Unit 22 ATM401/ATM601/Chem601

1. All students: Why do tropical cyclones not form at latitudes less than 5° from the equator? Determine the minimum planetary vorticity (in s^{-1}) needed to spawn a tropical storm. What wind speed must the sustained surface winds be at least to constitute a typhoon? Calculate the minimum east-west pressure gradient (Pa/m) needed to generate typhoon-force geostrophic winds at 5° and at 30° latitude assuming a density of $1.29 kg/m^3$

2. ATM601 students: The westerly speed, c, of a Rossby wave depends on its latitude, its wavelength, λ, and the westerly component of wind speed within the wave, u according to $c = u - 5.8 \cdot 10^{-13} \cos \varphi \cdot \lambda^2$ at 45° latitude.Assuming no wind, how much faster and in which direction does a long Rossby have travel with a wavelength of 6500 km compared with a smaller Rossby wave of wavelength 3500 km?

3. ATM601 students: Assuming a westerly wind exists, there is a critical Rossby wavelength, λ_{crit}, at which the waves are stationary with respect to the earth's surface. At 45° latitude the critical wavelength is given by $\lambda_{crit} = \sqrt{(\frac{u}{\beta})}$ with $\beta = 1.62 \cdot 10^{-11} m^{-1} s^{-1}$. Determine the critical wavelength that separates eastward moving Rossby waves from westward moving Rossby waves for an aloft wind speed of $70 \, m/s$.