the less is the effect of change of pressure ; though this may, after all, be no general rule. But since the effects of variations of pressure do not accurately follow the in­verse ratio of the specific gravities of water and of mercury, it is doubtful if the tides and these effects be independent of each other.

The effects of wind on the level of the sea do not seem to have been much attended to ; but Mr Lubbock has collected some important facts regarding its influence on the Thames. During strong north-westerly gales, the tide in the port of London marks high water earlier than other­wise, and does not give so much water, while the ebb tide runs out later, and marks lower ; but upon the gales abat­ing and the weather moderating, the tides put in and rise much higher, while they also run longer before high water is marked, and with more velocity of current, nor do they run out so long or so low. The reason assigned for all this is, that the strong north-west winds drive the sea along the Dutch coast, through the Straits of Dover, and conse­quently away from the mouth of the Thames; so that the tides during north-west winds are always much higher (producing frequently ruinous flooding) on the Dutch than upon the English coast. A south-westerly gale generally has a contrary effect, and an easterly one gives some water ; but the tides in all these cases always improve the moment the weather moderates. This is the opinion of those most competent to form one from their daily experience, and is no doubt correct. The subject is one of considerable im­portance as regards the accuracy of which tide predictions are susceptible, and merits further inquiry, in order to ascertain if possible the error which may be expected for a wind of a given force and direction.

The progress of the tide-wave in most places must obvi­ously be liable to be disturbed by great storms. Thus, during a violent hurricane, January 8. 1839, there was no tide at Gainsborough, twenty-five miles up the Trent, a circumstance unknown before. At Saltmarsh, only five miles up the Ouse from the Humber, the tide went on ebb­ing, and never flowed, till the river was dry in some places ; while at Ostend, towards which the wind was blowing, con­trary effects were observed. It has been supposed, that, owing to the sheltered situation of the port of London, the great undulations produced by the winds will be less sen­sible there than on the coasts of France, as, for example, at Brest. But it should be recollected, that if the tide at Lon­don come from the Atlantic, the irregularities felt at Brest will equally tend to affect it at all those places which it subsequently reaches.

In the Phil. Trans. for 1838, p. 249, there is a particular description of a very complete machine, by Mr Bunt, for registering, in a continuous form, the rises and falls of the tides, or their height for any instant of time. The prin­cipal parts are, an eight-day clock, which turns a vertical cylinder revolving once in twenty-four hours; a wheel, to which an alternate motion is communicated by a float rising and falling with the tide, in an almost close chamber, and connected by a wire with the wheel, which is kept con­stantly strained by a counterpoise ; and a small drum, on the same axis with the wheel, which by a suspending wire communicates one eighteenth of the vertical motion of the float to a bar carrying a pencil, which marks a curve on the cylinder, or on a sheet of paper wrapped round it. The lead­ing principle is obviously the same with that which Mr Keith first applied to the register thermometers and barometers. Various tide-gauges on similar principles have been con­structed by others, particularly by Captain Lloyd, Mr Mit­chell, and Mr Palmer, and are described in previous vo­lumes of the Philosophical Transactions.

Hitherto the phenomena of the tides have to a certain extent been referred to the equilibrium theory, the actual elevation of the waters being compared with the elevation which the moon would produce if the earth and moon were both at rest. But on account of the interruption of the land, the general motion of the waters of the ocean cannot conform to this theory, or admit of a fluid elevation re­sembling that of the equilibrium spheroid following the moon from east to west, except in some parts of the southern hemisphere. The Pacific, the largest ocean of all, has very small tides in its central parts; and at its eastern shore, near Cape Horn, the tide-wave runs from west to east, although there is apparently nothing to prevent its following the usual course. From such considerations, viewed in connection with various tide observations on the eastern and western sides of the Pacific and of the Atlantic, Captain Fitzroy (Voyage of the Adventure and Beagle, vol. ii. appendix, p. 279) has been led to propose a considerably different theory, in which the tide of each large ocean is considered to be nearly as independent of the tides of other waters as if it were a lake. The central area of each ocean is further supposed to be occupied by a lunar wave oscillating so as to keep time with the moon’s transits, and having its mo­tion kept up by the attraction of that luminary acting at each return. From the skirts of this oscillating central area, tides are supposed to be carried on all sides by free waves, the velocity of which would depend upon the depth and local circumstances of the sea ; and thus the littoral tides may travel in any direction, while the oceanic tides near the centre of the oscillating area may be small, or may altogether vanish. Such we take to be the substance of this theory, as explained, with some improvements, to the Cambridge Philosophical Society, by Mr Whewell. Single observations, as that gentleman has remarked, can be of little use in deciding upon such a theory. More light would be thrown upon it if the real forms and positions of the co- tidal lines could be ascertained for the shores of the Pacific. With this view it is desirable that numerous and connect­ed observations were made on the eastern shores of Aus­tralia, the Indian Archipelago, the Philippine isles, the Loo Choo Isles, and those of Japan. But we suspect that the magnitude and peculiarities of the diurnal inequality in some of those regions would throw great difficulties in the way of determining the cotidal lines, if they even admit of them at all.

Some of the facts which Captain Fitzroy considers most difficult to be reconciled with the theory which deduces tides in the Northern Atlantic from the movement of a tide-wave originating in the Southern Ocean are, lst, the com­parative narrowness of the space between Africa and Ameri­ca, with the certainty, that the sea is neither uniformly nor excessively deep in that space, and the trifling rise of the tide, not only upon each nearest shore (where it does not exceed four or five feet), but at Ascension Island, where the highest rise is not quite two feet ; 2dly, the absence of any regular tide about the wide estuary of the river Plata, the situation and shape of which seem so well dis­posed for receiving an immense tide ; 3dly, the flood-tide moving towards the west and south along the coast of Bra­zil, from near Pernambuco, to the vicinity of the river Plata ; and, lastly, the almost uniformity of the time of high water along that extent of the coast of Africa which reaches from near the Cape of Good Hope to the neighbourhood of the Congo.

Against the supposition that a tide-wave travels south­ward along the west coast of America, are the facts, that the flood-tide impinges upon Chilóe and the adjacent outer coast from the southward of west ; that it is high water within half an hour of the same time at Cape Pillar and at Chilóe, including the intermediate coast ; that from Valdi­via to the Bay of Mexillones (differing 18° in latitude), there is not an hour’s difference in the time of high water ; that from Arica to Payta, and from Panama to California, the times change gradually as the coast trends westward ; and