



CLIMATE EMERGENCY INSTITUTE

The Health and Human Rights Approach to Greenhouse Gas Pollution

Is Global Climate Change Tracking the Worst-Case Scenario?

**Our study shows that
the world economy has the world fixed on the worst-case climate change scenario (RCP8.5)**

**All indicators are increasing faster than ever
EVERYTHING IS GETTING WORSE FASTER**

Peter Carter

4 July 2020

Short version of study

The Crime of All Time

**The relevance of the worst-case scenario
is not limited to global surface warming by 2100,
but most crucially to the present and future
RATE of warming —
which is ACCELERATING**

**That means devastating global impacts are unavoidable
which is an unprecedented worst ever crime
against all Humanity
It is the crime of all time**

**This report is the most crucial evidence for all legal cases being brought
for the unprecedented abuse of human rights against
all today's children and youth**

Short Assessment

Seven Indicators:

- **Global average surface temperature increase**
- **Global fossil fuel CO₂ emissions**
- **Global CO₂ equivalent emissions (CO₂ plus the other GHGs like methane, nitrous oxide)**
- **Atmospheric CO₂ equivalent concentration**
- **Radiative forcing (total added heat)**
- **Atmospheric CO₂ concentration**
- **Ocean acidification (pH, acidification is inverse)**

All are tracking the worst-case scenario (RCP8.5)

Note use of screen captures for reference and authenticity

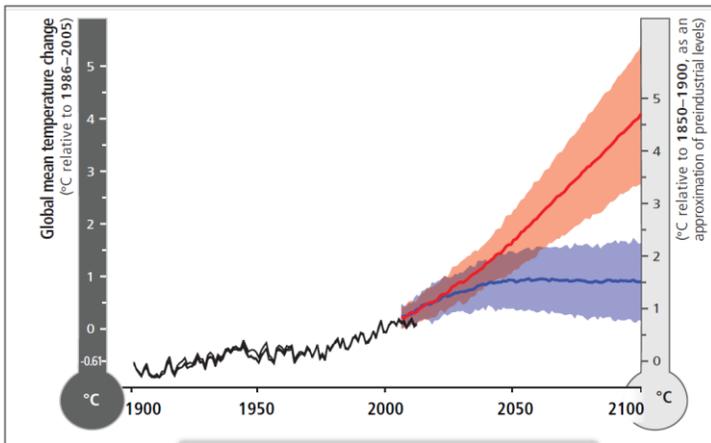
GLOBAL AVERAGE SURFACE TEMPERATURE INCREASE

is tracking the worst-case scenario (RCP8.5)

2019 increase from pre-industrial is 1.2°C*

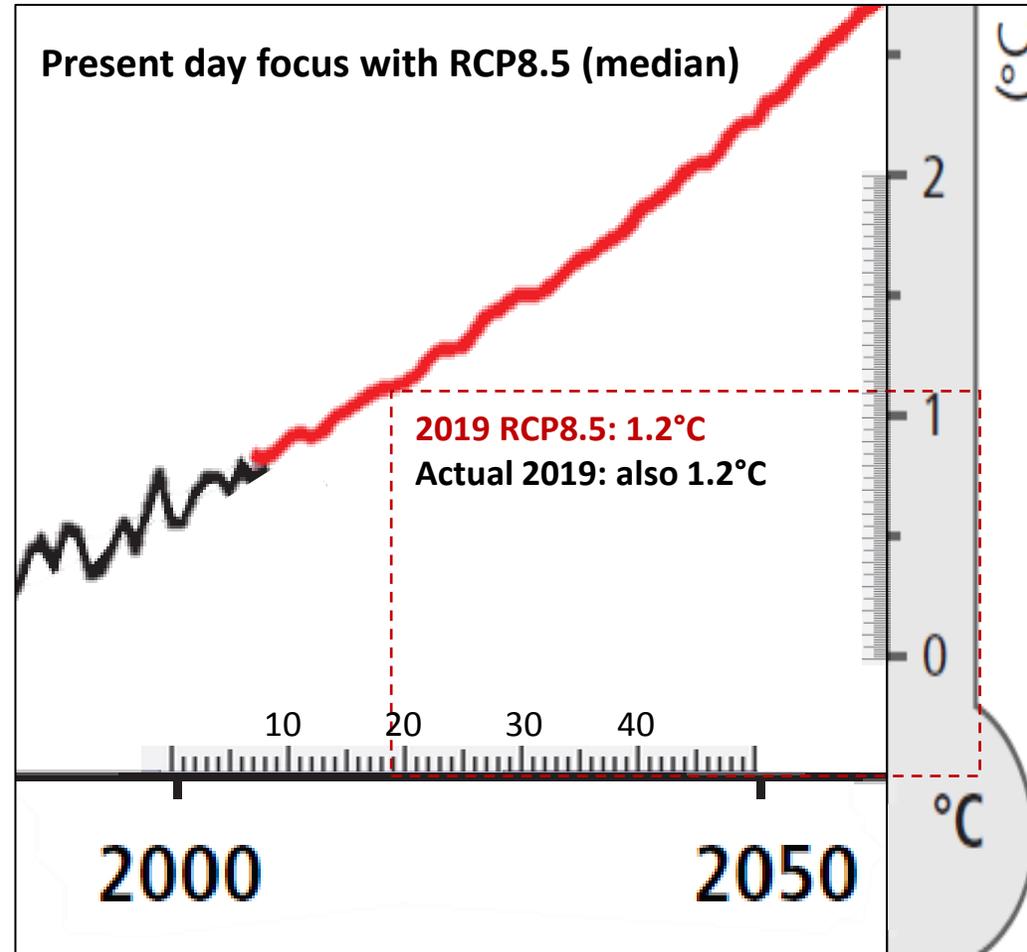
Projected 2019 RCP8.5
warming: 1.2°C
Actual 2019 warming: 1.2°C

Original for RCP8.5 from pre-industrial



IPCC 2014 5th assessment, WG2, Assessment Box SPM.1 Figure 1

https://www.ipcc.ch/site/assets/uploads/2018/02/ar5_wgll_spm_en.pdf



*Global Temperature in 2019
(15 January 2020),
NASA expert team, James
Hansen, M. Sato, R. Ruedy, G.
Schmidt, K.Lob, M. Hendrickson
Abstract ... "The 2019 global
temperature was +1.2°C
(~2.2°F)"

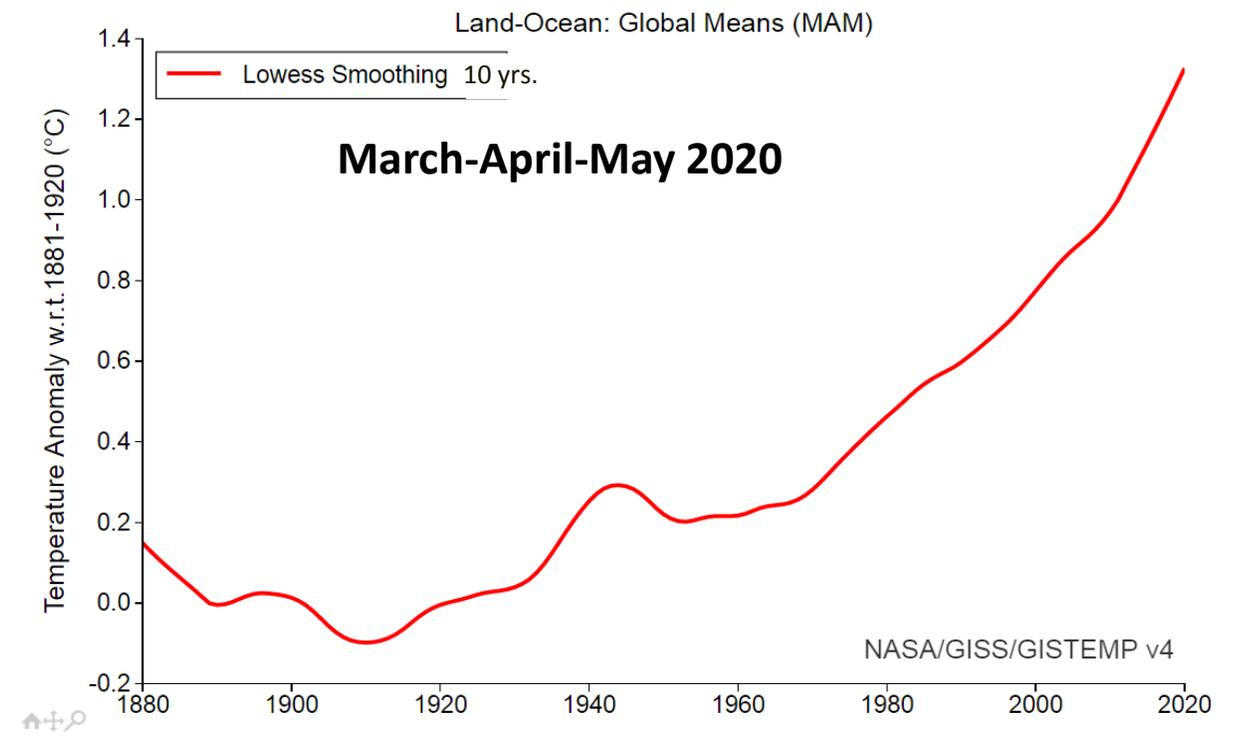
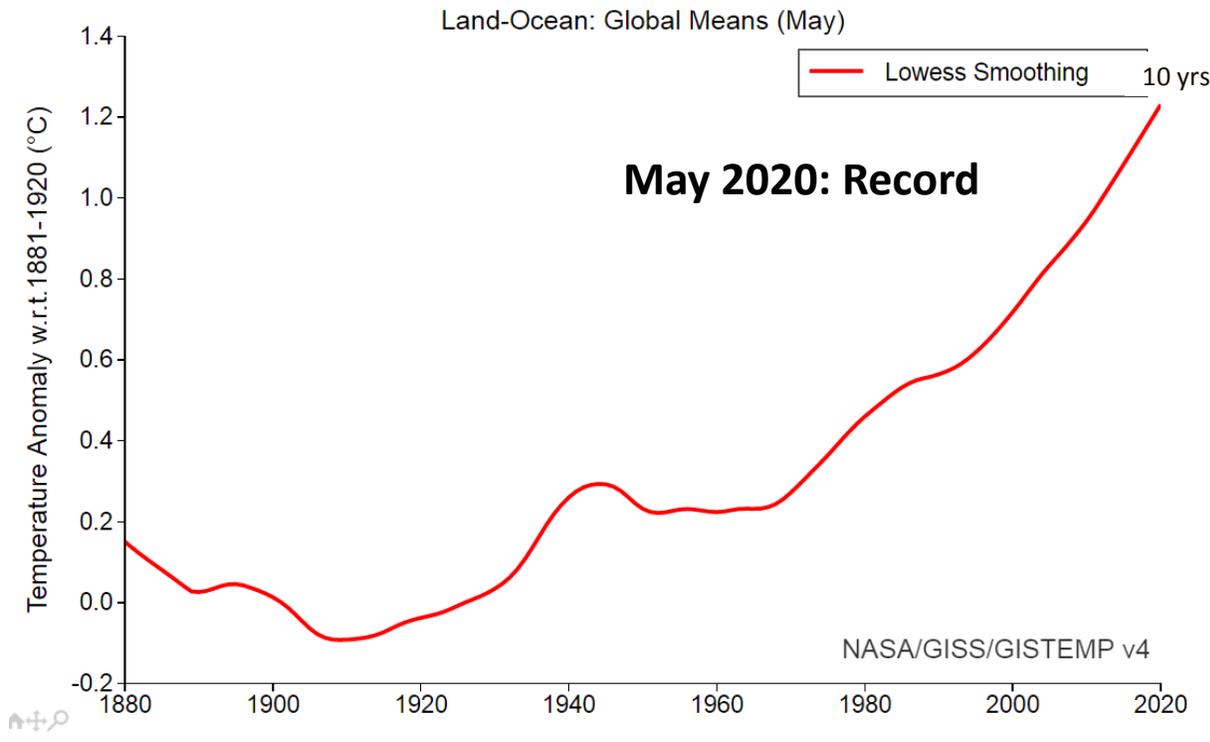
*The rate of global warming has
accelerated in the last decade*

http://www.columbia.edu/~jeh1/mailings/2020/20200115_Temperature2019.pdf

Accelerating Global Surface Temperature Increase

May 2020: monthly record

March-April-May: accelerating fast



Global Greenhouse Gas Emissions Have Tracked the Worst-Case Business-as-Usual Scenario for the Past 10 Years!

(UNEP 2019)

“The current level of global GHG emissions is by now almost exactly at the level of emissions projected for 2020 under the **business-as-usual, or no-policy, scenarios** used in the Emissions Gap Reports.

“In other words, essentially there has been no real change in the global emissions pathway in the last decade.”

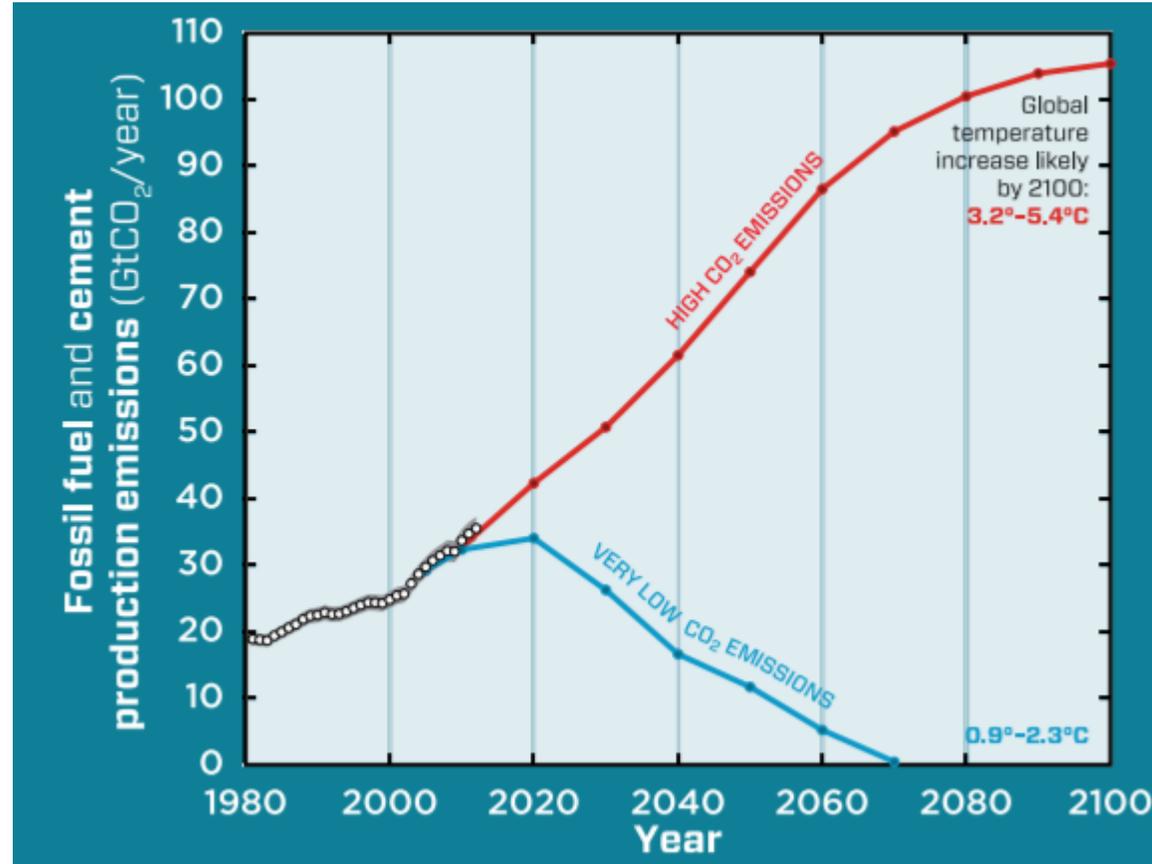
United Nations Environment Program

Lessons from a decade of emissions gap assessments, UNEP, Special Report April 2019

Accelerating Global fossil fuel CO₂ emissions are tracking the worst-case scenario (1980-2013)

“Global CO₂ emissions (white dots, uncertainty in grey) from fossil fuel use are following the high emissions trajectory (red line, RCP 8.5) predicted to lead to a significantly warmer world”. (Ocean acidification Summary, 2013)

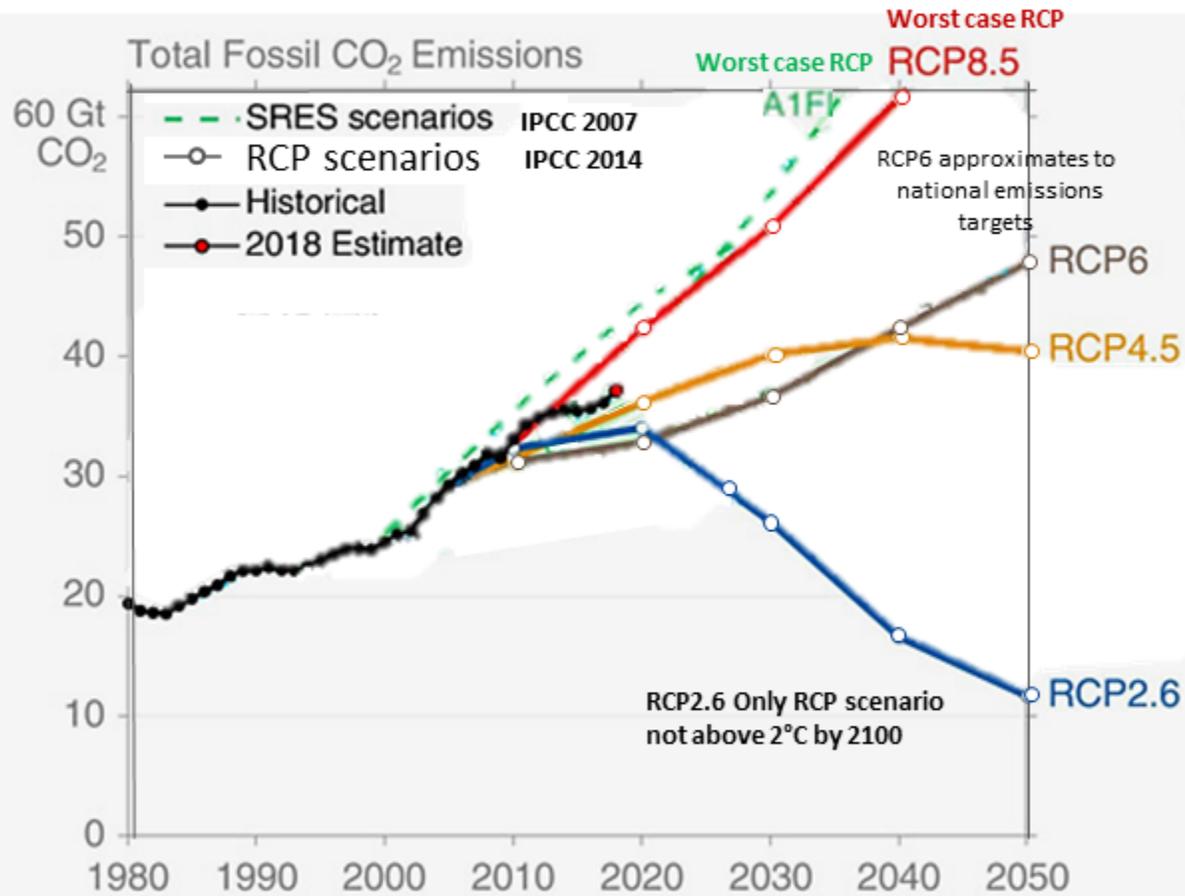
(“Emissions growth accelerated in the 2000s (IPCC 2014 5th assessment” , 5-357)



2013, Ocean Acidification Summary for Policymakers Third Symposium on the Ocean in a High-CO₂ World

2018 global CO2 emissions tracking the worst-case scenario RCP 8.5

Global fossil fuel CO2 emissions are tracking closet to the worst-case RCP 8.5



Total CO2 emissions are tracking the worst-case RCP 8.5

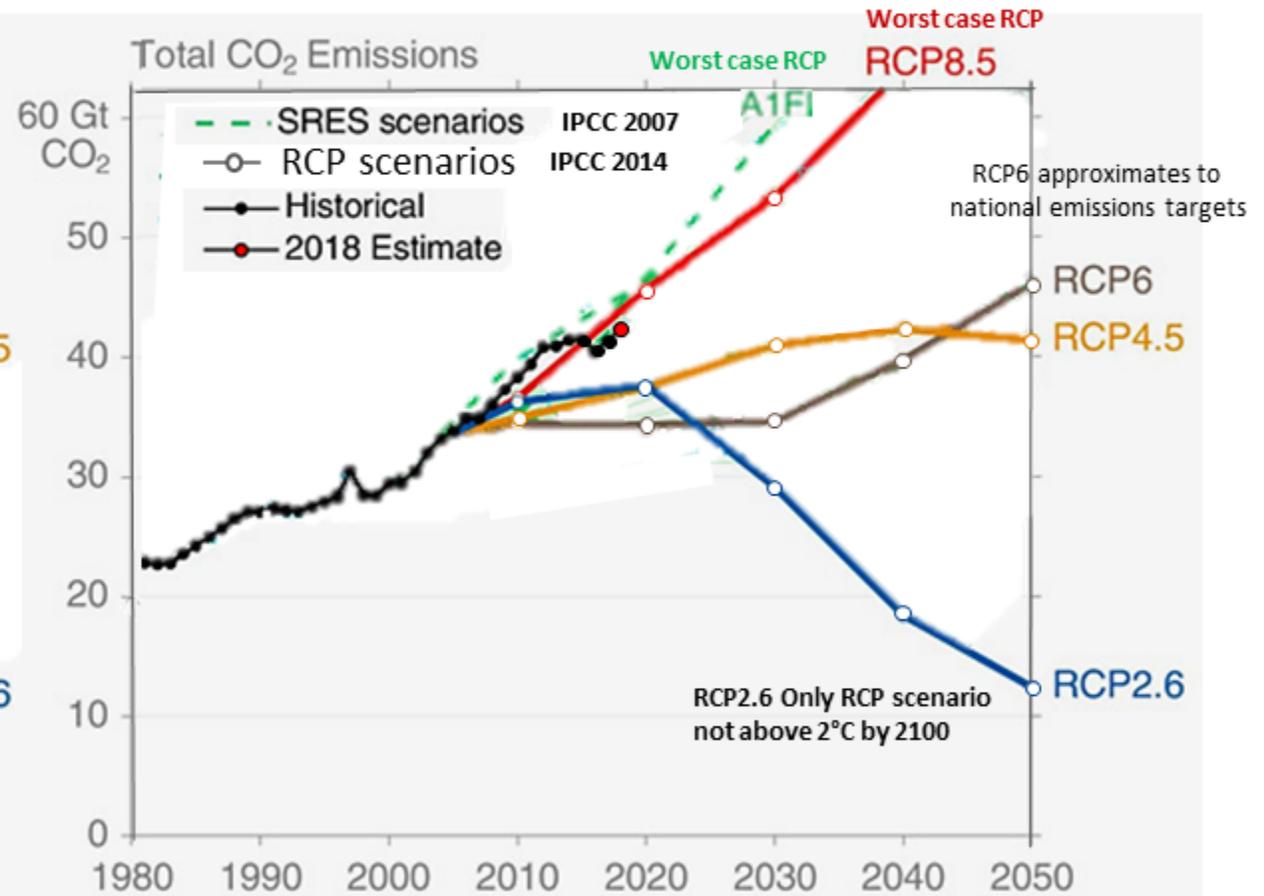


Figure: @robbie_andrew, @Peters_Glen

Figure: @robbie_andrew, @Peters_Glen

Adapted from Global fossil fuel CO2 emissions (left) and total CO2 emissions from fossil fuels and land use (right) for historical observations and RCP, SRES, and IS92 scenarios.

Credit: Glen Peters. Carbon Brief Explainer 21 August 2019 Explainer: The high-emissions 'RCP8.5' global warming scenario

GLOBAL CO2 EQUIVALENT EMISSIONS (2018)

are tracking above the worst-case scenario (RCP8.5), with increasing divergence since 2010

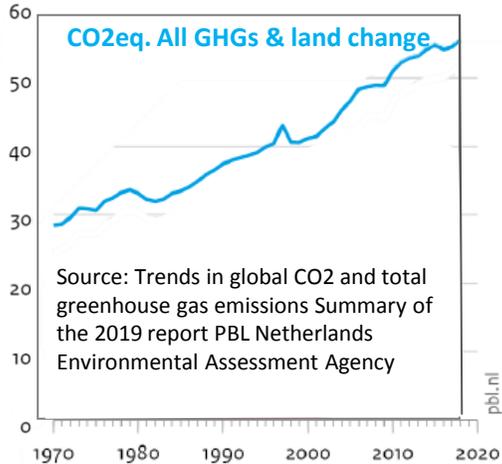
(CO2 equivalent includes the other greenhouse gases, along with CO2)

Trends in CO2 and total greenhouse gas emissions, PBL, 2019

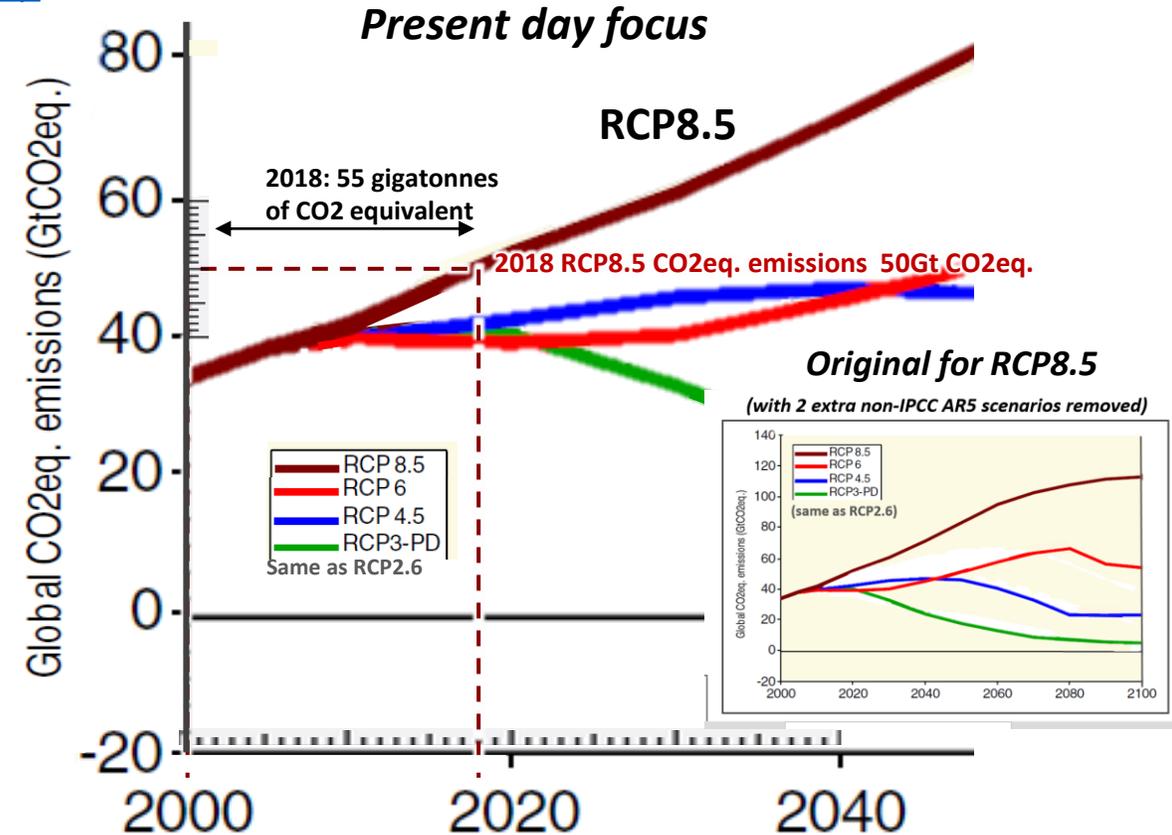
<https://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-summary-of-the-2019-report>

“The 2018 global greenhouse gas emissions amounted to 55.6 Gt CO2eq. when also including those from land-use change”

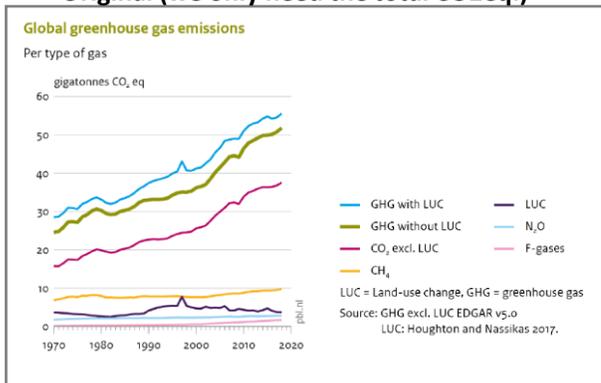
Gt. CO2eq. **Actual present CO2eq.**



Projected 2018 RCP8.5 emissions: 50GT CO2eq.
Actual 2018 emissions: 55.6Gt CO2eq.



Original (we only need the total CO2eq.)



Riahi, K., Rao, S., Krey, V., Cho, C., Chirkov, V., Fischer, G., Kindermann, G., Nakicenovic, N., and Rafaj, P. (2011); “RCP8.5 - A scenario of comparatively high greenhouse gas emissions,” Climatic Change (2011) 109:33-57, doi: 10.1007/s10584-011-0149-y. <https://link.springer.com/article/10.1007/s10584-011-0149-y>

ATMOSPHERIC CO2 EQUIVALENT CONCENTRATION (2019: 500 ppm) is tracking above the worst-case scenario RCP8.5

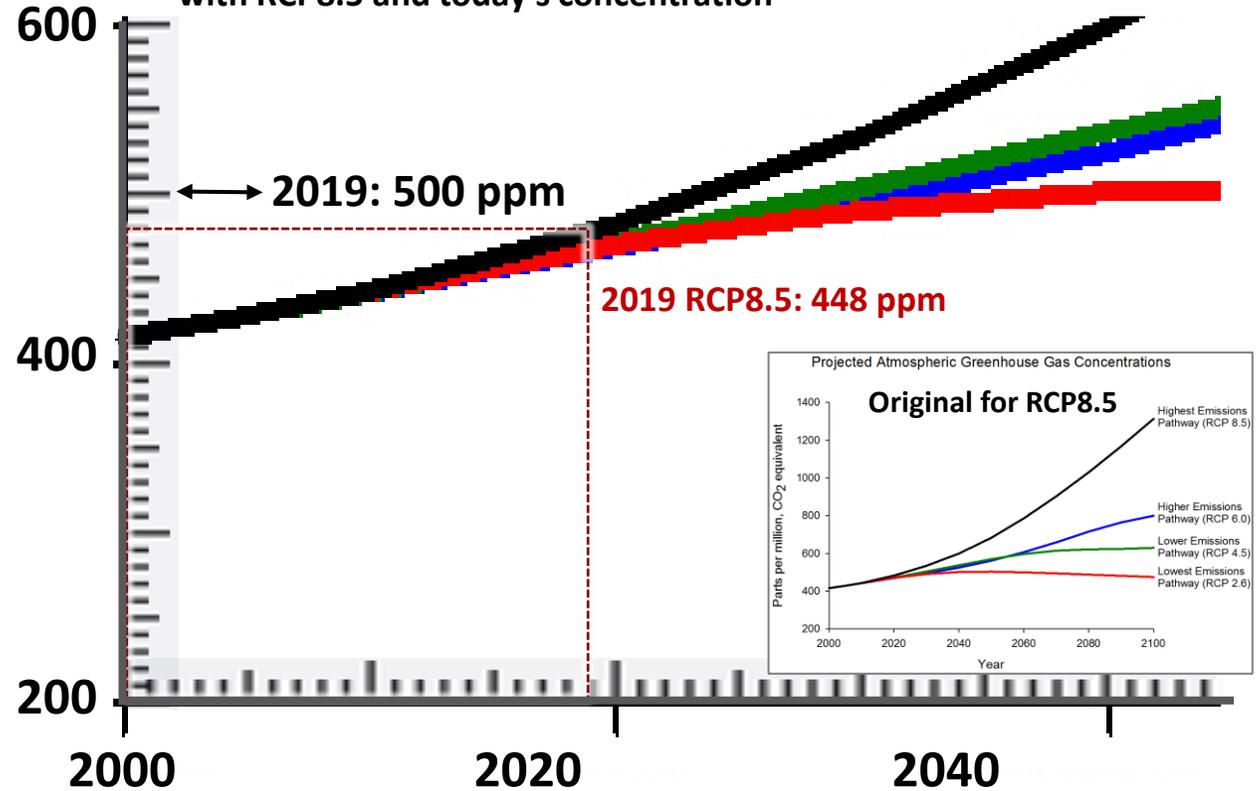
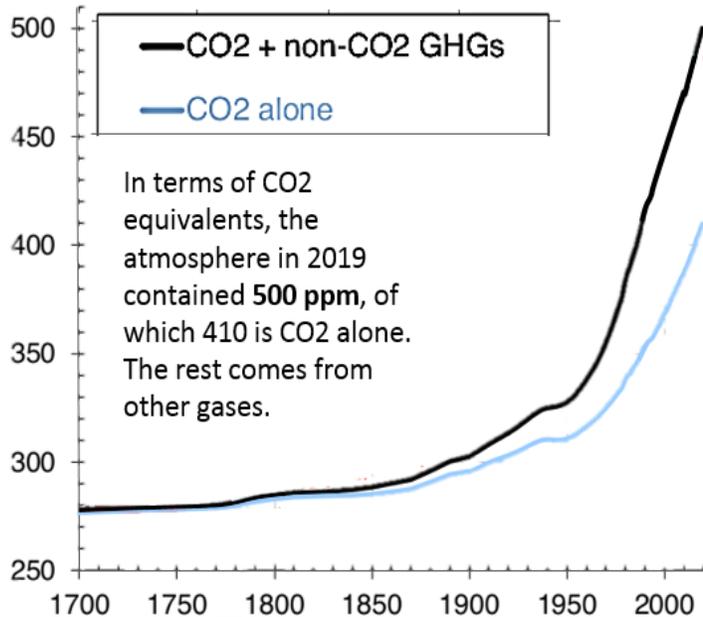
The CO2 equivalent includes the other greenhouse gases, like methane and nitrous oxide so it is higher than CO2 alone. It is the metric used by the IPCC in mitigation calculations.

**Worst-case
highest emissions
RCP8.5**

**Present day focus
with RCP8.5 and today's concentration**

**Projected 2019 RCP8.5 CO2 eq.: 448 ppm
Actual 2019 CO2 eq.: 500 ppm**

NOAA for atmospheric CO2 eq. in 2019
Adapted from NOAA's Annual Greenhouse Gas Index, 2020



https://19january2017snapshot.epa.gov/climate-change-science/future-climate-change_.html

Source: EPA Climate change science
Future of climate change , 2017

Climate Emergency institute

<https://www.esrl.noaa.gov/gmd/aggi/aggi.html>

The RCP scenarios (IPCC 2014 5th assessment) were set by pre-determined radiative forcing up to 2100

RADIATIVE (HEAT) FORCING (RF) (2019)

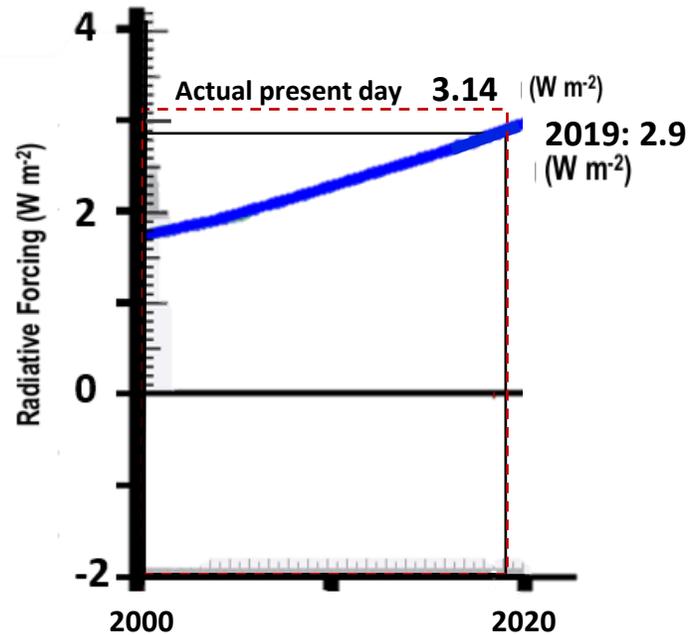
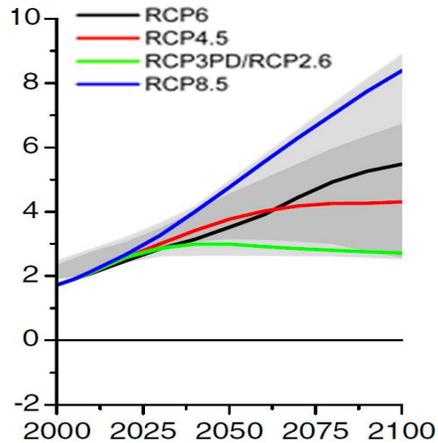
is tracking above the worst-case scenario RCP8.5

on an accelerating trajectory

‘Radiative forcing increased 43% from 1990 to 2019’ (5 atom bombs/second)

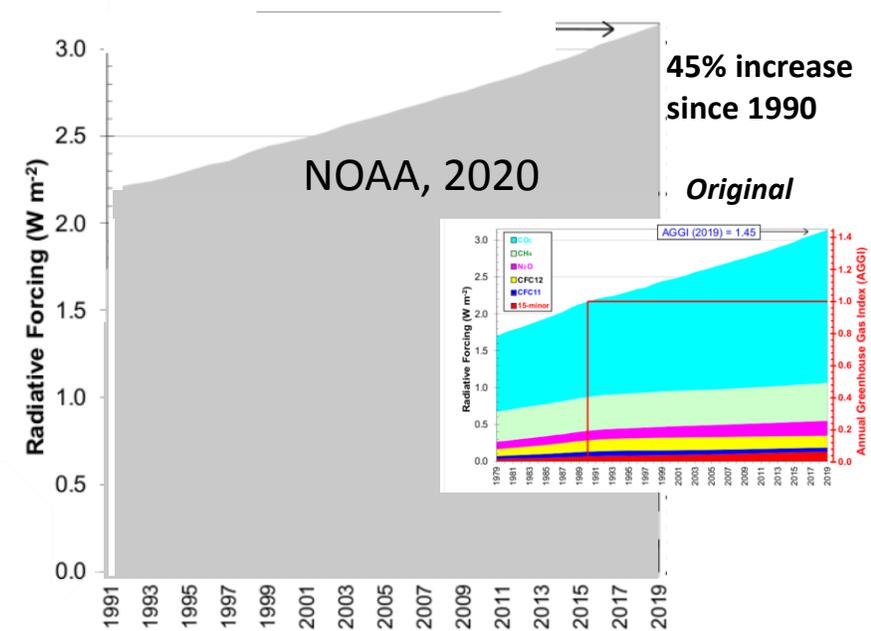
Projected 2019 RCP8.5 RF: 2.9 Watts/m²
Actual 2019 Radiative forcing: 3.14 W/m²

Original for RCP8.5



Actual present day

Actual 2019 (from NOAA 2020 Greenhouse Gas Index): 3.14 Watts/m²



The representative concentration pathways: an overview, Detlef P. van Vuuren, 2011
 (The 2014 IPCC 5th assessment RCP scenarios reference paper)
<https://link.springer.com/article/10.1007/s10584-011-0148-z>

THE NOAA ANNUAL GREENHOUSE GAS INDEX (AGGI) NOAA Earth System Research Laboratory,
 James.H.Butler, Stephen.A.Montzka (updated Spring 2020)
<https://www.esrl.noaa.gov/gmd/aggi/aggi.html>

ACCELERATING ATMOSPHERIC CO2 CONCENTRATION is tracking just below the worst-case scenario RCP8.5

Actual present

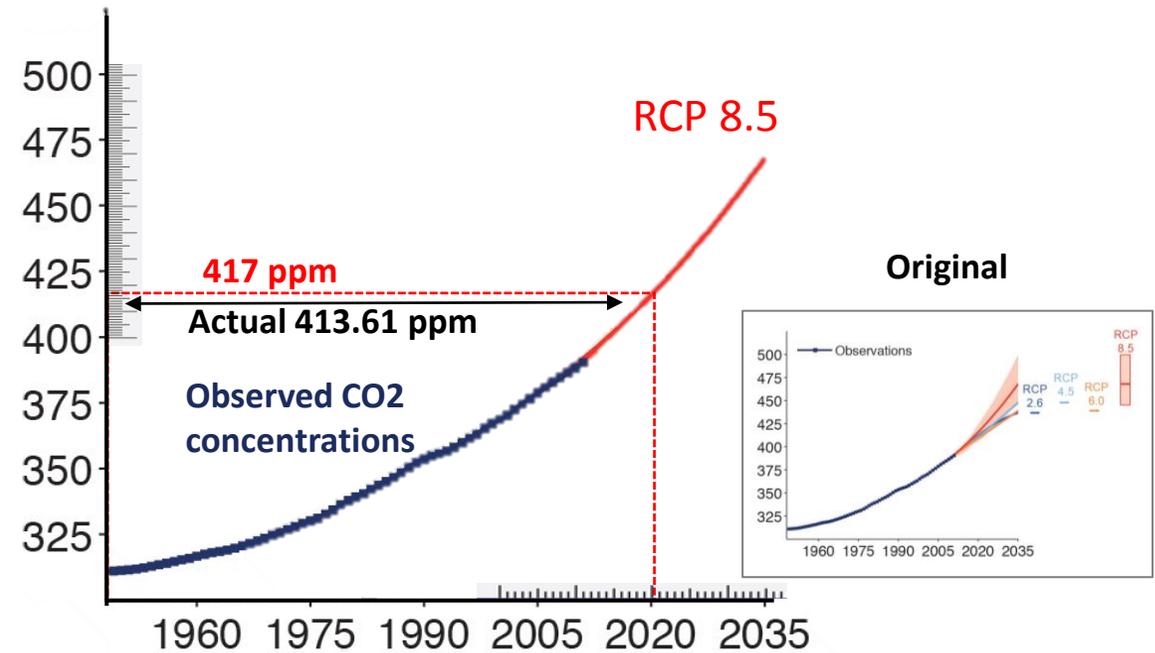
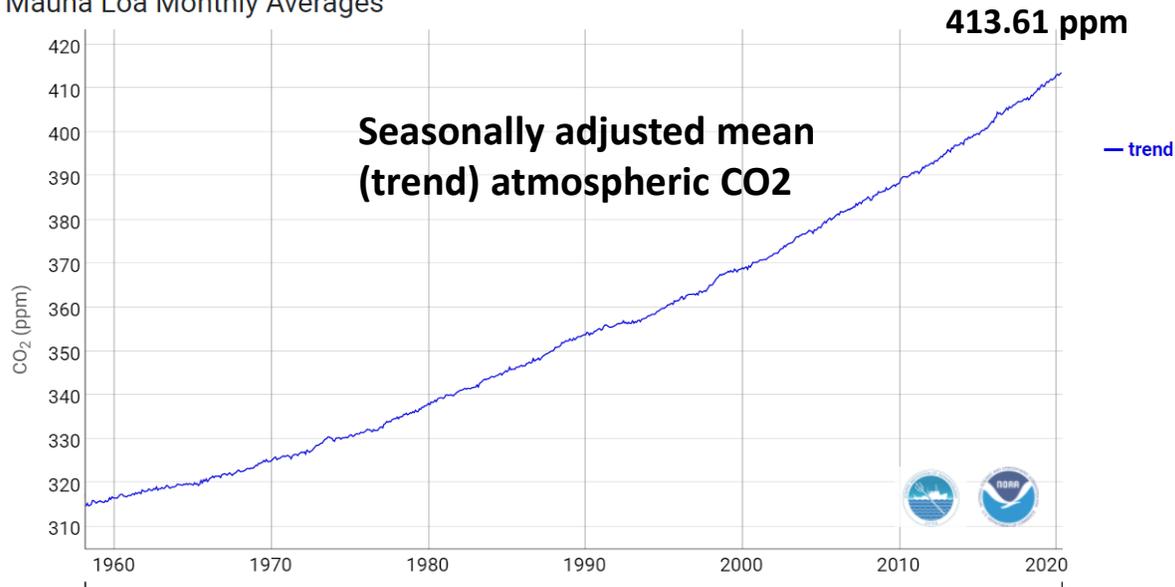
NOAA Trends in atmospheric CO₂,
Seasonally adjusted mean
May 2020: 413.61

Projected May 2020 RCP 8.5: 417 ppm
Actual May 2020: 413.61 ppm

Monthly Average Mauna Loa CO₂

Note: 60-year trend accelerating atmospheric CO₂

Mauna Loa Monthly Averages



IPCC 2014 5th assessment, TFE.3, Figure 1

The Covid Pandemic Effect on Atmospheric CO₂

**The Covid-19 pandemic's industrial downturn
reduced global CO2 emissions by a record amount
(17% in April 2020)**

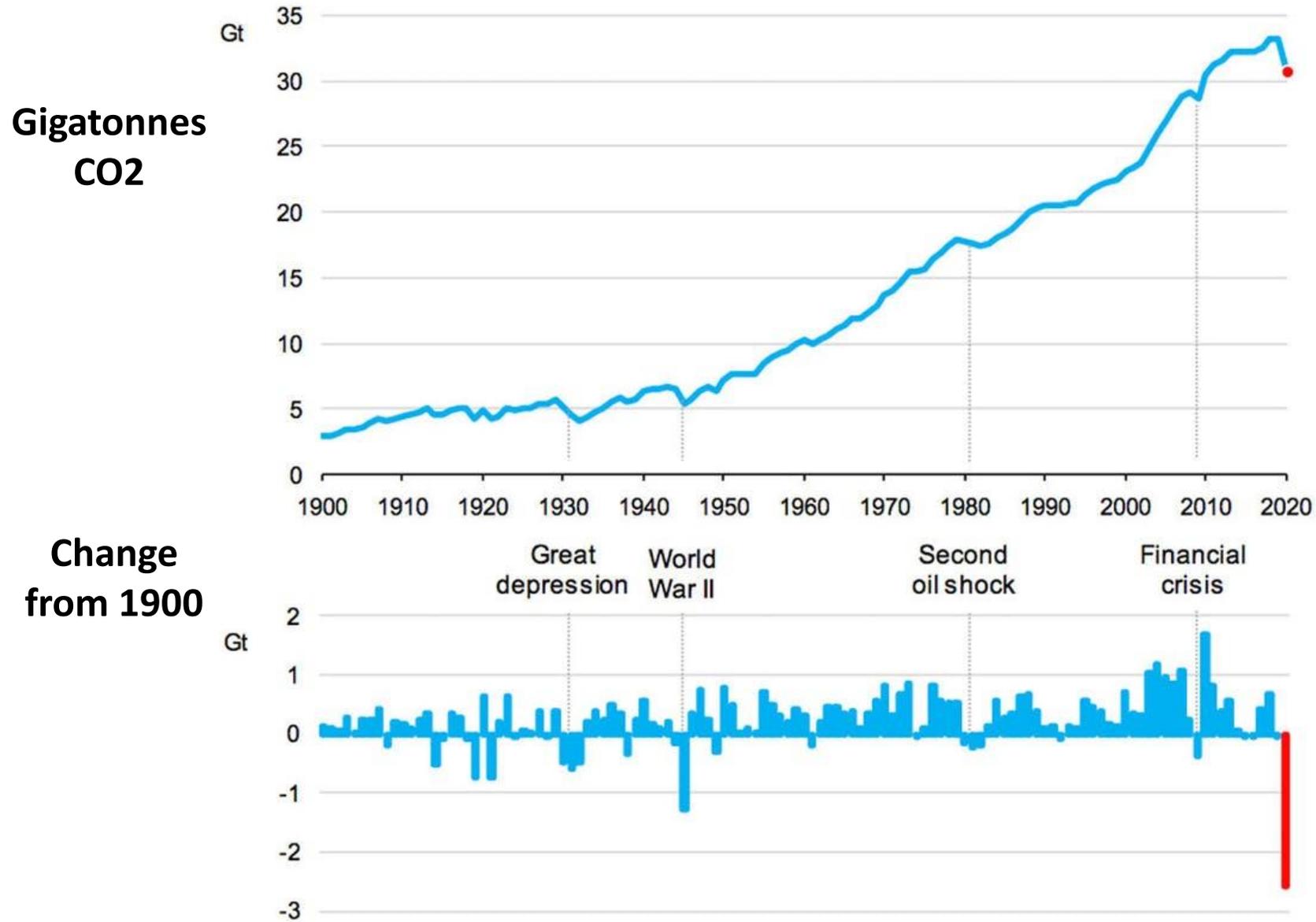
**but made no difference
to accelerating atmospheric CO2**

NOAA, Research News, Thursday, June 4, 2020

Rise of carbon dioxide unabated

***The rate of CO2 increase in the atmosphere
has been steadily accelerating.***

April 2020 Record Drop in CO2 Emissions 17%



The Covid-19 pandemic's temporary industrial downturn made no difference to accelerating atmospheric CO2

NOAA, Research News, Thursday, June 4, 2020

Rise of carbon dioxide unabated

Seasonal peak reaches 417 parts per million at Mauna Loa observatory

Atmospheric carbon dioxide measured at Mauna Loa Observatory reached a seasonal peak of 417.1 parts per million for 2020 in May, the highest monthly reading ever recorded, scientists from NOAA and Scripps Institution of Oceanography at the University of California San Diego announced today.

“Progress in emissions reductions is not visible in the CO2 record,” said Pieter Tans, senior scientist with NOAA’s Global Monitoring Laboratory. “We continue to commit our planet - for centuries or longer - to more global heating, sea level rise, and extreme weather events every year.” If humans were to suddenly stop emitting CO2, it would take thousands of years for our CO2 emissions so far to be absorbed into the deep ocean and atmospheric CO2 to return to pre-industrial levels.

If emissions reductions of 20 to 30 percent were sustained for six to 12 months, then the rate of increase of CO2 measured at Mauna Loa would be slowed.

Even though terrestrial plants and the global ocean absorb an amount of CO2 equivalent to about half of the 40 billion tons of CO2 pollution emitted by humans each year, the rate of CO2 increase in the atmosphere has been steadily accelerating. In the 1960s, the annual growth averaged about 0.8 ppm per year. It doubled to 1.6 ppm per year in the 1980s and remained steady at 1.5 ppm per year in the 1990s. The average growth rate again surged to 2.0 ppm per year in the 2000’s and increased to 2.4 ppm per year during the last decade. “There is abundant and conclusive evidence that the acceleration is caused by increased emissions,” Tans said.

Atmospheric CO₂ is Still Accelerating

Pandemic month May 2020 Atmospheric CO₂

High Growth Rate of 2.42 ppm (from May 2019)

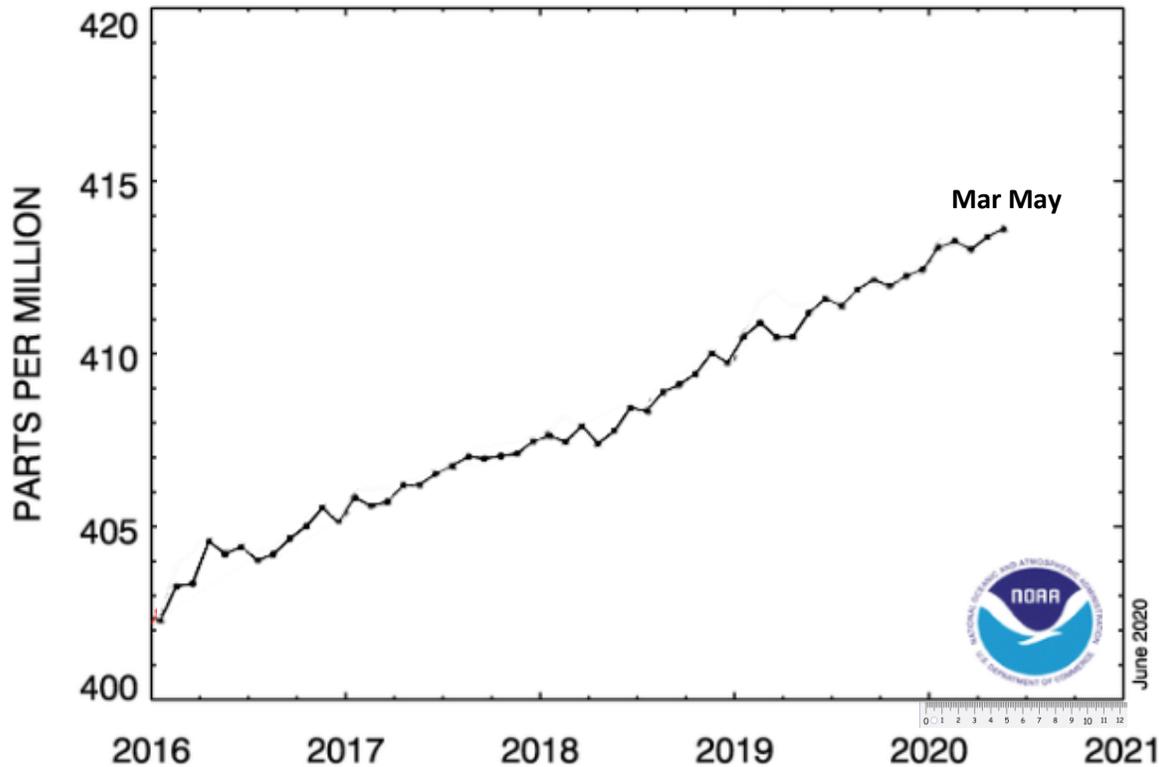
May 2020: 417.07 ppm
 May 2019: 414.65 ppm
Last updated: June 5, 2020

2.42 ppm /year !

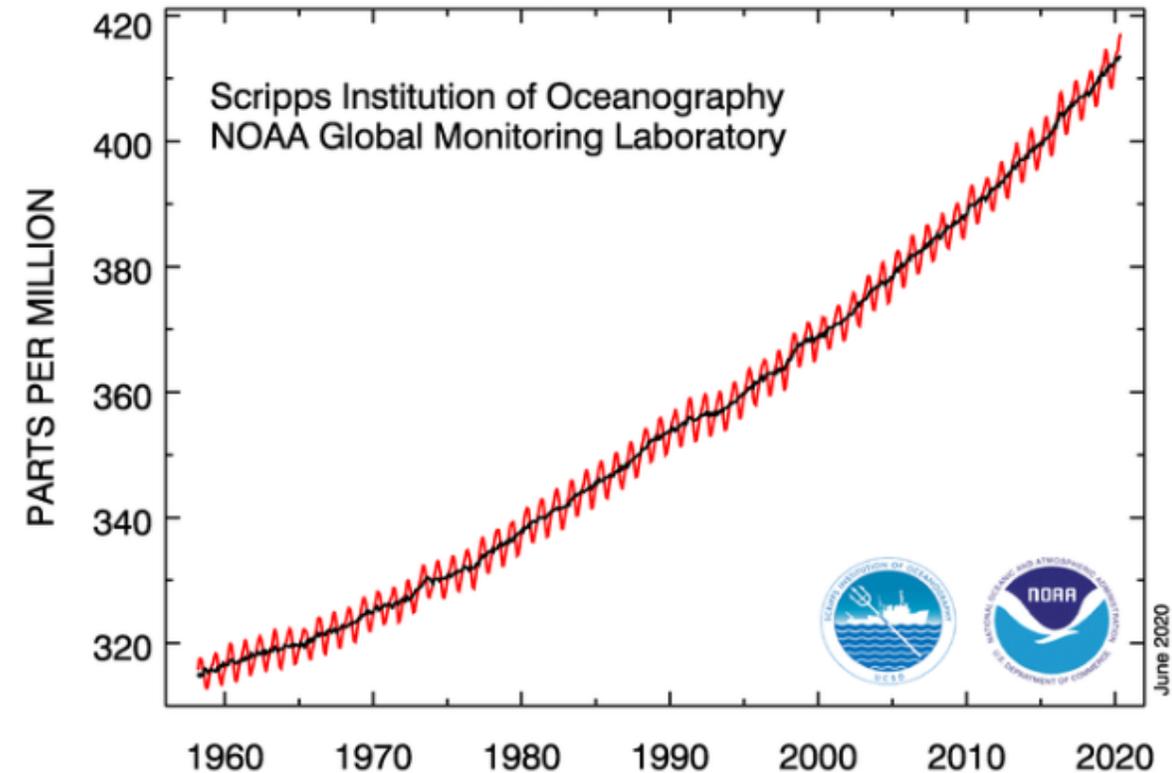
Growth rate 2000-2010 2.0 ppm/year
 1990-2000 1.5 ppm/year

Monthly Average Mauna Loa CO₂

RECENT MONTHLY MEAN CO₂ AT MAUNA LOA



Atmospheric CO₂ at Mauna Loa Observatory



March 2020 Atmospheric GLOBAL CO₂ Extreme Growth Rate of 3.06 ppm/year Record for non-El Nino year

3ppm/year is unprecedented in the history of the atmosphere

(A. Glikson, 2016 Cenozoic mean greenhouse gases and Temperature changes with reference to the Anthropocene,

March 2020: 413.67 ppm

March 2019: 410.61 ppm

Last updated: June 5, 2020

3.06 ppm /year

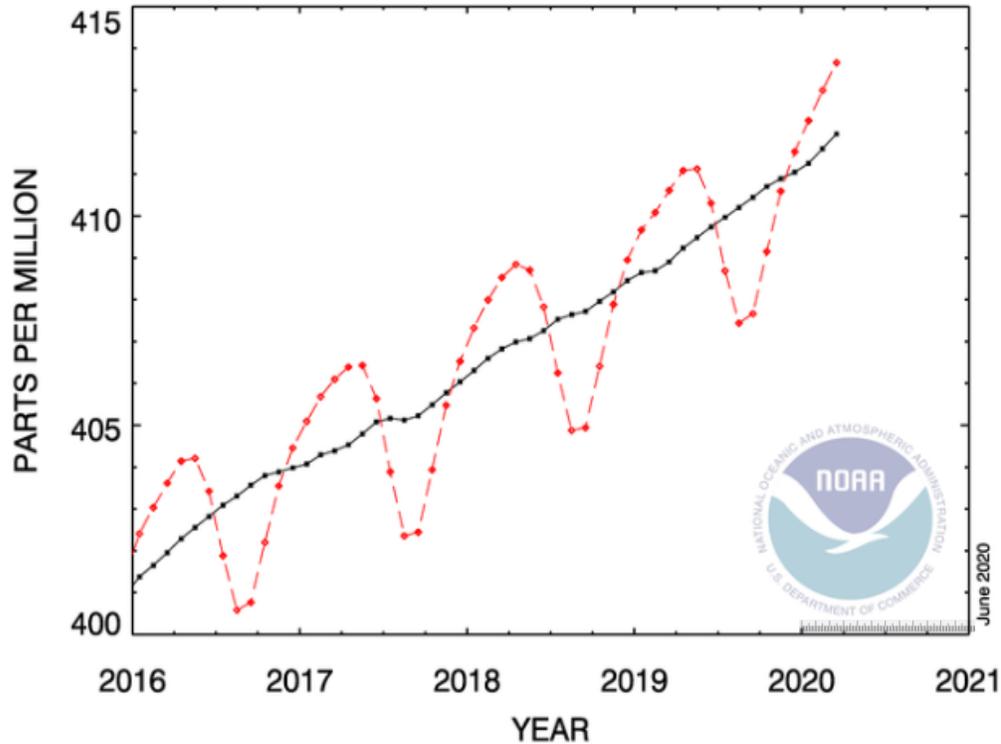
2000 1.1

2010 1.99

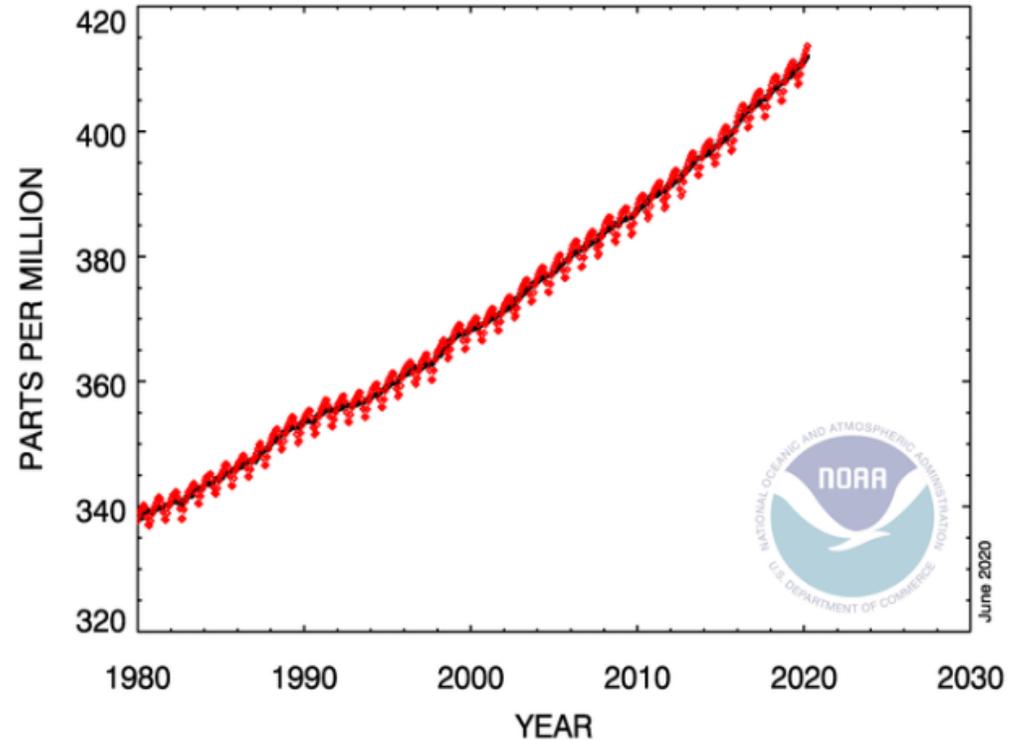
Monthly Average Mauna Loa CO₂

Global atmospheric CO₂ growth rate was above 3ppm.year in the 2015 -16 strong El Nino event.

RECENT GLOBAL MONTHLY MEAN CO₂



GLOBAL MONTHLY MEAN CO₂



ACCELERATING OCEAN ACIDIFICATION is tracking the worst-case scenario (RCP8.5)

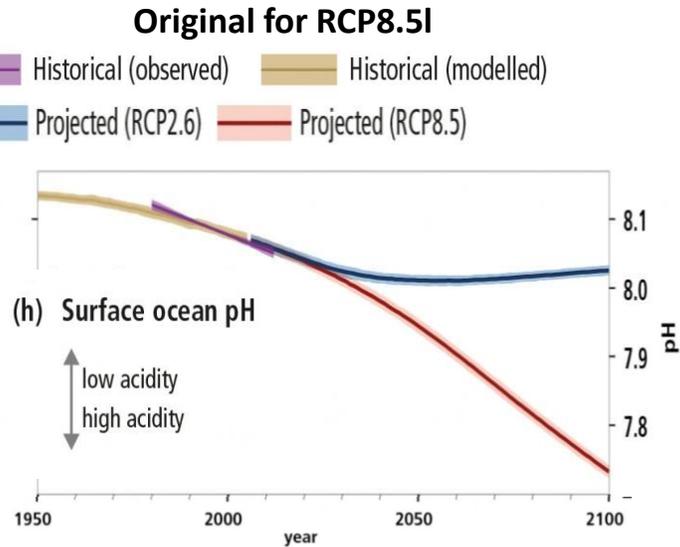
IPCC 2019 Ocean & Cryosphere Report
The lower the pH, the higher the acidity

The lower the pH,
the higher the acidity

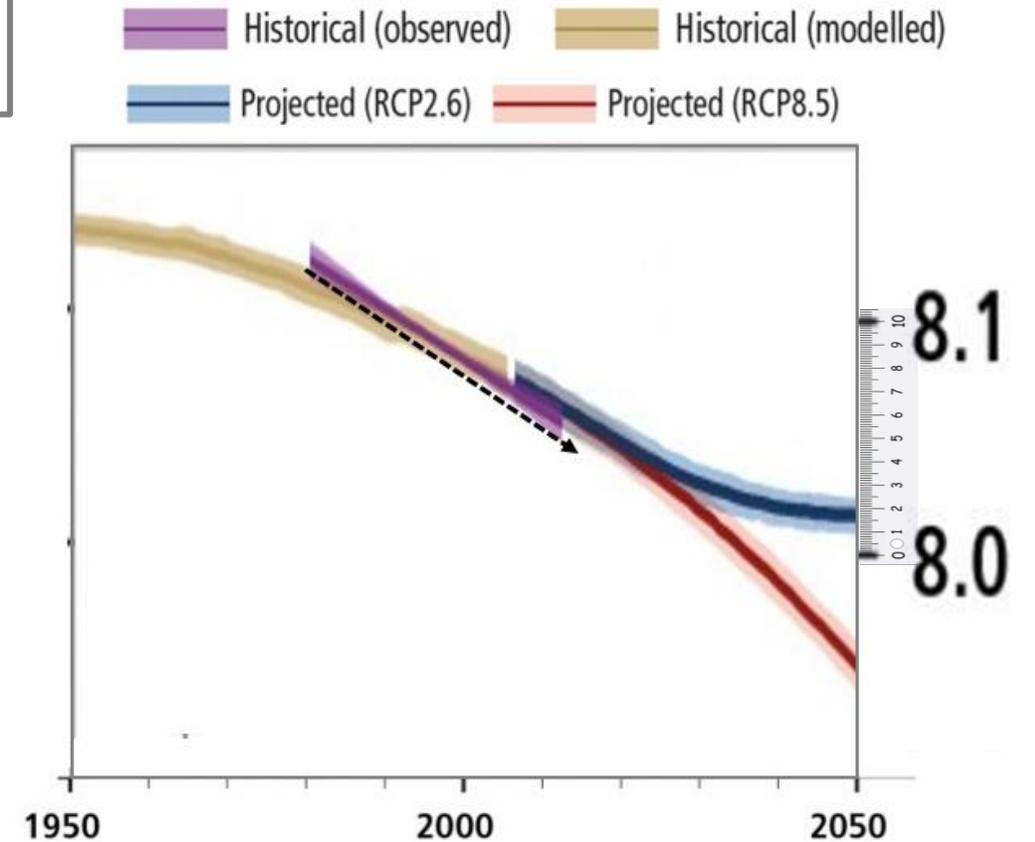
IPCC 2019 Ocean & Cryosphere Report Figure SPM.1 | Observed and modelled historical changes in the ocean and cryosphere since 1950, and projected future changes under low (RCP2.6) and high (RCP8.5) greenhouse gas emissions scenarios.

Ocean pH is tracking just below the
projected worst-case scenario

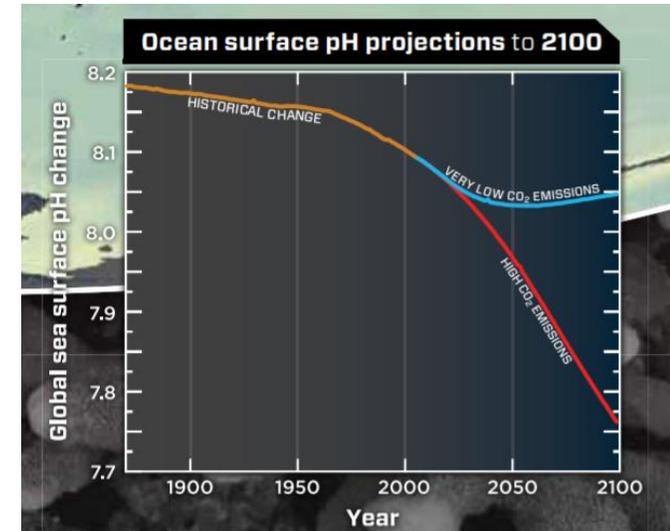
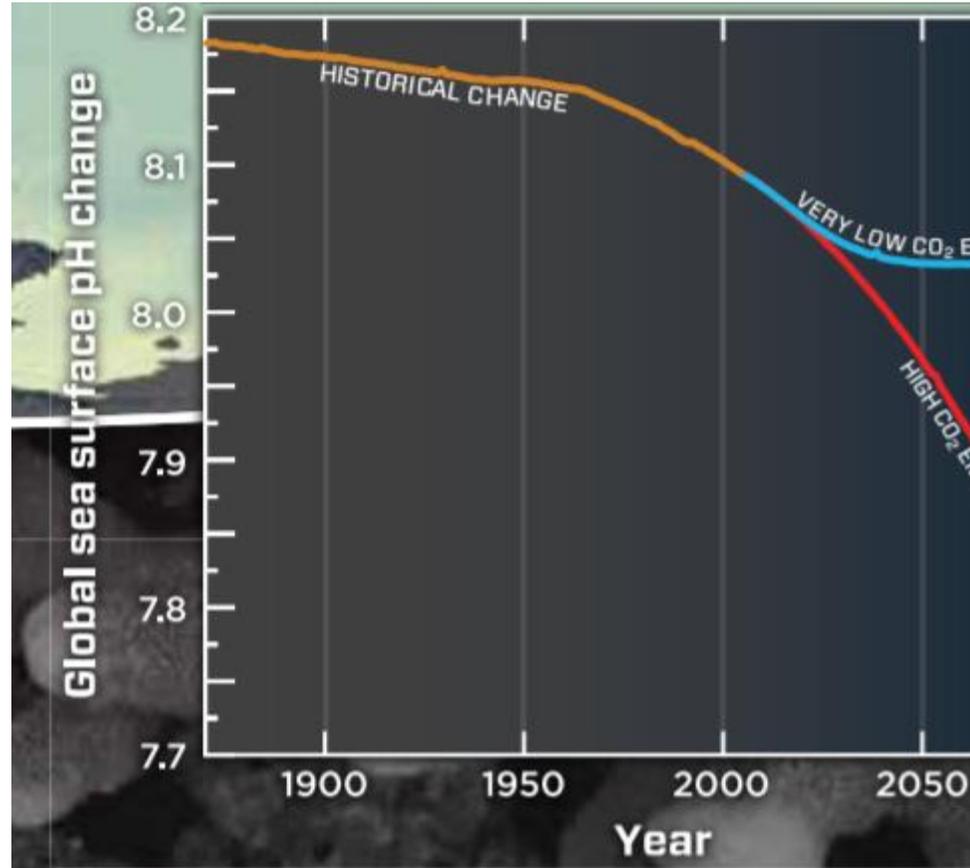
Present day focus



<https://www.ipcc.ch/srocc/download/>



Accelerating ocean acidification up to 2012



2013, Ocean Acidification Summary for Policymakers Third
Symposium on the Ocean in a High-CO₂ World

UNEP (2019): Past 10 years greenhouse gas emissions on business as usual worst-case scenario

Emissions should be declining by 7.6% / year

26 November 2019 STORY CLIMATE CHANGE
From 10 things to know about the Emissions Gap 2019

<https://www.unenvironment.org/news-and-stories/story/10-things-know-about-emissions-gap-2019>

“In 10 years of producing the emissions gap report, the gap between what we should be doing and what we actually are is as wide as ever.”

“The current level of global GHG emissions is by now almost exactly at the level of emissions projected for 2020 under the business-as-usual, or no-policy, scenarios used in the Emissions Gap Reports. In other words, essentially there has been no real change in the global emissions pathway in the last decade.”

“On the brink of 2020, we now need to reduce emissions by 7.6 per cent every year from 2020 to 2030.

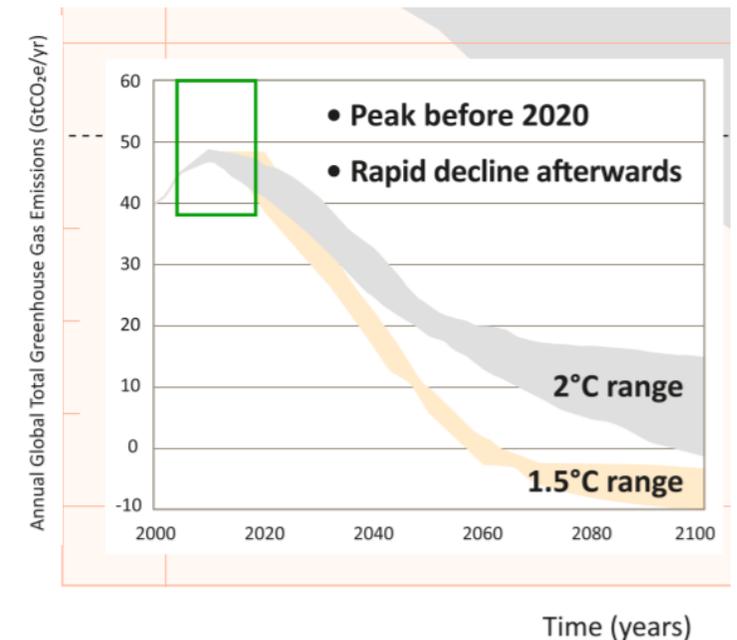
If we do not, we will miss a closing moment in history to limit global warming to 1.5°C. If we do nothing beyond our current, inadequate commitments to halt climate change, temperatures can be expected to rise 3.2°C above pre-industrial levels, with devastating effect”

(comment: these are only 2100 temperature increases and do not include extra warming from amplifying feed-backs) .

**UNEP, Lessons from a decade of emissions gap assessments,
Special Report 2019**

<https://wedocs.unep.org/bitstream/handle/20.500.11822/30022/EGR10.pdf?sequence=1&isAllowed=y>

Note UNEP 2011 for 2°C limit



Source: UNEP (2011)

Conclusion

Global greenhouse gas emissions and other main global climate change indicators are tracking the very worst-case scenario, at this time when global emissions need to be declining fast for the 1.5°C limit and a 2°C limit by 2100.

Continuing on the current worst-case trend can only lead to runaway global heating and climate chaos -global devastation.

All today's children and all future generations need all involved scientists to warn the public and policy makers of this and urge 2019 to be the peak for global emissions (2020 emissions will be a decline due to Covid) and a rapid decline at 7.6% per year.

**UN: To avoid run-away Climate Change
we must act now.**

UN Climate Secretariat, tweet, 25 June 2020

To avoid run-away Climate Change we must act now.

Post-script

Today's cosmic crime against all Humanity

The Amazon and the Great Barrier Reef
have tipped, neither can survive

The question is - can the human race survive

The burning Amazon rainforest is switching from carbon sink to source -headed for collapse

High temperatures, drying, deforestation and fires, an enormous carbon emissions feedback

Brazil registers most Amazon fires for the month of June since 2007, 1 July 2020



Aerial view in 2019 of a sawmill in Moraes Almeida, -a town along a section of the trans-Amazonian highway-, in Itaituba, Para state, Brazil. (CNN)

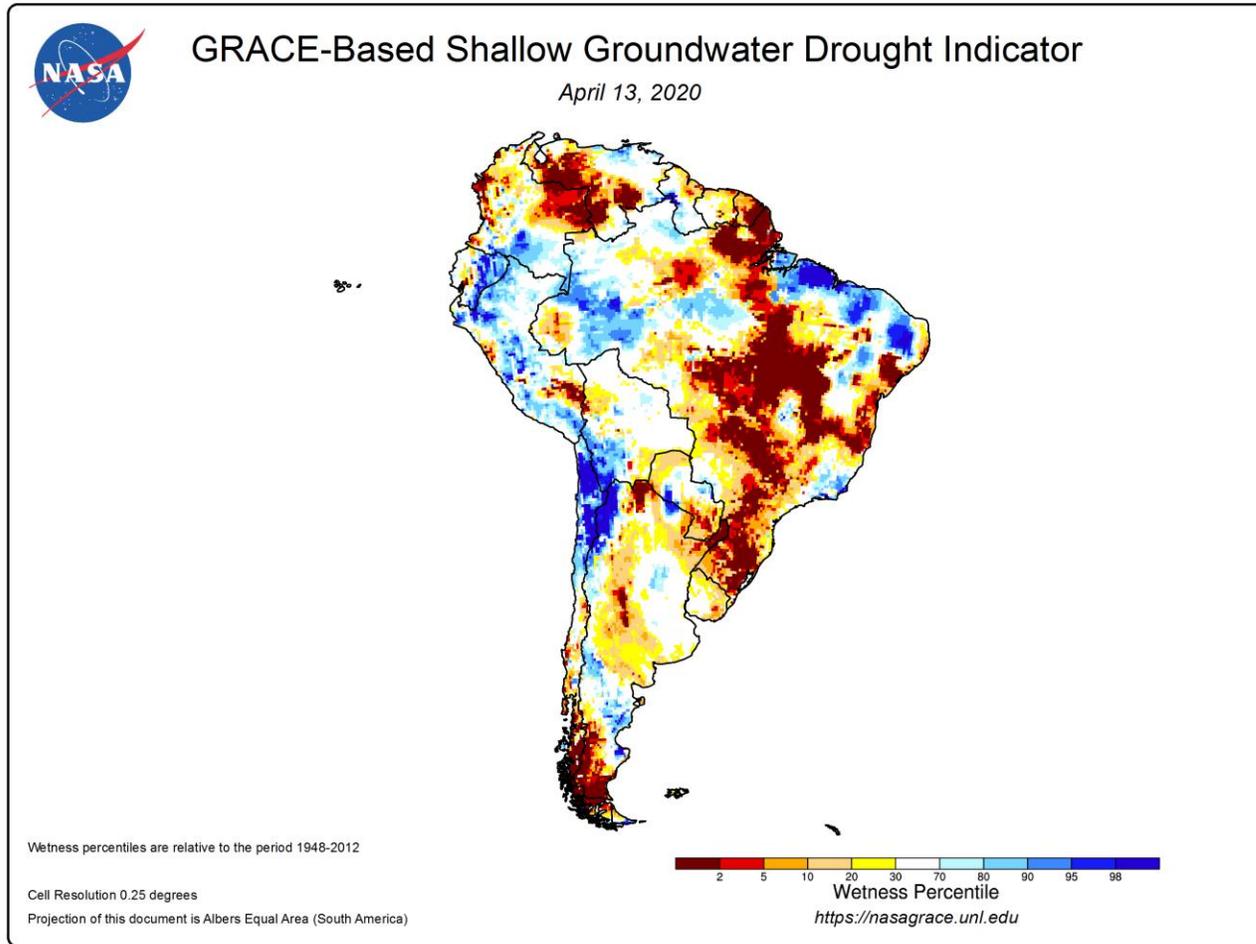
As thousands of fiery infernos rage across the Amazon rainforest, tropical vegetation, trees, and the fauna they house are being razed. Since August 15, more than 9,500 new forest fires have started across Brazil, primarily in the Amazon basin. 2019 was record year for Amazon forest fires, and 2020 will be worse.

This year so far, scientists have recorded more than 74,000 fires in Brazil. That's nearly double 2018's total of about 40,000 fires. The surge marks an 83% increase in wildfires over the same period of 2018, Brazil's National Institute for Space Research reported.

More than half of those 74,000 fires are in the Amazon rainforest.

The smoke plumes from the blazes spread from the state of Amazonas to the nearby states of Pará and Mato Grosso, and even blotted out the sun in São Paulo — a city more than 2,000 miles away. The largest state in Brazil, Amazonas, has declared a state of emergency.

The Amazon tipping point is here



2017 was the worst year for Amazon fires. Aug 2019 Brazil's Amazon rainforest has seen a huge jump in the number of fires this year, new space agency data suggests. The National Institute for Space Research (Inpe) said its satellite data showed an 84% increase on the same period in 2018- 74,000 fires .

Based upon current images, GRACE's satellite shows an Amazon that is in tenuous condition in an unprecedented state of breakdown.

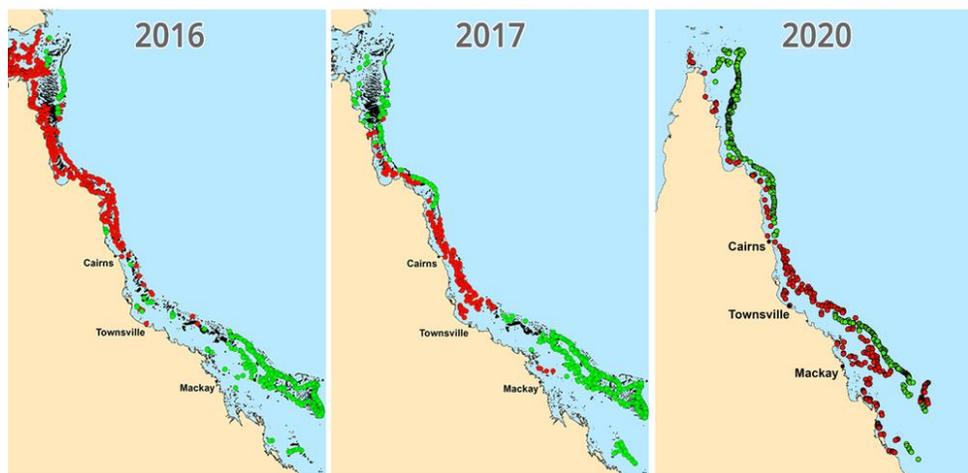
Within only the past few months, the world's two leading Amazon rainforest scientists made a startling announcement. Thomas Lovejoy (George Mason University) and Carlos Nobre (University of Sao Paulo) reported: "Today, we stand exactly in a moment of destiny: The tipping point is here, it is now." " Thomas Lovejoy of George Mason University and Carlos Nobre of the University of Sao Paulo in Brazil, both of whom have studied the world's largest rainforest for decades, wrote in an editorial Amazon tipping point: Last chance for action in the journal Science Advances 20 Dec 2019 .

The 2020 bleaching is the most severe and the most widespread ever recorded. It is the third major bleaching in five years- unprecedented

The last three mass bleaching events

The severity of the last three mass bleaching events on the Great Barrier Reef

■ Most severe bleaching ■ No or negligible bleaching



Source: ARC Centre of Excellence for Coral Reef Studies

This year, February 2020 had the highest monthly sea surface temperatures ever recorded on the Great Barrier Reef since the Bureau of Meteorology's records began in 1900.



Unprecedented third major bleaching in 5 years

The first recorded mass bleaching event along the Great Barrier Reef occurred in 1998, then the hottest year on record. Since then, we've seen four more mass bleaching events—and more temperature records broken—in 2002, 2016, 2017, and again in 2020.

For the first time, severe bleaching has struck all three regions of the Great Barrier Reef—the northern, central, and now large parts of the southern sectors. The north was the worst affected region in 2016, followed by the center in 2017. , it's clear our coral reefs will not survive business-as-usual emissions.

(Terry Hughes, distinguished professor, James Cook University, 2020 GBR report)