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High-resolution visibility and air quality forecasting using multi-layer urban canopy model for highly urbanized Hong Kong and the Pearl River Delta

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Visibility is a universally critical element which affects the public in many aspects, including economic activities, health of local citizens and safety of marine transportation and aviation. The Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility equation, an empirical equation developed by USEPA, has been modified by various studies to fit into the application upon the Asian continent including Hong Kong and China. Often these studies focused on the improvement of the existing IMPROVE equation by modifying its particulate speciation using local observation data. In this study, we developed an Integrated Forecast System (IFS) to predict the next-day air quality and visibility using Weather Research and Forecasting model with Building Energy Parameterization and Building Energy Model (WRF-BEP+BEM) and Community Multi-scale Air Quality Model (CMAQ). Unlike the other studies, the core of this study is to include detailed urbanization impacts with calibrated "IMPROVE equation for PRD" into the modeling system for Hong Kong's environs. The ultra-high resolution land cover information (∼1km x 1km) from Google images, was digitized into the Geographic Information System (GIS) for preparing the model-ready input for IFS. The NCEP FNL (Final) Operation Global Analysis (FNL) and the Global Forecasting System (GFS) datasets were tested for both hind-cast and forecast cases, in order to calibrate the input of urban parameters in the WRF-BEP+BEM model. The evaluation of model performance with sensitivity cases was performed on sea surface temperature (SST), surface temperature (T), wind speed/direction with the major pollutants (i.e. PM10, PM2.5, NO_x, SO_2 and O_3) using local observation and will be presented/discussed in this paper.

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