

# COVID-19: Air quality influences the pandemic

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From October to March, large parts of the Swiss Plateau and the Po-Plain may be covered by fog or haze. Such thermal inversions act like a cap and are trapping fine particulate matter that increases to excessive values below the inversion layer. This can aggravate the consequences of COVID-19. Credit: NASA-OB-DAAC, AQUA--MODIS-Satellite

The correlation between the high concentration of fine particles and the severity of influenza waves is well known to epidemiologists. An interdisciplinary team from the University of Geneva (UNIGE) and the ETH Zürich spin-off Meteodat investigated possible interactions between acutely elevated levels of fine particulate matter and the

virulence of the coronavirus disease. Their results, published in the journal *Earth Systems and Environment*, suggest that high concentrations of particles less than 2.5 micrometers in size may modulate, or even amplify, the waves of SARS-CoV-2 contamination and explain in part the particular profile of the COVID-19 pandemic. The increase in fine particles is generally favored by air temperature inversions, characterized by fog situations, or by Saharan dust intrusions. The study provides preventive measures related to air pollution to limit future outbreaks of morbidity and mortality due to the coronavirus.

Epidemiologists widely agree that there is a correlation between acute and locally elevated concentrations of [fine particles](#) and the severity of influenza waves. "We have investigated whether such a link also exists with the virulence of COVID-19 disease," says Mario Rohrer, researcher at the Institute for Environmental Sciences of the Faculty of Sciences of UNIGE and director of Meteodat.

## **A surprising time lag**

COVID-19 studies conducted in Italy and France suggest that SARS-CoV-2 was already present in Europe at the end of 2019, while the sharp increase in morbidity and mortality was only recorded in spring 2020 in Paris and London. "This time lag is surprising, but also suggests that something else than just the mere interaction of people may promote the transmission of the virus, and particularly the severity of the infection," says Mario Rohrer. His research team has been able to show that these increases in cases followed phases where the levels of fine particles in the air were higher.

The team made similar observations in the Swiss canton of Ticino, where fine-particle pollution increased sharply during a period of shallow fog on the Magadino plain and the Sotto Ceneri, observed at the end of February 2020. "Shortly afterwards, an explosive increase in

hospital admissions due to COVID-19 was recorded in Ticino. The fact that a large carnival event with some 150,000 visitors took place at the same time probably had an additional impact on the spread of the virus," says Mario Rohrer.

The information is important for Switzerland because the increase in fine particle concentrations is particularly frequent during thermal inversions, i.e. when fog forms on the Swiss Plateau, thus limiting the exchange of air masses. In these situations, emissions accumulate in the layer of air underneath the fog. Switzerland is also frequently swept by dust from Saharan sandstorms, also pointed out in this study.

## **Aggravating factor**

The Swiss research team shows that acute concentrations of fine particles, especially those smaller than 2.5 micrometers, cause inflammation of the respiratory, pulmonary and cardiovascular tracts and thicken the blood. "In combination with a viral infection, these inflammatory factors can lead to a serious progression of the disease. Inflammation also promotes the attachment of the virus to cells," he says. In addition, the coronavirus may also be transported by the fine particles. "This has already been demonstrated for influenza and an Italian study found coronavirus RNA on fine particles. All this remains to be demonstrated, of course, but it is a likely possibility," adds Rohrer.

## **A multifactorial pandemic**

Nonetheless, the researchers also emphasize that, although particulate matter pollution can influence the virulence of the virus and possible severe disease progression, physiological, social or economic factors will clearly also influence the further course of the pandemic. Mario Rohrer concludes that the findings of this study offer the possibility of taking

[preventive measures](#) in the event of future increases in fine particulate matter concentrations, thus limiting a new flare-up of Covid-19 morbidity and mortality.

**More information:** Mario Rohrer et al, Peaks of Fine Particulate Matter May Modulate the Spreading and Virulence of COVID-19, *Earth Systems and Environment* (2020). [DOI: 10.1007/s41748-020-00184-4](https://doi.org/10.1007/s41748-020-00184-4)

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