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Comprehensive Validation of Street Canyon PM2.5 Simulation in Complex Asian Residential Community with Fine Resolution using a Micro-scale Model

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Since complex building settings and deep street canyons, significant spatial variation of PM exists in Asian community. To study the dispersion of PM with complex topography, and to quantitatively assess residents' PM exposure, a coupled Lagrangian-Eulerian model GRAL is applied. In this work, a typical Asian residential community in Taiwan is selected to demonstrate the PM10 and PM2.5 simulation with a 5 m $\times$ 5 m resolution topography dataset. The objectives of this work are to optimize critical parameters and to estimate the GRAL performance of PM simulation in complicate micro-environment. Fine resolution building data is provided by a three-dimensional urbanization index dataset to resolve the topographical feature. Sensitivity test is implemented with different settings of dispersion time, released particles numbers, building resolution and roughness length, respectively. Particularly, an empirical algorithm is used to calculate the roughness length of the single community on the basis of 5 m $\times$ 5 m topography dataset. Subsequently with optimal parameter settings, the PM10 and PM2.5 simulation within street canyon is validated by both in-situ and mobile observation. The values of Normalised Mean Square Error (NMSE) and Fractional Bias (FB) in this study is quite good comparing to the reported PM simulation by four other models. Good agreements are found between simulation and observation in different types of street canyon with different wind condition, as well as the applicable scope and the limitation of the model are pointed out. On the basis of this work, PM simulation of GRAL in street canyon is comprehensively validated, and it is also demonstrated as a good tool for PM research in complex Asian residential community. Since similar characters, this modelling approach could be applied in the community of other cities in Asia.