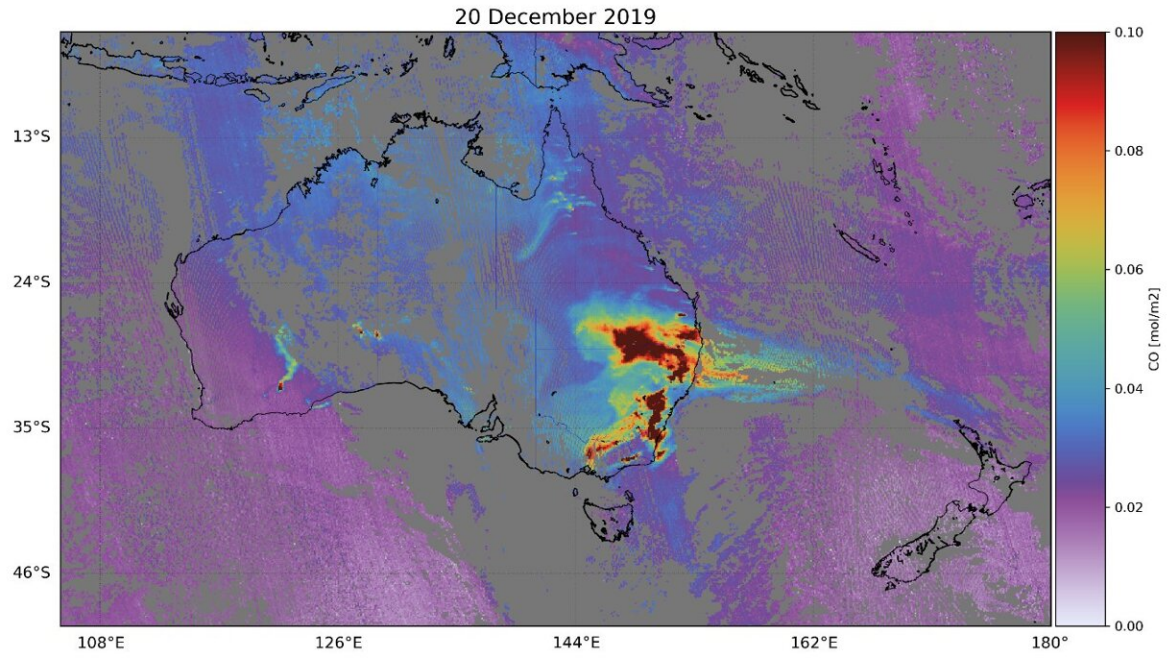
Australian 'Black Summer' wildfires produced almost twice as much CO2 as all Australians in a year

September 15 2021



The carbon monoxide concentration [mol/m2] measured with TROPOMI over Australia on December 20, 2019. The severe wildfires caused a strong increase of carbon monoxide in the atmosphere. The TROPOMI team has calculated the total CO2 emissions from these wildfires: almost twice as much than CO2 from the annual consumption of fossil fuels across Australia. Credit: SRON Netherlands Institute for Space Research

The Australian summer of 2019–2020, also known as the "Black Summer," was characterized by a series of devastating wildfires. Researchers from VU University Amsterdam and SRON Netherlands Institute for Space Research have determined the amount of CO_2 released by these fires using satellite data. The wildfires produced nearly twice as much CO_2 as Australia's annual fossil fuel consumption. The research was published in *Nature*.

The wildfires in predominantly eucalyptus forests raged for a period of three months in 2019–2020. The Dutch team of scientists from the VU and SRON now determine the total CO_2 emissions at over 700 billion kilograms. That is nearly double the annual emissions from fossil fuel consumption across Australia and comparable to annual emissions from air travel globally.

Satellite instrument TROPOMI

Forest fire models had already provided estimates, but those returned varying results. The team of researchers decided to use a different method to estimate CO_2 emissions. VU/SRON researcher and first author Ivar van der Velde explains: "By using satellite data of atmospheric carbon monoxide (CO) concentrations, we can much better estimate the total CO_2 emissions. For that we used the Dutch space instrument TROPOMI. It doesn't measure the emission magnitude of fires, but the impact on the amount of CO in the atmosphere. We used an atmospheric transport model to translate CO emissions at the surface into CO concentrations in the atmosphere. Next, we optimized the CO emissions in the model to match the CO observed with TROPOMI." Because the ratio between CO and CO_2 released during fires in eucalyptus forests is fairly well known from field measurements, the researchers were also able to derive the CO_2 emissions from these Black Summer fires.

"TROPOMI enables us to monitor wildfires and carbon monoxide emissions much more accurately from space thanks to the high precision of the instrument down to the lowest layers in the atmosphere where the fires occur," says Ilse Aben, VU professor and head of the TROPOMI research team at SRON.

New phenomenon

Wildfires are a natural recurring phenomenon in Australia. Climate and forest fire expert Guido van der Werf (VU): "Particularly in Australia's savanna regions fires occur frequently. The uniqueness of the "Black Summer' fires is that they were extremely large and raged in eucalyptus forests where we usually don't see these kinds of large fires." This research therefore raises new questions about these (still) rare, but very large fires, which are expected to become more frequent in the future. Van der Werf says: "This will hamper rapid recovery of the affected forests, and part of the emitted CO_2 will not be compensated for by CO_2 uptake during post-fire regrowth. Some of the emitted CO_2 will therefore remain longer in the atmosphere and thus contribute to global warming. This is in stark contrast to the often small wildfires that are generally seen as climate neutral because regrowth can occur relatively quickly after the fire. As a result, we may be dealing with a new phenomenon that is more similar to fires seen during large-scale deforestation, such as in the Amazon. Such deforestation fires are responsible for net CO_2 emissions as biomass is permanently removed from the ecosystem to make way for more farmland."

Given current global warming trends, the researchers say it is quite possible that the frequency, duration and magnitude of wildfires in Southeast Australia—and perhaps elsewhere—will only increase in the future. This will contribute to an even faster rise in CO_2 levels than anticipated.

More information: Vast CO2 release from Australian fires in 2019–2020 constrained by satellite, *Nature* (2021). DOI: 10.1038/s41586-021-03712-y , www.nature.com/articles/s41586-021-03712-y

Provided by SRON Netherlands Institute for Space Research