

Corona-induced CO₂ Emission Reductions Are Not Yet Detectable in the Atmosphere

Effects of the Pandemic Will Be Detected in the Atmosphere Much Later – To Reach the Paris Climate Goals, Decade-long Measures Are Needed



On the Zugspitze, KIT researchers monitor CO₂ concentration and other parameters of the atmosphere. (Photo: Markus Rettinger, KIT)

Based on current data measured in the energy, industry, and mobility sectors, restrictions of social life during the corona pandemic can be predicted to lead to a reduction of worldwide carbon dioxide emissions by up to eight percent in 2020. According to the Intergovernmental Panel on Climate Change (IPCC), cumulative reductions of about this magnitude would be required every year to reach the goals of the Paris Agreement by 2030. Recent measurements by researchers of Karlsruhe Institute of Technology (KIT) revealed that concentration of carbon dioxide (CO₂) in the atmosphere has not yet changed due to the estimated emission reductions. The results are reported in *Remote Sensing* (DOI: 10.3390/rs12152387).

The corona pandemic has changed both our working and our private lives. People increasingly work from home, have video conferences instead of business trips, and spend their holidays in their home country. The lower traffic volume also reduces CO₂ emissions. Reductions of up to eight percent are estimated for 2020. "In spite of the reduced emissions, our measurements show that CO₂



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concentration in the atmosphere has not yet decreased,” says Ralf Sussmann from the Atmospheric Environmental Research Division of KIT’s Institute of Meteorology and Climate Research (IMK-IFU), KIT’s Campus Alpine, in Garmisch-Partenkirchen. “To reduce CO₂ concentration in the atmosphere in the long run, restrictions imposed during the corona pandemic would have to be continued for decades. But even this would be far from being sufficient.”

To prove this, researchers additionally studied a long-term scenario that can be controlled well with atmospheric measurements: The goal of the Paris Climate Agreement to limit global warming to 1.5 degrees Celsius can only be reached by an immediate significant reduction of CO₂ emissions and a further decrease down to zero by 2055. “The restrictions imposed during the corona crisis, however, are far from being sufficient. They have just resulted in a one-time reduction by eight percent. To reach zero emissions in the coming decades, cumulative reductions of the same magnitude would be required every year, i.e. 16 percent in 2021, 24 percent in 2022, and so on. For this, political measures have to be taken to directly initiate fundamental technological changes in the energy and transport sectors,” Sussmann says.

For the study, the team used data from the Total Carbon Column Observing Network (TCCON). It measured the concentrations in different layers of the atmosphere above Garmisch-Partenkirchen and at other places around the globe. “High-tech infrared spectrometers are applied, which use the sun as a light source. The measurement method is highly precise, uncertainties are in the range of a few thousandths,” Sussmann adds.

Long Life of CO₂ Prevents Early Detection

According to the researchers, the long life of CO₂ and the high background concentrations that have accumulated since the start of industrialization prevent the changes in the atmosphere from being detected. “But also natural impacts make early detection difficult: Anthropogenic emissions, the main cause of the long-term increase in atmospheric CO₂, are superposed by annual fluctuations of the growth rate due to natural climate variabilities of ocean sinks and land vegetation,” Sussmann says. Successful emission reduction, hence, is hard to detect by atmosphere measurements.

For their study, the researchers compared the TCCON measurements with the prognoses of the atmospheric growth rate for 2020 – with and without corona restrictions. “Precision analysis of atmosphere measurements revealed that the impacts of COVID-19 measures on the atmosphere might be measured after little more than six months, if the reference state without COVID-19 would be

predicted precisely,” the climate researcher explains. “In any case, we would be able to find out within presumably two and half years, whether global political and social measures will help us find viable alternatives of fossil fuels and reach the goals of the Paris Climate Agreement.”

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