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Abstract

Adverse effects of wildfires on human health, visibility, and the environment are of great concern to Canadians during the wildfire season from April to October. In order to provide more accurate guidance on wildfire impacts on air quality and visibility, Environment and Climate Change Canada (ECCC) has been running an experimental air quality forecast system with near-real-time wildfire emissions at the Canadian Meteorological Centre Operations Division since 2013. Initially, only 3 summertime months (June, July and August) were covered by FireWork forecasts, but since 2015, when this system became operational at ECCC, the FireWork air quality forecast system has been run over the seven-months period from April 1 to October 31.

Modelling wildfire emissions and dispersion and forecasting time series of concentrations of air pollutants is essential in monitoring air quality and assessing wildfire impacts. Over the past four years, the performance of the FireWork system was regularly evaluated and analysed at ECCC. In this paper we show multi-year results for different statistics such as RMSE, correlation, and MB and some categorical scores. Some conclusions about FireWork’s performance analysis and potential improvements are also shown.

1. Introduction

- Biomass burning (BB), from both natural processes (e.g. wildfire) or anthropogenic activities (e.g. controlled prescribed fires or burns), can emit significant amounts of pollutants that can adversely impact local and regional air quality (AQ), public health and climate.
- Emissions from BB include primary pollutants such as carbon monoxide (CO), particulate matter (PM), and ammonia (NH3), as well as ozone (O3) precursors such as nitrogen oxides.
- In addition to their multiple impacts, wildfires have been identified as a major natural hazard with a strong effect on the economy and the environment in the summertime in Canada. Therefore, it is essential to explore their potential health impacts.
- Modelling wildfire emissions and dispersion and forecasting time series of concentrations of air pollutants is essential in monitoring air quality and assessing wildfire impacts.
- Sections 2 shows the methodology and modelling setup used in the Firework AQ modelling system.

Objective

- This work aims to validate the performance of the Firework forecast system over the past four years (2013-2016), and
- Intend to help all Canadians, and especially people involved in preventing air pollution-related health impacts, to understand the differences between particles from wildfires and those from urban sources in terms of potential impacts on exposed populations and the required response.

2. Methodology and Set-Up

- The Canadian WildFire Season
- PM2.5 Objective Scores
- Difference: FW - OPS
- Forecasted wildfire emissions contribution to average summertime PM2.5 concentrations

3. Results

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4. Conclusions

Since 2013, an online-coupled meteorology-chemistry wildfire model system, FireWork, has been deployed by the Canadian Meteorological Centre Operations division to deliver real-time air quality forecasts over North America during the Canadian wildfire season. Forecasted PM2.5 concentrations during the wildfire season for the 2013-2016 period showed FireWork to be a very useful tool in forecasting PM2.5 concentrations. In Canada, PM2.5 trends are strongly driven by wildfire-generated pollution. PM2.5 from wildfires has an impact on health, not only locally, but also in areas hundreds of kilometers away from the wildfire sources. For example, in May 2016 during the Fort McMurray fire event, the average forecasted wildfire contributions to total forecasted PM2.5 concentrations were above 50 μg/m³ for the area close to Fort McMurray. For maximum hourly PM2.5 concentration, the area close to Fort McMurray and a few hundred kilometers downwind of the city had forecasted maximum concentrations above 500 μg/m³ and the most heavily affected area had forecasted values above 10,000 μg/m³.