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# High-resolution PM2.5 forecasting using CAMS predictions, low-cost sensors and ensemble techniques

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Expediting urbanization has triggered an increase in cardiopulmonary diseases attributable to fine-particulate air pollution. Air Quality models simulate the dilution and dispersion of air pollutants that affect the atmosphere, contributing crucially to the comprehension of its processes. Air quality forecasts produced by the Copernicus Atmosphere Monitoring Service (CAMS) provide open access to accurate and reliable information but in a coarse resolution. Data-driven models can downscale the forecasts from deterministic air quality models on the basis of reliable measurements. Low-cost air quality sensors are widely known for their increased spatial coverage and economic operational costs, but usually, their reliability is in dispute. In this study, a dense network of calibrated PM2.5 measurements installed in the city of Patras is combined with CAMS forecasts and statistical approaches to generate 24h forecasts of $PM_{2.5}$ concentrations in an urban area of Greece. The implemented techniques are the analog ensemble (AnEn) and the Long Short-Term Memory (LSTM) network. Auxiliary variables of meteorological origin were also utilized. The required forecasts were retrieved from the European Center for Medium-Range Weather Forecasts (ECMWF), and were pin-pointed to the location of the air quality monitoring stations. The results showed that both methods had comparable performance, with low bias and relatively small errors. In the stations with high PM2.5 levels, AnEn performed better, whereas in the stations and seasons with moderate concentrations LSTM outperformed. A comprehensive validation is presented and discussed. AnEn and LSTM methods were proved reliable tools for air pollution forecasting and can be used for other regions with small modifications.