

## DEFLECTION OF THE VERTICAL IN TAHITI

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M. GOUGENHEIM, Ingénieur Hydrographe of the French Navy, has communicated to the International Hydrographic Bureau an interesting study on the question of the deflection of the vertical in Tahiti based on manuscript documents taken from the archives of the Hydrographic Service in Paris.

A triangulation of the western part of Tahiti was executed between 1845 and 1850 by Captain RIBOURT of the Staff. This permitted him to make a comparison of the latitudes, deduced from the triangulation of an astronomical observation effected on the mean parallel, and the latitudes of the same points located on the north and south coasts of the island, furnished by the astronomical observations. The compression of the earth and the logarithm of the major axis of the ellipsoid adopted were respectively  $1/305$  and  $6.8046385$ .

The astronomic latitude obtained at the southern end of the base (Point Punaavia, on the west coast of the island) by ten circummeridians of stars (mean discrepancy  $1.55''$ ) was :  $17^{\circ} 38' 08.0''$  South.

The astronomic latitude obtained on the north coast at Point Venus (Haapape Block-house) by 10 circummeridians of stars (mean discrepancy  $1.55''$ ) was :  $17^{\circ} 29' 25.6''$  South.

That of the same point, deduced from the triangulation of the latitude of the southern terminus of the base was :  $17^{\circ} 29' 59.1''$  S.; difference —  $33.5''$ .

The astronomic latitude obtained on the south coast of Mahaiatea by 6 circummeridians of stars (mean discrepancy  $1.70''$ ) was :

$$17^{\circ} 47' 08''.6 \text{ S.}$$

That of the same point, deduced from the triangulation of the latitude of the southern end of the base was :

$$17^{\circ} 46' 43.3'' \text{ S; a difference of } + 25.3''$$

The deflection of the vertical towards the centre of the island was therefore about  $30''$ .

These differences cannot be due to errors arising from the observations, but are due rather to the action of the mountains of Tahiti, whose highest point culminates in a peak of 2236 metres (7,320 ft.) in the centre of an almost circular island with radius of 32 kilometers (19.4 miles).

Further, the very steep slope seems to continue without change to the depths of more than 1000 meters (547 fathoms) which surround the island.

RIBOURT has also measured the zenithal distance of the sea horizon at point Punaavia and found :

towards the west :  $90^{\circ} 5' 48.80''$  (20 measurements; mean discrepancy  $0.17''$ )

towards the south :  $90^{\circ} 6' 07.35''$  (20 measurements; mean discrepancy  $0.14''$ )

difference  $18''.55$

Another operator, Adam KULCZYKI, determined in 1851 the deflection of the vertical at Moorea, a small island (located about 15 miles to the W.N.W.) of Tahiti, having a height of 1212 meters (4,000 ft) and a diameter of about 11 kilometers (5.6 miles).

He has obtained :

The Church of Afareaitu on the coast of the island  $17^{\circ} 33' 09.0''$  S.

The Church of Papetoai on the north coast  $17^{\circ} 29' 10.13''$  S.

while the transfer by triangulation of the latitude of the first point to the second gives :  $17^{\circ} 29' 36.2''$  difference of —  $26.07''$ .

This operator was also able to transfer by triangulation from Afareaitu the latitude of Punaavia determined by RIBOURT. He found  $17^{\circ} 33' 09.4''$  S., of which the perfect agreement with his direct observation seems to prove that in these two points, located approximately on the mean parallel of the island, the attraction of the neighbouring mountains produces a deflection of the vertical nearly east-west, and that the effect of an island on the vertical of a point of the other should be small in the north-south direction.

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