Aerosol	Density (kg m^{-3})	Real part of the refractive index at 550 nm (at RH= 0%)	Imaginary part of the refractive index at 550 nm (at RH= 0%)
Ammonium sulfate	$1.77 \times 10^{+3}$	1.53	10^{-7}
Ammonium nitrate	$1.7 \times 10^{+3}$	1.56	10^{-9}
Dust	$2.56 \times 10^{+3}$	1.56	6×10^{-3}
Black carbon	$1.8 \times 10^{+3}$	1.75	0.44
Sea salt	$2.17 \times 10^{+3}$	1.49	0.006
Water	$1.0 \times 10^{+3}$	1.33	1.00023×10^{-8}
Organics	$1.4 \times 10^{+3}$	1.53	1.96×10^{-9}

Table 2: Density and the refractive index of each aerosol type.

	Real Part of the Refractive Index	Imaginary Part of the Refractive Index	Extinction Efficiency	Scattering Efficiency	Absorption Efficiency		Aerosol Component Volume Fraction			
H2O	1.34	1.0×10^{-9}	0.20941	0.20941	0		0.2	0.2	0.3	0.1
Organics	1.45	1.0×10^{-3}	0.37171	0.36772	0.00399		0.5	0.3	0.3	0.7
Ammonium Sulfate	1.52	5.0×10^{-4}	0.49265	0.4906	0.00205		0.3	0.5	0.4	0.2
						Real Part Volume Average	1.449	1.463	1.445	1.453
						Imaginary Part Volume Average	6.5×10^{-4}	5.5×10^{-4}	$5. \times 10^{-4}$	$8. \times 10^{-4}$
					Method 1 (volume average of refractive indices, D=0.2 µm)	Extinction Efficiency	0.3688	0.3917	0.3618	0.3759
						Scattering Efficiency	0.3663	0.3895	0.3598	0.3727
						Absorption Efficiency	0.0026	0.0022	0.0020	0.0032
					Method 2 (refractive index of pure aerosol and aerosol concentration, D=0.2 µm)	Extinction Efficiency	0.3755	0.3997	0.3714	0.3797
						Scattering Efficiency	0.3729	0.3975	0.3694	0.3765
						Absorption Efficiency	0.0026	0.0022	0.0020	0.0032
					Error	Extinction Efficiency	-0.018	-0.021	-0.026	-0.010
						Scattering Efficiency	-0.018	-0.021	-0.027	-0.010
						Absorption Efficiency	-0.008	-0.005	-0.008	-0.001

Table S1: Different treatments of the soluble species surrounding the black carbon core using an online Mie calculator for a particle diameter of 0.2 µm: 1) volume averaging the refractive indices and calculating the extinction, scattering and absorption efficiency of the mixture, 2) using the optical properties of pure components and volume-weighting the pure optical properties. Three different aerosol component fractions on the right side of the table were used to generate Extinction Efficiency, Scattering Efficiency, and Absorption Efficiency; at the bottom of the table, the differences in the resulting values are examined.

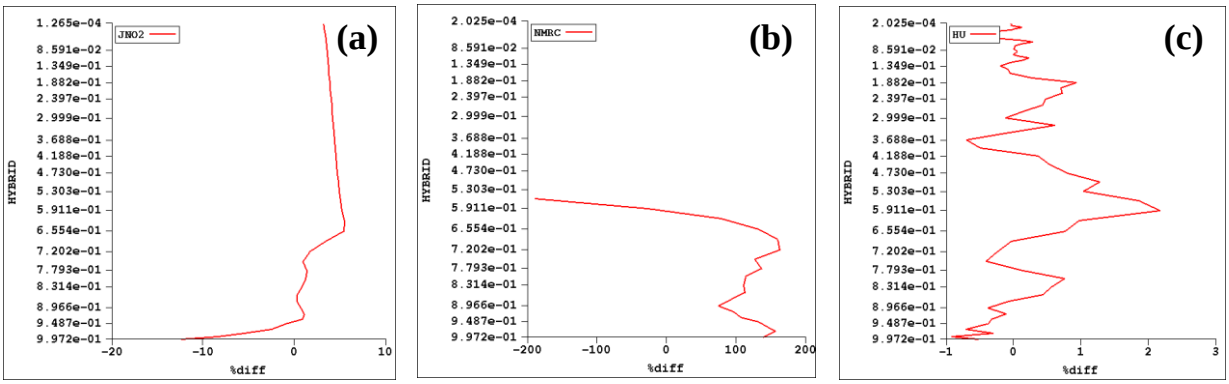

Figure S1: the percentage difference in (a) JNO_2, (b) number mixing ratio of clouds (droplets) and (c) specific humidity over an area with high values of JNO_2 difference.

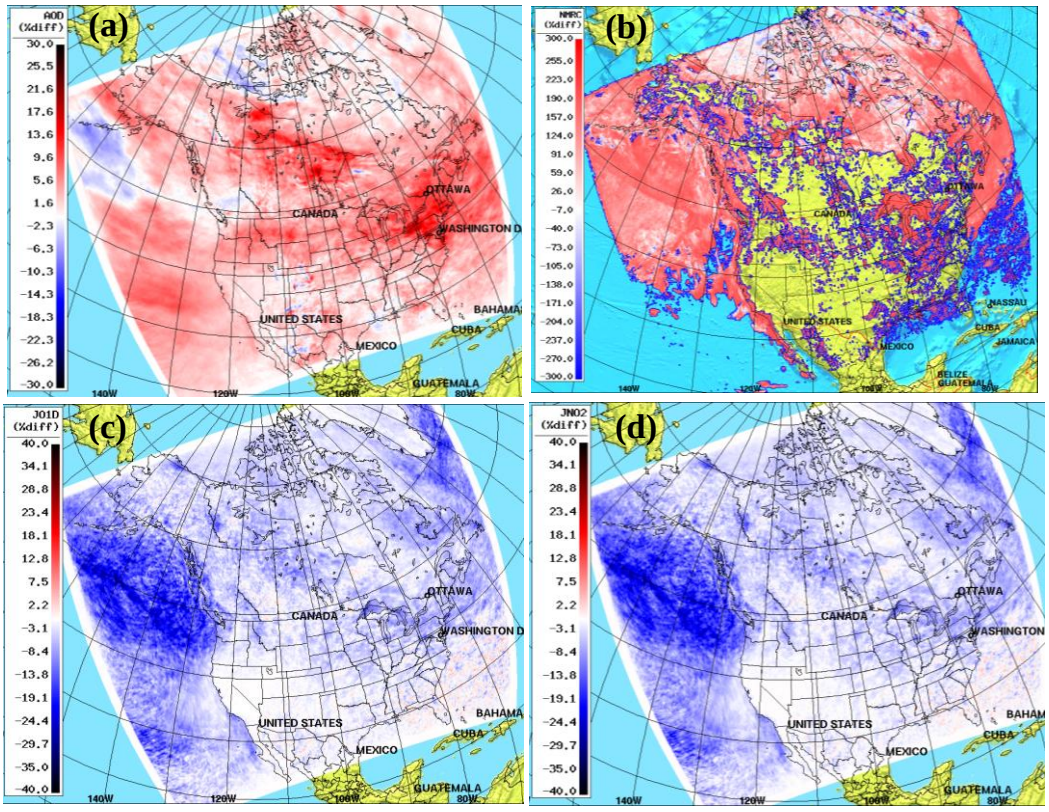

Figure 11: Percentage difference in daytime monthly average (June 2018) in (a) AOD (b) number mixing ratio of clouds at 820 hPa (~1.75 km above sea level), (c) JO^1D at the lowest model level, and (d) JNO_2 at the lowest model level, with and without online aerosol feedbacks.

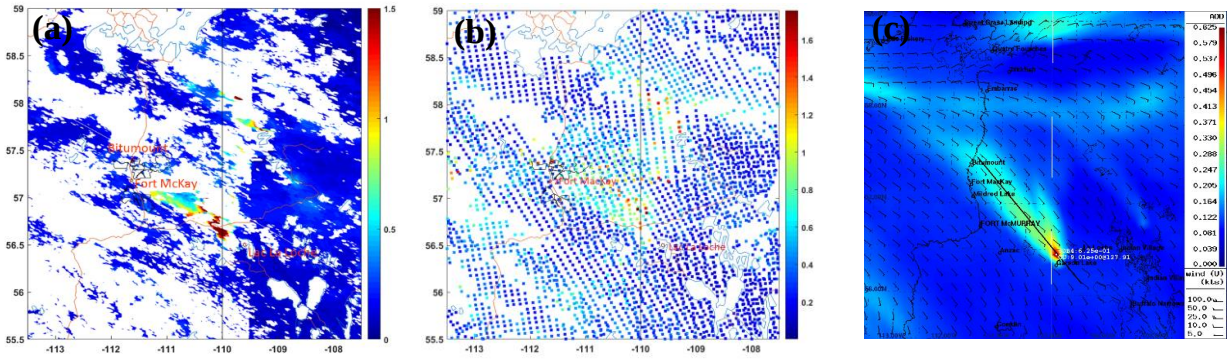

Figure 14: Lac La Loche forest fire, June 25, 2018 (a): MAIAC daily AOD at 550 nm, (b): VIIRS daily AOD at 550 nm and (c): GEM-MACH AOD at 580 nm and horizontal wind bars at 23:00 UTC. The color bar scale on VIIRS and GEM-MACH plots (b and c) show the true maximum values. The maximum AOD value in the MAIAC plot (maximum of 3) was scaled down to illustrate the fire plume. The cross sections in Fig. 15, Fig. 16 and Fig. 17 are plotted along the black line in (c).