

*Céleste* (in which the ratio of the heights of spring-tides and neap-tides was computed on an assumed mass of the moon) without an alteration of level which was, in fact, equivalent to an alteration of the moon's mass. Thus all things appeared to tend to show that the Equilibrium-theory would give the *formulæ* for the inequalities of the tides, but that the *magnitudes* which enter into these formulæ must be sought from observation.

Whether this result is consistent with theory, is a question not so much of Physical Astronomy as of Hydrodynamics, and has not yet been solved. A Theory of the Tides which should include in its conditions the phenomena of Derivative Tides, and of their combinations, will probably require all the resources of the mathematical mechanician.

As a contribution of empirical materials to the treatment of this hydrodynamical problem, it may be allowable to mention here Mr. Whewell's attempts to trace the progress of the tide into all the seas of the globe, by drawing on maps of the ocean what he calls *Cotidal Lines*;—lines marking the contemporaneous position of the various points of the great wave which carries high water from shore to shore.<sup>46</sup> This is necessarily a task of labor and difficulty, since it requires us to know the time of high water on the same day in every part of the world; but in proportion as it is completed, it supplies steps between our general view of the movements of the ocean and the phenomena of particular ports.

Looking at this subject by the light which the example of the history of astronomy affords, we may venture to repeat, that it will never have justice done it till it is treated as other parts of astronomy are treated; that is, till Tables of all the phenomena which can be observed, are calculated by means of the best knowledge which we at present possess, and till these tables are constantly improved by a comparison of the predicted with the observed fact. A set of Tide-observations and Tide-ephemerides of this kind, would soon give to this subject that precision which marks the other parts of astronomy; and would leave an assemblage of unexplained *residual phenomena*, in which a careful research might find the materials of other truths as yet unsuspected.

[2d Ed.] [That there would be, in the tidal movements of the ocean, inequalities of the heights and times of high and low water *corres-*

---

<sup>46</sup> *Essay towards a First Approximation to a Map of Cotidal Lines. Phil. Trans. 1833, 1836.*