Air Pressure and Fronts

Incorporates some materials from The STORM Project, Activity 5, Fronts and Activity 8, Drawing Isobars. (http://www.uni.edu/storm/activities/level2/index.shtml)

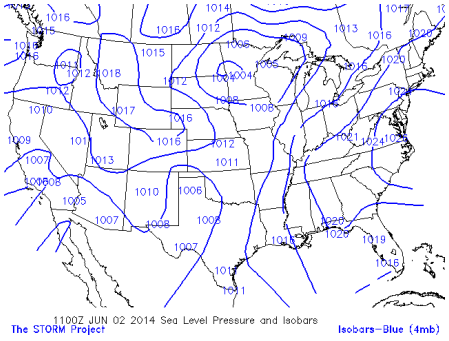
This activity is to help students become familiar with the relationships between air pressure, temperatures, and weather fronts, and to enable students to make predictions on the effects of fronts on the precipitation and temperatures of a location.

Engage:

1. Ask the class whether they ever watch the weather reports on television.
2. Has anyone ever heard the weather person talk about Highs and Lows? Sometimes they are talking about temperature, but there something else that meteorologists measure regarding the weather, putting H for high and L for low on the weather maps. What are these highs and lows? *(Air pressure)*
3. Ask the students to write down five things that they know about warm and cold fronts.

Explore:

Assist your students as needed with the following steps, using the student worksheets and the activity powerpoint.



1. Examine the sea level air pressure values with isobars (that connect similar numbers) for the US for June 2, 2014, on their student worksheet. Where are the lowest numbers? Where are the highest numbers? Invite the students to draw a L in the areas with low numbers and an H in the areas with high numbers.
2. Project the surface fronts map for June 2, 2014 and ask your students to compare their high and low pressure indications to those on the map; are they similar?
3. Examine the fronts for June 2. Are they near the low pressure or the high pressure? What types of fronts are they? Which directions are they moving?
4. Examine the fronts and temperatures for June 3, 2014. Which direction is the cold front moving? Which direction is the warm front moving? How do the temperatures ahead of the cold front compare to the temperatures behind the cold front? How do the temperatures ahead the warm front compare to the temperatures behind the warm front?
5. Examine the radar map for precipitation for June 3, 2014. Is there any precipitation near the cold front? If so, where? Is there any precipitation near the warm front? If so, where?

Explain:

Answer the following questions.

1. What weather would you expect a city to have if it is…
   a. In a region of high pressure?
   b. In a region of low pressure?

c. ahead of a cold front?
d. behind a cold front?
e. ahead of a warm front?
f. behind a warm front?

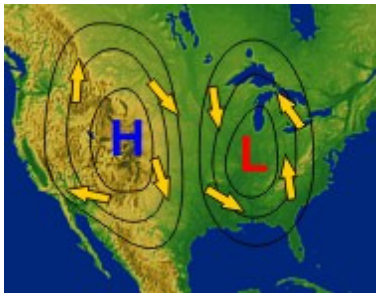
Extend:
Project the weather forecast map for Jan. 17, 2001, and invite your students to describe the different types of fronts and their directions.

1. Which type of front moves faster, a warm front or a cold front? *(A cold front).*
2. What conditions is Denver likely experiencing? Minneapolis? Houston? Why? *(Denver is near high pressure and is probably clear. Houston may have rain; it is near an approaching warm front. Minneapolis is behind a warm front and may be experiencing light precipitation.)*
3. What weather conditions can you anticipate in 24 hours, given the direction and movements of the fronts?
4. Examine the weather forecast map for January 18, 2001. How do your predictions compare with the conditions listed on the map?

For Further Inquiry:
Invite your students to use the various weather maps on http://www.uni.edu/storm/wximages/index.htm to observe the relationship between fronts, air pressure, temperatures, and precipitation, and to make predictions, then to observe the weather in the next day to compare their predictions to what happened.

Teacher Background: Air Pressure

You have probably seen a newspaper surface map marked with H's and L's which indicate high and low pressure centers. Surrounding these "highs" and "lows" are lines called isobars. "Iso" means "equal", and a "bar" is a unit of pressure so an isobar means equal pressure. We connect these areas of equal pressure with a line. Everywhere along each line is constant pressure. The closer the isobars are packed together the stronger the pressure gradient is. Pressure gradient is the difference in pressure between high and low pressure areas.



Although the changes are usually too slow to observe directly, air pressure is almost always changing. This change in pressure is caused by changes in air density, and air density is related to temperature.

Teacher Background: Fronts

The term “front” came from military meteorologists, who decided that just like enemies who are in battle will fight along a front, so to do air masses with different properties. These battle lines or fronts indicate a change in the weather. On a weather map fronts are drawn there is large change in temperature and a shift in wind direction. On a weather map, fair weather is generally associated with high pressure systems, while stormy weather is usually associated with low-pressure systems.

A cold front means a cold air mass is pushing into a warmer air mass, and is shown on the weather map with blue triangles pointing in the direction of the warmer air, or in the direction in which the colder air is moving. A warm front means a warm air mass is pushing into a colder air mass, and is shown on the weather map with rounded semicircles pointing in the direction of the moving warm air. Sometimes you will hear meteorologists also refer to fronts as “boundaries”.

Fronts extend outward from Lows, but not Highs. In the northern hemisphere, fronts rotate slowly counterclockwise around Lows. Cold fronts move at an average speed of about 30 miles per hour, while warm fronts average about half that speed.

Air Pressure and Fronts

Student Sheet

Engage:

Answer the following:

Write down five things that you know about warm and cold fronts.

_____

_____

_____

_____

Explore:

Use the maps on the next pages or on the powerpoint to answer the following questions.

1. Examine the sea level air pressure map for the US for June 2, 2014. Where are the lowest numbers? Where are the highest numbers? Draw a L in the areas with low numbers and an H in the areas with high numbers.

_____

_____

2. Examine the surface fronts map for June 2, 2014 and compare your high and low pressure indications to those on the map; are they similar?

_____

_____

3. Examine the fronts for June 2. Are they near the low pressure or the high pressure? What types of fronts are they? Which directions are they moving?

_____

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4. Examine the fronts and temperatures for June 3, 2014. Which direction is the cold front moving? Which direction is the warm front moving? How do the temperatures ahead of the cold front compare to the temperatures behind the cold front? How do the temperatures ahead the warm front compare to the temperatures behind the warm front?

_____

_____

5. Examine the radar map for precipitation for June 3, 2014. Is there any precipitation near the cold front? If so, where? Is there any precipitation near the warm front? If so, where?

_____

_____

Explain:

Answer the following questions.

2. What weather would you expect a city to have if it is
   a. in a region of high pressure?

_____

_____

   b. In a region of low pressure

_____

_____

   c. ahead of a cold front?

_____

_____

   d. behind a cold front?

_____

_____

   e. ahead of a warm front?

_____

_____

   f. behind a warm front?

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Extend:

Examine the weather forecast map for Jan. 17, 2001

1. What types of fronts are present? _____
2. Which type of front moves faster, a warm front or a cold front? _____
3. What conditions is Denver likely experiencing? Why?

_____

4. Minneapolis? Why?

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5. Houston? Why?

_____

6. What weather conditions can you anticipate in 24 hours for each city, given the direction and movements of the fronts?

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7. Examine the weather forecast map for January 18, 2001. How do your predictions compare with the conditions listed on the map?

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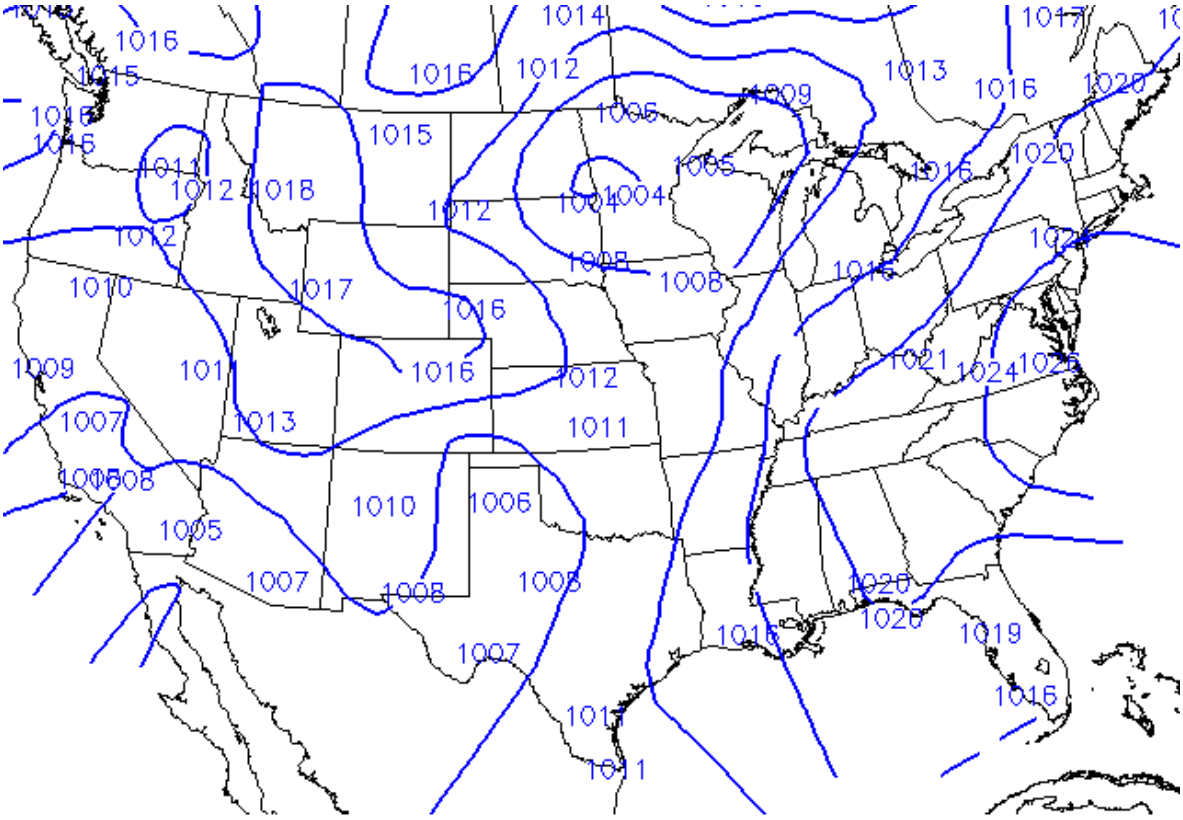
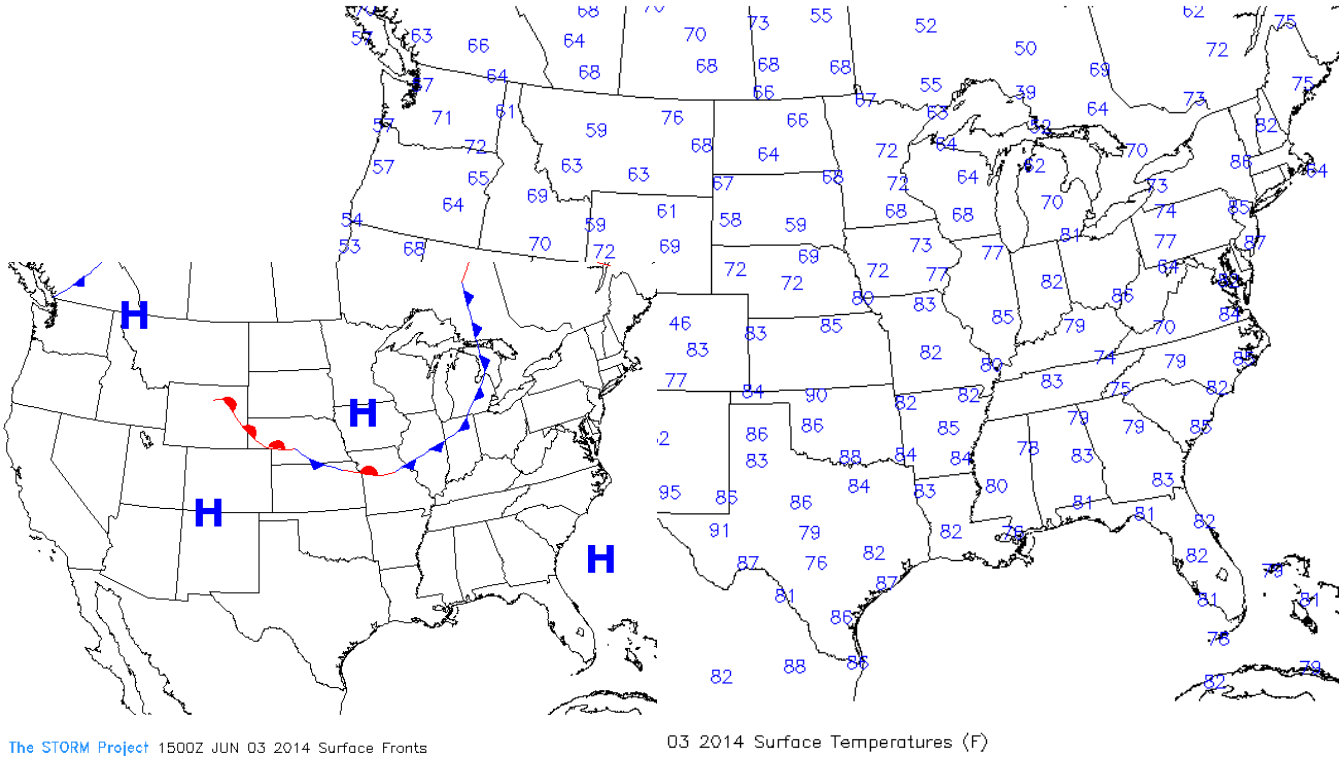
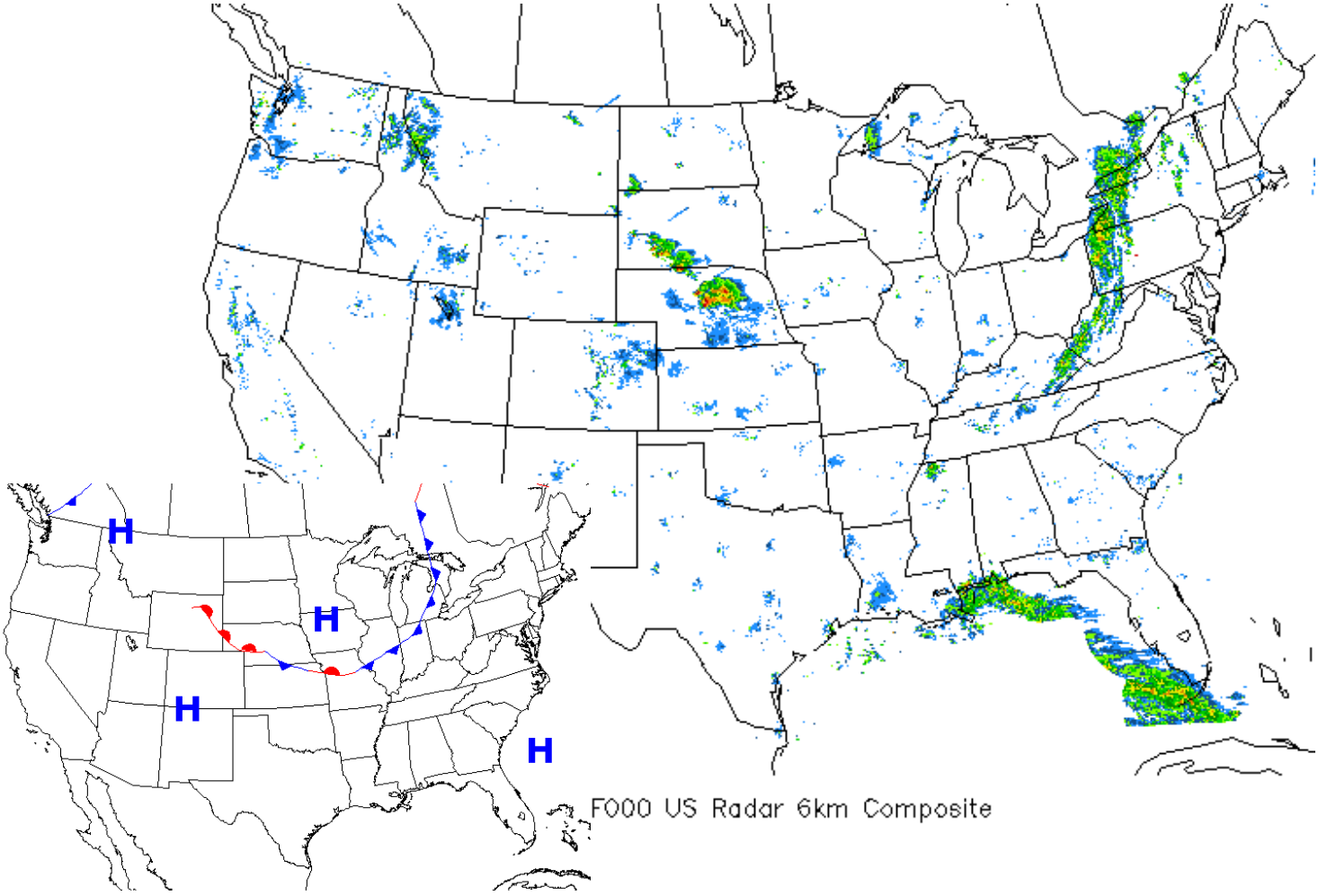


June 2 Sea Level Pressure



June 3, 2014 Temperatures and Front Maps



June 3, 2014 Radar Precipitation and Front Maps