Name: _____

Introduction to Oceanography 112 - M. Yasuda
Date: November 5, 2009
Assignment 11

Reading – Week 11 - The atmosphere (cont.) & Waves Part I

1. **Chapter 10** **Tsunami** Pages 284+
2. **Chapter 11** **Tides**

Vocabulary list (same as last week with some additions)

Parts of a wave
Motion of a wave
Frequency
Wave period
Wave front
Ray
Progressive waves
Orbital waves
Standing wave
Shallow water waves
Deep water waves
Wave-cut platforms
Erision
Classification of waves
Disturbing force
Restoring force
Capillary waves
Wind waves
Tides
Tsunami
Seiche
Development of wind waves
Wind strength
Wind duration
Fetch
Wave behavior
Dispersion
Wave interference
Rogue waves
Wave reflection
Wave diffraction
Wave refraction
Tides
Extreme tides
Gravitational force
Centrifugal force
Tidal cycles per day, month, year
Spring tide and neap tide
New moon and full moon
Apehelion and perihelion

Related websites

Tide calendar
http://ocean.peterbrueggeman.com/Divebums_Tide_Calendar_2009.pdf

California Grunion Facts and Runs for 2009
http://www.dfg.ca.gov/marine/gruschd.asp

GOALS

Wind waves

1. Know whether it is energy, matter, or both that is transported across far distances by waves
2. Know the definition of a wave, as we use this term in oceanography to describe capillary waves, wind waves, tides, and tsunami. Why are these all considered to be waves?
3. Be able to describe the basic difference between waves that are classified as shallow water waves and deep water waves
4. Know the disturbing and restoring forces associated with each of the major types of ocean waves
5. Know the relative heights of different types of waves
6. Know the three factors that contribute to the development of the largest wind waves – fetch, wind intensity and wind duration

7. Know whether waves of greater or lesser wavelength travel faster.
8. Be able to explain how wave interference can lead to rogue waves
9. Be able to explain how wave refraction can lead to headland erosion (in Coasts section)
10. Be able to explain how wave dispersion can cause the wavelength of wind waves arriving on our beaches to decrease over time after a storm has ended
11. Be able to explain how energy from the Sun is converted to the energy in wind waves
12. Be aware of the general relationships between winds, wind waves, storms and erosion

Tides

1. Be able to explain the reason for two tidal cycles per day (in some places)
2. Be able to explain the reason for one tidal cycle to be more extreme than the other, in places (daily inequality)
3. Be able to explain the tendency for two particularly extreme tides per month and during northern hemisphere winter of each year (spring tides)
4. Be able to describe and identify the two main tide-generating forces (gravitational and centrifugal forces)
5. Be able to explain why the actual tidal pattern of sea surface highs and lows move in a circle around amphidromic points, rather than strictly along lines of longitude

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QUICK QUIZ

1. In which direction does the northeast trade wind blow?
2. What is a monsoon?
3. What is a cyclone?
4. What do the letters ITCZ stand for?
5. What defines the position of the iTCZ?
6. Under what environmental conditions will clouds form when air contains water vapor?
7. What natural motion of air leads to cloud formation?
8. When condensation occurs, is energy released or consumed?
9. At what latitude are the deserts of the world?
10. Is San Diego located in a rainy or dry zonal band?
11. Atmospheric circulation refers to winds. True or False?

WEEK 11 - In-class/homework activities **Name:** _____
OCEA 112 – Memorie Yasuda

In-class/homework activities

Type your answers on a separate sheet of paper, double-spaced with wide margins so I have space to write comments. Where an essay answer is required, make sure to write out a complete and logical explanation using the best grammar and spelling you can.

A. Redo the multiple-choice questions that you missed on the midterm.

1. Write out the entire new answer on your answer sheet using a different colored ink.

2. Turn in just that page next week. If you want to mark up a photocopied version of that page, that is acceptable. **No points** if you write your answers on a separate sheet.

Each question will be worth ½ of its original value.

While you can take shortcuts in doing this, it will help you study for the final if you work on recognizing the problem with your first answer.

3. **The assignment is due at the start of class next week. No exceptions.**

B. Wind waves

1. Complete the wave chart as you do your reading and attach it to your homework.

2. If a wind wave has a wavelength of 200 m, what is the highest wave that it can develop?

3. What are the circumstances that allow a wind wave of a particular wavelength to develop the greatest height?

4. When we see neat rows of large waves at the beach on a windless sunny day, how did they originate and how far away?

5. Which waves travel at a faster speed – those with longer or shorter wavelength? Which diagram in your textbook illustrates this characteristic of wind waves?

6. What happens when two wind waves cross paths?
   a. If two troughs cross paths, the wave height becomes extra low.
   b. If two crests cross paths, the wave height becomes extra high.
   c. The wave height becomes zero.

C. Tides

Use the attached tide calendar when needed.

1. What lights the Earth and moon?

2. Sometimes when we see the moon at exactly **sunset** and it is fully or partially lit by the setting Sun. Whenever there is a full moon at sunset, we see it:
   a. Going westward on the 52 b. Going eastward on the 52
   c. Going eastward on the 52, to the south

3. Does the date of the full moon vary from place-to-place or is it generally coincident regardless where you are on Earth? The answer isn't in the book. You'll need to envision the geometry of the Sun and moon.

4. See tide calendar for December.

Daily pattern

a. How many tidal cycles occur each day in San Diego and how many hour apart is each cycle?
b. Is this a diurnal, semidiurnal or mixed tide kind of pattern?
c. Do two tidal cycles occur in all coastal areas? Which diagram in your textbook gives you the answer?
d. The daily highs and lows are not of equal height. Which diagram in your textbook gives you the answer? Name the term given to this feature of the tide.
e. Sea level or the zero line for tide occurs at Mean Low Low Tide (MLLW). What is MLLW with respect to the tidal cycle?
f. What is the tidal range in San Diego? What is the tidal range at the Bay of Fundy?

Tide summary Port of San Diego:
http://www.portofsandiego.org/maritime/check-port-and-harbor-conditions/424-tides-and-currents.html

Satellite images – Bay of Fundy:
http://earthobservatory.nasa.gov/IOTD/view.php?id=6650

Wikipedia – Bay of Fundy: **http://en.wikipedia.org/wiki/Bay_of_Fundy**

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Monthly pattern (use the December 2009 calendar below)

g. On which day is the Full moon?
h. How low **and** how high is the tide on the day nearest the Full moon?
i. Is the day of the Full moon a day of extreme tidal range or modest tidal range?
j. On which day is the New moon?
k. Can you see a New moon?
l. Is the day of a New moon a day of extreme tidal range or modest tidal range?
m. What kind of tide occurs in at Full and New moons when the tidal range is the greatest?
n. What kind of tide occurs when the tidal range is the least?
o. Why is the tidal range the greatest on two particular days of the month. Explain.

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Annual pattern

o. Why is the tidal range particularly extreme in winter?

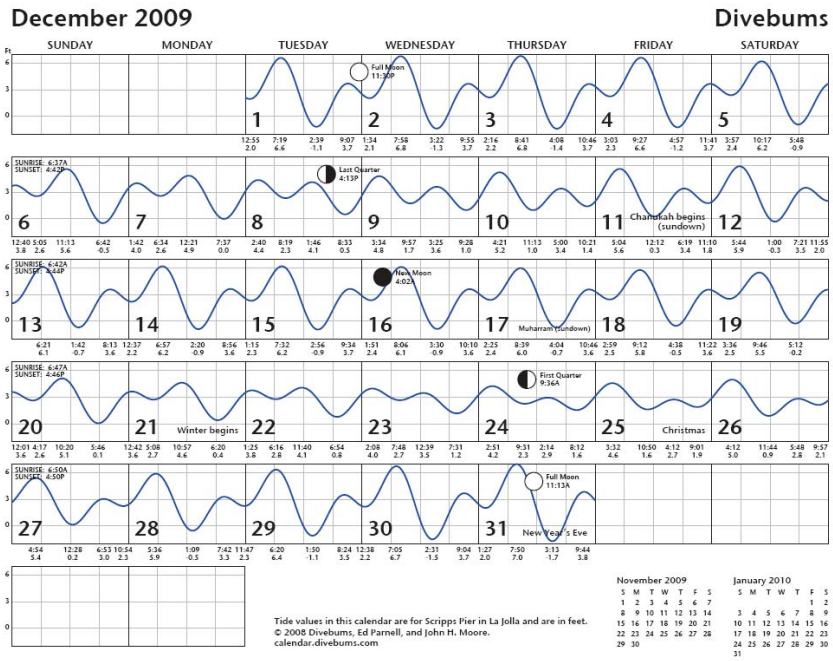
5. Consequences

Coastal erosion and loss of beach sand is a big problem around the world, including California. Most erosion occurs during isolated storms (during winter in southern California) rather than all year long.

a. Storms that arrive at the same time as high tide do the most damage. Explain why.

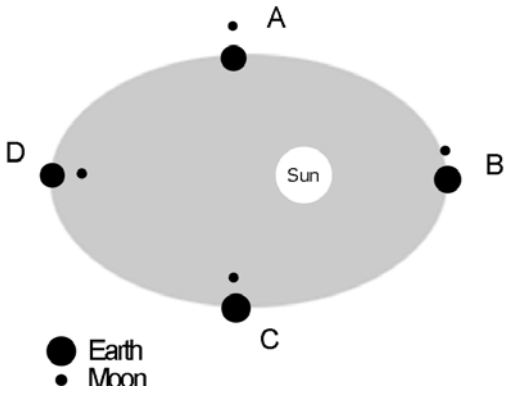
b. Is this hazard going to occur at the same rate in the future or not? Explain your answer.

Refer to this article:
http://www.kpbs.org/news/2009/mar/25/sea-level-rise-storms-and-san-diego/



6. For each of the imaginary situations illustrated on the diagram to the right, identify the following conditions on the Table.

Case	Neap or Spring Tide ? Choose closest	Phase of moon - Full, New or Quarter ?	Annual high tide - Y or N ?
A			
B			
C			
D			



D. Tsunami

Answer the following questions. Although we discussed the answers to these items in class, I provide these websites for reference.

DART™ (Deep-ocean Assessment and Reporting of Tsunamis)
http://nctr.pmel.noaa.gov/Dart/

Tsunami Hazards—A National Threat
http://www.tallyredcross.org/library/TsunamiHazardsANationalThreat.pdf

The Orphan Tsunami of 1700 —
Japanese Clues to a Parent Earthquake in North America
http://pubs.usgs.gov/pp/pp1707/

California Geological Survey - Tsunamis
http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Pages/About_Tsunamis.aspx

1. Do DART systems detect earthquakes **or** tsunami?

2. Do all undersea earthquakes generate tsunami?

3. How does DART determine when a tsunami has taken place?

4. How fast can information be passed from a DART buoy to land?
   And how is this information transmitted?

5. Are DART buoys distributed evenly across the Pacific and Atlantic?
   Explain the logic behind the pattern of placement for the buoys.

6. In a place like Indonesia or Cascadia, can you count on the buoy system to warn you about tsunami if you're at the beach? Explain your thinking.

f. Have there been historically significant tsunami in California? When and where?

g. What is the source of the ongoing tsunami threat to California and Cascadia.
   Explain briefly.

h. Who pays for DART?

i. What should you do in the event of a tsunami or a very large earthquake when you are at the coast?

j. Why is the risk of tsunami at Cascadia ongoing and why do we think the risk is imminent and high?.