.15	1.85	2.42	2.77	6.43	5.80	0.55	0.94	11.55	11.36
10-09-69	1.98	1.91	2.44	2.66	5.80	5.99	0.54	0.86	10.57	11.39
11-09-69	1.95	1.84	2.26	2.61	5.80	5.83	0.54	0.87	10.49	11.1
06-10-71		2.39		3.11		6.98		0.69		13.14
07-10-71	2.54	2.55	2.84	3.10	6.98	7.17	0.35	0.89	12.56	13.67
08-10-71	2.59	2.36	2.77	2.88						
09-08-72	2.75	2.35	2.89	2.80	6.93	6.66			12.52	11.82
10-09-72	2.86	2.36	2.93	2.86	6.98	6.85			12.72	12.12
04-09-75	2.78	2.37	2.59	2.48	7.11	7.03			12.48	11.88
05-09-75	2.87	2.52	2.70	2.71	7.50	7.67			13.07	12.90
19-07-78			2.81	2.94						
25-07-78	2.90	2.58								
26-07-78					7.68	7.63			12.85	12.83
28-07-78			2.27	2.62						
01-08-78	2.81	2.38								
02-08-78					7.70	7.81				
19-07-83	2.61	2.57	2.22	2.53	6.70	7.14			11.52	12.24
26-07-83	2.82	2.57	2.37	2.38	6.99	6.98			12.19	11.92
01-08-83	2.44	2.13	2.26	2.22	6.20	6.15			10.90	10.50
29-12-83	2.58	2.53	1.88	1.76	6.29	6.65			10.76	10.94
31-03-84			2.25	2.62						
31-03-84			2.45	2.42						
11-04-84	2.17	2.26								
27-09-84					7.95	7.61				
07-02-85					8.09	8.15				
20-06-85	2.53									
24-06-85		1.76								
23-07-85	2.99	2.31								
26-07-85			1.97	2.19						
14-09-85			1.44							
27-09-85		1.53								
10-10-85	1.58									
21-11-85	1.35	1.71								
27-11-85					7.58					
10-12-85			1.81							
26-04-86					5.69					
22-05-86			2.30							
22-05-86			2.45							
26-05-86		1.97								
21-09-86					5.74	6.61				
22-09-87				1.71						
23-09-87					6.22	5.56				
17-02-88			2.05							
18-02-88	1.85									
22-02-88				1.98						
23-02-88					5.98					
14-04-88		2.06								
04-07-88						4.83				
24-04-90			1.68							
25-04-90				2.20						
26-04-90		1.68								
24-08-95					5.53	4.85				
07-09-95			1.90	1.85						
08-09-95	1.97	2.10								
13-12-96	2.00									
19-12-96		1.60								
21-12-99			1.88							
22-12-99					6.20	5.19				
20-03-00				2.24						
22-03-00		2.18								
23-03-00	2.00									

Table B2.2: The tidal volumes of the separate channels and the total inlet in 10^8 m^3 .

date	Schaar	Hammen	Roompot	Geul	Total inlet
01-01-33					22.00
01-01-59					22.70
01-06-65	9.84		13.35	2.51	25.76
02-06-65	10.27		13.42	2.65	26.13
27-06-67					22.58
28-06-67					20.49
27-08-68	3.94	4.97	12.38	1.33	22.63
28-08-68	3.99	5.19	12.23	1.49	22.91
10-09-69	3.89	5.10	11.79	1.40	21.96
11-09-69	3.79	4.87	11.63	1.41	21.60
06-10-71					
07-10-71	5.08	5.94	14.16	1.23	26.22
08-10-71	4.95	5.65			
09-08-72	5.10	5.69	13.59		24.34
10-09-72	5.22	5.79	13.83		24.84
04-09-75	5.15	5.08	14.14		24.36
05-09-75	5.39	5.42	15.17		25.97
19-07-78		5.75			
25-07-78	5.48				
26-07-78			15.31		25.69
28-07-78		4.90			
01-08-78	5.18				
02-08-78			15.51		
19-07-83	5.18	4.75	13.83		23.76
26-07-83	5.39	4.75	13.97		24.10
01-08-83	4.57	4.47	12.35		21.39
29-12-83	5.11	3.65	12.94		21.70
31-03-84		4.88			
31-03-84		4.87			
11-04-84	4.42				
27-09-84			15.56		
07-02-85			16.24		
20-06-85					
24-06-85					
23-07-85	5.30				
26-07-85		4.15			
14-09-85					
27-09-85					
10-10-85					
21-11-85	3.06				
27-11-85					
10-12-85					
26-04-86					
22-05-86					
22-05-86					
26-05-86					
21-09-86			12.35		
22-09-87					
23-09-87			11.79		
17-02-88					
18-02-88					
22-02-88	3.90	4.03	10.81		18.74
23-02-88					
14-04-88					
04-07-88					
24-04-90					
25-04-90					
26-04-90					
24-08-95			10.38		
07-09-95		3.75			18.19
08-09-95	4.07				
13-12-96					
19-12-96					
21-12-99					
22-12-99					
20-03-00	4.18	4.12	11.38		19.68
22-03-00					
23-03-00					

Appendix B3: Storage locations of the tidal volume data

Addresses of the storage locations

Table B3.1: The report and archive numbers, titles and storage locations of the tidal volume data.

Appendix A4: Errors

Table B4.1: The used ebb and flood volumes in 10^8 m^3 to calculate the errors.

date	Schaar		Hammen		Roompot		Geul		Total inlet	
	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood
01-06-65					6.91	6.44	0.94	1.57	12.56	13.20
02-06-65					6.94	6.48	1.08	1.57	12.87	13.26
27-06-67									11.85	10.73
28-06-67									10.97	9.52
27-08-68	2.14	1.80	2.38	2.60	6.32	6.07	0.55	0.78	11.38	11.25
28-08-68	2.15	1.85	2.42	2.77	6.43	5.80	0.55	0.94	11.55	11.36
10-09-69	1.98	1.91	2.44	2.66	5.80	5.99	0.54	0.86	10.57	11.39
11-09-69	1.95	1.84	2.26	2.61	5.80	5.83	0.54	0.87	10.49	11.11
6-10-71		2.39		3.11		6.98		0.69		13.14
7-10-71	2.54	2.55	2.84	3.10	6.89	7.17	0.35	0.89	12.56	13.67
8-10-71	2.59	2.36	2.77	2.88						
4-09-75	2.78	2.37	2.59	2.48	7.11	7.03			12.48	11.88
5-09-75	2.87	2.52	2.70	2.71	7.50	7.67			13.07	12.90

Table B4.2: The errors of the ebb and flood volumes.

date	Schaar		Hammen		Roompot		Geul		Total inlet	
	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood
01-06-65					0%	1%	13%	0%	2%	0%
27-06-67									7%	11%
27-08-68	0%	2%	2%	6%	2%	4%	1%	17%	1%	1%
10-09-69	2%	4%	7%	2%	0%	3%	0%	1%	1%	2%
6-10-71		6%		1%		3%		22%		4%
7-10-71		7%		7%						
4-09-75	3%	6%	4%	8%	5%	8%			5%	8%

Table B4.3: The used tidal volumes in 10^8 m^3 to calculate the errors.

date	Schaar	Hammen	Roompot	Geul	Total inlet
01-06-65			13.35	2.51	25.76
02-06-65			13.42	2.65	26.13
27-06-67					22.58
28-06-67					20.49
27-08-68	3.94	4.97	12.38	1.33	22.63
28-08-68	3.99	5.19	12.23	1.49	22.91
10-09-69	3.89	5.10	11.79	1.40	21.96
11-09-69	3.79	4.87	11.63	1.41	21.60
07-10-71	5.08	5.94	14.07	1.23	26.22
08-10-71	4.95	5.65			
04-09-75	5.15	5.08	14.14		24.36
05-09-75	5.39	5.42	15.17		25.97

Table B4.4: The errors of the tidal volumes.

year	Schaar	Hammen	Roompot	Geul	Total inlet
1965			0%	5%	1%
1967					9%
1968	1%	4%	1%	11%	1%
1969	3%	5%	1%	1%	2%
1971	3%	5%			
1971	4%	10%			
1975	4%	6%	7%		6%

Appendix C: Tidal amplitude and tidal prism

- C1: The mean high and mean low water levels of the measurement locations**
- C2: The mean high and mean low water levels of the calculation sections**
- C3: The method used to calculate the mean high and mean low water levels of the calculation sections**
- C4: The calculated tidal prisms**
- C5: The errors**

Description

With the tidal amplitudes (MHW and MLW levels) of the measurement locations shown in appendix A1 the MHW and MLW levels of the calculation sections (figure **) are calculated. The combination of the measurement data to calculate the MHW and MLW levels of the calculation sections are shown in appendix A2. The calculated MHW and MLW levels of the calculation sections are shown in appendix A3. With these water levels the volume of the grid of 1968 between MHW and MLW is calculated using GIS. By adding up the calculated volumes of the sections the tidal prism is calculated. The results can be seen in appendix A4. The maximum error of the tidal prism is estimated with the estimated error of the grids. The maximum absolute error is calculated by multiplying the surface area at NAP +2 m with the error of the grids of 10 cm. The relative error is calculated by dividing the absolute error by the calculated grid volumes between MHW and MLW. The calculated errors can be seen in appendix A5.

Appendix C1: The mean high and mean low water levels of the measurement locations

- Figure C1.1: The water level measurement locations in the basin area.
- Figure C1.2: The MHW and MLW level of Roompot binnen, Burgsluis and Colijnsplaat.
- Figure C1.3: The tidal range of Roompot binnen, Burgsluis and Colijnsplaat.
- Table C1.1: The MHW and MLW levels and the tidal range of Roompot binnen, Burgsluis and Colijnsplaat.
- Figure C1.4: The MHW and MLW level of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis.
- Figure C1.5: The tidal range of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis.
- Table C1.2: The MHW and MLW levels and the tidal range of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis.
- Figure C1.6: The MHW and MLW level of Zierikzee, Krammer, Bruinisse and Krammersluizen.
- Figure C1.7: The tidal range of Zierikzee, Krammer, Bruinisse and Krammersluizen.
- Table C1.3: The MHW and MLW levels and the tidal range of Zierikzee, Krammer, Bruinisse and Krammersluizen.
- Figure C1.8: The MHW and MLW level of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid.
- Figure C1.9: The tidal range of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid.
- Table C1.4: The MHW and MLW levels and the tidal range of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid.
- Figure C1.10: The MHW and MLW level of Stavenisse.
- Figure C1.11: The tidal range of Stavenisse.
- Table C1.5: The MHW and MLW levels and the tidal range of Stavenisse.
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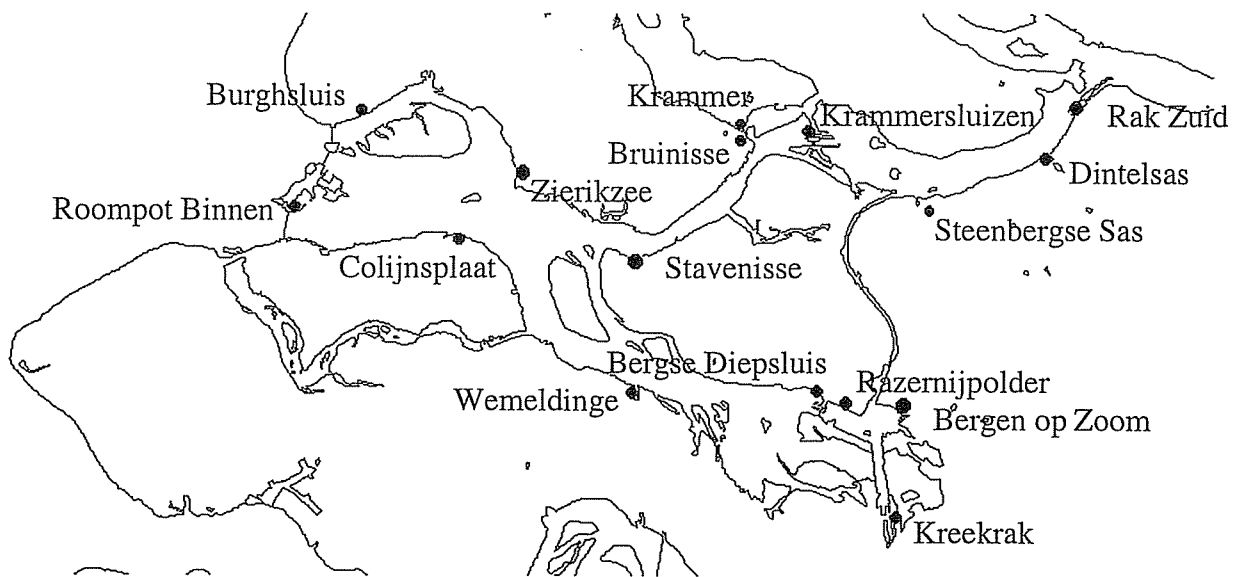


Figure C1.1: The water level measurement locations in the basin area.

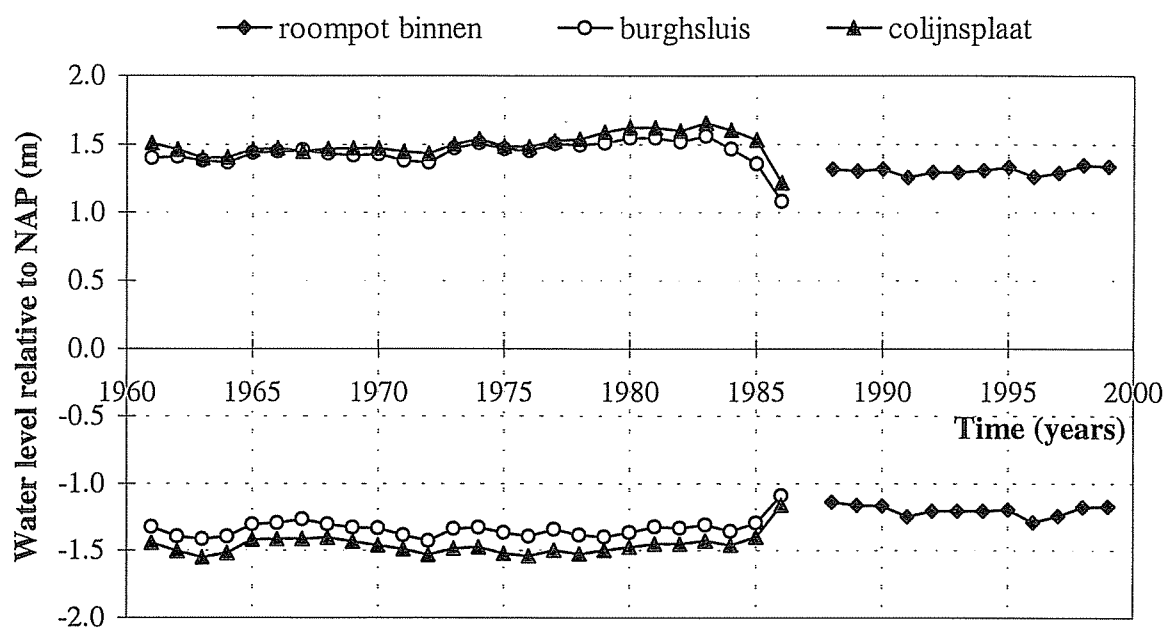


Figure C1.2: The MHW and MLW level of Roompot binnen, Burgsluis and Colijnsplaat.

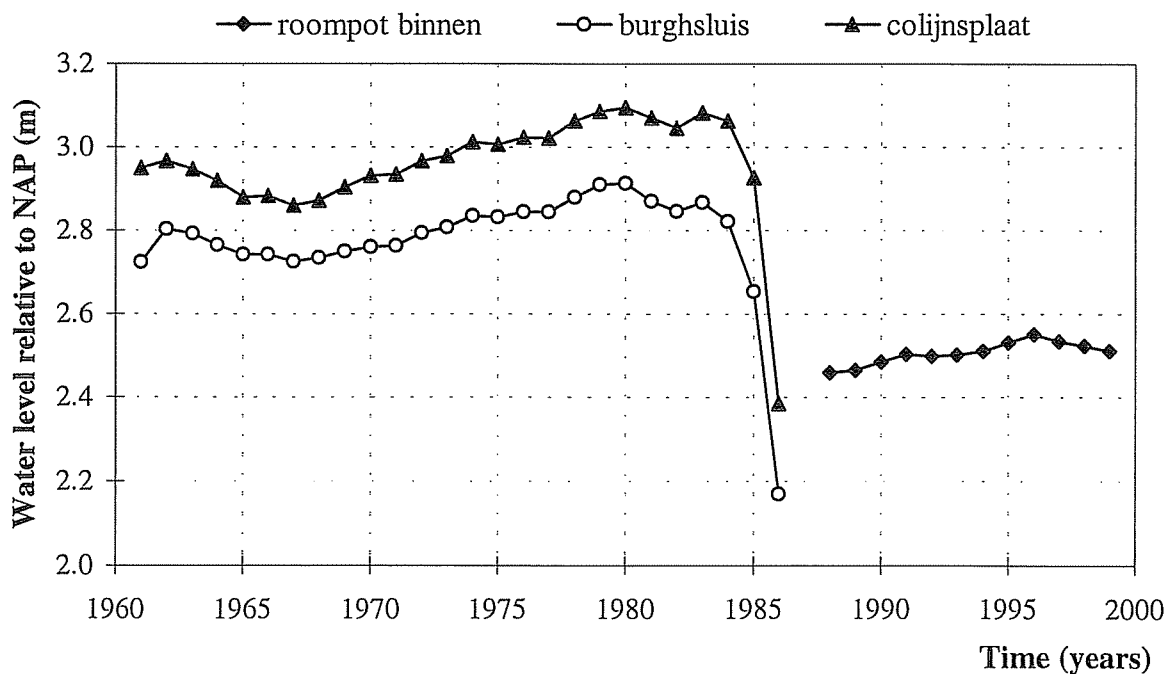


Figure C1.3: The tidal range of Roompot binnen, Burgsluis and Colijnsplaat.

Table C1.1: The MHW and MLW levels and the tidal range of Roompot binnen, Burgsluis and Colijnsplaat in meters relative to NAP.

	roompot binnen			burghsluis			colijnsplaat		
	MHW	MLW	tidal range	MHW	MLW	tidal range	MHW	MLW	tidal range
1961				1.40	-1.32	2.72	1.51	-1.44	2.95
1962				1.41	-1.39	2.80	1.46	-1.50	2.97
1963				1.38	-1.41	2.79	1.40	-1.55	2.95
1964				1.37	-1.40	2.76	1.40	-1.52	2.92
1965				1.44	-1.30	2.74	1.46	-1.42	2.88
1966				1.45	-1.30	2.74	1.47	-1.41	2.88
1967				1.46	-1.27	2.72	1.45	-1.41	2.86
1968				1.43	-1.30	2.73	1.47	-1.41	2.87
1969				1.42	-1.33	2.75	1.47	-1.43	2.90
1970				1.43	-1.33	2.76	1.47	-1.46	2.93
1971				1.38	-1.38	2.76	1.45	-1.49	2.93
1972				1.37	-1.43	2.79	1.43	-1.53	2.97
1973				1.47	-1.34	2.81	1.50	-1.48	2.98
1974				1.51	-1.33	2.84	1.54	-1.48	3.01
1975				1.46	-1.37	2.83	1.49	-1.52	3.01
1976				1.45	-1.39	2.84	1.48	-1.54	3.02
1977				1.50	-1.34	2.84	1.52	-1.50	3.02
1978				1.49	-1.39	2.88	1.54	-1.53	3.06
1979				1.51	-1.40	2.91	1.59	-1.50	3.09
1980				1.55	-1.37	2.91	1.62	-1.48	3.10
1981				1.55	-1.32	2.87	1.62	-1.45	3.07
1982				1.52	-1.33	2.85	1.60	-1.45	3.05
1983				1.56	-1.31	2.87	1.65	-1.43	3.08
1984				1.47	-1.35	2.82	1.60	-1.46	3.06
1985				1.36	-1.30	2.65	1.53	-1.40	2.93
1986				1.08	-1.09	2.17	1.22	-1.16	2.39
1987				measurement location removed			measurement location removed		
1988	1.32	-1.14	2.46						
1989	1.30	-1.16	2.46						
1990	1.32	-1.17	2.48						
1991	1.26	-1.25	2.50						
1992	1.29	-1.20	2.50						
1993	1.30	-1.21	2.50						
1994	1.31	-1.20	2.51						
1995	1.33	-1.20	2.53						
1996	1.26	-1.29	2.55						
1997	1.29	-1.24	2.53						
1998	1.35	-1.18	2.52						
1999	1.34	-1.17	2.51						

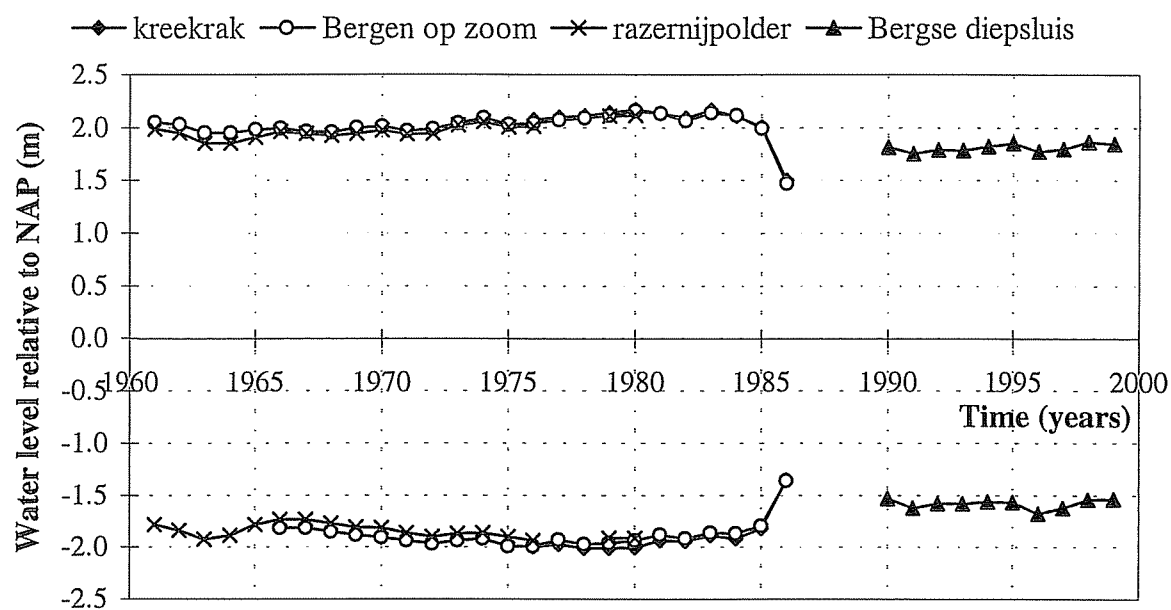


Figure C1.4: The MHW and MLW level of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis.

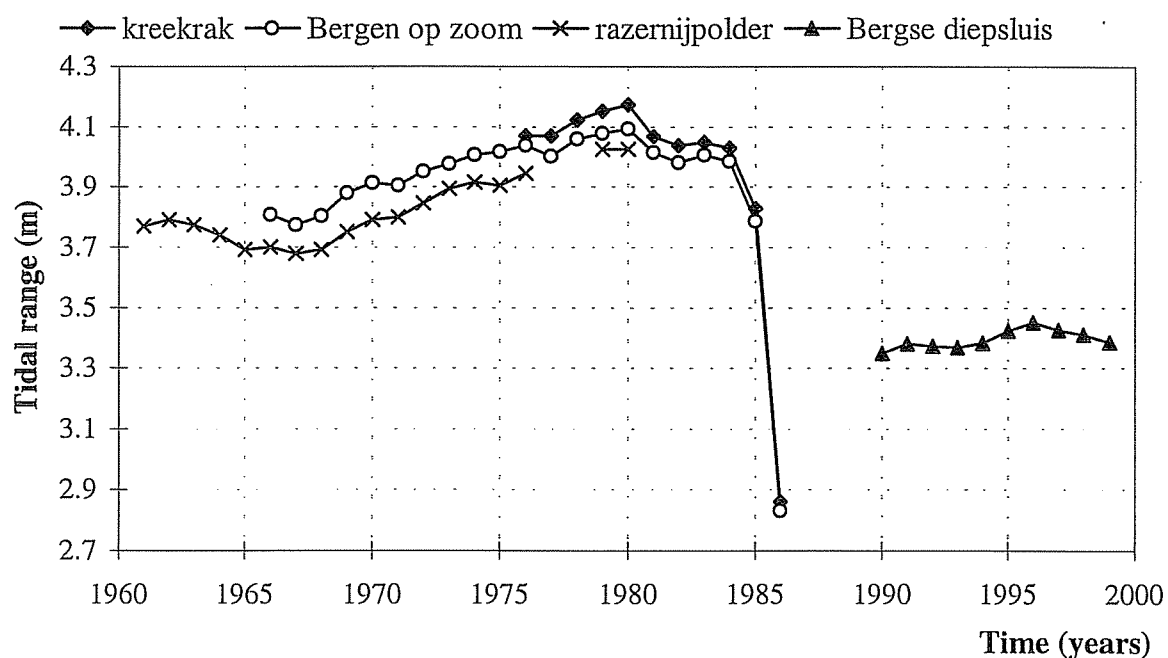


Figure C1.5: The tidal range of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis.

Table C1.2: The MHW and MLW levels and the tidal range of Kreekrak, Bergen op Zoom, Razernijpolder and Bergse Diepsluis in meters relative to NAP.

	Kreekrak			Bergen op zoom			Razernijpolder			Bergse diepsluis		
	MHW	MLW	tidal range	MHW	MLW	tidal range	MHW	MLW	tidal range	MHW	MLW	tidal range
1961				2.05			1.99	-1.78	3.77			
1962				2.03			1.95	-1.84	3.79			
1963				1.95			1.85	-1.92	3.77			
1964				1.95			1.85	-1.89	3.74			
1965				1.98			1.91	-1.78	3.69			
1966				1.99	-1.81	3.81	1.96	-1.74	3.70			
1967				1.96	-1.81	3.77	1.94	-1.73	3.68			
1968				1.95	-1.85	3.80	1.92	-1.77	3.69			
1969				2.00	-1.88	3.88	1.94	-1.81	3.75			
1970				2.01	-1.90	3.91	1.98	-1.82	3.79			
1971				1.97	-1.94	3.91	1.94	-1.86	3.80			
1972				1.98	-1.97	3.95	1.94	-1.90	3.85			
1973				2.04	-1.94	3.98	2.02	-1.87	3.89			
1974				2.09	-1.92	4.01	2.05	-1.86	3.92			
1975				2.03	-1.99	4.02	2.00	-1.90	3.91			
1976	2.07	-2.00	4.07	2.04	-2.00	4.04	2.01	-1.93	3.94			
1977	2.10	-1.97	4.07	2.07	-1.93	4.00						
1978	2.11	-2.01	4.12	2.09	-1.97	4.06						
1979	2.14	-2.01	4.15	2.12	-1.96	4.08	2.11	-1.92	4.03			
1980	2.17	-2.00	4.17	2.16	-1.93	4.09	2.12	-1.91	4.03			
1981	2.13	-1.94	4.07	2.13	-1.88	4.02	measurement location removed					
1982	2.09	-1.94	4.04	2.06	-1.92	3.98						
1983	2.16	-1.89	4.05	2.14	-1.87	4.01						
1984	2.11	-1.92	4.03	2.12	-1.87	3.99						
1985	2.01	-1.82	3.83	1.99	-1.80	3.79						
1986	1.50	-1.36	2.86	1.47	-1.36	2.83						
1987	DNM placed			Oesterdam finished								
1988												
1989												
1990										1.82	-1.53	3.35
1991										1.75	-1.63	3.38
1992										1.79	-1.58	3.37
1993										1.79	-1.58	3.37
1994										1.82	-1.56	3.38
1995										1.85	-1.57	3.42
1996										1.77	-1.68	3.45
1997										1.80	-1.63	3.42
1998										1.87	-1.55	3.41
1999										1.85	-1.54	3.39

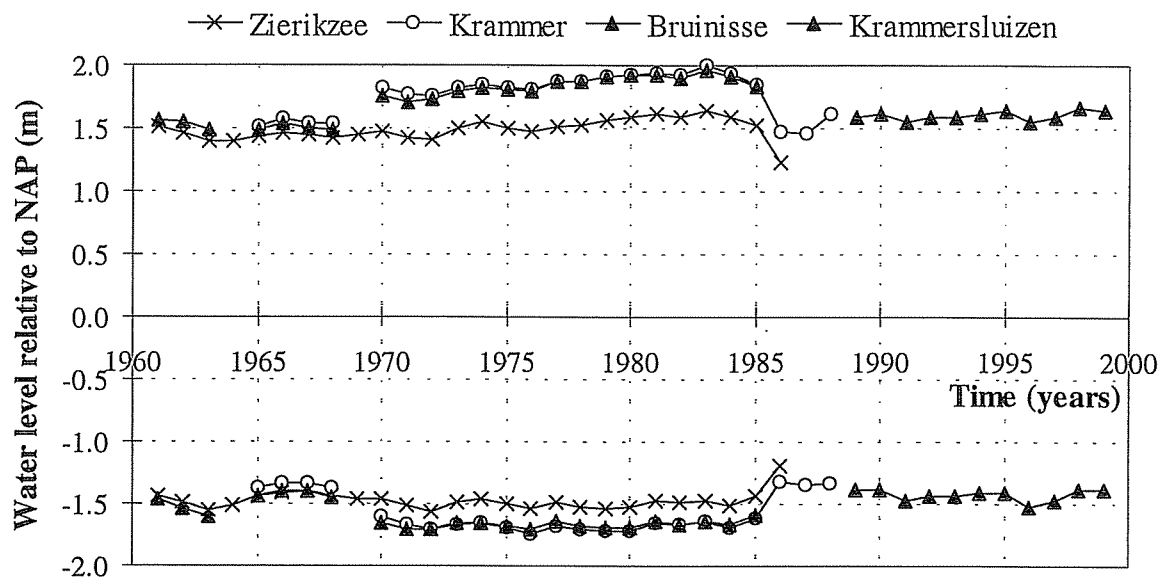


Figure C1.6: The MHW and MLW level of Zierikzee, Krammer, Bruinisse and Krammersluizen.

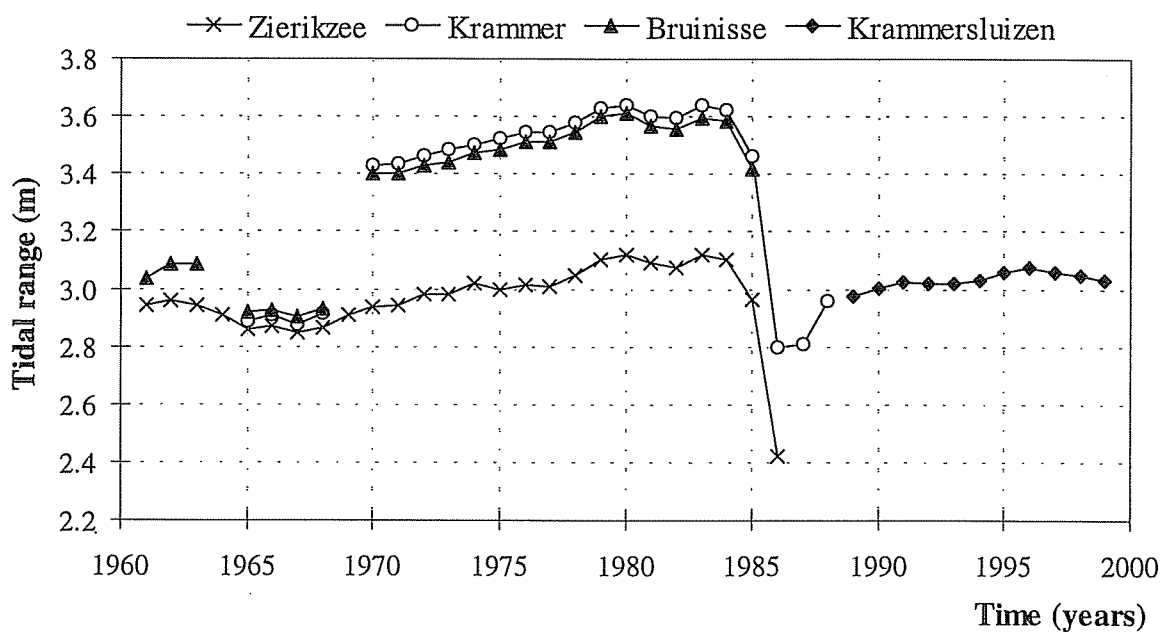


Figure C1.7: The tidal range of Zierikzee, Krammer, Bruinisse and Krammersluizen.

Table C1.3: The MHW and MLW levels and the tidal range of Zierikzee, Krammer, Bruinisse and Krammersluizen in meters relative to NAP.

	Zierikzee			Krammer			Bruinisse			Krammersluizen		
	MHW	MLW	tidal range	MHW	MLW	tidal range	MHW	MLW	tidal range	MHW	MLW	tidal range
1961	1.51	-1.43	2.94				1.57	-1.47	3.03			
1962	1.47	-1.49	2.96				1.55	-1.54	3.09			
1963	1.40	-1.55	2.94				1.48	-1.60	3.09			
1964	1.39	-1.51	2.91									
1965	1.43	-1.43	2.86	1.51	-1.37	2.89	1.49	-1.43	2.92			
1966	1.46	-1.41	2.87	1.57	-1.34	2.91	1.53	-1.39	2.93			
1967	1.45	-1.40	2.85	1.54	-1.33	2.87	1.50	-1.40	2.90			
1968	1.43	-1.44	2.86	1.54	-1.37	2.91	1.49	-1.45	2.93			
1969	1.45	-1.46	2.91									
1970	1.47	-1.47	2.94	1.83	-1.60	3.43	1.75	-1.65	3.40			
1971	1.42	-1.52	2.94	1.77	-1.66	3.43	1.70	-1.70	3.40			
1972	1.41	-1.57	2.98	1.76	-1.71	3.46	1.73	-1.70	3.43			
1973	1.50	-1.48	2.98	1.82	-1.66	3.48	1.79	-1.65	3.44			
1974	1.55	-1.47	3.02	1.85	-1.65	3.50	1.82	-1.65	3.47			
1975	1.50	-1.50	3.00	1.83	-1.70	3.52	1.81	-1.68	3.49			
1976	1.47	-1.54	3.01	1.80	-1.74	3.55	1.80	-1.71	3.51			
1977	1.52	-1.49	3.01	1.87	-1.67	3.55	1.87	-1.64	3.51			
1978	1.52	-1.53	3.05	1.87	-1.71	3.58	1.87	-1.68	3.55			
1979	1.57	-1.54	3.10	1.91	-1.72	3.63	1.90	-1.70	3.60			
1980	1.60	-1.53	3.12	1.93	-1.71	3.64	1.92	-1.69	3.61			
1981	1.62	-1.47	3.09	1.94	-1.66	3.60	1.93	-1.64	3.57			
1982	1.59	-1.49	3.08	1.93	-1.67	3.59	1.89	-1.66	3.56			
1983	1.65	-1.47	3.12	2.00	-1.64	3.64	1.96	-1.64	3.59			
1984	1.60	-1.51	3.10	1.93	-1.69	3.62	1.92	-1.67	3.58			
1985	1.52	-1.44	2.96	1.84	-1.62	3.46	1.84	-1.59	3.42			
1986	1.23	-1.19	2.42	1.48	-1.32	2.80	measurement location removed					
1987	measurement location removed			1.47	-1.34	2.81						
1988				1.62	-1.34	2.96						
1989				measurement location removed						1.59	-1.38	2.98
1990										1.62	-1.39	3.00
1991										1.55	-1.48	3.02
1992										1.59	-1.43	3.02
1993										1.59	-1.43	3.02
1994										1.62	-1.41	3.03
1995										1.65	-1.41	3.06
1996										1.56	-1.52	3.08
1997										1.59	-1.47	3.06
1998										1.66	-1.39	3.05
1999										1.65	-1.38	3.03

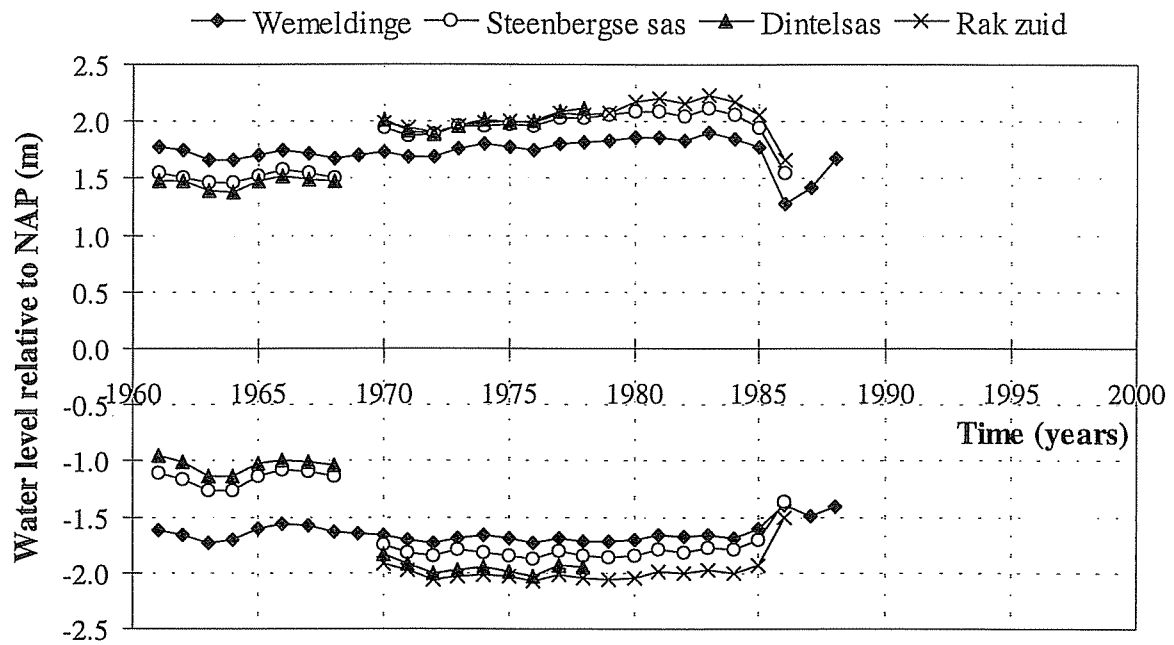


Figure C1.8: The MHW and MLW level of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid.

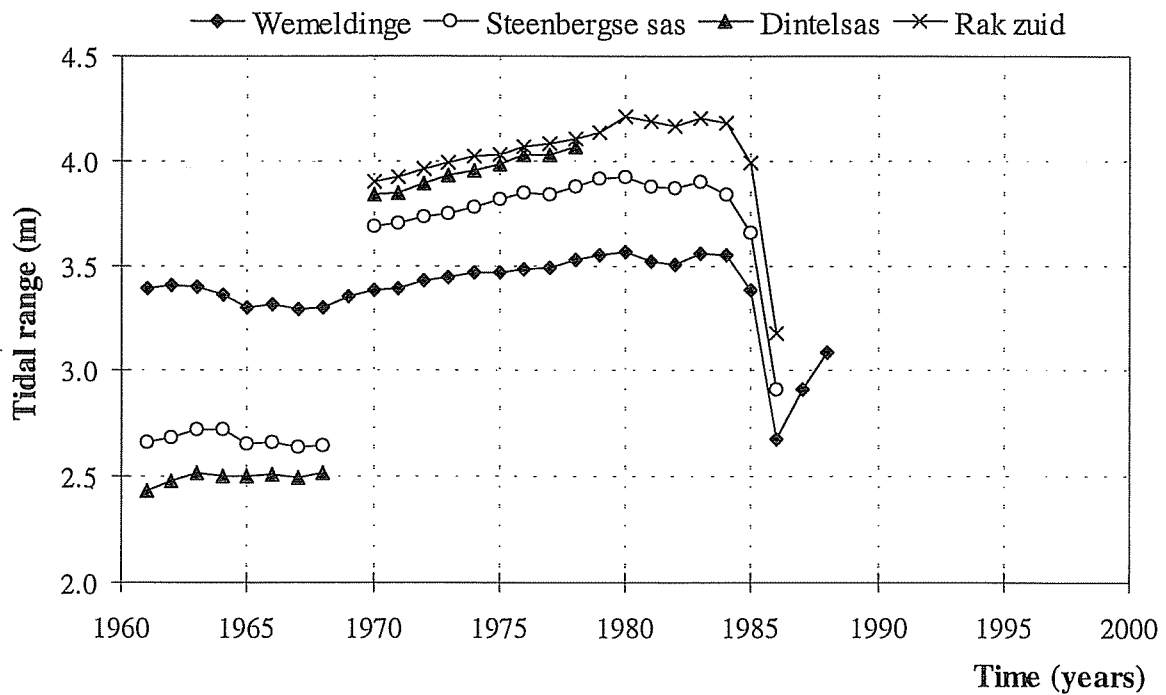


Figure C1.9: The tidal range of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid.

Table C1.4: The MHW and MLW levels and the tidal range of Wemeldinge, Steenbergse Sas, Dintelsas and Rak Zuid in meters relative to NAP.

[illegible]

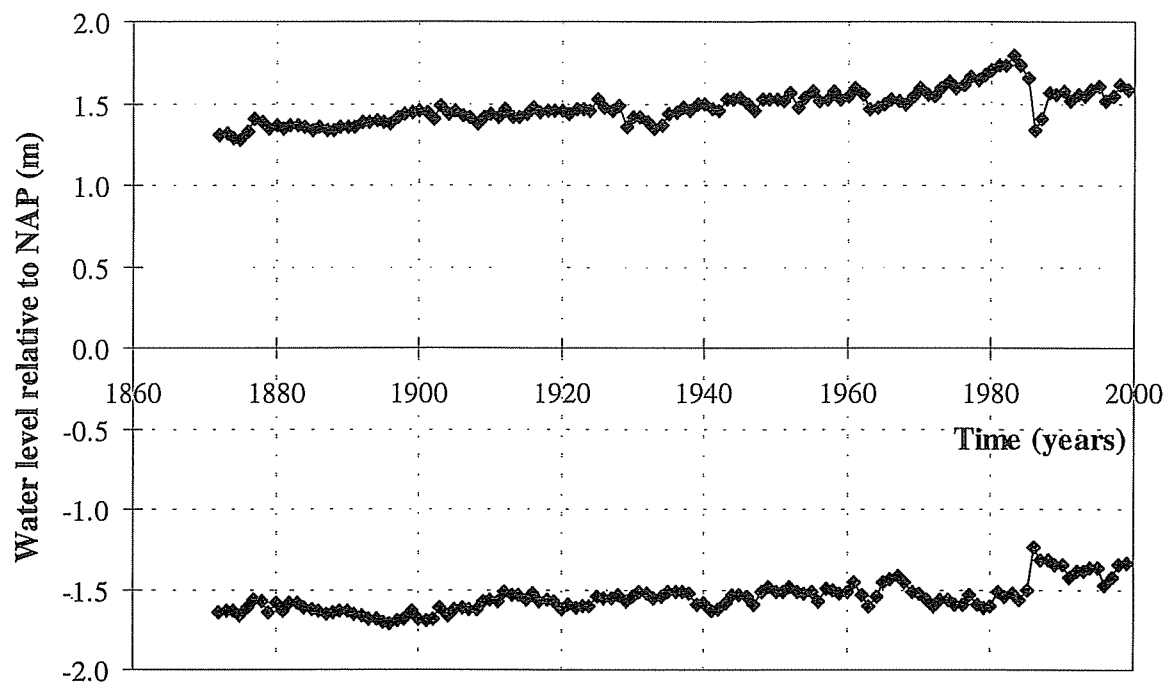


Figure C1.10: The MHW and MLW level of Stavenisse.

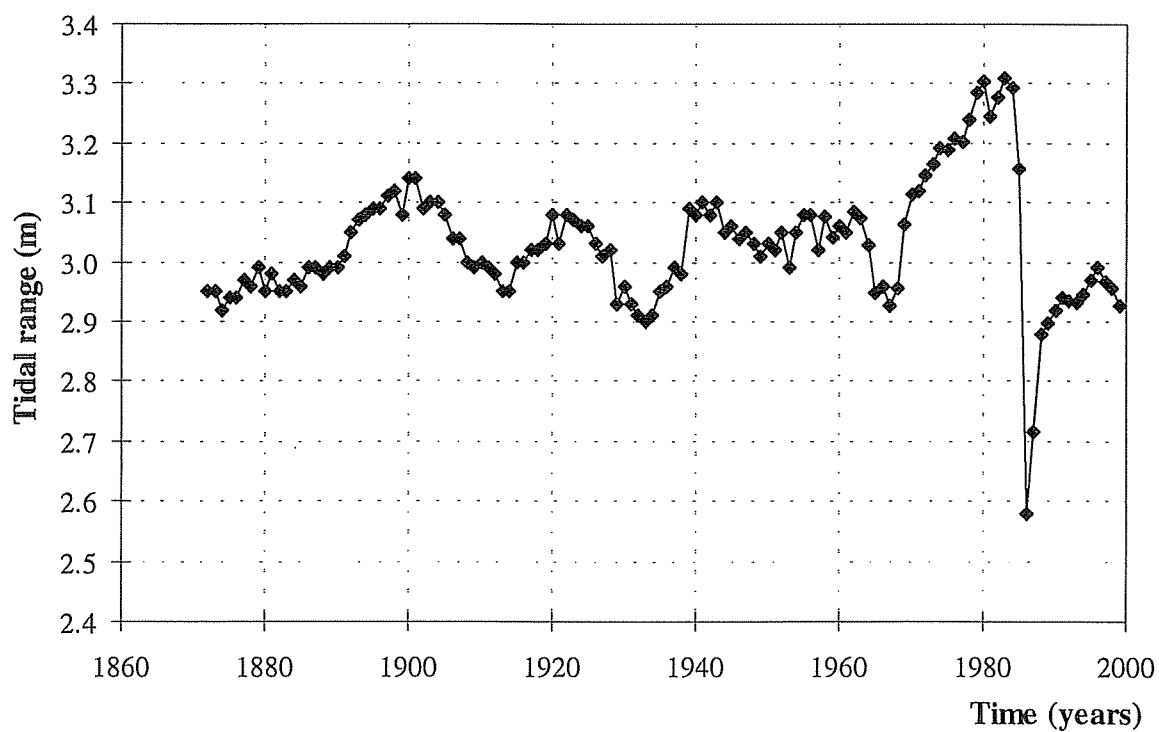


Figure C1.11: The tidal range of Stavenisse.

Table C1.5: The MHW and MLW levels and the tidal range of Stavenisse in meters relative to NAP.

Stavenisse				Stavenisse				Stavenisse			
	MHW	MLW	tidal range		MHW	MLW	tidal range		MHW	MLW	tidal range
1872	1.31	-1.64	2.95	1915	1.44	-1.56	3.00	1958	1.57	-1.51	3.08
1873	1.32	-1.63	2.95	1916	1.48	-1.52	3.00	1959	1.52	-1.52	3.04
1874	1.29	-1.63	2.92	1917	1.45	-1.57	3.02	1960	1.54	-1.52	3.06
1875	1.28	-1.66	2.94	1918	1.46	-1.56	3.02	1961	1.59	-1.46	3.05
1876	1.33	-1.61	2.94	1919	1.46	-1.57	3.03	1962	1.55	-1.53	3.08
1877	1.41	-1.56	2.97	1920	1.46	-1.62	3.08	1963	1.47	-1.61	3.08
1878	1.39	-1.57	2.96	1921	1.44	-1.59	3.03	1964	1.48	-1.55	3.03
1879	1.35	-1.64	2.99	1922	1.47	-1.61	3.08	1965	1.49	-1.46	2.95
1880	1.37	-1.58	2.95	1923	1.47	-1.60	3.07	1966	1.53	-1.43	2.96
1881	1.35	-1.63	2.98	1924	1.46	-1.60	3.06	1967	1.52	-1.41	2.93
1882	1.37	-1.58	2.95	1925	1.52	-1.54	3.06	1968	1.50	-1.46	2.96
1883	1.37	-1.58	2.95	1926	1.48	-1.55	3.03	1969	1.55	-1.52	3.06
1884	1.36	-1.61	2.97	1927	1.46	-1.55	3.01	1970	1.59	-1.52	3.12
1885	1.34	-1.62	2.96	1928	1.49	-1.53	3.02	1971	1.55	-1.57	3.12
1886	1.36	-1.63	2.99	1929	1.36	-1.57	2.93	1972	1.54	-1.61	3.15
1887	1.34	-1.65	2.99	1930	1.42	-1.54	2.96	1973	1.60	-1.57	3.17
1888	1.34	-1.64	2.98	1931	1.42	-1.51	2.93	1974	1.63	-1.56	3.19
1889	1.36	-1.63	2.99	1932	1.39	-1.52	2.91	1975	1.60	-1.59	3.19
1890	1.36	-1.63	2.99	1933	1.35	-1.55	2.90	1976	1.61	-1.60	3.21
1891	1.36	-1.65	3.01	1934	1.37	-1.54	2.91	1977	1.66	-1.54	3.20
1892	1.39	-1.66	3.05	1935	1.44	-1.51	2.95	1978	1.64	-1.60	3.24
1893	1.39	-1.68	3.07	1936	1.45	-1.51	2.96	1979	1.67	-1.61	3.29
1894	1.40	-1.68	3.08	1937	1.48	-1.51	2.99	1980	1.70	-1.60	3.30
1895	1.39	-1.70	3.09	1938	1.46	-1.52	2.98	1981	1.74	-1.51	3.25
1896	1.38	-1.71	3.09	1939	1.50	-1.59	3.09	1982	1.73	-1.55	3.28
1897	1.42	-1.69	3.11	1940	1.50	-1.58	3.08	1983	1.79	-1.52	3.31
1898	1.44	-1.68	3.12	1941	1.47	-1.63	3.10	1984	1.73	-1.56	3.29
1899	1.45	-1.63	3.08	1942	1.46	-1.62	3.08	1985	1.66	-1.50	3.16
1900	1.46	-1.68	3.14	1943	1.52	-1.58	3.10	1986	1.34	-1.24	2.58
1901	1.45	-1.69	3.14	1944	1.52	-1.53	3.05	1987	1.40	-1.31	2.72
1902	1.41	-1.68	3.09	1945	1.53	-1.53	3.06	1988	1.57	-1.31	2.88
1903	1.49	-1.61	3.10	1946	1.50	-1.54	3.04	1989	1.55	-1.34	2.90
1904	1.44	-1.66	3.10	1947	1.46	-1.59	3.05	1990	1.58	-1.34	2.92
1905	1.46	-1.62	3.08	1948	1.52	-1.51	3.03	1991	1.51	-1.43	2.94
1906	1.43	-1.61	3.04	1949	1.52	-1.49	3.01	1992	1.55	-1.38	2.93
1907	1.42	-1.62	3.04	1950	1.52	-1.51	3.03	1993	1.55	-1.39	2.93
1908	1.38	-1.62	3.00	1951	1.51	-1.51	3.02	1994	1.58	-1.36	2.95
1909	1.42	-1.57	2.99	1952	1.56	-1.49	3.05	1995	1.61	-1.36	2.97
1910	1.44	-1.56	3.00	1953	1.48	-1.51	2.99	1996	1.52	-1.47	2.99
1911	1.42	-1.57	2.99	1954	1.53	-1.52	3.05	1997	1.55	-1.42	2.97
1912	1.47	-1.51	2.98	1955	1.57	-1.51	3.08	1998	1.61	-1.34	2.96
1913	1.42	-1.53	2.95	1956	1.51	-1.57	3.08	1999	1.59	-1.34	2.93
1914	1.42	-1.53	2.95	1957	1.53	-1.49	3.02				

Appendix C2: The calculation methods of the MHW and MLW levels of the calculation section.

Figure C2.1: The water level measurement locations in the basin area and the calculation sections.

The calculation methods of the MHW and MLW levels of the calculation sections.

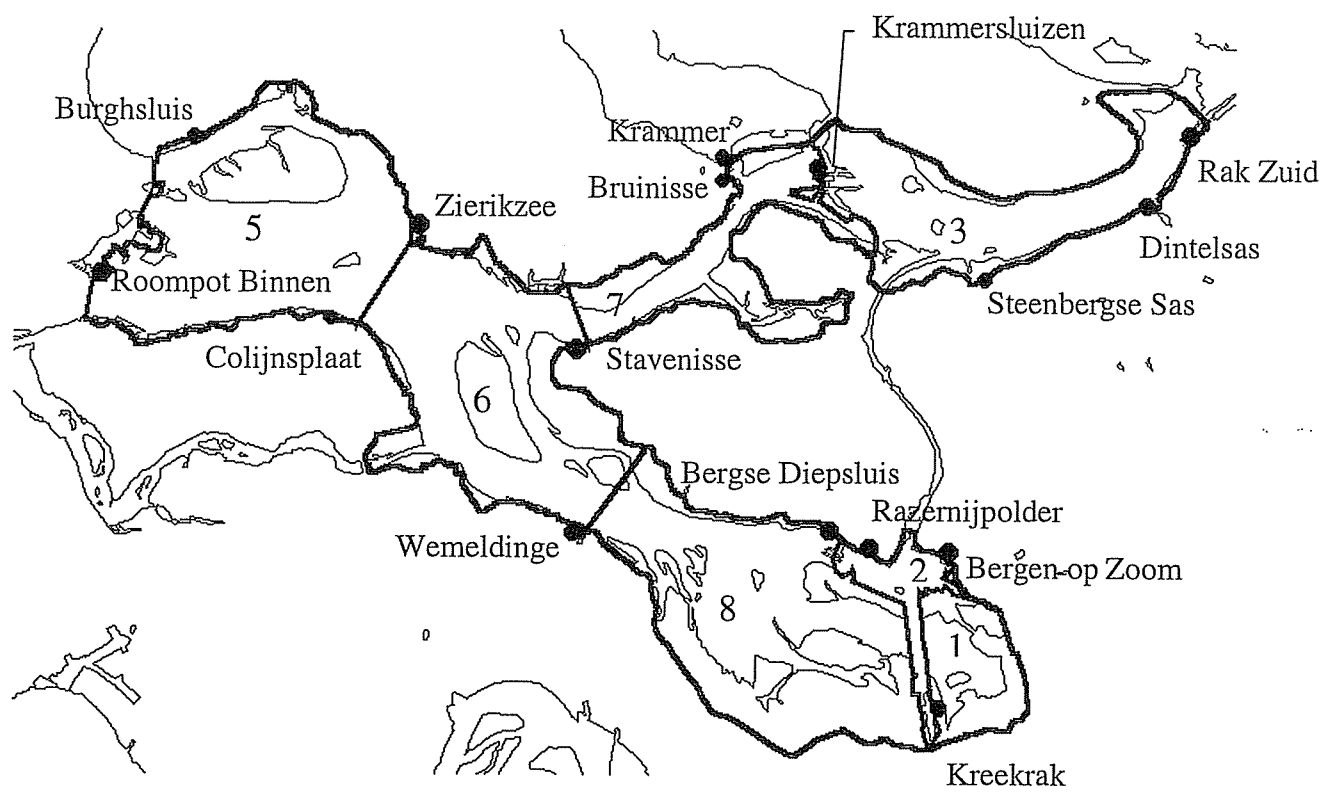


Figure C2.1: The water level measurement locations and the calculation sections.

Appendix C3: The MHW and MLW levels of the calculation section.

Figure C2.1: The MHW levels of the calculation sections.

Table C2.1: The MHW levels of the calculation sections.

Figure C2.2: The MLW levels of the calculation sections.

Table C2.2: The MLW levels of the calculation sections.

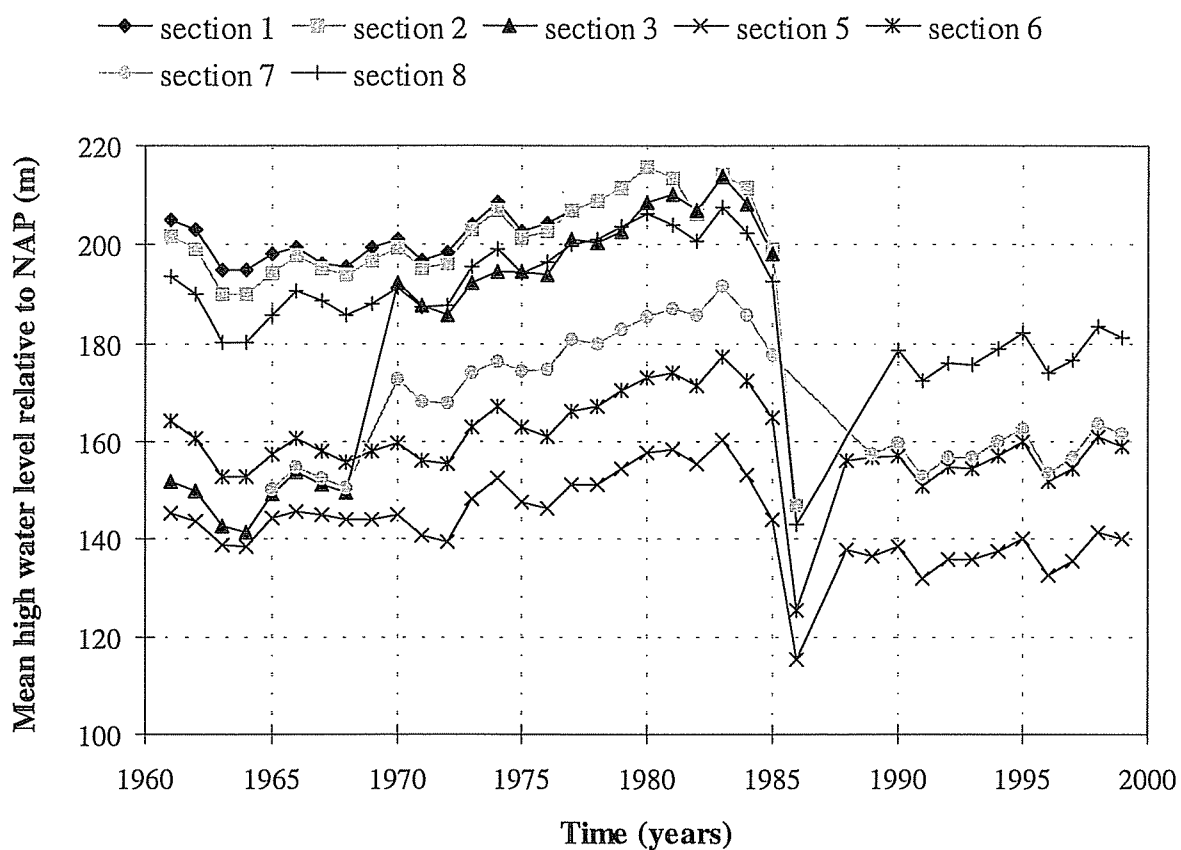


Figure C2.1: The MHW levels of the calculation sections.

Table C2.1: The MHW levels of the calculation sections in meters relative to NAP.

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8
1961	2.05	2.02	1.52	1.45	1.64		1.94
1962	2.03	1.99	1.50	1.44	1.61		1.90
1963	1.95	1.90	1.43	1.39	1.53		1.80
1964	1.95	1.90	1.41	1.38	1.53		1.80
1965	1.98	1.94	1.49	1.44	1.57	1.50	1.86
1966	1.99	1.98	1.54	1.46	1.61	1.55	1.91
1967	1.96	1.95	1.51	1.45	1.58	1.53	1.89
1968	1.95	1.94	1.50	1.44	1.56	1.51	1.86
1969	2.00	1.97		1.44	1.58		1.88
1970	2.01	1.99	1.92	1.45	1.60	1.73	1.91
1971	1.97	1.95	1.88	1.41	1.56	1.68	1.88
1972	1.98	1.96	1.86	1.39	1.55	1.68	1.88
1973	2.04	2.03	1.92	1.48	1.63	1.74	1.96
1974	2.09	2.07	1.95	1.53	1.67	1.76	1.99
1975	2.03	2.01	1.94	1.48	1.63	1.75	1.94
1976	2.04	2.03	1.94	1.46	1.61	1.75	1.96
1977	2.07	2.07	2.01	1.51	1.66	1.81	2.00
1978	2.09	2.09	2.00	1.51	1.67	1.80	2.01
1979	2.12	2.12	2.03	1.54	1.70	1.83	2.04
1980	2.16	2.16	2.09	1.58	1.73	1.85	2.06
1981	2.13	2.13	2.10	1.58	1.74	1.87	2.04
1982	2.06	2.06	2.07	1.55	1.71	1.86	2.01
1983	2.14	2.14	2.14	1.60	1.77	1.92	2.08
1984	2.12	2.12	2.08	1.53	1.73	1.86	2.02
1985	1.99	1.99	1.98	1.44	1.65	1.78	1.93
1986	1.47	1.47		1.15	1.25		1.43
1987							
1988				1.38	1.56		
1989				1.36		1.57	
1990				1.38	1.57	1.60	1.79
1991				1.32	1.51	1.53	1.72
1992				1.36	1.55	1.57	1.76
1993				1.36	1.54	1.57	1.76
1994				1.38	1.57	1.60	1.79
1995				1.40	1.60	1.63	1.82
1996				1.33	1.52	1.54	1.74
1997				1.35	1.55	1.57	1.77
1998				1.41	1.61	1.64	1.83
1999				1.40	1.59	1.62	1.81

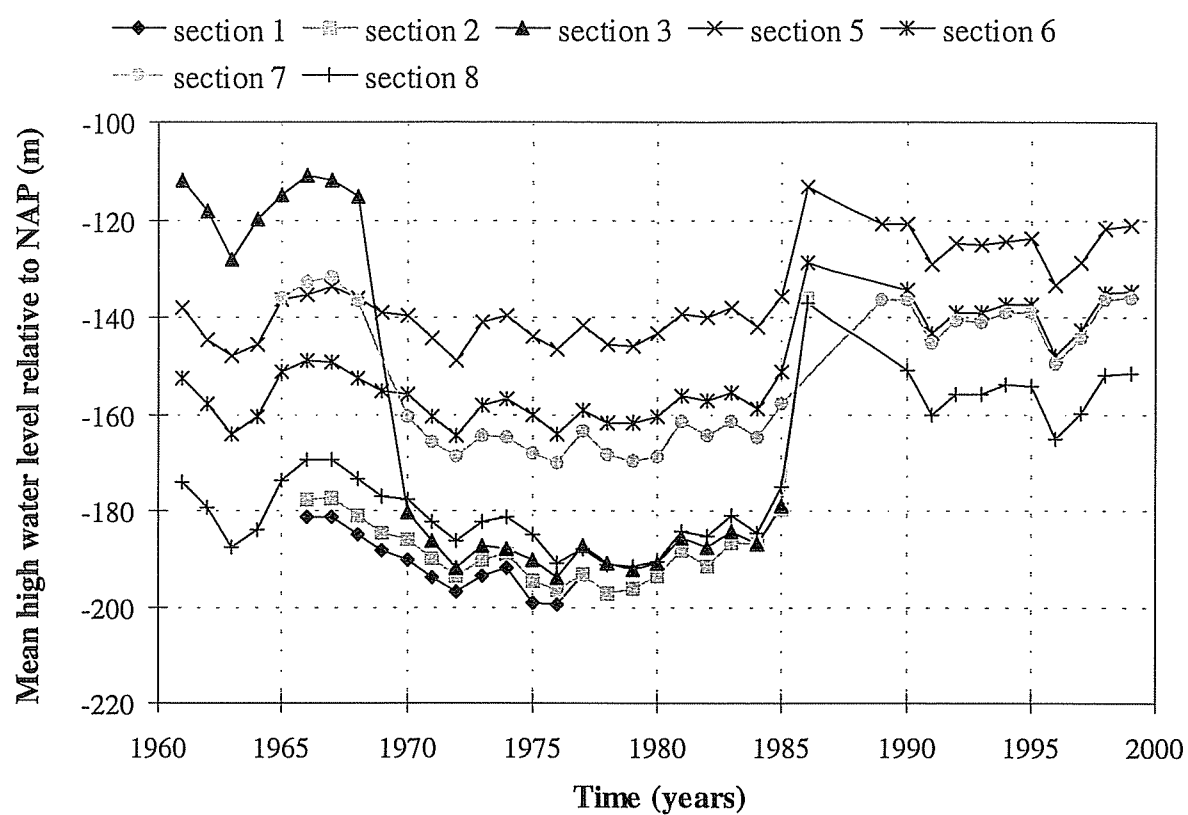


Figure C2.2: The MLW levels of the calculation sections.

Table C2.2: The MLW levels of the calculation sections in meters relative to NAP.

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8
1961			-1.12	-1.38	-1.52		-1.74
1962			-1.18	-1.45	-1.58		-1.79
1963			-1.28	-1.48	-1.64		-1.88
1964			-1.20	-1.46	-1.61		-1.84
1965			-1.15	-1.36	-1.51	-1.36	-1.74
1966	-1.81	-1.78	-1.11	-1.35	-1.49	-1.33	-1.70
1967	-1.81	-1.77	-1.12	-1.34	-1.49	-1.32	-1.69
1968	-1.85	-1.81	-1.15	-1.36	-1.52	-1.37	-1.73
1969	-1.88	-1.85		-1.39	-1.55		-1.77
1970	-1.90	-1.86	-1.80	-1.40	-1.56	-1.61	-1.78
1971	-1.94	-1.90	-1.86	-1.44	-1.60	-1.66	-1.82
1972	-1.97	-1.94	-1.92	-1.49	-1.64	-1.69	-1.86
1973	-1.94	-1.90	-1.87	-1.41	-1.58	-1.64	-1.82
1974	-1.92	-1.89	-1.88	-1.40	-1.57	-1.65	-1.81
1975	-1.99	-1.95	-1.90	-1.44	-1.60	-1.68	-1.85
1976	-2.00	-1.96	-1.94	-1.47	-1.64	-1.70	-1.91
1977	-1.93	-1.93	-1.87	-1.42	-1.59	-1.63	-1.88
1978	-1.97	-1.97	-1.91	-1.46	-1.62	-1.68	-1.91
1979	-1.96	-1.96	-1.92	-1.46	-1.62	-1.70	-1.91
1980	-1.93	-1.93	-1.91	-1.43	-1.60	-1.69	-1.91
1981	-1.88	-1.88	-1.86	-1.39	-1.56	-1.62	-1.84
1982	-1.92	-1.92	-1.88	-1.40	-1.57	-1.64	-1.85
1983	-1.87	-1.87	-1.84	-1.38	-1.56	-1.61	-1.81
1984	-1.87	-1.87	-1.87	-1.42	-1.59	-1.65	-1.85
1985	-1.80	-1.80	-1.79	-1.36	-1.51	-1.58	-1.75
1986	-1.36	-1.36		-1.13	-1.29		-1.37
1987							
1988				-1.18	-1.32		
1989				-1.21		-1.36	
1990				-1.21	-1.35	-1.36	-1.51
1991				-1.29	-1.43	-1.45	-1.60
1992				-1.25	-1.39	-1.41	-1.56
1993				-1.25	-1.39	-1.41	-1.56
1994				-1.24	-1.37	-1.39	-1.54
1995				-1.24	-1.37	-1.39	-1.54
1996				-1.33	-1.48	-1.50	-1.65
1997				-1.29	-1.43	-1.44	-1.60
1998				-1.22	-1.35	-1.36	-1.52
1999				-1.21	-1.35	-1.36	-1.51

Appendix C4: The volumes between MHW and MLW of the calculation section and the tidal prism.

Figure C4.1: The volume between MHW and MLW of the calculation sections.

Figure C4.2: The tidal prism.

Table C4.1: The volume between MHW and MLW of the calculation sections and the tidal prism.

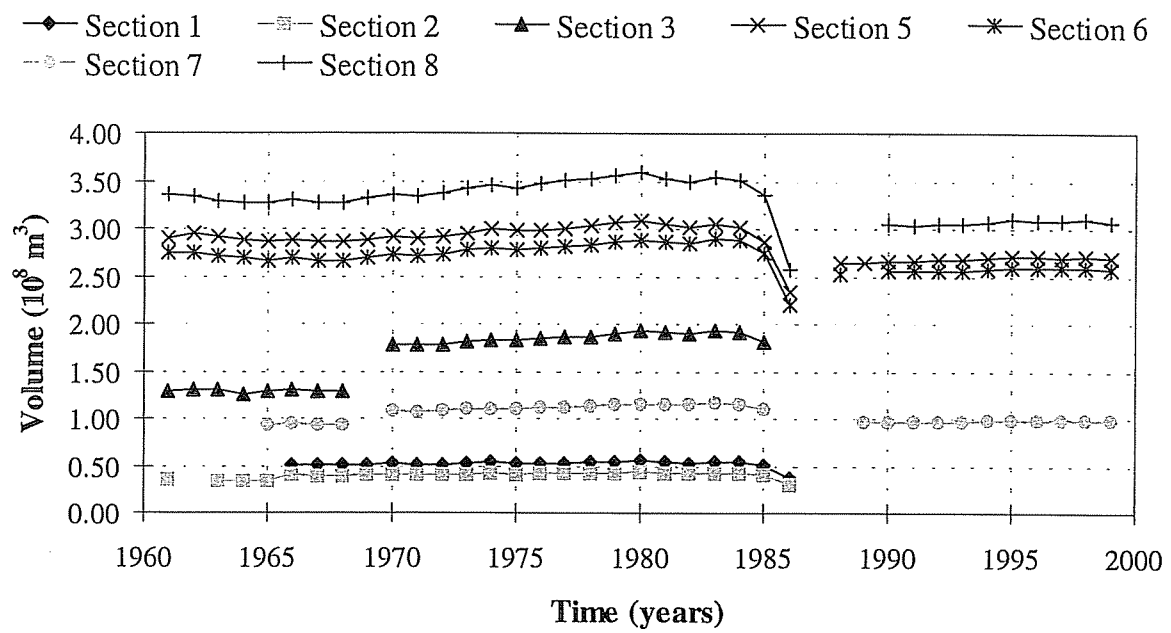


Figure C4.1: The volume between MHW and MLW of the calculation sections.

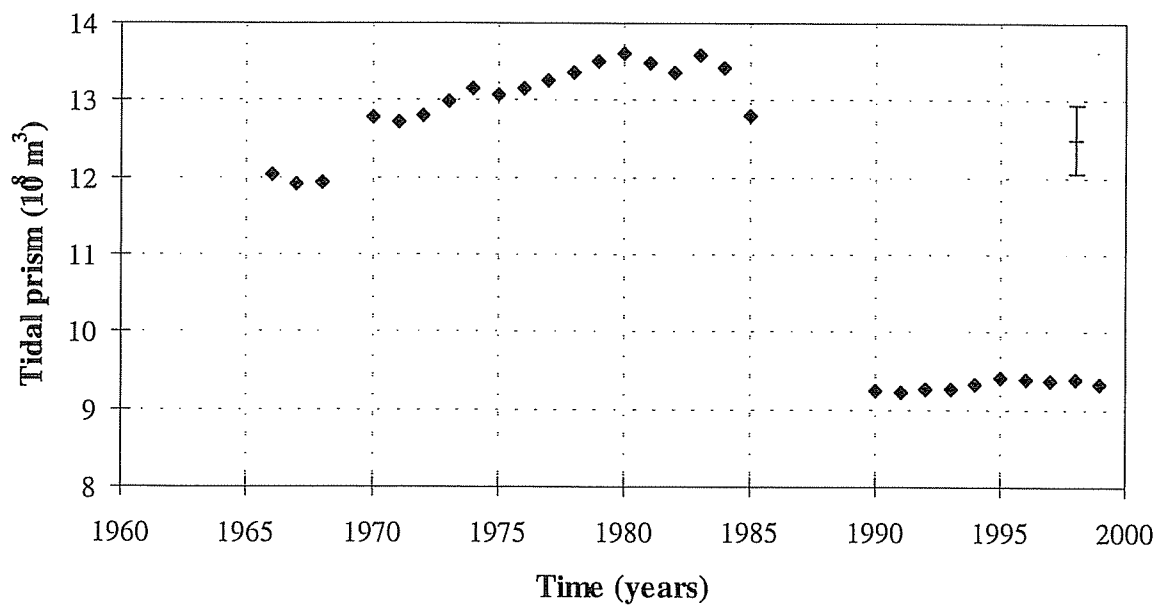


Figure C4.2: The tidal prism.

Table C4.1: The grid volumes between MHW and MLW of the calculation sections in 10^8 m^3 and the tidal prism in 10^8 m^3 .

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8	Tidal prism
1961		0.35	1.30	2.89	2.74		3.36	
1962			1.31	2.94	2.75		3.35	
1963		0.34	1.30	2.91	2.71		3.29	
1964		0.34	1.26	2.88	2.69		3.27	
1965		0.34	1.29	2.86	2.67	0.93	3.27	
1966	0.51	0.40	1.30	2.88	2.69	0.94	3.30	12.03
1967	0.50	0.40	1.29	2.86	2.66	0.93	3.27	11.92
1968	0.50	0.40	1.29	2.86	2.66	0.93	3.27	11.92
1969	0.52	0.40		2.89	2.70		3.31	
1970	0.52	0.41	1.78	2.91	2.73	1.08	3.35	12.78
1971	0.51	0.40	1.78	2.90	2.72	1.07	3.34	12.72
1972	0.51	0.41	1.79	2.92	2.73	1.08	3.37	12.81
1973	0.53	0.41	1.81	2.95	2.77	1.09	3.43	12.99
1974	0.54	0.42	1.83	3.00	2.80	1.11	3.45	13.15
1975	0.52	0.41	1.83	2.98	2.78	1.11	3.42	13.06
1976	0.53	0.42	1.84	2.98	2.79	1.11	3.48	13.15
1977	0.53	0.42	1.86	2.99	2.81	1.12	3.51	13.25
1978	0.54	0.43	1.87	3.03	2.84	1.13	3.53	13.36
1979	0.54	0.43	1.89	3.06	2.87	1.15	3.57	13.51
1980	0.55	0.43	1.93	3.08	2.88	1.15	3.59	13.62
1981	0.54	0.43	1.92	3.04	2.87	1.15	3.52	13.47
1982	0.53	0.42	1.91	3.02	2.84	1.15	3.50	13.36
1983	0.55	0.43	1.94	3.06	2.89	1.17	3.55	13.58
1984	0.54	0.43	1.91	3.02	2.88	1.15	3.51	13.43
1985	0.51	0.40	1.82	2.86	2.74	1.10	3.35	12.79
1986	0.38	0.31		2.34	2.21		2.58	
1987								
1988				2.64	2.53			
1989				2.64	8.77	0.96		
1990				2.67	2.56	0.97	3.05	9.25
1991				2.67	2.55	0.96	3.04	9.22
1992				2.68	2.57	0.97	3.05	9.27
1993				2.68	2.56	0.97	3.05	9.26
1994				2.69	2.57	0.98	3.07	9.32
1995				2.71	2.60	0.99	3.10	9.41
1996				2.72	2.60	0.98	3.09	9.38
1997				2.70	2.59	0.98	3.09	9.36
1998				2.71	2.60	0.99	3.10	9.40
1999				2.69	2.58	0.98	3.07	9.32

Appendix C5: Errors

Table C5.1: The surface areas of the calculation sections and the total basin at NAP +2 m.

Table C5.2: The absolute error of the calculation sections and the tidal prism.

Table C5.3: The relative errors of the calculation sections and the tidal prism.

Table C5.1: The surface areas of the calculation sections and the total basin at NAP +2 m in 10^6 m^2 .

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8	Total basin	Sections 5, 6, 7, and 8
1968	22.8	13.7	62.9	111.2	97.7	40.3	104.5	453.0	353.6

Table C5.2: The absolute error of the calculation sections and the tidal prisms in 10^6 m^3 .

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8	Tidal prism	Sections 5, 6, 7, and 8
Absolute error	2.3	1.4	6.3	11.1	9.8	4.0	10.4	45.3	35.4

Table C5.3: The relative errors of the calculation sections and the tidal prism.

	Section 1	Section 2	Section 3	Section 5	Section 6	Section 7	Section 8	Tidal prism
1961		3.92%	4.85%	3.84%	3.56%		3.11%	
1962		3.94%	4.82%	3.78%	3.55%		3.12%	
1963		4.05%	4.84%	3.82%	3.60%		3.17%	
1964		4.06%	4.99%	3.86%	3.62%		3.19%	
1965		4.04%	4.88%	3.88%	3.66%	4.34%	3.19%	
1966	4.46%	3.42%	4.82%	3.86%	3.63%	4.27%	3.16%	3.77%
1967	4.52%	3.46%	4.88%	3.89%	3.67%	4.32%	3.19%	3.80%
1968	4.53%	3.46%	4.86%	3.88%	3.67%	4.31%	3.20%	3.80%
1969	4.42%	3.41%		3.85%	3.61%		3.15%	
1970	4.40%	3.38%	3.52%	3.82%	3.58%	3.72%	3.12%	3.54%
1971	4.47%	3.41%	3.53%	3.83%	3.59%	3.76%	3.12%	3.56%
1972	4.44%	3.38%	3.52%	3.81%	3.57%	3.73%	3.10%	3.54%
1973	4.33%	3.32%	3.48%	3.77%	3.52%	3.68%	3.05%	3.49%
1974	4.25%	3.28%	3.44%	3.71%	3.48%	3.64%	3.02%	3.45%
1975	4.34%	3.32%	3.44%	3.73%	3.51%	3.64%	3.05%	3.47%
1976	4.32%	3.30%	3.41%	3.73%	3.50%	3.62%	3.00%	3.44%
1977	4.28%	3.26%	3.37%	3.71%	3.48%	3.58%	2.98%	3.42%
1978	4.24%	3.23%	3.36%	3.67%	3.44%	3.56%	2.96%	3.39%
1979	4.18%	3.20%	3.32%	3.63%	3.41%	3.51%	2.93%	
1980	4.12%	3.17%	3.26%	3.61%	3.39%	3.49%	2.91%	3.33%
1981	4.18%	3.22%	3.28%	3.65%	3.41%	3.51%	2.96%	3.36%
1982	4.30%	3.28%	3.30%	3.68%	3.44%	3.51%	2.99%	3.39%
1983	4.17%	3.21%	3.25%	3.63%	3.37%	3.45%	2.94%	3.34%
1984	4.20%	3.23%	3.30%	3.69%	3.40%	3.50%	2.98%	3.37%
1985	4.46%	3.40%	3.46%	3.88%	3.56%	3.66%	3.11%	3.54%
1986	6.02%	4.45%		4.75%	4.43%		4.05%	
1987								
1988				4.21%	3.86%			
1989				4.21%	1.11%	4.20%		
1990				4.17%	3.82%	4.14%	3.42%	3.82%
1991				4.17%	3.82%	4.19%	3.44%	3.83%
1992				4.15%	3.81%	4.15%	3.42%	3.81%
1993				4.15%	3.82%	4.15%	3.42%	3.82%
1994				4.13%	3.80%	4.12%	3.40%	3.80%
1995				4.10%	3.75%	4.06%	3.36%	3.76%
1996				4.09%	3.76%	4.13%	3.38%	3.77%
1997				4.11%	3.77%	4.13%	3.38%	3.78%
1998				4.11%	3.76%	4.07%	3.37%	3.76%
1999				4.14%	3.79%	4.11%	3.40%	3.79%

Appendix D: Inlet

Appendix D1: Cross-section profiles

4.1.1

4.1.2

/

Appendix D1: Cross-section profiles

Figure D1.1: The locations of the cross-sections

Cross-section profile of location 0.

Cross-section profile of location 1.

Cross-section profile of location 2.

Cross-section profile of location 3.

Cross-section profile of location 4.

Cross-section profile of location 5.

Cross-section profile of location 6.

Cross-section profile of location 7.

Cross-section profile of location 8.

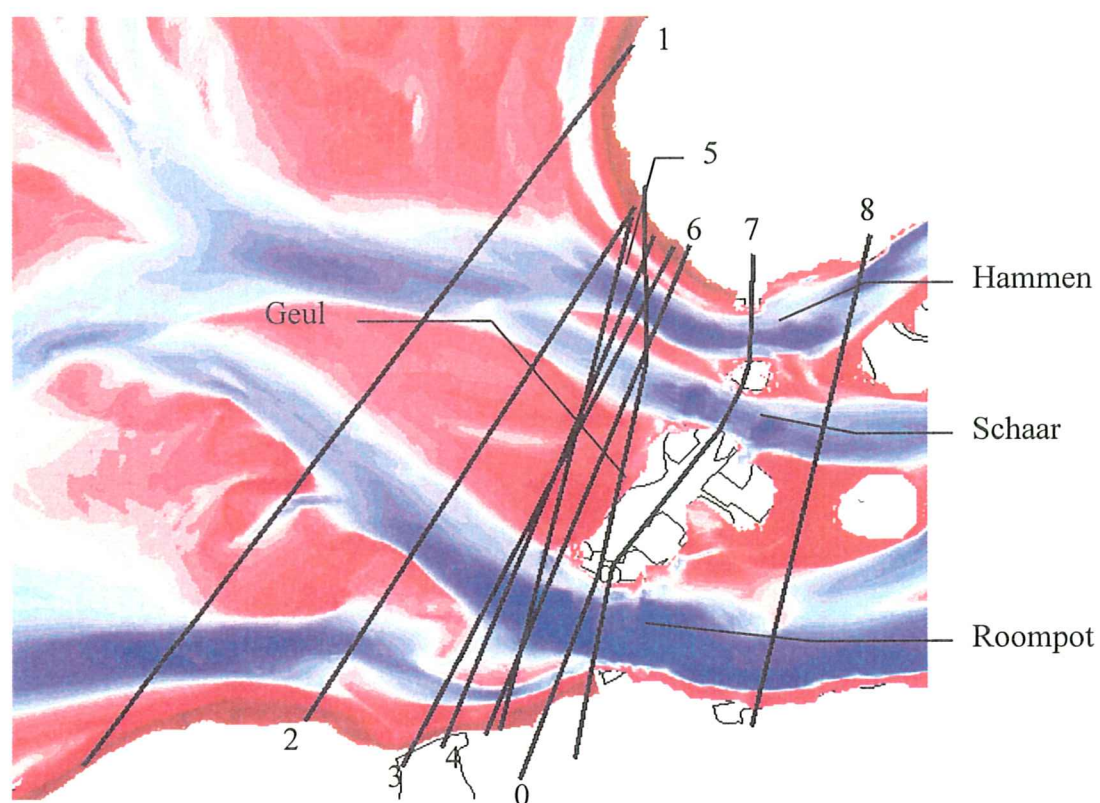
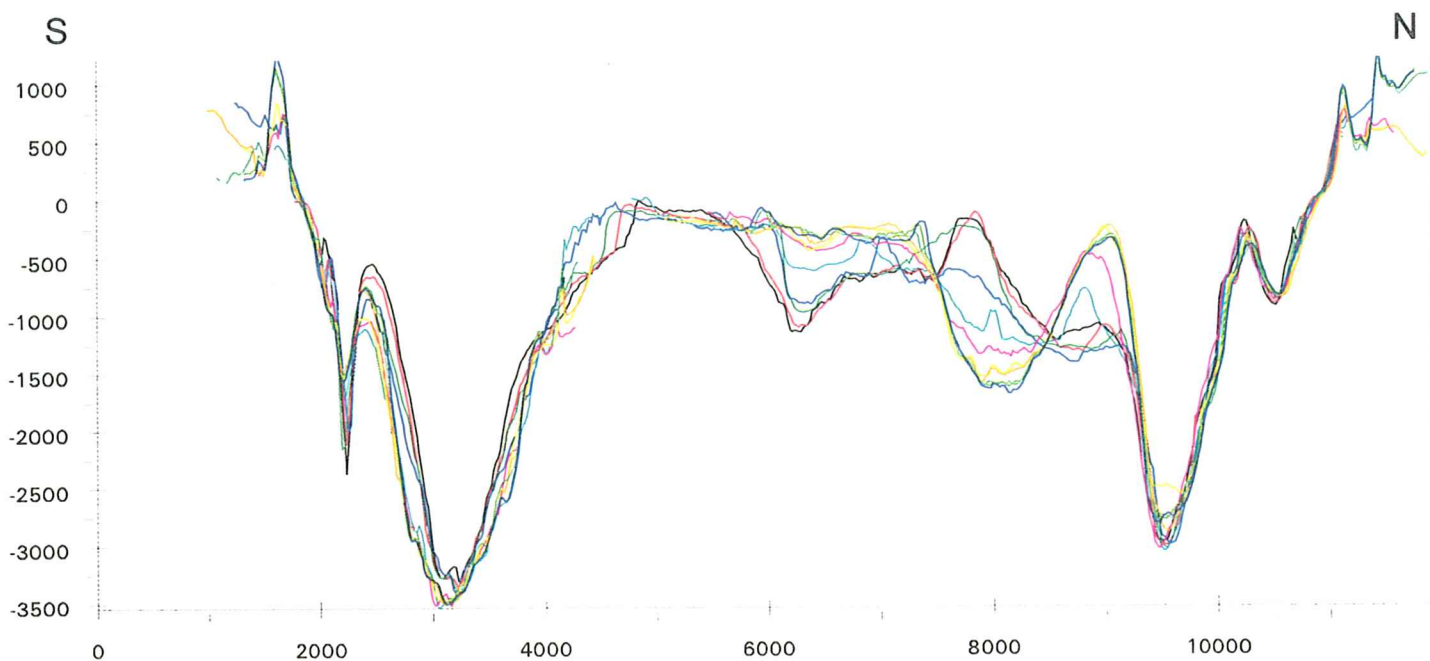
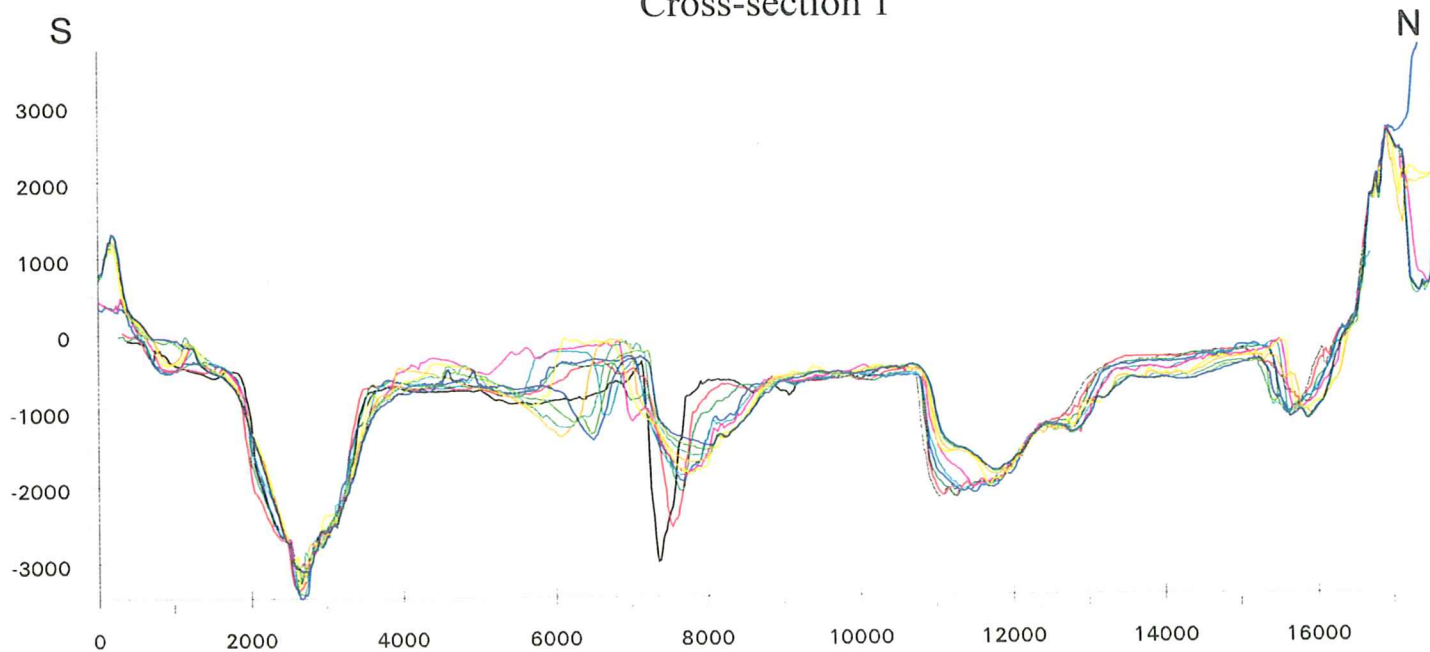


Figure D1.1: The locations of the cross-sections

Cross-section 0



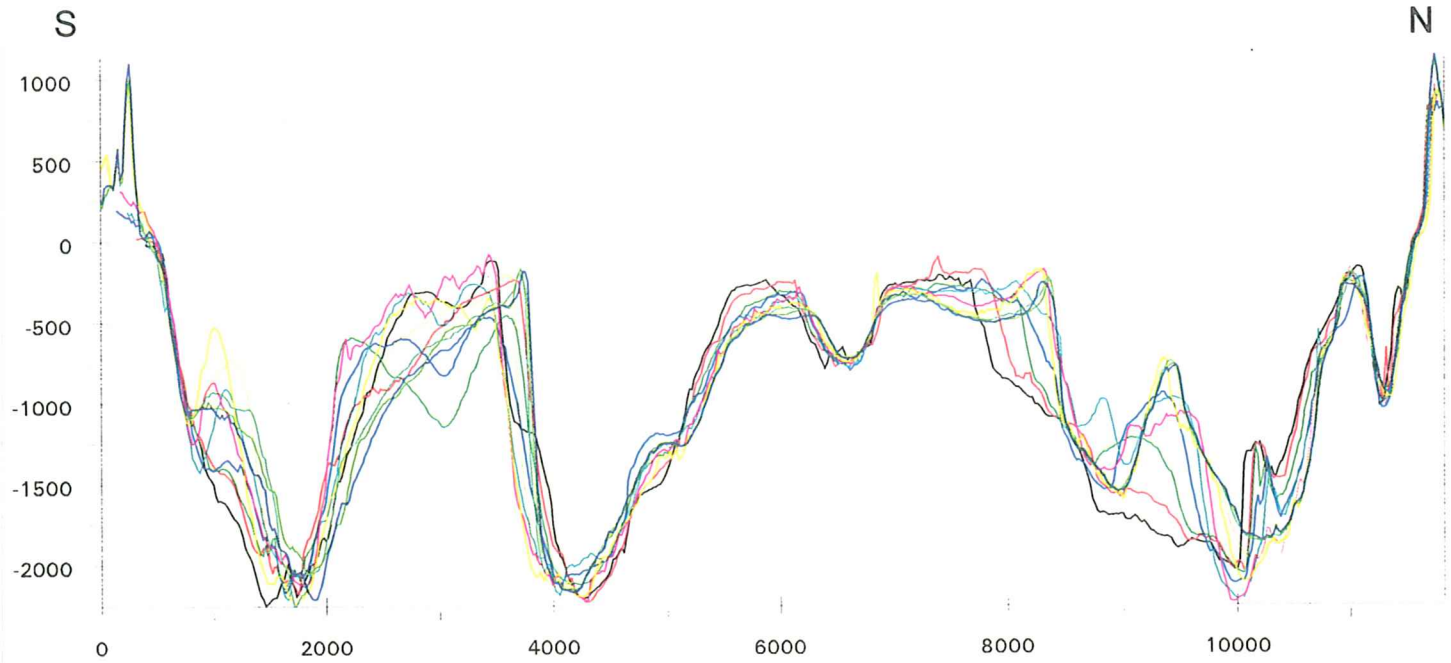
Cross-section 1



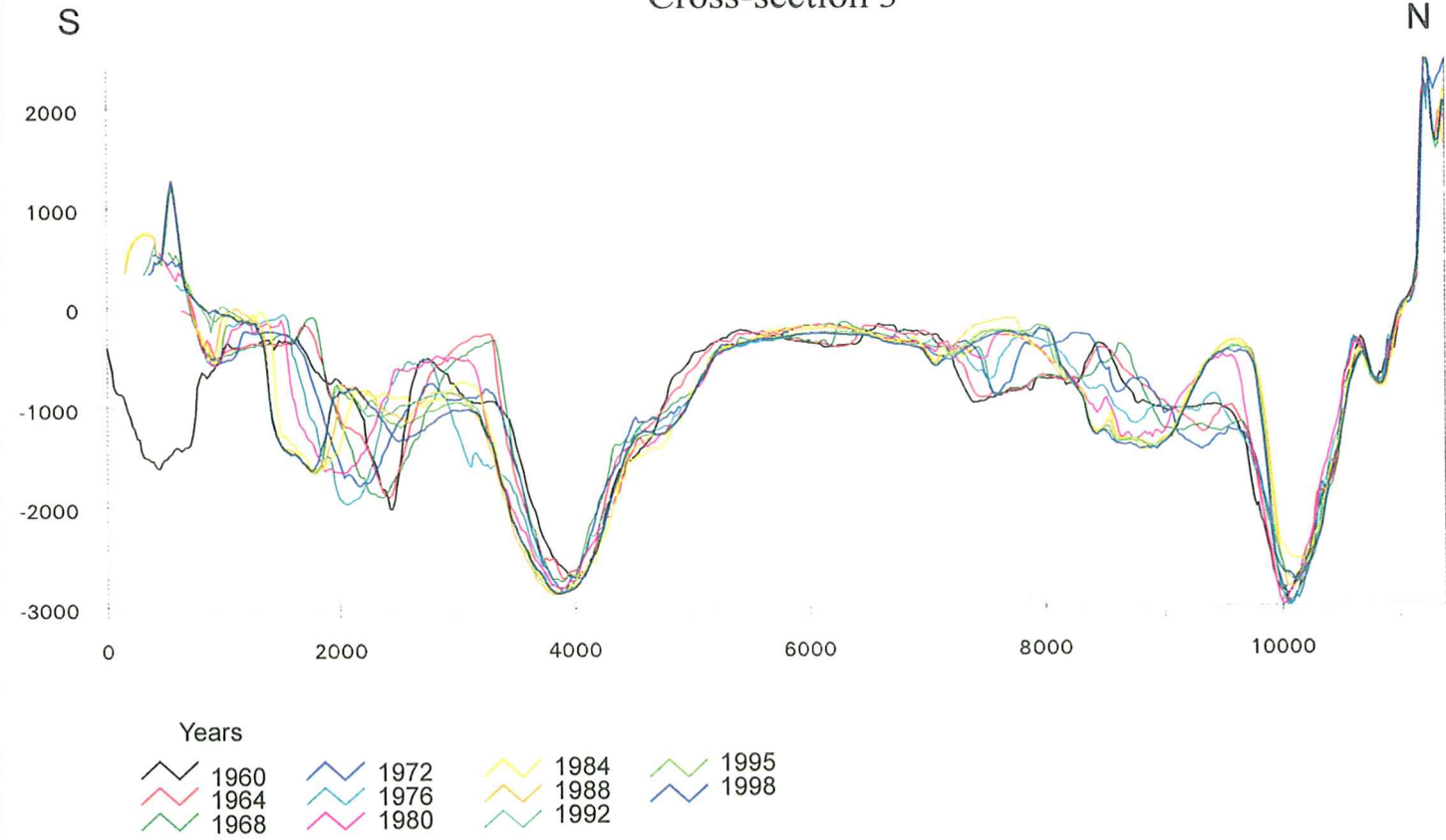
Years



Cross-section 2



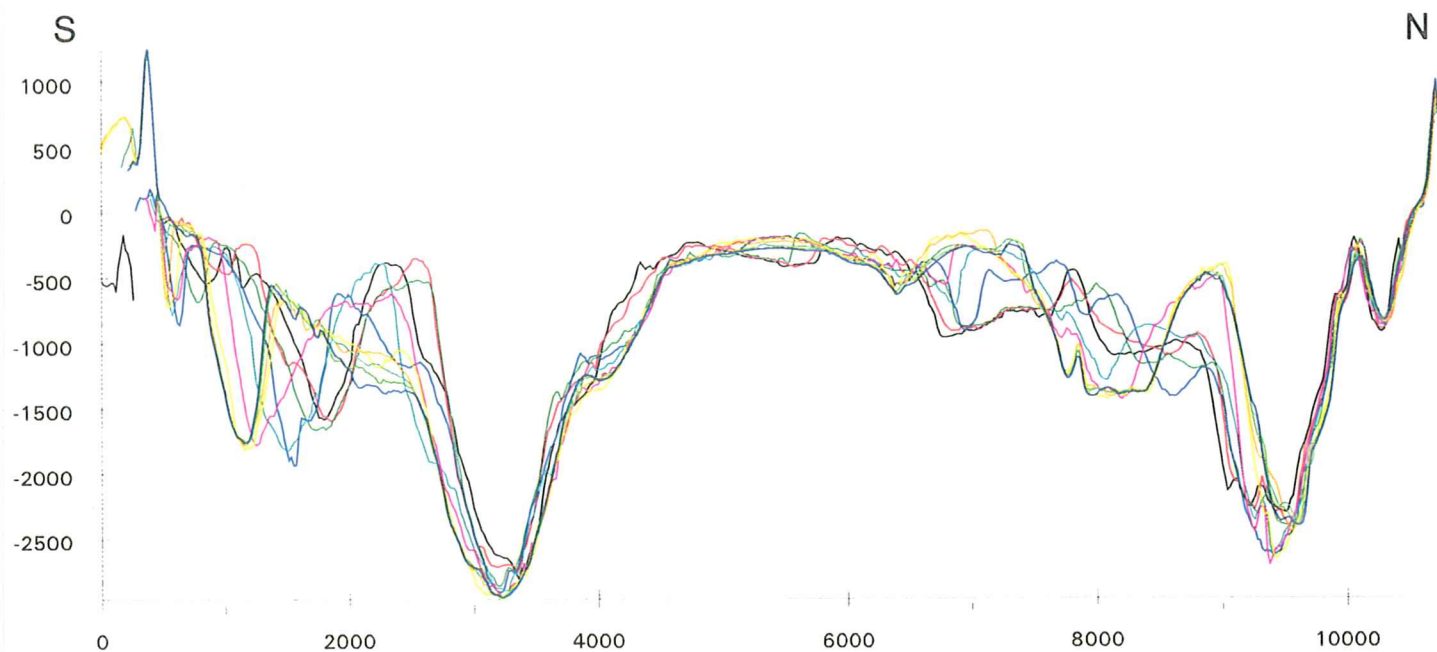
Cross-section 3



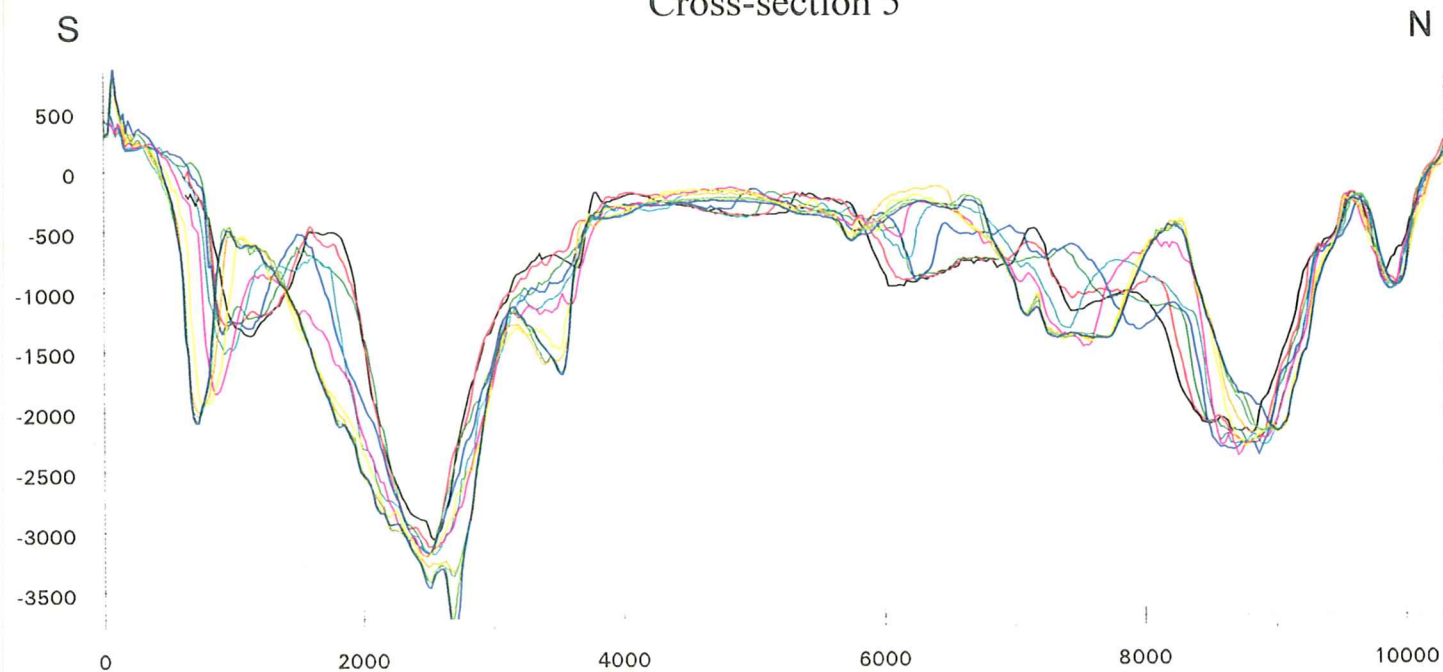
Years

- | | | | |
|------|------|------|------|
| 1960 | 1972 | 1984 | 1995 |
| 1964 | 1976 | 1988 | 1998 |
| 1968 | 1980 | 1992 | |

Cross-section 4



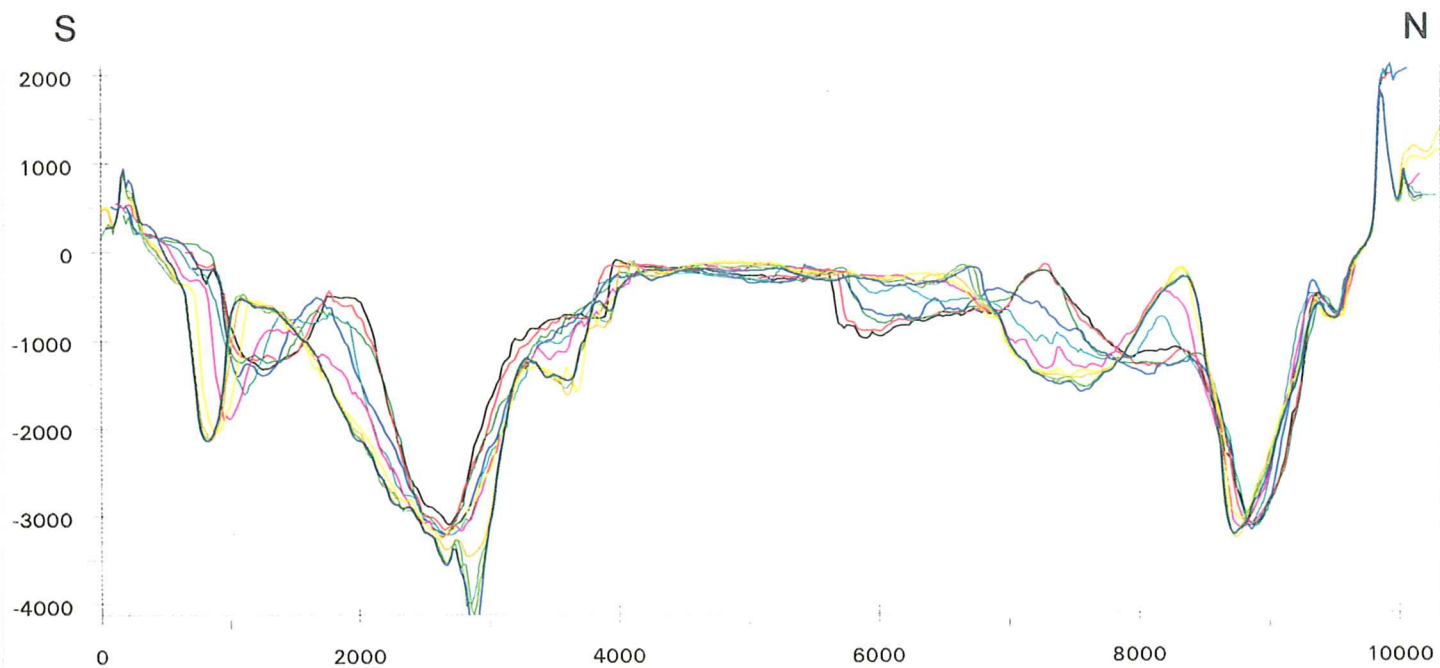
Cross-section 5



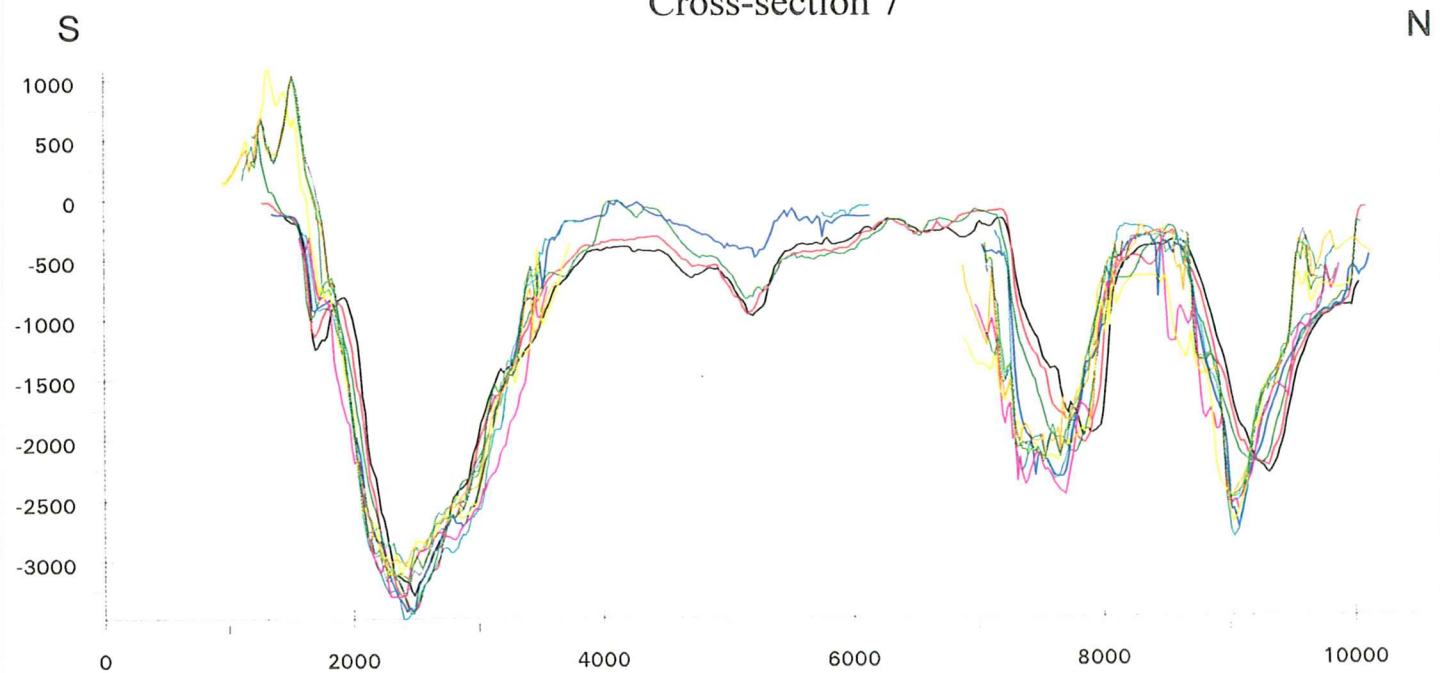
Years



Cross-section 6



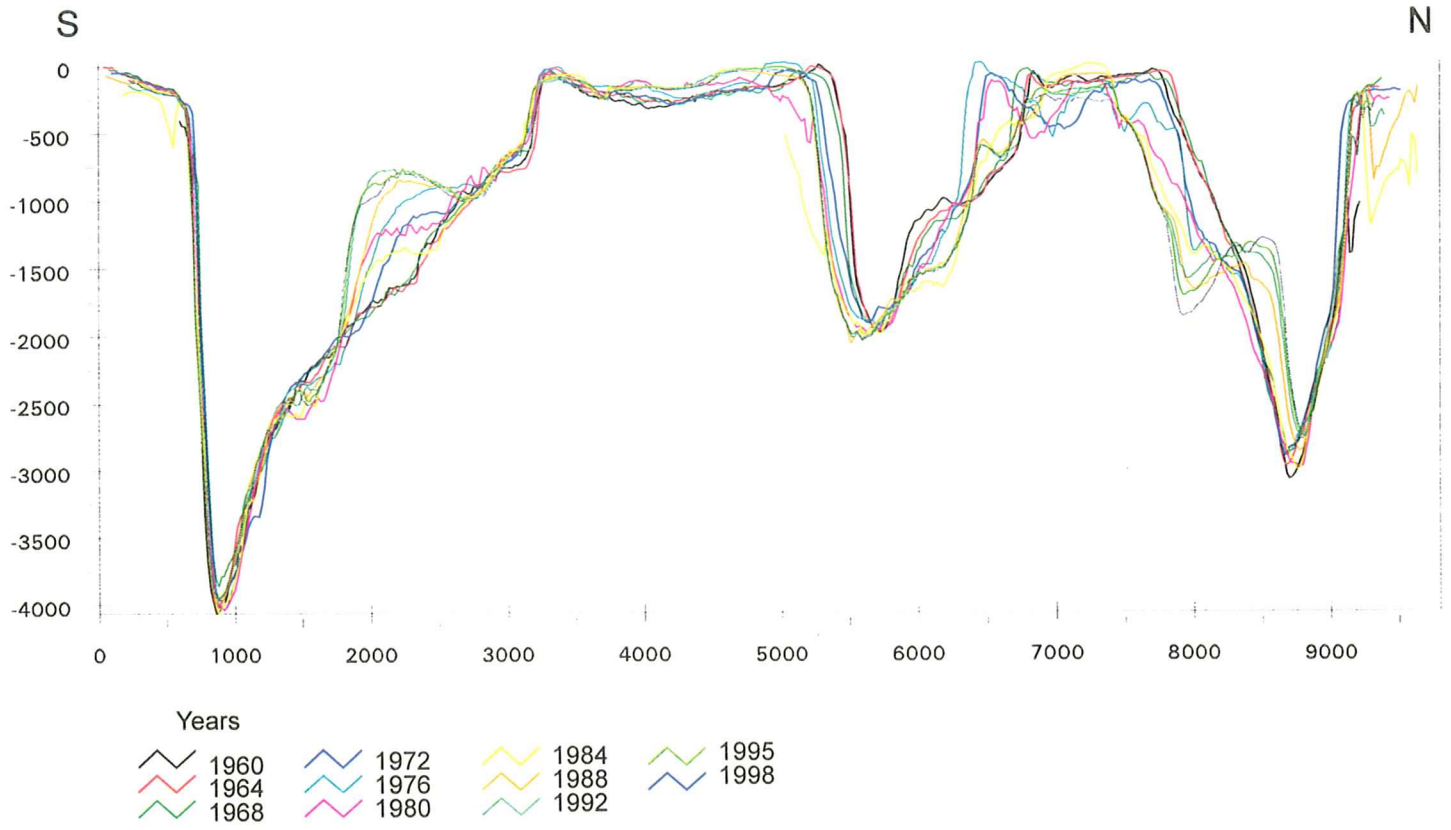
Cross-section 7



Years



Cross-section 8



Appendix E: Basin

E1: Bathymetric maps of the basin

E2: Cross-section profiles of the basin

E3: Sedimentation and erosion maps of the basin

E4: Sedimentation and erosion profiles over the vertical

Appendix E1: Bathymetric maps of the basin

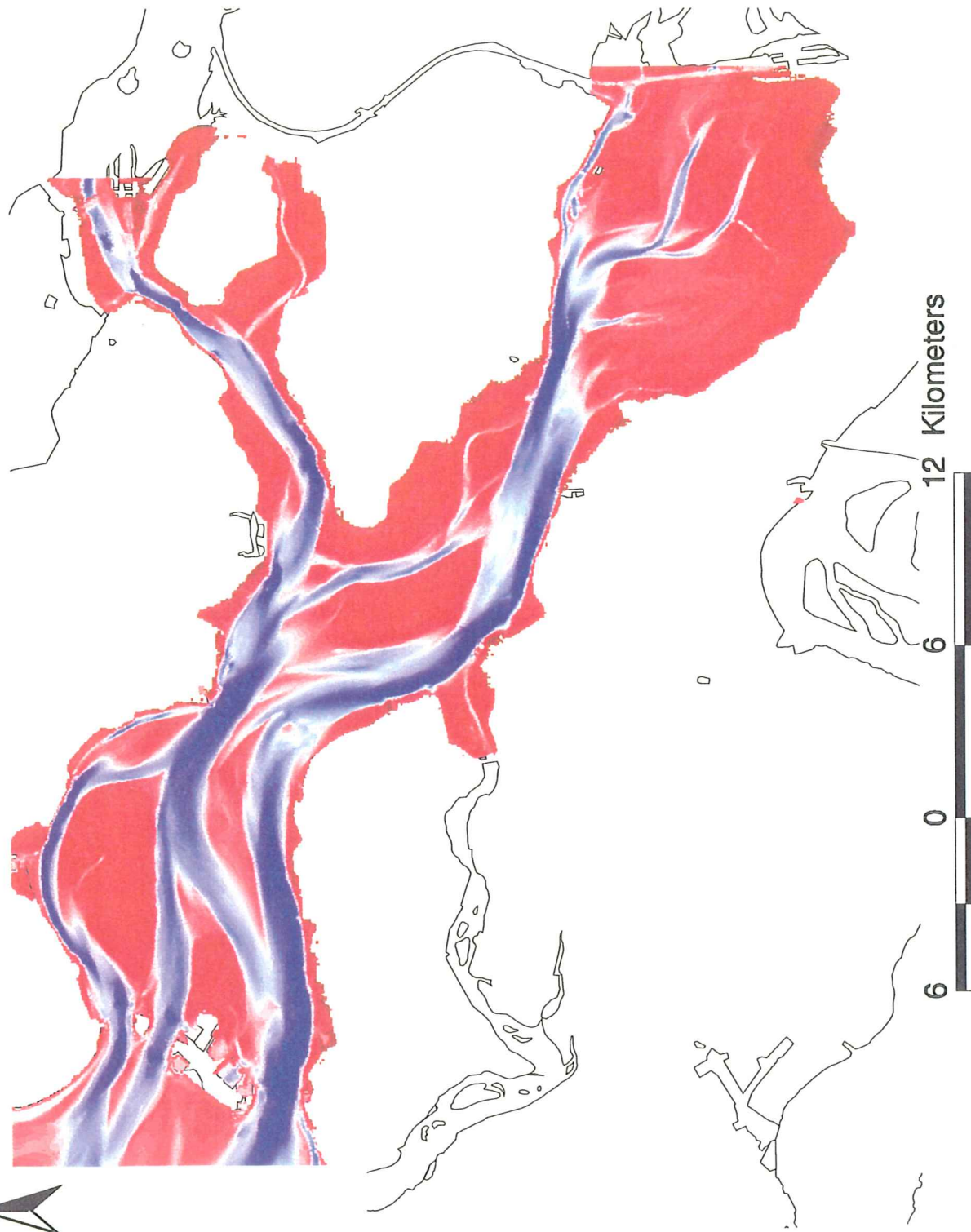
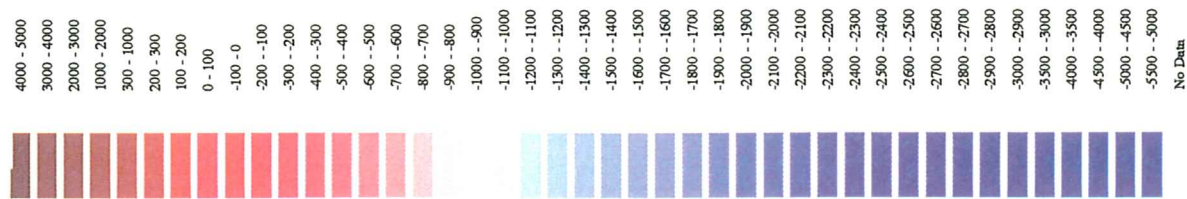
Bathymetric map of 1968

Bathymetric map of 1983

Bathymetric map of 1994

Bathymetry of 1994

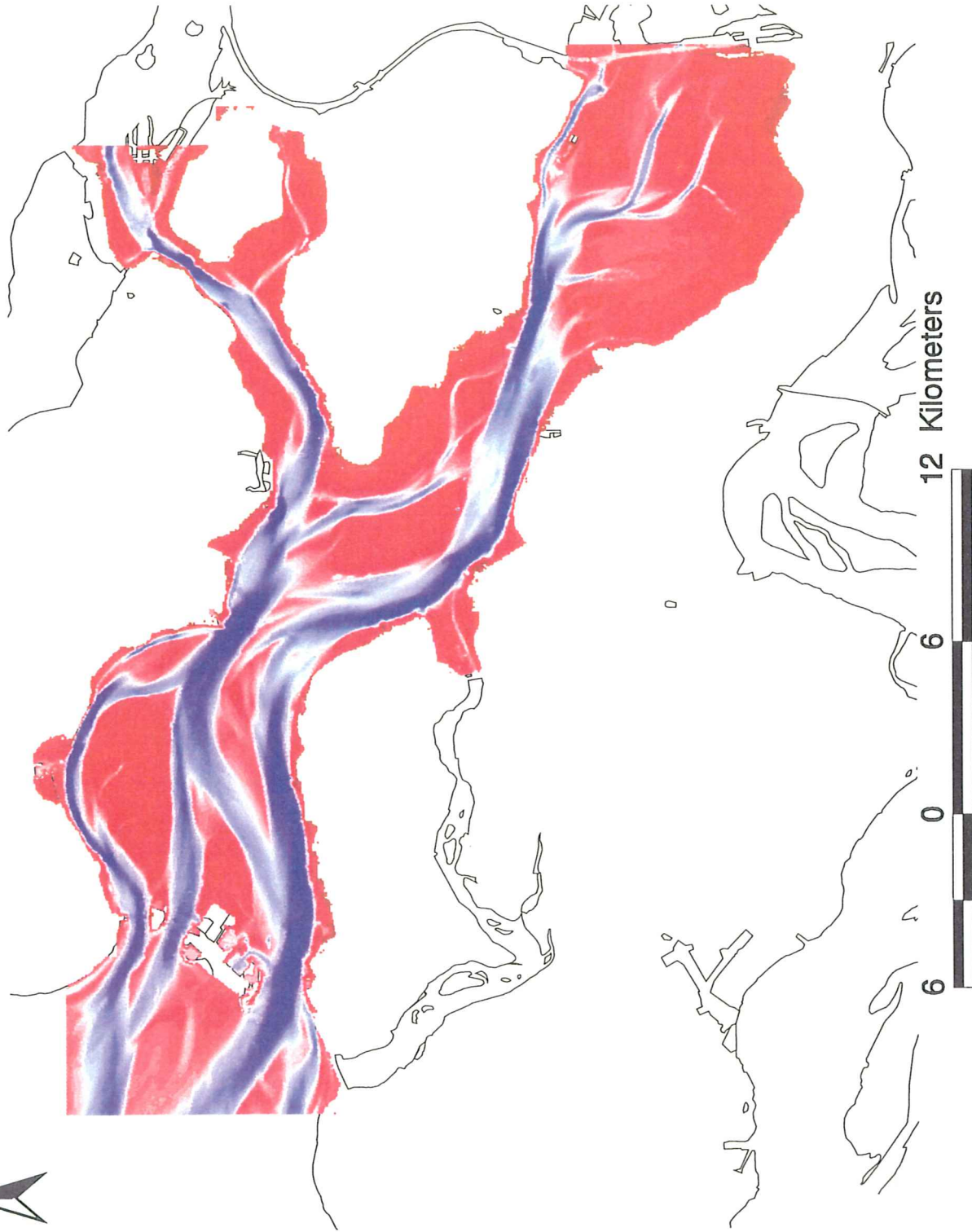
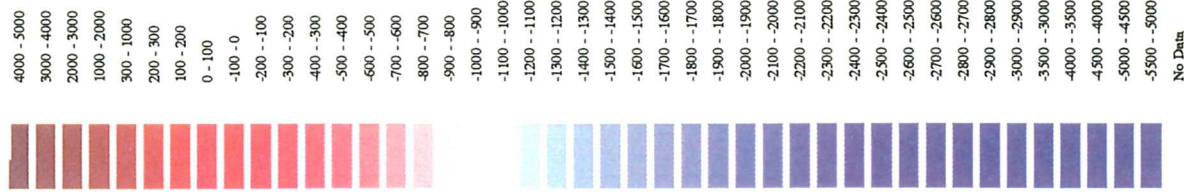
Depth in cm



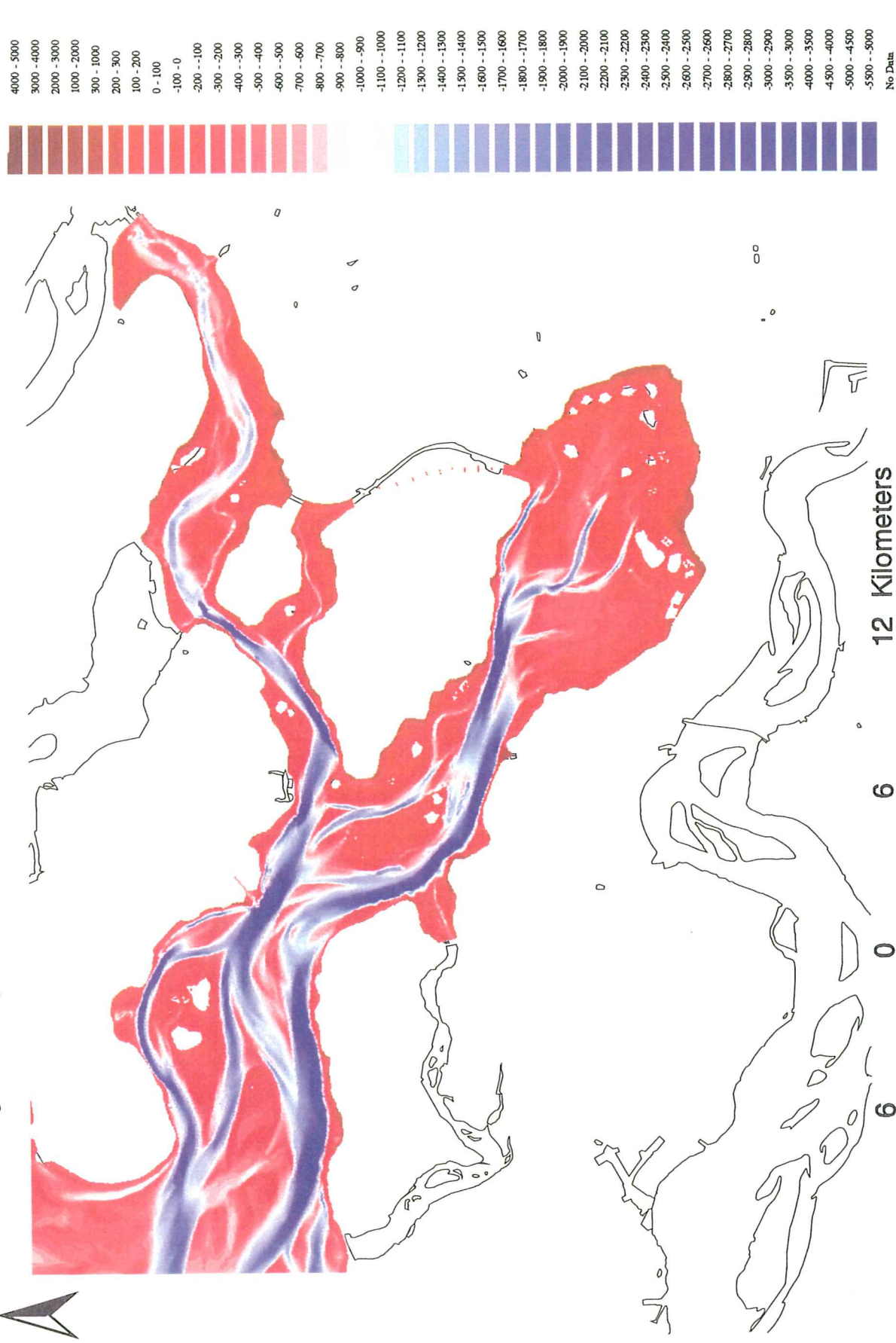
Bathymetry of 1983



Depth in cm



Bathymetry of 1968



Appendix E2: Cross-section profiles of the basin

Figure E2.1: The locations of the cross-section.

Table E2.1: The coordinates of the cross-section locations.

Cross-section profile 0

Cross-section profile 1

Cross-section profile 2

Cross-section profile 3

Cross-section profile 4

Cross-section profile 5

Cross-section profile 6

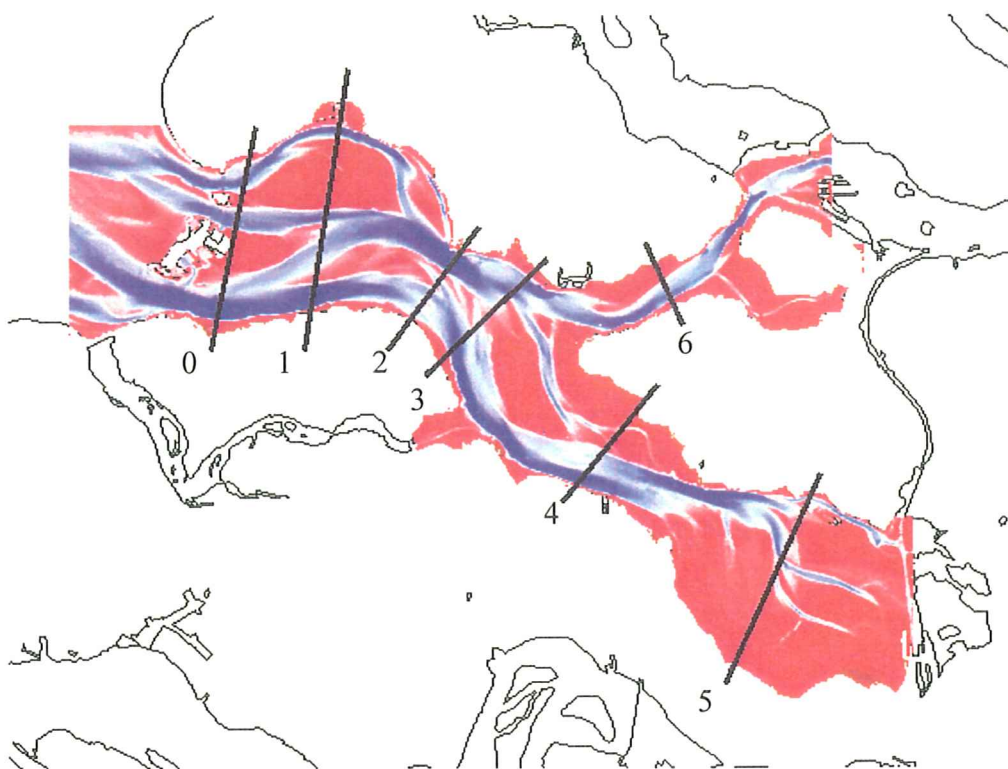
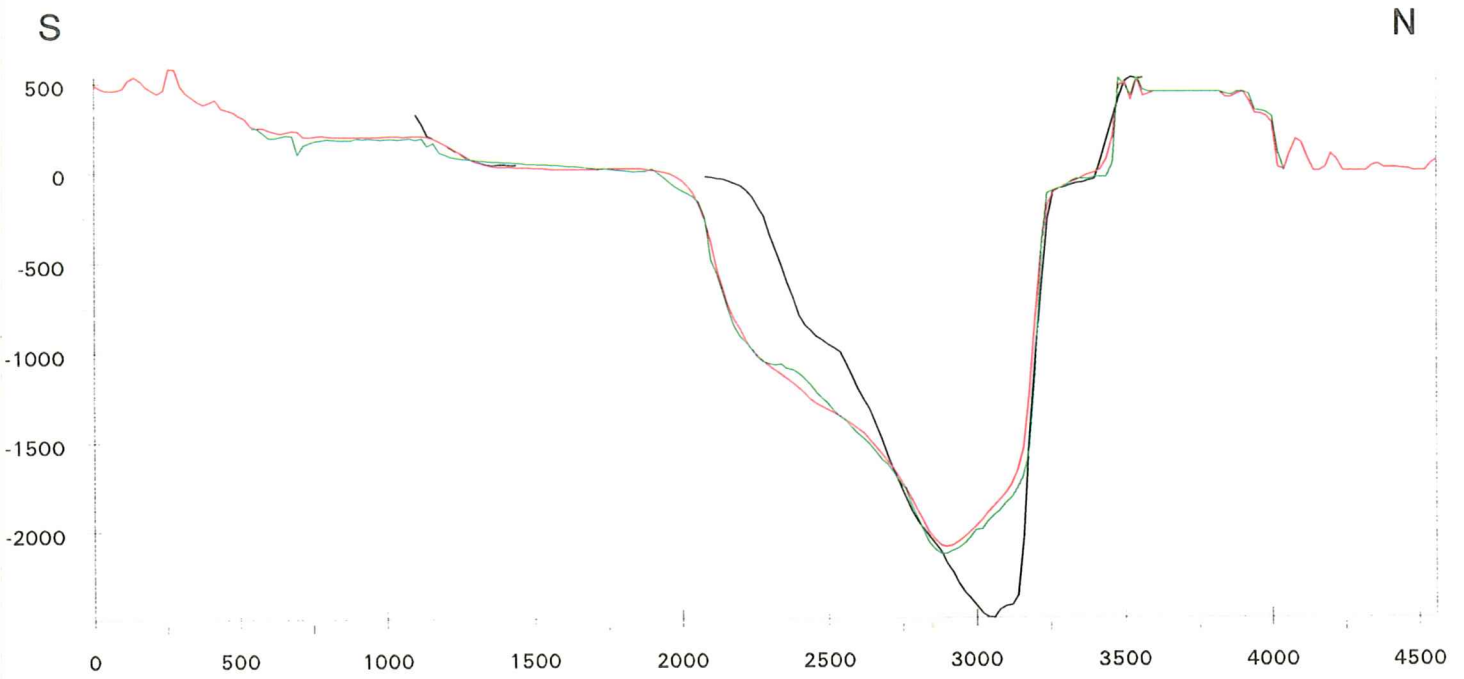


Figure E2.1: The locations of the cross-sections in the basin.

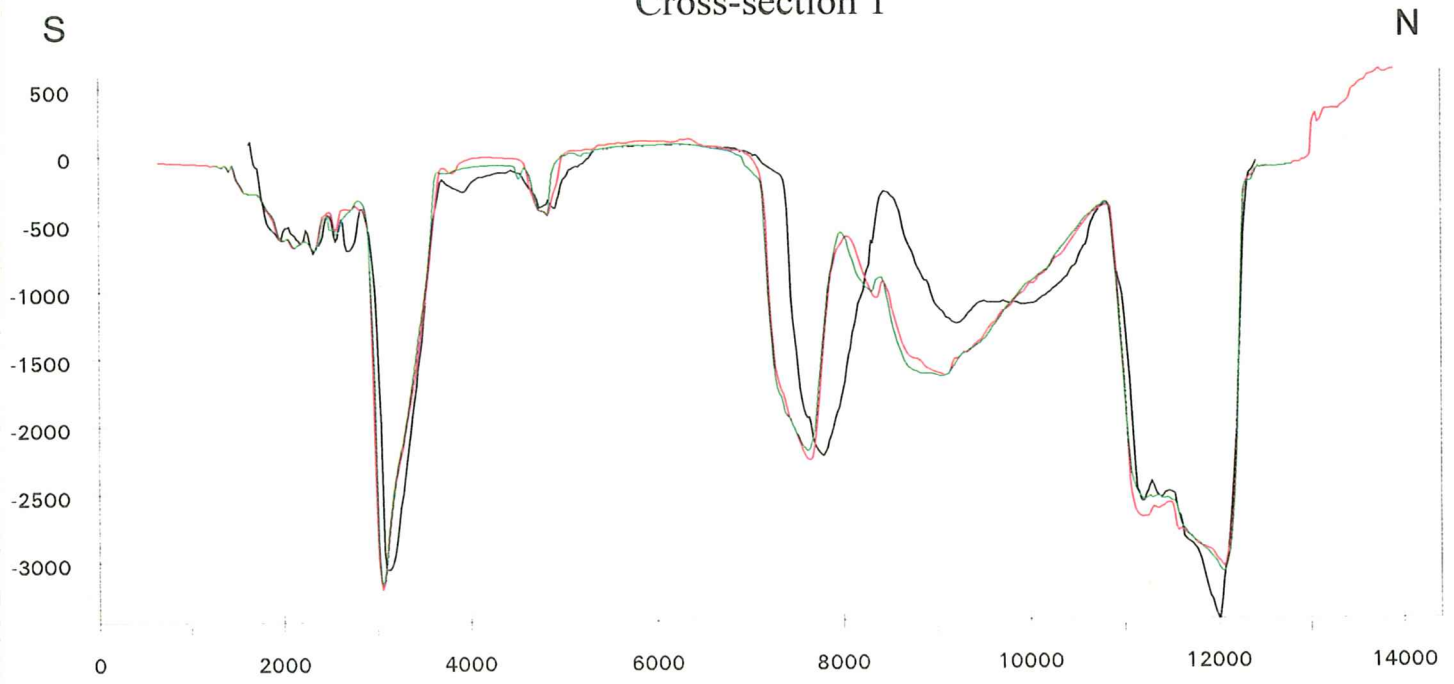
Table E2.1: The coordinates of the cross-section locations shown in figure E2.1.

	x	y
profiel 0	41530	412041
	39217	400702
profiel 1	46159	414934
	43961	400702
profiel 2	52740	407000
	48126	400702
profiel 3	56201	405339
	50000	399430
profiel 4	61664	398967
	56920	393066
profiel 5	69880	394454
	65020	383809
profiel 6	61085	406140
	62936	401975

Cross-section 0



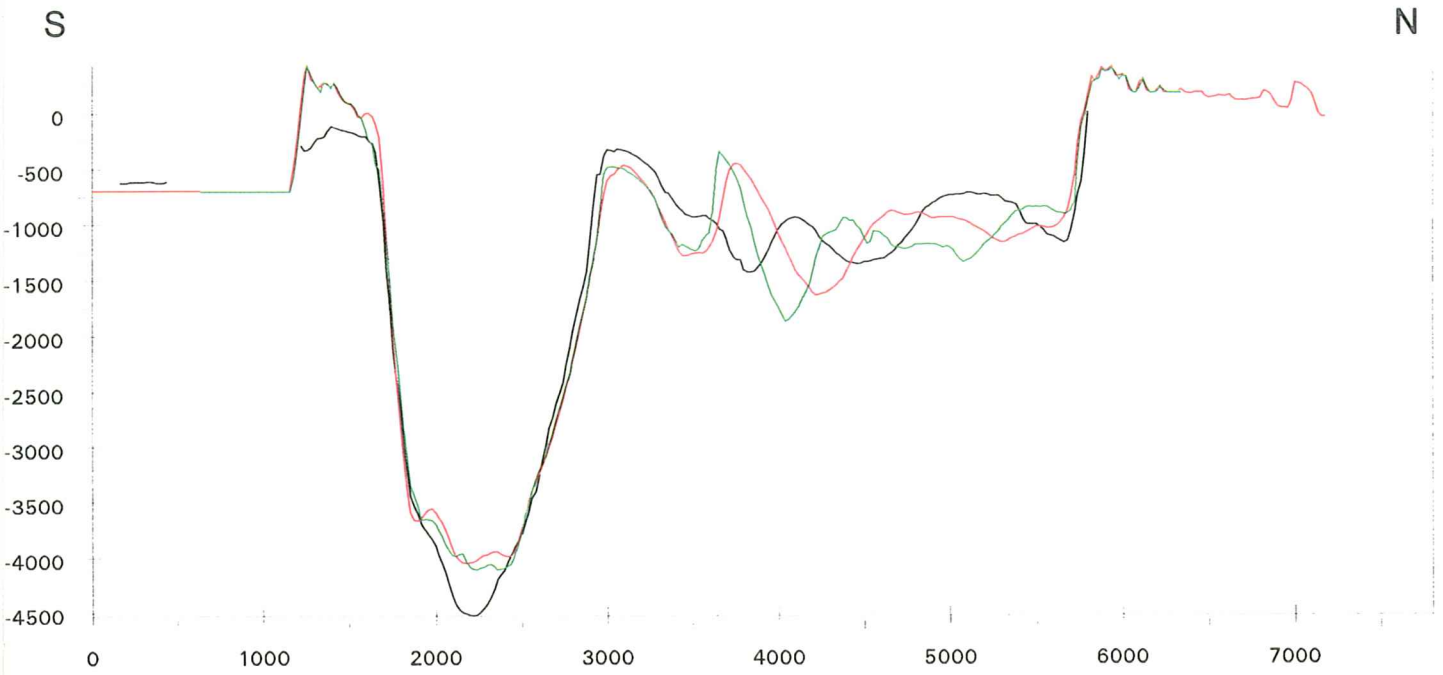
Cross-section 1



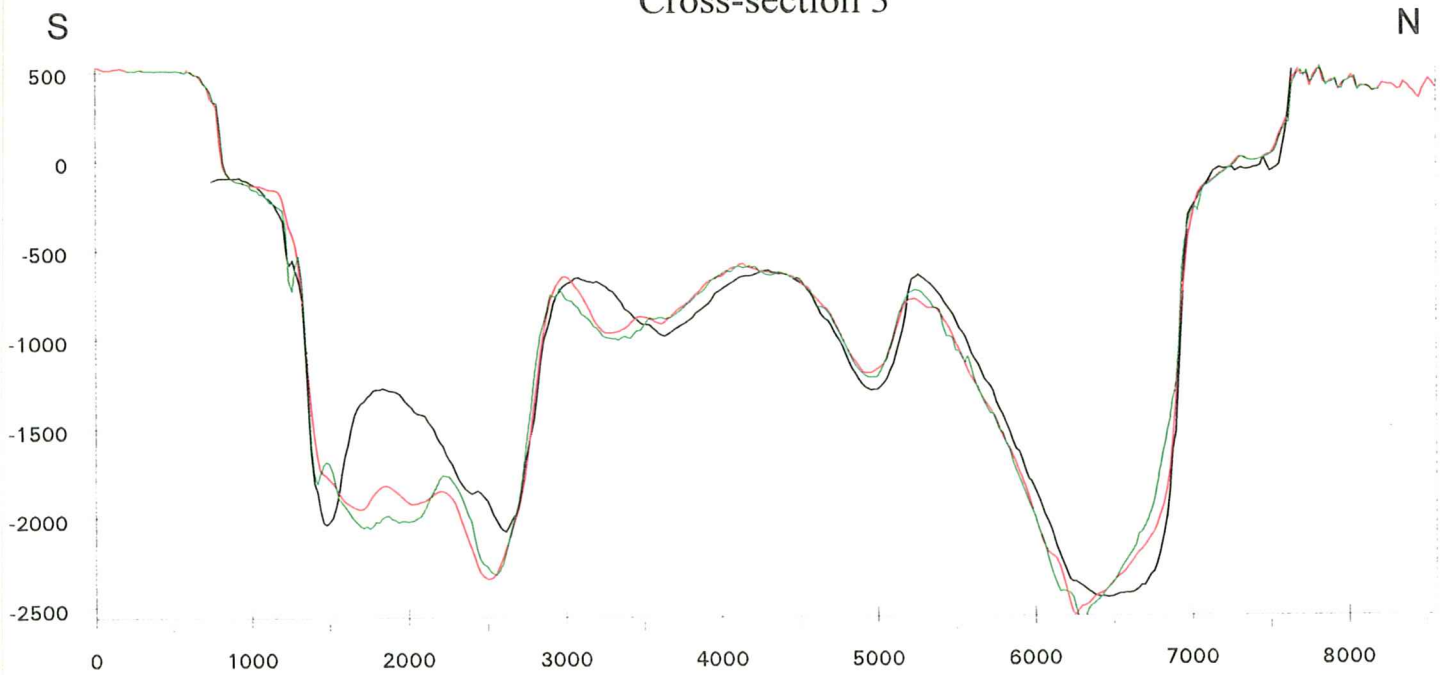
Years

- 1968
- 1983
- 1996

Cross-section 2



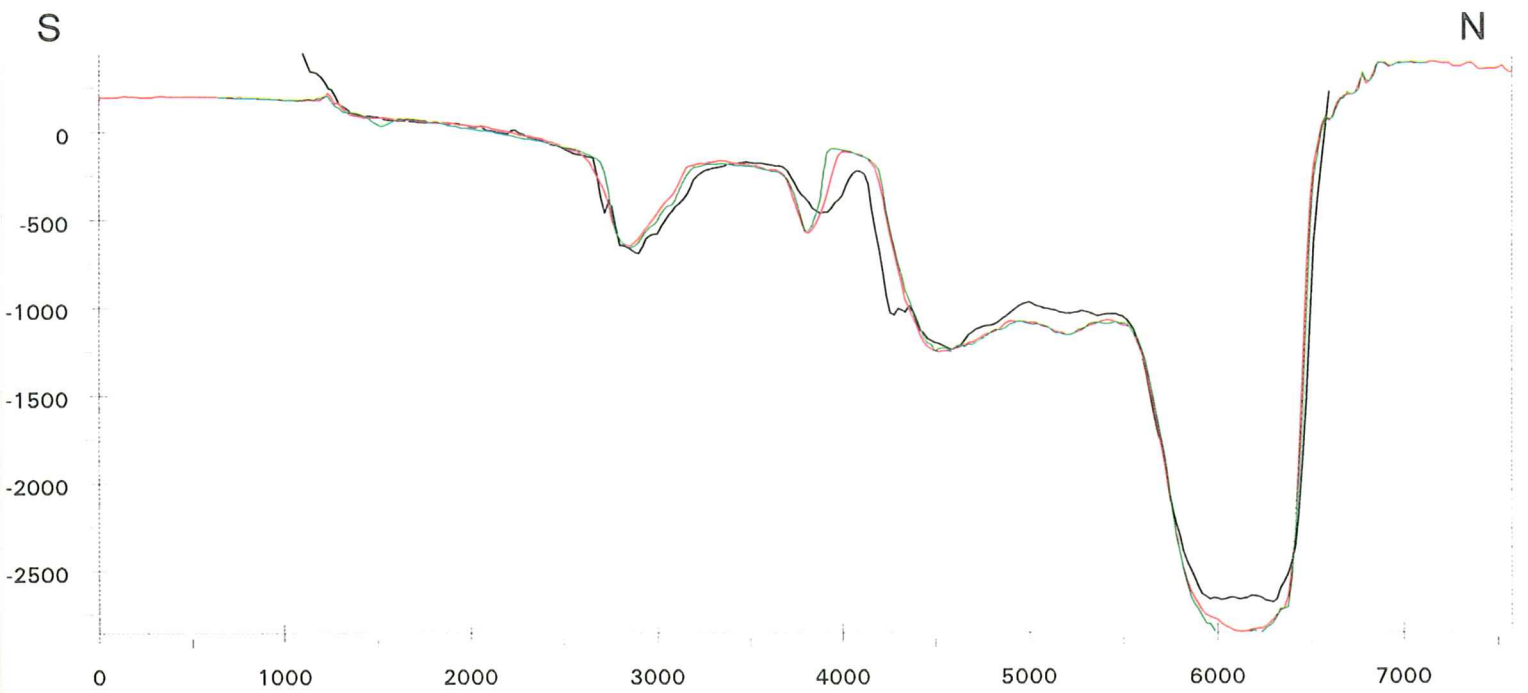
Cross-section 3



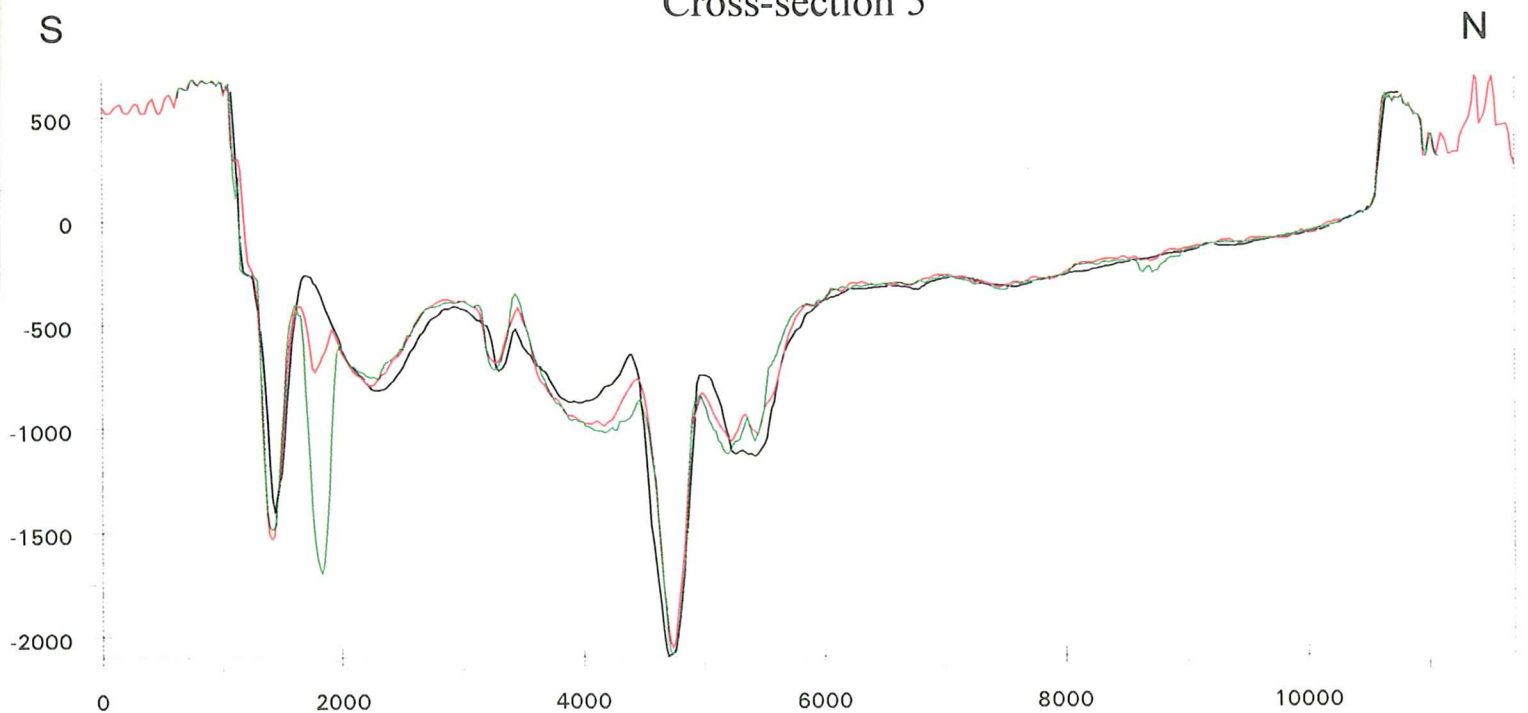
Years

- 1968
- 1983
- 1996

Cross-section 4



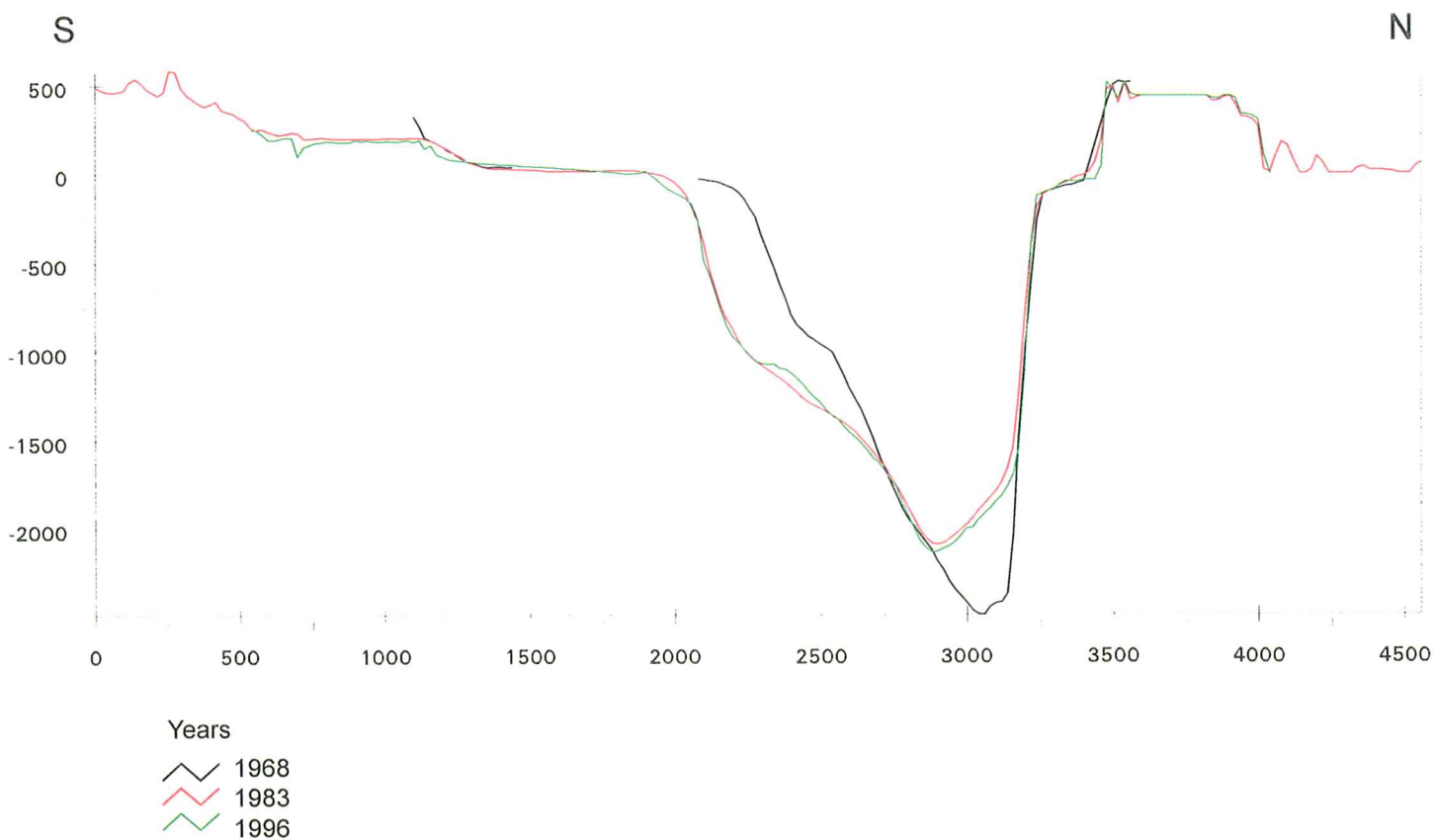
Cross-section 5



Years



Cross-section 6



Appendix E3: Sedimentation and erosion maps of the basin

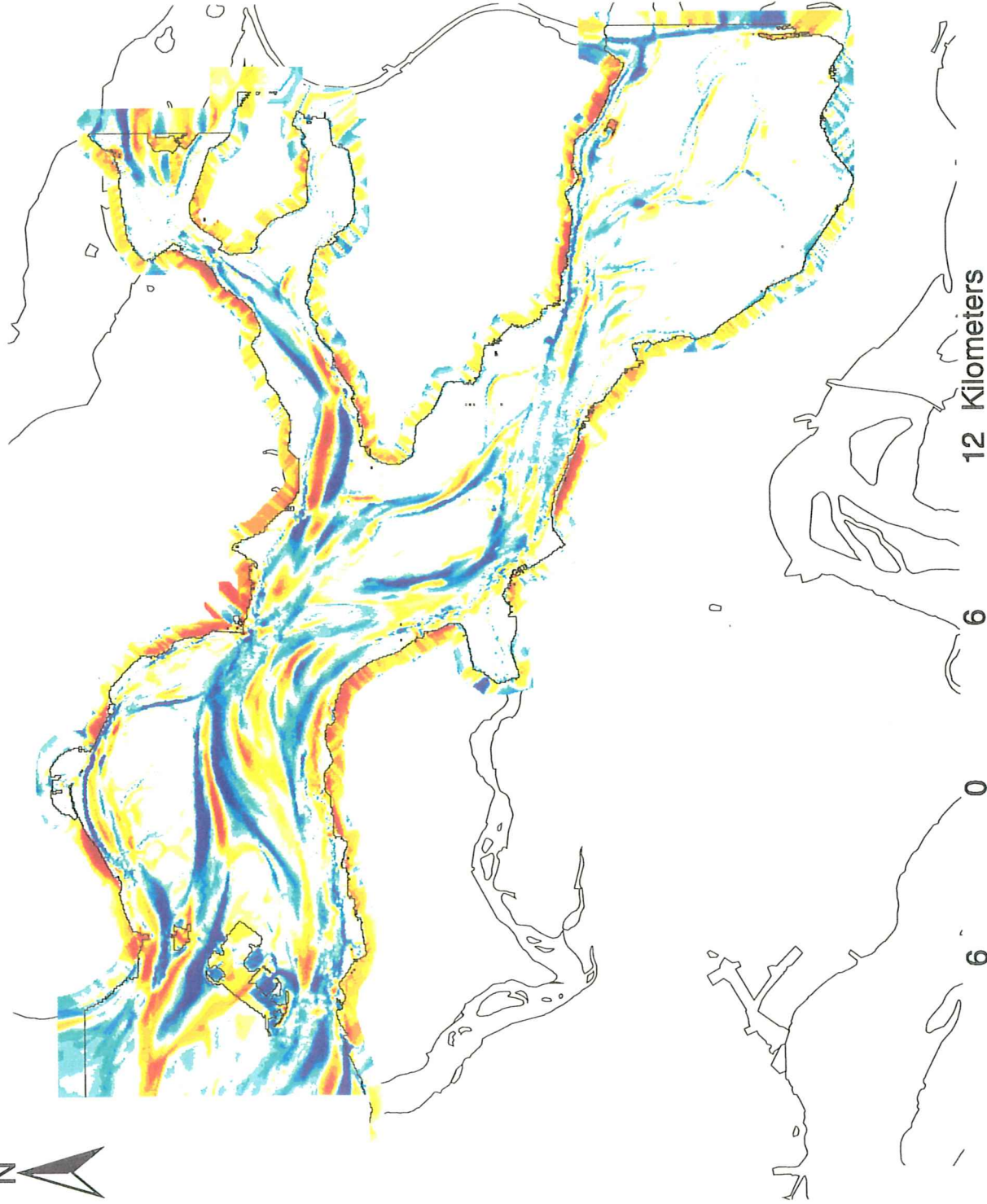
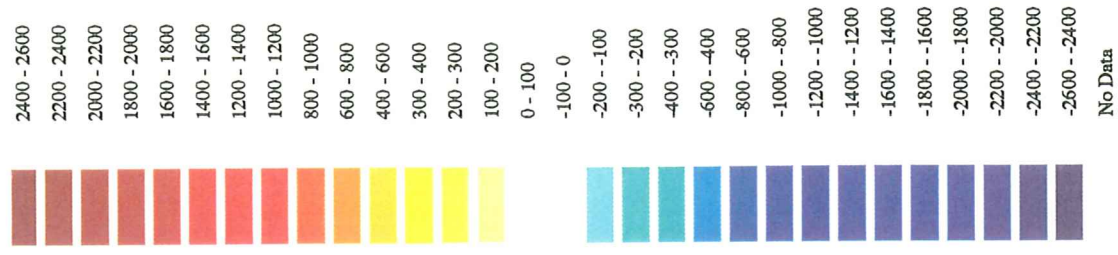
Sedimentation and erosion map between 1968 and 1983.

Sedimentation and erosion map between 1983 and 1994.

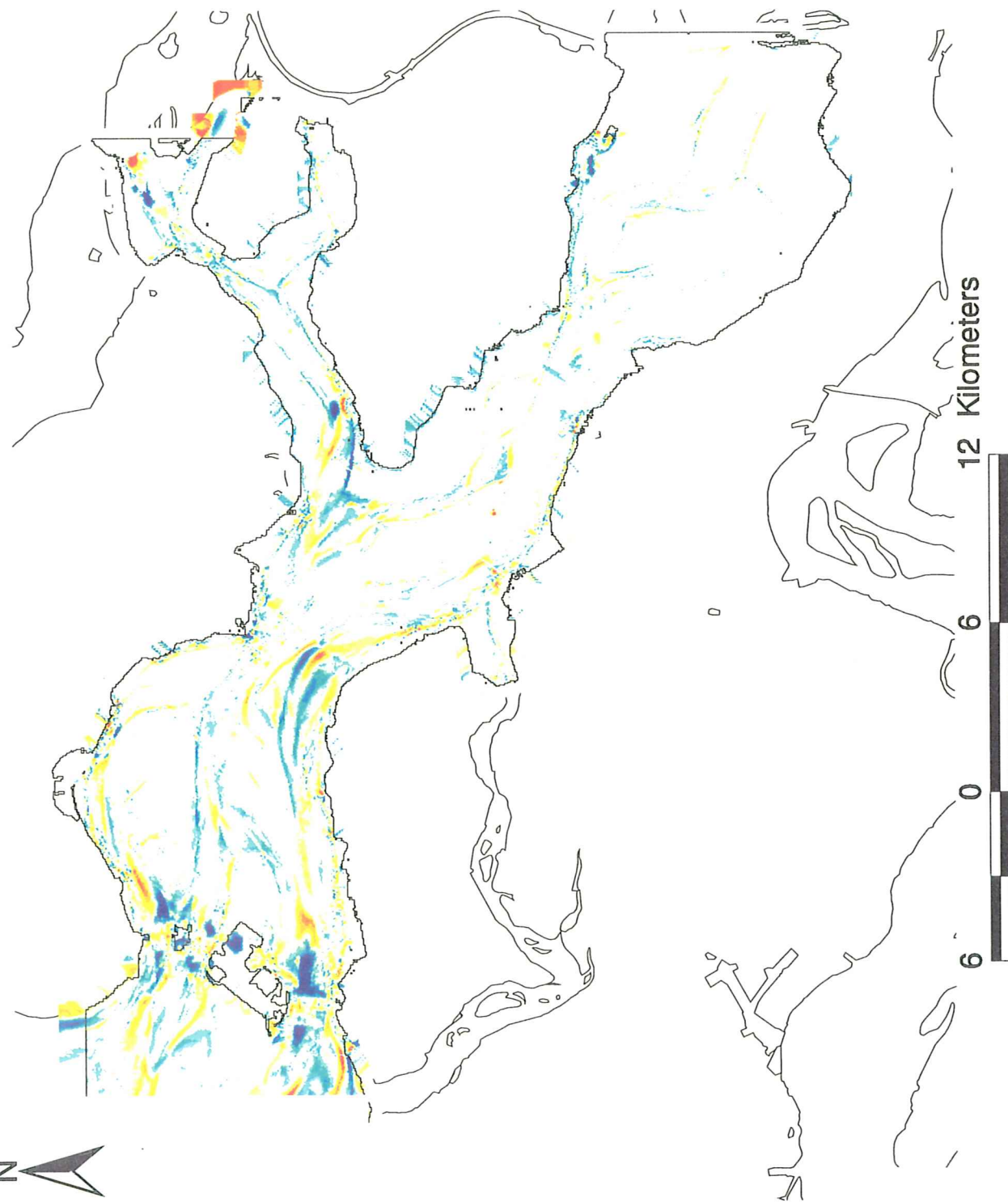
Sedimentation and erosion between 1968 and 1983



depth difference in cm



Sedimentation and erosion between 1983 and 1994



Appendix E4: Vertical sedimentation and erosion profiles

Figure E4.1: The calculation sections of the basin

Vertical sedimentation and erosion profile of calculation section 5

Vertical sedimentation and erosion profile of calculation section 6

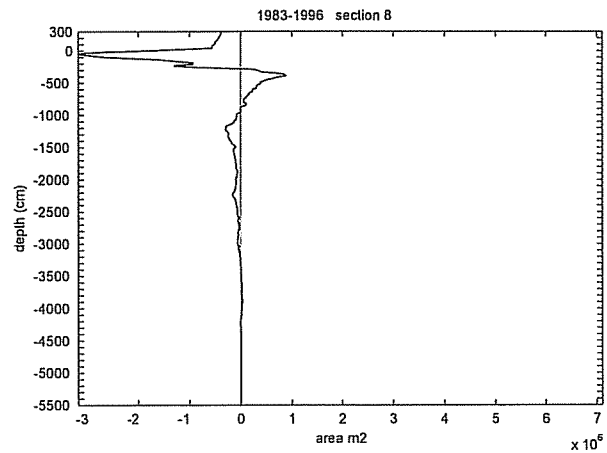
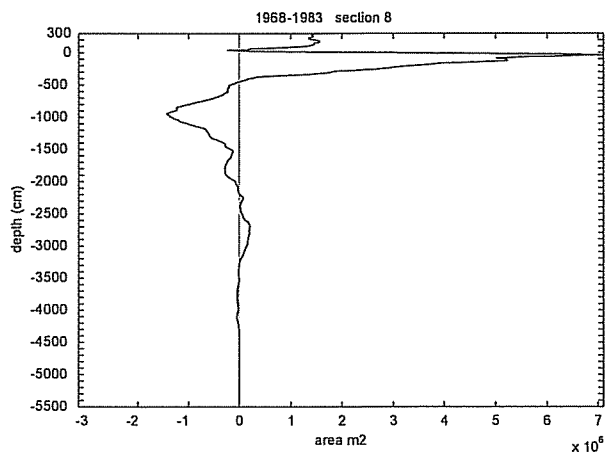
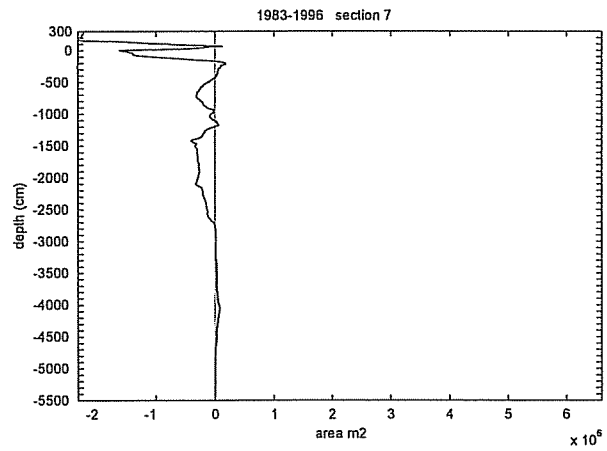
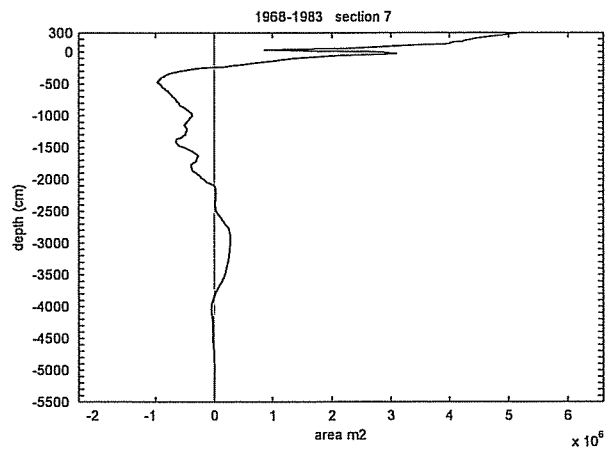
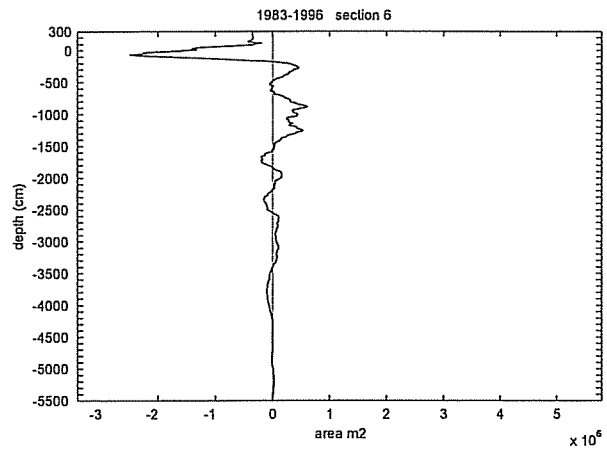
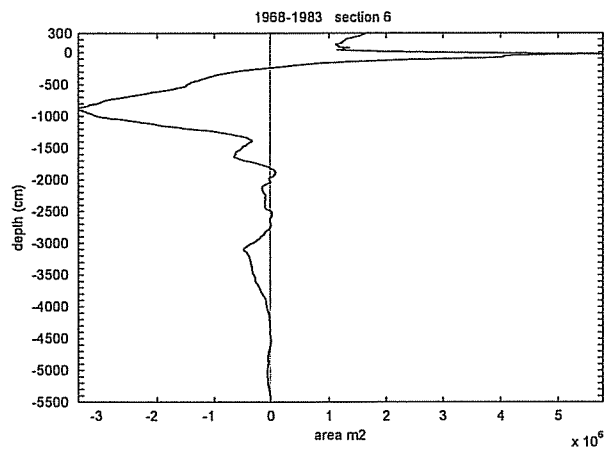
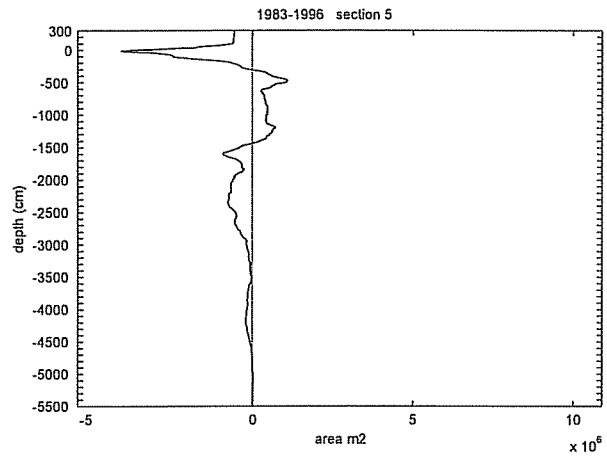
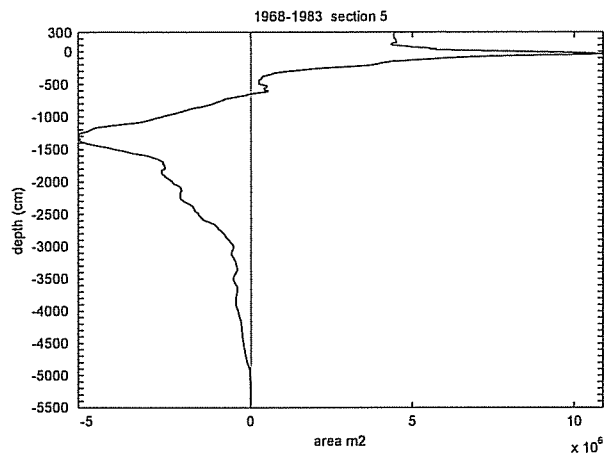
Vertical sedimentation and erosion profile of calculation section 7

Vertical sedimentation and erosion profile of calculation section 8



Figure E4.1: The calculation sections of the basin.

The vertical sedimentation/erosion profiles between
the indicated years of the different sections



Appendix F: Outer tidal delta

- F1: Bathymetric maps of the outer tidal delta**
 - F2: Sedimentation and erosion maps of the outer tidal delta**
 - F3: Calculated volumes of the outer tidal delta and the errors**
 - F4: Sedimentation and erosion profiles over the vertical**
-

Appendix F1: Bathymetric maps of the outer tidal delta

Bathymetric map of 1960

Bathymetric map of 1964

Bathymetric map of 1968

Bathymetric map of 1972

Bathymetric map of 1976

Bathymetric map of 1980

Bathymetric map of 1984

Bathymetric map of 1988

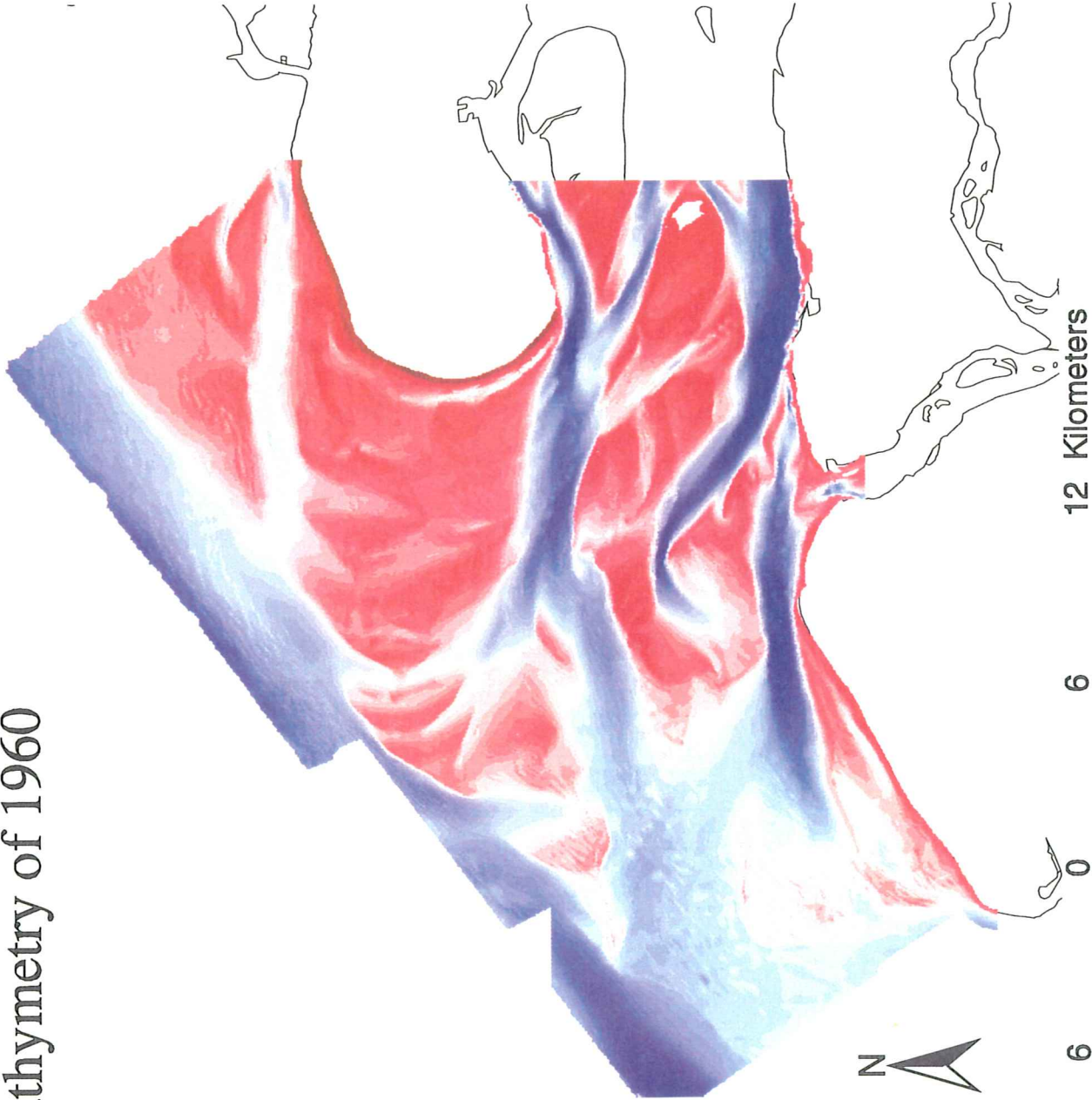
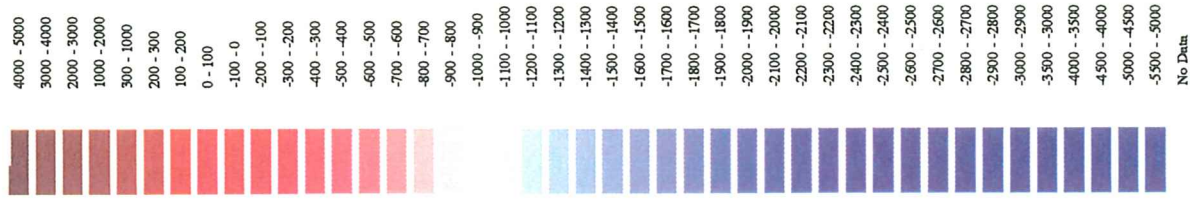
Bathymetric map of 1992

Bathymetric map of 1995

Bathymetric map of 1998

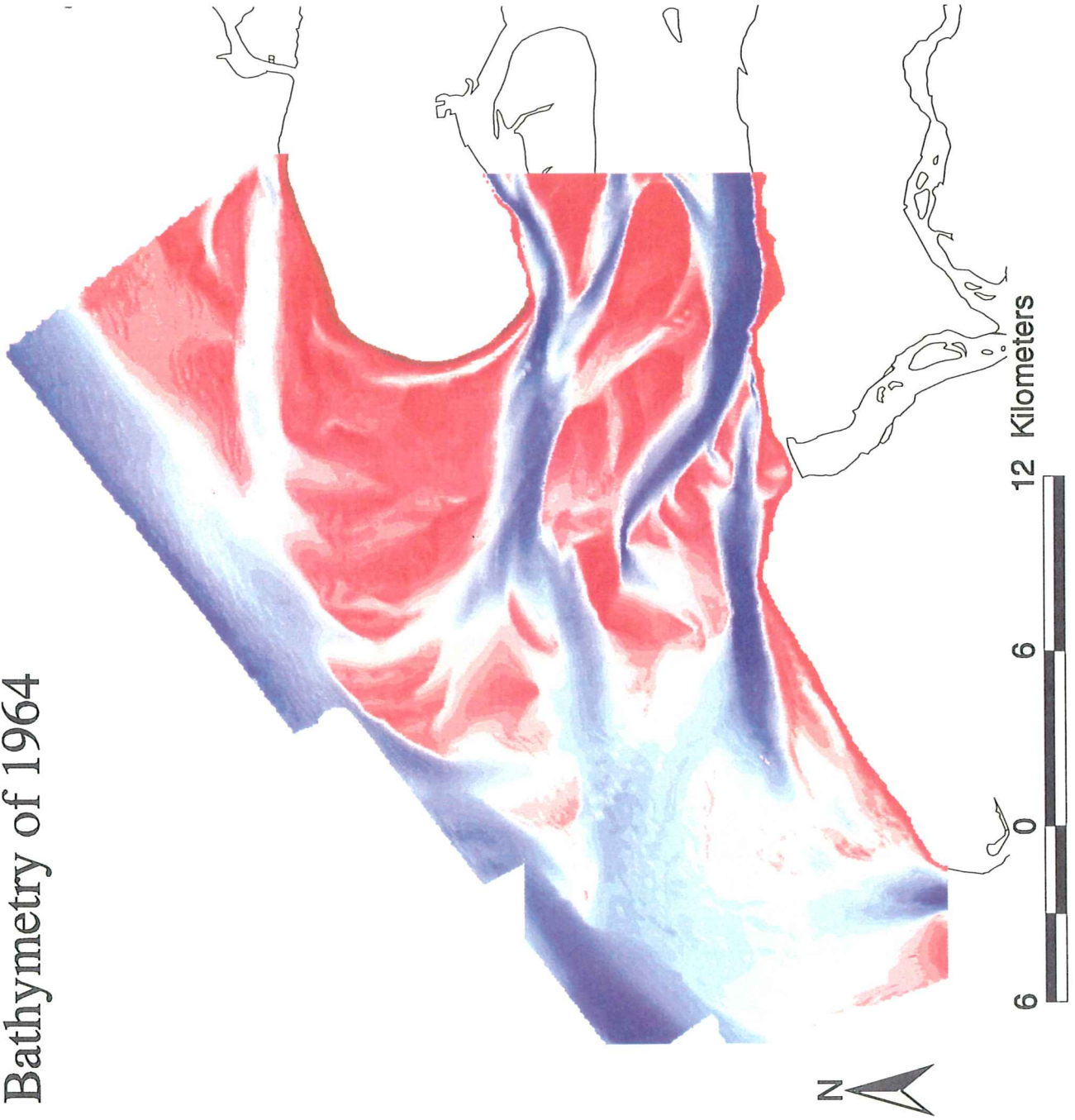
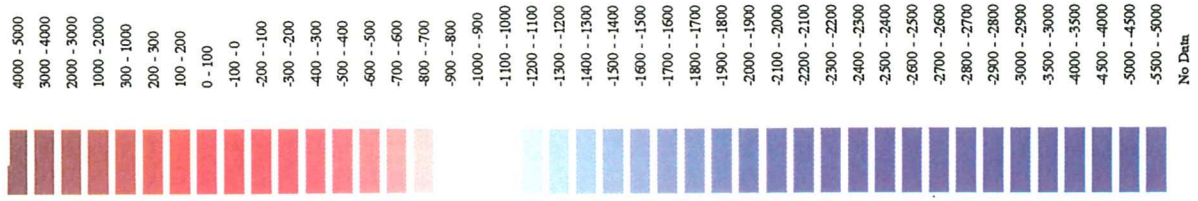
Bathymetry of 1960

Depth in cm



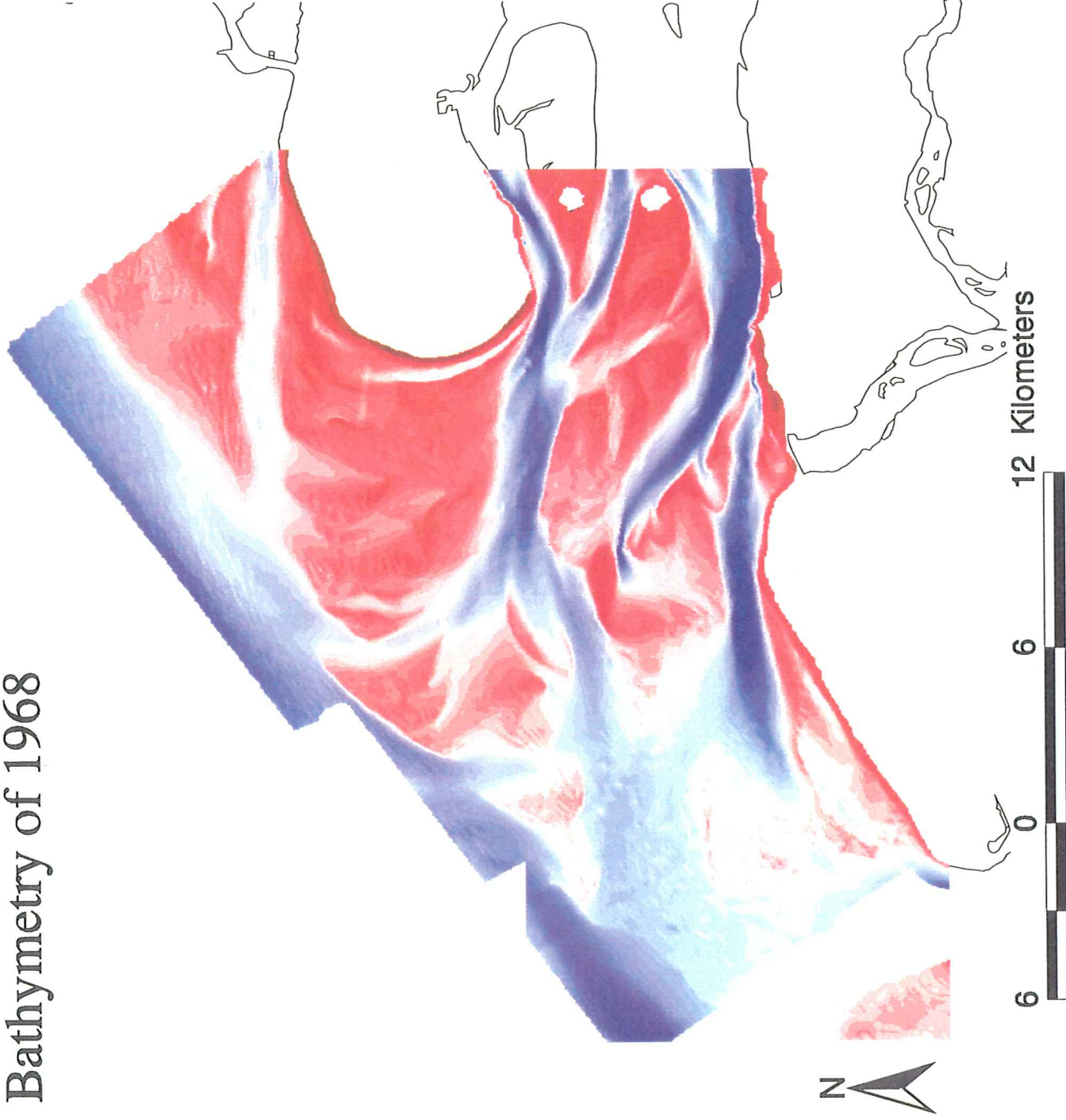
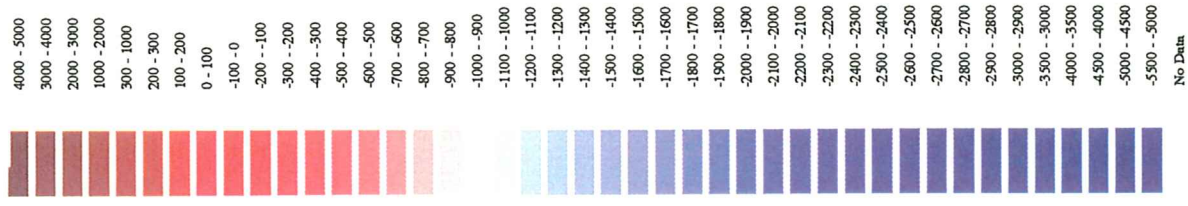
Bathymetry of 1964

Depth in cm



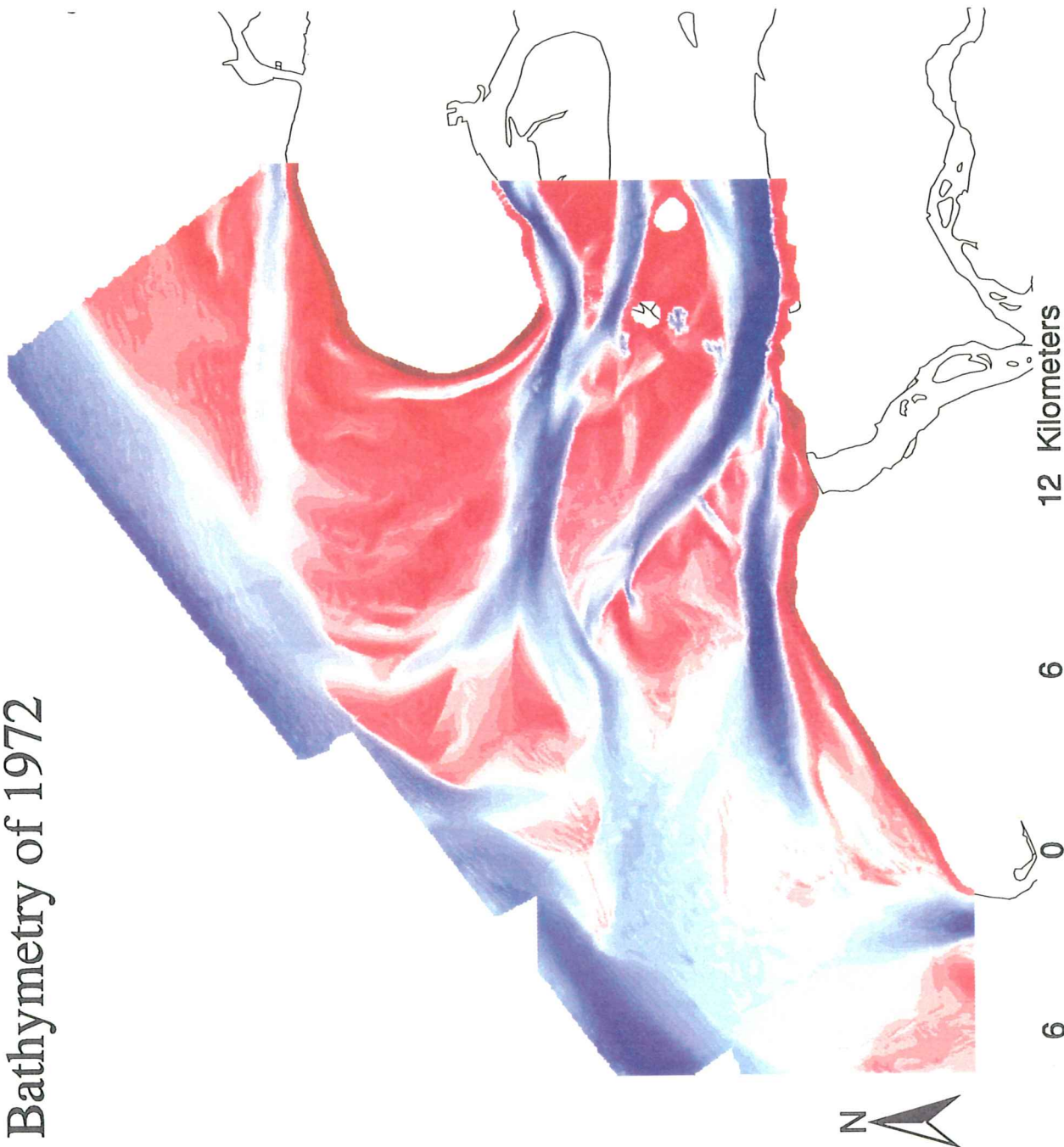
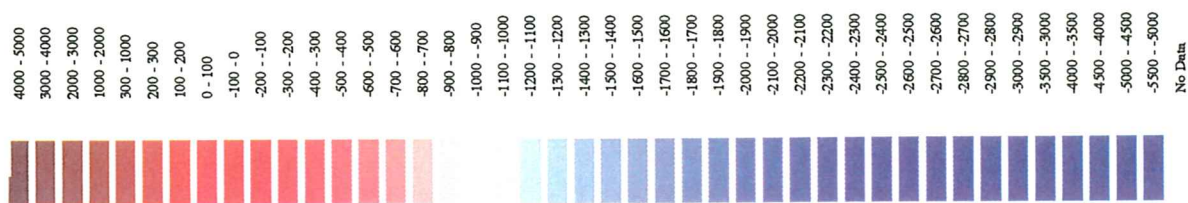
Bathymetry of 1968

Depth in cm



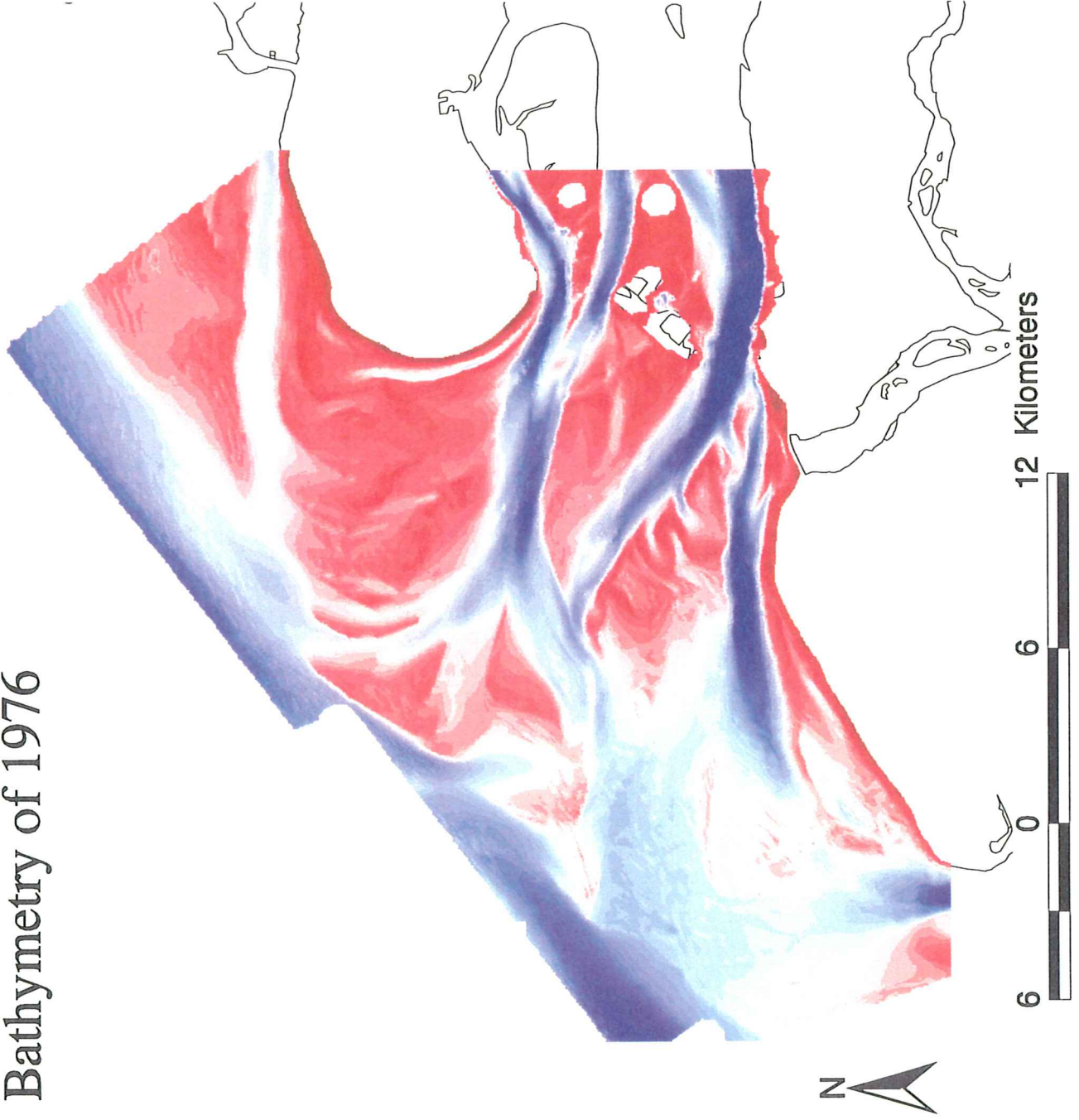
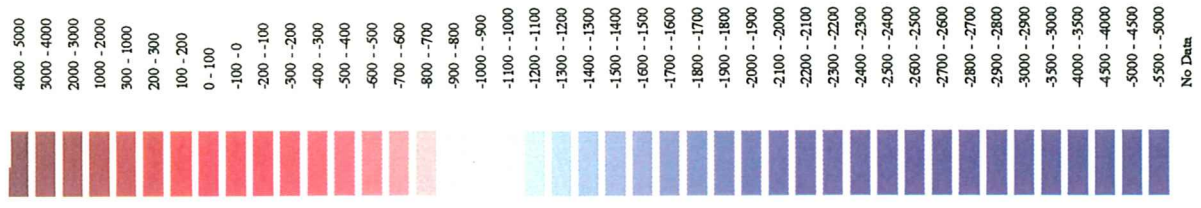
Bathymetry of 1972

Depth in cm



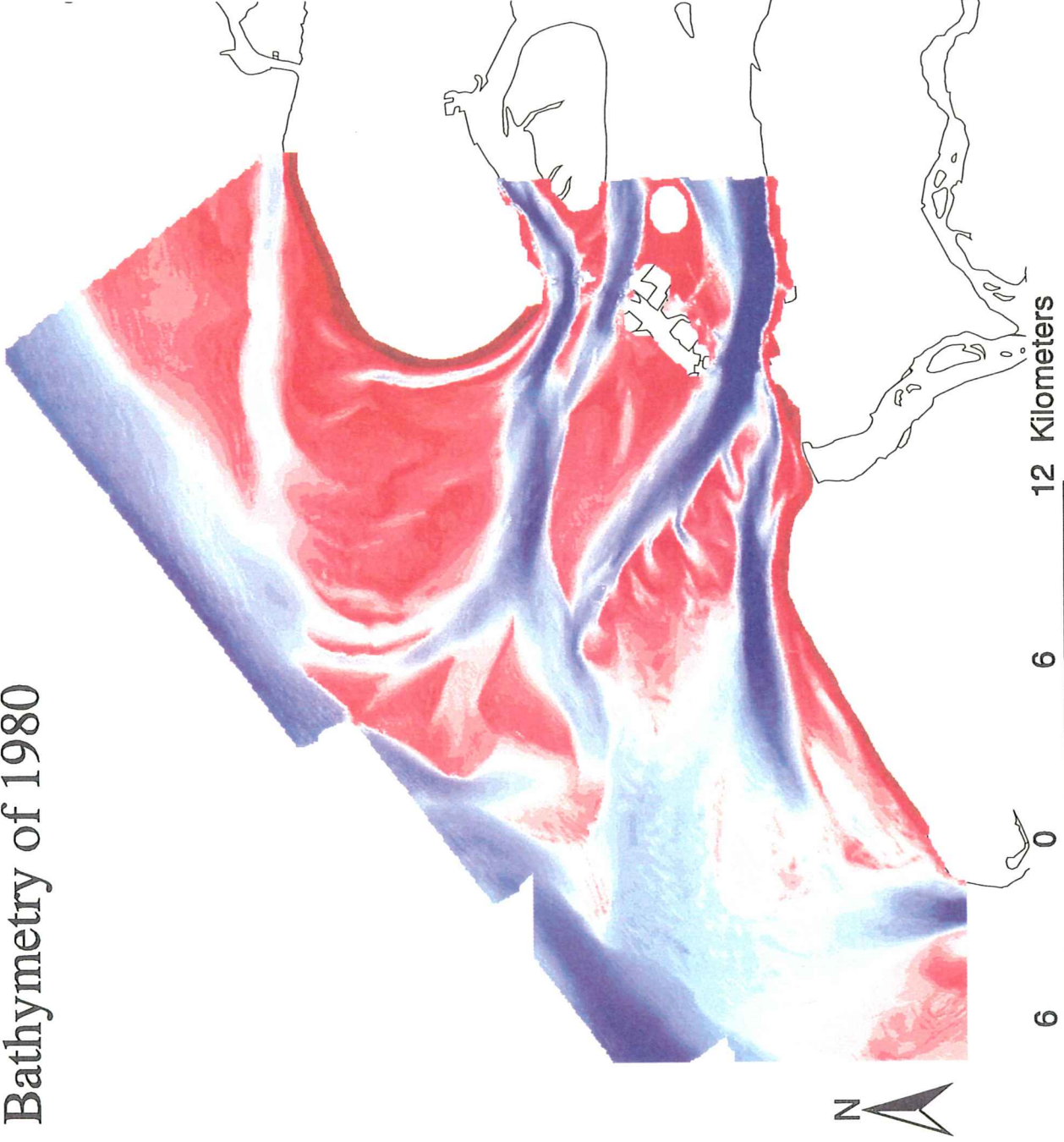
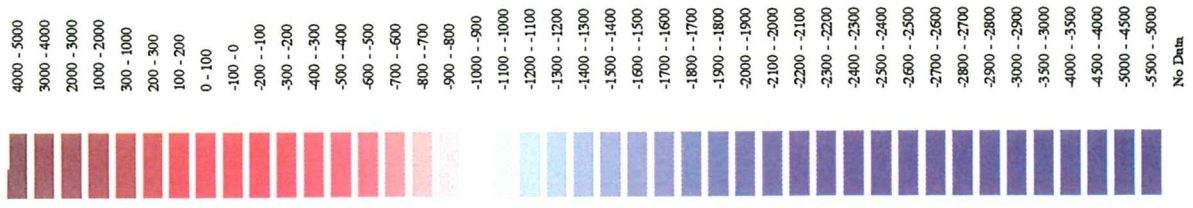
Bathymetry of 1976

Depth in cm



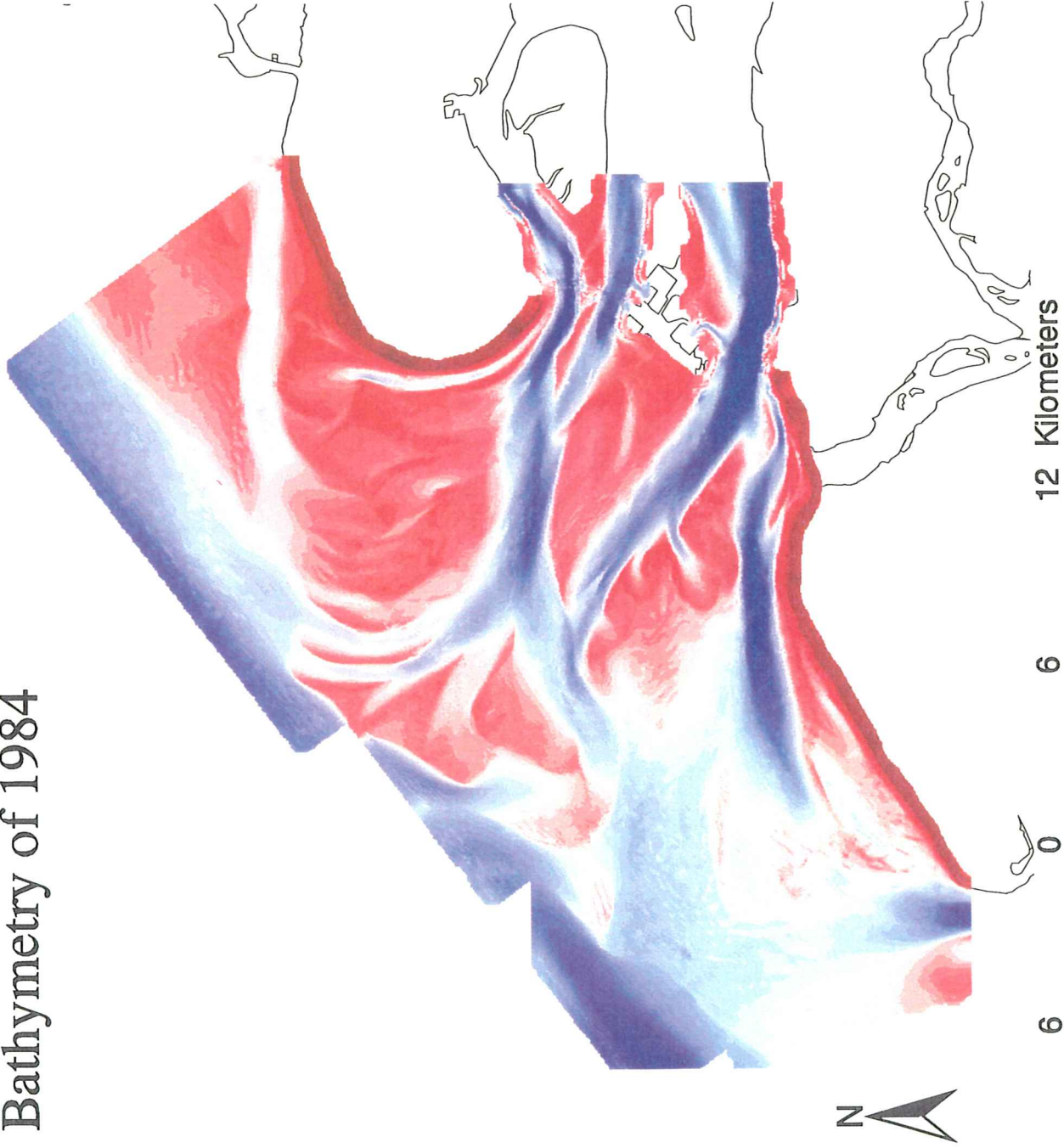
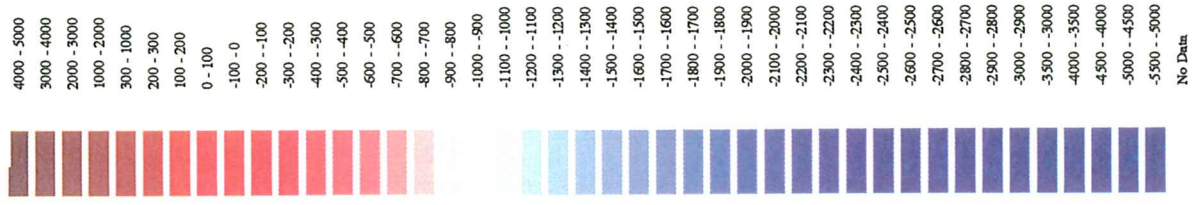
Bathymetry of 1980

Depth in cm

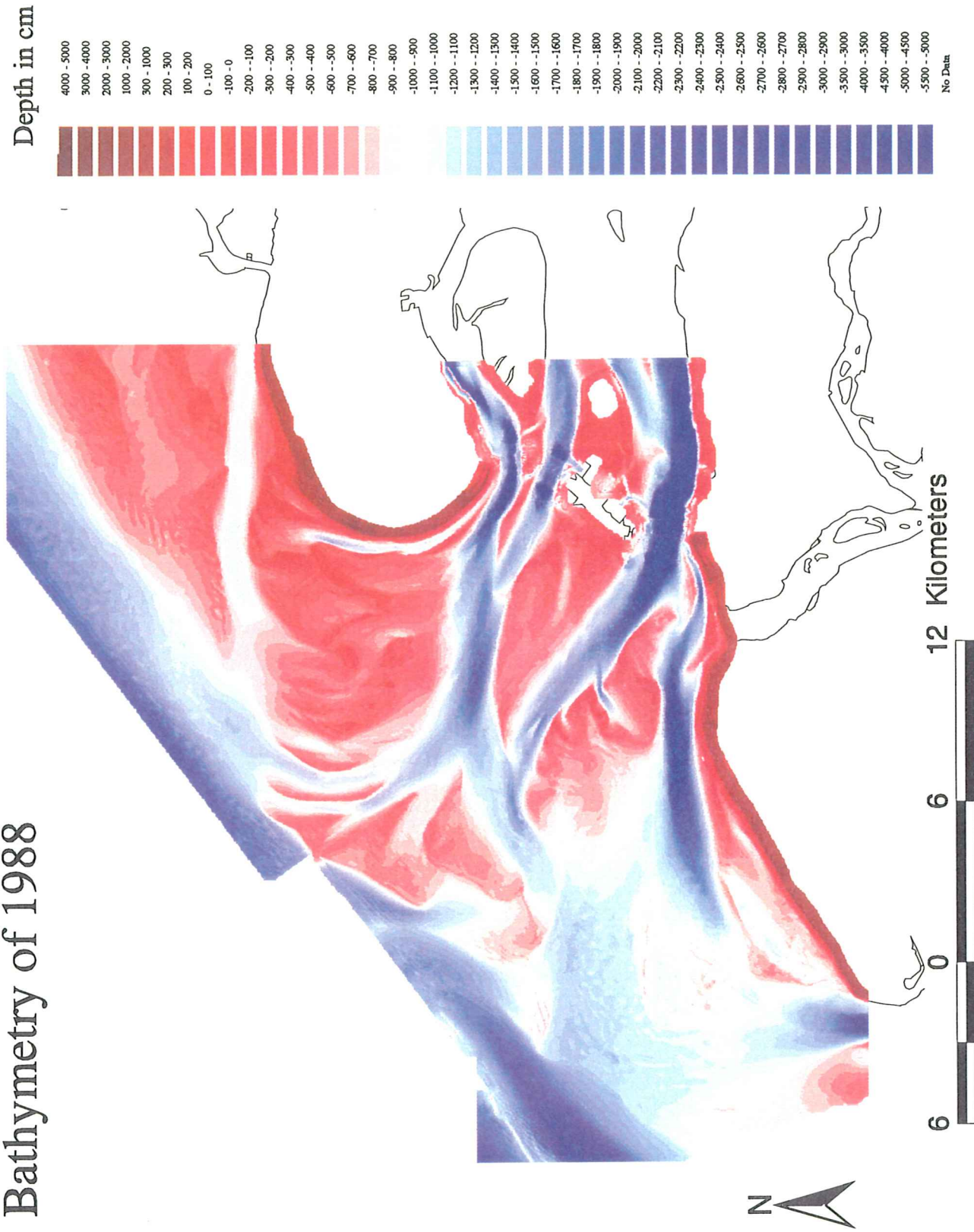


Bathymetry of 1984

Depth in cm

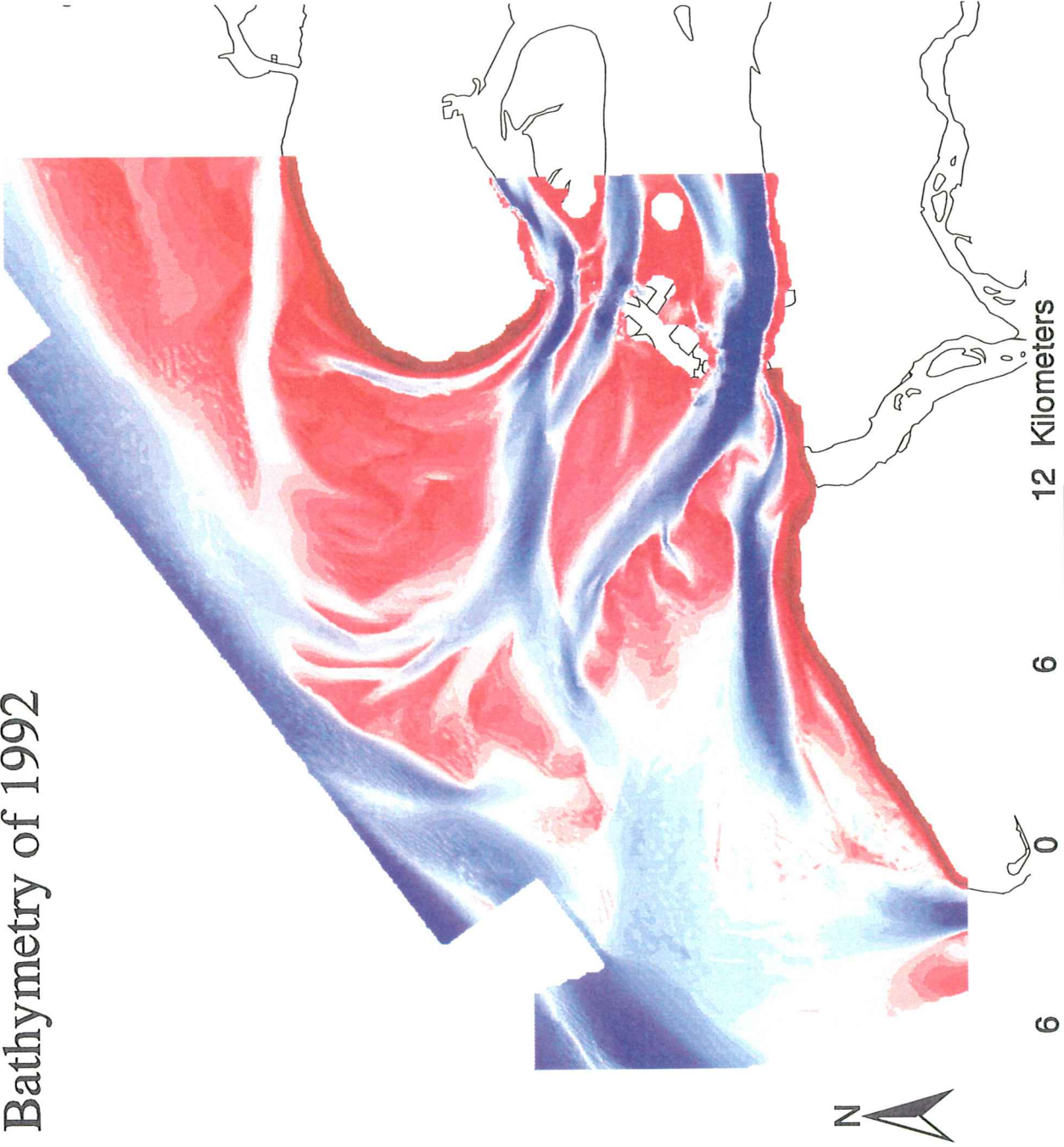
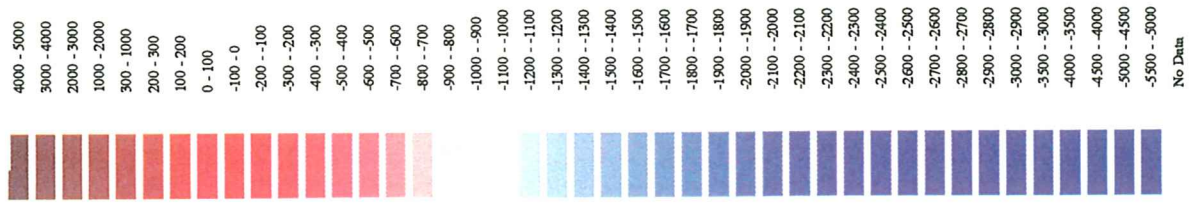


Bathymetry of 1988



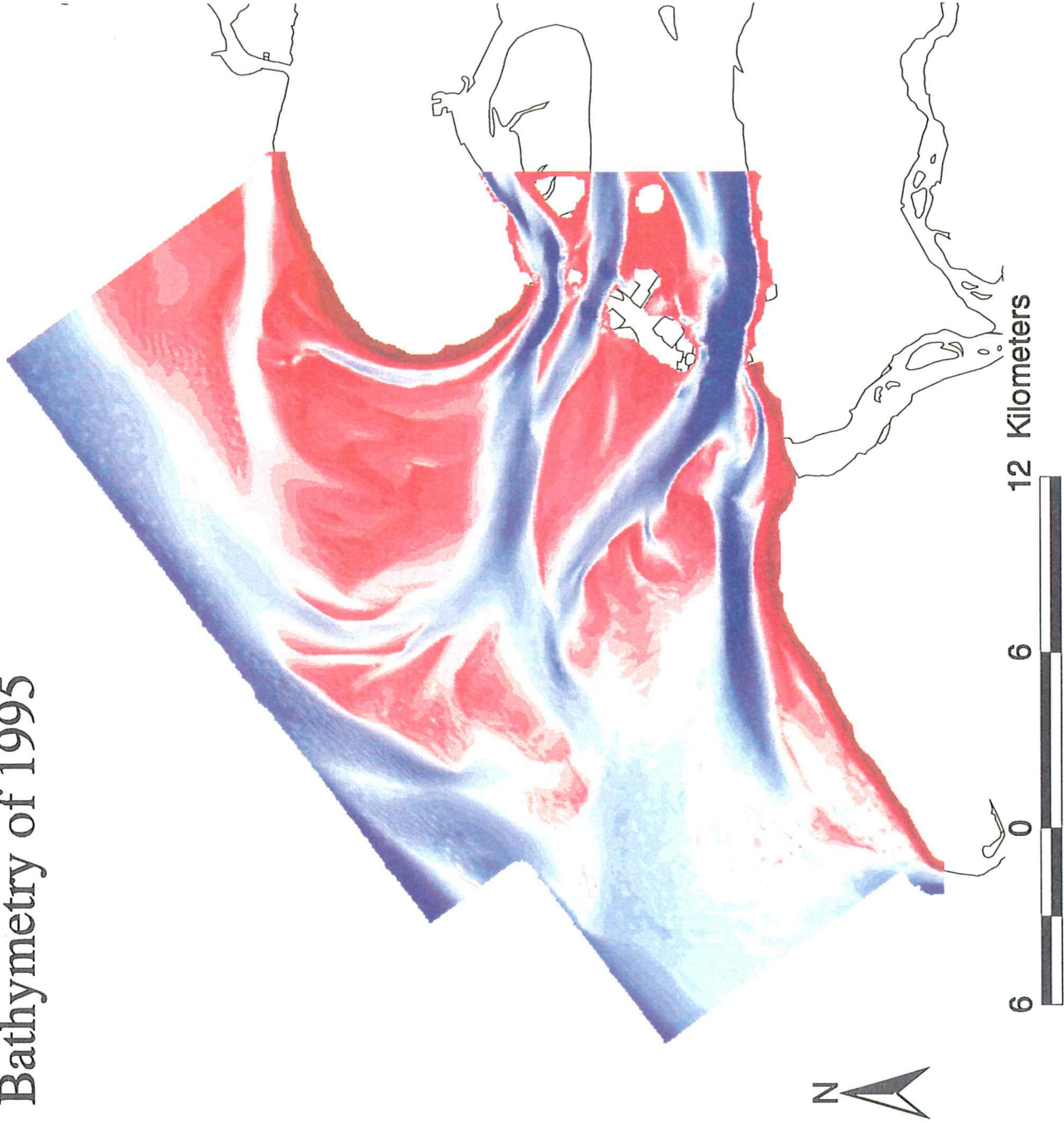
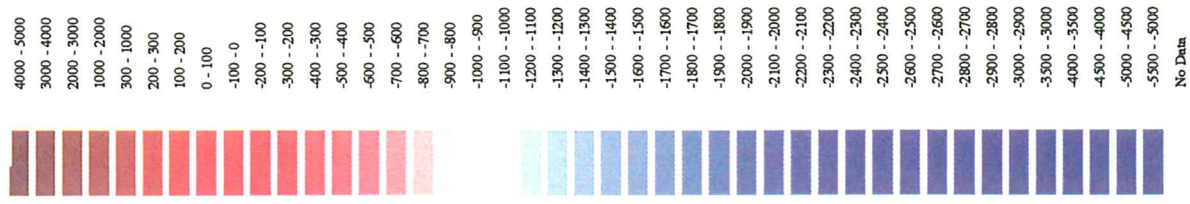
Bathymetry of 1992

Depth in cm



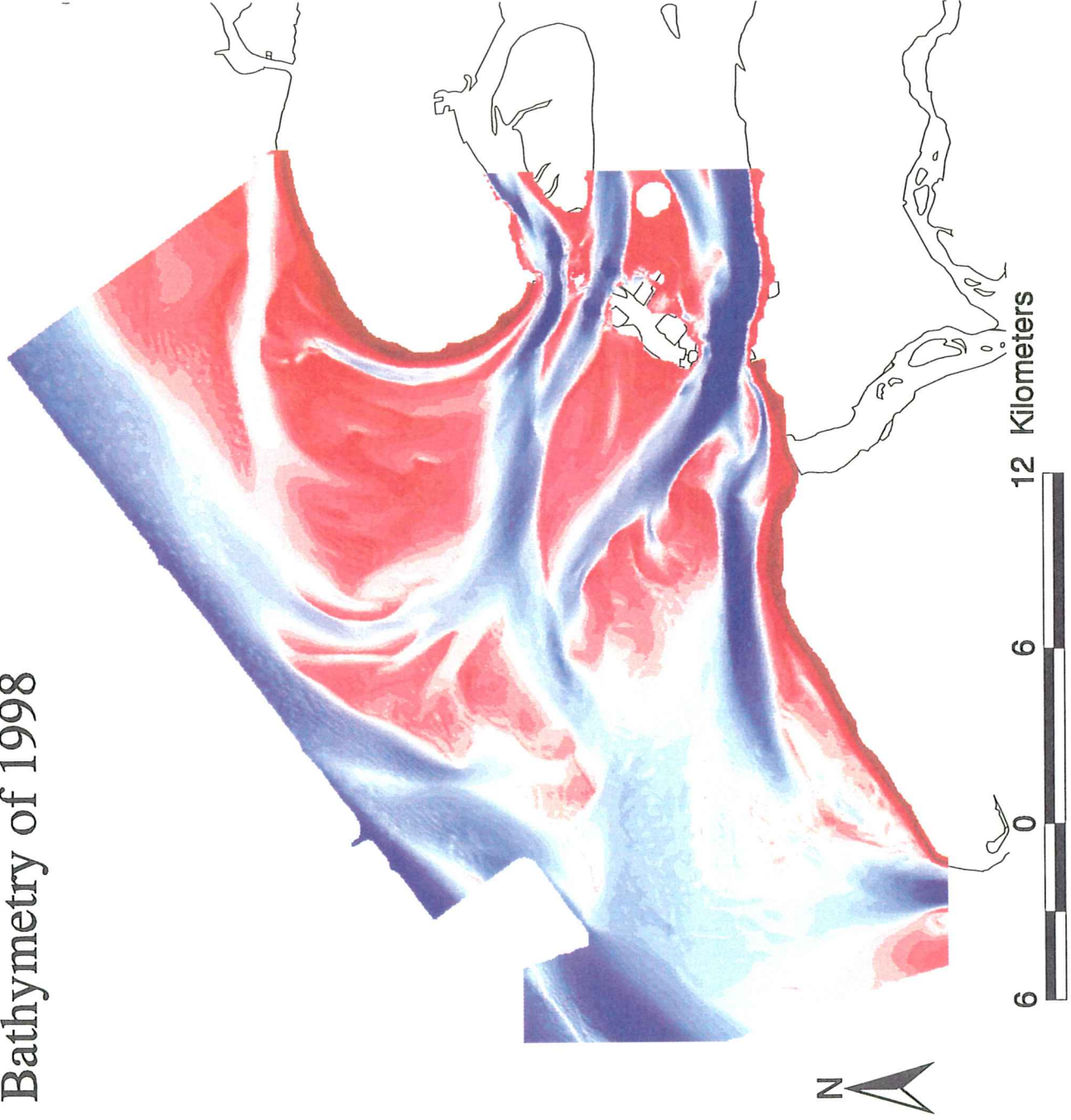
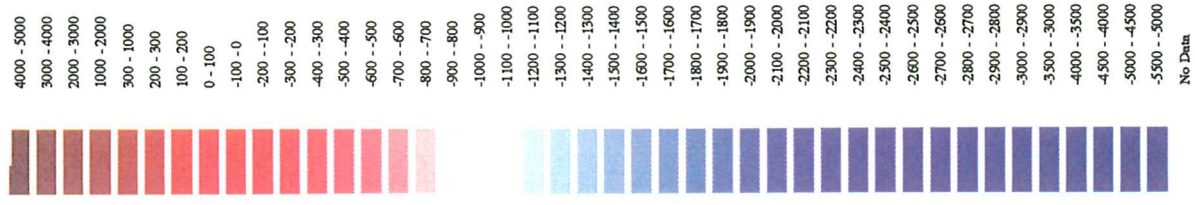
Bathymetry of 1995

Depth in cm



Bathymetry of 1998

Depth in cm

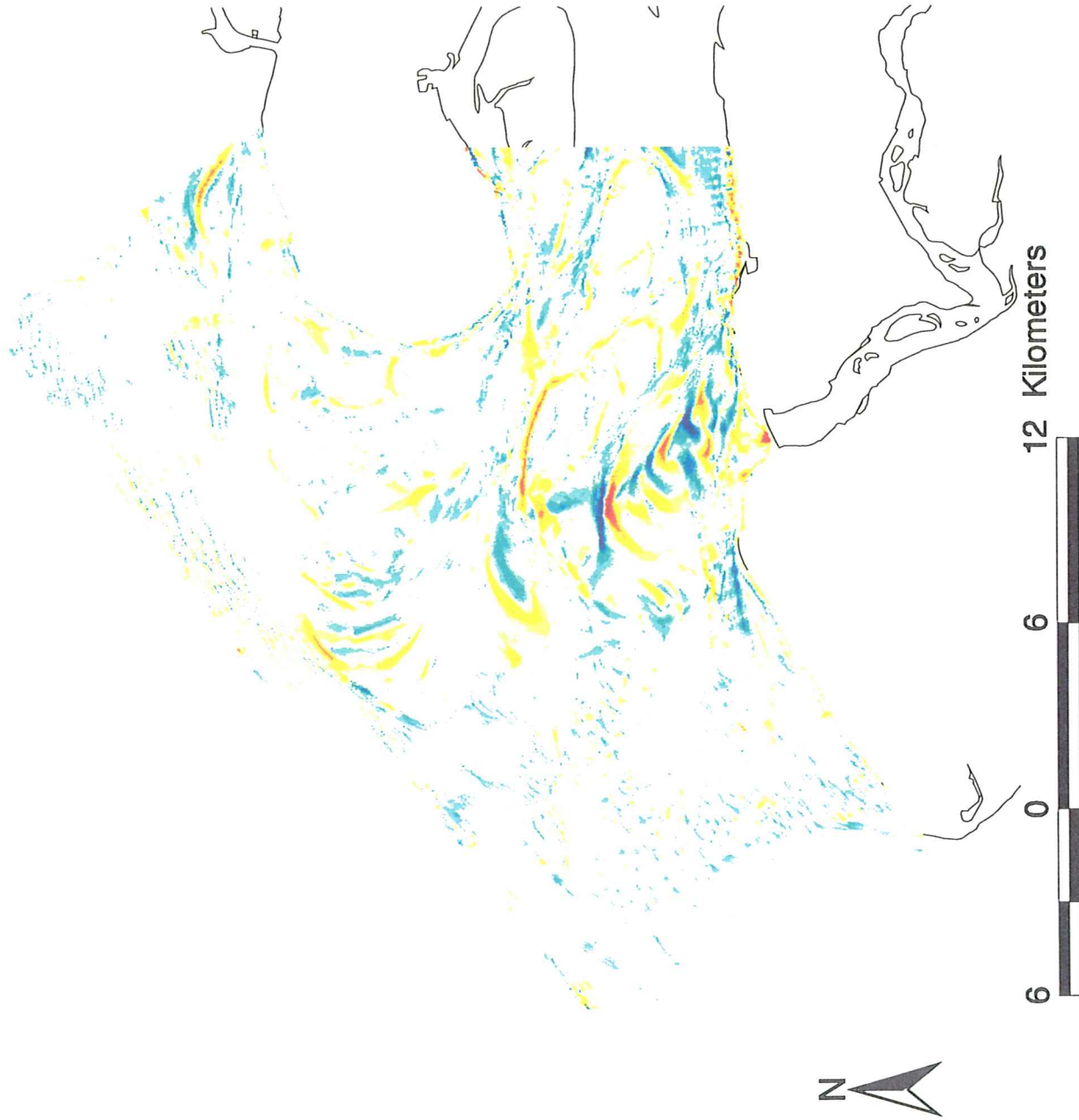
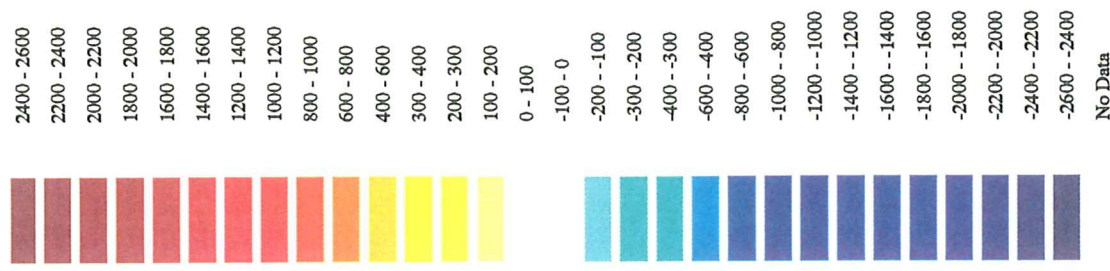


Appendix F2: Sedimentation and erosion maps of the outer tidal delta

Sedimentation and erosion map between 1960 and 1964.
Sedimentation and erosion map between 1964 and 1968.
Sedimentation and erosion map between 1968 and 1972.
Sedimentation and erosion map between 1972 and 1976.
Sedimentation and erosion map between 1976 and 1980.
Sedimentation and erosion map between 1980 and 1984.
Sedimentation and erosion map between 1984 and 1988.
Sedimentation and erosion map between 1988 and 1992.
Sedimentation and erosion map between 1992 and 1995.
Sedimentation and erosion map between 1995 and 1998.

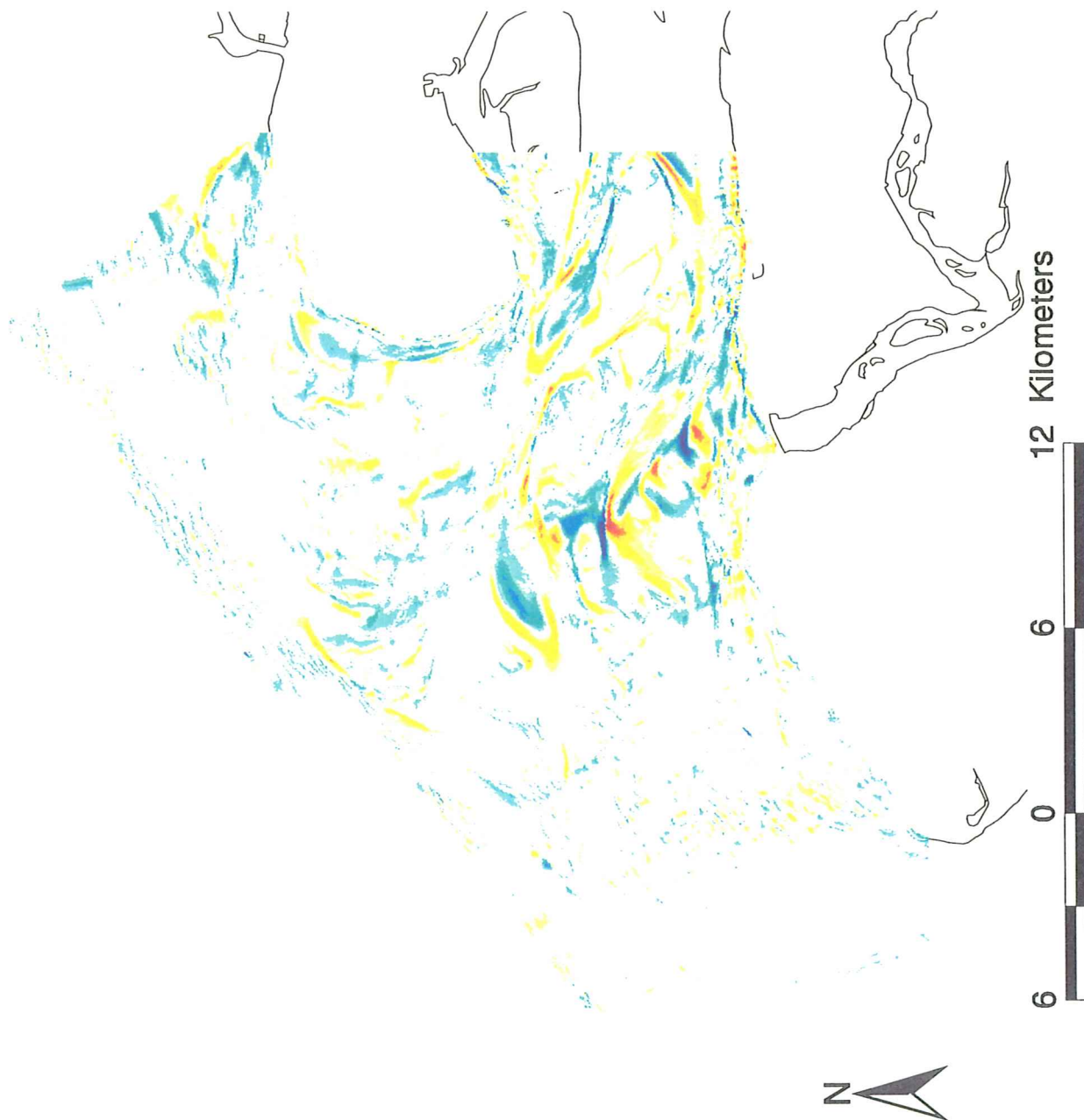
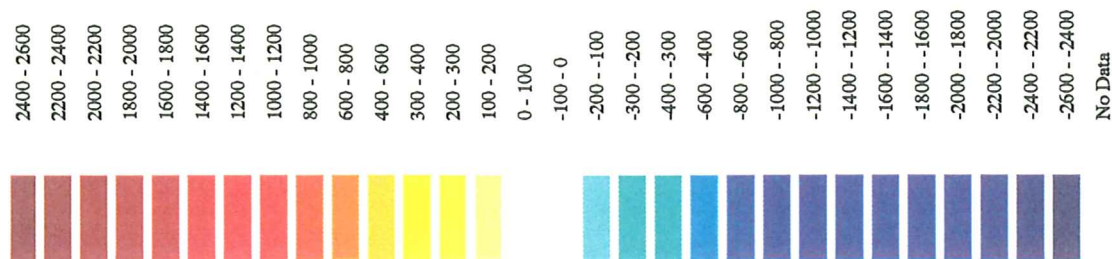
Sedimentation and erosion between 1960 and 1964

depth difference in cm



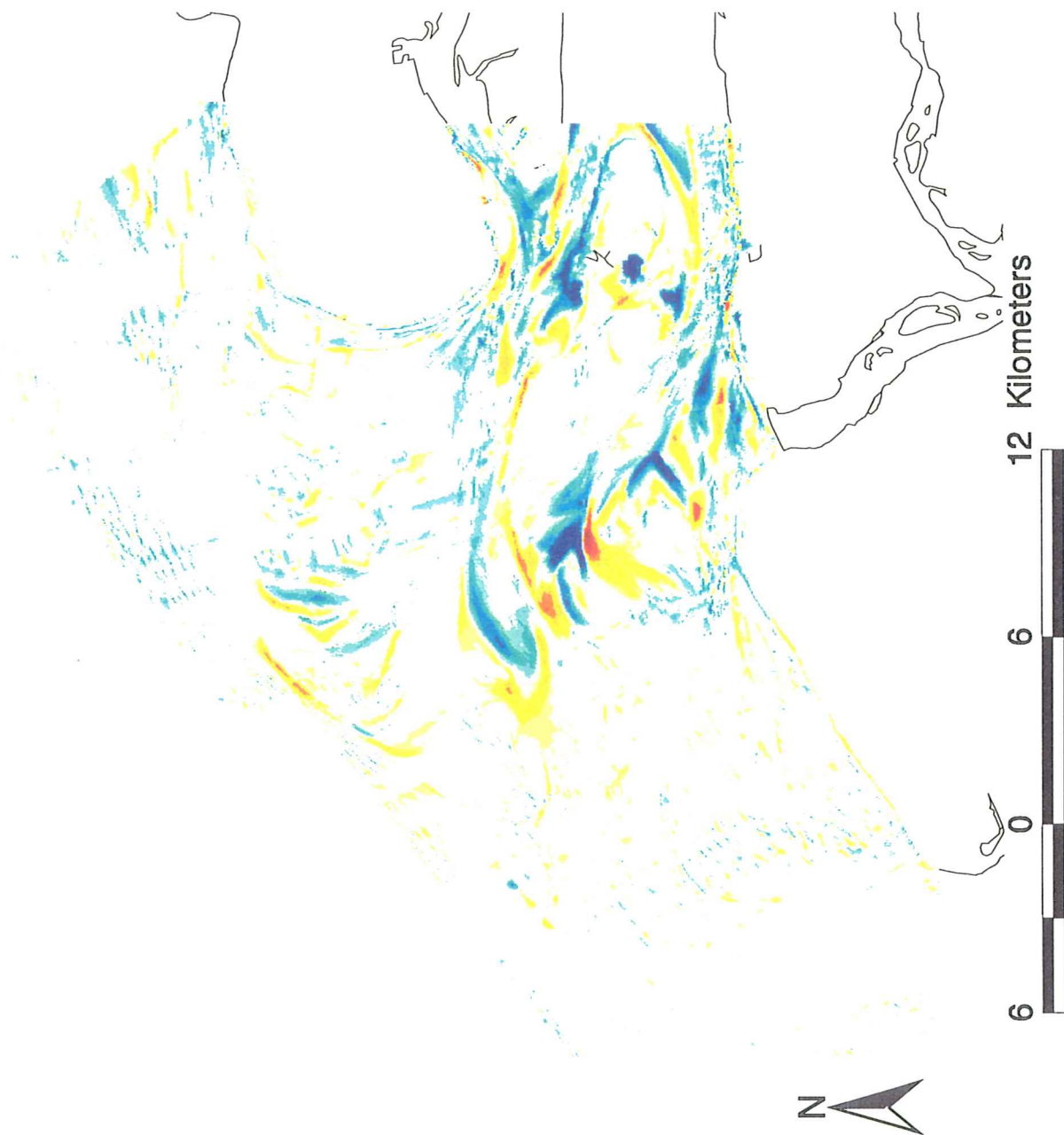
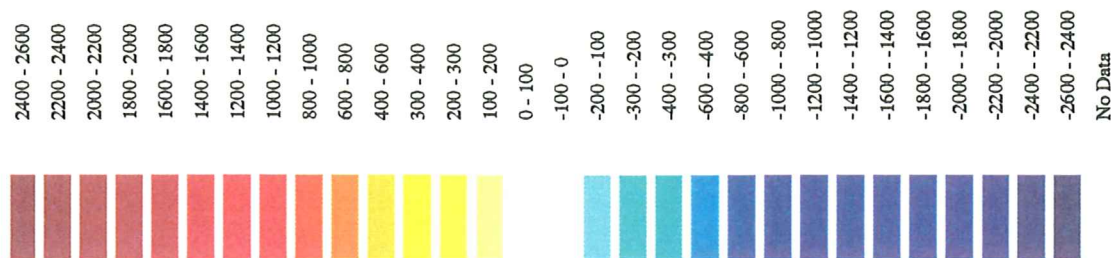
Sedimentation and erosion between 1964 and 1968

depth difference in cm



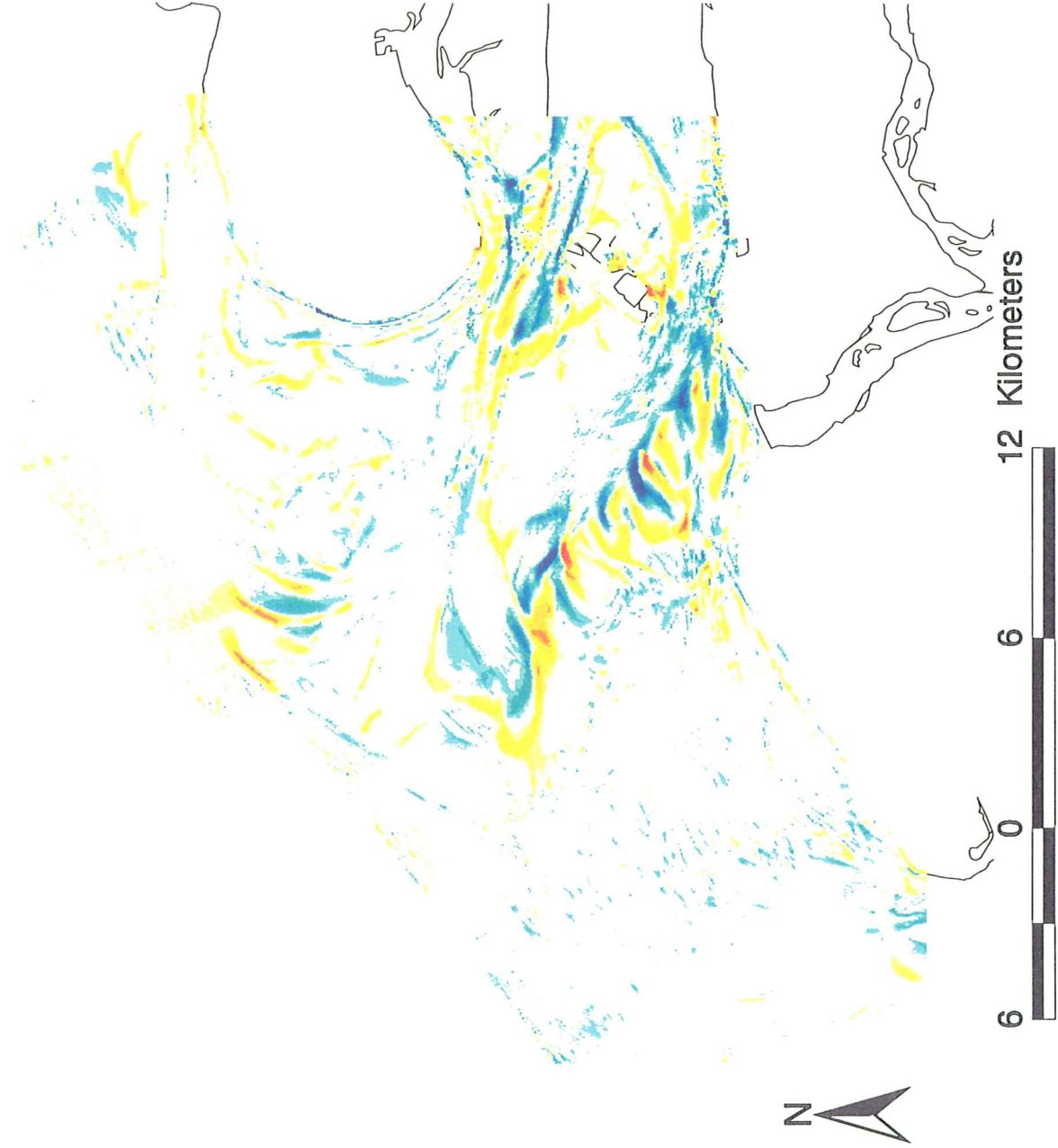
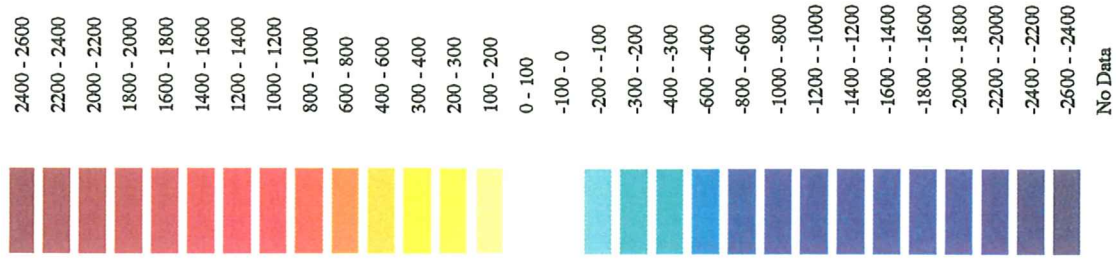
Sedimentation and erosion between 1968 and 1972

depth difference in cm



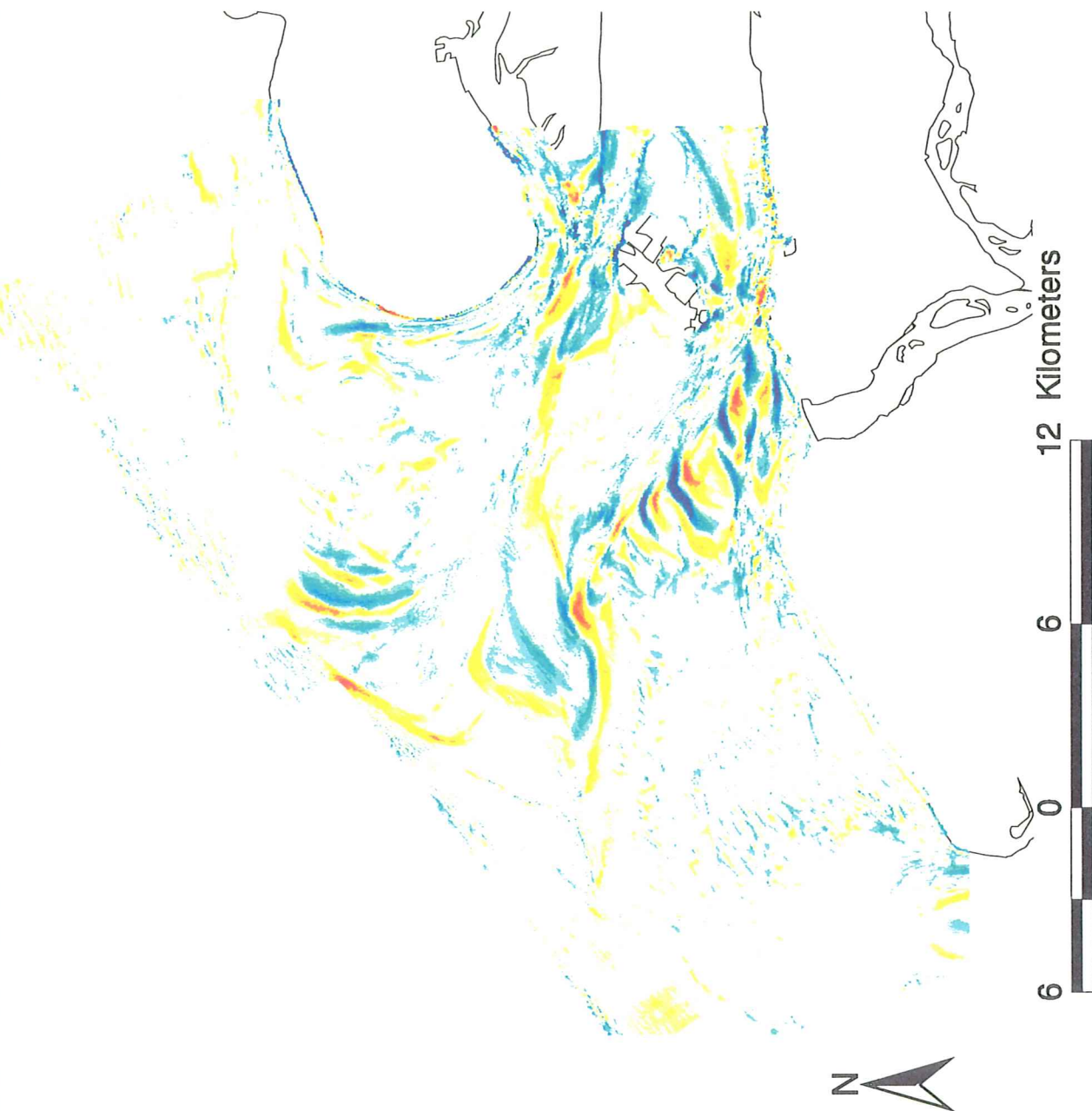
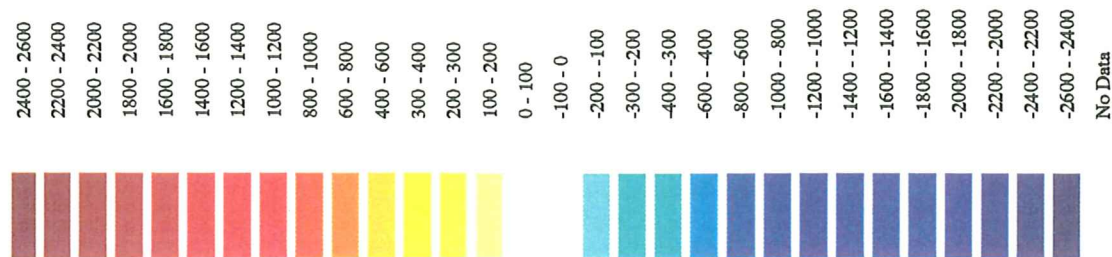
Sedimentation and erosion between 1972 and 1976

depth difference in cm



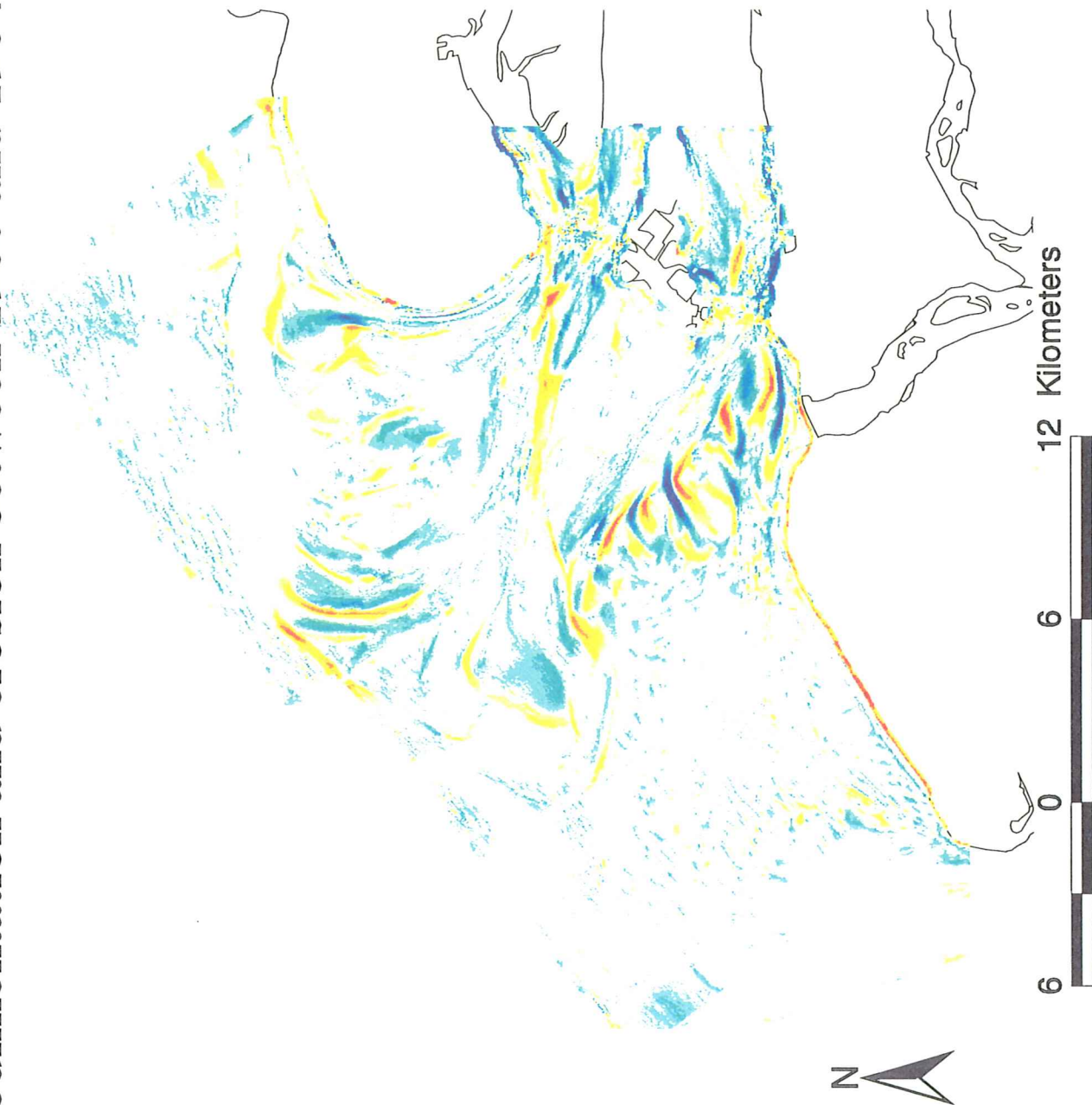
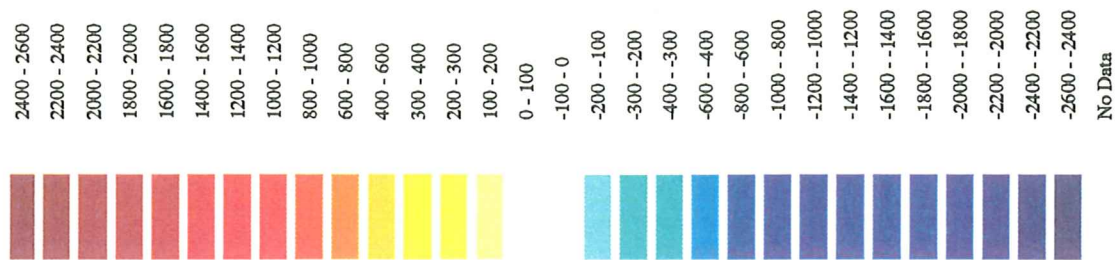
Sedimentation and erosion between 1976 and 1980

depth difference in cm



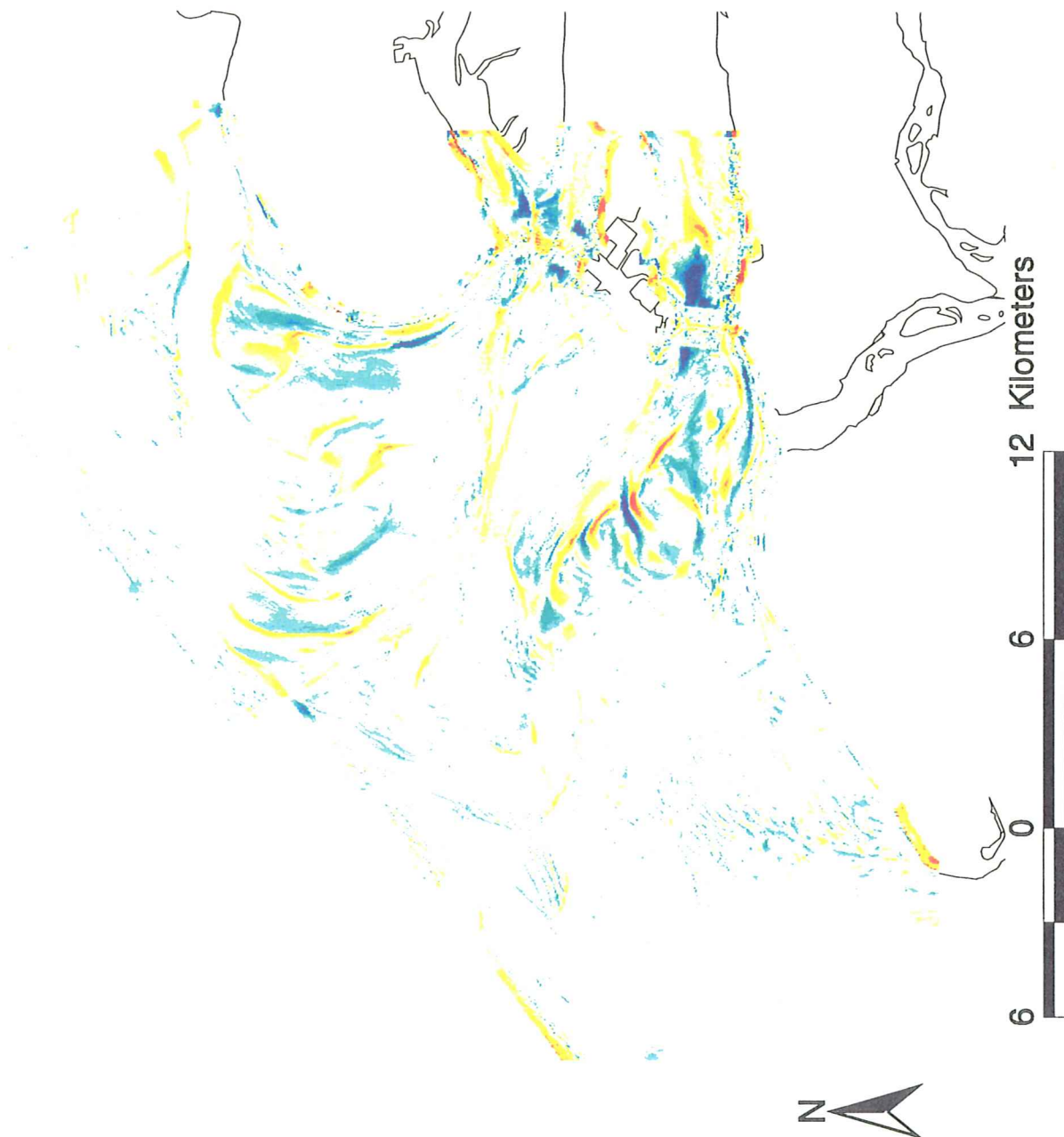
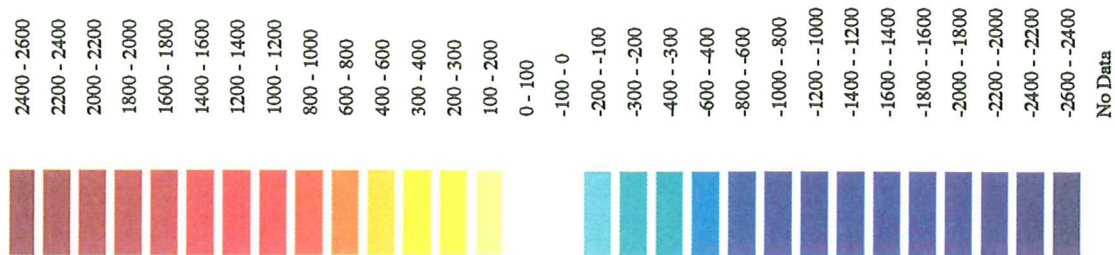
Sedimentation and erosion between 1980 and 1984

depth difference in cm

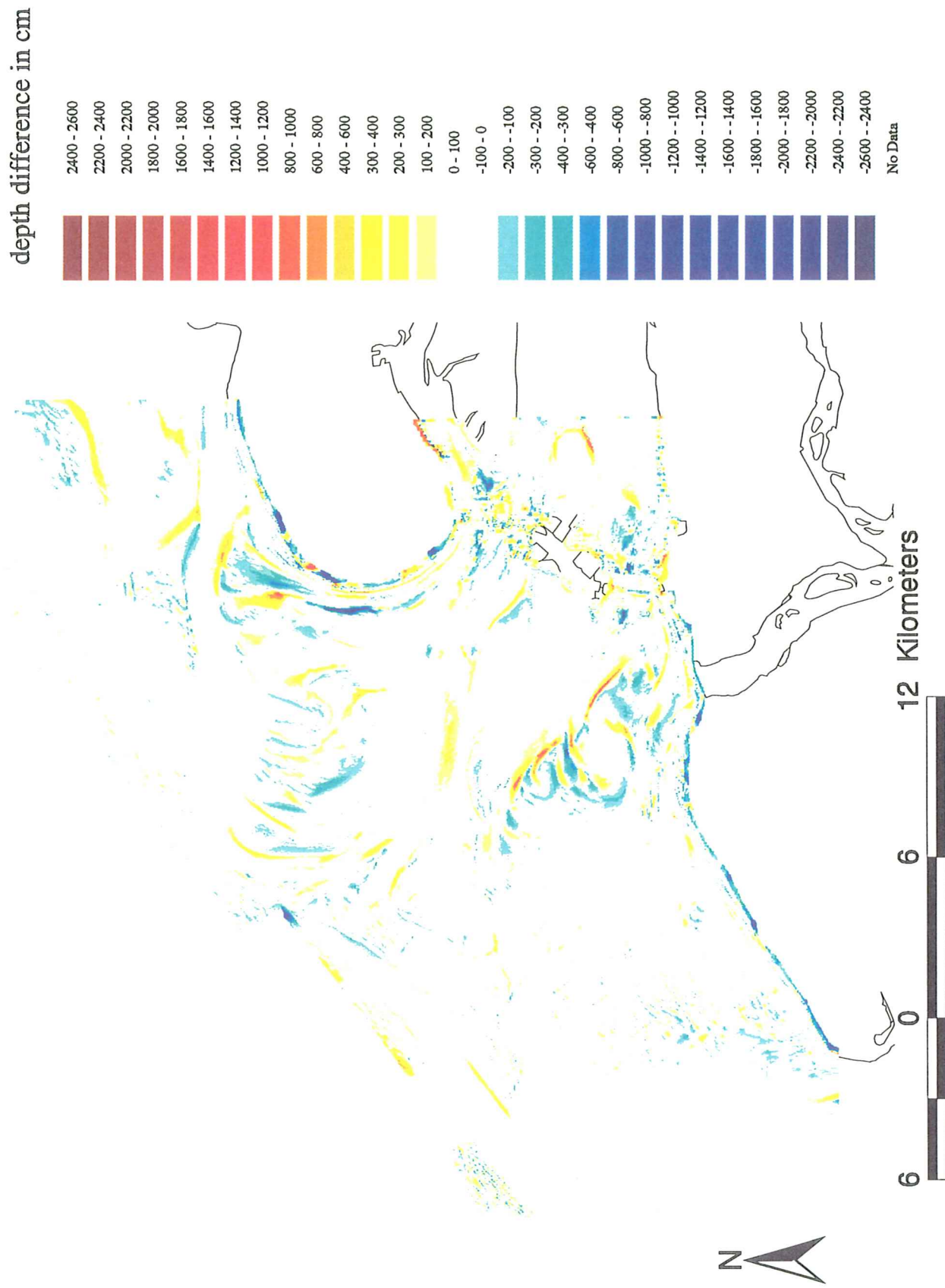


Sedimentation and erosion between 1984 and 1988

depth difference in cm

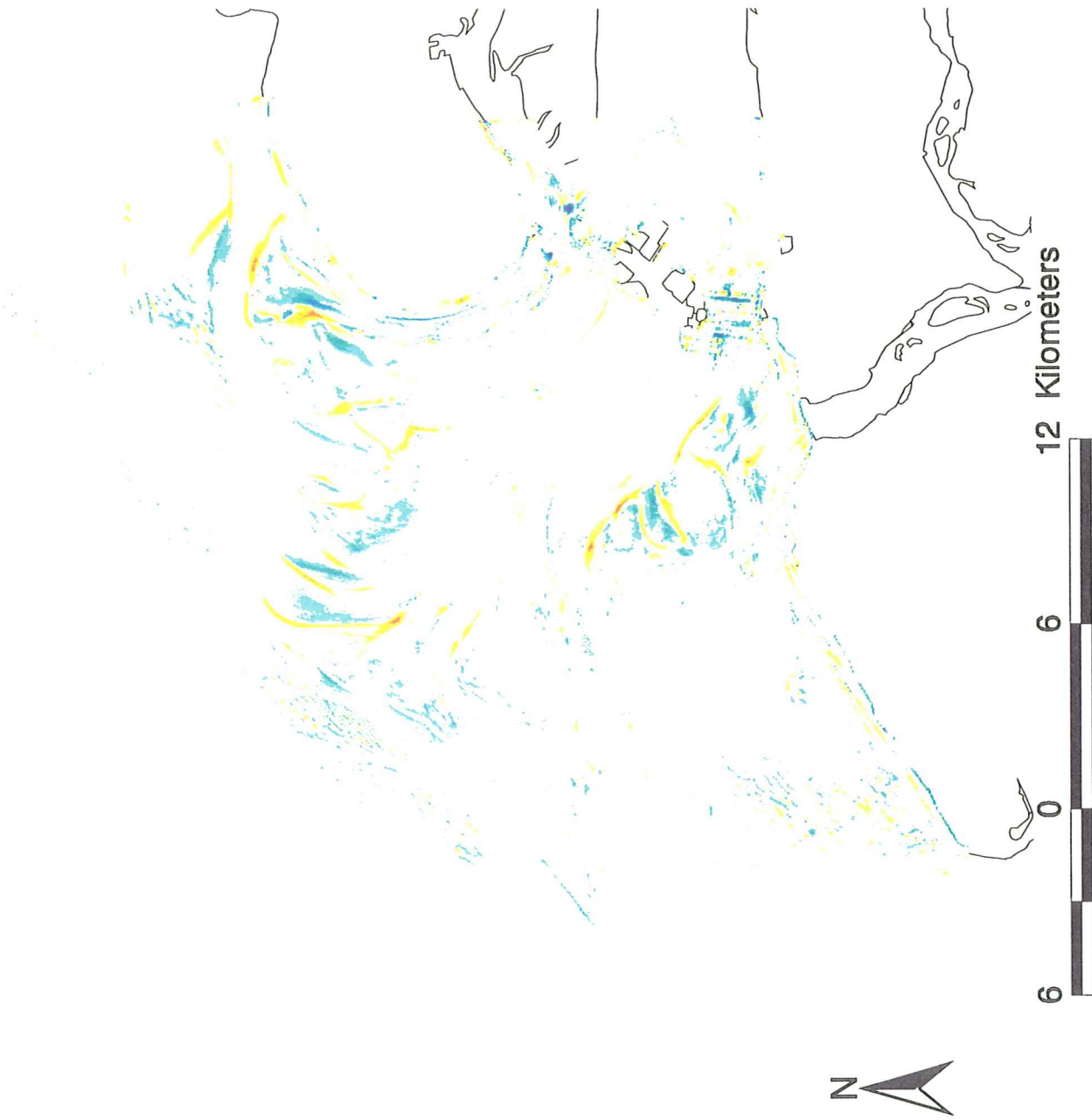
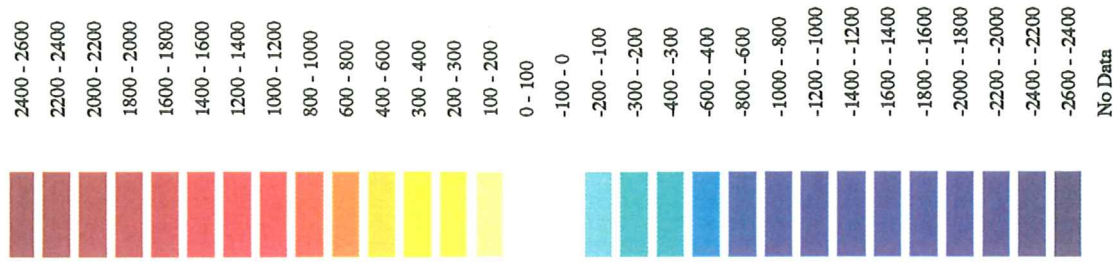


Sedimentation and erosion between 1988 and 1992



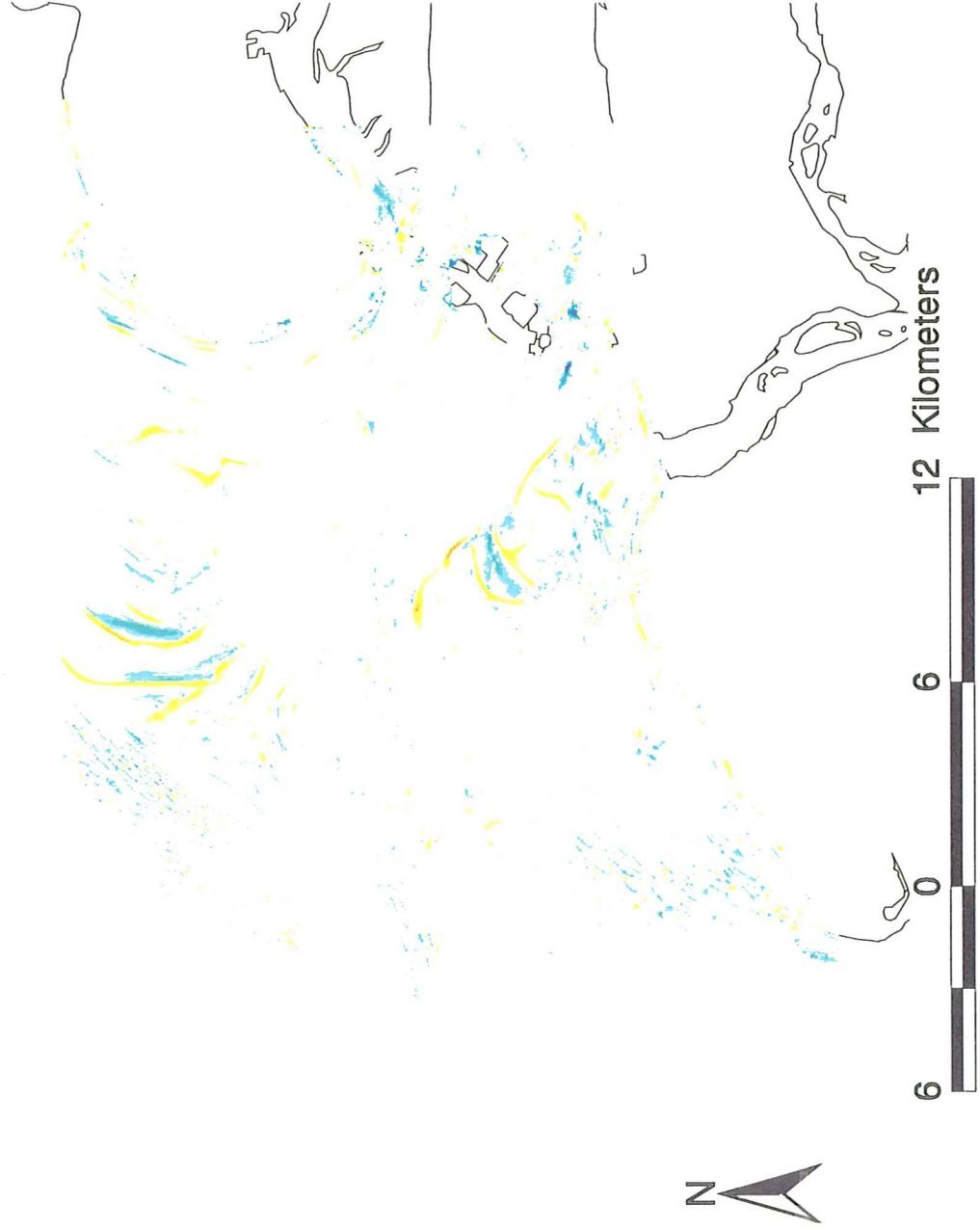
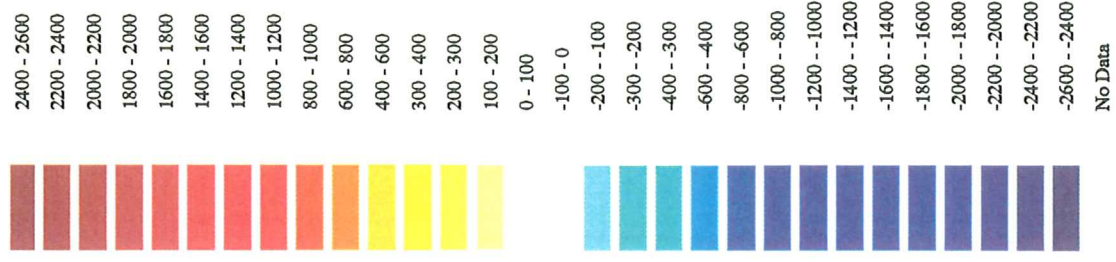
Sedimentation and erosion between 1992 and 1995

depth difference in cm



Sedimentation and erosion between 1995 and 1998

depth difference in cm



Appendix F3: Calculated volumes of the outer tidal delta and the errors

Appendix F3.1: Calculations with linear sections

Appendix F3.2: Calculations with morphological calculation areas

Appendix F3.1: Calculations with linear sections

Figure F3.1.1: The linear calculation sections.

Table F3.1.1: The surface area of the calculation sections at NAP.

Table F3.1.2: The absolute error.

Table F3.1.3: The volumes of the calculation sections below NAP.

Table F3.1.4: The relative errors.

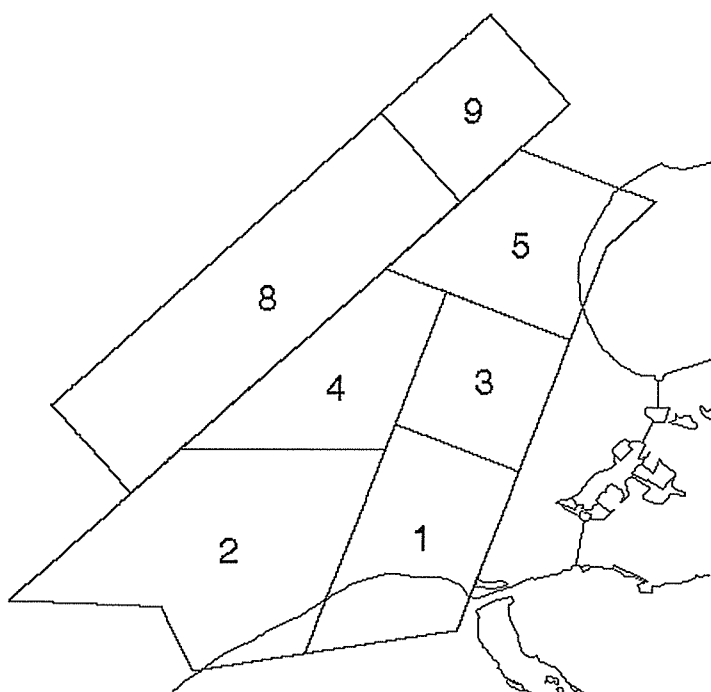


Figure F3.1.1: The linear calculation sections.

Table F3.1.1: The surface area of the calculation sections at NAP in 10^7 m^2 .

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 8	Section 9	Total area
1964	2.76	6.59	2.68	3.41	3.30	7.39	2.48	28.61
1968	2.77	6.55	2.68	3.41	3.30	7.39	2.48	28.58
1976	2.76	6.58	2.68	3.41	3.30	7.42	2.48	28.63
1980	2.76	6.58	2.68	3.41	3.31	7.39	2.48	28.60
1984	2.75	6.58	2.68	3.41	3.32	7.40	2.48	28.62
1988	2.75	6.58	2.68	3.41	3.31	7.42	2.48	28.63
1992	2.75	6.57	2.68	3.41	3.31	7.17	2.48	28.37
1995	2.75	6.50	2.68	3.41	3.31	7.15	2.48	28.28
1998	2.73	6.57	2.68	3.41	3.30	7.15	2.48	28.32

Table F3.1.2: The absolute error in 10^7 m^3 .

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 8	Section 9	Total area
1964	0.28	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1968	0.28	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1976	0.28	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1980	0.28	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1984	0.28	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1988	0.27	0.66	0.27	0.34	0.33	0.74	0.25	2.86
1992	0.27	0.66	0.27	0.34	0.33	0.72	0.25	2.84
1995	0.27	0.65	0.27	0.34	0.33	0.71	0.25	2.83
1998	0.27	0.66	0.27	0.34	0.33	0.71	0.25	2.83

Table F3.1.3: The volumes of the calculation sections below NAP in 10^7 m^3 .

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 8	Section 9	Total area
1964	31.30	68.15	25.18	35.03	13.75	70.83	22.85	267.09
1968	30.57	67.68	25.47	35.24	13.79	71.38	22.72	266.85
1976	29.78	66.74	26.07	34.90	13.42	69.59	22.48	262.98
1980	29.85	66.67	25.59	34.95	13.30	67.19	22.13	259.66
1984	29.95	67.64	25.98	35.66	13.69	68.73	22.69	264.35
1988	29.88	68.05	25.85	35.68	14.16	69.54	22.79	265.95
1992	29.61	67.99	25.52	35.44	14.56	64.54	22.71	260.36
1995	29.67	67.70	25.60	35.54	15.15	65.13	22.74	261.53
1998	29.76	68.50	25.72	35.53	15.15	65.62	22.78	263.06

Table F3.1.4: The relative errors.

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 8	Section 9	Total area
1964	0.88%	0.97%	1.06%	0.97%	2.40%	1.04%	1.08%	1.07%
1968	0.91%	0.97%	1.05%	0.97%	2.40%	1.04%	1.09%	1.07%
1976	0.93%	0.99%	1.03%	0.98%	2.46%	1.07%	1.10%	1.09%
1980	0.92%	0.99%	1.05%	0.98%	2.49%	1.10%	1.12%	1.10%
1984	0.92%	0.97%	1.03%	0.96%	2.42%	1.08%	1.09%	1.08%
1988	0.92%	0.97%	1.03%	0.96%	2.34%	1.07%	1.09%	1.08%
1992	0.93%	0.97%	1.05%	0.96%	2.27%	1.11%	1.09%	1.09%
1995	0.93%	0.96%	1.05%	0.96%	2.19%	1.10%	1.09%	1.08%
1998	0.92%	0.96%	1.04%	0.96%	2.18%	1.09%	1.09%	1.08%

Appendix F3.2: Calculations with morphological calculation areas

Figure F3.2.1: The morphological calculation areas.

Table F3.2.1: The surface area of the calculation areas at NAP -3 m and NAP.

Table F3.2.2: The absolute error.

Table F3.2.3: The volumes of the calculation sections below NAP -3 m and NAP.

Table F3.2.4: The relative errors.

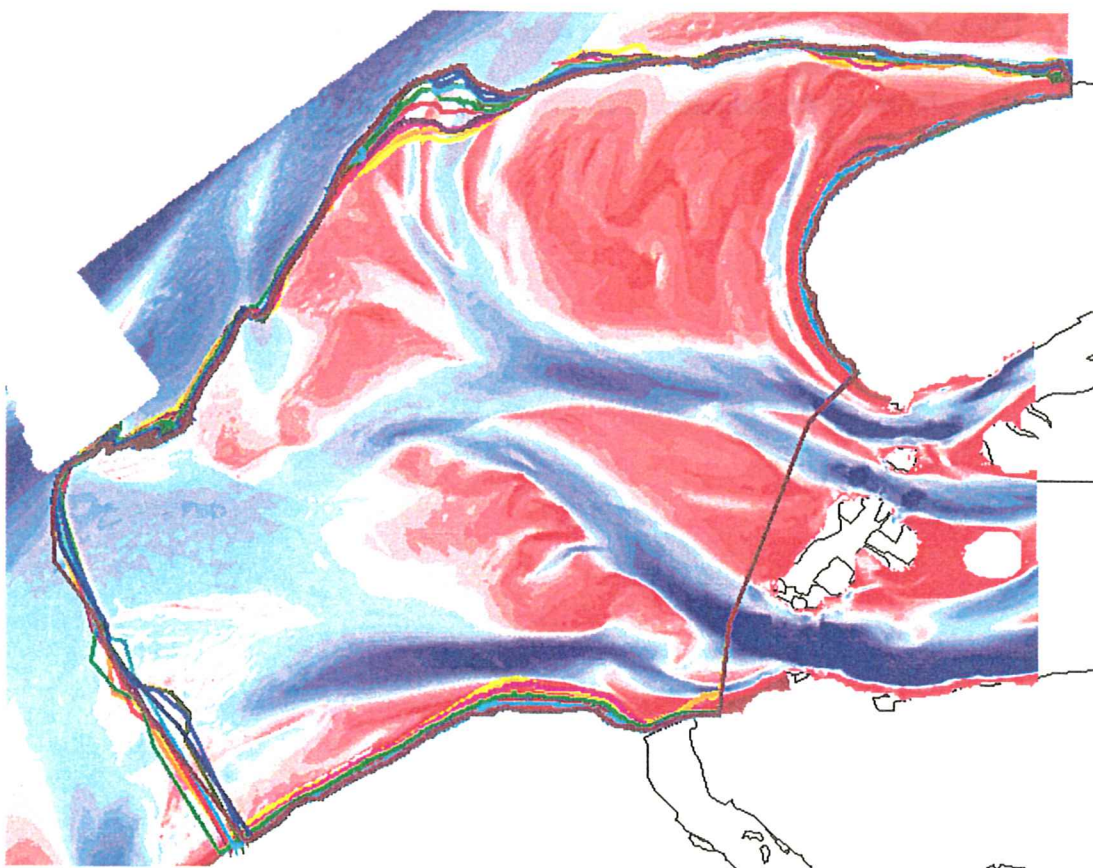
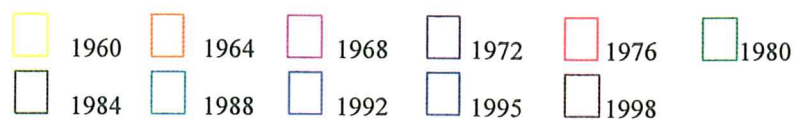


Figure F3.2.1: The morphological calculation areas.

Table F3.2.1: The surface area of the calculation areas at NAP -3 m and NAP in 10^8 m^2 .

	calculation area of 1960		calculation area of 1998		changing calculation areas in time	
	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m
1960	2.57	2.81	2.61	2.86	2.57	2.81
1964	2.55	2.81	2.58	2.86	2.55	2.82
1968	2.57	2.81	2.60	2.86	2.57	2.82
1972	2.57	2.81	2.61	2.86	2.59	2.83
1976	2.54	2.81	2.58	2.85	2.57	2.84
1980	2.51	2.81	2.55	2.85	2.56	2.86
1984	2.52	2.81	2.56	2.86	2.53	2.82
1988	2.54	2.80	2.58	2.85	2.57	2.84
1992	2.55	2.80	2.59	2.85	2.56	2.82
1995	2.57	2.80	2.61	2.85	2.59	2.83
1998	2.58	2.80	2.62	2.85	2.62	2.85

Table F3.2.2: The absolute error in 10^8 m^3 .

	calculation area of 1960		calculation area of 1998		changing calculation areas in time	
	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m
1960	0.26	0.28	0.26	0.29	0.26	0.28
1964	0.25	0.28	0.26	0.29	0.25	0.28
1968	0.26	0.28	0.26	0.29	0.26	0.28
1972	0.26	0.28	0.26	0.29	0.26	0.28
1976	0.25	0.28	0.26	0.29	0.26	0.28
1980	0.25	0.28	0.26	0.29	0.26	0.29
1984	0.25	0.28	0.26	0.29	0.25	0.28
1988	0.25	0.28	0.26	0.29	0.26	0.28
1992	0.26	0.28	0.26	0.29	0.26	0.28
1995	0.26	0.28	0.26	0.28	0.26	0.28
1998	0.26	0.28	0.26	0.28	0.26	0.28

Table F3.2.3: The volumes of the calculation sections below NAP -3 m and NAP in 10^8 m^3 .

	calculation area of 1960		calculation area of 1998		changing calculation areas in time	
	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m
1960	15.54	25.18	16.06	25.85	15.54	25.18
1964	15.38	24.98	15.85	25.59	15.40	25.02
1968	15.38	24.99	15.84	25.59	15.39	25.01
1972	15.11	24.75	15.52	25.30	15.19	24.89
1976	15.04	24.65	15.37	25.13	15.13	24.83
1980	14.91	24.47	15.17	24.88	15.09	24.83
1984	15.31	24.86	15.52	25.22	15.29	24.88
1988	15.39	24.96	15.59	25.31	15.47	25.14
1992	15.27	24.85	15.46	25.19	15.22	24.82
1995	15.44	25.03	15.63	25.37	15.48	25.14
1998	15.53	25.12	15.69	25.42	15.71	25.44

Table F3.2.4: The relative errors.

	calculation area of 1960		calculation area of 1998		changing calculation areas in time	
	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m	NAP -3.5 m	NAP +0 m
1960	1.65%	1.12%	1.63%	1.11%	1.65%	1.12%
1964	1.66%	1.13%	1.63%	1.12%	1.66%	1.13%
1968	1.67%	1.12%	1.64%	1.12%	1.67%	1.13%
1972	1.70%	1.13%	1.68%	1.13%	1.70%	1.14%
1976	1.69%	1.14%	1.68%	1.14%	1.70%	1.14%
1980	1.68%	1.15%	1.68%	1.15%	1.70%	1.15%
1984	1.65%	1.13%	1.65%	1.13%	1.65%	1.13%
1988	1.65%	1.12%	1.65%	1.13%	1.66%	1.13%
1992	1.67%	1.13%	1.68%	1.13%	1.68%	1.13%
1995	1.67%	1.12%	1.67%	1.12%	1.67%	1.12%
1998	1.66%	1.11%	1.67%	1.12%	1.67%	1.12%

Appendix F4: Vertical sedimentation and erosion profiles

Appendix F4.1: Vertical sedimentation and erosion profiles of the calculations with linear sections

Appendix F4.2: Vertical sedimentation and erosion profiles of the calculations with morphological calculation areas

Appendix F4.1: Vertical sedimentation and erosion profiles of the calculations with linear sections

Vertical sedimentation and erosion profile of section 1

Vertical sedimentation and erosion profile of section 2

Vertical sedimentation and erosion profile of section 3

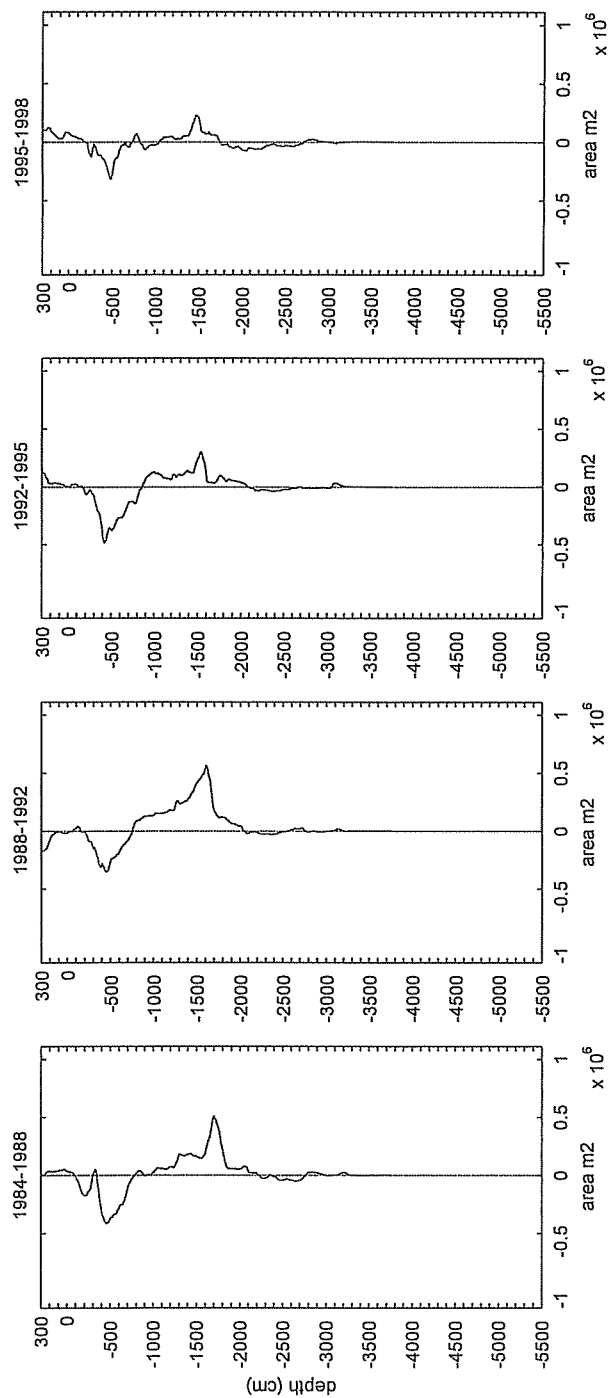
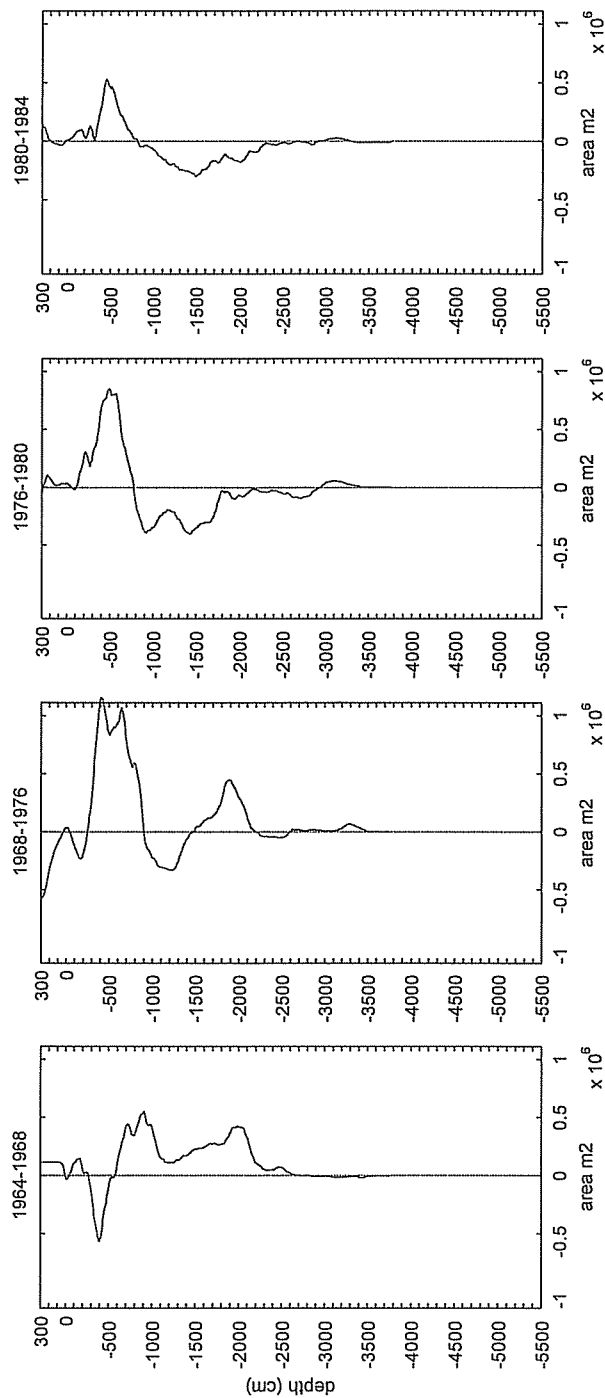
Vertical sedimentation and erosion profile of section 4

Vertical sedimentation and erosion profile of section 5

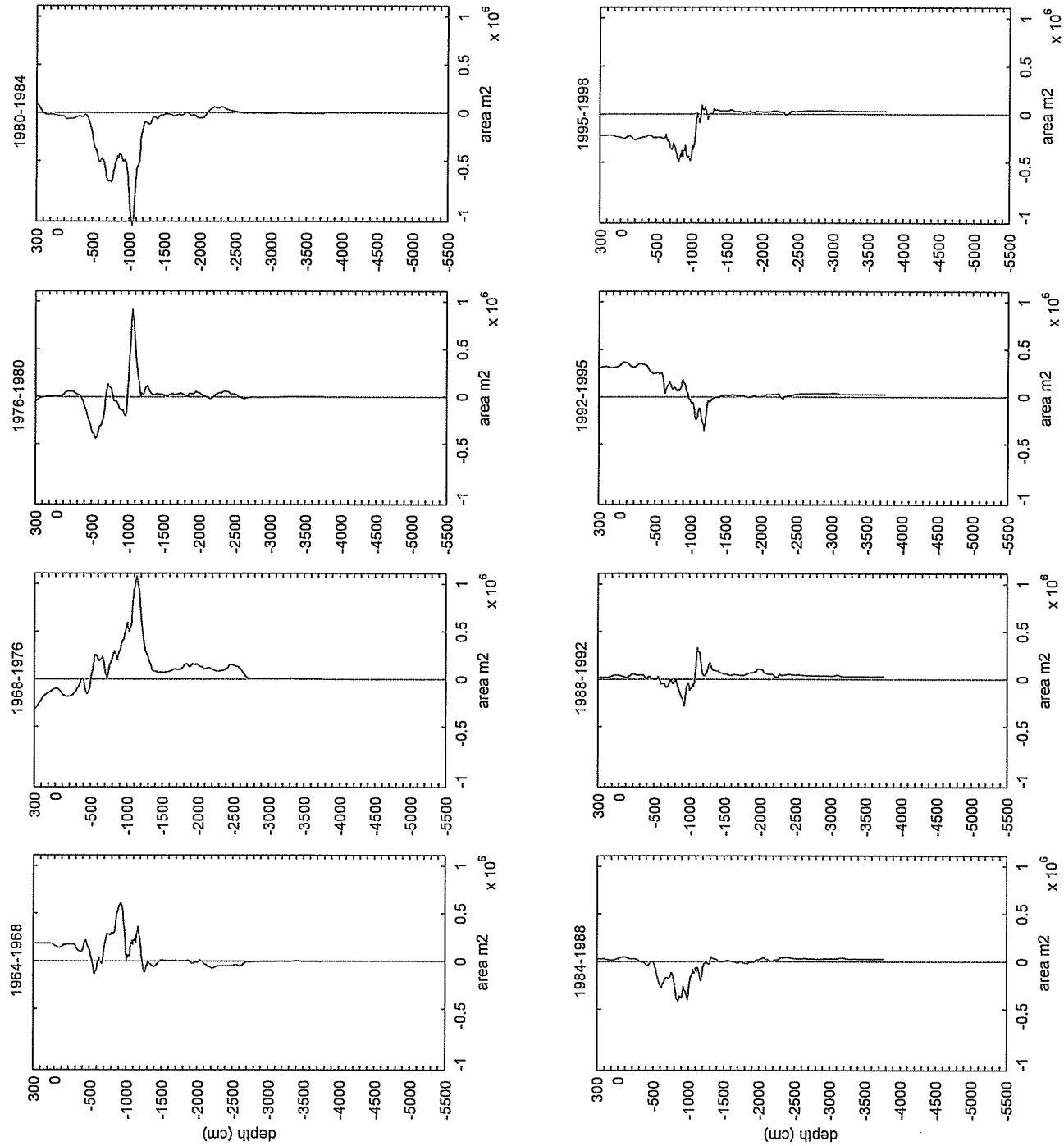
Vertical sedimentation and erosion profile of section 8

Vertical sedimentation and erosion profile of section 9

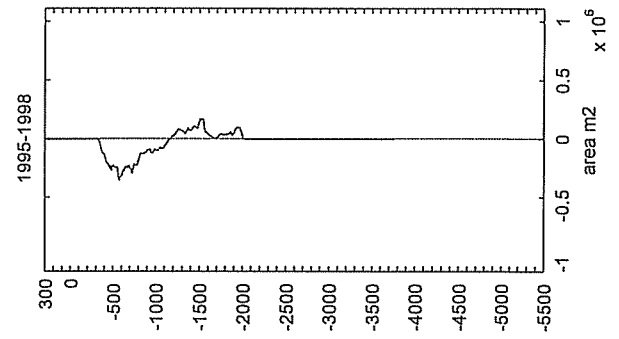
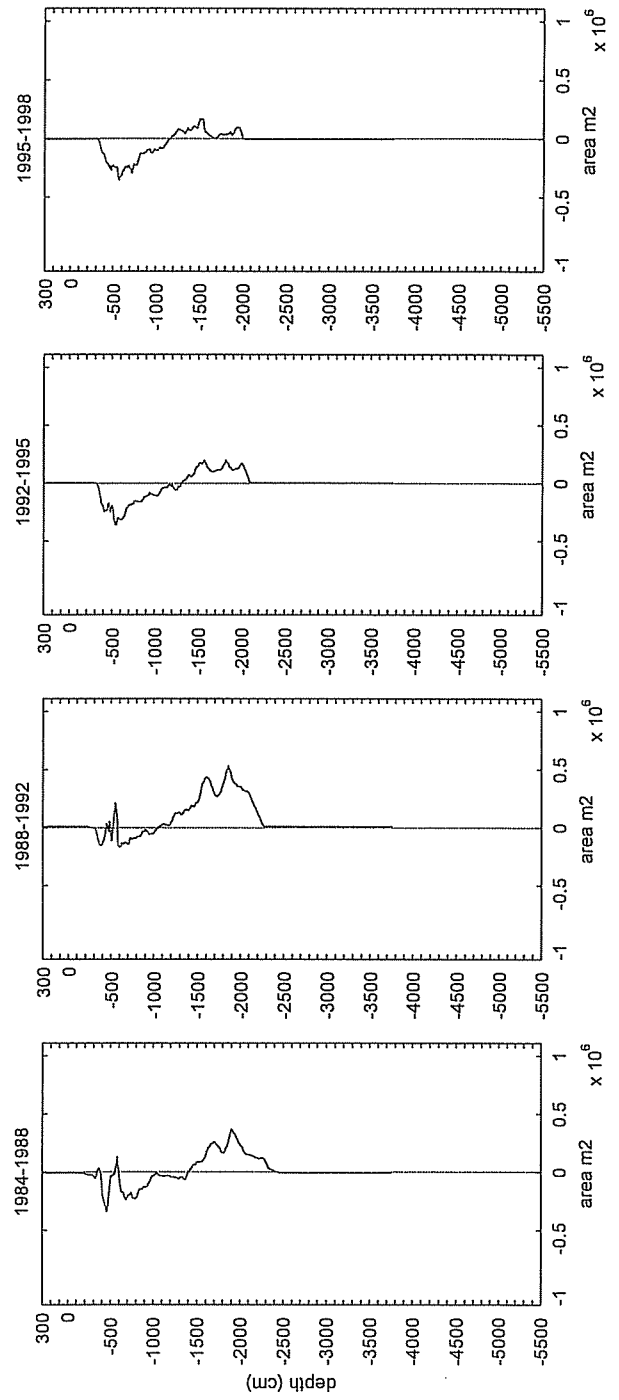
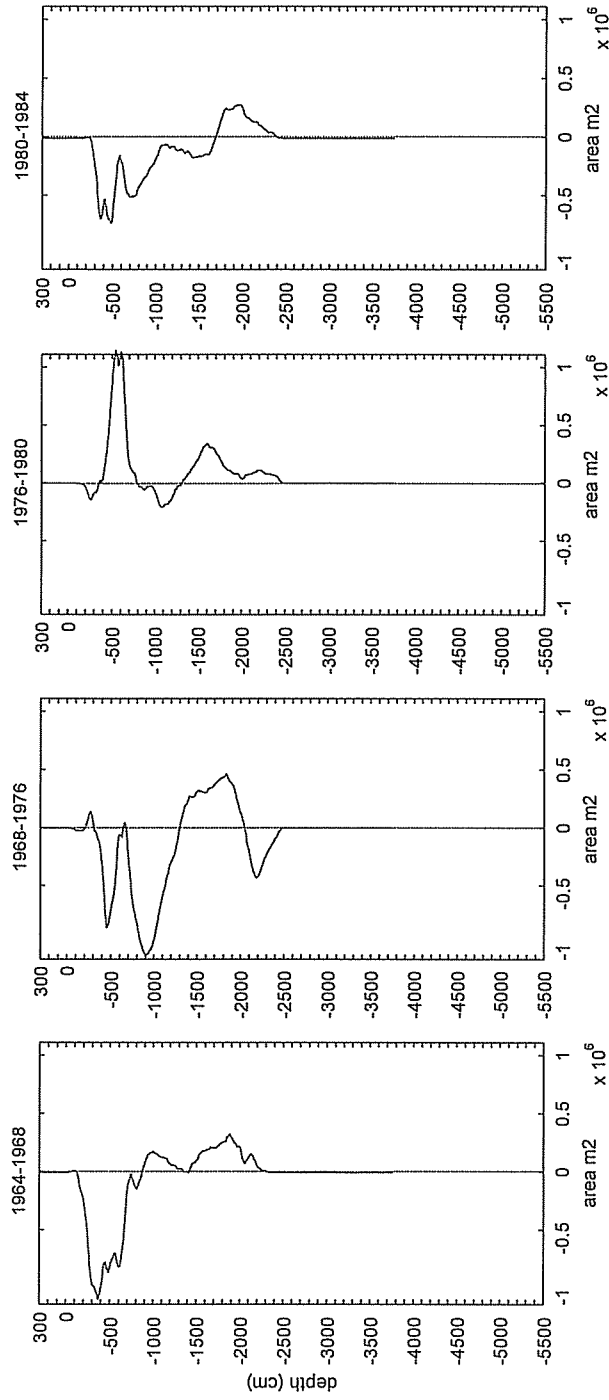
The vertical sedimentation/erosion profile between the indicated years of section 1



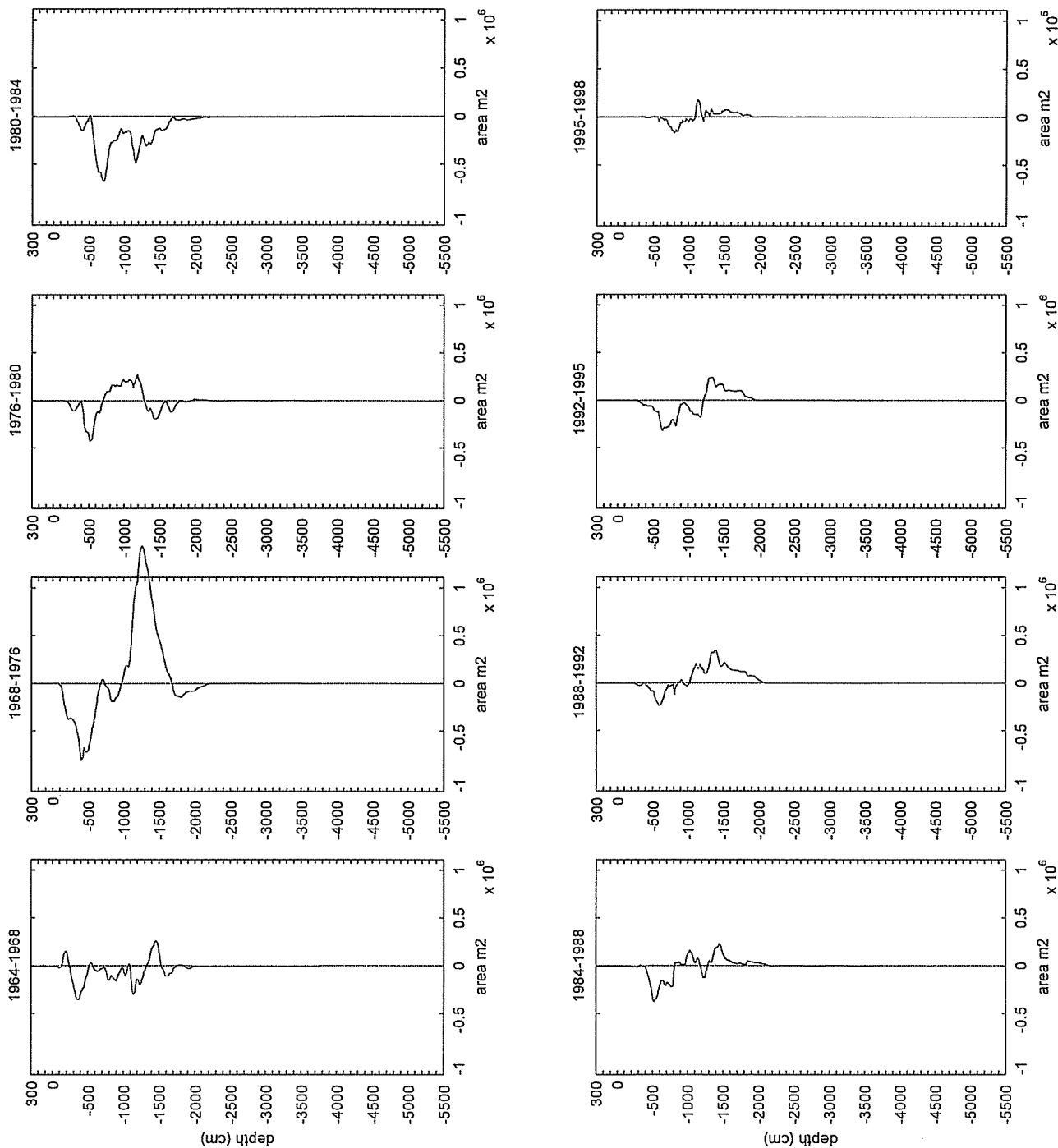
The vertical sedimentation/erosion profile between the indicated years of section 2



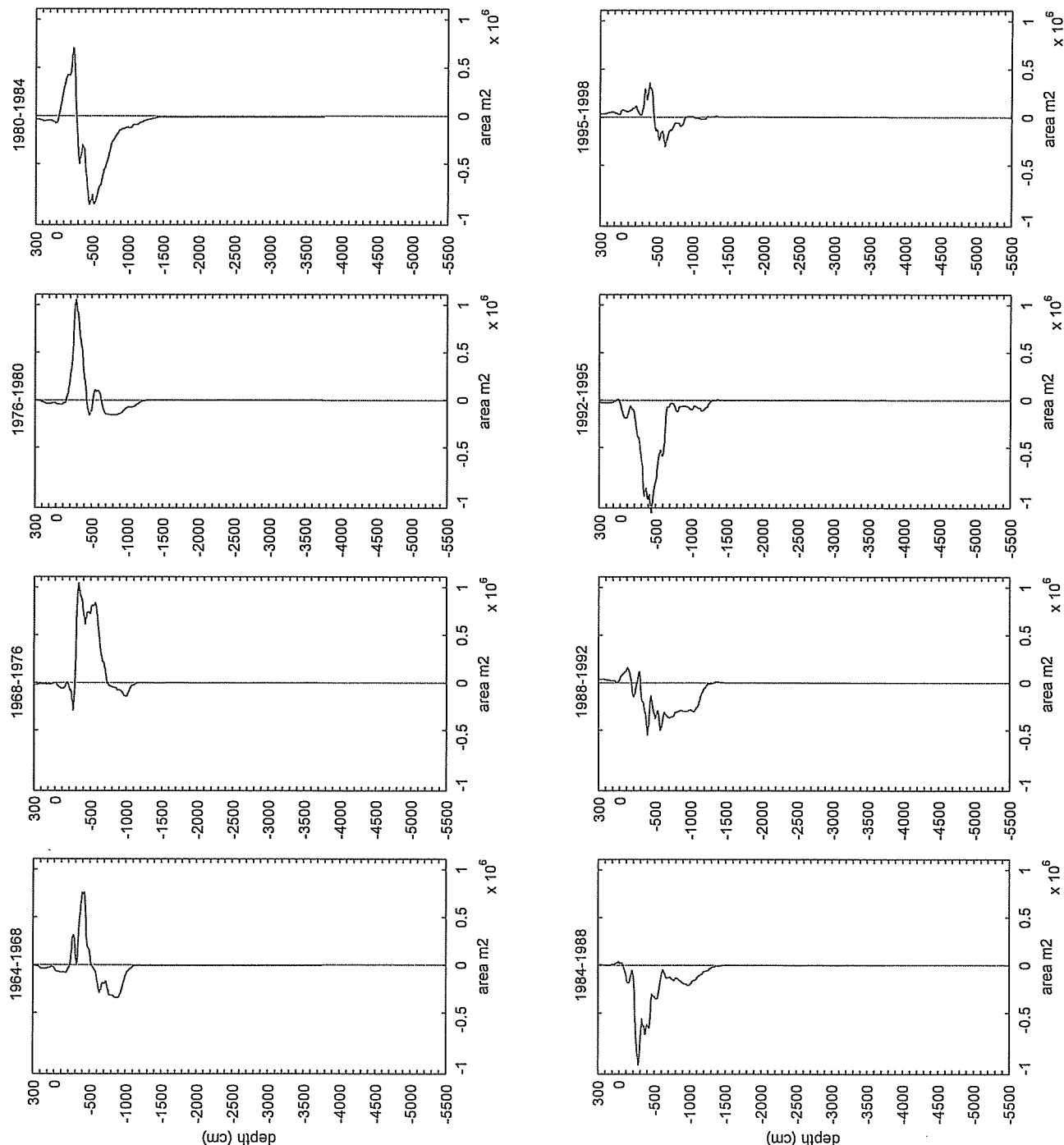
The vertical sedimentation/erosion profile between the indicated years of section 3



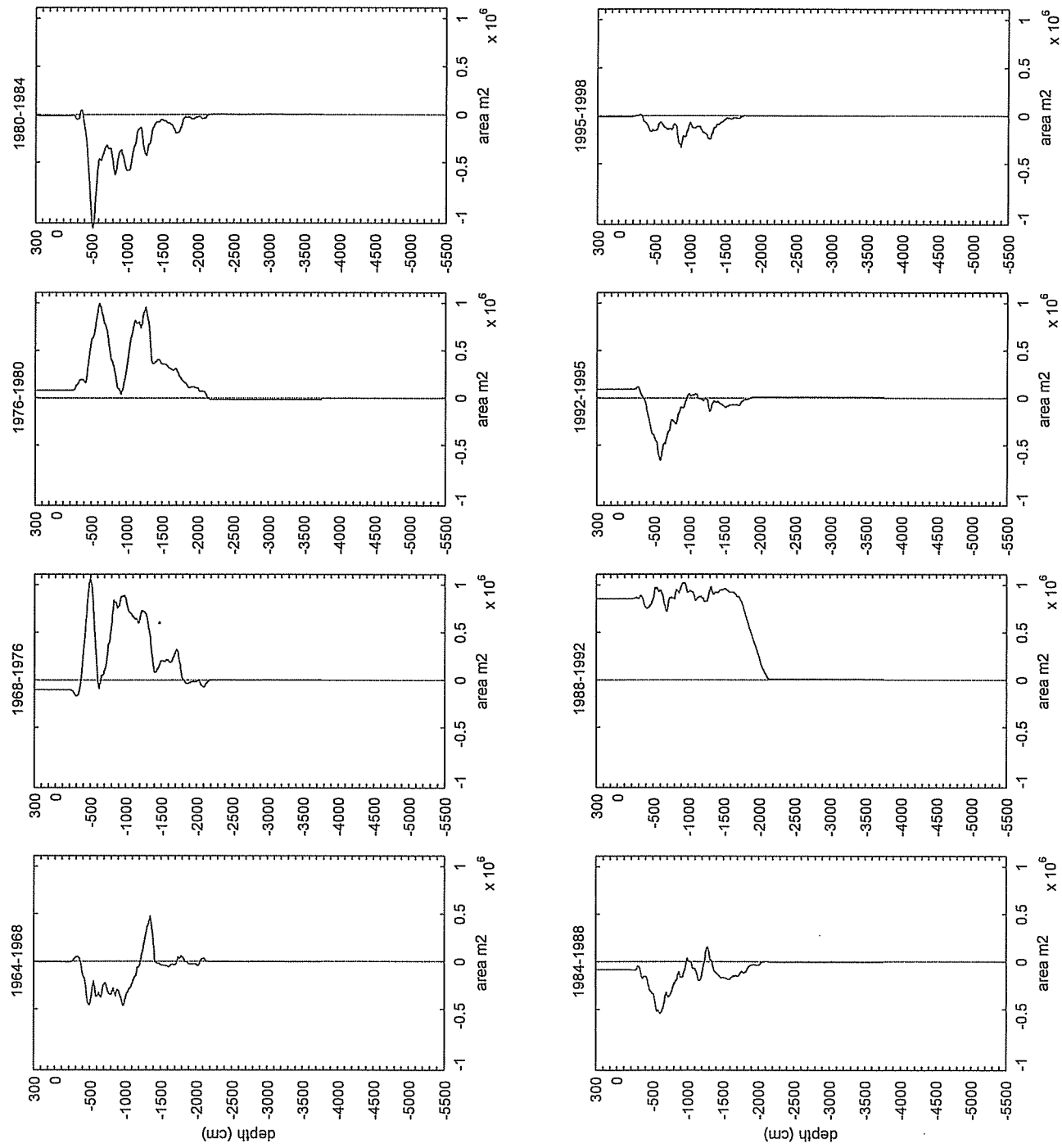
The vertical sedimentation/erosion profile between the indicated years of section 4



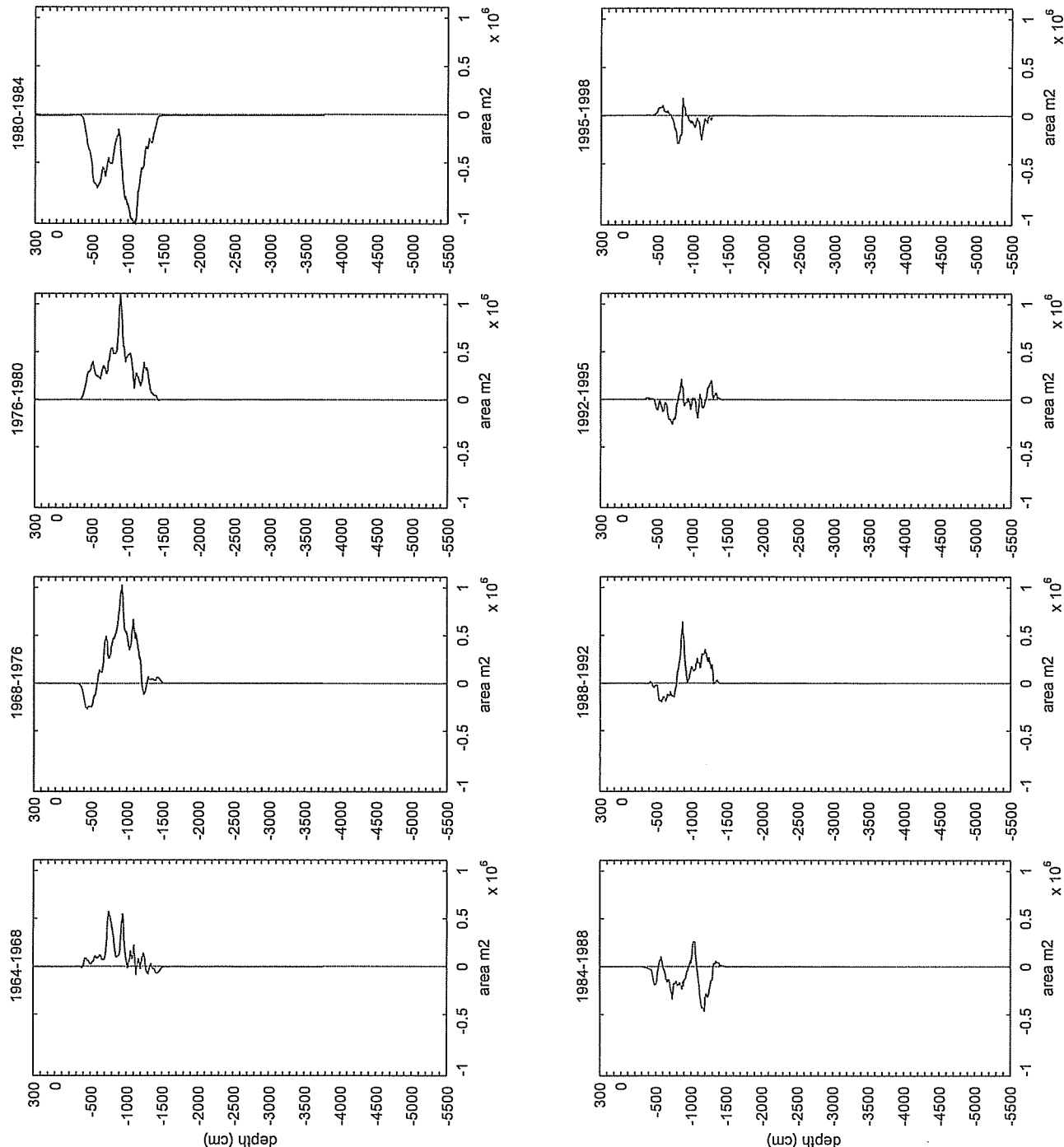
The vertical sedimentation/erosion profile between the indicated years of section 5



The vertical sedimentation/erosion profile between the indicated years of section 8



The vertical sedimentation/erosion profile between the indicated years of section 9



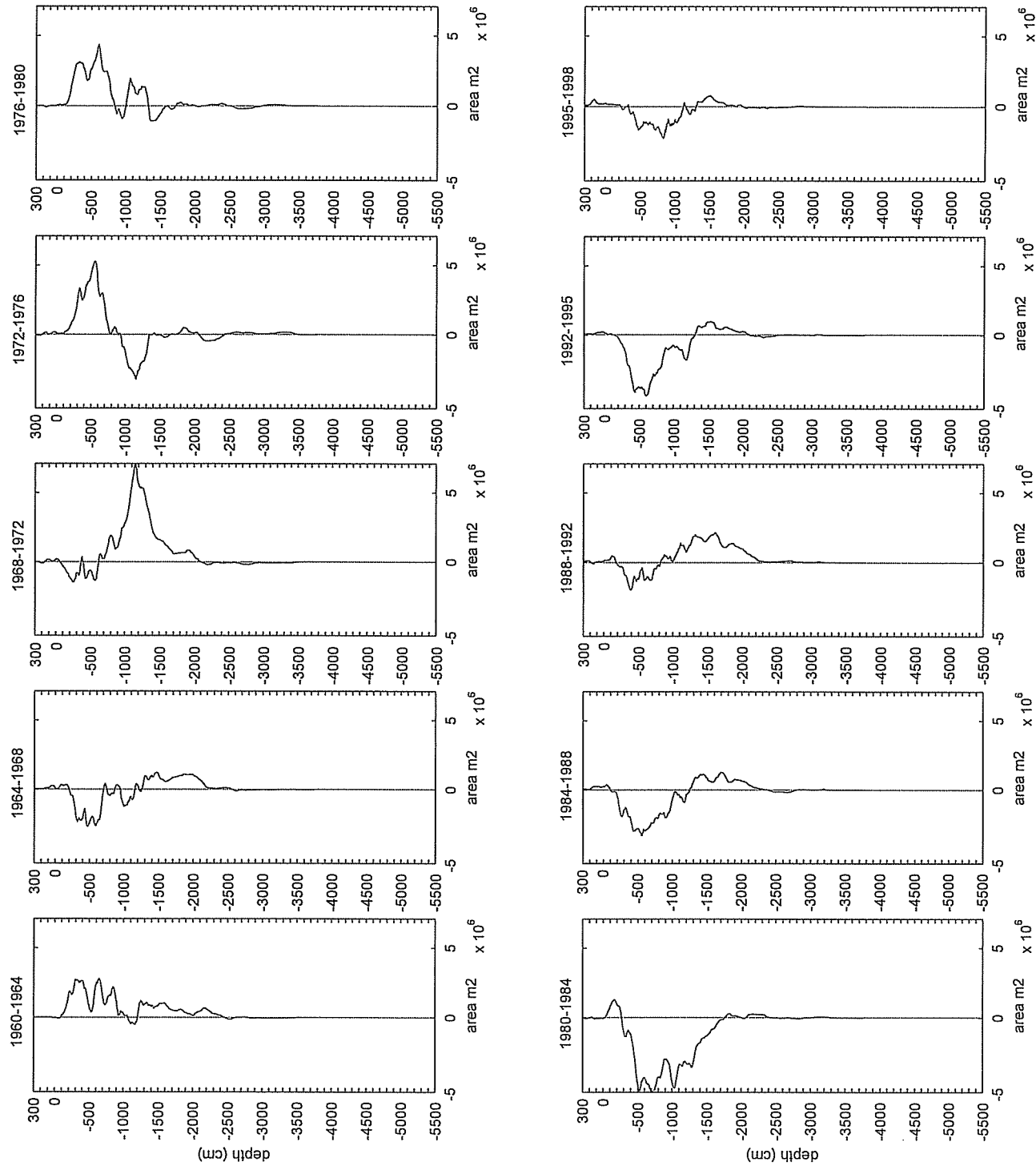
Appendix F4.2: Vertical sedimentation and erosion profiles of the calculations with morphological calculation areas

Vertical sedimentation and erosion profile of the calculation area of 1960

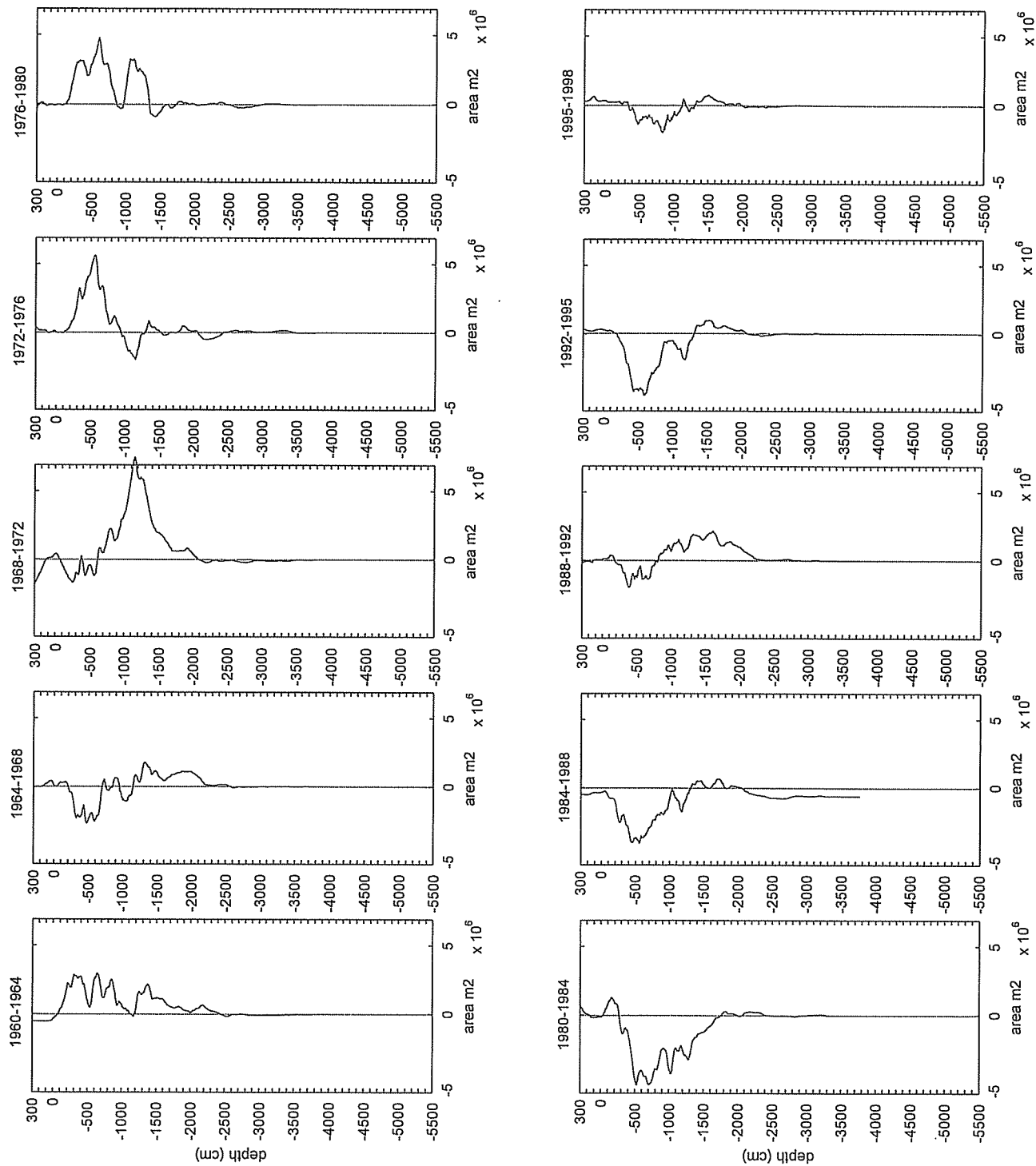
Vertical sedimentation and erosion profile of the calculation area of 1998

Vertical sedimentation and erosion profile of the changing calculation areas in time

The vertical sedimentation/erosion profiles between the indicated years of the calculation area of 1960



The vertical sedimentation/erosion profiles between the indicated years of the calculation area of 1998



The vertical sedimentation/erosion profiles between the indicated years of the volume calculations with changing calculation areas in time

