

Literacy-Based Science Task

Big Idea/Topic

Twisted Weather - Tornadoes on the Move

Reading/Writing Skills

Reading Skill: Integrating information using annotation, vocabulary identification, and main ideas

Writing Skill: Writing an explanation highlighting cause, mechanism and effect.

Standard Alignment

Science Standard:

S6E4. Obtain, evaluate, and communicate information about how the sun, land, and water affect climate and weather.

- d. Construct an explanation of the relationship between air pressure, weather fronts, and air masses and meteorological events such as tornadoes and thunderstorms.

ELA Standards:

ELAGSE6RI1: Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

ELAGSE6RI7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

ELAGSE6W2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

- A. Introduce a topic; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
- B. Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
- C. Use appropriate transitions to clarify the relationships among ideas and concepts.
- D. Use precise language and domain-specific vocabulary to inform about or explain the topic.
- E. Establish and maintain a formal style.
- F. Provide a concluding statement or section that follows from the information or explanation presented.

ELAGSE6W9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

ELAGSE6SL4: Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

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Pre-Reading: Twister Science

Students will be prepared to read after they have simulated the formation of tornadoes in a bottle. They should note the conditions required for the formation of the tornado (pressure difference, sustained hand (circular) motion etc.). They should also have explored the interactive map showing the regions and sections of the country where tornadoes are likely to form, as well as the air mass interactions which lead to the formation of thunderstorms and tornadoes.

Activity 1: Tornado in a Bottle

Students will simulate the formation of a tornado using a device made of two plastic bottles and a washer, super glue, food coloring, water and optional dish soap. The teacher will need to prepare one device per group before class (see directions in the resource section).

Begin by informing students that they will be investigating how tornadoes form. Allow students to explore without prompting by trying different movements with their tornado device to see if they can start a “tornado” shape in the water.

Once students can create a smooth vortex in the bottles, have them complete the [observation guide](#). Here, students can be prompted with questions such as:

1. What kind of materials did you use to generate the tornado?
2. What did you have to do to generate the tornado? What conditions were necessary?
3. What was the effect?
4. How long did the tornado last? How could you make it last longer?
5. What conditions do you think are necessary for tornadoes to form in the real world?

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Activity 2: Finding Tornado Alley

This activity allows students to create an [interactive map](#). Students will look at large air masses and their origins and superimpose them on the continental map of the United States. Note that students should have learned about differential heating and global winds (described in the previous standard element -S6E4c) BEFORE doing this lesson.

On their interactive maps, they will move the air masses around to illustrate the development of fronts, thunderstorms and tornadoes and see if they can find the corridor known as 'tornado alley' in the US. As students interact with the map, ask questions such as:

1. How will we know where to place the air masses?
2. What is the direction of the prevailing winds that move the air masses?
3. Why do storms move from West to East across the United States?
4. What do we call the place where the air masses meet? What kind of weather do you expect to experience there?
5. Allow students to guess the source of each air mass, based on their characteristics, then place the cutouts on the base map.
6. Ask students about the direction in which the air masses are moving. How do they know?
7. Ask students what might happen when air masses collide/meet. What kind of weather do they expect to see?
8. See if students can identify the corridor known as Tornado Alley. Why are these states prone to tornadoes?
9. What is Dixie Alley? Why do we sometimes get tornadoes in the state of Georgia as well?

[Cutouts](#) and [templates](#) are included in the resources section. (The weather symbols for fronts are also included. These will signify where air masses meet). These may also be printed on poster-sized paper and laminated for re-use.

Reading: Storm Chasers

Tell Students: We have created tornadoes in a bottle, and we have also looked at interactive weather maps that show us where tornadoes tend to develop and some of the conditions that are necessary for them to form.

Tell students that they are going to read an article that looks at the work of storm chasers, who are meteorologists that track and study tornadoes and their formation. Much is still unknown about why a tornado may or may not develop from a thunderstorm. Tell students that they will be looking for some of the key ingredients necessary for tornado formation, how a tornado develops and how storm chasers can predict where it will go next.

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Reading Skill: Integrating information to develop a coherent understanding of a concept.

Tell students that the article they will read has a lot of new information. Sometimes when an article has a lot of new information, it is helpful to read it several times to gradually see how the ideas relate. Today, they will be reading it three times, and will have a different task to do each time they read.

Before reading, have students examine the images or diagrams referenced in the text first and talk about what they see, what looks familiar and what they might not understand.

Strategy 1: First Read: Text Annotations

- The article may be read aloud by the teacher or students may read in 'chunks' or paragraphs on their own. During the first read, have students use a simple annotation protocol, as provided at the top of the article. Tell students they do not have to put a code on every sentence. For this article, students should focus on identifying information that seems important or identifying bits of information they do not understand. Take some time to address parts they do not understand before the next read.

Strategy 2: Identification of Key Terms:

- Give students the [graphic organizer](#) and instruct them to re-reading the text, looking for the first time the terms in the Cause column of the graphic organizer appear in the text. They should circle the term and then underline the sentence or phrase in that paragraph that defines or describes that term.
- Have students fill out the Cause section of the graphic organizer using the definitions they underlined from the text.

Strategy 3: Cause and Effect - Main Ideas Graphic Organizer

- On their last read, students will focus on cause and effect. They will look for how and why each of these ingredients are necessary for tornado formation. Students will record their answer under the column for 'Mechanisms'.
- Then, have students describe the effect, that is, the appearance of a tornado and the impact/damage they leave in their wake.
- This presents an ideal opportunity to segue into student-driven (or even teacher-driven) questions. Students may ask about water spouts, tornado categories, recent events, school-wide tornado drills or even why tornadoes are more common at certain times in the year. These discussions will enrich their understanding of the concepts presented in the article.

Post-Reading: Storm Tracking -This is NOT a Drill!

Writing Skill: Writing an explanation highlighting cause, mechanism and effect.

Activity 1: Twisted Weather - Tornadoes on the Move

In this activity, students are presented with information from a recent weather forecast. Meteorologists are watching a mass of polar air moving southeast from Western Canada and two other air masses moving north from the Gulf of Mexico. The meteorologists suspect that tornadoes could form when these air masses meet in 3-4 days, but they do not know where and exactly how. The students will

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play the role of lead meteorologists and experts who are consulted to help with the forecast. Using the information they have obtained from the maps, articles and weather data, students will make a prediction about where and how the tornado will **LIKELY** form, and what precautions people will need to take in the upcoming days. Students will communicate this information in one of two ways:

1. Written Task

Students will complete a writing task to prepare a forecast that describes what conditions could result in the tornado, where air masses will move and the sequence of events that would need to take place. They will include details about the possible location of fronts, thunderstorms and areas where tornadoes will likely form. Next, they will prepare a broadcast alert which will provide details of the weather over the next few days, what to expect and where, precautions and safety tips and what to do after the tornado.

2. Classroom Presentation

Students may do a class presentation in small groups where they delve into the role of the ‘weather person’ and illustrate/explain, using text and images (on PPT slides/posters), what will happen in the next few days that could create a tornado. Students can use the PPT guide to help create their forecast. This is linked [here](#).

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Print Ready Student Sheets



Tornado in a Bottle

Prep: Each setup will take 10-15 minutes.

You will need (per student/per small group):

- 2 empty 2-liter soda bottles (*with labels removed*)
- Electrical/duct tape
- Metal washer (*opening should be 0.25 in or 7mm*)
- Super glue
- Water (*enough to fill 2/3 of one of the soda bottles*)
- Blue food coloring

Directions for Demo Prep:

1. Remove the cap from the 2-liter soda bottles. Place the washer at the opening of one of the bottles and use the super glue to hold it fast.
2. Fill the other bottle about 2/3 of the way with water and add blue food coloring until the water is a clear and bright blue.
3. Invert the bottle with washer glued and the opening and use the electrical (or other strong) tape to tape the openings together on top of each other. Ensure that the two openings are firmly taped to each other with the metal washer in between.
4. Test the setup by inverting the bottle with the water so it is on top and swirling the liquid in a circular motion (do not shake). A water vortex should form as the water moves smoothly from the top bottle to the one below.

Adapted from the NASA activity [Tornado in a Bottle \(nasa.gov\)](https://www.nasa.gov/learningresources/151/151280main/Tornado_in_a_Bottle_50123main).



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OBSERVATION SHEET

What did you notice?

E.g., I noticed that (this happened)
_____ when I (did this)

What do you wonder about tornadoes?

I wonder

—

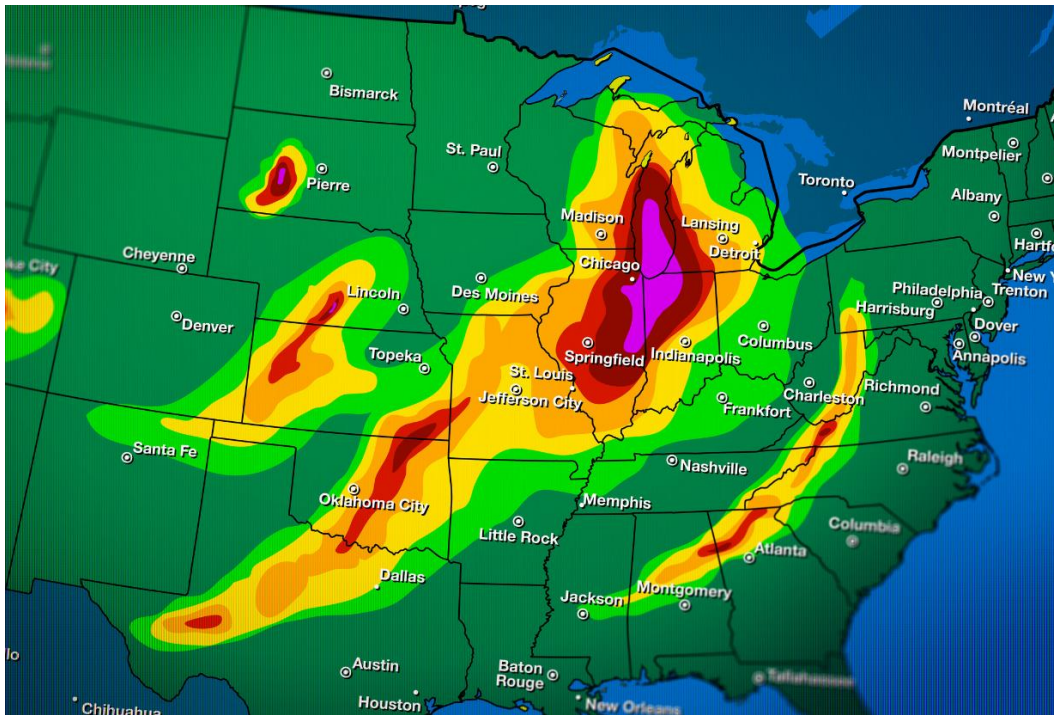
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Tornado Alley: Interactive Map



Student Directions:

- Get a [map of the United States of America](#) from your teacher
- Get a set of [weather cut-outs](#) from your teacher
- Cut out each of the air masses and symbols from the cut-out sheet
- Think about what you have learned about air movement across the world and the United States
 - Place each air mass where you think it belongs on the United States map
 - Now think about which direction the air masses would be moving and consider if you need to place the weather symbols on your map
- Place tornado alley on your map where you think it belongs
- Answer the following questions:
 - How did you know where to place the air masses?
 - What direction are the prevailing winds that move the air masses?
 - Why do storms move from West to East across the United States?
 - What do we call the place where the air masses meet?
 - What kind of weather do you expect to experience where the air masses meet?

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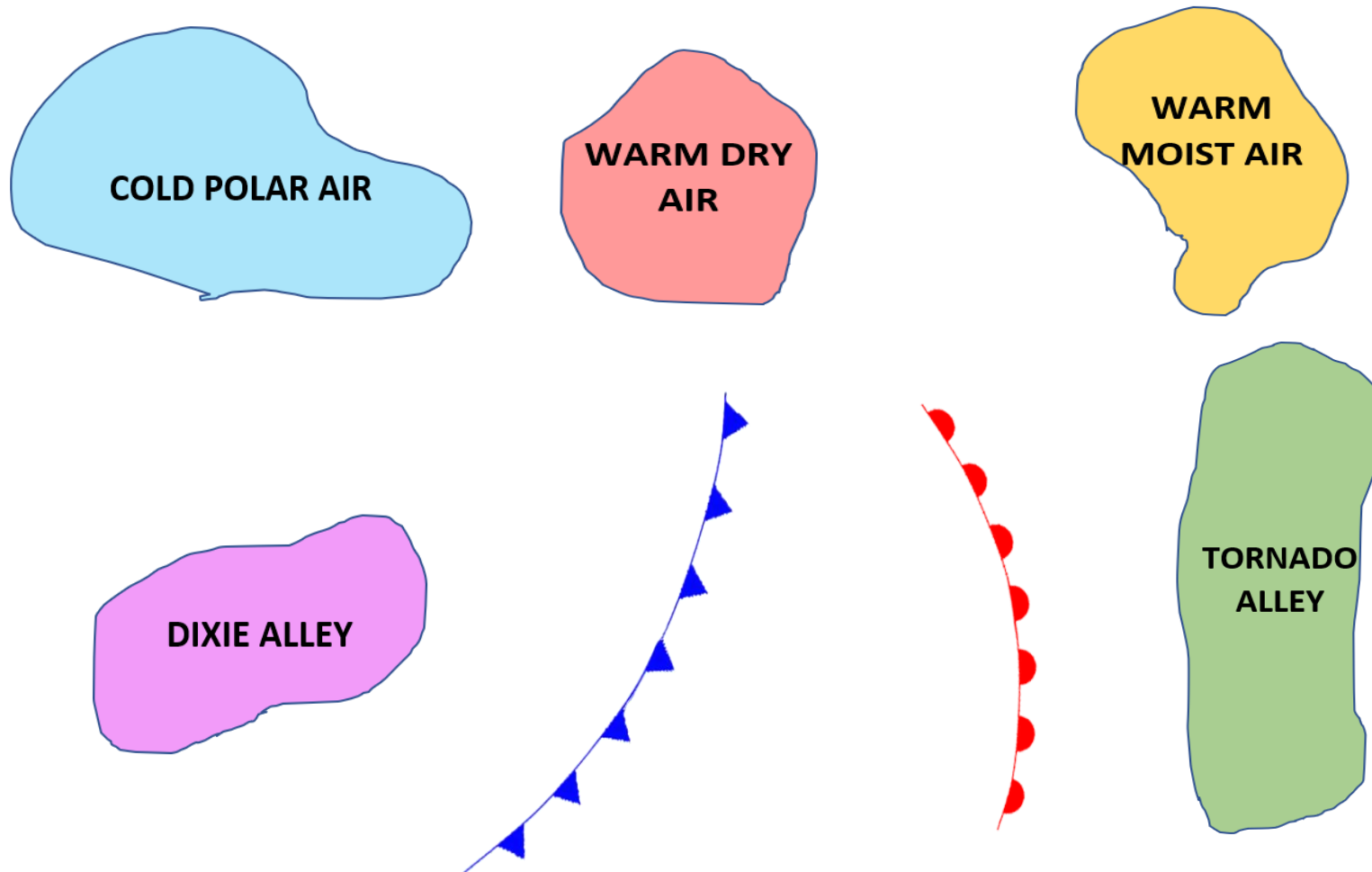


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AIR MASSES/WEATHER SYMBOLS FOR MAP OVERLAY

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CAUSE & EFFECT GRAPHIC ORGANIZER

Use the information from the article to fill out the cause-and-effect graphic organizer for tornadoes.

INFORMATIONAL TEXT - CAUSE & EFFECT GRAPHIC ORGANIZER			
Causes - Ingredients for a Tornado	Descriptions – Define or describe key definitions from the text.	Mechanism – In sequence, explain how each ingredient contributes to the formation of a tornado.	Effect – Use the text to describe the effect: What does a tornado look like? What are some of their impacts?
Air Masses			
Moisture			
Supercell Storm			
Windshear			
Updraft			

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Storm Chasers: Tracking Tornadoes

Use these codes as you read:

! This is important

✓ I knew that

X This is different from what I thought

? I don't understand

Tornadoes represent some of the most extreme weather events on the planet. Scientists who study the weather, called meteorologists, collect data and predict tornadoes. These meteorologists are looking for a combination of specific “ingredients” that make a tornado likely.

Early Formation of a Tornado

First, a tornado requires two masses of air. One must be low to the ground, hot, and full of moisture. The other should be high, cold, and dry. In the United States, warm, moist air rushes up from the Gulf of Mexico. High and dry winds come down from the Rocky Mountains. The two air masses meet up over the central United states in an area called Tornado Alley.

The problems arise because the hot air is underneath the cold air, but hot air is less dense and rises, while cool air is more dense and sinks. This mismatch between the location of the air masses and their density is known as instability. As the hot air, carrying its load of moisture, rises and cools, the water vapor condenses into droplets. Those droplets form enormous clouds. The process of condensation releases energy into the cloud, fueling a massive thunderstorm called a supercell storm (shown in Figure 1).



Figure 1

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Supercell storms are extra strong, rotating thunderstorms. They are the storms most likely to produce hail and flash floods. They are also the type of thunderstorm that can produce tornadoes, but only if two other ingredients are in place.

Later Steps in the Formation of a Tornado

The first extra ingredient is wind shear. Wind shear occurs when wind at ground level is blowing in a different direction or different speed from the wind higher up in the atmosphere. This creates a horizontal (along the ground) tube of spinning air, as shown in figure 2.

The second extra ingredient is an updraft, or rush of air moving up. The updraft pushes one end of the spinning tube upright. At the same time, rain and cold air push down the other end of the tube. Eventually, the spinning tube meets the supercell storm. It joins the rotation already taking place within the storm, increasing its power. All the ingredients are in place, and a tornado is born.

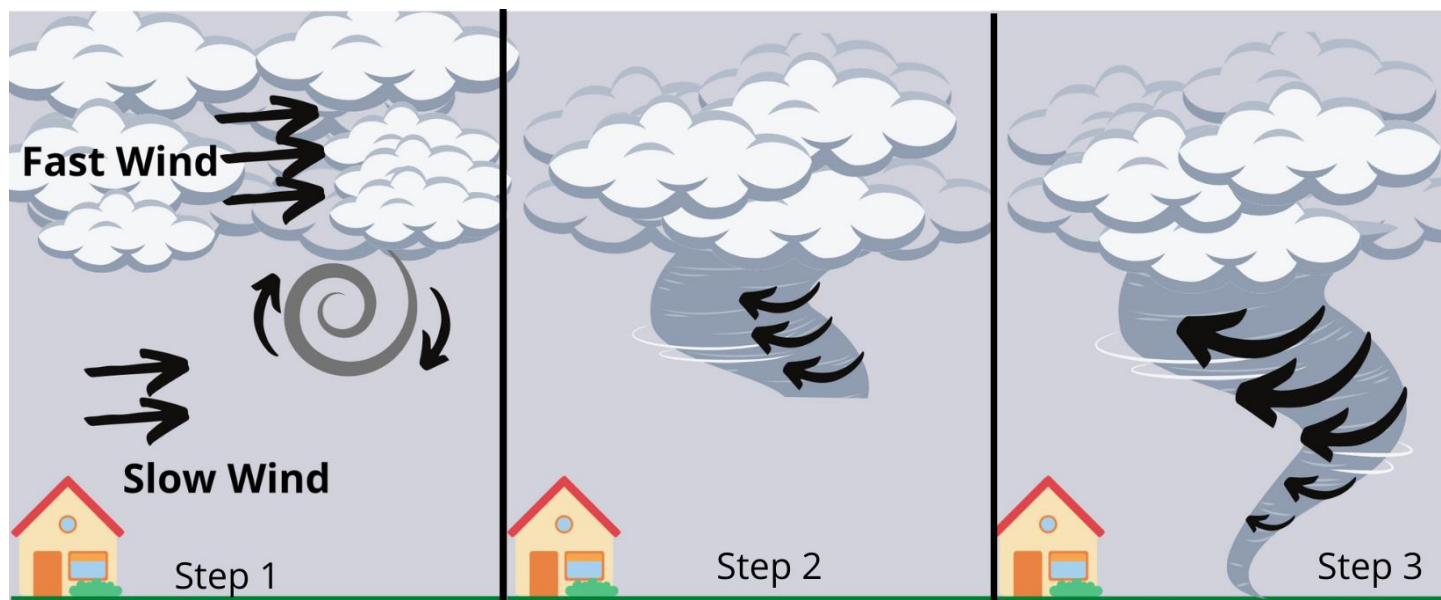


Figure 2

However, tornado forecasting is not perfect. Sometimes, even when the conditions seem right, no tornado forms. Even meteorologists do not know exactly why these ingredients sometimes come together to form a tornado, but other times, do not.

Safety in a Tornado

Tornadoes can cause extensive damage and loss of lives. It is critical that alerts are sent to the public as soon as conditions exist for their formation. The National Weather Service will issue a tornado *watch* to indicate that the ingredients necessary for a tornado are gathering. They will upgrade the tornado *watch* to a tornado *warning* to indicate that a tornado is about to form or has formed within a certain area. (Figure 3). In this case, people should move to a sheltered area indoors on the lowest floor of the building. They should get as far away from windows as possible: getting in a coat closet, under staircases, in a bathroom, or under tables may be good options. They should stay in a crouched position until the tornado has passed. When the tornado is over, they should watch for dangerous debris, dangling electrical wires and other hazards as they come out from their safe place.

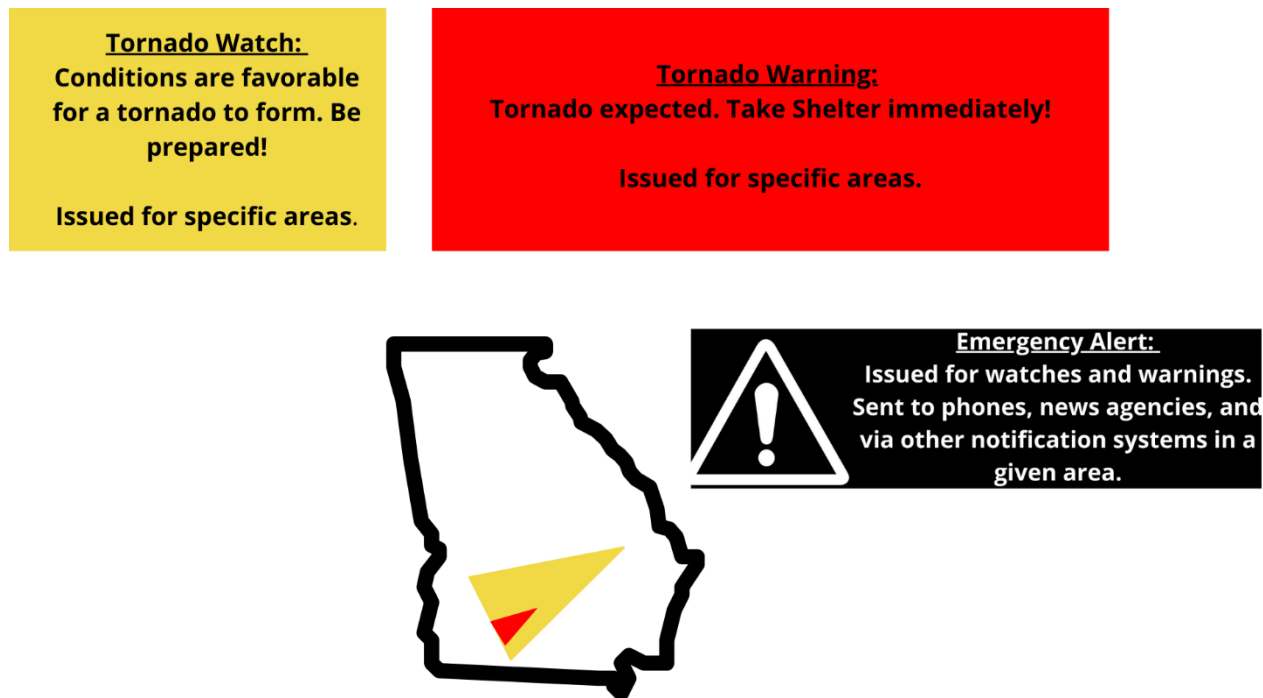


Figure 3