

Disturbances of equilibrium and consequent movements of the waters are partly irregular and transitory, dependent upon winds, and producing waves which sometimes, at a distance from the shore and during a storm, rise to a height of more than 35 feet; partly regular and periodic, occasioned by the position and attraction of the sun and moon, as the ebb and flow of the tides; and partly permanent, although less intense, occurring as oceanic currents. The phenomena of tides, which prevail in all seas (with the exception of the smaller ones that are completely closed in, and where the ebbing and flowing waves are scarcely or not at all perceptible), have been perfectly explained by the Newtonian doctrine, and thus brought "within the domain of necessary facts." Each of these periodically-recurring oscillations of the waters of the sea has a duration of somewhat more than half a day. Although in the open sea they scarcely attain an elevation of a few feet, they often rise considerably higher where the waves are opposed by the configuration of the shores, as, for instance, at St. Malo and in Nova Scotia, where they reach the respective elevations of 50 feet, and of 65 to 70 feet. "It has been shown by the analysis of the great geometrician Laplace, that, supposing the depth to be wholly inconsiderable when compared with the radius of the earth, the stability of the equilibrium of the sea requires that the density of its fluid should be less than that of the earth; and, as we have already seen, the earth's density is in fact five times greater than that of water. The elevated parts of the land can not therefore be overflowed, nor can the remains of marine animals found on the summits of mountains have been conveyed to those localities by any previous high tides."*

It is no slight operations we have further confirmation of the equilibrium of the waters which communicate round Cape Horn. (Arago, in the *Annuaire du Bureau des Longitudes pour 1831*, p. 319.) I had inferred, from barometrical observations instituted in 1799 and 1804, that if there were any difference between the level of the Pacific and the Atlantic (Caribbean Sea), it could not exceed three meters (nine feet three inches). See my *Relat. Hist.*, t. iii., p. 555-557, and *Annales de Chimie*, t. i., p. 55-64. The measurements, which appear to establish an excess of height for the waters of the Gulf of Mexico, and for those of the northern part of the Adriatic Sea, obtained by combining the trigonometrical operations of Delcrois and Choppin with those of the Swiss and Austrian engineers, are open to many doubts. Notwithstanding the form of the Adriatic, it is improbable that the level of its waters in its northern portion should be 28 feet higher than that of the Mediterranean at Marseilles, and 25 feet higher than the level of the Atlantic Ocean. See my *Asie Centrale*, t. ii., p. 332.

* Ressel, *Ueber Fluth und Ebbe*, in Schumacher's *Jahrbuch*, 1838, s. 225