CLIMATE-CARBON INTERACTIONS IN THE CURRENT CENTURY

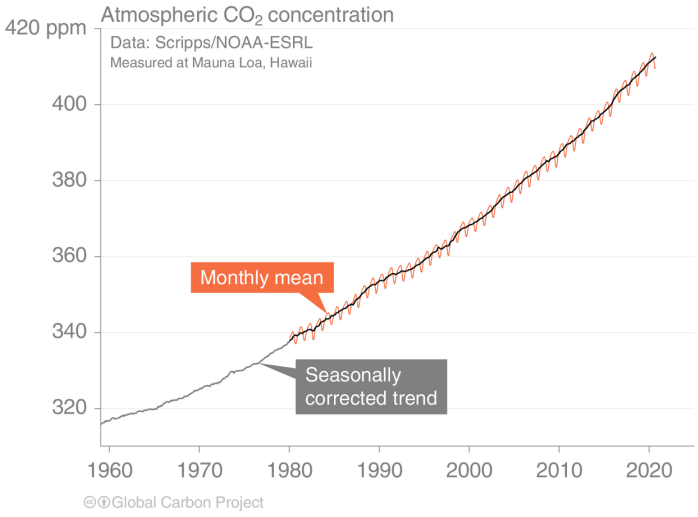
4C CARBON OUTLOOK

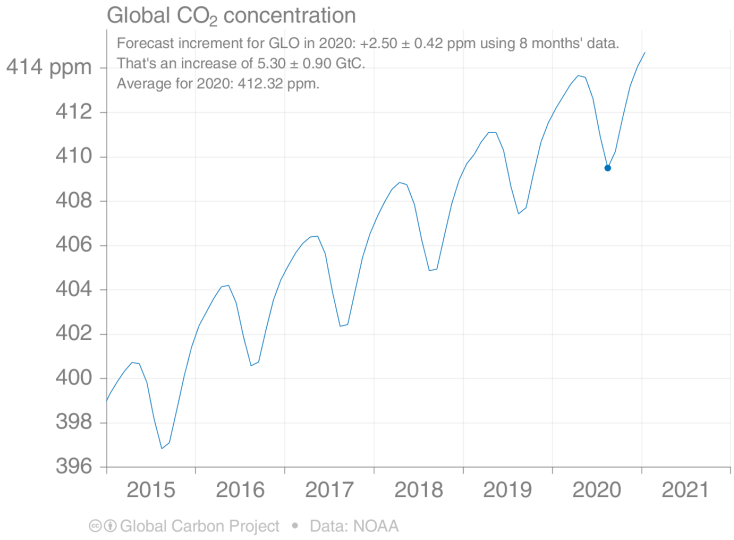
DECEMBER 2020

In 2020, global CO_2 concentrations continued to rise, reaching 412 ppm. This was despite a drop of -7% in annual emissions compared to 2019 as a result of the COVID-19 pandemic. The land sink was slightly weaker in 2020, thus there was a similar increase in atmospheric concentrations in 2019 and 2020.

RECORD DECREASE IN GLOBAL CO_2 EMISSIONS IN 2020

- Global fossil CO_2 emissions are expected to decline approximately 2.4 billion tonnes of CO_2 in 2020 (–7%), a record drop. The decrease in emissions, caused by COVID-19 confinement measures in place and confirmed with four methods, brings global fossil CO_2 emissions to 34 billion tonnes of CO_2.
- Preliminary estimates based on the detection of managed fires in tropical deforestation areas indicate that 2020 emissions from deforestation and other land-use change are similar to the previous decade's average at around 6 billion tonnes of CO_2.
- Total CO_2 emissions from human activities (from fossil CO_2 and land-use change) are set to be around 40 billion tonnes of CO_2 in 2020, compared to 43 billion tonnes of CO_2 in 2019.



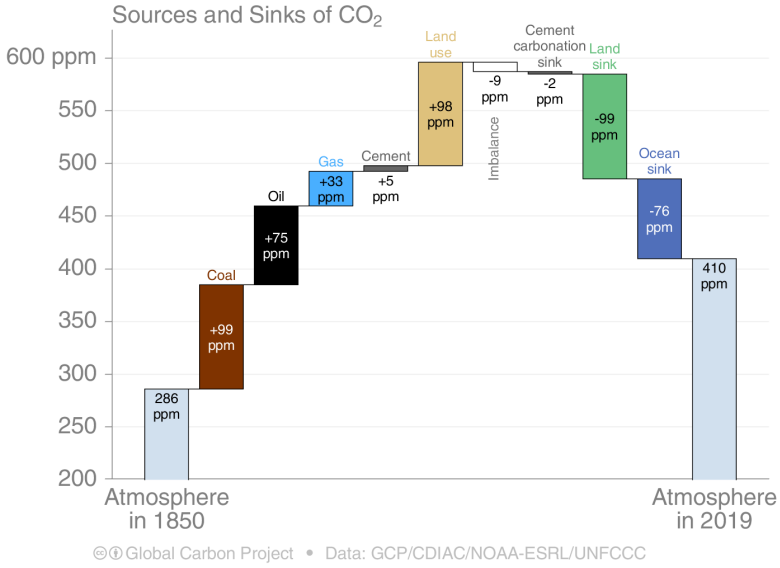


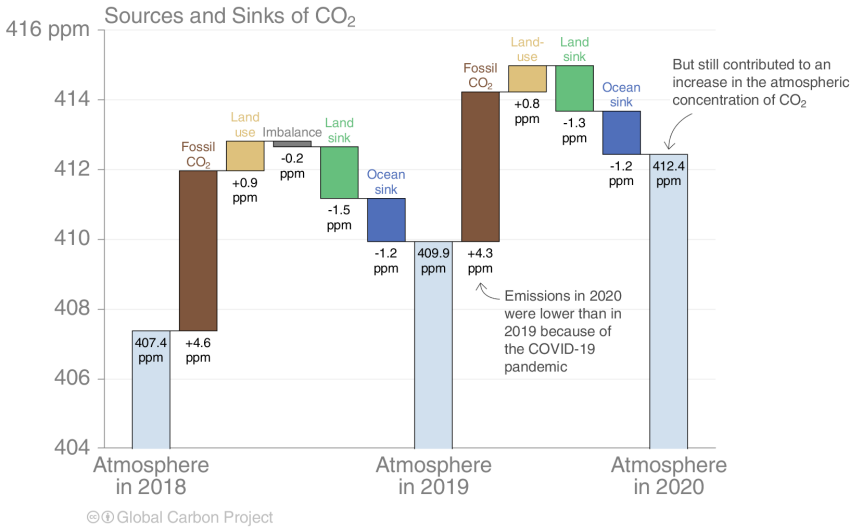
ATMOSPHERIC CO_2 ACCUMULATION

- The level of CO_2 in the atmosphere reached 410 parts per million (ppm) in 2019. The level of CO_2 continued to increase from continued (non-zero) emissions in 2020, by about 2.5 ppm and is therefore projected to reach 412 ppm averaged over the year.
- Atmospheric CO_2 concentrations in 2020 are 48% above pre-industrial levels, 16% above the 1990 levels, and 3% above the 2015 levels.
- Despite the significant decline in emissions in 2020, emissions were still high (around 2012 levels when including land-use change) leading to a significant increase in atmospheric concentrations.
- The atmospheric CO_2 level, and consequently the world's climate, will only stabilise when global CO_2 emissions are near zero.

THE LEVELS OF CARBON IN THE ATMOSPHERE, LAND AND OCEAN CONTINUE TO RISE, EMISSIONS FROM LAND-USE CHANGE DO NOT SHOW SIGNIFICANT DECLINE.

- Land and ocean carbon sinks continue to increase consistently with emissions, absorbing around 55% of the total anthropogenic emissions.
- The expected growth rate in atmospheric CO_2 concentration in 2020 (2.5 ppm) is near the 2019 growth rate, despite slightly lower anthropogenic emissions (bottom right figure).
- Year-to-year variations in the natural land sink can be very large, causing fluctuations in atmospheric CO_2 of the order of 0.5 ppm, with regular excursions above 1 ppm associated with El Nino natural climate fluctuations. Emissions from wildfires also contribute to this variability.
- Emissions from wildfires, such as in Australia, the sub-Arctic and California, are not the result of land-use change and are implicitly included in the land sink
- Compared to 2019, the total emissions to the atmosphere were about 7% lower in 2020, but the land sink was slightly weaker, leading to a similar increase in atmospheric concentrations.
- The effects of COVID emission reductions are essentially undetectable on the global scale, and only detailed regional model may be sufficient to detect COVID related changes.





References

- *Friedlingstein et al, 2020. Global Carbon Budget 2020, Earth System Science Data. https://essd.copernicus.org/articles/12/3269/2020/*
- *Global Carbon Budget data, figures, and links: https://www.globalcarbonproject.org/carbonbudget/index.htm*
- *Peters et al, 2017. Towards real-time verification of CO_2 emissions. Nature Climate Change 7, 848–852. https://rdcu.be/buifD*

Climate-Carbon Interactions in the Current Century

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