5-2020

Estimating Wildfire-Generated Ozone over North America Using Ozonesonde Profiles and a Differential Back Trajectory Technique

Omid Moeini

David W. Tarasick

C. Thomas McElroy

Jane Liu

Mohammed K. Osman

See next page for additional authors

Citation/Publisher Attribution

Moeini, Omid; Tarasick, David W.; McElroy, C. Thomas; Liu, Jane; Osman, Mohammed K.; Thompson, Anne M.; Parrington, Mark; Palmer, Paul I.; Johnson, Bryan J.; Oltmans, Samuel J.; Merrill, John. 2020. Estimating wildfire-generated ozone over North America using ozonesonde profiles and a differential back trajectory technique. *Atmospheric Environment: X* 7:100078. https://doi.org/10.1016/j.aeaoa.2020.100078

ATMOSPHERIC ENVIRONMENT: X 7 (2020) 100078

Contents lists available at ScienceDirect

Atmospheric Environment: X

journal homepage: http://www.journals.elsevier.com/atmospheric-environment-x

Estimating wildfire-generated ozone over North America using ozonesonde profiles and a differential back trajectory technique

Omid Moeini [a,b,*], David W. Tarasick [b], C. Thomas McElroy [a], Jane Liu [c], Mohammed K. Osman [b], Anne M. Thompson [d], Mark Parrington [e], Paul I. Palmer [f], Bryan Johnson [g], Samuel J. Oltmans [g,h], John Merrill [i]

[a] Department of Earth and Space Science and Engineering, York University, Toronto, ON, Canada
[b] Air Quality Research Division, Environment and Climate Change Canada, Toronto, ON, Canada
[c] Department of Geography, University of Toronto, Toronto, ON, Canada
[d] NASA Goddard Space Flight Center, Greenbelt, MD, USA
[e] European Centre for Medium-Range Weather Forecasts, Reading, UK
[f] School of GeoSciences, The University of Edinburgh, UK
[g] NOAA Earth System Research Laboratory, Global Monitoring Division, Boulder, CO, USA
[h] Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO, USA
[i] Graduate School of Oceanography, University of Rhode Island, Narragansett, RI, USA

ARTICLE INFO

Keywords:
Tropospheric ozone
Forest fires
Ozonesonde
Fire-generated ozone
Trajectory technique

ABSTRACT

An objective method, employing HYSPLIT back-trajectories and Moderate Resolution Imaging Spectroradiometer (MODIS) fire observations, is developed to estimate ozone enhancement in air transported from regions of active forest fires at 18 ozone sounding sites located across North America. The Differential Back Trajectory (DBT) method compares mean differences between ozone concentrations associated with fire-affected and fire-unaffected parcels. It is applied to more than 1100 ozonesonde profiles collected from these sites during the summer months June to August 2006, 2008, 2010 and 2011. Layers of high ozone associated with low humidity were first removed from the ozonesonde profiles to minimize the potential effects of stratospheric intrusions on the calculations. No significant influence on average ozone levels by North American fires was found for stations located at Arctic latitudes. The ozone enhancement for stations nearer large fires, such as Trinidad Head and Bratt's Lake, was up to 4.8% of the TTOC (Total Tropospheric Ozone Column). Fire ozone accounted for up to