

ERTH 260: Lab #8  
Working with Soundings: Using Mixing Ratio Information  
and Exploration into Meaning of Instability (Due Friday 6 April)  
(100 points)

**For questions 1(e), 3(b), 4(d), 5(d) show calculations on separate sheet. For questions 5(a) and 5(e) answer in complete sentences and on separate sheet.**

1. The Skew-T/Log p sounding for KFWD for 12 UTC 31 March 2015 is provided as Fig. 1. Note the mixing ratio lines (colored light blue and labeled near the bottom) that extend from bottom left to upper right). **(30 pts)**
  - a. What is the actual mixing ratio at the surface? \_\_\_\_\_ **(5 pts)**
  - b. What is the saturation mixing ratio at the surface? \_\_\_\_\_ **(5 pts)**
  - c. Draw a **green** line on the sounding from the dew point at the surface upward to 500 mb, parallel to the mixing ratio line and label it with the value you found in (a). **(On diagram, neatly) (5 pts)**
  - d. Draw a **red** line on the sounding from the temperature at the surface upward to 500 mb parallel to the nearest mixing ratio line and label it with the value you found in (b). **(On diagram, neatly) (5 pts)**
  - e. What is the relative humidity at the surface (check class website presentation on humidity for formula)? \_\_\_\_\_ (Show work below) **(10 points)**
2. On the sounding you are working on in (1) above, now draw a **black** line that extends upward from the surface temperature parallel to the dry adiabatic rate to around the 500 mb level. **(On diagram, neatly) (5 pts)**
3. This line corresponds to the dry adiabat you'd use to determine what the temperature of an ascending air parcel would be. Note that it crosses your line you drew in 1 (c) above. **(15 pts)**
  - a. Label this intersection point with a black X; **(On diagram, neatly) (5 pts)**
  - b. Say an air parcel is lifted from the surface to the elevation indicated by the X. What is the relative humidity of that air parcel when it gets to the X. Use the same formula you used in 1 (e). \_\_\_\_\_ **((10 points)**
4. As discussed in class, once the air parcel's relative humidity is 100%, if it continues to rise, it no longer can cool at the dry adiabatic rate. It will continue to cool, but at a lesser rate, called the wet adiabatic rate. Those are shown by the curves that slope from bottom right to upper left on this diagram. **(25 pts)**

- a. Continue the line you drew in black to the X indicating the parcel's temperature change, but, now, from the X, draw the line parallel to the nearest of these curves. **(On diagram, neatly) (5 pts)**
  - b. Note that this line crosses the original sounding. Label this crossing point with a Y and continue drawing the line past the tropopause. **(On diagram, neatly) (5 pts)**
  - c. Shade in the portion of the parcel's "ascent curve" that shows the parcel colder than the surrounding air at the same elevation in blue and that which shows the parcel warmer than its surroundings in red. **(On diagram, neatly) (10 points)**
  - d. How much warmer is the air parcel lofted to 500 mb in these steps than the surrounding air at the same elevation (in C<sup>0</sup>)? \_\_\_\_\_ **(5 pts)**
5. Figure 2 is the same Forth Worth Sounding plotted on a Stüve diagram. **(25 pts)**
- a. Comment on the obvious VISIBLE differences between the way the sounding appears on Figure 2 and the way it appears on Figure 1. **(5 pts)**
  - b. Assume that the environmental lapse rate stays the same, but that the dew point temperature is so low it does not appear on the diagram. On Figure 2, lift the surface air parcel and draw a **blue** line that extends upward from the surface temperature parallel to the dry adiabatic rate to the 500 mb level. **(On diagram, neatly) (5 pts)**
  - c. What is the temperature of the air parcel once it is lofted to a pressure elevation of 500 mb? . (in C<sup>0</sup>)? \_\_\_\_\_ **(5 pts)**
  - d. How much warmer or colder is the air parcel lofted in step (b) than the air parcel's temperature you obtained in 4 (d) above. (in C<sup>0</sup>)? \_\_\_\_\_ **(5 pts)**
  - e. Explain why there is a difference between these two temperatures? **(5 pts)**

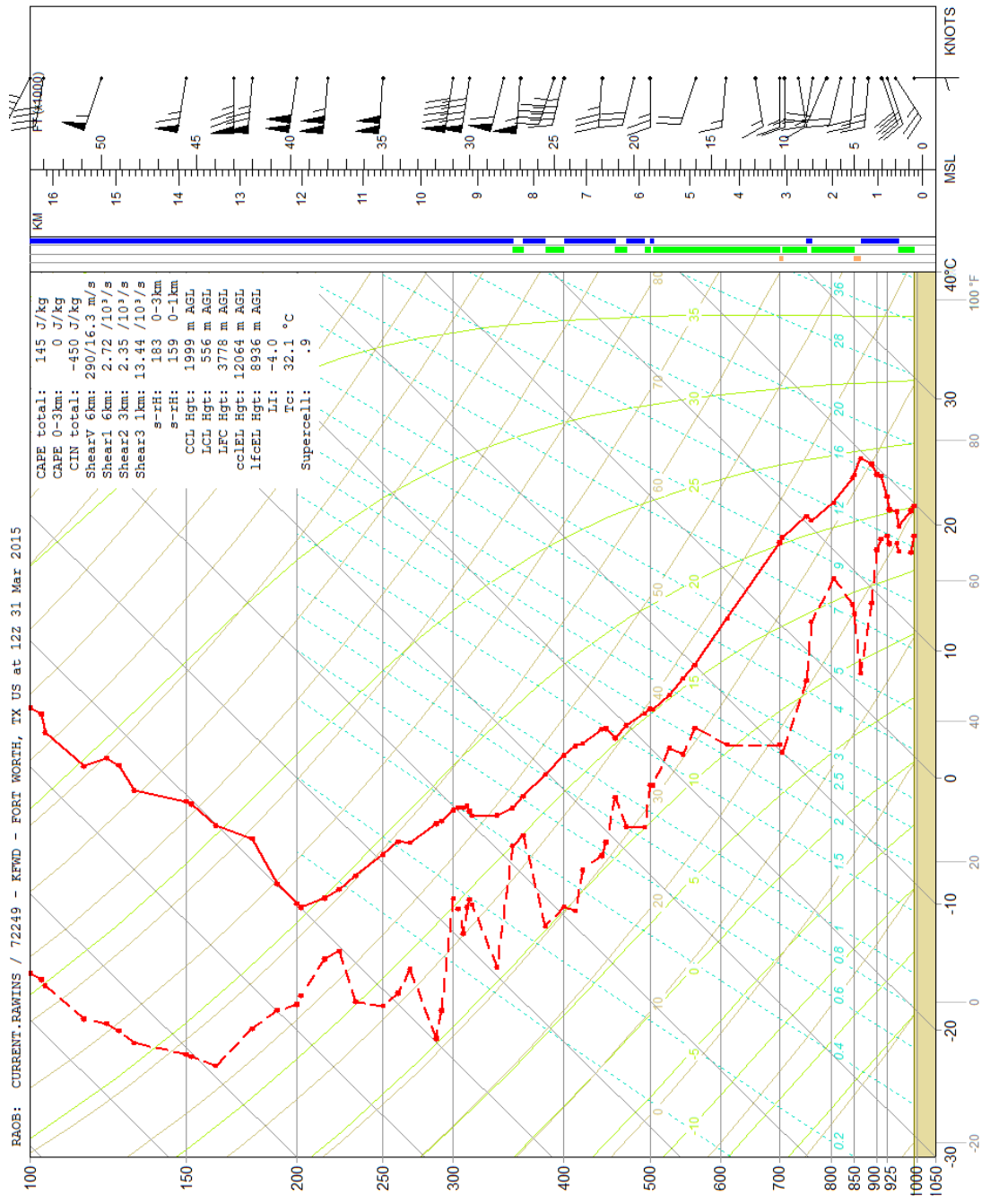


Figure 1: Skew-T/log p sounding for Fort Worth, TX, 12 UTC 31 March 2015

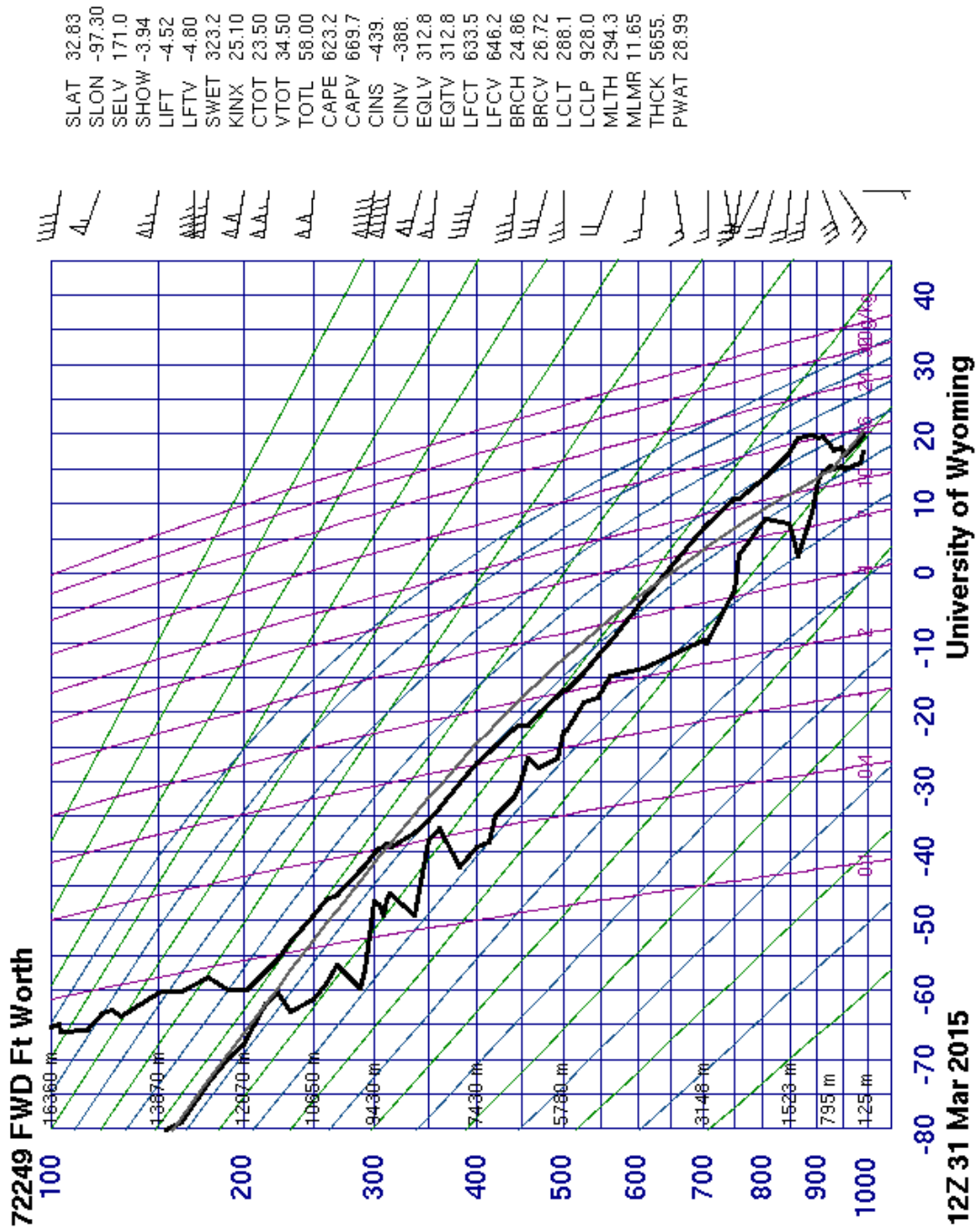


Figure 2: Stüve diagram sounding for Fort Worth, TX, 12 UTC 31 March 2015