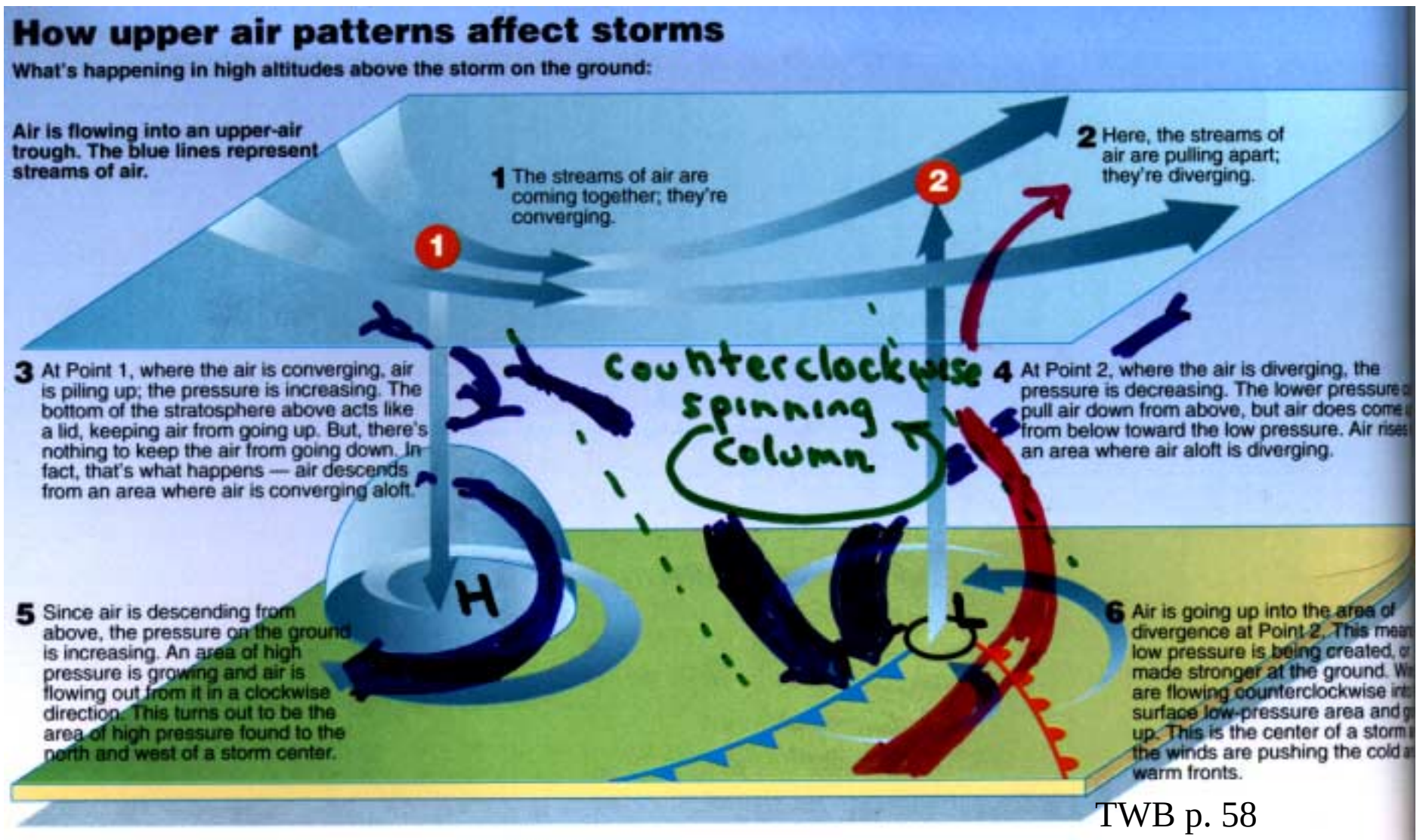


Lecture 15. Upper Atmospheric Cyclone Structure



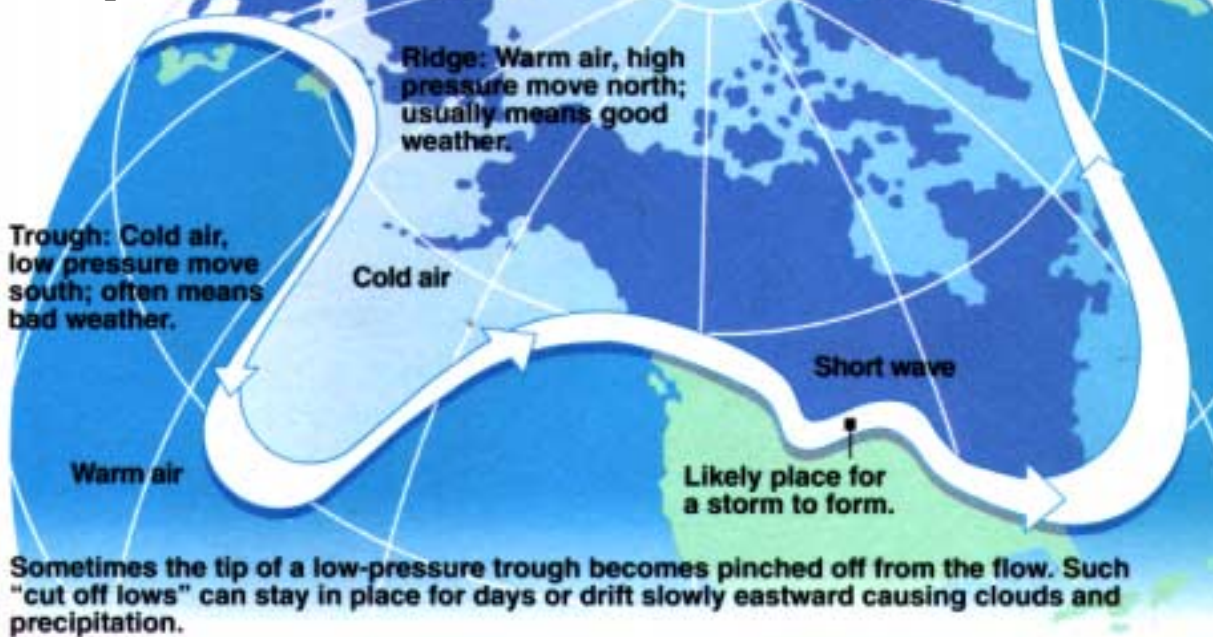
ET Cyclone mainly draws warm air up/poleward, cold air down/equatorward.
Core of cyclone rotates counterclockwise, tilts westward with height.

Long and Short Waves

How upper-air patterns affect the weather

Here's a typical pattern of winds 18,000 feet above the surface. The distance from the crest of the wave over the West — a ridge — to the bottom over the East — a trough — shows this is the long wave pattern. Ripples on the waves are short waves. The global pattern usually has four to seven long waves.

TWB p. 55



Long waves - 3000-5000 km ridge to trough, nearly stationary.

Short waves: 1000-2000 km ridge to trough, move with 500 mb winds.
...not always easily distinguishable.

Troughs: 'cyclonic' (counterclockwise - NH) spin of winds

Ridges: 'anticyclonic' (clockwise - NH) spin

Movement of Short Waves Through Long Waves

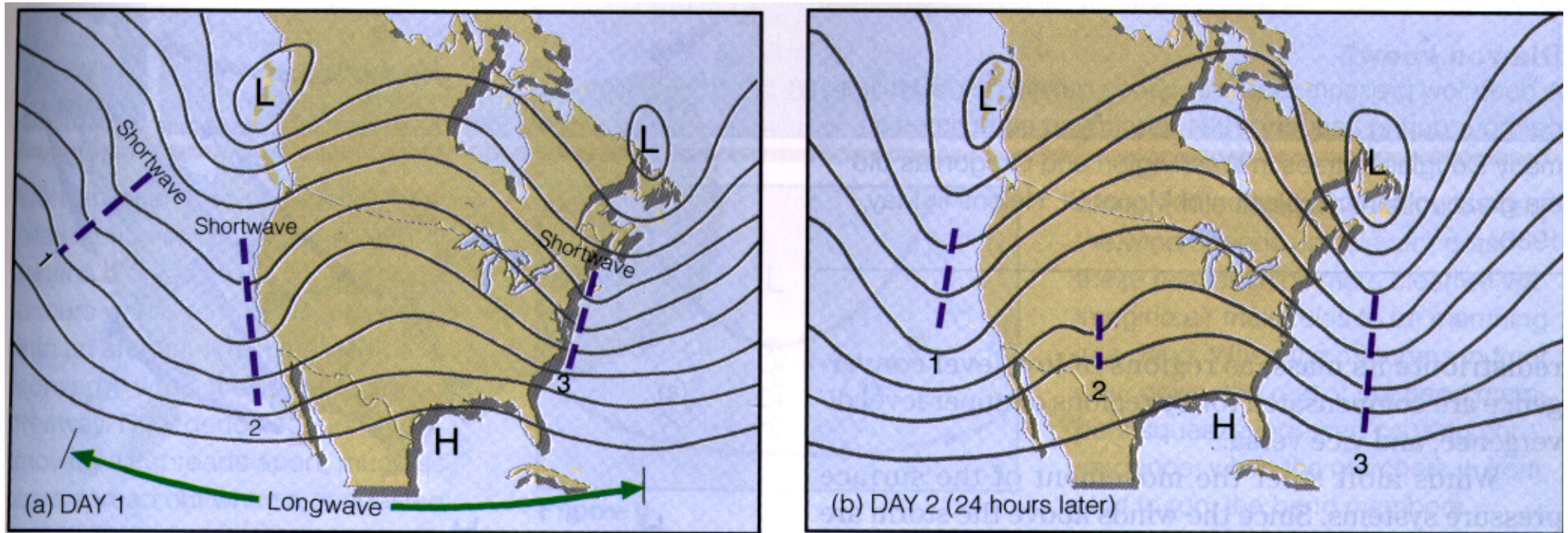


Figure 8.22

(a) Upper-air chart showing a longwave with three shortwaves embedded in the flow.

(b) Twenty-four hours later the shortwaves have moved rapidly around the longwave. Notice that the shortwaves labeled 1 and 3 tend to deepen the longwave trough, while shortwave 2 has weakened as it moves into a ridge.

EOM

Vorticity

- *Vorticity* is ‘spin’ of air parcel about vertical axis.

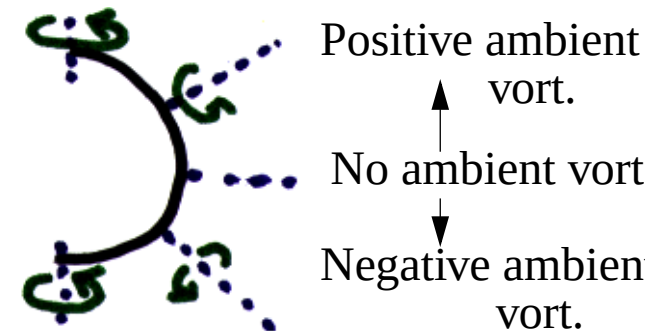
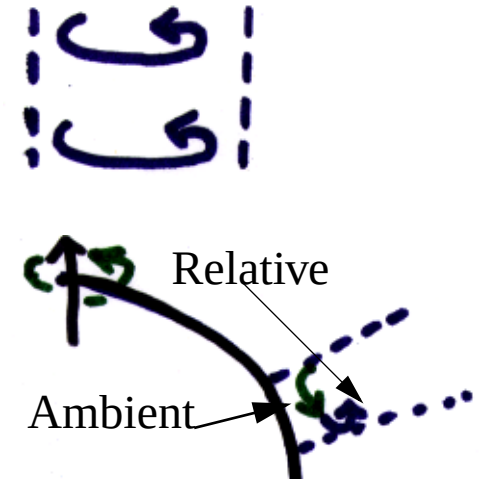
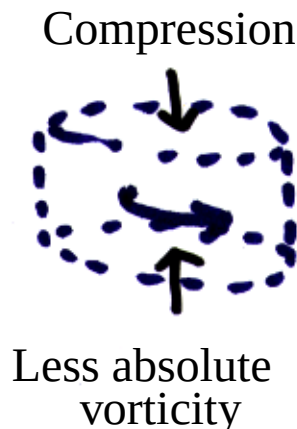
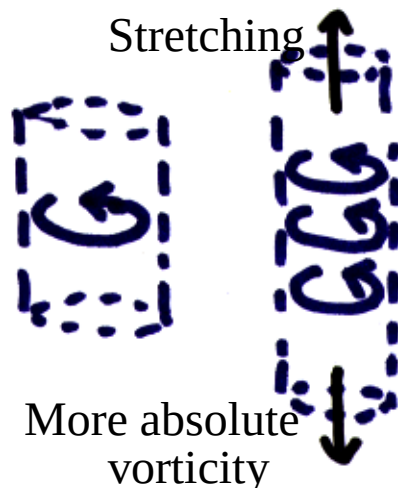
- Total or ‘absolute’ vorticity has two parts:

Relative vorticity = Spin of air relative to earth

+ Ambient vorticity = vertical part of earth’s spin

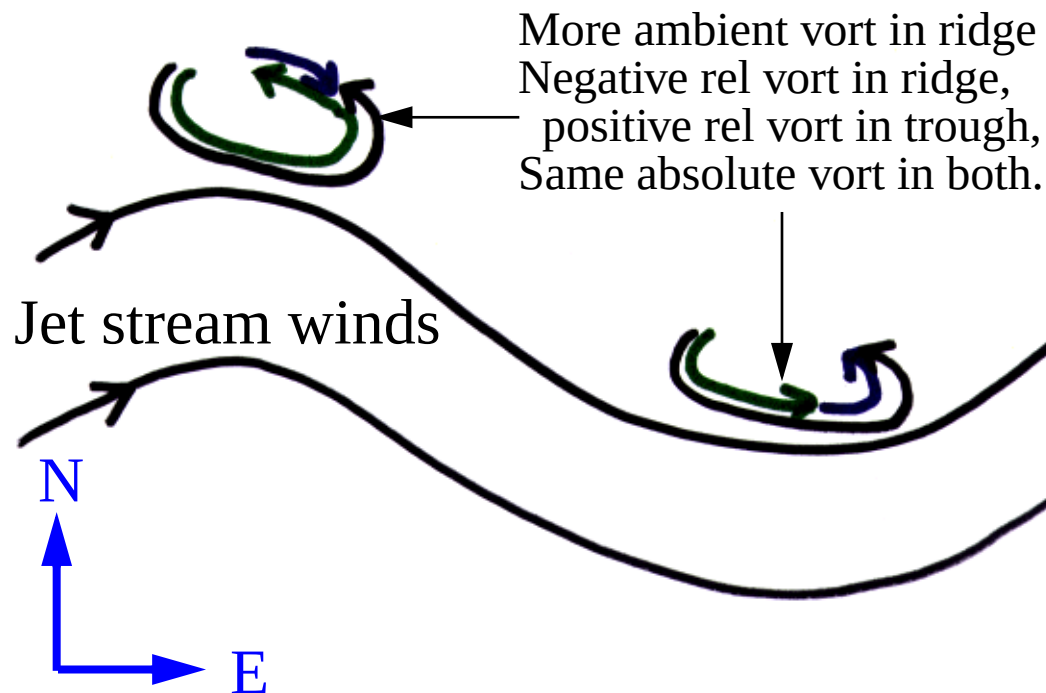
- Ambient vorticity is large at poles, zero at equator.

- Absolute vorticity only changed by stretching



Long (Rossby) waves

- Are set up by the pattern of oceans, land, and mountains around the globe.
- Involve little stretching or compression of air columns, so air keeps the same absolute vorticity as it moves from W to E throughout the wave.



- Named after a famous meteorologist of the 1920s and 1930s who was one of the first people to recognize the role of the jet stream in weather.

Storms crossing over the Rockies

When storms meet mountains

A simplified view of a storm as a spinning column of air shows why storms weaken as they move into high mountains, such as the Rockies, and then re-form or strengthen on the east side of the mountains.



(TWB p 54)

Storm Tracks

- Surface lows disappear over the Rockies
- Low formation in lee of Rockies and Gulf of Mexico
- Cold highs descend from Canada behind storms

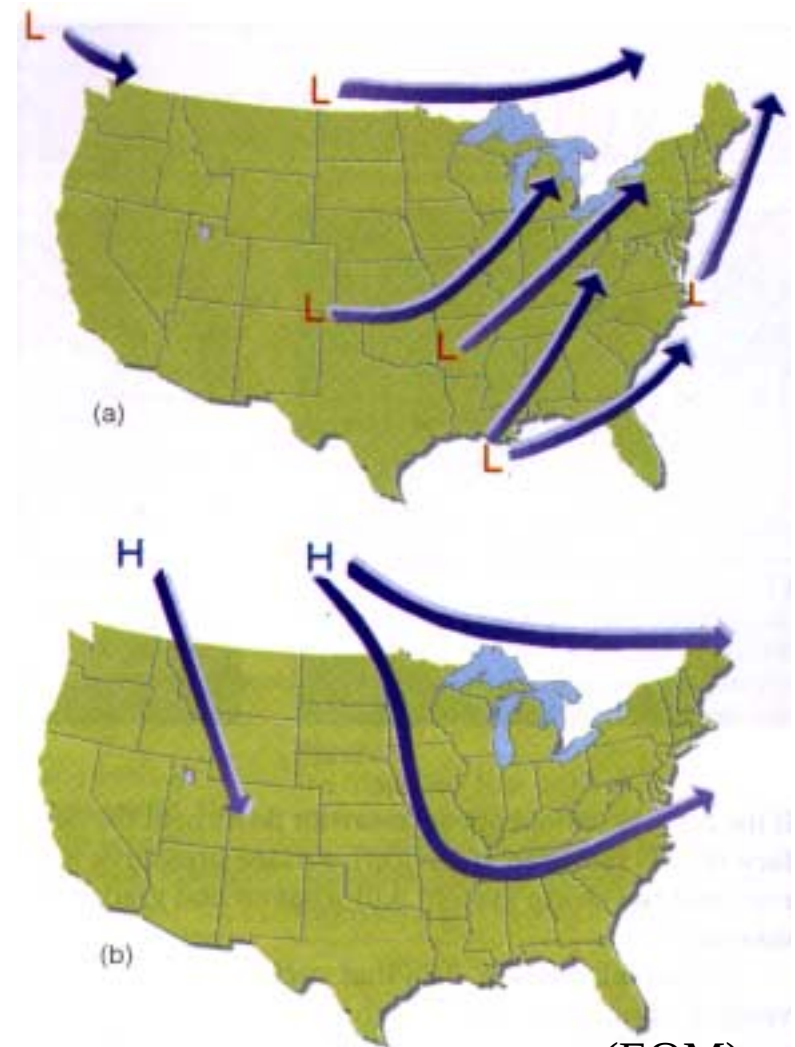


Figure 8.25 Typical paths of (a) winter mid-latitude cyclones and (b) winter anticyclones. (EOM)