

On the causes and impacts of anthropogenic climate change as a result of an increase in greenhouse gases affecting the top of the atmosphere energy balance

By Tom Di Liberto^{1*}

1. Innovim – NOAA/NWS/Climate Prediction Center

* All statements made reflect the thoughts and opinions of Tom Di Liberto and not that of his employer. Have a nice day.



Climate Change:

The who?, what? and huh?
of humankind's greatest
challenge

Tom Di Liberto



@TDiLiberto

When climate's got you down





Future Meteorologist!

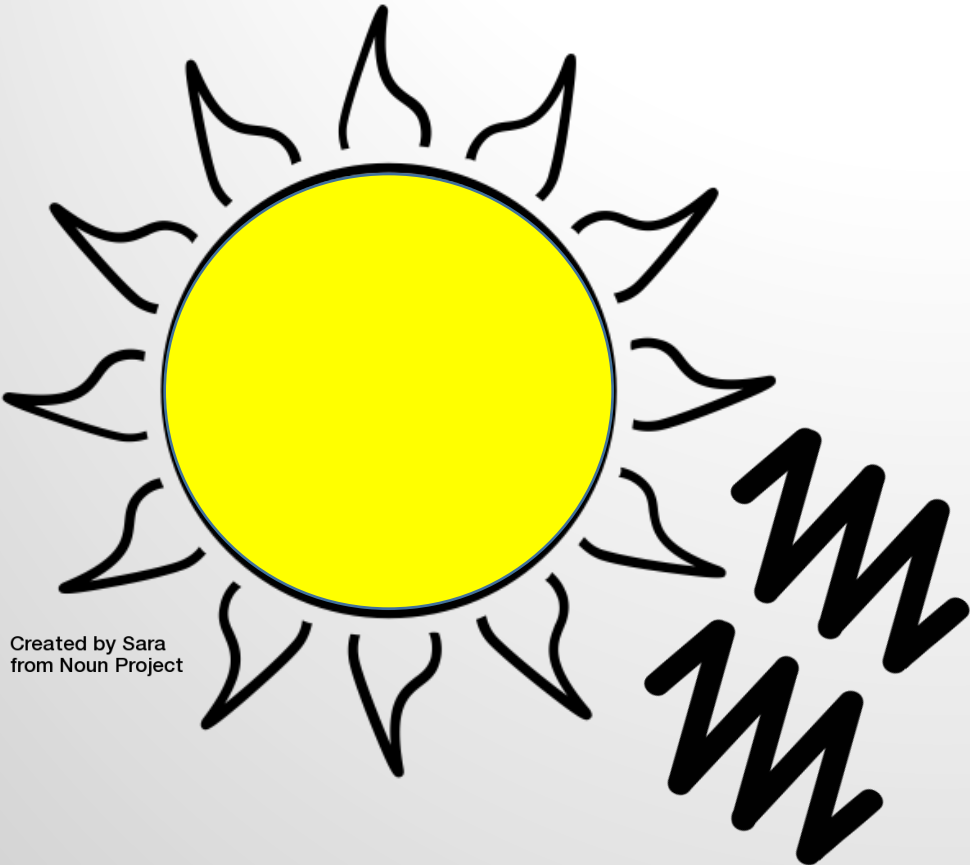
Age 4



12 13 '88



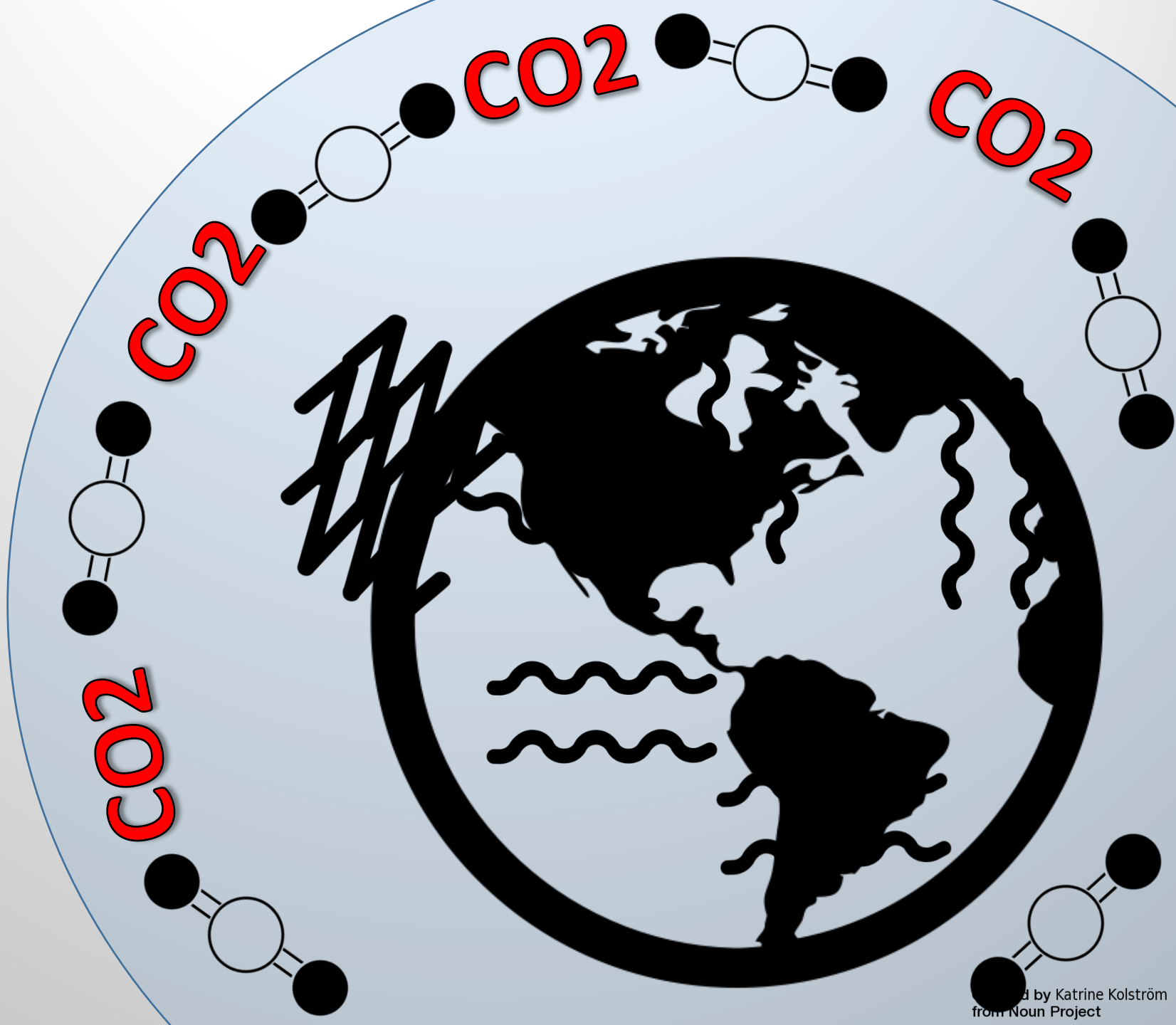
Future whatever he wants
Age: 10 months

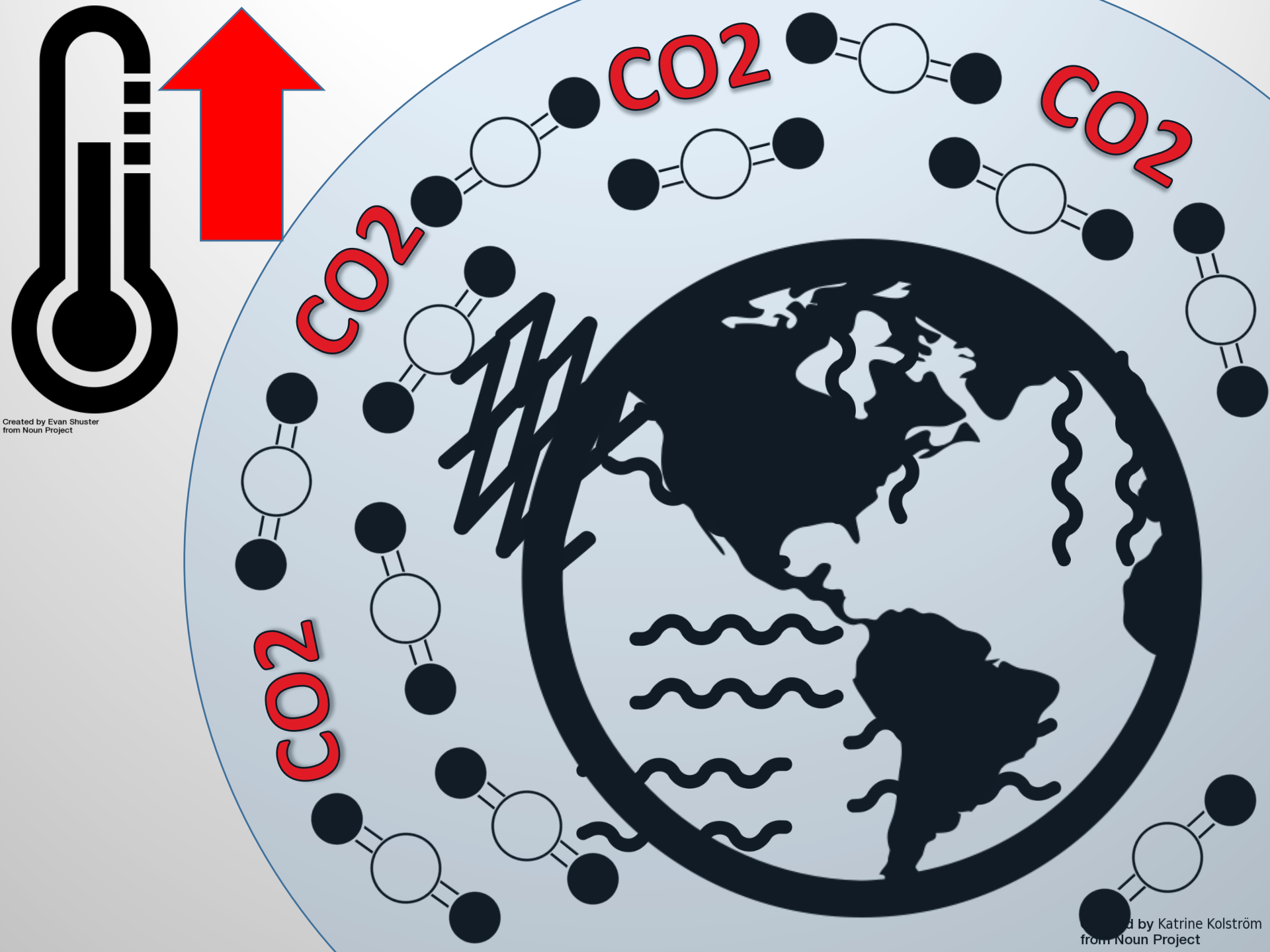


Created by Sara
from Noun Project



Created by Katrine Kolström
from Noun Project



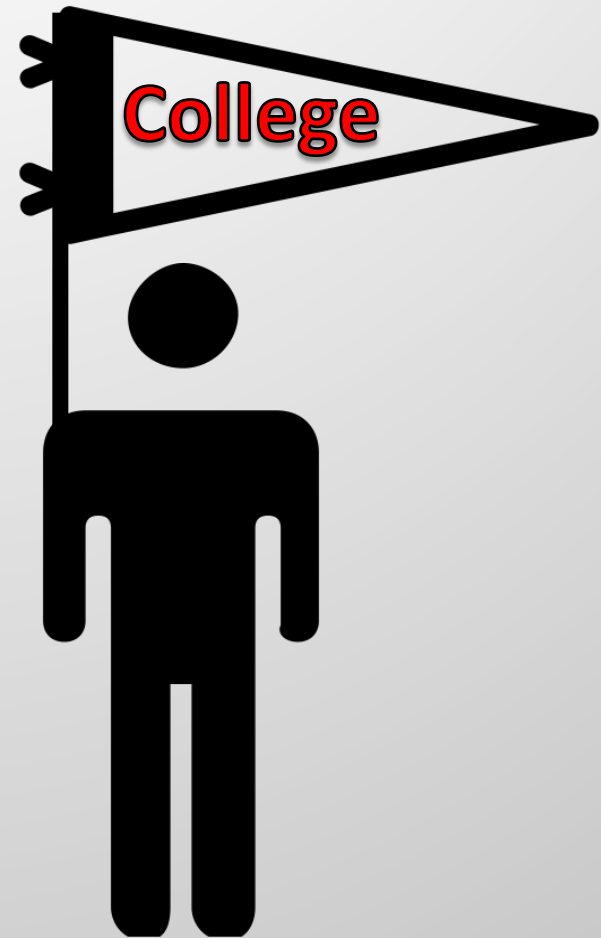


Created by Evan Shuster
from Noun Project

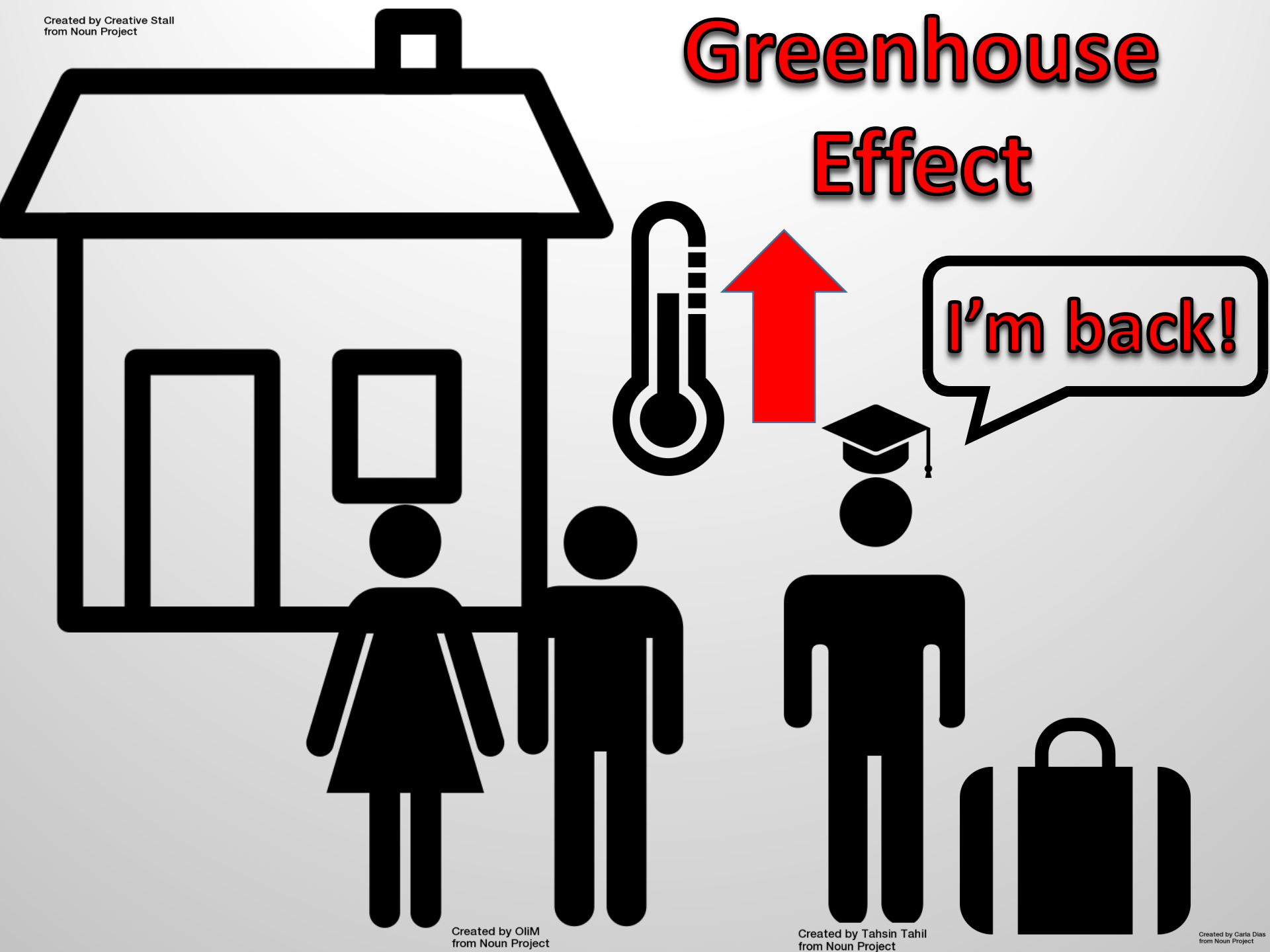
Created by Katrine Kolström
from Noun Project



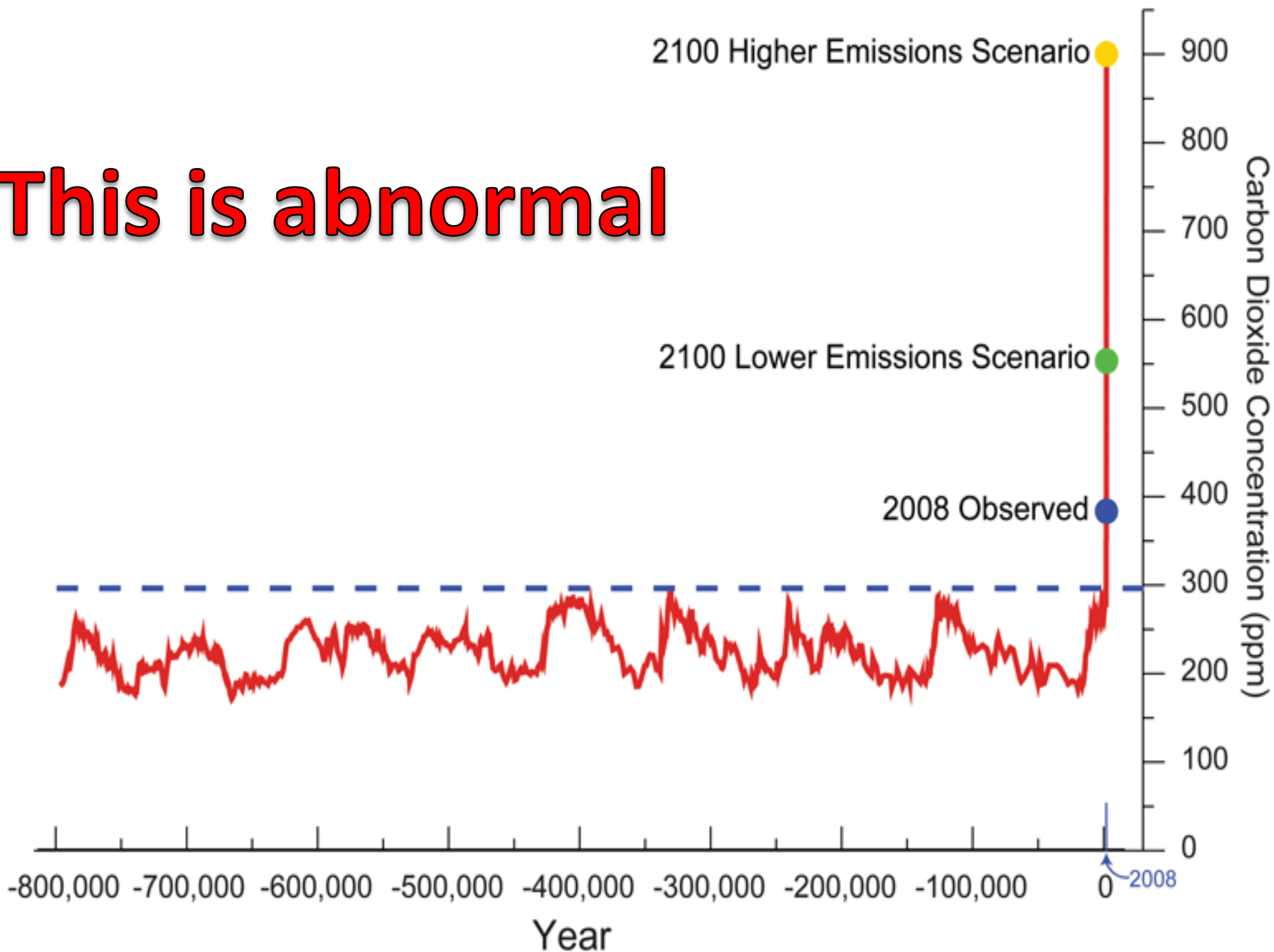
Greenhouse Effect



Greenhouse Effect



This is abnormal



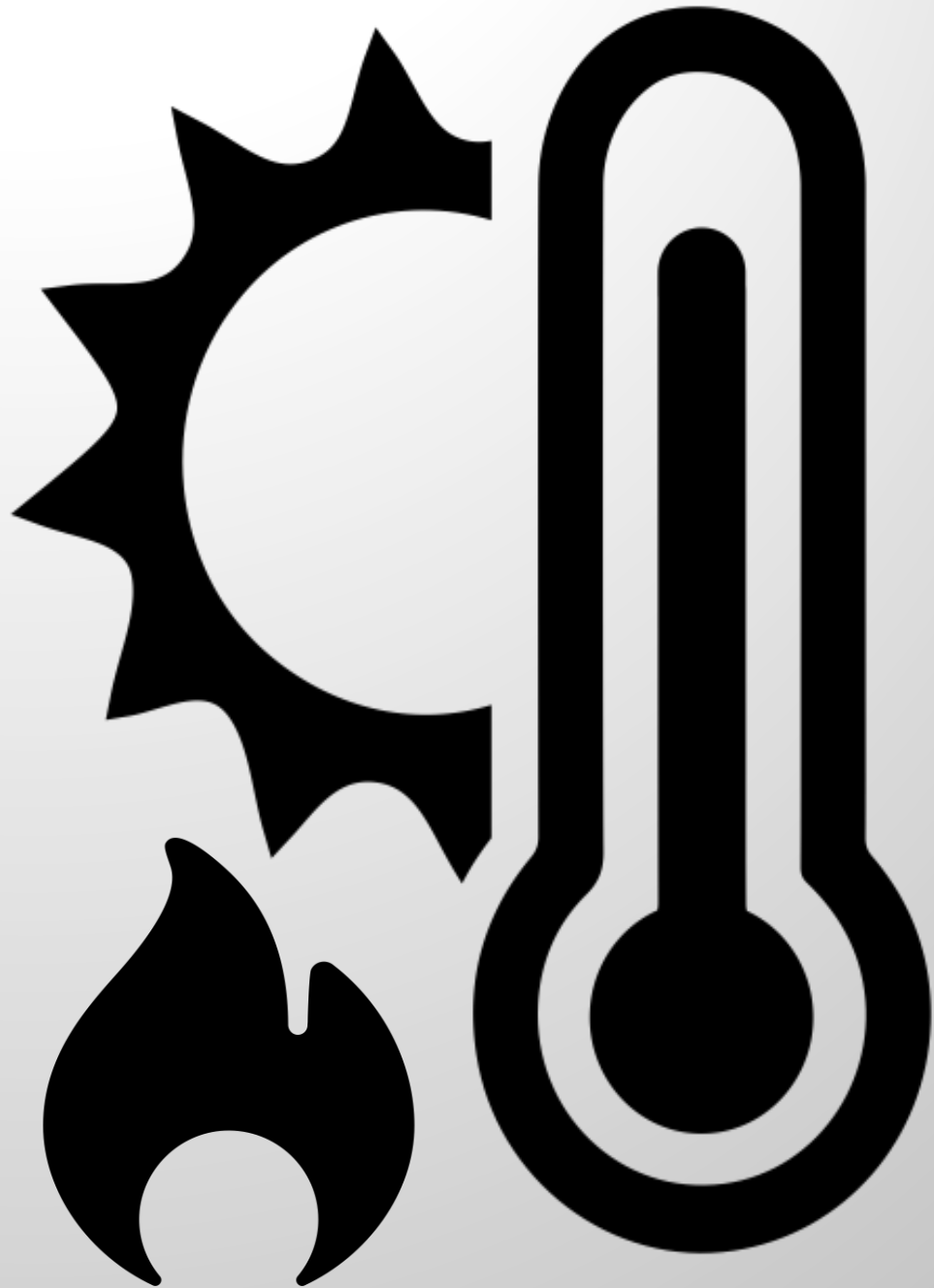
Australopithecus afarensis



My great x 50,000 grandparent

Very hot

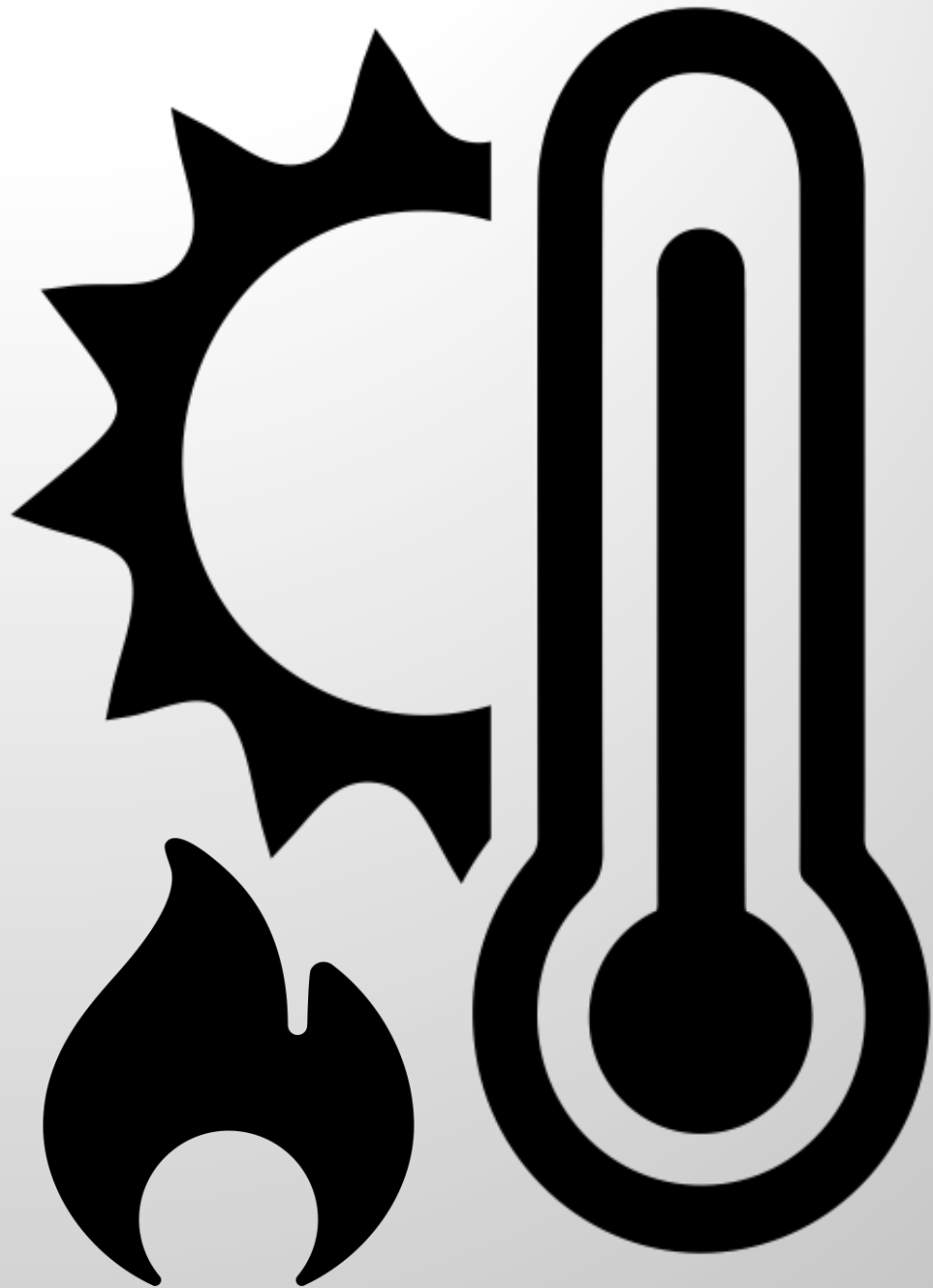
#1: 2014



Very hot

#1: 2015

#2: 2014



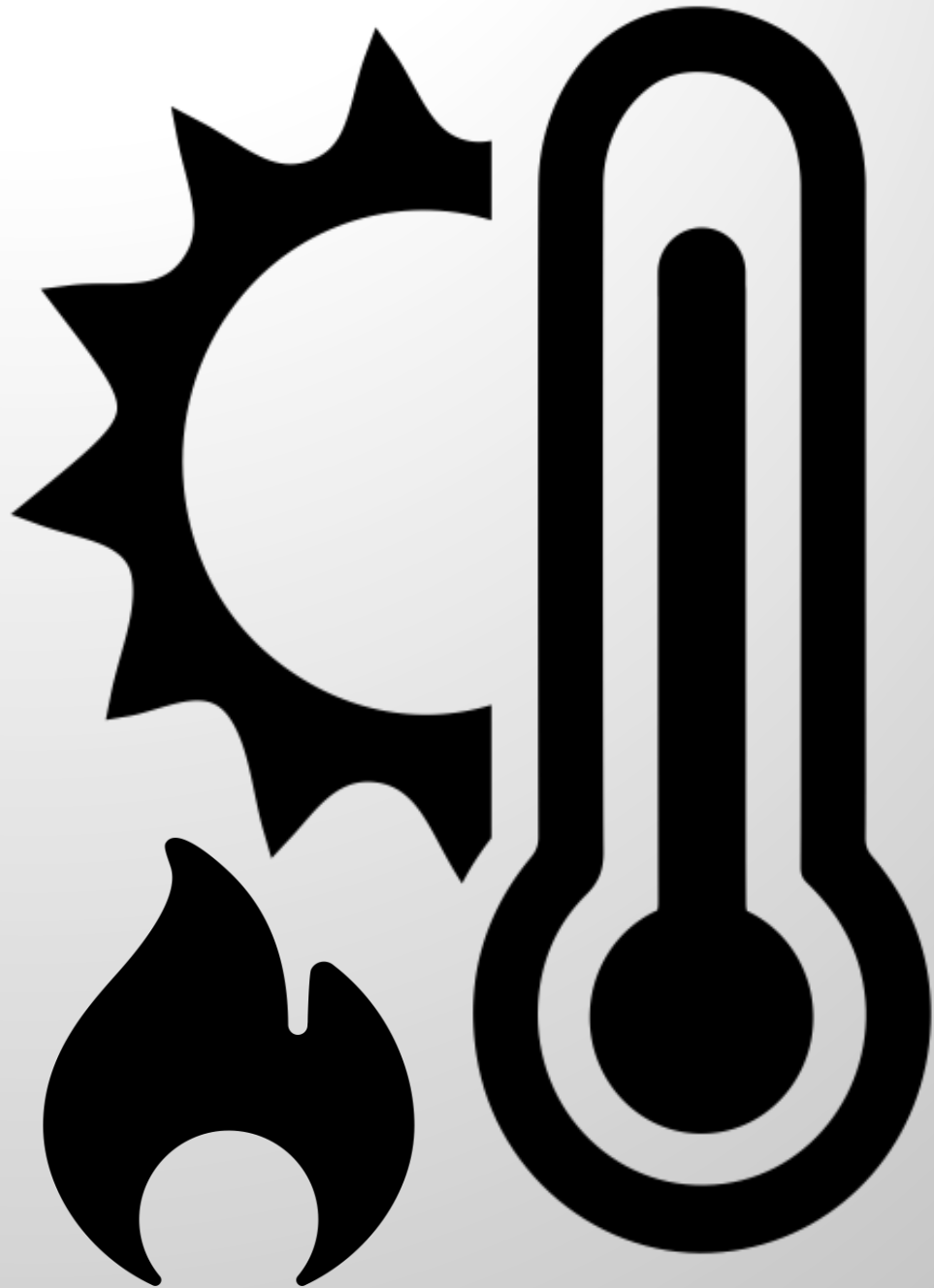
Very hot

Likely

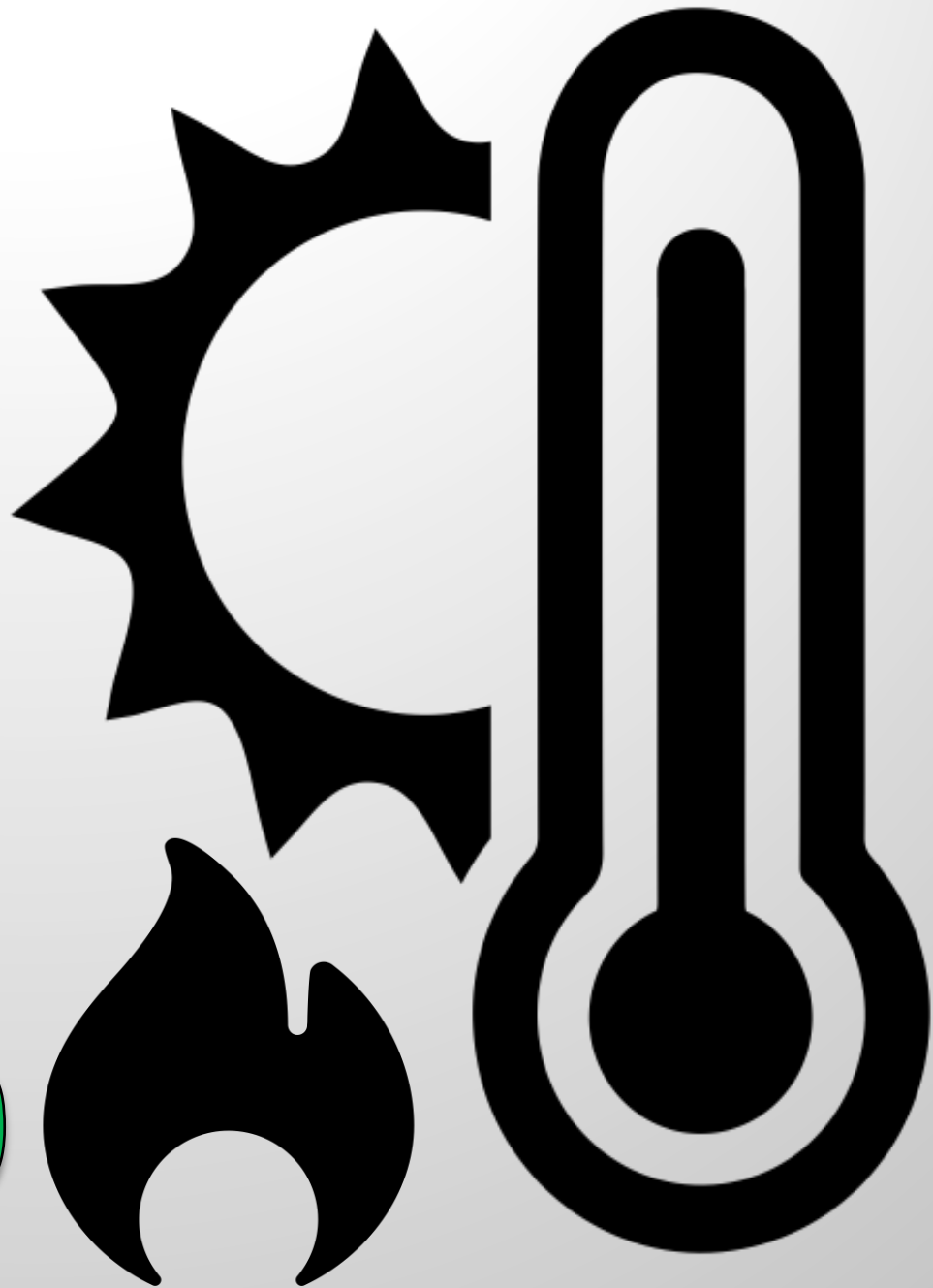
#1: 2016

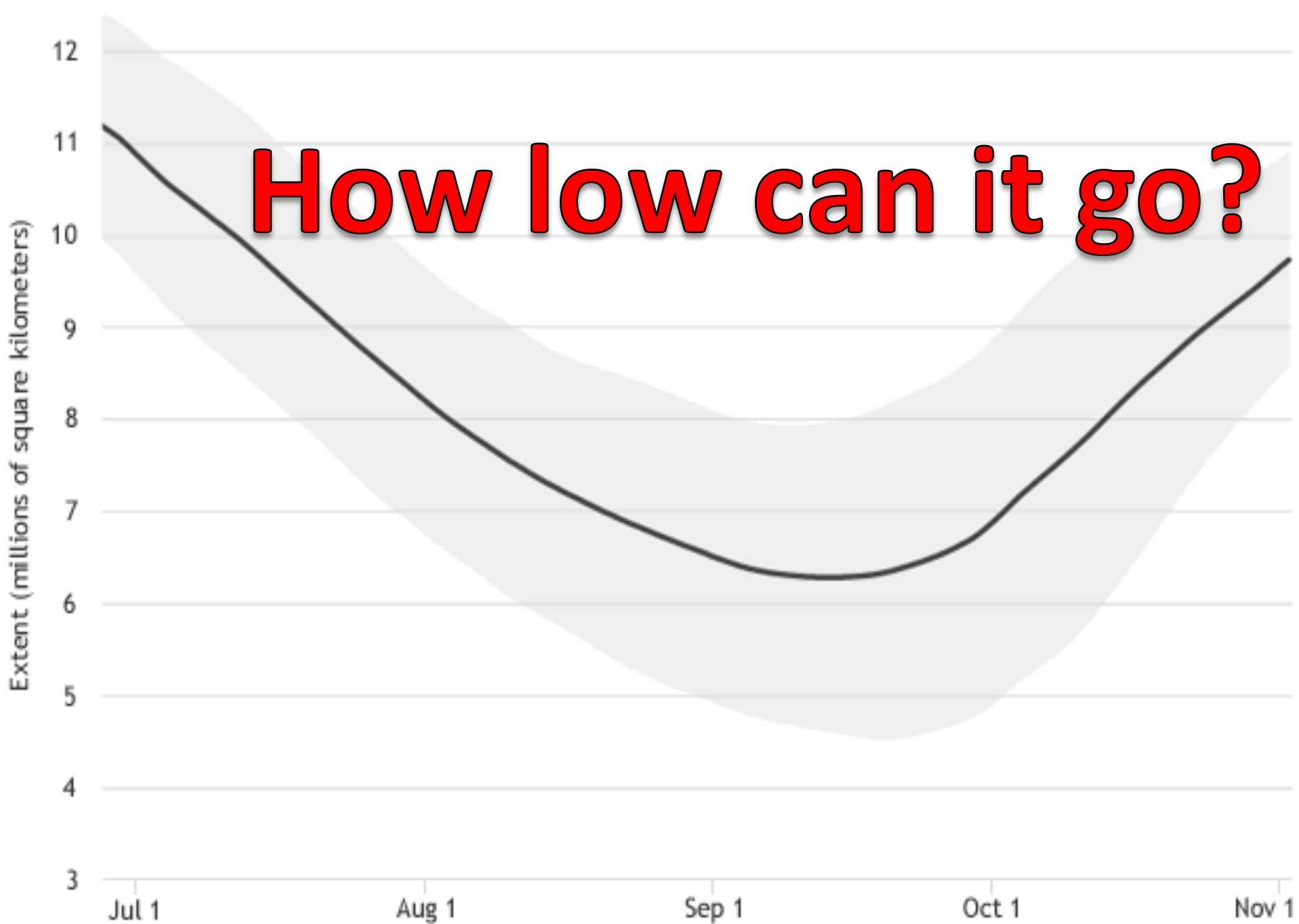
#2: 2015

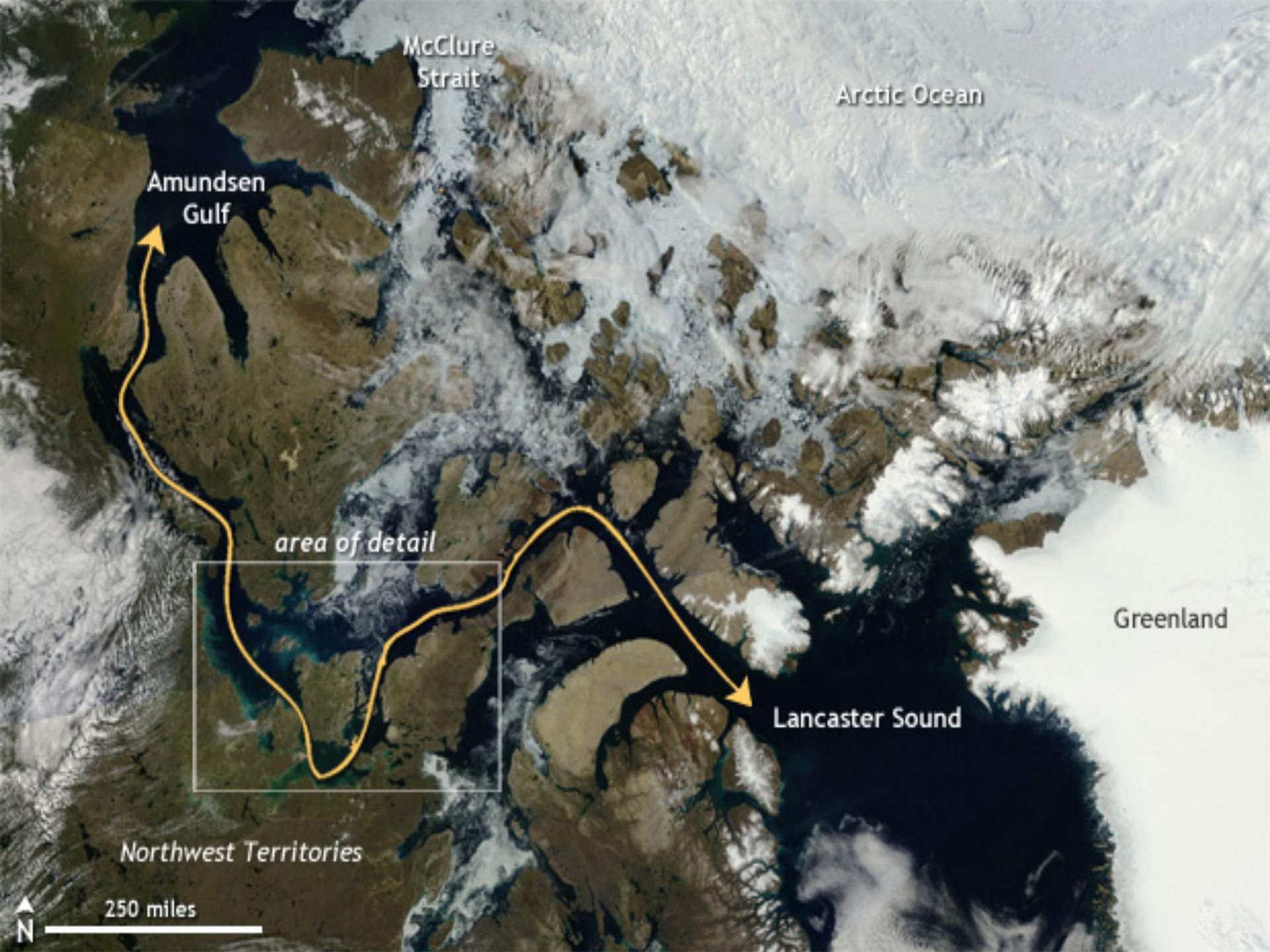
#3: 2014



Very hot
15 of 16
warmest
years are
since 2000







McClure Strait

Arctic Ocean

Amundsen Gulf

area of detail

Greenland

Lancaster Sound

Northwest Territories

250 miles



STEVEN SPIELBERG PRESENTS



BACK TO THE FUTURE

PG

A ROBERT ZEMECKIS FILM



Future



Temperature

A large, bright sun is the central focus, partially obscured by a layer of orange and yellow clouds. The sun's glow creates a strong backlight effect on the clouds. Overlaid on the center of the image is the text "1 in 25 yrs" in a bold, black, sans-serif font. The text is slightly transparent, allowing the sun's light to show through the letters.

1 in 25 yrs

1 in 20 yrs



12350F

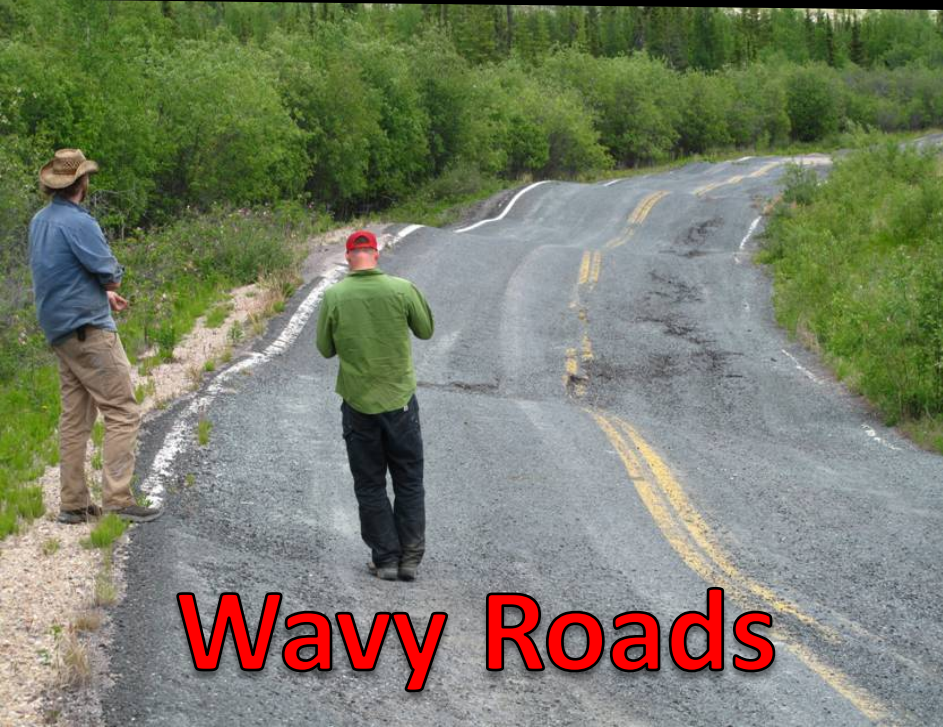
A lot of:



Air Conditioners



Flat Tires



Wavy Roads



Bendy Rails

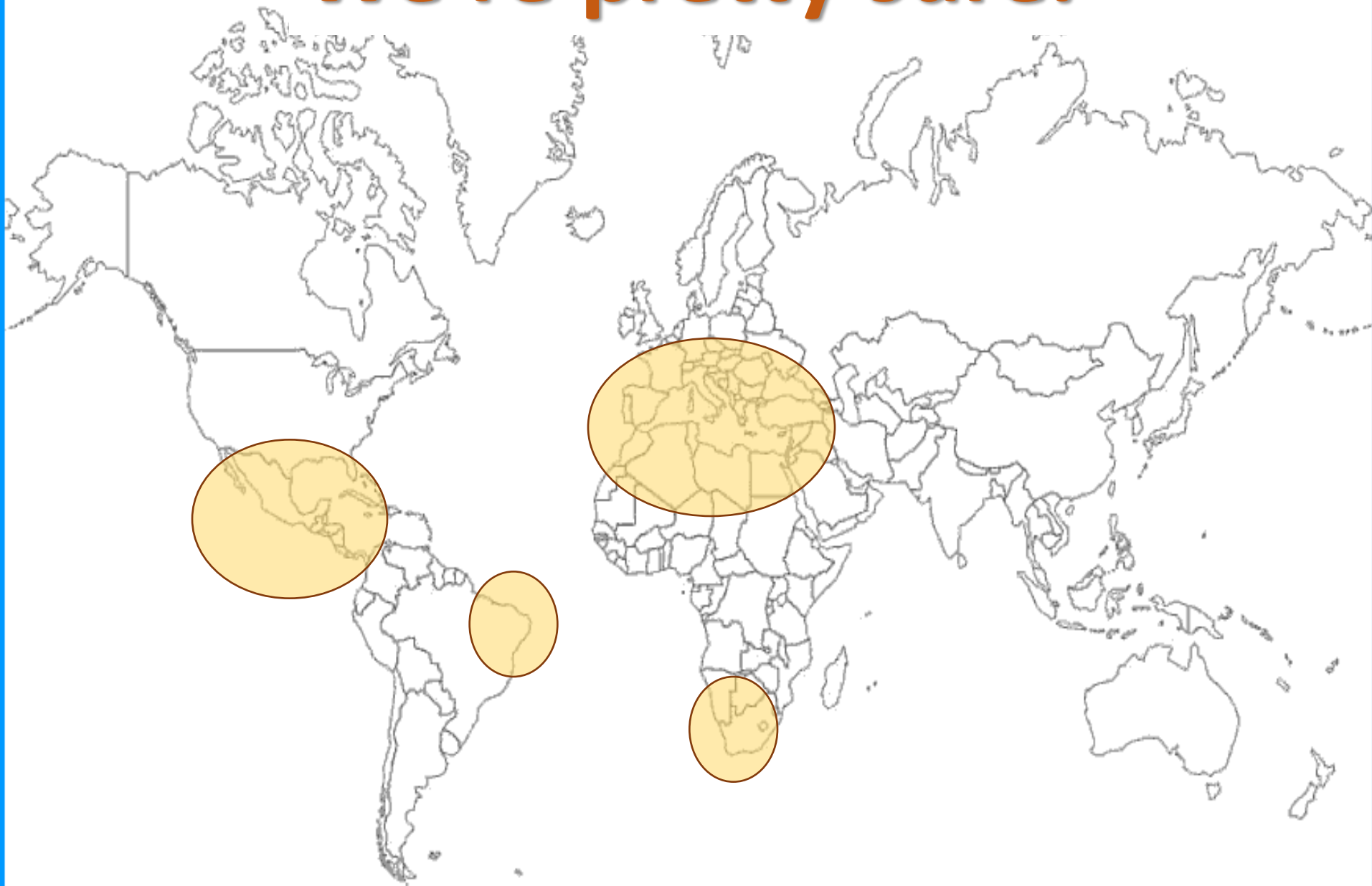


A photograph of a dry, cracked landscape under a blue sky with white clouds. The ground is parched and cracked into a mosaic of irregular polygons, typical of an arid environment. In the distance, a range of low mountains is visible under a bright blue sky filled with fluffy white clouds.

Drought

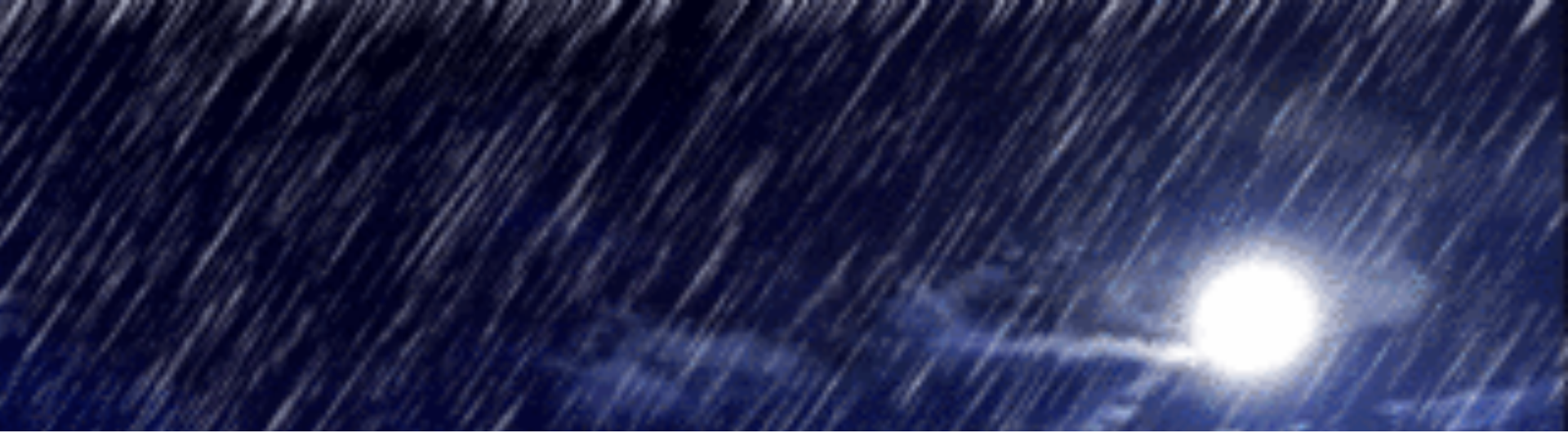
↑

We're pretty sure.





**Grass is
always
greener**



I in 20 yrs

15





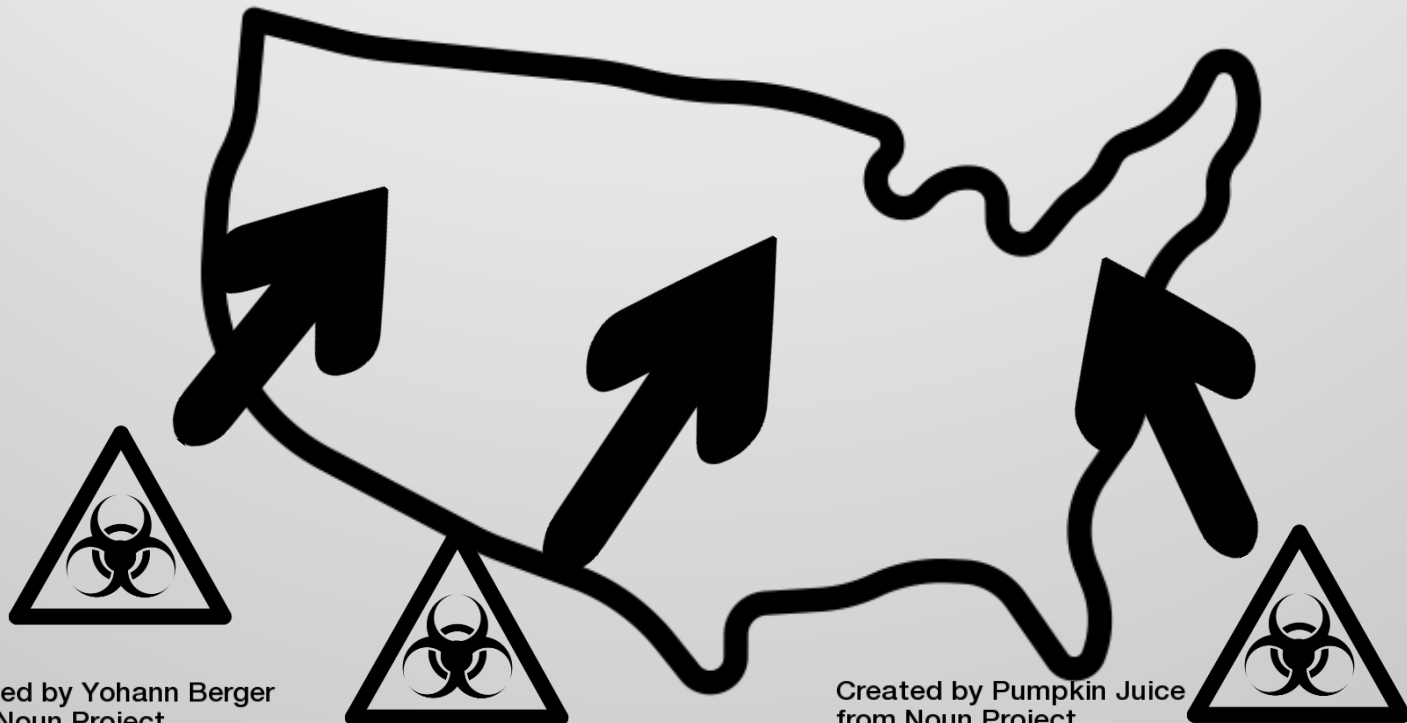
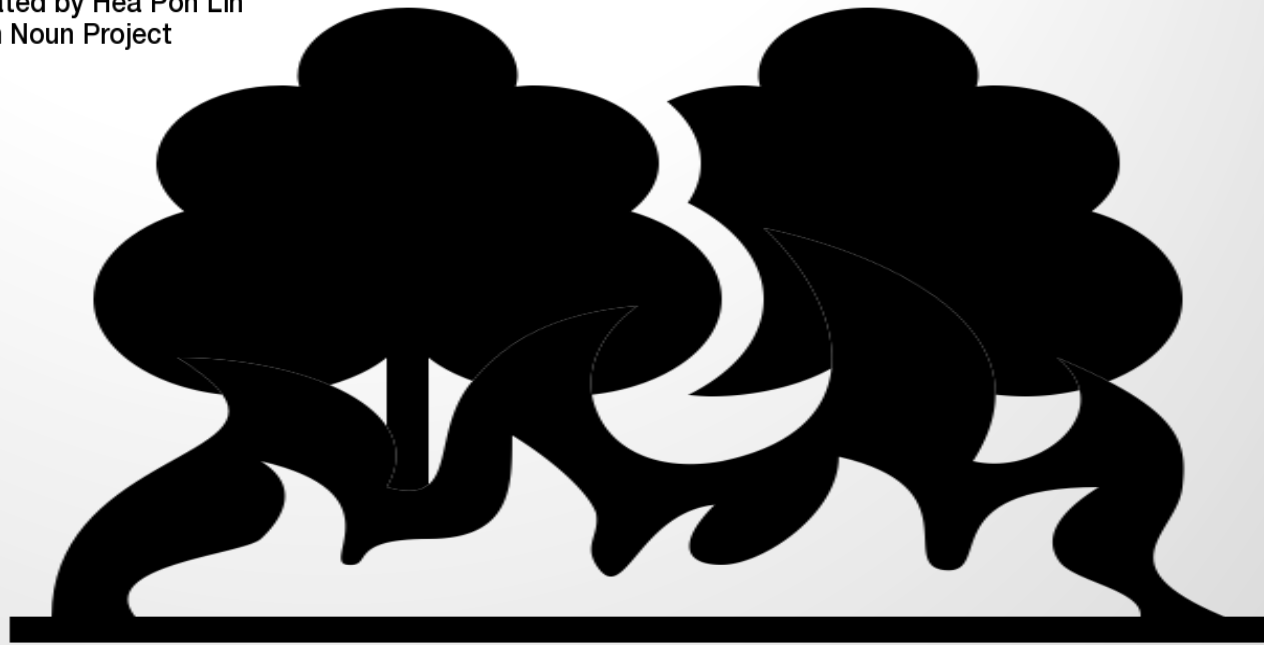
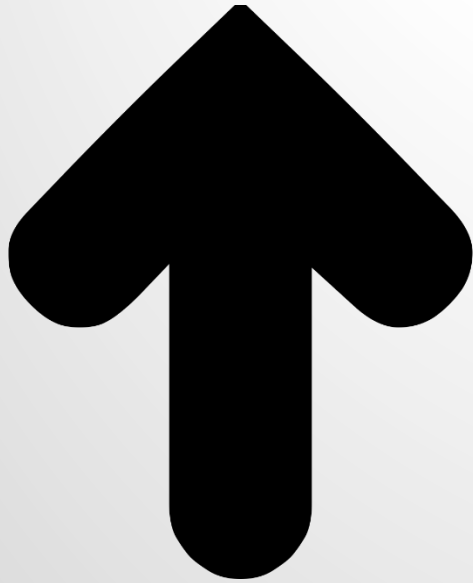
Patrick Dennis/The Advocate, via Associated Press

Panda Break



Gifsforum.com

Created by Hea Poh Lin
from Noun Project



Created by Yohann Berger
from Noun Project

Created by Pumpkin Juice
from Noun Project

Lionfish



Gross

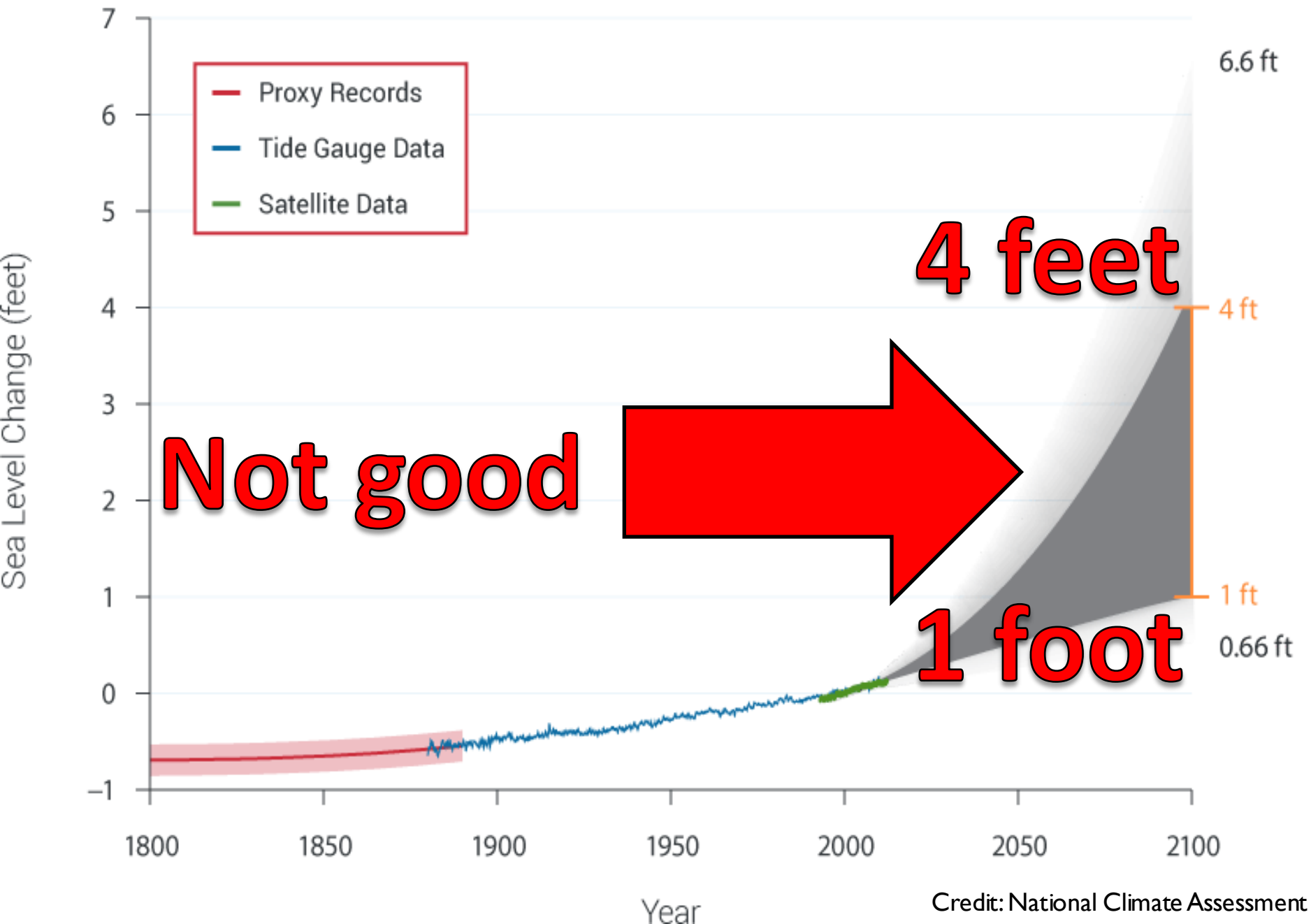


Credit: : AP

**Great Barrier Reef
this year**



Past and Projected Changes in Global Sea Level

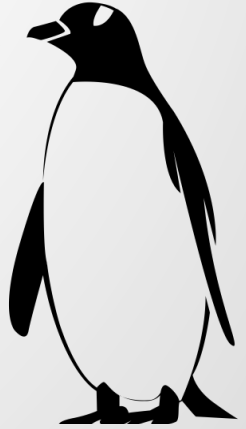




20 feet



**West
Antarctica
is 12 feet**



200 feet

Created by anbileru adaleru
from Noun Project

Created by Aldric Rodríguez Iborra
from Noun Project

Miami at high tide now!



Credit: Steve Rothaus, Miami Herald

Lots of \$\$\$\$

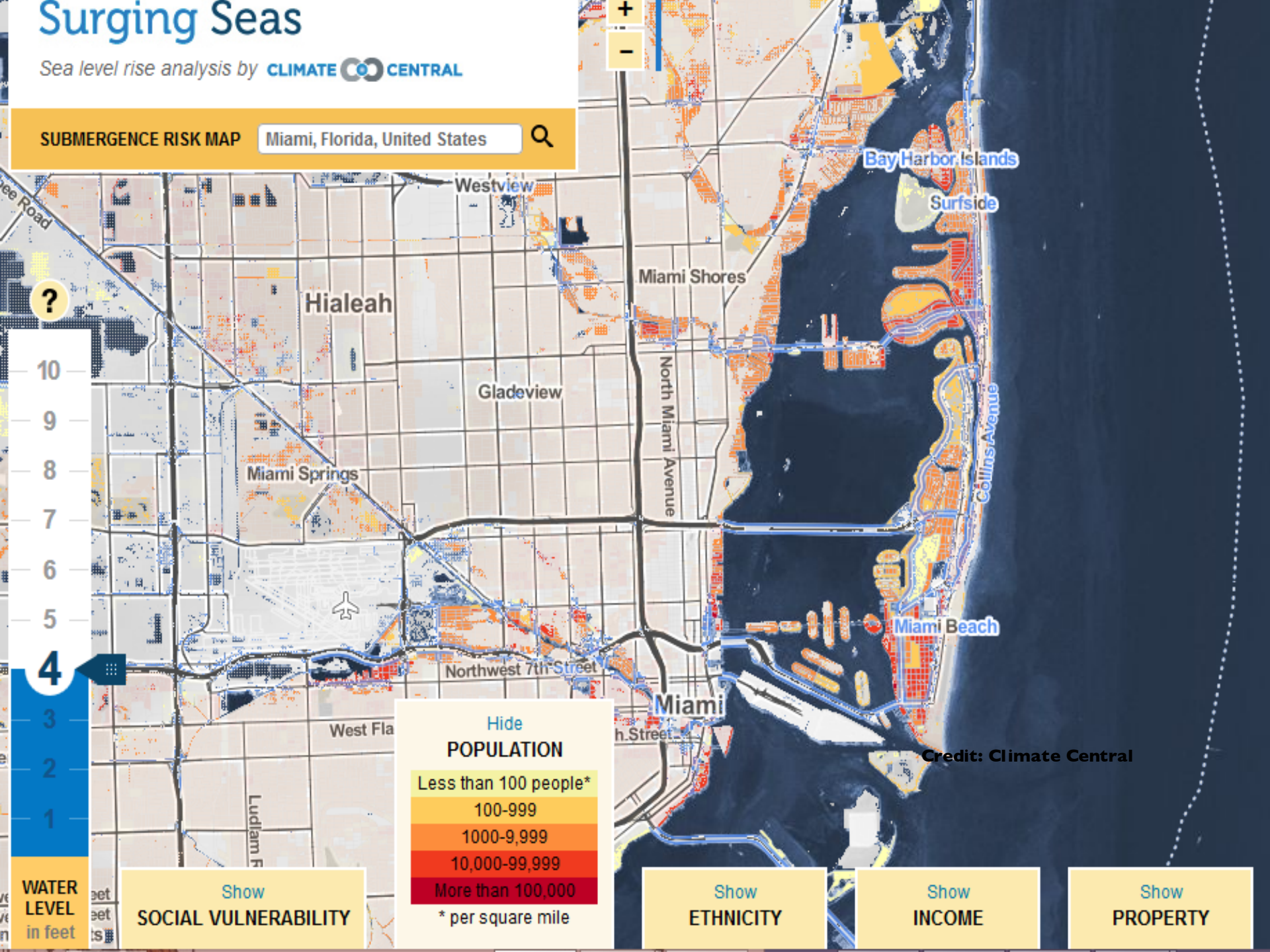


Surging Seas

Sea level rise analysis by **CLIMATE CENTRAL**

SUBMERGENCE RISK MAP

Miami, Florida, United States



Hide POPULATION

- Less than 100 people*
 - 100-999
 - 1000-9,999
 - 10,000-99,999
 - More than 100,000
- * per square mile

Show SOCIAL VULNERABILITY

Show ETHNICITY

Show INCOME

Show PROPERTY

Credit: Climate Central

Not a fun day at the beach



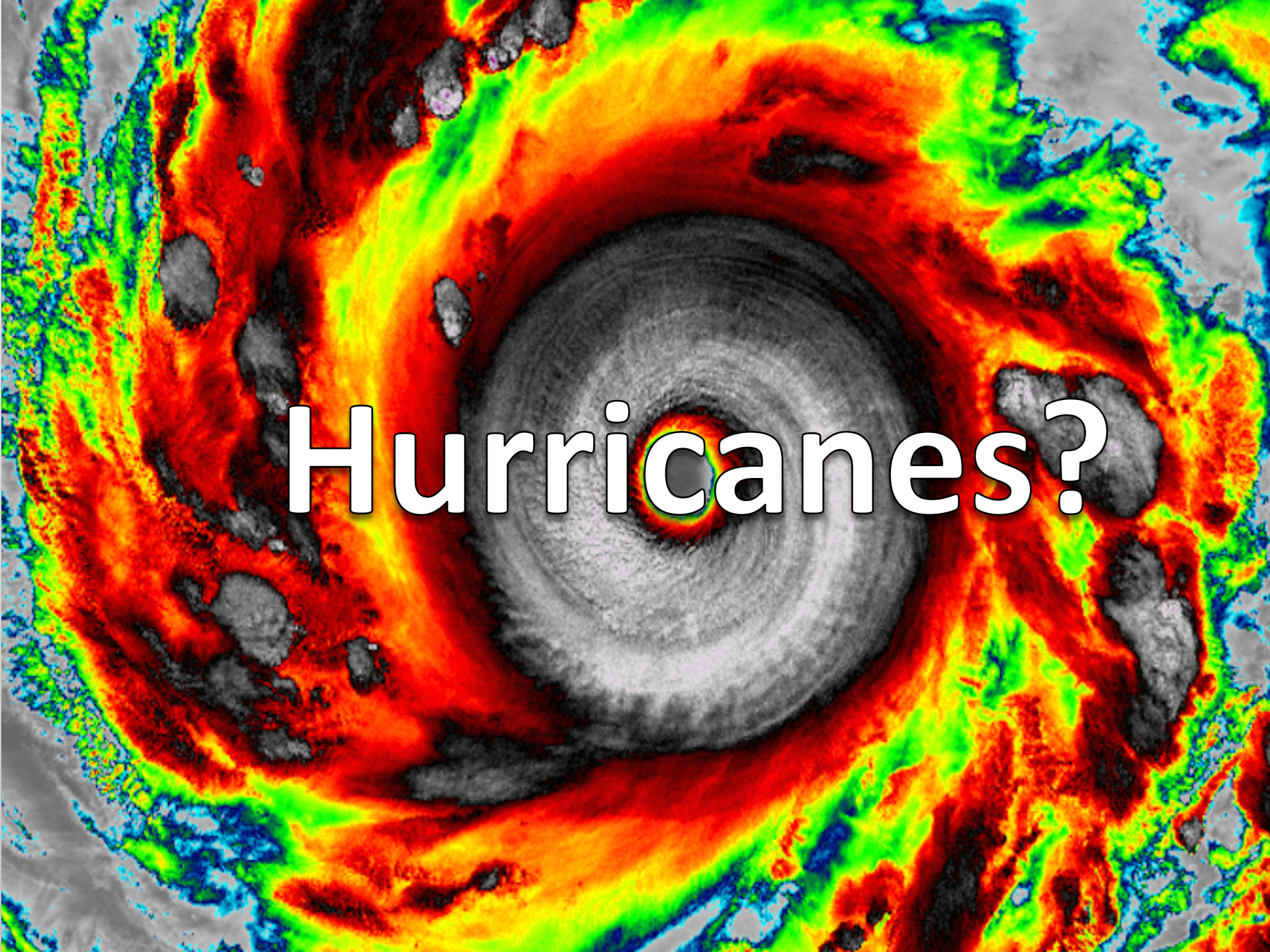
MY EYES! THE GOGGLES DO
NOTHING!

Ocean Acidification



**What we
know about
what we
don't know.**





Hurricanes?

A large, dark, funnel-shaped tornado is the central focus, extending from a dark, stormy cloud mass down to a grassy field. The sky is filled with heavy, grey clouds, and some light is visible through the gaps. The foreground is a flat, green field with a line of trees in the distance.

Tornadoes?



El Niño...
More like
El “I don’t know”

December 2015
compared to 1981-2010

Difference from average temperature (°F)



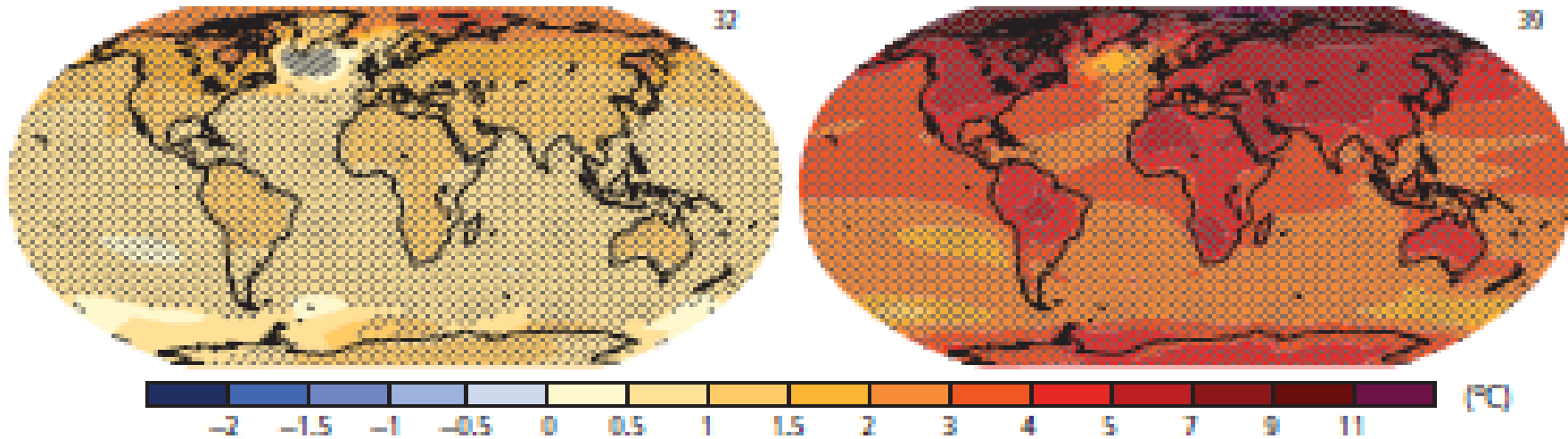
Climate.gov/NNVL
Data: Geo-Polar SST

IPCC AR5

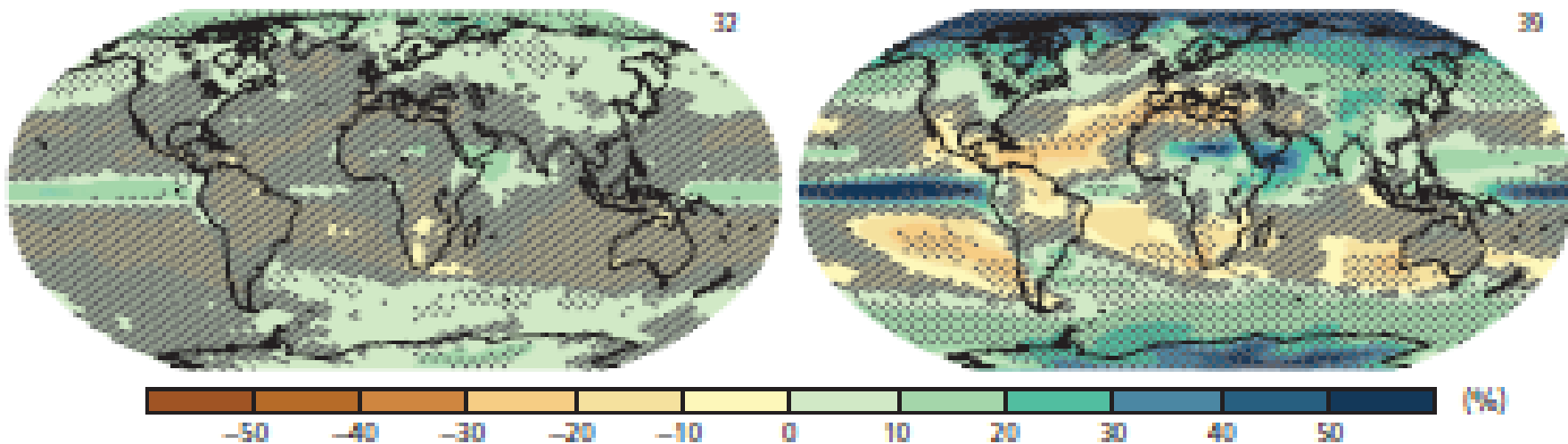
Optimistic

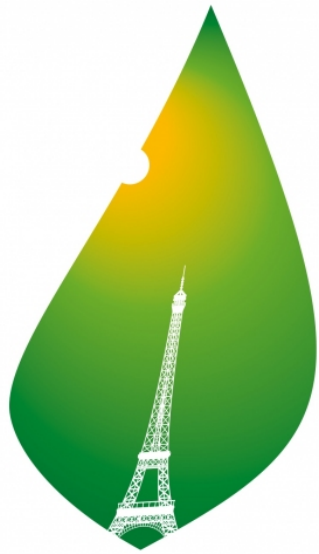
Pessimistic

(a) Change in average surface temperature (1986–2005 to 2081–2100)



(b) Change in average precipitation (1986–2005 to 2081–2100)





COP21 • CMP11

PARIS 2015

UN CLIMATE CHANGE CONFERENCE



Conférence sur les Changements Climatiques 2015

We did it...right?

COP21 • CMP11

Paris France

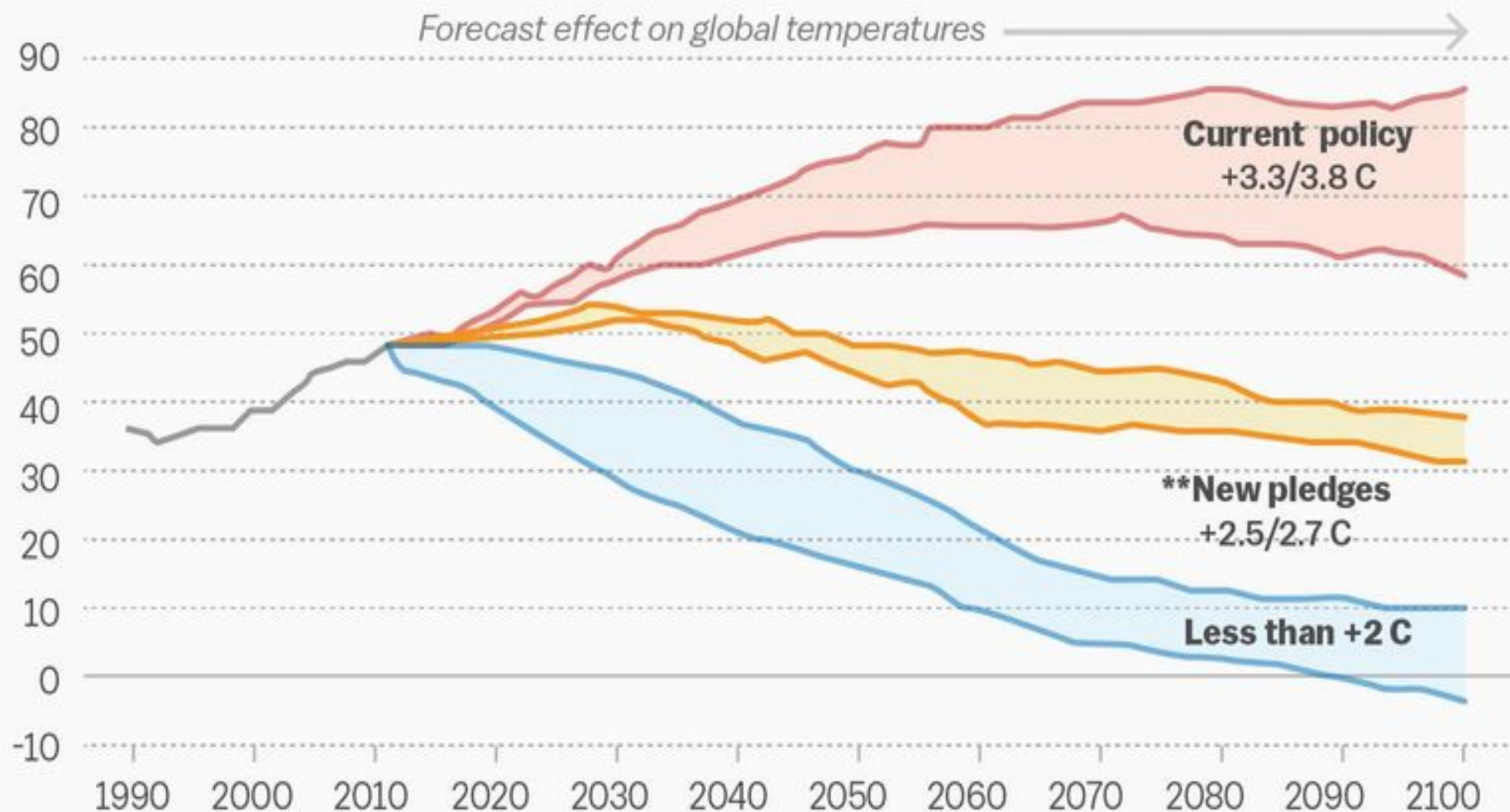


2°C



Estimated global greenhouse gas emissions

In gigatons, CO₂ equivalent



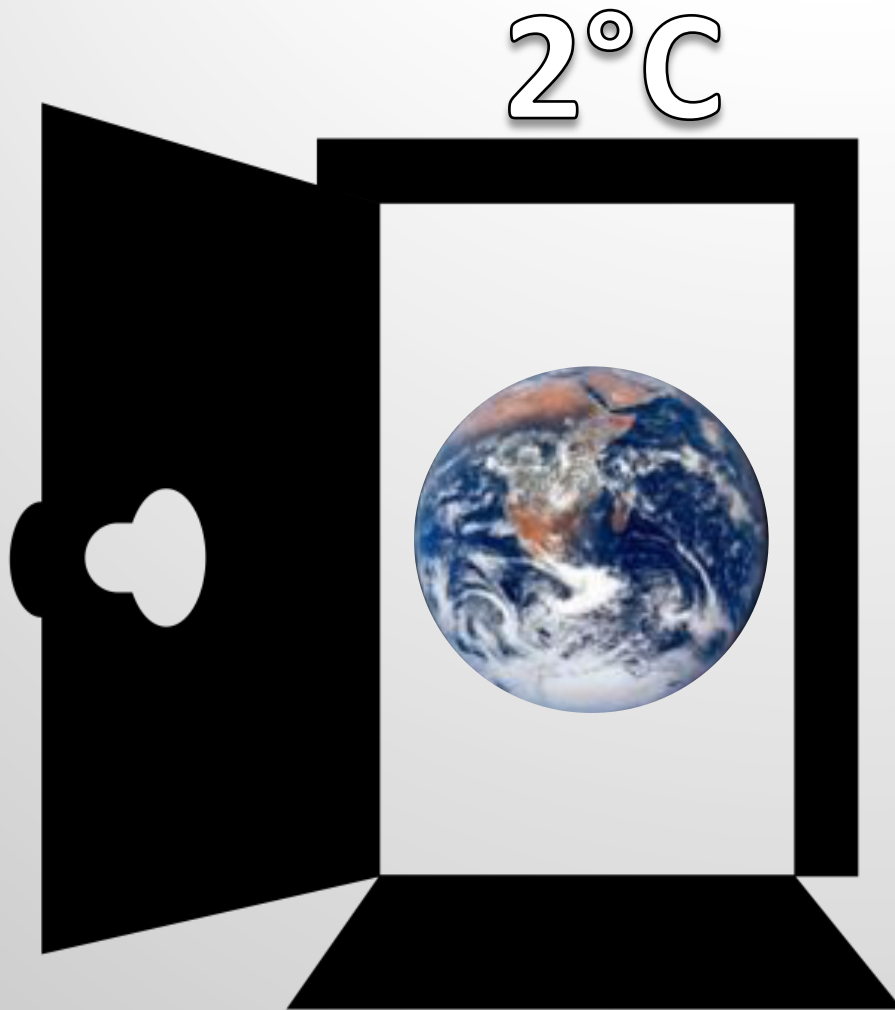
*Expected temperature change by 2100, versus period before Industrial Revolution

** Based on intended nationally determined contributions submitted to UNFCCC by Oct. 1

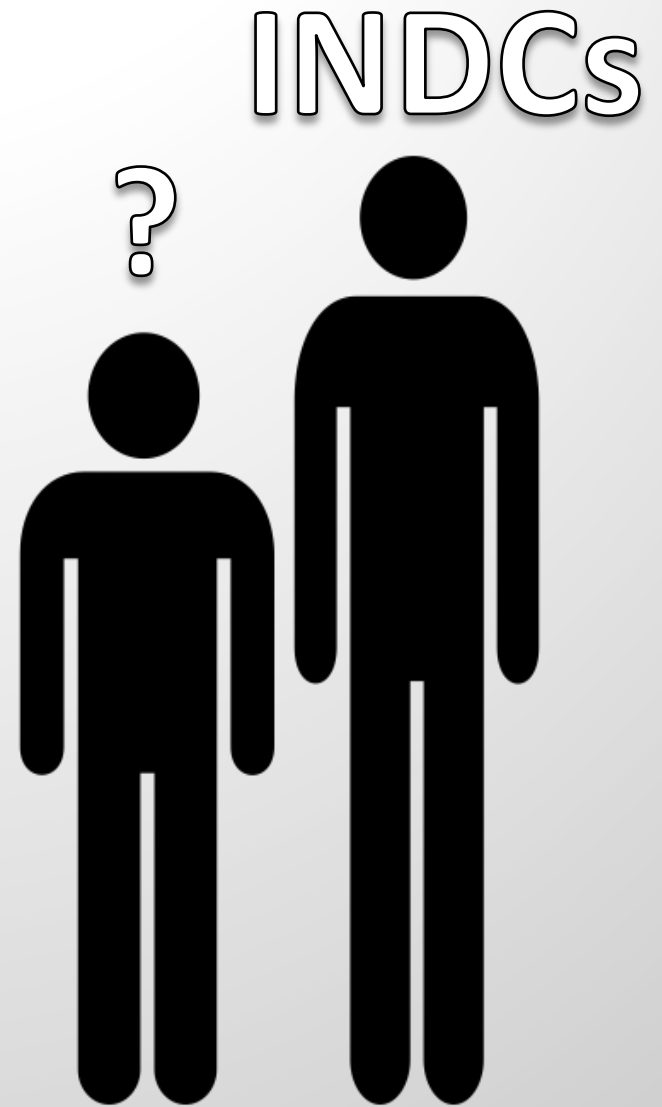
SOURCE: Climate Action Tracker

Javier Zarracina/Vox

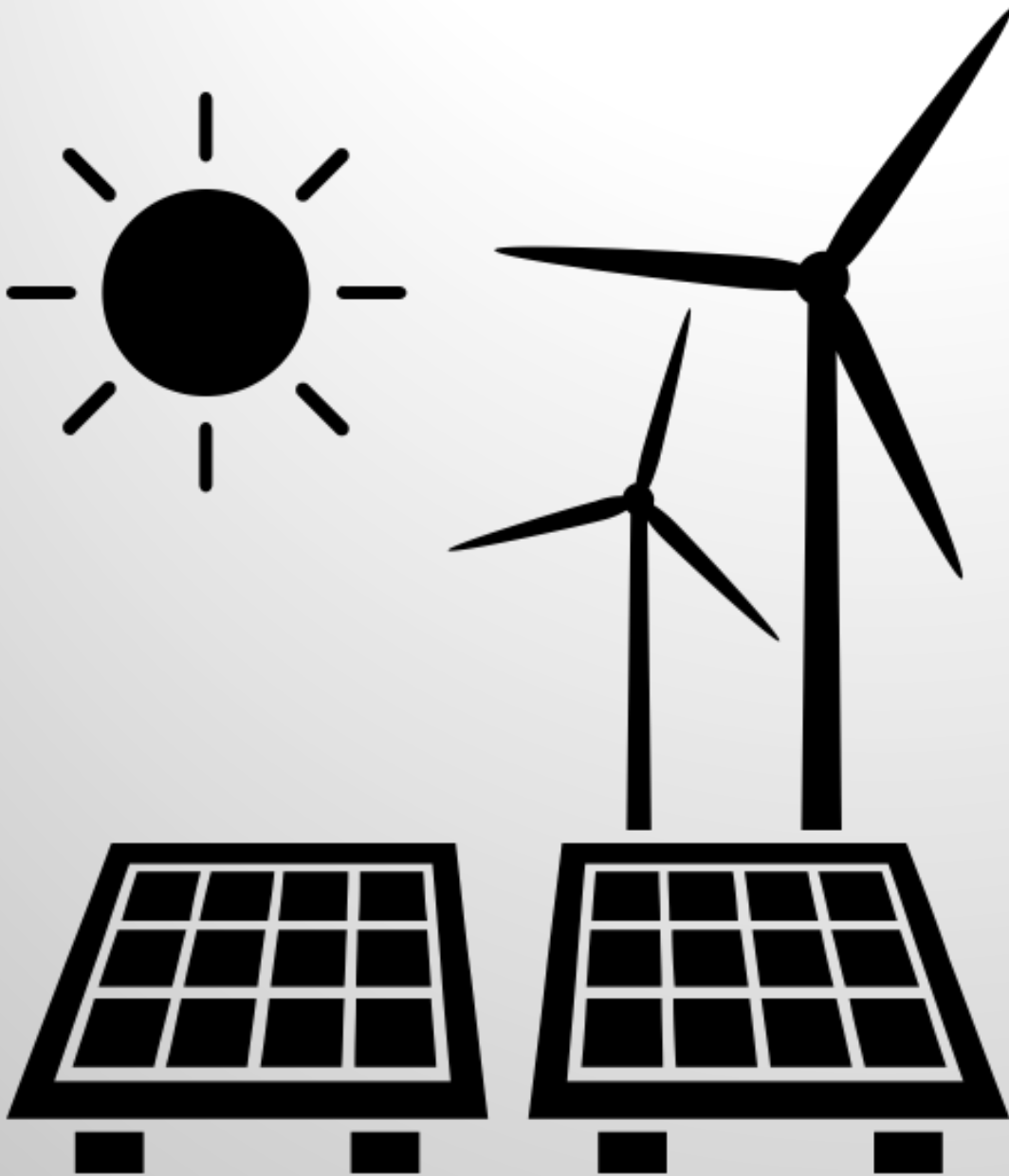
Vox



Created by Olaus Linn
from Noun Project



Created by Wayne Tyler Sall
from Noun Project



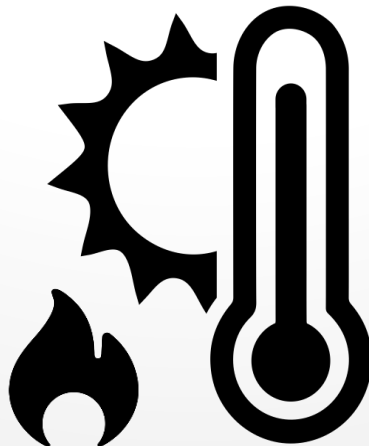
Created by Krisada
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Created by Tom Walsh
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Created by Daouna Jeong
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Created by Martin Vanco
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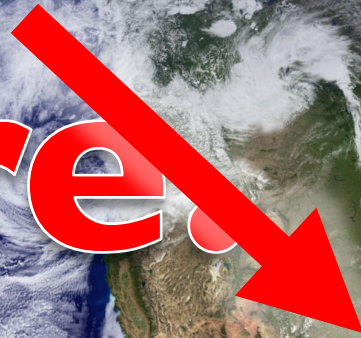


Created by Delwar Hossain
from Noun Project

**Climate
change isn't
fair.**

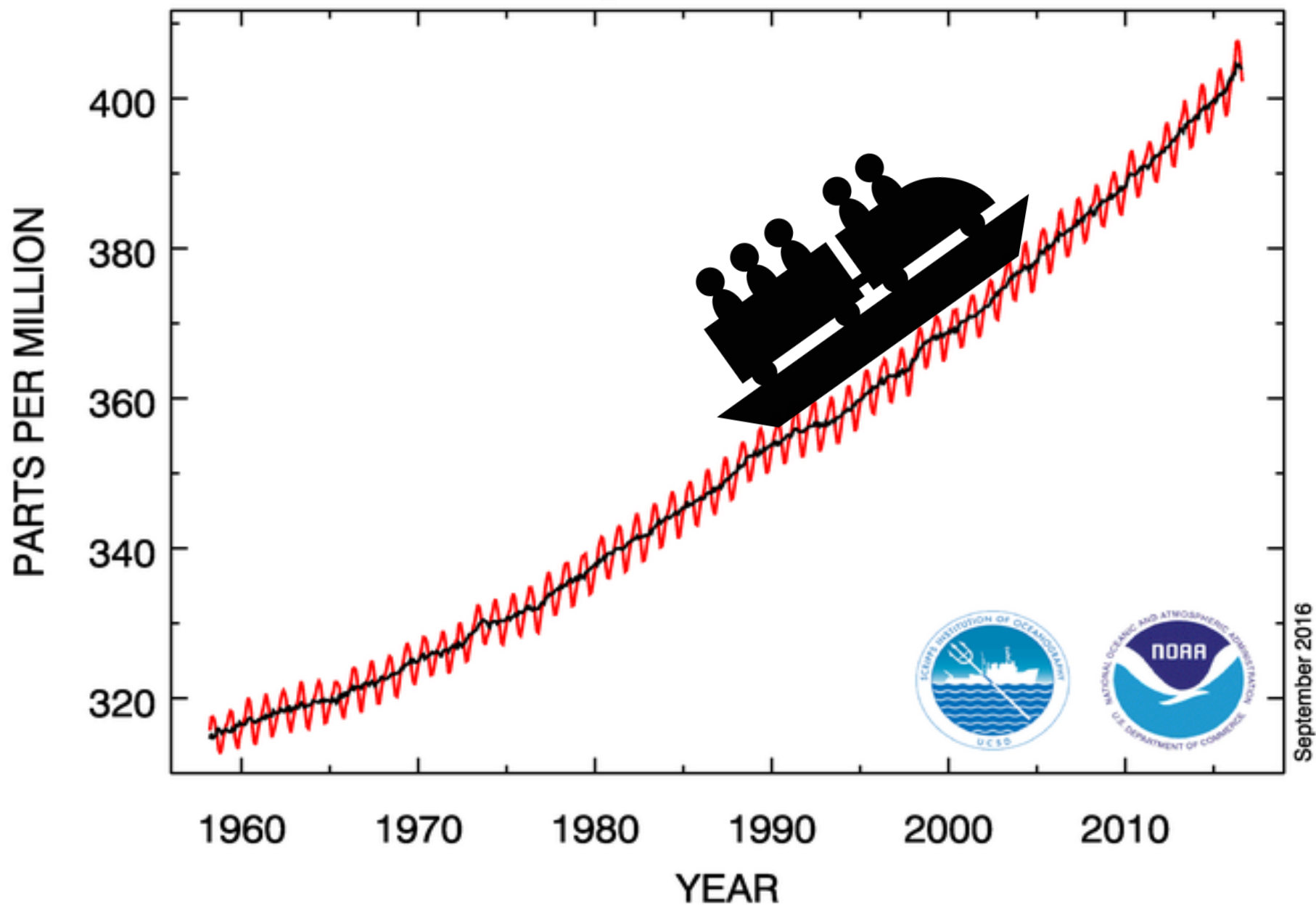
We are

here



Our only

Atmospheric CO₂ at Mauna Loa Observatory



Thank you!

Tom Di

 **Liberto**