GLOBE Weather NGSS-based instructional unit for middle school

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Why GLOBE Weather?
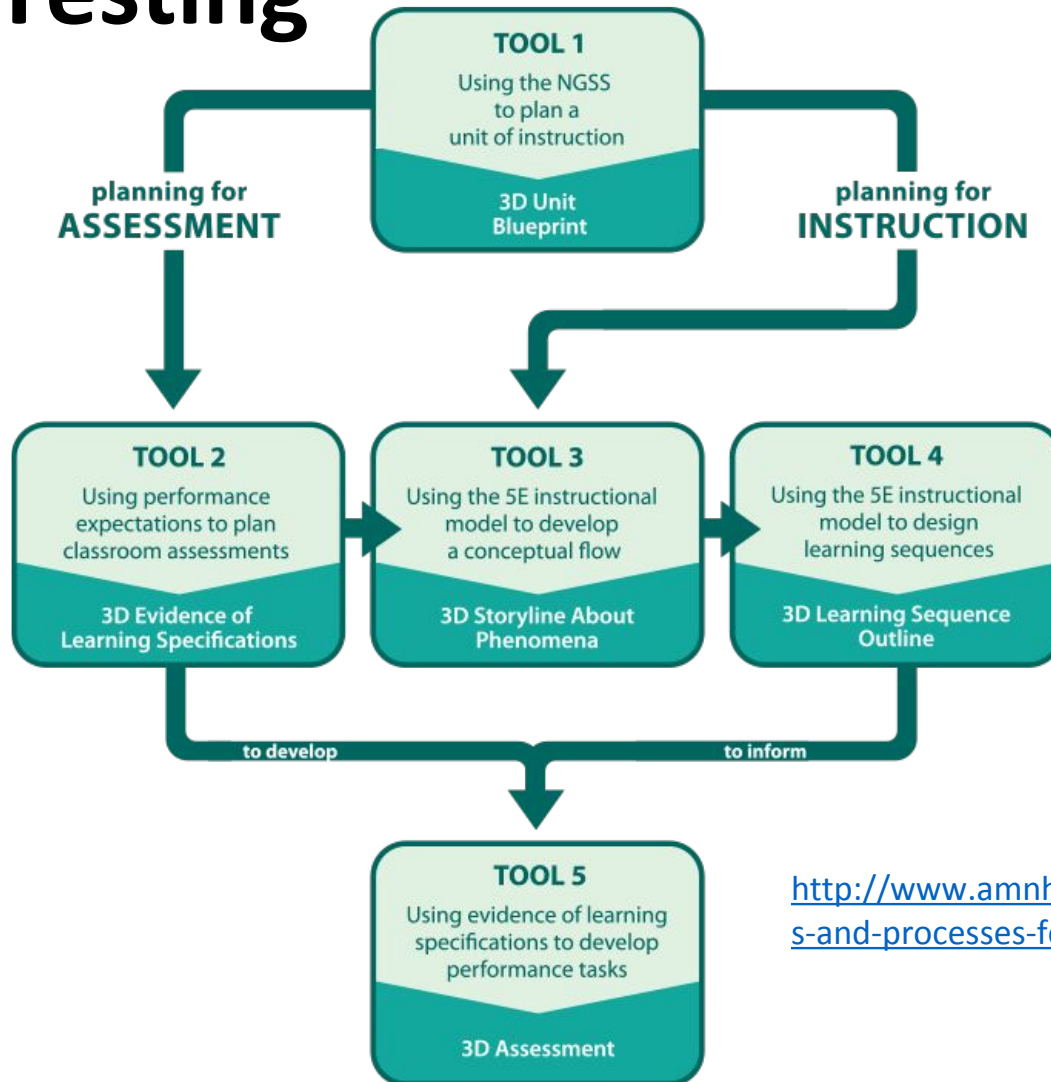
Answering the Call
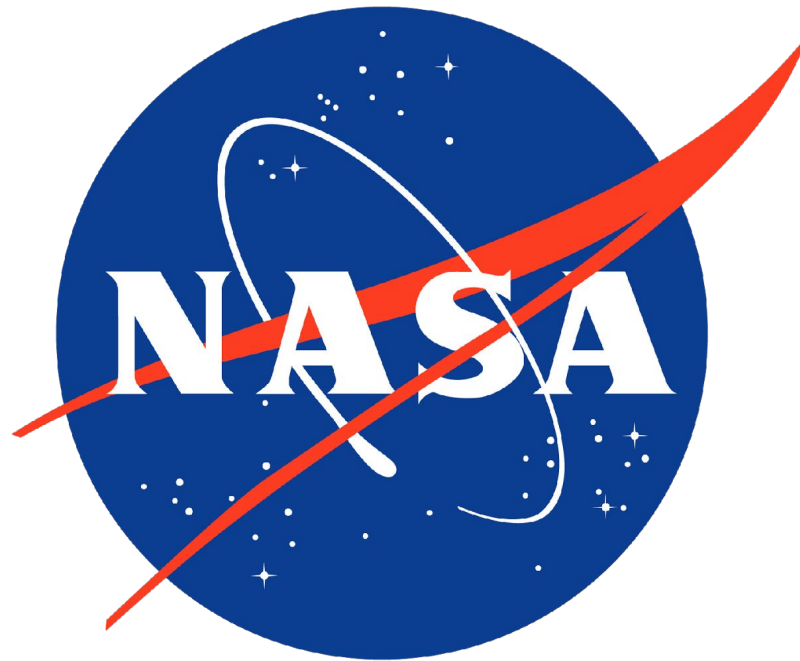
Process for Development and Testing

http://www.amnh.org/explore/curriculum-collections/five-tools-and-processes-for-ngss/

Outline of Session

- Background
  - Question/Phenomena/Answer
  - BSCS 5E Process
- Excerpt of one lesson from unit
  - *24-hour temperature data*
- Next Steps
  - Professional Development
  - Field Testing
- Feedback and Questions

Your presenters!

- Lisa Gardiner
- Becca Hatheway
- Renee Minaya
- John Ristvey
- Lindsey Mohan

NGSS Performance Expectations

MS-ESS2-5 *Collect (and analyze) data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.*

MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric ~~and oceanic~~ circulation ~~that determine regional climates~~.

ENGAGE: Provides an opportunity to pique students' interest and to elicit their knowledge about the phenomenon or concept.

EXPLORE: Provides an opportunity for students to have a shared experience of phenomena.

EXPLAIN: Provides an opportunity for students to develop explanations, use explanations, and use new scientific vocabulary.
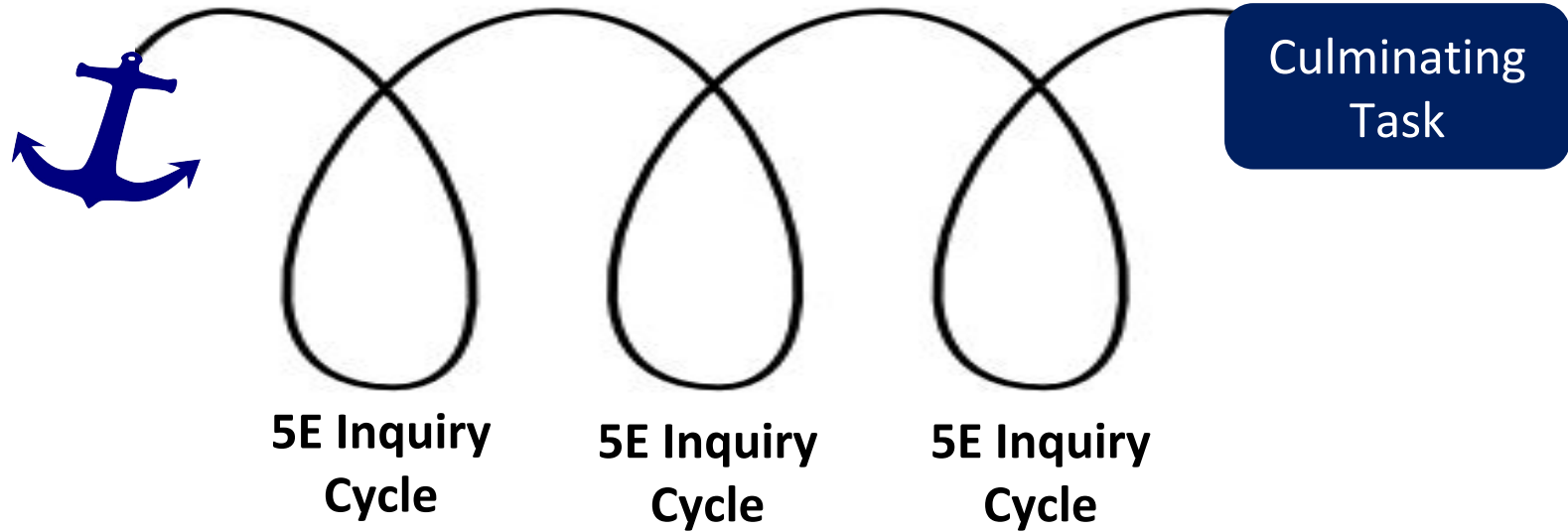
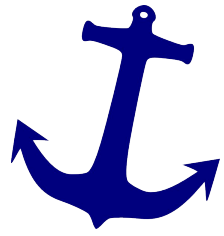**ELABORATE:** Provides an opportunity to dig deeper or to use and apply knowledge to new contexts.

EVALUATE: Provides an opportunity for teachers and students to assess the understanding developed.

Phenomena-driven learning & the 5E's

Anchoring Phenomenon:

▪ Observable to students

▪ Real-world

▪ Perplexing or demands an answer

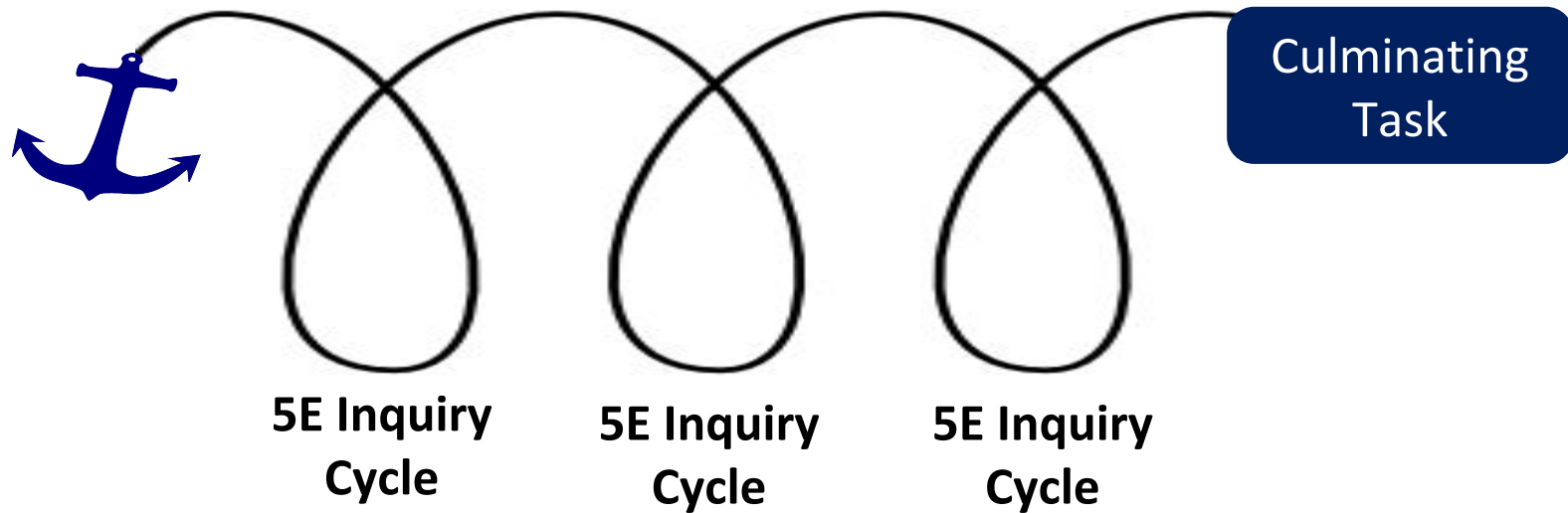▪ Not easily answered in a lesson

GLOBE Weather Anchor

Some storms bring dangerous amounts of precipitation to human communities. Why does this happen in some places and not others?

Phenomena-driven learning & the 5E's

Culminating Task

5E Inquiry Cycle   5E Inquiry Cycle   5E Inquiry Cycle

- **E**ngage and **E**xplore **Investigative Phenomena**

- Develop **E**xplanations along the way

- Practice using those explanations by **E**laborating to new contexts

- **E**valuate progress

- Loop back to **Anchor Phenomena** (What do we know now? What do we still need to learn?)

Sample Phenomenon

- Timelapse video of weather
  https://vimeo.com/channels/coloradocloudclips/page:8

Question-Phenomena-Answer

- P=Phenomena - Something that happens that students can observe
- Q=Question - A next question about how the Earth works based on an observable phenomena
- A=Answer - What students learn from observing a phenomena

Getting to know the GLOBE Weather QPAs

GLOBE WEATHER SEQUENCE 1
Question-Phenomena-Answer Map

★ GLOBE Protocol or modified protocol
★ GLOBE or other weather data analysis

P: Timelapse of clouds forming on a mostly clear day. ★

A: Clouds form because something is happening in the air around the clouds, and because of the water cycle (evaporation, condensation).

ENGAGE

Q: How is temperature related to clouds forming?

P: Weather balloon data between 0-12km; GLOBE Surface Temperature measurements; GLOBE temperature data for a 24-hour period. ★★

A: Temp decreases with altitude. Some land surfaces heat more than others. Water heats more slowly than land. As sun warms the land, the air temperatures warm up. When the sun sets, air temperatures go down.

EXPLORE

Overview of GLOBE Weather learning sequences

Learning sequence 1: Students investigate how convective clouds form and how they can turn into isolated thunderstorms.

Learning sequence 2: Students investigate air masses and storms at a cold front by exploring temperature, pressure, rainfall, and relative humidity.

Learning sequence 3: Students look globally, comparing temperature, precipitation, and winds at mid-latitudes and tropics. They model Coriolis effect and investigate rain shadow data.

I^2 Sense-making Strategy

1. Identify ("What I See")	2. Interpret ("What It Means")

Sense-making

3. Caption

I² Sense-making Strategy: Step 1 **Identify**

Example

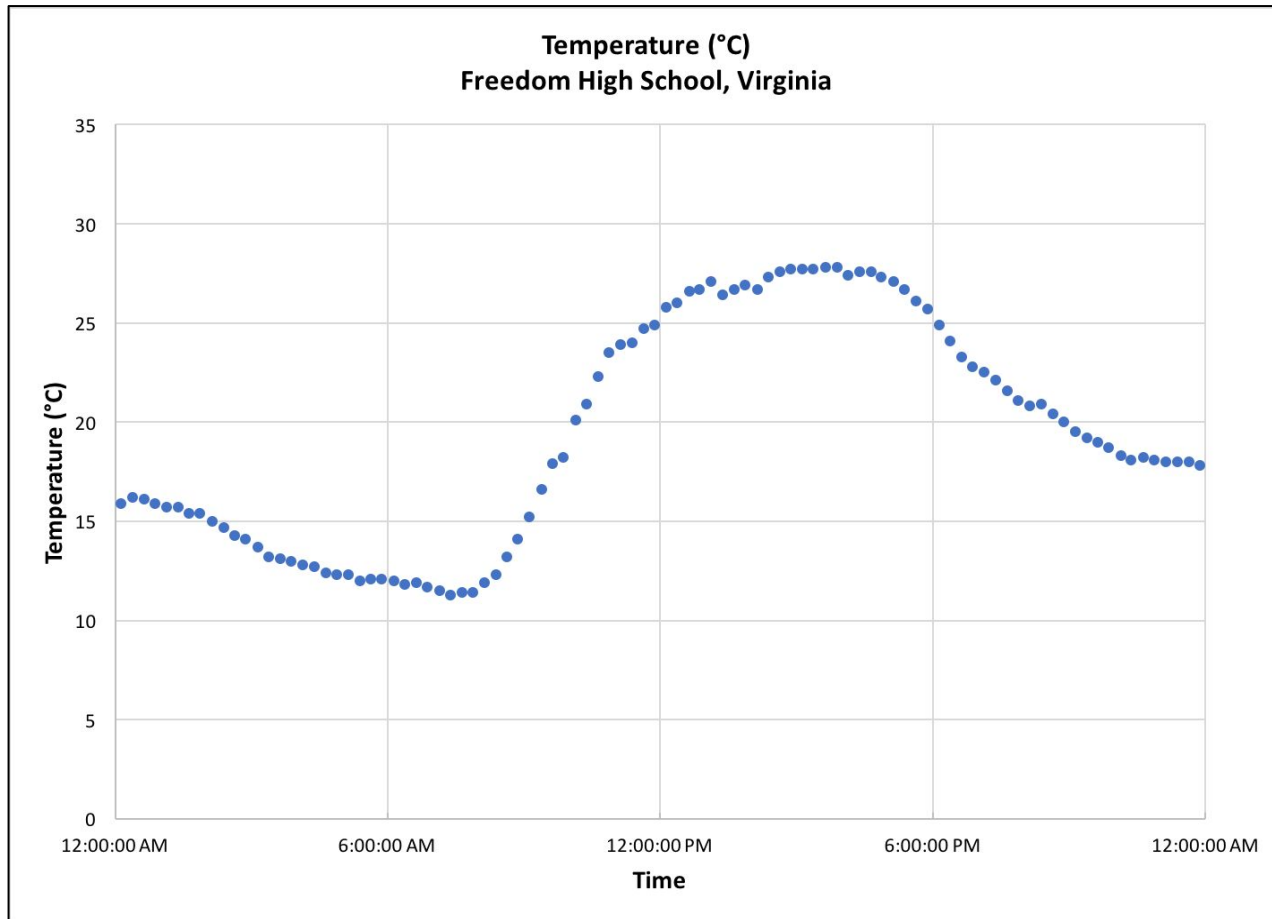## Step 1: Identify ("What I see" comments)

- Identify any changes, trends, or differences you see in the graph or figure.

- Draw arrows and write a "What I see" comment for each arrow.

- Be concise in your comments. These should be just what you can observe.

- Do not try to explain the meaning at this point.
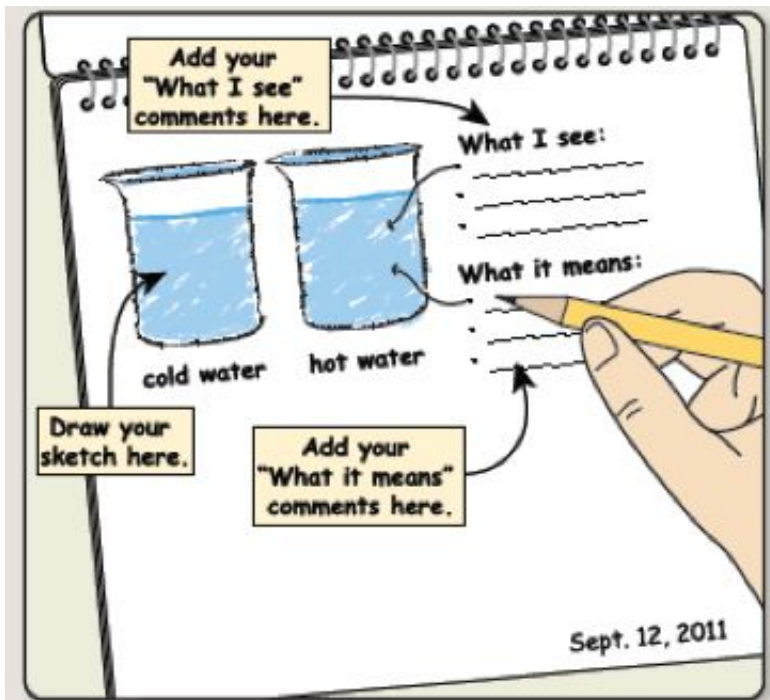
I² Sense-making strategy: Step 1

What do I see happening to temperature?

I² Sense-making Strategy Step 2 Interpret

Example
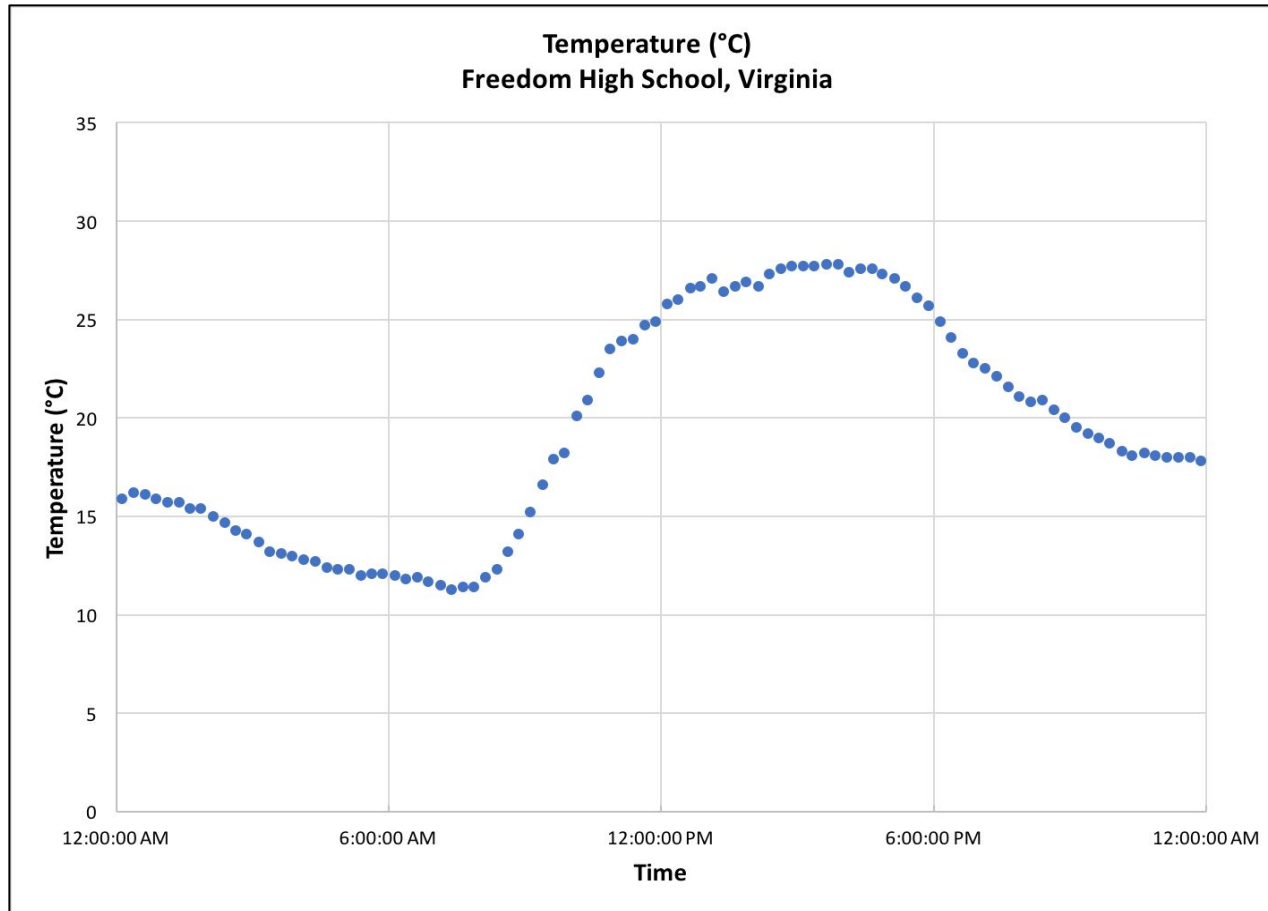

Step 2: Interpret ("What it means" comments)

■ Interpret the meaning of each "What I see" comment by writing a "What it means" comment.

■ Do not try to interpret the whole graph or figure.
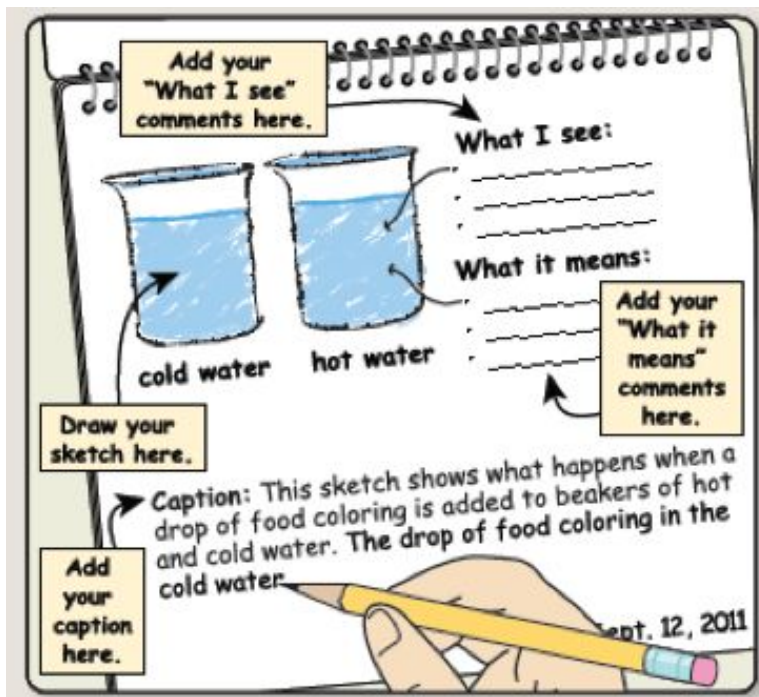
I² Sense-making strategy: Step 2

What It Means

Temperature (°C)
Freedom High School, Virginia

I² Sense-making strategy: Step 3 Caption

Example

Step 3: Caption

- Write a caption for the graph or figure.

- Start with a topic sentence that describes what the graph or figure shows.

- Then join each "What I see" comment with its "What it means" comment to make a sentence.

- Build a coherent paragraph out of your sentences.

I² Sense-making strategy: Step 3

Write a **Caption** using your **What I See** and **What it Means** statements.

Temperature (°C)
Freedom High School, Virginia
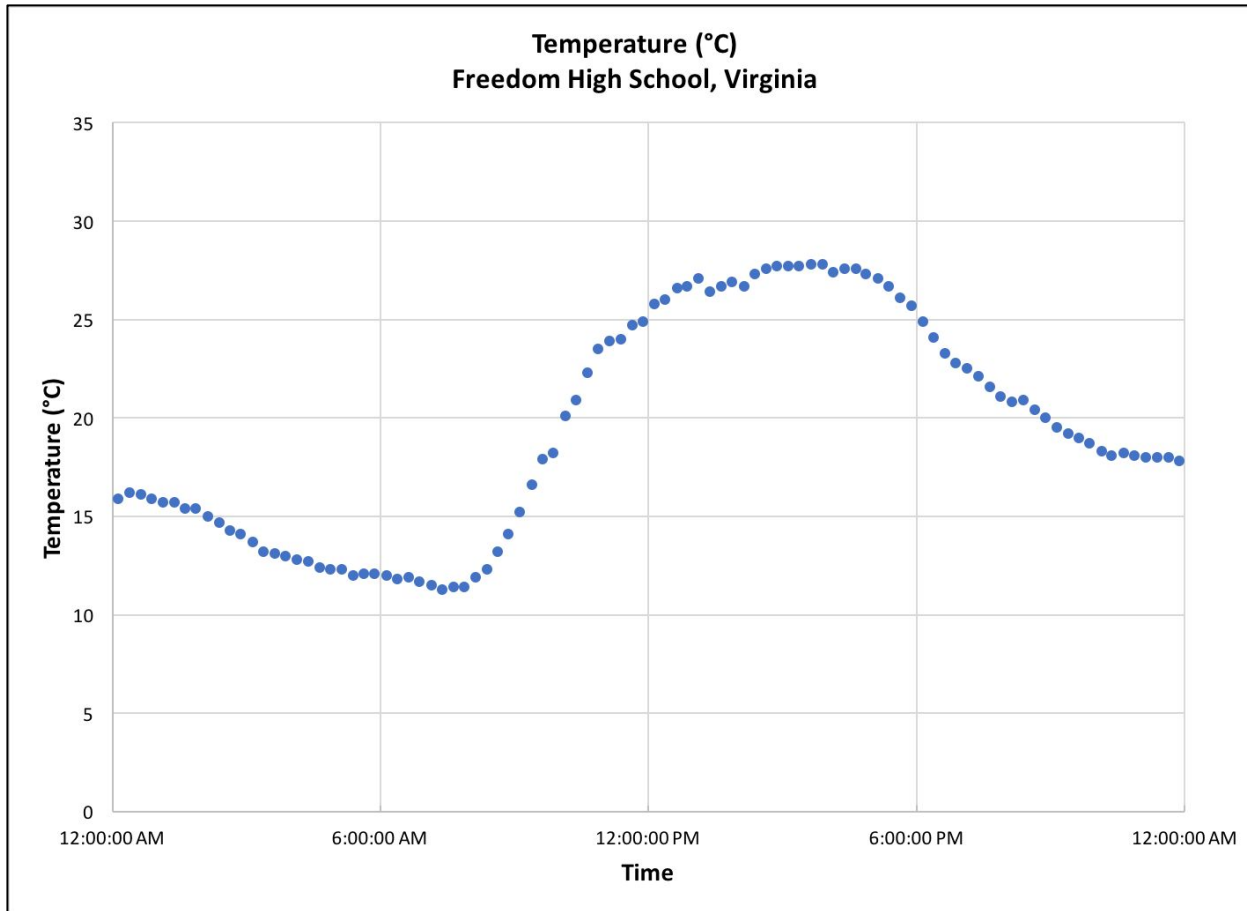
GLOBE Weather Task

In February 2017, the United States experienced a widespread winter storm. Students will analyze weather data from the storm as it traveled across the country, to determine which communities in the storm's path can expect heavy snow, light snow, ice, or no precip
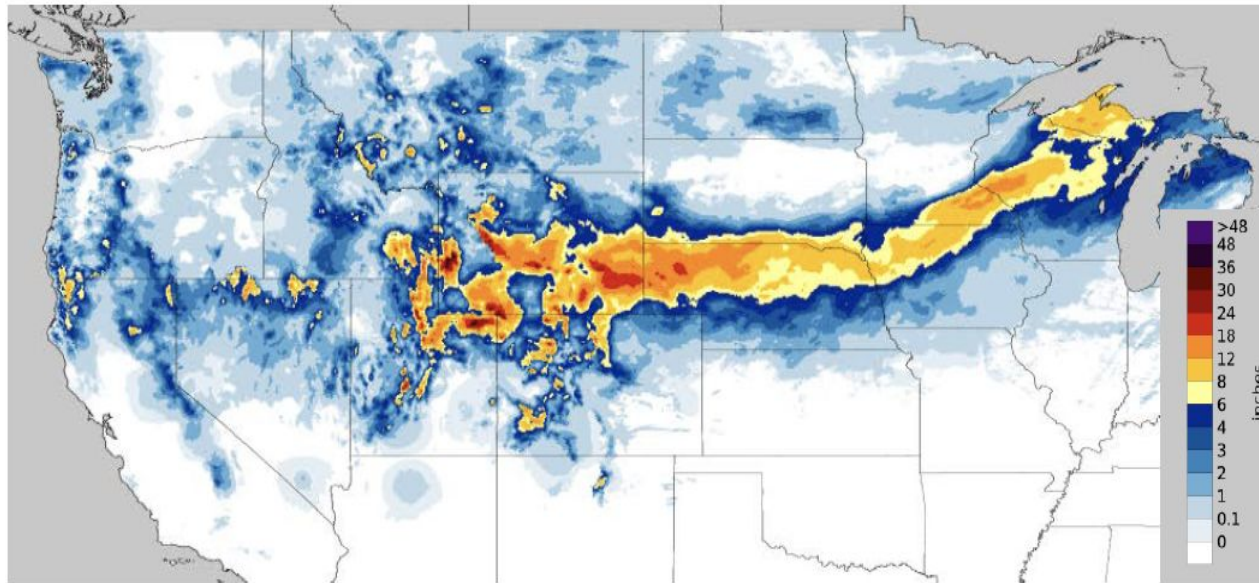
Credit: Image courtesy of NOAA/NWS

The GLOBE Program

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What's Next

Development Cycle:

1. Curriculum development
2. PD workshop for field testers
3. Field test curriculum
4. Review field test feedback
5. Revise curriculum
6. Repeat steps 2-4!
7. Disseminate

Cycle complete by early 2019

Discussion Questions

1. How would you, or the teachers you work with, incorporate GLOBE Weather into your curriculum?

2. In your experience, what other content areas could benefit from this phenomena-driven approach?

3. What successes have you had analyzing GLOBE data with your students?