

# Significant Enhancement of Secondary Organic Aerosol during Heatwaves in Northern China

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## Abstract

The severity and frequency of heatwaves are expected to rise with continued global climate change. Extreme heat may exacerbate secondary pollution, leading to exceedingly high health risk. However, there is still lack of understanding about the impact of heatwaves on secondary organic aerosol (SOA) formation, impeding precise and effective pollution control in the future. Here we deployed a long time-of-flight aerosol mass spectrometer (LTOF-AMS) to measure the chemical composition of submicron aerosols in urban Beijing in summer 2023 and the Positive Matrix Factorization (PMF) analysis was performed to resolve multiple SOA sources. During the campaign, two haze events were observed, one of which was accompanied with heatwaves lasting for six days. SOA, O<sub>3</sub>, and sulfate concentration respectively increased by 21%, 75%, and 41% during the heatwave haze compared to the non-heatwave haze, suggesting significantly enhanced secondary formation. The machine learning methods were used to identify the key drivers leading to the changes on SOA during the heatwave haze. The results indicate that intensified photochemical and heterogeneous reactions due to higher volatile organic compounds emissions and oxidant level, increased aerosol surface, stronger aerosol acidity, and higher ammonia concentration, mainly contribute to the SOA enhancement during the heatwave haze. By contrast, nighttime SOA formation is less affected by heatwaves. Our results suggest that SOA production might be largely accelerated in the future, calling for more stringent control on its precursors and reduction on atmospheric oxidation capacity.

## Early Career Scientist

YES, I am an early career scientist.

## IGAC Activities

MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, CCMi: Chemistry Climate Model Initiative, BBURNED: Biomass Burning Uncertainty: ReactionNs, Emissions and Dynamics, TOAR: Tropospheric Ozone Assessment Report, PACES: Air Pollution in the Arctic: Climate, Environment, and Societies

## IGAC Regional Working Groups

China Working Group