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Supplement of

Impacts of the July 2012 Siberian fire plume on air quality in the Pacific Northwest

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Table S1. Station information and modelling uncertainty for select sites used in this study.

Station	Station #	Elevation (m)	Lat.	Long.	8-hr O_3 uncertainty*	24-hr $PM_{2.5}$ uncertainty*
Whistler						
Whistler Peak High Elevation Site	1	2182	50.06	-122.96	(-5.6, 27.9)	(-0.3, 2.5)
Whistler Lidar	A	660	50.13	-122.95		
Lower Fraser Valley						
Port Moody Rocky Point Park	2	17	49.28	-122.85	(-11.6, 7.9)	(-3.3, 5.3)
Chilliwack Airport	3	12	49.16	-121.94	(-22.6, 1.4)	(1.2, 2.4)
Hope Airport	4	39	49.37	-121.50	(-18.2, 8.8)	(-4.0, 10.0)
UBC Lidar	B	80	49.26	-123.25		
Vancouver Island						
Ucluelet Amphitrite Point	C	14	48.92	-125.54	(-2.6, 12.3)	(0.9, 5.7)
Washington State						
Enumclaw	5	402	47.14	-121.93	(-22.8, 7.3)	
Cheeka Peak	D	480	48.30	-124.62	(-3.1, 4.9)	(-11.5, 2.4)
Quillayute	E	59	47.94	-124.56		
Mt Rainier Jackson Ctr	F	1782	46.78	-121.74	(-21.5, 12.7)	
Southern Interior						
Kelowna College	6	347	49.86	-119.48	(-14.0, 0.1)	(-3.3, -1.9)
Vernon Science Centre	7	476	50.23	-119.28	(-18.1, -2.2)	(1.6, 4.9)
Kamloops Fire Station	8	381	50.70	-120.39	(-15.2, -3.8)	(-1.0, 2.9)
Kelowna Airport	G	344	49.96	-119.38		
Central Interior						
Williams Lake Columneetza School	9	631	52.14	-122.15	(-19.5, 17.2)	(-1.1, 6.4)
Williams Lake CRD Library		609	52.13	-122.14		(-0.9, 6.5)
Quesnel Maple Drive		614	52.96	-122.50		
Quesnel Senior Secondary	10	490	52.98	-122.49		
Quesnel West Correlieu School		478	52.97	-122.52		
Prince George Gladstone School	11	617	53.86	-122.76		
Prince George Plaza 400		588	53.91	-122.74		
Norther Interior						
Burns Lake Fire Centre	12	710	54.23	-125.76		
Houston Firehall	13	602	54.40	-126.65		
Telkwa	14	515	54.69	-127.05		

*AURAMS model uncertainty (observed-model) during non-event days

Table S2. 1-hr AURAMS model performance for O_3 and $PM_{2.5}$ at 4 and 12km domain.

	y-intercept	Slope	r	Bias	MAE	RMSE
Current Study						
O_3 (4km)	8.5	0.66	0.69	2.35	7.57	9.55
$PM_{2.5}$ (4km)	5.68	0.35	0.35	1.14	3.71	4.97
O_3 (12km)	16.46	0.89	0.6	14.3	16.32	20.86
$PM_{2.5}$ (12km)	9.75	0.44	0.24	5.84	7.79	10.21
Makar et al. (2014)						
O_3 (All; Table 4a)	15.32	0.7	0.64	8.48	12.53	16.17
$PM_{2.5}$ (All; Table 4b)	3.36	0.45	0.28	1.2	5.28	7.72
$PM_{2.5}$ (LFV sites; Table 5)	7.95	0.24	0.23	2.82	6.77	10.53

Table S3. Source information and data availability

Site	Data	Source
British Columbia		
BCMoE network	O_3, $PM_{2.5}$	BCMoE (http://envistaweb.env.gov.bc.ca/)
Lower Fraser Valley Air Quality Monitoring Network	O_3, $PM_{2.5}$	BCMoE (http://envistaweb.env.gov.bc.ca/)
Amphitrite Point, Ucluelet	O_3, $PM_{2.5}$	ECCC ,contact info: Andrew.Teakles@canada.ca
UBC & WHI Lidar	Lidar	ECCC, contact info: Andrew.Teakles@canada.ca
Whistler Peak High Elevation Site	Particle size distribution , O_3, CO, Filter packs IC (tSO4), Black Carbon, TOT EC & OC, ACSM, Lidar	ECCC, contact info: Andrew.Teakles@canada.ca
BC surface air quality stations	O_3, $PM_{2.5}$ (climatology)	ECCC NAPS website (annual summaries: http://maps-cartes.ec.gc.ca/rnspa-naps/data.aspx)
Washington State		
WSMN	O_3, $PM_{2.5}$ (neph)	Puget Sound Clean Air website (http://airgraphing.pscleanair.org/)
Cheeka Peak	O_3, $PM_{2.5}$	Department of Ecology, State of Washington, https://fortress.wa.gov/ecy/enviwa/
Mt. Rainier Jackson Visitor Center	O_3	Department of Ecology, State of Washington, https://fortress.wa.gov/ecy/enviwa/
Air Quality Modelling		
All sites	AURAMS O_3, $PM_{2.5}$	ECCC, contact info: Andrew.Teakles@canada.ca
Satellite		
World	MODIS AOD	http://modis.gsfc.nasa.gov/data/
Pacific	MODIS true colour	http://visibleearth.nasa.gov/view.php?id=78406
Others		
Quillayute & Kelowna	Radiosondes	http://weather.uwyo.edu/upperair/sounding.html
Elevation data (for fig 1)	GLOBE Elevation	http://www.ngdc.noaa.gov/mgg/topo/globe.html

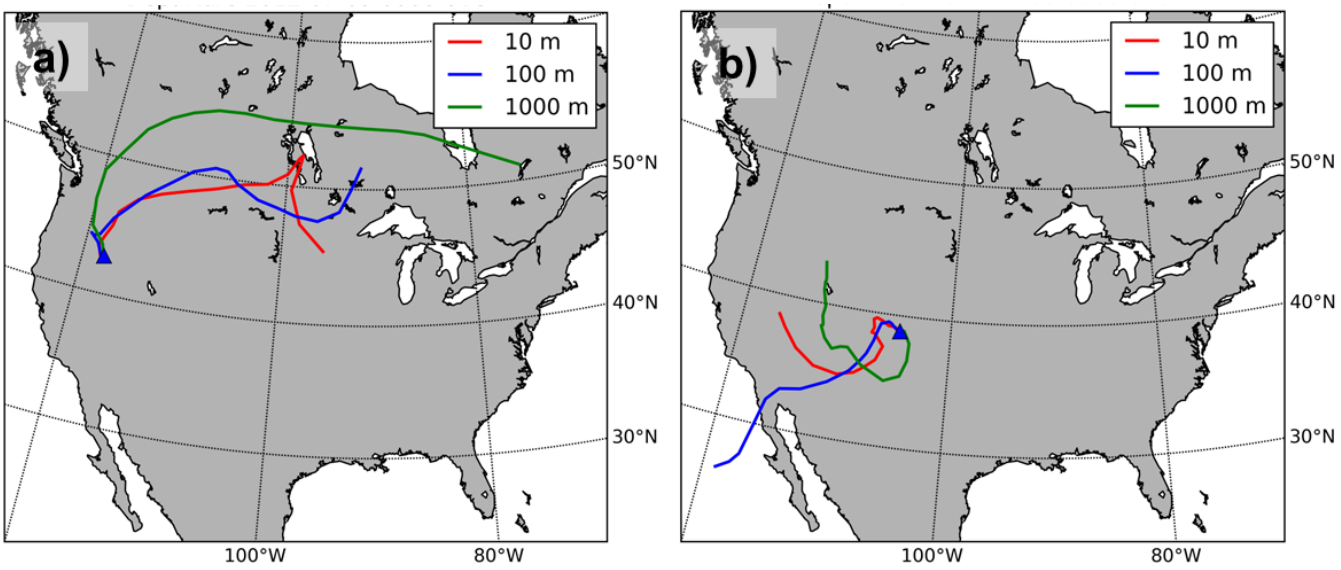

Fig. S1. Five day forward trajectories using the CMC Trajectory model from the Long Draw, Oregon (a) and Waldo Canyon, Colorado wildfires (b) released at 00UTC on July 9th, 2012 at heights of 10 m, 100 m, and 1 km AGL.

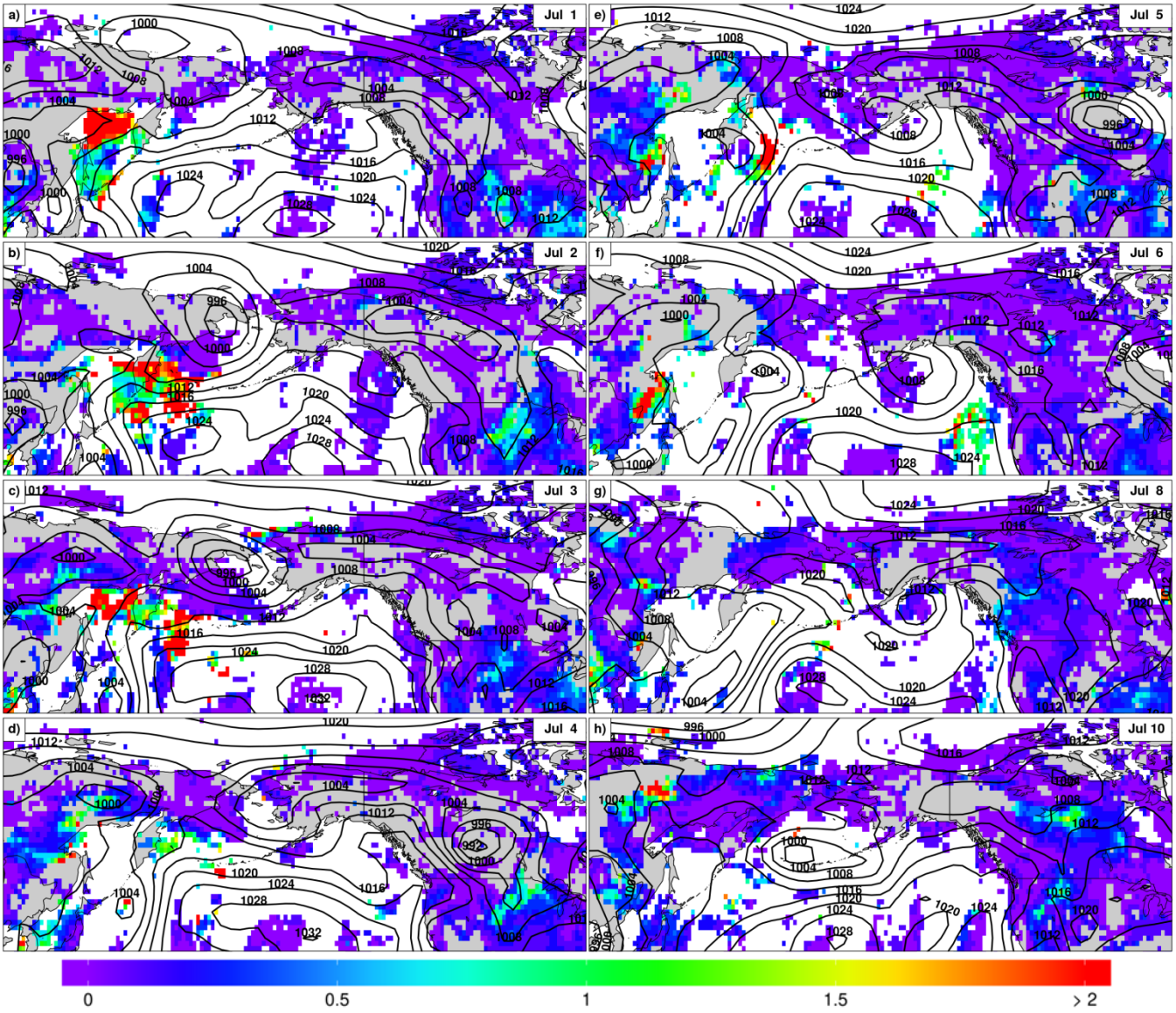

Fig. S2. The daily average MODIS Aerosol Optical Depth product for July 1-6 (a to f) illustrates the eastward progression of the Siberian Fire plume in early July onto the Western Pacific prior to its arrival off the coast of Washington and Oregon States on July 6th, 2012 (f). Enhanced AOD values spread across South and Central British Columbia by July 8th, 2012 (g) then shift southeastward out of the Pacific Northwest domain on July 10th, 2012 (h). Mean sea level pressure is contour (in solid black) on all panels.

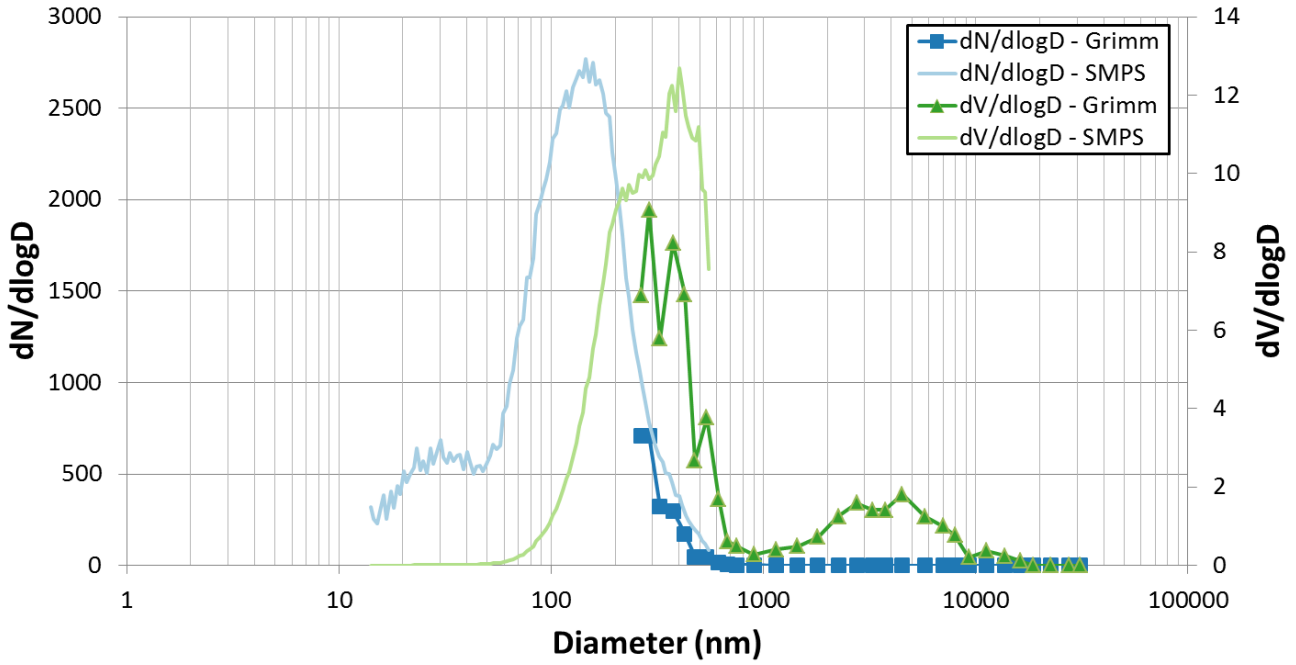

Fig. S3. Comparison of SMPS and GRIMM aerosol number and volume distributions for July 9th, 2012 16h30 -20h30 PST.

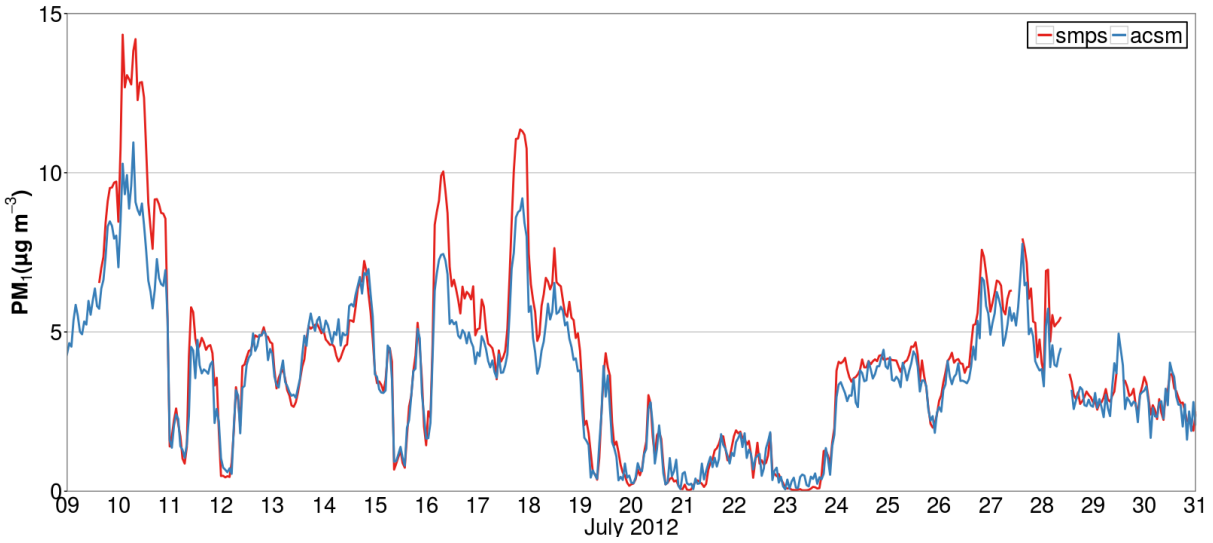

Fig. S4. Timeseries of SMPS PM_1 and ACSM readings between July 9th and July 31st, 2012. The ACSM data have been adjusted for a collection efficiency of 0.5.

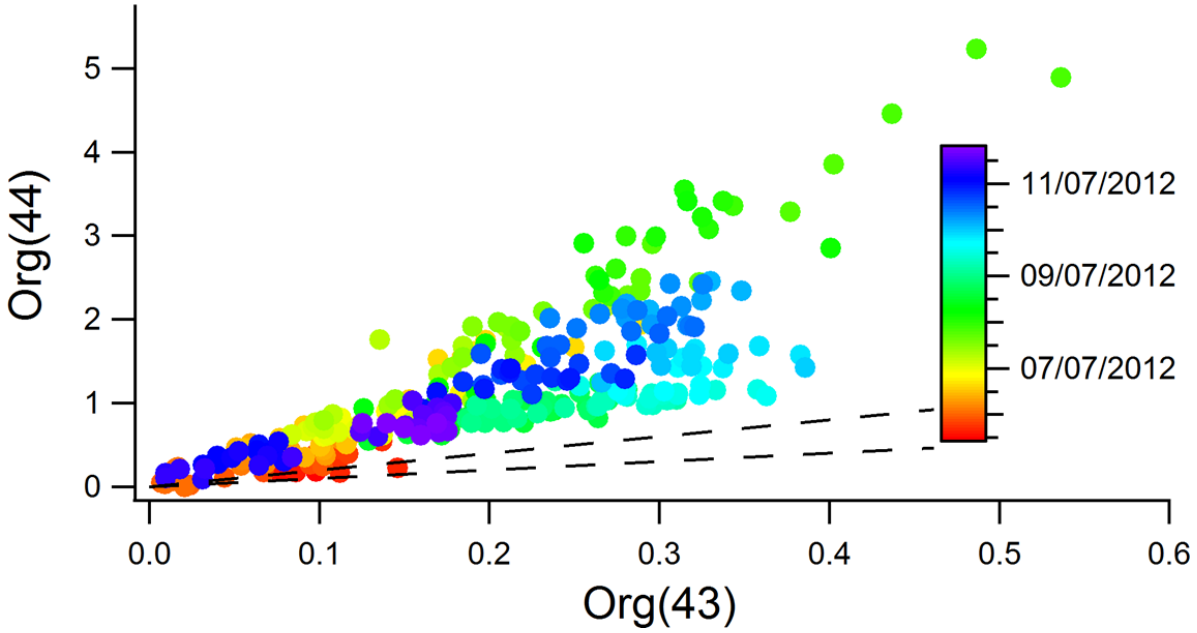

Fig. S5. The m/z44 and m/z43 components of the organic aerosol spectrum derived from the ACSM spectra. The ratio of organic signal at m/z44 (Org43) vs. m/z43 (Org44) is compared to show that the organic aerosol was more oxygenated during the LRT smoke event (July 6th 14:00 PST to July 8th 06:00 PST) than at any other times during the 6 day period from July 5th 12:00 to 11th 18:00 PST. Dashed black lines mark the 1:1 and 2.5 ratio lines for reference.

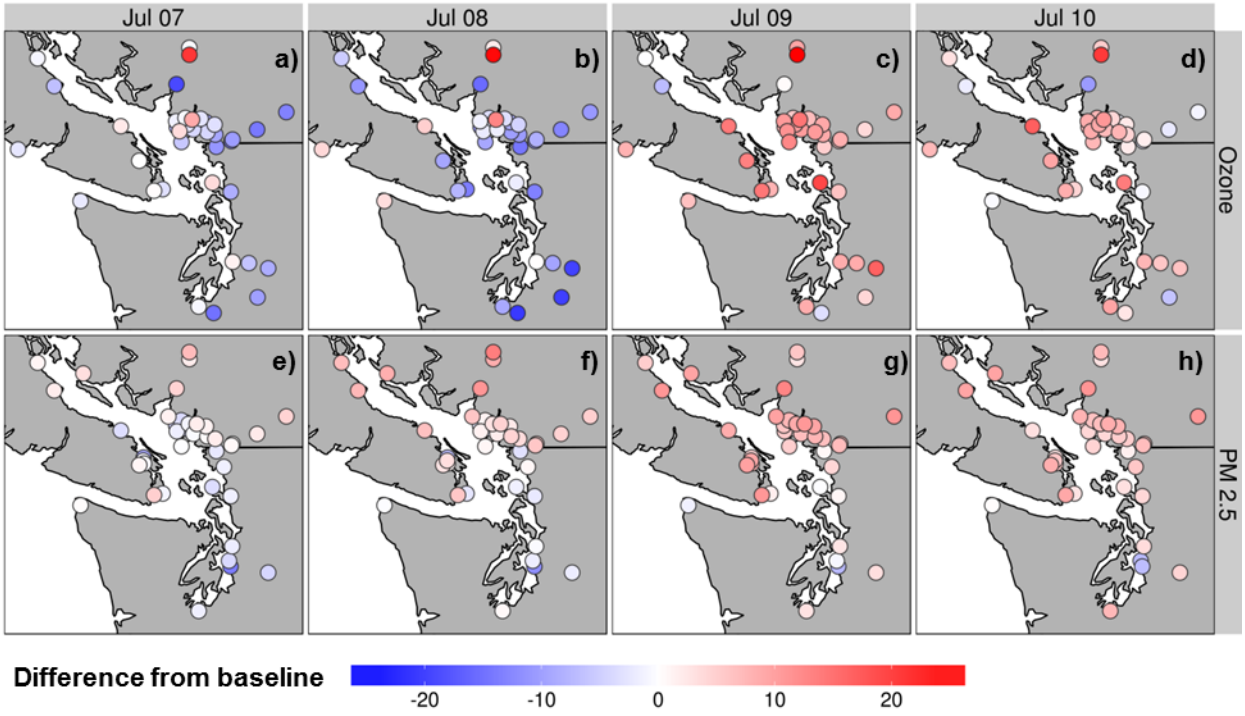

Fig. S6. Spatial map of the differences of the AURAMS baseline without wildfire emissions to daytime averaged 8-hr O_3 (ppbv, panels a, b, c, d) and of the daily averaged $PM_{2.5}$ (µg/m^3, e, f, g, h) from July 7th, 2012 to July 10th, 2012.

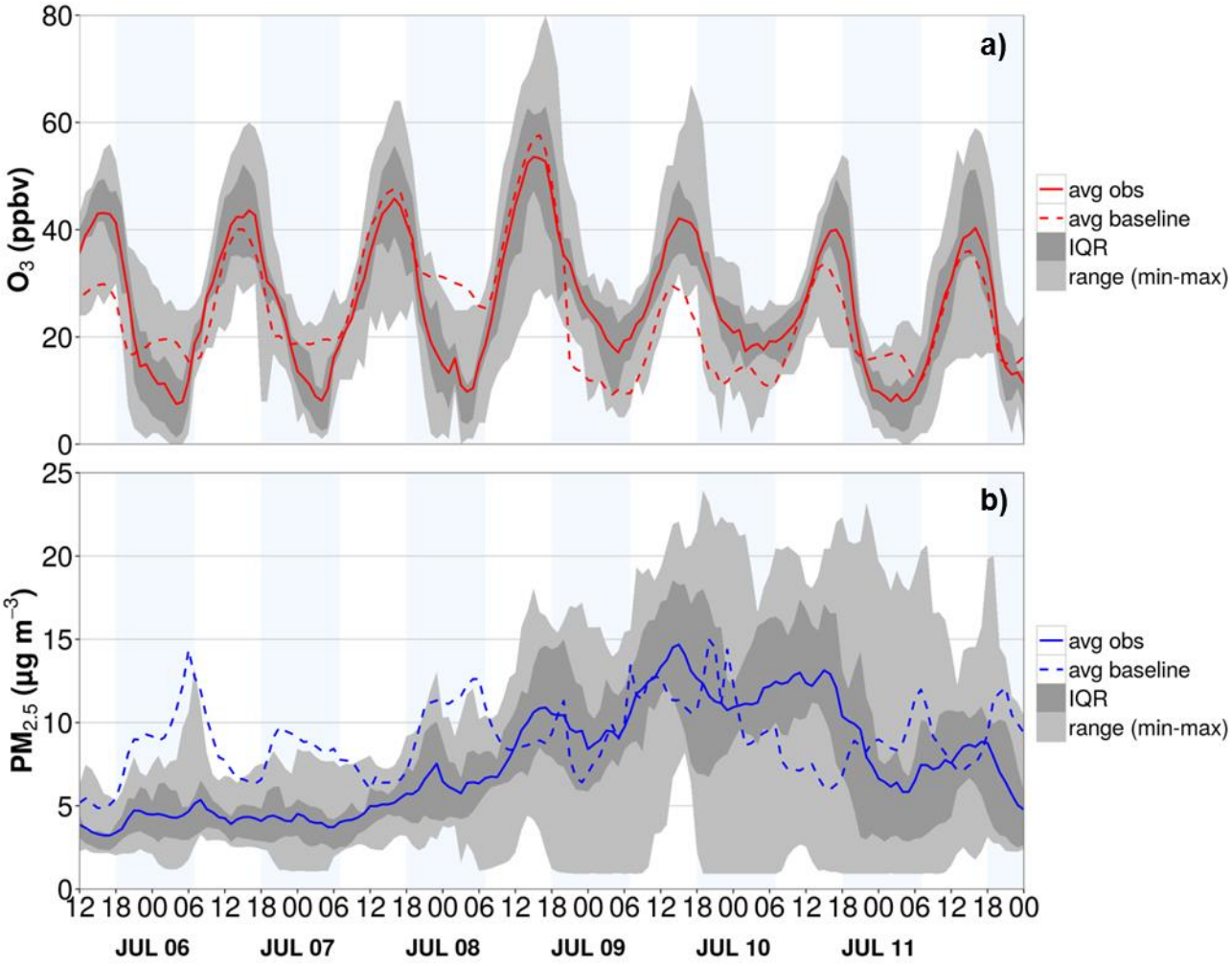

Fig. S7. Hourly average observed (solid) and AURAMS baseline (dashed) without wildfire emissions: hourly O_3 (a) and $PM_{2.5}$ (b) for sites across the Washington State air quality monitoring network. The light grey and dark grey shading represents the range and inter-quartile range (IQR) across the network at a particular hour. The shaded regions indicate night time hours between 18:00 PST to 07:00 PST.

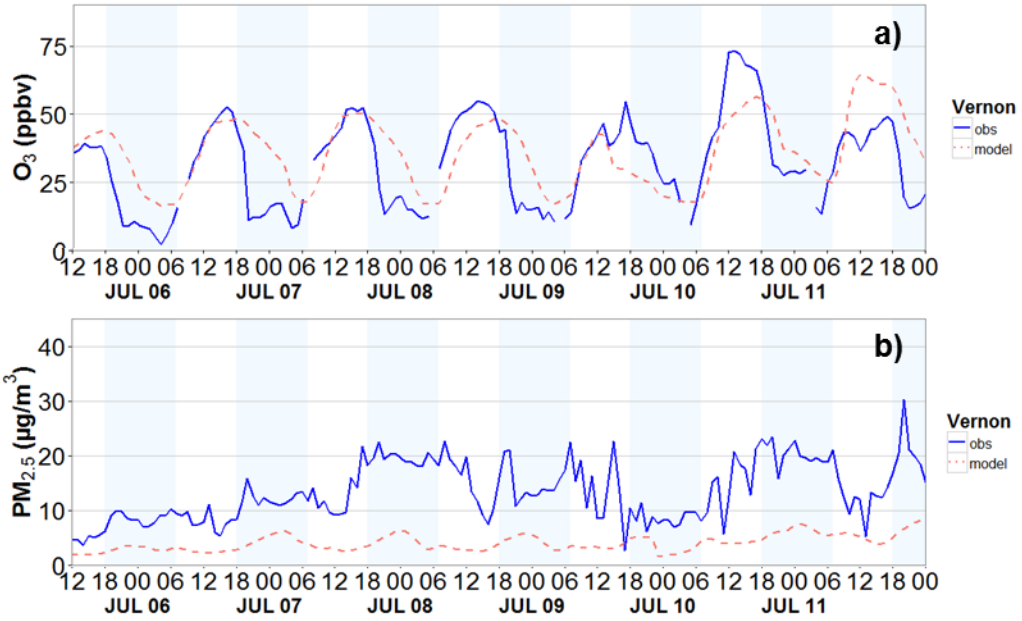

Fig. S8. The observed and modelled baseline hourly O_3 (a) and $PM_{2.5}$ (b) for Vernon (site 7). The shaded regions indicate night time hours between 18:00 PST to 07:00 PST.