Air Pressure Temp Probe Humidity

Weather Prediction

Overview

This lesson introduces students to the science behind weather formation. Using databot™ sensors, you will investigate atmospheric variables such as temperature, pressure, and humidity to understand how weather develops and changes over time.

Grades: Middle School
Time: 45 Minutes
Subject: Earth Science
Topics: Weather, Air Pressure, Temperature, Humidity

Background

Weather forecasting relies on analyzing changes in physical atmospheric parameters such as pressure, temperature, and humidity. These parameters serve as key indicators of atmospheric processes, enabling accurate predictions of weather changes. By monitoring these factors, we can better understand the dynamics of weather patterns and anticipate events such as storms, clear skies, or extreme conditions.

For example, a sudden drop in atmospheric pressure might signal the approach of a cyclone, leading to possible storms or rainfall.

Sharp temperature increases often accompany the arrival of warm fronts, while drops in temperature may indicate the presence of a cold front. Additionally, air temperature plays a critical role in processes such as condensation, which impacts precipitation formation.

High humidity often precedes rain, snow, or storms, while low humidity correlates with dry, clear weather.

The relationship between these parameters is highly interconnected, forming the foundation of meteorology. For instance, a combination of falling pressure, rising humidity, and increasing temperatures could indicate the approach of a thunderstorm front. Understanding these relationships helps refine weather forecasting and deepen insights into atmospheric processes.

What You Will Need/Prep

- databot
- IOS/Android Smart Device
- Install Vizeey™ on your Smart device.
- Ziploc bag + straw, container
- A glass of cold water
- A fan or heater or a container with dry rice or silica gel..

- Test your databot™ connection.
- You will be prompted to select and connect to databot™ each time you launch an experiment.
- If there are two or more databot's listed, the one closest to your device will be highlighted in blue.
- Study the background information and terms and prepare to explore!

Air Pressure Temp Probe Humidity

This lab focuses on using sensors to monitor atmospheric pressure, humidity, and temperature to predict weather changes. You will explore how these factors influence the weather and how they can be used to forecast short-term weather conditions. The databot™ will help you gather data to understand the relationship between these variables and their impact on the weather.

Learning Objectives

By completing this lab, students will:

- Understand how atmospheric pressure, humidity, and temperature affect weather.
- Learn how to use sensors to monitor and collect data about weather conditions.
- Predict weather changes based on sensor data.
- Enhance critical thinking and data analysis skills through real-world applications.

Important Terms

Atmospheric Pressure: The air around you has weight and it presses against everything it touches. That pressure is called atmospheric pressure or air pressure. Measured in hPa (hectopascals).

Humidity: The percentage of water vapor in the air, typically measured using a hygrometer.

Temperature: A measure of how hot or cold the air is, usually measured in degrees Celsius or Fahrenheit.

Pressure Systems: Areas of high or low pressure that influence weather patterns.

Weather: Weather refers to the atmospheric conditions in a specific place at a specific time. It includes factors such as temperature, humidity, air pressure, wind speed, and precipitation (rain, snow, sleet, or hail).

Interesting Facts

Modern meteorologists rely heavily on computer models that use atmospheric data to predict weather. This data often comes from weather stations, satellites, and sensors like the ones in this lab.

The coldest temperature ever recorded on Earth was -128.6°F (-89.2°C) in Antarctica, while the hottest was 134°F (56.7°C) in Death Valley, California.

The highest atmospheric pressure recorded at sea level was 1084 hPa in Siberia, while the lowest was 870 hPa during Typhoon Tip in 1979.

About 100 lightning bolts hit the Earth's surface every second, and each bolt can be up to five times hotter than the surface of the Sun.

A city can create its own microclimate due to urban heat islands, where buildings and asphalt retain heat, leading to higher temperatures compared to surrounding areas.

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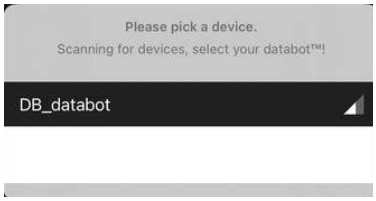
Using Vizeey

In order to work with the experiment you need to launch the Vizeey application and click on + in the upper right corner.

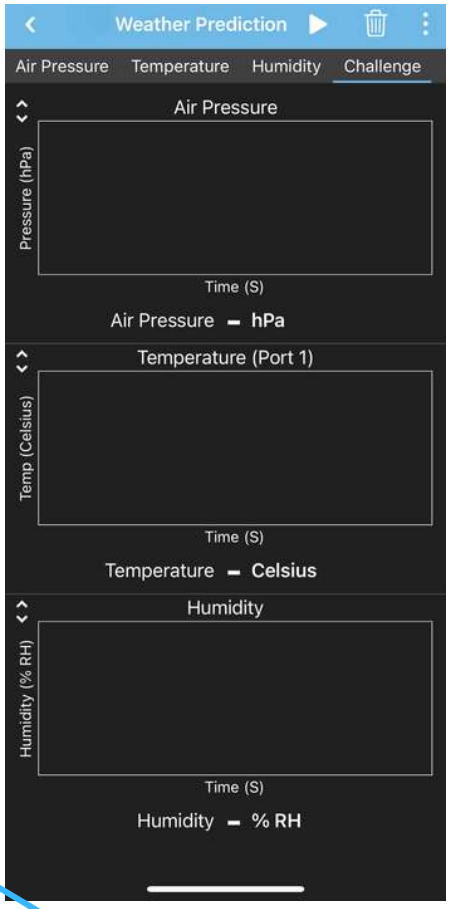
Then select “Add experiment from QR code” and scan the QR code prepared for this experiment. Your experiment will appear in the list.

When you start the experiment you will be immediately offered to connect to your databot. Make sure that databot is enabled.

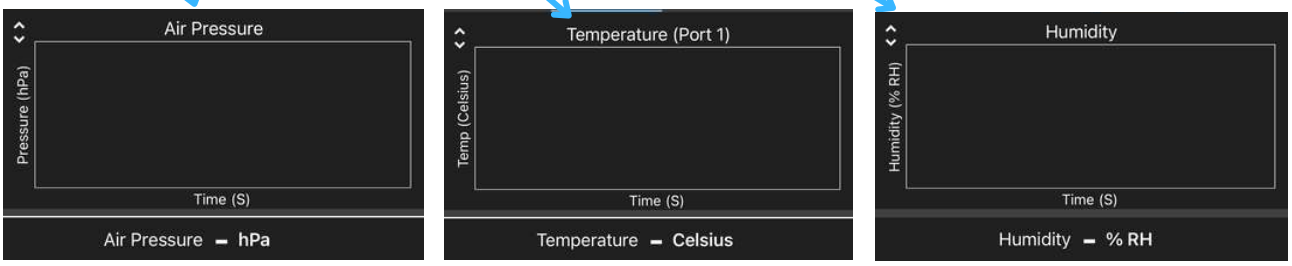


Once in the Experiment

This is the main experiment on weather forecasting, where you will analyze sensor readings to predict upcoming weather conditions. You will need to carefully observe changes in pressure, temperature, and humidity, then use that data to make an accurate weather prediction.



Here, you will find three additional tabs displaying atmospheric pressure, temperature, and humidity. These can be used in the first, second, and third parts of the experiment to practice generating and analyzing different weather conditions.



Don't forget to connect the temperature sensor to databot.

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Part 1: Initial Observations and Discussion Questions

- How do you think changes in temperature influence the weather?

_____

_____

- How might atmospheric pressure and humidity interact to create rain?

_____

_____

_____

- Why do you think weather changes so quickly sometimes, but other times it seems to stay the same for days?

_____

_____

Part 2: Hypothesis

Write your hypothesis for each part of the experiment

How do you think atmospheric pressure changes when a storm is approaching?

_____

_____

_____

What do you predict will happen to humidity levels before and after a rainstorm?

_____

_____

_____

Observing weather patterns is typically a lengthy process that can take days, weeks, or even months. However, since we don't have that kind of time, we will simulate weather conditions and draw conclusions from the collected data. Along the way, we'll also learn how to gather data using databot and interpret it effectively.

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Part 3: Experiment Procedure

Part 1: Atmospheric Pressure: Understanding the Influence of Air Pressure on Weather

High Pressure:

When atmospheric pressure increases, it is often associated with the arrival of anticyclones—areas of high pressure. Under these conditions, the weather tends to be stable, clear, and dry, with minimal or no cloud cover. This typically leads to:

- Warm and sunny weather
- Low chance of precipitation
- Light to moderate winds

Such conditions usually indicate good weather ahead.

Low Pressure:

A drop in atmospheric pressure signals the approach of a cyclone—an area of low pressure. These conditions are often linked to increased cloud cover and precipitation. It may result in:

- Cloudy and rainy weather
- Higher humidity levels
- Stronger winds and possible storms
- Cooler temperatures

Investigation of Air Pressure Changes

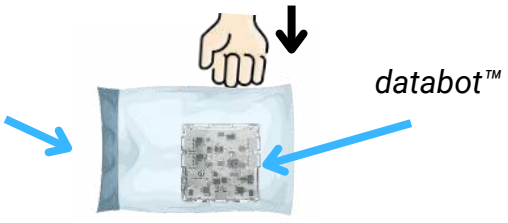
- Turn on databot™
- Tap on **"Weather Prediction"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Air Pressure"* and start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.

Simulate High Pressure:

- Place databot inside a plastic (ziploc)bag.
- Seal the bag tightly to make it airtight.
- Press down gently on the bag, increasing the pressure inside.
- Record the databot's readings as the pressure rises. _____

Simulate Low Pressure:

- Insert a straw into the bag and seal the opening around it.
- Suck out the air from the bag using the straw to decrease the pressure inside.
- Record the databot's readings as the pressure drops. _____



Air Pressure Temp Probe Humidity

Part 2: Temperature: Understanding the Influence of Temperature on Weather

Temperature Increase:

Rising temperatures are typically associated with warm air masses moving into a region or prolonged sunny conditions. This often indicates:

- The arrival of a warm front and potentially hot weather
- Increased wind activity or dry conditions if paired with high pressure
- Potential heatwaves during hot seasons

Such conditions suggest warming trends and possible shifts towards drier or more stable weather.

Temperature Decrease:

Falling temperatures are often linked to the arrival of a cold front. These changes may lead to:

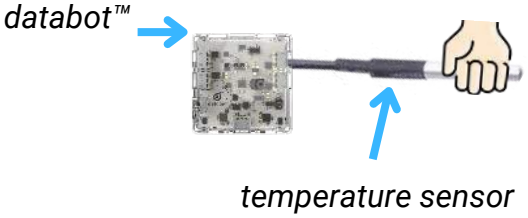
- A sudden drop in temperature, especially during a cold front passage
- Precipitation, such as rain or snow
- Frost formation, particularly at night or in winter months

Investigation of Temperature Changes

- Turn on databot™
- Connect the temperature sensor to port 1.
- Tap on **"Weather Prediction"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Temperature"* and start your experiment using:
- Use these icons at the top of the screen in Vizeey to start and to pause the experiment.

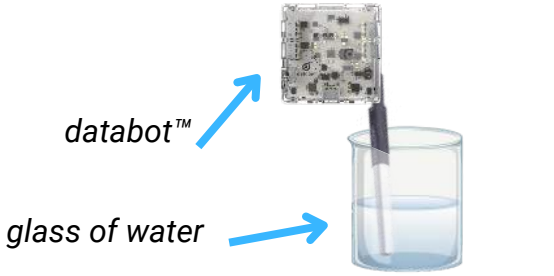
Simulate a Temperature Increase:

- Hold databot in your hands for 30 seconds to allow the heat from your body to increase its temperature readings.
- Record the changes in temperature. _____



Simulate a Temperature Decrease:

- Place databot inside a refrigerator, or a glass of water or next to a cold surface for a minute.
- Observe and record the drop in temperature. _____



Air Pressure Temp Probe Humidity

Part 3: Humidity: Understanding the Influence of Humidity on Weather

Increase in Humidity levels:

Air moisture levels rise when there is cloud cover, high temperatures, and little wind. A rise in humidity often signals:

- Potential precipitation in the near future
- Fog or increased cloud cover
- The likelihood of rain or snow, depending on the temperature
- A higher probability of storm formation

These conditions indicate that moisture is accumulating in the atmosphere, which can lead to unstable weather.

Decrease in Humidity levels:

Humidity levels drop when dry air moves into a region, which can be caused by:

- The influence of an outgoing cyclone or high-pressure system
- Clear skies and dry conditions with minimal cloud cover
- Warm summer weather with little to no rainfall

Investigation of Humidity Changes

- Turn on databot™
- Tap on **"Weather Prediction"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Humidity"* and start your experiment using:
- Use these icons at the top of the screen in Vizeey to start and to pause the experiment.

Simulate the Increase in Humidity:

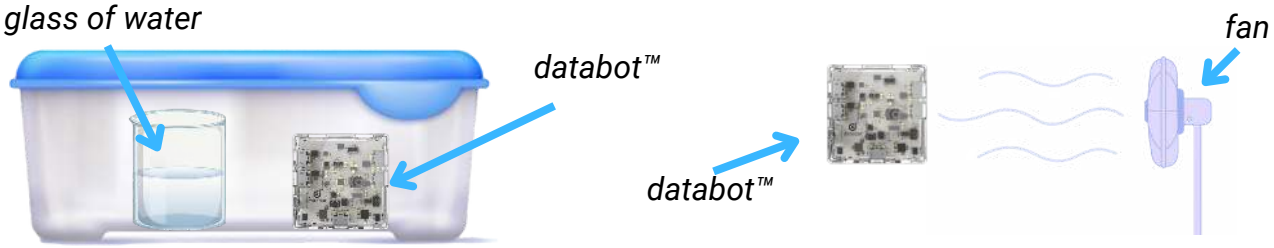
- Breathe gently onto the databot's sensor or place it inside a sealed container with a damp paper towel for a minute.
- Observe and record how the humidity levels rise.

_____

Simulate the Decrease in Humidity:

- Place databot in a dry environment, such as next to a source of warm air (a fan or heater) or inside a container with dry rice or silica gel.
- Monitor the changes and record the decrease in humidity.

_____



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Bringing It All Together: Weather Prediction

Now that we understand the key factors that influence weather—pressure, temperature, and humidity—we can analyze them to make predictions. Weather forecasting becomes more accurate when we consider all three indicators together. Here are some common combinations and what they tell us about upcoming weather:

- **High pressure + high temperature + low humidity** Warm and sunny weather, with little to no chance of precipitation.
- **Low pressure + high temperature + high humidity** Likely thunderstorms, with a strong possibility of rain.
- **High pressure + low temperature + low humidity** Clear, cold weather, with no precipitation.
- **Low pressure + low temperature + high humidity** Snowfall or rain turning into snow, depending on temperature.
- **High pressure + moderate temperature + moderate humidity** Pleasant and stable weather, ideal for outdoor activities.
- **Low pressure + warm air + moderate humidity** Cloudy skies with light rain or drizzle.
- **Rapidly falling pressure + high humidity** Approaching storm, likely with strong winds and heavy rain.
- **Rising pressure + decreasing temperature** Clearing skies, with cooler but stable weather ahead.

These combinations show how different factors interact to shape the weather we experience daily.

Experiment 4: Weather Prediction Challenge

Students will work in teams to analyze real-time weather data from the Databot and predict the weather based on observed conditions.

- One team will stay in the classroom, monitoring real-time data.
- The second team will take the Databot to another location (hallway or another room) and simulate different weather conditions.

(*It is important not to go far and make sure that the data from the databot is being transmitted.*)

Air Pressure Temp Probe Humidity

- Turn on databot and connect it to a phone or tablet.
- The monitoring team will track air pressure, temperature, and humidity readings using the Vizeey app.
  - *Don't forget to choose the tab "Challenge" for this part of measurement.*
- The second team will manipulate the environment to create specific weather conditions. For example:

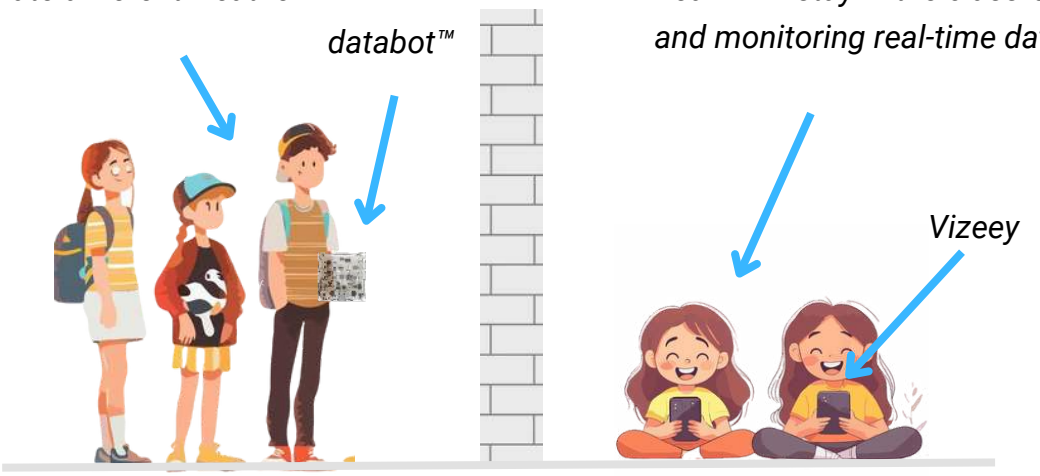
  1 - *Increase temperature by placing databot near a warm surface.*

  2 - Increase humidity by breathing on the sensor or placing it in a humid environment.

  3 - Change pressure by sealing it in a bag and pressing or removing air.

Team simulate different weather conditions.

Team will stay in the classroom, and monitoring real-time data.



- The monitoring team must analyze the data and guess what kind of weather is being simulated.

For example:
if they see high pressure, high temperature, and low humidity, they should predict warm, sunny weather.
If they detect low pressure, high humidity, and falling temperature, they should predict a storm or rain.

- Once the first team has made their predictions, switch roles.
- The second team will now analyze data while the first team creates new weather conditions.

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Part 6: Concept Questions

- What are some natural factors that can cause temperature to increase or decrease?

_____

- Why does high humidity often indicate rain or storms?

_____

- Why is it important to analyze pressure, temperature, and humidity together rather than separately?

_____

Part 7: Reflection

1. If you had to explain the connection between pressure, temperature, and humidity to a friend, how would you do it?

_____

_____

2. Did your predictions in Experiment 4 match the actual weather conditions simulated by the other team? Why or why not?

_____

_____

3. What would happen if we ignored one of these factors (pressure, temperature, or humidity) when predicting the weather?

_____

_____