

# TIDAL CURRENTS

Synopsis of replies received by the International Hydrographic Bureau  
to *Circular Letter No. 2-H of 1933.*

## I

(1) HAS YOUR SERVICE ALREADY UNDERTAKEN THE SYSTEMATIC COLLECTION OF INFORMATION CONCERNING TIDAL STREAMS ;

- (a) ALONG THE COASTS OF YOUR COUNTRY ;
- (b) OFF THE COAST ;
- (c) IN THE HARBOURS OF YOUR COUNTRY ?

### GREAT BRITAIN :

- (a) Yes.
- (b) Yes.
- (c) Yes.

Stream information has also been collected for many other parts of the world.

### POLAND :

Generally speaking as far as the Baltic is concerned, and particularly on the Polish territorial coast, tidal phenomena are but of small importance. For this reason no particular study has been made of the problem of prediction of Tides considered as Currents. Nevertheless both in the Danzig Bight and off the shore the more important currents are taken into consideration in the researches of the Maritime Observatory of the National Meteorological Institute at Gdynia. Amongst other things, as the basis for the study of their dynamical regime, the thalassographic programme of the Observatory includes systematic observations of currents in the Bight and off-shore (velocity and direction both surface and sub-surface). — It is only since August 1933 that these current observations have been taken.

### EGYPT :

As the fluctuation of the tide is small in Egyptian waters no record of Tidal Currents is being kept.

### GERMANY :

- (a) Yes, along the German North Sea Coast, also within the tidal areas thereof.
- (b) Yes, in the open North Sea.
- (c) Yes.

Also for places in the English Channel and in British and French waters.

### NORWAY :

- (a) No.
- (b) No.
- (c) No.

### NETHERLANDS :

- (a) Yes.
- (b) Yes.

(c) In the new waterway to Rotterdam observations concerning Tidal Streams were undertaken for special purposes during the years 1915-1926. In the other harbours observations have only occasionally been undertaken.

### NETHERLANDS EAST INDIES :

- (a) Yes.
- (b) Yes.
- (c) No.

*DENMARK :*

Yes, from Danish light-vessels and exploring ships; also, in co-operation with Finland, Germany and Sweden, has participated in systematic investigations in the Kattegat in August 1931.

*FRANCE :*

(b) Yes, partial collections at various times.

(c) Yes — also in the maritime rivers (Seine, Loire & Gironde) by the Services of the PONTS ET CHAUSSÉES.

*ITALY :*

(a) The ISTITUTO IDROGRAFICO has undertaken the systematic collation of information concerning Tidal Streams in the Straits of Messina. Similar information for the coasts of the Venetian lagoon is entrusted to the MAGISTRATO ALLE ACQUE, Venice.

(b) Off shore only one series of observations has been made, to the south-east of Sicily, during the hydrographic expedition of 1926.

(c) In the Italian ports (except in the Taranto Canal and in the channels at Venice and Messina) there are no Tidal Streams of any importance to navigation. At the above mentioned ports Tidal Stream observations have been carried out.

*U. S. OF AMERICA, H. O. :*

Yes, in connection with the hydrographic surveys, principally in the West Indies, Central and South America.

*U. S. OF AMERICA, C. & G. S. :*

(a) Yes, at a number of lightships and also on a number of important shoals.

(b) Yes, some years ago an investigation of the Gulf Stream was carried out by J. E. PILLSBURY.

(c) Yes.

*JAPAN :*

(a), (b) and (c). Yes, effort is being made to collect information as much as possible, but it can not yet be said to be systematic in a strict sense.

*CHILE :*

Has recently begun to carry out the study of Tidal Streams but the present economic conditions have prevented these being carried out continuously.

*ARGENTINA :*

Though the importance of the problem is fully recognised and the necessary instruments have been acquired, owing to the enormous work entailed in surveying the coast no systematic observations of Tidal Streams have yet been taken.

*BRAZIL :*

Has not yet commenced systematic observations of Tidal Streams but hopes to do so soon.

*SIAM :*

(a) Yes, but only in the areas which have been surveyed.

(b) No.

(c) Yes, during the course of the Surveys.

*AUSTRALIA :*

(a) No.

(b) No.

(c) No, except at Port Phillip to determine the times of turning of the streams and the directions thereof.



1927: in Hamburg during 2 tides; in the East Frisian Gatje at 18 stations during 1 tide at each.

1928: in Hamburg during 13 tides; off Hinterbrak above Hanöfersand at 17 stations with two instruments during 1 tide at each; between Twielenfleth and Bielenberg at 36 stations with two instruments during 1 tide at each; in the East Frisian Gatje and on the Geise at 83 stations with two instruments during 85 tides altogether.

1929: near the Düne of Heligoland at 37 stations with one, or two, instruments during 1 tide at each; in the mouth of the Geeste at 12 stations with two instruments during 1 tide at each.

1930: near Norderney at 46 stations with two instruments during 58 tides altogether, 1931: off Norderney at 10 stations with two instruments during 1 tide at each.

#### NORWAY :

Nil.

#### NETHERLANDS :

All observations were made with compass, log line and hour-glass.

Observations were taken from the North Hinder light-vessel during five years, and from the Schouwenbank, Maas, Haak's and Terschellinger Bank light-vessels during two years.

#### NETHERLANDS EAST INDIES :

As regards observations previous to 1896 see publication of the Government of Netherlands India, *Wind and Weather, Currents, Tides and Tidal Streams in the East Indian Archipelago*, by J. P. VAN DER STOK, Batavia, 1897.

More recent observations are made by means of compass, specially adapted log and glass.

#### DENMARK :

Does not specifically answer this question.

#### FRANCE :

Observations off the French coasts have usually been made with floats, from boats moored at fixed points.

The observations commonly lasted for 12 daylight hours but sometimes for 24 consecutive hours. At certain stations observations of 12 hours' duration were carried out for several days.

For the last few years the BOCCARDO apparatus has been used for observations at depths of from 10 to 100 metres and the IDRAC apparatus for greater depths.

#### ITALY :

Observations were made with the EKMAN-MERZ apparatus.

#### U. S. OF AMERICA, H. O. :

Current observations are generally made with current floats, but in some instances by means of current meters.

#### U. S. OF AMERICA, C. & G. S. :

See Special Publication No. 124 for apparatus used.

In general, current observations at each station cover a period of from one to three days, but at the more important stations observations have been carried over several weeks. At the lightships observations were recently taken over a period of several months.

#### JAPAN :

Surface observations have been made with current floats and sub-surface observations with the EKMAN-MERZ meter, in most cases during daylight hours for a day or two at Springs.

**CHILE :**

Uses the same method for carrying out the study of Tidal Streams as Great Britain, using the current meter at fixed stations.

**ARGENTINA :**

None at present.

**BRAZIL :**

None at present.

**SIAM :**

Formerly with current floats; latterly by means of AMSLER current meters.

**AUSTRALIA :**

Does not specifically answer this question.

**MONACO :**

Proposes carrying out experiments with the new IDRAC apparatus for the photographic recording of deep-sea currents.

**PORTUGAL :**

Does not answer this question.

**SPAIN :**

Nil.

**SWEDEN :**

See reply to I (1).

- (3) HAVE THESE OBSERVATIONS BEEN THE SUBJECT OF ANALYSIS, AND HAVE THE RESULTS THEREOF BEEN PUBLISHED ?

**GREAT BRITAIN :**

Observations have been used for compiling the *Tidal Stream Atlas*, the publication *Tides and Tidal Streams of the British Islands* and the information given on Charts and in Sailing Directions.

**POLAND :**

The results of observations for the period April 1933 to June 1934 have been presented in a special *Compte-Rendu* by the "Observatoire Maritime" of the "Institut National Météorologique".

**EGYPT :**

No.

**GERMANY :**

Tidal observations have been treated mathematically and *graphically* but not by harmonic analysis owing to the shortness of the observations. The observations of the following years have been published :—

1921 : A. SCHUMACHER and H. THORADE, *Die Gezeiten der Sylter Gewässer* (The Tides in the waters off Sylt). From the *Archiv der Deutschen Seewarte*, Vol. 41, No. 1, Hamburg, 1923.

1924: H. THORADE, *Gezeitenuntersuchungen in der Deutschen Bucht der Nordsee* (Tidal Research in the German Bight of the North Sea). From the *Archiv der Deutschen Seewarte*, Vol. 46, No. 3, Hamburg, 1928.

1926, 1928, 1929 as tidal-current information in the *Gezeitentafeln* (Tide Tables), 1933.

#### NORWAY :

Yes, in the *Vannstandsobservasjoner* (Tidal Observations) issued by DEN NORSKE GRAD-MÅLINGSKOMMISSJON, Oslo, 1894. No publication since 1894.

#### NETHERLANDS :

Yes, the observations were analysed; the methods and the results being published under the title *Etudes des phénomènes de marée sur les côtes néerlandaises I-IV* by Dr. J. P. VAN DER STOK. Publishers, KEMINK & ZOON, Utrecht.

#### NETHERLANDS EAST INDIES :

As regards observations previous to 1896 the results of the analyses are to be found in the publication of the Government of Netherlands India, *Winds & Weather, Currents, Tides and Tidal Streams in the East Indian Archipelago*, by J. P. VAN DER STOK, Batavia, 1897.

Recently further attention has been paid to Stream observations which have been made for periods enabling analyses to be made. This has already been done in Straat Riouw.

#### DENMARK :

The observations have been published, mainly in revised form, by J. P. JACOBSEN, Martin KNUDSEN and Kirstine SMITH in *Meddelelser fra Kommissionen for Havundersøgelser* (Reports of the Oceanographic Commission), Series Hydrography, Vols. I-II. For titles and contents of the different treatises see *Bibliographie des Marées*, "Conseil International de Recherches de l'Union Géodésique et Géophysique International", Bulletin N. 12, Venice, 1929.

A summary of the investigations in the Kattegat is given by Martin KNUDSEN in *Rapports et Procès-verbaux des réunions du Conseil International pour l'Exploration de la Mer*, Vol. LXXXI, p. 219, Copenhagen, 1932.

#### FRANCE :

Information concerning Tidal Streams off the French coasts has been collected, as regards the English Channel, in :

1841: GIVRY: *Instructions Nautiques du Pilote français*.

1878: GAUSSIN: *Annuaire des courants des marées de la Manche* (1879-1882).

A compendium of information concerning the Currents in French ports will be found in the work *Ports Maritimes de la France 1874 et suivants*.

The observations off the coasts of France and her Colonies have not yet been the subject of harmonic analysis.

#### ITALY :

The observations in the Straits of Messina have been analysed and published by Prof. VERCELLI in the publications of the "Comitato per lo Studio del Mediterraneo", Venice. Publisher FERRARI. The other observations have remained unpublished.

#### U. S. OF AMERICA, H. O. :

In view of the limited scope of the tidal work no systematic analysis and publication of information have been attempted.

#### U. S. OF AMERICA, C. & G. S. :

In some instances the current observations have been analysed harmonically, but in general the observations have covered too short a period to make an analysis practicable. The reductions have usually been made with a view of obtaining the times of slack water and of maximum flood and ebb current, and the mean velocity at the times of flood and ebb strength.

The results of current observations in a number of harbours and waterways of the U. S. A. will be found in Special Publications Nos. 111, 115, 123, 127, 142, 150, 162 and 174.

Results of current observations at a number of light-vessels off the Pacific Coast of U. S. A. are included in Special Publication No. 121.

**JAPAN :**

Some of the observations have been analysed and the results published.

**CHILE :**

Quite recently has begun the study of Tidal Streams by the methods used in Great Britain and making harmonic analyses of the observations.

**ARGENTINA :**

Not at present.

**BRAZIL :**

Not at present.

**SIAM :**

No.

**AUSTRALIA :**

The only information available is that published in the *General Notices to Mariners for Victorian Waters*, 1927, pages 45-51, which is based on 4 years' observations.

**PORTUGAL :**

See reply to I (1).

**SPAIN :**

None observed.

**SWEDEN :**

See reply to I (1).

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(4) HAS YOUR COUNTRY PUBLISHED TABLES OR OTHER DOCUMENTS TO PERMIT OF PREDICTIONS OF TIDAL STREAMS ?

(5) IS YOUR COUNTRY CONSIDERING THE PUBLICATION OF ANNUALS OR OTHER DOCUMENTS CONTAINING PREDICTIONS OF TIDAL STREAMS ALONG THE COASTS OR IN THE HARBOURS OF YOUR COUNTRY ?

**GREAT BRITAIN :**

(4) No special tables of complete Tidal Stream predictions are published. Special publications regarding streams are :

(a) *Tidal Stream Atlas. British Islands and adjacent waters.*

(b) *Tides and Tidal Streams of the British Islands.*

Information regarding Streams is also included on Charts and in Sailing Directions.

(5) Yes.

**POLAND :**

Publication of tables for prediction of Currents in the Gulf cannot be carried out until sufficient observations have been obtained and analysed.

## EGYPT :

No.

## GERMANY :

(4) The Deutsche Seewarte publishes :

- (a) *Gezeitentafeln für das Jahr 1933* (Tide Tables for the year 1933), etc: from the 4th Part of which the predictions for the Tidal Currents ensue.
- (b) *Atlas der Gezeiten und Gezeitenströme für das Gebiet der Nordsee, des Kanals und der Britischen Gewässer* (Atlas of the Tides and Tidal Currents for the area of the North Sea, the English Channel and the British waters), Hamburg, 1925.

(5) Yes, the Deutsche Seewarte intends to continue and perfect these publications.

## NORWAY :

No. The only tables published are :

- (A) *Höivannstabeller for den norske Kyst* (Tide Tables for the Norwegian Coast) printed in *Norsk Fiskevialmanak*, Bergen.
- (B) *Norsk Nautisk Arbok*, Oslo.

## NETHERLANDS :

Tables of velocity and direction of the Tidal Streams at the positions of the light-vessels may be found in the *Zeemansgids voor de Nederlandsche Kust*, Table V.

Graphically these Streams are shown on the Netherlands Charts Nos. 226 and 227.

## NETHERLANDS EAST INDIES :

Harmonic Tidal Constants are published in Parts I, II & III of *Zeemansgids voor den Nederlandsch Indischen Archipel*.

A Stream Table for Strait Riouw is in preparation.

## DENMARK :

See reply to I (3).

## FRANCE :

(4) The Hydrographic Service has not hitherto undertaken any general collection giving the Tidal Streams of the coasts of France and of the French Colonies in the form of tables similar to the lists of Harmonic and Non-harmonic Tidal Constants. It is proposed, however, to make a collection of non-harmonic constants in the form of tables in the near future.

(5) No.

## ITALY :

(4) Tables of constants for predicting Tidal Streams are contained in their Hydrographic Publication No. 3083 as an appendix to the *Nozioni Elementari sulle Maree*.

(5) Does not intend to publish other tables or annuals of this sort.

## U. S. OF AMERICA, H. O. :

See reply to I (3).

## U. S. OF AMERICA, C. &amp; G. S. :

(4) Publishes annually separate Current Tables for the Atlantic and Pacific Coasts of North America. Those for the Atlantic Coast for 1933 include the predicted times of slack water and strength of current, also velocity at strength, for each day of the year at 13 reference stations, and also give current differences and constants for obtaining the time and velocity at several hundred other places.

The Pacific Coast Tables for 1933 contain full particulars for 11 reference stations (including one in the Philippine Islands) and current differences and constants for several hundred other stations.



This Survey also published Tidal Current Charts for Boston Harbour, New York Harbour and San Francisco Bay. These are issued in sets of 12 giving the direction and velocity of the current for each hour of the Tide.

The predicted currents for the reference stations now included in the Annual Current Tables are based on harmonic constants which have been either obtained directly by the analysis of hourly current observations or have been inferred by some indirect method. The Tide Predicting Machine is used in making these current predictions.

(5) Will continue the above and also from time to time will publish Tidal Current charts for important harbours of the country.

*JAPAN :*

Has published the following documents to permit of predictions of Tidal Streams :

*Suiro-Zasso* (Miscellaneous information on Hydrography), No. 8 : For the Simonoseki Kaikyô.

*Suiro-Zasso* No. 9 for Kudako Suido and vicinity, Morosima Suido, Turusima Suido, Akasi Seto and Naruto Seto.

*Suiro-Zasso* No. 10 for Kurusima Kaikyô.

*Suiro Yoho* (Hydrographic Bulletin), 8th Year, No. 8 : For Urke Road.

etc.

etc.

Also publishes annually Tide Tables which contain predictions of Tidal Streams at 4 localities.

*CHILE :*

See reply to I (3).

*ARGENTINA :*

See reply to I (3).

*BRAZIL :*

See reply to I (3).

*SIAM :*

No, but will do so when the necessary researches have been carried out.

*AUSTRALIA :*

See reply to I (3). It is proposed to obtain and publish Tidal Stream information for Port Phillip, Victoria.

*PORTUGAL :*

See reply to I (1).

*SPAIN :*

(4) No.

(5) Does not answer this question.

*SWEDEN :*

(4) No.

(5) No.

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II.

HAS YOUR SERVICE COLLECTED INFORMATION CONCERNING TIDAL STREAMS ALONG YOUR COASTS, OFF THE COASTS OR IN CERTAIN HARBOURS, WHICH HAS NOT YET BEEN ANALYSED OR PUBLISHED ? IN WHICH CASE WOULD YOU COMMUNICATE THE WHOLE OF THIS INFORMATION TO THE BUREAU WITH A VIEW TO CONSIDERING THE MEANS OF THE EVENTUAL PUBLICATION OF THE RESULTS ?

*GREAT BRITAIN :*

Much has been collected for British Isles and adjacent waters, the British Empire and certain foreign countries. Though information derived from such observations has

been included in the publications mentioned above, harmonic analysis has only been undertaken in certain special cases, for investigation or experiment, and constants have not been published. Where a sufficient series has been obtained, the observations will be supplied to the I.H.B. for analysis, if required.

*POLAND :*

Does not specifically answer this question.

*EGYPT :*

No.

*GERMANY :*

Possesses observations which have not yet been published, and will gladly communicate the whole of the data to the I.H.B. for publication.

*NORWAY :*

No.

*NETHERLANDS :*

Does not answer this question.

*NETHERLANDS EAST INDIES :*

No.

*DENMARK :*

Does not specifically answer this question.

*FRANCE :*

No. All the current observations taken have been utilised or published.

*ITALY :*

Observations made off the south-east coast of Sicily are awaiting completion in order that they may provide suitable material for an analysis, which will be made at the Hydrographic Institute.

*U. S. OF AMERICA, H. O. :*

No.

*U. S. OF AMERICA, C. & G. S. :*

Additional current data awaiting publication consist of results from recent current surveys of Buzzards Bay, Narragansett Bay, New York Harbour and tributaries (from observations taken subsequent to previous publication covering New York Harbour); also has records of many short series of observations taken from time to time in various harbours of the country. Publication of these awaits supplementary observations. However, the annual current tables, to which reference is made above, include differences and constants based upon the observations which are available.

*JAPAN :*

Has further information concerning Tidal Streams which is now in course of being analysed and which will be published later.

*CHILE :*

Does not specifically answer this question.

*ARGENTINA :*

No.

*BRAZIL :*

No.

*SIAM :*

Sufficient information is not yet available.

*AUSTRALIA :*

See reply to I (3).

*PORTUGAL :*

See reply to I (1).

*SPAIN :*

No.

*SWEDEN :*

The main material is contained in the unpublished paper by H. PETERSSON before mentioned (1). The manuscript can, if desired, be sent to the I.H.B. A limited number of similar observations have, so far, not been analysed, mainly owing to their relatively short length or because there were doubts against the accuracy of the records due to technical faults of the instruments.

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III.

IN THE EVENT OF YOUR COUNTRY NOT HAVING UNDERTAKEN SYSTEMATIC OBSERVATIONS OF CURRENTS ALONG YOUR COASTS, WOULD YOU CONSIDER DOING SO WITH CURRENT METERS AND ANALYSING SAME WITH A VIEW TO THEIR EVENTUAL PUBLICATION ?

*GREAT BRITAIN :*

Observations will be obtained and analysed as required for Admiralty publications; no other observations will be obtained under present circumstances.

To obtain a series of Stream observations, except from light-vessels, entails keeping a ship at anchor at the station continually throughout the observations. The cost is thus prohibitive. If, and when, a satisfactory recording meter is produced, which can be slung from a buoy or raft and left for a number of days, the situation will be altered.

During the year 1933 a tidal stream survey of the waters surrounding the British Isles was commenced and observations were made at fifty-five stations, also at thirteen light vessels, TRINITY HOUSE co-operating. Additional observations have been supplied by the French and Netherlands Authorities, and arrangements have been made with the French Hydrographic Office to observe at selected positions near the coast of France in 1934. The tidal stream survey is expected to take four years to complete.

*POLAND :*

The thalassologic programme of the Maritime Observatory of the National Meteorological Institute at Gdynia includes systematic observations of currents in the Dantzig Bight and off shore (velocity and direction both surface and sub-surface).

*EGYPT :*

No.

*GERMANY :*

The Deutsche Seewarte intends to continue the observations by means of current-meters, to treat them and publish the results.

*NORWAY :*

Can at present say nothing on this subject.

*NETHERLANDS :*

Does not reply to this question.

*NETHERLANDS EAST INDIES :*

Systematic observations of Tidal Streams in the Strait Banka, similar to those in Strait Riouw, are in consideration with a view to obtaining harmonic constants and to publishing Stream tables.

*DENMARK :*

At present no working plans have been formed.

*FRANCE :*

The current observations made up till now on the coasts of France and her Colonies have not been taken under conditions admitting of the application of the new methods of scientific investigation (harmonic analysis, observations at all depths, measurement of density, salinity and temperature of the sea water). The Hydrographic Service proposes to complete these records partly by observations lasting for thirty days at a certain number of primary stations, and partly by observations of 24 consecutive hours duration at secondary stations during spring tides.

With regard to the coasts of the English Channel, the French Hydrographic Service is considering collaboration with the programme which the British Admiralty proposes to carry out.

*ITALY :*

Does not intend to undertake systematic observations.

*U. S. OF AMERICA, H. O. :*

Tidal and Current observations have been, and are being, made in connection with the Hydrographic Surveys in the West Indies, Central America and South America.

*U. S. OF AMERICA, C. & G. S. :*

The present programme for Current work consists mainly of systematic observations in the various harbours and waterways of the country.

*JAPAN :*

Intends to make as much effort as possible in this line.

*CHILE :*

See reply to I (1)

*ARGENTINA :*

When circumstances permit observations will be commenced, keeping in view the aims indicated by the I.H.B.

*BRAZIL :*

Is disposed to initiate soon the study of this important contribution to the safety of Navigation.

*SIAM :*

Yes.

*AUSTRALIA :*

There is little possibility of systematic work of this description being undertaken until the more important hydrographic surveys have been undertaken.

*PORTUGAL :*

Does not answer this question.

*SPAIN :*

Does not answer this question.

*SWEDEN :*

No.

