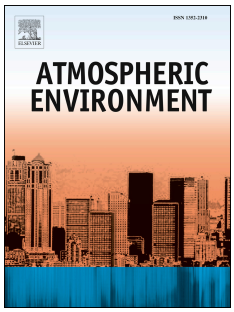
Accepted Manuscript



Simulating ozone concentrations using precursor emission inventories in Delhi – National Capital Region of India

Sumit Sharma, Mukesh Khare

PII: S1352-2310(16)30968-2

DOI: 10.1016/j.atmosenv.2016.12.009

Reference: AEA 15071

To appear in: *Atmospheric Environment*

Received Date: 19 May 2016

Revised Date: 1 December 2016

Accepted Date: 2 December 2016

Please cite this article as: Sharma, S., Khare, M., Simulating ozone concentrations using precursor emission inventories in Delhi – National Capital Region of India, *Atmospheric Environment* (2017), doi: 10.1016/j.atmosenv.2016.12.009.

Simulating ozone concentrations using precursor emission inventories in Delhi –National Capital Region of India

Sumit Sharma[1,2], Mukesh Khare[3*]

1 Research Scholar, Civil Engineering Department, Indian Institute of Technology, Hauz Khas, New Delhi-110 016, India

2 Fellow, Centre for Environmental Studies, The Energy and Resources Institute, IHC Complex, Lodhi Road New Delhi – 110 003, India, email- sumits@teri.res.in

3 Professor, Civil Engineering Department, Indian Institute of Technology, Hauz Khas, New Delhi-110 016, India, email- mukeshk@civil.iitd.ac.in

Abstract

This study simulates ground level ozone concentrations in a heavily populated and polluted National Capital Region (NCR- Delhi) in India. Multi-sectoral emission inventories of ozone precursors are prepared at a high resolution of 4x4 km² for the whole region covering the capital city of Delhi along with other surrounding towns and rural regions in NCR. Emission inventories show that transport sector accounts for 55% of the total NOx emissions, followed by power plants (23%) and diesel generator sets (7%). In NMVOC inventories, transport sector again accounts for 33%, followed by evaporative emissions released from solvent use and fuel handling activities (30%), and agricultural residue burning (28%). Refuse burning contributes to 73% of CO emissions mainly due to incomplete combustion, followed by agricultural residue burning (14%). These emissions are spatially and temporally distributed across the study domain and are fed into the WRF-CMAQ models to predict ozone concentrations for the year 2012. Model validations are carried out with the observed values at different monitoring stations in Delhi. The performance of the models over various metrics used for evaluation was found to be satisfactory. Summers and post-monsoon seasons were better simulated than monsoon and winter seasons. Simulations have shown higher concentrations of ozone formation during summers and lesser during winters and monsoon seasons, mainly due to varying solar radiation affecting photo-chemical activities. Ozone concentrations are observed lower at those locations where NOx emissions are higher, and concentrations increase close to the boundary of study domain when compared to the center of Delhi city. Downwind regions to Delhi are influenced by the ozone formed due to plume of precursor emissions released from Delhi. Considering significant background contributions, regional scale controls are required for reducing ozone in NCR.

Key words: Ozone, NCR, WRF-CMAQ modelling, air quality

1. Introduction

Globally, ground level ozone is a pollutant of concern (TRS, 2008) and is now being realized as an emerging air pollution issue in India also (Kumar et al., 2012; Ghude et al., 2014). Limited monitoring results show significant violations of prescribed standards in Indian cities (CPCB, 2015). Ozone concentrations are generally found to be lower in the city centers due to its reactions with primary nitric oxide (NO) released from vehicular sources (Sillman, 2003), and hence, could be higher outside the city

*Corresponding author :

Email: mukeshk@civil.iitd.ac.in (Mukesh Khare)

Tel: 011-26591212, Fax: 011-24682144