

# Topic 8 – Climate and Water

## Vocabulary

**Capillarity** – when water is drawn into openings due to attractive force between water and the particles.

**Ground water** – subsurface water found beneath the earth surface.

**Hydrologic cycle** – the water cycle; the method that water is recycled on Earth.

**Infiltrate** – water flows into soil and bedrock from the surface, greatest when the soil is dry.

**Permeability** – the amount of water that is allowed to infiltrate the ground between pore spaces, often measured in centimeters per hour (cm/hr).

**Porosity** – the percentage of pore space in a volume of soil.

**Prevailing winds** – the direction that wind comes from most of the time. North America is in a southwest prevailing wind called the prevailing westerlies.

**Runoff** – surface water that flows on the surface to a body of water.

**Sorted** – sediment (particles) arranged by size either by wind or water.

**Stream discharge** – the volume of water that flows in a given amount of time, example cubic meters per sec ( $m^3/sec$ ).

**Unsorted** – particles arranged in a random order.

**Water cycle** – hydrologic cycle.

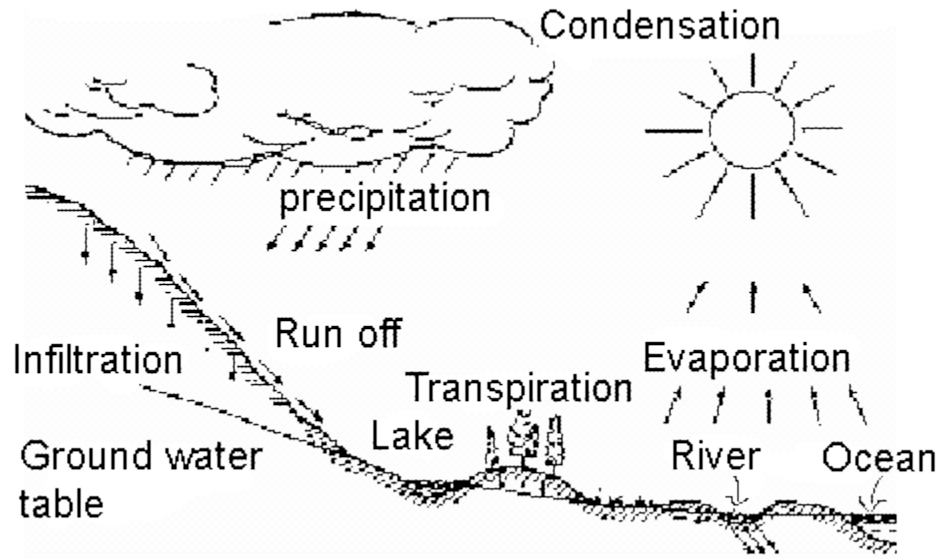
**Water retention** – amount of water that would be left in a volume of sediment or bedrock after liquid water has been removed.

**Water table** – interface of the saturated layer (liquid) to the unsaturated layer in the ground.

## Overview of Topic

### I. Water Cycle

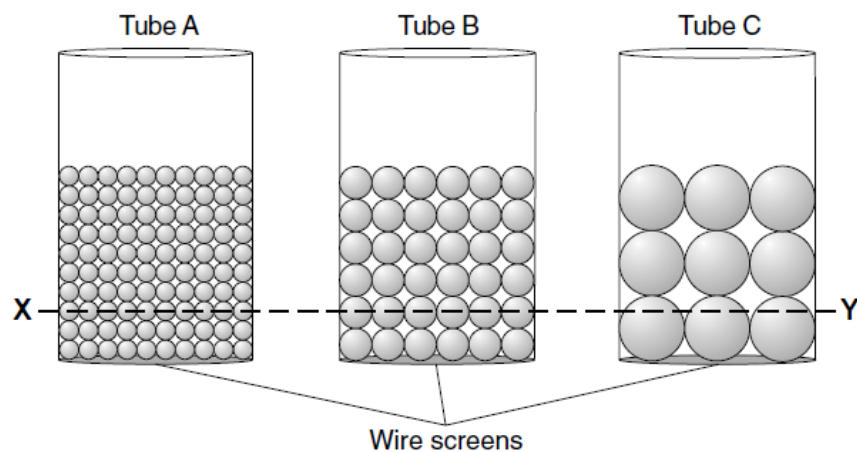
- Students should know by now most of the water cycle. Infiltration, runoff and discharge are illustrated here as they are new terms.
- a. Water is recycled in the atmosphere and on the surface.
  - The sun is the driving force behind the water cycle.



### b. What Affects Infiltration

- Slope of land
  - Greater slope less infiltration
  - Low slope more infiltration
- Saturation of ground
  - High saturation less infiltration
  - Low saturation more infiltration
- Porosity
  - High porosity more infiltration
  - Low porosity less infiltration
- Permeability
  - High permeability high infiltration
  - Low permeability low infiltration
- Capillarity
  - Greater capillarity greater infiltration
  - Low capillarity less infiltration
- Vegetation

- Higher vegetation low infiltration
- Low vegetation higher infiltration
- Land use
  - Infiltration varies on the type of land use
  - Impermeable surfaces: no infiltration or very little
    - Concrete
    - Asphalt
    - Very dry clay
  - More permeable; infiltration increases
    - Vegetation
    - Farm field
    - Very sandy soils



Tube A represents a soil that has a low permeability such as a clay rich soil.

- High runoff
- Standing water in rain due to low infiltration
- High capillarity

Tube B represents a soil with a moderate permeability.

- Low runoff
- Standing water if there is more precipitation than infiltration
- Low capillarity

Tube C represents a soil with a very high permeability.

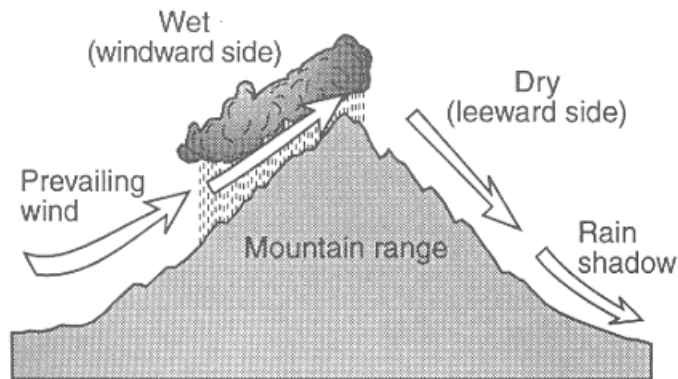
- Almost no runoff
- No standing water
- Very low capillarity

- c. What affect run off and stream discharge
  - Amount of precipitation
    - Increased potential for runoff
    - Increased water to streams and rivers
  - Saturation
    - Increased saturation increased runoff and discharge
  - Slope
    - Increase slope increase runoff and discharge
  - Evaporation
    - Increased evaporation decrease runoff and discharge
  - Flooding
    - Increase flooding increase discharge
  - Vegetation
    - Increased vegetation decreased runoff

## II. Climate

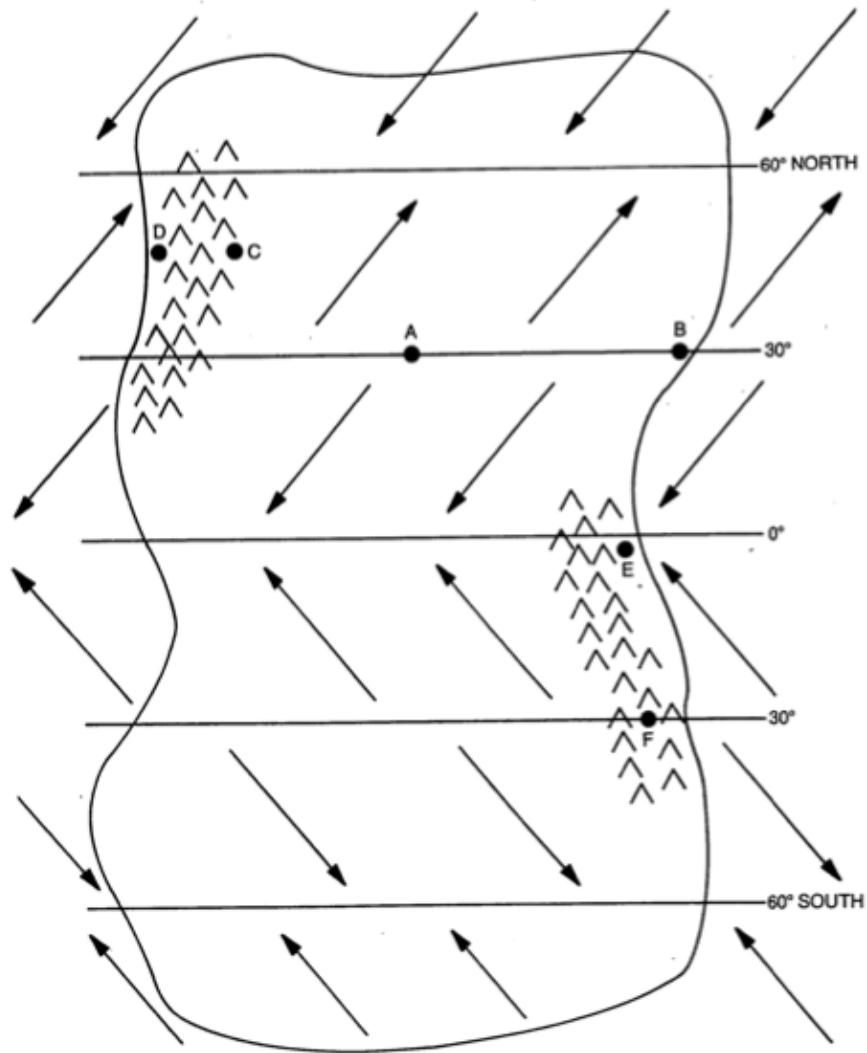
- Climate is long term weather patterns, usually 30 years that affect the amount of moisture and temperature in a region.
- a. Temperature and Moisture
  - Arid - A climate that lacks precipitation
  - Semi-arid – A climate that has some precipitation
  - Humid – A climate that has a lot of precipitation
  - Sub humid – A climate that has some precipitation
- b. Factors affecting the Climate (bold influence the most)
  - **Latitude** – Further from the equator the cooler temperatures become.
  - **Large bodies of water** – Large bodies of water moderate temperatures, in summer land next to water is cooler and in winter it is warmer. This is why we have thunderstorms in early winter and lake effect snow.
  - **Prevailing winds** – (page 14 ESRT) Prevailing winds most air masses from one location on Earth to another location. NYS is located in the south westerly wind belt and air from the Gulf of Mexico is moved to the costal US.
  - **Surface ocean currents** – (page 4 ESRT) Ocean currents on the east coast of continents are generally warm and on the west coast they are generally cooler. England and Iceland have very mild winter, even though they are located more north in latitude. England often has rainy winters compared to the same latitude in the United States.

- **Elevation** – The higher the elevation the cooler it is. There are glaciers (ice) located on mountain tops on the equator. Mount Kilimanjaro in Tanzania has a glacier. Mount Kilimanjaro is located 3° S latitude.
- **Mountain ranges** – Mountain ranges have a rainy side (windward) and a dry side (leeward). The prevailing winds always blow towards the windward side where is cooler and moist, whereas the leeward side is warmer and dry. The diagram below illustrates the windward and leeward side of a mountain.



- **Vegetation** – Vegetation, especially trees provide moisture to the atmosphere through transpiration. Tropical areas near the equator the trees have leaves year round providing moisture year round. Areas such as western NY have trees ½ the year providing the most moisture in the summer.
- **Cloud cover** – Clouds keep moisture at the surface increasing humidity. Page 14 of the ESRT show that the equator 0° is located in a moisture belt, many clouds form.

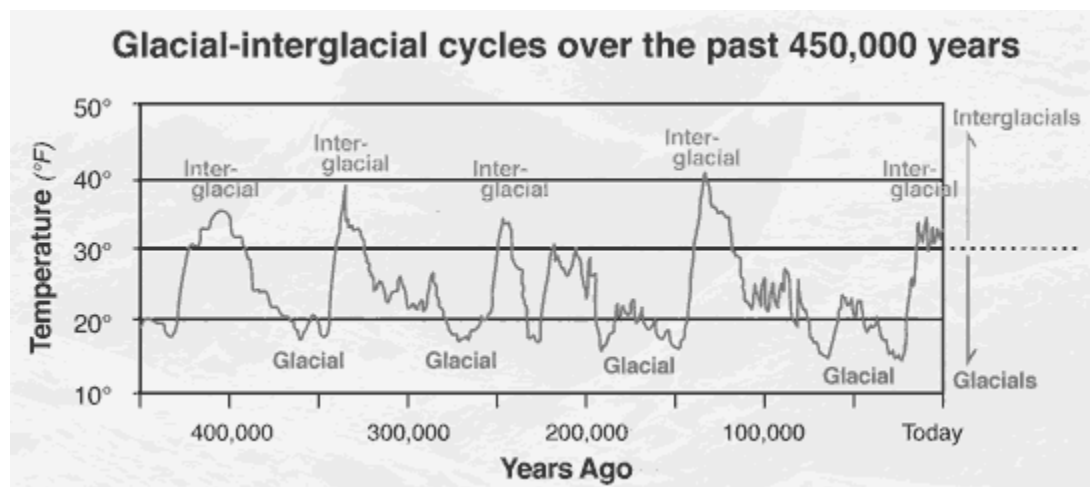
Diagram of Imaginary Continent on Earth



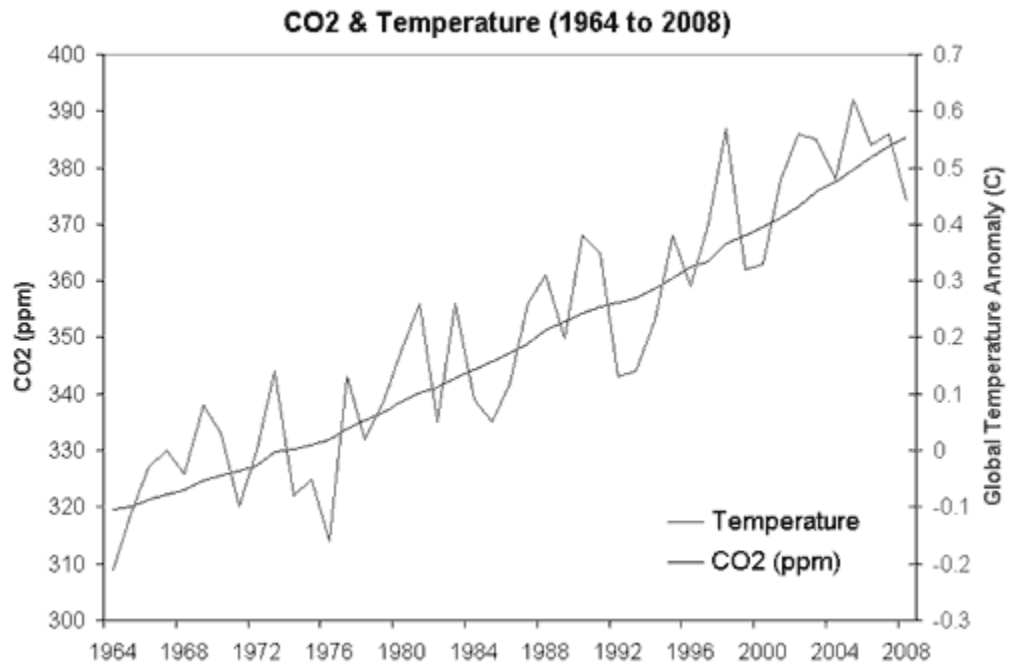
The table discusses the temperature and precipitation on the imaginary continent with the explanation. See page 14 of the ESRT.

Location	Temperature	Precipitation
A	Hot summers and cool winters because it is located in the middle of a continent	Low – Located at the divergence (moving away) wind belt. 30 °N and 30 °S latitude are located in a dry belt.
B	Cooler summers and warmer winter because it is located near a body of water and it also warmer that the west coast because ocean currents are warmer on the east coast.	High – located on a large body of water and a warm ocean current provides moisture to the atmosphere.
C	Warmer than location D. It is on the leeward side.	Dry – located on the leeward side.
D	Cooler than location C it is on the windward side.	Moist – located on the windward side and next to the ocean.
E	Warm – located on the equator and there is a low pressure belt (page 14 ESRT) where air rises and is warmer.	Very moist – Located on the equator next to the ocean and a low pressure center.
F	Cool – in the mountains at a higher elevation, also a high pressure belt (page 14 ESRT) that is cooler.	Dry – High pressure and locations 30 °N and 30 °S are dry locations.

- c. Climate change
- Natural cycle of ice ages and global warming
  - Last ice age 12,000 years ago



- Diagram shows warming (interglacial) and cooling (glacial) periods.
- Carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and water vapor contribute to climate temperature changes.
  - Increasing greenhouse gasses leads to global increased temperature.



The zig zag line represents actual measurements of CO<sub>2</sub> and the smooth line is the temperature. Carbon dioxide from burning of fossil fuels adds more carbon dioxide to the atmosphere.

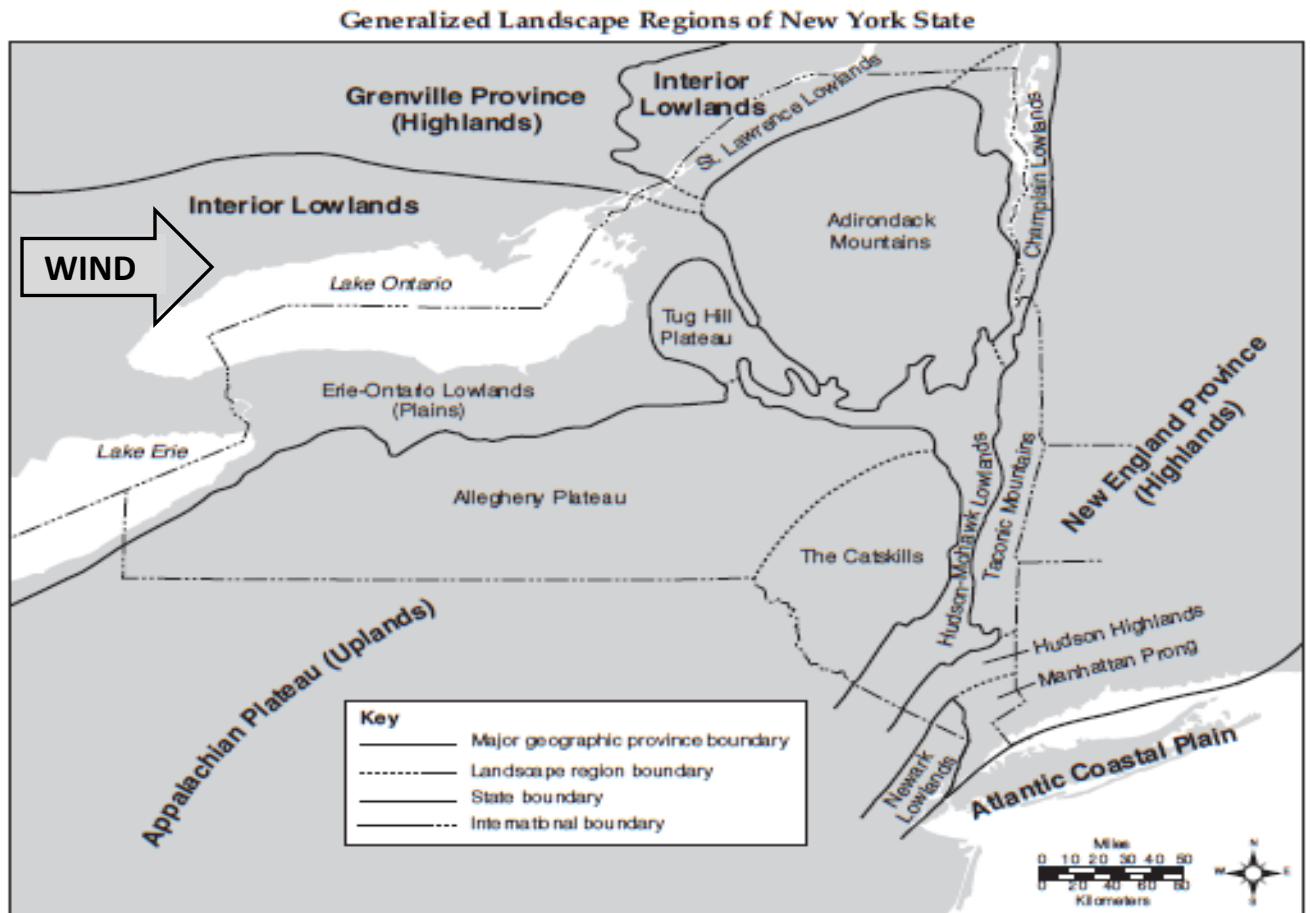


## Earth Science Reference Table – (ESRT)

Pages from ESRT used in Topic 8.

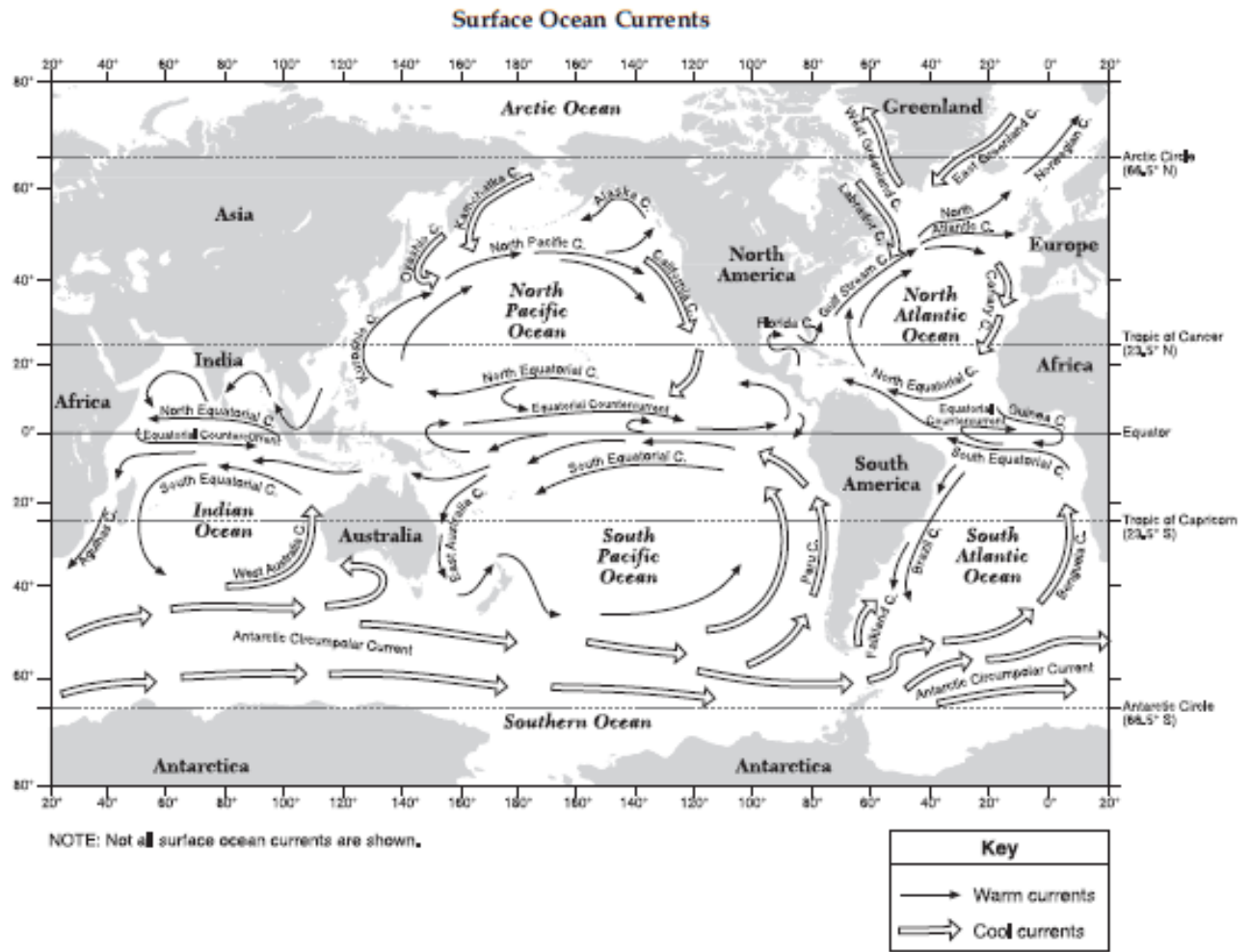
*Page 2, 4 and 14*

*Page 2 – Generalized Landscape Regions of New York State*



This chart is useful for both landscape regions and New York climate factors. Wind blows across NY State from west to east. Lake Ontario and Lake Erie are considered large bodies of water when it comes to climate. The west side of the Adirondack Mountains is the windward and the east side is the leeward.

NOTE – Page 3 can also be used to show latitude in New York State. More northern to colder the temperature.



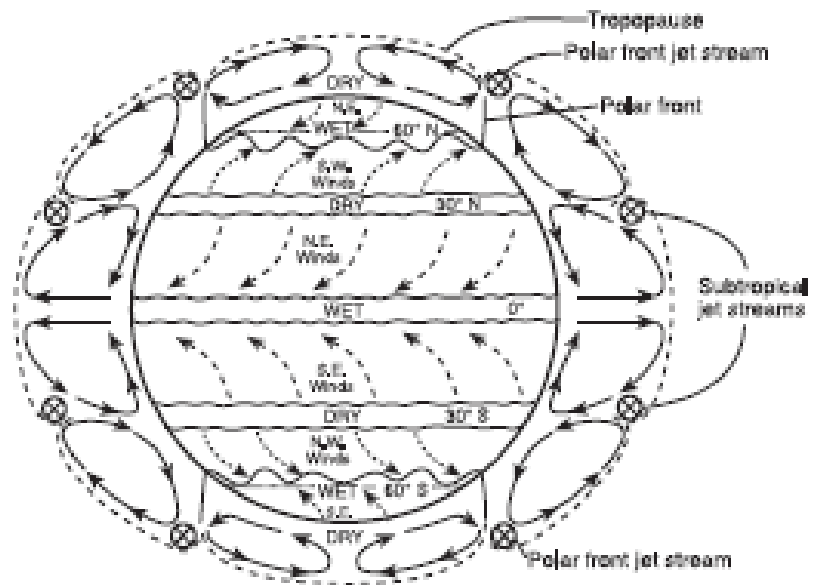
Major ocean currents are represented on the map. Notice how warm ocean currents bring warmer water to places like Iceland, Britain and Norway.

It also shows latitude and the further from the equator the colder the climate will be.

### Planetary Wind and Moisture Belts in the Troposphere

The drawing on the right shows the locations of the belts near the time of an equinox. The locations shift somewhat with the changing latitude of the Sun's vertical ray. In the Northern Hemisphere, the belts shift northward in the summer and southward in the winter.

(Not drawn to scale)



Notice the major latitude and how the air above these zone rises or sinks. Deserts and savannahs of the world are located near 30 °N or S of the equator. Wet zones are near the equator. The curved dotted lines represent how air masses move on earth. These wind belts are relatively permanent. The solid lines with arrows represent patterns of circulation in the troposphere. These patterns of circulation are known as convection cells.