Name: _____

GEOL1551 - Atmospheric and Oceanic Circulation Exercise

Readings: Textbook chapters covering atmospheric & oceanic circulation

Objective: Part 1of this exercise will introduce you to a global database from which you will be able to view and understand the circulation and structure of the atmosphere. Part 2 of this exercise will introduce you to the differences in ocean circulation patterns (current velocity, temperatures) around the globe, which greatly impact climate, weather, and biology.

Visit the website: https://earth.nullschool.net/

This provides real-time models, based on global data, of atmosphere and ocean circulation. Note that the projection shows vectors (arrows indicating the direction and magnitude of flow), and color-coding indicating the intensity of flow, temperature, or concentrations.

Select "earth" in the lower left corner of your screen and note the data provided. To minimize this menu simply press ESC. **You can click on a spot on the globe and it will give you the position, and the data for whatever modes you have enabled**.

Part 1 – Atmospheric Circulation: You will be asked to change the "Height" and the "Overlay" at times. As you begin, the Mode should be on "Air", Overlay on "Wind". Projection should remain on "O".

*Note: Altitude is measured in atmospheric pressure (pressure decreases upward) using hectoPascals. A hectoPascal is a unit of pressure; 1 millibar of atmospheric pressure equals 1 hPa. Wind direction indicates where the wind is coming *from*.

Questions:

1. Refer to the **North Pacific Ocean** and observe the **overall wind patterns** within the following latitude belts: 0 to 30, 30 to 60, 60 to 90. DO NOT pick a midpoint latitude (e.g. 15º) and report the wind direction at that point, unless it matches the overall trend. Do not pick an anomaly (like a tightly circulating STORM) – these are not representative of normal patterns. **Include the wind direction (0-359° - like on a compass) and wind speed (km/hr)** representative of each latitude belt at the following altitudes (heights).

A. The surface – example: XXº (direction) at XX km/hr **Date of observations:** _____

0-30N	
30-60N	
60-90N	

B. 850 hPa (this corresponds to roughly 1.5 km altitude – nearly a mile) **– change the HEIGHT**

0-30N	
30-60N	
60-90N	

C. 500 hPa (5.5 km)

0-30N	
30-60N	
60-90N	

D. 250 hPa (11 km)

0-30N	
30-60N	
60-90N	

2. Now look at the South Pacific – Explore the different latitude belts, at different heights, and compare with what you've written for the North Pacific above. Are they similar? Different? Describe what you've found.

3. What is the name of the high-speed currents seen at 500 to 250 hPa? Describe their patterns (Which direction do they flow? Are they straight? Undulating? Etc.). Remember, "direction" does not mean "right" or "left" use compass directions – From _____ to _____ (e.g. north to south, east to west, etc.)

4. Re-orient the Earth so you're looking down from the South Pole. Describe the current patterns at 500 hPa **relative to** the South Pole. Note: this should be a **rotational** direction (e.g. clockwise/counterclockwise)

5. **Find a Low-Pressure cell in the North Pacific surface wind pattern**.

A). Where is it (give Latitude and Longitude)? Explain how you know this is a Low-Pressure cell from the surface wind pattern. Then, change the Overlay to MSLP (Mean Sea Level Pressure), and check yourself.

B). Turn on the Temp overlay and look at the 1000 hPa winds. Describe how the **wind direction** and **temperature** would change as the Low-Pressure cell tracks over you.

6. Use surface wind patterns or the MSLP overlay: What kind of pressure system is situated directly over the continent of Antarctica?

7. Use surface wind patterns and the MSLP overlay: What kind of pressure systems are found surrounding Antarctica between about 50 to 70 degrees S? Which direction are they rotating?

8. Explain how these real-time atmospheric circulation patterns differ from the general patterns taught in class or seen in your textbook.

Part 2 – Oceanic Circulation

Remain at the website: https://earth.nullschool.net/

For this part of the exercise you will be using the **Ocean** Mode. To begin, the Projection should remain on "O", and the Mode should be on "Ocean", Animate should be on "Currents", and the Overlay should be on "Currents". You will be asked to change the Overlay between **Currents** and **SST** (Sea Surface Temperature).

Questions:

1. Where, in general, do the strongest (fastest) currents occur?

2. Compare the currents on the west side of ocean basins to those on the east side. Which currents are stronger?

3. Locate the Kuroshio Current off the coast of Japan. Describe its flow pattern. What is the fastest velocity you can find (in m/s)?

4. Turn on the SST overlay. Compare the SST distribution across the Atlantic and Pacific Ocean basins. Other than the poles, where are the coolest temperatures in each basin? (Middle? East? West?) – **Why**?

5. Globally, where are the coolest water temperatures (List TWO)? What is their temperature?

6. Toggle between Currents and SST. What is the moderately strong current that flows around Antarctica at about 50 to 60 degrees S? Click a point north of this current – What is the temperature? Click a point south of this current – What is the temperature?

7. What do we call the zone where the cold Antarctic water and the warmer water to the north meet?

8. What do you think happens to the very cold water as it moves north and meets the warmer water? (Think about the relative densities of cold versus warm water.)