Feelin' the Phenomena

ICAP Science: Weather

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Grade Level	6th – 8th Grade	**Time Frame**	3-4 class period(s)
Subject	Science	**Duration**	200 minutes

Essential Question

How can you use weather and climate models to predict tornadic activity? How do meteorologists use these models?

Summary

This lesson invites students to explore scientific models and simulations to learn about climate and weather phenomena. Students will learn from a meteorologist about how those in the field of climatology use math and science in their careers, as well as the details of this job and career path. By the end of this lesson, students will be able to investigate weather conditions related to tornadic activity, use evidence to predict the point in time when a tornado touched down, and compare their personal experiences to a career in meteorology. This lesson includes optional modifications for distance learning. Resources for use in Google Classroom are included.

Snapshot

Engage

Students deconstruct a photo to show what they know about weather phenomena.

Explore

Students explore one of several weather phenomena using a science simulation.

Explain

Students present their findings, including claims, evidence, and reasoning, to help clarify misconceptions about when a real tornado touched down in Alabama.

Extend

Students hear from a meteorologist to learn more about that career and how meteorologists understand weather phenomena. Students reflect on their work, then compare and contrast what they experienced with what meteorologists study.

Evaluate

In groups, students record their own forecasts, which include the variables they believe are the best indicators for predicting tornadic activity.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD403: Translate information into a table, graph, or diagram
IOD504: Determine and/or use a simple (e.g., linear) mathematical relationship that exists between data
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Next Generation Science Standards (Grades 6, 7, 8)

MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Attachments

- Alabama Tornado—Feelin the Phenomena - Spanish.docx
- Alabama Tornado—Feelin the Phenomena - Spanish.pdf
- Alabama Tornado—Feelin the Phenomena.docx
- Alabama Tornado—Feelin the Phenomena.pdf
- Earth Simulation Variables Cheat Sheet—Feelin the Phenomena - Spanish.docx
- Earth Simulation Variables Cheat Sheet—Feelin the Phenomena - Spanish.pdf
- Earth Simulation Variables Cheat Sheet—Feelin the Phenomena.docx
- Earth Simulation Variables Cheat Sheet—Feelin the Phenomena.pdf
- I Used To Think But Now I Know—Feelin the Phenomena - Spanish.docx
- I Used To Think But Now I Know—Feelin the Phenomena - Spanish.pdf
- I Used To Think But Now I Know—Feelin the Phenomena.docx
- I Used To Think But Now I Know—Feelin the Phenomena.pdf
- Lesson Slides—Feelin the Phenomena.pptx
- Using Desmos—Feelin the Phenomena - Spanish.docx
- Using Desmos—Feelin the Phenomena - Spanish.pdf
- Using Desmos—Feelin the Phenomena.docx
- Using Desmos—Feelin the Phenomena.pdf

Materials

- Lesson slides (attached)
- Alabama Tornado handout (attached; one per student)
- How to Use Desmos handout (attached; one per student)
- I Used to Think, But Now I Know handout (attached; one per student)
- Earth Simulation Variables Cheat Sheet handout (attached; one per student)
- Student devices with Internet access

5 minutes

Engage

Use the attached **Lesson Slides** to guide the lesson. Begin with **slide 2** and introduce the essential questions to students. Move to **slide 3** and briefly share the lesson's objectives.

Move to **slide 4** to show the radar image depicting an Oklahoma tornado outbreak. Read the questions aloud one-by-one, giving students time after each question to discuss their thoughts with an Elbow Partner.

- *How does this image make you feel?*
- *What experiences do you have with images like this?*
- *What information does this image provide that wouldn't be available to you otherwise?*

Allow approximately five minutes for this activity.

Teacher's Note: Transition

The next phase of this lesson involves students working with a simulation. Consider explaining to students that, in the activity above, they viewed a picture of a simulation (or a model), and next they will have the chance to interact with a simulation. You might also need to explain that a simulation or model is an imitation of a particular process and its operation. There is more information about the specific simulation used in the Explore activity in the next Teacher's Note.

Optional Modification For Distance Learning

To make use of the above activity in an online or distance learning environment, consider facilitating a class discussion about the radar image on a discussion board in your learning management system (such as Canvas or Google Classroom) or on a video conferencing application (such as Zoom).
Download all attachments to use this lesson in Google Classroom.

Explore

Teacher's Note: Simulation

In the next activity, students explore one of several weather phenomena using the free scientific simulation tool "Earth." The Earth simulation is a collection of near-real-time atmospheric and oceanic models. Data are aggregated from a variety of sources (e.g., NOAA, mesonets), and the simulation contains current measurements and satellite imagery as well as scientific projection models. To access a menu of data and other settings, click "earth" in the bottom-left corner of the simulation window. Categories of data are grouped as “modes” in the simulation menu. Within each mode, specific variables have “overlays” that visually display the data for each one. These data are updated between once an hour to once every five days, depending on their source. Click “about” in the menu to navigate to a new page with information about data sources and update frequency, as well as explanations of the variables. Explanations for variables relevant to this simulation are provided on the Simulation Variables Cheat Sheet handout.

Move to **slide 5**. Ask students to access the Earth simulation on their devices. Give each student a copy of the **Earth Simulation Variables Cheat Sheet** handoutand have students follow along on their own devices as you demonstrate how to find the basic functions in the menu.

Group students into pairs. Pass out copies of the attached **Alabama Tornado** and **Using Desmos** handouts to each student. Move to **slide 6**. This slide contains a screenshot of the menu with the functions annotated. Briefly go over the annotations with students, and then instruct students to begin the tasks on their Alabama Tornado handouts. Display this screenshot for students' reference as they work. Allow enough time for pairs to complete the questions.

Teacher's Note: Resources

Remind students that additional resources are available to them during these tasks, particularly if you hear concerns and questions voiced as they work. Students should refer to the Earth Simulation Variables Cheat Sheet and the Using Desmos handout to help them with navigating variables, the Earth simulation, and the Desmos Studio graphing site.

Explain

Now that students have experienced a simulation, they will create a presentation about their experience to share.

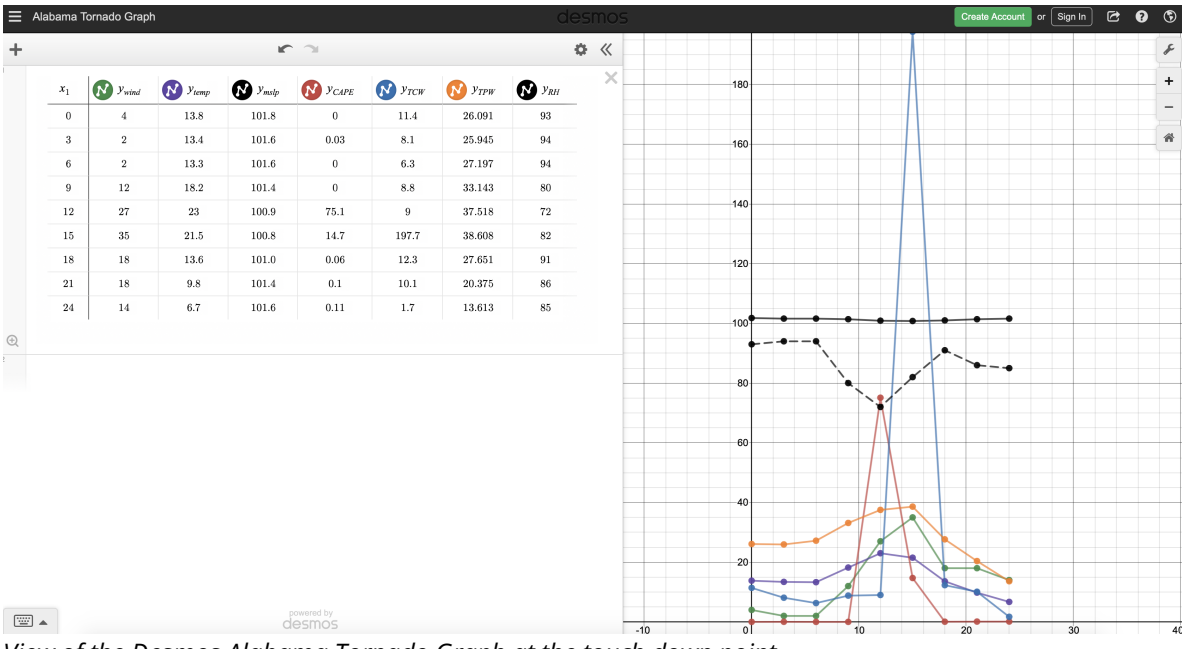
Move to **slide 7**. Pairs will prepare a presentation based on their findings for Question 3 on the Alabama Tornado handout. Employing the Claim, Evidence, Reasoning (CER) strategy, students should share a claim about what time the tornado likely touched down, supporting evidence for that claim, and an explanation of their reasoning. Ask students how they know their evidence supports their claim to draw attention to the reasoning aspect of their explanation. Inform students that their presentation should be kept to 5 minutes or less, and allow approximately 10 minutes for pairs to prepare their presentations.

Optional: Presentation Format

For an online or distance learning environment, feel free to adapt the means by which students create and present based on your classroom needs. Consider using a digital tool like Google Slides or Canva if your environment allows. Posters are another potential option.

Sample Student Responses

Students' answers and evidence will vary depending on how close to the track and touch down point they are. Ideally, after all the presentations, pairs should have robust enough data to show the relevant patterns. The most likely answer students will give for touch down is 3 p.m. The officially recorded time was 2 p.m., but because the data is available only every three hours, there's no way to capture it exactly. Any answer between 2 and 3 p.m. is acceptable. Any variable that students select as relevant in predicting tornadic activity is also acceptable, as long as it supports their claim. Three relevant variables that students are likely to choose include wind speed, CAPE (how tornadoes are actually measured), and MSLP (which has a close relationship to storm system formation in general). The graph below reveals the variables at the touchdown point.



View of the Desmos Alabama Tornado Graph at the touch down point

Move to **slide 8**. Have pairs take turns sharing their presentations. Each presentation should be limited to 5 minutes with only a question or two afterward if necessary. After the presentations, ask students whether, in light of what they learned during the presentations, they have any initial thoughts they would like to share about which variables seem to be the best indicators for predicting tornadic activity. This discussion will help scaffold an activity coming up later in the lesson.

Move to **slide 9**. Ask students to consider what they learned using the simulation and, further, how scientists might use simulations and models to accomplish their everyday work. Use the questions on the slide to guide a discussion that summarizes the Explore and Explain portions of the lesson. Seek to form a connection to the role and work of a meteorologist.

Teacher's Note: Weather Is Tough To Predict!

It is important for students to understand that because weather patterns are so complex, forecasts don't always perfectly predict what actually happens. They can only predict what is likely to happen based on the available data. Drive the conversation to this point if it doesn't come up naturally.

Optional Modification For Distance Learning

To make use of this lesson in an online or distance learning environment, facilitate the presentations by allowing each student presenter to use a video conferencing application like Zoom, which features screen sharing, to display their Google Slides presentation to the class. If they created posters using a site like Canva, you may also choose for students to present their work with a website such as VoiceThread. With VoiceThread, you can upload students' posters to the site beforehand. Then, students can choose whether they would like to make a quick video, a voice memo, or a written note to give feedback on other students' posters. Download all attachments to use this lesson in Google Classroom.

Move to **slide 10**. Show students the video linked on the slide. The video, an interview with a meteorologist, is also embedded below and linked here. You can find the full video URL in the Resources section below.

Embedded video

https://www.youtube.com/watch?v=2arUwaluIV8

Extend

Move to **slide 11**. Pass out a copy of the attached **I Used to Think, But Now I Know** handout to each student. Students will watch another interview clip from the meteorologist, this time focusing on the day-to-day profession, career track, and educational background. Before viewing the interview, have students complete the first part of the I Used to Think... But Now I Know handout by filling in the left side of the table ("I used to think ..."), focusing on what they think a meteorologist does and how meteorologists understand and use weather phenomena.

Move to **slide 12**. Show students the video linked on the slide.

Embedded video
https://www.youtube.com/watch?v=wtj0o8GjgVk

Move to **slide 13**. In their handouts, have students complete the right side of the tables (But Now I Know), focusing on what they learned after watching the interview.

Optional Modification For Distance Learning

For online or distance learning, consider creating multiple copies of the attached I Used to Think... But Now I Know handout using Google Docs. Students can add notes to the document and collaborate as a group using the "chat" feature in the document. You may also consider making this activity a discussion board post to which your students can respond directly. Download all attachments to use this lesson in Google Classroom.

Evaluate

Teacher's Note: Variables

The next activity assesses students' understanding of which variables are most effective in predicting tornadic activity. Be sure not to tell students which variables to use, as doing so would undermine the assessment of their understanding. The discussion after the presentations is intended to allow students to debrief as a class and identify which variables were highlighted as evidence for their predictions and consider which are the most effective predictors.

Move to **slide 14** and organize students into groups of three. Students will work together to prepare and record their own forecasts. Forecasts should be no longer than 5 minutes and should reference the variables that group members identified as being the best indicators for predicting tornadic activity. Have the group work together to write the script, and then take on different roles for filming: there should be one meteorologist, one storm chaser, and one cameraperson. Give students time to write and record their weather forecasts.

Come together as a class to watch the groups' weather forecasts. Have students discuss the variables used in the presentations and come to a class consensus about which are most effective in predicting tornadic activity and why.

Optional Modification For Distance Learning

To optimize this activity for distance learning, you may choose to have student groups film and record their forecasts using a video conferencing application like Zoom. Then, you can share the video with the rest of the class by uploading to your learning management system, such as Google Classroom or Canvas. Students can respond to the prompt *Which variables used in the presentations are most effective in predicting tornadic activity and why?* in a discussion board. Download all attachments to use this lesson in Google Classroom.

Resources

- Beccario, C. (2020). Earth: A global map of wind, weather, and ocean conditions. https://earth.nullschool.net
- Desmos. (n.d.). Graphing calculator. https://www.desmos.com/calculator
- K20 Center. (2020, April 22). ICAP - feelin' the phenomena - job content [Video]. YouTube. https://youtu.be/wtj0o8GjgVk
- K20 Center. (2020, April 22). ICAP - feelin' the phenomena - lesson content [Video]. YouTube. https://youtu.be/2arUwaluIV8
- K20 Center. (n.d.). Canva. Tech Tools. https://learn.k20center.ou.edu/tech-tool/612
- K20 Center. (n.d.). Claim, evidence, reasoning. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506fc09
- K20 Center. (n.d.). Desmos studio. Tech Tools. https://learn.k20center.ou.edu/tech-tool/2356
- K20 Center. (n.d.). Elbow partners. Strategies. https://learn.k20center.ou.edu/strategy/ccc07ea2d6099763c2dbc9d05b00c4b4
- K20 Center. (n.d.). Google classroom. Tech Tools. https://learn.k20center.ou.edu/tech-tool/628
- K20 Center. (n.d.). I used to think, but now I know. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f50639f2