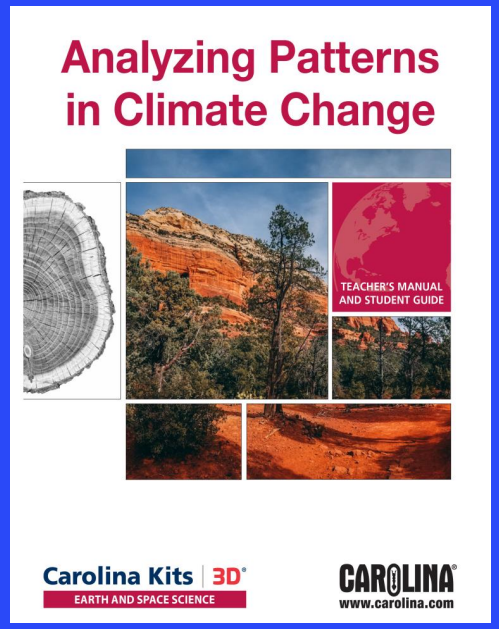
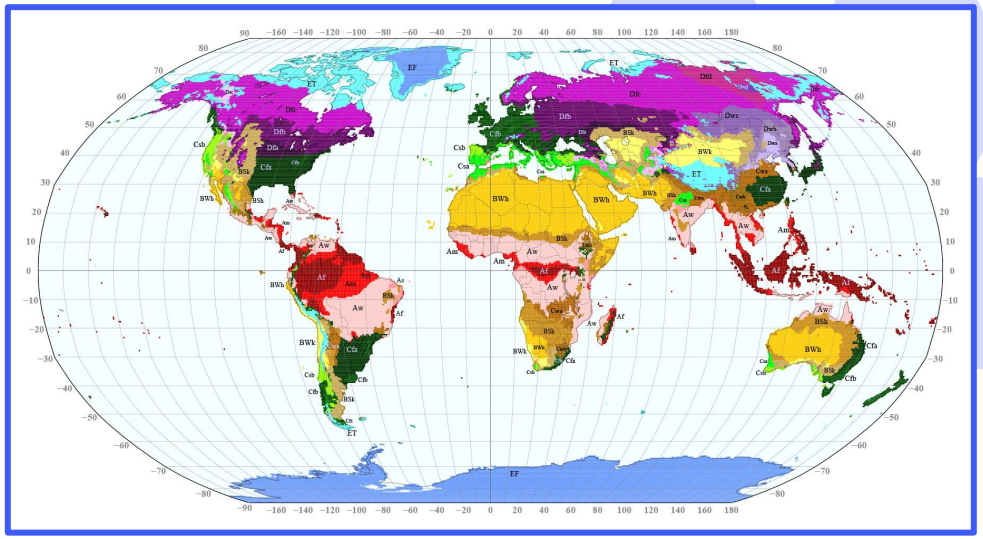


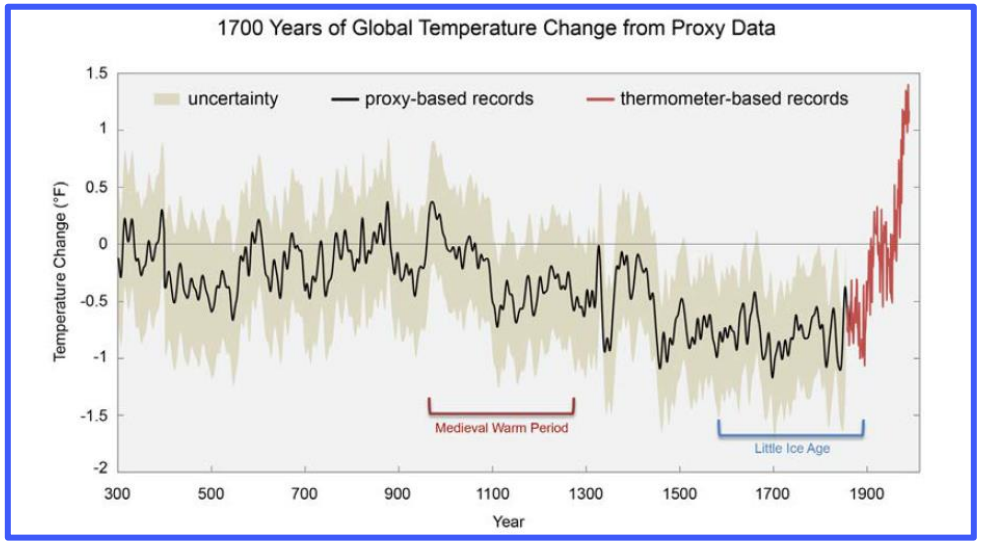
Using Models to Teach Climate and Climate Change

CAROLINA
UNLEASH LEARNING

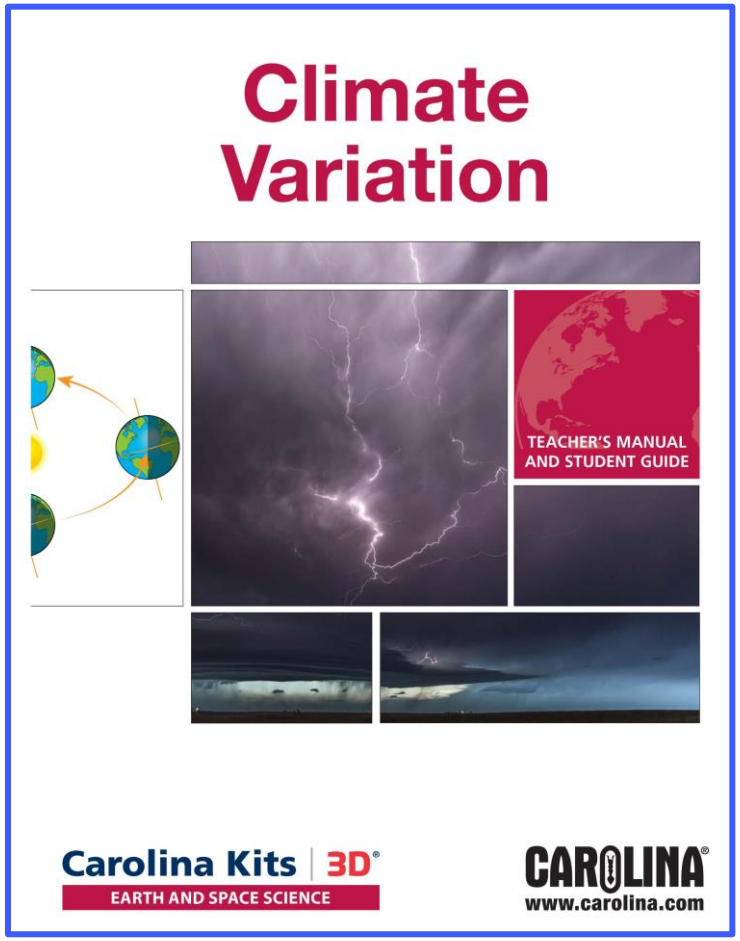
Workshop Overview

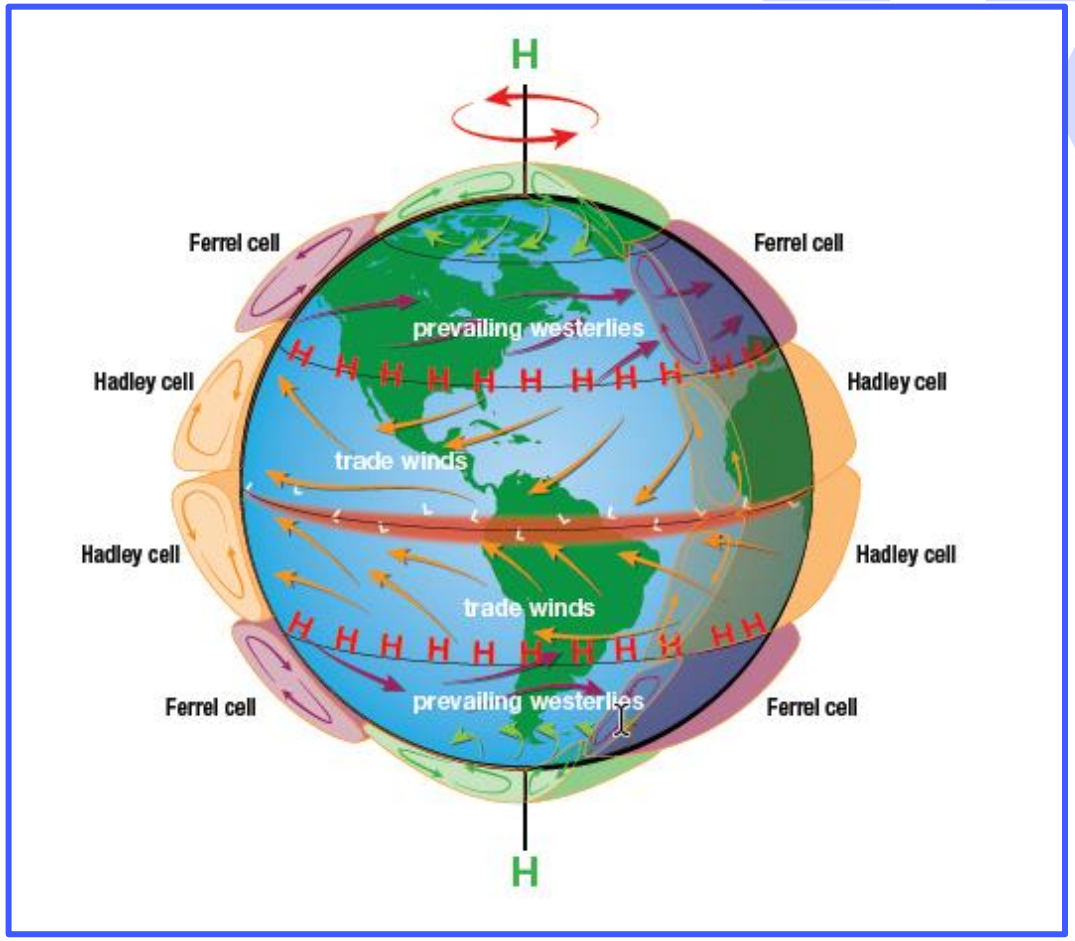
- Part 1: Climate Variation
  - Activity 1: Convection Currents
  - Activity 2: Coriolis Effect
- Part 2: Analyzing Patterns in Climate Change
  - Activity 3: Patterns in Tree Growth





Part 1: Climate Variation





Climate Variation Standards

Related Performance Expectations

The activities in this kit build toward the following Performance Expectations of the Next Generation Science Standards*:

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

Three-Dimensional Learning

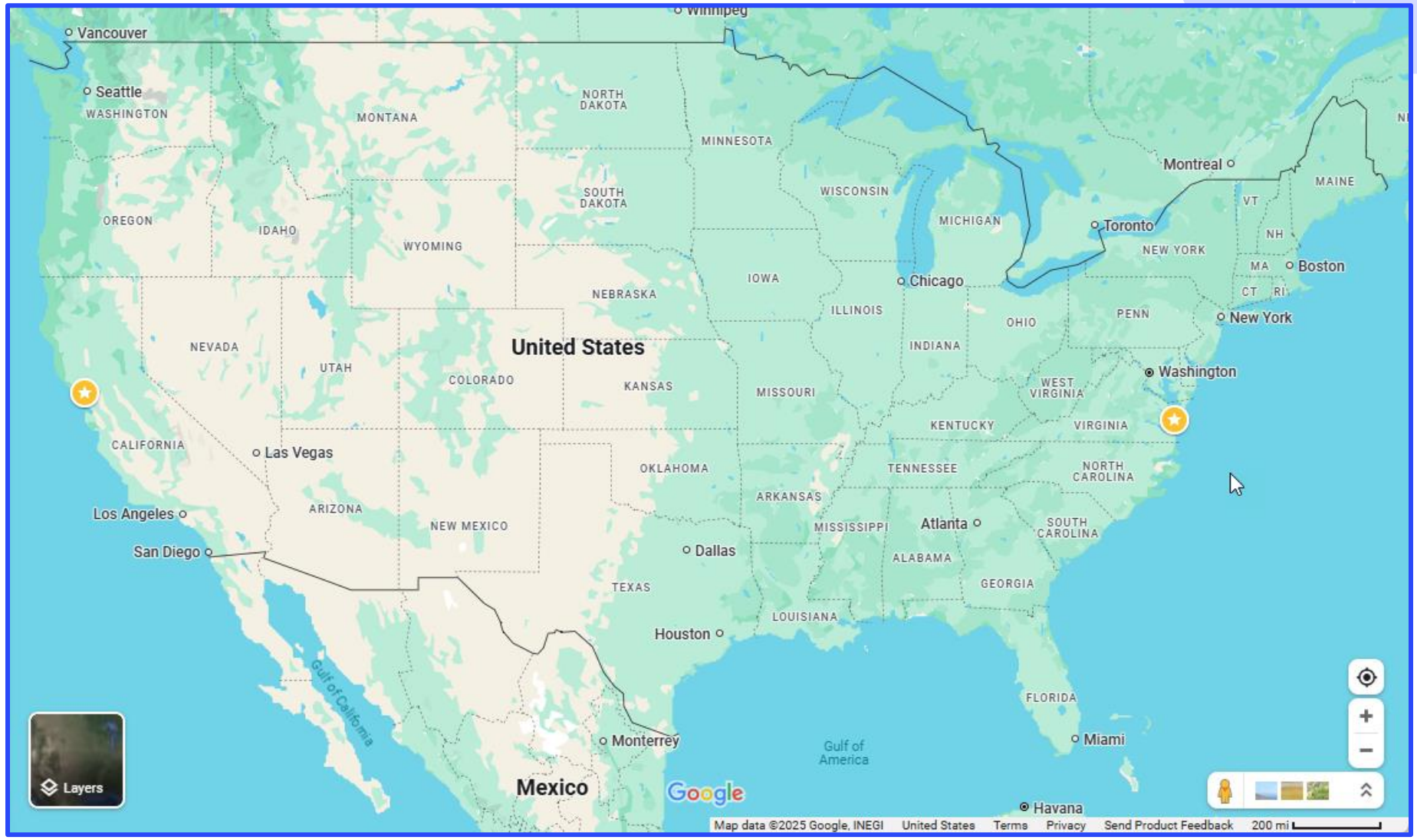
The activities in this kit address the following dimensions of the Next Generation Science Standards.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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.	**ESS2.D: Weather and Climate** • The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Climate Variation Sequence

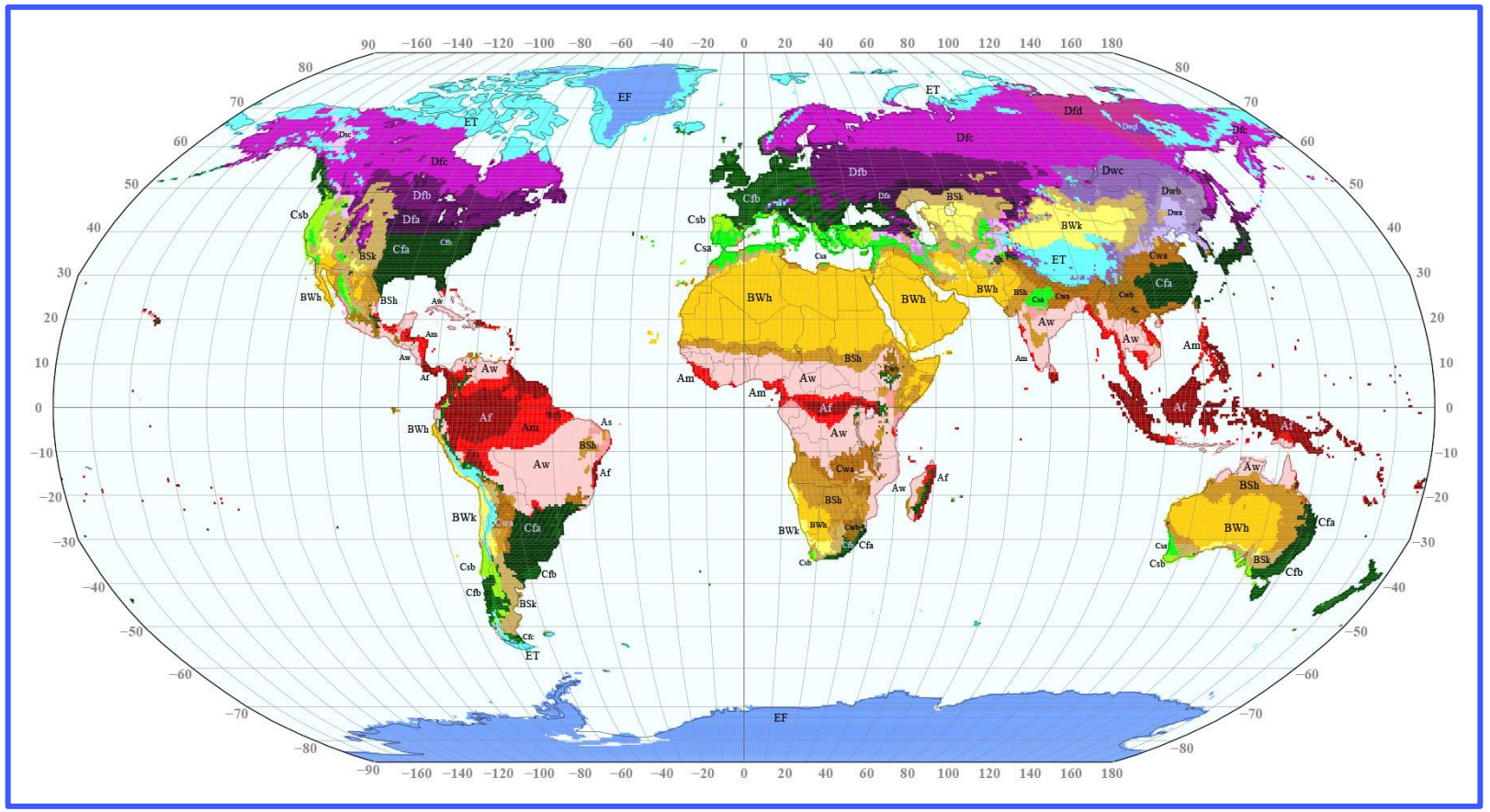
- Introduction: Phenomenon and Background Information
- Investigation 1: Earth’s Tilt
- Investigation 2: Surface: Land, Water, and Ice
- Investigation 3: Convection Currents
- Investigation 4: Earth’s Rotation (Coriolis Effect)
- Conclusion: Assessment Questions
- Final Performance: Claim – Evidence - Reasoning

Phenomenon



Driving Question

Why does Earth have such climate diversity?



Climate Variation : Convection Currents

Model convection currents using convection fluid (rheoscopic)

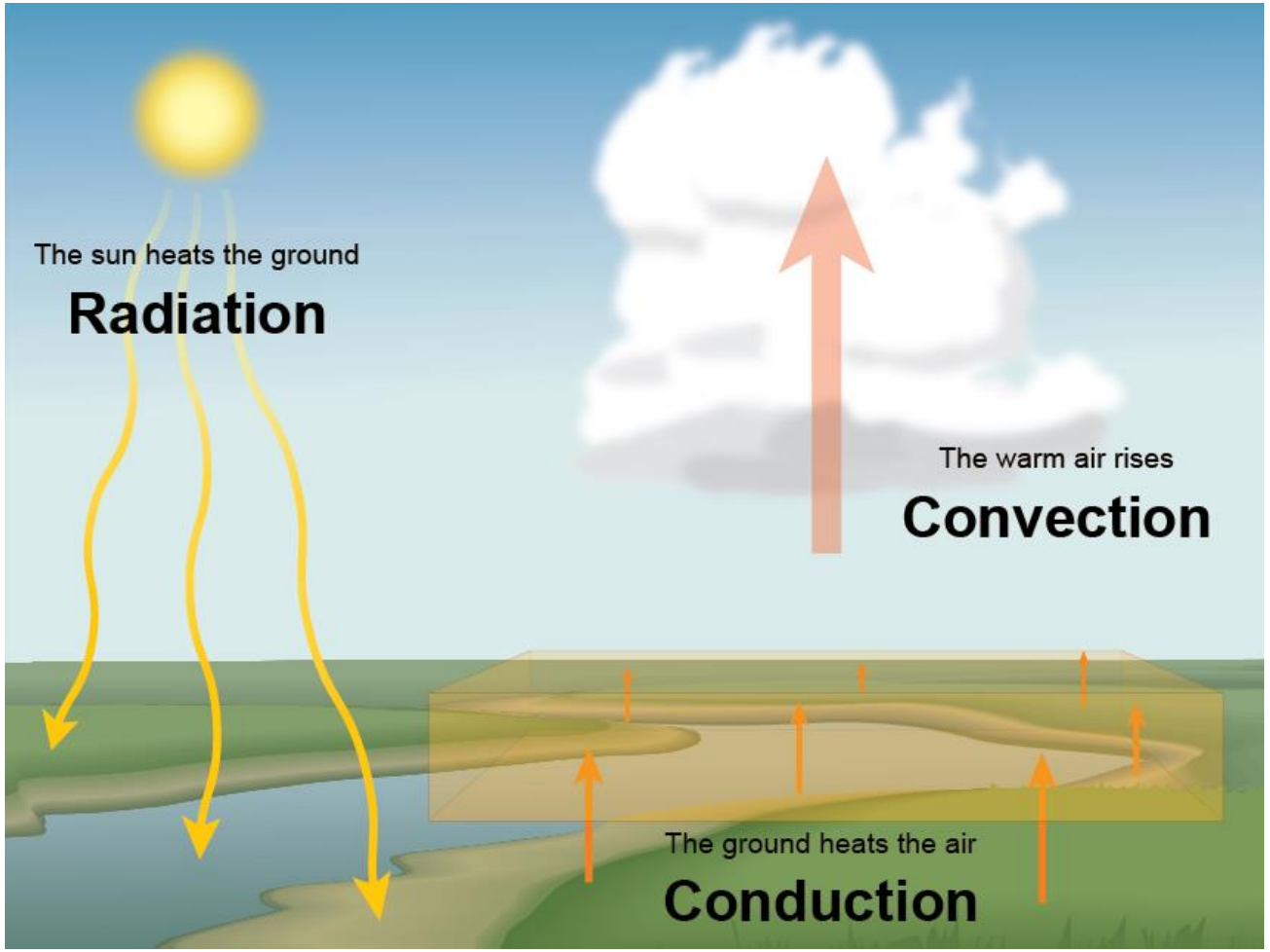
What happens to the fluid when exposed to heat?

What happens to the fluid when exposed to cold?

How does this relate to weather and climate?

How does this relate to other Earth Science topics?

Climate Variation : Convection Currents



Climate Variation : Coriolis Effect

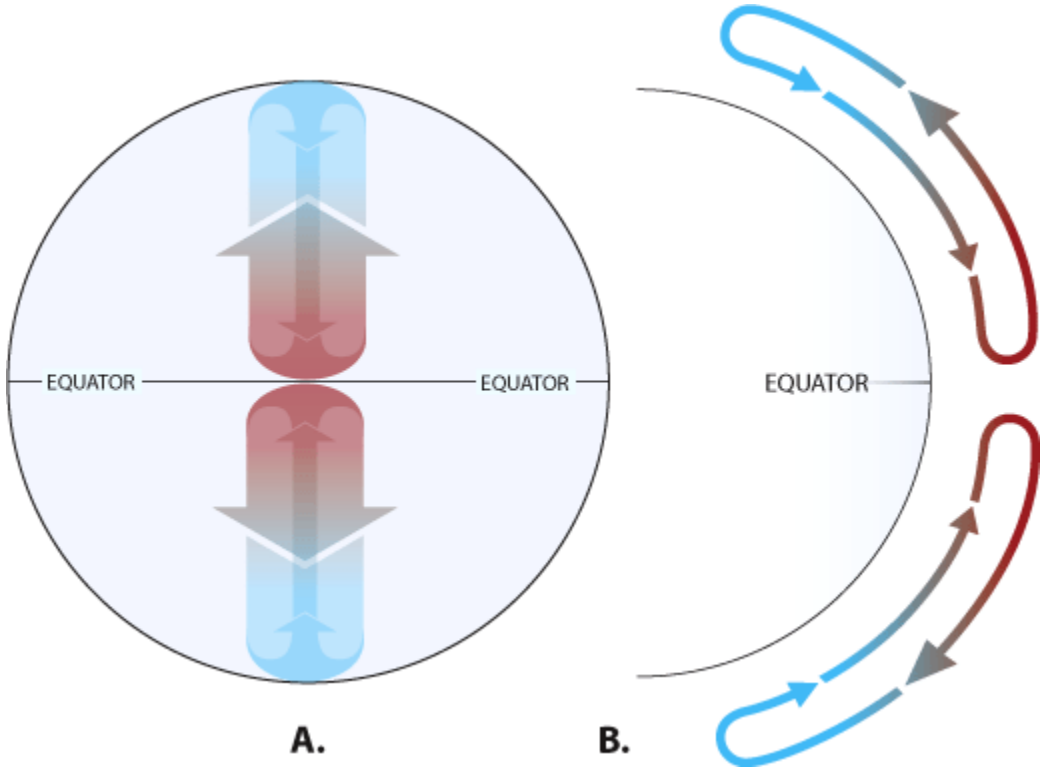
Model the Coriolis Effect using a turn table.

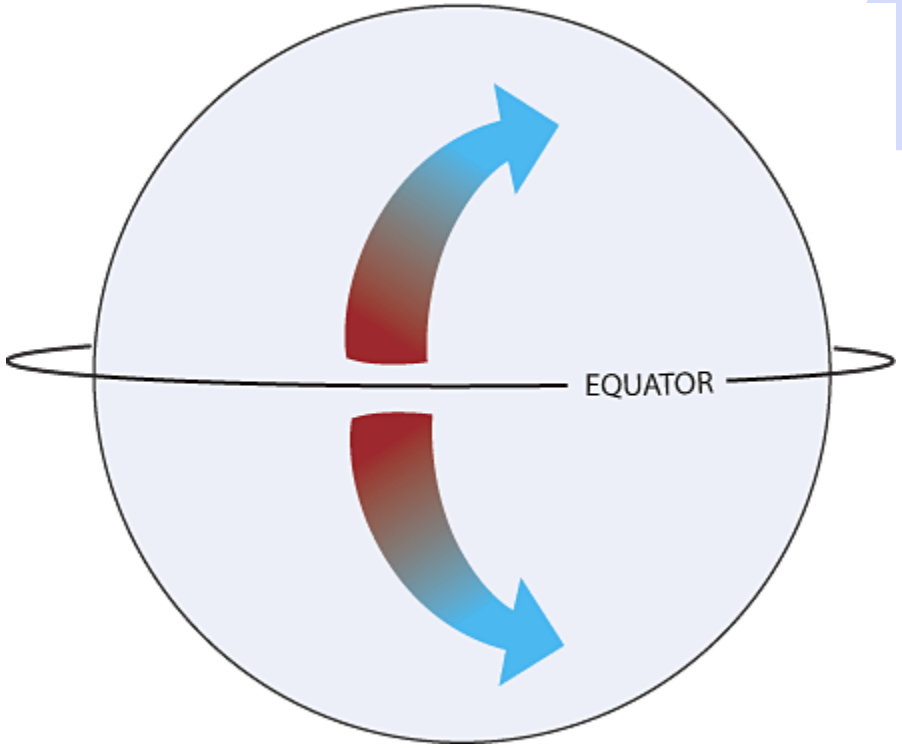
What happens to the line when you spin the table clockwise?

What happens to the line when you spin the table counterclockwise?

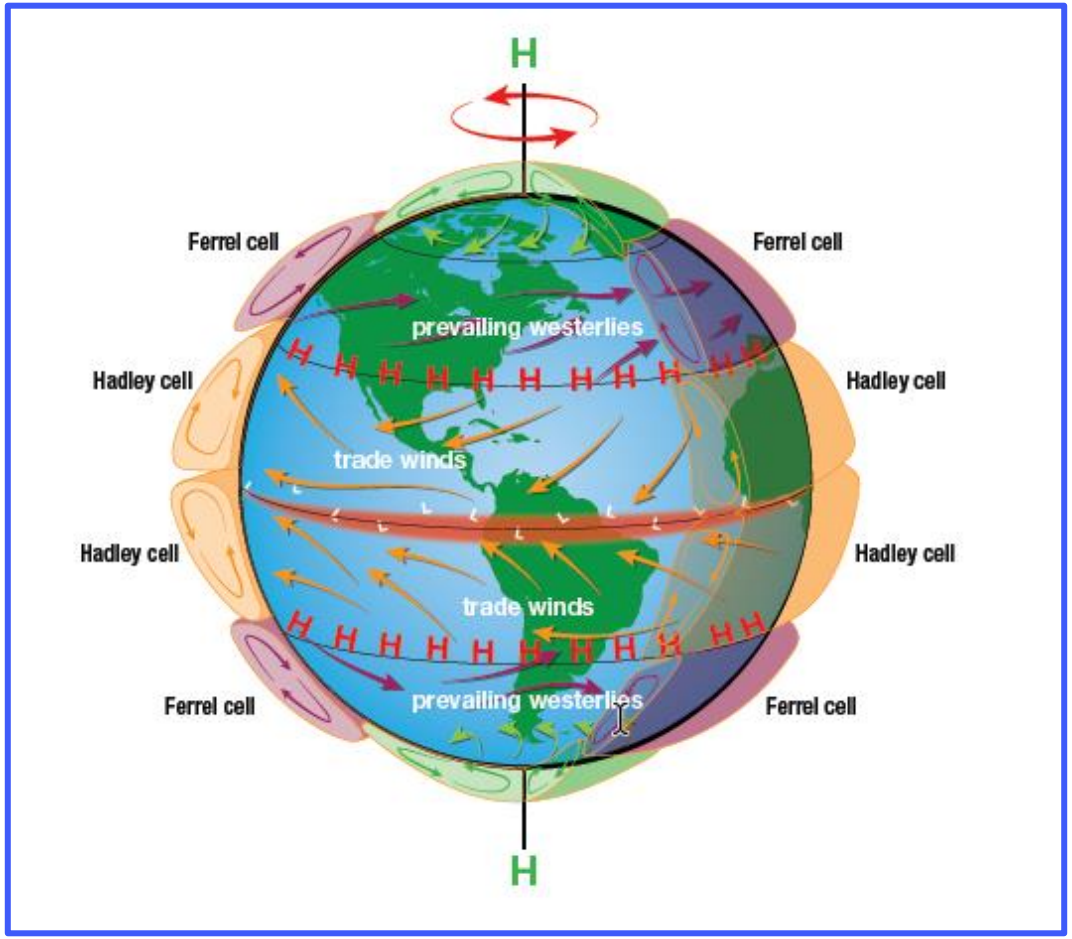
How does this relate to weather and climate?

Climate Variation : Coriolis Effect

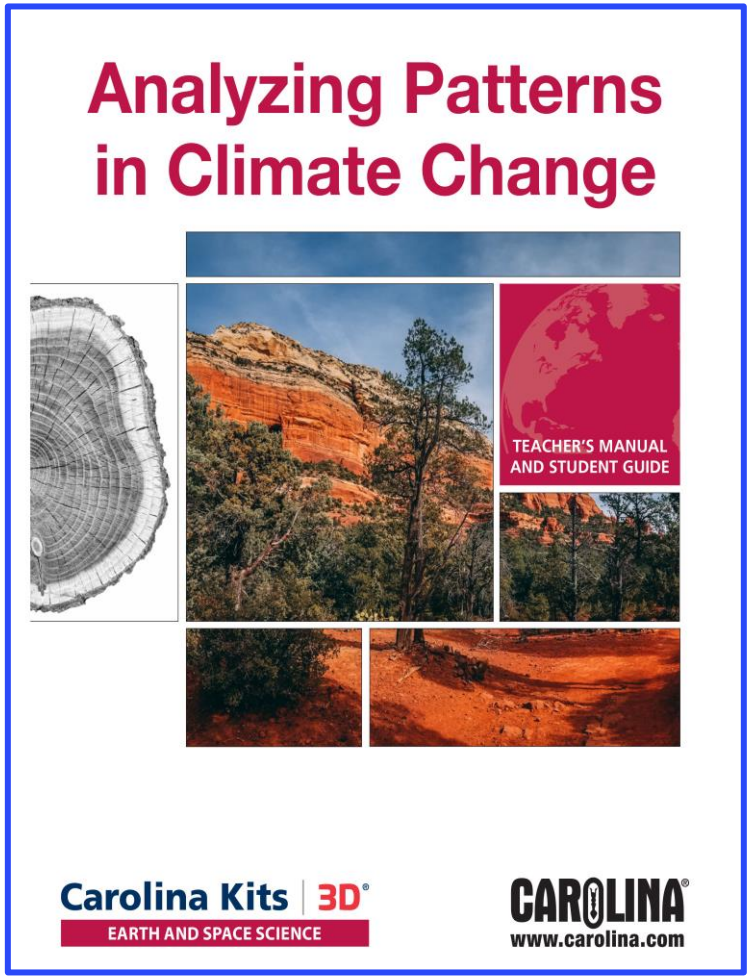


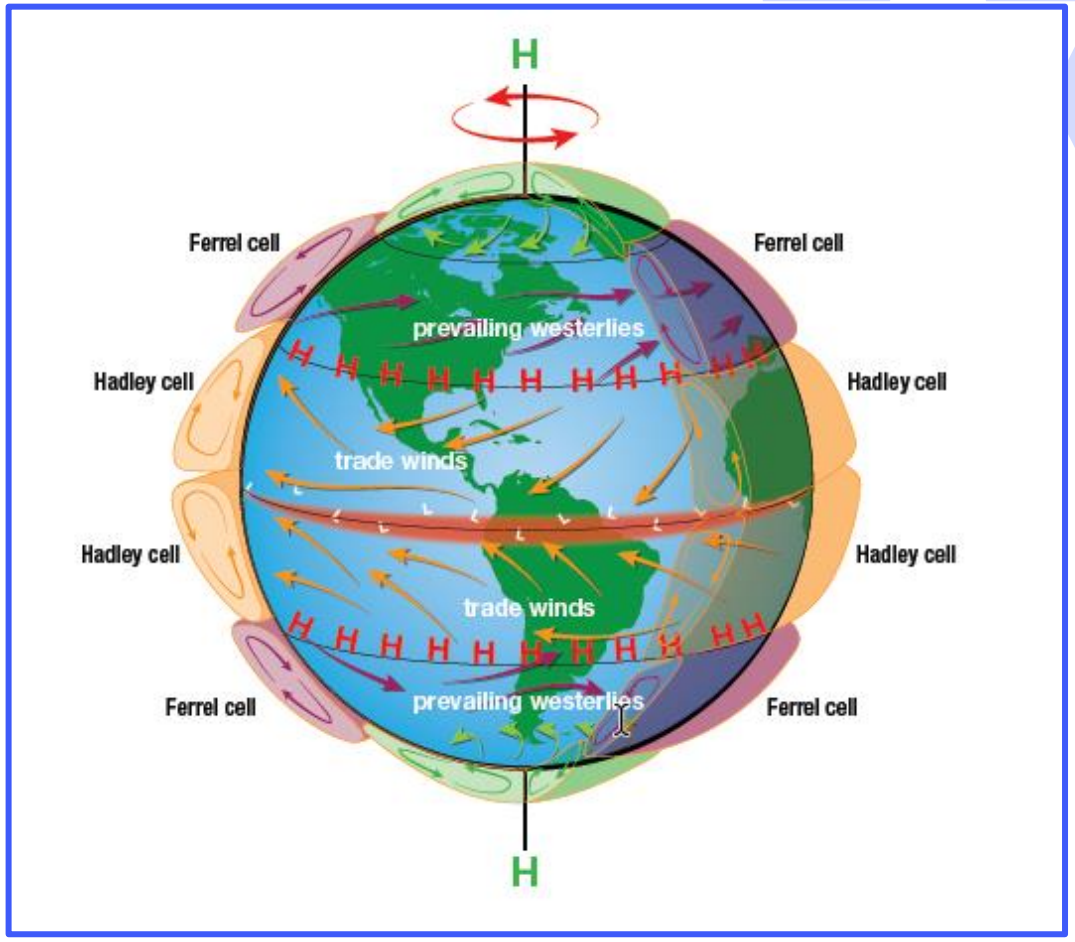


Climate Variation : Putting it Together



Part 2: Analyzing Patterns in Climate Change





Analyzing Patterns in Climate Change Standards

Related Performance Expectations

The activities in this kit build toward the following Performance Expectations of the Next Generation Science Standards*:

HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Three-Dimensional Learning

The activities in this kit address the following dimensions of the Next Generation Science Standards.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.	**ESS3.D: Global Climate Change** • Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Scale, Proportion, and Quantity** • Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly.

Analyzing Patterns in Climate Change Sequence

- Introduction: Phenomenon and Background Information
- Investigation 1: Earth’s Tilt
- Investigation 2: Surface: Land, Water, and Ice
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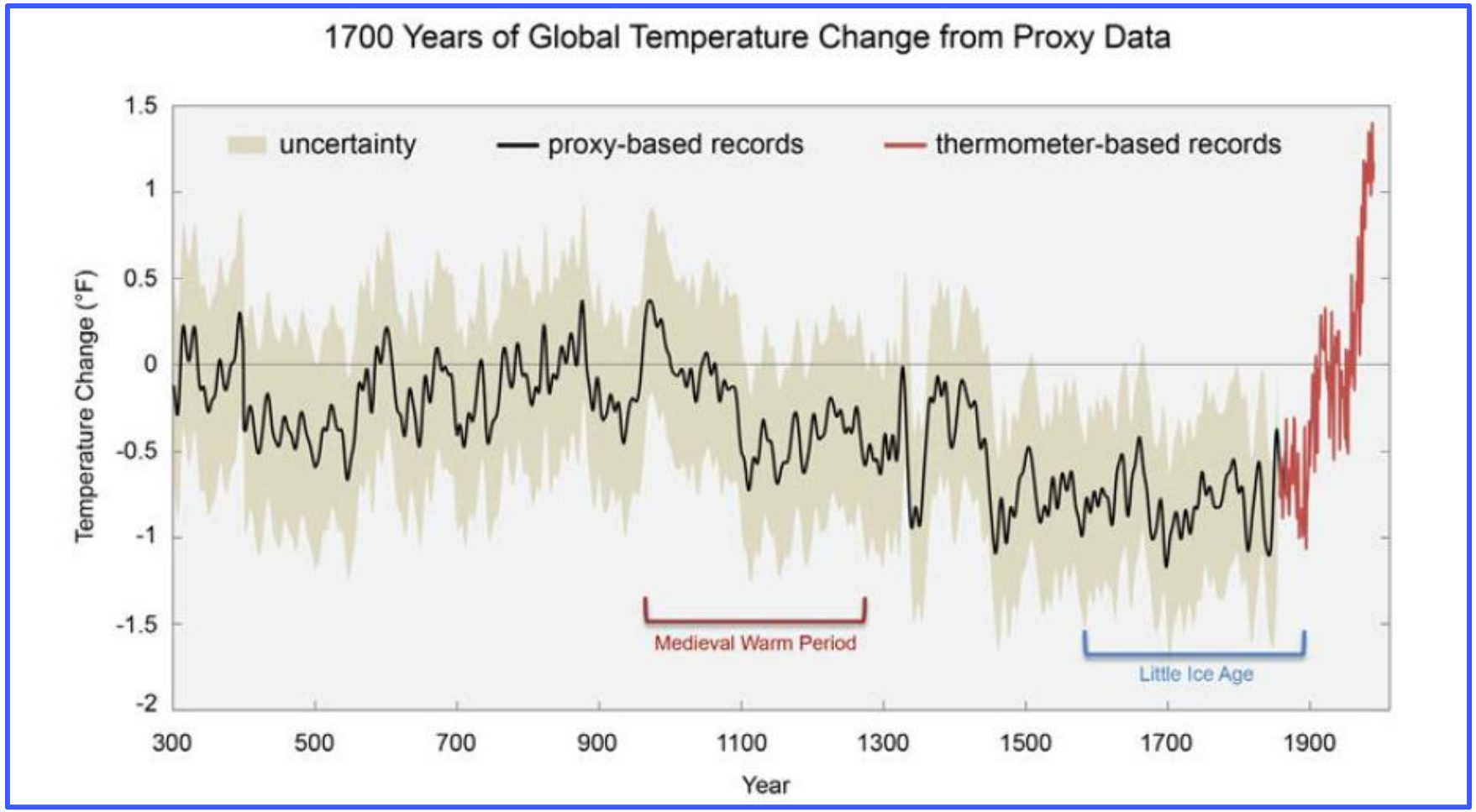
- Investigation 4: Earth’s Rotation (Coriolis Effect)
- Conclusion: Assessment Questions
- Final Performance: Claim – Evidence - Reasoning

Phenomenon



Driving Question

What characteristics of a natural phenomenon make it a suitable proxy for climate?

What does that term mean? Proxy?

What are some proxies that you know about?

Analyzing Patterns in Climate Change : Patterns in Tree Growth and Structure

1. Examine your tree cross section (tree cookie). Look at it both with and without the hand lens.

2. Use the ruler, paper, and pencil to make a 1:1 scale drawing of 1-cm wide by 5-cm section of your tree cookie.

Analyzing Patterns in Climate Change : Patterns in Tree Growth and Structure

Discuss the following with your table, then we'll talk about it together.

1. What patterns did you observe?

2. What do you think can explain the patterns that you observed?

3. How do you think you these patterns might be used as a proxy for climate data?

4. Do you think these patterns will be a good proxy for climate data? Why or Why not?

Analyzing Patterns in Climate Change : Patterns in Tree Growth and Structure

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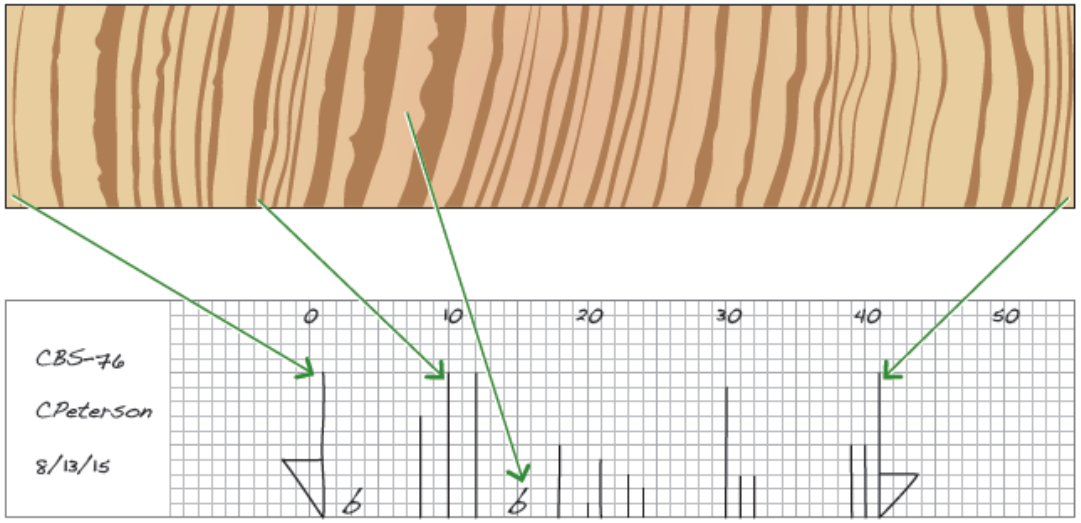
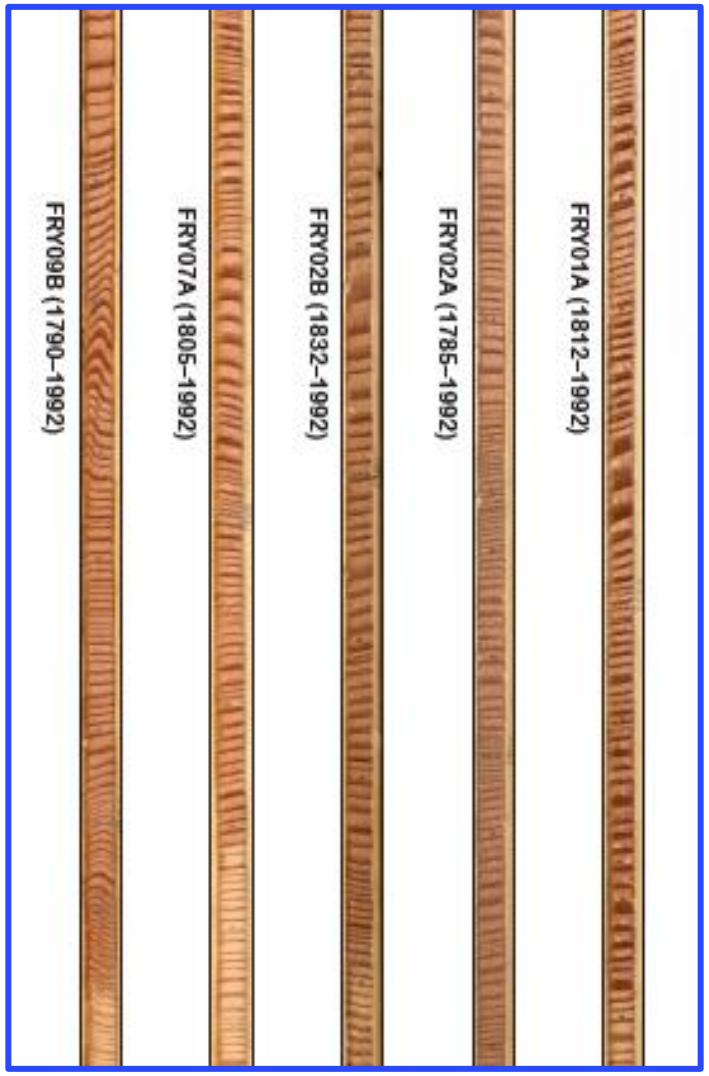
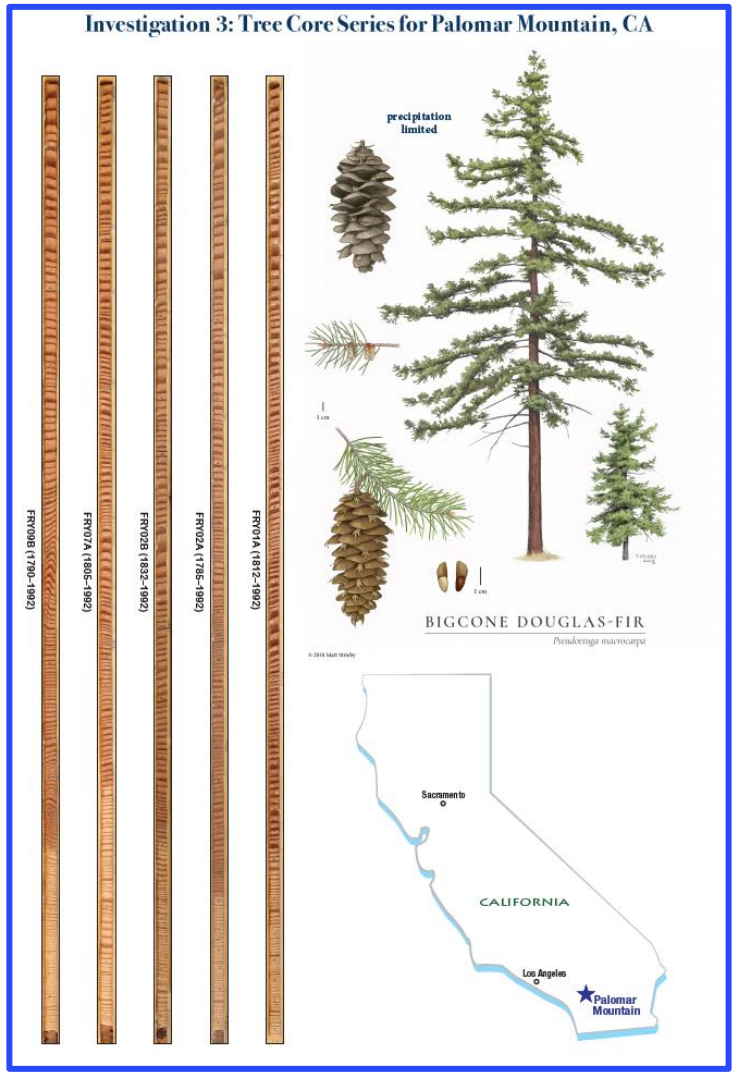


Skeleton Plot

Analyzing Patterns in Climate Change : Putting it Together





Analyzing Patterns in Climate Change : Going Further

1. Coral Cores
2. Speleothem Cores
3. Ice Cores
4. Pack Rat Middens
5. Historical Documents
6. Lake and Ocean Sediments