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A classification method for air quality prediction in Budapest, Hungary

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The air pollution of European cities is a key issue, including Budapest, the 9th largest city of the European Union that is facing concentrations of NO_x and PM10 above the European guidelines each year. There are several tools to provide air quality prediction for the public, with serious limitations of accuracy. The air pollution of Budapest, characterized by local and diffuse (domestic and traffic) sources, can also be investigated with statistical forecasting methods using 10 years of hourly measurement data of 11 urban air quality monitoring sites. In this study, a classification method was applied to provide a local air quality estimate for PM10 and NO_x pollutants in Budapest, according to the Air Quality Index (AQI) categories. Large-scale synoptic situation was characterized by the k-means clustering of the leading empirical orthogonal functions (EOFs) of the Central European mean sea level pressure and the 500 hPa geopotential field. 10 years of training data was applied from the ERA5 climate reanalysis database and the Hungarian Air Quality Monitoring Network (OLM) for linear (logistic regression) and nonlinear (neural network) classification algorithms. The study demonstrated that a simple statistical method could identify the potentially polluted days with high sensitivity, however, the relevance was low. The method can be applied to efficiently identify the potentially polluted periods in Budapest based on long-term meteorological datasets.