NAPS PM 2.5 Plots 2003-2019

Introduction

The data used in this document was obtained for 2003-2019 from Environment Canada's National Air Pollution Surveillance Program (NAPS) (EC NAPS Data). As of May 5, 2021, the data for 2020 has not be uploaded.

The following document reproduces the work by Dabek-Zlotorzynska et al. (2011) and extends the analysis to 2019. The document begins by outlining the NAPS stations and available data. Then the number of daily observations per site are used to calculate a dividing date - the date that approximately divides the total observations in half. Plots are constructed to present the data before and after the dividing date.

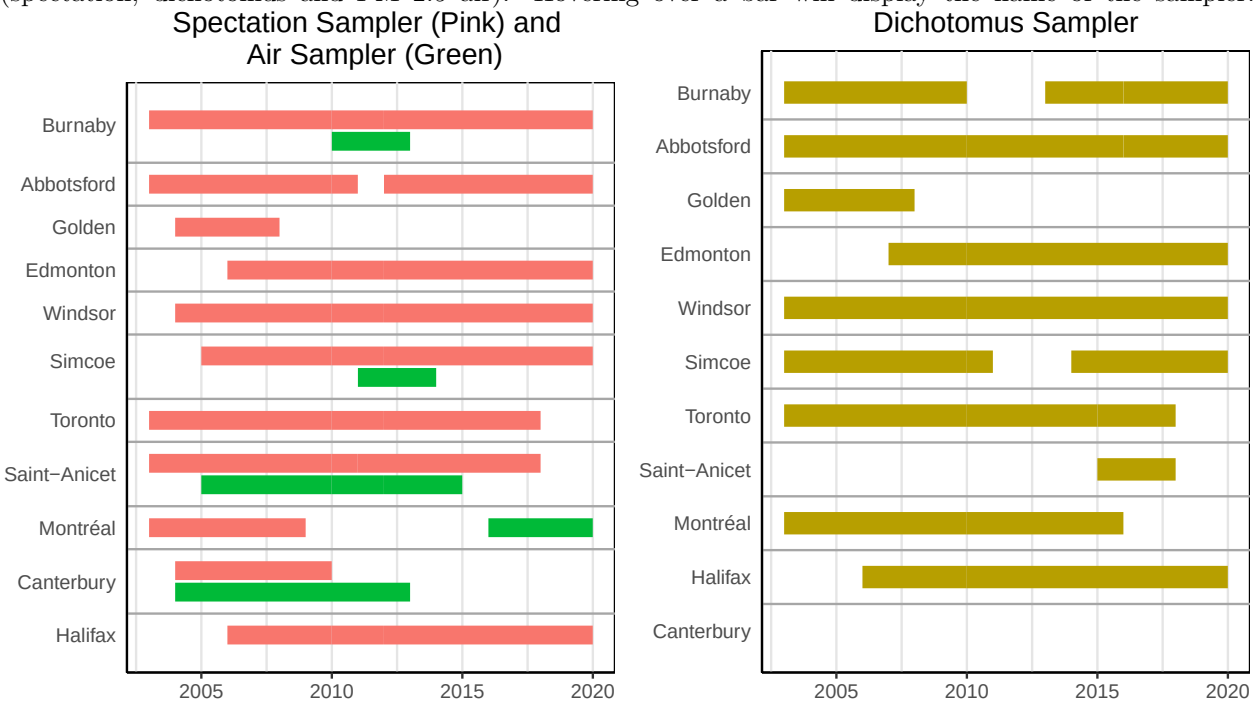
Summary of cities and change of stations

The following table summarizes the available spectation data for the selected sites. Information on the NAPS stations was found at the following link; NAPS Station Information

Station	Summary of spectation data	Change of Stations
Burnaby (S100119	Data for all years	No
Abbotsford (S101004)	Missing in 2011	Station changed from S101004 (2003 - 2010) to S101005 (2012+)
Golden (S103202)	Data from 2004-2007	No information on station closing/changing
Edmonton (S90132)	Missing from 2003-2005	No
Windsor (S60211)	Missing in 2003	No
Simcoe (S62601)	Missing 2003-2004	No
Toronto (S60427)	Missing after 2018	Station changed from 60427 (2003-2014) to 60439 (2015 - 20/06/2019) to 60445 (21/06/2019 +). Stations 60439 and 60445 were open in 2019 but are missing PM25
Saint-Anicet (S54401)	Missing after 2018	No
Montréal (S50104)	Missing after 2008	Station changed from 50104 (2003-2008) to 50134 (2008+). New station does not collect PM 2.5 spec
Canterbury (S40801)	Missing after 2009	Stopped site in 2014, did not combine with another station
Halifax (S30113)	Station opened in 2006	Station was combined with 30118 (1990-2018) but did not measure PM 2.5 spec

Timeline of stations

The following plot shows the timelines of the available NAPS data for the three different sampler types (spectation, dichotomus and PM 2.5 air). Hovering over a bar will display the name of the sampler.



Finding the cutoff date

Using six month increments, the dividing date was determined as; 2010-07-01. The following table presents the number of samples before and after the calculated date.

City	Number samples before cutoff	Number samples after cutoff	Percent before cutoff	Percent after cutoff
Abbotsford	832	723	0.5350482	0.4649518
Burnaby	918	825	0.5266781	0.4733219
Canterbury	522	94	0.8474026	0.1525974
Edmonton	536	1233	0.3029960	0.6970040
Golden	440	NA	1.0000000	NA
Halifax	329	1255	0.2077020	0.7922980
Montréal	743	566	0.5676089	0.4323911
Saint-Anicet	938	654	0.5891960	0.4108040
Simcoe	650	1173	0.3565551	0.6434449
Toronto	1032	788	0.5670330	0.4329670
Windsor	561	1224	0.3142857	0.6857143

The average of the percent before cutoff column is 0.529 and the percent after cutoff column is 0.519.

Figure 2: Total $PM_{2.5}$ mass by site

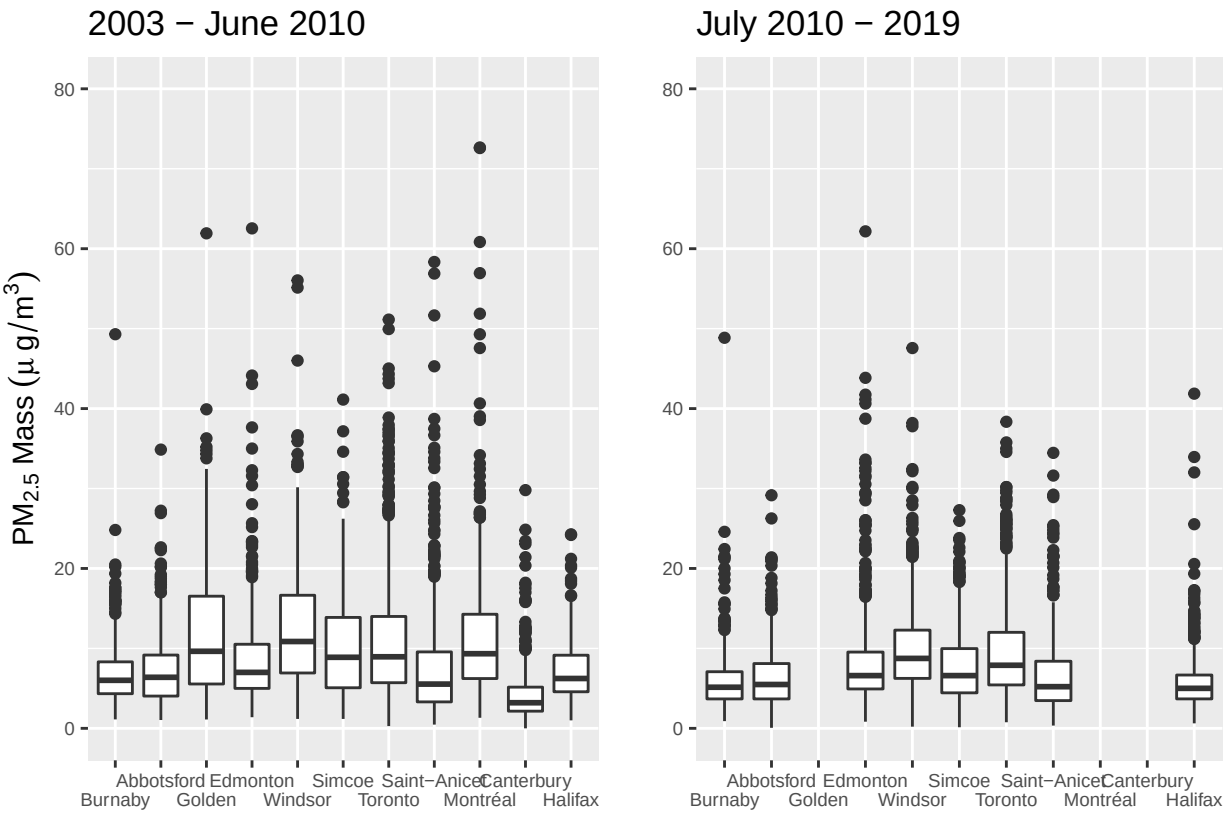


Figure 1: Figure 2: Total $PM_{2.5}$ mass (Median, 25th and 75th percentile, 2nd and 98th percentile)

Figure 3: Monthly mean $PM_{2.5}$ mass by site

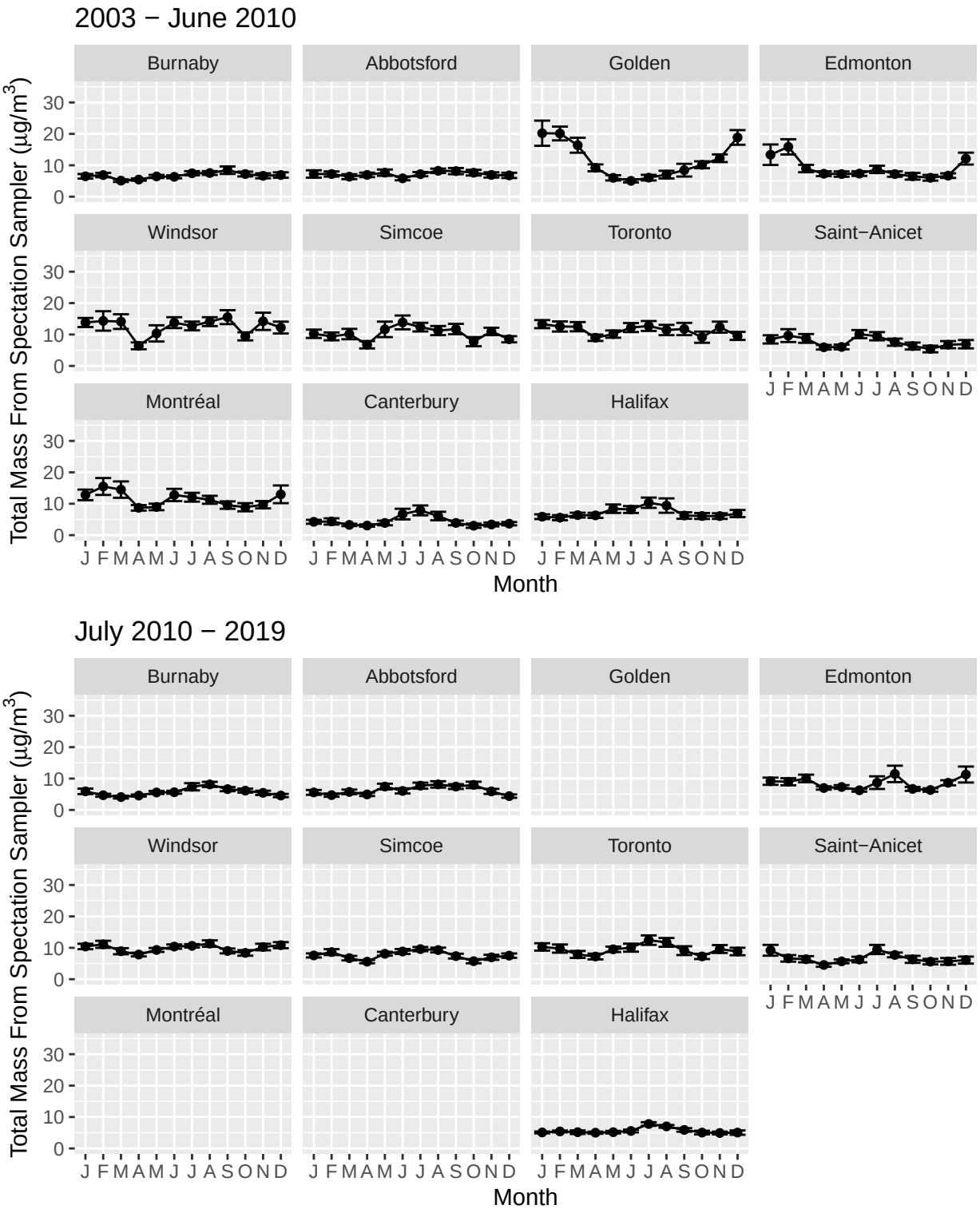
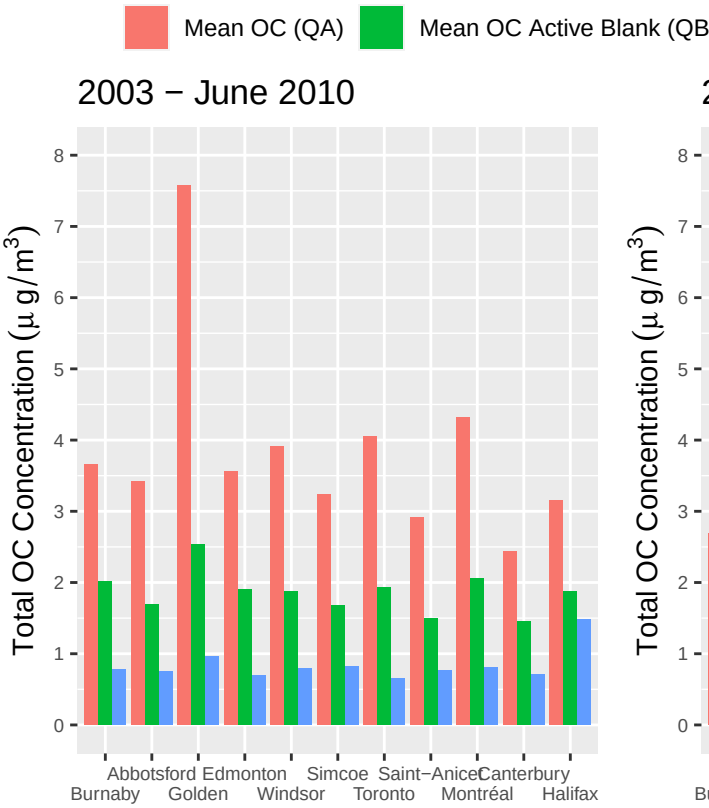


Figure 2: Figure 3: Monthly mean $PM_{2.5}$ (Mean and 90th percent CI)

Figure 4: Mean organic carbon (OC) by site



Data after 2010 does not include field blank cartridge information

Figure 5: Reconstructed $PM_{2.5}$ mass by major component and site

When calculating the major components, observations from the spectation sampler were used. For a given day, if the spectation observations were missing, and the site had pm 2.5 sampler observations (PM2.5 Manual Air Sampler) was used. This affected the observations for Montreal and Canterbury from 2010-2019.

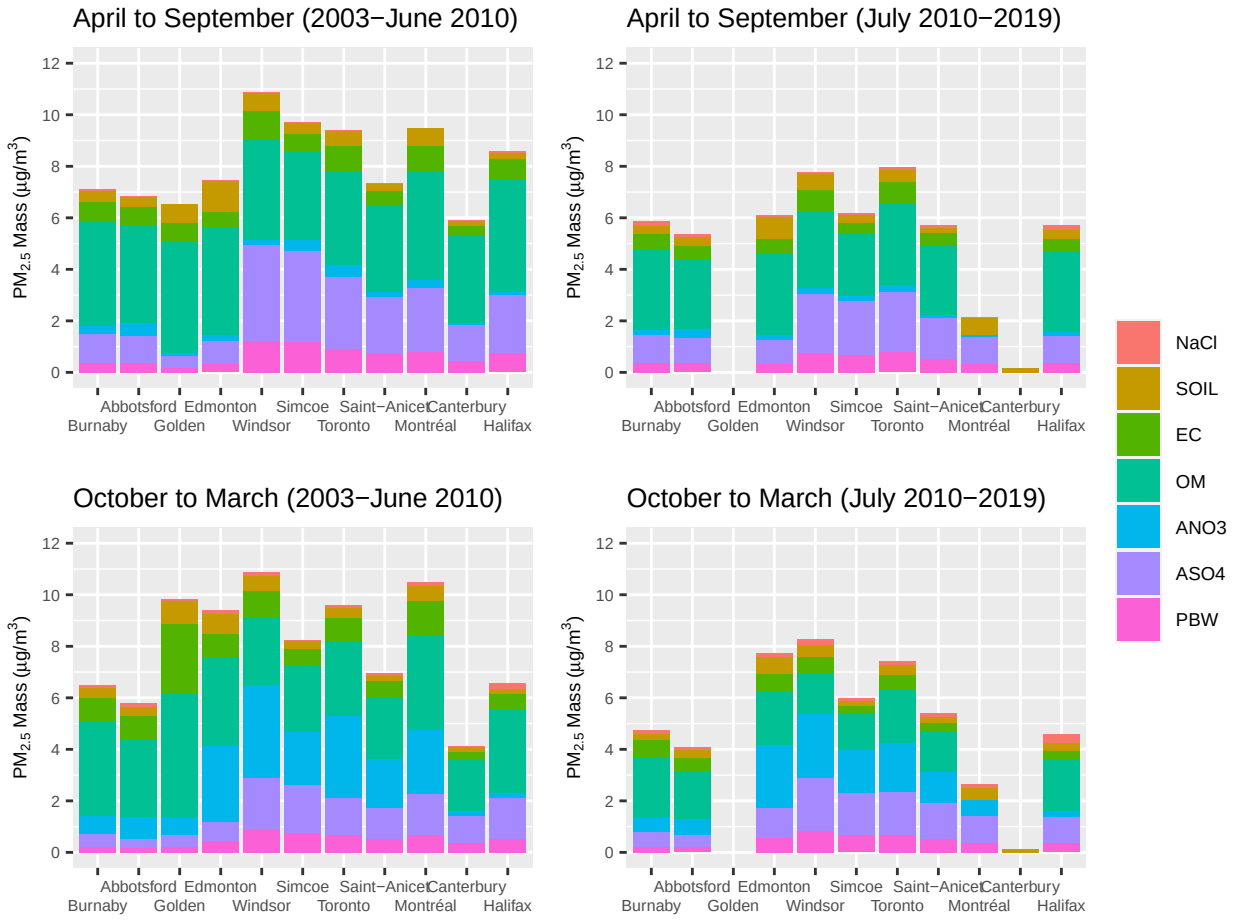


Figure 3: Figure 5: Reconstructed $PM_{2.5}$ mass by compound mean

Figure 6: Reconstructed $PM_{2.5}$ mass by 10 highest mass days and site

To generate the following figure, the days with the largest $PM_{2.5}$ mass that had observations for all reconstructed components were used. (i.e. there were days that had larger masses than used, but were missing observations)

For July 2010 - 2019, Golden, Montreal and Canterbury contained at least one missing observation each day.

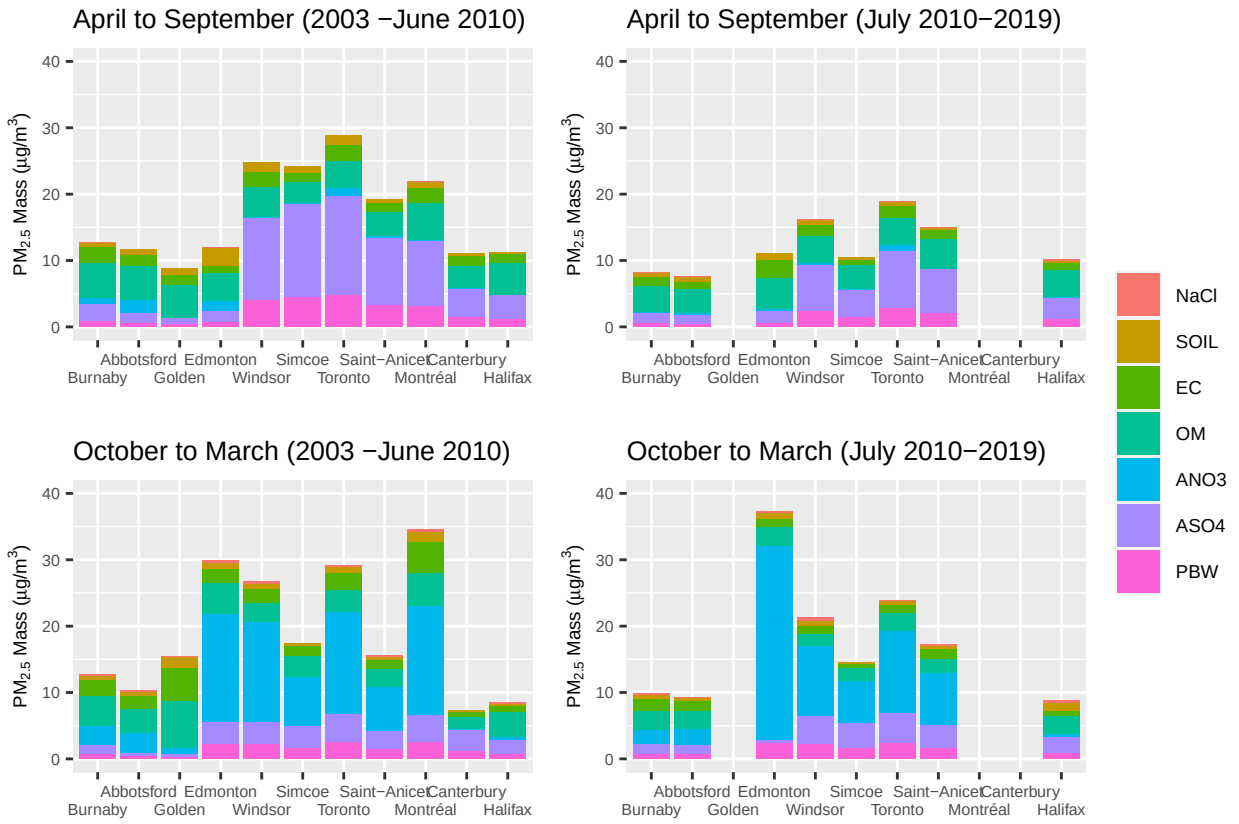


Figure 4: Figure 6: Reconstructed $PM_{2.5}$ mass by mean compound for the 10 hightest mass concentration days

Figure 7: Median ammonium sulphate and ammonium nitrate concentrations by site and month

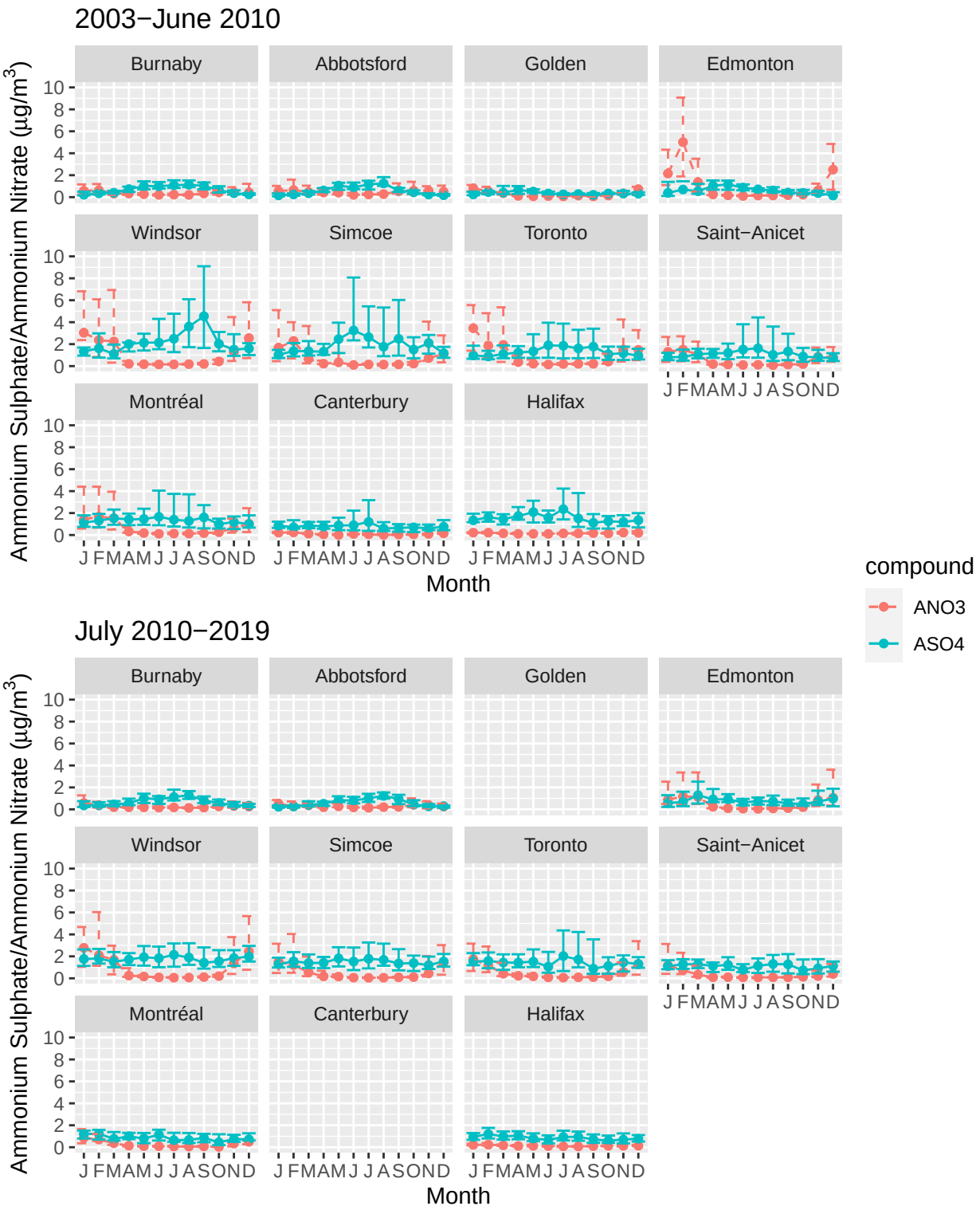


Figure 5: Figure 7: Ammonium sulphate and ammonium nitrate concentrations by site and month (mean and inter-quartile range)

Figure 8: Median elemental carbon (EC) and organic matter (OM) concentrations by site and month

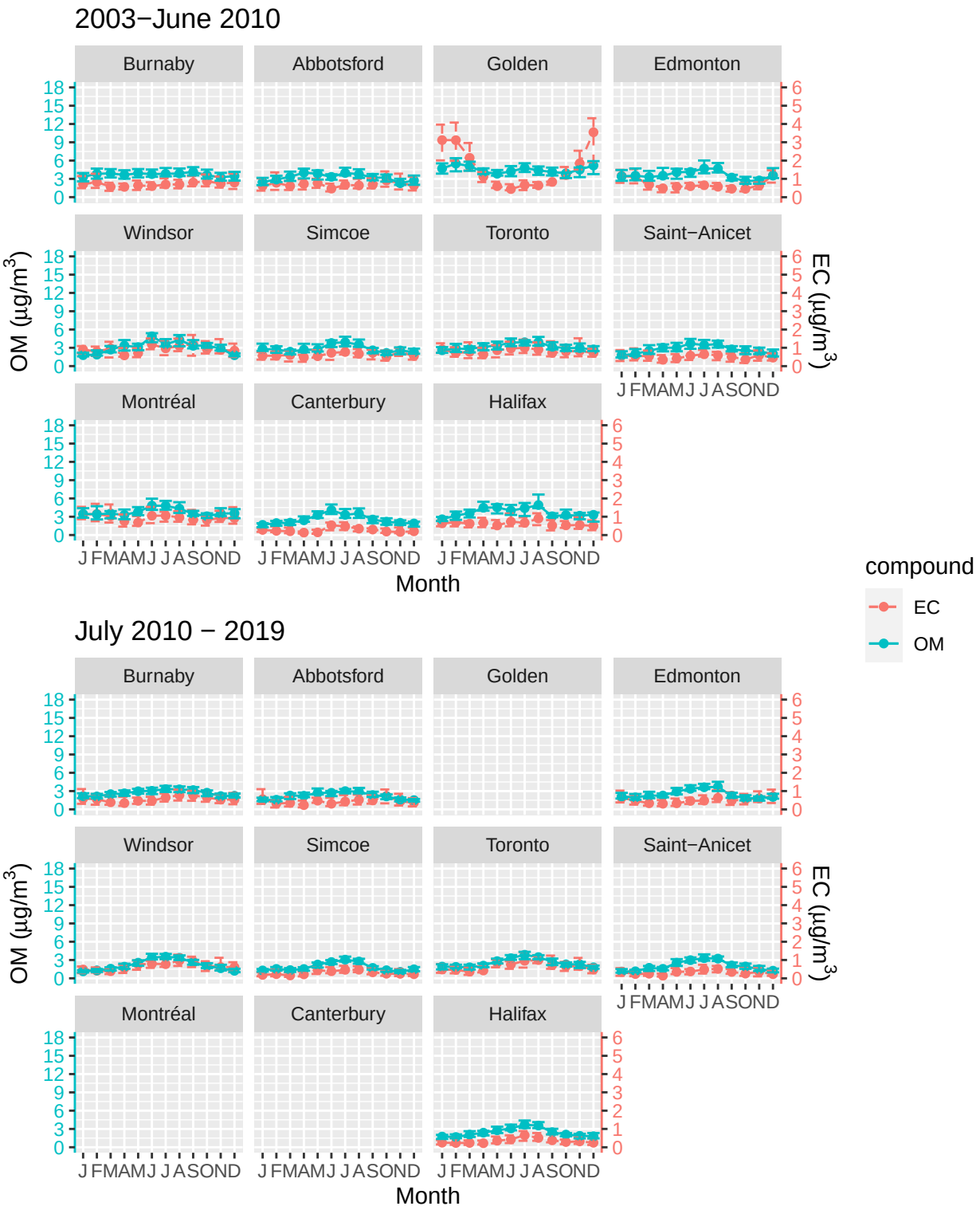


Figure 6: Figure 8: Elemental carbon (EC) and organic matter (OM) by site and month (mean and inter-quartile range)

Figure 9: Median soil and sodium chloride concentrations by site and month

Figure 10: Ammonia mixing ratio by site and month

Figure 11: Median sulphr dioxide mixing ratio and nitric acid concentrations by site and month

References

Dabek-Zlotorzynska, Ewa, Tom F. Dann, P. Kalyani Martinelango, Valbona Celo, Jeffrey R. Brook, David Mathieu, Luyi Ding, and Claire C. Austin. 2011. "Canadian National Air Pollution Surveillance (Naps) Pm2.5 Speciation Program: Methodology and Pm2.5 Chemical Composition for the Years 2003–2008." *Atmospheric Environment* 45 (3): 673–86. https://doi.org/https://doi.org/10.1016/j.atmosenv.2010.10.024.

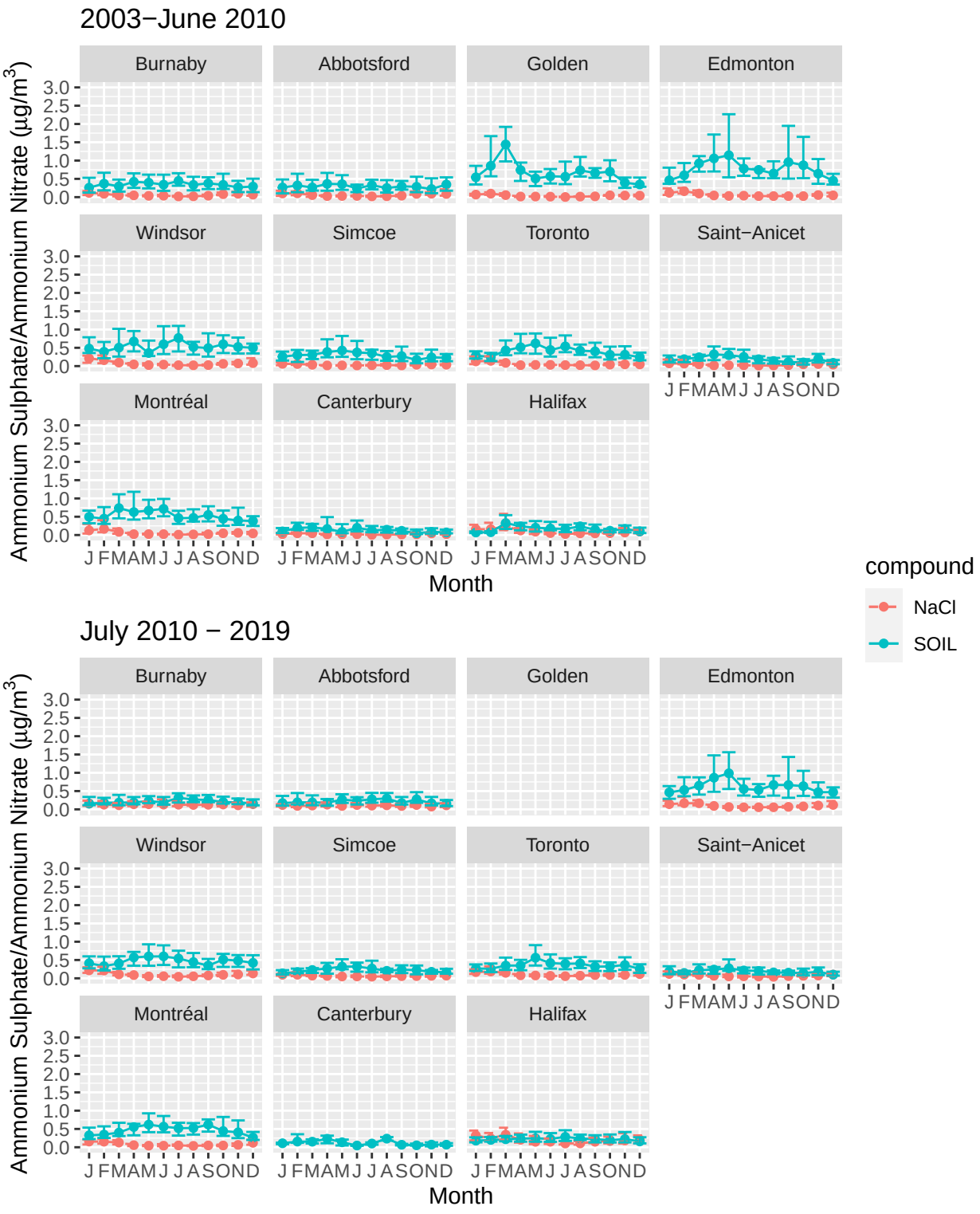


Figure 7: Figure 9: Soil and sodium chloride concentrations by site and month (mean and inter-quartile range)

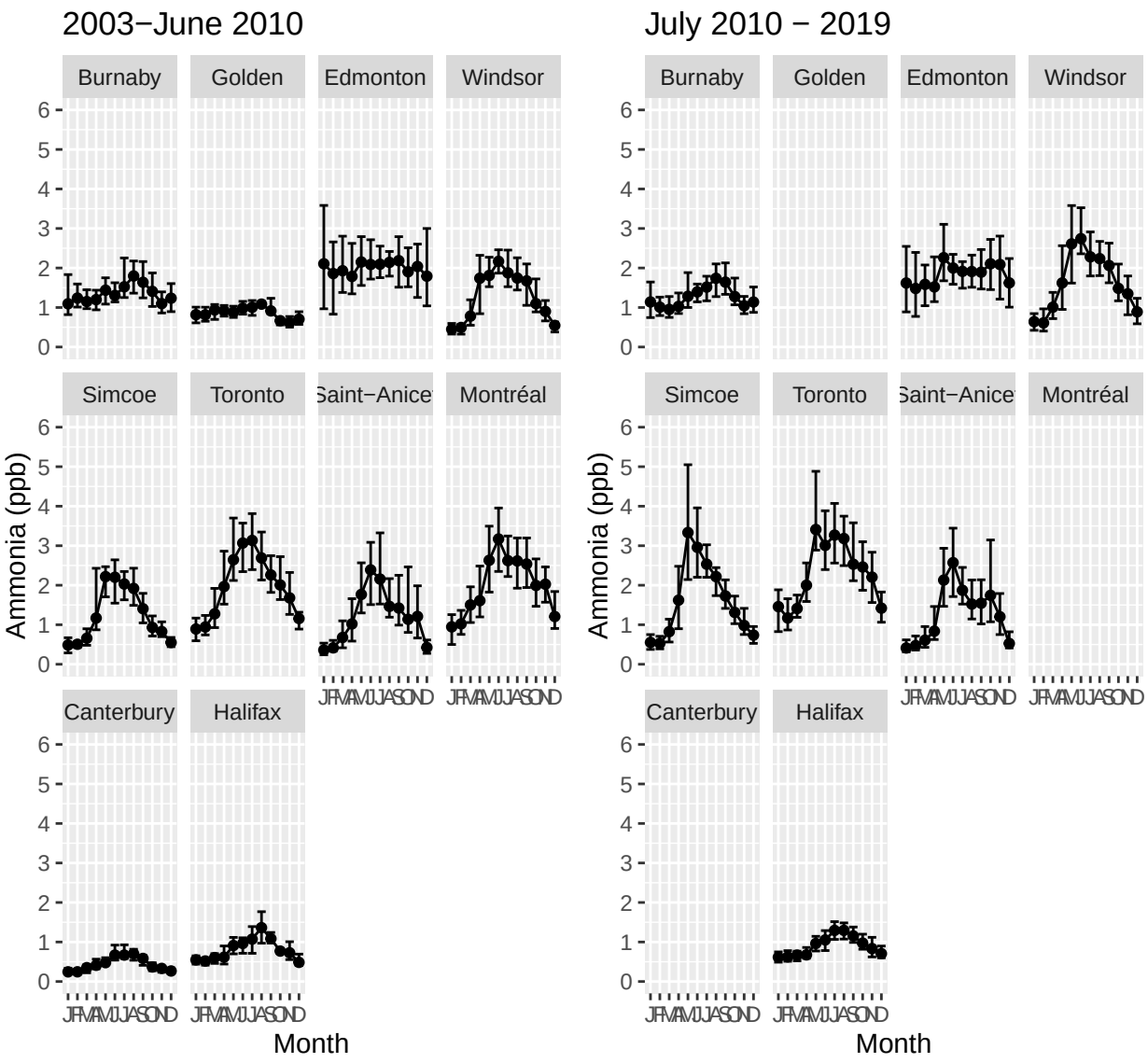


Figure 8: Figure 10a: Ammonia mixing ratio by site and month (mean and inter-quartile range)

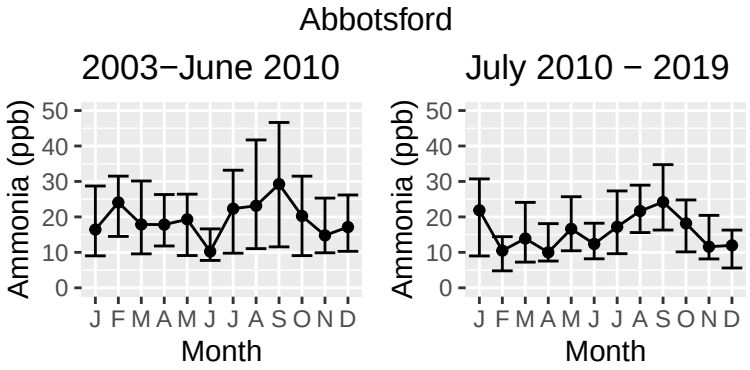


Figure 9: Figure 10b: Ammonia mixing ratio for Abbotsford by month (mean and inter-quartile range)

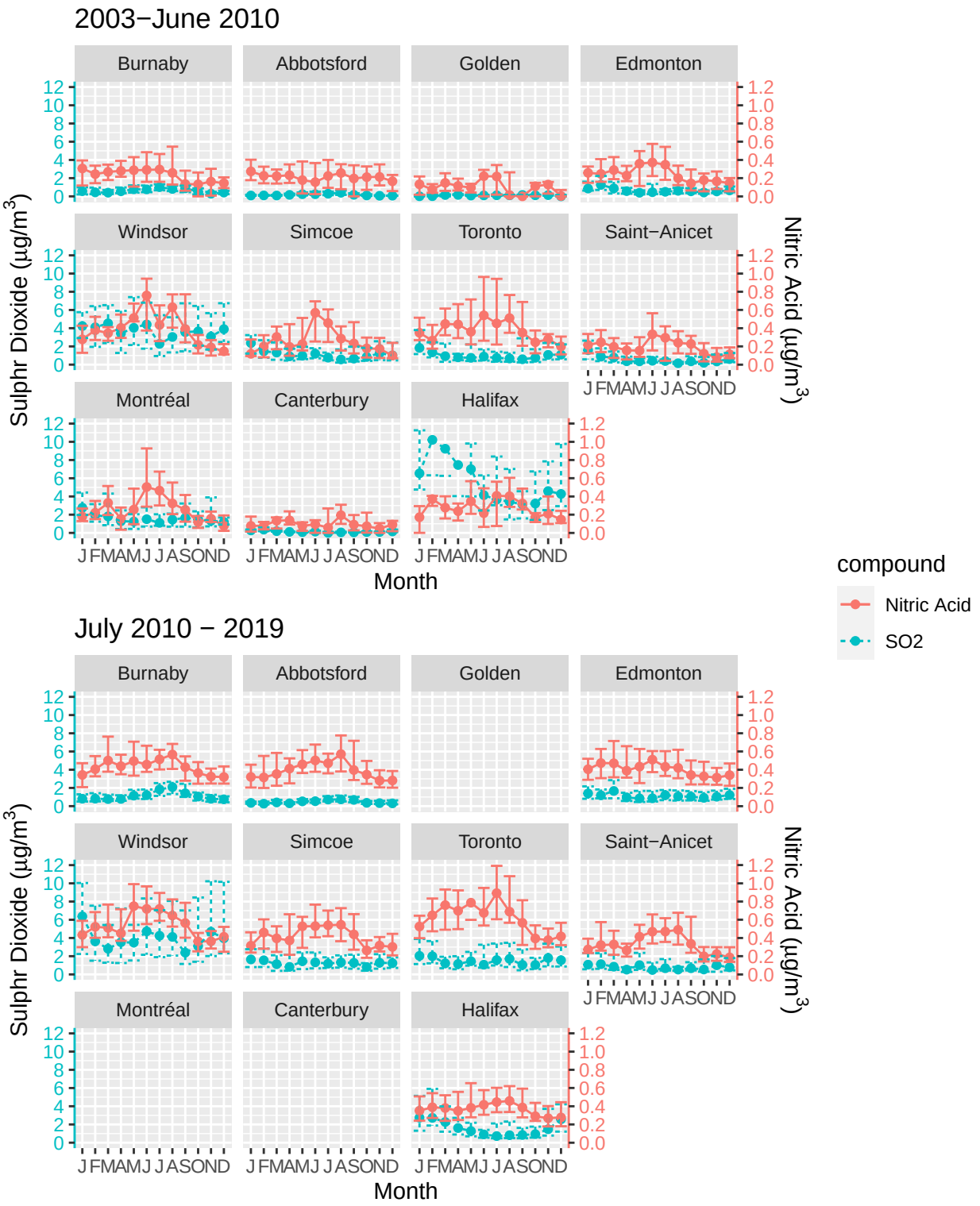


Figure 10: Figure 11: Sulphr dioxide mixing ratio and nitric acid concentrations by site and month (mean and inter-quartile range)