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23

Operational sea-level stations

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Preface

Coastal and island tide records comprise some of the largest and most reliable oceanic time series data in existence. Used in conjunction with wind, atmospheric pressure, sea-surface temperature or other water property measurements they can yield valuable information on non-tidal oceanic variability, particularly ocean transport over seasonal and interannual time scales. Changes in sea-level have many other applications, such as to give a better picture of the mechanisms and predictability of storm surges and an integrated indication of changes in ocean conditions that affect fisheries, for example the intensity and time of the annual upwelling of the Malabar coast.

Discussions between the Intergovernmental Oceanographic Commission and its subsidiary bodies, the SCOR/IOC Committee on Climatic Changes and the Ocean (CCCO) and the Joint WMO/IOC Working Committee for the Integrated Global Ocean Services System (IGOSS) and the Permanent Service for Mean Sea-Level (PSMSL) have identified a need for an expanded network of tide gauges and an enhanced system of sea-level data exchange for studies of the influence of the oceans on climate change and subsequent operational schemes for forecasting such changes.

As a first step in support of the effort to expand the network and enhance the data exchange system, the PSMSL has undertaken this survey to determine the present state of sea-level monitoring throughout the world. It will be used by those planning ocean research and service projects to define their ocean monitoring system requirements and to foster the submission of sea-level data to the PSMSL.

This report was prepared by Dr D.T. Pugh, Director of PSMSL and Miss H.E. Faull, Technical Secretary:

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The Permanent Service for Mean Sea-Level is a member of the Federation of Astronomical and Geophysical Services (FAGS) established by the International Council of Scientific Unions. Under the aegis of the International Association for the Physical Sciences of the Ocean, PSMSL is charged with the collection, dissemination and analysis of mean sea-level data. Financial support for PSMSL is received from Unesco through FAGS and through the Intergovernmental Oceanographic Commission, and from the United Kingdom Natural Environment Research Council.

Contents

Introduction

Discussions over the past two years, between PSMSL and several international organisations, including the Intergovernmental Oceanographic Commission and its related bodies, the Committee on Climatic Changes and the Ocean (CCCO), and The Integrated Global Ocean Services System (IGOSS), have identified a possible need for an enhanced system of sea-level data exchange, as an input both to studies of the influence of the oceans on climate change, and to subsequent operational schemes for forecasting such changes.

Although the relationships between changes in mean sea-level and changes in climate are neither simple nor direct, there are several advantages when considering sea-level as a representative oceanographic input to studies of climate change. Sea-level records, many of which extend over 100 years, are among the longest available series of ocean measurements. Also, sea-levels are relatively cheap and easy to measure continuously, when compared with programmes to monitor currents or thermohaline variations. By careful site selection it is possible to obtain values which are likely to be more representative of oceanographic processes over an extensive area, than are current or temperature/salinity measurements made at a single station.

For studies of climate changes, three potential applications of sea-level, corrected for vertical land movements, may be identified:

(1) Long-term trends in the global mean level over several decades due to changes in the volume of water in the oceans. A rise of 0.12 m over the past century has been estimated. Such changes may be due to a rise in the average ocean temperature, or to a melting of grounded ice caps, both of which imply climatic change.

(2) Shorter-term variations, of more local extent, over periods from several days to years. These are due to changes in the ocean's density structure and to changes in circulation patterns. In the case of changes in current patterns, mean sea-level will respond through changes in the sea-surface gradients which balance the geostrophic accelerations.

(3) Measurements of instantaneous sea-level at specific locations under the tracks of satellites which are making altimetry measurements, may be used for making 'ground truth' zero adjustments.

These three applications imply an increasing urgency for the data transmission, but a progressive decrease in the accuracy required. Over long periods the need is for stable datum control to within as few millimetres, but delays of a year or more before the data are available, are quite acceptable. At the other extreme, for 'ground truth' applications, an accuracy of a few centimetres may be acceptable, but the data are needed within days.

Traditionally PSMSL has collected, checked and published monthly mean sea-levels, and has paid particular attention to problems of datum definition and stability. Data are now received after a delay which varies from one to several years, from a network of national authorities, principally hydrographic departments, mapping agencies and oceanographic data centres. If there is a need for mean levels averaged over periods shorter than a month, and for more immediate data availability, then the active participation of such authorities is essential: no central international agency could be responsible for the technicalities of local measurement, or for the labour involved in the attendant data reduction.

At the request of its Advisory Committee, the IAPSO Committee on Tides and Mean Sea-Level, PSMSL has conducted a survey of all past, present and potential suppliers of sea-level data. The aims were to establish details of existing gauges, and to determine which authorities would be willing to co-operate in more rapid data transmission and in the installation of new equipment. Apart from its relevance to CCCO considerations, this survey has proved timely and valuable for PSMSL in the re-establishment of broken contacts with previous data sources, and in the identification of new sources.

A similar survey was published by PSMSL, under the auspices of IOC, in 1964, in an attempt to improve the global coverage of sea-level stations. The progress made as a result of this earlier survey is summarised in Appendix 3 to the present report.

Survey design

A copy of the questionnaire, entitled 'International Survey of Sea-Level Measurements' may be found in Appendix 1. The two main objectives: to gain a detailed inventory (as well as an overall impression) of the number and position of tide gauges currently in operation, and to explore the likely support of national authorities for participation in more extensive and rapid international data exchange, were covered in six questions, five if which required short (e.g. YES/NO) answers. The first question asked for details of the gauges currently in operation, and the completion of a table giving these details including what data (i.e. hourly, daily and monthly sea-levels) was available from these gauges. Questions 2, 3 and 4 were concerned with the willingness and ability of the authorities in question to participate in near-real-time data exchange (question 2), to participate in an international experiment to furbish a global data set of mean sea levels (question 3), and to extend the network of sea-level stations by co-operating in the installation of equipment in their countries at international expense (question 4). Question 5 asked for further organisations we could approach about these matters, and question 6 was to identify user interest in data exchange rather than just the supply of data.

It was stressed that no definite commitment would be implied from the responses to the questionnaire. Therefore the numbers quoted are only preliminary indications of the support for the activities suggested.

An explanatory letter was sent with each questionnaire (also in Appendix 1) which gave the reasons for the survey and urged a positive response.

A copy of the questionnaire was sent with the accompanying letter to 204 addresses. Most of these addresses were those of individuals or organizations with whom we had had some contact in the past: 61 were regular suppliers of data, some had provided data previously but had lost contact, and some were recipients of data from PSMSL who were likely to know of further sources of information even if they could not help us themselves. All these addresses were already on the PSMSL address list. Other sources of addresses were the Pacific tsunami warning system network, and the questionnaires themselves (see question 5). We have not yet received replies from the addresses obtained from the latter source.

In all, questionnaires were sent to 98 countries.

Summary of response

From the 204 questionnaires sent to organizations and individuals, 82 replies were received by 1 July 1982 (40 per cent). Of those who replied, 16 had not completed the questionnaire as they were not responsible for gauges; a further 8 who did not operate gauges had completed the questionnaire as far as they were able.

Fifty-eight organizations who replied are currently running a total of 743 gauges. Seven of these organizations are responsible for gauges not just on the coastline of their own nation but elsewhere. These include Prof K. Wyrtki (U.S.A.) who has a network of gauges on Pacific islands.

Names and addresses of the 82 organizations who replied to the questionnaire are given in Appendix 2.

Details of gauges

The responses to question 1 are summarised in Tables 1 (a to e). Table 1a gives a complete list of the gauges known to be operating from replies to the questionnaire, sequenced round the world coastlines in an easterly direction from Europe to eastern and northern Canada. Also in this table are the index numbers of the authorities responsible for the gauges (a list of whom appears as Appendix II), and the details, if given/known, of the types of gauges in use and the methods of reduction used.

In addition, Table 1a has appended a list of gauges known, through recent correspondence with the appropriate authorities, to be functioning, although their replies to the questionnaire have not yet been received.

The positions of all these gauges are plotted on maps 1-7:

Map 1 Europe
2 Africa and Middle East
3 Far East
4 Australia
5 New Zealand and Pacific Ocean
6 North America
7 Central and South America, Antarctica

Table 1b gives a summary, by country, of the number of gauges in operation. Tables 1c to 1e give details, by country, of the number of gauges from which hourly, daily and monthly mean values are available, and whether these are available in computer compatible format.

What would be the shortest time delay between measurement and sending the data to PSMSL?

At present, national authorities send monthly and annual mean values to PSMSL annually (regular suppliers) or every three to five years (on reminder or request). All of this data has, until very recently, been sent in tabulated form (i.e. not computer compatible), although we are now beginning to receive data from some larger organizations on magnetic tape. Hourly and daily mean values are not currently banked by PSMSL.

Tables 2 a), b), c) represent the response to this question, in conjunction with details of data available gleaned from question 1. Of the 37 organizations who replied to this question from whom hourly data is available, 12 can provide this data within a month of measurement, and 26 within 3 months.

Roughly half of the organizations (representing over 2/3 of the gauges) would send data in computer compatible format. The same proportions are true for daily mean values, where the organizations concerned overlap but are not all the same. Two organizations responsible for gauges who are not currently reducing the data from their gauges indicated that data could be provided within a month of measurement if reduction was started, which is an encouraging indication of willingness to co-operate.

Would you be prepared to send hourly data to PSMSL in a computer compatible format for the period of an international experiment extending over 3-5 years?

Fifty-one organizations replied to this question. Twenty-eight were willing to participate in such a venture (Table 3) and 23 were not willing. Many of those who said no do not presently have the facilities to send data in a computer compatible format, and this may have been the reason for their response.

Would you be prepared to co-operate in the installation, if necessary, of new equipment in your country, at international expense, in order to facilitate data exchange?

Table 4 lists 52 organizations who would be interested in this suggestions.

Which other organizations in your country, having responsibility for sea-level measurement and data reduction, could PSMSL approach?

Following the replies to this question, questionnaires were sent to a further 14 organizations. Replies from these have not yet been received.

Would you be interested in receiving sea-level data at more frequent intervals, through PSMSL, from other countries?

Thirty-five organizations expressed an interest in receiving sea-level data at more frequent intervals. Eight of these organizations particularly requested data from neighbouring countries. One organization was keen to receive regular updates to existing data.

Comment

The following countries, from whom no reply to the questionnaire has been received, are known, through recent correspondence, to have gauges in operation.

	No. of gauges known
Iceland	1
USSR	8
East Germany	3
Yugoslavia	?
Seychelles	2
Kenya	1
India	?
Sri Lanka	1
Argentina (+ Antarctica)	8 (+2)

Many national authorities are now reviewing their tide gauge networks, and introducing automatic data transmission and computerised data reduction procedures. This is involving them in major upheavals and consequent difficulty in making any commitment to international work. Such authorities include those in Denmark, Turkey, New Zealand, Norway and Mexico.

We know that gauges are running in India and in Yugoslavia but at present there are difficulties in getting the data and details of these gauges to us.

Conclusions

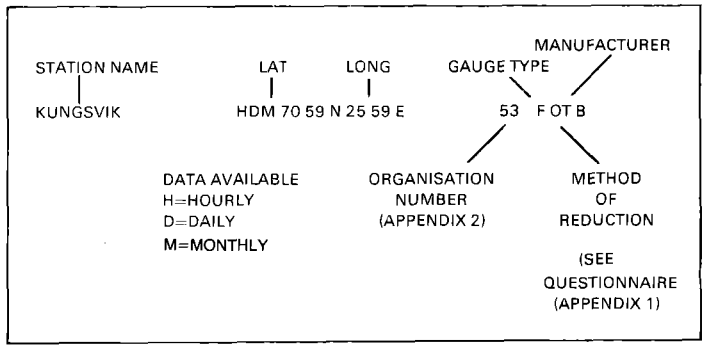
The response to the questionnaire was very encouraging: not only have we re-established contact with some organizations with whom we had lost touch, but we have also made new contacts. It is disappointing not to know the present situation around the African coast, India and Brazil. In the latter two cases we have good contacts who may respond to more specific proposals.

Although we did not ask about practical help for other countries, the Canadian Hydrographic Service in their reply, suggested that they would be prepared to assist other agencies in installing new equipment if some of the expenses were paid by an international organization. There may well be other countries which are willing to help in this or similar ways.

Full details of the replies to the questionnaire are available from PSMSL, and maps of gauges reported to be functioning in a particular area can be prepared on request.

Table 1a
Gauges running - 1982

KEY



NORWAY								
HONNINGSVAG	HDM	70 59 N	25 59 E	53	F	OT	B	
TROMSO		69 39 N	18 58 E	53	F	OT	B	
HARSTAD		68 48 N	16 33 E	53	F	OT	B	
RORVIK		64 52 N	11 15 E	53	F	OT	B	
KRISTIANSUND N		63 07 N	07 44 E	53	F	OT	B	
ALESUND		62 28 N	06 09 E	53	F	OT	B	
MALOY		61 56 N	05 07 E	53	F	OT	B	
SWEDEN								
KUNGSVIK	HDM	59 00 N	11 08 E	70	F		B	
SMOGEN	HDM	58 22 N	11 13 E	70	F		B	
GOTEBORG –								
TORSHAMNEN	HDM	57 41 N	11 48 E	70	F		B	
RINGHALS	HDM	58 15 N	12 07 E	70	F		B	
VIKEN	HDM	56 09 N	12 34 E	70	F		B	
KLAGSHAMN	HDM	55 31 N	12 54 E	70	F		B	
YSTAD	HDM	55 25 N	13 49 E	70	F		B	
KUNGHOLMSFORT	HDM	56 06 N	15 35 E	70	F		B	
OLANDS NORRA UDDE	HDM	57 12 N	17 06 E	70	F		B	
VISBY	HDM	57 59 N	18 18 E	70	F		B	
MARVIKEN	HDM	58 33 N	16 50 E	70	F		B	
LANDSORT	HDM	58 45 N	17 52 E	70	F		B	
STOCKHOLM	HDM	59 19 N	18 05 E	70	F		B	
FORSMARK	HDM	60 24 N	18 13 E	70	F		B	
SPIKARNA	HDM	62 22 N	17 32 E	70	F		B	
RATAN	HDM	64 00 N	20 55 E	70	F		B	
FURUOGRUND	HDM	64 55 N	21 14 E	70	F		B	
KALIX	HDM	65 42 N	23 06 E	70	F		B	
POLAND								
GDANSK/NOWY PORT	HDM	54 24 N	18 50 E	60	F		A	
WLADYSLAWOWO	HDM	54 48 N	18 25 E	60	F		"	
USTKA	HDM	54 35 N	16 52 E	60	F		A	
KOLOBRZEG	HDM	54 11 N	15 13 E	60	F		A	
SWINOUJSCIE	HDM	53 56 N	14 17 E	60	F		A	
DENMARK								
HESNAES	H	54 38 N	12 08 E	20	F	OT	C	
SPODSBJERG	H	54 56 N	10 50 E	20	F	OT	C	
BALLEN	H	55 49 N	10 38 E	20	F	OT	C	
GRENA	H	56 25 N	10 55 E	20	F	/T	C	
NETHERLANDS								
DELFZIJL	H	53 20 N	06 56 E	50	F	TN	B	
LAUWERSOOG	H	53 25 N	6 12 E	50	F	TN	B	
TERSCHELLING	H	53 22 N	05 13 E	50	F	TN	B	
HARLINGEN	H	53 10 N	05 25 E	50	F	TN	B	
DEN HELDER	H	52 58 N	04 45 E	50	F	TN	B	
IJMUIDEN	H	52 28 N	04 35 E	50	F	TN	B	
SCHEVENINGEN								
NOORDERSLUIS	H	52 06 N	4 16 E	50	F	TN	B	
HOEK VAN HOLLAND	H	51 59 N	04 07 E	50	F	TN	B	
HARINGVIELT	H	51 50 N	4 03 E	50	F	TN	B	
STAVENISSE	H	51 36 N	4 00 E	50	F	TN	B	
VLIETEPOLDER	H	51 36 N	3 45 E	50	P		B	
OOSTKAPELLE	H	51 36 N	3 33 E	50	F	TN	B	
VLISSINGEN	H	51 27 N	3 36 E	50	F	TN	B	
HANSWEERT	H	51 27 N	4 01 E	50	F	TN	B	
BATH	H	51 24 N	4 13 E	50	F	TN	B	
TERNEUZEN	H	51 20 N	3 49 E	50	F	TN	B	
CADZAND	H	51 23 N	3 23 E	50	F	TN	B	
UNITED KINGDOM								
LERWICK	HDM	60 09 N	01 08 W	75	F	LE	A	
WICK	HDM	58 26 N	03 05 W	75	F	LE	B	
BUCKIE	HDM	57 40 N	02 58 W	75	F	OT	C	
ABERDEEN I	HDM	57 09 N	02 05 W	75	F	MU	B	
ROSYTH	M	56 01 N	03 27 W	76				
LEITH	HDM	55 59 N	03 10 W	75	F	OT	C	
NORTH SHIELDS	HDM	55 00 N	01 27 W	75	F	OT	C	
WHITBY	HDM	54 29 N	00 36 W	75	B	AA	C	
IMMINGHAM	HDM	53 37 N	00 11 W	75	F	MU	B	
LOWESTOFT	HDM	52 28 N	01 19 E	75	F	OT	C	
FELIXSTOWE	HDM	51 57 N	01 21 E	75	B	AA	C	
SOUTHEND	HDM	51 31 N	00 44 E	75	F	KE	B	
TILBURY	HDM	51 28 N	00 22 E	75	F	KE	B	
TOWER PIER	HDM	51 30 N	00 05 E	75	F	KE	B	
SHEERNESS	HDM	51 27 N	00 45 E	75	B	OT	C	
DOVER	HDM	51 07 N	01 19 E	75	F	OT	C	
PORTSMOUTH	M	50 48 N	01 07 W	76				
DEVONPORT	M	50 22 N	04 11 W	76				
NEWLYN	HDM	50 06 N	05 33 W	75				
ILFRACOMBE	HDM	51 13 N	04 07 W	75	F	OT	C	
MILFORD HAVEN	HDM	51 42 N	05 01 W	75	F	MU	B	
FISHGUARD	HDM	52 01 N	04 59 W	75	F	LE	B	
HOLYHEAD	HDM	53 19 N	04 37 W	75	F	OT	C	
HILBRE ISLAND	HDM	53 23 N	03 13 W	75	F	MU	B	
LIVERPOOL PRINCES PIER	HDM	53 25 N	03 00 W	75	F	LG	B	
HEYSHAM	HDM	54 02 N	02 55 W	75	F	LE	B	
PORTPATRICK	HDM	54 51 N	05 07 W	75	F	LE	B	
MILLPORT	HDM	55 45 N	04 56 W	75	F	LE	B	
ULLAPOOL	HDM	57 54 N	05 10 W	75	F	MU	B	
STORNOWAY	HDM	58 12 N	06 23 W	75	B	OT	C	
SCRABSTER	HDM	58 37 N	03 33 W	75	B	AA	C	
EIRE								
MALIN HEAD	HDM	55 22 N	07 20 W	23	F	OT	A	
KILLYBEGS		54 37 N	08 26 W	25	F	OT	U	
ROSSAVEEL		53 16 N	09 33 W	25	F	OT	U	
BLENNERVILLE		52 15 N	09 44 W	25	F	OT	U	
DUNMORE EAST		52 08 N	06 59 W	25	F	OT	U	
DUN LAOIRE		53 17 N	06 08 W	25	F	OT	U	
DUBLIN		53 21 N	06 13 W	24	F	KV	A	
CHANNEL ISLANDS								
ST. HELIER	M	49 11 N	02 07 W	77	F	MU	A	
FRANCE (ATANTIC)								
DUNKERQUE	HDM	51 03 N	02 22 E	28	F	OT	B	
CALAIS	HDM	50 58 N	01 51 E	28	F	OT	B	
BOULOGNE	HDM	50 44 N	01 36 E	28	F	OT	B	
DIEPPE	HDM	49 56 N	01 05 E	28	F	OT	B	
ANTIFER	HDM	49 39 N	00 09 E	28	F	OT	B	
LE HAVRE	HDM	49 29 N	00 07 E	28	F	OT	B	
CHERBOURG	HDM	49 39 N	01 38 W	28	F	OT	B	
ROSCOFF	HDM	48 43 N	03 58 W	28	F	OT	B	
LE CONQUET	HDM	48 22 N	04 47 W	28	F	OT	B	
BREST	HDM	48 23 N	04 30 W	28	F	OT	B	
PORT TUDY	HDM	47 39 N	03 27 W	28	F	OT	B	
POINTE ST GILDAS	HDM	47 09 N	02 15 W	28	F	OT	B	
LA PALLICE	HDM	46 10 N	01 13 W	28	F	OT	B	
SOCOA	HDM	43 23 N	01 40 W	28	F	OT	B	
SPAIN (ATLANTIC)								
SANTADER	HDM	43 28 N	03 48 W	69	F	OT		
LA CORUNA	HDM	43 22 N	08 24 W	69	F	OT		
VIGO	HDM	42 14 N	08 44 W	69	F	OT		
PORTUGAL								
V CASTELO	HDM	41 41 N	8 50 W	62	F	OT	B	
LEIXOES	HDM	41 11 N	8 42 W	62			B	
AVEIRO (FOZ)	HDM	40 39 N	8 45 W	62	F	OT	B	
CASCAIS	HDM	38 42 N	9 25 W	62	F	BO	B	
SETUBAL (TR)	HDM	38 30 N	8 54 W	62	F	OT	B	
SINES	HDM	37 57 N	8 53 W	62	F	OT	B	
LAGOS	HDM	37 06 N	8 40 W	62	F	BO	B	
FARO-OLHAO	HDM	36 58 N	7 52 W	62	F	OT	B	
GIBRALTAR								
GIBRALTAR	HDM	36 07 N	05 21 W	76	F	LE		
SPAIN (MEDITERRANEAN)								
CADIZ	HDM	36 32 N	06 17 W	69	F	OT		
TARIFA	HDM	36 00 N	05 36 W	69	F	OT		
ALGECIRAS	HDM	36 07 N	05 26 W	69	F	OT		
MALAGA	HDM	36 43 N	04 25 W	69	F	OT		

MALLORCA							
PALMA DE MALLORCA	HDM	39 33 N	02 28 E	69	F	SD	
FRANCE							
(MEDITERRANEAN)							
TOULON	HDM	43 07 N	05 55 E	28	F	OT	B
MONACO							
MONACO CONDAMINE	HDM	43 44 N	7 25 E	49	F	OT	
ITALY							
GENOVA	HDM	44 24 N	08 54 E	40	F		B
TRIESTE	HDM	45 39 N	13 45 E	39	F	FU	A; F OT A
GREECE							
PREVEZA	HDM	38 57 N	20 46 E	32	F	OT	C
LEFKAS	HDM	38 50 N	20 43 E	32	F	OT	C
PATRAI	HDM	38 15 N	21 44 E	32	F	OT	C
POSIDHONIA	HDM	37 57 N	22 57 E	32	F	OT	C
KATAKOLON	HDM	37 39 N	21 19 E	32	F	OT	C
KALAMAI	HDM	37 01 N	22 08 E	32	F	OT	C
PIRAIEVS	HDM	37 56 N	23 27 E	32	F	OT	C
HALKIS	HDM	38 28 N	23 35 E	32	F	OT	C
THESSALONIKI	HDM	40 37 N	23 02 E	32	F	OT	C
KAVALLA	HDM	40 55 N	24 25 E	32	F	OT	C
ALEX/POLIS	HDM	40 51 N	25 53 E	32	F	OT	C
KHIOS	HDM	38 23 N	26 09 E	32	F	OT	C
SYROS	HDM	37 26 N	24 57 E	32	F	OT	C
LEROS	HDM	37 08 N	26 51 E	32	F	OT	C
RODOS	HDM	35 27 N	28 14 E	32	F	OT	C
SOUDA	HDM	35 20 N	24 04 E	32	F	OT	C
ROMANIA							
MANGALIA	D	43 48 N	28 35 E	63	F	ZG	A
CONSTANTA	M	44 10 N	28 40 E	63	F	OT	A
TOMIS	D	44 11 N	28 40 E	63	F	OT	A
ISRAEL							
ASHDOD	H	31 50 N	34 39 E	38	F	OT	A
ALGERIA							
ALGER		36 47 N	03 04 E	1	B	OT	U
SPANISH N. AFRICA							
CEUTA	HDM	35 54 N	05 19 W	69	F	OT	
AZORES							
PONTA DELGADA	HDM	37 44 N	25 40 W	62	F	OT	B
A. HEROISMA	HDM	38 39 N	27 13 W	62	F	OT	B
HORTA	HDM	38 32 N	28 37 W	62	F	OT	B
SANTA CRUZ	HDM	39 27 N	31 07 W	62	F	OT	B
MADEIRA							
FUNCHAL	HDM	32 38 N	16 54 W	62	F	OT	B
CANARY IS.							
ARRECIFE	HDM	28 57 N	13 43 W	69	F	OT	
STA. CRUZ							
DE LA PALMA	HDM	28 41 N	17 45 W	69	F	OT	
PTO. DE LA CRUZ							
PALMAS	HDM	28 08 N	15 25 W	69	F	AW	
IVORY COAST							
ABIDJAN	HDM	05 15 N	04 00 W	28	F	OT	A
GHANA							
TAKORADI	HDM	04 53 N	01 45 W	31	F		A
TEMA	HDM	05 37 N	00 00 E	31	F	LG	A
TOGO							
LOME	H	06 07 N	01 13 E	29	F	U	A
CONGO							
POINTE-NOIRE	HDM	04 47 S	11 50 E	28	F	OT	A
NABIMIA							
WALVIS BAY	H M	22 57 S	14 30 E	65	F	OT	A
LUDERITZ	H M	26 38 S	15 09 E	65	F	KE	A
SOUTH AFRICA							
PORT NOLLOTH	H M	29 15 S	16 52 E	65	F	KE	A
SALAMANDER	H M	33 04 S	19 00 E	65	F	KE	A
GRANGER BAY	H M	33 54 S	18 25 E	65	F	KE	A
HOUT BAY	DM	34 03 S	18 21 E	66	F		B
SIMONS BAY	H M	34 11 S	18 26 E	65	F	LE	A
MOSSEL BAY	H M	34 11 S	22 09 E	65	F	KE	A
KNYSNA	H M	34 05 S	23 03 E	65	F	KE	A
PORT ELIZABETH	H M	33 58 S	25 38 E	65	F	OT	A
EAST LONDON	H M	33 00 S	27 54 E	65	F	LE	A
DURBAN	H M	29 53 S	31 00 E	65	F	KE	A
RICHARDS BAY	H M	28 48 S	32 05 E	65	F	KE	A
MADAGASCAR							
NOSY-BE	HDM	13 24 S	48 17 E	28			
REUNION							
POINTE DES GALETS	HDM	20 55 S	55 17 E	28			
PAKISTAN							
KARACHI	HDM	24 48 N	66 58 E	54	F	MU	A
BANGLADESH							
HIRAN POINT	H	21 47 N	89 27 E	9	F		A
KHEPUPARA	H	21 59 N	90 13 E	9	F		A
CHARCHENGA	H	22 13 N	91 04 E	9	F		A
CHAR MADRAJ	H	22 12 N	90 50 E	9	F		A
SANDUIP	H	22 29 N	91 26 E	9	F		A
COX'S BAZAAR	H	21 27 N	91 59 E	9	F		A
SADARGHAT	H	22 20 N	91 50 E	9	F		A
SHAHAPURI	H	20 47 N	92 21 E	9	F		A
THAILAND							
KO PRAP	HD	9 50 N	98 26 E	71	F	OT	A
KO TAPHAO NOI	M	07 50 N	98 26 E	71	F	OT	A
KO MATTAPHON	HD	10 27 N	99 15 E	71	F	OT	A
KO LAK	HD	11 48 N	99 49 E	71	F	OT	A
PHRACHUAP KIRIKHAN	M	11 48 N	99 49 E	71	F	OT	A
BANGKOK BAR	M	13 27 N	100 36 E	71	F	OT	A
FORT PHRACHULA							
CHOMKLAO	M	13 33 N	100 35 E	71	F	OT	A
KO SICHANG	M	13 09 N	100 49 E	71	F	OT	A
AO SATTHHIP	HD	12 39 N	100 53 E	71	F	OT	A
LAEM SING	HD	12 28 N	102 04 E	71	F	OT	A
MACAU							
MACAU	HDM	22 12 N	113 33 E	62	F	OT	A
CHINA							
XIAMEN	HDM	24 27 N	118 04 E	14	F		A
KANMEN	HDM	28 05 N	121 17 E	14	F		A
YANTAL	HDM	37 32 N	121 23 E	14	F		A
QINHUANGDAO	HDM	39 54 N	119 36 E	14	F		A
HONG KONG							
CHI MA WAN, LANTAU IS	H M	22 14 N	114 00 E	34	F		A
NORTH POINT	H M	22 18 N	114 12 E	34	F		A
TAI PO, TOLO HARBOUR	H M	22 27 N	114 11 E	34	F		A
TSIM BEI TSUI	H M	22 29 N	114 01 E	34	F		A
KOREA							
INCHON	HDM	37 28 N	126 37 E	43	F	OT	A
KUNSAN	HDM	35 59 N	126 43 E	43	F	OT	A
GUNSAN OUTER PORT	HDM	35 58 N	126 40 E	43	F	FU	A
MOKPO	HDM	34 47 N	126 23 E	43	F	FU	A
DAEHEUG SAN DO	HDM	34 41 N	125 27 E	43	F	FU	A
SEOGWI PO	HDM	33 14 N	126 34 E	43	F	FU	A
JEJU	HDM	33 31 N	126 32 E	43	F	FU	A
GEOMUN DO	HDM	34 02 N	127 19 E	43	F	FU	A
YOSU	HDM	34 45 N	127 46 E	43	F	FU	A
CHUNGMU	HDM	34 49 N	128 26 E	43	F	FU	A
GADEOG DO	HDM	35 01 N	128 49 E	43	F	FU	A
PUSAN	HDM	35 06 N	129 02 E	43	F	FU	A
ULSAN	HDM	35 30 N	129 23 E	43	F	FU	A
POHANG	HDM	36 01 N	129 24 E	43	F	FU	A
ULREUNG DO	HDM	37 30 N	130 55 E	43	F	FU	A
MUGHO	HDM	37 33 N	129 07 E	43	F	FU	A
SOGCHO	HDM	38 12 N	128 36 E	43	F	FU	A
JAPAN							
JAPAN (HOKKAIDO)							
ABASHIRI	DM	44 01 N	144 17 E	42	F	FU	A
HANASAKI II	DM	43 16 N	145 34 E	42	F	FU	A
KUSHIRO	DM	42 58 N	144 23 E	42	F	FU	A
TOMAKOMAI	DM	42 38 N	141 38 E	42	F	FU	A
HAKODATE I	DM	41 47 N	140 44 E	42	F	FU	A
WAKKANAI	DM	45 25 N	141 41 E	42	F	FU	A
JAPAN (HONSHU-PACIFIC)							
HACHINOHE II	DM	40 32 N	141 32 E	42	F	FU	A
MIYAKO II	DM	39 39 N	141 58 E	42	F	FU	A
OFUNATO II	DM	39 01 N	141 46 E	42	F	FU	A
AYUKAWA	DM	38 18 N	141 31 E	42	F	FU	A
ONAHAMA	DM	36 56 N	140 55 E	42	F	FU	A
MERA	DM	34 55 N	139 50 E	42	F	FU	A
TOKYO II	DM	35 39 N	139 46 E	42	F	FU	A
YOKOHAMA	DM	35 28 N	139 39 E	42	F	FU	A
OKADA	DM	34 47 N	139 24 E	42	F	FU	A
UCHIURA	DM	35 01 N	138 54 E	42	F	FU	A
SHIMIZU-MINATO	DM	35 01 N	138 30 E	42	F	FU	A
OMAEZAKI II	DM	34 36 N	138 14 E	42	F	FU	A
MAISAKA	DM	34 41 N	137 37 E	42	F	FU	A
NAGOYA	DM	35 05 N	136 53 E	42	F	FU	A
TOBA II	DM	34 29 N	136 49 E	42	F	FU	A
OWASE	DM	34 04 N	136 13 E	42	F	FU	A
URAGAMI	DM	33 33 N	135 54 E	42	F	FU	A
KUSHIMOTO	DM	33 28 N	135 46 E	42	F	FU	A
JAPAN							
(HONSHU-INLAND SEA)							
SHIRAHAMA	DM	33 41 N	135 23 E	42	F	FU	A
WAKAYAMA	DM	34 13 N	135 09 E	42	F	FU	A
TAN-NOWA	DM	34 20 N	135 11 E	42	F	FU	A
OSAKA	DM	34 39 N	135 26 E	42	F	FU	A
KOBE	DM	34 41 N	135 11 E	42	F	FU	A
SUMOTO	DM	34 20 N	134 55 E	42	F	FU	A
UNO	DM	34 30 N	133 57 E	42	F	FU	A
JAPAN (SHIKOKU)							
KOCHI II	DM	33 30 N	133 35 E	42	F	FU	A
TOSA SHIMIZU	DM	32 47 N	132 58 E	42	F	FU	A
UWAJIMA II	DM	33 14 N	132 33 E	42	F	FU	A
MATSUYAMA II	DM	33 52 N	132 42 E	42	F	FU	A
TAKAMATSU	DM	34 21 N	134 03 E	42	F	FU	A
KOMATSUSHIMA	DM	34 00 N	134 35 E	42	F	FU	A
MUROTOMISAKI	DM	33 16 N	134 10 E	42	F	FU	A
JAPAN (KYUSHU)							
ABURATSU	DM	31 35 N	131 25 E	42	F	FU	A
KAGOSHIMA II	DM	31 35 N	130 34 E	42	F	FU	A
MAKURAZAKI II	DM	31 16 N	130 18 E	42	F	FU	A
MISUMI	DM	32 37 N	130 27 E	42	F	FU	A
OURA	DM	32 58 N	130 13 E	42	F	FU	A
KUCHINOTSU	DM	32 36 N	130 12 E	42	F	FU	A
NAGASAKI	DM	32 44 N	129 52 E	42	F	FU	A
FUKUE	DM	32 42 N	128 51 E	42	F	FU	A

JAPAN (AMAMI GUNTO)							
NAHA	DM	26 13 N	127 40 E	42	F	FU	A
ISHIGAKI	DM	24 20 N	124 09 E	42	F	FU	A
JAPAN							
(HONSHU-JAPAN SEA)							
SHIMONOSEKI I	DM	33 58 N	130 57 E	42	F	FU	A
TONOURA	DM	34 54 N	132 04 E	42	F	FU	A
SAKAI	DM	35 33 N	133 15 E	42	F	FU	A
SAIGO	DM	36 12 N	133 20 E	42	F	FU	A
MAIZURU II	DM	35 28 N	135 23 E	42	F	FU	A
TOYAMA	DM	36 46 N	137 13 E	42	F	FU	A
FUKAURA	DM	40 39 N	139 56 E	42	F	FU	A
AOMORI	DM	40 50 N	140 46 E	42	F	FU	A
JAPAN							
(OGASAWARA GUNTO)							
CHICHIJIMA	DM	27 06 N	142 11 E	42	F	FU	A
PHILIPPINES							
MANILA	HDM	14 35 N	120 58 E	59	F		A
LEGASPI	HDM	13 09 N	123 45 E	59	F		A
CEBU	HDM	10 18 N	123 54 E	59	F		A
DAVAO	HDM	07 05 N	125 38 E	59	F		A
JOLO	HDM	06 04 N	121 00 E	59	F		A
PAPUA NEW GUINEA							
VANIMO		02 41 S	141 17 E	57	F	LS	A
RABAUL		04 12 S	152 11 E	57	F	LS	A
RABAUL	HDM	04 12 S	152 11 E	79	F	FP	C
MADANG		05 12 S	145 47 E	57	F	LS	A
LAE		06 44 S	147 00 E	57	F	LS	A
PORT MORESBY		09 29 S	147 08 E	57	F	LS	A
AUSTRALIA							
BOOBY IS.	H	10 36 S	141 55 E	2	F	LS	A
DARWIN	HDM	12 29 S	130 58 E	2	F	LS	A
SNAKE BAY	H	11 24 S	130 40 E	2	F	LS	A
AURARI BAY	H	11 44 S	133 15 E	2	F	LS	A
MELVILLE BAY	H	12 12 S	136 40 E	2	F	LS	A
MILNER BAY	H	13 52 S	136 25 E	2	F	LS	A
CENTRE ISLAND	H	15 45 S	136 49 E	2	F	LS	A
KARUMBA	H	17 29 S	140 50 E	2	F	LS	A
WEIPA	H	12 41 S	141 53 E	2	F	MU	A; F LS A
COOKTOWN	H	15 28 S	145 15 E	2	F	LS	A
CAIRNS	H	16 56 S	145 47 E	2	F	LS	A
MOURILYAN HBR	H	17 36 S	146 07 E	2	F	MU	A; F LS A
CLUMP POINT	H	17 50 S	146 05 E	2	F	LS	A
CARDWELL	H	18 16 S	146 02 E	2	F	LS	A
LUCINDA	H	18 32 S	146 20 E	2	F	MU	A; F LS A
TOWNSVILLE I	HDM	19 20 S	146 50 E	2	F	AM	A; F LS A
CAPE FERGUSON	H	19 20 S	147 00 E	2	F	LS	A
BOWEN	H	20 01 S	148 15 E	2	F	MU	A; F LS A
THOMAS IS.	H	20 05 S	148 18 E	2	D	FO	A
SHUTE HARBOUR	H	20 30 S	148 55 E	2	F	LS	A
MACKAY	HDM	21 06 S	149 13 E	2	F	AM	A; F LS A
HAY POINT	H	21 20 S	149 20 E	2	F	LS	A
PORT ALMA	H	23 35 S	150 53 E	2	F	LS	A
GLADSTONE	H	23 50 S	151 15 E	2	F	MU	A; F LS A
BUNDABERG	HDM	24 46 S	152 22 E	2	F	LS	A
URANGAN	H	25 17 S	153 55 E	2	F	LS	A
MARYBOROUGH	H	25 32 S	152 43 E	2		U	
ALEXANDRA HEADS	H	26 41 S	153 07 E	2	B	NE	C
MOOLOOLAH RIVER	H	26 41 S	153 07 E	2	F	MU	A; F LS A
CALOUNDRA HEAD	H	26 48 S	153 09 E	2	B	NE	A
TANGALOOMA	H	27 11 S	153 23 E	2	F	OT	C
BRISBANE CAIRNCROSS	H	27 27 S	153 04 E	2	F	MU	A
BRISBANE MOGGILL	H	27 35 S	152 53 E	2		U	A
BRISBANE PORT OFFICE	H	27 28 S	153 02 E	2	B	NE	A
BRISBANE PINKENBA	H	27 26 S	153 07 E	2	F	OT	C
BISHOP IS.	H	27 52 S	153 10 E	2	D	FO	C
SOUTHPORT	H	27 57 S	153 25 E	2	F	LS	A
SNAPPER ROCKS	H	28 10 S	153 33 E	2	D	FO	A
TWEED HEADS	H	28 10 S	153 33 E	2	F	FI	A
BALLINA	H	28 52 S	153 35 E	2	F	FP	C
NORFOLK ISLAND	H	29 04 S	167 56 E	2	F	LS	A
COFF'S HARBOUR I	H	30 20 S	153 00 E	2	F	FI	A
CROWDY HEAD	H	31 49 S	152 45 E	2	F	LS	A
NEWCASTLE II	HDM	32 55 S	151 48 E	2	F	GE	A
NEWCASTLE III	H M	32 55 S	151 48 E	2	F	ES	A
SYDNEY, FORT DENISON	HDM	33 51 S	151 14 E	2	F	HS	A
CAMP COVE	HDM	33 50 S	151 17 E	2	F	HS	A
BOTANY BAY	H	33 59 S	151 13 E	2	F	FI	A
PORT KEMBLA	H	34 28 S	150 55 E	2	F	MU	A
PORT STEPHENS	H	34 28 S	150 55 E	2	F	FP	C
JERVIS BAY	H	35 07 S	150 42 E	2	F	LS	A
MERIMBULA	H	36 54 S	149 54 E	2	F	FI	A
EDEN	H	37 05 S	149 59 E	2	F	FI	A
LAKES ENTRANCE (INNER)	H	37 53 S	147 58 E	2	F	MU	A
LAKES ENTRANCE (OUTER)	H	37 54 S	147 58 E	2	F	MU	A
PORT ALBERT	H	38 41 S	146 41 E	2	F	MU	A
PORT WELSHPOOL	H	38 42 S	146 28 E	2	F	MU	A
STONY POINT	H	38 22 S	145 13 E	2	F	MU	A
WILLIAMSTOWN	HDM	37 52 S	144 55 E	2	F	LS	A
POINT LONSDALE	HDM	38 18 S	144 37 E	2	F	MU	A
GEELONG	H	38 06 S	144 36 E	2	F	MU	A
GEELONG	H	38 08 S	144 30 E	2	F	MU	A
GEELONG	H	38 09 S	144 22 E	2	F	MU	A
PORTLAND	H	38 21 S	141 37 E	2	F	MU	A
BURNIE	H	41 03 E	145 55 E	2	F	GE	A
DEVONPORT	H	41 09 S	146 16 E	2	F	LE	A
GEORGETOWN	HDM	41 04 S	146 48 E	2	F	KE	A
BELL BAY		41 08 S	146 52 E	2	F	U	
LAUNCESTON	H	41 26 S	147 08 E	2	F	KE	A
SPRING BAY	H	42 33 S	147 56 E	2	F	LS	A
HOBART	HDM	42 50 S	147 19 E	2	F	KE	A
PORT MACDONNELL II	HDM	38 03 S	140 42 E	2	F	LS	A
CAPE JAFFA	HDM	36 57 S	139 41 E	2	P	BM	C
VICTOR HARBOUR	HDM	35 34 S	138 38 E	2	F	LS	A
VIVONNE BAY	HDM	36 00 S	137 11 E	2	P	BM	C
PORT GILES	H	35 03 S	137 46 E	2	F	LS	A
PORT ADELAIDE (INNER HB)	HDM	34 51 S	138 30 E	2	F	LS	A
PORT ADELAIDE (OUTER HB)	HDM	34 47 S	138 28 E	2	F	BA	A
PORT WALLAROO	H	33 56 S	137 38 E	2	F	LS	A
PORT PIRIE	H	33 09 S	138 01 E	2	F	LS	A
PORT AUGUSTA	H	32 30 S	137 46 E	2	F	NZ	A
PORT LINCOLN	HDM	34 49 S	135 52 E	2	F	LS	A
ELLISTON	HDM	33 38 S	134 57 E	2	P	BM	C
THEVENARD	HDM	32 09 S	133 39 E	2	F	LS	A
FOWLERS BAY	HDM	32 00 S	132 26 E	2	P	BM	C
EUCLA	HDM	31 43 S	128 53 E	2	P	BM	C
ESPERANCE	HDM	33 52 S	121 54 E	2	F	LS	A
ALBANY	HDM	35 02 S	117 53 E	2	F	LS	A
BUSSELTON	H	33 38 S	115 20 E	2	F	LS	A
SAMPHIRE BAY	H	33 18 S	115 42 E	2	F	FP	C
BUNBURY	HDM	33 17 S	115 38 E	2	F	LS	A
MANDURAH	H	32 32 S	115 43 E	2	F	LS	A
FREMANTLE	HDM	32 03 S	115 44 E	2	F	LS	A
BARRACK ST (SWAN RIVER)	H	31 58 S	115 51 E	2	F	LS	A
GERALDTON	HDM	28 47 S	114 35 E	2	F	LS	A
DENHAM	H	25 56 S	113 32 E	2	F	FP	C
HAMELIN	H	26 23 S	114 09 E	2	F	FP	C
CARNARVON	HDM	24 53 S	113 37 E	2	F	LS	A
DAMPIER	HDM	20 38 S	116 42 E	2	F	MU	A
PORT HEDLAND	HDM	20 19 S	118 34 E	2	F	LS	A
BROOME	HDM	17 58 S	122 14 E	2	F	LS	A
KOOLAN IS.		16 09 S	123 45 E	2		U	
WYNDHAM	HDM	15 27 S	128 06 E	2	F	LS	A
PORT KEATS	H	14 11 S	129 34 E	2	F	LS	A
NEW ZEALAND							
AUCKLAND		36 51 S	174 49 E	52	F	MU	A
TAURANGA		37 39 S	176 11 E	52	F	MU	A
NAPIER		39 29 S	176 55 E	52	F		
WELLINGTON HARBOUR		41 17 S	174 47 E	52	F	EV	A
PICTON HARBOUR		41 17 S	174 02 E	52	D	FO	A
PORT LYTTELTON		43 36 S	172 43 E	52	F	EV	A
TIMARU HARBOUR		44 24 S	171 16 E	52	F	EV	A
DUNEDIN		45 53 S	170 31 E	52	B	PH	A
BLUFF (SOUTHLAND HARBOUR)		46 36 S	168 21 E	52	F	MU	A
PORT NELSON		41 15 S	171 36 E	52	B	PH	A
PORT TARANAKI		39 03 S	174 02 E	52	F	EV	A
ONEHUNGA		36 56 S	174 47 E	52	F	MU	A
PORT WHANGAREI		35 46 S	174 21 E	52	F	MU	A
WHANGAREI HARBOUR		35 50 S	174 29 E	52	F	MU	A
MARIANAS ISLANDS							
APRA HARBOR, GUAM	H M	13 26 N	144 39 E	80	F	FP	C; B MC C
SAIPAN	HDM	15 14 N	145 45 E	79	F	FP	C
CAROLINE ISLANDS							
KAPINGAMARANGI	HDM	01 06 N	154 47 E	79	F	FP	C
PONAPE	HDM	06 59 N	158 14 E	79	F	FP	C
MALAKAL	HDM	07 20 N	134 28 E	79	F	FP	C
TRUK, MOEN ISLAND	H M	07 27 N	151 51 E	80	F	FP	C; B MC C
YAP	HDM	09 31 N	138 08 E	79	F	FP	C
MARSHALL ISLANDS							
MAJURO	HDM	07 06 N	171 22 E	79	F	FP	C
KWAJALEIN	H M	08 44 N	167 44 E	80	F	FP	C; B MC C
ENIWETOK	HDM	11 22 N	162 21 E	79	F	FP	C
WAKE ISLAND	H M	19 17 N	166 37 E	80	F	FP	C; B MC C
GILBERT IS. (KIRIBATI)							
NAURU	HDM	00 32 S	166 54 E	79	F	FP	C
TARAWA	HDM	01 22 N	172 56 E	79	F	FP	C
ELLICE IS. (TUVALU)							
FUNAFUTI	HDM	08 32 S	179 13 E	79	F	FP	C
SOLOMON ISLANDS							
HONIARA	HDM	09 26 S	159 57 E	79	F	FP	C
VANUATU (NEW HEBRIDES)							
PORT VILA	HDM	17 45 S	168 18 E	81	F		
NEW CALEDONIA							
NOUMEA	HDM	22 18 S	166 26 E	79	F	FP	C
FIJI							
SUVA	HDM	18 08 S	178 26 E	79	F	FP	C
WESTERN SAMOA							

APIA HARBOUR	H	M	13 50 S	171 45 W	83	F	SD	U
AMERICAN SAMOA								
PAGO PAGO	H	M	14 17 S	170 41 W	80	F	FP	C; B BB C
PHOENIX ISLANDS								
CANTON ISLAND	HDM		02 48 S	171 43 W	79	F	FP	C
HAWAIIAN ISLANDS								
JOHNSTON ISLAND	H	M	16 45 N	169 31 W	79	F	FP	C; B MC C
MIDWAY ISLAND	H	M	28 13 N	177 22 W	80	F	FP	C; B MC C
FRENCH FRIGATE SHOALS	H	M	23 52 N	166 17 W	79	F	FP	C
NAWILIWILI BAY, KAUAI IS	H	M	21 58 N	159 21 W	80	F	FP	C; B MC C
MOKUOLOE ISLAND	H	M	21 26 N	157 47 W	80	B	BB	C
KAHULUI HARBOR, MAUI IS	H	M	20 45 N	156 28 W	80	F	LS	C; B MC C
HILO, HAWAII ISLAND	H	M	19 44 N	155 04 W	80	F	FP	C; B MC C
LINE ISLANDS								
CHRISTMAS ISLAND	HDM		01 59 N	157 28 W	79	F	FP	C
FANNING ISLAND	HDM		03 54 N	159 24 W	79	F	FP	C
COOK ISLANDS								
RAROTONGA	HDM		21 12 S	159 46 W	79	F	FP	C
PENRHYN	HDM		09 01 S	158 04 W	79	F	FP	C
ILES DE LA SOCIETE								
PAPEETE	HDM		17 32 S	149 34 W	79	F	FP	C
MARQUESAS ISLANDS								
HIVA OA	HDM		09 49 S	139 02 W	79	F	FP	C
GAMBIER ISLANDS								
RIKITEA	HDM		23 08 S	134 57 W	79	F	FP	C
EASTER ISLAND								
EASTER ISLAND	HDM		27 09 S	109 29 W	79	F	FP	C
USA (ALEUTIAN IS.)	HDM		27 09 S	109 29 W	79	F	FP	C
ADAK	H	M	51 52 N	176 38 W	80	F	LS	C; B MC C
UNALASKA	H	M	53 53 N	166 32 W	80	F	FP	C: B MC C
USA (ALASKA)								
PRUDHOE BAY	H	M	70 23 N	148 30 W	80	F	FP	C; B MC C
SAND POINT	H	M	55 20 N	160 30 W	80	F	FP	C; B MC C
ST.PAUL'S HARBOR, KODIAK	H	M	57 45 N	152 29 W	80	B	BB	C
ANCHORAGE	H	M	61 14 N	149 54 W	80	F	LS	C; B BB C
NIKISKI	H	M	60 41 N	151 24 W	80	B	BB	C
SELDOVIA	H	M	59 26 N	151 43 W	80	F	FP	C; B MC M
SEWARD	H	M	60 06 N	149 27 W	80	F	FP	C; B MC C
VALDEZ	H	M	61 08 N	146 21 W	80	F	FP	C; B MC C
CORDOVA	H	M	60 33 N	145 46 W	80	F	FP	C; B MC C
YAKUTAT	H	M	59 33 N	139 44 W	80	F	FP	C; B MC C
SITKA	H	M	57 03 N	135 20 W	80	F	FP	C; B MC C
SKAGWAY	H	M	59 27 N	135 19 W	80	B	BB	C
JUNEAU	H	M	58 18 N	134 25 W	80	F	FP	C
KETCHIKAN	H	M	55 20 N	131 38 W	80	F	FP	C; B MC C
CANADA (PACIFIC)								
PRINCE RUPERT	HDM		54 19 N	130 20 W	12	F		B
LANGARA POINT	HDM		54 15 N	133 02 W	12	F		B
QUEEN CHARLOTTE CITY	HDM		53 15 N	132 04 W	12	F		B
BELLA BELLA	HDM		52 10 N	128 08 W	12	F		B
PORT HARDY	HDM		50 43 N	127 39 W	12	F		B
ALERT BAY	HDM		50 35 N	126 57 W	12	F		B
CAMPBELL RIVER II	HDM		50 01 N	125 14 W	12	F		B
POINT ATKINSON	HDM		49 20 N	123 15 W	12	F		B
VANCOUVER	HDM		49 17 N	123 07 W	12	F		B
NEW WESTMINSTER	HDM		49 12 N	122 55 W	12	F		B
STEVESTON	HDM		49 07 N	123 11 W	12	F		B
TSAWWASSEN	HDM		49 00 N	123 08 W	12	F		B
FULFORD HARBOUR	HDM		48 46 N	123 27 W	12	F		B
PATRICIA BAY	HDM		43 39 N	123 27 W	12	F		B
VICTORIA	HDM		48 25 N	123 22 W	12	F		B
SOOKE	HDM		48 22 N	123 44 W	12	F		B
PORT RENFREW	HDM		48 33 N	124 25 W	12	F		B
BAMFIELD	HDM		48 51 N	125 08 W	12	F		B
PORT ALBERNI	HDM		49 14 N	124 49 W	12	F		B
TOFINO	HDM		49 09 N	125 55 W	12	F		B
USA (PACIFIC)								
CHERRY POINT	H	M	48 52 N	122 45 W	80	F	FP	C; B BB C
FRIDAY HARBOR (OCEAN.LAB)	H	M	48 33 N	123 00 W	80	F	FP	C
SEATTLE	H	M	47 36 N	122 20 W	80	F	FP	C; B MC C
PORT TOWNSEND	H	M	48 07 N	122 45 W	80	F	FP	C
PORT ANGELES	H	M	48 08 N	123 26 W	80	F	FP	C
NEAH BAY	H	M	48 22 N	124 37 W	80	F	LS	C; F SD C
TOKE POINT	H	M	46 42 N	123 58 W	80	F	FP	C
ASTORIA (TONGUE POINT)	H	M	46 13 N	123 46 W	80	F	LS	C; F SD C
DEPOE BAY	H	M	44 49 N	124 04 W	80	F	FP	C
SOUTH BEACH	H	M	44 38 N	124 03 W	80	F	FP	C
CHARLESTON II	H	M	43 21 N	124 19 W	80	F	LS	C
PORT ORFORD	H	M	42 44 N	124 30 W	80	F	LS	C; B MC C
CRESCENT CITY	H	M	41 45 N	124 12 W	80	F	FP	C; B MC C
TRINIDAD	H	M	41 04 N	124 09 W	80	F	FP	C
NORTH SPIT, HUMBOLDT BAY	H	M	40 46 N	124 13 W	80	F	LS	C
ARENA COVE	H	M	38 55 N	123 43 W	80	F	FP	C; B MC C
SACRAMENTO	H	M	38 35 N	121 30 W	80	F	FP	C
BENECIA	H	M	38 03 N	122 08 W	80	F	LS	C
PORT CHICAGO, SUISUN BAY	H	M	38 03 N	122 02 W	80	F	FP	C; B MC C
POINT REYES, DRAKES BAY	H	M	38 00 N	122 58 W	80	F	FP	C; B MC C
STOCKTON	H	M	37 57 N	120 17 W	80	F	LS	C
SAN FRANCISCO	H	M	37 48 N	122 28 W	80	F	LS	C; F SD C; B MC C
ALAMEDA (NAVAL AIR STN)	H	M	37 46 N	122 18 W	80	F	FP	C; B MC C
SAN MATEO	H	M	37 35 N	122 15 W	80	F	FP	C; B BB C
MONTEREY HARBOR	H	M	36 36 N	121 53 W	80	F	FP	C
PORT SAN LUIS WHARF	H	M	35 10 N	120 45 W	80	F	FP	C; B MC C
RINCON ISLAND	H	M	34 21 N	119 26 W	80	F	FP	C
SANTA MONICA	H	M	34 01 N	118 30 W	80	F	FP	C; B MC C
LONG BEACH	H	M	33 47 N	118 15 W	80	F	FP	C; B MC C
LOS ANGELES	H	M	33 43 N	118 16 W	80	F	FP	C; B MC C
NEWPORT BAY	H	M	33 36 N	117 53 W	80	F	FP	C; B MC C
LA JOLLA (SCRIPPS INST)	H	M	32 52 N	117 15 W	80	F	FP	C
SAN DIEGO (QUARANTINE ST)	H	M	32 43 N	117 10 W	80	F	FP	C; B MC C
MEXICO (PACIFIC)								
ENSENADA			31 51 N	116 38 W	48	F		A
SAN QUINTIN			28 29 N	115 59 W	48	F		A
ISLA GUADALUPE			28 53 N	118 18 W	48	F		A
ISLA CEDROS			28 06 N	115 11 W	48	F		A
SAN CARLOS			24 47 N	112 07 W	48	F		A
CABO SAN LUCAS			22 53 N	109 54 W	48	F		A
LA PAZ			24 10 N	110 21 W	48	F		A
LORETO			26 01 N	111 22 W	48	F		A
BAHIA DE LOS ANGELES			28 57 N	113 33 W	48	F		A
SAN FELIPE			31 01 N	114 49 W	48	F		A
GUAYMAS			27 55 N	110 54 W	48	F		A
VALLARTA			20 36 N	105 14 W	48	F		A
MANZANILLO			19 03 N	104 20 W	48	F		A
ACAPULCO			16 50 N	99 55 W	48	F		A
PUERTO ANGEL			15 30 N	96 30 W	48	F		A
EL SALVADOR								
ACAJUTLA	HDM		13 35 N	89 51 W	26	F	SD	A
COSTA RICA								
PUNTARENAS	HDM		09 58 N	84 50 W	17	F		A
QUEPOS	HDM		09 24 N	84 10 W	17	F		A
PANAMA (PACIFIC)								
PUERTO ARMUELLES		M	08 16 N	82 52 W	56	F	SD	U
BALBOA			08 58 N	79 34 W	55	F	FP	C
ECUADOR								
SAN LORENZO	H		01 18 N	78 50 W	22	F	ST	A
ESMERALDAS	H		01 00 N	79 57 W	22	F	ST	A
BAHIA DE CARAQUEZ	H		00 36 S	80 26 W	22	F	ST	A
MANTA	HDM		00 57 S	80 43 W	22	F	SD	A
GUAYAQUIL	H		02 12 S	79 53 W	22	F	ST	A
LA LIBERTAD	HDM		02 13 S	80 54 W	22	F	SD	A
GALAPAGOS IS.								
SANTA CRUZ	HDM		00 45 S	90 19 W	79	F	FP	C
PERU								
BASE NAVAL EL SALTO		M	03 25 S	80 18 W	58	F	SD	A
PTO. DE TALARA		M	04 35 S	81 17 W	58	F	SD	A
PTO. DE PIMENTEL		M	06 50 S	79 56 W	58	F	SD	A
PTO. DE CHIMBOTE		M	09 04 S	78 38 W	58	F	SD	A
PTO. DE CALLAO		M	12 03 S	77 09 W	58	F	SD	A
BASE NAVAL DE SAN JUAN		M	15 21 S	75 09 W	58	F	SD	A
PTO. DE MATARANI		M	17 00 S	72 07 W	58	F	SD	A
CHILE								
ARICA	H		18 28 S	70 20 W	13	F	SD	B
ANTOFAGASTA	H		23 39 S	70 25 W	13	F	SD	B
CALDERA	H		27 04 S	70 50 W	13	F	SD	B
COQUIMBO	H		29 56 S	71 21 W	13	B	BB	B
VALPARAISO	H		33 02 S	71 38 W	13	B	BB	B
JUAN FERNANDEZ	HDM		33 37 S	78 50 W	79	F	FP	C
R. CRUSOE	H		33 37 S	78 50 W	13	F	FB	B
TALCAHUANO	H		36 41 S	73 06 W	13	F	SD	B
PUERTO MONTT	H		41 29 S	72 58 W	13	B	MC	B
PUNTA ARENAS	H		53 10 S	70 54 W	13	B	MC	B
PUERTO WILLIAMS	H		54 55 S	67 37 W	13	F	SD	B
URUGUAY								
COLONIA	HDM		34 28 S	57 51 W	78	F	OT	A
MONTEVIDEO	HDM		34 55 S	56 13 W	78	F	OT	A
PUNTA DEL ESTE	HDM		34 58 S	54 57 W	78	F	SD	A
LA PALOMA	HDM		34 39 S	54 09 W	78	F	OT	A
BRASIL								
CANANEIA	H		25 01 S	47 56 W	10	F	OT	A
UBATUBA	H		23 30 S	45 07 W	10	F	OT	A
FRENCH GUIANA								
CAYENNE	H		05 00 N	52 00 W	29	F	OT	A
GUYANA								
GEORGETOWN	H		06 49 N	58 10 W	33	F	MU	A
TRINIDAD AND TOBAGO								
TRINIDAD			10 41 N	61 37 W	72	P	AM	B
PANAMA (CARIBBEAN)								
COCO SOLO			09 22 N	79 53 W	55	F	FP	C
MARTINIQUE								
LE ROBERT	HDM		14 41 N	60 56 W	28			

MEXICO (GULF)								
PROGRESO		21 18 N	89 39 W	48	F		A
CIUDAD DEL CARMEN		18 38 N	91 51 W	48	F		A
COATZACOALCOS		18 09 N	94 25 W	48	F		A
ALVARADO		18 46 N	95 46 W	48	F		A
VERACRUZ		19 11 N	96 07 W	48	F		A
TUXPAN		21 00 N	97 20 W	48	F		A
CIUDAD MADERO		22 15 N	97 48 W	48	F		A
PUERTO RICO							
MAGUEYES ISLAND	H M	17 58 N	67 03 W	80	F	FP	C; B MC C
SAN JUAN	H M	18 27 N	66 05 W	80	F	FP	C; B MC C
VIRGIN ISLANDS							
WEST INDIES LAB, ST CROIX	H M	17 45 N	64 36 W	80	F	FP	C
CHARLOTTE AMALIE	H M	18 21 N	64 55 W	80	F	FP	C
USA (GULF)							
PORT ISABEL	H M	26 04 N	97 13 W	80	F	FP	C; B BB C
PADRE ISLAND	H M	26 04 N	97 09 W	80	B	BB	C;B BB C
CAMERON COUNTY FISHING	H M	26 08 N	97 10 W	80	B	BB	C
PORT MANSFIELD	H M	26 33 N	97 26 W	80	F	FP	C
PORT ARANSAS	H M	27 49 N	97 04 W	80	F	FP	C
ROCKPORT	H M	28 01 N	97 03 W	80	F	FP	C
FREEPORT	H M	28 57 N	95 19 W	80	F	FP	C; B MC C
GALVESTON I	H M	29 17 N	94 47 W	80	F	FP	C; B BB C
GALVESTON II	H M	29 19 N	94 48 W	80	F	FP	C; B BB C
MORGAN'S POINT, GALVESTON	H M	29 41 N	94 51 W	80	F	FP	C
SABINE PASS	H M	29 42 N	93 51 W	80	F	FP	C; B BB C
GRAND ISLE	H M	29 17 N	89 58 W	80	F	FP	C; B MC C
SOUTH PASS	H M	28 59 N	89 08 W	80	F	FP	C; B MC C
WEST PASCAGOULA RIVER	H M	30 23 N	88 37 W	80	F	LS	C
BAYOU CUMBEST	H M	30 23 N	88 27 W	80	F	LS	C
PEARLINGTON, PEARL RIVER	H M	30 15 N	89 37 W	80	F	LS	C
BAY WAVELAND YACHT CLUB	H M	30 20 N	89 20 W	80	F	LS	C
BACK BAY (POPPS FERRY)	H M	30 25 N	88 59 W	80	F	LS	C
CADET POINT, BILOXI	H M	30 23 N	88 51 W	80	F	LS	C
DAUPHIN ISLAND	H M	30 15 N	88 04 W	80	F	FP	C; B MC C
PENSACOLA	H M	30 24 N	87 13 W	80	F	FP	C; B MC C
NAVARRE BEACH	H M	30 23 N	86 52 W	80	F	LS	C; B BB C
PANAMA CITY	H M	30 09 N	85 40 W	80	F	LS	C; B MC C
APALACHICOLA	H M	29 43 N	84 59 W	80	F	LS	C; B MC C
TURKEY POINT	H M	29 56 N	84 31 W	80	F	LS	C
SHELL POINT	H M	30 04 N	84 17 W	80	F	LS	C; B MC C
CEDAR KEYS II	H M	29 08 N	83 02 W	80	F	LS	C; B MC C
CLEARWATER BEACH	H M	27 59 N	82 50 W	80	F	LS	C; B MC C
ST. PETERSBURG	H M	27 46 N	82 37 W	80	F	LS	C; B BB C
FORT MYERS	H M	26 39 N	81 52 W	80	F	LS	C; B MC C
VACA KEY	H M	24 43 N	81 06 W	80	F	FP	C
NAPLES	H M	26 08 N	81 48 W	80	F	LS	C; B MC C
KEY WEST (NAVAL BASE)	H M	24 33 N	81 48 W	80	F	LS	C; B BB C
MARATHON SHORES	H M	24 44 N	81 02 W	80	F	LS	C; B MC C
BERMUDA							
ST. GEORGES	H M	32 22 N	64 42 W	80	F	FP	C; B MC C
USA (ATLANTIC)							
HAULOVER BEACH PIER	H M	25 54 N	80 07 W	80	F	LS	C
PALM BEACH	H M	26 42 N	80 03 W	80	F	LS	C
TITUSVILLE, INDIAN RIVER	H M	28 37 N	80 48 W	80	F	LS	C
DAYTONA BEACH SHORES	H M	29 09 N	80 58 W	80	F	LS	C; B BB C
MAYPORT	H M	30 24 N	81 26 W	80	F	LS	C; B MC C
FERNANDINA	H M	30 41 N	81 28 W	80	F	LS	C; B MC C
FORT PULASKI	H M	32 02 N	80 54 W	80	F	LS	C; B MC C
BEAUFORT	H M	32 26 N	80 40 W	80	F	FP	C
EDISTO BEACH	H M	32 30 N	80 18 W	80	B	MC	C
BLUFF PLANTATION, COMBAHEE	H M	32 41 N	80 44 W	80	F	FP	C
COMBAHEE	H M	32 42 N	80 50 W	80	F	LS	C
CHARLESTON I	H M	32 47 N	79 56 W	80	F	FP	C; B BB C
GENERAL DYNAMICS PIER	H M	33 01 N	79 55 W	80	F	LS	C
SOUTH SANTEE RIVER BRIDGE	H M	33 11 N	79 24 W	80	F	LS	C
WINYAH BAY SOUTH IS.	H M	33 14 N	79 12 W	80	F	LS	C; B BB C
BUCKSPORT, WACCAMAW R	H M	33 39 N	79 06 W	80	F	FP	C
SPRINGMAID PIER	H M	33 40 N	78 54 W	80	F	LS	C; B MC C
SOUTHPORT	H M	33 55 N	78 01 W	80	F	LS	C; B MC C
WILMINGTON	H M	34 14 N	77 57 W	80	F	FP	C; B MC C
ATLANTIC BEACH	H M	34 42 N	76 43 W	80	F	FP	C; B MC C
DUKE MARINE LAB BEAUFORT	H M	34 43 N	76 40 W	80	F	FP	C; B MC C
CAPE HATTERAS	H M	35 13 N	75 38 W	80	F	LS	C; B MC C
CURRITUCK SOUND	H M	36 10 N	75 46 W	80	B	MC	C
DUCK PIER OUTSIDE	H M	36 11 N	75 45 W	80	F	LS	C; B BB C
PORTSMOUTH	H M	36 49 N	76 18 W	80	F	FP	C
HAMPTON ROADS	H M	36 57 N	76 20 W	80	F	FP	C; B BB C
CHESAPEAKE BAY BRIDGE	H M	36 58 N	76 07 W	80	F	FP	C
KIPTOPEKE BEACH	H M	37 10 N	75 59 W	80	F	FP	C
GLOUCESTER POINT	H M	37 15 N	76 30 W	80	F	FP	C
WACHAPREAGUE	H M	37 36 N	75 41 W	80	F	FP	C
LEWISETTA	H M	38 00 N	76 28 W	80	F	FP	C
COLONIAL BEACH POTOMAC	H M	38 15 N	76 58 W	80	F	FP	C
SOLOMON'S ISLAND	H M	38 19 N	76 27 W	80	F	FP	C; B MC C
OCEAN CITY	H M	38 20 N	75 05 W	80	F	FP	C; B MC C
CAMBRIDGE	H M	38 34 N	76 04 W	80	F	FP	C; B MC C
INDIAN RIVER INLET	H M	38 37 N	75 04 W	80	F	FP	C
LEWES (BREAKWATER HARBOR)	H M	38 47 N	75 06 W	80	F	FP	C; B BB C
WASHINGTON DC	H M	38 52 N	77 01 W	80	F	FP	C
CAPE MAY	H M	38 58 N	74 58 W	80	F	FP	C; B MC C
MATAPEAKE	H M	38 58 N	76 21 W	80	F	FP	C
ANNAPOLIS (NAVAL ACADEMY)	H M	38 59 N	76 29 W	80	F	FP	C; B BB C
BALTIMORE	H M	39 16 N	76 35 W	80	F	FP	C; B MC C
ATLANTIC CITY	H M	39 21 N	74 25 W	80	F	FP	C; B BB C
MAYS LANDING, GREAT EGG	H M	39 27 N	74 44 W	80	F	LS	C
CHESAPEAKE CITY	H M	39 32 N	75 49 W	80	F	FP	C
HAVRE DE GRACE	H M	39 32 N	76 05 W	80	F	FP	C; B MC C
REEDY POINT	H M	39 34 N	75 34 W	80	F	FP	C
GREEN BANK, MULLICA R	H M	39 37 N	74 35 W	80	F	LS	C
WARETOWN, BARNEGAT BAY	H M	39 48 N	74 11 W	80	F	LS	C; F FP C
PHILADELPHIA (PIER 9N)	H M	39 57 N	75 08 W	80	F	FP	C; B MC C
TRENTON TERMINAL	H M	40 11 N	74 45 W	80	F	FP	C; B BB C
LONG BRANCH FISHING PIER	H M	40 18 N	73 59 W	80	F	FP	C; B BB C
SANDY HOOK	H M	40 28 N	74 01 W	80	F	FP	C; B MC C
PORT ELIZABETH	H M	40 40 N	74 08 W	80	F	LS	C
NEW YORK	H M	40 42 N	74 01 W	80	F	LS	C; B MC C
WILLETS POINT	HDM	40 48 N	73 47 W	80	F	FP	C; B MC C
NEW ROCHELLE	H M	40 54 N	73 47 W	80	F	FP	C; B MC C
PORT JEFFERSON	H M	40 57 N	73 05 W	80	F	FP	C; B MC C
MONTAUK	H M	41 03 N	71 58 W	80	F	FP	C; B MC C
BRIDGEPORT	H M	41 10 N	73 11 W	80	F	FP	C
NANTUCKET	H M	41 17 N	70 06 W	80	F	FP	C; B MC C
NEW LONDON	H M	41 22 N	72 06 W	80	F	FP	C; B MC C
NEWPORT	H M	41 30 N	71 20 W	80	F	FP	C; B MC C
WOODS HOLE (OCEAN. INST)	H M	41 32 N	70 40 W	80	F	FP	C; B MC C
PROVIDENCE (STATE PIER)	H M	41 48 N	71 24 W	80	F	FP	C; B MC C
BOSTON	H M	42 21 N	71 03 W	80	F	FP	C; B BB C
SEAVEY ISLAND	H M	43 05 N	70 45 W	80	F	FP	C; B BB C
PORTLAND	H M	43 40 N	70 15 W	80	F	FP	C; B MC C
ROCKLAND	H M	44 06 N	69 06 W	80	F	FP	C; B MC C
BAR HARBOR	H M	44 23 N	68 12 W	80	F	FP	C; B BB C
CUTLER	H M	44 39 N	67 13 W	80	F	FP	C; B MC C
EASTPORT	H M	44 54 N	66 59 W	80	F	FP	C; B BB C
CANADA (ATLANTIC AND ARCTIC)							
ST. JOHN N.B.	HDM	45 16 N	66 04 W	12	F		C
SPENCER ISLAND	HDM	45 18 N	64 47 W	12	B		B
PARKERS COVE	HDM	44 48 N	65 32 W	12	B		B
YARMOUTH	HDM	43 50 N	66 08 W	12	F		C
BOUTILIER POINT	HDM	44 40 N	63 58 W	12	F		B
HALIFAX	HDM	44 40 N	63 35 W	12	F		C
POINT TUPPER	HDM	45 36 N	61 22 W	12	F		C
NORTH SYDNEY	HDM	46 13 N	60 15 W	12	F		C
PICTOU	HDM	45 41 N	62 42 W	12	F		C
CHARLOTTETOWN	HDM	46 14 N	63 07 W	12	F		C
RUSTICO	HDM	46 28 N	63 17 W	12	B		B
POINTE-DU-CHENE	HDM	46 15 N	64 32 W	12	F		C
LOWER ESCUMINAC	HDM	47 05 N	64 53 W	12	F		B
DALHOUSIE	HDM	48 04 N	66 23 W	12	P		B
RIVIERE-AU-RENARD	HDM	49 00 N	64 23 W	12	F		B
STE-ANNE-DES-MONTS	HDM	49 08 N	66 29 W	12	F		B
POINTE-AU-PERE	HDM	48 31 N	68 28 W	12	F		B
RIVIERE-DU-LOUP	HDM	47 51 N	69 34 W	12			
ST-JEAN-PORT-JOLI	HDM	47 13 N	70 17 W	12			
ST-FRANCOIS	HDM	47 00 N	70 49 W	12			
QUEBEC CITY	HDM	46 50 N	71 10 W	12			
CAP A LA ROCHE	HDM	46 34 N	72 06 W	12			
TROIS-RIVIERES	HDM	46 20 N	72 33 W	12			
CHAMPLAIN	HDM	46 26 N	72 24 W	12			
BATISCAN	HDM	46 30 N	72 15 W	12			
GRONDINES	HDM	46 35 N	72 02 W	12			
PORTNEUF	HDM	46 41 N	71 53 W	12			
NEUVILLE	HDM	46 42 N	71 34 W	12			
ST-JOSEPH-DE-LA-RIVE	HDM	47 27 N	70 22 W	12			

PORT-ALFRED	HDM	48 20 N	70 52 W	12			
TADOUSSAC	HDM	48 08 N	69 43 W	12			
BAIE COMEAU	HDM	49 14 N	68 08 W	12	F		B
SEPT-ILES	HDM	50 12 N	66 24 W	12	F		B
HARRINGTON HBR	HDM	50 30 N	59 29 W	12	F		B
SAVAGE COVE	HDM	51 20 N	56 42 W	12	B		B
LARK HARBOUR	HDM	49 06 N	58 22 W	12	F		B
PORT-AUX-BASQUES	HDM	47 34 N	59 08 W	12	F		B
ARGENTIA	HDM	47 18 N	53 59 W	12	F		C
ST. JOHN'S, NFLD.	HDM	47 34 N	52 43 W	12	F		C
WEST ST. MODESTE	HDM	51 36 N	56 42 W	12	F		B
NAIN	HDM	56 33 N	61 42 W	12	F		B
FROBISHER BAY	HDM	63 45 N	68 32 W	12	P		C
LAKE HARBOUR	HDM	62 51 N	69 53 W	12	P		C
CHURCHILL	HDM	58 46 N	94 11 W	12	F		B
CORAL HARBOUR	HDM	64 08 N	83 10 W	12	B		B
HALL BEACH	HDM	68 45 N	81 13 W	12	P		C
IGLOOLIK	HDM	69 23 N	81 48 W	12	P		C
RESOLUTE	HDM	74 41 N	94 53 W	12	P		C
ALERT	HDM	82 30 N	62 19 W	12	P		C
CAMBRIDGE BAY	HDM	69 07 N	105 04 W	12	B		B
CAPE PARRY	HDM	70 09 N	124 40 W	12	B		B
SACHS HARBOUR	HDM	71 58 N	125 15 W	12	B		B
TUKTOYAKTUK	HDM	69 25 N	132 58 W	12	B		B
ANTARCTIC							
BASE O'HIGGINGS	H	62 12 S	58 45 W	13	P	MC	B

NOTES

GAUGE TYPE : BLANK = NOT GIVEN, OR MANUFACTURED LOCALLY

METHOD OF REDUCTION : BLANK = NOT GIVEN
U = DATA NOT CURRENTLY REDUCED

GAUGE TYPES

F = FLOAT
P = PRESSURE
B = BUBBLER
D = DIAPHRAGM

GAUGE MANUFACTURES

AA = AANDERAA
AK = AMETEK
AM = AMSLER
AW = ALPINA WERK
BA = BALLAUF
BB = BRISTOL BUBBLER
BM = BOTTOM MOUNTED
BO = BOREL
ES = ESDAILE
EV = EVERSHED & VIGNOLES
FI = FIELDMAN
FO = FOXBORO
FP = FISCHER & PORTER
FU = FUESS
GE = GENTS
HS = HARRISON
KE = KENT
KV = KELVIN
LE = LEA
LG = LEGE
LS = LEUPOLD & STEVENS
MC = METERCRAFT
MU = MUNRO
NE = NEYRPIC
NZ = NEGRETTI ZAMBRA
OT = OTT
PH = PHILIPS
SB = SEBA DELT
SD = STANDARD
ST = STEVENS
TN = TNO 1975
U = UNKNOWN
ZG = ZÁVOD GRIDOMETPRIBOROV RIGA, USSR

Table 1a (continued)
Gauges thought to be running — 1982

ICELAND		
REYKJAVIK	64 09 N	21 56 W
SPITSBERGEN		
BARENTSBURG	78 04 N	15 14 E
USSR		
RUSSKAYA GAVAN	76 14 N	62 39 E
MURMANSK	68 58 N	33 03 E
KALININGRAD	54 57 N	20 13 E
EAST GERMANY		
SASSNITZ	54 32 N	13 40 E
WARNEMUNDE	54 11 N	12 05 E
WISMAR	53 54 N	11 28 E
USSR (BLACK SEA)		
PORT TUAPSE	44 06 N	39 04 E
SEYCHELLES		
PORT VICTORIA	04 37 S	55 27 E
KENYA		
KILINDINI	04 04 S	39 39 E
SRI LANKA		
COLOMBO	06 57 N	79 51 E
USSR (PACIFIC)		
YUZHNO KURILSK	44 01 N	145 52 E
NAGAEVA BAY	59 44 N	150 42 E
PETROPAVLOVSK	53 01 N	158 38 E
ARGENTINA		
USHUAIA II	54 49 S	68 13 W
COMODORO RIVADAVIA	45 52 S	67 29 W
PUERTO MADRYN	42 46 S	65 02 W
QUEQUEN II	38 35 S	58 42 W
MAR DEL PLATA (PUERTO)	38 02 S	57 32 W
MAR DEL PLATA (CLUB)	38 00 S	57 33 W
BUENOS AIRES	34 36 S	58 22 W
PALERMO	34 34 S	58 24 W
ANTARCTICA		
BAHIA ESPERANZA	63 18 S	56 55 W
ARGENTINE IS.	65 15 S	64 16 W
ALMIRANTE BROWN	64 54 S	62 52 W

Table 1b
Summary of gauges currently operating.

Country	Organisation No. (Appendix 2)	No. of stations
Norway	53	7
Sweden	70	18
Poland	60	5
Denmark	20	4
Netherlands	50	17
United Kingdom	75, 76	31
Eire	23, 24, 25	7
Channel Is	77	1
France	28	15
Spain	69	7
Portugal	62	8
Gibraltar	76	1
Majorca	69	1
Monaco	49	1
Italy	39, 40	2
Greece	32	16
Romania	63	3
Israel	38	1
Algeria	1	1
Spanish N. Africa	69	1
Azores	62	4
Madeira	62	1
Canary Is.	69	3
Ivory Coast	28	1
Ghana	31	2
Togo	29	1
Congo	28	1
Namibia	65	2
South Africa	65, 66	11
Madagascar	28	1
Reunion	28	1
Pakistan	54	1
Bangladesh	9	8
Thailand	71	10
Macau	62	1
China	14	14
Hong Kong	34	4
Korea	43	17
Japan	42	57
Philippines	59	5
Papua N G	57	5
Australia	2	104
New Zealand	52	15
Pacific Islands (inc. Hawaii)	79, 80, 81, 83	36
USA (Alaska)	80	16
Canada (Pacific)	12	20
USA (Pacific)	80	33
Mexico (Pacific)	48	15
El Salvador	26	1
Costa Rica	17	2
Panama (Pacific)	55, 56	2
Ecuador	22	6
Peru	58	7
Chile	13, 79	11
Uruguay	78	4
Brasil	10	2
French Guiana	29	1
Guyana	33	1
Trinidad & Tobago	72	1
Panama (Caribbean)	55	1
Martinique	28	1
Mexico (Caribbean)	48	7
Puerto Rico	80	2
Virgin Islands	80	2
USA (Gulf)	80	34
Bermuda	80	1
USA (Atlantic)	80	72
Canada (Atlantic & Arctic)	12	53*
Antarctica	13	4

* 14 of these gauges are river gauges not included in the response to the questionnaire but known to be running.

Table 1c
Gauges from which hourly values are available

Country	Organisation No. (Appendix 2)	No. of gauges
Norway	53	9
Sweden	70	18*
Poland	60	5
Denmark	20	4*
Netherlands	50	17*
United Kingdom	75	28*
Eire	23	1
France	28	15*
Spain	69	7*
Portugal	62	8*
Gibraltar	76	1
Majorca	69	1*
Monaco	49	1
Italy	39, 40	2*
Greece	32	16*
Israel	38	1
Spanish N Africa	69	1*
Azores	62	4*
Madeira	62	1*
Canary Is	69	3*
Ivory Coast	28	1*
Ghana	31	2
Togo	29	1*
Congo	28	1*
Namibia	65	2*
South Africa	65	10*
Madagascar	28	1*
Reunion	28	1*
Pakistan	54	1*
Bangladesh	9	8
Thailand	71	10
Macau	62	1*
China	14	4*
Hong Kong	34	4
Korea	43	17
Japan	42	57
Philippines	59	5
Papua N G	57	1
Australia	2	112
USA (Wyrtki)	79	26*
USA (NOAA)	80	172*
El Salvador	26	1*
Costa Rica	17	2
Ecuador	22	6
Chile	13, 79	11*
Uruguay	78	4
Brasil	10	2
French Guiana	29	1*
Guyana	33	1
Martinique	28	1*
Puerto Rico	80	2*
Virgin Islands	80	2*
Bermuda	80	1*
Canada	12	73*
Antarctica	13	1*

* Computer compatible data.

Table 1d
Gauges from which daily mean values are available

Country	Organisation No. (Appendix 2)	No. of gauges
Norway	53	9
Sweden	70	18*
Poland	60	5
United Kingdom	75	28*
Eire	23	1
France	28	15*
Spain	69	7
Portugal	62	8*
Gibraltar	76	1
Majorca	69	1
Monaco	49	1
Italy	39, 40	2*
Greece	32	16*
Roumania	63	2*
Spanish N. Africa	69	1
Azores	62	4*
Madeira	62	1*
Canary Is	69	3
Ivory Coast	28	1*
Ghana	31	2
Togo	29	1*
Congo	28	1*
Namibia	65	2*
South Africa	65	10*
Madagascar	28	1*
Reunion	28	1*
Pakistan	54	1*
Thailand	71	10
Macau	62	1*
China	14	4*
Korea	43	17
Japan	42	57
Philippines	59	5
Australia	2	112
USA (Wyrtki)	79	26*
USA (NOAA)	80	172*
El Salvador	26	1*
Costa Rica	17	2
Ecuador	22	2
Uruguay	78	4
French Guiana	29	1*
Martinique	28	1*
Puerto Rico	80	2*
Virgin Islands	80	2*
Bermuda	80	1*
Canada	12	73*

* Computer compatible data.

Table 1e
Gauges from which monthly mean values are available

Country	Organisation No. (Appendix 2)	No. of gauges
Norway	53	9
Sweden	70	18*
Poland	60	5
United Kingdom	75	28*
	76	3
Eire	23, 24	2
Channel Is	77	1
France	28	15*
Spain	69	7
Portugal	62	8*
Gibraltar	76	1
Majorca	69	1
Monaco	49	1
Italy	39, 40	2*
Greece	32	16*
Romania	63	1
Israel	38	1
Spanish N. Africa	69	1
Azores	62	4*
Madeira	62	1*
Canary Is	69	3
Ivory Coast	28	1*
Ghana	31	2
Togo	29	1*
Congo	28	1*
Namibia	65	2*
South Africa	65	10*
Madagascar	28	1*
Reunion	28	1*
Pakistan	54	1*
Thailand	71	10
Macau	62	1*
China	14	4*
Hong Kong	34	4
Korea	43	17
Japan	42	57
Philippines	59	5
Papua N G	57	1
Australia	2	104
USA (Wyrtki)	79	26*
USA (NOAA)	80	172
El Salvador	26	1*
Costa Rica	17	2
Ecuador	22	2
Peru	58	7
Uruguay	78	4
French Guiana	29	1*
Martinique	28	1*
Puerto Rico	80	2
Virgin Islands	80	2
Bermuda	80	1
Canada	12	73

* Computer compatible data.

Table 2
Time lag between measurement and sending data to PSMSL

	<1 month		*1-3 months*		*3 months - 1 year*		*>1 year*	
	A	*G*	*A*	*G*	*A*	*G*	*A*	*G*
a)								
HOURLY DATA								
Computer compatible	6	44	6	89	5	234	4	116
not " "	6	20	8	35	1	104	1	17
b)								
DAILY DATA								
Computer compatible	6	52	5	77	2	27	3	44
not " "	3	11	6	22	3	117	2	74
c)								
MONTHLY DATA								
Computer compatible	5	50	6	78	1	26	3	44
not " "	7	21	7	28	2	116	2	74

A = number of authorities
G = number of gauges

Table 3
Response to a 3 to 5 year experiment — summary

The following 26 organisations, representing 22 countries, would be prepared to send hourly data to PSMSL in a computer compatible format for the period of an international experiment extending over 3 to 5 years:

	Organisation No. (Appendix 2)		*Organisation No. (Appendix 2)*
Sweden	70	China	14
Poland	60	Korea	43
Netherlands	50	Australia	2
United Kingdom	75	New Zealand	52
Eire	23, 25	U.S.A.	79, 80
France	28, 29	El Savador	26
Spain	69	Panama	55
Portugal	62	Ecuador	22
Italy	39, 40	Chile	13
S. Africa	65	Brasil	10
Pakistan	54	Canada	12

In addition, Cyprus (18) would be prepared to send data, but they have no gauges of their own running; and Bangladesh (9) could send data tabulated from analogue charts.

Table 4
Countries interested in new equipment

The following organisations would be interested in the installation of new equipment, at international expense.
Those marked * do not currently have gauges operating, although other organisations within the same country may have gauges operating.

	Organisation No. (Appendix 2)		*Organisation No. (Appendix 2)*
Norway	53	Thailand	71
Sweden	70	China	14
Poland	60	Korea	43, 44*
Denmark	20	Indonesia	36*
Netherlands	50	Philippines	59
United Kingdom	75	Papua N G	57
Eire	23, 24, 25	Australia	2
Channel Islands	76	New Zealand	52
France	28, 29	Vanuatu	81
Spain	69	U S A	79, 80
Portugal	61, 62	Mexico	48
Italy	39, 40	El Savador	26
Greece	32	Costa Rica	17
Romania	63	Panama	56
Cyprus	18*	Ecuador	22
Lebanon	54*	Peru	58
Algeria	1	Chile	13
Ghana	31	Uruguay	78
South Africa	65, 66	Brasil	10
Pakistan	54	Guyana	33
India	35*	Trinidad	72
Bangladesh	9	Canada	12

Figure 1 Distribution of gauges - Europe

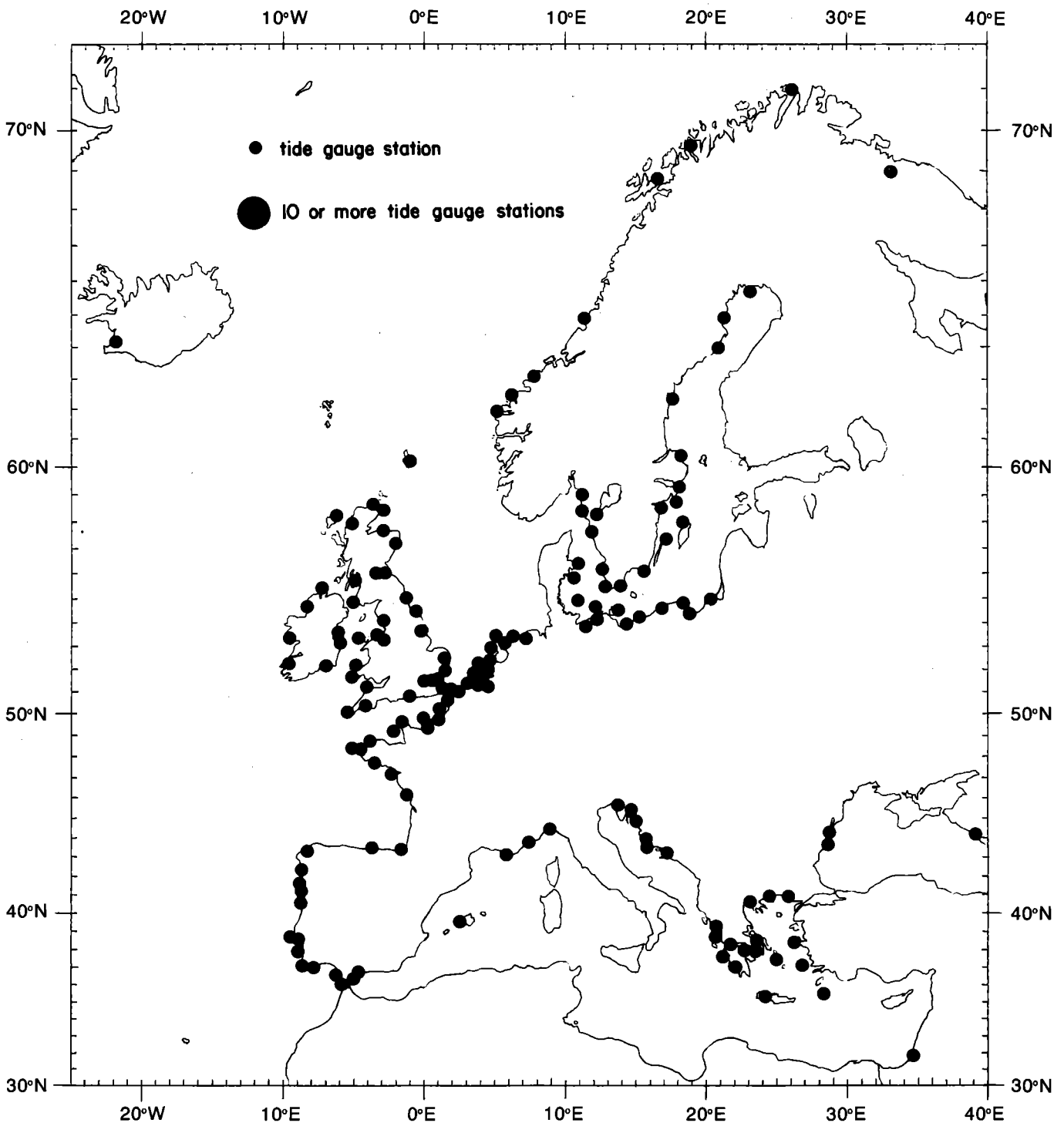


Figure 2 Distribution of gauges - Africa and Middle East

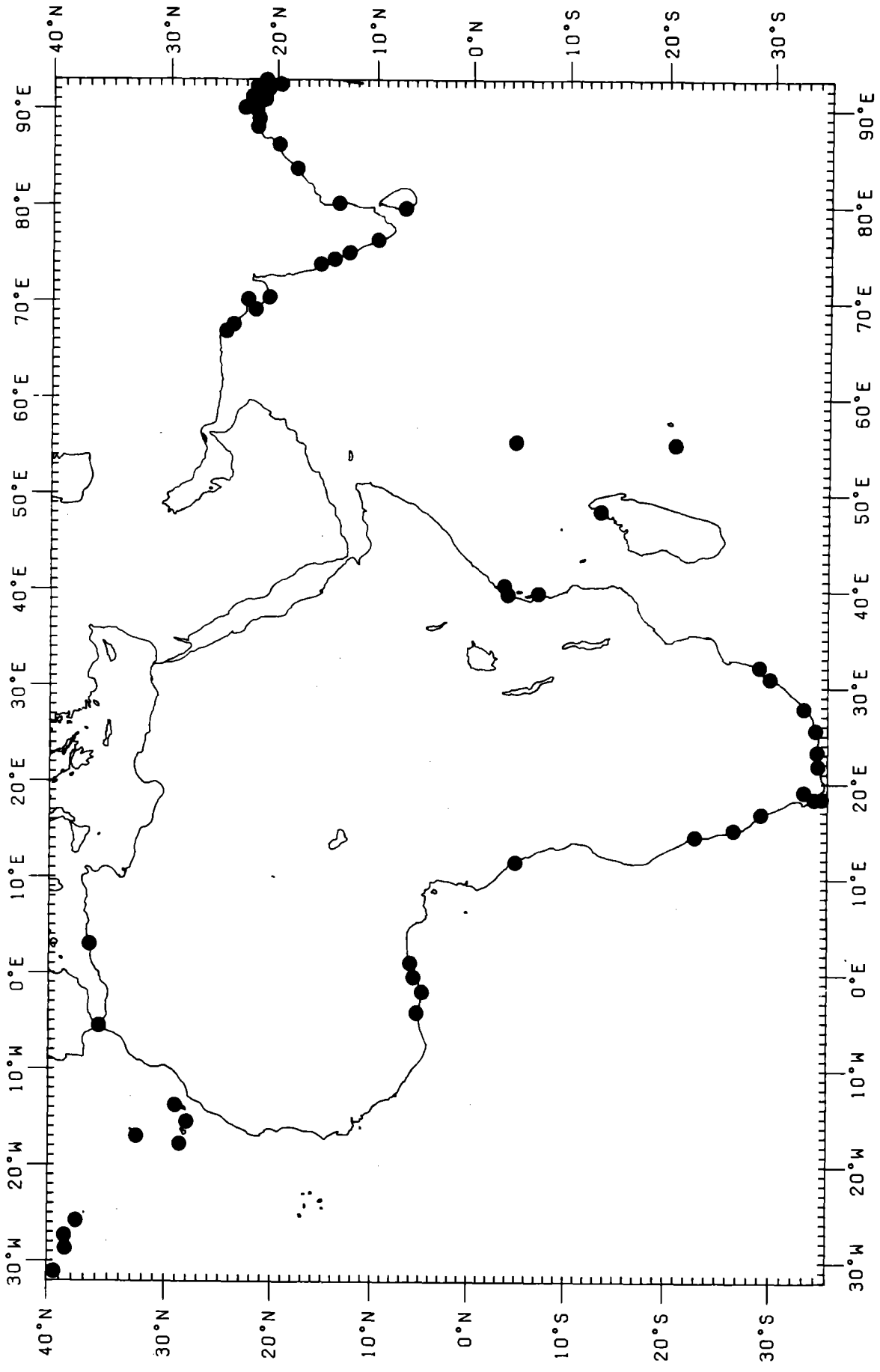


Figure 3 Distribution of gauges - Far East

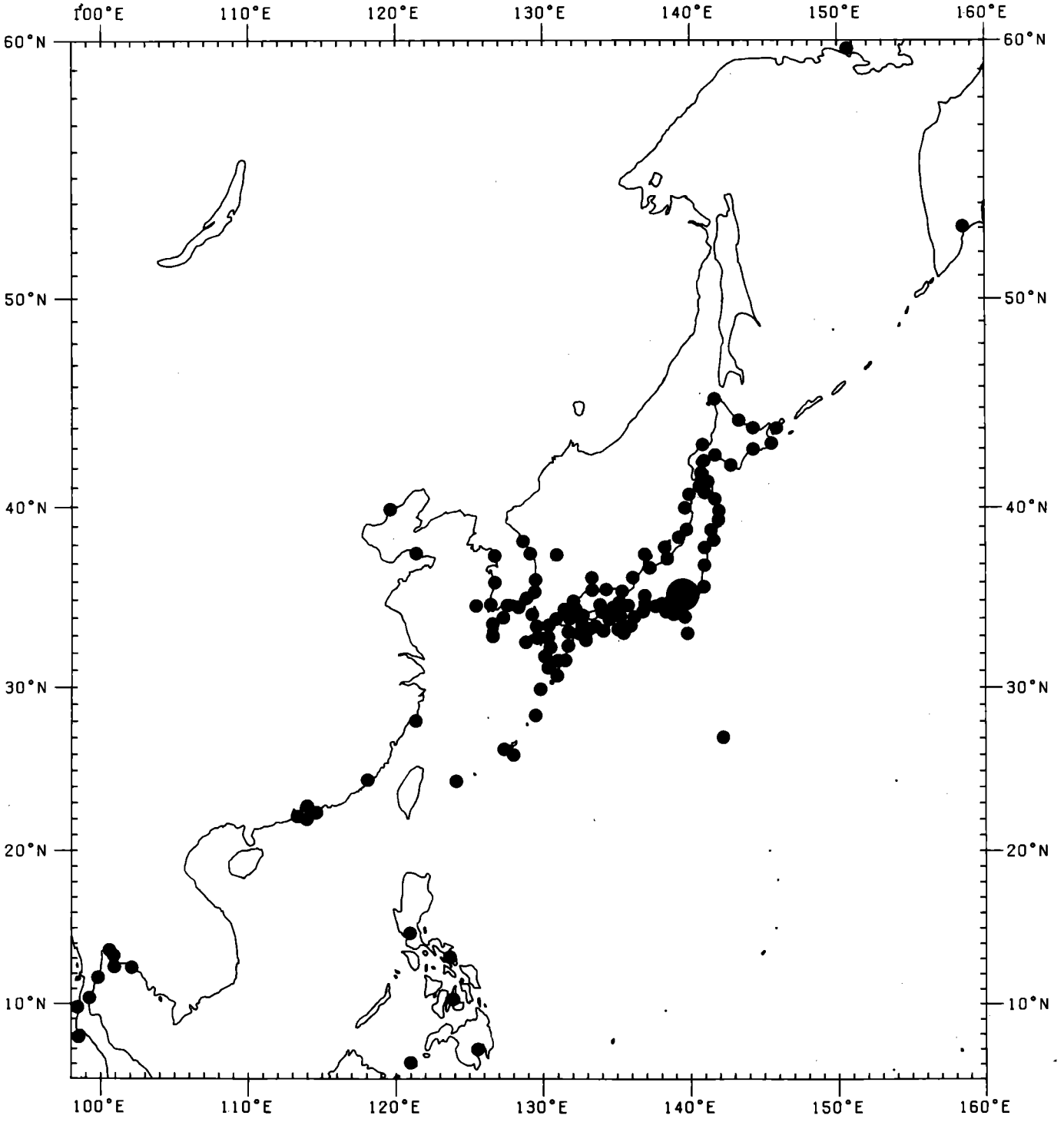


Figure 4 Distribution of gauges - Australia

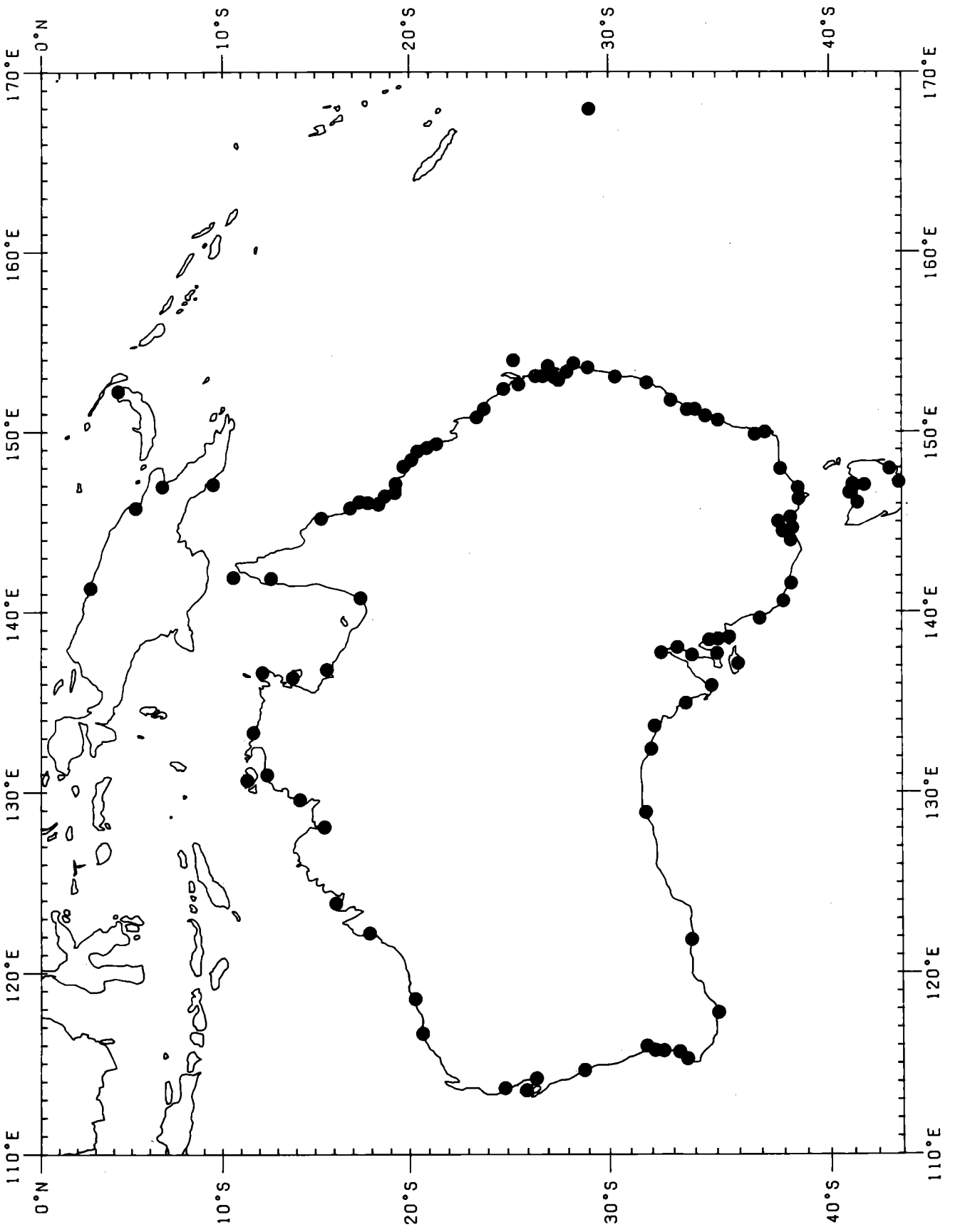


Figure 5 Distribution of gauges - New Zealand and Pacific Ocean

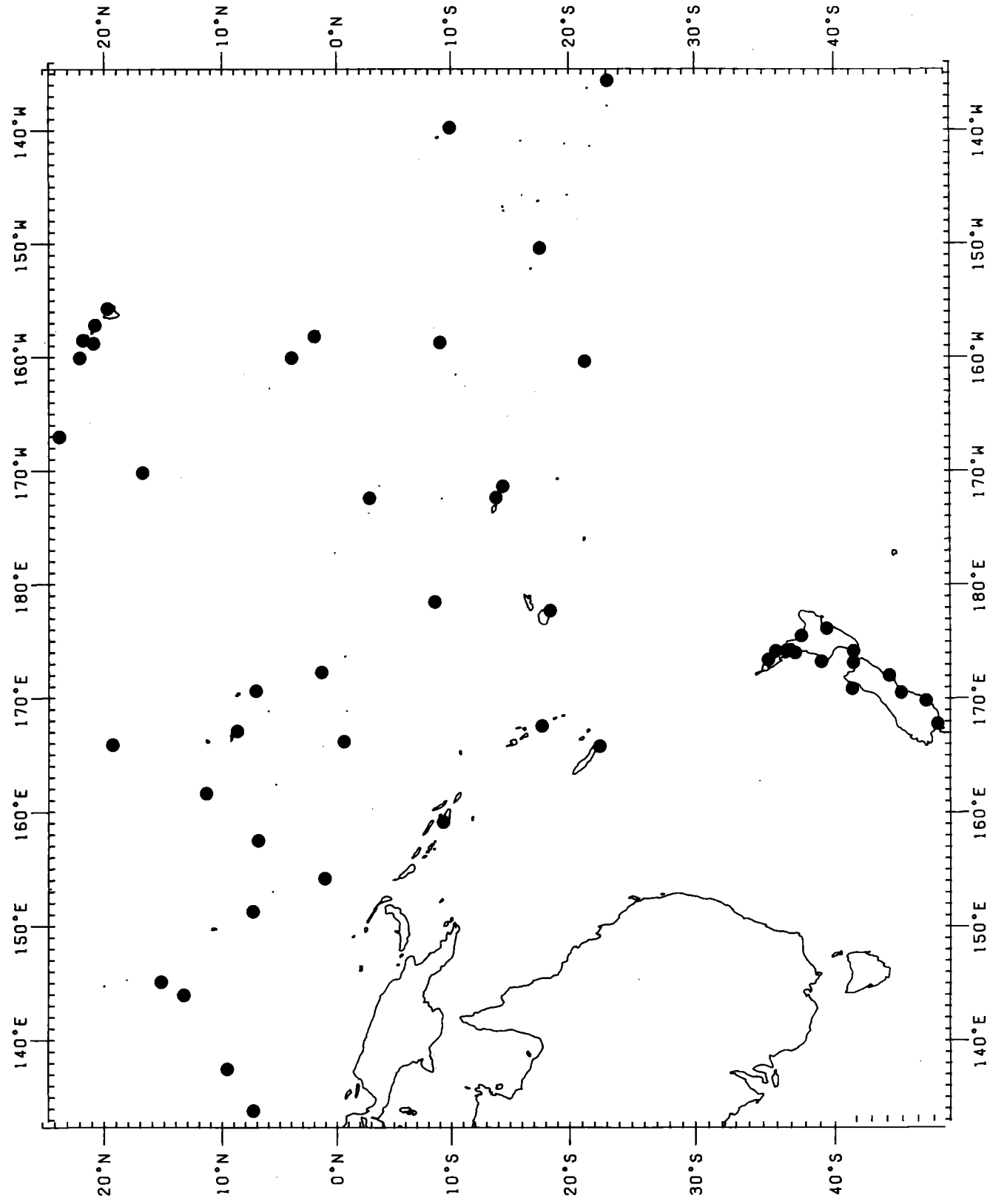


Figure 6 Distribution of gauges - North America

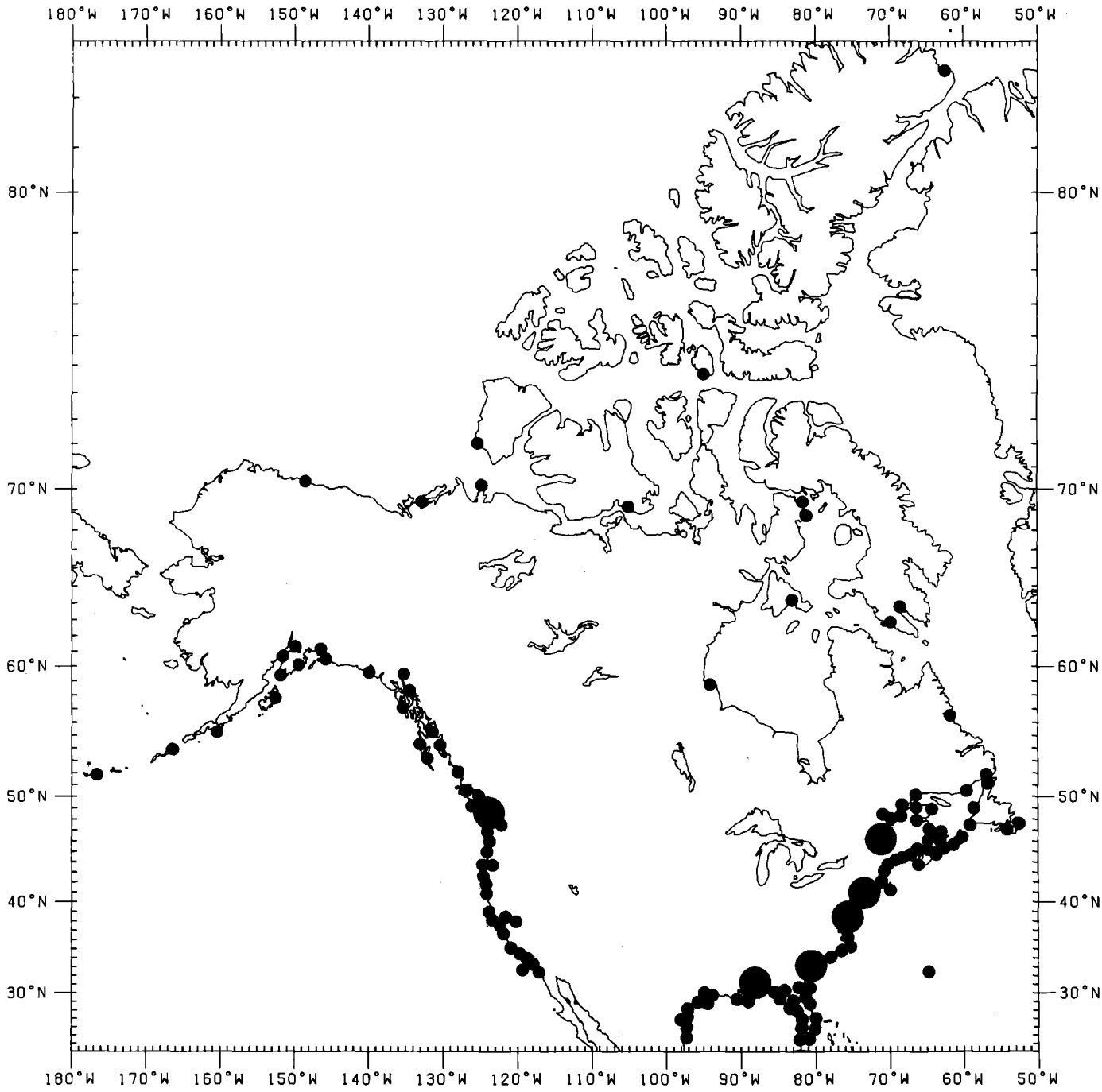
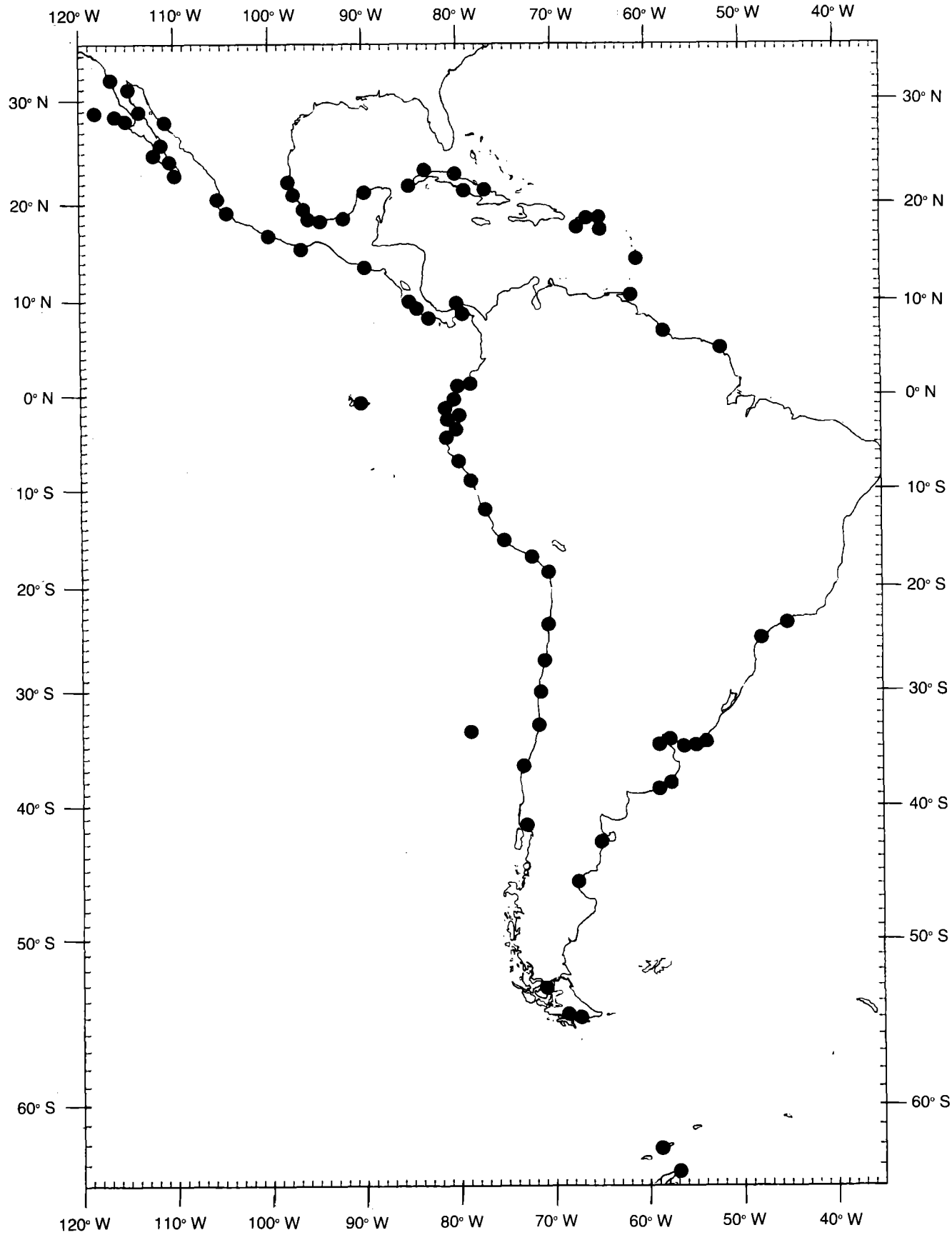


Figure 7 Distribution of gauges - Central and South America



Appendix 1
Copy of questionnaire sent to authorities

International Survey of Sea-Level Measurements

Your co-operation in this survey is greatly appreciated. Only provisional answers are required and no definite commitment will be implied.

Name and address of organization:

.....
.....
.....
.....
.....

1. The attached table concerns the gauges for which your organization has responsibility. Please complete it as far as you are able.

   A Name of station .....

   B Geographical coordinates .....

   C Type of gauge - manufacturer, method of operation (float, bubbler, etc.)

   D Method of data reduction

   (a) tabulated from analogue charts

   (b) automatic digitisation from analogue charts

   (c) direct computer entry and editing

   E Data available
   computer compatible - i.e. on computer punched cards
   or magnetic tape

2. What would be the shortest time delay between measurement and sending the data to PSMSL?

   .....
   .....
   .....
   .....
   .....

3. Would you be prepared to send hourly data to PSMSL in a computer compatible format for the period of an international experiment extending over 3-5 years?

   YES/NO

4. Would you be prepared to co-operate in the installation, if necessary, of new equipment in your country, at international expense, in order to facilitate data exchange?

   YES/NO

5. Which other organizations in your country, having responsibility for sea-level measurement and data reduction, could PSMSL approach?

   .....
   .....
   .....
   .....
   .....

6. Would you be interested in receiving sea-level data at more frequent intervals, through PSMSL, from other countries?

.....

.....

.....

.....

.....

Please send completed questionnaires to

Permanent Service for Mean Sea-Level
Bidston Observatory
Birkenhead
Merseyside L43 7RA
United Kingdom

International Survey of Sea-Level Measurements

A	B		C	D			E											
Name of station	Geographical co-ords		Type of gauge	Method of Data reduction			Data available											
	Latitude ° '	Longitude ° '		a	b	c	Hourly				Daily				Monthly			
							Available		Computer compatible		Available		Computer compatible		Available		Computer compatible	
							Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

Appendix 2
List of organizations who have replied to the questionnaire

1. Service hydrographique de la Marine nationale
   Institut national de cartographie
   123, rue de Tripoli
   B.P. 69
   Hussein dey
   Alger
   Algeria

2. The Secretary
   PCTMSL - National Mapping Council
   Unit 3 Cameron Offices
   P.O. Box 31
   Belconnen Act 2616
   Australia

3. The Director
   CSIRO
   Division of Fisheries & Oceanography
   P.O. Box 21
   Cronulla
   NSW 2230
   Australia

4. Prof. G.W. Lennon
   Flinders University
   Bedford Park
   S. Australia 5042
   Australia

5. The Director
   Dept. of Harbours & Marine
   Edward Street
   Box 2195
   Brisbane
   Queensland 4001
   Australia

6. Maritime Services Board of NSW
   CNR. Newcomen and Scott Streets
   Newcastle 2300
   NSW
   Australia

7. Maritime Services Board of NSW
   BOX 32 GPO
   Sydney 2002
   NSW
   Australia

8. Dept. of Marine & Harbors
   Box 19 P.O. Port Adelaide
   South Australia 5015
   Australia

9. Department of Hydrography
   Biwta Bhaban
   141-143 Motijheel Commercial Area
   Dacca - 2
   Bangladesh

10. Prof. A.R. De Mesquita
    Instituto Oceanográfico
    da Universidade de São Paulo
    Cidade Universitaria Butanta
    05508 São Paulo S.P.
    Brasil

11. Dr. Alberto Dos Santos Franco
    Instituto de Pesquisas Tecnológicas
    Cidade Universitaria Butanta
    Caixa Postal 7141
    São Paulo
    Brasil

12. Canadian hydrographic Service
    615 Booth Street
    Ottawa K1A OE6
    Ontario
    Canada

13. Director
    Instituto Hidrográfico de la Armada
    Casilla 324
    Valparaiso
    Chile

14. Mr. Luo Chuanwei
    Deputy Director
    Institute of Marine Scientific &
    Technical Information
    National Bureau of Oceanography
    118 Qi Wei Road
    He Dong District
    Tianjin
    China

15. Agence Transcongolaise des Communications
    Direction du Port de Pointe-Noire
    B.P. 711
    Pointe-Noire
    Congo

16. Dept. of Survey
    P.O. Box 114
    Rarotonga
    Cook Islands
    South Pacific

17. Instituto Geográfico Nacional
    Apartado 2272
    San José
    Costa Rica, C.A.

18. Department of Merchant Shipping
    Ministry of Communications and Works
    Limassol
    Cyprus

19. Det Danske Meteorologiske Institut
Lyngbyvej 100
2100 Kobenhavn 0
Denmark

20. The Royal Danish Administration
of Navigation and Hydrography
Nautical Division
Esplanaden 19
1263 Copenhagen k
Denmark

21. Dr. O. Bedsted Andersen
Geodaetisk Institut
Geodaetisk Afdeling 1
Gamelehave Alle 22
2920 Charlottenlund
Denmark

22. F.A. Echeverria
Director
Instituto Oceanográfico de la Armada
Casilla N.° 5940
Avenida 25 de julio - Vía Puerto Marítimo
Guayaquil
Ecuador

23. Ordnance Survey Office
Phoenix Park
Dublin
Eire

24. Dublin Port & Docks Board
Engineer's Office
Port Centre
Alexandra Road
Dublin 1
Eire

25. Mr P. Corish
Hydrometric Section
Office of Public Works
17/19 Lower Hatch St.
Dublin 2
Eire

26. Instituto Geográfico Nacional
Ingeniero Pablo Arnoldo Guzmán
Apartado postal N.° 06-247
San Salvador
El Salvador, C.A.

27. Le Directeur
Centre national pour l'exploitation
des océans
66, avenue d'Iena
75116, Paris
France

28. Le Directeur
Establissement principal de S.H.O.M.
13, rue du Chatellier
B.P. 426
29275 Brest Cedex
France

29. Le Directeur
Office de la recherche scientifique
et technique outre-mer (O.R.S.T.O.M.)
24, rue Bayard
75008 Paris
France

30. Le Directeur
Institut scientifique et technique
des pêches maritimes (I.S.T.P.M.)
Rue de l'Ile d'Yeu
B.P. 1049
44037 Nantes Cedex
France

31. Survey Department
P.O. Box 191
Cantonments
Accra
Ghana

32. Hydrographer of the Navy
Hydrographic Service
BST 902
Athinai
Greece

33. Transport and Harbours Dept.
Hydrographic Office
Water Street
Stabroek
Georgetown
Guyana

34. Port Works Division
Civil Engineering Office
8/f, Empire Centre
Salisbury Road
Kowloon
Hong Kong

35. The Chief Hydrographer
to the Government of India
Naval Hydrographic Office
Post Box No. 75
107 A Rajpur Road
Dehra Dun 248 001
India

36. Dr. Aprilani Soegiarto
Directeur
Lembaga Oceanologi Nasional
of the Indonesian Institute of Sciences
P.O.B. 580/DAK
Jakarta Utara
Indonesia

37. Director
Nationa Cartographic Centre
P.O. Box 1844
Tehran
Iran

38. The Director
Coast Study Division
Israel Ports Authority
P.O.B. 20121 Tel-Aviv
Israel

39. Instituto Talassográfico di Trieste
Viale R, Gessi 2
1 34123 Trieste
Italy

40. The Director
Instituto Idrográfico della Marina
Passo Osservatorio 4
16134 Genova
Italy

41. Harbourg Master's Dept.
P.O. Box 116
Newport East
Kingston
Jamaica, W.I.

42. Director, Marine Dept.
Japan Meteorological Agency
1-3-4 Ote-Machi, Chiyoda-Ku
Tokyo 100
Japan

43. Republic of Korea
Hydrographic Office
C.P.O. Box 1578
Seoul
Korea

44. The Director (NODC)
Korean Ocean Research
& Development Institute
P.O. Box 17
Yeongdong
Seoul
Korea

45. Marine Research Centre
National Council for Scientific Research
P.O.B. 123
Jounieh
Lebanon

46. The Chief Hydrographer
Royal Malaysian Navy
Naval Staff Division
Ministry of Defence
Jalan Padang Tembak
Kuala Lumpur Malaysia

47. The Director-General
Mauritius Marine Authority
P.O. Box 379
Port Louis
Mauritius

48. Sr. Manuel Almazan Soria
Jefe del Departamento de Investigaciones
de la Dirección General de Estudios
del Territorio Nacional
Secretaría de Programación y Presupuesto
San Antonio Abad 124 P.B.
Col. Tránsito
06820 México D.F.

49. Service des travaux publics
Division des travaux maritimes
Rue Louis Notari
MC-98000
Monaco

50. Rijkwaterstaat
Directie Waterhuishouding en Waterbeweging
Postbus 20907
2500 Ex's-Gravenhage
Hooftskade 1
Netherlands

51. The Director
New Zealand Oceanographic Institute
P.O. Box 12-346
Wellington North
New Zealand

52. The Hydrographer
Royal New Zealand Navy
Hydrographic Office
P.O. Box 33-341 Takapuna
Auckland 9
New Zealand

53. Norges Sjokartverk
Klubbgt 1
Postboks 60
4001 Stavanger
Norway

54. Hydrographer of the Pakistan Navy
Hydrographic Dept.
Naval Headquarters
Islamabad
Pakistan

55. Panama Canal Commission
Meteorological and Hydrographic Branch
Apo Miami 34011
USA

56. Instituto Geográfico Nacional
Tommy Guardia
Ministerio de Obras Públicas
Apartado 5267
Panamá 5

57. Dept. of Transport and Civil Aviation
Marine Division
Hydrographic Section
P.O. Box 457
Konedobu
Papua New Guinea

58. The Director
Dirección de Hidrografía
y Navegación de la Marina
Av. Gamarra n.° 500
Chucuito
Callao 1
Perú

59. Director
Bureau of Coast & Geodetic Survey
421 Barraca St.
San Nicolás
Manila
Philippines

60. Institute for Meteorology
& Water Economy
01-673 Warszawa ul Podlesna 61
Poland

61. Instituto Geográfico e Cadastral
Praça da Estrela
Lisboa
Portugal

62. Instituto Hidrográfico
Rua des Trinas 49
Lisboa 2
Portugal

63. Ing. Gheorghe Serpoianu
Institutul Roman de Cercetari Marine
Bulevardul Lenin No. 300
Constantza 8700
Romania

64. Director, Meteorological Service
41 Hillcrest Road
Singapore 1128
Republic of Singapore

65. Hydrographic Office S.A. Navy
Maritime Headquarters
Private Bag
Tokai
7965
South Africa

66. Dr C.L. Merry
University of Capetown
Dept. of Surveying
Rondesboch 7700
Republic of South Africa

67. Chief Director of Surveys and Mapping
Dept. of Community Development
Private Bag
7705 Mowbray
South Africa

68. Director
Instituto Hidrográfico de la Marina
Tolosa Latour N.° 1
Cádiz
Spain

69. Director del Centro Español
de Datos Oceanográficos
Instituto Español de Oceanografía
Alcalá 27
Madrid 14
Spain

70. Sveriges Meteorologiska
och Hydrologiska Institut
Box 923
S601 19 Norrkoping
Sweden

71. The Director
Hydrographic Dept.
Royal Thai Navy
Bangkok 6
Thailand

72. Dr D. Ramsaroop
Data Aquisition Programme
Institute of Marine Affairs
Carenage Post Office
Carenage
Trinidad & Tobago W.I.

73. Director General
Turkish State Meteorological Service
P.O.B. 401 Ankara
Turkey

74. Mr Sveket Gucluer
Department of Navigation
& Hydrography
Seyir ve Hidrografi Daire Baskanligi
Cubuklu - Istanbul
Turkey

75. Dr D.E. Cartwright
IOS Bidston
Bidston Observatory
Birkenhead
Merseyside L43 7RA
United Kingdom

76. CDR. N.C. Glen
Tidal Branch
Hydrographic Unit
M.O.D.
Tauton
Somerset TA1 2DN
U.K.

77. Dept of Public Building & Works
States Offices
South Hill
Jersey
Channel Islands
U.K.

78. Servicio de Hidrografía de la Armada
Capurro 980
Montevideo
República Oriental del Uruguay

79. Prof. K. Wyrtki
University of Hawaii at Manoa
Dept. of Oceanography
2525 Corea Road
Honolulu
Hawaii 96822
U.S.A.

80. Office of Marine Surveys & Maps
U.S. Dept. of Commerce
Noaa National Ocean Survey
Rockville
Maryland 20852
U.S.A.

81. Mr A. McFarlane
Dept. of Geology, Mines and
Rural Water Supplies
G.P.O.
Port Vila
Vanuatu

82. Ministry of Transport
Marine and Shipping Division
P.O. Box 1607
Apia
Western Samoa

83. Superintendent
Apia Observatory
Private Bag
Apia
Western Samoa

Appendix 3
The progress of the 1964 PSMSL report on 'A global network of tide gauge stations'

Resolution 9 of the Second Session of the Intergovernmental Oceanographic Commission, held in Paris during September 1962, requested PSMSL, in consultation with appropriate organizations, to submit to the Third Session of the Commission:

(a) a report on the existing distribution of properly maintained tidal stations;
(b) a proposal for an improved network of such stations; and
(c) any further information which would enable the Commission to take further action in promoting such a network.

This report identified over 100 sites where new installations were desirable for mean sea-level research. When this report was submitted to the Intergovernmental Oceanographic Commission at its Third Session in June 1964, the Commission responded by passing a Resolution (III - 7), (copy attached), which requested Member States to consider the possibility of filling gaps in the network and to report their findings to the Secretariat of the Commission. It recommended that a Symposium on Tide gauge instrumentation be organized, and asked Member States who had surplus gauges that they were willing to lend or present to other countries to make the information available for promulgating in 'International Marine Science'.

PSMSL has no record of the response of Member States to the request that gaps be filled. At best the improvement was only marginal.

A Symposium on 'Tidal instrumentation and predictions of tides' was held in Paris in May 1965, the Proceedings of which were published by Unesco.

The Canadian Government responded to the Resolution by making fifteen gauges available for distribution through IOC; with the co-operation and advice of PSMSL, these gauges were eventually distributed to eight countries. These were Argentina (3), Brazil (4), Philippines (1), United Arab Republic (1), Australia (2), Israel (1), Tunisia (1) and Cuba (2). Data from the Argentina Antarctic installation at Almirante Brown have been received by PSMSL since 1966, and Brazil is known to operate a gauge on Fernando de Noronha Island, one of their proposed sites. We have no further information about the remaining gauges.

Resolution adopted by the Intergovernmental Oceanographic Commission at its Third Session

(June 1964)

Resolution III-7

TIDE GAUGES

The Intergovernmental Oceanographic Commission,

Having studied the report UNESCO/IOC/III-9, prepared for the Commission by the Permanent Service for Mean Sea-Level, and believing that a greater knowledge of sea-level is vital to both oceanographic and meteorological research;

Requests Member States (i) to study the existing network of permanent tide gauges shown in the above report, (ii) to inform the Permanent Service for Mean Sea-Level, through the Secretariat of the Commission, of any errors in the 'Index of Gauges' and also to report details of any additional gauges as and when established, and (iii) *to consider the possibility of filling gaps in the network and to report findings to the Secretariat of the Commission;*

Recommends further that Member States arrange for close liaison to be maintained between agencies operating tide gauges and scientists working in the field of sea-level studies to ensure that research requirements are considered when new gauges are installed and in the processing of sea-level records.

Recommends that a Symposium on Tide Gauge Instrumentation be held in Paris in May 1965, jointly by Unesco and IAPO, and that standardization of presentation of data for automatic processing and the need for offshore oceanographic buoys and platforms to be fitted with tide gauges where practical, to be discussed.

Considers that the installation of gauges and the presentation of data should take into account all uses to which sea-level data are put, both scientifically such as in the theoretical relationships between coastal levels and those in the open sea and for such practical purposes as tidal prediction, port operation, coastal engineering, tsunami warning, etc.

Asks Member States who may have surplus gauges that they are willing to lend or present to other countries to inform the Secretariat of the Commission so that this information may be promulgated in 'International Marine Science'.

Addendum

The following replies to the questionnaire were received between 1 July and 20 September 1982. These stations are included on the maps

Belgium

Dienst der Kust - Hydrografie
Residentie «De Mast»
E. Feysplein 15
B-8400 Oostende
Belgium

3 gauges

Shortest time delay before sending data?	1 month
Prepared to participate in an international experiment	Yes
Willing to accept equiqment installed at international expense?	Yes

Belgium

Antwerpse Zeediensten
Loodsgebouw
Tavernierkaai 3
2000 Antwerpen
Belgium

2 gauges

Shortest time delay before sending data?	3 months
Prepared to participate in an international experiment?	No
Willing to accept equipment installed at international expense?	—

Cuba

Instituto de Oceanología
Ira. N.° 17406 e/ 184 y 186
Rpto. Flores, Playa
Ciudad de La Habana
Cuba

5 gauges

Shortest time delay before sending data?	3-6 months
Prepared to participate in an international experiment?	No
Willing to accept equipment installed at international expense?	Yes

Cyprus

Department of Land and Surveys
Ministry of the Interior
Nicosia
Cyprus

No gauges

Willing to accept equipment installed at international expense?	Yes

Hong Kong

Royal Observatory
Nathan Road
Kowloon
Hong Kong

3 gauges

Shortest time delay before sending data?	1 month
Prepared to participate in an international experiment?	Yes
Willing to accept equipment installed at international expense?	Yes

India

The Director
Geodetic and Research Branch
Survey of India
Post Box No 77
Dehra Dun - 248001 U.P.
India

13 gauges

Shortest time delay before sending data?	1 year

Kenya

Kenya Port Authority
PO Box 95009
Mombasa
Kenya

1 gauge

Shortest time delay before sending data?	1-2 weeks
Prepared to participate in an international experiment?	Yes
Willing to accept equipment installed at international expense?	Yes

Pakistan

National Institute of Oceanography
37-K, block 6
P.E.C.H.S.
Karachi
Pakistan

1 gauge

Shortest time delay before sending data?	3 months
Prepared to participate in an international experiment?	Yes
Willing to accept equipment installed at international expense?	Yes

Tanzania

Tanzania Harbours Authority
P.O. Box 9184
Dar es salaam
Tanzania

No gauges

Willing to accept equipment installed at international expense?	Yes

Yugoslavia

Institute for Oceanography and Fisheries
58000 Split Box 114
Mose Pijade 63
Yugoslavia

5 gauges

Shortest time delay before sending data?	1 year
Prepared to participate in an international experiment?	Yes
Willing to accept equipment installed at international expense?	Yes

List of gauges from recent replies to questionnaire

Belgium

Nieuwpoort	HDM	51	09	N	02	44	E	F	OT	B
Oostende	HDM	51	14	N	02	56	E	F	OT	B
Zeebrugge	HDM	51	21	N	03	12	E	F	OT	B
Antwerp (Prosperpolder)		51	21	N	04	14	E	F	OT	B
Antwerp (Loodsgebouw)		51	14	N	04	24	E	F	OT	B

Cuba

Cabo San-Antonio	HDM	21	54	N	84	54	W	F	SB	A
Siboney	HDM	23	05	N	82	45	W	F	SB	A
La Isabela	HDM	22	56	N	80	00	W	F	SB	A
Gibara	HDM	21	06	N	76	07	W	F	SB	A
Casilda	HDM	21	45	N	79	59	W	F	SB	A

Hong Kong

Kau Lau Wan	H	22	28	N	114	22	E	B	VE	A
Waglan	H	22	11	N	114	18	E	B	VE	A
Lok On Pei	H	22	22	N	114	00	E	F	MU	A

India

Kandla	HDM	23	01	N	70	13	E	F		A
Okha	HDM	22	28	N	69	05	E	F		A
Veraval	HDM	20	54	N	70	22	E	F		A
Bombay	HDM	18	55	N	72	50	E	F		A
Marmagao	HDM	15	25	N	73	48	E	F		A
Karwar	HDM	14	48	N	74	07	E	F		A
New Mangalore	HDM	12	55	N	74	48	E	F		A
Cochine	HDM	09	58	N	76	16	E	F		A
Nagappatinam	HDM	10	46	N	79	51	E	F		A
Madras	HDM	13	06	N	80	18	E	F		A
Vishakhapatinam	HDM	17	41	N	83	17	E	F		A
Paradip	HDM	20	16	N	86	42	E	F		A
Haldia	HDM	22	02	N	88	06	E	P		A

Kenya

Mombasa	DM	04	02	S	39	38	E	F	MU	A

Pakistan

Manora Tidal Observatory	HDM	24	48	N	66	58	E	F	MU	A

Tanzania

Dar-es-Salaam		06	50	S	39	18	E	T		

Yugoslavia

Split Luka	H	43	30	N	16	26	E	F	OT	B
Split Rt Marjana	H	43	30	N	16	23	E	F	OG	B
Dubrovnik	H	42	39	N	18	04	E	F	OT	B
Bakar	H	45	18	N	14	32	E	F	OG	B
Rovinj	H	45	05	N	13	38	E	F	OT	B