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Could COVID-19 decide our climate future?

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The COVID-19 pandemic has been dynamically reshaping our lifestyle and society. Despite huge drops in global pollution as people stayed at home, our study reveals 2020's initial lockdowns had little effect on the climate. The challenge now is to use this knowledge to create a global green economic recovery, which will help us avoid the most dangerous climate change.

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In early 2020, the world suddenly fell quiet as measures were put in place to combat the COVID-19 pandemic. No more traffic jams — the clear roads and skies and cleaner air were a brief silver lining. But has the pandemic really been making an impact on climate change?

Monitoring global emissions of carbon dioxide (CO2) — a major greenhouse (heat-trapping) gas — is complex, especially as it's difficult to get real-time data. But during the lockdown, Google and Apple released mobility reports to provide health officials with insights into how our movements were changing in response to their policies, organised into sectors including transport, industry and power generation. This mobility data also mirrors what was happening to the emissions from these sectors during the lockdown. In other words, if we knew by how much activity had fallen relative to normal (pre-lockdown) in each sector, we could use this information to estimate what was happening to the emissions of pollutant gases that can affect climate and air quality, including CO2 (mainly from the burning of fossil fuels), nitrogen oxides NOx (majorly from transport emissions), and sulfur dioxide SO2 (mostly from power generation).

Thanks to Apple and Google, there was a new and fast way of estimating how lockdown was changing daily pollution levels in 123 countries responsible for 99% of global CO2 emissions. By analyzing these data, we found that the biggest changes were seen

in CO2, SO2 and NOx, all of which saw a major fall in emissions during 2020's initial lockdowns.

We next translated these drops in emissions into global temperature change using a simple climate model. The results showed that, with SO2 and NOx affecting the climate in opposite ways, their competing effects would more or less neutralize each other. Therefore, any effect of lockdown on global temperatures could be anticipated solely based on changes in CO2. The dramatic drop in CO2, largely the result of a fall in road transport, meanwhile had a surprisingly small effect. We found that even if some lockdown measures stay in place until the end of 2021 (which seems increasingly likely), temperatures will only be 0.01°C lower than if we followed current national climate plans and strategies: the Nationally Determined Contributions through which countries pledge to reduce national greenhouse gas emissions and adapt to the impacts of climate change.

So, is this minor effect on climate caused by the 2020 lockdown important? The answer is yes — while the rapid but short-lasting fall in greenhouse gas emissions shows only a temporary blip in our long-term climate trajectory, studying the climate effects of lockdown enables us to learn what could happen next and to get better prepared for the future.

Here is our current track — the landmark 2015 Paris Agreement has an ambition to keep global temperature rise due to human activity below 1.5°C compared to pre-industrial levels. However, temperatures are already estimated to have risen by almost 1.2°C. Forecasting what will happen in the coming decades is therefore increasingly important. Modeling various scenarios for economic recovery from the pandemic and their predicted effect on global temperatures allowed us to estimate what will be likely the consequences for climate, including two contrasting options we can take: fossil fuel-based economic recovery or green recovery. In the fossil fuel scenario, the economic recovery could bring an increase in greenhouse gas emissions by 10% by 2030, and put us on a trajectory to 2050 that pushes the Paris Agreement goals further beyond reach. In contrast, in the green recovery scenario, we invest just 1.2% of GDP in low carbon technologies whilst refusing to bail out fossil fuel companies. This could reduce emissions by 50% by 2030, halve the amount of warming we can expect to see by 2050 from 0.6°C to 0.3°C, and keep the Paris Agreement goals in sight. So, which option do you wish to take?

Since this study was originally published in August 2020, we have already seen greenhouse gas emissions recovering to near-normal levels in places as economies open up again and people return to the workplace. Although, with second and even third waves of the pandemic and related lockdowns, the global situation is still far from normal, it's clear that the widespread behavioral changes we saw in the first half of 2020 (e.g. the massive drop in car travel) can't be maintained without structural economic change and the investment that entails.

In its own way, despite the minimal effect on global temperatures, the pandemic may have drawn more attention to the need for global cooperation on climate change. As our study highlights, climate change will possibly become a casualty of economic recovery, rather than being integrated with it. Instead, we need to work closely with policymakers to ensure that we do change trajectories —and lives — for the better.