

CFD Modeling of Particulate Matter (PM₁₀ & PM_{2.5}) Dispersion in Urban Street Canyon using ANSYS CFX – a case of Metro Manila, Philippines

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ABSTRACT

Air pollution has become one of the major environmental problems facing the world today. Air pollutant dynamics, specifically the dispersion of particulate matters (PM) in the atmosphere in mega cities has been the topic of numerous studies concerning the increasing trend in air quality degradation which can be used as one of the baseline information for climate change mitigation. In the Philippines, previous studies show seasonal and diurnal trend in air pollutant concentration, specifically particulate matters (PM₁₀ & PM_{2.5}), along major streets caused primarily by road-side emission sources. However, the effect of urban street canyon in the dispersion of air pollutants has never been established specifically in Metro Manila, considering the continuous increase of road-side buildings and infrastructures.

Particulate matter dispersion dynamics in four different sites in Metro Manila, namely: EDSA Muñoz, Lung Center of the Philippines (LCP), UST España and Ayala Ave., Makati, will be analyzed using CFD modeling (computational fluid dynamics) in ANSYS software which has been used in solving complex and diverse three-dimensional fluid flow problems. Meteorological parameters (temperature, wind direction and wind velocity) coming from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) will be used during the pre-processing of atmospheric boundary in the dispersion simulation setup of CFD modeling.

Moreover, the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model will also be used to determine seasonal PM source apportionment and to further analyze the CFD simulation results. Multivariate analysis such as principal component analysis (PCA) and hierarchical cluster analysis (CA) will be employed in establishing the correlation between the pollutants (PM₁₀ & PM_{2.5}) and meteorological parameters and to classify the different monitoring stations based on the pollutant sources and mechanisms that govern air pollution dynamics.

Keywords: *CFD Modeling, particulate matter dispersion, ANSYS CFX, urban street canyon, HYSPLIT model, principal component analysis (PCA), cluster analysis (CA)*