

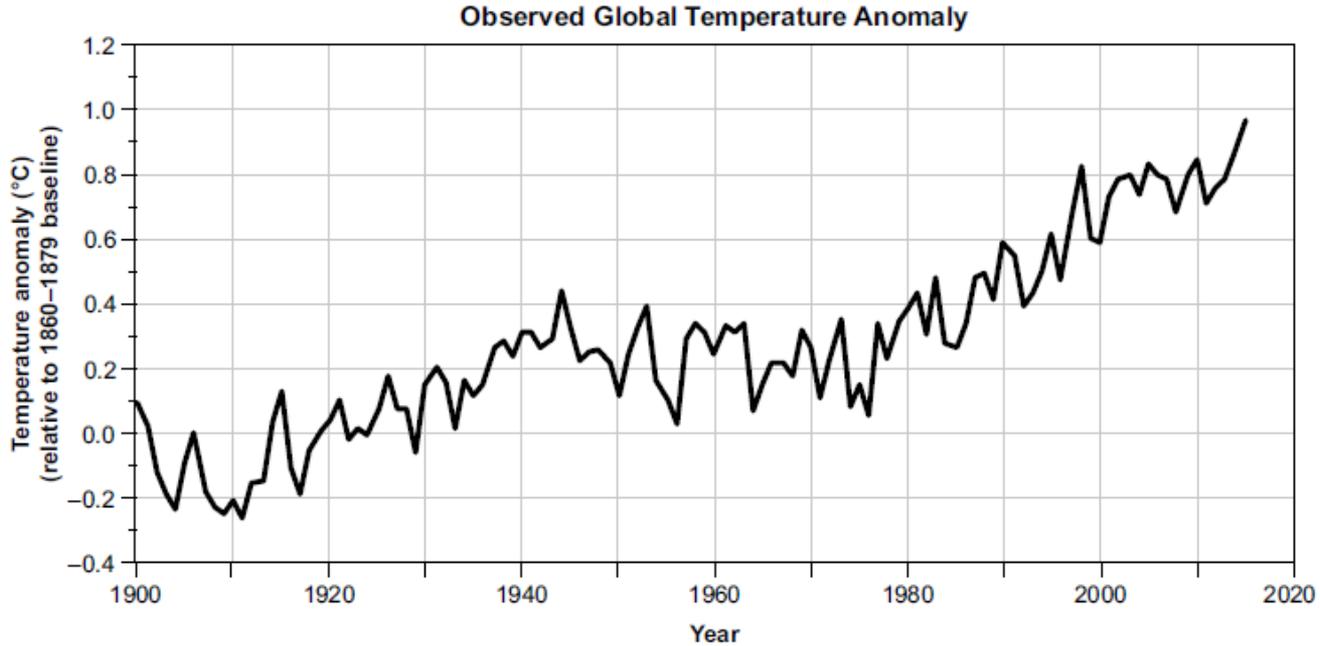
Evidence for Climate Change



Questions

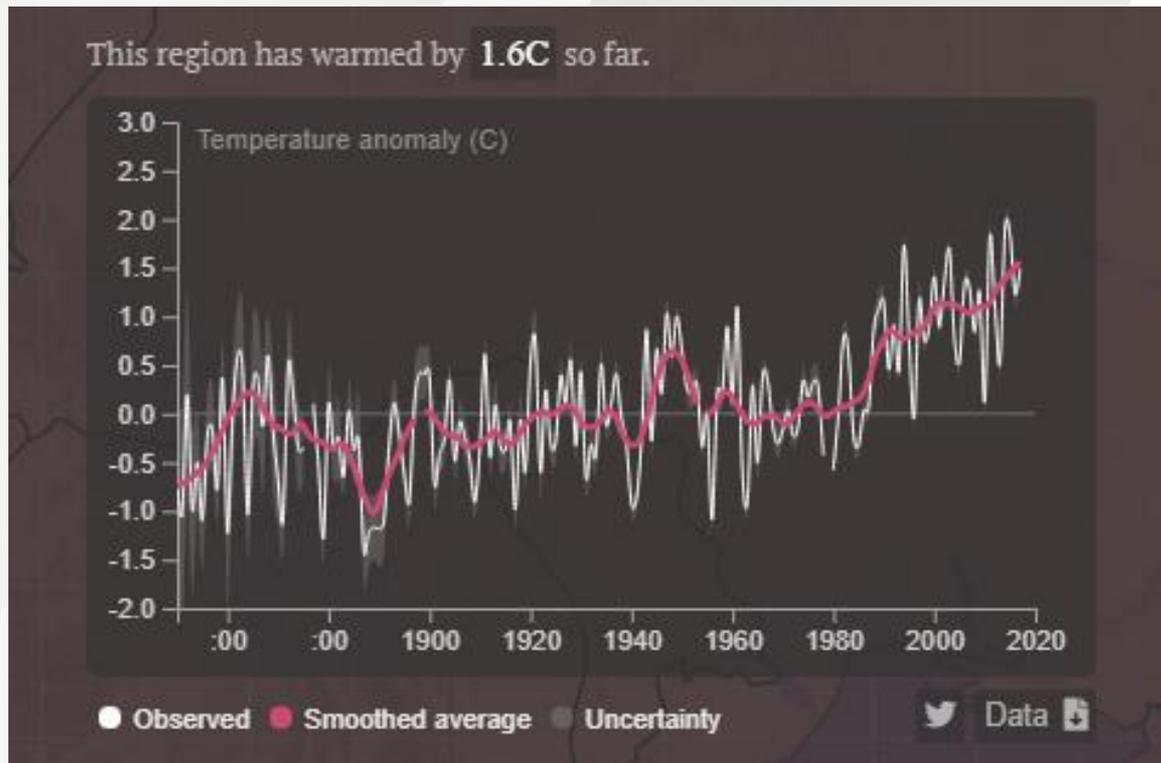
- What questions about climate change do you hear the most?
- What is the question that you are most worried about being asked?
- What is the question you have always wanted to ask?

Earth is getting warmer



Source: NASA GISS

Geneva is getting warmer



A few degrees may not seem like much...

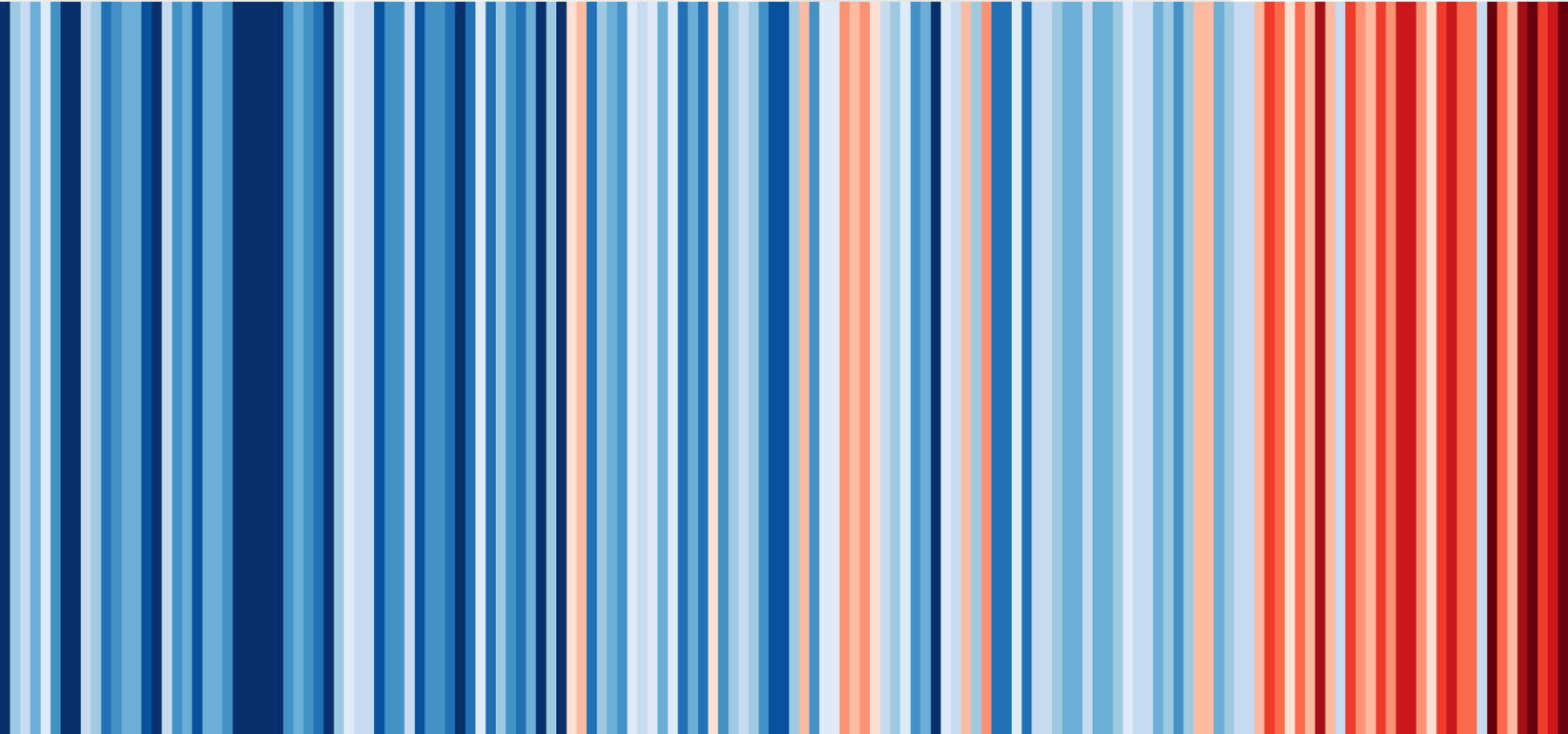


37°C = healthy

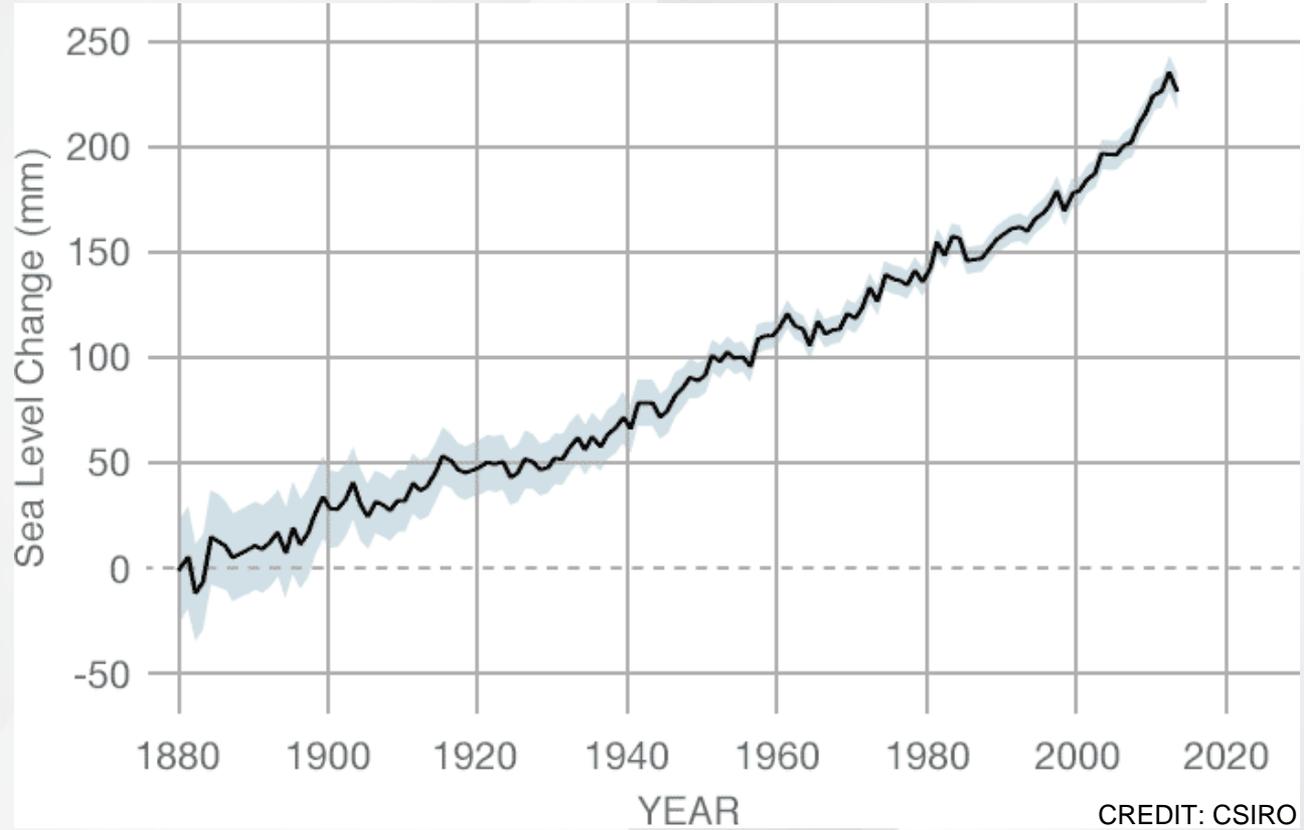


39°C = sick

Switzerland (1864 – 2018)

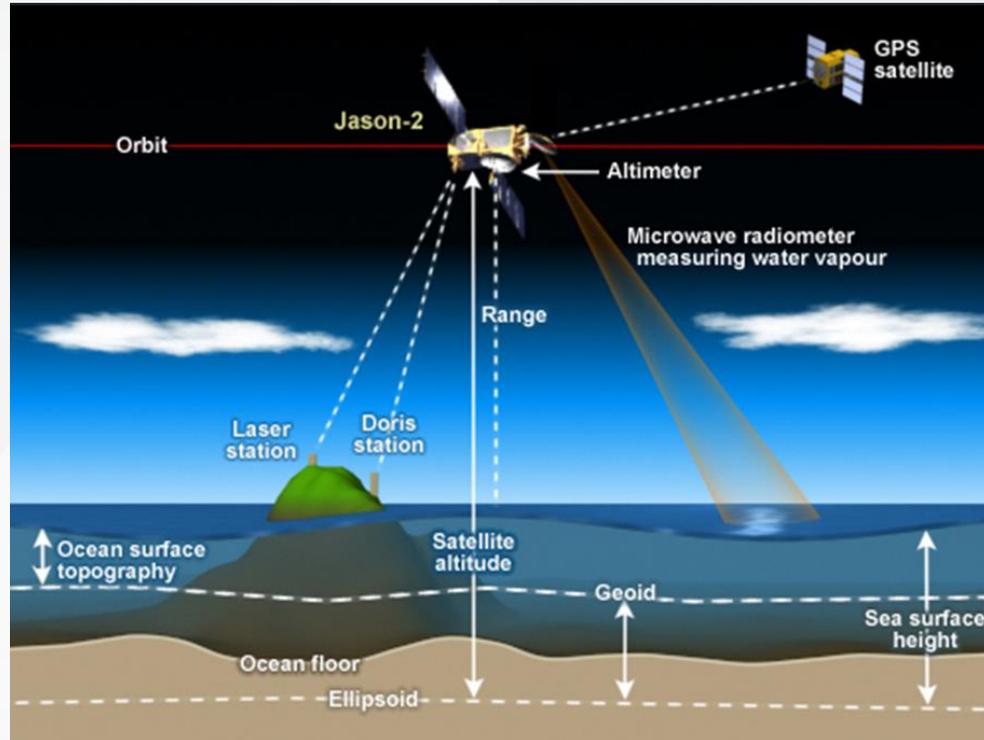


Sea Levels are rising



CREDIT: CSIRO

Satellite Altimetry: Measuring Sea Level



A few centimetres may not seem like much...



2004

Heat

- Predict
- Observe
- Explain
- Apply



Predict and Explain:
What happens when ice heats up?



Predict and Explain:
What happens when water heats up?



Predict and Explain:
What happens to the balloons?



Predict and Explain:
How will this feel?



A Climate Change demo

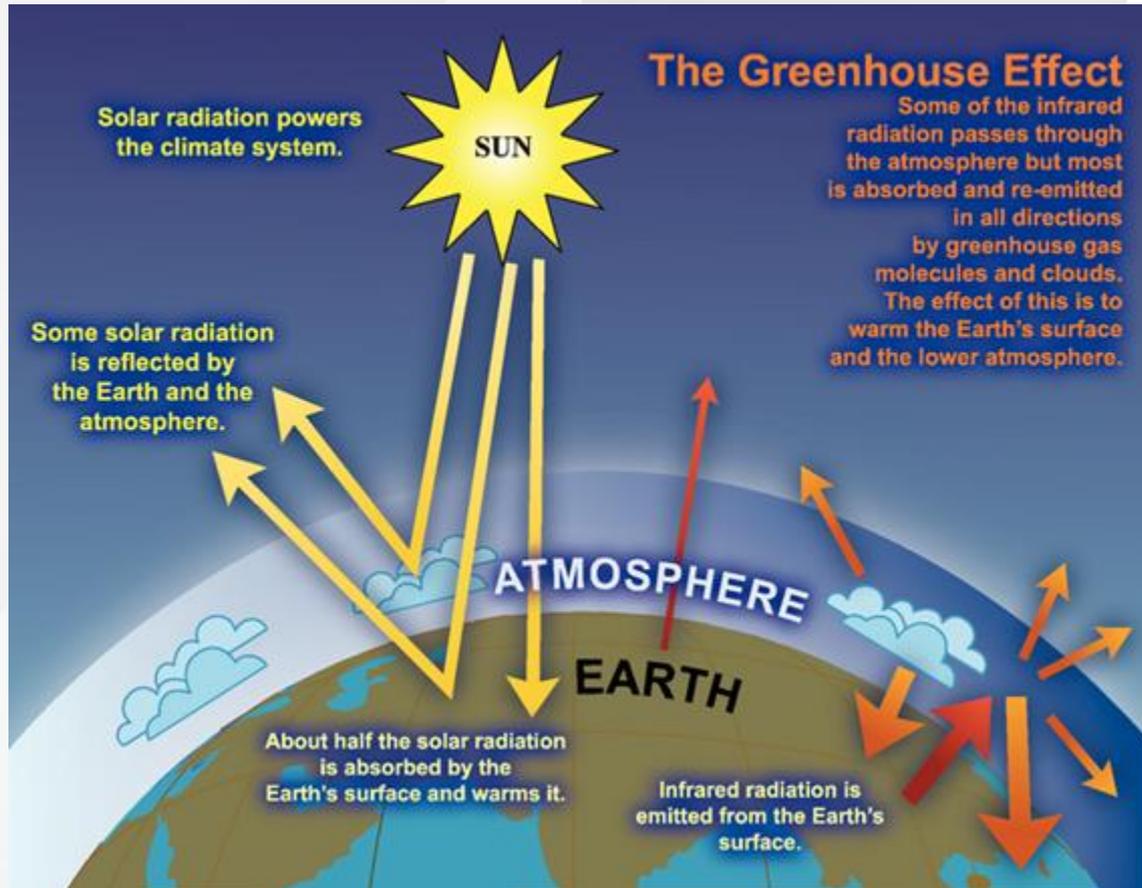
Download the Evidence for Climate Change resource and videos at:

<https://resources.perimeterinstitute.ca/>

How do these observations
relate to the Earth?



Earth's atmosphere traps heat



Keeling Curve

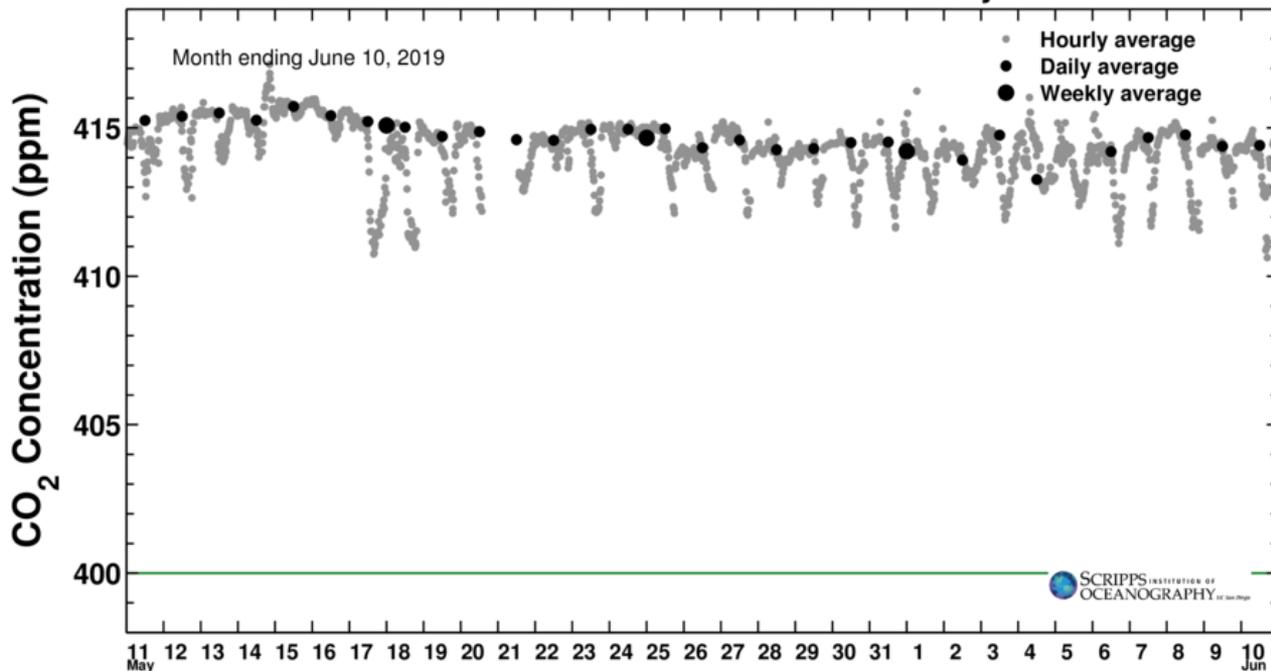
- Measurement of the concentration of CO₂ in the atmosphere
- Continuous record at Mauna Loa since 1958

One month

Latest CO₂ reading
June 10, 2019

414.41 ppm

Carbon dioxide concentration at Mauna Loa Observatory

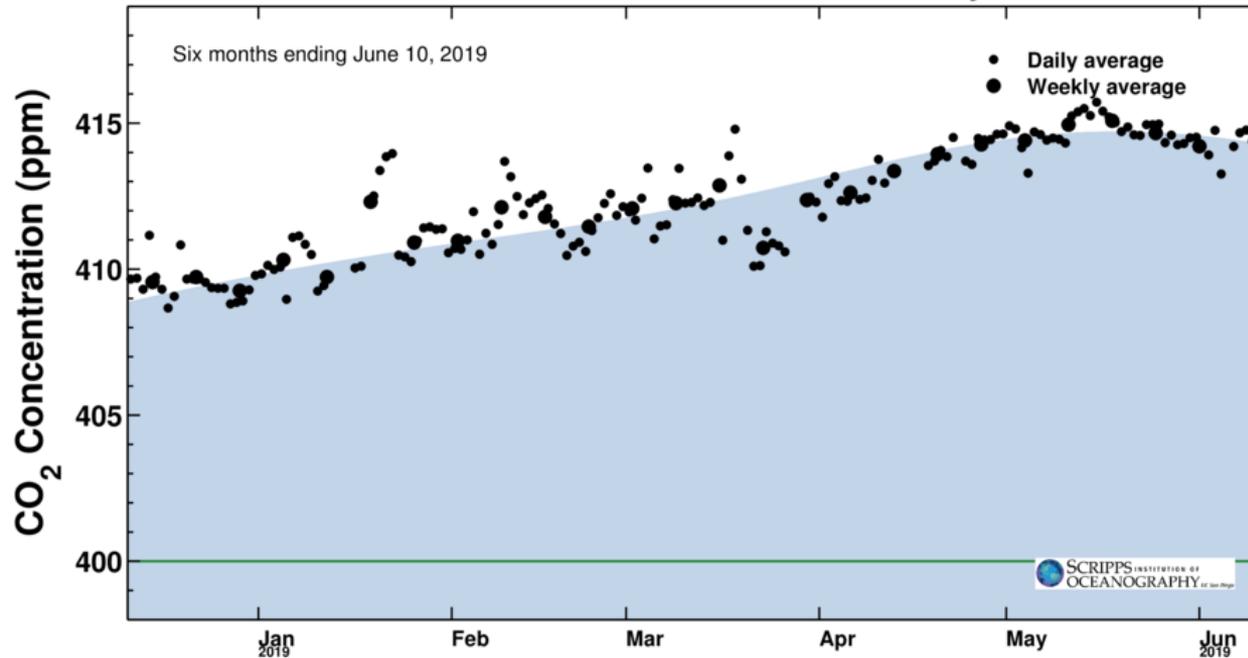


six months

Latest CO₂ reading
June 10, 2019

414.41 ppm

Carbon dioxide concentration at Mauna Loa Observatory

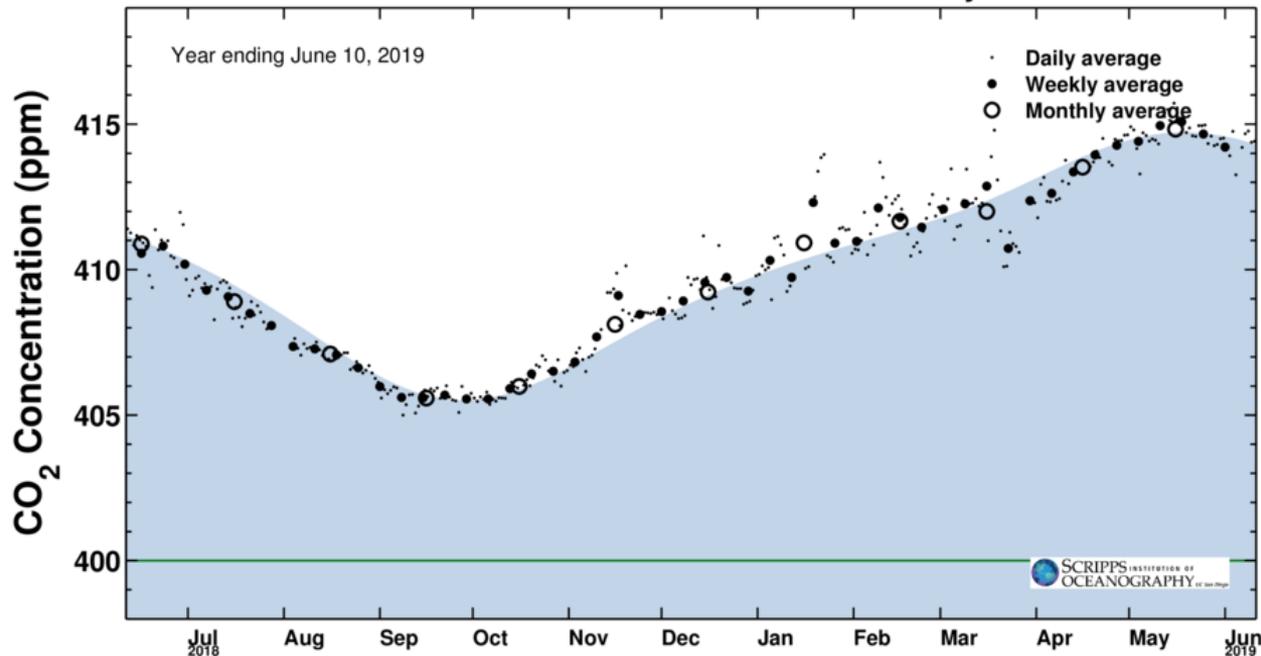


1 year

Latest CO₂ reading
June 10, 2019

414.41 ppm

Carbon dioxide concentration at Mauna Loa Observatory

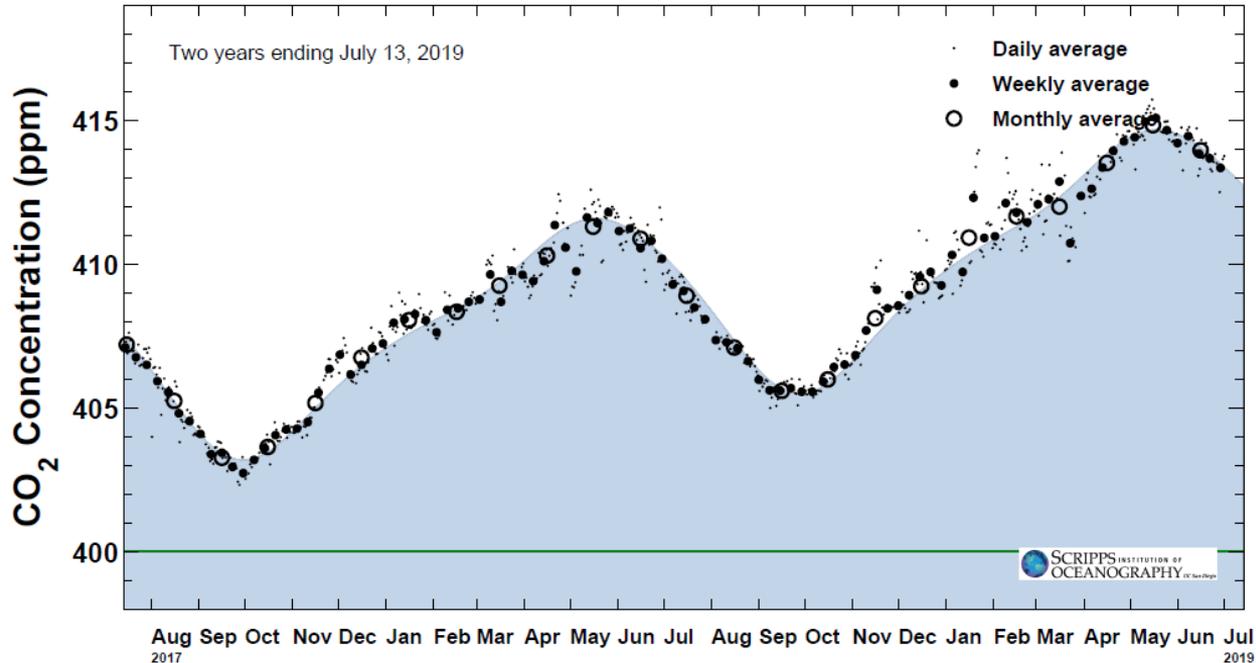


2 year

Latest CO₂ reading
July 01, 2019

413.76 ppm

Carbon dioxide concentration at Mauna Loa Observatory

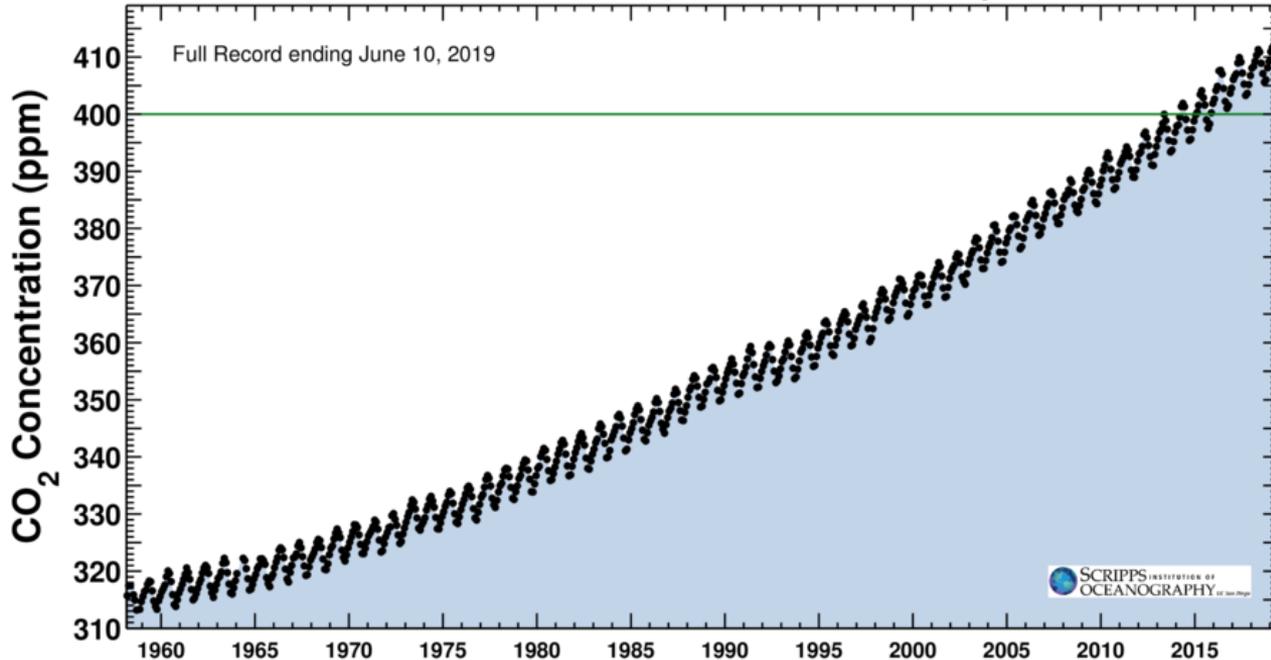


Full record

Latest CO₂ reading
June 10, 2019

414.41 ppm

Carbon dioxide concentration at Mauna Loa Observatory

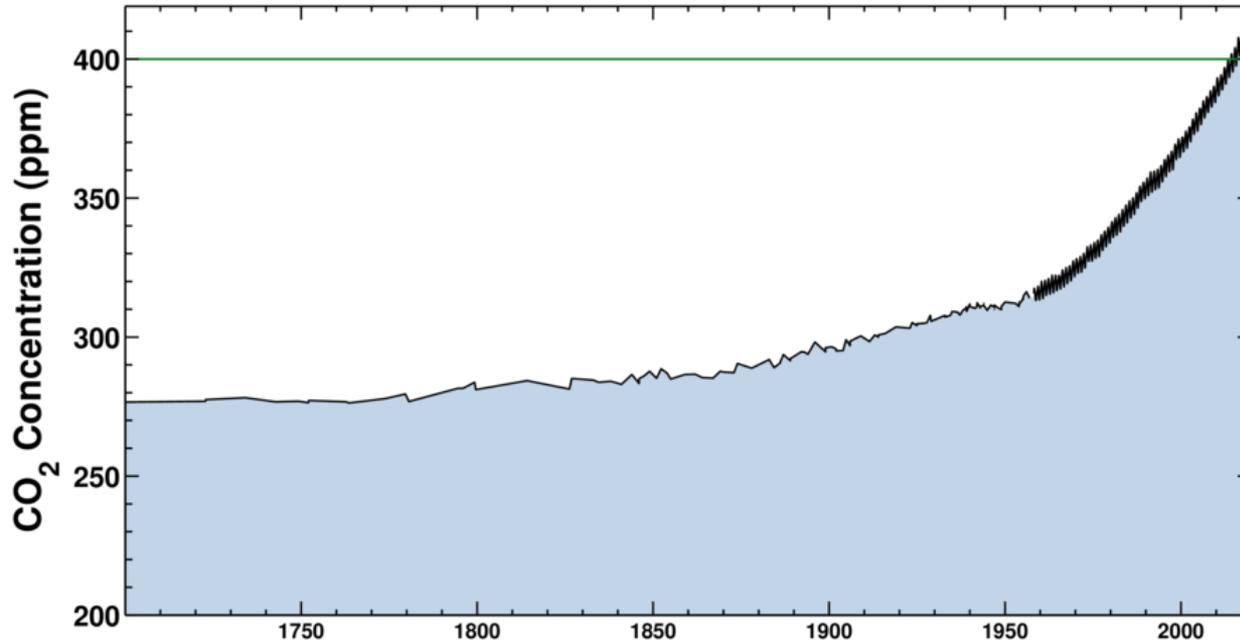


1700 - present

Latest CO₂ reading
June 10, 2019

414.41 ppm

Ice-core data before 1958. Mauna Loa data after 1958.

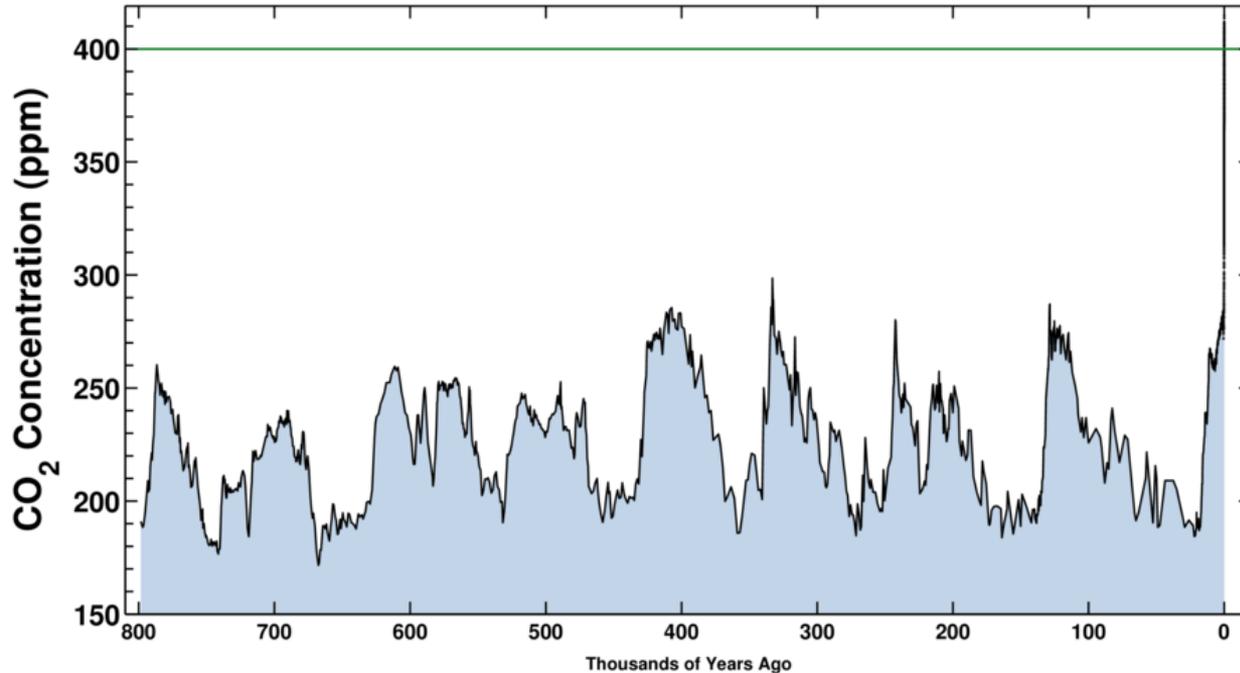


Last 800,000 years

Latest CO₂ reading
June 10, 2019

414.41 ppm

Ice-core data before 1958. Mauna Loa data after 1958.

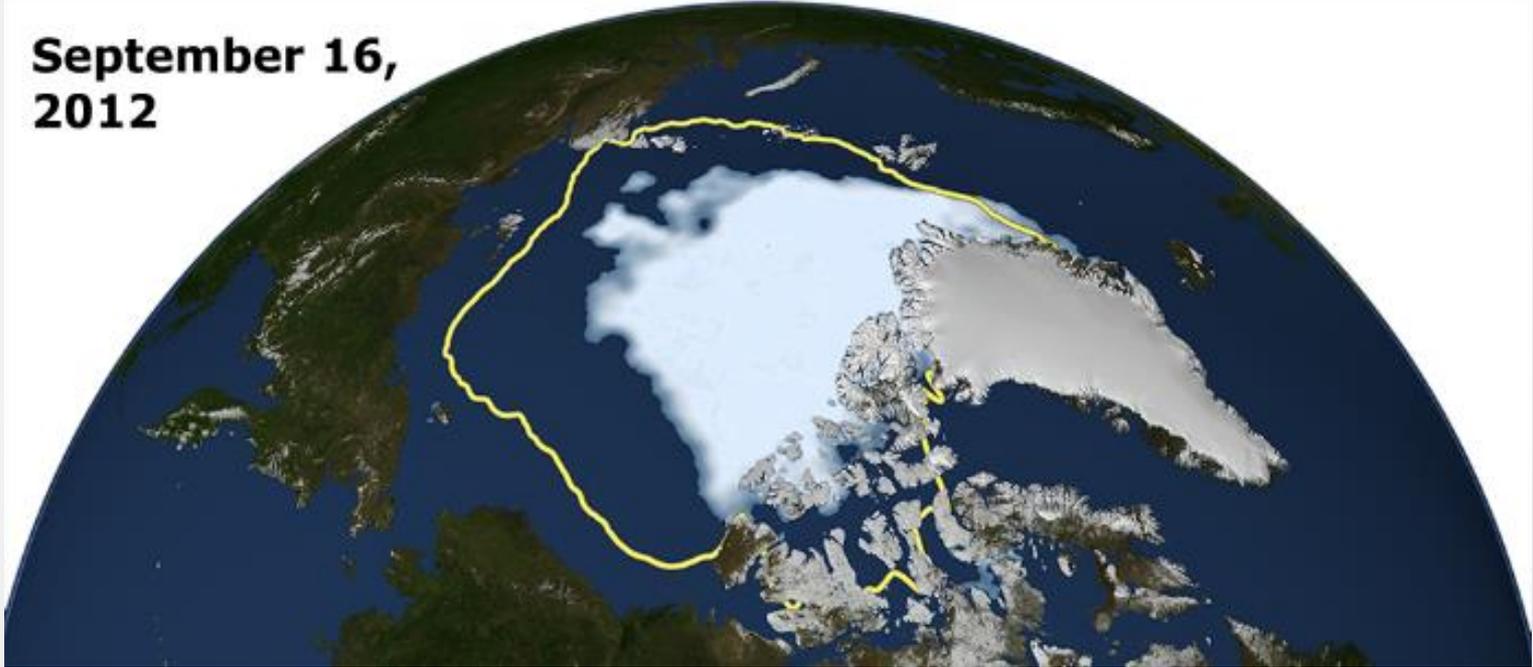


Observe and Explain



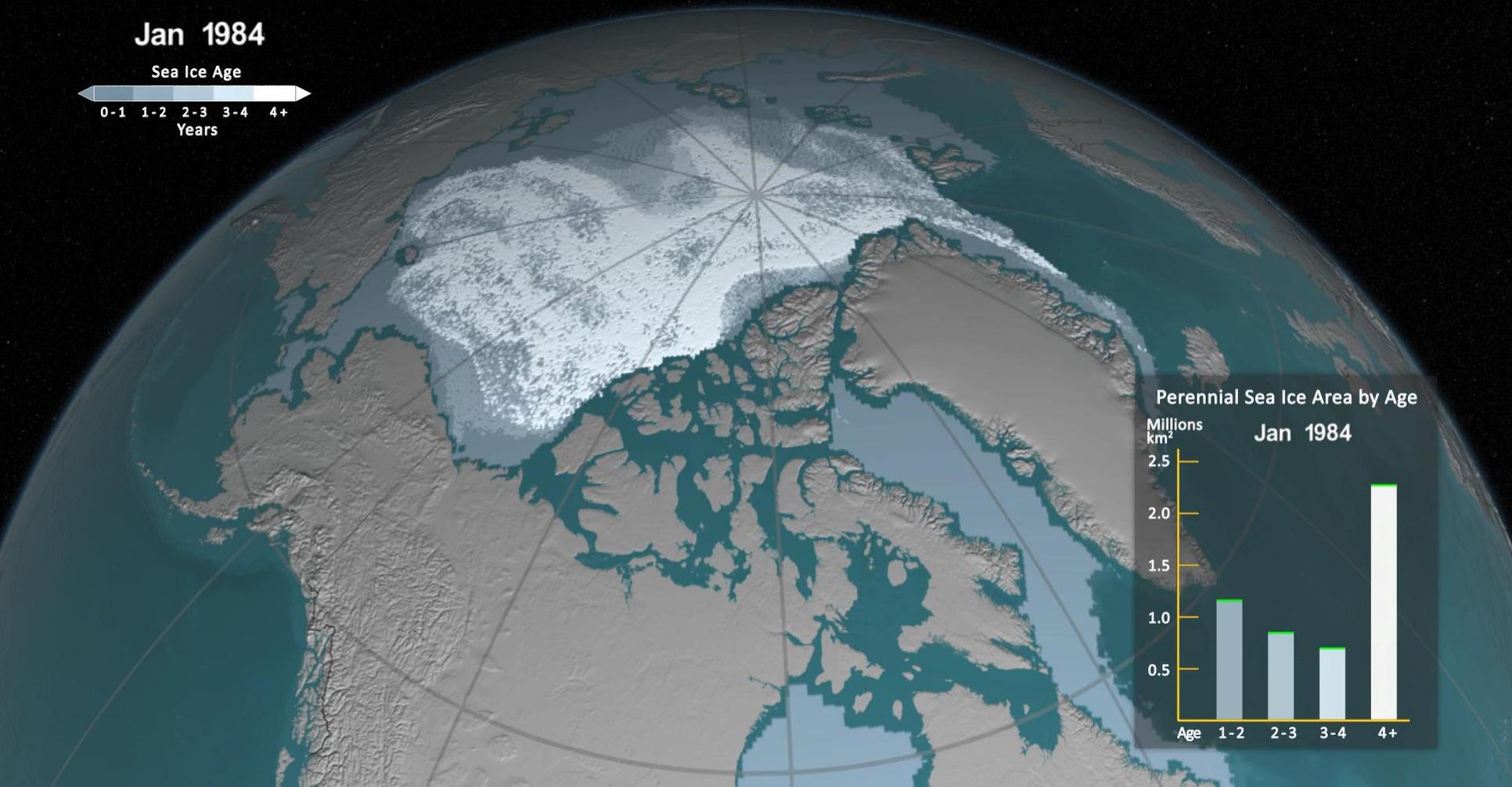
Apply: Less sea ice accelerates climate change

**September 16,
2012**

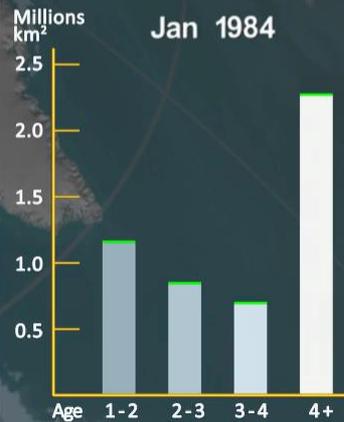


Jan 1984

Sea Ice Age



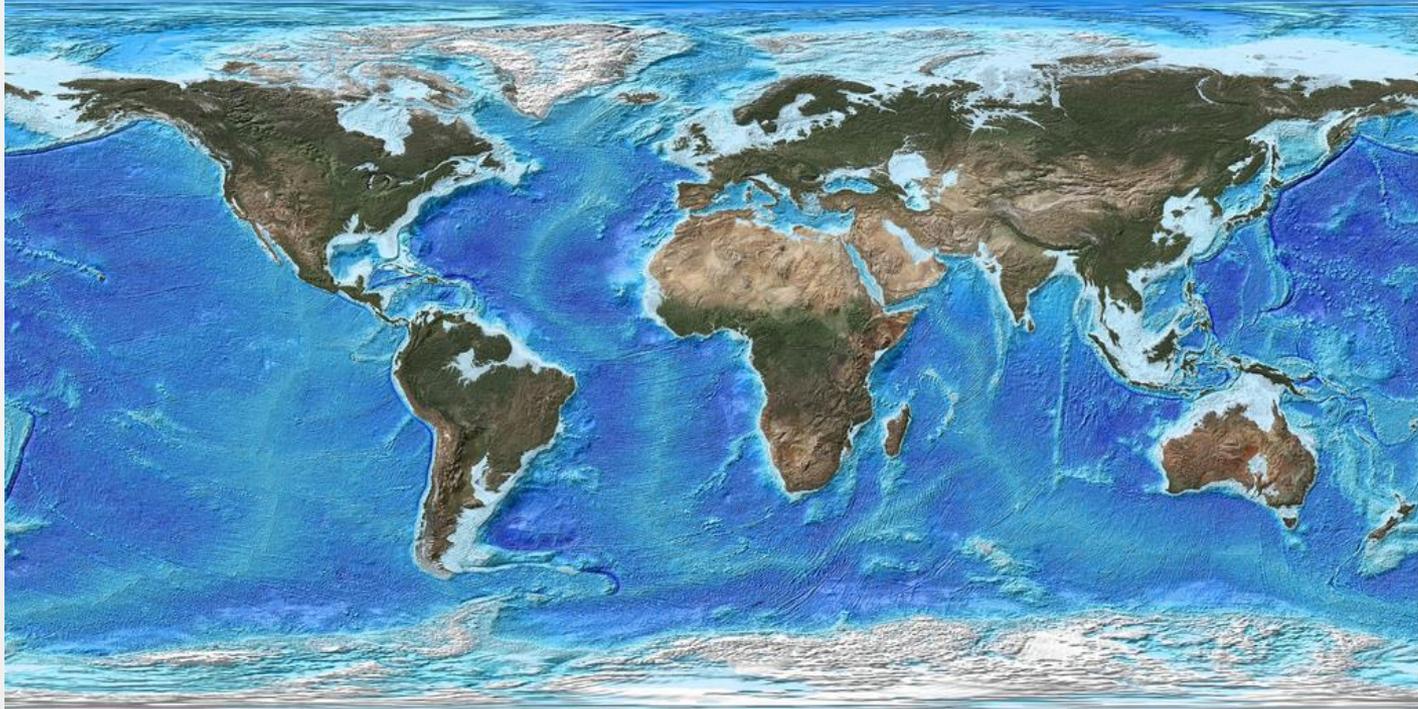
Perennial Sea Ice Area by Age



Observe and Explain

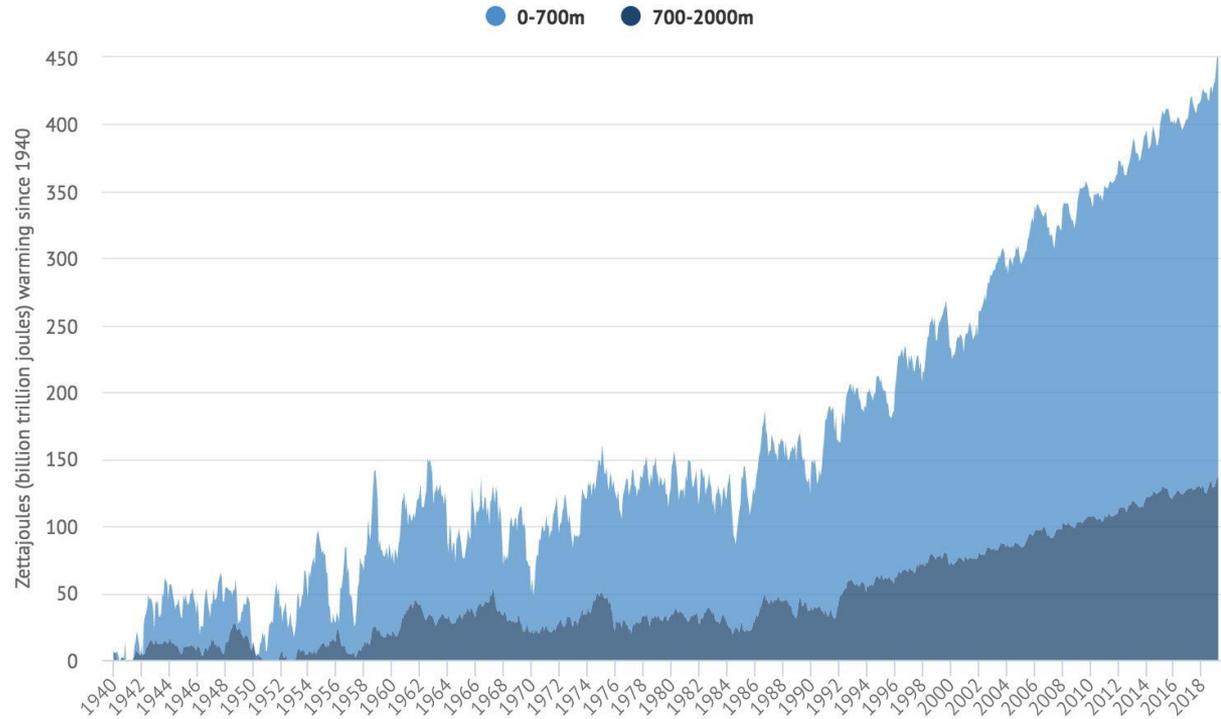


Apply:
70% of the Earth is covered by water



Oceans are hotter

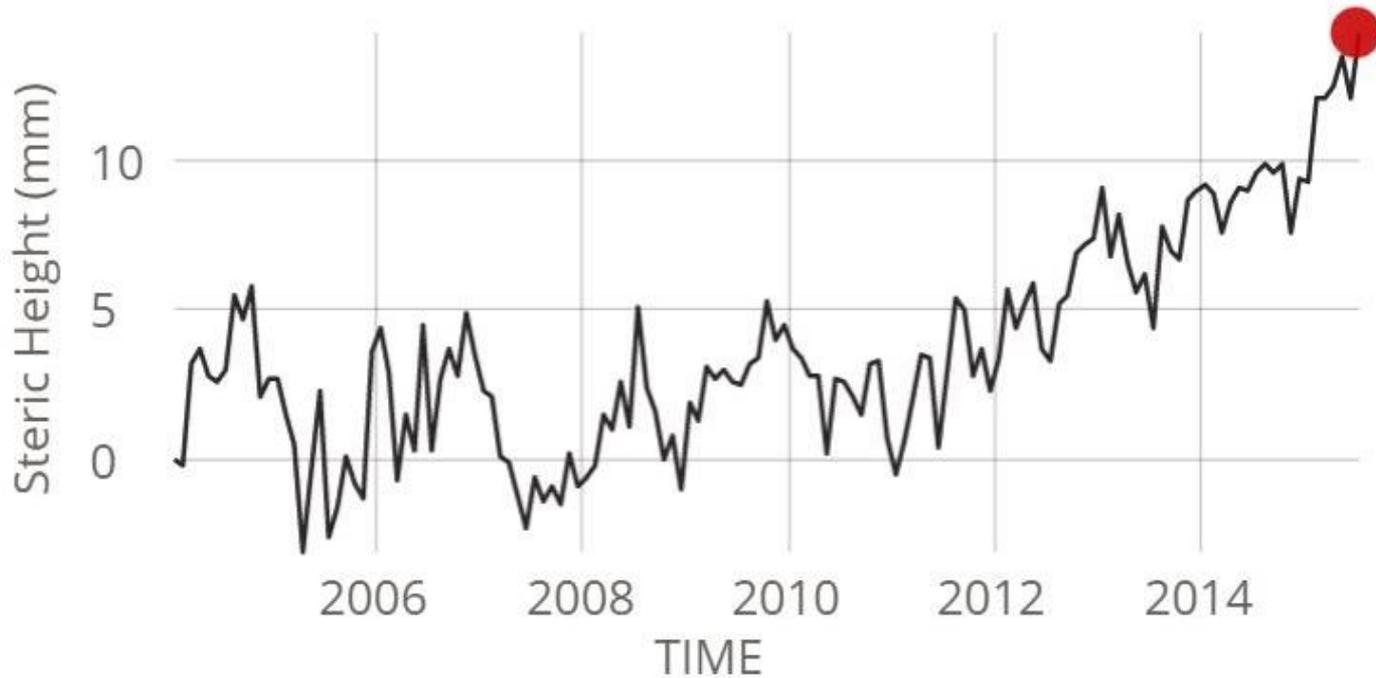
Global ocean heat content



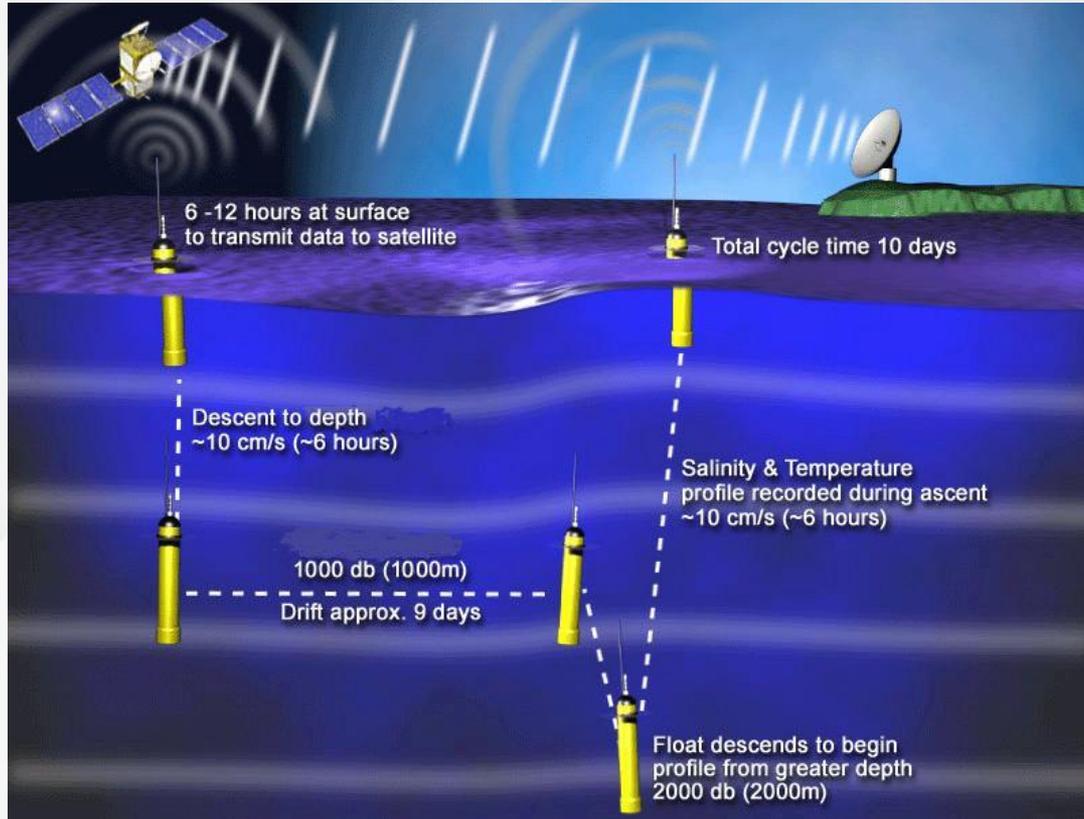
Observe and Explain



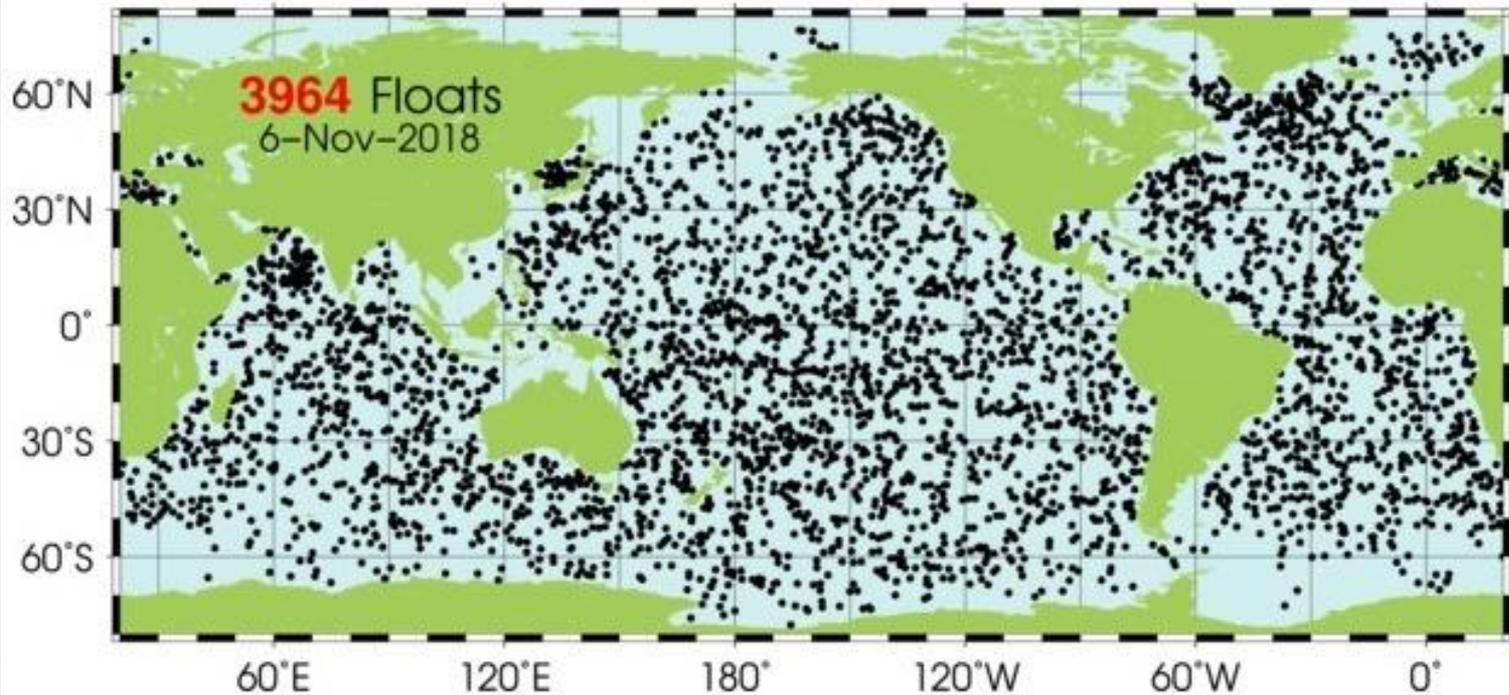
Apply: Measuring the Ocean's Volume



ARGO: Measuring the Ocean's Volume



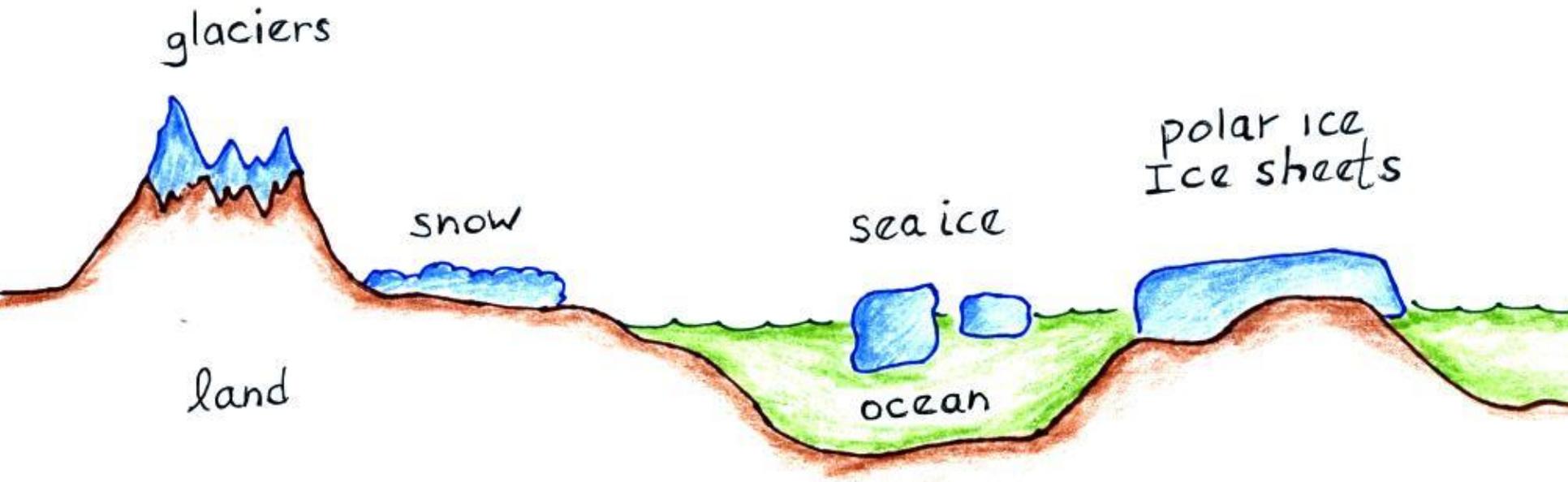
ARGO: Measuring the Ocean's Volume



Observe and Explain



Apply: Land Ice vs Sea Ice



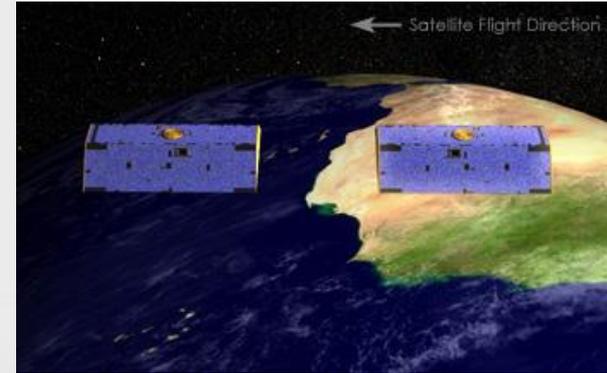
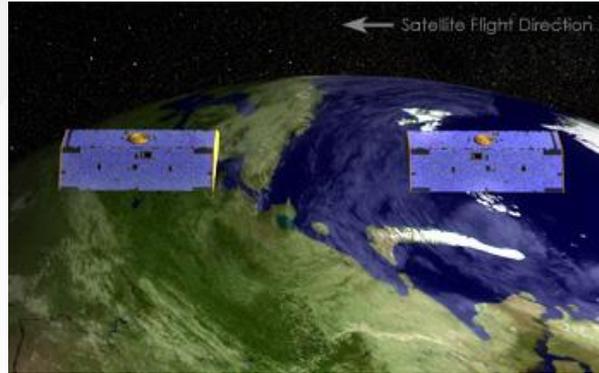
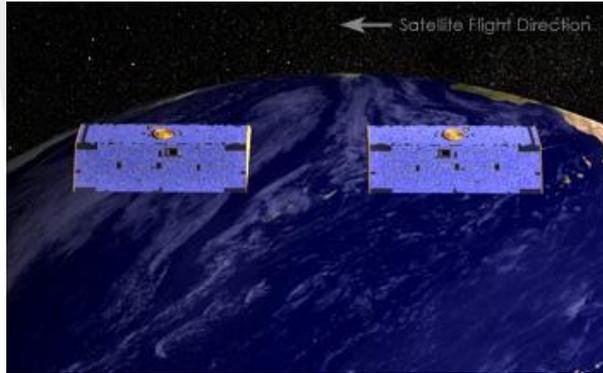


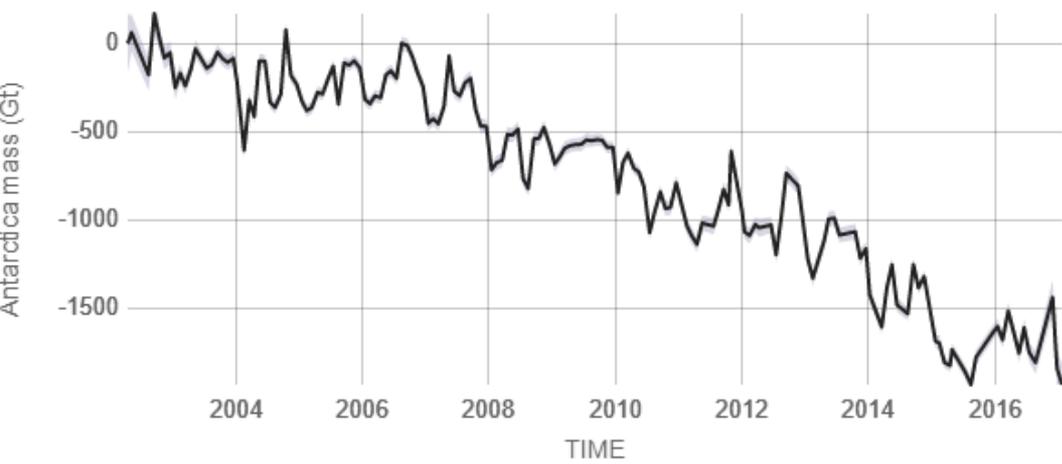
A melting ice berg does not cause a direct change in sea level



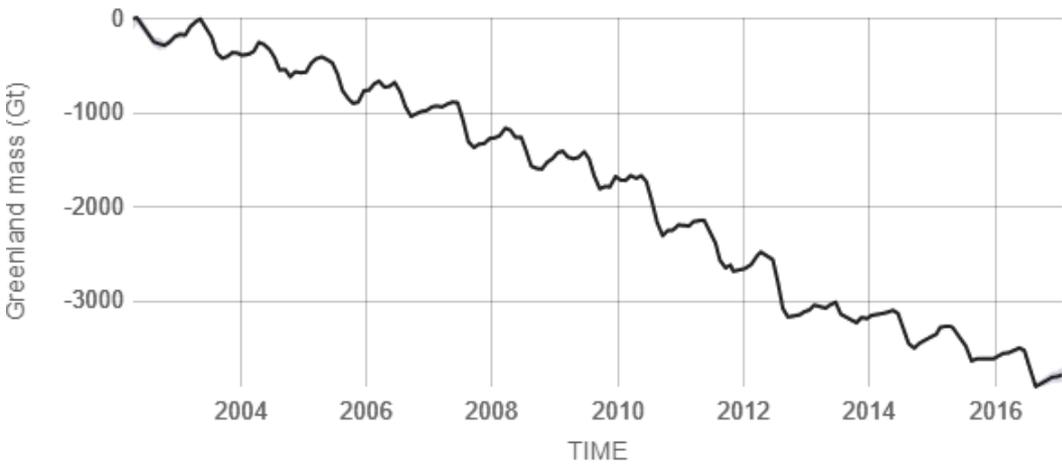
A melting glacier adds water to the ocean and causes a direct change in sea level

GRACE: Measuring Land Ice Mass





Source: climate.nasa.gov



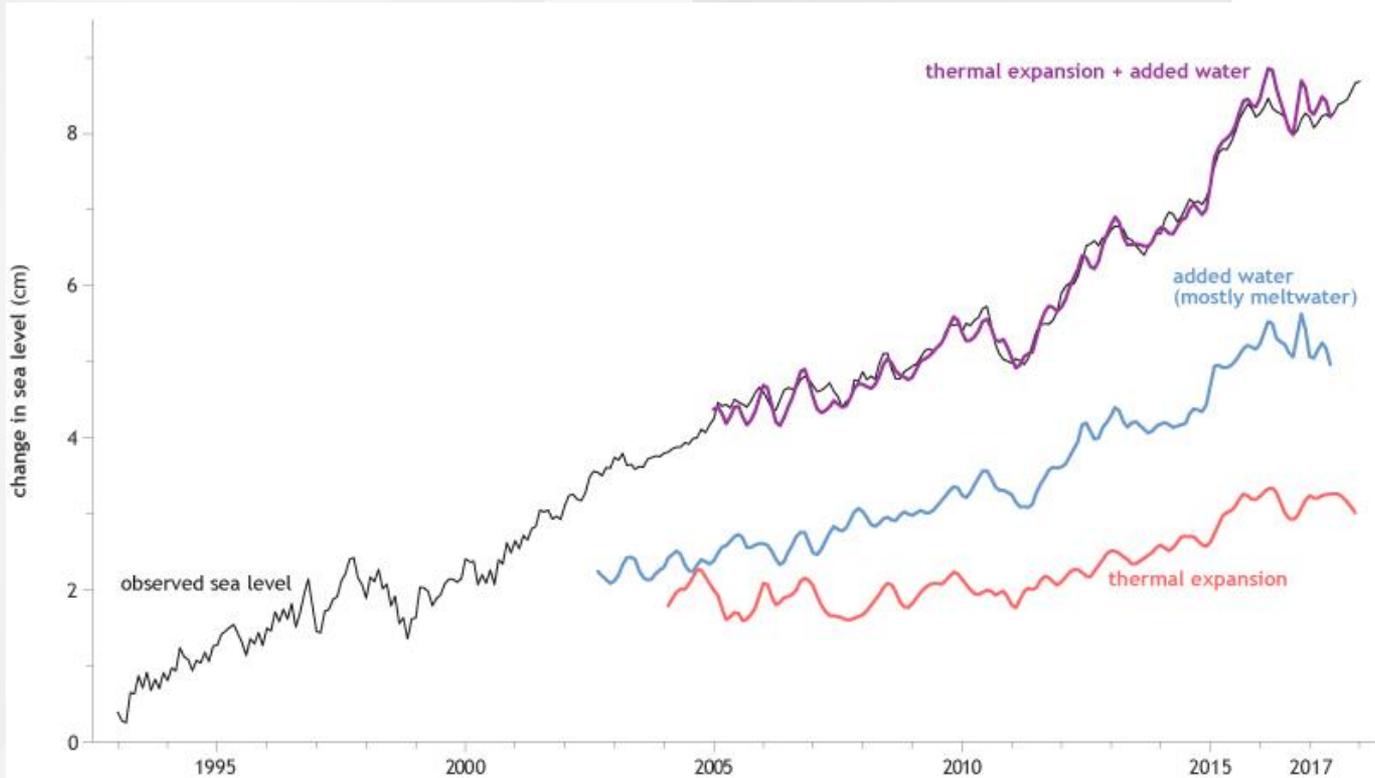
Source: climate.nasa.gov

Antarctica ice mass is decreasing at 127 Gt per year

> 400 Gt per year!

Greenland ice mass is decreasing at 286 Gt per year

Sea Level Budget



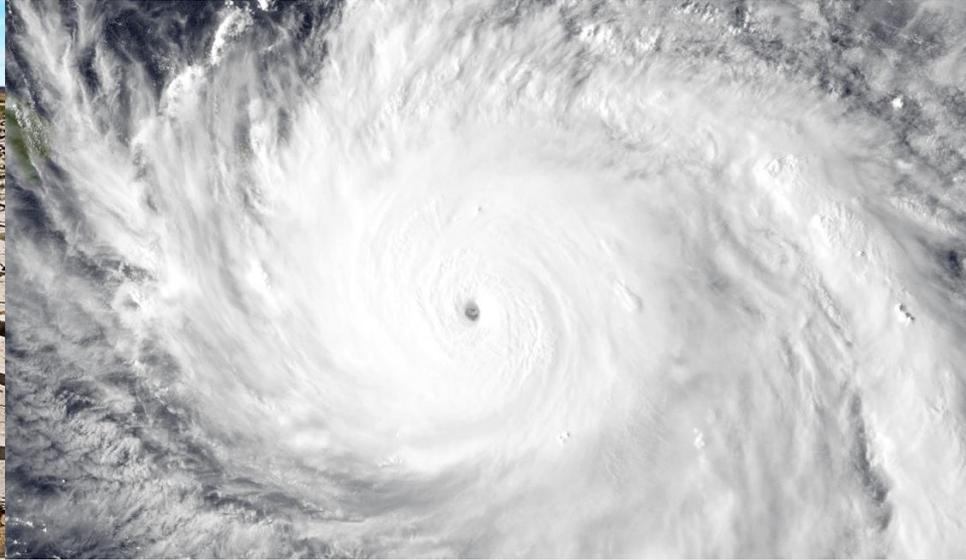
Effects of climate change

Increased flooding



Effects of climate change

More extreme weather events



Effects of climate change

More intense wildfires



Effects of climate change

Thawing permafrost



Effects of climate change

Spreading diseases



Climate Change



It's real...

It's us...

It's serious...

And the window of time to prevent dangerous impacts is closing fast.

Katharine Hayhoe, Texas Tech

Resources



DRAWDOWN.ORG

GLOBAL WEIRDING
WITH KATHARINE HAYHOE



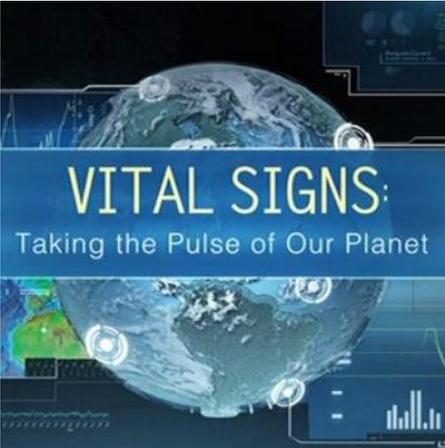
NEW EPISODES
EVERY OTHER WEDNESDAY
GLOBALWEIRDINGSERIES.COM KTTZ.ORG



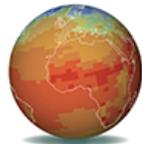
Skeptical



CarbonBrief
CLEAR ON CLIMATE



VITAL SIGNS:
Taking the Pulse of Our Planet



climateprediction.net

the world's largest climate modelling experiment for the 21st century

PI PERIMETER
INSTITUTE

Some positive things to consider:

- Ozone layer is recovering
- World bank no longer funding fossil fuel exploration
- Cost of batteries is falling rapidly
- UK is no longer using coal to generate electricity
- Students striking for climate action

Project Drawdown Top 10

1. Refrigerant Management (\$3M Global Cooling Prize)
2. Wind Turbines
3. Reduced Food Waste
4. Plant-Rich Diet
5. Tropical Forests
6. Educating Girls
7. Family Planning
8. Solar Farms
9. Silvopasture
10. Rooftop Solar



Simple actions you can take:

- Talk about Climate Change
- Reduce your own personal footprint
 - Transportation and energy choices
 - Carbon offsets
 - Dietary choices
- Lobby for systemic change
 - Political, social, economic