

Air Mass Thunderstorms

- Air mass thunderstorms are the most common type of thunderstorms.
 - Are of short duration
 - Isolated in nature
 - Separated from frontal boundaries.
 - Consist of multiple cells
 - Have three distinct stages
 - Cumulus, mature, and dissipative
- *Cumulus*
 - Commences when unstable air begins to rise because some locations heat up more than others (i.e., differential heating).
 - The air which rises cools adiabatically to form cumulus humilis clouds.
 - When enough moisture is present, the cumulus clouds increase in height.
- *Mature*
 - Initiates when rain begins to fall.
 - Downdrafts form in areas with the heaviest rainfall.
 - Downdrafts are strengthened when the rain evaporates.
 - Represent the strongest portion of the thunderstorms life.
 - This is also the stage when the familiar ‘anvil’ develops at the top of the cumulus cloud.
- *Dissipative*
 - Downdrafts begin to dominate as heavy rain envelops most of the cloud.
 - When downdrafts occupy the entire base, the storm begins to dissipate.
 - Rain begins to diminish as the remaining liquid droplets evaporate.

Severe Thunderstorms

- Severe thunderstorms (which have wind speeds exceeding 58 mph and/or hailstones larger than 1.00 in.) differ from air mass thunderstorms in that the downdrafts and updrafts reinforce each other and in turn intensify the storm.
- Typically appear as groups of storms.
- Squall Line Thunderstorms
 - Consist of numerous thunderstorm cells arranged in a linear band.
 - They can be up to 300 miles in length.
 - Vertical wind shear is necessary for squall line formation.

- Vertical wind shear is defined as the change of wind direction and speed with increasing height.
 - Typically in squall lines, wind velocities increase with increasing height.
 - Strong winds aloft push the updrafts in front of the downdrafts. As a result, rising air feeds moisture into the storm.
 - When the downdrafts hit the Earth's surface, they spread out as cold, dense air. This is known as a 'gust front'. Gust fronts act similar to cold fronts.
- **Supercell Storms**
 - Supercell storms bring violent weather and sometimes produce destructive tornadoes.
 - Usually a single, isolated cell.
 - Just like squall lines, the downdrafts amplify the nearby updrafts.

Geographic Distribution of Thunderstorms

- The location in the United States with the highest number of thunderstorm days per year is central Florida.
 - The reason why is that Florida is surrounded on three sides by very warm water.
 - This leads to differential heating and thunderstorm development.

Tornadoes

- Tornadoes are defined as rapidly rotating winds under the base of a cumulonimbus cloud.
- Often the shape of the tornado gives away its strength.
 - Rope tornadoes are usually weak and are 'strung out' with various undulations. They are *usually* the weaker tornadoes.
 - Wedge tornadoes are shaped like a wedge and produce the most violent types of tornadoes.

Supercell Tornado Development

- The initial step in the formation of a tornado in a supercell thunderstorm is a horizontal rotation in the cloud itself.
 - This is known as a 'mesocyclone'.
 - Vertical wind shear is needed for the formation of a mesocyclone.
 - As a result, there is a rolling motion about a horizontal axis.

- If there are strong updrafts, the horizontally rotating air can be tilted in the vertical.
- As the vertical column of air descends out of a cloud, the cloud base protrudes downward to form a 'wall cloud'.
 - They often occur near the southwestern end of a thunderstorm near the areas of heavy rainfall and severe hail.
- Out of the wall cloud emerges a 'funnel cloud' which is the same as a tornado *except* that the circulation has not reached the ground. When it reaches the ground, it is a tornado.

The Location and Timing of Tornadoes

- The United States has the most tornadoes of any nation in the world. There are a few reasons for this.
 - The U.S. covers a wide range of latitudes.
 - The warm waters of the Gulf of Mexico border the U.S. to the southeast.
 - The U.S. is affected by polar and arctic air masses even into spring.
 - The eastern two-thirds of the continent is basically flat.
 - No mountain ranges are oriented in an east-west direction.
- Most tornadoes occur in the spring for two reasons.
 - Air masses are most dissimilar.
 - Vertical wind shear is the greatest.

Helpful Links:

<http://www.physicalgeography.net/fundamentals/7t.html>

<http://www.spc.noaa.gov/faq/tornado/suprcell.htm>

<http://www.spc.noaa.gov/faq/tornado/index.html>