Assessment of Meteorological Parameters on Air Pollution Variability in North-West Himalayas

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Abstract:

Air quality in the Northwest Himalayas is influenced by a combination of meteorological factors, seasonal variations, and elevation-specific dynamics. This study examines the impact of temperature, wind speed, humidity, and precipitation on key pollutants, including PM2.5, PM10, SO2, CO, O3, and NO2, using data from 2010 to 2024. Findings indicate that particulate matter concentrations peak during winter due to atmospheric stagnation and biomass burning, whereas monsoon rainfall significantly reduces pollution levels through wet deposition.Temperature shows a strong negative correlation with pollutant concentrations, while wind speed and humidity exhibit season-dependent influences The study also highlights the role of elevation in air quality variation. Lower elevation zones (below 2,000 m) experience higher pollution levels due to human activities and pollutant entrapment in valley regions, whereas higher elevations (above 3,500 m) benefit from stronger winds and lower emissions, leading to better air dispersion . PM2.5 concentrations are particularly sensitive to humidity fluctuations, exacerbating pollution in valley regions where pollutants tend to stagnate. The transport of pollutants from the Indo-Gangetic Plain further contributes to poor air quality in the lower Himalayas, particularly during winter and post-monsoon seasons.These findings underscore the need for elevation-specific and seasonally tailored air quality management strategies. The study provides crucial insights into pollution dynamics in the Himalayas, emphasizing the importance of regional cooperation and policy interventions to mitigate air pollution and its associated health risks. Air quality in the Northwest Himalayas is influenced by a combination of meteorological factors, seasonal variations, and elevation-specific dynamics. This study examines the impact of temperature, wind speed, humidity, and precipitation on key pollutants, including PM2.5, PM10, SO2, CO, O3, and NO2, using data from 2010 to 2024. Findings indicate that particulate matter concentrations peak during winter due to atmospheric stagnation and biomass burning, whereas monsoon rainfall significantly reduces pollution levels through wet deposition.Temperature shows a strong negative correlation with pollutant concentrations, while wind speed and humidity exhibit season-dependent influences The study also