U. S. DEPARTMENT OF COMMERCE
Henry A. Wallace, Secretary

COAST AND GEODETIC SURVEY
Leo Otis Colbert, Director

MAGNETIC OBSERVATORY RESULTS

AT SAN JUAN, PUERTO RICO

FOR 1929-30

EOLINE R. HAND in Charge of Observatory

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compiled by

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INTRODUCTION

A magnetic observatory known as the Porto Rico Magnetic Observatory was maintained on Vieques Island, near Puerto Rico, from March 1903 to October 1924.[1] In 1924 conditions became unfavorable and in 1925 a new observatory was built on a site near the top of a hill about 10 kilometers south of San Juan on the highway from San Juan to Guaynabo; the results for 1926-28 have already been published.[1] The approximate geographic position of the observatory is, on the Puerto Rico datum,

Latitude: 18° 22'.9 North
Longitude: 66° 07'.1 West

The elevation is about 100 meters.

The differences of the various elements of the earth's magnetic field at San Juan and Vieques are shown in table 7.

BUILDINGS AND CLIMATE

The buildings at the San Juan observatory were originally of wooden construction on concrete foundations. Although the variation building was fairly well insulated against temperature changes, it was not effectively protected against the extreme humidity of the region.

On September 13, 1928, a great hurricane destroyed the office building and its contents; but the variation and absolute buildings, though damaged, remained standing and the magnetograph was put back in operation September 24. A hurricane-proof office building was erected in the fall of 1929.

The performance of the magnetograph was better than in 1926-28, in spite of the effects of the climate on the variometers (the warm, moist, salty air is favorable to corrosion and to the growth of molds; molds will even grow on the glass and metal surfaces inside the variometers).

PERSONNEL

The work of the division of geomagnetism and seismology (known before 1940 as the division of terrestrial magnetism and seismology) of the United States Coast and Geodetic Survey includes the office, field, and observatory work. Other magnetic observatories were operated by the Survey during the biennium at Cheltenham, Maryland; Honolulu, Territory of Hawaii; Sitka, Alaska; and Tucson, Arizona.

During 1929-1930, N. H. Heck, hydrographic and geodetic engineer, was chief of the division. The work of the San Juan observatory was in the charge of Eoline R. Hand, hydrographic and geodetic engineer, who made all the observations. Some of the office computations were made several years ago under the direction of D. L. Hazard, chief magnetician (now retired).

DESCRIPTION OF INSTRUMENTS

Variation instruments.--The magnetograph used during the biennium was of the Eschenhagen pattern and consisted of a recording apparatus and three variometers which recorded, respectively, changes in magnetic declination (D), horizontal intensity (H), and vertical intensity (Z). The variometers are identified as Schulze no. 25 (D), Toepfer no. 10 (H), and Schulze no. 21 (Z).

The H variometer was successfully compensated for temperature by the use of a temperature compensating magnet. The Z variometer also included a temperature compensating magnet, but it was later found that it was overcompensated.

Temperature of the magnetograph.--The daily temperature range was usually small. Temperature variations were recorded photographically on each magnetogram by means of a thermograph built into the Z variometer. In addition, both the H and Z variometers had thermometers which were read several times daily. The thermometer readings served to calibrate the photographic temperature trace, from which temperature and temperature corrections were derived.

Absolute instruments.--Magnetometer no. 31, of the India Survey pattern, was used for observations of declination and horizontal intensity. Schulze earth inductor no. 1 was used for observations of dip.

EFFECTS OF SHRINKAGE

Magnetograms undergo appreciable variations (about 1%) in their dimensions; the principal change occurs during the developing of the exposed photographic paper. The direct effect of shrinkage is that the scale values applicable to a given magnetogram depend on the amount of shrinkage of that gram.[2] The amount of shrinkage is determined by measuring the distance between shrinkage points on the gram, the points having been pricked with a known separation distance before the gram was placed on the recording drum.

The effect of shrinkage for the period 1929-1930 is considered negligible.

NOTES AND REFERENCES

1. Inquiries regarding the availability and price of the reports should be addressed to the Director, U. S. Coast and Geodetic Survey, Washington 25, D. C.

2. The effect of any consistent error in the adopted scale value is to give ranges too small or too large, while the mean value for any period is affected materially only in case the absolute observations are consistently made at a time when the value of the element is near its maximum or minimum.

3. A more detailed discussion is given in the 1926-28 volume of this series (see note 1).

4. The considerations involved in the change of method of observing scale values are discussed in the Tucson report for 1929-1930 (see note 1), pages 5 and 7.

5. Daniel L. Hazard, Directions for Magnetic Measurements (Serial 166), third (1930) edition, reprinted with corrections, 1938. (For sale by Superintendent of Documents, Government Printing Office, Washington 25, D. C. Current price 65 cents.)

6. L. A. Bauer and J. A. Fleming, Researches of the Department of Terrestrial Magnetism, Vol. II, Land Magnetic Observations 1911-1913 and Reports on Special Researches (1915), pp. 270-273 (published by the Carnegie Institution of Washington).

7. In the selection of the 10 quiet or least disturbed days of each month some consideration was given to the lists used by the four other observatories of the Survey and to the lists for the observatories operated by the Carnegie Institution of Washington.

It was not always possible to select 10 quiet days in each month.

8. G. van Dijk. The Magnetic Character of the Year 1929, Terr. Mag. 35, 178 (1930). G. van Dijk, The Magnetic Character of the Year 1930, Terr. Mag. 36, 255 (1931).

9. W. N. McFarland, Direct Scaling of Absolute Magnetic Values, Terr. Mag. 31, 89-95 (1926). The method is described briefly in the volumes for Cheltenham, Honolulu, Sitka, and Tucson for 1925-26 (see note 1).