Exercise 10. Tides

This exercise is a relatively short, and may be assigned as a take-home exercise if the topic is well covered in lecture. The exercise emphasizes that the sea is not level and is affected by tides and winds, as well as density differences. If the subject has not yet been introduced in the lecture, the lab instructor must present sufficient material on tides and surge for the student to answer the questions.

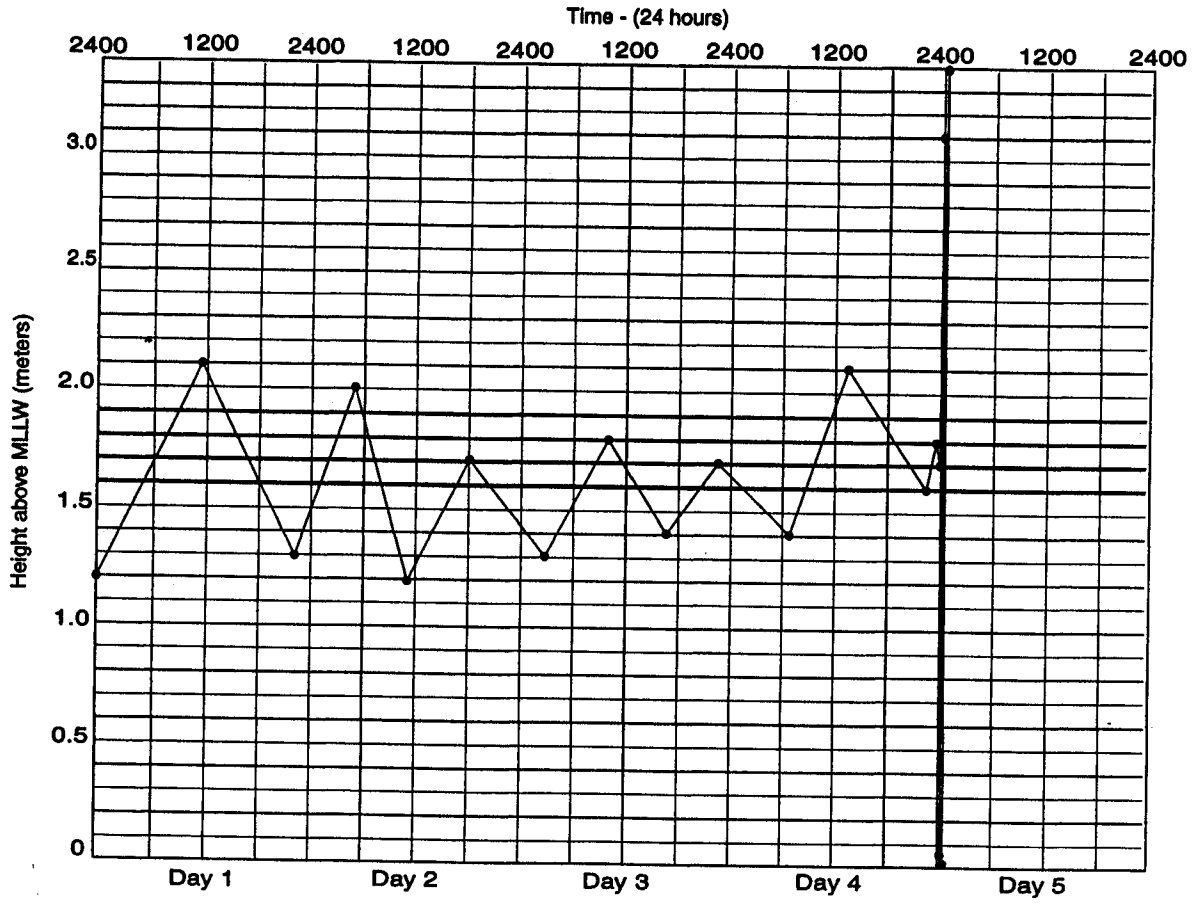
1. See completed graph below.

   a. Day 1: (effectively) diurnal; Day 3: semidiural; Days 2 & 4: mixed.

   b. The least tidal range is 0.2 meters on Day 4.

   c. Mean high water for the 4 days is 1.9 meters (average of all the high tides).

   d. Sail between ~0600–1500 on Day 1, ~0230–0730 on Day 2, ~0800–1200 on Day 3 (very tight), and 0900–2000 hours on Day 4. For those student's who like to live on the edge, 1815 on Day 2, 2205 on Day 3, and the latest part of Day 4 might work.



2. See completed graph on previous page.

   a. The rapid rises and falls of sea level recorded on Day 5 are characteristic of tsunamis. These seismic waves are generated by movement of the seafloor due to faulting, submarine landslides or volcanic action.

   b. The trough entered the harbor first (evident by the rapid fall in sea level) and is followed by the first large crest.

   c. The frequency of tsunamis is great enough in the Pacific that tsunami prediction and warning centers have been developed in Alaska and Hawaii. When an earthquake that might trigger seismic waves occurs, tsunami travel times to populated areas are calculated and tide and water level gauges are closely monitored. If seismic sea waves are observed, then populated areas are alerted and safety preparations can be made.

3. a. Based on Figure 10–7, travel times consist of the following:
   Sitka, Alaska: ~3 hours
   Honolulu, Hawaii: ~4.6 hours
   San Luis Obispo, California: ~5.6 hours
   Valparaiso, Chile: 18.1 hours.

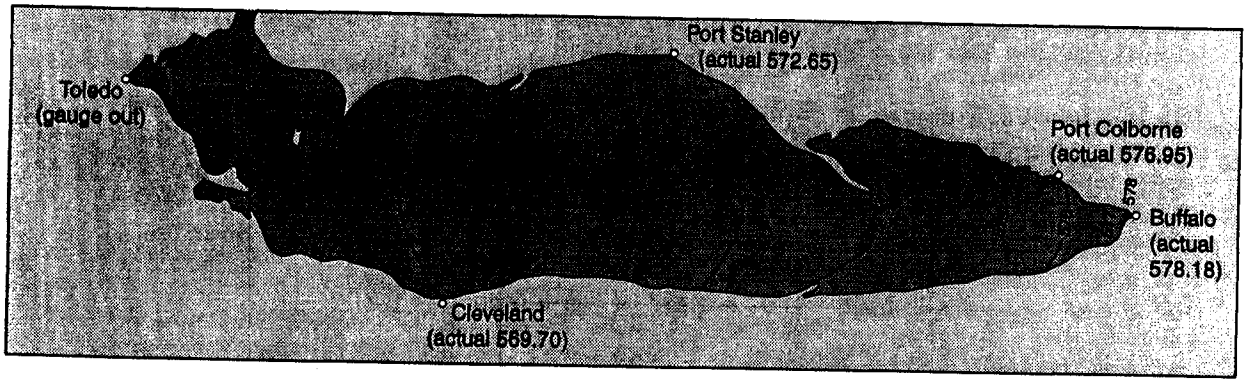
   b. The average velocity of the tsunami between the Aleutian Trench and Hawaii was 487.2 mph. Between the Aleutian Trench and Valparaiso, the average velocity was 445.6 mph. The difference in velocity is best explained by a greater average depth in the travel path.

   c. The wave height above stillwater level may be estimated from the tide gauging stations:
   Sitka: a matter of inches (a matter of centimeters)
   Honolulu: ~2 feet (0.6 meters) [~4 feet (1.22 meters) from crest to trough]
   San Luis Obispo: 3.5–4.5 feet (1.07–2.3 meters).

   d. The first evidence of the arrival of the tsunami on the shoreline at Honolulu was a slight rise or crest followed by a large fall. The third crest, which was preceded by an enormous fall, was the crest in the series that did the greatest damage.

4. a. See completed graph on Figure 10–8 below.

   b. The wind setup at Buffalo is about 6.5 feet (578 - the nodal point value of 571.5 = 6.5 feet). The maximum difference in water level between Buffalo and Toledo is a little more than 12 feet (578 ft - 566 ft = 12 feet).



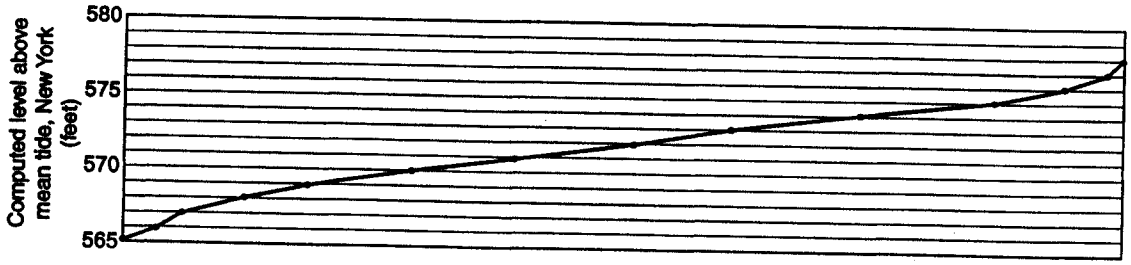


Figure 10–8

5. July 22 will be the next high water about 10+ days after the eggs are laid. This date will be the next peak on the neap-to-spring-tide cycle during the month. Recall that there are about 19–20 days between spring tide peaks (see Figure 12–5 for example of cycle). California law allows people to "fish" for grunion with bare hands only.