

# Climate Change Overview for Susquehanna Group

by Valdi Weiderpass

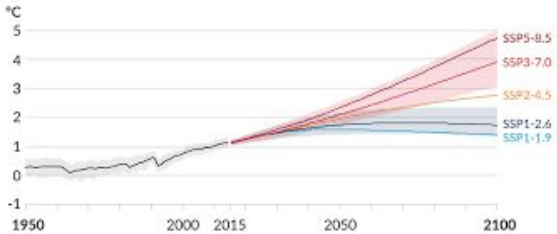
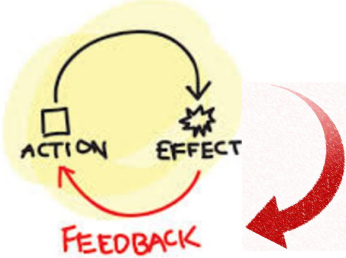


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1. Intergovernmental Panel on Climate Change (IPCC) 6<sup>th</sup> Assessment Report key points

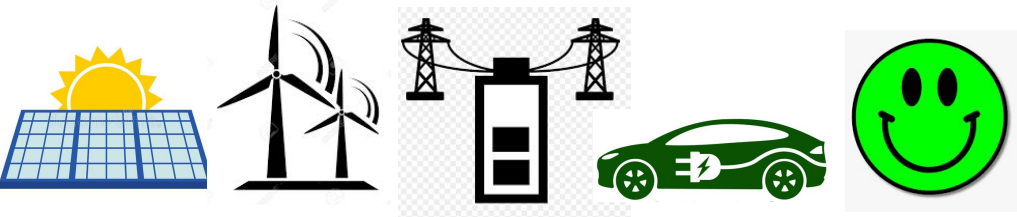


2. Self-reinforcing feedback loops  
→ Climate Tipping Points



3. Degrees of warming matter! (+1.5°C=bad, +2°C=worse, etc.)

4. What has to be done now!



# What is the IPCC?

- **Intergovernmental Panel on Climate Change (IPCC) is the United Nations (UN) body for assessing the science related to climate change. 195 nations are members!**
  - **Established by UN Environment Program (UNEP) & World Meteorological Organization (WMO) in 1988**
  - **Provides political leaders with periodic scientific assessments concerning climate change, its implications and risks**
  - **Puts forward strategies for adaption & mitigation (To mitigate is to prevent worst of climate change)**
  - **Thousands of people contribute to the work of the IPCC. Scientists volunteer to assess thousands of scientific papers published each year.**

# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

**Note: Report is over 3,940 pages long & was written by 234 scientists from 66 countries. It cites over 14,000 scientific papers!**

- **“A.1 It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.”**

**Note: Unequivocal = clear, unambiguous, apparent, obvious, etc.**

**Cryosphere means all of the ice on Earth.**

**Biosphere means all of the ecosystems on Earth. Zones of life.**

# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

## SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

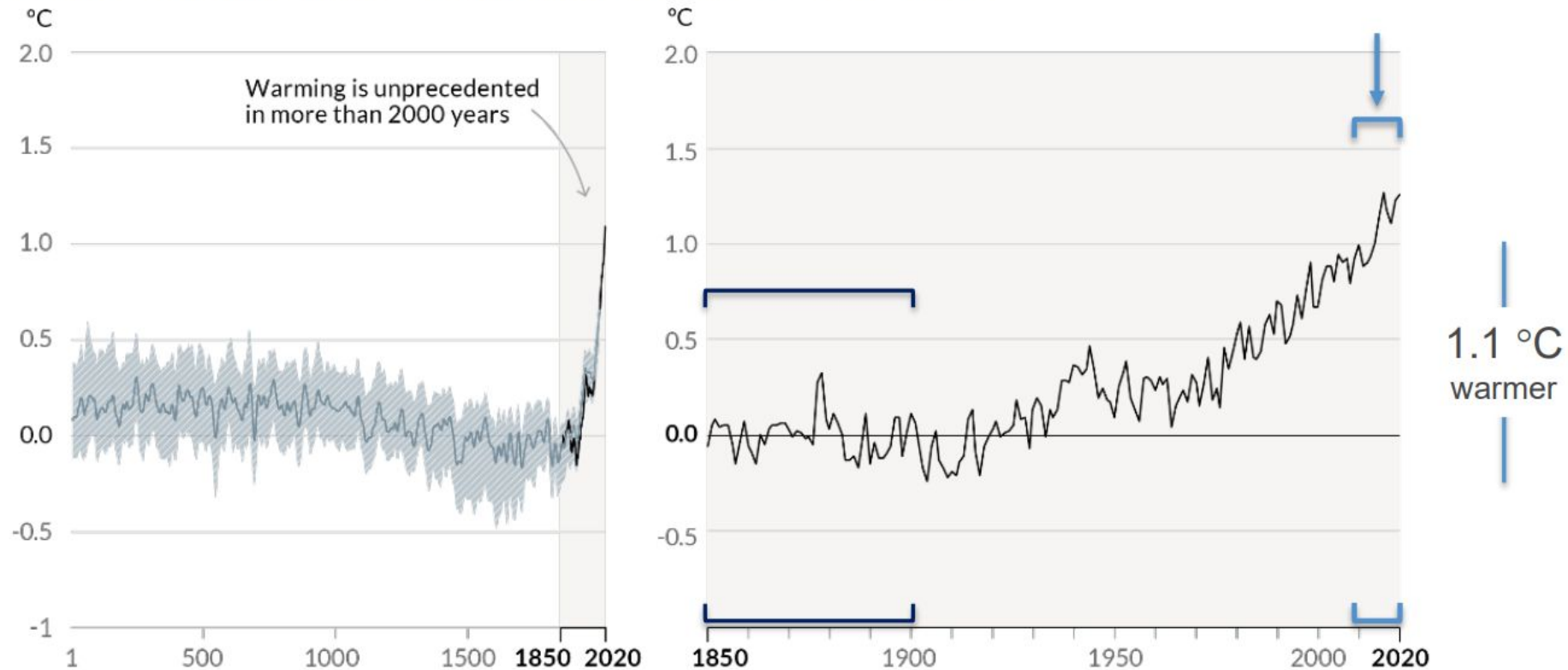
ipcc

INTERGOVERNMENTAL PANEL ON climate change



Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Changes in global surface temperature relative to 1850-1900



Valdi Weiderpass 10/19/2021

## IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

- **A.2 The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years.**

**Human activities are responsible;**

- **dramatically increasing greenhouse gas (GHG) emissions, which trap heat (fossil fuel use is cause of GHG emissions, including carbon dioxide & methane)**
- **changing land use with deforestation & agricultural practices are reducing greenhouse gas absorption**

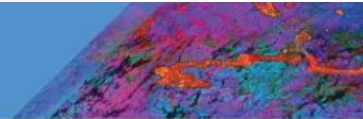
# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

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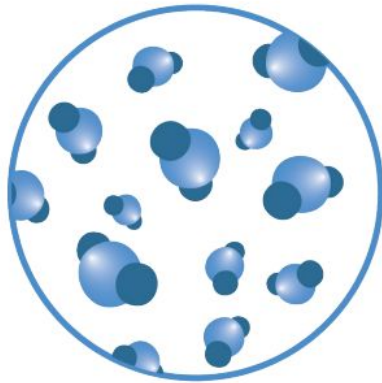
INTERGOVERNMENTAL PANEL ON climate change



From 1901 to 2018  
we had 8 inches of

In last 3 decades, lost 40%+  
(September measurements)

**CO<sub>2</sub>**  
concentration



**Highest**

in at least

**2 million years**

**Sea level**  
rise



**Fastest rates**

in at least

**3000 years**

0.05 in/yr 1901 to 1971  
0.075 in/yr 1971 to 2006  
0.15 in/yr 2006 to 2018

**Arctic sea ice**  
area



**Lowest level**

in at least

**1000 years**

**Glaciers**  
retreat



**Unprecedented**

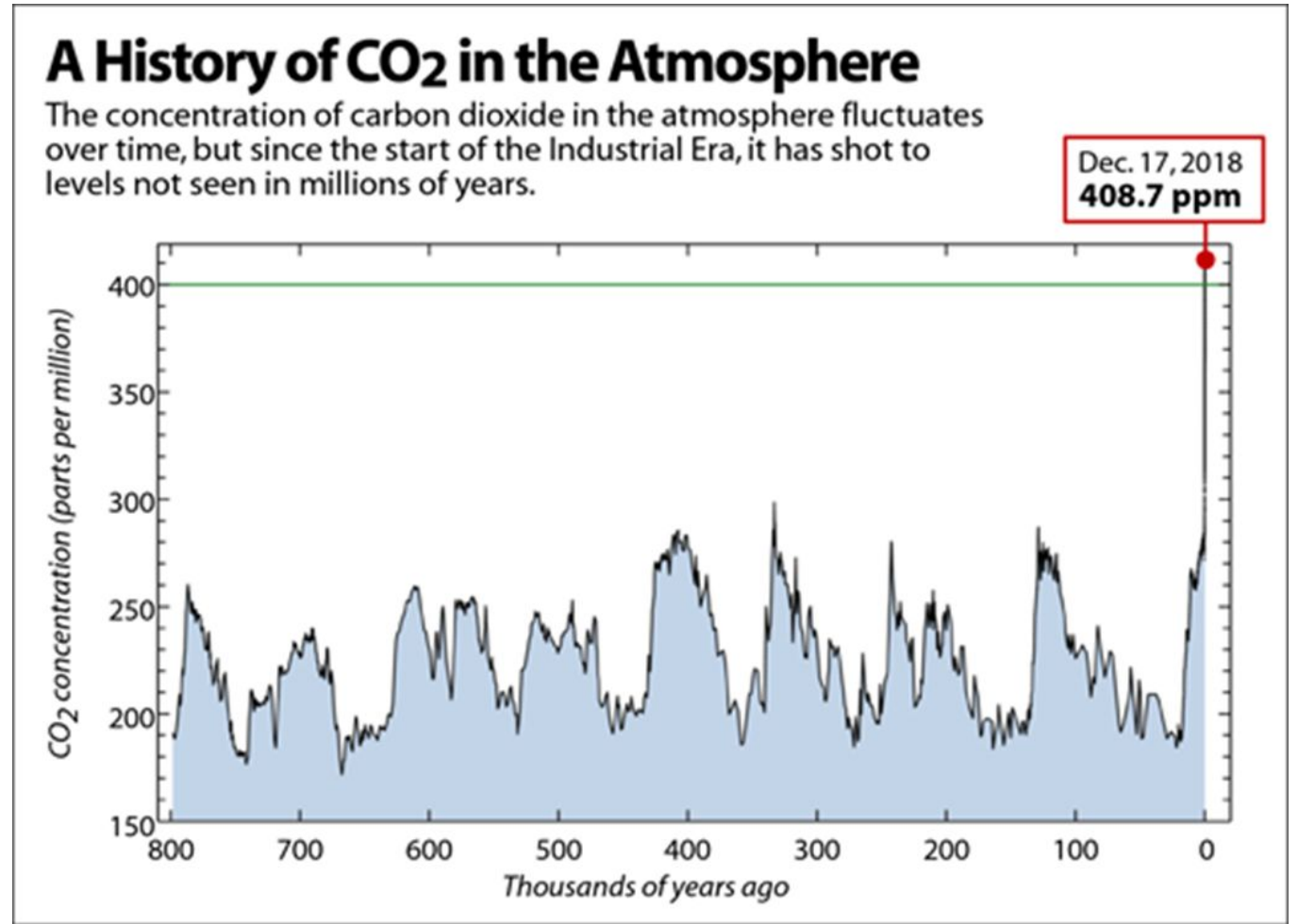
in at least

**2000 years**

## IPCC 6<sup>th</sup> Assessment Report, 8/2021: (non-IPCC helpful info)

- Carbon Dioxide (CO<sub>2</sub>) concentration in atmosphere exceeded 415 ppm on 5/11/2019!  
420 ppm on 5/1/2021!

This high a level of CO<sub>2</sub> has not happened in over 3 million years! This was > 1 million years before human ancestors (Homo Erectus) stood upright & 2.8 million years before modern humans (Homo Sapiens) appeared. This was during the Pliocene age and sea levels then were more than 15 feet higher! (200 ft higher during part of it!)



SOURCES: Scripps Institution of Oceanography

InsideClimate News

## IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

- **A.3 Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5.**

**Note: AR5 is the IPCC 5<sup>th</sup> Assessment Report on Climate ( 2014 ).**

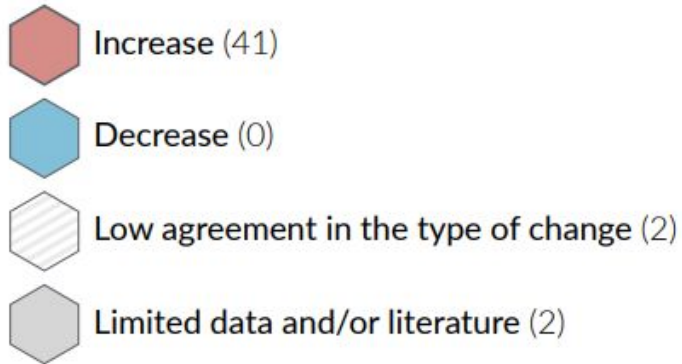


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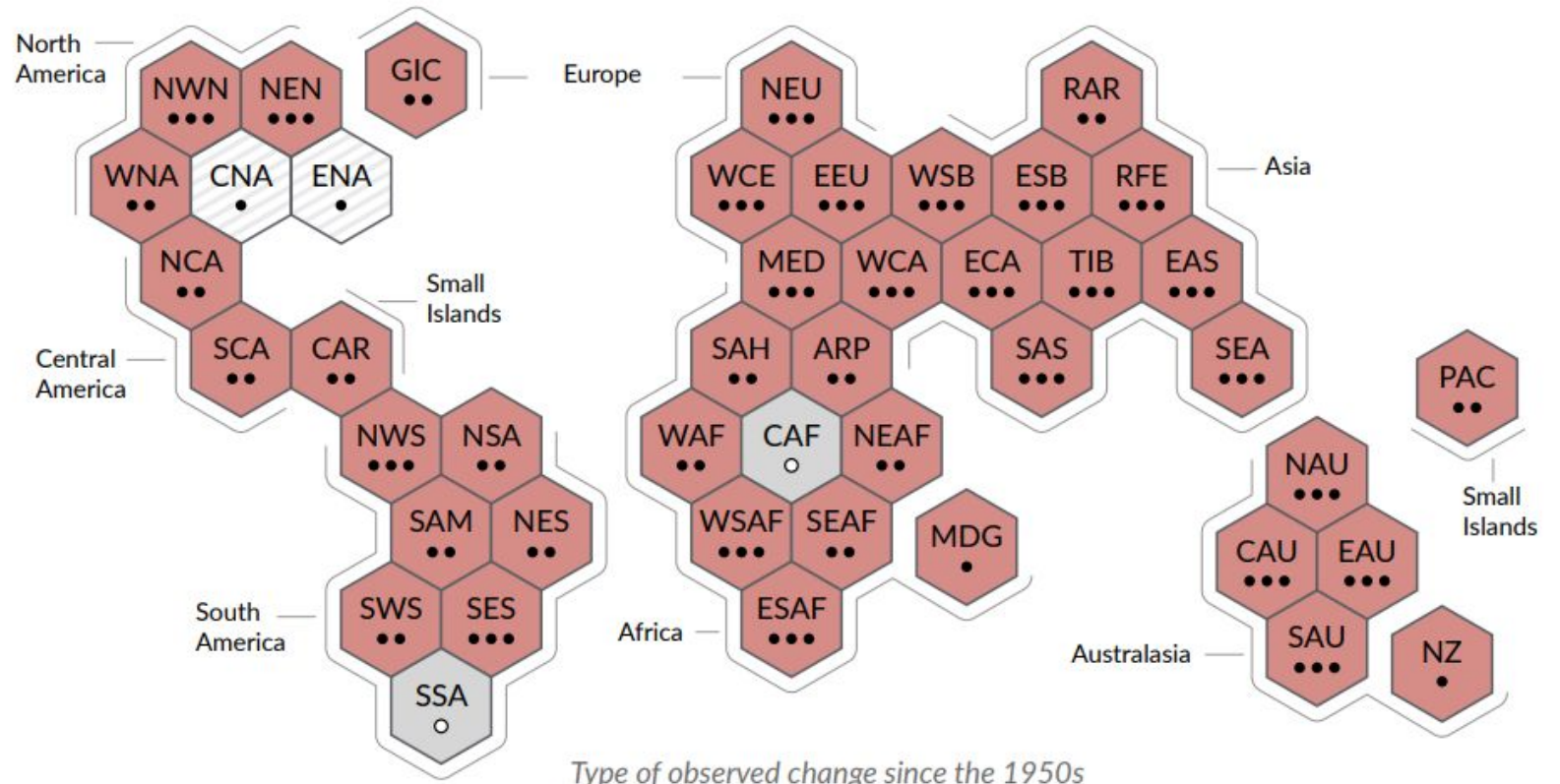
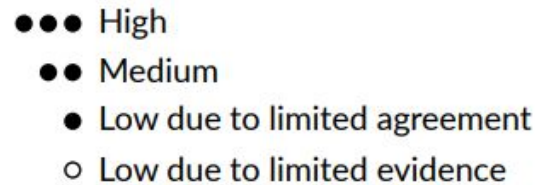
## Areas of world with increase in HOT EXTREMES since 1950s (red areas)

a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions

Type of observed change in hot extremes



Confidence in human contribution to the observed change



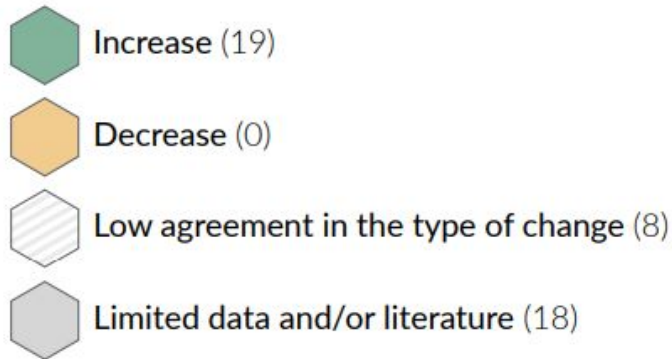
Type of observed change since the 1950s

# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

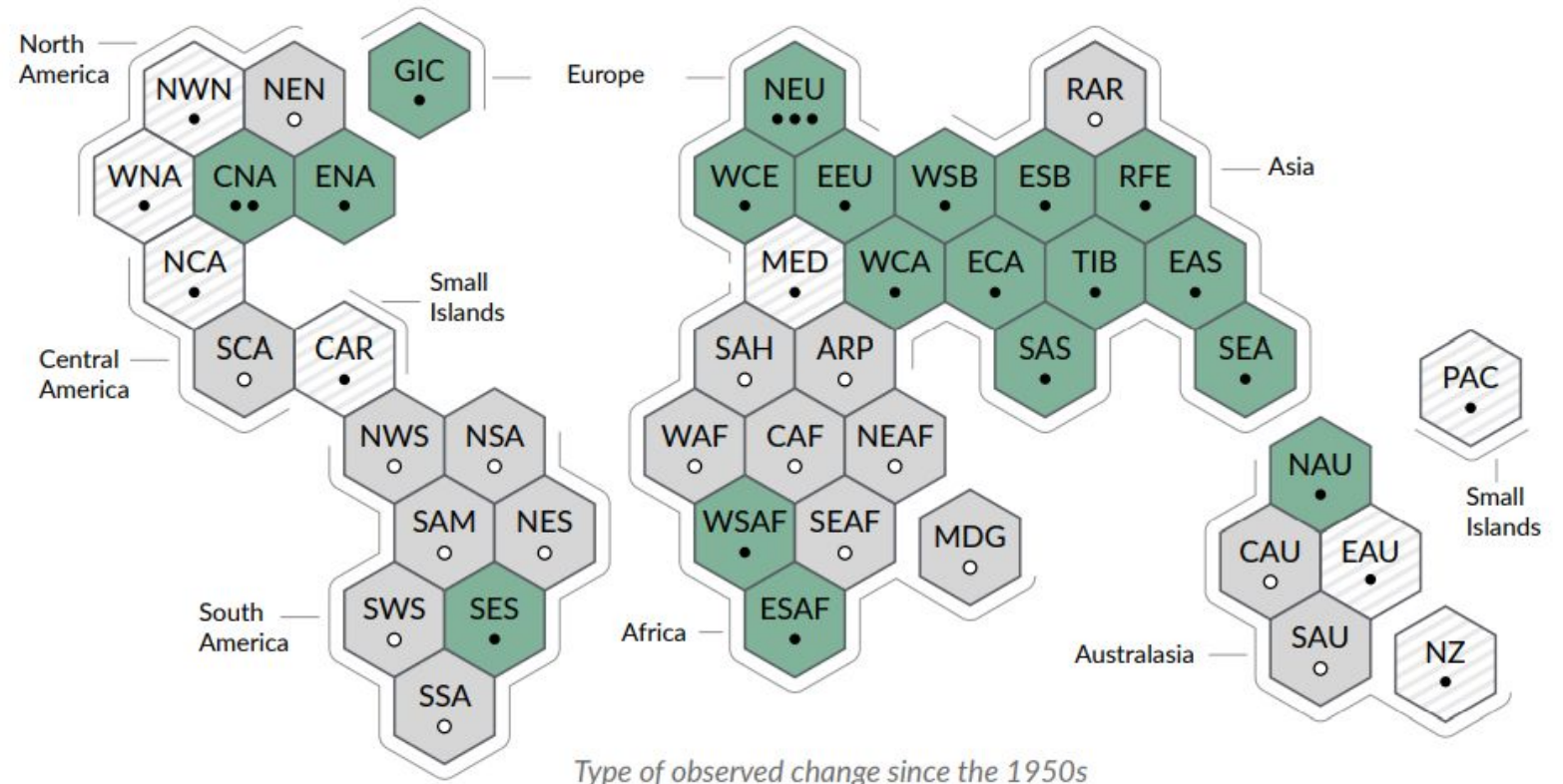
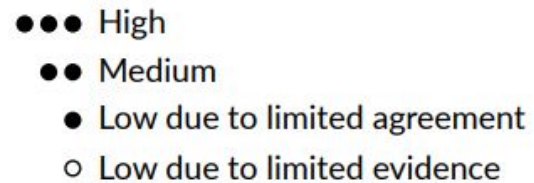
## Areas of world with increase in HEAVY PRECIPITATION since 1950s (green areas)

b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

Type of observed change in heavy precipitation



Confidence in human contribution to the observed change

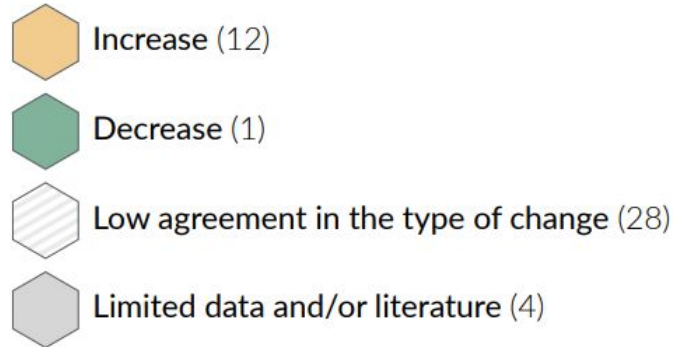


# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points

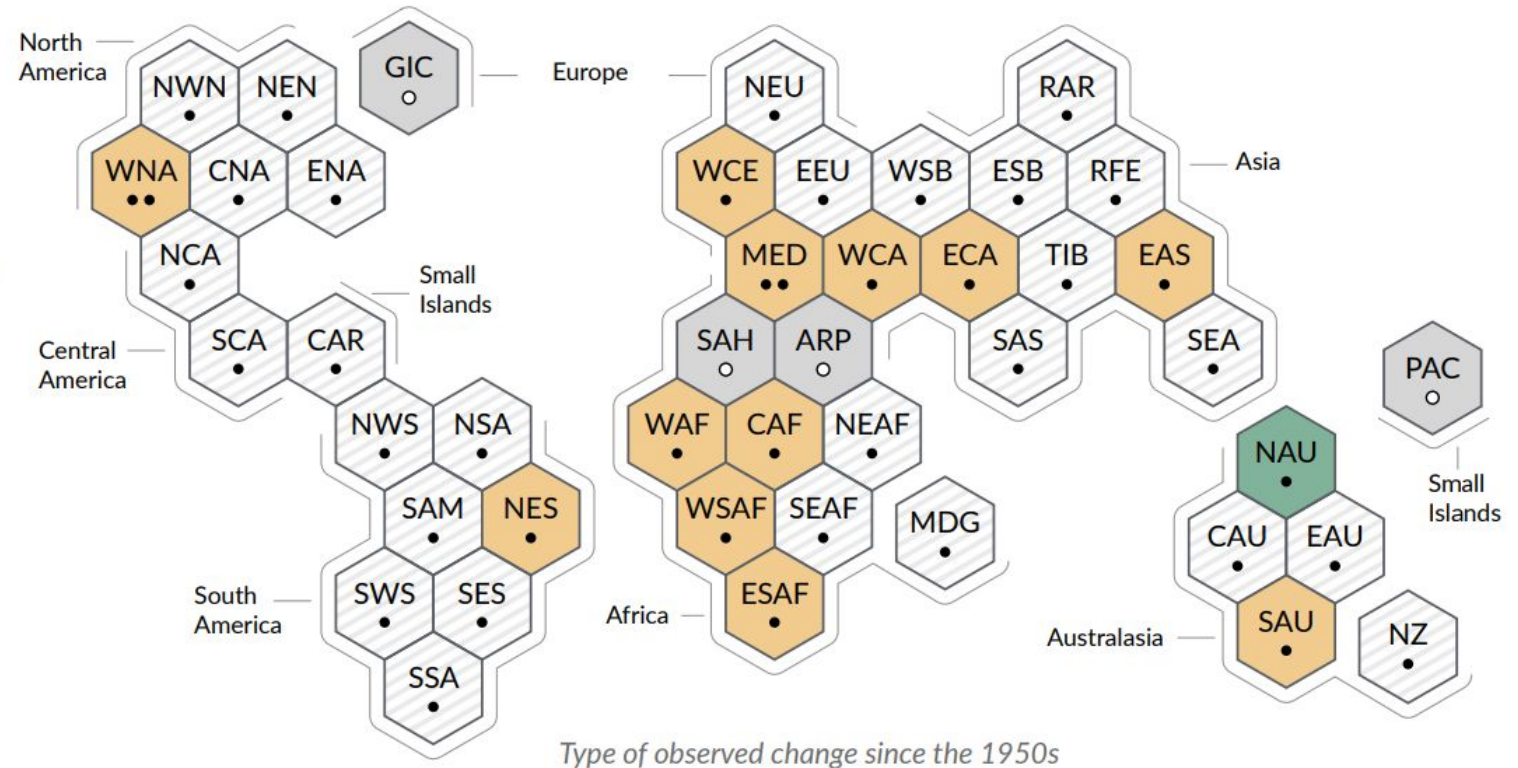
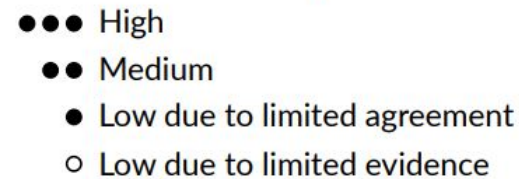
## Areas of world with increase in DROUGHT since 1950s (yellow areas)

c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions

Type of observed change in agricultural and ecological drought



Confidence in human contribution to the observed change



# IPCC 6<sup>th</sup> Assessment Report, 8/2021: Key Points (red = my add'l info)

## SIXTH ASSESSMENT REPORT

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ipcc

INTERGOVERNMENTAL PANEL ON climate change



489,000 global heat deaths/yr  
2000 to 2019 data; The Lancet,  
Planetary Health, 7/21



### Extreme heat

More frequent

More intense

USA death risk due to heat up  
by 5–10%, 2000 to 2006; The  
Lancet, Planetary Health, 7/21



### Heavy rainfall

More frequent

More intense

Deaths, building  
damage, crop loss



### Drought

Increase in some  
regions

Crop loss, migration,  
conflict, deaths



### Fire weather

More frequent

Building damage,  
deaths



### Ocean

Warming

Acidifying

Losing oxygen

Food supply threat,  
potential conflict

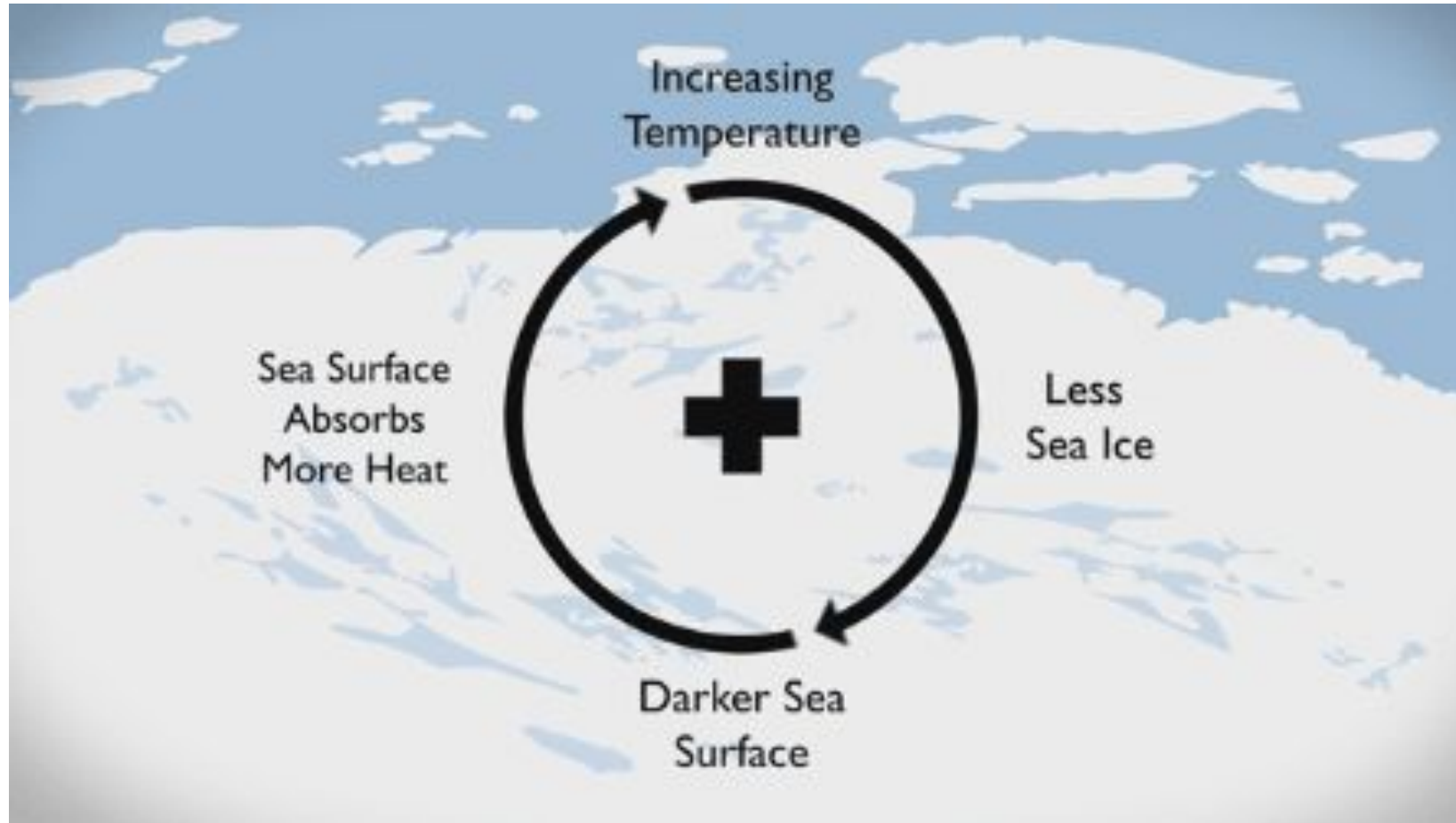
## Self-reinforcing Feedback Loops → Climate Tipping Points

- Strong self-reinforcing feedback loops can quickly amplify small changes – this happens when a *change in A leads to a change in B which in turn produces more change in A and so on.*  
Example: This is what happens when you hear feedback from a microphone and a loudspeaker being too close to each other – the noise picked up by the mic is amplified by the speaker which is picked up by the mic again.

Note: Self-reinforcing feedback loops are also called Positive Feedback Loops.

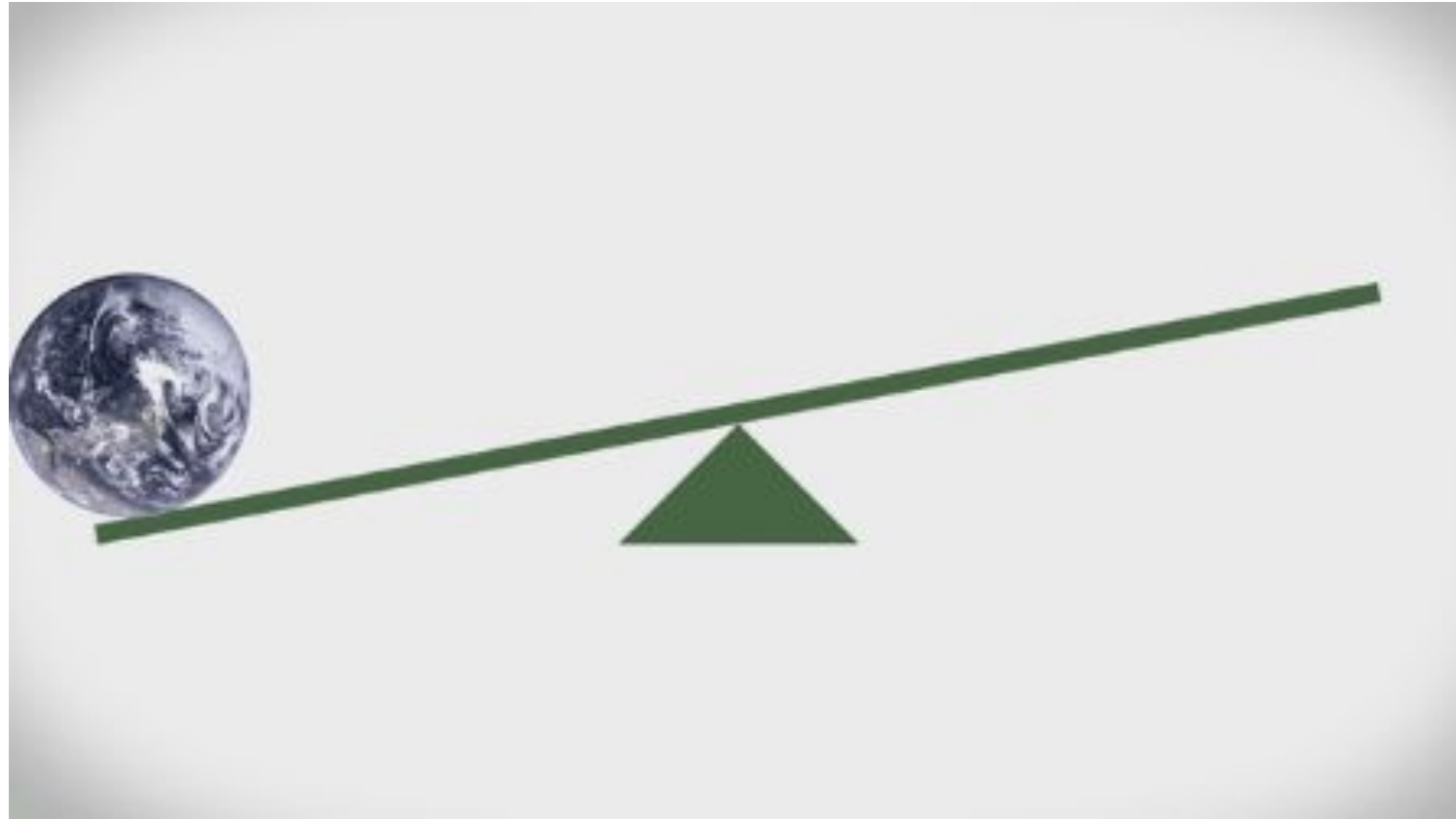
Credit for info in this section: [climatetippingpoints.info](http://climatetippingpoints.info)

## Self-reinforcing Feedback Loops → Climate Tipping Points



In the climate system, an example of a positive feedback loop is the ice-albedo effect (illustrated above) – less sea ice due to warming results in a darker sea surface overall, which reflects less heat, raises local temperatures, and leads to yet more sea ice loss. If this process isn't stopped by a negative feedback then a tipping point is hit beyond which a large shift to a new relatively steady state becomes inevitable.

## Self-reinforcing Feedback Loops → Climate Tipping Points



**You can think of tipping points as being like a see-saw** – before the pivot you have to keep pushing the ball yourself, but after the pivot the ball rolls away quickly without any further pushing. This is an example of a gradual change (like increasing temperature) hitting a **critical threshold** beyond which the change becomes **self-perpetuating** until a **‘new normal’** is reached. Once you’re past a tipping point **it’s more difficult to get back** – the system has found a new stable state.

# Self-reinforcing Feedback Loops → Climate Tipping Points

Very simplified map showing just 7 of many potential Climate Tipping Points

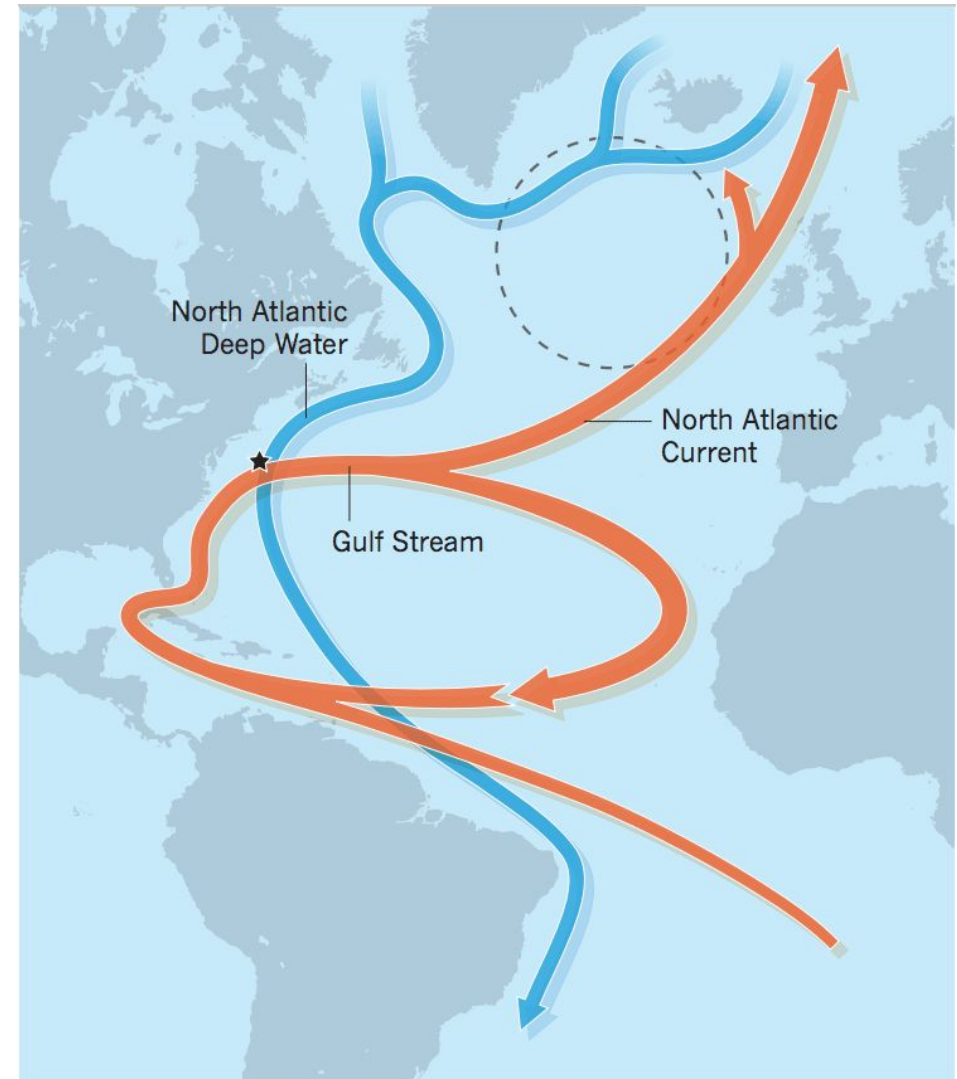


Based on: Lenton et al (2008), Tipping elements in the Earth's climate system, *PNAS*, 2008, 105 (6)1786–1793



## Self-reinforcing Feedback Loops → Climate Tipping Points

- 1. **Gulf Stream Slowdown could result in Shutdown of Atlantic Meridional Overturning Circulation (AMOC)**
- Slowing due to meltwater from Greenland
- Could cause less warmth for northern Europe as well as higher sea levels in eastern US as water expands there from thermal expansion from heating, instead of flowing north. Could harm farming in Europe and cause more coastal flooding on US east coast.



Credit: Springer. Praetorius (2018) North Atlantic circulation slows down, Nature.

## Self-reinforcing Feedback Loops → Climate Tipping Points

- **2. Amazon rainforest dieback**
- Caused by slash and burn agriculture spreading into what was rainforest & decreasing rainfall there.
- Rainforest ecosystem could fail and switch to savanna
- Could lead to a large release of carbon
- Recent studies report that areas of the Amazon may now already be starting to release more CO<sub>2</sub> than they absorb!



Aerial view of deforestation in the Amazon rainforest, near Belém, Brazil. Credit: Sue Cunningham Photographic / Alamy Stock Photo.

# Self-reinforcing Feedback Loops → Climate Tipping Points

- 3. Ice sheet collapse

- Many ice sheets (especially in West Antarctica) are grounded at sea on prominent underwater ridges. Once warming seas melt the ice past these ridges these ice sheets can be melted from underneath as well as from the top and sides, which could cause a tipping point in ice sheet melting.

- Can cause rapid sea level rise

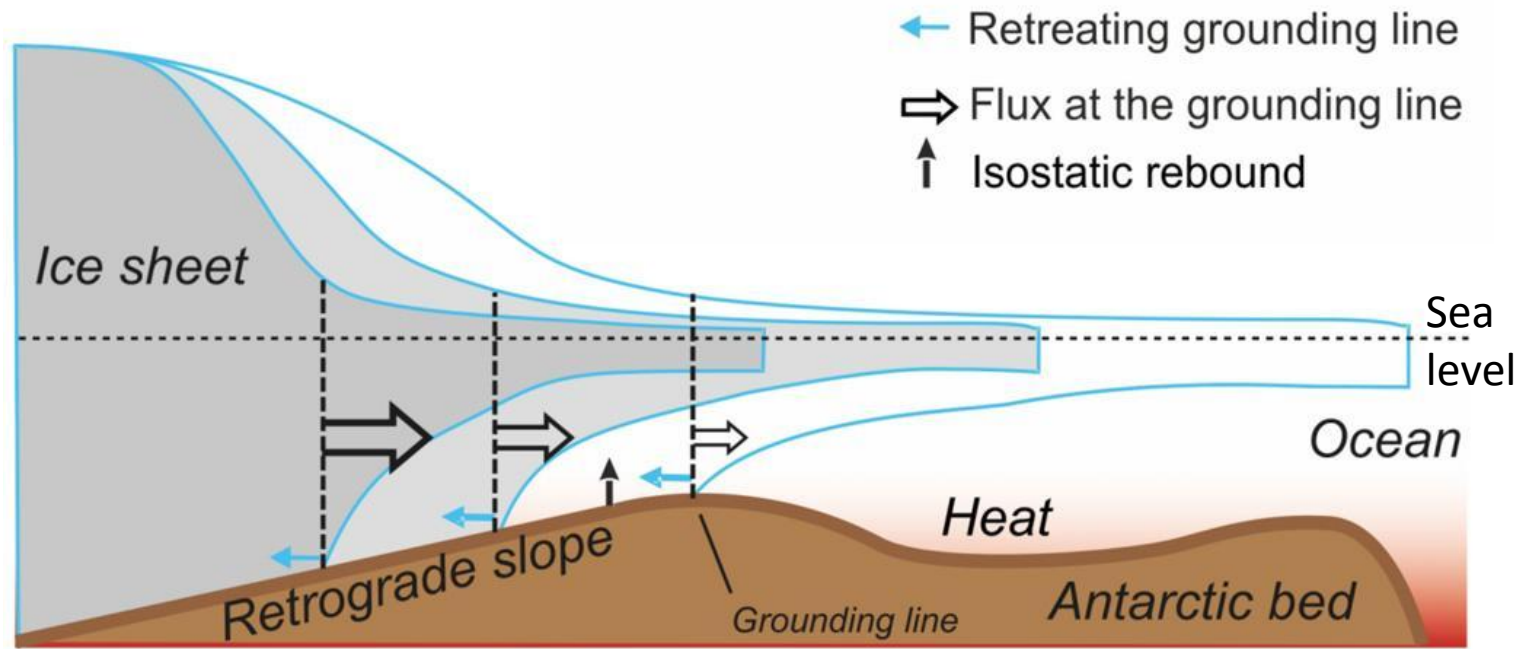


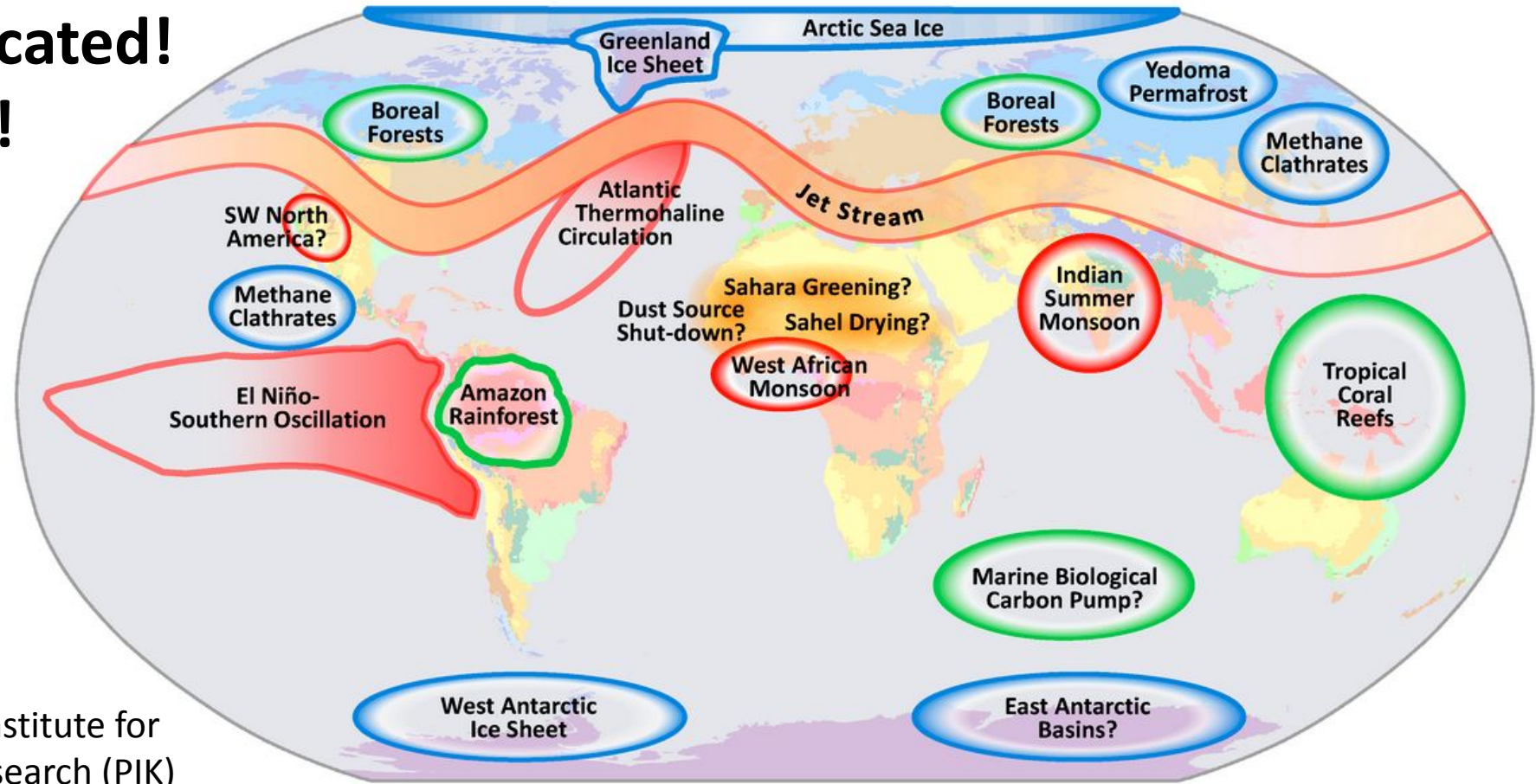
Illustration of Marine Ice Sheet Instability, or MISI. Thinning of the buttressing ice shelf leads to acceleration of the ice sheet flow and thinning of the marine-terminated ice margin. Because bedrock under the ice sheet is sloping towards the ice sheet interior, thinning of the ice causes retreat of the grounding line followed by an increase of the seaward ice flux, further thinning of the ice margin, and further retreat of the grounding line. Credit: IPCC SROCC (2019) Fig CB8.1a.

## Self-reinforcing Feedback Loops → Climate Tipping Points

- **4. Permafrost thawing (huge worry!)**
- A lot of methane is trapped frozen in seafloor sediments and in permafrost on land. Global warming could cause these deposits to melt, and beyond a melting tipping point this could become self-perpetuating and release large volumes of greenhouse gases that would further add to global carbon emissions. Methane is about 85 times as bad a greenhouse gas as CO<sub>2</sub>, in first 20 years after methane is emitted!
- This frozen ground holds a vast amount of carbon, accumulated from dead plants and animals over thousands of years. **There is around twice as much carbon in permafrost than is currently in the Earth's atmosphere.**

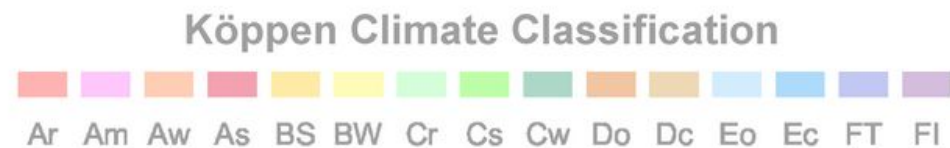
# Self-reinforcing Feedback Loops → Climate Tipping Points

It's complicated!  
Huge risks!



Credit: Potsdam Institute for Climate Impact Research (PIK)

- Cryosphere Entities
- Circulation Patterns
- Biosphere Components



# Degrees of warming matter!

- Each degree and fraction of a degree can make the situation much worse and the amount of change can be exponential, very dramatic!
- Some of these tipping points could trigger each other in a cascading domino effect, leading to global warming being amplified towards a 'Hothouse Earth'!

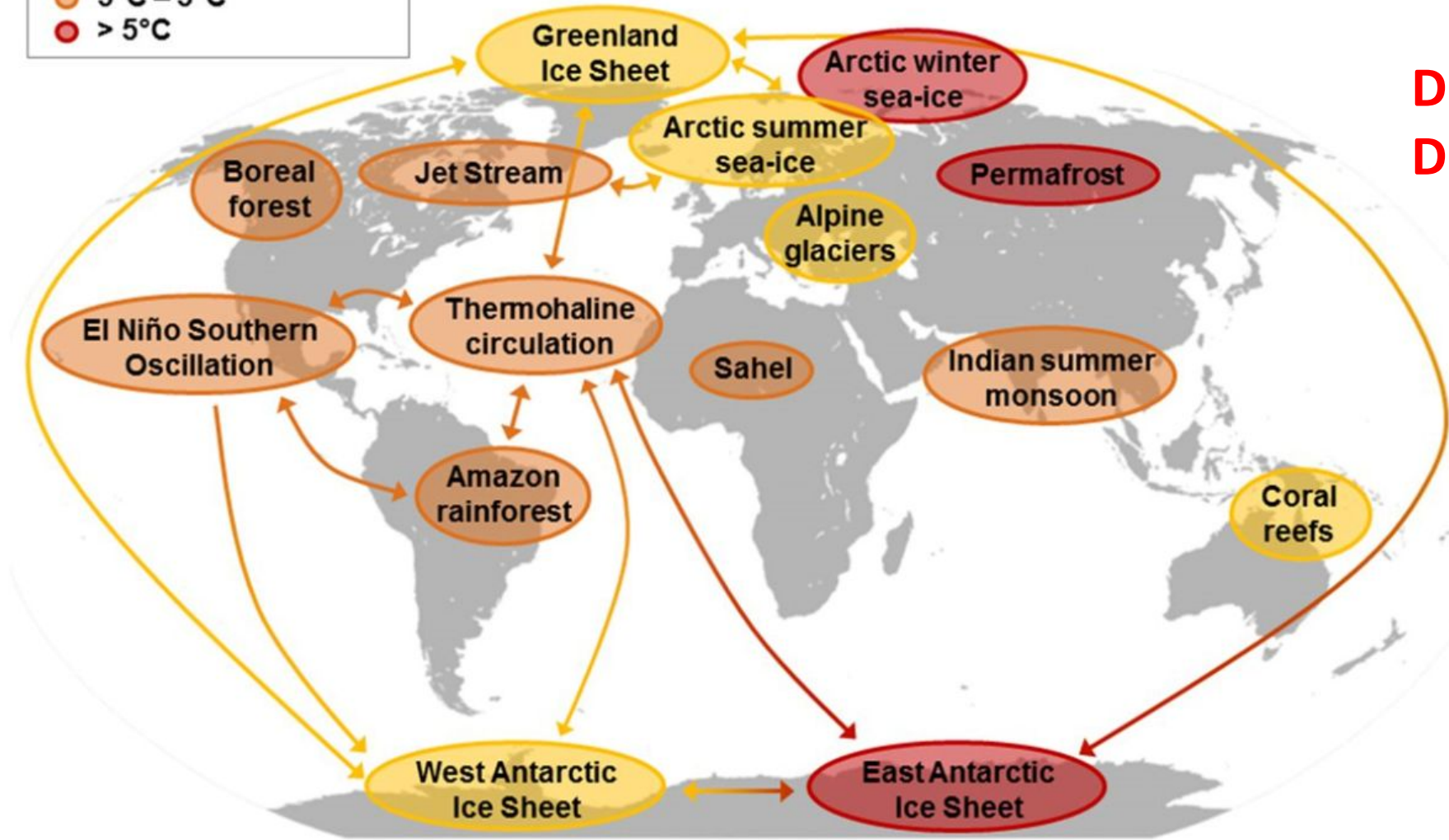
# Degrees of warming matter!

Tipping elements at risk:

- 1°C – 3°C
- 3°C – 5°C
- > 5°C

The Tipping Point cascade at the heart of the 'Hothouse Earth' hypothesis. Credit: [Steffen et al \(2018\) PNAS](#)

**Dangerous  
Dominoes!**



# Degrees and fractions of degrees of warming matter!

## AS GLOBAL TEMPERATURES RISE, OUR WORLD AT

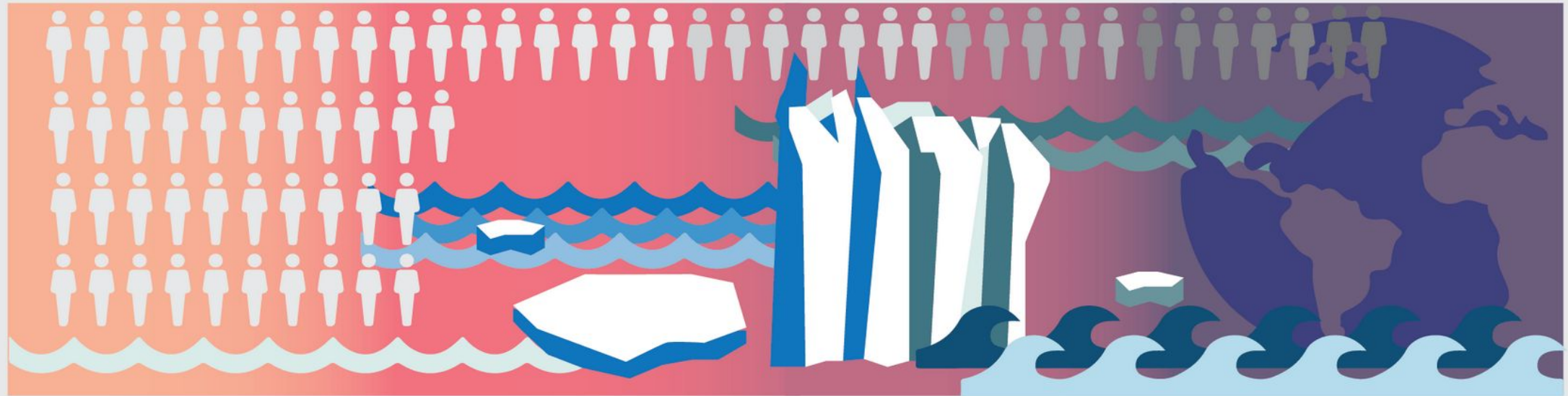




# Degrees and fractions of degrees of warming matter!

## IMPACTS ON SEA LEVEL RISE...

Note: These rises may occur at much different times. Example: 4°C may take centuries to cause 9 meter rise.



**1.5°C**

1.5°C

**2.0°C**

**3.0°C**

**4.0°C**

Rising sea levels displace 46 million people;  
Sea level rise of 48cm

Fewer opportunities for infrastructure adaptation;  
Sea level rise of 56cm

Near-complete melting of the Greenland ice sheet;  
Sea level rise of 7+ meters

470-760 million people at risk;  
Sea level rise of nearly 9 meters

**Rising sea levels displace 46 million people. Sea level rise of 0.5m, 1.7ft (per IPCC 6AR)**

**Fewer opportunities for infrastructure adaptation. 0.6m, 2ft rise (per IPCC 6AR)**

**Near complete melting of Greenland ice sheet. Sea level rise 7+m, 23+ft**

**470-760 million people at risk. Sea level rise of nearly 9 meters, 29.5ft !**

# Degrees and fractions of degrees of warming matter!

## IMPACTS ON WATER AT...



**1.5°C** 1.5°C

Water shortages in the Mediterranean, Australia, Brazil and Asia

**Water shortages in the Mediterranean, Australia, Brazil, and Asia.**

**2.0°C**

8% of the global population faces severe water shortages

**8% of global population faces severe water shortages.**

**3.0°C**

Almost half of Himalayan high mountain glaciers lost

**Almost half of Himalayan mountain glaciers lost; big drop in river flows.**

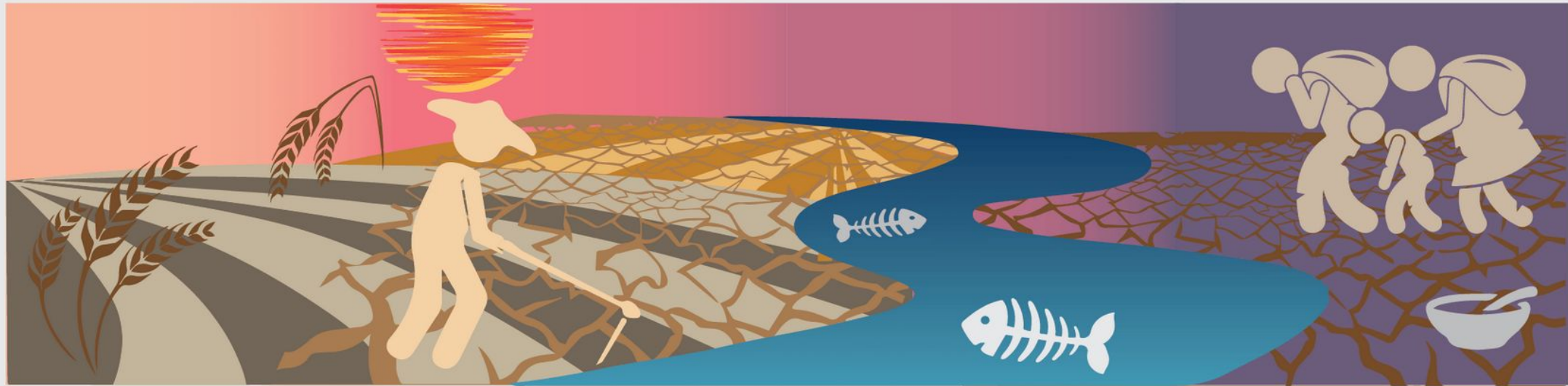
**4.0°C**

More frequent and severe extreme droughts

**More frequent and severe droughts.**

# Degrees and fractions of degrees of warming matter!

## IMPACTS ON FOOD AT...



**1.5°C** 1.5°C

Wheat, rice, maize and soybean production suffers

**Wheat  $\downarrow$ 9%, maize (corn)  $\downarrow$ 3%, & other cereal grain production suffers. Marine fish catch  $\downarrow$ 1.5 mill tons/yr.**

**2.0°C**

Agricultural yields fall rapidly

**Farm yields fall quickly.**

**Wheat  $\downarrow$ 16%, maize (corn)  $\downarrow$ 6%. Marine fish catch  $\downarrow$ 3+ million tons/yr. (out of 155 mm/yr)**

**3.0°C**

Fish species go extinct locally

**Fish species go extinct locally.**

**4.0°C**

High levels of food insecurity, development path reversed

**High levels of food insecurity (starvation). Development path reversed.**

# Degrees and fractions of degrees of warming matter!

## IMPACTS ON FLORA & FAUNA AT...



**1.5°C** **1.5°C**

9 out of 10 coral reefs  
at risk from severe  
degradation

**90% of coral reefs likely  
to severely degrade or die.**

**2.0°C**

All coral reefs  
disappear

**99% of coral reefs die!**

**3.0°C**

Marine ecosystems  
may collapse

**Marine ecosystems  
may collapse!**

**4.0°C**

Half of all plant and  
animal species face  
local extinction

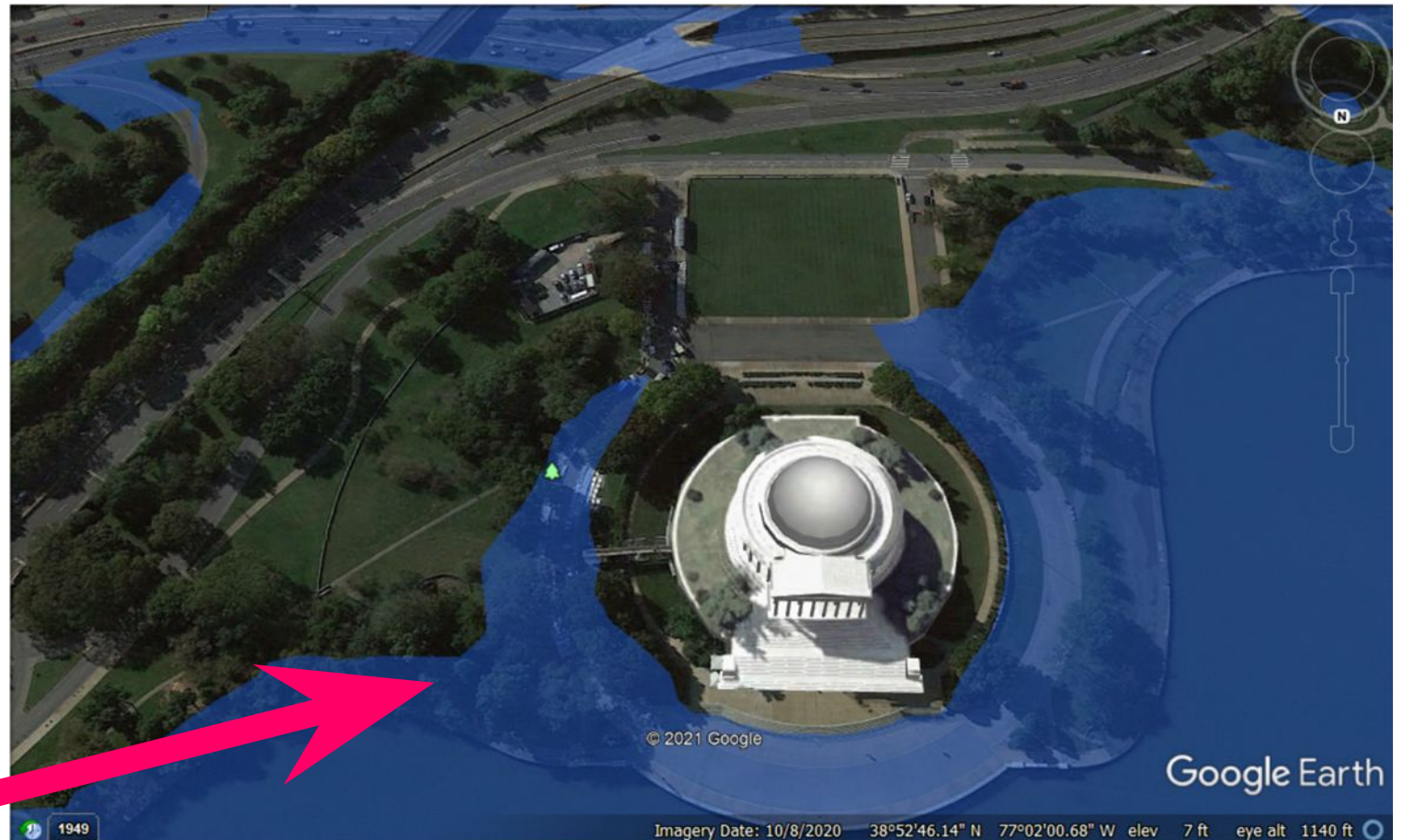
**Half of all plant &  
animal species face  
local extinction!**

## Degrees of warming matter! Huge risk of unknown interactions!

- International study published May 20, 2019 in Proceedings of National Academy of Sciences; ( [Time 5-21-2019 Sea Level Rise Study](#) ) there's a **1 in 20 (5%) chance that sea level will rise over 7.5 feet by the year 2100, if emissions mostly unchecked w 5°C rise!**

- area 3x size of California inundated.
- would be about 200 million climate refugees.  
(1 million refugees migrated to Europe from Syrian crisis, partly due to climate change)
- Washington, D.C., NY City, London, Shanghai, etc. as well as about a quarter of Bangla Desh would be at risk of being unlivable.

**Jefferson Memorial w 7.5 ft rise;  
almost surrounded by sea water!**



# Degrees of warming matter! 1.5°C Lincoln Memorial after decades

0.4°C rise from our current 1.1°C level (Note: 0°C is the reference baseline level from 1850-1900)



Reflecting pool overflow w sea water, surrounding walkway inundated.

# Degrees of warming matter! 3°C Lincoln Memorial after century(+)



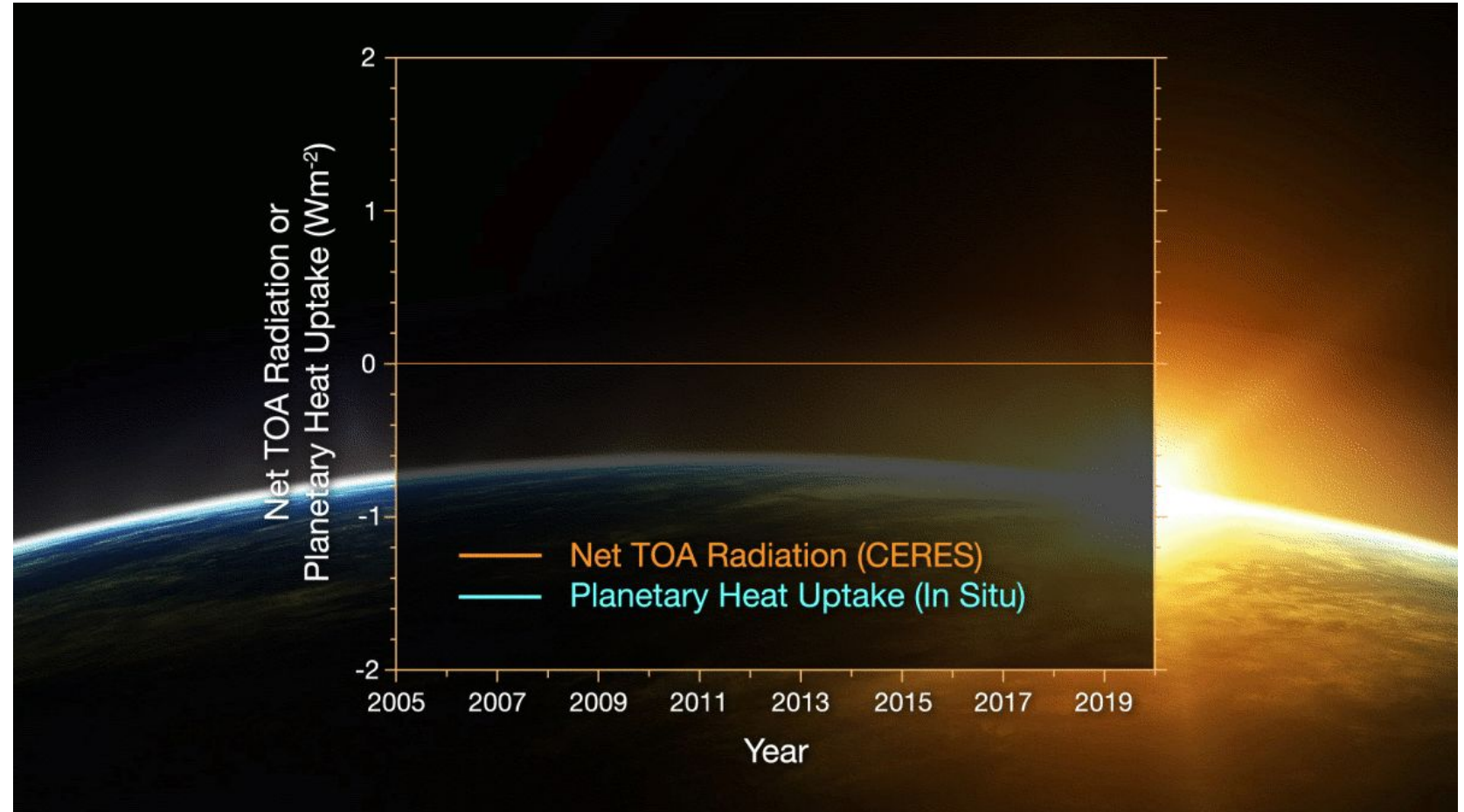
# Warming is accelerating! (& so are emissions)

Heat (Watts/square meter) trapped by Earth increased 50% from 2005 to 2019 per NASA/NOAA data in study published 6/2021 in Geophysical Research Letters.

Top Of Atmosphere (TOA) heat flow analysis from CERES satellite measurements.


Planetary heat uptake (In Situ) from many buoys that measure ocean temperatures.

Oceans absorb 90% of the excess heat energy retained by Earth's atmosphere.  
Oceans now absorb 5 Hiroshima atomic bombs per second, in equivalent heat! CNN Oceans heat 1-13-2020





# Unchecked CLIMATE CHANGE risks breakdown of human civilization and a thermal runaway to 'Hothouse Earth'!

- Many people are worried about this and many **young people are afraid to have children due to Climate Crisis concerns.** 
- Climatologists are generally not experts in public opinion and politics! Interactions of opinion, politics, and countries are hard to predict!
- How Climate Change could lead to breakdown of human civilization has been analyzed and a theorized scenario of how this might unfold has been written by David Spratt, Climatologist & Research Director, along with Ian Dunlop, a former fossil fuel industry executive.
- Published in May 2019, by an independent Australian think tank, called 'The Breakthrough - National Centre for Climate Restoration', and is titled "Existential climate-related security risk: A scenario approach".

Link: [Breakthrough - Existential climate-related security risk - A scenario approach](#)

# Climate Change path to human civilization breakdown intro:

- Introductory backdrop (from Breakthrough Climate scenario paper):
  - “Climate change intersects with pre-existing national security risks to function as a threat multiplier and accelerant to instability, contributing to escalating cycles of humanitarian and socio-political crises, conflict and forced migration.”
  - “Climate-change impacts on food and water systems, declining crop yields and rising food prices driven by drought, wildfire and harvest failures have already become catalysts for social breakdown and conflict across the Middle East, the Maghreb (northern Africa) and the Sahel (broad east-west swath just south of Sahara), contributing to the European migration crisis.”

## Climate Change path to human civilization breakdown scenario:

- **2020-2030: “Policy-makers fail to act on evidence that the current Paris Agreement path — in which global human-caused greenhouse emissions do not peak until 2030 — will lock in at least 3°C of warming.” Actions needed to keep warming below 2°C are not taken! “... by 2030 carbon dioxide levels have reached 437 parts per million — which is unprecedented in the last 20 million years — and warming reaches 1.6°C.”**
- **2030-2050: “Emissions peak in 2030, and start to fall consistent with an 80 percent reduction in fossil-fuel energy intensity by 2100 compared to 2010 energy intensity. This leads to warming of 2.4°C by 2050, consistent with the Xu and Ramanathan “baseline-fast” scenario. However, another 0.6°C of warming occurs — taking the total to 3°C by 2050 — due to the activation of a number of carbon-cycle feedbacks and higher levels of ice albedo and cloud feedbacks than current models assume.”**

## Climate Change path to human civilization breakdown scenario:

- **2050: Tipping points for ice sheets, widespread loss of permafrost, & Amazon large-scale drought/dieback have been passed.**  
**‘The “hothouse Earth” scenario has been realized...’**
    - **35% of global land area & 55% of global population, has 20+ days/year of lethal heat**
    - **Jet stream destabilized, severely affects Asian & West African monsoons**
    - **Gulf stream slows further, severely affects Europe**
    - **North America has devastating weather extremes, wildfires, heatwaves, drought & inundation.**
    - **Deadly heat conditions persisting 100+ days per year in West Africa, tropical South America, the Middle East & South-East Asia, over a billion people displaced from the tropical zone.**
    - **Water scarcity affects 2 billion people worldwide!**
- (Note: this is not full impact list!)**

## Climate Change, human civilization breakdown path scenario: (end)

- **Food production is inadequate to feed global population & food prices skyrocket due to one-fifth decline in crop yields, decline in nutrition content of food crops, catastrophic decline in insect populations, desertification, monsoon failure & chronic water shortages, w conditions too hot for human habitation in significant food-growing regions.**

**!!! Civilization collapse is likely. !!!**

**Even w 2C warming, 1 billion people may need relocation!**



**But do NOT give up hope!  
We have a choice for a  
better future!**

# What has to be done now?!

**Good news: We have the technology and economic ability to save us!**

**Two major strategies need to be implemented to address Climate Change in order to minimize its harmful effects. We need to start now with appropriate scale of effort and urgency; WWII scale & speed!**

- **1) Adaptation: Adjusting to new conditions**

Example: You're on a boat and it starts to leak. You can adapt by bailing water out of the boat, in order to stay afloat.

- **2) Mitigation: Addressing the root cause of the problem in order to prevent it from getting worse.**

Example: You're on a boat and it starts to leak. You can address the root cause of the problem by patching the hole in the boat to stop or at least minimize the leak and keep it from getting worse.

## What has to be done now?! Adaptation to Climate Change; examples

- **Build sea walls, elevate/harden infrastructure, retreat**

Example: In the U.S., cities like Charleston, Houston, Miami, and San Francisco (to name a few) already have [billion-dollar investments](#) planned to protect their sea-bound populations.

- **Reduce use and recycle water to address drought.**

Example: Spain — which has lost 20 percent of its [fresh water](#) in just the past 20 years — has made significant changes to its national [water policy](#).

- **Favor drought-tolerant crops like [rice, cowpea, and maize](#) (corn)**

Example: Many African countries have done this in response to decreasing rain.

- **Use prescribed fires to prevent uncontrollable wildfires**

Example: Southeastern United States — the region of the country with the highest use of prescribed fires. It's no surprise [this practice is increasing](#) in the region given that by mid-century “NOAA suggests that the risk of very large fire weeks [will increase by 300%](#)”.

Credit for content of this slide: [The Climate Reality Project](#)

# What has to be done now?! Mitigation of Climate Change; 2 ways

- **1) Reduce Greenhouse Gas (GHG) emissions**

**10/2018 IPCC warned: Need to cut greenhouse gas emissions 50% by 2030 & need to get to 'net zero by 2050' to try to limit warming to 1.5°C!**



- reduce energy use via efficiency improvements, etc.
- electrify everything based on clean energy & get off of fossil fuels!
- regenerative agriculture, with localization and change in diet
- phase out powerful GHG chemicals:  
Hydrofluorocarbons (HFC); used in AC & refrigeration, HFC 134a has 15yr life, 3,000X Global Warming Potential (GWP) vs CO<sub>2</sub>, 150 nations signed Kigali Amendment to reduce use 80% by 2047, can avoid 0.4C warming by 2100

Sulfur Hexafluoride (SF<sub>6</sub>); used in high voltage switchgear, lasts 1,000 yrs, 23,500X GWP vs CO<sub>2</sub>, global emissions equivalent to 100 million cars

- **2) Enhance absorption/sequestration of Greenhouse Gases**

- plant trees, stop deforestation
- regenerative agriculture

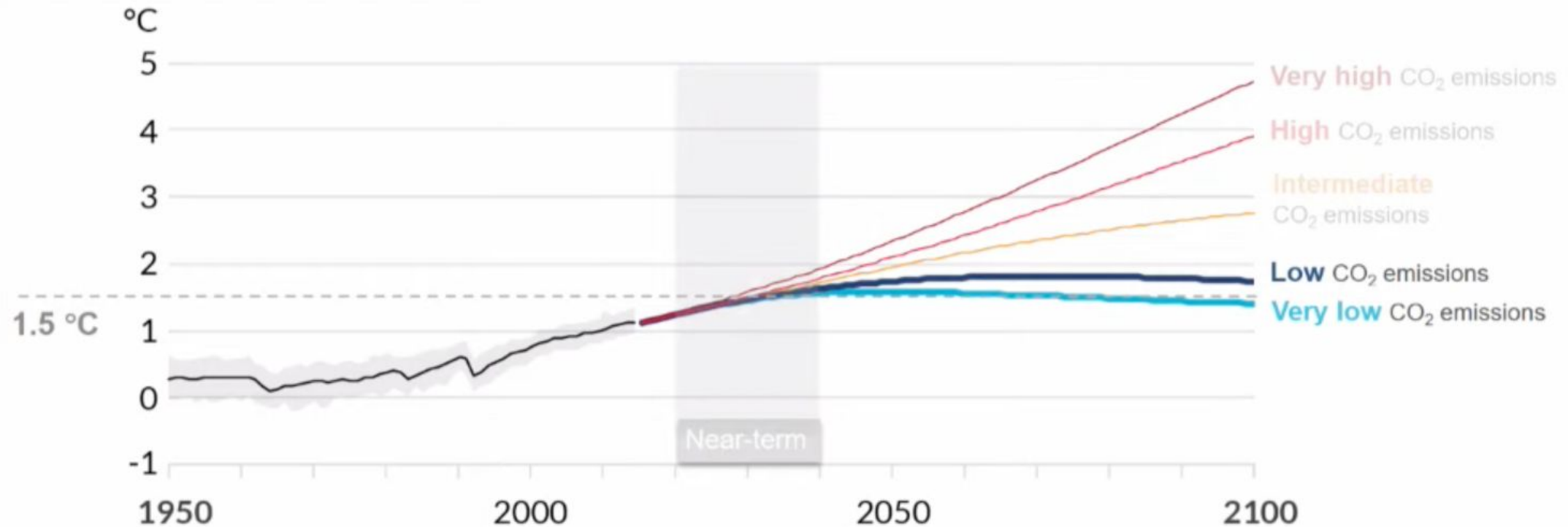


## What has to be done now?! Mitigation of Climate Change; examples

- **Replace fossil fuels like coal, oil, and natural gas with clean, renewable energies like solar, wind, geothermal, wave energy, etc.**  
Renewables became “the cheapest form of new electricity generation [across two thirds of the world](#)” in 2019 (compared to in just 1% of the world 5 yrs earlier)
- **Replace traditional internal-combustion vehicles with electric options (ideally charged with renewable energy).**  
Electric vehicles (EV) are improving. As [Bloomberg NEF](#) describes: “Over 2 million electric vehicles were sold in 2018, up from just a few thousand in 2010.” (global) 3 million in 2020.
- **Retrofit old buildings to make them more energy efficient —**  
a fast-growing industry worth [\\$300 billion globally](#).
- **Plant trees & preserve forests so they can absorb & store more CO<sub>2</sub>.**  
Example: Indian state of Madhya Pradesh planted 66 million trees in just one day!  
Credit for content of this slide: [The Climate Reality Project](#)



## Future emissions cause future additional warming

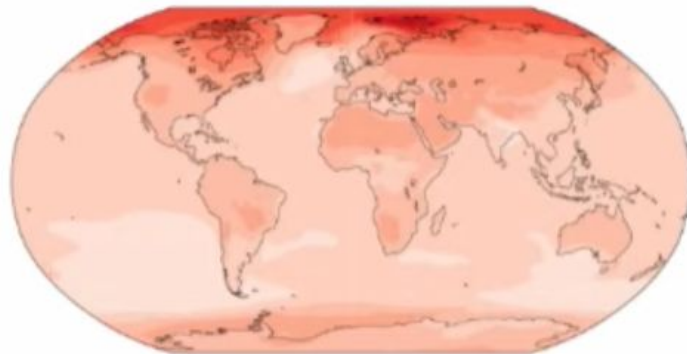


My comment: We have choices to make in greenhouse gas emissions. Some bad effects are already 'baked in' and will continue for centuries (and may get worse slowly), but if we make substantial and rapid changes to lower emissions we can prevent the horrible scenarios I just finished explaining.

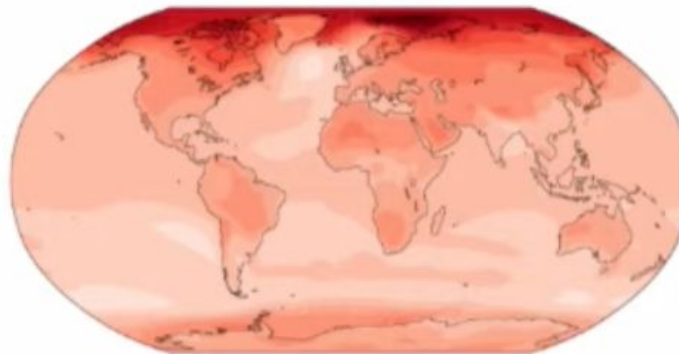
With every additional amount of global warming, changes get larger.

Simulated changes...

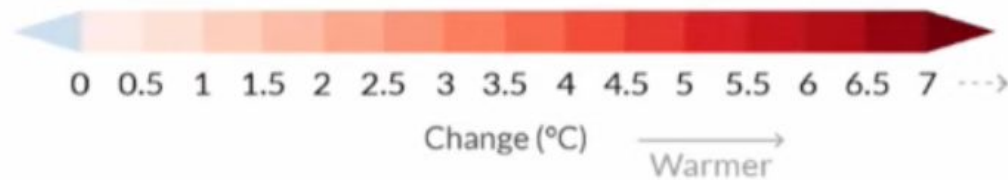
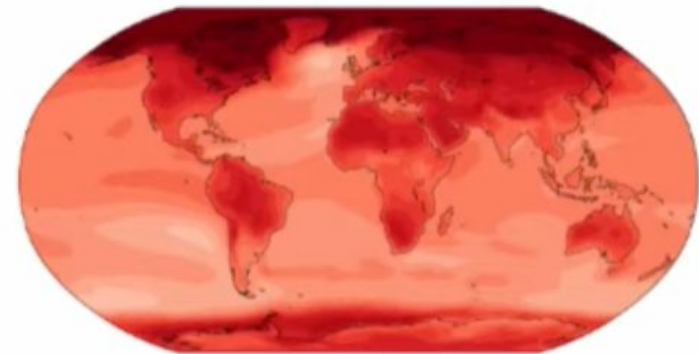
...at 1.5°C



...at 2°C



...at 4°C



# Do what you can personally, but push for system change!

- **Ideas for individuals:**

**Sign up for renewable energy, weatherize, switch to air-source heat pumps or geothermal, combine trips, use public transport, bicycle, make next vehicle EV, LED light bulbs, reduce/eliminate meat, buy less stuff (get things fixed, instead), etc.**

- We need to push for collective action! Climate can't be solved individually.

- Press for industry action! Contact them and ask what they are doing about their greenhouse gas footprint. Boycott & divest from bad firms.

# Push for system change; public will &

## government!

• **Push for government action at appropriate scale & speed (WWII)!**

**Contact government officials**, by letter, email, or phone.

**Tell them** what town/city you live in and zip code and that **climate actions will determine your vote/support.**

**Do it at federal, state and local levels of government!**

**Keep doing it!** Just existing activists doing it is not enough.

- **Support good legislation:**

**Example: Build Back Better budget reconciliation act (federal)**

**Climate and Community Investment Act (CCIA, NY State)**

- **Help good candidates campaign, help people register and vote!**

# Push for system change; via public will & government!

• Cost and jobs are not valid excuses!

- Extreme weather / Climate related disasters cost U.S. taxpayers \$99B in 2020. [Center for American Progress 9-1-2021](#) \$100B for first 9 months in 2021!
- U.S. jobs in 2018: 335,000 solar + 111,000 wind = 446,000 total versus only 211,000 in fossil fuels! [Forbes 4-22-2019 Renewable Job Boom](#)  
Renewable jobs are growing faster.

\* Fossil fuel air emissions cause 1 in 5 deaths, 8.7 million/yr globally!  
350,000 deaths/yr in US! [Yale Climate Connections 04-2021](#)



\* Benzene, a powerful carcinogen, is allowed in gasoline at 0.6%!

Protest! Tell your friends, relatives, co-workers, neighbors, etc. about the climate change crisis & the need to contact officials. Volunteer w groups.

A better world, with a habitable climate, cleaner air & water, better health, better jobs, and quieter streets is possible!



# Questions? Ideas? Comments?

Electrify Transportation



Decarbonize The Grid

Remove Carbon



Fix Food



Win Politics And Policy



Protect Nature



Turn Movements Into Action

Clean Up Industry



Innovate!



Invest!



Slide Credit: [Speed & Scale book website](https://www.speedandscale.com)

Act now for our planet  
at [speedandscale.com](https://www.speedandscale.com).

**Speed  
& Scale**

# Effects of Arctic Amplification





Effects of Arctic Amplification



# EarthNow

Here's the latest from EarthNow...




WEATHER AND CLIMATE CONNECTIONS FOR 3D SPHERICAL DISPLAYS



0:09 / 2:35



## CLIMATE CHANGE is biggest threat – big risk of unknown


- 10/2018 IPCC warned:  
need to cut greenhouse gas emissions 50% by 2030 &  
need to get to 'net zero by 2050' to try to limit warming to 1.5°C! 
- 4/2021: Burning fossil fuels kills 8.7 million people worldwide &  
350,000 in USA, per study by Harvard & three British universities! 
- **Many young people are afraid to have children  
because of the threat of climate change!** 

- Climate change is changing jet stream
- Climate vs jet stream - Arctic Amplification

# SIERRA CLUB supports helpful ideas, YOU can too!

- **BU student Climate Forum with Rep. Brindisi 4/29/2019 – led by GROW (Generation Repairing Our World) – led to Climate Crisis Working Group to advise him**  
– Susquehanna Group supported this. (Rep. Tenney not interested in Climate Change.)
- **Climate Jobs New York**; coalition of labor unions w plan to transition NY to a green economy that helps preserve a habitable climate!  
- supported by labor and 30 environmental groups including Sierra Club  
- centerpiece; building offshore wind turbines to power 6 million homes, create >10,000 jobs
- **Climate Leadership & Community Protection Act (CLCPA)** NY law enacted 7/18/2019; set NY goals; 70% of electricity from renewables by 2030, 100% carbon-free electricity by 2040.  
Reduce greenhouse gas emissions in NY by 85% from 1990 levels by 2050.
- **Climate & Community Investment Act (CCIA)** is proposed to impose carbon fee in NY to fund transition to green economy
- **Green New Deal** US Congress resolution – guidelines for a just transition to renewables (- inspired the **THRIVE act being written in Senate**)

## SIERRA CLUB supports helpful ideas. **Things YOU can do!** 😊

- **Switch your electricity supply** to a company providing community shared solar ☀️
  - **save 10%** off of your electricity supply & delivery charges
  - speed the transition to renewable energy to help save a habitable climate 💰
- **Insulate, weatherize, switch to LED lights to save energy and money!**
- **Buy an electric vehicle** next time you need a new vehicle. ⚡️ 
- **Get involved:** phone calls, letters, e-mails, protest, political campaigns, volunteer with groups