KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT

MEDEDELINGEN EN VERHANDELINGEN

No. 90

R. DORRESTEIN

WIND AND WAVE DATA OF NETHERLANDS LIGHTVESSELS SINCE 1949

1967

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STAATSDRUKKERIJ / 'S-GRAVENHAGE

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WIND- EN GOLFGEGEVENS VAN NEDERLANDSE LICHTSCHEPEN SINDS 1949

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PREFACE

The main part of this publication consists of frequency tables of the waves and winds observed and reported every three hours by the Netherlands lightvessels 'Goeree', 'Texel' and 'Terschellingerbank' during the nine years 1949 to 1957 inclusive.

The preparation of this publication began in 1961 and the necessary work was done mainly in the years 1962, '63 and '64. For a minor part of the tables (the tables F, G, H and I) the period considered could be extended up to 1963 inclusive. For some tables (F and I), observations from the lightvessel 'Noord-Hinder' are also included.

In regard to the winds, this publication may be considered partly as an extension of the treatise of DRS. G. VERPLOEGH: 'Climatological data of the Netherlands lightvessels over the period 1910-1940', K.N.M.I. Meded. en Verh. 67 I, II, III, 1956-'59.

Some of the tables were designed to meet especially the needs of civil engineers and others concerned with the practical aspects of winds and waves in the southern North Sea. DR. R. DORRESTEIN planned the publication, supervised the mechanical processing work with punched cards by the 'Afdeling Machinale Bewerking Waarnemingen' of K.N.M.I. and the laborious non-mechanical correction and finishing work, and wrote the explanatory text and discussion. The text has been written in English, in order to reach an international circle of readers.

Among the many persons who contributed to this publication, I should like to mention MR. A. W. GRIFFIOEN who performed the major part of the non-mechanical work necessary for the compilation of the tables.

Finally, I again take the opportunity to express my appreciation to the observers on board the lightvessels for the continuous attention and effort they have spent (and still spend) during many years, to perform their observations in the best possible way, sometimes under the most difficult conditions. These observations constitute the backbone of this publication.

De Bilt, August 1966

The Director in Chief of the
Royal Netherlands Meteorological Institute
PROF. DR. W. BLEEKER

VOORBERICHT

Deze publikatie bevat in hoofdzaak frequentietabellen betrekking hebbende op de golven en winden, zoals deze elke drie uur zijn waargenomen en gerapporteerd door de drie Nederlandse lichtschepen 'Goeree', 'Texel' en 'Terschellingerbank' over de negen jaren 1949 tot en met 1957, met toelichting en discussie.

De voorbereiding ervan werd begonnen in 1961 en het benodigde werk is voornamelijk verricht in de jaren 1962 tot en met 1964. Voor een kleiner deel van de tabellen (de tabellen F, G, H en I) kon achteraf het beschouwde tijdvak worden uitgebreid tot en met 1963. Voor enkele tabellen (F en I) zijn mede waarnemingen van het lichtschip 'Noord-Hinder' gebruikt.

Wat de winden betreft, kan deze publikatie ten dele worden gezien als een vervolg op het werk van DRS. G. VERPLOEGH: 'Klimatologische gegevens van de Nederlandse lichtschepen over de periode 1910-1940', K.N.M.I. Meded. en Verh. 67 I, II, III, 1956-'59.

Bij het ontwerp van de tabellen, die ten dele (E, F en G) een minder conventioneel karakter dragen, werd mede rekening gehouden met de vragen die door de praktijk worden gesteld. DR. R. DORRESTEIN maakte het plan voor de publikatie, had het toezicht over de machinale bewerking van de op ponskaarten vastgelegde waarnemingen door de 'Afdeling Machinale Bewerking Waarnemingen' van het K.N.M.I. en over het vrij omvangrijke niet-machinale correctie- en aanvullingswerk, en schreef de toelichting en verklarende tekst. Teneinde een internationale kring van geïnteresseerden te kunnen bereiken werd deze tekst in het Engels gesteld, in de overweging dat dit voor de Nederlandse gebruikers geen groot bezwaar zou opleveren.

Onder de vele medewerkers van het K.N.M.I. die een aandeel hadden in de totstandkoming van deze publikatie dient nog met name de heer A. W. GRIFFIOEN te worden genoemd, die het grootste deel van het voor het opstellen der tabellen benodigde niet-machinale werk uitvoerde.

Tenslotte wil ik bij deze gelegenheid wederom mijn dank betuigen aan de waarnemers op de lichtschepen, voor de toewijding en aandacht waarmede zij vele jaren lang, ook bij nacht en ontij, zo goed mogelijk hun waarnemingen verrichtten (en verrichten), welke waarnemingen de ruggegraat vormen van deze publikatie.

De Bilt, augustus 1966

De Hoofddirecteur van het
Koninklijk Nederlands Meteorologisch Instituut
PROF. DR. W. BLEEKER

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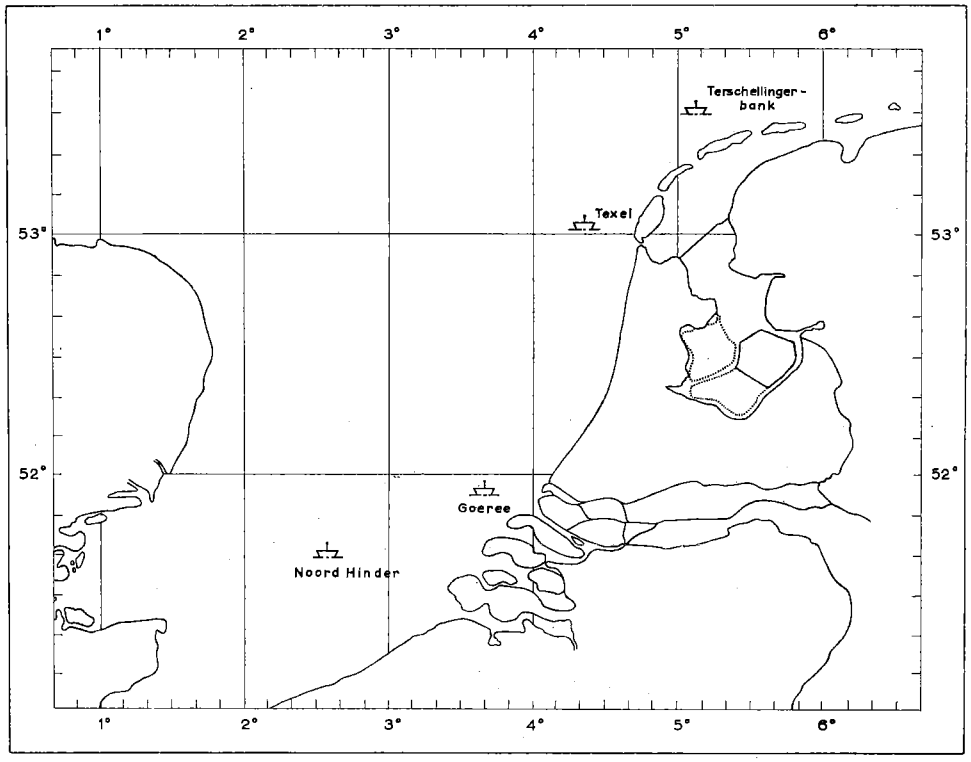
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Terschellinger-
bank
Texel
Goeree
Noord Hinder

1 GENERAL INTRODUCTION AND EXPLANATION

The purpose of this publication is to present frequency tabulations and some characteristic data on wind and wave observations made since 1949 from the Netherlands lightvessels in the southern North Sea. Emphasis has been laid on the wave observations, but in view of the close relationships between the waves and the locally observed winds, certain data on the winds and on the correlation between observed waves and winds are also given.

The major part of the frequency tabulations was prepared mechanically by means of punched cards containing the three-hourly meteorological observations from the lightvessels. However, considerable manual effort was necessary to remove certain imperfections inherent in the mechanically prepared tables. Several tables were compiled entirely by hand.

1.1 Earlier publications

Comprehensive summaries of the meteorological reports of the Netherlands lightvessels, for every individual year since 1949, are published regularly in year-books by the Koninklijk Nederlands Meteorologisch Instituut. These year-books also give chronological lists of six-hourly wind and wave observations, and frequency tables of wind force and direction, and of wave heights, periods and directions, per individual month (directions grouped to 8 points, wave periods grouped to 3 categories).

Frequencies of wind forces and directions as reported by Netherlands lightvessels in the southern North Sea in earlier years, accompanied by some discussion and computations of certain parameters, have been published by VAN DER STOK (1912)* for the period 1882-1910 and by VERPLOEGH (1956-1959) for the period 1910-1939. Some data on wind and wave frequencies for the lightvessel Goeree in the years 1949-1954 were given by DORRESTEIN (1955).

Climatological summaries for the North Sea, based on meteorological observations from sailing ships, have been published mainly by German scientists. A publication by MARKGRAF and BINTIG (1954) gives extensive data on wind frequencies over a large sea area including the southern North Sea. Frequencies of winds and waves as reported by four German lightvessels in the southern North Sea (including the lightvessel S 2, temporarily stationed about 70 miles North-west of Texel) in the years 1949-1952 have been published bij ROLL (1956). Frequencies of winds and waves as reported by three German ships with 'Bordwetterwarten' working in the North Sea in the years 1950-1957 have been published by PETRI (1958), but these observations were mainly made north of 54 °N and their number was rather limited.

More recently, VAN STRAATEN (1961) used wind and wave data from Netherlands lightvessels to derive certain characteristic parameters which were considered by him as significant for the transport of sand in the coastal zone. He also gave a few tables and diagrams on frequencies of winds and waves as reported by the lightvessels

* See list of references on page 123.

Goeree, Texel and Terschellingerbank during the eleven years 1949-1959. Some frequency tables on winds and waves as reported by the lightvessel Goeree in these eleven years were also given by BAKKER (1962), primarily to serve the interests of coastal engineers.

Some data on the average numbers and durations of occasions (spells) of waves higher, or lower, than 5, 8 and 12 feet, respectively, for various locations including those of the German lightvessels already referred to, have been given by KIPPER and JOSEPH (1963).

1.2 Positions and depths

The approximate positions and water depths of the lightvessels are given in the next table 1. See chart on page 10.

TABLE 1

Name	Latitude North	Longitude East	Approx. shortest distance from the continental coast	Average water depth
Goeree	51°54′	3°38′	10 miles	22 m
Texel	53°04′	4°27′	10 miles	28 m
Terschellingerbank	53°29′	5°08′	7 miles	23 m
Noord-Hinder	51°39′	2°34′	28 miles	36 m

The positions of the first three lightvessels have varied somewhat over the years, but the deviations from the positions given have never been more than 3 miles for Goeree, 4 miles for Texel and 1 mile for Terschellingerbank.

1.3 Period of observation

Most of the frequency tables (A to E) refer to the lightvessels Goeree, Texel and Terschellingerbank and to the nine years 1949-1957. Regular visual observations of wave parameters were not made until 1949. The period selected ends at 1957 because after that year the method of reporting of waves was slightly altered (see below, par. 1.5.2), so that the wave information on punched cards before and after 1 January 1958 cannot simply be processed together.

The position for the lightvessel Noord-Hinder, about halfway Vlissingen and Harwich, was unoccupied between 1939 and February 1953. Since then, observations from this lightvessel are available, but the period 1953-1957 was considered too short as a basis for frequency tables. Also, a comparison between these data and those of the other three lightvessels would be less reliable. In some of the tables (F and I), however, the period of observation has been extended to 1963 and the observations of Noord-Hinder have been used as well.

1.4 Observers

The observations were made and reported by the following captains and mates.

A. Bakelaar, H. J. van Bokhorst, A. Boon, J. Buis, J. Cupido, A. Dral, H. J. de Dreu, N. H. Edcius, G. M. Felius, J. J. Fillerup, P. van der Gaag, A. Haarsma, J. C. van der Jagt, Th. A. Jonkers, L. Kuiper, K. J. G. Lampers, J. Lap, S. van der Meer, C. A. Reijtenbach, E. Roobol, L. G. van Saane, J. M. Vlaming, D. C. van de Velde, M. G. A. Vierling, J. de Wit.

1.5 Methods of observation and reporting

The observations were normally made every three hours: at 00, 03, 06, 09, 12, 15, 18 and 21 h. G.M.T.

1.5.1 *Wind*

The wind direction has been observed and reported in tens of degrees with respect to true North. (The magnetic variation was about 6 to 8 degrees).

The wind force has been estimated in Beaufort numbers in the usual way. These Beaufort numbers have been reported, as well as the estimated wind speeds in knots, on the basis of the W.M.O. conversion table (table 2). Wind speeds in knots have not been used in this publication, however.

TABLE 2 *Conversion table in use since* 1946[1]) *(one knot* = 0.515 *metres/sec)*

Beaufort number	1	2	3	4	5	6	7	8	9	10	11
Speed in knots (height 10 metres)	1-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63

Each wind force (Beaufort number) thus corresponds to an interval of the wind speed scale, amounting to 5-7 knots for the wind forces 4 to 10.

1.5.2 *Waves*

The direction, the period and the height of the waves have been observed and reported.

The average direction from which the waves come has been reported in tens of degrees with respect to true North. In most cases the waves are typical wind waves

[1]) The actual (average) relation between Beaufort number and wind speed most probably deviates rather substantially from this official table (see G. VERPLOEGH, K.N.M.I. Meded. en Verh. 66 (1956) and 89 (1967): corrections should be applied to the numbers of knots given in the table, amounting to (roughly) + 2 knots for the range 4-16 knots, + 1 knot for 17-21 knots, 0 for 22-27 knots, and negative for higher wind speeds.
Added during proof correction: See also the extensive discussion on this point by H. WALDEN (1965), Deutscher Wetterdienst Seewetteramt, Einzelveröff. Nr. 47, Hamburg.

and the direction of the waves does not differ much from that of the wind; for differences between wave and wind directions, see tables E.

The average period of the higher, well-developed waves has been determined by counting and has been reported as a code figure P_w: $P_w = 2$ means 5 seconds or less, $P_w = 3$ means higher than 5 but no more than 7 sec., $P_w = 4$ means higher than 7 but no more than 9 sec., etc.

The average height of the higher, well-developed waves in the centres of the wave groups has been estimated by eye and reported to the nearest half metre. It is assumed that this height approximates the so-called 'significant' wave height.

The foregoing applies whenever only one 'wave system' could be observed: pure wind waves not mixed with swell, or pure swell with negligible local wind and chop. In cases where the observers were able to distinguish two, simultaneously present, different 'wave systems', they have estimated and reported the directions, periods and heights for each of these. In the years 1949 to 1957 this occurred in some ten percent of the total number of cases.

Since 1958 the observers have been encouraged to look out more sharply for swell waves under the local sea, and to report whenever possible, first 'sea' and secondly 'swell'. As a result, there was a notable increase in the percentage of reports with two wave groups.

Almost without exception the observers have reported clear values for wave direction, period and height, also at night, at least for 'sea 'waves, though the instruction left them free to report 'confused' waves and waves of 'indeterminate' period or height if conditions did not permit reliable observations.

It must be admitted that the accuracy of the visual wave observations in general cannot be high. In recent years many wave measurements have been made with a wave-recorder (floating accelerometer type, DORRESTEIN (1959)) on the lightvessels Goeree and Texel, and a comparison, made by GRIJM (1959), between measured and visually observed wave characteristics (daylight observations) has indicated that in 85 to 90 percent of cases the visually observed wave height did not deviate by more than 20 percent from the measured 'significant' height and that on the average there was no appreciable systematic deviation. For the cases where the heights of two simultaneous wave systems were reported, the measured heights turned out to coincide in general more closely with the largest of the two visually observed values, than with the root of the sum of their squares.

1.6 Summary of the tables

The frequency tables A to E inclusive are presented for the three lightvessels Goeree, Texel en Terschellingerbank separately.

In the following, by 'frequency' is always meant 'relative frequency', that is, a ratio between two numbers of observations, unless indicated otherwise. In the tables A and C a frequency is the number of all observations of certain winds or/and waves made in a given time period divided by the total number of observations made in the

same time period, and then it is identified with the estimated fraction of time that these winds or/and waves have occurred.*)

Directions of winds and waves have been grouped into 12 sectors of 30 degrees, often indicated by their average direction in tens of degrees.

Wave periods have been grouped into 5 intervals bounded by the values 5, 7, 9 and 11 seconds.

Expressions like 'waves of 4 metres and higher', etc. will often occur. Since the wave heights have been reported to the nearest half metre, the exact meaning of such expressions is: waves higher than $3\frac{3}{4}$ metres, etc.

In the tables A, B and C, showing frequencies in parts per thousand ,a zero means: one or more observations, but less than 0.5 parts per thousand; a blank means: no observations; annual figures, based on 26296 observations or a little less, and lower than 1.5 parts per thousand have been given with one decimal (then 0.0 means: one observation).

TABLES A. (pag. 40-52)	Frequencies (fractions of time) of waves of certain height and direction, per month and for all months together.
TABLES B 1. (pag. 53-59)	Relative frequencies of waves of certain height and period per wave direction sector and for all directions together.
TABLES B 2. (pag. 60-62)	Relative frequencies of waves of certain height and period for one of three selected wave direction sectors and for summer and winter half-year, respectively.
TABLES C 1. (pag. 63-65)	Annual variation of frequencies (fractions of time) of waves from a certain direction and with height: above $1\frac{3}{4}$ m, $2\frac{3}{4}$ m and $3\frac{3}{4}$ m, respectively. (The information is also contained in the tables A, apart from small rounding errors).
TABLE: C 2. (pag. 66-68)	Annual variation of frequencies (fractions of time) of winds from a certain direction and with force at least 4, 6 and 8 Beaufort, respectively**).
TABLES C 3. (pag. 69)	Annual variation of frequencies (fractions of time) of waves with height below or above certain values. (The information is also contained in the tables A, apart from small rounding errors).
TABLES D 1. (pag. 70-77)	Numbers of (simultaneous) observations of certain wave height and wind force, for four selected wind direction sectors respectively, and for summer and winter half-year, respectively.

* This is permissible, since the observations were made regularly every three hours and since phase-locked periodic fluctuations with a period of three hours in the wind or wave quantities studied can be assumed to be negligibly small: such a fluctuation corresponds to the eighth harmonic of the daily variation, which is small in itself.

** Frequency data on winds of force 10 and more, included in the tables C 2 for force 8 and more, refer to the fifteen years 1949 to 1963 incl. and were derived from the tables I.

TABLES D 2. (upper part). Mean wave heights associated with winds of certain force and direction, for summer and winter half-year, respectively.
(pag. 78-79)

TABLES D 2. (lower part). 'Equivalent' wave heights associated with three wind forces and twelve wind direction sectors, for summer and winter half-year, respectively. 'Equivalent' has been defined here with respect to frequency of being exceeded: during winds blowing from a given wind direction sector, winds of force 4 or higher and wave heights in excess of the 'equivalent' wave height associated with force 3 to 4 occurred during equal fractions of time.
(pag. 78-79)

TABLES E. Numbers of observations grouped with respect to wave height and *difference* between wave and wind directions, for winds of force 4 and higher blowing from four selected wind direction sectors, respectively, and for summer and winter half-year, respectively.
(pag. 80-87)

The tables F, G and I refer to the fifteen years 1949 to 1963 inclusive, so far as the lightvessels were stationed at their positions.

TABLES F 1. Maximum reported wave heights per individual month, with mean and standard deviation per calendar month, for four lightvessels separately.
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TABLES F 2. Maximum reported wind force per individual month, with mean and standard deviation per calendar month, for four lightvessels separately.
(pag. 90-91)

The tables G and H are given for the lightvessel Goeree only.

TABLES G 1. Annual variation of numbers of occasions (*series* of observations) with wave height above $1\frac{3}{4}$ m, $2\frac{3}{4}$ m and $3\frac{3}{4}$ m, respectively, and of durations exceeding given values.
(pag. 92)

TABLES G 2. Annual variation of numbers of occasions (*series* of observations) with wind force at least 7, 8 and 9 Beaufort, respectively, and of durations exceeding given values.
(pag. 93)

TABLES G 3. Annual variation of numbers of occasions (*series* of observations) with wave height below $\frac{3}{4}$ m and below $\frac{1}{4}$ m and of certain durations.
(pag. 94)

TABLES G 4. Annual variation of numbers of occasions (*series* of observations) with wind force 3 or less and 2 or less and of certain durations.
(pag. 95)

TABLES G 5. Annual variation of total duration per month of occasions (spells) with wave height below $\frac{3}{4}$ m and below $\frac{1}{4}$ m and lasting one half day at least: mean values and scatter in individual years.
(pag. 96)

TABLES G 6. Annual variation of total duration per month of occasions (spells) with wind force 3 or less and 2 or less and lasting one half day at least: mean values and scatter in individual years.
(pag. 97)

TABLES G 7. Same as G 5 but now only series of observations lasting one day at least were taken into account.
(pag. 98)

TABLES G 8. Same as G 6 but now only series of observations lasting one day at least were taken into account.
(pag. 99)

TABLE H. (pag. 100) Annual variation of frequencies (fractions of time) for 1949-1957 incl. and 1949-1963 incl., respectively, of winds with force at least 4, 6 and 8 Beaufort, respectively, and of waves with heights below $\frac{3}{4}$ m and above $1\frac{3}{4}$ m, $2\frac{3}{4}$ m and $3\frac{3}{4}$ m, respectively.

TABLE I 1. (pag. 101-119) Gives selected series of simultaneous wind and wave observations from all lightvessels present, extracted from the logbooks, for the years 1949 to 1963 inclusive. We have selected all periods with wave height 5 metres or more and/or wind force 10 ('storm'; Nederlands: 'zware storm') or more reported by at least one of the lightvessels, except those with only one such observation from only one of the lightvessels. The latter have been collected in TABLE I 2. The series of observations in table I 1 have been extended by one preceding and by one following observation not obeying the criterion mentioned.

1.7 Some details on the method of preparation of the tables

The rough frequency tables of waves and winds, as derived directly from the meteorological punch cards, have shortcomings due to three complicating factors.

1. in some ten percent of all observations during the years 1949 to 1957, *two* wave systems were reported;
2. the lightvessels have not been at their stations all the time; during the years 1949 to 1957 they have been absent for 4 to 7 percent of the time;
3. in a few cases the observers were not able to report reliable estimates of the wave parameters, especially in stormy weather.

These three factors will be dealt with consecutively in par. 1.7.1, 1.7.2 and 1.7.3.

1.7.1 In the frequency tables A, B, C1, C3, D1 and E every observation, including those with two wave groups, must be represented by one wave height, one period or one direction only. These parameters should be such that the 'wave situation' is characterized in the best possible way.

The tables A were first made mechanically, so that all cases with two wave groups were represented by the first group only. Then these tables were corrected by applying changes of wave height and/or direction individually in all cases with two wave groups where this was deemed necessary. The parameters of the second wave group were taken instead of those of the first group: (1) if the second wave height was $1\frac{1}{2}$ m or more and larger than the first wave height; (2) with equal heights of $1\frac{1}{2}$ m or more, if the second wave period was larger than the first wave period; (3) with equal heights of $1\frac{1}{2}$ m or more and equal periods if the second wave direction deviated from the wind direction more than the first wave direction. It was not considered worth while to correct all cases where both wave heights were 1 metre or less. Obviously, the effect of these corrections was to increase the frequencies for the higher wave heights

and periods at the expense of the frequencies for lower heights and periods. The work was facilitated by the use of mechanically made, chronological lists of all wind and wave observations with two wave groups.

The total numbers of observations that were corrected in this way are 296 for Goeree, 277 for Texel and 163 for Terschellingerbank. These numbers are roughly one percent of the total numbers of all observations.

For the tables B, corrections of this kind were considered to be less necessary; so they were not applied here.

The tables C 1 and C 3 are based on the same corrected numbers as the tables A. Since no corrections were made for wave heights of 1 metre or less, it is realized that the tables for the lower wave heights contain a small systematic error.

The tables D 1, like A, were first made such that all cases with two wave groups were represented by the first group only. Then these tables were corrected by increasing the wave height individually in all cases where the wave height of the second group was larger than that of the first group, without further restrictions. The tables D 2 were derived from the corrected tables D 1; values are given only when based upon 4 observations at least. The 'equivalent' wave heights were determined from graphical plots of the cumulative numbers of observations of the tables D 1 versus wave height.

The tables E, which bear upon selected wind directions only, were first made mechanically for the observations with one wave group only. They were completed manually with the aid of adequate chronological lists of wind and wave observations with two wave groups. For each observation the wave group with the highest waves was taken into account or, if the heights in both groups were equal the wave group with the higher period was taken into account or, with equal heights and periods in both groups, the wave group with the largest deviation between wave and wind direction was taken into account. The percentages of the processed observations with two wave groups were 11-14 for the directions 050-070°, 14-26 for 110-160°, 8-13 for 200-220° and 5-7 for 290-310°.

1.7.2 The second complicating factor arises because each of the lightvessels has been absent from its station during a small fraction of the time, so that many of the frequency tables do not refer to the complete combination of months which these tables are supposed to refer to. Also, the periods of absence are different for the various lightvessels. When frequency tables of two lightvessels are compared, some bias might thus be introduced. The simplest way to minimize this shortcoming is, for the time intervals of absence of a lightvessel, to substitute the observations of another lightvessel. It was decided to apply this procedure (simple in principle but rather laborious in practice) for the tables A (and C 1) and C 2, but not for the tables B, D and E. The following table gives, for each lightvessel, the periods with observations lacking during one day at least, together with the name of the lightvessel whose observations were taken as a substitute.

For comments on possible errors introduced by this substitution procedure, see below, par. 1.8.

TABLE 3

Lightvessel	Period with no observations	Lightvessel substituting	Number of observ.
Goeree	1949 June-20 -July 23	Texel	260
Goeree	1949 Oct. 5 -Oct. 10	Terschellingerbank	42
Goeree	1950 June 15 -July 13	Texel	225
Goeree	1951 April 12-May 23	Texel	328
Goeree	1953 May 16 -May 19	Texel	25
Goeree	1954 Aug. 31 -Sept. 24	Noord-Hinder	200
Goeree	1954 Sept. 25-Oct. 15	Texel	168
Texel	1949 Sept. 19-Nov. 4	Terschellingerbank	369
Texel	1950 Aug. 31-Nov. 16	Terschellingerbank	619
Texel	1951 July 10 -Aug. 1	Terschellingerbank	180
Texel	1953 Apr. 8 -May 8	Terschellingerbank	242
Texel	1954 Aug. 12 -Aug. 14	Goeree	19
Texel	1954 Aug. 14 -Sept. 24	Terschellingerbank	333
Texel	1955 June 3	Terschellingerbank	8
Terschellingerbank	1949 Nov. 18-Dec. 22	Texel	269
Terschellingerbank	1950 Aug. 9 -Aug. 30	Texel	175
Terschellingerbank	1951 June 19 -July 10	Texel	165
Terschellingerbank	1954 June 1 -Aug. 11	Texel	576
Terschellingerbank	1954 Aug. 12 Aug. 14	Goeree	19

1.7.3 Wave heights and periods were not reported, and sometimes the waves were reported as 'confused' by the lightvessel Texel during a few gale periods, mainly in January 1954 and 1956 and in December 1954, on 31 occasions in all. Since the omission of these occasions of mostly high waves would notably affect the tables A for Texel, the missing wave heights and directions have been rated *a posteriori*, with the help of preceding and following observations and of the wind data of Texel and of the wave data of other lightvessels. In the table I 1 the major part of the rated wave heights have been given, in parentheses. In one similar case the wave height was rated for Goeree (7 Nov. 1952). The rated values then were included in the tables A (and in the tables C 1), but not in the tables B, D and E.

1.7.4 *Tables F.* The maximum reported wave heights and wind forces per month were taken from the meteorological logbooks. In all cases where two wave groups of different height had been reported, the higher value was taken. When two wave groups of equal height had been reported, that height was taken.

Maximum data for months in which observations were lacking for one day or more have been taken from the nearest of the other lightvessels and then placed in

parentheses if there existed a possibility that the maximum wave height of the month had occurred in this period of no observations.

1.7.5 *Tables G.* These tables, given for the lightvessel Goeree only, were derived from 12 auxiliary tables which were prepared by direct reference to the logbooks. There is one auxiliary table for each calendar month; each of these tables gives chronologically, for 15 individual months consecutively, all reported wind force values 3 or less and 7 or more on one line, and directly below all wave heights of $\frac{1}{2}$ m or less and of 2 m or more. For all reports with two wave groups, the same convention was adopted as described in par. 1.7.4. For the highest wind forces and waves the direction sector has been indicated too.

In the tables G, data on uninterrupted series of three-hourly observations with the wave height or the wind force obeying a given criterion have been presented. Such series have been loosely called: 'occasions' or 'spells', with the implication that the criterion has been obeyed continuously from beginning to end. It is assumed that this implication is correct in the majority of cases.

Series running from one month into the following month have been incorporated with the month in which the series started, but in counting the numbers of observations in the series (as was necessary for the compilation of the tables G 5-G 8) every observation has been reckoned to its 'own' month.

For the tables G 1 the convention was adopted that two series of observations with wave height above H metres (H = $1\frac{3}{4}$, $2\frac{3}{4}$, $3\frac{3}{4}$), separated by one or more observations with wave height H $-$ $\frac{1}{2}$ metres *only*, were counted as *one* occasion with wave height above H metres. For the tables G 2 the convention was adopted that two series of observations with wind force N or more (N = 7, 8, 9, 10), separated by one or more observations with wind force N $-$ 1 *only*, were counted as *one* occasion with wind force N or more. Similar conventions were *not* adopted for the tables G 3 to G 8.

1.7.6 *Tables H.* The wave height frequencies were derived from the auxiliary tables discussed in par. 1.7.5, the wind frequencies from the year-books of the K.N.M.I. (see list of references).

1.8 Some comments on the choice and the design of the tables

The reader might have missed frequency tables on waves of certain period and direction, or on combinations of certain wave periods and wind forces, irrespective of wave height. In our opinion, however, such data on wave periods without wave heights are comparatively less interesting; indeed, there exists a rather close correlation between wave height and period, as has been extensively illustrated in the tables B.

The tables C have been given to demonstrate the annual variation of wave heights and wind forces, and the tables C 2 allow a comparison to be made between frequencies of wind forces for the nine years 1949 to 1957 and for earlier or later periods.

Some comments on the design of the tables D1, D2, E and F have also been given in the discussion below: paragraphs 2.8, 2.8.2, 2.9 and 2.6.

The tables D 1 and D 2 have been given for summer and winter half-year separately, in order to show any differences between the relation between wind force and wave height in summer and in winter; such differences might be expected because of different fetch and duration conditions.

A similar consideration has led to the preparation of tables B 2 for three selected wave direction sectors: one sector around SE in which direction the fetches are short for all three lightvessels considered; one sector around SW from which direction mainly warm air masses (with the air warmer than the water) are moving over the sea; and one sector around NNW which is characteristic for cold air masses (with the air colder than the water).

The substitution procedure as outlined in par. 1.7.2 was not applied to the tables D and E because, for a given wind direction and force, the waves at the different lightship locations may be significantly different. For strong winds and gales from easterly directions the waves near Noord-Hinder and, to a lesser extent, Terschellingerbank are expected to be higher than those near Goeree and Texel. For strong winds and gales from southerly directions the waves near Noord-Hinder and Texel are expected to be higher than those near Goeree and Terschellingerbank. For strong winds and gales from westerly directions the waves near Noord-Hinder may be lower than those at the other three locations.

The tables F, G and I have been presented also because of their possible application for practical purposes. As for the numbers of spells of low waves and weak winds, given by the tables G 3 and G 4, one cannot yet compute from these tables the probabilities of experiencing such spells in a given individual month, because the spells cannot be treated as if they were statistically independent events. For this reason the tables G 5 to G 8 have been added.

In the tables F and G, no discrimination whatever has been made with respect to wave or wind *direction*. For low waves and weak winds (tables G 3 to G 8), directions are less important. For the high waves and gales, separation into a number of wave and wind direction sectors would obviously have increased the volume of the tables F, G 1 and G 2 considerably. There are, however, two other objections against such a separation: (1) any devision into a small number of relatively large direction sectors is more or less arbitrary; (2) during most 'occasions' of high waves and gales a shift in wave and wind direction occurs which can be quite substantial. It was considered that sufficient information on the directions of high waves and gales can be found in the tables A and I.

The table I 1 is the only one giving information on *simultaneous* observations from all lightvessels considered during gale periods, including the worst ones of the fifteen years 1949 to 1963.

2 DISCUSSION OF RESULTS

Only the most important conclusions to be drawn from the tables will be presented in the following. By plotting the data in various ways, probably some more conclusions could be drawn; this has not been done here.

2.1 Some general remarks

All of the monthly and annual relative frequencies and other data presented in the tables refer to a specified set of years (either 1949-'57 or 1949-'63), but all of them may be assumed to be applicable to some extent to any other set of years. In particular, for practical purposes, it may be claimed that all tables have a certain predicting value.

However, as everyone knows, the parameters characterizing the weather in a particular calendar month (say: August) vary widely from year to year, and the same is true for the frequencies of certain winds and waves, maximum wind forces or wave heights, numbers of occasions with certain winds and waves etc. Some data on this scatter in individual years is given in the tables F 1, F 2 and G 5-G 8. It is, therefore, obvious that average relative frequencies or other parameters over a number of years will always depend on the years that were used in the averaging.

This gives rise to the question: what is the degree of reliability of the values given in the tables when applied to other years than those used in the averaging? It is clear that each of the smaller numbers given in the twodimensional tables A, B, D and E has a very low significance in this respect. Cumulative frequencies, as may be derived from these tables and as actually given in the tables C, in general are more reliable in this respect so far as they are based on larger numbers of observations.

2.1.1 *Reliability of the relative frequencies presented in the tables C*

The possible differences in relative frequencies for different sets of years are demonstrated for the lightvessel Goeree by the table H, in which monthly frequencies of certain wind forces and wave heights over the nine years 1949-1957 and over the fifteen years 1949-1963 have been put together. There is no reason to be alarmed by the rather large differences which appear in certain places in this table, but the table may help to make the reader conscious of the limited reliability of the frequency values given in the tables C, when he attempts to use these values for another set of years.

From listings of the frequencies of certain wind forces and wave heights for every individual month from 1949 to 1963 it could be deduced that the root mean square (rms) deviations of these frequencies of wind forces 3 and less, and of wave heights below $\frac{3}{4}$ metres, for each particular calendar month, are of the order 30 to 50 percent of their average value. For example, August, wind forces 3 and less: average number of observations 113, total number of observations per month $31 \times 8 = 248$, thus

average relative frequency 113/248 = 457 ‰ = 1000 — 543 ‰ (comp. table H); computed rms deviation 45.6 observations or 45.6/113 = 40 percent of the average value, maximum relative frequency 191/248 = 770 ‰ (August 1949), minimum relative frequency 24/248 = 97 ‰ (August 1957).

For the frequencies of wind forces 6 and more and of wave heights above 1¾ metres in individual months the rms deviations are of the order 50 to 70 percent of their average value, for the frequencies above 2¾ metres they are 60 to 140 percent of their average value.

Then, if for each particular calendar month the frequencies of certain winds or waves in individual years may be considered as mutually uncorrelated 'stochastic' elements taken from a 'population' which is constant ('homogeneous') during an interval of, say, one hundred years (this is very nearly true), the rms deviation of the average frequency over nine years from its 'true' value would be $1/\sqrt{9}$ or one third of the values mentioned above. The frequencies given in the columns B of table H would have rms deviations which are $\sqrt{9/15}$ or 0.78 times those of the frequencies of the columns A.

2.1.2 *Comparisons between different lightvessels and between different time periods*

The differences found between frequencies and mean values etc. of winds and waves for different lightvessels or for different time periods (sets of years) can be expected to be partly real, that is, caused by the differences in position of the lightvessels or by actual deviating conditions in different time periods, and partly due to slight systematic differences between the observers on board the different lightvessels as they express their non-instrumental impressions in Beaufort numbers and wave heights. Since in general the differences found are small, it is not easy to state the extent to which they are real.

The term 'real' used in the above paragraph presupposes the existence of a fictitious 'ideal' standard observer, using always exactly the same criteria. As for wind force, however, it should be remembered that even with such an 'ideal' observer no *strict* relation exists between reported wind force and average wind speed at a certain height and that even the average relation between wind force and wind speed for a given location could slightly depend on local conditions.

For the lightvessels off the Dutch coast in the period 1910 to 1939 VERPLOEGH (1956-1959) found only small differences in the wind frequencies for the different positions from Noord-Hinder to Terschellingerbank (except for the lower frequencies of strong winds and gales reported by the lightvessel Maas which was stationed only 8 miles off Hook of Holland). He also found differences between the mean wind vectors in the mentioned period and in earlier periods, such differences being considered by him as real because they were very similar for the various lightvessels. The differences were interpreted by him in terms of variations in the frequencies of various circulation types.

In order to judge the 'reality' of differences found between frequencies, mean values etc. of the observed winds and waves, we can obviously apply two principles:

1. differences found for different time periods obtain a higher probability of being real, if they are similar for various lightvessels;
2. differences found between different lightvessels are probably real if similar differences are found for previous time periods.

Regarding the first of these statements, if certain differences between frequencies in two different sets of years are found to be probably real in the sense just described (examples will be given in par. 2.2.2), quite another question is whether or not it will be justified to assume that the frequencies in both sets of years can still be considered as averages of elements taken from the same population in the statistical sense (comp. the previous par. 2.1.1). Statistical tests to decide on such questions have not been carried out.

In the following we shall mainly resort to the second principle mentioned above.

The data derived from the wind observations of German ships (MARKGRAF and BINTIG, 1954) show an increase of the average wind force and of the frequencies of strong winds and gales over the open North Sea when going from the Channel northward to about 56° North, but also show in most instances a decrease of these quantities when approaching either the British or the continental coast. This increase and decrease are most pronounced in the months September to April and are slight or non-existent in May to August.

Similar effects can be safely assumed to exist *a fortiori* for the frequencies of the higher waves, because of the restricted fetches for certain directions in the Southern Bight and in the sea areas closer to the coasts, and because of the shallower depths in such areas. An obvious decrease of the frequencies of high waves from West to East along a line at about 54° North joining the German lightvessel S 2 (3°32'E) and the lightvessels in the German Bight was found by ROLL (1956).

2.2 Moderate and strong winds and gales

2.2.1 *Frequencies, general* (tables C 2, see also table H)

The tables C 2 for each lightvessel show the typical well-known features:

(1) the highest frequencies of moderate and strong winds and gales are found in Nov. to Jan. incl.;

(2) the lowest frequencies are found in May and June;

(3) the highest frequencies of wind forces $\geqslant 4$ and $\geqslant 6$ are found for the directions SSW to WNW;

(4) the highest frequencies of wind forces $\geqslant 8$ are found for the directions WSW to NW.

It is typical that for all three lightvessels November is the month with the highest frequencies of wind forces 4 and more, whereas December is the month with the highest frequencies of wind forces $\geqslant 6$, $\geqslant 8$ and $\geqslant 10$.

2.2.2 *Comparisons of frequencies* (tables C 2)

The lightvessel Goeree shows higher annual frequencies of wind forces $\geqslant 4$ and $\geqslant 6$ than Texel and Terschellingerbank. It appears that the major differences occur for the direction sectors 24 (SW-WSW) in the months April to August incl. and 03 (NNE-NE) in the months March to August inclusive.

The differences between Texel and Terschellingerbank are less conspicuous. In September and October the monthly frequencies of wind forces $\geqslant 4$ and $\geqslant 6$ for Texel are markedly higher than for Terschellingerbank and then especially for the sectors 21, 24 and 27 (SSW to W). During most of the year the frequencies of these wind forces for the sectors 21 and 24 (SSW to WSW) are higher for Texel than for Terschellingerbank, but especially in the months August to December.

As for the frequencies of wind forces $\geqslant 8$ the three lightvessels show no outstanding differences. Texel shows the highest gale frequency.

In order to be able to discuss the 'reality' of the differences mentioned above as to frequencies of wind forces regardless of direction the following comparative table 4 has been compiled from different sources. The data of Goeree can be compared with those of the former lightvessel Schouwenbank, those of Texel with those of Haaks and those of Terschellingerbank with those of the former lightvessel of that name. Some published German data are also included in order to extend the comparison.

TABLE 4 *Parts per hundred (fractions of time)*

Wind force	Season	Netherlands lightvessels							German vessels			
		NH	Schb	Gr	Hks	Tx	Tb(1)	Tb(2)	A	B	S2	E1
4 and more	Winter	58	45	66	53	64	53	61		68		
	Spring	37	32	51	33	45	35	43		49		
	Summer	34	33	50	29	42	29	41		42		
	Autumn	51	44	65	48	67	49	60		61		
	Year	45	39	58	41	54	41	51		55	47	
6 and more	Winter	22.9	14.6	24.2	19.0	23.0	17.4	22.0	29	31		
	Spring	9.2	8.3	8.5	7.3	7.2	7.2	8.0	16	15		
	Summer	7.4	6.9	9.4	5.4	5.6	4.7	4.9	12	11		
	Autumn	18.9	15.3	21.0	17.9	20.3	16.3	19.1	21	26		
	Year	14.9	11.4	15.8	12.2	14.0	11.3	13.5	19	21	15,4	
8 and more	Winter	5.4	2.7	4.1	4.1	4.3	3.3	4.1	9	9		2.6
	Spring	1.1	0.7	0.8	1.0	0.9	0.6	0.9	3	3		0.9
	Summer	0.7	0.9	0.9	0.6	0.5	0.3	0.6	2	1		0.9
	Autumn	4.0	2.8	2.1	3.9	2.7	3.3	1.8	6	8		3.1
	Year	2.8	1.8	2.0	2.4	2.1	1.9	1.9	5	5	3.2	1.9

Explanation (table 4):

NH	: Lightvessel Noord-Hinder,	51°37′N, 2°36′E, 1910-'16 and '20-'39[1])
Schb	: Lightvessel Schouwenbank	51°47′N, 3°27½′E, 1910-'14 and '21-'34[1])
Gr	: Lightvessel Goeree,	51°54′N, 3°38′E, 1949-57[2])
Hks	: Lightvessel Haaks,	52°57½′N, 4°18½′E, 1910-'14 and '19-'39[1])
Tx	: Lightvessel Texel,	53°04′N, 4°27′E, 1949-'57[2])
Tb (1)	: Lightvessel Terschellinger-bank	53°27′N, 4°49½′E, 1910-'14 and '21-39[1])
Tb (2)	: Lightvessel Terschellinger-bank	53°29′N, 5°08′E, 1949-'57[2])
A	: German ships, sea area between Dover and 53°N, many years[3])	
B	: German ships, sea area 53-54°N, 4-6°E, 1906-'14 and '20-'39[4])	
S 2	: Lightvessel S 2,	54°00½′N, 3°32′E, 1947-'53[5])
E 1	: Lightvessel Elbe 1,	54°00′N, 8°10½′E, 1924-'57[6])

Winter: December, January and February; etc.

References (table 4):

[1]) G. VERPLOEGH (1956-1959), see list of references on page 123

[2]) This publication

[3]) Deutsches Hydrographisches Institut (1965), Nordsee-Handbuch Südlicher Teil (Nr. 2007), page 78, Hamburg

[4]) H. MARKGRAF and P. BINTIG (1954), see list of references on page 123

[5]) J. RICHTER 1954 — Ueber die Häufigkeit der Windstärken bei 'S 2', Der Wetterlotse 6 (68/69), pp. 77-80, Hamburg

[6]) J. RICHTER (1962) — Ueber Stürme und ihre Häufigkeit an der deutschen Nordseeküste, Der Wetterlotse 14 (186), pp. 140-3, Hamburg

The table indicates, first, a general increase between 1910-'39 and 1949-'57 in the frequencies of wind forces $\geqslant 4$ in all seasons and of wind forces $\geqslant 6$ mainly in autumn and winter. For the frequencies of wind forces $\geqslant 8$ an increase is indicated in winter and a decrease in autumn. Since these trends are apparent for all lightvessels considered they may be real (for the sets of years considered), at least, for a major part.

The higher annual frequencies of wind forces $\geqslant 4$ and $\geqslant 6$ of Goeree with respect to the northern lightvessels were not found for Schouwenbank and thus may not be real. From a plot of the annual frequencies of wind forces $\geqslant 4$, $\geqslant 6$ and $\geqslant 8$ for Goeree and Texel versus wind speed it can be shown that the differences between both lightvessels *could* be completely attributed to systematic differences in the interpretation of the observers on board both vessels *if* there was an average difference of 0.6 and 0.7 knots, respectively, in the wind speeds corresponding to the transition between force 3 and 4 (about 11 knots) and between 5 and 6, (about 22 knots), respectively. These differences correspond to roughly one tenth of a degree in the Beaufort scale, which is rather small indeed.

However, *both* Goeree and Schouwenbank show a notably lower annual variation

of these frequencies than the northern lightvessels and show higher frequencies of wind forces $\geqslant 4$ in summer, higher frequencies of wind forces $\geqslant 6$ in spring and summer and lower frequencies of wind forces $\geqslant 8$ than Texel and Haaks in autumn and winter. As to wind forces $\geqslant 6$, similar differences are apparent from a comparison of columns A and B in table 4. Thus these features are probably real. Inspection of the tables for the former lightvessels in the original publication shows that the differences just mentioned are mainly traced to the directions SW and NE, and since this was also found for Goeree it can be assumed to be a real feature. This would point to a certain 'funneling effect' in the Southern Bight for winds of forces 4 to 7 in summer.

The large differences in frequencies of wind forces $\geqslant 4$ in September and October for Texel and Terschellingerbank were not found for Haaks and Terschellingerbank in 1910-'39. However, both Texel and Haaks show higher frequencies than Terschellingerbank for winds of forces $\geqslant 4$ and $\geqslant 6$ from South-West and $\geqslant 8$ from all directions for most of the year.

The table further indicates that the German ships sailing in the southern North Sea have given appreciably higher frequencies of wind forces $\geqslant 4$, $\geqslant 6$ and $\geqslant 8$ than the Netherlands lightvessels including the lightvessel Noord-Hinder. These differences appear too large to be ascribed only to the differences in positions and could be partly due to systematic differences in the interpretation of the observers. The data given for the German lightvessels are more in line with those for the Netherlands lightvessels.

2.2.3 *Numbers and durations of occasions* (tables G 2)

An example illustrating the use of the tables G 2 is given with the first table.

It may be mentioned that similar statistics of 'gale periods' for the former lightvessels in the years 1910-'39 have been published by VERPLOEGH (1956) (Part I) and for Goeree in the years 1949-'54 by DORRESTEIN (1955).

Several conclusions may be drawn from the tables G 2. For example: both the numbers of occasions (periods) with gales and their average durations are greatest in the months October to February incl.; an average winter half-year will show $(6+9+12+10+4+2)/15$ or approximately 3 periods with wind force 8 or more and lasting one day or longer; the longest duration observed in June, July and August of a period with wind force 9 or more has been less than $1\frac{1}{2}$ days; in April there is an estimated probability of 5/15 or one in three or less of experiencing a period with wind force 7 or more lasting one day or longer, etc.

The decrease of the numbers with duration is of an exponential character. The average durations decrease with increasing wind force.

It may be noted that the numbers of occasions with, for example, wind forces 7 or more essentially equal the numbers of occasions with wind forces 5 or less, possibly including wind forces 6 (cf. the end of par. 1.7.5), and that the total and average durations of the latter periods could be estimated from the tables.

2.3 Moderate and high waves

2.3.1 *Frequencies, general* (tables C 1, C 3, see also table H)

From the tables C 1 and C 3 similar conclusions may be drawn as from the tables C 2 (par. 2.2.1), for example:

(1) the highest frequencies of moderate and high waves are found in December and January;
(2) the lowest frequencies are found in June;
(3) for Texel, the highest frequencies of waves higher than $1\frac{3}{4}$ m occur for the directions WSW to WNW;
(4) for Texel, the highest frequencies of waves higher than $2\frac{3}{4}$ m and $3\frac{3}{4}$ m occur for the directions WSW to NW.

2.3.2 *Frequencies of three lightvessels compared* (tables C1, C3)

The lightvessel Goeree shows higher annual frequencies of wave heights $\geqslant 1\frac{3}{4}$, $\geqslant 2\frac{3}{4}$ and $\geqslant 3\frac{3}{4}$ metres than Texel and Terschellingerbank. For all three height categories the frequencies are highest near Goeree in April to December incl. and for the first two categories also in February and March. It appears that the major differences between Goeree and Texel occur for the direction sectors 33, 36, 03, 06 (NW to ENE) and 24 (SW-WSW).

Just as in the case of the wind frequencies (par. 2.2.2), the differences in annual frequencies of Goeree and Texel probably do not constitute a real feature. From a plot of these annual frequencies versus wave height it can be shown that the differences between both lightvessels *could* be explained completely by systematic differences in the interpretation of the observers on board both vessels *if* there was an average difference of 12 centimetres in the reported wave heights for wave heights of about 1 metre, increasing to about 20 centimetres for wave heights of about 3 metres. In this connection, it may be interesting also to mention the average wave heights reported by each of the lightvessels, which can be computed from the tables A (all months, all directions). These average wave heights are 1.20 metres for Goeree, 1.09 metres for Texel and 1.08 metres for Terschellingerbank.

If the explanation suggested above for the differences in annual wave height frequencies of Goeree and Texel is valid, the question arises: What would the average ratios of the wave heights reported by both lightvessels to the 'significant' wave heights be? Only rough comparisons with the results of simultaneous instrumentally measured wave heights have been made: they indicate that this ratio for both lightvessels is between 1.0 and 1.1 (see also par. 1.5.2.)

As for the differences in frequencies mentioned above for certain directions, these differences might be real to some extent since similar differences for mostly the same directions were found to be real for the wind frequencies (par. 2.2.2).

The differences between the annual and monthly frequencies of Texel and Terschellingerbank are small. There are, however, rather conspicuous differences for

some directions. For the direction sectors 21 and 18 (SSE to SW) the values of Texel are higher in all months, which is immediately explicable from the difference in exposure of both lightvessels. On the other hand, during most of the year the frequencies of Terschellingerbank are higher than those of Texel for the direction sectors 09 and 06 (NE tot ESE), which is also explicable from the difference in position, and for the direction sector 33 (NW to NNW), which could perhaps be explained from the differences for both lightvessels in sea depths along the first 120 miles in these directions.

2.3.3 *Numbers and durations of occasions* (Tables G 1)

An example illustrating the use of the tables G 1 is given with the first table. Similar statistics of periods of high waves near Goeree in the years 1949-'54 were given earlier by DORRESTEIN (1955). Some graphs referring to the former lightvessel S2 (54°00½'N, 3°32'E) and other German lightvessels were given by KIPPER and JOSEPH (1963).

The conclusions to be drawn from the tables G 1 are quite similar to those exemplified in the discussion of par. 2.2.3. For exemple: per summer season (June, July and August) the expected number of periods with wave heights above 1¾ metres and lasting three days or longer is (2 + 6 + 6)/15 or approximately one.

It may be noted that the numbers of occasions with, for example, wave height exceeding 1¾ metres essentially equal the numbers of occasions with waves lower than 1¾ metres including observations with wave heights lower than 1¼ metres (cf. the end of par. 1.7.5), and that the total and average durations of the latter periods could be estimated from the tables.

2.4 Weak winds and calms

2.4.1 *Frequencies, general* (tables C 2)

Since the frequencies of wind forces 0 to 3 inclusive necessarily are the complement of the frequencies of wind forces 4 and more, the reader may be referred to the discussions given in paragraps 2.2.1 and 2.2.2.

2.4.2 *Numbers of occasions* (tables G 4, G 6, G 8)

Examples illustrating the use of the tables have been given with the tables. The reader may draw several conclusions from the tables G 4 similar to those discussed in par. 2.2.3 for the tables G 2.

The tables G 6 and G 8 illustrate the wide variability in the total durations of weak winds and calms. Winter months with higher durations than the summer average, and summer months with shorter durations than the winter average are not uncommon.

It should be noted that the 15 years considered obviously constitute a sample which is rather too small to serve as a basis for the estimation of a frequency distribution

of durations, as has, in fact, been done in the tables G 6 and G 8. This explains the somewhat irregular character of the tables. However, the estimation of probabilities of certain durations for a particular month might be a little improved by an intelligent interpretation of the numbers presented, and by considering also the data for the preceding and the following months. Example (table G 6, wind force 3 or less): the probability of experiencing a total duration less than 4 days in October might well be one or two in 15, or of the order of ten percent.

2.5 Low waves and smooth seas

2.5.1 *Frequencies, general* (Tables C 3)

From the three tables C 3 it can be seen that the maximum frequencies of waves lower than ¼, ¾ and 1¼ metres occur in one of the months May, June or March. All months from March to August inclusive show distinctly higher frequencies than the other months. The minimum frequencies of waves lower than 1¼, ¾ and ¼ metres occur in one of the months November, December or January.

2.5.2 *Frequencies of three lightvessels compared* (tables C 3)

The lightvessel Goeree shows lower annual frequencies of wave heights below ¾ and below 1¼ metres than Texel and Terschellingerbank. This is an extension of the differences in frequencies for higher waves already discussed in par. 2.3.2, and this is probably not a real feature.

On the contrary, the annual frequencies of calms and of waves lower than ¼ metre of Goeree are higher than those of Texel and Terschellingerbank. Goeree shows the highest frequencies of calms in all months except July, and the highest frequencies of waves lower than ¼ metre in all months except February, July and October. It may well be that these differences are, at least partly, real.

2.5.3 *Numbers and durations of occasions* (tables G 3, G 5, G 7)

Illustrations of the use of the tables are given with the tables. The tables have been constructed in a similar way to the tables G 4, G 6, G 8 referring to periods with weak winds and calms which were briefly discussed in par. 2.4.2. The conclusions to be drawn are of a similar nature and the remarks made in par. 2.4.2 also apply here.

2.6 Extreme wind forces and wave heights

The tables F 1 and F 2 give maximum wave heights and maximum wind forces as reported by each of the four lightvessels in every individual month. They allow the reader to derive easily approximate frequency distributions for maximum wave heights and wind forces and to draw up associated considerations of risks, for any month or combination of months he may desire. The maximum values for every

'summer', defined here as the period April to September inclusive, and for every 'year', defined as the period July to June inclusive, have been included in the tables.

For all observations with wind forces 10 or more and with wave heights 5 metres or more (or, above $4\frac{3}{4}$ metres), all related information on wind and wave directions, wave periods and simultaneous occurrences on two or more of the lightvessels can be taken from the tables I.

2.6.1 *Extreme wind forces, general* (tables F 2, I)

All lightvessels show the highest average maxima of wind force in January, followed by December and November. This means an extension of the trend outlined in par. 2.2.1 for moderate and strong winds. For all lightvessels June is the month with the lowest average maxima of wind force; followed by May, April and July.

Wind force 11 ('violent storm'; Nederlands: 'zeer zware storm') has been reported approximately once every two years by all lightvessels. This is roughly the same frequency as reported by the lightvessels in the years 1910-'39 (VERPLOEGH, 1956-'59, Part I, page 68). Wind force 12 ('hurricane', Nederlands: 'orkaan') has been reported in the years 1949-'63 by Terschellingerbank only: on March 1, 1949 and on February 1, 1953. The number of 'hurricanes' reported by the former lightvessels in 18 to 26 years in the period 1910-'39 varied between zero (Terschellingerbank) and three (Maas and Haaks).

The standard (root mean square) deviations of the maximum wind forces appear to be smaller for combinations of months than for single months, as is illustrated in both columns to the right of the tables.

2.6.2 *Extreme wave heights, general* (tables F 1, I)

January and December are the months with the highest average maxima (for Texel November also). June shows the lowest average maxima, except for Terschellingerbank, where in all months April to July inclusive the average maxima are practically equal.

It should be remembered that the accuracies in the estimates of exceptionally high waves necessarily are limited, because of less experience of the observers and because of the less comfortable condition of ship and observers during storms or hurricanes in many cases. One example in which the wave heights probably have been overestimated is given by the 'twin-storms' of December 22-23 1954, during which Terschellingerbank (where the depth is less than 25 m) reported two series of observations with wave height 9 metres (and wind forces 11 and 10; see table I 1). Texel reported 8 metres twice on December 23 but gave no wave height reports during the rest of the period in which the storms were at their maximum (the missing data have been replaced by ratings, see table I 1); Goeree reported 8 metres on December 23-24. It would seem probable that the real maximum of the (significant) wave height near all three lightvessels on these occasions was about 7 metres (implying individual waves

that may reach 11-12 metres!) — but, obviously, it is not possible to know the true values.

ROLL (1956), in his discussion of maximum wave heights in the southern North Sea, concluded that maximum (significant) wave heights of about 8 metres would be a reality in the relatively deeper areas some distance from the coasts, that is to say: over a period of the order of ten to twenty years, as considered by him. It should be recognized that the maximum wave height over a longer period, say 50 or 100 years, would be somewhat higher. In this report we shall not dwell upon the extrapolation problem involved here, and its difficulties (see, for an attempt to extrapolate the wave height frequencies for the lightvessel Goeree, BAKKER (1962)).

The conclusions that can be drawn from the reports by the Netherlands lightvessels in the years 1949-1963 do not conflict with the conclusion of Roll just mentioned.

2.6.3 *Maximum wind forces and wave heights of four lightvessels compared*

The tables F 2 show that the average maximum wind forces per year and per 'summer' for the northern lightvessels are a little higher than for Goeree and Noord-Hinder, but the differences hardly seem significant. The latter holds too for the average maximum wave heights reported by the different lightvessels.

2.6.4 *A few outstanding cases* (tables I)

It may be seen that the five most severe periods of storms or hurricanes and of high waves in the 15 years considered have been:

1949: March 1;
1953: January 31 - Februari 1;
1954: January 16;
December 21-24;
1962: February 16-17 (especially in the north).

In all these cases the strongest winds and the highest waves came from WNW, NW or NNW.

2.7 Relation between wave height and wave period (tables B 1, B 2)

The tables B 1 and B 2 are twodimensional relative frequency tables. They all illustrate the well-known rather strong positive correlation between wave height and wave period. From the tables, average wave periods for certain wave heights may be *estimated.* The word 'determined' would be less appropriate here because of the wide steps of the wave period scale (see par. 1.5.2). These steps, moreover, have been poorly defined: it has never been clear, for example, whether the exact sense of 'more than 5 but not more than 7 seconds' would be 5.1 to 7.0 seconds, or 5.5 to 7.4 seconds, or something else. (The instructions on this point were clarified after 1957). In the following it will be assumed that the period columns in the tables B 1 and B 2 can be characterized by 4, 6, 8, 10, 12 seconds, respectively.

2.7.1 *Tables of three lightvessels compared for all directions together*

The lightvessel Goeree not only has reported, on the average, waves a little higher than those of Texel and Terschellingerbank, as has already been discussed in par. 2.3.2, but Goeree has also reported, on the average, somewhat higher wave periods, as is shown by the higher totals of Goeree in the period groups 5-7 seconds and 7-9 seconds, and the lower total in the period group $\leqslant 5$ seconds. The average wave period for all wave observations of Goeree is estimated from the tables to be 5.7 seconds, for the observations of Texel it is 5.3 seconds and for those of Terschellingerbank 5.2 seconds. It is hard to say to what extent the differences between Goeree and Texel would be real; for the lightvessel Terschellingerbank, stationed a little closer to the coast than the other lightvessels, a little lower average wave period appears natural.

2.7.2 *Dependence on wave direction* (tables B 1)

When the tables B 1, e.g. for Texel, for typical seaward directions such as 290-340° and for typical landward directions such as 110-160° are compared, it can be seen that for the latter not only the average wave periods are lower, because the wave heights are lower, but the average wave periods for equal heights also are lower. For example, for wave heights of $1\frac{1}{2}$ metres ($1\frac{1}{4}$ to $1\frac{3}{4}$ metres) the average period is about 6.5 seconds for the directions 290-310° and less than 5 seconds for the directions 110-130°. The explanation is, obviously, that the latter waves are mainly still developing, and are accompanied by stronger winds than the former waves which are mainly in a more 'mature' stage, or may even be swell waves.

For the higher wave heights, 2 metres or more (above $1\frac{3}{4}$ metres), the average wave periods for all three lightvessels are 7 to 8 seconds if the waves are coming from directions between 230 and 010° (SW to NNE) and 5 to 6 seconds if the waves are coming from directions between 080 and 180° (ENE to S).

2.7.3 *Annual variation* (tables B 2)

The tables B 2 show a comparison between the relation wave height - wave period for summer (May to October inclusive) and for winter (November to April inclusive). It may be seen that for waves of given height and direction the average wave periods in winter are only slightly higher than in summer in most cases, if the waves are coming from seaward directions. There are no conspicuous differences between the relation height-period in summer and in winter.

2.8 Relation between wind force and wave height (tables D 1, D 2)

The two-dimensional tables D 1 contain the numbers of certain combinations of simultaneously observed wind force and wave height for three lightvessels separately, and for summer half-year and winter half-year. These tables were made for all twelve

wind direction sectors of 30 degrees but, since they all have a similar character, they have been presented for four selected wind direction sectors only (the same as were selected for the tables E). In all cases the strong positive correlation between wind force and wave height is clearly illustrated.

For a given wind force, the scatter in wave height is largest for the wind directions from the sea (290-310°) and smallest for the wind directions from the land (110-160°). Observations of wave heights largely in excess of the mean wave height for the given wind force and direction may partly represent swell waves.

The tables D 2 contain some information extracted from the tables D 1 for all wind directions.

2.8.1 *Mean wave heights for given wind forces and directions* (tables D 2, upper part)

The tables D 2 show, for all wind directions, a more or less regular increase of mean wave height with wind force. The effect of wind direction is most pronounced for the higher wind forces, as could be expected. The highest mean wave heights are found for the wind direction sectors 30, 33 and 36 (WNW to NNE), these being the typical seaward directions for all three lightvessels. The lowest mean wave heights have been reported by 'Goeree' for the wind direction sectors 12 and 15, by Texel for the sector 12, and by Terschellingerbank for the sector 15, these being the typical landward directions.

For the seaward sectors 30, 33 and 36 together the following comprehensive table of mean wave heights has been compiled from the tables D 1. Some similar data from two German lightvessels in the years 1949 to 1952 inclusive, for winds blowing from the 'northwestern quadrant' and for the three wind force combinations 4 and 5, 6 and 7, and 8 and 9, respectively, as taken from ROLL (1956), have been added for comparison. (The positions of these lightvessels were given in the explanation to table 4 in par. 2.2.2).

TABLE 5 *Mean wave heights in metres for winds from WNW to NNE (Netherlands lightvessels) or from W to N (German lightvessels)*

Su = summer half-year. Wi = winter half-year. Yr = whole year.

Wind-force	Goeree		Texel		Tersch.bank		S2	Elbe 1
	Su	Wi	Su	Wi	Su	Wi	Yr	Yr
3	0.8^5	1.0	0.8^5	0.9	0.8^5	0.8^5	–	–
4	1.3	1.4	1.3	1.3	1.2^5	1.3^5	1.5	1.1
5	1.7^5	1.9	1.7	1.8	1.7^5	1.8		
6	2.3	2.4	2.2	2.1^5	2.2^5	2.3	2.5	1.8
7	3.0	2.9	2.4	2.7^5	2.6	2.8^5		
8	3.3	3.4	3.0^5	3.2^5	3.0^5	3.3^5	3.6	3.1
9	4.0	4.1^5	3.9	3.7	–	4.1^5		

Firstly, it may be seen from this table and from the tables D 2 that the mean wave heights for a given wind force and wind direction in most cases are a little smaller in summer than in winter, which could be expected from the generally shorter wind fetches and durations prevailing in summer. It must be admitted, however, that these differences between summer and winter are small throughout and not apparent in many cases. In the following we shall mainly consider the winter data, because they contain the bulk of the observations of the stronger winds and the higher waves.

On the whole, the mean wave heights for given wind forces reported by Goeree are 0.1 to 0.2 metres higher than those reported by Texel (winter data), while those reported by Terschellingerbank are only slightly higher than those reported by Texel. It might well be that these differences can be completely attributed to small systematic differences in the estimation of wind forces and wave heights by the observers on board the different light vessels. Such differences could arise via a combination of the effects already explained in par. 2.2.2 (for wind force) and in par. 2.3.2 (for wave height). Both wind force and wave height would have been estimated systematically a little higher by the observers on Goeree than by those on Texel, but since the effect of the wave height would predominate the mean wave heights for given wind forces would come out still a little higher for Goeree than for Texel.

The mean wave heights reported by the former German lightvessel S 2 agree quite well with the Netherlands data, whereas the mean wave heights for the German lightvessel Elbe 1 are distinctly lower, probably because of the more sheltered position of this lightvessel.

For the wind directions away from the land, the approximate minima of the mean wave heights (considered as a function of wind direction) have been assembled in the following table 6, together with some comparative German data taken from the source already mentioned in this paragraph.

TABLE 6 *Mean wave heights in metres, for winds from the direction away from the closest land (Netherlands lightvessels) or from E to S (German lightvessels)*

Wind force	Goeree	Texel	Tersch.bank	S 2	Elbe 1
3	0.5^5	0.5^5	0.5^5	–	–
4	0.8^5	0.8	0.8	1.1	0.6
5	1.2	1.1^5	1.1		
6	1.5	1.4	1.3^5	2.4	0.9
7	1.8^5	1.7^5	1.7		
8	2.1	2.1	2.0	3.1	–
9	–	–	–		

Because of the shortness of the fetches concerned (10 nautical miles for Goeree and Texel, 7 nautical miles for Terschellingerbank) and consequently the shortness of the characteristic adjustment times for the wind waves (three hours at most), and

because of the relatively small importance of swell from other directions, the wave heights given in table 6 for the Netherlands lightvessels can be assumed to approximate the steady situation associated with a wind of the given force over the given fetches.

The mean wave heights for S 2 for winds from E to S are clearly higher and those for Elbe 1 are lower; both facts are understandable in view of the positions of these lightvessels.

2.8.2 *'Equivalent' wave heights* (tables D 2, lower part)

As explained previously (par. 1.6), the term 'equivalent' has been defined here with respect to frequency of being exceeded. For example: for Goeree, summer, there were as many observations of winds of force 8 or higher from the direction sector 30 (namely: 19, see the appropriate table D 1), as there were observations of wave heights in excess of about 3.2 metres with winds blowing from this sector (the table D 1 gives 18 observations of wave heights above 3¼ metres and 49 of wave heights above 2¾ metres).

If the scatter in the wave heights for each given wind force was negligible, the 'equivalent' wave heights would be directly related to the mean wave heights for given wind forces: for example, the 'equivalent' wave height associated with force 7 to 8 would be approximately mid-way between the mean wave heights for force 7 and for force 8. Actually, the 'equivalent' wave heights associated with wind forces 5 to 6 and 7 to 8 are a little higher, which can be understood from the scatter of the wave heights for given wind forces in combination with the decrease of the frequencies with wind force.

Most of the statements given in the previous paragraph (2.8.1) for the mean wave heights, such as those regarding the dependence on wind direction, the small differences between winter and summer and the small differences between lightvessels, also apply to the 'equivalent' heights.

The knowledge of these 'equivalent' wave heights for various locations is convenient when it is required to estimate wave height frequencies for locations in similar restricted sea areas anywhere in the world, where no long series of wave observations have been made but where information on wind frequencies is available. This problem then can practically be reduced to estimating the 'equivalent' wave heights, after which the wind force (or speed) frequencies can directly be 'translated' into wave height frequencies.

The estimation of 'equivalent' wave heights for locations where no data on waves are available is facilitated by the fact that experience has shown that these 'equivalent' heights in restricted sea areas appear to depend mainly on the geometry of the sea area concerned, and hardly or not at all on the wind frequencies. The latter statement is also confirmed by the small differences between winter and summer for the Netherlands lightvessels.

Off open ocean coasts the situation is less simple because of the frequent occurrence of swell waves from distant storm areas in many cases.

2.9 Relation between wind and wave directions (occurrence of swell waves) (tables E)

In a restricted sea area like the southern North Sea, one may generally take it for granted that during moderate or strong winds there are no important differences between the direction of the local wind and the direction from which the highest waves are coming. But exceptions may occur.

The tables E have been presented to show the extent of differences between wave and wind directions or, more specifically, the relative importance of typical swell waves which are at least as high as the more locally generated wind sea during moderate and stronger winds (see par. 1.7.1). Here, four wind direction sectors have been selected: one sector around WNW which is toward the open sea for all lightvessels considered; one sector around SE, the typical direction of winds from the land, when such winds occur observable swell waves from other directions may be expected in many cases; and two sectors around SSW and ENE for which wind directions the direction of the dominant waves may be expected to be typically skewed toward the sea, because of the situation of the Netherlands coast.

Some comments on the design and the method of preparing of these tables have been given already in paragraphs 1.7.1 and 1.8. The direction differences have been grouped into 12 intervals of 30 degrees; it will be understood that the plus sign means the wave direction veers away from the wind direction and that the minus sign means a backing of the wave direction with respect to the wind direction; the columns farthest to the right contain the observations for which the wave and wind directions were almost opposite.

It may be noted that for the observations of any wave height in the tables E the distribution of the simultaneously observed wind forces may be read from the tables D 1.

All tables E indicate that in the majority of cases the differences between wave and wind direction are less than 20 or 30 degrees. All these cases thus probably represent 'wind waves' or 'sea'. Only if the waves are too high or too long for the local wind, should these waves be called 'swell'. The relatively small number of observations with direction differences in excess of 45 degrees according to the tables E point to cases of 'swell' waves which are at least as high as the more locally generated 'sea' waves.

2.9.1 *Average shift of wave direction with respect to wind direction*

The tables E for all lightvessels show a notable average shift of wave direction with respect to wind direction for the sector 050-070° (about ENE, a backing) and for the sector 200-220° (about SSW, a veering), as expected in view of the situation of the Netherlands coast.

These average shifts may be estimated from the tables. The differences between them for summer and for winter turn out to be negligible.

For the wind directions 050-070° the average angle of backing of the wave directions from the wind directions is about 17° for Goeree, 12° for Texel and 8° for Terschellingerbank. The average shifts decrease, however, if only the higher waves (that is,

also: the stronger winds) are considered. For the waves higher than 1¾ metres only, the average angle of backing is 12°, 8° and 7°, respectively.

For the wind directions 200-220° the average angle of veering of the wave directions from the wind directions is about 16° for Goeree, 12° for Texel and 14° for Terschellingerbank. For waves higher than 1¾ metres only, again, the average shifts are lower: 11°, 6° and 11°, respectively.

2.9.2 *Spread of wave directions for given wind direction*

For all lightvessels the spread of wave direction is largest for the wind directions 110-160° (the directions from the land).

Just as for the average shifts, the differences between the spread for summer and for winter are small, and the spreads decrease if only the higher waves are considered.

The percentages of the observations with direction differences less than 15 degrees (represented by the columns '—1 to +1' in the tables E) vary from about 50 (Goeree, wind directions 050-070° and 110-160°) to about 70. The percentages of the observations with direction differences less than 45 degrees vary from about 75 (Texel, wind directions 110-160°) to about 95 (all vessels, wind directions 290-310°).

TABLES

TABLE A *Parts per thousand (fractions of time)*

January
2232 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 W	21	24	27 S	30	33	Calm
0	28	3	3	4	2		1	3	3	1	1	2	2	4
½	250	18	17	4	18	13	24	31	49	26	22	14	14	
1	232	18	12	14	19	13	11	11	34	27	31	18	24	
1½	188	11	15	8	26	2	3	4	25	20	34	15	26	
2	158	8	7	3	28	1	0	2	15	22	35	17	18	
2½	81	7	3	3	3	3			2	8	23	11	19	
3	32	8		1					3	1	4	8	7	
3½	12	1		1					1	2	0	4	2	
4	9									1	5	2	1	
4½	4									0	1	2		
5	0										0			
5½	1										1			
6	2									0	0	0	0	
⩾ 6½	3										3			
All	1000	74	56	38	96	31	40	51	133	108	162	94	114	4

TABLE A *Parts per thousand (fractions of time)*

January
2232 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	14	1	2	1	2	1	1	1	1	4		1		4
½	238	25	30	12	21	12	19	19	37	18	16	6	25	
1	231	14	18	4	17	4	14	15	37	32	25	22	28	
1½	193	7	4	2	18	3	7	5	24	35	33	25	29	
2	170	11	6	5	14	3	0	3	31	22	33	15	24	
2½	86	9	2	2	5	0		4	7	10	23	12	11	
3	33	4	0	1				0	4	2	7	7	7	
3½	15	1						1	1	1	4	5	2	
4	9								3	1	3	3		
4½	3								1	0	1	0		
5	3								1		1	1		
5½	1										1			
6	2										2			
⩾ 6½														
All	1000	73	63	27	78	23	42	48	148	128	149	97	125	4

TABLE A *Parts per thousand (fractions of time)*

January
2232 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	43	3	3	3	3	0	1	4	1	1	0	1	4	17
½	189	10	16	11	17	7	16	20	34	13	6	9	30	
1	237	8	19	17	26	9	10	15	48	19	20	26	21	
1½	232	5	24	11	8	7	2	3	57	36	33	24	23	
2	149	6	8	9	14	2		1	30	22	25	15	18	
2½	77	9	4	8	4			0	8	7	12	17	9	
3	42	3	0	2	2			3	4	4	6	13	4	
3½	21	1	4		1				2	2	3	5	3	
4	8								3	0	1	1	2	
4½	1										0	0		
5	1										1			
5½	1	1									0			
6	1										1			
⩾ 6½														
All	1000	46	77	59	75	24	29	47	187	103	109	113	114	17

TABLE A *Parts per thousand (fractions of time)*

February 2032 obs. — Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	73	11	10	3	1	4	7	5	3	1	6	2	2	15
½	276	21	26	5	16	11	21	32	35	24	30	25	29	
1	293	17	25	17	20	16	14	17	46	43	32	24	25	
1½	202	13	26	16	25	3	8	8	19	23	24	19	17	
2	92	4	7	5	12		2	1	13	11	14	14	8	
2½	29	4		0	4				0	3	5	8	4	
3	23	2	2		6					0	1	7	2	
3½	3	0	0							0	0	0	0	
4	4										2	2		
4½	2												2	
5														
5½	0											0		
6														
⩾ 6½	1												1	
All	1000	74	96	47	85	34	52	64	117	107	116	103	91	15

TABLE A *Parts per thousand (fractions of time)*

February 2032 obs. — Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	31	4	3	1	2	1	1	0	3	2	4		2	6
½	327	31	37	18	17	30	23	18	47	20	22	25	38	
1	274	20	19	17	12	6	8	14	52	31	30	33	33	
1½	202	17	26	14	12	3	0	7	33	23	26	17	23	
2	110	4	8	2	11			5	26	9	24	14	7	
2½	41	3	1		6				9	3	6	7	5	
3	6	0							0	0	1	1	2	
3½	3										1	0	1	
4	2										1	0	0	
4½	3											1	1	
5														
5½														
6	0												0	
⩾ 6½														
All	1000	80	95	52	61	40	33	45	171	89	115	100	115	6

TABLE A *Parts per thousand (fractions of time)*

February 2032 obs. — Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	45	6	3	1	1	0	1	1	3	4	0	2	2	17
½	242	28	31	5	9	9	21	17	35	27	19	22	19	
1	266	25	25	12	7	5	9	26	52	37	28	10	29	
1½	217	21	26	16	13	1		6	39	40	17	15	23	
2	137	12	11	13	10			1	25	13	24	7	19	
2½	64	5	4	14	7			2	5	4	8	6	7	
3	21	2	3	2				0	0	1	2	3	6	
3½	6	0							0		3		1	
4	2										1	0	0	
4½	1												1	
5	1												1	
5½														
6														
⩾ 6½														
All	1000	100	103	64	48	17	32	55	160	128	104	67	109	17

TABLE A *Parts per thousand (fractions of time)*

March
2232 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	82	4	11	4	12	1	6	4	5	4	5	2	6	17
½	376	54	35	34	45	26	32	18	39	13	17	20	41	
1	272	37	13	14	60	11	9	6	29	26	16	20	29	
1½	148	14	9	9	17	9	1	4	18	18	14	14	21	
2	80	6	4	10	9			0	6	9	11	9	16	
2½	29	1	0	3	5				2	3	3	3	8	
3	6									2	1	1	2	
3½	3		2								1			
4	3	0									0	1	1	
4½														
5	0												0	
5½	0											0		
6														
⩾ 6½	1												1	
All	1000	116	73	74	150	47	49	33	99	76	69	70	126	17

TABLE A *Parts per thousand (fractions of time)*

March
2232 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	87	4	11	1	8	4	8	8	6	4	2	2	2	27
½	383	45	39	33	52	34	31	21	34	20	12	23	39	
1	248	37	15	11	26	7	21	11	23	16	20	20	41	
1½	169	26	4	9	15	3	6	3	23	25	13	18	23	
2	65	8	4	5	2				9	16	4	10	7	
2½	31	2		1	3			0	4	4	4	6	6	
3	9	0								0	4	4	1	
3½	1											0	0	
4	3									1			2	
4½	1										0		0	
5														
5½														
6														
⩾ 6½	0											0		
All	1000	123	74	61	106	48	66	42	99	87	60	83	122	27

TABLE A *Parts per thousand (fractions of time)*

March
2232 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	126	15	10	4	4	4	7	6	3	4	7	2	7	54
½	277	43	36	20	19	12	31	16	30	20	17	9	24	
1	276	36	47	23	26	18	21	11	26	24	10	10	24	
1½	150	19	22	12	13		0	1	16	21	15	13	18	
2	91	11	6	10	1			1	9	17	7	6	23	
2½	49	4	3	6					7	12	4	3	11	
3	23	2		2					6	2	2	2	7	
3½	3									1	0		1	
4	1												1	
4½	1												1	
5														
5½														
6	0												0	
⩾ 6½	1											1		
All	1000	130	124	76	63	34	60	35	97	101	62	45	120	54

TABLE A *Parts per thousand (fractions of time)*

April
2160 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	81	3	11	6	5	2	3	6	7	8	5	3	4	18
½	381	67	59	22	20	7	11	17	39	30	31	27	51	
1	317	61	30	19	10	3	2	2	49	40	19	28	53	
1½	152	33	9	14	3		1	0	18	17	17	7	31	
2	44	6							8	6	6	7	12	
2½	17	2							1	0	6	5	2	
3	8	0									1	4	2	
3½	1												1	
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	172	109	61	38	13	18	25	122	102	86	81	156	18

TABLE A *Parts per thousand (fractions of time)*

April
2160 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	84	6	11	2	3	2	6	3	1	9	4	3	2	33
½	382	83	67	15	18	11	13	13	32	32	33	11	51	
1	307	71	34	10	4	0	2	5	48	39	27	15	52	
1½	151	37	16	10	3		0	1	20	16	14	13	21	
2	54	7	2	5					13	11	6	6	3	
2½	13								4	0	2	3	4	
3	7								1	1	0	1	3	
3½	2											1	1	
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	203	130	42	27	13	21	23	120	107	88	54	137	33

TABLE A *Parts per thousand (fractions of time)*

April
2160 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	86	14	6	2	3	0	4	4	5	5	4	0	2	37
½	226	56	34	12	4	1	10	7	16	17	40	7	23	
1	310	80	69	11	7	1	2	4	21	43	34	12	26	
1½	222	47	51	7	2	0		2	30	34	19	7	21	
2	106	20	32						7	17	11	5	13	
2½	33	4	6						5	7	3	2	6	
3	16		2							1	4	5	4	
3½	2										2			
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	222	199	31	17	4	15	17	83	123	117	39	95	37

TABLE A *Parts per thousand (fractions of time)*

May
2232 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 26 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	91	9	8	4	7	2	4	4	16	2	4	3	9	19
½	393	77	56	50	34	5	8	12	46	30	27	13	35	
1	293	45	30	43	20	6	0	3	38	28	17	22	40	
1½	141	25	11	21	1			3	15	8	6	21	31	
2	59	10	2	10	0				8	3	1	7	17	
2½	14	4								0	1	1	8	
3	6										1	1	4	
3½	2										2			
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	168	107	128	63	13	12	22	121	72	60	68	150	19

TABLE A *Parts per thousand (fractions of time)*

May
2232 obs.

Texel

Wave heigt (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	85	7	7	2	5	9	4	6	15	2	1		4	22
½	405	69	67	41	28	18	6	11	41	41	26	17	40	
1	288	57	40	21	13	9	0	6	30	31	17	19	46	
1½	155	28	21	7	1			0	25	14	7	12	40	
2	45	12	4	2				1	8	4	1	3	9	
2½	18	6		3					0			1	7	
3	1										1			
3½	0									0				
4	1									0	1			
4½														
5														
5½														
6														
⩾ 6½														
All	1000	179	139	76	47	35	11	24	120	93	55	52	147	22

TABLE A *Parts per thousand (fractions of time)*

May
2232 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	116	9	12	2	3	2	3	5	7	5	13	2	11	43
½	282	78	46	11	13	1	4	9	17	28	30	15	29	
1	316	60	73	12	11	4	3	7	25	57	22	9	33	
1½	172	50	46	4	2		0	0	6	24	9	9	19	
2	79	34	6	2					2	15	3	5	11	
2½	25	8	9	2				0	1	5		1	2	
3	8	0							0	6	0			
3½	1									0	0	0		
4	1									0	0			
4½														
5	0										0			
5½	1										1			
6														
⩾ 6½														
All	1000	239	187	33	29	7	10	22	59	142	80	43	105	43

TABLE A *Parts per thousand (fractions of time)*

June
2160 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	84	1	3	2	10	1	4	5	8	7	5	2	1	36
½	351	42	41	39	19	6	9	11	55	30	34	19	45	
1	376	83	18	25	8	1		3	40	35	43	43	77	
1½	145	34	2	7	0			0	20	17	18	14	32	
2	42	6	1						3	2	12	6	12	
2½	3								0	1	1			
3	2										2			
3½														
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	166	65	73	38	7	13	19	127	92	115	83	167	36

TABLE A *Parts per thousand (fractions of time)*

June
2160 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	84	1	7	3	4	3	1	5	7	7	3	3	2	36
½	362	57	49	28	7	6	4	19	63	37	27	12	52	
1	323	76	28	11	4	0	3	1	39	38	34	17	72	
1½	176	38	9	4				0	17	35	16	17	41	
2	49	8	2	1				1	6	6	17	2	6	
2½	5								1	1	0	1		
3														
3½														
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	180	95	46	16	9	8	27	134	124	99	51	174	36

TABLE A *Parts per thousand (fractions of time)*

June
2160 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	97	6	4	3	1	1	3	4	6	9	8	6	5	43
½	257	42	26	12	7	2	4	6	27	37	43	12	38	
1	341	83	47	15	4	0	0	3	20	52	46	14	56	
1½	213	48	37	2	1	0	1	1	9	62	21	6	24	
2	71	16	6						4	25	8	5	7	
2½	18	5	3						1	7	0		2	
3	2									2				
3½														
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	200	122	31	14	4	8	14	67	194	127	43	132	43

TABLE A *Parts per thousand (fractions of time)*

July
2232 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	82	8	10	2	12	3	1	5	5	2	3	1	4	26
½	332	56	28	22	18	6	9	8	30	58	39	21	39	
1	338	61	19	15	17	1	1	4	35	49	49	37	50	
1½	168	27	4	5	3				22	38	30	17	22	
2	51	7	3		1				6	7	12	7	9	
2½	20	0	1		2				4	4	4	3	2	
3	8								3	4	0	1		
3½														
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	159	65	43	52	9	12	17	104	162	137	87	125	26

TABLE A *Parts per thousand (fractions of time)*

July
2232 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	89	12	13	4	3	1	4	4	5	4	1	3	4	30
½	347	86	44	9	5	4	7	4	45	54	28	32	28	
1	316	57	33	7	7	2	3	3	44	41	44	34	42	
1½	172	22	5	4	2			0	27	35	31	23	22	
2	51	4	2	1	2				10	9	9	5	9	
2½	17	2							3	4	5	1	3	
3	7								3	3		1		
3½														
4														
4½														
5														
5½														
6														
⩾ 6½														
All	1000	182	97	25	18	8	14	12	128	149	119	99	109	30

TABLE A *Parts per thousand (fractions of time)*

July
2232 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	70	10	5	5	3	0	2	2	6	3	2	4	5	22
½	273	53	47	8	6	2	5	9	24	41	29	13	35	
1	285	59	39	4	7		3	3	15	54	45	18	39	
1½	186	26	33	0	2	1		1	12	52	24	14	20	
2	118	13	12		2			0	10	43	15	7	17	
2½	44	2	1						3	22	5	2	9	
3	14		1						2	9	1	0		
3½	6									4	2			
4	4								1	2	1			
4½														
5														
5½														
6														
⩾ 6½														
All	1000	164	137	17	20	4	10	15	73	230	125	59	126	22

TABLE A *Parts per thousand (fractions of time)*

August
2232 obs.

Terschellingerbank

Wave height (m)	All direc-tions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	71	9	8	3	7	1	3	4	7	5	4	1	9	9
½	397	48	34	30	25	11	11	26	107	53	31	19	57	
1	275	32	4	7	12	1	2	6	35	66	36	34	39	
1½	155	8	2	0	0		1	2	30	40	24	25	22	
2	63		1	2					10	25	18	5	2	
2½	23			1					2	1	14	4	0	
3	13								0	0	9	2	1	
3½	2										0		1	
4	1												1	
4½														
5														
5½														
6														
⩾ 6½														
All	1000	97	49	44	44	13	18	38	136	191	137	91	133	9

TABLE A *Parts per thousand (fractions of time)*

August
2232 obs.

Texel

Wave height (m)	All direc-tions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	85	9	6	4	4	7	3	7	12	4	3	1	4	21
½	375	64	46	17	19	9	8	19	59	43	36	14	41	
1	255	46	7	5	7	1	0	5	41	47	30	30	34	
1½	167	13	3		0			2	34	48	35	15	17	
2	72		3	2				0	13	25	15	5	10	
2½	29							0	5	2	16	2	4	
3	9								1	2	5	1		
3½	4								1		2	1		
4	0											0		
4½														
5														
5½														
6														
⩾ 6½														
All	1000	133	64	28	31	17	11	34	166	170	142	70	110	21

TABLE A *Parts per thousand (fractions of time)*

August
2232 obs.

Goeree

Wave height (m)	All direc-tions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	100	4	6	1	3	4	4	2	3	5	12	3	7	48
½	289	64	31	9	4	9	16	11	27	40	28	9	39	
1	266	39	26	9	7	1	2	4	33	54	33	20	37	
1½	165	13	9	3	2		1	3	31	49	24	10	19	
2	92	3	4					1	11	30	24	11	8	
2½	49	1	0						5	21	10	4	7	
3	26								1	12	8	3	3	
3½	10									4	3	0	3	
4	2										0	1	0	
4½														
5														
5½														
6														
⩾ 6½														
All	1000	125	76	22	17	13	23	22	112	217	143	63	122	48

TABLE A *Parts per thousand (fractions of time)*

September
2160 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	38	1	3	3	7	2	7	3	6	1	2	1		2
½	328	24	21	12	34	18	21	26	45	27	39	22	38	
1	264	33	19	7	17	5	7	12	39	29	35	19	42	
1½	179	6	4	2	3	6	0	7	21	24	34	27	44	
2	109	1				0		0	7	23	30	24	23	
2½	63	1							5	15	21	13	8	
3	8	1								3	1	1	2	
3½	11									4	4		3	
4	1										1			
4½														
5														
5½														
6														
⩾ 6½														
All	1000	68	47	24	61	31	36	48	123	127	168	108	160	2

TABLE A *Parts per thousand (fractions of time)*

September
2160 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	42	1	2	3	4	4	6	3	3	4	1	1		9
½	334	38	19	10	26	23	21	23	44	27	43	24	38	
1	232	25	19	12	9	4	8	7	48	27	24	22	25	
1½	182	6	4	3	0	4	0	3	31	28	36	29	38	
2	128	3	1					2	11	22	27	31	31	
2½	62	1							5	13	21	12	10	
3	12								1	6	3	1	0	
3½	6								0	2	4			
4	1										1			
4½														
5														
5½														
6														
⩾ 6½														
All	1000	74	45	28	40	35	35	38	143	131	161	120	141	9

TABLE A *Parts per thousand (fractions of time)*

September
2160 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	67	4	7	0	2	3	5	4	4	4	1	3	2	28
½	223	43	34	8	13	10	19	14	23	17	13	11	17	
1	249	21	26	18	14	9	10	9	35	35	24	19	29	
1½	194	10	10	6	4	3	0	3	23	38	34	26	34	
2	159	6	7	3	1		1	2	28	29	23	30	31	
2½	64	2	0	1			0		10	20	13	8	8	
3	36								5	11	10	7	3	
3½	5								1		1	2	0	
4	3								2			1		
4½														
5														
5½														
6														
⩾ 6½														
All	1000	86	85	37	35	25	36	32	132	154	119	107	123	28

TABLE A *Parts per thousand (fractions of time)*

October
2232 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	40	6	0	0	7	4	3	5	8		1	1	1	4
½	312	33	11	8	41	22	27	30	44	39	24	14	18	
1	267	30	7	4	26	18	14	15	43	39	29	17	25	
1½	184	12	3	4	13	4	2	6	19	45	25	12	39	
2	122	7	4	5	8		1	1	15	22	21	12	27	
2½	58	2	1					2	2	7	12	13	18	
3	13		0							3	1	4	4	
3½	3									1	0	1	1	
4	1											1		
4½	1												1	
5														
5½														
6														
⩾ 6½														
All	1000	90	26	20	94	48	48	60	132	155	112	75	134	4

TABLE A *Parts per thousand (fractions of time)*

October
2232 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	59	7	2	3	5	5	4	5	4	6	2	3	3	10
½	256	21	23	9	23	19	19	23	29	31	17	7	34	
1	297	34	10	11	22	16	18	14	48	42	26	21	35	
1½	198	16	1	0	10	4	2	4	29	50	27	26	29	
2	117	6	2	1	0		1	1	25	26	19	20	17	
2½	45	2	2	2	0			2	3	8	8	9	8	
3	21		2					2	0	4	1	6	5	
3½	2										0	1	1	
4	1											1	0	
4½														
5	1												1	
5½														
6														
⩾ 6½														
All	1000	85	43	27	62	45	43	51	138	166	101	93	134	10

TABLE A *Parts per thousand (fractions of time)*

October
2232 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	53	11	3	3	2	1	4	5	3	4	1	0	3	14
½	221	31	28	6	21	9	19	22	30	15	13	2	24	
1	272	31	18	12	16	12	13	11	43	40	23	18	35	
1½	222	26	13	8	7	4	0	9	42	42	22	18	32	
2	121	7	2	6	1	1		1	22	28	17	17	19	
2½	57	2	1	3				2	11	14	8	6	9	
3	34	1	2	2					2	4	7	7	9	
3½	9		1							0		3	5	
4	7		1								0	2	3	
4½	1								1					
5	1											1		
5½														
6														
⩾ 6½														
All	1000	110	70	39	47	27	37	51	154	148	92	74	140	14

TABLE A *Parts per thousand (fractions of time)*

November
2160 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	20	1			4	1	5	4	1	0	1			2
½	230	18	7	3	31	11	36	42	28	11	13	12	17	
1	303	34	21	7	32	12	25	23	44	31	33	13	27	
1½	217	26	16	4	6	12	12	19	25	19	37	16	25	
2	134	19	6	4	3	2	1	3	10	15	33	16	20	
2½	64	12		1		1		3	4	11	9	15	9	
3	24	1							2		3	9	9	
3½	6		0									1	5	
4	3										1	0	1	
4½														
5														
5½														
6														
⩾ 6½														
All	1000	111	51	19	76	40	80	94	114	87	131	82	114	2

TABLE A *Parts per thousand (fractions of time)*

November
2160 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	25	4	1		3	1	2	3	3	3			0	5
½	217	15	14	2	18	21	40	28	28	15	9	5	20	
1	243	37	18	6	23	10	9	21	33	21	30	18	18	
1½	246	24	17	6	9	10	10	18	44	24	39	16	27	
2	153	19	6	3	0	1	4	8	31	15	25	21	21	
2½	65	8					1	3	11	11	10	9	11	
3	33	6						0	5	2	7	7	6	
3½	11	2							2		1	4	2	
4	6	0									3	3		
4½	0								0					
5	0								0					
5½														
6														
⩾ 6½														
All	1000	114	56	18	53	43	67	81	158	91	125	83	106	5

TABLE A *Parts per thousand (fractions of time)*

November
2160 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	31	2	2		7	2	4	0	2	1	1	0	0	8
½	153	21	6	2	20	11	24	18	19	9	7	5	12	
1	265	31	12	8	16	11	19	26	42	22	31	23	24	
1½	230	27	12	10	11	7	7	21	42	23	22	16	31	
2	171	20	12	2	4	4	5	13	31	17	22	22	19	
2½	84	14	9	1				5	13	9	12	9	12	
3	39	9		3					4	4	6	6	8	
3½	17	2							0	0	1	6	6	
4	6	2										2	1	
4½	3	1										1	1	
5														
5½														
6														
⩾ 6½														
All	1000	129	54	27	57	35	58	83	154	86	103	90	116	8

December
2232 obs.

TABLE A *Parts per thousand (fractions of time)*

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	32	1		1	1	3	3	6	3	1	3	3		6
½	237	7	8	4	23	13	26	27	39	29	25	21	16	
1	270	7	8	7	23	17	19	21	45	43	35	18	26	
1½	174	11	5	2	5	10	4	9	20	28	34	26	19	
2	142	3	2	5	1	1	3	4	18	22	48	11	23	
2½	78	2	1	4				2	15	17	24	6	8	
3	30	1	1	0					5	2	13	5	2	
3½	14	1	0							4	5	3	1	
4	7									0	3	3	1	
4½	2										1	1		
5	4										1	3		
5½	4									0	2	1		
6	1											1		
⩾ 6½	6											6		
All	1000	34	25	24	54	44	55	68	145	146	193	109	96	6

December
2232 obs.

TABLE A *Parts per thousand (fractions of time)*

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	35	1		2	1	6	3	7	3	1	3	1		6
½	236	5	9	12	29	13	26	24	24	24	27	20	23	
1	192	9	9	3	13	8	9	13	29	32	29	17	21	
1½	236	8	5	3	3	6	12	17	42	40	45	25	31	
2	152	5	2	4	1		4	5	32	25	41	16	19	
2½	85	1	1	2			0		21	17	26	7	9	
3	33	0		2					10	6	9	4	2	
3½	12									5	7			
4	4										2	2		
4½	0											0		
5	5										2	3	0	
5½	4									0	1	2		
6	2										0	0	1	
⩾ 6½	3											2	1	
All	1000	29	26	27	46	33	55	66	161	151	192	99	107	6

December
2232 obs.

TABLE A *Parts per thousand (fractions of time)*

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	48	2	1	1		1	0	1	9	4	2	1	1	24
½	139	11	11	7	10	6	15	8	27	13	15	9	8	
1	258	17	13	14	13	13	23	16	55	34	26	16	17	
1½	213	16	4	5	1	2	13	10	54	30	38	23	17	
2	173	10	13	10	1		4	4	28	29	39	19	17	
2½	89	2	6	1			0	0	19	16	20	10	14	
3	42	1	1				0	0	9	5	12	6	7	
3½	15									2	8	5	0	
4	8									0	4	4	0	
4½	5										1	3	1	
5	1											0	1	
5½	1											1		
6	0											0		
⩾ 6½	5											2	3	
All	1000	60	51	38	26	23	56	39	200	133	165	99	87	24

TABLE A *Parts per thousand (fractions of time)*

All months
26296 obs.

Terschellingerbank

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	60	5	6	3	6	2	4	5	6	3	3	2	3	13
½	322	39	29	20	27	12	20	23	42	31	28	19	33	
1	292	38	17	15	22	9	9	10	40	38	31	25	38	
1½	171	18	9	8	9	4	3	5	21	25	25	18	27	
2	91	7	3	4	5	0.5	0.7	1.1	10	14	20	11	16	
2½	40	3	0.5	1.0	1.1	0.3		0.6	3	6	10	7	19	
3	14	1.1	0.3	0.1	0.5				1.1	1.4	3	4	3	
3½	5	0.2	0.3	0.1					0.1	0.9	1.1	0.7	1.3	
4	2	0.0								0.1	1.1	0.7	0.5	
4½	0.7									0.0	0.2	0.3	0.2	
5	0.4										0.1	0.2	0.0	
5½	0.5									0.0	0.2	0.2		
6	0.3									0.0	0.0	0.2	0.0	
⩾ 6½	1.0										0.3	0.5	0.2	
All	1000	111	64	50	71	28	36	45	123	119	124	87	130	13

TABLE A *Parts per thousand (fractions of time)*

All months
26296 obs.

Texel

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	61	5	5	2	4	4	4	4	5	4	2	2	2	17
½	321	45	37	17	22	17	18	18	40	30	25	16	36	
1	267	40	21	10	13	6	8	10	39	33	28	22	37	
1½	187	20	10	5	6	3	3	5	29	31	27	20	28	
2	97	7	3	3	3	0.3	0.8	2	18	16	18	12	14	
2½	41	3	0.5	0.9	1.2	0.0	0.2	0.8	6	6	10	6	6	
3	14	1.0	0.2	0.2				0.3	2	2	3	3	2	
3½	5	0.2						0.1	0.4	0.7	2	1.1	0.6	
4	2	0.0							0.3	0.2	0.9	0.8	0.2	
4½	0.6								0.1	0.0	0.1	0.2	0.2	
5	0.8								0.1		0.2	0.3	0.1	
5½	0.4									0.0	0.2	0.2		
6	0.3										0.2	0.0	0 1	
⩾ 6½	0.3											0.2	0.1	
All	1000	121	77	38	49	29	34	41	141	124	117	83	127	17

TABLE A *Parts per thousand (fractions of time)*

All months
26296 obs.

Goeree

Wave height (m)	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33	Calm
0	74	7	5	2	3	2	3	3	4	4	4	2	4	30
½	231	40	29	9	12	7	15	13	26	23	22	10	25	
1	279	41	34	13	13	7	10	11	34	39	28	16	31	
1½	201	26	24	7	5	2	2	5	30	38	23	15	23	
2	122	13	10	4	3	0.6	0.8	2	17	24	18	12	17	
2½	54	5	4	3	1.0		0.1	0.8	7	12	8	6	8	
3	25	2	0.8	0.9	0.2		0.0	0.3	3	5	5	4	4	
3½	8	0.3	0.4		0.1				0.3	1.3	2	2	2	
4	3	0.2	0.1						0.5	0.3	0.8	0.9	0.7	
4½	1.1	0.1							0.1		0.2	0.3	0.4	
5	0.4										0.1	0.1	0.2	
5½	0.3	0.1									0.1	0.1		
6	0.2										0.1	0.0	0.0	
⩾ 6½	0.5											0.3	0.2	
All	1000	134	107	39	37	18	31	36	123	147	111	70	115	30

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

All directions — 24720 obs.

Wave height (m)	All periods	Period of waves (seconds)				
		⩽ 5	5–7	7–9	9–11	> 11
0	49	44	4	0.3	0.1	0.0
½	331	264	62	3	0.6	0.1
1	297	155	133	9	1.0	0.1
1½	170	39	111	19	1.2	
2	90	3	57	27	2	
2½	40	0.2	15	22	3	0.1
3	15	0.0	3	9	2	0.2
3½	5	0.1	0.7	2	1.3	0.0
4	2		0.1	2	0.5	
⩾ 4½	2		0.1	1.3	0.5	0.4
All	1000	505	386	95	12	1.0

All months — Texel

All directions — 24033 obs.

Wave height (m)	All periods	Period of waves (seconds)				
		⩽ 5	5–7	7–9	9–11	> 11
0	54	50	4	0.4		0.1
½	338	269	58	11	0.6	0.0
1	270	128	118	21	2	0.6
1½	181	39	108	30	3	0.4
2	94	7	52	32	2	0.7
2½	39	0.3	14	22	3	
3	15	0.1	2	10	2	0.0
3½	5		0.8	3	1.1	0.2
4	3		0.1	2	0.3	0.4
⩾ 4½	2		0.2	0.6	0.7	
All	1000	494	359	131	14	2

All months — Goeree

All directions — 24265 obs.

Wave height (m)	All periods	Period of waves (seconds)				
		⩽ 5	5–7	7–9	9–11	> 11
0	46	35	10	0.6		0.2
½	238	159	67	12	0.2	
1	288	120	141	26	0.6	
1½	205	30	141	34	0.7	
2	125	1.4	76	46	0.9	0.1
2½	56	0.1	24	31	2	0.1
3	26	0.1	7	17	2	0.2
3½	9		0.8	6	2	0.2
4	4		0.1	2	0.9	0.4
⩾ 4½	2			0.2	2	0.1
All	1000	346	467	174	11	1.3

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 350°–110° — 2786 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	45	33	11			
½	358	187	161	9	1	
1	342	93	225	20	3	1
1½	161	21	112	28	0	
2	56	0	33	22	1	
2½	27		5	18	3	
3	10			8	2	0
3½	2			0	2	
4	0			0		
⩾ 4½						
All	1000	335	547	106	11	1

All months — Terschellingerbank

Direction of waves 020°–040° — 1630 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	88	74	14			
½	447	351	91	6		
1	268	133	129	7		
1½	133	33	85	15		
2	47	4	33	10		
2½	7		3	4		
3	5		1	2	1	
3½	4			3	1	
4						
⩾ 4½						
All	1000	594	355	48	2	

All months — Texel

Direction of waves 350°–010° — 2998 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	44	32	10	2		
½	381	197	146	35	3	0
1	317	89	170	54	3	2
1½	162	28	94	35	5	1
2	60	4	27	23	4	2
2½	25	0	8	14	2	
3	8		0	8	0	
3½	2			1	1	
4	0				0	
⩾ 4½						
All	1000	350	455	170	20	4

All months — Texel

Direction of waves 020°–040° — 1855 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	83	73	10	1		
½	476	375	80	20	1	
1	270	130	112	25	2	1
1½	115	24	68	19	4	1
2	45	8	29	8		1
2½	7		2	5	1	
3	4			4	1	
3½						
4						
⩾ 4½						
All	1000	609	301	80	9	2

All months — Goeree

Direction of waves 350°–10° — 3243 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	56	22	30	4		
½	297	96	146	53	2	
1	305	39	168	94	3	
1½	189	4	111	70	4	
2	101		47	52	2	
2½	37		14	21	1	
3	12		0	11	1	
3½	2			1	1	
4	1			0	0	
⩾ 4½	1				1	
All	1000	160	519	305	16	

All months — Goeree

Direction of waves 020°–040° — 2657 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	46	30	15			
½	266	181	81	5		
1	322	99	207	17		
1½	220	21	171	28	0	
2	97	2	65	29		0
2½	34		16	18	1	
3	8		3	5		
3½	5			5	0	
4	1			1		
⩾ 4½						
All	1000	333	558	107	2	0

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 050°–070° — 1288 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	49	43	2	5		
½	388	370	16	2		
1	305	207	95	3		
1½	156	61	84	9	2	
2	76		64	12		
2½	21		16	5		
3	2		2	1		
3½	2			2		
4						
⩾ 4½						
All	1000	681	277	40	2	

All months — Terschellingerbank

Direction of waves 080°–100° — 1855 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	89	89				
½	384	370	14			
1	313	247	64	1		
1½	118	42	73	2		
2	74	7	58	9		
2½	16		12	4		
3	7		7			
3½						
4						
⩾ 4½						
All	1000	755	229	16		

All months — Texel

Direction of waves 050°–070° — 975 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	83	81	2			
½	453	412	40	1		
1	249	156	90	1	2	
1½	124	25	92	8		
2	64	2	51	11		
2½	22		12	9		
3	6		2	4		
3½						
4						
⩾ 4½						
All	1000	676	288	34	2	

All months — Texel

Direction of waves 080°–100° — 1172 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	91	91				
½	459	447	12			
1	258	203	54	1		
1½	116	54	61	1		
2	53	12	41			
2½	23	4	19			
3						
3½						
4						
⩾ 4½						
All	1000	811	187	1		

All months — Goeree

Direction of waves 050°–070° — 1023 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	55	49	6			
½	232	203	28			
1	330	217	112	1		
1½	171	50	118	3		
2	113	8	98	8		
2½	76	1	63	13		
3	22	1	14	8		
3½						
4						
⩾ 4½						
All	1000	529	439	32		

All months — Goeree

Direction of waves 080°–100° — 940 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	77	77				
½	311	304	6			
1	356	330	27			
1½	147	83	64			
2	74	1	72	1		
2½	27		27			
3	5		5			
3½	3		3			
4						
⩾ 4½						
All	1000	795	204	1		

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 110°–130° — 721 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	72	72				
½	444	441	3			
1	313	284	29			
1½	141	94	47			
2	17		15	1		
2½	12		12			
3						
3½						
4						
⩾ 4½						
All	1000	892	107	1		

All months — Terschellingerbank

Direction of waves 140°–160° — 943 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	105	105				
½	548	543	5			
1	248	224	24			
1½	80	53	27			
2	19	6	11	2		
2½						
3						
3½						
4						
⩾ 4½						
All	1000	931	67	2		

All months — Texel

Direction of waves 110°–130° — 725 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	144	144				
½	555	550	5			
1	196	170	26			
1½	92	70	22			
2	10	6	5			
2½	1		1			
3	3	3				
3½						
4						
⩾ 4½						
All	1000	942	58			

All months — Texel

Direction of waves 140°–160° — 865 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	124	124				
½	505	499	5	1		
1	239	202	37			
1½	104	58	46			
2	24	13	11			
2½	4	1	3			
3						
3½						
4						
⩾ 4½						
All	1000	897	102	1		

All months — Goeree

Direction of waves 110°–130° — 464 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	95	95				
½	358	353	5			
1	388	369	19			
1½	127	71	56			
2	32	2	30			
2½						
3						
3½						
4						
⩾ 4½						
All	1000	890	110			

All months — Goeree

Direction of waves 140°–160° — 808 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	94	94				
½	495	490	5			
1	311	287	24			
1½	74	57	17			
2	24	4	20			
2½	1		1			
3	1		1			
3½						
4						
⩾ 4½						
All	1000	932	68			

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 170°–190° — 1166 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	101	101				
½	518	516	2			
1	226	202	24			
1½	117	51	65	1		
2	26	3	21	1		
2½	11		11			
3						
3½						
4						
⩾ 4½						
All	1000	875	123	2		

All months — Terschellingerbank

Direction of waves 200°–220° — 2932 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	51	51				
½	345	332	13	0		
1	333	239	92	1		
1½	165	66	92	7	0	
2	74	5	59	10		
2½	23	1	16	6		
3	9		3	5		
3½	1	1	0			
4						
⩾ 4½						
All	1000	694	276	30	0	

All months — Texel

Direction of waves 170°–190° — 1014 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	114	114				
½	452	434	17			
1	239	190	48	1		
1½	120	47	67	6	1	
2	50	7	37	5	2	
2½	17		9	8		
3	6		1	5		
3½	2			2		
4						
⩾ 4½						
All	1000	792	180	26	2	

All months — Texel

Direction of waves 200°–220° — 3476 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	45	44	2			
½	304	267	34	3	0	
1	273	153	113	5	1	
1½	194	50	124	19	1	
2	122	12	77	30	2	1
2½	42		20	21	1	
3	15		5	9	1	
3½	3		2	1		
4	2		1	1		
⩾ 4½	2		0	1		
All	1000	526	378	90	6	1

All months — Goeree

Direction of waves 170°–190° — 938 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	90	90				
½	370	369	1			
1	314	277	37			
1½	142	81	61			
2	53	3	49	1		
2½	21		16	5		
3	10		10			
3½						
4						
⩾ 4½						
All	1000	820	174	6		

All months — Goeree

Direction of waves 200°–220° — 3085 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	35	35				
½	206	193	12			
1	283	191	91	1		
1½	250	68	173	9		
2	139	2	113	24		
2½	58		36	22		
3	22		12	9	0	1
3½	3		1	2	0	
4	4		1	2	0	1
⩾ 4½	1				1	
All	1000	489	440	68	2	2

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 230°–250° — 2862 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	25	22	3			
½	261	230	30	1		
1	323	196	123	3		
1½	208	52	139	17	1	
2	113	4	75	33	1	
2½	51	0	24	24	3	
3	12	0	4	4	4	
3½	6		2	1	2	
4	1			1		
⩾ 4½	1			1		
All	1000	506	399	85	10	

All months — Terschellingerbank

Direction of waves 260°–280° — 3079 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	28	27	2			
½	223	171	52			
1	258	106	144	8	0	
1½	197	31	140	25	1	
2	159	1	96	56	7	
2½	84		25	54	5	
3	27		5	16	5	1
3½	8		3	5	1	
4	9		0	7	2	
⩾ 4½	5		1	3	1	
All	1000	335	467	173	23	1

All months — Texel

Direction of waves 230°–250° — 3032 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11	
0	39	35	3				
½	269	230	37	2			
1	272	150	114	8			
1½	238	57	149	30	3	0	
2	115	5	64	42	4	1	
2½	43		16	23	4		
3	17		4	7	6		
3½	6		2	3	1		
4	1			0	1		
⩾ 4½	0				0		
All	1000	477	388	116	17	1	

All months — Texel

Direction of waves 260°–280° — 2802 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11	
0	25	24	1				
½	230	190	38	2			
1	245	105	118	19	1	1	
1½	223	34	140	46	2		
2	144	6	76	60	3		
2½	80	1	25	52	3		
3	29		4	24	2		
3½	12		2	8	2	0	
4	8		0	4	1	2	
⩾ 4½	4		1	1	2		
All	1000	360	406	215	15	4	

All months — Goeree

Direction of waves 230°–250° — 3704 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	29	25	4			
½	161	121	40			
1	268	119	145	5		
1½	255	33	199	23		
2	160	1	112	46	1	
2½	81	0	40	40	1	
3	35		11	22	3	
3½	9		2	6	1	
4	2			2		
⩾ 4½						
All	1000	299	553	143	5	

All months — Goeree

Directionsof waves 260°–280° — 2855 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	39	31	6			1
½	196	120	74	3		
1	249	65	175	9		
1½	214	12	167	34		
2	158		88	70		
2½	70		23	46	1	
3	45		12	29	4	
3½	19		1	13	4	1
4	7			5	1	1
⩾ 4½	4			1	3	
All	1000	228	545	209	14	3

TABLES B 1 *Parts per thousand*

All months — Terschellingerbank

Direction of waves 290°–310° — 2157 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	23	21	1	0		
½	221	121	93	5	1	
1	281	82	182	14	4	
1½	197	11	144	35	7	
2	127	1	62	56	8	
2½	81		24	48	9	1
3	42		9	30	2	1
3½	9		0	6	3	
4	6		0	3	3	
⩾ 4½	12			8	2	2
All	1000	237	516	204	39	4

All months — Terschellingerbank

Direction of waves 320°–340° — 3301 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	25	15	9	0	1	0
½	264	130	121	9	3	1
1	292	65	204	21	2	
1½	206	15	151	39	2	
2	115	2	64	45	5	
2½	57	0	14	35	7	
3	24		4	18	2	
3½	10		0	6	3	0
4	3			3	1	
⩾ 4½	4			2	1	1
All	1000	226	566	178	26	3

All months — Texel

Direction of waves 290°–310° — 2025 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	29	27	1			1
½	207	132	58	17		
1	257	76	146	33	2	
1½	229	24	129	70	6	
2	142	4	69	65	4	1
2½	68		16	44	7	
3	35		2	29	4	0
3½	14		0	9	3	1
4	12			11	1	
⩾ 4½	8			4	4	
All	1000	263	421	282	30	4

All months — Texel

Direction of waves 320°–340° — 3094 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	21	13	8	1		
½	279	153	102	23	1	
1	302	74	176	45	5	2
1½	212	25	127	52	6	2
2	109	6	53	45	4	2
2½	50		16	27	7	
3	18		4	11	4	
3½	5		0	2	3	
4	2			1	0	1
⩾ 4½	1				1	
All	1000	271	486	206	28	7

All months — Goeree

Direction of waves 290°–310° — 1761 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	30	20	10			
½	148	59	85	5		
1	241	16	189	35	1	
1½	210	1	140	68		
2	170		78	89	3	
2½	85		19	56	10	
3	64		3	51	10	
3½	27		2	18	7	1
4	14			7	6	1
⩾ 4½	13			1	10	2
All	1000	97	526	329	45	5

All months — Goeree

Direction of waves 320°–340° — 2787 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	38	19	18	1		
½	218	64	125	29		
1	272	32	174	65	1	
1½	188	3	117	67	1	
2	146		47	95	3	1
2½	73		8	59	5	1
3	36	0	1	28	4	1
3½	15			10	4	0
4	6			3	2	1
⩾ 4½	8				8	
All	1000	118	492	358	28	4

TABLES B 2 *Parts per thousand*

Direction of waves 110°–160° Tersch.bank

Summer: May–Oct. 561 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	128	128				
½	590	583	7			
1	225	185	39			
1½	50	21	29			
2	7	2	5			
2½						
3						
3½						
4						
⩾ 4½						
All	1000	920	80			

Terschellingerbank

Winter: Nov.–Apr. 1103 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	72	72				
½	459	456	3			
1	303	283	20			
1½	135	96	39			
2	24	5	16	3		
2½	8		8			
3						
3½						
4						
⩾ 4½						
All	1000	911	86	3		

Direction of waves 110°–160° Texel

Summer: May–Oct. 528 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	230	230				
½	500	493	7			
1	233	196	37			
1½	34	25	9			
2	4	4				
2½						
3						
3½						
4						
⩾ 4½						
All	1000	947	53			

Texel

Winter: Nov.–Apr. 1062 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	79	79				
½	545	541	3	1		
1	210	182	28			
1½	134	85	49			
2	26	13	13			
2½	4	1	3			
3	2	2				
3½						
4						
⩾ 4½						
All	1000	903	96	1		

Direction of waves 110°–160° Goeree

Summer: May–Oct. 423 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	149	149				
½	499	492	7			
1	279	262	17			
1½	69	45	24			
2	5		5			
2½						
3						
3½						
4						
⩾ 4½						
All	1000	948	52			

Goeree

Winter: Nov.–Apr. 849 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	67	67				
½	418	415	4			
1	369	344	25			
1½	106	71	35			
2	38	5	33			
2½	1		1			
3	1		1			
3½						
4						
⩾ 4½						
All	1000	901	99			

TABLES B 2 *Parts per thousand*

Direction of waves 200°–250° Tersch.bank

Summer: May–Oct. 2985 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	45	44	1			
½	328	310	17	1		
1	311	218	92	1		
1½	191	68	114	9		
2	83	6	62	15		
2½	28	1	17	10	1	
3	10	0	4	3	3	
3½	3		1		2	
4						
⩾ 4½						
All	1000	648	308	39	6	

Terschellingerbank

Winter: Nov.–Apr. 2809 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	>11
0	31	29	2			
½	277	251	26	0		
1	345	217	124	4		
1½	181	49	116	15	1	
2	104	3	73	28	1	
2½	46	1	23	20	2	
3	11		4	6	1	
3½	3	1	1	1		
4	1			1		
⩾ 4½	1			1		
All	1000	552	368	76	5	

Direction of waves 200°–250° Texel

Summer: May–Oct. 3328 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	53	50	3			
½	340	303	37	0		
1	284	170	111	3		
1½	204	60	126	17	1	
2	85	11	51	22	1	
2½	21		8	11	2	
3	11		3	6	2	
3½	2		1	1		
4	0			0		
⩾ 4½						
All	1000	593	339	61	7	

Texel

Winter: Nov.–Apr. 3180 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	30	28	2			
½	228	189	34	5	0	
1	259	131	116	11	1	
1½	227	46	146	31	3	0
2	157	6	94	51	5	1
2½	66		30	35	2	
3	21		7	10	4	
3½	7		3	3	1	
4	2		1	1	1	
⩾ 4½	2		0	1	0	
All	1000	400	432	149	17	1

Direction of waves 200°–250° Goeree

Summer: May–Oct. 3421 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–*q*	9–11	> 11
0	36	34	2			
½	194	167	27			
1	278	157	118	3		
1½	236	54	168	13		
2	144	1	113	29	0	
2½	69	0	43	25		
3	32		11	18	2	1
3½	7		2	4	0	
4	3		1	2		
⩾ 4½					1	
All	1000	414	486	95	3	1

Goeree

Winter: Nov.–Apr. 3368 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	27	25	2			
½	168	140	28			
1	271	146	123	3		
1½	270	43	206	20		
2	157	2	112	42	1	
2½	72		34	38	1	
3	26		12	14	1	
3½	6		1	4	1	
4	3			2	0	1
⩾ 4½						
All	1000	356	517	123	4	1

TABLES B 2 *Parts per thousand*

Direction of waves 320°–010° Tersch.bank

Summer: May–Oct. 3380 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	38	27	10		0	
½	323	179	137	7	1	
1	339	97	224	17	1	
1½	185	18	134	33	0	
2	74	1	49	24	1	
2½	28		12	12	4	
3	9		4	4	1	
3½	3		0	1	1	
4	1			1		
⩾ 4½	1				1	
All	1000	322	569	99	10	

Terschellingerbank

Winter: Nov.–Apr. 2707 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	29	18	10	0	1	0
½	286	127	142	12	3	1
1	284	53	201	25	4	1
1½	187	17	132	36	2	
2	106	2	51	47	6	
2½	62	0	8	47	7	
3	28		0	24	3	0
3½	10			6	4	0
4	3			3	1	
⩾ 4½	4			2		2
All	1000	218	544	202	30	5

Direction of waves 320°–010° Texel

Summer: May–Oct. 3284 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	43	31	12			
½	355	185	138	30	2	0
1	319	83	180	52	4	1
1½	183	22	112	42	6	1
2	70	5	35	27	2	0
2½	25		6	16	3	
3	4		1	3	0	
3½	1		0	1		
4	1			1		
⩾ 4½						
All	1000	326	484	171	17	2

Texel

Wnter: Nov.–Apr. 2808 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	21	13	5	3		
½	306	166	110	28	3	
1	296	80	164	45	4	3
1½	191	31	108	45	5	2
2	101	4	45	41	7	4
2½	51	0	19	26	6	
3	25		4	17	4	
3½	7			2	4	
4	2			0	1	1
⩾ 4½	1				1	
All	1000	294	454	207	35	10

Direction of waves 320°–010° Goeree

Summer: May–Oct. 3269 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	49	27	21	1		
½	295	95	143	55	2	
1	315	37	177	96	4	
1½	184	2	116	62	3	
2	104		47	54	2	1
2½	37		12	22	3	1
3	9	0	1	7	0	1
3½	5			3	2	0
4	2			2		1
⩾ 4½						
All	1000	162	517	302	16	3

Goeree

Winter: Nov.–Apr. 2761 obs.

Wave height (m)	All periods	Period of waves (seconds) ⩽ 5	5–7	7–9	9–11	> 11
0	46	13	29	4		
½	220	64	129	27		
1	260	34	164	62		
1½	194	4	112	76	1	
2	143		48	93	2	
2½	74		12	59	3	
3	39		1	33	5	
3½	12			8	4	
4	4			2	3	
⩾ 4½	9				9	
All	1000	116	493	363	28	

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 1¾ m — Terschellingerbank

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	302	24	10	8	31	4	0	2	22	34	74	44	48
Feb.	155	11	10	5	23		2	1	13	15	24	33	18
Mar.	122	8	6	13	14			0	8	15	17	13	29
Apr.	70	8							9	6	14	16	17
May	81	14	2	10	0				8	4	5	9	29
June	46	6	1						3	3	15	6	12
July	79	8	4		3				13	15	16	11	11
Aug.	102		1	4					12	26	41	11	7
Sep.	192	3				0	.	0	12	45	57	38	36
Oct.	198	9	5	5	8		1	4	17	32	34	31	51
Nov.	232	32	7	5	3	3	1	6	16	26	47	41	44
Dec.	287	7	4	9	1	1	3	6	38	45	96	40	35
Year	156	11	4	5	7	0.8	0.7	2	14	22	37	24	28

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 1¾ m — Texel

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	321	26	9	8	19	4	0	8	48	37	74	43	43
Feb.	167	7	10	2	17			5	35	12	34	26	19
Mar.	111	10	4	7	5			0	13	22	13	21	17
Apr.	76	7	2	5					18	12	9	12	12
May	66	18	4	5				1	9	5	4	4	17
June	54	8	2	1				1	7	7	18	3	6
July	76	5	2	1	2				16	16	14	7	13
Aug.	115		3	2				1	20	29	38	9	13
Sep.	210	4	1					2	18	44	57	44	41
Oct.	188	8	6	4	1		1	5	28	37	29	37	33
Nov.	269	34	6	3	0	1	6	12	49	28	46	44	40
Dec.	299	7	3	7	1		4	5	63	53	88	36	32
Year	163	11	4	4	4	0.4	0.9	3	27	22	35	24	24

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 1¾ m — Goeree

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	300	19	16	18	22	2		5	47	34	49	52	36
Feb.	232	20	18	30	18			4	31	19	39	17	36
Mar.	170	17	9	17	1			1	22	32	13	12	46
Apr.	156	25	40						12	25	20	12	23
May	115	43	15	4				0	4	28	6	7	13
June	92	21	9						10	34	9	5	9
July	186	15	13		2			0	16	79	24	9	25
Aug.	180	4	4					1	17	67	46	20	20
Sep.	267	8	7	4	1		1	2	46	60	47	49	42
Oct.	231	11	8	11	1	1		3	37	47	31	35	46
Nov.	322	48	21	6	4	4	5	18	49	31	41	46	49
Dec.	342	13	21	11	1		5	4	56	52	83	51	44
Year	216	20	15	8	4	0.6	0.9	3	28	43	30	23	32

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 2¾ m — Terschellingerbank

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	64	9		2					4	4	17	16	11
Feb.	34	3	3		6					1	4	10	6
Mar.	13	0	2							2	2	2	4
Apr.	9	0									1	4	3
May	8										3	1	4
June	2										2		
July	8								3	4	0	1	
Aug.	16								0	0	9	2	4
Sep.	20	1								7	6	1	5
Oct.	18	0								4	1	5	6
Nov.	34	1	0						2		4	11	15
Dec.	67	2	1	0					5	7	24	23	4
Year	24.3	1.4	0.6	0.2	0.5				1.3	2.5	6.3	6.4	5.3

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 2¾m — Texel

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	65	5	0	1				1	10	4	19	16	9
Feb.	15	0							0	0	4	4	6
Mar.	14	0								1	4	4	4
Apr.	9								1	1	0	2	5
May	3									1	2		
June													
July	7								3	3		1	
Aug.	14								2	2	7	3	
Sep.	20								2	8	8	1	0
Oct.	26		2					2	0	4	2	8	8
Nov.	51	8						0	8	2	12	13	8
Dec.	62	0		2					10	12	20	13	4
Year	24.1	1.3	0.2	0.2				0.3	3.1	3.0	6.7	5.5	3.5

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 2¾ m — Goeree

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	74	4	4	2	4			3	9	6	13	20	9
Feb.	31	3	3	2				0	1	1	7	3	10
Mar.	30	2		2					6	4	3	4	11
Apr.	18		2							1	6	5	4
May	11	0							0	7	3	0	
June	2									2			
July	24		1						3	15	4	0	
Aug.	39								1	16	11	4	6
Sep.	44								8	11	11	11	3
Oct.	52	1	4	2					4	4	7	13	17
Nov.	65	14		3					5	5	7	15	17
Dec.	79	1	1				0	0	9	8	25	22	13
Year	39.2	2.2	1.3	0.9	0.3		0.0	0.3	3.8	6.7	4.3	4.3	7.6

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 3¾ m — Terschellingerbank

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	19									2	12	4	1
Feb.	8										2	2	3
Mar.	5	0									0	1	3
Apr.													
May													
June													
July													
Aug.	1												1
Sep.	1										1		
Oct.	2											1	1
Nov.	3										1	0	1
Dec.	23									1	6	15	1
Year	5.2	0.0								0.2	1.9	2.1	1.0

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 3¾ m — Texel

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	17								5	1	7	4	
Feb.	6										1	2	2
Mar.	4									1	0	0	2
Apr.													
May	1									0	1		
June													
July													
Aug.	0											0	
Sep.	1										1		
Oct.	2											1	1
Nov.	7	0							1		3	3	
Dec.	18									0	4	10	2
Year	4.8	0.0							0.5	0.3	1.6	1.7	0.7

TABLE C 1 *Parts per thousand (fractions of time)*

Wave height > 3¾ m — Goeree

Month	All directions	Direction of waves (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	12	1							3	0	4	1	2
Feb.	5										1	0	3
Mar.	4											1	3
Apr.													
May	2									0	2		
June													
July	4								1	2	1		
Aug.	2										0	1	0
Sep.	3								2			1	
Oct.	9		1						1		0	3	3
Nov.	9	3										3	2
Dec.	22									0	5	11	5
Year	6.0	0.3	0.1						0.6	0.3	1.2	1.8	1.6

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 4 — Terschellingerbank

Month	All directions	Wind direction (tens of degrees)											
		36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	659	29	28	26	64	36	32	45	89	80	109	66	55
Feb.	518	21	27	36	58	43	24	56	63	52	71	36	30
Mar.	452	31	22	29	75	34	26	20	48	48	46	30	41
Apr.	442	52	57	37	16	8	12	16	70	44	38	29	53
May	406	56	34	48	31	6	8	7	50	43	32	26	65
June	377	42	29	30	12	5	2	6	64	54	53	31	50
July	429	37	20	17	18	6	8	8	67	83	76	50	38
Aug.	424	14	7	8	19	4	10	23	72	100	88	45	34
Sep.	554	12	20	9	17	20	20	44	70	90	102	73	79
Oct.	573	30	11	12	43	30	34	53	68	108	74	55	57
Nov.	678	42	31	25	34	38	70	97	60	52	104	54	69
Dec.	666	17	17	14	23	33	40	77	108	95	134	67	40
Year	514	32	25	24	34	22	24	37	69	71	77	47	51

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 4 — Texel

Month	All directions	Wind direction (tens of degrees)											
		36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	670	27	26	25	55	35	35	45	92	93	115	74	48
Feb.	569	26	29	32	70	30	27	44	81	62	77	54	37
Mar.	462	30	20	20	76	29	35	21	54	52	48	30	47
Apr.	480	72	64	45	17	6	7	14	82	44	44	26	59
May	404	51	40	42	30	8	10	15	53	41	31	29	55
June	378	36	38	24	13	1	5	7	57	77	46	29	44
July	442	33	31	15	11	4	8	7	81	86	82	41	43
Aug.	433	19	8	13	16	6	4	20	89	96	86	40	37
Sep.	635	15	17	15	21	19	17	43	88	113	130	81	75
Oct.	671	31	16	12	37	36	37	67	114	133	77	64	47
Nov.	702	42	34	29	44	34	61	86	80	56	103	75	59
Dec.	683	13	15	18	26	22	39	67	112	125	134	75	38
Year	544	33	28	24	34	19	24	36	82	82	81	51	49

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 4 — Goeree

Month	All directions	Wind direction (tens of degrees)											
		36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	667	20	39	49	53	30	25	67	136	62	81	69	36
Feb.	601	21	43	67	56	18	27	66	89	70	60	37	48
Mar.	504	28	60	56	44	32	29	23	62	68	23	24	55
Apr.	534	75	126	31	17	4	5	19	62	75	42	23	57
May	488	74	112	39	24	8	6	16	34	74	30	27	43
June	466	80	74	23	8	0	4	9	46	112	42	26	40
July	537	51	55	9	15	3	5	10	56	155	72	49	58
Aug.	509	22	31	17	14	3	9	24	80	136	81	50	43
Sep.	608	23	25	26	31	16	16	29	97	106	108	80	51
Oct.	619	31	26	25	41	23	27	45	117	93	77	58	54
Nov.	728	53	38	26	49	40	42	102	111	62	72	70	61
Dec.	699	13	23	30	30	26	37	72	148	89	107	78	46
Year	579	41	54	33	32	17	19	40	87	92	66	49	49

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 6 — Terschellingerbank

Month	All directions	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	258	17	8	9	31	9	4	10	29	33	52	33	22
Feb.	136	5	7	7	14	8	5	10	18	13	23	14	12
Mar.	118	5	9	7	17	6	2	3	14	14	16	9	15
Apr.	67	3	1	3	1		1	3	15	7	11	9	13
May	54	5	1	5	3			3	9	6	5	4	11
June	20	2	2			0			3	4	6	1	2
July	46	1	2	1	1		0		8	10	13	5	4
Aug.	81	0	2	2	0		1	2	15	22	22	9	5
Sep.	167	2	0			6	1	10	15	40	40	29	24
Oct.	174	4	2	6	15	3	4	16	22	32	26	19	25
Nov.	233	14	7	6	3	19	20	31	19	21	39	28	26
Dec.	265	4	4	7	4	7	8	20	44	40	75	34	17
Year	135	5	4	4	8	5	4	9	18	20	28	16	15

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 6 — Texel

Month	All directions	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	269	17	9	11	25	11	4	14	27	30	61	36	26
Feb.	149	11	5	1	21	3	3	12	23	15	24	18	12
Mar.	109	8	3	4	17	2	6	2	13	20	12	7	17
Apr.	64	5	3	6	1		0	1	15	7	7	8	11
May	43	6	1	5	1			3	8	3	6	4	7
June	19	1	3					0	4	6	4	1	
July	53	0	2	3	2			0	10	12	12	6	5
Aug.	96	2	2	2			0	4	28	19	24	11	4
Sep.	182	5	1	2	2	4	2	7	29	41	45	25	19
Oct.	185	4	5	6	9	2	3	19	33	35	25	26	18
Nov.	243	15	10	5	7	12	18	27	35	23	37	33	21
Dec.	272	4	3	8	2	2	11	23	51	47	64	39	17
Year	140	6	4	4	7	3	4	9	23	21	27	18	13

TABLE C 2 *Parts per thousand (fractions of time)*

Wind force ≥ 6 — Goeree

Month	All directions	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	248	11	10	22	19	10	3	15	45	25	36	33	18
Feb.	182	6	14	23	25	1	3	14	31	13	21	13	17
Mar.	114	5	10	17	2			2	22	23	4	7	20
Apr.	84	7	14	2				4	17	10	10	8	12
May	57	12	6	8	1			2	4	16	4	3	1
June	37	6	6					1	6	15	2	1	1
July	109	0	3	0	2			1	14	50	14	10	14
Aug.	137	2	3				1	5	24	50	28	15	10
Sep.	174	5	2	4	4	3	2	5	35	39	32	26	17
Oct.	180	7	8	6	4	2	2	12	35	34	29	24	18
Nov.	277	26	11	10	6	13	11	36	48	30	33	29	25
Dec.	295	4	10	16	3	2	12	20	63	43	56	39	27
Year	158	8	8	9	5	3	3	10	29	29	22	17	16

TABLES C 2 *Parts per thousand (fractions of time)*

Wind force ⩾ 8* — Terschellingerbank

Month	All directions ⩾ 10	All directions ⩾ 8	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	9	43	4		3	1	1	1	3	3	8	10	5	4
Feb.	7	18	2	1		1	1		0	1	1	5	1	1
Mar.	1	18	0	2	1	4			0	1	1	3		4
Apr.		7	0						0	0	0	0	2	3
May		2										2	0	
June		1										1		
July	2	6								1	4	1	1	
Aug.		11								0	4	6	1	
Sep.	0	15						0	1	1	6	3	1	1
Oct.	2	16			1	0			4	4	1	1	1	3
Nov.	2	24	1				1	1	2	2		4	8	5
Dec.	10	63	0	1	2			1	2	10	7	22	15	2
Year		18.8	0.8	0.4	0.6	0.6	0.3	0.3	1.2	2.0	2.7	4.9	3.0	2.0
⩾ 10 Bft Year	2.7		0.1	0.0	0.0				0.0	0.3	0.3	0.8	0.7	0.3

Wind force ⩾ 8* — Texel

Month	All directions ⩾ 10	All directions ⩾ 8	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	8	48	3	1	1	3	0		6	4	2	16	8	4
Feb.	6	19	2	0		2				2	1	5	3	2
Mar.	1	17	0	0	1	6				2	0	1	1	4
Apr.		6								1		3	0	1
May	0	3			1						0	1		
June														
July	0	4								1	3	0		
Aug.		10								2	1	5	2	
Sep.		19						0	1	3	7	6	0	
Oct.	2	24	0	2				0	4	4	4	3	4	2
Nov.	2	37	2		1		0	2	4	5	2	8	8	5
Dec.	9	63			0		0	0	4	9	9	22	16	2
Year		20.9	0.6	0.3	0.4	0.9	0.1	0.3	1.6	2.8	2.6	5.9	3.6	1.7
⩾ 10 Bft Year	2.4		0.1						0.0	0.2	0.1	0.9	0.9	0.1

Wind force ⩾ 8* — Goeree

Month	All directions ⩾ 10	All directions ⩾ 8	Wind direction (tens of degrees) 36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
Jan.	4	44	3	0	4	3	0		5	4	3	11	8	3
Feb.	4	16	2	0				1	2	1	0	0	1	6
Mar.	1	16	0	0	4					2	3	0	0	4
Apr.		4										2	1	1
May		4								0	1	2	0	
June														
July		7								1	4	2	0	
Aug.	0	19								2	7	5	4	1
Sep.		13								5	5	2	1	
Oct.	2	17	0	2					0	2	1	2	4	4
Nov.	3	33	5		1		1	1	3	5	2	4	9	3
Dec.	8	63		0	0		0	1	2	13	4	18	16	6
Year		19.7	1.0	0.3	0.8	0.3	0.2	0.3	1.0	3.1	2.6	4.1	3.8	2.4
⩾ 10 Bft Year	1.8		0.1		0.1					0.1	0.2	0.2	0.7	0.4

* Second column and last line: wind force ⩾ 10.

TABLE C 3 *Parts per thousand (fractions of time)*

All directions
All periods

Terschellingerbank

Month	Calm	Wave height below:				Wave height above:			
		¼ m	¾ m	1¼ m	1¾ m	1¾ m	2¾ m	3¾ m	4¾ m
Jan.	4	28	278	510	698	302	64	19	6
Feb.	15	73	348	643	845	155	34	8	1
Mar.	17	82	459	730	878	122	13	5	2
Apr.	18	81	463	780	930	70	9		
May	19	91	485	778	919	81	8		
June	36	84	434	810	954	46	2		
July	26	82	413	752	921	79	8		
Aug.	9	71	468	743	898	102	16	1	
Sep.	2	38	366	628	808	192	20	1	
Oct.	4	40	352	618	802	198	18	2	
Nov.	2	20	249	552	768	232	34	3	
Dec.	6	32	268	540	713	287	67	23	14
Year	13	60	382	673	845	155	24	5.2	2.1

TABLE C 3 *Parts per thousand (fractions of time)*

All directions
All periods

Texel

Month	Calm	Wave height below:				Wave height above:			
		¼ m	¾ m	1¼ m	1¾ m	1¾ m	2¾ m	3¾ m	4¾ m
Jan.	4	18	257	487	679	321	65	17	5
Feb.	6	31	358	628	833	167	15	6	0
Mar.	27	87	471	720	889	111	14	4	0
Apr.	33	84	466	772	924	76	9		
May	22	85	490	777	934	66	3	1	
June	36	84	446	770	946	54			
July	30	89	436	750	924	76	7		
Aug.	21	85	462	717	885	115	14	0	
Sep.	9	42	376	607	790	210	20	1	
Oct.	10	60	315	613	812	188	26	2	1
Nov.	5	25	242	486	731	269	51	7	0
Dec.	6	35	272	464	701	299	62	18	13
Year	17	61	382	650	838	162	24	4.8	1.8

TABLE C 3 *Parts per thousand (fractions of time)*

All directions
All periods

Goeree

Month	Calm	Wave height below:				Wave height above:			
		¼ m	¾ m	1¼ m	1¾ m	1¾ m	2¾ m	3¾ m	4¾ m
Jan.	17	43	232	468	700	300	74	12	3
Feb.	17	45	286	552	768	232	31	5	1
Mar.	54	126	403	678	830	170	30	4	2
Apr.	37	86	312	622	844	156	18		
May	43	117	398	713	885	115	11	2	1
June	43	97	354	696	908	92	2		
July	22	70	343	628	814	186	24	4	
Aug.	48	100	388	654	820	180	39	2	
Sep.	28	67	290	540	733	267	44	3	
Oct.	14	53	274	547	769	231	52	9	1
Nov.	8	31	184	449	678	322	65	9	
Dec.	24	48	187	445	658	342	79	22	8
Year	30	74	305	583	784	216	39	6.0	1.4

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Summer: May-Oct. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	55	33	15	7								
½	329	26	59	201	43							
1	224	2	20	83	107	12						
1½	75			6	35	32	2					
2	33				1	11	19	2				
2½	6				1	1	2	2				
3	3								3			
3½												
4												
⩾4½												
Total	725	61	94	297	187	56	23	4	3			

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Summer: May-Oct. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	65	27	33	5								
½	319	26	63	177	52	1						
1	194	3	15	61	88	25	2					
1½	66		1	3	21	30	11					
2	22			2	1	4	11	4				
2½	11						1	8	2			
3												
3½												
4												
⩾4½												
Total	677	56	112	248	162	60	25	12	2			

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Summer: May-Oct. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	63	29	26	8								
½	258	48	94	103	13							
1	245	1	16	85	120	23						
1½	77		2	1	38	32	4					
2	34				1	20	9	4				
2½	16				1		7	8				
3	8						1	7				
3½	1							1				
4												
⩾4½												
Total	702	78	138	197	173	75	21	20				

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Winter: Nov.-Apr. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	44	22	17	5								
½	229	17	62	130	20							
1	188	4	5	62	99	18						
1½	143		1	10	44	72	15	1				
2	61			1	8	10	31	9	2			
2½	18					3	5	6	4			
3	7							4	2	1		
3½	3								1	2		
4												
≥4½												
Total	693	43	85	208	171	103	51	20	9	3		

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Winter: Nov.-Apr. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	36	15	19	2								
½	137	11	46	41	39							
1	178	3	9	45	99	19	3					
1½	107			4	45	40	15	3				
2	55			1	5	10	28	8	3			
2½	11						1	8		2		
3	5							2	1	2		
3½												
4												
≥4½												
Total	529	29	74	93	188	69	47	21	4	4		

TABLE D 1 *Numbers of observations*

Wind direction 050°-070° Winter: Nov.-Apr. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	56	23	28	5								
½	151	12	29	104	6							
1	225	3	16	67	127	12						
1½	192		1	13	81	81	16					
2	136			1	8	40	81	6				
2½	67			1		1	25	35	5			
3	23						2	11	10			
3½	6								5	1		
4												
≥4½												
Total	856	38	74	191	222	134	124	52	20	1		

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Summer: May-Oct. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	169	75	69	25								
½	661	51	170	346	94							
1	299	12	21	74	137	47	8					
1½	45		2	3	7	13	18	2				
2	8		2			1	3	1	1			
2½												
3												
3½												
4												
≥4½												
Total	1182	138	264	448	238	61	29	3	1			

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Summer: May-Oct. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	167	66	71	30								
½	462	62	140	167	87	6						
1	230	7	18	52	106	43	3	1				
1½	44	2	1	7	10	10	11	3				
2	2					1		1				
2½	1								1			
3												
3½												
4												
≥4½												
Total	906	137	230	256	203	60	14	5	1			

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Summer: May-Oct. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	206	66	97	42	1							
½	494	39	133	273	48	1						
1	269	6	17	92	123	26	5					
1½	41			1	9	20	10	1				
2	4				1		1	2				
2½												
3												
3½												
4												
≥4½												
Total	1014	111	247	408	182	47	16	3				

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Winter: Nov.-Apr. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	139	49	66	24								
½	805	45	151	469	136	4						
1	593	4	34	139	272	127	17					
1½	233	1	1	20	23	70	94	21	2	1		
2	57			1	4	11	20	16	5			
2½	14			1				10	3			
3	4							1	3			
3½												
4												
⩾4½												
Total	1845	99	252	654	435	212	131	48	13	1		

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Winter: Nov.-Apr. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	136	57	66	11	2							
½	848	42	170	431	204	1						
1	418	6	21	88	216	75	12					
1½	245	3	3	23	34	87	79	16				
2	45			2	2	1	22	17	1			
2½	6			1					5			
3	3							1	2			
3½												
4												
⩾4½												
Total	1701	108	260	556	458	164	113	34	8			

TABLE D 1 *Numbers of observations*

Wind direction 110°-160° Winter: Nov.-Apr. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	184	84	83	16	1							
½	617	58	146	312	101							
1	519	5	17	120	286	88	3					
1½	148		5	8	27	54	46	8				
2	65	1				9	22	27	6			
2½	3								2	1		
3	2									2		
3½	1									1		
4												
⩾4½												
Total	1539	148	261	456	415	151	71	35	8	4		

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Summer: May-Oct. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	68	28	31	9								
½	509	36	127	279	65	2						
1	501	7	32	117	265	70	10					
1½	237	1	2	9	55	114	53	3				
2	88					21	52	10	3	2		
2½	25					3	11	6	3	2		
3	6							2			4	
3½												
4												
⩾4½												
Total	1434	72	192	414	385	210	126	21	6	4	4	

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Summer: May-Oct. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	94	45	37	11	1							
½	485	26	125	269	64	1						
1	524	9	27	155	287	42	3	1				
1½	343		2	18	119	142	61	1				
2	138			2	2	48	68	17	1			
2½	33					1	12	16	4			
3	14					1		5	6	1	1	
3½	4							2	2			
4												
⩾4½												
Total	1635	80	191	455	473	235	144	42	13	1	1	

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Summer: May-Oct. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	102	33	58	11	34							
½	366	30	108	194	205							
1	446	8	16	174	125	42	1					
1½	301			14	11	125	37					
2	194					68	94	21				
2½	61					4	18	32	7			
3	21						8	7	5	1		
3½	2								1	1		
4	6								4	2		
⩾4½	2									2		
Total	1501	71	182	393	375	239	158	60	17	6		

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Winter: Nov.-Apr. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	73	28	32	13								
½	513	25	108	304	70	4	2					
1	586	5	20	173	282	92	14					
1½	247	1	1	10	54	99	76	5	1			
2	148			1	6	21	77	39	2	1	1	
2½	40						5	20	14	1		
3	20							4	9	6	1	
3½	2										2	
4												
⩾4½												
Total	1629	59	161	501	412	216	174	68	26	8	4	

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Winter: Nov.-Apr. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	54	25	24	5								
½	414	35	101	219	58	1						
1	442	7	31	117	253	33		1				
1½	349	1		24	140	142	40	2				
2	245	1		1	12	68	121	37	5			
2½	101					7	25	53	15	1		
3	44						4	22	17	1		
3½	1								1			
4	6								2	4		
⩾4½	3							1			2	
Total	1659	69	156	366	463	251	190	116	40	6	2	

TABLE D 1 *Numbers of observations*

Wind direction 200°-220° Winter: Nov.-Apr. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	98	45	41	12								
½	369	25	122	191	31							
1	514	5	32	154	276	41	6					
1½	518	1	3	38	160	245	69	2				
2	295		1	1	10	51	190	41	1			
2½	124					7	42	58	17			
3	51						2	19	25	4	1	
3½	8							3	5			
4	5									5		
⩾4½												
Total	1982	76	199	396	477	344	309	123	48	9	1	

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Summer: May-Oct. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	32	18	13	1								
½	222	34	63	116	9							
1	305	3	17	151	117	17						
1½	236		2	31	116	79	7	1				
2	124				18	49	50	6	1			
2½	71				6	9	31	23	2			
3	20						10	5	4		1	
3½	2									2		
4												
⩾4½												
Total	1012	55	95	299	266	154	98	35	7	2	1	

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Summer: May-Oct. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	34	25	8	1								
½	210	27	67	97	18		1					
1	291	3	22	132	121	13						
1½	214	1	7	29	114	55	8					
2	115			3	18	38	42	14				
2½	57				3	14	31	9				
3	21					3	6	6	6			
3½	5							3	1	1		
4	4									4		
⩾4½												
Total	951	56	104	262	274	123	88	32	7	5		

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Summer: May-Oct. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	50	24	24	2								
½	138	20	54	59	5							
1	302	3	12	108	169	10						
1½	186	1	3	16	94	66	6					
2	139				18	74	44	1	2			
2½	69				4	8	45	10	2			
3	31					1	9	19	2			
3½	9							5	3	1		
4	9								5	4		
⩾4½												
Total	933	48	93	185	290	159	104	35	14	5		

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Winter: Nov.-Apr. Terschellingerbank

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	31	13	13	5								
½	160	16	57	83	4							
1	218	5	28	105	71	8	1					
1½	170		7	32	83	41	7					
2	166			3	33	65	53	11	1			
2½	97				3	18	53	19	4			
3	60					4	18	23	13	2		
3½	20					1	2	7	5	4	1	
4	16					1	1	2	6	3	3	
⩾4½	15							3	2	2	1	7
Total	953	34	105	228	194	138	135	65	31	11	5	7

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Winter: Nov.-Apr. Texel

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	21	10	10	1								
½	147	24	53	62	8							
1	233	6	26	98	93	9	1					
1½	245		4	27	107	74	32	1				
2	178			2	36	60	71	7	1	1		
2½	97			1	2	17	39	30	8			
3	52					6	11	20	15			
3½	20						2	8	4	4	2	
4	21							1	13	5		2
⩾4½	16								1	2	7	6
Total	1030	40	93	191	246	166	156	67	42	12	9	8

TABLE D 1 *Numbers of observations*

Wind direction 290°-310° Winter: Nov.-Apr. Goeree

Wave height (m)	All winds	Wind force 1	2	3	4	5	6	7	8	9	10	11
0	21	13	6	2								
½	76	22	19	34	1							
1	179	4	21	71	80	3						
1½	184		3	24	95	59	3					
2	172	1		2	31	79	53	6				
2½	104				1	19	48	31	5			
3	69					2	18	31	18			
3½	37							10	21	4	2	
4	12						1		5	4	2	
⩾4½	17								1	2	11	3
Total	871	40	49	133	208	162	123	78	50	10	15	3

TABLES D 2 *Upper part: mean wave heights (metres)*
Lower part: 'equivalent' wave heights (metres)

Summer: May—Oct. Terschellingerbank

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
1	0.4	0.3	0.2^5	0.2^5	0.2^5	0.3	0.3	0.3^5	0.4	0.4	0.3^5	0.3^5
2	0.5^5	0.5^5	0.5^5	0.4^5	0.4^5	0.4	0.4	0.5	0.5^5	0.5^5	0.5^5	0.6^5
3	0.8	0.7	0.6^5	0.8^5	0.6	0.5^5	0.6	0.6^5	0.7^5	0.8	0.8^5	0.9
4	1.2	1.0^5	1.0	0.9^5	0.9	0.8	0.9	1.0	1.1	1.2	1.3	1.3
5	1.7^5	1.5	1.4	1.2^5	1.1	1.1^5	1.1^5	1.4	1.5	1.6^5	1.6^5	1.7^5
6	2.3^5	1.9^5	2.0	1.8	1.4^5	1.3	1.5	1.8	2.0	2.1^5	2.2	2.2
7	2.3^5	—	2.2^5	2.0	—	—	1.8	2.1^5	2.4	2.5^5	2.4^5	2.8
8	—	—	—	—	—	—	2.2	2.2^5	2.7	3.2	2.7	3.4
3/4	1.0^5	0.9^5	0.8^5	0.8^5	0.8	0.7^5	0.8	0.8^5	0.9	1.0	1.0^5	1.0^5
5/6	2.2^5	1.8^5	1.8^5	1.6	1.4	1.4^5	1.4	1.6	1.8	2.0	2.0	2.0^5
7/8	—	—	—	—	—	—	2.1	2.5	2.8	3.0	3.0	3.6

Summer: May—Oct. Texel

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	27	33
1	0.3	0.3	0.3	0.2^5	0.2^5	0.3^5	0.3	0.3	0.3^5	0.3	0.3	0.4
2	0.5^5	0.5	0.4	0.4	0.3^5	0.4	0.4^5	0.5	0.5^5	0.5^5	0.6^5	0.6
3	0.8	0.7	0.6^5	0.6	0.5^5	0.7	0.6	0.7	0.7	0.7^5	0.9	0.9
4	1.3	1.0^5	0.9	0.8^5	0.8	0.8^5	0.9^5	1.0^5	1.1^5	1.2	1.2^5	1.3
5	1.7^5	1.4	1.3	1.1	1.0^5	1.1	1.3	1.5	1.5^5	1.7	1.7^5	1.7
6	2.1^5	1.9^5	1.7	1.4	1.3^5	1.5	1.7^5	1.8	1.9	2.0^5	2.2	2.2
7	2.3	2.5	2.3^5	2.1	1.4	—	2.4	2.3^5	2.3^5	2.4^5	2.4^5	2.3
8	—	2.9	—	—	—	—	2.9	2.8^5	2.8	2.8^5	3.0^5	—
3/4	1.1	0.9	0.8	0.7^5	0.7^5	0.7^5	0.8	0.8^5	0.9	0.9^5	1.0^5	1.1
5/6	2.1	1.8	1.6^5	1.4^5	1.3^5	1.5	1.6	1.7	1.8	1.9^5	2.0	2.0^5
7/8	—	2.8^5	—	—	—	—	2.8^5	2.8	2.7^5	2.8	3.1	—

Summer: May—Oct. Goeree

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
1	0.4	0.3	0.3	0.2	0.2	0.2^5	0.2	0.3	0.2	0.3	0.3	0.3
2	0.5	0.5	0.5	0.3^5	0.3^5	0.3^5	0.4	0.4	0.5	0.5	0.4^5	0.6^5
3	0.8^5	0.8	0.7	0.6^5	0.5^5	0.6	0.6^5	0.7^5	0.7^5	0.8	0.9	0.8^5
4	1.3	1.1^5	1.1	1.0	0.9^5	0.8^5	1.0	1.1^5	1.2^5	1.2^5	1.2^5	1.3
5	1.7^5	1.6	1.5	1.3	1.2^5	1.2	1.3^5	1.5^5	1.7	1.7	1.7^5	1.8
6	2.3	2.2	2.1	1.8^5	1.4	1.3^5	1.7	2.0	2.2	2.3	2.3	2.3^5
7	2.8^5	2.8^5	2.6	2.0	—	—	2.2^5	2.4	2.8	2.8^5	2.9	3.2
8	—	4.0	—	—	—	—	—	3.0^5	3.2	3.4^5	3.2^5	3.3
3/4	1.0	1.0	0.9	0.8	0.8	0.8	0.8^5	0.9^5	1.0	1.0	1.0	1.1
5/6	2.2	2.1	2.0	1.7	1.4^5	1.4	1.6	1.8	2.0	2.0^5	2.0^5	2.1
7/8	—	3.4	—	—	—	—	—	2.8^5	3.1	3.1^5	3.2	3.4

TABLES D 2 *Upper part: mean wave heights (metres)*
Lower part: 'equivalent' wave heights (metres).

Winter: Nov.—Apr. Terschellingerbank

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
1	0.3	0.3^5	0.3	0.2	0.3	0.3	0.2^5	0.3	0.4	0.2^5	0.4	0.4
2	0.5^5	0.5	0.4^5	0.4	0.5	0.4	0.4^5	0.4^5	0.5	0.6	0.6^5	0.6^5
3	0.8	0.7	0.7	0.6^5	0.6^5	0.6	0.6	0.7	0.7^5	0.8^5	0.9	0.8^5
4	1.3	1.1^5	1.1	1.0^5	0.9^5	0.8	0.9	1.0	1.1	1.3	1.4	1.4
5	1.6^5	1.6	1.5	1.4	1.3	1.1^5	1.2^5	1.3	1.5^5	1.6^5	1.9	1.7^5
6	2.2^5	2.1	1.9	1.9	1.6	1.4^5	1.5	1.7	2.0^5	2.1^5	2.3^5	2.3
7	2.7^5	2.5	2.3	2.2^5	1.9^5	1.8^5	1.8^5	2.1^5	2.2^5	2.5^5	2.9	2.8^5
8	3.2	3.3	2.6	2.5^5	2.5^5	1.9	2.1	2.6	2.8	3.2	3.4^5	3.3
3/4	1.0^5	0.9	0.9	0.8^5	0.8	0.7^5	0.8	0.9	0.9^5	1.0	1.1^5	1.1
5/6	2.1	2.0	1.8	1.7^5	1.5	1.4^5	1.5	1.5^5	1.8	1.9	2.1	2.1
7/8	3.0	3.3	2.7	2.6^5	2.5	2.1^5	2.2	2.5	2.6^5	3.0	3.2	3.1

Winter: Nov.—Apr. Texel

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
1	0.5	0.4	0.3	0.3^5	0.3	0.2^5	0.3^5	0.4	0.3^5	0.4	0.4^5	0.4
2	0.6	0.5	0.4^5	0.4^5	0.4	0.4	0.5^5	0.5^5	0.5^5	0.6	0.6^5	0.6^5
3	0.9	0.7^5	0.8	0.6	0.6	0.6^5	0.7	0.7	0.7^5	0.8^5	0.9	0.9
4	1.2^5	1.1	1.0^5	0.8^5	0.7^5	0.9	1.0	1.1	1.2	1.2^5	1.3^5	1.3
5	1.7^5	1.6^5	1.4^5	1.3	1.2^5	1.3	1.4^5	1.6	1.6^5	1.7	1.8	1.8
6	2.2	2.0^5	1.8	1.7	1.5	1.5^5	1.8^5	2.0	1.9^5	2.1	2.1	2.2
7	2.7^5	2.3	2.2	2.0^5	1.7	1.9	2.2^5	2.4^5	2.4	2.5	2.7	2.7
8	2.8^5	—	2.2^5	2.2^5	—	2.5	2.7	2.7^5	2.8^5	3.0	3.3	3.2
3/4	1.1	0.9	0.8	0.7	0.6	0.7^5	0.8^5	0.9	0.9^5	1.0	1.1	1.0^5
5/6	2.0	1.9^5	1.7	1.6	1.4	1.5^5	1.7	1.8	1.8^5	1.9^5	2.0	2.0
7/8	3.1^5	3.0	2.6	2.3	—	2.3^5	2.5	2.8	2.7^5	2.8	3.1	3.0^5

Winter: Nov.—Apr. Goeree

Wind force	Wind direction (tens of degrees)											
	36 N	03	06	09 E	12	15	18 S	21	24	27 W	30	33
1	0.5	0.3	0.2^5	0.2^5	0.3	0.2	0.2	0.2^5	0.3	0.3	0.4	0.3^5
2	0.6	0.5	0.4^5	0.4^5	0.4	0.4	0.4	0.5	0.6	0.6	0.7	0.6
3	1.0	0.8^5	0.7^5	0.7	0.6^5	0.6	0.6^5	0.8	0.8^5	0.9^5	0.9^5	1.0
4	1.3^5	1.3	1.2	1.0^5	0.9	0.9	1.0	1.1^5	1.2	1.3	1.4	1.4
5	1.9	1.8	1.6	1.3^5	1.2^5	1.2^5	1.3^5	1.5^5	1.6^5	1.8	1.8^5	1.9
6	2.3^5	2.2	2.0^5	1.9^5	1.6^5	1.6	1.7^5	1.9^5	2.1	2.2	2.3	2.4^5
7	3.0	2.7^5	2.5^5	2.3^5	1.9	1.8^5	2.1	2.4	2.5^5	2.7	2.8	2.9^5
8	3.7	2.7^5	3.0	2.9	—	2.1	2.7^5	2.8^5	3.1^5	3.2^5	3.3	3.5
3/4	1.2	1.0^5	1.0	0.9	0.8	0.8	0.8^5	0.9^5	1.0^5	1.1	1.1^5	1.2
5/6	2.2	2.1	1.9	1.7	1.5	1.5^5	1.6	1.7^5	1.9	2.0	2.1	2.2
7/8	3.3	3.2^5	2.9	2.7	2.1^5	2.1	2.5	2.8	3.0^5	3.0^5	3.1^5	3.3^5

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 050°—070°
Summer: May—Oct. Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	43				6	4	29	4					
1	118			2	9	18	80	9					
1½	70			2	8	1	56	3					
2	33				1	4	26	2					
2½	6						6						
3	3			2		1							
3½													
4													
≥ 4½													
All	273			6	24	28	197	18					

Wind force ≥ 4, wind direction 050°—070°
Summer: May—Oct. Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	53				3	5	45						
1	115			1	10	27	72	5					
1½	62		2		3	17	37	2				1	
2	20					5	15						
2½	11					3	8						
3													
3½													
4													
≥ 4½													
All	261		2	1	16	57	177	7				1	

Wind force ≥ 4, wind direction 050°—070°
Summer: May—Oct. Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	13				4	2	7						
1	143	1		1	21	58	58	4					
1½	74			1	5	37	28	2	1				
2	34				4	10	20						
2½	16			1		4	11						
3	8						8						
3½	1						1						
4													
≥ 4½													
All	289	1		3	34	111	133	6	1				

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 050°—070°
Winter: Nov.—Apr. Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	21				1	4	15	1					
1	115			2	10	13	72	18					
1½	133		1	2	4	27	90	9					
2	60			1	1	8	43	7					
2½	18				3		14	1					
3	7				3	1	3						
3½	3						3						
4													
≥ 4½													
All	357		1	5	22	53	240	36					

Wind force ≥ 4, wind direction 050°—070°
Winter: Nov.—Apr. Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	41				7	7	24	1				2	
1	119			4	8	33	71	3					
1½	103	1		2	8	20	70	2					
2	54				5	10	39						
2½	11						11						
3	5						5						
3½													
4													
≥ 4½													
All	333	1		6	28	70	220	6				2	

Wind force ≥ 4, wind direction 050°—070°
Winter: Nov.—Apr. Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	6				1	2	2	1					
1	140	1			26	47	61	4	1				
1½	177		1	1	27	63	82	3					
2	135			4	7	40	83	1					
2½	66				2	15	49						
3	23					5	18						
3½	6					3	3						
4													
≥ 4½													
All	553	1	1	5	63	175	298	9	1				

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 110°—160°
Summer: May—Oct. Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	94	6	5		2	15	54	7	1		1	2	1
1	193	2	4	5	8	45	93	22	4	5	2	2	1
1½	40					8	24	5	1	1		1	
2	6					1	4		1				
2½													
3													
3½													
4													
≥ 4½													
All	333	8	9	5	10	69	175	34	7	6	3	5	2

Wind force ≥ 4, wind direction 110°—160°
Summer: May—Oct. Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	93	4	10	4	1	5	47	7	3	3	1	1	7
1	153		4	2	8	17	90	24	3	1	2		2
1½	34				1	6	19	4		2	1		1
2	2	1					1						
2½	1							1					
3													
3½													
4													
≥ 4½													
All	283	5	14	6	10	28	157	36	6	6	4	1	10

Wind force ≥ 4, wind direction 110°—160°
Summer: May—Oct. Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	50	3	2	1	1	9	21	8		2	2		2
1	154	2	4		9	20	79	27	6	4	2		
1½	39	1			2	6	22	6	2				
2	4		1				2	1					
2½													
3													
3½													
4													
≥ 4½													
All	247	6	7	1	12	35	124	42	8	6	4		2

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 110°–160°
Winter: Nov.–Apr.

Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	140	3	7	5	4	18	67	18	2	5	3	3	5
1	415	9	5	5	12	76	250	34	12	6	3	3	
1½	212	2	1	2	9	31	125	24	12	3	2		1
2	55			1	2	16	32	2	1	1			
2½	13					2	7	4					
3	4					4							
3½													
4													
≥ 4½													
All	839	14	13	13	27	147	481	82	27	15	8	6	6

Wind force ≥ 4, wind direction 110°–160°
Winter: Nov.–Apr.

Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	206	7	6	8	5	10	131	14	6	10	3	3	3
1	301	6	7	9	8	22	144	54	18	14	7	6	6
1½	215	1	2	1	1	20	129	32	16	6	2	4	1
2	45		1			1	29	9	1	4			
2½	5						5						
3	3					1	1		1				
3½													
4													
≥ 4½													
All	775	14	16	18	14	54	439	109	42	34	12	13	10

Wind force ≥ 4, wind direction 110°–160°
Winter: Nov.–Apr.

Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	102	5	2	1		6	66	17	1	1		2	1
1	377	2	9	6	11	48	201	71	13	4	4	4	4
1½	135	1	2		6	18	67	31	1	4	2	1	2
2	64				4	6	35	12	5	1			1
2½	3						2	1					
3	2						1	1					
3½	1						1						
4													
≥ 4½													
All	684	8	13	7	21	78	373	133	20	10	6	7	8

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 200°–220°
Summer: May–Oct.

Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	67	1				5	48	4	1	3	4	1	
1	345				1	7	225	74	17	6	9	6	
1½	225		2			5	156	50	9	1	1	1	
2	88					4	53	25	2	2	2		
2½	25					1	15	9					
3	2						2						
3½													
4													
≥ 4½													
All	752	1	2		1	22	499	162	29	12	16	8	

Wind force ≥ 4, wind direction 200°–220°
Summer: May–Oct.

Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	66					1	46	5	2	2	4	6	
1	332		1			7	239	44	15	13	7	4	2
1½	324					5	255	46	10	4	3	1	
2	136					3	113	20					
2½	33					1	29	3					
3	14					2	12						
3½	4						4						
4													
≥ 4½													
All	909		1			19	698	118	27	19	14	11	2

Wind force ≥ 4, wind direction 200°–220°
Summer: May–Oct.

Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	34					1	18	9		1	2	3	
1	248				1	7	121	95	10	3	5	6	
1½	287					4	166	101	7	6	3		
2	194					5	122	58	9				
2½	61					1	40	20					
3	21						17	4					
3½	2						2						
4	6						6						
≥ 4½	2						1	1					
All	855				1	18	493	288	26	10	10	9	

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 200°–220°
Winter: Nov.–Apr. Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	76					5	48	16	3	1		2	
1	388				1	19	246	75	25	9	7	6	
1½	235					2	157	47	18	8	3		
2	147					4	90	43	4	5	1		
2½	40					2	29	8	1				
3	20					2	15	3					
3½	2							2					
4													
≥ 4½													
All	908				1	34	585	195	51	23	11	8	

Wind force ≥ 4, wind direction 200°–220°
Winter: Nov.–Apr. Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	58	1	1				33	10	3	1	3	6	
1	289					11	199	41	13	9	8	6	2
1½	323					22	181	87	12	14	7		
2	244					7	185	43	3	4	1	1	
2½	101						82	18	1				
3	44						36	8					
3½	1						1						
4	6						3	2		1			
≥ 4½	3						3						
All	1069	1	1			40	723	209	32	29	19	13	2

Wind force ≥ 4, wind direction 200°–220°
Winter: Nov.–Apr. Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +11	+11 to +13	+14 to +16	+17 to −17
0,½	31					3	16	5	3			4	
1	323		1			14	163	100	19	12	9	5	
1½	476					11	244	171	37	8	3	2	
2	293					2	164	109	14	3	1		
2½	124						80	40	4				
3	51						44	7					
3½	8						5	2	1				
4	5					1	4						
≥ 4½													
All	1311		1			31	720	434	78	23	13	11	

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 290°—310°
Summer: May—Oct. Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	9		1				7	1					
1	134				5	23	81	16	9				
1½	203				2	32	119	41	9				
2	124			1		21	86	10	6				
2½	71				2	15	50	3	1				
3	19				1	3	12	3					
3½	2						2						
4													
≥ 4½													
All	562		1	1	10	94	357	74	25				

Wind force ≥ 4, wind direction 290°—310°
Summer: May—Oct. Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	19						13	5			1		
1	134			3	5	13	83	24	6				
1½	177				3	14	127	24	9				
2	112					8	80	24					
2½	57					6	45	6					
3	21					2	18	1					
3½	5						5						
4	4						4						
≥ 4½													
All	529			3	8	43	375	84	15		1		

Wind force ≥ 4, wind direction 290°—310°
Summer: May—Oct. Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +11	+11 to +13	+14 to +16	+17 to −17
0,½	5						2	2	1				
1	179				1	30	84	54	9			1	
1½	166				4	33	92	32	5				
2	138				2		92	40	4				
2½	69					11	47	11					
3	31					2	23	6					
3½	9					1	8						
4	9						8	1					
≥ 4½													
All	606				7	77	356	146	19			1	

TABLES E *Numbers of observations*

Wind force ≥ 4, wind direction 290°–310°
Winter: Nov.–Apr.

Terschellingerbank

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	×17 to −17
0,½	4					1	3						
1	80	1	1	1	5	14	47	9	2				
1½	131			1	6	22	77	18	7				
2	163			1	1	25	104	25	7				
2½	97				1	15	64	16	1				
3	60					9	41	9	1				
3½	20					2	12	5	1				
4	16					8	6	2					
≥ 4½	15					3	12						
All	586	1	1	3	13	99	366	84	19				

Wind force ≥ 4, wind direction 290°–310°
Winter: Nov.–Apr.

Texel

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	8						7	1					
1	103				3	14	63	19	3	1			
1½	213		1	1	6	35	140	26	4				
2	176			1	5	26	117	26		1			
2½	96		1	1		15	69	10					
3	52				1	6	42	3					
3½	20					1	17	2					
4	21					4	16	1					
≥ 4½	16						16						
All	705		2	3	15	101	487	88	7	2			

Wind force ≥ 4, wind direction 290°–310°
Winter: Nov.–Apr.

Goeree

Wave height (m)	All directions	Wave direction minus wind direction (tens of degrees)											
		−16 to −14	−13 to −11	−10 to −8	−7 to −5	−4 to −2	−1 to +1	+2 to +4	+5 to +7	+8 to +10	+11 to +13	+14 to +16	+17 to −17
0,½	1						1						
1	82			1	2	12	47	17	3				
1½	158			1	1	27	89	33	7				
2	169				1	19	103	37	9				
2½	104				1	12	78	11	2				
3	69				1	9	47	12					
3½	37					10	23	4					
4	12					1	11						
≥ 4½	17					1	16						
All	649			2	6	91	415	114	21				

TABLE F 1 *Maximum wave heights (metres)*

All directions — Texel

Year	Month of the year												Su[1].)	Yr.[2])
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	5	6	6½	3½	2½	2	2½	3	2	(3)	4	5½	3½	6½
1950	2½	2½	3	3	2	2½	2½	2	(2½)	(2½)	3½	3	3	5½
1951	4	3	2½	3	2	2½	(2)	2½	2	2	3½	3½	3	4
1952	3½	3	2½	2½	2	2½	2	2½	3	4	4	3	3	3½
1953	4	(5½)	2½	(1½)	(2½)	1½	1½	2½	3	2½	3	3	3	5½
1954	6	2½	2½	2	2½	2	3	3½	(4)	(5)	3½	8	4	6
1955	4	2½	2½	2	4	2½	2	2½	2	3½	3	4	4	8
1956	5	2½	3	2	1½	2	3	3½	3½	3½	4	3½	3½	5
1957	3	2½	2½	2	2½	2½	2	4	3	2½	5	4	4	4
1958	7½	3	2½	2½	1½	1½	3	2	3½	4	1½	2	3½	7½
1959	4	2	2½	2½	2	2½	2½	1½	1½	4	3	4½	2½	4
1960	6	2	2	2½	2½	4	3½	2	2½	4	4	5½	4	6
1961	4	5	3½	1½	3½	2	4½	4	4	4½	4	6	4½	5½
1962	6	6½	2½	3½	4½	2	2½	4	4	3	4	6	4½	6½
1963	2½	1½	2	2	2	3	2	2½	4½	4	4½	2½	4½	6
Mean	4.5	3.3	2.8	2.4	2.5	2.3	2.6	2.8	3.0	3.5	4.5	4.3	3.6	5.6
St.dev.	1.4	1.6	1.1	0.6	0.9	0.6	0.7	0.8	0.7	0.8	0.8	1.6	0.6	1.3

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 1 *Maximum wave heights (metres)*

All directions — Noord-Hinder

Year	Month of the year												Su.[1])	Yr.[2])
	J	F	M	A	M	J	J	A	S	O	N	D		
1949														
1950	(no lightvessel on station until 18 Febr. 1953)													
1951														
1952														
1953			2½	2½	2½	2½	3	3	3½	2½	2½	2½	3½	
1954	3½	3½	2	2½	3	2½	(3½)	2½	3	3	3	5½	3½	3½
1955	4	3	3	2	3½	2½	2	3	2½	3½	3	3½	3½	5½
1956	3½	3	3	2½	2	2½	4	3	2½	4	4	3½	4	3½
1957	3	3	3	3	3	2	2½	3½	3½	2½	3½	3	3½	4
1958	4	4	2	2½	3	2	3	3	2½	4	2	2½	3	4
1959	4	2	2	4	2½	2	2	1½	2	8	3½	4	4	4
1960	4	3	2	3½	1½	3	4	3	4½	4½	4½	7½	4½	8
1961	5	5	3	1½	3	2	3½	4	2½	4½	4½	4	4	7½
1962	5	6	2	2½	3	2	2½	3½	2	3	4	6	3½	6
1963	4	2	2½	3	2½	2	1½	3	3	3	6	2½	3	6
Mean	3.9	3.4	2.5	2.7	2.7	2.3	2.9	3.0	2.9	3.9	3,7	4.0	3.6	5.2
St.dev.	0.6	1.2	0.4	0.6	0.5	0.3	0.8	0.6	0.7	1.5	1.1	1.6	0.5	1.7

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 1 *Maximum wave heights (metres)*

All directions — Terschellingerbank

Year	Month of the year												Su.[1]	Yr.[2]
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	7	4	7½	3	2	2	2	3	1½	3	(4)	(5½)	3	7½
1950	2½	3	4	3½	2½	3	3	(2)	2½	2½	2½	3	3½	5½
1951	4½	3	4	3	2½	(2½)	2	3	2½	2	4	3	3	4½
1952	3½	3	2½	2	2	2	2½	2½	3½	4	4	3½	3½	4
1953	4	6½	3	1½	2½	1½	2½	2½	3½	2½	2½	2½	3½	6½
1954	6½	2	2½	2½	3	(2)	(3)	(3½)	4	4½	3	9	4	6½
1955	4	3	2½	2½	3½	2½	2	4	2	3½	3½	4	4	9
1956	4½	2½	3½	1½	2	2½	3	3	2½	3	4	3	3	4½
1957	3½	2½	2	2	2½	2	1½	3	3	2½	2½	3	3	4
1958	4	3½	2½	2½	2	1½	2½	2	3	4	1½	2	3	4
1959	3	2½	2	2	2	2	1½	1½	1½	3	2	3½	2	4
1960	5½	2	2	2	2	3½	2½	2	1½	3	3½	4	3½	5½
1961	3	3½	4	1½	2½	2	2½	4	4½	4	4	5	4½	4
1962	3	(6½)	(2½)	(3½)	3½	4	3	3½	3	4	3	3½	4	6½
1963	3	1½	1½	2	1½	(3)	(2)	(2½)	(4½)	(4)	3	3	4½	4
Mean	4.1	3.3	3.1	2.3	2.4	2.4	2.4	2.8	2.9	3.3	3.1	3.8	3.5	5.3
St.dev.	1.3	1.4	1.4	0.6	0.5	0.7	0.4	0.7	1.0	0.7	0.8	1.7	0.6	1.5

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 1 *Maximum wave heights (metres)*

All directions — Goeree

Year	Month of the year												Su.[1]	Yr.[2]
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	4	4	7½	3½	2	(2)	(2½)	3	2	4½	4½	7	3½	7½
1950	2½	2½	2½	3	2	(2½)	3	3	4	3	3½	3	4	7
1951	3½	3½	4	3	(2)	2	2½	2½	2½	2	3½	3½	3	4
1952	3½	3	3	2	1½	2½	3	2½	3	3½	4½	4½	3	3½
1953	4½	5	2½	2	2½	2½	3	3	3½	2½	3	2½	3½	5
1954	6	3	3	3	3	3	3½	3½	(3)	(5)	3½	8	3½	6
1955	5½	3	3	2½	5½	2½	2½	3½	2½	4	3½	4	5½	8
1956	4	2½	3½	2½	2	2½	4	4	3	4	4	3½	4	4
1957	3½	2½	3	3	3	2½	2½	4	4	3	3½	3½	4	4
1958	6	3½	2	2½	3	2	3	2½	4	4	2½	3½	4	6
1959	5	2	2½	3½	3	2½	3	3	2	5½	3½	4	3½	5
1960	6	3	3½	3	2	4	3½	3½	4	4	6	6½	4	6
1961	5	4½	5	1½	3	2½	5	4	3	6	4½	4½	5	6½
1962	4½	5	2	3	3	3	(2½)	(4)	(4)	3	5	6	3½	6
1963	4½	1½	2½	2	2½	3½	2	3½	3½	3	5½	2	3½	6
Mean	4.5	3.2	3.3	2.7	2.7	2.6	3.0	3.3	3.2	3.8	4.0	4.4	3.8	5.6
St.dev.	1.1	1.0	1.4	0.6	0.9	0.5	0.7	0.5	0.7	1.1	0.9	1.7	0.7	1.3

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 2 *Maximum wind forces (Bft.)*

All directions — Texel

Year	Month of the year												Su.[1])	Yr.[2])
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	10	10	11	8	6	6	7	8	(6)	(10)	9	11	8	11
1950	6	9	7	9	6	7	7	7	(8)	(7)	8	9	9	11
1951	9	8	8	7	6	7	(6)	7	7	7	10	9	7	9
1952	8	8	9	7	6	7	6	6	8	9	11	8	8	10
1953	11	11	7	(6)	(6)	5	6	7	8	6	8	8	8	11
1954	11	6	7	6	6	6	7	8	(8)	10	9	11	8	11
1955	8	8	7	6	10	6	5	7	6	9	9	9	10	11
1956	10	7	7	6	5	7	10	8	8	8	8	8	10	10
1957	9	7	7	7	8	6	6	9	9	8	10	10	9	10
1958	11	9	7	7	7	6	8	7	9	9	7	7	9	11
1959	9	7	7	7	7	8	7	6	6	10	8	9	8	9
1960	11	7	7	7	6	9	8	6	7	8	9	10	9	11
1961	10	10	9	7	9	7	9	9	9	9	9	11	9	10
1962	10	11	7	8	8	7	7	9	8	8	9	10	9	11
1963	9	6	7	7	7	8	6	8	9	8	10	8	9	10
Mean	9.5	8.0	7.6	7.0	6.9	6.8	7.0	7.5	7.7	8.4	8.9	9.2	8.7	10.4
St.dev.	1.4	1.6	1.1	0.8	1.3	1.0	1.3	1.0	1.1	1.1	1.0	1.2	0.8	0.7

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 2 *Maximum wind forces (Bft.)*

All directions — Noord-Hinder

Year	Month of the year												Su.[1])	Yr.[2])
	J	F	M	A	M	J	J	A	S	O	N	D		
1949														
1950	(no lightvessel on station until 18 Febr. 1953)													
1951														
1952														
1953			7	6	7	7	7	7	9	7	8	6	9	
1954	9	8	8	7	9	7	(8)	8	7	8	10	11	9	9
1955	10	7	7	5	9	6	6	6	6	8	7	9	9	11
1956	9	8	7	6	6	6	10	8	7	9	9	8	10	9
1957	8	7	8	7	7	5	7	9	9	8	10	8	9	10
1958	10	9	6	7	7	7	8	6	8	9	7	7	8	10
1959	9	6	6	8	6	7	7	6	6	11	10	9	8	9
1960	10	7	8	7	6	8	9	6	9	8	10	11	9	11
1961	9	9	8	5	8	6	8	9	7	10	10	9	9	11
1962	10	10	7	8	7	6	7	8	7	8	8	11	8	10
1963	9	6	7	7	6	7	5	8	8	8	10	7	8	11
Mean	9.3	7.7	7.2	6.6	7.1	6.5	7.4	7.4	7.5	8.5	9.0	8.7	8.7	10.1
St.dev.	0.6	1.1	0.7	1.0	1.1	0.8	1.3	1.2	1.1	1.1	1.2	1.7	0.6	0.8

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 2 *Maximum wind forces (Bft.)*

All directions — Terschellingerbank

Year	Month of the year												Su.[1]	Yr.[2]
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	10	11	12	8	6	5	7	8	6	10	(9)	(11)	8	12
1950	7	9	8	9	6	8	8	(7)	8	7	8	9	9	11
1951	10	9	8	7	6	(7)	(6)	7	9	6	9	9	9	10
1952	8	7	9	6	7	7	7	6	10	9	9	8	10	9
1953	11	12	9	6	6	5	6	7	8	6	7	6	8	12
1954	10	6	7	7	6	(6)	(7)	(8)	8	11	8	11	8	10
1955	9	9	7	6	9	6	6	7	6	8	8	9	9	11
1956	10	7	8	5	6	7	10	9	8	8	8	9	10	10
1957	9	7	7	6	7	6	6	9	8	9	10	10	9	10
1958	11	10	8	7	7	5	7	7	9	10	6	7	9	11
1959	10	7	7	7	7	7	7	5	5	9	9	10	7	10
1960	10	7	7	7	6	9	8	6	7	7	10	10	9	10
1961	9	9	9	6	8	6	8	9	8	9	10	11	9	10
1962	9	(11)	(7)	(8)	8	7	7	8	8	8	9	9	8	11
1963	8	6	6	7	7	(8)	(6)	(8)	(9)	(8)	10	7	9	9
Mean	9.4	8.5	7.9	6.8	6.8	6.6	7.1	7.4	7.8	8.3	8.7	9.1	8.7	10.4
St.dev.	1.1	1.9	1.4	1.0	0.9	1.1	1.1	1.1	1.3	1.4	1.1	1.5	0.7	0.8

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLE F 2 *Maximum wind forces (Bft.)*

All directions — Goeree

Year	Month of the year												Su.[1]	Yr.[2]
	J	F	M	A	M	J	J	A	S	O	N	D		
1949	9	8	11	8	5	(6)	(7)	8	6	9	9	10	8	11
1950	7	7	7	8	6	(7)	7	7	8	7	8	8	8	10
1951	9	9	9	7	(6)	6	6	7	7	6	9	10	7	9
1952	9	8	8	6	6	7	8	8	9	8	10	9	9	10
1953	11	11	7	6	6	6	7	8	9	6	8	6	9	11
1954	10	8	7	6	7	7	8	8	(7)	(10)	9	11	8	10
1955	9	7	8	6	9	6	6	7	6	9	7	9	9	11
1956	9	7	8	6	6	7	9	9	8	9	8	8	9	9
1957	8	7	7	7	7	6	7	10	9	8	10	9	10	9
1958	10	9	7	7	7	7	9	7	9	9	7	8	9	10
1959	9	6	6	8	7	6	7	6	6	11	9	9	8	9
1960	10	7	8	7	6	8	8	6	8	8	9	11	8	11
1961	9	9	9	6	8	6	8	9	8	10	10	9	9	11
1962	10	10	7	9	8	7	(7)	(9)	(8)	8	9	11	9	10
1963	10	5	7	6	7	8	6	8	8	8	10	7	8	11
Mean	9.3	7.9	7.7	6.9	6.7	6.7	7.3	7.8	7.7	8.4	8.8	9.0	8.5	10.1
St.dev.	0.9	1.7	1.2	0.9	1.0	0.7	1.0	1.1	1.1	1.4	1.0	1,4	0.7	0.8

[1]) 'Summer' = months April to Sept., incl.
[2]) 'Year' = July of previous year to June of year indicated, incl.

TABLES G 1 *Numbers of occasions in 15 months (years 1949 to 1963 incl.)*

Wave height > 1¾ m — Goeree

Month	All durations	Duration of period at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	94	82	76	64	52	37	27	22	17
Feb.	64	57	53	46	33	22	16	14	10
Mar.	55	49	47	40	24	15	11	7	5
Apr.	62	53	49	42	30	17	15	9	4
May	50	44	39	32	19	14	10	6	5
June	60	53	43	39	19	12	6	4	2
July	64	57	52	49	37	28	17	8	6
Aug.	69	61	55	54	37	24	13	8	6
Sep.	69	61	54	47	31	26	15	15	10
Oct.	76	69	62	57	35	29	23	16	12
Nov.	83	77	74	67	48	33	24	21	16
Dec.	88	84	78	73	51	38	27	21	15

Example. Near the lightvessel Goeree, in 15 October months 76 periods with wave height exceeding 1¾ metres began; strictly speaking: 76 series of one or more consecutive three-hourly observations with wave height exceeding 1¾ metres (see, however, the end of par. 1.7.5), that is an average of 5.1 of such periods per October month, or on the average once in 6 October days. In 15 October months 57 of such periods lasted 12 hours (4 observations) or longer, 23 lasted two days (16 observations) or longer.

Wave height > 2¾ m — Goeree

Month	All durations	Duration of period at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	56	49	45	36	18	7	5	2	2
Feb.	24	21	17	14	7	2	0		
Mar.	17	16	14	8	3	1	1	1	1
Apr.	13	12	10	7	1	0			
May	12	8	6	6	2	1	0		
June	6	5	4	3	2	0			
July	19	17	12	10	2	2	0		
Aug.	33	27	18	11	6	2	1	0	
Sep.	30	26	24	17	5	0			
Oct.	34	30	25	20	11	8	6	4	2
Nov.	40	34	28	23	14	5	4	3	2
Dec.	45	38	34	26	13	7	4	2	2

Wave height > 3¾ m — Goeree

Month	All durations	Duration of period at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	22	17	12	7	0				
Feb.	7	5	4	4	1	0			
Mar.	3	3	2	2	0				
Apr.	0								
May	1	1	1	1	0				
June	1	1	0						
July	2	2	2	1	1	0			
Aug.	4	3	2	1	0				
Sep.	6	4	0						
Oct.	9	8	8	7	2	2	0		
Nov.	10	9	9	7	1	1	0		
Dec.	14	12	11	9	4	2	1	0	

TABLES G 2 *Numbers of occasions in 15 months (years 1949 to 1963 incl.).*

Wind force ≥ 7 — Goeree

Month	All durations	Duration of gale at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	82	73	60	56	35	16	10	5	1
Feb.	44	39	29	23	14	7	4	2	1
Mar.	29	21	13	10	5	2	1	1	1
Apr.	25	19	19	15	5	0			
May	15	13	11	8	4	1	0		
June	12	6	5	3	2	1	0		
July	29	21	18	13	4	2	0		
Aug.	41	33	25	19	12	3	1	0	
Sep.	37	29	24	17	7	3	1	0	
Oct.	58	45	36	27	17	11	7	4	3
Nov.	70	59	48	39	21	10	7	2	1
Dec.	77	62	50	43	22	13	7	4	4

Example. Near the lightvessel Goeree, in 15 October months 58 periods with wind force 7 or more began; strictly speaking: 58 series of one or more consecutive three-hourly observations with wind force 7 or more (see, however, the end of par. 1.7.5), that is an average of 3.9 of such periods per October month, or on the average once in 8 October days. In 15 October months 45 of such periods lasted 6 hours (2 observations) or longer, 17 lasted one day (8 observations) or longer.

Wind force ≥ 8 — Goeree

Month	All durations	Duration of gale at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	53	42	33	28	10	4	2	1	0
Feb.	18	13	8	8	4	2	1	1	0
Mar.	11	9	6	5	2	0			
Apr.	5	5	4	1	0				
May	4	4	3	1	0				
June	2	2	1	1	0				
July	9	6	5	3	2	1	0		
Aug.	17	13	11	8	1	1	0		
Sep.	15	11	8	5	1	0			
Oct.	23	19	15	12	6	3	1	0	
Nov.	37	32	24	20	9	3	0		
Dec.	45	40	26	23	12	5	4	1	1

Wind force ≥ 9 — Goeree

Month	All durations	Duration of gale at least							
		hours			days				
		6	9	12	1	1½	2	2½	3
Jan.	23	16	12	10	2	0			
Feb.	7	5	4	3	1	0			
Mar.	3	3	3	2	1	0			
Apr.	1	0							
May	2	1	1	0					
June	0								
July	2	1	1	0					
Aug.	4	2	1	1	1	0			
Sep.	4	3	1	1	0				
Oct.	9	7	6	3	1	1	0		
Nov.	14	10	7	6	2	0			
Dec.	19	16	12	8	1	0			

TABLE G 3 *Numbers of occasions (spells) in 15 months (years 1949 to 1963 incl.)*

Wave height $< \frac{3}{4}$ m — Goeree

Month	Duration of spell (days)								
	one half day and more	½-<1	1-<2	2-<3	3-<4	4-<6	6-<8	8-<10	10 and more
Jan.	72	36	21	6	7	2			
Feb.	73	33	21	7	5	5	1		1
Mar.	100	40	32	12	5	7	3	1	
Apr.	89	32	26	17	6	5	1	2	
May	101	38	33	12	8	8	2		
June	89	36	23	14	4	8	3	1	
July	95	31	35	18	4	4	2	1	
Aug.	92	31	33	14	5	8			1
Sep.	70	20	30	9	6	3	2		
Oct.	72	25	20	12	8	4	2	1	
Nov.	58	23	20	9	3	2	1		
Dec.	65	28	21	8	6	2			

Example. Near the lightvessel Goeree, in 15 April months 89 periods with wave height below $\frac{3}{4}$ metres and lasting one half day or more began; strictly speaking: 89 series of four or more consecutive three-hourly observations with wave height below $\frac{3}{4}$ metres, that is an average of about 6 of such periods per April month, or on the average once in 5 April days. In 15 April months 26 of such periods lasted one day or longer but less than two days (8 to 15 observations), $6 + 5 + 1 + 2 = 14$ of them lasted three days or longer.

TABLE G 3 *Numbers of occasions (spells) in 15 months (years 1949 to 1963 incl.)*

Wave height $< \frac{1}{4}$ m — Goeree

Month	Duration of spell (days)								
	one half day and more	½-<1	1-<2	2-<3	3-<4	4-<6	6-<8	8-<10	10 and more
Jan.	18	13	5						
Feb.	26	17	5	3		1			
Mar.	45	28	11	4	1	1			
Apr.	39	18	12	4	3	2			
May	46	30	11	2	2	1			
June	40	25	8	5	2				
July	34	25	7	2					
Aug.	51	36	14	1					
Sep.	34	24	6	3	1				
Oct.	24	11	9	2	1	1			
Nov.	22	18	4						
Dec.	24	16	6	1	1				

TABLE G 4 *Numbers of occasions (spells) in 15 months (years 1949 to 1963 incl.)*

Wind force ≤ 3 — Goeree

Month	Duration of spell (days)								
	one half day and more	½-<1	1-<2	2-<3	3-<4	4-<6	6-<8	8-<10	10 and more
Jan.	83	40	28	9		5		1	
Feb.	99	46	35	9	4	3	1		1
Mar.	112	59	23	11	9	7	2		1
Apr.	129	60	43	14	5	5	1	1	
May	124	49	42	19	4	6	4		
June	117	51	34	18	4	6	2		2
July	112	47	37	14	7	6	1		
Aug.	114	51	38	14	4	4	1		2
Sep.	106	58	30	9	3	3	2		1
Oct.	92	43	21	16	7	1	3	1	
Nov.	75	40	19	9	4	3			
Dec.	84	38	32	5	6	3			

Example. Near the lightvessel Goeree, in 15 October months 92 periods with wind force 3 or less and lasting one half day or more began; strictly speaking: 92 series of four or more consecutive three-hourly observations with wind force 3 or less, that is an average of 6.1 of such periods per October month, or on the average once in 5 October days. In 15 October months 21 of such periods lasted one day or longer but less than two days (8 to 15 observations), none of them lasted ten days or longer.

TABLE G 4 *Numbers of occasions (spells) in 15 months (years 1949 to 1963 incl.)*

Wind force ≤ 2 — Goeree

Month	Duration of spell (days)								
	one half day and more	½-<1	1-<2	2-<3	3-<4	4-<6	6-<8	8-<10	10 and more
Jan.	39	26	9	3	1				
Feb.	39	23	11	4		1			
Mar.	72	41	21	5	4	1			
Apr.	64	35	22	6	1				
May	74	55	13	5		1			
June	69	45	16	6	2				
July	69	41	22	5	1				
Aug.	70	49	17	2		1	1		
Sep.	49	36	10	2		1			
Oct.	51	28	20	3					
Nov.	31	23	7	1					
Dec.	39	27	8	4					

TABLE G 5 *Total duration of spells lasting one half day at least*

Wave height $< \frac{3}{4}$ m — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting one half day at least in an individual month							
			0	$\frac{1}{2}$-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	6.4	15		2	1	9	1	2			
Feb.	8.2	15			2	6	5		2		
Mar.	11.9	15			1	1	4	7	2		
Apr.	10.9	15				6	5	1	1	2	
May	11.8	15			1	1	6	5	1	1	
June	11.0	15			1	1	6	7			
July	11.3	15			2	2	3	5	3		
Aug.	11.8	15			1	5	1	5	2	1	
Sep.	9.7	15		1	1	4	5	2	1	1	
Oct.	9.3	15		1	1	4	4	4	1		
Nov.	6.1	15		1	5	4	4	1			
Dec.	6.4	15	1		3	6	4	1			

Example. Near the lightvessel Goeree, in March the mean total duration of all periods with wave height below $\frac{3}{4}$ metres and lasting one half day at least was 11.9 days, that is a frequency of 11.9/31 = 38 parts per hundred (this may be compared with the value 42.0 parts per hundred following from table H for *all* observations with wave height below $\frac{3}{4}$ metres in the years 1949-'63). In 2 of the 15 March months considered the total duration of such periods was 16 days or more but less than 20 days.

TABLE G 5 *Total duration of spells lasting one half day at least*

Wave height $< \frac{1}{4}$ m — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting one half day at least in an individual month							
			0	$\frac{1}{2}$-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	1.0	15	4	9	2						
Feb.	1.8	15	5	7	1	1	1				
Mar.	3.6	15	2	1	6	6					
Apr.	3.4	15	2	3	6	2	2				
May	3.3	15		5	4	6					
June	2.7	15	1	5	5	4					
July	2.3	15	3	5	3	4					
Aug.	2.8	15	2	6	2	5					
Sep.	2.3	15	4	3	3	5					
Oct.	2.2	15	4	4	2	5					
Nov.	1.2	15	6	5	2	2					
Dec.	1.6	15	2	8	5						

TABLE G 6 *Total duration of spells lasting one half day at least*

Wind force ≤ 3 — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting one half day at least in an individual month							
			0	½-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	7.8	15		1	3	6	2	1	2		
Feb.	9.1	15			2	4	5	3	1		
Mar.	13.0	15				1	6	5	2	1	
Apr.	12.6	15				2	4	6	2	1	
May	13.6	15			1		4	6	2	2	
June	12.7	15				1	6	3	5		
July	12.3	15				2	5	6	1	1	
Aug.	12.9	15			1	2	3	6		3	
Sep.	10.5	15			1	4	6	3			1
Oct.	10.0	15				4	6	3	2		
Nov.	6.6	15			3	8	3	1			
Dec.	7.6	15		1	1	5	8				

Example. Near the lightvessel Goeree, in October the mean total duration of all periods with wind force 3 or less and lasting one half day at least was 10.0 days, that is a frequency of 10.0/31 = 33 parts per hundred (this may be compared with the value 36.4 parts per hundred following from table H for *all* observations with winds of force 3 or less in the years 1949-'63). In 2 of the 15 October months considered the total duration of such periods was 16 days or more but less than 20 days.

TABLE G 6 *Total duration of spells lasting one half day at least*

Wind force ≤2 — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting one half day at least in an individual month							
			0	½-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	2.6	15	1	7	3	4					
Feb.	2.8	15	2	5	6		2				
Mar.	5.6	15			5	8		2			
Apr.	4.3	15		3	6	3	3				
May	4.7	15	1		6	6	2				
June	4.5	15		1	6	7	1				
July	4.6	15		3	5	4	2	1			
Aug.	4.7	15	1	1	7	4	1	1			
Sep.	2.8	15	2	5	4	3	1				
Oct.	3.6	15		5	3	7					
Nov.	1.7	15	1	9	4	1					
Dec.	2.3	15	1	7	5	2					

TABLE G 7 *Total duration of spells lasting at least one day*

Wave height $< \frac{3}{4}$ m — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting at least one day in an individual month							
			0	1-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	4.8	15	2	2	2	6	3				
Feb.	5.4	15		1	3	7	2		2		
Mar.	10.1	15		1		1	10	3			
Apr.	9.5	15			2	6	3	1	2	1	
May	10.1	15		1		4	5	4	1		
June	9.5	15			2	3	4	6			
July	9.9	15		2		4	3	4	2		
Aug.	10.4	15	1			6		6	2		
Sep.	8.8	15	1	1	1	5	3	3		1	
Oct.	8.2	15		2	1	4	4	4			
Nov.	5.0	15	1	2	4	4	3	1			
Dec.	5.2	15	1	2	2	7	3				

Example. Near the lightvessel Goeree, in March the mean total duration of all periods with wave height below $\frac{3}{4}$ metres and lasting one day at least was 10.1 days. In 3 of the 15 March months considered the total duration of such periods was 12 days or more but less than 16 days.

TABLE G 7 *Total duration of spells lasting at least one day*

Wave height $< \frac{1}{4}$ m — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.								
		Total	Total duration (days) of spells lasting at least one day in an individual month							
			0	1-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	0.5	15	10	5							
Feb.	1.1	15	9	4	1		1				
Mar.	2.4	15	3	5	3	4					
Apr.	2.7	15	4	3	4	3	1				
May	2.0	15	3	6	2	4					
June	1.6	15	7	2	5	1					
July	1.2	15	9	1	4	1					
Aug.	1.2	15	8	2	4	1					
Sep.	1.3	15	7	3	4	1					
Oct.	1.7	15	7	2	2	4					
Nov.	0.4	15	12	2	1						
Dec.	0.9	15	7	6	2						

TABLE G 8 *Total duration of spells lasting at least one day*

Wind force ≤ 3 — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.									
		Total	Total duration (days) of spells lasting at least one day in an individual month								
			0	1-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	6.1	15	1	3	2	5	1	1	2		
Feb.	7.2	15	1		4	3	5	2			
Mar.	10.4	15			1	3	7	2	2		
Apr.	9.9	15		1	1	3	5	5			
May	11.2	15		1		1	6	5	1	1	
June	10.5	15				5	3	7			
July	10.2	15			1	3	7	2	2		
Aug.	10.5	15	1		1	3	6	1	1	2	
Sep.	8.1	15		1	2	6	4	1			1
Oct.	8.3	15			2	7	3	1	2		
Nov.	4.7	15		1	7	5	2				
Dec.	6.0	15	1	1	2	6	5				

Example. Near the lightvessel Goeree, in October the mean total duration of periods with wind force 3 or less and lasting one day at least was 8.3 days. In 2 of the 15 October months considered the total duration of such periods was 16 days or more but less than 20 days.

TABLE G 8 *Total duration of spells lasting at least one day*

Wind force ≤ 2 — Goeree

Month	Mean total duration per month (days)	Number of years in 1949 to 1963 incl.									
		Total	Total duration (days) of spells lasting at least one day in an individual month								
			0	1-<2	2-<4	4-<8	8-<12	12-<16	16-<20	20-<24	24-31
Jan.	1.4	15	6	4	4	1					
Feb.	1.9	15	7	3	3	1	1				
Mar.	3.8	15	3	2	4	4	2				
Apr.	2.9	15	4	4	4	1	2				
May	2.3	15	5	3	3	4					
June	2.8	15	3	4	4	4					
July	2.9	15	4	5	1	4	1				
Aug.	3.7	15	7	1	4	1	2				
Sep.	1.5	15	7	5	2		1				
Oct.	2.4	15	4	3	3	5					
Nov.	0.8	15	9	4	2						
Dec.	1.3	15	7	3	4	1					

TABLE H *Parts per thousand (fractions of time)*

All directions — Goeree

A = nine years 1949 to 1957 inclusive
B = fifteen years 1949 to 1963 inclusive

Month	Wind force						Wave height							
	4 and more		6 and more		8 and more		below ¾m		above 1¾m		above 2¾m		above 3¾m	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Jan.	667	704	248	282	44	60	232	229	300	304	74	91	12	17
Feb.	601	623	182	190	16	27	286	326	232	209	31	41	5	10
Mar.	504	526	114	106	16	11	403	420	170	132	30	22	4	3
Apr.	534	531	84	104	4	4	312	388	156	146	18	15		
May	488	513	57	70	4	4	398	414	115	109	11	13	2	1
June	466	512	37	60		2	354	396	92	101	2	8		1
July	537	552	109	113	7	8	343	395	186	159	24	23	4	3
Aug.	509	543	137	142	19	18	388	413	180	175	39	36	2	3
Sep.	608	597	174	148	13	14	290	344	267	202	44	37	3	3
Oct.	619	636	180	194	17	30	274	324	231	219	52	62	9	15
Nov.	728	727	277	274	33	46	184	234	322	294	65	70	9	12
Dec.	699	710	295	283	63	61	187	230	342	302	79	75	22	23
Year	579	597	158	164	19.7	23.9	305	343	216	196	39	42	6.0	7.7

TABLE I 1 *Chronological list of series of observations*

Wave height ⩾ 5 m and/or wind force ⩾ 10	Four lightvessels

Explanation (compare par. 1.5.1, 1.5.2 and 1.6 of text)

Every line represents simultaneous wind and wave observations of all lightvessels present. Blanks in the columns for wind and first wave group mean that observations are lacking. Time is G.M.T.

dd is reported wind direction in tens of degrees with respect to true North.

B is reported wind force Beaufort.

$d_w d_w$ is reported direction from which waves came, in tens of degrees with respect to true North; $d_w d_w = 49$ or 99 means confused waves.

P_w is code figure for wave period: $P_w = 2$ means 5 seconds or less, $P_w = 3$ means higher than 5 but no more than 7 sec, $P_w = 4$ means higher than 7 but no more than 9 sec, etc. $P_w = x$ means: wave period 'indeterminate'.

H_w is wave height expressed in *half* metres; values in parentheses were not really reported but are rated values (see par. 1.7.3 of text).

From 1958 on, the first wave group $d_w d_w P_w H_w$ always represents wind waves ('sea') and the second wave group (if present) represents swell; if then no second wave group has been given, this means that no typical swell could be observed.

TABLE I 1

Year and month	Day and hr.		Noord Hinder						Goeree						
			dd	B	$d_w d_w$	$P_w H_w$	$d_w d_w$	$P_w H_w$	dd	B	$d_w d_w$	$P_w H_w$	$d_w d_w$	P_w
1949														
Jan.	01	21							22	9	22	5	8	
	02	00							22	9	22	4	8	
	02	03							22	9	22	4	8	
	02	06							20	9	20	4	8	
	02	09							20	7	20	3	6	
	02	12							20	7	20	3	6	
	02	15							20	6	20	3	5	
Jan.	20	21							27	5	29	3	4	
	21	00							27	6	27	4	5	
	21	03							27	6	27	4	5	
	21	06							27	6	27	4	5	
	21	09							27	6	27	3	5	
	21	12							27	6	27	4	5	
	21	15							31	6	29	4	5	
	21	18							31	6	29	4	5	
Febr.	09	15							24	7	24	5	6	
	09	18							27	7	27	5	6	
	09	21							29	7	27	6	7	
	10	00							27	7	27	6	8	
	10	03							27	7	27	6	8	
	10	06							27	7	27	6	8	
Febr.	27	12							27	6	27	5	7	
	27	15							27	6	27	5	7	
	27	18							30	7	27	5	7	
	27	21							32	8	27	5	7	
	28	00							32	7	27	5	7	
Mar.	01	00							27	8	27	5	6	
	01	03							25	9	27	5	6	
	01	06							30	10	27	6	7	
	01	09							32	11	30	7	15	
	01	12							34	11	30	7	15	
	01	15							34	10	30	7	14	
	01	18							34	8	32	5	9	
	01	21							34	8	32	5	9	
	02	00							34	9	34	5	12	
	02	03							36	8	34	5	9	
Oct.	26	09							20	8	20	4	6	
	26	12							20	9	20	5	9	
	26	15							20	9	20	5	9	
	26	18							32	9	20	5	9	32 7
Dec.	04	06							25	9	25	4	8	
	04	09							32	9	30	5	8	

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
18	8	20	3	7				18	9	22	3	6			
18	8	20	3	7				20	10	22	3	7			
20	10	20	4	10				20	10	22	2	7			
22	8	22	4	8				22	9	22	3	6			
18	8	20	4	3				18	9	22	3	5			
19	9	21	4	10				20	10	22	3	6			
20	9	22	4	8				22	9	22	3	6			
27	9	28	4	6				26	8	26	4	8			
26	9	26	4	7				25	9	26	4	11			
27	9	27	4	7				24	9	25	4	12			
27	9	27	4	7				29	8	26	4	13			
29	9	28	4	8				29	9	28	5	14			
30	8	28	4	8				28	8	28	5	11			
30	8	28	4	8				27	8	27	5	10			
32	8	30	4	7				31	8	28	4	8			
25	8	24	4	6				21	8	20	2	4			
27	8	27	3	7				26	11	25	3	7			
27	8	27	4	7				26	11	26	4	8			
27	10	27	4	8				26	10	26	4	8			
27	10	27	6	8				27	10	26	4	8			
30	8	27	6	8				27	8	26	4	8			
29	8	28	4	6				28	9	28	4	7			
28	9	28	4	6				27	10	28	4	8			
30	10	30	5	9				29	10	29	5	8			
32	10	32	5	12				31	10	30	5	8			
32	8	32	4	8				27	8	30	4	6			
22	9	24	5	8				26	9	25	4	6			
24	9	24	5	8				26	10	26	4	7			
27	11	28	4	9				26	11	26	4	8			
34	10	30	5	13				34	12	34	4	15			
34	9	32	5	9				34	11	34	4	14			
34	9	32	5	8				35	10	34	4	13			
30	9	32	6	8				33	9	31	4	11			
33	8	32	6	8				34	9	34	4	10			
35	8	32	6	8				34	8	34	4	8			
35	7	32	5	7				02	8	01	4	8			
								18	9	20	2	4			
								20	10	24	2	6			
								22	10	24	3	6			
								31	7	30	3	3			
25	9	25	3	7											
29	10	28	4	7											

TABLE I1 *(continued)*

Year and month	Day and hr.		Noord Hinder							Goeree							
			dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H
1949																
Dec.	04	12								29	9	30	6	8		
	04	15								29	8	30	5	7		
	04	18								29	9	30	5	7		
	04	21								29	9	29	5	8		
	05	00								27	8	29	5	7		
	05	03								27	8	29	5	7		
	05	06								27	8	27	4	6		
	05	09								27	8	27	4	8		
	05	12								25	7	27	4	7		
	05	15								27	8	27	5	8		
	05	18								29	8	29	5	8		
	05	21								32	9	30	5	9		
	06	00								29	8	30	5	9		
Dec.	17	12								29	8	27	4	7		
	17	15								29	9	27	5	9		
	17	18								29	10	29	5	14		
	17	21								29	10	29	5	13		
	18	00								29	10	29	5	13		
	18	03								29	10	29	5	13		
	18	06								29	10	29	5	12		
	18	09								29	9	29	5	11		
1951																
Jan.	07	09								27	7	22	4	5		
	07	12								24	7	24	4	5		
	07	15								25	7	24	4	5		
	07	18								24	6	25	4	5		
	07	21								24	5	24	3	4		
1952																
Nov.	06	00								27	7	27	3	5		
	06	03								30	7	29	4	6		
	06	06								30	8	29	4	7		
	06	09								30	8	29	4	7		
	06	12								32	7	29	4	7		
	06	15								32	7	29	4	6		
	06	18								27	6	29	4	5		
	06	21								27	7	25	3	4		
	07	00								29	9	29	4	8		
	07	03								30	10	30	4	9		
	07	06								36	10	49	x	(9)		
	07	09								36	10	30	4	6	36	5
	07	12								36	10	32	4	7	36	5
	07	15								34	9	32	4	6	36	4

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
28	10	28	4	7											
28	10	28	4	10											
29	11	29	4	10											
28	9	28	5	11											
28	10	28	5	11											
28	9	28	5	11											
28	9	28	5	11											
26	8	27	5	10											
24	9	25	5	11											
30	10	29	5	11											
30	10	29	5	11											
30	10	29	5	11											
31	9	30	4	8											
28	9	27	3	5											
31	10	30	4	10											
30	10	30	4	10											
31	11	30	5	10											
29	9	30	4	9											
30	10	30	4	10											
30	9	30	4	10											
30	9	30	4	9											
28	7	24	4	5				24	8	24	3	6			
27	8	27	4	7				24	10	24	4	8			
29	9	29	4	8				26	10	25	4	9			
29	8	29	4	8				25	10	25	4	8			
28	7	29	4	7				27	9	27	4	8			
28	9	28	4	5				27	7	27	3	5			
28	10	28	4	6				30	8	27	5	6			
29	10	29	4	7				30	9	27	5	8			
30	9	30	5	7				31	9	27	5	8			
30	9	30	6	7				31	8	27	5	8			
29	9	30	6	7				30	8	27	5	6			
27	6	29	6	6				28	6	29	5	6			
20	4	29	6	4				25	4	29	5	5			
27	11	28	4	4				11	6	29	4	3	11	2	3
04	6	28	4	6				06	5	09	2	2	29	4	3
36	8	36	3	3	30	4	4	36	6	04	2	2	29	4	4
34	10	36	5	8				36	9	36	4	6			
34	9	35	5	7				34	9	34	4	8			
32	8	35	5	7				34	8	34	4	7			

TABLE I1 *(continued)*

Year and month	Day and hr.		Noord Hinder							Goeree						
			dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H
1953																
Jan.	31	15								29	8	30	4	6		
	31	18								29	10	30	4	7		
	31	21								29	11	30	5	9		
Febr.	01	00								33	11	32	5	9		
	01	03								32	10	32	5	9		
	01	06								32	11	32	5	9		
	01	09								34	11	33	5	10		
	01	12								34	10	34	5	10		
	01	15								34	9	34	5	8		
1954																
Jan.	15	18	25	8	25	6	6			26	8	24	5	6		
	15	21	27	9	27	6	7			26	9	25	5	7		
	16	00	27	9	27	6	7			26	10	27	5	10		
	16	03	27	9	27	6	7			26	10	27	5	10		
	16	06	27	9	27	6	7			27	10	27	5	12		
	16	09	27	9	27	5	7			27	10	27	5	11		
	16	12	27	9	27	5	7			26	9	27	5	12		
	16	15	27	8	27	5	5			28	8	27	5	9		
	16	18	29	6	27	5	4			27	8	27	4	8		
	16	21	28	7	27	5	4			27	7	27	4	7		
Oct.	06	21	34	7	34	5	5									
	07	00	29	7	34	5	5									
	07	03	32	7	34	5	5									
	07	06	34	8	34	5	5									
	07	09	34	8	36	6	6									
Dec.	04	15	24	8	24	5	5			25	8	25	4	6		
	04	18	27	10	27	6	7			29	10	28	5	8		
	04	21	28	9	29	6	8			29	10	29	5	8		
	05	00	29	8	28	6	7			30	9	30	5	8		
Dec.	21	15	23	7	25	5	5			26	8	28	5	7		
	21	18	26	9	26	6	6			27	10	29	4	9		
	21	21	29	8	27	6	5			31	10	30	5	9		
	22	00	29	10	29	6	7			30	10	30	5	10		
	22	03	29	9	29	6	7			31	10	31	5	11		
	22	06	31	9	30	6	7			31	10	31	5	11		
	22	09	31	9	31	6	7			32	10	32	5	9		
	22	12	30	8	30	6	6			33	9	32	5	9		
	22	15	28	7	29	5	5			32	8	32	5	7		
	22	18	28	7	29	5	4			29	7	31	5	6		
	22	21	29	7	29	5	4			27	7	30	4	6		
	23	00	26	8	26	5	5			28	8	30	4	5		

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
27	8	27	4	5				28	8	28	4	5			
28	11	28	3	8				27	11	28	5	8			
29	11	29	4	8				32	10	28	5	8	32	5	7
30	11	30	4	9				34	12	31	6	11	28	5	7
30	11	30	4	9				34	12	34	6	13	28	5	7
30	11	30	4	8				34	12	34	6	13	28	5	7
								35	10	34	6	9	28	4	5
								36	10	34	7	9	28	4	2
								36	8	34	7	9	28	4	2
26	9	26	3	7	32	2	3	25	7	27	3	5			
26	10	26	3	10				25	10	27	4	8			
26	11	99	x	(12)				25	10	27	4	12			
26	11	99	x	(12)				25	10	27	4	13			
27	11	99	x	(12)				25	10	27	4	13			
27	11	27	3	12				27	10	27	4	13			
26	10	26	3	11	32	3	3	27	10	27	4	13			
27	10	27	3	11	32	3	3	27	9	27	4	13			
27	9	27	4	10	32	3	3	28	8	29	4	12			
26	8	26	3	6	32	3	3	28	7	29	4	9			
31	7	32	3	7				31	9	32	5	7			
31	9	32	4	8				32	11	32	5	9			
31	10	99	x	(10)				34	11	34	5	9			
35	10	99	x	(10)				02	7	34	5	7	02	3	4
36	5	32	5	6				04	6	34	5	6	02	3	4
23	8	23	3	5				27	4	27	4	4			
27	10	27	4	7				27	10	27	5	7			
27	9	27	4	6				29	10	27	5	7			
28	8	28	4	7				29	9	27	5	7			
24	8	24	3	6	30	3	4	27	8	27	4	7	31	4	5
26	10	99	x	(8)				29	10	29	4	8			
31	10	99	x	(10)				30	10	29	4	16			
30	10	99	x	(11)				29	11	29	4	18			
29	11	99	x	(12)				31	11	29	4	18			
32	11	99	x	(12)				32	10	29	4	18			
32	8	32	5	6				32	10	29	4	18			
31	7	32	5	6				31	8	29	4	16			
29	7	32	4	5				32	7	29	4	15			
28	6	32	4	4	28	2	3	29	7	30	4	9			
27	6	32	3	4	27	2	3	27	6	30	4	6	27	3	3
27	7	27	2	4	32	3	3	27	8	27	3	4	30	4	4

TABLE 11 *(continued)*

Year and month	Day and hr.	Noord Hinder								Goeree							
		dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
1954																	
Dec.	23 03	27	8	26	5	5				27	9	28	4	8			
	23 06	28	10	29	6	7				28	10	28	4	9			
	23 09	30	10	30	6	7				31	11	31	5	14			
	23 12	30	11	30	6	11				32	11	32	5	15			
	23 15	31	10	30	6	10				31	11	32	5	15			
	23 18	32	10	31	6	10				31	10	32	5	15			
	23 21	32	10	31	6	9				33	10	32	5	16			
	24 00	30	8	31	5	7	49	4	9	32	10	32	5	16			
	24 03	30	8	31	5	7				32	11	32	5	16			
	24 06	31	8	31	5	7				33	9	32	5	10			
	24 09	31	8	31	5	7				33	9	32	5	10			
	24 12	31	7	31	5	4	25	3	2	32	8	32	5	9			
1955																	
Jan.	16 18	36	7	36	3	4				23	5	20	2	3			
	16 21	36	10	36	4	8				36	9	36	5	11			
	17 00	32	9	32	3	8	36	4	5	36	8	36	5	11			
	17 03	32	8	32	3	7				34	9	34	4	8			
May	18 03	27	9	27	3	6				25	9	25	4	8			
	18 06	28	9	27	3	6				26	9	27	4	11			
	18 09	28	9	27	3	7				26	9	26	4	11			
	18 12	27	8	27	3	6				27	8	27	5	10			
	18 15	27	6	27	3	5				28	8	28	5	8			
	18 18	26	5	27	3	5				30	7	31	5	7			
1956																	
Jan.	20 18	22	7	22	3	6				22	8	22	4	7			
	20 21	22	9	22	3	7				22	8	22	3	7			
	21 00	25	8	22	4	7				25	8	25	4	8			
	21 03	32	7	30	4	6	22	4	4	28	8	27	4	8			
	21 06	28	7	28	4	6	22	4	2	28	8	28	4	8			
	21 09	28	6	28	4	6				29	7	29	4	7			
	21 12	32	4	28	3	4				28	6	29	4	6			
Jan.	22 03	22	8	22	3	6				23	9	25	4	7			
	22 06	30	7	22	3	5	28	3	5	27	8	27	4	7			
	22 09	30	7	22	3	3	30	3	5	29	7	29	4	7			
	22 12	29	6	30	3	5				28	7	29	4	7			
July	29 12	22	8	22	4	4				22	6	22	2	3			
	29 15	20	10	22	5	8				22	8	22	3	5			
	29 18	22	9	22	6	8				22	9	22	3	8			
	29 21	22	8	23	6	7				22	9	22	4	8			
	30 00	26	7	25	5	6				25	9	23	4	8			
	30 03	25	7	25	5	6				26	8	25	4	8			
	30 06	24	7	24	5	6				25	8	25	4	8			

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
27	9	99	x	(10)				27	9	27	3	6	30	4	5
27	9	99	x	(12)				31	11	30	4	14			
31	11	32	5	16				31	11	30	4	14			
31	11	32	5	16				31	11	30	5	18			
31	11	99	x	(16)				31	11	30	6	18			
31	11	99	x	(16)				31	11	30	6	18			
31	8	99	x	(13)				31	7	30	6	16			
31	10	99	x	(13)				30	9	30	5	12			
32	9	99	x	(12)				31	7	30	5	12			
33	8	99	x	(10)				32	8	30	5	12			
33	6	32	3	5				34	6	32	4	7			
33	7	33	3	5				33	7	32	4	8			
05	6	05	4	4				05	6	05	3	3			
36	8	36	4	6				03	7	03	3	5			
35	8	36	4	7				35	8	35	4	6			
33	7	36	4	6				32	7	35	4	6			
18	7	19	3	4				18	6	21	2	3			
23	7	21	3	5				18	7	21	2	3			
25	9	23	4	7				24	6	24	2	4			
27	9	25	4	8				27	8	26	3	6			
27	10	26	4	8				27	9	26	3	7			
28	8	28	4	8				28	9	27	3	7			
24	8	24	5	7				23	8	23	3	5			
22	10	24	x	(8)				23	9	23	4	7			
24	10	24	x	(9)				25	10	27	4	8			
28	10	27	x	(9)				27	10	27	4	8			
29	9	29	x	(9)				27	10	27	5	9			
29	8	29	5	10				28	9	27	5	9			
29	7	29	5	7				28	8	27	5	9			
26	9	23	x	(8)				23	9	23	4	7			
28	10	26	x	(8)				27	10	27	4	7			
28	8	28	4	8				28	10	27	4	8			
28	7	28	4	9				29	8	27	4	8			
20	4	19	2	2				18	5	20	2	2			
20	7	20	2	4				20	3	20	2	1			
20	10	20	4	6				20	10	20	4	6			
22	9	22	4	6				22	10	20	4	6			
25	9	23	4	6				21	10	20	4	6			
25	9	25	4	6				25	9	20	4	6			
25	8	25	4	6				25	9	24	4	6			

TABLE I1 *(continued)*

Year and month	Day and hr.		Noord Hinder									Goeree							
			dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w		dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H
	30	09	23	7	23	4	6					25	8	25	4	8			
	30	12	26	7	25	4	5					27	8	27	4	8			
	30	15	26	7	25	4	5					27	8	27	4	8			
	30	18	23	6	24	5	4					25	7	27	4	8			
1957																			
Nov.	04	00	16	8	16	3	5					18	7	18	3	5			
	04	03	17	10	17	3	6					16	8	17	3	5			
	04	06	19	10	17	3	6					23	10	21	3	6			
	04	09	22	8	22	4	7					24	9	23	3	7			
	04	12	24	7	23	4	6					23	6	23	3	5			
Dec.	08	12	27	8	27	3	5					28	7	27	3	6			
	08	15	27	8	27	3	6					26	8	26	3	6			
	08	18	24	8	25	4	6					26	8	26	3	6			
	08	21	27	8	26	4	6					26	9	26	3	7			
1958																			
Jan.	07	00	29	8	28	4	6					28	9	28	4	8			
	07	03	29	9	29	4	6					28	9	28	4	9			
	07	06	29	9	29	4	7					28	9	28	4	9			
	07	09	29	9	29	4	8					31	10	31	4	12			
	07	12	31	8	30	4	7					31	9	31	4	12			
	07	15	29	8	29	4	6					31	8	31	4	9			
Jan.	09	12	27	9	27	4	6					25	7	26	4	5			
	09	15	28	9	27	4	6					26	8	26	4	5			
	09	18	28	10	27	4	7					27	9	27	4	7			
	09	21	31	10	29	5	7					28	10	29	4	11			
	10	00	31	9	31	5	8					29	10	30	5	12			
	10	03	29	8	29	5	7					29	9	30	5	11			
	10	06	27	6	27	4	5					28	8	30	4	7			
Oct.	16	12	32	9	32	4	8					29	9	29	3	8			
	16	15	31	9	31	4	8					29	8	29	3	8			
	16	18	30	9	30	4	8					29	9	29	3	8			
	16	21	32	9	30	4	8					29	8	29	3	8			
	17	00	32	9	32	4	8					29	8	29	3	8			
1959																			
Oct.	18	03	18	8	18	2	4	20	4	3		16	7	16	2	4			
	18	06	23	10	22	4	4	23	5	7		23	9	23	3	6			
	18	09	25	10	25	4	4	24	4	7		25	9	25	3	7			
	18	12	24	7	24	3	3	25	4	6		26	8	26	3	6			
Oct.	27	00	23	9	23	3	8					22	9	23	3	8			
	27	03	23	9	23	4	9					21	10	21	3	9			
	27	06	23	11	23	4	12					22	10	22	3	10			
	27	09	22	11	22	5	11					20	11	21	3	11			

Texel							Terschellingerbank						
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w H_w
24	8	24	4	6			23	10	24	5	6		
25	8	25	4	6			23	10	24	5	6		
25	8	25	4	6			23	10	24	5	6		
25	8	25	4	5			24	9	24	5	6		
19	7	20	3	4			18	7	18	2	3		
16	7	20	3	4			18	7	18	2	3		
18	10	18	3	4			16	9	16	2	3		
22	10	22	4	10			20	10	19	3	4		
22	7	22	4	9			22	7	22	4	5		
27	9	27	3	5			27	9	27	3	5		
26	8	27	3	5			27	10	27	4	6		
27	10	27	4	8			26	10	27	4	6		
26	7	27	4	7			34	5	27	3	4		
27	9	27	4	8			26	9	27	3	5		
27	10	27	5	8			27	10	27	4	7		
29	11	29	5	15			28	11	27	4	7	32	4 6
31	8	29	5	10			34	10	32	4	8	27	3 5
34	7	30	4	7			34	8	32	3	5	27	2 3
35	6	36	4	6			34	7	34	3	5	27	2 2
25	8	25	4	6			25	9	25	3	6		
26	9	25	4	7			26	10	25	4	7		
27	10	27	4	8			25	11	25	4	8		
29	10	28	4	8			32	10	32	4	8	25	4 6
30	8	30	4	7			32	10	32	4	8		
29	7	30	4	6			30	7	32	4	5		
26	7	26	4	6			28	7	32	4	5		
29	9	29	4	8			31	9	31	4	8		
30	9	30	4	8			30	10	31	4	8		
30	9	30	4	8			32	10	31	4	8		
30	9	30	4	8			31	10	31	4	8		
31	9	31	4	8			34	9	31	4	8		
16	7	16	2	3			16	6	16	2	2		
18	8	18	2	3			16	6	16	2	2		
23	9	23	4	5			18	9	18	3	4		
27	9	27	4	6			25	9	25	3	5	18	2 2
24	9	24	4	6			23	7	23	3	4		
22	9	22	4	6			23	8	23	3	4		
22	10	22	4	7			23	9	23	4	5		
20	10	21	5	8			22	8	22	5	6		

TABLE I1 *(continued)*

Year and month	Day and hr.		Noord Hinder									Goeree							
			dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w		dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H
	27	12	22	9	22	5	14					24	7	24	4	5	22	3	
	27	15	23	8	22	5	12					22	8	22	4	7	24	3	
	27	18	31	7	31	3	3	22	4	5		22	8	22	4	7			
Oct.	28	21	36	8	36	4	8					35	4	35	3	2	27	3	
	29	00	36	9	36	5	16					36	7	36	4	4			
	29	03	34	9	34	5	14					35	7	35	4	4			
	29	06	36	8	36	5	14					36	7	36	4	4			
	29	09	36	8	36	5	13					01	7	01	4	6			
	29	12	36	8	36	5	16					36	7	36	4	8			
	29	15	36	7	36	4	9					36	7	36	4	7			
1960																			
Jan.	20	00	28	8	28	3	6	22	4	6		28	8	28	3	6			
	20	03	28	8	28	3	6	22	4	6		27	9	27	3	7			
	20	06	29	9	29	4	8					28	10	28	3	9			
	20	09	29	10	29	4	12					30	10	30	3	12			
	20	12	29	10	29	4	12					31	10	31	4	12			
	20	15	29	8	29	4	8					31	9	31	4	12			
	20	18	29	5	29	4	6					32	7	32	4	9			
Jan.	24	18	22	8	22	3	6					19	7	19	2	3			
	24	21	23	9	23	4	12					21	8	21	3	7			
	25	00	23	9	23	4	12					22	9	22	3	12			
	25	03	23	5	23	4	8					24	7	24	3	8			
Jan.	29	06	28	8	28	3	3	27	4	5		27	8	27	3	7			
	29	09	29	8	30	3	4	28	4	6		27	8	27	3	11			
	29	12	29	8	29	3	4	31	4	6		30	8	30	3	11	27	3	
	29	15	29	7	29	3	4	31	4	5		30	8	30	3	11	27	3	
	29	18	29	5	29	3	2	31	4	3		31	5	31	3	5			
Nov.	17	18	23	7	23	2	3					17	7	17	2	4			
	17	21	27	10	27	4	7					26	8	26	3	6			
	18	00	28	8	28	3	4	26	4	7		27	9	27	5	11			
	18	03	28	7	28	3	4	27	4	6		29	9	29	5	12			
	18	06	28	7	28	3	3	27	4	6		29	8	29	5	11			
	18	09	27	6	27	2	3	29	3	3		30	7	30	3	8			
Dec.	03	18	23	8	23	4	8					23	8	23	3	7	24	4	
	03	21	24	9	24	4	9					24	9	24	3	10			
	04	00	22	9	22	4	9					24	9	24	3	10			
	04	03	23	10	23	4	12					24	10	24	3	11			
	04	06	23	10	23	4	14					23	11	23	4	12			
	04	09	22	11	22	4	15					23	11	23	4	13			
	04	12	24	8	24	3	5	22	4	11		25	7	24	3	7	26	4	
	04	15	24	7	24	3	6	22	4	10		27	8	27	4	8			

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
21	8	21	5	6				22	5	22	2	3			
22	8	22	5	6				22	7	22	3	4			
24	8	24	5	6				22	7	22	3	4			
34	6	34	2	2	29	3	3	25	3	25	2	2	32	3	3
36	7	36	3	4	29	3	2	36	4	36	2	2	32	3	3
36	7	36	3	4				36	6	36	3	4			
36	7	36	4	5				36	6	36	3	4			
36	8	36	4	6				36	6	36	4	5			
35	7	35	4	6				36	6	36	2	2	36	4	5
36	7	36	4	6				35	6	35	3	3	36	4	5
27	9	27	3	6	21	3	6	27	7	27	3	4			
								27	10	27	4	7			
27	11	27	3	8				27	10	27	4	11			
31	11	31	4	11				32	10	32	4	11			
31	11	31	4	12				33	10	32	4	11			
35	10	33	4	10				34	9	34	4	10			
34	8	31	4	8				34	8	34	4	7			
13	7	14	2	3				18	6	18	2	3			
20	8	20	3	4				19	6	19	2	3			
21	8	21	4	6				21	8	22	3	4			
25	8	25	4	6				22	7	22	3	4			
29	8	29	3	5				24	5	24	3	3			
30	8	29	4	6				22	4	24	2	2			
33	8	33	4	7				34	7	34	3	3			
34	8	34	4	7				34	7	34	3	4			
33	7	33	4	6				34	7	34	3	4			
15	6	15	2	3				13	6	13	2	2			
16	7	16	2	3				12	6	12	2	2			
10	4	13	2	2				11	6	11	2	3			
27	5	27	3	3				13	4	13	2	2			
30	7	30	3	5				29	4	29	2	2			
29	7	29	3	6				30	4	30	2	2	04	2	2
24	7	24	3	7				25	5	25	3	3			
25	5	25	3	5				26	6	26	3	3			
23	7	24	3	6				26	7	26	3	3			
23	8	24	3	7				26	5	26	3	3			
23	9	24	3	8				24	9	24	4	6			
23	10	24	4	11				24	10	24	4	8			
25	9	24	4	9				27	9	27	4	4	24	4	6
26	9	25	4	8				27	9	27	4	7	24	4	6

TABLE I1 *(continued)*

Year and month	Day and hr.	Noord Hinder								Goeree							
		dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
	04 18	26	8	26	3	7				27	9	27	3	8	28	4	9
	04 21	28	8	28	3	8				29	7	27	4	11			
	05 00	26	8	26	3	8				27	9	27	4	11			
	05 03	26	8	26	3	8				27	8	27	4	9			
1961																	
Jan.	29 12	21	9	21	3	8				21	8	22	3	7	24	3	5
	29 15	20	9	20	3	10				21	8	22	3	7	24	3	5
	29 18	20	9	20	3	10				22	9	22	3	8	25	4	7
	29 21	21	9	21	3	9				23	9	24	4	10			
	30 00	22	8	22	3	9				23	8	24	4	9			
Oct.	17 18	32	9	32	4	7	27	4	4	30	9	31	3	9			
	17 21	32	9	32	3	7	34	4	8	33	10	33	3	10			
	18 00	34	8	34	3	5	35	4	7	32	10	33	4	11			
	18 03	33	9	33	3	5	35	4	8	34	9	33	4	8			
	18 06	33	8	32	3	5	35	4	7	33	8	33	4	7			
	18 09	33	8	33	3	5	35	4	7	33	8	33	3	6	33	4	9
	18 12	33	8	33	3	5	35	4	7	32	8	32	3	6	33	4	8
	18 15	34	9	34	3	6	35	4	8	35	8	34	3	6	33	4	8
	18 18	36	9	36	3	5	35	4	7	36	9	36	4	12			
	18 21	36	10	36	3	6	36	4	9	36	9	36	3	12			
	19 00	36	10	36	3	6	36	5	9	35	9	35	3	11			
	19 03	36	9	36	3	6	36	5	9	36	9	36	3	11			
	19 06	36	8	36	3	6	36	5	9	36	8	36	3	9			
Nov.	13 09	05	9	05	3	5	04	5	8	05	8	04	3	8			
	13 12	05	10	05	4	6	04	5	8	05	9	04	3	8	02	3	5
	13 15	05	9	05	4	6	04	5	8	05	10	04	3	8	02	3	6
	13 18	05	10	05	4	6	04	5	8	05	10	04	3	9			
	13 21	05	9	05	4	5	04	5	8	05	9	04	3	9			
Dec.	05 09	22	9	22	3	5	23	4	7	24	9	24	4	8	21	3	4
	05 12	29	9	29	2	4	25	4	7	23	9	23	3	9			
	05 15	29	9	29	3	5	30	4	7	27	9	27	4	9	23	3	6
	05 18	30	9	30	3	5	31	4	8	31	9	31	4	9			
	05 21	30	9	30	3	5	31	4	8	28	9	28	4	9			
	06 00	29	8	29	3	4	30	4	7	28	9	28	4	8			
	06 03	28	8	28	3	4	30	4	7	28	8	28	4	8			
	06 06	29	7	29	3	3	30	4	6	28	8	28	4	8			
	06 09	29	7	29	3	3	31	4	4	30	6	30	3	6	28	3	6
1962																	
Jan.	11 09	20	8	20	2	7				22	8	22	3	6			
	11 12	22	10	22	3	10				22	10	22	3	9			
	11 15	25	10	25	3	9	22	3	10	23	10	23	4	9			
	11 18	24	8	24	3	8				25	9	25	4	8			

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
27	9	27	3	9				27	9	27	4	7			
27	9	27	3	8				27	10	27	4	7			
28	9	27	3	9				27	9	27	4	7			
27	9	27	3	9				25	9	27	4	8			
20	8	20	3	5				23	9	23	3	6			
21	9	20	3	6				23	9	23	3	6			
22	9	22	3	8				23	9	23	3	6			
22	10	22	3	8				23	9	23	3	6			
22	9	22	3	7				23	9	23	3	6			
31	9	31	3	8				27	4	27	3	3			
30	9	31	4	8				34	9	34	3	6			
31	9	31	4	8				34	9	34	3	6			
33	9	33	4	8				34	9	34	4	7			
33	8	33	4	7				34	9	34	4	8			
34	8	33	4	8				34	8	34	4	8			
34	8	34	4	8				36	7	36	3	4	34	4	6
36	8	36	2	3	34	4	7	36	7	36	3	4	34	4	6
36	8	36	3	7				36	8	36	4	6			
35	7	36	3	7				36	8	36	4	6			
35	9	36	4	9				04	7	04	3	4	36	4	6
02	9	36	4	8				06	7	06	3	4			
05	7	05	2	3	02	4	6	07	6	07	2	3	36	4	4
06	9	06	3	5				07	9	07	3	6			
05	9	05	3	6				07	10	07	4	6			
06	9	06	4	6				07	10	07	4	6			
06	9	06	3	6				05	9	05	4	6			
05	9	05	3	6				05	9	05	4	6			
23	9	23	3	8				22	9	22	3	6			
23	10	23	3	8				22	10	22	3	7			
28	10	28	3	8	23	3	5	27	10	27	4	7	22	3	3
28	11	28	4	12				27	10	27	4	8			
27	10	27	4	12				27	10	27	4	8			
27	10	27	4	12				27	11	27	5	9			
28	10	28	4	12				27	11	27	5	9			
28	10	28	3	7				27	10	27	5	10			
28	8	28	2	4				32	8	27	4	8			
20	9	20	3	6				20	7	20	3	3			
20	10	20	3	8				20	9	20	3	5			
21	9	21	4	9				23	7	23	3	4			
25	9	25	4	8				26	8	26	3	6			

TABLE I1 *(continued)*

Year and month	Day and hr.	Noord Hinder								Goeree							
		dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H
Jan.	22 09	27	8	27	3	7				26	8	26	3	6			
	22 12	27	7	27	3	6				27	8	27	3	6			
	22 15	27	7	27	3	6				26	7	26	3	5			
	22 18	26	7	26	3	6				27	6	27	3	5			
	22 21	27	8	27	3	6				29	7	29	3	7			
	23 00	28	7	28	3	6				28	7	28	3	7			
	23 03	28	7	28	3	6				28	7	28	3	7			
	23 06	28	7	28	3	6				27	7	27	3	7			
	23 09	28	6	28	3	5				27	7	27	3	6			
Febr.	12 03	26	8	26	3	8				25	9	25	3	7			
	12 06	24	9	24	3	8				24	10	24	3	7			
	12 09	23	9	23	3	9				24	9	24	3	9			
	12 12	24	8	24	3	8				24	10	24	4	10			
	12 15	26	9	26	3	8				24	9	24	3	9			
Febr.	13 09	32	9	32	3	8				32	7	32	4	4			
	13 12	32	10	32	4	9				32	8	32	4	8			
	13 15	36	10	36	4	12				34	9	34	4	9			
	13 18	36	9	36	4	9				34	10	34	4	9			
	13 21	35	9	35	4	8				34	8	34	4	8			
	14 00	35	9	35	3	10				34	9	34	4	8			
	14 03	36	8	36	3	10				34	8	34	4	8			
	14 06	35	9	35	3	11				33	8	33	4	8			
	14 09	35	8	35	3	9				34	8	34	4	7			
Febr.	16 03	29	8	29	2	5				26	7	26	3	5			
	16 06	28	8	28	3	6				26	8	26	3	6			
	16 09	27	8	27	3	6				26	8	26	3	6			
	16 12	26	8	26	3	7				27	9	26	3	7			
	16 15	32	8	32	3	6	26	3	6	27	8	27	3	7			
	16 18	32	8	32	3	7				30	9	30	3	8	29	3	6
	16 21	31	9	31	3	9				30	10	30	3	9			
	17 00	30	9	30	3	8				30	10	30	3	9			
	17 03	32	10	32	3	9				32	10	32	3	9			
	17 06	33	9	33	3	9				32	10	32	3	9			
	17 09	32	8	32	3	8				32	9	32	3	9			
	17 12	33	8	33	3	7				32	8	32	3	9			
Dec.	15 21	28	8	28	3	5				27	7	27	2	5			
	16 00	32	10	32	3	8				31	10	31	4	9			
	16 03	30	10	30	3	8				29	10	29	3	9			
	16 06	31	11	31	4	12				29	11	29	4	11			
	16 09	32	10	32	4	12				31	10	31	4	11			
	16 12	33	9	32	4	10				33	9	35	4	12			
	16 15	32	8	32	3	8				34	8	34	3	8			

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
29	9	29	2	2	29	3	6	30	8	30	3	4			
26	9	26	3	10				27	9	27	3	5			
27	10	27	4	11				27	9	27	3	6			
27	10	27	4	12				27	8	27	3	6			
26	9	27	4	11				27	8	27	3	6			
27	9	27	4	9				27	8	27	3	6			
27	10	27	4	9				27	8	27	3	6			
27	10	27	4	11				27	8	27	3	6			
27	9	27	4	8				27	7	27	2	2	27	3	6
24	9	24	3	7				23	8	23	3	5			
24	9	24	3	7				24	9	24	3	6			
24	10	24	4	9				24	8	24	3	5			
25	9	25	4	9				27	8	27	3	6			
28	8	28	3	3	25	4	8	28	9	28	3	6			
31	4	31	2	1	33	3	3	30	4	30	3	3			
35	8	35	3	5				32	4	32	2	1			
34	9	34	3	7				35	8	35	3	4			
33	8	33	3	8				34	7	34	3	4			
34	9	34	3	8				32	7	32	3	5			
34	8	34	3	8				32	8	32	3	5			
35	9	34	3	8				33	8	33	3	6			
34	9	34	3	8				34	7	34	3	6			
34	8	34	3	9				34	6	34	3	5			
28	9	28	3	8											
28	10	28	3	8											
27	10	27	3	10											
28	10	28	3	8											
29	11	29	3	9											
29	11	29	4	12											
29	11	29	4	12											
31	11	31	4	13											
31	11	31	4	13											
31	11	31	4	13											
31	10	31	4	12											
32	9	32	4	8											
29	9	29	3	8				32	8	32	3	5			
29	10	29	4	9				29	8	29	3	6			
29	10	29	4	12				29	9	29	3	7			
30	10	29	4	12				32	7	32	3	6			
31	9	31	4	8				04	7	04	2	3	32	3	4
36	7	36	4	4				02	6	02	2	3	32	3	4
35	6	35	2	3				34	5	34	3	3			

TABLE II *(concluded)*

Year and month	Day and hr.		Noord Hinder								Goeree							
			dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	I
1963																		
Jan.	19	09	08	9	08	3	7				07	9	07	3	8			
	19	12	06	9	06	3	7				06	10	06	3	9			
	19	15	07	9	07	4	8				07	10	07	3	9			
	19	18	07	9	07	3	7				09	9	09	3	8			
Nov.	17	18	19	7	19	2	4				19	6	19	3	5			
	17	21	21	9	21	3	7				20	10	20	3	5			
	18	00	23	7	23	3	7				23	10	23	3	7			
	18	03	23	8	23	3	7				24	8	24	3	6			
	18	06	23	7	23	3	6				23	8	23	3	6			
	18	09	22	9	22	4	12				23	8	23	3	6			
	18	12	22	10	22	4	12				24	11	23	4	11			
	18	15	23	10	23	4	11				23	10	23	4	11			
	18	18	23	9	23	4	11				23	9	23	4	10			
	18	21	23	8	23	3	8				27	8	26	4	7			
Nov.	21	15	22	8	22	3	7				23	8	23	2	5			
	21	18	22	10	22	4	10				23	9	23	3	7			
	21	21	24	10	24	4	11				24	9	23	3	7			
	22	00	24	10	24	4	12				26	10	26	3	9			
	22	03	24	9	24	4	10				27	9	27	3	9			
	22	06	27	8	27	3	7				28	9	28	3	9			

Texel								Terschellingerbank							
dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w	dd	B	$d_w d_w$	H_w	P_w	$d_w d_w$	P_w	H_w
08	7	08	2	4				09	7	09	3	3			
07	9	08	3	5				09	7	09	3	3			
07	9	07	3	5				07	8	07	3	4			
09	9	09	3	5				09	8	09	3	5			
16	6	16	2	3				18	6	18	2	2			
17	8	17	3	4				18	7	18	2	3			
20	8	20	3	6				20	8	20	3	4			
23	8	23	3	5				24	8	24	3	5			
22	8	22	3	5				23	8	23	3	5			
20	8	20	3	5				20	7	20	2	3			
22	5	22	3	5				22	8	22	3	5			
24	9	24	3	5				23	8	23	3	5			
23	9	23	3	7				23	9	23	3	5			
25	8	23	3	6				23	9	23	3	5			
20	8	20	3	6				21	8	21	3	5			
23	10	23	3	9				21	10	21	3	5			
23	10	23	3	9				22	10	22	3	5			
23	9	23	3	8				26	9	26	3	6			
27	9	27	3	8				27	9	27	3	6			
27	9	27	3	8				27	8	27	3	6			

TABLE I 2 *Isolated observations of one lightvessel only*

(Further explanation, see table I 1, pag. 101)

Wave height ⩾ 5 m
and/or
Wind force ⩾ 10

Four lightvessels

Year	Month	Day and hr.		Lightvessel	dd	B	$d_w d_w$	P_w	H_w	$d_w d_w$	P_w	H_w
1949	Jan.	08	21	Terschellingerbank	36	10	34	4	12			
1951	Nov.	28	21	Texel	34	10	34	5	7			
	Dec.	09	00	Goeree	20	10	20	4	6			
1952	Sep.	26	15	Terschellingerbank	25	10	25	5	7			
1954	Nov.	27	06	Noord-Hinder	21	10	21	6	6			
1957	Aug.	25	21	Goeree	27	10	27	4	8			
1958	Feb.	05	18	Terschellingerbank	30	10	31	4	7			
1959	Jan.	09	18	Terschellingerbank	03	10	03	3	5			
	Jan.	12	15	Goeree	32	7	32	4	10			
	Nov.	13	12	Noord Hinder	16	10	16	2	4	18	3	5
	Dec.	23	00	Terschellingerbank	17	10	17	3	5			
	Dec.	27	06	Terschellingerbank	25	10	25	4	7			
1960	Nov.	02	18	Terschellingerbank	23	10	23	4	7			
1961	Feb.	01	03	Noord Hinder	24	9	24	3	10			
	Mar.	21	06	Goeree	36	9	36	3	10			
	July	04	15	Goeree	33	8	33	3	8	33	4	10
1962	Nov.	15	18	Goeree	32	9	32	5	10			
1963	Nov.	19	15	Noord Hinder	22	9	22	4	10			

SUMMARY

Wind and wave data collected every three hours since 1949 by Netherlands lightvessels are listed in frequency and other tables. The method of preparation of these tables is given, and a summary of them can be found in par. 1.6 of the text.

An interpretation of some of the data is given.

Relative frequencies (percentages of observations) of winds of force 4 and more, 6 and more and 8 and more, respectively, for the years 1949-1957 were compared with those recorded by the Netherlands lightvessels during 1910-1939 and with wind data from other sources (par. 2.2.2). An increase in the frequency of wind forces 4 and more in all seasons, and an increase in the frequency of wind forces 6 and more in autumn and winter is indicated. The comparison supports the idea that some of the (mostly small) differences between frequencies of different lightvessels are real, that is, caused by the differences in ship positions: the lightvessel Texel may have a little higher frequency of gales than Goeree and Terschellingerbank, especially in autumn and winter; Goeree shows a lower annual variation in the wind frequencies than the northern lightvessels. Other differences are probably due to slight systematic differences between the observers on board the different lightvessels.

A similar statement can be made for the frequencies of wave heights in excess of various values (par. 2.3.2 and par. 2.5.2).

The highest wind force reported during the fifteen years 1949-1963 inclusive was 11 (violent storm) for Goeree (on 6 occasions) and for Texel (on 9 occasions), and 12 (hurricane) for Terschellingerbank (on 2 occasions). The maximum significant wave height experienced by any of the three lightvessels in these years was probably 7 to 8 metres.

SAMENVATTING

Gegeven zijn frequentietabellen en andere tabellen over winden en golven, zoals deze sinds 1949 elke drie uur zijn gerapporteerd door Nederlandse lichtschepen. De wijze van vervaardiging der tabellen is toegelicht en enkele resultaten zijn besproken.

Par. 1.6 geeft een overzicht van de verschillende tabellen. De volgende informatie is gegeven. Frequenties van bepaalde winden (tabellen C 2 en H); frequenties van bepaalde golfhoogten en -richtingen (A, C 1, C 3, H); verband tussen golfhoogte en golfperiode (B 1, B 2); verband tussen golfhoogte en windkracht (D 1); gemiddelde golfhoogten bij gegeven windkracht en 'equivalente' golfhoogten (zie par. 2.8.2) (D 2); verschillen tussen waargenomen wind- en golfrichtingen (E); maxima van waargenomen windkrachten en golfhoogten per individuele maand in de 15 jaren 1949 t.e.m. 1963 (F 1, F 2); aantallen en duren van perioden van hogere golven en van harde winden (alleen Goeree, G 1, G 2); analoge informatie voor lage golven en zwakke winden, met gegevens over de variaties van jaar tot jaar (alleen Goeree, G 3 tot G 8); gedetailleerde rapporten der lichtschepen over wind en golven tijdens alle perioden met windkracht 10 of meer en/of met golfhoogte 5 meter of meer in de 15 jaren 1949 t.e.m. 1963 (I 1, I 2).

De windfrequenties over de jaren 1949-1957 zijn vergeleken met die bij de Nederlandse lichtschepen in 1910-1939 en met enige andere windgegevens (par. 2.2.2). Er blijkt een algemene toeneming van de frequenties van windkracht 4 en meer in alle seizoenen, en van windkracht 6 en meer in herfst en winter te zijn geweest. De vergelijking geeft verder steun aan de gedachte dat sommige van de (meestal geringe) verschillen tussen de lichtschepen onderling reeël zijn, d.w.z. veroorzaakt door hun verschillende ligging: het lichtschip Texel toont iets hogere stormfrequenties dan Goeree en Terschellingerbank, speciaal in herfst en winter; Goeree geeft een lagere jaarlijkse gang in de windfrequenties dan de noordelijke lichtschepen. Andere verschillen zijn waarschijnlijk toe te schrijven aan geringe systematische verschillen tussen de waarnemers op de verschillende lichtschepen.

Voor de frequenties van golfhoogten boven bepaalde waarden kan iets dergelijks worden gesteld (par. 2.3.2 en par. 2.5.2).

De hoogste windkracht gerapporteerd in de 15 jaren 1949 t.e.m. 1963 was 11 (zeer zware storm) voor Goeree (6 stormen) en voor Texel (9 stormen), en 12 (orkaan) voor Terschellingerbank (2 stormen). De maximale significante golfhoogte, die in deze jaren bij alle drie lichtschepen is voorgekomen, is vermoedelijk 7 tot 8 meter geweest.

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