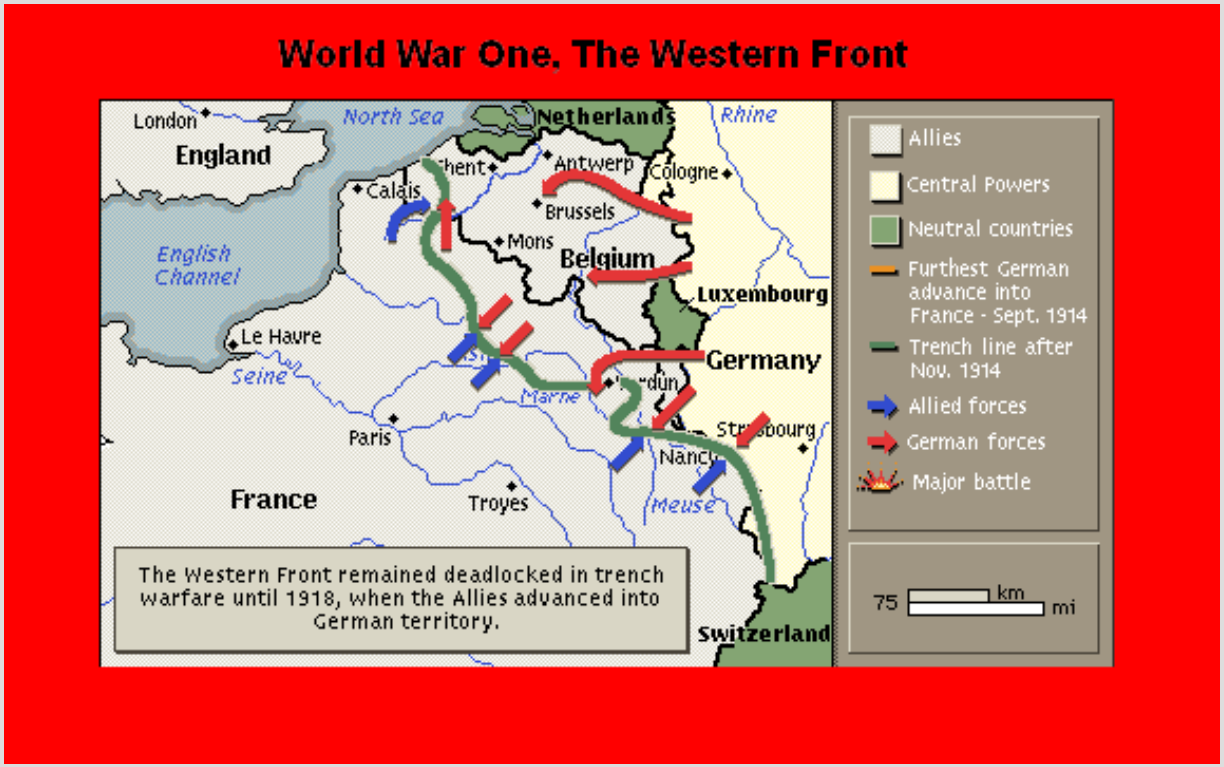
NATS 101
Section 13: Lecture 22

Fronts

Last time we talked about how air masses are created.

When air masses meet, or clash, the transition zone is called a front.

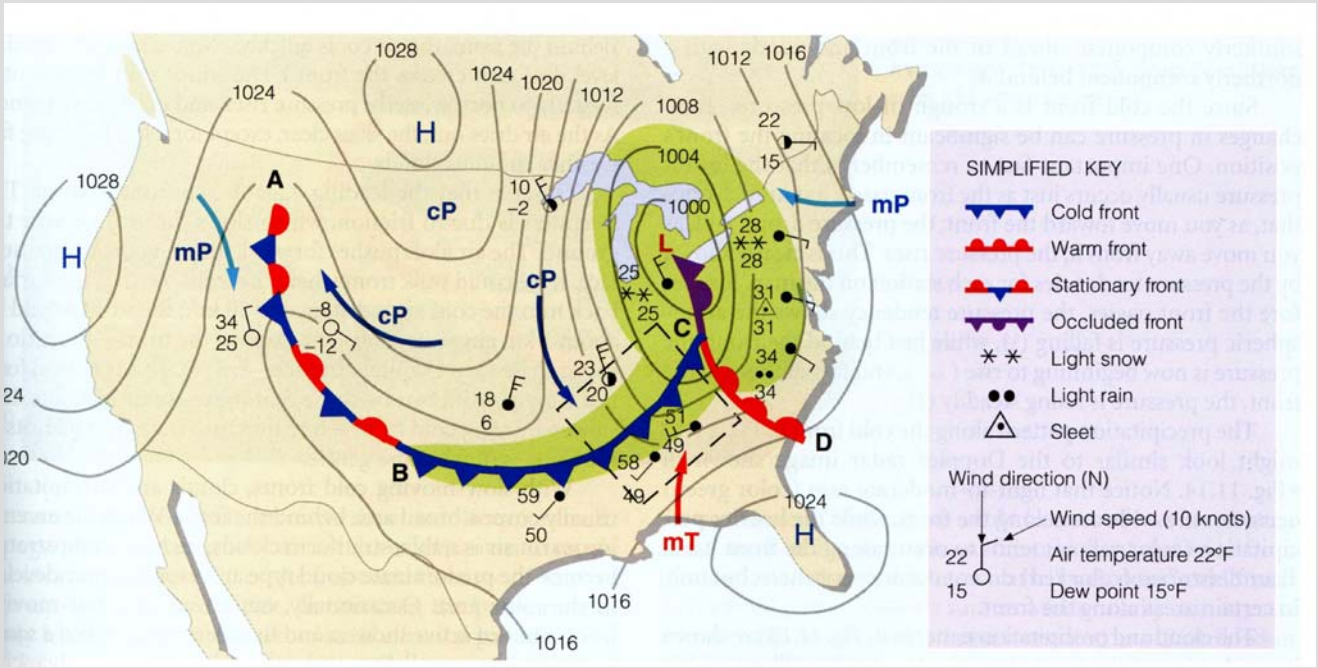
The concept of “fronts” in weather developed from the idea of the front line of battle, specifically in Europe during World War I



How are weather fronts analogous to battle fronts in a war?

Which air mass “wins” depends on what type of front it is.

Four types of fronts



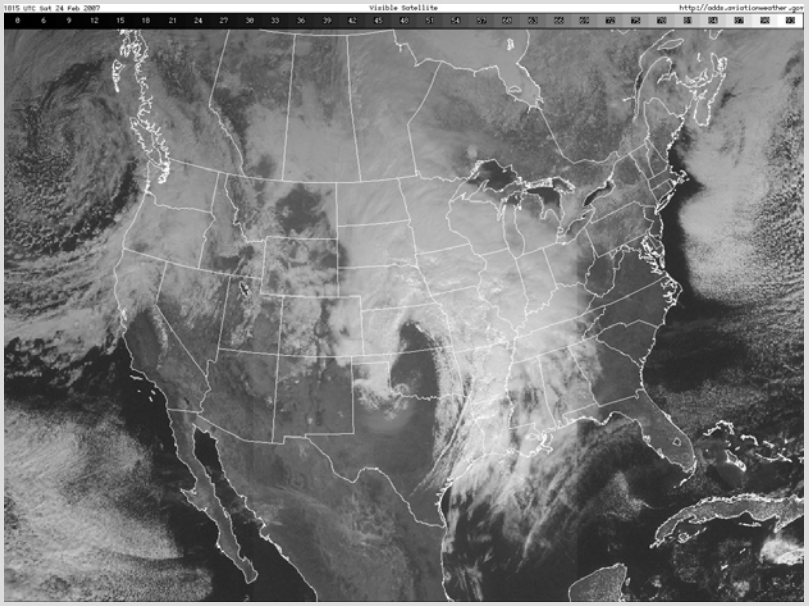
COLD FRONT: Cold air overtakes warm air. ***B to C***

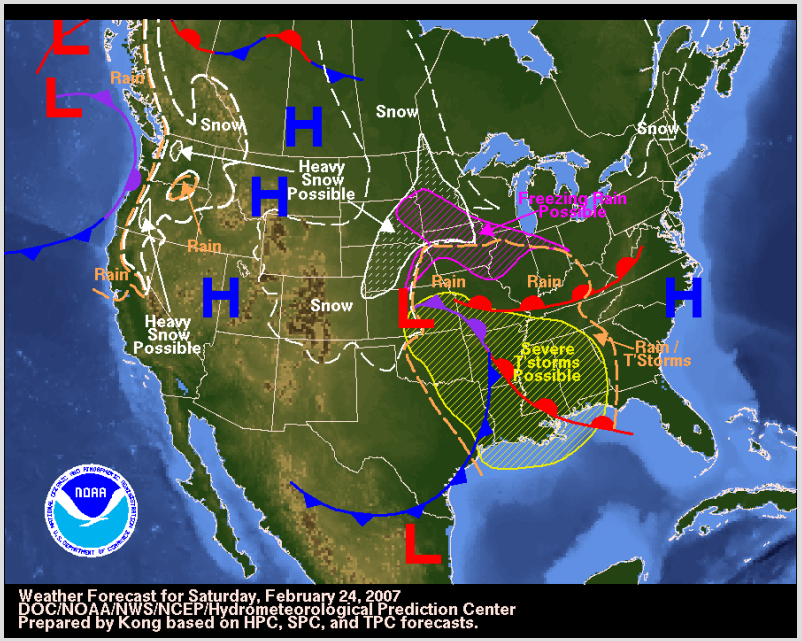
WARM FRONT: Warm air overtakes cold air. ***C to D***

OCCLUDED FRONT: Cold air catches up to the warm front.
C to Low pressure center

STATIONARY FRONT: No movement of air masses. ***A to B***

Fronts and Extratropical Cyclones
Feb. 24, 2007 Case

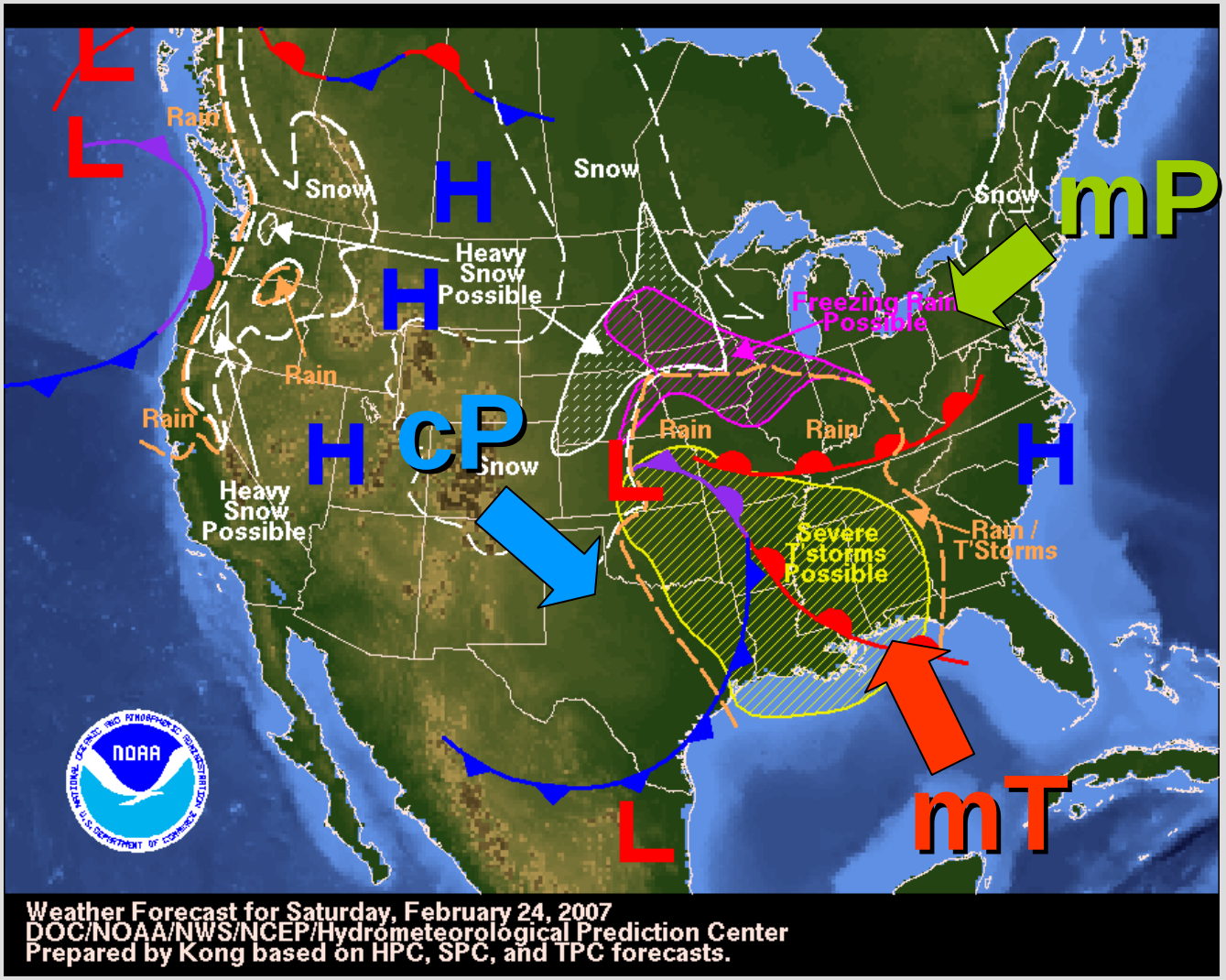




In mid-latitudes, fronts are part of the structure of extratropical cyclones.

Extratropical cyclones form because of the horizontal temperature gradient. How are they a part of the general circulation?

Type of weather and air masses in relation to fronts: Feb. 24, 2007 case



Characteristics of a front

1. **Sharp temperature changes over a short distance**

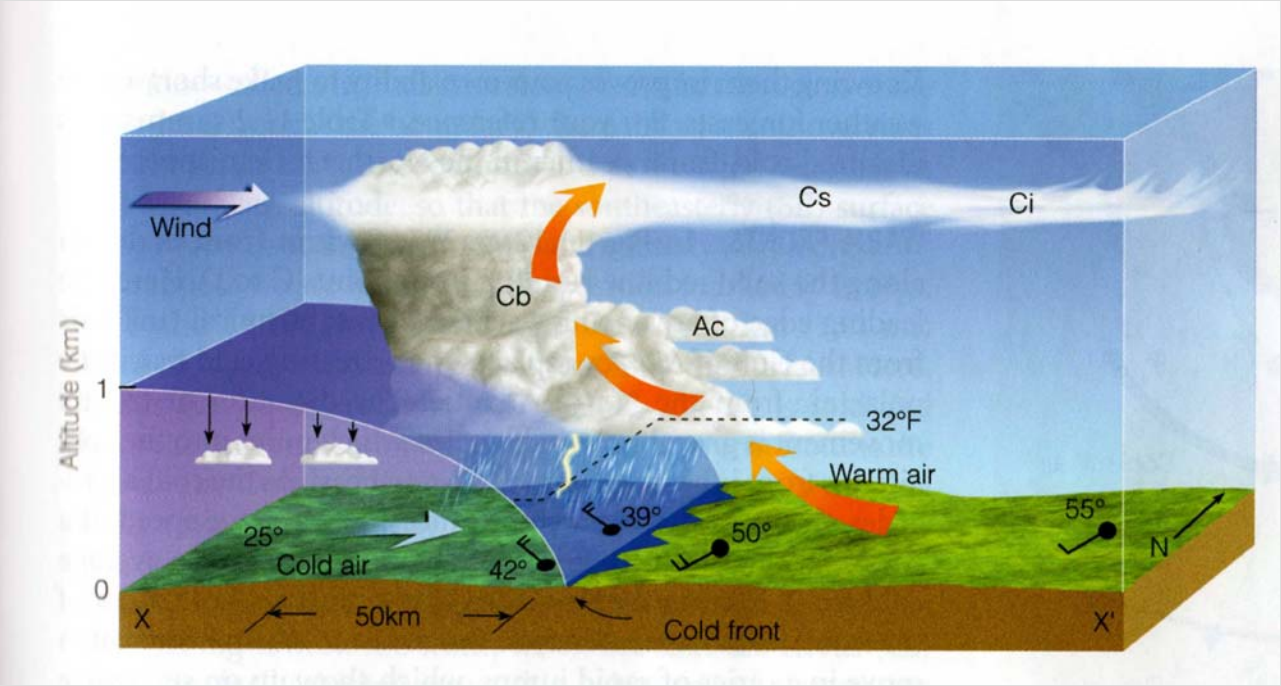
2. **Changes in moisture content**

3. **Wind shifts**

4. **A lowering of surface pressure, or pressure trough**

5. **Clouds and precipitation**

We'll see how these characteristics manifest themselves for fronts in North America using the example from Feb. 2007…



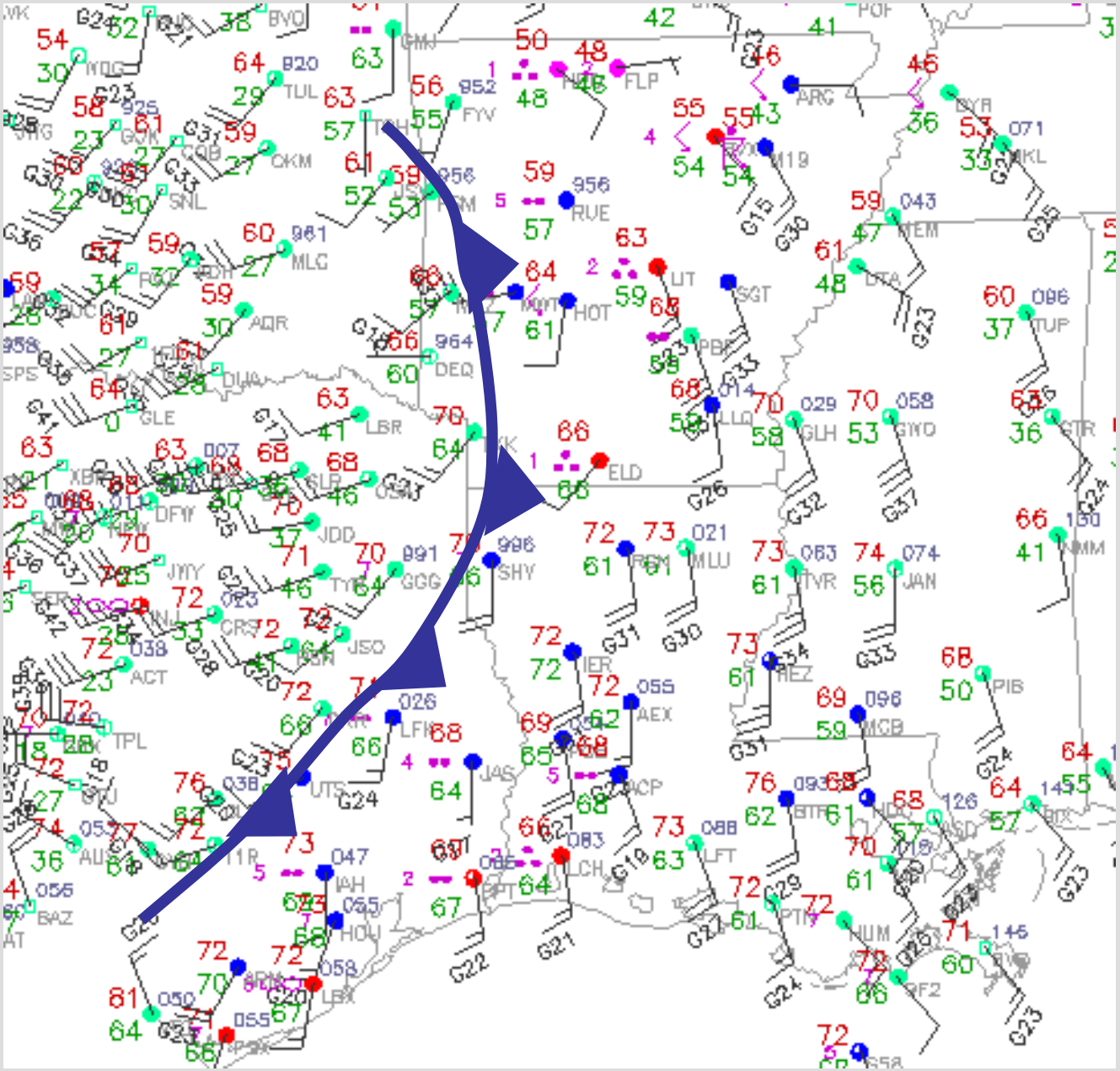
COLD FRONT

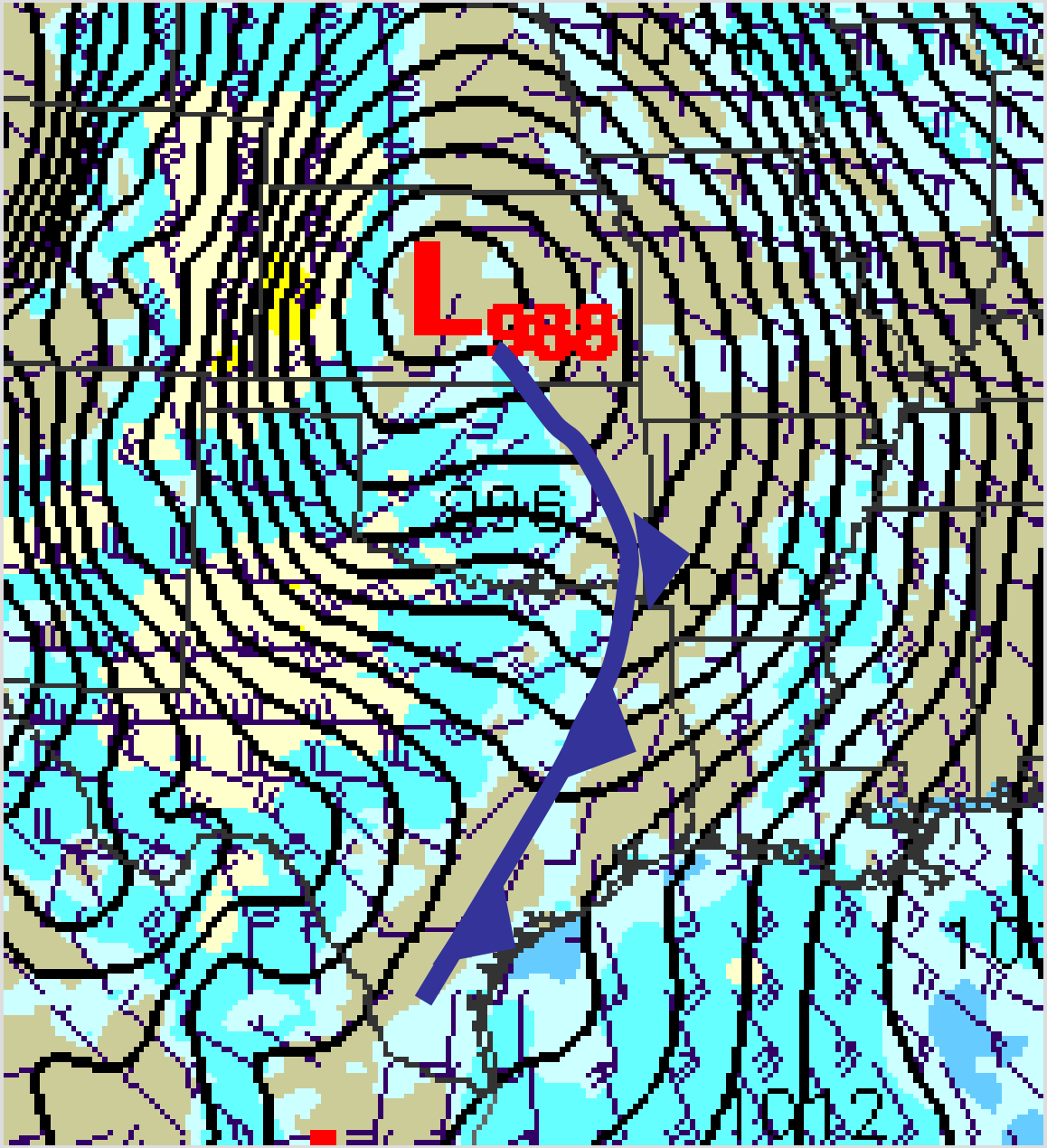
Horizontal extent: About 50 km

<u>AHEAD OF FRONT</u>: Warm and southerly winds. Cirrus or cirrostratus clouds. Called the warm sector.

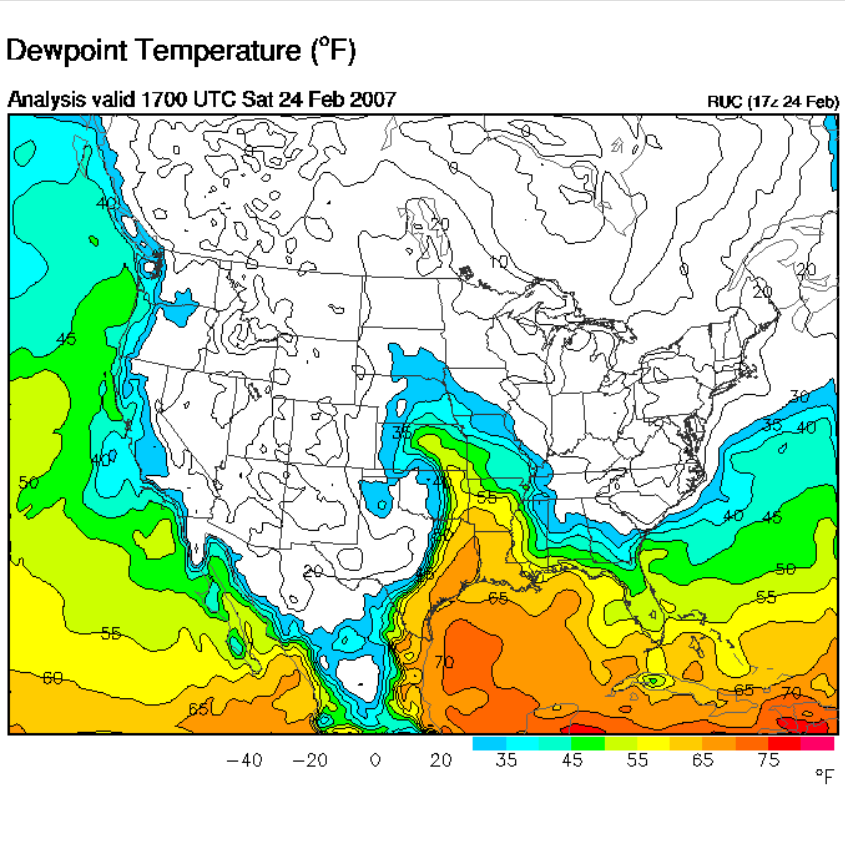
<u>AT FRONT</u>: Pressure trough and wind shift. Area of rain showers, which can be thunderstorms if the air ahead of the front is warm and moist enough. Unstable, vertically developed clouds.

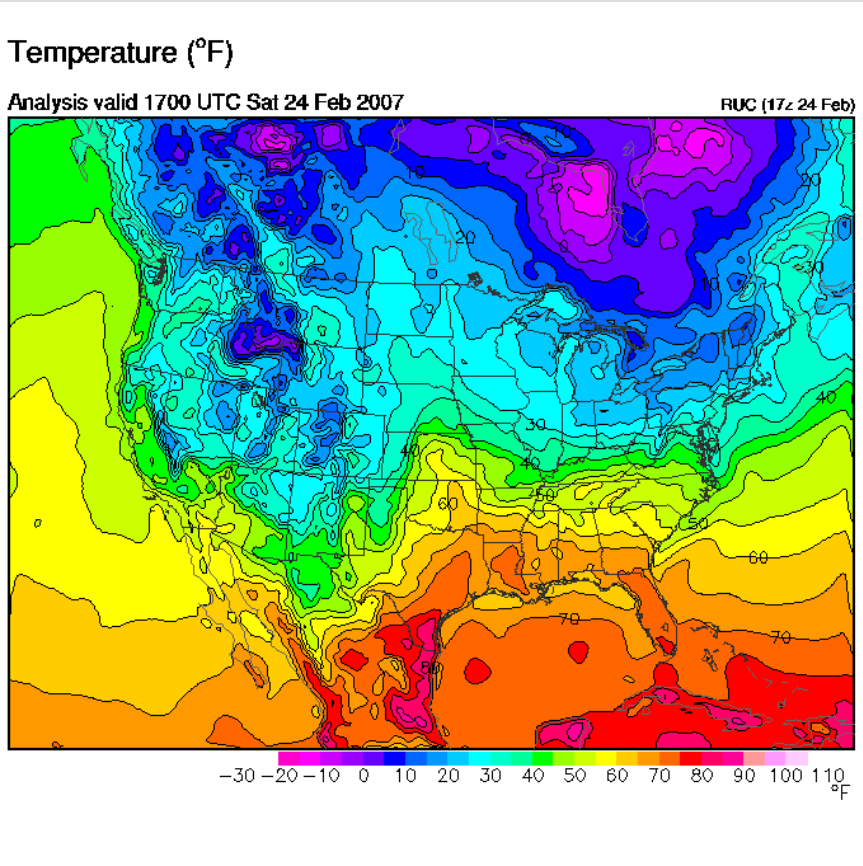
<u>BEHIND FRONT</u>: Rapid clearing and drying in the cold air. Pressure rises. Winds typically northerly or westerly.





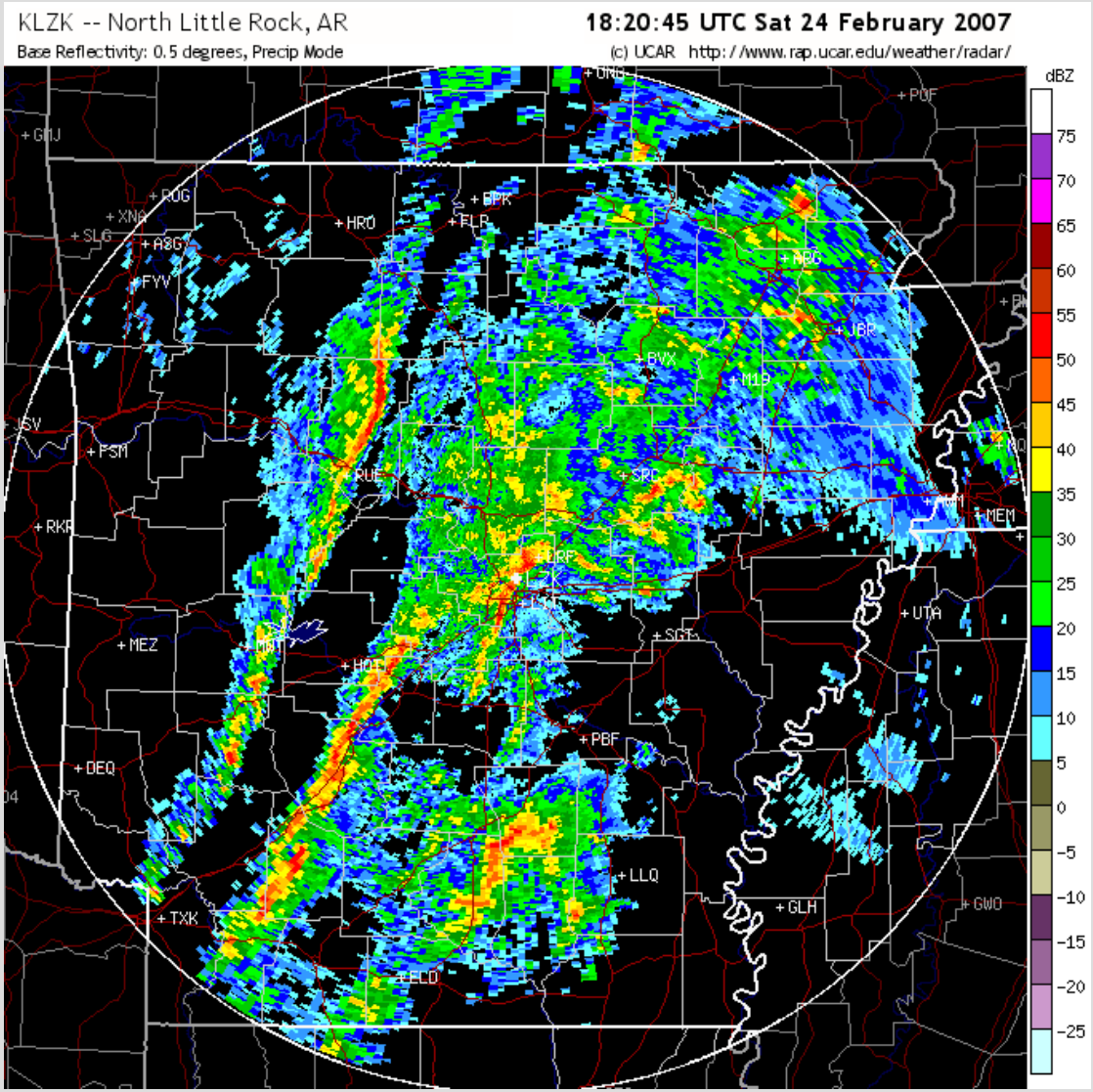
Fronts follow the pressure trough





How are temperature and dewpoint changing in the vicinity of the front?

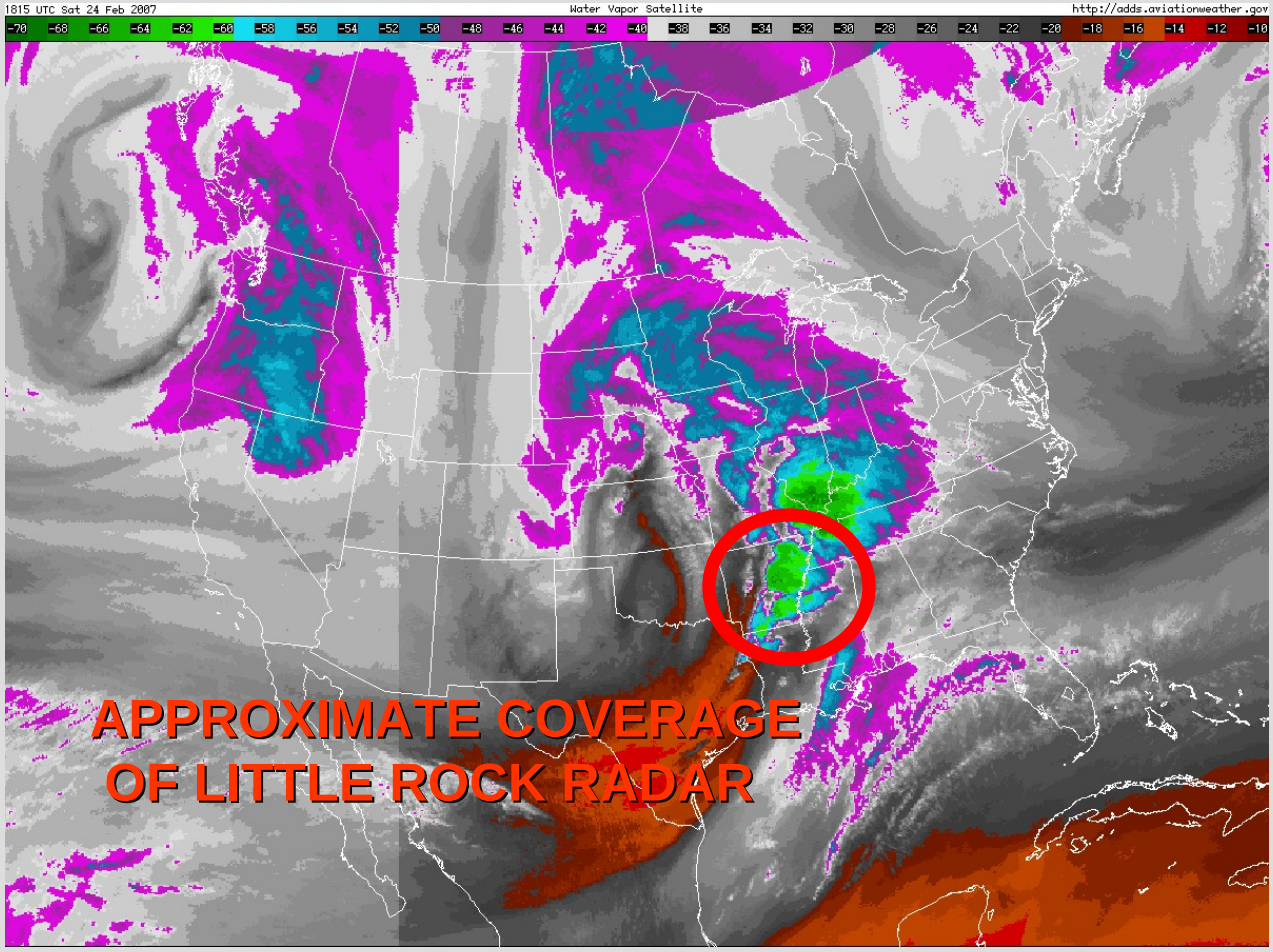
Try to identify the location of the cold front by looking at these maps.



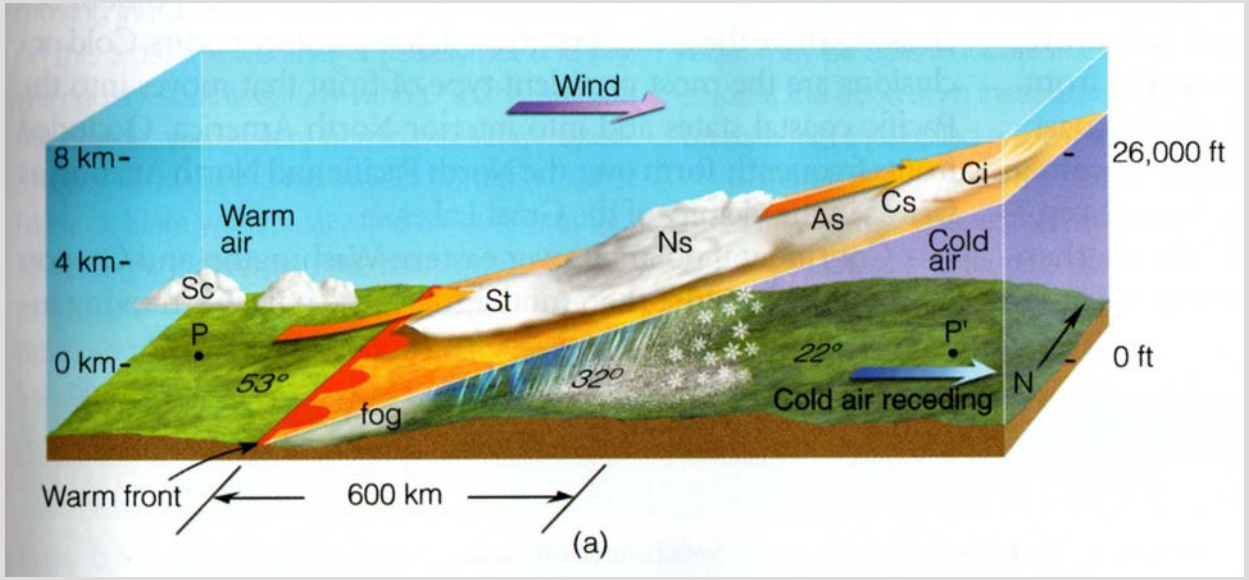
Typically a line or lines of showers or thunderstorms on a cold front.

These are called *squall lines*.

ENHANCED IR SATELLITE IMAGE



Very cold, highly vertically developed clouds along the cold front in Arkansas where the squall lines are.



WARM FRONT

Horizontal extent: About 600 km

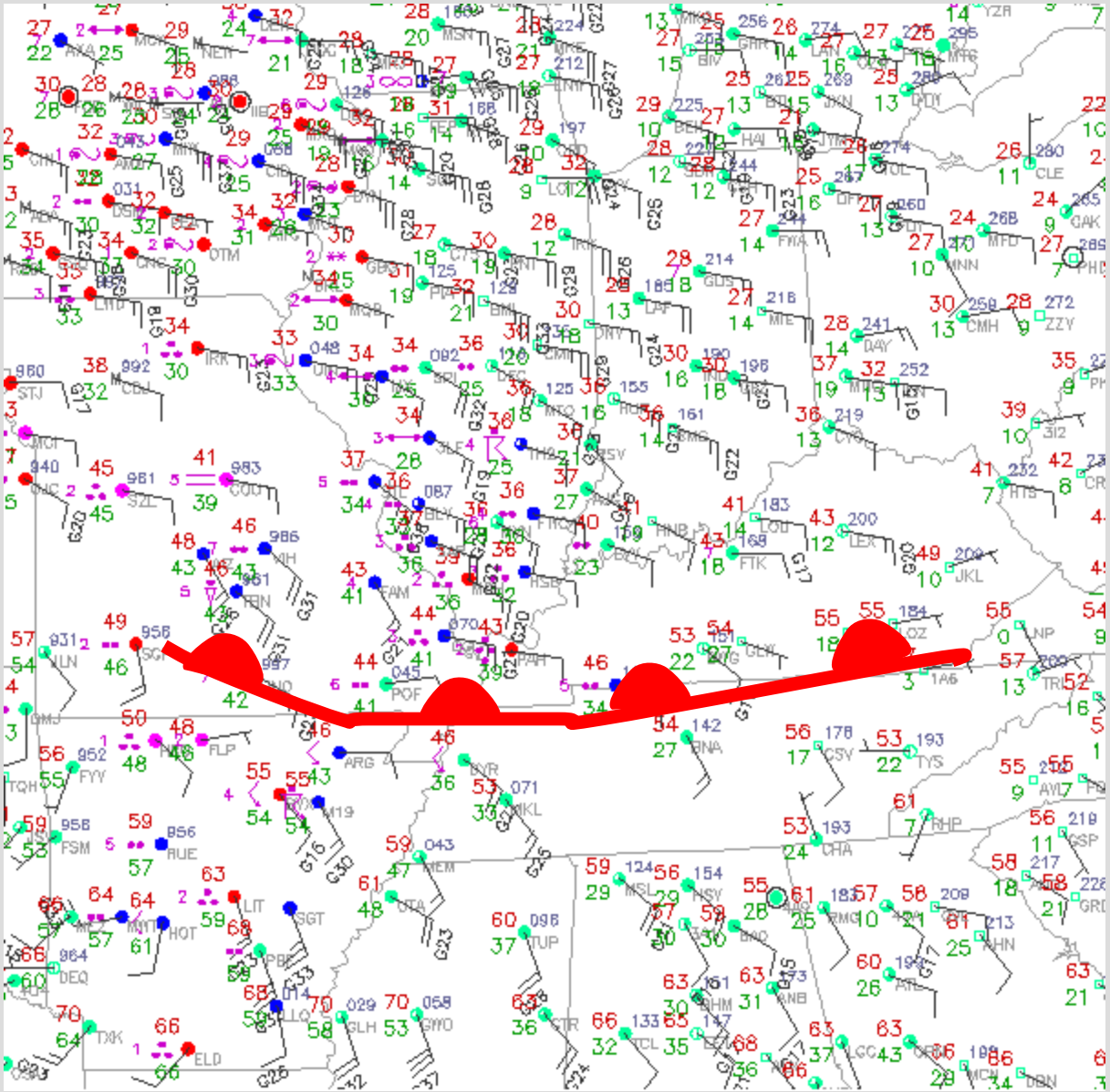
<u>AHEAD OF FRONT</u>: Easterly to Southeasterly winds. Widespread precipitation from stable clouds like nimbostratus. May include fog.

As get father north away from the front precipitation typically transitions because the cold air layer gets deeper

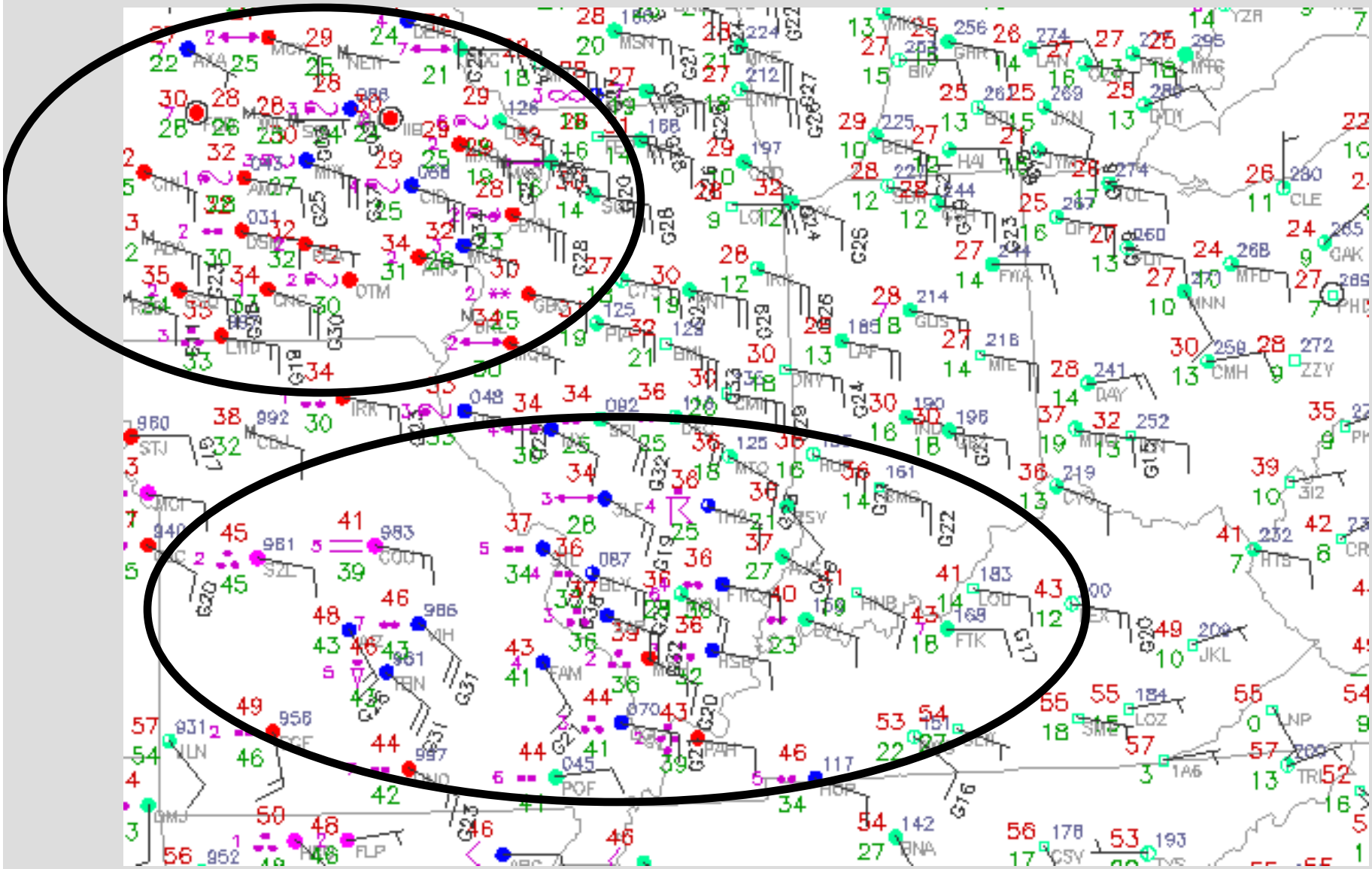
rain → freezing rain and sleet → snow

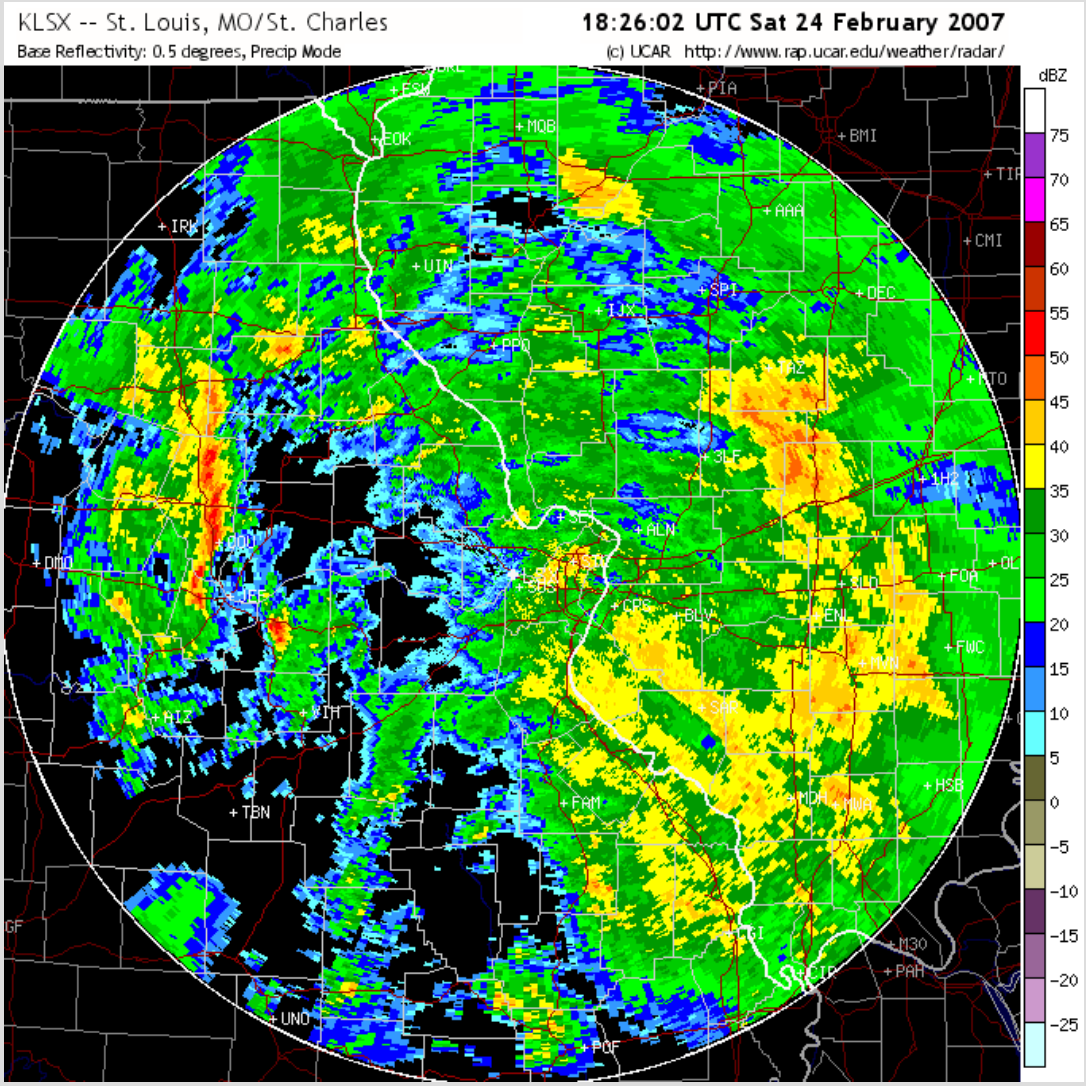
<u>AT FRONT</u>: Pressure trough and wind shift to the south.

<u>BEHIND FRONT</u>: Warming, rising pressure and southerly winds.



What are the precipitation types on the circled areas?

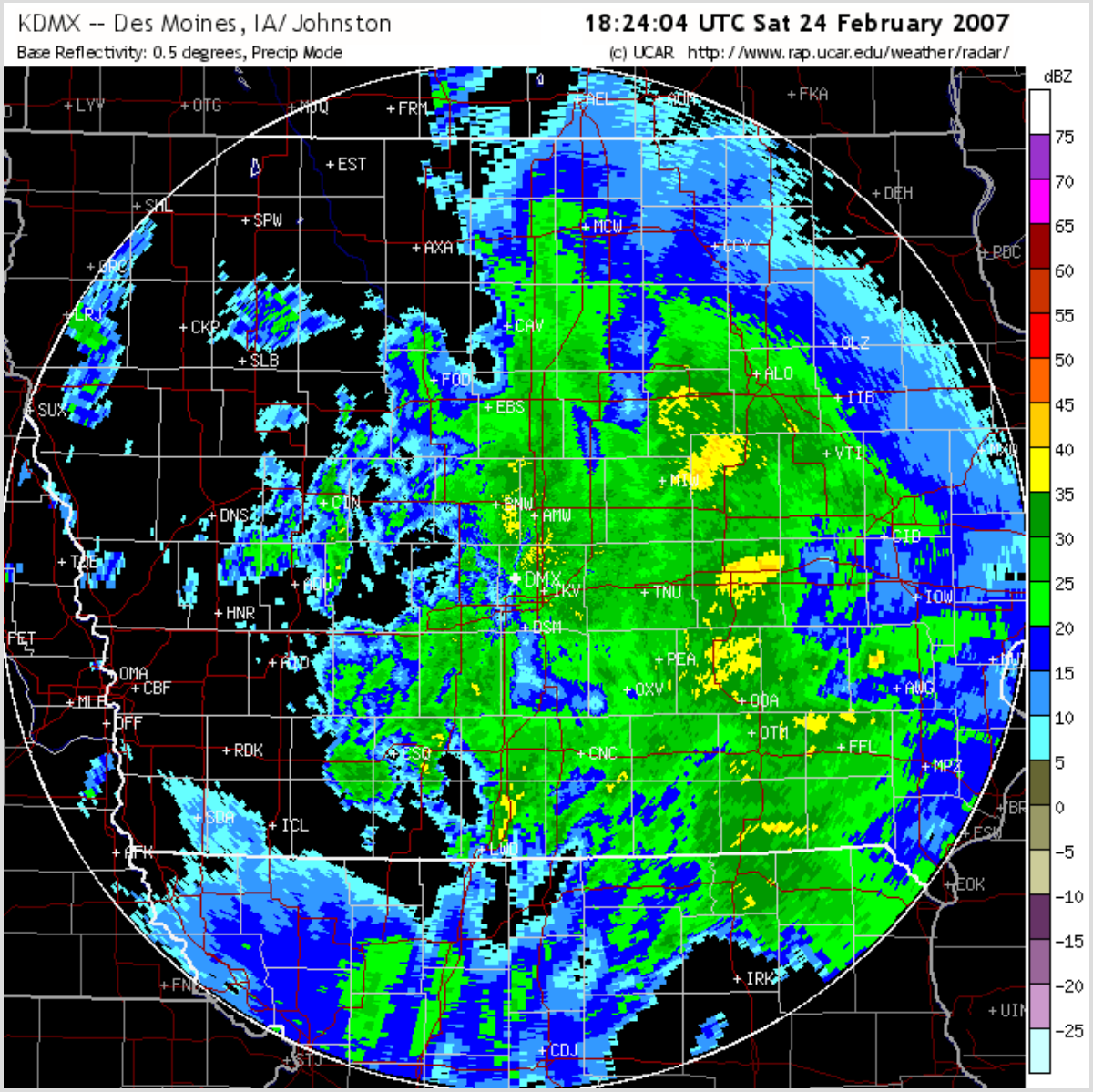




Rain on a warm front is typically widespread and steady.

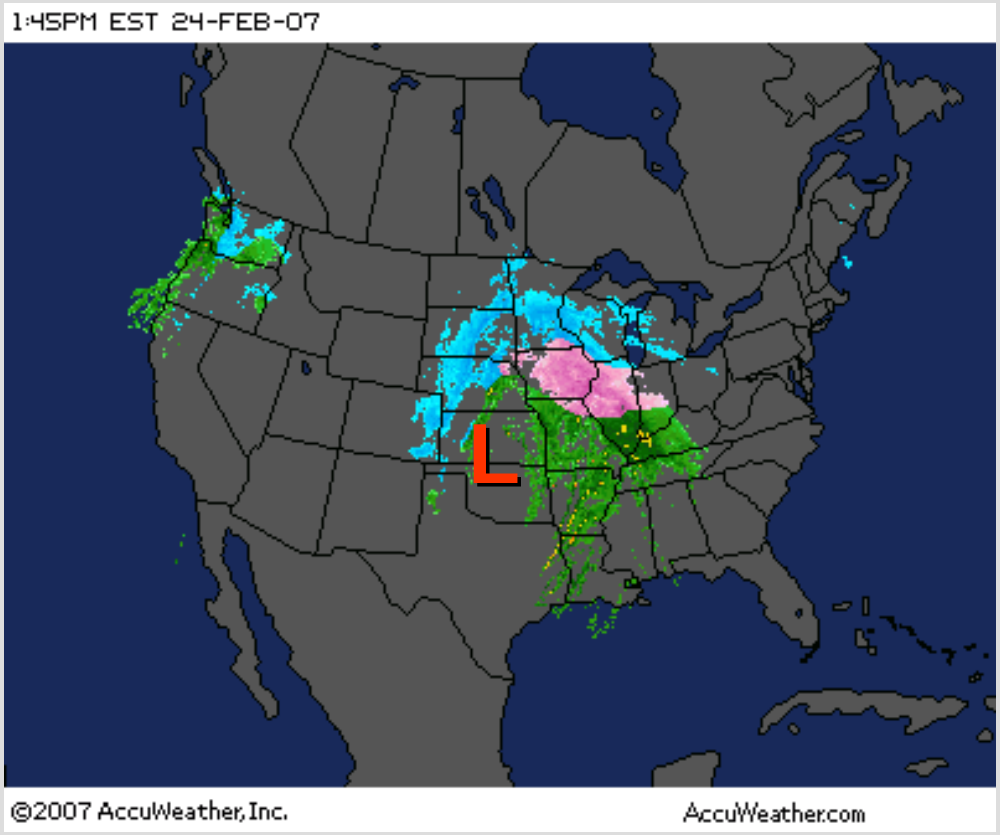
It is also not typically very heavy, as with the thunderstorms on the cold front.

Note the lack of the really strong radar echoes here (i.e. not a lot of orange and red colors).



Freezing rain is occurring in Iowa where the radar reflectivity is highest (yellows)

Far enough north and west of the warm front is typically where the snow happens because the cold air is deep enough.

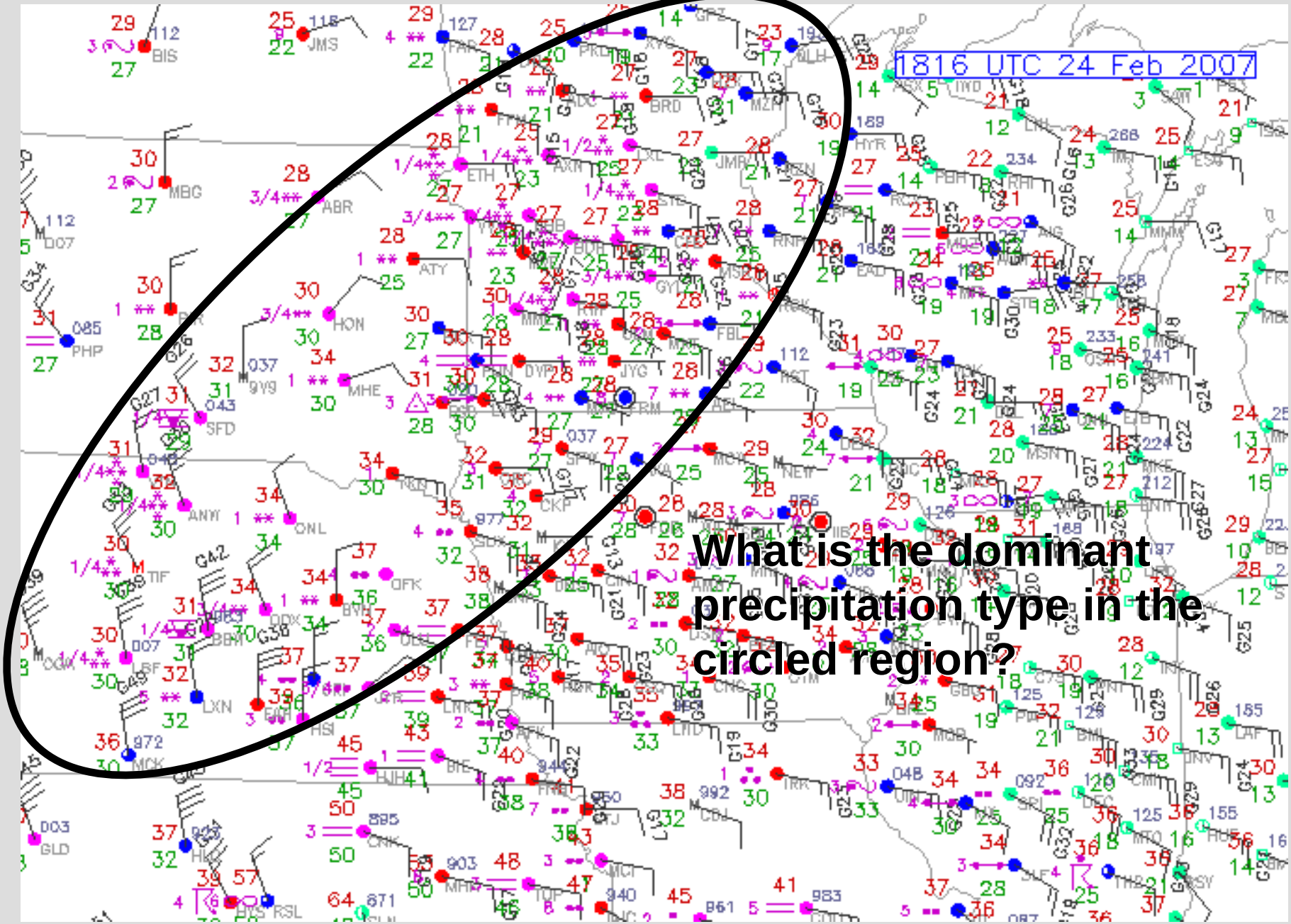


Radar color key

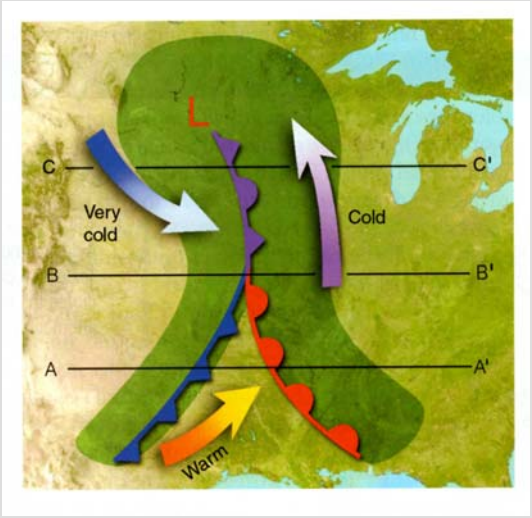
RAIN

FREEZING RAIN or SLEET

SNOW


1816 UTC 24 Feb 2007
What is the dominant precipitation type in the circled region?

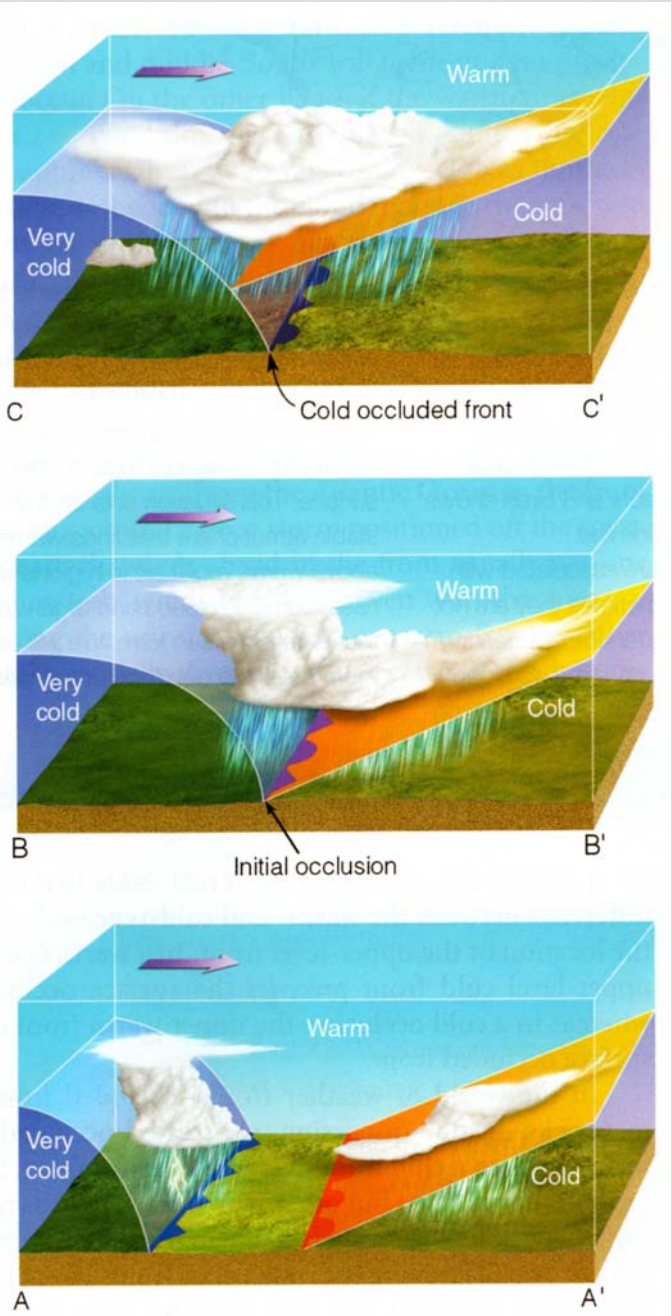
OCCLUDED FRONT

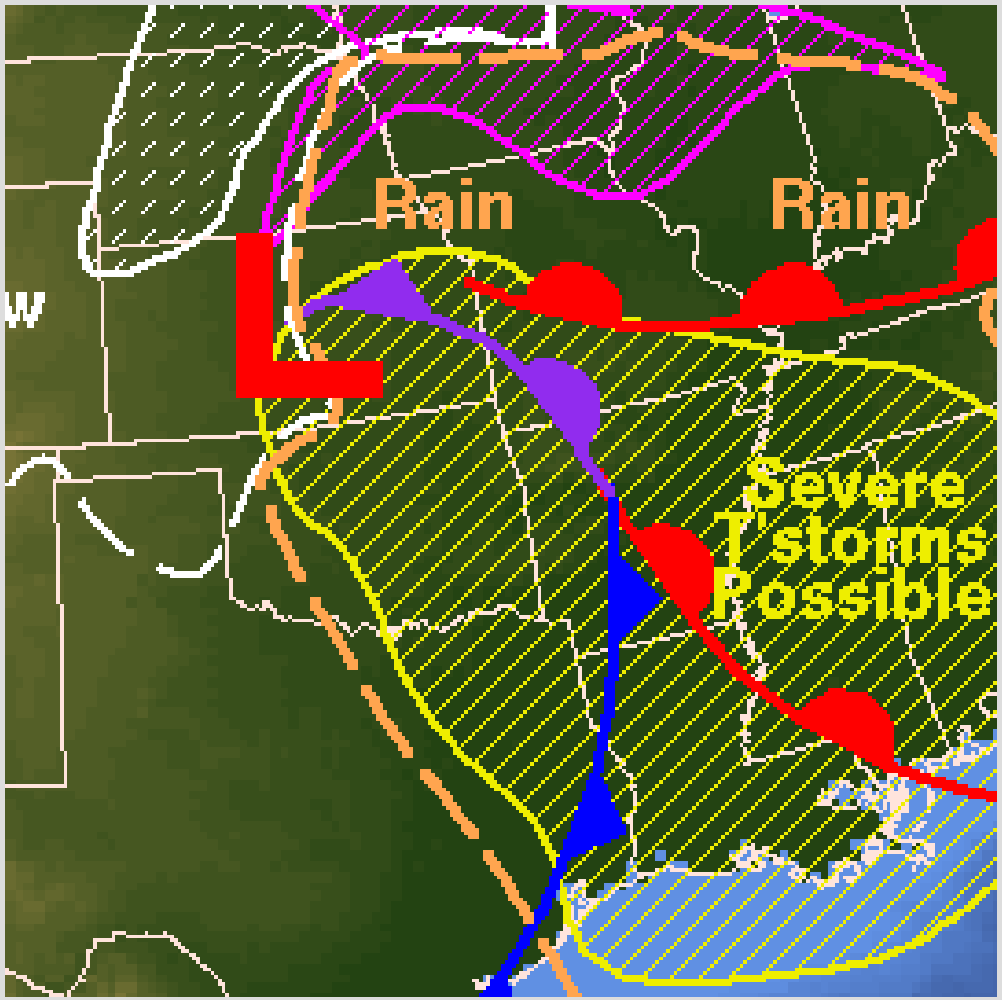


Cold front “catches up” to the warm front, forming a wedge of warm air above the ground.

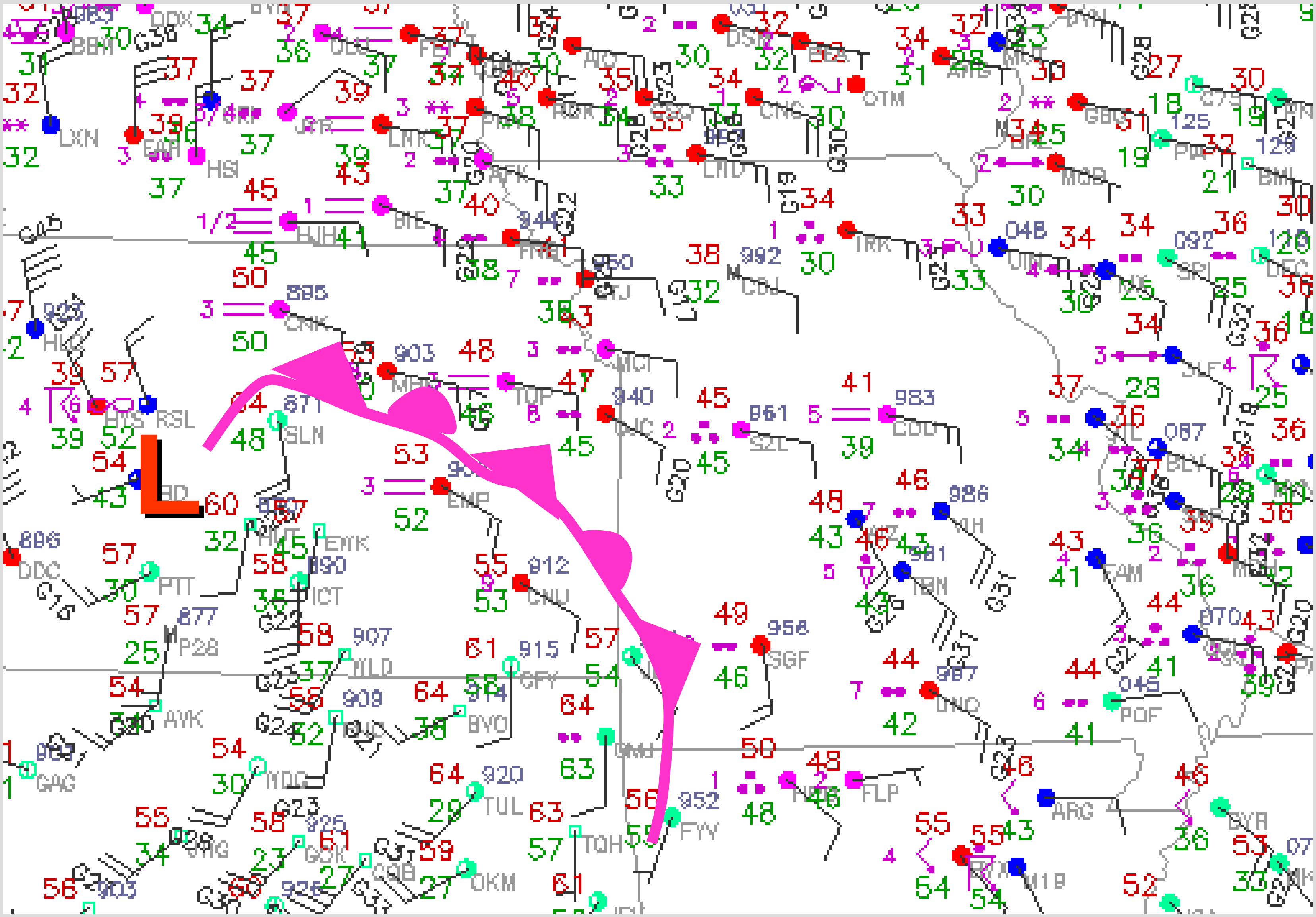
At the occlusion, precipitation may range from widespread and steady to localized and heavy.

Near the center of the low pressure.





Occluded front in our example case extends from the center of the low pressure in central Kansas through southwest Missouri.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CFV
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BVO
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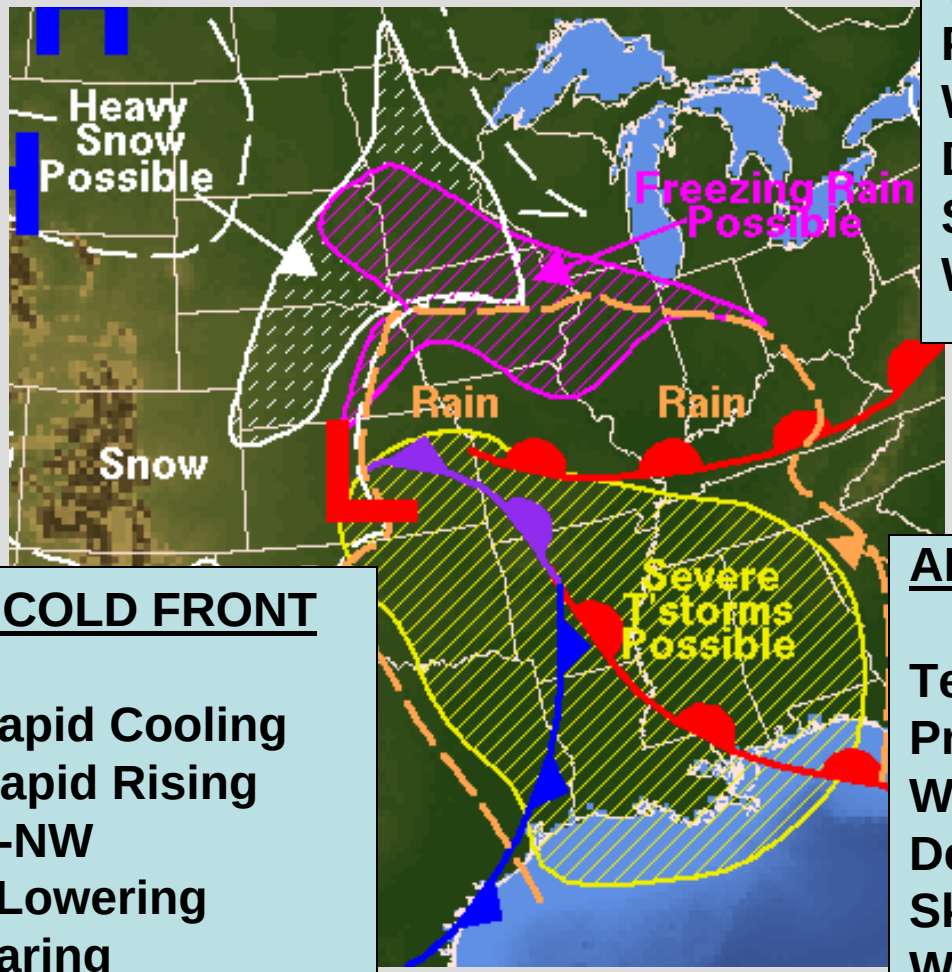
WDG
TUL
GOK
OKM
TQH
FYV
SGF
FLP
ARG
UNO
POF
CDB
TBN
VIH
FAM
BLV
SPI
DEC
CNC
OTM
MQB
TRK
UIN

Tucson cold front passage

Things to Note:

Wind shifts (trees and smoke stack)
Precipitation (squall lines)
Temperature drop and lowering of cloud bases
Clearing at the end

Summary of Lecture 22



AHEAD OF WARM FRONT

Temp: Slow Warming
Press: Falling
Wind: E-SE
Dew Pt: Rising
Sky: Lowering Ceiling
Wx: Steady Precip., Low Vis.

BEHIND COLD FRONT

Temp: Rapid Cooling
Press: Rapid Rising
Wind: W-NW
Dew Pt: Lowering
Sky: Clearing
Wx: Improving

AHEAD OF COLD FRONT

Temp: Warm
Press: Steady
Wind: S-SW
Dew Pt: High
Sky: Variable
Wx: Showers and T-storms

WARM SECTOR