

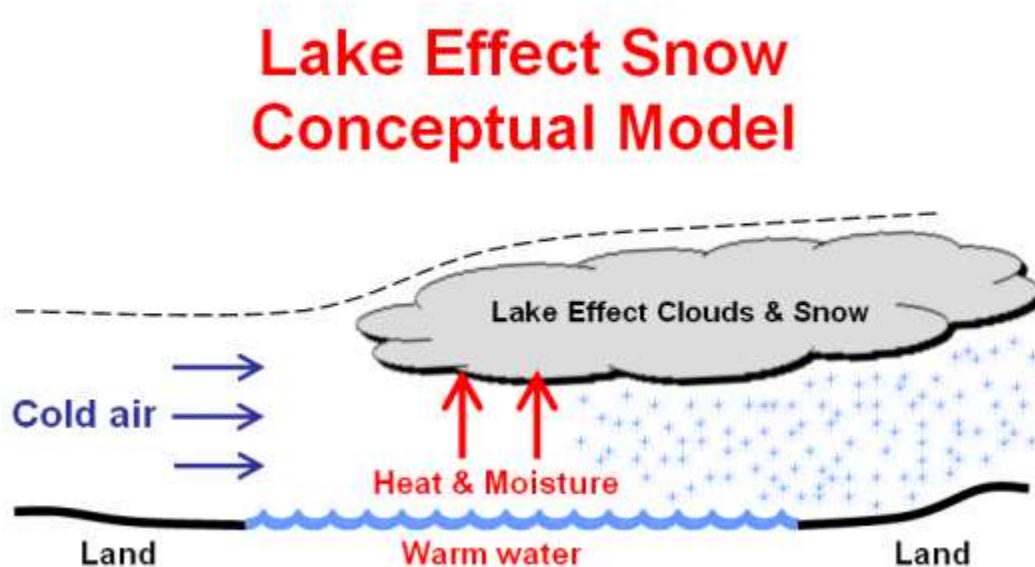
Local Influences on Weather

Lake Effect and Sea/Land Breezes

Areas near large bodies of water—such as the Great Lakes and Atlantic Ocean—can experience different weather from locations elsewhere. Sometimes the effects can be significant and dangerous.

Lake Effect Snow (LES) is common downwind (east) of Lakes Erie and Ontario. LES occurs when cold air originating over Canada moves over the relatively warmer open waters of the Great Lakes. Moisture and heat are transferred into the lower portion of the atmosphere. When this air reaches higher elevations, such as the Appalachian and Tug Hill Plateaus, it rises up, cools, condenses, and precipitates. The warmer air can also be uplifted over more dense cold air near the ground.

Here is one conceptual model (source: <https://www.weather.gov/apx/lesConceptual>):



LES often occurs in narrow bands, with one location receiving many centimeters of snow and locations nearby receiving none. More information about LES is available at <http://scijinks.jpl.nasa.gov/lake-snow/>.

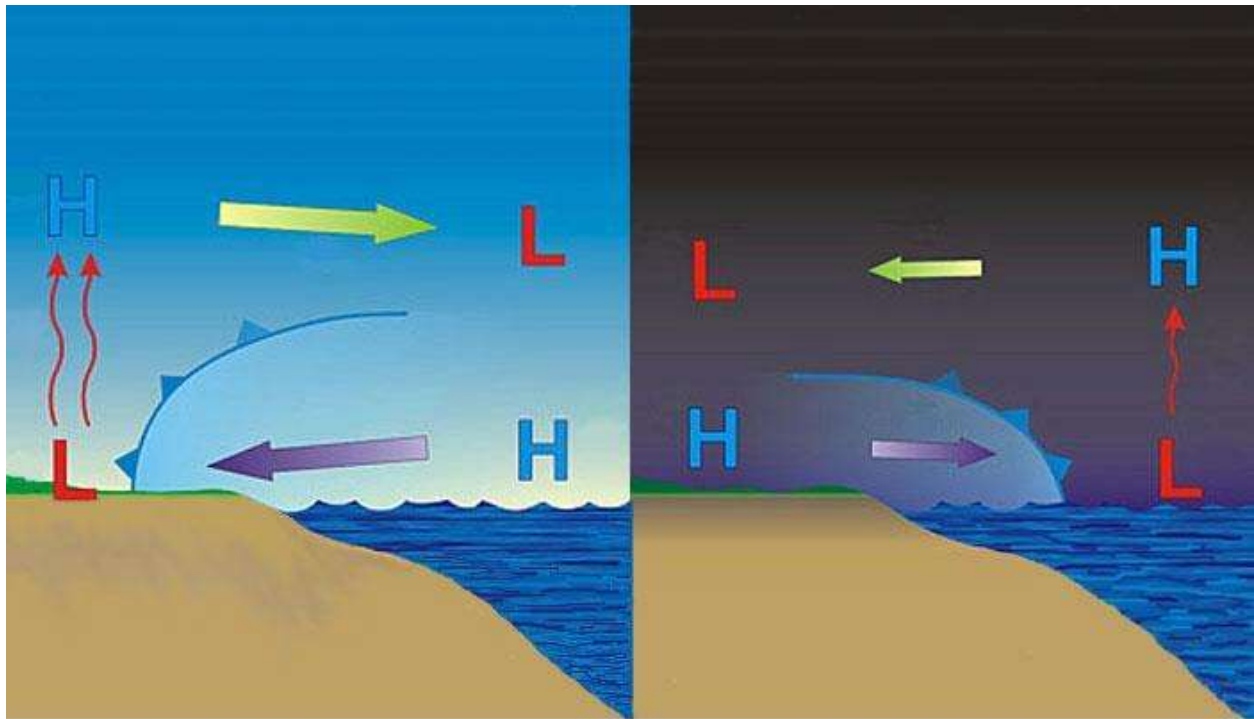
Do you experience lake effect weather where you are? If so, how can you and your students prepare for the effects?

How could you incorporate these concepts into your lessons?

People living near the Atlantic or other coasts will often hear in summer forecasts something like "High temperatures today will be in the upper 80s, except at the coast where temperatures will be cooler." If you go to the beach in the early morning, the air probably is calm, but by later morning the wind becomes very strong. These conditions result from **sea breezes**.

Water has a higher specific heat than land materials, so it takes longer to warm. Sunlight striking beaches and adjacent water will heat up sand, rocks, and pavement more quickly. This energy is transferred to the overlying air, which becomes less dense and rises. As it does so, cooler air from over the ocean moves onshore, to be heated in turn. The rising air will cool, water vapor will condense, and areas inland may experience afternoon thunderstorms. ("Tourist Florida" commonly has such weather.)

As the Sun sets, land materials cool off faster than the water, and the pattern reverses to create **land breezes**. These are less well known because most of the effect is felt offshore. As shown in the figures below, sea and land breezes are parts of local **convective cells**.



(Source: <http://climate.ncsu.edu/edu/k12/.breezes>)

Do you live in an area that experiences sea and land breezes?

Describe differences between weather near a coast and further inland caused by sea breezes.

How could you incorporate these concepts into your lessons?

Orographic Effects

Mountains can also influence local weather. The best example involves the Cascades in the Northwest. Moist air blowing onshore from the Pacific Ocean is forced to rise up as it reaches the **windward side** of the peaks. As it rises, it cools and water vapor condenses to form the cloudy, wet weather for which locations such as Seattle and Portland are well known. As the air moves over the mountains and sinks, it warms and becomes drier. Conditions on the **leeward side** can be arid, and create **rain shadow deserts**.

Here is a link to an animation describing mountain weather:

<https://training.spotternetwork.org/video/mountainweatherfromNova.swf>

In New York State, the Adirondacks and Catskills can influence local weather and produce much greater snowfall on their windward sides than on their leeward sides.

Is your area affected by such orographic effects?

How can this influence the local economy?

How could you incorporate these concepts into your lessons?

Droughts

Residents in urban areas take their water supply for granted because municipalities have developed safe, secure systems. But those living in rural areas are well aware that precipitation at times is well below expected levels. If this pattern continues, areas can experience droughts. These can have severe impacts on the local economy.

The NWS Climate Prediction Center and other agencies closely monitor drought and other persistence conditions that can impact livelihoods and threaten health.

Examine the current drought forecasts

Monthly: <http://droughtmonitor.unl.edu/>

Seasonal: http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

Describe what is currently happening on your area, and what is expected in the next few months.

How could you incorporate these concepts into your lessons?

Other Local Weather Conditions

Describe any other factors that can influence local weather.

For example, in urban areas, tall buildings can channel air flow and create strong winds. West-east streets along the Hudson River in Manhattan often have gusts on a summer afternoon that disappear as soon as a pedestrian turns the corner.

How could you incorporate these concepts into your lessons?