Air Masses and Fronts

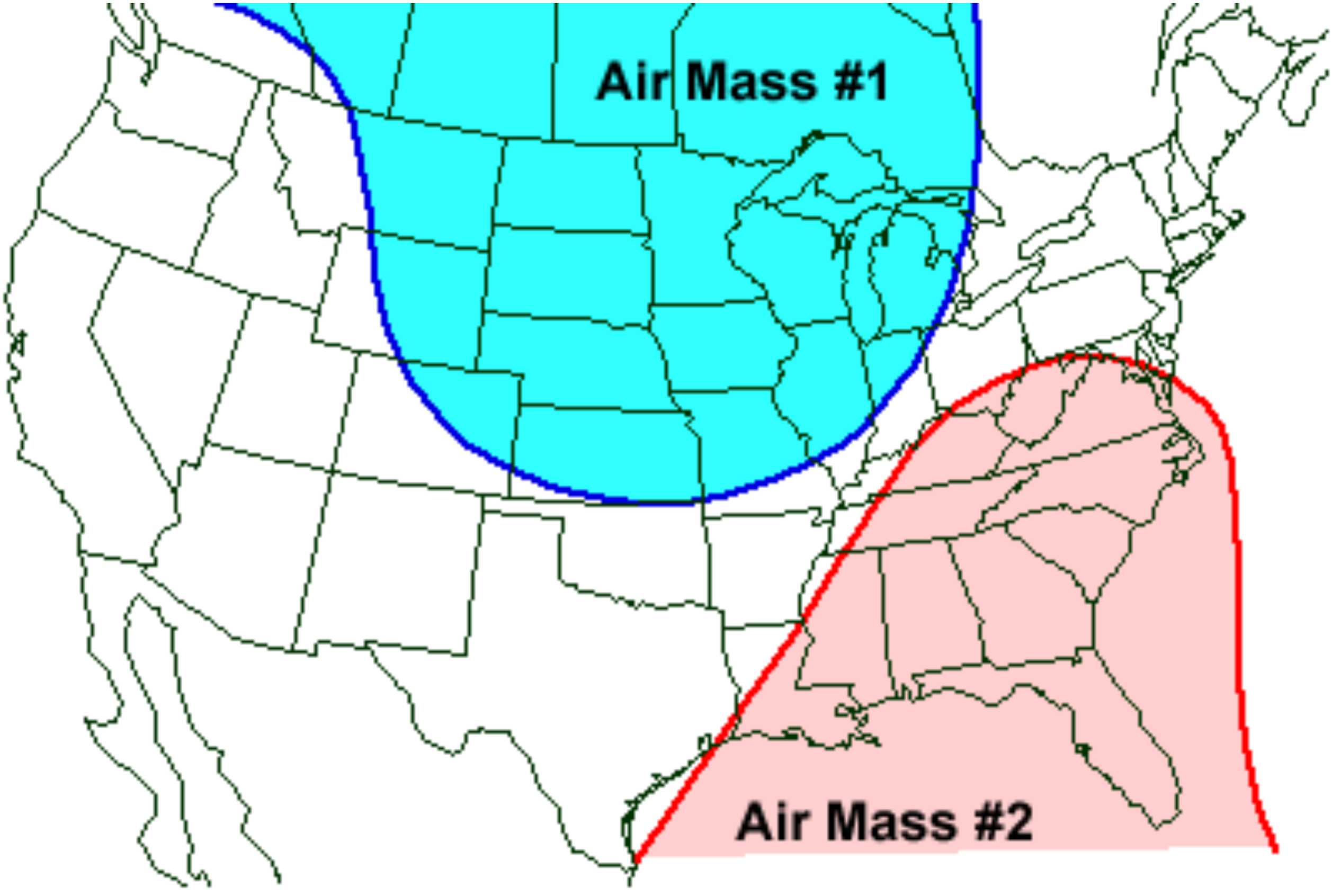
Holt Science and Technology

Weather and Climate

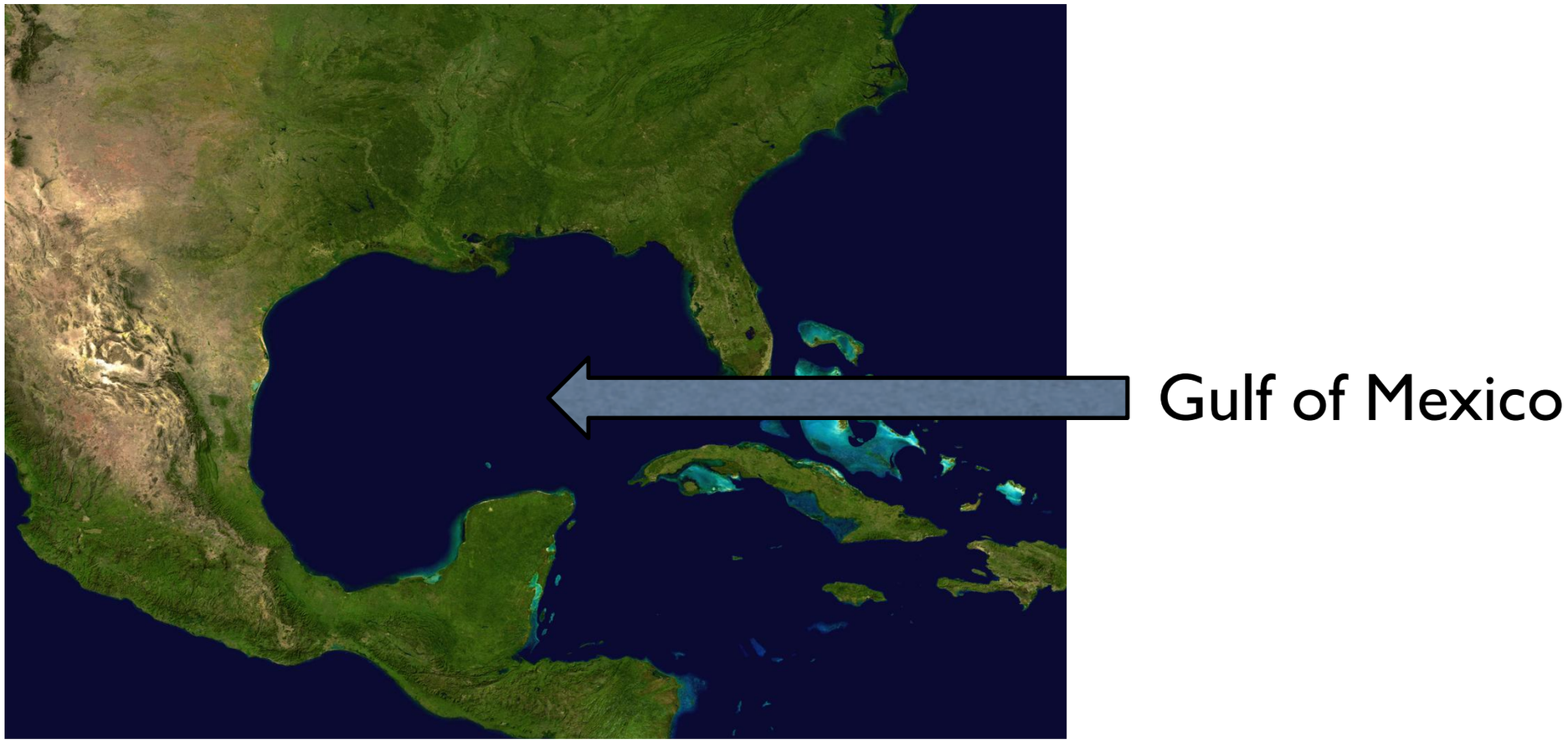
Chapter 2, Section 2

Types of Air Masses

- Changes in weather are caused by the movement and interaction of air masses.
- An **air mass** is a large body of air that has similar *temperature* and *moisture* content throughout. An air mass can be thousands of km across and extend 16km (10mi) into the stratosphere. (*not in book*)
- Air masses are named according to their *moisture* and *temperature* characteristics.


Air Mass #1
Air Mass #2

An air mass gets its *moisture* and *temperature* characteristics from the area over which it forms. These areas are called **source regions**.



For example, an air mass that develops over the Gulf of Mexico is *warm* and *wet* because this area near the equator is warm and has a lot of water that evaporates into the air.

MATCHING GAME

Turn and talk with your partner. Which description do you think describes each type of air mass? Why?

1. continental (c)

2. polar (P)

3. maritime (m)

4. tropical (T)

A. warm air

B. cool air

C. humid air

D. dry air

MATCHING GAME

How did you do?

1. continental (c)
2. polar (P)
3. maritime (m)
4. tropical (T)

A. warm air
B. cool air
C. humid air
D. dry air

Air Masses That Affect Weather in North America

1. continental (c)-dry air (forms over dry land)

2. polar (P)-cold air (forms toward the poles)

3. maritime (m)-humid/moist air (forms over water)

4. tropical (T)-warm air (forms toward the equator)

Types of Air Masses

What types of air masses fill in the blanks?

- A air mass forms over the ocean and has *humid* air.
- A air mass forms over land and has *dry* air.
- A air mass forms in the tropics and has *warm* air.
- A air mass forms toward the poles and has *cold* air.

Types of Air Masses

What types of air masses fill in the blanks?

- A **maritime** air mass forms over the ocean and has *humid* air.
- A **continental** air mass forms over land and has *dry* air.
- A **tropical** air mass forms in the tropics and has *warm* air.
- A **polar** air mass forms near the poles and has *cold* air.

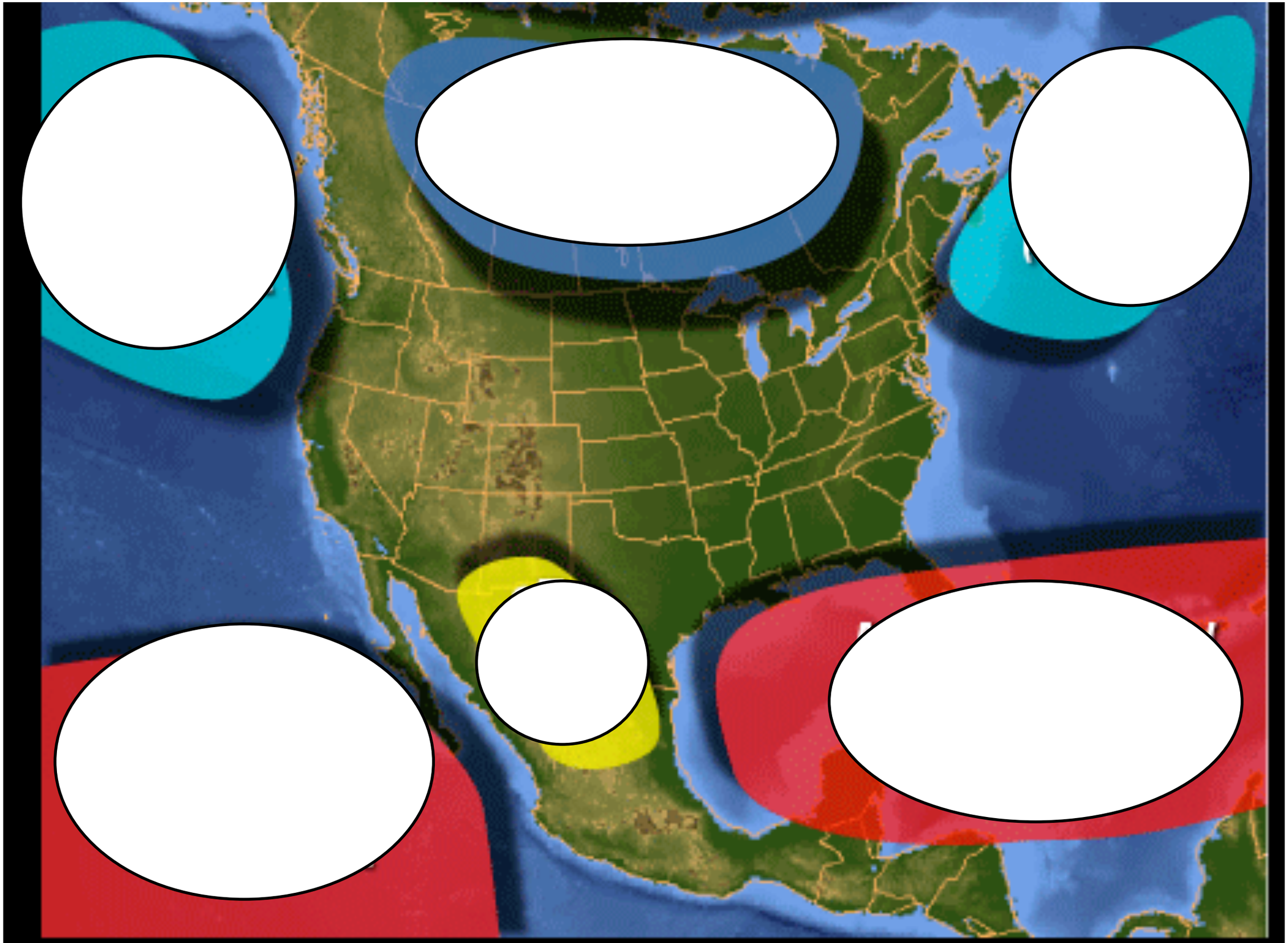
Labeling air masses

- When naming the different air masses, we use a two-letter symbol.
- The first letter indicates the moisture conditions of the air mass. It is lowercase.
- The second letter represents the temperature characteristics of the air mass. It is uppercase.

Types of Air Masses

- A maritime tropical (mT) air mass has warm, humid air.
- A maritime polar (mP) air mass has cold, humid air.
- A continental tropical (cT) air mass has hot, dry air.
- A continental polar (cP) air mass has cold, dry air.

What kinds of air masses are shown here?



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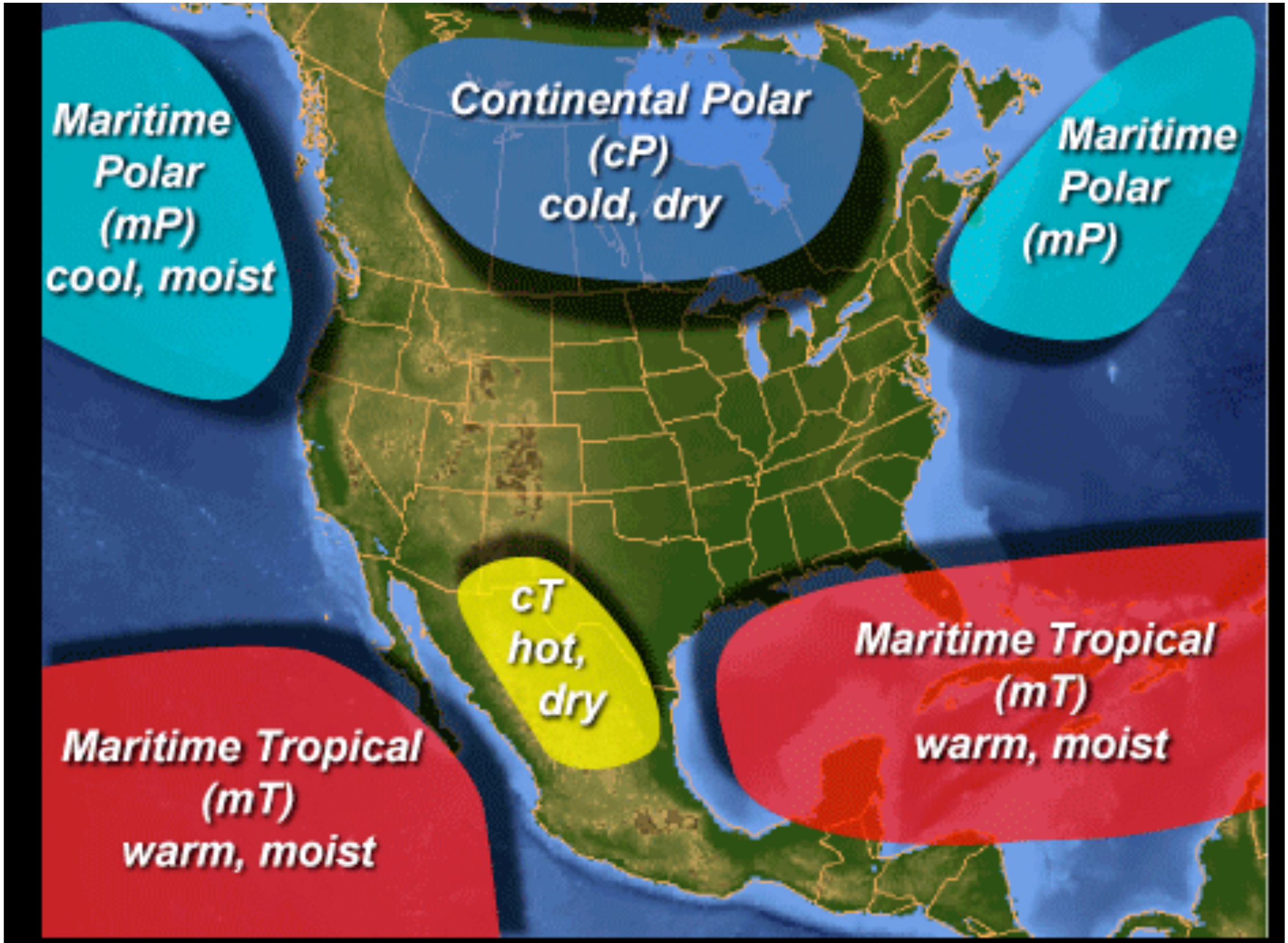


Which air masses directly affect Massachusetts?

North American Air Masses

Maritime polar air masses from the Pacific Ocean bring cool,humid air to the West Coast.

Continental polar air masses from central and northern Canada bring cold air to the central and eastern United States.

Maritime polar air masses from the Atlantic Ocean are often pushed out to sea by westerly winds.

You are here

Pacific Ocean

Atlantic Ocean

Gulf of Mexico

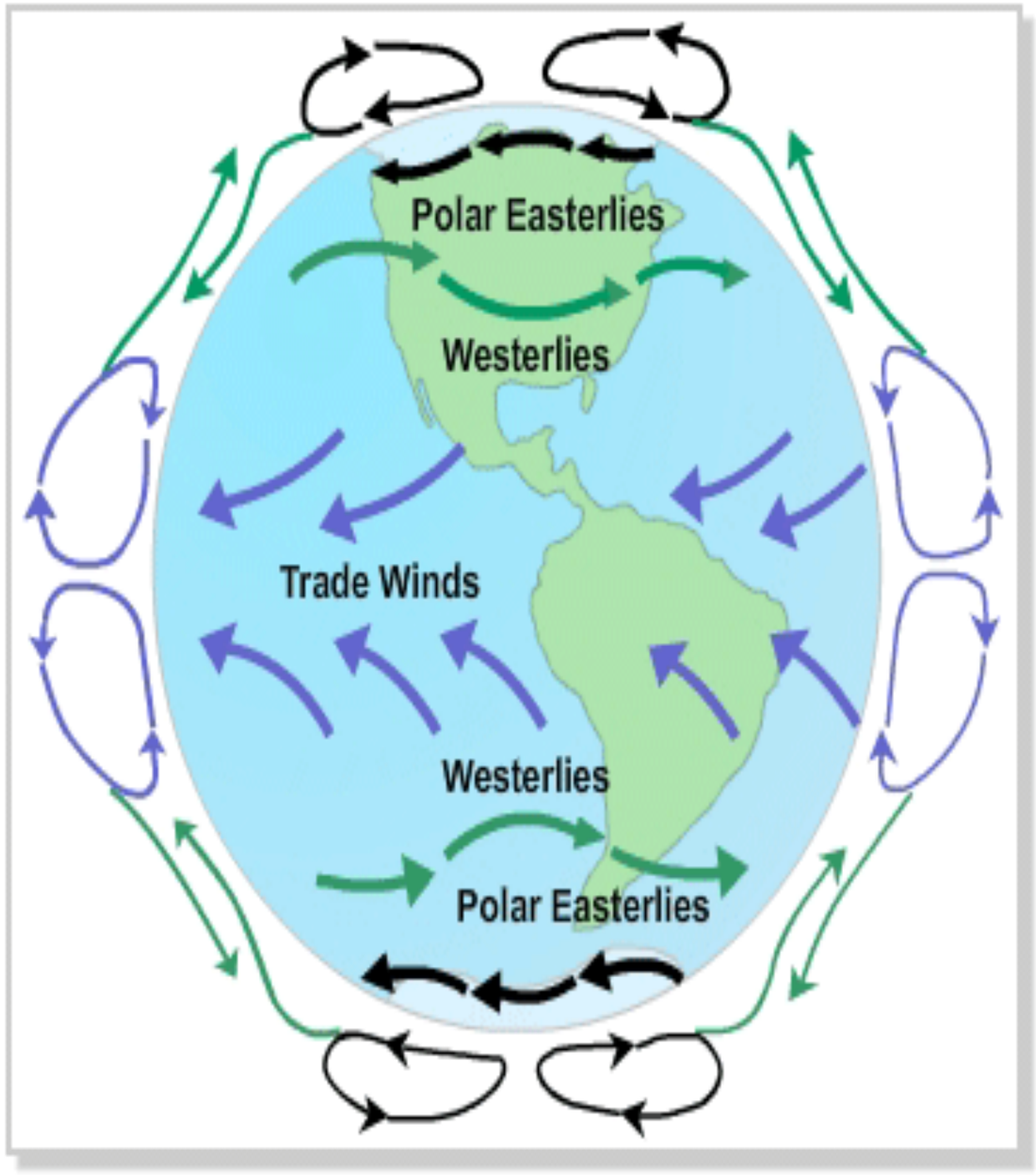
Maritime tropical air masses from the Pacific Ocean bring warm, humid air to California and the West Coast.

Continental tropical air masses from the South bring hot, dry air to the southern plains.

Maritime tropical air masses from the Gulf of Mexico bring warm, humid air to the eastern United States.

How Air Masses Move

- These air masses move. Global winds usually move these masses of air from one part of the globe to another.
- The major wind belts over the United States are the **westerlies**.



Jet streams also push air masses in a similar west-to-east direction.

How Air Masses Move

- As these air masses move, they will eventually meet one another, but they often do not mix, due to their different **densities**.
- The boundary where two air masses meet is called a **front**.
- Weather at a front is usually cloudy and stormy.

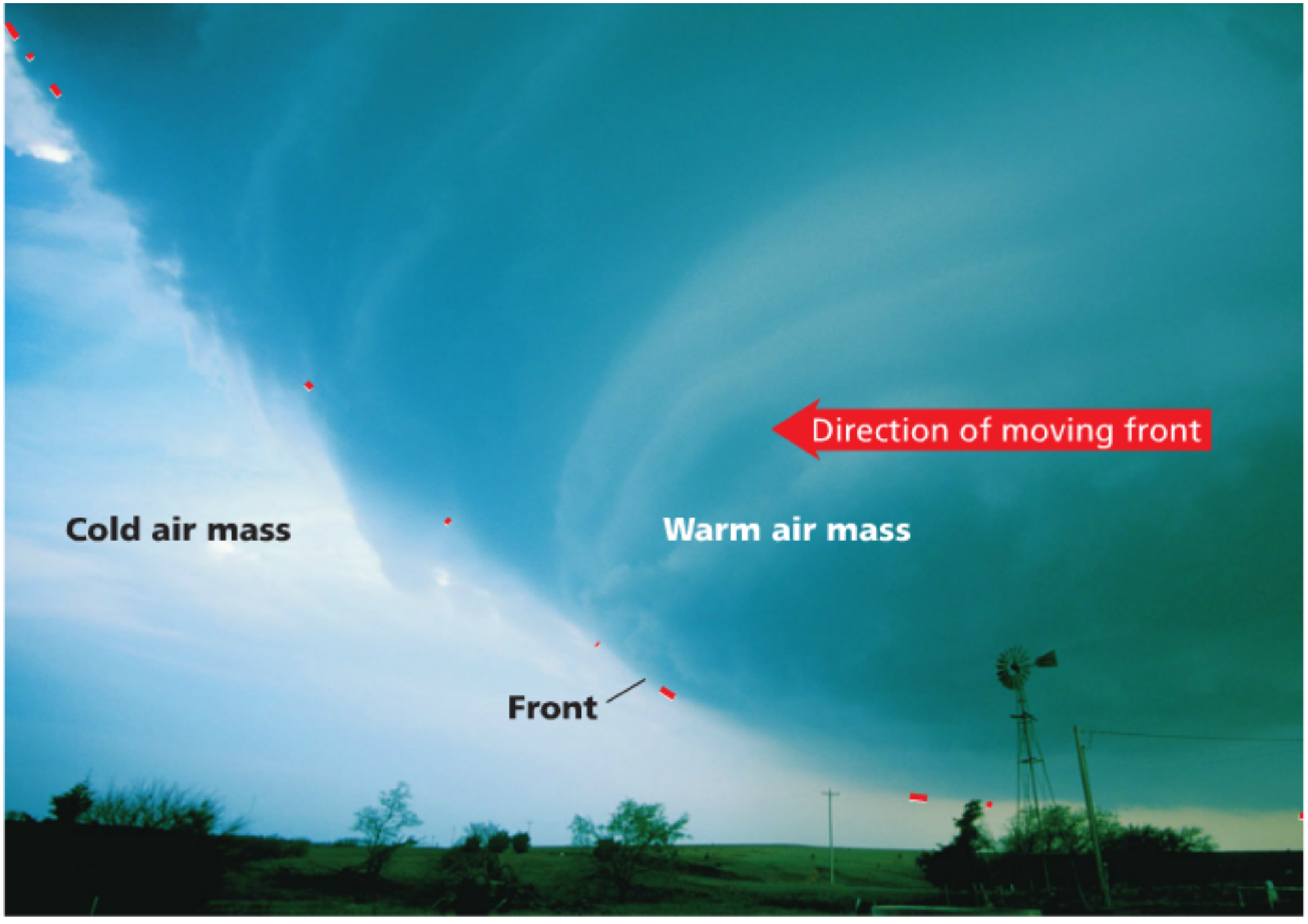
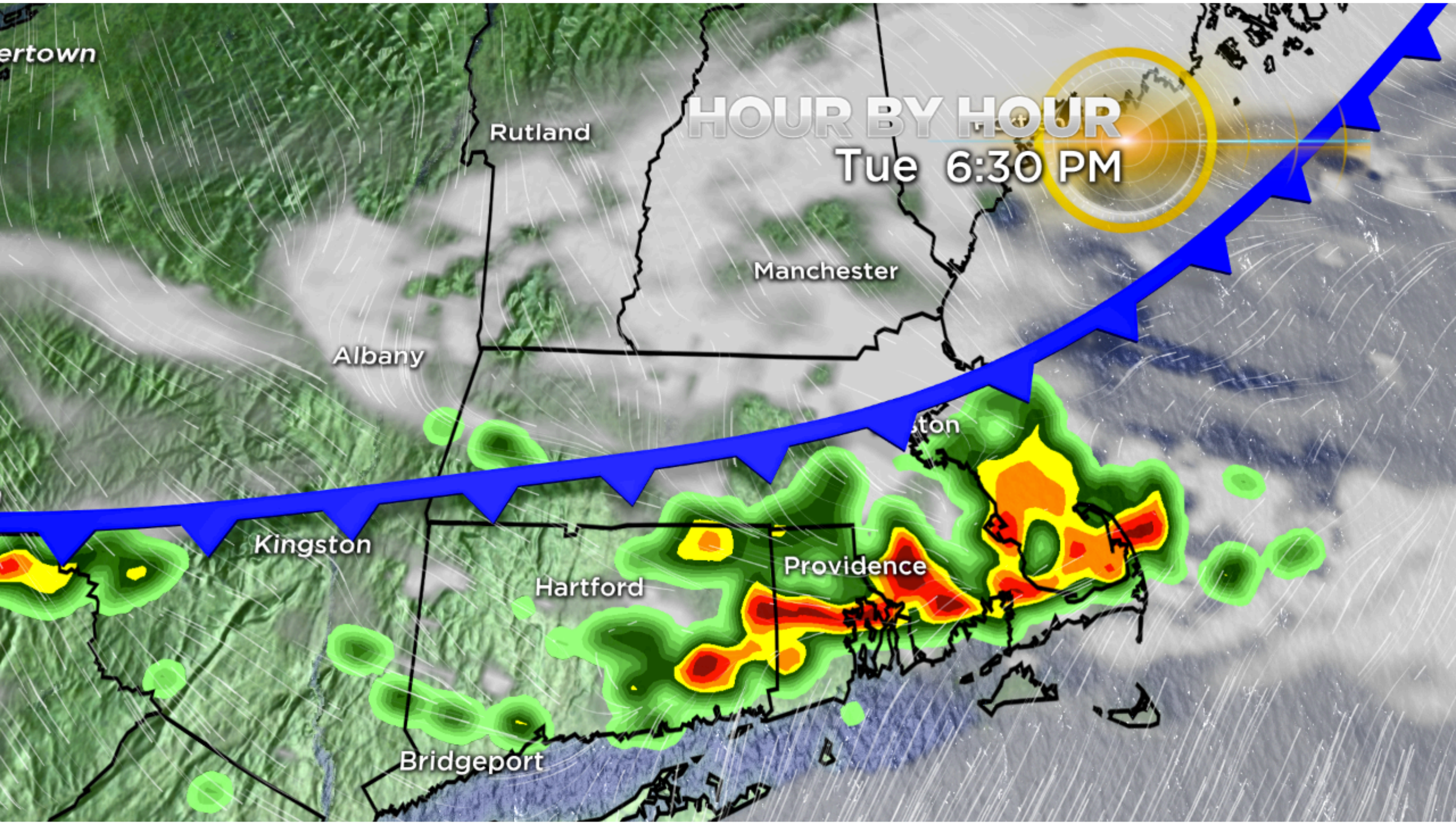
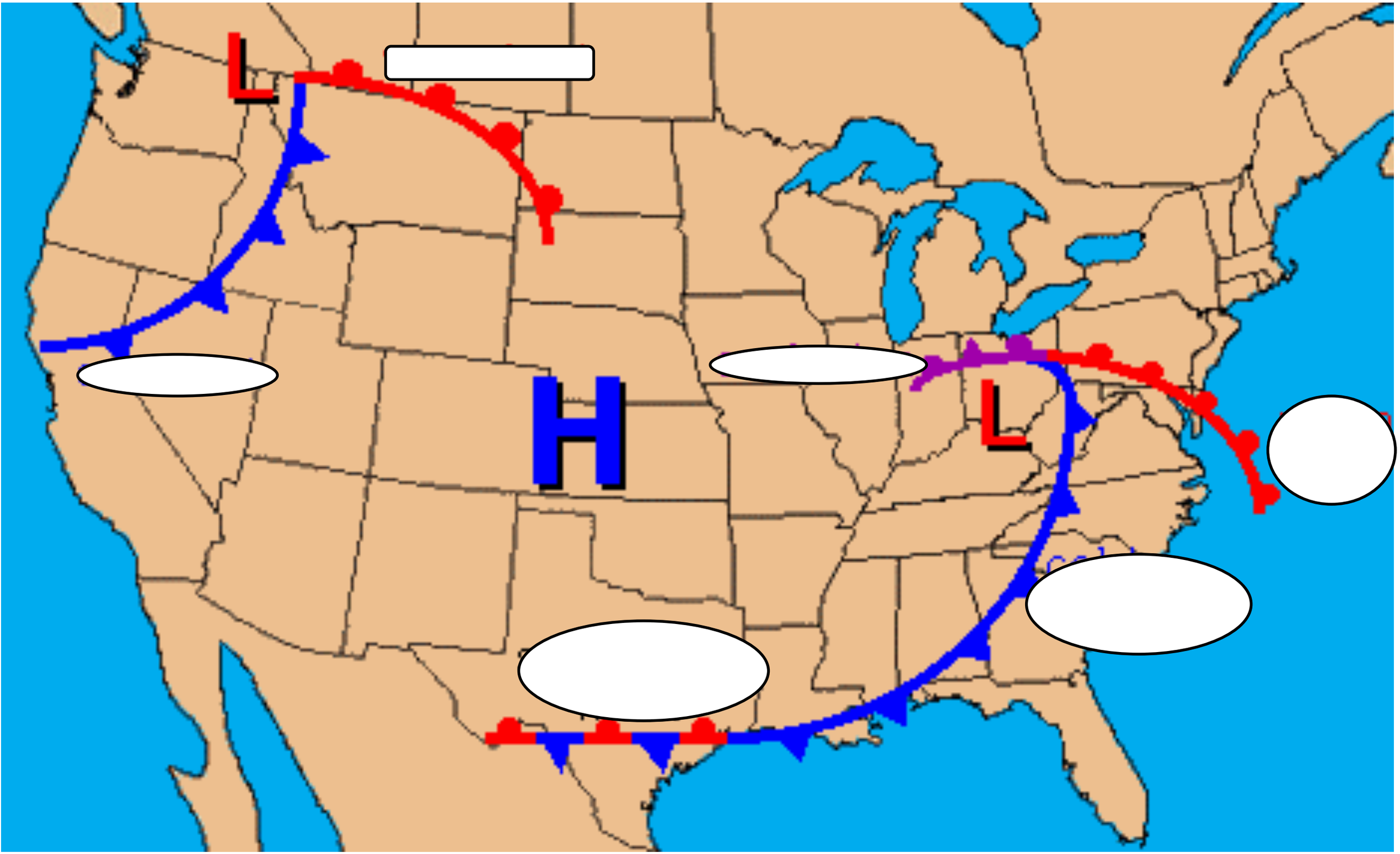


FIGURE 4
How a Front Forms
The boundary where unlike air masses meet is called a front. A front may be 15 to 600 kilometers wide and extend high into the troposphere.



https://cbsboston.files.wordpress.com/2017/06/2017-rpm-4km2.png

What does this weather map show?

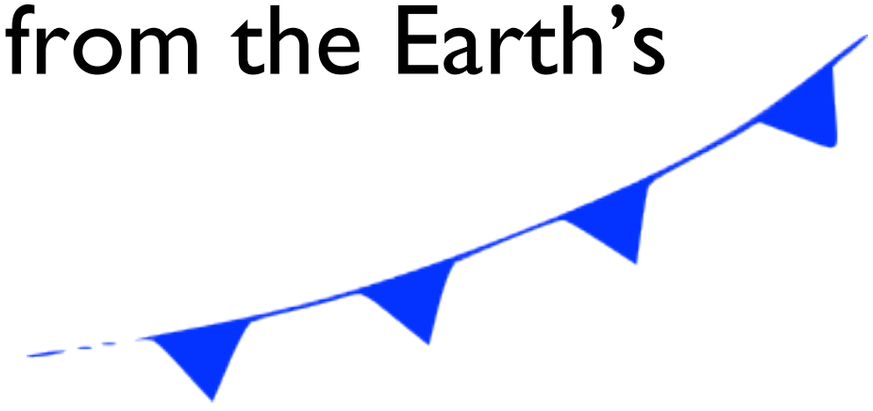


Types of Fronts

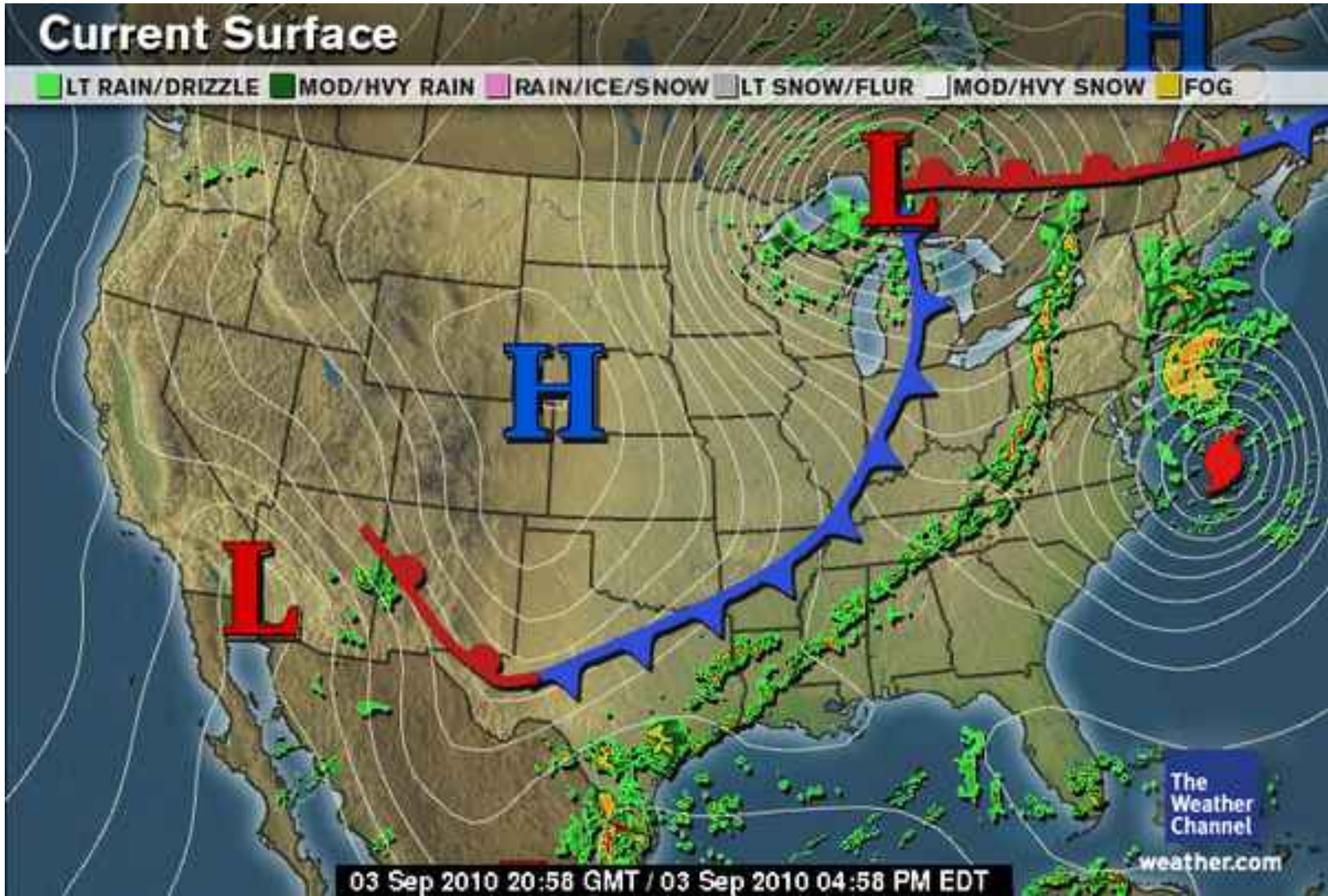
- Cold front
- Warm front
- Occluded front
- Stationary front

Cold Fronts

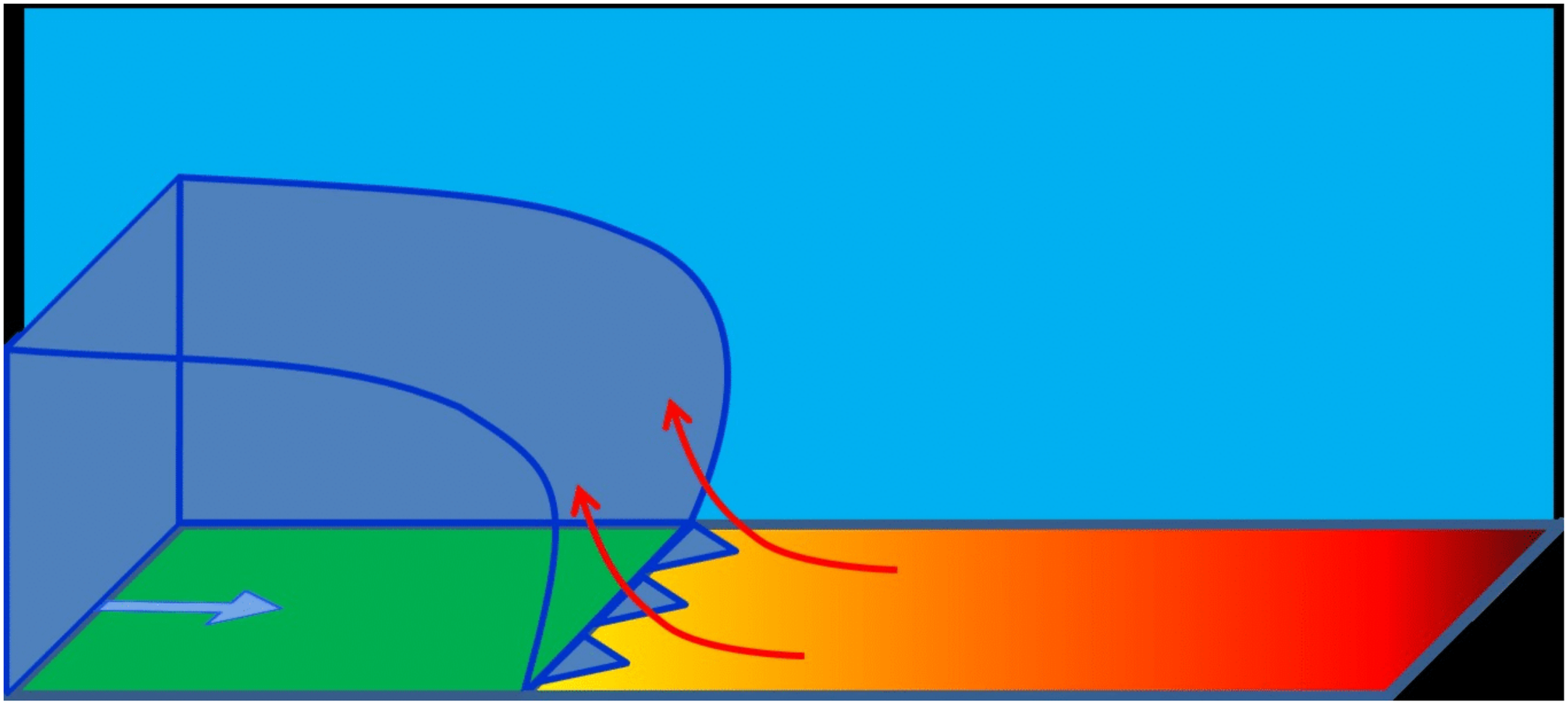
- A **cold front** occurs when a cold air mass meets and forces a warm air mass to move upward.
- Because the moving cold air is more dense, it moves under the less-dense warm air.
- Cold fronts can move very fast, producing thunderstorms, heavy rain, or snow.
- Cooler weather usually follows a cold front because the warm air is pushed away from the Earth's surface.



A cold front on a weather map is indicated by a blue line with triangles (like icicles) pointed in the direction that the front is moving towards.



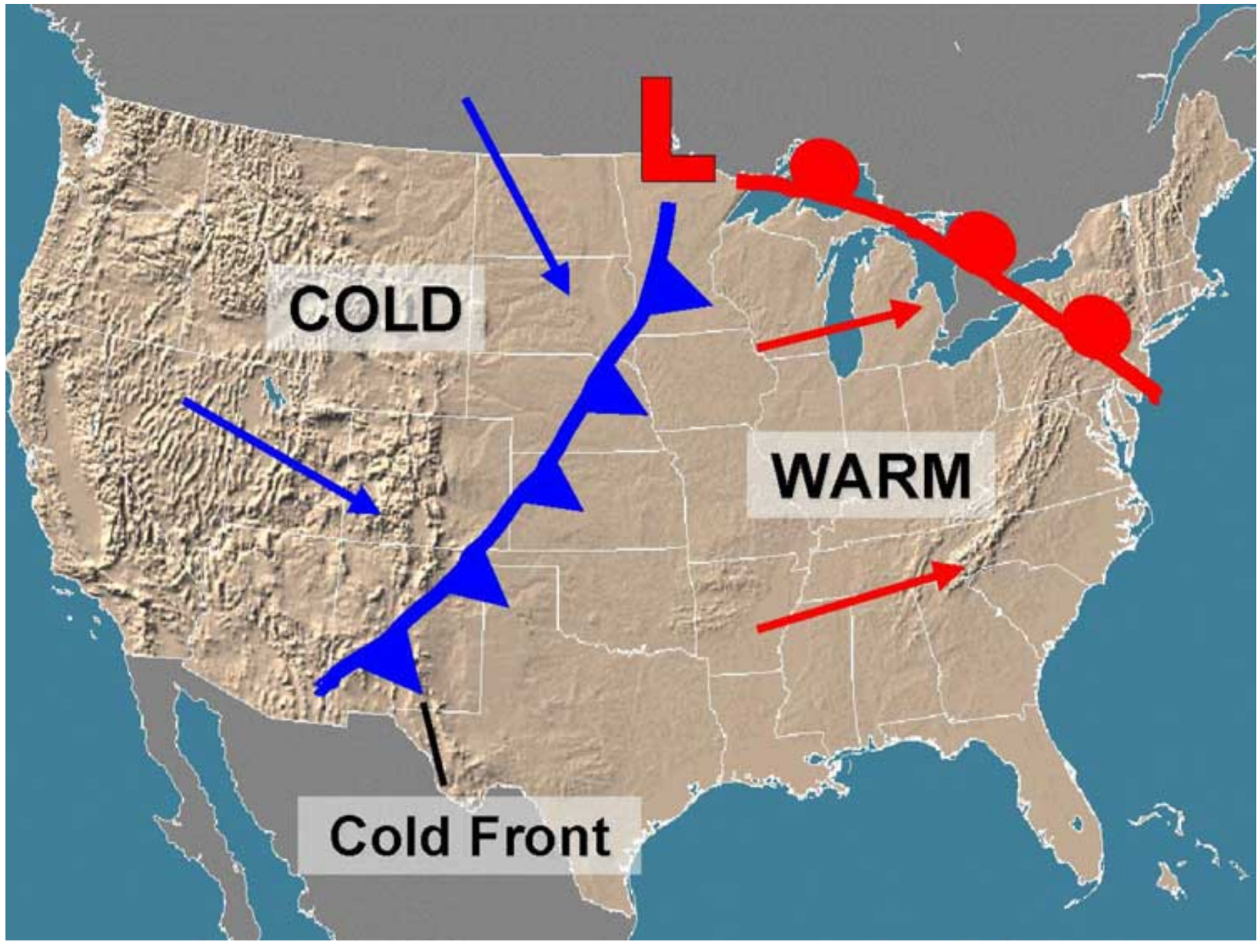
A **cold front** pushes under warm air, creating thunderstorms, heavy rain, or snow, and cooling the air near the surface.



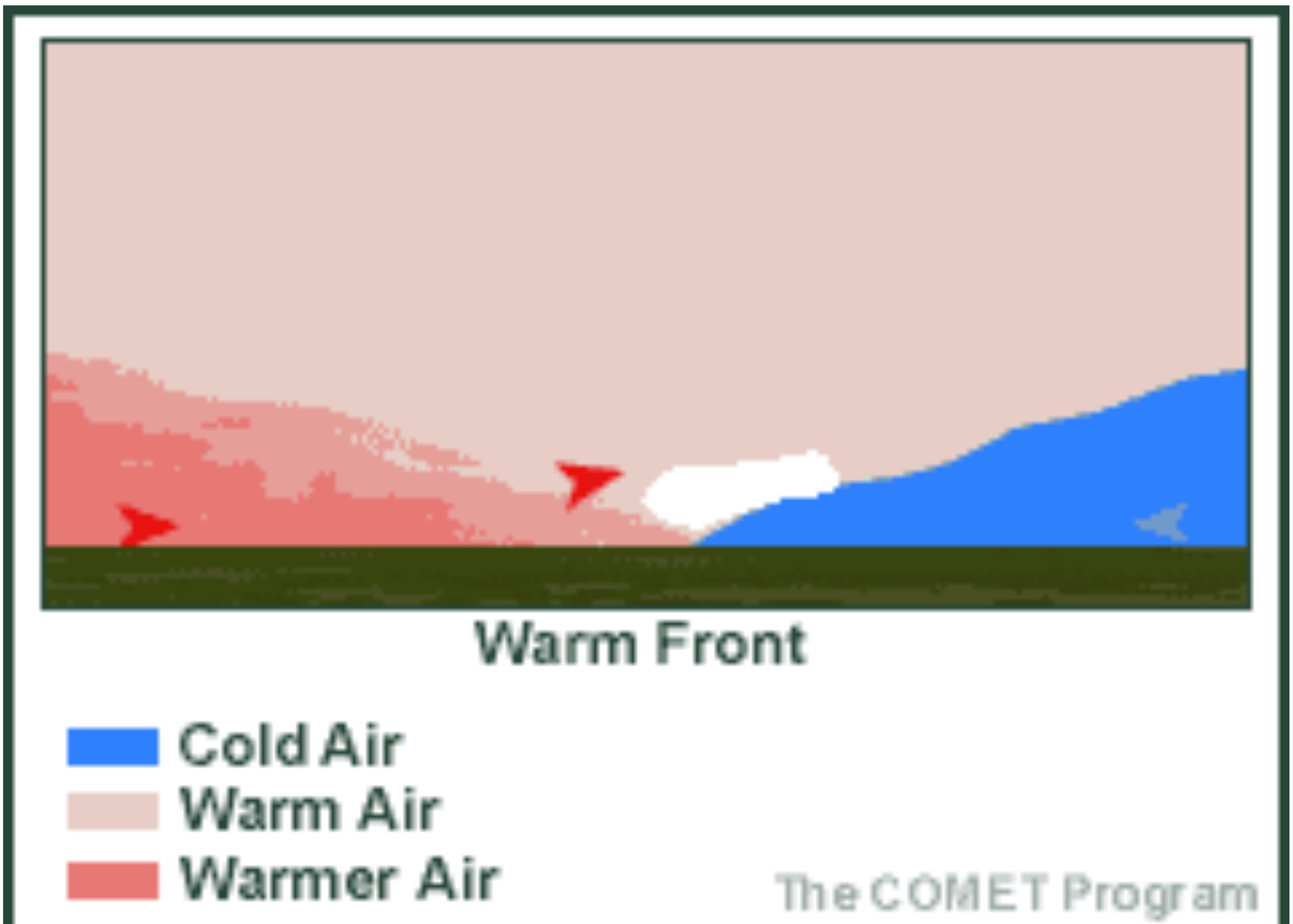
Warm Fronts

- A **warm front** occurs when a warm air mass meets and overrides a cold air mass.
- The warm air gradually replaces the cold air.
- Warm fronts generally bring drizzly precipitation.
- It is followed by dry, warm weather.

On a weather map, a **warm front** would appear as a red line with semi-circles (like suns) indicating the direction of movement.



A **warm front** forms where warm air moves over cold, denser air, bringing drizzly rain, and warming the air near the surface.

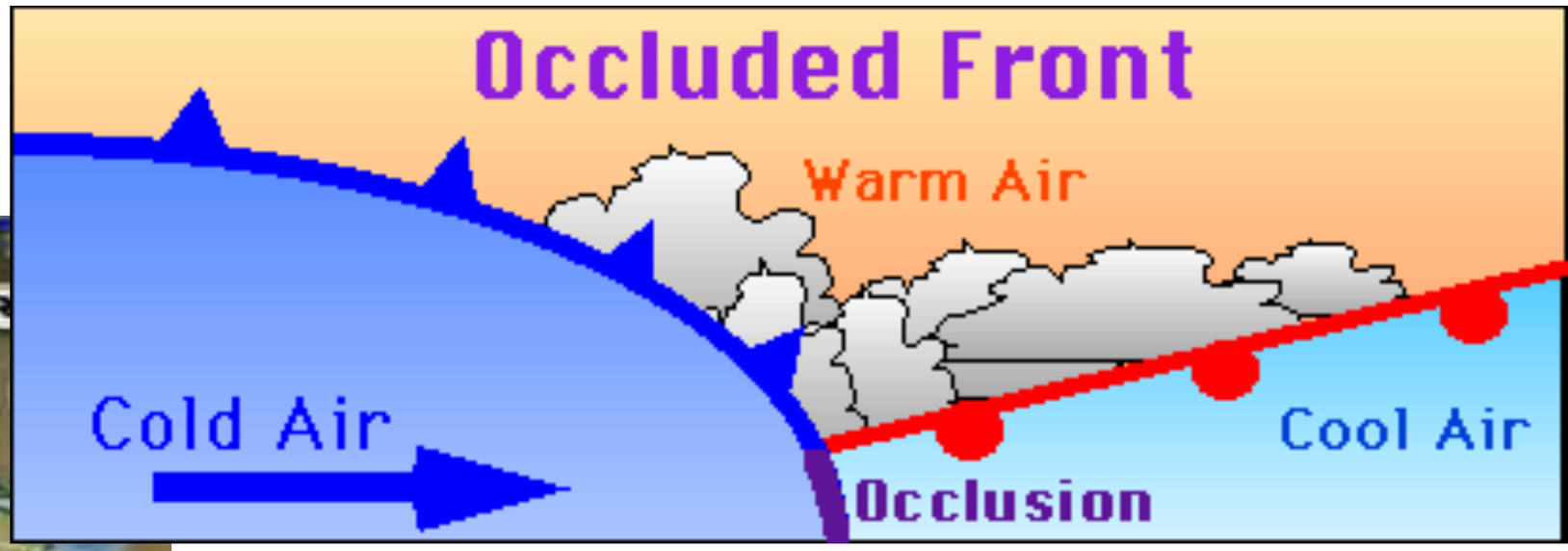


Occluded front

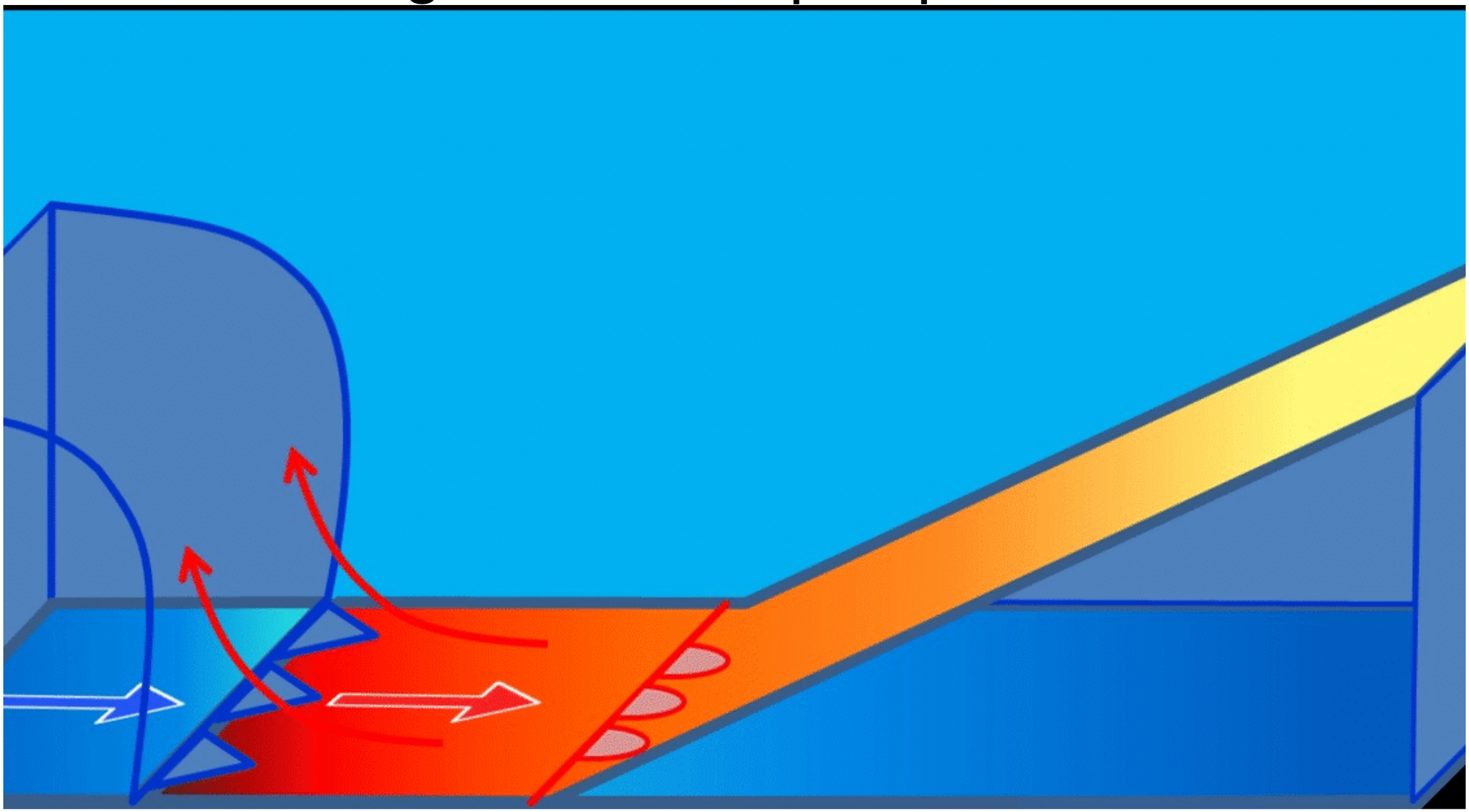
- An **occluded front** forms when a warm air mass sometimes is caught between two cooler air masses OR a cold front catches up to a slower-moving warm front.
- In an occluded front, the warm air mass is cut off from the ground as it is lifted above the two other air masses.
- This produces cool temperatures and large amounts of precipitation.

Occluded Fronts

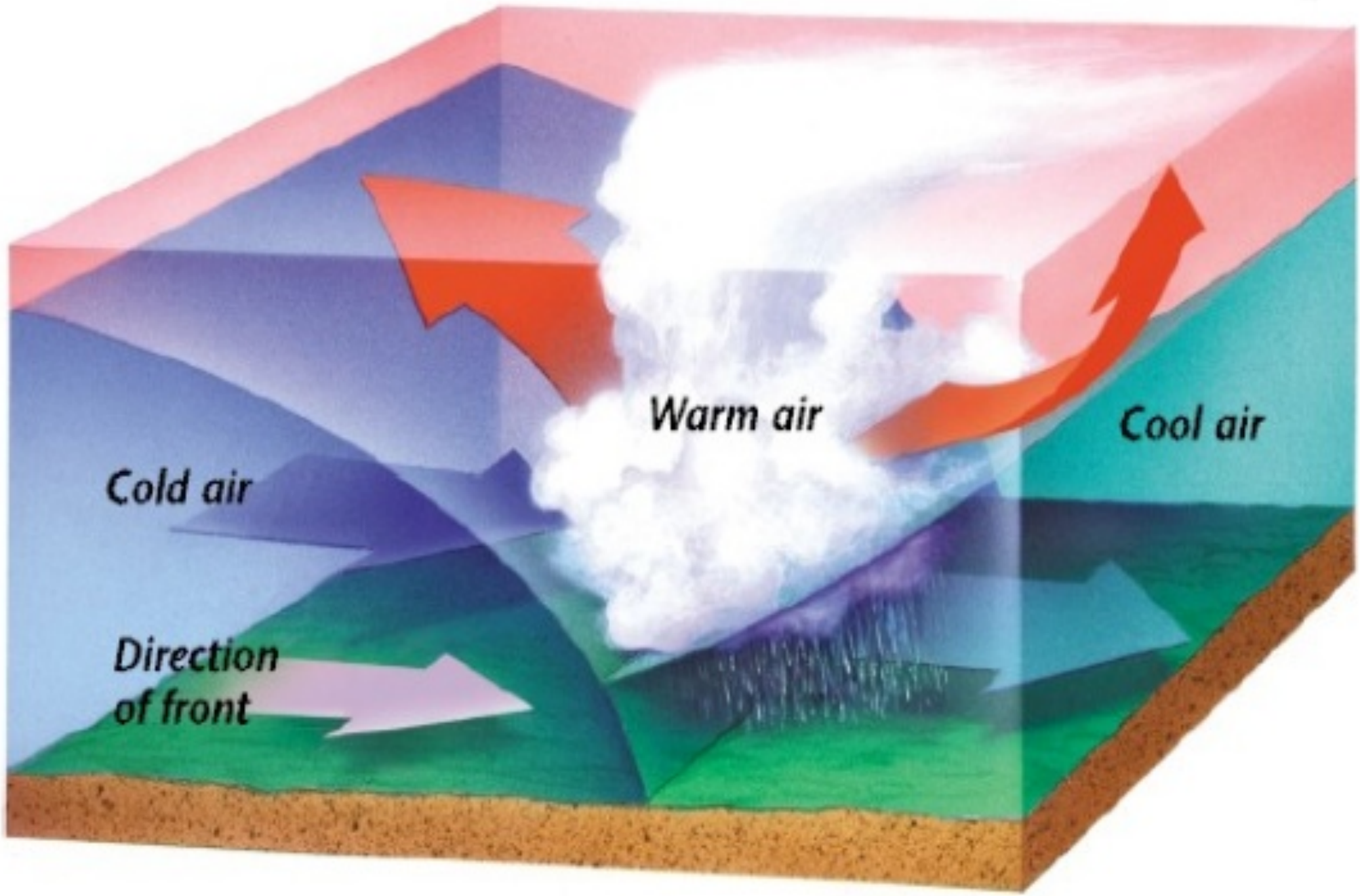
These are shown as purple lines of alternating triangles and semicircles pointing in the same direction.



An **occluded front** forms when a warm air mass is caught between two cold air masses, bringing cool temperatures and large amounts of precipitation.

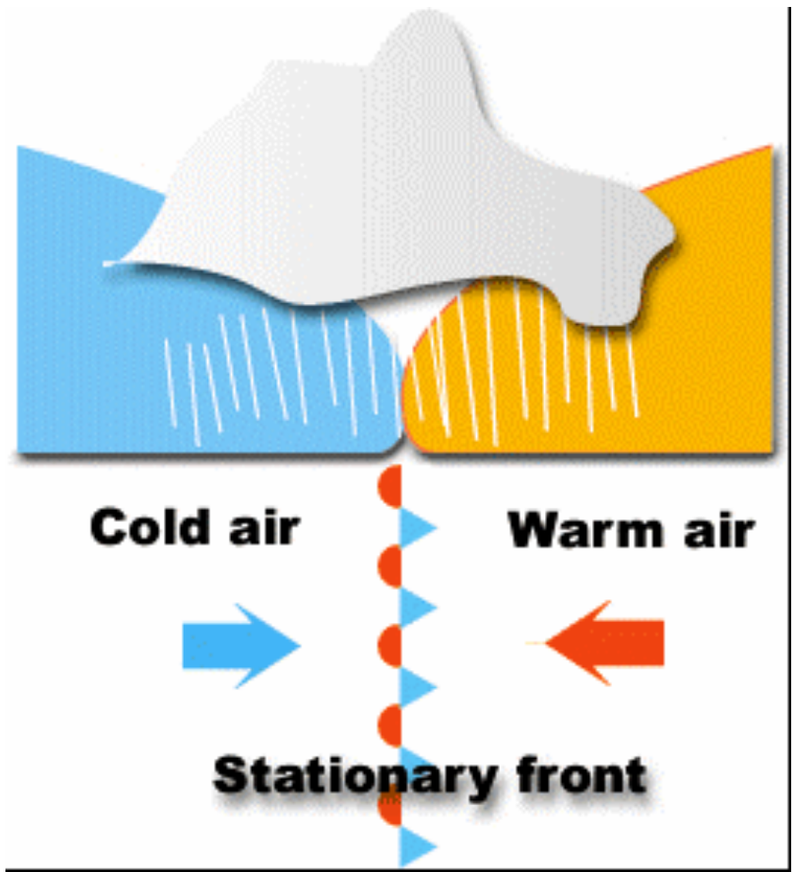


77 Occluded Front



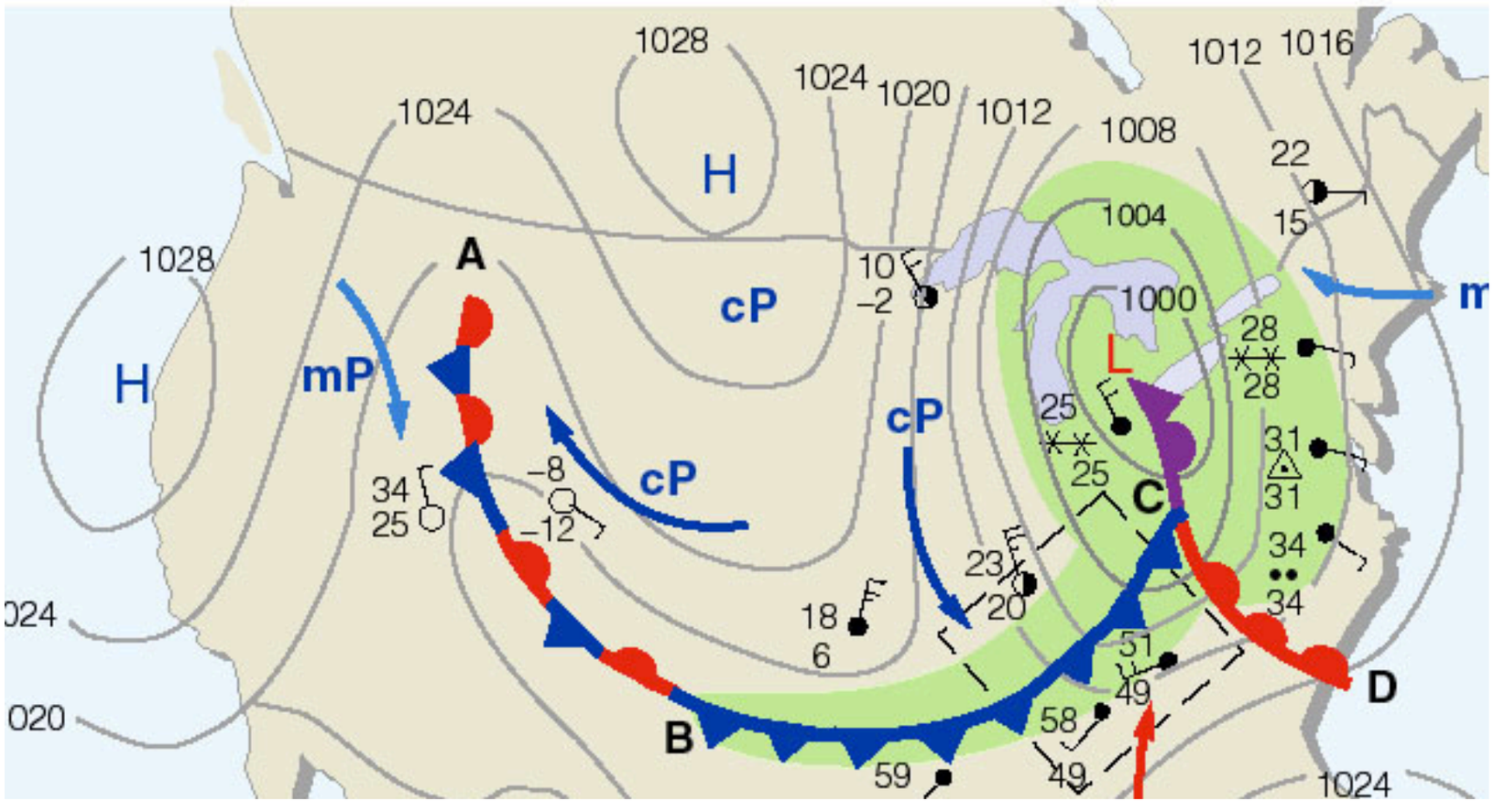
Stationary Fronts

- A **stationary front** forms when a cold and warm air mass meet, but neither air mass moves over or under the other. (not enough wind?)
- A stationary front can bring many days of clouds and precipitation.

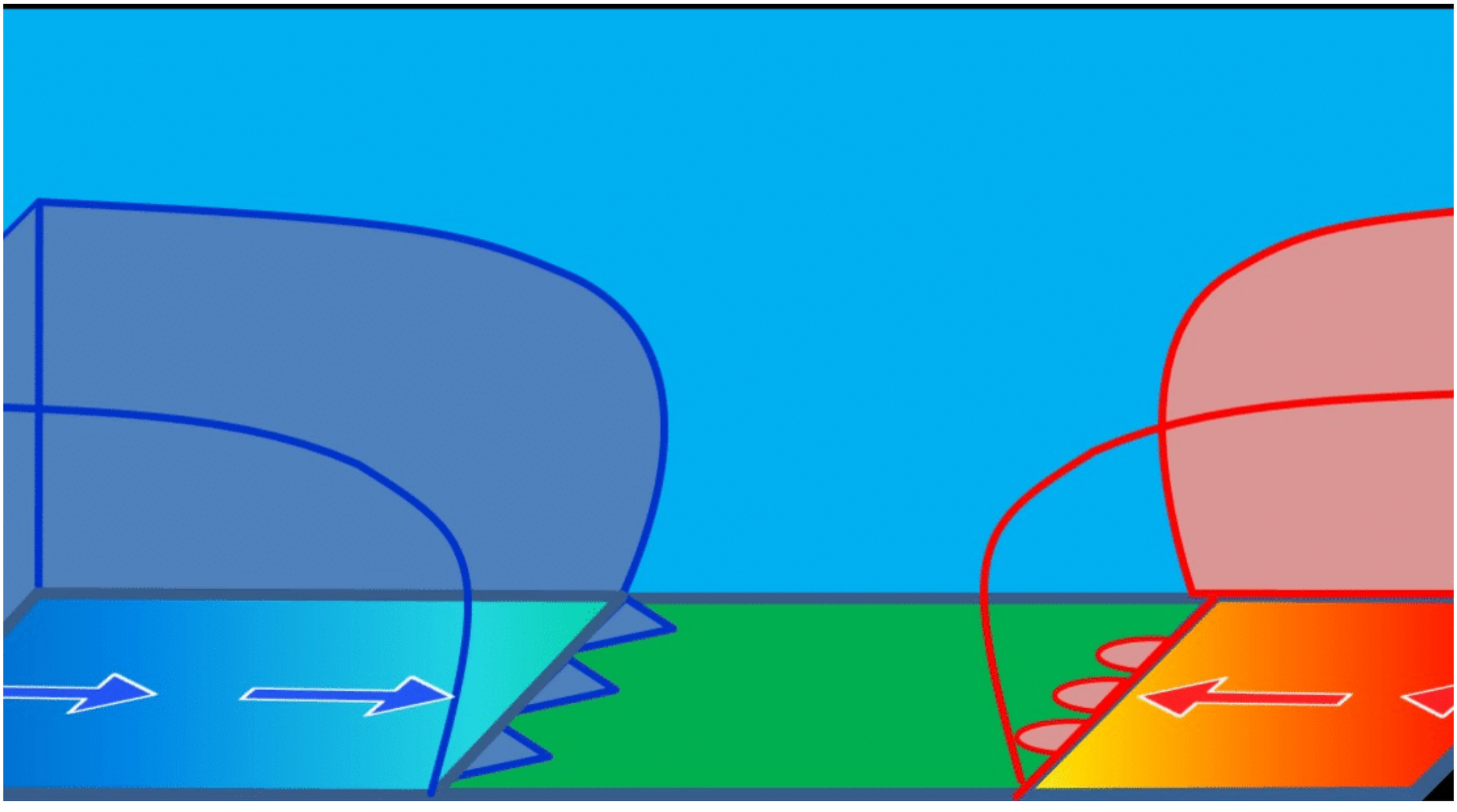


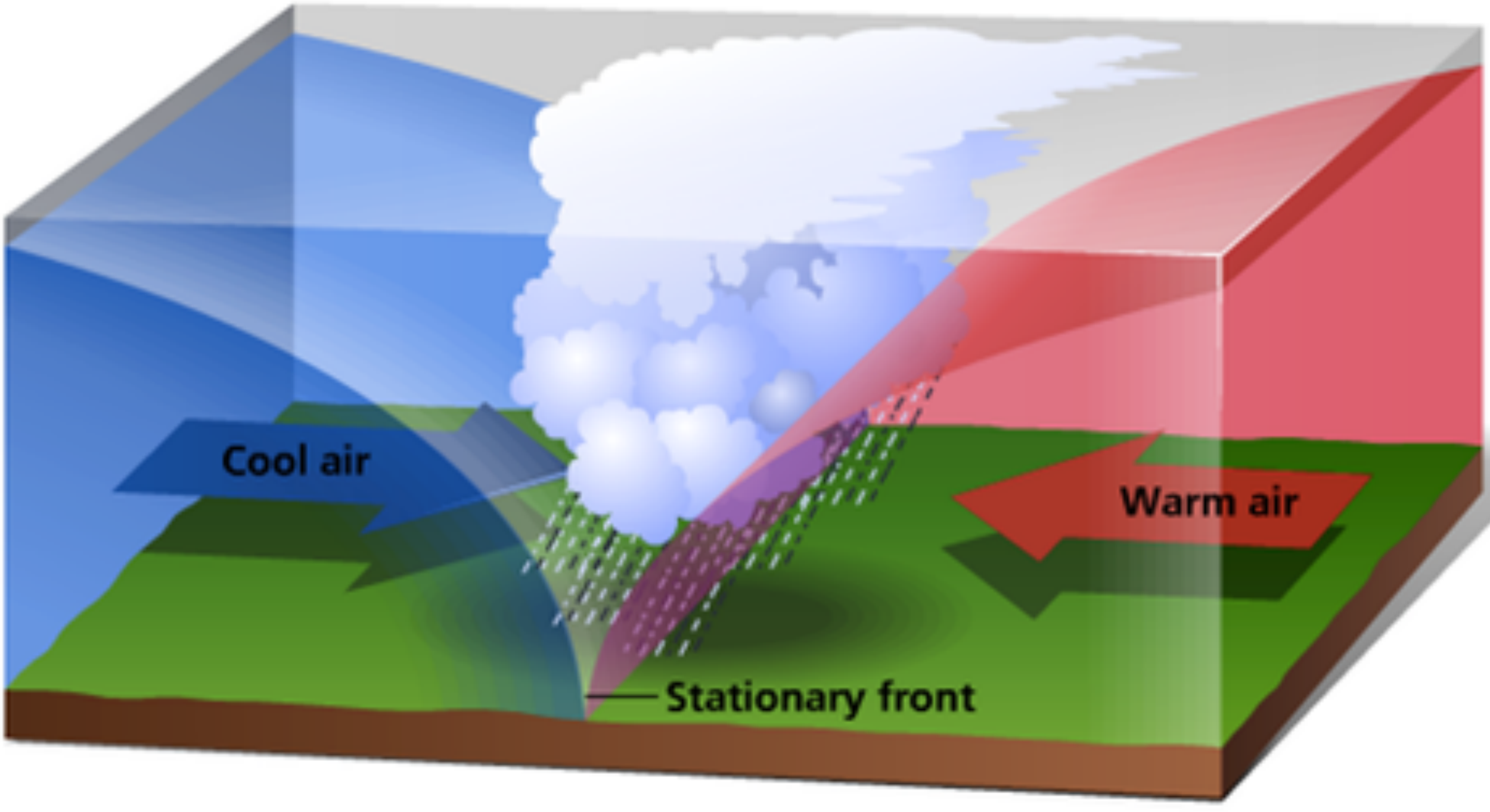
Stationary Fronts

These are shown as lines of alternating blue triangles and red semicircles pointing in opposite directions.

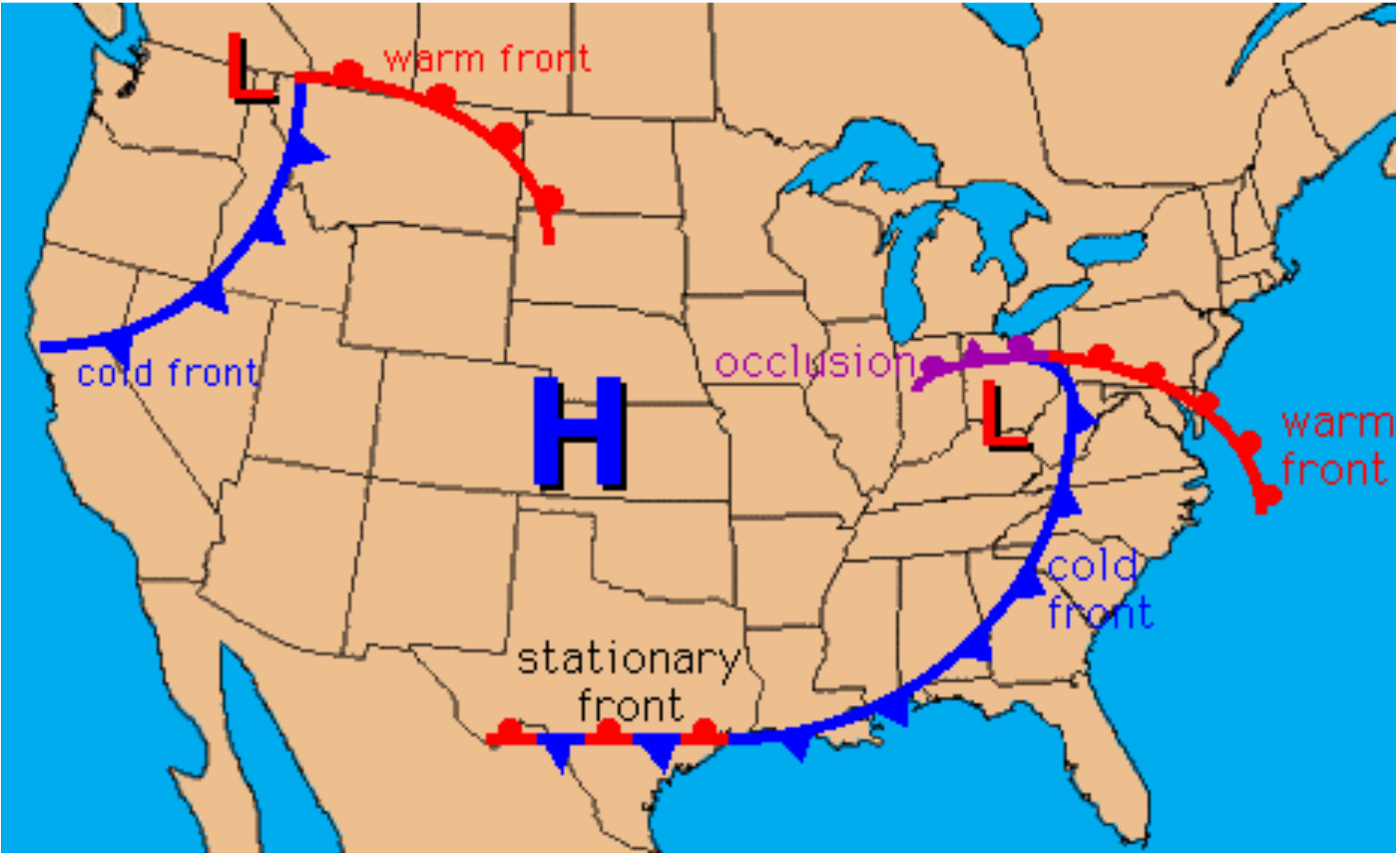


A **stationary front** forms when and cold air mass meets a warm air mass, but they remain separated, bringing many days of cloudy, wet weather.




Cool air
Warm air
Stationary front

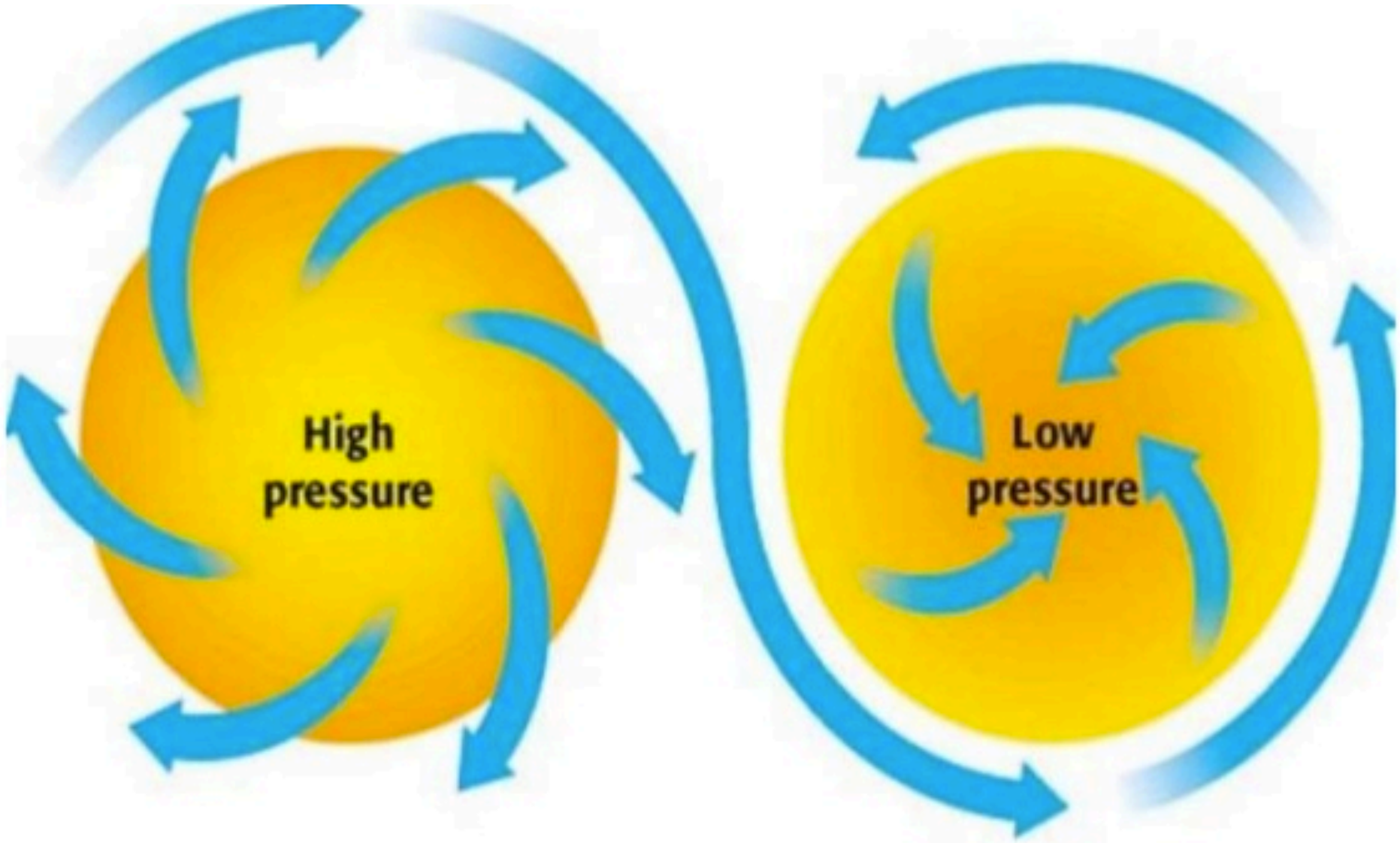
What does this weather map show?



Air Pressure

- Areas of different pressure affect the weather.
- **Cylcones** are areas that have lower pressure than the surrounding areas. Air masses *converge* (come together) and rise, causing stormy weather.
- **Anticyclones** are areas that have high pressure. Air *diverges* (moves apart) and sinks. Cooler, denser air moves out of the center toward areas of lower pressure, bringing dry, clear weather.

Anticyclone and Cyclone



In the Northern Hemisphere, use the right-hand rule:

-Hold your right hand in the thumbs-up position

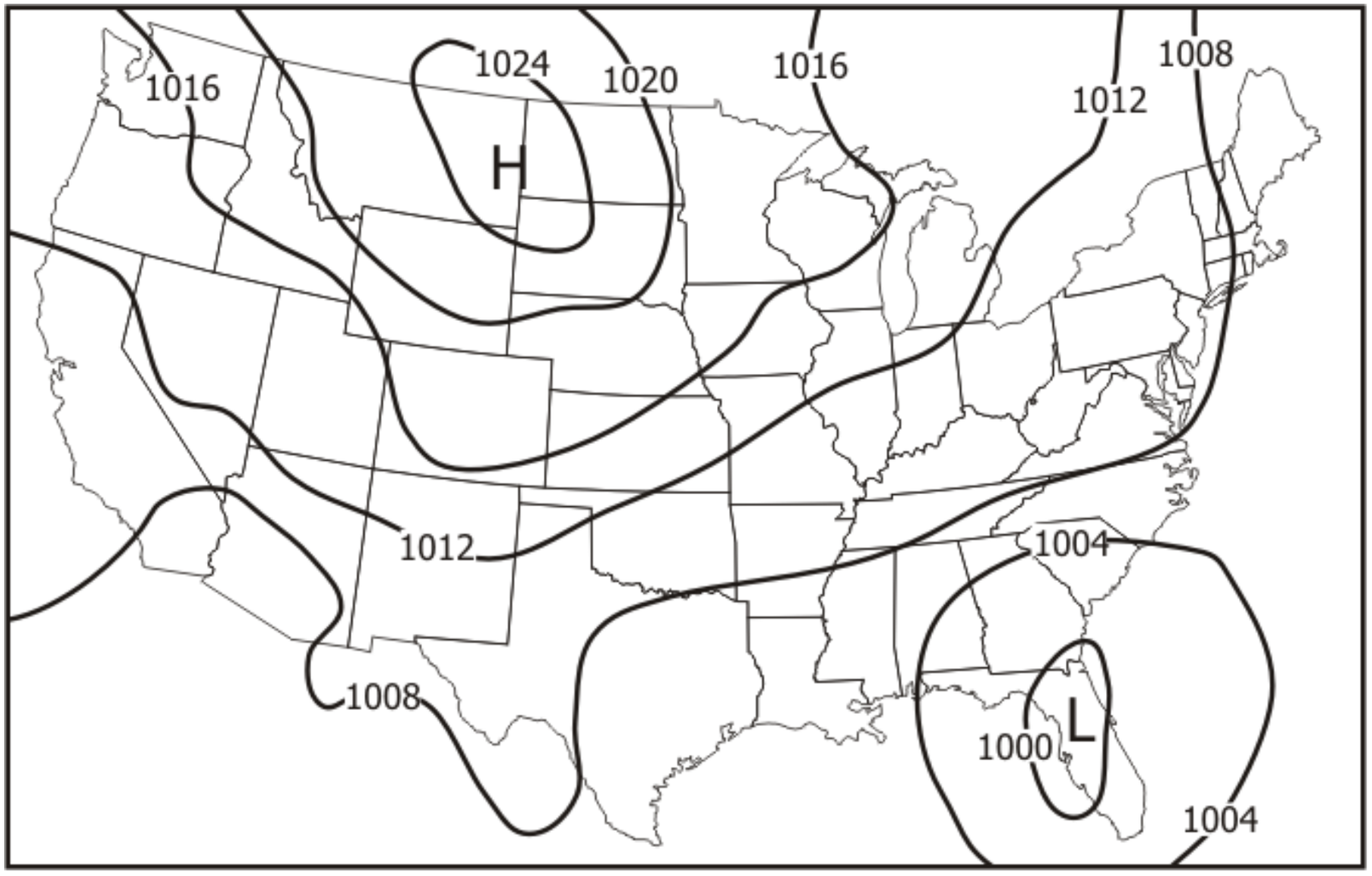
-Your thumb is the pressure area, your fingers are the wind

-The wind moves outward, in a clockwise motion, for HIgh pressure

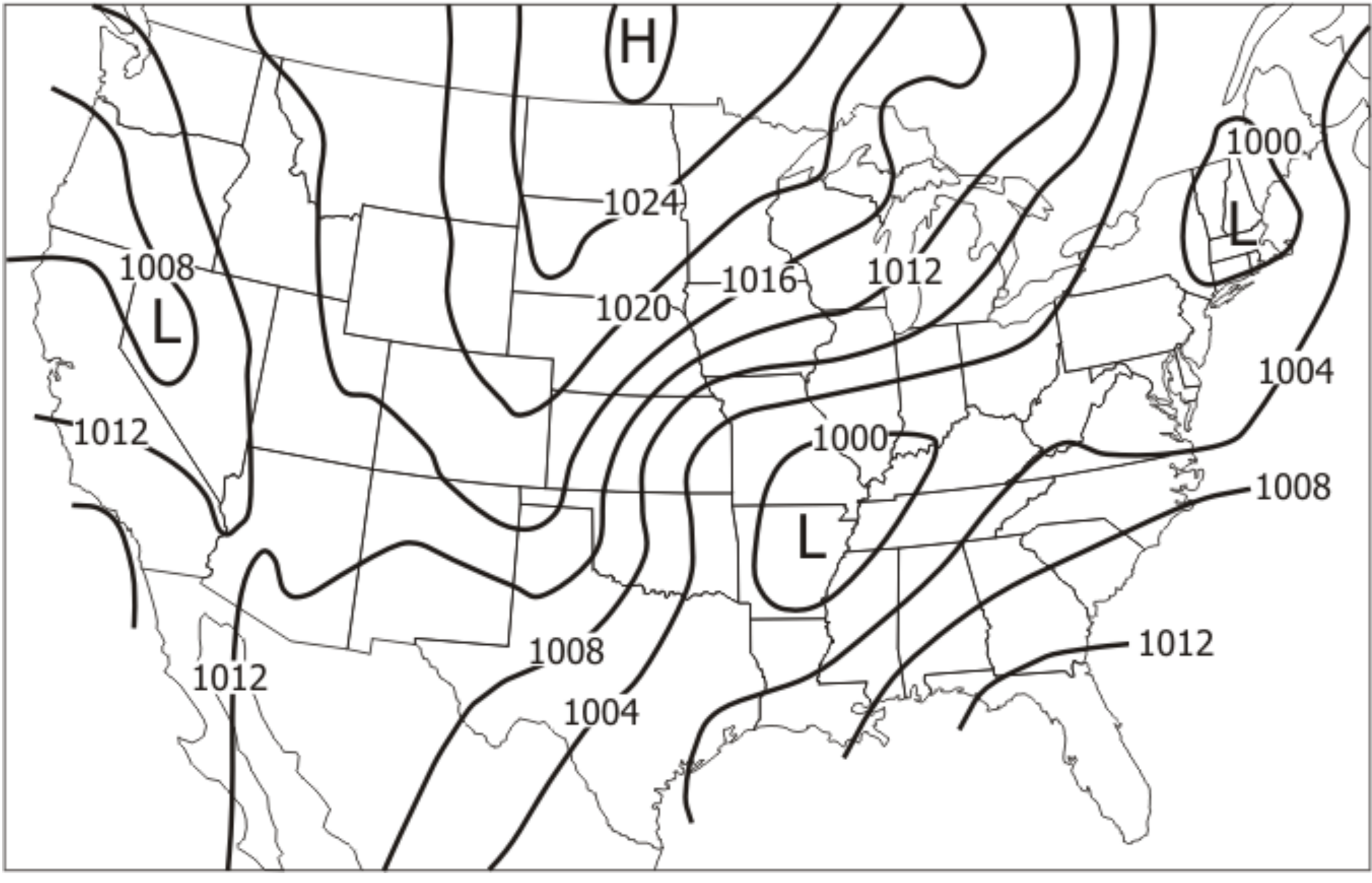
ISOBARS

(not in the book)

An **isobar** is a line on a map connecting points having the same **atmospheric pressure.**



H represents high pressure; L represents low pressure


H
1024
1020
1016
1012
1008
L
1012
1008
1012
1004
1000
L
1000
1008
L
1012
1008
1004

The map below shows the location of South Carolina.

South Carolina is humid during the summer months. Which of the following is the **most likely** cause of the humid conditions?

A. runoff from inland mountains

B. flooding from rivers and streams

C. groundwater bubbling to the surface

D. evaporation from the surface of the ocean

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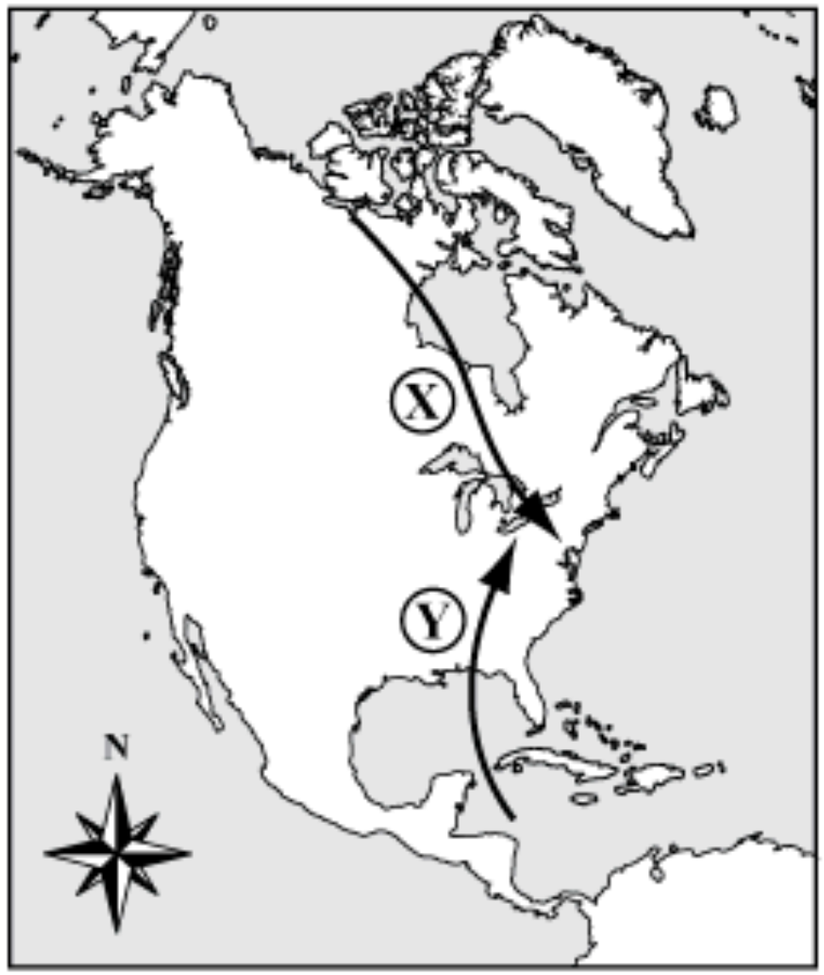
The paths of two air masses, X and Y, are shown in the diagram below.



Air mass X is a cold air mass. Air mass Y is a warm air mass. When the air masses meet, winter storms may be produced.

Which of the following **most likely** contributes to the formation of these storms?

A. Cold air mass X moves over warm air mass Y, and evaporation occurs.

B. Warm air mass Y moves over cold air mass X, and condensation occurs.

C. Cold air mass X mixes with warm air mass Y, and the overall temperature increases.

D. Warm air mass Y mixes with cold air mass X, and the overall temperature decreases.

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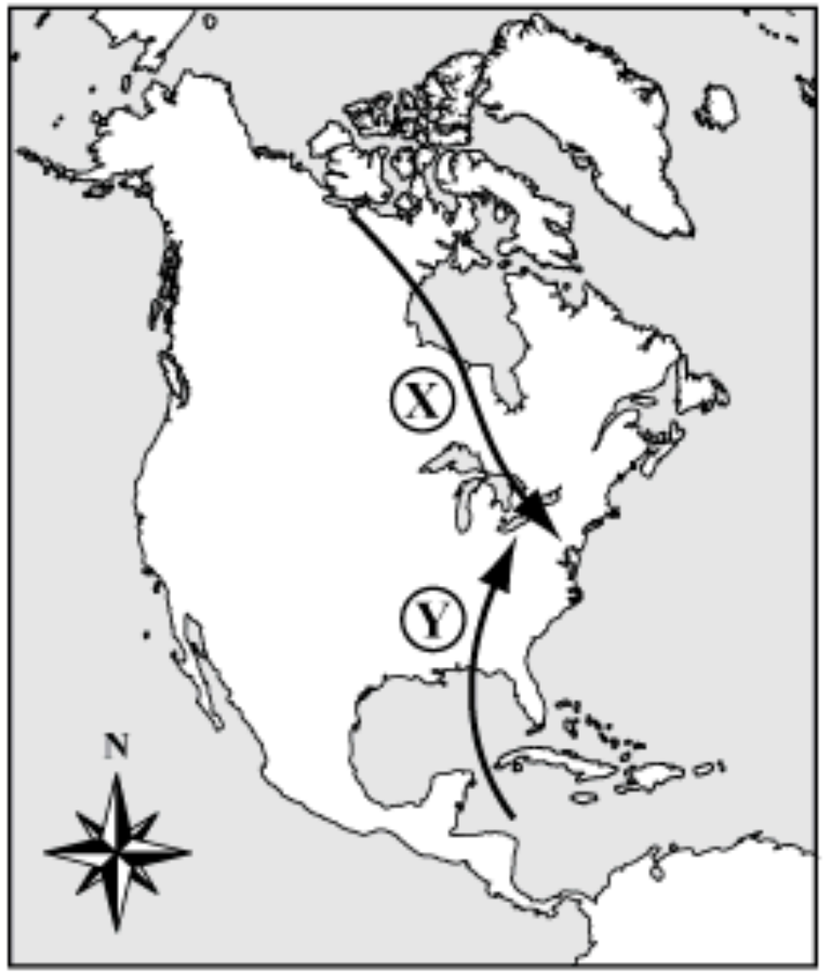

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The map below shows the Grand Banks area off the coast of Newfoundland, Canada.

The Grand Banks area has over 200 foggy days a year. Which of the following conditions produce the fog in the Grand Banks area?

A. dry air and fast ocean currents

B. cold air masses and high clouds

C. moist air and cold temperatures near the ocean surface

D. high air temperatures and high air pressure near the coast

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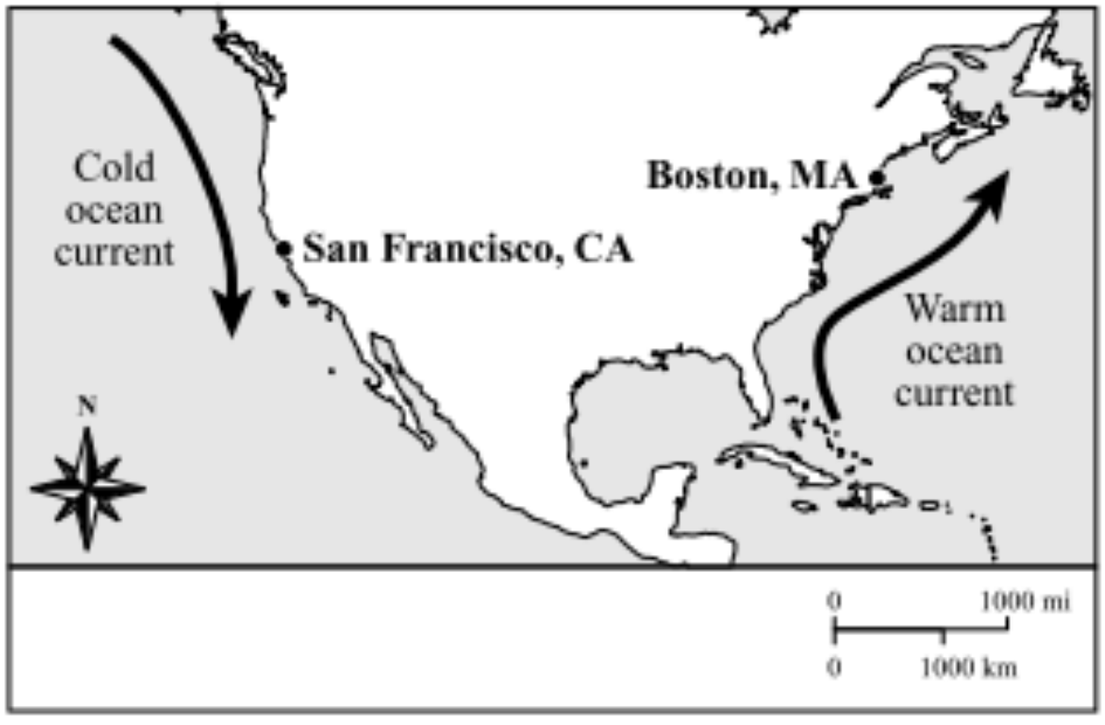

Based on the map, how do ocean currents **most likely** affect the climates of San Francisco and Boston?

A. More precipitation falls in San Francisco than in Boston.

B. Average wind speeds are greater in San Francisco than in Boston.

C. Average summer temperatures are lower in San Francisco than in Boston.

D. Storms move from east to west in San Francisco and from west to east in Boston.

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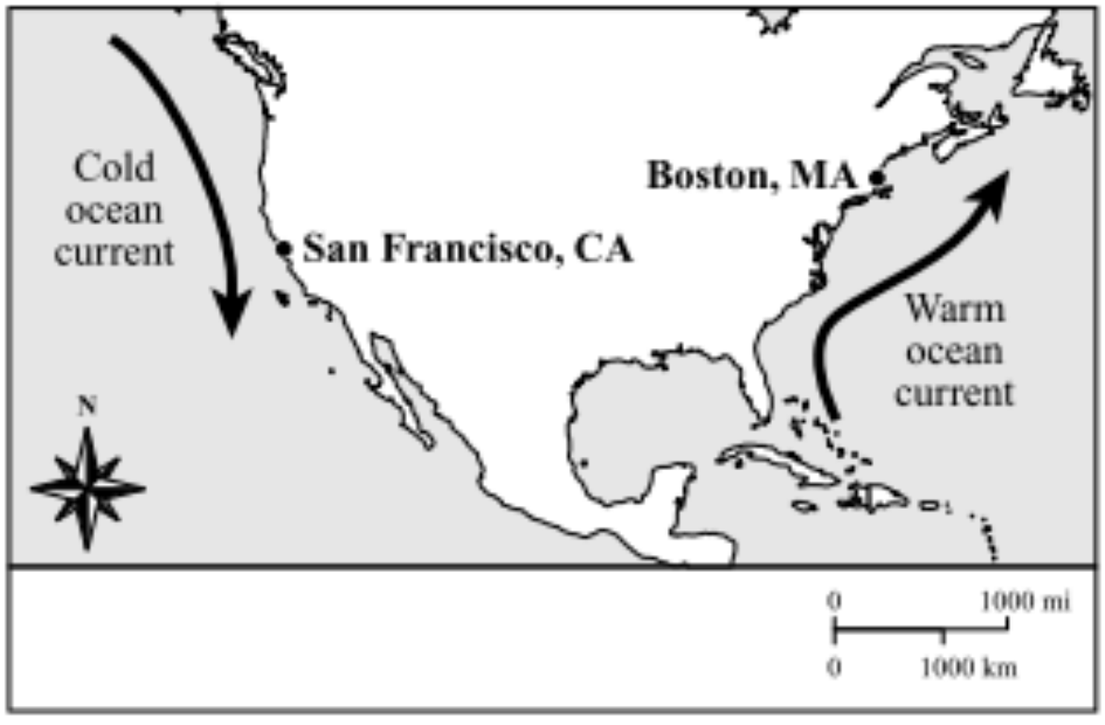

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The map below shows the locations of two cities. City Y is near the coast, and city Z is near the middle of a continent. The cities have the same elevation.

Based on the map, which of the following statements describes how the climates of the two cities are **most likely** different?

A. City Y receives less rain than city Z.

B. City Y has colder winters than city Z.

C. City Y has cooler summers than city Z.

D. City Y receives more sunlight than city Z.

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