APCA 6, 7/2 - 7/6 removed

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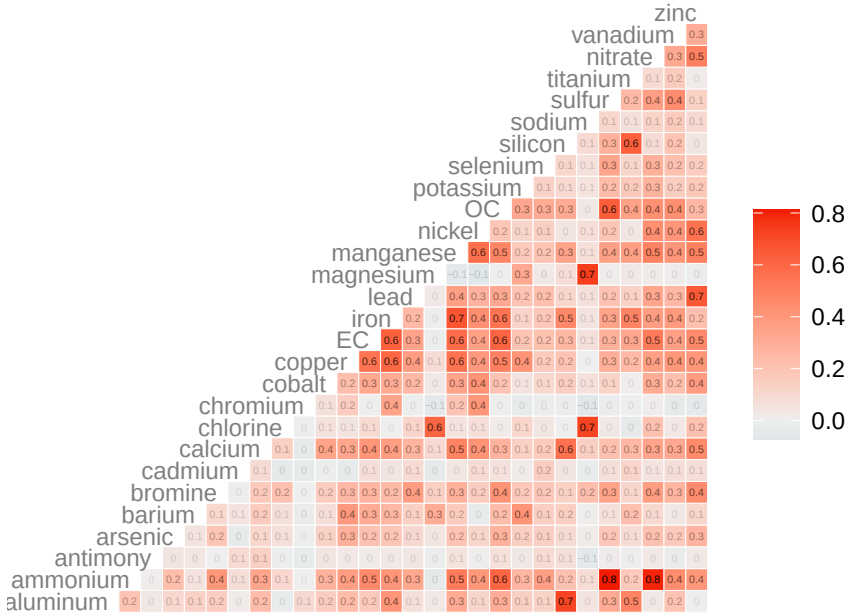
```
##        date        pm25    aluminum    ammonium     arsenic      barium
## 0.000000000 0.003745318 0.004993758 0.004993758 0.004993758 0.004993758
##     bromine     cadmium     calcium    chlorine    chromium      copper
## 0.004993758 0.004993758 0.004993758 0.022471910 0.004993758 0.004993758
##          EC        iron        lead   magnesium   manganese      nickel
## 0.019975031 0.004993758 0.004993758 0.004993758 0.004993758 0.004993758
##          OC   potassium    selenium     silicon      sodium      sulfur
## 0.019975031 0.004993758 0.004993758 0.004993758 0.004993758 0.004993758
##    titanium     nitrate    vanadium        zinc
## 0.004993758 0.004993758 0.004993758 0.004993758
```

Correlation Matrix: NYC Air Pollution Dataset

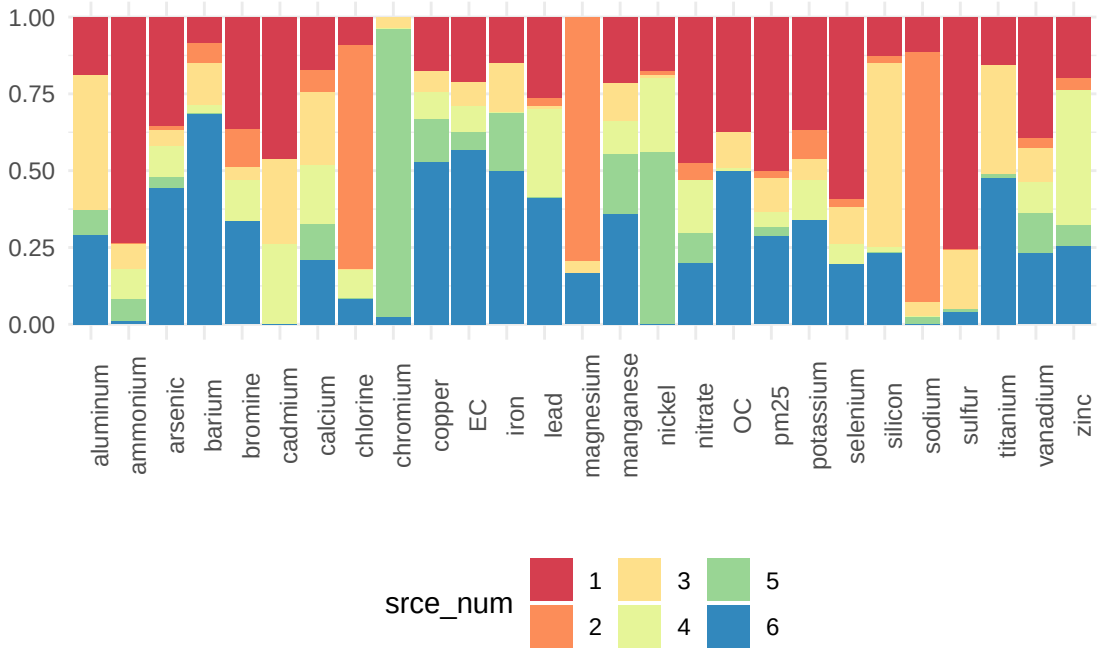


Loadings

element	MeanConc	source_1	source_2	source_3	source_4	source_5	source_6	r_squared	PredConc	Pct_error
aluminum	20.90	4.84	-0.17	11.07	-1.09	2.05	7.35	0.42	24.05	15.05
ammonium	869.87	628.42	-8.06	70.88	81.75	62.09	8.11	0.90	843.20	-3.07
arsenic	0.46	0.14	0.01	0.02	0.04	0.01	0.17	0.13	0.39	-15.96
barium	2.16	0.31	0.23	0.50	0.10	-0.05	2.48	0.29	3.57	65.14
bromine	3.03	1.01	0.34	0.11	0.38	-0.12	0.92	0.31	2.64	-12.85
cadmium	1.94	0.22	-0.09	0.13	0.12	-0.07	-0.01	0.02	0.29	-85.08
calcium	46.69	6.97	2.96	9.46	7.83	4.62	8.43	0.42	40.27	-13.75
chlorine	34.68	6.20	49.87	-4.65	6.24	0.15	5.66	0.67	63.48	83.06
chromium	2.51	-0.55	-0.18	0.14	-0.36	3.55	0.09	0.35	2.71	8.06
copper	4.42	1.02	-0.06	0.40	0.49	0.80	3.04	0.64	5.69	28.82
EC	650.69	142.28	0.10	51.58	57.00	38.48	378.70	0.68	668.14	2.68
iron	103.96	15.71	-0.48	16.15	0.48	19.55	51.36	0.94	102.77	-1.15
lead	1.78	0.56	0.06	0.02	0.61	0.01	0.88	0.40	2.13	19.44
magnesium	7.58	-0.19	7.32	0.39	-0.35	-0.50	1.52	0.86	8.19	8.07
manganese	1.84	0.49	-0.02	0.28	0.25	0.43	0.81	0.67	2.23	21.19
nickel	3.90	0.68	0.05	0.04	0.93	2.18	-0.55	0.95	3.33	-14.60
nitrate	1476.52	787.41	92.41	-13.54	287.32	158.68	331.74	0.56	1644.02	11.34
OC	2568.37	746.82	-44.59	227.16	19.63	-19.07	987.68	0.77	1917.64	-25.34
pm25	9503.51	3956.83	174.16	895.89	390.83	223.80	2263.48	0.83	7904.98	-16.82
potassium	35.98	13.24	3.44	2.36	4.68	-0.30	12.18	0.30	35.60	-1.05
selenium	0.33	0.16	0.01	0.03	0.02	0.00	0.05	0.18	0.27	-19.02
silicon	56.87	7.60	1.33	35.80	1.15	-0.83	13.92	0.90	58.98	3.70
sodium	91.96	9.32	65.42	3.54	0.20	1.90	-1.61	0.94	78.78	-14.33
sulfur	658.69	346.73	-3.66	89.36	-17.57	3.12	18.65	0.72	436.62	-33.71
titanium	2.16	0.38	-0.02	0.85	-0.06	0.03	1.14	0.43	2.32	7.14
vanadium	2.25	1.18	0.09	0.34	0.30	0.40	0.69	0.32	2.99	32.99
zinc	25.27	5.11	0.95	-1.92	11.19	1.78	6.46	0.97	23.56	-6.76

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:

4) 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 aalong with manganese, iron, and copper
  - decided this was not road dust because as particle sizes became smaller correlatioonos increased even though mass-relevant contributions are mainly in the 1-10 range, and it was strongly correlated with SO2
  - instead thought this was a combustion source such as on-road diiesel 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 crustaal 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 aal. aged sea salt: Na + Mg, suflate, 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, caaadmium, calcium, manganese, iron

1) regional/seecondary

- Masiol et al. secndary ammonium sulfate: ammonium, sulfate, Br, OC, V
  - emissions of SO2 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, NO2
  - higher concentrations in winter, no weekly patterns
- Squizzato et al. secondary sulfate: sulfate, ammonium, OC, EC, selenium, vanadium, arsenic, bromine
  - decrease over the years becaause 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.)

6) traffic (?)

- Masiol et al. EC and OC from primaary 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

5) 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 buring: 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