

A causal analysis between ground-level ozone and meteorological and other pollutant variables: A deep AI-based approach applied to the climate of Craiova City, Romania

Abstract:

Ground-level ozone (O_3) is a key air pollutant influenced by air pollutants and meteorological conditions. Understanding the causal relationships between ground-level ozone and (i) meteorological factors and (ii) other air pollutants is critical for two reasons: 1) accurately predicting and forecasting and 2) air quality management. This research investigates the causality and time-lagged effects of air pollutants and meteorological factors on ozone formation and depletion using Granger causality tests, cross-correlation analysis, multiple linear regression (MLR), deep NARMAX model, and structural equation modelling (SEM). A time-series dataset containing hourly meteorological and ozone concentration data over multiple years is analysed to determine key drivers of ozone fluctuations. The dataset was downloaded from the Romanian Environmental Agency's website (<https://calitateaer.ro/>) from four air quality monitoring stations from Dolj County. It spans five years (January 1, 2020 –December 31, 2024). The results provide insights into the delayed effects of air pollutants and meteorological conditions on ozone pollution and help develop more effective predictive models for air quality management.

Keywords: ground-level ozone, causal analysis, meteorological variables, time-series analysis, Granger causality, cross-correlation, structural equation modelling, air pollution, forecasting.

References:

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