

The Harmonic Tide Plane is an endeavour to express this level of low water at ordinary spring tides, in the harmonic notation. It was first defined in the Tide Tables for India, where the method of harmonic analysis was first extensively used for tidal reduction; and it is there termed "Indian spring low-water mark." In this analysis, the various elementary tidal undulations, considered as functions of time, are all referred to Mean Sea Level as their horizontal axis. The Harmonic Tide Plane is defined as being at the vertical distance below Mean Sea Level, which is given by the sum of the semi-amplitudes of the following harmonic components:—

M_2 the principal lunar semi-diurnal component.

S_2 " " solar " " "

K_1 the luni-solar diurnal component.

O_1 the lunar diurnal component, due to the moon's change in declination.

In the level as thus defined, the two leading components which go to make up the diurnal inequality, are included. This must be considered as a compromise, to represent the ordinary practice of taking the diurnal inequality into account, in arriving at the low-water datum. In the formula given in the United States Tide Tables, these same components are used to represent the diurnal inequality, but they are modified by a function of their arguments; the level of the harmonic tide plane being defined by the following sum:—

$$M_2 + S_2 + (K_1 + O_1) \sin \frac{1}{2} (M^\circ - K^\circ - O^\circ)$$

(See Tide Tables, U.S. Coast Survey, for 1897, page 17, foot note.)

We are able to give two examples of the relation between these planes of reference, for two of our harbours, Quebec and Halifax. At these, the original low-water datum of the Admiralty charts was definitely fixed by reference to a bench-mark, and the Harmonic Tide Plane has now been determined from the observations; and the actual relation between them will be seen from the levels now given for these harbours.

From these explanations, it is evidently very difficult to re-determine the low-water datum when its level is left unrecorded; and at best, the result arrived at is uncertain. It may, therefore, be excusable to emphasize the primary importance of bench-marks in maritime matters, as well as for reference in the construction of harbour works; as this does not seem to be as fully appreciated, even by mariners and ship owners, as it deserves to be. For if the trouble