REVIEWS OF BOOKS

EINFÜHRUNG IN DIE GEOPHYSIK - III - DYNAMISCHE OZEANOGRAPHIE

(INTRODUCTION TO GEOPHYSICS - III - DYNAMIC OCEANOGRAPHY)

by PROF. DR. A. DEFANT,

DIRECKTOR DES INSTITUTS UND MUSEUMS FÜR MEERESKUNDE, Berlin, Julius Springer, 1929.

The need of a treatise on dynamic Oceanography, which would combine the very numerous and scattered reports on this subject, was becoming very apparent, particularly since the scientific expeditions of the *Meteor* and *Willebrord Snellius* attracted attention too long diverted from this important matter.

The theories of V. W. EKMAN and V. BJERKNES, in particular, have thrown a fresh light on the movement of the waters and led to conclusions which are already the standards and to methods now employed in practice.

In order to become acquainted with them, it was necessary to read a large number of reports and memorandums, scattered throughout numerous publications and Reviews, the mathematical exposition of which made the text difficult for certain readers.

V. Walfrid EKMAN had, it is true, published in December 1928 in the Journal of the Permanent International Council for the Exploration of the Sea, an article entitled : *A Survey of some theoretical Investigations of Ocean-Currents*, in which, for the use of practical Oceanography, he laid down the principles and essential results of modern theories upon Ocean currents.

There was however no complete treatise ; Professor Dr. A. DEFANT who, by his own work, is largely responsible for the advancement of this science of dynamic Oceanography, supplies the want. The book is written with the clearness and logic which one is accustomed to find in the works of this author. It is a synthesis of modern theories eliminating mathematical developments which would tend to obscure the exposition, whilst setting out the essential parts of the formulae to demonstrate the bases of the systems and to allow them to be turned to practical use. The author illustrates them by many examples, drawn from most recent experiences, and especially from the wonderful research work of the *Meteor*. Numerous bibliographical references and a List of authors quoted supply abundant documentary information.

The work is divided into ten chapters :

The first two define the various areas of force with which one must reckon : interior forces due to the distribution of mass, exterior forces due to the wind, the attraction of heavenly bodies ; deflective force due to the rotation of the earth, and friction. The equations of hydrodynamics are deduced from these, and with the equation of continuity every problem can be solved.

Chapter III deals with the Statics of the sea, gravitation, pressure, specific volume and an examination of bases of stable equilibrium of the various forces. Chapter IV deals with the Kinematics of the Sea, the field of current (Strömfeld) and its different peculiarities (*), methods of representing it, current lines and trajectory of molecules ; vertical movements of emergence and immersion brought about by the variations of the horizontal velocity of neighbouring currents and in connection with the equation of continuity ; the influence of the configuration of the bottom and the form of the coasts.

Chapter V, one of the most important, explains the general dynamics of currents. As the problem, owing to its complexity, cannot be fully solved, a certain number of typical cases are examined. If friction be neglected, a stationary current in a homogeneous sea follows the direction of the isobaths owing to a deflective action due to the rotation of the earth and its velocity can be ascertained by the density of these lines. Next comes a survey of the influence of changes in the depth of the sea and the action of the spherical form of the earth, which leads up to the idea of the *critical slope*. After having spoken of the currents which oscillate around a mean position, there are general considerations of the influence of friction, interior molecular friction and turbulence friction.

(*) *On this subject see the article in* Hydrographic Review N° 11, *May* 1929, p. 181.

These preliminaries lead up to the study of stationary currents in a homogeneous sea taking friction and exterior forces into account. A distinction is made between :

1) The drift current (Trifström) produced by the wind blowing on the horizontal and homogeneous surface of water : its rotation towards the right (the direction of rotation of the apparent sun) when its depth increases, which rotation reaches 180° at the frictional depth (Reibungstiefe) : theoretical results which can be brought sufficiently into agreement with observations by the use of suitable coefficients.

2) The gradient current (Gradientström) which becomes, according to the depth, a surface current (Oberflächenström), a sub-surface current (Tiefenström) or a bottom current (Bodenström and which as it sinks, diminishes in intensity and turns in an opposite direction to the drift current.

It is their ensemble which EKMAN calls the elementary current (Elementarström). The Chapter concludes with a survey of the turbulence movement.

Chapter VI goes into what happens to the preceding results when the sea is no longer homogeneous, but shows discontinuity and is formed of distinct layers (*). It is then that the peculiarities of the field of current and lines of convergence and divergence are seen. Herein is found the application to the movements of masses of water of the theories and calculations originally established for air masses by F. M. EXNER and V. BJERKNES.

Chapter VII is devoted to the dynamics of convection currents and gives an explanation of the BJERKNES theory of circulation, the method of calculating velocities, with an interesting application to the case of the Gulfstream, the law of the solenoid fields, and a survey of the influence of friction on convection currents.

Chapter VIII is entitled : "On Oceanic Circulation". It deals with the influence of the atmosphere on the surface of the sea and the currents resulting therefrom. The author has given the title of oceanic troposphere to the upper layers and that of stratosphere to the rest of the liquid sea, and examines the circulation in these zones.

Chapter IX deals with the nature of waves : the results obtained from the diverse theories on their shapes agree but imperfectly with the profiles shown by the stereophotographs of the *Meteor* : the periods of their oscillations, their velocities of translation, the influence of the shape of the coast and changes of depth, together with some curious reflections on internal waves and the phenomena of dead water.

Chapter X is headed "Tides and tidal Currents". The mathematical theories of the actions of the stars are not touched upon, but the peculiarities of tides in bays and channels, and particularly in the case of the Red Sea, where the agreement between theory and practice pointed out by Prof. Fr. VERCELLI in 1925 is proved : a study of the influence of the rotation of the earth leads to an explanation of amphidromic points ; next the effect of friction on tides and current tides is examined. As to Ocean tides, reference is made to the works of R. A. HARRIS and R. STERNECK and the surveys which the author made in 1924, and those by R. STERNECK in 1926, of the tides in the Atlantic Ocean and their propagation. Finally a rough estimate is made of the amount of tidal energy absorbed by the friction throughout the seas of the world ; the results, the accuracy of which cannot of course be anything but very approximate, prove that the secular acceleration of the movement of the stars can be attributed to this.

In this book, therefore, although of a limited size, it is clear that a very complete account can be found of the most up to date theories which affect the dynamics of the Ocean in which not only oceanographers, but above all these who are in constant touch with the phenomena of the sea cannot fail to be interested.

P. V.

(*) *See a curious example in the* Hydrographic Review *N°* 12, November 1929, p. 241.

LA TOPOGRAPHIE SANS TOPOGRAPHES - TRAITÉ DE PHOTOGRAMMÉTRIE

(TOPOGRAPHY VITHOUT TOPOGRAPHERS.
TREATISE ON PHOTOGRAMMETRY).

by MAJOR F. OLLIVIER

XVIII - 301 pages. Ill. Editions de la *Revue d'Optique* - Paris - 1929.

This volume which has just been published by the *Revue d'Optique Théorique et Instrumentale*, in Paris, is the work of a Chef de Bataillon of Military Engineers, Ingénieur Diplomé of the Ecole Supérieure d'Optique. The author gives us the benefit of his practical knowledge of optics, which permits him to give a very condensed and valuable discussion of photogrammetric appliances and their accuracy. He confines himself to a study of verticai photographs (*) taken from the ground, but we trust the study will be continued to include photographs taken from aircraft. He invites attention to the fact — and hydrographers should not forget this — that such employment of photographs is but an improvement of the method which BEAUTEMPS-BEAUPRÉ described in 1808 in the following words:-

"I believe that I have found a method of avoiding these errors, by making from each "station, a sketch of the coast whereon the most conspicuous objects are not only indicated by "letters or figures, but whereon the values of angles observed are written, as well as the bear-"ings of the stations with reference to each other, estimates of the distances, etc... This method "of operation, which I have always followed, has given me the inestimable advantage of always, "while constructing my charts, having the objects, as they appeared at the time of taking the "angles, before my eyes and, frequently this directed my attention to errors which had slipped "into the observations".

These sound considerations are still true, particularly when dealing with the yet numerous coasts of which no accurate and detailed topographical surveys have been made. The hydrographic surveyor will find it of much interest to substitute for the coast views of BEAUTEMPS-BEAUPRÉ the beautiful photographs which can be obtained with modern appliances which, suitably installed, would guarantee quasi-vertical exposures.

In the preface and in Chapter I there is a very complete historical account of photogrammetry. This is followed by a study of stereophotogrammetry and stereo-autogrammetry with which tremendous progress has been made in methods of photographic topography by permitting automatic identification of the same points on two photographs.

Chapter II includes a description of the impression of relief given by binocular vision and a description of various stereoscopes; it gives accurate and very clear ideas regarding this difficult question where physiology complicates the geometrical problem.

Chapter III contains an outline description of the stereocomparator and of the autograph as well as a study of the method of using the apparatus. In this type of instrument, where complication of parts masks the simplicity of the principles, the author has succeeded in making the instrument very easy to understand. This is followed by a detailed description of the instruments, phototheodolites, stereo-comparator, VON OREL stereo-autograph and an explanation of their use. Finally there is a very close investigation into the errors and accuracy of the results, which leads to the conclusion that the photographic method normally yields accuracy at least equal to that obtainable with the older methods and gives much better results in a mountainous country.

The illustrations are remarkably clear; good reproductions of the apparatus and of several surveys facilitate the reading of this work which should contribute much towards extending the use of these methods, which have passed the test stage and should be more frequently employed.

P. V.

(*) *The author has adopted the term* vertical photographs *when the plate is vertical and the optical axis of the apparatus is horizontal. Many others use the less logical denomination* horizontal photographs *in such case.*

METEOROLOGY OF POLAR REGIONS.

Dr. G. C. SIMPSON, Head of the Meteorological Office of the British Air Ministry, delivered a lecture, at the Royal Geographical Society of London, on the subject of Meteorology of the Polar regions, and on the relative importance of establishing climatic stations in the Arctic and Antarctic. The September 1929 number of the *Geographical Journal*, give an account of the lecture delivered by Dr. SIMPSON and of the opinions expressed by several eminent persons interested in polar subjects.

There is a suggestion that, during the year 1932, on the occasion of the jubilee of the great Polar Year 1882-83 (during which, on the initiative of Dr. NEUMAYER of the Deutsche Seewarte, and of Lieut. Karl WEYPRECHT of the Austrian Navy, no fewer than twelve nations organized expeditions to the Arctic and Antarctic), a scientific expedition be organized, under the auspices of the Aeroarctic Society, with international cooperation, in order to collate observations concerning meteorology, terrestrial magnetism, etc...

During the lecture, Dr. SIMPSON developped the three following proposals:

1st., Our knowledge of polar meteorology is such that little further advance can be made by spasmodic meteorological observations; 2nd, we need observations taken simultaneously in all parts of the polar regions as well as, of course, in other regions of the world, so that the actual conditions existing at any one time over the whole polar region can be studied in detail; 3rd, we need observations at a few representative positions which will give unbroken records extending over many years.

For this purpose, Dr. SIMPSON proposes to establish two first-class geophysical observatories, one in the north of Canada and one to the north of Siberia, and to establish two similar observatories in the Antarctic: one in the Ross Sea area and another in the Weddell Sea area. These stations should be in such situations that they could be visited without danger every year. Then, the ordinary network of telegraphic reporting stations would be slowly and methodically extended northwards as opportunity offered. For this purpose, no new settlements would be necessary, but trading posts with the necessary wireless apparatus for sending their messages may be used. This policy is already being followed in Canada and Russia, and has long been followed by Norway in Spitsbergen and by Denmark in Greenland.

The position is not quite the same in the Antarctic. The great expanse of the Southern Ocean will always cause a break between the network of stations in the southern continents and any network which could be established on the Antarctic Continent. This break is so wide that it is very doubtful whether it would be possible to construct synoptic charts which would connect the two networks. Therefore, Dr. SIMPSON does not advocate the immediate establishment of further stations in the Antarctic beyond the two geophysical observatories already referred to.

During the discussion, it was remarked that, as concerns terrestrial magnetism, it would be of great advantage to have a considerable number of stations as close together as possible for one whole year. Such stations all around one pole should enable the phenomena of terrestrial magnetism to be observed in much greater detail.

Although the Poles have not the predominant influence on the weather previously conceded to them, and that hot regions still have a very important role therein, it is desirable nevertheless that a few stations should be established in the Polar regions, and should be so established as to last some time.

ANNALI IDROLOGICI - 1927

Published by the Ufficio Idrografico del R. Magistrato alle Acque, Venezia.

This volume, which forms the fifth Annali which the *Ufficio Idrografico del R. Magistrato alle Acque* issues, has been published in 1929, and contains reports on the work carried out in 1927 in fluvial hydrology, pluviometric research and the regime of the lagoons.

The meteorological part includes in particular the means of the observations recorded at

the Venice (Lido) and Triest observatories. A table of the wind frequencies for 1927 for Fiume, Triest, Venice (Lido), Padova, Colle Venda and Trento is given in page 19.

An article on the mean-sea level at Venice during 1927 will be found on page 262. The observations were made at the tide-gauge of the southern embankment of the Lido. A graph shows the mean levels observed, yearly and decennial, from 1917 to 1926, and compares them with the barometric pressure. The observations were made with two tide-gauges: one, of the THOMSON type, reduction 1/5 and the other, an R/200 pattern of the Ufficio Idrografico, reduction 1/20. The readings are referred to a plane situated 1.50 m. below sea level, which is that adopted by the Istituto Geografico Militare as the zero of the altimetric net of Italy. The mean level for each period is obtained by meaning up the ordinates of all the high waters and low waters, by the formula:

$$h = \frac{1}{n}\left(\frac{h_0}{2} + h_1 + h_2 + \ldots + h_n + \frac{h_n}{2}\right)$$

Inspection of the graph for 1927 shows that the mean level for 1927 is situated 154.89 cm. above the plane of reference, *i.e.*, at 4.89 cm. of the base plane of the Italian altimetric net, and at 3.71 cm. above the decennial mean for 1917-1926. This particular rise of the level in 1927 with reference to the altimetric zero is partly explained by the mean barometric pressure of 761 $^{m}/_{m}$ which happens to be less than to the barometric mean of the ten preceding years; it is also explained by the general climatic conditions of the year, in which prevailing N.E. and S.E. winds, and a high temperature were experienced. Comparison with the mean outflows of the rivers during this same period, allows various comparisons to be made: the maximum barometric pressures, and also the minimum river outflows correspond to the minimum February levels.

Speed of tidal streams in the channel of the Port of the Lido.

Current measurements were carried out in the latter half of May, 1927, in the channel of the Port of the Lido by means of an EKMANN-MERZ apparatus which had been carefully calibrated at Strà Basin. Speed observations were made at three different depths: at 1 m. below water level, at 1 m. above the bottom; and half way up the vertical distance.

Page 266 gives a diagram of the current speeds thus observed, of the height of the tide in the channel, and also the corresponding meteorological data: pressure, direction and force of wind. It has thus been possible to determine the harmonic constants of the currents with a view to forecasting to work out the non-periodic currents which are superimposed on the tidal currents, and obtain new determinations as to the system of ebb and flow through the channel of the port of the Lido.

GUIDE DU CALCULATEUR

(ASTRONOMIE, GÉODÉSIE, NAVIGATION, etc.)

(THE CALCULATOR'S GUIDE, ASTRONOMY, GEODESY, NAVIGATION, etc...)

by J. BOCCARDI.

8vo, 2 Volumes, 78-147 pp. published by J. PASTORE, Catania (Italy) and A. HERMANN, Paris, 1902.

The author has assembled in this book the practical rules which apply generally to all scientific calculations and which are not usually found in educational Manuals.

The first volume contains general remarks on the various special logarithmic and numerical tables, general advice to be followed before making computations, practical processes and artifices which may be used in the course of the computations, and certain rules applicable to the checking of computations and in the search for errors.

The second volume contains the rules for special computations, and, in particular for the calculation of orbits.

ROUKOVODSTVO DLIA POLZOVANIA MORSKIMI KARTAMI

(MANUAL ON NAUTICAL CHARTS)

8vo - 68 pages - 10 plates.

The Hydrografitcheskoie Upravlenie of Leningrad has just issued the 1929 edition of the Manual on Nautical Charts. This new Manual is drawn up by Hydrographer-Geodesist P. V. MESSER of the Hydrographic Department. It is intended to replace the former "Manual for reading Russian and British Nautical Charts", part I, published in 1917. As new rules for the compilation of charts were introduced in 1910, the Manual gives details of both the old and the new systems. In this connection, the number of Russian Hydrographic Charts in use at the present moment and already published up to 1910 is 315, and the charts published after 1910 amount to 159.

The new Manual is entirely translated into English; this feature is likely to facilitate the use of U.S.S.R. charts by foreign seamen. The first part of the volume gives general information concerning the publication and the sale of Russian charts and on, the methods of correcting and of keeping them up-to-date. A chapter is devoted to the explanation of conventional symbols and to the method of indicating bearings, soundings, tidal data, magnetic variation, lights,etc... on charts.

The book gives also the buoyage regulations in the different regions of the U.S.S.R., and a list of local terms which appear most frequently on Russian charts of the White Sea, Black Sea, Caspian Sea, Arctic and Pacific Oceans.

The price of the Manual is 2 roubles.

ZVOUKOVOIE IZMIERENIE GLOUBIN

(SONIC MEASUREMENT OF DEPTHS)

by K. S. OUKHOV.

8vo - 90 pages - 22 figures and plates. — *Published by the Hydrografitcheskoie Upravlenie, Leningrad*, 1927. — Price: 1.50 roubles.

This book, published in Russian, reviews the different methods of echo-sounding and enumerates the various types of apparatus employed for such sounding. A very complete bibliography relating to echo-sounding (83 books and articles) will be found on page 86.

THEORIA I PRAKTIKA GHIROSKOPITCHESKOVO KOMPASSA

Tchast I - Theoria

(THEORY AND PRACTICE OF THE GYROSCOPIC COMPASS - Part I. - Theory).

2d edition.

by BORIS IVANOVITCH KOUDREVITCH.

8vo - 192 pages - 80 figures. — *Published by the Hydrografitcheskoie Upravlenie, Leningrad*, 1929. Price: 1 rouble.

This book has been re-edited in order to take the place of the first edition of the "Elementary theory of the gyroscopic compass" (which was published in 1922), which is now out of print. The second part "Practice of the gyroscopic compasses" was published in 1925. The new edition of the first part is completed by a certain number of mathematical developments on the theory and compensation of gyroscopic compasses.

ZAPISSKI PO GHIDROGRAFII

(HYDROGRAPHIC BULLETIN, Volume VII.)

Published by the Hydrografitcheskoie Upravlenie, Leningrad, 1929.

This Hydrographic Bulletin contains in particular an article drafted by N. WAGNER, on contemporary methods of chart reproduction, a short history of the Supplementary International Hydrographic Conference, and a very exhaustive bibliographic review of *Hydrographic Review*, Vol. VI, N° 1, May, 1929, published by the International Hydrographic Bureau.

ANNUAL REPORT OF THE U.S. HYDROGRAPHIC OFFICE FOR THE FISCAL YEAR 1928.

In the Annual Report of the U. S. Hydrographic Office for the fiscal year 1928, the following information is noted :

There were 151 employees on the roll of the Hydrographic Office, on 1st July, 1927.

For the drafting work necessitated by information derived from foreign sources, five new pantogravers have been constructed for the Hydrographic Office, in view of increasing its production. Besides, the U. S. Hydrographic Office has been charged with the compilation of aviation charts along the sea boundaries of the United States, Central America, and the West Indies, according to a pre-established programme.

A standard aviation chart and 14 provisional charts have been prepared and published during the fiscal year.

In the course of the fiscal year 1928, the engraving section carried out the following work:

New copper plates engraved	70
New copper plates being prepared	30
Copper plates extensively corrected	41
Copper plates receiving minor corrections	153

The pantograver section did the following work:

Charts engraved on copper	28
Data cut on glass	3
Soundings and corrections to copper plates	19
Miscellaneous work	4
Pilot Chart data engraved on copper	22

The examination of charts in view of keeping them in an up-to-date condition bore on 1,033 American charts out of a total of 2,870 charts.

In the course of the fiscal year 1928, the U. S. Hydrographic Office printed a total of 999,775 charts ; of which 750,567 were Pilot Charts ; 242,450 lithographed navigational charts ; and 6,758 navigational charts printed from copper plates.

In the course of the year, the Hydrographic Office prepared or regrained 890 zinc plates. It has been possible greatly to reduce direct copper-plate printing in the course of the fiscal year 1928. At the beginning of the year, there were 263 engraved chart plates, from which charts had to be printed by hand ; by the end of the year, this number had been reduced to 218 by transfer of a certain number of copper plates on lithographic zinc plates.

The surveys carried out by the Hydrographic Office in the course of the 1928 season has already been detailed on pages 81 and 83, *International Hydrographic Bulletin* N° IV, of April 1929.

The number of Notices to Mariners published by the Hydrographic Office in the course of the year was 5,051 different notices, *i.e.* an increase of about 95 per week. In addition, 30 Notices to Aviators were issued.

The Sailing Directions Section redrafted 4 volumes of Sailing Directions and 56 Supplements to Sailing Directions, the latter containing altogether 1,731 pages. The publication of 6 volumes of Light Lists must be added thereto, as also that of Publication N° 205 "Radio Aids to Navigation".

In the course of the year, 28 chart plates were condemned.

ANNUAL REPORT OF THE DIRECTOR, UNITED STATES COAST AND GEODETIC SURVEY, FOR THE FISCAL YEAR ENDED JUNE 30, 1929

8vo, 42 pages, 17 charts—*United States Government Printing Office, Washington*, 1929—Prix: 15 cents

This new report of the Director of the Coast and Geodetic Survey sets forth in very full detail the different work which is undertaken by the Coast and Geodetic Survey.

The first part of the report lays down, in a general manner the functions of the Office, its progress and needs in connection with the different branches of its activity, *i.e.*: hydrographic and topographic work, chart publication, geodetic surveying, observing tides and currents, terrestrial magnetism and seismology.

The second part sets out under its different branches the field work carried out, and the third part gives, in detail, the production of the different divisions of the Washington Office.

At the end of the report a recapitulative table, by sections, of the various field-parties is given with details of the areas of operation, the nature of the work, and the name of the persons who are in charge of the operations.

Numerous charts and diagrams accompany this interesting report: particular attention is directed to the table showing the organization of the different sections of the Coast and Geodetic Survey on 1st July 1929.

The various tables show the extent of the various surveys carried out in the United States, Alaska, the Philippine Islands, the Hawaiian Islands, Panama, Porto Rico and the Virgin Islands including hydrography proper, sweeping topography, triangulation, traverses, levelling, determinations of longitude, determinations of latitude, determinations of azimuths, magnetic observations, seismological observations, gravity observations and primary and secondary tidal observations.

For airway maps, a diagram shows the distribution of the projected programme of 82 charts.

Other similar diagrams show the present situation of the progress of the surveys undertaken by the Coast and Geodetic Survey.

THE UNITED STATES COAST AND GEODETIC SURVEY, ITS WORK, METHODS AND ORGANIZATION.

U. S. Coast and Geodetic Survey Special Publication N° 23, in-8°, 130 pages, 40 fig.
United States Government Printing Office, Washington, 1928.

This monograph of the Coast and Geodetic Survey reproduces the major part of the articles contained in the previous edition of 1925; but bringing them up-to-date with reference to the new publications issued by the Coast and Geodetic Survey.

The publication gives a very interesting summary of the work carried out by the Service. Some idea of its importance may be formed remembering that the coast line of the United States, Alaska, and the islands, extends over nearly 20,000 kms. If all the indentations and circumvolutions of the coast be taken into account, this figure would be brought up to about 165,000 kms.

The first chapter of the publication gives a short historical outline of the Coast and Geodetic Survey since its creation in 1807. Some information on this subject may be found on page 195 of *Hydrographic Review*, Vol. I., N° 2, 1924.

The Survey has 10 steamers and 4 motor vessels, of which 4 were specially built for hydrographic work. The personnel taking part in the hydrographic expeditions consists of 141 hydrographic and geodetic engineers, 7 magnetism observers, 18 tide observers, 63 mates, 550 enlisted men and an average of 160 other employees. The office staff numbers 230 altogether. The Survey itself is divided into several Sections: Geodesy, Hydrography and Topography, Charts, Tides and Currents, Terrestrial Magnetism, Instruments.

Field stations have been established at Manila, Boston, New-York, New-Orleans, San Francisco, Seattle, and Honolulu.

The monograph published in 1928 reviews by turns the different spheres of activity of the Service, which are classified under 17 different headings.

I. — *Astronomical work:* Determination of time, determination of longitudes, latitudes and azimuths. The different instruments used are listed and a sketch-map gives the state of progress of the astronomical determinations made by the Coast and Geodetic Survey, as on 31st December, 1927.

II. — *Base Measurements.*

III. — *Triangulation:* Reconnaissance, erection of station marks, measurement of angles and fixing of stations. A sketch-map gives the state of progress of triangulation in the United States, as on 31st December 1927.

IV. — *First order traverse.*

V. — *Topography:* Chain, steel tape, with the transit and stadia surveying; plane table photographic methods.

VI. — Chapter VI relative to *Hydrography* has been redrafted in its various paragraphs which include: depth measurement with hand-lead and by means of sounding machines, deep-sea soundings, use of the wire drag, echo-sounding, methods of fixing position of soundings at sea by means of observation of visible shore objects or of buoys moored at sea.

VII. — Chapter VII is devoted to *Tides*, to the description of automatic tide-gauges, tidal bench marks, tide tables and the machines used by the Survey for tide predicting.

VIII. — Chapter VIII reviews the different types of *Currents:* rectilinear, reversing, rotary, surface drifts caused by the wind and permanent currents. It gives the principles of the method of current observation and the rules followed for the preparation of the current tables.

IX. — *Terrestrial Magnetism:* Use of the magnetometer and theodolite, of the dip circle, and of the earth inductor.

X. — Chapter X relates to *Nautical Charts:* the material used to produce them, system of projection, and chart compilation, further the chart reproduction processes: engraving and lithography. It is known that this last process is largely used in the United States by the Coast and Geodetic Survey, by means of aluminium plates, the engraving on the copper plates being transferred on to the aluminium plate by photographic process without introducing distortion. Over 96 % of the charts published by the Coast and Geodetic Survey are now printed by lithography, of which 93 % are offset printed, *i.e.*, the paper does not come into contact with the aluminium printing plate, but, instead, the impression is made on a rubber sheet from which it is transferred to the chart paper. This process gives sharp and unbroken lines.

XI. — *Coast Pilots.* This chapter recalls that the first known volume of the Sailing Directions published in America (The American Coast Pilot) was drafted by Capt. Lawrence FURLONG and appeared in 1796.

The Coast Pilots published by the Coast and Geodetic Survey comprise 12 volumes. The compilation of these volumes is done by officers who proceed to the site, and have worked on the spot before drafting their manuscritps in the office; this method thus gives full guarantee as to accuracy.

XII. — *Physical oceanography.*

XIII. — *Levelling.* In this chapter the FISCHER first-order level and the different cathetometric sights used by the Coast and Geodetic Survey are mentioned. A sketch-map gives the state of progress of the first-order levelling carried out by the Coast and Geodetic Survey, as on 31st December, 1927.

XIV. — *Seismology and use of the seismograph.*

XV. — *Gravity measurements.* A sketch-map shows the stations at which the Coast and Geodetic Survey had determined the intensity of gravity, up to 31st December, 1927.

XVI. — Chapter XVI gives a short historical sketch of the *Measurement of geodetic Arcs*, and a brief statement of the theory of isostasy for the determination of the form of the Earth. It also shows the progress made in geodesy under the auspices of the Geodetic Association founded in 1861, and continued by the International Research Council since 1919.

XVII. — This chapter sets out the *nature of the various Documents* which are to be found in the Archives of the Coast and Geodetic Survey. The earliest records on file date back to 1816. The first topographic and hydrographic surveys date from 1834, and the first magnetic and maregraphic observations began in 1832.

MANUAL OF FIRST-ORDER TRIANGULATION

by C. V. HODGSON, Assistant Chief, Division of Geodesy, U. S. C. & G. S.

U. S. Coast and Geodetic Survey Special Publication N° 120, 8vo, 185 pages, 64 fig. and tables. — *Government Printing Office, Washington.* — Price : 40 cents.

The purpose of this manual is to give a summary of the methods employed by the Coast and Geodetic Survey for first and second-order triangulations and for base measurement.

The detail of the theoretical principles on which triangulation and base measurement rest, have not been reproduced in this book ; only such reference thereto is made as will enable engineers to carry out such work with the accuracy they consider necessary.

A first chapter entitled : *Reconnaissance*, indicates how to select and establish the different polygons.

Chapter 2 deals with *First-Order Triangulation.*

Chapter 3 with *Base Measurement.*

Chapter 4 with *Azimuth Determination.*

Chapter 5 gives general information on special *Control Operations.* Lastly, chapter 6 gives a series of *Numerical Tables* relating to the terrestrial ellipsoid.

Instructions are included in the book, concerning the use and care of theodolites, especially of the 12-inch Coast and Geodetic Survey azimuth theodolite of the 7-inch vertical circle, of vertical collimator employed for centering the theodolite over the station mark, of the projector or heliotrope. The same chapter also gives a description of the standard heliotrope, of an emergency heliotrope and of a small signal lamp with automatic lighter.

The manual also gives general information on the organization of expeditions and the preparation of the programme of observations.

A few pages enumerate the principal sources of errors, the corrections for the signal phases, the errors of horizontal refraction, of excentricity, etc...

Examples of computations are given for the calculations made in the field, and the use of nomograms for obtaining the reduction to the centre of the station is noted.

For base measurement, the description of the instruments and examples of computations used by the Coast and Geodetic Survey are given, and at the end of the volume, a bibliographical list may be found of the Special Publications issued by the Coast and Geodetic Survey relating to triangulation and base measurement.

MANUAL OF SECOND AND THIRD ORDER TRIANGULATION AND TRAVERSE

by

C. V. HODGSON, Hydrographic and Geodetic Engineer,
United States Coast and Geodetic Survey.

U. S. Coast and Geodetic Survey Special Publication N° 145, *8vo, 226 pages, 90 fig. and Tables. United States Government Printing Office, Washington,* 1929. — Price : 60 cents.

Previously the instructions relative to second and third-order triangulation were to be found scattered in various separate Coast and Geodetic Survey Publications ; they have been collected into the present Manual, the object of which is to give the different rules and practices followed by the Coast and Geodetic Survey in carrying out its second-order surveys.

Until recent years, the terms "primary", secondary", and "tertiary" were used, in order of decreasing accuracy, to designate the principal grades of triangulation and traverse used in Government surveys. This led to considerable confusion, for on an extended piece of triangulation the more accurate class was usually called "primary", irrespective of the degree of accuracy obtained, while the subsidiary schemes were usually classed as "secondary".

In order to secure more uniformity in the nomenclature and in its employment, the Federal Board of Surveys and Maps, in May, 1925, after referring the matter to the various Federal Map making Bureaus represented on the Board, recommended that the four grades of vertical and horizontal control ordinarily used be designated as first order, second order, third order, and fourth order, respectively, the first named being the most accurate. The use of the terms has been made compulsory by the Director of the Coast and Geodetic Survey and must be applied to the different sorts of stations made by the Survey. They have also been adopted by the Committee on Triangulation of the International Geodetic and Geophysical Union, so that no doubt there will soon be international concurrence in this terminology.

Besides, the recent Coast and Geodetic Survey Publication lays down from the very first pages the method of classification adopted by the Surveys for its different station marks; of course, the length of the sides of the triangles has nothing to do with the order of the triangulation.

The following Tables give the accuracy with respect to conditions required of the three first orders of triangulation and traverse.

TRIANGULATION.

	First order.	*Second order.*	*Third order.*
Discrepancy between computed length and measured length of base or adjusted length of check line, not to exceed	1 in 25,000	1 in 10,000	1 in 5,000
Triangle closure:			
Average not to exceed	1 sec.	3 sec.	6 sec.
Maximum, not to exceed	3 sec.	8 sec.	12 sec.
Usual number of Observations:			
Positions with 1-second direction theodolite.	16	4	2
Positions with 2-second direction theodolite.	20 to 24	4 to 8	2 to 4
Sets with 10-second repeating theodolite...	5 to 6	2 to 3	1 to 2
Base Measurement:			
Actual error of base not to exceed	1 in 300,000	1 in 150,000	1 in 75,000
Probable error of base not to exceed	1 in 1,000,000	1 in 500,000	1 in 250,000
Astronomical azimuth, probable error of result.	0.5 sec.	2.0 sec.	5.0 sec.

TRAVERSE.

	First order.	*Second order.*	*Third order.*
Closing error in position, not to exceed	1 in 25,000	1 in 10,000	1 in 5,000
Probable error of main scheme angles	1.5 sec.	3.0 sec.	5.0 sec.
Number of stations between astronomical azimuths	10 to 15	15 to 25	20 to 35
Astronomical azimuth, discrepancy per main angle station, not to exceed	1.0 sec.	2.0 sec.	5.0 sec.
Astronomical azimuth, probable error of result.	0.5 sec.	2.0 sec.	5.0 sec.

The general information, placed at the beginning of the book, gives additional information on these various orders of operations, and directs attention to the necessity, with regards to Hydrography, of having available station marks of well known degree along the coast, in order to determine the position of the vessel or boats which carry out the soundings with any accuracy.

The various chapters of the Manual of Second and Third-order Triangulation and traverse, are similarly arranged to those of the Manual of First-order Triangulation which has been reviewed above.

The first chapter concerns reconnaissance work and the form to be given to the polygons, the selection of stations, building of standard signals and station marks. The second chapter relative to the triangulation operations proper, gives, first, a detailed description of the various instruments, of which the following may be mentioned: the repeating vernier theodolite with 7-inch circle, the 4 ½-inch theodolite with vernier microscope, the 6 1/4-inch micrometer theodolite, the new 5 ½-inch WILD prism-microscope direction theodolite, the 9-inch PARKHURST direction theodolite, the vertical collimator, old and new type, the heliotrope and signal lamps.

As in the Manual of First-Order Triangulation, tables, usual specimen types of computation and nomograms are given in this chapter.

The third chapter details the instruments, the methods of operation and gives specimens of computations used in second and third-order base measurements.

The same items are given in the fourth chapter which deals with second and third-order traverses.

The fifth chapter contains the classification of azimuths of the various orders.

Lastly, the sixth chapter gives some usual formulae and various numerical tables for traverse corrections.

At the end of the volume may be found a bibliographical list of publications issued by the Coast and Geodetic Survey on different field operations.

MANUAL OF FIRST-ORDER LEVELLING

Special Publication N° 140 *of the Coast and Geodetic Survey, Washington D. C.* 8vo, 92 *pages, illust.*

Price: 30 cents.

This handbook forms part of the new series of very complete Manuals published by the U. S. Coast and Geodetic Survey for its different kinds of work.

The present Manual is in two parts. Part I gives in great detail many important phases of levelling work, such as causes of error and how to avoid them, descriptions of instruments used by the Coast and Geodetic Survey with illustrations of the latest patterns of levelling instruments and rod. The level has a tube parallel with the telescope, which contains two adjustable 45° prisms. These enable the observer to note the position of the ends of the level bubble at the instant when he reads the rod through the telescope. The rods are of the self-reading type. The graduations of meters and hundredths are on a thin strip of invar one inch in width, supported by a bar of wood on which the figures for units of length are painted. The U. S. Coast and Geodetic Survey have used several years this alloy of nickel and steel, the coefficient of dilatation of which is about 1/25 that of steel.

The second part gives a description of the usual calculations with numerous numerical examples and the principles of compensation of a system.

INSTRUCTIONS FOR REDUCING AND ANALYSING TIDAL STREAM OBSERVATIONS

by COMMANDER H. D. WARBURG.

British Admiralty Publication H. D. N° 290 - 8vo, 25 pages with tables.
H. M. Stationery Office, London 1929 — Price: 9d net.

Apart from a few remarks concerning the measurement of currents by means of the EKMANN current-meter contained in Addendum N° 1 to "General Instructions for Hydrographic Surveyors", 1918, the British Admiralty had not, so far, published detailed instructions for reducing and analysing tidal stream observations. The use of a standard method for reducing such observations was, however, found necessary since, instead of isolated observations as formerly, recent developments in automatic recorders now make it possible to obtain much more detailed and complete information for the purposes of analyses. This object has been attained by the abridged manual prepared by Commander H. D. WARBURG, Superintendent of Tidal Work, Hydrographic Department of the British Admiralty.

These Instructions have been drawn up primarily for the use of Surveying Vessels, but will be welcomed also by private observers interested in questions concerning tidal streams and others for whom no corresponding Instructions are available.

When the period of duration of observations permits, it is recommended to calculate both harmonic constants and non-harmonic constants, in addition to the ordinary reference of the stream to the tide.

This booklet thus forms a very suitable complement to the previously issued "Instructions for Analysing Tidal Observations" which deal with the analysis of the vertical motion of the tide & were published by the Hydrographic Department of the British Admiralty in February 1928.

The Instructions now under review, in a chapter headed "General Remarks", direct attention to the advisability of carrying on tidal stream observations systematically and continuously in view of analysis either by the harmonic or by the non-harmonic method, and for reference to the vertical movement of the tide in places where tides are known and where tides and currents have similar characteristics.

For harmonic analysis a minimum of 15 days is necessary, and for non-harmonic analysis observations should be continuous for at least half a lunar month; in each case, however, it is preferable to double the period. Where the stream is rotatory it must be reduced to components running in N.S. and E.W. directions. It is recommended that streams be observed at regular hourly intervals, care being taken to record the meridian of the time used at the actual place of observation.

Chapter II gives the procedure for referring the vertical movement of the stream to the tide from a short series of tidal stream observations — using 13 consecutive hourly observations. The form in which results should be forwarded to the Hydrographic Office is given together with details as to the various items of meteorological information which must be attached.

Chapter III gives the method, accompanied by examples, to be followed for the analysis of tidal stream observations when a series extending over a sufficiently long duration is available. Where diurnal inequality does not exercise too great an influence, it will be sufficient to compute the non-harmonic constants, *i.e.* (*a*) the luni-stream interval of slack water and (*b*) the rates at springs and neaps. In all other cases, where it is desired to later obtain accurate predictions, it is preferable to compute the harmonic constants for the tidal stream.

The rules to be followed are in every respect similar to those followed for calculating ordinary harmonic constants for the vertical movement of the tide; it is sufficient to assume that amplitudes H for the tidal streams refer to the velocities of the stream and g to its phase-lag when running at its greatest rate in a plus (+) direction. Before streams can be analysed or referred to tides dominant, currents should be eliminated from each day's observations separately.

The appropriate use of the Traverse Table for computing N-S and E-W components should be noted. Examples are given using either 15 or 29 days observations.

At the end of the Instructions are given a few notes concerning tidal stream predictions under various circumstances as follows :—

1. When stream are referred to high water ;
2. When, in case of diurnal inequality, the streams are referred to higher high water ;
3. When prediction depends on non-harmonic constants ;
4. When prediction depends on harmonic constants.

BIBLIOGRAPHY ON TIDES, 1910-1927.

by PROF. J. PROUDMAN, SECRETARY OF THE COMMITTEE ON TIDES

published by the Section of Oceanography of the International Geodetic and Geophysic Union. Bulletin N° 12, Venezia 1929, 8vo, 27 pages.

This Bibliography gives lists of publications on Tides and certain kindred matters which have been issued from 1910 to 1927.

The subjects considered have been divided into the following groups :

A. *Dynamical theory of actual tides and lake seiches.*

B. *Dynamical theory of tidal motion in general and under ideal conditions, including that of lake-seiches.*

C. *Dynamical theory of atmospheric effects on the sea and of sea-seiches.*

D. *Development of astronomical forces, methods of analysis and prediction, auxiliary tables and predicting machines.*

E. *Methods of observation, tide-gauges and current-meters.*

F. *Harmonic constants of elevations and currents and discussions on them.*

G. *Non-harmonic constants of elevations and currents and discussions on them.*

H. *Analysis of atmospheric effects on the sea and on sea-seiches.*

I. *Records of observation and daily mean values.*

J. *Historical, educational and popular publications.*

The following groups of publications have been omitted :

1. Ephemeral tide-tables.
2. Publications on utilisation of tidal energy.
3. Records of observation of lake-seiches.
4. Reports of institutions when not containing results of scientific work.
5. Short descriptive reviews of other publications ; reports of lectures and discussions.
6. Theoretical publications at variance with the principles of mechanics.

All entries are arranged in chronological order as regards years but in alphabetical order of authors' names for entries of the same year.

BOOKS RECENTLY SUPPLIED TO THE INTERNATIONAL HYDROGRAPHIC BUREAU BY THE INSTITUTE FÜR MEERESKUNDE OF BERLIN

Among the volumes recently kindly supplied to the International Hydrographic Bureau by the Institute für Meereskunde of Berlin, in order to complete the Bureau's library, the following pamphlets are worthy of note. These books are published by Ernst Siegfried MITTLER und Sohn Publishers, Kochstrasse 68-71, Berlin SW. 68 :

Das Museum für Meereskunde zu Berlin, von Prof. Dr. Albrecht PENCK, Direktor des Museums, 16mo, 35 pages, with photo ill., 1 Jahrgang, 1. Heft, Berlin 1907, Price 1 RM

Ebbe und Flut, von Dr. Fr. BIDLINGMAIER, 16mo, 46 pages, 19 fig. ill., 2 Jahrgang, 5 Heft, Berlin 1908, Price 1 RM.

Heft 47. — *Nautische Vermessungen,* von Dr. E. KOHLSCHUTTER, 16mo, 38 pages, 22 fig. ill., 4 Jahrgang, 11 Heft, Berlin 1910, Price 1 RM.

Heft 51. — *Der Golfstrom* in Seiner Historischen, Nautischen und Klimatischen Bedeutung, von Dr. Ludwig MECKING, 16mo, 28 pages, 14 fig. ill., 5 Jahrgang, 3 Heft, Berlin 1011, Price 1 RM.

Heft 55. — *Der Kreisel als Kompassersatz auf Eisernen Schiffen,* von Prof. Dr. H. MAURER, 16mo, 32 pages, 15 fig. ill., 5 Jahrgang, 7 Heft, Berlin 1911, Price 1 RM.

Heft 78. — *Auf S.M.S., "Möwe"*, Bilder aus der Vermessungästtigkeit der Kaiserlichen Marine, von Kapitänleutnant SCHLENZKA, 16mo, 40 pages, 22 fig. ill., 7 Jahrgang, 6 Heft, Berlin 1913, Price 1 RM.

Heft 154-155. — *Die Ermittelung der Meerestiefe,* von Walter STAHLBERG, 16mo, 39 pages, 21 fig. ill., 13 Jahrgang, 10 u. 11 Heft, Price 2 RM. Berlin 1920.

Heft 160. — *Das Deutsche Seekarten-Werk,* von Kapitän SPIESS, 16mo, 32 pages, 4 fig. ill., 1 chart, Berlin 1926. Price 1 RM.

Heft 181. — *Mit der Deutschen Atlantischen Expedition auf dem Forschungsschiff "Meteor"*, von Dr. Gunther BÖHNECKE, 16mo, 36 pages, 12 fig. ill., Berlin 1928. Price 1 RM.

Die Zirkulation des Indischen Ozeans, auf Grund von Temperatur und Salzgehaltstiefenmessungen und Oberflächenstrombeobachtungen, von Lotte MÖLLER, 8mo, 48 pages, 24 fig. ill., Veröffentlichungen des Instituts Für Meereskunde, A, Heft 21, Berlin Avril 1929. Price 8 RM.

Die Strömungen im Subtropsichen Konvergenzgebiet des Indischen Ozeans, von Madgalene WILLIMZIK, in 8vo, 27 pages, 6 fig. ill., 3 charts, Veröffentlichungen des Instituts für Meereskunde, *A* - Heft 14, Berlin, Mai 1929. Price 8 RM.