

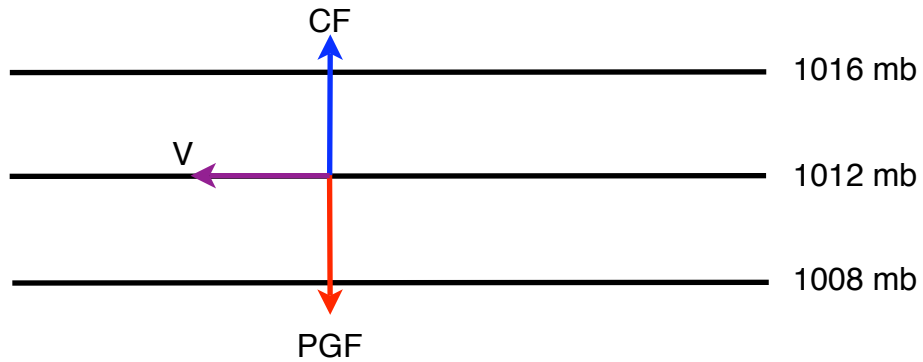
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NATS 101 Introduction to Weather and Climate, Section 54, Fall 2005
Quiz #3 Take Home: Due Tuesday, 6 December 2005.

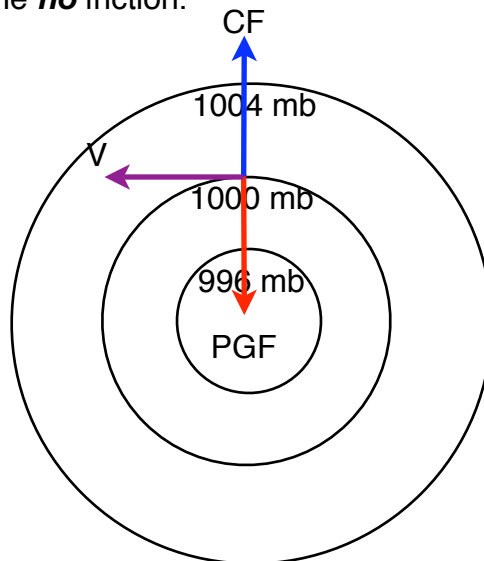
Staple your work when finished! **Answers should be brief - essay answers will not be graded.**

1. Forces on the wind: [12 points]

- a. Draw the force vectors for the pressure system below. Label the pressure gradient force (PGF), the wind vector (V), and the Coriolis force (CF). Assume **no** friction.



- b. Draw the force vectors for the pressure system below. Label the vectors as you did in part a. Assume **no** friction.

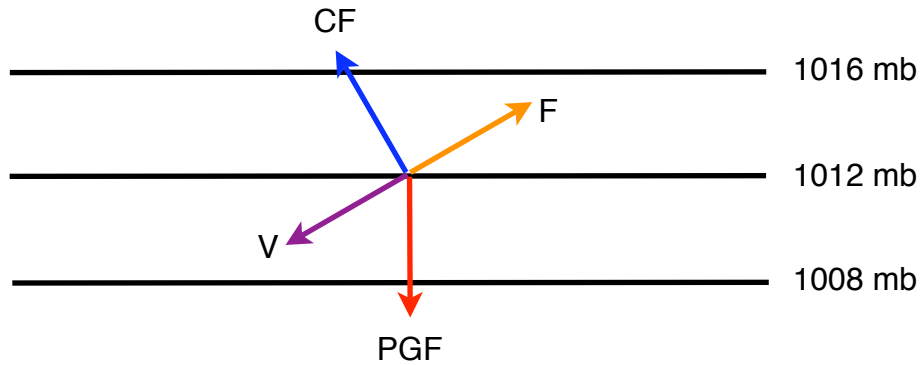


- c. Are parts a and b representative of upper level or surface flow?

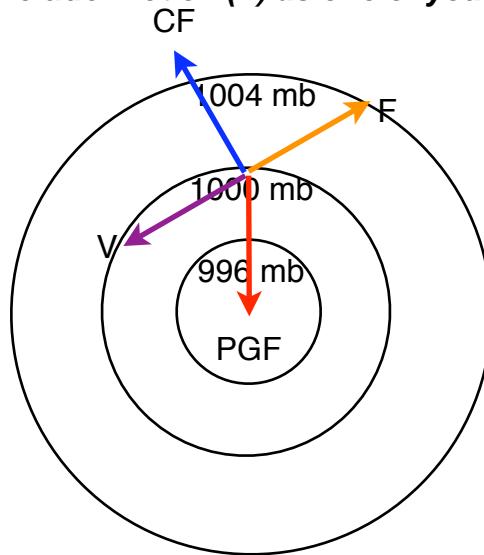
Upper level flow since there is no friction.

Name _____

- d. Draw the geostrophic wind flow by putting arrows indicating direction of the wind. Label the vectors as you did in part a. **Now include friction (F) as one of your vectors.**



- e. Draw the force vectors for the pressure system below. Label the vectors as you did in part a. **Now include friction (F) as one of your vectors.**

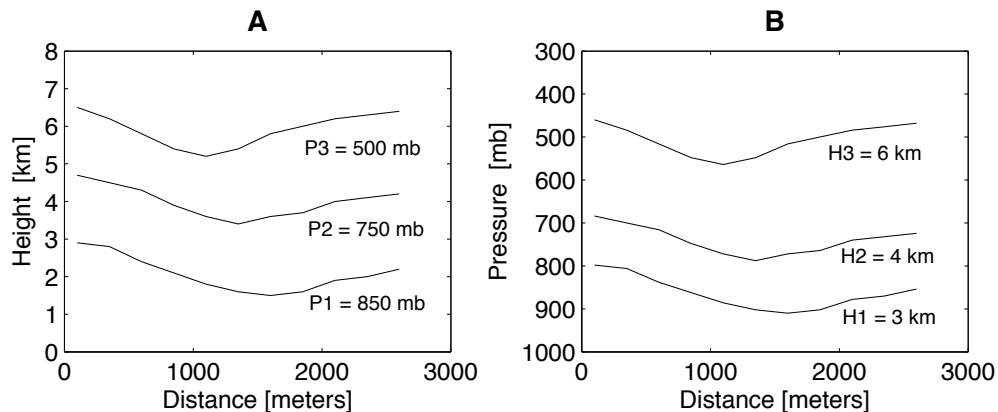


- f. Are parts d and e representative of upper level or surface flow?
Surface flow since there is friction.

Name _____

2. Pressure and Temperature [18 points]

In the figure below there are two graphs. On graph A the y axis is height and the X axis is distance. The plotted lines are pressure surfaces. On graph B the y axis is pressure and the X axis is distance. Here we take coordinates from graph A (i.e. the height of P1 at a given distance) and plot it as a function of pressure on graph B. You can see that the patterns are the same whether we are looking at isobars (lines of constant pressure) on a constant height chart (chart A), or contours (lines of constant height) on a constant

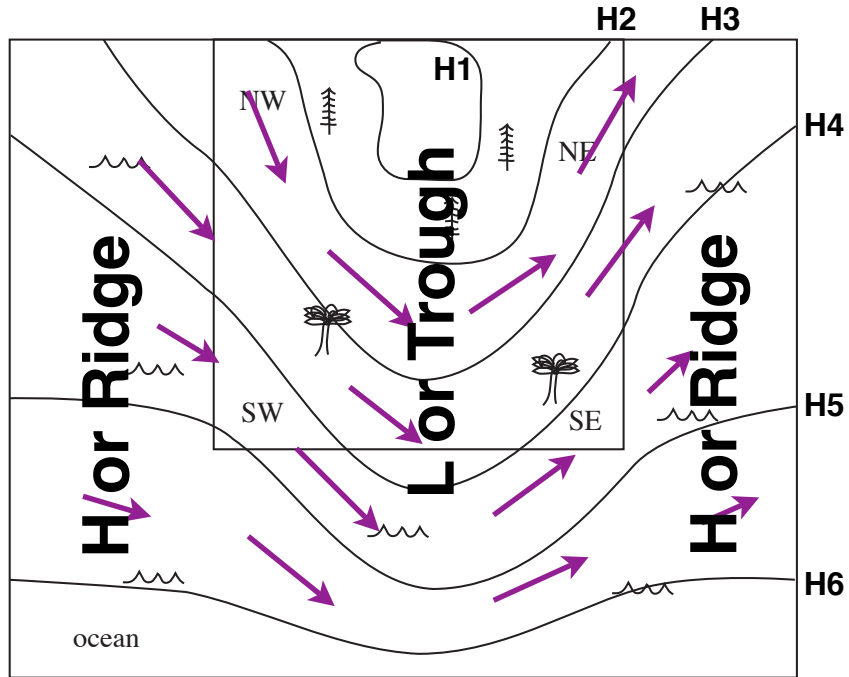


pressure chart (chart B).

Except for surface maps, meteorologists use constant pressure surfaces (like B above) for weather maps. One of several reasons for this is the fact that ***the difference in height between two constant pressure (or isobaric) surfaces is directly proportional to the mean temperature (adjusted for the amount of water vapor present) in the layer between the surfaces.*** In other words, if at any point the 600 mb layer was close to the 500 mb layer, then the mean temperature between those layers at that point is colder than at any other point where the layers are farther apart.

On the next page is a diagram of height contours for the 400 mb level over the winter-time US. A box in the top middle represents the land, water surrounds the box representing the ocean (Mexico has been left out so the Atlantic connects to the Pacific in this picture). As winter approaches over the US, the land cools more quickly than the oceans. For instance, in the middle of February the average ocean temperatures range from 77°F off the coast of Florida, to 45°F off the coast of New England. The temperatures in the middle of the country are usually lower - near zero and below zero temperatures are not uncommon. Temperatures still decrease with increasing latitude, as they do during any season. From these temperature changes, we can infer the heights of a 400 mb surface. When we draw the height contours we get a pattern like that shown in the figure below.

Name _____



- Indicate on the figure where the highest contour lines are and where the lowest contour lines are by labeling the contours H1-H6, assuming H1 represents the lowest height and H6 represents the highest height.
- Draw the wind pattern in the figure corresponding to the height contours. (Notice that the lowest heights would correspond to the lowest pressure if the map were a constant height rather than a constant pressure surface.)

A low area is called a “trough” on a constant pressure surface and the highs are called “ridges”.

- Mark the trough(s) with an “L” and the ridge(s) with an “H” where you think they are located.