

5E Lesson Template

Lesson Author(s)	Natalie Eger
Lesson Title	Tornado Damage
Lesson Source	ArcGIS Explorer Online http://www.arcgis.com/explorer/ YouTube https://www.youtube.com/watch?v=mPcUDIXX2G4 https://www.youtube.com/watch?v=cvOut9VUqKY Washington Post http://www.washingtonpost.com/blogs/wonkblog/wp/2013/05/21/why-are-tornadoes-so-hard-to-predict/
Technology Needs (if any)	Access to YouTube Access to ArcGIS Explorer Online (Tuscaloosa, Alabama Tornado Imagery)
School	8th Grade
Math or Science?	Science
Lesson Concepts	Weather, natural hazards, geospatial technology
Objectives	Students will be able to: <ul style="list-style-type: none"> • Gather and analyze data from a tornado site using geospatial technology. • Determine what causes a tornado • Explain why tornado predictions are difficult and how predictions can be improved.
CO State Standards	Earth Systems Science: Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system 1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models a. Differentiate between basic and severe weather conditions, and develop an appropriate action plan for personal safety and the safety of others (DOK 1-3) b. Observe and gather data for various weather conditions and compare to historical data for that date and location (DOK 1-2) c. Use models to develop and communicate a weather prediction (DOK 1-2) 21st Century Skills: 1. Why does weather vary from day to day? 2. What are the strengths and limitations of different types of weather models?

	<p>3. What are the variables that make predicting weather challenging?</p> <p>4. How do weather patterns relate to climate?</p>
Materials List and Advanced Preparation	<p>Notes about Tornadoes Worksheet</p> <p>Guided worksheet for ArcGIS Explorer online</p> <p>Article from Washington Post</p> <p>Reserve enough computers.</p> <p>Access to ArcGIS Explorer Online</p> <p><i>*Lesson Plan can be used in parts or all can be used in a week</i></p>
Safety	<p>All classroom procedures will be followed. Keep an eye on students who may come off topic and google other sites.</p>
Accommodations for Learners with Special Needs	<p>Aid to work with the website.</p>

5Es

1. ENGAGEMENT		Time: 5 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Teacher will ask questions before the video is shown.</p> <p>Students will watch a short clip from YouTube showing the damage and power of an F5 tornado in Tuscaloosa, AL.</p> <ul style="list-style-type: none"> • http://www.youtube.com/watch?v=mPcUDIXX2G4 	<ul style="list-style-type: none"> • 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? Why or why not? • Are natural hazards caused by nature only? 	<ul style="list-style-type: none"> • Students might think that natural hazards are only tornadoes, hurricanes, tsunamis or earthquakes. • Students may not recognize that drought or wildfires are considered natural hazards. • Students may or may not make the connection between natural hazards and weather patterns.
Evaluation/Decision Point Assessment		Student Outcomes
<p>Questioning informs the teacher about what the students already know.</p> <p>Evaluation will be formative assessment using open-ended questions. Students will participate as whole class.</p>		<p>Students will be able to identify the different types of natural hazards.</p> <p>Students will acknowledge that natural hazards are not restricted to nature.</p>

2. EXPLORATION			Time: 1-2 hours
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions	
<ul style="list-style-type: none"> After students watch the video of the F5 tornado in Tuscaloosa, AL students will then do an activity measuring the distance the tornado travelled, the area of damage, the width of the tornadoes path and then assess the damage. The activity will be a guided. This will help the students understand how to use the website and the variety of tools that ArcGIS Explorer Online provides. 	<ul style="list-style-type: none"> What is the total area damage the tornado caused? What is the total distance (in miles) which the tornado travelled? Is your distance smaller or larger than the area)? What is the width (in miles) of the tornado's path? 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? What trend did you notice while labeling types of damage? Where was the most damage? What buildings were impacted the most? 	<ul style="list-style-type: none"> Students will have difficulties at first using the geospatial technology. Students may not understand why there is such a large area of damage when the tornado did not directly travel through a section of town. 	
Evaluation/Decision Point Assessment		Student Outcomes	
A guided worksheet will be used to assess the student's ability to interpret data from the map and how to make sense of the data found.		Students will become familiar with ArcGIS Explorer Online. Students will learn how to gather measurements and data after a natural disaster occurs.	

3. EXPLANATION			Time: 50 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions	
<ul style="list-style-type: none"> • Students will watch this short clip (2:46) to learn about the basics of tornadoes. https://www.youtube.com/watch?v=cvOut9VUqKY • After the video, the teacher will ask students question based on what the video talked about. • Students will take notes about tornadoes. 	<ul style="list-style-type: none"> • If scientists do not know when a tornado will form, how can we predict for them? • What is a supercell? • What “ingredients” make up a tornado? • How long does a tornado last? • Where should you seek shelter? What if you don’t have a storm shelter? • What other types of weather patterns are associated with a tornado? • Where does the warm air come from? • Where does the cold air come from? • How do scientists determine the type of tornado? What is the scale called? • Where are tornadoes more likely to occur? 	<ul style="list-style-type: none"> • Students may not be able to identify where the Gulf of Mexico is. • Students may think a supercell has something to do with biology. • Depending on student’s regional location, they may not know where to seek shelter during a tornado. • Students may think that tornadoes just involve a lot of wind. They may be unaware that thunder, lightning, hail, rain, and wind are all weather conditions that can occur during or before a tornado. • Students might be aware that tornadoes are categorized as an F something, but they will not know what F stands for. • Students will not know the criteria used to categorize a tornado. 	
Evaluation/Decision Point Assessment		Student Outcomes	
Formative assessment asking students open ended questions. Students will also use a guided fill-in the blank note worksheet to help them organize their thoughts.		Students will understand how a tornado forms and define key terms.	

4. ELABORATION		Time:30 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Students will read an article from the Washington Post why tornadoes are hard to predict. http://www.washingtonpost.com/blogs/wonkblog/wp/2013/05/21/why-are-tornadoes-so-hard-to-predict/ Students will have to think of ways scientists can better predict for tornadoes.</p>	<ul style="list-style-type: none"> • How can we predict tornadoes? • Why do we not know when tornadoes will occur? • How can we use science to improve our “predictions” or warning times for tornadoes? 	<p>Students will think that we are able to predict when tornadoes will occur</p>
Evaluation/Decision Point Assessment		Student Outcomes
<p>Formative assessment about the article.</p>		<p>Students will use critical thinking skills to explain why tornadoes are difficult to predict. Students will then brainstorm ideas to better predict when and where tornadoes can occur.</p>

5. EVALUATION		Time: Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
Differentiation		Time: N/A
<p>Students who are behind or need support An aid to help with the website.</p>	<p>For advanced or gifted students.</p>	
<p>Pair up in groups for the exploration and/or elaboration.</p>	<p>Designing a way to predict tornadoes.</p>	

Name: _____ Date: _____ Class _____
Period: _____

Directions: Type in the following address <http://www.arcgis.com/explorer/>. Once you are on the GIS site, type in the search bar "Tuscaloosa, Alabama tornado imagery". Open the map.

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

About 4.59 miles²

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

About 1.87 miles

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

About 1 mile

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?

The damage area of 11,000,000 m² is due to the wind and debris from the tornado. The pathway of the tornado caused the most damage.

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

Homes and buildings were destroyed. Roads were also destroyed. Looking closer at the map the trees were lying horizontally. Their roots were ripped out of the ground.

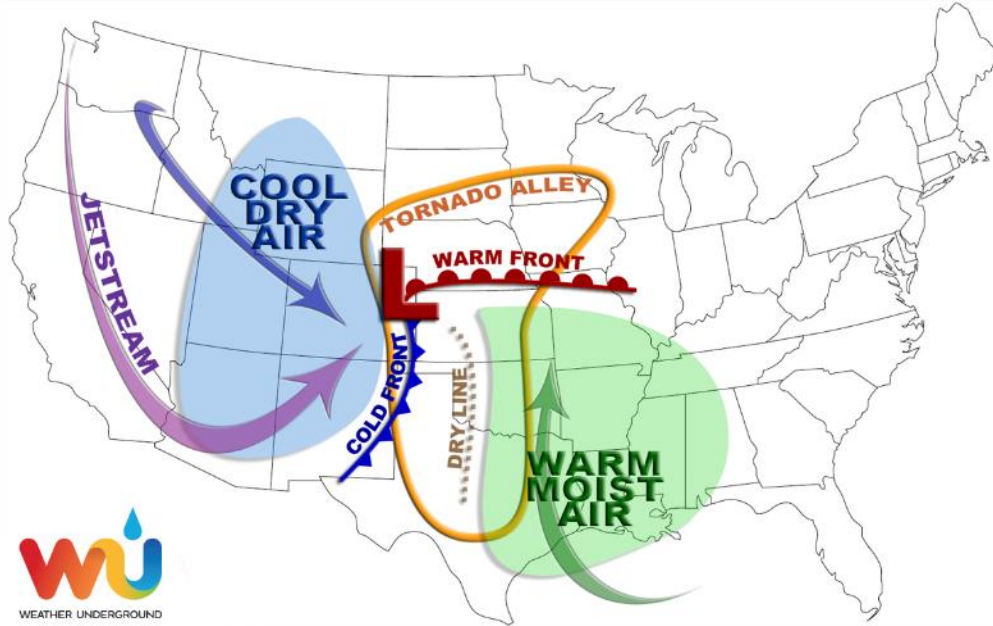
6. What trend did you notice while labeling types of damage? Where was the most damage? What buildings were impacted the most?

The most damage occurred where the tornado's path was. The most damage were homes being destroyed.

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

Fujita-Pearson Number	Estimated Wind Speed*	Path Width*	Path Length*	Description Of Destruction
0 (Gale)	40-72 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, braches broken, sign boards damaged, shallow-rooted trees blown over.
1 (Moderate)	73-112 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 (Significant)	113-157 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 (Severe)	158-206 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 (Devastating)	207-260 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 (Incredible)	261-318 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

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. A **supercell** is _____
5. Tornadoes hit the ground when _____
6. When a tornado occurs, you should seek shelter in a _____. If you don't have a _____ then you should seek coverage in a _____ or in a _____.
7. Other weather conditions associated with tornadoes are:
 -
 -
 -
 -
8. Why is it difficult to predict when a tornado will occur?
9. What are scientists doing to help better "predict" tornadoes?