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TOWARDS ADVANCED AIR QUALITY MONITORING AND MODELLING IN ARMENIA: DIGITAL SOLUTIONS AND FUTURE PROSPECTS

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The paper considers the current state and future development of air quality monitoring and modeling in Armenia, focusing on the transition from a retrospective system toward a predictive, data-driven framework. The study is based on national monitoring infrastructure and environmental datasets, with emphasis on integrating meteorological and analytical components. The aim of the study is to develop and justify an advanced methodological framework for predictive air quality monitoring based on artificial intelligence, meteorological integration, and digital analytics, supported by comparative analysis of international experience. The proposed approach combines environmental data analysis, machine learning, and meteorological modeling. Air quality data (PM, NO_x, SO_2) are integrated with meteorological parameters (temperature, wind, humidity) into a unified system. The methodology includes data preprocessing, exploratory analysis, forecasting models, and decision making. The analysis shows strong potential for identifying relationships between pollutant concentrations and meteorological conditions. The proposed models enable short- and medium-term forecasting, improve detection of pollution patterns, and provide a basis for risk classification. The study further underlines the growing role of artificial intelligence in environmental sciences, particularly in situations involving large-scale, heterogeneous, and continuously changing datasets. The integration of machine learning techniques with atmospheric and meteorological analysis may significantly enhance the speed and efficiency of environmental assessment processes compared to conventional monitoring approaches. Special attention is also given to the potential application of predictive systems for rapid response strategies during high-risk pollution episodes, including traffic regulation, industrial emission control, and public health protection measures. The transition toward a predictive air quality monitoring system in Armenia is feasible and scientifically justified. The proposed framework can support decision-making processes, improve environmental governance, and contribute to the development of a modern, digital environmental monitoring system. The implementation of predictive monitoring systems could improve data accessibility, strengthen analytical capabilities, and support evidence-based environmental governance. Moreover, the development of digital monitoring platforms may contribute to international scientific collaboration and facilitate the adoption of modern environmental management practices aligned with global sustainability objectives.

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