NETHERLANDS GEODETIC COMMISSION.
(RIJKSCOMMISSIE VOOR GRAADMETING EN WATERPASSING).

GEODETIC ACTIVITY
IN
THE NETHERLANDS
1933, 1934 AND 1935.

NOTE PRESENTED IN THE SIXTH GENERAL ASSEMBLY
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GEODETIC ACTIVITY IN THE NETHERLANDS
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I. PRECISE LEVELLING. The new first-order levelling has been continued and will be finished in 1936.

II. GRAVITY RESEARCH.

In the years 1934 and 1935 an important expedition was made. The Minister of Defence, His Exc. Mr. Dr. L. N. Deckers, has consented, at the request of the Netherlands Geodetic Commission, to direct a newly built submarine, Hr. Ms. K XVIII, to go to the Indies via Buenos Ayres, Capetown and Fremantle (W. Australia) in stead of along the normal route, and to allow the making of gravity observations and of echo-soundings during the voyage. This long cruise of eight months has given a great opportunity for scientific work, and so sincere acknowledgements are due to His. Exc. Dr. Deckers, and other authorities of the Netherlands Navy for this great contribution to science. Acknowledgements are likewise due to the Captain of the ship, Lieut. Comm. D. C. M. Hetterschy, to the Officers, M. S. Wytema, C. van der Linden, C. ter Poorten, C. Leeuwenburg and A. J. Marcus, and to the crew of the ship for their support of the scientific work and their helpful assistance. Lastly the Commission may thankfully acknowledge the assistance by the "Bureau des Longitudes" in Paris, which has lent a chronometer of the French Navy for this expedition, and the help of the "Bataafsche Petroleum My" in the Hague for their lending a Holweck-Lejay Gravity Apparatus. This last contribution has rendered it possible to measure gravity on land during the stay in the ports.

The further scientific equipment of the expedition has been the same as during former expeditions: the three pendulum apparatus for the determination of gravity at sea, combined with two Nardin chronometers of the Commission and the above mentioned French chronometer. The differences in rate of the chronometers have been determined by means of a recording apparatus.

The ship left Den Helder on November 14 and touched at the following ports; the numbers of gravity stations at sea and on land are mentioned:

Date 1934	stations at sea	stations on land
November 14, Dep. Den Helder,		
	21	
November 24, Arr. Funchal, (Madeira)		2
December 5, Dep. Funchal,		
	18	
December 12, Arr. São Vicente, (Cape Verde Is.)		2
December 16, Dep. São Vicente,		
	23	

Pays-Bas.

Date 1934/35	stations at sea	stations on land
December 28, Arr. Dakar, (Fr. W. Africa)		1
January 5, Dep. Dakar,	32	
January 17, Arr. Pernambuco, (Brazil)		2
January 24, Dep. Pernambuco,	12	
January 31, Arr. Rio de Janeiro, (Brazil)		4
February 12, Dep. Rio de Janeiro,	12	
February 18, Arr. Montevideo, (Uruguay)		
February 22, Dep. Montevideo,	1	
February 23, Arr. Buenos Ayres, (Argentine)		1
March 2, Dep. Buenos Ayres,	1	
March 3, Arr. Mar del Plata, (Argentine)		2
March 7, Dep. Mar del Plata,	52	
April 2, Arr. Capetown, (S. Africa)		6
April 29, Dep. Capetown,	17	
May 4, Arr. Durban, (S. Africa)		2
May 13, Dep. Durban,	14	
May 22, Arr. Port Louis, (Mauritius)		
May 31, Dep. Port Louis,	21	
June 20, Arr. Fremantle, (W. Australia)		7
July 2, Dep. Fremantle,		
July 11, Arr. Surabaya	15	
Total number of stations	239 at sea	29 on land

The ship has submerged 231 times.

The soundings have been made by means of an Atlas Sounding apparatus; the echo-times, however, have often been determined with an accurate stop-watch of which the dial allows the reading of 0.01 sec.

The computation of the results has not been finished but provisional results are already available. They have been subjected to a rough isostatic reduction and so provisional figures and conclusions can already be given.

The first object of the expedition, besides obtaining more gravity stations in the southern hemisphere, was to get more data about the following effects found during former expeditions: the tendency of oceanic gravity to show positive anomalies with regard to continental gravity and the sudden transition to positive anomalies near the edge of the continental shelf and near islands. The first effect had been found in the North Atlantic and in the Pacific during the crossing from San Francisco to Manilla. The second had been found at the end of the Channel, near the Azores, near Socotra, at the south coast of Ceylon, in many instances in the East Indies, at the west coast of Central and North America and in many places in the West Indies and in the Mediterranean, in short practically near all the coasts that have been investigated save a few of the oceanic islands.

The provisional figures for the present expedition are:

Mean anomalies in the Oceans.

	free-air anom.	regional isost. anom.	number of stations
Channel—Madeira	+ 15	+ 33	18
V. Cisneros—S. Vicente	+ 14	+ 31	8
S. Vicente—Dakar (via Mid. Atl.)	— 2	+ 18	22
Victoria—Mid. Atl. Ridge	— 6	+ 19	9
Mid. Atl. Ridge	— 22	— 32	4
Mid. Atl. Ridge—Pernambuco	— 20	+ 2	12
Argentine—Bromley Plateau	— 1	+ 24	11
Bromley Plateau	+ 15	— 25	3
Bromley Plateau—Trist. d. Cunha	+ 37	+ 46	9
Tristan da Cunha	+ 95	— 11	1
Trist. d. Cunha—Capetown	+ 22	+ 41	24
Mauritius—Indian Ocean	+ 30	+ 44	13
Mid. Indian Ocean	+ 88	+ 68	1
Indian Ocean—Fremantle	+ 2	+ 30	5
Australia—Java	— 7	+ 12	9

The provisional figures for the regional isostatic anomalies are uncertain; the figures for the free-air anomalies are probably right up to one or two milligal.

The crossing of the Indian Ocean, between Mauritius and Fremantle, has been separated in three figures because in the middle part of this crossing no observations could be made on account of technical difficulties for submerging, save in one station at 91° longitude E. The first figure reaches from Mauritius up to 71° E., the second figure gives gravity for this station and the third extends from 106° E. up to the Australian coast.

Pays-Bas.

In general the mean anomalies over these oceanic stretches (with the exception of the Mid-Atlantic Ridge and the Bromley Plateau) are positive, certainly after isostatic reduction, but those near to the equator, between W. Africa and Brazil, are less; the free-air anomalies are decidedly negative here. As the continental stations on both sides show still larger negative anomalies, as the next table shows, it may be permitted to ask whether this part of the Earth's surface perhaps shows some general deviation, eventually brought about by a wrong figure for the Earth's flattening in the formula for standard gravity and whether the relative difference of oceanic gravity and continental gravity is not present here too.

The new figures in the North Atlantic, those in the South Atlantic and those in the Indian Ocean are certainly confirming this systematic difference. It is of fundamental importance to notice that the difference is only shown by the deeper parts of the oceans; the figures for the Mid. Atlantic Ridge and the Bromley Plateau as well as for the island of Tristan da Cunha show normal or negative anomalies (Madeira and Mauritius show also positive anomalies).

The positive anomalies in the Indian Ocean are in strong contrast with the longitude term, which has been supposed to exist in the value of gravity. According to this term, as it has been derived by Heiskanen and other geodesists, the Indian Ocean ought to show negative anomalies. So the results of the expedition are not in favour of a three-axial ellipsoid.

The following list gives the figures for the differences of the isostatic anomalies of the stations on the continental shelf and of the stations over deep water adjoining the shelf (oceanic minus continental values); not everywhere the discontinuity coincides exactly with the place where the depth increases, but it is always near to it. For this problem, the free-air anomalies cannot be used because of the effect of the topography which dominates all other effects; the figures which are given are roughly reduced according to the method of regional isostatic reduction. Uncertainties of 10 or 20 milligal may be expected.

Discontinuities near the coasts (oceanic minus continental anomalies).

Europe	End of the Channel	+ 100 milligal
W. Africa	S. E. of Canary Islands	+ 40 ,,
	Villa Cisneros	+ 60 ,,
	Dakar	+ 70 ,,
	Victoria	+ 50 ,,
S. America (E. Coast)	Pernambuco	+ 90 ,,
	Maceio	+ 100 ,,
	Belmonte	+ 20 ,,
	Rio de Janeiro	+ 10 ,,
	Domingo d. Torres	0 ,,
	Mar del Plata	+ 30 ,,
Tristan da Cunha		+ 70 ,,
S. Africa	Malmesbury (N. of Capet.)	+ 70 ,,
	Humansdorp (S.E. coast)	+ 50 ,,
	Bashee River (,,)	+ 20 ,,
	Durban	+ 40 ,,
S. Madagascar	from the west	+ 80 ,,
	towards the east	+ 80 ,,
W. Australia	Fremantle	+ 150 ,,
	N. W. Cape	+ 50 ,,

The great difference at Fremantle is partly caused by a strong negative anomaly of — 80 milligal in a few Australian stations near to the coast (Fremantle and Perth). Further inland the anomaly is less negative and so the difference from the deep sea stations is smaller.

The list shows that everywhere, with the exception of Rio de Janeiro and the stations to both sides of Rio de Janeiro, the same systematic discontinuity has been found as during previous expeditions. It thus becomes more and more probable that it occurs everywhere near the coasts. The exceptions near Rio de Janeiro and neighbouring stations are remarkable as they all occur in gravity profiles which don't run from the continent to the deep sea but to an adjoining submarine plateau of a depth which only slightly exceeds 2000 m. This encourages the supposition that this plateau has a continental character and that the discontinuity is related to the continental edge, which has not been reached.

The expedition promises results for many more local problems, as e.g. the question whether the gravity west of the Iberian Peninsula and of Marocco shows evidence of eventual crustal folding zones continuing in the ocean and the question whether the Romanche Deep (between W. Africa and Brazil) is compensated, but it is premature to draw conclusions about these problems from the provisional figures. The last question may probably be answered in the affirmative.

PUBLICATIONS.

In 1934 the Commission published: "Gravity Expeditions at Sea", Vol II, by F. A. Vening Meinesz in collaboration with J. H. F. Umbgrove and Ph. H. Kuenen. It contains the isostatic reduction of the results of the expeditions of the years 1923—1932 according to the Hayford-Bowie method, the Heiskanen-Airy method and the regional method. An attempt is given for an interpretation of the results. For the narrow strip of negative anomalies in the East Indies, the hypothesis of a buckling of the Earth's crust is put forward. For the positive anomalies in the oceans and in the deep basins of the East and West Indies the hypothesis of convection-currents in the substratum is advocated.