HYDROGRAPHIC BIBLIOGRAPHY

I. EXTRACTS AND REVIEWS

THE NETHERLANDS ROYAL METEOROLOGICAL INSTITUTE.

(Publication N° 102 — MEDEDEELINGEN EN VERHANDELINGEN, in-8°, 72 pages 16 illustrations. s'Gravenhage, 1927).

The series of publications entitled: — *Mededeelingen en Verhandelingen* which was begun in 1905, has as its aim to collate all available data concerning the organisation and arrangement, the history and development, the present position and work of the Netherlands Royal Meteorological Institute; also to collate all memoirs written by the scientists attached to the Institute and those of its collaborators.

This publication is issued in Dutch (usually accompanied by a French translation), in French, English or German according to the nature of the articles or the wishes of the authors.

N° 102 gives a detailed description of the present organisation of the Royal Netherlands Meteorological Institute — an organisation which dates from 1906. The following are the various sections of the DE BILT Institute :—

Section I. General.
— II. Weather and General Meteorology.
— III. Climatology.
— IV. Oceanography and Maritime Meteorology
— V. Terrestrial Magnetism and Seismology.

The section of General Meteorology has special charge of the Storm-warning Service, the Service for announcing high tides caused by storms, and the Service of Meteorological Messages for aerial navigation.

The duties of the Section of Oceanography and Maritime Meteorology include the study of meteorological phenomena encountered at sea and the movements of the waters of seas and oceans. The material for these studies is supplied chiefly by observations made on board of long-voyage Dutch ships, vessels of the Dutch Navy and lightships. All Dutch shipping companies contribute by making records of observations in the form prescribed by the Institute.

Fos some ten years the Oceanographical Section has looked upon the study of tides on the Netherlands coast as entering into its domain, and this study inevitably leads to research concerning the meteorological conditions on the coasts. The vast collection of observations to be found in the logs of lightships provided the data necessary for these studies. (Pub. 90.13 *a c*).

The annual tabulation of heights of water as recorded by automatic tide-gauges, which is published by the General Service of the Waterstaat (Department of Roads and Bridges) provides valuable data for the study of the tides.

The fourth Section has a further special task to fulfil:— It issues and tests the meteorological instruments for the vessels of the Royal Netherlands Navy. However, the cost of purchase and of repair of these instruments is not met by the Institute's funds. With reference to the meteorological instruments for other Dutch ships, the Institute and its branches assist, so far as the Institute's budget permits, in their purchase, examination and repair.

NINTH ANNUAL REPORT OF THE TIDAL INSTITUTE OF LIVERPOOL (1928)

The ninth annual report of the Tidal Institute of the University of Liverpool indicates a steady growth in the work of tidal analysis and prediction executed by the Institute.

The most important new feature has been an investigation of the circumstances attending storm-floods in the Thames Estuary.

Tide-gauge records from London Bridge and Southend were supplied by the Port of London Authority. Dr Doodson examined all the irregularities which have occurred at Southend since 1911, paying special attention to those disturbances of magnitude exceeding six feet. Hourly heights of the regular tide were computed and compared with the observed heights over a sufficiently long period in each case.

Dr Doodson next studied the meteorological conditions as indicated by the charts of the Meteorological Office, and classified the sequences of phenomena associated with all the disturbances of sea-level exceeding four feet at Southend. It was also decided to investigate disturbances at some distance from the Thames Estuary.

The Ordnance Survey supplied hourly heights from their gauges at Dunbar and Felixstowe for all the storm-effects under investigation. The Hydrographic Department collected information regarding the sea level for January 4th-8th, 1928, from Belgium, Holland, Germany and Denmark, and forwarded this to the Institute. For four great storms Dr Doodson made a detailed study of the associated variations of sea-level all round the North Sea and this revealed some remarkable sequences.

He also investigated the very difficult problem of finding the probability of future storm-floods of dangerous magnitude.

ANALYSES.

The Institute has carried out analyses for seven ports as follows:—

Durban, one year's observations, 1926-1927.
Princess Royal Harbour, one year's observations, 1924.
Thursday Island, one year's observations, 1924-1925.
Jeselton, British North Borneo, six months' observations, 1908.
Zanzibar Harbour, nine months' observations 1925-1927.
Johore Bahru, one years' observations, 1924.

PREDICTIONS.

The Institute has prepared predictions for fifty-one ports as follows :—

Hourly Heights. — Liverpool 1929.

Times and Heights of High and Low Water. 1929 :—

Liverpool, Portland, Immingham, Durban, Hong Kong, Singapore, Shanghai, Lisbon, Port Adelaide, Ekaterinskaya, Kem, Gibraltar, Puerto Belgrano, Ponta Delgada, Port Swettenham Wei-hai-wei, Shatt-al-Arab Bar, Penang, Side Saddle, Sandakan, Simon's Bay, Kuantan, Jodore Bahru, London Bridge, Southend, Tilbury, Royal Albert Dock, Avonmouth, Southampton, Port Hedland, Sydney, Princess Royal Harbour, Newcastle, Thursday Island, Georgetown, British Guiana, Freetown, Sierre Leone, Zanzibar 1929, Newchwang.

Brisbane, Auckland, Bluff, Dunedin, Lyttleton, New Plymouth, Wellington, Westport, Portage Island, Victoria and Vancouver for 1930.

Times of Slack Water :—

Turn Point, 1928, 1929, 1930, Strait of Canso, 1930.

PUBLICATIONS.

The following papers have been published during the year :—

The analysis of tidal observations (A. T. Doodson. Phil. Trans Royal Society, Vol. 227).

The computation of harmonic tidal constants (A. T. Doodson, Instructions for analysing Tidal Observations, Admiralty Publication).

Application of numerical methods of integration to tidal dynamics (A. T. DOODSON, Monthly Notices R. Astron. Soc. Geophys. Supp., Vol. I).

On the tides in a flat semicircular sea of uniform depth (J. PROUDMAN, Monthly Notices R. Astron. Soc., Geophys. Supp. Vol. 2).

The determination of earth-tides by means of water-tides in narrow seas (J. PROUDMAN, Union Géod. Géophys. Internationale, Sect. d'Océanographie, Bull. II).

Tides (J. PROUDMAN, Chambers's Encyclopaedia, Vol. 10).

With assistance from the Tidal Committee of the International Union of Geodesy and Geophysics, Professor PROUDMAN has prepared a Bibliography which is being published by the Union. It comprises all publications on tides and certain kindred subjects which have been issued since the beginning of 1910 in a Latin or Teutonic language.

THE ANALYSIS OF TIDAL OBSERVATIONS

BY A. T. DOODSON, D. Sc.

Tidal Institute, University of Liverpool. In-8°, 55 pages, May 1928.

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY OF LONDON. Series A., Vol. 227, pp. 223-279.

The methods of analysis of tidal observations in common use are as follows :—

(1) The B. A. methods, essentially as evolved by THOMPSON, ROBERTS and DARWIN, and published in the "Reports of the British Association for the Advancement of Science" between the years 1866 and 1885. These have been used by ROBERTS and the Survey of India.

(2) Darwins "Method for the Solar Constituents" and his methods based on the use of the "tidal abacus" both published in 1892. These have been extensively used throughout the world.

(3) The U. S. A. method, first published in 1893, and chiefly used by the Coast and Geodetic Survey.

(4) Börgen's Method, 1894, principally used in Germany.

These methods may be judged by the following criteria :—

(*a*) The amount of labour involved ;

(*b*) The degree of elimination of all other constituents in the analysis for a particular constituent ;

(*c*) The completeness of the analysis.

The method now described may perhaps be regarded as the logical outcome of Darwin's method, but it has wider claims to attention as it attemps to satisfy all the criteria mentioned above.

The method has been well tested at the Tidal Institute ; over 30 years of tidal records from many parts of the world have been analysed by this method.

The method is probably speedier in operation than any yet published, though comparisons as to time taken by any method are not readily available.

The harmonic analysis referred to is based on the rigid application of the Least Square Rule to the hourly means.

The method of analysis described depends essentially on this simplification of the coefficients of the Least Square Rule. Except that multiplications are not by cosines and sines but by integers closely proportional to them, this is the essence of the Tidal Institute method.

An attempt has been made to include in the method all constituents likely to be of importance. The choice depends on :—

(1) The author's development of the tide-generating potential ;

(2) His researches on shallow-water effects.

A Table shows the 61 constituents, with increments in phase in degrees per mean solar hour and per mean solar day.

The exposition is divided into two parts; 1° are found the theoretical considerations, followed by tables fundamental to the method but not required by computers; 2° are detailed instructions to computers without reference to theoretical considerations, and these instructions are followed by tables required in actual computations, including forms and tests such as the computer may check his own work; ending by the calculation of H and g drawing special attention to the phase log so that the computer will readily understand that g must never be referred to as "kappa" and must not be quoted without SS, the longitude of the time meridian in hours, reckoned positive when west of Greenwich and negative when east of Greenwich.

BRITISH ADMIRALTY TIDE TABLES, 1927, AND INSTRUCTIONS FOR ANALYSING TIDAL OBSERVATIONS.

The publication of the fourth edition 1927, of Part 2 of the Admiralty Tide Tables, containing Non-Harmonic Tidal Constants, Tidal Differences and Harmonic Tidal Constants for the Principal Ports, etc., of the World, may well be regarded as a memorable event in the history of practical aids to navigation.

The harmonic constants of the principal tidal constituents for about a thousand ports are given and very strong reasons are given for the use of these constants. It is even indicated that the non harmonic constants will ultimately be omitted, and mariners are therefore advised to become familiar with the new methods.

In general, the non-harmonic constants and differences are of little value outside the Atlantic Ocean.

For heights of tide at times other than high water, it is assumed that the tidal oscillation is simply harmonic. This is never the case where there is diurnal inequality and is very rarely the case for ports situated in relatively shallow water.

The harmonic method, however, is uniformly applicable, and its results in general are of very much greater value than those of the non-harmonic methods. The computations required are not excessive. No knowledge of tidal theory is required. The harmonic constants have been given in such a form that the predictions are automatically rendered in the standard time kept at the place, a feature which is unique to the present publication. Since the values of mean-sea-level with respect to chart datum are given, the mariner can readily obtain the actual depth of water available; and it is to be hoped that the methods advocated receive a favourable reception by seamen.

Instructions for analysing tidal observations have been published separately in February 1928, by the Hydrographic Department, together with revised instructions for computing non-harmonic constants, which will consequently no longer be given in the tide tables.

The method described for computing harmonic constants, the work of Dr A. T. Doodson of the Tidal Institute, University of Liverpool, is new, and by its use, much of the labour required by earlier methods is avoided.

Instructions are given for the calculation of 9 harmonic tidal constants from observations of hourly heights extending over 29 or 15 solar days. These are based on the method of analysis of Tidal Observation fully developed by Dr Doodson in the paper quoted above from the Philosophical Transactions of the Royal Society of London.

A short explanation of the method of Analysis (supplementary to Explanations of the Harmonic Methods as given in Admiralty Tides Tables, Part II) and readily accessible to any novice computer, is given with examples illustrating the systematic uniformity, the simpleness and celerity of the method.

ANALES HIDROGRAFICOS — Tomo VIII

in 8° - 301 pages - illust.

Servicio Hidrografico — Ministerio de Marina, Republica Argentina.

Talleres Graficos Argentinos L. J., Sarmiento, 779, Buenos Aires, 1928.

This volume contains first a summary of the general activities of the Argentine Hydrographic Service during the year 1926, both for the strictly hydrographic work of the bureau and for the buoyage and lighting of the coast which are in charge of that bureau.

The report shows the areas of the ocean in which soundings have been taken during the past few years:

1901 - 1910	10 years	5,135 square miles.
1911 - 1920	10 —	9,300 — —
1921 - 1926	6 —	28,075 — —

The report contains a detailed enumeration of the work completed by the different groups operating on the Argentine coast. The volume contains also a summary of the Second International Hydrographic Conference at Monaco in 1926 and the work of the International Hydrographic Bureau.

One chapter is devoted to the South Atlantic Expedition of the *Meteor* and the results obtained by acoustic sounding.

A very complete article outlines the method of procedure employed in the Oceanographic Laboratory of the Hydrographic Service for the analysis of sea water and the determination of the composition of the ocean bottom.

In this volume there is also an article on the preparation of original charts and the procedure followed up to the time of printing. One chapter is devoted to a description of the echo-sounding device Mark II (for shoal waters) of the British Admiralty, another to the description of the new model of the Anschütz gyroscopic compass and the sounding device based on the Lucas system.

Finally, volume VIII of the *Anales* concludes with a very interesting article on the instruments of the Naval Observatory, which has received entirely new material during the year 1927. This new material comprises:

3 chronometers (adjustable, capable of regulation) equipped with electric winding; made by Leroy.
1 automatic time signalling device, Brillie-Leroy system.
1 recording chronometer, Gautier system.
1 motor chronometer for use in making comparisons, Guillet-Lepaute system.
2 electric clocks.

The operation and the winding of the clocks are described in detail.

The Guillet chronometer for comparisons, which is used to make a very accurate determination of the difference in the beats of two clocks, has been made the subject of a special descriptive article.

This is the model adopted by the Paris Observatory under the name of "comparateur à diapason" by Professor Guillet.

A detailed description is given of the operation of the time signal device (*Brillie-Leroy system*) and it is shown that the instrument is capable of automatically sending out a series of Morse signals of variable duration with an accuracy of + 0.03 seconds.

Finally, the photographs and the diagrams give a clear idea of the operation of the Gautier recording chronometer for recording the observations of transits, after having been synchronized with a repeating clock.

ANNUAL REPORT OF THE DIRECTOR, UNITED STATES COAST AND GEODETIC SURVEY,

To the Secretary of Commerce, for the Fiscal year ended June 30th, 1927

Octavo, 47 pages, illustrated with 15 diagrams, United States Government Printing Office, Washington, 1927.

Price 50 cents.

This report, published by the Director of the Coast and Geodetic Survey on the occasion of the III[th] anniversary of the Service, outlines the work which has been accomplished, the work projected and the work in progress up to June 1927. It lists the work of the Instrument Section, the Geodesic Section, the Section for Terrestrial Magnetism, the Hydrographic Section, Section for Tidal and Current Surveys and the Chart Section.

The work of this last named section has been considerably augmented by the demand for charts for the airways in the United States.

The report clearly brings out the most important needs of the Service, principally the purchase of new instruments and the upkeep and repair of those already in existence. It also points out the need of speeding up the process of modern chart construction and the necessity for augmenting the floating material of the Service.

The following table shows the increase in the activities of the Service in the course of the past few years:

	1923	1924	1925	1926	1927
Publication of Charts	197,426	221,543	230,535	232,286	246,836
Works published	35,185	37,671	37,180	38,537	41,423

The report enumerates in detail the various hydrographic and topographic surveys completed on the various coasts of the United States, of Alaska, the Hawaiian Islands, the Philippines and Porto Rico by the 28 groups of operators and the detailed tables give the number of soundings taken, the length of the coast surveyed — the total amounting to 589,332 soundings 17,658 square miles, 2,560 miles of coast, together with the determination of a number of geographical positions amounting in all to 1,111.

The coloured charts give a very clear indication of the state of progress of the hydrographic work.

One chapter is devoted to the Bureau in Washington, to the organization of the different sections and to the work accomplished by each in the course of the year. The Instrument Section has completed the construction of a number of instruments and apparatus in the course of the year which the report describes in detail.

A list of the new charts published during the year is appended to the report.

TOPOGRAPHICAL MAP OF THE ANTARCTIC AND NAVIGATIONAL CHART OF THE ANTARCTIC

published by the *American Society of Geography*

These maps have been designed to meet the needs of those who wish to follow current Antarctic exploration. Specifically they were prepared for use by the expeditions of Commander Richard E. Byrd and Captain Sir Hubert Wilkins.

The map of the Antarctic is on a scale of 1 : 4.000.000 and is printed in black and white

and blue, in four sheets each 32 inches square. This size permits adequate representation of the known data. It incorporates the work of all the major expeditions of the last thirty years, among them those of SHACKLETON, SCOTT, AMUNDSEN, the *Belgica*, CHARCOT, MAWSON, DRYGALSKI, NORDENSKJÖLD, BRUCE and FILCHNER and, in so far as it has not been superseded, the work of the earlier explorers and seamen.

Practically all known soundings in Antarctic waters are represented on the map, while the more abundant data permit drawing of bathymetric contours of 200, 500 and 1000 metres and thence downward for each 1000 metres. Lines of equal magnetic variation are shown for 1927. The network of goegraphical coordinates is drawn for every degree to facilitate the plotting of new data as they are received.

The large scale and the use of color bring out very graphically how enormous is the area of Antarctica that is still unknown. Only narrow belts of territory have been mapped. The two-thousand-mile stretch between Graham Land and Ross Sea is totally unknown ; and, except for two landfalls, so is the whole opposite coast of the continent for nearly a third of the way round the globe in that latitude.

The Navigational Chart of the Antarctic, on a scale of 1 : 12.000.000, which accompanies the above map is made for use in aircraft navigation.

It shows the outlines of ice and land as far as known and the lines of equal magnetic deviation. Its use is explained in a pamphlet accompanying the maps.

These maps may be retained at the American Society of Geography.

ANALYTISCH - GEOMETRISCHE UNTERSUCHUNGEN UBER DIE AZIMUTGLEICHE IN DER MERKATORKARTE

by

PROF. W. IMMLER, ELSFLETH

in-8°, 40 pages, 24 illustrations.

Extract from the 45th issue, N° 2,

Aus Dem Archiv Der Deutschen Seewarte, Hamburg 1928.

Professor W. IMMLER, who is the author of numerous studies on the question of lines of equal azimuth on the Mercator projection and who has recently devised a system of curves for utilizing the Wier diagram for finding immediately the elements required for plotting a line of position tangent to the curve of equal azimuth on the Mercator projection (published in vol. XI of the *Annalen der Hydrographie* which appeared on 15th November 1928) has included in the same work a number of investigations of this question. He points out the analogy of this problem with that of the line of altitude which is much used in nautical astronomy ; he studies the form which the lines of equal altitude take when transferred to the Mercator projection and discusses the accuracy of the different methods employed for their utilization.

A bibliography of the German works on this question completes the volume (*see* also *Hydrographic Review*, November 1928 page 49).

P. V.
