Source Regions for Air Masses

- **Areas where air masses form are known as 'source regions'.**
    - **Air must remain over a source region for a prolonged period of time in order for an air mass to form.**
        - **Source regions are only in the high or low latitudes.**
        - **Source regions must be quite large geographically.**

Air Masses

- **Air masses are classified by two factors:**
    - **Temperature of the source region**
    - **Moisture of the source region**
- **Based on moisture content, air masses can be classified by the following:**
    - **Continental (dry)**
    - **Maritime (moist)**
- **Based on temperature, air masses can be classified by the following:**
    - **Tropical (warm)**
    - **Polar (cold)**
    - **Arctic (very cold)**
    - **Equatorial (hot)**
- **A small letter *c* or *m* is used for moisture conditions followed by a capital *T, P, A, or E* which represents temperature.**
- **Maritime arctic (mA) air masses do not occur because Arctic air forms only over land, not water.**
- **Continental equatorial (cE) air masses do not occur because of the limited land masses near the equator.**
- **There are six types of air masses.**

Types of Air Masses

- **Continental polar (cP)**
    - **Forms over large, high latitude land areas.**
        - **Northern Canada or Siberia**
    - **Low T, low T_D.**
- **Continental arctic (cA)**
    - **Form poleward of the Arctic Circle.**
    - **Very low T, very low T_D.**
- **Maritime polar (mP)**
    - **Similar to continental polar air masses but are warmer and moister.**
    - **Forms over the Northern Pacific Ocean and Northern Atlantic Ocean.**
- **Continental tropical (cT)**

- **Forms over hot, low latitude areas during the summer.**
  - **Southwestern United States and northern Mexico.**
- **Very high T, very low T_D.**

- **Maritime tropical (mT)**
  - **Develop over warm tropical waters.**
  - **Warm, but not as hot as cT.**
- **Maritime equatorial (mE)**
  - **Originates over the bodies of water located at the equatorial latitudes.**
  - **High T, very high T_D.**

Fronts

- **A front is defined as a boundary that separates air masses with different temperature and other features.**
  - **Often represent the dividing line between tropical and polar air.**
    - **A front may also accompany a shift in wind direction, a change in moisture content, and an increase in cloud cover.**
    - **Usually the tell tale signs of a frontal passage are a change in wind direction and moisture content.**
- **Cold front**
  - **When cold air advances on warm air ahead of it.**
- **Warm front**
  - **When a warm air mass moves toward a cold air mass.**
- **Stationary front**
  - **Similar to a cold front in structure.**
  - **Neither air mass has recently undergone any significant movement.**
- **Occluded front**
  - **At the surface, they separate two polar air masses.**
    - **A colder polar air mass usually advances on a slightly warmer air mass ahead of it.**

Cold Front

- **Regarding the structure of a 'typical' cold front, its upper boundary slopes back in the direction of the cold air.**
  - **The steepest part of the slope is near the leading edge at the surface.**
- **Cloud cover associated with a cold front results from the convergence of two dissimilar air masses.**
  - **Cold northwesterly winds meet the warm air ahead of it and force it upwards.**

- **As a result, cumuliform clouds form along a cold front.**
- **Precipitation is of short duration.**

Warm Fronts

- **Separate the advancing warm air from the cold air ahead of it.**
  - **Warm air flows upward along the front.**
    - **This is known as 'overrunning'.**
- **The gradual slope of the warm front leads to a progression of cloud types.**
  - **The sequence of clouds, from the surface location of the warm front at the surface out to well in front of the boundary is as follows:**
  - **Stratus, nimbostratus, altostratus, cirrostratus, and cirrus.**
- **Are about half as steep as cold fronts.**
- **Precipitation is less intense as along cold fronts.**
- **Can create precipitation for up to several days.**

Occluded Fronts

- **An occluded front basically lifts a warm air mass from the surface as two fronts meet.**
- **There is minimal temperature difference from one side of an occluded front to another.**
- **Eventually, the cold front meets the warm front in its entirety and the system is occluded.**

Drylines

- **A dryline is a boundary separating humid air from dry air.**
  - **Serves as a focus for severe thunderstorm development in the spring in the southern Great Plains.**
- **As the dryline moves eastward, dry air (which is denser than humid air) lifts the moister air ahead of it.**

An Aside

- **Why is dry air denser than moist air? [Assume identical temperature and pressures.]**
- **<u>Atomic unit mass</u>:**
  - **Oxygen = 16 X 2 = 32**
  - **Nitrogen = 14 X 2 = 28**
- **<u>Water vapor atomic unit mass: [H_2O]</u>**
  - **Hydrogen = 1 X 2 = 2**
  - **Oxygen = 16**

- **Total atomic units for water vapor = 18**
- **Imagine a box of dry air with Nitrogen and Oxygen molecules. In the atmosphere, the ratio of N_2 to 0_2 molecules is 4 to 1. Therefore the box has four nitrogen molecules and one oxygen molecule. Now imagine a box of the same exact volume of wet air next to the dry air box. There are five molecules in the box, and the distribution of molecules is three nitrogen molecules, one oxygen molecule, and one water molecule. Since the water molecule has less mass (18) than the nitrogen molecule (28), the overall mass of the box of wet air will be less than the mass of the box of dry air.**
    - **Considering that D = M/V, if the volume of both boxes are the same, the fact that the box of dry air will have the greater overall mass means that its density will also be greater than the box of moist air.**

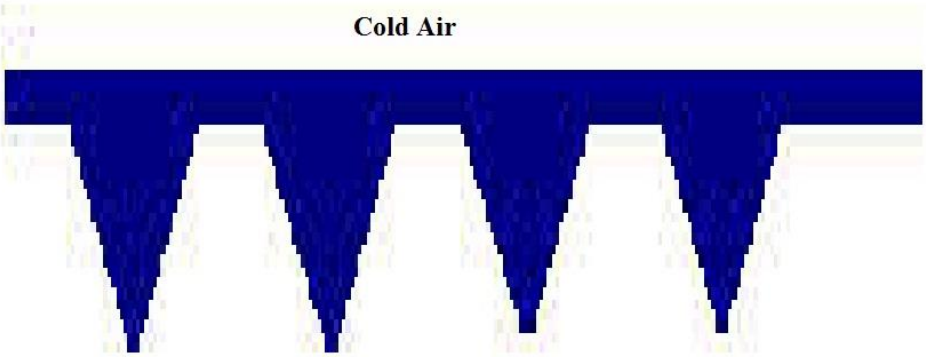
Helpful Links:

http://www.weather.gov/jetstream/airmass

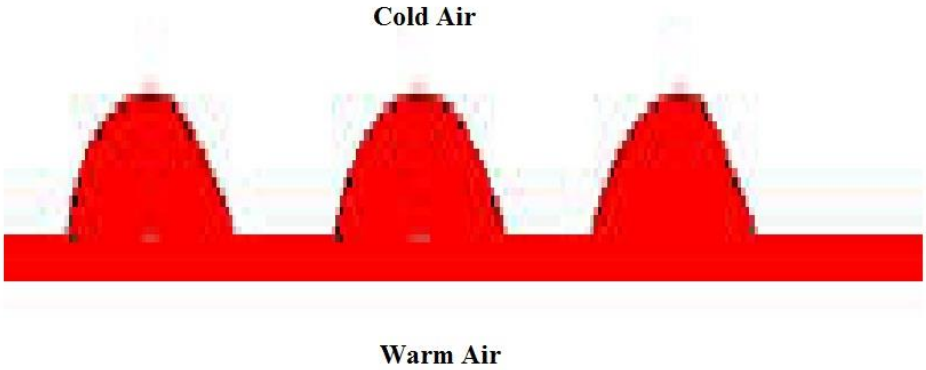
http://www.phschool.com/atschool/phsciexp/active_art/weather_fronts/

http://www.physicalgeography.net/fundamentals/7r.html

Cold Front (One-dimensional) Color of front: Blue

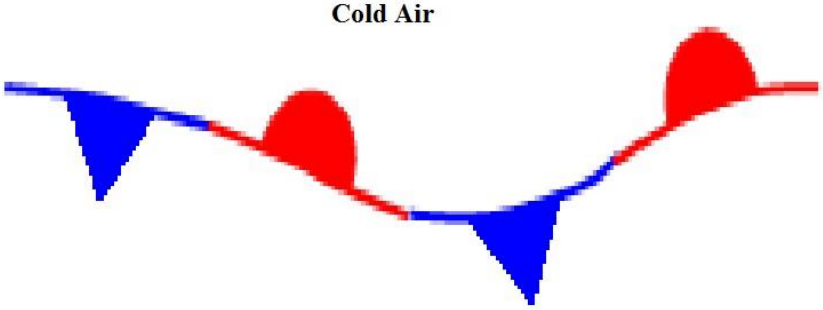


Warm Front (One-dimensional) Color of front: Red



Stationary Front (One-dimensional) **Colors of front: Red and Blue**

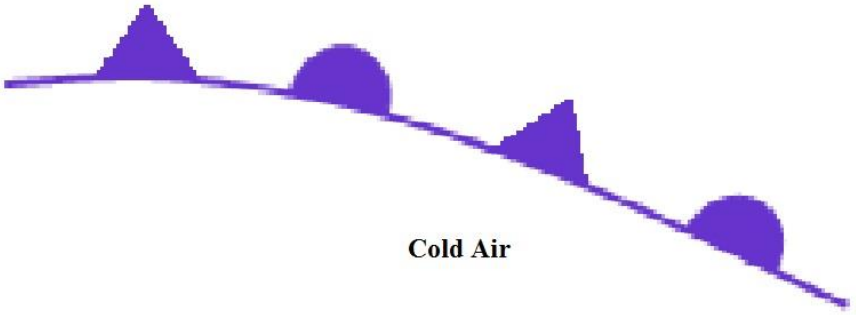
Cold Air



Warm Air

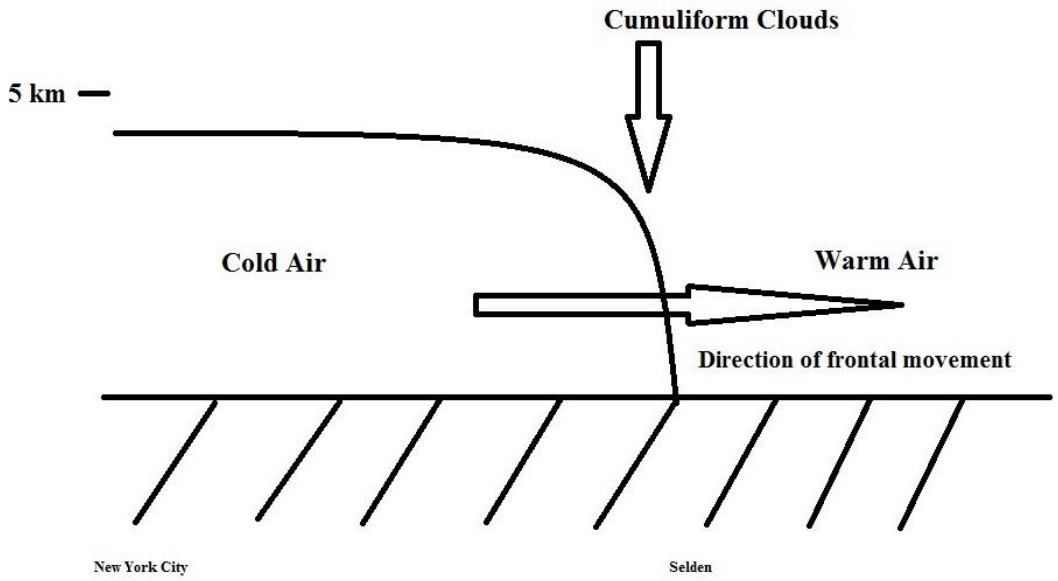
Occluded Front (One-dimensional)

Cool Air

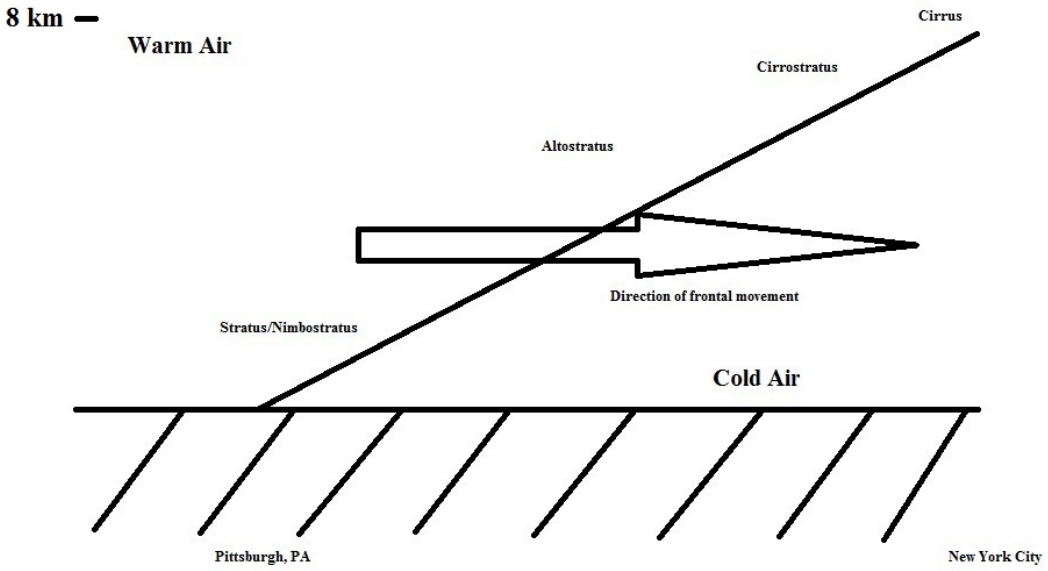


Cold Air

Cold Front (Three-Dimensional)



Warm Front (Three-dimensional)



Occluded Front (Three-Dimensional)