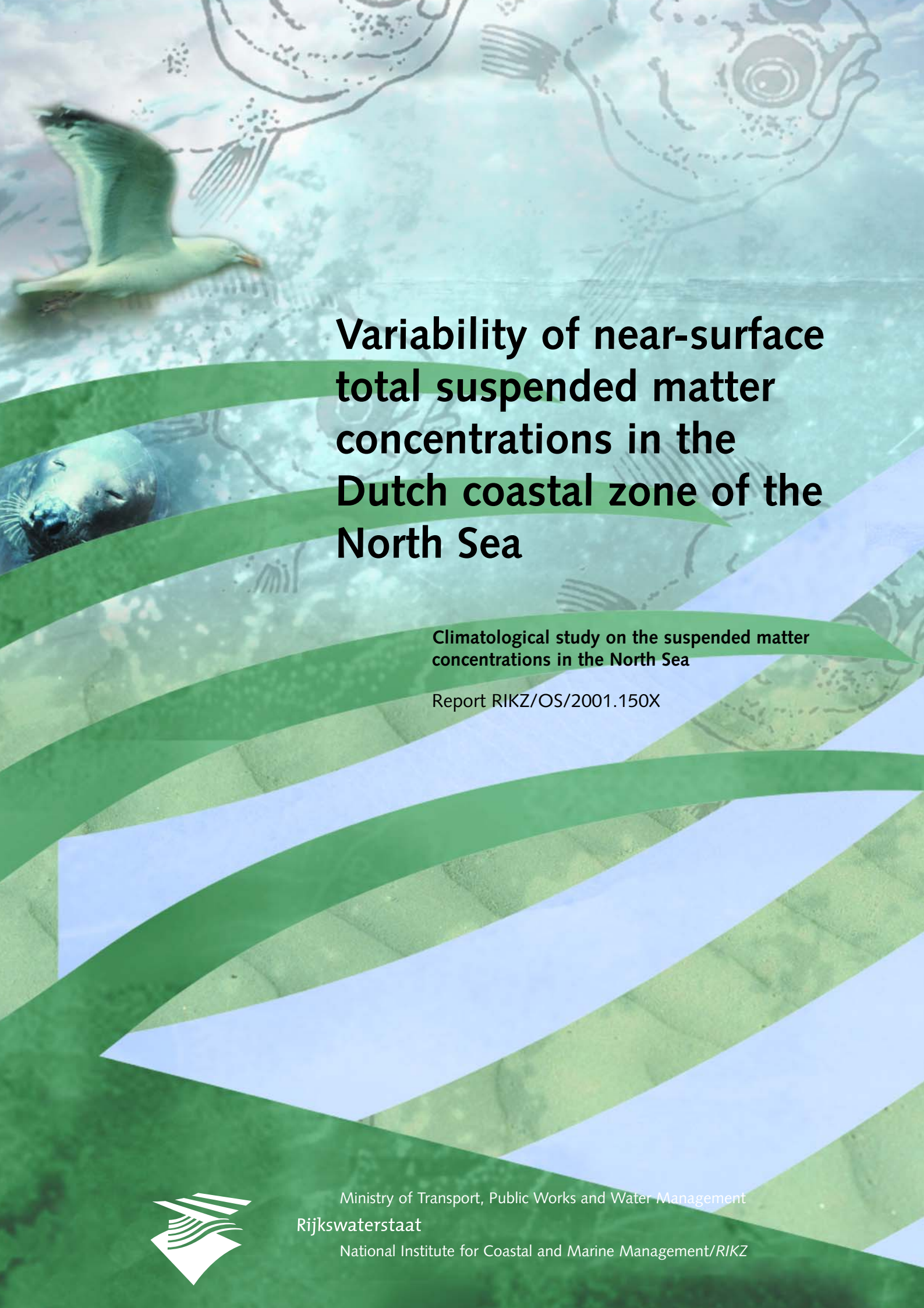




# Variability of near-surface total suspended matter concentrations in the Dutch coastal zone of the North Sea

Climatological study on the suspended matter  
concentrations in the North Sea

Report RIKZ/OS/2001.150X



Ministry of Transport, Public Works and Water Management  
Rijkswaterstaat  
National Institute for Coastal and Marine Management/RIKZ



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Authors:  
J.M. Suijlen and R.N.M. Duin

RWS/RIKZ  
Kortenaerkade 1  
P.O. Box 20907  
2500 EX The Hague  
Tel +31 70 3114311  
Fax +31 70 3114321

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## Summary

Observed total suspended matter concentrations (TSM) in the upper layer of the water column in the Dutch coastal zone are statistically analysed. A correlation between TSM and seasonal wave climate is established. A winter and a summer season are defined on the basis of the wave climate. Winter and summer charts of the mean, median and mode of the TSM distribution are presented. The three-parameter lognormal distribution gives a good approximation of the observed probability distribution.

The investigated area is divided in a southern and a northern region, mainly on the basis of observed TSM ranges. The southern region contains the transects W, S and G (Fig. 1.1) and the northern region all transects north of Hook of Holland up to Terschelling. In each region also a near-coast part is defined (less than 6 km off-shore) and an open-sea part (at least 15 km from the coast). The underlying rationale for this subdivision is the strong cross-shore TSM gradient in the first 6 km from the coast and the very small cross-shore gradient at the larger distances. The 4 specially identified regions are called South<sub><6</sub>, South<sub>>15</sub>, North<sub><6</sub>, North<sub>>15</sub>. The mean concentrations in North<sub>>15</sub> are about 3.7 mg/l in summer and 4.6 mg/l in winter, while those in South<sub>>15</sub> are about 5 mg/l in summer and 9 mg/l in winter. The mean concentrations in North<sub><6</sub> are about 12 mg/l in summer and 30 mg/l in winter, while those in South<sub><6</sub> are about 18 mg/l in summer and 55 mg/l in winter. The ratio between the mean winter and summer concentrations equals about 2.5 and 1.3 in the regions North<sub><6</sub> and North<sub>>15</sub>, respectively. The ratio equals about 3 and 1.7 in the regions South<sub><6</sub> respectively South<sub>>15</sub>. The coefficient of variation roughly lies in the range 0.8-1.2, with the smallest values in the near-coast part during winter. The ratio between the mean and mode (most frequently occurred concentration) is about 2.5 for all seasons and regions. The modes of TSM roughly fall in the range 0.9-1.2 mg/l in North<sub>>15</sub> during the summer period. During winter the modes in North<sub>>15</sub> equal some 2-2.5 mg/l.

Probability graphs of TSM are presented for the winter and summer periods for each selected region. The role of TSM in the under-water light climate is discussed. All information is based on ship surveys that yielded no data during storms with wind forces > 8 Bft. Some preliminary results of recent in-situ measurements under such storm conditions show that TSM then may be strongly enhanced due to waves.



# 1. Introduction

The total suspended matter concentration (TSM<sup>1</sup>) plays an important role in the marine system of the North Sea. The TSM is the main source of turbidity, which is important to the under water light climate. Under water light and nutrients are the determining factors for primary production, which is at the basis of the food chain in the sea. Marine suspended sediments in the Dutch coastal zone originate mainly from the English Channel and Flemish Banks (Gossé, 1976; Gossé, 1977; Eisma and Kalf, 1979). Because of their large flux (order 20 Mton/year, Rijkswaterstaat-WL, 1985; Salden, 1998) in a relatively narrow band along the coast (<10 km), the marine suspended matter is very important for the sediment budget of the Wadden Sea. Furthermore, the flow of marine suspended matter strongly affects the navigational depth of the channels to the Dutch sea ports, causing the need for substantial maintenance dredging (Van Alphen, 1990; Verlaan and Spanhoff, 2000).

The natural variability of TSM values is known to be large (Gossé, 1976; Rijkswaterstaat-WL, 1985; Groenendijk, 1992). Anthropogenic influences on the TSM will therefore be relatively difficult to detect. As examples of human activities that potentially affect the turbidity in the water column, we mention sand mining and dredging of shipping lanes. For a sustainable use of the North Sea the responsible authorities need information about the natural system and on possible effects from its use.

This report provides detailed information on the statistics of the natural total suspended matter concentrations (TSM). Such information is needed for testing hypotheses about foreseeable changes in the turbidity levels originating from potential human activities.

The aim of this report is to give basic information on the distribution of the near surface TSM in the Dutch coastal zone. Most of the information is visualised by charts and graphs, which are commented on.

The basic charts show the summer and winter distributions of the mean, median and mode of the near surface TSM (Figs. 12-14). Besides these basic charts typical TSM distributions after calm and stormy weather are shown (Figs. 19-22). Also charts are given that present the ratio between winter and summer concentrations (Fig. 15-17).

Four basic types of TSM graphs are presented:

- time series of TSM at stations with a long-term sampling programme (Fig. 5).
- probability graphs of summer and winter TSM values (Figs. 9-11)
- cross-shore gradients of summer and winter TSM values (Figs. 23-26)
- seasonal monthly TSM means (Fig. 7).

Fig. 11.2 and Fig. 11.3 show the probability graphs of TSM data, which are aggregated from stations classified by the distance to the coast and by their position against Hook of Holland. These sub-regions are called South and North, respectively. The graphs of Fig. 26 show the cross-shore TSM gradients of these aggregated data in these sub-regions.

Besides these basic graphs, figures are shown which establish the relation between TSM and the wave climate (Fig. 7). The impact of the wave climate is confirmed by the strong correlation between TSM and the depths of the transects (Fig. 27).

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<sup>1</sup> All matter which remains on a 0.45 µm cellulose acetate filter

Since increases or decreases in TSM values will have an effect on the light climate and on primary production, graphs of seasonal monthly means of the light attenuation coefficient (Fig. 31) and Chlorophyll-A concentrations (ChlA) have been added (Fig. 32). Chlorophyll A is applied here as an indicator of the primary production (phytoplankton). Furthermore time series of ChlA at some stations are presented (Fig.29) as well as hindcasts of the euphotic depth (Fig. 34).

Table 1 presents the monthly means, medians and coefficients of variation (CV) of TSM. In this table the UTM co-ordinates, the water depth, the mean salinity and percentage river water of the sampled stations are also mentioned.

Table 2 contains the results of the statistical analyses of the summer and winter concentrations at the individual stations (means, median, mode, CV, threshold  $\kappa$  of the three parameter lognormal (LN3) distribution and GOF-test).

Table 3 contains the results of the statistical analyses of the summer and winter concentrations at the aggregated stations in the regions South and North, including the results for the so called "long-winter" (=Lwinter, cf. chapter 3.1).

Table 4 contains the results of the statistical analyses of the  $K_d$  measurements at some stations along the N-transect during the period 1995-1999.

Table 5 presents the monthly means, medians and coefficients of variation of Chlorophyll A at some stations along the N-transect.

Table 6 gives the statistical parameters of TSM data at some stations with a long term programme (1983-1999), while table 7 shows a comparison between the mean TSM during the periods 1975-1983 and 1983-1999, respectively.

Table 8 contains the TSM data (May 1975 until March 1983) used for the determination of the statistical parameters.

This report merely presents observations and correlation's. A scientific analysis and discussion, including a comparison with the literature, is presented elsewhere. Major findings are that the observed TSM values have a three-parameter lognormal statistical distribution (Johnson and Kotz, 1970), and that they are correlated with the long-wave energy.

This study was commissioned by the North Sea Directorate (NSD). The project manager at NSD was drs. A. Stolk.

## 2. Area investigated and total suspended matter concentrations

The TSM data are the result of a long-term monitoring programme (WAKWON) of the Dutch Coastal zone by Rijkswaterstaat from May 1975 through February 1983, cf. table 8. The stations are shown in figures 1.1 and 1.2. Figure 1.1 defines the investigated area of the Continental Shelf. Figure 1.2 shows an overview of the bathymetry, while figure 1.3 gives detailed information about the depths around the stations. In most surveys all stations were surveyed within about 4 days, resulting in quasi-synoptic surveys. The survey frequency was about 22 times a year.

The distributions of the long-term mean of the salinity and of the fresh water content<sup>2</sup> in the upper layer<sup>3</sup> are shown in figures 2.1 and 2.2, respectively. The influence of the most important fresh water sources (e.g. the Scheldt near Walcheren, the Rhine-Meuse near Hook of Holland, the Ems near Borkum) is clearly visible.

The positions of the isolines of the fresh water percentage are determined by the residual flows in the Southern part of the North Sea and by the fresh water originating from the rivers. The bending of the fresh water plumes to the north-east along the Dutch coast demonstrates that the residual (surface) currents are north-easterly directed parallel to the coast. The distribution patterns of the TSM and of the river water fraction resemble each other at first sight (cf. Figs. 2.2 and 3). The TSM isolines in Fig. 3 show also a north-eastern pattern along the Dutch coast with the highest TSM concentrations near Walcheren. The total suspended matter in the Dutch coastal zone originates mainly from (erosion of) the English Channel (Van Alphen, 1990) and is carried along the Dutch coastal zone by the (tidal) currents.

The behaviour of the suspended matter concentrations in cross-shore direction differs significantly from that of the river water contents: as a typical example some results of the Noordwijk-transect are shown in figure 4.

The most important part of the suspended matter load along the Dutch shore is concentrated in a narrow band with a width of less than about 6 km (cf. Fig. 4). The fresh water part, on the other hand, is nearly linearly distributed between the coast and the stations at 30-50 km from the coast. The cause of this different behaviour is the settling velocity of the suspended matter. Due to vertical and horizontal density gradients, especially in the lower part of the water column in the area between the S and N-transects (Fig. 1.1), and due to the Coriolis forces, residual water flows are directed to the coast during most of the time (most frequent wind direction: from the west-southwest) (Dronkers et al. 1990; Visser, 1993; De Kok, 1994; Salden, 1998). These residual currents concentrate the suspended matter in a relatively narrow band resulting in the large observed gradient. Besides this concentrating transport mechanism, wave action is important for the high concentrations in the shallow near-shore zone.

The figures in Figure 5.1 present filtered (time) TSM values obtained with a long-term sampling programme at some stations. Two straightforward ways of filtering have been applied, namely (i) sampling the data points in consecutive time frames of 2 months and taking their average value for each time interval, and (ii) taking moving averages (time window 2 years; no weighting of the data) of these new time series (2-monthly values). The 2-monthly TSM values

<sup>2</sup> Based on an assumed salinity of pure seawater of 35.1, cf. table 5 of Suijlen, 1981

<sup>3</sup> Similar observations of the lower part of the water column do not exist

show a periodicity of one year, while the long-term averages show a periodicity of some 5-8 years. It is not impossible that the latter periodicity corresponds with the so-called North Atlantic Oscillation (NAO), which has a major periodicity of 7.3-8.0 year, as well as periodicity's of 2.2 and 20 years (Rogers, 1984). The NAO is the large-scale alternation of the atmosphere between the Azores High and the Icelandic Low. The NAO is responsible for periods with heavy zonal storm tracks, transporting cyclones towards Western Europe, and for blocking phases with a reduced influence of the Atlantic on the weather in Europe.

In the above-mentioned long-term cycle (5-8 years) in the TSM moving averages, their values vary with a factor 2 (cf. Figs. 5.1 and 5.2). The moving averages of the salinity's appear to have about the same periodicity (cf. Fig. 5.2). An increase c.q. decrease of the salinity at the station W20 implies an increase respectively decrease of the flow, or residual displacements, of oceanic water through the Strait of Dover. Of course the salinity at this station is also influenced by the flow rates of the rivers Rhine, Meuse and Scheldt, so salinity changes can partly be caused by changing river run-offs.

According to Otto et al. (1990), the residual fluxes through the Dover Strait vary with about a factor 2-3. The long-term averages of salinity and TSM are mainly in phase after 1987 (cf. Fig. 5.2), therefore the residual TSM load, which is a product of the flow and the suspended matter, will vary with about a factor 4-6. So, for an estimated long-term TSM load of 20 Mton/year (Rijkswaterstaat-WL, 1985; 1982, Salden, 1998), the mean load in a specific year can as well be low (e.g. between 6-10 Mton/y) as high (e.g. 40-60 Mton/y).

It is known that both waves (Van Rijn and Louisse, 1987) and tidal currents determine the resuspension of particulate matter in shallow waters (depth < 50 m). Since the amplitudes of the tidal currents in winter do not differ significantly from those in summer, the tidal currents can not be responsible for the one-year periodicity. This strongly suggests that the latter is caused by waves. A second indication for the decisive role of waves in the TSM is the simultaneous occurrence over the whole study area of increases in TSM. Such a phenomenon can not be caused by transports by residual water movements that, on the average, are about 3-5 km per day between Hook of Holland and Texel (Otto, 1978). The existence of a correlation between observed TSM values at the two Noordwijk stations N2 and N20 and the wave climate of the long (10-33 s, 30-100 mHz) waves (wave climate taken from Fig. 6) is corroborated in the Figures 5.3. Furthermore, the ratios between maximum (winter) and minimum (summer) TSM values are for all stations significantly larger in the near-shore zone than on deeper water. For instance, for station N2 (local depth 10 m) the ratio of the estimated mean peak value to that of the mean dip value amounts about 10 (= 50/5) while that for station N20 (local depth 20 m) is only 2.5 (=10/4), cf. figure 5.3. This again points to the influence of waves.

### 3. Definitions of Seasons and Regions

#### 3.1 Definition of Summer and Winter period for the total suspended matter concentrations

In a statistical analysis it turns out that the available data are insufficient to reliably estimate per station and per month of the year statistical parameters like the mean, median and standard deviation of the TSM: the TSM values scatter too much and the number of available data is relatively small (about 15 data per station between May 1975 and February 1983). Some aggregation of data is therefore necessary, e.g. by considering longer periods (than one month) for which statistical parameters are estimated.

In the chapter 2 it was made plausible that waves have a great effect on the resuspension processes in the shallow water in the Dutch coastal zone. As a working hypothesis we therefore assume that the statistics of the TSM largely follow the statistics of the wave heights. Figure 6 shows the monthly means and median values of the HTE3 observed at EuP and IJM (cf. Fig. 1.1). The parameter HTE3 is a measure for the wave height of waves with periods between 10 and 30 s (Rijkswaterstaat, 1996). Monthly averaged these wave heights show a typical seasonal trend with minimal heights during the summer months May, June, July and August (cf. Fig. 6).

The ratio between the mean and median of the monthly averaged low-frequency wave height is about 2.5 (Fig. 6), all over the year, which means that the probability density distribution is rather skew. This has to be kept in mind in the present analysis. For example, the monthly averaged HTE3 gives little account of wave heights during a typical winter storm. Waves with an effective HTE3 of about 4 m, as occasionally encountered in the data, generate orbital velocities with amplitudes of about 0.4 m/s at 20 m water depths. According to linear wave theory, a mean wave height HTE3 of about 0.6 m (winter period) generates orbital velocities of less than 0.1 m/s. The latter value is small compared to the maximal tidal velocity of about 0.6 m/s during a standard tidal cycle, so relatively little effect of waves is anticipated for such values, in contrast with the observed correlation. We prefer to consider the value of the monthly means of HTE3 to be representative for the *number* of significant storms, i.e. of storms that generate waves with heights exceeding a chosen threshold value. For instance, from an inspection of the observations at IJM, we choose a threshold value of 0.9 m wave height of the long waves. Then, the number of storms during the period May-September falls in the range 0 to 5. On the average, 25 of such storms occur in the period October-April, while in an individual winter (1 October- 31 March) circa 15 to 55 of such storms may occur. This variability in the number of storms, especially those in the English Channel, could be one of the reasons for the 5-8 year periodicity shown in Fig. 5.1. The 8 year periodicity of stormy and calm winters in the Netherlands was earlier reported (Stolk, 1991).

Wave activity is minimal during the months May until August. The TSM values at the stations in the near shore zone (< 6 km) are then also minimal. This can be seen in Figure 7.1 that presents aggregated TSM data as a function of the month of the year for the near-shore zone; Figure 7.2 gives the results for the stations on deeper water and at larger distances to the coast. Figures 7.1 and 7.2 also present the correlation between the aggregated monthly TSM values

and the ditto monthly mean wave power. The latter is proportional to the square of the wave heights ( $HTE3^2$ ) (Groen and Dorrestein, 1976). Obviously the months May, June, July and August belong to one class, the Summer period, while January and February are the kernel of a second class, the Winter period, in the right hand graphs of Fig. 7. The months March and April show wave activities that are smaller than those of November. However, the TSM values during March and April are always larger than those during November. Therefore, the periods with maximal TSM and maximal wave activity are not synchronous. TSM values during September and October are in most cases at the same level as those of May-August. In order to maximise the number of data per period, the TSM data of September and October are grouped under the Summer period.

Two possible winter periods remain. Requiring maximal TSM values, the Winter period would consist of the months December, January, February and March (cf. right hand graphs of Fig. 7). As an alternative, favouring a maximal number of data, the Winter ("Lwinter") period would also include the months April and November, so would consist of the whole year except the period May-October. Because of the low TSM values of April and November (cf. Fig. 7.2), the Lwinter period delivers significantly smaller values for the medians and means (about 10 %) than the Winter period (December-March). In this report all graphs and charts are based on analyses with the Winter period 1 December - 31 March.

### 3.2 Definition of subregions in the total suspended matter analyses

As a further means to obtain better statistics of the TSM data, measuring stations can be clustered into sub-regions of the North Sea. Based on an inspection of the observed mean TSM values, the study area is divided in a southern and a northern region. The southern region contains the transects W, S and G (Fig. 1.1) south of Hook of Holland. The northern region contains the transects T through TS. The A-transect is not included in the southern region because of its significantly larger concentrations (cf. Fig. 7.1). The R-transect is not included in the northern region because of the specific distances of its stations to the coast that differ from those of the other transects.

The aggregated southern data contain the data of W1 and S1 for 1 km, W4, S4, and G6 for 4 km off the coast. Similarly, the northern aggregated data concern T1, N1, E1, C1 at 1 km off-shore, T2, N2, E2, and C2 for 2 km, respectively T4, N4, E4, C4, and TS4 for 4 km off-shore. The aggregation of data for distances larger than 10 km from the coast is straightforward, containing all stations. Each region is also divided in a near-coast part (distance to the coast < 6 km) and an open sea part at distances larger than 15 km from the coast. Thus 4 special regions are identified, called South<sub><6</sub>, South<sub>>15</sub>, North<sub><6</sub>, North<sub>>15</sub>, where the indices refer to the limiting distances from the coast. The first reason for this subdivision is that the cross-shore gradients of the TSM values differ strongly between the near-coast zone and the open-sea. The near-coast zone is also characterised by its smaller water depths that in general are less than 15 m, with a mean depth of about 10 m. The depths at the stations more than 20 km from the coast are always larger than 20 m (cf. Fig. 1.2), with a mean depth of about 25 m. Waves, therefore, will have their largest impact in the shallow waters of the zone near the coast.

## 4. Theoretical probability distribution

The present TSM data set is extensive and shows a large scatter. Only by the above clustering of data, in this report a statistically significant climatology is obtained that is characterised by parameters like the mean, median and mode. Assumptions about the statistical distribution of the data underlie the statistical treatment of the data. We apply various methods to test these assumptions. We do so both for the TSM data and for the wave data, the latter in view of our working hypothesis concerning the relation between TSM and wave data. Because of this hypothesis, we first pay special attention to the wave data. As long as the wave energy absorbed by the sea bed is small, e.g. compared with the energy delivered by the tidal currents, any possible effect of waves is not likely to be seen in the TSM. Only when the wave energy exceeds some threshold value, we expect to observe a correlation between wave energy and TSM values. One of the consequences of such a correlation would be that the skewness of the wave height distribution will cause a skewness in the TSM values, resulting in a relatively large coefficient of variation of the TSM. The empirical probability distribution of the wave heights is presented in Figure 8, in order to see which theoretical probability distribution is possibly best suited for the TSM.

The straight lines in Fig. 8 are the theoretical probability distributions based on a lognormal distribution (cf. **Appendix A**). A lognormal distribution for the wave heights fits rather well, except for values smaller than about 0.1 m. Waves with such small heights are probably not relevant to the near-bottom (erosion) processes. In first instance one might therefore assume the lognormal distribution to provide a good approximation of the TSM probability distribution as well. As an example, the empirical probability distributions of the TSM values at N2 and N20 are presented in Figure 9. The straight lines result from fitting the data according to a Lognormal distribution (LN). The curved lines are fitted through the data according to the three-parameter Lognormal distribution (LN3).

It can be seen that the lognormal distribution for the TSM values does not fit the data very well (cf. Fig.9). Furthermore, if the estimates of the statistical parameters (e.g. the mean and standard deviation) are based on the lognormal distribution, the estimates of the mode (the most frequently occurring value, cf. **Appendix A**) deliver unrealistic, i.e. too small, values. The so-called Three Parameter Lognormal distribution (LN3) fits the data rather well in this example. Figures 9.1 through 9.10 show the empirical probability (= cumulative distribution) and the empirical density distributions of each station. Because of the small number of observations, which is in the order of 90 and 50 for the Summer and Winter period, respectively (cf. table 2), the scatter in the empirical distributions is large. The aggregation of the data in the virtual South and North transects delivers a larger sample resulting in smoother distributions. The cumulative and density distributions of the virtual stations in the South-region and North-region are given in Figures 10.1 and 10.2, respectively. It can be clearly seen that a symmetrical distribution, like the normal distribution, will not represent the statistics of the TSM values.



## 5. Results

### 5.1 Probability graphs of the total suspended matter concentrations

The probability graphs for the chosen “summer” and “winter” periods are presented in Figure 11. The figure contains also the best fits of the lognormal (LN) and the three-parameter lognormal (LN3) distribution. Figures 11.1, 11.2 and 11.3 show the results for the A-transect, the South-region and the North-region, respectively.

In almost all cases an adopted LN3 distribution gives satisfactory results. The LN distribution is mostly not acceptable (cf. Fig.11).

In order to obtain estimates of the mean, median, mode and standard deviation, probability graphs of each individual station were made. Again the LN3 distribution fits the data rather well. Almost all values of  $\kappa$ , which is called the threshold in table 2, are negative, what is to be expected. Only a few stations (W10, TS4 and R3) deliver positive  $\kappa$  significantly differing from 0 during the Winter period. The deviating behaviour of TSM at these stations is probably due to the small sample size and the large scatter of the data and has very probably no physical background.

The results of the GOF-W test on the data of each station and on the aggregated data are presented in tables 2 and 3. The coefficients of variation (CV) range from about 0.8 in the near-shore zone in winter to about 1.2 at larger distances from the coast in summer. The values of the GOF-W test and the P value confirm that the LN3 distribution is the best of the three tested distributions (LN3, LN and the Normal distribution). In the case that  $\kappa$  almost equals zero, the LN distribution fits also (cf. station A10 in fig. 11.1).

### 5.2 Charts of the seasonal mean, median and mode of the total suspended matter concentrations

Estimates of the mean, median and mode of the TSM values, in the summer and the winter periods, are plotted (contours) in Figures 12, 13 and 14, respectively. The underlying data are contained in table 2. In all charts the highest values are found near the coast. Some of the charts suggest (detailed) structures in the data fields that are mainly artefacts due to the interpolation technique.

In general, it can be stated that the density of stations is fundamentally too small for a reliable and objective interpolation of the TSM data in the whole study area. When better interpolation techniques become available, the data of table 2 can be used for a smoother and better justified presentation of the results. Some details of the used interpolation method can be found in

#### **Appendix C.**

The charts are based on the observations between May 1975 and February 1983. It can be safely assumed that the charts are also representative for the present situation. The latter is corroborated by tables 6 and 7 that contain statistical information of TSM at most of the stations with a long-term sampling programme. The comparison of the mean values in table 7 illustrates that no significant differences exist between the two periods 1975-1983, respectively 1983-1999 (e.g. winter means W-transect are 28.9 and 27.2 mg/l during the first and second period, respectively; winter means N-transects are 11.1 and 11.3 mg/l, respectively).

Charts of the different statistical quantities (mean, median, mode) are presented since each of them gives different information about the TSM values with their

asymmetrical distributions (cf. **Appendix A**). The mean and median are measures for the central part of a statistical distribution. The mean is sensitive to the contributions of extremes, while the median is nearly independent of the extreme values. The mode is the most frequently occurring value and is nearly independent of large values that may occur during episodic events (i.e. storms). The mode of the TSM distribution is suited to obtain information about the under water light climate which biota experience during most of the time. The mean is more appropriate to information about suspended matter transports which can be very large during stormy weather.

The mean ratio between the mean and mode of the TSM distribution appears to be about 2 (winter) or 3 (summer), while that between the mean and median is about 1.2 (winter or summer).

The yearly mean TSM values are about 4 mg/l at distances larger than 20 km from the coast (cf. Fig. 3). It is noteworthy that the chart of the summer mode in Fig. 14.1 shows that the most frequently occurring value in that region (i.e. North<sub>>15</sub>) is about 1 mg/l. Furthermore, during the winter period the mode of the TSM values in that region amounts about 2-3 mg/l, which is again lower than the yearly mean values there.

The winter mean chart (Fig. 12.2) shows a TSM minimum in the Noordwijk and Egmond transects, which is in agreement with earlier findings (Lee and Folkard, 1969; Gossé, 1976). However, this minimum is confined to only one station of the Egmond transect in the median winter chart (Fig. 13.2). This confirms that the median is not sensitive to concentrations which are smaller than the median (i.e. about 4 mg/l).

### 5.3 Charts of ratios between the winter and summer parameters

Charts of the ratios of the winter and summer TSM values are presented since it is difficult to see in Figs. 12 through 14 what the differences are between the winter and summer estimates of the parameter values. Figures 15, 16 and 17 show the winter/summer ratios of the seasonal means, medians and mode, respectively. These ratios between winter and summer quantities are nearly everywhere<sup>4</sup> larger than 1, which should be expected because of a stronger wave action during the winter period. The seasonal effect is largest (ratio values order 2-3) in the southern area and near the coast (< 4 km), because of the lower depths and, thus, a relative large wave influence. In deeper water, the effect is in general smaller. For instance, the region North<sub>>15</sub> shows a minimal seasonal effect, with the winter/summer factor in general being smaller than 1.7 for the mean and the median.

### 5.4 Charts of ratios of mean total suspended matter concentrations with respect to reference values

The variation coefficient of the TSM data is about 1 (cf. tables 1, 2 and 3) and the variability in the data is large. This hampers the detection of a possible increase of TSM values and of a trend change due to human activities, since (temporarily) increased TSM values may well have natural causes like changes of the wave climate and an increased sediment import from the English Channel. An instrument for an early detection of a man made trend change may be provided by charts with ratios between the concentrations per station and the concentrations of some reference stations that experience negligible anthropogenic influences. In a first approximation it is assumed that the mean TSM values at the stations T10, N10, E10 and C10 satisfy the latter condition.

<sup>4</sup> The area with values smaller than 1 in fig. 15 is merely caused by the two values of 0.85 at E20 and E30

The effects of most human impacts will occur closer to shore, than the 10 km of these stations. For instance, the usually on-shore directed near-bottom residual currents cause that dredged material from the dump sites (e.g. during the period 1975-1984 of this report the main dump site was Loswal Noord located within 7 km from the coast) will be concentrated in the first 4 km from the coast (Groenendijk, 1992). The selected reference stations (T10, N10, E10 and C10) are taken that close to the shore that they still yield conveniently high (and reliable) TSM reference values.

Figure 18.1 shows the ratios between the average summer TSM values per station and the mean of the T10, N10, E10 and C10 averaged summer values. The isoline with the value 1 virtually crosses the reference stations, which is to be expected. More interestingly, the 0.7 and 1.0 isolines show patterns that are nearly independent of the season (cf. Figs. 18.1 and 18.2). These ratios can therefore be used for an early detection of a change in time at a specific location.

### 5.5 Charts of extreme values of total suspended matter concentrations

The response of the TSM to storms is illustrated with Figure 19 that gives the mean concentrations of the surveys starting on 5 April 1977, 7 January 1981, 9 February 1981 and 23 February 1981 respectively; four surveys are aggregated in this figure to obtain a smooth distribution. The surveys, and thus Fig. 19, are representative for periods after stormy weather with wave heights HTE3 larger than about 1.2 m. The mean values of the concentrations per station show values of 10-15 mg/l in the open sea for depths larger than 20 m. These values are about a factor 3-4 times higher than the mean values for the whole winter periods (cf. Figure 12.2). During the storms themselves the actual TSM values have probably been larger. The latter could not be measured since surveys are made only during less stormy periods with wind forces smaller than about 8 Bft.

Since the probability distributions of the TSM values per station are fairly well established (cf. table 2), in principle charts can be produced of possibly occurring TSM values in the Dutch coastal zone, e.g. deduced from the TSM values per station that are exceeded with any chosen likelihood. Furthermore, one can do so while e.g. discriminating between the summer and winter periods. Such TSM charts we call "synthetic". We prefer to present in this report another form of synthetic TSM charts, namely charts derived purely from the measurements, i.e. without applying any theoretical statistical distribution.

Figure 20 shows a synthetic TSM distribution interpolated from TSM values per station that are the mean of the two highest values at each station observed during all ship surveys underlying this report. Due to this procedure, for various stations different surveys have been used. Main purpose of Fig. 20 is to illustrate that the actual maximum values during storms will be higher than the values in Fig. 19, i.e. the TSM values during storms Bft > 8 will in general be higher than those in Figs. 19 or 20.

The TSM values in open sea range from 20 to 30 mg/l for the synthetic distribution of Fig. 20, which is about a factor two higher than the values in Figure 19, and about a factor 8-10 higher than the yearly mean values (cf. figure 3).

Surveys with lowest TSM values are found during the summer period. Figure 21 shows the mean of the summer surveys of 28 July 1978, 13 July 1981, 7 September 1981, and 17 May 1982. The concentrations in the open sea are as low as 1 mg/l. An interpolated chart derived from the 2 lowest measured values

per station (synthetic map analogous to the above one for the 2 highest values) does not contain much information, since all values equal the detection limit ( $\approx 0.1$  mg/l), except for some stations in the first kilometres ( $< 2$  km) from the coast.

Figure 22 shows mean TSM values of two surveys (survey 22 March 1977 and survey 22 January 1981) at relatively calm conditions in the storm season just before a next storm. In the open sea the values are as low as about 0.5-3 mg/l. Obviously, over the whole area the system responds quickly to wave energy as follows from comparing Fig. 22 (just before storms) with Fig. 19 (just after storms); we believe that only waves are that highly variable that they can provide the driving force of such a dynamic increase in TSM.

After the storms the concentrations decreased on the average with about a factor 3 within two weeks or so (not illustrated in this report); some stations even decreased with a factor 8, including stations at water depths larger than 20 metres.

## 5.6 Cross-shore graphs of total suspended matter concentrations

Figures 23 and 24 show the seasonal mean and mode of the TSM values per station in all transects. These figures are better suited to illustrate the large cross-shore gradients than Figs. 12 and 14. The steepest gradients are in the A- and C-transects. For comparison, also the measured yearly mean river water percentages are given in Figs. 23 and 24, which are virtually identical to the winter and summer mean percentages. The values change more gradually than the TSM values in Figs. 23 and 24.

Figs. 23 and 24 confirm that the ratios between the Winter mode and Summer mode are larger than the ratios of the winter and summer means (cf. Figs. 17 and 15).

Fig. 12.2 (TSM, winter period) strongly suggests the existence of a turbidity minimum at about 20-30 km from the coast between Hook of Holland and Den Helder. Such a minimum is absent in the summer season (Fig. 12.1). The turbidity minimum in the Winter period is nicely illustrated in Fig. 25. The figure presents as a function of cross-shore distance the ratios of the mean of the Winter TSM medians of the stations N, E, C with respect to the ditto winter mean of the median TSM values of the (N, E, C) stations at 50 and 70 km off shore. The relative TSM minimum (ratio smaller than 1) at about 20-30 km from the coast is obvious. It has to be mentioned, however, that the values in Fig. 25 have a low significance because of a large variation coefficient. No turbidity minimum is found in a similar plot for the summer season (not shown).

The cross-shore gradients of the TSM data aggregated to the regions South and North are illustrated in Figures 26.1 and 26.2. The mean, median and mode of the TSM are presented in the figures. By presenting the mode and mean in one graph, the difference between the two can be seen easily. The relative differences between the mean and mode of the TSM in the regions South<sub>>15</sub> and North<sub>>15</sub> are in the summer larger than in the winter. The mode of the TSM in North<sub>>15</sub> has values of about 1 mg/l and 2 mg/l in Summer and Winter, respectively.

The relative maximums at South2 and South4 (cf. Fig. 26.1) are due to the contributions of W2 and W4 (cf. Fig. 23.1: W-transect), which are larger than that of W1.

### 5.7 Seasonal effects in the monthly means of the total suspended matter concentrations (TSM)

Graphs of monthly mean TSM values have been presented in Fig. 7, and some aspects have been discussed in the chapter 3.1. Here, some more comments are made on Fig. 7.

The monthly mean TSM values show a smooth, more or less sinusoidal, behaviour over the year. The month March seems to deviate from this smooth trend in showing for many (groups of) stations relatively high TSM values. The latter is more obvious when compared with the average wave power in that month, which is moderate for the Winter season (right hand side of Fig. 7). In contrast with March, the month November shows relatively low TSM values (Fig. 7, left hand side), although the wave power in that month exceeds that of March (Fig. 7, right hand side). This difference between these two months may (partly) be explained by assuming a more consolidated sea bed in November, due to stabilising effects of the biota during the calm summer period as suggested by Postma, 1967. Nowadays a lot of research is done on the effects of biota on the bed (Amos et al., 1997; Widows et al, 2000).

The TSM values in May at the stations more than 10 km from the coast appear to be relatively high compared with a general sinusoidal-like trend (Fig. 7.2, left). In the near-coast zone the TSM values are about constant in the months May-August (Fig. 7.1), therefore one would expect that the May concentrations off shore will more or less equal those of June, July and August. The May values tend to be enhanced, which might quite well be due to the plankton bloom in April and May (cf. Fig. 32). Usually the mean percentage of the organic part of the TSM in the near-shore zone (< 6 km) is about 5 %, while this mean percentage can be as high as 30% at distances of more than 10 km from the coast. Since the mode of the TSM at the stations more than 10 km from the coast is usually smaller than 1.5 mg/l during the summer, the contribution of phytoplankton blooms and detritus to the TSM value of these stations will be well detectable.

### 5.8 Cross-shore plots of $TSM^{-0.5}$ versus depth

Figure 27 shows for the various transects the inverse square root ( $TSM^{-0.5}$ ) of the seasonal (Winter and Summer period) mean values of TSM per station as a function of depth. A good correlation is found with little differences between the winter and summer period. The means of the correlation coefficients are  $0.90 \pm 0.07$  and  $0.94 \pm 0.05$  for the Winter and Summer period, respectively. Plotting the inverse square root  $TSM^{-0.5}$ , rather than any other power of TSM, is based on the assumption that low-frequency waves, and notably their energy near the seabed, determine the TSM values to leading order. This wave power is proportional to the square of the orbital velocities. At the present wavelengths and depths, the orbital velocity is in a first approximation inversely proportional to depth (Groen and Dorrestein, 1976), therefore in the present simple model the square root of the concentration is expected to be inversely proportional to depth. The observed strong correlation between  $TSM^{-0.5}$  and depth of Fig. 27 supports our model.

Except for transect TS, the correlation coefficients are all larger than 0.8. The stations in the transects A, W, S, N and C show the highest correlation's ( $r > 0.92$ ) independent of the season. The slopes of the Summer and Winter data do not differ significantly (cf. Fig. 27), while the local absolute TSM values differ with a factor 2-5 between summer and winter.

The TSM values at W2 and W4 are no longer enhanced with respect to W1 in Fig. 27, in contrast with figs. 23 and 24, indicating that the local maximums at W2 and W4 in the latter figures are probably caused by wave action on the

bed. On the other hand, in Fig. 27, the  $TSM^{-0.5}$  values at station W10 seem to be exceptional. Inspection of the depth profile near W10 in fig. 1.3 shows that this station is only 2.5 km out of a 8 m shoal. By Choosing a depth value of 8 m rather the 20 m, the  $TSM^{-0.5}$  values of W10 station fit the regression lines perfectly. It can be concluded that TSM at W10 is mostly carried along by (tidal) currents from the shallower surroundings.

For most stations the observed summer and winter data scatter identically above or below the regression line of the summer respectively winter graph. This demonstrates the internal consistency of the data set, and once more underlines the importance of the depth and, thus, of the long-wave energy on the seasonal means of TSM.

It can be seen that most lowest concentration values per transect, represented in Fig. 27 by the highest  $TSM^{-0.5}$  values, coincide with the largest depths, as expected in our description. An interesting phenomenon can be seen in the transects N, E and C. According to Visser, 1993 the salinity fronts during the Winter will cause turbidity minima between 10 and 40 km from the coast. Indeed she found in the winter a significant difference between the stations C30 and C70 that she attributed to the hypothesised effects of the salinity fronts. However, Fig. 27 clearly demonstrates that the difference between the mean TSM value at C30 and C70 is determined mainly by the depth and, thus, the wave climate. The figure does confirm that during the winter period only the stations C10, C20, E20, E30 and probably N30 may be influenced by the density circulation that is believed to create the relative turbidity minima between 10 and 30 km off shore.

Keeping in mind that the stations at 10, 20 and 30 km off the Holland coast may be influenced by the above circulation in Winter, it is not fully justified to incorporate them in correlating  $TSM^{-0.5}$  with depth. Figure 28 shows the linear regression results per transect (Winter period) in which these stations (labelled with a cross) have been ignored. It appears that the stations N20, N30, E20, E30, C10 and C20 are outside the 98% confidence band. Requiring a 99% confidence interval, only the stations E20, C10 and C20 are outside the 99% lines, while N30 touches the 99% line. This indicates that at least the latter stations, but probably also N20 and E30, differ significantly from the other ones in the Holland transects, which might quite well be due to the density circulation.

Using the same statistical method as in Fig. 28, all data points at 10, 20 and 30 km in all other transects are within the 95 % and 98 % confidence bands. Therefore all other stations at 10, 20 and 30 km off shore do not show any special behaviour.

## 5.9 Long-term influence of TSM on long-term Chlorophyll-A concentrations

The growth of phytoplankton strongly depends on the light flux and on the availability of nutrients. Therefore, an increase in TSM values should result in a lower yield of phytoplankton, if all other parameters like the supply of nutrients are constant.

In Chapter 2 time series of salinity and TSM are shown (Fig. 5.2); a 2-year moving average has been applied to the (2-monthly averaged) original data. Figure 29.1 shows the Chlorophyll-A and TSM signals at stations W20, N20, T2 and TS10 treated with the same moving average window. We use Chlorophyll-A concentrations (ChlA) as an indicator of the phytoplankton concentrations. It appears that during some periods the phase of the ChlA signal is opposite to that of the TSM. These periods are labelled with their starting and end months (Fig. 29.1). If we assume that light is the most limiting growth factor during these periods, a (long-term) correlation between their TSM and ChlA values can

be expected. Such a correlation (curved lines) is indeed observed in Figure 30 (correlation coefficient 0.7 or larger for the stations W20, N20 and T2; data of the selected periods). The curves of the fits to the data of the selected periods in Fig. 30 are based on the assumption that ChlA in first approximation will be inversely proportional to TSM, or more precisely:  $\text{ChlA} = a \text{TSM}^{-b}$ , with  $a$  and  $b$  positive constants. For  $b=1$  the ChlA values are exactly inversely proportional to TSM. It appears that the constant  $b$  ranges from about 1.0 to 1.5 for the selected periods and stations (W20, N20 and T2). A change with 1 mg/l in the long-term mean TSM values would imply on the average a change of about  $1.0 \pm 0.3 \mu\text{g/l}$  in ChlA at these stations, according to the present description. The values can be derived directly from the solid curves in Fig. 30.

If all TSM and ChlA data (1975-1999) are considered, no clear correlation between them is found (cf. dashed lines in Fig. 30,  $r < 0.1$ ). Other factors apparently mask the influence of TSM on the Chlorophyll A production.

The station TS10 is representative for stations where the supply of nutrients often is the limiting factor. This is illustrated by ChlA and the dissolved inorganic Nitrogen concentrations (DIN) between March 1991 and November 1995 at station TS10 (cf. Fig. 29.2). In this period the ChlA and DIN signals are completely in phase, which strongly suggests that growth is limited by DIN. Data points of selected periods (indicated) are well fitted with a power function ( $\text{ChlA} = a \text{TSM}^{-b}$ ); for the total data sets no clear relations are found.

#### **5.10 Effects of the total suspended matter concentrations on the light attenuation coefficient $K_d$**

##### **5.10.1 long-term variability**

The light climate in the water column is greatly influenced by the local TSM values. The under water light climate can be characterised by various parameters, of which the light attenuation coefficient  $K_d$  is the most prominent one. The light intensity in the water column is described by the model of Lambert-Beer, in which the attenuation of the irradiance under water is approximated by  $\exp(-K_d z)$ , where  $z$  is the distance to the water surface. If the light attenuation coefficient  $K_d$  is known, then the thickness of the euphotic layer and the under water visibility range for the human eye can also be determined. The euphotic layer is defined as the region where photosynthesis occurs. The thickness of that layer, the so-called euphotic depth  $h_{eu}$  is usually defined as the depth where still 1 % is present of the surface light in the spectral part responsible for photosynthesis (Jerlov, 1976), therefore  $h_{eu} = \ln(100)/K_d = 4.6/K_d$ . The mean under water (horizontal) visibility range  $V_R$  is defined after Williams, 1970 as  $V_R = 3.5/K_d$ . Williams also gives  $V_{Rmax} = 5.8/K_d$  as theoretical maximum  $V_R$  value, while Jerlov takes  $4/K_d$ . According to these definitions the horizontal visibility range is about the same as the euphotic depth.

Rijkswaterstaat has measured the wavelength averaged light attenuation coefficient  $K_d$  about once a month at a few stations (Noordwijk transect) since the midst of 1995. It appears that the  $K_d$  values are rather well fitted by a lognormal distribution. Table 4 contains the results of the corresponding statistical analyses. The mean ratio of the mean and median is about 1.03, while that of mean and mode is about 1.2. The yearly means of  $K_d$  are 1.1, 0.62, 0.53 and 0.26 ( $\text{m}^{-1}$ ) at the stations N2, N10, N20 and N70, respectively. The CV is about 0.3 for all stations.

Figure 31 shows the seasonal trend in the monthly means of the  $K_d$  at some stations in the N-transect. From the figure it is seen that the seasonal effect on  $K_d$  is much less pronounced than on TSM (cf. Fig. 7). Only at station N2 the  $K_d$  values are clearly enhanced in the winter period. All stations show a peak in the  $K_d$  signal around April. It is well known that phytoplankton and detritus affect the light attenuation (Peeters et al., 1991; Fransz et al., 1991). In the present region the first algae blooms occur in the months March until May (Peeters et al., 1991). The relation between the  $K_d$  signal in April and the phytoplankton production is illustrated by Figure 32. The figure presents the monthly means of the ChlA values, for the two periods 1975-1999 (bold solid line) and 1995-1999. The latter coincides with the  $K_d$  measurements. Over the period 1975-1999 the Chlorophyll A spring peak is observed during April (N70) and May (N2, N10, N20). The seasonal means over the short period (1995-1999) show more peaks at April (N2, N20 and N70) than at May. It is therefore straightforward to assume that the April peak in the  $K_d$  signal as observed during 1995-1999 originates mainly from the Chlorophyll A production around that month. Please note that the differences between both lines in each graph of Fig. 32 are of little significance in view of the large CV (about 1.3) in the values of the monthly ChlA means.

Fig. 31 shows also the monthly means of the euphotic depth. It appears that the mean euphotic depth is about half of the local depth at the stations N2, N10 and N20. At station N70, however, the euphotic depth approaches the local depth. The euphotic depth at N70 as derived from the mode of  $K_d$  ( $1.2 \times \text{mean}$ ) even exceeds the local depth during a large part of the year (Fig. 31). For the Noordwijk stations the horizontal visibility range is between 4 and 30 m when taken equal to the euphotic depth (cf. Fig. 31). During periods of algae blooms or after storms the  $V_R$  can be much lower.

Assuming that the TSM and ChlA values are the most important factors to determine  $K_d$ , these factors and  $K_d$  are likely correlated. According to the model of Lambert-Beer a linear relation between  $K_d$  and TSM respectively ChlA is expected. A multiple regression on the data of table 4.3 yields  $K_d$  ( $1/m$ ) =  $0.055 \text{ TSM (mg/l)} + 0.021 \text{ ChlA (}\mu\text{g/l)} + 0.04$  for the N-transect with  $r^2=0.93$ . The regression is forced through the intercept  $0.04 \text{ (m}^{-1}\text{)}$  being about the  $K_d$  value of ocean water (Jerlov, 1976). In order to obtain an impression of the robustness of the former formula a second fit has been made, with the linear regression again forced through the intercepts  $0.04 \text{ (m}^{-1}\text{)}$  and with  $0.03 \times \text{ChlA}$  as prescribed ChlA term, an approximation of the generally accepted formula of Riley, 1975. This fit yields  $K_d$  ( $1/m$ ) =  $0.05 \text{ TSM (mg/l)} + 0.03 \text{ ChlA (}\mu\text{g/l)} + 0.04$  (for the N-transect with  $r^2=0.76$ ). Both formula's were found to fit the available data set very well (not shown), with differences only occurring for very high TSM and/or ChlA values. A seasonal hindcast of  $K_d$  based on the first relation is shown in Figure 33 (thin line). The used seasonal means of TSM and ChlA are taken from the data of the period 1975-1999. The effect of the April-May peaks in the seasonal ChlA values (Fig. 32) is visible in Fig. 33; the enhanced  $K_d$  values at station N2 during the winter are due to a relatively strong TSM contribution. In Figure 34 the euphotic depth  $h_{eu} = 4.6 / K_d$  (moving averages of two year) of the individual stations at the N-transect is hindcasted from the latter  $K_d$  formula and the observed TSM and Chlorophyll A data.

### 5.10.2 short term variability

It has to be kept in mind that all presented graphs and conclusions are based on ship measurements for sea states below Bft. 7-8. Therefore the highest TSM

values, and the strongest light attenuation, that will occur during heavy storms have not been observed. Figure 35 shows 8 minutes averages of measured TSM and light attenuation coefficients  $K_d$  as recorded continuously by optical instruments (optical back-scatterometer and two irradiance meters) at an in-situ buoy near the surface at the station N10. The TSM and  $K_d$  signals are seen to correlate perfectly. In the figure also the TSM values and  $K_d$  signals as measured by the r.v. Mitra are displayed. A preliminary comparison between ship and buoy measurements shows that both sets of data agree well but that events with strongly enhanced values are being missed by the vessel, as expected. In Fig. 35 also the measured waves are shown to indicate their impact on TSM. Obviously total suspended matter is a source-limited quantity in this area since the highest concentrations do not always coincide with the highest wave energy (compare the wave heights of the storms at 28 May and 11 July and their respective TSM). The relation between TSM and wave energy (taken as  $HTE3 * HTE3$ ) for the 28 May storm is shown in detail in Figure 36. Changes in the wave energy are clearly reflected in the TSM and  $K_d$  signals. The ratio between mean and median per month of the TSM (OBS-signals) is about 1.3. The CV of the OBS per month range from 0.6 to 1.2. These statistical parameters do therefore not differ significantly from those of the ship observations.



# Appendix

## Appendix A: Applied statistical methods

### *Definitions of the statistical parameters*

#### *Mean*

The mean or average is a measure of central tendency. The mean is the point of the distribution of a random variable  $x$  at which the distribution balances. In this case the distance between each value of this variable and the mean will be in balance at this point. The mean is sensitive for outliers because the value of each number is important. The mean of a sample ( $\bar{x}$ ) of  $n$  units in which each unit has the equal chance of being chosen is estimated by:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

#### *Median*

The median is also a measure of central tendency. The values of the random variable are ordered from smallest to largest and the sample median ( $m$ ) is defined as to be the middle order statistic if  $n$  (the units of the sample) is odd and the average of the middle two order statistics if  $n$  is even. For a continuous distribution, the  $m$  is the unique number such that half of the distribution is less than  $m$  and half of the distribution is greater than  $m$ . Because the sample median only depends on the middle or middle two observations, it is unaffected by "outliers" (very large or very small values).

In formula :

Let  $Y_1 \leq \dots \leq Y_n$  the ordered values of the random sample  $X_1 \leq \dots \leq X_n$  then the median ( $m$ ) is defined as:

$$m = Y_{(n+1)/2} \text{ if } n \text{ is odd}$$

$$m = \frac{1}{2} (Y_{n/2} + Y_{(n+2)/2}) \text{ if } n \text{ is even.}$$

#### *Mode*

A third measure of location of the density of the values of a sample is the mode ( $M$ ). It is not necessarily a measure of central location. The  $M$  is defined as the point of the density at which its maximum is attained.

#### *Standard deviation*

The standard deviation of a random variable ( $x$ ) is a measure of spread. The sample standard deviation, the square root of the sample variance, is defined as:

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

*Normal Distribution*

The normal or Gaussian distribution is the most frequently used distribution in probability and statistics. The probability density function ( $f(x)$ ) of a random variable  $x$  (= the relative frequency distribution of that variable) is given by:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right], \quad -\infty < x < \infty, \quad -\infty < \mu < \infty, \quad \sigma > 0$$

where  $\mu$  denotes the mean of the distribution and  $\sigma$  denotes the standard deviation. The measures are the mean and the standard deviation of the population. When we have a sample those measures are estimated by the mean  $\bar{x}$  and the standard deviation  $s$ .

The probability density function of a random variable is the relative frequency distribution of that random variable, that is, it is the histogram representing the population associated with that random variable.

*Log normal distribution (two-parameter lognormal distribution)*

If  $y=\log(x)$  has a normal distribution with parameters mean= $\mu$  and sd= $\sigma$  then  $x$  is said to be a random variable from a lognormal distribution with parameters meanlog= $\mu$  and sdlog= $\sigma$ . The two major characteristics of the lognormal distribution are that it is bounded below at 0, and it is skewed to the right.

The density function of  $x$  is given by:

$$f(x) = \frac{1}{x\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{\log(x)-\mu}{\sigma}\right)^2\right], \quad x > 0, \quad -\infty < \mu < \infty, \quad \sigma > 0$$

In a sample of  $n$  units  $\mu$  and  $\sigma$  are estimated respectively by the sample mean and sample standard deviation of the log-transformed  $x$ -values.

*Three parameter lognormal distribution*

The three parameter lognormal distribution is an extension of the two-parameter lognormal distribution in which instead of  $x$ ,  $(x-\kappa)$  has a two-parameter log-normal distribution. The third parameter  $\kappa$ , which may be positive or negative, simply shifts the two-parameter distribution to the right or to the left by the amount  $\kappa$ , without changing its shape. Note that in the case  $\kappa = 0$ , the three-parameter lognormal distribution reduces to the usual (two-parameter) lognormal distribution.

In formula:

$$f(x) = \frac{1}{(x-\kappa)\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2}\left(\frac{\log(x-\kappa)-\mu}{\sigma}\right)^2\right],$$

$$x > \kappa, \quad -\infty < \mu < \infty, \quad \sigma > 0, \quad -\infty < \kappa < \infty$$

*GOF-W test*

This is the Shapiro-Wilk goodness-of-fit test which can be used to test if the distribution of the random variable belongs to a specified distribution (normal, log-normal).

### *Estimation methods of the statistical parameters*

The S-PLUS 2000 and ENVIRONMENTALSTATS software packages (Millard, 2000) are used for the estimation of the statistical parameters. The Shapiro-Wilk goodness-of-fit test is based on the 'sw.gof' function of ENVIRONMENTALSTATS. The estimation of the distribution parameters is based on the minimum variance unbiased, which is the straightforward standard method. Only the estimation of the parameters of the three parameter lognormal distribution is dedicated. The estimation of the  $\mu$ ,  $\sigma$ , and  $\kappa$  is based on zero-skewness estimator ('zero.skew' function of ENVIRONMENTALSTATS) due to Griffith, 1980. The mode  $M$  of the lognormal distributions is then computed by  $M = \exp(\mu - \sigma^2) + \kappa$ .

### **Appendix B: Quality of the laboratory analyses**

The attached sheet (in Dutch) by courtesy of the CENTRILAB B.V. at Soest shows the instructions for the chemical analyst. It applies to the analyses of TSM concentrations from 1975 until 1984. It appears that much attention was paid to the removal of saline water from the filter and to the drying of the filter in a standardised manner (e.g. 1.75 hour at 105°C and 0.75 hour in an exsiccator). CENTRILAB reported values with one decimal (e.g. 2.8 mg/l). The used methods allow a detection limit of about 0.1 mg/l. No documents of Rijkswaterstaat could be found with evidence to support the assumed detection limit of about 0.1 mg/l. On the other hand no document from that period exists which makes plausible that the detection limit was worse than 1 mg/l. The original laboratory data are therefore used for the statistical analyses. The database of Rijkswaterstaat (i.e. DONAR) contains in general only TSM values without decimals (e.g. 2 mg/l). The DONAR data from samples taken between 1975 and 1983 consist of laboratory results in which the decimals have been left out (e.g. the laboratory result of 2.8 mg/l becomes 2 mg/l). This procedure is of course not correct. Therefore, in the course of this work some of the TSM data in DONAR have been replaced by the original laboratory data. The correction was limited to TSM values smaller than 10 mg/l and for the period May 1975 until March 1983, except for the period January 1977 until July 1978. For this latter period DONAR contains not corrected data below values of 10 mg/l.

The present determination of the statistical parameters is based on the correct laboratory results, which are contained in the compiled data set of M. Visser (table 8). The zero's in table 8 which indicate values lower than the detection limit have been replaced by a value 0.05 mg/l for the statistical processing. In order to prevent a statistical bias, the data of the summer period of 1979 have been left out. This period contains extremely high (from a statistical standpoint) values at stations further than 6 km from the coast, which are very doubtful. The values can not be explained from the observed wave energy, from observed TSM concentrations at neighbouring stations, nor from the maximal observed values of the light attenuation coefficient  $K_d$  at these stations. The maximum of  $K_d$  is about 1 ( $\text{m}^{-1}$ ), cf. the 80% quantile in table 4.1 during the summer, which is smaller than 0.73 ( $\text{m}^{-1}$ ) for stations N10, N20 and N70. Concentration values larger than 20 mg/l imply  $K_d$  values larger than about 1 ( $\text{m}^{-1}$ ) (cf. the formulas in Chapter 5.10). It is therefore improbable that concentration values larger than 15-20 mg/l at the mentioned stations are reliable. For the computation of monthly means and medians (table 1) the very unlikely data of 22 September 1975 have also been left out because of their large effect on the mean of September (about a factor 2). The unlikely data (bold in table 8; > 18 mg/l and > 10 km from the coast) all have in common a high percentage of organic mass (>99%), which is extremely high compared to

the usual values 2-10 %. For the figures of long-term TSM variability the data between 28 May until 12 June 1985 have been left out, since the values during this calm weather period were extremely unlikely (e.g. TSM= 59 mg/l at TS20, which has a summer mode and mean of 0.8 and 3.1 mg/l, respectively). TSM concentrations of about 30-50 mg/l imply  $K_d$  values of 1.5-2.5 ( $m^{-1}$ ), resulting in Secchi disk observations  $S$  of less than 1 m (cf.  $S \approx 1.25/K_d$  formula of Visser, 1970). Such turbidity of the open sea around 6 June 1985 has not been reported by the crew of the r.v. Holland.

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# RIJKNINSTRUMENT VOOR ZUIVERING VAN AFVALWATER ZWEVENDE STOF

Alvorens de bepaling uit te voeren wordt het monster zodanig geschud, dat de zwevende stof zo gelijkmatig mogelijk door de vloeistof is verdeeld.  
Het volume van het in behandeling genomen monster is afhankelijk van de hoeveelheid zwevende stof. Bij afmeten ligt die tussen 100 en 200 ml, bij opwerklentmeter tussen 1 en 2 l, tenzij voor actieve slak van afvalwater en pasterisaten 25 tot 250 ml wordt genomen.

Voor een nauwkeurig resultaat wordt een 500  $\mu$  filter in een vloeistofcilinder onder afzuigen met geringe overdruk. Het filter wordt enige malen met gedestilleerd water, droog voor en na de filtratie het filter in een open petrikschaal gedurende 1 uur bij 105° C, aluit de schalen, laat afkoelen in een exsiccator en weeg.

$$1000 \times (g^1 - g^2) = \text{mg zwevende stof/liter}$$

$V_1$  = hoeveelheid in beschikking genomen monster.  
 $G^1$  = gewicht van het schaalijde met filter na filtratie en droging in mg.  
 $G^2$  = gewicht van het schaalijde met filter voor filtratie in mg.

## GLADREEST VAN DE ZWENDE STOF

Diese bepaling wordt uitgevoerd op een monster van voldoende hoeveelheid organische stof in de zwevende bestanddelen. De gladreest wordt alleen bepaald indien het gewicht van de zwevende stof op het filter groter is dan 50 mg.

Draag het filter in een van te voren geglaid en gewogen keegreze. Gelaat gedurende 20 minuten in een wafelover bij 80°C, laat afkoelen in een exsiccator en weeg.

$$\frac{A}{B} \times 100 = \% \text{ gladreest van de zwevende stof}$$

$A$  = gewicht in g van de gladreest.  
 $B$  = gewicht in g van de zwevende stof op het filter.

Het verdient aanbeveling het filter met behulp van een gewone te verklein en pas daarna te gleden.

Voorberg, maart 1969

21/06/83

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21 JUN '00 15:19 CONTINUED BY SIEST

# RIJKNINSTRUMENT VOOR ZUIVERING VAN AFVALWATER ZWEVENDE STOF

Alvorens de bepaling uit te voeren wordt het monster zodanig geschud, dat de zwevende stof zo gelijkmatig mogelijk door de vloeistof is verdeeld.  
Het volume van het in behandeling genomen monster is afhankelijk van de hoeveelheid zwevende stof. Bij afmeten ligt die tussen 100 en 200 ml, bij opwerklentmeter tussen 1 en 2 l, tenzij voor actieve slak van afvalwater en pasterisaten 25 tot 250 ml wordt genomen.

Voor een nauwkeurig resultaat wordt een 500  $\mu$  filter in een vloeistofcilinder onder afzuigen met geringe overdruk. Het filter wordt enige malen met gedestilleerd water, droog voor en na de filtratie het filter in een open petrikschaal gedurende 1 uur bij 105° C, aluit de schalen, laat afkoelen in een exsiccator en weeg.

$$1000 \times (g^1 - g^2) = \text{mg zwevende stof/liter}$$

$V_1$  = hoeveelheid in beschikking genomen monster.  
 $G^1$  = gewicht van het schaalijde met filter na filtratie en droging in mg.  
 $G^2$  = gewicht van het schaalijde met filter voor filtratie in mg.

## GLADREEST VAN DE ZWENDE STOF

Diese bepaling wordt uitgevoerd op een monster van voldoende hoeveelheid organische stof in de zwevende bestanddelen. De gladreest wordt alleen bepaald indien het gewicht van de zwevende stof op het filter groter is dan 50 mg.

Draag het filter in een van te voren geglaid en gewogen keegreze. Gelaat gedurende 20 minuten in een wafelover bij 80°C, laat afkoelen in een exsiccator en weeg.

$$\frac{A}{B} \times 100 = \% \text{ gladreest van de zwevende stof}$$

$A$  = gewicht in g van de gladreest.  
 $B$  = gewicht in g van de zwevende stof op het filter.

Het verdient aanbeveling het filter met behulp van een gewone te verklein en pas daarna te gleden.

Voorberg, maart 1969

Instruction sheet for the analysis of TSM samples.

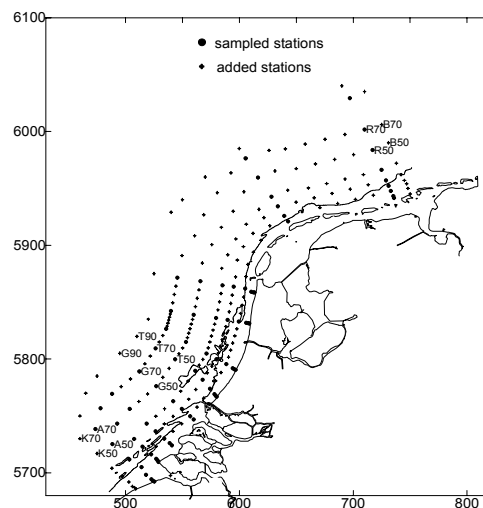
## Appendix C: Interpolation method

### *Applied triangulation method*

The used SURFER-6 software does not provide reliable interpolation results of the TSM data at the present low density of the TSM stations, as mentioned in chapter 5.2. Still, by adding hypothetical stations in the sampling grid to the actually sampled stations, plausible concentration contour lines were obtained. The concentrations at these hypothetical stations were computed by linear interpolation (weighted by distance) of the observed concentration values at neighbouring sampling stations. Usually, the latter were the nearest stations in shore-parallel direction. For example, the concentration values at the added stations between G50 and T50 are linear interpolations from the values at G50 and T50. In this way, maximum justice is done to the original data in the final interpolation of the measured field.

Furthermore, the interpolation method of the SURFER-6 software is not stable at the boundaries of the field. This problem was circumvented by adding artificial extra stations outside the field. For the cross-shore boundary transects A (Appelzak) and R (Rottum) the artificial transects K (Knokke) respectively B (Borkum) were added, with stations at the same off-shore distances as A respectively R. The artificial stations were given the same concentration values as the corresponding real sampling stations. For example, the value of K50 is identical to that of A50, the value of R50 equals that of B50. Thus, plausible contour lines were obtained near the boundary cross-shore transects. For the same reason artificial stations were added seaward of the sampling field that usually stopped at the 70 km off-shore boundary line. These extra stations were positioned in the same cross-shore transects as considered before, usually some 20 km off-shore from the most seaward (real or artificial) station in the sampled field, and their values were taken identical to those of the latter. For instance, the values of the added stations G90 and T90 were identical to those of G70 respectively T70. By this method the interpolated results within the measured field are hardly influenced.

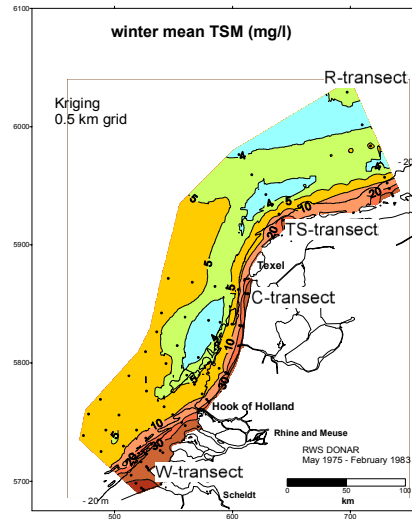
The used real and artificial stations are displayed in the figure. For this artificial field subsequently contour lines were computed with the triangulation method of SURFER 6.



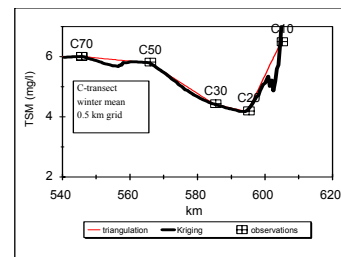
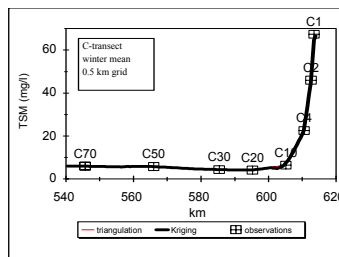
*Overview of the sampled (.) stations and artificial stations to be able to apply the triangulation interpolation method of SURFER6.*

### Triangulation in comparison with Kriging

Kriging is a popular method for interpolating irregularly spaced data like the present WAKWON data. Applying the default Kriging method of SURFER6 on the winter mean of TSM concentrations delivers the map below<sup>5</sup>. This map suggests detailed structures in the 4 and 5 mg/l contours (e.g. 4 and 5 mg/l contour islands).



A global comparison of this map with Fig. 12.2 that shows the triangulation of the same data set, confirms that the contour pattern is about the same. The Kriging method delivers a more accurate 30 mg/l contour line, while the 4 mg/l and 5 mg/l contours shows artefacts (e.g. the 4 mg/l contour island near the R-transect and the 5 mg/l island in the W-transect, while the minimum concentrations of the data set are 4.5 and 7.3 mg/l, respectively). Results of the used interpolation techniques for the C-transect are shown more detail in the graphs below.



From the graphs it appears that triangulation delivers the expected linearly interpolated values, while Kriging shows a complicated, sometimes inaccurate behaviour (cf. the right hand graph). In this case the triangulation method, though not perfect, is preferable to the shown Kriging method.

<sup>5</sup> data used for the menu of SURFER6. Menu Scattered Data Interpolation; method: Kriging; options: Kriging options; variogram model: linear; scale C:1500 km; scale A:40 km; no drift; search: search options: search type: quadrant; search rules: data per sector: 6; minimum total data:5; max. empty sectors: 4; search ellipse: radius 1: 40 km; radius 2: 229 km; angle: 0

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## Figures

### Stations of the WAKWON programme (May 1975-Feb. 1983)

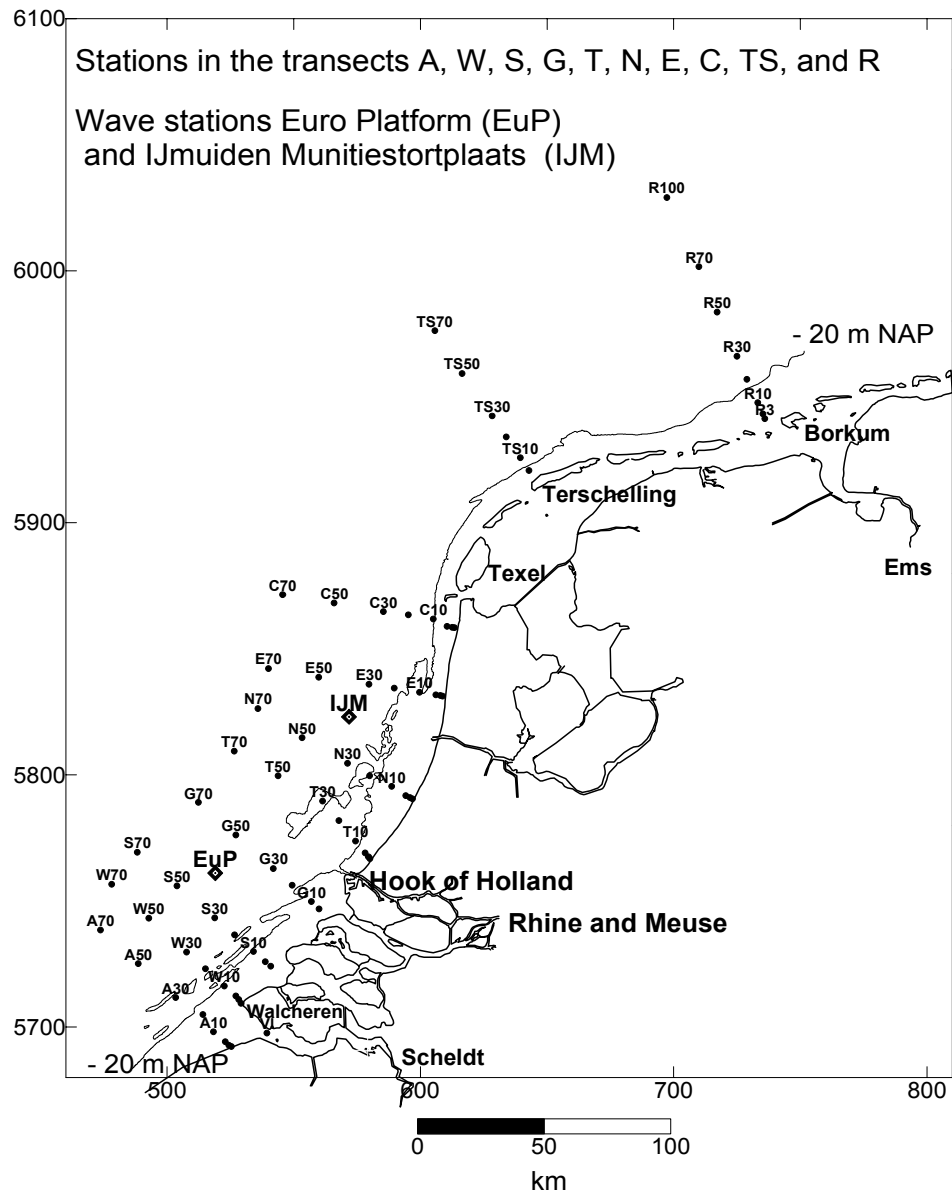


**Figure 1.1** The stations of the monitoring programme WAKWON. The number in the station label indicates the distance to the coast in km. The transects are called after their letters (e.g. T-transect (Ter Heijde) near Hook of Holland). IJM and EuP are the locations of the wave stations

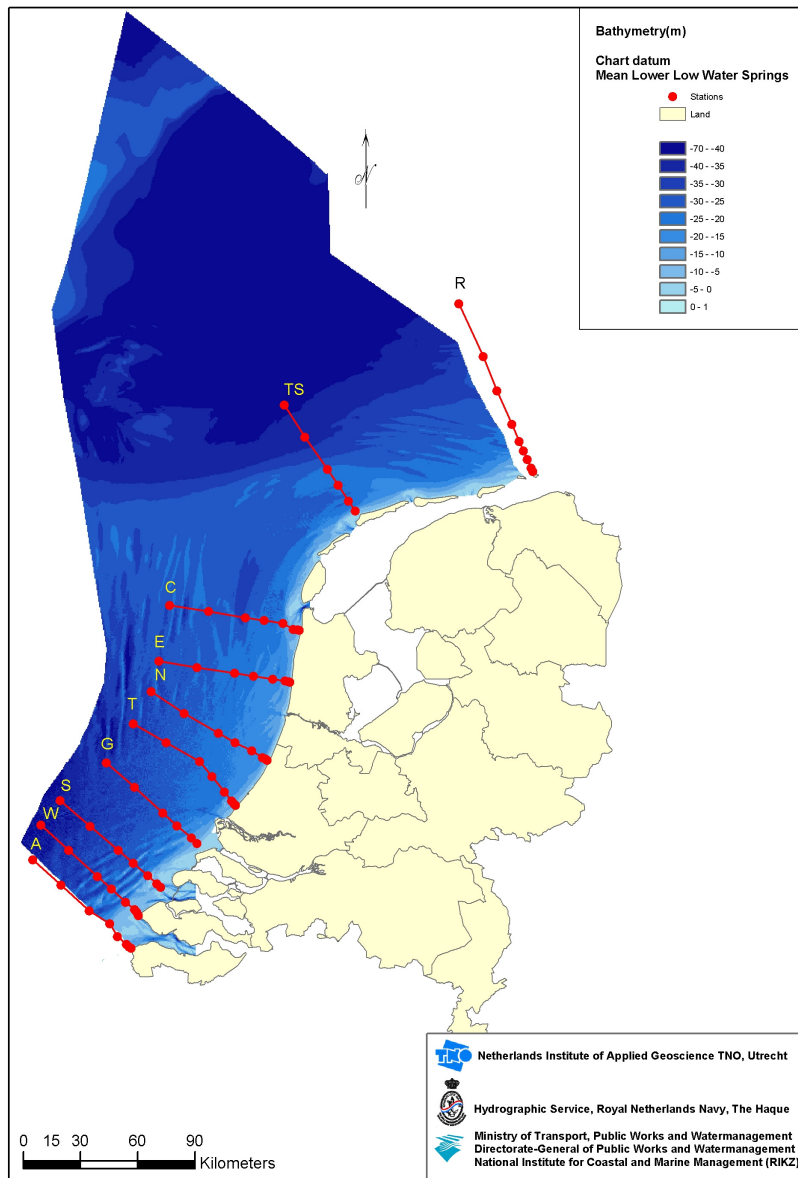


Figure 1.2 Bathymetry of the investigated area

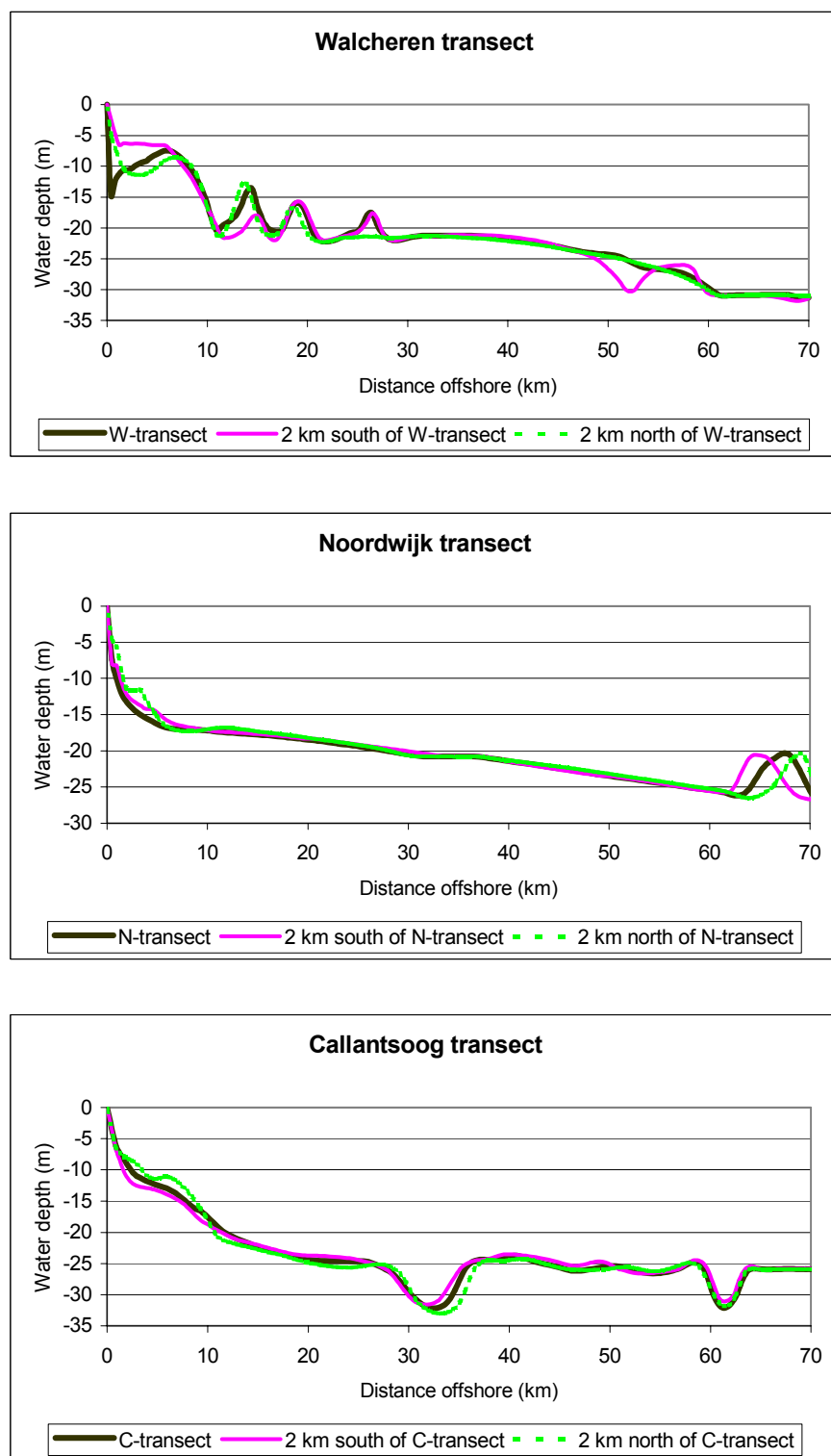


**Figure 1.3** Depths of stations along the W, N, and C-transects

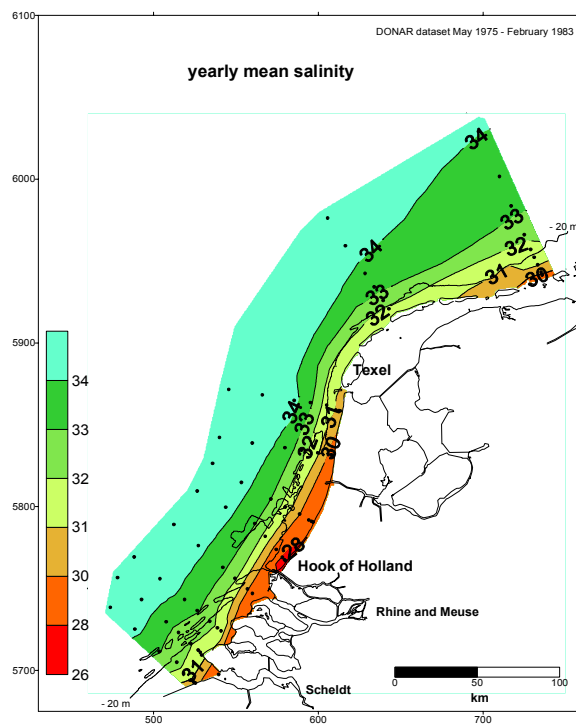


Figure 2.1 Mean salinity (1975-1983) in the Dutch coastal zone

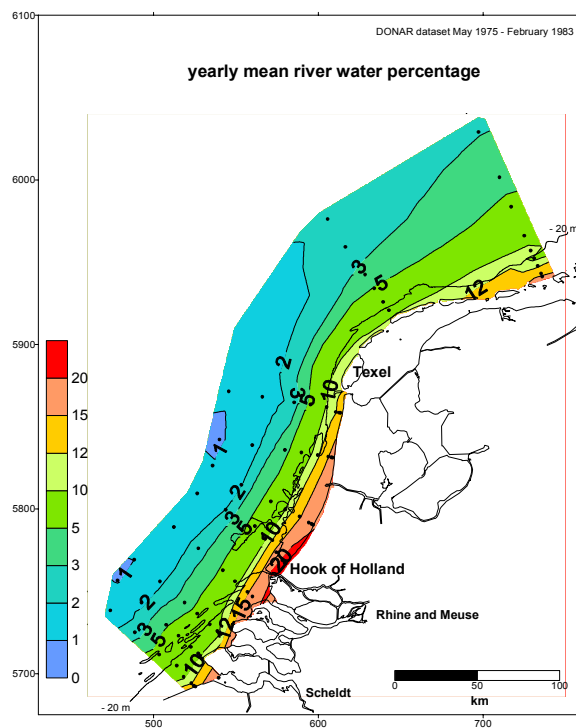


Figure 2.2 Mean fresh water percentage (1975-1983) in the Dutch coastal zone

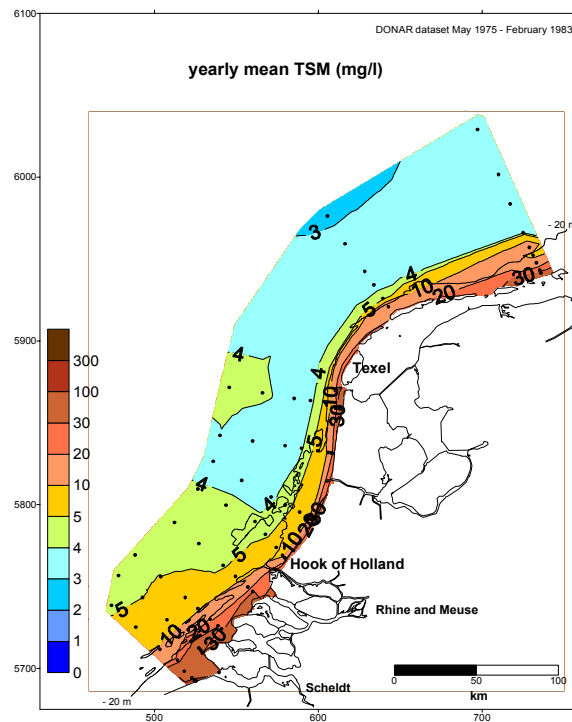


**Figure 3** Mean total suspended matter concentrations (1975-1983) in the Dutch coastal zone

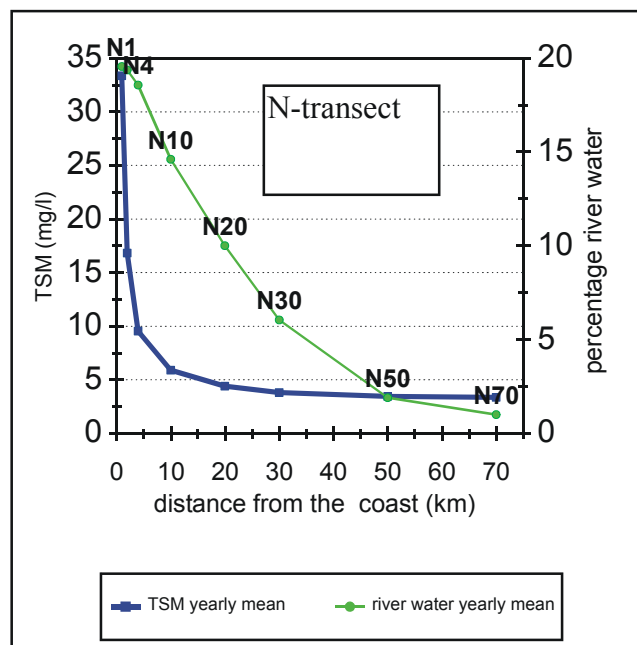


**Figure 4** Yearly mean fresh water content (%) and suspended matter concentration (mg/l) as a function of cross-shore distance along the N-transect. Gradients in these parameters are clearly visible

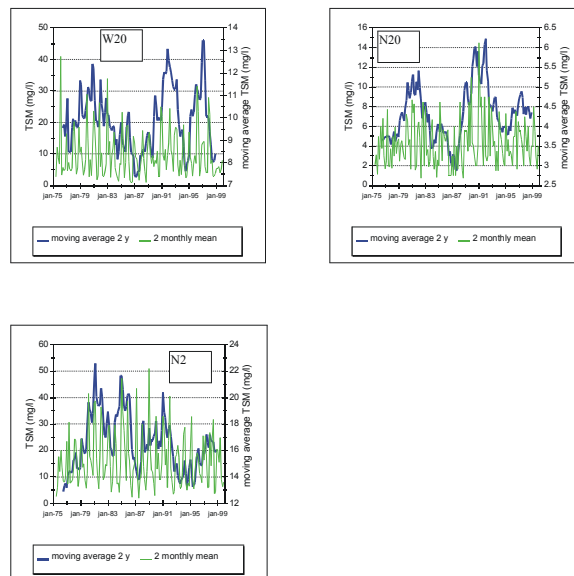


**Figure 5.1** Two monthly means and two yearly moving averages of the total suspended matter concentrations at some stations with a long-term sampling programme

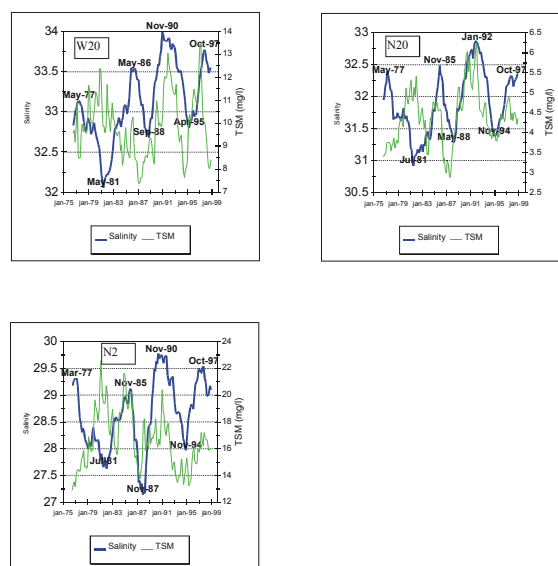


**Figure 5.2** Two yearly moving averages of the total suspended matter concentrations and salinity at some stations with a long-term sampling programme

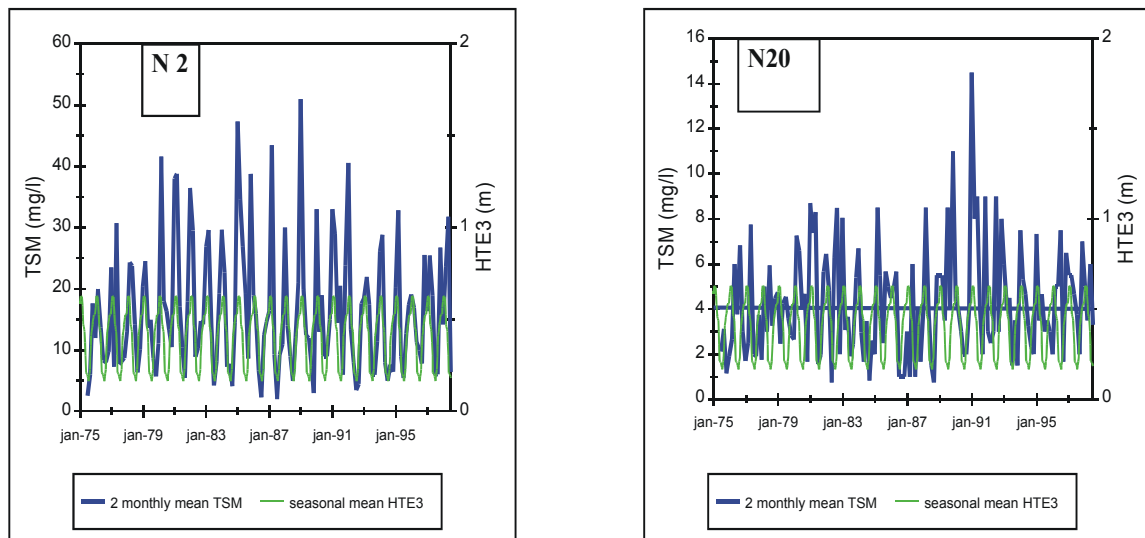


**Figure 5.3** Two monthly means of the total suspended matter concentrations and the climatological wave heights HTE3 at the stations N2 and N20

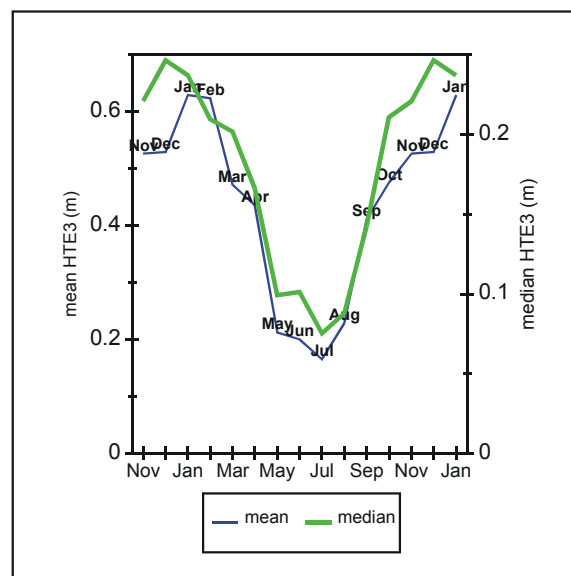


**Figure 6** Monthly averaged wave heights HTE3 of the mean of the stations IJM and EuP. The wave heights of EuP are normalised to those of station IJM

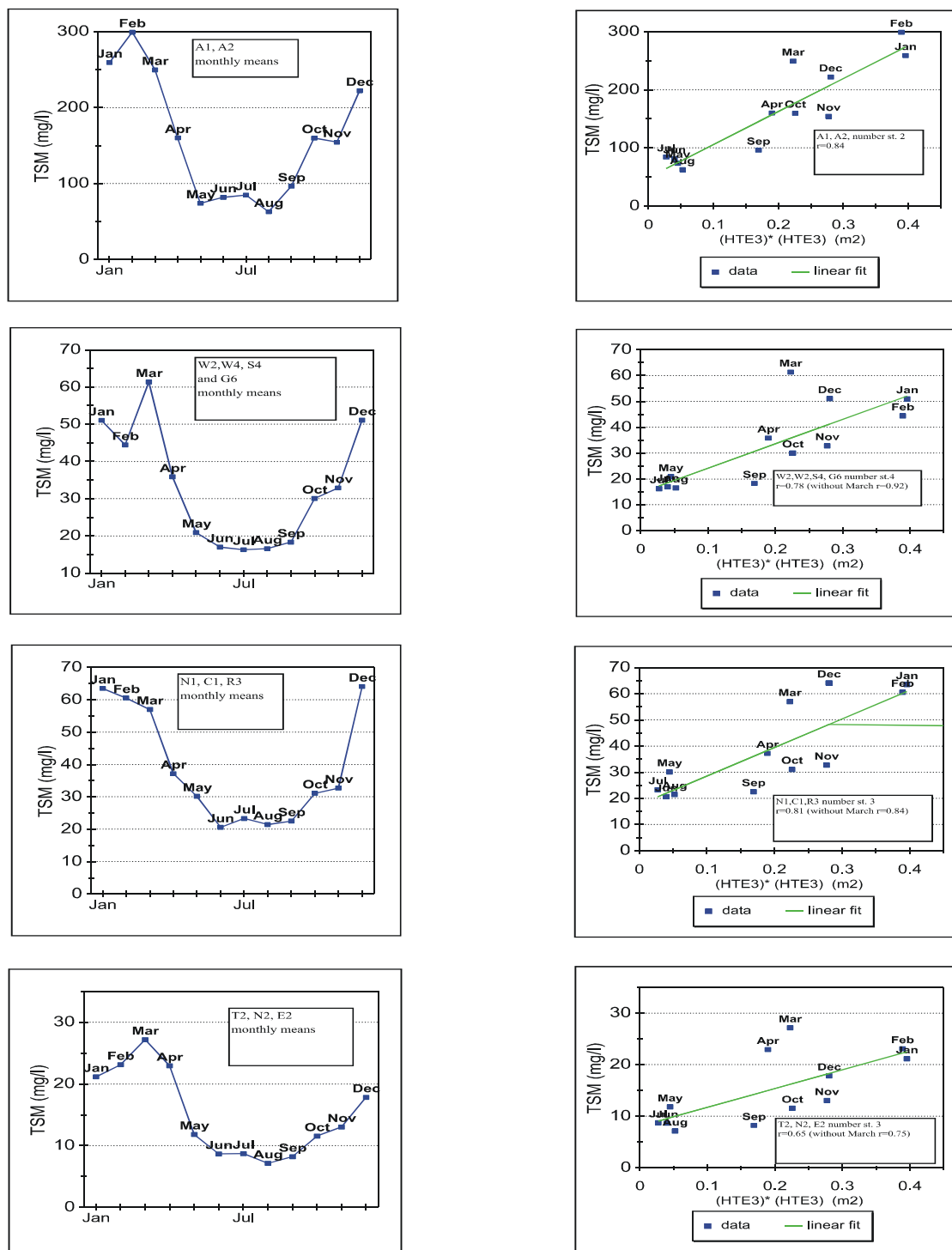


**Figure 7.1** The seasonal effects on the monthly means of the total suspended matter concentrations. The stations (1-6 km from the coast) are primarily aggregated to the yearly mean concentration. The right hand graphs show the correlation between the monthly TSM means and  $(HTE3)^2$  which is proportional to the wave energy

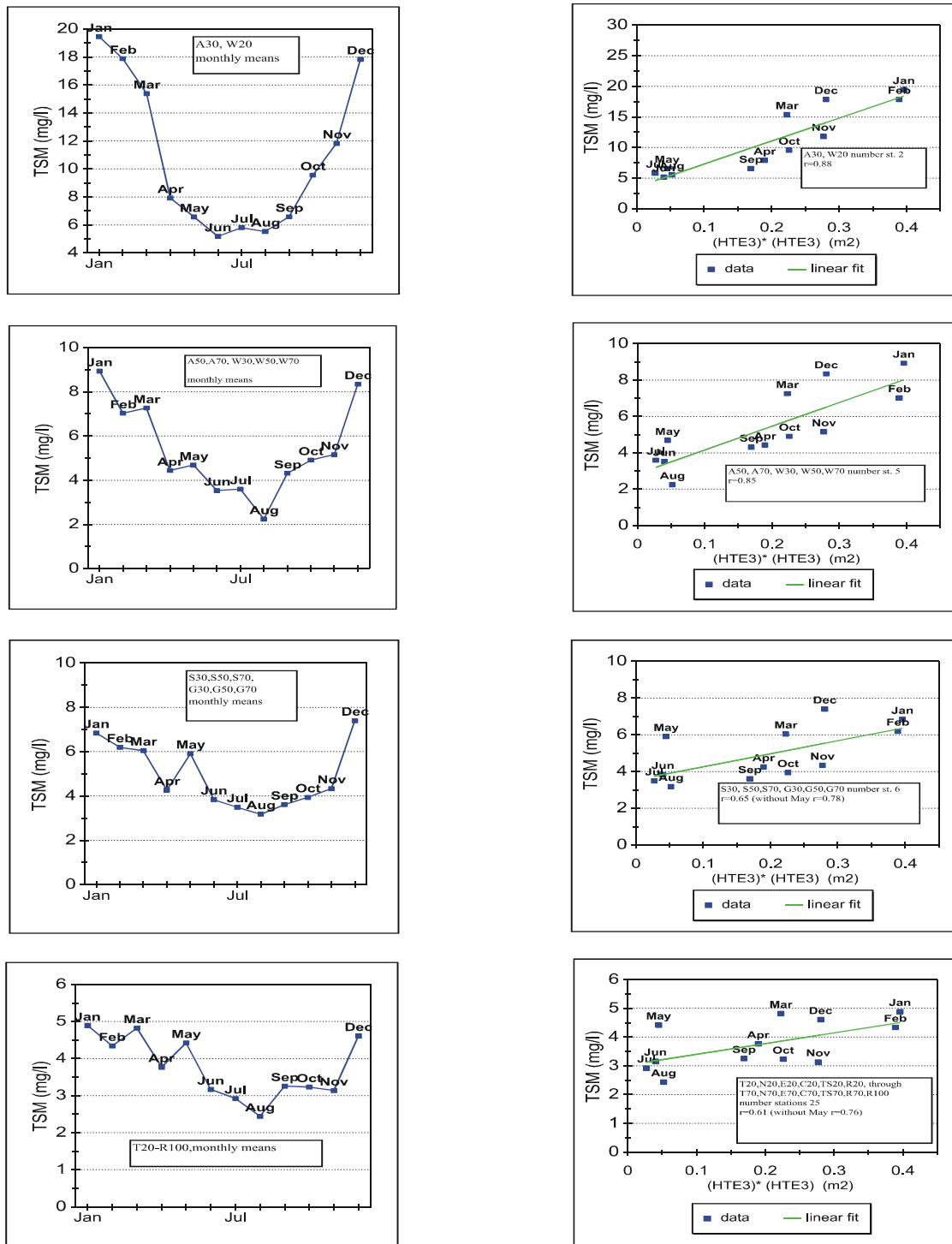


**Figure 7.2** The seasonal effects on the monthly means of the total suspended matter concentrations. The stations (20-70 km from the coast) are primarily aggregated to the yearly mean concentration. The right hand graphs show the correlation between the monthly TSM means and  $(HTE3)^2$  which is proportional to the wave energy

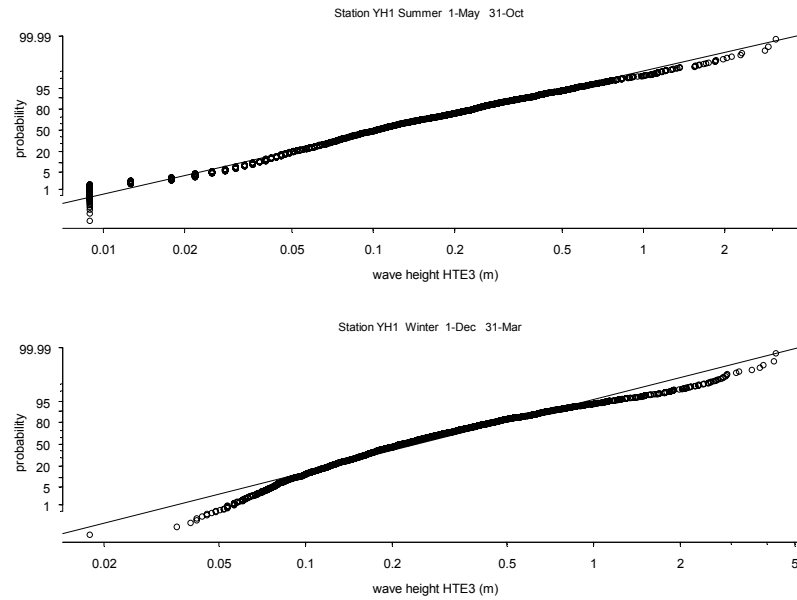


**Figure 8.1** Empirical probability distribution of the wave heights HTE3 (30...100 mHz) at the IJmuiden Munitiestortplaats station (IJM, fig. 1.1) during the period 1980-1998

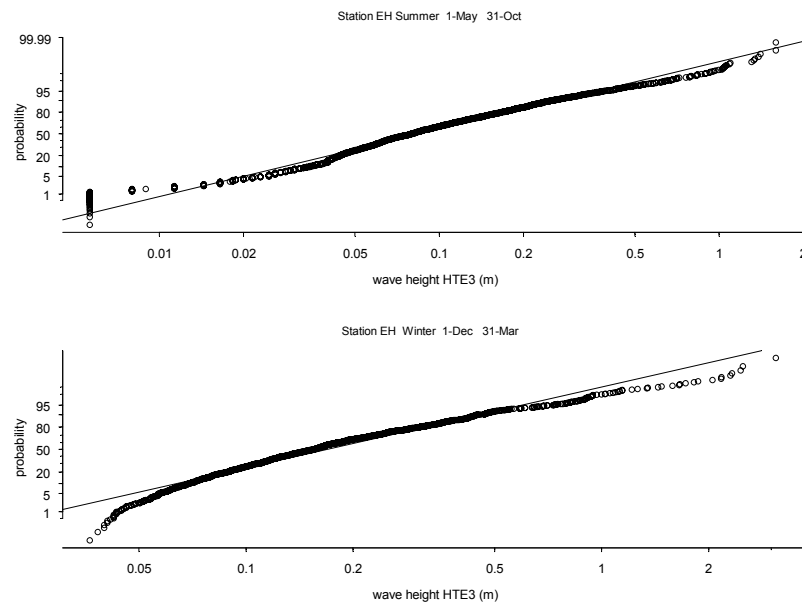


**Figure 8.2** Empirical probability distribution of the wave heights HTE3 (30...100 mHz) at the Europlatform station (EuP, fig. 1.1) during the period 1985-1998

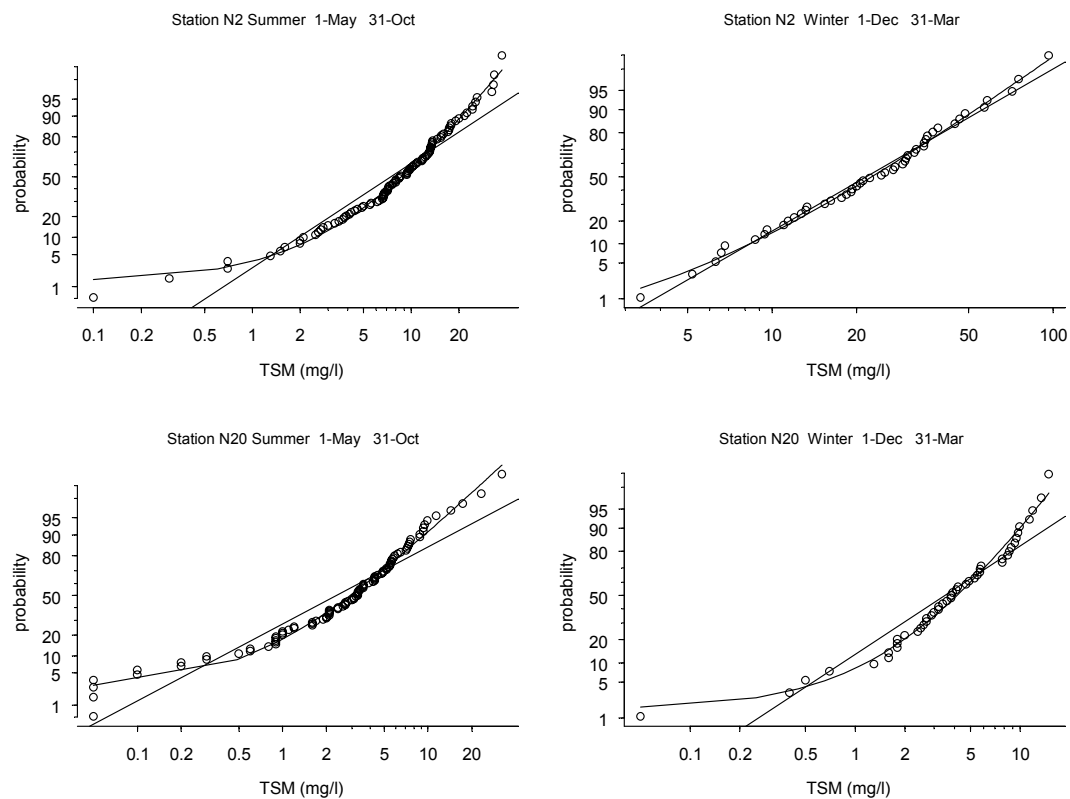


**Figure 9** Empirical probability distributions of TSM at the stations N2 and N20. The straight lines represent the best fits to the data according to a Lognormal distribution (LN). The curved lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

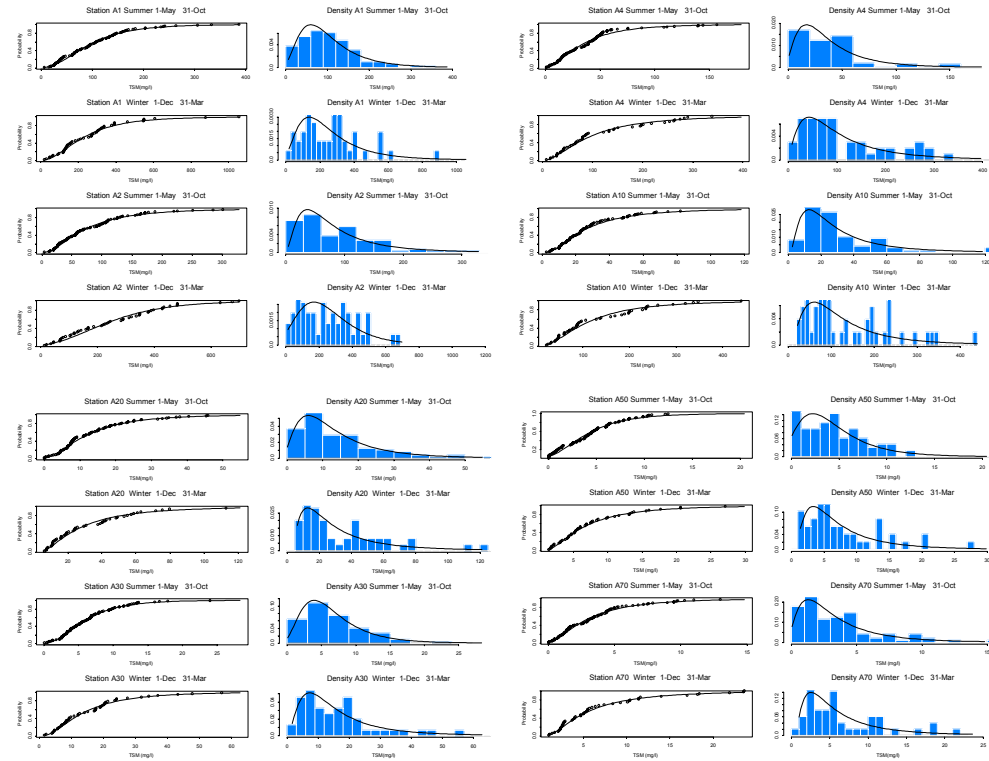


**Figure 9.1** Cumulative and density TSM distributions at the stations of the A-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

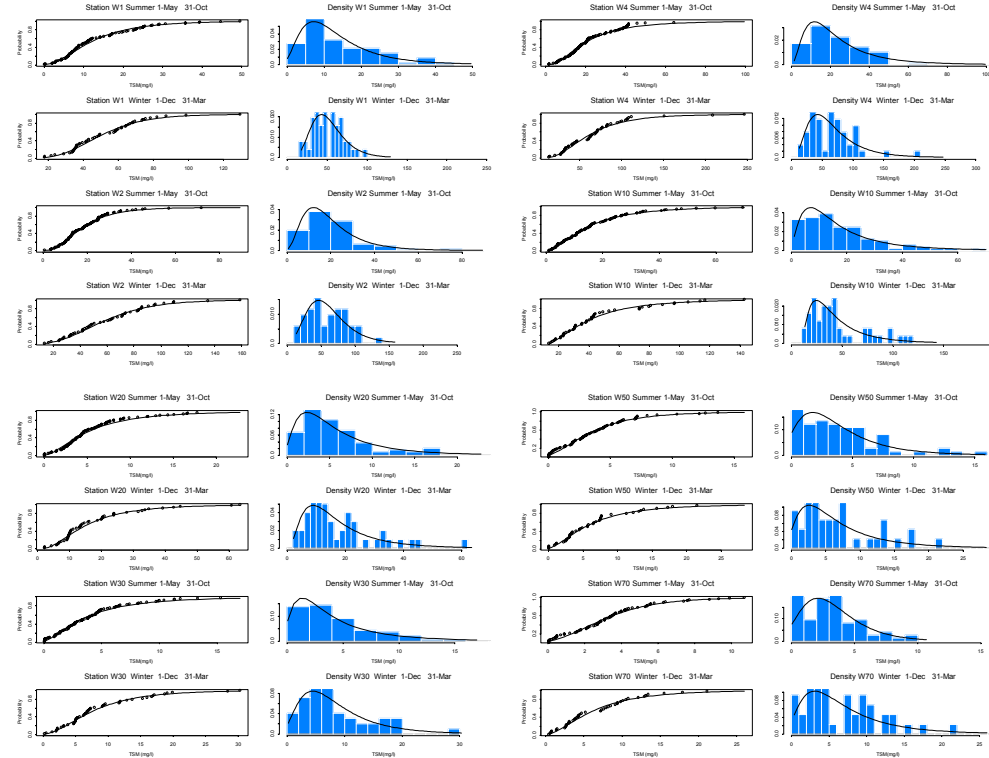


**Figure 9.2** Cumulative and density TSM distributions at the stations of the W-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

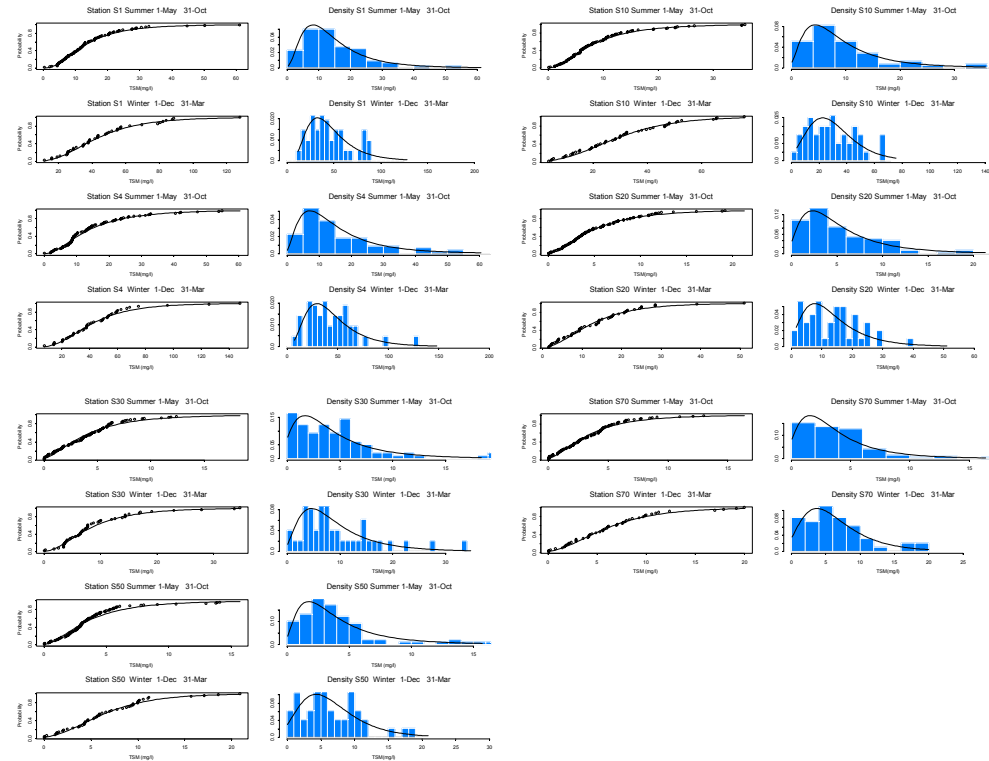


**Figure 9.3** Cumulative and density TSM distributions at the stations of the S-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

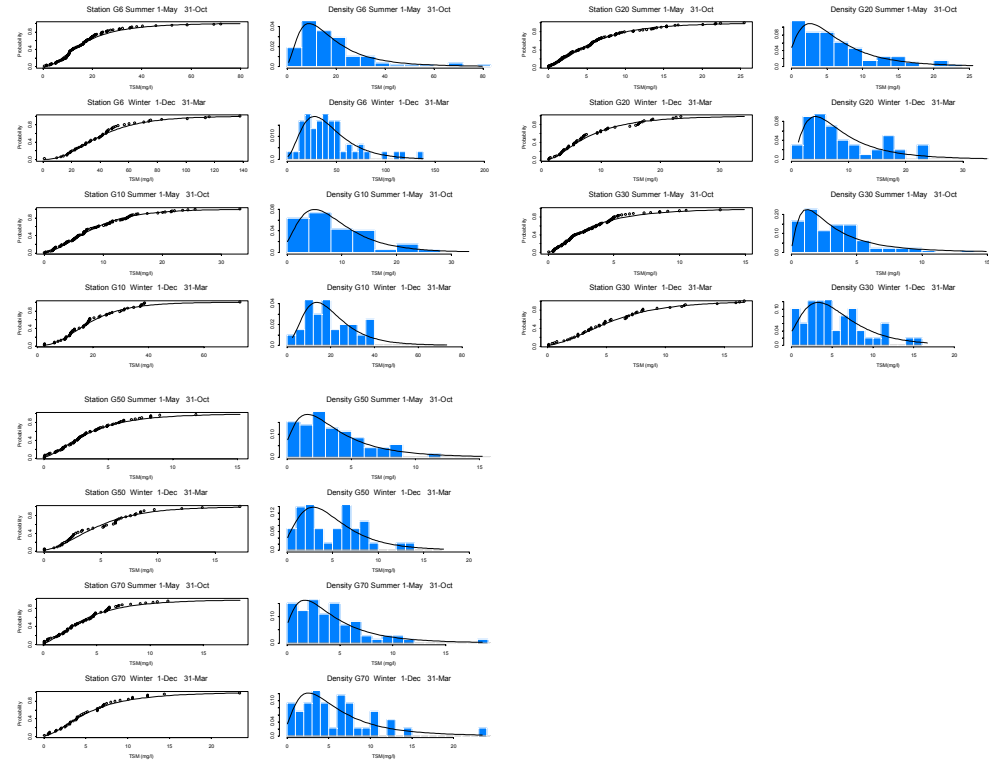


**Figure 9.4** Cumulative and density TSM distributions at the stations of the G-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

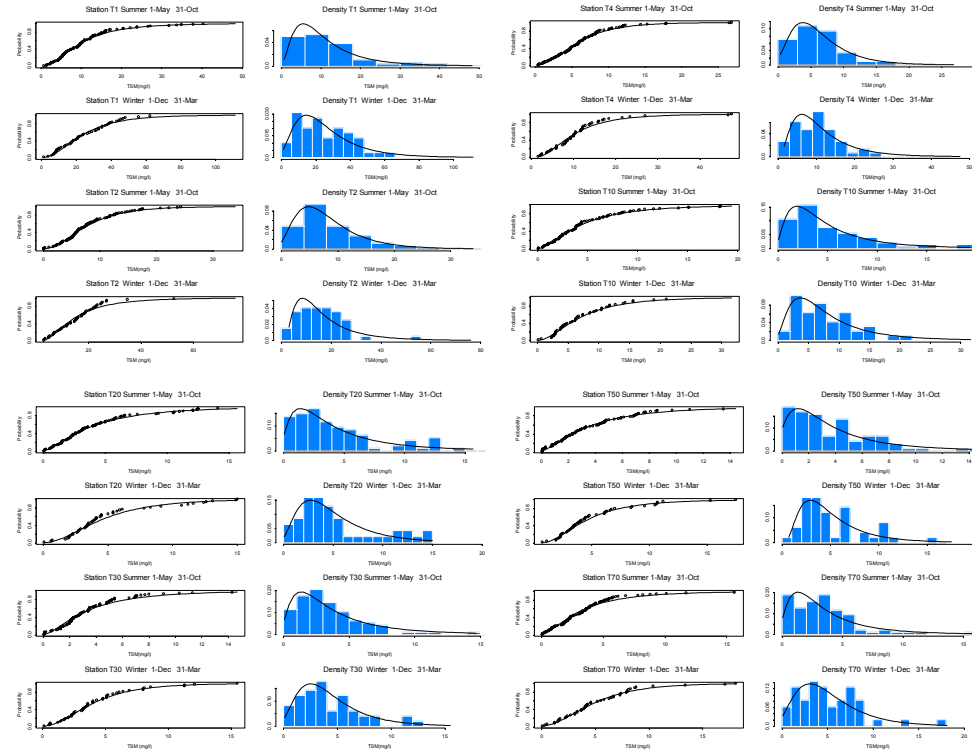


**Figure 9.5** Cumulative and density TSM distributions at the stations of the T-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

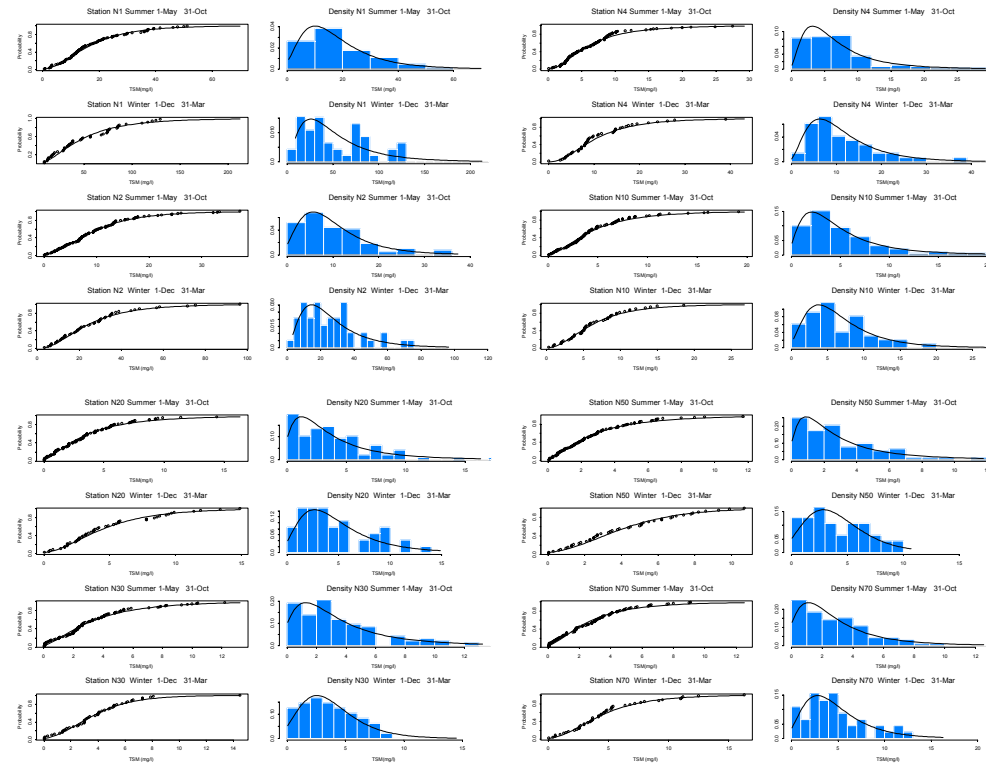


**Figure 9.6** Cumulative and density TSM distributions at the stations of the N-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

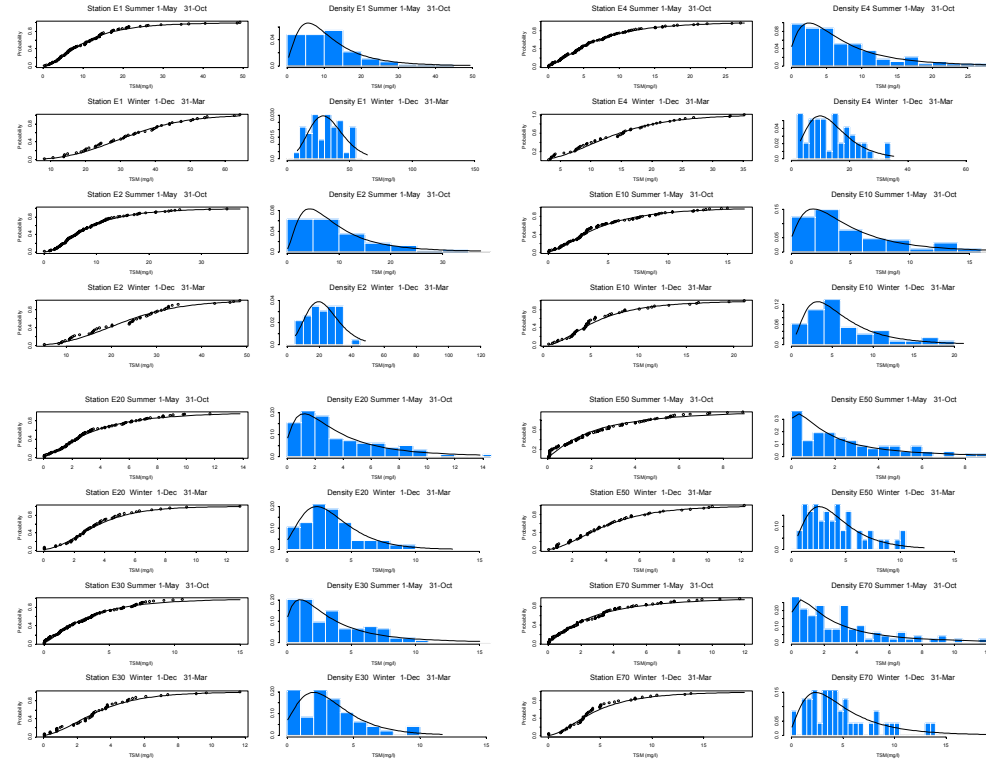


**Figure 9.7** Cumulative and density TSM distributions at the stations of the E-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

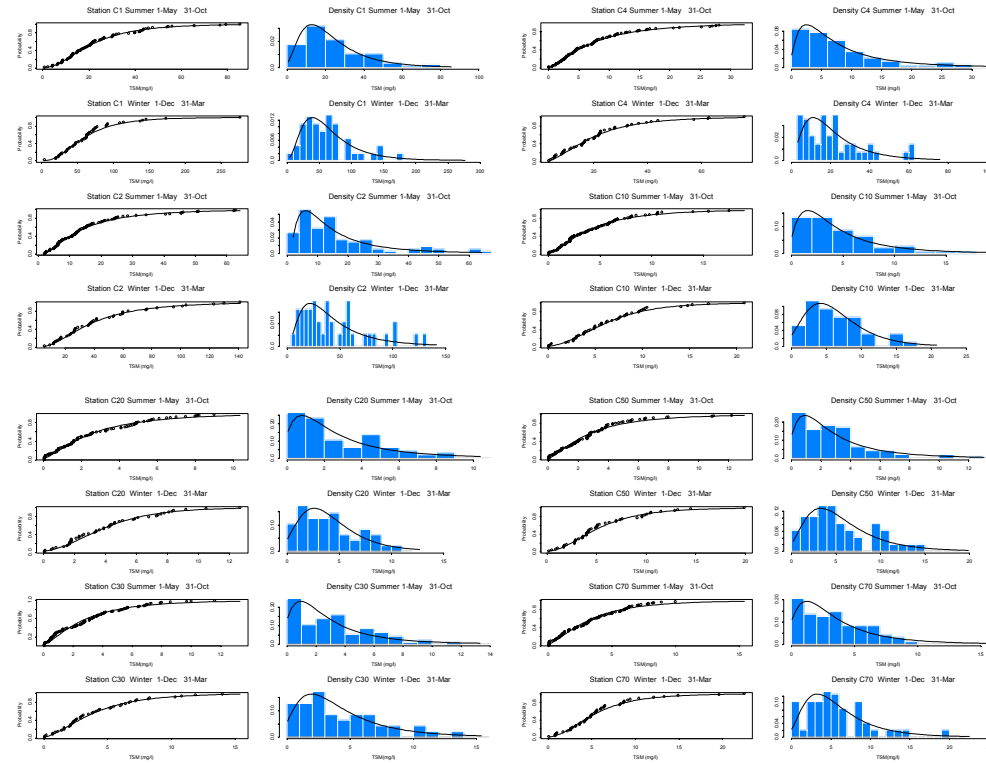


**Figure 9.8** Cumulative and density TSM distributions at the stations of the C-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

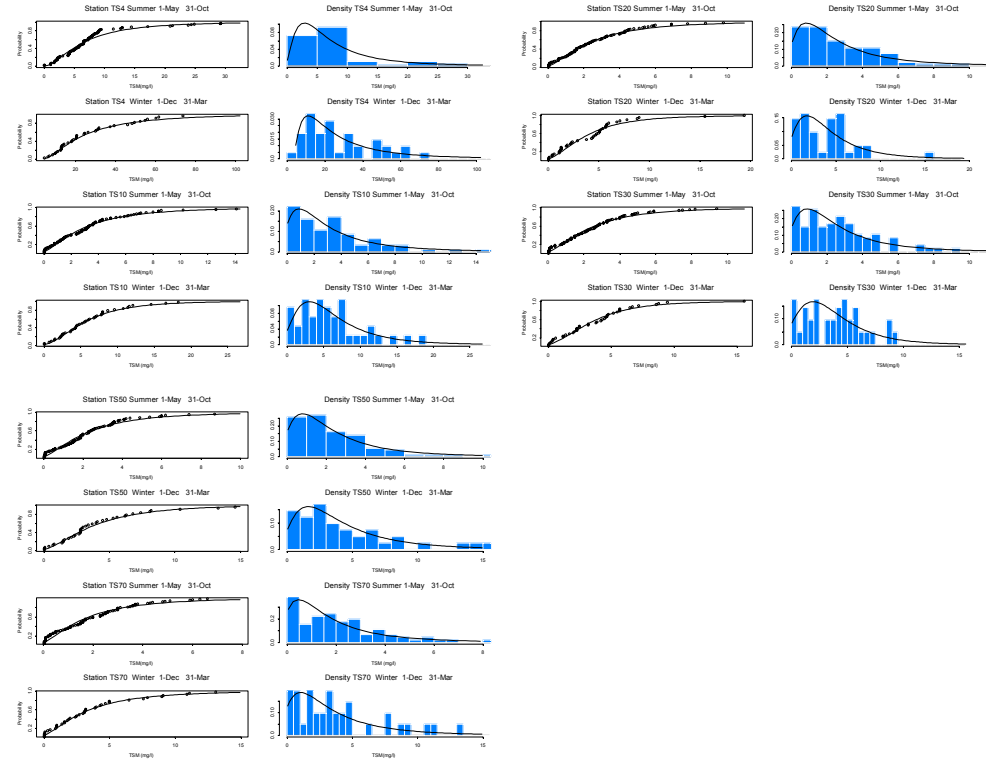


**Figure 9.9** Cumulative and density TSM distributions at the stations of the TS-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

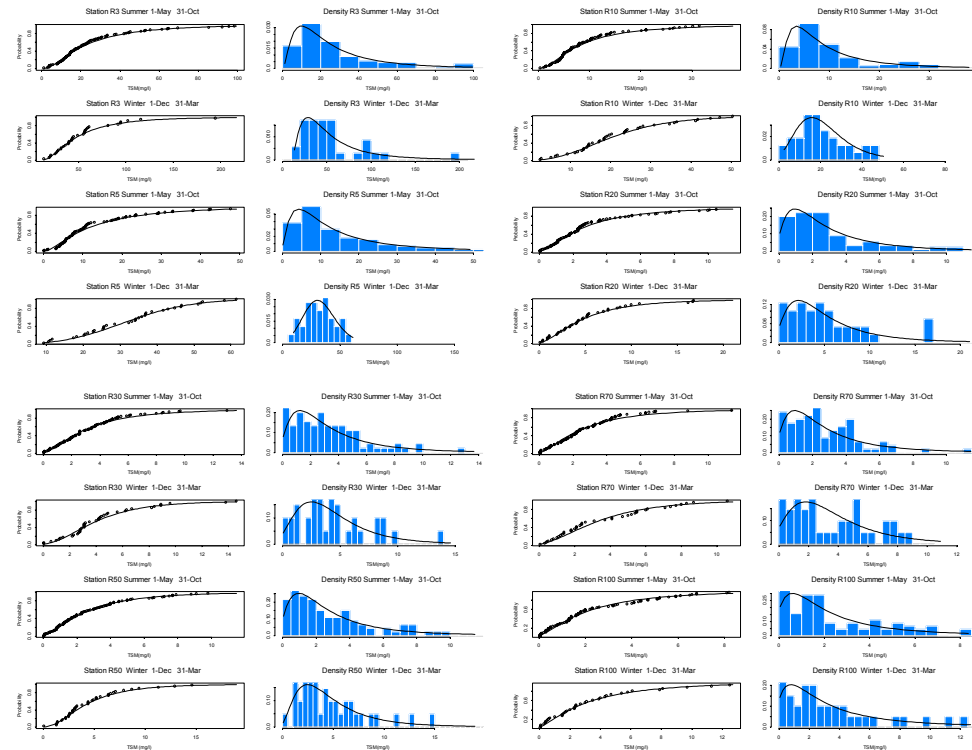


**Figure 9.10** Cumulative and density TSM distributions at the stations of the R-transect. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

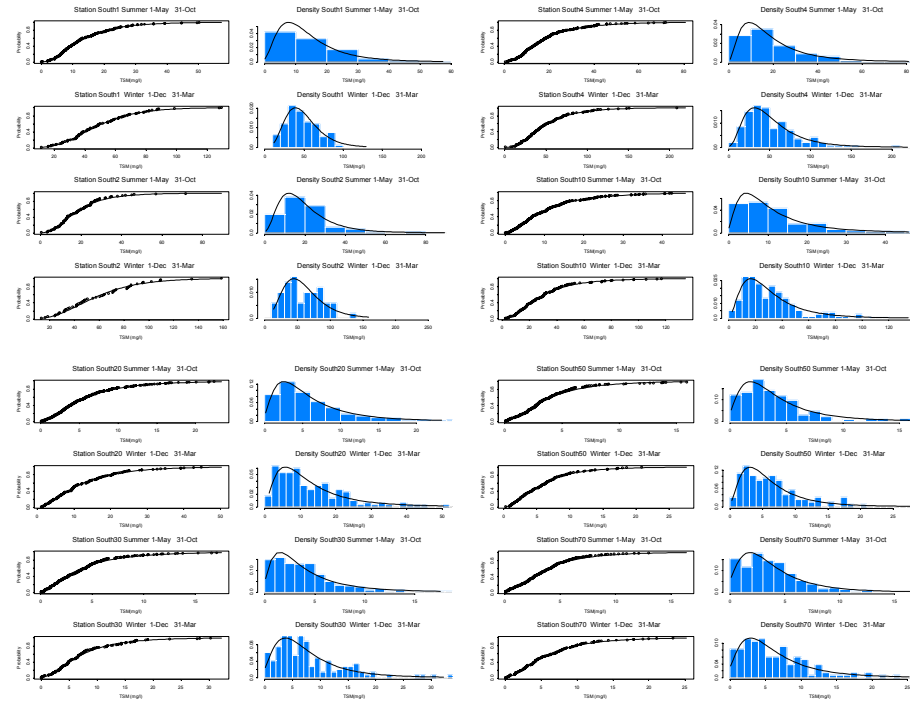


**Figure 10.1** Cumulative and density TSM distributions at the virtual stations South in the virtual transect South. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3) Sample sizes are in the order of 250 and 120 for the Summer and Winter period, respectively

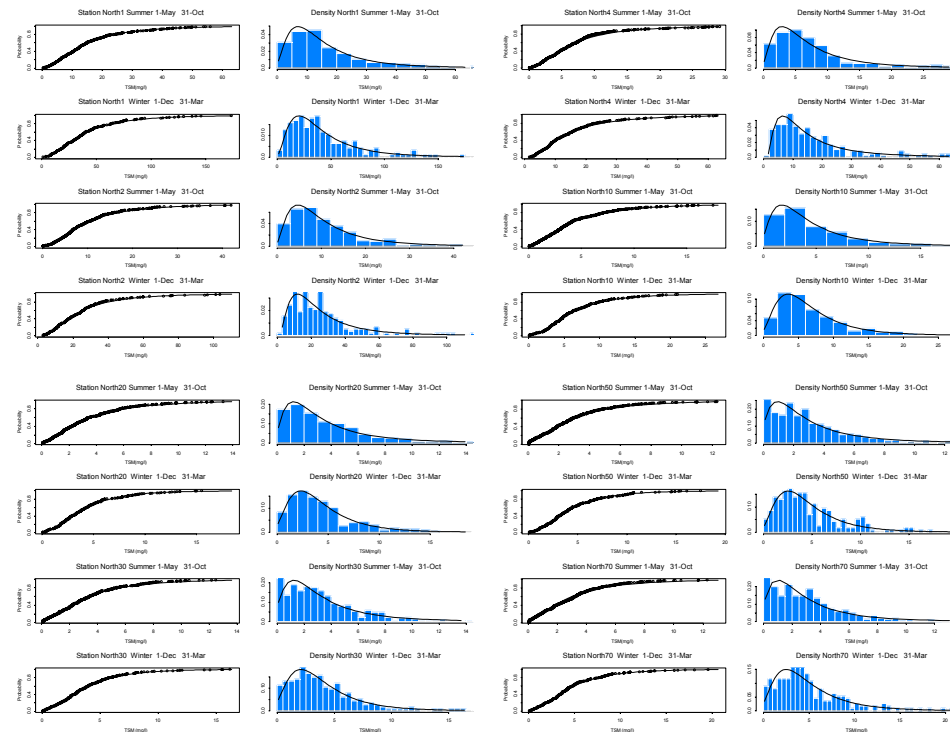


**Figure 10.2** Cumulative and density TSM distributions at the virtual stations North in the virtual transect North. The lines are fits through the data according to a three-parameter Lognormal distribution (LN3) Sample sizes are in the order of 450 and 220 for the Summer and Winter period, respectively

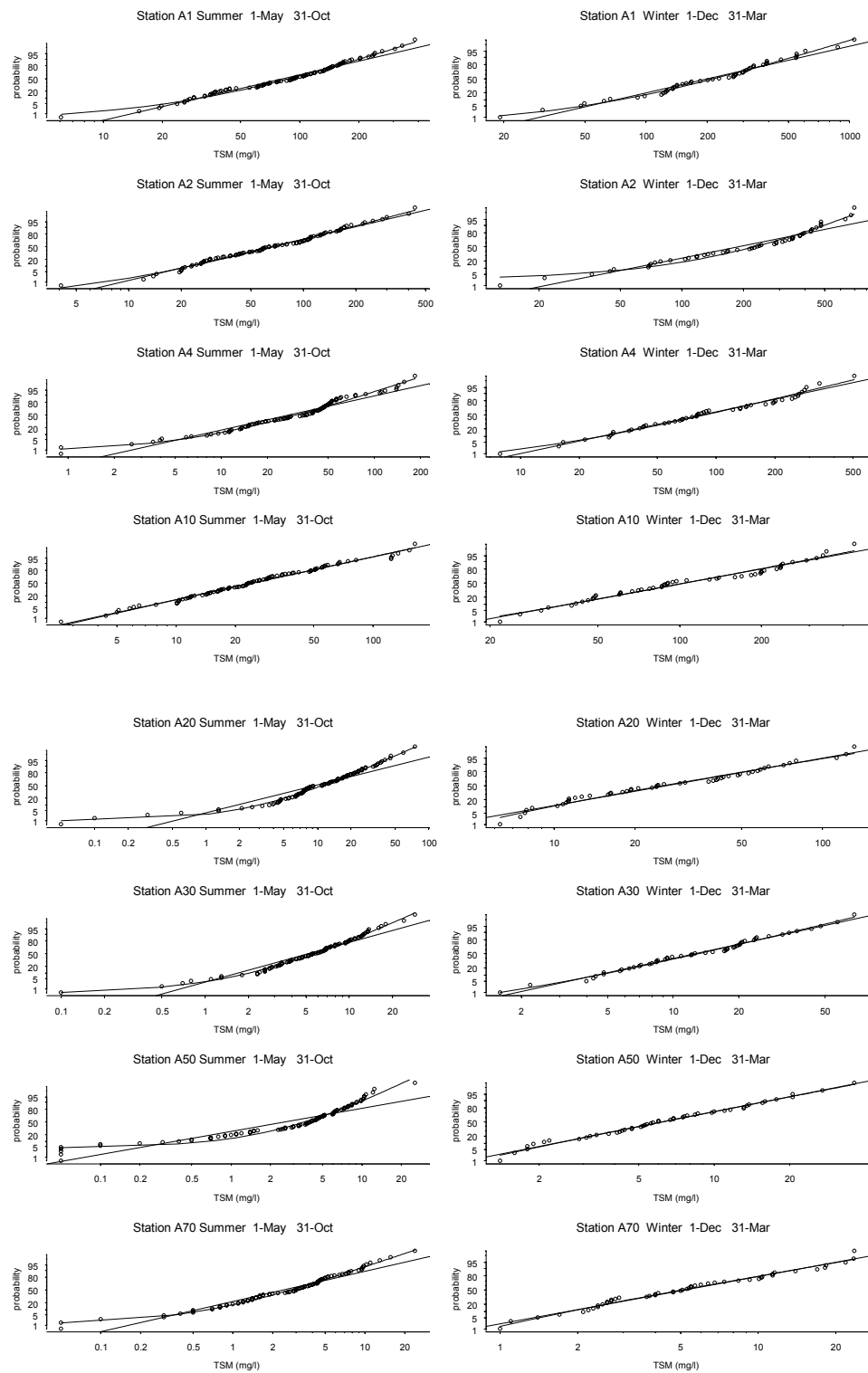


**Figure 11.1** Summer and winter probability distributions of TSM at the stations in the A-transect. The straight lines represent the best fits to the data according to a Lognormal distribution (LN). The curved lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

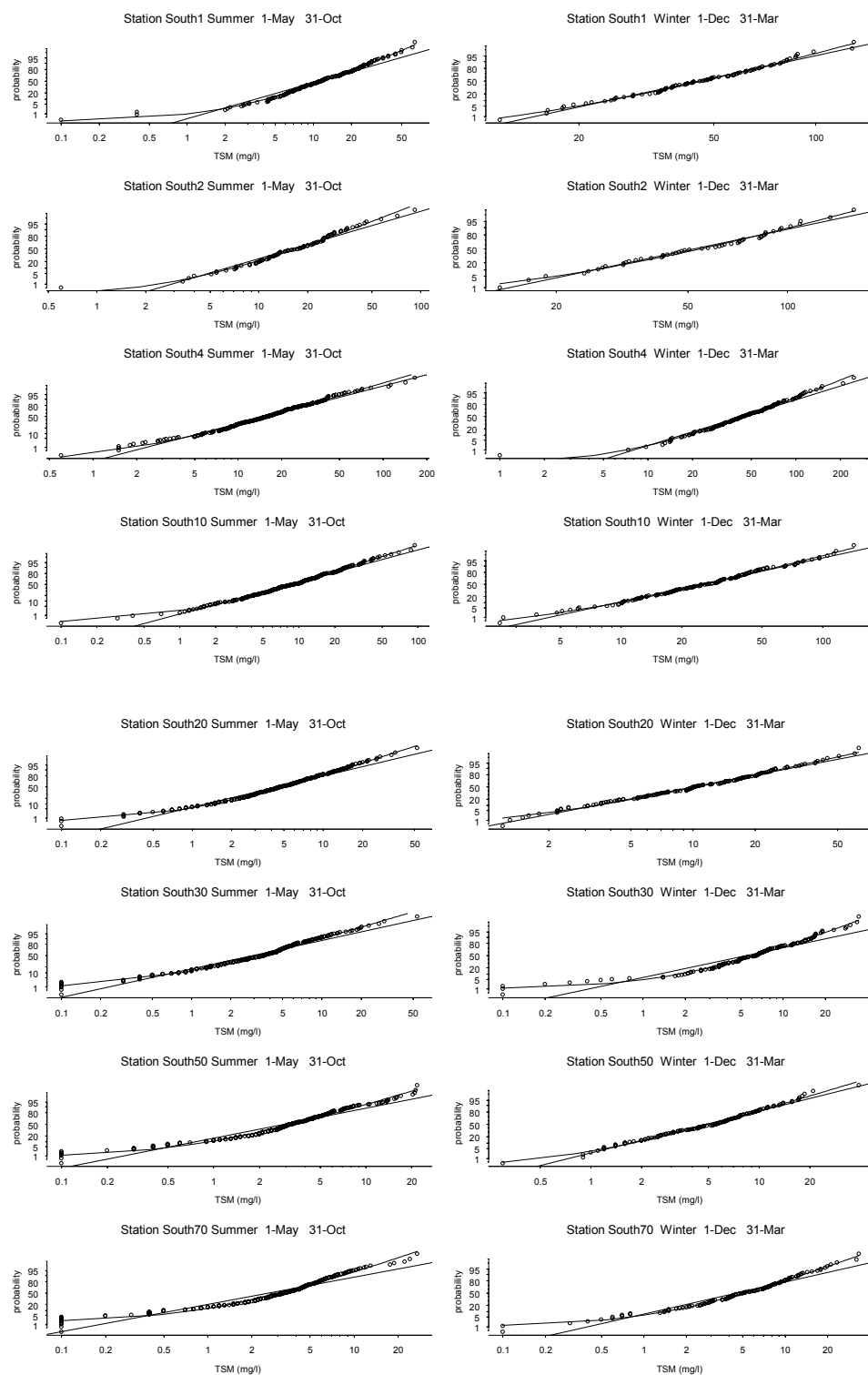


**Figure 11.2** Summer and winter probability distributions of TSM at the stations in the transects W through G (region South). The straight lines represent the best fits to the data according to a Lognormal distribution (LN). Curved lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

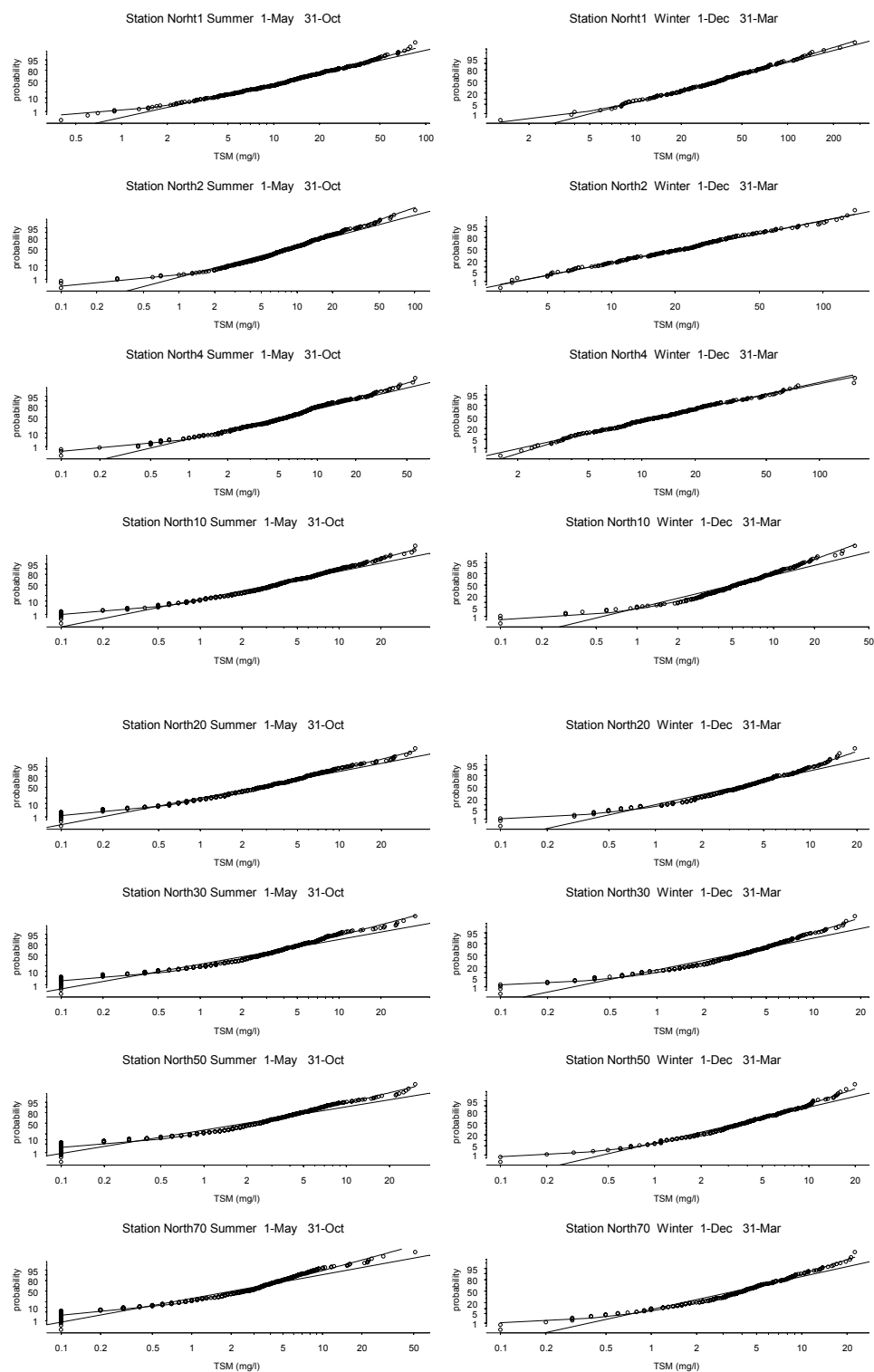


**Figure 11.3** Summer and winter probability distributions of TSM at the stations in the transects T through TS (region North). The straight lines represent the best fits to the data according to a Lognormal distribution (LN). Curved lines are fits through the data according to a three-parameter Lognormal distribution (LN3)

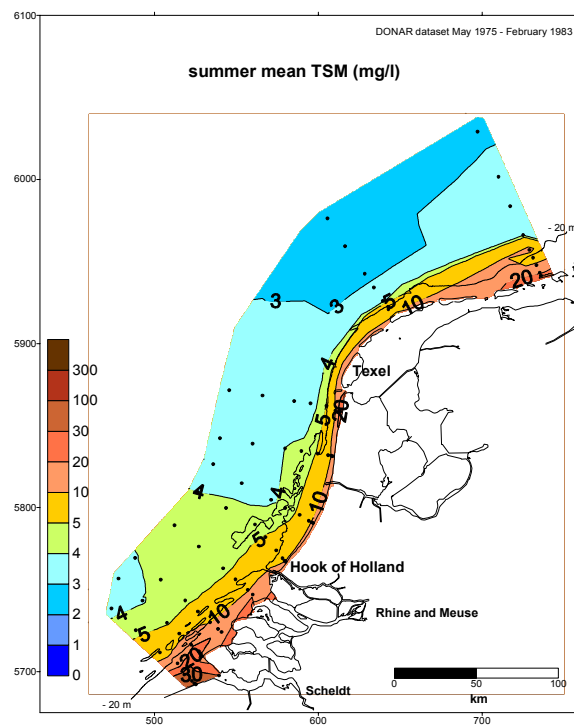


Figure 12.1 Summer mean of total suspended matter concentrations

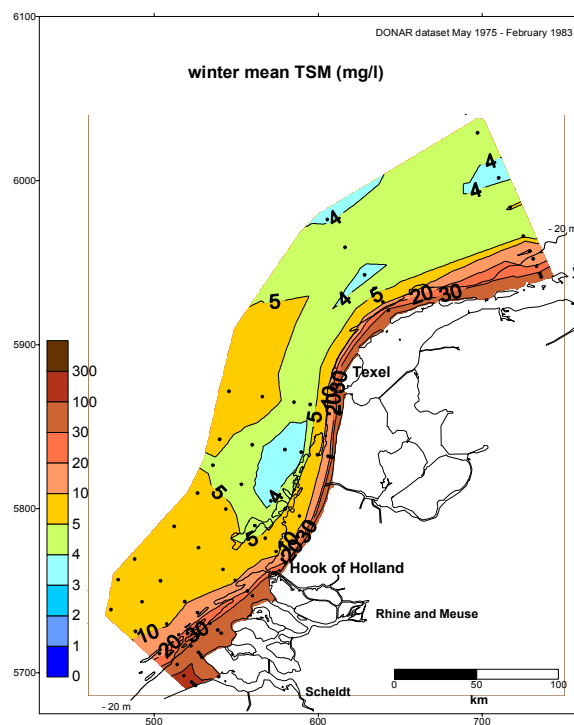


Figure 12.2 Winter mean of total suspended matter concentrations

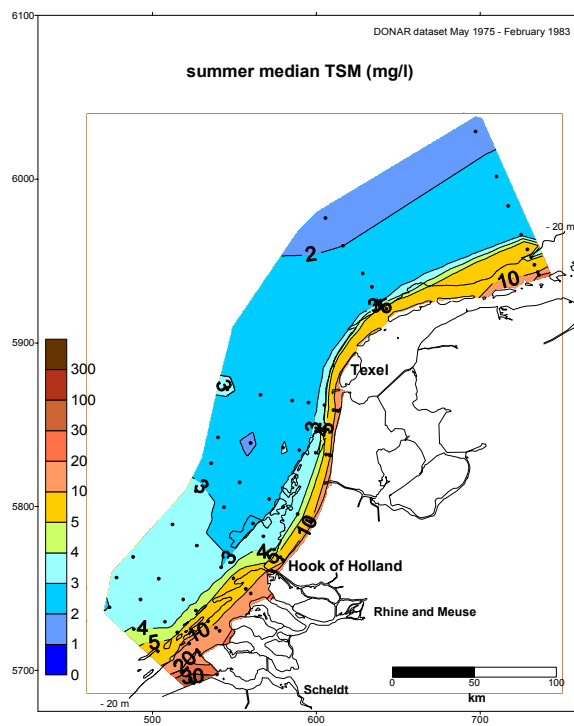


Figure 13.1 Summer median of total suspended matter concentrations

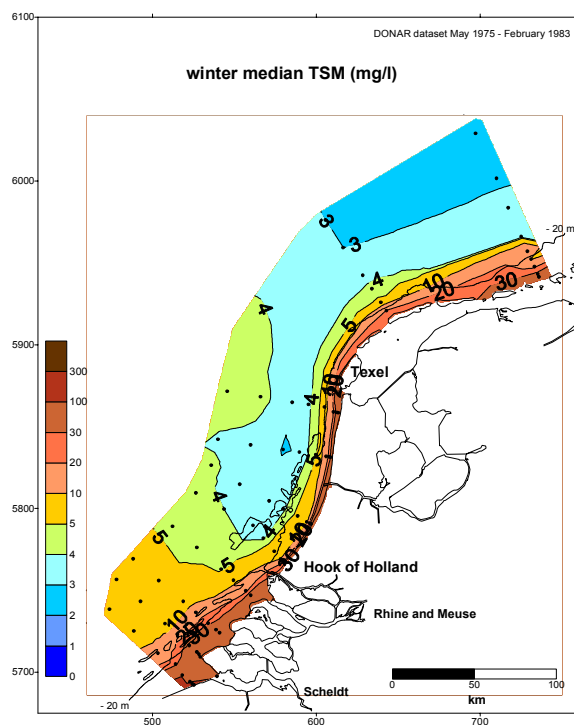


Figure 13.2 Winter median of total suspended matter concentrations

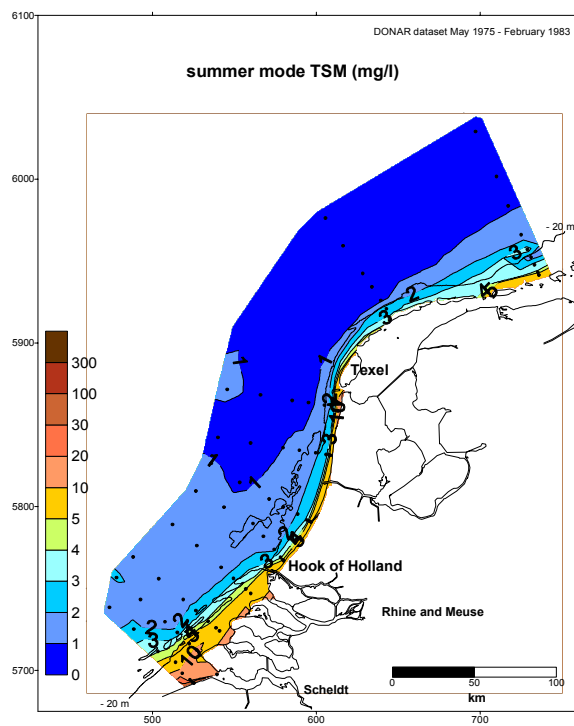


**Figure 14.1** Summer mode of total suspended matter concentrations

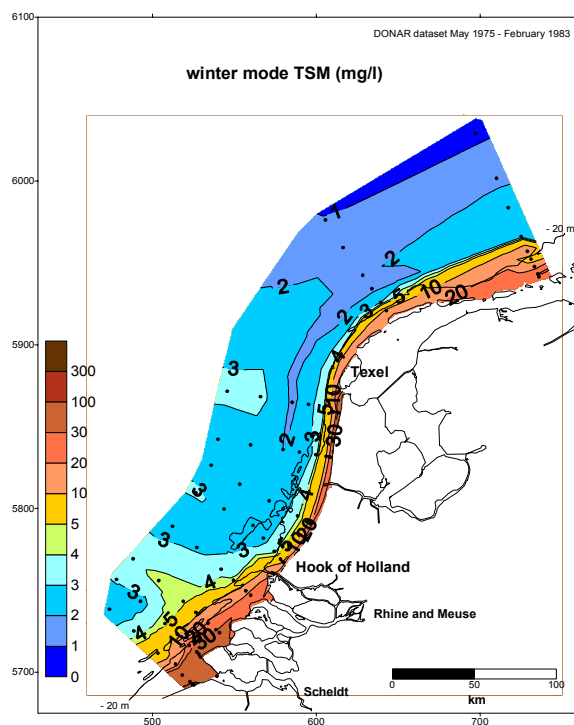


**Figure 14.2** Winter mode of total suspended matter concentrations

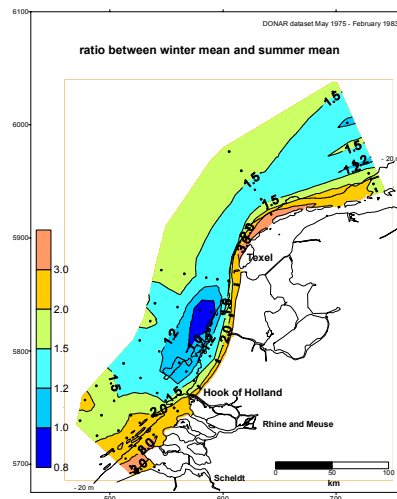


**Figure 15** Ratio between the Winter and Summer mean of total suspended matter concentrations.

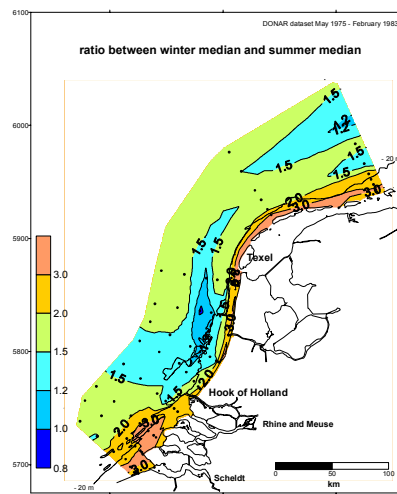


**Figure 16** Ratio between the Winter and Summer median of total suspended matter concentrations

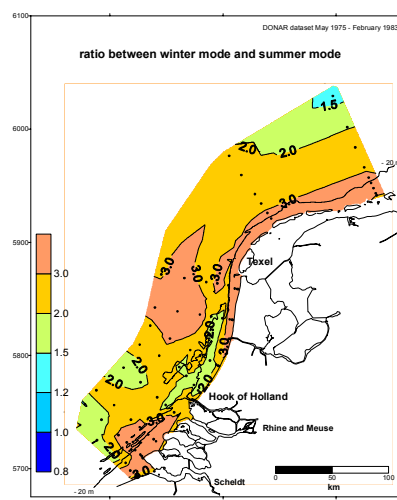


**Figure 17** Ratio between the Winter and Summer mode of total suspended matter concentrations

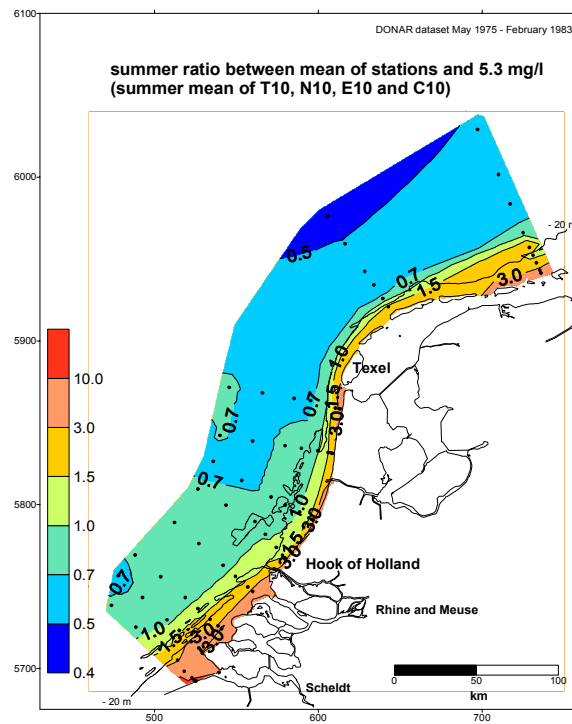


**Figure 18.1** Ratios between Summer mean TSM values per station and a reference TSM of 5.3 mg/l (=summer mean of the stations T10, N10, E10 and C10)

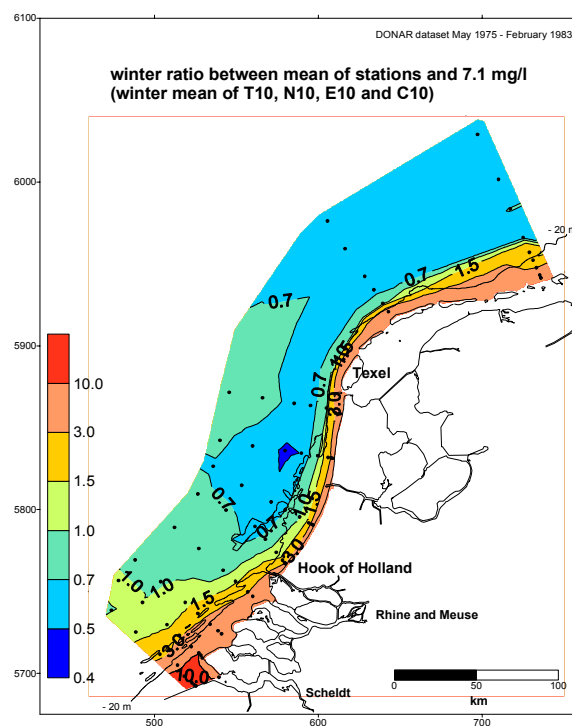


**Figure 18.2** Ratios between Winter mean TSM values per station and a reference TSM of 7.1 mg/l (=winter mean of the stations T10, N10, E10 and C10)

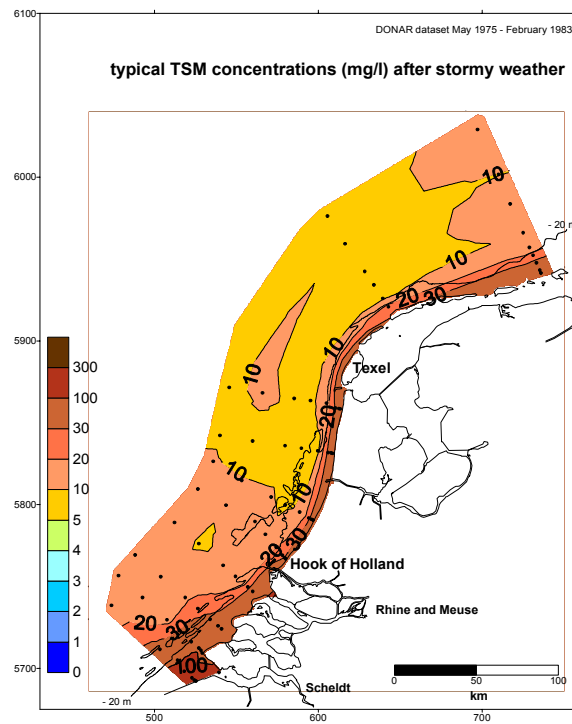


**Figure 19** Mean TSM (mg/l) distribution of the surveys starting on 5 April 1977, 7 January 1981, 9 February 1981 and 23 February 1981. This distribution is representative for situations shortly after stormy weather

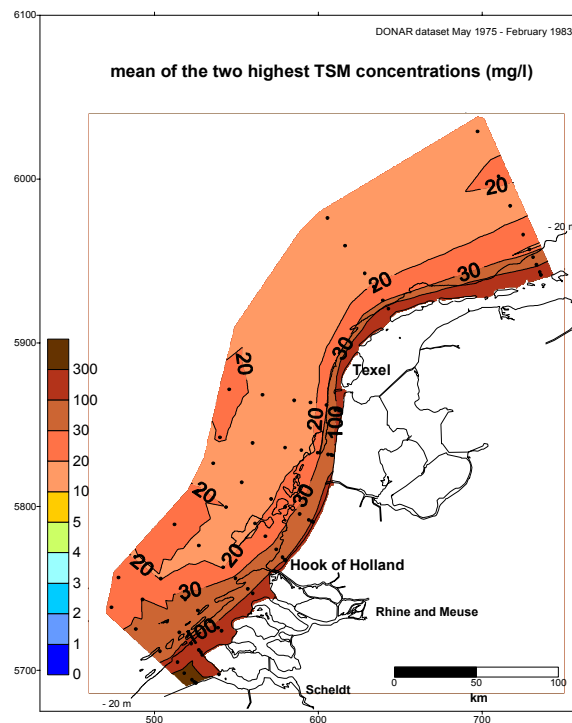


**Figure 20** TSM (mg/l) distribution based on the mean of the observed two highest values per station

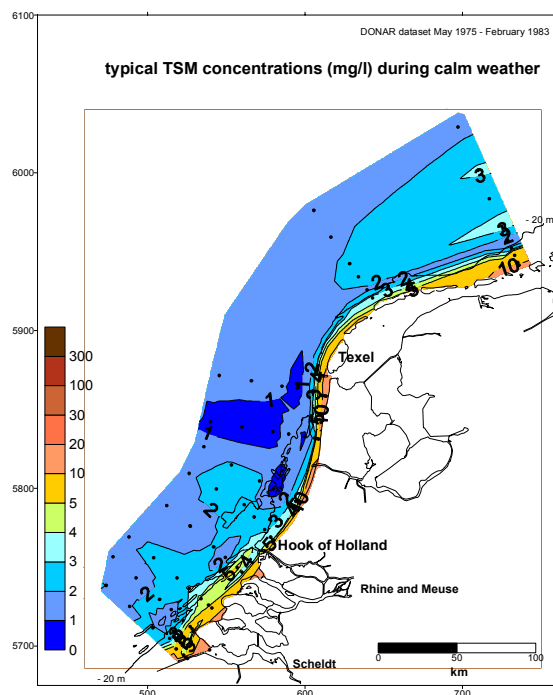


**Figure 21** Mean TSM (mg/l) distribution of the surveys starting on 28 July 1978, 13 July 1981, 7 September 1981, and 17 May 1982. This distribution is representative for situations during calm summer weather

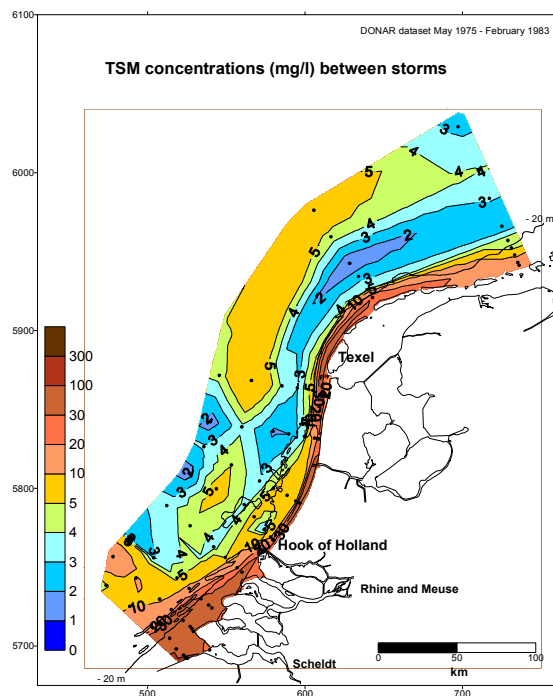


**Figure 22** Mean TSM (mg/l) distribution of the surveys starting on 22 March 1977 and 22 January 1981. The surveys were performed before the storms that delivered the high TSM values of the surveys of 5 April 1977 and 9 February 1981 (c.f. Fig. 19)

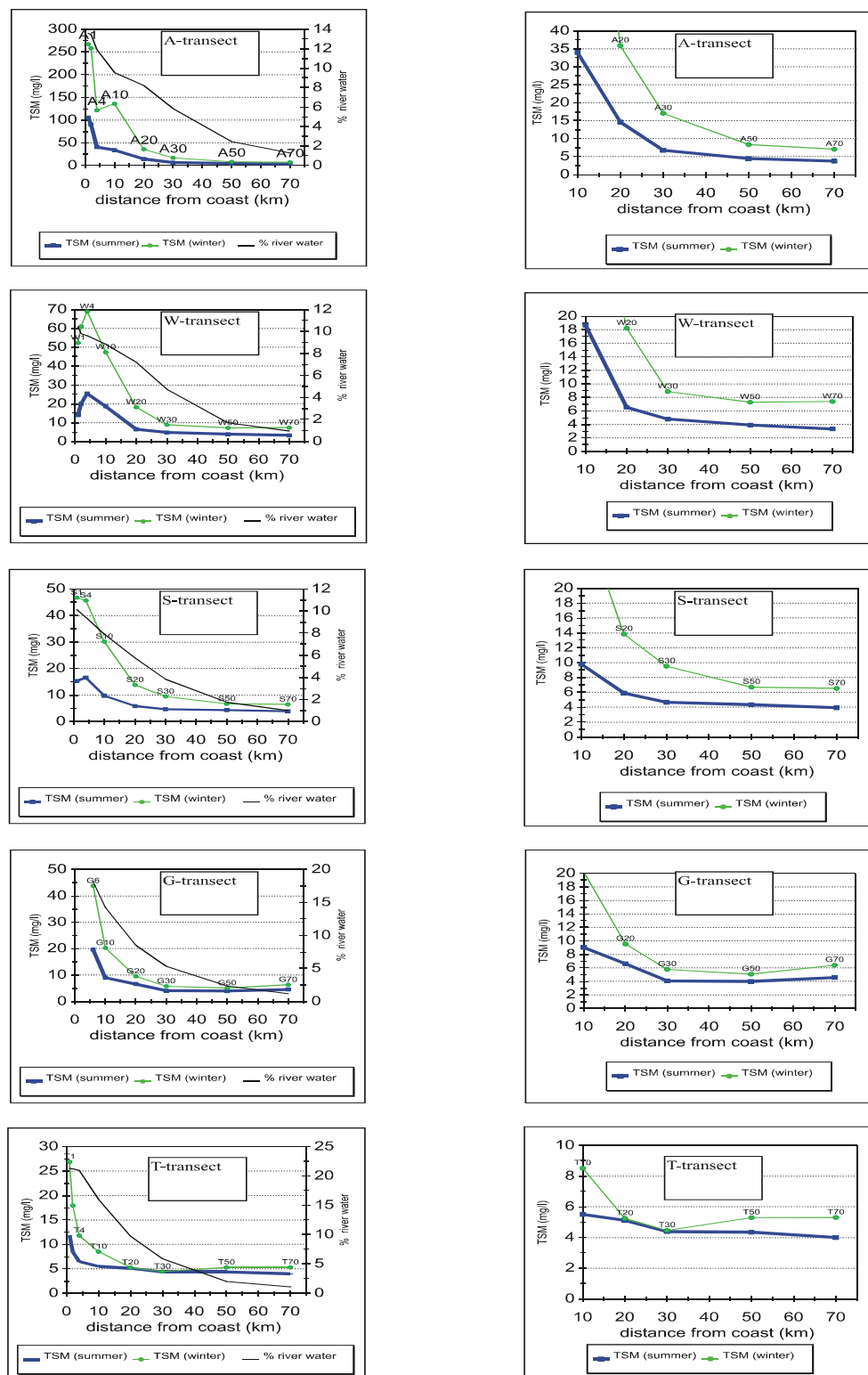


**Figure 23.1** Seasonal mean total suspended matter concentrations and yearly mean values of river water percentages as a function of cross-shore distance. The right hand graphs are concentrated on stations between 10 and 70 km

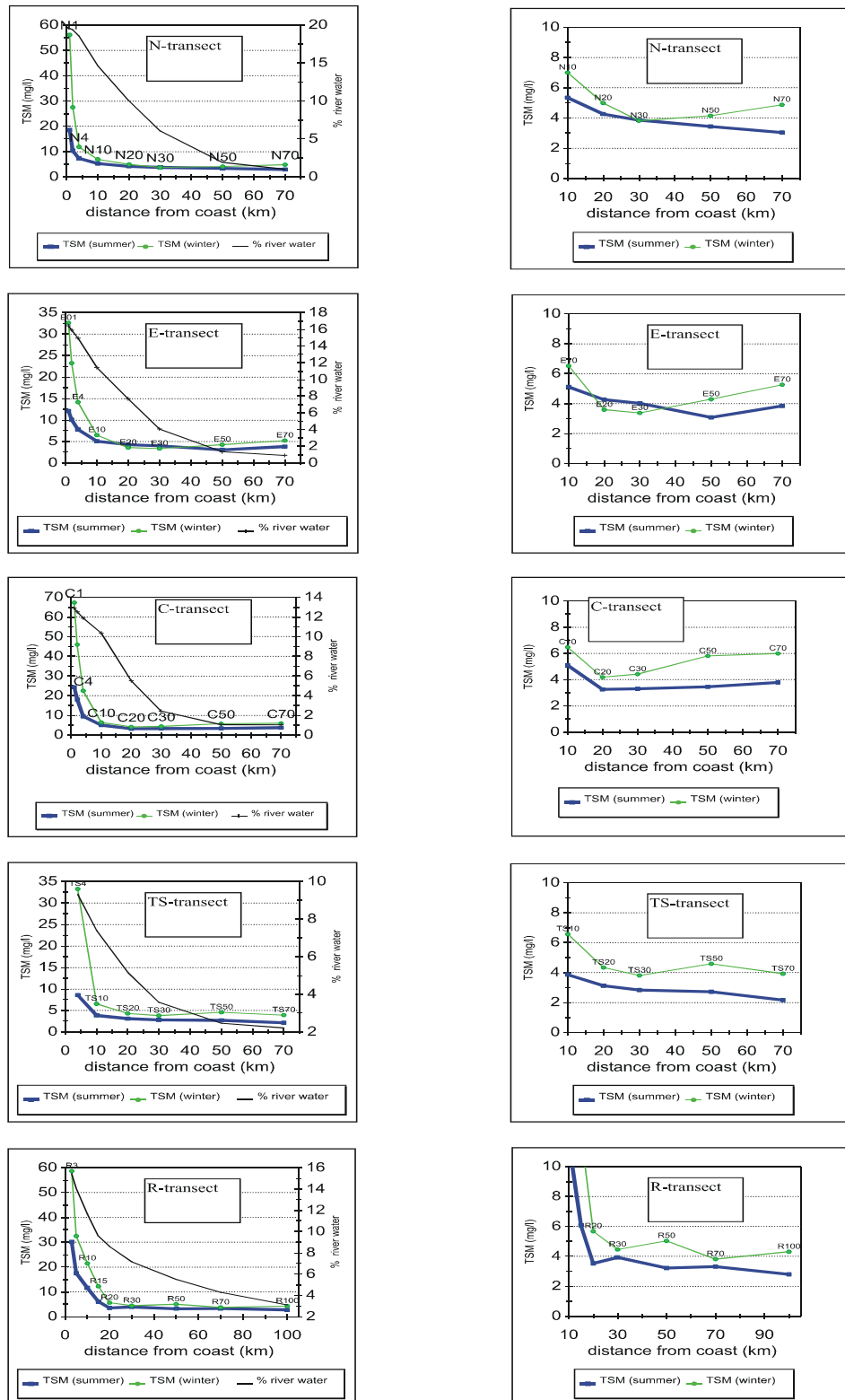


**Figure 23.2** Seasonal mean total suspended matter concentrations and yearly mean values of river water percentages as a function of cross-shore distance. The right hand graphs are concentrated on stations between 10 and 100 km

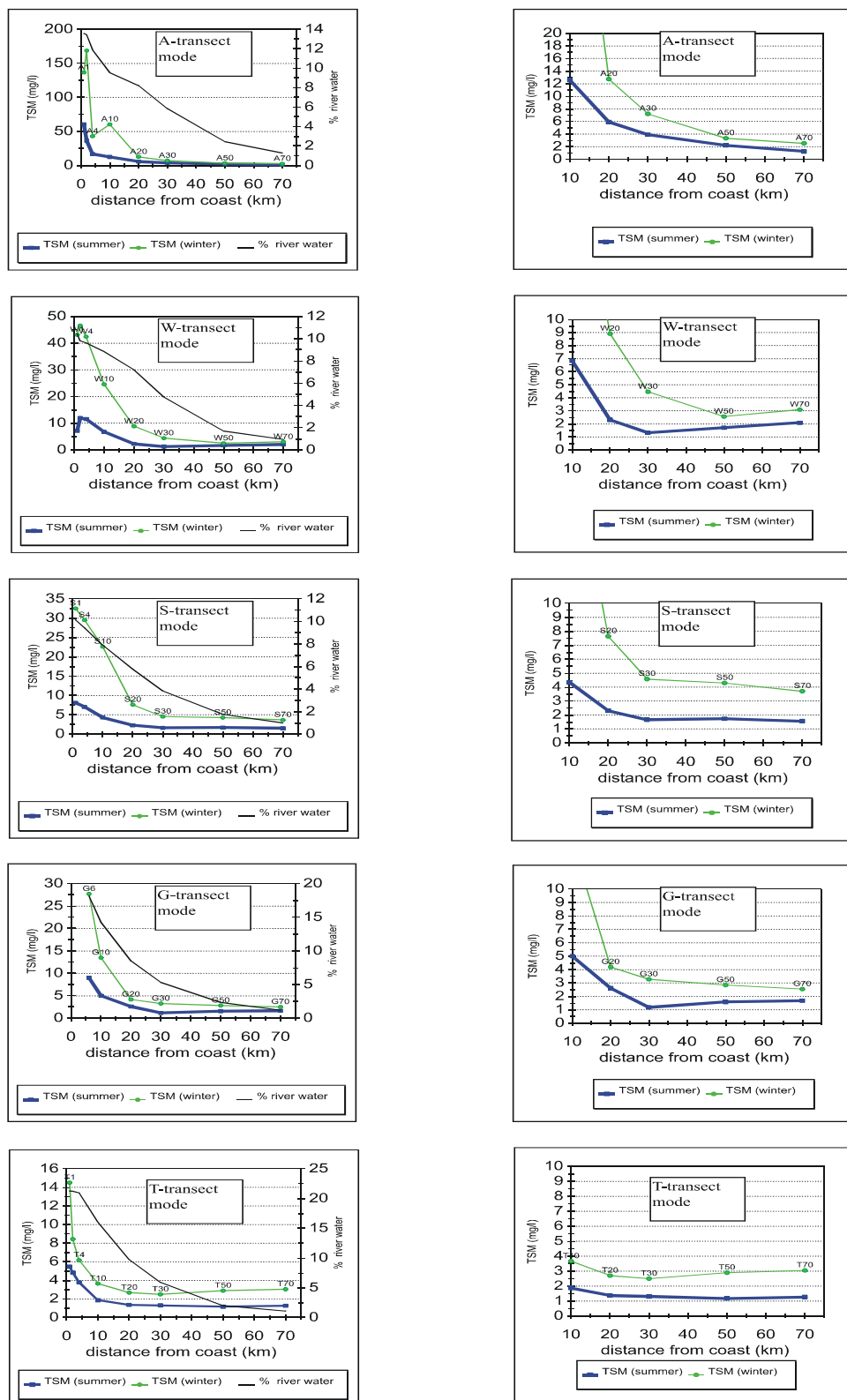


**Figure 24.1** Cross-shore gradients of the seasonal mode of total suspended matter concentrations and yearly mean of river water percentages as a function of cross-shore distance. The right hand graphs are concentrated on stations between 10 and 70 km

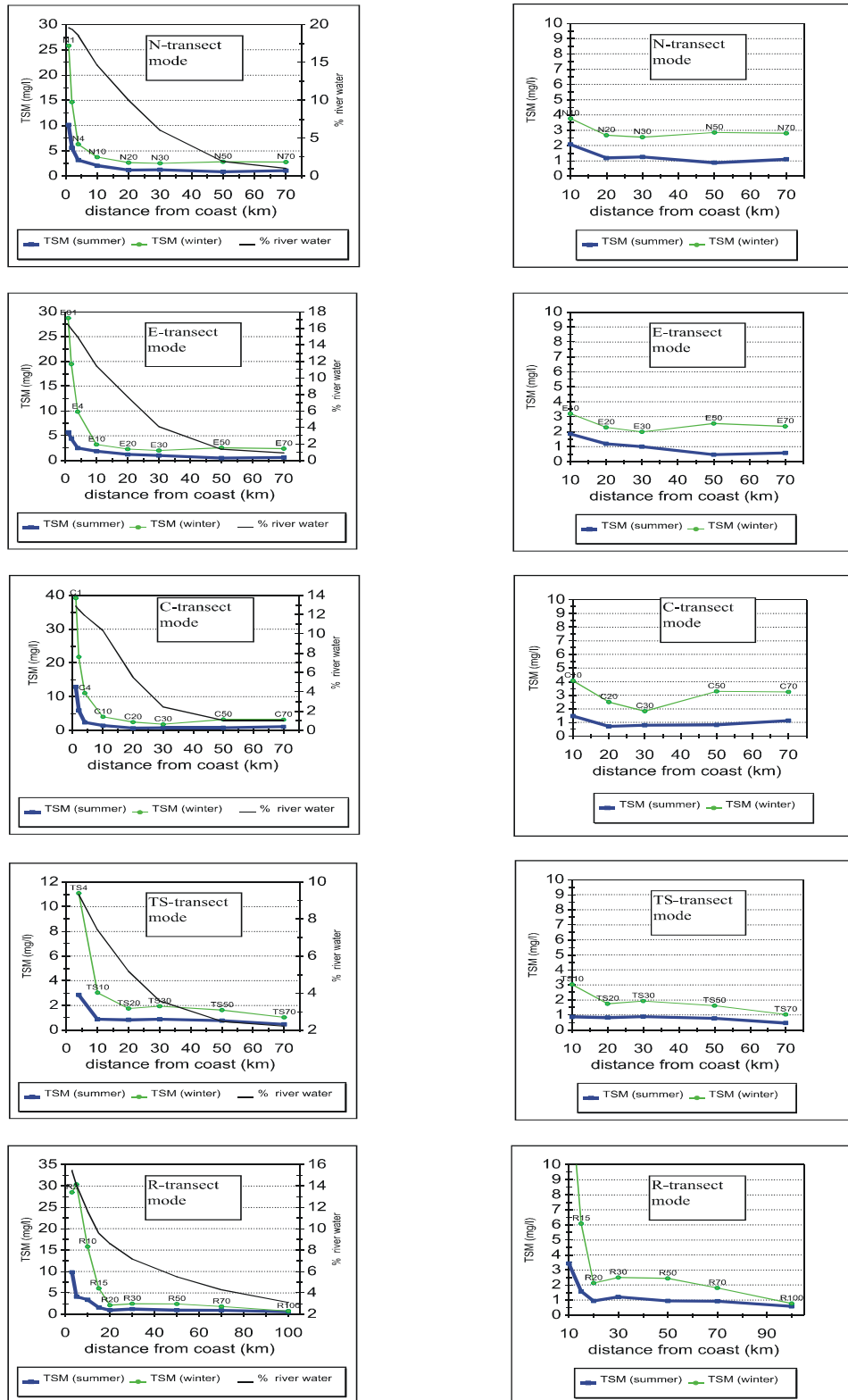


**Figure 24.2** Cross-shore gradients of the seasonal mode of total suspended matter concentrations and yearly mean of river water percentages as a function of cross-shore distance. The right hand graphs are concentrated on stations between 10 and 100 km

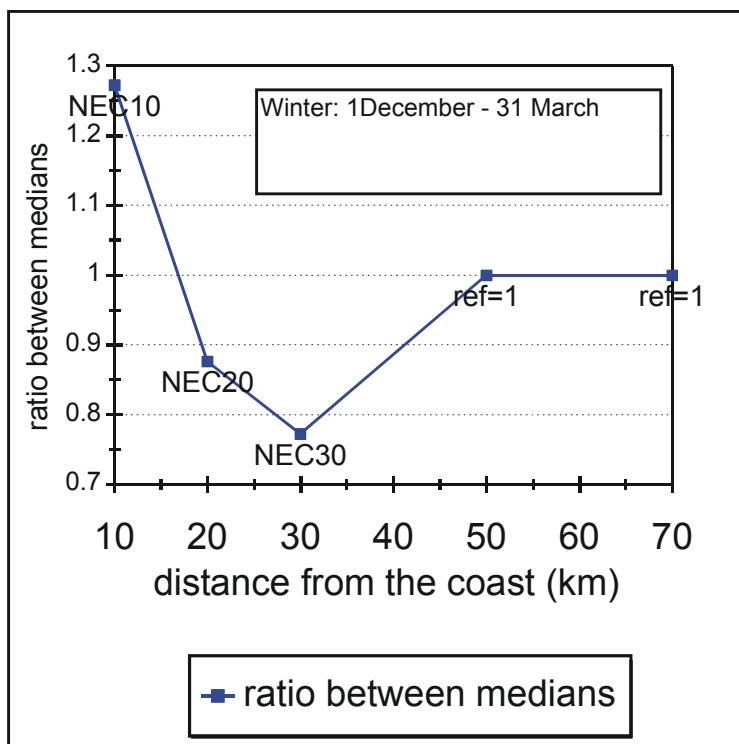


**Figure 25** Ratios as a function of cross-shore distance of the mean of Winter TSM medians of the (N, E, C) stations at 10, 20 and 30 km off shore with respect to the mean of the winter TSM medians at 50 and 70 km. Medians of the N, E and C transects have been averaged

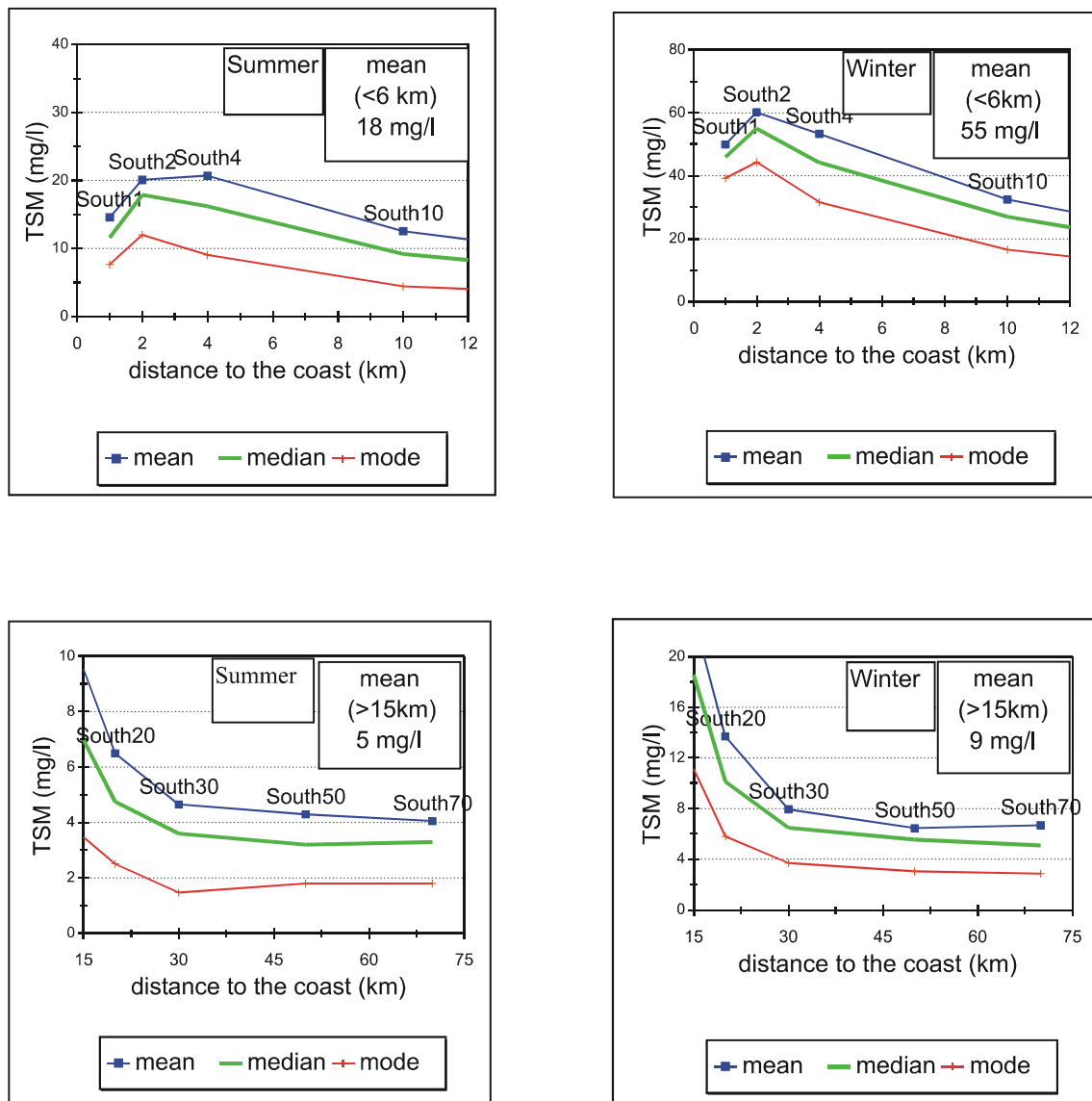


**Figure 26.1** Cross-shore dependency of the mean, median and mode of total suspended matter concentrations in the region South, aggregated from the W, S and G-transects

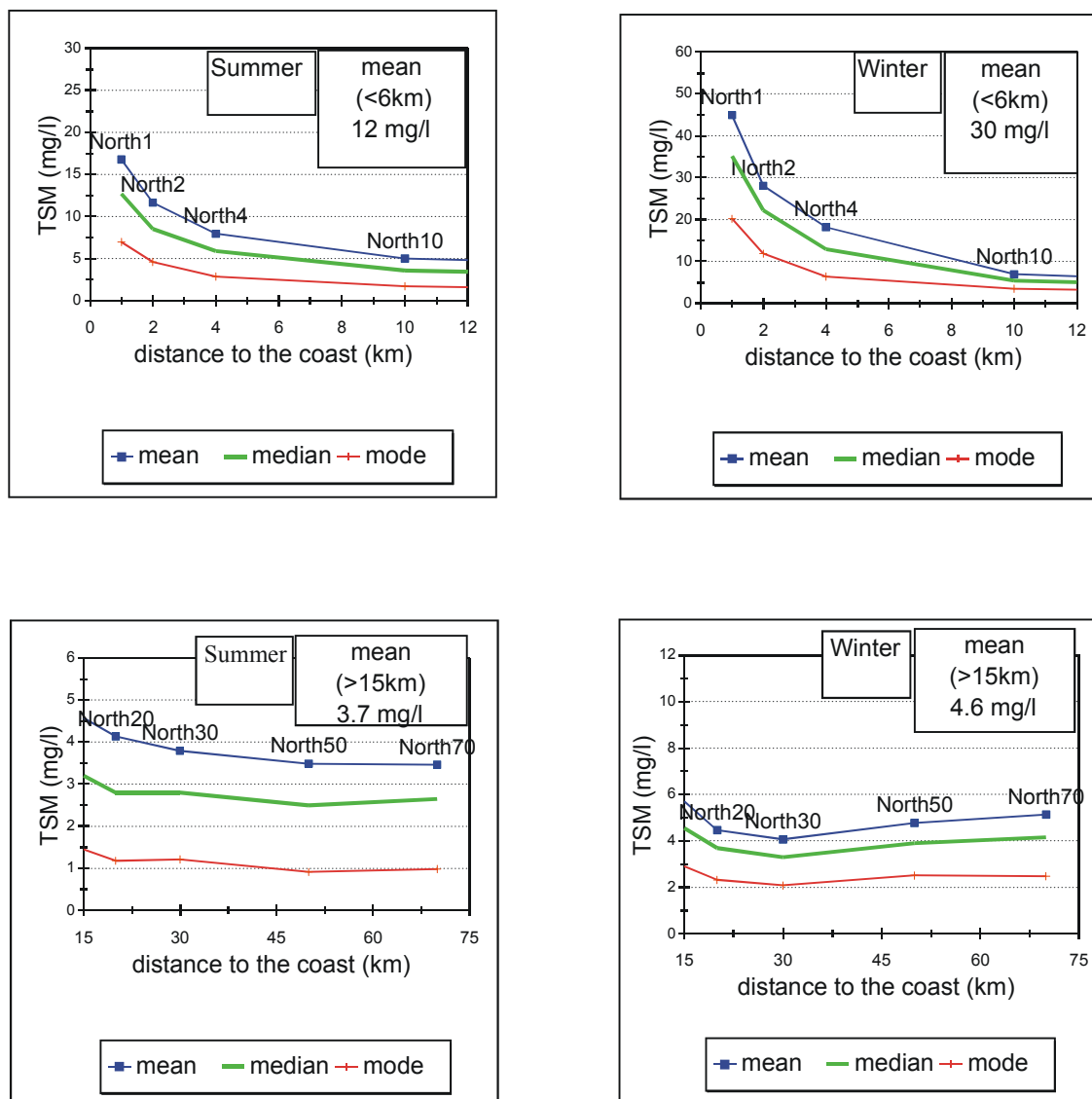
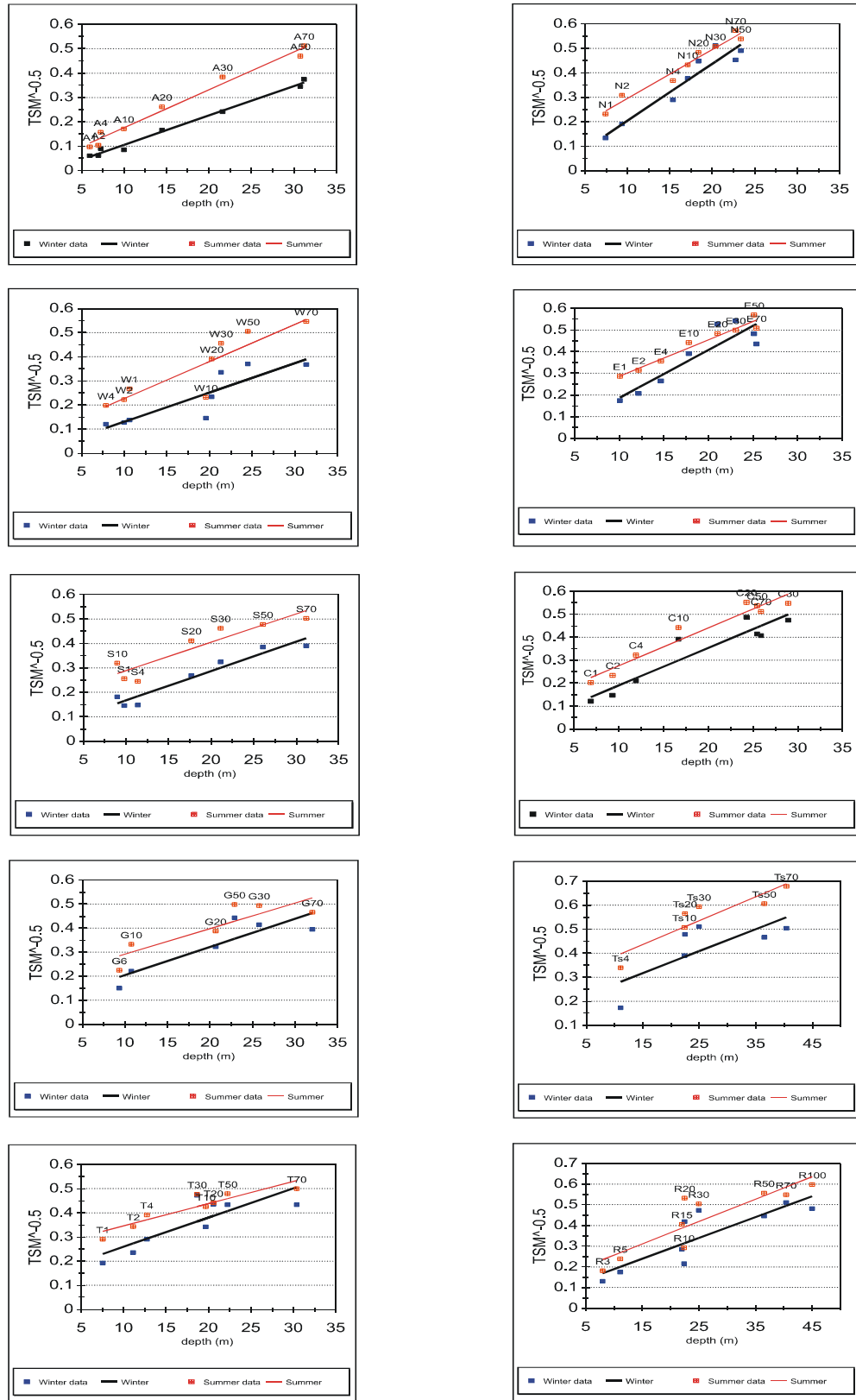


**Figure 26.2** Cross-shore dependency of the mean, median and mode of total suspended matter concentrations in the region North, aggregated from the T, N, E, C and TS-transects

Figure 27  $TSM^{-0.5}$  versus depth for individual transects

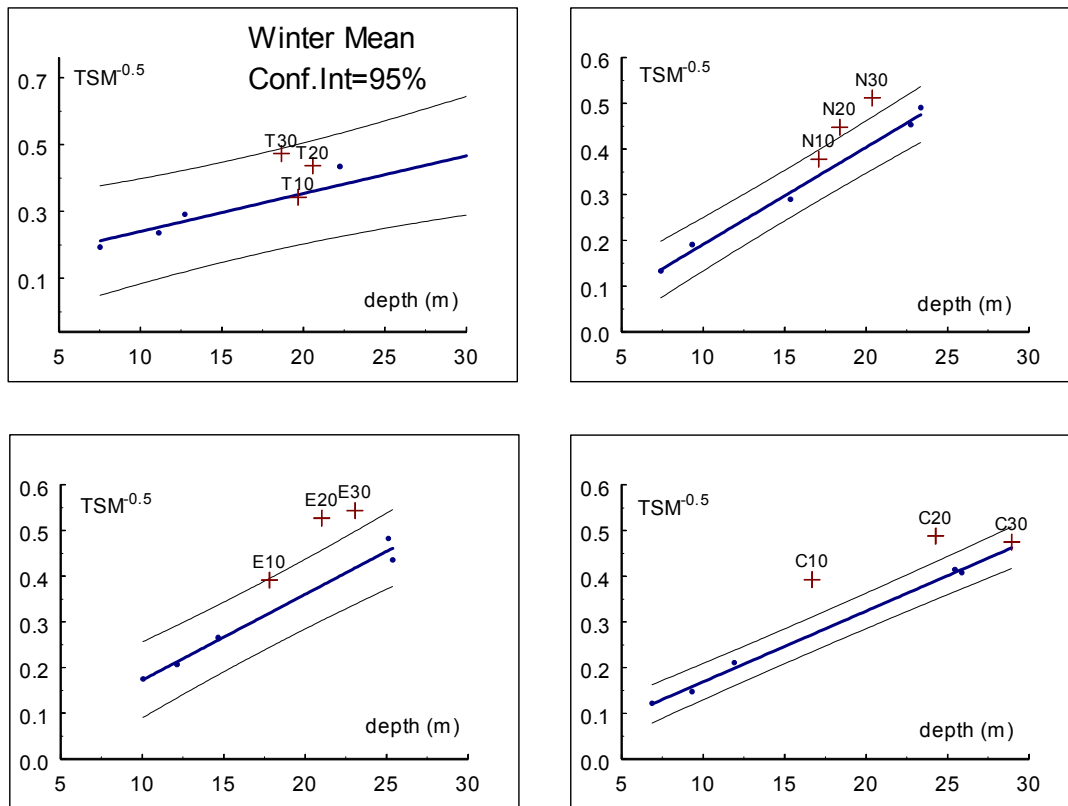


**Figure 28** Linear regression per transect between  $TSM^{-0.5}$  and depth for the stations labelled with (.) during Winter. The data of the stations at 10, 20 and 30 km (labelled with a cross) are not used for the regression

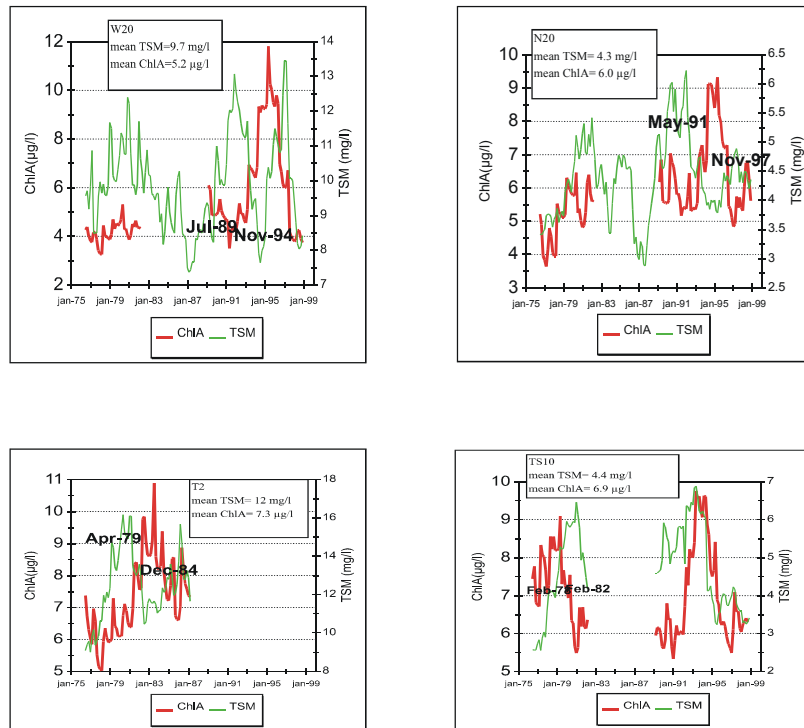


**Figure 29.1** Moving averages (2-year window) of Chlorophyll A and total suspended matter concentrations at stations W20, N20, T2 and TS10

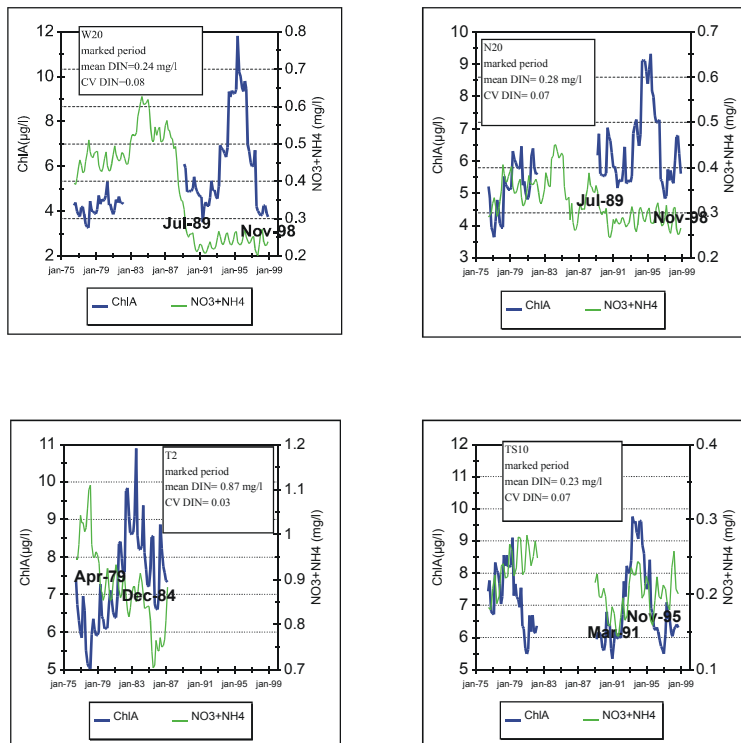


**Figure 29.2** Moving averages (2-year window) of Chlorophyll A and dissolved inorganic Nitrogen concentrations at stations W20, N20, T2 and TS10

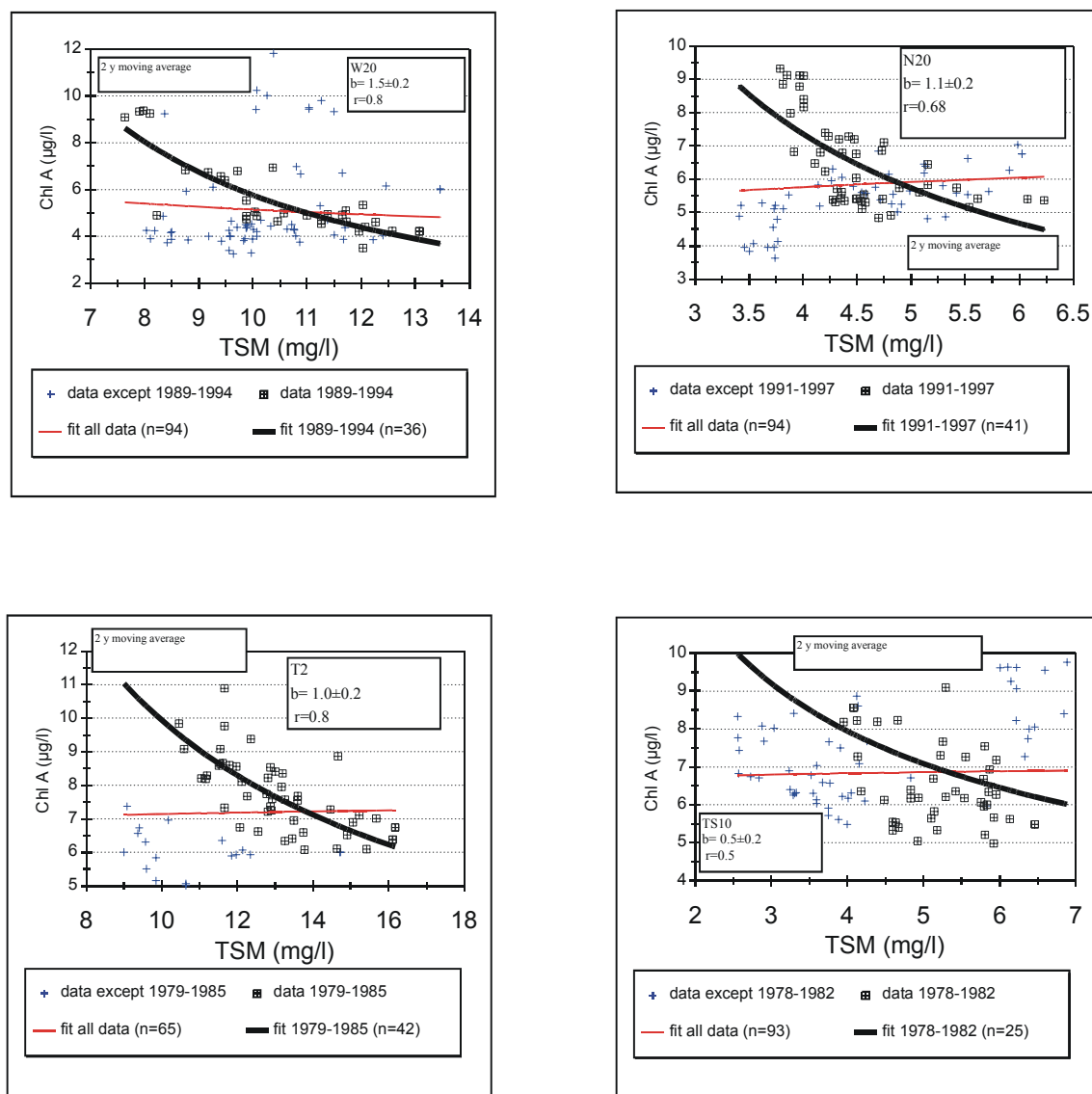


**Figure 30** Chlorophyll A concentration versus TSM at the stations W20, N20, T2 and TS10

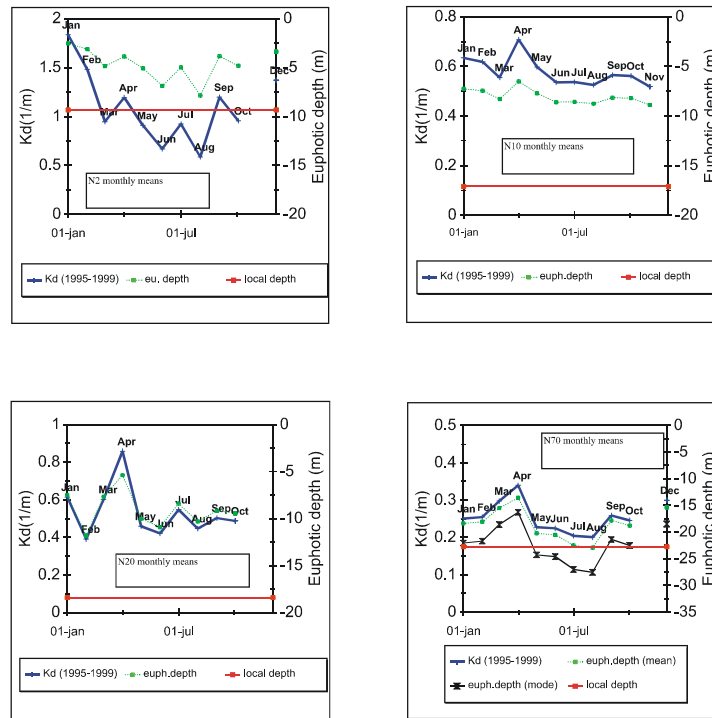


**Figure 31** Monthly means of the light attenuation coefficient  $K_d$  and of the euphotic depth at stations N2, N10, N20 and N70 for the years 1995-1999. The local depth is indicated

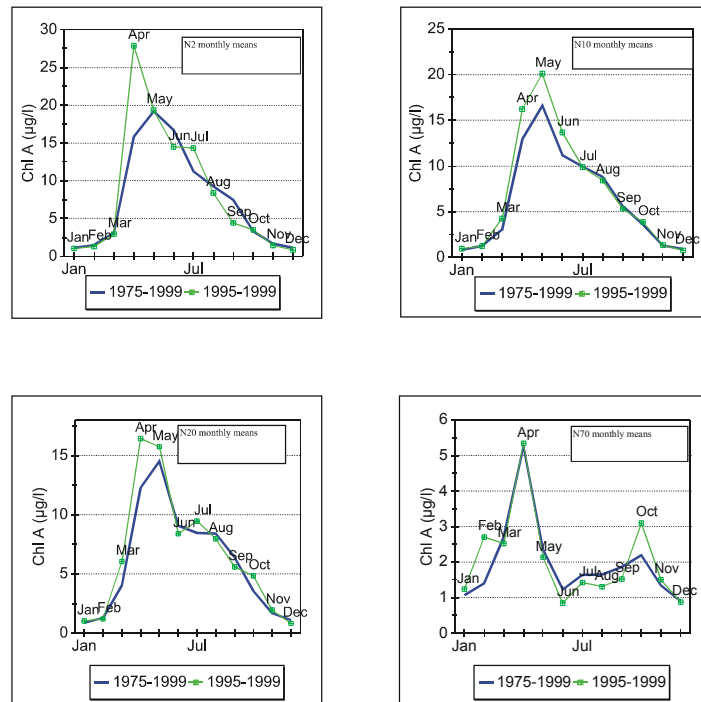


**Figure 32** The seasonal effects in the monthly means of the Chlorophyll A concentrations at stations N2, N10, N20 and N70

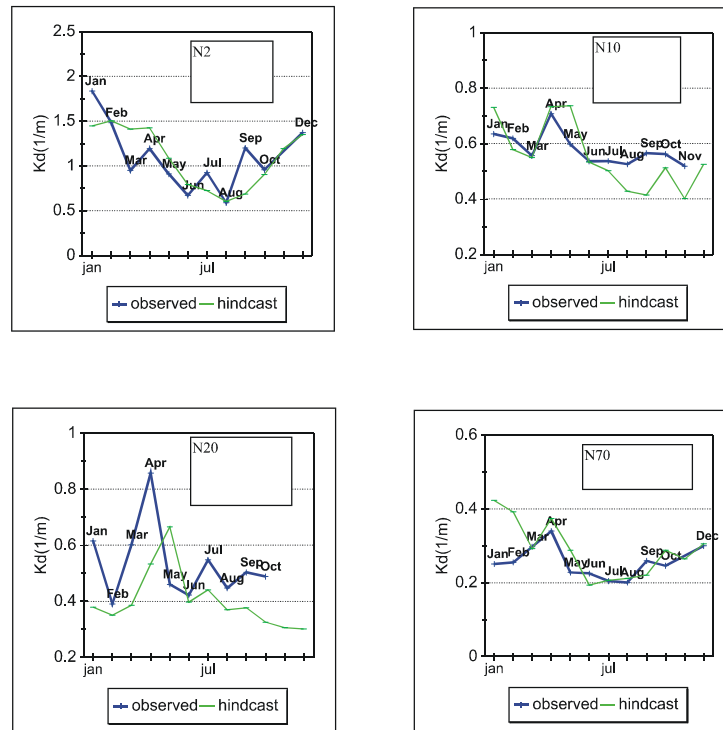


**Figure 33** Hindcast of the seasonal monthly means of  $K_d$  based on the seasonal means of TSM and Chl A

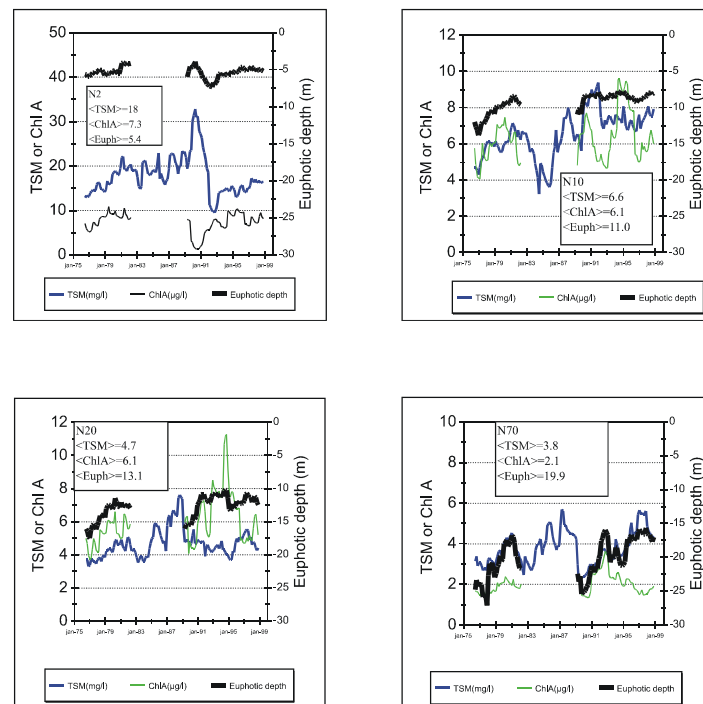


**Figure 34** Hindcast of the euphotic depths at stations N2, N10, N20 and N70 based on the observed TSM and Chl A data

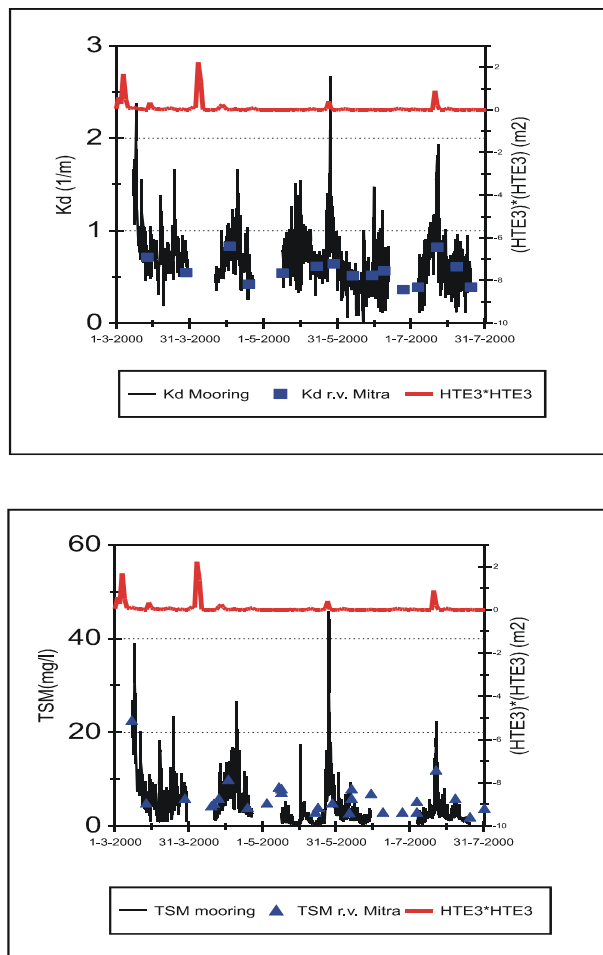


**Figure 35** High frequent TSM and  $K_d$  signals obtained with an in-situ system at station N10

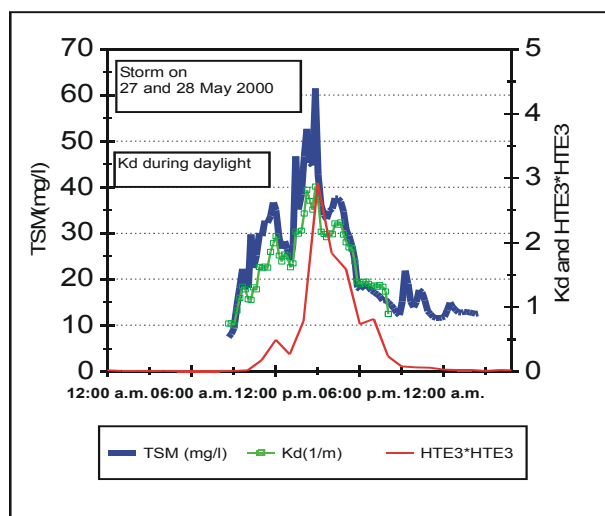


**Figure 36** High frequent in-situ TSM and  $K_d$  signals and wave heights at station N10 during the May 28, 2000 storm



# Tables

Table 1a. Monthly medians, monthly means and the coefficients of variation of the TSM concentrations (mg/l) for the survey period between May 1975 and February 1983

The data of 22 September 1975 and from 1 May 1979 through 20 August 1979 are not used for the determination of the monthly means and medians preventing statistical bias

| station | median | mean  | median | mean  | median | mean | median | mean | median | mean  | median | mean  | median  | mean     | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
|---------|--------|-------|--------|-------|--------|------|--------|------|--------|-------|--------|-------|---------|----------|-----------|-------|-------|-------------|-----------|---------------|
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| A1      | 224.9  | 265.7 | 269.1  | 145.7 | 78.3   | 76.5 | 51.9   | 64.9 | 99.4   | 145.8 | 131.2  | 135.6 | 144.9   | 145.8    | 131.2     | 135.6 | 144.9 | 145.8       | 131.2     | 135.6         |
| A2      | 234.5  | 349.8 | 187.5  | 136.2 | 61.3   | 54.5 | 42.6   | 55.0 | 74.0   | 159.2 | 146.8  | 129.1 | 135.8   | 135.8    | 129.1     | 146.8 | 129.1 | 135.8       | 135.8     | 129.1         |
| A4      | 89.3   | 82.5  | 67.8   | 53.4  | 21.2   | 22.3 | 24.9   | 26.9 | 45.0   | 50.7  | 52.7   | 81.4  | 51.5    | 51.5     | 50.7      | 52.7  | 81.4  | 51.5        | 51.5      | 50.7          |
| A10     | 128.8  | 88.8  | 90.7   | 51.0  | 25.5   | 16.9 | 24.0   | 17.2 | 34.1   | 50.8  | 60.4   | 88.2  | 56.4    | 56.4     | 60.4      | 88.2  | 56.4  | 56.4        | 88.2      | 56.4          |
| A20     | 19.7   | 38.5  | 24.5   | 14.5  | 9.3    | 9.1  | 8.6    | 6.6  | 13.6   | 23.5  | 13.1   | 19.4  | 16.7    | 16.7     | 23.5      | 13.1  | 19.4  | 16.7        | 16.7      | 23.5          |
| A30     | 12.1   | 13.7  | 10.9   | 8.3   | 5.9    | 5.0  | 6.5    | 4.0  | 6.1    | 8.1   | 8.1    | 14.1  | 8.6     | 8.6      | 8.1       | 14.1  | 8.6   | 8.6         | 14.1      | 8.6           |
| A50     | 5.2    | 5.9   | 7.4    | 5.6   | 4.7    | 2.9  | 4.2    | 2.8  | 4.4    | 5.5   | 6.1    | 7.2   | 5.1     | 5.1      | 5.5       | 6.1   | 7.2   | 5.1         | 5.1       | 5.5           |
| A70     | 3.7    | 4.9   | 4.7    | 4.3   | 4.3    | 2.7  | 2.0    | 1.5  | 3.4    | 3.8   | 4.0    | 8.0   | 3.9     | 3.9      | 3.8       | 4.0   | 8.0   | 3.9         | 3.9       | 3.8           |
| station | median | mean  | median | mean  | median | mean | median | mean | median | mean  | median | mean  | median  | mean     | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| A1      | 267.5  | 280.5 | 245.5  | 152.6 | 81.9   | 88.9 | 91.8   | 67.1 | 119.3  | 154.4 | 159.6  | 257.3 | 164.7   | 164.7    | 257.3     | 154.4 | 159.6 | 257.3       | 164.7     | 164.7         |
| A2      | 250.8  | 307.9 | 251.5  | 167.6 | 65.6   | 74.5 | 77.6   | 58.4 | 73.2   | 165.2 | 149.3  | 187.0 | 152.5   | 152.5    | 149.3     | 187.0 | 152.5 | 152.5       | 149.3     | 187.0         |
| A4      | 127.4  | 139.6 | 103.7  | 58.1  | 27.7   | 29.7 | 40.3   | 26.1 | 43.3   | 76.5  | 69.3   | 107.2 | 70.6    | 70.6     | 69.3      | 107.2 | 70.6  | 70.6        | 107.2     | 70.6          |
| A10     | 145.7  | 115.4 | 47.7   | 24.2  | 23.4   | 33.0 | 20.3   | 35.4 | 69.5   | 61.5  | 115.9  | 70.8  | 518.295 | 5688.072 | 61.5      | 115.9 | 70.8  | 518.295     | 5688.072  | 61.5          |
| A20     | 40.5   | 42.2  | 30.7   | 15.6  | 10.2   | 11.8 | 14.8   | 7.5  | 16.0   | 25.3  | 18.2   | 26.2  | 21.6    | 21.6     | 25.3      | 18.2  | 26.2  | 21.6        | 21.6      | 25.3          |
| A30     | 18.6   | 19.9  | 14.0   | 9.6   | 6.7    | 5.3  | 7.0    | 4.9  | 7.0    | 14.1  | 10.5   | 14.2  | 10.5    | 10.5     | 14.1      | 10.5  | 14.2  | 10.5        | 10.5      | 14.1          |
| A50     | 7.5    | 9.5   | 8.3    | 5.5   | 4.6    | 3.5  | 4.7    | 3.0  | 4.4    | 5.2   | 5.6    | 7.7   | 5.8     | 5.8      | 5.2       | 5.6   | 7.7   | 5.8         | 5.8       | 5.2           |
| A70     | 5.8    | 7.9   | 5.3    | 4.5   | 4.1    | 2.9  | 3.4    | 2.1  | 4.3    | 3.8   | 3.5    | 10.2  | 4.8     | 4.8      | 4.3       | 3.8   | 3.5   | 10.2        | 4.8       | 4.8           |
| station | CV     | CV    | CV     | CV    | CV     | CV   | CV     | CV   | CV     | CV    | CV     | CV    | CV      | CV       | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| A1      | 0.64   | 0.67  | 0.73   | 0.56  | 0.62   | 0.65 | 0.64   | 0.62 | 0.54   | 0.62  | 0.58   | 0.44  | 0.47    | 0.47     | 0.64      | 0.67  | 0.73  | 0.56        | 0.62      | 0.65          |
| A2      | 0.71   | 0.51  | 0.74   | 0.65  | 0.65   | 1.38 | 0.87   | 0.70 | 0.55   | 0.61  | 0.44   | 0.97  | 0.73    | 0.73     | 0.71      | 0.51  | 0.74  | 0.65        | 0.65      | 1.38          |
| A4      | 0.81   | 0.72  | 0.90   | 0.53  | 0.46   | 0.78 | 0.97   | 0.85 | 0.76   | 0.86  | 0.75   | 0.73  | 0.62    | 0.62     | 0.81      | 0.72  | 0.90  | 0.53        | 0.46      | 0.78          |
| A10     | 0.63   | 0.83  | 0.80   | 0.50  | 0.61   | 0.76 | 0.96   | 0.71 | 0.57   | 0.76  | 0.45   | 0.58  | 0.68    | 0.68     | 0.63      | 0.83  | 0.80  | 0.50        | 0.61      | 0.76          |
| A20     | 0.91   | 0.88  | 0.54   | 0.64  | 0.74   | 0.78 | 1.07   | 0.86 | 0.61   | 0.69  | 0.66   | 0.70  | 0.76    | 0.76     | 0.91      | 0.88  | 0.54  | 0.64        | 0.74      | 0.78          |
| A30     | 0.73   | 0.99  | 0.64   | 0.66  | 0.62   | 0.63 | 0.98   | 0.66 | 0.55   | 0.55  | 1.00   | 0.53  | 0.72    | 0.72     | 0.73      | 0.99  | 0.64  | 0.66        | 0.62      | 0.63          |
| A50     | 0.81   | 1.05  | 0.54   | 0.54  | 0.52   | 0.93 | 0.77   | 0.81 | 0.54   | 0.75  | 0.60   | 0.62  | 0.71    | 0.71     | 0.81      | 1.05  | 0.54  | 0.54        | 0.52      | 0.93          |
| A70     | 1.03   | 0.85  | 0.57   | 0.65  | 0.78   | 0.80 | 0.85   | 0.86 | 0.81   | 0.73  | 0.76   | 0.70  | 0.78    | 0.78     | 1.03      | 0.85  | 0.57  | 0.65        | 0.78      | 0.80          |
| station | median | mean  | median | mean  | median | mean | median | mean | median | mean  | median | mean  | median  | mean     | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| W1      | 55.3   | 46.1  | 41.2   | 26.6  | 8.0    | 8.3  | 8.0    | 8.6  | 13.0   | 26.3  | 31.3   | 45.5  | 26.7    | 26.7     | 45.5      | 26.3  | 31.3  | 45.5        | 26.7      | 26.7          |
| W2      | 64.6   | 41.9  | 70.9   | 25.7  | 18.6   | 10.0 | 13.2   | 22.1 | 13.6   | 25.9  | 29.7   | 60.6  | 33.1    | 33.1     | 29.7      | 60.6  | 33.1  | 33.1        | 29.7      | 60.6          |
| W4      | 71.9   | 39.6  | 68.1   | 39.1  | 15.6   | 15.1 | 17.6   | 16.5 | 15.1   | 39.6  | 36.5   | 71.2  | 37.0    | 37.0     | 39.6      | 68.1  | 39.1  | 15.6        | 15.1      | 17.6          |
| W10     | 43.2   | 29.5  | 40.3   | 19.8  | 13.8   | 13.5 | 10.2   | 14.6 | 11.4   | 22.8  | 21.4   | 38.6  | 23.3    | 23.3     | 22.8      | 21.4  | 38.6  | 23.3        | 23.3      | 22.8          |
| W20     | 14.7   | 13.6  | 13.1   | 5.5   | 4.4    | 3.2  | 3.9    | 4.6  | 4.3    | 7.5   | 8.5    | 9.7   | 7.8     | 7.8      | 8.5       | 9.7   | 7.8   | 7.8         | 9.7       | 7.8           |
| W30     | 10.4   | 5.2   | 7.2    | 3.9   | 3.5    | 3.1  | 2.7    | 2.5  | 4.0    | 5.5   | 6.2    | 5.6   | 5.3     | 5.3      | 5.5       | 6.2   | 5.6   | 5.3         | 5.3       | 5.5           |
| W50     | 7.3    | 3.7   | 4.5    | 2.4   | 3.9    | 2.6  | 2.2    | 1.2  | 3.3    | 4.6   | 3.7    | 7.5   | 3.9     | 3.9      | 4.5       | 2.4   | 3.9   | 2.6         | 2.2       | 1.2           |
| W70     | 8.4    | 3.5   | 4.3    | 3.4   | 4.0    | 3.1  | 2.8    | 1.6  | 4.4    | 4.1   | 4.3    | 8.4   | 4.3     | 4.3      | 4.0       | 3.1   | 2.8   | 1.6         | 4.4       | 4.1           |
| station | mean   | mean  | mean   | mean  | mean   | mean | mean   | mean | mean   | mean  | mean   | mean  | mean    | mean     | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| W1      | 55.4   | 48.6  | 49.3   | 28.3  | 11.0   | 10.4 | 9.8    | 10.8 | 16.0   | 27.2  | 30.6   | 59.3  | 29.7    | 29.7     | 59.3      | 27.2  | 30.6  | 59.3        | 29.7      | 29.7          |
| W2      | 66.3   | 48.4  | 65.7   | 30.0  | 20.7   | 12.4 | 16.8   | 21.0 | 16.9   | 33.9  | 30.3   | 69.6  | 36.0    | 36.0     | 69.6      | 30.3  | 33.9  | 69.6        | 36.0      | 36.0          |
| W4      | 78.9   | 39.6  | 80.9   | 41.8  | 18.3   | 18.5 | 24.1   | 24.1 | 26.4   | 41.1  | 37.3   | 72.7  | 42.7    | 42.7     | 72.7      | 41.1  | 41.1  | 72.7        | 42.7      | 42.7          |
| W10     | 49.5   | 36.3  | 52.3   | 24.0  | 14.9   | 15.8 | 16.6   | 16.9 | 17.2   | 28.0  | 22.9   | 56.0  | 29.2    | 29.2     | 56.0      | 22.9  | 28.0  | 56.0        | 29.2      | 29.2          |
| W20     | 20.3   | 15.9  | 16.7   | 6.3   | 6.5    | 5.0  | 4.7    | 6.2  | 6.2    | 10.5  | 13.1   | 21.5  | 11.1    | 11.1     | 10.5      | 13.1  | 21.5  | 11.1        | 11.1      | 10.5          |
| W30     | 14.6   | 6.0   | 7.9    | 4.3   | 5.6    | 4.3  | 2.6    | 4.3  | 4.1    | 7.1   | 8.5    | 6.3   | 6.2     | 6.2      | 7.1       | 8.5   | 6.3   | 6.2         | 6.2       | 7.1           |
| W50     | 8.1    | 4.7   | 9.2    | 3.0   | 5.4    | 3.5  | 3.1    | 1.7  | 4.0    | 5.7   | 4.8    | 8.0   | 5.1     | 5.1      | 4.9       | 5.7   | 4.8   | 8.0         | 5.1       | 5.1           |
| W70     | 11.0   | 5.3   | 6.0    | 4.3   | 4.0    | 3.7  | 3.0    | 1.6  | 4.7    | 3.9   | 5.4    | 7.7   | 5.0     | 5.0      | 4.7       | 3.9   | 5.4   | 7.7         | 5.0       | 5.0           |
| station | CV     | CV    | CV     | CV    | CV     | CV   | CV     | CV   | CV     | CV    | CV     | CV    | CV      | CV       | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| W1      | 0.26   | 0.43  | 0.35   | 0.43  | 0.84   | 0.65 | 0.60   | 0.71 | 0.55   | 0.44  | 0.31   | 0.58  | 0.51    | 0.51     | 0.26      | 0.43  | 0.35  | 0.43        | 0.84      | 0.65          |
| W2      | 0.50   | 0.47  | 0.34   | 0.48  | 0.54   | 0.61 | 0.51   | 0.52 | 0.63   | 0.60  | 0.33   | 0.66  | 0.52    | 0.52     | 0.50      | 0.47  | 0.34  | 0.48        | 0.54      | 0.61          |
| W4      | 0.59   | 0.57  | 0.68   | 0.48  | 0.67   | 0.66 | 0.59   | 0.71 | 1.13   | 1.31  | 0.85   | 0.57  | 0.61    | 0.61     | 0.59      | 0.57  | 0.68  | 0.48        | 0.67      | 0.66          |
| W10     | 0.54   | 0.65  | 0.71   | 0.74  | 0.56   | 0.85 | 0.91   | 0.80 | 1.00   | 0.75  | 0.45   | 0.65  | 0.72    | 0.72     | 0.54      | 0.65  | 0.71  | 0.74        | 0.56      | 0.85          |
| W20     | 0.64   | 0.68  | 0.64   | 0.55  | 0.85   | 0.86 | 0.77   | 1.12 | 0.86   | 1.13  | 1.06   | 0.90  | 0.86    | 0.86     | 0.64      | 0.68  | 0.64  | 0.55        | 0.85      | 0.86          |
| W30     | 0.60   | 0.62  | 0.69   | 0.58  | 0.95   | 0.82 | 0.82   | 0.70 | 0.82   | 0.62  | 0.48   | 0.76  | 0.70    | 0.70     | 0.60      | 0.62  | 0.69  | 0.58        | 0.95      | 0.82          |
| W50     | 0.76   | 0.82  | 1.25   | 0.63  | 0.93   | 0.78 | 0.86   | 1.05 | 0.50   | 0.76  | 0.67   | 0.47  | 0.79    | 0.79     | 0.76      | 0.82  | 1.25  | 0.63        | 0.93      | 0.78          |
| W70     | 0.85   | 0.88  | 0.75   | 0.89  | 0.77   | 0.69 | 0.83   | 0.92 | 0.52   | 0.58  | 0.94   | 0.28  | 0.74    | 0.74     | 0.85      | 0.88  | 0.75  | 0.89        | 0.77      | 0.69          |
| station | median | mean  | median | mean  | median | mean | median | mean | median | mean  | median | mean  | median  | mean     | year mean | UTM-E | UTM-N | local depth | salinity  | % river water |
| Jan     | Feb    | Mar   | Apr    | May   | Jun    | Jul  | Aug    | Sep  | Oct    | Nov   | Dec    | Jan   | Feb     | Mar      | year mean | km    | km    | m NAP       | year mean | year mean     |
| S1      | 55.2   | 36.3  | 44.4   | 32.2  | 13.5   | 9.7  | 12.1   | 8.2  | 9.0    | 20.5  | 21.9   | 28.3  | 24.3    | 24.3     | 20.5      | 21.9  | 28.3  | 24.3        | 24.3      | 20.5          |
| S4      | 37.6   | 34.9  | 55.2   | 24.7  | 17.0   | 9.7  | 12.6   | 9.9  | 9.3    | 23.6  | 20.9   | 38.6  | 24.5    | 24.5     | 23.6      | 20.9  | 38.6  | 24.5        | 24.5      | 23.6          |
| S10     | 34.1   | 24.6  | 32.4   | 9.4   | 10.1   | 6.9  | 9.9    | 5.1  | 9.1    | 14.7  | 23.2   | 34.2  | 17.0    | 17.0     | 14.7      | 23.2  | 34.2  | 17.0        | 17.0      | 14.7          |
| S20     | 16.1   | 7.9   | 12.1   | 5.9   | 4.1    | 4.0  | 3.7    | 3.4  | 5.1    | 8.2   | 8.9    | 14.3  | 7.8     | 7.8      | 8.2       | 8.9   | 14.3  | 7.8         | 7.8       | 8.2           |
| S30     | 8.1    | 5.5   | 7.7    | 3.3   | 3.5    | 3.1  | 2.7    | 2.5  | 3.1    | 5.1   | 4.0    | 4.9   | 5.5     | 5.5      | 5.1       | 4.0   | 4.9   | 5.5         | 5.5       | 5.1           |
| S50     | 7.0    | 5.0   | 6.2    | 3.6   | 3.7    | 3.2  | 3.2    | 3.0  | 2.7    | 3.9   | 4.1    | 9.3   | 4.6     | 4.6      | 3.9       | 4.1   | 9.3   | 4.6         | 4.6       | 3.9           |
| S70     | 5.8    | 6.2   | 5.6    | 3.5   |        |      |        |      |        |       |        |       |         |          |           |       |       |             |           |               |

**Table 1b. Monthly medians, monthly means and the coefficients of variation of the TSM concentrations (mg/l) for the survey period between May 1975 and February 1983**

The data of 22 September 1975 and from 1 May 1979 through 20 August 1979 are not used for the determination of the monthly means and medians preventing statistical bias

| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|----------|----------|-------------------|--------------------|-------------------------|
| N1      | 41.2 | 41.5 | 45.5 | 36.2 | 32.4 | 19.7 | 16.6 | 23.3 | 17.0 | 32.8 | 22.1 | 22.1 | 40.1      | 33.4     | 596.854  | 5790.416          | 18.6               | 28.31                   |
| N2      | 19.9 | 28.1 | 25.2 | 20.6 | 12.2 | 8.6  | 7.1  | 7.4  | 8.9  | 9.8  | 9.4  | 18.4 | 14.6      |          |          |                   | 16.4               | 19.6                    |
| N4      | 8.8  | 8.3  | 8.2  | 10.4 | 7.7  | 3.6  | 6.0  | 3.7  | 7.8  | 6.3  | 5.3  | 15.3 | 7.6       |          |          |                   | 18.6               | 18.6                    |
| N10     | 6.2  | 4.9  | 5.4  | 6.7  | 5.9  | 3.2  | 4.3  | 3.4  | 3.5  | 4.0  | 3.5  | 5.9  | 4.7       |          |          |                   | 16.4               | 16.4                    |
| N20     | 4.5  | 3.0  | 4.8  | 4.5  | 5.2  | 2.1  | 3.0  | 2.4  | 2.9  | 3.1  | 2.0  | 3.6  | 3.4       |          |          |                   | 18.6               | 18.6                    |
| N80     | 3.0  | 3.2  | 4.3  | 4.3  | 5.2  | 3.0  | 2.6  | 2.4  | 2.8  | 2.2  | 2.6  | 4.7  | 3.3       |          |          |                   | 18.6               | 18.6                    |
| N80     | 3.5  | 3.2  | 3.9  | 3.6  | 4.2  | 2.4  | 2.4  | 0.9  | 2.1  | 2.3  | 2.8  | 1.3  | 2.9       |          |          |                   | 18.6               | 18.6                    |
| N70     | 3.7  | 4.3  | 4.6  | 2.4  | 3.5  | 1.8  | 1.7  | 2.6  | 2.9  | 2.2  | 1.0  | 3.2  | 2.8       |          |          |                   | 18.6               | 18.6                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| N1      | 66.8 | 56.6 | 53.1 | 49.5 | 19.7 | 16.6 | 23.3 | 17.0 | 32.8 | 22.1 | 22.1 | 40.1 | 33.4      | 596.854  | 5790.416 | 18.6              | 28.31              | 19.6                    |
| N2      | 23.1 | 29.2 | 33.4 | 23.7 | 12.3 | 9.7  | 7.7  | 7.6  | 8.4  | 12.2 | 12.2 | 20.5 | 16.8      | 595.876  | 5790.953 | 9.3               | 28.37              | 19.4                    |
| N4      | 11.1 | 10.6 | 13.5 | 16.6 | 9.9  | 5.2  | 7.1  | 4.2  | 7.8  | 7.9  | 7.8  | 13.2 | 9.6       | 594.249  | 5791.757 | 15.4              | 28.65              | 18.6                    |
| N10     | 6.7  | 6.0  | 8.6  | 7.5  | 8.9  | 3.6  | 4.8  | 3.8  | 4.1  | 6.2  | 4.2  | 6.8  | 5.9       | 588.724  | 5795.363 | 17.1              | 30.02              | 14.6                    |
| N20     | 5.5  | 3.9  | 5.9  | 5.6  | 6.1  | 3.0  | 3.1  | 3.8  | 5.0  | 3.5  | 2.6  | 5.1  | 4.4       | 579.959  | 5799.601 | 18.4              | 31.62              | 10.0                    |
| N20     | 3.6  | 3.7  | 3.7  | 5.9  | 4.9  | 3.0  | 3.5  | 3.5  | 4.2  | 2.9  | 2.6  | 4.7  | 3.8       | 571.236  | 5804.567 | 20.4              | 33.00              | 6.05                    |
| N80     | 4.6  | 3.8  | 4.1  | 4.3  | 4.3  | 2.8  | 1.7  | 2.5  | 4.2  | 3.2  | 1.8  | 4.3  | 3.5       | 553.334  | 5814.723 | 23.4              | 34.43              | 1.93                    |
| N70     | 4.7  | 5.0  | 5.3  | 3.7  | 3.8  | 2.5  | 2.9  | 2.4  | 2.5  | 2.7  | 1.4  | 3.8  | 3.4       | 535.911  | 5826.275 | 22.7              | 34.75              | 1.01                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| N1      | 0.98 | 0.64 | 0.56 | 0.64 | 0.71 | 0.83 | 0.58 | 0.75 | 0.58 | 0.63 | 0.83 | 0.74 | 0.71      |          |          |                   | 18.6               | 18.6                    |
| N2      | 0.59 | 0.72 | 0.77 | 0.51 | 0.63 | 0.65 | 0.90 | 0.73 | 0.65 | 0.63 | 0.83 | 0.39 | 0.67      |          |          |                   | 18.6               | 18.6                    |
| N4      | 0.55 | 0.87 | 0.80 | 0.77 | 0.85 | 0.77 | 4.4  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1       |          |          |                   | 18.6               | 18.6                    |
| N10     | 0.64 | 0.55 | 0.92 | 0.74 | 1.01 | 0.73 | 0.83 | 0.76 | 0.83 | 0.77 | 0.81 | 0.81 | 0.78      |          |          |                   | 18.6               | 18.6                    |
| N20     | 0.80 | 0.71 | 0.67 | 0.79 | 0.75 | 1.04 | 0.67 | 0.93 | 1.61 | 1.00 | 0.97 | 0.75 | 0.89      |          |          |                   | 18.6               | 18.6                    |
| N20     | 1.07 | 0.99 | 0.89 | 0.89 | 0.70 | 0.73 | 0.97 | 1.00 | 1.21 | 1.00 | 0.68 | 0.97 | 0.84      |          |          |                   | 18.6               | 18.6                    |
| N80     | 0.62 | 0.78 | 0.66 | 0.94 | 0.82 | 0.64 | 1.03 | 0.94 | 1.37 | 0.70 | 0.87 | 0.74 | 0.84      |          |          |                   | 18.6               | 18.6                    |
| N70     | 0.67 | 0.72 | 0.72 | 1.01 | 0.72 | 0.86 | 0.96 | 0.63 | 0.75 | 0.78 | 1.07 | 1.03 | 0.83      |          |          |                   | 18.6               | 18.6                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| E1      | 27.2 | 38.1 | 31.3 | 21.3 | 12.2 | 6.3  | 6.6  | 6.7  | 4.4  | 4.1  | 4.1  | 11.8 | 16.0      |          |          |                   | 18.6               | 18.6                    |
| E2      | 22.6 | 26.4 | 24.0 | 19.6 | 10.8 | 6.0  | 6.9  | 6.4  | 6.2  | 10.4 | 10.6 | 20.0 | 14.1      |          |          |                   | 18.6               | 18.6                    |
| E4      | 12.3 | 14.5 | 15.4 | 15.9 | 7.5  | 4.7  | 4.1  | 5.5  | 4.0  | 6.1  | 10.9 | 11.8 | 8.4       |          |          |                   | 18.6               | 18.6                    |
| E10     | 4.8  | 4.4  | 6.5  | 8.2  | 6.2  | 3.6  | 1.8  | 2.8  | 3.3  | 3.9  | 4.2  | 4.6  | 4.5       |          |          |                   | 18.6               | 18.6                    |
| E20     | 2.4  | 3.0  | 3.7  | 3.8  | 3.8  | 3.4  | 2.4  | 2.5  | 2.1  | 3.3  | 2.3  | 4.9  | 3.1       |          |          |                   | 18.6               | 18.6                    |
| E30     | 3.4  | 2.5  | 3.0  | 3.6  | 4.5  | 4.4  | 8    | 12   | 0.9  | 3.7  | 4.5  | 3.8  | 2.9       |          |          |                   | 18.6               | 18.6                    |
| E50     | 3.2  | 3.2  | 4.5  | 2.6  | 2.3  | 4.2  | 1.3  | 0.5  | 1.6  | 2.3  | 3.4  | 2.5  | 2.6       |          |          |                   | 18.6               | 18.6                    |
| E70     | 4.2  | 3.6  | 4.7  | 3.7  | 4.1  | 2.5  | 0.7  | 1.2  | 3.2  | 2.3  | 3.0  | 3.7  | 3.1       |          |          |                   | 18.6               | 18.6                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| E1      | 27.6 | 38.7 | 36.0 | 26.3 | 12.2 | 8.8  | 10.9 | 8.5  | 12.0 | 18.3 | 16.9 | 30.2 | 20.5      | 583.799  | 5831.220 | 10.1              | 29.40              | 16.4                    |
| E2      | 23.4 | 24.3 | 23.7 | 24.2 | 12.9 | 8.7  | 8.7  | 8.0  | 8.1  | 13.5 | 16.9 | 19.9 | 16.0      | 607.948  | 5831.449 | 12.2              | 29.58              | 15.9                    |
| E4      | 13.5 | 14.3 | 15.1 | 17.7 | 10.9 | 6.0  | 6.0  | 5.1  | 5.1  | 10.9 | 10.9 | 10.9 | 10.9      | 606.135  | 5831.780 | 14.7              | 29.91              | 15.0                    |
| E10     | 5.4  | 4.8  | 9.2  | 8.0  | 7.4  | 6.4  | 3.1  | 3.3  | 4.3  | 4.7  | 4.3  | 7.5  | 5.7       | 599.683  | 5832.757 | 17.8              | 31.13              | 11.4                    |
| E20     | 3.3  | 3.3  | 4.9  | 5.1  | 5.3  | 4.4  | 3.6  | 2.9  | 2.4  | 4.2  | 3.6  | 4.0  | 3.8       | 589.731  | 5834.335 | 21.0              | 32.43              | 7.69                    |
| E30     | 3.7  | 2.9  | 3.8  | 4.6  | 5.0  | 4.6  | 5.0  | 4.6  | 1.5  | 2.9  | 4.8  | 3.6  | 3.6       | 579.779  | 5835.913 | 23.1              | 33.68              | 1.09                    |
| E50     | 2.9  | 3.9  | 4.7  | 4.5  | 2.5  | 4.7  | 2.2  | 0.9  | 2.1  | 3.0  | 3.6  | 5.1  | 3.4       | 559.908  | 5838.780 | 25.1              | 34.63              | 1.35                    |
| E70     | 6.9  | 3.9  | 5.8  | 4.6  | 5.0  | 3.6  | 1.5  | 1.9  | 3.6  | 3.0  | 3.0  | 4.8  | 4.0       | 540.058  | 5842.191 | 25.4              | 34.78              | 0.92                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | CV   | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| E1      | 0.46 | 0.43 | 0.40 | 0.46 | 0.69 | 0.52 | 0.88 | 0.72 | 0.76 | 0.78 | 0.61 | 0.45 | 0.60      |          |          |                   | 18.6               | 18.6                    |
| E2      | 0.51 | 0.49 | 0.44 | 0.68 | 0.82 | 0.91 | 0.69 | 0.92 | 0.63 | 0.88 | 0.73 | 0.49 | 0.68      |          |          |                   | 18.6               | 18.6                    |
| E4      | 0.69 | 0.45 | 0.51 | 1.10 | 0.87 | 0.89 | 0.82 | 0.89 | 0.82 | 0.89 | 0.87 | 0.97 | 0.83      |          |          |                   | 18.6               | 18.6                    |
| E10     | 0.57 | 0.57 | 0.70 | 0.53 | 0.68 | 0.92 | 1.07 | 0.84 | 0.72 | 0.60 | 0.59 | 0.84 | 0.72      |          |          |                   | 18.6               | 18.6                    |
| E20     | 0.57 | 0.52 | 0.67 | 1.09 | 0.98 | 0.67 | 0.92 | 0.92 | 1.08 | 0.59 | 0.77 | 0.76 | 0.79      |          |          |                   | 18.6               | 18.6                    |
| E30     | 0.90 | 0.74 | 0.72 | 1.06 | 1.01 | 0.91 | 0.89 | 1.09 | 1.18 | 0.56 | 0.50 | 0.54 | 0.51      |          |          |                   | 18.6               | 18.6                    |
| E50     | 0.60 | 0.71 | 0.46 | 1.01 | 1.01 | 0.82 | 1.09 | 1.03 | 1.21 | 0.68 | 0.80 | 0.88 | 0.86      |          |          |                   | 18.6               | 18.6                    |
| E70     | 0.86 | 0.53 | 0.97 | 0.89 | 0.92 | 1.01 | 0.99 | 1.14 | 0.80 | 0.75 | 0.52 | 0.83 | 0.85      |          |          |                   | 18.6               | 18.6                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| C1      | 63.5 | 62.6 | 49.7 | 24.9 | 30.4 | 19.5 | 12.5 | 15.8 | 18.8 | 20.5 | 43.0 | 62.1 | 35.3      |          |          |                   | 18.6               | 18.6                    |
| C2      | 34.5 | 36.6 | 36.7 | 25.2 | 24.5 | 13.0 | 8.8  | 8.8  | 12.9 | 19.3 | 24.8 | 37.9 | 23.6      |          |          |                   | 18.6               | 18.6                    |
| C4      | 20.0 | 16.6 | 16.6 | 22.6 | 13.3 | 4.9  | 4    | 4.9  | 7.4  | 8.0  | 11.8 | 20.6 | 12.9      |          |          |                   | 18.6               | 18.6                    |
| C10     | 6.7  | 5.3  | 7.7  | 5.1  | 5.7  | 3.0  | 2.5  | 2.1  | 4.4  | 4.7  | 4.3  | 4.3  | 4.6       |          |          |                   | 18.6               | 18.6                    |
| C20     | 3.4  | 3.4  | 3.6  | 3.5  | 4.1  | 2.0  | 2.5  | 1.2  | 1.9  | 2.6  | 1.9  | 7.3  | 3.1       |          |          |                   | 18.6               | 18.6                    |
| C30     | 4.2  | 2.8  | 2.9  | 2.7  | 3.9  | 1.8  | 1.3  | 2.4  | 2.8  | 3.1  | 2.8  | 4.3  | 3.2       |          |          |                   | 18.6               | 18.6                    |
| C50     | 5.0  | 4.1  | 4.2  | 2.4  | 3.7  | 2.3  | 1.7  | 2.6  | 1.8  | 2.8  | 3.4  | 4.3  | 3.2       |          |          |                   | 18.6               | 18.6                    |
| C70     | 5.3  | 5.6  | 4.4  | 3.1  | 3.0  | 3.6  | 1.8  | 1.0  | 2.4  | 3.4  | 3.5  | 3.1  | 3.3       |          |          |                   | 18.6               | 18.6                    |
|         |      |      |      |      |      |      |      |      |      |      |      |      |           |          |          |                   |                    |                         |
| station | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | year mean | UTM-E km | UTM-N km | local depth m NAP | salinity year mean | % river water year mean |
| C1      | 73.4 | 60.3 | 74.7 | 27.6 | 32.3 | 19.5 | 22.1 | 19.1 | 19.7 | 30.9 | 42.6 | 61.6 | 40.3      | 613.525  | 5858.343 | 6.9               | 30.62              | 12.9                    |
| C2      | 36.2 | 39.7 | 49.2 | 25.5 | 24.1 | 18.3 | 11.5 | 12.4 | 15.7 | 28.8 | 31.6 | 36.7 | 29.1      | 612.622  | 5858.538 | 9.3               | 30.75              | 12.5                    |
| C4      | 31.1 | 17.8 | 21.0 | 19.0 | 13.2 | 6.5  | 9.8  | 5.0  | 13.2 | 11.3 | 20.2 | 22.9 | 15.9      | 610.944  | 5858.893 | 10.1              | 30.97              | 11.9                    |
| C10     | 6.3  | 6.2  | 8.0  | 6.1  | 7.0  | 3.8  | 4.1  | 2.7  | 6.8  | 5.8  | 5.8  | 4.8  | 5.6       | 605.144  | 5861.862 | 16.7              | 31.50              | 10.4                    |
| C20     | 3.2  | 4.3  | 4.6  | 4.6  | 3.9  | 3.8  | 3.1  | 2.1  | 3.1  | 3.1  | 2.6  | 3.5  | 6.0       | 595.244  | 5863.409 | 24.3              | 33.18              | 5.53                    |
| C30     | 4.4  | 4.0  | 4.0  | 2.9  | 4.2  | 3.2  | 2.9  | 2.6  | 3.1  | 3.0  | 2.6  | 6.6  | 3.6       | 585.413  | 5864.749 | 28.9              | 34.25              | 2.                      |

Table 2. The statistical parameters of the TSM concentrations (mg/l) for the survey period between May 1975 and February 1983

The data from 1 May 1979 through 20 August 1979 are not used for the determination of the statistical parameters preventing statistical bias

|                | Summer 1 May- 31 October |        |        |        |        |        |        |        |        |        | Winter 1 December- 31 March |        |        |        |        |        |        |  |  |  |
|----------------|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------|--------|--------|--------|--------|--------|--|--|--|
|                | Summer                   | Summer | Summer | Summer | Summer | Summer | Summer | Summer | Summer | Winter | Winter                      | Winter | Winter | Winter | Winter | Winter | Winter |  |  |  |
| station        | A1                       | A2     | A4     | A10    | A20    | A30    | A50    | A70    |        | A1     | A2                          | A4     | A10    | A20    | A30    | A50    | A70    |  |  |  |
| sample size    | 98                       | 98     | 98     | 98     | 98     | 98     | 97     | 96     |        | 51     | 51                          | 51     | 51     | 50     | 51     | 49     | 49     |  |  |  |
| meanlog        | 4.75                     | 4.3    | 3.65   | 3.19   | 2.63   | 2.04   | 1.83   | 1.2    |        | 5.59   | 6.06                        | 4.58   | 4.69   | 3.16   | 2.64   | 1.79   | 1.57   |  |  |  |
| SDlog          | 0.53                     | 0.75   | 0.67   | 0.82   | 0.68   | 0.51   | 0.51   | 0.76   |        | 0.59   | 0.38                        | 0.79   | 0.73   | 0.89   | 0.73   | 0.8    | 0.86   |  |  |  |
| Threshold      | -27.51                   | -5.54  | -7.53  | 0.23   | -2.79  | -1.99  | -2.54  | -0.58  |        | -51.78 | -200.04                     | -9     | -3.79  | 1.97   | -0.97  | 0.19   | 0.26   |  |  |  |
| GOF-West       | 0.99                     | 0.99   | 0.98   | 0.99   | 0.99   | 0.99   | 0.97   | 0.99   |        | 0.99   | 0.97                        | 0.98   | 0.97   | 0.97   | 0.99   | 0.99   | 0.98   |  |  |  |
| P-value        | 0.32                     | 0.641  | 0.061  | 0.376  | 0.434  | 0.925  | 0.003  | 0.54   |        | 0.696  | 0.071                       | 0.349  | 0.074  | 0.134  | 0.796  | 0.721  | 0.284  |  |  |  |
| geometric mean | 82.38                    | 65.74  | 27.73  | 24.51  | 9.49   | 5.19   | 2.6    | 2.39   |        | 202.25 | 190.04                      | 84.48  | 104.11 | 26.34  | 12.67  | 6.27   | 5.18   |  |  |  |
| mean           | 105.39                   | 90.64  | 40.52  | 34     | 14.61  | 6.77   | 4.52   | 3.81   |        | 267.32 | 258.15                      | 121.64 | 136.08 | 35.93  | 17.07  | 8.37   | 7.1    |  |  |  |
| Median         | 93.55                    | 66.4   | 36.15  | 23.7   | 11     | 5.7    | 4.1    | 3      |        | 228.5  | 234.5                       | 80.2   | 90.7   | 24.35  | 12.6   | 6      | 5.1    |  |  |  |
| mode           | 60.42                    | 36.52  | 16.96  | 12.57  | 5.93   | 3.94   | 2.34   | 1.27   |        | 136.68 | 168.94                      | 43.06  | 60.4   | 12.75  | 7.23   | 3.35   | 2.55   |  |  |  |
| Variation Coef | 0.68                     | 0.86   | 0.87   | 0.94   | 0.88   | 0.71   | 0.85   | 0.97   |        | 0.76   | 0.68                        | 0.86   | 0.73   | 0.83   | 0.82   | 0.84   | 0.84   |  |  |  |
| station        | W1                       | W2     | W4     | W10    | W20    | W30    | W50    | W70    |        | W1     | W2                          | W4     | W10    | W20    | W30    | W50    | W70    |  |  |  |
| sample size    | 94                       | 97     | 98     | 98     | 95     | 93     | 93     | 74     |        | 51     | 51                          | 51     | 50     | 50     | 49     | 44     | 43     |  |  |  |
| meanlog        | 2.67                     | 3.03   | 3.04   | 2.73   | 1.71   | 1.36   | 1.6    | 1.77   |        | 4.14   | 4.42                        | 4.17   | 3.43   | 2.73   | 2.27   | 1.94   | 1.99   |  |  |  |
| SDlog          | 0.59                     | 0.53   | 0.69   | 0.76   | 0.75   | 0.81   | 0.57   | 0.38   |        | 0.32   | 0.35                        | 0.54   | 0.75   | 0.67   | 0.58   | 0.71   | 0.66   |  |  |  |
| Threshold      | -3.12                    | -3.64  | -1.22  | -1.76  | -0.86  | -0.7   | -1.85  | -2.97  |        | -13.42 | -26.63                      | -5.47  | 7.16   | -0.9   | -2.49  | -1.63  | -1.66  |  |  |  |
| GOF-West       | 0.99                     | 0.99   | 0.97   | 0.99   | 0.98   | 0.98   | 0.97   | 0.97   |        | 0.98   | 0.99                        | 0.98   | 0.98   | 0.98   | 0.99   | 0.98   | 0.98   |  |  |  |
| P-value        | 0.232                    | 0.68   | 0.007  | 0.799  | 0.021  | 0.04   | 0.026  | 0.033  |        | 0.472  | 0.78                        | 0.27   | 0.382  | 0.216  | 0.619  | 0.512  | 0.469  |  |  |  |
| geometric mean | 10.28                    | 16.19  | 19.18  | 12.9   | 4.08   | 2.66   | 2.19   | 2.08   |        | 48.29  | 53.42                       | 57.96  | 39.6   | 14.24  | 6.36   | 4.11   | 3.05   |  |  |  |
| mean           | 20.1                     | 25.51  | 18.7   | 6.54   | 4.8    | 3.92   | 3.35   | 3.29   |        | 52.39  | 61.09                       | 69     | 47.43  | 18.25  | 8.89   | 7.29   | 7.41   |  |  |  |
| Median         | 10.55                    | 17.9   | 20.1   | 14.1   | 4.6    | 3.5    | 3.2    | 3.1    |        | 49     | 57.6                        | 63.7   | 38.6   | 13.45  | 6.8    | 5.7    | 5.2    |  |  |  |
| mode           | 7.17                     | 12.02  | 11.66  | 6.85   | 2.32   | 1.32   | 1.73   | 2.1    |        | 43.16  | 46.61                       | 42.46  | 24.66  | 8.92   | 4.47   | 2.57   | 3.1    |  |  |  |
| Variation Coef | 0.74                     | 0.69   | 0.95   | 0.91   | 1.1    | 1.32   | 0.86   | 0.74   |        | 0.41   | 0.51                        | 0.64   | 0.65   | 0.75   | 0.76   | 0.97   | 0.86   |  |  |  |
| station        | S1                       | S4     | S10    | S20    | S30    | S50    | S70    |        |        | S1     | S4                          | S10    | S20    | S30    | S50    | S70    |        |  |  |  |
| sample size    | 88                       | 88     | 97     | 97     | 97     | 98     | 98     |        |        | 41     | 42                          | 50     | 50     | 49     | 48     | 48     |        |  |  |  |
| meanlog        | 2.66                     | 2.67   | 2.19   | 1.71   | 1.54   | 1.35   | 1.41   |        |        | 3.84   | 3.82                        | 4      | 2.8    | 2.25   | 2.38   | 2.2    |        |  |  |  |
| SDlog          | 0.6                      | 0.7    | 0.67   | 0.69   | 0.69   | 0.71   | 0.65   |        |        | 0.47   | 0.5                         | 0.31   | 0.52   | 0.61   | 0.4    | 0.47   |        |  |  |  |
| Threshold      | -1.85                    | -1.39  | -1.12  | -0.6   | -0.6   | -1.12  | -0.6   |        |        | -4.94  | -5.9                        | -26.89 | -4.84  | -1.96  | -4.94  | -3.5   |        |  |  |  |
| GOF-West       | 0.99                     | 0.99   | 0.99   | 0.99   | 0.99   | 0.98   | 0.97   |        |        | 0.99   | 0.98                        | 0.98   | 0.98   | 0.98   | 0.98   | 0.98   |        |  |  |  |
| P-value        | 0.57                     | 0.331  | 0.736  | 0.025  | 0.004  | 0.039  | 0.039  |        |        | 0.027  | 0.387                       | 0.239  | 0.202  | 0.37   | 0.442  | 0.439  |        |  |  |  |
| geometric mean | 11.92                    | 11.73  | 7.01   | 3.83   | 2.67   | 2.93   | 2.36   |        |        | 41     | 38.75                       | 24.48  | 10.39  | 6.72   | 4.47   | 4.39   |        |  |  |  |
| mean           | 15.28                    | 16.6   | 9.8    | 5.89   | 4.68   | 4.36   | 3.95   |        |        | 46.79  | 45.7                        | 30.21  | 13.85  | 9.52   | 6.73   | 6.55   |        |  |  |  |
| Median         | 12.35                    | 12.2   | 7.2    | 4.3    | 3.7    | 3.15   | 3.3    |        |        | 38.5   | 38.3                        | 28.5   | 12.85  | 7.4    | 5.8    | 5.3    |        |  |  |  |
| mode           | 8.12                     | 7.08   | 4.35   | 2.32   | 1.67   | 1.74   | 1.56   |        |        | 32.56  | 29.56                       | 22.67  | 7.65   | 4.58   | 4.3    | 3.71   |        |  |  |  |
| Variation Coef | 0.75                     | 0.85   | 0.83   | 0.93   | 0.97   | 0.95   | 0.97   |        |        | 0.53   | 0.61                        | 0.58   | 0.72   | 0.81   | 0.7    | 0.74   |        |  |  |  |
| station        | G6                       | G10    | G20    | G30    | G50    | G70    |        |        |        | G6     | G10                         | G20    | G30    | G50    | G70    |        |        |  |  |  |
| sample size    | 97                       | 98     | 98     | 97     | 72     | 73     |        |        |        | 50     | 50                          | 50     | 49     | 43     | 43     |        |        |  |  |  |
| meanlog        | 2.85                     | 2.42   | 1.94   | 1.09   | 1.4    | 1.51   |        |        |        | 3.92   | 3.17                        | 2.09   | 2.07   | 1.9    | 1.8    |        |        |  |  |  |
| SDlog          | 0.67                     | 0.51   | 0.86   | 0.66   | 0.69   | 0.68   |        |        |        | 0.48   | 0.45                        | 0.71   | 0.47   | 0.49   | 0.69   |        |        |  |  |  |
| Threshold      | -1.98                    | -3.68  | -1.94  | -0.22  | -1.03  | -1.11  |        |        |        | -12.39 | -5.94                       | -0.7   | -3.05  | -2.41  | -1.21  |        |        |  |  |  |
| GOF-West       | 0.98                     | 0.99   | 0.98   | 0.99   | 0.98   | 0.97   |        |        |        | 0.99   | 0.98                        | 0.98   | 0.98   | 0.98   | 0.99   |        |        |  |  |  |
| P-value        | 0.106                    | 0.361  | 0.098  | 0.501  | 0.122  | 0.051  |        |        |        | 0.718  | 0.428                       | 0.51   | 0.389  | 0.326  | 0.868  |        |        |  |  |  |
| geometric mean | 14.58                    | 6.45   | 4.04   | 2.62   | 2.45   | 2.75   |        |        |        | 35.06  | 16.88                       | 7.16   | 3.93   | 3.43   | 3.19   |        |        |  |  |  |
| mean           | 19.71                    | 9.03   | 6.64   | 4.08   | 4.01   | 4.6    |        |        |        | 43.85  | 20.32                       | 9.56   | 5.8    | 5.08   | 6.41   |        |        |  |  |  |
| Median         | 16                       | 7.15   | 5.5    | 3      | 3.05   | 3.79   |        |        |        | 39.7   | 17.9                        | 6.85   | 4.8    | 4.3    | 4.7    |        |        |  |  |  |
| mode           | 10.4                     | 5.01   | 2.63   | 1.19   | 1.59   | 1.69   |        |        |        | 27.74  | 13.51                       | 4.2    | 3.29   | 2.85   | 2.56   |        |        |  |  |  |
| Variation Coef | 0.88                     | 0.72   | 0.85   | 1.12   | 0.96   | 0.97   |        |        |        | 0.61   | 0.61                        | 0.72   | 0.79   | 0.76   | 0.74   |        |        |  |  |  |
| station        | T1                       | T2     | T4     | T10    | T20    | T30    | T50    | T70    |        | T1     | T2                          | T4     | T10    | T20    | T30    | T50    | T70    |  |  |  |
| sample size    | 99                       | 99     | 99     | 95     | 95     | 95     | 95     | 49     |        | 49     | 49                          | 49     | 49     | 49     | 49     | 48     |        |  |  |  |
| meanlog        | 2.33                     | 2.31   | 2.05   | 1.51   | 1.38   | 1.26   | 1.32   | 1.23   |        | 3.35   | 2.62                        | 2.35   | 2.04   | 1.69   | 1.66   | 1.52   | 1.92   |  |  |  |
| SDlog          | 0.67                     | 0.5    | 0.5    | 0.78   | 0.85   | 0.81   | 0.8    | 0.77   |        | 0.56   | 0.71                        | 0.62   | 0.68   | 0.58   | 0.52   | 0.62   | 0.48   |  |  |  |
| Threshold      | -1.09                    | -2.97  | -2.25  | -0.59  | -0.57  | -0.52  | -0.78  | -0.62  |        | -6.43  | 0.2                         | -0.91  | -1.17  | -1.17  | 1.5    | -0.2   | -2.36  |  |  |  |
| GOF-West       | 0.99                     | 0.99   | 0.99   | 0.99   | 0.98   | 0.97   | 0.98   | 0.97   |        | 0.99   | 0.98                        | 0.98   | 0.98   | 0.98   | 0.98   | 0.98   | 0.99   |  |  |  |
| P-value        | 0.883                    | 0.28   | 0.213  | 0.948  | 0.569  | 0.003  | 0.108  | 0.038  |        | 0.613  | 0.037                       | 0.147  | 0.022  | 0.045  | 0.921  | 0.467  | 0.618  |  |  |  |
| geometric mean | 8.88                     | 6.01   | 4.95   | 3.6    | 2.99   | 2.6    | 2.35   | 2.4    |        | 20.46  | 13.96                       | 9.33   | 5.97   | 3.83   | 3.31   | 4.32   | 3.77   |  |  |  |
| mean           | 11.82                    | 8.48   | 6.5    | 5.51   | 5.12   | 4.39   | 4.35   | 4.4    |        | 26.9   | 17.96                       | 11.8   | 8.52   | 5.25   | 4.47   | 5.3    | 5.31   |  |  |  |
| Median         | 9.7                      | 6.8    | 5.9    | 3.9    | 3.2    | 2.95   | 2.9    | 3.2    |        | 22.3   | 15.4                        | 10.1   | 6.35   | 3.9    | 3.6    | 4      | 4.25   |  |  |  |
| mode           | 5.48                     | 4.84   | 3.8    | 1.88   | 1.37   | 1.32   | 1.18   | 1.28   |        | 14.52  | 8.44                        | 6.18   | 3.67   | 2.7    | 2.5    | 2.9    | 3.05   |  |  |  |
| Variation Coef | 0.84                     | 0.76   | 0.72   | 0.99   | 1.09   | 1.19   | 1.06   | 1.1    |        | 0.76   | 0.95                        | 0.78   | 0.88   | 0.74   | 0.72   | 0.68   | 0.73   |  |  |  |
| station        | N1                       | N2     | N4     | N10    | N20    | N30    | N50    | N70    |        | N1     | N2                          | N4     | N10    | N20    | N30    | N50    | N70    |  |  |  |
| sample size    | 91                       | 96     | 97     | 95     | 97     | 94     | 92     | 92     |        | 46     | 46                          | 46     | 49     | 47     | 48     | 47     | 46     |  |  |  |
| meanlog        | 3.05                     | 2.53   | 1.85   | 1.59   | 1.32   | 1.31   | 0.96   | 1.14   |        | 3.93   | 3.29                        | 2.48   | 2.02   | 1.8    | 1.9    | 2.09   | 1.84   |  |  |  |
| SDlog          | 0.54                     | 0.53   | 0.7    | 0.7    | 0.79   | 0.73   | 0.87   | 0.68   |        | 0.67   | 0.59                        | 0.58   | 0.55   | 0.52   | 0.36   | 0.33   | 0.48   |  |  |  |
| Threshold      | -5.59                    | -3.93  | -0.75  | -0.92  | -0.76  | -0.92  | -0.35  | -0.89  |        | -6.81  | -4.2                        | -2.17  | -1.79  | -1.94  | -3.29  | -4.42  | -2.17  |  |  |  |
| GOF-West       | 0.99                     | 0.99   | 0.99   | 0.99   | 0.98   | 0.98   | 0.99   | 0.97   |        | 0.97   | 0.99                        | 0.98   | 0.99   | 0.98   | 0.98   | 0.97   | 0.99   |  |  |  |
| P-value        | 0.493                    | 0.564  | 0.292  | 0.375  | 0.078  | 0.018  | 0.011  | 0.011  |        | 0.103  | 0.928                       | 0.483  | 0.849  | 0.391  | 0.358  | 0.158  | 0.73   |  |  |  |
| geometric mean | 13.9                     | 7.44   | 5.32   | 3.51   | 2.34   | 2.16   | 2      | 1.74   |        | 42.17  | 21.6                        | 8.8    | 5.27   | 3.5    | 2.56   | 2.79   | 3.47   |  |  |  |
| mean           | 18.66                    | 10.49  | 7.38   | 5.35   | 4.27   | 3.87   | 3.44   | 3.05   |        | 56.19  | 27.57                       | 11.92  | 7      | 4.99   | 3.82   | 4.15   | 4.87   |  |  |  |
| Median         | 14.1                     | 8.55   | 5.9    | 4      | 3.3    | 2.65   | 2.4    | 2.55   |        | 43.4   | 42.7                        | 8.7    | 5.4    | 3.8    | 3.35   | 3.5    | 4.2    |  |  |  |
| mode           | 10.12                    | 5.64   | 3.17   | 2.08   | 1.26   | 1.26   | 0.87   | 1.1    |        | 25.82  | 14.67                       | 6.32   | 3.77   | 2.67   | 2.56   | 2.86   | 2.81   |  |  |  |
| Variation Coef | 0.72                     | 0.75   | 0.88   | 0.96   | 1.11   | 1      | 1.16   | 1.02   |        | 0.76   | 0.71                        | 0.76   | 0.77   | 0.73   | 0.7</  |        |        |  |  |  |

Table 3. The statistical parameters of the TSM concentrations (mg/l) at the aggregated stations for the survey period between May 1975 and February 1983

The data from 1 May 1979 through 20 Augustus 1979 are not used for the determination of the statistical parameters preventing statistical bias

**South** = data of W, S and G transects at the same distance to the coast**North** = data of T, N, E, C and TS transects at the same distance to the coast

Summer 1 May- 31 October

Winter 1 December- 31 March

LWinter 1 November- 30 April

|                | South<br>Summer  | South<br>Summer | South<br>Summer | South<br>Summer | South<br>Summer | South<br>Summer | South<br>Summer | South<br>Summer |
|----------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | South1km         | South2km        | South4km        | South10km       | South20km       | South30km       | South50km       | South70km       |
| sample size    | 183              | 97              | 283             | 293             | 284             | 281             | 237             | 239             |
| meanlog        | 2.68             | 3.03            | 2.84            | 2.30            | 1.73            | 1.32            | 1.40            | 1.45            |
| SDlog          | 0.59             | 0.53            | 0.70            | 0.78            | 0.73            | 0.80            | 0.67            | 0.62            |
| Treshhold      | -2.62            | -3.64           | -1.41           | -1.00           | -0.82           | -0.52           | -0.79           | -1.13           |
| GOF-Wtest      | 0.99             | 0.99            | 0.99            | 1.00            | 1.00            | 0.99            | 0.99            | 0.98            |
| P-value        | 0.454            | 0.680           | 0.073           | 0.948           | 0.853           | 0.032           | 0.004           | 0.001           |
| geometric mean | 11.05            | 16.19           | 15.28           | 8.53            | 4.43            | 2.94            | 2.92            | 2.66            |
| mean           | 14.62            | 20.10           | 20.73           | 12.58           | 6.50            | 4.66            | 4.30            | 4.05            |
| Median         | 11.60            | 17.90           | 16.20           | 9.20            | 4.75            | 3.60            | 3.20            | 3.30            |
| mode           | 7.67             | 12.02           | 9.06            | 4.44            | 2.51            | 1.48            | 1.80            | 1.80            |
| Variation Coef | 0.75             | 0.69            | 0.93            | 0.98            | 0.94            | 1.12            | 0.90            | 0.91            |
|                | South<br>Winter  | South<br>Winter | South<br>Winter | South<br>Winter | South<br>Winter | South<br>Winter | South<br>Winter | South<br>Winter |
|                | South1km         | South2km        | South4km        | South10km       | South20km       | South30km       | South50km       | South70km       |
| sample size    | 92               | 51              | 143             | 150             | 150             | 147             | 128             | 133             |
| meanlog        | 4.10             | 4.30            | 3.97            | 3.39            | 2.47            | 2.11            | 1.77            | 1.90            |
| SDlog          | 0.35             | 0.39            | 0.54            | 0.63            | 0.71            | 0.61            | 0.65            | 0.65            |
| Treshhold      | -14.21           | -19.33          | -8.07           | -3.60           | -1.34           | -1.97           | -0.78           | -1.50           |
| GOF-Wtest      | 0.99             | 0.99            | 1.00            | 0.99            | 0.99            | 0.99            | 0.99            | 0.99            |
| P-value        | 0.819            | 0.783           | 0.882           | 0.734           | 0.338           | 0.117           | 0.705           | 0.551           |
| geometric mean | 45.01            | 52.50           | 43.16           | 25.15           | 9.99            | 5.44            | 4.85            | 4.54            |
| mean           | 50.00            | 60.20           | 53.34           | 32.49           | 13.71           | 7.94            | 6.47            | 6.69            |
| Median         | 46.00            | 55.10           | 44.20           | 27.00           | 10.15           | 6.50            | 5.55            | 5.10            |
| mode           | 39.28            | 44.39           | 31.67           | 16.50           | 5.81            | 3.72            | 3.05            | 2.89            |
| Variation Coef | 0.46             | 0.52            | 0.68            | 0.75            | 0.82            | 0.82            | 0.81            | 0.86            |
|                | South<br>LWinter | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         |
|                | South1km         | South2km        | South4km        | South10km       | South20km       | South30km       | South50km       | South70km       |
| sample size    | 141              | 79              | 220             | 232             | 227             | 198             | 202             |                 |
| meanlog        | 3.99             | 3.74            | 3.92            | 3.16            | 2.25            | 1.97            | 1.69            | 1.72            |
| SDlog          | 0.37             | 0.59            | 0.52            | 0.67            | 0.75            | 0.60            | 0.64            | 0.68            |
| Treshhold      | -15.41           | 0.37            | -10.19          | -1.92           | -0.50           | -1.58           | -1.00           | -0.96           |
| GOF-Wtest      | 0.99             | 0.98            | 1.00            | 1.00            | 1.00            | 0.99            | 1.00            | 1.00            |
| P-value        | 0.729            | 0.228           | 0.802           | 0.541           | 0.743           | 0.025           | 0.869           | 0.614           |
| geometric mean | 37.18            | 42.43           | 38.02           | 21.16           | 8.77            | 5.02            | 4.07            | 4.25            |
| mean           | 42.79            | 50.12           | 47.56           | 27.65           | 12.01           | 7.07            | 5.65            | 6.07            |
| Median         | 37.80            | 42.10           | 39.30           | 22.50           | 9.35            | 5.60            | 4.45            | 4.45            |
| mode           | 31.85            | 29.95           | 28.51           | 13.14           | 4.85            | 3.43            | 2.61            | 2.58            |
| Variation Coef | 0.52             | 0.59            | 0.69            | 0.79            | 0.87            | 0.82            | 0.84            | 0.86            |
|                | North<br>Summer  | Summer          | Summer          | Summer          | Summer          | Summer          | Summer          | Summer          |
|                | North1km         | North2km        | North4km        | North10km       | North20km       | North30km       | North50km       | North70km       |
| sample size    | 363              | 376             | 478             | 467             | 455             | 454             | 450             | 450             |
| meanlog        | 2.69             | 2.28            | 1.86            | 1.43            | 1.15            | 1.18            | 1.02            | 1.06            |
| SDlog          | 0.70             | 0.73            | 0.77            | 0.77            | 0.84            | 0.77            | 0.84            | 0.80            |
| Treshhold      | -1.96            | -1.10           | -0.70           | -0.80           | -0.38           | -0.60           | -0.46           | -0.52           |
| GOF-Wtest      | 1.00             | 0.99            | 0.99            | 1.00            | 0.99            | 0.99            | 0.98            | 0.98            |
| P-value        | 0.437            | 0.128           | 0.012           | 0.067           | 0.014           | 0.000           | 0.000           | 0.000           |
| geometric mean | 11.95            | 8.12            | 5.39            | 3.26            | 2.55            | 2.31            | 1.99            | 2.02            |
| mean           | 16.77            | 11.67           | 7.96            | 5.01            | 4.13            | 3.79            | 3.49            | 3.47            |
| Median         | 12.70            | 8.55            | 5.90            | 3.60            | 2.80            | 2.80            | 2.50            | 2.65            |
| mode           | 6.97             | 4.62            | 2.87            | 1.71            | 1.18            | 1.22            | 0.92            | 0.99            |
| Variation Coef | 0.85             | 0.96            | 0.98            | 0.98            | 1.10            | 1.08            | 1.15            | 1.21            |
|                | North<br>Winter  | Winter          | Winter          | Winter          | Winter          | Winter          | Winter          | Winter          |
|                | North1km         | North2km        | North4km        | North10km       | North20km       | North30km       | North50km       | North70km       |
| sample size    | 189              | 192             | 237             | 235             | 226             | 228             | 231             | 224             |
| meanlog        | 3.65             | 3.05            | 2.48            | 1.95            | 1.58            | 1.51            | 1.62            | 1.67            |
| SDlog          | 0.69             | 0.76            | 0.87            | 0.59            | 0.56            | 0.56            | 0.57            | 0.60            |
| Treshhold      | -3.85            | -0.10           | 0.78            | -1.45           | -1.21           | -1.24           | -1.15           | -1.23           |
| GOF-Wtest      | 1.00             | 0.99            | 1.00            | 0.99            | 0.99            | 0.99            | 1.00            | 0.99            |
| P-value        | 0.987            | 0.426           | 0.686           | 0.240           | 0.253           | 0.178           | 0.493           | 0.185           |
| geometric mean | 33.42            | 21.09           | 13.01           | 5.08            | 3.27            | 2.90            | 3.57            | 3.67            |
| mean           | 44.93            | 28.07           | 18.19           | 6.96            | 4.46            | 4.07            | 4.78            | 5.13            |
| Median         | 35.20            | 22.25           | 12.90           | 5.40            | 3.70            | 3.30            | 3.90            | 4.15            |
| mode           | 20.22            | 11.89           | 6.41            | 3.50            | 2.32            | 2.08            | 2.51            | 2.48            |
| Variation Coef | 0.84             | 0.85            | 1.05            | 0.80            | 0.75            | 0.78            | 0.74            | 0.80            |
|                | North<br>LWinter | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         | LWinter         |
|                | North1km         | North2km        | North4km        | North10km       | North20km       | North30km       | North50km       | North70km       |
| sample size    | 276              | 285             | 358             | 354             | 343             | 346             | 344             | 338             |
| meanlog        | 3.49             | 3.02            | 2.54            | 1.95            | 1.58            | 1.46            | 1.51            | 1.54            |
| SDlog          | 0.73             | 0.73            | 0.79            | 0.58            | 0.58            | 0.60            | 0.63            | 0.65            |
| Treshhold      | -2.59            | -0.96           | -0.38           | -1.60           | -1.24           | -1.06           | -0.92           | -0.93           |
| GOF-Wtest      | 1.00             | 1.00            | 0.99            | 1.00            | 0.99            | 0.99            | 1.00            | 0.99            |
| P-value        | 0.720            | 0.900           | 0.112           | 0.377           | 0.032           | 0.024           | 0.185           | 0.136           |
| geometric mean | 29.10            | 19.18           | 12.17           | 4.89            | 3.18            | 2.85            | 3.28            | 3.34            |
| mean           | 39.84            | 25.72           | 17.16           | 6.71            | 4.51            | 4.09            | 4.61            | 4.78            |
| Median         | 31.60            | 19.30           | 12.25           | 5.35            | 3.70            | 3.30            | 3.60            | 3.70            |
| mode           | 16.73            | 11.02           | 6.39            | 3.39            | 2.22            | 1.95            | 2.13            | 2.13            |
| Variation Coef | 0.87             | 0.85            | 1.01            | 0.78            | 0.78            | 0.83            | 0.80            | 0.84            |

Table 4.1. The statistical parameters of the light attenuation coefficient  $K_d$  (1/m) (LN-distribution) along the N-transect for the survey period between June 1995 and December 1999

| Summer 1 May- 31 October |       |       |       |       | LWinter 1 November- 30 April |       |       |       |       |
|--------------------------|-------|-------|-------|-------|------------------------------|-------|-------|-------|-------|
| station                  | N2    | N10   | N20   | N70   | station                      | N2    | N10   | N20   | N70   |
| sample size              | 32    | 77    | 30    | 29    | sample size                  | 10    | 20    | 9     | 11    |
| meanlog                  | -0.21 | -0.64 | -0.79 | -1.53 | meanlog                      | 0.16  | -0.47 | -0.50 | -1.28 |
| SDlog                    | 0.37  | 0.28  | 0.28  | 0.24  | SDlog                        | 0.41  | 0.34  | 0.37  | 0.40  |
| GOF-Wtest                | 0.91  | 0.95  | 0.90  | 0.96  | GOF-Wtest                    | 0.93  | 0.91  | 0.94  | 0.95  |
| P-value                  | 0.015 | 0.003 | 0.006 | 0.255 | P-value                      | 0.421 | 0.070 | 0.556 | 0.659 |
| geometric mean           | 0.81  | 0.53  | 0.45  | 0.22  | geometric mean               | 1.17  | 0.63  | 0.60  | 0.28  |
| mean                     | 0.87  | 0.55  | 0.47  | 0.22  | mean                         | 1.26  | 0.66  | 0.64  | 0.30  |
| median                   | 0.85  | 0.53  | 0.45  | 0.21  | median                       | 1.11  | 0.63  | 0.62  | 0.33  |
| mode                     | 0.71  | 0.49  | 0.42  | 0.20  | mode                         | 0.99  | 0.56  | 0.53  | 0.24  |
| Variation Coef           | 0.38  | 0.29  | 0.31  | 0.25  | Variation Coef               | 0.40  | 0.33  | 0.37  | 0.35  |
| quantile20               | 0.60  | 0.42  | 0.36  | 0.18  | quantile20                   | 0.83  | 0.47  | 0.44  | 0.20  |
| Lower LimitQ20           | 0.50  | 0.38  | 0.31  | 0.16  | Lower LimitQ20               | 0.53  | 0.38  | 0.28  | 0.13  |
| Upper LimitQ20           | 0.68  | 0.45  | 0.40  | 0.19  | Upper LimitQ20               | 1.07  | 0.70  | 0.56  | 0.25  |
| quantile80               | 1.10  | 0.67  | 0.58  | 0.27  | quantile80                   | 1.65  | 0.83  | 0.83  | 0.39  |
| Lower LimitQ80           | 0.97  | 0.63  | 0.52  | 0.24  | Lower LimitQ80               | 1.28  | 0.71  | 0.65  | 0.31  |
| Upper LimitQ80           | 1.31  | 0.73  | 0.66  | 0.30  | Upper LimitQ80               | 2.58  | 1.03  | 1.29  | 0.58  |

table 4.2. Monthly medians, monthly means and the coefficients of variation of the light attenuation coefficient  $K_d$  (1/m) along the N-transect for the survey period between June 1995 and December 1999

| station | median | median | median | median | median | median | median | median | median | median | median | median | year mean |
|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|
|         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |           |
| N2      | 1.836  | 1.482  | 0.953  | 1.200  | 0.815  | 0.695  | 0.908  | 0.544  | 1.360  | 0.774  | NA     | 1.371  | 1.085     |
| N10     | 0.598  | 0.629  | 0.521  | 0.644  | 0.523  | 0.590  | 0.526  | 0.512  | 0.522  | 0.535  | 0.519  | 1.088  | 0.601     |
| N20     | 0.615  | 0.391  | 0.509  | 0.822  | 0.499  | 0.395  | 0.423  | 0.432  | 0.503  | 0.488  | NA     | NA     | 0.508     |
| N70     | 0.251  | 0.255  | 0.283  | 0.344  | 0.198  | 0.221  | 0.205  | 0.194  | 0.270  | 0.246  | NA     | 0.300  | 0.252     |
|         | mean   | mean   | mean   | mean   | mean   | mean   | mean   | mean   | mean   | mean   | mean   | mean   | year mean |
|         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |           |
| N2      | 1.836  | 1.482  | 0.949  | 1.193  | 0.909  | 0.671  | 0.924  | 0.588  | 1.199  | 0.956  | NA     | 1.371  | 1.098     |
| N10     | 0.635  | 0.619  | 0.556  | 0.708  | 0.598  | 0.536  | 0.537  | 0.526  | 0.565  | 0.562  | 0.519  | 1.088  | 0.621     |
| N20     | 0.615  | 0.391  | 0.602  | 0.858  | 0.460  | 0.422  | 0.548  | 0.447  | 0.503  | 0.488  | NA     | NA     | 0.533     |
| N70     | 0.251  | 0.255  | 0.298  | 0.340  | 0.228  | 0.225  | 0.205  | 0.201  | 0.259  | 0.246  | NA     | 0.300  | 0.255     |
|         | CV     | CV     | CV     | CV     | CV     | CV     | CV     | CV     | CV     | CV     | CV     | CV     | year mean |
|         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |           |
| N2      | NA     | 0.580  | 0.082  | 0.517  | 0.357  | 0.322  | 0.221  | 0.224  | 0.234  | 0.467  | NA     | NA     | 0.334     |
| N10     | 0.524  | 0.313  | 0.173  | 0.263  | 0.405  | 0.342  | 0.168  | 0.257  | 0.294  | 0.205  | NA     | NA     | 0.294     |
| N20     | NA     | 0.108  | 0.400  | 0.205  | 0.276  | 0.190  | 0.453  | 0.200  | 0.470  | 0.149  | NA     | NA     | 0.272     |
| N70     | 0.485  | NA     | 0.558  | 0.033  | 0.373  | 0.276  | 0.159  | 0.197  | 0.095  | 0.024  | NA     | NA     | 0.244     |

Table 4.3. Monthly means of salinity (1975-1999), TSM concentrations (1975-1999), Chlorophyll A concentrations (1975-1999) and the light attenuation coefficient  $K_d$  (1/m) (1995-1999) along the N-transect  
Data from 1 May 1979 through 20 August 1979 and 6 May 1999 have not been used preventing statistical bias.

| station | quantity         | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Dec   |
|---------|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| N2      | salinity         | 28.38 | 28.24 | 27.35 | 28.67 | 28.90 | 28.25 | 28.15 | 29.12 | 28.86 | 29.33 | 28.88 |
| N2      | TSM(mg/l)        | 25.44 | 26.34 | 23.98 | 19.36 | 11.82 | 7.29  | 8.13  | 6.67  | 8.90  | 14.55 | 23.63 |
| N2      | ChlA( $\mu$ g/l) | 1.11  | 1.49  | 3.08  | 15.86 | 19.20 | 16.72 | 11.25 | 9.27  | 7.47  | 3.31  | 1.12  |
| N2      | $K_d$ (1/m)      | 1.84  | 1.48  | 0.95  | 1.19  | 0.91  | 0.67  | 0.92  | 0.59  | 1.20  | 0.96  | 1.37  |
| N10     | salinity         | 29.98 | 29.86 | 29.72 | 30.22 | 30.40 | 30.35 | 30.50 | 30.68 | 30.82 | 30.75 | 31.08 |
| N10     | TSM(mg/l)        | 12.29 | 9.29  | 8.07  | 7.68  | 6.32  | 4.64  | 4.54  | 3.60  | 4.59  | 7.19  | 6.02  |
| N10     | ChlA( $\mu$ g/l) | 0.83  | 1.27  | 3.05  | 12.91 | 16.60 | 11.19 | 9.95  | 8.80  | 5.61  | 3.61  | 1.29  |
| N10     | $K_d$ (1/m)      | 0.64  | 0.62  | 0.56  | 0.71  | 0.60  | 0.54  | 0.54  | 0.53  | 0.57  | 0.56  | 0.52  |
| N20     | salinity         | 31.98 | 31.09 | 31.47 | 31.31 | 31.82 | 31.39 | 31.62 | 31.76 | 32.07 | 32.51 | NA    |
| N20     | TSM(mg/l)        | 5.76  | 5.07  | 4.67  | 4.23  | 5.81  | 2.94  | 3.98  | 2.68  | 3.59  | 3.73  | NA    |
| N20     | ChlA( $\mu$ g/l) | 0.87  | 1.28  | 4.03  | 12.27 | 14.52 | 9.06  | 8.46  | 8.41  | 6.39  | 3.57  | NA    |
| N20     | $K_d$ (1/m)      | 0.62  | 0.39  | 0.60  | 0.86  | 0.46  | 0.42  | 0.55  | 0.45  | 0.50  | 0.49  | NA    |
| N70     | salinity         | 34.98 | 34.90 | 34.92 | 34.94 | 34.98 | 34.94 | 34.70 | 34.82 | 34.71 | 34.82 | 34.96 |
| N70     | TSM(mg/l)        | 6.50  | 5.79  | 3.45  | 3.97  | 3.51  | 2.19  | 2.27  | 2.37  | 2.44  | 3.56  | 4.38  |
| N70     | ChlA( $\mu$ g/l) | 1.07  | 1.40  | 2.71  | 5.26  | 2.35  | 1.23  | 1.64  | 1.65  | 1.86  | 2.19  | 0.90  |
| N70     | $K_d$ (1/m)      | 0.25  | 0.26  | 0.30  | 0.34  | 0.23  | 0.23  | 0.21  | 0.20  | 0.26  | 0.25  | 0.30  |

Table 5. Monthly medians, monthly means and the coefficients of variation of Chlorophyll A concentrations ( $\mu\text{g/l}$ ) along the N-transect

| station | median<br>Jan | median<br>Feb | median<br>Mar | median<br>Apr | median<br>May | median<br>Jun | median<br>Jul | median<br>Aug | median<br>Sep | median<br>Oct | median<br>Nov | median<br>Dec | year mean | survey period    |
|---------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------|------------------|
| N2      | 0.90          | 1.20          | 2.48          | 12.70         | 11.32         | 12.40         | 9.60          | 7.55          | 5.32          | 2.52          | 1.36          | 0.86          | 5.68      | period 1975-1999 |
| N2      | 0.91          | 1.15          | 2.48          | 18.00         | 9.14          | 14.35         | 10.70         | 7.07          | 4.04          | 3.04          | 1.34          | 0.72          | 6.08      | period 1995-1999 |
| N10     | 0.73          | 1.06          | 1.96          | 11.35         | 8.78          | 7.80          | 7.75          | 7.56          | 3.93          | 2.68          | 1.13          | 0.72          | 4.62      | period 1975-1999 |
| N10     | 0.73          | 0.94          | 2.38          | 14.81         | 9.89          | 12.70         | 9.90          | 8.00          | 3.72          | 2.46          | 0.98          | 0.67          | 5.60      | period 1995-1999 |
| N20     | 0.80          | 0.98          | 2.50          | 8.20          | 9.35          | 6.12          | 6.95          | 7.95          | 5.08          | 2.52          | 1.20          | 0.88          | 4.38      | period 1975-1999 |
| N20     | 0.81          | 1.20          | 2.44          | 14.80         | 8.14          | 7.36          | 6.52          | 6.44          | 2.88          | 4.30          | 1.70          | 0.79          | 4.78      | period 1995-1999 |
| N70     | 1.12          | 1.10          | 2.15          | 4.04          | 1.45          | 0.95          | 1.33          | 1.30          | 1.70          | 1.92          | 1.40          | 0.90          | 1.61      | period 1975-1999 |
| N70     | 1.22          | 2.44          | 2.32          | 4.63          | 2.06          | 0.86          | 1.28          | 1.00          | 1.48          | 2.68          | 1.51          | 0.90          | 1.87      | period 1995-1999 |
|         | mean<br>Jan   | mean<br>Feb   | mean<br>Mar   | mean<br>Apr   | mean<br>May   | mean<br>Jun   | mean<br>Jul   | mean<br>Aug   | mean<br>Sep   | mean<br>Oct   | mean<br>Nov   | mean<br>Dec   | year mean |                  |
| N2      | 1.11          | 1.49          | 3.08          | 15.86         | 19.20         | 16.72         | 11.25         | 9.27          | 7.47          | 3.31          | 1.67          | 1.12          | 7.63      | period 1975-1999 |
| N2      | 1.03          | 1.30          | 2.95          | 27.88         | 19.35         | 14.49         | 14.33         | 8.37          | 4.43          | 3.51          | 1.44          | 0.84          | 8.33      | period 1995-1999 |
| N10     | 0.83          | 1.27          | 3.05          | 12.91         | 16.60         | 11.19         | 9.95          | 8.80          | 5.61          | 3.61          | 1.29          | 0.93          | 6.34      | period 1975-1999 |
| N10     | 0.96          | 1.23          | 4.26          | 16.22         | 20.10         | 13.67         | 9.90          | 8.42          | 5.32          | 3.88          | 1.34          | 0.77          | 7.17      | period 1995-1999 |
| N20     | 0.87          | 1.28          | 4.03          | 12.27         | 14.52         | 9.06          | 8.46          | 8.41          | 6.39          | 3.57          | 1.70          | 1.09          | 5.97      | period 1975-1999 |
| N20     | 1.02          | 1.20          | 6.06          | 16.45         | 15.75         | 8.40          | 9.46          | 7.97          | 5.60          | 4.83          | 1.94          | 0.82          | 6.62      | period 1995-1999 |
| N70     | 1.07          | 1.40          | 2.71          | 5.26          | 2.35          | 1.23          | 1.64          | 1.65          | 1.86          | 2.19          | 1.34          | 0.90          | 1.97      | period 1975-1999 |
| N70     | 1.24          | 2.70          | 2.52          | 5.34          | 2.14          | 0.85          | 1.42          | 1.31          | 1.53          | 3.10          | 1.51          | 0.88          | 2.04      | period 1995-1999 |
|         | CV<br>Jan     | CV<br>Feb     | CV<br>Mar     | CV<br>Apr     | CV<br>May     | CV<br>Jun     | CV<br>Jul     | CV<br>Aug     | CV<br>Sep     | CV<br>Oct     | CV<br>Nov     | CV<br>Dec     | year mean |                  |
| N2      | 0.64          | 0.74          | 0.76          | 0.92          | 1.10          | 0.93          | 0.82          | 0.57          | 0.71          | 0.75          | 0.81          | 0.54          | 0.77      | period 1975-1999 |
| N2      | 0.38          | 0.49          | 0.79          | 0.85          | 1.34          | 0.79          | 0.96          | 0.44          | 0.43          | 0.50          | 0.39          | 0.43          | 0.65      | period 1995-1999 |
| N10     | 0.77          | 0.59          | 1.03          | 0.75          | 1.20          | 1.02          | 0.77          | 0.79          | 1.07          | 0.84          | 0.53          | 0.60          | 0.83      | period 1975-1999 |
| N10     | 0.94          | 0.56          | 1.02          | 0.56          | 1.39          | 0.68          | 0.58          | 0.53          | 1.09          | 1.07          | 0.54          | 0.44          | 0.78      | period 1995-1999 |
| N20     | 0.52          | 0.77          | 1.09          | 0.85          | 1.19          | 1.08          | 0.81          | 0.52          | 0.75          | 0.70          | 0.90          | 0.66          | 0.82      | period 1975-1999 |
| N20     | 0.55          | 0.86          | 1.02          | 0.62          | 1.45          | 0.55          | 1.15          | 0.52          | 0.96          | 0.60          | 0.47          | 0.19          | 0.74      | period 1995-1999 |
| N70     | 0.47          | 0.71          | 0.60          | 0.66          | 1.23          | 0.64          | 0.75          | 0.64          | 0.52          | 0.60          | 0.39          | 0.41          | 0.64      | period 1975-1999 |
| N70     | 0.42          | 0.38          | 0.61          | 0.59          | 0.83          | 0.53          | 0.56          | 0.56          | 0.42          | 0.75          | 0.17          | 0.10          | 0.49      | period 1995-1999 |

table 6. The statistical parameters of the TSM concentrations (mg/l) at some stations between March 1983 and December 1999

Most of the medians are integers because of the round figures in DONAR after 1983

**Summer 1 May- 31 October****Winter 1 December- 31 March**

|                | Summer<br>W2 | Summer<br>W20 | Summer<br>W70 | Summer<br>S10 | Summer<br>G6 | Summer<br>N2 | Summer<br>N10 | Summer<br>N20 | Summer<br>N70 | Summer<br>TS4 | Summer<br>TS10 | Summer<br>R3 |
|----------------|--------------|---------------|---------------|---------------|--------------|--------------|---------------|---------------|---------------|---------------|----------------|--------------|
| sample size    | 124          | 114           | 67            | 103           | 122          | 161          | 278           | 139           | 94            | 139           | 86             | 170          |
| meanlog        | 3.04         | 1.48          | 0.93          | 2.17          | 2.20         | 1.93         | 1.30          | 1.03          | 0.54          | 1.61          | 0.75           | 3.11         |
| SDlog          | 0.74         | 0.86          | 0.82          | 0.85          | 0.99         | 0.86         | 0.73          | 0.94          | 1.22          | 1.01          | 0.94           | 0.71         |
| Threshold      | -2.32        | -0.25         | 0.02          | -0.88         | -0.25        | 0.11         | 0.27          | -0.18         | 0.47          | 0.01          | 0.44           | -0.15        |
| GOF-W test     | 0.99         | 0.97          | 0.90          | 0.99          | 0.99         | 0.97         | 0.96          | 0.96          | 0.87          | 0.98          | 0.90           | 0.99         |
| P-value        | 0.12         | 0.00          | 0.00          | 0.26          | 0.11         | 0.00         | 0.00          | 0.00          | 0.05          | 0.00          | 0.00           | 0.21         |
| geometric mean | 17.56        | 4.00          | 2.56          | 7.44          | 8.62         | 7.04         | 4.02          | 2.46          | 2.45          | 5.01          | 2.71           | 22.33        |
| mean           | 24.94        | 5.95          | 3.73          | 11.65         | 14.27        | 10.16        | 5.09          | 4.19          | 4.47          | 8.24          | 3.92           | 28.95        |
| median         | 21.5         | 4             | 2             | 8             | 8            | 7            | 4             | 2             | 2             | 5             | 2              | 23           |
| Variation Coef | 0.88         | 0.91          | 1.38          | 1.05          | 1.11         | 1.08         | 0.84          | 1.28          | 1.74          | 1.21          | 1.55           | 0.87         |
|                | Winter<br>W2 | Winter<br>W20 | Winter<br>W70 | Winter<br>S10 | Winter<br>G6 | Winter<br>N2 | Winter<br>N10 | Winter<br>N20 | Winter<br>N70 | Winter<br>TS4 | Winter<br>TS10 | Winter<br>R3 |
| sample size    | 126          | 71            | 43            | 69            | 117          | 136          | 154           | 77            | 46            | 117           | 37             | 92           |
| meanlog        | 3.91         | 2.57          | 2.00          | 3.35          | 3.53         | 2.95         | 1.89          | 1.42          | 1.29          | 3.12          | 1.49           | 4.01         |
| SDlog          | 0.64         | 0.61          | 0.53          | 0.67          | 0.77         | 0.69         | 0.76          | 0.73          | 0.74          | 0.61          | 0.73           | 0.48         |
| Threshold      | -0.79        | -1.70         | -1.16         | -0.52         | 1.34         | -0.28        | 1.43          | 0.00          | 0.49          | -3.43         | 0.38           | -6.85        |
| GOF-W test     | 1.00         | 0.98          | 0.97          | 0.99          | 0.99         | 0.99         | 0.98          | 0.96          | 0.96          | 0.99          | 0.96           | 0.98         |
| P-value        | 0.972        | 0.269         | 0.238         | 0.772         | 0.302        | 0.282        | 0.030         | 0.002         | 0.029         | 0.619         | 0.097          | 0.140        |
| geometric mean | 49.05        | 10.94         | 5.98          | 27.98         | 35.79        | 18.81        | 8.40          | 4.15          | 4.24          | 18.28         | 4.92           | 47.48        |
| mean           | 60.38        | 13.94         | 7.26          | 34.99         | 47.08        | 24.13        | 10.29         | 5.42          | 5.24          | 23.73         | 6.16           | 54.90        |
| median         | 50           | 11            | 6             | 27            | 34           | 19           | 8             | 4             | 4             | 18            | 5              | 48           |
| Variation Coef | 0.70         | 0.71          | 0.63          | 0.71          | 0.87         | 0.81         | 0.79          | 0.86          | 0.75          | 0.73          | 0.83           | 0.55         |

Table 7. Comparison of the mean TSM concentrations (mg/l) in the W and N-transects during the first and second period

**Period 1: from May 1975 through February 1983****Period 2: from March 1983 through December 1999**

|         | Period 1<br>Summer<br>W2 | Period 1<br>Summer<br>W20 | Period 1<br>Summer<br>W70 | Summer<br>W70 | Period 1<br>Summer<br>mean of W-stations |         | Period 2<br>Summer<br>W2 | Period 2<br>Summer<br>W20 | Period 2<br>Summer<br>W70 | Summer<br>W70 | Period 2<br>Summer<br>mean of W-stations |
|---------|--------------------------|---------------------------|---------------------------|---------------|------------------------------------------|---------|--------------------------|---------------------------|---------------------------|---------------|------------------------------------------|
| station | 20.1                     | 6.5                       | 3.3                       | 10.0          |                                          | station | 24.9                     | 6.0                       | 3.7                       | 11.5          |                                          |
| mean    | 17.9                     |                           |                           |               |                                          | median  | 21.5                     | 4.0                       | 2.0                       | 9.2           |                                          |
|         | Period 1<br>Winter<br>W2 | Period 1<br>Winter<br>W20 | Period 1<br>Winter<br>W70 | Winter<br>W70 | Period 1<br>Winter<br>mean of W-stations |         | Period 2<br>Winter<br>W2 | Period 2<br>Winter<br>W20 | Period 2<br>Winter<br>W70 | Winter<br>W70 | Period 2<br>Winter<br>mean of W-stations |
| station | 61.1                     | 18.3                      | 7.4                       | 28.9          |                                          | station | 50.0                     | 13.9                      | 7.3                       | 27.2          |                                          |
| mean    | 57.6                     | 13.5                      | 5.2                       | 25.4          |                                          | median  | 50.0                     | 11.0                      | 6.0                       | 22.3          |                                          |
|         | Period 1<br>Summer<br>N2 | Period 1<br>Summer<br>N10 | Period 1<br>Summer<br>N20 | Summer<br>N70 | Period 1<br>Summer<br>mean of N-stations |         | Period 2<br>Summer<br>N2 | Period 2<br>Summer<br>N10 | Period 2<br>Summer<br>N20 | Summer<br>N70 | Period 2<br>Summer<br>mean of N-stations |
| station | 10.5                     | 5.3                       | 4.3                       | 3.0           | 5.8                                      | station | 10.2                     | 5.1                       | 4.2                       | 4.5           | 6.0                                      |
| mean    | 8.6                      | 4.0                       | 3.3                       | 2.6           | 4.6                                      | median  | 7.0                      | 4.0                       | 2.0                       | 2.0           | 3.8                                      |
|         | Period 1<br>Winter<br>N2 | Period 1<br>Winter<br>N10 | Period 1<br>Winter<br>N20 | Winter<br>N70 | Period 1<br>Winter<br>mean of N-stations |         | Period 2<br>Winter<br>N2 | Period 2<br>Winter<br>N10 | Period 2<br>Winter<br>N20 | Winter<br>N70 | Period 2<br>Winter<br>mean of N-stations |
| station | 27.6                     | 7.0                       | 5.0                       | 4.9           | 11.1                                     | station | 24.1                     | 10.3                      | 5.4                       | 5.2           | 11.3                                     |
| mean    | 23.4                     | 5.4                       | 3.8                       | 4.2           | 9.2                                      | median  | 19.0                     | 8.0                       | 4.0                       | 4.5           | 8.9                                      |

Table 8a. The observed TSM concentrations (mg/l) between May 1975 and February 1983  
This data set was compiled by M. Visser from the original laboratory results. The dates are the sampling dates of the stations along the A-transect  
The bold values of the TSM concentrations are not explained in relation to the wave heights and light attenuation

| date     | A1    | A2    | A3    | A10   | A20   | A30   | A50   | A70   | W1    | W2    | W4    | W10   | W20   | W30   | W50   | W70   | S1    | S4    | S10   | S20   | S30   | S50   | S70   | G6    | G10   | G20 |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| 26/05/75 | 26    | 14.5  | 17.6  | 21    | 26    | 31    | 37    | 41    | 6.9   | 11.1  | 11.1  | 11.1  | 2.3   | 1.8   | 1.3   | 0.9   | 1.8   | 21.5  | 21.5  | 1.8   | 1.3   | 1.3   | 1.4   | 1.4   | 1.5   | 1.5 |
| 02/06/75 | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |     |
| 06/06/75 | 36.8  | 36.4  | 36.1  | 39.6  | 24.6  | 24.6  | 16.6  | 6.9   | 11.1  | 11.1  | 11.1  | 2.3   | 1.8   | 1.3   | 0.9   | 1.8   | 21.5  | 21.5  | 1.8   | 1.3   | 1.3   | 1.4   | 1.4   | 1.4   | 1.3   |     |
| 16/06/75 | 27    | 39.6  | 11.3  | 51    | 7.5   | 13.7  | 0.8   | 13    | 5.5   | 10.2  | 67    | 2.9   | 1.2   | -1    | -1    | -1    | 24.8  | 8.4   | 1.5   | 0.7   | 3.5   | 3     | 0.9   | 1.2   | 1.6   |     |
| 20/06/75 | 30    | 38    | 10.6  | 44.5  | 13.5  | 10.9  | 0.7   | 44    | 10.9  | 10.7  | 11.1  | 2.1   | -1    | -1    | -1    | -1    | 16.3  | 16.3  | 1.5   | 0.9   | 6.8   | 2.5   | 1.6   | 4.2   | 2.1   |     |
| 28/06/75 | 70.8  | 80.5  | 23.3  | 39.1  | 36.5  | 2.8   | 1.6   | 1.6   | 1.3   | 17    | 8     | 4.4   | -1    | -1    | -1    | -1    | 27.9  | 12.6  | 5.8   | 1.6   | 1.1   | 2.3   | 1.1   | 1.6   | 3.6   |     |
| 29/06/75 | 35.1  | 41    | 15.3  | 12    | 6.9   | 11    | 0.7   | 11    | 1.1   | 10.6  | 19.8  | 4.2   | 2.1   | 0.1   | -1    | -1    | 12.1  | 3.1   | 4.6   | 1.6   | 0.1   | 2.1   | 0.8   | 2.8   | 4.9   |     |
| 03/07/75 | 61.6  | 38.5  | 49.6  | 28.6  | 27.3  | 2.8   | 0.7   | 0.7   | 10.1  | 27.1  | 14.8  | 4.2   | 6.6   | 0.5   | -1    | -1    | 6.4   | 9.4   | 11.7  | 2.5   | 1.3   | 2.6   | 5.1   | 20.5  | 1     |     |
| 20/07/75 | 70    | 39.8  | 32.8  | 24    | 5.5   | 8.4   | 11    | 5.9   | 11.3  | 35.3  | 32.6  | 33.3  | 33.3  | 3.8   | -1    | -1    | 12.6  | 18.1  | 5.5   | 7.5   | 4.5   | 5.3   | 1.3   | 20.8  | 3.8   |     |
| 08/08/75 | 70.4  | 39.6  | 27.6  | 14.2  | 14.2  | 4.3   | 4.5   | 3     | 25.1  | 21.5  | 18.8  | 6.5   | 1.2   | 0.1   | -1    | -1    | 13.1  | 18.3  | 10.5  | 6.7   | 0.4   | 2.1   | 4.5   | 16.8  | 3.4   |     |
| 22/08/75 | 114.5 | 107.9 | 52.6  | 39.5  | 37    | 24    | 25.6  | 24    | 35.8  | 35    | 41.1  | 94.7  | 27.3  | 54.1  | -1    | -1    | 44.8  | 47.3  | 35.8  | 25.8  | 18.6  | 21    | 27    | 40.3  | 25.6  |     |
| 01/09/75 | 147.8 | 92.9  | 46.6  | 31    | 21.1  | 6     | 0.7   | 1.6   | 25.5  | 11.8  | 16.6  | 22.6  | 12    | 3.8   | -1    | -1    | 6.1   | 22.1  | 23.1  | 8.2   | 0.9   | 0.4   | 52.3  | 11.6  | 15.4  |     |
| 10/09/75 | 184.4 | 111.3 | 29.3  | 15.4  | 33    | 11    | 2.6   | 24.3  | 23.3  | 18    | 16.5  | 7.6   | 4.4   | -1    | -1    | -1    | 28.8  | 8.2   | 47    | 3     | 1.6   | 7.8   | 0.4   | 8.9   | 6.8   |     |
| 05/10/75 | 157.1 | 107.1 | 13.6  | 7.7   | 1     | 2     | 21.6  | 21.6  | 6.5   | 5.7   | -1    | -1    | -1    | -1    | -1    | -1    | 10.8  | 1.9   | 4.7   | 2.7   | 4.5   | 2.6   | 1.5   | 9.4   | 8.5   |     |
| 24/11/75 | -1    | -1    | -1.6  | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |     |
| 01/12/75 | 122   | 144.4 | 38.8  | 18    | 18    | 18    | 23    | 45    | 26.8  | 27.3  | 21.6  | 10.2  | 7.7   | 4.8   | -1    | -1    | 10.7  | 25.1  | 9.5   | 21    | 3.2   | 2     | 2.6   | 1.7   | 3.8   |     |
| 08/12/75 | 128.6 | 167.3 | 49.1  | 46    | 8.3   | 4.4   | -1    | -1    | 21.8  | 16.5  | 14.3  | 41.8  | 6     | 0.5   | -1    | -1    | 25.8  | 66.7  | 15    | 5.6   | -1    | -1    | 1.8   | 1     | 2.6   |     |
| 15/12/75 | 325.4 | 291   | 254.9 | 209.8 | 11.1  | 37.1  | 22.2  | 29.9  | 40.6  | 8.9   | 71.9  | 30.7  | 42.7  | 5     | -1    | -1    | 80.6  | 14.3  | 38    | 14.2  | 4.6   | 1.4   | 2.2   | 37.1  | 8.5   |     |
| 04/02/76 | 392.9 | 381.1 | 88.2  | 77.6  | 39.2  | 19.6  | 2.9   | 2.6   | 2.6   | 37.5  | 62.3  | 70    | 75.4  | 39.3  | 5     | -1    | 41.8  | 31.5  | 31.9  | 8.2   | 3.5   | 4.3   | 6.2   | 46    | 17.4  |     |
| 02/03/76 | 479   | 159.6 | 21.4  | 60.5  | 40.8  | 9.2   | 4.3   | 6     | 23.9  | 49    | 42.8  | 80.9  | 60.8  | 6.2   | -1    | -1    | 34.8  | 55.2  | 32.5  | 12.1  | 6.7   | 5.9   | 5.6   | 101.1 | 89.3  |     |
| 04/03/76 | 299.3 | 429.5 | 179.6 | 38.9  | 29.5  | 10.9  | 8.4   | 4     | 36    | 109.7 | 246.7 | 53.3  | 23.9  | 9.8   | -1    | -1    | 28.9  | 16.5  | 52.7  | 6.5   | 7.4   | 4.8   | 4.2   | 111.8 | 16.8  |     |
| 06/04/76 | 180.5 | 167.2 | 22.9  | 36.9  | 10.7  | 5.1   | 1.9   | 2.8   | 28.9  | 11.6  | 37    | 15.3  | 4.8   | 2     | -1    | -1    | 15.4  | 22.3  | 18.2  | 5.9   | 3.3   | 6.4   | 8.1   | 39.3  | 25.2  |     |
| 23/04/76 | 118   | 172   | 92.2  | 7     | 1.6   | -1    | -1    | -1    | 26.1  | 17.8  | 39.9  | 12.1  | 2     | 0.1   | -1    | -1    | 36.1  | 35.5  | 8.3   | 6.7   | 7.7   | 7.8   | 4.8   | 56.4  | 26    |     |
| 11/05/76 | 105.7 | 60.6  | 36.2  | 34.8  | 21    | 3.3   | 4.7   | 4.4   | 9.7   | 15.2  | 7.4   | 10.6  | 4.4   | 3.3   | -1    | -1    | 12.3  | 8.6   | 13.3  | 9.3   | 5.4   | 4.3   | 4.7   | 98.4  | 6.7   |     |
| 24/05/76 | 27.6  | 26.6  | 8.6   | 7.9   | 6.4   | 6.7   | 4.6   | 4.3   | 9.7   | 16.5  | 40.4  | 20.7  | 3.7   | 3.5   | -1    | -1    | 10.8  | 1.9   | 4.7   | 2.7   | 4.5   | 2.6   | 1.5   | 9.4   | 8.5   |     |
| 08/06/76 | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |     |
| 01/07/76 | 76.5  | 165.3 | 16.9  | 11    | 19.9  | 11    | 3.6   | 3.6   | 2.9   | 4.1   | 16.7  | 12.1  | 8.1   | 4.4   | -1    | -1    | 4.4   | 4.7   | 3     | 8     | 6     | 5.5   | 2.8   | 189.5 | 13.9  |     |
| 29/06/76 | 159.4 | 80.8  | 47.9  | 15    | 14.9  | 0.8   | 2.6   | 1.4   | 12.1  | 28.4  | 29.4  | 10.7  | 6.1   | -1    | -1    | -1    | 7.9   | 7.5   | 8.1   | 3.3   | 1.3   | 1.3   | 0.9   | 12.4  | 7.2   |     |
| 10/07/76 | 35.2  | 44    | 13.6  | 26.4  | 8.6   | 2.6   | 1     | 0.8   | 7.7   | 7.1   | 8.9   | 5.3   | 2.7   | 2.7   | -1    | -1    | 7.9   | 15.9  | 7.1   | 4.5   | 2.6   | 3.6   | 1     | 23.9  | 5.2   |     |
| 12/07/76 | 180.2 | 14.5  | 12.0  | 16.8  | 8.5   | 7.5   | 4.1   | 3.8   | 10.5  | 16    | 16.4  | 16.2  | 7.1   | 4.8   | -1    | -1    | 12.1  | 14.7  | 4.4   | 7.1   | 6.4   | 6.1   | 5.8   | 9.4   | 7     |     |
| 18/07/76 | 50.5  | 38.9  | 43.6  | 16.8  | 11    | 13.4  | 3.8   | 1.6   | 11.1  | 28.9  | 15.4  | 47.9  | 5.9   | 1.1   | -1    | -1    | 13    | 14.5  | 2.1   | 1.1   | 0     | 2.9   | 4.6   | 16.4  | 12.2  |     |
| 24/07/76 | 132.9 | 116.4 | 72.3  | 7.5   | 3.7   | 9     | 1.6   | 1.7   | 6     | 13.6  | 11.6  | 10.4  | 9.9   | 3.3   | -1    | -1    | 2.7   | 3.9   | 2.9   | 3.9   | 3.3   | 2.7   | 5.9   | 6.1   | 6.3   |     |
| 06/08/76 | 61.3  | 32.6  | 50.1  | 22.8  | 8.3   | 6.6   | 1.5   | 0.3   | 23.4  | 10.5  | 13.4  | 10.8  | 4     | 2.2   | -1    | -1    | 5.9   | 5.7   | 3.4   | 1.8   | 0.3   | 0.9   | 1     | 14.1  | 0     |     |
| 13/08/76 | 46.4  | 21.1  | 46.3  | 12.6  | 18.4  | 7.1   | 6.4   | 5     | 17.2  | 35.2  | 31.9  | 18.5  | 6.2   | 0.1   | -1    | -1    | 4.3   | 8.9   | 7.8   | 3     | 0     | 0     | 1.4   | 5.7   | 0     |     |
| 06/09/76 | 163.9 | 154.4 | 60.8  | 47.5  | 25.1  | 6.3   | 4.9   | 4.1   | 27.1  | 24.9  | 20.7  | 24.8  | 7.2   | 6.1   | -1    | -1    | 22    | 32.7  | 16.4  | 12.3  | 4.1   | 4.9   | 4.2   | 11.4  | 12.9  |     |
| 13/09/76 | 143.7 | 91    | 14.8  | 14.8  | 1     | 1.2   | 0.4   | 0.4   | 15.2  | 10.4  | 10.4  | 10.4  | 10.4  | 10.4  | -1    | -1    | 11.9  | 16.4  | 12.5  | 0.4   | 0     | 0     | 0     | 0     | 0     |     |
| 21/09/76 | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |     |
| 28/09/76 | 128.3 | 292.3 | 48.8  | 18.8  | 21    | 21.1  | 18.2  | 27.1  | 24.1  | 30.3  | 32.2  | 6.4   | 4     | 0.1   | -1    | -1    | 8     | 16.6  | 9.2   | 9.2   | 3     | 3     | 3     | 3     | 3     | 3   |
| 05/10/76 | 118.1 | 149.1 | 22.2  | 28.9  | 9     | 5.3   | 5.9   | 4.7   | 20.6  | 18.2  | 13.4  | 14.9  | 7     | 8.3   | -1    | -1    | 20.8  | 8.6   | 12.7  | 11.1  | 6.1   | 7.2   | 7.8   | 18.9  | 10.9  |     |
| 09/10/76 | 136.6 | 83.9  | 48.4  | 46.4  | 19.2  | 4.2   | 3.2   | 1.2   | 199.3 | 11.2  | 30.2  | 20.5  | 4.8   | 1.4   | -1    | -1    | 14.1  | 22.9  | 19.9  | 16.2  | 14.1  | 14.1  | 14.1  | 14.1  | 14.1  |     |
| 17/10/77 | 212.6 | 36.8  | 40.8  | 8.9   | 12    | 8     | 3.2   | 1.2   | 55.3  | 83.2  | 96    | 57.1  | 13.7  | 4.8   | -1    | -1    | 37.3  | 45.9  | 46.5  | 25.1  | 12    | 4.4   | 4.3   | 22.4  | 18.9  |     |
| 18/10/77 | 44.1  | 28.8  | 47.8  | 10.3  | 6.6   | 6.7   | 5.5   | 46.5  | 48    | 36.9  | 30.3  | 10.3  | 6.3   | 3.1   | 4.7   | -1    | -1    | 40.7  | 45.7  | 39.7  | 24.9  | 1.6   | 7.8   | 5.8   | 17.1  |     |
| 25/10/77 | 135.4 | 57.6  | 72.3  | 7.5   | 2.2   | 1.6   | 1.7   | 1.7   | 99.2  | 71.6  | 76.7  | 17.6  | 2.2   | 0.2   | 7     | -1    | 17.6  | 47    | 47    | 17.6  | 47    | 17.6  | 47    | 17.6  | 47    |     |
| 28/10/77 | 62.3  | 21    | 15.8  | 32.9  | 6.3   | 1.6   | 1.8   | 2.3   | 17.9  | 27.6  | 13.1  | 13.4  | 2.3   | 2.8   | 3.1   | 31    | 34.7  | 14.1  | 4.8   | 1.6   | 1.8   | 0.3   | 0.3   | 14.3  | 13.4  |     |
| 29/10/77 | 28.4  | 230.7 | 28.4  | 16.8  | 18.7  | 4.3   | 3.5   | 1.2   | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  | 35.2  | 42.1  |     |
| 05/04/77 | 141.3 | 246.6 | 74.4  | 73.9  | 34.4  | 10.5  | 8.2   | 6.2   | 52.3  | 74.6  | 19.7  | 11.6  | 7.8   | 6.5   | 15.6  | -1    | -1    | 28    | 22.7  | 17.2  | 4.2   | 3.9   | 6.0   | 1.2   | 4     |     |
| 03/04/77 | 108.7 | 47.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  |     |
| 05/05/77 | 19.3  | 20.4  | 15.3  | 28.7  | 0     | 11.5  | 1.4   | 0.8   | 22    | 19.9  | 15.6  | 12    | 3.4   | 1     | 4.5   | 0.9   | 14.7  | 55.9  | 9     | 35.7  | 12.4  | 1.2   | 1.5   | 1.5   | 1.1   |     |
| 17/05/77 | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |     |
| 23/05/77 | 39.4  | 27.5  | 11.5  | 5.6   | 6.9   | 3.3   | 4.8   | 7.2   | 20.1  | 16.6  | 6.6   | 0     | 17    | 1.4   | 4.9   | -1    | -1    | 3.8   | 3     | 3     | 3     | 3     | 3     | 3     | 3     |     |
| 26/05/77 | 205.4 | 20.5  | 8     | 4.5   | 3     | 8     | 4.5   | 3     | 7.2   | 30    | 39.9  | 8.7   | 0.7   | 0.7   | 0.7   | 0.7   | 8.1   | 8.1   | 4.2   | 4.2   | 4.2   | 4.2   | 4.2   | 4.2   | 4.2   |     |
| 26/06/77 | 61.6  | 36.9  | 15.9  | 16.3  | 9.1   | 3.9   | 0     | 1     | 9.6   | 12.3  | 20.5  | 42.5  | 4.7   | 4.7   | 5.9   | 37    | 14.1  | 13.1  | 7.4   | 4.8   | 4.3   | 4.2   | 8.7   | 15.3  | 3.8   |     |
| 04/07/77 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 | 185.9 |     |
| 10/07/77 | 140   | 251.4 | 47.2  | 54.9  | 40.9  | 9.4   | 6.1   | 9.7   | 20.1  | 38.5  | 23.8  | 15.1  | 1.5   | 2     | 3.3   | 20.3  | 25.9  | 12.2  | 11.6  | 11.7  | 13    | 6.5   | 6.2   | 11.2  | 5.5   |     |
| 02/08/77 | 92.4  | 125.7 | 36.1  | 17.5  | 7.6   | 3.9   | 0.3   | 1.2   | 25    | 22.1  | 12.4  | 14.3  | 8.9   | 3.9   | 0.2   | 2.2   | 7.1   | 5.6   | 10    | 0.3   | 2.6   | 2.1   | 4.4   | 10    | 3.5   |     |
| 14/08/77 | 42.1  | 11.6  | 6.2   | 2.4   | 6     | 2.4   | 6     | 2.4   | 6     | 6.3   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |

Table 8b. The observed TSM concentrations (mg/l) between May 1975 and February 1983  
This data set was compiled by M. Visser from the original laboratory results. The dates are the sampling dates of the stations along the A-transect  
The bold values of the TSM concentrations that are not explained in relation to the wave heights and light attenuation

| date   | G20  | G50  | G70 | TH1  | TH11  | TH10 | TH20 | TH50 | TH70 | N1   | N2   | N4   | N10  | N20  | N50  | N70  | E1   | E2   | E4   | E10  | E20  | E30  | E50  | E70  |
|--------|------|------|-----|------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 200705 | 1    | -1   | -1  | 1    | 1     | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |      |
| 020605 | -1   | -1   | -1  | 4.3  | 2.1   | 2.3  | 0.1  | 3    | 2.1  | 1.5  | 0.4  | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |      |
| 180605 | 18   | 18   | 18  | 18   | 18    | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   | 18   |      |
| 060605 | 1.1  | -1   | -1  | 6    | 4.7   | 1.6  | 1.3  | 2.3  | 1.5  | 1.5  | 1.6  | 1.5  | 1.6  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  | 1.5  |      |
| 080705 | 1.1  | -1   | -1  | 5.6  | 1.8   | 2.1  | 1.5  | 0.6  | 1.8  | 1.1  | 0.8  | 2.3  | 0.7  | 1.8  | 0.1  | 2.6  | 2.6  | 2.5  | 0.7  | 4.6  | 1.1  | 1.1  | 0.8  | 0.6  |
| 040705 | 0.4  | -1   | -1  | 6.7  | 3.1   | 3.1  | 0.6  | 1.6  | 1.5  | 1.5  | 4.2  | 3.6  | 3    | 6.6  | 1    | 1    | 1.6  | 4.3  | 2.6  | 2.1  | 2.1  | 1.8  | 0.3  | 0.3  |
| 280705 | -1   | -1   | -1  | 6.3  | 7.4   | 3.6  | 4.4  | 1.5  | 0.7  | 2.1  | 0.8  | -1   | 6.8  | 5.3  | 4.1  | 0.3  | 0.6  | 0.3  | 6.3  | 3.5  | 1    | 0.5  | 1.8  | 1.6  |
| 120805 | 3.1  | 3.1  | 3.1 | 4.2  | 3.2   | 3.3  | 5.9  | 2.5  | 3.5  | 2    | 0.1  | 1.8  | 0.8  | 1.1  | 0.5  | 1    | 1.8  | 1.8  | 1.3  | 1.6  | 1.8  | 1.8  | 4.1  | 1.1  |
| 250805 | 4    | -1   | -1  | 2.3  | 7.6   | 8.2  | 9.2  | -1   | 8    | 4.7  | 8    | 3    | 1.3  | 11.9 | 8    | 3    | 5.6  | 4.6  | 4.3  | 1.6  | 8.4  | 6.1  | 1.8  | 1.7  |
| 060905 | 4.6  | -1   | -1  | 5.7  | 8.5   | 5.8  | 3.1  | 3.1  | 1.8  | 1    | 1.1  | 8    | 7    | 12   | 5.6  | 4.2  | 0.5  | 0.8  | 1.1  | 12.6 | 6.8  | 4.8  | 7    | 1.5  |
| 220905 | 30.1 | -1   | -1  | 4    | 24.3  | 26.8 | 23.6 | 25.1 | 21.3 | 22.6 | 29.3 | 24.6 | 37.3 | 27.5 | 23.3 | 23.3 | 21.1 | 25.3 | 23.8 | 40.6 | 31.6 | 28.8 | 9.5  | 24.5 |
| 011005 | -1   | -1   | -1  | 23.8 | 17.6  | 7.6  | 5.5  | -1   | 2.6  | 8.5  | 3.5  | 2.1  | 25.5 | 21.6 | 12.2 | 1.3  | 2.6  | 3    | 2.6  | 33.1 | 63.1 | 48.1 | 11   | 7.5  |
| 201005 | -0.8 | -1   | -1  | 31.8 | 5.2   | 1.8  | 2.8  | 0.8  | 1.5  | 2.6  | 2.1  | 21.3 | 7.1  | 17   | 16   | 0.1  | 0.3  | 2.8  | 0.7  | 6.3  | 5.4  | 3.6  | 1    | 1    |
| 041105 | -1   | -1   | -1  | 13.6 | 15.6  | 5.7  | 2.3  | -1   | 3.1  | -1   | 5.4  | 15   | 0.6  | -1   | 4.1  | -1   | 0.3  | 2.3  | 15.6 | 9.4  | 3.5  | 3    | -1   | 6.6  |
| 261105 | -1   | -1   | -1  | -1   | -1    | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |      |
| 081205 | 0.6  | -1   | -1  | 1.8  | 1.8   | 2.5  | -1   | -1   | 4    | 3.3  | 2.3  | 22.8 | 12   | 2.6  | 1.1  | -1   | 2.8  | 1.5  | 19.5 | 8.4  | 4    | 3.5  | 1    | 2.8  |
| 260106 | 1.6  | -1   | -1  | 44.7 | 34.9  | 27   | 12.7 | 3.7  | 3.5  | 2.5  | 12.2 | 46.6 | 19.1 | 8.5  | 6.4  | 1.6  | 1.7  | 2.9  | 5.4  | 13.8 | 5.2  | 4    | 0.6  | 0.6  |
| 040206 | 2.6  | -1   | -1  | 34.8 | 11.8  | 8.1  | 3    | 2    | 4    | 37.3 | 20   | 11.7 | 3.8  | 2.6  | 1.2  | 1.7  | 1.5  | 56.9 | 27.8 | 14.9 | 6.8  | 0.3  | 2    | 3.7  |
| 020306 | 3.1  | -1   | -1  | 36.6 | 24.7  | 21.6 | 3.7  | 2.7  | 2    | 2.9  | 3.3  | 75.7 | 22.3 | 14.7 | 5.1  | 2.7  | 3.4  | 2.7  | 4.6  | 40.4 | 2.9  | 7.9  | 5.4  | 3.7  |
| 040306 | 0.1  | -1   | -1  | 17.7 | 17.6  | 13.7 | 10.5 | 2.9  | 3.4  | 4    | 4.3  | 71.1 | 19.1 | 4.6  | 0.3  | 1.8  | 5.1  | 0.7  | 4.7  | 2.1  | 16.8 | 10.9 | 3.3  | 4.1  |
| 060406 | 4.7  | -1   | -1  | 14.1 | 10    | 9.5  | 6.6  | 4.1  | 4.4  | 3.1  | 5    | -1   | -1   | 9.4  | 18.5 | 6.2  | 6.4  | 7.9  | -1   | -1   | 3.7  | 21.4 | 8.6  | 0.2  |
| 210406 | 4.1  | -1   | -1  | 46.5 | 38    | 44.1 | 4    | 1.8  | 2    | 1    | 1.9  | 2    | 32.3 | 18.7 | 11   | 7.2  | 4.7  | 5.7  | 5.1  | 4.5  | -1   | 1.5  | 1    | 1.1  |
| 110506 | 4.5  | -1   | -1  | 12.3 | 17.2  | 8.2  | 4.1  | 4.3  | 7    | 5.9  | 3.1  | 20.9 | 9.5  | 9.6  | 7    | 7.1  | 5.2  | 4.5  | 3.5  | -1   | 2.9  | 17.7 | 2.7  | 1.4  |
| 240506 | 8.9  | -1   | -1  | 3.1  | 3.1   | 3.6  | 2.2  | 3.4  | 2.2  | 2.5  | 2.3  | 35.5 | 12.5 | 8.4  | 8.1  | 9.3  | 4.8  | 5    | 4.9  | 10.5 | 7.1  | 6    | 3.2  | 2.9  |
| 080606 | -1   | -1   | -1  | 10.9 | 9.5   | 8.9  | 6.2  | -1   | 6.3  | 5.1  | 4.1  | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |
| 150606 | 4.9  | -1   | -1  | 4.8  | 5.4   | 5.4  | 5.5  | 2.6  | 2    | 4.3  | 4.8  | 11.9 | 8.6  | 7.6  | 3    | 4.3  | 5.1  | 2.4  | 3.2  | -1   | 5.6  | 8.1  | 7.1  | 5.6  |
| 290606 | 1.7  | -1   | -1  | 4.3  | 0.3   | 1.2  | 4.4  | 4.4  | 1    | 1    | 1    | 10.3 | 4.4  | 5.1  | 0.8  | 0.9  | -1   | -1   | 1    | 3.5  | 1.5  | -1   | -1   | -1   |
| 130706 | 1.7  | -1   | -1  | 12.8 | 5.5   | 4.8  | 2.8  | 1.4  | 1.3  | 2.6  | 1.9  | 11.8 | 8.4  | 5.7  | 0.5  | 0.6  | 2.6  | 0.6  | -1   | -1   | 8.2  | 2.7  | 1.6  | 0.3  |
| 170706 | 1.7  | -1   | -1  | 2.4  | 1.8   | 1.4  | 2.4  | 1    | 0.1  | 0.3  | 0.1  | 15.5 | 10.8 | 6.8  | 0.9  | 3.8  | 5.1  | 1.7  | 17.4 | 4.8  | 6.7  | 4.3  | 1.5  | 2.8  |
| 280806 | 3.4  | -1   | -1  | 18.9 | 7.6   | 4.7  | 5.9  | 6.2  | 4    | 3.5  | 4.2  | 14.1 | 13.1 | 7.2  | 6.6  | 8.8  | 5.9  | 6.9  | 5.2  | 10.5 | 8.3  | 6.9  | 7.1  | 2.5  |
| 090906 | 1.9  | -1   | -1  | 10.6 | 5.7   | 4.6  | 2.1  | 2.4  | 1.1  | 1.5  | 2.1  | 3.1  | 3    | 2.9  | 2.4  | 3.4  | 2.3  | 0.6  | 1.8  | 3.6  | 3.3  | 5.7  | 1.9  | 0.4  |
| 210906 | 8.9  | -1   | -1  | 8.9  | 8.9   | 7.2  | 6.2  | 5.5  | 3.2  | 1.8  | 3.5  | 12.2 | 8.8  | 22   | 2.2  | 2.4  | 3    | 1    | 17.1 | 5.9  | 4.8  | 2.8  | 0.4  | 0.4  |
| 041006 | 5.3  | -1   | -1  | 6.4  | 7.7   | 4.6  | 2.3  | 0.8  | 2.7  | 1.2  | 37   | 19.4 | 15.4 | 5.3  | 6.9  | 4.5  | 4.1  | 3.2  | 4.1  | 14.8 | 11.9 | 7.8  | 2.5  | 3.1  |
| 061006 | 0.6  | -1   | -1  | 2.5  | 2.5   | 2.5  | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    |
| 211006 | -1   | -1   | -1  | -1   | -1    | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |
| 031106 | 0.3  | -1   | -1  | 8.3  | 4.5   | 6.4  | 2.1  | 3.5  | 3.7  | 4.7  | 4.7  | 16.7 | 13.7 | 4.8  | 2.8  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  |
| 151106 | 6.3  | -1   | -1  | 8.3  | 4.5   | 6.4  | 2.1  | 3.5  | 3.7  | 4.7  | 4.7  | 16.7 | 13.7 | 4.8  | 2.8  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  | 4.1  |
| 091206 | 11.4 | -1   | -1  | 8.6  | 7     | 4.3  | 4.1  | 3.4  | 3.3  | 2.3  | 2.7  | 17.7 | 17.7 | 16.3 | 2    | 0.4  | 2.6  | 0.3  | 0.4  | 14.6 | 15.9 | 1.6  | 1.1  | 0    |
| 140107 | 1.4  | 0.6  | 0.6 | 10.9 | 10.8  | 8.2  | 15.6 | 6.8  | 7.5  | 8    | 3.1  | 3.1  | 30.4 | 46.6 | 4.8  | 1.9  | 3.8  | 5.1  | 1.7  | 17.4 | 4.8  | 6.7  | 4.3  | 1.5  |
| 310107 | 9.3  | 6.4  | 9.1 | 0.1  | 5     | 6    | 2.9  | 6.1  | 4    | 3.5  | 8.3  | 9.1  | 6.8  | 6.8  | 8    | 5.8  | 4    | 2.3  | 3    | 2.1  | 20.4 | 23.7 | 8.3  | 3.4  |
| 140207 | 4.8  | 0    | 0   | 6.2  | 4.8   | 4.8  | 4.8  | 4.8  | 4.8  | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   |
| 280207 | 4.8  | 2.6  | 3.1 | 1.3  | 3.4   | 1.6  | 2.9  | 2    | 1.4  | 4.4  | 3.7  | 70.5 | 3.4  | 1.6  | 3.7  | 2.7  | 3    | 0.6  | 0.6  | 18.8 | 9.2  | 4.2  | 3.1  | 2.7  |
| 230307 | 0.8  | 0.7  | 0.8 | 0.7  | 0.8   | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  | 0.8  | 0.7  |
| 090407 | 5.9  | 5.9  | 5.9 | 5.1  | 120.8 | 18.6 | 13.2 | 17.4 | 19.2 | 24.4 | 22.6 | 23.8 | -1   | 38.8 | 20.2 | 18.9 | 12.4 | 18.4 | 14.9 | 13.7 | -1   | 40.9 | 74.8 | 11   |
| 130407 | 4.6  | 0    | 0   | 5.9  | 4.8   | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  | 4.8  |
| 050507 | 4.9  | 0.9  | 1.9 | 4.8  | 3.5   | 1.1  | 1.1  | 4.4  | 4.3  | 1.9  | 0.7  | 13.7 | 14.6 | 7    | 5.9  | 5.5  | 3.3  | 0.5  | 6.4  | 17.7 | 3.2  | 0    | 3.4  | 2.3  |
| 170507 | -1   | -1   | -1  | -1   | -1    | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |
| 220507 | 2.3  | 2.6  | 2.3 | 6.1  | 7.1   | 4.5  | 3.5  | 3.2  | 3.2  | 2.1  | 4.8  | 3.9  | 9.6  | 6.7  | 4.4  | 3.5  | 3.4  | 3.7  | 3.3  | 2.8  | 1.7  | 4.1  | 0.9  | 5.6  |
| 060607 | 7.9  | 4.5  | 7.9 | 4.5  | 7.9   | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  | 7.9  | 4.5  |
| 200607 | 1    | 0    | 0.1 | 16.1 | 8.4   | 6.8  | 4.9  | 2    | 2.8  | 4.5  | 4.8  | 4.1  | 4.4  | 13.6 | 0.9  | 0    | 0    | 5.2  | 4.4  | 10.8 | 4.7  | 2.8  | 3.2  | 2.2  |
| 040707 | 2.9  | 6    | 3.2 | 5.2  | 6     | 4.1  | 4.1  | 2.3  | 2    | 4.7  | 4.7  | 72.8 | 6.1  | 7    | 5.3  | 3.3  | 3.9  | 4.6  | 5.7  | 4.4  | 4.2  | 3.9  | 4.2  | 8.4  |
| 180707 | 4.9  | 5.8  | 1.5 | 5.0  | 1.8   | 1.2  | 12.1 | 7.7  | 1.8  | 2.2  | 1.2  | 1.5  | 1.8  | 0.9  | 1.8  | 0.9  | 1.8  | 1.2  | 1.2  | 1.2  | 1.2  | 1.2  | 1.2  | 1.2  |
| 020807 | 4.5  | 11.8 | 0.5 | 10   | 6.3   | 5.7  | 1    | 7    | 5.4  | 6.6  | 4.3  | 12.4 | 3.5  | 7.5  | 3    | 3.6  | 2.7  | 2.1  | 2.2  | 21.6 | 10.1 | 6.3  | 1.1  | 2.8  |
| 040807 | 2.8  | 2.7  | 2.8 | 2.7  | 2.8   | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  | 2.8  | 2.7  |
| 190807 | 1.4  | -1   | -1  | 12   | 9     | 0    | 2.6  | 0.7  | 0    | 0    | 1.9  | 10.1 | 9.6  | 0.7  | 0.9  | 0.9  | 0    | 2    | 3.1  | 7.9  | 1.4  | 1.4  | 0.6  | 0    |
| 130907 | 2.8  | 4.2  | 2.7 | 4.5  | 6.8   | 7.7  | 4.6  | 5.2  | 1.6  | 7    | 4.6  | 5.2  | 1.6  | 7    | 4.6  | 5.2  | 1.6  | 7    | 4.6  | 5.2  | 1.6  | 7    | 4.6  | 5.2  |
| 090907 | -1   | -1   | -1  | -1   | -1    | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   |
| 230907 | 1.6  | 2.4  | 1.6 | 2.4  | 1.6   | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  | 1.6  | 2.4  |
| 071007 | 4.6  | 2.7  | 0.4 | 6.8  | 5.9   | 3.3  | 3.8  | 1.5  | 6.5  | 0    | 0    | 11.1 | 5.6  | 1.9  | 1.9  | 5.4  | 1    | 1.5  | 0.1  | 5.5  | 0.8  | 0.6  | 9.2  | 3.7  |
| 301007 | 5.7  | 4.9  | 5.7 | 4.9  | 5.7   | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  | 5.7  | 4.9  |
| 081107 | 7.6  | 3.9  | 4.4 | 17.7 | 11.1  | 6.1  | 10.1 | 3.5  | 1.7  | 2.5  | 1.9  | 18.4 | 13.7 | 7.6  | 7.5  | 4.7  | 4.1  | 0.9  | 0.5  | 12.9 | 11.7 | 7.3  | 2.3  | 4    |
| 261107 | 3.7  | 1.7  | 1.5 | 8.1  | 7.3   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

Table 8c. The observed TSM concentrations (mg/l) between May 1975 and February 1983  
This data set was compiled by M. Visser from the original laboratory results. The dates are the sampling dates of the stations along the A-transect  
The bold values of the TSM concentrations can not be explained in relation to the wave heights and light attenuation

| date   | C1  | C2  | C4  | C10 | C20 | C30  | C50 | C70 | T54 | T50 | T50 | T50 | R3  | R5  | R10  | R20  | R30 | R50 | R70 | R100 |
|--------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|-----|-----|-----|------|
| 20075  | 46  | 157 | 19  | -   | -   | -    | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 020675 | -   | -   | -   | -   | -   | -    | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 118    | 118 | 20  | 144 | 13  | 05  | 04   | 13  | 09  | 54  | 38  | 16  | 53  | 15  | -   | 12.4 | 6.3  | 43  | 36  | 11  | 43   |
| 160675 | 127 | 26  | 23  | 13  | 05  | 04   | 13  | 09  | 54  | 38  | 16  | 53  | 15  | -   | 12.4 | 6.3  | 43  | 36  | 11  | 43   |
| 060775 | 125 | 2   | 26  | 25  | 18  | 31   | 18  | 13  | 52  | 46  | 09  | 51  | 04  | 05  | 11   | 03   | 07  | 09  | 05  | 07   |
| 140775 | 105 | 165 | 43  | 21  | 07  | 1    | 09  | 11  | 23  | 08  | 06  | 13  | 15  | 9   | 106  | 18   | 16  | 13  | 25  | 05   |
| 200775 | 303 | 86  | 21  | 16  | 3   | 05   | 05  | 05  | 42  | 83  | 06  | 23  | -   | -   | 82   | 73   | 57  | 18  | -   | 11   |
| 120875 | 253 | 62  | 43  | 21  | 08  | 73   | 43  | 84  | 82  | 83  | 04  | 62  | 84  | 79  | 65   | 33   | 16  | 15  | 13  | 07   |
| 250875 | 64  | 97  | 31  | 67  | 65  | 69   | 28  | 71  | 43  | 49  | 33  | 4   | 33  | 42  | 23   | 181  | 21  | 72  | 75  | 22   |
| 060975 | 149 | 122 | 75  | 21  | 18  | 05   | 51  | 28  | 53  | 13  | 21  | 41  | 16  | 03  | 147  | 155  | 61  | 71  | 23  | 4    |
| 220975 | 768 | 456 | 281 | 218 | 238 | 258  | 263 | 221 | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 061075 | 518 | 428 | 129 | 28  | 13  | 28   | 61  | 65  | 0   | 13  | 18  | 0   | 0   | 0   | 64.3 | 235  | 28  | 26  | 48  | 26   |
| 201075 | 178 | 138 | 23  | 18  | 16  | 06   | 28  | 33  | 115 | 18  | 18  | 21  | 06  | 23  | 496  | 176  | 104 | 33  | 23  | 13   |
| 061175 | 181 | 68  | 82  | 47  | -   | -    | 35  | 26  | 7   | 07  | 13  | 18  | -   | 21  | 985  | 371  | 108 | 89  | 42  | -    |
| 261175 | -   | -   | -   | -   | -   | -    | -   | -   | 93  | 21  | 38  | 59  | 21  | -   | 178  | 518  | 53  | 168 | 82  | 77   |
| 061275 | 464 | 013 | 206 | 04  | 01  | -    | 09  | 09  | 203 | 21  | -   | 01  | 28  | 1   | 1967 | 231  | 112 | -   | -   | -    |
| 260176 | 366 | 243 | 277 | 01  | 43  | 31   | 76  | 87  | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 160276 | 396 | 152 | 89  | 03  | 18  | 22   | 7   | 45  | 191 | 23  | 22  | 17  | 01  | 1   | 9618 | 43   | 472 | 102 | 7   | 56   |
| 020376 | 363 | 17  | 156 | 62  | 33  | 29   | 51  | 64  | 301 | 114 | 58  | 45  | 34  | 76  | 399  | 341  | 262 | 251 | 88  | 62   |
| 170376 | 775 | 174 | 156 | 89  | 46  | 23   | 42  | 44  | 301 | 57  | 54  | 47  | 41  | 31  | 362  | 359  | 409 | 464 | 94  | 89   |
| 060476 | 237 | 389 | 275 | 47  | 35  | 27   | 52  | 62  | 117 | 07  | 3   | 12  | 26  | 14  | 959  | 196  | 241 | 54  | 11  | 19   |
| 210476 | -   | -   | 218 | 1   | -   | -    | 0   | 24  | 2   | 19  | 15  | -   | -   | -   | 11   | 209  | 9   | 175 | 79  | 85   |
| 110576 | -   | -   | 8   | 42  | 15  | 4    | 53  | 57  | 48  | 1   | -   | 16  | 22  | 19  | 126  | 58   | 121 | 75  | 53  | 59   |
| 060676 | -   | -   | 146 | 48  | 43  | 41   | 47  | 75  | 88  | 14  | 07  | 61  | 09  | 01  | 119  | 4    | 16  | 24  | 12  | 45   |
| 150676 | 132 | 74  | 47  | 49  | 49  | 53   | 79  | 5   | -   | 17  | 16  | 16  | 13  | 36  | 65   | 94   | 63  | 39  | 26  | 12   |
| 260676 | 164 | 104 | 09  | -   | 13  | 21   | -   | 16  | 84  | 16  | 4   | 27  | 11  | 31  | 924  | 56   | 81  | 68  | -   | 14   |
| 130776 | 855 | 78  | 21  | 48  | 16  | 07   | 09  | 07  | 19  | 12  | 26  | 28  | 39  | -   | 78   | 96   | 48  | 21  | 19  | 34   |
| 270776 | 3   | -   | -   | -   | -   | -    | 3   | 18  | 59  | 75  | 25  | 9   | -   | -   | 1    | 75   | 09  | -   | -   | -    |
| 150876 | 153 | 88  | 76  | 31  | 25  | 42   | 55  | 38  | 63  | 24  | 02  | 47  | 02  | 08  | 1594 | 111  | 65  | 4   | 11  | 32   |
| 060976 | 163 | 64  | 43  | 05  | 12  | 4    | -   | 29  | 46  | 14  | 7   | 0   | -   | -   | 1    | 44   | 63  | 62  | 09  | 45   |
| 200976 | 84  | 38  | 33  | 21  | 19  | 08   | 21  | 64  | 66  | 31  | 4   | 13  | 2   | 23  | 381  | 329  | 257 | 21  | 6   | 08   |
| 210976 | 185 | 265 | 65  | 34  | 12  | 01   | 0   | 12  | 54  | 0   | 0   | 0   | -   | -   | 54   | 0    | -   | -   | -   | -    |
| 061076 | -   | -   | 163 | 11  | 55  | 22   | 34  | 34  | 143 | 06  | 13  | 34  | 05  | 17  | -    | -    | 6   | 31  | 11  | 14   |
| 211076 | -   | -   | -   | -   | -   | -    | -   | -   | 244 | 15  | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 021176 | 498 | 181 | 79  | 12  | 11  | 23   | 33  | 53  | 11  | 19  | 14  | 42  | 22  | -   | 23   | 42   | 29  | 52  | 22  | 0    |
| 151176 | 283 | 135 | 75  | 60  | 67  | 34   | 4   | 54  | -   | -   | -   | -   | -   | -   | 25   | 42   | 91  | 51  | 61  | 32   |
| 061276 | 334 | 389 | 169 | 01  | 13  | 0    | 17  | 0   | -   | 45  | 14  | 51  | 42  | 22  | 24   | 801  | 343 | 155 | 82  | 09   |
| 261276 | 433 | 6   | 27  | 14  | 19  | 17   | 36  | 49  | 102 | 07  | 11  | 06  | 16  | -   | 202  | 203  | 407 | 17  | 05  | 06   |
| 100177 | -   | 99  | 414 | 97  | 74  | 44   | 5   | 08  | 132 | 79  | 58  | 19  | 56  | 4   | 981  | 448  | 141 | 44  | 09  | 44   |
| 140277 | 273 | 12  | 54  | 49  | 49  | 49   | 53  | 52  | 19  | 23  | 12  | 4   | 218 | 228 | 218  | 228  | 218 | 228 | 218 | 228  |
| 260277 | 633 | 129 | 87  | 1   | 21  | 61   | 02  | 43  | 264 | 52  | 13  | 47  | 48  | 43  | 551  | 383  | 309 | 111 | 53  | 27   |
| 230377 | 197 | 13  | 18  | 19  | 18  | 4    | 0   | 18  | 19  | 0   | 0   | 18  | 19  | 0   | 18   | 19   | 0   | 18  | 19  | 0    |
| 050477 | -   | -   | 238 | 109 | 83  | 64   | 62  | 33  | 156 | 73  | 93  | 33  | 32  | 22  | -    | -    | -   | -   | -   | -    |
| 260477 | 34  | 38  | 24  | 38  | 58  | 17   | 21  | 67  | 182 | 29  | 12  | 12  | 55  | 17  | 21   | 66   | 462 | 264 | 74  | 29   |
| 050577 | 257 | 27  | 0   | 0   | 0   | 01   | 0   | 21  | 11  | 0   | 0   | 0   | 0   | 0   | 03   | 1536 | 186 | 51  | 45  | 18   |
| 270577 | -   | -   | -   | -   | -   | -    | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 120577 | 122 | 12  | 67  | 16  | 34  | 07   | 04  | 92  | 27  | 31  | 14  | 17  | 132 | 57  | 33   | 91   | 24  | 37  | 26  | 22   |
| 060677 | 209 | 158 | 0   | 59  | 08  | 0    | 0   | 66  | 66  | 0   | 0   | 0   | 0   | 0   | 29   | 47   | 74  | 3   | 0   | 0    |
| 260677 | 125 | 58  | 0   | 0   | 33  | 19   | 46  | 57  | 53  | 51  | 4   | 24  | 24  | 0   | 133  | 129  | 44  | 68  | 32  | 78   |
| 100177 | 79  | 29  | 17  | 57  | 72  | 23   | 32  | 66  | 56  | 42  | 43  | 49  | 51  | 239 | 31   | 143  | 69  | 29  | 49  | 79   |
| 140777 | 129 | 55  | 48  | 4   | 08  | 22   | 06  | 13  | 76  | 86  | 54  | 82  | 17  | 73  | 381  | 82   | 137 | 73  | 881 | 22   |
| 060877 | 12  | 54  | 49  | 09  | 49  | 2    | 7   | 5   | 0   | 19  | 4   | 23  | 19  | 4   | 218  | 218  | 228 | 218 | 228 | 218  |
| 260277 | 633 | 129 | 87  | 1   | 21  | 61   | 02  | 43  | 264 | 52  | 13  | 47  | 48  | 43  | 551  | 383  | 309 | 111 | 53  | 27   |
| 230377 | 197 | 13  | 18  | 19  | 18  | 4    | 0   | 18  | 19  | 0   | 0   | 18  | 19  | 0   | 18   | 19   | 0   | 18  | 19  | 0    |
| 050477 | -   | -   | 238 | 109 | 83  | 64   | 62  | 33  | 156 | 73  | 93  | 33  | 32  | 22  | -    | -    | -   | -   | -   | -    |
| 260477 | 34  | 38  | 24  | 38  | 58  | 17   | 21  | 67  | 182 | 29  | 12  | 12  | 55  | 17  | 21   | 66   | 462 | 264 | 74  | 29   |
| 050577 | 257 | 27  | 0   | 0   | 0   | 01   | 0   | 21  | 11  | 0   | 0   | 0   | 0   | 0   | 03   | 1536 | 186 | 51  | 45  | 18   |
| 270577 | -   | -   | -   | -   | -   | -    | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 120577 | 122 | 12  | 67  | 16  | 34  | 07   | 04  | 92  | 27  | 31  | 14  | 17  | 132 | 57  | 33   | 91   | 24  | 37  | 26  | 22   |
| 060677 | 209 | 158 | 0   | 59  | 08  | 0    | 0   | 66  | 66  | 0   | 0   | 0   | 0   | 0   | 29   | 47   | 74  | 3   | 0   | 0    |
| 260677 | 125 | 58  | 0   | 0   | 33  | 19   | 46  | 57  | 53  | 51  | 4   | 24  | 24  | 0   | 133  | 129  | 44  | 68  | 32  | 78   |
| 100177 | 79  | 29  | 17  | 57  | 72  | 23   | 32  | 66  | 56  | 42  | 43  | 49  | 51  | 239 | 31   | 143  | 69  | 29  | 49  | 79   |
| 140777 | 129 | 55  | 48  | 4   | 08  | 22   | 06  | 13  | 76  | 86  | 54  | 82  | 17  | 73  | 381  | 82   | 137 | 73  | 881 | 22   |
| 060877 | 12  | 54  | 49  | 09  | 49  | 2    | 7   | 5   | 0   | 19  | 4   | 23  | 19  | 4   | 218  | 218  | 228 | 218 | 228 | 218  |
| 260277 | 633 | 129 | 87  | 1   | 21  | 61   | 02  | 43  | 264 | 52  | 13  | 47  | 48  | 43  | 551  | 383  | 309 | 111 | 53  | 27   |
| 230377 | 197 | 13  | 18  | 19  | 18  | 4    | 0   | 18  | 19  | 0   | 0   | 18  | 19  | 0   | 18   | 19   | 0   | 18  | 19  | 0    |
| 050477 | -   | -   | 238 | 109 | 83  | 64   | 62  | 33  | 156 | 73  | 93  | 33  | 32  | 22  | -    | -    | -   | -   | -   | -    |
| 260477 | 34  | 38  | 24  | 38  | 58  | 17   | 21  | 67  | 182 | 29  | 12  | 12  | 55  | 17  | 21   | 66   | 462 | 264 | 74  | 29   |
| 050577 | 257 | 27  | 0   | 0   | 0   | 01   | 0   | 21  | 11  | 0   | 0   | 0   | 0   | 0   | 03   | 1536 | 186 | 51  | 45  | 18   |
| 270577 | -   | -   | -   | -   | -   | -    | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -   | -   | -   | -    |
| 120577 | 122 | 12  | 67  | 16  | 34  | 07   | 04  | 92  | 27  | 31  | 14  | 17  | 132 | 57  | 33   | 91   | 24  | 37  | 26  | 22   |
| 060677 | 209 | 158 | 0   | 59  | 08  | 0    | 0   | 66  | 66  | 0   | 0   | 0   | 0   | 0   | 29   | 47   | 74  | 3   | 0   | 0    |
| 260677 | 125 | 58  | 0   | 0   | 33  | 19   | 46  | 57  | 53  | 51  | 4   | 24  | 24  | 0   | 133  | 129  | 44  | 68  | 32  | 78   |
| 100177 | 79  | 29  | 17  | 57  | 72  | 23   | 32  | 66  | 56  | 42  | 43  | 49  | 51  | 239 | 31   | 143  | 69  | 29  | 49  | 79   |
| 140777 | 129 | 55  | 48  | 4   | 08  | 22   | 06  | 13  | 76  | 86  | 54  | 82  | 17  | 73  | 381  | 82   | 137 | 73  | 881 | 22   |
| 060877 | 12  | 54  | 49  | 09  | 49  | 2    | 7   | 5   | 0   | 19  | 4   | 23  | 19  | 4   | 218  | 218  | 228 | 218 | 228 | 218  |
| 260277 | 633 | 129 | 87  | 1   | 21  | 61   | 02  | 43  | 264 | 52  | 13  | 47  | 48  | 43  | 551  | 383  | 309 | 111 | 53  | 27   |
| 230377 | 197 | 13  | 18  | 19  | 18  | 4    | 0   | 18  | 19  | 0   | 0   | 18  | 19  | 0   | 18   | 19   | 0   | 18  | 19  | 0    |
| 050477 | -   | -   | 238 | 109 | 83  | 64   | 62  | 33  | 156 | 73  | 93  | 33  | 32  | 22  | -    | -    | -   | -   | -   | -    |
| 260477 | 34  | 38  | 24  | 38  | 58  | 17   | 21  | 67  | 182 | 29  | 12  | 12  | 55  | 17  | 21   | 66   | 462 | 264 | 74  | 29   |
| 050577 | 257 | 27  | 0   | 0   | 0   | 01</ |     |     |     |     |     |     |     |     |      |      |     |     |     |      |