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Analysis of Fine and Coarse Particle Number Count Concentrations Using Boosted Regression Tree Technique in Coastal Environment

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Abstract

Particle number count concentrations ([PNC]) is a new metric unit that can be used to quantify the characteristics of particles in the atmosphere. This study was conducted to explore the variability of [PNC] and the relationship between the factors that influenced this variation. The [PNC], gases (SO_2 and NO_x), and meteorological factors (wind speed, wind direction, humidity, pressure and temperature) data were gathered for a six months period from the Institute of Ocean and Earth Sciences (IOES) Station, Kelantan, Malaysia by using a particle counter (GRIMM, model EDM180), EcoTech EC9805T Series and EcoTech EC9841T Series for gases and Lasteem Model LSI for meteorological measurements. The [PNC] data were categorised into fine particle number count concentrations ($FPNC_{0.25–0.99}$ and $FPNC_{1.0\ -2.49}$) with diameters of 0.25–0.99 μm, 1.0 -2.49 μm and coarse particles number count concentrations ($CPNC_{2.5–10}$) with diameters of 2.5–10 μm. The particle number concentration were measured and reported in number count/particles at the entire size or number in every litre of air flow that pumped into the instruments (EDM180, GRIMM). The concentration of FPNC was found higher (maximum of 5,826,380 counts/L) compared to CPNC (maximum of 818 counts/litre). An artificial intelligent technique (boosted regression trees (BRT) algorithm) was constructed from multiple regression models, and the best iteration of the BRT model was performed by optimising prediction performance. The analysis revealed that the significant variation in the FPNC was largely influenced by SO_2 (46.53%), Julian day (13.71%) and wind direction (10.50%). In contrast, the CPNC was primarily influenced by wind speed (22.33%), wind direction (18.89%), Julian day (18.17%) and pressure (11.38%).

Keywords: Particle number count concentrations; Fine particles; Coarse particles; Boosted regression trees; Coastal area