Chapter 10, Part 2

Local Wind Systems

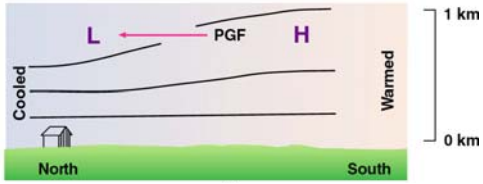
Question

- Why do we have thunderstorms in the afternoon on many summer days in Gainesville?

1. Thermal Circulations

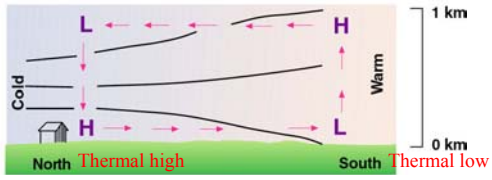
- The pressure decreases with altitude.

2. Thermal Circulations



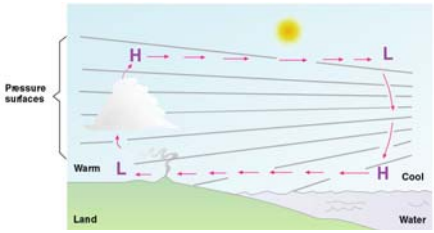
- Warm air expands and cold air contracts.
- The pressure above the warm air is thus higher than above the colder air for a given altitude.
- There is a force and wind from the warmer to colder air.

3. Thermal Circulations



- As air flows, the air above the colder region becomes further compressed.
- This creates a high pressure near the surface.
- A surface wind blows from cold to warm regions.

Sea Breeze

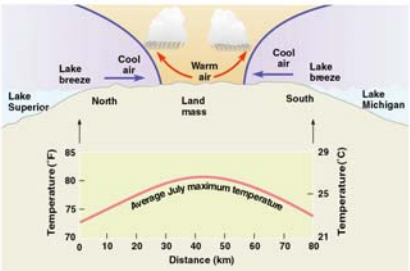


- During the day, the water heats less than the land.
- The air above the water is cooler and the air blows from water to land.
- Rising air over land creates clouds.

Afternoon Showers in Florida

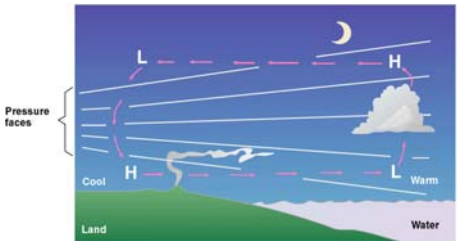
- Because of the sea breeze, air blows from the east on the east coast and from the west on the west coast.
- The converging and rising air creates clouds and rain.

Temperature and Sea Breezes



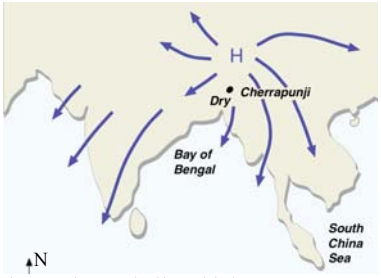
- Because of sea (lake) breezes, the temperature tends to be cooler on the coast and warmer inland during the summer.

Land Breeze



- At night the air cools more than the water.
- The wind blows from land to sea.
- Clouds created by rising air form over the water.

Winter Monsoon

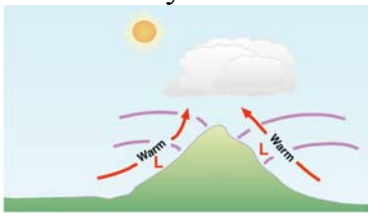


- In the winter a large shallow high pressure area develops over Siberia, producing clockwise flowing air that goes to the Indian Ocean and South China Sea.
- Monsoon wind system = changes direction seasonally.

Summer Monsoon

- In the summer air over the continents becomes much warmer and air flows in from the water, creating rain and the wet season.

Valley Breeze



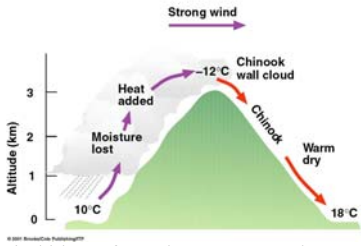
- During the day sunlight warms the valley walls.
- The warm air rises producing a valley breeze and frequently clouds.
- The process reverses at night (mountain breeze).

Clouds on Mountain Slopes

Katabatic Winds

- Strong downhill winds result when air flows from a high plateau (cold, high pressure) to a valley (warmer, low).
- Examples: bora (Yugoslavia), mistral (France), Columbia Gorge wind (US).

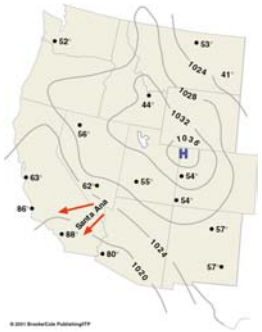
Chinook Wind



- As wind blows from the West over the Rocky Mountains it looses its moisture and warms creating the warm dry Chinook wind on the eastern slope.
- The warming is due to latent heat and compression.

Chinook Wall Cloud

Santa Ana Wind

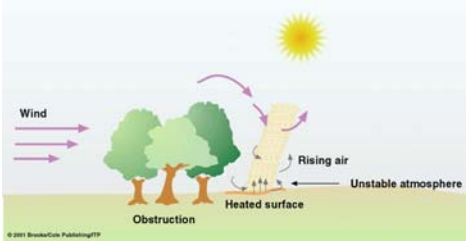


- Air descends from elevated desert plateau, funneling through mountain canyons, into LA basin and San Fernanodo Valley.
- Air warms through compression, carries dust and sand, and dries out vegetation.

Desert Winds - Haboob

- Cold downdrafts along leading edge of a thunderstorm lift dust and sand. (Shown: Pheonix, Arizona).

Desert Winds – Dust Devils



- Warm rising air is twisted by wind blowing past an obstacle leading to a dust devil, whirlwind, or willy-willy.
- Different from tornado where air descends.

Other Local Winds of Interest

- Texas norther – intense winter storm goes east across the Great Plains through Texas. Temperatures may drop 10° in a few hours.
- Northeasters – storm develops off of east coast and moves north east along the coast. They usual bring heavy winds and snow.

Summary

- Thermal circulations created by uneven heating/cooling over land and water create sea breezes, afternoon showers in Florida, and the monsoon in India and Asia.
- Wind flowing over or down mountains create valley breezes, katabatic winds, the Chinook wind, and the Santa Ana wind.