

# Insights into a Decadal Trend of Surface-level Ozone and Formaldehyde at a Coastal Suburban Site in the Eastern Australia

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### Abstract

Ozone ( $O_3$ ) and formaldehyde (HCHO) are important photochemical secondary pollutants in the tropospheric atmosphere. They have always been emphasized because of not only their complex origin but also the severe deleterious impacts on human health, crops and ecosystems. Herein, a differential optical absorption spectroscopy was deployed to measure  $O_3$ , HCHO,  $NO_2$ , and aromatics (i.e., benzene, toluene, xylene, abbreviated as BTX) at Springwood (SPW), a suburban site on the eastern coast of Australia. We analysed 10-year observational data collected from 2011 to 2020. The non-parametric methods of Mann Kendall test and Sen's estimator were used to test the long-term trends and calculate the slope of the trends. Trend analyses show that  $O_3$  increases by 0.02 ppb per month, while HCHO decreases by 0.03 ppb per month. In addition, significant seasonal variations were found with respect to  $O_3$ , HCHO and  $NO_2$ . A multiple linear regression model based on HCHO and its source-related indicator compounds were constructed to estimate background, primary emissions, and secondary sources of HCHO for each year. It has been found secondary formed HCHO was identified as the main source of HCHO at SPW. In order to reveal the characteristics of the air mass transport, 72h backward trajectories once per hour were calculated by the NOAA HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) model. Five clusters of air mass backward trajectories were identified using *k*-means clustering. When the clusters of continental air masses were under control,  $O_3$ , secondary HCHO and  $NO_2$  correspondingly raise by 13.3%, 28.2% and 100%, as compared with those of marine-influenced air masses. This study characterized long-term ground-based measurements of  $O_3$  and HCHO in Australia for the first time. These findings not only provide scientific evidence for air quality alterations in similar coastal regions worldwide but also offer insights for devising photochemical pollution prevention strategies in distressed areas.

### Early Career Scientist

YES, I am an early career scientist.

### IGAC Activities

MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, TOAR: Tropospheric Ozone Assessment Report

### IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group, China Working Group