

Lab 5: Ocean Waves and Tides

Goals

1. Be able to identify the different characteristics of ocean waves
2. Understand lunar cycles
3. Importance of Tides

I. Ocean Waves


There are three physical characteristics which define an ocean wave:

1. the wave height (h),
2. the wavelength (λ),
3. the wave frequency ($\omega = 2\pi f$).

The wave period T is just $T = 1/f$, where f is the wave frequency in cycles per second or Hz.

As noted above, the wave speed depends on the wavelength and the wave period, but not on the wave height. In this exercise you will access live weather buoy data and investigate the local wind speed and direction and the local wave field. Using data retrieved from the wave-rider buoys west of Vancouver Island, you will calculate the approximate wavelength of the waves and their group speed.

Wind speed is still often reported in knots. A knot is a nautical mile per hour, where a nautical mile is one minute of latitude. The conversion from knots (kts) to metres per second (m/s) is $1 \text{ kts} = 0.55 \text{ m/s}$. Direction is reported in degrees from North.

From the [National Buoy Data Center](#) you can access real-time wave data from buoys moored off the west coast of North America. If you access the data for wave buoy 46221, you will be presented with information about the buoy and the most recent measurements made by it. You may wish to switch to metric units. Data for the last 24 hours can be retrieved by clicking on the  symbol beside each data type. This will bring up a plot of the data for the last 24 hour period.

For two buoys (i.e. 46222 and 46221), retrieve the most recent wave information.

http://www.ndbc.noaa.gov/station_page.php?station=46222

http://www.ndbc.noaa.gov/station_page.php?station=46221


Question 1 - Where is buoy 46222? Where is buoy 46221?

Question 2 - Record the wave height, dominant wave period, mean wave direction, and water temperature for buoys 46222 and 46221.

Question 3 - Assuming these are deep water waves, use the above formulae to convert the wave periods into approximate wavelengths λ' , and calculate both the phase and groups speeds of the dominant waves.

Question 4 - Based on the wind direction for the last 24 hours, where do you think these waves are coming from?

For reference, a wave with a period of 5 seconds, will have an approximate wavelength of 39 m, a phase speed of 7.8 m/s, and a group speed of 3.9

Under 'Previous Observations,' look for WVHT (Wave Height), and click on the  symbol. PRINT THIS GRAPH. Do this for both buoys (46222 and 46221).

Question 5 - Based on the WVHT graphs, on what dates were the wave heights the highest?

Question 6 - Based on the WVHT graphs, on what dates were the wave heights the lowest?

II. Lunar Cycles and Tides

As the Moon orbits the Earth, we see various phases. First, we see no moon at all. Then, we start seeing a waning crescent Moon at about sunset. As the days go by, the Moon rises later in the evening. The Moon becomes full, then it starts to wane towards no Moon at all called New Moon. The cycle continues.

On the January and February Moon Calendars, go online and record your Moon observations.

Question 7 - On what dates are the New and Full Moons?

Question 8 - On what dates are the First and Last Quarter Moons?

Question 9 - How are wave heights related to the phases of the Moon?
Hint: High waveheight compared to the phase of the Moon on that date.
Low waveheight compared to the phase of the Moon on that date.

Question 10 - Draw the orbit of the Moon around the Earth with the Sun in perspective.

Question 11 - What is the term used when a high waveheight is present on the lunar cycle? What is the term used when a low waveheight is present on the lunar cycle?

Question 12 - Does the Sun also cause the high and low waveheights? If so, how and when does this occur?

Question 13 - What is the term used when a high waveheight is present on the solar cycle? What is the term used when a low waveheight is present on the solar cycle?

Question 14 - What are tides? How are they similar and different from ocean waves?

Question 15 - Should we rely on the phases of the Moon to give us an accurate prediction for waveheight? How about the position of the Sun?

Question 16 - Why is predicting the local waveheight important?

Question 17 - Give an example when predicting the tides was important in history.

Question 18- When would you best anchor your yacht at the shore without causing great damage to it? Describe using the phase of the Moon and the tides.

III. Application of tides

Using the attached tide tables answer the following questions.

Use the Los Angeles, California Tide Table for January 2012:

Question 19 - On January 9/10, what type of tide is forecast?

Question 20 - What is the usual type of tide in Los Angeles?

Question 21 - When do spring tides occur?

Question 22 - When do neap tides occur?

Use the Bahia de Los Angeles Tide Table for January 2012:

Question 23 - What is the usual type of tide in Bahia?

Question 24 - When do spring tides occur?

Question 25 - When do neap tides occur?

Question 26 - What type of tide is forecast for January 30th?

Question 27 - What is the phase of the Moon on January 30th?

Question 28 - What is the tidal range in Bahia?

Use the San Felipe Tide Table for January 2012:

Question 29 - Are the tides higher or lower than in Bahia? Why?

Question 30 - What is the tidal range in San Felipe?

Question 31 - What is the reading (in centimeters) for the neap tide?
When does it occur?

Question 32 - What is the reading (in centimeters) for the spring tide?
When does it occur?

When you are in Bahia, keep record when high tide and low tide occurs.
Write it in your field notebooks and journals. Compare with the attached
tide tables.