

<b>Hydrographic Surveying</b> <b>Belgian users &amp; user requirements</b>
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The data logging and processing of bathymetric information along the Belgian coast is carried out in different ways. Most of the data are collected by the hydrographic vessel, 'Ter Streep', owned by the Ministry of the Flemish Community and used by the Coastal Hydrographic Service in Oostende. Other parts of the data are collected by a hovercraft, by an amphibious car and by other vessels, which are owned by contractors, working for the local government. To each of them, specific tasks are dedicated.

The data collected by the different vessels are used for different purposes. For each of them, the accuracy of the collected data (in depth and in positioning) is important :

- Navigation charts, which are established according to the IHO standards;
- Dredging : for planning and for monitoring the works;
- Specific tasks : e.g. wreck searching, surveys for finding suitable locations for 'measuring poles' (these are offshore constructions, used for measuring the physical and meteorological parameters at sea, such as tides, waves, salinity, wind, temperature, etc.)
- Monitoring of the erosion of the beaches
- Localisation of shipwrecks and determination of the minimum safe depth on these obstacles.

#### **Equipment of the Coastal Hydrographic Service:**

- Single beam : -DGPS : code based;
  - Echosounder: this apparatus is used to determine the normal depth of the sea bottom; it can also give an impression of the thickness of the layer of mud that covers the seabed. The last data are used for dredging works.
  - This echosounding is corrected for heave and for roll.
  - Single beam-techniques give the opportunity to collect real-time waterdepth-data under the ship. When the parallel lines sailed by the ship are close to one another, navigation charts can be established from the collected data. (after tidal reduction)
- Multi beam : -DGPS : code based;
  - Echosounding, also corrected for heave, roll and pitch, by using several echosounders at the same time.
  - This equipment gives the opportunity to get fully detailed images of the seabed. The resolution here is very high and allows the drawing of big scaled charts. Sailing speed is slow when using this equipment, but it offers full detail which is especially important for areas with complex patterns on the seabed such as sandbanks, special features, wrecks, etc.
- Side Scan Sonar: a tool used for making scanning images of objects on the seabed. This is particularly useful for the localisation of wrecks. Images, coming from this sonar, offer a good qualitative view on the orientation and the position of the wreck.

#### **Survey-frequencies and products of the Coastal Hydrographic Service:**

- For the 3 navigational charts of the Belgian coast, part of the seabed configuration is amended every year, and normally a new edition of the chart is issued when the stock of the former runs out; these amendments are the result of detailed surveys in the Belgian conshelf area. Weather permitting, every working day the hydrographic survey vessel is used during day-time. The necessary updates of the charts appear in the Notices to Mariners, in order to allow people to keep their charts up to date in between two editions.
- The harbours of Zeebrugge (monthly), Oostende (2-monthly), Blankenberge (3-monthly) and Nieuwpoort (6-monthly) are surveyed regularly; so, it is possible to look for a time scheme for the dredging works, that fit the needs of the maintenance of the harbours.
- Channels are surveyed several times a year; there the surveying activities take place in close cooperation with the dredging works.
- The coastal zone is surveyed twice a year: this is part of the monitoring of the beach erosion and the coastal protection.

<b>Evaluation of some BAS records of 04/01/1995 - Comparisons with Belgian hydrographic surveys</b>
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For this evaluation we took the BAS records of Argoss BV of the 4th of January 1995 into consideration, because we consider this run as one of the best SAR-pictures.

For 1995, the Coastal Hydrographic Service (HD), Oostende (Belgium) has a lot of bathymetric records near the Kwinte- and Middelkerke bank; so we will focus our comparisons with BAS to this area alone. We subdivided this study in 3 parts:

**1) A small-scale comparison:**

The *Annex 1* is a valuable run of the 4th of January 1995, made by Argoss BV, on a rather unusual scale of 1/168.350, while the *Annex 2* represents, on the same scale, an extract of our CARIS-files of the Belgian nautical chart 'Vlaamse Banken' ('Flemish Banks') or D11. This last is also composed, for the concerned area, of the surveys of 1995; here we have to add that, in the more complicated areas, the cartographer has to introduce more smoothed bathymetric lines.

A visual comparison between these 2 maps can be carried out on the bathymetric lines of 5 m, 10 m and 20 m.

Here we already can notice that the lines of 20 m fit the best on both maps, while the differences on the 5 and 10 m seem to be higher. But even, on the 20 m, we can see that the classical surveys show slightly higher depths than the satellite records.

**2) A mid-scale comparison:**

The *Annex 3* is exactly the same area as the *Annex 1*, but here a scale of 1/20.000 has been chosen. The reason for this choice is that in the Coastal Hydrographic Service a single beam map of April 1995 was available in the same scale for the whole area. See also the *Annex 4*.

Here again a visual comparison between these 2 maps can be made on the bathymetric lines of 5 m, 10 m and 20 m.

Our findings of this comparison are the following:

-for the 20 m bottom line: the accordance is rather good, excepted when some more complex bottom-features occur;

-for 10 m bottom line: mostoften BAS is deeper than the the HD-measurements. The remark for the more complicated areas, mentionned above is also valid here;

- for 5 m bottom line: only for 4 lines on the southern part of the Middelkerke Bank, we are able to make a comparison. Here the BAS-records are deeper; that is the reason why the isolated and closed lines in this system are shorter than the HD-ones.

**3) A large-scale comparison:**

The *Annex 3* shows, somewhere in the southern part of the Middelkerke Bank, a rectangle, where, at the last resort, some detailed quality control has been carried out on a more statistical basis.

The *Annexes 5* (BAS-data of 04/01/95) and *6* (HD multi-beam survey of HD, dated 05/10/95) show this area on a scale of 1/5.000.

Between the *Annexes 5* and *6*, there is still some difference in time, but, as bottom changes are rather low, we found it reasonable to base a further study on it.

With CARIS, the Coastal Hydrographic Service was able to manufacture a difference chart, where nearly 9.400 figures are available. See also *Annex 7*.

With Excel 95, it was now possible to subdivide the differences into classes or intervals of 1 dm, so that also the table and the histogram of the frequency distribution can be determined.

The *Annex 8* shows the table of the frequency distribution of the 9405 values (in figures and percentages), while the *Annex 9* (in figures) provides the concerned histogram.

On this histogram we can notice that the distribution is nearly symmetric, as the mean equals 0,016 metres and the class 0 exceeds firmly the other classes.

The standard deviation, being a measure of the scatter or the dispersion of the values (differences), is 0,693 metres, which is rather high.

As we still had some questions with this configuration, we subdivided the concerned area into 2 parts. We repeated the exercise of the frequency distribution for the north eastern part, being a bit more flat and deeper than the other part. See the *Annex 7* again.

The *Annex 10* and *11* are related to the last distribution with a population size of 2259. Here we can notice that the distribution, translated in the histogram, has a longer tail to the left and is thus skewed to the left as well.

On the other hand, here the number of the 0-values is also significantly higher than the surrounding classes, which is rather strange...

Here the mean value and the standard deviation are -0,387 and 0,560 metres.

From the first to the third of January 1995, a rather severe and long lasting storm surge period occurred in the North Sea, causing residual sea levels of more than 1,40 metres in Oostende (Belgium).

No doubt, the bottom configuration on the 5th of January 1995 (date of the SAR run) is likely to be influenced by this storm event...

## CONCLUSIONS:

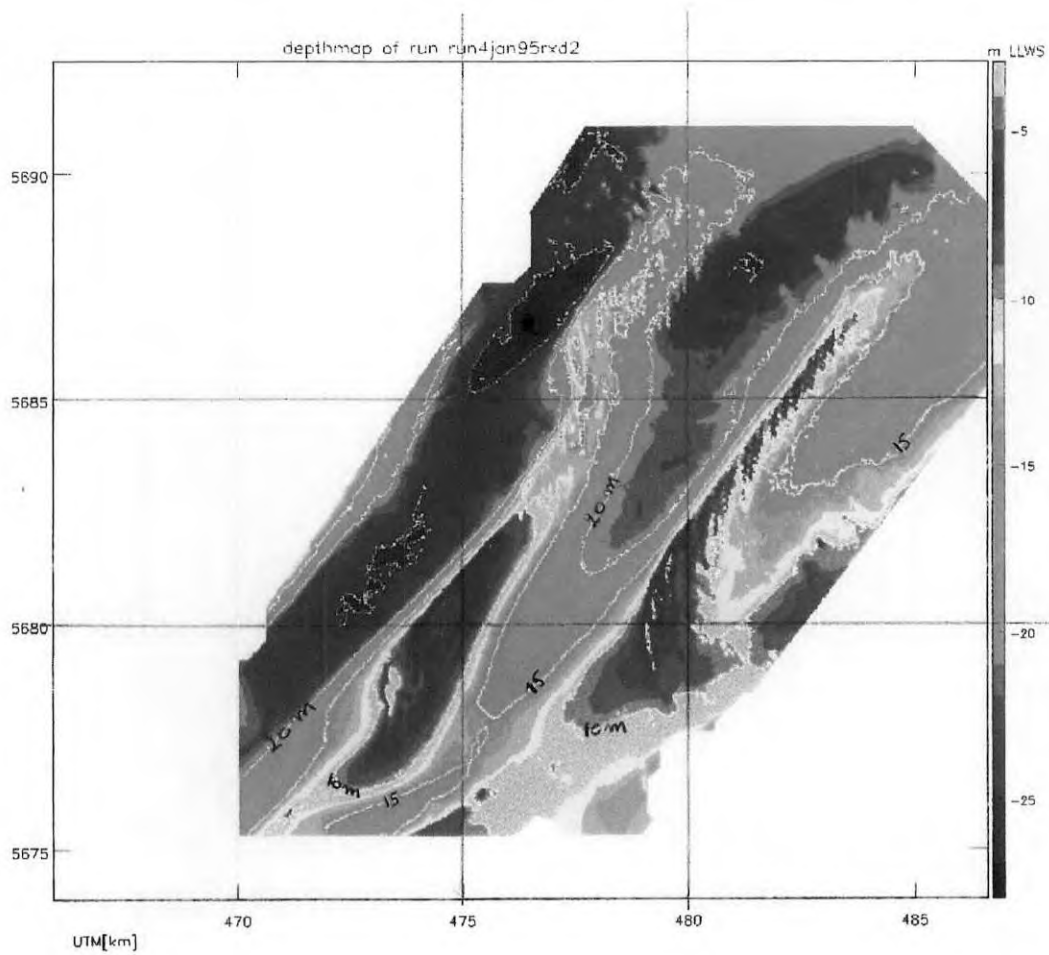
- The quality of the runs may differ the one from the other;
- For referencing or calibrating the BAS-data, we do NOT know how many of the classical records of HD have been taken into account by Argoss BV;
- Apart from a certain offset the more smoothed deeper areas of the BAS-measurements are comparable with the HD-data;
- For some depth-levels the offsets have NOT always the same sign: this is very strange;
- For the more complicated areas - even the deeper ones - BAS provides, compared to the classical records, less or no details at all;
- Perhaps the value of the run of the 5th of January 1995 is questionable, due to the foregoing storm event: in other words, these data are perhaps not representative enough for a common standard of comparison, due to temporal bottom changes?
- By using SAR from satellite pictures, the actual pixel-size is rather big (25 m); a trial with a high resolution radar is, in our opinion, worthwhile to carry out at a later stage.

Oostende, 10/02/1999

Ing. Johan Verstraeten

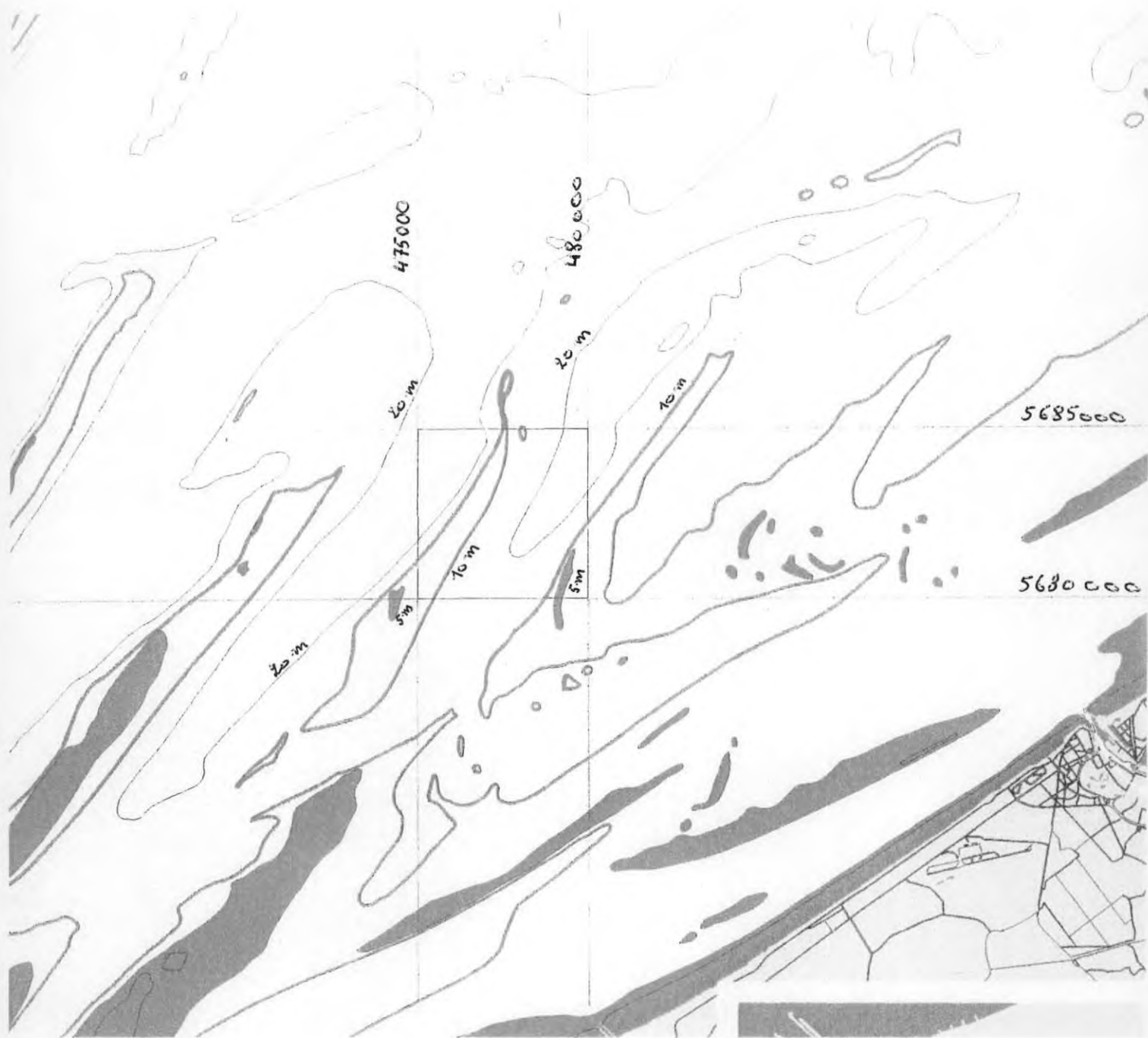
Ing. Carlos Van Cauwenberghe

## Dieptekaart 1995



ARGOSS B.V.  
BAS - SURVEY run 4 JANUARI 1995  
KWINTE-en MIDDELKERKEBANK with surroundings  
scale 1/168350

ARGOSS B.V.  
BAS - OPNAME run 4 JANUARI 1995  
KWINTE-en MIDDELKERKEBANK en omgeving  
schaal 1/168350



AFDELING WATERWEGEN KUST - HYDROGRAFIE  
KWINTE-en MIDDELKERKEBANK with surroundings  
extract chart D11 - VLAAMSE BANKEN  
scale 1/168350

AFDELING WATERWEGEN KUST - HYDROGRAFIE  
KWINTE-en MIDDELKERKEBANK en omgeving  
uitreksel kaart D11 - VLAAMSE BANKEN  
schaal 1/168350



MINISTERIE VAN DE VLAAMSE GEMEENSCHAP  
DEPARTEMENT LEEFMILIEU EN INFRASTRUKTUUR  
ADMINISTRATIE WATERWEGEN EN ZEEWEZEN  
AFDELING WATERWEGEN KUST --- HYDROGRAFIE



# KWINTE - MIDDELKERKE BANK

Periode van opname : APRIL 1995

Geografische Europese Koördinaten  
U.T.M. Ruitennet - Zone 31  
Diepten in dm t.o.v. plaatselijk gem. LLWS (H-vlak)  
Reductie volgens de M2 methode  
Schaal: 1 op 20000

Plaatsbepalingssysteem : DGPS

## Belangrijke opmerkingen:

Echoloding : uitgevoerd met een Atlas-Deso 20 met frekventies 30 kHz en 210 kHz  
(Voorzien van een deiningscompensator Hippy 120)  
Bebakening : bijgewerkt t.e.m. B.A.Z. nr. 19  
  
Editing en kartering uitgevoerd in de Hydrografische Dienst der Kust te Oostende  
Reductie: M2-methode (reductiekaart 1987 - prog. TIJDUC)

Opgemaakt in het Datacenter  
Hydrografische Dienst der Kust  
OOSTENDE de 24/10/1995

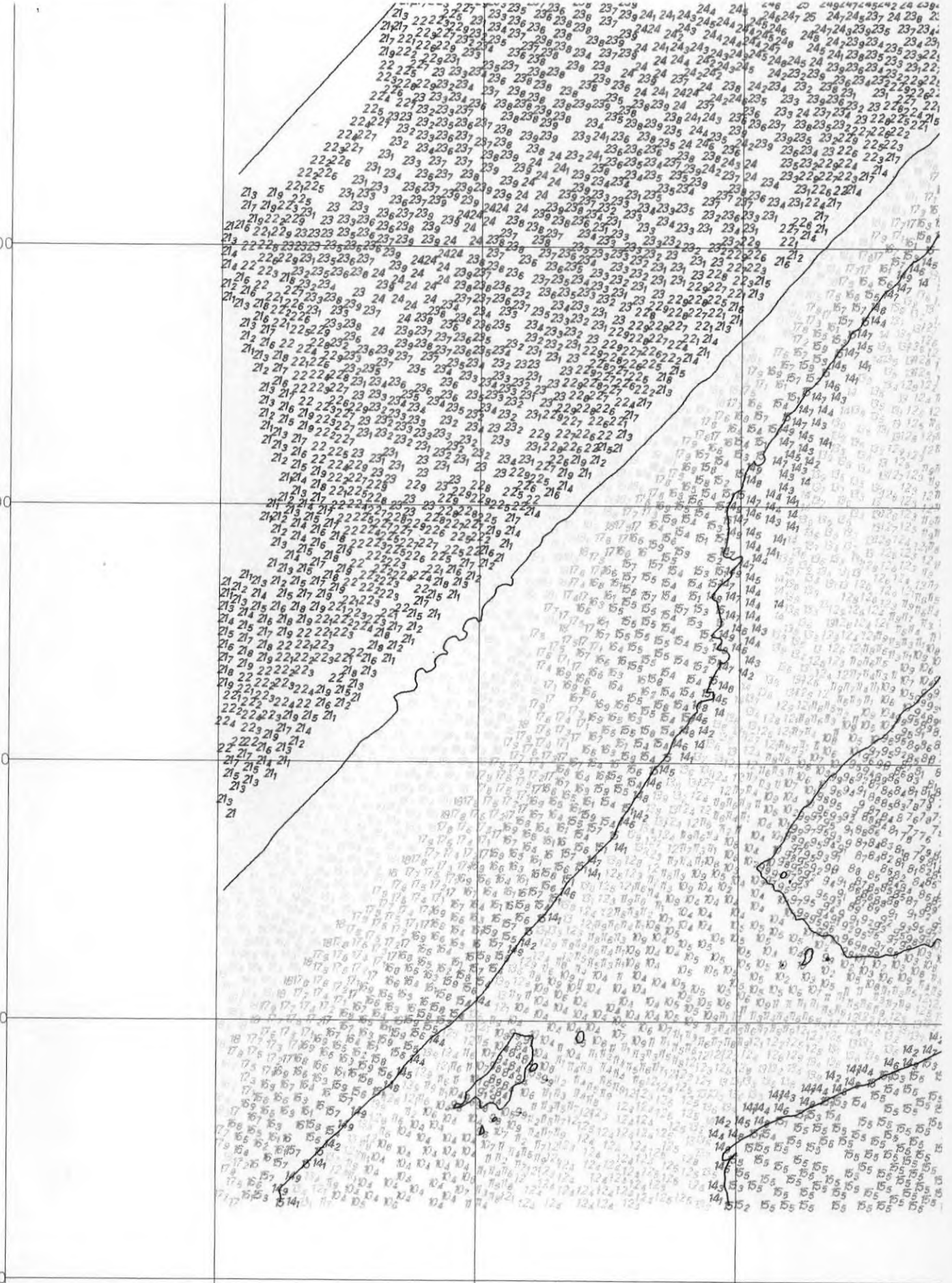
Uitgewerkt en geplot  
d.m.v. PROMETHEUS  
(Shoal Biasing)

JANSSEUNE WALTER

Hoofd v/d HYDROGRAFIE:

C. VAN CAUWENBERGHE

Schaal: 1 op 20000



ARGOSS B.V.  
BAS - OPNAME run 4 JANUARI 1995  
KWINTE-en MIDDELKERKEBANK  
schaal 1/20000

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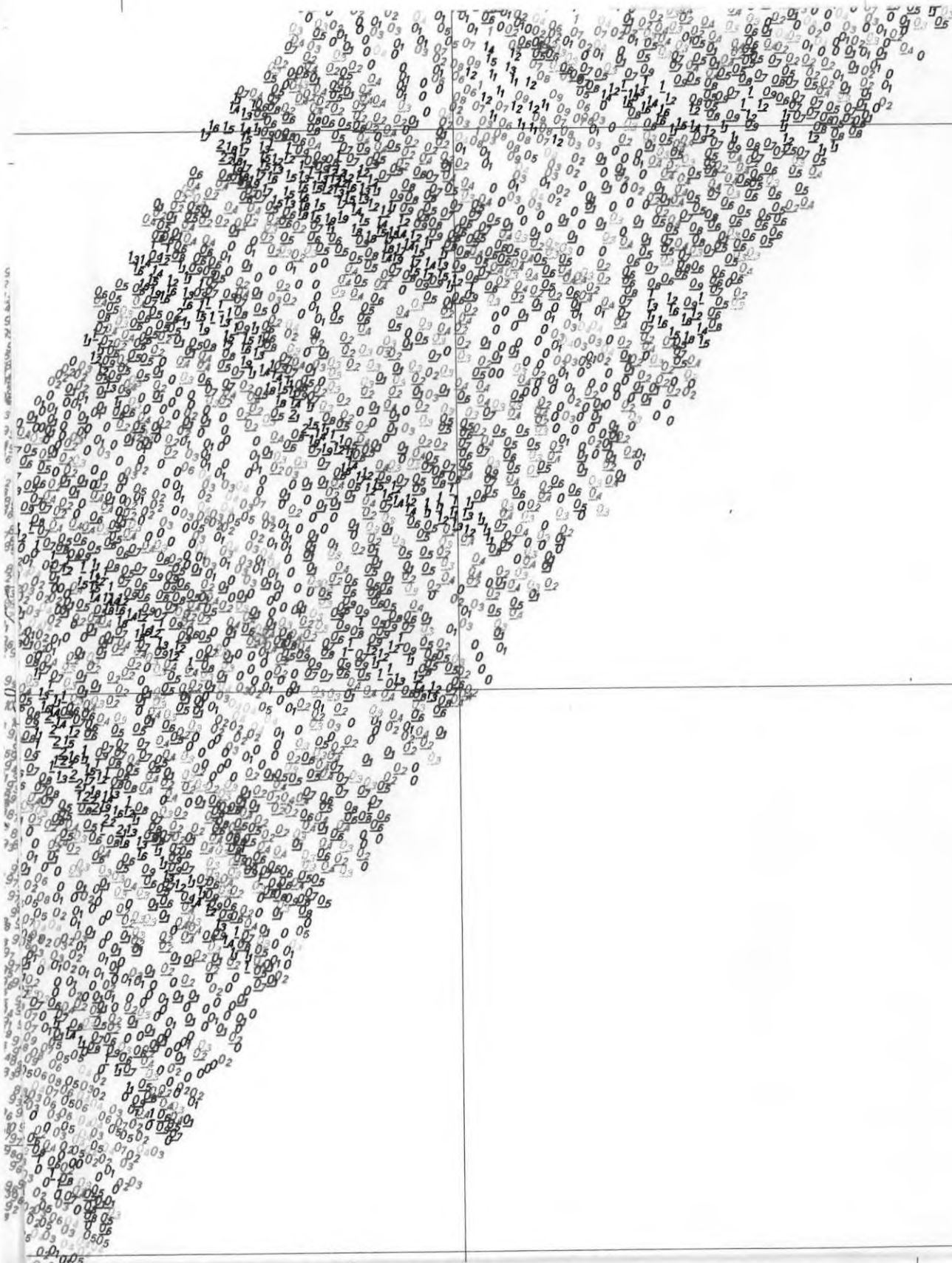
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89	9	92																				

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middelkerkebank 1/5000  
opname BAS 04/01/1995  
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opname mb 05/10/95 HD - BAS 4/01/95

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middelkerkebank 1/5000

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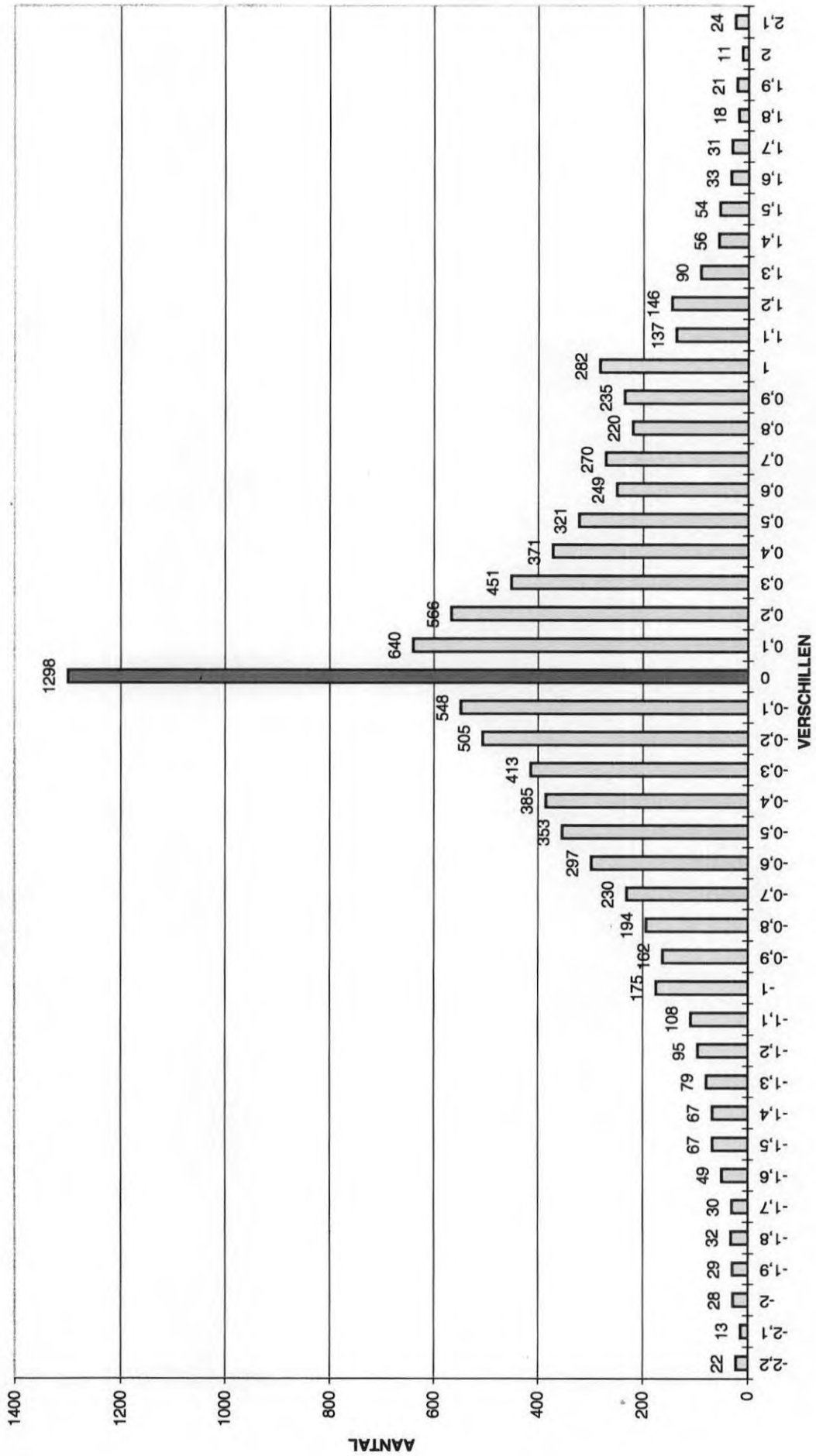
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	-1,3	79	0,84		
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	1,4	56	0,60		
	1,5	54	0,57		
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	1,7	31	0,33		
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VERSCHILKAART MB 05/10/95 HD - BAS 04/01/95



Verschilkaart MB 05/10/95 - 04/01/95 BAS Bovenste gedeelte		
verschil	aantal metingen	%
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-2.1	3	0.13
-2	7	0.31
-1.9	21	0.93
-1.8	19	0.84
-1.7	18	0.80
-1.6	22	0.97
-1.5	36	1.59
-1.4	33	1.46
-1.3	30	1.33
-1.2	54	2.39
-1.1	46	2.04
-1	46	2.04
-0.9	59	2.61
-0.8	74	3.28
-0.7	102	4.52
-0.6	134	5.93
-0.5	185	8.19
-0.4	184	8.15
-0.3	169	7.48
-0.2	204	9.03
-0.1	169	7.48
0	282	12.48
0.1	115	5.09
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0.3	60	2.66
0.4	34	1.51
0.5	11	0.49
0.6	13	0.58
0.7	19	0.84
0.8	12	0.53
0.9	8	0.35
1	4	0.18
1.1	10	0.44
1.2	8	0.35
1.3	2	0.09
1.4	1	0.04
1.5	1	0.04

totaal                      2259                      100



# verschilkaart MB 05/10/95 - 04/01/95 BAS bovenste gedeelte

