Response to reviewer #4

Major comments:

1. How well does the AURAMS model capture the observed air quality?

This study used the AURAMS model simulation without Siberian wildfire influence as a baseline, which is a reasonable approach. My main concern is how well the model simulates the observed air quality. Any model deficiency would influence the main results in this study. Please provide statements about the model performance regarding O3, speciated PM and total PM2 in Section 2.2. In addition, I strongly encourage providing an evaluation of model for the period where the Siberian wildfire doesn't impact the Pacific Northwest regions (maybe July 01 to 05?).

Author's response:

The quality of the baseline model used in the study is a fair concern. The accuracy of the baseline simulation is a limiting factor in resolving air quality enhancements especially in regions like the LFV where the enhancements were shown to be less pronounced. Our study carefully assessed the reliability of the model simulation on a site-by-site basis and included an appropriate uncertainty measure to the 8-hr O_3 and 24-hr $PM_{2.5}$ enhancement reported in Table 4. A bias in the baseline simulation could affect the reported enhancement result; however, the actual enhancement (not known) should fall into the range of enhancement listed in Table 4. Other baselines derived from climatology or persistence forecasts are also subject to the same uncertainties and constraints but are less often explored in that context. Generally, air quality predictions from air quality models outperform simple climatological and persistence forecasts particularly under changing underlying air quality conditions (air quality episodes).

Additional information regarding the overall performance of the AURAMS baseline simulation during non-event days (July 5th and July 12th to 15th) was added to Section 2.3.1 AURAMS baseline simulation and to the supplementary material as Table S2. The 1-hr model performance for O3 and PM2.5 is comparable to the assessed reliability of the AURAMS model from other studies (Makar et al., 2014) (Table S2). Please note the model performance for 8-hr and 24-hr averaging periods could differ from the 1-hr statistics but are reflected in the uncertainty ranges in Table 4. The 8-hr and 24-hr uncertainty ranges have also been added to Table S1 for selected sites. The baseline simulation of speciated PM2.5 would have no effect on the findings of the study as these fields were not examined.

2. The manuscript was overall well written. However, some figures and legend should be improved. Particularly, it was hard to follow the discussion on some individual observation sites and geographical impact analysis, as I am not familiar with most of the site/region name. Also, I found several acronyms are used without definition or defined but not used later (e.g., BC in the abstract, AGL, ASL, LFV, CWS). Please improve throughout the manuscript. Please try to improve them throughout the manuscript.

Author's response:

Improvements to the geographical referencing of sites and regions have been improved thanks to the corrections for the minor comments listed below. Figure 1 has been modified to use numeric site ids for ambient monitoring sites listed in Table 3 and lettered site id for other sites mentioned in the study. Supplementary information on the station names, ids, latitude, longitude, and altitude has been added to Table S1. Site ids have also been added to Figure 2 and 3. MODIS image showing wildfire location in Russia and smoke drifting eastward across the Pacific has now been incorporated into Figure 1 and georeferenced using a bounding box on Figure 1a. The polygons for the province of British Columbia, Canada Washington State, United States of America have been highlighted on Figure 1 for added clarity on the regions affected by the smoke plume. The location of the Kelowna and Quillayute airports were also noted in Figure 1. Please see response to minor comments below for added details.

Acronyms for AGL and ASL are now defined in the text and captions when used.

Minor comments:

Table 1:

1. For individual sites, please provide lat/lon/alt information

   Author's response: Lat/lon/alt information was added as a new table (Table S1) in the supplementary section.

2. Please either provide a full name of network or change the legend to tell where in the texts to find them
   Author's response: Revised Table 1 to include the full name of the network

3. It would be helpful if the order of network/site in Table 1 follows the text in Section 2. It would be even more helpful if it were ordered by country and region.
   Author's response: Revised Table 1 so that Networks/Site are ordered by Region and then by order in the text.

4. For Mr. Rainier, is it Teledyne-API 400 or Teledyne-API T400?
   Author's response: Corrected in the latest version of Table 1 to Teledyne-API T400.

5. In the last row, the second column about SMPS size range is incorrect. It should be 14 m to 572 nm (to be consistent with the texts) or 0.14 um to 0.57 um.

Author's response: Text revised to indicate a size range of 14 nm to 572 nm. Equivalently, it would be 0.014 um to 0.572 um.

Table 2: The legend says "used in the study", but the main text (P5; L13-14) says CWS for O3 were not used in this study. Please fix the inconsistency.

Author's response:

Removed the text "used in the study" from the legend.

Main text (P5; L13-14) was meant to indicate that multi-year aspect of CWS was not consider even though the 8-hr threshold used by CWS was a benchmark for severely degraded air quality conditions in the study.

Main text (P5; L12-17) has been revised to the following to improve clarity:

"Based on measurements collected over 70 air quality monitoring stations in the Pacific Northwest, the air quality impacts of the Siberian wildfire plume were assessed by examining the O_3 and $PM_{2.5}$ concentrations at various averaging periods of 1-hr, 8-hr and 24-hr, depending on the pollutant. For each monitoring station, severe air quality episodes were identified using the regional objective and national standards, applicable at the time of the event (Table 2), as thresholds, and were compared to the average historical July daily maxima values from 2000 to 2010. It should be noted that although some of these standards, for example the Canada Wide Standard (CWS) for O3 (CCME, 2014), are based on multi-year statistics, all standards were compared to hourly observations of their respective averaging periods."

Please put reference in new column and get rid of footnote.

Author's response: New reference column added to Table 2.

Table 3 – Please provide lat/lon/alt for each site.

Author's response: Lat/lon/alt was not directly listed for all the 50+ sites used in the study. This information is available through the source information provided in Table S3 (previously Table S1) and also provided in a new table (Table S1) in the supplementary section. Table 3 was revised to incorporate the site id used in Figure 1.

Table 4 –The current version is not easy to read due to multiple lines in "area of interest". I understand the table may look different for the published version. Please check the table readability again for published version.

Author's response: Modified Table 4 to have a wider" area of interest" column

Table S1- please try to use the same full/acronym name for network/sites as Table 1.

Author’s response: Table S1 has been adjusted to use the same network names as Table 1 and to make a few minor formatting changes

Figure 1

1) Please use numbering for each site in a map and provide a list of full and short name for each site. The main texts often use full site names but Fig 1 shows short name only.

Author’s response: A numbering approach was adopted for labelling sites on Figure 1 mentioned in Table 3. Other sites including lidar, atmospheric radiosondes, marine and background monitoring are lettered from A to G. The full site name and lat/lon/alt information are provided as a new table (Table S1) in the supplementary section. Short names for sites were removed as they were rarely used and no longer needed.

2) Provide wildfire location in Fig 1a.

Author’s response: Siberian wildfires were widespread across Eastern Russia at the time of the event and smoke originated from an aggregate of these active fires. MODIS true color image (previously part of Fig. 2) is now incorporated into Figure 1(b). A boundary box is added to transport map to show the location of the MODIS image.

3) Please improve figure legend; including the black outlined area (LFV); changing “Lower Fraser Valley” to “Lower Fraser Valley (LFV)”; explaining the symbol type.

Author’s response: The Lower Fraser Valley was changed to Lower Fraser Valley (LFV; outlined in black in Figure 1(c)).

4) Please include all the sites that are used in the texts in Figure 1. The main texts uses more sites than presented in Fig 1. I was quite confused which site they are talking about. Also, please provide lat/lon/height for each site when it is first mentioned in the texts.

Author’s response: All the sites that are explicitly mentioned in the text have now been added to Figure 1. The lat/long information for these sites is now presented in supplemental Table S1.

5) Regarding the Section 3.3 to 3.6, it would be helpful to see where they are located in a map.

Author’s response: Currently this is not listed in the manuscript; however, Table 3 does provide an overview of the stations contained in these regions and as such provide sufficient geographical information for the purpose of this study.

Figure 2

1) The MODIS true color image is hard to see. Not sure where (a) is over exactly.

Author’s response: MODIS true color image is now incorporated into Figure 1(b). A boundary box is added to Figure 1(a) to show the location of the MODIS image.

2) Please consider moving the second sentence to acknowledgements.

Author’s response: This is now reflected in the new Figure 1 caption.

3) I’d like to see the AOD plots like (b)-(d) but from July 1st to 6th as a consecutive order in supplementary materials. That would be more convincing to show the plume transport.

Author’s response: Figure 2b to d and additional AOD plots are now incorporated in the supplementary material as Fig S2.

Figure 3

1) This figure needs much improvement. It is really hard to see the smoke plume.

Author's response: The main focus of figure 3 is to illustrate the worst air quality conditions experienced by the network on a daily basis. The MODIS image was added to supplement the discussion of the air quality conditions experienced by the network. MODIS AOD images for July 6th, 8th, and 10th in Fig S2 will be used to support the discussion of plume transport in the Pacific Northwest.

2) What is the light blue circle near the KFS site?

Author's response: The light blue circle near the KFS site is part of the MODIS image product used. It marks the Kelowna location geographically and is part of the tailored MODIS imagery available for this location. Figure 2 caption has been revised to include:

"The light blue circle on the MODIS source imagery indicates the location of the Kelowna Airport (site G) on all panels. "

3) For 24-hr PM2.5, is it just daily mean? Similarly for Fig 4, what do you mean by "maximal" enhancement of 24-hr PM2.5?

Author's response: For 24-hr PM2.5, it is not just the daily mean. Instead, we calculate the observed PM2.5 as a rolling 24-hr average metric and report the peak values on a given day. This metric provide a more reliable view of the peak air quality conditions from the event since the smoke plume had only a temporary effect on some sites. This avoids time issues when the plume enhancement lasted < 24 hours and stretched between 2 calendar days.

For Figure 4 (now Figure 3), we compare the rolling 24-hr PM2.5 condition to the baseline condition. The maximal difference between the two indicates how much the additional PM2.5 from the wildfire smoke affected a sites air quality.

Figure 4

1) Please provide the temporal period used in the figure.

Author's response: We modified the figure caption to read:

"Fig. 3. Overview of the maximal enhancements to 8-hr O3 and 24-hr PM2.5 rolling average estimated for the study area (a and b, respectively) and the LFV (c and d, respectively) based on the differences between the ambient air quality observation and the AURAMS baseline modelling for the July 6-10, 2012 smoke event. Abbreviations used in this figure are defined in Table S1 and throughout the text."

2) Similarly to Fig 1, I strongly recommend to put a number in each site.

Author's response: We've added numbers and/or alphabetical letters to stations that are explicitly mentioned in the text.

Figure 5

3) I don't see the two sites in Fig 1. Please show them in Figure 1. Also, please put lat/lon/alt information for each site here. The texts explaining Fig 5 uses height but the figure shows pressure. Please provide a pressure level for the height discussed in the main texts.

Author's response: Kelowna Airport, BC (Site G) and Quillayute Airport, WA (Site E) have been added to Figure 1 and identified as radiosonde sites in the legend. The lat/lon/alt metadata for these stations has been included in a new Supplemental Table S1.

The titles for the subpanels in Figure 5 (now Figure 4) have been adjusted to match the station name found in Table S1.

Mixing height is typically reported in height coordinates whereas tephigrams are rely mainly pressure coordinates. Height estimates can be used instead if a standard atmosphere is assumed. To address the discrepancy, the level at which the mixing height was reached is now indicated on each subpanel with a label indicating the height in meters.

The caption was revised to:
"Fig. 4. Skew-T atmospheric radiosondes for Quillayute (UIL) and Kelowna (YLW) at 00Z on July 8th, 2012. The atmospheric dry bulb temperature (T) and dewpoint temperature (Td) are shown from the surface up to 100 mb. Black dashed line is a trace of a surface parcel lift to estimate the mixed layer depth at the height where it intersects the environment dry bulb temperature."

4) In the legend, "dry bulb" to "dry bulb temperature".
Author's response: Caption now includes dry bulb temperature (see above).

Figure 6

1) Please explain WHI1 and WHI2 in the legend.

Author's response:
WHI1 and WHI2 are described in the revised caption.
"Fig. 5. Whistler lidar (site A, 650 m ASL) measured backscatter ratio of the 1064 nm channel to that of clear air for the July 2012 Siberian smoke plume (a) and observed (solid) 1-hr O3 (b), 1-hr CO (c), and 1-hr PM1 (based on the ACSM) and PM2.5. (d) at Whistler Peak High Elevation station (site 1, 2182 m ASL, indicated as a horizontal white line in panel a). AURAMS baseline (dashed) 1-hr O3 and 1-hr PM2.5 are shown in panel b) and d), respectively. Elevated aerosol backscatter in panel (a) are noted from July 6 14:00 PST (WHI1) to July 8 06:00 PST (WHI2) by red dashed lines. The shaded regions indicate night time hours between 18:00 PST to 07:00 PST."

2) In the legend (3rd line), "a horizontal blue line" should be "a horizontal white line". I see white line.

Author's response: Revised caption to read white line (see above).

3) "(d)" must be shown in the PM figure. "ACSM" line is not explained in the legend.
Author's response: ACSM now mentioned for PM1 mass estimates (see above).

Figure 7

1) Why is the hourly organics lower than OC(TOT) some period?
Author's response: There are a few reasons why the hourly organics can differ from OC(T900; previously TOT). The first is that the OC(T900) and hourly organics from the ACSM have different sampling periods. The OC (T900) is derived from two 8-day integrated samples (day and night). Secondly, it is estimated that a multiplier (or ~1.9) is needed to convert OC to OM for an aged aerosols. Other considerations are some ACSM calibration issues and loss of semi-volatiles due to the fact that EnCan-total-900 is a thermal method that purges samples to 50 C.

To clarify the sampling period of the EC(T900) and OC(T900), we have adjusted the caption to re-iterate the sampling period for the instrument even, although it was mentioned in the methodology section.

Revised caption reads:
"Fig. 6. Aerosol chemistry measurements taken at Whistler Peak High Elevation site (site 1) between July 6th 2012 and July 12th, 2012. Hourly Organics (Org), NO_3^-, NH_4^+, SO_4^{2-} measured by the ACSM (a, b), EC and OC as sampled over a 8-day period (July 3-11, with day and night split) using the EnCan Total-900 thermal method (T900) (a), SO4 as a 3-day integrated sample by quartz filter pack (FP) (b), and rBC as acquired using the Single Particle Soot Photometer (SP2) (c). The shaded regions indicate night time hours between 18:00 PST to 07:00 PST."

2) Is there any particular reason to use "particle SO4" instead of just "so4"? Here is all about aerosol chemistry, so it sounds a bit odd to call "particle SO4".
Author's response: Revised legend and caption to use SO_4^{2-}.

Figure 8

Related to my first major comment, the model doesn't seem to capture the observed PM2.5 before July 8th. Please see if the model has systematic biases in PM simulations. Given that, please provide how it may affect the results.
Author's response: The AURAMS baseline simulation is having some challenges reproducing the hourly $PM_{2.5}$ trends in the LFV. Figure 8 b shows the LFV regional bias for 1-hr $PM_{2.5}$ centered on the zero mark with network average deviations between +3 and -5. However, the modelled 24-hr $PM_{2.5}$ metric is somewhat more reliable as it smooths out the peak in through in the model performance. The enhancement to the 24-hr PM2.5 for LFV network, listed in Table 4, reflects an enhancement ranging from 6 to 13 ug/m^3 (or an uncertainty of -3 to +4 in the 24-hr $PM_{2.5}$). The minimum enhancement of 6 ug/m^3 indicates that model uncertainty cannot account for the variance 24-hr $PM_{2.5}$ conditions that occurred during the smoke event. Additional discussion on 1-hr PM2.5 model performance is discussed in the new subsection 2.3.1.

Figure 9 – Unless what the text explains about Fig 9c (P9;L28-31), I don't see any clear increase in O3 episode in Figure 9c.
Author's response: Figure 9c (now Figure 8c) shows that the O3 exceedance that occurred on July 8 2012 in Chilliwack may have been solely due to anthropogenic sources and is not meant to be reflective of the overall enhancement observed in the LFV, which was illustrated by Figure 9a (now Figure 8a). In addition, on July 9th and 10th, enhancement to the 8-hr daytime O3 varies spatially across the LFV as describe by Figure S6, with the strongest enhancement over the northern portion of the LFV and closer to the coast. Table 4 indicates a daily maximum enhancement to the 8-hr O3 in the LFV of 10 ppbv with an uncertainty range of 2 to 23 ppbv (-8 to +13).

Figure 10 – Please provide lat/lon/alt for each site.
Author's response: These are now incorporated in supplemental Table S1.

Figure S1- Please mark the wildfire locations.
Author's response: Figure S1 removed has been removed and greater emphasis on the transport assessment of the Siberian plume has been made in Introduction.
Modis True Colour Images of wildfires in Siberia on June 29th have been added to Figure 1 and georeferenced using a bounding box on panel (a) of Figure 1.

Figure S2 – What period is it? And please put time and location information for the wildfires.

Author's response: The release date/time for the forward trajectory modeling for the Long Draw and Waldo fires has been added to the Figure S2 (similar to the previous S1) and caption has been revised to lists the release date/time with the release height information.

Caption revised to:
"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."

Main text revision in section 2.2 also reflects the release time for the trajectory modeling.

1) Waldo Canyon, Colorado wildfire: detected June 23, 2012 and was declared 100 percent contained on July 10, 2012
2) Long Draw, Oregon wildfire: started July 8th at 6pm by lightning and grew quickly.

Figure S3- Please use full name of MSLP.
Author's response: Caption has been revised to reflect the added AOD source imagery added:
"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.."

Figure S5 – I don't understand why this figure reflects the OC dominance.
Author's response: Sentence is revised to "Further, a comparison of the mass concentrations estimated from the SMPS, based on the assumptions of spherical particles and a particle mass density of 1.2 g/cm^3 as a result of the dominant organic composition during that period (Figure 6), with the ACSM for July 9-31 is illustrated in Figure S4."

Figure S6 – I am not sure the plot and legend are consistency. Please check the legend again and consider rewrite it.
Author's response: Unsure on how to revise the legend at this time but remain open to further revision prior to final publication

Main texts

P2 L29-30 – Please provide a reference
Author's response: No reference is needed in this case. The sentence has been revised for clarity to: Further study is still required to better understand the interactions of the above factors on downwind air quality for long-range transport events".

P2 L30 – Please add year (2012) after "July and August"
Author's response: Modified to "July and August 2012".

P2 L31 - Please add year (2012) after "August
Author's response: Modified to "August 2012".

P3 L5 – Please explain more what you mean by "noted entrainment signature".
A "noted entrainment signature" is meant to indicate a period where aerosols are entrained into the boundary layer through turbulent or thermal mixing processes. Cottle et al noted the entrainment of layers aloft using increased optical thickness measurements in the boundary layer over time, low volume depolarization levels aloft and in the boundary layer.
Author's response:
The main text on P3 L4-6 was revised to clarify to:
"HYSPLIT trajectory analysis confirmed that aerosol layers subsiding over the LFV had largely originated from over wildfire source areas in Siberia at least 6 days earlier. Aerosol backscatter measurement and low depolarization volume ratios during the event showed the progressive entrainment of smoke into the LFV through July 10th, 2012. Their findings suggest that the high PM2.5 observed by the region's fixed air quality monitoring network was associated the progressive entrainment of aerosols into the LFV."

Section 2.1.1 – Please keep the same order as Table 1 and provide lat/lon/alt information.
Author's response: Table 1 has been revised to order the sites by geographical region and then by order presented in the text.

Section 2.1.2 – Table 1 shows CORALNet, which is not mentioned in the text here.
Author's response: CORALNet was the previous terminology used when referencing the lidar network but is no longer used or referenced in that way. Originally, the main text and Table 1 incorporated this information but was then revised in later version of the manuscript.

Table 1 has been revised to no longer reference CORALNet.

Section 2.1.3 – Isn't this part of Ambient AQ monitoring data? If so, perhaps move to Section 2.1.2.
Author's response: The instrumentation and purpose for the Whistler High Elevation Monitoring Site differs from that of the Ambient AQ monitoring data listed in section 2.1.1 and 2.1.2. These differences are also consistent with categories and labeling in Figure 1.

P5 L6 – Is there any good reason for choosing 10m, 2.5km, 5km, and 7.5km? It seems too big jump from 10 m to 2.5km.
Author's response: Figure S1 has been removed. Introduction and Section 2.2 has been modified to rely on Cottle et al. transport assessment for the plume.

The previous logic for the release heights is somewhat arbitrary and essential a desired to estimate the transport for various heights in the atmosphere ranging from near the surface to near the tropopause. For our study 4 evenly spaced heights were used. Wildfire aerosols lofted above 5km are transported to the Pacific Northwest within a 7 to 10 day timeframe (based on previous dispersion results).

P5 L9 – Are all 72 sites shown in Figure 1?
Author's response: A total of 73 sites (72 + Whistler High Elevation Monitoring Site (site #1)) were used to determine the enhancements. Several communities (William Lake (site #9), Quesnel (site #10), Prince

George (site #11) have multiple sites in the community. Due to the scale of the figures 1, 3, 4, only 63 sites plotted in Figure 3 (similar issues exist with over plotting in Figure 1 and 2.

P5 L27-28 – What do you mean by interpolate weather into the AURAMS domains?
Not dynamically computed? Does it mean it is subject to a potentially large bias?
Author's response: Driving meteorological fields were interpolated from the 2.5 km meteorology simulated by the GEM-LAM model to the 4 km grid used in this study. The interpolation is not ideal but commonly done when setting up atmospheric modeling studies on local area model domains. The advantage in this case is the driving meteorology is based on a higher resolution model which can help minimize any information loss. The interpolation was required since both the resolution and domain of the AURAMS simulation differs from the meteorological source data. It does not mean that it is subject to potentially large bias and can be assess on its reliability based on both the model performance statistics provided in Table S1 and Table S2.

P6 L1 – What is the size range covered in AURAMS?
Author's response: AURAMS uses a chemically-speciated 12-bin sectional distribution to characterize particulate matter from 0.01 to 40.96 µm in diameter. Main text on P6 L1 has been modified to reflect this.

P6 L3-8 – This is related to my first major comment. Can you comment on any expected bias when using climatology as boundary condition? Again, the model evaluation should be presented in this study.
Author's response: A climatological boundary conditions is currently the standard setup for the AURAMS model to use in regional studies. It could lead to a poor performance of the model particularly when conditions at the lateral boundaries deviate from the climatological expectation. This was clearly the case during the July 2012 Siberian wildfire event and justifies statements made in the conclusion section about the need to include these sources to improve air quality modeling. Performance of the AURAMS modeling in this study has now been included through Table S1 and S2, to supplement the existing uncertainty ranges provided in Table 4.

P6 L23-25 – how far were the Siberian wildfire plumes rise?
Author's response: Dispersion modelling suggests that pollutants lofted above 5km reached the Pacific Northwest with 6-10 days.

P7 L3 –please provide the NA wildfire period.

Author's response:

1) Waldo Canyon, Colorado wildfire: detected June 23, 2012 and was declared 100 percent contained on July 10, 2012
2) Long Draw, Oregon wildfire: started July 8th at 6pm by lightning and grew quickly.
3) Matthew Creek (49 45.550, - 120 48.396) on July 9th 2012

P7 L4-7 – It is hard to understand what Figure S3 shows.

Author's response: AOD imagery for revised Fig. S2 will help with discussion of plume position in section 3.1. L4-9 revised to

"July 8-9, poor air quality conditions continued to spread across the Interior, coinciding with the northward and inland progression of the plume as collaborated by AOD imagery (Fig. S2 g), and caused air quality exceedances at several communities (see Table 3). Over in the coastal region, elevated O_3 and $PM_{2.5}$ also occurred on July 8th, with isolated 8-hr O_3 exceedances at Chilliwack (site 3) and Enumclaw (site 5). MODIS AOD on July 10th (Fig. S2 h) show the plume remnant had shifted southeastward and out of the Pacific Northwest domain."

In addition, discussion of plume motion relative to meteorological features (L1, L2) on Figure S3 (now Figure S2) were omitted in the latest revision.

P7 L11 – I am not sure if I missed something, but I don't see PM increase for Whistler High Elevation site. Please put numbers for each site in Figure 4. It should help to understand the texts better.

Author's response: 24-hr PM increase at Whistler High Elevation site was 10µg/m^3 and is reflected properly on Figure 3. Figure 3 now has labels for sites listed in Table 3 and Table S1.

P7 L15 and L17 – Please provide pressure level for that height.

Author's response: See previous response. Corrections to Figure 4 should help establish what pressure level we are referring.

P7 L10-11 – I don't understand why Figure S5 reflects that OC is dominant during that period. Any explanation?

Author's response: Sentence is revised to "Further, a comparison of the mass concentrations estimated from the SMPS, based on the assumptions of spherical particles and a particle mass density of 1.2 g/cm3 as a result of the dominant organic composition during that period (Figure 6), with the ACSM for July 9-31 is illustrated in Figure S4."

P8 L11 – What is "1 hour data"? hourly mean?

Author's response: Yes, 1-hr averaged data (ACSM & SMPS are sampled on a half hour interval).

P9 L18 – "High O3 concentration" è "High O3 concentrations"

Author's response: The text was revised.

P9 L18-19 – Is this also due to the Siberian fires?

Author's response: The high ozone levels are likely due to the Siberian Fire.

P11 L3-7 – These parts leaved me more questions than answer. Can you explain

more about the surface PM2.5 analysis and impact analysis?
Author's response: The Firework output was removed in the latest revision.
main text for L3-7, P11 has been revised to

"On July 10th, as the bulk of the Siberian plume shifted northeastward out of British Columbia, remnants of the plume shifted over the Southern Interior and Whistler; however, attribution of the plume's impacts was impeded due to local wildfire activity (Matthew Creek; approx. 100 km west of Kelowna; 155 acres). Overall, the maximal air quality enhancements due to smoke from the Siberian wildfires in the Southern Interior was approximately 15 ppbv and 15 μg/m^3 for 8-hr O_3 and 24-hr $PM_{2.5}$, respectively, based on the impact analysis conducted at Vernon (site 7) for the July 6-9 period (Fig. S10)."

P11 L15-16 –If I understood this correctly, " the additional" is better to be removed.
Author's response: "Additional" was removed.

P11 L23-25 – To be consistent, please don't use bracket.
Author's response: The square brackets were removed.

P11 L32 – I believe most CTM simulations include wildfire emissions. The recommendation doesn't sounds useful. Please clarify it if necessary.
Author's response: A climatological boundary conditions is currently the standard setup for the AURAMS model to use in regional studies. It could lead to a poor performance of the model particularly when conditions at the lateral boundaries deviate from the climatological expectation. This was clearly the case during the July 2012 Siberian wildfire event and justifies statements made in the conclusion section about the need to include these sources to improve air quality modeling.

Text in conclusion on L31-32, P11 and L1, P12 was revivsed to clarify:

"This demonstrates the need to include wildfire emissions within chemical transport model, and to derive effective parameterizations for the lofting and subsequent reactions in modelling ambient air quality conditions. Lateral boundary for chemistry used in regional air quality modeling application should be responsive to the long-range transport of pollutants."