Topic Page: tide

Definition: **tide** from *Dictionary of Energy*

Earth Science. the regular cyclical rise and fall of the water level in the oceans and other large bodies of water, caused by the interaction of the rotating earth with various forces, principally the gravitational attraction of the moon and the sun.

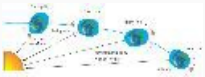

Image from: **The daily rise and fall of the ocean's tides are...** in *Philip's Encyclopedia*

Summary Article: **tide**
From *The Columbia Encyclopedia*

alternate and regular rise and fall of sea level in oceans and other large bodies of water. These changes are caused by the gravitational attraction of the moon and, to a lesser extent, of the sun on the earth. More generally, tides are the deformations of celestial bodies from a perfectly spherical shape that result from stresses created by their mutual gravitational attraction (see gravitation). Another way of viewing the tide is as the longest possible ocean wave, one which stretches all the way around the earth. The tide regarded as a wave is sometimes referred to as a tidal wave, although this term has been commonly applied to the shock wave propagated by an underwater earthquake. (To avoid confusion, such shock waves are now called tsunamis, their Japanese name, or seismic sea waves.) Numerous schemes have been proposed to harness the earth's tides, especially in various estuaries, as a practical source of power, but none as yet have proved economically or technologically feasible.

Tidal Effect on the Earth

Tides are raised in the earth's solid crust and atmosphere as well as in the oceans. Every body in the universe has some tidal effect, however small, on every other body. This effect is directly proportional to the mass of the body causing the tide but inversely proportional to the cube of the distance between the bodies. The earth's nearby moon is about 2.17 times as effective as the more massive sun in raising tides on the earth, even though the sun exerts a much greater total force on the earth than does the moon. Thus, the moon's proximity explains its dominant role in creating tides.

Direct and Indirect Tides

At any given time, there are two high tides on the earth, the direct tide on the side facing the moon and the indirect tide on the opposite side. As the earth rotates on its axis, the location of the two diametrically opposed tidal bulges varies on the earth's surface. The earth's rotation and the moon's revolution, which have the same direction, bring each point on the earth opposite the moon once every 24 hr and 50 min. Therefore, the average interval between direct and indirect high tides is about 12 hr and 25 min. In many places along the Atlantic coasts of N America and Europe, the two daily low tides are of nearly equal duration and magnitude, called semidiurnal tides.

In certain shallow seas and narrow estuaries, the tides differ from this simple pattern. For example, in certain regions such as the Pacific coast of N America, one of the two daily tides is appreciably higher than the other or the interval between successive tides is unequal; these are called mixed tides. In other regions, such as the Gulf of Mexico, there is only one high tide per day called a diurnal tide, with a period of 24 hr and 50 min.

The Magnitude and Effects of Tidal Ranges

The range of the tides is the difference in sea level between high and low tides. Spring tide, having the maximum range, occurs during the full moon when the earth is between the moon and the sun, and new moon when the moon is between the earth and the sun. At these times in the lunar cycle when the moon, earth, and sun are aligned the condition is known as syzygy. The term king tide is used in some regions to describe the highest tides of the year. Neap tide, having the minimum range, occurs during the moon's first and last quarters, when the moon, earth, and sun form a right angle. The typical tidal range in the open ocean is 2 ft (0.61 m) but is much greater near the coast. Tidal ranges vary around the world and average about 6 to 10 ft (2 to 3 m). The world's widest tidal range occurs in the Bay of Fundy, in E Canada, where the sea level changes by 40 ft (12 m) during the day, while the Mediterranean, Baltic, and Caribbean Seas are relatively tideless.

As the tides change, currents must flow to redistribute the ocean's water. Near the coast, the direction of the current changes every 6 1/4 hr from toward the shore (flood current) to away from the shore (ebb current). In the open ocean, the tidal currents are rotary, shifting through all directions of the compass in a period matching that of the local tide. When tidal currents flow into the mouth of a river, they speed up. In extreme cases, the tidal rise advances up the river as a solid wall of water often several feet high, a rare phenomenon called a tidal bore. During times of high tide accompanied by high wind and low pressure, as during a hurricane, a tidal surge can occur, causing coastal erosion, flooding, and damage to coastal cities.

The Prediction of Tides

Detailed prediction of ocean tides from theories of classical mechanics and hydrodynamics has not been entirely successful, largely because of complications introduced by the irregular shape of the ocean basins and coastlines. Useful results are obtained empirically by analyzing records of previous tides at a particular location to predict future tides. The importance of tides for maritime activities has prompted the compilation of tide tables for harbors, which give the time and height of high water and low water based on past observations and corrected for the varying positions of celestial bodies.

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