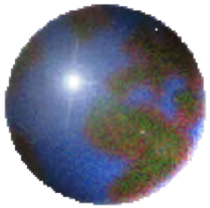


Air Masses and Fronts

GEOG/ENST 2331 – Lecture 14

Ahrens: Chapter 11

Air Masses and Fronts

- **Air masses**
  - **Source regions**
  - **Classification**
  - **Modification**
- A large body of air whose properties of **temperature** and **moisture** are fairly uniform in any horizontal direction at any given altitude.
- Typically air masses cover many thousands of square kilometres
- Fronts

Air masses

- The temperature and moisture of air depend on continuous exchanges with the surface
- Temperature: energy inputs vs. energy losses
- Moisture: evaporation vs. precipitation

Source region

- Must be large, homogenous surface area
- Air needs to remain in place for a substantial time
- Typical source regions for North America include adjacent oceans, Gulf of Mexico, the Arctic and sub Arctic and the American/Mexican deserts
- Ontario is not a good source region; nor are most mid-latitudes – conditions change too frequently

Air mass classification

c - land (continental)

m - water (maritime)

A – high Arctic latitudes

P – polar latitudes

T – tropical latitudes

Air mass classification

Source Region	Arctic (A)	Polar (P)	Tropical (T)
Land (continental)	cA Dry, very cold Stable Ice and snow	cP Dry, cold Stable	cT Dry, hot Stable aloft Unstable surface
Water (maritime)	mA Moist, cold Unstable	mP Moist, cool Unstable	mT Moist, warm Usually unstable

Air masses are not confined to their source regions and migrate to regions with less extreme weather conditions.

1. The region to which the air mass migrates undergoes major changes in temperature and humidity

2. The air mass itself becomes more moderate

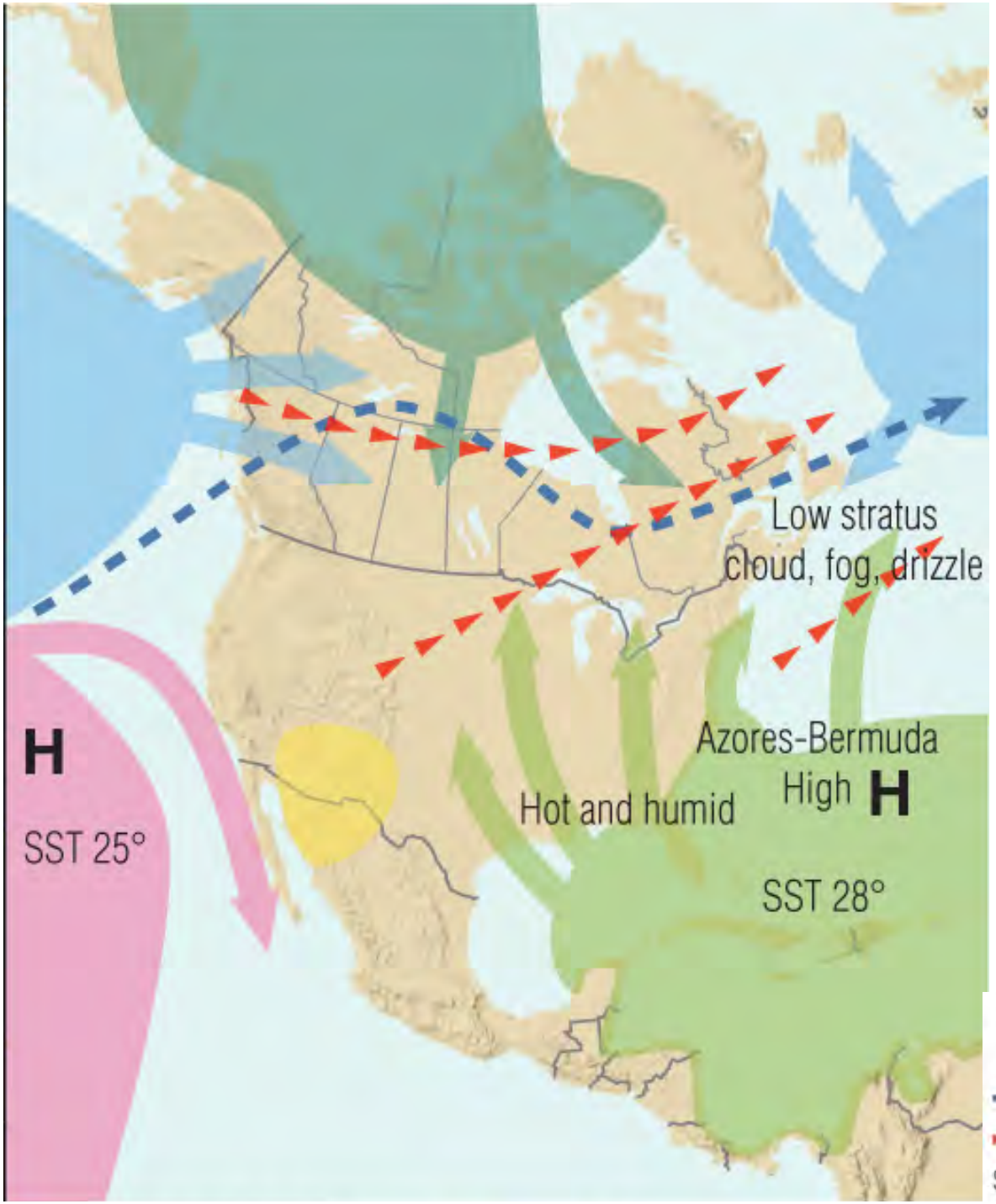
Winter

Ahrens: Figure 11.2a

Winter Air Masses and Circulation

- Polar jet stream
- Primary storm tracks
- SST Sea surface temperature
- Continental Arctic
- Maritime Arctic
- Maritime Polar
- Pacific Maritime Tropical
- Atlantic Maritime Tropical

Summer

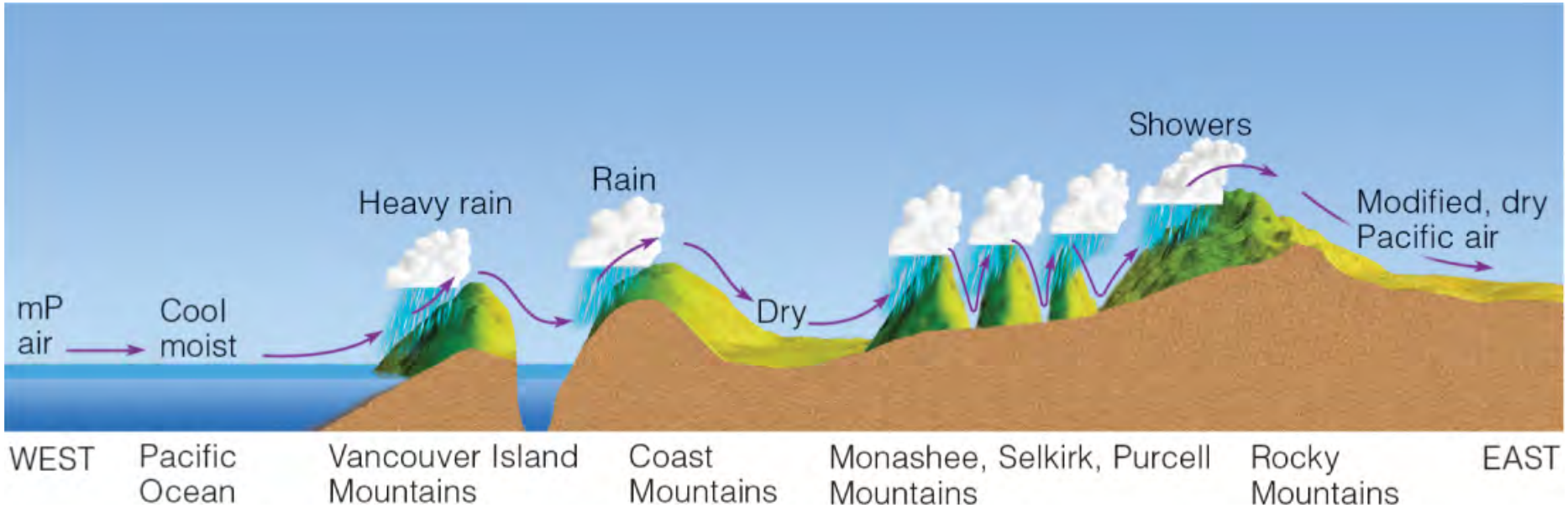


Ahrens: Figure 11.2b

Summer Air Masses and Circulation

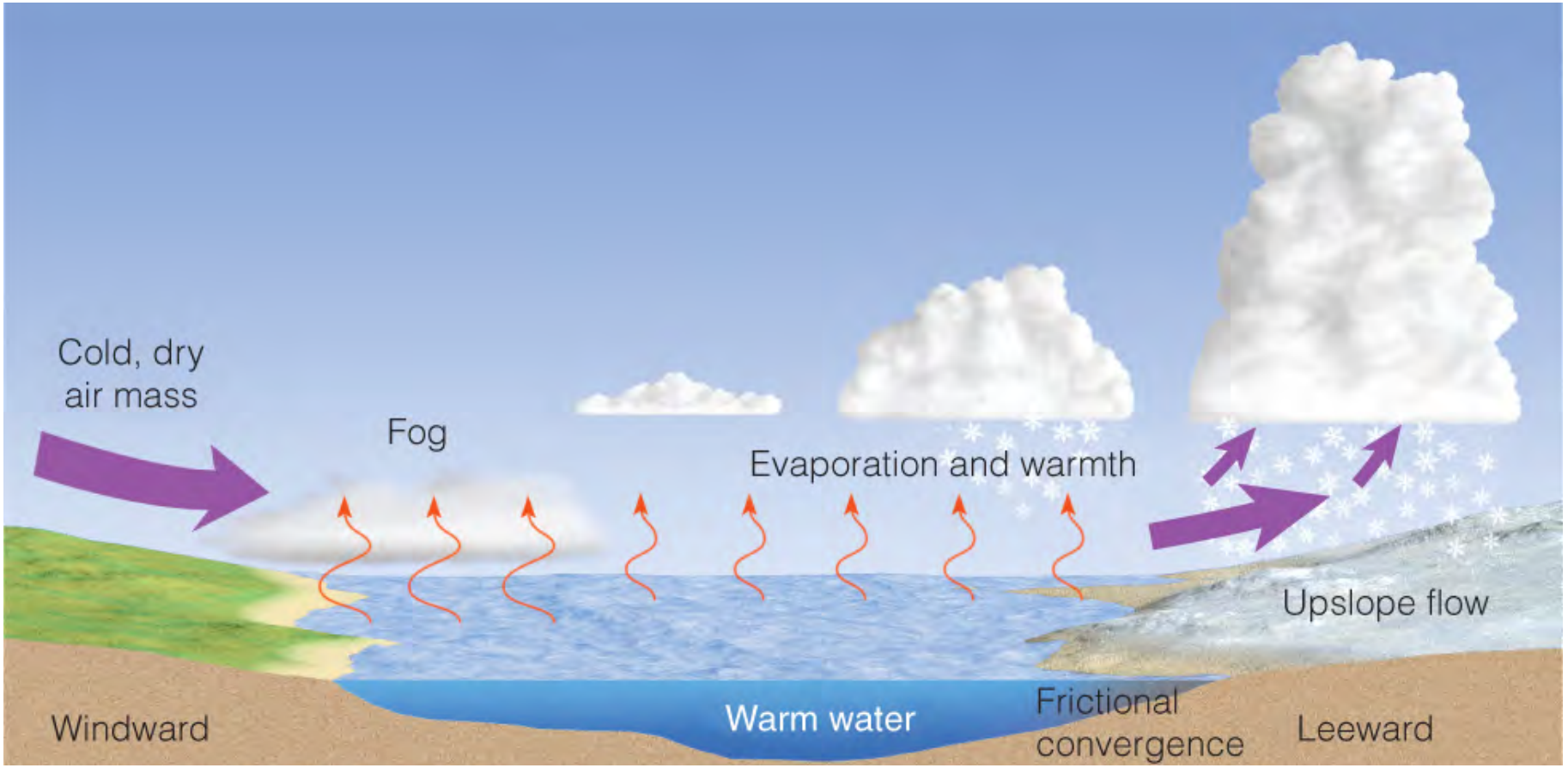
- Polar jet stream
- Primary storm tracks
- SST Sea surface temperature
- Continental Tropical
- Maritime Arctic
- Maritime Polar
- Pacific Maritime Tropical
- Atlantic Maritime Tropical

Modified Air Masses



Ahrens: Figure 11.7

Lake effect precipitation



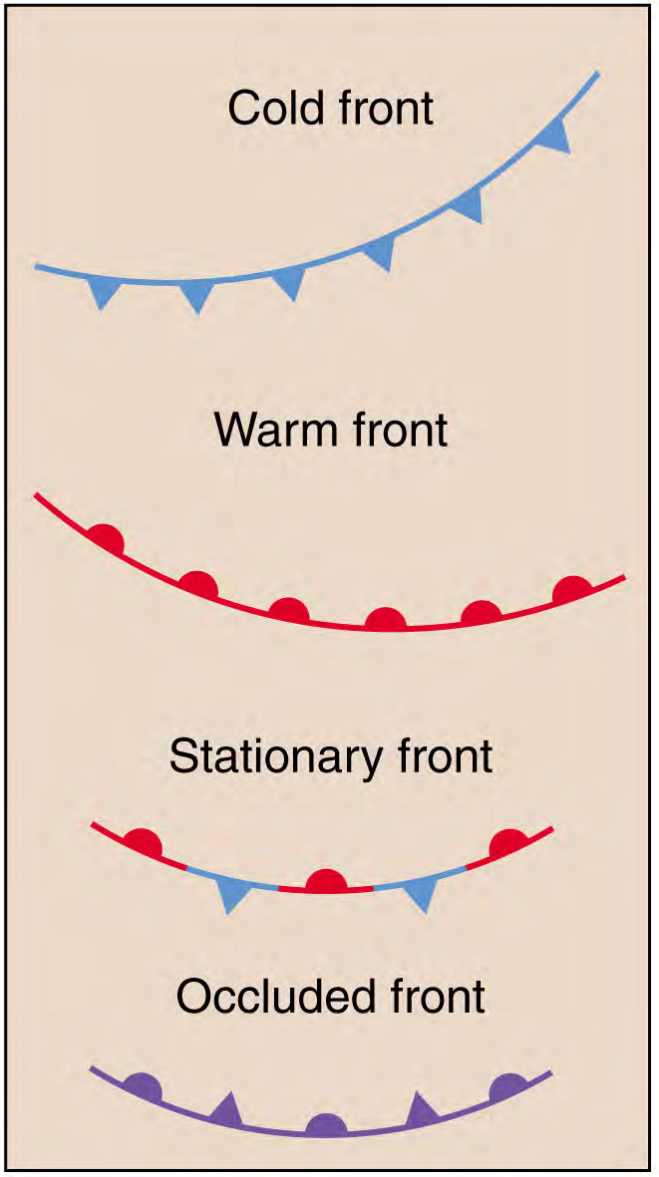
Ahrens: Fig. 1, p. 314

Lake effect snow in the Great Lakes

Ahrens: Fig. 2, p. 315

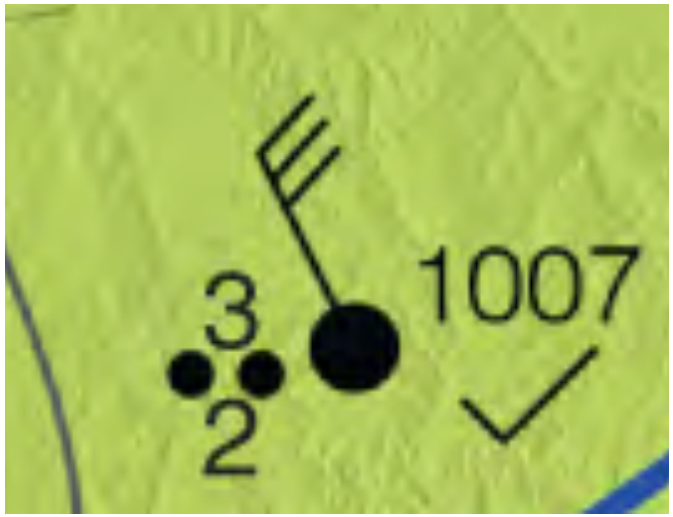
Fronts

- **Fronts**
  - **Warm and cold**
  - **Stationary**
  - **Occluded**
  - **Drylines**



Station model for meteorology

- Temperature
- Dew point
- Sea Level Pressure
- Pressure trend
- Wind direction



See Appendix B!

SELECTED WEATHER MAP SYMBOLS

Fronts

Warm Front

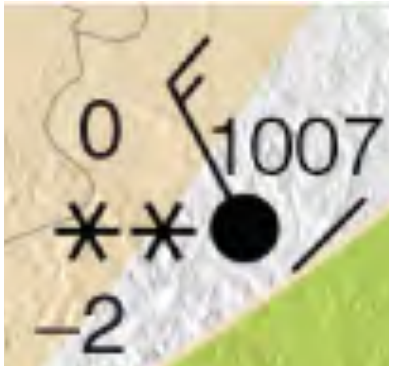
Cold Front

Stationary Front

Occlusion

Cloud Cover

Full,
Half,
Quarter, etc
(shaded accordingly)



Winds

Almost Calm
(< 1 m/s)

1 to 4 m/s

5 to 6 m/s

7 to 8 m/s

9 to 11 m/s

12 to 14 m/s

15 to 16 m/s

17 to 18 m/s

19 to 20 m/s

Precipitation

Drizzle , or ,,

Light Rain •

Moderate Rain Shower

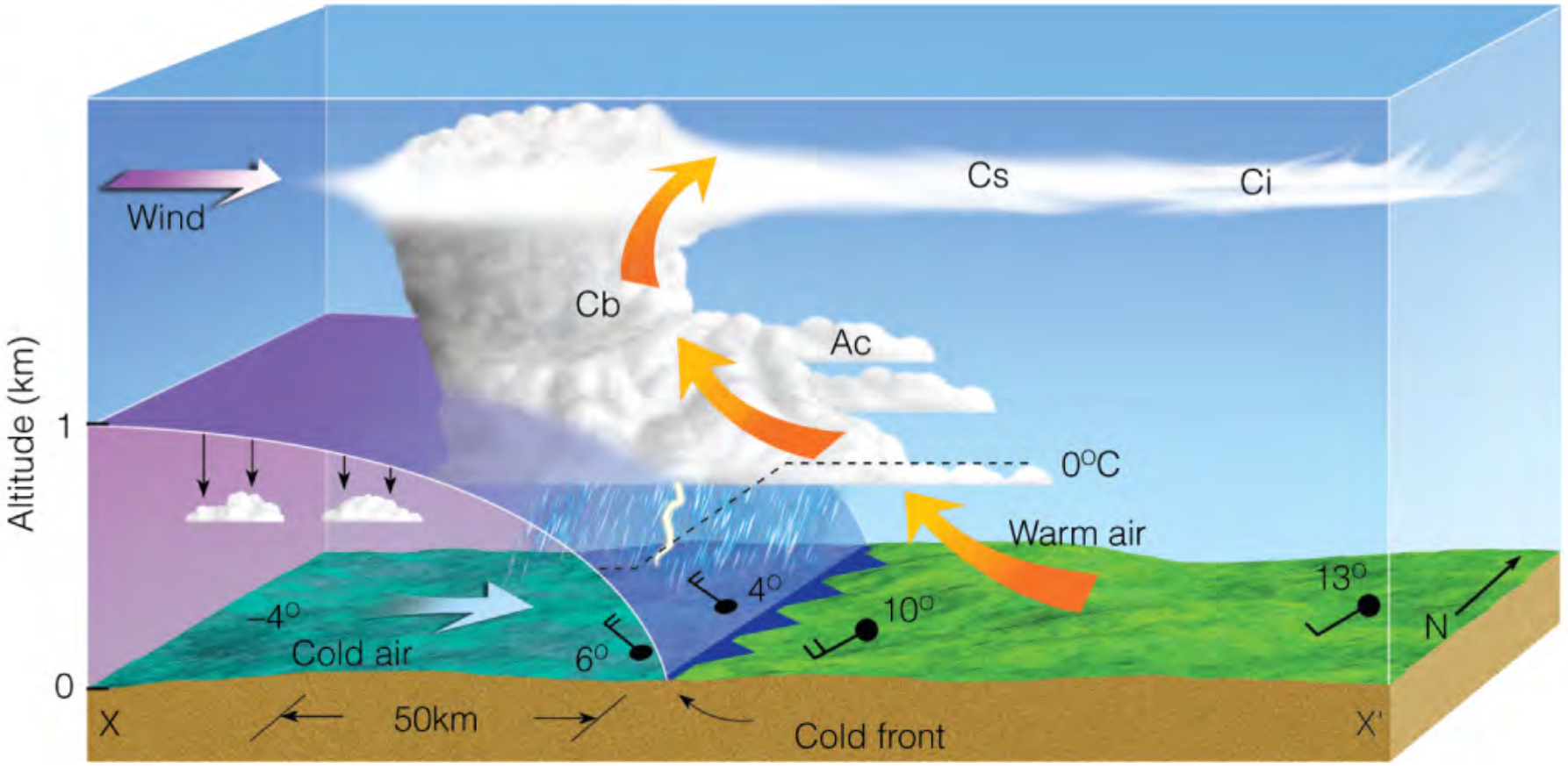
Heavy Rain

Area of continuous Precipitation

Moderate Snow * * or * * *

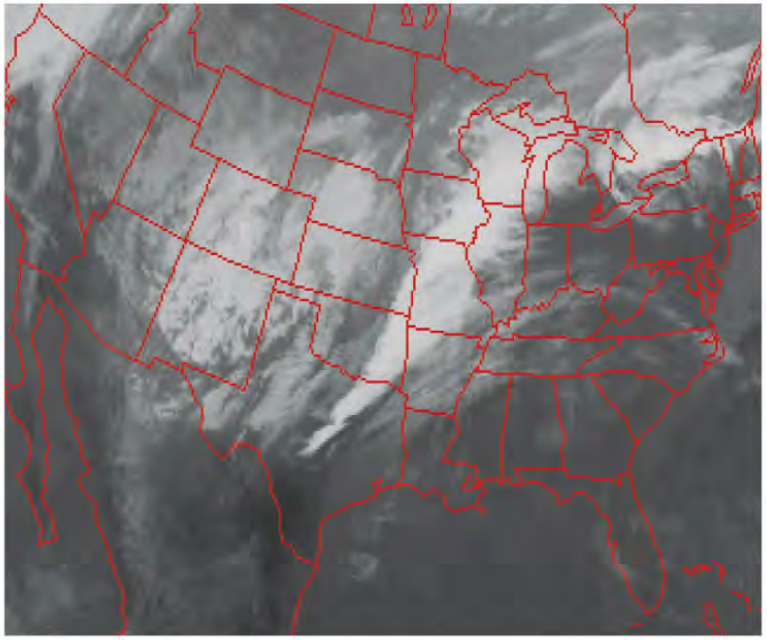
Snow Shower *

Cold Fronts

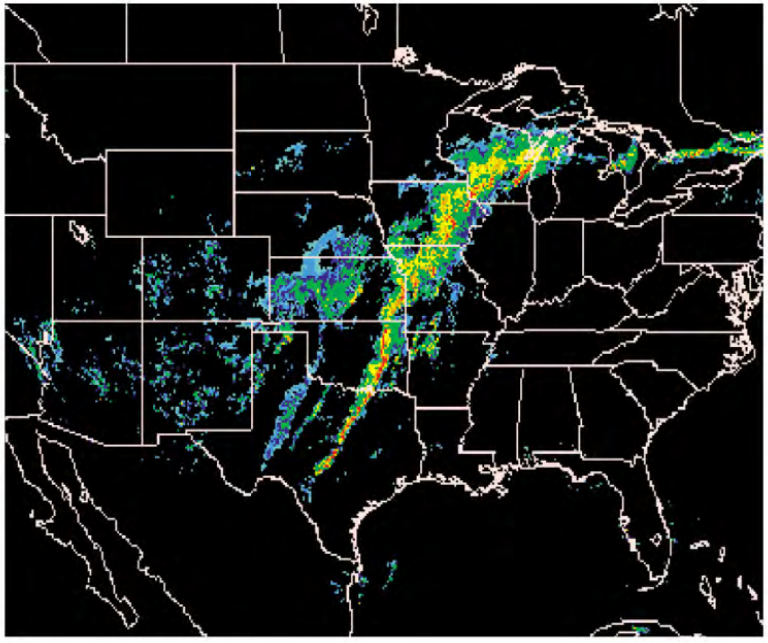


Ahrens: Active Fig. 11.14
The vertical displacement of air along
a cold front boundary; steep profile (1:50 to 1:100)

Cold Front



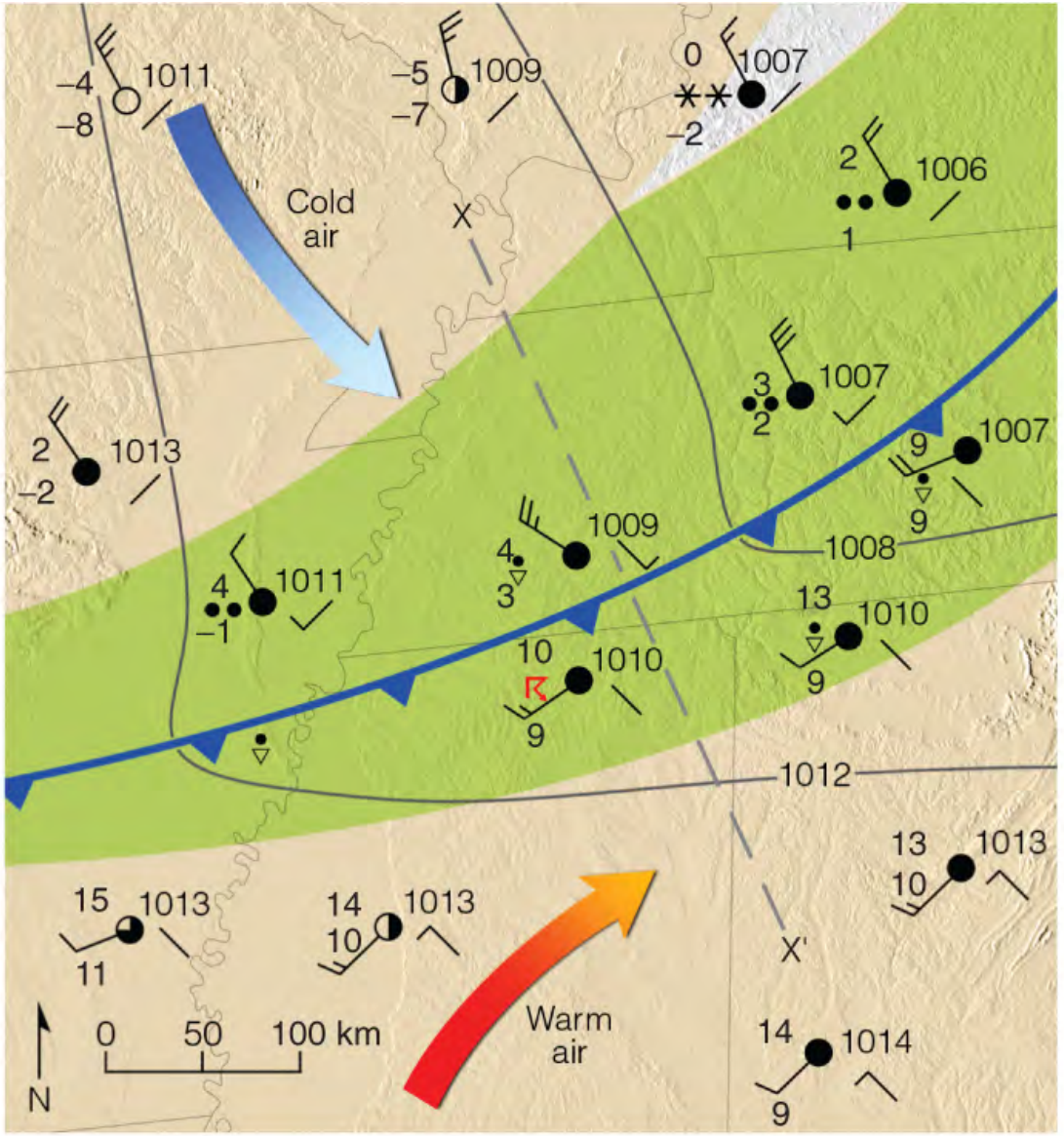
(a)



(b)

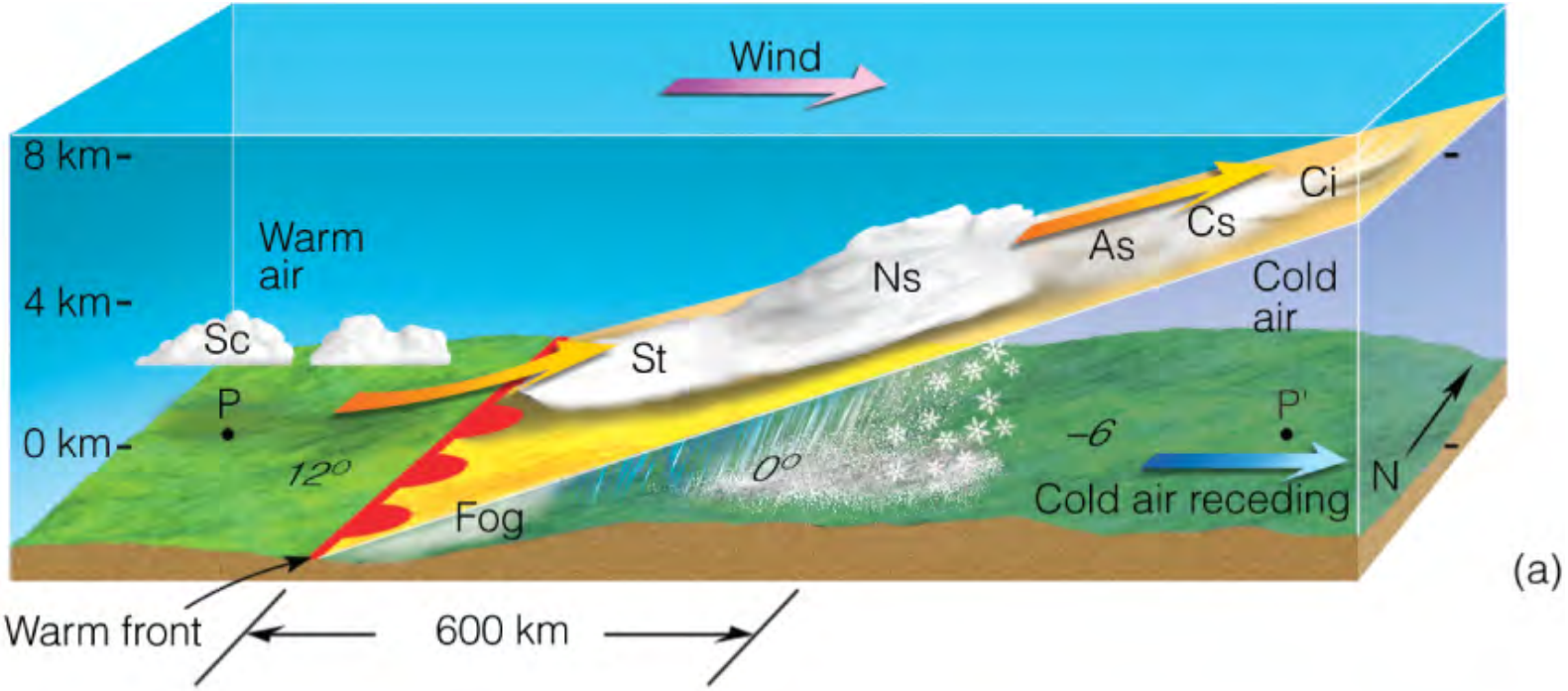
Identifying cold fronts

- Strong temperature gradient
- Humidity change
- Shift in wind direction
- Pressure change
- Clouds and precipitation patterns



Ahrens: Fig. 11.12

WARM FRONTS

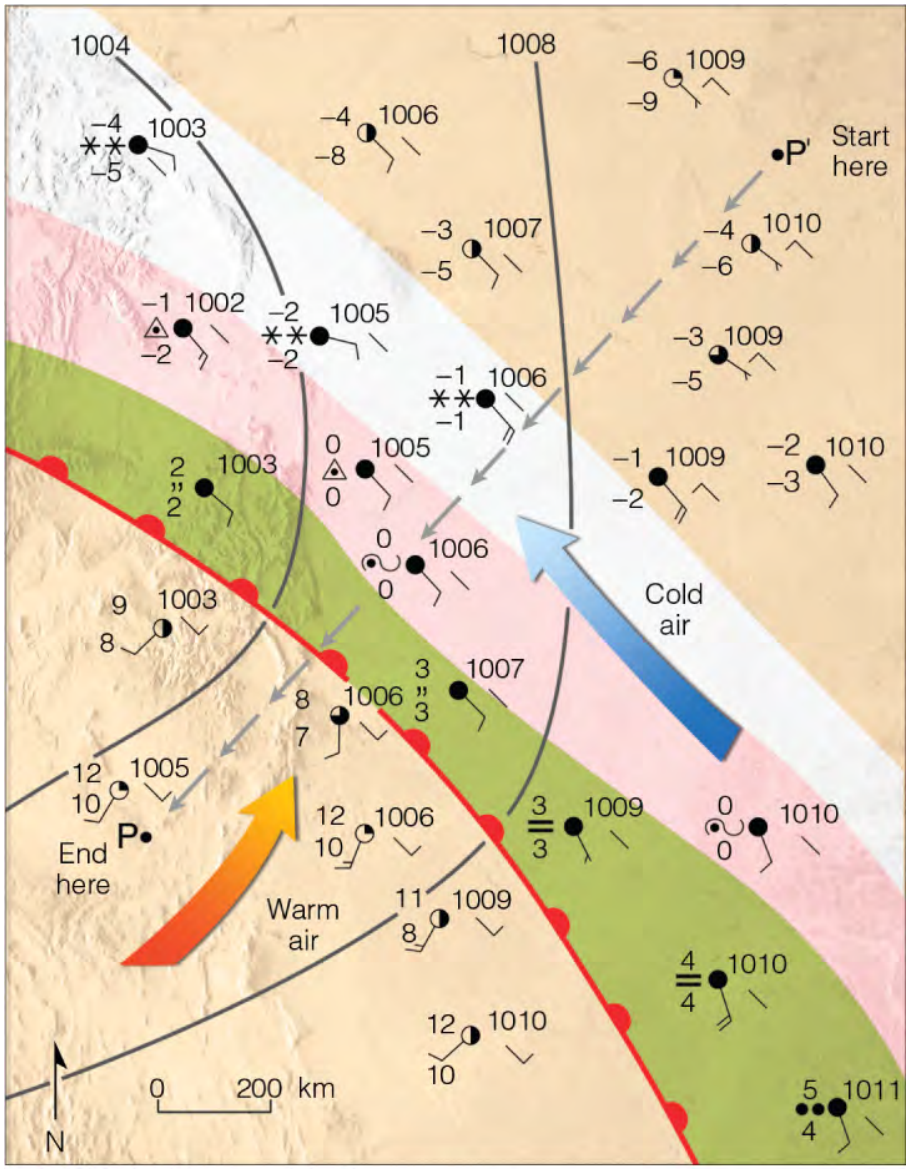


Overrunning leads to extensive cloud cover along the gently sloping surface of cold air.

Ahrens: Fig. 11.18

Warm front identification

- Here, mT overrides mP
- Profile 1:150 - 1:300
- Gentle precipitation (drizzle)

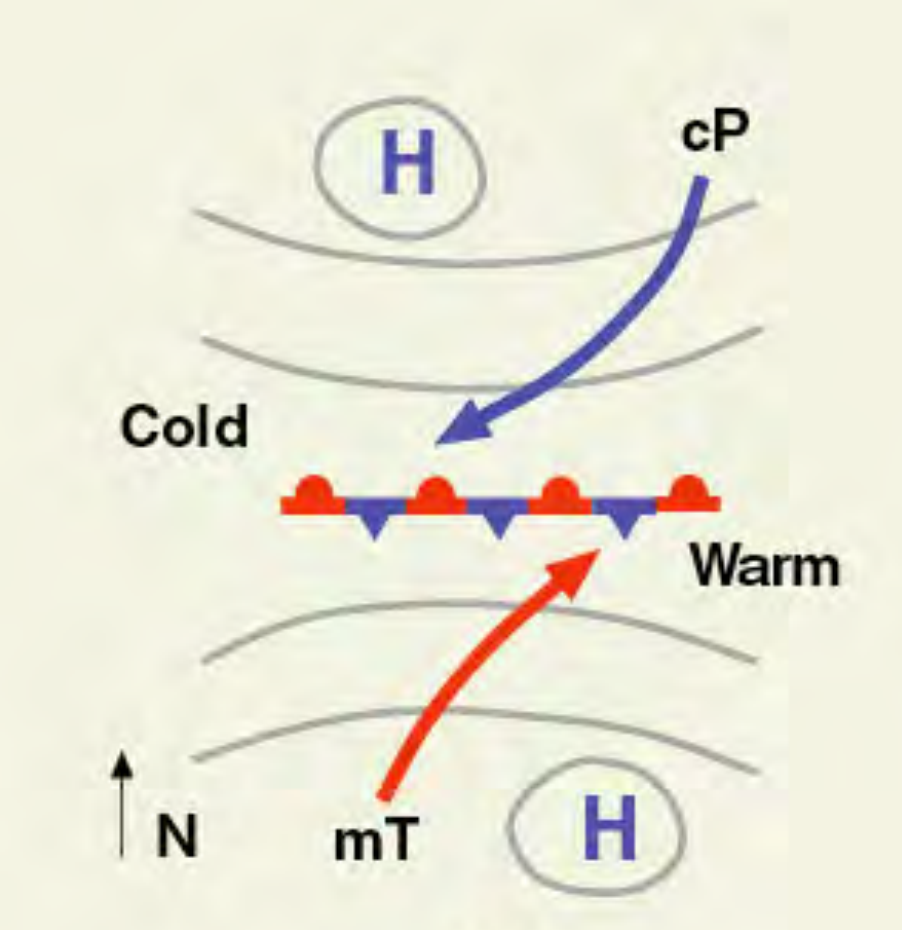


Ahrens: Active Fig. 11.17

Stationary fronts

- Boundary between fronts stalls
- Stable but with strong horizontal wind shear

- Quite common along the Polar Front
  - Boundary between Polar and Ferrel cells

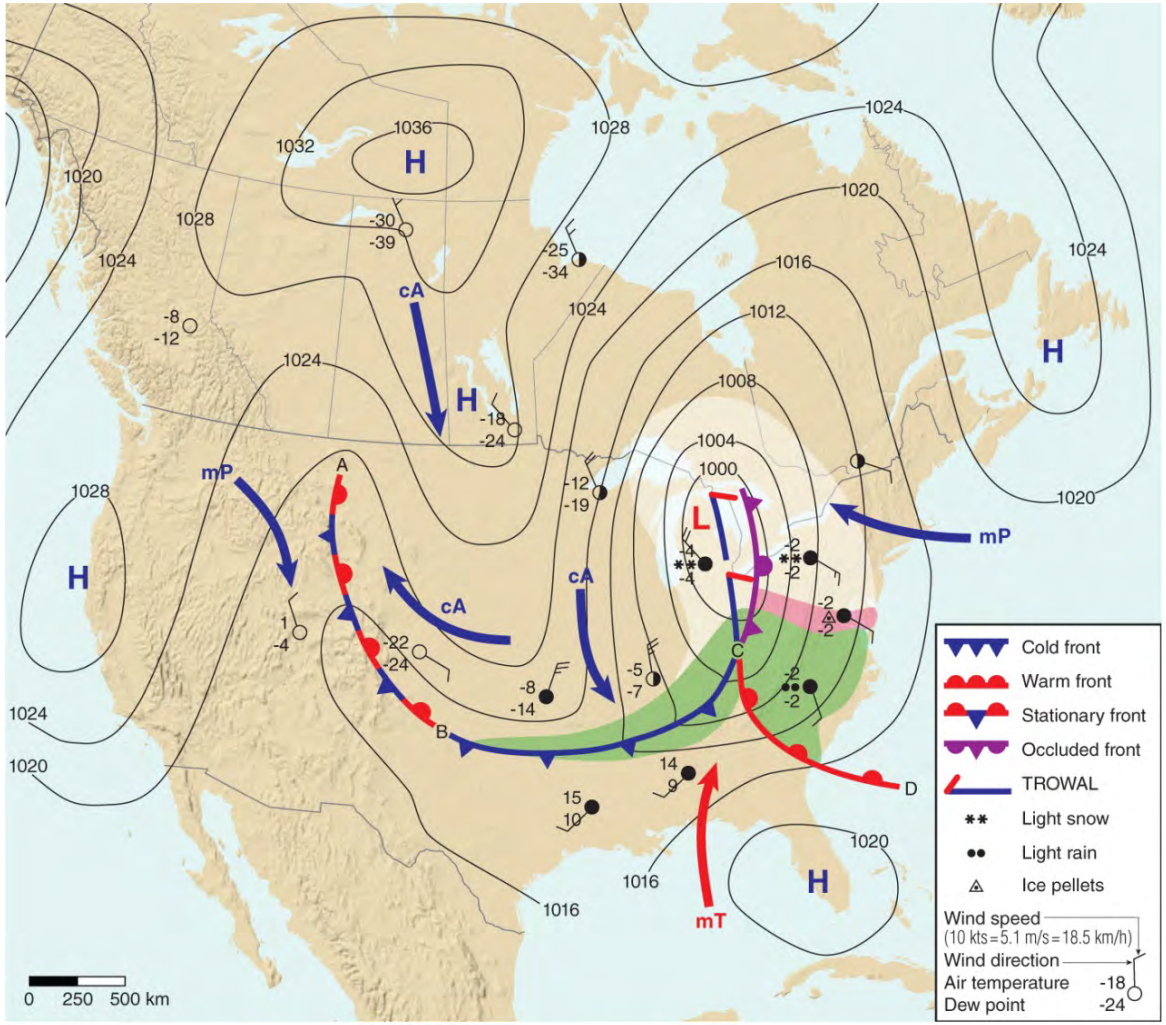


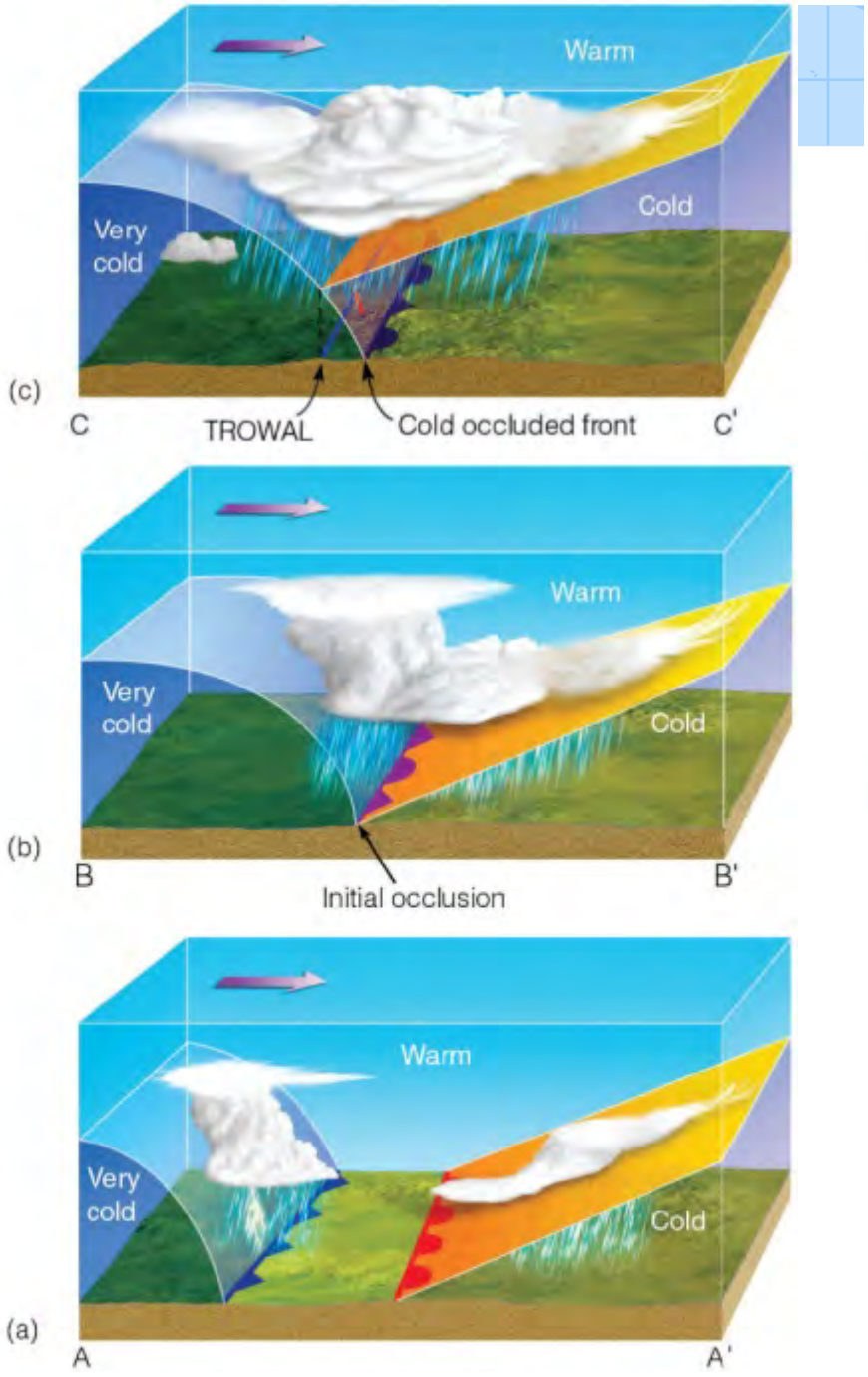
Midlatitude cyclone

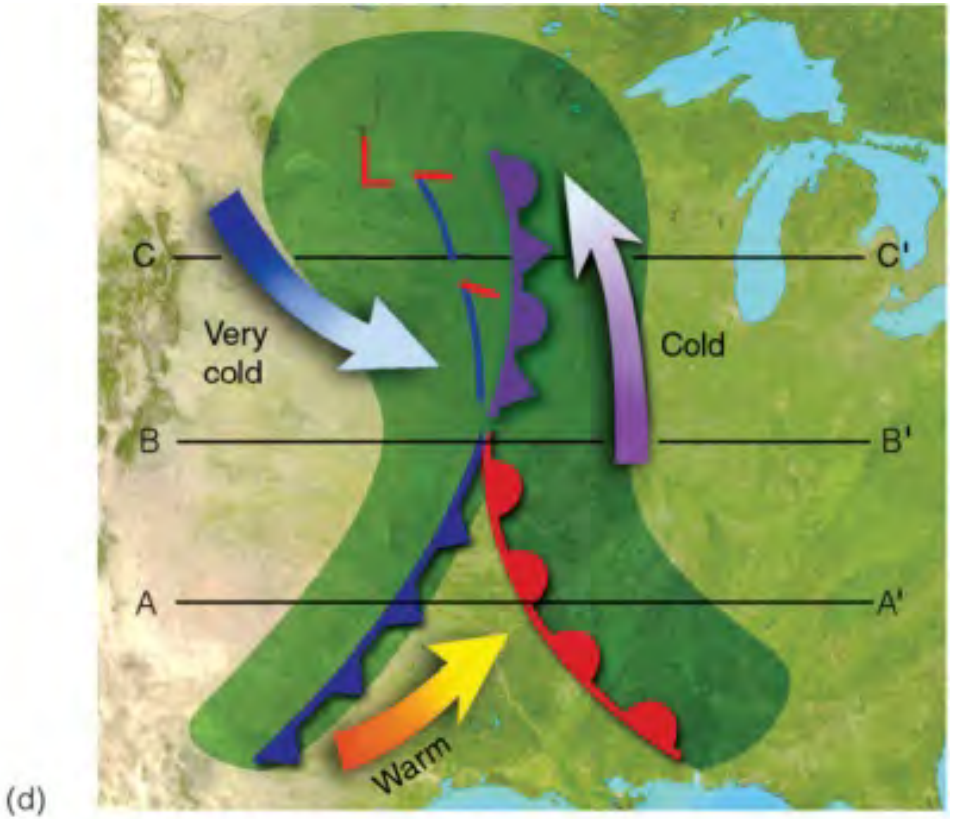
Kink in the polar front

Cold and warm fronts rotate around a central low

Wedge of warm air to the south







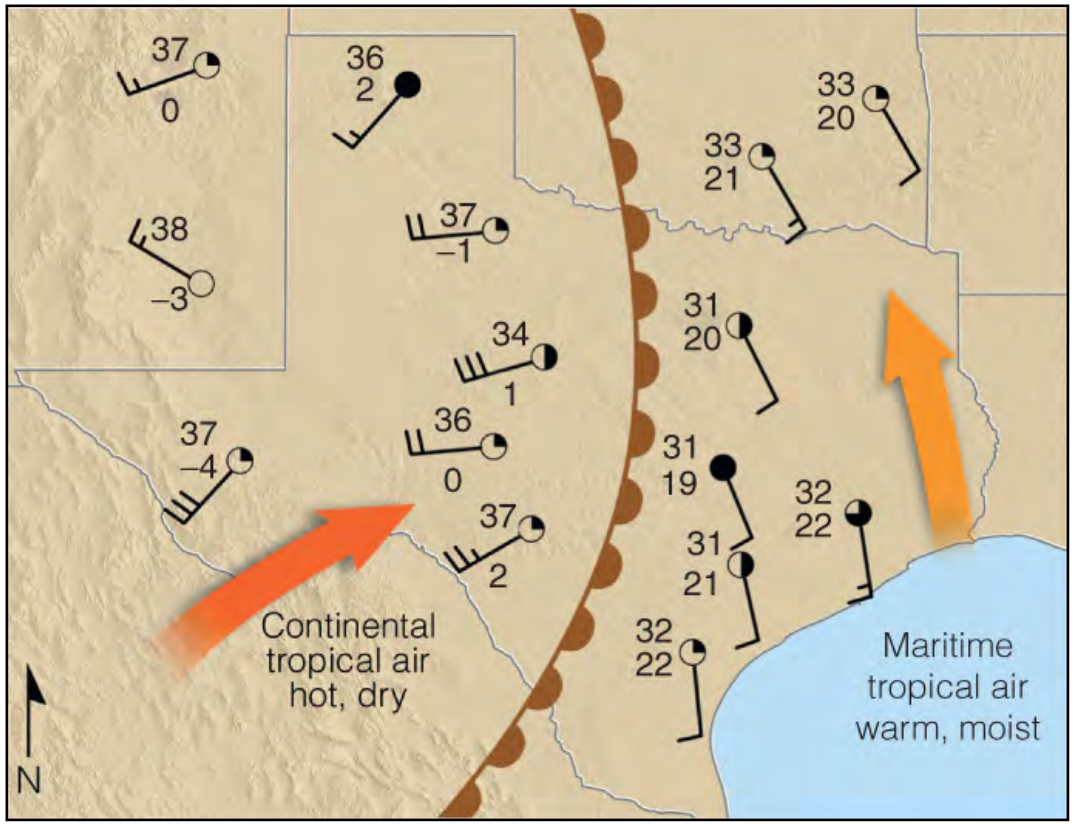
OCCLUDED FRONT

TROWAL: TRough Of Warm Air Aloft

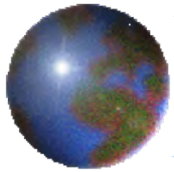
Ahrens: Fig. 11.20

Drylines

- Boundaries between dry and moister air are called drylines
- They frequently occur throughout the US Great Plains and are an important contributor to storm development



Ahrens: Fig. 11.19



Next lecture

- Midlatitude cyclones
- Ahrens: Chapter 12