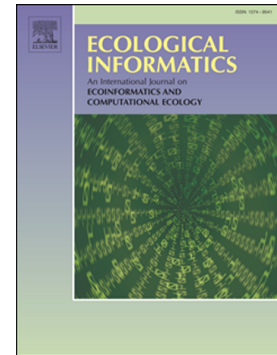


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Air quality assessment using weighted interval type-2 fuzzy inference system

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**Abstract.** This paper presents an integrated model based on interval type-2 fuzzy reasoning approach and interval type-2 fuzzy analytic hierarchy process for assessment of air quality in urban areas. In the proposed model, interval type-2 fuzzy reasoning approach is employed to determine impacts of different air pollutants to describe complex relationship between air pollutants and air quality index by considering individual weights of different air pollutants through the aggregation of toxicological impacts and concentration level of different air pollutants using interval type-2 fuzzy analytic hierarchy process. The proposed approach is advantageous over its counterparts to model the inter-personal and intra-personal uncertainties involved in classification of air quality index. Finally, the developed air quality assessment model is applied on the historical data set collected from ambient air quality monitoring stations operating near by the Victoria memorial, in Kolkata Metropolitan area. The study shows that the air quality index increased significantly during the festive season due to extensive fireworks in those areas.

**Keywords:** Air quality assessment, interval type-2 fuzzy logic system, interval type-2 fuzzy analytic hierarchy process; air quality index.

## 1. Introduction

In the era of expanding economies and urbanization, air pollution becomes one of the most impenetrable environmental challenges that almost all countries around the world are facing today. Due to the presence of harmful or poisonous substances in the air, the environment is becoming polluted day by day. As a consequence the earth is gradually becoming unhygienic for the living beings. Over the decades, numerous studies established the fact that exposure to air pollution affects human health, specially, cardiovascular diseases, respiratory diseases, etc. [7]. As per the estimation of World Health Organization (WHO) urban air pollution (UAP) in developing countries has resulted in more than 2 million deaths per annum along with various cases of respiratory illnesses [5, 6, 41, 42].

People living in India are facing an apocalypse right now due to unhealthy air, killing 1.8 million Indians every year which includes 1,250,296 deaths due to household air pollution and 621,137 deaths due to ambient air pollution and costing the economy an estimated 3% of GDP [10]. Most of these deaths are due to non-communicable diseases caused by pollution such as acute lower respiratory disease (ALRI); chronic obstructive pulmonary disease (COPD), lung cancer; ischaemic heart disease (IHD) and stroke (see Table 1). The report shows that deadly air pollution is not now confined only to Delhi-NCR (National Capital Region) or even to India's

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