and at each ebb, on an average, 448,000,000 cubic feet pass from the Sound westward.

Again, where the tide up a large river is detained at the head of a gradually contracting estuary by sand-bars with only narrow passages, it sometimes moves up the river all at once in one or a few great waves, producing what is called an *eager* (or bore); as at the mouth of the Hoogly (one of the mouths of the Ganges), on the Tsien-Tang in China, and on the Amazon. In the Tsien-Tang, at the equinoxes, the wave moves as a foaming wall of water, 20 feet or more high and four or five miles broad, and thus it passes Hang-Chau-Fu at a rate of 25 miles an hour, dying out about 80 miles above. The change from ebb to flood tide is almost instantaneous. (Macgowan, 1855.)

At the large northern mouth of the Amazon, the *pororoca*, as it is there called, passes up the stream in three or four closely following waves, each 15 to 20 feet high. As soon as the previous tide stops running out, the approaching wave is seen as a white line on the eastern horizon; onward it comes with rumbling sounds (imitated in the word *pororoca*) that grow louder and louder; finally it rushes forward over the top of the long wall, like an endless cataract, in quick pursuit by the other waves; and continues up the river for 70 or 80 miles, or two thirds of the way to Macapa. (J. C. Branner, 1884.)

Rivers with open mouths receive the tidal wave quietly and carry it as far within as high-tide level goes, the movement being communicated to the water of the river, and the salt water following for part of the distance, and ending as an under-current. It extends up the Amazon to Obidos, nearly 500 miles; up the Hudson to Troy, 150 miles, two waves being in the river at once; up the Connecticut to Hartford, 50 miles. Rising above the level of the wells along the coast and the outlets of subterranean streams, it raises their waters, so that such wells also have their tides.

In seas more or less shut in from the ocean and outside of the general course of the tidal wave, the tides are small. In the Mediterranean, for example, the tide is perceived only at the ends of bays, as at Venice in the Adriatic.

In consequence of the tidal movement *the sea has its flood-grounds*, like rivers; but the floods occur twice a day, with each recurring tide.

At some places in the Pacific, owing to the conjunction of tidal waves, high water occurs uniformly at 12 h., and low at 6 h. This is the case at Tahiti, where the tide has a height of 1 to 1½ feet. The author governed himself accordingly in his excursions at low water over the coral reefs.

2. Winds: Wind-made Waves and Currents.

As the great currents of the oceans — the Atlantic and others — are attributed by many to the action of the regular winds, these currents may here come under consideration as well as those made by storm-winds. But the currents made by the storm-winds, that is, the *littoral* currents and the