AMS Research:

From Poster to Classroom

Presenting Author:

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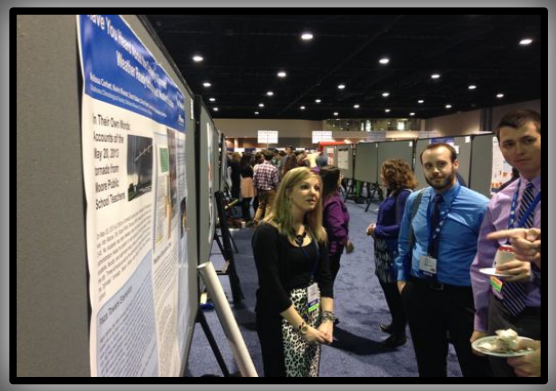
Oklahoma Climatological Survey

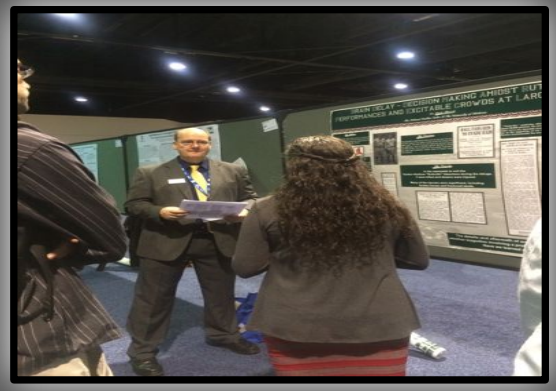
Norman Public Schools

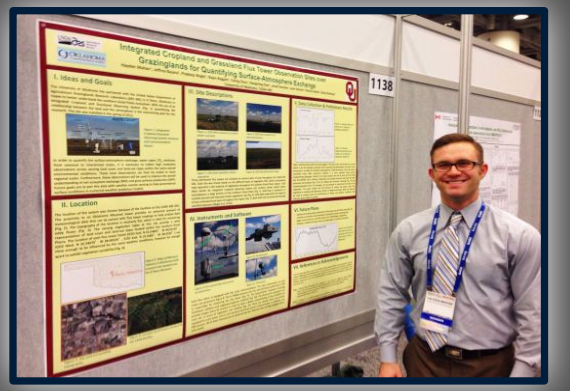
AMS Annual Meeting in Phoenix, AZ

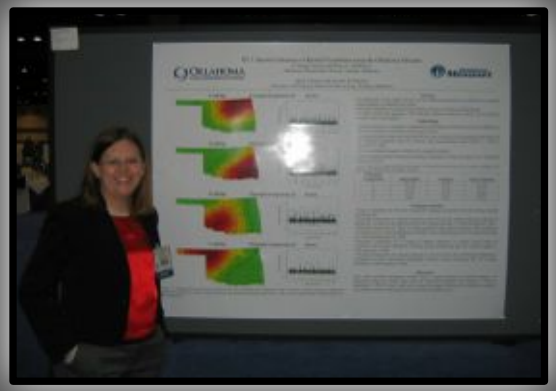
5 Jan 2015

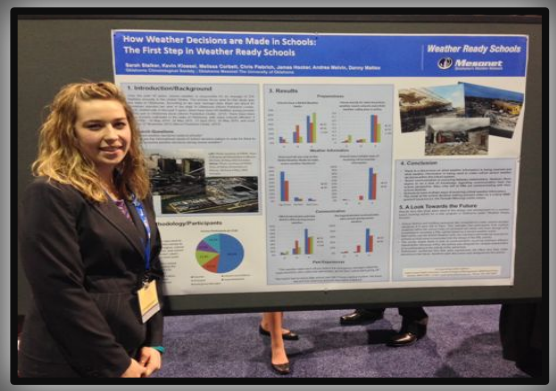
Each year at the annual AMS meeting, a wealth of current research is presented in the poster hall.

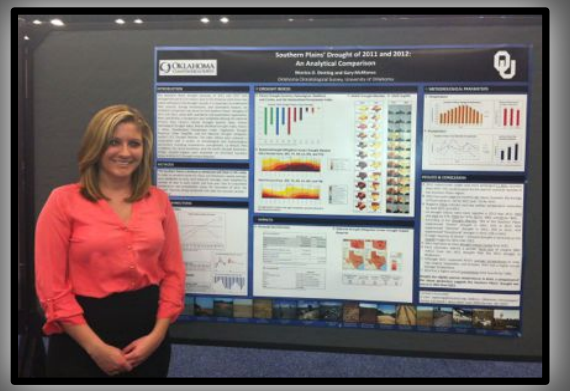






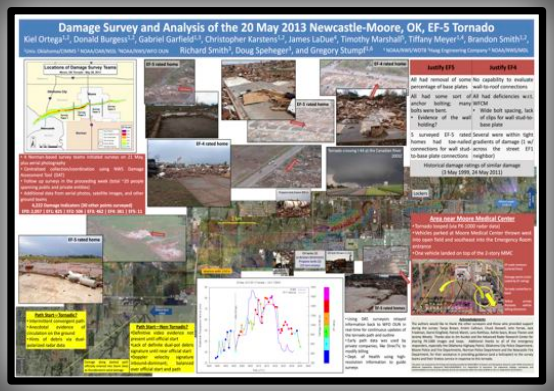


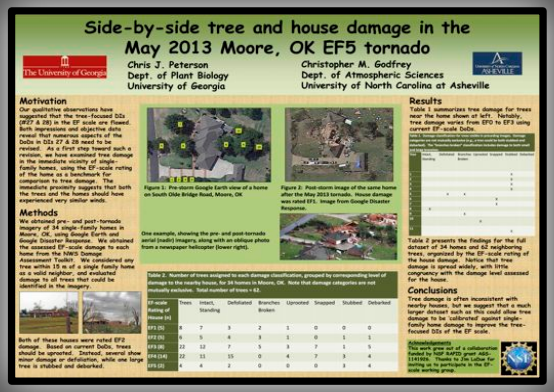


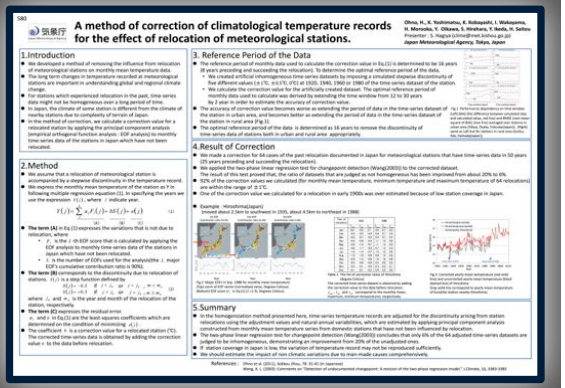


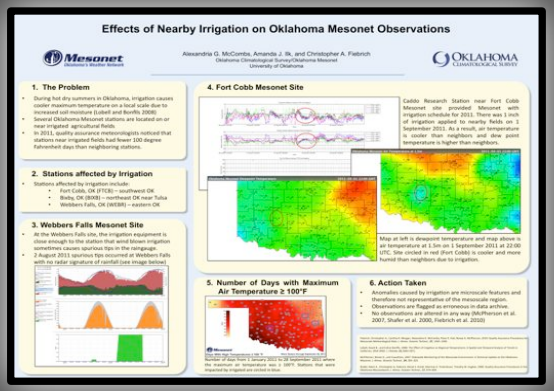
Most of this research is unknown outside of the weather community in attendance at AMS.

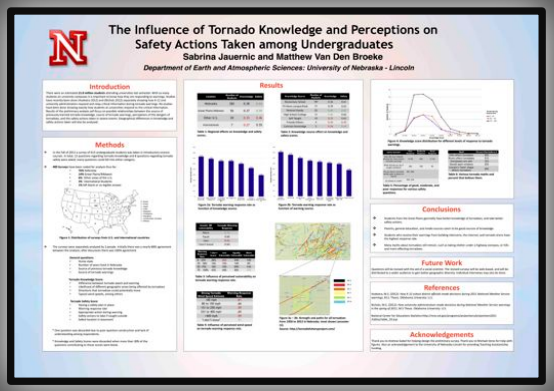
What happens when these posters and the information they contain are rolled up and sealed back in their tubes?

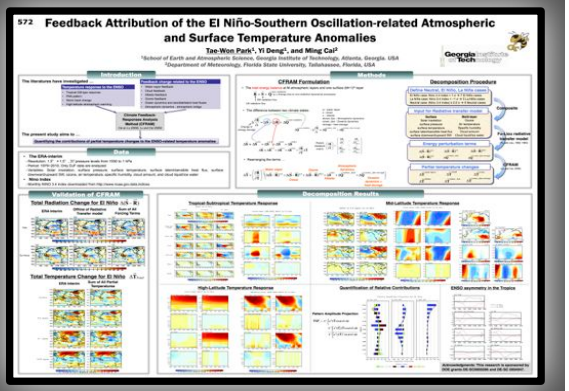






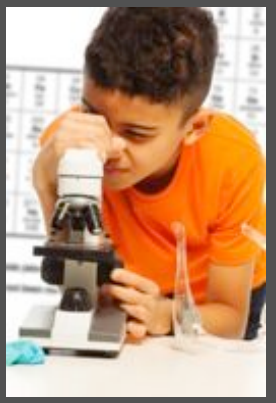






Many posters and their data are never heard from again.

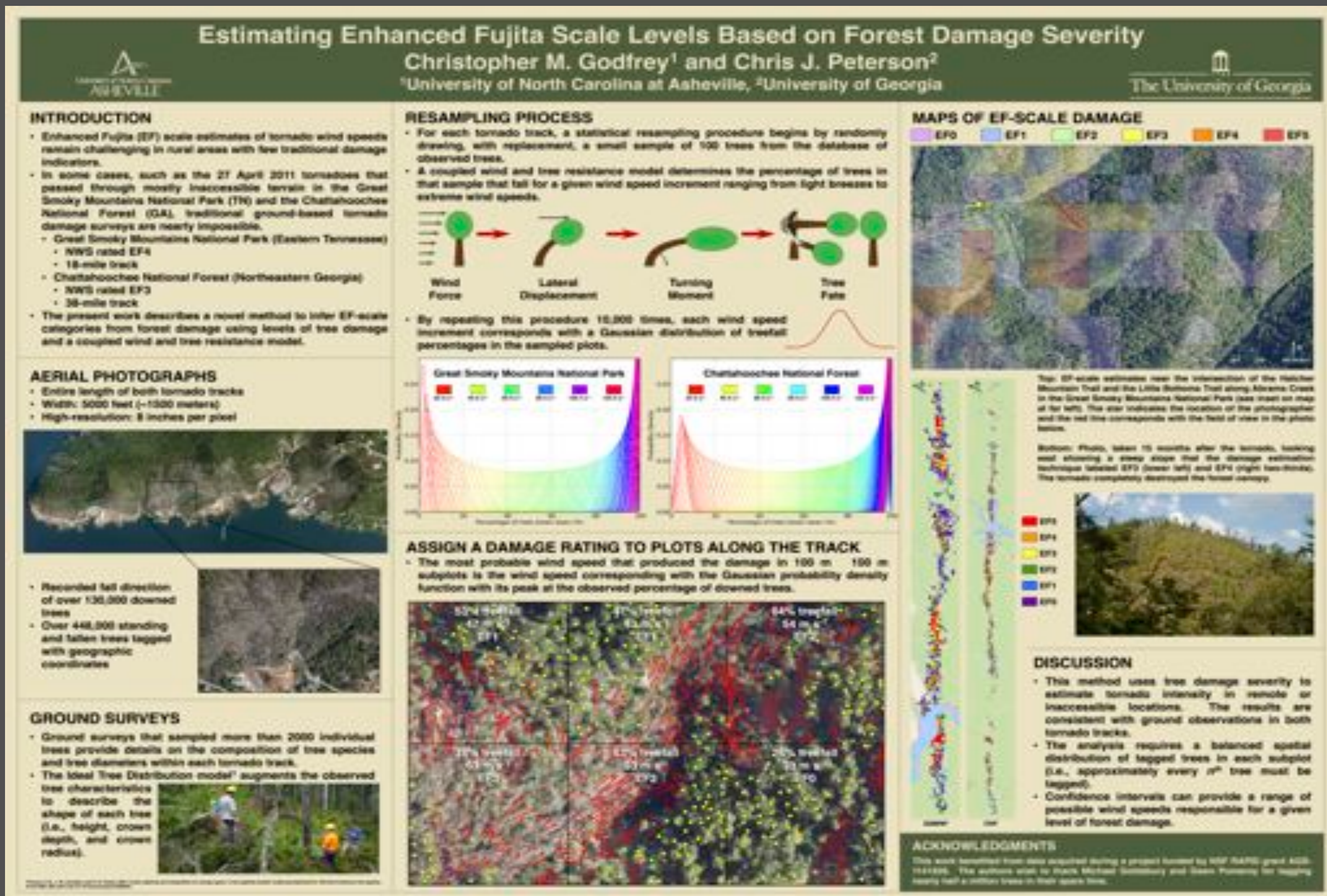
Often students perceive science class as a stagnate subject area whose basic concepts were discovered long ago.



$$F=ma$$
$$p=mv$$
$$L=I\omega$$
$$\Delta U=Q-W$$

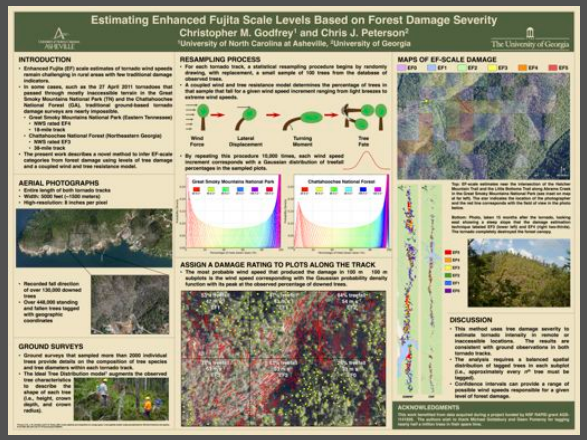
Posters portray science as an ongoing pursuit and expose students to new avenues of learning.

Proof of Concept:
From AMS in Atlanta, GA



To IMS in Norman, OK

(Irving Middle School)

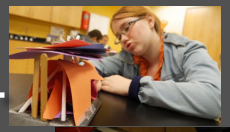
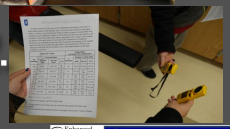
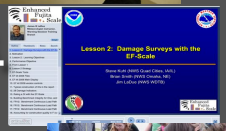


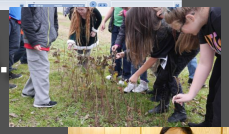
IRVING COUGARS

NEXT GENERATION SCIENCE STANDARDS

5e Learning Cycle

1. Engage
2. Explore
3. Explain
4. Elaborate
5. Evaluate

1. 
2. 
3. 

4. 
5. 

Courtesy: WDTB

The Standards

The *Next Generation Science Standards (NGSS)* developed by teachers, scientists, and leaders in science and science education from around the country, focus on the big ideas in science and emphasizes the common practices that scientists use every day, such as planning investigations, developing models, and designing solutions. The *NGSS* encourage students to learn the processes of science in a deep, meaningful way through firsthand investigative experiences, instead of just memorizing facts for a test. This scientific way of thinking will ensure that the concepts children learn in school will stay with them not just for a day, a week, or a year—but for a lifetime.

Courtesy: http://ngss.nsta.org/parent-q-and-a/

NGSS were not adopted in Oklahoma, but the Oklahoma Academic Standards for Science are very similar.

What Oklahoma Academic Standards Do	What Oklahoma Academic Standards Do Not
▪ Do focus on deep thinking, conceptual understanding, and real-world problem solving skills ▪ Do set expectations for students to be College, Career, and Citizenship ready ▪ Do incorporate literacy in Science, Social Studies, and Technical Subjects ▪ Do emphasize the use of citations and examples from texts when creating opinions and arguments ▪ Do increase rigor and grade-level expectations ▪ Do determine the full range of support for English Language Learners and Students with Special needs.	▪ Do Not dictate how teachers should teach ▪ Do Not mandate a specific curriculum ▪ Do Not limit advanced work beyond the standards ▪ Do Not require the purchase or development of entirely new instructional materials ▪ Do Not prescribe all that can or should be taught ▪ Do Not limit efforts to prepare students for College, Career, and Citizenship readiness ▪ Do Not prescribe interventions for students below grade-level
Were Not written or funded by the Federal Government. Oklahoma educators and content specialists participated in the writing, review and feedback process of the Oklahoma Academic Standards.	

Courtesy: http://ok.gov/sde/oklahoma-academic-standards

Next Generation Science Standards covered on the Lesson Inspired by the Poster

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

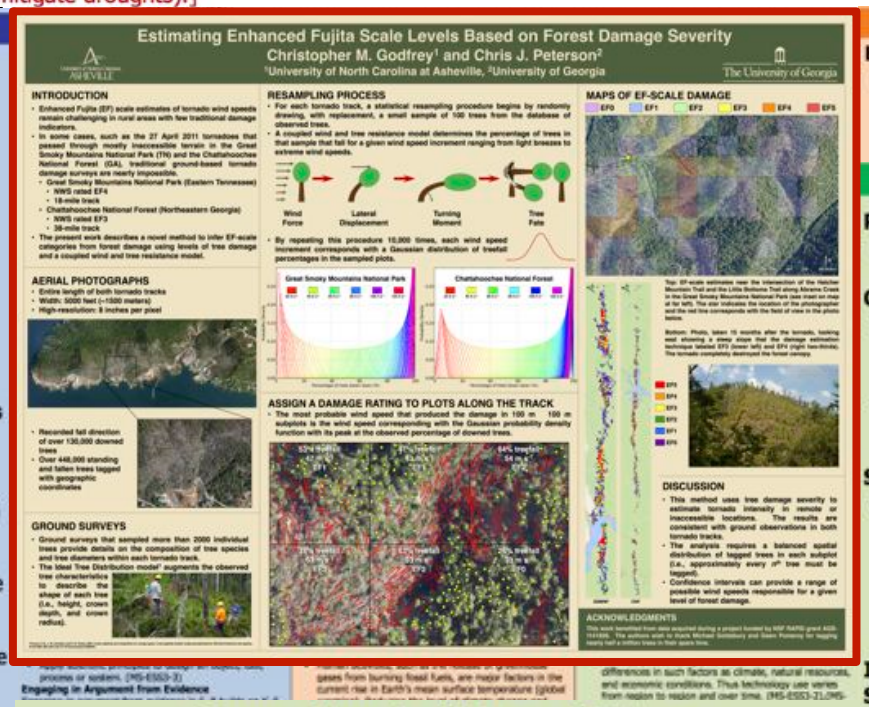
- Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)
- Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)



Disciplinary Core Ideas

ESS3.B: Natural Hazards

- Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)

Crosscutting Concepts

Patterns

- Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1),(MS-ESS3-4)

Stability and Change

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

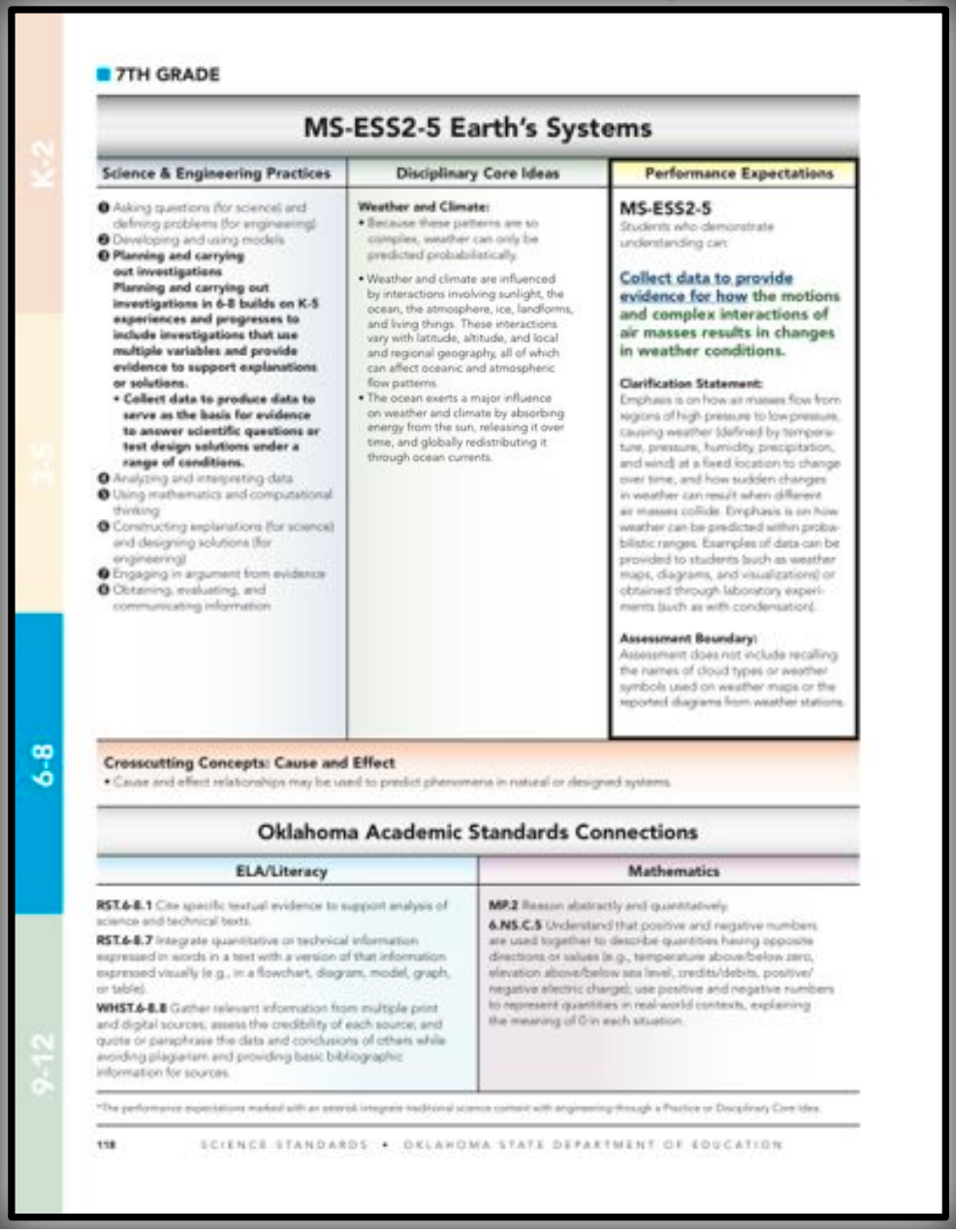
- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1),(MS-ESS3-4)
- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2),(MS-ESS3-3)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)

Oklahoma Academic Standards for Science covered on the Lesson Inspired by the Poster



K-2
3-5
6-8
9-12

■ 7TH GRADE

MS-ESS2-5 Earth's Systems

Science & Engineering Practices	Disciplinary Core Ideas	Performance Expectations
❶ Asking questions (for science) and defining problems (for engineering) ❷ Developing and using models ❸ **Planning and carrying out investigations** **Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.** **• Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.** ❹ Analyzing and interpreting data ❺ Using mathematics and computational thinking ❻ Constructing explanations (for science) and designing solutions (for engineering) ❼ Engaging in argument from evidence ❽ Obtaining, evaluating, and communicating information	**Weather and Climate:** • Because these patterns are so complex, weather can only be predicted probabilistically. • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.	**MS-ESS2-5** Students who demonstrate understanding can: **Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** **Clarification Statement:** Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation). **Assessment Boundary:** Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.

Crosscutting Concepts: Cause and Effect

• Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Oklahoma Academic Standards Connections

ELA/Literacy	Mathematics
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. **RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). **WHST.6-8.8** Gather relevant information from multiple print and digital sources, assess the credibility of each source, and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.	**MP.2** Reason abstractly and quantitatively. **6.NS.C.5** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Engage:
Gulf Coast Contractor "Hurricane Houses"

Task: Build a domicile with material and time constraints while keeping in mind the natural hazards of the gulf region.

NATIONAL WEATHER CENTER

ACTIVITY

HURRICANE HOUSES

DESCRIPTION:

Students will learn what features of design and types of building materials make a house more weather resistant. Students will build a house that will survive hurricane force winds.

MATERIALS:

2 standard size sheets of construction paper
4 straws (with or without flexible bend - it only matters that all students have the same type) – or 4 popcicle sticks
glue stick
60 cm cellophane (Scotch) tape
Styrofoam tray turned upside down (The produce department of a local grocery store might donate fruit/vegetable trays. The tray is to be used for the base only. It cannot be cut apart and used for the house.)

Tools: supply scissors, metric ruler (markers are optional)

The size or kind of materials may vary. The most important factor is that ALL teams have the same materials. The purpose is to judge design. If every team has the same materials then design is the ONLY variable. An extension activity is to change materials (See below).

BACKGROUND:

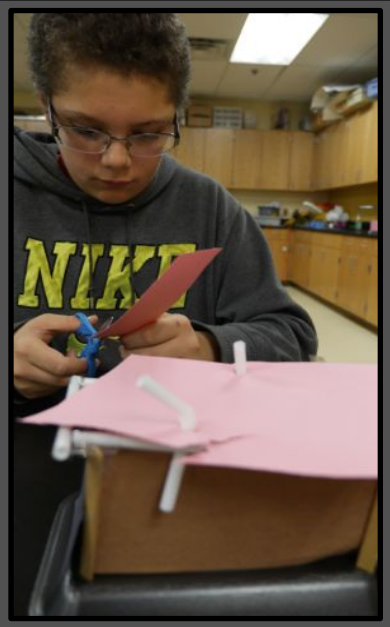
1) Begin by teaching the essentials of weather and specifically of hurricanes.

2) Review Volume and Surface Area: Surface area is the sum of the area of each side (exclude bottom of house). (Optional)

The surface area will be used for comparison after the houses are tested by the "hurricane force" winds. Did the surface area affect the success of house to withstand the winds?

Give students samples of each shape and have them calculate surface area and volume. The amount of time needed will depend how their previous experience.

3) Use a leaf blower to "blow away the houses."



Activity developed by Dr. Kevin Kloesel

Engage:
Gulf Coast Contractor “Hurricane Houses”

Analyze: Did your home make it? Why or why not? Identify designs that are better-suited for the potential hazards.

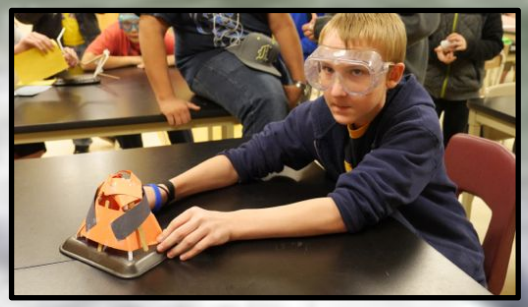
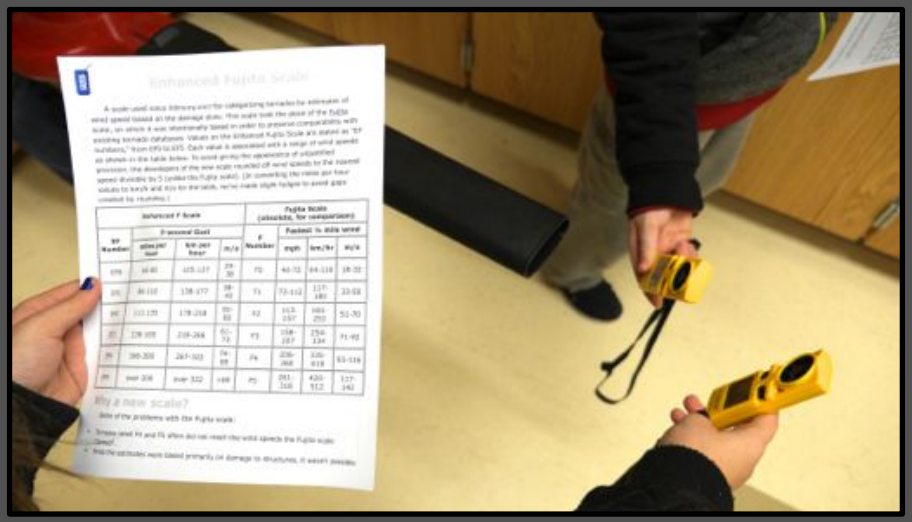


Image Courtesy:
http://www.noaanews.noaa.gov/stories2005/images/ivan091504-1515zb.jpg

Explore:
What do tornadic and hurricane force winds feel like?

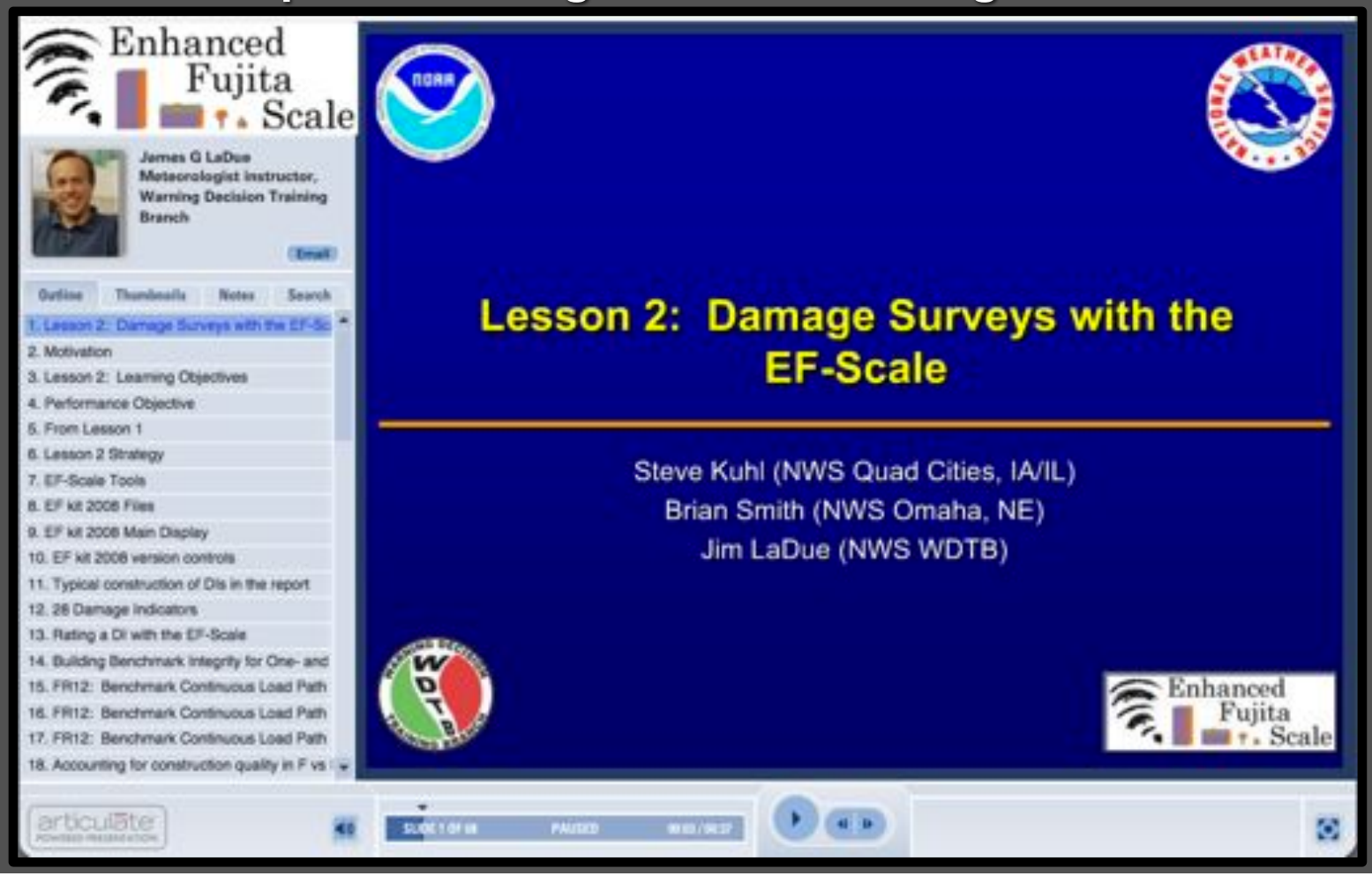
Task: Measure and classify wind speeds.



Explain:
How is tornado damage assessed?

Question: How are tornadoes rated based on damage surveys? What are damage indicators?

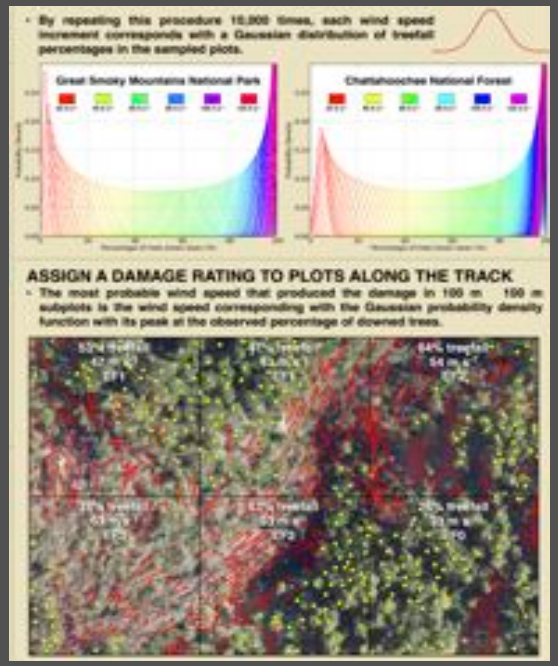
Task: Complete Warning Decision Training Branch module

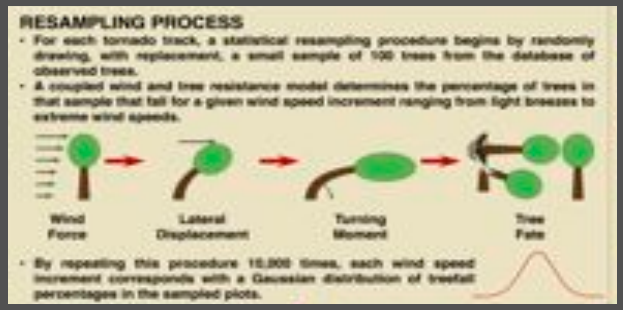


Elaborate:

How might tornadoes that occur in inaccessible forests be rated if no damage survey can be conducted on the ground?

Task: Design a model based on Godfrey and Peterson's findings presented in their poster.





Elaborate:

How might tornadoes that occur in inaccessible forests be rated if no damage survey can be conducted on the ground?

Task: Design a model based on Godfrey and Peterson's findings presented in their poster.

Evaluate:

Why was our classroom model not viable?

Task: Infer tornado intensity based on the percentage of downed trees in a grid

Takeaway Message

1. Widespread curriculum development is happening across the country due to the implementation of new standards.

2. Emphasis is put on emulating the scientific process rather than memorizing words and facts.

3. Now is the perfect time to integrate new meteorological research into lessons to add urgency and meaning to an otherwise static curriculum.

4. Partnerships between research scientists and K-12 educators to develop inquiry-based classroom lessons will result in a more engaging educational experience and will better prepare students for careers in science.

AMS Research:

From Poster to Classroom

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Oklahoma's Weather Network

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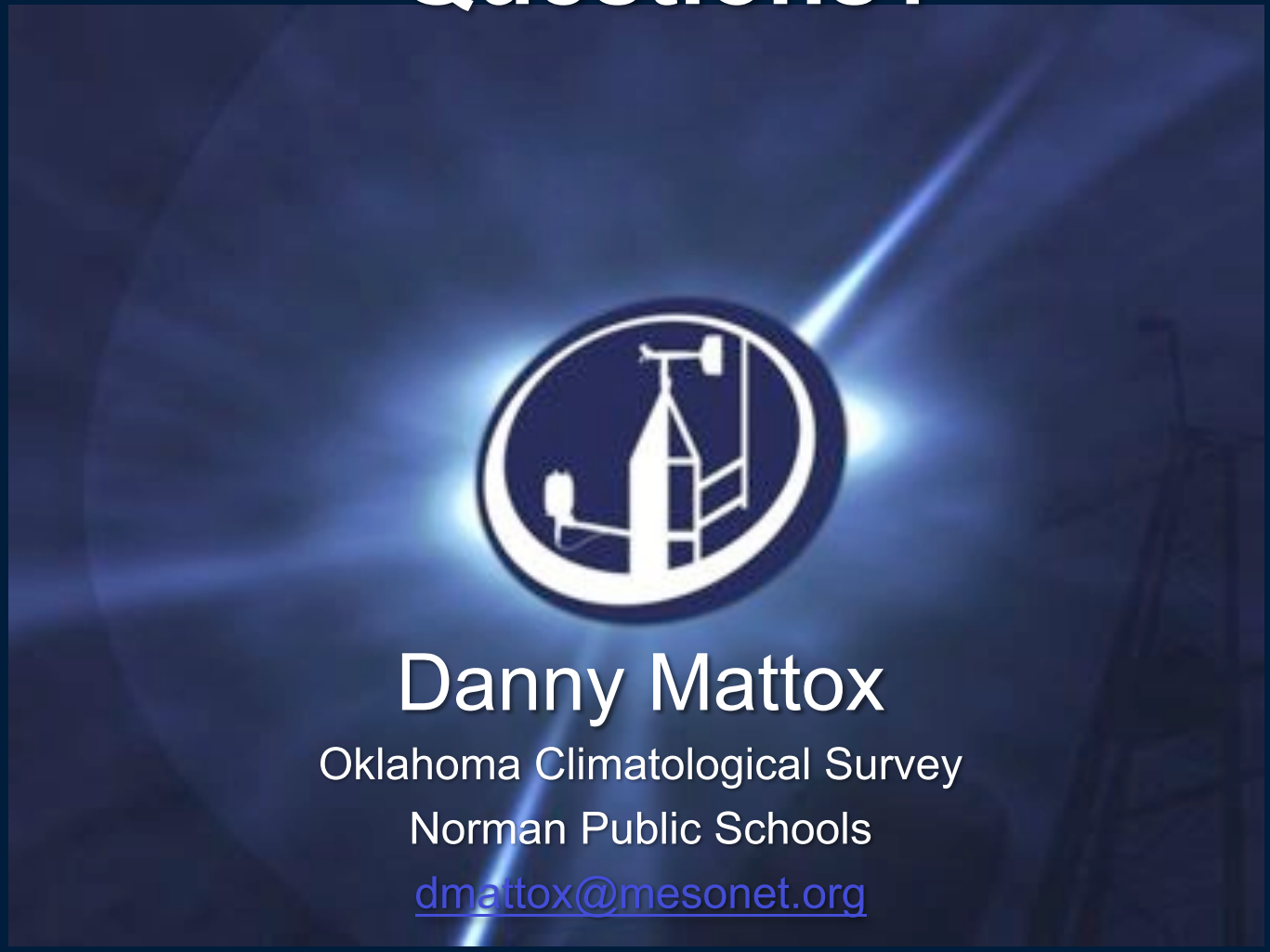
Questions?



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