

Lecture 15. Upper Atmospheric Cyclone Structure

How upper air patterns affect storms

What's happening in high altitudes above the storm on the ground:

Air is flowing into an upper-air trough. The blue lines represent streams of air.

1 The streams of air are coming together; they're converging.

2 Here, the streams of air are pulling apart; they're diverging.

3 At Point 1, where the air is converging, air is piling up; the pressure is increasing. The bottom of the stratosphere above acts like a lid, keeping air from going up. But, there's nothing to keep the air from going down. In fact, that's what happens — air descends from an area where air is converging aloft.

counterclockwise
spinning
column

4 At Point 2, where the air is diverging, the pressure is decreasing. The lower pressures pull air down from above, but air does come from below toward the low pressure. Air rises in an area where air aloft is diverging.

5 Since air is descending from above, the pressure on the ground is increasing. An area of high pressure is growing and air is flowing out from it in a clockwise direction. This turns out to be the area of high pressure found to the north and west of a storm center.

6 Air is going up into the area of divergence at Point 2. This means low pressure is being created, or made stronger at the ground. We are flowing counterclockwise into surface low-pressure area and go up. This is the center of a storm; the winds are pushing the cold warm fronts.

TWB p. 58

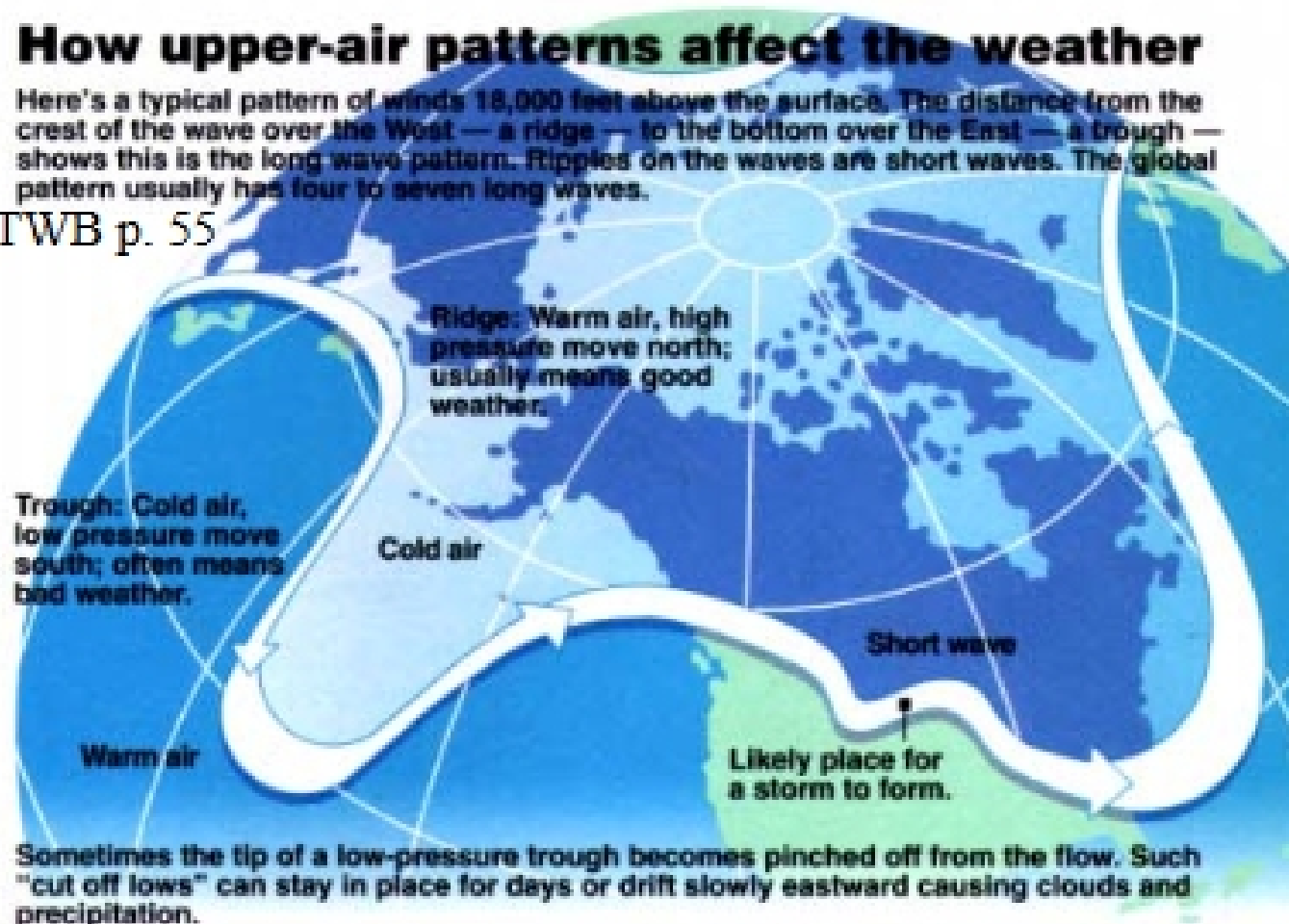
ET Cyclone mainly draws warm air up/poleward, cold air down/equatorward. Core of cyclone rotates counterclockwise, tilts westward with height.

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

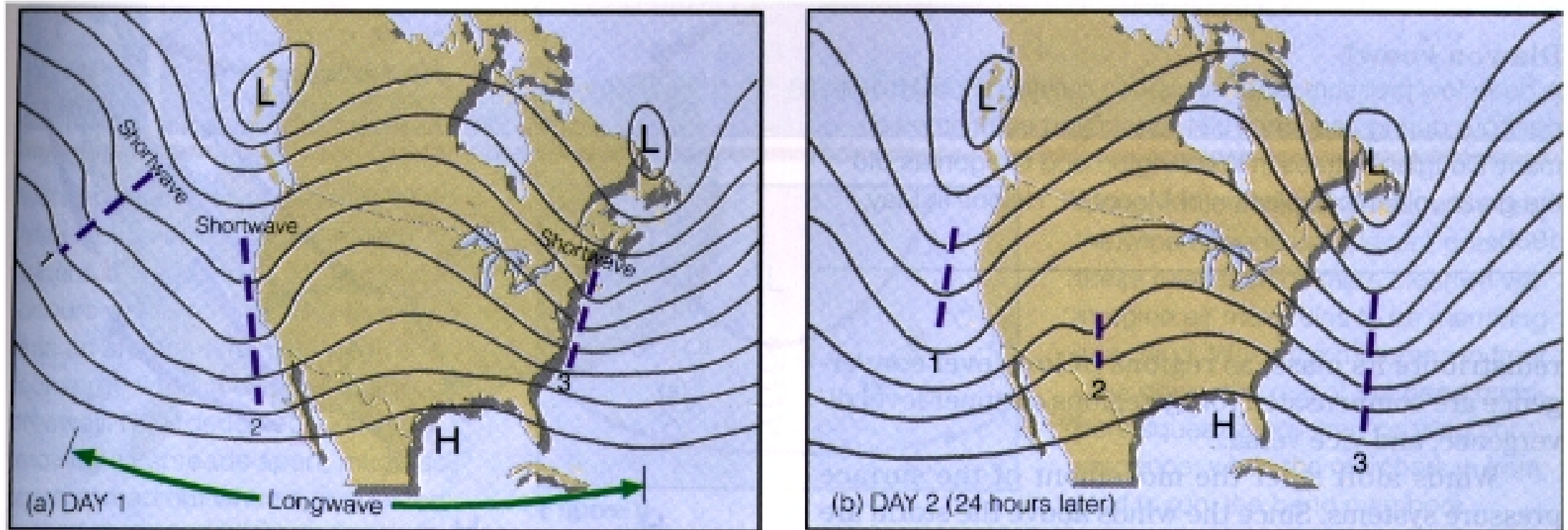


Figure 8.22

(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