Tides and Currents

INTRODUCTION

OBJECTIVES

1. Define and describe how currents are formed.
2. Define the following terms as they relate to currents
    a. Coriolis effect
    b. Coastal current
    c. Longshore current
    d. Riptide
    e. Gyre
3. Name and locate geographically the following major currents
    a. North Atlantic Gyre
    b. Gulf Stream
    c. North Atlantic
    d. Canary Current
    e. North Equatorial Current
    f. California Current
4. Describe what tides are and what causes them.
5. Summarize how we predict tides and discuss why.
6. Examine the way tides are measured and describe the equipment used.
7. Define the following terms as they relate to tides
    a. Ebb
    b. Flow
    c. Centrifugal Force

Currents

1. How are currents formed?
    a. There are three main reasons for the occurrence of ocean currents
        i. The density of seawater varies from place to place, because the salt content is not the same everywhere. Water flows from the regions of higher density to regions of lower

density thus producing currents.
    ii. Sun's rays fall on the surface of the sea at different angles and produce unequal heating. This generates convection currents in the sea.
    iii. Winds blowing on the sea surface push water into current. Currents are also caused by the rotation of the earth.
2. Coriolis Effect
    a. The earth's rotation produces clockwise currents in the northern hemisphere.
    b. The earth's rotation produces counter clockwise currents in the southern hemisphere.
3. Coastal Current - Gulf Stream
    a. Amongst the currents, the Gulf Stream is the most important. This stream flows from the Gulf of Mexico northwards to Canada like a river in the middle of the Atlantic Ocean.
4. Major currents
    a. Pacific North equatorial current.
        i. Japan current
        ii. North Pacific current
        iii. California current
    b. Atlantic, North equatorial current.
        i. Gulf Stream
        ii. Canaries current
5. Longshore Current
    a. Develop when the waves are not at a 90-degree angle to the beach. They generally develop on long or straight beaches.
    b. Carry sand to the shore, depositing them in areas of slower moving water.
6. Nearshore Current
    a. is created when a wave hits a beach at a90-degree angle. They flow perpendicular to a beach in a seaward direction. Nearshore currents are strong and narrow.
    b. move large amounts of sand.
7. Riptides
    a. A riptide is a strong current of water that is flowing from the shore to the sea.
    b. Riptides sometime occur where wave or tidal action causes a buildup of water between sandbars, along jetties, or under piers.
    c. When excess water reaches a maximum volume it finds a weal spot or low point in the sandbar and rushes out through that low point and quickly dissipates in the deeper water just outside the submerged sandbar.
    d. The strength of the current can vary from weak to very strong and can form very suddenly.

Tides

1. Ask the following questions. What are tides? What causes tides?
2. Tides explanation.
    a. Tides are the periodic rise and fall of a body of water.
    b. The gravitational pull of the moon and sun causes our tides. The tides in the upper reaches of the Bay of Fundy can rise & fall over 50 feet. This is an extreme case.
    c. The sun produces a gravitational force that is 180 times stronger than that of the moon because of its size. Since the moon is closer to Earth, its gravitational force is nearly twice that of the Sun's.
    d. The force of the moon's pull on Earth causes the Earth and its waters to move towards it. The waters on the side of Earth that are nearer to the moon are pulled harder, drawing the water away from the Earth which produces high tides.

e. The positions of the moon and sun also affects the height of tides. When there is a full moon, or a new moon, the moon and the sun are lined up, creating a larger pull on the Earth. The result is a higher than normal tide known as a spring tide.
f. When the moon is in its first or last quarter phase, the moon and sun are not lined up and are at right angles to Earth. This placement causes a lesser pull on the Earth and the resulting tide is much lower than normal. This type of tide is known as a neap tide.
g. Another factor is centrifugal force. Centrifugal force pushes outward from the center of rotation. The earth and the moon, orbiting the sun together, form a single spinning body, with a center of rotation inside the earth. In most places the moon's gravitational pull counteracts the effects of centrifugal force on the ocean.

3. How do we predict tides?
   a. NOAA collects data from a network of tide gauges, measuring stations and automated buoys up and down the U.S. coastline. They use this information to predict tide time, heights, speeds and currents.
4. Why do we predict tides?
   a. Tides touch all who sail the sea and live along its shore.
   b. Mariners rely on tide tables to steer safely into ports or to avoid shallow areas.
   c. Engineers consult tide tables when building bridges or shallow structures.
   d. Families buying a beach house, fisherman looking for fish, ecologists, weather forecasters.
5. Beach experiment
   a. As soon as you arrive on the beach, break students into teams.
   b. Have each team place a stake at the tide line.
   c. At the end of the beach session, have the students measure the difference between the stake and the present tide line.
   d. Discuss your findings.

RESOURCES

http//www.bergen.org/AAST/Projects/ES/BS/erosion_currents.html
http//graffant.tripod.com/bodybag/ocean.html
http//www.thehopewellrocks.ca/english/fundytides2.htm