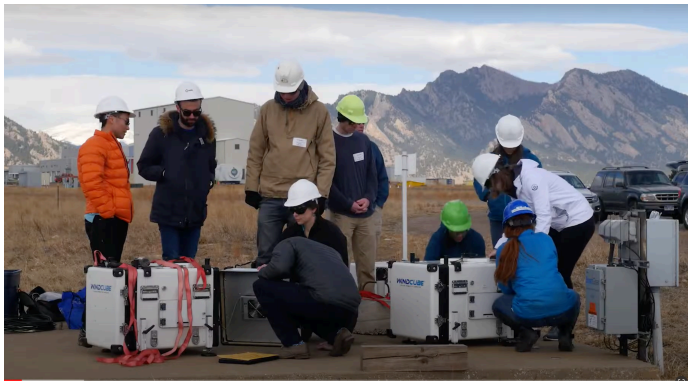
Data Puzzles

Windstorms on the Front Range

Teacher Guide

Setting the Stage

In 2022, strong winds caused the Marshall Fire in Boulder County, Colorado to quickly spread and become the most costly wildfire in Colorado history. Although strong winds are a common weather event at the foot of the Rocky Mountains, a particularly windy month soon after the fire had the public feeling on-edge and scientists wondering “Are wind patterns along the Front Range changing as the climate warms?” The answer may lead to better preparation and communication to the public about hazardous wind storm events.



Lesson Overview

In this Data Puzzle, students analyze and interpret authentic data to explain …

Part 1 – (20 minutes) Eliciting Students’ Ideas
Access students' prior knowledge and experiences with strong windstorms.

Part 2 – (40 minutes) Identifying Important Science Ideas
Students engage with a contemporary science investigation through an interactive reading in which students are tasked with 1) making connections between the science investigation and the opening scenario, and 2) identifying an investigative question.

Part 3 – (30 minutes) Supporting Ongoing Changes in Thinking
Students test/compare their current understandings of the investigative question against authentic data.

Part 4 – (30 minutes) Constructing Evidence-Based Explanations
Students finalize new understandings as they relate to the investigative question.

Data Puzzles

Instructional Overview	
Grade Level	Middle & High School
Instructional Time	~120 minutes
Building Toward	**NGSS Disciplinary Core Idea:** ● ESS2.D Weather and Climate **NGSS Science and Engineering Practices:** ● Analyzing and Interpreting Data ● Constructing Arguments from Evidence **NGSS Crosscutting Concepts:** ● Stability and Change ● Systems and System Models
Investigative Question	● Are wind patterns along the Front Range of Colorado changing?
What Students Will Do	● Analyze and interpret data to evaluate how wind patterns are changing. ● Construct arguments from evidence about how wind patterns and weather change over time
Materials	❑ Slide deck ❑ Student worksheet ❑ Answer Key ❑ Datasets
Material Preparation	❑ Print student worksheets ❑ Review presenter notes in lesson slides ❑ Review Answer Key
Vocabulary	● Humidity: the amount of water vapor in the air ● Frequency: the number of times something occurs over a period of time

Part 1 - Eliciting Students' Ideas
20 minutes

Refer to Part 1 slides included in the slide deck. See presenter notes for additional information.

1. **Opening Scenario** - Introduce the Data Puzzle and explain that the purpose of the opening scenario is to identify times in the students' own lives when they may have experienced phenomenon or events similar to what they will explore in the data puzzle.

2. Facilitate a whole-class conversation in which students share their own experiences related to strong winds (either in their own lives or in their community). Student experiences and language should be used as resources to relate back to later in the Data Puzzle.

3. Introduce students to the importance of wind and weather alerts. This will set the stage for why the research the scientist is doing is important.

4. Introduce students to Dr. Julie Lundquist, the scientist featured in the Data Puzzle, who studies the atmosphere and windstorms along the Front Range in Colorado.

Part 2 - Identifying Important Science Ideas
40 minutes

Refer to Part 2 slides included in the slide deck. See presenter notes for additional information
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1. Students read the puzzle plot text included in the student worksheet either individually, in small groups, or as a whole class. While reading, students are asked to do the following tasks:
    a. Circle important points or science ideas.
    b. Underline or highlight the investigative question the scientists are investigating.
    c. Define any new science vocabulary words in the margins.

2. Show the following resources and videos (*the links are also embedded in the puzzle plot text*) to help students understand the importance of wind.
    a. Estimating wind speed - Visual damage at various wind speeds
    b. Is spring in COlorado getting windier?

3. Facilitate a whole-class discussion to help make connections between the reading and the opening scenario by utilizing the following prompts:
    a. Do you feel tense or uneasy in strong winds as described in the reading? Why or why not?
    b. Do you think it is getting windier? Why or why not?

4. Students summarize important science ideas presented in the puzzle plot by drawing and describing the weather conditions needed for a red flag warning to be issued.

5. Students make a prediction for the investigative question that they will test in Part 3 by analyzing real data.

Part 3 - Supporting Ongoing Changes in Thinking

30 minutes

Refer to Part 3 slides included in the slide deck. See presenter notes for additional information.

1. Orient students to the graph/figure by giving them an opportunity to study and discuss the graph both as a whole class and then with a partner.

2. Students work in pairs to identify patterns in the dataset.

3. Students cite evidence from the graph to evaluate whether or not the data supported or refuted their initial prediction for the investigative question.

Part 4 - Constructing Evidence-Based Explanations

30 minutes

Refer to Part 4 slides included in the slide deck. See presenter notes for additional information.

1. Students work either individually or in pairs to construct a newspaper article update about Dr. Lundquists investigation. The article should focus on what this means for the public and how they should prepare themselves for windstorms.

2. Digging Deeper: After students construct and share their articles, watch the Washing Post video **These "Native American women want to help lead California's prescribed burning**" as a whole class (~3 minutes) to see what communities are doing to be proactive in managing fire weather risk.

Additional Teacher Resources
Videos

- PBS: Embracing controlled burns to protect wildfire-prone areas

Articles

- High Winds and Marshall Fire on December 30th, 2021. NOAA.
- As Boulder County burns, a new focus on fire resilience

Resource Last Updated: June 2025
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