Local Winds

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CHAPTER 1 Local Winds

- Describe the types of local winds and how they are created.
- Explain how local winds influence a region's environment.

Which large rainstorms are crucial for people in some parts of the world?

India, Pakistan, and other nations in southern Asia are great places to go to see monsoon rains. The region depends on the water they bring. Parts of the Southwestern United States also receive monsoon rains. These rains break the summer heat. They also provide water to desert plants. With winter rains and summer rains, these deserts are more lush than many.

Local Winds

Local winds are winds that blow over a limited area. Local winds blow between small low and high pressure systems. They are influenced by local geography. Nearness to an ocean, lake, or mountain range can affect local winds. Some examples are found below. Local winds can affect the weather and climate of a region.

Land and Sea Breezes

Ocean water is slower to warm up and cool down than land. So the sea surface is cooler than the land in the daytime. It is also cooler than the land in the summer. The opposite is also true. The water stays warmer than the land during the night and the winter. These differences in heating cause local winds known as land and sea breezes (**Figure** 1.1).

- A **sea breeze** blows from sea to land during the day or in summer. That's when air over the land is warmer than air over the water. The warm air rises. Cool air from over the water flows in to take its place.
- A **land breeze** blows from land to sea during the night or in winter. That's when air over the water is warmer than air over the land. The warm air rises. Cool air from the land flows out to take its place.

Monsoons

Monsoons are like land and sea breezes, but on a larger scale. They occur because of seasonal changes in the temperature of land and water. In the winter, they blow from land to water. In the summer, they blow from water to land. In regions that experience monsoons, the seawater offshore is extremely warm. The hot air absorbs a lot of the moisture and carries it over the land. Summer monsoons bring heavy rains on land. Monsoons occur in several places around the globe. The most important monsoon in the world is in southern Asia (**Figure** 1.2). These monsoons are important because they carry water to the many people who live there.

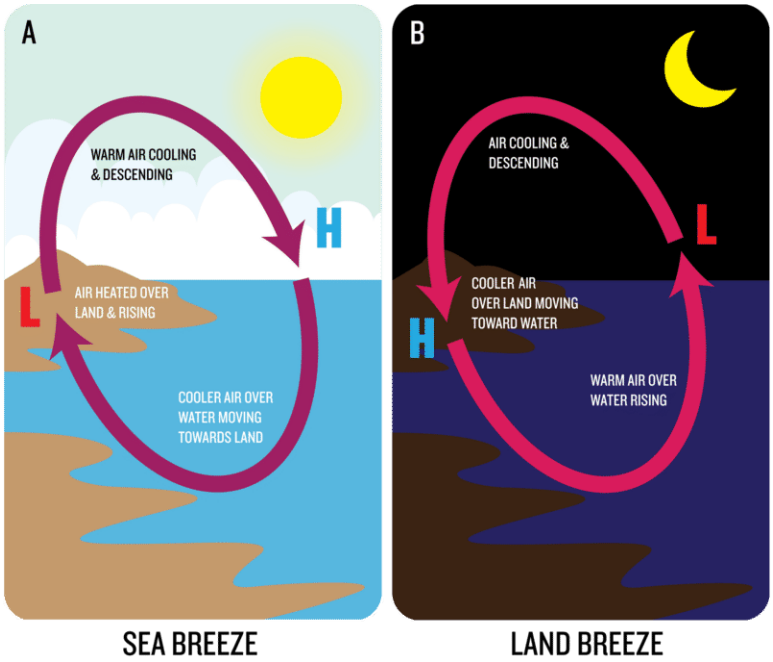

FIGURE 1.1

Land and sea breezes blow because of daily differences in heating.

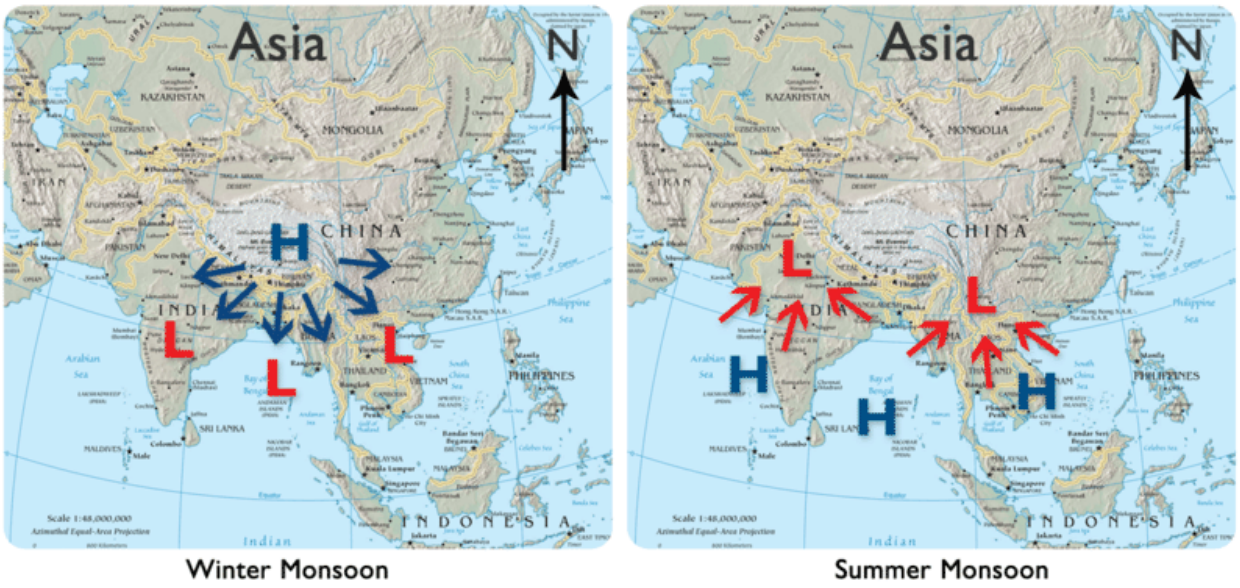

FIGURE 1.2

Monsoons blow over southern Asia.

Mountain and Valley Breezes

The air on a mountain slope warms more than the air over the nearby valley. The warm air rises and brings cool air up from below. This is a **valley breeze**. At night the mountain slope cools more than the air over the valley. The air

flows downhill creating a **mountain breeze**.

Katabatic Winds

Katabatic winds move the same way as mountain and valley breezes. However, they are much stronger. Katabatic winds form over a high plateau that is surrounded by mountains. In winter, the plateau grows cold. Air sinks through the gaps in the mountains. Over Antarctica and Greenland, these winds are frigid.

Chinook Winds

Chinook winds (**Figure** 1.3) occur when air is forced over a mountain range. Warm air rises over the Sierra Nevada in California, for example, because it is pushed eastward by the westerly winds. The air cools as it rises and precipitates. The air is now dry. It sinks down the far side of the mountains and may create strong winds. These Chinook winds are relatively warm. If there is snow, the winds may melt it quickly. The dry sinking air creates a **rainshadow effect**. Rainshadow effect is responsible for many of the world's deserts.

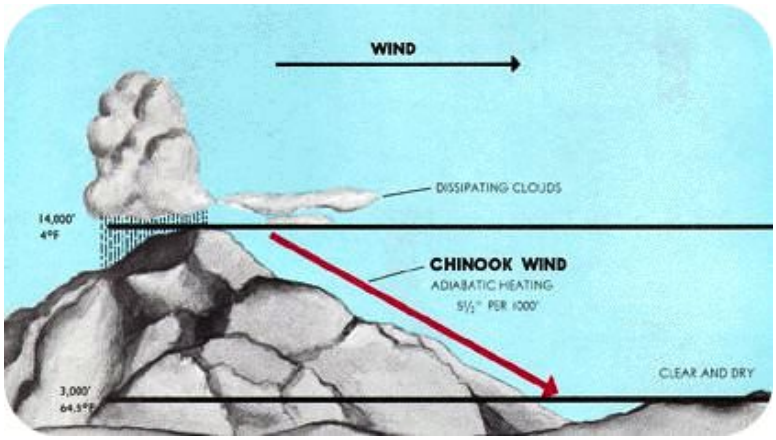

FIGURE 1.3

As air rises over a mountain it cools and loses moisture. The air warms by compression on the leeward side. The resulting warm and dry winds are Chinook winds. The leeward side of the mountain experiences rainshadow effect.

Santa Ana Winds

Santa Ana winds (**Figure** 1.4) are responsible for many large fires in Southern California (**Figure** 1.5). The Santa Ana winds arrive at the end of California's long summer drought season. Air east of the Sierra Nevada Mountains cools in late fall. This creates a high pressure zone. The air is then forced downhill through the deserts of the Southwest. It blows westward toward the ocean. The air is blocked by the San Gabriel and San Bernardino Mountains. So it is funneled rapidly through the mountain passes. If a fire starts, it spreads quickly. The result is large-scale devastation.

Desert Winds

High summer temperatures on the desert create high winds and monsoon storms. Strong winds in the desert can pick up dust and blow it around. A dust storm known as a **haboob** (**Figure** 1.6) forms in the downdrafts on the front of a thunderstorm.

FIGURE 1.4

The winds are especially fast through Santa Ana Canyon, for which they are named. Santa Ana winds blow dust and smoke westward over the Pacific from Southern California.

FIGURE 1.5

In October 2007, Santa Ana winds fueled many fires that together burned 426,000 acres of wild land and more than 1,500 homes in Southern California.

FIGURE 1.6

A haboob in the Phoenix metropolitan area, Arizona.

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Summary

- Local winds blow between high pressure and low pressure areas.
- Winds blow up and down slope, on and off land and sea, through deserts or over mountain passes.
- Some local winds are well known in an area: haboobs in the desert, Santa Ana winds in Southern California, Chinook winds in Colorado.

Review

1. What causes local winds to blow?
2. Describe valley breezes and mountain breezes. How are they an example of how local winds form?
3. How do Chinook winds lead to rainshadow effect?

References

1. Christopher Auyueng. Land and sea breezes blow in different directions if it is day or night . CC BY-NC 3.0
2. Map courtesy of the Central Intelligence Agency's World Factbook; modified by CK-12 Foundation - Hana Zavadska. Monsoons blow over southern Asia . Public Domain
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