Asking Questions About Our Changing Climate: A Mi-STAR Unit

GIFT Workshop
New Orleans

Michigan Technological University
1885

THE HERBERT H. AND GRACE A. DOW FOUNDATION

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Michigan Science Teaching and Assessment Reform

Today's Agenda

I. Introduction to Mi-STAR Curriculum 

II. Explore Mi-STAR Climate Change Unit 

III. Wrap-up & Questions 

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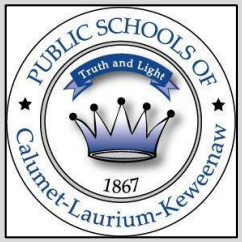
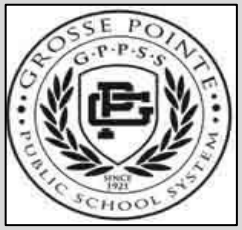
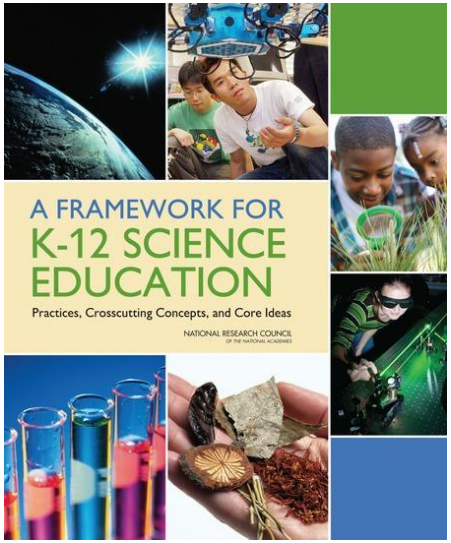
Mi-STAR is a Partnership to reform STEM education





Mi-STAR is…

Motivated by a vision in which science is taught and learned as an integrated body of knowledge that can be applied to address real-world problems and phenomena.



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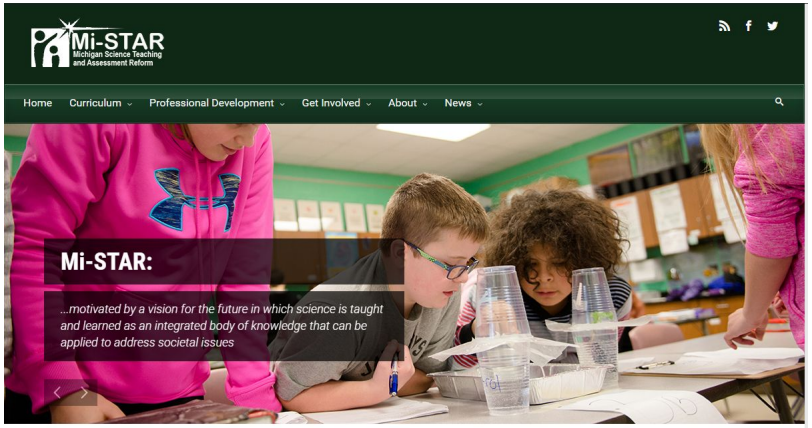
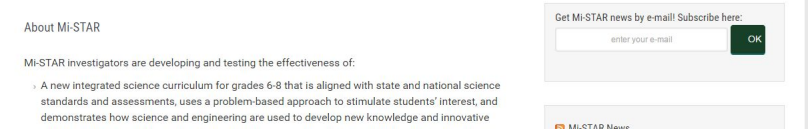
Mi-STAR

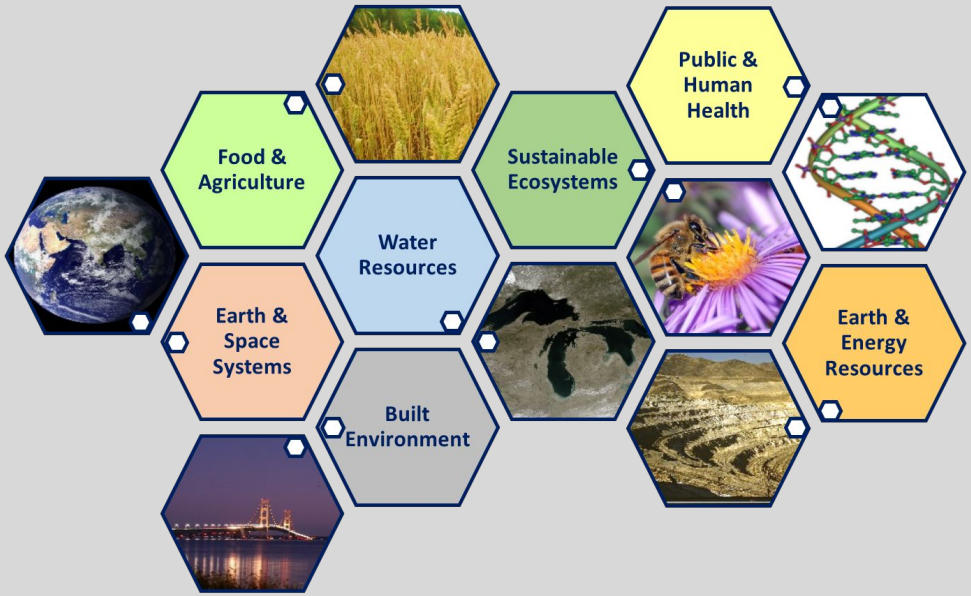
- Developing Middle School Curriculum and Assessments
- Made in Collaboration with Michigan Teachers
- Hosted online at: http://mi-star.mtu.edu/
- Includes Teacher Professional Development





Mi-STAR's approach…

- **Integrated – Demonstrate relations between disciplines**
  - ***Biology +Chemistry +Physics +Earth Science +Engineering (+Math +Communications)***
- **Theme-Based – Align with 21st–century topics of interest**



Mi-STAR's approach…

- **Michigan Centric – Focus on specific examples from MI**
  - ***Relevant to children and families in Michigan***
- **Driven by "Unit Challenges"**
  - ***Ongoing problems/projects that students interact with throughout the course of each unit of curriculum.***
- **Three-dimensional, Student Centered Learning Activities**

Unit Challenge

Unit 8.7: Our Changing Climate

***How* do we ask good, clarifying questions about factors influencing climate change?**

Performance Expectation MS ESS 3.5:
***Students will be able to* Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
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.	**ESS3.D: Global Climate Change** • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	**Stability and Change** • Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Unit 8.7: Our Changing Climate

***How* do we ask good, clarifying questions about factors influencing climate change?**

	ANCHOR	UNCOVER	SHARE	CONNECT	CHECK
• Lesson 1					**CHECK**
• Lesson 2		**UNCOVER**	**SHARE**		
• Lesson 3					
• Lesson 4				**CONNECT**	
• **Lesson 5**	**ANCHOR**	**UNCOVER**	**SHARE**	**CONNECT**	**CHECK**
• Lesson 6					
• Lesson 7					
• Lesson 8					**CHECK**

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<u>How</u> do we ask good, clarifying questions about factors influencing climate change?

- Explore Mi-STAR Climate Change Unit
  - Anchoring Experience: *My Dad's An Alien*
  - Uncover Your Ideas: *Asking Questions about Rising Temperatures*
  - Share Your Ideas: *The Importance of Asking Clarifying Questions in Science*
  - Connect Your Ideas: *Investigate 2 Claims of Why Global Climate Change is Happening*
  - Check Your Progress: *Bubble Map Reflection*

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Anchoring Your Experience

Asking Questions About our Changing Climate

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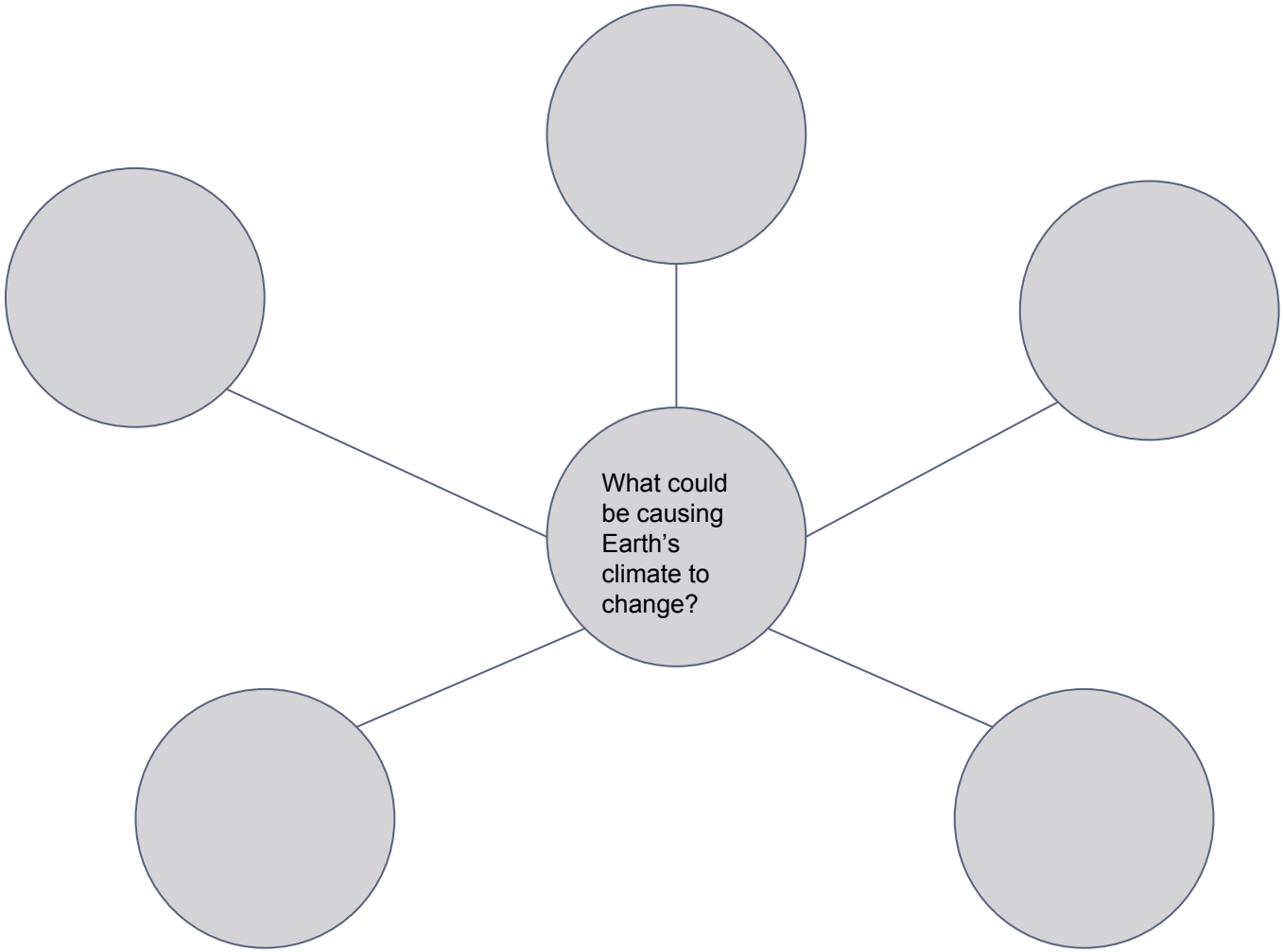
Anchoring Your Experience

Asking Questions

- Claim: My Dad is a space alien.
  - Speaks a weird language.
  - Drinks green stuff.
  - “Look at him!”
  - He has a space ship.
- Why is asking questions about evidence important?

Bubble Map



Asking Questions About Rising Temperatures

Uncover & Share Your Ideas

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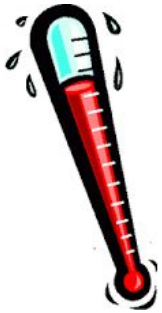
Let's Discuss……



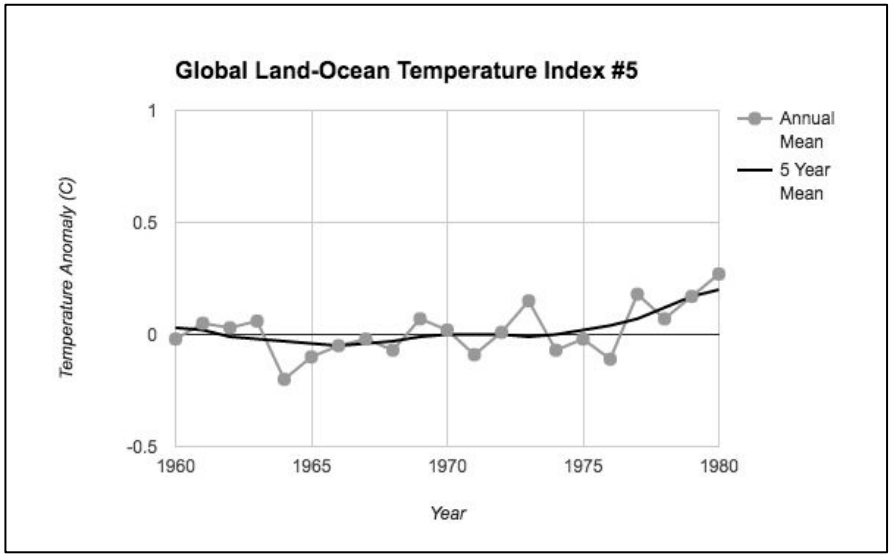
Claim: *Global temperatures are rising.*

What evidence would you want to see to investigate this claim further?

Claim: *Global temperatures are rising.*

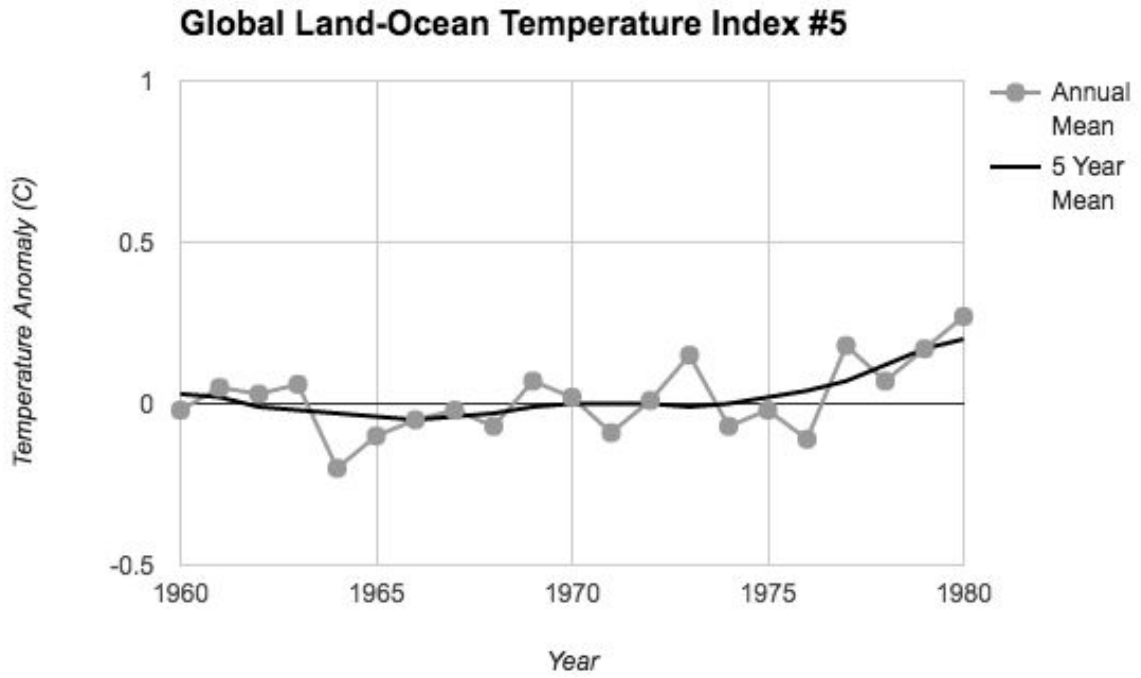
In Groups of Three:

- Carefully study the graph provided
- Consider if you would support or reject the claim based on the data evidence presented in your graph? Why?
- Generate questions that you have about the data presented that would help identify and clarify the evidence provided in order to investigate the claim further.
- Write one question per sticky note



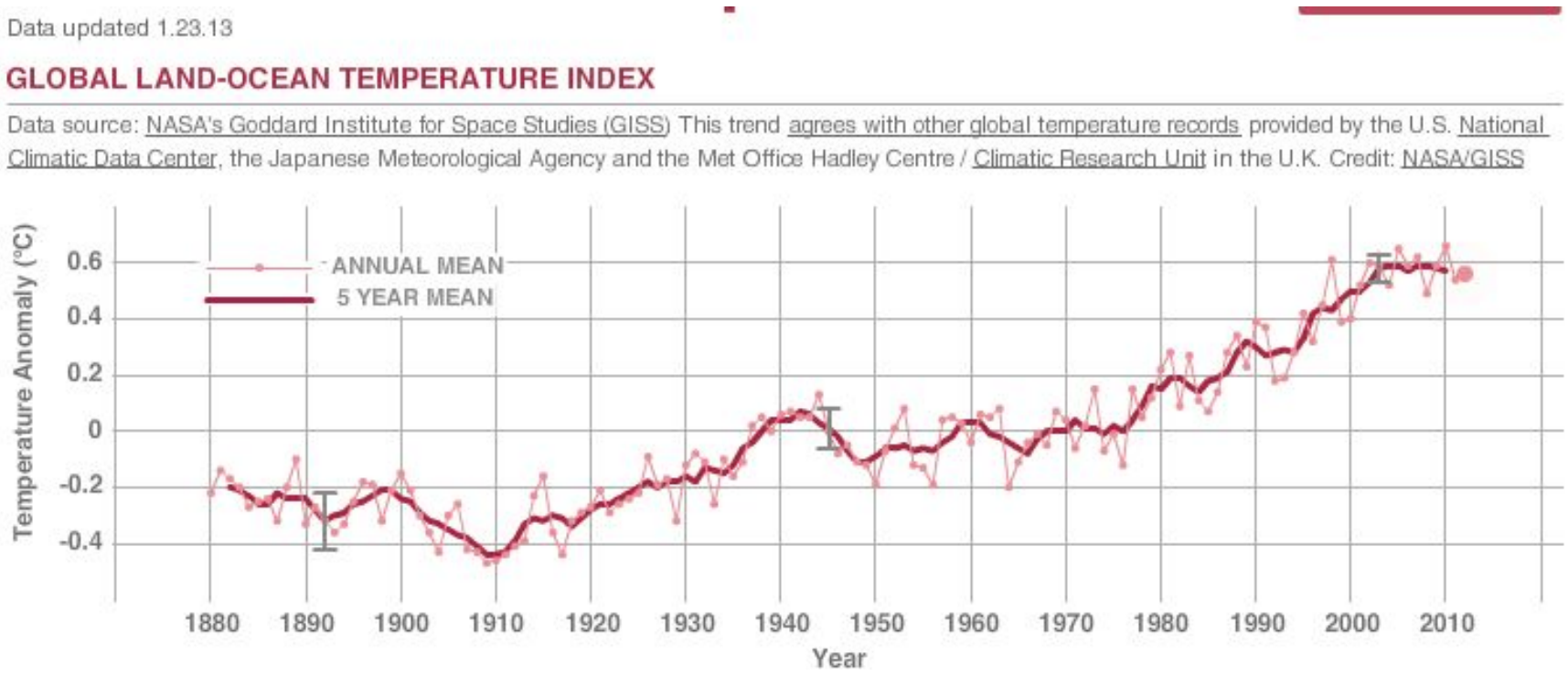
Share Your Ideas

What Clarifying Questions Do You Have?



Did Asking Questions Lead to a Deeper Understanding of the Evidence Presented?

Putting it All Together….



Source: NASA-GISS surface temperature analysis: http://climate.nasa.gov/key_indicators#globalTemp

Share Your Ideas

Importance Of Asking Clarifying Questions in Science

1. Did your questions lead you to a deeper understanding of the graph?
2. How is questioning used to clarify evidence of an argument?
3. How is questioning used to identify evidence of an argument?

Connect Your Ideas

- Work in groups to investigate two claims:

Claim A*:* "Natural processes are causing the current change in mean surface temperature just as they have in the past."

Claim B: “Human activities are causing the current change in mean surface temperature, which is different than changes in the past."

Claim A Jigsaw

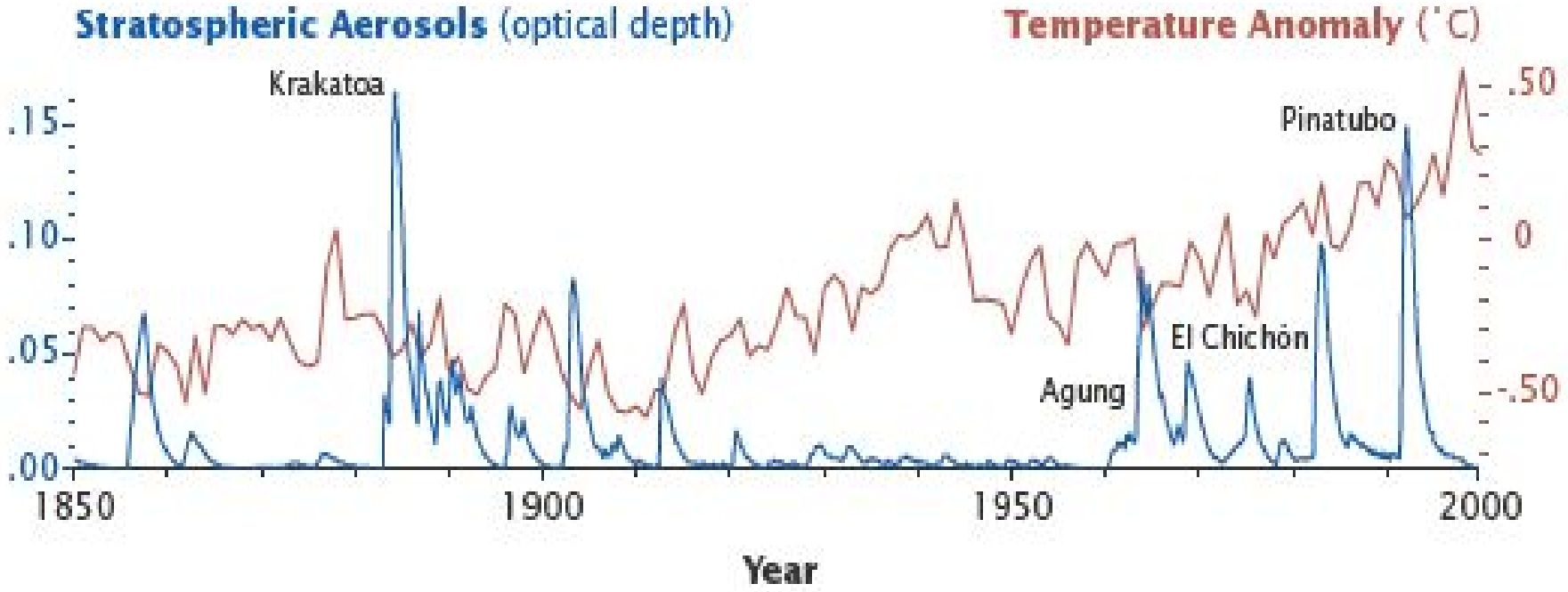
- Each member of the group will investigate a natural process that could be impacting climate and then report back to their group.

1. Volcanic activity
2. Earth's orbit
3. Solar Activity

Claim A

- We _____ (support/refute) the claim that "natural processes are causing the current change in mean surface temperature just as they have in the past."

Claim A - Volcanic Activity

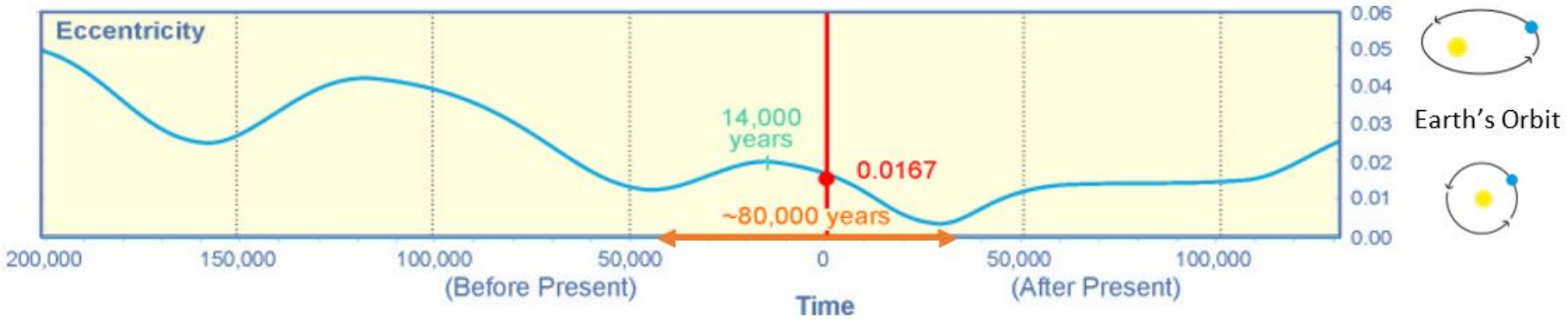


Volcanic eruptions are shown in black.

*Hint:
What happens to the Earth's temperature when there is volcanic activity?
Can changes in volcanic activity explain the current temperature increase?

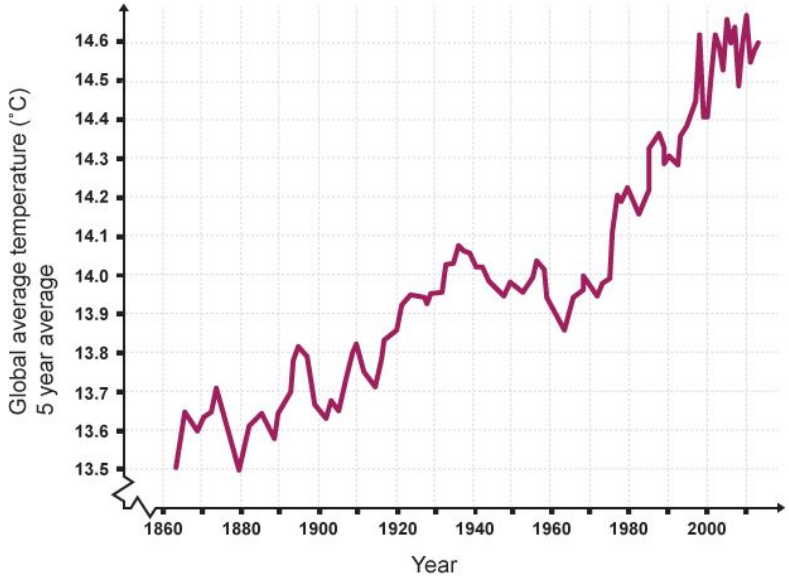
Figure adapted from: http://earthobservatory.nasa.gov/Features/Aerosols/page3.php

Claim A - Earth's Orbit



The term eccentricity describes the shape of the earth's orbit as it revolves around the sun. This can vary from nearly circular to more elongated. The variations that influence the amount of solar radiation that the Earth receives occur at frequencies of about 100,000 and 400,000 years.

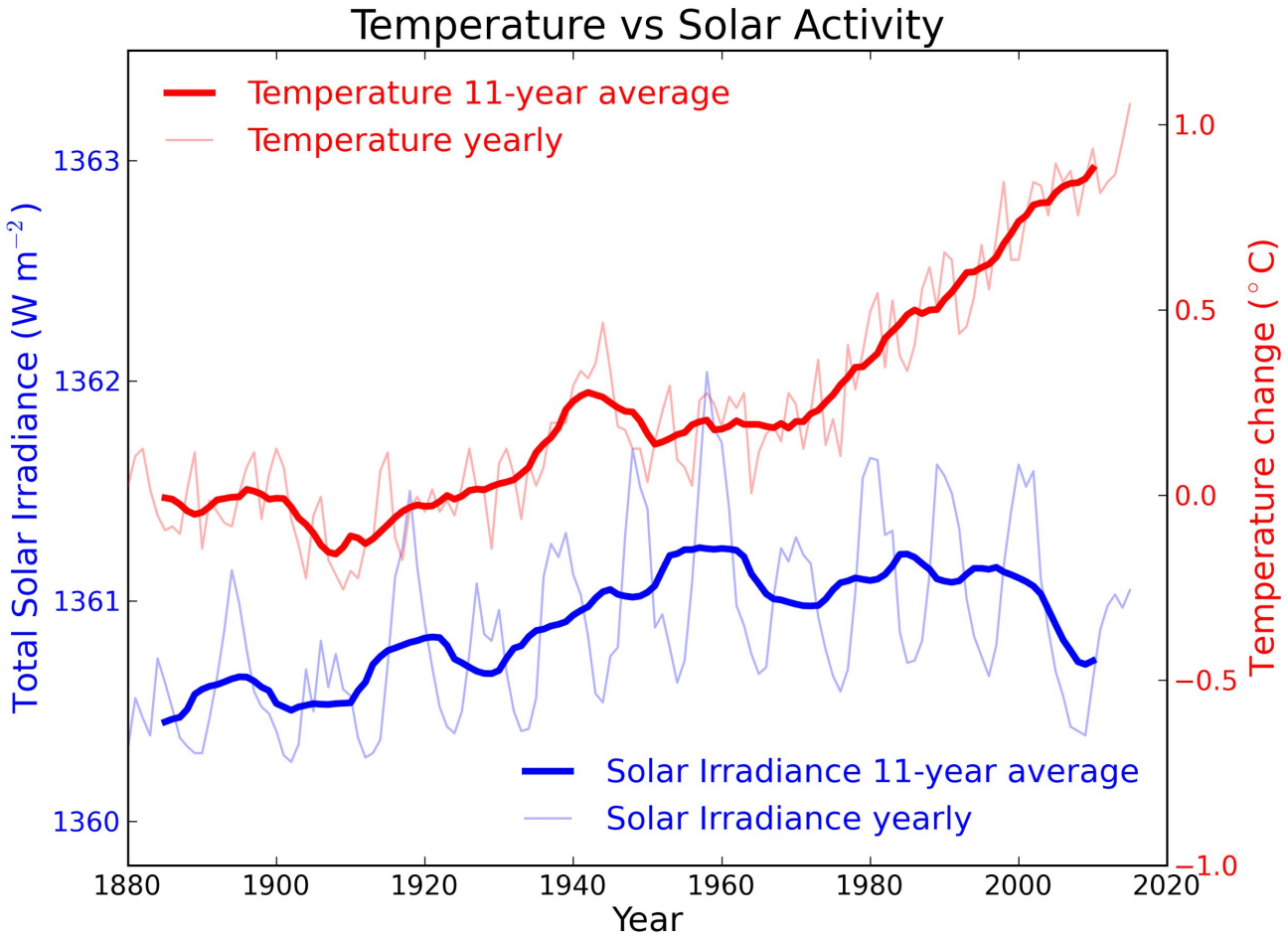
*Hint: Is Earth's orbit currently becoming more elongated or more circular? How long does it take for changes in the Earth's orbit to occur? Can changes in the Earth's orbit explain the current temperature increase?



Graph from: http://www.bbc.co.uk/education/guides/znsk7ty/revision/4

Figure adapted from https://wattsupwiththat.com/2009/02/23/ice-ages-and-sea-level/, http://academic.emporia.edu/aberjame/student/howard2/theory.htm, http://www.ncdc.noaa.gov/paleo/ctl/clisci100ka.html, http://pics-about-space.com/shape-of-the-earth-s-orbit-around-sun?p=3#

Claim A - Solar Activity



*Hint:
Since 1980, what has happened to the the sun's energy output?

If the sun is cooler, what should happen to the Earth's temperature?

Figure from: https://static.skepticalscience.com/pics/TvsTSI.png

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Claim B Directions

- Now investigate claim B with your group using the provided graphs.

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Claim B

- We _____ (support/refute) the claim that "human activities are causing the current change in mean surface temperature, which is different than changes in the past."

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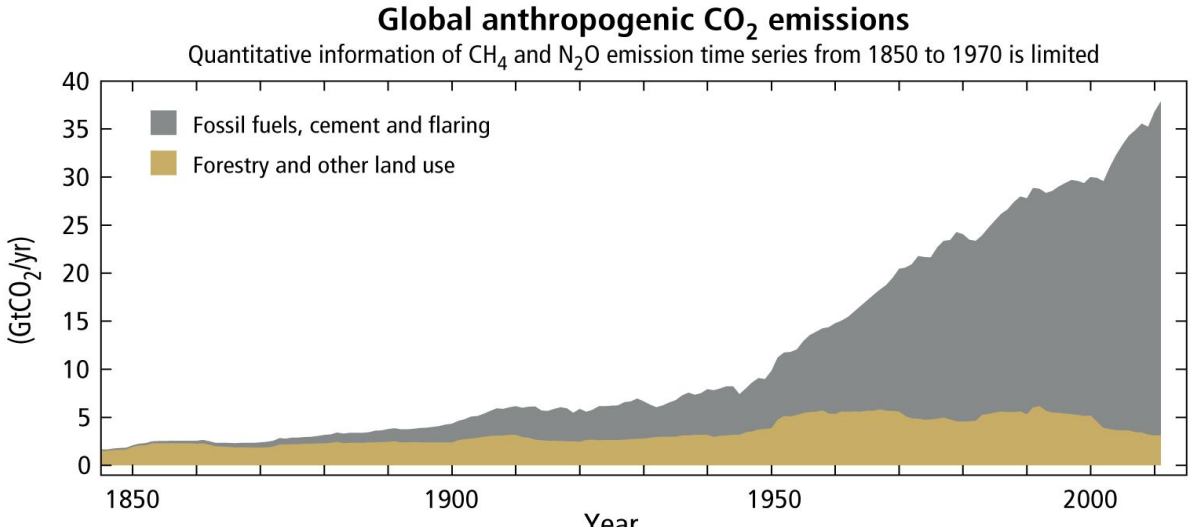
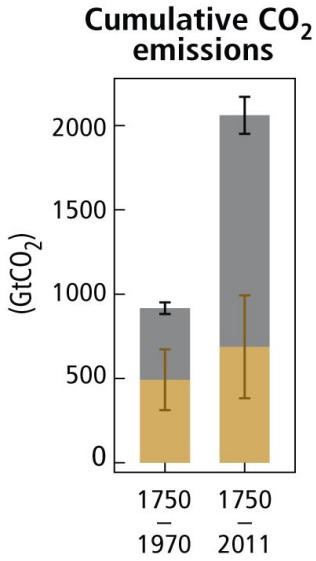
Claim B - Human Activities





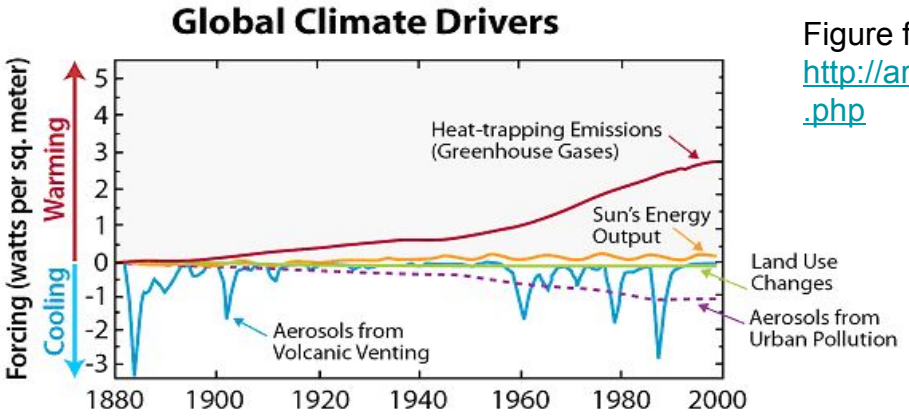


Figure from: http://ar5-syr.ipcc.ch/topic_observedchanges.php

Figure from: http://www.ucsusa.org/global_warming/science_and_impacts/science/human-contribution-to-gw-faq.html#.V7tSTZgrKUl, adapted from Hansen et al. 2005. Earth's energy imbalance: Confirmation and implications. *Science* 308:1431-1435

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Drawing Conclusions

- Did your initial questioning help you to identify evidence that you would need?
- Did you have questions that would lead to further investigation?
- Given the evidence, do you support/refute Claim A and Claim B?

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Thank You!

Please Give Us Your Feedback

To access this lesson visit:
http://bit.ly/MiSTARClimateChange

For further information visit our website:
http://mi-star.mtu.edu/

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