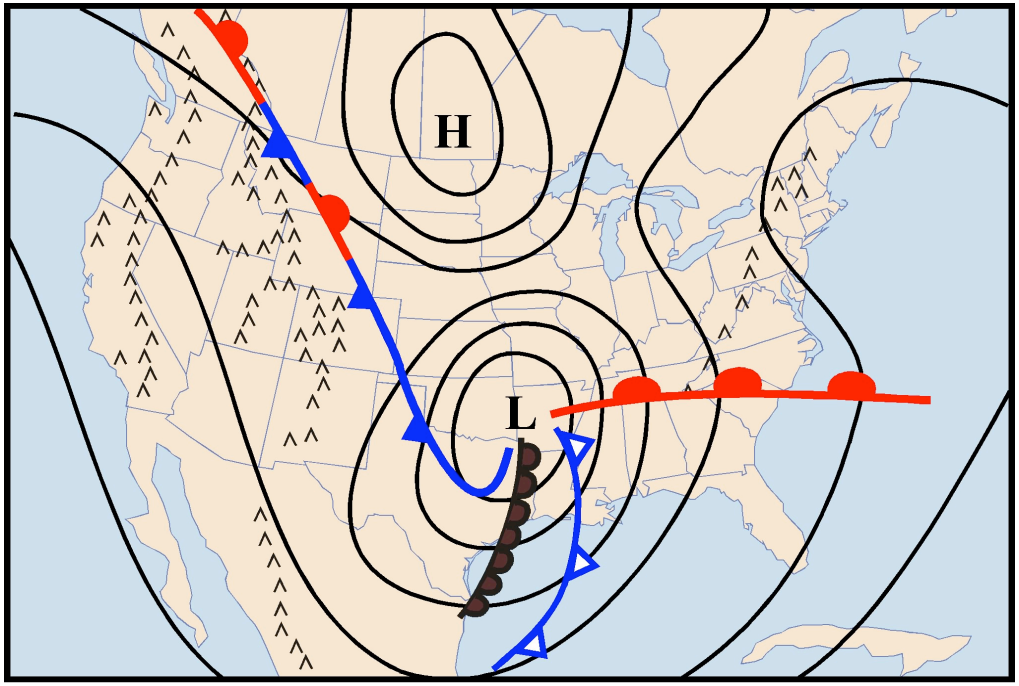
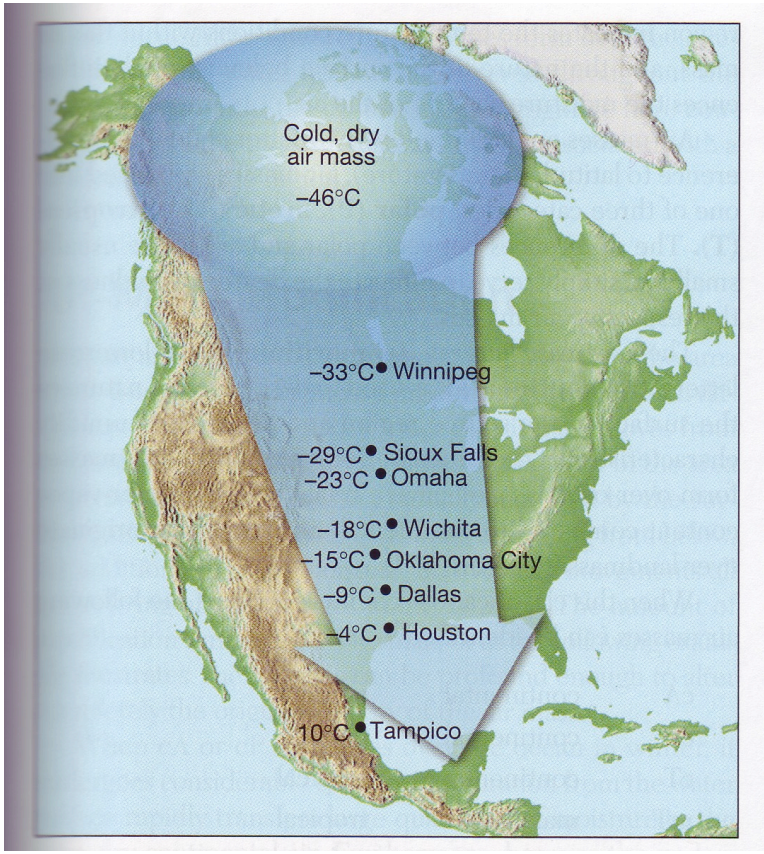
Lab Exercise # 7
Thunderstorms



What is an Air Mass

- The weather patterns are the result of the movements of large bodies of air, called air masses.
- An air mass is an immense body of air, usually
  - 1,600 km (1,000 miles) or more cross
  - Several kilometers thick
  - Characterized by homogeneous physical properties (such as temperature and moisture) at any given altitude

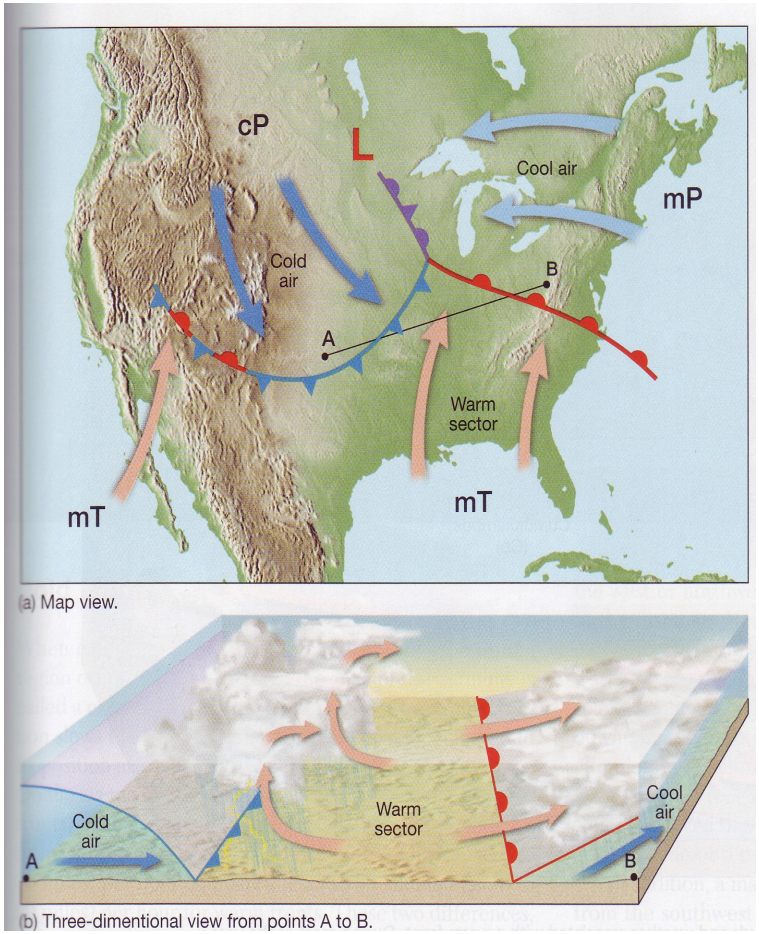


What is an Air Mass

- When the air masses move out of their origin, they carry their physical properties (temperature and moisture) elsewhere.
- The air masses are modified as they move, but they also modify the weather in the areas over which they move.
- Because it may take several days for an air mass to traverse an area, the region under its influence will probably experience generally constant weather conditions, a situation is called air-mass weather.

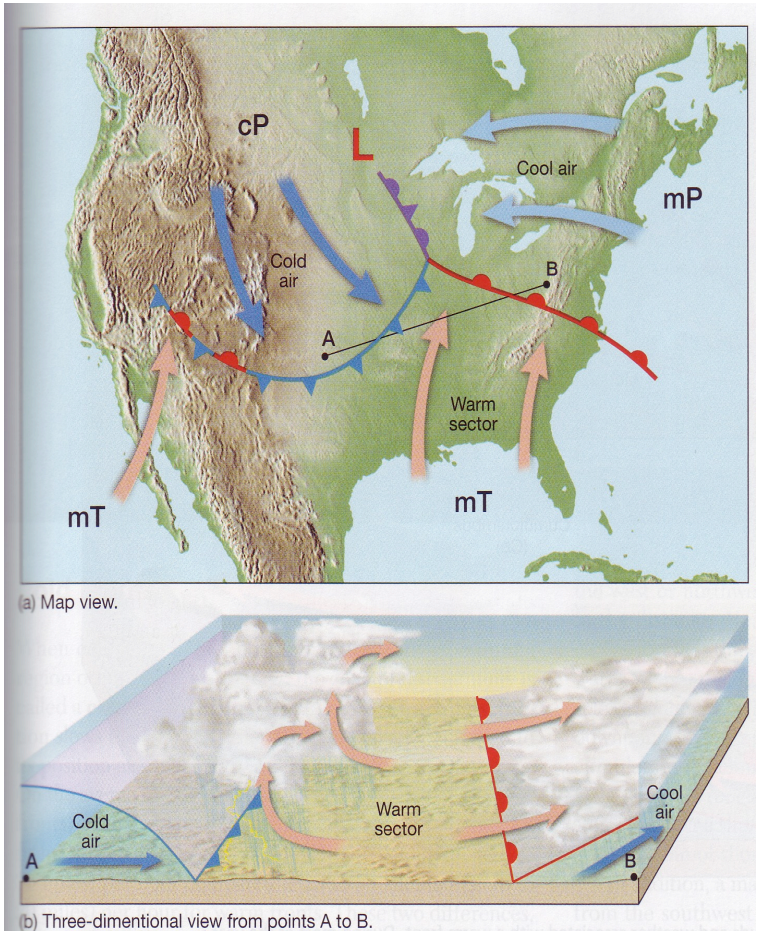
Fronts

- ✓ Fronts are boundary surfaces that separate air masses of different densities.
- ✓ One air mass is usually warmer and often contains more moisture than the other.
- ✓ Above the ground the frontal surface slopes at a low angle so that warmer air overlies cooler air.
- ✓ In the ideal case, the air masses on both sides of the front would move in the same direction and at the same speed.



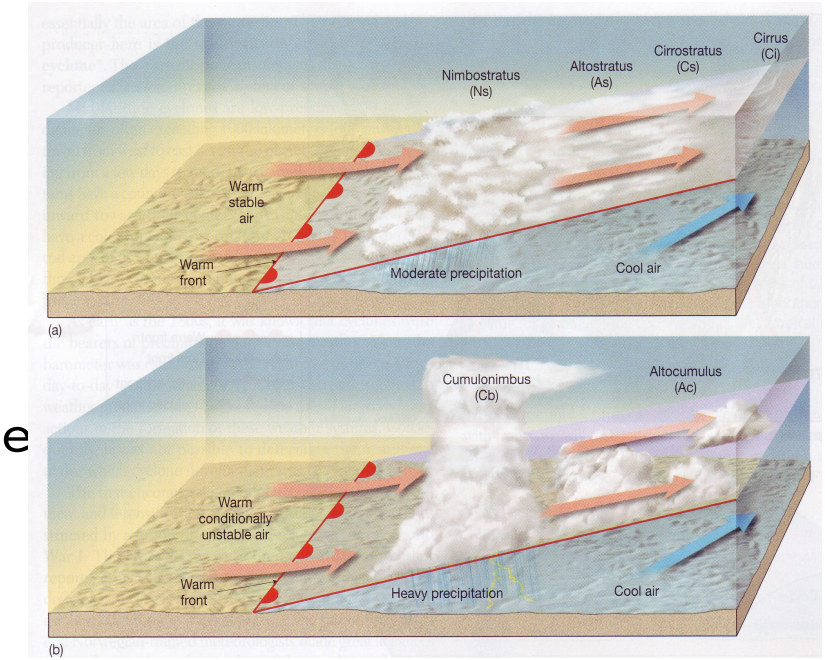
Fronts

- ✓ However, generally, one air mass moves faster.
- ✓ Thus, one air mass actively advances into another and "clashes" with it.
- ✓ It is along these zones of conflicts (fronts) that mid latitude cyclones develop and produce much of the precipitation and severe weather in the belt of the westerlies.
- ✓ It is always the warmer, less dense air forced aloft, whereas the cooler, denser air acts as a wedge on which lifting takes place.



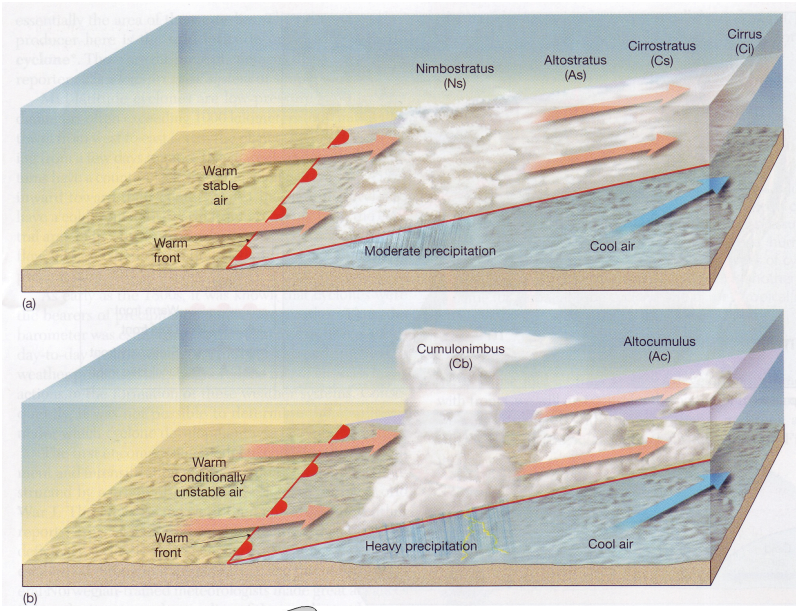
Warm Fronts

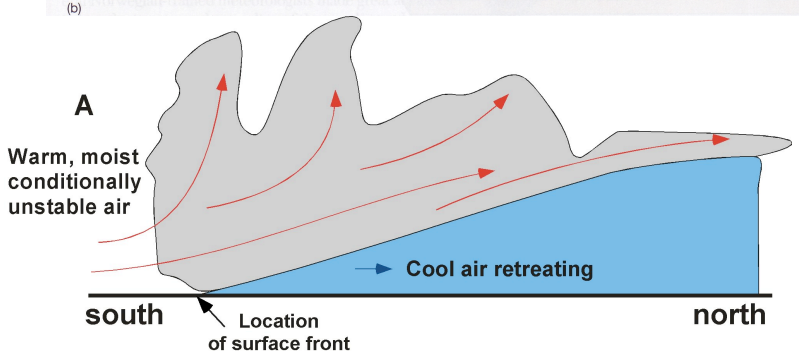
- When the surface (ground) position of a front moves so that warm air occupied formerly covered by cooler air, it is called warm front.
- This boundary separating two air masses acquires a very gradual slope.
- As warm air ascends the retreating wedge of cold air, it expands and cools adibatically, causing moisture in the ascending air to condense into clouds that often produce precipitation.
- The first sign of the approaching warm front is cirrus clouds.

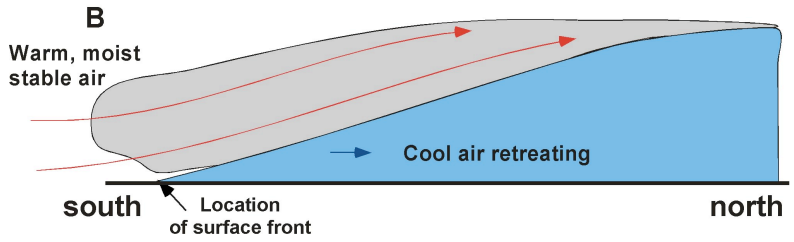


Warm Fronts

- Warm fronts tend to produce light-to-moderate precipitation over a wide area for an extended period.
- When a warm front passes, temperatures gradually rise.
- The moisture content and stability of the warm air mass largely determine the time period required for clear skies to return.

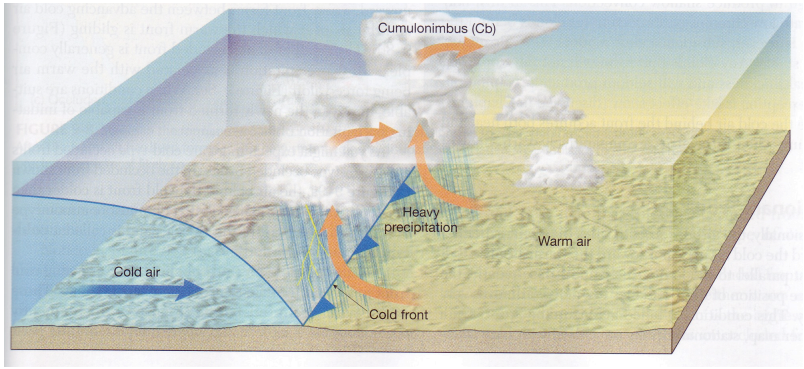


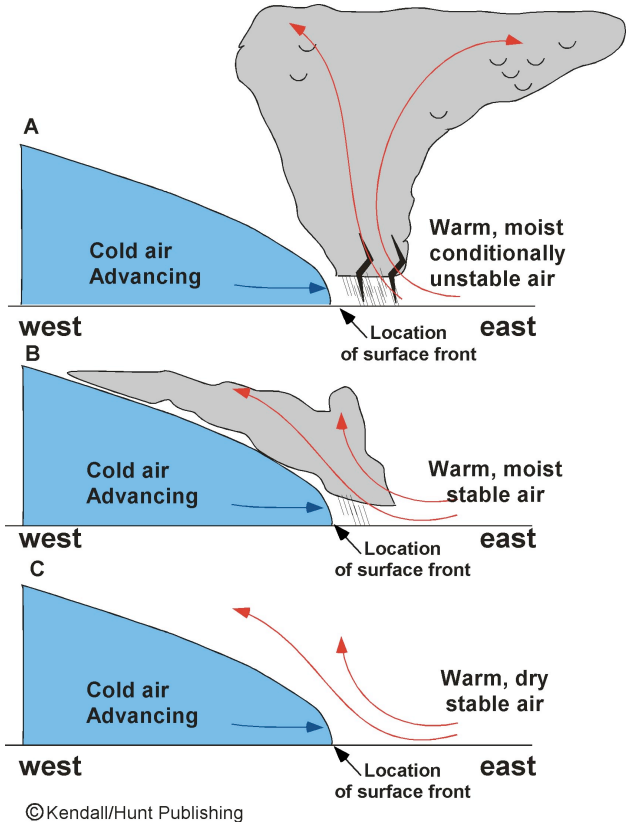


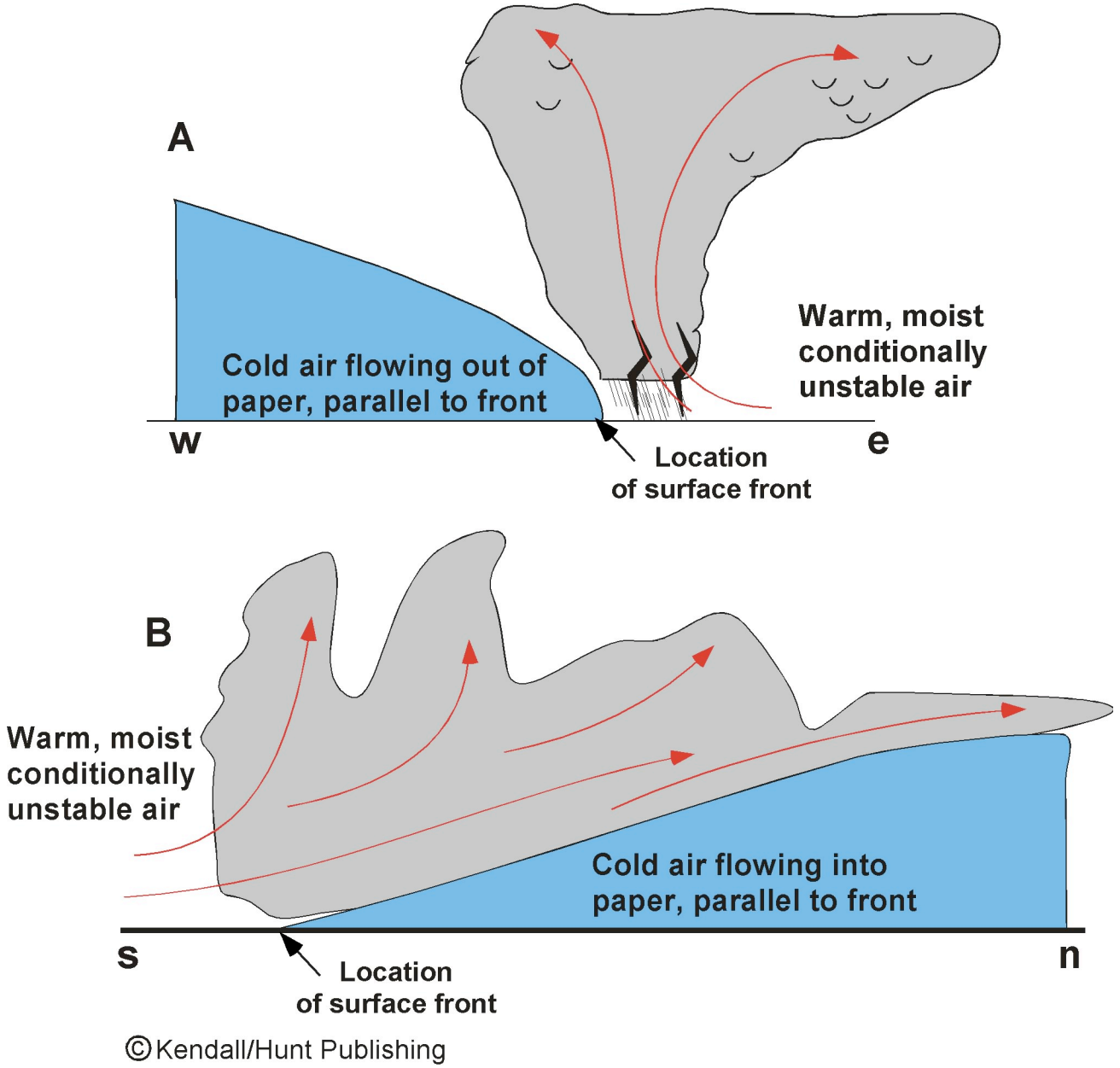


Cold Fronts

- When cold, continental polar air actively advances into a region occupied by warmer air, the zone of discontinuity is called a cold front.
- Friction slows the surface position of a cold front compared to its position aloft.
- Thus, the cold front deepens as it moves.
- On the average, cold fronts are about twice as steep as warm fronts.
- In addition, cold fronts advance at speeds around 35 to 50 kilometers per hour compared to 25 to 35 kilometers per hour for warm fronts.
- These differences account for the more violent nature of cold front weather.

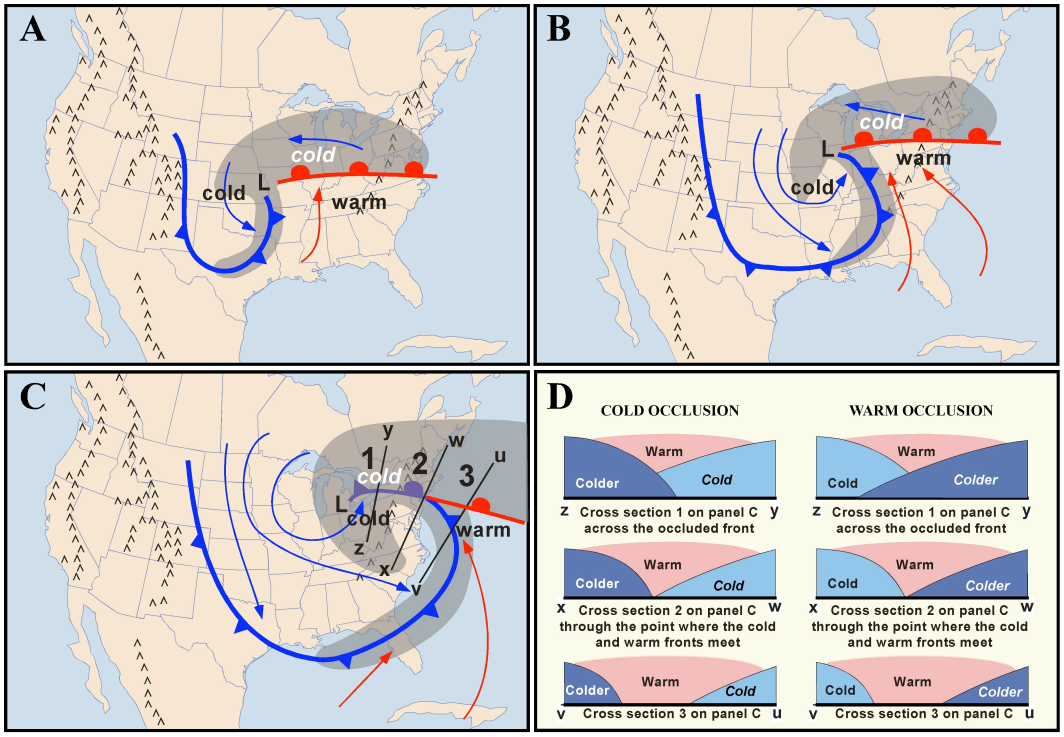






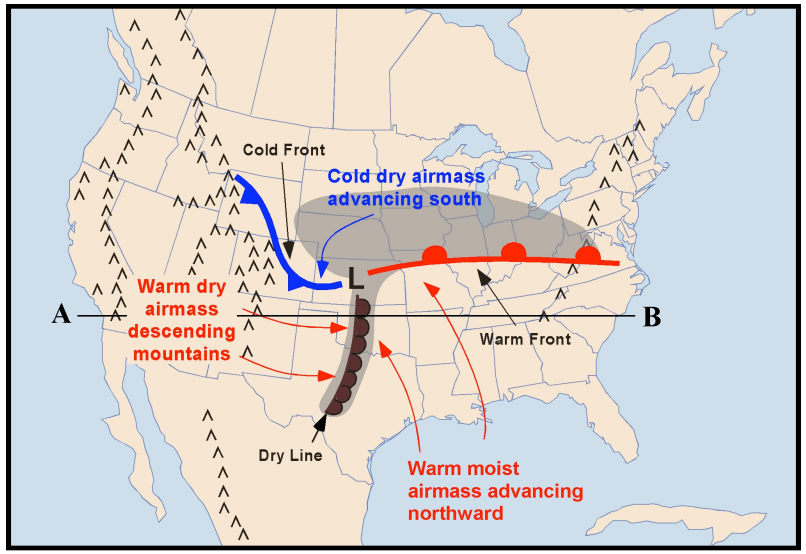
Occluded Fronts

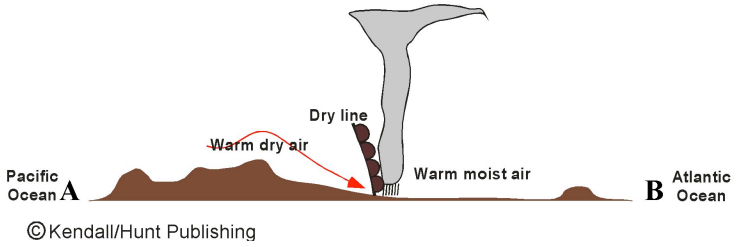
- ✓ A rapidly moving cold front overtakes a warm front.
- ✓ As the cold air wedges the warm front upward, a new front forms between the advancing cold air and the air over which the warm front is gliding.
- ✓ Then, the most precipitation associated with the warm air is forced aloft.



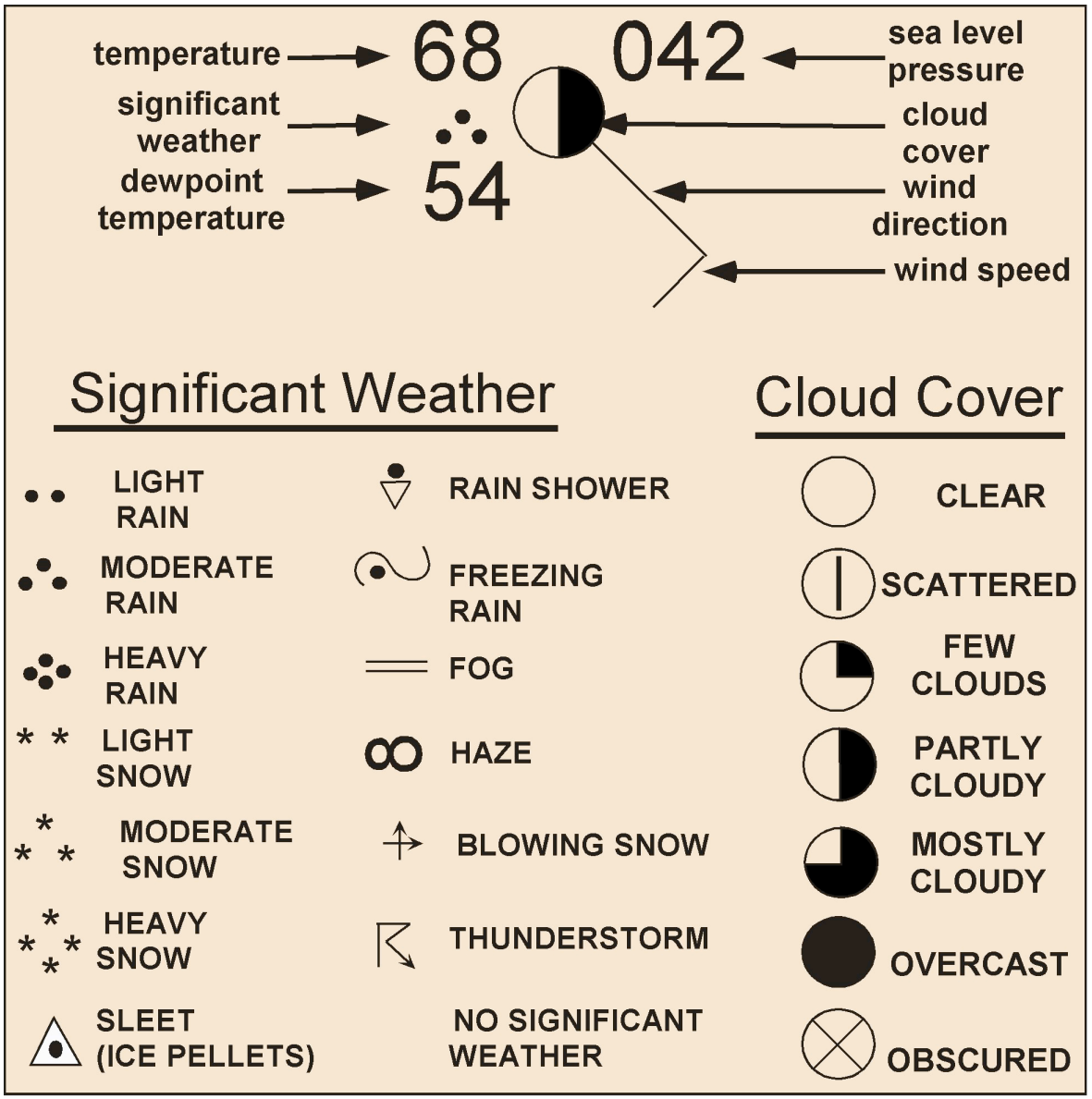
Drylines

- ✓ Humidity is also important in frontal boundary, as humidity influences the density of air, with humid air is less dense than dry air.
- ✓ In the summer, air masses originated over the northern Great Plains displace warm, humid air over the lower Mississippi Valley.
- ✓ Along the frontal boundary, the drier air is denser and forcefully lifts the moist air in its path, just like a cold front.
- ✓ This is called a dryline.
- ✓ Dryline often produces tornadoes and severe weather.





Surface Weather Maps



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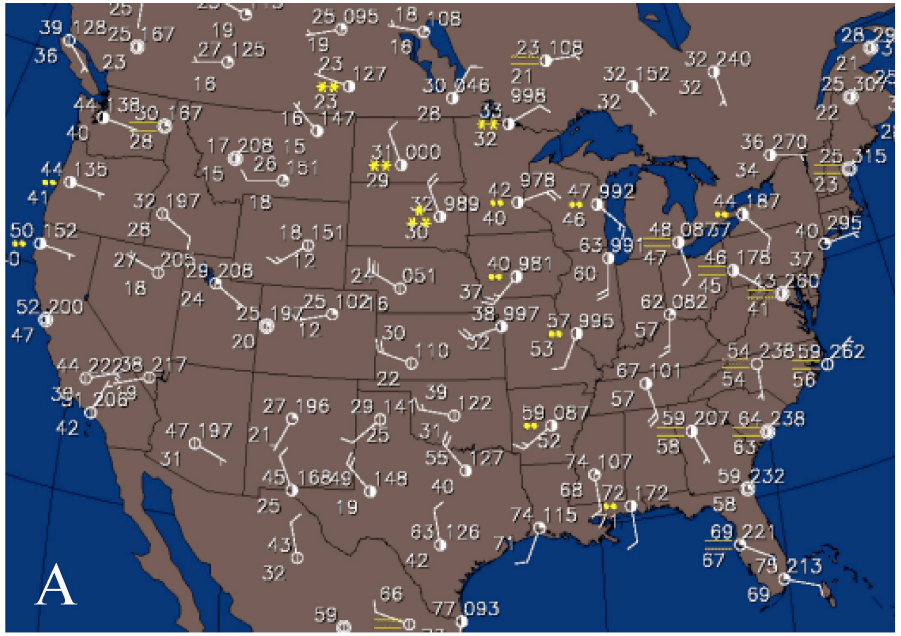

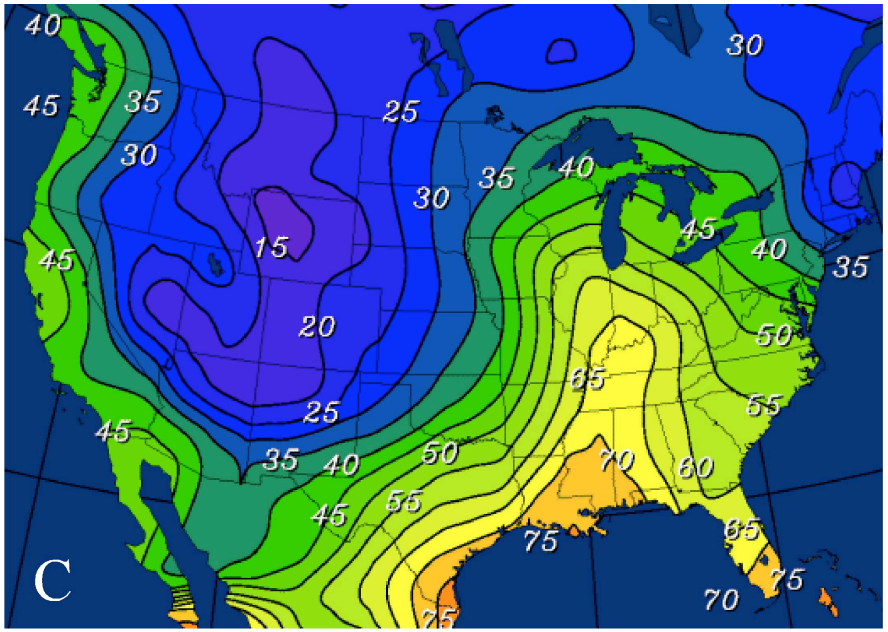

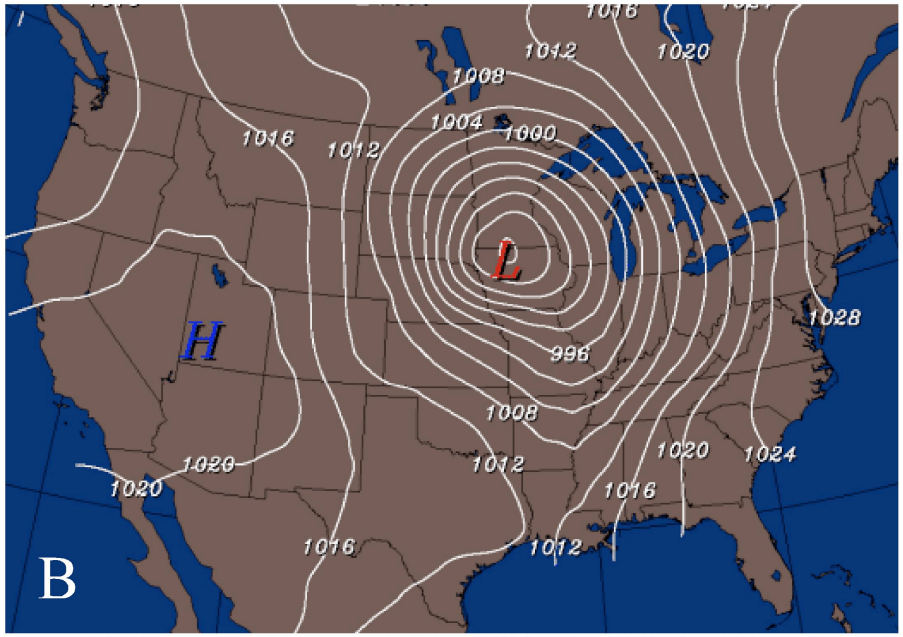

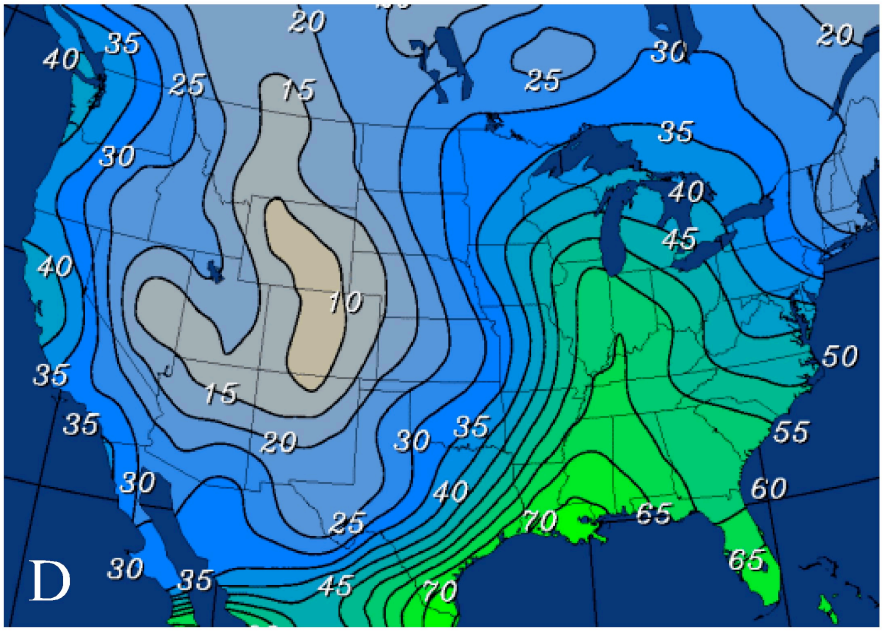

Courtesy of the Department of Atmospheric Science, University of Illinois at Urbana-Champaign

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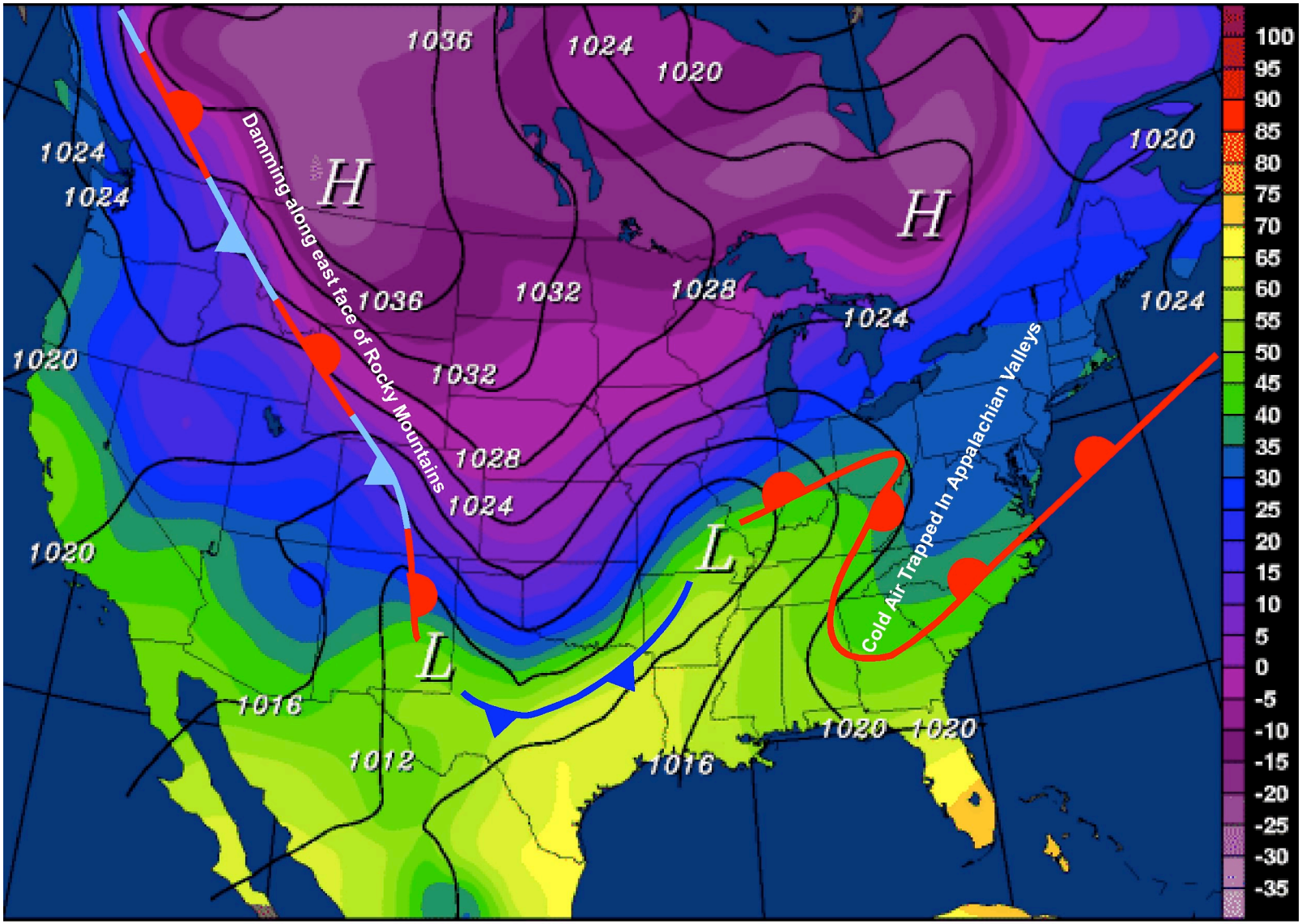

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