

# Weather tools and forecasting



A.

Descending air

Diverging wind

Diverging wind

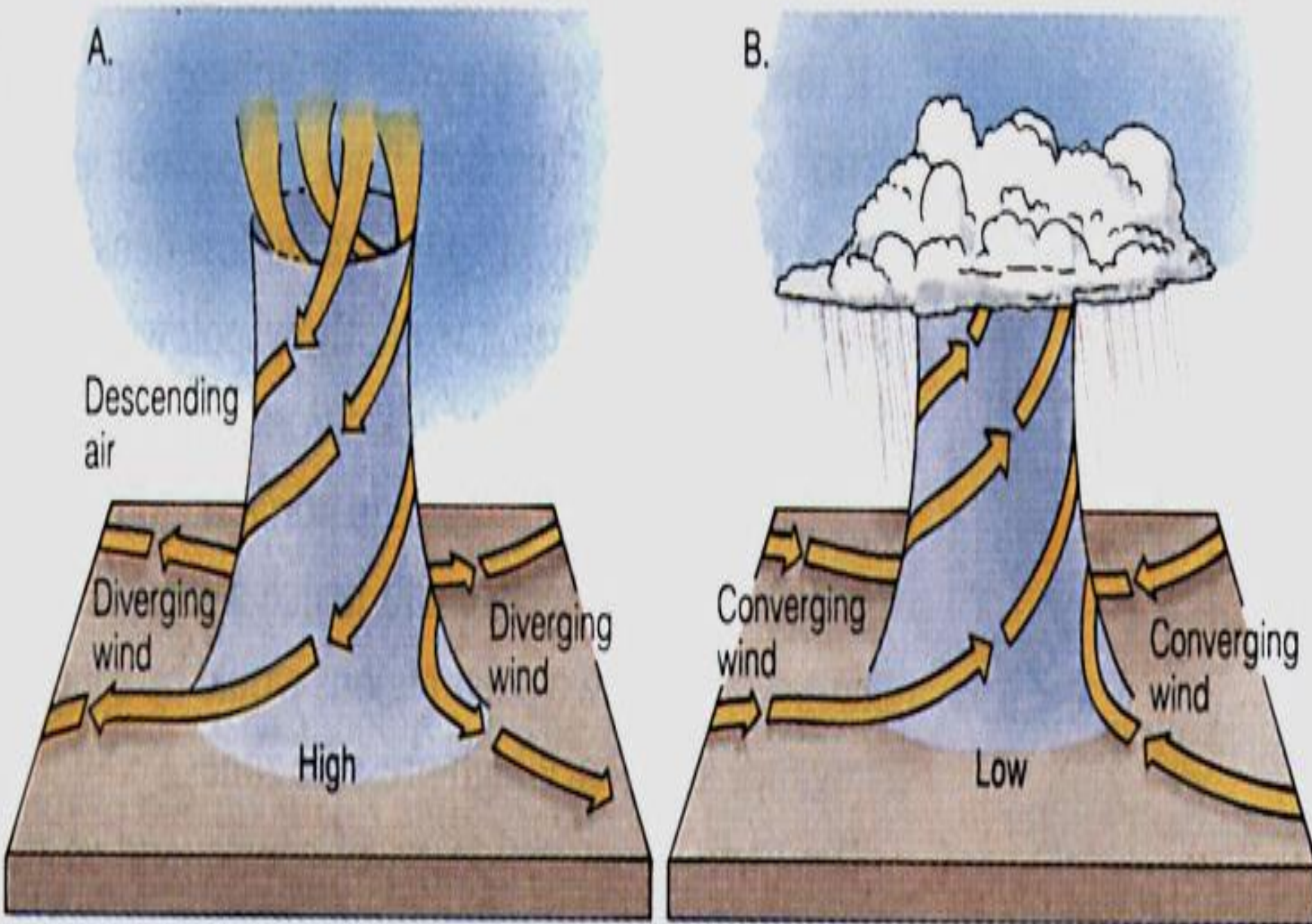
High

B.

Converging wind

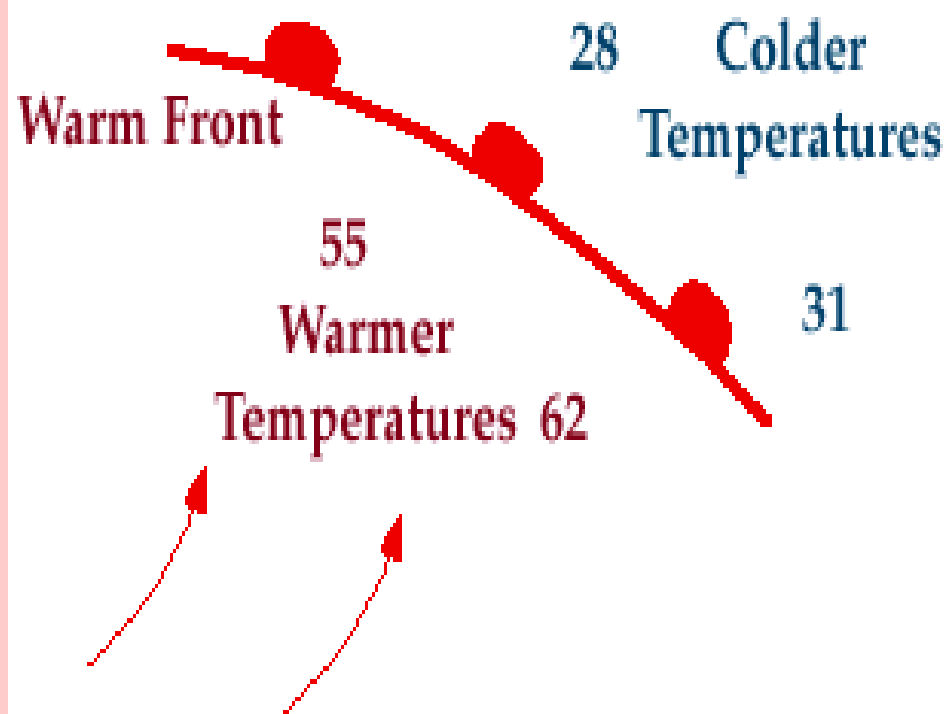
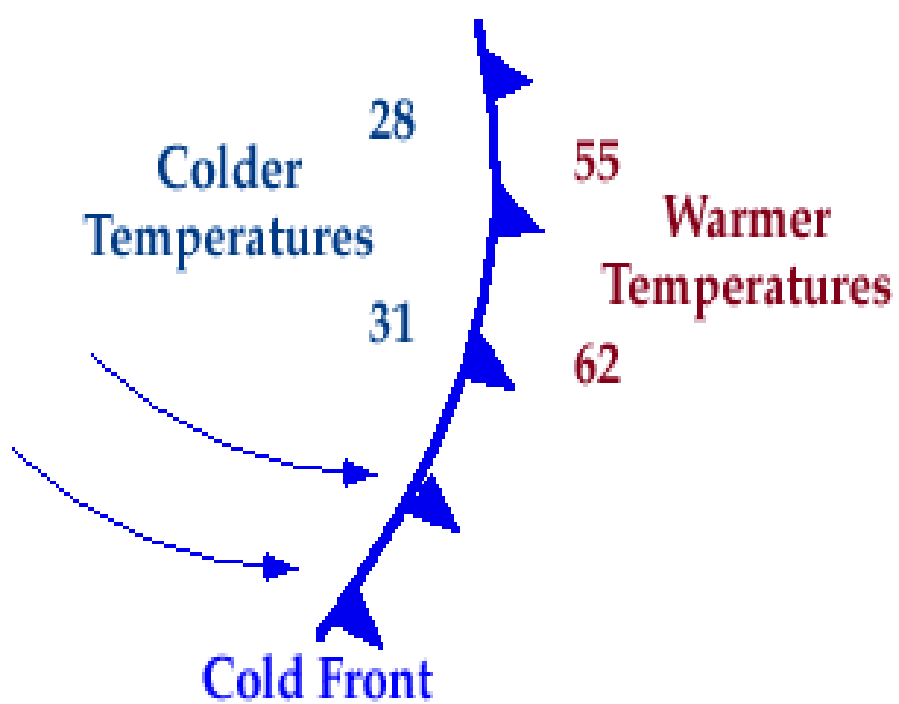
Converging wind

Low



# Putting it all together - What do we already know?

- Pressure Systems:
  - High pressure systems indicate cold falling air that rotates counter-clockwise around the pressure system and bring GOOD WEATHER
  - Low pressure systems – indicate warm rising air that cools as it gets up into the atmosphere forming clouds when the air reaches its DEW POINT (the temperature at which condensation begins) – air rotates clockwise and generally brings BAD WEATHER



## Stationary Front

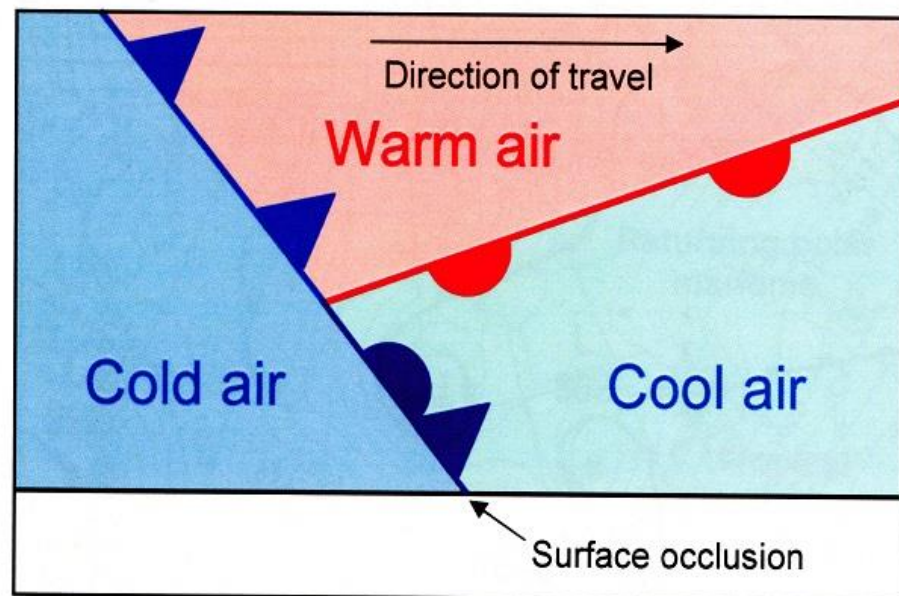
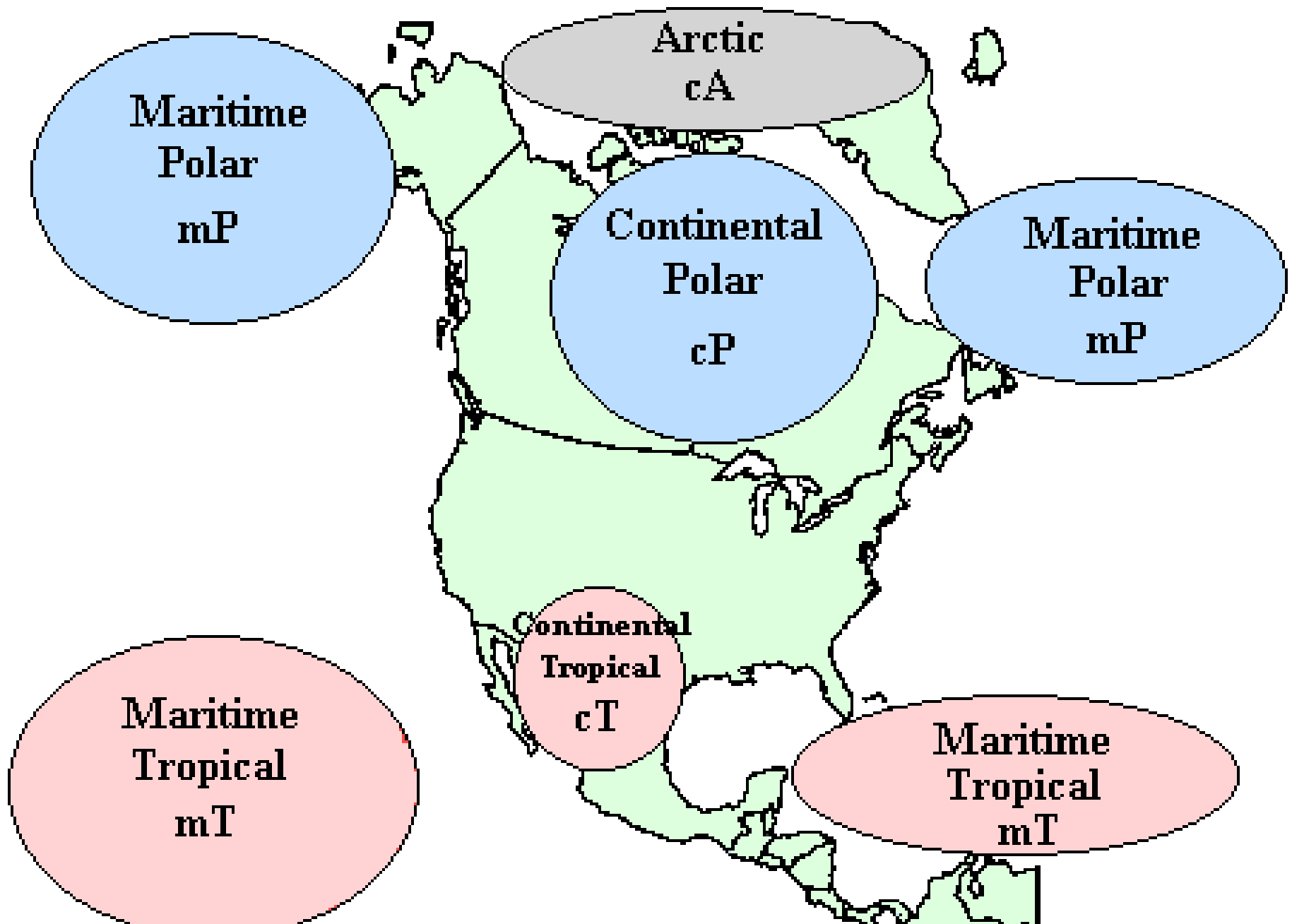


Figure 18. Slope of an occluded front.

# What do we already know?

- **Fronts: the beginning of an air mass**
  - **Cold Fronts** – a fast moving cold air mass is overtaking and pushing a the warm air up and over it (cold air is more dense so it will always push warm air up) the cold air is forcing the warm air up rapidly and we can **expect precipitation and likely thunderstorms with a cold front.**
  - **Warm Fronts:** a warm air mass is overtaking and going up and over a cold air mass, again we can **expect precipitation.**
  - **Stationary Fronts:** a warm air mass meets a cold air mass and neither air mass moves – they stay stationary (still) – this means **extended periods of rain**
  - **Occluded Fronts:** a warm air mass is sandwiched inbetween 2 cold air masses and has cut the warm air mass off from the ground. The two cold air masses meet and push the warm air mass upwards. **We can expect precipitation** as the warm air rises upward in the troposphere.

# North American Air Mass Source Regions



# Air Masses

- Maritime = forms over water (moist air mass)
- Continental = forms over land (dry air mass)
- Tropical = warm – forms near the equator
- Polar = cold – forms near the poles
  - Maritime Polar (moist and cold)
  - Maritime Tropical (moist and warm)
    - Maritime Tropical air masses are where **hurricanes and tropical storms form**
  - Continental Polar (dry and cold)
    - When a continental polar air mass meets a maritime tropical air mass, there is a possibility of tornadoes forming. **These two air masses meet most often in hurricane alley in central US**
  - Continental Tropical (dry and warm)





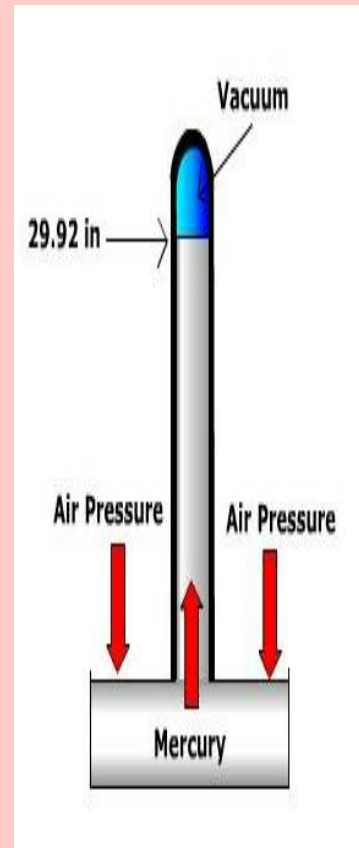
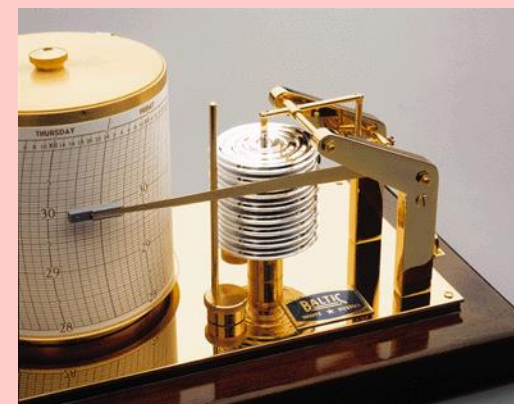
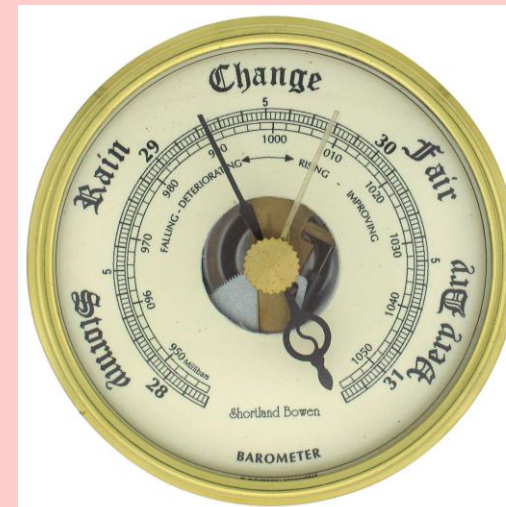
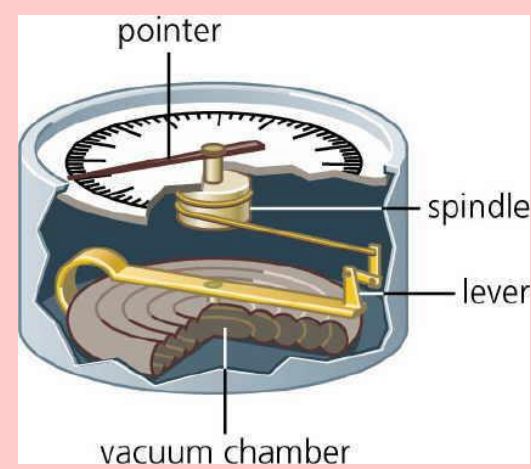
# Clouds

- Cumulus – white puffy clouds – indicate **fair weather**
- Stratus – overcast day, form low in the sky and **cover it like a blanket**
- Cirrus – high in the sky made of **ice crystals**
- -nimbus/nimbo – **rain producing**
  - Nimbostratus – low clouds that blanket the sky and bring steady precipitation
  - Cumulonimbus – also known as thunderheads – form when warm air is pushed up quickly by updrafts and bring precipitation and possible lightning and thunder
- -alto – high

**I can describe different tools  
used to collect weather data**

# Barometers

- **Barometer** is an instrument used to measure **atmospheric pressure** in Inches of mercury or millibars. 1 Bar = 1000 mB
- Changes in pressure can forecast short term changes in the weather.
  - **Dropping = bad weather,**
  - **Rising = good weather**
- Barographs record long-term changes to identify Low and High pressure system.

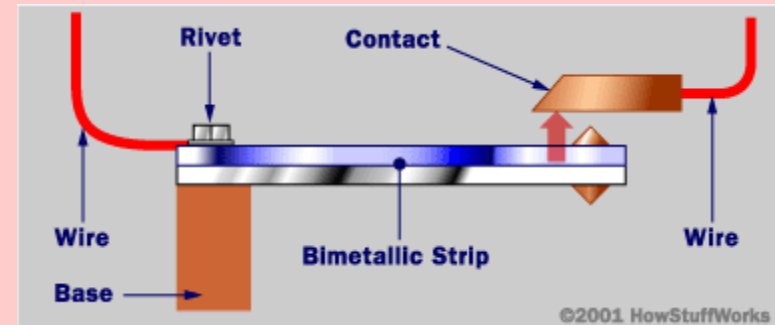
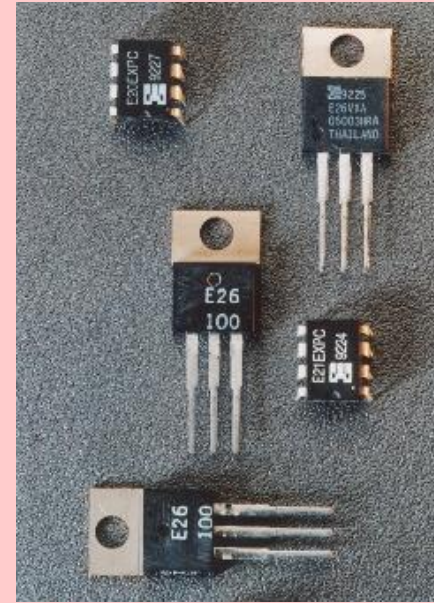
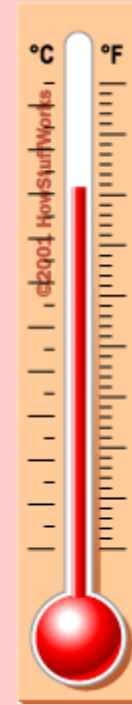


# Barometric Pressure - Forecasting

- If the barometer is measuring the air pressure going up that is an indication that a **HIGH PRESSURE** system is heading our way and we can expect **GOOD WEATHER**
- If the barometer is measuring that the air pressure is going down, that is an indication that we can expect a **LOW PRESSURE SYSTEM** which means **BAD WEATHER.**

# Thermometers

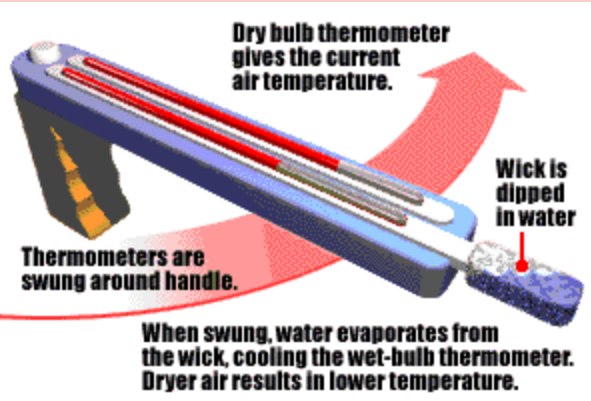
- Bulb Type
  - Bulb thermometers rely on the simple principle that **a liquid changes its volume relative to its temperature** – these are the types we use in class – they are very simple/
- Bimetallic Type
  - two different expanding metals are fused together to bend with a temperature change
- Thermistor
  - Most common used today, This device changes its **resistance** with changes in temperature



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# Psychrometers

## Partial Relative Humidity Chart for 30° C



- The simplest hygrometer - a sling psychrometer - consists of two thermometers mounted together with a handle attached on a chain. One thermometer is ordinary. The other has a cloth wick over its bulb and is called a wet-bulb thermometer.

Difference Between Dry Bulb and Wet Bulb Temperatures	Relative Humidity
None	100%
0.5°	96%
1.0°	93%
1.5°	89%
9.0°	44%
9.5°	42%
14.5°	19%
15.0°	17%
18.0°	5%

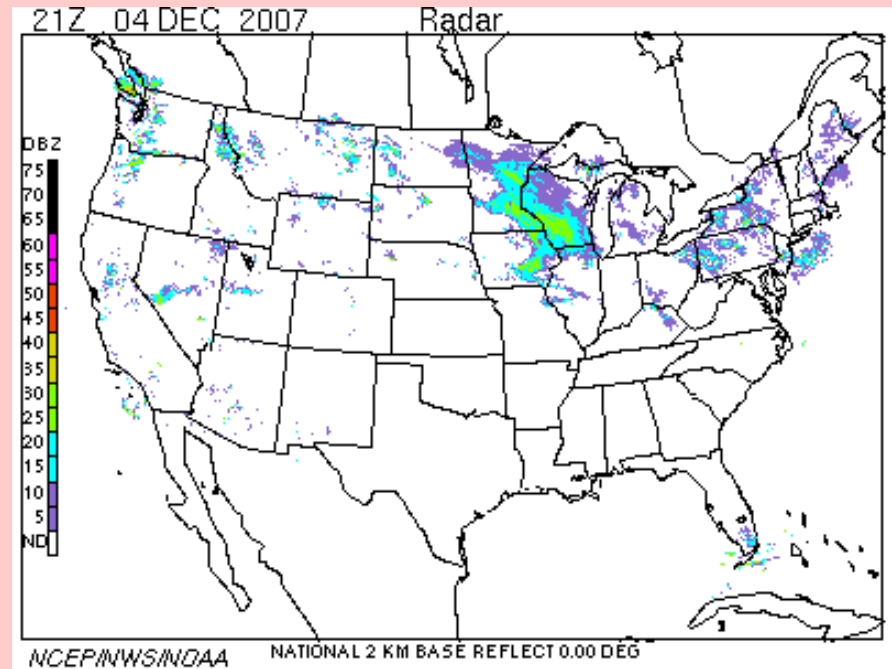
# Anemometer

- Anemometer includes both wind speed and wind direction sensors.
- stands up to hurricane-force winds, yet are sensitive to the lightest breeze.
- Wind direction vane identifies the direction of the wind
  - direction is “from” a west wind is from the west



# Radar

- Radar is an electronic instrument, which determines the direction and distance of objects that reflect radio energy back to the radar site. It stands for Radio Detection and Ranging. This is what meteorologists use to see rain or snow.
- colors show the strength and physical phase of water





# What is Doppler Radar?

- Doppler Radar detects precipitation intensity, wind direction and speed, and provides estimates of hail size and rainfall amounts.
- Doppler Radar gives forecasters the capability of providing **early detection of severe thunderstorms** that may bring strong damaging winds, large hail, heavy rain, **and possibly tornadoes**.
- Combined with satellites, radar gives forecasters the ultimate tools to provide accurate forecasts and advanced severe weather warnings.

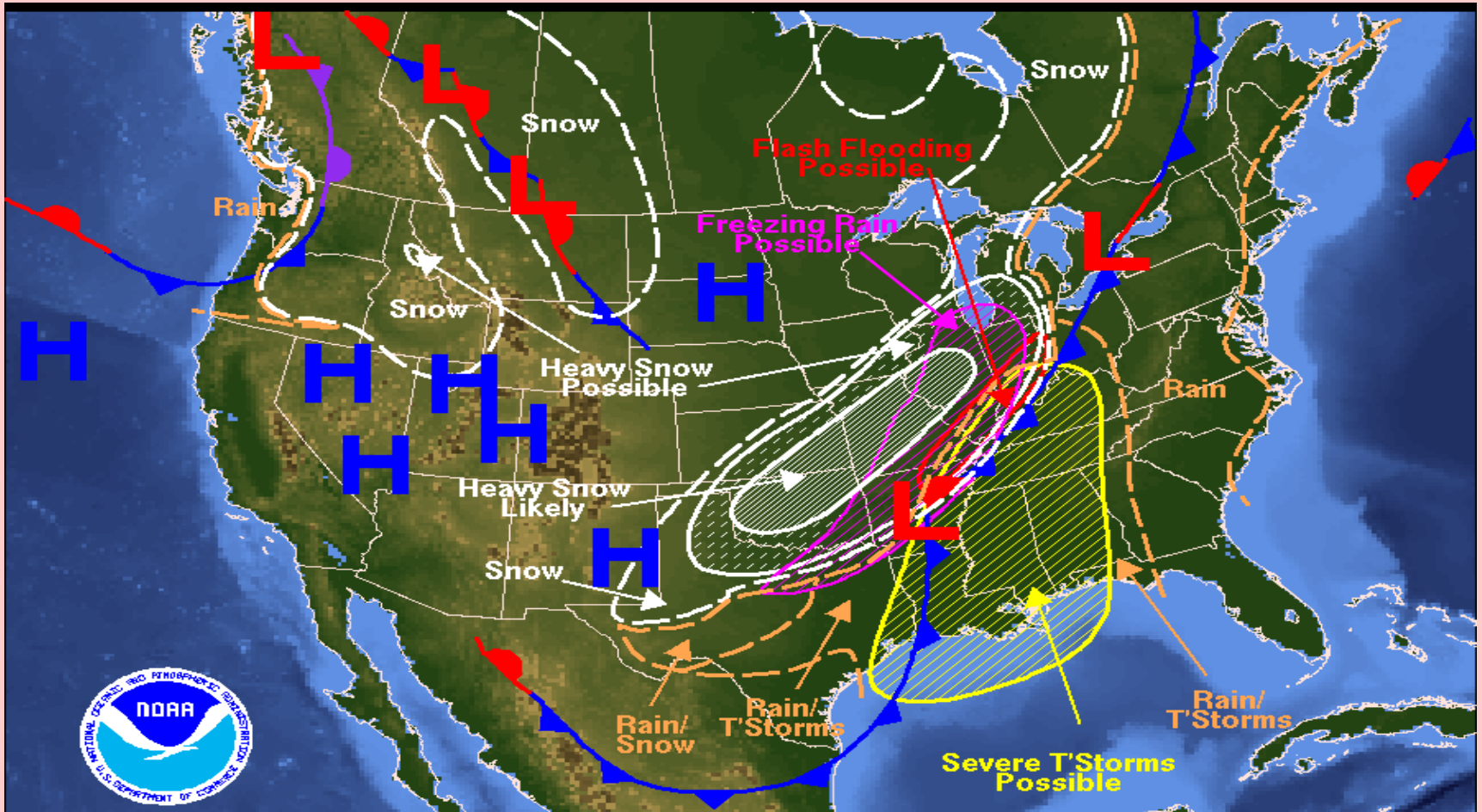
# What is a weather satellite?

- A weather satellite is a type of satellite that is primarily used to monitor the weather and climate of the Earth.
- Satellites can be either polar orbiting, seeing the same part of the Earth every 12 hours, or geostationary, (hovering over the same spot on Earth by orbiting over the equator while moving at the speed of the Earth's rotation.)
- These meteorological satellites see more than clouds and cloud systems. City lights, fires, effects of pollution, auroras, sand and dust storms, snow cover, ice mapping, boundaries of ocean currents, energy flows, etc., are other types of environmental information collected using weather satellites.

# Summary

- Weather instruments reveal the invisible factors that help predict weather.
- Meteorologists use the measurement of Temperature, air pressure, humidity and wind speed/direction to identify weather conditions.
- **Satellites and Radar** show the movement of air masses, storms and fronts.

# Obj 24: I can read and understand a weather Map



# Fronts on a weather map

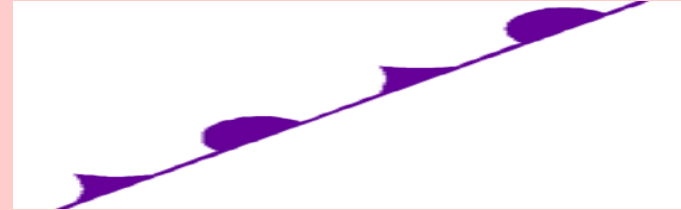
Warm



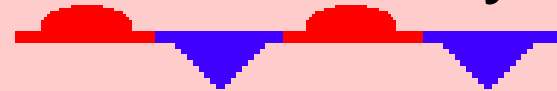
- Cold



occluded

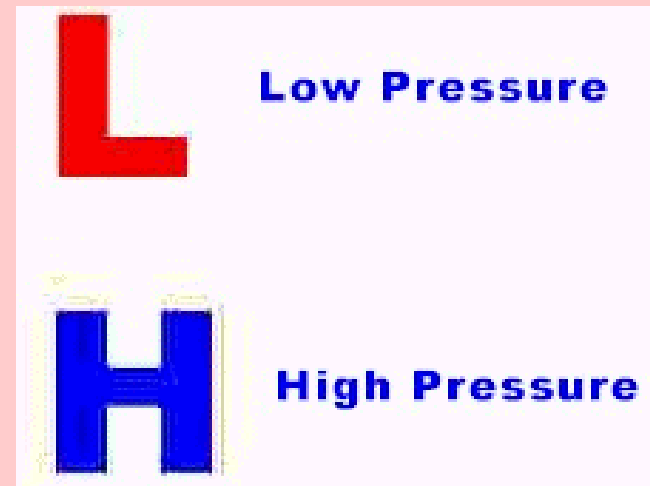


Stationary



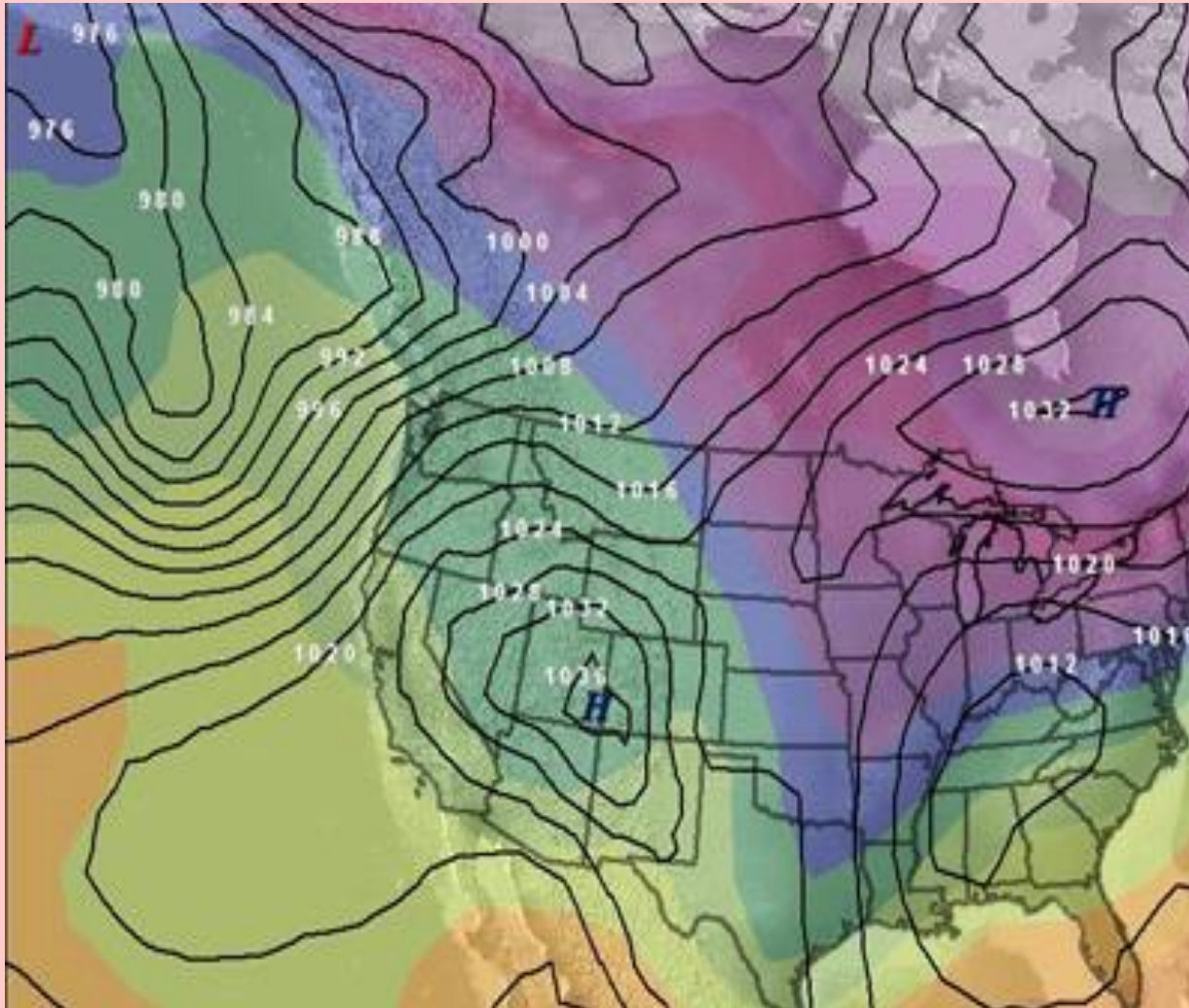
The symbols point in the direction that the front is moving towards

**Pressure symbols:**



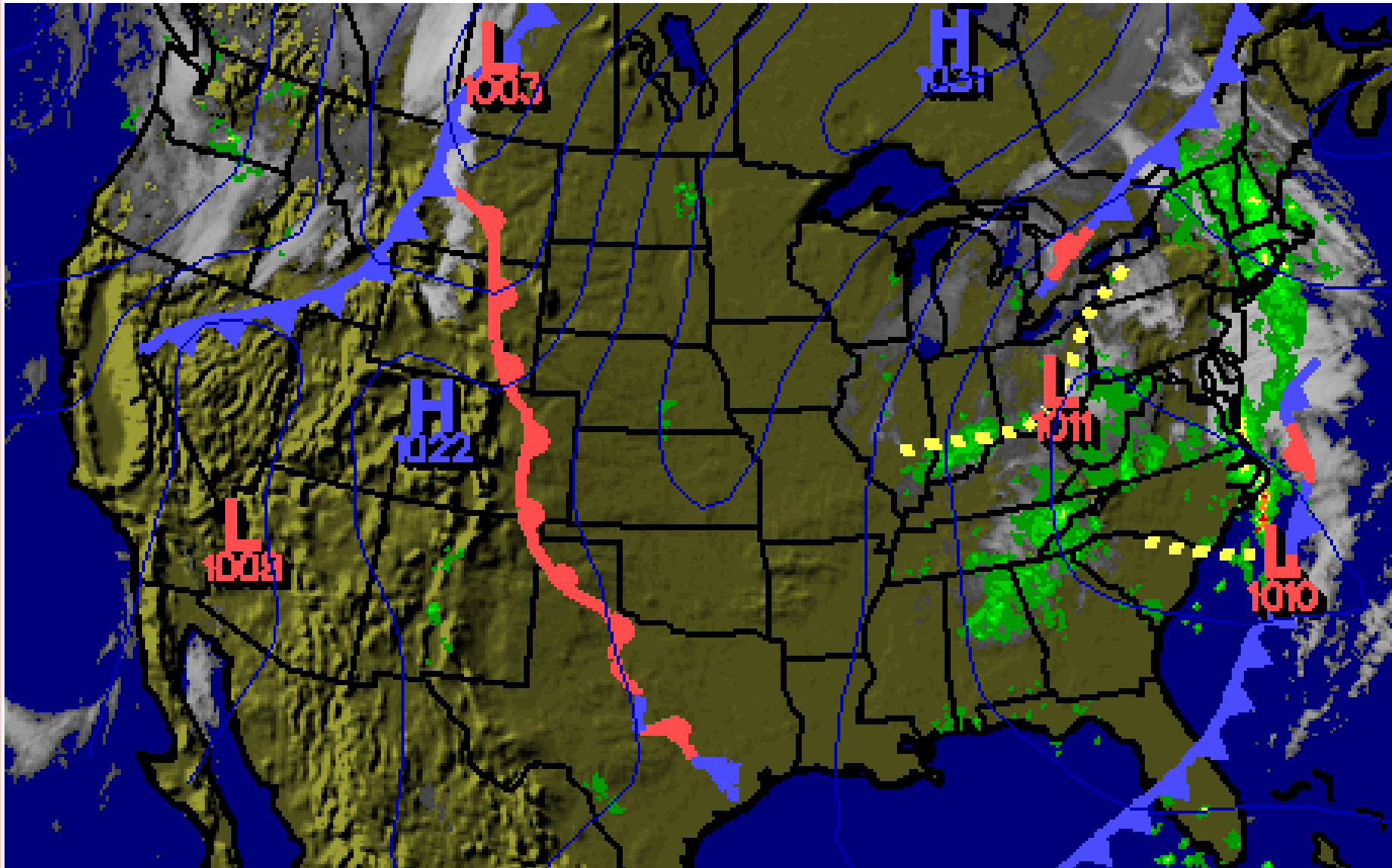
**Isobars:** connect areas with equal air pressure

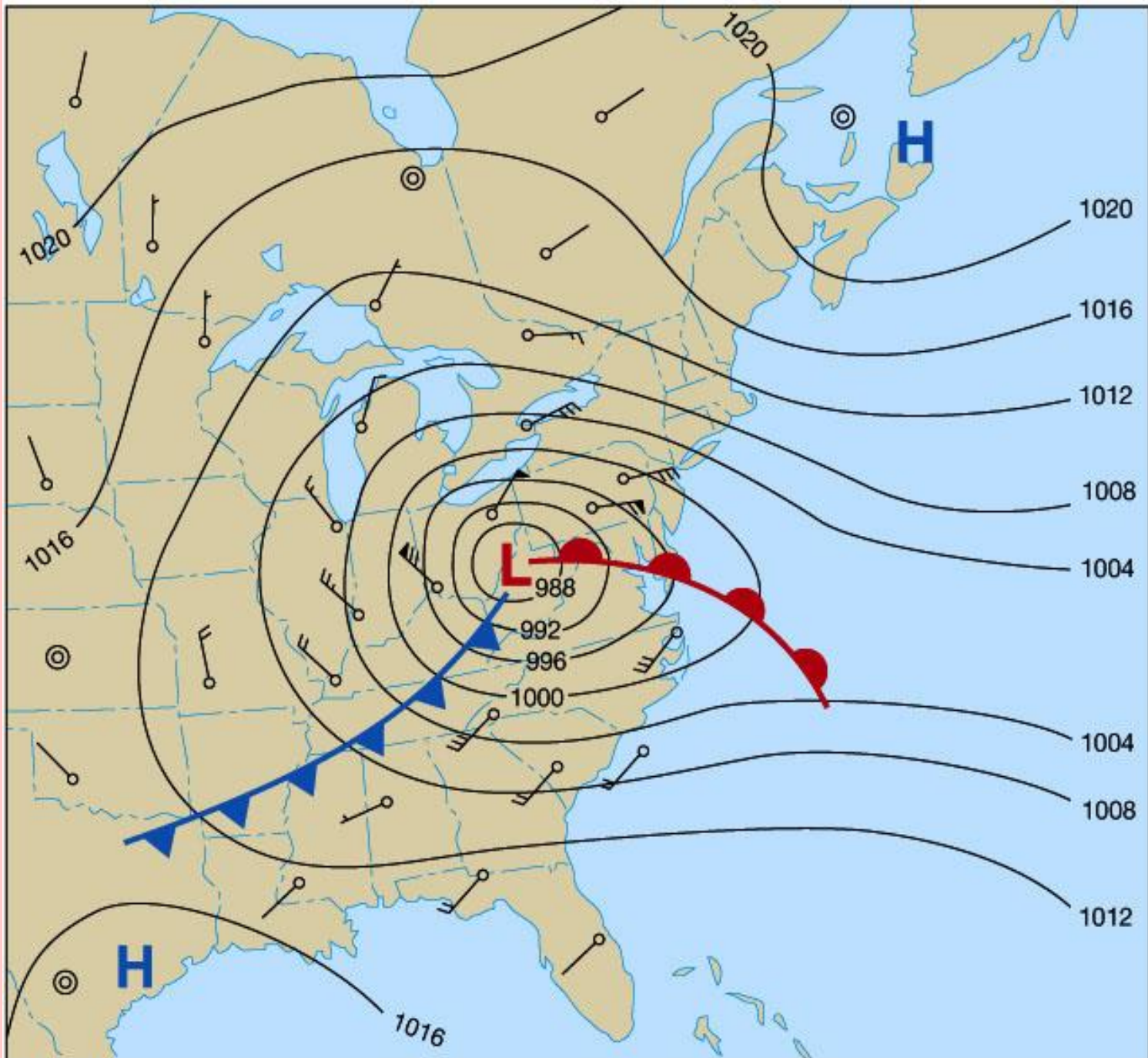
The **distance between the isobars** is called the pressure gradient



- The **closer the isobar lines**, the greater the change in air pressure, and the greater/faster the winds speeds.
- **High pressure systems** bring clear/sunny weather and wind flows out and clockwise (right)
- **Low pressure systems** bring overcast/stormy weather and wind flows in and counter-clockwise (left)

# Weather Map



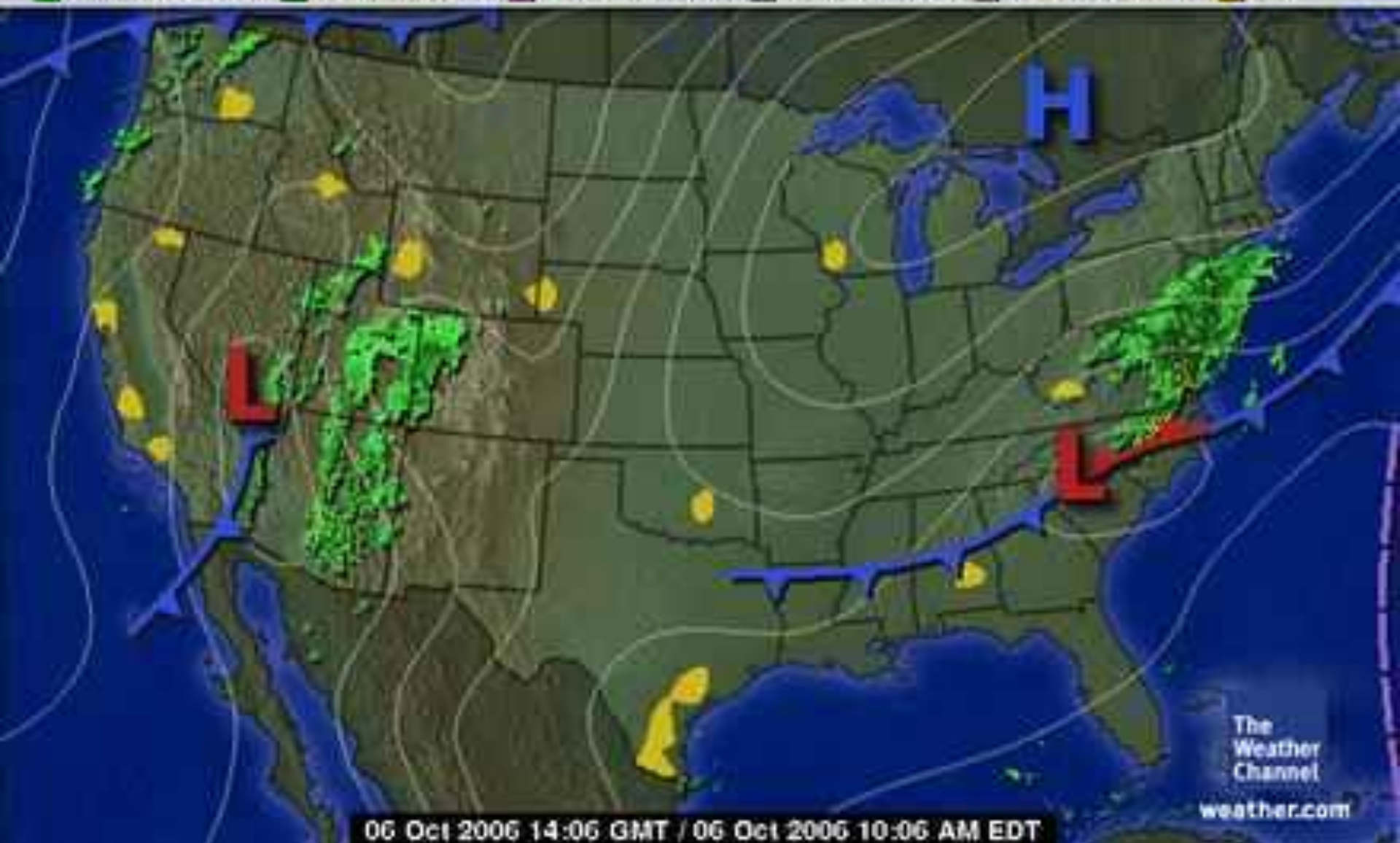


ff	Miles per hour
⊙	Calm
—	1-2
└	3-8
└└	9-14
└└└	15-20
└└└└	21-25
└└└└└	26-31
└└└└└└	32-37
└└└└└└└	38-43
└└└└└└└└	44-49
└└└└└└└└└	50-54
└└└└└└└└└└	55-60
└└└└└└└└└└└	61-66
└└└└└└└└└└└└	67-71
└└└└└└└└└└└└└	72-77
└└└└└└└└└└└└└└	78-83
└└└└└└└└└└└└└└└	84-89
└└└└└└└└└└└└└└└└	119-123



# Current Surface

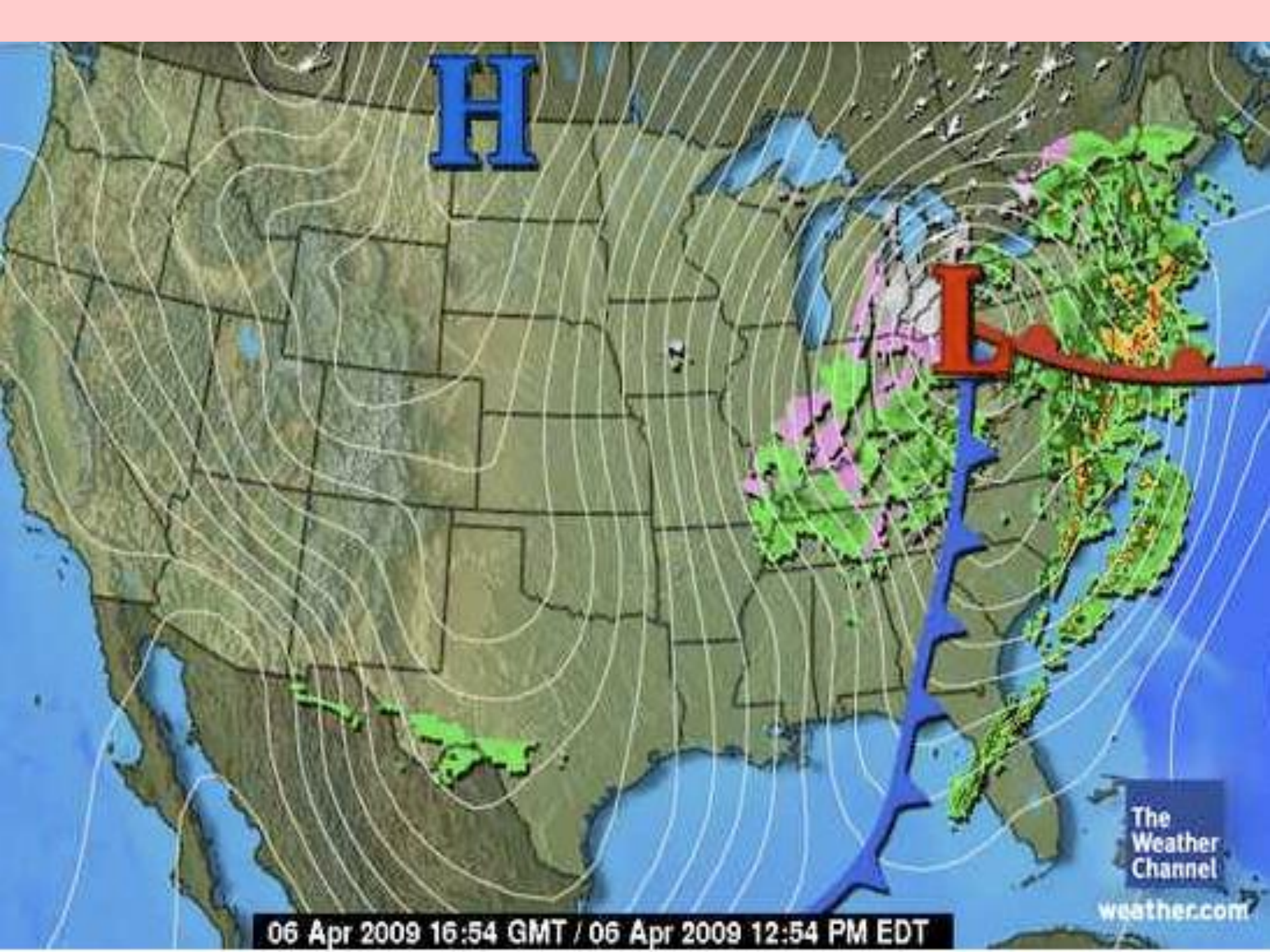
LT RAIN/DRIZZLE MOD/HVY RAIN RAIN/ICE/SNOW LT SNOW/FLUR MOD/HVY SNOW FOG



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