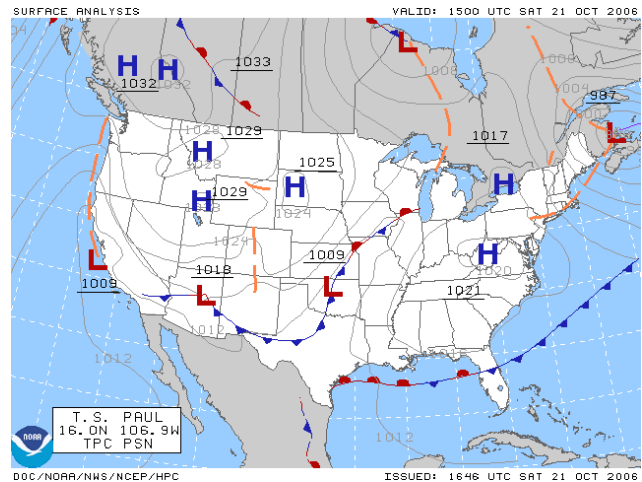


What's With Weather?: Forecast It!

One minute it's sunny and the next you can build a snowman! We all experience weather, but what really is weather and how do we predict it? Learn about how meteorologists forecast the weather before building some forecasting tools and setting up a weather station of your own!

Supplies:

- For Observation Journal:
 - Crayons/markers
 - Paper
 - For Barometer:
 - Glass jar
 - Balloon or plastic wrap
 - Rubber band
 - Ruler
 - Straw
 - Tape
 - Scissors
 - For Thermometer
 - Bottle
 - Rubbing Alcohol
- Straw
 - Marker
 - Food Coloring
 - Clay or playdoh
 - Pan of hot water, pan of cold water



What's With Weather?

Here in Colorado the weather seems to change quickly! But what really is weather and how do we forecast it?

Weather is the mix of events that happen each day in our atmosphere. Weather can be rain, sunshine, wind, warm days, cold days, and all the different changing pieces of our atmosphere. Weather is different in different parts of the world and it moves and changes—sometimes over days and sometimes over minutes! I bet you've experienced that here in Fort Collins when it's sunny in the morning and snowing by dinner! There are many different pieces that make up weather—**temperature, atmospheric pressure, wind, humidity, precipitation, and cloudiness**—are all changing pieces that help us describe, predict, and understand weather.

The average weather pattern in a place over several decades is called **climate**.

Why is it important for us to be able to understand and **forecast**—predict—the weather correctly? There's more at stake than just knowing if you can wear your favorite shorts or if you need to bring a jacket!

Farmers need to know when it's safe to plant new seedlings—baby plants—without them being killed by frost or cold. They also need to know what rain will be like to plan irrigation and avoid flooding. **Engineers and construction companies** need to know what the weather will be before they pour concrete that could be destroyed by cold or unexpected downpours, or make other building decisions. **Sports and event companies** can plan to avoid cancelations. **Power companies** can benefit by knowing when people will be using increased electricity to run heaters or AC! There's a lot of reasons to forecast the weather correctly! So how do we forecast the weather?

Forecasting Weather

Scientists called **meteorologists** use a variety of tools to observe, understand, and forecast Earth's weather. Data is collected at **weather stations** around the world by **thermometers** (they measure temperature), **barometers** (they measure atmospheric pressure), and **anemometers** (they measure wind speed). Scientists working for the U.S. National Weather Service also launch thousands of **weather balloons** across the country twice each day. These weather balloons rise up to 20 miles into the atmosphere and can drift over 100 miles! They carry instrument packages called **radiosondes** that collect information about the weather. Scientists have been using these balloons since the 1930s. . .almost 100 years! Since the 1960s, meteorologists



Launching a weather balloon



GOES-17 weather satellite operated by NOAA and NASA.

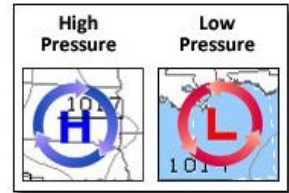
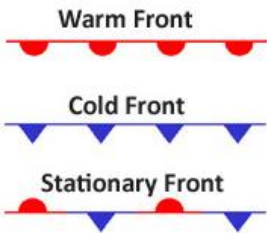
also use information collected by **weather satellites** orbiting above Earth. Satellites give us information about clouds and wind speeds, but can also see fires, volcanoes, dust storms, pollen, effects of pollution, ocean currents, hurricanes, and other information about our environment! They can also help track storms. Knowing where storms are now helps forecasters predict where they will be tomorrow. Meteorologists use the information collected by all these tools to create weather maps and forecasts!

Weather Maps

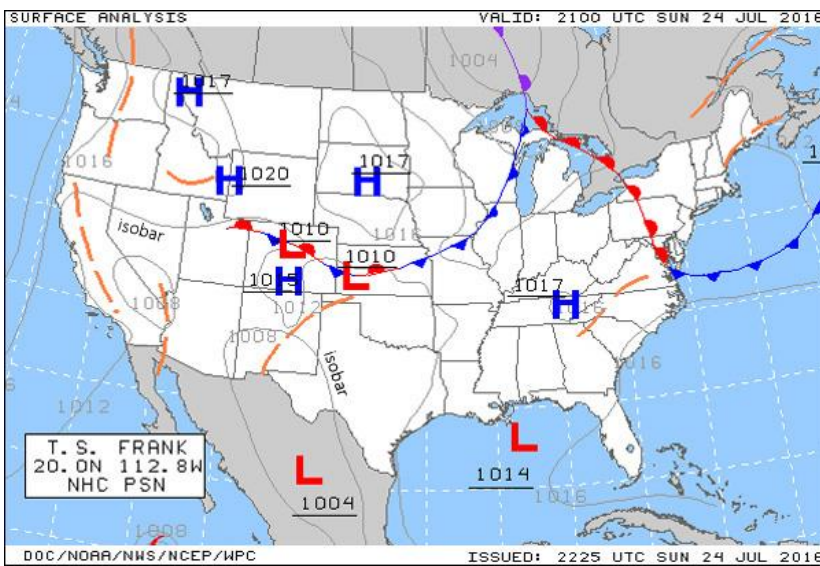
Weather maps are filled with all kinds of symbols representing different types of weather and things that change our weather. They might look confusing, but if you know the symbols you can decode the maps! A spiral, for example, is a hurricane. A thick line is a **front**. A front is a zone where temperature, humidity, and wind change quickly—they are a boundary between two air masses. Storms happen along fronts! When a warm air mass moves into the place of a cold air mass we call the boundary between them a **warm front**. On a weather map a



warm front is represented by a red line with half circles pointing the direction the air is moving (you can remember red circles—like a sun—means warm). A **cold front** is when cold air moves into the place of a warm air mass. A **cold front** is when cold air moves into the place of a warm air mass. On a weather map a cold front is a blue line with triangles pointing the way the air is moving. If warm and cold air meet and don't move we call that a **stationary front** (red and blue line). The letter "H" on a weather map means a **high pressure system**. These usually mean cool and dry air, good weather, and light wind. A letter "L" means a **low pressure system**. These are usually warm and moist air, stormy weather, and strong winds.



See if you can find some of these symbols on this weather map! Can you decode them?



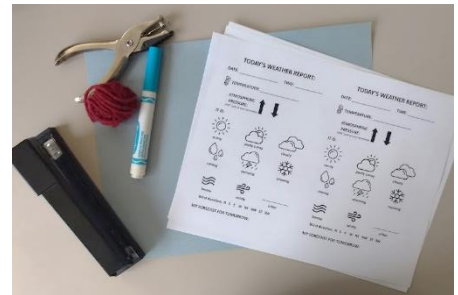
Your Turn!

Now that you know a bit about weather and how meteorologists forecast it, it's your turn! Use the instructions below to build your very own barometer, thermometer, and weather journal to start your very own weather station. What will you discover about weather in your town? Tag us @focomod with your creations! Check out our Explore Earth: Investigating Clouds Discovery at Home to grow your weather station and meteorologist skills and keep your eye out for more "What's With Weather" Discovery at Home activities!

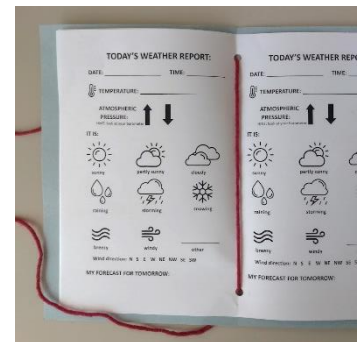
Make Your Own Weather Journal:

Meteorologists track weather over multiple days to make the best forecasts. Weather data over decades gives us information about a place's **climate**. You can track the weather from your home! Use your observation skills and the tools below! Keep your eye out for other Discovery at Home tools you can add to your weather station. Over time you will be able to forecast the weather too!

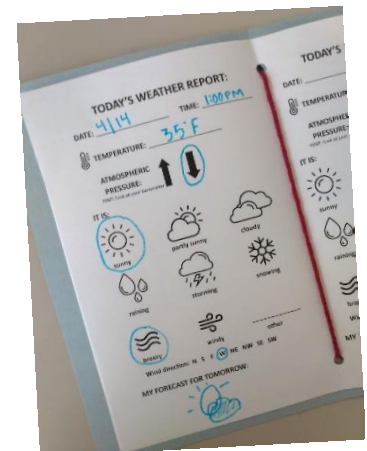
1. Gather your supplies! You'll need paper (or you can print the handy weather report sheets at the end of this pdf! Make sure to print double sided!) and a pencil/marker. If you want to make a book, you'll need a stapler or hole punch and string too.



2. Fold your paper and cover paper in half. Place your journal paper inside the cover. You can use plain paper or print off our journal pages. Decorate your cover! Attach the journal pages to the cover using stapler or by punching a hole at top and bottom and tying together with string!



3. Fill out your observation journal! Try and fill it out at the same time every day to be able to make the most accurate forecasts. After a few days try forecasting the weather. Why did you forecast that? What data did you base your forecast off of?
4. Try some of the other activities included here!



Make Your Own Barometer:

A **barometer** measures **atmospheric pressure**. Atmospheric pressure is the weight of the atmosphere overhead! Meteorologists track atmospheric pressure because **a change in atmospheric pressure means a change in weather**. Weather is controlled by changes in air pressure—high and low pressure systems (remember these are represented by “H” and “L” on our weather maps!). High pressure causes air to flow down and fan out near the ground, keeping clouds from forming—so nice weather! When air pressure is low, air flows together and then upward where it gathers, rising, cooling, and forming clouds—stormy weather! You can monitor the atmospheric pressure in your town by building your own barometer!

TIP: It won't be exciting at first, but if you watch for several days, you'll notice the pressure is changing without you realizing it!

5. Gather your supplies! You'll need a glass jar, ruler, straw, balloon or plastic wrap, scissors, tape, and a rubber band.

6. Cut the long end off the balloon. Cut a small slit in the end of the balloon.



7. Stretch the balloon so that it fits over the mouth of the jar. Make sure it's nice and tight and secure with a rubber band. If you don't have a balloon use plastic wrap. Make sure it's not loose or saggy...we need our jar to be sealed nice and tight!



8. Tape the end of the straw onto the middle of your balloon lid. A longer straw will make the barometer more accurate. You can put two straws together by cutting a small slit in the end of a straw, squeezing it to make the end smaller, and slipping it into another straw.



9. Keep your barometer indoors and in a place where it won't get bumped. Place a ruler behind your straw to observe it rising and falling.



Observe:

Observe your barometer for several days and record what you see in your weather journal. Be sure to observe at the same time each day. What do you notice? Does the straw point to the same place on the ruler each day? Is it rising and falling? What does that mean? Remember, a straw rising means increasing pressure—sunny and clear—a straw falling means decreasing pressure—cloudy and stormy!

What's Happening?

When you sealed the jar you captured air inside it. The air pressure inside the jar was exactly the same as the outside pressure, but as the weather changes the air pressure outside the jar changes. This causes the pressure on the balloon to increase or decrease, causing the straw to rise and fall.

Make Your Own Thermometer:

A thermometer measures temperature—how hot/cold the atmosphere is. Meteorologists report temperature using Celsius or Fahrenheit. In the U.S. we use Fahrenheit, but most other countries use Celsius. Temperature can tell us important things—for example it can't snow until it's below freezing (32°F)—but temperature is also relative (compared to something). A 70° day would feel chilly after a week of 90° weather, but hot after a week of 40° weather! Thermometers are some of the oldest tools we use to understand the weather. Try making your own thermometer and see what you observe!

1. Gather your supplies!
You'll need a clear bottle, water, straw, rubbing alcohol, food coloring, and clay (playdoh works too!)



2. Start by filling your bottle $\frac{1}{4}$ of the way with equal parts rubbing alcohol and water. Add a couple drops of food coloring. We're using red like in a real thermometer.



PRO TIP: If you're not using a clear straw add extra drops. The darker the water, the easier it will be to see it in the straw. Mix in the coloring.

3. Form a small clay pancake (we're using playdoh!) and poke a hole through for your straw. Be sure there is no clay inside your straw!
4. Stick your straw into the bottle. The end should be in the liquid but **SHOULDN'T** touch the bottom of the bottle.
5. Secure the straw at the top of the bottle with your clay. Be sure you have a tight seal. Pinch it tight against the straw but don't crush it. Make sure the top of your straw is poking out the top and is open to the air.



Observe:

Note where the water level **IN THE STRAW** is. Make a mark on the outside of the bottle. You can calibrate your thermometer by noting what the air temperature is (say how warm it is in your home) and noting that next to the mark.

Place your bottle in a pan of hot water. What happens to the water level in the straw? Label the level and temperature. What happens when you take your thermometer out? What happens to the level when you place it in cold water? Label that level and temperature.

What's Happening?

Air expands when warm, but since the bottle is airtight the air can only expand through the straw, sending the water level higher. Air contracts when it cools, making the water level drop. (The mixture will freeze below 32°F and won't work.)


Forecast It!



Use your new tools to set up a weather station! Observe the weather over the course of a week or two at the same time every day. What do you notice? What patterns do you see?

After a few days of data can you forecast the next few days of weather? Were you right?

TODAY'S WEATHER REPORT:

DATE: _____ TIME: _____

 TEMPERATURE: _____

ATMOSPHERIC PRESSURE:  
HINT: look at your barometer

IT IS:



sunny



partly sunny



cloudy



raining



storming



snowing



breezy



windy


other



Wind direction: N S E W NE NW SE SW

MY FORECAST FOR TOMORROW:

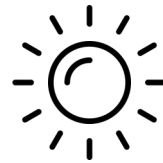
TODAY'S WEATHER REPORT:

DATE: _____ TIME: _____

 TEMPERATURE: _____

ATMOSPHERIC PRESSURE:  
HINT: look at your barometer

IT IS:



sunny



partly sunny



cloudy



raining



storming



snowing



breezy



windy

other

Wind direction: N S E W NE NW SE SW

MY FORECAST FOR TOMORROW: