New innovative statistical tool improves pollution control in cities

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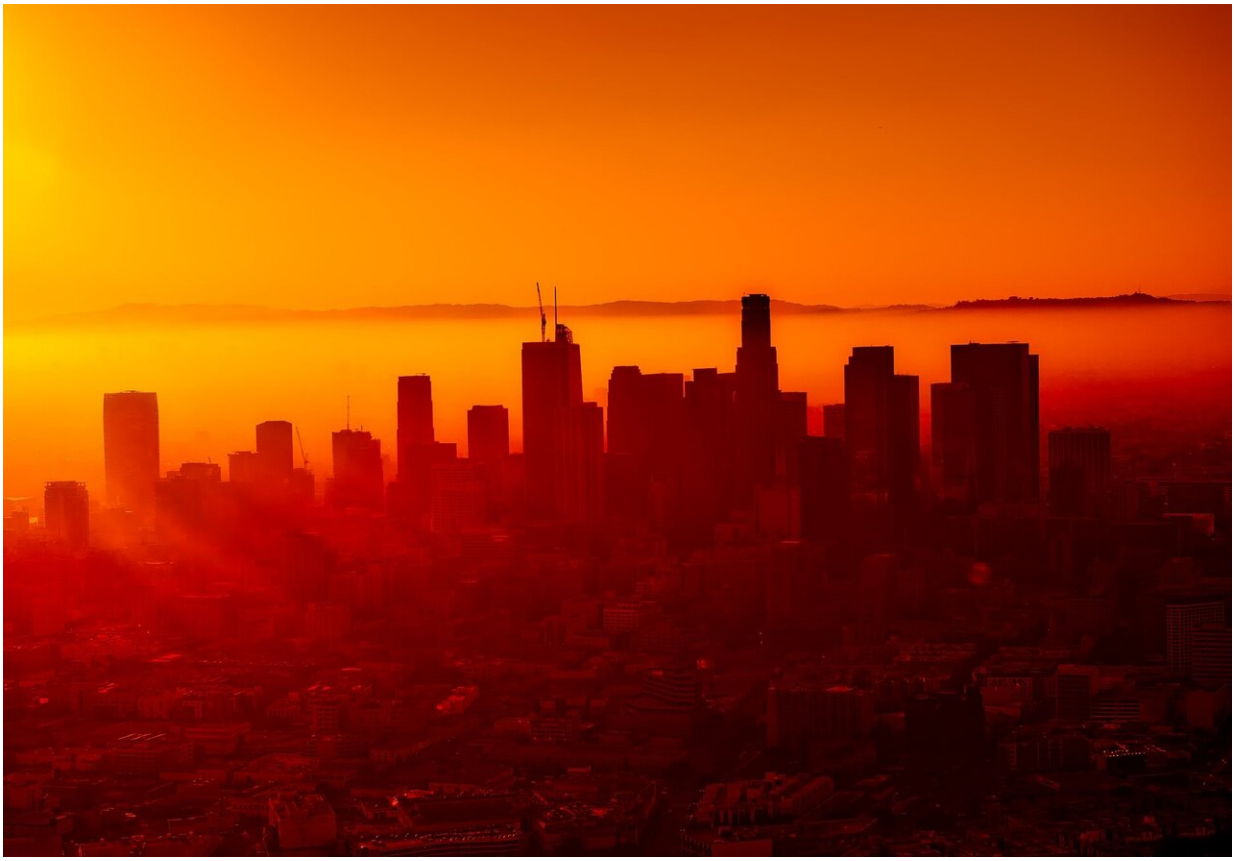

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Recent research has studied the relation between environmental pollution and climate change, and suggests the use of covariables to establish sampling points that are representative of the quality of air in urban

surroundings

A study by the Universitat Jaume I (UJI) has designed an innovative statistical tool to improve the control of pollution in cities. The work, headed by researcher Ana Belén Vicente Fortea of the Department of Agricultural Sciences and the Natural Medium, suggests the use of covariables to establish sampling points that are representative of the environmental pollution of urban surroundings. The results of this work have been published in the *Environmental Pollution* journal.

The research, which also analyzes the relation between the quality of air and climate change, proposes a new statistical method to "take on one of the main issues that emerges in the assessment of the quality of air in a field of study: deciding the number of sampling points that are representative of each microenvironment," says Ana Belén Vicente Fortea, from the Department of Crystallography and Mineralogy. "We have added covariables for the first time, because we show that they decrease variability and increase the quality of the comparison of pollution among sampling points," add the authors of the work, which they have completed alongside scientists from the Universidad National Autónoma of Mexico and the Pompeu Fabra University of Barcelona.

The UJI researchers explain that, until now, other scientists have used Pearson's correlation coefficient or the coefficient of divergence to find significant differences. However, "our study reveals that the application of covariables increases the solving of pollution control," they add.

Covariables are the various items that are added to models and which influence a variable's value, and which also improve the possible prediction of this same variable. Specifically, this study focuses on the variability of the concentration of PM10 suspended particles in space and time. In this study, the divergence and redundancy coefficient (CODR) is improved with additions such as covariables of the distance

among stations and also of Pearson's variation coefficient. This new coefficient is known as CODRcv(d) and, by addressing the distance between stations in Spain, Mexico and Italy, makes it possible to improve the decision on how many stations are necessary to sample PM10.

In the case of Castellón, the use of covariables would help improve the characterisation of the study areas. "We would know the number of stations that are necessary to characterise a specific area, and where to place them. This way, we could assess risk areas for the population in a more precise way, and also save public funds," says Ana Belén Vicente Fortea.

A study from Villarreal, Monterrey and Piedmont

The objective of this research was to analyze how the new statistical model behaves in different surroundings in order to become a useful tool for the development of future air quality plans in other industrialized areas. The three areas studied have been Villarreal, the city of Monterrey in Mexico and the Piedmont region in Italy. The province that Villarreal is located in, is a strategic area in the framework of the controlling of pollution in the European Union. Around 80% of European ceramic tiles and manufacturers of ceramic frits are concentrated in two areas, creating the so-called "ceramic clusters"; one is in Modena (Italy) and the other in Castellón. UJI researcher Sergi Meseguer recalls that in this type of areas "there is a large amount of pollutants in the air from this type of industry, which is why it is hard to meet the limits established by European regulation as regards suspended particles."

Meanwhile, the Mexican city of Monterrey, from the northern state of Nuevo León, has high concentration levels of particulate matter in the environment caused by the extraction of construction materials from the hill that surrounds the city. Lastly, the region of Piedmont, in northern

Italy, has air pollution issues, mainly because it houses the largest industrial, commercial and agricultural area with high population density in Italy. As a result, the population is exposed to high levels of pollution.

This study is the result of the collaboration between researchers Ana Belén Vicente Fortea and Sergi Meseguer Costa, from the Department of Agricultural Sciences and the Natural Medium; Pablo Juan Verdoy from the Department of Mathematics of the UJI; Carlos Díaz Ávalos from the Department of Probability and Statistics of the Universidad Nacional Autónoma of Mexico, and Laura Serra Saurina of the Department of Experimental and Health Sciences of the Pompeu Fabra university of Barcelona, during their stay at the Biostatistics Department of the University of Florence, in Italy.

More information: A.B. Vicente et al. Variability of PM10 in industrialized-urban areas. New coefficients to establish significant differences between sampling points, *Environmental Pollution* (2017). DOI: 10.1016/j.envpol.2017.12.026

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