bly the *raz de marée* of the French coast, which occasionally rise to a height of several feet, and, where the shores converge inland, do considerable damage. Still more serious are the effects of a violent cyclone-storm. The mere diminution of atmospheric pressure in a cyclone must tend to raise the level of the ocean within the cyclone limits. But the further furious spiral inrushing of the air toward the centre of the low-pressure area drives the sea onward, and gives rise to a wave or succession of waves having great destructive power. Thus, on 5th October, 1864, during a great cyclone which passed over Calcutta, the sea rose in some places 24 feet, and swept everything before it with irresistible force, drowning upward of 48,000 people.

Besides the height and force of waves it is important to know the depth to which the sea is affected by such superficial movements. Sir G. Airy states that ground-swell may break in 100 fathoms water.[256] It is common to find bowlders and shingle disturbed at a depth of 10 fathoms, and even driven from that depth to the shore, and waves may be noticed to become muddy from the working-up of the silt at the bottom, when they have reached water of 7 to 8 fathoms in depth.[257] In the English Channel coarse sediment is disturbed at depths of 30 or more fathoms.[258] It is stated by Delesse that engineering operations have shown submarine constructions to be scarcely disturbed at a greater depth than 5 metres (16·4 feet) in the Mediterranean and 8 metres (26·24 feet) in the Atlantic.[259] In the Bay of Gas-

[256] Encyclopedia Metropolitana, art. "Waves." Gentle movement of the bottom-water is said to be sometimes indicated by ripple-marks on the fine sand of the sea-floor at a depth of 600 feet.

[257] T. Stevenson's "Harbors," p. 15.

[258] A. R. Hunt, Proc. Roy. Dublin Soc. iv. 1884, p. 285. For further information on this subject see postea, pp. 451, 455.

[259] "Lithologie des Mers de France," 1872, p. 110.