OCEANOGRAPHY

A STUDY OF THE SEMI-ANNUAL COMPONENT OF SEA LEVELS IN THE ASIATIC ARCHIPELAGO.

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The results relating to the second half-year of the years 1927, 28, 29 and 30 have been summarized in the table below. For each of the years under consideration will be found the total variation of the sea levels in centimetres (col. I) the value in centimeters of the maximum amplitude of the semi-yearly component (col. II) and the date on which this maximum occurs (col. III). The tidal stations for which the maximum occurs approximately on the same date have been assembled in the same group; the five following groups will be found in the table: group 1, in which the maximum occurs from November 10 to 24; group 2, with the maximum between Nov. 13 and December 1st; group 3. from Nov. 25 to January 15; group 4 in which the maximum takes place in January-February and group 5, in which the maximum is reached in February.

1st. Phase. — In each group and for each year under investigation, the different stations may be considered as being in phase. Anomalies may be due merely to the fact that the component under investigation could not be isolated in a pure enough condition, owing to its very low amplitude.

The stations of each group on the chart, are aligned along the curves which follow the general contour of the coasts of Sumatra and Java in the Indian Ocean and which constitute isophases for the half-yearly component. There is an exception as regards group 3 whose stations have a component in phase opposition the those of the neighbouring stations, such as Toeban and which should be placed, on account of their geographical position, in group 2; it was observed, in a previous note (1), that the same anomaly occurred in the case of the yearly component of these stations.

Geing from one group to the next, the maximum of the half-yearly component takes place later and later. It becomes dephased in the sense of retardation when moving from the Indian Ocean towards the continent.

Finally, it may be observed that, on all stations in groups 1 and 5, the maximum of the half-yearly component occurs in the same period as the minimum of the yearly component; the same coincidence takes place at Belawan (group 2). In groups 2, 3 and 4, it seems to be the reverse, but in a less apparent form; thus in group 3, the stations of Prigi-Radja, Soesang, Oepang and Menade appear to be exceptions, but we noticed that the phase of their half-yearly component is very indefinite. To sum up, the stations situated on the Indian Ocean (group 1) or directly under its influence (Belawan) have a maximum of half-yearly component which coincides with that of the yearly one, the reverse takes place in the sea of Java, with the only exception of particular stations in group 5.

The upshot of the previous remarks is that the half yearly component of the sea of Java is behind that of the Indian Ocean.

2° Amplitude. — In the ports of the west coast of Sumatra, the amplitude of the component under investigation is about one third of the total variation of sea levels; this component is therefore an important one; it is still so on the south coast of Java, where its amplitude reaches, on an average, one quarter of the level variation. The proportion becomes one fifth on the north coast of Java, as well as at Belawan, which is a port

(1) *See :* ("Hydrographic Review" Vol. XIX, August 1942, p. 48).

	71	1927			1928			1929			1930		
		I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
1.	Sibolga	—	—	—	—	—	—	—	—	—	22	9,3	18 Nov.
	Emmahaven	26	5,3	12 Nov.	21	5,3	14 Nov.	22	5,6	10 Nov.	25	8,5	20 »
	Benkoelen	30	6,2	12 »	35	9,8	15 »	34	6,2	12 »	27	8	17 »
	Kroé	—	—	—	—	—	—	—	—	—	27	11	15 »
	Plaboean Ratoe	—	—	—	—	—	—	36	—	—	32	9,2	22 »
	Tjilatjap	31	4,4	12 Nov.	25	4	16 Nov.	40	5,1	10 Nov.	31	8,1	24 »
	Padjitan	—	—	—	19	—	—	44	4	14 Oct.	32	8,1	20 »
	Amboina	—	—	—	—	—	—	—	—	—	16	1,2	15 »
2.	Belawan	29	5,8	17 Nov.	33	4,6	18 Nov.	27	5,9	16 Nov.	33	7,4	30 »
	Bengkalis	—	—	—	—	—	—	—	—	—	14	6,5	28 »
	Tandjong Priok	22	4,2	17 Nov.	20	4,2	17 Nov.	20	4,8	12 Nov.	25	4	20 »
	Batavia	—	—	—	22	4,6	19 »	22	4,7	12 »	23	4,8	28 »
	Cheribon	16	4,4	17 Nov.	19	4,4	17 »	17	4,9	12 »	20	4,1	24 »
	Tegal	23	3,3	12 »	22	2,7	28 »	26	3,6	14 »	25	2,7	23 »
	Pekalongan	12	3,2	15 »	18	3,2	30 »	14	4,5	15 »	20	4,3	24 »
	Semarang	13	3,7	15 »	13	2,1	30 »	10	4,2	10 »	16	4,3	24 »
	Toeban	—	—	—	—	—	—	—	—	—	22	3,1	23 »
3.	Prigi Radja	—	—	—	—	—	—	—	—	—	15	0,7	1er Oct.
	Tambilahan	—	—	—	44	—	—	31	3	30 Déc.	31	3	15 Déc.
	Soensang	—	—	—	33	—	—	35	0,9	25 Nov.	34	0,7	5 Jan. (30)
	Oepang	—	—	—	—	—	—	70	5	18 Nov.	76	4,5	19 Nov.
	Moesangketjil	—	—	—	—	—	—	—	—	—	16	—	15 Déc.
	Bandjermasin	37	—	—	59	4,8	28 Déc.	35	2,4	10 Déc.	39	5,2	25 Déc.
	Makassar	24	2	28 Déc.	24	3,6	20 »	34	2,1	10 Jan. (30)	28	1,3	15 Jan. (31)
	Manado	26	—	—	7	0,7	5 »	17	0,5	15 Déc.	15	3,2	5 Déc.
4.	Pontianak	—	—	—	66	—	—	90	4	25 Jan.	92	8,3	5 Fév.
5.	Soerabaya	14	3,3	25 Fév.	12	3	28 Fév.	13	2,9	27 Fév.	20	4,7	14 Fév.
	Sambilangan	16	4	25 »	14	3,5	28 »	11	3	28 »	20	4,6	12 »
	Djamoeanrif	16	3,4	25 »	16	3,8	28 »	14	2,8	28 »	17	3,6	12 »

situated on the north-east coast of Sumatra; and about one third at Bengkalis, between Sumatra and the Peninsula of Malacca.

On all other stations, the amplitude of the component of six months is frequently a very small fraction of the total variation of the levels (from 1/15 to 1/40) this ratio obtains particularly on stations in group 3. It should be noted that the amplitude of the component under consideration passes suddenly from a value of 7 cm. (1/3 of the total variation) at Bengkalis, to a value of 7 m/m (1/25 of the various) at Prigi-Radja, which two ports are fairly near each other but separated by many close small islands.

We may now definitely state that the ratio of the amplitude of the annual component to that of the half-yearly one never exceeds 2, in groups 1, 2, 4 and 5, and that it seems very high in group 3, where it reaches 15 when at all calculable.

As a rule, in the sea of Java, the half yearly component has an amplitude below that of the annual one and forms a small portion of the total variation of the sea level; the reverse occurs on the coasts of the Indian Ocean.

On the whole, these remarks suggest, there again, the existence of two separate systems of half-yearly components.