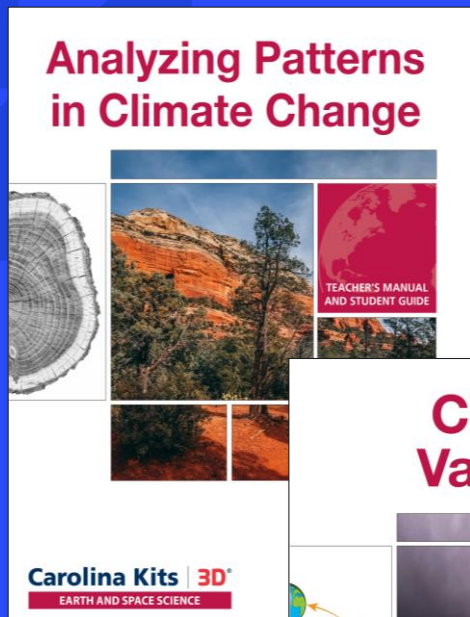
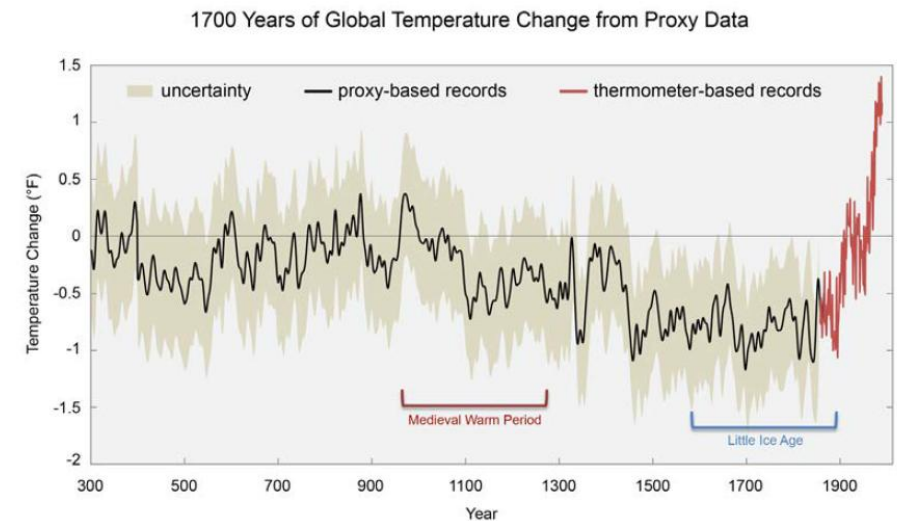
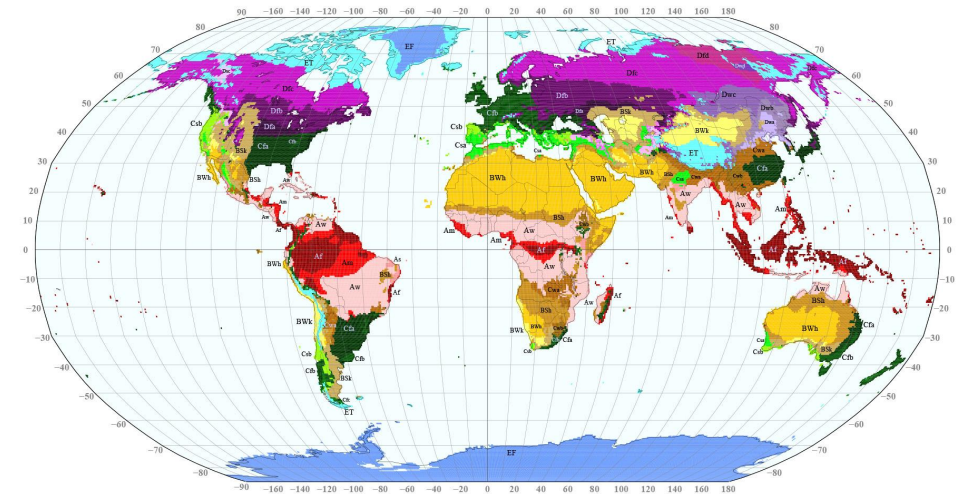




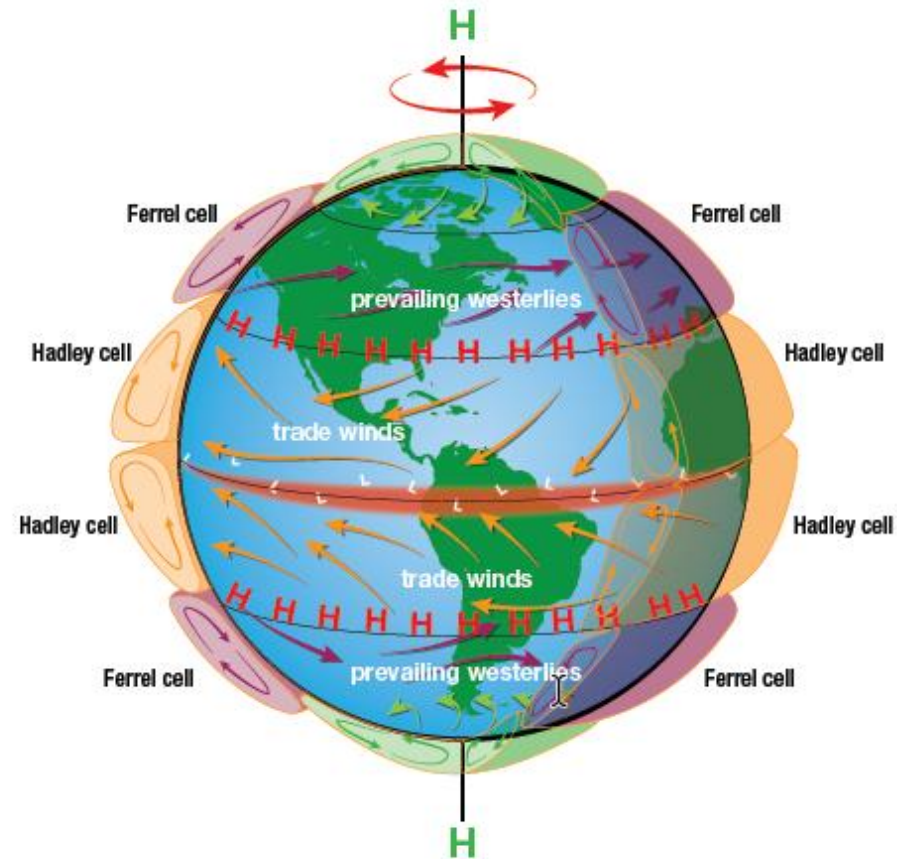
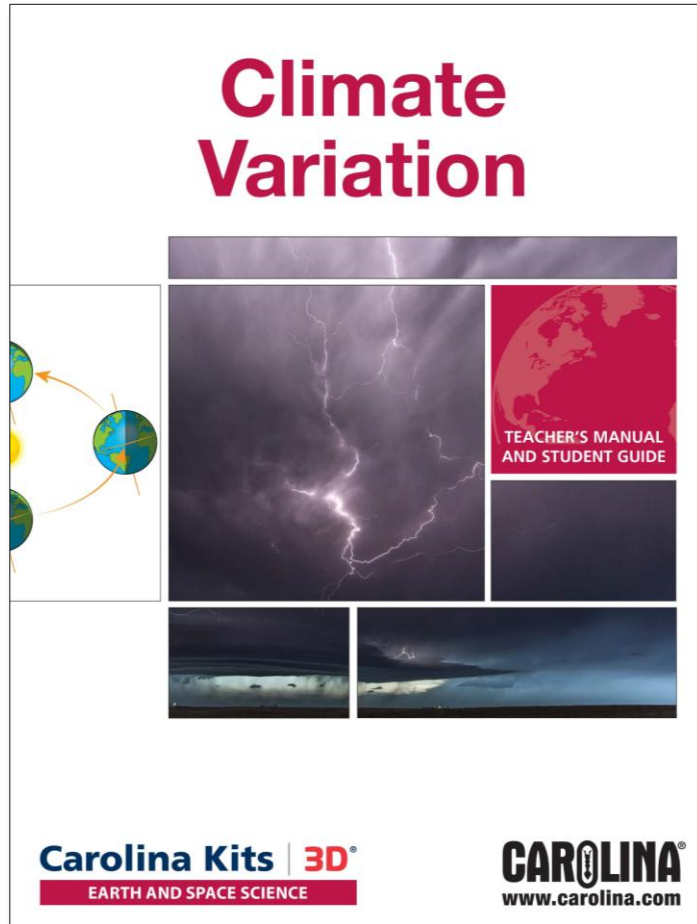
Using Models to Teach Climate and Climate Change

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



Building Toward TEKS Science Concepts

Climate Variation

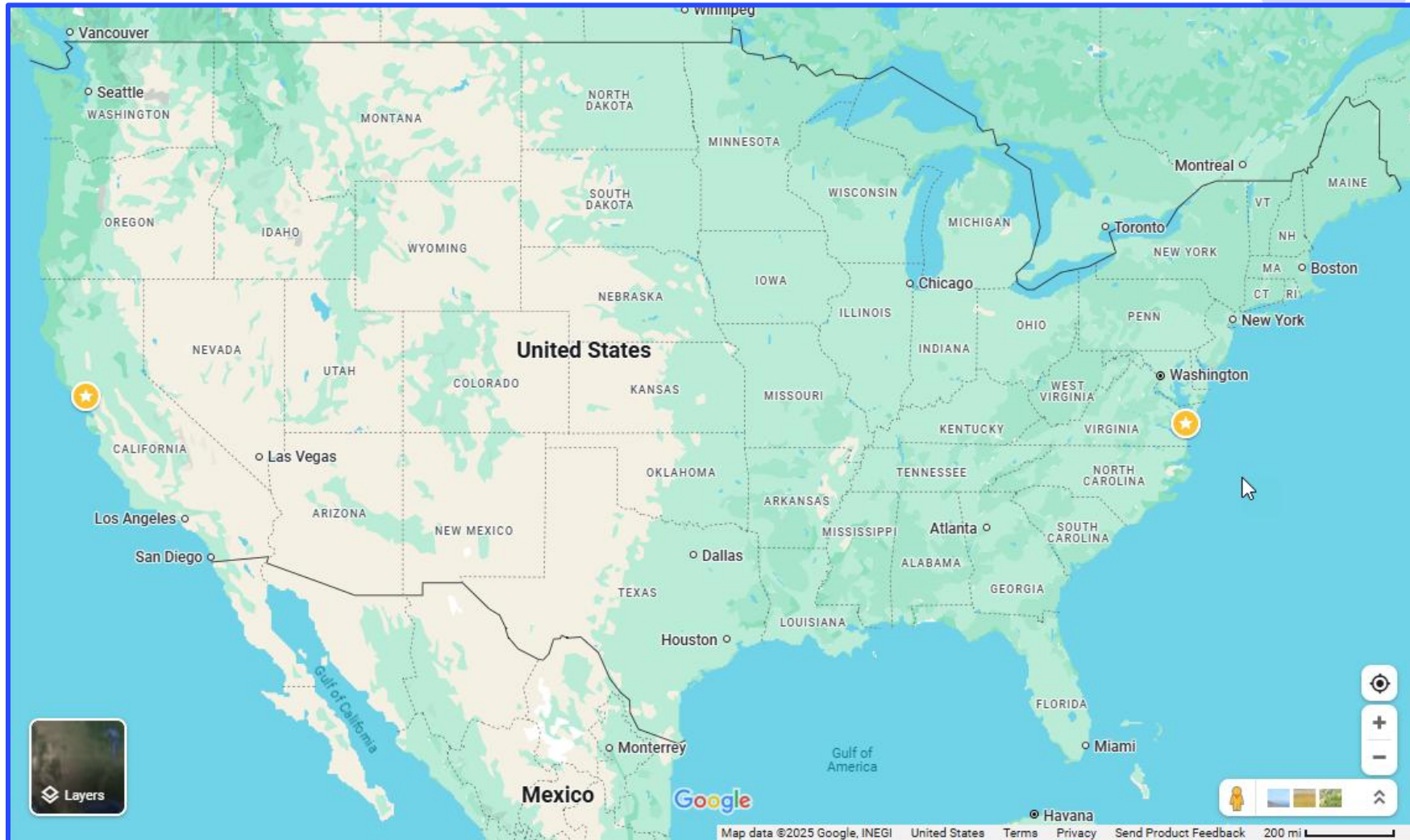
The activities in this kit align with the following TEKS science standards:

- **ESS.11.D:** Evaluate how the combination of multiple feedback loops alter global climate.
- **ESS.11.A:** Analyze how energy transfer through Milankovitch cycles, albedo, and differences in atmospheric and surface absorption are mechanisms of climate.
- **ESS.11.F:** Explain how the transfer of thermal energy among the hydrosphere, lithosphere, and atmosphere influences weather.

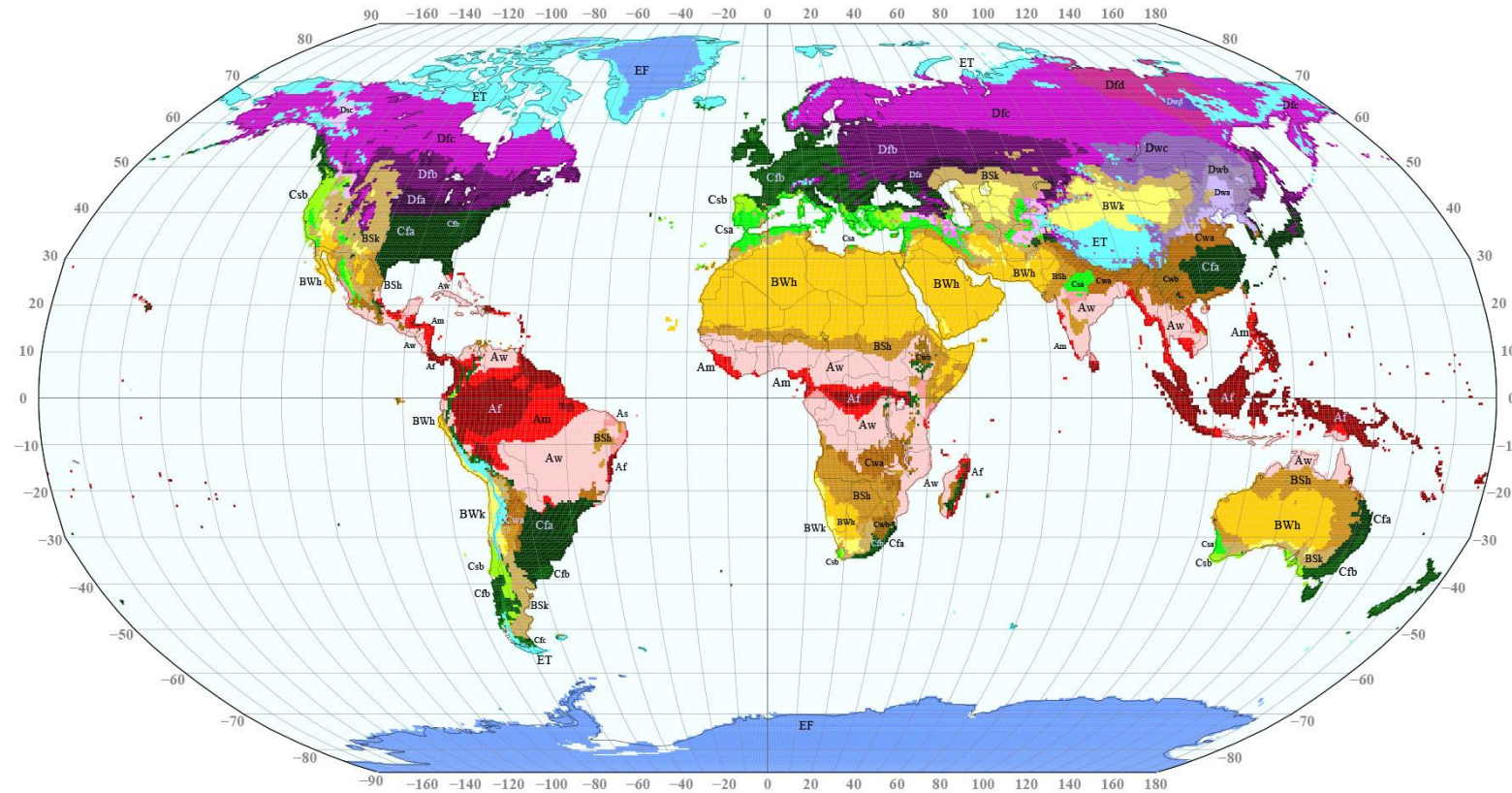
Climate Variation Sequence

- 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



Why does Earth have such climate diversity?

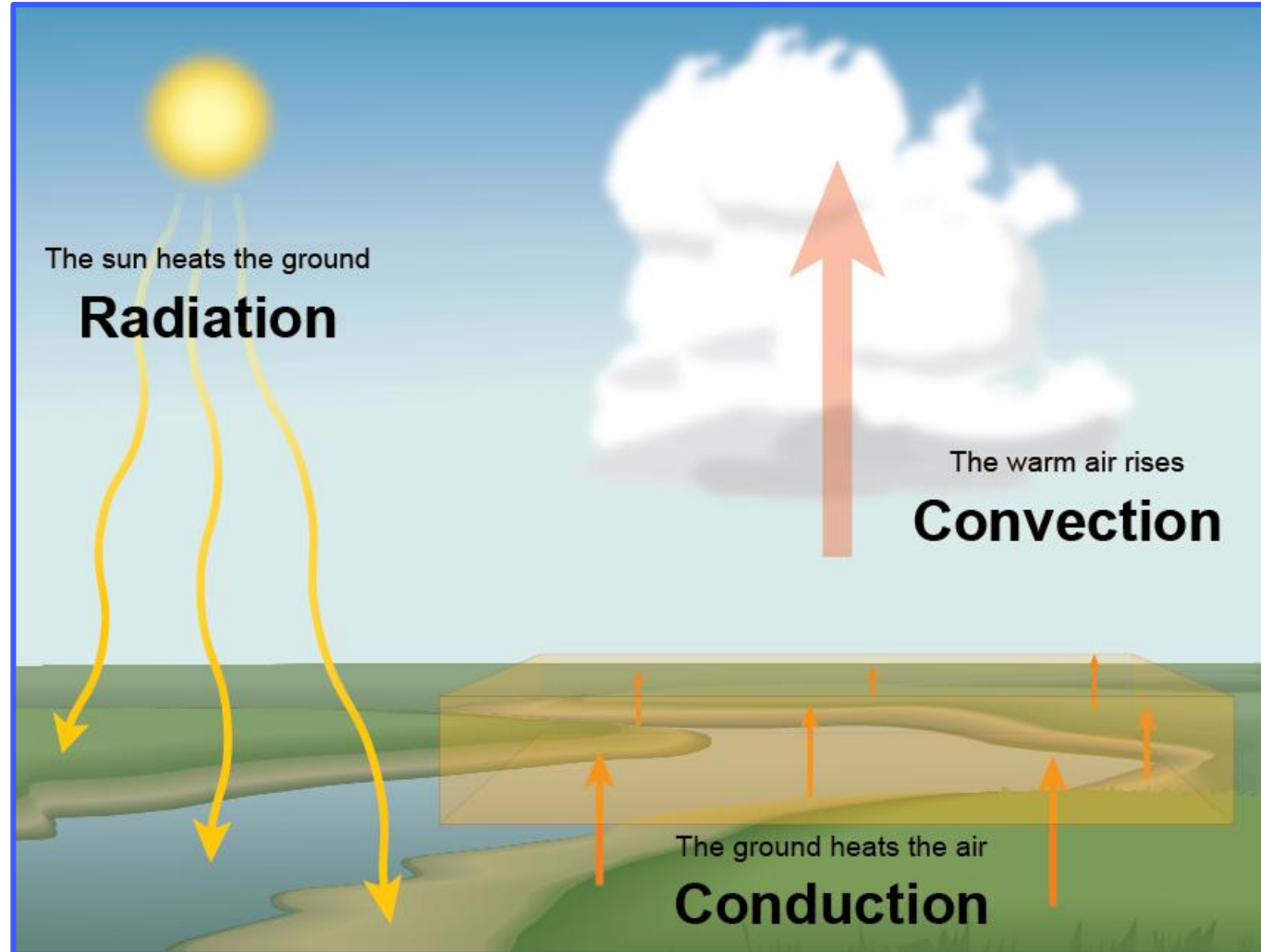


Climate Variation: Convection Currents

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



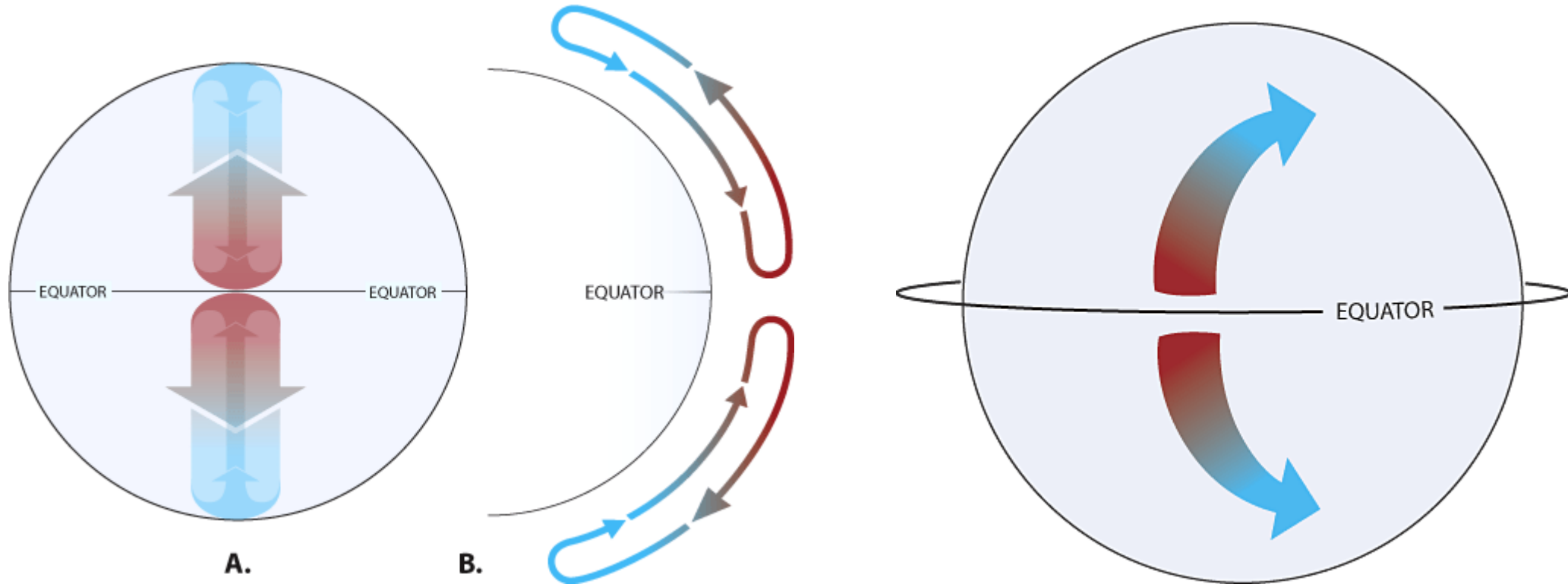
Courtesy of National Oceanic and Atmospheric Administration. "The Transfer of Heat Energy." Last modified January 2, 2024.
<https://www.noaa.gov/jetstream/atmosphere/transfer-of-heat-energy>.

Climate Variation: Coriolis Effect

Model the Coriolis Effect using a turntable.

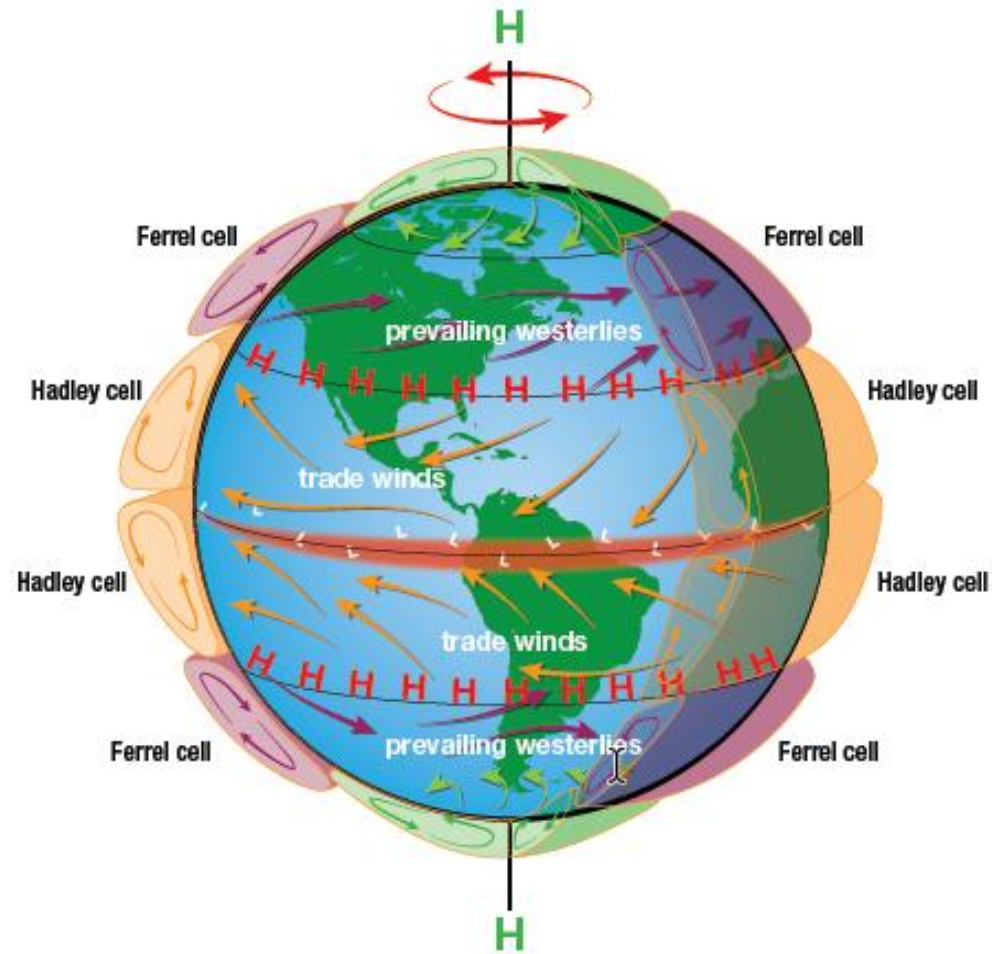
- What happens to the line when you spin the table clockwise?
- What happens to the line when you spin the table counterclockwise?
- How does this relate to weather and climate?

Climate Variation: Coriolis Effect

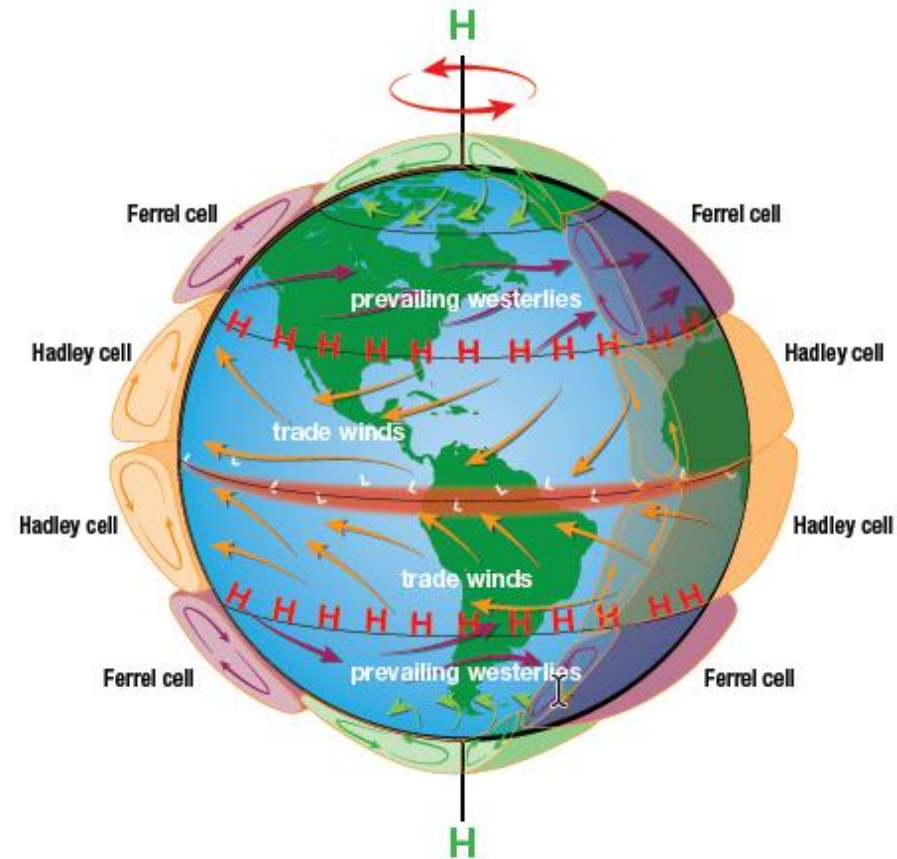
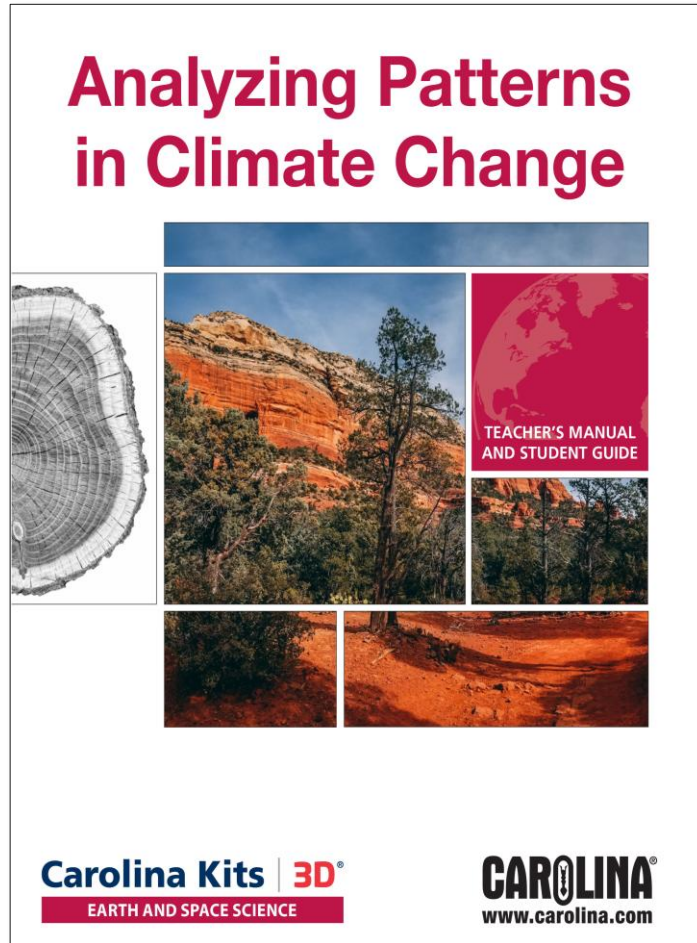


Courtesy of National Ocean Service, National Oceanic and Atmospheric Administration. "The Coriolis Effect."
https://oceanservice.noaa.gov/education/tutorial_currents/media/supp_cur04a.html.

Climate Variation: Putting It Together



Part 2: Analyzing Patterns in Climate Change



Building Toward TEKS Science Concepts

Analyzing Patterns in Climate Change

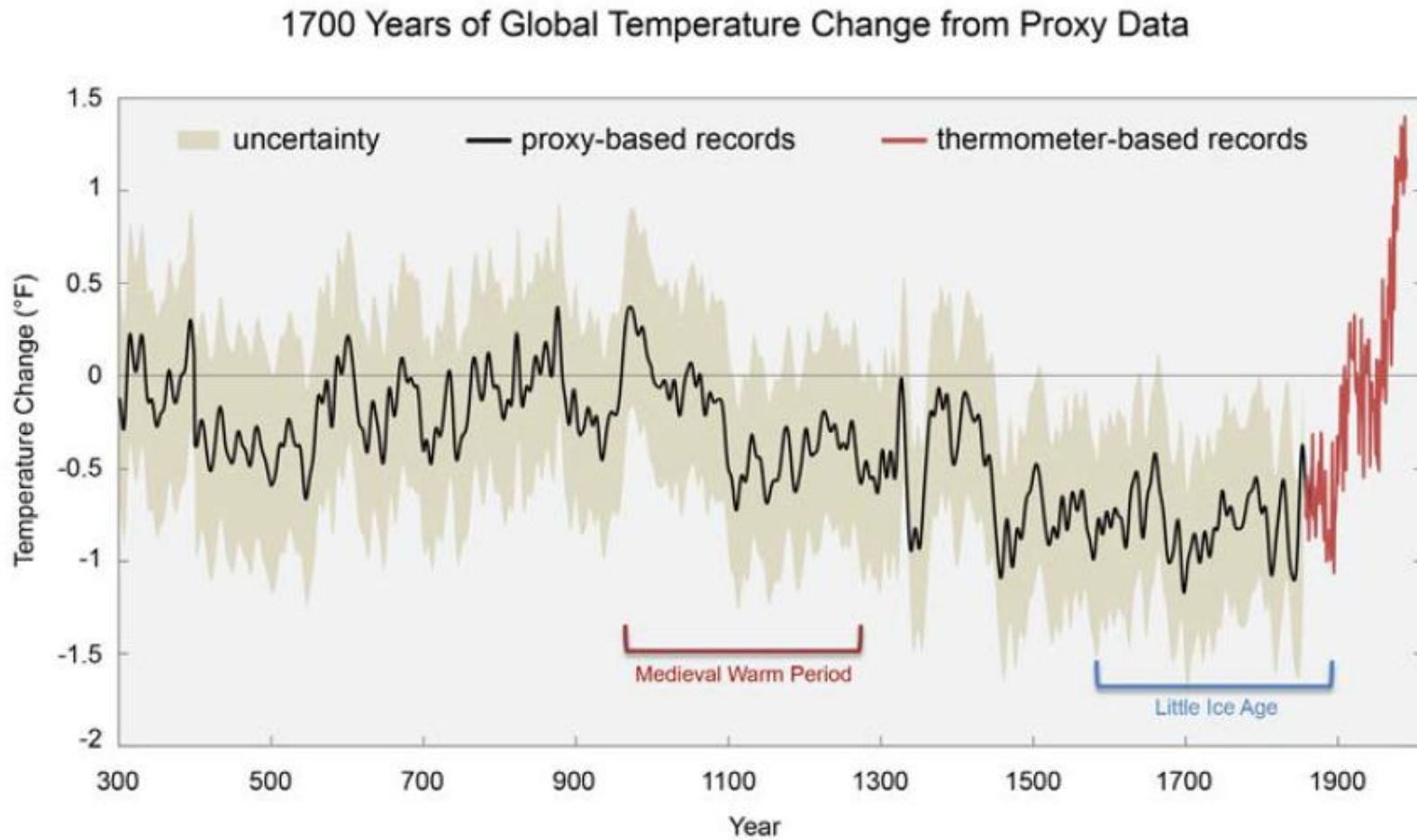
The activities in this kit align with the following TEKS science standard:

- **ESS.11.E:** Investigate and analyze evidence for climate changes over Earth's history using paleoclimate data, historical records, and measured greenhouse gas levels.

Analyzing Patterns in Climate Change Sequence

- Introduction: Phenomenon and Background Information
- Investigation 1: Patterns in Tree Growth and Structure
- Investigation 2: Analyzing Tree Cores
- Investigation 3: Tree Core Series
- Investigation 4: Climate Proxy Poster Presentation
- 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 the term “proxy” mean?
- 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 a 1-cm wide by 5-cm section of your tree cookie.



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

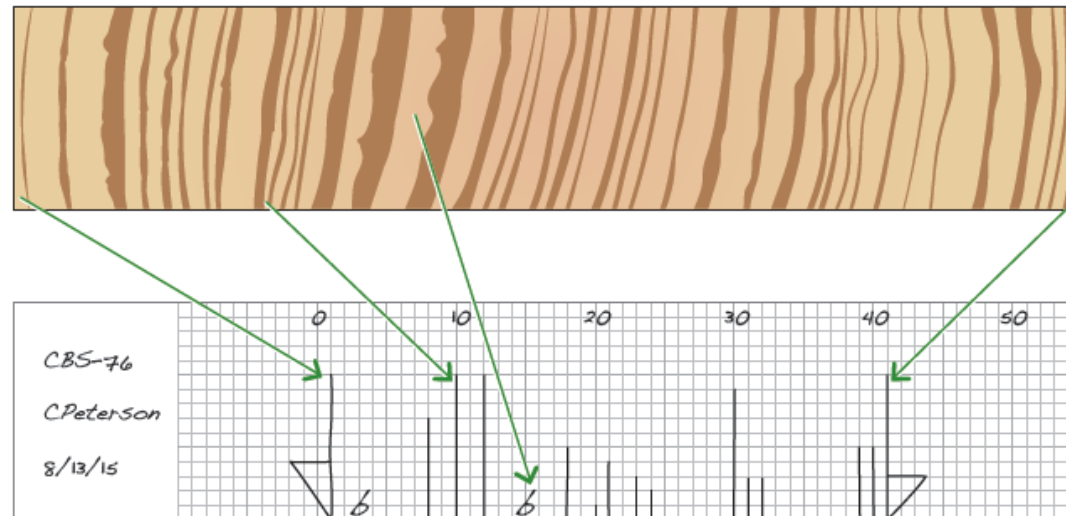
Discuss the following with your table, then we'll talk about it together.

1. What patterns did you observe?
2. What do you think can explain the patterns that you observed?
3. How do you think 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

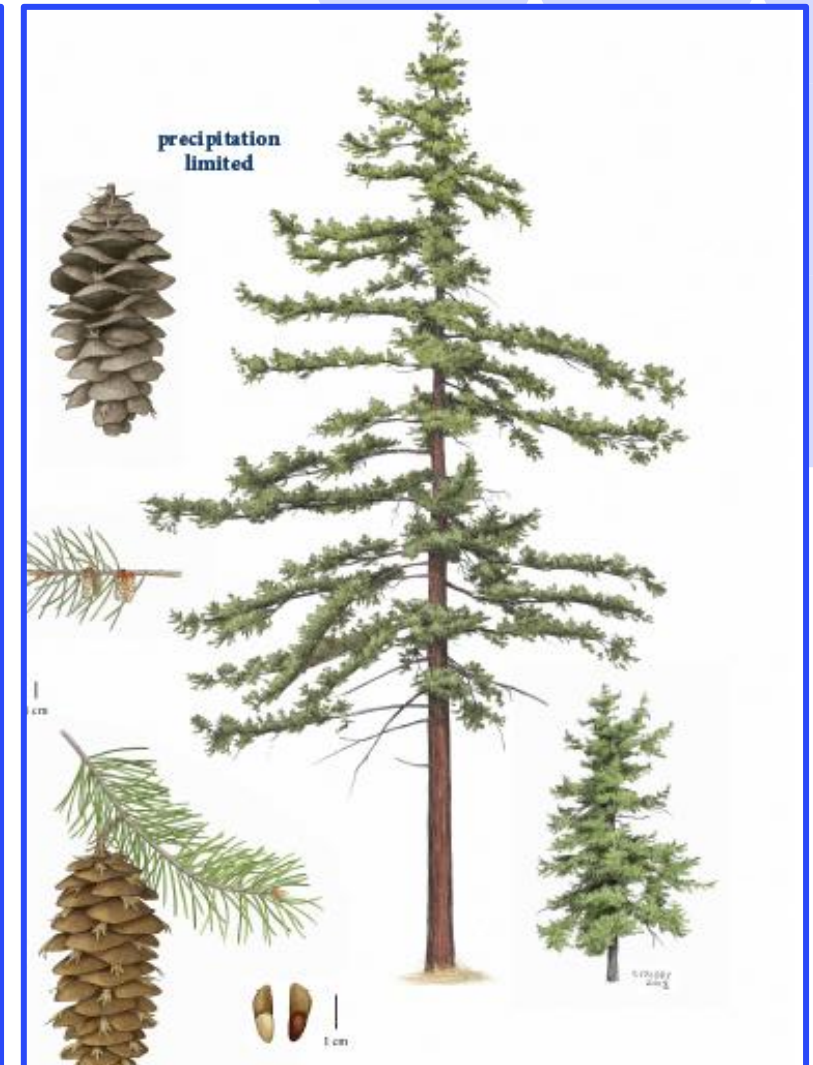
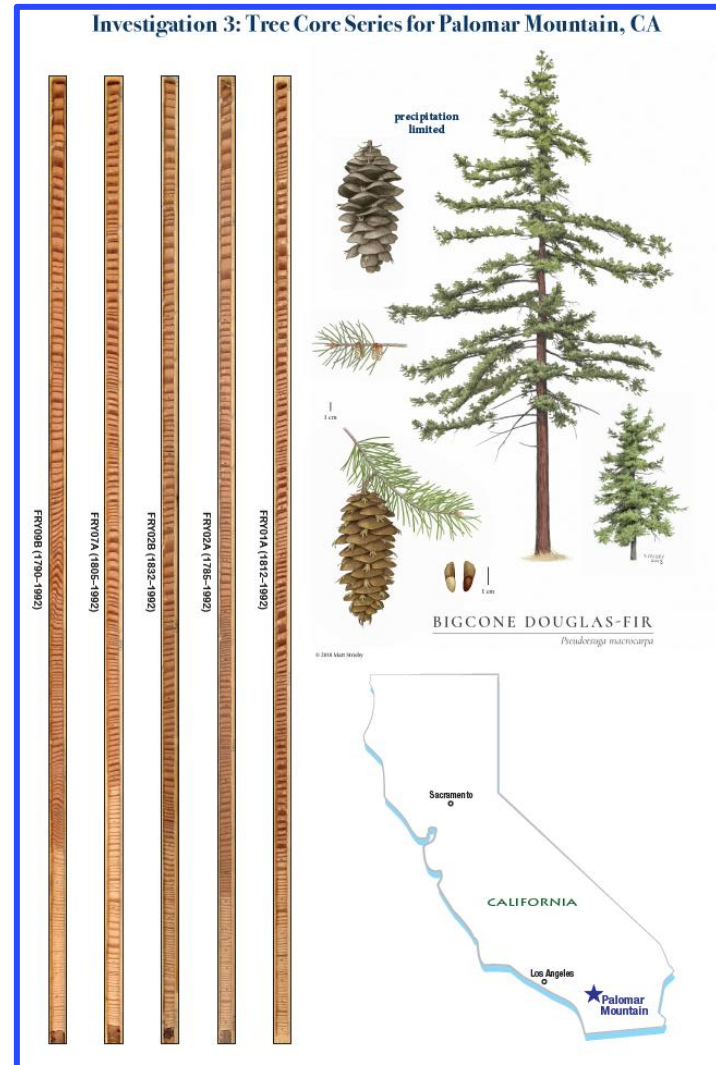
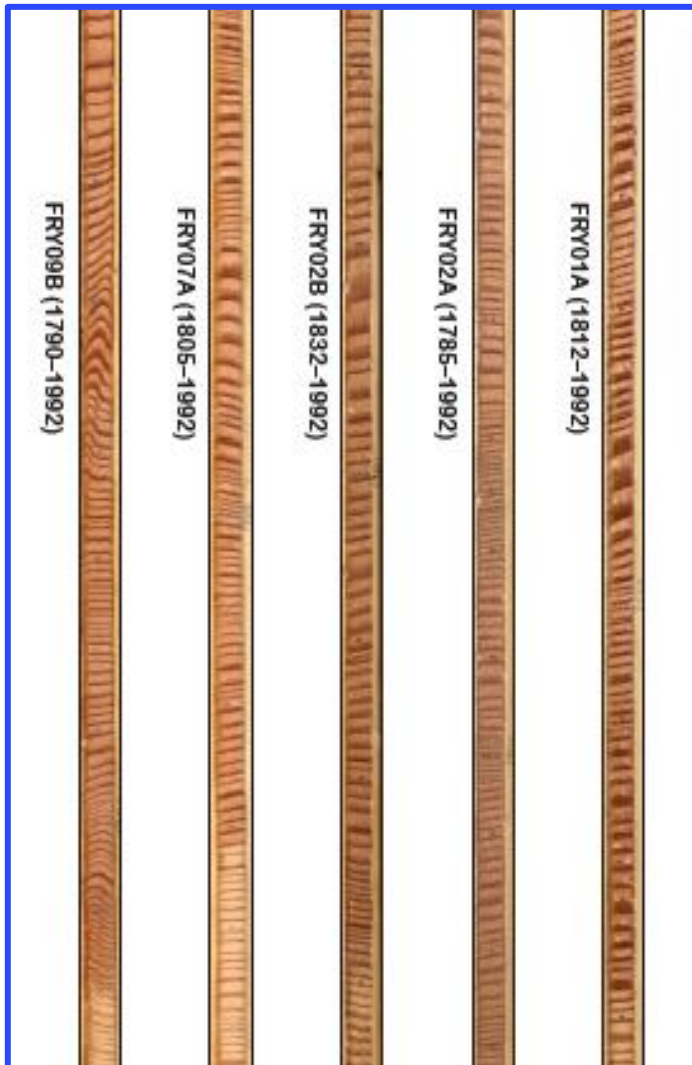


FRY10A (1805–1992)



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

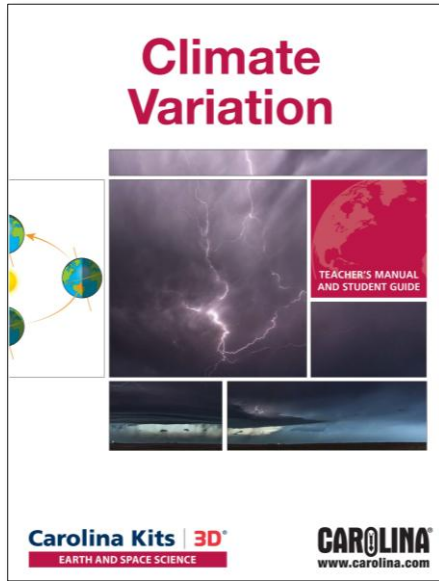


NASA's Goddard Space Flight Center/Ludovic Brucker. Courtesy of National Aeronautics and Space Administration (NASA). "Core questions: An introduction to ice cores." Last modified October 22, 2024. <https://science.nasa.gov/science-research/earth-science/climate-science/core-questions-an-introduction-to-ice-cores/>.

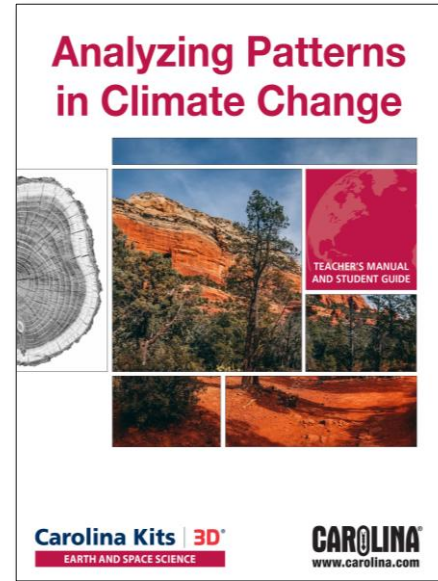
USGS photo/Kenneth Cole. Courtesy of National Park Service. "Middens, a window into the past? No kiddin'!" Last updated December 13, 2018. <https://www.nps.gov/cabr/blog/s/middens-a-window-into-the-past-no-kiddin.htm>.



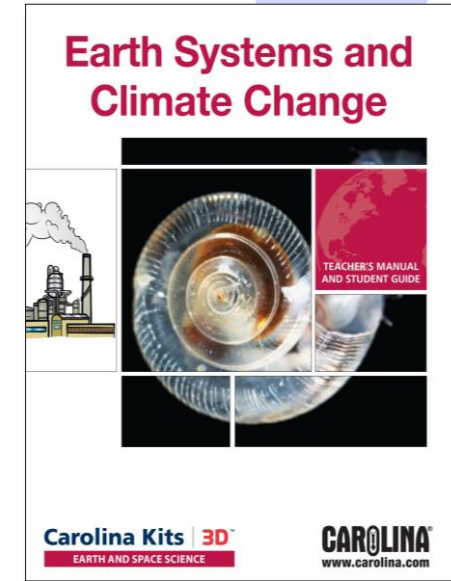
Workshop Review



Climate Variation Kit
Item 331158



**Analyzing Patterns in
Climate Change Kit**
Item 331160



**Earth Systems and
Climate Change Kit**
Item 331150

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