Forecasting, Fronts, and Frightful Weather

We have individually covered the six elements that make up our ever-changing weather: temperature, air pressure, wind speed & direction, humidity, cloud coverage and precipitation. Now that you know more about what each of the elements are and what makes them change, let's see how meteorologists put them all together to forecast our weather, which helps us plan our daily lives AND keep us safe!

FORECASTING

It has been mentioned many times throughout this unit that forecasting weather is not an easy job and meteorologists are never 100% correct, but as technology advances they are able to get fairly close to letting us know what weather to expect within a week or two and warn us of coming severe weather. Meteorologists collect, track, and record the data on the basic six elements of weather on a daily basis. Weather stations use basic weather instruments from thermometers to barometers. They also use more high-tech instruments such as radars and weather satellites which give them an even bigger picture of the changing weather. **Doppler radar** is able to detect how much precipitation is in an area, as well as wind speed and direction. Weather satellites photograph and track clouds and large-scale air movements which you will learn about in a moment. Other sources of data collection come from ships, buoys, airplanes, and weather balloons. Six-foot-wide weather balloons are sent up everyday with a special device attached called a radiosonde. **Radiosondes** measure and record the air's temperature, pressure, wind speed & direction, and relative humidity as it ascends into the air and sends the information back to the weather station by radio signal. All of this weather data is put into computers, which make maps, graphs, and charts so that meteorologists are better able to see the weather patterns and predict what weather is coming. Supercomputers, used by the National Weather Service, can handle large amounts of weather data from all of these sources at once and put it together to mathematically calculate weather predictions. Meteorologists then analyze their data and communicate their results to us by broadcasting weather forecasts on TV stations showing us weather maps and weekly forecast predictions.

AIR MASSES

When meteorologists put all of their data together they are able to identify the location of air masses. This is important because the movement of air masses is what causes major changes in the weather. An **air mass** is a large body of air that has the same temperature, moisture level (humidity), and air pressure throughout. Air masses are so large, they typically cover hundreds, thousands, or millions of square miles. There are five major kinds of air masses that affect the weather in North America: continental tropical, continental Arctic, continental polar, maritime polar, and maritime tropical. They are named according to where they form. If the name uses the word "**continental**" then you know it was formed over land and therefore contains dry air. If the name uses the word "**maritime**" then you know it was formed over oceans and therefore contains moist air. If the name uses the word "**polar**" it tells you that the temperatures in that air mass are cold. **Arctic** air masses are even colder! The word "**tropical**" tells you the temperatures in that air mass are warm. So, with this information, can you tell what kind of air would be in each of the five air masses? A maritime tropical air mass is moist and warm. A continental polar air mass is dry and cold. Make sense? These air masses do not mix together because they have different densities with their differing temperature and humidity levels, BUT they do clash….

GAME OF STORMS…WHEN TWO AIR MASSES FACE OFF

Air masses do not stay in one spot, nor do they mix together, so at some point two different air masses will meet and face off. This is called a **front**. Norwegian meteorologists, Vilhelm Bjerknes and his son, Jacob, introduced the idea of fronts in the early 1920s. They used the term "front" because it reminded them of a battlefront in the military. We are going to use the analogy of fronts as opposing football teams. Like in a game, one of the air masses will "win," pushing the other out of the way. The differing temperatures and humidity levels of the opposing fronts bring a change in the weather. There are four types of fronts, each with their own "team symbol" that are shown on weather maps. The symbols on the line will face the direction that the front is moving. Let's learn a little about each one.

Cold Fronts 

By far, cold fronts are the team to fear! Cold air is more dense than warm air which means it has a little more "weight" to push other fronts around. You can think of a cold front as the football team of giants. They also move rather quickly which make their hits harder, bringing more severe weather. So when a cold air mass meets a warm air mass it pushes it up and out of its way. If that warm air is moist, cumulous clouds will form and often develops into cumulonimbus clouds that bring heavy rain, thunderstorms, or snow. After the cold front passes the air tends to be cooler and drier with blue skies.

Warm Fronts 

Like the little guy on a football team, a warm front does not have enough force to push a dense cold front out of its way. They have a different game plan. Warm air masses move slower and when they catch up to a cold air mass they stretch up and over the cold air, gradually moving it out of the area, causing stratus clouds to form. Warm fronts bring a less severe weather change with higher humidity and steady, light rain or snow. After it passes, warm fronts leave behind clear, warmer weather.

Stationary Fronts 

A stationary front is when a warm air mass and a cold air mass are more evenly matched up, neither one having enough force to move the other out of the way. They just stay in one spot, not moving, giving many days of cloudy, wet weather. The weather can be a combination of the two kinds of fronts, along with lots of clouds. You can think of it as two football teams lined up facing each other, not moving.

Occluded Fronts 

These fronts occur when two cold fronts gang up on a warm front, trapping it between the two. It's as if you have three teams on one field! A fast-moving cold front will catch up to a slow-moving warm front, lift it up, and then run into another cold front that is in front of it. The two cold fronts meet, pushing up the warm front. Occluded fronts bring cold temperatures and large amounts of rain and snow.

WHAT MAKES WEATHER SEVERE?

Anytime two air masses meet, weather changes. <u>But the greater the difference in temperature and humidity between the two masses, the more intense the weather change will be.</u> This is what causes severe weather such as thunderstorms, tornadoes, hurricanes, and floods. When warm, moist air quickly rises up, thunderstorms form bringing heavy rain, strong winds, noisy thunder, and scary lightning. If the thunderstorms are severe enough they can form deadly tornadoes or flash floods. Hurricanes can form if the severe storm is over an ocean, causing storm surges, flooding, and damaging winds. If you had to give just one reason why the study of meteorology is an important field of science, it would be how meteorologists are able to save so many lives by the warnings they give of approaching severe weather.