S71 - Quantifying Nitrous Oxide Levels in the Portland (OR, USA) Metropolitan Area

Sunday, January 12, 2025

6:30 PM - 8:30 PM

Hall C (New Orleans Ernest N. Morial Convention Center)

Abstract

Continuous measurements of the concentration of nitrous oxide (N2O) in ambient air in the Portland (OR, USA) metropolitan area were taken over two months during the summer of 2024. Nitrous oxide (N2O) is a long-lived greenhouse gas and a major contributor to natural and anthropogenic radiative forcing. Numerous studies have reported on N2O fluxes from wetlands and from agriculture. However, quantification of N2O in urban areas is lacking, where sources can include fossil fuel combustion, waste, and industrial emissions. The sampling location is in downtown Portland (OR, USA), the center of 5 cities with a combined population of 2.5 million. An Agilent 6890N gas chromatograph (GC) equipped with a micro-electron capture detector (ECD) was fully automated to measure ambient concentrations of N2O and SF6 every ten minutes. Air is drawn from the rooftop of the five-story Science Research and Teaching Center (45.513N, 122.686W, 63m). Calibration of the N2O GC-ECD system occurred in 6-hour intervals, with a working reference calibrated against the WMO N2O scale. Automated instruments at the same location measure methane (CH4) and carbon dioxide (CO2) as well as an instrumented meteorological tower (wind direction, wind speed, temperature, relative humidity). We hypothesized that there were no major urban sources of N2O emissions, but that concentrations would be elevated above the global background due to dispersed urban emissions, nearby agricultural sources, and wildfires during the summer months. The mean measured N2O concentration was 340 ± 1 ppb. The diurnal cycle of N2O in Portland was identified by subtracting the daily average from measurements and plotting them on the same graph; minima occurred at 12 PM PDT and maxima at 4 AM and 7 PM PDT, with an amplitude of 1 ppb. Hourly averages of the measured N2O concentration were computed and compared with hourly averages of CH4 and CO2 concentrations. Air parcel back-trajectories were obtained using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model and used to identify the influence of regional wildfires and nearby agriculture on measured greenhouse gas concentrations. During periods dominated by easterly flow, emissions from regional wildfires were identified by elevated N2O concentration and a robust correlation with CO2. Additionally, higher-than-average N2O concentrations were found during periods of northerly flow, which may result from regional urban or agricultural emissions. Results presented here include a

time series of ambient N2O, CH4, and CO2 during summer 2024 with a discussion of important regional greenhouse gas contributors.

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