An Investigation of the Impact of Canadian wildfires on US Air Quality using Satellite, Model and Ground Measurements: supplemental document

Figure S1 shows the changing trends of monthly surface PM2.5 and total FRP from January 2001 to December 2020 (a total of 240 months). There are much variations of monthly change of both surface PM2.5 and total FRP due to the inter-annual characteristics of surface PM and wildfires, and some variations between the two variables matches well with each other but some are not. Of all the regions and months, the largest FRP occurs in 236 (September 2020) at EPA region 8. The total FRP of EPA region 8 in September 2020 reaches 4675228.5 MW and the corresponding monthly mean PM2.5 is around 30 $\mu g m^{-3}$. Both surface pollution level and FRP peaks match well in this month which indicates that large fires largely increase the surface PM2.5. Large wildfires (high FRP) are commonly occur at EPA region 8, 9 and 10. total FRP larger than $5 \times 2 \times 10^5$ MW usually lead to obvious increasing/peaks of corresponding surface PM2.5. However, low FRP (small scale fires) hardly cause any obvious increase on the surface pollution levels. Of all the regions, PM2.5 at region 10 are most sensitive to FRP changes which could because of the lowest population (15.7 people per square mile) in all EPA regions. Sometimes the variation of PM2.5 is also influenced by wildfires from other regions. In August 2018, there are large wildfires in region 9 and 10 (peaks at x=211, frp=7.3$\times 2 \times 10^5$ MW for region 9 and frp=5.4$\times 2 \times 10^5$ MW for region 10) and no large fires in region 8, while surface PM2.5 in region 8 shows a peak corresponding to the wildfires in the neighboring region.

Over the 20 years, surface PM2.5 in EPA region 1 to region 7 are showing noticeable decreasing trend (shown in table S1). Surface pollution in EPA region 9 also shows decreasing trend in months without large fires (low FRP), however, EPA region 8 and 10 have a much constant surface PM2.5 values in the 20 years and no obvious change in low wildfire months.

	Region1	Region2	Region3	Region4	Region5	Region6	Region7	Region8	Region9	Region10
1	-0.39	-0.24	-0.29	-0.26	-0.36	-0.22	-0.3	-0.41	-0.54	-0.21
2	-0.26	-0.17	-0.28	-0.26	-0.36	-0.16	-0.29	-0.42	-0.36	-0.35
3	-0.32	-0.28	-0.33	-0.24	-0.45	NaN	NaN	-0.16	-0.34	-0.09
4	-0.22	-0.2	-0.32	-0.3	-0.32	NaN	NaN	-0.12	-0.2	-0.06
5	-0.26	-0.24	-0.4	NaN	-0.33	NaN	-0.17	-0.07	-0.3	-0.04
6	-0.5	-0.45	-0.69	NaN	-0.54	NaN	-0.27	NaN	NaN	-0.05
7	-0.51	-0.44	-0.74	-0.47	-0.48	-0.11	-0.29	NaN	NaN	NaN
8	-0.46	-0.43	-0.8	-0.57	-0.49	-0.24	-0.31	NaN	NaN	NaN
9	-0.2	-0.2	-0.4	-0.41	-0.47	NaN	-0.29	NaN	NaN	NaN
10	-0.24	-0.28	-0.4	-0.41	-0.39	-0.29	-0.15	NaN	NaN	-0.2
11	-0.36	-0.3	-0.4	-0.29	-0.4	-0.28	-0.29	-0.3	NaN	-0.4
12	-0.35	-0.22	-0.26	-0.24	-0.4	-0.2	-0.3	-0.44	NaN	-0.3

Table S1. Estimated yearly decrease (unit: *100%) in surface PM2.5 using linear regression models
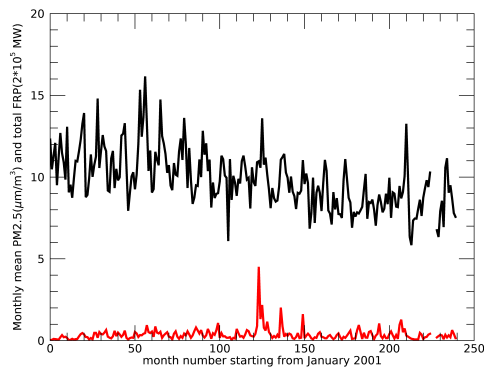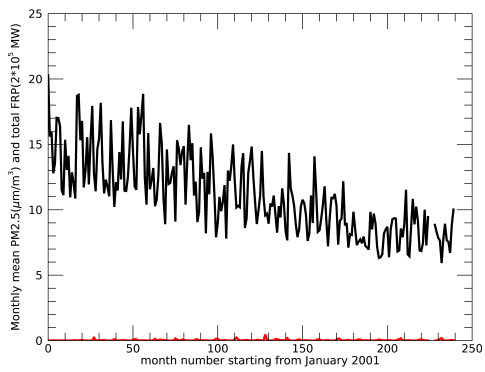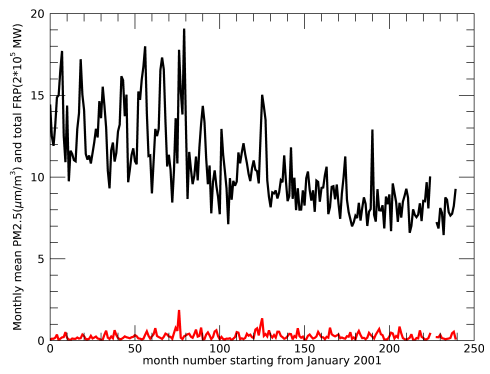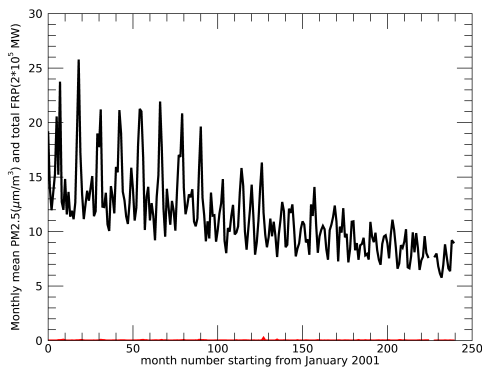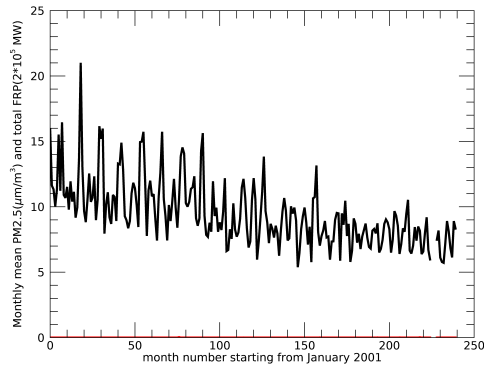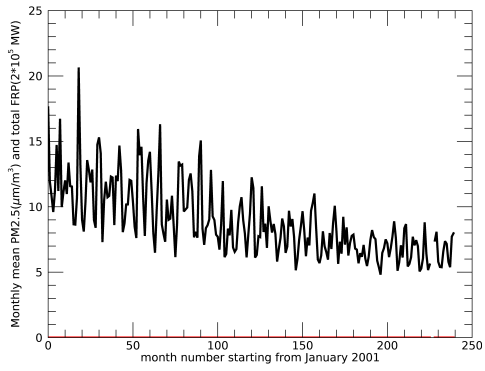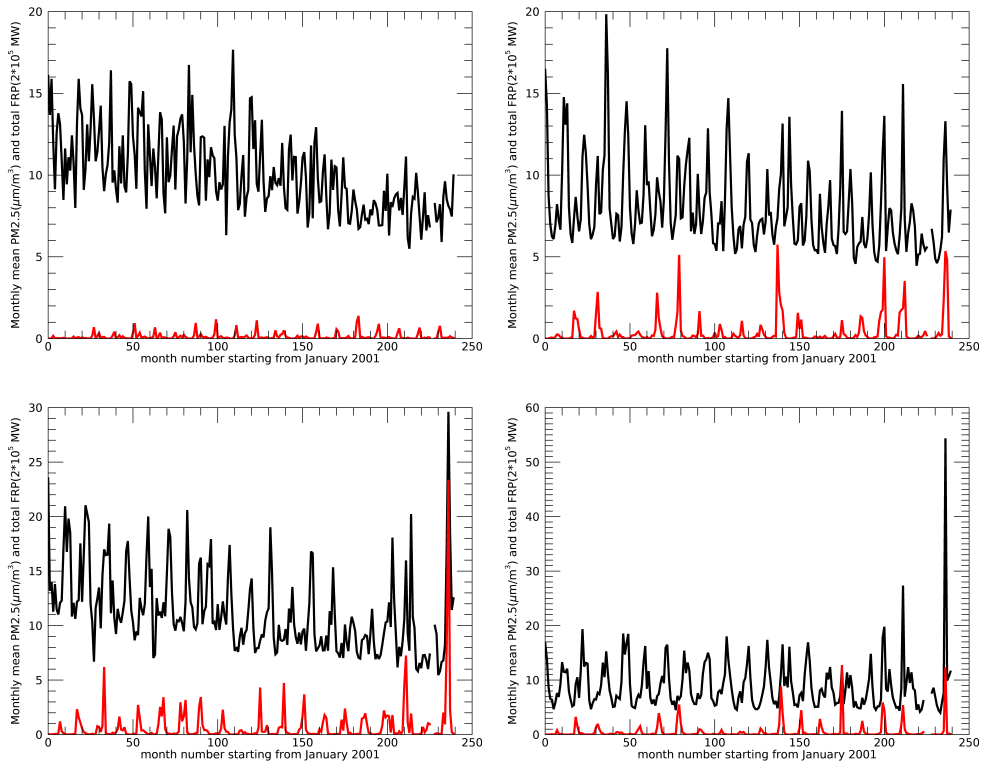
Fig. S1. *Monthly change of mean surface PM2.5 concentrations (black) and monthly total FRP (red) in different EPA regions (EPA region 1 to 10) from January 2001 to December 2020 (a total of 240 months).*

Date	MAIAC coverage (%)	WRF-Chem vs. MAIAC AOD			
		RMSE	R	slope	intercept
20180809	63.2	0.26	0.5	0.37	0.0003
20180810	63.1	0.33	0.3	0.23	0.05
20180811	67.9	0.3	0.4	0.23	0.06
20180812	62.9	0.35	0.3	0.15	0.08
20180813	64.6	0.32	0.47	0.21	0.07
20180814	56.7	0.26	0.45	0.34	0.04
20180815	60.2	0.24	0.52	0.41	0.03
20180816	63.9	0.26	0.5	0.42	0.04
20180817	60.8	0.42	0.45	0.2	0.1
20180818	57.8	0.42	0.54	0.25	0.08
20180819	52.6	0.44	0.6	0.25	0.08
20180820	49.8	0.36	0.62	0.32	0.08
20180821	46.4	0.35	0.58	0.33	0.09
20180822	59.8	0.24	0.56	0.48	0.05
20180823	64.2	0.24	0.63	0.57	0.03
20180824	62.1	0.36	0.31	0.21	0.18
20180825	59.4	0.2	0.49	0.58	0.09

Table S2. MAIAC AOD coverage and statistics of two AOD product (WRF-Chem AOD and MAIAC AOD)