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Oklahoma Alliance for Geographic Education

Lesson Title:
The Oklahoma Standard: Tornados
Mapping the 10 Deadliest Tornados in the State's History with the Oklahoma Giant Map
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Grade Level:
6-7

Purpose/Objective:
Students will develop an understanding of how tornados form. Identify and locate the cities where the top 10 worst tornados in Oklahoma occurred on the Giant Map of Oklahoma. They will specifically gather and analyze data from the Moore, Oklahoma 2013 tornado site using geospatial technology.

National Geography Standards from *Geography of Life*
Geographic Elements & Standards:
The World in Spatial Terms – 1: The geographically informed person knows and understands how to use maps and other geographic representations, tools, and technologies to acquire, process and report information from a spatial perspective.
The World in Spatial Terms – 3: How to Analyze the Spatial Organization of People, Places, and Environments on Earth's Surface.
Environment and Society – 15: How physical systems affect human systems.

Oklahoma *C3 Social Studies Standards*
Grade 6 World Studies
1.2 – Identify, evaluate and draw conclusions from different kinds of maps, graphs, charts, diagrams, timelines and other representations, such as photographs and satellite-produced images or computer-based technologies.
3.3 - Analyze the impact of natural disasters on human populations including forced migration, scarcity of consumer goods, and loss of employment.
Grade 7 World Geography
1.3 – Construct and use maps, globes, graphs, charts, models, and databases to analyze spatial distributions and patterns.
6.1 – Evaluate and draw conclusions from different kinds of maps, graphs, charts, diagrams, and other sources and representations (e.g. aerial and shuttle photographs, satellite-produced images, the geographic information system (GIS), atlases, almanacs, and computer-based technologies).

Geographic Themes:
Location, place, and movement

Objectives:

1. Students will be able to classify the different types of natural hazards and explain how a tornado forms, use a guided fill-in the blank note worksheet to help them organize their thoughts and define key terms.
2. Students will identify the 10 worst tornadoes in Oklahoma history, locate the cities where they happened on the National Geographic Giant Map of Oklahoma.
3. Students will become familiar with ArcGIS Explorer Online and will learn how to gather measurements and data after a natural disaster occurs.
4. Students will use critical thinking skills to explain why tornadoes are difficult to predict, then brainstorm ideas to better predict when and where tornadoes can occur.
5. Students will design an illustrated timeline map detailing the path of destruction of the Moore 2013 tornado based on study with a written description to go with it.

Materials:

1. National Geographic OKLAHOMA Giant Map & Materials
2. Computer with internet access
3. Projector and Screen
4. Guided worksheet for ArcGIS Explorer online
5. Tornado Notes Worksheet
6. YouTube Video – *How Tornados Form*
7. YouTube Video – Channel 9 Coverage of 2013 Moore, Oklahoma tornado
8. Article from Washington Post – *Why are tornadoes so hard to predict?*
9. Colored Pencils/Markers
10. Pencil

Time Frame:

2 class periods

Procedures:

Day 1

1. Begin by asking students probing questions regarding natural disasters:
   - What kind of natural disasters are there?
   - Why do we study natural hazards?
   - Why do we need to prepare for natural disasters?
   - Does every state or country have the same type of natural disasters?
   - Are natural hazards caused by nature only?
2. Gather students around the giant map of Oklahoma. Locate and discuss physical features and cities on the map.
3. Name the major natural disaster associated with Oklahoma…Tornadoes.
4. Hand out the Tornado Notes worksheet and watch the YouTube video: How tornadoes are formed. https://www.youtube.com/watch?v=cvOut9VUqKY Discuss findings from the video and ask students how these conditions are connected to our state while they complete the How tornadoes are formed notes page.

5. Have students name what they believe to be the top 10 most destructive tornados in Oklahoma history and have volunteers mark their location on the Giant Map with plastic dots. (Provided in Giant Map materials.) May not get all 10.
6. Guide students to the following Top 10 Deadliest Tornados in Oklahoma: https://www.weather.gov/oun/tornadodata-ok-deadliest). Display on projector screen and list these 10 on the backside of their Tornado Notes worksheet and place the remaining dots on the giant map if necessary.
7. Have students note the area of the Newcastle, Moore, & Oklahoma City is listed multiple times.
8. Students will watch a short clip from YouTube showing the damage and power of an F5 tornado in Moore, Oklahoma in 2013. https://www.youtube.com/watch?v=obsx7u32s0o

Day 2

1. Review formation of tornados, locate the 10 deadliest tornados in Oklahoma history on the giant map.
2. Summarize the events and devastation seen from the Moore, Oklahoma 2013 tornado and show its path of destruction from its beginning with chains on the giant map.
3. Hand out the ArcGIS worksheet.
4. Display area map of Moore, Oklahoma on ArcGIS online http://www.arcgis.com/explorer/ following the 2013 tornado on the projector screen.
5. Pair students into groups of two. Allow 15-20 minutes to collaborate and answer the worksheet questions. Discuss findings with whole class.

Assessment:

1. Design a timeline map showing the path of the 2013 Moore tornado from its beginning at Newcastle to its arrival in Moore.
2. Write a short summary explanation regarding the path the tornado took and the destruction that occurred to accompany the map timeline.

Resources:

ArcGIS Explorer Online - http://www.arcgis.com/explorer/
YouTube – 1. https://www.youtube.com/watch?v=obsx7u32s0o
2. https://www.youtube.com/watch?v=cvOut9VUqKY
Washington Post - https://www.washingtonpost.com/news/wonk/wp/2013/05/21/why-are-tornadoes-so-hard-to-predict/?utm_term=.86a27952f722
National Weather Service - https://www.weather.gov/oun/tornadodata-ok-deadliest

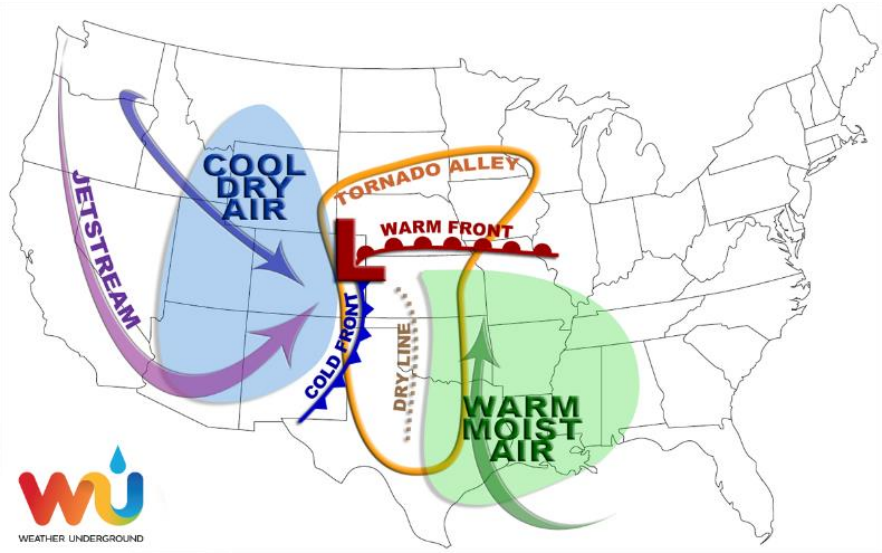
Connections:

History, Science

Extensions and Enrichment:

1. Put students into pairs. Allow them to work in pairs for 15-20 minutes around the map by reading the Washington Post blog "Why are tornadoes so hard to predict?"
2. Answer questions on the Predicating Tornados worksheet and discuss as a class.

How Tornadoes are Formed **NOTES**



https://s.w-x.co/severe_weather_setup_1200px.png

1. Tornadoes occur primarily in the _____ region of the United States.

2. Warm moist air comes from the _____ of _____ during the _____ and _____.

3. Cold air comes from _____ crashing into the _____.

4. Other weather conditions associated with tornadoes are:
   -
   -
   -
   -

5. A supercell is _____.

6. Tornadoes hit the ground when _____ _____.

7. When a tornado occurs, you should seek shelter in a _____. If you don't have a _____, then you should seek coverage in a _____ or _____.

Washington Post – *"Why are tornados so hard to predict?"*

1. Why is it difficult to predict when a tornado will occur?

2. What are scientists doing to help better predict tornadoes?

ArcGIS Online Worksheet – 2013 Moore, Oklahoma Tornado

Directions:

1. Type in the following address http://www.arcgis.com/explorer/.
2. Once you are on the GIS site, type in the search bar *"2013 Moore, Oklahoma tornado imagery".*
3. Open the map and answer the following questions.

1. What is the total area damage the tornado caused (Answer in square miles)? (Hint: the brown gray section of the map)

2. What is the total distance (in miles) which the tornado travelled? Is your distance smaller or larger than the area?

3. What is the width (in miles) of the tornado's path?

4. How can the area be larger or smaller if the distance of the tornado's path is significantly different? How can so much damage occur?

5. Zoom into the picture and label the damage that was caused. Briefly explain what you observed about the damage.

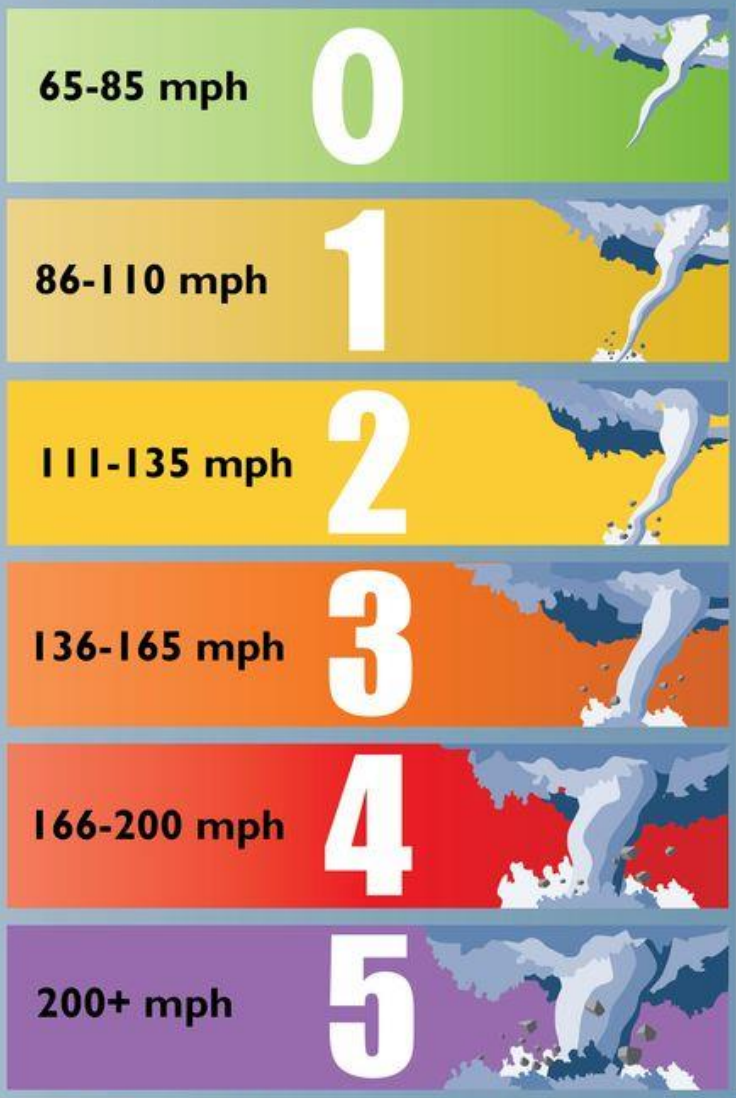
6. What trend did you notice while labeling types of damage? Where was the most damage? What buildings were impacted the most?

7. Based on the data you collected and the Fujita chart provided, what type of tornado occurred in Moore, OK? Explain why.

Enhanced Fujita Scale for Tornados

The Enhanced Fujita Scale (EF), introduced in 2007, provides estimates of tornado strength based on damage surveys. The original scale was developed by Dr. Theodore Fujita and implemented in 1971.

Wind Speed	EF Scale	Typical Damage
65-85 mph	0	Peels surface off some roofs, some damage to gutters or siding
86-110 mph	1	Roof severely stripped, mobile homes overturned or badly damaged, loss of exterior doors, windows and other glass broken
111-135 mph	2	Roofs torn off well-constructed homes; foundations of frame homes shifted; mobile homes completely destroyed
136-165 mph	3	Entire stories of well-constructed homes destroyed; severe damage to large buildings such as shopping malls
166-200 mph	4	Well-constructed houses and whole-frame homes completely leveled
200+ mph	5	Strong frame houses leveled off foundations and swept away; high-rise buildings have significant structural deformation



Source: Weather Underground (*www.wunderground.com/resources/severe/fujita_scale.asp*)

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