Thunderstorms

WHAT YOU SHOULD LEARN IN THIS EXERCISE:

- The environmental conditions necessary for thunderstorm formation.
- How to determine atmospheric stability from soundings.
- How to predict where thunderstorms are likely to form.

You will determine where thunderstorms are likely to form based on station observations and soundings. The formation of thunderstorms requires several factors including:

1. source of moisture
2. lifting mechanism
3. unstable atmosphere

Part A: Getting started

A1. Create a folder on your CD entitled "Thunderstorms." You should save all of the plots and data for today's lab in this folder for easy referencing later.

A2. Launch the program called "Thunderstorm"

A3. After you are finished with the exercise, ***list the state(s) in which you forecast thunderstorms here and turn this front page in to your TA.***

Part B: Forecasting thunderstorm formation

Using the information on the map and the soundings provided, identify where you would expect thunderstorms to form by answering the following questions.

- If you want to erase a line/contour, choose that line/contour on the pull-down menu and click "Clear Current Contour". *Once you clear a contour you cannot get it back!*
- If you want to erase all of the lines/contours, choose "Clear All Contours". *Once you clear all the contours you cannot get them back!*

B1. Where is the moisture? (Where are the highest dew point temperatures?)
Using the pull down menu select "High Dew Points." Contour the areas with dew points greater than 50°F with the mouse. Once you have drawn the contour it will be shaded in automatically.

B2. What is the lifting mechanism?

a. Select "Cold Front" from the pull down menu. Use the mouse to draw the cold front in the appropriate place on the map.
b. Select "Warm Front" from the pull down menu. Use the mouse to draw in the warm front in the appropriate place on the map.
c. Select "Dryline" from the pull down menu. Use the mouse to draw the dryline in the appropriate place on the map.

B3. Where is the atmosphere most unstable?
The Lifted Index is a tool that meteorologists use to determine how unstable the atmosphere is. The Lifted Index is computed by subtracting the temperature of an air parcel lifted to the 500mb level from the actual air temperature at 500mb. The resulting value indicates how unstable the atmosphere is and how likely it is that thunderstorms will develop.

Click on the "Show Soundings" button to bring up a window with the soundings. Use the pull down menu to view each sounding. As you look at each sounding the location of the city at which the sounding was taken is highlighted in blue. Based on the soundings for the four cities, determine the atmospheric temperature at 500 mb, the parcel temperature at 500 mb, the LI (Lifted Index), the stability and the potential weather conditions. Fill in this information on the chart located at the end of this exercise (page 5).

The table on the next page shows how Lifted Index (LI) is interpreted by meteorologists.

Lifted Index (LI): Tool used by meteorologists to determine how unstable the atmosphere is

LI = temperature (air temperature at 500 mb) - temperature (lifted air parcel to 500 mb)

Translation of LI into Potential Weather

LI > 2	No significant activity
0 < LI < 2	Showers probable; isolated thunderstorm possible
-2 < LI < 0	Thunderstorms probable
-4 < LI < -2	Severe thunderstorms possible
LI < -4	Severe thunderstorms probable, tornadoes, possible

B4. Based on your answers to B1 through B3, identify where thunderstorms might develop. Choose "Thunderstorm" in the drop down menu. Click and drag the thunderstorm symbols at the bottom right of the map to the location where you expect thunderstorms to occur.

B5. Save your map.

B6. Answer question A3 on the first page and turn it in to your TA.

Extended Exercise #5:
Due at the beginning of Hands-On class November 21-22

WHAT YOU NEED TO TURN IN:
Please organize the following materials in the order they are listed, staple, and turn in.

- Cover page with your name, the date, title of exercise: "Thunderstorms," and your section number and instructor
- The map you analyzed in part B
- The completed chart for B3 (found on page 5)
- Answers to questions 1 through 4

Note: Your answers should be typed. This will provide you with a backup copy of your assignment and prevent any misinterpretation by the TA grading the assignment.

PART C: QUESTIONS FOR THOUGHT

1. Thunderstorm exercise questions

(a) Print the map you forecasted thunderstorms on.
(b) Draw in the correct symbols for each of the fronts you analyzed.
(c) What was the lifting mechanism for these thunderstorms?
(d) What other two lifting mechanisms are on the map? Why wouldn't thunderstorms form along those boundaries?

2. Where in the United States does the highest frequency of thunderstorms occur? Why there?

3. From the list of thunderstorms provided(i - iv), choose the thunderstorm that each statement in (a) - (h) describes.

i. airmass (ordinary) thunderstorms
ii. squall line thunderstorms
iii. supercell thunderstorms
iv. mesoscale convective complexes

(a) These thunderstorms typically last an hour or less.

(b) These thunderstorms always rotate.

(c) These thunderstorms are often found aligned with a cold front and can form out ahead of a cold front.

(d) These thunderstorms often contain a wall cloud.

(e) These thunderstorms typically form in the middle of airmasses.

(f) These thunderstorms can be as much as 1000 times larger than the smallest thunderstorms.

(g) These thunderstorms are aligned next to each other and may produce a bow echo.

(h) These storms move slowly, often persist for more than 12 hours and may cover an entire state.

4. You and your friend are talking on a corded telephone from your respective apartments. Your friend's apartment is exactly 1 mile due east of your apartment. Exactly 5.00 seconds after a flash of lightning, you hear a rumble of thunder. Exactly 2.07 seconds later you hear that same rumble of thunder over the telephone from your friend's apartment.

(a) What was the distance and direction from your apartment to the lightning bolt? (Note: There are two possible directions.)
(b) What should you do with the telephone conversation?

Table for B3

Based on the soundings for the four cities listed, determine the atmospheric temperature, the parcel temperature, the LI, the stability and the potential weather conditions.

	Atmospheric temperature at 500 mb	Parcel temperature at 500 mb	LI	Unstable/Stable	Potential Weather
Topeka, KS					
Springfield, MO					
Shreveport, LA					
Nashville, TN					