

**ATM 317**  
 Homework 1  
 Due: Monday, Feb. 11

1. Cool season precipitation-type forecasts can be a challenge for forecasters.
  - a. On many forecast maps, the 1000–500hPa thickness contours are presented as two different colors representing values  $>5400$  m and values  $\leq 5400$  m. For many regions, the 5400 m thickness contour is used as a proxy to delineate an equal probability of the precipitation type being either rain or snow. Calculate the mean virtual temperature of the layer for the thickness value of 5400 m. Do you think it's reasonable to use this 5400 line to delineate an equal probability of rain or snow?
  - b. Identifying forecasts regions of freezing rain can very difficult. In preparing a forecast, one forecasts rule is to identify regions where the surface temperature is below freezing and the 850–700 hPa thickness is  $\geq x_{freezing}$  m. With that you know about the required temperature profile for freezing rain, calculate the value of  $x_{freezing}$  and explain why this value would be appropriate for this forecaster rule.
  
2. Consider Figure 1, which shows 1000–500 hPa thickness contours (dashed lines) along with isopleths of some variable  $A$  (solid lines).  $A$  has the same values at 500 hPa as it does at 1000 hPa.

At which level, 1000 or 500 hPa, is the geostrophic advection of  $A$  at station X larger? Explain your answer and reference Figure 1 below.  
 (Hint: your answer can be proved with the basic physical definition of thermal wind.)

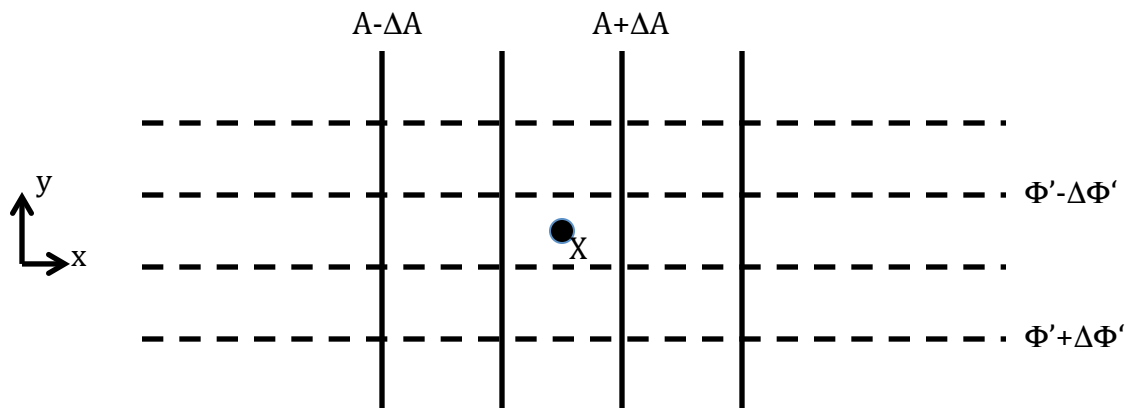


Figure 1: The 1000-500 hPa thickness contours (dashed lines) and isopleths of variable  $A$  (solid lines).  $A$  has the same values at 500 hPa as it does at 1000 hPa.