

ON INVESTIGATIONS OF THE TIDAL WAVES M_f AND M_m

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ABSTRACT

The comparison of astronomical time observations with the theory of solid-Earth tides makes it possible to determine the Love number, k , which characterizes the elastic properties of the Earth. In addition, the comparison of values of k determined from different tidal waves allows us to judge the accuracy of the nutational theory in astronomical observations since both tides and the Earth's nutation are produced by the same causes.

The non-uniformity of the Earth's rotation has been investigated previously (Djurovic, 1975, 1976; Guinot, 1970, 1974; Pil'nik, 1970, 1974, 1975, 1976) to derive k . These works show that the Love number derived from the M_f tide, $k(M_f)$, is greater than that for the M_m tide, $k(M_m)$. In this investigation 9103 residuals of observed Universal Time made from 1951 to 1975 were analyzed. This extended series of observations was based on Standard Time results from 1951 to 1967 and Bureau International de l'Heure results from 1968 to 1975. Only the M_f and M_m tidal waves were investigated using Tukey's method of spectral analysis. The Love numbers were estimated using the methods of Pil'nik (1974).

This analysis yields the estimates for the Love numbers, $k(M_f) = 0.301 \pm 0.005$, and $k(M_m) = 0.282 \pm 0.004$. A phase shift in the M_f wave is found to change considerably, depending on the length of the data record analyzed. The elliptical wave M_m is delayed in phase by more than one day.

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DISCUSSION

- B. Guinot: In similar studies, using the same method as Pil'nik, I found a strong dependence of the value of k derived from the M_f wave on the position in time of the interval under consideration. Has Pil'nik found such a phenomenon?
- Ya. S. Yatskiv: Pil'nik uses a technique of direct comparison between theoretical results and observations; it is not necessary to be able to separate the contributions of the M_f and M_m waves.
- N. P. J. O'Hara: Over how long an interval does the series of observations extend? A 20-year series is long enough to enable the terms at 13.66 and 13.63 days to be resolved from each other.
- Ya. S. Yatskiv: That is true if you are using the method of least squares, but in the method employed here the window prevents separation of these terms.