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Joint space-time geostatistical model for air quality surveillance

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Air pollution and peoples' generalized concern about air quality are, nowadays, considered to be a global problem. Although the introduction of rigid air pollution regulations has reduced pollution from industry and power stations, the growing number of cars on the road poses a new pollution problem. Considering the characteristics of the atmospheric circulation and also the residence times of certain pollutants in the atmosphere, a generalized and growing interest on air quality issues led to research intensification and publication of several articles with quite different levels of scientific depth.

As most natural phenomena, air quality can be seen as a space-time process, where space-time relationships have usually quite different characteristics and levels of uncertainty. As a result, the simultaneous integration of space and time is not an easy task to perform. This problem is overcome by a variety of methodologies. The use of stochastic models and neural networks to characterize space-time dispersion of air quality is becoming a common practice. The main objective of this work is to produce an air quality model which allows forecasting critical concentration episodes of a certain pollutant by means of a hybrid approach, based on the combined use of neural network models and stochastic simulations.

A stochastic simulation of the spatial component with a space-time trend model is proposed to characterize critical situations, taking into account data from the past and a space-time trend from the recent past. To identify near future critical episodes, predicted values from neural networks are used at each monitoring station.

In this paper, we describe the design of a hybrid forecasting tool for ambient NO2 concentrations in Lisbon, Portugal.