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Contribution to Gauteng atmospheric emissions characterization and source identification using conditional probability function modelling

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ABSTRACT

More than 50 percent (50%) of Gauteng Province areas has been declared by the South African government as an air quality priority area due to poor ambient air quality. The Gauteng province has highest number of industrial activities registered on the National Atmospheric Emission Inventory System (NAEIS) of South Africa which account more than 40% percent of South African Air Quality listed activities (www.saaelip.environment.gov.za). Gauteng ambient monitoring stations measured numerous sources of air emissions, including chemical plants, manufacturing, mining activities and domestic fuel burning, both resulting in heavy air emissions. Gauteng ambient monitoring stations was installed with the aim of monitoring local area sources within Gauteng region. The problem of residential air pollution is mostly related to dense communities of low-income such as townships. The study explores sources of pollution affecting Gauteng province, South Africa. The goal of this study was to assess and determine significant emission sources that affect the province by investigating ambient concentration correlation parameters, pollution roses, and probability modelling functions using Openair software package for air pollution analysis based on the R statistical package. The investigation focused on the following contaminants: sulphur dioxide, nitrogen dioxide, ozone and PM_{10} (particulate matter in which 50% of particles have an aerodynamic diameter of less than 10 μm). Hourly data were used to formulate probability functions for defining and characterizing secret or unknown sources of pollution. In addition, K-clustering algorithm analysis technique has been employed to provide effective graphical meaning for sources in characterizing the classes and source identification. The analysis disclosed major and minor sources. Problematic directional emission sources were identified for PM_{10},ozone, sulfur dioxide and nitrogen dioxide.

The K-clustering algorithm analysis technique was used to provide effective graphical meaning for sources in class characterization and source identification. This study provides baseline information for a comprehensive understanding of the current pollution levels and possible sources within Gauteng province, South Africa.