TIDES (cont'd)

Idealized Tide Prediction (review)

Actual tides and their prediction

- Tidal bulges move like shallow water waves
- Continents block them
- They form rotating tidal cells
- Reflection and amplification near coasts

1. Review of Idealized Tidal Prediction using Equilibrium Tide Theory

See notes from last time.

All that theory gives us the basic driving forces. We can use it to predict roughly when high and low tides will occur, and when we expect the tidal amplitude to be greatest and least. But these predictions are idealized, because they don’t take into account the actual motion of the tidal bulges around the earth.

2. Actual Tides on a Complicated Earth

The tides that we see at various places on the earth differ from what you would predict from the above model. Each ocean basin and each coastal area responds uniquely to tidal forces.

1. Continents interrupt the passage of tides.
2. Tidal bulges are like shallow-water waves (because their L is so large)
   a) Recall... this means that the speed depends on water depth: For average water depth (3.7 km) the tidal bulges travel at 700 km/hour (=435 Miles per hour)
   **Not fast enough to keep up with tide-raising forces (e.g., position of Moon)**
   b) Direction and speed are altered by:
      - friction with bottom
      - reflection from continents and continental margins
      - refraction
      - Reflection and/or amplification as they move into shallow, coastal waters

So here’s what we actually see:

- Tidal “cells” in various areas of the oceans
- In each cell, crests of tide waves "rotate" around central point

See Fig. 9-14 in Thurman and Trujillo

Basin shape and depth determines the dominant period of the cells:

- Some basins, such as the North Atlantic, have semidiurnal cells.
- Other basins, such as the Gulf of Mexico, have diurnal cells

Exact shape of each coastline also affects timing and amplitude of tides there.

Over 150 different factors involved with the exact timing and height of the tides!

So.....Tidal prediction is thus based on historical records at each location, and also based on the 18.6-year lunar cycle. Over that interval, the Moon completes all possible positions with respect to the Earth.