

Single-Cell Model

- In 1735, British physicist George Hadley proposed a ‘single-cell model’ to describe the general flow pattern of the atmosphere.
- His model assumed the following:
 - Planet covered by water
 - A fixed Sun that remains overhead at the Equator
- Hadley theorized that warm air at the Equator expanded into the upper atmosphere, moved toward both poles, sank back to Earth and returned to the Equator.

Three-Cell Model

- The Three-Cell Model divides the circulation of both hemispheres into three cells.
 - Hadley Cell
 - Heat-driven
 - Circulates air between the tropics and subtropics.
 - Ferrel Cell
 - Middle-latitudes
 - Polar Cell
- Hadley Cell
 - At the Equator, heating causes air to move vertically and diverge toward the poles.
 - This creates an area of low pressure known as the Intertropical Convergence Zone (ITCZ).
 - As a result of the upward motions, heavy convective showers and thunderstorms are often found in this region.
 - This region is also known as the ‘doldrums’.
 - After reaching between 20° and 30° latitude, the air in the Hadley cell sinks toward Earth to form the subtropical highs.
 - As a result, there is a lack of cloud formation and deserts are observed in this region.
 - This region is known as the ‘horse latitudes’.
 - In the Northern Hemisphere, the pressure gradient force directs the wind to move from the subtropical highs toward the ITCZ.
 - The Coriolis Force directs the air to the right to form the ‘northeast trade winds’ (or the northeast trades).
 - In the Southern Hemisphere, these are known as the ‘southeast trade winds’.
- Ferrel Cells

- Moves air between the subtropical highs and the subpolar lows.
 - In the Northern Hemisphere, air moving from the subtropical highs to the subpolar lows is deflected toward the right.
 - This creates the westerlies.
 - The westerlies represent the storm track that affects our weather.
- Polar Cells
 - Air is transported from the polar highs to the subpolar lows.
 - As a result of the Coriolis Force, this creates the polar easterlies.

Semipermanent Pressure Cells

- There are several semipermanent cells of high and low pressure on Earth.
- During the Northern Hemisphere winter there are the:
 - Aleutian Low [Pacific Ocean]
 - Icelandic Low [Atlantic Ocean]
 - Siberian High [Central Asia]
- During the Northern Hemisphere summer there are the:
 - Hawaiian High [Pacific Ocean]
 - Azores High [Atlantic Ocean]
 - Tibetan Low [Southwest Asia]

Ocean Currents

- Ocean currents are horizontal movements of surface water that are mainly found at the edge of major oceanic basins.
 - Driven by the *winds* in the lower atmosphere.
 - Oceanic currents resemble the global wind pattern.
- In the North Atlantic Ocean, the North Equatorial Current turns northward to form the Gulf Stream.
 - At 40°N, westerlies force the current to the east towards northern Europe.
 - This makes winters in northern Europe warmer than they otherwise would be.

Monsoons

- A monsoon is defined by the seasonal reversal in surface winds.
 - It is *not* defined as ‘heavy rain’.
- Most evident over southern Asia, especially India.
 - In January:
 - The winds flow southwestward toward the Indian Ocean from the Himalayas.

- The air coming off the mountains is compressed and warmed adiabatically, creating dry conditions.
- In summer:
 - Southern Asia receives strong solar radiation.
 - Air over the land heats up more rapidly than over the water.
 - The warmer air over the land rises and is replaced by onshore winds.
 - This brings warm, moist air from the Indian Ocean.
 - As a result, torrential rains occur.

Chinooks

- A 'chinook' wind are winds that descend the eastern slopes of the Rocky Mountains.
 - The air that descends warms adiabatically.
 - Most common in winter.
 - Known as a 'snow-eater', because of the rapid heating of the air and subsequent melting of the snow.

Santa Ana Winds

- 'Santa Ana winds' are found in California.
 - Found during the autumn.
 - Occur when air flowing from high pressure over the Rockies descends the western slopes and warms adiabatically.
 - Aids in the spread of wildfires in California.

Sea breezes

- Found in coastal regions (such as Long Island).
- During the daytime, the air over the land, which warms more rapidly than water, rises upward.
 - As a result, the air over the nearby water moves inland to replace the air that has risen upward over the land.
 - This is known as the 'sea breeze', which produces a sudden drop in temperatures as it moves inland.

Helpful Links:

<http://www.ux1.eiu.edu/~cfjps/1400/circulation.html>

http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm?chapter_no=visualization