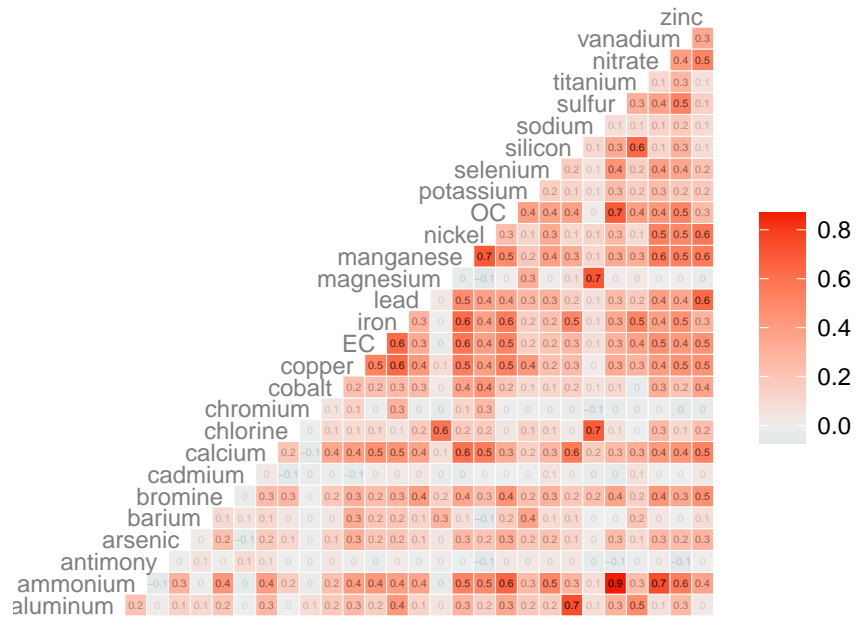


APCA 6, 7/2 - 7/6 removed

Rachel Tao

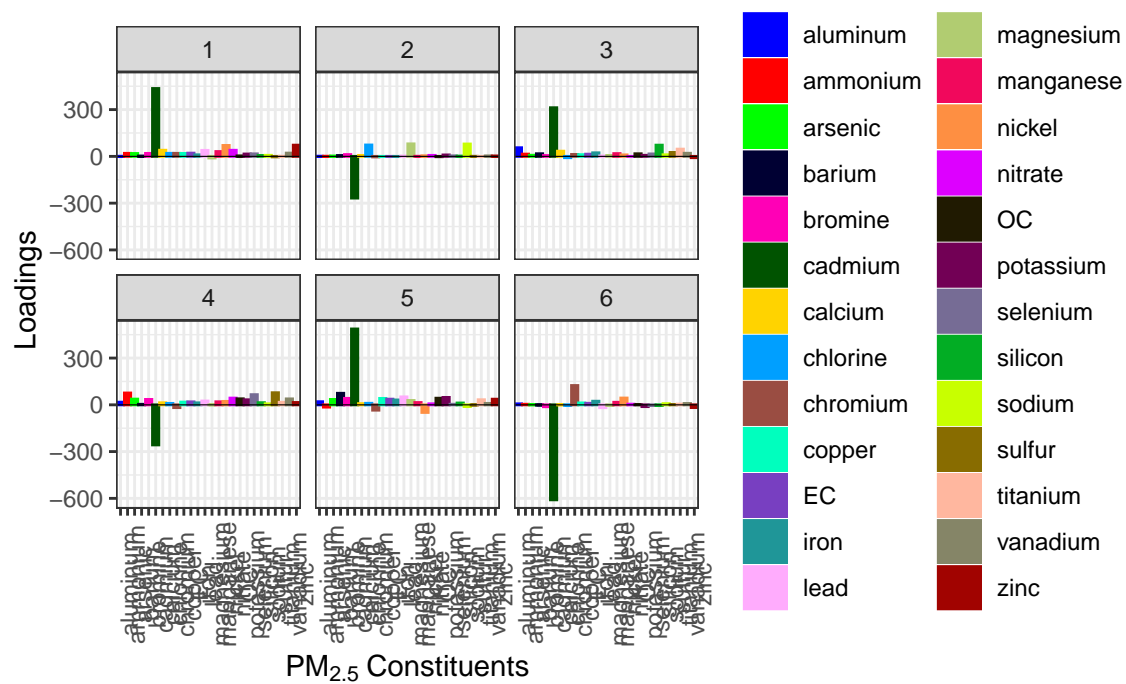
1/23/2021

### Correlation Matrix: NYC Air Pollution Dataset

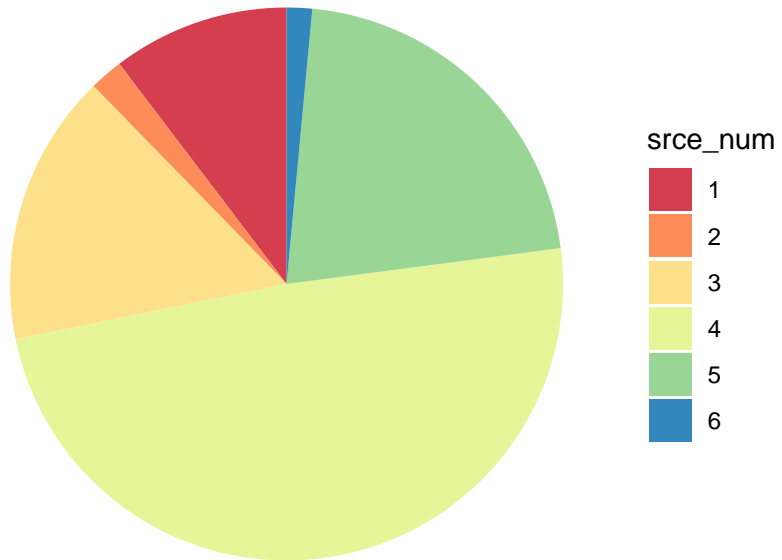


## Loadings

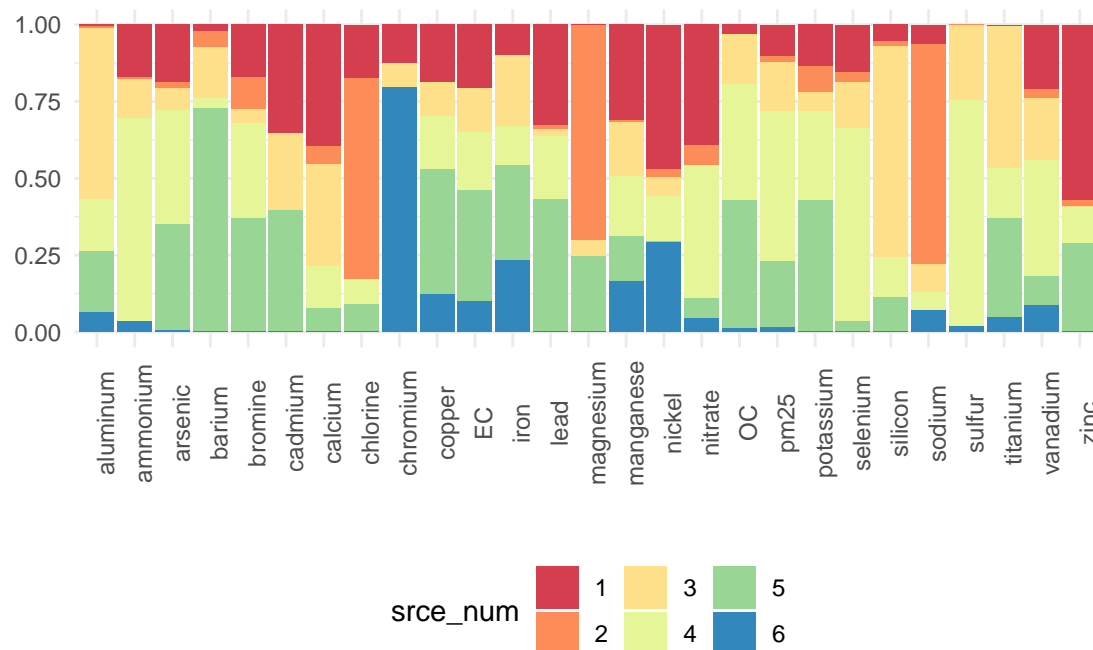
element	MeanConc	source_1	source_2	source_3	source_4	source_5	source_6	r_squared	PredConc	Pct_error
aluminum	22.18	0.13	0.20	14.69	4.47	5.33	1.68	0.44	26.51	19.51
ammonium	1120.78	205.57	9.02	153.02	799.87	-154.09	40.46	0.93	1053.86	-5.97
arsenic	0.49	0.07	0.01	0.03	0.15	0.14	0.00	0.16	0.40	-17.98
barium	1.87	0.07	0.16	0.52	0.11	2.30	-0.06	0.26	3.10	65.68
bromine	3.06	0.51	0.31	0.14	0.92	1.10	-0.32	0.38	2.66	-13.12
cadmium	1.68	0.12	-0.07	0.09	-0.07	0.13	-0.17	0.01	0.03	-98.37
calcium	51.85	16.07	2.49	13.58	5.46	3.11	0.07	0.56	40.78	-21.35
chlorine	37.07	11.45	42.81	-4.87	5.40	5.83	-2.02	0.69	58.58	58.04
chromium	2.13	0.50	-0.09	0.32	-0.46	-0.88	3.19	0.26	2.58	20.89
copper	4.55	1.07	-0.07	0.63	0.99	2.33	0.69	0.67	5.64	23.87
EC	707.73	145.70	-3.45	98.42	133.30	253.47	68.64	0.52	696.09	-1.64
iron	105.50	11.02	-0.32	24.81	13.89	33.86	25.18	0.96	108.45	2.79
lead	2.02	0.88	0.04	0.05	0.56	1.16	-0.41	0.51	2.28	13.15
magnesium	7.12	-0.81	6.30	0.47	-0.02	2.20	-0.30	0.88	7.84	10.22
manganese	2.10	0.71	0.01	0.40	0.44	0.34	0.38	0.73	2.28	8.74
nickel	4.94	2.49	0.13	0.34	0.78	-1.73	1.55	0.88	3.55	-28.14
nitrate	1613.47	608.43	101.61	0.31	670.44	103.38	66.42	0.56	1550.59	-3.90
OC	2693.20	64.84	-46.27	346.91	800.00	882.38	20.93	0.82	2068.79	-23.18
pm25	10322.11	901.08	170.76	1386.50	4257.78	1867.95	129.58	0.85	8713.65	-15.58
potassium	36.15	6.59	3.98	2.97	14.05	20.54	-4.98	0.32	43.14	19.34
selenium	0.40	0.05	0.01	0.05	0.22	0.01	-0.01	0.29	0.33	-15.71
silicon	61.01	3.59	1.09	46.19	8.85	7.53	-3.03	0.94	64.22	5.26
sodium	95.65	5.13	59.40	7.82	4.95	-8.24	5.69	0.90	74.77	-21.83
sulfur	788.05	-20.40	2.28	155.69	477.01	-10.82	10.88	0.83	614.64	-22.01
titanium	2.37	0.02	-0.02	1.23	0.44	0.86	0.12	0.48	2.65	11.89
vanadium	2.86	0.76	0.11	0.72	1.38	0.33	0.32	0.43	3.61	26.55
zinc	26.09	15.40	0.54	-1.79	3.20	7.76	-3.75	0.93	21.36	-18.14



Source proportions



Bar graph of the above proportions



This dataset includes air pollution data from 3 monitors in NYC during the years 2007-2015, excluding the dates surrounding 4th of July (7/2-7/6) from each year.

For this experiment, we have a 6-factor solution.

Sources plus notes comparing with other studies:

1) road dust (?)

- Masiol et al. Zinc “At first glance, the factor 9 could be interpreted as road dust.”
  - mostly zinc, with moderate values of nickel, calcium, copper, manganese, and potassium
  - mainly in winter
  - zinc is a tracer for lubricating oil combustion, brake and tire wear along with manganese, iron, and copper
  - decided this was not road dust because as particle sizes became smaller correlations increased even though mass-relevant contributions are mainly in the 1-10 range, and it was strongly correlated with SO<sub>2</sub>
  - instead thought this was a combustion source such as on-road diesel truck traffic, ship traffic, or building heating
- Squizzato et al. road dust: Al, Si + Mg, Ca, Fe, Ti, Mn, Cu, OC, EC, sulfate, nitrate, Na, Cl
- it seems like our road dust looks different from Masiol’s Zinc anyway (less zinc, more range of elements) and also different from Squizzato’s road

dust

2) salt

- Masiol et al. fresh sea salt: chlorine, sodium, nitrate, sulfate, ammonium, EC, OC, Fe
  - no clear seasonal/weekly patterns, but may be higher in winter due to northeasters
  - possible crustal particles in seawater leading to Al and Si
  - watch out for one-day high peaks due to storms
- Masiol et al. sodium, Br, OC, sulfate, nitrate
  - origin from coastal areas in southeaster US
  - less chlorine than fresh salt
- Squizzato et al. aged sea salt: Na + Mg, sulfate, nitrate, OC, EC, low Cl
- Squizzato et al. road salt: Cl + OC, EC, nitrate, sulfate, Si, Ca, Fe
- Squizzato et al. fresh sea salt: Cl + Na, Ca, Mg
- our salt is really just chlorine, sodium, and magnesium but does also include Ba, Br, Ca, Ni, nitrate, K, selenium, silicon, vanadium, zinc

3) crustal

- Masiol et al. Al, Si + some K, Ca, Mn, Fe
  - no weekly cycles, higher in spring and summer
- aluminum, silicon, titanium, sulfur, vanadium, cadmium, calcium, manganese, iron

4) regional/secondary

- Masiol et al. secondary ammonium sulfate: ammonium, sulfate, Br, OC, V
  - emissions of SO<sub>2</sub> from coal-fired power plants in upper Ohio River Valley
  - biogenic and sea salt sulfate
  - highest in summer, minimum on Saturdays (may not be a true pattern)
- Masiol et al. secondary ammonium nitrate: ammonium, nitrate, Br, NO<sub>2</sub>
  - higher concentrations in winter, no weekly patterns
- Squizzato et al. secondary sulfate: sulfate, ammonium, OC, EC, selenium, vanadium, arsenic, bromine
  - decrease over the years because of decreased coal use. also talk about residual oil here (could be combined?)
- Squizzato et al. secondary nitrate: nitrate, ammonium, sulfate, OC, EC, higher in winter
  - reductions in NYC related to less traffic (?)
- We also have a lot of selenium, pretty high arsenic, and potassium in here (not mentioned in Masiol et al.)

5) traffic (?)

- Masiol et al. EC and OC from primary engine dust, V, Mn, Fe, Cu from road traffic emissions
  - weekly patterns decreased on weekends
- Squizzato et al. spark-ignition and diesel: OC, EC, Mg, Al, Si, Ca, Fe, Cu, Zn, Mn
- EC, OC + pretty much everything else except sulfur sodium and ammonium. a lot of the barium, not so much vanadium

6) industrial (?)

- it doesn't look like this is in the Masiol paper
- Squizzato et al. industrial: Pb, Fe, Mn, Cu, Zn, As, Se
  - Coke production: As, Zn, Se, and Pb
  - Metal/steel: Pb, Fe, Mn, Cu, Zn
- lots of chromium, copper, EC, iron, manganese, nickel, nitrate, vanadium, aluminum, ammonium, OC

Masiol et al. Biomass Burning: K, OC, Br, EC, Ca, higher in summer Squizzato et al. biomass burning: K, OC, EC, sulfate, nitrate, Na, Al, Si, Cl, Ca, Fe, Zn, Br Masiol et al. Residual oil/domestic heating: vanadium, nickel, calcium, manganese, EC, iron, higher in winter Squizzato et al. residual oil: Ni, Mn, Zn, Ca