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87.202 - PRINCIPLES OF EARTH & ENVIRONMENTALSYSTEMS II
STUDY QUESTIONS AND PROBLEMS V

1. It takes 29 days for the moon to complete one rotation on its axis. Is the Coriolis force at a given latitude on the moon larger or smaller then at the same latitude on earth? By how much?

2. A wind speed of 10 m s^{-1} is measured at the equator.

   a. Calculate the magnitude of the Coriolis force (the Coriolis parameters are tabulated in Table 1).

   b. Can the wind be geostrophic? Why or why not?

   c. What would be the relation between wind direction and isobars at the equator?

3. Suppose that at a particular location the isobars on an upper level chart at 3 km are the same distance apart and have the same direction as the isobars on the sea-level chart. Would the geostrophic wind at 3 km be the less, the same, or greater than the geostrophic wind at sea level. Why?

4. Why does the wind near the ground blow towards low pressure while the wind aloft blows almost exactly parallel to the isobars.

5. a. Make two drawings showing the surface wind direction around (i) a low-pressure center and (ii) a high- pressure center in the Southern Hemisphere.

   b. Is the gradient wind speed around a low-pressure center in the Southern Hemisphere greater or less than the geostrophic wind speed? Draw a diagram that shows why your answer is right.

6. On a surface weather map the 4 mb isobars are 300 km apart and the specific volume of the air is 0.775 $m^3\ kg^{-1}$. Calculate the magnitude of the geostrophic wind at 45° N latitude. (ans: 10.0 $m\ s^{-1}$)

7. At 60^{o}S latitude on an upper level 500 mb chart the slope of the 500 mb surface is 30 m/100 km.

    a. Calculate the geostrophic wind velocity. (ans: 23.3 m s^{-1})

    b. For a cyclone with a radius of 200 km calculate the gradient wind speed. (ans: 14.7 m s^{-1})

    c. Given a horizontal temperature gradient of 1^{o}C/50 km calculate the thermal wind velocity at a height of 4 km. The average surface temperature in the area of interest is 12^{o}C and the environmental lapse rate is 8^{o}C km^{-1}. (ans: 23.1 m s^{-1})

Table 1. Variation of Coriolis parameter with latitude

Latitude φ (deg)	Coriolis parameter $f\ (s^{-1})\ x\ 10^{-5}$
0	0
5	1.3
10	2.5
15	3.8
20	5.0
25	6.2
30	7.3
35	8.4
40	9.4
45	10.3
50	11.2
55	12.0
60	12.6
65	13.2
70	13.7
75	14.1
80	14.4
85	14.5
90	14.6