NATIONAL INSTITUTE OF OCEANOGRAPHY

WORMLEY, GODALMING, SURREY

A Catalogue of Wave Data from the North Sea, to 1971

by

L. DRAPER

N.I.O. Internal Report No. A. 57

OCTOBER 1972

NATIONAL INSTITUTE OF OCEANOGRAPHY
Wormley, Godalming, Surrey.

A CATALOGUE OF WAVE DATA FROM THE NORTH SEA, TO 1971

By L. DRAPER

N. I. O. Internal Report No. A 57

A CATALOGUE OF WAVE DATA FROM THE NORTH SEA, TO 1971

L. DRAPER

Summary

This is a compilation of existing data under the auspices of the ad hoc committee which met during the 1st Conference on Port and Ocean Engineering under Arctic Conditions, Trondheim, 23-30 August 1971, which later became known as the Trondheim Committee. Also included is some previously collected information on the severe storm of October 1970.

---o0o---

The Committee was under the chairmanship of Dr. C. L. Bretschneider, (a list of persons present is given in Appendix I). It expressed concern that although the need for wave data over the whole of the North Sea was acute, there was virtually no co-ordination of wave work and that it was possible that some valuable results of instrumental measurements might be lying unused. Accordingly, the author of this report was charged with contacting all organisations which might hold such data and to request that it be made available for study. A letter (Appendix II) dated 18 October 1971 was sent to all persons listed in Appendix III, together with a copy of the Committee's resolution. (Appendix IV.)

There was not a 100% response, but amongst those who did reply there was a strong willingness to help. However, only a small number did have data which they could offer unconditionally; several companies felt that, for a variety of reasons, they were unable to make their data available at present.

In deep water there appears to be no location where there is adequate information to construct a yearly wave climate, except for those locations previously known to N. I. O. This information is also necessary for making estimates of extreme conditions. In coastal waters there are several locations where waves have been measured for periods of at least one year, but in some cases very little analysis, if any, has been done. In areas where it is possible to record waves using pressure sensors on or near the sea bed, the extreme

wave heights are likely to be depth-limited and can be calculated without recourse to measurements.

MEASURED DATA OFFERED

(extracts from letters on dates stated)

Elf Norge A/S 29 October 1971

Waverider measurements from NEPTUNE 7

58°39'N	2°29'E	10 December 1970 - 20 January 1971
57°25'N	5°34'E	20 January 1971 - 20 February 1971
Block 25-1		1 April 1971 - 25 August 1971 and from 1 November 1971

Deutsches Hydrographisches Institut 27 October 1971

Several near-shore locations of the German Bight from surface-following devices fixed to posts. The results will be published by D. H. I. The JONSWAP measurements, September 1968 and July/August 1969 are available.

Meteorologisk Instituut, Oslo 1 December 1971

Wave records from a Baylor recorder and Waverider at different positions in the North Sea during periods 20 July 1966 - 8 December 1967 and 31 January - 28 July 1967. The data is partly processed and controlled. Further processing is expected to start in Spring 1972. The method of your Institute will be used.

Danish Institute of Applied Hydraulics

Hanstholm Harbour (N. W. corner of Jutland) 2 December 1972

(a) October 1957 - January 1958

(b) August 1958 - January 1959

(c) June 1962 - April 1965

(d) December 1971 onwards

Water depth 12-13 m

Instrumentation:

(a) and (b)	bottom mounted Mk. IX presure cell
(c)	bottom mounted Van Reijsen pressure cell
(d)	Waverider

Records: Pen records, filed at D. I. A. H.

Hirtshals Harbour (north coast, Skagerrak) December 1970 onwards

Water depth 10.5 m

Instrumentation: Waverider until June 1971

Van Reijsen pressure cell from June 1971

Records: Pen records

Waverider data at D. I. A. H.

Van Reijsen data at Danish Board of Maritime Works.

Thyborøn Inlet

Van Reijsen pressure cell.

Dates and location of records presently unknown.

THE SEVERE STORM OF 18 - 21 OCTOBER 1970

This storm was one of the most severe yet experienced in the northern North Sea, and appreciable damage was done to rigs operating in that area. The winds over the Norwegian Sea were from between west and north, and a considerable amount of wave energy entered the North Sea. At British land stations there were no really large hourly-mean wind speeds, the highest being at Kirkwall (Orkney) at 2200 hours on 18 October when it reached 44 knots, from 250°.

At the time there was a persistent report that a wave of 22 metres (72 ft.) in height had been recorded by a Waverider operated from Glomar Grand Isle, but the record does not contain anything above 17.8 metres (58.4 ft.). (This wave was recorded at about 1230 hours on 19 October) except when noise is said to be present, when the pen hit the stops at both sides beyond the 20 metre scale. The recorder failed early in the morning of 20 October. The supply vessel standing-by Glomar Grand Isle reported a maximum vertical displacement of its fathometer of 66 feet, although this may be higher or lower than the true wave height. The height of 58 feet recorded by the Waverider is about the same height as the wave recorded by FAMITA at 57°30'N 3°E in November 1969; this was 61 feet from crest to trough with a zero-crossing period of the record of 12.1 seconds, and it seems likely that the highest wave in that storm was about 76 feet in height.

In the October 1970 storm there was more than one visual estimate of an extreme wave height of 75 feet. The N. I. O. recorder on FAMITA measured a wave 49 feet in height, and the estimated value of the height of the highest wave in that storm at that point is 59 feet. Further south the NEPTUNE recorded waves continuously with a Waverider and the highest wave in the whole storm was 15. 8 metres, 52 feet from crest to trough.

Off the Humber estuary the N. I. O. recorder on DOWSING Light Vessel recorded a wave 24. 7 feet in height, with a zero-crossing period of 8. 0 seconds. The most probable value of the height of the highest wave in the storm at DOWSING is 32 feet. This area, being somewhat sheltered by the land, was probably not as rough as those areas further east.

The height of the highest wave reported from SEA QUEST, in the outer part of the Moray Firth, was 45 feet, but this location also was somewhat sheltered from the severe winds.

Some reports covering this time are attached.

FAMITA 57. 5°N 3. 0°E

Date	Time	Wind	Waves H_s	Waves T_s
19 October	0001 GMT	290° 45 kt	7m	9 sec
	0300	270° 45 kt	7m	8 sec
	1200	300° 45 kt	7m	9 sec
20 October	1200	340° 45 kt	8m	12 sec
	2100	310° 35 kt	8m	12 sec
21 October	0600	340° 30 kt	7m	10 sec
	1200	360° 50 kt	6m	10 sec
	2100	350° 20 kt	4m	8 sec

GLOMAR GRAND ISLE 59°10'N 2°23'E

October 1970	18th	19th	20th	21st
SUSTAINED WIND SPEED MPH	55	45 - 55	50 - 55	35
Wind Direction	WNW	NNW	NNW	N
WAVE HEIGHT (Ft.)	25 - 35	35 - 50	30 - 50	30 - 50
Occasional Max. (Ft.)		69	65	
Period (Sec.)	8	8	13	12
Direction	WNW	NW	NNW	N
SWELL HEIGHT (Ft.)	25 - 35	50 - 60	45 - 60	50
Occasional Max. (Ft.)	36	65	75	75
Period	12	12	25	25
Direction	W	NNW	NNW	NNW

AMOCO Platform 53°22'N 02°34'E

Date (October 1970)	Wind (knots)		Wave Height (feet)
16th	E	-	4 - 5
17th	E	10	3
18th	W	15	4
19th	WNW	40	12 - 15
20th	NW	35	15 - 18
21st	NW	40	18 - 25
22nd	NW	25	12 - 15
23rd	NNW	15	6 - 7

Ocean Viking, Norwegian Block 2/7

(ODECO (UK) Limited)

Hourly visual observations of wave heights included several up to "35-45 ft." with "swells 50-60 ft." quite common and one "swells 55-65 ft." in the remarks column. Periods were generally around 11 to 13 seconds at the height of the storm.

STAFLO BLOCK 30. 16 56. 5°N 02. 1°E

Date	Time	Wind	Waves
19th October	0001 GMT	250° 50 Kt	22 Feet
	0600	310° 35 Kt	22
	1200	310° 45 Kt	14
	1800	310° 40 Kt	14
20th October	0001	320° 30 Kt	18
	1200	340° 55 Kt	27
	1900	350° 50 Kt	27
21st October	0001	320° 45 Kt	28
	0600	330° 40 Kt	21
	1200	360° 45 Kt	20
	1800	330° 35 Kt	18

OTHER DATA

These references are taken, in the main, from North Sea Wave Data. 1971

Draper, L. North Sea Spectrum book of papers. Thomas Reed, London 243 - 246

DARBYSHIRE, MOLLIE, 1960 Waves in the North Sea. Dock and Harbour Authority 41, 481, 225 - 228

DRAPER, L. 1968 Waves at Smith's Knoll Light Vessel, North Sea. N. I. O. Internal Report A33

DRAPER, L and GRAVES, R. 1968 Waves at Varne Light Vessel, Dover Strait. N. I. O. Internal Report A34.

TORUM, A. 1968 BOLGEANALYSER. Langtids-og kortidsstatistikker for bolgemalinger ved Vardo, Berlevag, Arviksand og Ferkingstad. No. 600248 Norges Tekniske Hogskole, Trondheim.

DUTTON, M. J. 1967 Analyses of wave heights in the North Sea. London Weather Centre Memo. No. 10.

HOGBEN, N. and LUMB, F. E. 1967 Ocean Wave Statistics. H. M. S. O.

OCEANOGRAPHIC ATLAS OF THE NORTH ATLANTIC OCEAN, 1963

Section IV, Sea and Swell U. S. Publication 700. U. S. Naval Oceanographic Office.

KIPPER, J. M. and JOSEPH, E. 1963 A study of wave persistence for selected locations in the North Atlantic Ocean, North Sea and Baltic Sea, U. S. Naval Oceanographic Office, TR 149

DORRESTEIN, R. 1967 Wind and Wave data of Netherlands Light Vessels since 1949. K. N. M. I. Mededeling en Verhandeling nr. 90

ROLL, H. U. 1956 Die Meereswellen in der sudlichen Nordsee, Deutscher Wetterdienst Seewetteramt, Hamburg, Einz. No. 8

PETRI, O. 1958 Statistik der Meereswellen in der Nordsee. Deutscher Wetterdienst Seewetteramt, Hamburg, Einz. No. 17

NORDSEE-HANDBUCH: Ostlicher Teil, Sudlicher Teil, Westlicher Teil, Nordlitcher Teil. Deutsches Hydrographisches Institut, Hamburg.

WASSING, F. 1968 Data for investigations, North Sea. CESCO Information No. 10. 00. 13/1 CESCO N. V. The Hague, Netherlands.

JONSWAP 1970 Description of the objects and preliminary results of JONSWAP. E. O. S. (a publication of American Geophysical Union) July.

HOUMB, O. G. 1969 Hindcasting wind sea and swell in the North Sea. The Decade Ahead 1970-1980 Marine Technology Society, Washington D. C. p. p. 281 - 297

KRUSEMAN, P. February 1971 GOEREE Light Vessel. Presentation of 243 Wave Spectra for Netherlands L. V. GOEREE with some preliminary conclusions. K. N. M. I. De Bilt. NATO Sub-committee on Oceanographic Research. Tech. Report No. 53 "Wave Recording Project".

BURRIDGE, D. M., 1971 Some aspects of the climate of the North Sea as observed from offshore installations. London Weather Centre Memorandum 22.

DRAPER, L. and DOBELL, Mrs. E. G. Waves at TONGUE Light Vessel, outer Thames Estuary, August 1971. N. I. O. Internal Report A49.

DRAPER, L. and DRIVER, J. S. Winter Waves in the Northern North Sea at 57°30'N 3°E, August 1971.

DRAPER, L. Waves at NORTH CARR Light Vessel, Fife Ness, August 1971. N. I. O. Internal Report A50

WALDEN, H. and RUBACH, H. -J. 1967 Simultaneous measurements of waves, with non-stabilised recording accelerometers, at places of various depths in the German Bight.
Deutsches Hydrographisches Zeitschrift 20, (4), 157 - 167. Also N. I. O. Translation T/125 September, 1968.

In addition, a year's data from both DOWSING Light Vessel, off the Humber Estuary, and GALLOPER Light Vessel, off the Thames Estuary, are being analysed at N. I. O.

ACKNOWLEDGEMENTS

Help in compilation of this October storm information is gratefully acknowledged from the following organisations:

1. AMOCO (UK)
2. BP
3. Esso (various offices)
4. A. H. Glenn and Associates
5. Global Marine Europa Limited
6. London Weather Centre
7. ODECO (UK) Limited
8. Shell (various offices)
9. Societe de Foragers en Mer NEPTUNE

CONCLUSIONS

At first the result of this exercise may appear to be a disappointment. The author, at least, did not expect any earth-shattering discoveries, but looked on the task as a further step in a prolonged programme of persuasion designed to result in a concerted attack on the dearth of such information. At the time of writing there is a strong evidence that the goal may be achieved in the not too distant future - certainly the willingness to achieve it is there in abundance, the remaining obstacles are mainly financial procrastination and administrative technicalities.

APPENDIX I

ATTENDANTS AT THE DISCUSSION MEETING ON WAVES IN THE NORTH SEA

Chairman of the meeting: Dr. C. L. Bretschneider, Honolulu.

Name	Affiliation
J. A. Battjes	Delft University of Technology.
R. Dorrestein	The Royal Dutch Meteorological Institute.
Hans O. Jahns	Esso Production Research Co., Houston, Texas.
Lars Håland	Norwegian Meteorological Institute.
Hans Walden	Deutsches Hydrographisches Institut.
J. A. Jensen	Kampsax, Consulting Engineers, Copenhagan.
P. C. Wistesen	Consulting Engineer, Fredrikshavn, Denmark.
K. G. Nolte	AMOCO, Tulsa, Oklahoma.
P. M. Aagaard	Chevron Oil Field Research Co. La Habra, California.
F. Grubas	INTERCONSULT SPA, Milan.
A. O. Bell	British Petroleum, London.
I. Siem	AMOCO NORWAY, OIL CO.
L. P. Johnston	Shell U. K. Lowestoft.
C. C. Anderson	PHILLIPS PETROLEUM, Stavanger.
P. Tryde	The Technical University of Denmark, Coastal Eng. Lab.
Ian Larsen	VBB Ltd., Stockholm.
T. Sorensen	The Danish Institute of Applied Hydraulics, Copenhagen.
E. W. Bijker	Delft University of Technology, Department of Civil Eng. Netherlands.
F. W. van Bilderbeek	SEADRILLING NETHERLANDS, Der Haag, Netherlands.
L. C. S. Kobus	ZAPATA OFFshore Co., Houston, Texas.
N. Nordenstrøm	Det Norske Veritas, Oslo.
B. Pedersen	Det Norske Veritas, Oslo.
L. Draper	National Institute of Oceanography, U. K.
O. G. Houmb	Technical University of Norway, Department of Port. and Ocean Engineering, Trondheim.

APPENDIX II

NATURAL ENVIRONMENT RESEARCH COUNCIL

NATIONAL INSTITUTE OF OCEANOGRAPHY

TELEPHONE: WORMLEY 2122
TELEGRAPHIC ADDRESS: OCEANS, WORMLEY, SURREY
RLY. STATION: WITLEY

WORMLEY, GODALMING,
SURREY.

OUR REF. Wave 3b-10

YOUR REF.

18th October, 1971.

Dear Sir,

NORTH SEA WAVE DATA

The concern over wave conditions which occur, or are liable to occur, in the North Sea led to a well-attended additional meeting in Trondheim, Norway, during the Conference on Port and Ocean Engineering under Arctic Conditions, 23rd-26th August, 1971.

It was agreed that the only possible way to minimize the risk of accident was for all existing data to be pooled so that, if possible, the information could be combined and the results made available to all organisations concerned with the design and safety of offshore installations. The scarcity of reliable wave data in this area is such that design criteria for waves cannot be much better than inspired guesses. The only possible way to achieve safe design at minimum expense is to have as much reliable data as exists, and as much as can be obtained, made freely available.

The conference asked the writer if he would be prepared to collect all data which was promised and to attempt to extract as much pertinent information as possible from it. This I gladly agreed to do. If you are able to help in this will you please let me know what information you have available with details of the location, duration of the installation and an assessment of the data's reliability. A copy of the resolution emanating from the meeting is enclosed.

There is no doubt that the safety of the men who work in this area can only be increased by co-operative ventures such as this; your participation would be appreciated by all concerned.

Yours faithfully,

Laurence Draper

L. Draper

A list of the recipients of this letter is also enclosed.

Encl.

APPENDIX III

List of Recipients of the Letter of 18th October.

DR. C. L. BRETSCHNEIDER,	University of Hawaii.
J. A. BATTJES	Delft University of Technology.
R. DORRESTEIN	The Royal Dutch Meteorological Institute.
HANS O. JAHNS	Esso Production Research Co., Houston, Texas.
LARS HÅLAND	Norwegian Meteorological Inst.
HANS WALDEN	Deutsches Hydrographisches Institut, Hamburg 4.
J. A. JENSEN	Kampsax, Consulting Engineers, Copenhagen.
P. C. WISTISEN	Consulting Engineer, Fredrikshavn, Denmark.
K. G. NOLTE	Amoco, Tulsa, Oklahoma.
P. M. AAGAARD	Chevron Oil Field Research Co., La Habra, California.
F. GRUBAS	Interconsult SPA, Milan.
A. O. BELL	British Petroleum, London.
I. SIEM	Amoco Oil Co., Oslo, Norway.
L. P. JOHNSTON	Shell, Lowestoft U. K.
C. C. ANDERSON	Phillips Petroleum, Stavanger.
P. TRYDE	The Technical University of Denmark - Copenhagen.
IAN LARSEN	VBB Ltd., Stockholm.
T. SORENSEN	Danish Institute of Applied Hydraulics, Copenhagen.
E. W. BIJKER	Delft University of Technology, Netherlands.
F. W. VAN BILDERBEEK	Seadrilling Netherlands, Den Haag.
L. C. S. KOBUS	Zapata Offshore Co., Houston Texas.
N. NORDENSTROM	Det Norske Veritas, Oslo.
B. PEDERSEN	Det Norske Veritas, Oslo.
O. G. HOUMB	Technical University of Norway, Trondheim.
T. R. WOOD	Amoco Europe, London.
Ir. A. L. BOUWENS	Netherlands Offshore Operators Committee, Scheveningen.
A. LINDBOM	Norsk Texaco Oil A/S, Oslo.
R. J. LOEFFLER	Esso Exploration Norway Inc. Oslo.
M. LESSER	Conoco Norway Inc. Oslo.
H. HAAVIND	Norske Murphy Oil Co., Oslo.
G. M. FEDDERSON	Norske Murphy Oil Co., London.
WINTERSHALL NORGE	Norske Murphy Oil Co., Oslo 2.
B. MOYSSET	Elf Norge A/S, Stavanger.
	Norske Hydro A/S, Oslo 2.
F. THOMAS	Phillips Petroleum Cy., Norway.
D. S. WATT	A/S Norske Shell, Tananger
	Bataafse Internationale, The Hague.
F. W. POPP	Syracuse Oils Norge A/S, London.
P. P. STABELL	Syracuse Oils Norge A/S, Oslo 2.
F. BERGERSEN	Syracuse Oils Norge A/S, Oslo 1.
J. C. REES	Pan-Ocean Oil Co. (U. K.)
D. WOOD	Total Oil Marine, Glen House, London, SW1.
F. C. ROWLAND	Penrod.
J. ESTRADE	Neptune, Paris.

APPENDIX IV

TECHNICAL UNIVERSITY OF NORWAY

TRONDHEIM, NORWAY

INTERNATIONAL CONFERENCE ON
PORT AND OCEAN ENGINEERING
UNDER ARCTIC CONDITIONS

THE POAC-SECRETARY

PHONE (075) 30100, EXT. 150
CABLE ADDRESS:
NTH 7034 TRONDHEIM, NORWAY
ATTENTION POAC-CONFERENCE

Trondheim, September 1971

As a result of a suggestion by O.G. Houmb of the Technical University of Norway, Trondheim, a group of interested people met during the POAC-Conference 23-26 August 1971 at Trondheim, and discussed the problem of information on extreme wave conditions in the North Sea. The meeting was chaired by Dr. C.L. Bretschneider.

After discussion lasting for 2 hours, the meeting decided that:

Comparisons of existing published analyses of wave data from the North Sea show that there are significant differences in wave height parameters, including extremes used for design purposes in the northern North Sea. It is known that many measurements have been made but which have not been published. It would be to the benefit of all concerned if the analysis of all existing data could be made available for study. Only in this way can a more reliable assessment be made of conditions existing, and liable to exist, in this area.

The scarcity of reliable wave data causes confusion and therefore expense, amongst both the operators and the government organizations involved in framing the relevant regulations; it is realized that the data has been expensive to obtain, but an absence of co-operation may well be drastically expensive.

The meeting asked L. Draper if he would approach those organizations believed to hold such wave data to enquire as to what

../.

data they have and whether they would be prepared to release it for study.

A list of those attending is attached.

C.L. Bretschneider
Chairman
C.L. Bretschneider
.....
sign.

L. Draper
Laurence Draper
.....
sign.

L.C.S. Kobus
L.C.S. Kobus
.....
sign.

O.G. Houmb
O.G. Houmb
.....
sign.