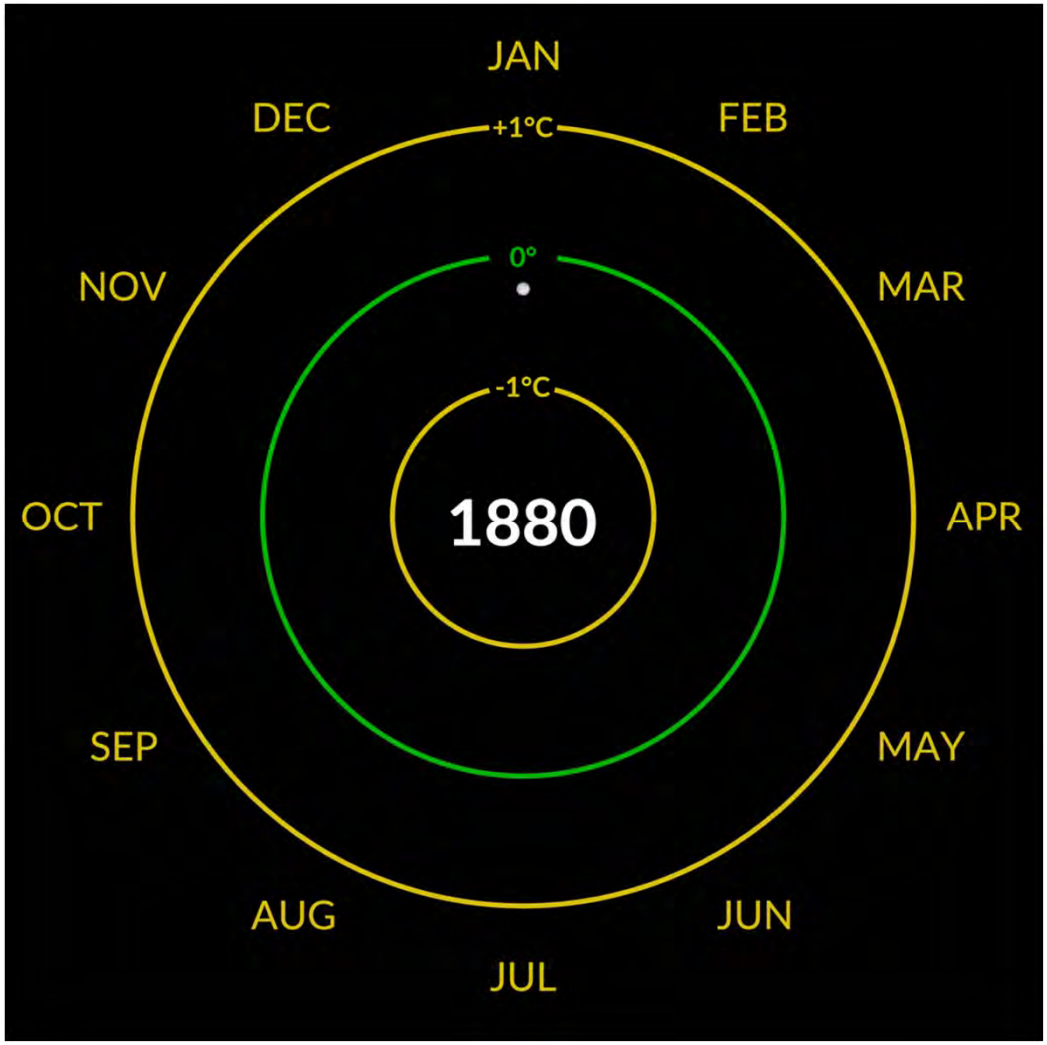
Fragile System Part Deux

Lecture 2 – Climate & Disasters



https://climate.nasa.gov/climate_resources/300/video-climate-spiral-1880-2022/

Final Exam

- Wednesday December 11th 3:30pm, SRC Gym
- ~100 multiple choice questions, covering all topics, slight emphasis on Impacts
- 1.5 hours Individual, 1 hour Group

Bring your Student ID – it will be checked

Do you write with the CfA? Join the rest of the class at 5pm for the group portion!

Impacts Review Session

Monday December 9th

3-4pm LIFE 2201

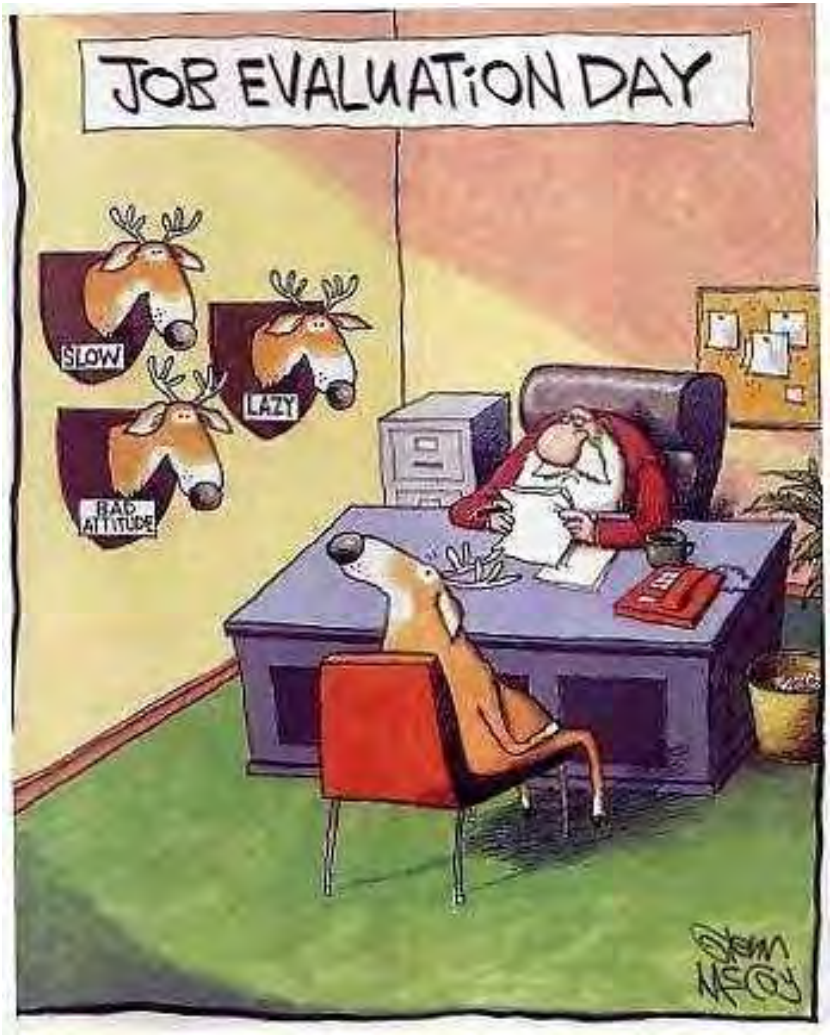
It's two days before the exam – so study first, and come prepared with your questions!

Session will be recorded – but please come along if you can and ask your questions!

Course Evaluations

We are always striving to improve our teaching.
Your feedback is very important to us!

- Lucy Porritt – Fragile Systems, Admin
- Doug McCollor – Storms
- May Ver – Waves
- Simon Peacock – Earthquakes
- David Sasse – Landslides and Volcanoes
- Mitch D'Arcy - Volcanoes

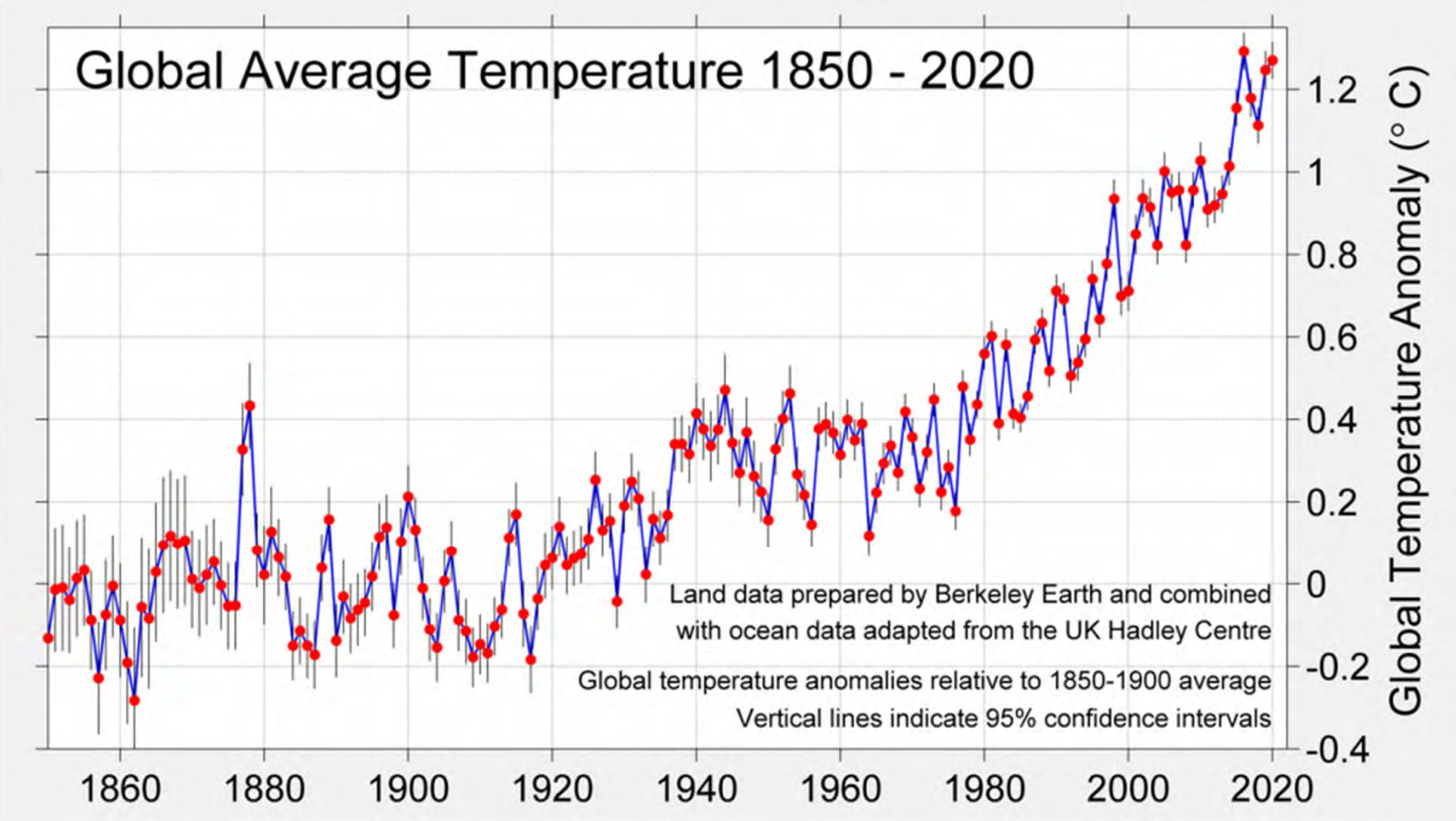


Learning goals

- Explain the basics of how and why the global temperatures are rising
- Investigate the factors that may contribute to climate change and the relative role they play.
- Analyze your own carbon footprint and what you can do to help decrease it
- Discuss the affects of a warming climate on the frequency and intensity of our disasters we have studied in the course

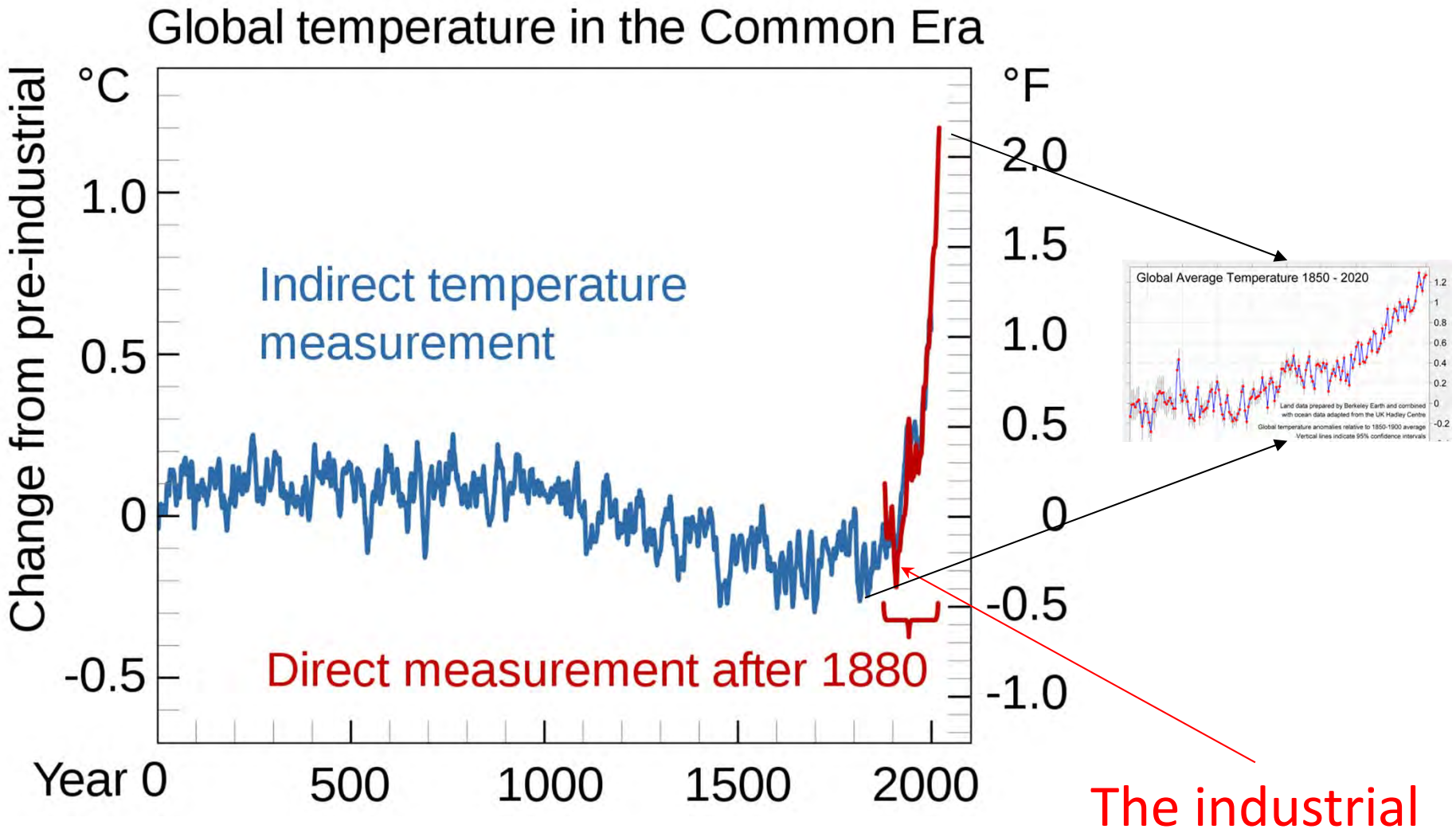
Climate Change

- This graph often cited - just natural variation in climate?
- See a larger perspective….



Climate Change

The global climate “Hockey Stick”

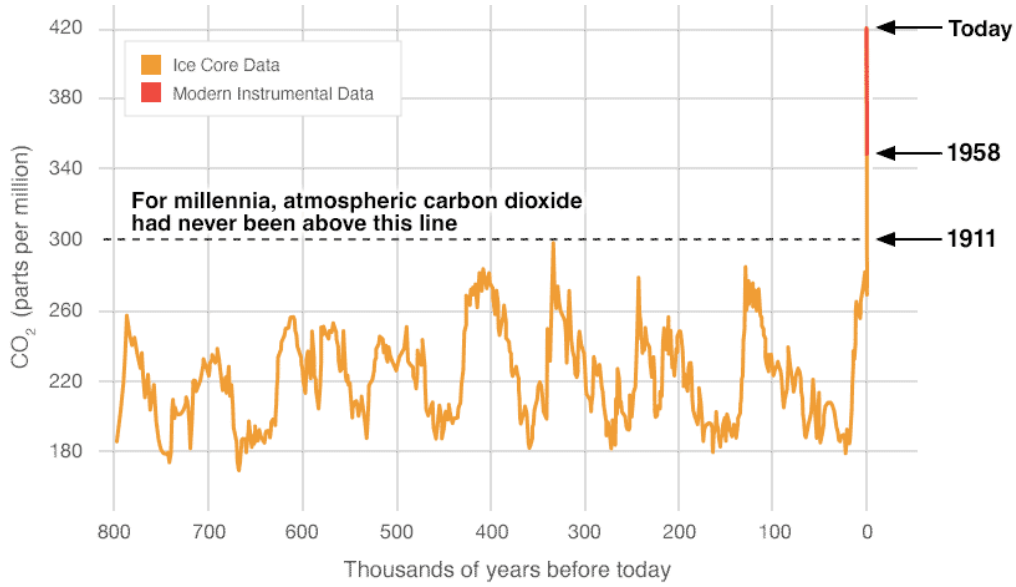


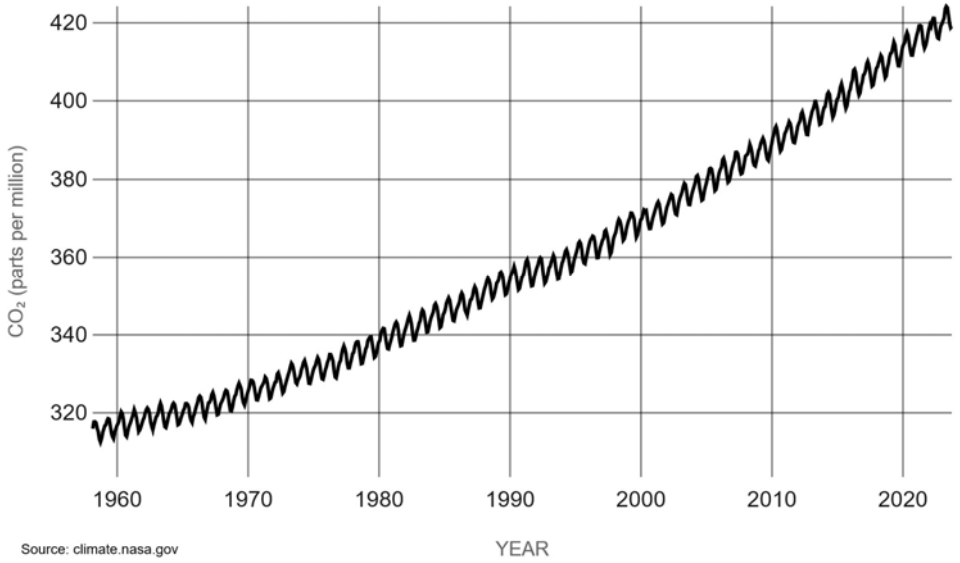
Factors Contributing to Climate Change

Rank the following in terms of their impact on global climate, from most to least impact:

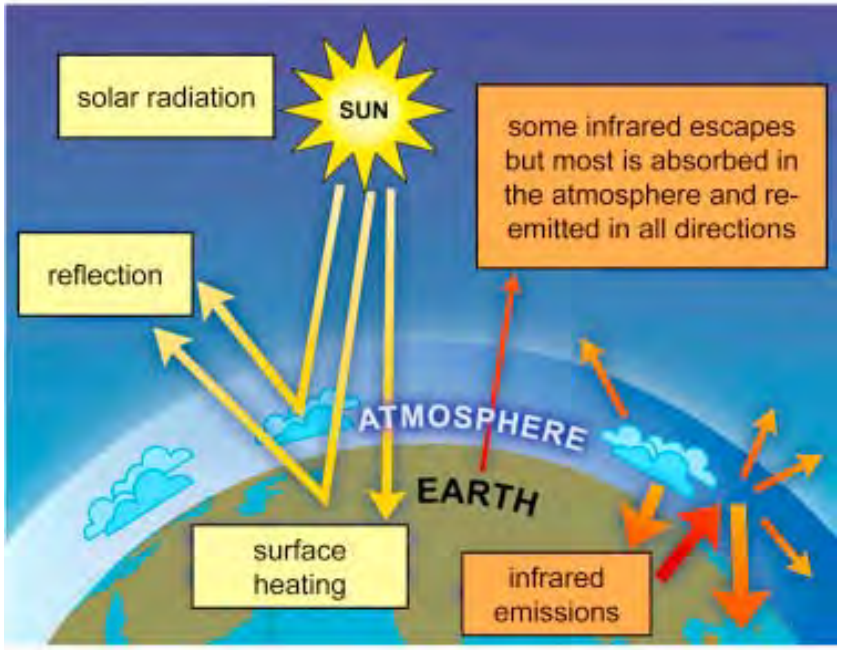
Volcanic eruptions
Greenhouse gases
Ozone layer
Orbital changes
Solar output
Land use
Aerosols

Climate Change - Cause





https://climate.nasa.gov/vital-signs/carbon-dioxide/



https://www.sciencedirect.com/science/article/pii/S0160932716300308#fig0005

Temperatures correlate with CO_2 levels

Increased CO_2 and other greenhouse gasses trap more radiated heat

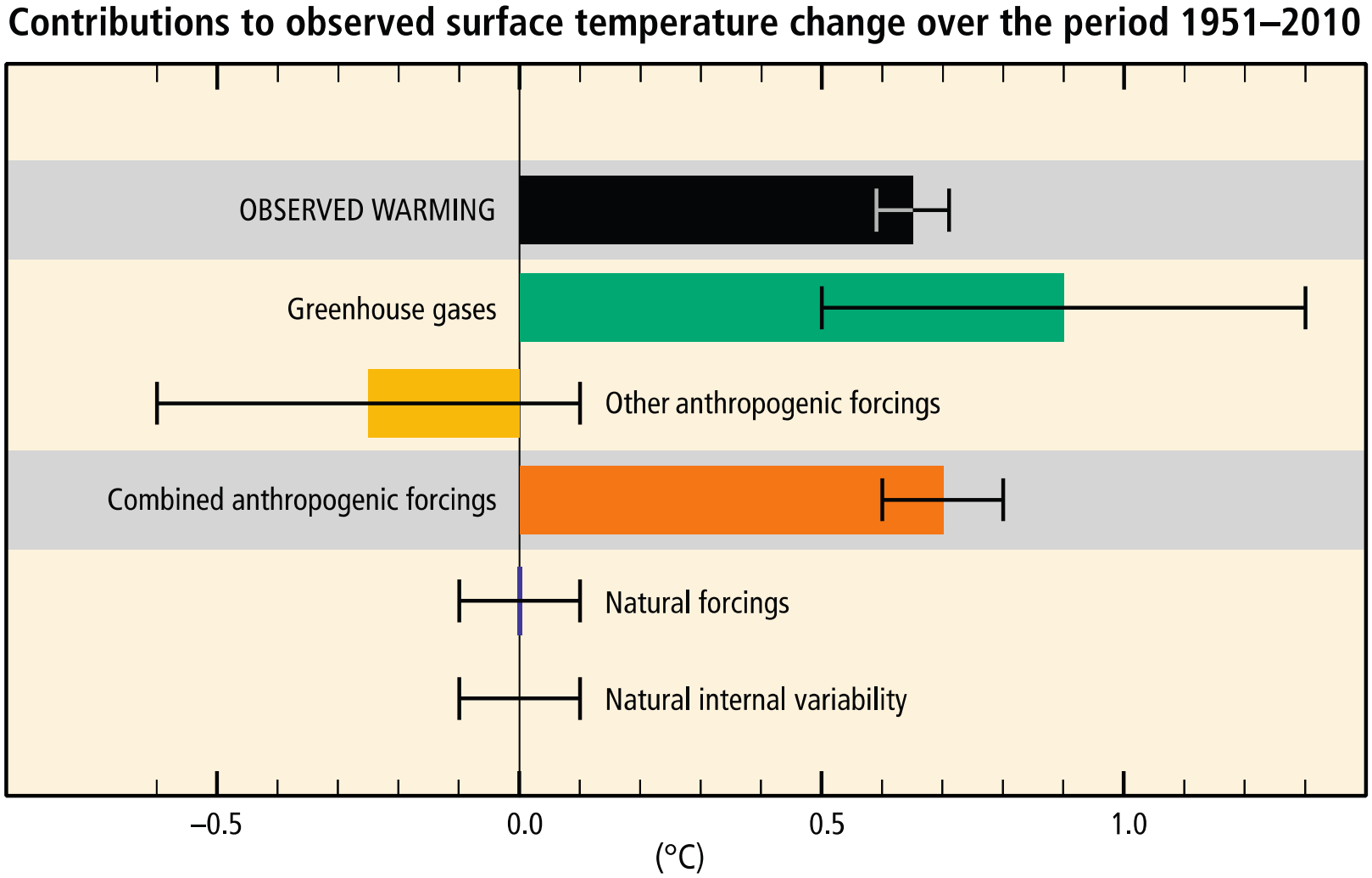
Factors Contributing to Climate Change

Open the dashboard app and use the **Learn Tab** to explore the following:

https://dashboard.eoas.ubc.ca/globaltemps

1. Which of our contributing factors correlates the best with the observed temperature anomaly?
2. Which factor has the strongest negative correlation with temperature?
3. Looking at the volcanic data, how many major negative temperature excursions are there? What volcanic eruptions might they relate to? (Google the years and see what you can find!).

Factors Contributing to Climate Change

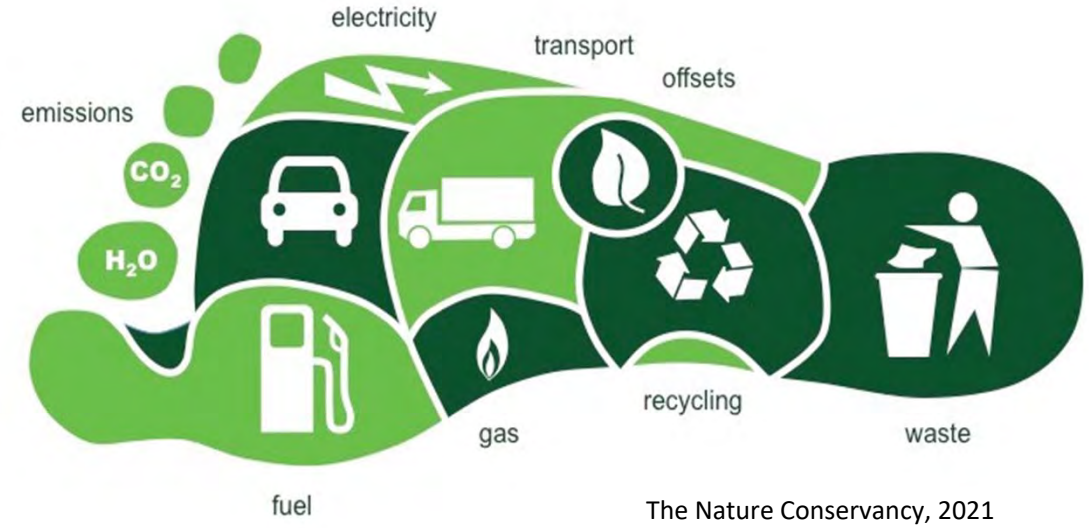


IPCC, 2014

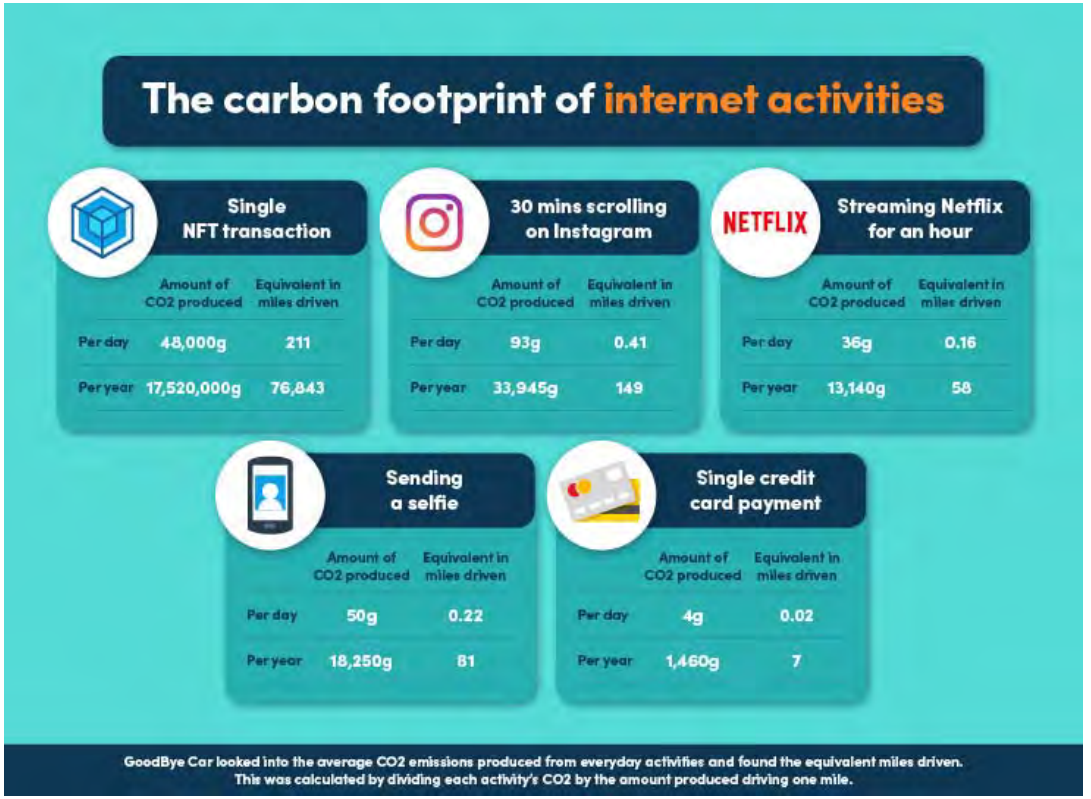
What's Your Carbon Footprint?

Carbon Footprint - is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions

Average person globally produces ~4 tons of CO_2 per year



The Nature Conservancy, 2021



https://www.goodbyecar.uk/blog/emissions-of-daily-activities

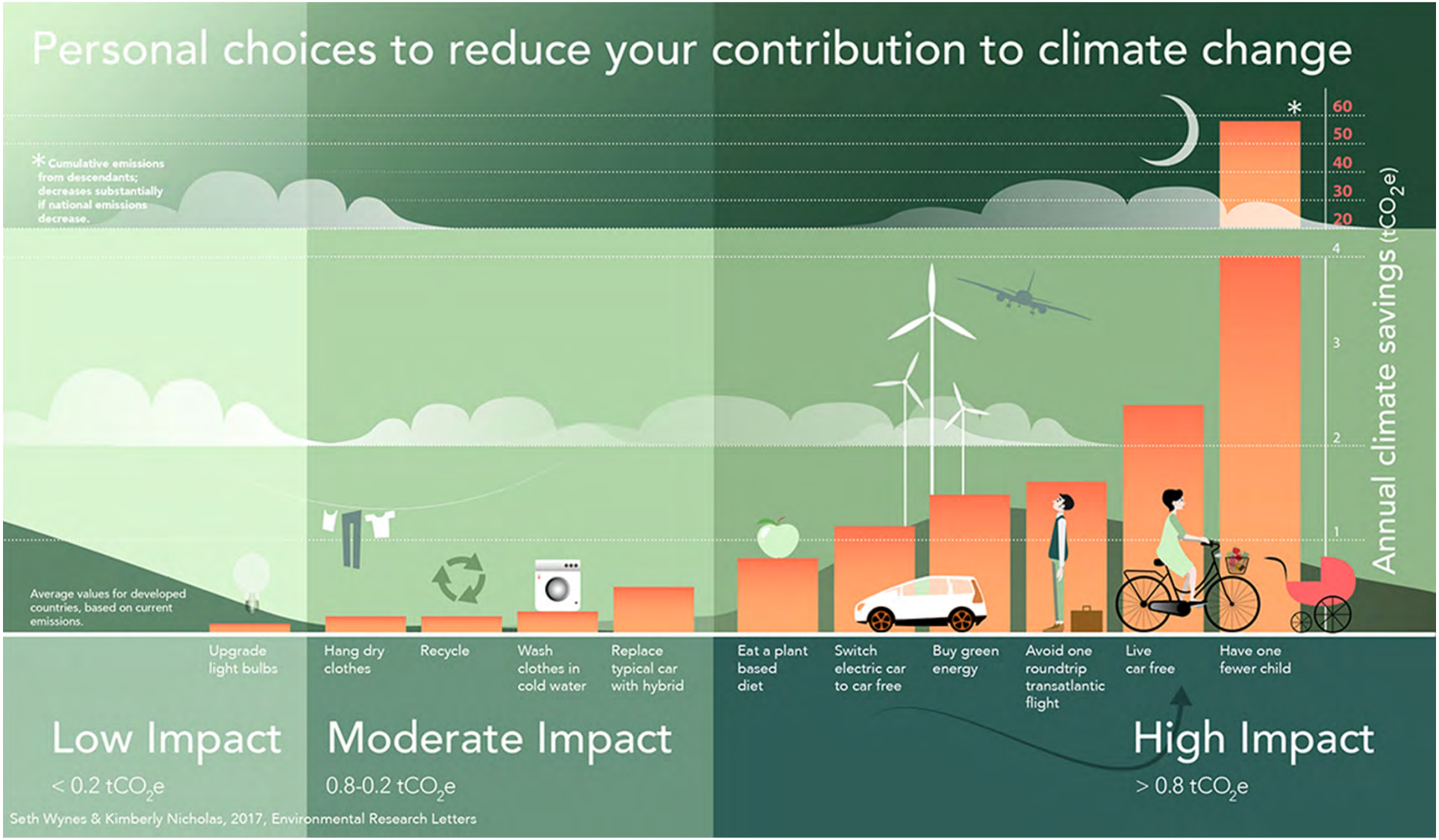
Calculate Your Carbon Footprint

Complete a short quiz:

www.footprintcalculator.org

Finished? “Skip to view my results”

Reduce Your Carbon Footprint



https://www.worldometers.info/world-population/

Credit: Catrin Jakobsson, with data from Wynes and Nicolas (2017)

Climate Change and Disasters

CO_2 and other greenhouse gases have caused Earth to warm more quickly than it has in the past. How much warming has happened?

https://climate.nasa.gov/interactives/climate_time_machine

Climate Change and Disasters

In groups of 4 – use the NASA Climate Time Machine to answer the following questions:

1. Which region of the world has experienced the most temperature change
2. How much more CO_2 was in the atmosphere in 2016 compared to 2002 (in general)
3. What amount of sea level rise will completely submerge Miami? And New Orleans?
4. Does the amount of sea ice affect the sea level? (You wont get this from the animations)

https://climate.nasa.gov/interactives/climate_time_machine

Direct impacts of warming

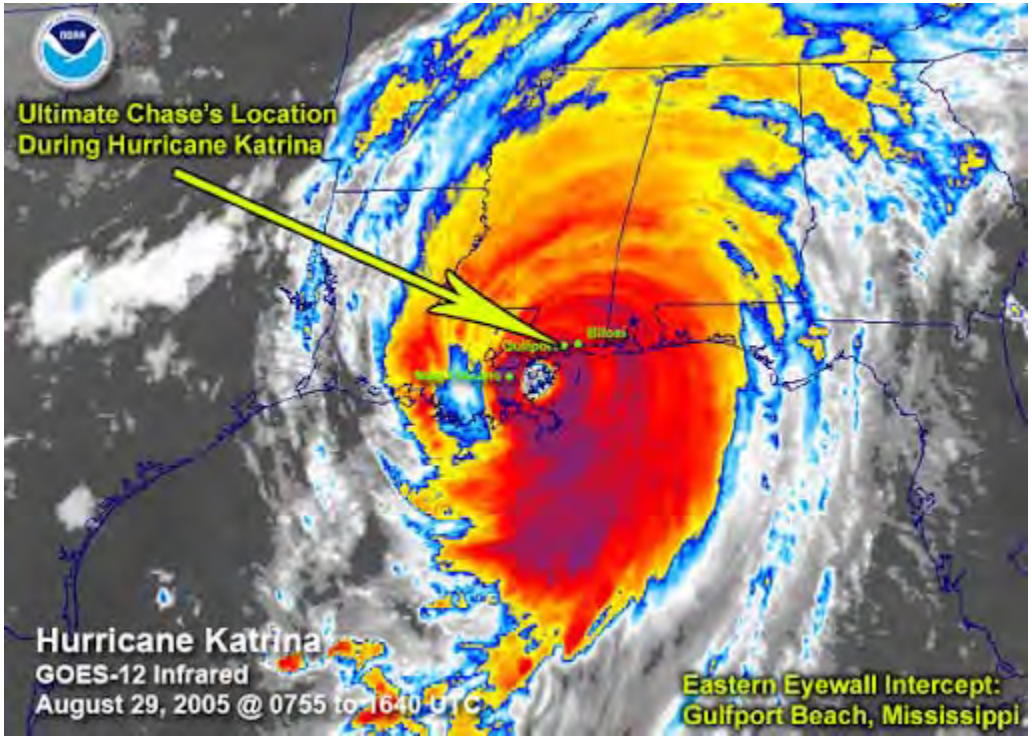
- Sea-surface temperatures and lakes are warming
- Arctic sea ice is melting
- Glaciers and permafrost are melting
- Sea level is rising
- Seawater is becoming more acidic
- Heavier rainfall causes flooding in many regions
- Extreme drought is increasing
- More frequent heat waves

Impacts of warming

Storms

Have hurricanes changed in frequency and intensity?

- Warmer sea surface temperatures
- Stronger winds



More intense hurricanes predicted

https://www.gfdl.noaa.gov/global-warming-and-hurricanes/#synthesis-and-summary-for-atlantic-hurricanes-and-global-warming

Impacts of warming

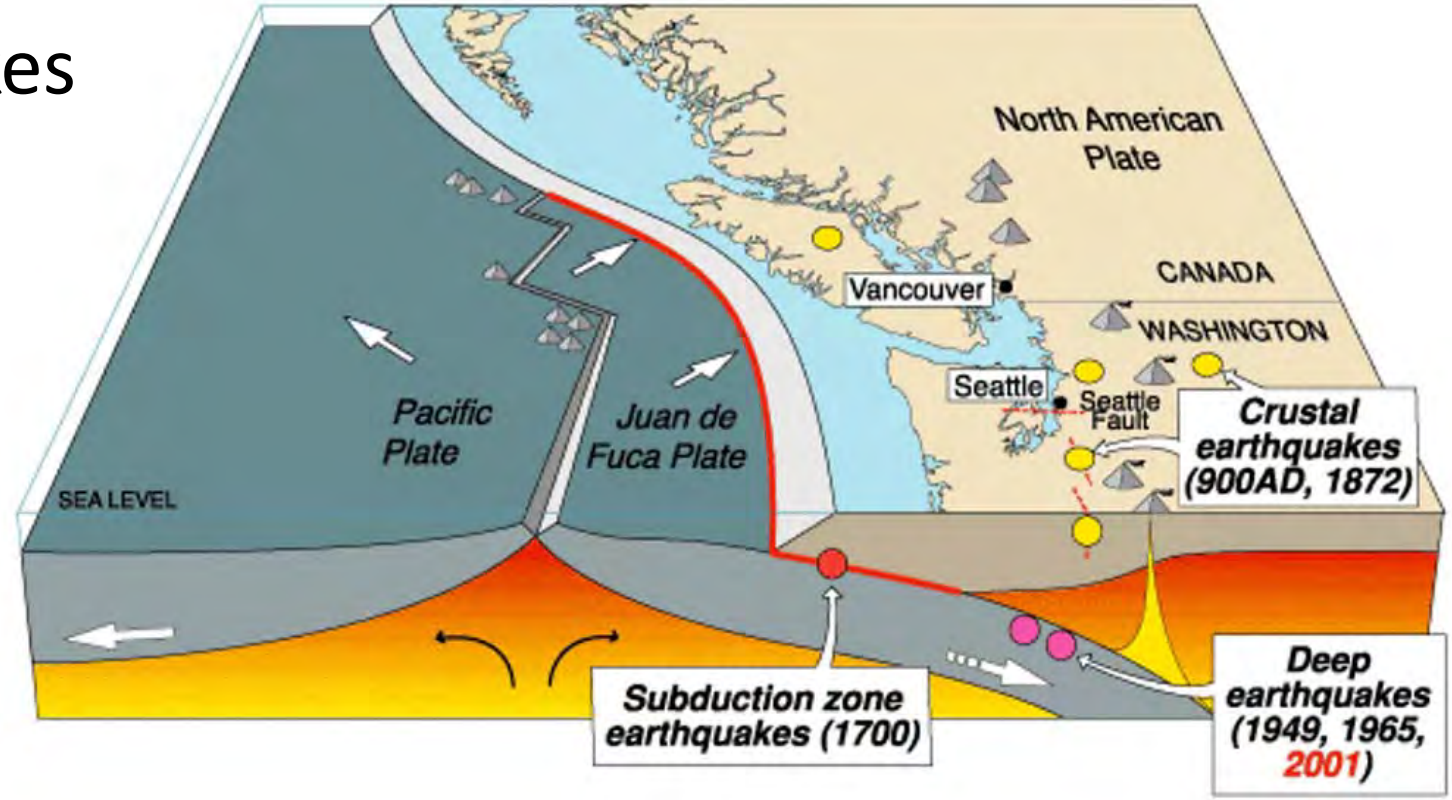
Waves

- Warmer sea surface temperatures
- Stronger winds
- Higher sea levels
- More coastal erosion

https://dailyhive.com/vancouver/vancouver-sea-level-rise-map

Impacts of warming

Earthquakes



It's a great day for an earthquake!

Changes in climate can lead to changes in groundwater distribution and glacial unloading. Both can be a source of **small** earthquakes.

Impacts of warming

Landslides

More landslides as a result of increased rainfall

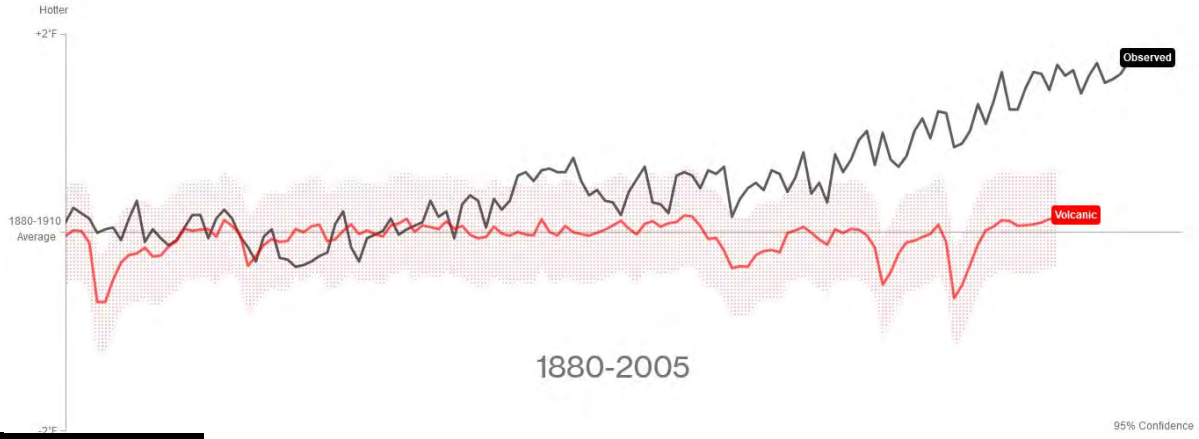
https://www.ctvnews.ca/climate-and-environment/how-climate-change-played-a-role-in-the-b-c-floods-1.5679948

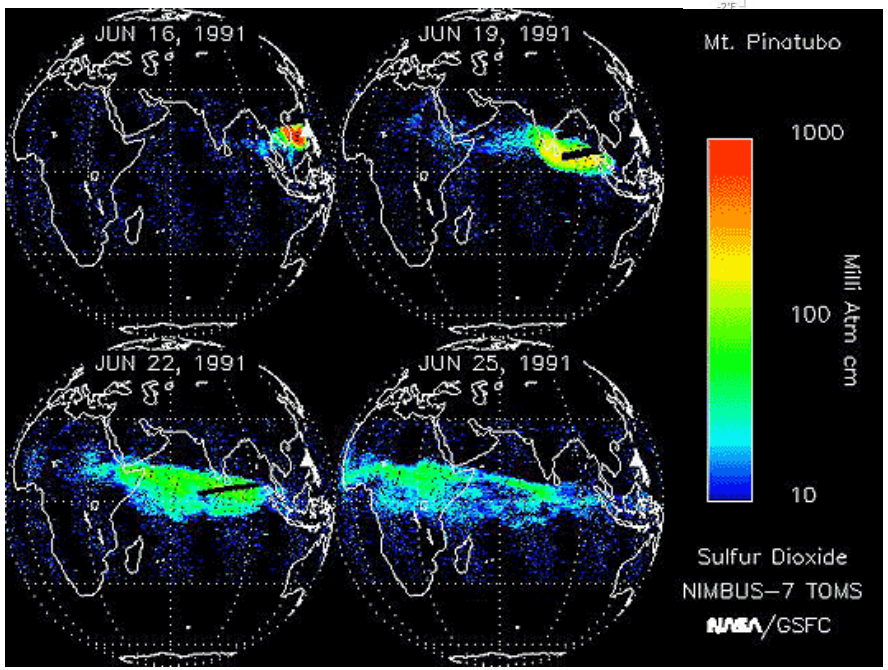
Impacts of **or on** warming

Volcanoes

https://www.bloomberg.com/graphics/2015-whats-warming-the-world/

Volcanoes release a lot of CO_2 and SO_2





Climatic Impact of the 1991 Pinatubo Eruption

22,000,000 tons of SO_2

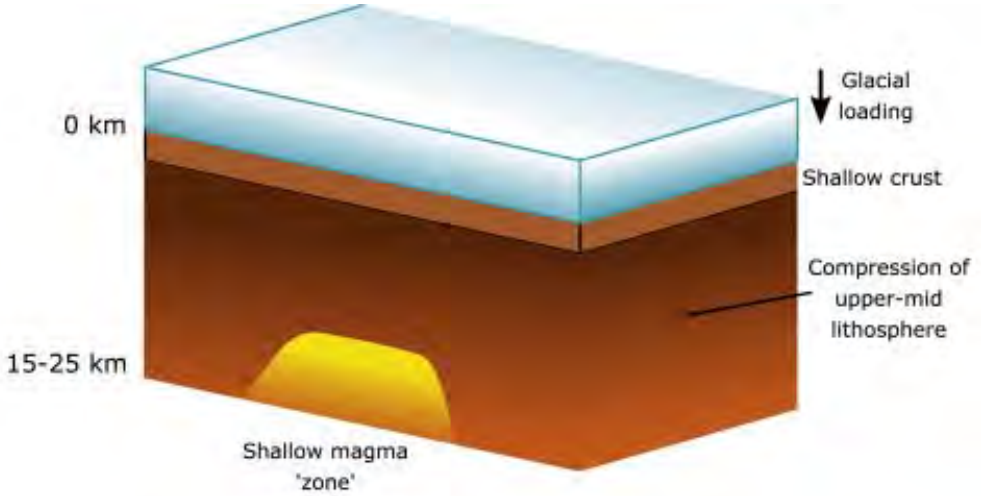
Global Temperature decreased 0.5 - 0.6 C

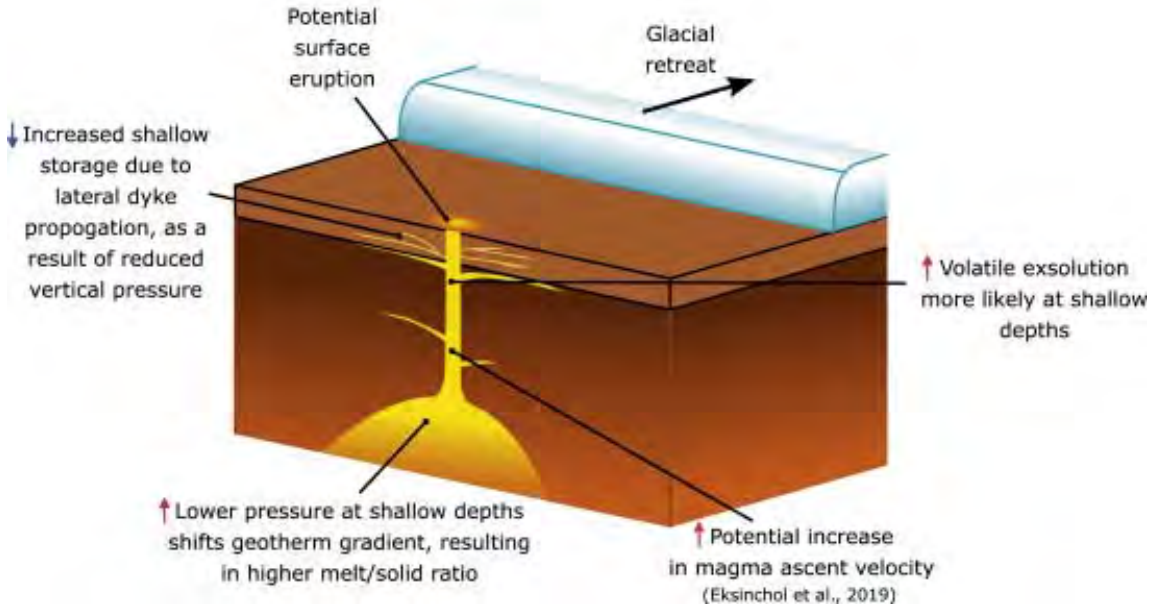
Impacts of warming
Volcanoes

Evidence from Iceland:

- Cooler glacial periods and suppressed volcanic activity
- Warmer periods with increased volcanic activity

Only applicable to volcanic areas currently glaciated



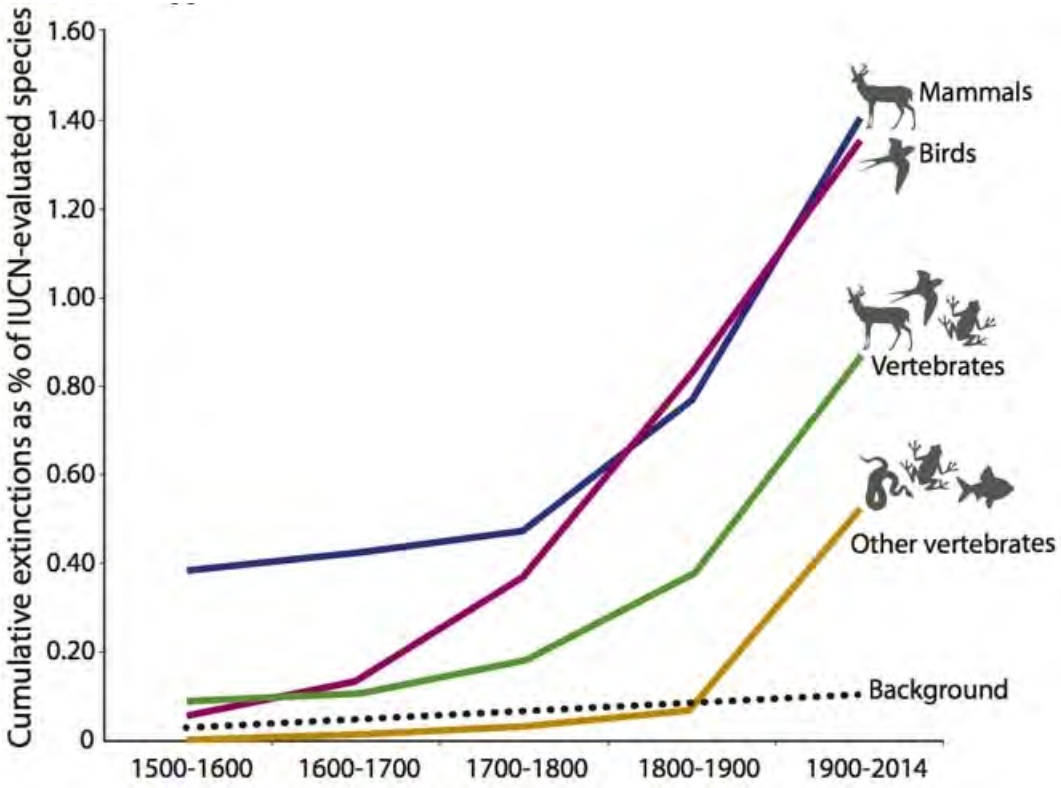


https://www.sciencedirect.com/science/article/pii/S2666033420300046

Impacts of warming (and other human activity)

(Impacts) Extinctions

6th Mass extinction is happening….



https://earth.org/data_visualization/the-6th-mass-extinction/

Next Class

- Risk to YOU
- Disaster preparedness – the important stuff!

https://www.freepik.com/free-photos-vectors/emergency-kit