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Numerical Simulation of Air Pollutant Using Coupled AERMOD-WRF Modeling System over Visakhapatnam: A Case Study

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Abstract : Accurate identification of deteriorated air quality regions is very helpful in devising better environmental practices and mitigation efforts. In the present study, an attempt has been made to identify the air pollutant dispersion patterns especially NOX due to vehicular and industrial sources over a rapidly developing urban city, Visakhapatnam (17°42’ N, 83°20’ E), India, during April 2009. Using the emission factors of different vehicles as well as the industry, a high resolution 1 km x 1 km gridded emission inventory has been developed for Visakhapatnam city. A dispersion model AERMOD with explicit representation of planetary boundary layer (PBL) dynamics and offline coupled through a developed coupler mechanism with a high resolution mesoscale model WRF-ARW resolution for simulating the dispersion patterns of NOX is used in the work. The meteorological as well as PBL parameters obtained by employing two PBL schemes viz., non-local Yonsei University (YSU) and local Mellor-Yamada-Janjic (MYJ) of WRF-ARW model, which are reasonably representing the boundary layer parameters are considered for integrating AERMOD. Significantly different dispersion patterns of NOX have been noticed between summer and winter months. The simulated NOX concentration is validated with available six monitoring stations of Central Pollution Control Board, India. Statistical analysis of model evaluated concentrations with the observations reveals that WRF-ARW of YSU scheme with AERMOD has shown better performance. The deteriorated air quality locations are identified over Visakhapatnam based on the validated model simulations of NOX concentrations. The present study advocates the utility of tNumerical Simulation of Air Pollutant Using Coupled AERMOD-WRF Modeling System over Visakhapatnam: A Case Studyhe developed gridded emission inventory of NOX with coupled WRF-AERMOD modeling system for air quality assessment over the study region.

Keywords : WRF-ARW, AERMOD, planetary boundary layer, air quality
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