



Cape of Storms or Cape of Good Hope?

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Target Grade: 7th grade history with STEM and ELA connection

Time Required: 70 minutes

Standards

Next Generation Science Standards (NGSS):

- **MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- **MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Tennessee State Social Studies Standards:

- **7.58** Analyze why European countries were motivated to explore the world, including: religion, political rivalry, and economic gain.
- **7.59** Identify the significance of the voyages and routes of discovery of the following explorers by their sponsoring country:
 - England: Henry Hudson
 - France: Jacques Cartier
 - Portugal: Vasco da Gama, Bartolomeu Dias
 - Spain: Christopher Columbus, Hernando de Soto, Ferdinand Magellan, Amerigo Vespucci

Common Core ELA Standards

- **CCSS.ELA-LITERACY.W.7.1** Write arguments to support claims with clear reasons and relevant evidence.
- **CCSS.ELA-LITERACY.W.7.9** Draw evidence from literary or informational texts to support analysis, reflection, and research.

Lesson Objectives

Students will:

- Explain why Bartolomeu Dias sailed around the southern tip of Africa and what challenges he and his crew faced.



- Categorize famous shipwrecks in the southern cape of Africa based on the main cause of the shipwreck and understand how weather and other factors can impact maritime exploration and the safety of sailors.
- Use real data to compare sea temperatures in different areas and explain how currents carry air masses with them, affecting the way things move in the water and causing changes in the weather.
- Write a persuasive letter to a friend who is considering taking a high paying job as a commercial fisherman in the area, weighing the pros and cons of the job and thinking about the impact of exploration and commerce on cultures and societies.

Central Focus

During this lesson, students will embark on a thrilling adventure through history and science as they examine the fascinating world of maritime exploration. They'll begin by reading and annotating an article about Bartolomeu Dias and categorizing famous shipwrecks in the southern cape of Africa based on the main cause of the shipwreck. This activity will help them gain a deeper understanding of the impact of weather and other factors on maritime exploration and the importance of safety measures for sailors. They'll then explore scientific concepts such as convection currents and sea temperatures and learn how they can explain weather patterns. Finally, they'll put their critical thinking and persuasive writing skills to the test as they write a letter to a friend who is considering taking a high-paying job as a commercial fisherman in the area. This lesson plan is designed to be informative, educational, and engaging as students set sail on a thrilling adventure through history and science!

Keywords: Portuguese empire, shipwrecks, weather patterns, convection currents, sea temperatures, persuasive writing skills, critical thinking skills, air masses, frontal boundaries, data collection

Background Information

Prior to this lesson, the teacher should have knowledge of the following topics:

1. **European Exploration:** The teacher should have a solid understanding of the motives behind European exploration during the Age of Exploration, which took place from the 15th to the 17th centuries. These motives included a desire to find new trade routes to Asia that bypassed the Ottoman Empire, which controlled the land routes at the time, as well as a desire to spread Christianity and establish colonies in new territories. The teacher should also be familiar with the major European explorers of the time and their voyages, including Christopher Columbus, Vasco da Gama, Ferdinand Magellan, and Bartolomeu Dias.
2. **Maritime Exploration:** The teacher should be knowledgeable about the challenges faced by sailors and explorers during maritime exploration, including the risks of shipwrecks, storms, and navigational difficulties. The teacher should understand the types of ships used during this time, including caravels and galleons, and have a basic understanding of the technology and instruments used in navigation, such as the astrolabe and magnetic compass.



3. **Geography:** The teacher should have a strong understanding of the geography of Africa, including the location of the southern tip and the significance of this area for maritime exploration. The teacher should also be able to locate major cities and ports in Africa and understand the impact of geography on weather patterns and ocean currents. Additionally, the teacher should be knowledgeable about the geography of Asia and the trade routes that connected Europe, Asia, and Africa. Found at the southern tip of the Cape Peninsula, the Cape of Good Hope was first named the Cape of Storms in the 1480s. This famous geographical location was named by the Portuguese explorer Bartolomeu Dias. To attract traveling the southern coast of Africa to the Cape Sea Route, it was eventually renamed as the Cape of Good Hope. Later, sailors on their way to Asia from Europe found the Cape to be an important port and waypoint to their journeys.
4. **Science:** The teacher should have a basic understanding of how ocean currents work and their impact on weather patterns, including how they affect the distribution of heat around the planet. The teacher should also understand the concept of density and how it relates to the movement of warm and cold air masses, which can result in the formation of weather patterns such as thunderstorms, hurricanes, and tornadoes. The area where the Atlantic and Indian Oceans meet can create treacherous environments for ships. Ocean currents from the east (the Agulhas) and northwest (Benguela), cause such environments due to their differing temperatures; the warm Agulhas current runs into the cold Benguela current. When these types of currents come together, they can create perilous fog and waves. Much like low and high air pressure in the atmosphere, warm and cold ocean currents do not have the same density – warm water rises and cold water sinks – and therefore collide, creating heavy waves and unstable weather such as fog. This weather makes it incredibly difficult to navigate the waters so much so that the dangerous environments caused by these waves have resulted in many shipwrecks.
5. **Ethical considerations:** The teacher should be familiar with the ethical considerations surrounding exploration and commerce, including the impact on cultures and societies. European exploration and colonization had a significant impact on the peoples and cultures of the regions they encountered, often resulting in the exploitation and oppression of indigenous peoples. The teacher should be prepared to facilitate discussions on these topics, encouraging students to consider the ethical implications of exploration and commerce and how they relate to modern-day issues.
6. **Social Studies:** The teacher should have a basic understanding of the impact of European exploration on the people and cultures of Africa and Asia, including the establishment of trade routes and colonial empires. The teacher should also be familiar with the economic, social, and political factors that drove European expansion during this time.



Prior to this lesson, students should have a basic understanding of the following concepts:

1. **Basic geography:** Students should have a basic understanding of the major continents and oceans of the world, including their locations and general characteristics. Students should also be able to identify major countries and cities on a world map and understand their significance in global history and economics.
2. **European history:** Students should have a general understanding of the major events and figures in European history that led up to the Age of Exploration, including the Renaissance, the Reformation, and the rise of the major European powers. Students should also be familiar with the major explorers of the time, such as Christopher Columbus, Vasco da Gama, and Ferdinand Magellan.
3. **Scientific concepts:** Students should have a basic understanding of scientific concepts such as weather patterns, ocean currents, density, and convection currents. Students should understand how weather patterns are created by differences in air pressure, temperature, and humidity, and how ocean currents are created by differences in water temperature and salinity. Students should also understand the concept of density and how it relates to the movement of warm and cold air masses and water currents, as well as the concept of convection currents and their role in redistributing thermal energy.
4. **Literacy skills:** Students should have basic reading comprehension skills, including the ability to annotate and summarize a text, make connections to their own experiences and knowledge, and participate in group discussions. Students should also be able to analyse and interpret data, such as temperature data, and use it to draw conclusions and make predictions.

*Note: As an extension, this lesson can connect to climate change and build upon students' understanding by making predictions as to what will happen to the climate as sea temperatures begin to rise.

If students have any additional questions about any scientific concepts include in the lesson, direct them to the Information Sheet.

Materials

- Optional for Density Tank demonstration:
 - Density tank
 - Hot and Cold Water
 - Food Coloring (red and blue)
- All at Sea worksheet
- Shipwrecks article: <https://insideguide.co.za/cape-town/shipwrecks/>

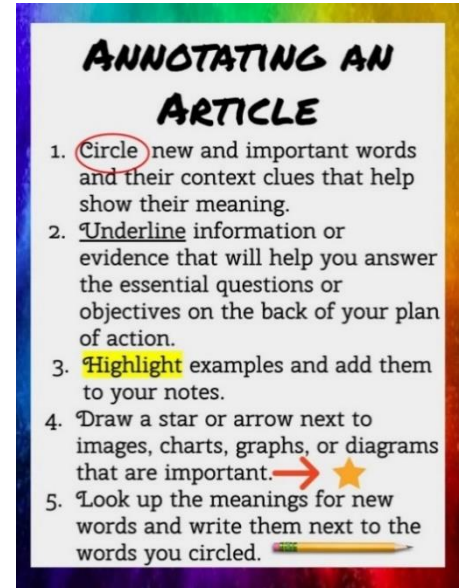


- Worksheet “All at Sea”
- Article about Bartolomeu Dias: <https://www.history.com/topics/exploration/bartolomeu-dias>

Instruction

Opening (15 minutes)

- Provide students with the following article:
<https://www.history.com/topics/exploration/bartolomeu-dias>
 - The article discusses Bartolomeu Dias, a Portuguese explorer who led the first European expedition to sail around the southern tip of Africa, opening the way for a sea route from Europe to Asia. His voyage also helped establish Portuguese trade and colonial empire in Africa and Asia.
- Have students work in pairs to read and annotate the article using the guide.
- Discuss with students how they annotated the article and summarize the text. Use the following question prompts to encourage conversation:
 - What motivated Bartolomeu Dias to undertake his voyage around the southern tip of Africa, and what were his goals?
 - What challenges did Dias and his crew face during their voyage, and how did they overcome them?
 - How did Dias' discovery of a sea route to Asia impact Portuguese trade and colonial expansion, and what were the consequences for the people and cultures they encountered?
 - How might history have been different if Dias had not succeeded in his voyage or if another country had discovered the sea route to Asia first?
 - What can we learn from Bartolomeu Dias' legacy as an explorer, and how does his voyage relate to modern-day exploration and discovery?



Investigation (25 minutes)

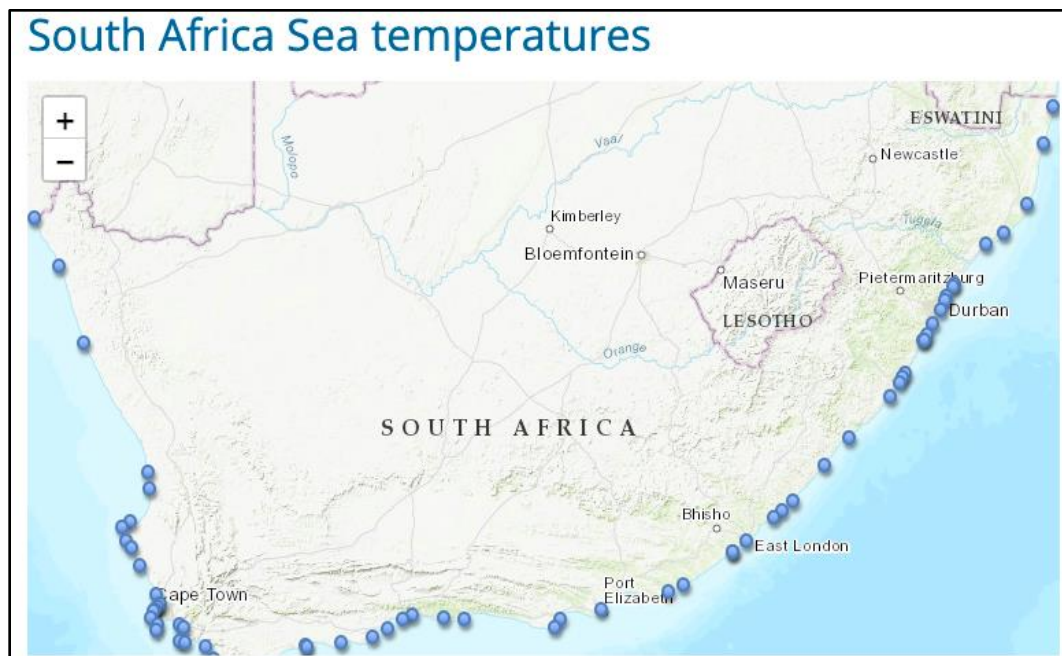
- Emphasize the importance of exploration and the risks that come with it. Just as Bartolomeu Dias faced challenges and overcame them to achieve his goals, sailors and explorers who sailed the seas faced risks that could lead to shipwrecks.
- Reintroduce the southern cape of Africa as an example of a very dangerous voyage. Explain to the students they will get to learn about famous shipwrecks in this area by categorizing the causes of the shipwrecks they read about.
- Divide students into groups of 4 and provide students with the worksheet “All at Sea.”
- Have each group read about 10 shipwrecks at <https://insideguide.co.za/cape-town/shipwrecks/>



- After reading descriptions of sea wrecks, students should categorize them based on the main cause of the shipwreck, which may include storms, hitting submerged rocks, or heavy fog.
- Following this section, pause to discuss the students and lead the following discussion with the students to connect to topics discussed in their science classes:
 - How do the challenges faced by Bartolomeu Dias and his crew during their voyage compare to the challenges faced by sailors in the shipwrecks you read about?
 - How did exploration and maritime trade impact the development of European empires in Africa and Asia?
 - Do you think the weather patterns in the area could have been predicted? Why or why not?
 - What factors might be contributing to the increase in weather patterns in the area where the shipwrecks occurred?
- After the discussion, instruct students to answer the question on their worksheet: What do you predict is the cause of increased weather patterns in the Cape area?

Discovery (15 minutes)

- Following the worksheet, instruct students to go to the website:
<https://www.seatemperature.org/africa/south-africa/>



- Using Port Edward as an example, have students click on the dots and record the temperature data for two cities on the Eastern, Southern, and Western coasts on their worksheet.
- On their worksheet, students will then use their data to answer the following questions:
 - Where is the ocean warmer? Where is it cooler? (Use east coast, west coast, or/and south coast in your answer)



- Compare the average sea temperature to the land temperature. Why might these numbers be similar?
- Thinking back on the text, why might these sea temperatures cause weather patterns (fog, storms, strong winds) off the southern coast?
- Why might it be useful for voyagers to know ocean temperatures when preparing for their journey?
- During this time, circulate the room to help students. Students will likely struggle with the questions because it is asking them to analyze data and make connections to a scientific concept.
 - Remind students of the concept that currents carry air masses with them. The types of air masses are Maritime Tropical (mT), Maritime Polar (mP), Continental Polar (cP), and Continental Tropical (cT). Air masses that come from the sea are mT and mP.
 - When two air masses with different temperature, humidity, and pressure characteristics meet, this can cause a front. When a cold air mass and a warm air mass meet, they do not readily mix due to their differences in density. Instead, the warmer, less dense air rises above the denser, colder air. This lifting of warm air creates a boundary between the two air masses, known as a front. Depending on the characteristics of the air masses and the direction of movement of the front, different types of weather conditions can result, such as rain, thunderstorms, or snow.
 - The instructor can also choose to provide students with the Information Sheet as a scientific concept reference sheet.
- Once all students have finished the worksheet, highlight selected student responses, and reiterate the information above to ensure students draw the connection between sea temperatures and weather patterns. Use this conversation to check for understanding and any misconceptions.
- If needed, the teacher can demonstrate the density experiment to visually show cold and warm temperatures not mixing, leading to frontal boundaries (where weather systems occur).

Optional Demonstration (10 minutes)

- The teachers can perform a demonstration or show this video to show how convection currents work. <https://vimeo.com/655997862/53c127bb7a>
- Fill a density tank with cold water (blue) on one side and warm water (red) on the other side.

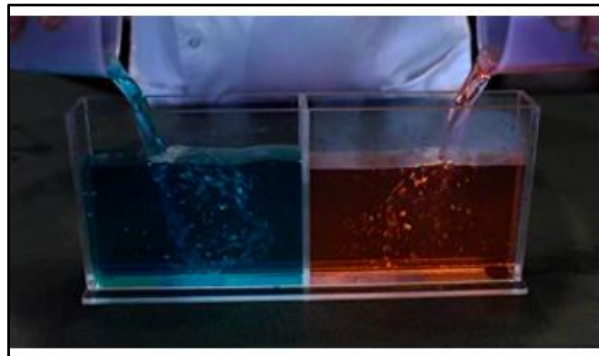


Figure 1: https://m.media-amazon.com/images/I/714iSkaSj+L._SL1280_.jpg



- Ask select students to share a prediction with the class of what will happen when the center divider is pulled out.
 - Emphasize that one side is warm and the other is cold.
- Remove the center divider.

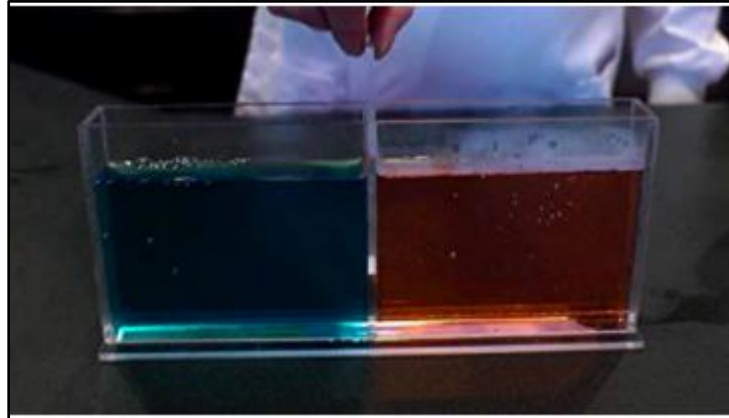


Figure 2: https://m.media-amazon.com/images/I/61TuzDigBiL._SL1280_.jpg

- Engage students in a discussion about what actually happened.
- Discuss with students how this connects to weather patterns and what occurs when two fronts meet.
 - The movement of cold and warm water/air causes convection currents. Convection currents can affect the way things move in the water and redistribute thermal energy that causes changes in the weather.

Activity extension (10 minutes)

- Introduce a color-coded map that shows sea temperatures around the globe.

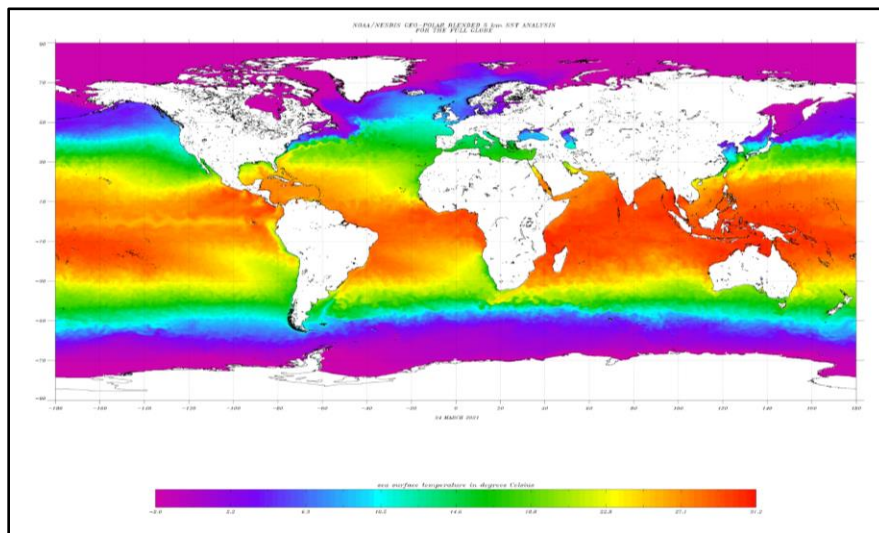


Figure 3: https://www.ospo.noaa.gov/data/sst/contour/global_small.cf.gif



- Ask students to predict other locations on the map where they would expect to find a high concentration of shipwrecks/high concentration of storms.
- Share and discuss a couple of the students' answers. Encourage students to use scientific vocabulary and relate to conversation back to the last question on their worksheet: Why might it be useful for voyagers to know ocean temperatures when preparing for their journey?

Closure (10 minutes)

- Remind students of the two names associated with the southern tip of Africa: Cape of Storms and Cape of Good Hope.
- Have them reflect upon why each name exists.
- Instruct them to write a persuasive letter to a friend who is considering taking a high-paying job as a commercial fisherman in that area.
 - The pay is nearly double compared to what he/she could earn in other commercial fishing opportunities.
 - The letter needs to address both the pros and cons of taking the job, and they need to make a final recommendation about whether the job should be accepted or not.
 - The next day's lesson will begin with a tally of how many chose each name and a listing of the pros/cons of each argument.

Differentiation

Reading level: The article about Bartolomeu Dias may be challenging for some students to read and comprehend. To support struggling readers, the teacher can provide a simplified version of the article or a video that summarizes the key points. Alternatively, the teacher can pair struggling readers with stronger readers to work on the article together, with the stronger reader assisting with comprehension and annotation.

Grouping: The teacher can group students heterogeneously or homogeneously, depending on the needs of the class. For example, students who struggle with reading or writing can be paired with stronger readers or writers to work on the worksheet together. Alternatively, students who are more advanced can work on additional research projects or present their findings to the class.

Graphic organizers: To support students who struggle with organizing their ideas, the teacher can provide graphic organizers or templates to help students structure their notes and ideas. For example, the teacher can provide a KWL chart to help students organize what they know, what they want to know, and what they learned about the topic.

Role-playing: To engage students who learn best through hands-on activities, the teacher can have students role-play different parts of the lesson. For example, students can work in groups to act out different parts of the article while another member reads it.



Technology: To engage students who are more comfortable with technology, the teacher can incorporate different forms of technology into the lesson. For example, students type their responses to the All at Sea worksheet.

Differentiated Assignments: The teacher can provide differentiated assignments that allow students to choose from a variety of options. For example, for the closure activity, students can choose to write a persuasive essay, create a visual aid, or give a presentation instead of writing a letter. This allows students to work on assignments that are more aligned with their strengths and interests.

Assessment

Formative assessments:

- **Annotation and discussion of the article about Bartolomeu Dias:** Students will work in pairs to read and annotate the article about Bartolomeu Dias and discuss their annotations with the class. This allows the teacher to check for understanding and provide feedback to students.
- **Categorizing shipwrecks:** After reading descriptions of shipwrecks, students will categorize them based on the main cause of the shipwreck. This will allow the teacher to assess students' ability to analyze and interpret data, as well as their understanding of the impact of weather patterns and ocean currents on maritime travel.
- **Sea temperature analysis:** Students will analyze sea temperature data and answer questions about the data, including where the ocean is warmer and cooler and how sea temperatures can impact weather patterns. This will allow the teacher to assess students' ability to analyze and interpret scientific data and draw conclusions based on that data.

Summative assessment:

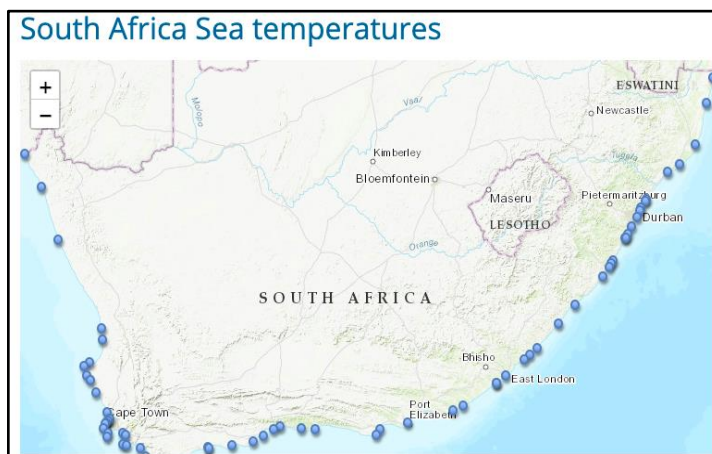
- **Persuasive letter:** Students will write a persuasive letter to a friend who is considering taking a high-paying job as a commercial fisherman near the southern tip of Africa. The letter will need to address both the pros and cons of taking the job, and students will need to make a final recommendation about whether the job should be accepted or not. This will allow the teacher to assess students' ability to synthesize information from the lesson, analyze and evaluate arguments, and write persuasively.

All at Sea

Name of the Ship that Wrecked	What caused this ship to wreck?

What do you predict is the cause of increased weather patterns in the cape area?

Go to the following website: <https://www.seatemperature.org/africa/south-africa/>. Once there you should be looking the image below.



Click on the blue dots on the map to read more information about that location's weather. Fill in the table below by recording temperatures for two cities in the Eastern coast, Southern coast, and Western coast each. Use the Port Edward city as an example of how you should fill out the table.

City Name	Location (east coast, west coast, or south coast)	Temperature on land	Average sea temperature for current month
Port Edward	East Coast	21.1°C / 70°F	Avg: 22.6°C / 72.7°F

Where is the ocean warmer? Where is it cooler? (Use east coast, west coast, or/and south coast in your answer)

Compare the average sea temperature to the land temperature. Why might these numbers be similar?

Thinking back on the text, why might these sea temperatures cause weather patterns (fog, storms, strong winds) off the southern coast?

Why might it be useful for voyagers to know ocean temperatures when preparing for their journey?

Weather and Ocean Currents Informational Sheet

Weather

- Temperature and Humidity

Humidity is the water vapor in the air, measured as relative humidity. It's the percentage of water vapor that air holds compared to the maximum it can hold. Warm air holds more water vapor than cool air, so changing temperature can change relative humidity. At 100 percent humidity, water droplets form and create dew when the air gets cold enough.

Temperature measures the amount of heat in the air. Heat causes air molecules to move faster, increasing temperature. The sun is the source of atmospheric heat, and different areas have varying temperatures. Ground-level temperature depends on sunlight, heat absorption, and heat retention by clouds and greenhouse gases.

- Air Pressure

Atmospheric pressure forecasts the weather. Low pressure results in precipitation, wind, and cloudy weather. High pressure brings calm and pleasant weather. Air flows from high to low pressure, causing weather patterns and wind.

- Fronts

When a cold air mass and a warm air mass meet, they do not readily mix due to their differences in density. Instead, the warmer, less dense air rises above the denser, colder air. This lifting of warm air creates a boundary between the two air masses, known as a front. Depending on the characteristics of the air masses and the direction of movement of the front, different types of weather conditions can result, such as rain, thunderstorms, or snow.

- Types of Fronts

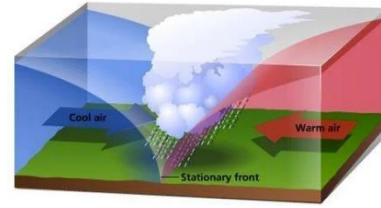
Cold Front: A cold front is when a cold air mass meets a warmer air mass. When a cold front moves into an area, it can push the warm air up, causing it to cool and condense into clouds. These clouds can produce precipitation such as rain, snow, or hail.



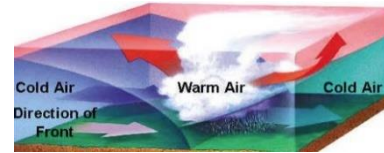
Warm Front: A warm front is when a warm air mass meets a colder air mass. When a warm front moves into an area, it typically brings a gradual change in weather. As the warm air mass rises over the colder air mass, it can form clouds, which can eventually lead to precipitation such as rain or snow.



Stationary Front: It occurs when a cold front and a warm front meet, but neither of them is strong enough to push the other out of the way. As a result, they remain stationary, and the area in between them can experience a mix of both warm and cold weather patterns. Stationary fronts can sometimes bring long periods of rain or snow.



Occluded front: This happens when a fast-moving cold front overtakes a slower-moving warm front, lifting the warm air off the ground. The warm air is then forced to rise, creating clouds and precipitation. As the cold front continues to move forward, it can lift the warm front completely off the ground, forming an occluded front.



Ocean Currents

Ocean currents are the movement of seawater caused by gravity, wind (Coriolis Effect), and water density. These movements are predictable and always in one direction. As the currents move, they can carry warm or cool water to different areas. This can change the temperature of the land and the amount of rain and snow.



- **Ocean Temperature Differences**

Unequal heating of Earth causes ocean temperature differences, ranging from 30°C (86°F) in the tropics to -2°C (28°F) near the poles. Deeper waters are colder due to less sunlight reaching below the surface. The deep ocean has an average temperature of 4°C (39°F) and colder water sinks below warmer water due to its heavier weight.

Ocean Currents and Climate Regulation

Ocean currents act much like a conveyor belt, transporting warm water and precipitation from the equator toward the poles and cold water from the poles back to the tropics. Thus, currents regulate global climate, helping to counteract the uneven distribution of solar radiation reaching Earth's surface.

Convection Currents

Convection currents transfer heat from one place to another by mass motion of a fluid. The heat transfer function of convection currents drives the earth's ocean currents, atmospheric weather and geology. Convection powers ocean currents, mixing waters worldwide. Cold polar water sinks while lighter, warmer water rises to the surface, drawing warm water northward and cold water southward. The process distributes heat and nutrients globally.

