REVIEWS OF BOOKS AND ARTICLES

THE "MARION" EXPEDITION TO DAVIS STRAIT AND BAFFIN BAY - 1928 - SCIENTIFIC RESULTS - Part 3 :

Arctic Ice, with Special Reference to its Distribution to the North Atlantic Ocean.

by EDWARD H. SMITH.

(Bulletin N° 19 of the *U. S. Coast Guard* - 8vo - 220 pages - 122 ill. - *U. S. Gov. Printing Office,* Washington - 1931).

This Publication includes a study of arctic ice from the freezing of water and the agglomeration of snow through the various stages of development and new formations to its final melting and distribution towards the North Atlantic Ocean. The material is based on the following expeditions: *Scotia,* 1913; *Michael Sars,* 1924; *Dana,* 1925; *Chance,* 1926; *Marion,* 1928; and *Godthaab,* 1928. In addition to these investigations, which are confined solely to the waters inaccessible in summer time, we have the records of the International Ice Patrol for a period of several years, 1913 to 1929, covering the ice season, March to July, in the regions south of Newfoundland. As a result of the work of these expeditions we now are able, for the first time, to construct a fairly accurate picture of the system of oceanic circulation and therefore the paths taken by arctic ice from its region of formation to its ultimate fate in the North Atlantic.

The author gives a comprehensive exposition of arctic ice, its condition, behaviour and distribution in the western North Atlantic.

Part 1 of the present Bulletin is an exposition of the bathymetry of Davis Strait. Part 2 deals with the physical oceanography of Davis Strait with special reference to the circulation of those waters. The section now under review (Part 3) deals with the drift of the ice in the established currents out of Davis Strait into the North Atlantic.

The writer, who has been associated with the Ice Patrol since 1920, was leader in 1928 of the *Marion* Expedition to Davis Strait and Baffin Bay, and in this book his readers are presented with some very interesting information concerning arctic ice.

The first few pages are devoted to an historical survey of the principal voyages of exploration in the Arctic.

A list of more or less standard definitions of ice terminology and a classification of sea ice are given.

Three forms of sea ice are studied: Fast ice, Polar ice cap, and Pack ice, with the annual variations in the limits of pack ice.

Another chapter deals with the study of land ice and glaciation in the different parts of the arctic regions, particularly in East Greenland.

The rate of productivity of West Greenland glaciers is studied and the manner in which icebergs "calve". Several pages are devoted to the form and size of bergs, to their structure, colour and density and to the disintegration and melting of ice-bergs, with a series of illustrative photographs. This is followed by a study of the general drift and fate of icebergs in the western North Atlantic and of the methods employed to protect transatlantic shipping from the ice menace. The seasonal character of the ice invasions in the North Atlantic and the annual amounts of glacier ice and sea ice are investigated also.

A very complete bibliographic list concerning sea ice is inserted at the end of the volume.

ALGUMAS CONTRIBUICOES PARA O ESTUDO PROGRESSIVO DA MODERNA OCEANOGRAFIA

(A FEW CONTRIBUTIONS TO THE SYSTEMATIC STUDY OF MODERN OCEANOGRAPHY)

by CONTRA-ALMIRANTE E ENGENHEIRO HIDRÔGRAFO A. RAMOS DA COSTA,
DIRECTOR DOS SERVIÇOS DE HIDROGRAFIA, NAVEGAÇAO E METEOROLOGIA NAUTICA.

(8 vo - 55 pages - *Imprensa da Armada* - Lisbon - 1930)

This publication reviews in a very interesting manner all the researches made up to the present concerning the hydrodynamic investigation of ocean currents and modern methods for the determination of these currents from the point of view of oceanography.

The introductory chapter is devoted to a short historical account of research-work and studies concerning oceanic circulation.

The volume is divided into three parts :-

1º Oceanic circulation from the geodetic point of view ; 2º A closer study of ocean currents from the point of view of oceanography ; 3º Advantages of the use of mathematical analysis for the study of ocean currents.

In the first chapter, the writer develops a classification of ocean currents :- 1º Convection, and density or gradient currents ; 2º Drift currents (ebb) ; 3º Drift currents (flow) ; 4º Compensation currents ; 5º Tidal streams ; 6º Currents of volcanic origin.

Part 3, which deals with the analytical and mathematical investigation of ocean currents according to gravimetric potential, is based on the explanation of BJERKNES' method which is developed in the publication : *Dynamic Meteorology and Hydrography,* issued by the Carnegie Institution of Washington, lengthy extracts from which are included in Bulletin Nº 14 of the United States Coast Guard, December, 1925, under the title : *A Practical Method for Determining Ocean Currents,* by Edward SMITH.

A bibliographical list is given at the end of the book.

A SURVEY OF SOME OF THE METHODS USED IN MODERN DYNAMICAL OCEANOGRAPHY.

by GEORGE F. McEWEN,
SCRIPPS INSTITUTION OF OCEANOGRAPHY OF THE UNIVERSITY OF CALIFORNIA,
LA JOLLA, CALIFORNIA.

(Reprinted from *Contributions to Marine Biology* — Stanford University Press - September 1930 - Pages 57-68).

In the course of these few pages the author brings under review a series of synthetic works relating to the study of ocean currents which lead up to the modern conception of dynamic Oceanography.

Beginning with the systematic measurement of currents undertaken by Lieutenant PILLSBURY, of the United States Navy, in the Gulf Stream, the writer summarises the works of MOHN, ZÖPPRITZ, EKMAN, BJERKNES, SANDSTRÖM, WÜST and E. SMITH which contribute, with the writer's own book, to establish a modern theory of Oceanography which must be included amongst those which are most fertile in practical deductions.

ANNALES DE LA COMMISSION POUR L'ÉTUDE DES RAZ DE MARÉE Nº 1

(MEMOIRS OF THE COMMISSION FOR THE STUDY OF TIDAL WAVES - Nº 1.)

(Publication of the International Union of Geodesy & Geophysics —
8vo - 95 pages - Librairie Larose, 11, rue Victor-Cousin, Paris (Ve), 1931. —
Price : 10 francs).

The *Annales de la Commission pour l'Etude des Raz de Marée* (Memoirs of the Commission for the Study of Tidal Waves) are published by the Secretary of the Commission, 8, rue François-Millet, Paris, XVIe.

Nº 1 of this Publication, issued under the auspices of the International Union of Geodesy and Geophysics, includes a tentative chronological list of invasions of coastal regions according to details received by the Secretary of the Commission in reply to the inquiry-form which he issued, such collation of statistical documents being of a nature to advance later investigations. The text of the inquiry-form is reproduced hereunder :

FORM RELATING TO THE SUDDEN AND UNEXPECTED FLOODING OF COASTAL REGIONS BY THE SEA.

(TIDAL WAVE, EARTHQUAKE FLOOD OR STORM FLOOD) (1)

Name of Country or Dependency : .....

State, province, county, etc... : .....

1. The phenomena here recorded took place on.....19.....
2. They were observed at the following places : .....
3. They began at..... (Zone standard time, hours counted from 0 to 24).
4. They ended at..... (Zone standard time, hours counted from 0 to 24).
5. They began with { the overrunning of the shore by the sea. (2) / the withdrawal of the sea from the shore.
6. Then followed { .....withdrawals of the sea and .....overrunnings of the shore (2). / .....overrunnings of the shore and.....withdrawals of the sea.
7. The successive phenomena took place at the times :
   - 1st { invasion of sea at ..... / withdrawal of sea at.....
   - 2nd { invasion of sea at ..... / withdrawal of sea at.....
   - 3rd { invasion of sea at ..... / withdrawal of sea at.....
8. The highest level reached by the water was.....ft.....in. above mean sea level.
9. The lowest level reached by the water was.....ft.....in. below mean sea level.
10. The furthest distance reached by the sea was..... yards inland from the mean high water mark.
11. The furthest distance uncovered by the sea was.....yards seaward from the mean low water mark.
12. Casualties (nature, number of victims) : .....
13. Damage to property, etc... : .....
14. Objects carried inland (description, approximate weight, distance carried) :.....
15. Length of time from one swell to the next during the observed phenomena :.....
16. Height of swell during the observed phenomena : .....
17. Time of high tide nearest to the observed phenomena : .....

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(1) *Fill up a separate form for each instance of flooding. It is also desired that forms be filled up for floodings which have been observed in the past, however long ago.*

(2) *Cross out the reference which does not apply.*

18. Figures supplied by the tide-gauge during the observed phenomena :.....
(Enclose a tracing of the tide-gauge curve for the period of the observed phenomena and mark mean sea level on this tracing).
19. General state of the weather before and during the phenomena : .....
20. Information from any neighbouring seismometers, starting from the preceding day.
21. Information regarding ordinary tides at the place of observation :
a) Height of the highest high waters :.....ft.....in. above datum.
b) Height of the lowest low waters :.....ft.....in. above datum.
22. Supplementary information : .....
23. Name, profession and address of the observer : .....
This form, intended for the Secretariat of the International Commission for the study of Tidal Waves, is to be delivered / addressed { to .....

NOTES CONCERNING TIDAL WAVES.

A *Tidal wave* is the name commonly given to the unexpected rising of the sea and the consequent flooding of the coastal regions.

The flooding may be produced by two very different causes :

1° *Earthquake floods* are caused by dislocations of the earth's crust, of seismic or volcanic origin.

2° *Storm floods* are caused by atmospheric depressions and are thus of meteorological origin.

In the case of earthquake floods the influx of the sea is very sudden ; it is followed — or occasionally preceded — by a sudden withdrawal of the sea far away from the shore. The sea may rise locally to 100 ft. above mean sea level. The phenomenon is nearly always associated with a serious earthquake.

In a storm flood the influx of the sea is progressive and relatively slower and the individual waves are somewhat irregular. The sea returns gradually to its original level without first withdrawing beyond it. The water usually rises less than 10 ft. and the seismometers usually show only a strong microseismic disturbance. According as to whether the atmospheric depression, which is the primary cause of the storm flood, is near to the shore or far away from it, the intensity of the phenomena is very variable. If the depression is far away from the shore, there may be only a strong swell which merely floods the low-lying shore beyond the reach of the tide.

As regards devastating effects, earthquake floods are much more dangerous than storm floods. Also, under present conditions, it is practically impossible to forecast the occurrence of earthquake floods. On the contrary, it can now be held that a suitable organisation would be able to give warnings of the occurrence of storm floods and that these warnings, of progressively increasing reliability, would help the inhabitants of affected regions to avoid the dangers.

But before this is possible it is necessary to possess exact information as to the nature of these floods.

The object of this form is to facilitate the study of observations of tidal waves and to tabulate statistics concerning them, to determine the geographical distribution of the regions most affected, the importance of the attendant dangers and, if possible, the probable causes of the phenomena described.

CONGRESO INTERNACIONAL DE OCEANOGRAFIA, HIDROGRAFIA MARINA E HIDROLOGIA CONTINENTAL.

(INTERNATIONAL CONGRESS OF OCEANOGRAPHY, MARINE HYDROGRAPHY AND CONTINENTAL HYDROLOGY.)

(Sevilla, 1st-7th May, 1929 - Vol. I. - 8vo. - 554 pages - 1930 — Vol. II. - 8vo - 319 pages. - 1931 — *Graficas Reunidas, S. A.*, Madrid, 1930).

These volumes contain the proceedings of the sessions of the International Congress held at Seville, 1st-7th May, 1929, and, in addition, the papers submitted to this Congress, among which the following should be noted :-

VOLUME I.

Méthodes modernes de détermination du relief des mers (*Modern methods of determination of ocean relief*). — Ingén. Hydrographe COURTIER.

Origine et évolution de la cartographie catalane (*Origin and development of Catalonian Cartography*) (Conférence). — Prof. Charles DE LA RONCIÈRE.

Documenti di interesse per la storia dell'Oceanografia e della figurazione costiera : Cristoforo Colombo e la scuola cartografica Genovese dei Secoli XIV-XVII. (*Documents of interest to the history of Oceanography and the Figuration of the coast. Christopher Columbus and the Genoese school of cartography in the XIV-XVII centuries*). — Prof. P. REVELLI.

Salinità e densità dell'acqua marina e metodi di determinazione (*Salinity and density of sea-water and methods of determination*). — Prof. M. PICOTTI.

Temporal Variations in the Ocean's temperature. — Prof. HELLAND-HANSEN (SVERDRUP).

Compass and dip-circle deviations caused by harmonic motion. — Prof. William J. PETERS (Prof. G. W. LITTLEHALES).

On the Hughes Echo-sounders. — Lieut. R. N. ROBERTS.

Lo studio degli stretti come vie di communicazione fra i mari (*Study of straits as routes of communication between seas*). — Prof. VERCELLI (Prof. PICOTTI).

Les ultra-sons et leur application au sondage sous-marin (*Ultra-sounds and their application to submarine sounding*). — Ing. FLORISSON.

The Configuration of the Oceanic Basins. — Prof. G. W. LITTLEHALES.

Algunos datos sobre densimetria del agua del mar (*A few data concerning sea-water densimetry*). — Dr Fr. NAVARRO.

Die Ozeanische Zirkulation (*Oceanic circulation*). — Prof. A. DEFANT.

Coopération à une carte internationale à l'échelle du millionième (*Collaboration in an international one-millionth chart*). — Ing. Hydr. COURTIER.

On a new current-meter. — Dr RAUSCHELBACH.

Nouvel Enregistreur des Courants sous-marins (*New submarine current recorder*). — Prof. IDRAC.

The study of Ocean and Sea Straits. — Prof. LIAKHNITSKY.

L'attività del R. Comitato Talassografico nel 1927 e 1928 (*Activities of the Royal Thalassographic Commission in* 1927 *and* 1928). — Prof. G. MAGRINI.

Expedition maregraph (recording gauge) for the registration of Tides at open sea. — Prof. Was. SHOULEJKIN.

Fenômenos dinàmicos en el estrecho de Gibraltar (*Dynamic phenomena in the Straits o Gibraltar*). — Prof. R. DE BUEN.

La bibliografia internazionale dell'Oceanografia (*International Oceanographic Bibliography*). — Prof. G. MAGRINI.

La variazione del livello medio del Mediterraneo. Nota preliminare (*Variation in the mean level of the Mediterranean. Preliminary note*). — Prof. G. MAGRINI.

VOLUME II.

Notice sur la sonde thermoélectrique à grand rendement (*Note on the thermo-electric sounder of high efficiency*). — GORCEIX.

Investigations avec les modèles réduits et leurs lois d'analogie (*Investigations on small scale models and their laws of similitude*). — SMETANA, Jan.

Periodicity of oscillations of the Vistula. — BOROWIK, J.

Hydrological Laboratory. Researches on small scale Models and their Laws of similitude. — LIAKHNITSKY, V. E.

Catalogue de l'Exposition Internationale d'Instruments d'Océanographie, Hydrographie Maritime et Hydrologie continentale (*Catalogue of the International Exhibition of Oceanographic, Marine Hydrographic, and Continental Hydrologic Instruments.*

REPORT OF THE COMMITTEE ON SUBMARINE CONFIGURATION AND OCEANIC CIRCULATION.

quarto, 103 pages, presented at the Annual Meeting of the Division of Geology & Geography, National Research Council, April 25th, 1931, published by the U. S. National Research Council, 2101 Constitution Avenue, Washington, D. C.

The Committee on Submarine Configuration and Oceanic Circulation of the National Research Council of the United States of America published on 25th April 1931 a new report containing a certain number of articles worthy of note, more especially;

Oceanographic work of the United States Navy, by Rear-Admiral GHERARDI;

Work of the United States Coast & Geodetic Survey;

Oceanographic Research carried out in the North Atlantic and in the Pacific Oceans by various nations and diverse institutions.

Extracts from these Publications were given in the *International Hydrographic Bulletin* for November 1931, page 272, particularly as to improvements in the technique of hydrography by the U. S. Coast and Geodetic Survey, and as to Echo-Sounding in the Baltic Sea by the Swedish Navy.

ANNUAL REPORT OF THE DIRECTOR OF THE SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIFORNIA,

for the year 1st July 1930 to 30th June 1931.

The Annual Report of the Director of the Scripps Institution of Oceanography at La Jolla, California, to the President of the University of California, for the year 1st July, 1930 to 30th June, 1931, contains 24 mimeographed octavo pages.

The following points are of special interest to Hydrography:

The Institution's vessel has been improved by the construction and equipement on board of a laboratory which permits many chemical determinations to be made at sea. During the year she was utilised for making important investigations as to the penetration of light in sea water, as well as for collecting water and plankton samples and observing temperatures and recording other conditions at sea.

The salinity of 3,171 sea-water samples was determined in the Institution's laboratory during the year, and 11,411 records of ocean temperatures, and 10,671 records of winds and meteorological conditions at sea were received.

Data from shore stations have been averaged by weeks and months as usual. Surface data supplied by Naval and other ships have been averaged by months, and tabulated on the usual forms. These tabulations filled nearly a thousand pages and cover the period from 1925 to 1931. The work of plotting the results on special charts began in April. The records in this form are to be used as a basis for a detailed study of surface drift.

TRANSACTIONS OF THE AMERICAN GEOPHYSICAL UNION TWELFTH ANNUAL MEETING, April 30 and May 1, 1931.

(8vo - 229 pages, published by the National Research Council of the National Academy of Sciences, Washington, D.C., June, 1931.)

The present Volume includes the transactions of the Twelfth Annual Assembly of the American Geophysical Union.

The Twelfth Annual Assembly of the Union and the meeting of its sections, April 30 and May 1, 1931, were held in the building of the National Academy of Sciences and National Research Council at Washington, D. C.

During the business session of the Twelfth General Assembly, the General Secretary reported on the year's activities of the Union and on the Stockholm Meeting, and proposed geophysical work in polar regions and Resolutions submitted by the several sections were adopted; following this, there was a "Symposium on Time-Signals" sponsored by the sections of Geodesy and Seismology which emphasized the great need of an extension of existing time-signal service. The individual section meetings were marked by numerous progress-reports on the geophysical activities, not only in the United States, but also in Canada and in Mexico. The Section of Geodesy, in addition to such progress-reports, discussed gravity-work, instrumental progress, the moon's influence on latitude, and the establishment astronomically of points on an unsurveyed line. In the Section of Seismology, attention was devoted to theoretical considerations, relations of geodetic operations to seismological interpretations, registration of time-signals, progress-reports on instrumental developments, and the provision made to realise the Union's Resolution at its eleventh annual assembly to establish a seismological observatory in South America (near Huancayo, Peru).

In the Section of Meteorology much time was given to discussion of the International Polar Year prospects, followed by a report on the Madrid meeting in March 1931 of the International Commission for the Exploration of the Upper Air, discussion of proposed International Cloud Atlas, and papers on atmospheric turbidity, measurement of color of sea and sky, and cyclical variations in relation to long-range weather forecasting. In the Section of Terrestrial Magnetism and Electricity the papers were given in four groups relating to (1) the year's investigations in progress in the United States, (2) the Stockholm assembly, (3) extra-terrestrial considerations, and (4) polar research.

The communications to the Section of Oceanography were chiefly progress-reports showing excellent development of oceanographical work in the United States by governmental and private organisations, a discussion of Gulf Stream temperature-investigations, and on the measurement of specific gravity of sea-water by the KNUDSEN and PLUMMET methods. In the Section of Volcanology five papers were given relating to the solubility of water in granite magmas, and to the Merapi, Katmai District, Cripple Creek and Valles Mountain volcanoes.

On May 1, 1931, the first annual meeting of the Section of Hydrology was devoted to statements of the formal organisation of the Section, the field, scope, and status of the science of hydrology, progress-reports on various governmental and private programs, cooperation of hydrologists, glacier-measurements, hydrologic laboratories, studies in evaporation, and geological relations.

Among the many interesting articles contained in the publication, the following are mentioned:

United States Naval Observatory time-service — J. F. HELLWEG.

The first International Polar Year of August 1882 *to August* 1883 — Alfred J. HENRY.

The second International Polar Year, 1932-1933 — Herbert H. KIMBALL.

Report of the Madrid Meeting of the International Commission for the Exploration of the Upper Air — W. R. GREGG.

The proposed International Cloud-Atlas — W. J. HUMPHREYS.

Measurements of the Colour of the Sea & Sky — Charles BITTINGER & E. O. HULBERT.

Oceanographic Work of the United States Hydrographic Office — W. R. GHERARDI.

Oceanographic Work at the Scripps Institution of Oceanography, University of California during the past year. — T. WAYLAND VAUGHAN

Oceanographic Work of the United States Coast and Geodetic Survey during the past year. — E. H. PAGENHART.

Oceanographic Work carried on by the United States Coast Guard during the ice-patrol season of 1930 *and the plans for oceanographic work to be carried on during the ice-season of* 1931 — N. G. RICKETTS.

Oceanographic Work of the United States Bureau of Fisheries — Elmer HIGGINS.

Oceanographic Work of the Buffalo Museum of Science in 1930 — Charles J. FISH.

Oceanographic Program at the University of Washington — Thomas G. THOMPSON.

Progress in Gulf-Stream temperature-investigations — Charles F. BROOKS.

Preliminary Report on the results obtained by duplicate measurements of specific gravity of sea-water by the KNUDSEN *and* PLUMMET *methods* — H. R. SEIWELL.

BULLETIN GÉODÉSIQUE N° 30

(GEODETIC BULLETIN N° 30.)

The *Bulletin Géodésique* N° 30 (April, May, June, 1931) gives translations into English and French of a very important article by Dr W. HEISKANEN on the *Isostatic Tables calculated by him for the reduction of the intensity of observed gravity according to* AIRY'S *hypothesis.* The author gives a very clear explanation of the hypotheses of PRATT and AIRY, and recalls the procedure initiated by HAYFORD for the calculation of corrections according to PRATT'S hypothesis and, particularly, the zones and compartments which he utilized and which are in current use to-day. By means of these zones and the Tables computed by HAYFORD and W. BOWIE, the author has calculated Tables for the correction of the intensity of gravity according to the AIRY hypothesis, by using the formulae of Walter D. LAMBERT given in a remarkable analysis made by this mathematician and published in the *Bulletin Géodésique* N° 26 (April, Mai, June, 1930). Calculations are given for the different values of the thickness T of the earth's crust: 40, 60, 80 and 100 kilometres, *i. e.*, the thickness corresponding to zero elevation; like the depth of compensation of HAYFORD, this thickness is one of the unknown values of the problem, which must be so selected as to reduce to a minimum the sum of the squares of the errors. In publishing these Tables, the author renders great service to geodecists in that he provides them with a means of easy comparison of the results obtained from the two compensation hypotheses both of which, at present, enjoy equal favour. The lack of Tables for the practical calculation of the corrections resulting from AIRY'S hypothesis, has so far been the principal obstacle to its application, although this hypothesis appeared, at least in certain regions, to give results more in conformity with experience than that of PRATT.

The *Bulletin Géodésique* N° 30 also publishes a report by Mr. Hishashi KIMURA of the *International Latitudes Service,* of which he is the Director, and a biography of the celebrated German geodecist and explorer, Alfred Lothar WEGENER, who has recently fallen a victim of Science.

P. V.

PHYSICS OF THE EARTH — II. THE FIGURE OF THE EARTH

(Bulletin N° 78 of the *National Research Council* - published by the *National Research Council* of the *National Academy of Sciences* - Washington, D. C. - February - 1931).

The National Research Council of the United States of America published in its Bulletin N° 78 a collection of short papers by leading scientists in several branches of geophysics, treating of the size and shape of the earth. The object of this publication

is to give to the reader, presumably a scientist but not a specialist in this subject, an idea of its present status together with a forward-looking summary of its outstanding problems. Several committees were formed to prepare reports on the following subjects :- The Figure of the Earth ; Gravity, Deflection of the Vertical and Isostasy ; Tides, Ocean and Earth ; Variation of Latitude ; Seismology ; Terrestrial Magnetism ; The Age of the Earth ; Field Methods for detecting Unhomogeneities in the Earth's Crust ; Internal Constitution of the Earth ; Meteorology ; Oceanography ; Volcanology.

The volumes will appear serially in the Bulletin Series of the National Research Council, with no particular regard as to sequence, each volume being issued when ready.

Bulletin N° 78 is devoted to Tides, Gravity and Variation of Latitude, divided into chapters as follows :

GRAVITY, DEFLECTION OF THE VERTICAL, AND ISOSTASY :

Isostasy : William BOWIE.
The Influence of Isostasy on Geological Thought : Harry Fielding REID.
The Shape and Size of the Earth : W. D. LAMBERT.
Determination of "*g*" by means of the Free Swinging Pendulum : C. H. SWICK.
Gravity Measurements with the Eötvös Torsion Balance : Donald C. BARTON.
Geodetic Instruments : D. L. PARKHURST.
On some of the Greater Problems of Physical Geology : Clarence L. DUTTON.
The Determination of Elevations : H. G. AVERS.
The Determination of Geographic Positions : C. V. HODGSON.

VARIATION OF LATITUDE :

The Variation of Latitude : W. D. LAMBERT, Frank SCHLESINGER, E. W. BROWN.

TIDES, OCEAN AND EARTH :

Tidal Theory : A. T. DOODSON.
Tidal Computations and Predictions : Paul SCHUREMAN
Mean Sea-Level : H. A. MARMER.
Earth Tides : W. D. LAMBERT.
Tidal Friction : W. D. LAMBERT.

CHART DATUMS.

by H. A. MARMER

(8vo - 45 pages - 20 fig. — Special Publication N° 170 of the *U. S. Coast and Geodetic Survey. — U. S. Gov. Printing Office,* Washington - 1930 — Price : 10 cents.).

Corresponding to a recent distribution of information concerning chart datums, this new Publication is a summary of and, at the same time, a complement to its predecessors on the same subject, namely :- Special Publication N° 135 of the U. S. Coast and Geodetic Survey, *Tidal Datum Planes,* 1927, which was reviewed in *Hydrographic Review,* Vol. VI., N° 2 of November, 1929, p. 230, and an article entitled *Hydrographic Datum Planes* published by the author in *Hydrographic Review,* Vol. VI., N° 1 of May, 1929, p. 37. The need for and the different kinds of datum planes are explained in the introduction. The first chapter includes general remarks on tidal phenomena, on different regimes and irregularities of tides. The second chapter contains a study of the fluctuations in low water level, its daily, monthly, yearly and long-period variations.

The author then passes to a study of the principal chart datums and the considerations which govern the choice of such datums ; mean low water ; lower low water ; Spring low water ; monthly lowest low water ; harmonic tide plane.

Another chapter deals with the determination of datum planes and yet another with the changes in these datums and with various assumptions concerning coastal stability and the constancy of tidal phenomena ; the book concludes by emphasising the necessity for the maintenance of bench marks.

LE PROBLÈME DE LA MARÉE DE L'EURIPE

(THE PROBLEM OF THE TIDE IN THE EURIPOS)

by DEMETRIUS EGINITIS, MEMBER OF THE ACADEMY,

DIRECTOR OF THE OBSERVATORY, PROFESSOR AT THE NATIONAL UNIVERSITY.

(8vo - 142 pages - Fig. Tables - Extract from the *Annales de l'Observatoire National d'Athènes*, Volume XI. — Athens - 1930).

The *problem of the tide in the Euripos* has from antiquity roused general interest and curiosity, and particularly that of scientific circles and seamen.

ARISTOTLE, who died at Chalcis in August 322 B. C., left an explanation of the irregularity of the tidal streams of the Euripos, of which the accuracy was not investigated until much later through the observations made by BABIN, then by the British surveyor MANSELL and by MIAOULIS.

In the very complete study of the problem of the tide of the Euripos now published, the author gives a very interesting historical account of all investigations which have been made regarding this phenomenon, and particularly of the recent publications of CALYVAS (1882), KRÜMMEL (1888), ENDROS (1914), STERNECK (1916), SARRIS (1921) and MAZIS (1927), as well as those recently undertaken by the Hydrographic Service of the Greek Ministry of Marine since 1921.

The Tables by MANSELL, the works of MIAOULIS and MAZIS and the documents of the Hydrographic Service of the Greek Navy served as a basis for the present investigations.

In the Euripos the tidal phenomenon is complicated by hydrological manifestations and the tidal stream, which is *regular* during 22 or 23 days of the synodical month, becomes *irregular* for some days at the moment of quadratures.

THE IRREGULAR STREAM : What is called the *inconstancy* or *irregularity* of the stream begins from the day of quadrature of the moon or the day after, during which period the occurrence and frequency of the changes of direction are absolutely irregular. During this period of irregularity, the direction of the tidal stream sometimes changes as many as five times in an hour and often more than 12 times a day ; sometimes the stream remains slack for half-an-hour or even an hour ; sometimes it maintains the same direction for twelve consecutive hours ; sometimes also, though rarely, and then in very calm weather, the change of direction is regular, *i. e.*, at regular hours only, corresponding to those of the regular period.

It is observed that the tidal stream sometimes alternates slightly after slack, and shortly before the quadratures ; *irregularity of current is* then said to be *imminent*, and, in fact, the irregularity begins shortly afterwards, as has already been stated, either on the day of the quadrature of the moon or on the following day.

VELOCITY OF THE STREAM IN THE STRAIT OF EURIPOS : The stream in the Strait of Euripos attains a maximum velocity at the period of equinoctial syzygies, of 13 to 15 kilometres an hour (8 to 8 ½ knots), and a minimum velocity during solstices of 8 - 8 ½ kilometres an hour (5 ½ knots). After the syzygies, the velocity of the current diminishes continuously until the quadratures, during which period it has a maximum variation of between 2 - 2 ½ kilometres an hour (1 to 2 knots).

According to the findings of the Hydrographic Service, the average maximum velocity of the current during syzygy is 6 knots, whilst the average minimum velocity during the three days following quadrature is 2.5 knots. The ordinary velocity of the current is 7 knots, owing to a prevailing North . wind. In August, 1924, during the period of full moon, the current attained a maximum velocity of 9 knots during a lunar eclipse. The influence of the wind is greater during periods of small tides and is apt to cause a reversal of the stream.

Chapter 3 deals with all tidal irregularities in the Euripos.

In Chapter 4 the author discusses the solutions proposed up to the present and the

present position of the problem of the Euripos, which has not yet been completely and generally solved as sufficiently lengthy and accurate tidal observations have not yet been collated.

Chapter 5 attempts a general solution of the various questions involved in connection with the problem of the Euripos, by means of the principles of harmonic analysis of the tides and of the dividing of the channel into several dynamic oscillation basins; it also contains a close discussion of the hypotheses advanced in connection with this subject by FOREL à propos of the Euripos, and shows that, in consequence of the narrowness of the Strait of Euripos, the two parts of the Gulf of Eubœa, situated at either end of the Strait, oscillate just as much on account of tides as of seiches, and, in so far as the regular stream is concerned, *as though they were two independent basins of the sea*. In both cases, the stream running in the Strait of Euripos is the result of the difference in the levels at the two ports of Chalcis, which are connected by the Strait.

The frequent and irregular turns of the tidal stream towards the periods of quadratures are caused by the alternations of rise and fall in the level at these two ports; these variations are due to different mechanical and particularly *meteorological* causes, independent of the luni-solar tide, but are identical with those which produce *seiches* in lakes, and which were explained for the first time by FOREL. According to this theory, seiches, which are sometimes far greater than the tides of the Euripos towards the quadratures, are less than the great difference of level at the two ports towards the syzygies. Consequently, they cannot affect the regularity of the stream. Towards the quadratures, on the contrary, they exceed the small change in level at the two ports and may, therefore, cause the turning or prolongation of the regular stream several times a day.

The author then proceeds to examine the various peculiarities of the tides in the Euripos Strait, and analyses the explanations given and the remarks made on them up to date.

He concludes by stressing the necessity of obtaining further data for investigation of these phenomena, particularly by:

1. The establishment of Automatic Tide-gauges in the South Port, in the Port of Aulis, at Ædepsos, Skiathos and at the southern extremity of the Gulf of Eubœa, and even at other suitable points on the Ægean Sea;

2. The carrying out of simultaneous meteorological observations on both sides of the Strait of Euripos, near the extremities of the Gulf of Eubœa.

DIE GEZEITEN-ERSCHIENUNGEN DER JADE

(TIDAL PHENOMENA OF THE JADE)

by MAX BLUM

(8vo - 60 pages - Map - 16 figures — Published by the *Institut für Meereskunde* - *Heft 22* - Berlin - July, 1931).

This pamphlet gives a very complete study of tides and tidal streams in the Jade based on investigations carried out at 42 stations situated round the coast and in the interior of the Jade itself, as well as in its immediate approaches.

The author has constructed tidal curves in sinusoidal form for several positions in the Jade. He derives therefrom establishments and amplitudes for 30 stations in this area. Diagrams show the points in the Jade of simultaneous high and low water, and also the points of equal amplitude.

The method of reduction of these observations employed by the author is discussed in the pamphlet.

GUIDA PRATICA PER L'ANALISI ARMONICA DELLE MAREE

(PRACTICAL GUIDE FOR THE HARMONIC ANALYSIS OF TIDES).

(Published by the *Commissione Mareografica Italiana* - Venice - 1926 - 27 pages - Tables).

This pamphlet, which is published by the Italian Tidal Committee, is an abridged practical guide for the harmonic analysis of tides.

Definitions of the terms relating to harmonic analysis of tides are given at the beginning of the pamphlet and are followed by an explanation of the method of preparing tables of hourly ordinates, when a sufficiently long set of tidal observations has been made, from which the elements for the calculation of each tide may be taken.

Then the pamphlet passes on to the calculation of each constituent wave by means of previously obtained data and by using the numbers in Table I, which indicate the times at which the particular days of each constituent begins for the different waves. The numbers given in Table II of the pamphlet show the differences between the ordinary hours and the constituent hours exceeding half-an-hour, and for which the hour ordinate should be reproduced for *K* tides or skipped for the other constituents. By means of these Tables the amplitude of each constituent and then the lag are obtained and the phase lag is deduced from the Tables published in the treatise by FROCHOT: *Le Calcul des Marées* (*The Calculation of Tides*) - Paris - 1906 - which permit the value of the astronomical argument to be found. Finally, the pamphlet exposes the method of calculating the establishment of the port by means of harmonic constants for semi-diurnal tides.

PHOTOMAPPING METHODS USED IN EUROPE.

by FREDERIC A. HENNEY.

(*The Military Engineer* - Washington, D.C. - May-June, 1931 - pp. 238-243).

In this article the writer reviews the different methods and instruments used in Europe in connection with the making of maps from photographs.

Although it is only within the last few years that photomapping has become economically practicable, it dates back to the beginning of this century. In fact, a stereo-comparator was constructed in 1901; the following years saw the construction of various photo-theodolites and, in 1911, a stereo-autograph was produced. It is above all in Europe that the firms of H. WILD, in Switzerland, and Carl ZEISS and HUGERSHOFF & HEYDE, in Germany, have produced highly-perfected instruments for this purpose.

The author points out that, owing to the improvements in apparatus, photographic instruments now have a tendency to replace, in the majority of cases, the older plane-table methods of survey. He studies the application of photographic methods to surveys of flat country, then of rough or uneven and of mountainous country, indicating the various types of apparatus used for taking views and for the restitution of prints.

With regard to the excessive expenditure involved in the establishment of frequent ground control points for aerial photographs, the author points out that this has now been greatly reduced by the use of photographic cameras with several objectives, which permit vertical and oblique photographs to be taken at the same time; he suggests that it is in the improvement of these instruments that the future and progress of photomapping resides.

PLANETABLING FROM THE AIR.

An approximate Method of Plotting from Oblique Aerial Photographs.

by O. M. MILLER,
of the American Geographical Society's School of Surveying.

(Reprinted from *The Geographical Review*, Vol. XXI., N° 2, April, 1931, pp. 201-212, & Vol. XXI, N° 4, October, 1931, pp. 660-662 ; *American Geographical Society*, New York).

The idea of this method and field procedure was suggested for use in the Antarctic exploratory flight of Sir Hubert WILKINS, as enabling photographs taken during such a flight to be utilised as material for a map without adding unduly to the cost of the expedition.

The author describes in this papei a method of oblique aerial surveying as a means of making small-scale contour maps at a relatively low cost as compared with either ground survey or conventional air survey methods.

The method here developed depends on the assumption that it is possible to determine the horizontal or any line parallel to the horizon on the photograph by trial and error, provided the silhouette of the landscape against the sky is visible. It enables the position of the air station in space and the tilt and direction of the camera axis at the time of exposure to be determined very quickly by graphical methods and by simple formulae depending on the fundamental principles of perspective. Once two or more air positions have been determined from the intial ground control the extending of the latter, so that other air stations can be determined and other ground points plotted, is undertaken in very much the same way as a plane-table surveyor makes his map in the field.

PARABOLIC EQUAL-AREA PROJECTION WORLD MAP.

by OSCAR S. ADAMS, U. S. COAST AND GEODETIC SURVEY.

(*The Military Engineer* - May-June, 1931, pp. 264-265).

In this article the writer describes a new system of projection for drawing general charts, which preserves the equal-area surface and which is suitable for use in the representation of various statistics, meteorological data, etc.

The present article is an amplification of the remarks published in the treatise entitled :- *Elements of Map Projection with Applications to Map and Chart Construction*, by Charles H. DEETZ and Oscar S. ADAMS, Special Publication N° 68 of the United States Coast and Geodetic Survey, 3rd edition, this revision being dated 1st May, 1931.

The author states that he was led to study such systems of projection at the suggestion of various U. S. Government Departments which deal with the subject of statistics and to recommend this particular system after consideration of an article published by Colonel J. E. E. CRASTER in the *Geographical Journal* of November, 1929, which dealt with a certain number of equal-area projections in which the parallels are represented by straight lines parallel to the straight-line equator and for which the meridians may be either sinusoidals or parabolas. In the latter case, if it is desired that the map should have the equator represented by a straight line twice as long as the straight-line central meridian, as it is in the sinusoidal equal-area projection, the outer meridian will have to be represented by a parabola the equation of which is :-

$$y^2 = \tfrac{1}{2}\, m\, x,$$

the origin being at the vertex of the curve.

By means of simple formulae, the author demonstrates that it is easy to calculate the lengths of the parallels intersected by the meridians, and a table of their values is given to six places of decimals.

In order to avoid too great distortion of the chart, it was decided to divide the chart into sections chosen so that the continents should be shown with but a small amount of distortion; the central section included an extent in longitude of 160 degrees (80° on each side of the central meridian which is that of 100° E. of Greenwich); the outer equal sections include 120 degrees each, having respectively meridian 40° E. of Greenwich and meridian 120° E. of Greenwich as central meridians.

DER MERIDIANSTÄNDIGE LITTROWSCHE KARTENENTWURF ZUM GEBRAUCH IN POLNAHEN BREITEN

(THE INVERSE LITTROW CHART-PROJECTION FOR USE IN POLAR REGIONS)

by PROFESSOR W. IMMLER, ELSFLETH.

Professor W. IMMLER, who has already published several articles on the LITTROW projection (see *Annalen der Hydrographie* 1920, page 265, and 1928, page 337; also *Hydrographic Review*, Vol. V., N° 2, page 49), demonstrates on page 462, number XII of 1931 of the *Annalen*, that, by transformation of this projection by reciprocal radius-vectors (which transformation preserves the property of being conformal), a new projection may be obtained in which the pole will no longer be at infinity and in which the line of equal azimuth, instead of being a straight line, will be a circle. This new projection can thus be used in polar regions for solving the problem of the intersection of several lines of equal azimuth — a problem which particularly affects airplanes or dirigibles which resort largely to wireless direction-finding to fix their positions.

It is known that the co-ordinates of a point in latitude φ and longitude l, reckoned from the meridian of one of the wireless stations, are, on LITTROW's projection:

$$\xi = \frac{\sin l}{\cos \varphi}, \qquad \eta = \tan \varphi \cos l,$$

and that the equation of the line of equal azimuth a towards the W/T station in latitude ψ is:

$$\tan \psi = \eta + \xi \cot a.$$

Professor W. IMMLER makes the following transformation:

$$x = \frac{\xi}{\xi^2 + \eta^2} = \frac{\sin l}{\cos \varphi \ (\sin^2 l + \tan^2 \varphi)},$$

$$y = \frac{\eta}{\xi^2 + \eta^2} = \frac{\tan \varphi \cos l}{\sin^2 l + \tan^2 \varphi},$$

which places the pole at the origin of the co-ordinates and makes the equation of the line of equal azimuth:

$$x^2 + y^2 = y \cot \psi + x \cot \psi \cot a.$$

This circle, which passes through the pole and the wireless station, is very easy to draw.

The parallels are elliptical lemniscates and the meridians hyperbolic lemniscates.

If a second azimuth has been observed, the circle of equal azimuth will be found in the same way by adopting the meridian of the second point of which bearings are taken as the origin ; the suitable part of this circle is then transferred on to the system of the meridian of the first point taken, the longitudes of all its points being corrected without changing the latitudes.

By analogy with the inverse MERCATOR projection, this projection might be called : the inverse LITTROW projection.

P. V.

PROJECTIONS FOR WORLD MAPS.

by B. J. S. CAHILL, F.R.G.S., ARCHITECT.
WEBSTER BLOCK, OAKLAND, CALIF., 1st May, 1929).

(See : *The Monthly Weather Review* - April, 1929 - pages 128-132).

The author has elaborated several spherical projections on a regular octahedron tangent to the sphere. He was actuated by the idea of avoiding extremes and that an entire map of the world coul not be represented on a horizontal plane tangent to the pole nor on a cylindrical construction tangent to the equator, but, on the contrary, on a certain oblique plane between these two extremes. On the other hand, he discards the conical projection as the development of the Equator is a circle which is difficult to connect for the two hemispheres. Therefore a regu ar octahedron with a square base tangent to the Equator was chosen. The different facets of this octahedron may then be developed on the same plane by assembling them along their common sides in order to obtain various systems of projection which the author calls the *Butterfly Map*.

The use of maps of this kind is advocated for diverse statistical purposes, and for making maps of meteorological data which it would be interesting to publish on a standard type of projection and scale, in order that they should be comparable one with the other.

In a more recent article the author draws up a variant of this octahedral projection on each facet of which the gnomonic projection is used. He considers that charts of this kind may be useful for air navigation and for the utilisation of long distance radio-goniometric bearings.

ZAPISKI PO GIDROGRAFII

(HYDROGRAPHIC NOTES).

VOLUME LXVI.

(Published by the *Gidrografitcheskoie Upravlenie* - Leningrad - 15th October, 1931)

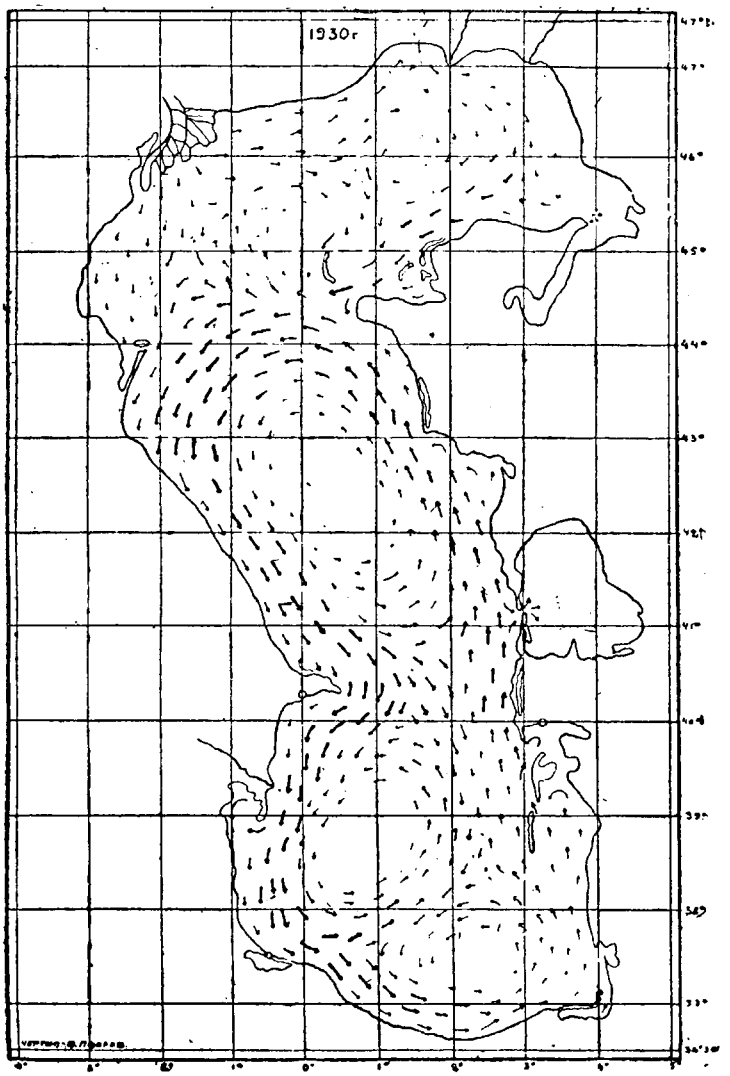
This new volume of the *Zapiski po Gidrografii* contains a number of interesting articles of which the following must be mentioned :

1. *Data concerning Tides at the entrance of the White Sea.* — This article discusses certain data on the subject of the ebb and flow in the entrance to the White Sea.

The surveying vessel *Azimuth* continued her 1925 cruise during the summer of 1926 in order to carry out a number of hydrological observations at different points in the entrance to the White Sea. In particular, tidal and current observations were taken, more especially off the Island of Sosnovetz, the Three Islands and the village of Intsa. The results of the harmonic analyses of these observations are given and harmonic constants for these three stations for the constituents M_2, K_2, S_2, N_2, O_1, P_1, K_1 and Q_1

are included in the article. Current observations are referred to high water at Sosnovetz. A graph gives, by means of a system of zones, a representation of the level of the sea for the entire area of the entrance to the White Sea, in twelve drawings, at each hour after the time of high water at Sosnovetz Island.

2. Another article includes the researches made by a special Office established at Baku in 1929 to study the currents of the Caspian Sea, using the statistical data concerning these currents which have been collected since 1877 and with the aid of Russian documents on this question in existence up to 1930. The author has constructed a general diagram of the circulation in the Caspian Sea of which a sketch is given below.



3. An article relating to the reduction to the horizon of sextant angles contains an interesting diagram for doing this.

4. Another article deals with the simplification of the calculations for the graphic compensation of triangles.

5. This Publication contains also an article describing various instruments used in chart-engraving and, particularly, a special pad mounted on a tripod for standardising the drawing of conventional symbols and of sounding figures on charts.

At the end of this volume is a detailed bibliographical resumé of Volume VIII, N° 1 of the *Hydrographic Review*, published by the International Hydrographic Bureau.

MEASUREMENT OF SEVEN BASE LINES OF THE BALTIC POLYGON Executed in the Year 1929.

by ILMARI BONSDORFF.

(8vo - 240 pages — Tables & Figures — Special Publication N° 1 of the *Baltic Geodetic Commission* - Helsinki - 1930).

At the Congress of the Baltic Geodetic Commission in Stockholm, 1926, a proposal for the uniform measurement of the base lines of the Baltic polygon at the expense of the Commission was put forward. A preparatory Committee was formed and decided to propose that, during the summer season of 1929, the same observers using the same instruments should measure 7 base lines, situated as equidistant as possible in the Baltic polygon. These measurements were to be made by 3 observers with at least 4 invar wires. The countries interested should be requested to prepare the base lines for the measurement and to provide the expedition with the necessary assistants. The expenditure on the work was expected to amount to 4,000 dollars.

At subsequent meetings in Riga (1927) and Berlin (1928), the author gave an account of the progress of the preparations, which showed that the preparatory work had progressed so far that the work could be commenced. Seven base lines belonging to the polygon were selected for the combined measurement.

Special Publication N° 1 of the Baltic Geodetic Commission gives an account of the measurements made in the year 1929. It describes the measuring apparatus, the organisation of measurements, the method employed and the computation of the results of the measuring operations. It gives an analysis of the probable measuring errors, of the changes in the wires, of the accidental and systematic measuring errors; and attention is directed particularly to the simultaneous lengthening of the wires used.

The author concludes by emphasising the necessity of establishing a standard base in each country for the purpose of rapidly checking the wires used before starting and after finishing the field work.

BATHYMETRIC CHART OF THE BOTHNIAN BAY AND THE NORTH KVARK ECHO SOUNDINGS IN THE YEARS 1927-1929

by HENRIK RENQUIST.

(8vo - 28 pages — Publication N° 68 of the *Merentutkimuslaitoksen* - Helsinki - 1930).

During the years 1927-1929, the author took echo soundings in the Gulf of Bothnia and the North Kvark. This work and the results obtained are analysed in the Publication under consideration.

Up to the present the sounding operations carried out in these regions were limited to ordinary hydrographic work in coastal waters, the number of deep-sea soundings being comparatively small. With the aid of modern echo-sounding instruments, and particularly the *Echo Sounder* (British Admiralty type) constructed by Henry HUGHES & Sons for the Finnish Thalassological Institute, the *Nautilus* was able to carry out her programme of work systematically.

Steaming at an average speed of 9 knots, for deep-sea work, from 20 to 30 soundings per hour were considered sufficient, with an average distance of from 600 to 800 metres between the soundings. Generally speaking, as far as deep-sea soundings are concerned, the distance between the soundings taken on each line is considerably less than the distance between the lines.

The apparatus on board the *Nautilus* was regulated to correspond to a velocity of propagation of the sound wave of 1,443 m. (4734.3 ft.) per sec. The depths obtained were checked frequently by wire soundings and no appreciable error was observed.

The lines run across the Gulf of Bothnia have allowed soundings to be inserted on charts with greater accuracy than any other method up to the present time, as the crossing, of several hours out of sight of lighthouses and landmarks, was made without

stopping the ship and running at an almost constant speed for the purpose of obtaining a good dead-reckoning. Stations in sight of land were fixed mainly by sextant angles (*Vermessungsquintant*, C. PLATH). On pages 12 and 13 of the pamphlet, the author describes the method of continual observation of angles by sextant which permits interpolation of the values of several angles at the precise moment of sounding.

The initial and terminal points of each line of soundings across the Gulf were fixed in this manner.

The results are given on a bathymetric chart of the northern portion of the Gulf of Bothnia, scale 1:800,000 in latitude 64°30'. This chart shows the results of previous operations as well as the 6,055 new echo-soundings taken during a run of 2,600 miles lasting 277 working hours, carried out during the years 1927-29 by the *Nautilus*.

The plotting-sheet for the soundings was on a scale of 1:100,000 for the west and north coasts of the Gulf of Bothnia, and on a scale of 1:50,000 for the eastern coast. All the soundings were then transferred to a collecting sheet on a scale of 1:200,000 and the depth-lines were inserted at intervals of 20 m.

The Publication contains also a series of deductions for the calculation of the volume and mean depth of this portion of the Gulf.

OSSERVAZIONI DI MAGNETISMO A ROMA DAL XVI SECOLO FINO AI NOSTRI GIORNI

(MAGNETIC OBSERVATIONS MADE IN ROME FROM THE XVIth CENTURY TO THE PRESENT DAYS)

by PROFESSOR L. PALAZZO, DIRECTOR (EMERITUS)
DEL UFFICIO CENTRALE DI METEOROLOGIA E GEODINAMICA DI ROMA

(8vo. - 7 pages. Extract from *Atti del 2° Congresso Nazionale di Studi Romani*, Dottor Paolo CREMONESE, Editore, Roma, 1931 - IX.)

Professor L. PALAZZO, Emeritus Director of the *Ufficio Centrale di Meteorologia e Geodinamica di Roma*, sets out in this small pamphlet the history of the magnetic investigations carried out in Italy over a very long period, for it covers the last four centuries.

The first and oldest accurate determination of magnetic variation was made in Rome by the Rev. Giorgio HARTMANN, of Bamberg (1489-1564), who, during a visit to Rome, took the first observations either in the year 1510 or in 1540. The date of 1510 appears to be confirmed by the researches of Professor Gustav HELLMANN, Emeritus Director of the Meteorological Institute of Berlin, published in his work: *Die Anfänge der magnetischen Beobachtungen* (*The Beginnings of Magnetic Observations*), (*Zeitschrift der Gesellschaft für Erdkunde zu Berlin, Bd.* 32, 1897), and in his publication *Rara Magnetica*, in which was reproduced in facsimile the celebrated letter written by HARTMANN, in March 1544, to Duke ALBERT OF PRUSSIA, giving a description of magnetic observations which he had begun in Rome and continued later at Nuremberg.

It was during this visit to Rome that Father G. HARTMANN applied himself to the construction of the pocket sun-dial, using a mariner's compass to orient the dials.

It is an interesting fact that 18 years separated the discovery of the change in magnetic variation from one place to another, which was made by Christopher COLUMBUS during his first voyage across the Atlantic Ocean, and the commencement of systematic observations for variation.

The variation observed at that period by HARTMANN at Rome was about 6° East.

Bartolomeo CRESCENZIO, in his *Nautica Mediterranea*, shows that towards the year 1600 the variation at Rome was about 11°20' East.

Towards 1640, Father KIRCHER found the value at Rome to be 2°45' East.

AUZOUT, in 1670, found 2°15' West.

In 1680, Father Francesco ESCHINARDI found 5° West.

G. D. CASSINI, in 1695, gives the value of D as 7°30' W.

Such are the earliest values of variation observed at Rome.

The author then enumerates subsequent observations which, represented graphically, are useful for the determination of annual change. This change may be represented by means of a sinusoidal curve, which attains an eastern maximum towards 1600, passes through *zero* about 1655, thence towards a western maximum about 1806, which by extrapolation gives its next passage through *zero* between 1950 and 1960, at which date the magnetic and the geographical meridians at Rome will coincide.

This series of observations carried out at Rome, and which is, without doubt, the longest in the world, speaking roughly, gives a period of 490 years, *i.e.*, from 1470 to 1960, for a cycle of change in variation.

RADIO BEACONS AND RADIOBEACON NAVIGATION.

by GEORGE R. PUTNAM,

COMMISSIONER OF THE U. S. LIGHTHOUSE SERVICE

(42 pages - Charts and ill. - *Gov. Printing Office*, Washington, 1931).

A small pamphlet, *Radio Fog Signals and their Use in Navigation in connection with the Radiocompass*, was published by the Lighthouse Service in 1921, and was included also in the Annual Report of the Lighthouse Service for that year; this was revised and published separately in 1924, under the same title. The present Publication is a revision of these brought up-to-date to 1st July, 1931.

The contents of this interesting Publication are divided into the following chapters :-

Introduction; Radiobeacon Navigation; Location and distribution of radiobeacon stations; Operating system of United States radiobeacons (Time schedules for sending signals; frequency band reserved for radiobeacons; frequency separation, and synchronisation of sending periods of radiobeacons; power and range; signal characteristics; tone; types of wave transmission for radiobeacons); Sources of error in radiobeacon navigation; Distance-finding stations; Radio bearings in rescue work; Use of radio signals to avoid collision; Other special uses of radio bearings in navigation; Equipment of a radiobeacon station (Transmitter, code machine, power supply, antenna, control clock and synchroniser, and warning device); Radiocompass for ship use, as developed in the United States; Precautions in using ship radiocompasses and radio bearings; Principles of operation of the radiocompass; Other methods of using radio bearings in navigation; Historical notes; Future development of radiobeacon as aids to marine navigation; Radiobeacons in other countries; Radio in aerial navigation; List of United States radiobeacons for marine use (May 1, 1931)

LES RADIOPHARES

(RADIO-BEACONS)

by HENRI BLONDEL,

INSPECTEUR GÉNÉRAL DES PONTS ET CHAUSSÉES, EN RETRAITE,
MEMBRE DE L'ACADÉMIE DES SCIENCES.

(Mémoire N° 13 des *Annales des Ponts et Chaussées* (Partie Technique) N° VI, November-December 1930, published by the *Ecole Nationale des Ponts et Chaussées*, Paris - p. 227 to 360).

This *mémoire*, which gives the complete technique of French radio-beacons, is divided into several parts. The first part deals in a general way with the different types of radio-beacons and radio-compasses and with the various methods of fixing the positions

of vessels. One chapter is devoted to the history of French radio-beacons and another outlines the programme actually being carried out: Types of radio-beacons, nature and length of wave, note of modulation, call signs, method of emission, location of radio-beacons, and timing of emissions.

The second part describes the technical details of the radio-beacons: production of oscillations, selection of triode valves, methods of modulation, output, aerials, counterpoise, principles of automatic controls (fog radio-beacons and entry into port radio-beacons, long range radio-beacons) and automatic transmission and adjustment (light vessel radiobeacons).

In the third part the various French radio-beacon stations are described.

Appendices provide information regarding the power and the output of the transmitting stations; comparisons of the various processes for modulation and the characteristics of valves used in the principal French radio-beacons.

THE ORFORDNESS ROTATING BEACON AND MARINE NAVIGATION.

(Special Report N° 10 of the Radio Research Board - 14 pp. - Ill., photos — *His Majesty's Stationery Office* — London, 1931).

A previous report (*Radio Research Special Report N° 6*) describes a lengthy series of experiments carried out at Gosport by the Radio Research Board on a rotating loop beacon of the type originated by the Air Ministry for aerial navigation. These experiments indicated that the rotating loop beacon system should form a useful and reliable aid to marine navigation and, accordingly, the Wireless Direction-Finding Committee of the Board of Trade recommended that an experimental, but more permanent beacon of similar type should be erected at a place where an extended trial of this system could be made by ships at sea. The site selected was Orfordness, and the cost of the installation and operation of the beacon erected there has been shared equally by the General Lighthouse Fund and the Air Ministry. The chief object of the trial of the Orfordness beacon was to ascertain in particular its performance when observations were carried out by the personnel of various classes of ships of the Mercantile Marine. The results of the observations on the beacon have been analysed on behalf of the Board of Trade by the Radio Research Board of the Department of Scientific and Industrial Research and the present report contains a summary and a discussion of these results.

The pamphlet under review gives a description of the principle of the beacon, the method of taking bearings by stop-watch and the use of an automatic recorder; results obtained from about 160 ships are then summarised and discussed. In a summary of the results obtained by the Trinity House authorities, 16 out of the 21 observations recorded show no error in the observed bearing and the maximum in the remaining five cases is 1°. This refers to the case of bearings taken in a ship at anchor in such a position that its true bearing from the beacon is accurately known. Under such favourable conditions it is to be concluded that at ranges up to 45 miles the wireless bearings obtained from the beacon are accurate to within 1°, although for observations at sea made by ships engaged upon their normal duties, attention must be directed to various factors which may affect the accuracy of the wireless bearings recorded, and particularly to the frequent lack of a suitable chronograph for making accurate bearing observations.

Altogether out of over 1,500 observations taken by observers on 19 ships, it is found that 80 per cent of the wireless bearings are correct within 2° (the majority of the results were obtained within 100 miles of the beacon). This limiting accuracy of 2° is comparable with that of the normal ship's wireless direction-finder, and is further considered to be adequate for most navigational purposes.

Both reports contain several interesting records of "freak" reception of the beacon at exceptionally great distances. The most notable of these is that submitted by S/S *Bangalore*. When in a position near Algiers, at a distance of 908 miles from Orfordness, and using a single valve detector only, the operator took a series of seven bearings, the mean of which was practically coincident with the true bearing. In a somewhat similar

manner the S/S *Sasebo*, when fishing off the West Coast of Ireland, took bearings on the beacon at a distance of 491 miles. The S/S *Hebrides* has also submitted bearings accurate to within 2° taken while the ship was at anchor at distances of 428 and 446 miles from the beacon.

Coastal deviation.

The results show that in the approximate directions 22° and 240° from the beacon a permanent error of from 1° to 2° is experienced in the observed bearings over an arc of about 5° on either side of the above directions. Apart from this there is no evidence amongst all the results reviewed that any instrumental error is associated with the rotating beacon installation itself.

On a conservative basis it may be stated that with the ordinary type of ship's two-valve receiver the reliable service range of the beacon is from 70 to 100 miles at all times, while the range of accurate bearings is increased to 250 miles in the daytime when conditions are favourable in regard to freedom from interference.

GUIDAGE RADIO-ÉLECTRIQUE DES NAVIRES ET DES AÉRONEFS

(RADIO-ELECTRIC GUIDANCE OF SHIPS & AIRCRAFT)

by PIERRE DAVID, DOCTEUR ÈS-SCIENCES,

INGÉNIEUR EN CHEF OF THE FRENCH NATIONAL LABORATORY OF RADIOELECTRICITY

The *Revue Scientifique*, Paris, in its numbers 18 and 19, 1931, pages 553 and 592, gives interesting information on the various systems of radio-electric guidance of ships and aircraft, their underlying principles, and their advantages and disadvantages.

The author successively reviews the various processes :

1) Guidance by means of simple goniometers (radio-compasses) ;
2) Guidance by means of fixed net goniometers ;
3) Guidance by means of a directed transmitter (loop rotating) ;
4) Fixed leading line (radio-beacon) by equal transmission from crossed loop radio-beacons ;
5) Variable leading line, by means of crossed loops with unequal transmission, or by means of combined antennae and loops ;
6) Means of producing leading beams ;
7) Sweeping of a sector by swaying beam ;
8) Combined rotating beam emitter ;
9) Automatic radiogoniometers (Hertzian or radio-compass) ;
10) Leader cables ;
11) Altitude guidance ; landing of aircraft with no visibility.

HISTOIRE GÉNÉRALE DE LA NAVIGATION DU XV^{e} AU XX^{e} SIÈCLE

(GENERAL HISTORY OF NAVIGATION FROM THE XVth TO THE XXth CENTURY)

by CAPITAINE DE VAISSEAU F. MARGUET

(8 vo - 306 pages - 57 fig. - *Société d'Editions Géographiques, Maritimes et Coloniales*, 184, Boulevard St-Germain, Paris (VI^{e}) - 1931)

This publication, which partly reproduces the *Histoire de la Longitude à la Mer au XVIII^{e} siècle en France* (History of Longitude at Sea in the 18th century, in France) by Captain MARGUET, has been enlarged and considerably re-arranged with regard to its opening chapters which give a detailed historical account of the "position by dead reckoning" and of the "marine chart". The volume contains very interesting information on the use of the first marine time-pieces, the first lunar tables, and concerning the instruments and methods of observation and computation used by seamen for the determination of longitudes.

A chapter is devoted to the discovery of the Pacific Ocean and another deals with the outstanding improvements in navigational methods introduced during the 19th century.

THE PROGRESS OF NAVIGATION

by CHARLES H. BROWN

(*The Nautical Magazine*, Glasgow, January 1932, pages 14 to 24)

In the number of the *Nautical Magazine* published on the occasion of the centenary of its creation, 1832-1932, there is a number of articles which review the varying progress made in the last century in the various branches of nautical technology. An article entitled: *The Progress of Navigation*, by Charles H. BROWN, sums up, in a few pages, the important developments in nautical methods and instruments achieved during the past century. The author gives a rapid summary of the stages of these developments, citing epoch-making dates in the progress of navigation. From the invention of the marine compass in the 14th century, from the primitive instruments used by COLUMBUS during his voyages, the author passes to the improvements made in dead reckoning through the adoption of the log and the sinical quadrant. He mentions the creation, in 1714, of the Commission of Longitudes; the invention of the Quadrant by HADLEY in 1731; HARRISON'S Chronometer in 1735 and the publication of the *Nautical Almanac* which appeared in 1767 and the establishment of the Hydrographic Department of the British Admiralty which followed shortly afterwards, viz :— in 1795. He also refers to the improvements made in sounding and in sounding appliances from the THOMSON Sounding Machine, invented in 1872, to the echo-sounding instruments of modern days. He refers more particularly to improvements made in the compass, since 1873, through the ingenuity of Sir William THOMSON and to the evolution of the magnetic compass from that time until the invention of the gyro compass; the HOLMES Magnetic Repeater Compass and course recorders of recent invention are also mentioned. These devices have led to the adoption of greatly improved automatic steering machinery and course recorders. The author stresses the improvement brought about in recent years by the Board of Trade Commiette which has the duty of elaborating the programmes of nautical examinations with a view to perfecting methods; these have culminated recently in the publication of simple and convenient Tables for carrying out all nautical calculations.

The introduction of wireless telegraphy as an aid to navigation in the year 1898, has provided new methods of fixing the position at sea. Radio bearings have been in use since 1906, and, in their turn, have been improved so far that to-day radio-beacons can communicate their positions to ships enveloped in fog, whilst a leader-cable leads them into port.

All these improvements have revolutionised navigation to such an extent during the last century, that it is difficult to conceive in what direction navigational improvements can be made in the next hundred years.

H. B.

A STANDARDIZED NAVIGATOR'S WORKBOOK.

Under the above title, Lieutenant William A. MASON, U. S. Navy, publishes in the *United States Naval Institute Proceedings*, Vol. 57, March 1931, page 331, an interesting article in which he emphasises the necessity of rapidly taking a fix on board ship by means of a method which would permit the factors recorded for the computations to be abbreviated as far as possible.

The writer has devised a celluloid strip on which the form of calculation selected is inserted in one vertical column. The distance between the various steps of the form engraved on the celluloid is such as to coincide with the lines of the note-book or register in which the observations are recorded and in which the computations will subsequently be made. This strip (or small ruler) is 13 11/16 inches long, 1 11/16 inches wide, and 1/16 inch thick. A metal clip is attached to each end of this strip by which it may be fixed to the required page of the register and held in place by its edges. The width of the strip has been specially adapted so that it may divide the page of the register vertically into five columns sufficiently wide to hold all the factors necessary for the computation of an observation; the strip itself can be slid across the page and brought into coincidence with each of these five columns. Some forty lines are engraved vertically on the strip so that all computations may be made in one vertical column, which is generally sufficient for all requirements, and each observation can be computed separately. Data which refer directly to the observations are shown in red on the strip so that the work-book serves also as a record of the observations; it is sufficient to insert these successively on the same horizontal line in the place which they occupy for the computation. This method also permits the necessary astronomical data to be inserted, taking into account their slight hourly changes during observation, each on the same horizontal line. All material errors which may have crept into the computation may thus be detected at a glance.

It will be readily seen that this ingenious device is adaptable to every sort of current navigational computation and permits the ordinary work-book sold to be used as the register.

BROWN'S DISTANCE CHART.

(Compiled by CAPTAIN W. D. CAMPBELL, Glasgow; BROWN, Son & FERGUSON Ltd. Price: 4 s.).

This Publication gives the distances between principal ports of the world in tabular form. It is printed on a sheet about 40×40 inches suitable for mounting on a wall or board. Though naturally not as complete as similar compilations in book form, the Tables are very conveniently arranged and all are visible at a glance. This Publication should be very useful in offices and chartrooms where information of this sort is needed quickly and frequently.

The principal Table gives the distances between 18 British and North European ports and about 250 of the largest ports of the world. Supplementary Tables give direct distances between various American, Asiatic and Australian ports.

TRAITÉ DE TÉLÉMÉTRIE

(TREATISE ON RANGE-FINDING)

by P. MAZUIR

Octavo, 329 pages; 15 plates; *Editions de la Revue d'Optique Théorique et Instrumentale*, 3 & 5, Boulevard Pasteur, Paris (15e), 1931).

Progress in range-finding originated in the necessity of getting over the difficulty of having to use a very long base for measuring the distance of a remote point. The possible solutions of the problem are of two types. One type requires two separate observation stations, each with its observer and measuring instruments. These are sometimes referred to under the name of *bistatic methods*. The other type, adopting a bolder solution, reduces the base sufficiently to allow the two observation stations to fall within the range of one and the same observer; suitable optical instruments bring the two images to the observer, using either monocular vision (coincidence range-finders) or binocular vision, each eye receiving one of the images (stereoscopic range-finders). In the latter case, the device consists of a single rigid apparatus, sometimes cumbersome, but nevertheless transportable and complete in itself. Such device is known as a *monostatic range-finder*, but this should not obscure the fact that a base and two observation points exist, in accordance with the requirements of geometry.

The first chapters are devoted to the study of the optical pieces used in the construction of range-finders, in particular, a very complete study of "deviator systems" is included, this being one of the essential parts of monostatic range-finders. The properties of the eye, in both binocular and monocular vision, have also been studied, with particular regard to those properties used in range-finding. This leads to the examination of the conditions which favour good monocular as well as good stereoscopic observations.

Range-finding devices have attained a degree of perfection and ease of manipulation which opens to them a wide field of application; those using the range-finder (and the number is bound to increase) will find in M. MAZUIR's book a convenient and sure guide.

TEORIE MODERNE SU L'ORIGINE E SU LA STRUTTURA DEI CICLONI

(MODERN THEORIES ON THE ORIGIN AND CONSTITUTION OF CYCLONES)

by Prof. CESARE FABRIS.

The Italian National Committee on Geodesy and Geophysics publishes an interesting memorandum, signed by Professor Cesare FABRIS, dealing with modern theories concerning the origin and constitution of cyclones.

This welcome initiative is due to the President of the Committee, Professor L. DE MARCHI; it brings within easy reach of its readers an up-to-date acquaintance with works which are disseminated throughout a large number of Publications in different languages. On account of the studies on upper air to which he has devoted himself, Professor Cesare FABRIS of the Marco Polo Lyceum, Venice, is eminently fitted to draw up this monograph, which he has completed by an excellent bibliography.

After a detailed explanation of the BJERKNES theories, the author subjects them to criticism and demonstrates that, even though certain peculiarities are no longer admissible at present, these theories constituted a remarkable advance in the domain of dynamic meteorology and its applications. The existence of a surface of discontinuity and of the polar front, analysis of the various air-masses and of their warm or cold fronts are incontestable triumphs.

The author then reviews the most important of the other theories to which this renaissance of meteorology has given rise, those of EXNER, FICKER, STÜVE, VERCELLI, DEFANT, etc., the authors of which have directed their efforts more particularly towards giving an explanation of the origin of cyclones, an essentially difficult question the solution of which would doubtless facilitate the forecasting of these phenomena and the solving of which is therefore of primary importance to seamen.

P. V.

MEDICIAN CHARTS OF THE FIRST HALF OF THE 17th CENTURY

In an article entitled :- *Un astuccio della prima metà del secolo XVII con quattro Carte da Navigare costruite per la Marina Medicea dell'Ordine di Santo Stefano* (Leather case of the first half of the XVIIth Century containing four Navigational Charts constructed for the Medician Navy of the Order of St Stephen), published by the *Rivista Marittima*, Rome, February, 1931, pages 163-174, Professor Sebastiano CRINO gives a very interesting description of four ancient charts contained in a very finely-worked leather case.

This case was found in a corner of the Roman College, amongst various manuscripts and parchments, in the year 1877 ; dating from the first half of the 17th Century, it belonged to some gentleman of the Medician Navy of the Order of St Stephen. The marine charts which it contains are four in number ; two of them are the work of the Genoese Giacomo MAGGIOLO and date from 1561 and 1567 respectively ; the first represents the basin of the Mediterranean and the second the coasts of Sardinia, Corsica and the northern Tyrrhenean Sea. The third chart is dated 1551 and is due to Giacomo OLIVES ; it represents the Mediterranean Sea ; finally, the fourth chart, drawn up by Placido CALOIRO and OLIVA, dates from 1636. The two latter charts were made at Messina.

A photograph of the leather case containing the charts, as well as photographs of each of these old charts, accompany the article in the *Rivista Marittima*, and historical notices of the highest interest are given by the writer concerning each of them.