M A R E E S T E R R E S T R E S

B U L L E T I N d' I N F O R M A T I O N S

N° 9

15 décembre 1957

C S A G I

GROUPE XIII (GRAVIMETRIE)

COMMISSION POUR L'ETUDE DES MAREES TERRESTRES

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U C C L E

Belgique.

L.B. SLICHTER - (Los Angeles)

On a favorable period of observations in 1958 for the determination of a phase lag in Earth Tides.

(letter to Dr.G. Jobert,Paris)

During the lunar-solar cycles, there are, as you know, intervals of several days duration in which the diurnal tidal excitation terms are steady and remarkably simple. Gravity observations taken at such times may be expected to yield simple, significant information about the solid earth's response to the 12 and 24 hour terms, free of the complexities introduced both by rapidly varying components, and by the varying fortnightly excitations.

The enclosed graph shows the remarkable four-fold coincidence which will occur during the vernal equinox, on March 20-21, 1958. Then the lunar node, the apogee, and the new moon all occur nearly simultaneously at the vernal equinox. As a result, the excitation will be steady, and to our order of precision, purely harmonic at stations on the equator. During these two days, the term sin p (p lunar parallax) will vary less than 1/2 %, and the length of the lunar day will vary only a fraction of a minute. The solar term also will be simple, and in phase with the lunar term. For next March, we have been planning observations at Bukavu, (2 1/2 ° from the equator). There would obviously be great advantage in operating several stations simultaneously in central equatorial Africa, during March. Some of these advantages are:

(1) The probability of simultaneous gaps in the records, due to instrumental failures, would be small.

(2) The additional observations would reveal sources of systematic error,-- such as instrumental drifts, effects introduced by local foundation conditions, or local geological structures.

(3) The effective instrumental precision would be multiplied, because of the increased number of independent observations.

Because you have a La Coste-Romberg meter of high sensitivity, which is a duplicate of our two, I am writing to ask whether you might plan to cooperate with us in obtaining maximum observational material at this time in Africa. Perhaps Leopoldville would be a suitable second site. This area is far from the ocean, and in any event the coverage

at ocean stations during the IGY should greatly improve the accuracy of the corrections due to the water tides.

Recent studies, including those by Knopoff and Mac Donald at this Institute, indicate that the "Q" of crustal rocks, in the frequency range 1/10 cycle to several megacycles per second is constant at about 250. Similarly, Press, using surface waves of period 300 sec. from the Kamchatka earthquake, observes a "Q" of about 270. If the "Q" of the mantle at 12 hour periods (a period about 3000 fold longer than those usually observed in bodily seismic waves) is also about 250, then the phase lag T to be expected in the 12 hour term is $\frac{12}{T} = 250$, or $T = 1/20$ hour $= 3$ minutes. We may, with careful work, be able to detect such a phase lag. We might with luck extend by several orders of magnitude the frequency-range in which elastic losses in the earth are observed. It would, I think, be highly worthwhile to make the effort, during our IGY gravity program, and it seems that by good luck, the conditions in March will be ideal. I would welcome your comments, and would be delighted if you find it possible to collaborate with us in a project for the accurate determination of a potential phase-lag, under the favorable conditions presented during next March.

Table I

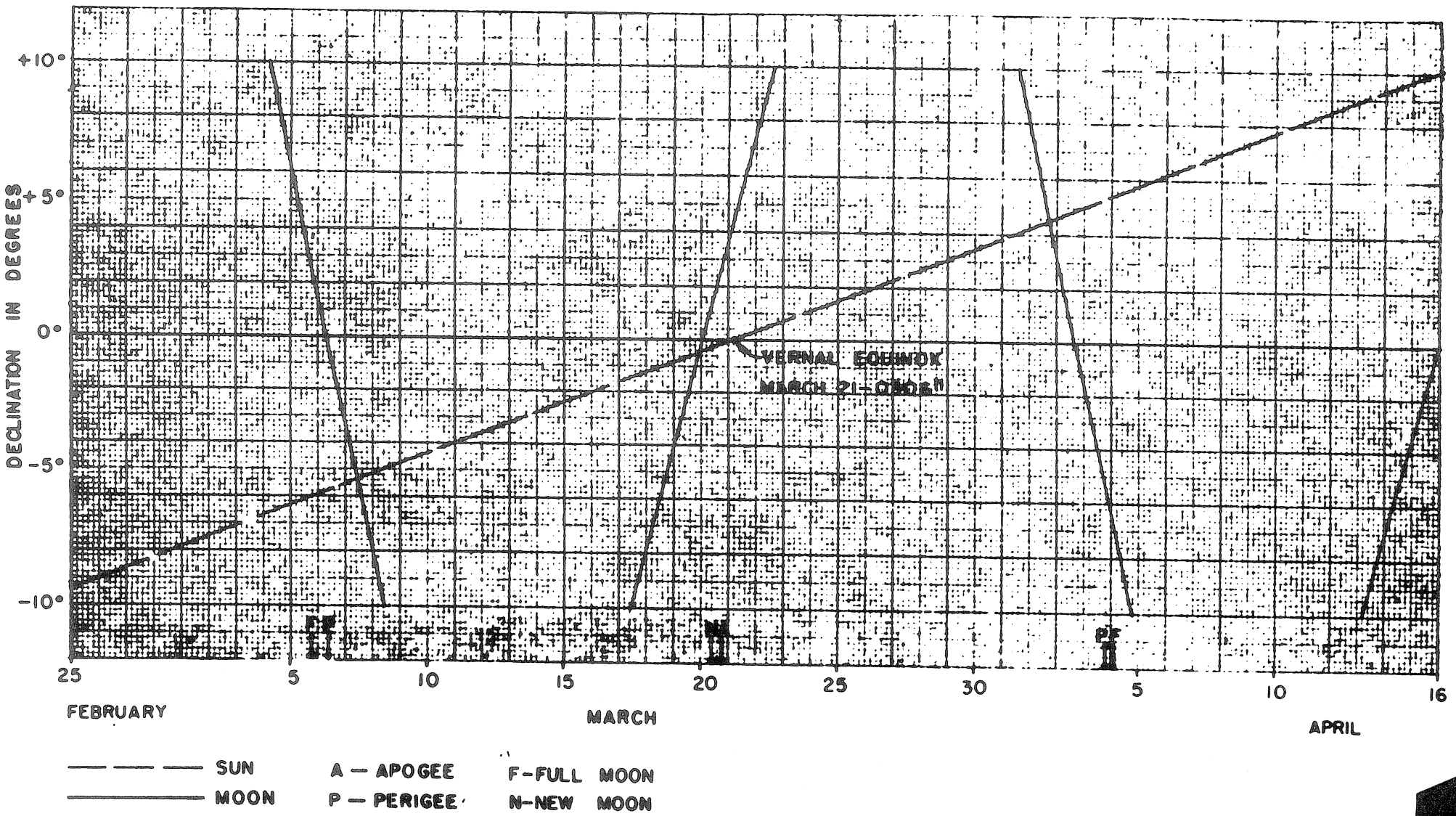
(re Moon, 1958)

Apogee & Perigee	Declination		Full and New Moon	Remarks
d - h	d h	o ' "	d h min.	
Jan. 9 - 00 P	Jan. 9 - 10	+4 57 48.0	Jan. 5 - 20 - 09 F	
	Jan.11 - 11	-4 48 57.0		
Jan.25 - 00 A	Jan.23 - 00	-4 53 08.8	Jan.19 - 22 - 08 N	
	Jan.25 - 12	+4 57 30.0		
Feb. 5 - 23 P	Feb. 5 - 20	+4 52 20.0	Feb. 4 - 08 - 05 F	
	Feb. 7 - 20	-4 57 20.9		
Feb.21 - 15 A	Feb.19 - 7	-4 58 23.9	Feb.18 - 15 - 38 N	
	Feb.21 - 20	+4 56 20.1		
Mar. 6 - 09 P	Mar. 5 - 7	+4 53 13.8	Mar. 5 - 18 - 28 F	Favorable
	Mar. 7 - 6	-4 51 36.5		
Mar.20 - 19 A	Mar.18 - 13	-4 57 48.3	Mar.20 - 09 - 50 N	Equinox Mar.21
	Mar.21 - 3	+4 59 50.5		Favorable

Apogee & Perigee	Declination		Full and New Moon	Remarks
d h	d h	o ' "	d h min	
Apr. 3-21 P	Apr. 1-18	+4 50 01.8	Apr. 4-03-25 F	
	Apr. 3-18	-4 59 33.9		Favorable
Apr.16-23 A	Apr.14-19	-4 54 04.1	Apr.19-03-23 N	
	Apr.17- 9	+4 59 47.5		Favorable
May 2-06 P	Apr.29- 3	+4 49 43.3	May 3-12-23 F	
	May 1- 4	-4 54 08.9		
May 14-11 A	May 12- 2	-4 52 17.8	May 18-19-00 N	
	May 14-15	+4 53 27.6		
May 30-07 P	May 26-10	+4 50 51.3		
	May 28-13	-4 59 15.7		
June11-05 A	June 8-10	-4 57 48.4	June 1- 2-55 F	
	June10-23	+4 52 31.4		
June26-09 P	June22-16	+4 54 28.7	June17-07-59 N	
	June24-19	-4 48 43.6		
July 8-23 A	July 5-20	-4 53 38.6	July 1-06-04 F	
	July 8- 9	+4 59 46.7		
July21-11 P	July19-23	+4 54 43.0	July16-18-33 N	
	July22- 2	-4 53 40.9		Favorable
Aug. 5-18 A	Aug 2- 5	-4 55 10.7	July30-16-47 F	
	Aug. 4-18	+4 57 05.7		
Aug.17-15 P	Aug.16- 8	+4 50 19.9	Aug.15-03-33 N	
	Aug.18-10	-4 57 40.0		Favorable
Sept.2-11 A	Aug.29-13	-4 51 56.7	Aug.29-05-53 F	
	Sept 1- 2	+4 54 54.2		
Sept14-17 P	Sept12-18	+4 51 28.5	Sept.13-12-02 N	
	Sept14-19	-4 52 00.3		Favorable
Sept29-22 A	Sept25-19	-4 52 54.1	Sept.27-21-43 F	

Apogee & Perigee	Declination		Full and New Moon	Remarks
	Sept. 28- 9	+4 56 44.2		Equinox Sept. 23
Oct. 13-02 P	Oct. 10- 4	+4 57 45.5	Oct. 12-20-52 N	
	Oct. 12- 6	-4 52 52.6		
Oct. 27-00 A	Oct. 23-00	-4 59 08.1	Oct. 27-15-41 F	
	Oct. 25-15	+4 56 15.2		
Nov. 10-14 P	Nov. 6-14	+4 53 23.7	Nov. 11-06-34 N	
	Nov. 8-17	-4 53 02.0		
Nov. 23-05 A	Nov. 19- 7	-4 58 35.0	Nov. 26-10-16 F	
	Nov. 21-22	+4 59 17.3		
Dec. 9-00 P	Dec. 3-22	+4 51 50.3	Dec. 10-17-23 N	
	Dec. 6- 3	-4 58 40.4		
Dec. 20-21 A	Dec. 16-16	-4 59 50.1	Dec. 26-03-54 F	
	Dec. 19- 6	+4 56 15.9		

DECLINATION OF SUN AND MOON, FEBRUARY 25 TO APRIL 16, 1958.



JAPANESE REPORT OF WORKING GROUP XIII-GRAVIMETRY

Part 1. (July 1957-Oct.1957)

The present status of Working Group XIII in Japan is as follow:

I. Gravimetry Stations.

The list of gravimetry stations in Japan is shown in Table I.

II. Earth Tide Studies.

The stations for measuring earth tides are classified two groups: one is for continuous recording of long periods such as the whole IGY period: the other is for short periods of about one month. The locations and the instruments are described in Table I.

A) Long period stations.

Ichinohe type gravity variometers have been almost set up in the stations, but the drifts caused by the after effects of transporting the instruments are still somewhat large, so the records are now taken with below expecting sensitivity.

Observations at Kanozan by means of an Askania Gs-11 gravimeter will be commenced after the installation of Kanozan observatory of the Geographical Survey Institute, which is now under construction, are completed.

B) Short period stations.

Observations at the laboratory of the Geographical Survey Institute in Chiba were commenced at the end of June 1957 by means of the Askania Gs-11 Gravimeter and will be continued until the instrument is moved to the Kanozan observatory.

Observations by members of Kyoto University are in progress smoothly using another Askania Gs-11 Gravimeter. The thirty-five day observations at Kyoto (C 181), Matsushiro (C 142) were

already finished and now the observation is carring out at Omaezaki (——).

C) Preliminary results

Preliminary results worked out from the tidal gravity changes obtained at Kyoto, Matsushiro and Chiba by means of Darwin's method are shown in Table II.

D) Anomalous changes.

Anomalous gravity changes were occasionally appeared on the records. In some cases periodic anomalous changes of about 20 minute period were continued several waves and the other cases were non-periodic.. During the period of the first thirty-five day observations at Kyoto and Chiba, the anomalous changes of about 60 times were appeared at Kyoto station and 50 times at Chiba station. About 20 times of these anomalous changes were recorded commonly at the both stations. Causes for these anomalous changes have not yet been clarified..

During that period earthquakes were recorded several times.

III. Gravity Measurements.

In order to make the gravity tie between Japan and the Antarctic, three members of the Geographical Survey Institute were dispatched by the Japanese Antarctic Research Expedition Ship "Soya", which left from Tokyo on 21th October 1957. The gravity measurements will be carried out at Singapore and Cape-town on the way for and from the Antarctic as well as at the Japanese antarctic research station named Showa Base, Ongul Island, by means of a GSI pendulum apparatus and a Worden Gravimeter.

Gravity measurements for IGY stations in the interior of Japan will be carried out shortly by means of gravimeters.

T. Okuda
The convener
Working Group XIII.

Table 2

Station	Lat.	Long.	Height	Epoch	Period	M_2	k	S_2	k
Kyoto	35°02'	135°47'	58^m	VII, 1,1957	30^{day}	1.14±0.01	+1°51	1.06 ±0.01	+4°75
Chiba	35°38'	140°06'	27^m	VII, 1.1957	30	1.12±0.01	+0°95	0.94 ±0.01	-9°70
Matsushiro	36°32'	138°13'	434^m	VIII 26,1957	30	1.16±0.01	+1°62	1.14 ±0.02	-1°69

Station	K_1	k	O_1	k
Kyoto	1.17 ± 0.08	+ 12°12	1.05 ± 0.04	1°46
Chiba	0.91 ± 0.06	+ 9°65	0.97 ± 0.04	-0°82
Matsushiro	0.71 ± 0.08	- 7°74	0.89 ± 0.03	-0°18

Primary values analysed by means of Darwin's method.

Station: VEDRIN — Belgique

Latitude 50°30'
Longitude 4°51'30" E
Altitude 173 mètres
Profondeur cave 80 mètres

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(Dr. J. Verbaandert (Observatoire Royal)
(Ing. Géol. A. wery (x)

Station permanente, début des observations au printemps 1958

Nature du sol: terrain remanié; les appareils reposent sur un plancher de béton

Nature du sous-sol: calcaires viséens du bord nord du synclinorium de Namur; proximité d'un filon métallifère sulfureux exploité.

Equipement: 1 paire de pendules horizontaux en quartz construits à l'Observatoire Royal de Belgique.

1 gravimètre Askania G S 11 enregistreur (gravimètre n° 98 appartenant à l'Institut Géographique Militaire)
enregistreur du FNRS.

(x) La mise en place de cette station pour l'étude des marées terrestres résulte d'une collaboration étroite entre l'Observatoire Royal de Belgique, l'Ing. L. Jones, chef du service Gravimétrique de l'Institut Géographique Militaire et l'Ing. Wéry Géologue.

Station: WARMIFONTAINE — Belgique

Latitude 49°50'
Longitude 5°22'50" E
Altitude 390 mètres
Profondeur cave 148 mètres

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Station permanente, début des observations au printemps 1958

Nature du sol : terrain remanié (déchets d'ardoises)

Nature du sous-sol: Phyllades (schistes ardoisiers) siegeniens (hunsruckiens supérieurs) du bassin dévonien de l'Eifel.

Equipement: 1 paire de pendules horizontaux en quartz construits à l'Observatoire Royal de Belgique

1 paire de pendules horizontaux Tomaschek-Ellenberger (en commande appartenant à l'Observatoire Royal de Belgique).

1 gravimètre Askania G S 11 enregistreur (en commande, appartenant à l'Observatoire Royal de Belgique).

Remarques: Cet équipement constitue une partie des installations de la station géophysique souterraine de l'Observatoire Royal de Belgique à Warmifontaine.

(x) La mise en place de cette station belge pour l'étude des marées terrestres résulte d'une collaboration étroite entre l'Observatoire Royal de Belgique, l'Ing. L. Jones, chef du Service Gravimétrique de l'Institut Géographique Militaire et l'Ing.Wéry Géologue.

Station: BATTICE — Belgique

Latitude 50°38' N
Longitude 5°48'30" E
Altitude 330 mètres
Profondeur 30 mètres

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(Dr. J. Verbaandert (Observatoire Royal),
(Ing. Géol. A.Wéry (x)

Station temporaire, trois mois au cours de 1958 ou 1959

Nature du sol: terrain remanié; les appareils reposent sur un plancher de béton

Nature du sous-sol: craies du crétacé supérieur surmontant le houiller du bassin de Herve (région orientale du synclinal de Liège).

Equipement: 1 Gravimètre Askania G S 11 enregistreur (à prélever pour trois mois soit à Vedrin, soit à Warmifontaine)

(x) La mise en place de cette station belge pour l'étude des marées terrestres résulte d'une collaboration étroite entre l'Observatoire Royal de Belgique, l'Ing. L. Jones, chef du service Gravimétrique de l'Institut Géographique Militaire et l'Ing. Wéry, Géologue.

Station: MARTELANGE Belgique

Latitude 49°50' N
Longitude 5°43'40"E
Altitude 375 mètres
Profondeur cave 144 mètres

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(Dr. J. Verbaandert (Observatoire Royal)
(Ing.Géol. A. Wéry (x)

Station temporaire, trois mois au cours de 1958 ou 1959

Nature du sol: terrain remanié (déchets d'ardoises).

Nature du sous-sol: Phyllades (schistes ardoisiers) siegeniens (hunsruckiens supérieurs) du bassin dévonien de l'Eifel; proximité d'une faille importante.

Equipement: 1 Gravimètre Askania G S 11 enregistreur (à prélever pour trois mois soit à Vedrin soit à Warmifontaine.

(x) La mise en place de cette station belge pour l'étude des marées terrestres résulte d'une collaboration étroite entre l'Observatoire Royal de Belgique, l'Ing. L. Jones, chef du service Gravimétrique de l'Institut Géographique Militaire et l'Ing. Wéry Géologue.

EXTRAIT DE LA 3e EDITION DES AMENDEMENTS AU GUIDE DU CSAGI DES CENTRES MONDIAUX DE RASSEMBLEMENT DES DONNEES DE L'AGI. (Bureau du Coordinateur de l'AGI le 20 novembre 1957).

Section XIII, p.13

France liste des stations

B362 Bagnères de Bigorre
B359 Besançon
B156 Paris-Observatoire
B260 Pic du Midi
B158 Strasbourg
C139 Alger
E583 Bangui
C357 Beni Abbes
C311 M'Bour
C273 Tamanrasset

Inde (Geodetic and Research Branch, Survey of India, Dehra Dun)

"/USA E498 Delhi
"/USA E537 Bombay

Documents reçus aux Centres Internationaux.

Japon.

Station CHIBA	Tableaux mensuels I à V de juillet 1957 (Gravimètre Askania G S 11)	
Station KYOTO	Tableaux mensuels I à V de juillet 1957 (Gravimètre Askania G S 11)	
Station MATSUSHIRO	Tableau mensuel V	août 1957

Les Tableaux V de ces trois stations sont reproduits p. 145 du présent bulletin.

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