October 2020: State of the Global Climate Emergency

2020: Global climate change indictors (data sets)

Which indicators are accelerating and which are tracking the worst-case scenario?

Peter Carter, 31 October 2020
Accelerating Global Average Temperature Increase and Atmospheric CO2 concentration 1960-2020

Source: NOAA, NASA GISS

2020 CO2: 414 ppm 2020
2020: Temperature increase to meet/beat 2016 record

Peter Carter, Climate Emergency Institute
Atmospheric CO2 Will Continue to Accelerate

The 2020 record drop in global emissions of expected 8% is not enough to affect atmospheric CO2 trajectory and governments are bailing out the fossil fuel industry to keep burning.
State of the climate: 2020 on course to be warmest year on record

(despite a cooling Na Nina effect)

The current record is 2016 at 1.28°C, boosted by a strong El Nina

NASA GISS data puts five of the nine months in 2020 – January, April, May, June, July and September – at record temperature increases.
Five Data Sets Indicating 2020 will be a New Record Global Temperature Increase

Global surface temperature records, 1970-2019, and 2020 to-date (despite a cooling Na Nina effect)
Accelerating September 2020 record Northern Hemisphere Temperature Increase of 1.49°C

Accelerating September 2020 record global temperature increase of 1.16°C

Temperature increase is still accelerating despite a cooling Na Nina effect.
Northern Hemisphere just had its hottest summer on record

NOAA report headline, 14 September 2020

+1.19°C (re. 20th century average)

NH record August: 1.19 °C
North America record August: 1.52°C
NH record summer: (June-Aug): 1.19 °C
NH record year-to-date (Jan-Aug) tied with 2016: 1.32°C (2016 temperature was boosted by a strong El Nino, there is no 2020 El Nino)

This is despite a cooling Na Nina effect
The accelerating NH 2020 summer record temperature increase with respect to the 1881-1920 period is **+1.38° C** (NASA GISS)

This is despite a cooling Na Nina effect

![Graph showing temperature anomaly trend](attachment:graph.png)
2020: Accelerating Atmospheric Cumulative CO2 Emissions
Tracking the Worst-case Scenario

Last updated July 2020

Cumulative Fossil Fuel with Atmospheric CO$_2$ Increase

4 August 2020, PNAS, C.R. Schwalm et al, RCP8.5 tracks cumulative CO2 emissions
Accelerating Atmospheric CO2

September 2020: 414.87 ppm (mean)

800,000-year limit 300 ppm

NOAA (National Oceanic & Atmospheric Administration)

Products: Trends in CO₂, CH₄, N₂O, SF₆

Global Monitoring Laboratory
Earth System Research Laboratories
Accelerating Atmospheric Methane

September 2020: 1,790 ppb

800,000-year limit 800 ppb

NOAA (National Oceanic & Atmospheric Administration)

Products: Trends in CO₂, CH₄, N₂O, SF₆

Global Monitoring Laboratory
Earth System Research Laboratories
Accelerating Atmospheric Nitrous Oxide

September 2020: 333 ppb

800,000-year limit 300 ppb
Accelerating Ocean Acidification
(caused by accelerating atmospheric CO2)

Ocean acidification in the interior of the western North Pacific

Relative acidification by inverted pH

30°N: $-0.026 \pm 0.002$/decade

Data Japan Meteorological Agency
Global Environment and Marine Department
Updated on 23 Mar. 2020
OCEAN DEOXYGENATION is tracking above the worst-case scenario

Oxygen content

Deoxygenation

(i) Ocean oxygen (100–600m depth) change relative to 1986–2005

IPCC, 2019, Special Report on the Ocean and Cryosphere in a Changing Climate
https://www.ipcc.ch/srocc/download/
Accelerating Ocean Heat Content

Ocean heat is the single best global climate change indicator
Accelerating Marine Heatwaves Tracking Worst-case Scenario

IPCC, 2019, Special Report on the Ocean and Cryosphere in a Changing Climate  Figure SPM.1
"Observational records of ocean heat content show that ocean warming is accelerating."

Cheng, L., J. Abraham, Z. Hausfather, K. E. Trenberth, 2019: How fast are the oceans warming? Observational records of ocean heat content show that ocean warming is accelerating, Science, 363. doi: 10.1126/science.aav7619. in press
OCEAN HEAT CONTENT
accelerating

0-2000 m Global Ocean Heat Content
- 3-Month average through Apr-Jun 2020
- Yearly average through 2019
- Pentacial average through 2015-2019

NOAA/NESDIS/NCEI Ocean Climate Laboratory
Updated from Levitus et al. 2012

Global Ocean Heat and Salt Content
NOAA
OCEAN HEAT CONTENT
accelerating

Record-Setting Ocean Warmth
Continued in 2019, Lijing Chen et al
February 2020

11 Jan 2019:, How fast are the oceans warming? Lijing Cheng et al
Climate Change: Ocean Heat Content, LuAnn Dahlman and Rebecca Lindsey, August 17, 2020

Heat already stored in the ocean will eventually be released, committing Earth to additional surface warming in the future.

Annual ocean heat content compared to average (1993-2019)

[Graph showing ocean heat content over time with different depth ranges indicated]