THE WEATHER CLASSROOM®

CAREERS IN METEOROLOGY

This lesson addresses the following National Standards:

Science in Personal and Social Perspectives
- Natural Hazards
- Science and Technology in Society

Science in Technology
- Understandings in Science and Technology

Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Language Arts: Drama and Public Speaking
- Speak/React quickly to unexpected situations

Preview

If you study weather and weather forecasting, you're a meteorologist. Meteorologists can work for the government, universities, television and radio stations, at nuclear power plants, airports, farms and fisheries, insurance, investment companies and much more.

People interested in the Earth and its atmosphere can take many different career paths. Hydrologists, oceanographers, climatologists, storm chasers, city planners, architects – these diverse careers all require a basic understanding of weather and its effects.

Weather Fact

The term meteorologist comes from the ancient Greek term meteor or "things in the air." Forecasters are called meteorologists because they are all concerned with rain, snow, ice and clouds (hydrometeors), as well as dust and haze, known as lithometeors.

Weather Terms

All glossary terms can be found at: http://www.weatherclassroom.com/glossary/

Meteorology
Hydrology
Oceanography
Climatology
Forecast
Anemometer
Barometer
Thermometer
Hygrometer
Doppler radar
Beaufort wind scales
Radar
Nexrad

Q & A

Start Talking

What is a meteorologist? What is the historical development of the field? Compare meteorology today with that of 100 years ago. What changes have occurred? Has the study of weather increased in importance over the past century? Explain.

Answer: A meteorologist is a scientist who studies the atmosphere and atmospheric phenomena. People have always observed and tried to understand and predict the weather. In prehistoric times, the weather watchers were holy men who specialized in forecasting the weather for the rest of the tribe.

Galileo invented the first thermometer; other scientists developed more accurate thermometers and invented and perfected barometers and hygrometers. During World War II, we began using RADAR. Today we use satellites, computers and more sophisticated Doppler RADAR and NEXRAD to study, forecast, analyze and communicate the weather.

Weather prediction has always been important. As life has become more complex in the past century, getting forecasts right may seem more important to more people. But, a crop that was ruined because no one knew a storm was coming would have had devastating repercussions for a farmer centuries ago.

To whom is weather forecasting important? Why? Create a class list of people/jobs/events that are affected by the weather and determine how important accurate forecasting is to each.

Answer: The class list will vary, but examples include farmers, tourists, construction workers, air traffic controllers, outdoor event planners, etc.

Going further: Tom Baker is a meteorologist for the Navy who served in Desert Storm. Was weather or climate significant during Desert Storm? Why or why not?

Understanding and working within a desert climate was very significant to battle plans in Desert Storm. It was most important to know how to survive in heat and produce vehicles that traveled well in the desert. Cloud conditions, wind speed and wind direction were important for accuracy during Allied bombing raids.

Have students consider battles they have studied – the battle of the "Ironsides" (Monitor and Merrimac), the German invasion of Russia, D-Day, etc. Have students: Discuss the importance of the weather to the battle. Relate "what if" scenarios to describe what might have happened had the weather been different.

Answers will vary.

Q & A

What do you need to do to become a meteorologist? What coursework is recommended by the meteorologists in the video? Where can you go to find out about colleges that offer degrees in meteorology?

Answer: Stretch your interest in weather starting now – build a backyard weather station, watch and compare weather forecasts, on-air and online; start a Weather Watchers' Club at school; take higher science and math courses in high school. In college, to go a school with a degree program and study physics, calculus and meteorology, climatology, etc.

In your community, whom might you interview or identify as a possible mentor? Are there companies for whom you might apply for an internship? Answers will vary.

Going Further: Where can you go to find out about colleges that offer degrees in meteorology? Check "Colleges and Universities" online at weatherclassroom.com (http://www.weatherclassroom.com/resources/meteorologist.php) to find out more about degrees in meteorology.

Hands On

The Impact of Weather

I think the most important thing a meteorologist can do is make sure people know about weather conditions so they can protect themselves and their families.

- Tom Baker, Naval Reservist, meteorologist

Definition: An oral history is a recording of reminiscences of first-hand experiences from interviewees. It becomes a primary document of the history of a community and can be put to a variety of uses.

What other comments were made by the meteorologists interviewed in Careers in Meteorology about the meteorologist's commitment to people? How has knowing the weather affected your life? Is it important to know and trust the weather forecast? Explain.

Help your class research and produce an oral history that reflects the importance of meteorologists in the lives of people in their community.

1. Discuss the definition of oral history with students and invite them to brainstorm and finalize questions to help interviewees tell stories about the impact of weather forecasting on their lives.
    a. Their questions should be open-ended, not easily answered by "yes" or "no."
    b. Be sure they ask interviewees to pinpoint as closely as possible the time and date of the incident they describe.
    c. Help students find ways to "prime the pump" and "dig" for details and sequence. They want enough information to make a complete story.
2. Help students determine the best and safest population to include in their histories and work with them to contact interviewees and set schedules. For example: interview only family members or school faculty and staff or make arrangements for student interviews at a local senior citizens activity center.
3. Work with students to share available equipment and tapes. Remind students to label and, if possible, provide transcripts of their interviews.
4. Students should also send thank you notes to the community members they interview. Thank you notes might include a tape or transcript of the interview. After students have completed their interviews, help them determine the best way to showcase their work and share it with the community; ask a local radio station to air their oral history or display tapes, transcripts and pictures at the local library.

Internet Investigation

Have students list all the tools used by the meteorologists featured in Careers in Meteorology.

Extension: Invite teachers who specialize in higher math, chemistry and physics to participate in a panel discussion with students on preparing for these classes.

(Possible Responses: Weather instruments such as barometers or thermometers, high-performance airplanes equipped with measuring and sampling instruments, radar equipment, satellites and computer models for analyzing data).

Ask: What kind of information could a meteorologist learn from this equipment? Are any examples of this equipment available for your first-hand use? Which ones? How often do you use them? Which tools are not available for your immediate use?

1. Divide the class into teams to research different sections of the Student Handout: All about Weather Technology. Refer to the Careers in Meteorology online resource sheet to provide teams with online resources they will need. Set a deadline for sharing findings in 1-2 minute group presentations.
2. Discuss the kinds of coursework needed to learn to use each of the instruments they have researched.

RADAR

1. What is the meaning of the acronym RADAR?
2. When you look at a map based on data sent by RADAR, what kind of weather are you seeing? Explain.
3. Why are RADAR maps shown in color? How are colors used to indicate precipitation intensity? Explain.
4. What is NEXRAD Doppler? How does it work? To what agency does the NEXRAD network belong?
5. What are the three integral parts of RADAR? How do they work?
6. Explain the statement: “in a basic way radar works like SONAR.”
7. What do thunderstorms and possible tornadoes look like on a RADAR-produced may? Why do they look this way?
8. Besides particles in the air, what else can Doppler RADAR determine? How does it show that wind is blowing precipitation in a specific direction?

Satellites: GOES

1. What does the acronym GOES stand for?
2. What is a geosynchronous orbit?
3. How high is the orbit of the GOES satellites? Why is this orbit important for weather forecasting?
4. Which GOES satellites monitor U.S. weather? What are the primary instruments carried aboard these satellites? List the data they collect of job they do for weather forecasters.

Satellites: Polar-Orbiting

1. The polar-orbiting satellite follows a sun synchronous orbit. What does this mean? How is this sun synchronous orbit different from the geosynchronous orbit of the GOES satellites?
2. In one sentence, explain the difference between the GOES and polar-orbiting satellites for weather forecasting.
3. Besides immediate weather information, what specific data do polar-orbiting satellites collect that affects longer term forecasting?

CAREERS IN METEOROLOGY

Directions: Use the web sites featured in the online resources page for your assigned topic to find the answers to the questions on the following pages. Take notes or write out answers on a separate sheet of paper. Be prepared to make a 1-2 minute presentation to the class on the information you discover.

All About Weather Technology

Instrumented Aircraft

1. What is the connection between weather reconnaissance flights and the U.S. Air Force Reserve?
2. Tell the story of the first weather reconnaissance flight in 1943?
3. What territory do the hurricane hunters cover? Why? How close do these planes get to a hurricane?
4. How do NOAA planes differ from those of the U.S. Air Force?
5. What weather instruments and equipment are used by the scientists who fly these missions? What do the scientists measure?
6. How does the information collected by these reconnaissance flights help meteorologists forecast and track hurricanes?

Challenge: Describe the experience of flying into a hurricane from personal accounts found online. Do you agree or disagree with Stanley Czyzk of NOAA that being a hurricane hunter is a "dream job?" Explain.

Computer Forecasting Models

1. What is a computer forecasting model? How does it help forecasters make predictions?
2. Are computer forecasting models infallible? Why or why not? Give an example to explain your answer.
3. What new models are projected for the future? Why will forecasts projected by computer models improve as computers become faster and are better able to handle more data? Explain.
4. What are the three main classes of computer models? How are they classified?
5. List and describe the defining characteristics of each of the individual models. What kinds of forecasts does each provide, what is their reliability and how far into the future can each forecast?

Directions: Work with your team to develop an experimental design to test one of the maxims listed below. Remember to use the Scientific Method: State the problem. Form a hypothesis. Describe the method you will use to gather data on the problem, including both an experimental and control setup. Provide for more that one test of the hypothesis. Record and analyze their data. State a conclusion.

Weather Wisdom

1. When bubbles in coffee collect in the center of the cup the weather will be fair; when they form a ring around the edge of the cup, you can expect rain.
2. When the moon wears a halo around her head, she will cry before morning and the tears [rain] will reach you tomorrow. (Native American legend)
3. Listen carefully to the crickets. Count the number of chirps in 14 seconds. Add 40 and you should have the temperature in Fahrenheit.
4. Telephone wires hum and whine when a weather change is due.
5. When the sun sets unhappy [covered with clouds], the morning will be angry with storm. (Zuni legend)
6. When the leaves of trees turn over, it foretells windy conditions and possible severe weather.
7. Red sky at morning, sailors' take warning; red sky at night, sailors' delight.
8. When the night has a fever [temperature between 9:00 PM and 12:00 midnight is very high] it cries [rains] in the morning.
9. No matter what the ground wind, if high clouds are moving from a westerly quadrant, fair weather will persist.
10. If it storms the first Sunday of the month, it will storm every Sunday of the month.
11. The higher the clouds, the better the weather.

Weather Lore

On what did meteorologists rely before the advent of special technology? Even with modern tools, how accurate are long-range forecasts? Explain.

1. Ask students to share any "weather lore" they may know, such as "Red sky at morning, sailors' take warning; red sky at night, sailors' delight." On what is such lore based? (Answer: personal experience passed through generations)
2. Distribute Student Handout: Weather Wisdom. Which maxims do students think might be true and which are they sure are false? Why?
    a. Divide students into research teams. Assign each team a maxim chosen from the student handout and provide teams 48 hours to devise experiments to test the reliability of their assigned maxim. If necessary, go over the requirements of a valid and reliable scientific experiment as defined by the Scientific Method.
3. Have teams share their designs and invite the class to critique each for "sound science."

Extension: If appropriate, give students time to implement their experimental designs and report on their findings and conclusions. Discuss the reliability of weather lore and its place in forecasting today.

Think Fast

Mish Michaels, one of the meteorologists featured in the program, mentioned that sometimes when she's doing her weather forecast on live TV, she'll accidentally step on the cord for the chroma wall "clicker," making it slip our of her hand. When that happens, she's stuck on one weather map for her whole two and a half minute presentation!

Have students discuss times they have seen news reporters and/or meteorologists handle similar mix-ups. How did they respond to unexpected circumstances? Did the students sympathize with the startled reporters of did they think the reporters should have handled the mix-ups better? Explain. Invite volunteers to talk about time when they had to respond quickly and extemporaneously to unforeseen events or circumstances. Discuss their responses and reactions. Guide the class through the following improvisation activities designed to help them develop the skill of reacting quickly and competently to unanticipated conditions.

Note: These activities are adapted from in an improvisation unit submitted to the web by teachers studying drama and the media arts at Brigham Young University. Check Careers in Meteorology online resources to find out more from the Community Learning Web.

Activity 1: Wiz ... Bong!

1. Sit in a circle of 10-15 students. The first student begins by saying "Wiz" while point to the person sitting to his or her left.
2. That person may respond by repeating "Wiz" and pointing to the person to his or her left.

OR...

That person may respond "Bong," raising his or her left arm and making a fist. This gesture shoots the response back to the right.

3. If a person speaks out of turn or stumbles he or she is out. The winner is the last one left.
4. The game should move fast with no pauses for "thinking" about what to say or what arm gesture to make.

Activity 2: Quick Reactions

Note: You will need several ordinary objects such as a kitchen pot or picture frame on hand for this activity.

1. Gather students in a circle and give one student an object to hold. Set the scene for a story but keep it open ended. The person holding the object should begin to tell a story.
2. After one or two sentences the person should pass or toss the object to another in the circle who will continue the story. Pass the object quickly. The object's recipient must speak as soon as he or she touches the object. Everyone must hold the object once. When the object gets to the last 3 or 4 students, remind them that they must be begin the story's ending.
3. Repeat this activity with small circles and allow the object to pass around the circle more than once. Remind students that the point of the activity is speed.
4. Going Further: Have the students in the circles stand and begin a new story. This time not only must their sentences be reactive, but they must also act out what they are saying. For example: If a student begins by saying that last night he cut his finger, he must act this out using the object as the "blade." The next student might say: "so I ran to the bathroom to put a bandage on my cut." The object is not he bandage. Continue this story as many times around the circle as you wish. Remind students they must be able to act out their statement with the object and move fast.

When the improvisation activities are complete, reconvene the class and ask students to discuss their experiences.

What is the difference between fast thinking and fast reactions? Which is harder and which is more exciting? Why? How might this kind of activity help a person later respond to unexpected circumstances as on-camera meteorologists? Explain.

Internet Resources

All About Weather Technology Instrumented Aircraft

The Weather Channel
http://www.weather.com/weather_center/special_reports/hurricanes/forecast/flying.html

NOAA: Hurricane Hunters
http://www.nc.noaa.gov/aoc.html

USA Today
http://www.usatoday.com/weather/hurricane/whhunt0.htm

U.S.A.F Reserves: Hurricane Hunters
http://www.hurricanehunters.com

Computer Forecasting Models

The Weather Channel: Computer Forecasting Models
http://www.weather.com/encyclopedia/winter/models.html

USA Today
http://www.usatoday.com/weather/wmodels.htm

RADAR

The Weather Channel: How to Read U.S. Doppler Radar Maps
http://www.weather.com/weather/maphowto/doppler.html

USA Today
http://www.usatoday.com/weather/wearadar.htm

National Weather Service
http://www.nws.noaa.gov/er/okx/tour/doppler.html

Satellites

The Weather Channel: How to Read a Satellite Map
http://www.weather.com/weather/maphowto/satellite.html

NOAA
http://psbsgi1.nesdis.noaa.gov:8080/EBB/ml/genlsatl.html

National Weather Service
http://www.nws.noaa.gov/er/mhx/stlltg/htm

Think Fast

Community Learning Web
http://www.cln.org/themes/improve.html

Careers in Meteorology

The Weather Channel: Meteorological Careers
http://www.weather.com/learn_more/resources/careers.html