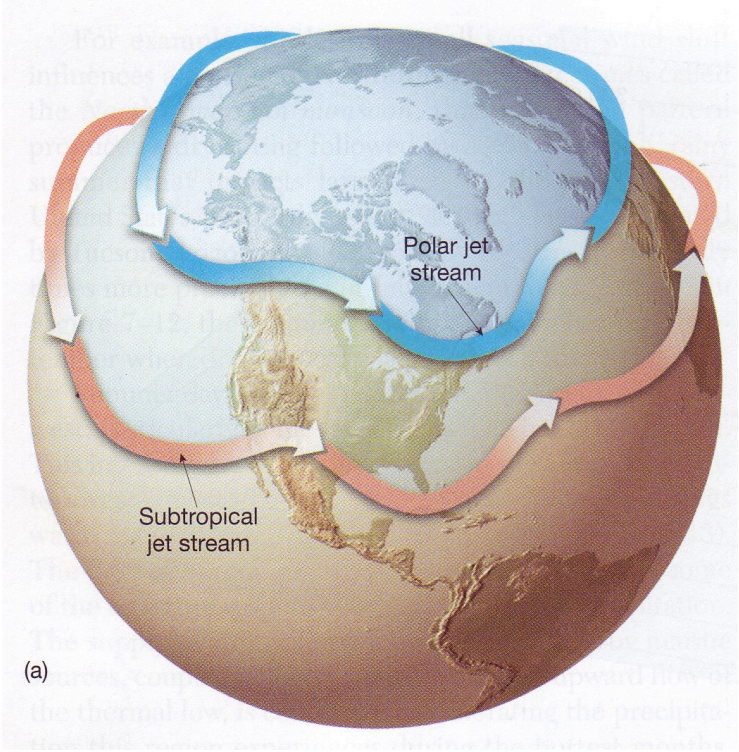
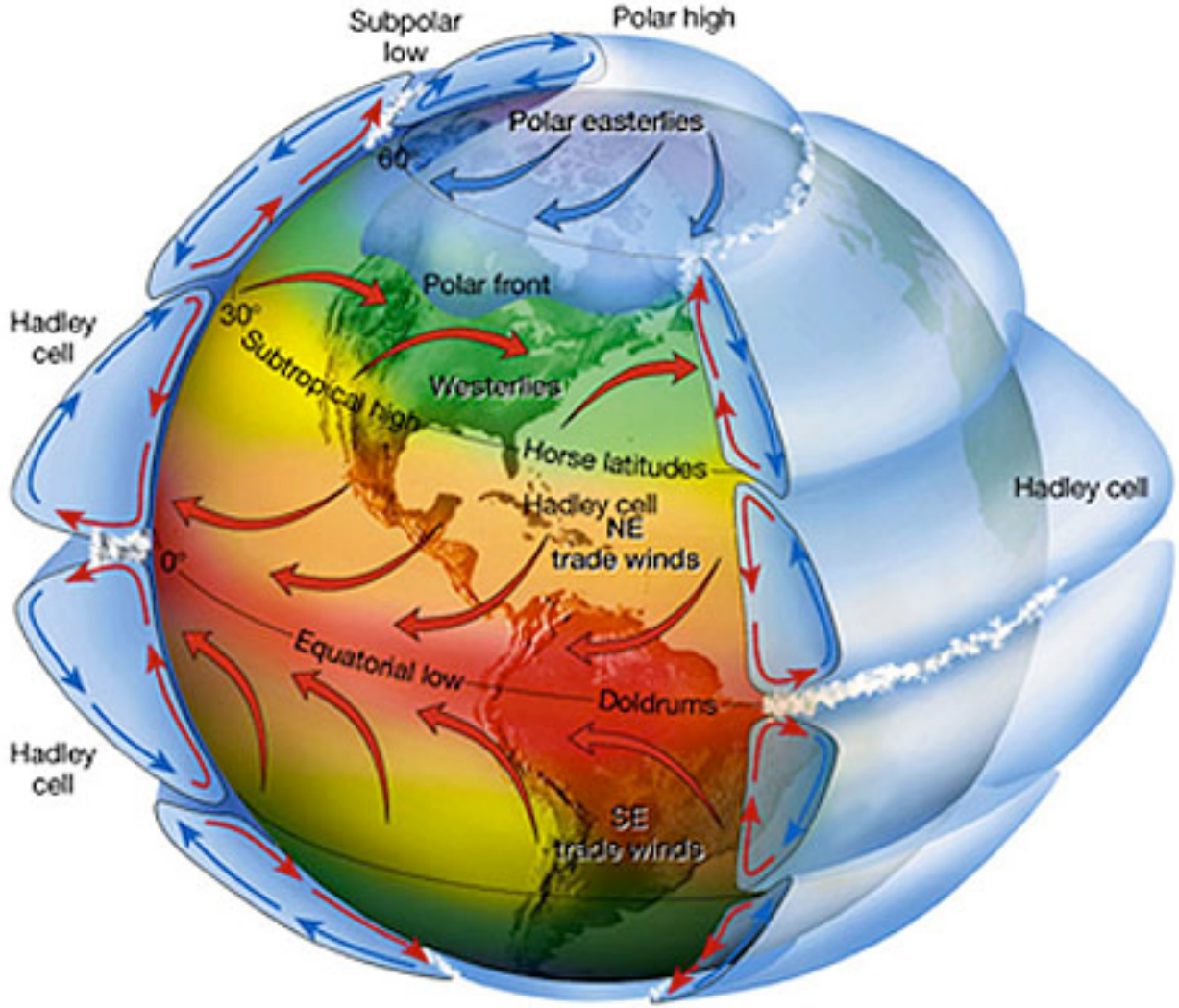
Lab Exercise # 8
Jet Stream



The Atmospheric General Circulation

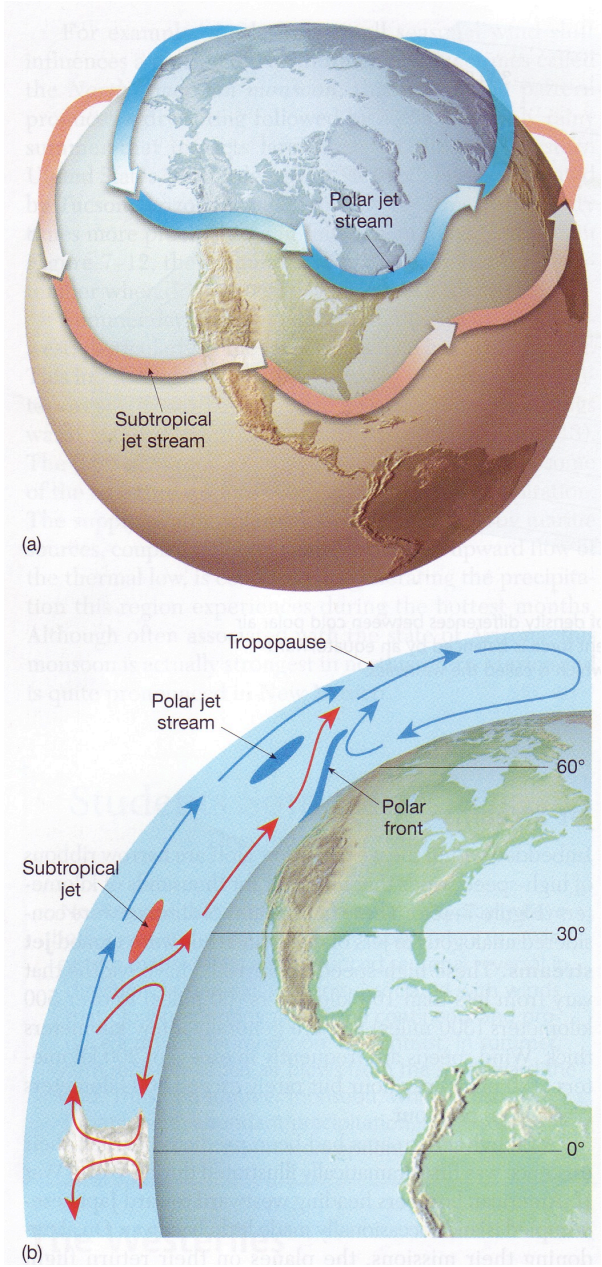


Jet Streams

- Embedded within the westerly flow aloft are narrow ribbons of high-speed winds that meander for thousands of kilometers (i.e., jet streams).
- These high-speed air currents have;
  - Widths from 100 km to 500 km
  - A few kilometers thick
  - Wind speeds from 200 km/hr to 400 km/hr.
- What is the origin of these winds?
- The main reason is that large temperature contrasts at the surface produce steep pressure gradients aloft and hence faster upper air winds.

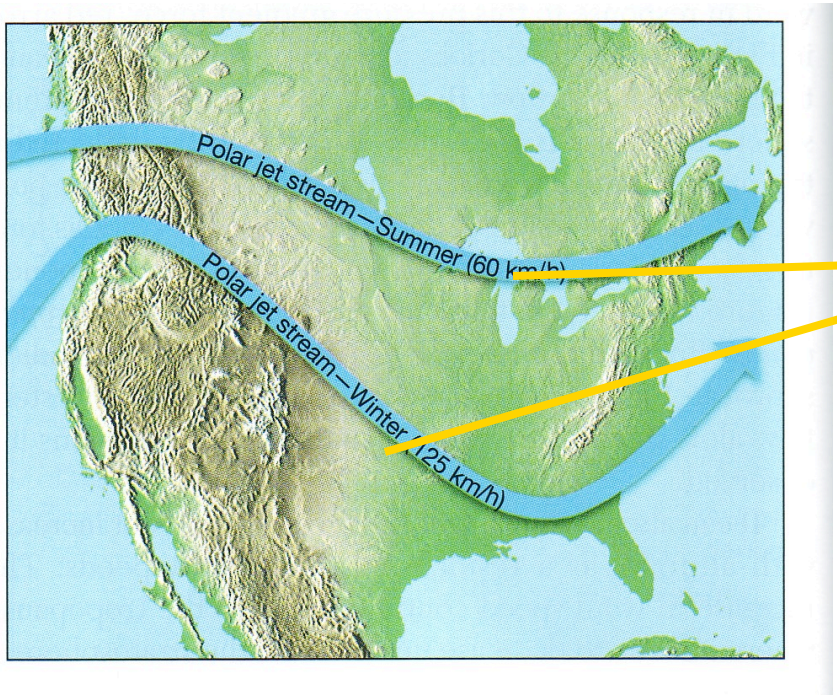
Jet Streams

- In other words, **jet streams** are located in regions of the atmosphere where large horizontal temperature differences occur over short distances.
- These large temperature contrasts occur along **fronts**.
- For example, the best-known stream occurs along the polar front, **polar jet stream**.
- The **subtropical Jet** is relatively weaker and slower and mainly a wintertime phenomenon.



Jet Streams

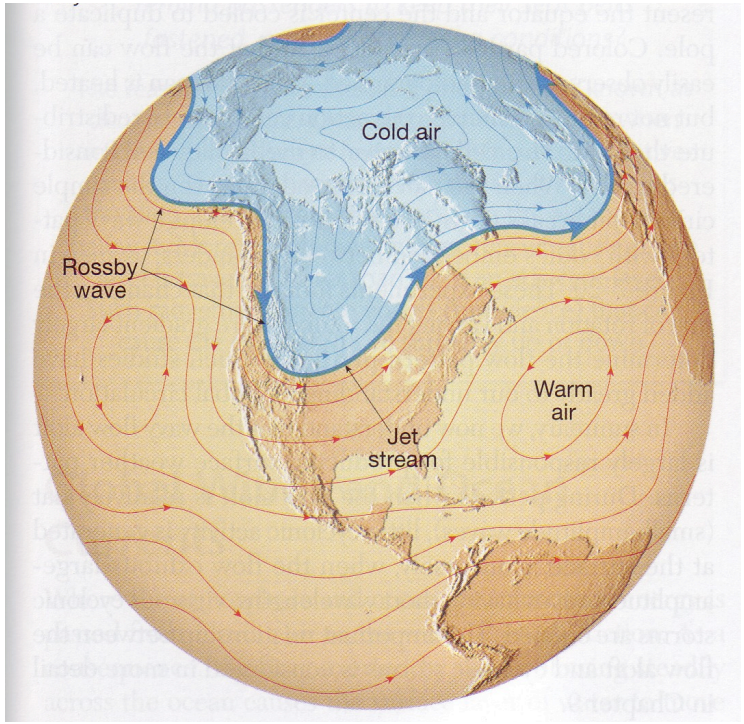
- ✓ The jet moves northward in summer, while it moves southward in winter.
- ✓ It travels at 125 km/hr in the winter and roughly half that speed in the summer.
- ✓ The polar jet has large impact on weather of the midlatitudes



For example, tornado activity shift

Waves in the Westerlies

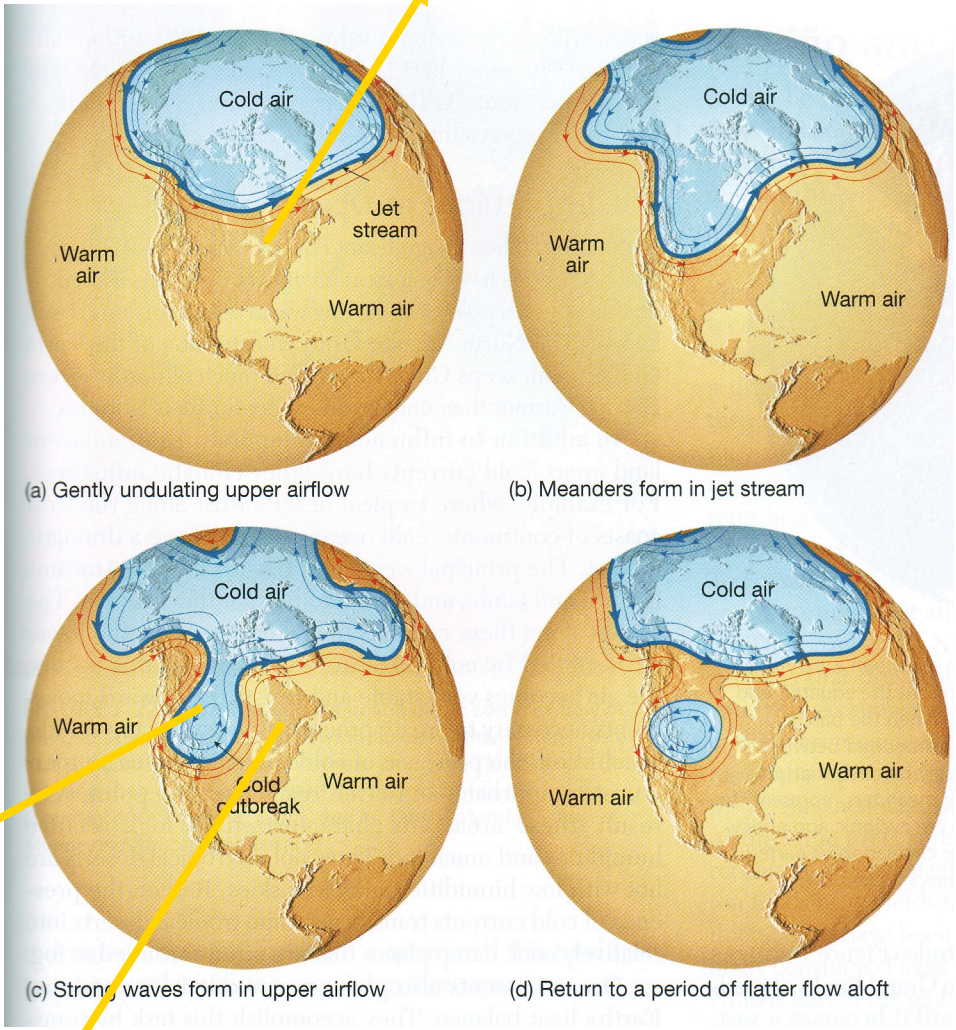
- ✓ Jet stream is an **integral** part of the westerlies that moves faster.
- ✓ It is **not** a dramatic **anomaly**, like hurricanes.
- ✓ Observations show that the westerlies follow **wavy** paths, called **Rossby waves**.
- ✓ Longest wave patterns have wavelengths of 4,000 to 6,000 km, so that 3 to 6 would fit around the globe.
- ✓ These long waves tend to remain stationary or move slowly.



Westerlies & Earth's Heat Budget

- ✓ The equator has excess heat, whereas the poles experience a deficit.
- ✓ The flow near the equator is somewhat **meridional** (north to south), but at most other latitudes the flow is zonal (west to east).
- ✓ The reason for the zonal flow is the Coriolis force.
- ✓ Now, the question is How can wind with a west-to-east flow transfer heat from south to north?

Few disturbances

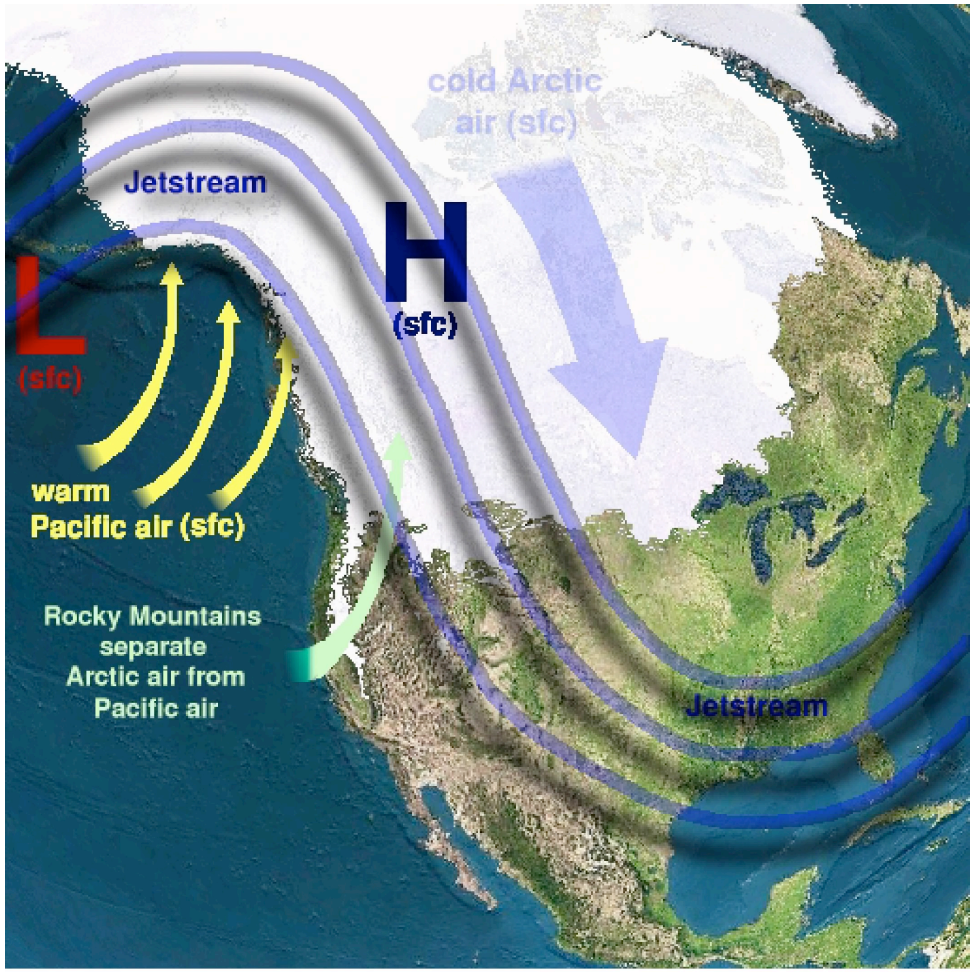


Large amplitude waves, eddies produce weather

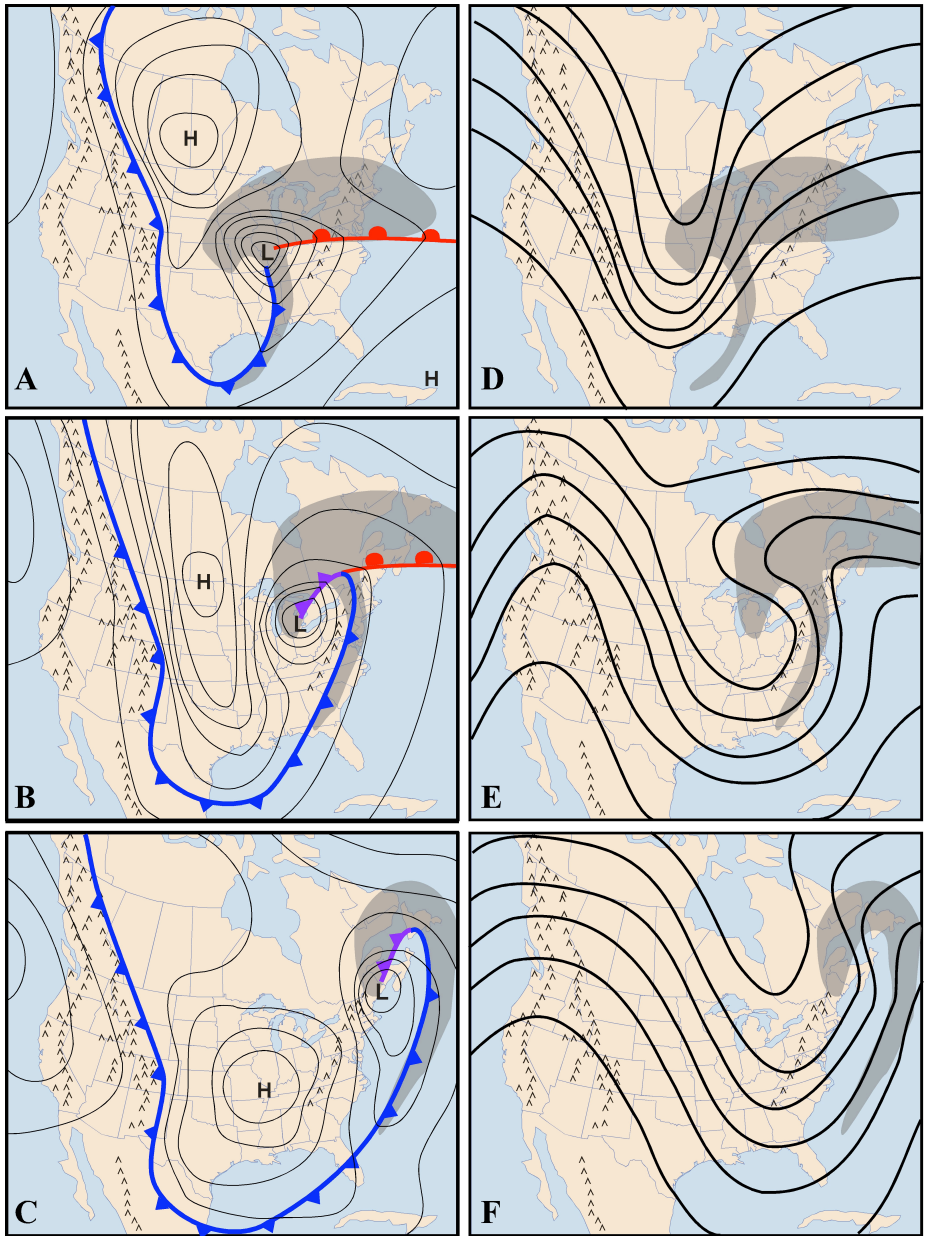
Strong cyclonic activities last 1-6 weeks redistribute heat

Formation of Cold Airmasses

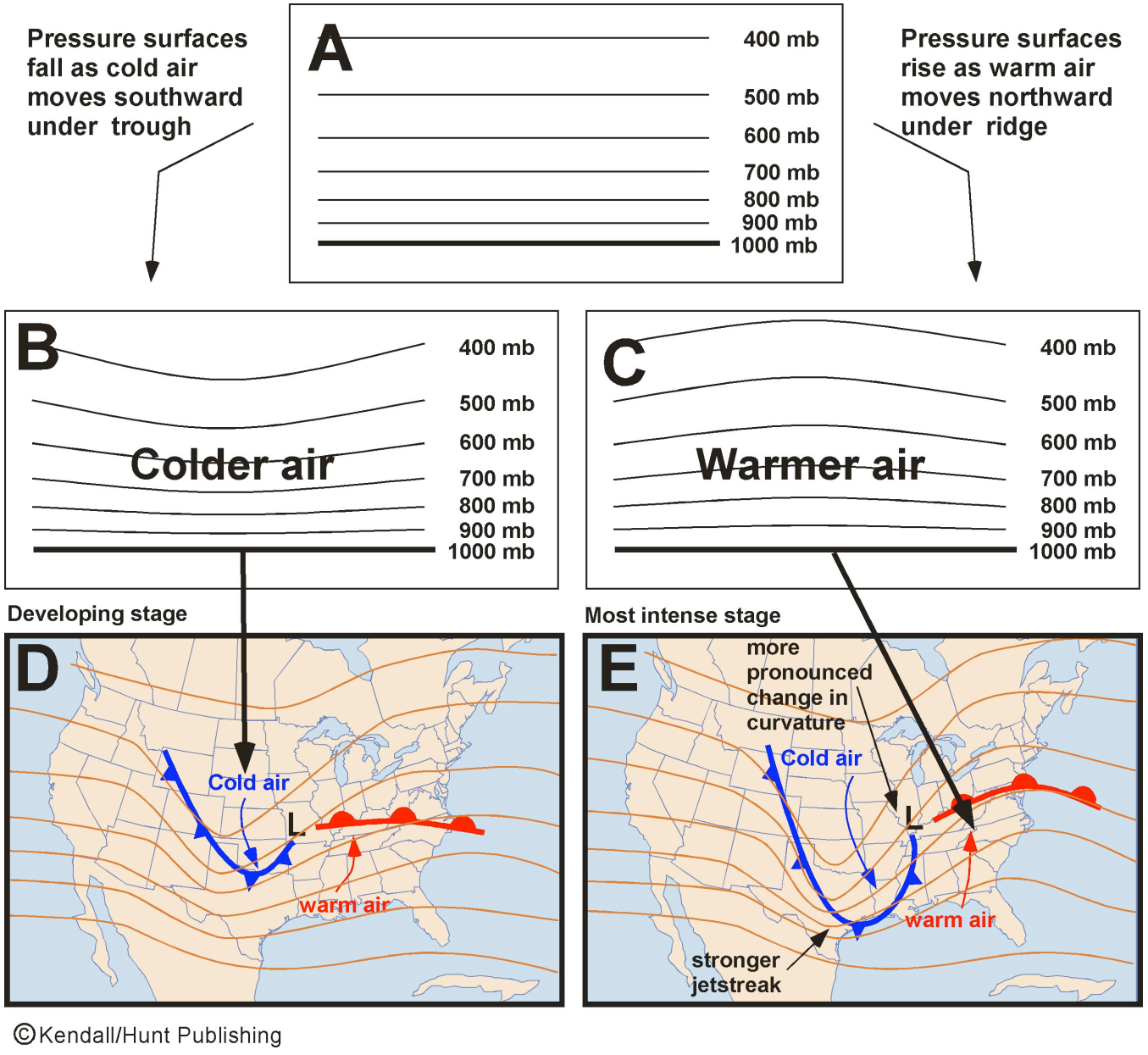
- Formation is one requirement
- Cold outbreaks movement another requirement
  - Sinking and spreading
  - Stearing winds
  - Intensified ridge & trough will intensify stearing flow
- The more rapidly the cold airmass plunges, the less it will be modified (warmed)



- ✓ Strong cyclones over the North Pacific & the central or eastern US can indirectly enhances the polar outbreaks by intensifying trough & ridge regions.
- ✓ Rocky mountains also favors intensification of trough & ridge
- ✓ Progression occurs over a period of 2-3 days.
- ✓ During this time eastern North America cools while western part warms.



Storm Intensification



Ensemble Forecasting of Jet Stream