



Southern AER

ATMOSPHERIC EDUCATION RESOURCE

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Did You Know?

Thomas Jefferson, one of America's first weather observers, is said to have bought his first thermometer on July 4, 1776, the same day the Declaration of Independence was signed in Philadelphia, PA. According to his records, the weather at 2:00 PM on that day in Philadelphia was cloudy and 76 degrees.



Measuring the Weather Around Us

Have you ever watched a weather report on TV and wondered, "How do they measure the air pressure or know how fast the wind is blowing?" Meteorologists and weather observers around the world rely on the use of specialized **weather instruments** to determine everything from temperature to wind speed to air pressure and more! Weather instruments allow us to measure the weather conditions around us so we know just how hot, cold, wet, dry, windy, or cloudy it is. These measurements not only provide us with a current picture of the weather, but are important in predicting future weather conditions as well.

Chances are, you're already familiar with basic

weather instruments such as the thermometer or possibly you have a rain gauge set up in your back yard. Although these common types of weather instruments are household words, there are many other types of weather instruments used every day that you may never have heard of. Do you know, for example, what an anemometer is? How about a hygrometer? Do you know what a barometer measures? In this issue of *Southern AER*, we'll explore different types of weather instruments and how they are used. You'll even learn how to make some weather instruments of your own so you, too, can measure the weather around you and



A typical weather station includes instruments for measuring a variety of weather variables.

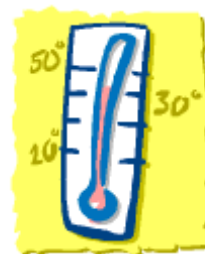
be well on your way to becoming amateur meteorologist extraordinaire!

The Thermometer: Is It Hot Enough for You?

Probably the best-known type of weather instrument is the **thermometer**, which is used to measure temperature. There are many different types of thermometers, but one of the most common types used for measuring air temperature is the **liquid-in-glass thermometer**. Used for centuries, the liquid-in-glass thermometer consists of a thin glass tube contain-

ing a special type of liquid, usually mercury or alcohol, and a scale that shows how high up the glass tube the liquid extends. When the temperature heats up, the liquid in the tube expands, causing it rise higher up the glass tube and resulting in a higher reading on the thermometer's scale. When the temperature cools down, the liquid contracts, causing it to

shrink back down the tube. This results in a lower reading on the thermometer's scale.



The Anemometer: Catching the Wind

Weather observers use an instrument called an **anemometer** to measure wind speeds. Although there are many different types of anemometers, one of the most commonly-used types is the **cup anemometer**. It is made by putting rotating cups onto a moving shaft. When wind blows into the cups, they move, generating an electrical current that increases as the wind blows faster. The elec-

trical current controls the display on a dial, much like the speedometer of a car, or a computer.

Although anemometers are good at measuring wind speed, they don't tell us what direction the wind is blowing. For that, meteorologists use a **wind vane**, which is usually shaped like an arrow and spins around when the wind blows, pointing in the direction the wind is blowing from.

Another type of instrument used to measure the wind is called an **aerovane**. An aerovane looks like a wind vane, but with a propeller attached to the end to measure wind speed. By measuring both wind speed and direction at the same time, the aerovane is like having two weather instruments in one!

*“Who has seen the wind?
Neither you nor I:
But when the trees bow
down their heads
The wind is passing by.”*

— Christina Rossetti



An aerovane measures both wind speed and direction.



Barometers are useful in predicting changes in the weather.

Barometers: Under Pressure

Unlike changes in temperature or wind speed, changes in air pressure are not very noticeable, but changes in air pressure can provide us with valuable clues as to what kind of weather is coming our way. Meteorologists measure air pressure using a special instrument called a **barometer**. Although

barometers used to be made out of glass tubes filled with mercury, much like a large thermometer, modern barometers use a metal chamber that is sensitive to changes in the air pressure. When the pressure of the air above us rises or falls, the metal chamber contracts or expands, causing the dial on

the barometer to move in one direction or another, indicating a change in air pressure. Unlike a mercury barometer, this kind of barometer known as an **aneroid barometer**, doesn't contain any liquid. In fact, that's how it gets its name: the word *aneroid* means “without liquid.”

Weather Instrument Names: It's Greek to Me

So far, you've learned about several types of weather instruments and what they're used for. There are many different types of weather instruments that are used to measure a variety of weather variables. For example, a rain gauge is used to measure rainfall amounts and a wind vane is used to measure wind direction. Below is a list of some other types of weather

instruments and what they're used to measure. You may notice that the names of these instruments all end in -meter,

which is from the Greek word *metron*, meaning “measure.” The prefixes of these names also come from Greek and

help describe what each type of instrument measures.

Instrument	Used to Measure	Prefix	From the Greek Word	Meaning
Thermometer	Temperature	thermo-	<i>therme</i>	heat
Barometer	Air Pressure	baro-	<i>baros</i>	weight
Anemometer	Wind Speed	anemo-	<i>anemos</i>	wind
Hygrometer	Relative Humidity	hygro-	<i>hugros</i>	moist
Psychrometer	Humidity	psychro-	<i>psukhros</i>	cold*

*A psychrometer uses two thermometers to measure humidity, one of which cools down when water on its bulb evaporates.

Activities and Games

Wordsearch

See how many of the words listed below you can find. Do you remember what each word means? You can also find an interactive version of this wordsearch online at:

http://www.dnr.state.sc.us/cliamte/sercc/education/wordsearch/instruments_wordsearch.html



Weather Instruments:

THERMOMETER
 MERCURY
 BAROMETER
 ANEROID
 ANEMOMETER
 WEATHER
 INSTRUMENTS
 RAINGAUGE
 WINDVANE
 HYGROMETER
 TEMPERATURE
 HUMIDITY
 PRESSURE



A rain gauge is used to measure rainfall amounts.

FunFacts!

- The world's largest thermometer, in Baker, CA, is an incredible 134 feet tall! Its height symbolizes the highest temperature ever recorded in the Western Hemisphere: 134°F on July 10, 1913 in nearby Death Valley.
- German physicist Gabriel D. Fahrenheit developed the temperature scale that bears his name in 1714. The "zero point" on his scale was the lowest temperature he could attain with a mixture of ice, water and salt.
- The mercury barometer was invented by Italian Evangelist Torricelli in 1643.
- One type of hygrometer used to measure humidity is made with human hair! The **hair hygrometer** uses several strands of human (or sometimes horse) hair that are bundled together and connected to an indicator dial. Since hair is sensitive to changes in humidity, the strands of hair stretch or shrink as the humidity goes up or down. This is the same reason why some people (especially those with naturally curly hair) experience "bad hair days" when the humidity is high! You can learn more about how a hair hygrometers works at:

<http://www.usatoday.com/weather/whairhvg.htm>

- To make sure that their measurements are accurate, weather instruments are often housed in shelters that protect them from the sun, rain, snow, and other elements that can cause the reading to be inaccurate. This type of shelter is often called a **Stevenson Screen**, because it was originally designed by Scottish civil engineer Thomas Stevenson. Thomas Stevenson, by the way, was the father of author Robert Louis Stevenson, who wrote such works as *Treasure Island* and *The Strange Case of Dr Jekyll and Mr. Hyde*.



A Stevenson Screen is used to protect weather instruments from the elements.

You Try It!

This activity is also available from the SERCC online at:

<http://www.dnr.state.sc.us/climate/sercc/education/barometer.pdf>

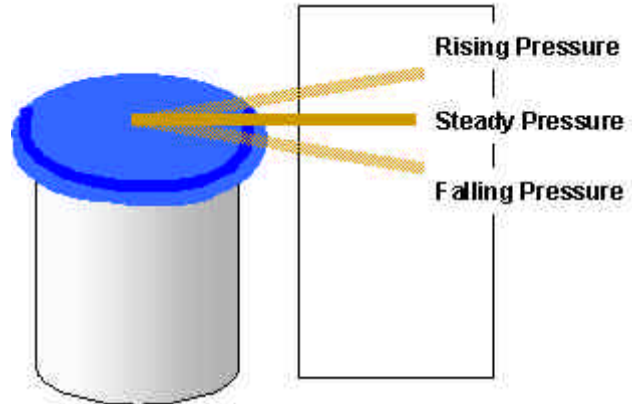
Also available: How to Make an Anemometer:

<http://www.dnr.state.sc.us/climate/sercc/education/anemometer.pdf>

How to Make a Barometer

Materials Needed:

- small glass jar or tin can
- large (12") round balloon
- rubber band
- scissors
- tape
- small stirring stick
- 5" x 7" index card



Step 1

Use the scissors to cut the top of the balloon off.

Step 2

Wrap the top of the balloon tightly around the opening of the jar or can and seal it with the rubber band. Try to get the balloon as tight as possible and make sure that the rubber band is tight enough so that no air will get in.

Step 3

Tape the stirring stick to the center of the stretched out balloon so that one end of the stick points away from the jar or can.

Step 4

Place the jar or can next to a wall. Tape the index card to the wall so that the end of the stick is pointing to it.

Step 5

Make a mark on the index card next to where the stick is pointing. You may wish to label the mark with the date and time.

Step 6

Look at the card each day and see if the stick points above or below where it did the day before. If it points **above** the previous day's mark, the pressure is **rising**. If it points **below** the previous day's mark, the pressure is **falling**.

Quick Quiz

1. What type of weather instrument is used to measure air pressure?
2. Where is the world's largest thermometer located?
3. Where does the word anemometer come from?
4. In what year was the barometer invented?
5. What is a Stevenson Screen used for?

Learn More About It

Now that you've learned about some of the basic types of weather instruments that meteorologists use everyday to report on and predict the weather, you may want to learn more about other types of weather instruments and even how to make some basic weather instruments of your own.

Below are some websites that offer more information about weather instruments:

USATODAY.com's weather measurements page offers links to sites about how instruments are used to measure the weather:

<http://www.usatoday.com/weather/basics/measurements.htm>

Project Atmosphere Australia Online has instructions for making several types of weather instruments:

<http://www.schools.ash.org.au/paa/instruments.htm>

The Franklin Institute Online offers tips on how to make your own weather station:

<http://www.fi.edu/weather/todo/todo.html>

Also, be sure to check out our website for more educational and climate data resources:

<http://www.dnr.state.sc.us/climate/sercc>



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Send comments or questions to: sercc@dnr.state.sc.us
