

4.040 Field observation and numerical simulation of ozone (O₃) formation and accumulation in Pearl River Estuary, South China.

Early Career Scientist

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Abstract:

A field measurement was simultaneously conducted at a suburban site (Tung Chung, TC) in Hong Kong and a rural site (ZH) of Zhuhai city from September to November 2016 in the coast of Pearl River Estuary (PRE). Totally 9 ozone (O₃) episode events were captured (hourly maximum O₃ at ZH > 100 ppbv). The dry air, strong solar radiation and increase of CO, SO₂ were investigated during episodes. Higher NO_x was measured at TC but with less O₃. Typhoon and continental anticyclone mainly influenced PRE on episodes. A simulation model, the Weather Research and Forecasting coupled with Chemistry (WRF/Chem) was applied to understand those phenomena. Simulated results showed good performances with the observations. Higher NO_x was found on the surface and much O₃ in the upper air. Compared with non-episodes, elevated O₃ at both sites were attributed to increase of regional transport and photochemical reactions. More specifically, the vertical transport accounted major part for regional transport during typhoon influenced days, however, the horizontal transport was mainly responsible for it during days controlled by anticyclone. Photochemical reaction was the first contributor at ZH with higher elevations. The larger depletion by chemical consumption and vertical mixing were extracted at TC with more traffic effect and tough surface. From simulations, O₃ accumulation was always found in PRE. With the special topography, PRE is

surrounded by many continental cities. According to physical environment, the divergence wind field with low speed, mesoscale circulations over estuary and compressed planet boundary heights during episodes trapped air pollutants. With such effect, VOCs accumulation trend were also discovered in daytime. The results suggested PRE was a natural "pool" for O₃ and its precursors accumulation and reactions. This study is also significant for advance the knowledge of the O₃ accumulation phenomenon in other regions of the world with similar topography.