Effects of the 2015 summer wildfires in western Canada on air quality in eastern North America

Introduction

Smoke from western forest fires in Alberta and Saskatchewan, Canada during June and July, 2015 drifted eastward across the Great Lakes region, eastern Canada and northeastern US during July and caused distinct increases in concentrations of fine particles measured at air quality monitoring stations during July 5-6. Challenges:

• do clouds & precip during transport affect O3 & PM2.5 growth?

• does transported smoke aloft get mixed downward to the sfc? Here, the meteorological factors that caused smoke plumes to move across the continent and to get transported downward to the surface are examined. July 5 & 6 were selected because of the cold front and weather not optimum for boundary layer mixing.

Smoke Source



Image credit: Canadian Wildland Fire Information System



IMAGE: SASKATCHEWAN MINISTRY OF HIGHWAYS AND INFRASTRUCTURE VIA THE CANADIAN PRESS/AP/ASSOCIATED PRESS



Above: NOAA-HMS fire-smoke analysis, July 4 (left) & July 6 (right) Source: NOAA Office of Satellite and Product Operations

Why was early summer 2015 a strong wildfire season?



Above: 500 hPa GPH anomaly, June 1-30, 2015 Source: NOAA Earth System Research Laboratory, Physical Sciences Division

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<u>Transport</u>



Above: 700 hPa GPH pattern July 3-6 supports flow from NW-SE July 3-4, followed by a large upper trough. Source: NOAA Earth Science Research Laboratory, Physical Sciences Division





Above: NASA Worldview charts show Aerosol Optical Depth, July 2 (left), fire detections & visible smoke July 3 (middle) and true colour visible image July 4 (right)

Ground-level Observations



micrograms/cu.m at EDT 14:00 July 6 Source: Ont. Min. of Environ. & Climate Change



Above: PM2.5 concentrations in Minnesota July 6 increased to 160 micrograms/cu. m Source: Airnowtech.org











Above: back trajectories July 4-6 Source: NOAA Air Resources Laboratory



Local meteorology

- a low pressure trough and cold front moved southeastward across the Great Lakes region July 5-6
- scattered showers
- light winds
- mostly cloudy skies



Above: surface analysis, July 6 afternoon Source: NOAA-NCEP Weather Prediction Center



Left: radar mosaic, July 6 afternoon Source: College of DuPage NEXLAB



Above: observations July 5, Thunder Bay, showing light winds, partly cloudy skies & cold front passage Source: University of Wyoming, Dept. of Atm. Science



Above: observations July 5, Chicago IL, showing light winds & mostly sunny skies

Summary

- strong fire season
- transport SE to Great Lakes region
- unsettled weather conditions included partly cloudy skies, scattered showers, & light winds
- the least confident conditions for air quality forecasting!