

Examining Ozone Sensitivity in Jakarta Greater Area: Satellite Analysis and Modeling verification

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Abstract

Photochemical ozone (O_3) formation is influenced by a ratio of VOC to NO_x . Formaldehyde (HCHO) to nitrogen dioxide (NO_2) Ratio (FNR), derived from satellite measurements, serves as a valuable indicator for inferring O_3 formation. We investigate the long-term trend of HCHO, NO_2 , and analyze the O_3 sensitivity in Jakarta Greater Area (JGA), a vast urban agglomeration in Indonesia, by employing Ozone Monitoring Instrument (OMI) measurement spanning 2010 to 2019. The space-borne FNR inferred from the OMI was applied to the JGA and verified by a series of sensitivity tests of the Weather Research and Forecasting model with Chemistry (WRF-Chem) simulations by reducing the NO_x and VOC emissions. The results show that a slight decrease in NO_2 and an increase in HCHO contributed to declining O_3 in Jakarta with a ten-year average of FNR of 3.7. Conversely, O_3 increases in rural areas with a higher FNR of 4.4. The results of WRF-Chem sensitivity modeling showed that O_3 concentration decreased when the NO_x emission reduced at 50 % and almost no response to VOC reduction of 50 %. O_3 concentration experiences the biggest reduction by halving NO_x and VOC emissions revealing O_3 sensitivity to both precursors. This study presents the preliminary results of modeling verification to O_3 sensitivity using global emission inventory from the Emissions Database for Global Atmospheric Research (EDGAR). However, further research utilizing precise local emission inventories is essential to enhance modeling accuracy and refine our understanding of ozone formation in this region.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

ACAM: Atmospheric Chemistry and the Asian Monsoon, 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