ON THE TIDES AND TIDAL CURRENTS IN THE NORTHERN PART OF THE HWANG HAI (YELLOW SEA)

by

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(In Japanese. *Suiro Yôhô* (Hydrographic Bulletin) 12 (1933), pp. 47-61, 89-99, 137-149, 18 pl.).

Extract from the *Japanese Journal of Astronomy and Geophysics*, Vol. XI, No. 3
National Research Council of Japan, Tokyo, 1934, pp. (41)-(42).

The author first gives the results of current observations at twelve stations remote from land in the Hwang Hai made within recent years by the Hydrographic Department and fisheries institutions of Japan. The observations at each station were made at various depths below the surface and extended for about 24 hours. The author decomposed the observed currents into the north and east components, and then each of them into semi-diurnal and diurnal components by assuming a period of 24 hours 50 minutes. The direction, velocity and time of the maximum and minimum currents were obtained both for semi-diurnal and diurnal currents. By assuming probable relations existing among the amplitudes and phase lags for semi-diurnal component tides and those for diurnal components, the author derived the harmonic constants of M_2 and K_1 currents for the directions of the maximum and minimum velocities. The results of observations and analysis may be summarized as follows : —

1. The oceanic or non-periodic current seems to increase with the depth below the surface, but there is no definite relation between the depth and direction of current. The depths of the sea at current stations are from 31 to 76 metres.

2. For the semi-diurnal current the direction revolves with time counter-clockwise at the greater number of stations ; for the diurnal current the number of stations at which the direction revolves counter-clockwise and clockwise is nearly equal, the velocity of diurnal current being generally smaller than that of semi-diurnal current.

3. The results of current observations at six stations show that the time of the maximum velocity of current is nearly the same at various layers below the surface, that the direction of the maximum velocity is nearly the same from the surface of the sea to the bottom, and finally that the velocity of current at a depth D (expressed by unit of the depth of the sea) below the surface at the time of maximum strength can be expressed by the following formula :

$$\text{Velocity} = 0.87 + 1.11\,D - 1.27\,D^2$$

4. The results of current observations above stated as well as those made at a number of coastal stations extending over a shorter period show that semi-diurnal current is nearly simultaneous all over the northern part of the Hwang Hai, running with its maximum strength to the north-east or to the east towards the Oryoku Kô (Yalu River) at 6.4 hours (lunar time of the meridian 135° E.) and to the opposite direction at 0.4 hour.

5. The directions of diurnal current in the northern part of the Hwang Hai are principally in the east and west and the time of turn of current slightly retards from the east to west.

6. In the western half of the northern part of the Hwang Hai, or on the north side of the Shantung Peninsula, the diurnal inequality of tidal currents is very conspicuous and the current diagram is very complicated, the current often running once to the east and once to the west in a day when the moon is far from the equator.

In conclusion, the author studies the tides in the northern part of the Hwang Hai by the data of current observations and tidal observations. He calculates the gradient of sea-level and directions of co-tidal and co-range lines by using the data of current observations. From the gradient of sea-level thus obtained, combined with the data of tidal observations on the coast, the tidal constants at each current station were obtained. Finally he prepared a co-tidal and co-range chart of tides M_2 and K_1. The characteristic feature of the co-tidal chart of M_2 is the existence of an amphidromic point very near to the east of the Shantung Promontory, around which the tidal wave revolves counter-clockwise in 12 hours. The co-tidal chart of K_1 tide shows that an amphidromic point exists in the Pwok Hai very near to the Pechili Strait, around which the tidal wave revolves counter-clockwise in 24 hours.

ON THE CURRENT IN THE OKHOTSK SEA AND THE ORIGIN OF THE "OYASIO"

by

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(In Japanese. *Suiro Yôhô* (Hydrographic Bulletin) 12 (1933), pp. 325-8, 3 pl.).
Extract from the *Japanese Journal of Astronomy and Geophysics*, Vol. XI, No. 3,
National Research Council of Japan, Tokyo, 1934, page (42).

The author has prepared two dynamical charts of the Okhotsk Sea in the summer season, one from the results of hydrographical observations made in 1916 by the *Unyô Maru* belonging to the Imperial Fisheries Institute, and the other from observations made in 1917. These charts reveal a south-going current in the middle part of the sea. One part of this current returns northward off the west coast of Kamchatka, and the remaining part runs out to the Pacific through the middle part of the Kurile Islands. In the western part of the sea it is expected that several systems of vertical currents will be found to exist.

AN ANNUAL PERTURBATION IN THE RANGE OF TIDE.

by

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(Extract from *Proceedings of the Royal Society, A, Vol.* 144, London 1934, pages 538-559).

On several occasions seasonal changes in the semi-diurnal tides have been ascertained to exist. In 1902 and 1903, DARWIN noted their presence at Ross Island in the Antarctic; others have been noted in Chesapeake Bay and its tributaries, from monthly averages calculated. In 1925 the Tidal Institute noted their existence in the tides of Newchwang.

Tidal analysis in the past has been restricted to a search for constituents indicated by the tide generating potential and by the shallow water theory. In the Report of the British Association for 1923, Professor PROUDMAN has shown that additional frictional constituents are possible. However, none of the above suggests an annual variation in the range of tide. For the purpose of continuing the investigations, a direct method of analysis for such an annual perturbation was considered desirable.

Constituents which will produce an annual perturbation of M_2 may be considered as having either of the following arguments:

$$\left[(\text{Argument of } M_2) - h\right]$$

or

$$\left[(\text{Argument of } M_2) + h\right],$$