SEA GRANT
Telephone: (251) 438-5690
February 7, 2007

By
Rick Wallace, Extension Marine Specialist
Auburn University Marine Extension and Research Center

The tide and its rhythmic cycle are of interest to boaters, fishermen and waterfront property owners. Warren Buffet, who probably qualifies on all three counts once said, "Its only when the tide goes out that you discover who's been swimming naked." But what does make the tide go out?

Tides are a result of the gravitational pull of the moon and the sun and a centrifugal force. These forces can be visualized by imagining (or drawing) a circle representing the earth, a smaller circle immediately to the right as the moon, and a larger circle as the sun, but much further away in line with the earth and the moon. This alignment causes a strong gravitational force on the side of the earth facing the sun and the moon which results in a bulge in the ocean's surface. Another bulge occurs in the ocean on the opposite side of the earth because of a centrifugal force. As the earth rotates, a single location on the earth will move from directly underneath one bulge (high tide) to the edge of the bulge (low tide) and then to directly under the second bulge (another high tide) etc. Since the earth rotates through two bulges and two low areas in 24 hours, this would account for the twice daily (semi-diurnal) tide on the U.S. East Coast.

Things get a little more complicated when we begin to take into account the movement of the moon around the earth. As the moon moves away from an alignment with the sun to a point 90 degrees away (first quarter moon) the gravitational forces of the

sun and moon are not working together and tidal forces are at a minimum. This results in a weak or neap tide. When the moon arrives at a position opposite the sun (full moon) the gravitational and centrifugal forces are aligned and there is a strong tide (spring tide). Finally, the moon moves 90 degrees (third quarter moon) for another neap tide and then back to the starting point in alignment with the sun (new moon) which gives another spring tide. So, the position of the moon causes two spring tides and two neap tides during the 29.5 days it takes to make one orbit around the earth.

Next, we can consider the movement of the earth around the sun as well as how the moon moves around the earth. Both orbits are not circular, but elliptical, so that once a year (January 2) the earth is closer to the sun than any other time. Likewise, once a month the moon is also closer to the earth than any other time. When either the moon or the sun is close to the earth, tides will be higher and lower than otherwise expected. The position of the moon and the sun relative to the Equator also affects the tide.

The tidal cycle is also greatly influenced by the shape and size of the water basin. For example, in the northern Gulf of Mexico we have daily tides (diurnal) instead of the expected twice daily tides. The east and west Gulf have mixed tides which are twice daily, but the two highs are quite different from each other as are the two lows.

Locally, the height of the tide is greatly affected by the wind. Regular Causeway travelers have no doubt noticed that low tides can be extremely low when there is a strong north wind and high tides extremely high with a strong south wind. Barometric pressure and river discharge into Mobile Bay also influence the height of the water relative to the predicted tide heights.