EXTRACTS OF BOOKS

CONSIDERAZIONI TEORICO-SPERIMENTALI SUL REGIME DELLE MAREE DEL MARE ADRIATICO

(THEORETICAL-EXPERIMENTAL CONSIDERATIONS ON THE TIDAL REGIME OF THE ADRIATIC SEA.)

Note by Prof. MARIO TENANI, *published in the Rendiconti della R. Accademia Nazionale dei Lincei, Classe di Scienze Fisiche, Matematiche e Naturali, Rome, July-August* 1929 (VII).

During the year 1928, the vessels *Tritone* and *Scilla* of the Royal Italian Navy carried out, along the Albanian Coast, a series of hydrographic operations necessitating the temporary installation of two tide-gauges — one at Durazzo and the other at S. Giovanni di Medua. Two RICHARD tide-gauges were used and harmonic constants were deduced, from the observations made, by the method set out by Dr. A. T. DOODSON in the *Phil. Trans. of the Royal Society, London, A* 227, 1928. Professor M. TENANI used the harmonic constants thus computed (*) for comparison with the theoretical results for the Adriatic Sea deduced by means of the method developped by STERNECK in 1919 (*Die Gezeitenerscheinungen in der Adria (parte II), Denkenschriften der Akad. der Wiss, in Wien, Math. Natur-wiss. klasse*, vol. 96, p. 277, 1919) which consists in assimilating the tides in the Adriatic to the tidal wave originated in that Sea by the oscillations of the Ionian Sea, transmitted through the Straits of Otranto. In his paper, Professor TENANI gives an account of the method adopted by STERNECK, no observed constants being available, for computing theoretical constants for the Straits of Otranto inferred from observations made at Pola. Similarly Professor TENANI used observations made at Durazzo, at S. Giovanni di Medua, together with other observations made in 1918 at Ancona and in 1927 at Pesaro, for calculating constants for the section of the Straits of Otranto. The results thus obtained concord remarkably. By attributing to each set of observation a certain weight according to its duration, Professor TENANI deduced mean values for the Straits of Otranto, the mean errors of which are very small.

This provides experimental confirmation of the method of theoretical deduction as applied to the Adriatic Sea, and confirms the possibility of extending these considerations to the computation of constants for other Seas.

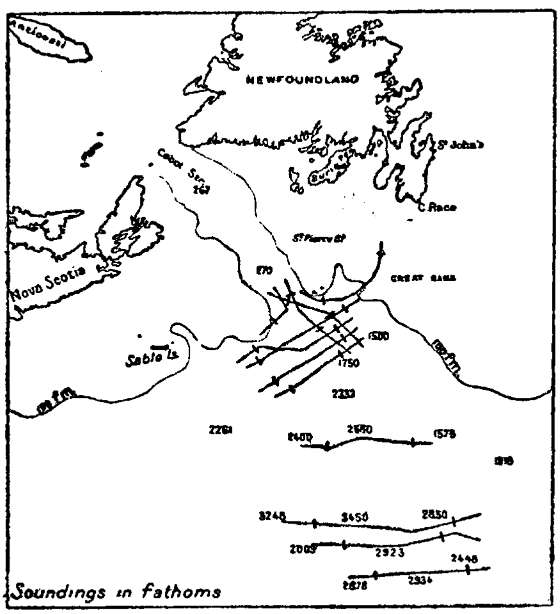
(*)

		M_2	S_2	N_2	K_2	K_1	O_1	P_1	M_4	MS_4	
DURAZZO	H = c/m	9.3	5.5	0.6	1.5	5.0	1.4	1.6	0.1	0.2	29 days:
	g =	102°	104°	123°	104°	48°	27°	48°	105°	337°	30th May-27th June 1928
S. GIOV. DI MEDUA	H = c/m	9.3	5.1	1.5	1.4	5.3	0.4	1.7	0.2	0.2	15 days:
	g =	108°	106°	144°	106°	42°	352°	42°	198°	337°	20th April 4th May 1928

EARTHQUAKE SOUTH OF NEWFOUNDLAND. NOVEMBER 18th, 1929.

This earthquake was of unusual intensity. The shocks were felt along 940 miles of the American coast and caused breaks in some dozen telegraph cables lying at great depths. At sea, seismic waves were experienced by the liner *Olympic* and during two minutes she felt unusual vibrations. Several seismic waves broke on the southern shores of Newfoundland sweeping away roadways and several houses. It had already happened in 1884 that three cables were broken on the south eastern slope of the Newfoundland Bank under similar conditions.

On page 945 of *Nature* London, 21st. December 1929, an interesting article by J. W GREGORY will be found countaining a sketch map showing the places where breaks in telegraphic cables occurred.



The study of this earthquake reveals the nature of the submarine canyons which lie off the Atlantic Coast of Canada and the United States. The earthquake was particularly of intensity at its centre, for more than 400 miles therefrom it overthrew factory chimneys, and was still of the order of 7 and over of the ROSSI-FOREL scale when it reached the seismometers of Nova-Scotia. The seismic wave drowned 26 people in the Burin peninsula of Newfoundland. The attached sketch reproduces the information concerning breaks in cables supplied by the Western Union Telegraph Co. and by the Commercial Cable Co. It shows that the breaks lie mainly on two roughly parallel lines in the continuation of the submarine depression, in places 285 fathoms deep, of the Cabot Strait. The lines are not exactly straight: but as the positions of the breaks are based on insulation tests made at the shore ends, they may not be accurate and may be displaced by strains or injuries to the cable elsewhere that at the main breaks.

Each of the damaged cables has two breaks from 80 to 150 miles apart. The trough of Cabot Strait trends from north-west to south east. The earthquake appears to have been due to a renewed subsidence in the southern continuation of the Cabot Strait depression though the general trend is to the south-south-east. The depths along the middle of this submarine curve were 1750, 2332, 2680, 3450 and 2934 fathoms, and the depth is usually hundreds of fathoms greater than in the area on either side. The earthquake is probably due to a fresh subsidence of the floor of this submarine rift valley.

The new evidence throws new light on the nature of the famous submarine canyon of the Hudson River which, off New-York, makes a kink in the 100 fathoms line with a depression 400 fathoms deep.

The St. Lawrence Valley has been interpreted as a strip sunk between parallel faults by Mgr. LAFLAMME (Trans. R. Soc. Canada, ser. 3, vol. 1, 1908). Its tributary, the Saguenay fiord was the site of the violent earthquake of February 1925. That of the St. Lawrence is probably due to subsidence as its bed is in places 150 fathoms below sea-level. It trends approximately east and west in line with the pivotal line across Newfoundland.

Such submarine canyons have been attributed to the following processes:

To excavation by rivers when the land stood thousands of feet higher than at present; to the power of glaciers to excavate troughs far below sea-level; to the accumulation of layers of sediment on either side of a channel kept clear by currents. These hypotheses were suggested by DARWIN for the canyons of the Blue-Mountains in New South Wales, and by J. Y. BUCHANAN for the submarine canyon off the Congo. The fourth explanation is that they, like fiords, are due to the subsidence of strips of land along faults; that conclusion, advanced in "The Nature and Origin of Fiords" (1913), appears strongly supported by the evidence of this new earthquake which, in this case, has not enjoyed the usual comparative harmlessness of submarine disturbances, as its central zone lies acros the main series of trans-Atlantic cables.

The re-sounding of the ocean around the epicentral area of the Cabot Channel earthquake may be expected to reveal instructive changes in depth.

SCIENTIFIC EXPLORATION IN THE BARENTS SEA BY THE "POSEIDON" IN 1927

(*After an article by* Bruno SCHULZ, *published in the* Annalen der Hydrographie und Maritimen Meteorologie, *Berlin, September* 1929, *page 294).*

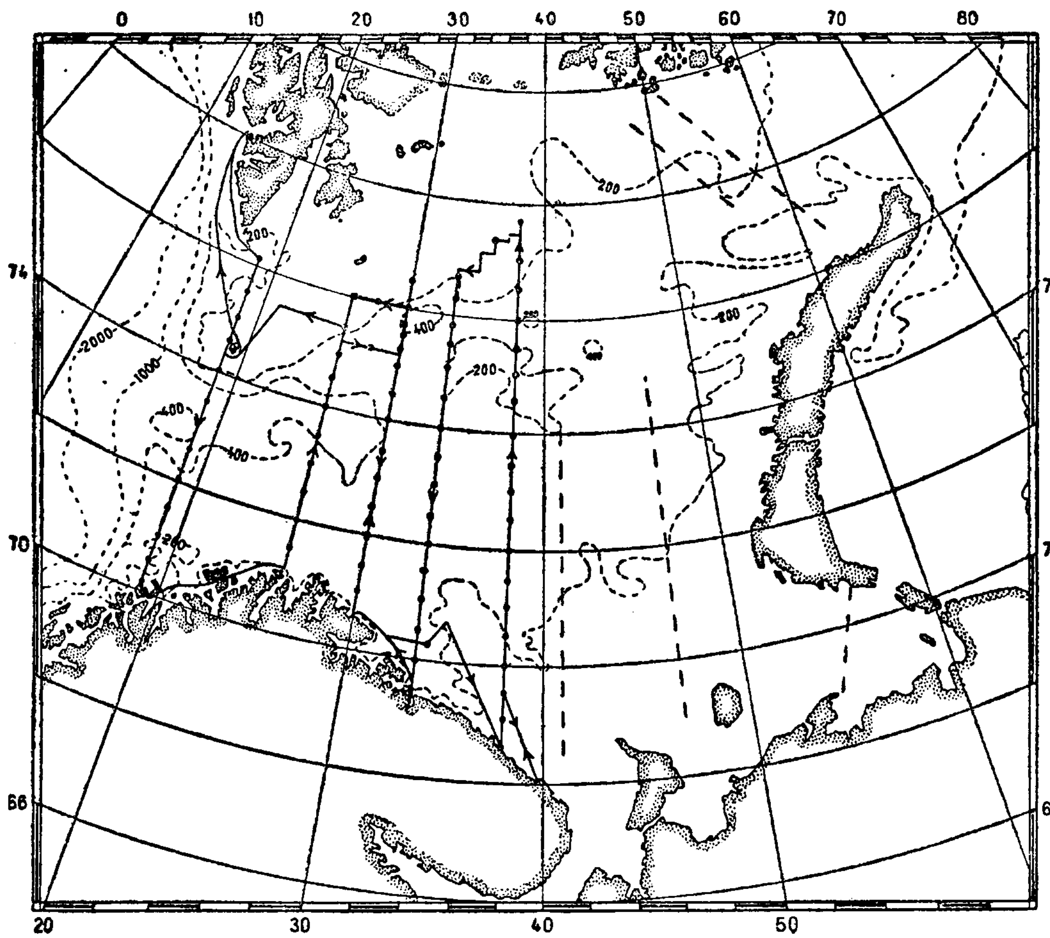
For some years, numerous German ships have carried on the fishing industry in the Barents Sea. Russia has already been engaged in the exploration of this zone, and the research work undertaken by the Biological Station at Alexandrowsk from 1898 to 1908, and by the exploring ship *Persey* in 1923 on behalf of the Maritime Scientific Institute of Leningrad, have contributed to a knowledge of this sea. German research began in 1913 with a voyage made by the German Governement Exploring ship *Poseidon* in the southern portion of the Barents Sea. The results of this expedition were published by the Biological Institute of Heligoland in 1919. It is only since 1926 that it was possible to resume these researches on board the Fishery patrol vessel *Zieten,* both from a biological and from a hydrographical point of view.

In order to follow up this expedition, a fresh voyage of research was undertaken in 1927 by the German Government exploring ship *Poseidon,* in the Barents Sea.

The principal object of this cruise was to carry out a survey of the hydrographical conditions in the Barents Sea by German and Russian ships, as simultaneously as possible, and in accordance with a common plan, which was agreed upon in advance. The programme of work consisted, in the first instance, of hydrographical researches, and owing to favorable circumstances during the month of August, they succeeded in making five hydrographical profiles, corresponding to the meridians of 19°, 26°, 30°, 33 1/2° and 38° East Long. respectively, from the coast to the edge of the ice.

Surface observations were not only made in the Barents Sea, but also between Bear Island and the Eisfjord of Spitzbergen. The hydrographical researches rested with the Deutsche Seewarte, whilst those connected with Biology and the fishing industry were entrusted to the Biological Institute at Heligoland, the Fisheries Department, and to the German Association of Sea Fisheries. The results of the Expedition were published in the account of the German Scientific Expedition for the Exploration of the Sea (New Series, Vol. IV, part 5, Berlin 1929, 114 pages, 13 tables with 26 diagrams contained in the text). The sketch annexed shows in full lines the course followed by the *Poseidon,* and in dotted lines the course followed by the Russian exploring party, which was at work at the same time.

The *Poseidon* ascertained the temperature and salinity in all this zone, and collected important data on the ramifications of the sea currents in the Barents Sea. The configuration of the sea-bottom plays a considerable part in the determination of hydrographical conditions in the depths. The observations were so dense that, apart from the profiles already mentioned, the flow of the North Cape Current and its ramifications could be equally well followed up on horizontal profiles at depths of 50, 100, 200, 300 meters ; in the same way it was possible to make vertical profiles in the direction of each of the arms of the North Cape Current.



CHARTS GIVING LINES OF EQUAL DISTANCES FROM PORTS.

In a supplement to the *Geografisk Tidsskrift* 1929, published by the Committee of the Royal Danish Geographical Society under the title :- "The Commercial-Geographic Importance of the Situation of Copenhagen", is given a comparison of the navigation of ships through the Kiel Canal and through the Sound. (See Chapter V, page 109).

Among other maps accompanying this chapter is given one of the Baltic and the North Sea showing the "day-isochrones for Copenhagen", which is here reproduced (Fig. 1).

Further in the same article appears also a chart of the Atlantic showing "5-day isochrones for Copenhagen", a reproduction of which is also given (Fig. 2).

The times are calculated for an 8-knot steamer (about 200 miles in the 24 hours).

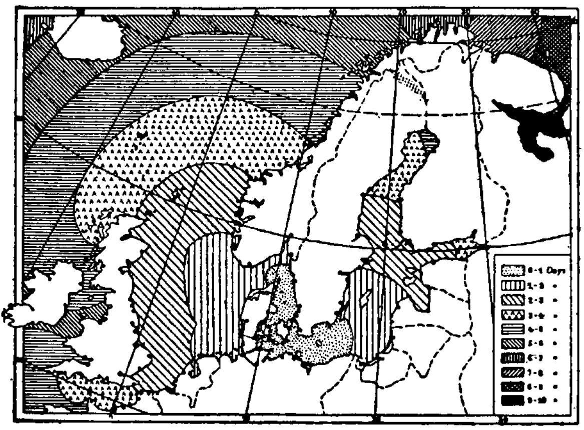


Fig. 1

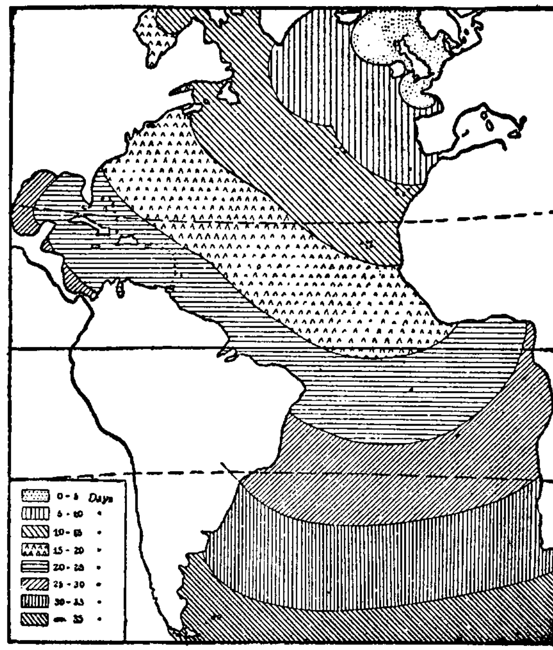


Fig. 2

It is of interest to note these sketches as they give a synoptic representation of distances from one of the most important ports of the world.

THE SHIP'S POSITION BY THREE RADIO BEARINGS

In an article entitled: "Der Schiffsort bei drei Funkpeilungen", Dr. H. MAURER takes up the study of the application to radiogoniometry of position finding by three radio bearings.

When a ship's position has been checked by three radio-compass stations, the lines of bearing generally form a "cocked-hat" and the question arises as to where the ship should be assumed to be at the moment.

This problem has often been discussed and Dr. MAURER is led to conclude that:

1st. — In the case of three radio bearings, the centre of the circle inscribed within the triangle formed by the three bearings should be adopted as the best of the ship position.

2nd. — In the case of an acute-angled triangle, the point of intersection of the perpendiculars from the apices may just as well be taken for the position of the ship as the centre of the inscribed circle. In the case of an obtused-angled triangle, the same is true for the point of intersection of the perpendiculars from the apices of the supplementary triangle, *i. e.* the triangle obtained by replacing the obtuse-angle α by its supplement: $180^{\circ} - \alpha$.

3rd. — The fact that a small triangle of position or a punctiform triangle of position is obtained by means of radio bearings, does not permit any conclusions to be drawn as to the quality of the radiogoniometric fix.

DIRECT MEASUREMENT OF DISTANCE FROM W/T STATION BY ELECTRIC WAVES

The *Jahrbuch der drahtlosen Telegraphie und Telephonie* (N° 33), Berlin 1929, contains an article by W. BURSTYN in which he suggests a method of determining the distance of W/T Station from a ship during foggy weather, provided that this distance is less than 3 miles. Near the aerial of the station the maximum strength of the electric field E is $E_1 \frac{\sqrt{1-u^2+u^4}}{u^3}$ and that of the magnetic field H is $E_1 \frac{\sqrt{1+u^2}}{u}$ where $u = \frac{2\pi r}{\lambda}$, λ being the wave-length employed and r the distance. The units adopted for H and E are such that H is equal to E at infinite distance; the phase angle φ between them is given by the equation $\tan \varphi = \frac{1}{u^3}$. The distance is obtainable in various ways, of which the simplest is to find or estimate (by a system described by the Author) the value of the ratio E/V, where V is the value of a rectangular hyperbola drawn through $E = 1$ and $u = 1$. This value is 0.8 for 5 kms., 1.0 for 3 kms., 1.25 for 2.5 kms., 1.8 for 2 kms., and 3.5 for 1.5 kms.

NOTE CONCERNING THE COEFFICIENT OF GEODETICAL REFRACTION

Mr. Silvio BALLARIN has published in *Universo* (the monthly publication of the Military Geographical Institute of Florence), the results of an experimental study which he made with reference to geodetic refraction.

Intricate formulae for calculating geodetic refraction, although based on the most plausible hypothesis concerning the constitution of the atmosphere, do not provide, *in practice*, better results than empirical calculations. Therefore, it is better to try to improve some of these formulae in a simple and purely *empirical* manner and particularly that of BOUGUER, which, as is well known, is based on the condition that:—

$$\Delta Z_1 + \Delta Z_2 = n \varphi$$

where ΔZ_1 et ΔZ_2 are the *angles of refraction* at the two ends of the path followed by the light ray between two geodetic positions, φ being the angle comprised between the two vertical planes containing these positions (assumed to be on the local sphere) and n the constant known as *coefficient of geodetic refraction.*

After an analysis of a large number of observations provided by the Military Geographical Institute, the author reaches the following conclusions:

1°) A decrease of the coefficient of refraction at different altitudes is observed, the amount of this decrease being approximately 0,010 for each thousand meters. By the above analysis, the following probable values for the coefficient of refraction are obtained:

from 0 m. to 1000 m.	$n = 0.134$ (*)	± 0.002
from 1000 m. to 2000 m.	$n = 0.121$	± 0.006
from 2000 m. to 3000 m.	$n = 0.111$	± 0.009

2°) From the values obtained for the various regions examined, *viz*:

PIEMONTE (Italy)	(mean altitude 2000 m.)	$n = 0.122 \pm 0.006$
COLONY OF ERYTHREA (Africa)	(» » 1200 m.)	$n = 0.124 \pm 0.006$
MARCHE-UMBRIA (Italy)	(» » 900 m.)	$n = 0.131 \pm 0.002$

(*) *This value is in accord with the value* n = 0.131 *found by* GAUSS *in Hanover, a country in which the same average altitudes exist.*

it is concluded that n does not depend very much on local conditions, and consequently it does not appear necessary, in practice, to adopt "local constant coefficients".

The author came to the conclusion that proposals to consider that the coefficient of refraction differs from one station to another are not supported by experience, and therefore, the path of the light ray may be considered as being circular and that the assumption made by BOUGUER, although empirical, is in fact sufficiently satisfactory, if a slight change of the BOUGUER coefficient n is admitted with change of altitude, this being in accordance with the laws of Physics.

IS THE EARTH AN ELLIPSOID WITH THREE UNEQUAL AXES ?

This question, which he had previously investigated in 1926 in Publication N° 6 and in 1928 in *Gerlands Beiträge zur Geophysik*, vol. XIX - H. 4, is the subject of a new work by W. HEISKANEN (Publication N° 12 of the Geodetic Institute of Finland).

In his work of 1928, based on the *anomalies of gravity*, he placed the major axis of the equator in the meridian of Greenwich and estimated at 242 metres the difference between the length of the two axes of the equatorial ellipse.

The new investigation utilizes the *deviations of the vertical* according to the work of HAYFORD and the measurements made in Europe. It yields the following results :

Flattening of the Equator...	0.000026 ± 0.000009
Longitude of major axis of Equator..............................	$38^\circ \pm 10^\circ$ East of Greenwich
Difference in lengths of equatorial axes	$165^m \pm 57^m$

With the same material HEISKANEN obtained the following values for the major axis a at the equator and for the mean flattening α of the meridian :-

$$a = 6378410^m \pm 35^m$$

$$\frac{1}{\alpha} = 298.3 \pm 1$$

or, taking the value of $\frac{1}{\alpha} = 297$ of the international ellipsoid,

$$a = 6378391^m \pm 32^m$$

which differs by three metres only from the international value.

In the Proceedings of the *Académie des Sciences* of Paris of 8th November 1928, and of 2nd January, 14th January, 11th February and 4th March, 1929, an interesting theoretical discussion is reported between Messrs Mario BOSSOLASCO and Thadée BANACHIEWICZ, on the question of determining whether the gravity should be at its maximum at the extremity of the major axis or of the minor axis of the equatorial ellipse.

P.V.