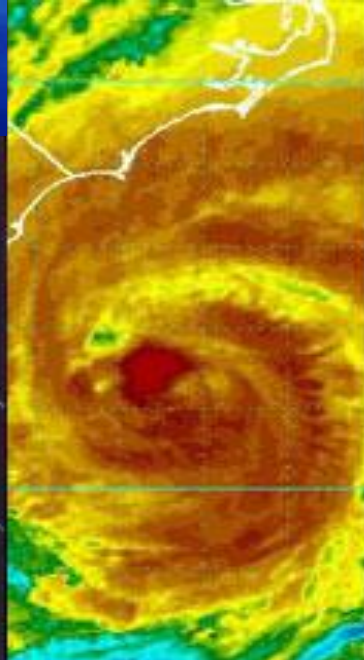
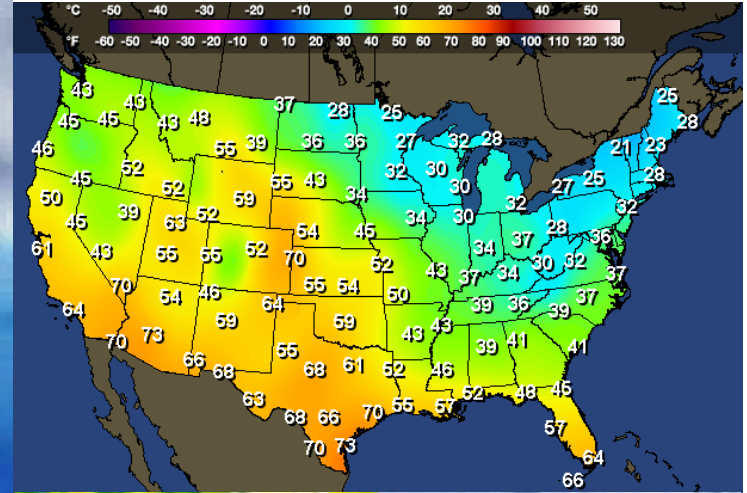


# PART 1

# WEATHER



# What is Weather?

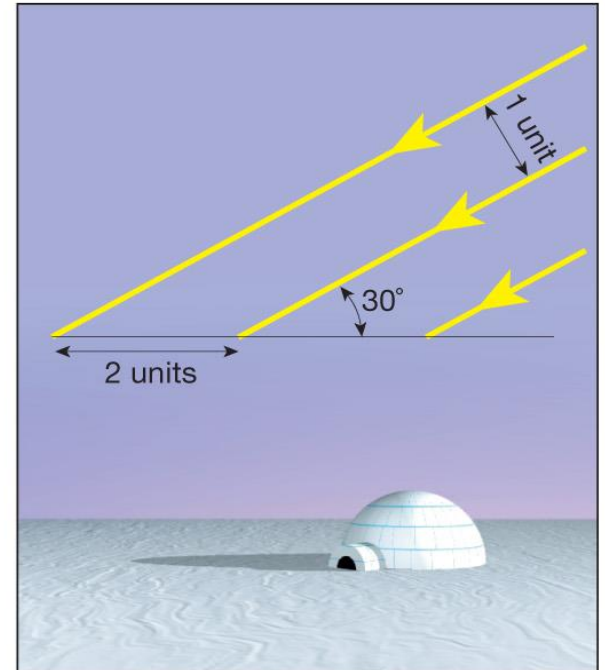
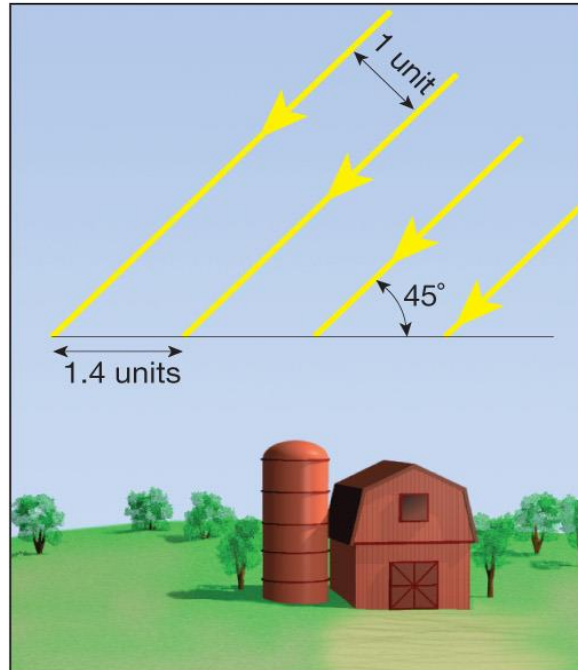
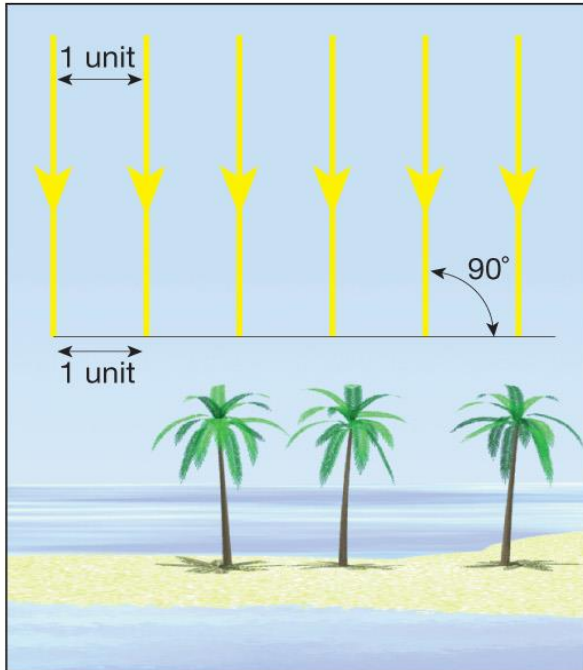
Weather is the **state of the atmosphere**: hot or cold, wet or dry, calm or stormy, clear or cloudy.



- Most weather phenomena occur in the **troposphere**:
  - On Earth, the *common weather phenomena* include wind, clouds, rain, snow, fog and dust storms.
  - *Less common* events include *natural disasters* such as tornadoes, hurricanes, typhoons and ice storms.
- Weather is one of the fundamental processes that shape the Earth through *weathering* and *erosion*.
- Weather is **driven by air pressure differences between one place and another**; in turn, air pressure is defined by **temperature and moisture**.

# Heating of the Atmosphere

The Sun shines more directly **near the equator** bringing these areas **more energy**; the **polar regions** are at shallow angles of sunlight and receive **less energy** (plus they get little or no sunlight at all during the winter!).



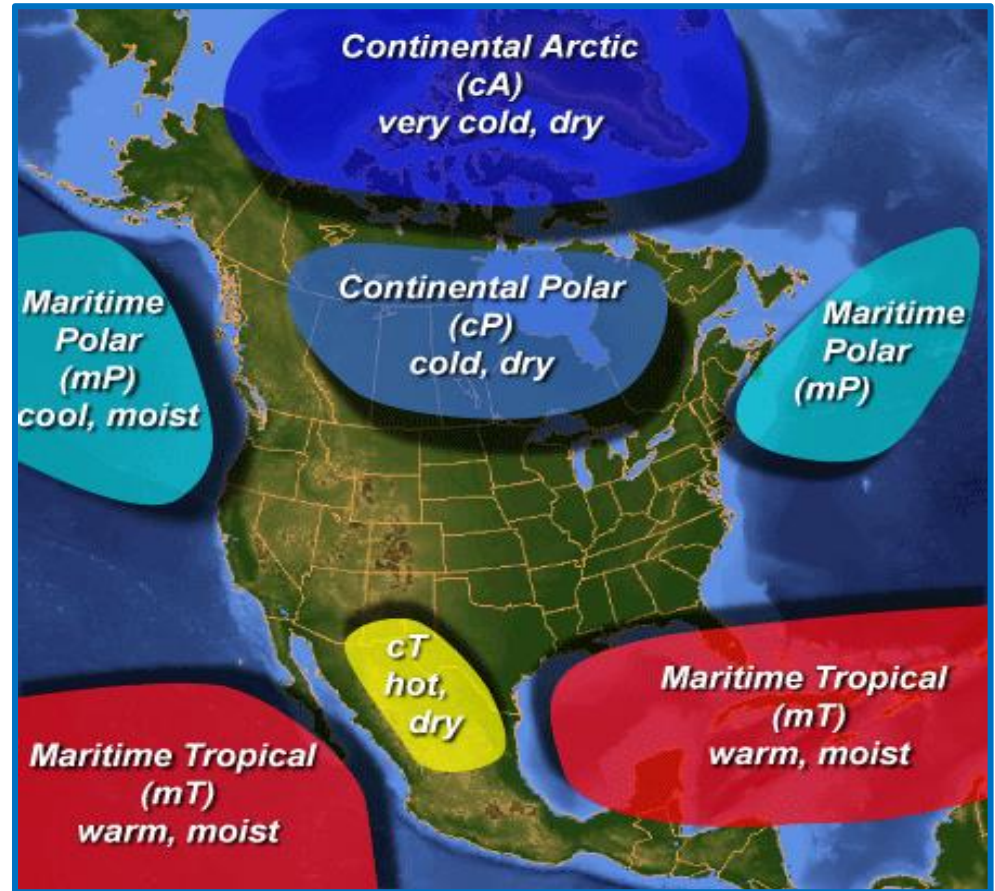
Unequal heating creates a restless movement of air to distribute heat energy from the Sun across the planet.



# Air Masses

Air mass is defined as a *large body of air* that has *similar temperature and moisture within*.

- Originate in flat, uniform areas with light winds.
- *Examples:* snow covered Arctic plains, tropic-subtropic oceans, forests, mountains, large bodies of water.
- Classified by their origin:
  - Land (continental)
  - Water (maritime)
  - Latitude (Equatorial, Tropical - within 25° of equator, Polar - poleward of 60° north and south, Arctic/Antarctic)

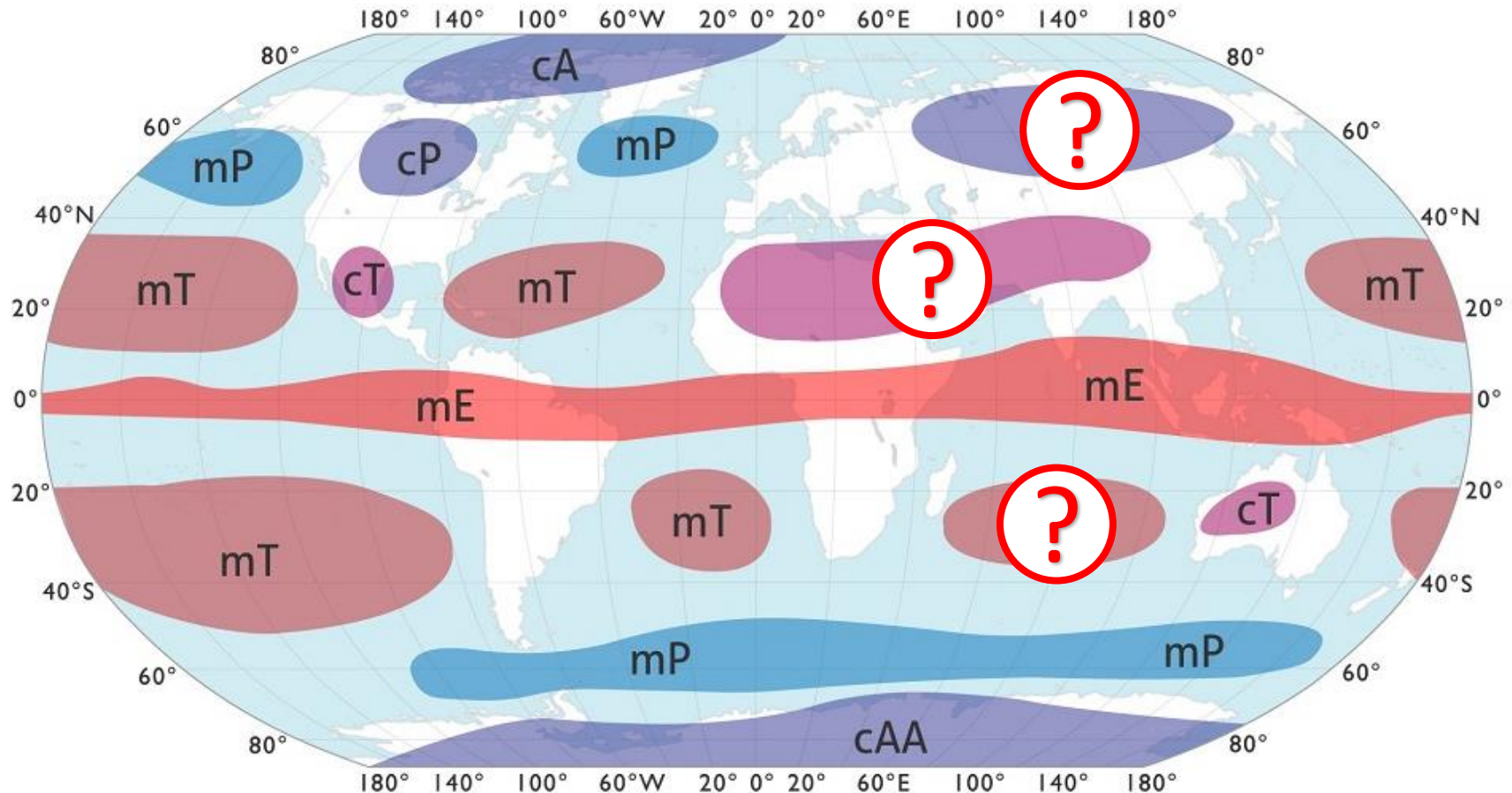


Air masses affecting the U.S. weather during the course of a typical year.

# Air Masses of the World

**c = continental**

**m = maritime**



**P = Polar**

**T = Tropical**

**A/AA = Arctic/Antarctic**

**E = Equatorial**

# Air Masses and Fronts

Air masses cover many thousands of square kilometers.



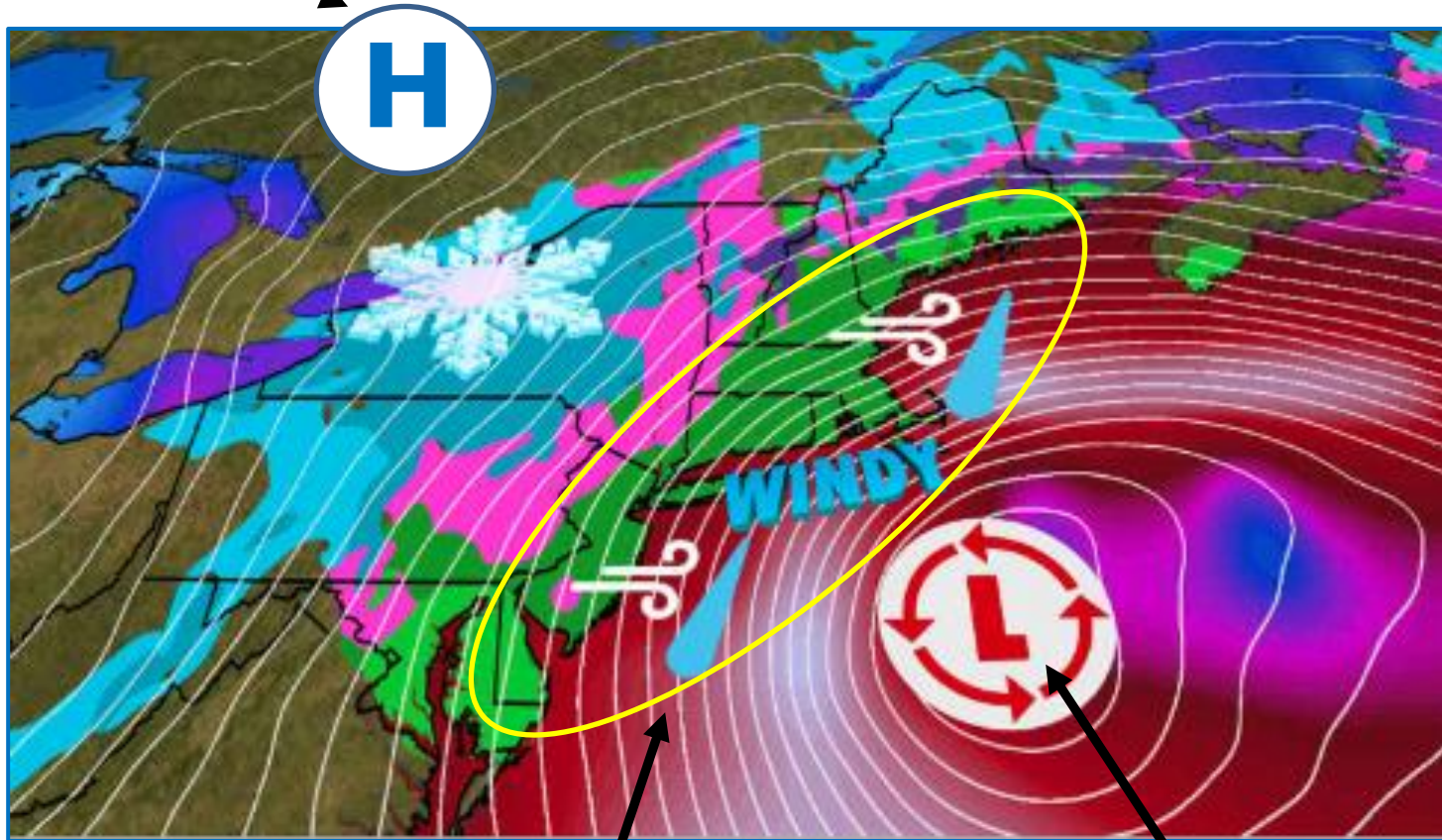
A boundary that separates two different air masses is called a weather (atmospheric) front.



# Winter Storm Anyone?

## Weather Map Example

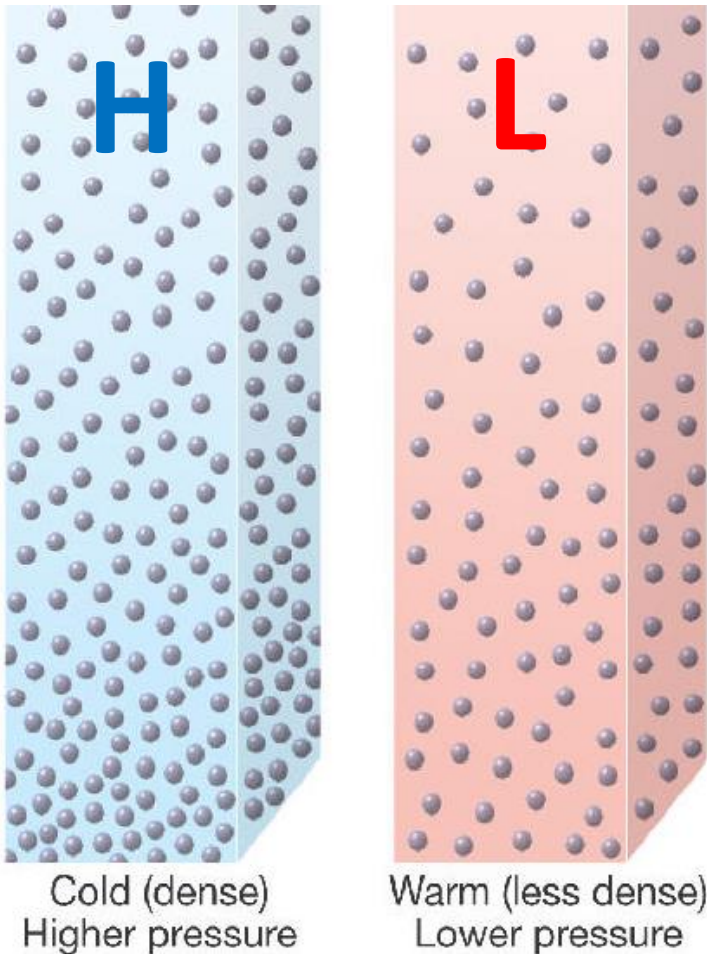
And this?



And why is it *windy* here?

What's this?

# Air Pressure Differences



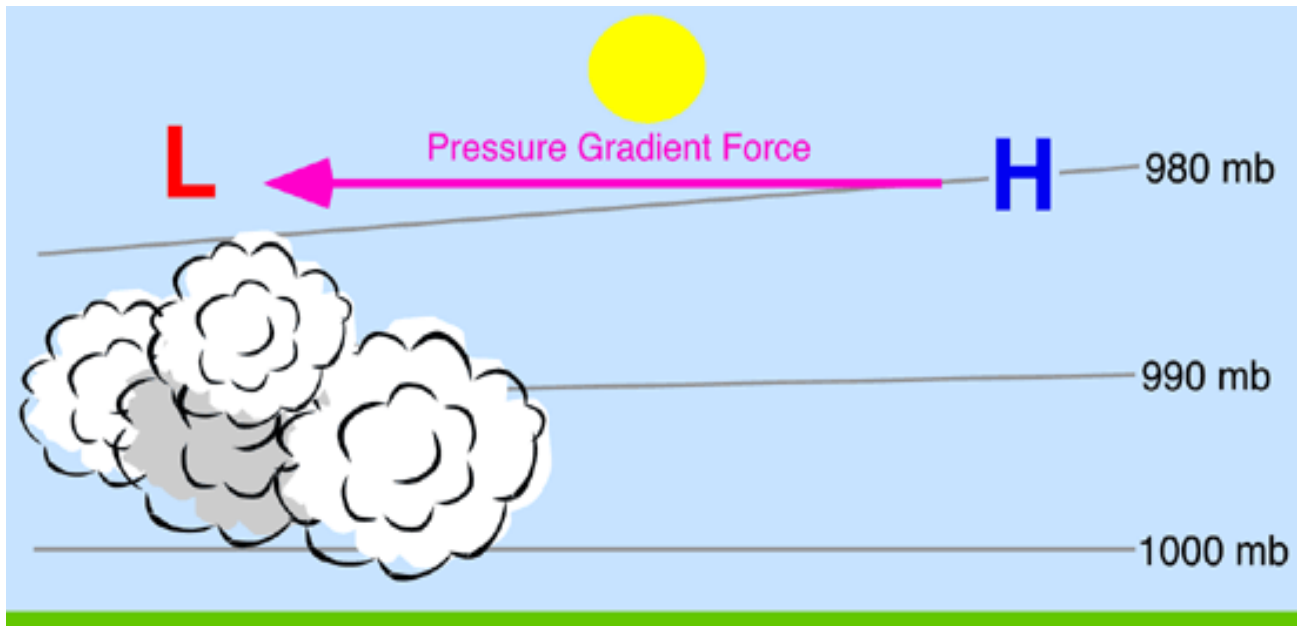
- Air pressure differences can occur due to:
  - the Sun angle at any particular spot
  - surface temperature differences (higher altitudes are cooler than lower altitudes)
- As air **warms**, it **expands** and becomes **less dense** creating **lower air pressure (L)**.
- **Cool** air **sinks** and becomes **denser** creating **higher air pressure (H)**.

Differences in air pressure cause **wind**:  
flow of air on a large scale.



# Wind

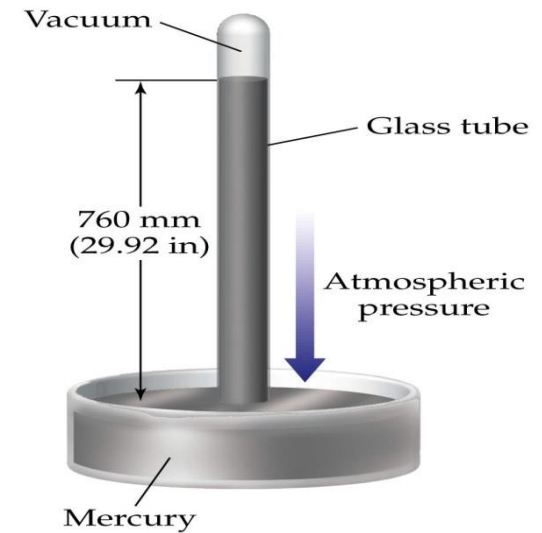
- Winds blow (that is *air moves*) from areas of high pressure to areas of low pressure.



- Wind speed is often a way of classifying storms.  
Meteorologists distinguish two types of winds:  
**Local Winds** and **Global Winds**.

# How to Measure?

- **Air pressure** is measured using a **barometer** (from Greek *baros* 'weight').



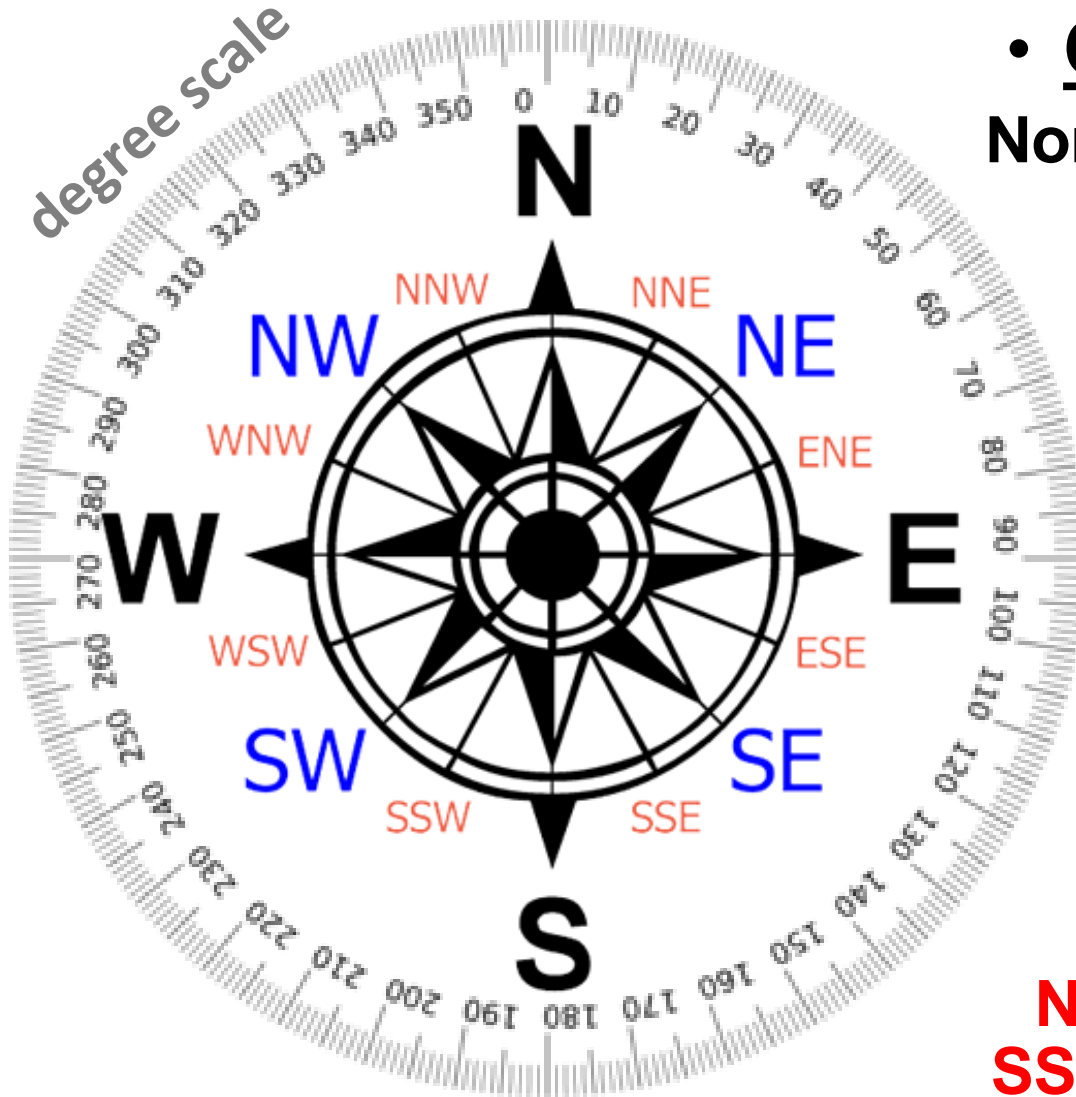
Winds are characterized by their **direction** and **speed**.



- **Winds are named** by the **direction from which they come**.

- **Wind speed** is measured by **anemometer** (from Greek *anemos* 'wind').

# Compass Rose



- Cardinal directions:  
North, East, South, West

- Half-cardinal (*intercardinal*) directions:  
Northeast,  
Southeast,  
Southwest,  
Northwest

- Intermediate directions:  
NNE, ENE, ESE, SSE,  
SSW, WSW, WNW, NNW



# Wind Rose

- A wind rose shows how **wind speed** and **direction** are typically distributed at a particular location over a specified period of time (year, season, month):
  - typically uses **16 directions**
  - can quickly indicate the **dominant wind directions** and the direction of strongest wind speeds.
- Compiling a wind rose is one of the **preliminary steps taken in constructing airport runways**, as aircraft typically perform their best take-offs and landings pointing into the wind.

