

SMILE Teacher Workshop  
2007 Winter Teachers Workshop  
Buoy Data

**Key: Exploring Buoy Data**

Station: \_\_\_\_\_

1. Using the latitude and longitude given for your station, locate it on a classroom map.

**All of these buoys are coastal, so they will be very close to shore.**

2. What direction is the wind blowing at the buoy station? (Wind data tells what direction the wind is coming *from*.)

**Port Orford: From SW, to NE**

**St. Georges: From SW, to NE**

**Stonewall: From W, to E**

3. What is the wind speed at this station in knots and miles per hour? (1 knot = 1.15 mph)

**Port Orford:  $11.7 \text{ [kt]} \times 1.15 \text{ [mph/kt]} = 13.455 \text{ [mph]}$  (Beaufort 4)**

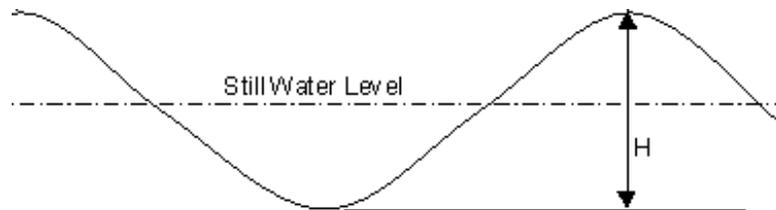
**St. Georges:  $11.7 \text{ [kt]} \times 1.15 \text{ [mph/kt]} = 13.455 \text{ [mph]}$  (Beaufort 4)**

**Stonewall:  $19.4 \text{ [kt]} \times 1.15 \text{ [mph/kt]} = 22.31 \text{ [mph]}$  (Beaufort 5)**

If sailors near this buoy were using the Beaufort scale, how would the sea look to them? (Hint: Refer to Satellite Winds activity.) How would it look on land?

**Beaufort scale should be 4 or 5 (as much as 6 if you look at the gusts at Stonewall Banks). Students can refer to the Beaufort handout from the Satellite Winds activity to see what these levels would look like.**

4. What is the wave height at the buoy? How many times your height are the waves? (Example: If wave height is 20 feet and you are 5 feet tall, the waves are 4 times your height. Wave height is the distance from the bottom of the trough to the wave crest.)



**The purpose of this calculation is to demonstrate how large ocean waves frequently are. Have the students picture themselves standing in a wave trough, and imagine how far above their heads the crest would be.**

5. Does the wind speed at this station appear to be increasing or decreasing? (Hint: refer to Continuous Winds chart.)

**Port Orford and St. Georges are decreasing, Stonewall is increasing.**

6. Look at the Conditions summary and the chart of Wind Speed and Barometric pressure. Is the barometric pressure rising or falling? How is the wind speed related to barometric pressure?

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**When the pressure is high the wind speed is low and vice versa; there appears to be an inverse relationship. This may not always be the case, as wind speed depends largely on pressure gradients and other factors:**

**Wind speed is affected by a number of factors, operating on varying scales (from micro to macro scales). These include the pressure gradient, Rossby waves and jet streams and local weather conditions. There are also links to be found between wind speed and wind direction, notably with the pressure gradient and surfaces that the air is to be found over.**

***Pressure gradient* is a term to describe the difference in air pressure between two points in the atmosphere or on the surface of the Earth. It is vital to wind speed, because the greater the difference in pressure, the faster the wind flows (from the high to low pressure) to balance out the variation. The pressure gradient, when combined with the Coriolis Effect and friction, also influences wind direction**

**Rossby waves are strong winds in the upper troposphere. These operate on a global scale and move from West to East (hence being known as Westerlies). The Rossby waves are themselves a different wind speed to what we experience in the lower troposphere.**

**Local weather conditions play a key role in influencing wind speed, as the formation of hurricanes, monsoons or cyclones as freak weather conditions can drastically affect the velocity of the wind.**

7. Look at the plot of Surface Winds. Locate your buoy on the plot. (You will need to use the latitude and longitude of the buoy, it is not visible on the map.)
8. The St. Georges buoy is equipped to measure ocean currents. (Ask for the data from the students with the St. Georges station if you have one of the other buoys.) At 4 pm and 20 feet of depth the current direction is 280°. What is this in a cardinal direction? (You will need to convert degrees to a cardinal direction, e.g. North = 0°, East = 90°, South = 180°, and West = 270°. Note that current directions indicate the direction the current is moving to, the opposite of the convention for wind direction.)

**280 degrees is approximately West Northwest (WNW).**

**Note: The convention for indicating the direction of ocean currents differs from the convention used for wind directions. A "westerly" wind is a wind that blows from the west and goes to the east; a "westward" current is a current that comes from the east and flows towards west. This can cause confusion to people who rarely, if ever, go to sea; but it is easily understood and remembered when related to practical experience with winds and ocean currents. On land, it is important to know from where the wind blows: any windbreak must be erected in this direction. Where the wind goes is of no consequence. At sea, the important information is where the current goes: a ship exposed to current drift has to stay well clear from obstacles downstream. Where the water comes from is irrelevant.**

How does this compare to Mean Wave Direction in the Conditions summary?

**Mean Wave Direction is approximately the same as the current direction.**

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What is the current speed in knots and miles per hour?

**Speed is given in knots (.29 knots). Using the conversion above this equals .3335 mph.**

For the following questions, assume your buoy has the same current data as St. Georges (see question 8). Plot your answers on the map handout.

9. If we released a beach ball at this buoy at 3:50 pm, where might we expect it to be at 4:50 pm? (Assume that the only force on the ball would be wind since it floats on the surface of the ocean.)

**Orford: Wind speed is 13.5 [mph] to the NE, x 1 [hour] = 13.5 miles NE at 4:50**

**Georges: Wind speed is 13.5 [mph] to the NE, x 1 [hour] = 13.5 miles NE at 4:50**

**Stonewall: Wind speed is 22.3 [mph] to the E, x 2 [hours] = 22.3 miles E at 4:50**

10. New current data tells us that the current has increased to 3 mph and now is directly west. If we released a drifter buoy at this station at 3:50 pm, where might we expect it to be at 4:50 pm? (Assume that the only force on the drifter buoy is from ocean currents.)

**Orford: Current is 3 [mph] to the W, x 1 [hour] = 3 miles W at 4:50**

**Georges: Current is 3 [mph] to the W, x 1 [hour] = 3 miles W at 4:50**

**Stonewall: Current is 3 [mph] to the W, x 1 [hour] = 3 miles W at 4:50**

11. Based on your answers to 9 and 10 above, where might we expect to find an object that would be affected by both wind and currents, like a sailboat? (Remember your vectors!)

**Students can add both of the above vectors (as we did in the Nautical Science activity) to see how the course changes.**

12. Using the data from Station 46002 (West of Coos Bay, Oregon) plot the Wind Speed (WSPD) vs. Wave Height (WVHT) on the graph paper below. How are the two related? What would you expect to see with hurricane-force winds? Refer to the Beaufort scale to test your prediction.

**As Wind Speed increases, Wave Height increases.**