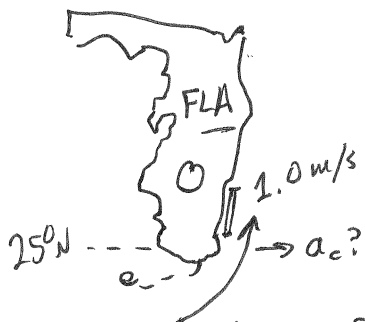


Practice Questions for Final Exam: ESR 320

1. In class we talked about the Coriolis Effect on wind, but we said it applies equally to major ocean currents. The Gulfstream just offshore of Miami Beach has a mean velocity of 1.0 m/s. What is the Coriolis acceleration (in m/s²) that the water experiences if Miami Beach is at a latitude of 25°N?



$$\Phi = 25^\circ$$

$$f = 2\omega \sin \Phi \quad (\text{Coriolis Parameter})$$

$$\omega = (\text{rotation of earth}) = \frac{2\pi}{(1 \text{ day})(86,400 \text{ s/d})} = 7.3 \times 10^{-5} \text{ s}^{-1}$$

$$f = 2(7.3 \times 10^{-5} \text{ s}^{-1})(\sin 25^\circ) = 6.2 \times 10^{-5} \text{ s}^{-1}$$

$$a_{\text{cor}} (= \frac{dv_x}{dt}) = f v_y = (6.2 \times 10^{-5} \text{ s}^{-1})(1 \text{ m/s})$$

$$a_c = 6.2 \times 10^{-5} \text{ m/s}^2$$

NOTE: Does not sound like much. But over one day, the water moves 86.4 km north (1 m/s x 86,400 s/d) but has "accelerated" by 5.3 m/s to the right

2. A weather map showing the state of Oregon indicates a high pressure over California has spilled up into Oregon. The barometric pressure at the California-Oregon border is 102.0 kPa and the pressure at the Oregon-Washington border (500 km north) is 101.7 kPa, and the isobars are approximately parallel (as shown).

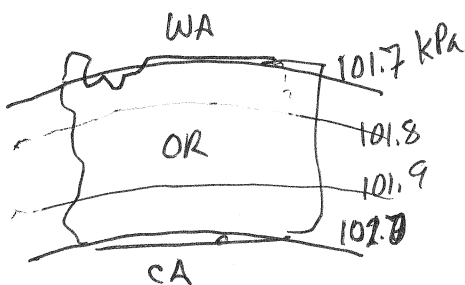
A) What is the magnitude of the average wind over Oregon? (The average air density for the lower 2000 m of atmosphere is about 1.1 kg/m³; use that for ρ_a .)

In class derived $a_c = a_p$ (Coriolis = Pressure accel. = Pressure Accel.)

$$f v = -\frac{1}{\rho_a} \frac{dp}{dy} \quad \frac{dp}{dy} = \text{Pressure Gradient}$$

$$\text{OR } v = -\frac{1}{\rho f} (\text{grad.})$$

$$f = 2\omega \sin \Phi = 1 \times 10^{-4} \text{ s}^{-1} \text{ at } \sim 45^\circ \text{N}$$



(4)

$$v = \frac{-1}{(1.1 \text{ kg/m}^3)(1 \times 10^{-4} \text{ s}^{-1})} \left(-\frac{102.0 - 101.7 \text{ kPa}}{500,000 \text{ m}} \right) (1000 \text{ Pa/kPa})$$

$$\text{WIND} = \boxed{5.5 \text{ m/s}} \approx \boxed{12 \text{ mph}}$$

B) What is the direction of the wind?

WEST WIND (west to east) \Rightarrow

C) What is the expected weather like?

Sunny, dry