

WaterWeb

current water info for schools

A publication of the Southwest Florida Water Management District



The WaterWeb Query

QUESTION:

What is the dew point and how can it be used to predict the weather?

ANSWER:

Moisture in the air may be described by weather forecasters as the dew point. The dew point is a temperature that tells how saturated the air is with water. The dew point temperature is the point at which the air must be cooled before it condenses some of its vapor into droplets. When the dew point is high it means that the moisture content is high. If the difference between the temperature of the air and the dew point is great, it means the air is dry and rain is unlikely. But if the difference is small, you may need an umbrella!

Inside this issue

- 2 Hydrologic Conditions
- 3 Classifying Our Clouds
- 4 Weather Forecasting Instruments
- 5 Droughts
- Weather Proverbs and Signs
- 6 Making a Barometer
- 7 Crossword Puzzle & Word Scramble
- 8 Web Sites to Explore



Try asking a friend to answer this simple riddle: What will always exist and can't be controlled? The answer is *weather*. Maybe that's why it is such a common topic of conversation. People talk about weather all the time because it influences us in so many ways. Will it be warm enough to go to the beach? Is it going to be too rainy to ride a bike to school? Will there be enough wind to fly a kite at the park? If it rains today, do I need to water my lawn on my watering day tomorrow? Will the weekend camping plans have to be canceled because of a severe weather warning? We may not realize it, but weather factors play an important role in our lives and directly affect our daily routines and activities.

But what exactly is weather? Weather is what it is like outside on any day at any moment. Weather may include outdoor conditions such as sunny, cloudy, stormy, humid, dry, hot, cold, etc. Changes in the weather are caused when different kinds of air masses meet. When air masses of different temperatures and densities meet, they don't mix well and a front is formed. A front may bring precipitation in the form of rain, snow or hail, although in our area, it will most likely be in the form of rain showers.

The hydrologic cycle, or water cycle, plays an important role in weather. As the sun heats the earth's surface, water evaporates into the atmosphere where it condenses to form clouds. Eventually, some form of precipitation is created, which then returns to the earth. All the weather occurs in the lower 8 miles of the earth's atmosphere in an area called the *troposphere*.

A climate refers to the weather patterns that take place in an area over a long period of time. In west-central Florida, we live in a humid subtropical climate. It is no wonder that during the winter season our pleasant climate attracts visitors and tourists from colder climates. However, from June to November, during the hurricane season, tropical storms and severe weather can also occur. These weather conditions remind us about the importance of modern weather forecasting.

This issue of *WaterWeb* focuses on weather. All the articles and activities are designed to help you learn more about topics related to the weather and climate in our area.

Hydrologic Conditions

Introduction

One of the most basic but essential tasks of meteorologists is to monitor rainfall amounts. This information is important for a variety of reasons, particularly in regard to our surface and groundwater supply levels.

Surface Water

Water on the land's surface in water bodies such as lakes, streams, rivers and oceans is called *surface water*. Surface water accounts for almost 20 percent of the Southwest Florida Water Management District's (SWFWMD) water supply. Six rivers and creeks within the boundaries of the SWFWMD provide fresh water to the public in Tampa, Bradenton, Punta Gorda and Port Charlotte, as well as Manatee and Sarasota counties.

Lake levels are a key indicator of long-term trends in hydrologic conditions. Each month the SWFWMD measures the water levels in a variety of lakes. These levels are compared to the adopted minimum low management (MLM) levels. The MLM level is the annual low level for the lake, which is usually recorded at the end of the dry season. If the lake levels are too low, plants and animals could suffer. Excess human water consumption might further endanger the natural environment. To prevent this, conservation measures may be actively encouraged or enforced.

Groundwater Levels

Ground water is water that has seeped into the earth and is contained in soil and rock underground. Ground water pumped from underground aquifers makes up more than 80 percent of our water supply. Water soaks into the aquifer in a process known as groundwater *recharge*. Measuring rainfall amounts helps to determine how much water is being recharged into the aquifer. Without sufficient recharge, water supplies become low and salt water may intrude into the freshwater storage system. When water levels are low, emergency watering restrictions limit the amount of water that can be removed from the aquifer. These restrictions remain in place until water levels return to their normal ranges.

Water Allocation

Rainfall data also helps us determine how water supplies should be allocated. Florida's population is growing rapidly and we need to be sure that there is enough clean, fresh water to go around. Knowing how much rain an area is likely to receive is essential in determining how our water resources should be distributed.

Flood and Drought Prediction

Keeping track of current rainwater levels and comparing them to average standards also makes it easier to predict the occurrence of floods and droughts.

Any rainfall amounts that differ drastically from the norm can cause severe problems within the community. If we are able to foresee these types of issues, we are better equipped to handle them when they arise.

Stormwater Infrastructure

Florida is a relatively low-lying land with vast numbers of surface water bodies. In addition, new communities are constantly being developed throughout the state. The combination of these factors makes stormwater infrastructure a significant issue facing Florida residents. When it rains, that rain needs to be able to flow to some sort of water body. If the land has been developed and there are not adequate channels to collect rainwater, homes and businesses can become flooded. To prevent this, developers must know how much rain usually falls in an area and plan accordingly.

Recovery of Water Resources

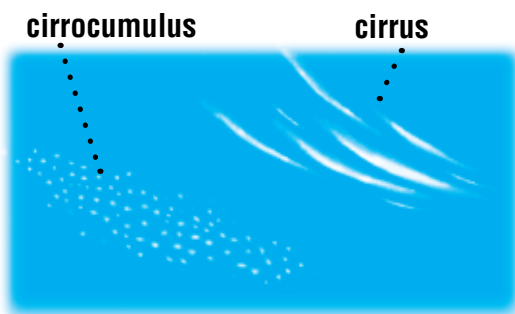
For long-term recovery of the water resource, many factors are necessary. These include conservation, reclaimed water use and the development of safe, sustainable, environmentally friendly and droughtproof alternative water sources. For more information, please contact the SWFWMD's Operations Department at 1-800-423-1476, ext. 4318.

Check Your Hydrologic Conditions Facts

1. The SWFWMD's water supply comes from surface and ground water. What percent comes from each of these sources? Draw a pie chart to illustrate these amounts.
2. What are MLM levels?
3. List a few ways to help recover water resources throughout the SWFWMD.
4. How long do emergency water restrictions remain in effect?

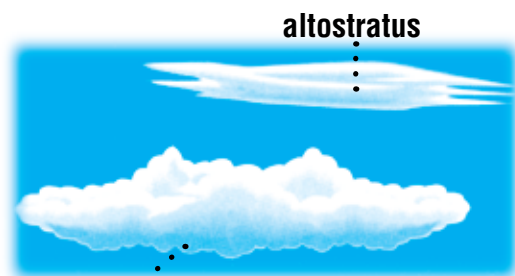
Classifying Our Clouds

Our Florida skies often look like beautiful paintings filled with clouds that range from wispy, feathery shades of white to massively heaped piles resembling dark, towering walls. Look up at the sky and you will most likely see clouds of many different shapes and sizes. All clouds are made of water, tiny ice crystals or a combination of both. As an important part of the hydrologic or water cycle, clouds form when air rises and cools to its point of saturation. Most of the clouds exist in the lower 8 miles of the atmosphere called the *troposphere*. Approximately 200 years ago, Luke Howard devised a system to help classify clouds based on their general appearance and altitude. A modern version of this system is still in use throughout the world today. The following names are used to describe the four main cloud types: cirrus, cumulus, stratus and nimbus. Clouds are divided into low-level, medium-level or high-level categories determined by the height of their bases and are further classified according to their appearance. Clouds are named according to their type and height. Use the illustrations below to help you understand how clouds are classified.



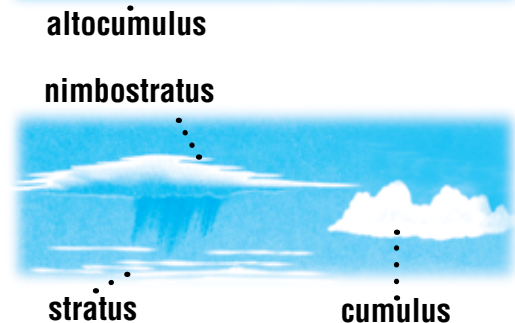
High-Level Clouds

The high-level clouds have base heights that lie between 16,000–35,000 feet. They are formed from tiny ice crystals. All three of the main types of clouds contained at this level are thin, wispy and transparent because the atmosphere contains very little water vapor. Cirrus clouds, which often resemble hair, have descriptive names for their shapes such as painter’s brush, hen scratchings and mares’ tails. Cirrocumulus clouds appear as a regular spotted or rippled pattern consisting of individual cloudlets. Cirrostratus clouds may signal a change in the weather and are so transparent you can often see right through them.



Medium-Level Clouds

The medium-level clouds have base heights that lie between 7,000–16,000 feet. Three main types of clouds exist at this altitude. Nimbostratus clouds are sheets of clouds producing continuous rain or snow. Altostratus clouds are light clouds that often cover an entire sky and may have the sun shining through them. Altocumulus clouds appear as a pattern of small, puffy cottonballs moving slowly across the sky.



Low-Level Clouds

The low-level clouds usually have a base height below 7,000 feet. There are four main types of clouds found at this level. Stratus clouds appear in smooth, featureless sheets. Stratocumulus clouds appear as sheets, but they contain more rolls and bulges. Cumulus clouds are heaped, puffy clouds, which can often be seen on a sunny day. Cumulonimbus clouds can cause short periods of heavy rain, thunderstorms and lightning.

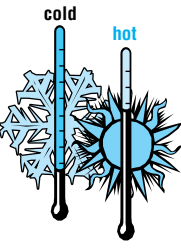
EXTENDED ACTIVITIES

1. Become a cloud photographer. Take several photographs of the various clouds in Florida’s beautiful skies. Try to identify the type of cloud contained in each photograph and write a brief description about it. You may even want to combine the pictures to make a large poster or mural about clouds. To help you get started, browse through several books on weather at your local library. These books usually contain photographs or pictures of the main types of clouds.
2. Try out your artistic talents by creating a watercolor or pen-and-ink drawing that illustrates several different types of clouds. The next time you visit an art museum or art gallery, look for examples of different cloud types used in works of art.
3. Keep a cloud diary and record the different clouds that you see each day.

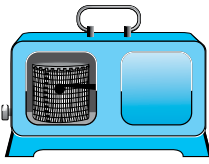
Weather Forecasting Instruments

Modern weather forecasting is a complex process that requires a variety of instruments and state-of-the-art technology. Technology has played an important role in the improvement of weather forecasting. According to the National Weather Service, the three-to-four-day weather forecast that we receive today is as accurate as the two-day forecast was 15 years ago. Next time you get a weather update from your computer, television or radio, think about all the instruments that meteorologists use to provide us with accurate and up-to-date information about weather.

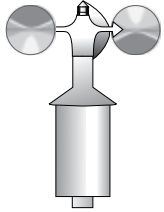
BASIC INSTRUMENTS AND HOW THEY ARE USED



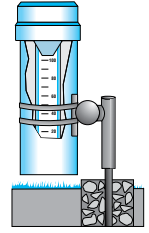
thermometers
to measure
air temperature



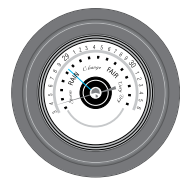
hydrograph
to measure
the amount of
water vapor in the
air called *humidity*



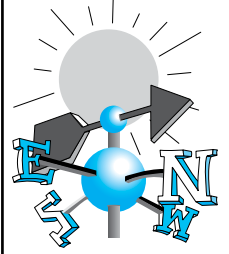
anemometer
to measure
wind speed



rain gauge
to measure
the amount
of rainfall



barometer
to measure
air pressure
by weighing the
amount of air over
a particular area



weather vane
to measure
wind direction

Weather Balloons

Twice each day, hydrogen gas balloons carrying weather instruments are released at approximately 1,000 sites around the world. These balloons are monitored by radar and provide important data about weather conditions.

Ocean Buoys

Ocean buoys are moored or allowed to drift along with the ocean currents at several points around the world. Weather-sensor instruments attached to the buoys measure water temperature, air temperature and pressure and humidity.

Doppler Radar

Doppler radars are remote sensing tools that can detect the slightest

weather system by measuring frequency differences between signals that bounce off objects moving away or toward its antenna. *Radar* stands for radio detection and ranging. The antennae on the radars are so sensitive that they can detect insects, dust and differences in air density, in addition to precipitation. There are hundreds of Doppler radars used throughout the United States to measure weather.

Satellites

Weather satellites, positioned thousands of miles above the earth's surface, provide forecasters with pictures that show what is currently happening in the atmosphere. Visual images of clouds, storms and other weather conditions presented in real time are extremely useful for warning

people about dangerous weather that may be approaching an area.

Computers

High-powered computing is essential for today's weather forecasting because it helps to produce fast and accurate weather forecast models. The supercomputers at the National Center for Atmospheric Research can calculate massive amounts of data in just a few seconds. They are also staffed 24 hours a day, 365 days a year and maintained at a stable temperature and humidity level. Advanced computer systems make it possible to simultaneously compare several forecasting models on the same screen. We can only imagine how technology will be used in weather forecasting in the future.

EXTENDED ACTIVITIES

1. Study a weather report from a newspaper, TV news or computer web site. Then list several instruments that were used to provide the forecast. For an extra challenge, write a summary describing the actual weather that occurred vs. the forecast.
2. Think about new weather-forecasting instruments that may be developed in the future. Describe a few of these instruments and explain how they will be able to predict the weather faster and more accurately.

Droughts

The most common form of precipitation in Florida is rain. In fact, the average amount of rainfall within the boundaries of the Southwest Florida Water Management District (SWFWMD) is approximately 54 inches per year. However, the amount of precipitation can vary from season to season and from year to year. Approximately 60 to 65 percent of the annual precipitation usually occurs between June and September. We know that as more people move to our area, the demand for water will continue to increase. But what happens when there isn't enough rain? A drought occurs. Droughts challenge the water consumption needs of agricultural, residential and recreational users.

What exactly is a drought?

A drought is a period of time during

which precipitation is much lower than the average amount of precipitation for that time of year at that particular place. A drought may cause water tables and the water levels in streams and rivers to fall and the soil to become dry.

How do droughts affect us?

Droughts have a serious impact on everything in our environment. Plants and crops suffer from the unusually dry weather. Our wildlife faces an additional challenge of finding enough water for their survival. In extremely dry conditions, forest fires can ignite easily and spread quickly. Residents may be required to follow regulations to ensure that they reduce their water consumption. Recreational activities, such as fishing and boating, may be

limited. Although a drought may appear to be over with the arrival of rain showers, this is not always the case. When the rain does fall, much of it is lost due to evaporation and transpiration, which are phases of the hydrologic cycle. Precipitation that reaches surface water bodies or sinks into the ground is often insufficient to recharge the aquifers. Therefore, the surface water levels and water tables remain low. Often, people do not believe there is a serious drought when they see rain showers, and may be reluctant save water. During drought conditions, it is especially important that water users understand and practice water conservation.

What Do You Think?

Read the following statement and list several reasons why you agree or disagree with it.
Regardless of whether or not we are experiencing a drought, it is important for all of us to protect and conserve our water resources.

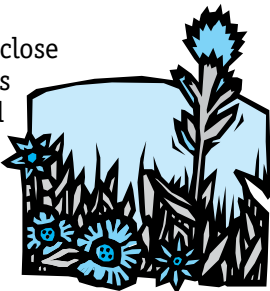
Weather Proverbs & Signs

When a storm is approaching, sea gulls remain on the beach and avoid flying over the ocean.



On Groundhog Day, if the groundhog sees its shadow and returns to its home, it means that winter will be extended.

Dandelions close their flowers when a cold front is moving to the area.



Throughout history, people have been interested in predicting the weather. People often relied on clues within their environment, such as changes among plants and animals, to warn them of an approaching storm. Here are just a few examples of proverbs and signs about weather forecasting that have been passed on to us. Add to the list by thinking about proverbs you have heard from your relatives, or by creating one of your own!

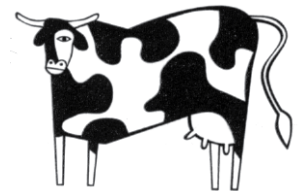
Weather Proverbs & Signs

Up to 12 hours before a storm, mosquitoes and flies will swarm and feast.

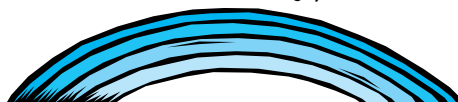


Frogs increase their croaking several hours before a storm is approaching.

Grazing animals such as cattle and sheep huddle together when the weather is about to change.



Red sky at night, sailor's delight.
 Red sky in the morning, sailor's warning.
 (A red sky at night means fair weather is predicted. But a red sky in the morning means that it will be stormy.)



A rainbow in the morning gives you fair warning. (This means that if there is a rainbow in the morning, there will most likely be rain approaching.)

Making a Barometer

You have learned that barometers are used to measure air pressure by weighing the amount of air over a particular area. High pressure systems are associated with cold air, and low pressure systems are associated with warm air. Cold air is heavier than warm air, so it causes a downward pressure on the earth's surface. Warm air does just the opposite by rising and releasing pressure. The change in pressure can be used to predict stormy weather or fair, clear weather.

Learning Goals

- ✓ To learn about the changes in air pressure through an experiment.
- ✓ To stimulate thought about instruments used for predicting weather.

Subjects

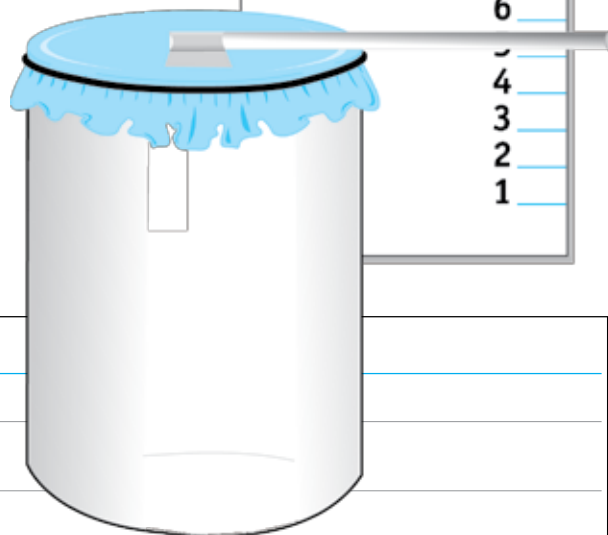
Science
Mathematics

Materials

8 oz. glass of water
balloon
straw
tape
rubber band
index card
pen
scissors
ruler

Barometer Experiment

10
9
8
7
6
5
4
3
2
1



Activities

1. Measure the diameter of the top of the glass.
2. Cut a piece of the balloon big enough so that when stretched, its diameter will be at least 1 inch larger than the top of the glass.
3. Stretch the balloon over the top of the glass and seal it with a rubber band and some tape.
4. Cut one end of the straw to make a pointer, and tape the other end to the center of the balloon piece so that it is horizontal.
5. On the right end of the index card, make 9 short lines to be used as a scale and number them 1–9.
6. Position the index card behind the glass so that the straw is lined up with number 5. Then tape the card to the glass.
7. Make a chart like the one below to record daily changes in air pressure.
8. Discuss the results.

DISCUSSION QUESTIONS

1. Describe the changes in air pressure using the information you recorded on your chart. What weather conditions caused the straw to move up or down on the scale?
2. If possible, use a real barometer along with your barometer and run the experiment again. Use the heading "Other Observations" to record the readings for the real barometer. Compare your data collected from the two barometers and discuss the results.

AIR PRESSURE MONITOR

Date	Weather Conditions	Barometric Reading (1–9)	Other Observations

SAMPLE

WaterWeb Crossword Puzzle

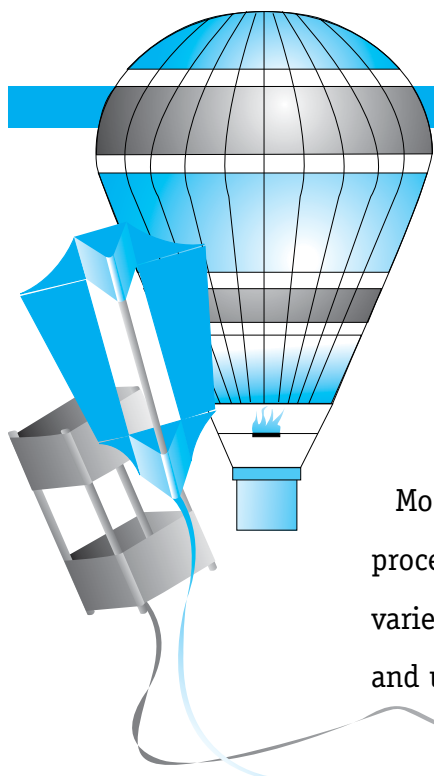
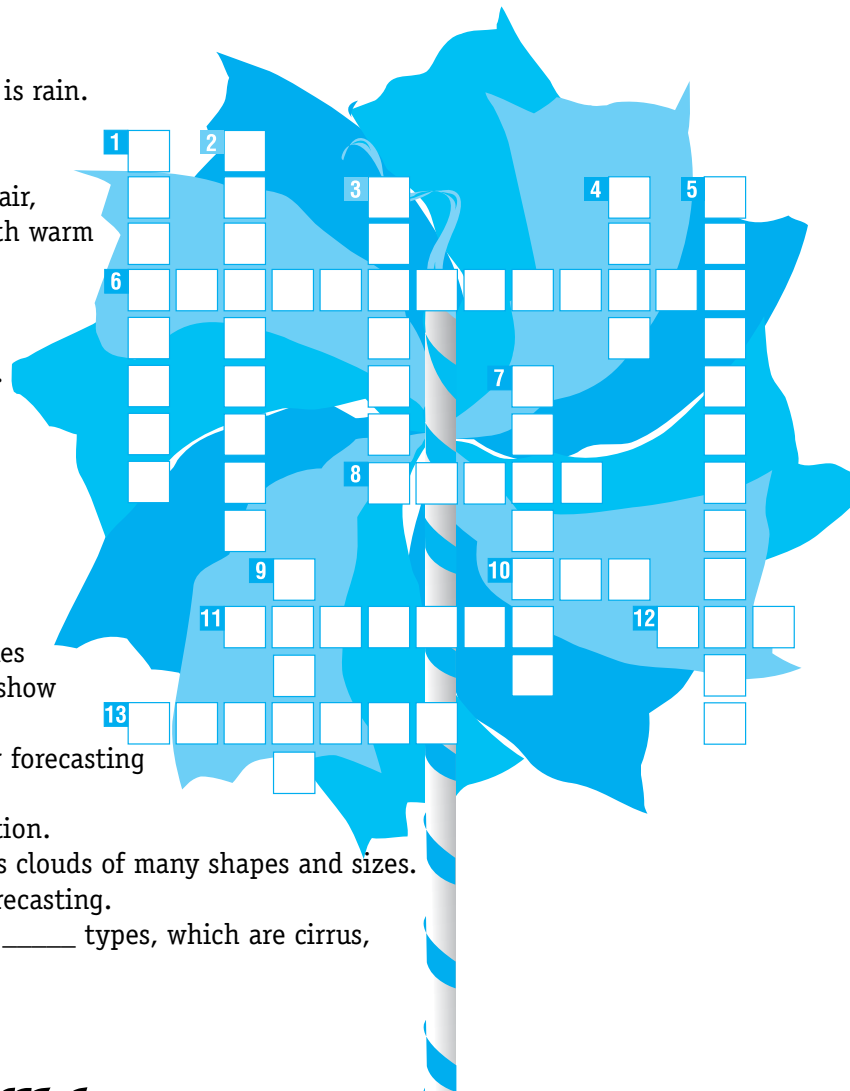
Sharpen your pencils. Complete each sentence with the correct word that fits in the puzzle.

Across:

6. In Florida, the most common form of _____ is rain.
8. The word that stands for radio detection and ranging is _____.
10. High pressure systems are associated with cold air, whereas low pressure systems are associated with warm or _____ air.
11. The _____ in our area is described as humid subtropical.
12. Barometers are used to measure _____ pressure.
13. A _____ may cause water tables and the water level in streams and rivers to fall and the soil to become dry.

Down:

1. Moisture in the air may be described by weather forecasters as the _____ (2 words).
2. A weather _____ is positioned thousands of miles above the earth's surface and takes pictures to show what is happening in the atmosphere.
3. A powerful remote sensing tool used in weather forecasting is _____ radar.
4. Snow, hail and _____ are examples of precipitation.
5. Part of the hydrologic cycle called _____ creates clouds of many shapes and sizes.
7. Many instruments are used in modern _____ forecasting.
9. Latin names are used to describe the four main _____ types, which are cirrus, cumulus, stratus and nimbus.

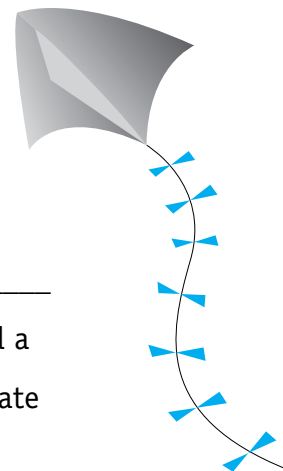


WaterWeb Scramble

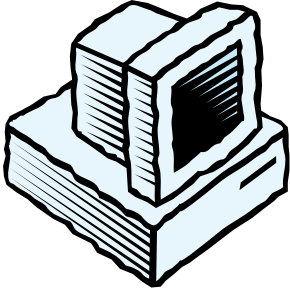
Unscramble the letters to form words. Then use these words to complete the paragraph.

- theware _____
- sinsmenrutt _____
- oolynegthc _____
- plomcex _____

Modern _____ forecasting is a _____ process that requires state-of-the-art _____ and a variety of _____ that help provide us with accurate and up-to-date information about our weather conditions.



Sites for WaterWeb Readers to Explore



There is a lot of information about weather available on the Internet. Here are just a few web sites for you to explore. All have numerous related links for you to gather additional material and participate in activities about topics related to weather.

The Weather Channel

weather.com

The National Weather Service

weather.gov

The National Weather Service for Tampa Bay

www.srh.noaa.gov/tbw

The Cable News Network's Weather main page

cnn.com/weather/

Weather site of USA Today

usatoday.com/weather/

Also, don't forget to explore the Southwest Florida Water Management District's web site:

WaterMatters.org

Answers

Activities on page 7

WaterWeb Crossword Puzzle answers

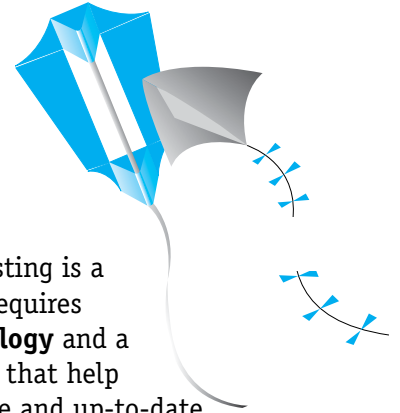


WaterWeb Scramble answers

weather
instruments
technology
complex

Paragraph:

Modern **weather** forecasting is a **complex** process that requires state-of-the-art **technology** and a variety of **instruments** that help provide us with accurate and up-to-date information about our weather conditions.



Credits

Southwest Florida
Water Management District

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