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Extreme wave conditions along the coast of the Netherlands

Wave propagation models for the coast between Cadzand and Hoek van Holland

Report on numerical model studies

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delft hydraulics

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Executive's summary

The proposed new "Act on the Sea Defence" ("Wet op de Waterkering") makes it mandatory to make a 5-yearly evaluation of the safety of the coastal defence of The Netherlands. At this moment Rijkswaterstaat (Directorate-General for Public Works and Water Management) is studying the aspects required for a probabilistic approach. This includes both the input parameters and the method for the safety analysis. Important elements in this analysis are the hydraulic boundary conditions (water levels, wave conditions, wind and currents). The HYDRA-project was set up by the National Institute for Coastal and Marine Management of Rijkswaterstaat (further referred to as RIKZ) to provide hydraulic input parameters for this safety analysis along the coast and in the estuaries of the Netherlands. Because of the increasing importance of probabilistic methods in failure analysis, the HYDRA-project has two goals:

- to provide multi-dimensional statistics of the hydraulic conditions in deeper water (approximately the NAP -20 m contour line);
- to select a procedure to compute the hydraulic conditions along a dike-ring in a uniform way.

The whole HYDRA-project consists of a larger number of separate studies related to the deep water statistics, analysis of wave measurements, wave modelling in the nearshore zone and translation of deep water statistics to the shore.

In an earlier stage DELFT HYDRAULICS, in cooperation with the Hydraulic Department of the Delft University of Technology, had carried out a study related to the sensitivity of the HISWA-model as a tool for the second item (DELFT HYDRAULICS, 1993). In this study, a large number of parameters with respect to incoming wave conditions, current conditions and model coefficients were varied. It was concluded that the HISWA-model is the most suitable operational model presently available for the coast along the North Sea. For wave modelling in the estuaries and tidal inlets HISWA seems less suitable, because the model does not very accurately describe the changes in wave periods due to wave breaking in shallow water. Consequently, RIKZ decided both to extend the area modelled with HISWA and to test recent formulations to describe the frequency change using a fully spectral model. In a subsequent study DELFT HYDRAULICS prepared a suite of HISWA-models for the coast of the Netherlands between Hoek van Holland and Rottumeroog and carried out preliminary computations with these models (DELFT HYDRAULICS, 1994).

In their letter of September 23, 1994, Rijkswaterstaat invited DELFT HYDRAULICS to submit a proposal for numerical modelling of the wave conditions along the coast of the Delta region between Cadzand and Hoek van Holland using the HISWA model. This study is an extension of the study that was carried out for the wave conditions along the coast between Hoek van Holland and Rottumeroog (DELFT HYDRAULICS, 1994). Based on the proposal of October 10, 1994, the scope was defined in subsequent discussions leading to the proposal of October 28, 1994. In their letter of March 6, 1995, reference OSE/955395, RIKZ commissioned DELFT HYDRAULICS to carry out the study following this proposal under contract number RKZ-156. Aspects such as the proposed schematisations, boundary conditions and interim results were regularly discussed during progress meetings.

The study presented in this report is concerned with the preparation of wave propagation models using HISWA for the coast between Cadzand and Hoek van Holland for wave conditions from a direction of 330°N.

One coarse, and three detailed HISWA models have been prepared in total in the study presented here. The detailed models cover the coast of the Delta region from Zeeuws-Vlaanderen to the Maasvlakte. The coarse model provides the boundary conditions for the detailed models. The models are shown in Figure 3.1. The bathymetry for the models was compiled from a number of data sets available from RIKZ.

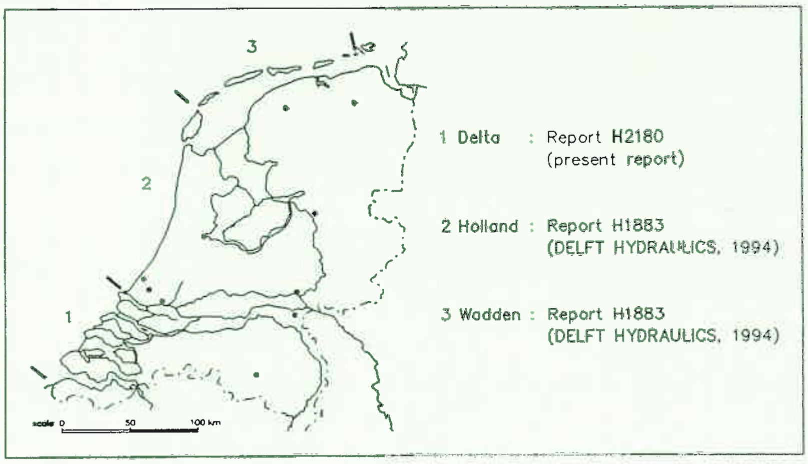
With the HISWA models preliminary computations have been carried out to test the models and to obtain a first impression of the wave conditions under extreme conditions along the coast of The Netherlands. The incoming wave conditions were calibrated to obtain wave heights corresponding to the Bruinsma-values. The preliminary computations were carried out for waves coming from a direction of 330°N. For parts of the coasts that have south-westerly orientation, e.g. the southwestern coast of Walcheren, parts of the coast of Schouwen en Goeree and the part of Voorne protected by the Slufter, the results from the preliminary computations may not be the most critical design wave conditions.

The computed significant wave heights along the contour lines show rather large variations, caused by differences in orientation of the coast, differences in the width of the nearshore shallow water area and sheltering effects in the entrances to the estuaries. The range of wave conditions along the contourlines is given in the table below.

Contour line	$P_{exc} = 10^{-2}$		$P_{exc} = 10^{-4}$	
	H_s (m)	T_{m01} (s)	H_s (m)	T_{m01} (s)
NAP -10 m	0.5 - 5.3	9.0 - 9.7	0.6 - 6.2	9.8 - 10.7
NAP -5 m	0.4 - 5.2	9.0 - 9.7	0.5 - 6.0	9.8 - 10.7
NAP -0 m	0.4 - 3.4	9.0 - 9.7	0.5 - 4.2	9.8 - 10.7

Range of wave conditions at the given contour line along the coast in the Delta region

With the present report a series of studies related to the extreme wave conditions along the coast of the Netherlands has been completed. Nearshore extreme wave conditions are now available for the entire North-Sea coast of the Netherlands. The sketch below indicates the considered areas and the report in which the results have been presented.



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List of notations

c_{fc}	friction coefficient for current
c_{fw}	friction coefficient for waves
H_s	significant wave height, defined as $4\sqrt{m_0}$
NAP	Normaal Amsterdam Peil (reference level of the Netherlands)
P_{exc}	probability of exceedance
T_{m01}	energy averaged wave period
α	constant (wave breaking)
γ_d	wave breaking coefficient deep water
γ_s	wave breaking coefficient shallow water
Θ_o	main wave direction
Θ_{max}	sector width HISWA computation

1 Introduction

Rijkswaterstaat (Directorate-General for Public Works and Water Management) is developing procedures for a regular evaluation of the safety of the coastal defence of the Netherlands. The National Institute for Coastal and Marine Management (RIKZ) has started several studies concerning the hydraulic boundary conditions along the entire coast of the Netherlands in the HYDRA-project. The objective of these studies is both a statistical description of the conditions and to establish methods to obtain consistent results along the entire coast. The hydraulic boundary conditions are the input for models which evaluate the strength of dikes and dunes. The present study concerns the setting up of numerical models to compute the wave conditions nearshore (NAP -10 m, NAP -5 m and NAP -0 m contour lines) from those at deeper water.

The work carried out under the contract for the present studies included:

- setting up HISWA-models of the area between Cadzand and Hoek van Holland,
- compilation of bathymetry data in the area to be modelled,
- determination of the boundary conditions,
- preliminary computations to determine the wave conditions along the NAP -10 m, NAP -5 m and NAP -0 m contour line in points with a spacing of 200 m for conditions with a probability of exceedance of 10^{-4} per year and 10^{-2} per year.

The project was carried out between March 1995 and May 1995 under project number H2180. The work was performed by Messrs J. Dekker, E. Ehrlich and G. Hartsuiker. Mr. Hartsuiker wrote also this report.

This report is arranged in the following way:

- Chapter 2 gives a short analysis of the purpose of the study and describes the used approach;
- The setting up of the models and the applied schematisations are discussed in Chapter 3;
- Chapter 4 describes boundary conditions and the results of the preliminary computations near the coast.

In this report only typical examples of the results of the preliminary computations are included to support the text and the conclusions. All the results are presented in a separate appendix to this report.

All computations were carried out with version 100.21 of the HISWA-package. No specific problems arose.

2 Problem analysis and approach

The statistical evaluation of water levels and wave conditions to predict the extreme situations to be considered in evaluating the safety of the coastal defence of the Netherlands is being carried out for offshore locations near the NAP -20 m contour line. These design conditions have to be transferred to locations nearshore to provide the necessary input data for computations of e.g. dune erosion and dike run-up. For the transfer of the wave conditions a set of 2-dimensional wave models was required. The most suitable program presently available to construct such models is the HISWA-model. HISWA, acronym for HIndcast Shallow water WAves, is a numerical model developed by Delft University of Technology to simulate wave growth and propagation in areas of variable water depth and ambient current. HISWA models the wave 'action' (equivalent to wave energy when there is no current) in discrete directional sectors at points on a rectangular grid. The frequency spectrum is characterized by one (varying) mean frequency for each directional sector. Wave growth by the action of wind and dissipation by bottom friction and wave breaking are accounted for, as well as depth and current refraction. HISWA is therefore suitable for application in large areas of shallow water where modelling of a directionally spread wave field is required. A more extensive description of the model is given in Holthuijsen et al. (1989). In a recent study into the suitability for, and the sensitivity of the HISWA model for the prediction of extreme conditions along the coast (DELFT HYDRAULICS, 1993), it was concluded that HISWA has some drawbacks with respect to the prediction of the wave period, especially in the tidal inlets to the Wadden Sea where the waves grow again due to wind input after being broken on the shoals lying before the inlet.

The statistical evaluation of the offshore wave conditions provides boundary conditions for the wave models. The HISWA models must therefore extend down to the NAP -20 m line or further offshore. Along the coast the models must provide accurate results at 200 m intervals along the NAP -10 m, NAP -5 m and NAP -0 m lines. Research by RIKZ has shown that in the inlets to the Wadden Sea the highest wave heights occur sometimes during an opposing ebb current, sometimes with a flood current and sometimes in situations without a current, depending on the location in the inlet (RIJKSWATERSTAAT, 1994). A similar effect might occur in the entrances to the estuaries in the area considered in this study. In the present study, currents in the estuaries were not taken into account in the wave computations.

As in the previous studies, the required resolution of the grid nearshore and the position of the boundary offshore prohibit an approach using one model between the offshore boundary and the coast, as this leads to an extremely large number of computational points. A more feasible approach is the use of nested grids: more coarse grids covering the offshore area where variations in the bathymetry and wave conditions are not very large, and smaller, more detailed computational grids near the coast and in the entrance to the estuaries. According to the information given by RIKZ in their letter RIKZ/OS/946740, extreme wave conditions between Cadzand and Hoek van Holland are expected to occur with storms from directions of about 330°N.

For the bottom topography of the models a similar approach using coarse and fine grids is used. This allows refinement of the bathymetry, where necessary. For the offshore areas bathymetry data are used from existing flow models and nautical maps. In the coastal zone these are replaced by measured data with a finer resolution.

In all computations the settings of the parameters for wave breaking and bottom friction derived in the sensitivity study were used. The same parameter settings were used in computations for the coast between Hoek van Holland and Rottummeroog (DELFT HYDRAULICS, 1994). The computations were carried out with version 100.21 of the HISWA-package. The parameter settings were:

friction coefficients :	$c_{fw} = 0.006$
	switch "frequency change friction" off
breaking coefficients:	$\gamma_d = 1.13$ (deep water)
	$\gamma_s = 0.75$ (shallow water)
	switch "frequency change breaking" off

3 Schematisations

3.1 Coordinate system

All coordinates are given with reference to the geodetical system of the Netherlands ("Parijs-coordinaten"). Wave and wind directions are mostly given in nautical conventions, i.e. as the direction from which wind or waves are coming with respect to north. Positive angles are given clockwise from north and indicated as °N. Orientation of the grids and, occasionally, also some other directions are given in mathematical conventions with respect to the coordinate system, i.e. positive angles are anti-clockwise with respect to the X-axis.

3.2 Computational grids

3.2.1 General

For choosing the computational grids for the HISWA computations, several factors are of importance. The size and orientation of the grid are mainly determined by the area of interest, the main wave direction and the position where the boundary conditions are known. The step sizes for the integration of the action balance equation depend on the variations in the bottom topography and on numerical considerations. In general the following aspects should be considered:

- computations must start on a position where the wave height can be assumed constant along the whole boundary or where the variation along the incoming boundary is known,
- the side boundaries of the model should not affect the results in the area of interest,
- the direction of the X-axis of the computational grid may not deviate too much from the main wave direction and/or wind direction for a good representation of the directional spreading,
- the bottom topography must be modelled in sufficient detail; this applies especially for areas where the variations are large such as near shoals and tidal channels,
- the ratio of the mesh sizes in X- and Y-direction should be small enough for stability of the computation.

For the schematizations in the present study it was further essential that:

- the boundary conditions would be available at the NAP –20 m contour line, either from the "Bruinsma" boundary conditions or from the statistical evaluations,
- extreme wave conditions are from directions around 330°N (Rijkswaterstaat, letter RIKZ/0S/946740),
- the resolution of the computations had to be sufficiently detailed to provide reliable results at 200 m intervals along the NAP –10 m, NAP –5 m and NAP –0 m contour lines,
- wave directions travelling from the coast were not of relevance for the conditions near-shore.

In addition to the sectors Holland and Wadden defined in the previous study (DELFT HYDRAULICS , 1994) one sector was identified in the present area of interest. This sector includes the entire coast between Cadzand and Hoek van Holland with the estuaries of the Westerschelde and Oosterschelde and the former estuaries of the Brouwershavense Gat and Haringvliet. The orientation of the normal to the coast differs largely in the Delta area and ranges from south through west to north. The sector is further indicated as Delta.

Due to the large variation in coastal orientation, and the representation of the wave energy in a sector of limited width, the computed wave heights for waves from 330°N are not very reliable for coastal sections with orientation further south than about 270°N (West). This concerns eg. the south-west coast of Walcheren, the southern part of the Slufter and small parts of the coast of Schouwen and Goeree.

3.2.2 Sector Delta

For the sector Delta detailed grids were developed that can compute the nearshore wave conditions for incoming wave directions between 307.5°N and 352.5°N. Three detailed grids were defined to cover the area of this sector, both to allow computations for a part of the coast without having to compute all of it and to keep the number of computational points within acceptable limits.

- model Z1 : covering Zeeuws-Vlaanderen to Walcheren
- model Z2 : covering Walcheren to Schouwen
- model Z3 : covering Brouwersdam to Maasvlakte

To cover the wide range of directions that might occur in the nearshore area due to refraction, the detailed grids had a computational sector of 165°. In general, the orientation of the grids is to the central direction of 330°N. This leads to the dimensions and orientation of the grids given in the table below. To obtain a numerically stable computation, step sizes Δ_X and Δ_Y in x- and y-direction must, in the absence of a current, comply with

$$\frac{\Delta_x}{\Delta_y} \leq \cotan(\theta_{max})$$

where Θ_{max} is half the sector width. For the rather large computational sector of 165°N, the ratio of the step sizes must be smaller than 0.13. Choosing for Δ_Y 200 m in accordance with the required spacing of the results along the coastline, it follows that Δ_X must be smaller than 26 m. The chosen mesh size was therefore 20 x 200 m. This yields also a high resolution perpendicular to the coast, thus allowing a good modelling of the bars in the cross-shore profile.

Name	XCLEN (m)	YCLEN (m)	SECTOR (°)	MXC (#)	MYC (#)	MDC (#)	XPC (m)	YPC (m)	ALPC (°xy)	ALPC (°N)	DX (m)	DY (m)	DΘ (°)	N_pts (x-y)
Z0	66000.	138000.	120.	330	276	16	-50000.	410000.	-60.000	330.000	200.00	500.00	7.50	91687
Z1	27000.	35000.	165.	1350	175	22	-9000.	389000.	-60.000	330.000	20.00	200.00	7.50	237776
Z2	20000.	55000.	165.	1000	275	22	1000.	404000.	-60.000	330.000	20.00	200.00	7.50	276276
Z3	20000.	46000.	165.	1000	230	22	26000.	428000.	-60.000	330.000	20.00	200.00	7.50	231231

Dimensions and orientation of the computational grids for the sector Delta

To provide the boundary conditions for these detailed models, a larger model with a coarser resolution was required. Because the changes in water depth are not very large in the offshore area, no significant changes in wave direction due to wave refraction will occur. The directional sector was therefore smaller than for the detailed models and was given the commonly used value of 120°. Due to the smaller computational sector, the orientation of the outer models should not differ more than about 10° from the deep water wave direction.

One outer model was developed. This model, Z0, had an orientation of 330°N allowing computation of wave directions between 320°N and 340°N. The offshore boundary of the models was chosen in such a way that along this boundary the bottom level is 20 m or more below NAP. Together with the requirement that boundary effects should not affect the results along the boundaries of the detailed models, this led to the grid indicated in Figure 3.1. Variations in the bathymetry are of a rather large scale in the offshore area. For this reason the model resolution could be more coarse than in the nearshore area. A mesh size of 200 x 500 m was assumed to be a fair choice for a grid which has a fair resolution and a feasible number of computational points.

With the given directional sectors for the offshore and nearshore grid and the chosen directional step size no energy loss due to interpolation will occur at the boundary of the detailed grids. Dimensions and orientations of all grids for the sector Delta are given in the above table and Figure 3.1.

3.3 Bottom topography

3.3.1 Requirements

For the bathymetry of the area to be modelled with HISWA a few different areas can be recognized. In the offshore area the variations in the bottom level are rather gradual and the changes are not very large in comparison with the depth. In this area a rather coarse representation of the bathymetry for the HISWA computations is sufficient. A bottom grid with a spacing of the order of 500 m is considered adequate in this area.

In the nearshore areas a more fine bottom grid is necessary to represent all relevant features. Along the coast between Cadzand and Hoek van Holland the cross-shore profile shows often a number of bars and troughs and in the estuaries relatively deep tidal channels. To include these accurately in the models, a resolution of the order of 40 m or smaller is required in cross-shore direction. Along the coast a wider spacing can be used as the variations are smaller in this direction. A resolution of 200 m is considered sufficient.

3.3.2 Available data

For the bottom topography in the area of interest a number of different sources are available:

- bathymetry of the KUSTSTROOK flow-model,
- survey-data of the coast line ("JARKUS-profiles").

The KUSTSTROOK-model is a flow model covering a large part of the relevant area of the North Sea between the Belgium-Netherlands border and Ameland (Figure 3.3). The model was prepared at RIKZ (RIJKSWATERSTAAT, 1993d). The bathymetry was compiled from several other models such as ZUNOWAK and HOKU. The resolution of the bathymetry is approximately 1 km parallel to the coast. Perpendicular to the coast the resolution varies. Near the coast the distance between two points is about 200 m; further from the coast the distance gradually increases to 3 km.

The JARKUS-profiles are profiles approximately perpendicular to the coast with a spacing of about 200 m along the coast. These profiles, obtained by yearly surveys, start above the highest HW-levels and extend to approximately 1 km offshore. Every 1 km along the coast the profiles extend to approximately 2.5 km offshore (so-called "doorlodingen"). For the present study the JARKUS-data of the survey of 1990 were used.
Spacing of the data points within each profile is 5 m in the upper part of the profile and 10 m further seaward. Because this small distance between two points would yield a very large amount of data from the JARKUS-profiles, a simple procedure was applied to reduce the data by removing redundant data points. In parts of the profiles with a fairly constant slope, data points were removed in such a way that the profile was approximated with an accuracy of 10 cm (actual value minus value interpolated from the adjacent points). Starting from the seaward side of the profile all points after the first point with a level of NAP +8 m were also removed. Depending on the section of the coast a reduction to 25 or 35% of the original number of points was yielded. The local maxima of bars and troughs are still present in the profile.

3.3.3 Outer model

The bathymetry for the outer model was based on the data from the KUSTSTROOK-model and the JARKUS-profiles. From the KUSTSTROOK-model the data in the narrow area covered by the JARKUS-data were removed and replaced by the reduced data from the JARKUS-profiles along the coast of the Delta region. It appeared that this was not sufficient to cover the SW-part of the outer model. For the remaining area additional data were digitized from nautical chart 1035 (Hydrografisch Bureau, 1983). Because nautical charts give the depth with respect to mean low water (MLW), a correction was applied to account for the difference between MLW and NAP. This correction was based on data on the tide at Zeebrugge and a comparison of the depth at the boundary of the KUSTSTROOK-model. The depths from chart 1035 were increased by 2.7 m.

The origin of the bottom data of the outer models is shown in Figure 3.2. Additional points with a level of NAP +8 m were generated along the coast line and for the inland areas. Based on this set of data the bathymetry for the outer models was obtained by interpolation. The bottom grid for each model was taken equal to the computational grid, i.e. with a resolution of 200 x 500 m. This is sufficient for an accurate representation of the offshore areas. The bathymetry of the outer models is shown in Figure 3.3.

3.3.4 Nested models

For the nested models of the Delta region the bathymetry was based on the data-set compiled for the outer model. Additional points with a level of NAP +8 m were generated for the inland areas and the working harbours and construction areas of the Delta dams. The origin of the bottom data for the models for the Delta region is shown in Figures 3.4 to 3.6.

Based on this set of data the bathymetry for the models Z1, Z2 and Z3 was obtained by interpolation. The bottom grid for each model was taken equal to the computational grid, i.e. with a resolution of 20 x 200 m. This is sufficient for an accurate representation of these coastal areas. The bathymetry of the models for the Delta region is shown in Figures 3.7 to 3.9.

4 Preliminary computations

4.1 Boundary conditions

4.1.1 General

Preliminary computations were carried out for two conditions: water level and wave height conditions with a frequency of exceedance of 10^{-2} and with a frequency of exceedance of 10^{-4}. The design water levels were based on a recent re-evaluation of the extreme water levels along the coast of the Netherlands (see Section 4.1.2). A new statistical evaluation of the wave heights is in progress. For the present study the wave heights along the offshore boundaries of the models were based on presently available data (Section 4.1.3). The models were tested for waves coming from direction 330°N.

4.1.2 Water levels

The water levels for the preliminary computations were taken from the recently fixed design levels ("basispeilen") for the coast of the Netherlands (RIJKSWATERSTAAT, 1993a, 1993b, 1993c). These levels are based on a new statistical evaluation of observed water levels combined with the results of mathematical modelling. The design levels have an exceedance frequency of 10^{-4}. The levels for other frequencies of exceedance are derived from these design levels. The values for other frequencies of exceedance will be published in the near future. The table below summarizes the levels with an exceedance frequency of 10^{-2} and 10^{-4} for a number of stations along the coast. The values for the 10^{-2} exceedance were provided by RIKZ.

Station	$P_{exc} = 10^{-2}$	$P_{exc} = 10^{-4}$
Cadzand	4.20	5.20
Vlissingen	4.35	5.45
Westkapelle	4.00	5.05
Roompot-buiten	4.10	5.35
Brouwershavense Gat	3.95	5.20
Haringvlietsluizen	4.05	5.35
Hoek van Holland	3.55	5.00

Storm surge levels for two frequencies of exceedance (in m wrt NAP)

The water levels for the detailed models were selected based on the above design levels. However, the above table shows that the design water level varies along the coast. From Cadzand to Hoek van Holland the design level gradually decreases, whereas the levels increase going eastward into the estuaries (compare e.g. Westkapelle with Vlissingen and Roompot-buiten). To account for this difference in design levels the water levels in the detailed models were chosen in accordance with the above levels. To reduce the number of computations for the outer model in this phase, the wave conditions in the outer model were computed for one water level per frequency of exceedance. This water level was chosen more or less equal to the level near Cadzand, which is about the highest value. When the water level in a detailed model is lower than in the outer model, the wave height at the boundaries of the detailed model as given by the outer model will be too high for the given water level. However, the wave height will adapt quickly to the smaller water depth by increasing wave breaking. The water levels applied in the HISWA-computations are given in the table below.

HISWA-model	$P_{exc} = 10^{-2}$	$P_{exc} = 10^{-4}$
Z0	4.20	5.30
Z1	4.20	5.30
Z2	4.00	5.30
Z3	3.85	5.30

Water levels applied in the HISWA-computations (in m wrt NAP)

4.1.3 Wave conditions

Wave height

Awaiting the completion of the statistical evaluation of the hydraulic conditions in deeper water, the boundary conditions for the present study were based on the current set of design wave heights, the so-called "Bruinsma-conditions". These boundary conditions, given as a relation between the water level and the significant wave height, are presented in Figure 4.1 (TAW, 1984). The significant wave heights near the NAP -20 m line read from this graph for various water levels are presented in the table below.

Station	$P_{exc} = 10^{-2}$				$P_{exc} = 10^{-4}$			
	varying water level		uniform water level		varying water level		uniform water level	
	WL	H_s	WL	H_s	WL	H_s	WL	H_s
Borkum (Bo)	3.50	6.9	3.55	6.9	4.6	7.9	5.0	8.2
Eierlandse Gat (EG)	3.25	7.6	3.55	7.9	4.2	8.5	5.0	9.2
Den Helder (DH)	3.40	8.0	3.55	8.2	4.4	8.9	5.0	9.3
IJmuiden (IJ)	3.55	6.9	3.55	6.9	5.0	8.1	5.0	8.1
Hoek van holland (HvH)	3.85	6.9	3.55	6.7	5.0	7.8	5.0	7.8
Vlissingen (Vl)	4.20	5.9	3.55	5.3	5.3	6.8	5.0	6.6

Significant wave heights according to the Bruinsma-method (in m; after TAW, 1984)

As the table shows the wave heights are not uniform along the coast, but decrease from Den Helder towards the south. To assess the variation in wave height along the incoming boundary of the outer grid Z0, the results of the studies of the HSMAX-project were used (D.U.T., 1993, 1995). As the station EUR is located near the centre of the incoming boundary, this point was used as a reference. The results presented in the HSMAX-reports are for far more extreme wind speeds (50 m/s) than the values chosen here (27 and 35 m/s) and therefore the wave heights shown in Figure 10 of the final report of the HSMAX-study (D.U.T., 1995) had to be scaled with the value corresponding to the Bruinsma-method.

A comparison of the wave height according to Bruinsma for Hoek van Holland with the results of the HSMAX-study for a wind speed of 30 m/s (D.U.T., 1995; tables 2 to 8) shows that the Bruinsma-value is of the same order as the values predicted for station LEG. The value for LEG was therefore initially used for scaling and calibration with the Bruinsma-value for Hoek van Holland. From the results of the HSMAX-study it further follows that for wind from 330°N the predicted wave height in station EUR is 13 to 18% higher than the value predicted at LEG. This ratio varies somewhat with the wind speed and the applied model. The results along the incoming boundary were therefore scaled with a value 15% higher than the value according to the Bruinsma-method for Hoek van Holland. This is H_s = 7.7 m for an exceedance probability of 10^{-2} and H_s = 9.0 m for an exceedance probability of 10^{-4}. The initially applied incoming wave heights along the boundary are shown in Figure 4.2.

During the preliminary computations it turned out that the computed wave height at the station Vlissingen was too high. In a number of successive steps the incoming wave heights in the southern part of the model were reduced. It was found that the value at the boundary near EUR could not be kept at the same value without obtaining large, unrealistic variations in the wave height along the boundary. The wave height near EUR for the 10^{-2} condition was finally taken equal to the Bruinsma-value for Hoek van Holland. For the 10^{-4} condition the value at this point is about 0.3 m higher than the Bruinsma value. The incoming wave height finally applied at the boundary are also presented in Figure 4.2. Numerical values are given the table below.

Model	YC	$P_{exc} = 10^{-2}$				$P_{exc} = 10^{-4}$			
	(m)	H_s (m)	T_{m01} (s)	Dir (.N)	Ms (-)	H_s (m)	T_{m01} (m)	Dir (.N)	Ms (-)
Z0	0.	6.40	9.11	330.	4.	8.15	10.28	330.	4.
	11500.	6.50	9.18	330.	4.	8.20	10.31	330.	4.
	23100.	6.60	9.25	330.	4.	8.20	10.31	330.	4.
	34600.	6.70	9.32	330.	4.	8.20	10.31	330.	4.
	46200.	6.80	9.39	330.	4.	8.20	10.31	330.	4.
	57700.	6.90	9.46	330.	4.	8.20	10.31	330.	4.
	69300.	6.90	9.46	330.	4.	8.10	10.25	330.	4.
	80800.	6.80	9.39	330.	4.	8.00	10.18	330.	4.
	92400.	6.33	9.06	330.	4.	7.50	9.86	330.	4.
	103900.	6.05	8.85	330.	4.	7.07	9.57	330.	4.
	115500.	5.83	8.69	330.	4.	6.82	9.40	330.	4.
	127000.	5.67	8.57	330.	4.	6.62	9.26	330.	4.
	138000.	5.50	8.44	330.	4.	6.43	9.13	330.	4.

Variation of wave conditions along the incoming boundary of the outer model Z0

Wave period

The corresponding wave periods were computed using the relation determined in the preceding study for RWS (DELFT HYDRAULICS, 1993). Based on data from wave measurements it was found that for the available stations the relation can be approximated by

$$T_{m01} = C\sqrt{H_s}$$

for H_s in m and T_{m01} in s. The coefficient C varies between 3.3 and 3.8 s/m$^{1/2}$ depending on the station, but for the most relevant stations C = 3.6 s/m$^{1/2}$ is a fair average. This value was used to assess the wave period along the boundary of the outer models. The applied wave periods are included in the above table.

Wave direction

The results of the HSMAX-study (D.U.T., 1993) show that the wave direction in the stations does not deviate more than about 10° from the wind direction. Because the wave conditions in deeper water near the coast are not very sensitive to the wave direction (DELFT HYDRAULICS, 1993), the direction of the incoming waves was taken equal to the wind direction. The directional spreading of the incoming waves was taken to be 25° ($\cos^4(\theta - \theta_o)$ distribution).

4.1.4 Computational parameters

For the wind speed corresponding to the applied wave conditions the same values were taken as for the trial computations of the preceding study (DELFT HYDRAULICS, 1993). For the condition with a frequency of exceedance of 10^{-2}, a wind speed of 27 m/s was used; for the 10^{-4} condition the wind speed was 35 m/s.

The parameters for the energy dissipation due to bottom friction were also adopted from the earlier study. This implies the following setting for the coefficients:

c_{fw} = 0.006
c_{fc} = 0.005
switch "frequency change friction" off

The coefficients for wave breaking were taken from the previous study, so that the following settings were applied:

γ_d = 1.13 (deep water)
γ_s = 0.75 (shallow water)
α = 1.0
switch "frequency change breaking" off

4.2 Presentation and discussion of results

4.2.1 Output areas

To obtain a general impression of the overall, 2-dimensional development of the wave field a rectangular area was defined for each model. This output grid coincides with the computational grid. The spacing of this grid in the direction of the computation is larger than for the computational grid. The mesh size is 500 x 500 m for the outer models and, 200 x 200 m for the models alóng the coast of the Delta region. This is sufficient to obtain a good resolution in colour plots of the envisaged scale. The results in these areas can be presented in isoline plots (e.g. significant wave height) and vector-plots (e.g. wave direction). This report presents only a limited number of plots to support the text. More plots are presented in a separate appendix to this report.

For comparison of the results of different computations a number of output lines were defined. These output lines are usually located near the side boundaries of the detailed models in the area where the models overlap. The output lines were extended to the incoming boundaries of the outer models. A few separate output points were defined which coincide with the position of the measurement locations of RIKZ (RIJKSWATERSTAAT, 1988). These are given in the table below. One additional point was defined at the seaward side of the shoal area near Vlissingen. Because the Bruinsma-value for Vlissingen was determined using a level of NAP -15 m at the reference point (RIJKSWATERSTAAT, 1983), this additional output station was chosen near the NAP -15 m contour at the entrance to the Westerschelde estuary. For the calibration it was assumed that this point corresponds to the point where the Bruinsma-value for Vlissingen is defined (see table in Section 4.1.3). The assumed position is included in the table.

The location of the output lines and output points is shown in Figure 4.3.

Station	Code	Depth (m-NAP)	Position (geographical)		Position (Paris-coord.)	
			Longitude (°E)	Latitude (°N)	Easting (m)	Northing (m)
Platform Euro-0	EUR	32	3°16'35"	51°59'55"	10,044	447,580
Lichteiland Goeree	LEG	21	3°40'02"	51°55'05"	36,662	437,913
Schouwenbank	SWB	25	3°18'42"	51°44'54"	11,671	419,677
Vlissingen - Bruinsma	VLS	15	3°52'27"	51°32'06"	50,000	395,000

Position of output points

For the requested output along the NAP -10 m, NAP -5 m and NAP -0 m contours, the RAY and DEPTH commands from HISWA were used to generate the output points. The rays were defined with the starting point onshore and the end point at sea. In this way the combination of commands locates the most landward point in each ray with the specified depth. The distance between the rays was approximately 200 m, while the orientation was perpendicular to the coast. Because of the variation of the coastal orientation and the complex structure of the bathymetry at the mouths of the estuaries, with tidal channels and tidal flats, the resulting output locations have a completely different "character" compared with the output locations for the coast of Holland (DELFT HYDRAULICS, 1994).

For certain parts of the coast, however, the position of some of these contours are rather far offshore due to large areas of relatively shallow water. For these parts of the coast some of the contours have been omitted. This concerns in particular the NAP -10 m line at Schouwen, the NAP -10 m and NAP -5 m contours at the Brouwersdam, Goeree and Voorne. To accomodate for this lack of information a number of additional rays was defined further offshore on which the NAP -10 m and NAP -5 m were identified. The wave conditions on the contour lines for these "sea-rays" are also presented. These additional rays were defined with the starting point at the seaward boundary of the models and the end point at the coast.

The distance between the rays was 500 m. For these "sea-rays" output was requested along the NAP -10 m and NAP -5 m contours.

Figures 4.4 to 4.8 show the output points generated in this way. The NAP -0 m contour line is sometimes hard to identify, as this line nearly coincides with the coast line shown for reference.

Further, the wave conditions are presented for a number of selected curves: one approximately perpendicular to the coast at each of the coastal sections (Zeeuws-Vlaanderen, Walcheren, Schouwen, Goeree and Maasvlakte) and three about 1 km seaward of the Oosterscheldedam, the Brouwersdam and the Haringvliet sluices.

4.2.2 Results in outer model

In the outer models the wave height decreases gradually due to bottom friction and some wave breaking. Where the water depth is getting smaller than about 4 times the significant wave height, breaking becomes the dominant process and the wave height is largely determined by the local water depth. The change in the significant wave height for waves with a frequency of exceedance of 10^{-4} in the outer model is shown in Figure 4.9.

The results from the model Z0 in the stations where RIKZ carries out measurements are shown in the table below. During the calibration of the model, it appeared to be not possible to obtain a good agreement between the computed wave heights and the Bruinsma-values in both the stations Vlissingen (VLS) and Hoek van Holland (EUR/LEG) without using unrealistic variations of the wave height along the deep water boundary (see also Section 4.1.3). The table shows that the computed results after the calibration are in fair agreement with the values according to Bruinsma. It should further be noted that in the areas of interest nearshore the limitation of the wave heights by the local waterdepth is generally of more importance, so that the bathymetry, the water level and coefficients of the breaking formulation are the most important parameters for the nearshore wave heights (DELFT HYDRAULICS, 1993).

Station	Water depth (m)	Z0D3C1 (330°N)	Bruinsma 10^{-2}	Water depth (m)	Z0D3C2 (330°N)	Bruinsma 10^{-4}
EUR*)	-	6.90	6.9 (HH)	-	8.20	7.8 (HH)
LEG	25.98	6.41	-	27.08	7.47	-
SWB	32.36	6.71	-	33.46	7.92	-
VLS	19.15	6.02	5.9	20.25	6.87	6.8

*) value prescribed at boundary

Significant wave height at measurement stations of RIKZ for the computations for the model Z0 compared with the value according to the Bruinsma-method (in m)

As the statistical evaluation of the wave heights in deep water, presently being carried out within the HYDRA framework, may lead to different extreme wave heights in the stations used for calibration, a further calibration of the models may be carried out after this study has been completed.

4.2.3 Results in nested models

In the nearshore area along the coast of the Delta region between Cadzand and Hoek van Holland the wave height decreases further, mainly due to depth-induced wave breaking. Figure 4.10 shows an example of the variation in significant wave height for the model Z2 for waves from 330°N for the condition 10^{-4}. In the relatively shallow area between the most seaward NAP -10 m contour near the offshore boundaries of the nested model the wave height decreases probably due to increased bottom friction and some wave breaking.

The wave heights along the contour lines show more, rather gradual variations which is different from the results that were found for the coast of Holland and the North Sea side of the Wadden Islands. This is caused by the rather large shallow areas that extend some 5 to 15 km offshore. An example of this gradual change in wave height along the NAP -10 m and NAP -5 m contour can be seen in Figure 4.11 and 4.12 for the northwesterly side of Walcheren. From profile 40 to 80 the wave height at the NAP -10 m contour decreases from about H_s = 4.0 m to a value near H_s = 2.0 m. At the NAP -0 m contour line (Figure 4.13) the differences are smaller.

The wave period is virtually constant along the contours as the effect of wave breaking on the mean frequency is switched off. Differences in the mean wave period are caused by the variation in the mean period of the incoming waves along the boundary. In some areas further into the estuaries the overall mean wave period decreases, because some directional sectors contain locally-generated wave energy characterized by a shorter wave period. This reduces the direction-averaged mean wave period.

The main wave direction shows more variations due to differences in orientation of the coast. Refraction causes a change in wave direction so that the direction of the waves is more or less perpendicular to the coast. This can be seen in e.g. Figures 4.11 to 4.13 which show an increase of the main wave direction between the profiles 1 to 30. This change can be attributed to the orientation of the normal to the contour lines, as can be seen in Figure 4.5. Figure 4.13 shows further some irregularities in the wave period and, to a lesser extend, in the wave height (e.g. between profiles 1 and 10). The results in other areas (see the Annex) show similar variations. This occurs mainly at the NAP -0 m contour line and has numerical causes, such as interpolation between grid points of which one is a point on land where wave height and period are zero. At these locations the wave height can be averaged from neighbouring points. For the wave period the constant value along the contour should be used.

It should further be noted that for some parts of the coast the orientation is nearly parallel with the main wave direction (e.g. Walcheren SW coast, parts of Schouwen and Goeree). In these areas the computed wave heights may not be fully reliable due to strong refraction of the waves. Further, the resolution perpendicular to the main wave direction is coarser than in the wave direction. For these parts of the coast other wind and wave directions may cause higher nearshore wave heights.
The results along the contourlines for the various parts of the coast in the Delta area are summarized in the table below. Values for the NAP -0 m contour line for the Maasvlakte, though presented in the Annex, have been omitted, because these are unreliable due to the presence of a breakwater protecting this part of the coast.

Model Region	Contour (profiles)	P_{exc} = 10^{-2}		P_{exc} = 10^{-4}	
		Dir = 330°N		Dir = 330°N	
		H_s (m)	T_{m01} (s)	H_s (m)	T_{m01} (s)
Z1 Zeeuws-Vl	NAP -10 m (1-60)	3.2-2.0	9.7	3.7-2.4	10.7
	NAP -5 m (1-60)	3.3-2.0	9.7	3.8-2.4	10.7
	NAP -0 m (1-60)	2.8-2.0	9.7	3.5-2.4	10.7
Z1 Walcheren-SW	NAP -10 m (11-88)	2.7-0.5	9.7	3.0-0.6	10.7-10.4
	NAP -5 m (11-88)	2.6-0.4	9.7	3.0-0.5	10.7-10.4
	NAP -0 m (11-88)	2.4-0.4	9.7	2.7-0.5	10.7-10.4
Z1 Sea-rays	NAP -10 m (all)	5.5-3.4	9.7	6.2-3.8	10.7
Z2Walcheren-NW	NAP -10 m (all)	4.5-1.8	9.7	5.0-2.2	10.7-10.6
	NAP -5 m (all)	4.3-1.8	9.7	4.8-2.2	10.7-10.6
	NAP -0 m (all)	3.4-1.8	9.7	4.2-2.0	10.7-10.6
Z2 Schouwen	NAP -5 m (10-94)	3.6-1.8	9.7-9.5	4.2-2.2	10.6-10.4
	NAP -0 m (10-94)	2.4-1.4	9.7-9.5	3.0-2.0	10.6-10.4
Z2 Sea-rays	NAP -10 m (all)	6.0-3.4	9.7-9.4	6.9-4.0	10.7-10.3
	NAP -5 m (all)	4.6-2.0	9.7-9.4	5.4-2.2	10.7-10.3
Z3Brouwersdam	NAP -0 m (all)	2.2-1.6	9.5	2.8-2.0	10.4-10.3
Z3 Goeree	NAP -0 m (all)	2.4-1.2	9.5	3.1-1.8	10.3-10.0
Z3 Voorne	NAP -0 m (all)	1.6-0.6	9.4-4.9	2.1-0.8	10.1-6.0
Z3 Slufter	NAP -10 m (all)	5.3-4.8	9.2-9.1	6.0-5.5	10.0-9.9
	NAP -5 m (all)	4.0-2.0	9.2-9.1	4.7-2.6	10.0-9.9
	NAP -0 m (all)	2.8-1.2	9.2-9.1	3.5-1.7	10.0-9.9
Z3 Maasvlakte	NAP -10 m (1-30)	5.3-3.5	9.1-9.0	6.2-4.2	9.9-9.8
	NAP -5 m (1-30)	5.2-2.0	9.1-9.0	6.0-2.7	9.9-9.8
	NAP -0 m (1-30)	*)	*)	*)	*)
Z3 Sea-rays	NAP -10 m (all)	5.5-2.4	9.6-9.0	6.3-3.0	10.5-9.7
	NAP -5 m (all)	5.2-2.2	9.6-9.0	6.0-2.8	10.5-9.7

*) unreliable due to breakwater

Range of wave conditions at the given contour line along the coast of Delta region

5 Conclusions

From the trial computations using the developed HISWA models for the Delta region it can be concluded that the significant wave heights along the contour lines show rather large variations. These variations are larger than those found for the coast of Holland between Hoek van Holland and Den Helder and the North Sea side of Wadden Islands. The variations are caused by differences in orientation of the coast, differences in the width of the nearshore shallow water area and by sheltering in the entrances to the estuaries.

A further calibration of the boundary conditions may be considered after the statistical evaluation of the deep-water wave conditions that is being carried within the HYDRA-framework, has been completed. For these future computations the bathymetry can also be updated.

The present results complete a set of preliminary nearshore design wave conditions for the entire North-Sea coast of the Netherlands. This set comprises only waves from direction of 330°N and it should be noted that for some parts of the coast other wave directions may be more critical.

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Computational grids sector Delta

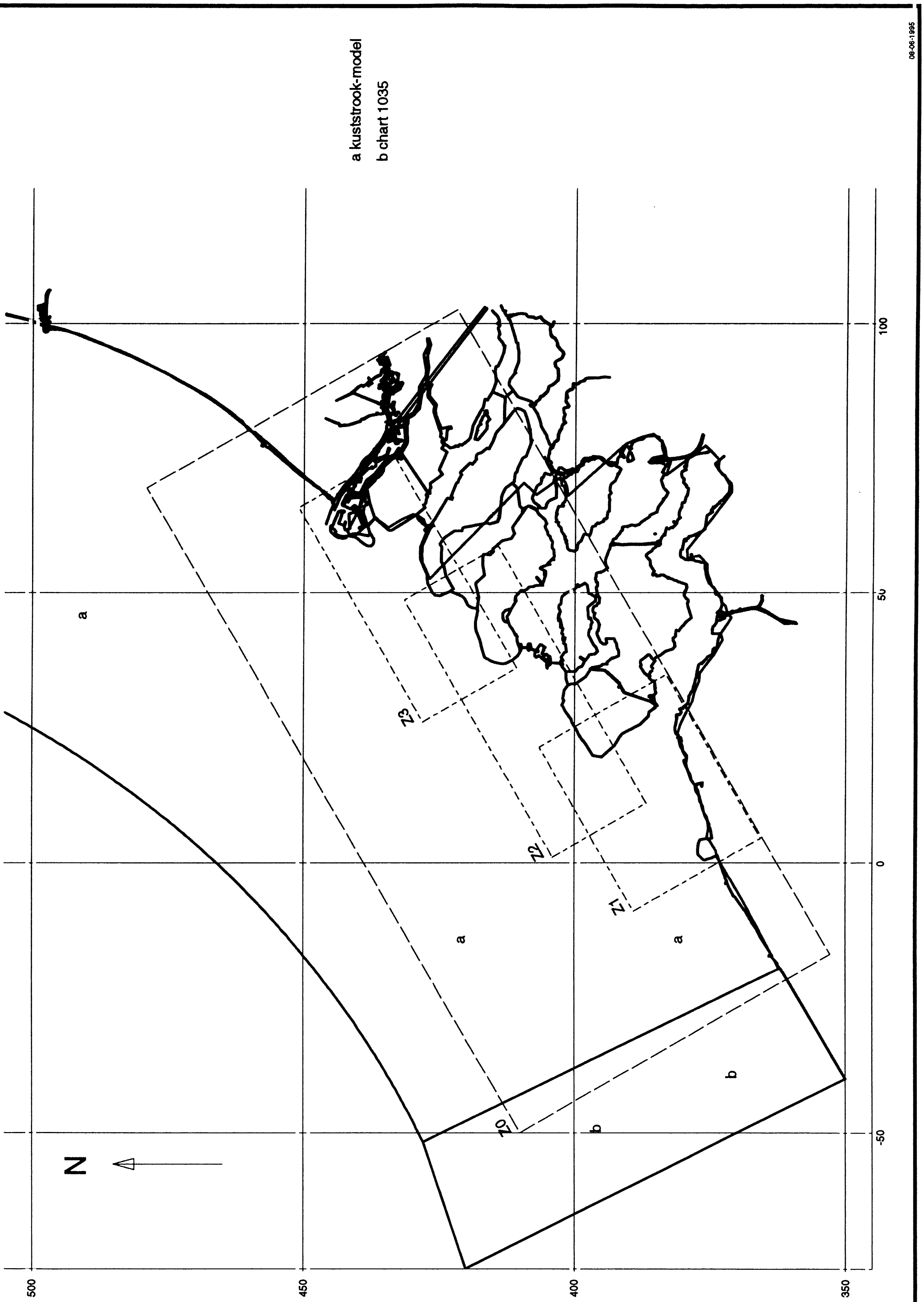
HYDRA

scale 1 :1,000,000

DELFT HYDRAULICS

H 2180

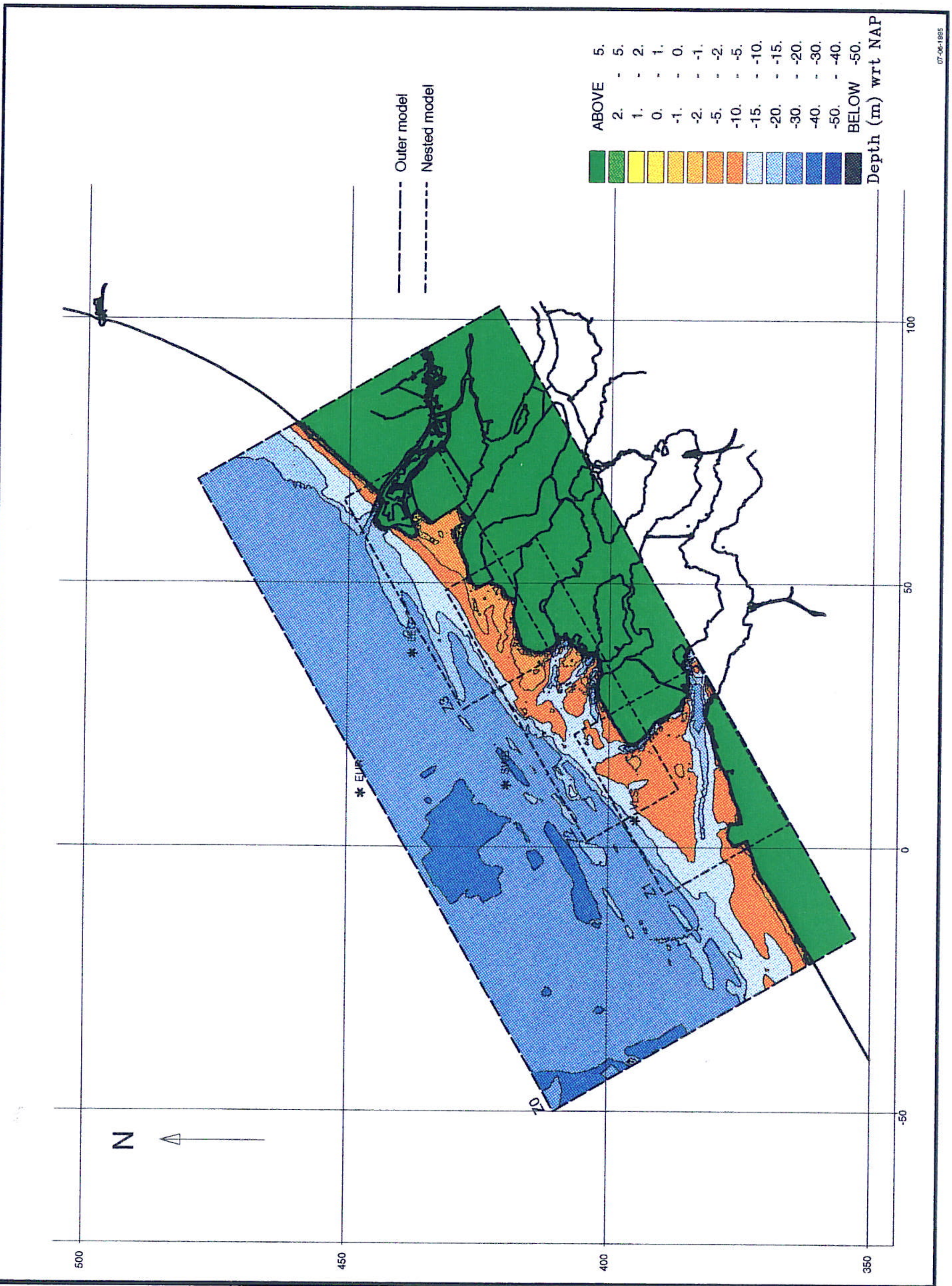
Fig. 3.1



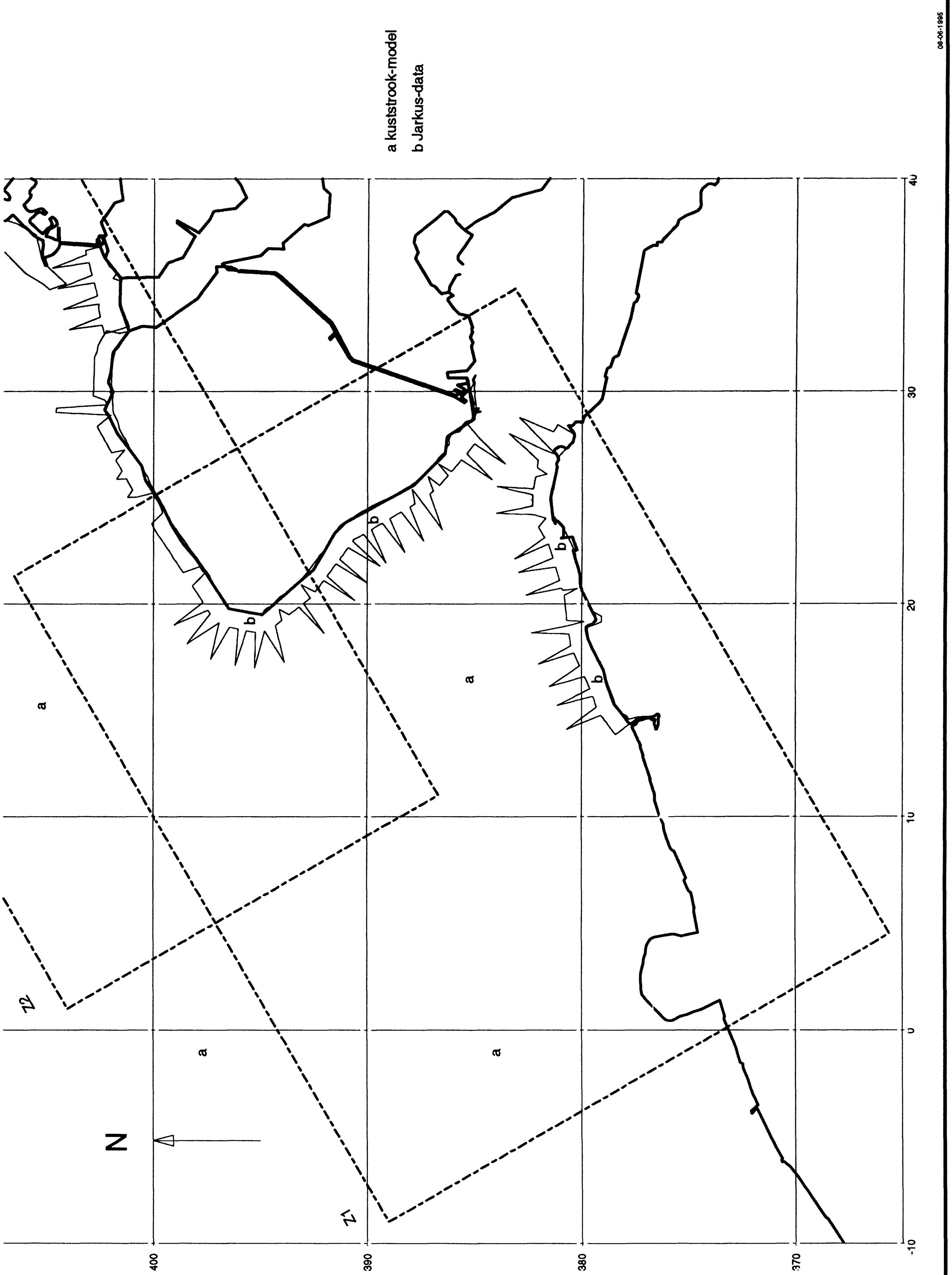
Origin of bathymetry data,model Z0

HYDRA	Z0
scale 1 :1,000,000	
H 2180	Fig. 3.2

DELFT HYDRAULICS



Bathymetry model Z0 (in m wrt NAP)	HYDRA	Z0
	scale 1 :1,000,000	
DELFT HYDRAULICS	H 2180	FIG. 3.3



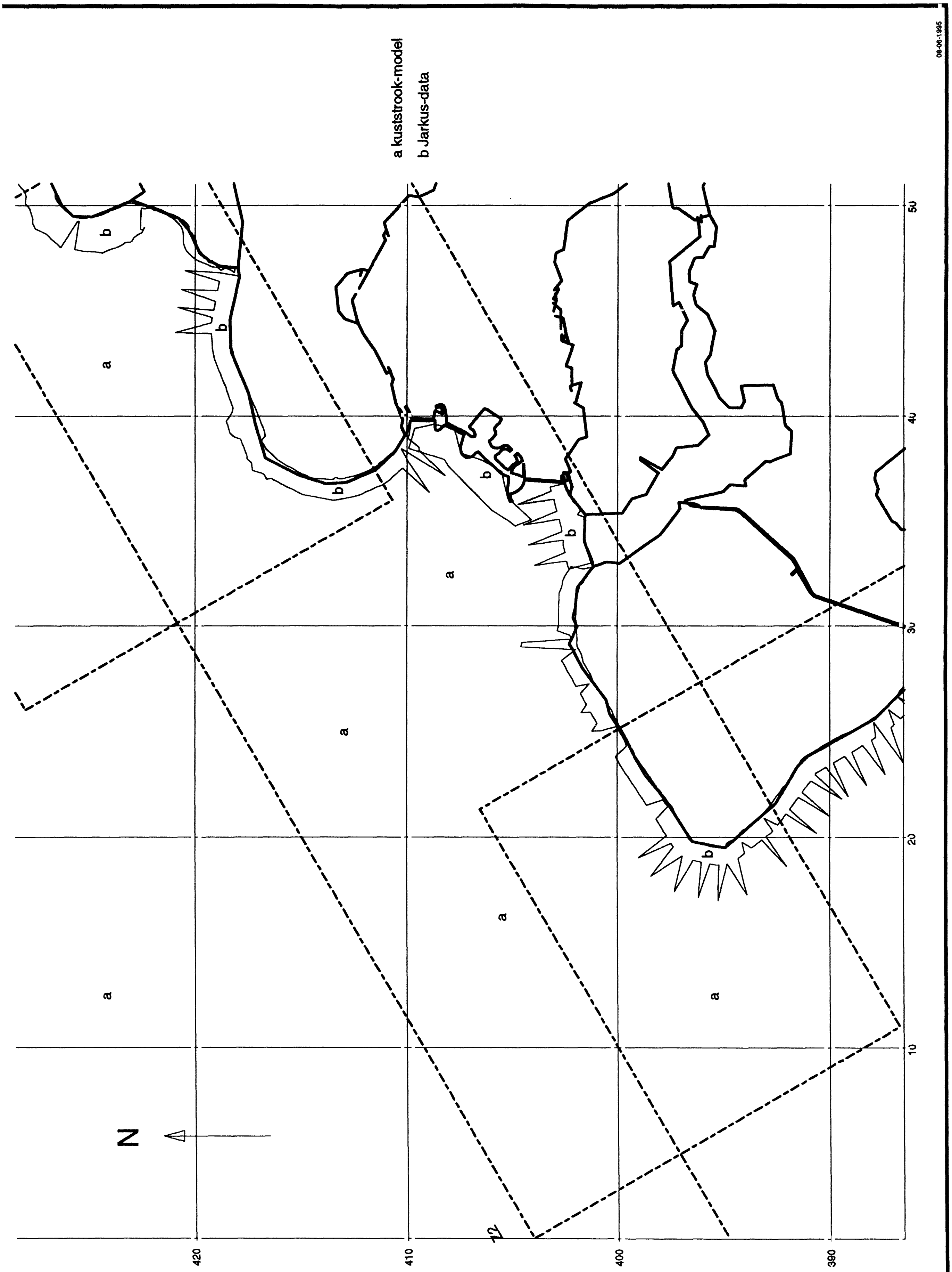
Origin of bathymetry data, model Z1

HYDRA | Z1

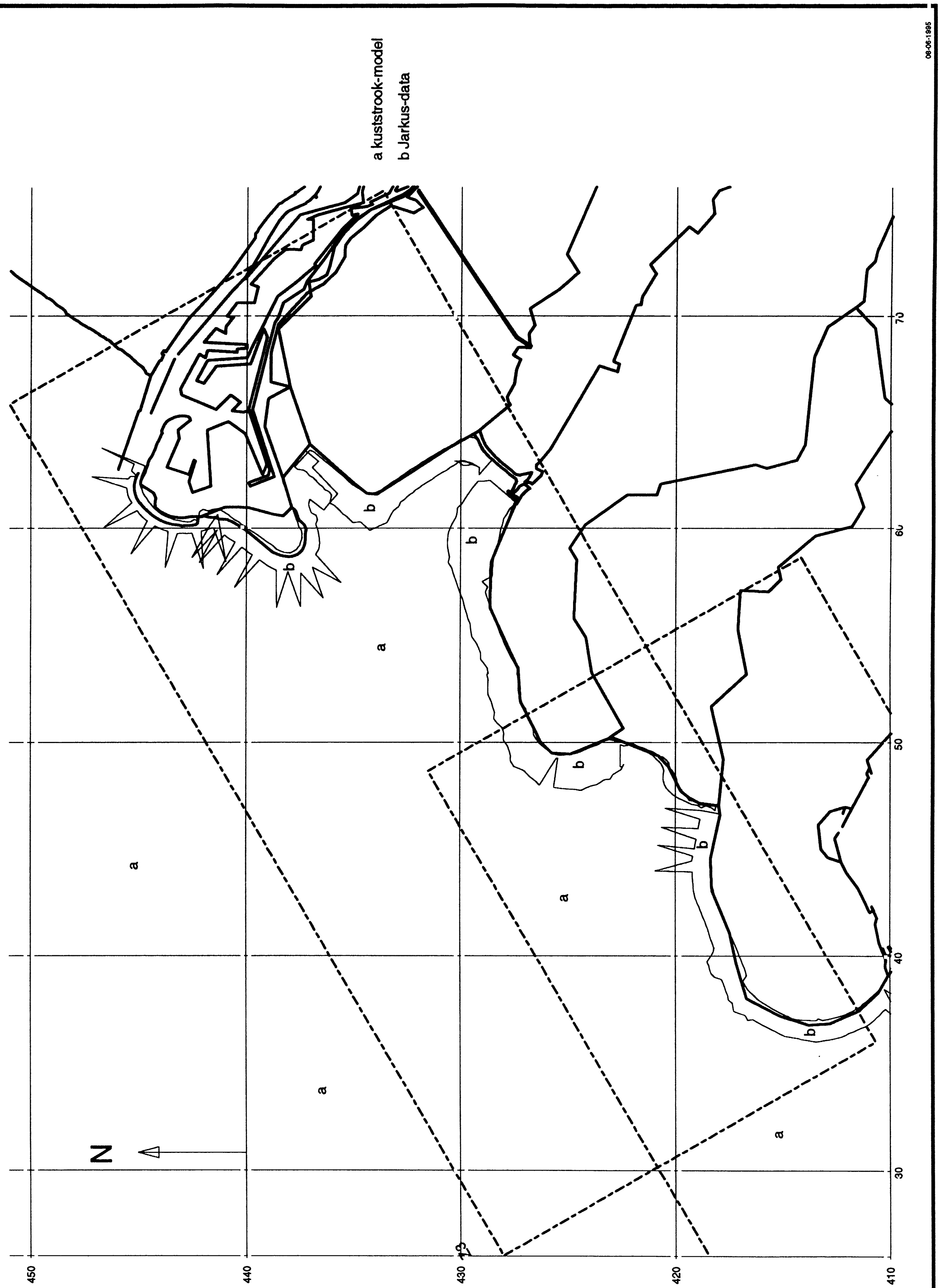
scale 1 : 250,000

DELFT HYDRAULICS

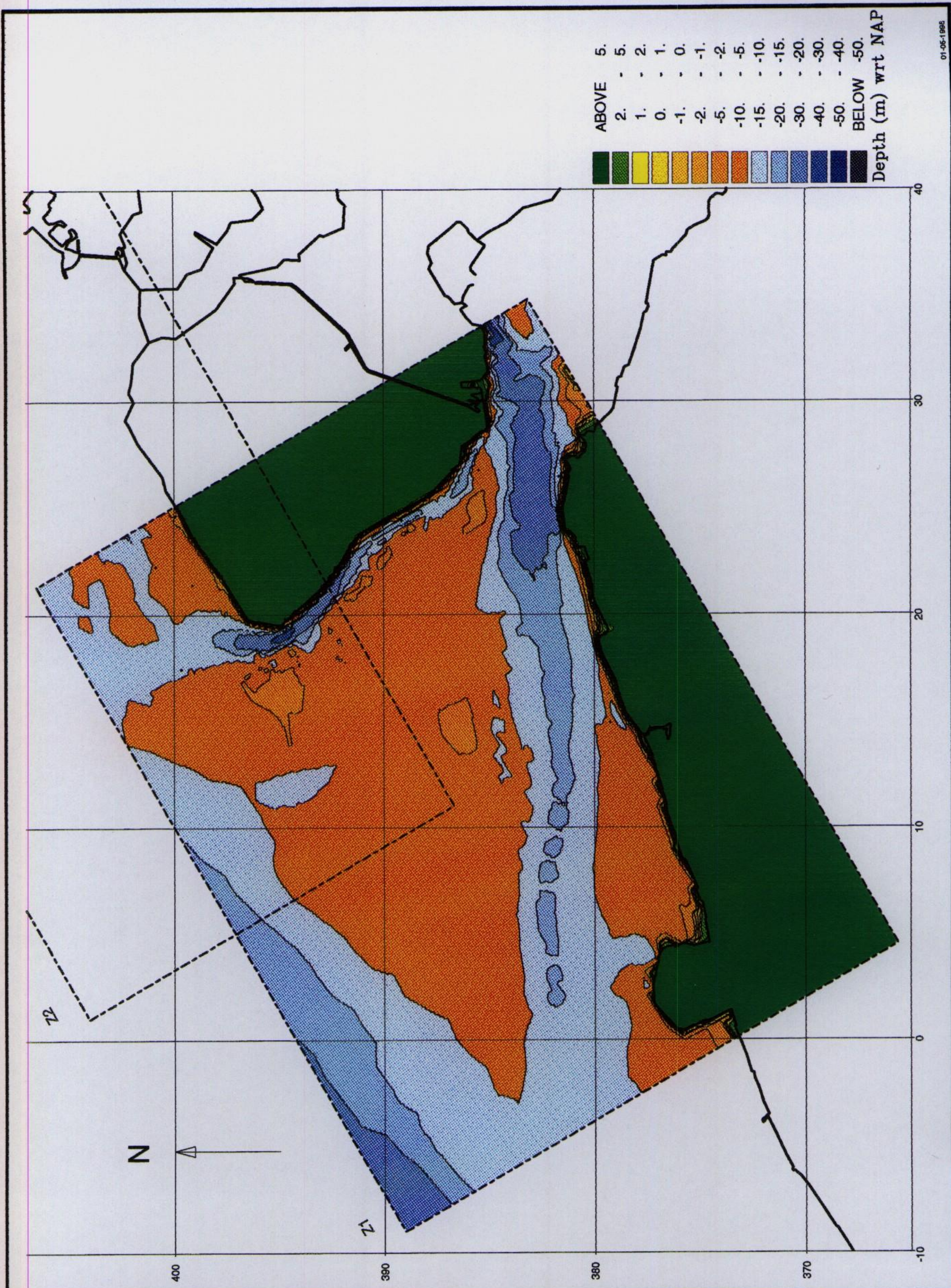
H 2180 | Fig. 3.4



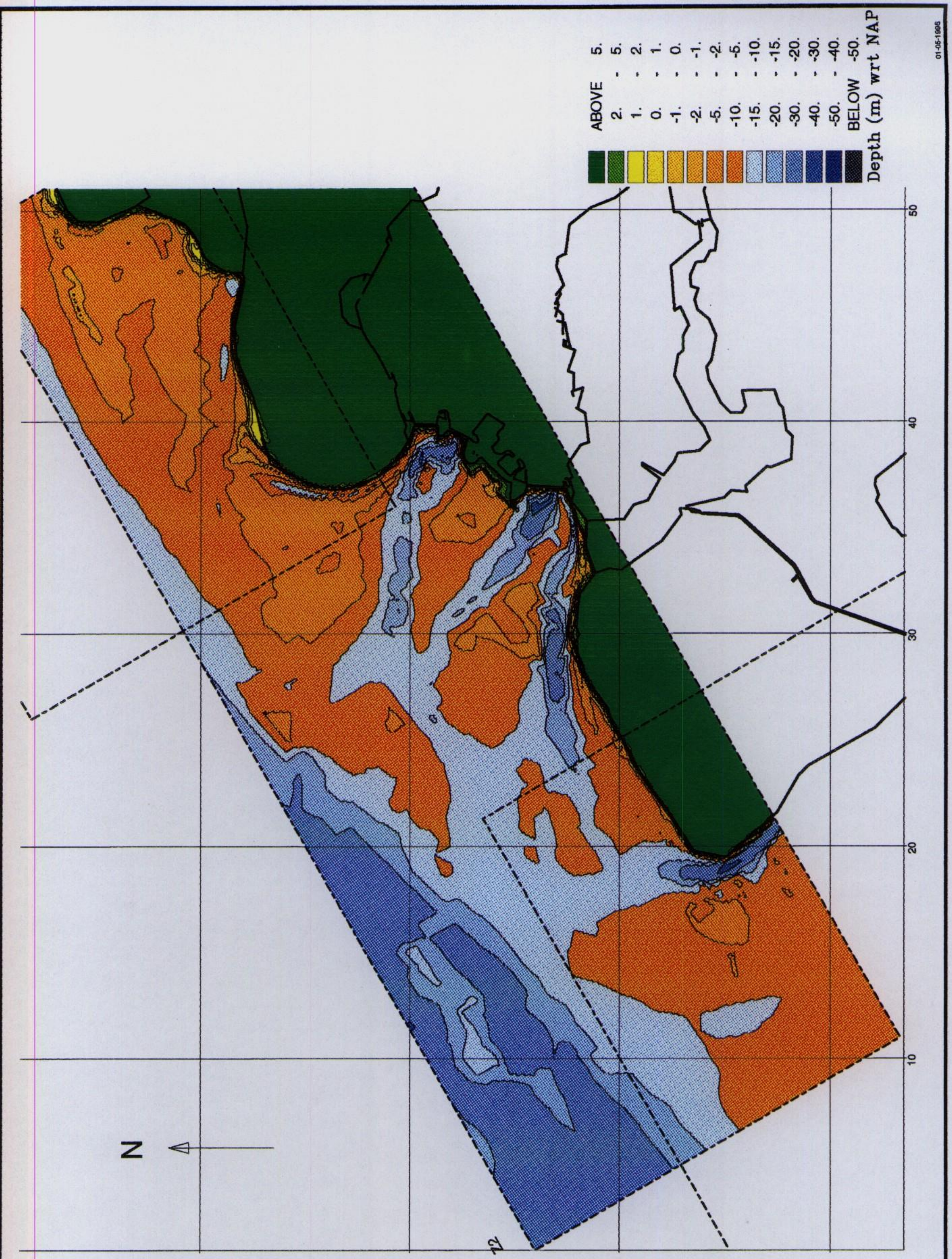
Origin of bathymetry data, model Z2	HYDRA	Z2
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	Fig. 3.5



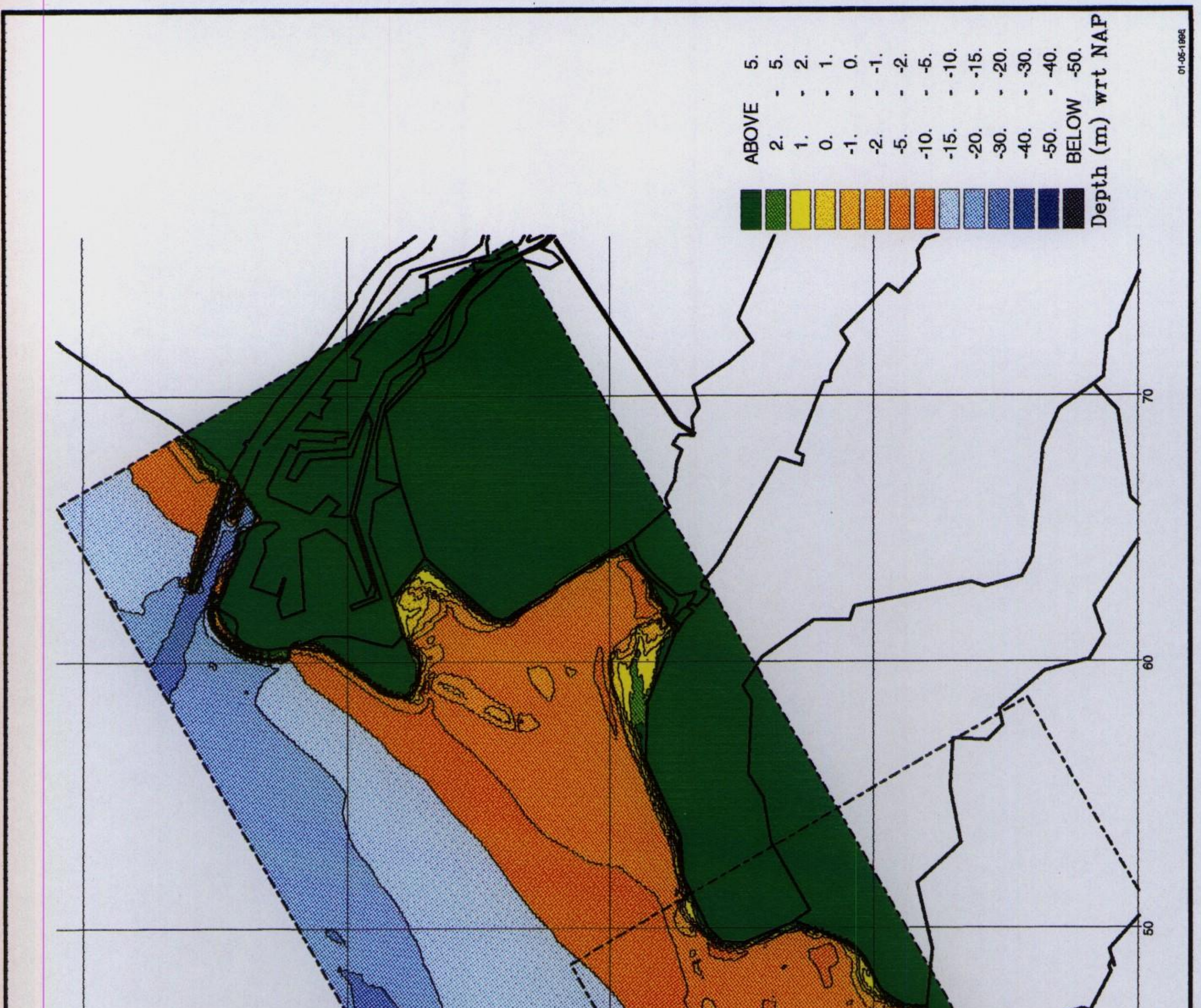
Origin of bathymetry data, model Z3	HYDRA	Z3
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	Fig. 3.6



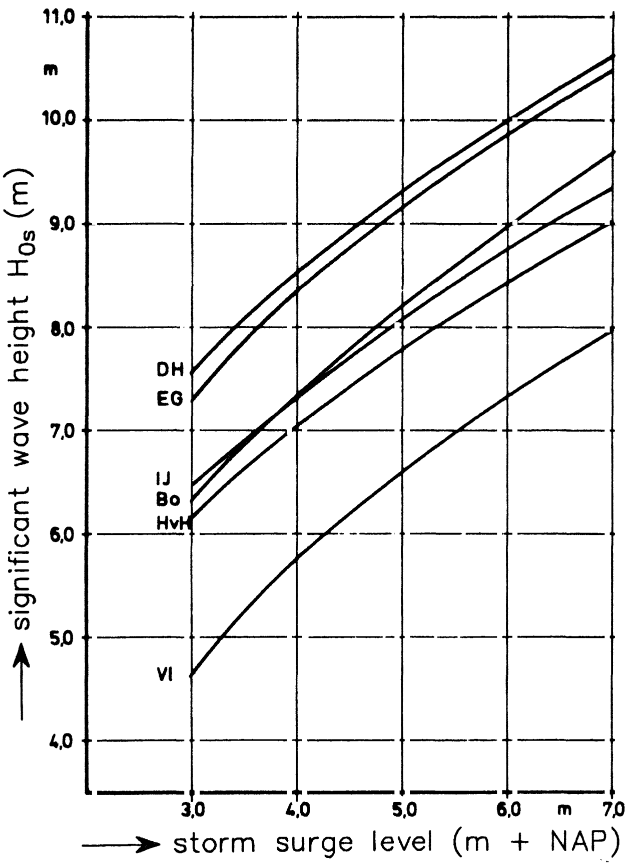
Bathymetry model Z1 (in m wrt NAP)	HYDRA	Z1
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	FIG. 3.7

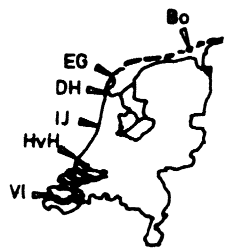


Bathymetry model Z2 (in m wrt NAP)	HYDRA	Z2
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	FIG. 3.8



Bathymetry model Z3 (in m wrt NAP)	HYDRA	Z3
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	FIG. 3.9





DH = Den Helder

EG = Eierlandsche Gat

IJ = IJmuiden

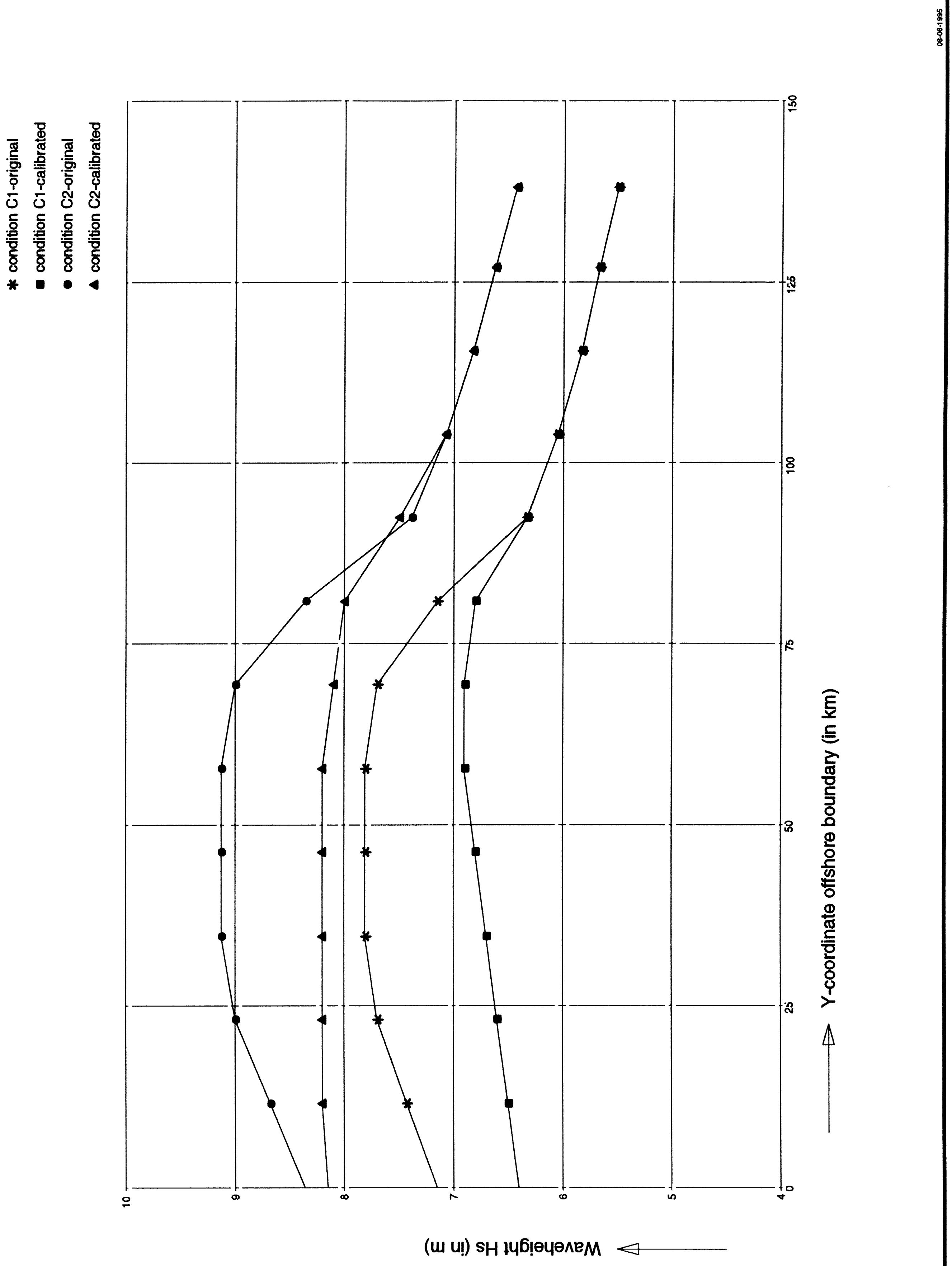
Bo = Borkum

HvH = Hoek van Holland

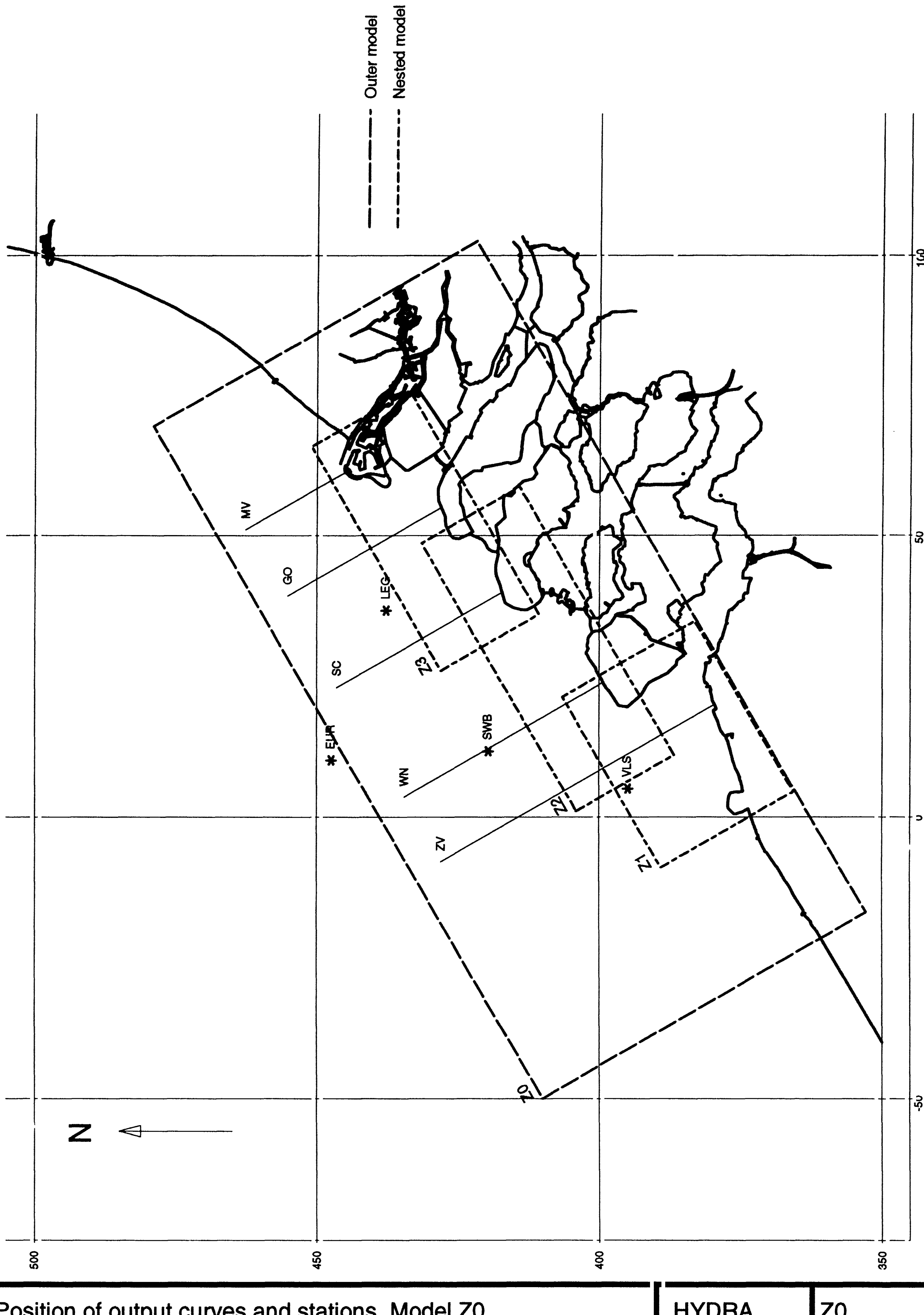
Vl = Vlissingen *)

*) outside shoal area

EXPECTED SIGNIFICANT WAVE HEIGHT VERSUS STORM SURGE LEVEL	HYDRA	
DELFT HYDRAULICS	H 2180	FIG. 4.1



Significant wave heights along offshore boundary	HYDRA	
DELFT HYDRAULICS	H 2180	Fig. 4.2

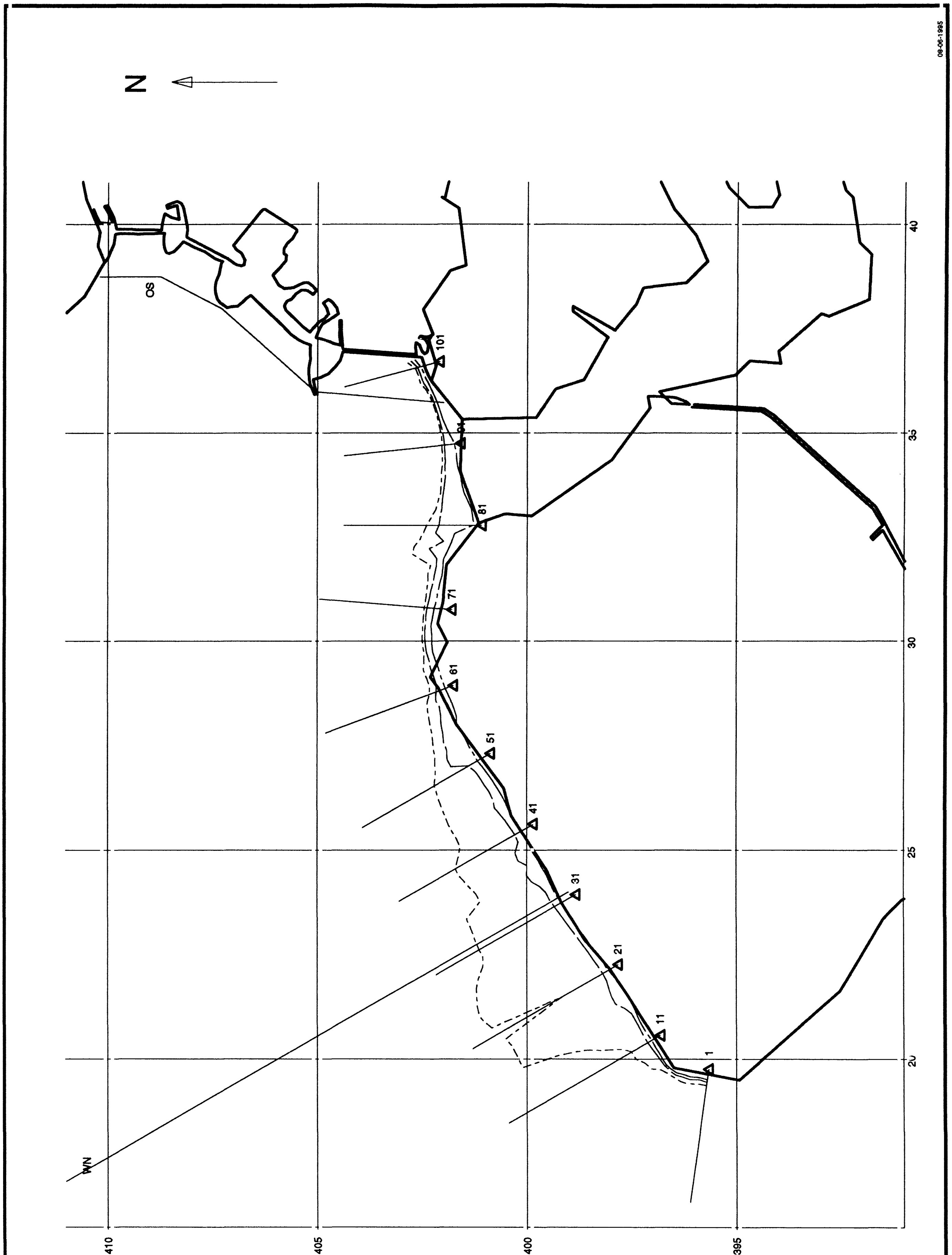


Position of output curves and stations, Model Z0	HYDRA	Z0
	scale 1 :1,000,000	
DELFT HYDRAULICS	H 2180	FIG. 4.3

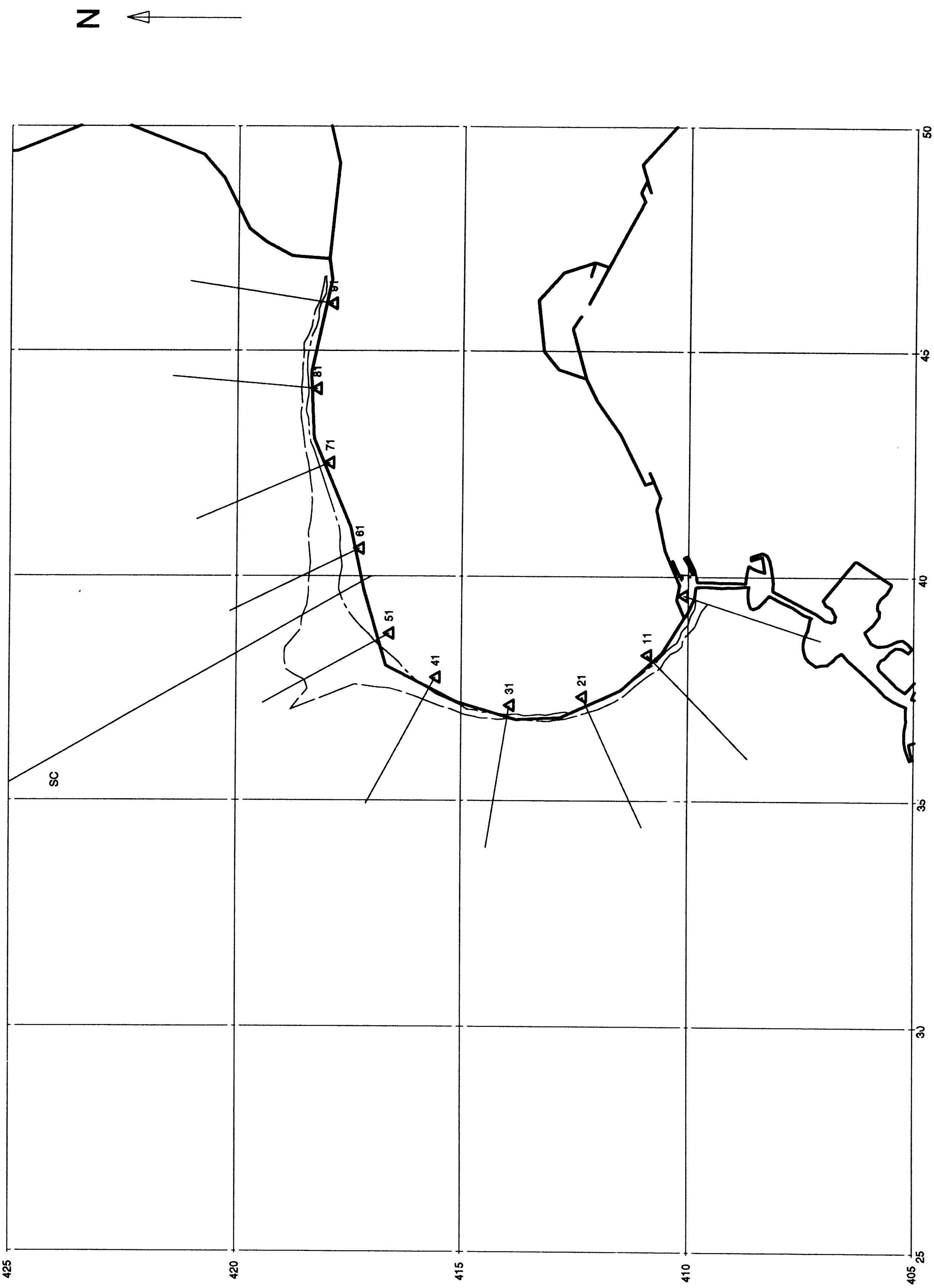
Position of output contours and curve, Model Z1
Zeeuws-Vlaanderen and Walcheren

HYDRA	Z1
scale 1 : 125,000	
H 2180	FIG. 4.4

DELFT HYDRAULICS



Position of output contours and curves, Model Z2 Walcheren and Oosterschelde	HYDRA	Z2
	scale 1 : 125,000	
DELFT HYDRAULICS	H 2180	FIG. 4.5



Position of output contours and curve, Model Z2
Schouwen

HYDRA	Z2
scale 1 : 125,000	
H 2180	FIG. 4.6

DELFT HYDRAULICS

Position of output contours and curves, Model Z3
Brouwersdam, Goeree and Haringvliet

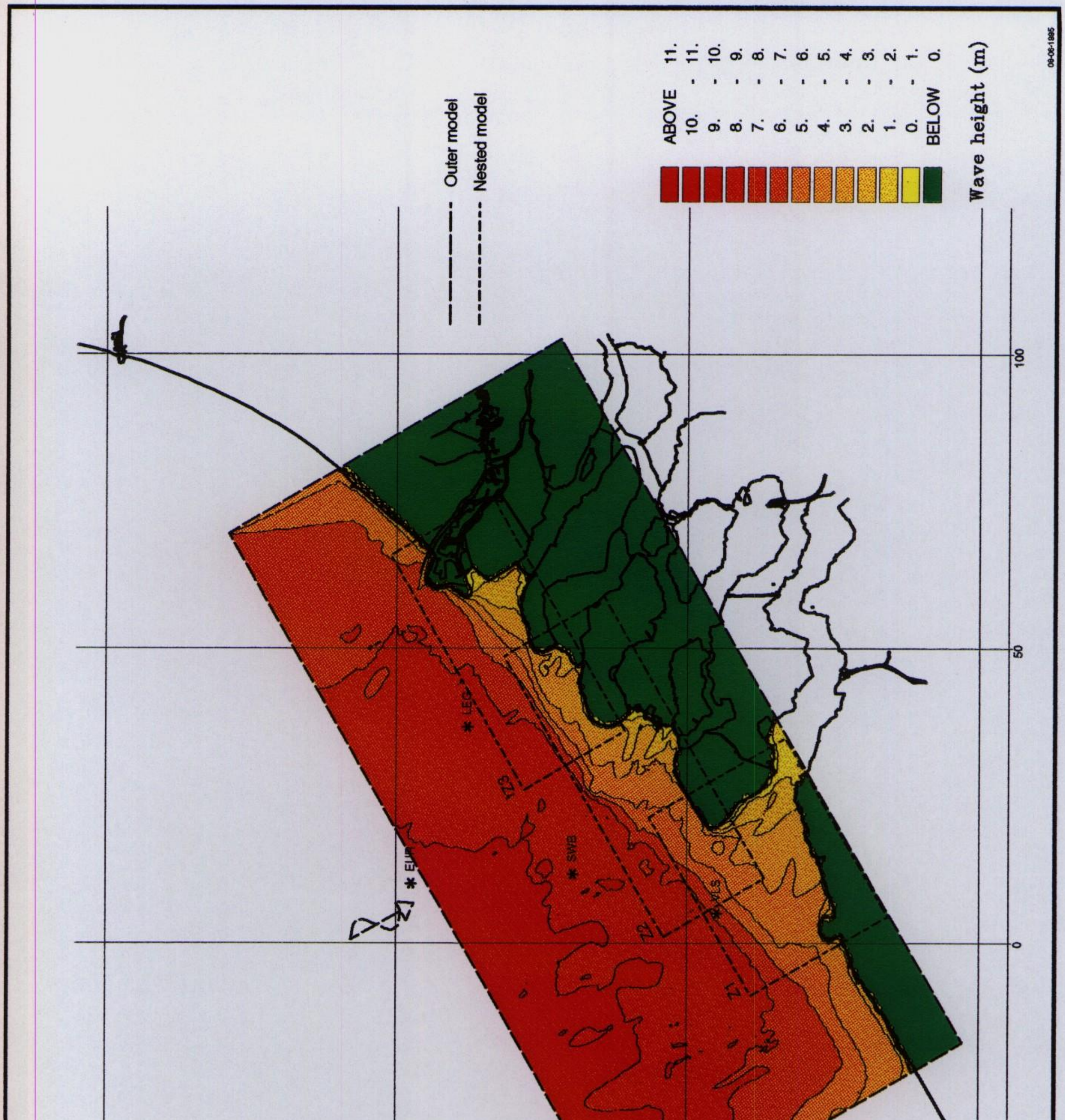
HYDRA	Z3
scale 1 : 125,000	
H 2180	FIG. 4.7

DELFT HYDRAULICS

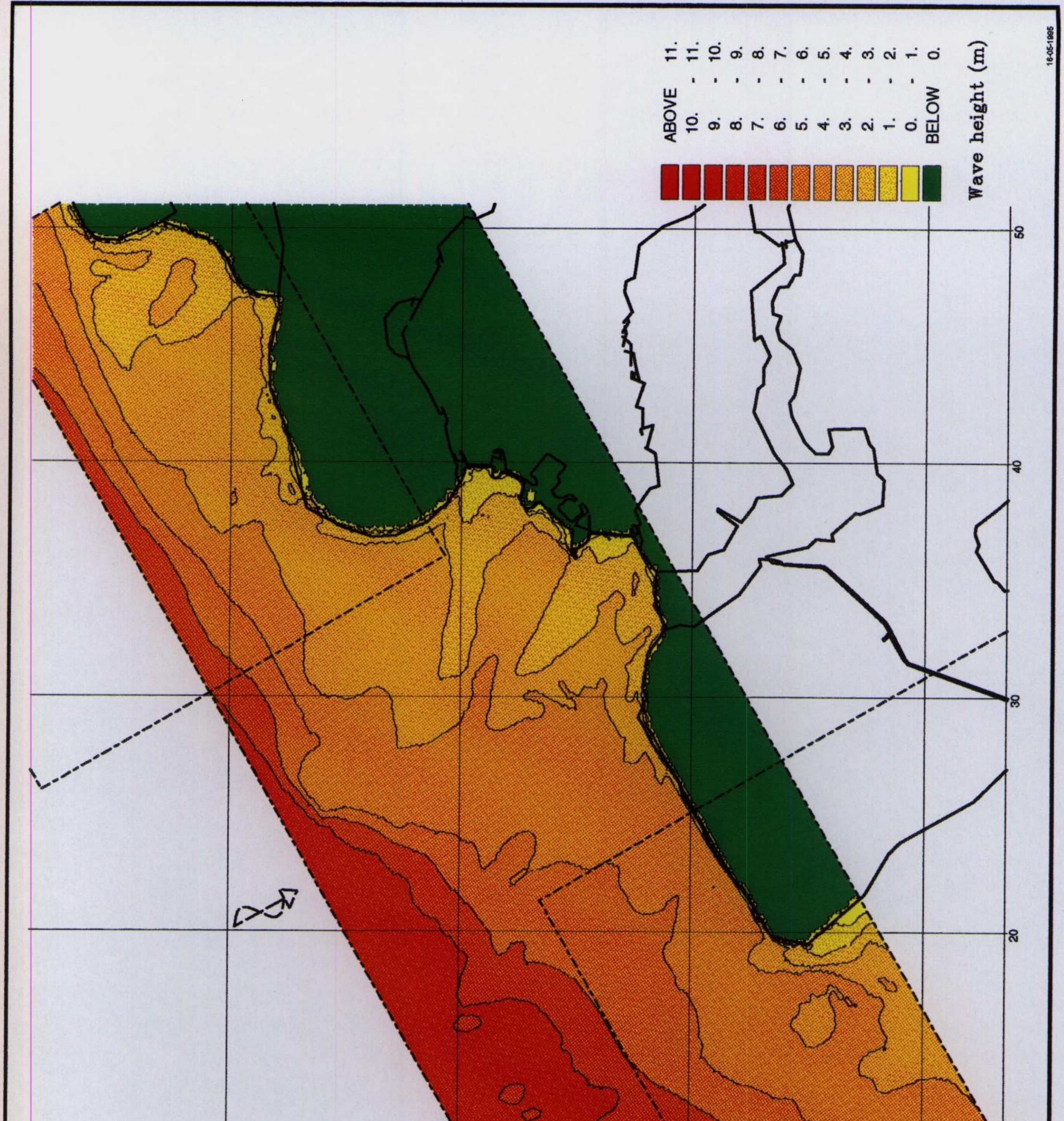
Position of output contours and curve, Model Z3
Voorne, Slufter and Maasvlakte

HYDRA	Z3
scale 1 : 125,000	
H 2180	FIG. 4.8

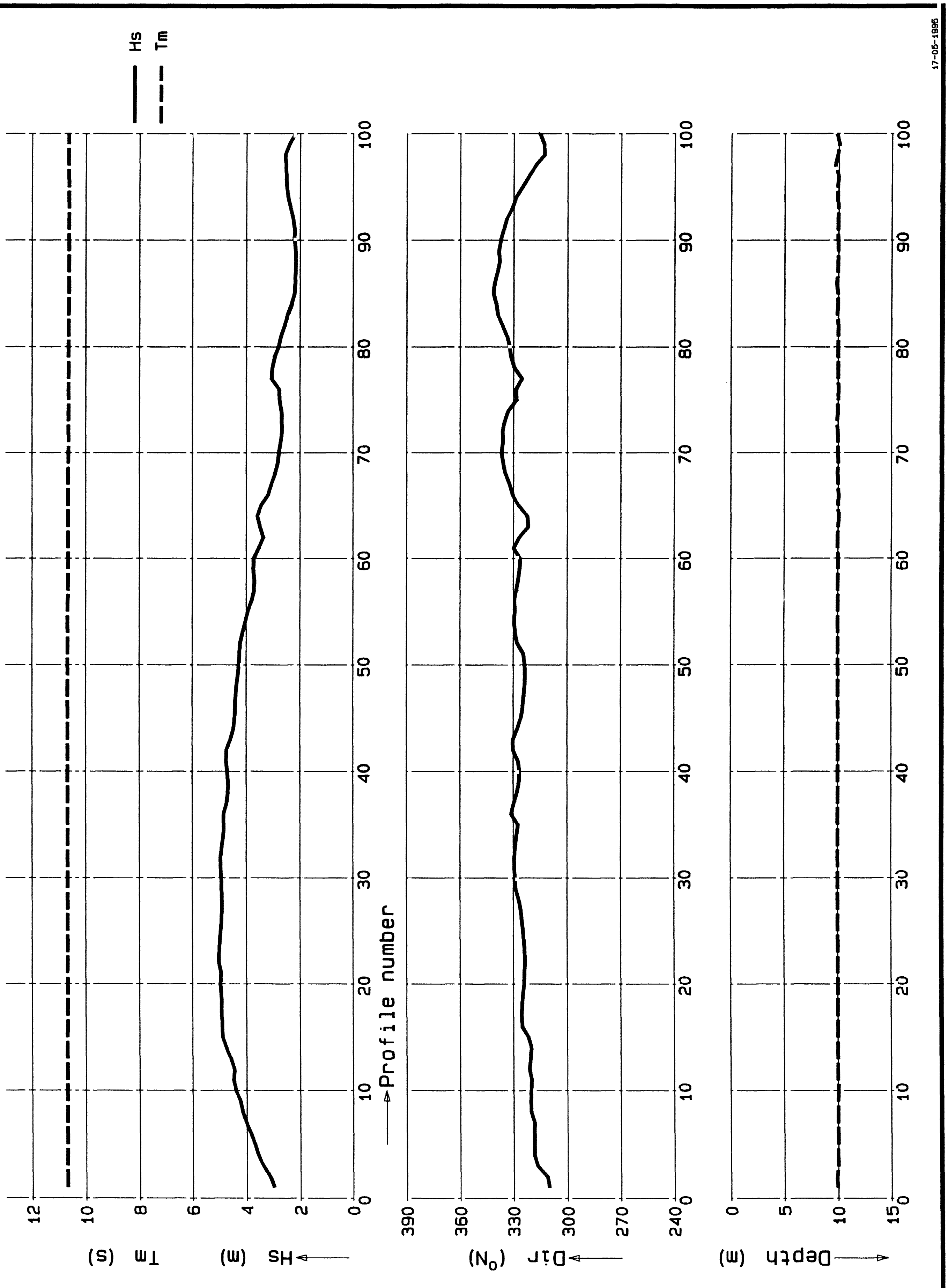
DELFT HYDRAULICS



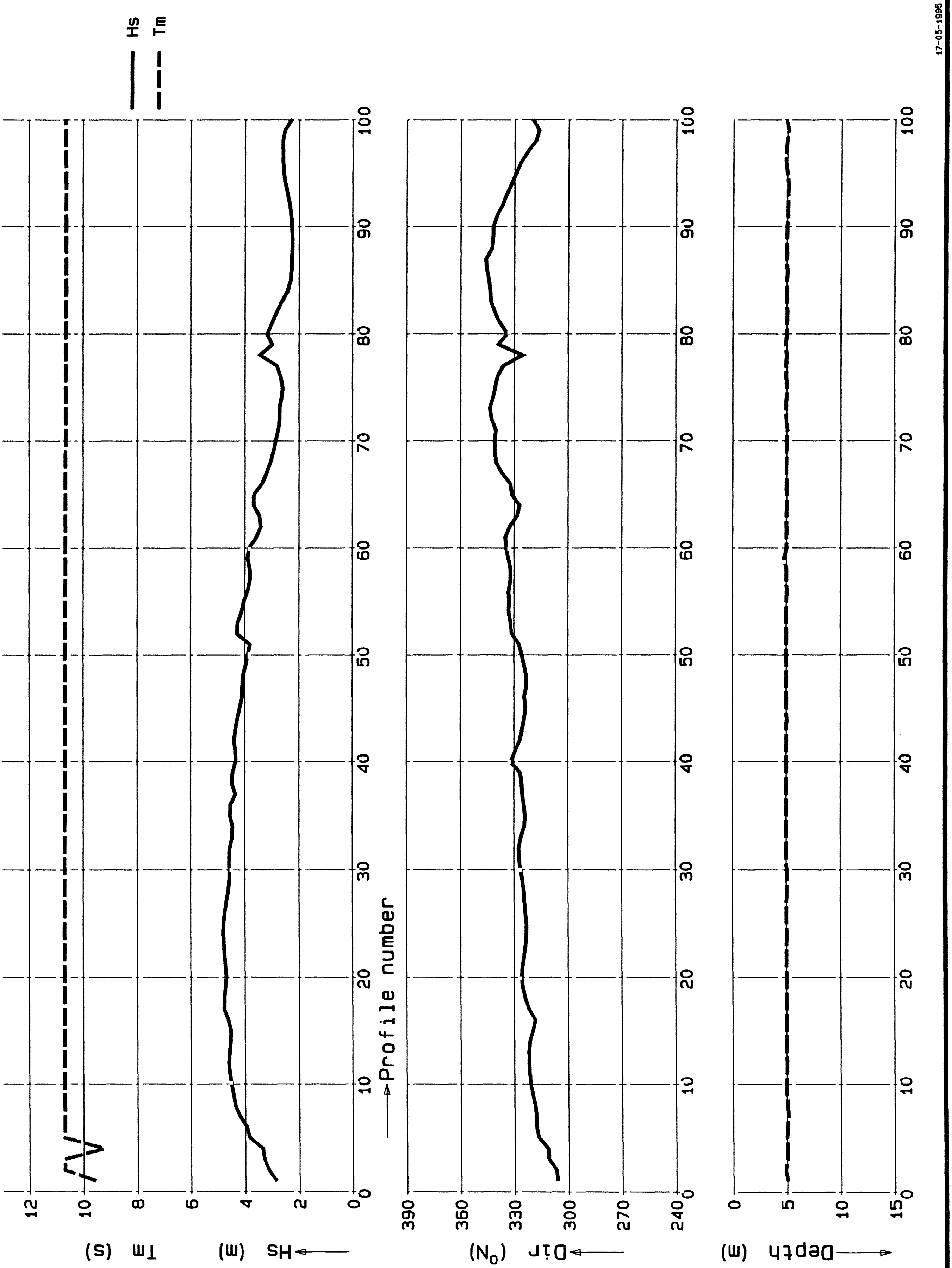
Isolines of computed significant wave height (in m) Model Z0 Direction 330°N, condition 10^{-4}	HYDRA	Z0D3C2
	scale 1 :1,000,000	
DELFT HYDRAULICS	H 2180	FIG. 4.9



Isolines of computed significant wave height (in m) Model Z2 Direction 330°N, condition 10^{-4}	HYDRA	Z2D3C2
	scale 1 : 250,000	
DELFT HYDRAULICS	H 2180	FIG. 4.10



Wave conditions along NAP-10m contour Model Z2, Walcheren - NW coast Direction 330°N, condition 10^{-4}	HYDRA	WND3C210
DELFT HYDRAULICS	H 2180	FIG. 4.11

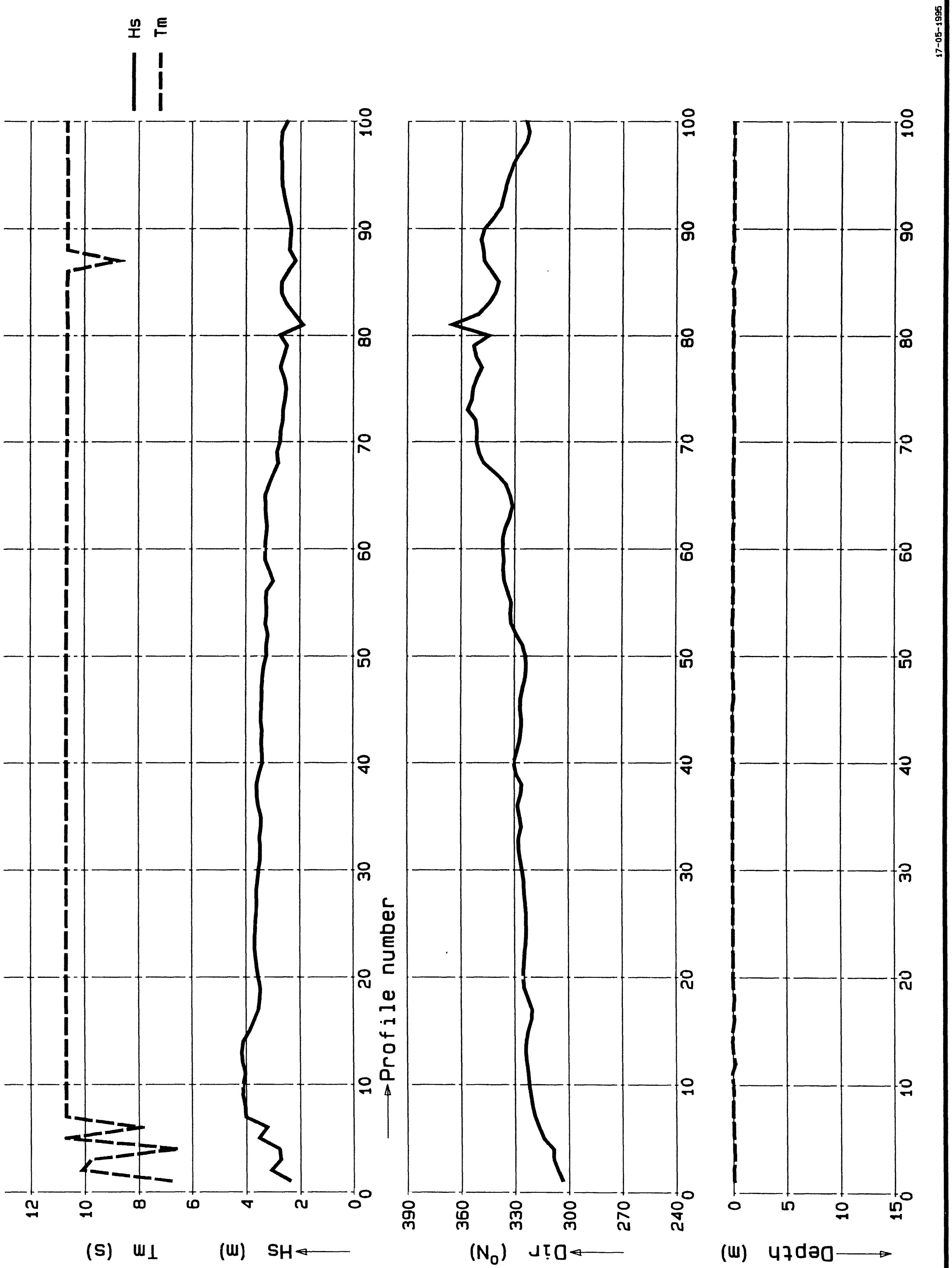


Wave conditions along NAP-5m contour
Model Z2, Walcheren - NW coast
Direction 330°N, condition 10^{-4}

HYDRA	WND3C205

DELFT HYDRAULICS

H 2180	FIG. 4.12



Wave conditions along NAP-0m contour Model Z2, Walcheren - NW coast Direction 330°N, condition 10^{-4}	HYDRA	WND3C200
DELFT HYDRAULICS	H 2180	FIG. 4.13

Appendix

Listing of HISWA-input files

```
PROJ 'HYDRA-2 H2180 Z0'    'D3C1'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 16-05-1995'
     'Wind direction 330°N, 1:100 conditions                                  '
     '                                                                         '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C1'
SET LEVEL=4.20   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                XPB      YPB     ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT  -50000.  410000. -60.000      330      276   200.00    500.00
$ Computational grid
$     XCLEN    YCLEN    SECTOR   MXC   MYC   MDC  F/R    XPC      YPC      ALPC
GRID  66000.  138000.    120.    330   276    16   F   -50000.  410000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z0'      FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
$ INC VAR    YC        HSIG     PER       DIR      MS       &
INC VAR         .00     6.40     9.11    -60.00     4.      &
          11500.00      6.50     9.18    -60.00     4.      &
          23100.00      6.60     9.25    -60.00     4.      &
          34600.00      6.70     9.32    -60.00     4.      &
          46200.00      6.80     9.39    -60.00     4.      &
          57700.00      6.90     9.46    -60.00     4.      &
          69300.00      6.90     9.46    -60.00     4.      &
          80800.00      6.80     9.39    -60.00     4.      &
          92400.00      6.33     9.06    -60.00     4.      &
         103900.00      6.05     8.85    -60.00     4.      &
         115500.00      5.83     8.69    -60.00     4.      &
         127000.00      5.67     8.57    -60.00     4.      &
         138000.00      5.50     8.44    -60.00     4.
$ Boundary conditions
BOUND RIGHT REFL 0
BOUND LEFT  REFL 0
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=27.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'   XFLEN   YFLEN     XPF       YPF     ALPF       MXF       MYF
FRAME 'ZO-REKEN'    66000.  138000.  -50000.  410000. -60.000      132       276
$CURVE      SNAME          XP1          YP1
$            INT            XP           YP
CURVE 'Z-VLAAND'    20000.      379500.  &
            1400    -8000.      427997.
CURVE 'WALCH-NW'    24000.      399000.  &
            1025     3500.      434507.
CURVE 'OOST-SVK'    35730.      402000.  &
```

```
                77    36000.    405060.  &
                75    38000.    407300.  &
                41    38750.    408750.  &
                36    38750.    410200.
CURVE 'SCHOUWEN'    40000.    417000.  &
               850    23000.    446445.
CURVE 'GOEREE  '    55000.    428000.  &
               785    39300.    455193.
CURVE 'MAASVLAK'    61500.    444500.  &
               525    51000.    462687.
CURVE 'BROUWERS'    46100.    418100.  &
                53    46350.    420200.  &
                56    48450.    421000.  &
                77    49700.    423800.
CURVE 'HARINGVL'    61700.    427850.  &
                84    63950.    430350.
$
POINTS 'STAT-RWS'  FILE 'stat-rws.par'
$
$ ----------------- Definition of output actions -----------------
TAB   'Z0-REKEN' FILE 'z0d3c1rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'Z-VLAAND' FILE 'z0d3c1zv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALCH-NW' FILE 'z0d3c1wn.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'OOST-SVK' FILE 'z0d3c1os.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHOUWEN' FILE 'z0d3c1sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'GOEREE  ' FILE 'z0d3c1go.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAASVLAK' FILE 'z0d3c1mv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'BROUWERS' FILE 'z0d3c1br.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'HARINGVL' FILE 'z0d3c1hv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'STAT-RWS' FILE 'z0d3c1st.dat'  XP YP DEP HS PER DIR DSPR DISS QB
$
$ ----------------- Nested output -----------------
$ Nested grid
$ NGRID 'gridname'  XNLEN  YNLEN  SECTOR   MXN   MYN  MDN  XPN     YPN     ALPN
NGRID 'DELTA-1 '   27000.   35000.  165.  1350   175   22  -9000. 389000. -60.0
NGRID 'DELTA-2 '   20000.   55000.  165.  1000   275   22   1000. 404000. -60.0
NGRID 'DELTA-3 '   20000.   46000.  165.  1000   230   22  26000. 428000. -60.0
$ Nested output
$ NEST 'gridname' 'filename'
NEST  'DELTA-1 ' 'z0d3c1z1.nst'
NEST  'DELTA-2 ' 'z0d3c1z2.nst'
NEST  'DELTA-3 ' 'z0d3c1z3.nst'
$
$ ---------------- Stop -----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z1'    'D3C1'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 20-04-1995'
     'Wind direction 330°N, 1:100 conditions                                  '
     '                                                                        '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C1'
SET LEVEL=4.20   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$               XPB      YPB     ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT   -9000.  389000. -60.000     1350      175    20.00   200.00
$ Computational grid
$     XCLEN    YCLEN   SECTOR   MXC   MYC   MDC  F/R    XPC      YPC     ALPC
$GRID  27000.   35000.    165.  1350   175    22   F    -9000.  389000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z1'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c1z1.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=27.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'  XFLEN   YFLEN     XPF      YPF     ALPF       MXF       MYF
FRAME 'Z1-REKEN'    27000.  35000.   -9000.  389000. -60.000      135       175
$ Curves
$CURVE     SNAME        XP1         YP1
$           INT         XP          YP
CURVE 'Z-VLAAND'    20000.     379500.  &
             1400   -8000.     427997.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'        XP1         YP1          XQ1         YQ1
$          INT          XP          YP           XQ          YQ
RAY   'WALZ     '    30750.0    385206.0     30750.0    382006.0 &
                8    29151.0    385206.0     29151.0    382006.0 &
                5    28745.0    385417.0     26668.0    382853.0 &
               15    26442.0    387331.0     24365.0    384767.0 &
                4    25901.0    387774.0     23561.0    385592.0 &
               21    23836.0    391204.0     21247.0    389323.0 &
               17    21110.0    393262.0     18554.0    391337.0 &
               10    19895.0    394763.0     17373.0    392793.0 &
                4    19661.0    395021.0     16473.0    395299.0 &
                3    19755.0    395657.0     16586.0    396103.0
RAY   'ZVLA     '    14449.0    377591.0     12524.0    380147.0 &
                5    15290.0    378233.0     13320.0    380755.0 &
```

```
                 3    15652.0   378411.0    14402.0   381357.0 &
                 5    16580.0   378641.0    15291.0   381679.0 &
                12    18909.0   379452.0    17581.0   382582.0 &
                 9    20532.0   379628.0    19767.0   382941.0 &
                13    23073.0   380486.0    22053.0   383624.0 &
                 7    24228.0   381235.0    23400.0   384326.0 &
                 5    24849.0   381303.0    24961.0   384501.0 &
                10    26571.0   381061.0    27665.0   384068.0 &
                 8    27913.0   380272.0    29561.0   383015.0
RAY   'ZEE1    '      -9000.0   389000.0     4500.0   365617.0 &
                70    21311.0   406500.0    34811.0   383117.0
$ DEP '-sname--'  '-rname--'      DEP-C1      DEP-C2
DEP 'WALZ-00M'    'WALZ    '        4.20
DEP 'WALZ-05M'    'WALZ    '        9.20
DEP 'WALZ-10M'    'WALZ    '       14.20
$
DEP 'ZVLA-00M'    'ZVLA    '        4.20
DEP 'ZVLA-05M'    'ZVLA    '        9.20
DEP 'ZVLA-10M'    'ZVLA    '       14.20
$
DEP 'ZEE1-10M'    'ZEE1    '       14.20
$
$ ----------------- Definition of output actions -----------------
TAB   'Z1-REKEN' FILE 'z1d3c1rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'Z-VLAAND' FILE 'z1d3c1zv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'WALZ-00M' FILE 'wzd3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALZ-05M' FILE 'wzd3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALZ-10M' FILE 'wzd3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZVLA-00M' FILE 'zvd3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZVLA-05M' FILE 'zvd3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZVLA-10M' FILE 'zvd3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE1-10M' FILE 'z1d3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ---------------- Stop ----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z2'    'D3C1'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 20-04-1995'
     'Wind direction 330°N, 1:100 conditions                                  '
     '                                                                        '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C1'
SET LEVEL=4.00   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                 XPB      YPB     ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT    1000.  404000. -60.000      1000      275    20.00   200.00
$ Computational grid
$     XCLEN    YCLEN    SECTOR   MXC   MYC   MDC  F/R    XPC      YPC     ALPC
$GRID  20000.   55000.     165.  1000   275    22   F     1000.  404000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z2'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c1z2.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=27.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'   XFLEN   YFLEN     XPF      YPF      ALPF       MXF       MYF
FRAME 'Z2-REKEN'    20000.   55000.    1000.  404000. -60.000       100       275
$ Curves
$CURVE      SNAME        XP1         YP1
$           INT          XP          YP
CURVE 'WALCH-NW'    24000.     399000.  &
           1025     3500.     434507.
CURVE 'OOST-SVK'    35730.     402000.  &
              77    36000.     405060.  &
              75    38000.     407300.  &
              41    38750.     408750.  &
              36    38750.     410200.
CURVE 'SCHOUWEN'    40000.     417000.  &
             850    23000.     446445.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'         XP1         YP1          XQ1          YQ1
$          INT           XP          YP           XQ           YQ
RAY    'SCHO      '    39576.0    410105.0    38587.0    407062.0 &
                 4    38861.0    410361.0    37819.0    407335.0 &
                 4    38517.0    410608.0    36215.0    408385.0 &
                 5    37845.0    411333.0    35543.0    409110.0 &
                 3    37625.0    411611.0    34725.0    410258.0 &
```

```
                 4    37299.0   412341.0    34399.0   410988.0 &
                 3    37144.0   412770.0    34003.0   412160.0 &
                 2    37069.0   413163.0    33928.0   412553.0 &
                 4    37071.0   413745.0    33910.0   414245.0 &
                 3    37179.0   414335.0    34018.0   414835.0 &
                 4    37365.0   414876.0    34514.0   416329.0 &
                 8    38099.0   416286.0    35328.0   417886.0 &
                 4    38344.0   416484.0    36744.0   419255.0 &
                25    43081.0   418144.0    41882.0   421111.0 &
                 7    44147.0   418236.0    44425.0   421424.0 &
                13    46616.0   417791.0    47172.0   420942.0
RAY   'WALN      '    19755.0   395657.0    16586.0   396103.0 &
                 3    19878.0   396233.0    16344.0   396920.0 &
                 5    20222.0   396605.0    18122.0   400242.0 &
                50    28657.0   401680.0    26957.0   404624.0 &
                 4    29197.0   401823.0    28641.0   404974.0 &
                11    31327.0   401792.0    31883.0   404943.0 &
                 3    31868.0   401537.0    32441.0   404786.0 &
                 4    32781.0   401075.0    32781.0   404375.0 &
                21    36915.0   402143.0    36281.0   404354.0
RAY   'ZEE2      '     1000.0   404000.0    11000.0   386679.0 &
               110    48631.0   431500.0    58631.0   414179.0
$ DEP '-sname--'  '-rname--'     DEP-C1      DEP-C2
DEP 'SCHO-00M'    'SCHO    '       4.00
DEP 'SCHO-05M'    'SCHO    '       9.00
$
DEP 'WALN-00M'    'WALN    '       4.00
DEP 'WALN-05M'    'WALN    '       9.00
DEP 'WALN-10M'    'WALN    '      14.00
$
DEP 'ZEE2-05M'    'ZEE2    '       9.00
DEP 'ZEE2-10M'    'ZEE2    '      14.00
$
$ ----------------- Definition of output actions -----------------
TAB   'Z2-REKEN' FILE 'z2d3c1rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'WALCH-NW' FILE 'z2d3c1wn.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'OOST-SVK' FILE 'z2d3c1os.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHOUWEN' FILE 'z2d3c1sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'SCHO-00M' FILE 'scd3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHO-05M' FILE 'scd3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'WALN-00M' FILE 'wnd3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALN-05M' FILE 'wnd3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALN-10M' FILE 'wnd3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE2-05M' FILE 'z2d3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZEE2-10M' FILE 'z2d3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ----------------- Stop -----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z3'    'D3C1'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 09-05-1995'
     'Wind direction 330°N, 1:100 conditions                                  '
     '                                                                         '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C1'
SET LEVEL=3.85   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                XPB      YPB     ALPB       MXB      MYB    DXB    DYB
INP GRID  BOT   26000.  428000. -60.000     1000      230   20.00  200.00
$ Computational grid
$    XCLEN   YCLEN   SECTOR  MXC   MYC   MDC  F/R   XPC     YPC     ALPC
$GRID  20000.   46000.    165.  1000   230    22   F    26000.  428000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z3'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c1z3.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=27.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'   XFLEN   YFLEN     XPF      YPF     ALPF      MXF      MYF
FRAME 'Z3-REKEN'    20000.   46000.   26000.  428000. -60.000     100      230
$ Curves
$CURVE     SNAME        XP1        YP1
$           INT          XP         YP
CURVE 'SCHOUWEN'    40000.    417000.  &
             850    23000.    446445.
CURVE 'GOEREE  '    55000.    428000.  &
             785    39300.    455193.
CURVE 'MAASVLAK'    61500.    444500.  &
             525    51000.    462687.
CURVE 'BROUWERS'    46100.    418100.  &
              53    46350.    420200.  &
              56    48450.    421000.  &
              77    49700.    423800.
CURVE 'HARINGVL'    61700.    427850.  &
              84    63950.    430350.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'          XP1         YP1         XQ1         YQ1
$          INT            XP          YP          XQ          YQ
RAY   'MAAS    '       61100.0    441449.0     58057.0    440460.0 &
               5        60822.0    442357.0     58707.0    441751.0 &
```

```
                 2   60770.0  442638.0   58784.0  442395.0 &
                 2   60760.0  442923.0   58961.0  442986.0 &
                 2   60794.0  443207.0   59224.0  443512.0 &
                 2   60873.0  443485.0   59549.0  443941.0 &
                 2   60993.0  443745.0   59933.0  444308.0 &
                 2   61151.0  443983.0   60192.0  444705.0 &
                 2   61343.0  444194.0   60509.0  445057.0 &
                 2   61566.0  444373.0   60877.0  445356.0 &
                 2   61807.0  444512.0   61319.0  445609.0 &
                 2   61929.0  444539.0   61887.0  445738.0 &
                 2   62034.0  444526.0   62365.0  445679.0 &
                 5   62744.0  444226.0   63194.0  445338.0
RAY   'SLUF     '    59360.0  437581.0   58514.0  435123.0 &
                 2   59194.0  437671.0   57432.0  435495.0 &
                 2   59054.0  437818.0   56509.0  436228.0 &
                 2   58987.0  438000.0   55857.0  437334.0 &
                 2   58984.0  438192.0   55815.0  438638.0 &
                 2   59044.0  438380.0   56193.0  439833.0 &
                18   61064.0  441185.0   58443.0  443021.0
RAY   'VOOR     '    64463.0  429976.0   62602.0  428624.0 &
                24   61652.0  434081.0   59088.0  432004.0 &
                 3   61727.0  434195.0   58427.0  434252.0 &
                 3   61658.0  434305.0   59577.0  436179.0 &
                18   63926.0  436815.0   62588.0  438020.0
RAY   'GOER     '    50205.0  423119.0   47354.0  421666.0 &
                 5   49683.0  423999.0   46898.0  422049.0 &
                 5   49410.0  424788.0   46280.0  423460.0 &
                 2   49416.0  424930.0   46016.0  424871.0 &
                 3   49395.0  425428.0   46162.0  426479.0 &
                 2   49483.0  425668.0   46568.0  427419.0 &
                 4   49811.0  426206.0   47872.0  428876.0 &
                 4   50422.0  426539.0   49019.0  429415.0 &
                10   52239.0  427295.0   51333.0  430260.0 &
                 6   53451.0  427490.0   52827.0  430424.0 &
                 8   55067.0  428165.0   53895.0  430927.0 &
                 7   56522.0  428519.0   55898.0  431453.0 &
                 5   57518.0  428585.0   57665.0  431381.0 &
                 6   58767.0  428522.0   59263.0  431074.0 &
                11   60879.0  427746.0   61734.0  430095.0 &
                 2   61220.0  427452.0   62075.0  429801.0
RAY   'BROU     '    47020.0  418115.0   44201.0  419141.0 &
                 4   47142.0  418956.0   44323.0  419982.0 &
                 5   47559.0  419623.0   45631.0  421921.0 &
                 7   48813.0  420236.0   46885.0  422534.0 &
                 3   49380.0  420788.0   46808.0  422333.0 &
                10   50200.0  422800.0   47418.0  423924.0
RAY   'ZEE3     '    26000.0  428000.0   36000.0  410679.0 &
                92   65837.0  451000.0   75837.0  433679.0
$ DEP '-sname--'  '-rname--'    DEP-C1     DEP-C2
DEP 'MAAS-00M'    'MAAS    '      3.85
DEP 'MAAS-05M'    'MAAS    '      8.85
DEP 'MAAS-10M'    'MAAS    '     13.85
$
DEP 'SLUF-00M'    'SLUF    '      3.85
DEP 'SLUF-05M'    'SLUF    '      8.85
DEP 'SLUF-10M'    'SLUF    '     13.85
$
DEP 'VOOR-00M'    'VOOR    '      3.85
$
DEP 'GOER-00M'    'GOER    '      3.85
$
```

```
DEP 'BROU-00M'    'BROU    '        3.85
$
DEP 'ZEE3-05M'    'ZEE3    '        8.85
DEP 'ZEE3-10M'    'ZEE3    '       13.85
$
$ ----------------- Definition of output actions -----------------
TAB   'Z3-REKEN' FILE 'z3d3c1rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'SCHOUWEN' FILE 'z3d3c1sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'GOEREE  ' FILE 'z3d3c1go.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAASVLAK' FILE 'z3d3c1mv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'BROUWERS' FILE 'z3d3c1br.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'HARINGVL' FILE 'z3d3c1hv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'MAAS-00M' FILE 'mad3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAAS-05M' FILE 'mad3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAAS-10M' FILE 'mad3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'SLUF-00M' FILE 'sld3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SLUF-05M' FILE 'sld3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SLUF-10M' FILE 'sld3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'VOOR-00M' FILE 'vod3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'GOER-00M' FILE 'god3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'BROU-00M' FILE 'brd3c100.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE3-05M' FILE 'z3d3c105.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZEE3-10M' FILE 'z3d3c110.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ----------------- Stop -----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z0'    'D3C2'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 16-05-1995'
     'Wind direction 330°N, 1:10000 conditions                                '
     '                                                                        '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C2'
SET LEVEL=5.30   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                    XPB      YPB      ALPB       MXB      MYB    DXB     DYB
INP GRID  BOT  -50000.  410000. -60.000       330      276  200.00   500.00
$ Computational grid
$    XCLEN    YCLEN   SECTOR   MXC   MYC   MDC  F/R    XPC      YPC      ALPC
GRID  66000.  138000.    120.   330   276    16   F   -50000.  410000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z0'      FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
$ INC VAR      YC       HSIG     PER      DIR      MS       &
INC VAR          .00     8.15    10.28   -60.00     4.      &
           11500.00     8.20    10.31   -60.00     4.      &
           23100.00     8.20    10.31   -60.00     4.      &
           34600.00     8.20    10.31   -60.00     4.      &
           46200.00     8.20    10.31   -60.00     4.      &
           57700.00     8.20    10.31   -60.00     4.      &
           69300.00     8.10    10.25   -60.00     4.      &
           80800.00     8.00    10.18   -60.00     4.      &
           92400.00     7.50     9.86   -60.00     4.      &
          103900.00     7.07     9.57   -60.00     4.      &
          115500.00     6.82     9.40   -60.00     4.      &
          127000.00     6.62     9.26   -60.00     4.      &
          138000.00     6.43     9.13   -60.00     4.
$ Boundary conditions
BOUND RIGHT REFL 0
BOUND LEFT  REFL 0
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=35.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'   XFLEN   YFLEN     XPF      YPF      ALPF       MXF      MYF
FRAME 'ZO-REKEN'    66000.  138000.  -50000.  410000.  -60.000     132      276
$CURVE      SNAME          XP1          YP1
$            INT            XP           YP
CURVE 'Z-VLAAND'    20000.     379500.  &
            1400    -8000.     427997.
CURVE 'WALCH-NW'    24000.     399000.  &
            1025     3500.     434507.
CURVE 'OOST-SVK'    35730.     402000.  &
```

```
             77   36000.    405060.  &
             75   38000.    407300.  &
             41   38750.    408750.  &
             36   38750.    410200.
CURVE 'SCHOUWEN'  40000.    417000.  &
            850   23000.    446445.
CURVE 'GOEREE  '  55000.    428000.  &
            785   39300.    455193.
CURVE 'MAASVLAK'  61500.    444500.  &
            525   51000.    462687.
CURVE 'BROUWERS'  46100.    418100.  &
             53   46350.    420200.  &
             56   48450.    421000.  &
             77   49700.    423800.
CURVE 'HARINGVL'  61700.    427850.  &
             84   63950.    430350.
$
POINTS 'STAT-RWS'  FILE 'stat-rws.par'
$
$ ----------------- Definition of output actions -----------------
TAB   'ZO-REKEN' FILE 'z0d3c2rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'Z-VLAAND' FILE 'z0d3c2zv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALCH-NW' FILE 'z0d3c2wn.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'OOST-SVK' FILE 'z0d3c2os.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHOUWEN' FILE 'z0d3c2sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'GOEREE  ' FILE 'z0d3c2go.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAASVLAK' FILE 'z0d3c2mv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'BROUWERS' FILE 'z0d3c2br.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'HARINGVL' FILE 'z0d3c2hv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'STAT-RWS' FILE 'z0d3c2st.dat'  XP YP DEP HS PER DIR DSPR DISS QB
$
$ ----------------- Nested output -----------------
$ Nested grid
$ NGRID 'gridname'  XNLEN  YNLEN  SECTOR  MXN   MYN  MDN  XPN     YPN     ALPN
NGRID 'DELTA-1 '   27000.  35000.  165.  1350   175   22  -9000. 389000. -60.0
NGRID 'DELTA-2 '   20000.  55000.  165.  1000   275   22   1000. 404000. -60.0
NGRID 'DELTA-3 '   20000.  46000.  165.  1000   230   22  26000. 428000. -60.0
$ Nested output
$ NEST 'gridname' 'filename'
NEST  'DELTA-1 ' 'z0d3c2z1.nst'
NEST  'DELTA-2 ' 'z0d3c2z2.nst'
NEST  'DELTA-3 ' 'z0d3c2z3.nst'
$
$ ----------------- Stop -----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z1'    'D3C2'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 21-04-1995'
     'Wind direction 330°N, 1:10000 conditions                                 '
     '                                                                         '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C2'
SET LEVEL=5.30   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                XPB      YPB     ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT   -9000.  389000. -60.000     1350      175    20.00   200.00
$ Computational grid
$     XCLEN    YCLEN    SECTOR   MXC   MYC   MDC  F/R    XPC      YPC     ALPC
$GRID  27000.   35000.     165.  1350   175    22   F     -9000.  389000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z1'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c2z1.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=35.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points -----------------
$
$ Frames
$ FRAME '--name--'   XFLEN   YFLEN     XPF       YPF      ALPF       MXF       MYF
FRAME 'Z1-REKEN'    27000.  35000.   -9000.  389000. -60.000       135       175
$ Curves
$CURVE     SNAME         XP1          YP1
$            INT          XP           YP
CURVE 'Z-VLAAND'    20000.     379500.  &
             1400   -8000.     427997.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'         XP1          YP1          XQ1          YQ1
$            INT          XP           YP           XQ           YQ
RAY   'WALZ    '     30750.0     385206.0     30750.0     382006.0 &
                8    29151.0     385206.0     29151.0     382006.0 &
                5    28745.0     385417.0     26668.0     382853.0 &
               15    26442.0     387331.0     24365.0     384767.0 &
                4    25901.0     387774.0     23561.0     385592.0 &
               21    23836.0     391204.0     21247.0     389323.0 &
               17    21110.0     393262.0     18554.0     391337.0 &
               10    19895.0     394763.0     17373.0     392793.0 &
                4    19661.0     395021.0     16473.0     395299.0 &
                3    19755.0     395657.0     16586.0     396103.0
RAY   'ZVLA    '     14449.0     377591.0     12524.0     380147.0 &
                5    15290.0     378233.0     13320.0     380755.0 &
```

```
                3   15652.0  378411.0   14402.0  381357.0 &
                5   16580.0  378641.0   15291.0  381679.0 &
               12   18909.0  379452.0   17581.0  382582.0 &
                9   20532.0  379628.0   19767.0  382941.0 &
               13   23073.0  380486.0   22053.0  383624.0 &
                7   24228.0  381235.0   23400.0  384326.0 &
                5   24849.0  381303.0   24961.0  384501.0 &
               10   26571.0  381061.0   27665.0  384068.0 &
                8   27913.0  380272.0   29561.0  383015.0
RAY   'ZEE1     '   -9000.0  389000.0    4500.0  365617.0 &
               70   21311.0  406500.0   34811.0  383117.0
$ DEP '-sname--'  '-rname--'      DEP-C2
DEP 'WALZ-00M'    'WALZ    '        5.30
DEP 'WALZ-05M'    'WALZ    '       10.30
DEP 'WALZ-10M'    'WALZ    '       15.30
$
DEP 'ZVLA-00M'    'ZVLA    '        5.30
DEP 'ZVLA-05M'    'ZVLA    '       10.30
DEP 'ZVLA-10M'    'ZVLA    '       15.30
$
DEP 'ZEE1-10M'    'ZEE1    '       15.30
$
$ ----------------- Definition of output actions -----------------
TAB   'Z1-REKEN' FILE 'z1d3c2rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'Z-VLAAND' FILE 'z1d3c2zv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'WALZ-00M' FILE 'wzd3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALZ-05M' FILE 'wzd3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALZ-10M' FILE 'wzd3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZVLA-00M' FILE 'zvd3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZVLA-05M' FILE 'zvd3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZVLA-10M' FILE 'zvd3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE1-10M' FILE 'z1d3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ----------------- Stop -----------------
STOP
$
```

```
PROJ 'HYDRA-2 H2180 Z2'    'D3C2'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 21-04-1995'
     'Wind direction 330°N, 1:10000 conditions                              '
     '                                                                       '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C2'
SET LEVEL=5.30   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                  XPB      YPB     ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT     1000.  404000. -60.000      1000      275    20.00   200.00
$ Computational grid
$     XCLEN    YCLEN   SECTOR   MXC   MYC   MDC  F/R    XPC     YPC      ALPC
$GRID  20000.   55000.    165.  1000   275    22   F     1000.  404000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z2'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c2z2.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=35.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'  XFLEN   YFLEN     XPF      YPF     ALPF       MXF      MYF
FRAME 'Z2-REKEN'    20000.   55000.    1000.  404000. -60.000      100      275
$ Curves
$CURVE     SNAME         XP1         YP1
$            INT          XP          YP
CURVE 'WALCH-NW'    24000.     399000.  &
            1025     3500.     434507.
CURVE 'OOST-SVK'    35730.     402000.  &
              77    36000.     405060.  &
              75    38000.     407300.  &
              41    38750.     408750.  &
              36    38750.     410200.
CURVE 'SCHOUWEN'    40000.     417000.  &
             850    23000.     446445.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'        XP1         YP1         XQ1         YQ1
$          INT           XP          YP          XQ          YQ
RAY   'SCHO    '    39576.0    410105.0     38587.0    407062.0 &
               4    38861.0    410361.0     37819.0    407335.0 &
               4    38517.0    410608.0     36215.0    408385.0 &
               5    37845.0    411333.0     35543.0    409110.0 &
               3    37625.0    411611.0     34725.0    410258.0 &
```

```
                 4   37299.0   412341.0    34399.0   410988.0 &
                 3   37144.0   412770.0    34003.0   412160.0 &
                 2   37069.0   413163.0    33928.0   412553.0 &
                 4   37071.0   413745.0    33910.0   414245.0 &
                 3   37179.0   414335.0    34018.0   414835.0 &
                 4   37365.0   414876.0    34514.0   416329.0 &
                 8   38099.0   416286.0    35328.0   417886.0 &
                 4   38344.0   416484.0    36744.0   419255.0 &
                25   43081.0   418144.0    41882.0   421111.0 &
                 7   44147.0   418236.0    44425.0   421424.0 &
                13   46616.0   417791.0    47172.0   420942.0
RAY   'WALN      '   19755.0   395657.0    16586.0   396103.0 &
                 3   19878.0   396233.0    16344.0   396920.0 &
                 5   20222.0   396605.0    18122.0   400242.0 &
                50   28657.0   401680.0    26957.0   404624.0 &
                 4   29197.0   401823.0    28641.0   404974.0 &
                11   31327.0   401792.0    31883.0   404943.0 &
                 3   31868.0   401537.0    32441.0   404786.0 &
                 4   32781.0   401075.0    32781.0   404375.0 &
                21   36915.0   402143.0    36281.0   404354.0
RAY   'ZEE2      '    1000.0   404000.0    11000.0   386679.0 &
               110   48631.0   431500.0    58631.0   414179.0
$ DEP '-sname--'  '-rname--'      DEP-C2
DEP 'SCHO-00M'    'SCHO    '        5.30
DEP 'SCHO-05M'    'SCHO    '       10.30
$
DEP 'WALN-00M'    'WALN    '        5.30
DEP 'WALN-05M'    'WALN    '       10.30
DEP 'WALN-10M'    'WALN    '       15.30
$
DEP 'ZEE2-05M'    'ZEE2    '       10.30
DEP 'ZEE2-10M'    'ZEE2    '       15.30
$
$ ---------------- Definition of output actions ----------------
TAB   'Z2-REKEN' FILE 'z2d3c2rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
TAB   'WALCH-NW' FILE 'z2d3c2wn.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'OOST-SVK' FILE 'z2d3c2os.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHOUWEN' FILE 'z2d3c2sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'SCHO-00M' FILE 'scd3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SCHO-05M' FILE 'scd3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'WALN-00M' FILE 'wnd3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALN-05M' FILE 'wnd3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'WALN-10M' FILE 'wnd3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE2-05M' FILE 'z2d3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZEE2-10M' FILE 'z2d3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ---------------- Stop ----------------
STOP
$


PROJ 'HYDRA-2 H2180 Z3'    'D3C2'
     'Wave conditions dutch coast;RWS-RIKZ (G.Hartsuiker,E.Ehrlich) 09-05-1995'
     'Wind direction 330°N, 1:10000 conditions                                '
     '                                                                        '
$ General commands
TEST 30
RESULT '/u/ehrlich/scratch/HRESD3C2'
```

```
SET LEVEL=5.30   NEGMES=9999
$
$ ----------------- Grid definitions -----------------
$ Bottom grid
$                  XPB      YPB      ALPB       MXB      MYB     DXB     DYB
INP GRID  BOT   26000.  428000. -60.000     1000      230    20.00   200.00
$ Computational grid
$     XCLEN    YCLEN   SECTOR   MXC   MYC   MDC  F/R    XPC      YPC      ALPC
$GRID  20000.   46000.    165.  1000   230    22   F    26000.  428000.  -60.00
$
$ ----------------- Boundary conditions -----------------
$ Bottom
READ BOT  'h2180_bottom_z3'     FAC=-1.   IDLA=4    NHED=0  FREE
$ Waves
BOUND NEST 'z0d3c2z3.nst'
$ Wind
$    VELOCITY (m/s)  DIRECTION WRT USER X+
WIND VEL=35.0  DIR=-60.0
$
$ ----------------- Computational parameters -----------------
$ Breaking
$   HMAX/DEPTH(SHALLOW) K*HMAX(DEEP) MULTIPL.FACTOR EFFECT ON FREQ.
BREAK  GAMS=0.75  GAMD=1.13
$ Bottom friction
FRIC  CFW=0.006  CFC=0.005
$
$ ----------------- Definition of output areas/lines/points ----------------
$
$ Frames
$ FRAME '--name--'  XFLEN   YFLEN    XPF     YPF     ALPF      MXF     MYF
FRAME 'Z3-REKEN'   20000.  46000.  26000.  428000. -60.000     100     230
$ Curves
$CURVE     SNAME        XP1        YP1
$           INT         XP         YP
CURVE 'SCHOUWEN'    40000.     417000.  &
              850   23000.     446445.
CURVE 'GOEREE  '    55000.     428000.  &
              785   39300.     455193.
CURVE 'MAASVLAK'    61500.     444500.  &
              525   51000.     462687.
CURVE 'BROUWERS'    46100.     418100.  &
               53   46350.     420200.  &
               56   48450.     421000.  &
               77   49700.     423800.
CURVE 'HARINGVL'    61700.     427850.  &
               84   63950.     430350.
$
$ Points
$
$ Rays/depth
$ RAY '-rname--'        XP1        YP1        XQ1        YQ1
$            INT         XP         YP         XQ         YQ
RAY   'MAAS     '   61100.0    441449.0    58057.0   440460.0 &
               5    60822.0    442357.0    58707.0   441751.0 &
               2    60770.0    442638.0    58784.0   442395.0 &
               2    60760.0    442923.0    58961.0   442986.0 &
               2    60794.0    443207.0    59224.0   443512.0 &
               2    60873.0    443485.0    59549.0   443941.0 &
               2    60993.0    443745.0    59933.0   444308.0 &
               2    61151.0    443983.0    60192.0   444705.0 &
               2    61343.0    444194.0    60509.0   445057.0 &
```

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                 2   61566.0  444373.0   60877.0  445356.0 &
                 2   61807.0  444512.0   61319.0  445609.0 &
                 2   61929.0  444539.0   61887.0  445738.0 &
                 2   62034.0  444526.0   62365.0  445679.0 &
                 5   62744.0  444226.0   63194.0  445338.0
RAY  'SLUF       '   59360.0  437581.0   58514.0  435123.0 &
                 2   59194.0  437671.0   57432.0  435495.0 &
                 2   59054.0  437818.0   56509.0  436228.0 &
                 2   58987.0  438000.0   55857.0  437334.0 &
                 2   58984.0  438192.0   55815.0  438638.0 &
                 2   59044.0  438380.0   56193.0  439833.0 &
                18   61064.0  441185.0   58443.0  443021.0
RAY  'VOOR       '   64463.0  429976.0   62602.0  428624.0 &
                24   61652.0  434081.0   59088.0  432004.0 &
                 3   61727.0  434195.0   58427.0  434252.0 &
                 3   61658.0  434305.0   59577.0  436179.0 &
                18   63926.0  436815.0   62588.0  438020.0
RAY  'GOER       '   50205.0  423119.0   47354.0  421666.0 &
                 5   49683.0  423999.0   46898.0  422049.0 &
                 5   49410.0  424788.0   46280.0  423460.0 &
                 2   49416.0  424930.0   46016.0  424871.0 &
                 3   49395.0  425428.0   46162.0  426479.0 &
                 2   49483.0  425668.0   46568.0  427419.0 &
                 4   49811.0  426206.0   47872.0  428876.0 &
                 4   50422.0  426539.0   49019.0  429415.0 &
                10   52239.0  427295.0   51333.0  430260.0 &
                 6   53451.0  427490.0   52827.0  430424.0 &
                 8   55067.0  428165.0   53895.0  430927.0 &
                 7   56522.0  428519.0   55898.0  431453.0 &
                 5   57518.0  428585.0   57665.0  431381.0 &
                 6   58767.0  428522.0   59263.0  431074.0 &
                11   60879.0  427746.0   61734.0  430095.0 &
                 2   61220.0  427452.0   62075.0  429801.0
RAY  'BROU       '   47020.0  418115.0   44201.0  419141.0 &
                 4   47142.0  418956.0   44323.0  419982.0 &
                 5   47559.0  419623.0   45631.0  421921.0 &
                 7   48813.0  420236.0   46885.0  422534.0 &
                 3   49380.0  420788.0   46808.0  422333.0 &
                10   50200.0  422800.0   47418.0  423924.0
RAY  'ZEE3       '   26000.0  428000.0   36000.0  410679.0 &
                92   65837.0  451000.0   75837.0  433679.0
$ DEP '-sname--'  '-rname--'       DEP-C2
DEP 'MAAS-00M'    'MAAS     '        5.30
DEP 'MAAS-05M'    'MAAS     '       10.30
DEP 'MAAS-10M'    'MAAS     '       15.30
$
DEP 'SLUF-00M'    'SLUF     '        5.30
DEP 'SLUF-05M'    'SLUF     '       10.30
DEP 'SLUF-10M'    'SLUF     '       15.30
$
DEP 'VOOR-00M'    'VOOR     '        5.30
$
DEP 'GOER-00M'    'GOER     '        5.30
$
DEP 'BROU-00M'    'BROU     '        5.30
$
DEP 'ZEE3-05M'    'ZEE3     '       10.30
DEP 'ZEE3-10M'    'ZEE3     '       15.30
$
$ ----------------- Definition of output actions -----------------
TAB  'Z3-REKEN' FILE 'z3d3c2rk.dat'  XP YP DEP HS PER DIR DSPR DISS QB
```

```
TAB   'SCHOUWEN' FILE 'z3d3c2sc.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'GOEREE  ' FILE 'z3d3c2go.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAASVLAK' FILE 'z3d3c2mv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'BROUWERS' FILE 'z3d3c2br.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'HARINGVL' FILE 'z3d3c2hv.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'MAAS-00M' FILE 'mad3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAAS-05M' FILE 'mad3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'MAAS-10M' FILE 'mad3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'SLUF-00M' FILE 'sld3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SLUF-05M' FILE 'sld3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'SLUF-10M' FILE 'sld3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'VOOR-00M' FILE 'vod3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'GOER-00M' FILE 'god3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'BROU-00M' FILE 'brd3c200.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
TAB   'ZEE3-05M' FILE 'z3d3c205.dat'  XP YP DEP HS PER DIR DSPR DIST QB
TAB   'ZEE3-10M' FILE 'z3d3c210.dat'  XP YP DEP HS PER DIR DSPR DIST QB
$
$ ---------------- Stop -----------------
STOP
$
```

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