ESCI 107 – The Atmosphere
Lesson 12 – Air Masses

Reading: ***Meteorology Today*****, Chapter 11**

GENERAL

- **An *air mass* is defined as a large body of air that has a fairly uniform horizontal distribution of temperature and moisture content.**
  - **Air masses are at least around 1000 miles in horizontal extent.**
  - **The temperature and moisture content of an air mass are not exactly uniform, but the horizontal gradients of these variables are small.**
- **The region where an air mass is formed is called the *source region*.**
  - **In order to form, and air mass must remain in its source region for a week or more.**
  - **Source regions must be large and uniform.**
- **Air masses are associated with anticyclones (areas of high pressure).**
  - **High-pressure systems are usually stagnant, with little vertical mixing.**
  - **Low-pressure systems have surface convergence, which brings in air from different locations, and is not good for air mass formation.**
- **The major source regions for air masses are either found in the tropics or in the polar regions.**

AIR MASS CLASSIFICATION

- **Air masses are classified according to the latitude of their source region, and according to whether they are formed over land or over water.**
  - **Latitude of source region**
    - **Arctic**
    - **Polar**
    - **Tropical**
  - **Air masses formed over water are called *maritime* air masses.**
  - **Air masses formed over land are called *continental* air masses.**
- **The five categories of air masses are then**
  - **continental arctic – *cA***
  - **continental polar – *cP***

- **continental tropical – *cT***
- **maritime tropical – *mT***
- **maritime polar – *mP***

AIR MASS MODIFICATION

- **Once an air mass moves out from its region of origin, it can become modified by the surface over which it is passing.**
- **If an air mass is colder than the surface over which it is passing it receives the designation, *k*.**
- **If an air mass is warmer than the surface over which it is passing it receives the designation, *w*.**
  - **For example, if a continental polar air mass (cP) moves out over the warm water, it becomes (cPk).**
- **An air mass's stability can be assessed by whether it is colder or warmer than the surface over which it is passing.**
  - **Cold air over a warm surface will be unstable**
  - **Warm air over a cold surface will be stable**
- **A *k* air mass will often be associated with cumuliform clouds**
- **A *w* air mass will often be associated with stratiform clouds**
- **An air mass can be modified so much that it becomes an entirely different air mass type.**
  - **A cP air mass moving out over the water will eventually become an mP air mass.**

PROPERTIES OF NORTH AMERICAN AIR MASSES

- **Continental Polar (cP)**
  - **Forms over Canada and Alaska**
  - **Cold and dry**
  - **Stable**
  - **Dominant air mass over central and eastern U.S. in Winter.**
    - **Brings cool sunny days, and clear, cold nights.**
  - **In summer it brings temporary relief from hot, humid weather.**

- **rarely reaches west of the Rocky Mountains**

- **Continental Arctic (cA)**
  - **Forms over Arctic Basin and Greenland icecap**
  - **Similar to cP air mass, but colder and drier**
  - **Very cold and dry**
  - **Stable**
  - **Only reaches central and eastern U.S. in fall, winter, or spring.**
  - **rarely reaches west of the Rocky Mountains**
- **Maritime Polar (mP)**
  - **Formed over the oceans at high latitudes**
  - **cool and humid (not as cold as cP)**
  - **Affects west coast of U.S. year round, especially Northern California, Oregon, and Washington.**
    - **This is why the summers on the West Coast of the U.S. are mild, or even chilly.**
    - **Brings rain and clouds to West Coast during winter.**
  - **Only rarely affects the Northeast U.S.**
    - **In winter it is responsible for the *nor'easters*, with lots of snow, sleet, or freezing rain.**
    - **In summer, it brings very pleasant weather to New England.**
- **Maritime Tropical (mT)**
  - **Originates over the tropical oceans.**
  - **Hot and humid**
  - **Responsible for the majority of precipitation over central and eastern U.S.**
    - **Dominant air mass over central and eastern U.S. in the summertime**
      - **Brings hot, sticky weather**
      - **Becomes very unstable as it moves over hot land, frequently resulting in afternoon thunderstorms**
    - **Occasionally affects central and eastern U.S. in wintertime, producing lots of precipitation as it is forced to rise over cP air.**
  - **mT air occasionally affects southern California , Arizona, Nevada, and Utah in the winter, bringing heavy rain to these areas.**

- **mT air also is brought into Arizona during the North American monsoon.**

- **Continental Tropical (cT)**
  - **Only source that affects U.S. is in Northern Mexico and the desert southwest of U.S.**
  - **Hot and dry**
  - **Unstable, but little moisture, so few clouds and no precipitation.**

LAKE EFFECT SNOW

- **Occurs when cP or cA air masses move over warm water and then over opposite shore.**
- **Air picks up moisture from water.**
- **It is also heated from below, which makes it unstable**
- **Speed convergence (due to increased friction over land) enhances upward motion, and intensifies the snow showers.**
- **Brings heavy snow showers along leeward lakeshore.**