INTRODUCTION

This product will consist of the development of a consistent set of modeled fire emissions from 2016 through 2023 for North America at 36 km spatial resolution. This new fire emissions will have unique specificity with respect to how different types of fires are processed and tracked for contribution using the source apportionment feature in the Community Multiscale Air Quality (CMAQ) model. These new fire emissions will have a consistent methodology for emissions estimation and provide differentiation with respect to source (e.g., U.S., Canada, and Mexico) area for wildfire and fire type (e.g., prescribed broadcast burns, prescribed pile burns, etc.) for managed burns.

The CMAQ model will be applied for multiple years to quantify human exposure to particulate matter less than 2.5 microns (PM2.5) and ozone (O3) from the different types of fire tracked with source apportionment. It is expected that this application will provide needed information about the relative persistence of exposure of population to wildfire compared to other types of managed fires. Currently, little is known about the comparative exposure for people in different parts of the U.S. to wildfire compared to managed fire that may be more common in their area and the times of year that exposure might be typically expected. A subset of the CMAQ output will be made publicly available to support human health and exposure equity applications.

Photochemical models have been used to quantify and compare impacts of PM2.5 from prescribed and wildfire where prescribed fires had the exact same spatial footprint as actual wildfires but moved to the prescribed fire season and modeled with a much lower fuel consumption more reflective of broadcast burning (Kiely et al., 2024). Counterfactual scenarios where wildfires would have a smaller footprint and burn a shorter number of days were compared to the historical wildfire and related intervention broadcast burns using a photochemical grid model to predict O3 and PM2.5 impacts (U.S. Environmental Protection Agency, 2021).

METHODS

The hemispheric CMAQ simulation was done using v5.4 with updates to aerosol nitrate photolysis (REF). Hourly biogenic VOC was estimated using the inline MEGAN v3.2 option in CMAQ. Hourly biogenic NO was estimated using the inline BDSNP (no version number) option in CMAQ. Lightning NO emissions were based on day specific WWLLNs global lightning strike data. Wildland fire emissions were estimated based on FINN v1.5. Anthropogenic emissions were based on HTAPv3 (Crippa et al, 2023). Sea salt and dust were estimated using CMAQ inline options. The last day of the 2019 CMAQ hemispheric simulation was used to initialize the 2020 simulation. Each subsequent year was initialized with the last day of the preceding year. Gridded CL2 emissions were provided to support marine chemistry and a monthly ocean water mask file that climatology-scale estimates of dimethyl sulfide and mass concentration of chlorophyll in ocean water.

REFERENCES

Crippa 2023 <https://essd.copernicus.org/articles/15/2667/2023/>

