Forces that Affect Atmospheric Motion

Pressure gradient force moves air from High Pressure→Low Pressure.

Coriolis Force deflects moving objects to the left in the southern hemisphere and to the right in the northern hemisphere. This causes the characteristic pattern of rotation around pressure cells.

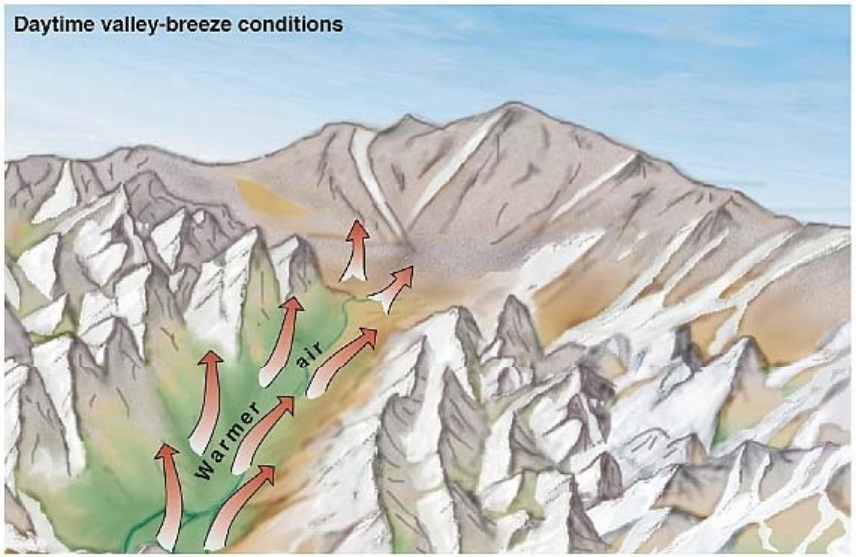
Gravity causes cold air to drain down slope and pool in the bottom of valleys.

Friction with surface objects modifies direction and reduces speed. This is especially important in mountains and downtown urban canyons.

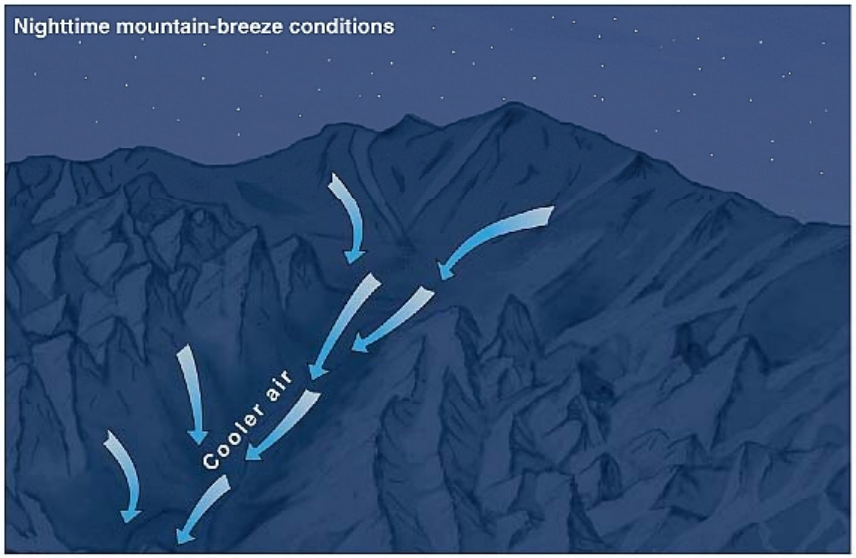
Cold Air Drainage

As the Ground Cools, the Air Also Cools, Flows Downhill and Pools in the Valleys

Cold Air Drainage in Mountains at Night



Valley–Mountain

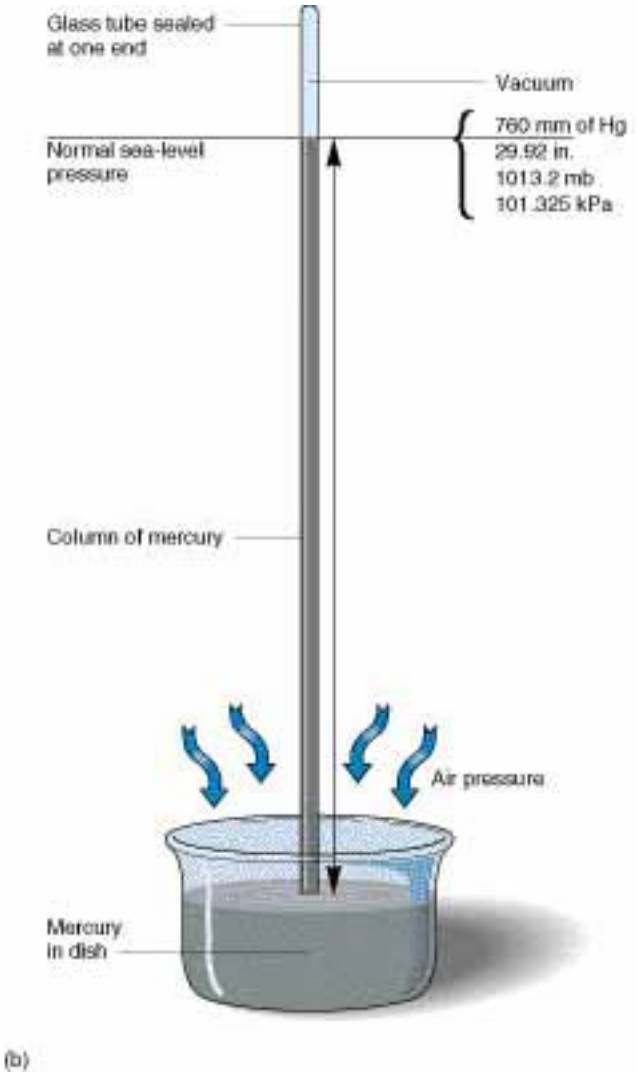


Mountain–Valley

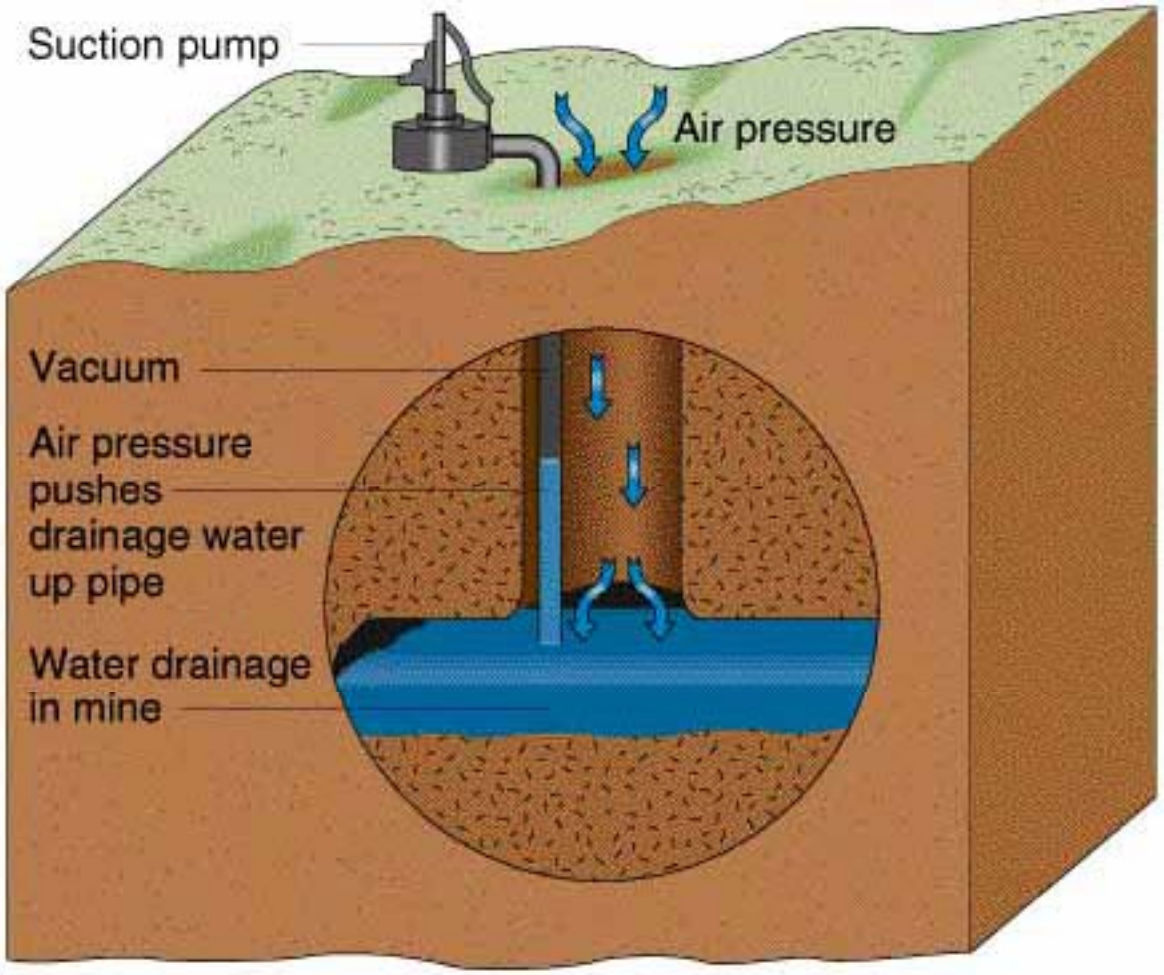
Effect of Friction on Winds in Mountains and Rugged Terrain

Downtown Skyscrapers and Urban Canyons Show Effect of Friction on Winds

The Atmosphere Exerts Pressure on the Surface

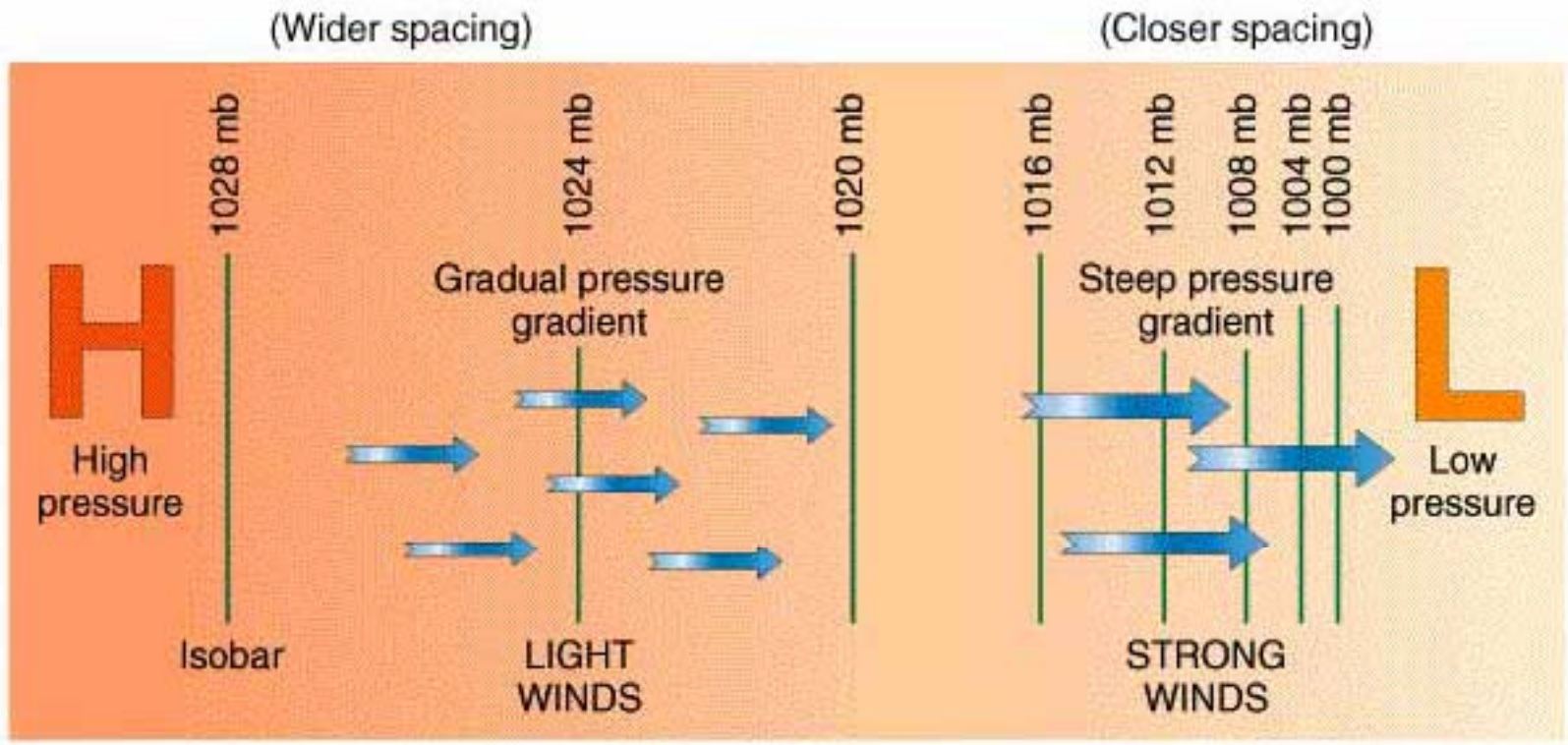


Atmospheric Pressure Forces Water Upward in a Pump



(a)

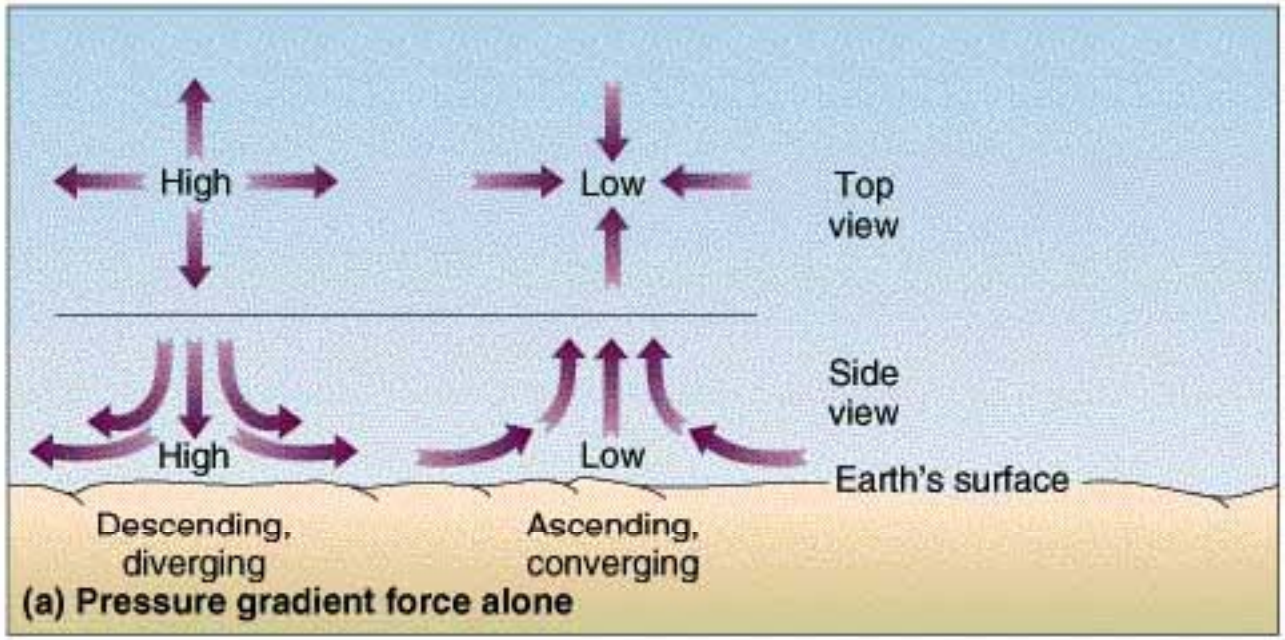
Air Moves from High Pressure toward Low Pressure. The Pressure Gradient Force Is the Most Important Force Affecting Atmospheric Motion.



Air Moves Vertically in Pressure Cells

Upward in a Low and Downward in a High

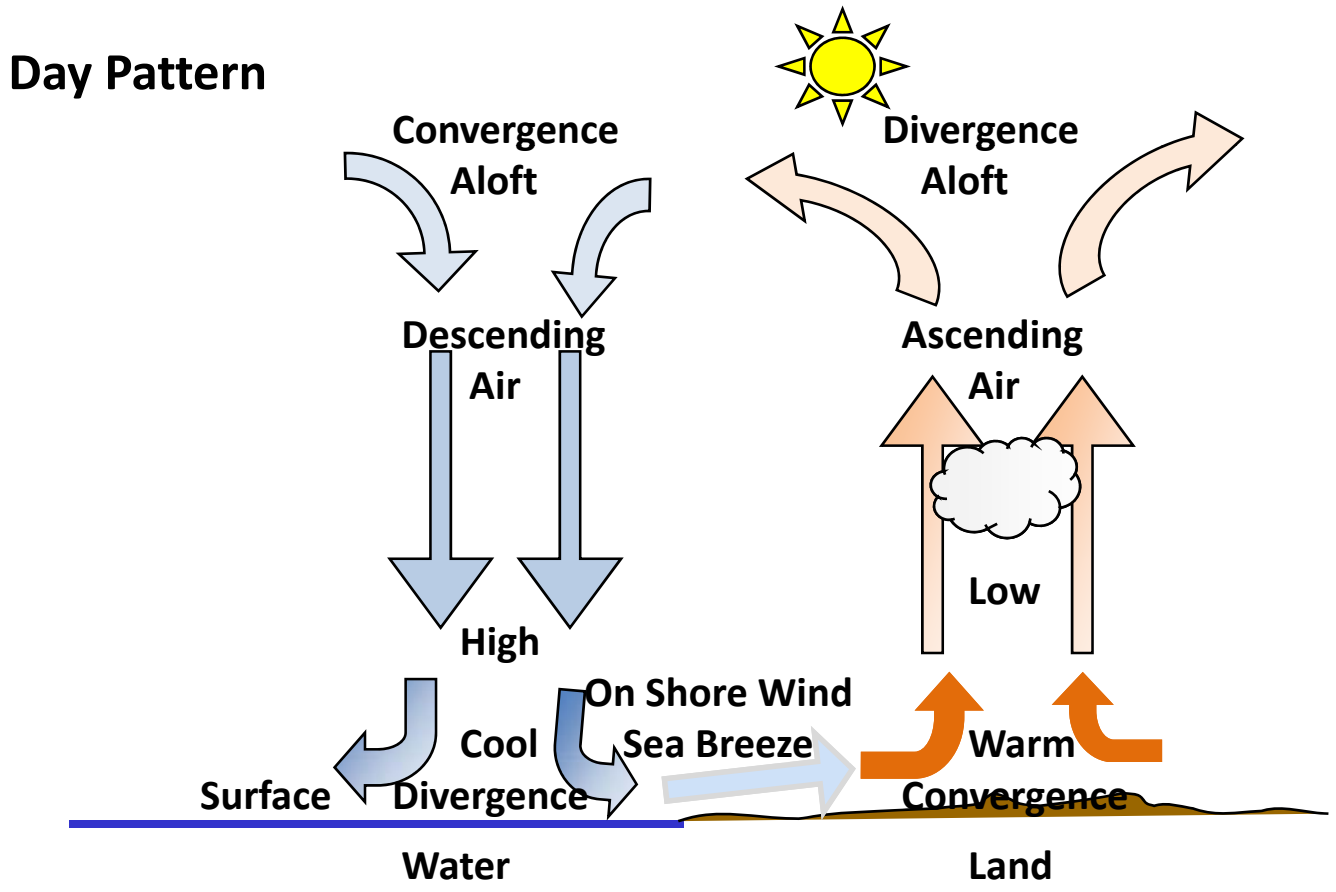
Top view and side view of air movement in an idealized high-pressure area and low-pressure area on a nonrotating Earth.



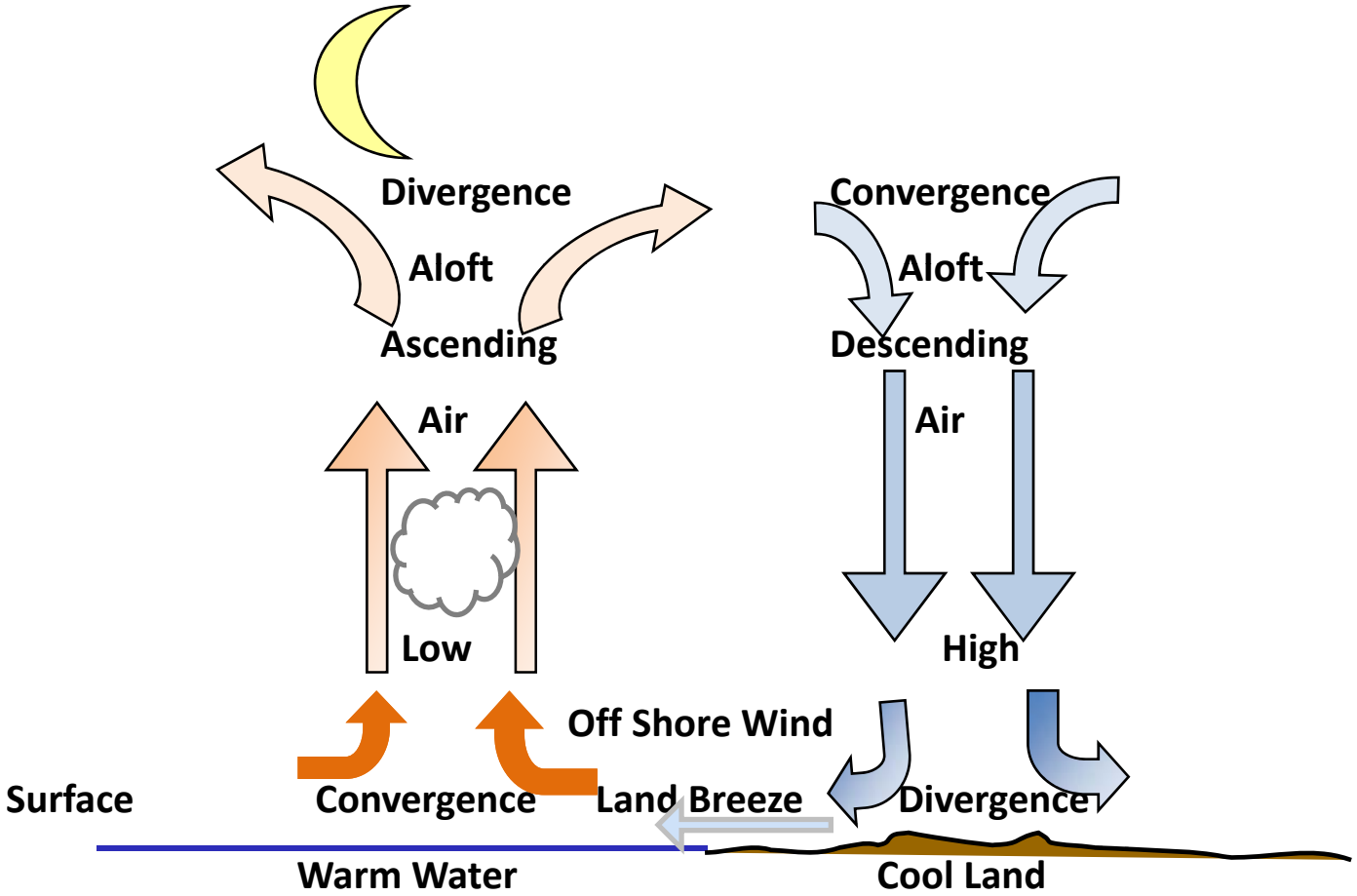
The Simple Thermal Circulation Cell

The Land and Sea Breeze is the best example. It develops due to differential heating when the earth's surface is composed of two materials with different thermal characteristics. The best example is the thermal contrast between land and water.

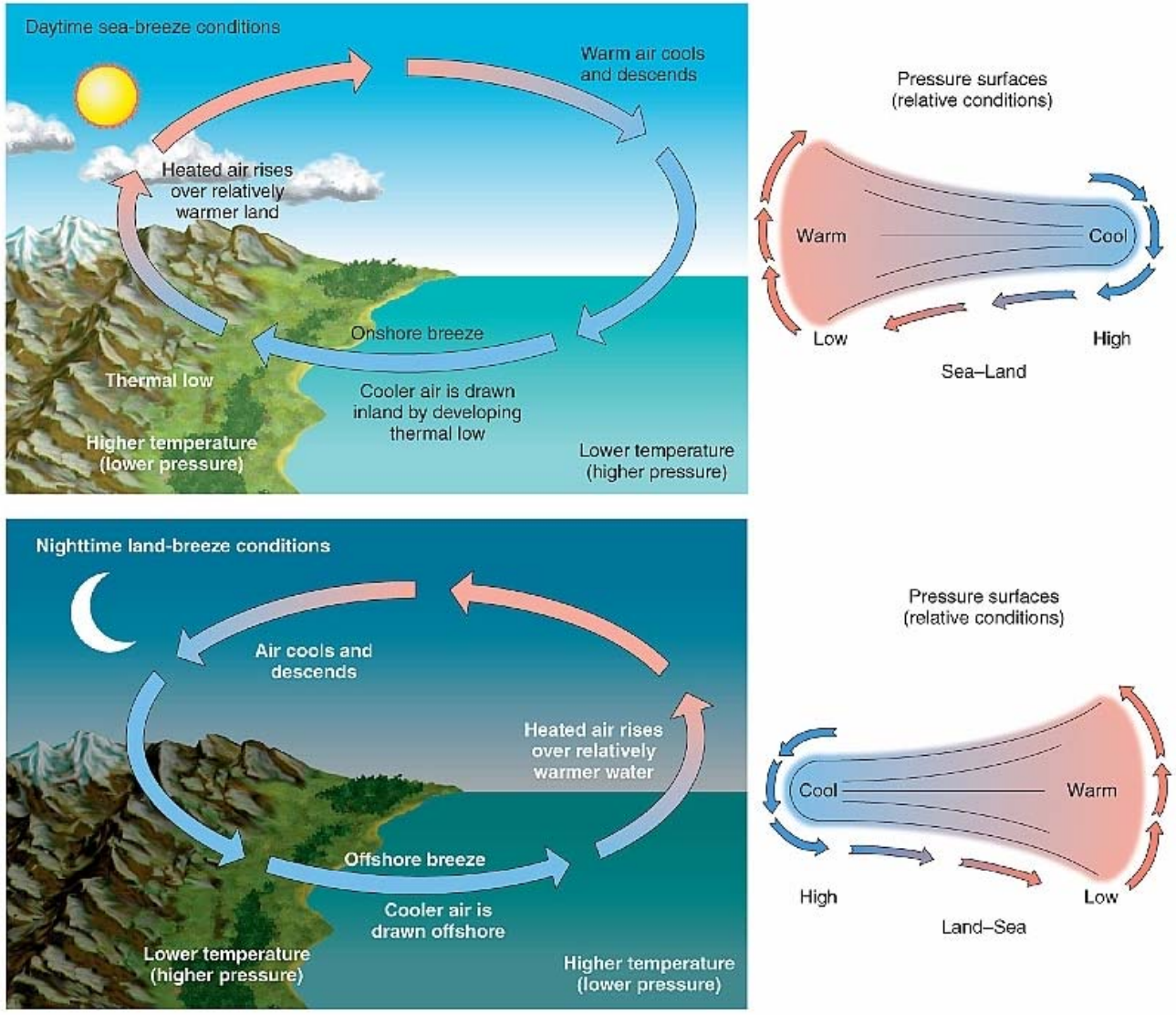
Day Pattern of Land and Sea Breeze



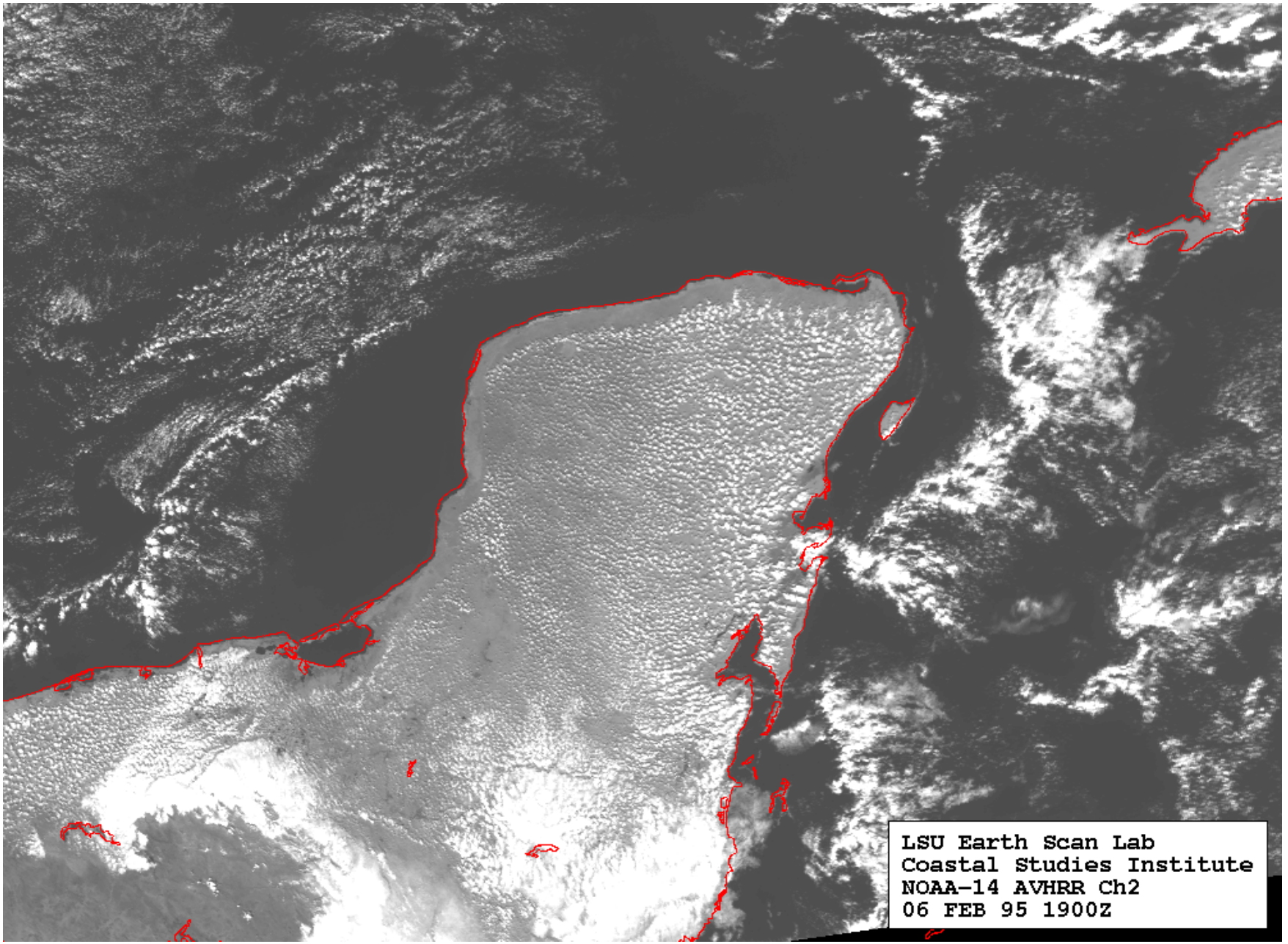
Night Pattern of Land and Sea Breeze



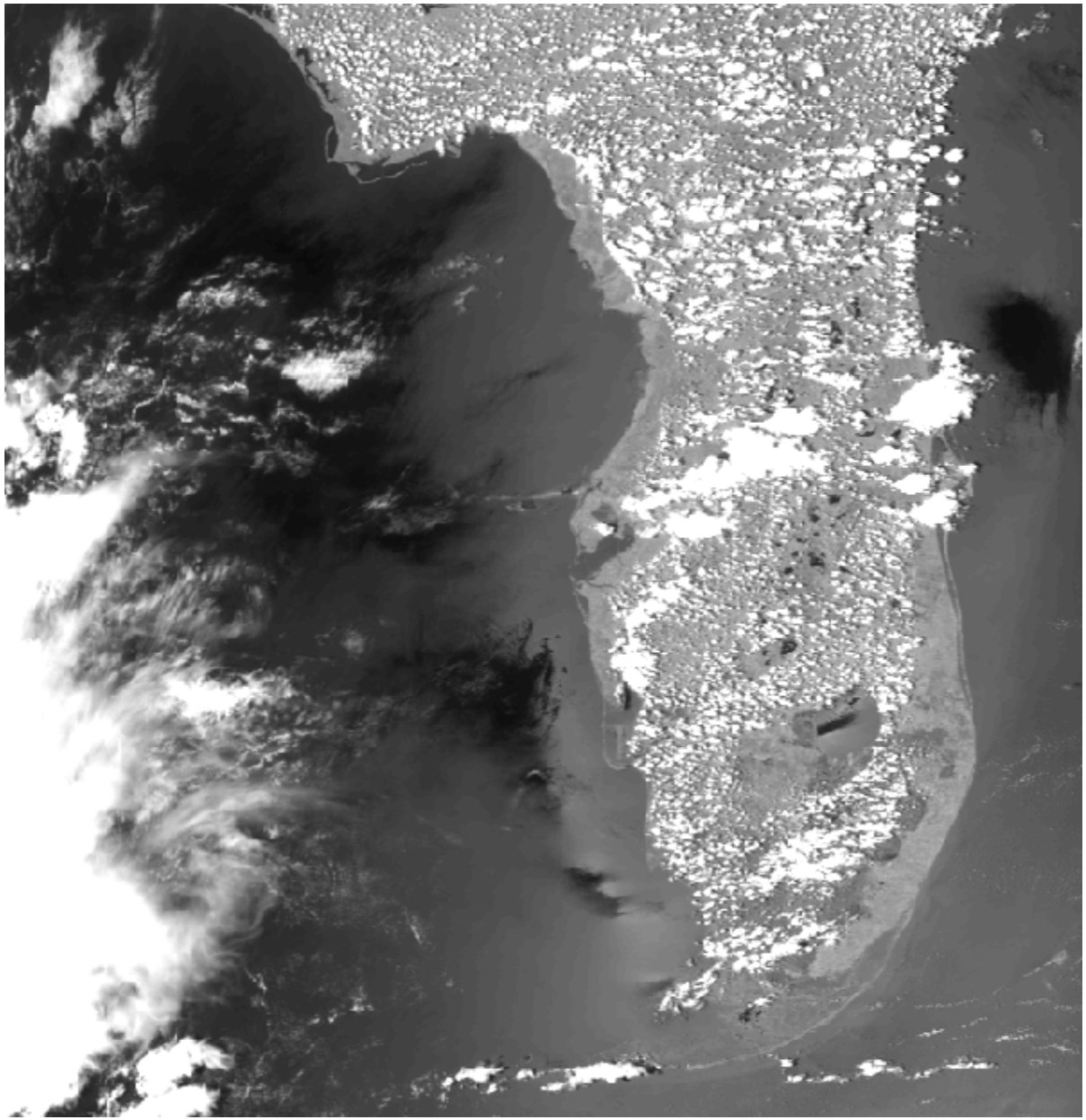
Another Illustration of Land and Sea Breeze



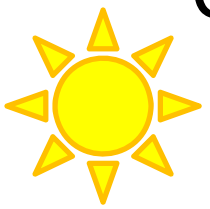
Clouds Following the Coast Line Indicates Land and Sea Breeze Effect

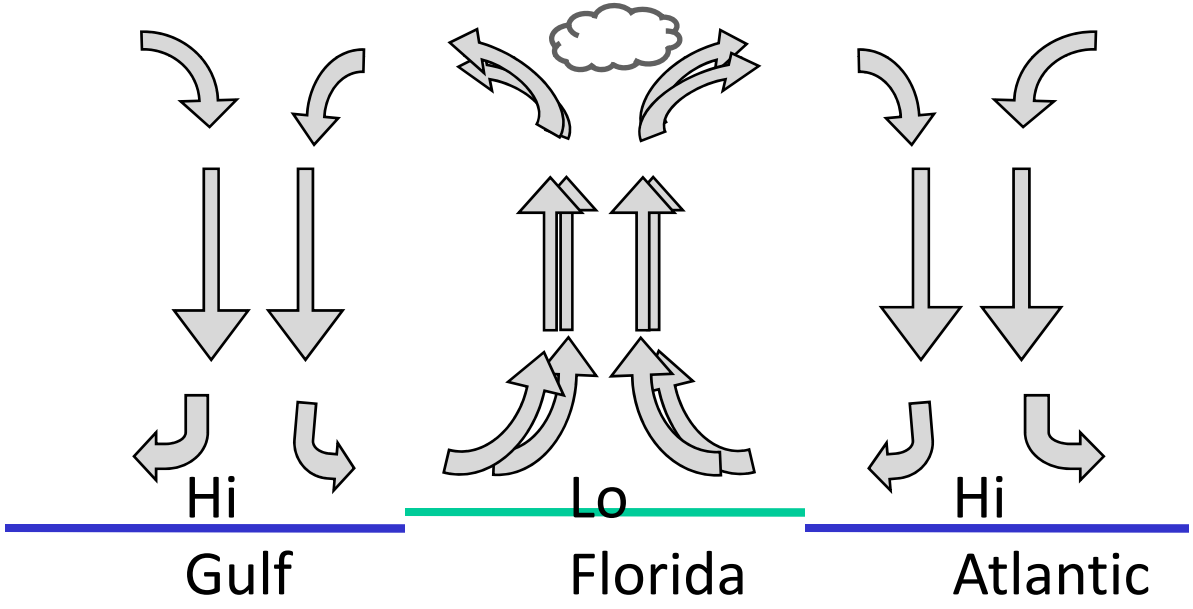


Clouds Following the Coast Line Indicates Land and Sea Breeze Effect along Coast of Florida



Florida Develops a Double-barreled Circulation During the Day

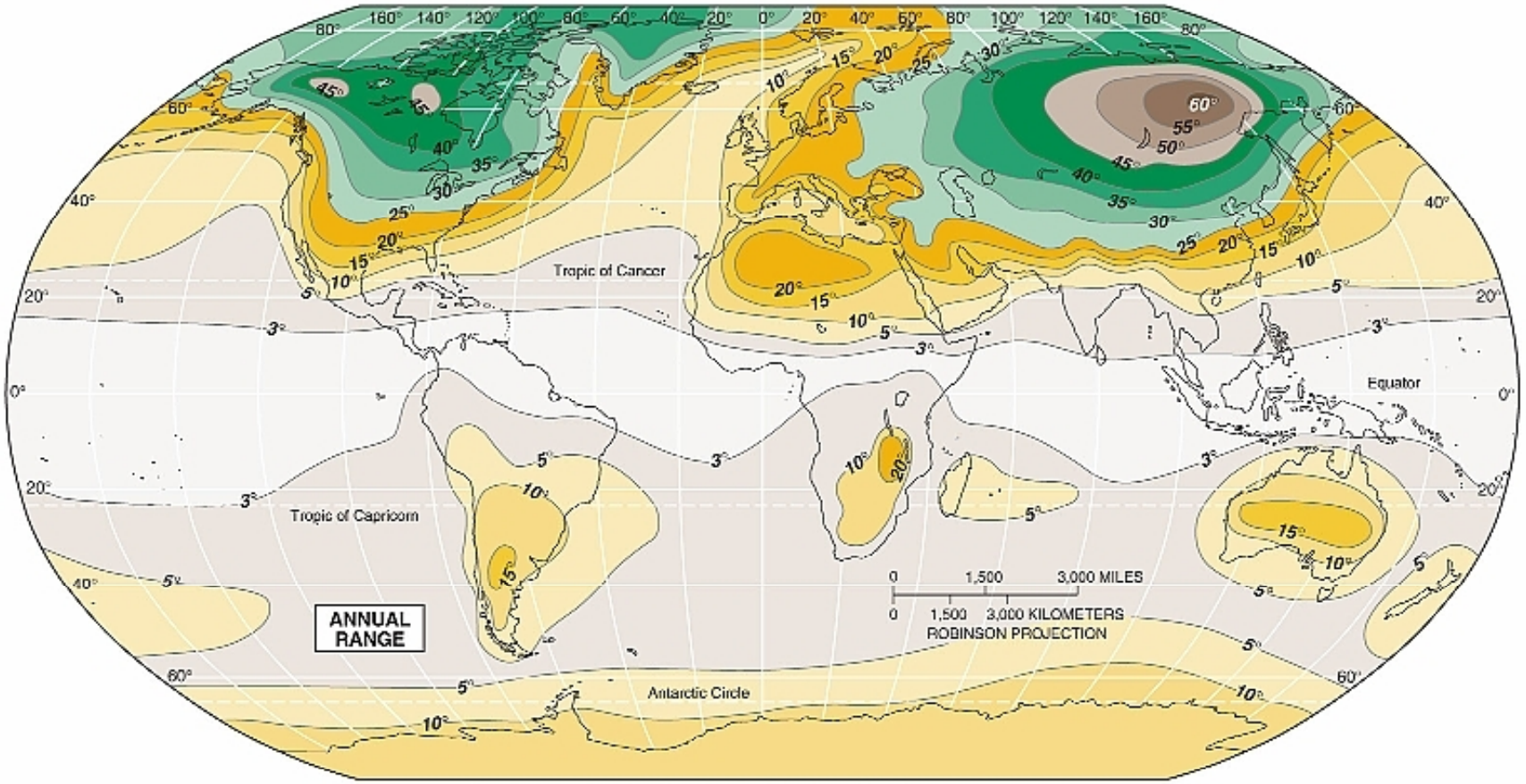




Annual Temperature Range in °C.

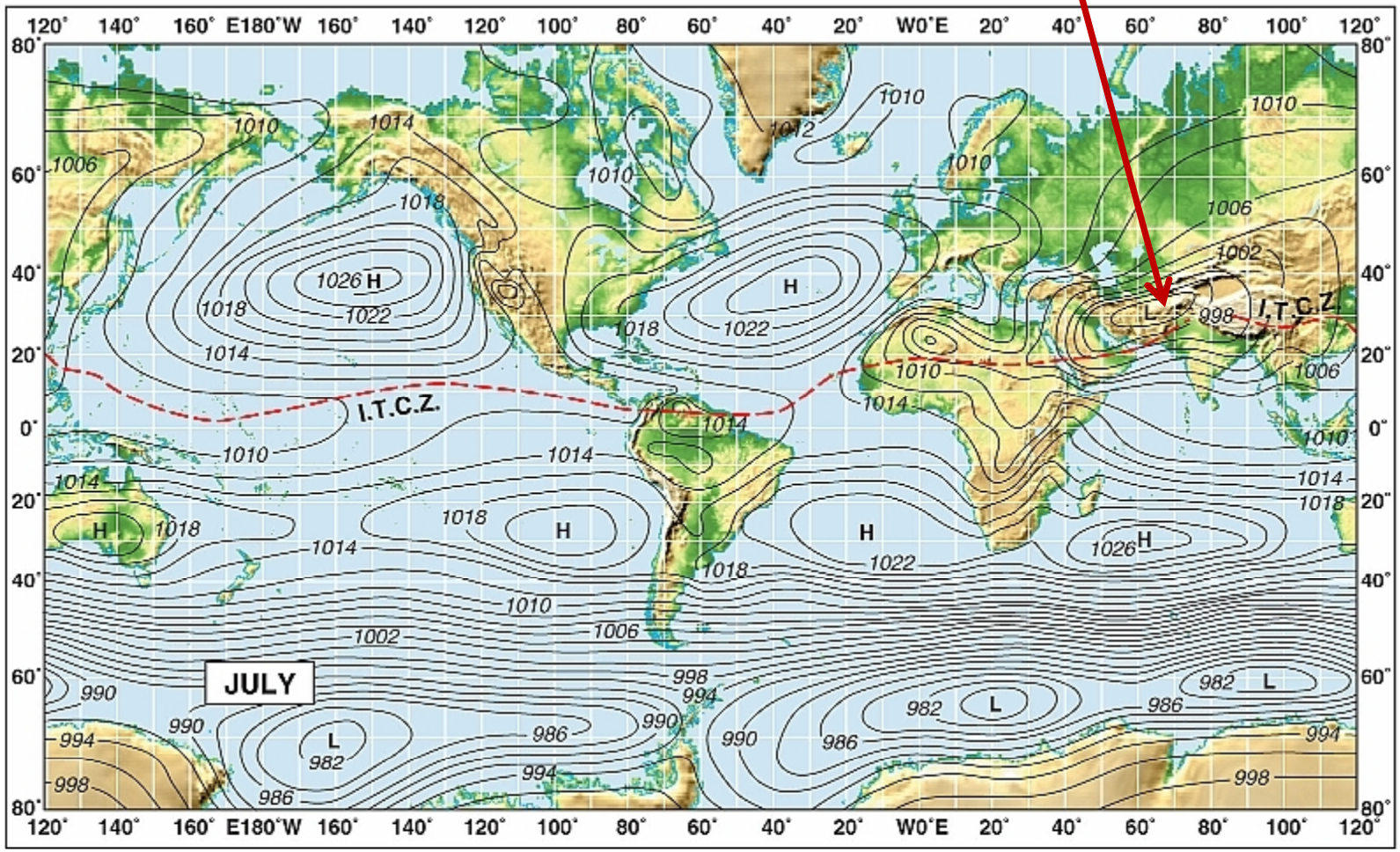
The Atmosphere Has to Respond to Such Large Temperature Changes over So Much Land.

Extreme Annual Temperature Range is called Continentality



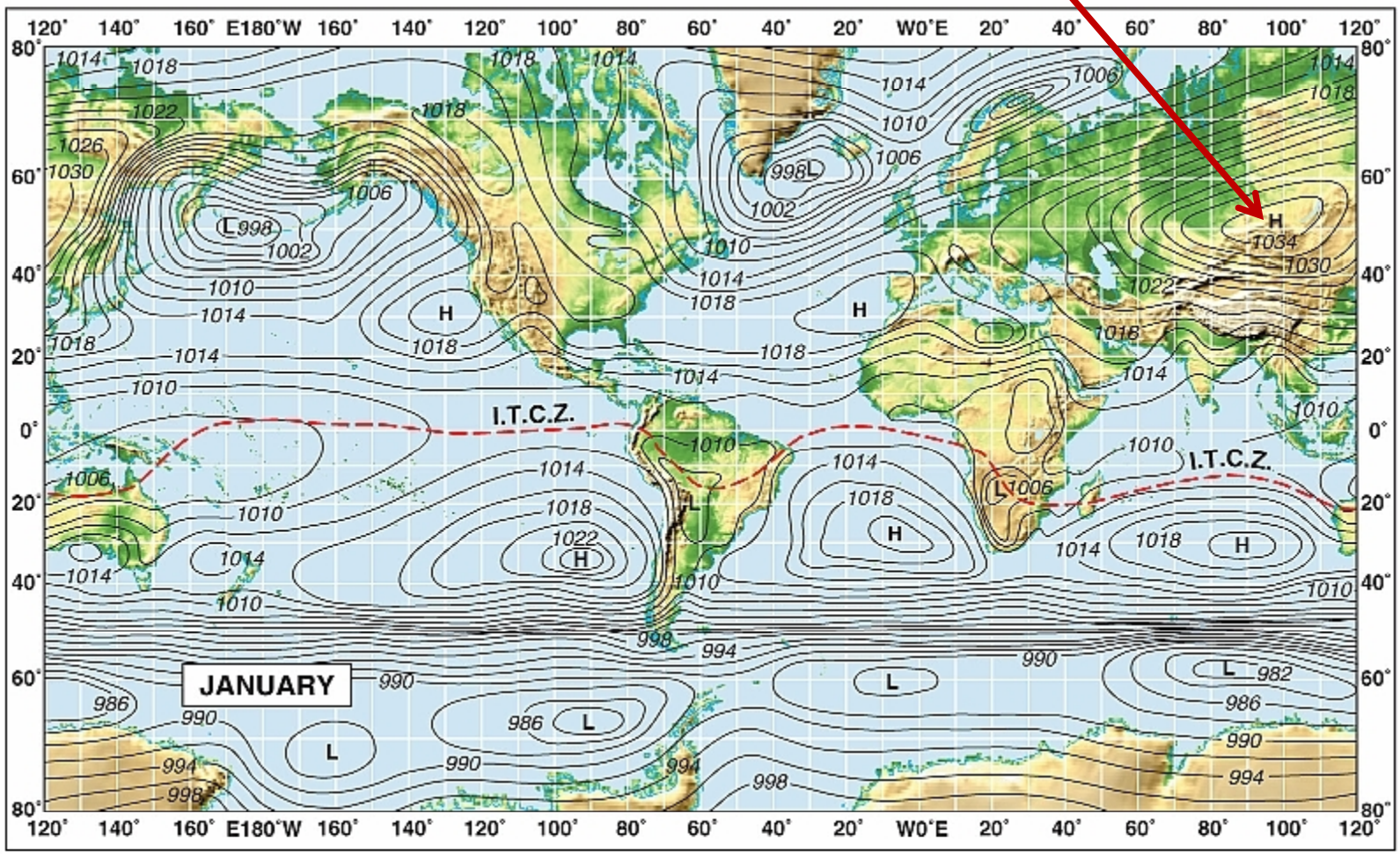
F°	5	9	18	27	36	45	54	63	72	81	90	99	108	F°
C°	3	5	10	15	20	25	30	35	40	45	50	55	60	C°

Strong Low Pressure Develops over Southern Asia in Summer



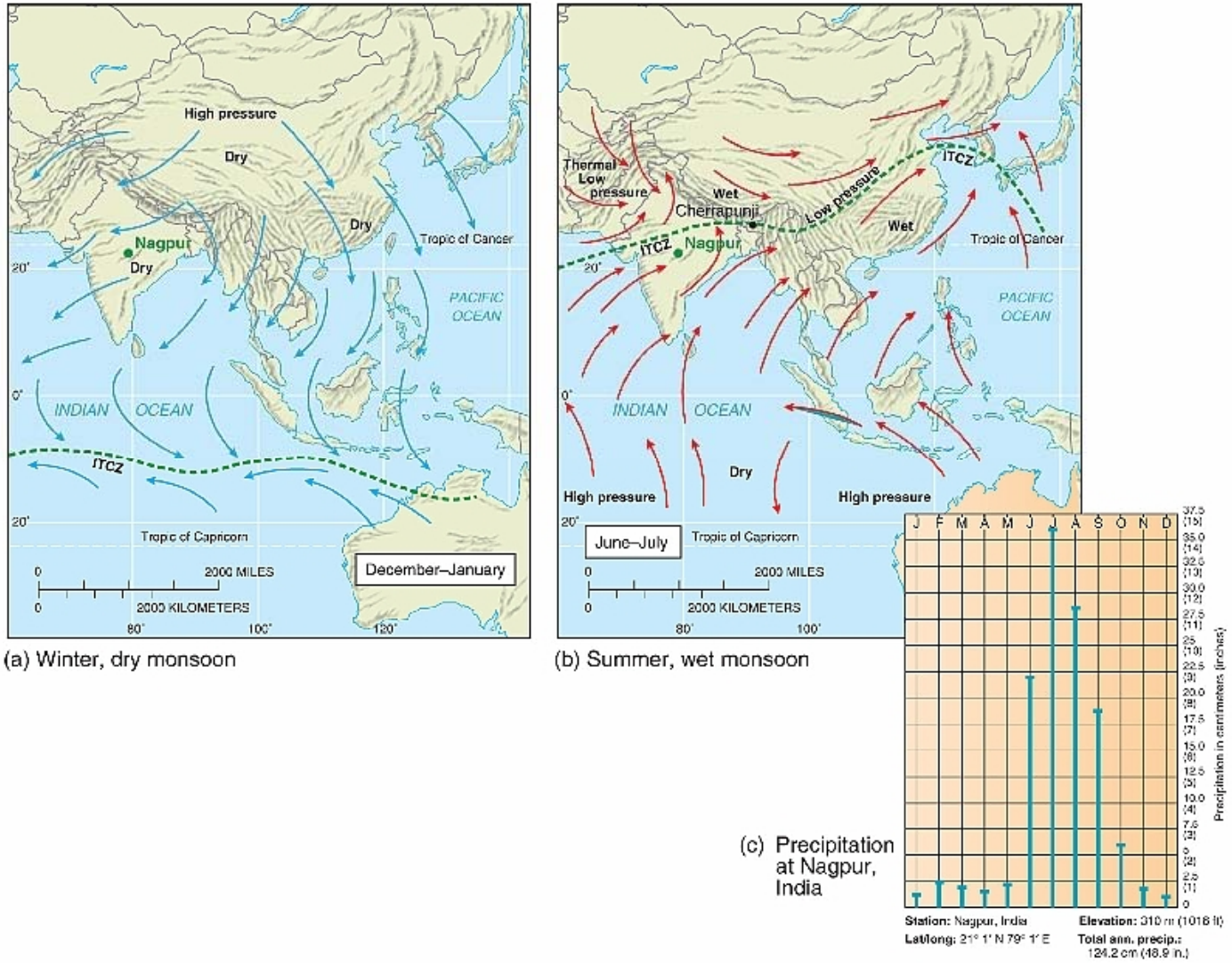
(b)

Strong High Pressure Develops over Asia in Winter

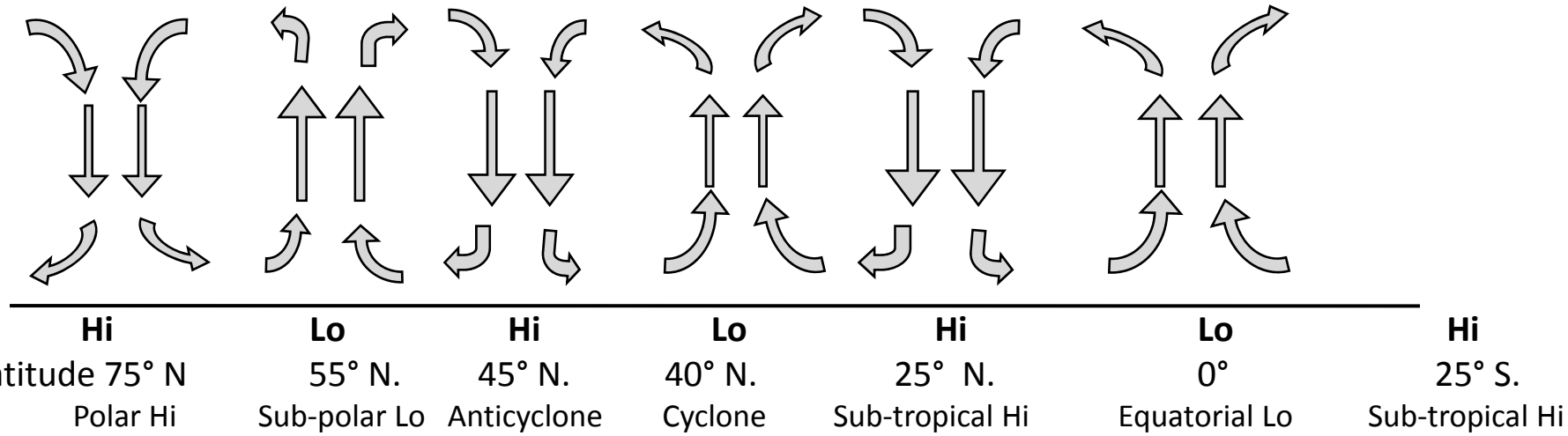


(a)

The Massive Shift in Pressure over Asia from Summer to Winter Drives the Monsoon Cycle and Causes Wind Direction to Shift 180° from Summer to Winter

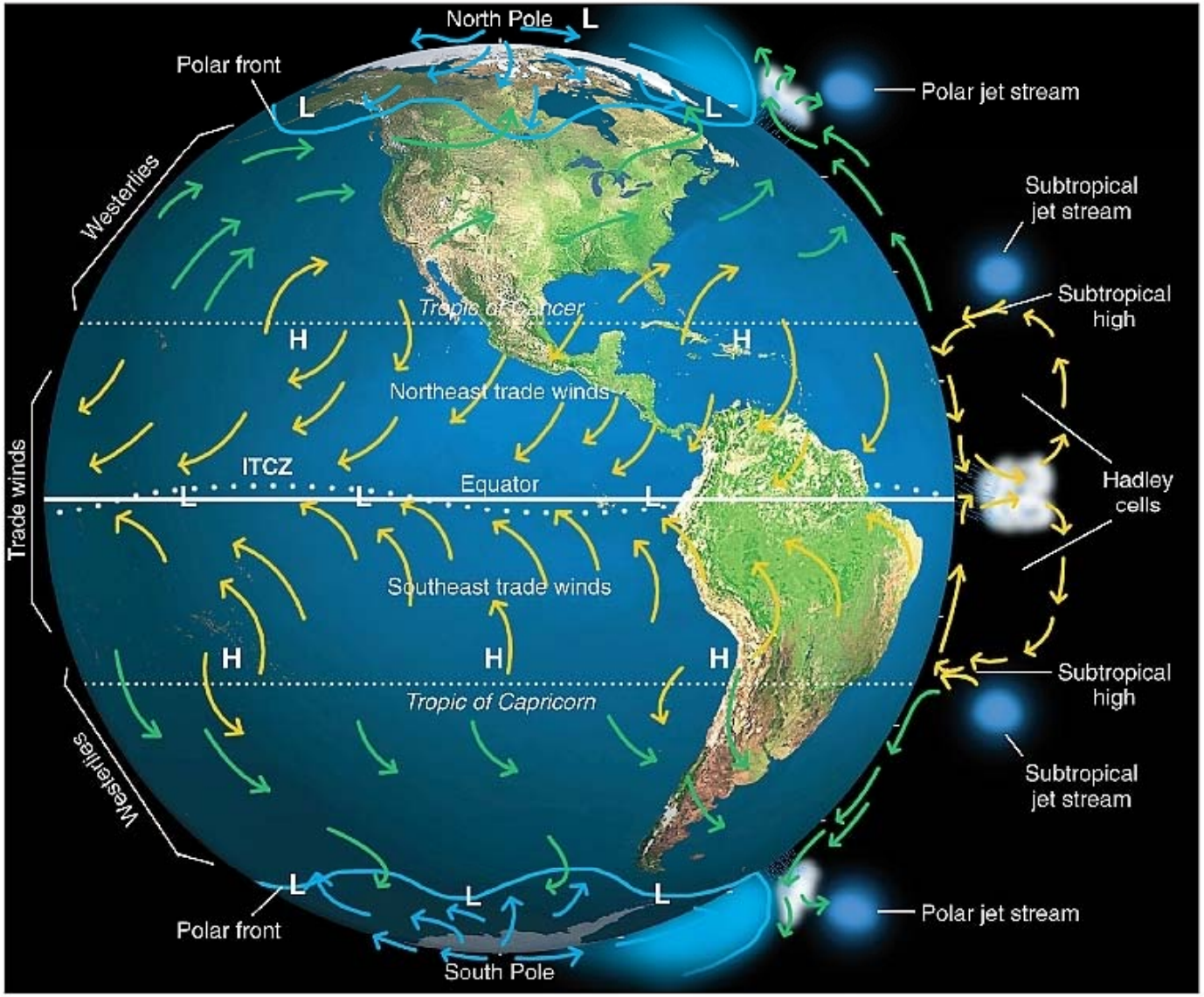


The Circulation of the Earth's Atmosphere is Organized as Chains of High and Low Pressure Cells



This diagram shows the chain of pressure cells extending from the Arctic to the Equator. A similar pattern occurs in the Southern Hemisphere

Global Pattern of Pressure Cells and Winds



(a)

Side View of Atmospheric Circulation in Northern or Southern Hemisphere