空氣品質

影響北台灣臭氧汙染事件的因素

The influence factors causing O_3 episode pollution in Northern Taiwan

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ABSTRACT

The application of statistical models has excellent potential to provide crucial information for mitigating the challenging issue of ozone (O_3) pollution by capturing its associations with explanatory variables, including reactive precursors (VOCs and NO_X) and meteorology. Considering the large contribution of O_3 in degrading the air quality and cause polluted O_3 concentration in Taiwan, three-year (2019–2021) hourly concentration data of VOC, NOX and O_3 from 4 monitoring stations of Taiwan: Tucheng (TC), Zhongming (ZM), Taixi (TX) and Xiaogang (XG), was evaluated to identify the effect of anthropogenic emissions on O_3 formation. Owing to the high-ambient reactivity of VOCs on the underestimation of sources, photochemical oxidation was assessed to calculate the consumed VOC (VOCcons) which was followed by the source identification of their initial concentrations. VOCcons was observed to be highest in the summer season (16.7 and 22.7 ppbC) at north (TC and ZM) and in the autumn season (17.8 and 11.4 ppbC) in southward-located stations (TX and XG, respectively). Results showed that VOCs from solvents (25–27%) were the major source at northward stations whereas VOCs-industrial emissions (30%) dominated in south. Furthermore, machine learning (ML): eXtreme Gradient Boost (XGBoost) model based deweather analysis identified that meteorological factors favor to reduce ambient O3 levels at TC, ZM and XG stations (− 67%, − 47% and − 21%, respectively) but they have a major role in accumulating the O_3 (+38%) at the TX station which is primarily transported from the upwind region of south-central Taiwan. Crucial insights using ML outputs showed that the finding of the study can be utilized for region-specific data-driven control of emission from VOCs-sources and prioritized to limit the O3-pollution at the study location-ns as well as their accumulation in distant regions.

Keywords: *Volatile organic carbons, Ozone, Photochemical oxidation, Source characterization Machine learning*