Explore AQS monitor datasets

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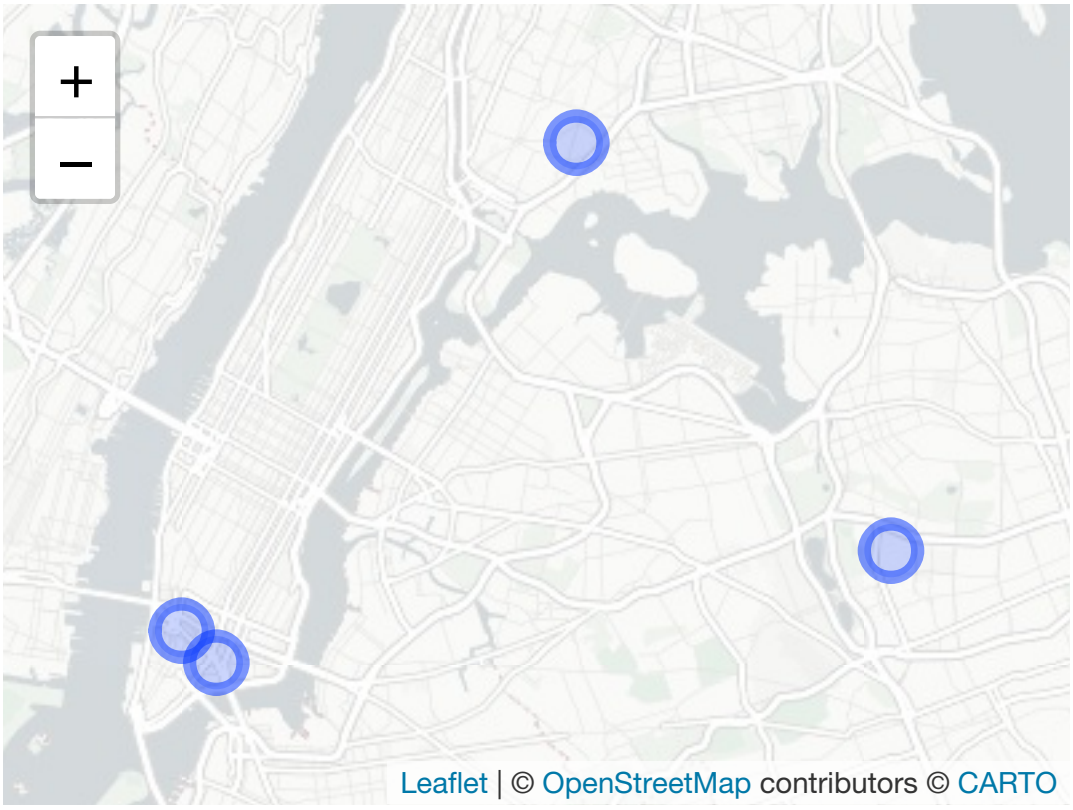
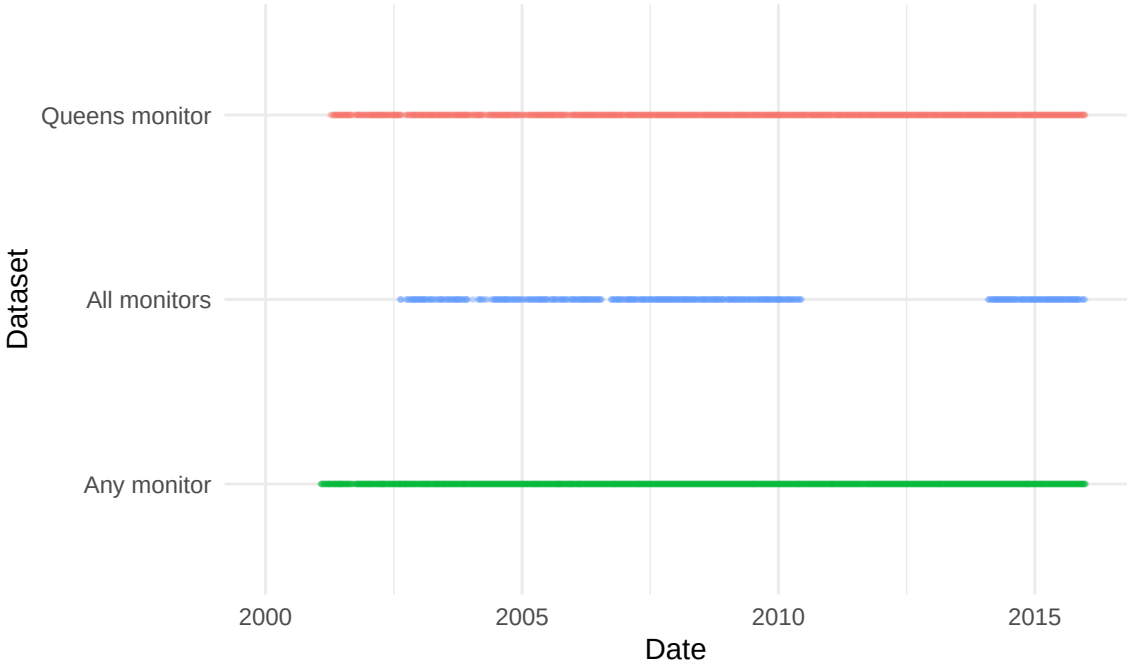
Map of monitor locations



Data availability over time at each monitor



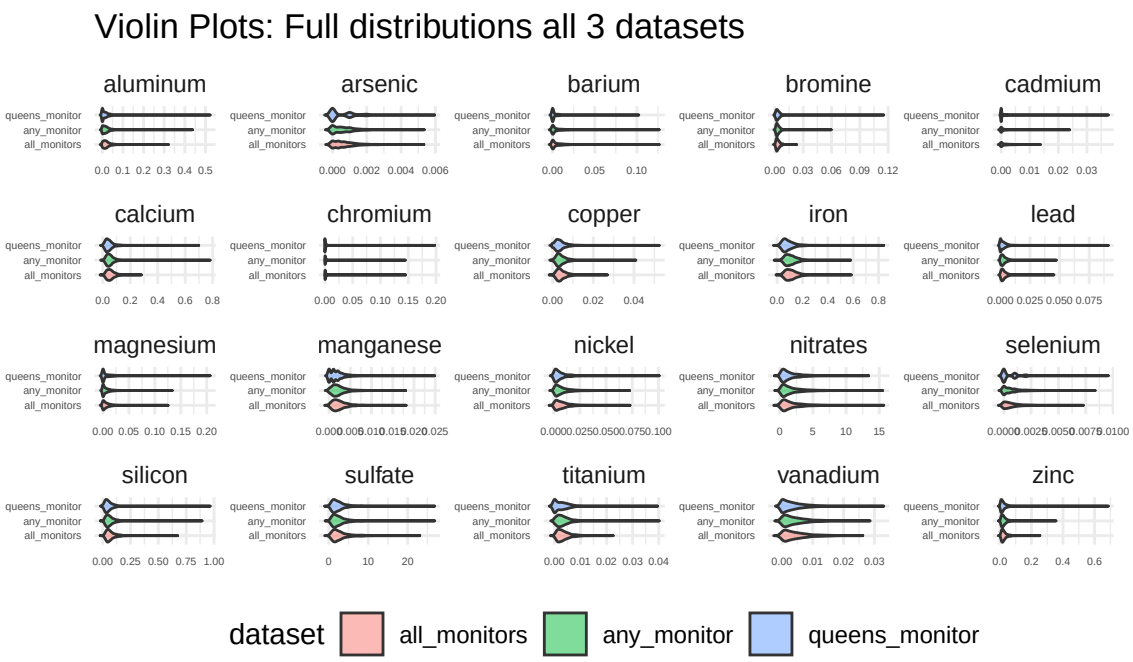
The 'all monitors' dataset starts later than the other two datasets (around 2003) and also includes a gap of about 2-3 years from 2011-2014. The queens monitor and 'any monitor' dataset have full data 2001 onwards. For analyses, we should use the 'any monitors' dataset or the queens dataset so that we have data for the entire period of interest.

Distribution

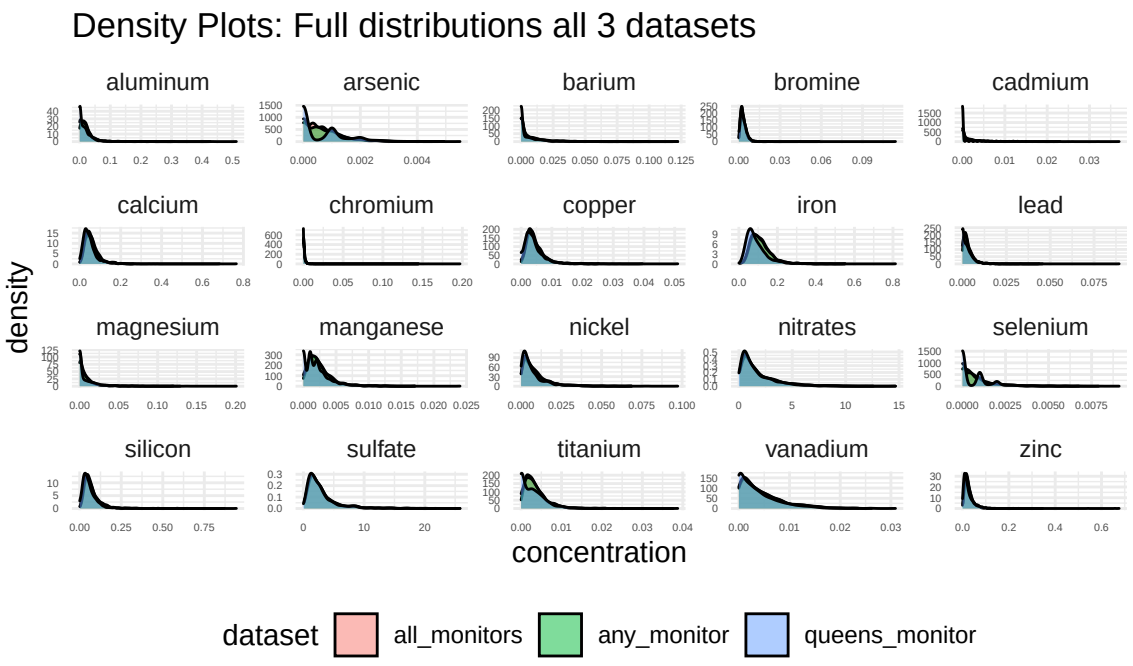
NOTES (potential measurement error):

- arsenic and selenium are not well-measured by the instrument
- sodium and sulfate are highly correlated because they have similar frequencies

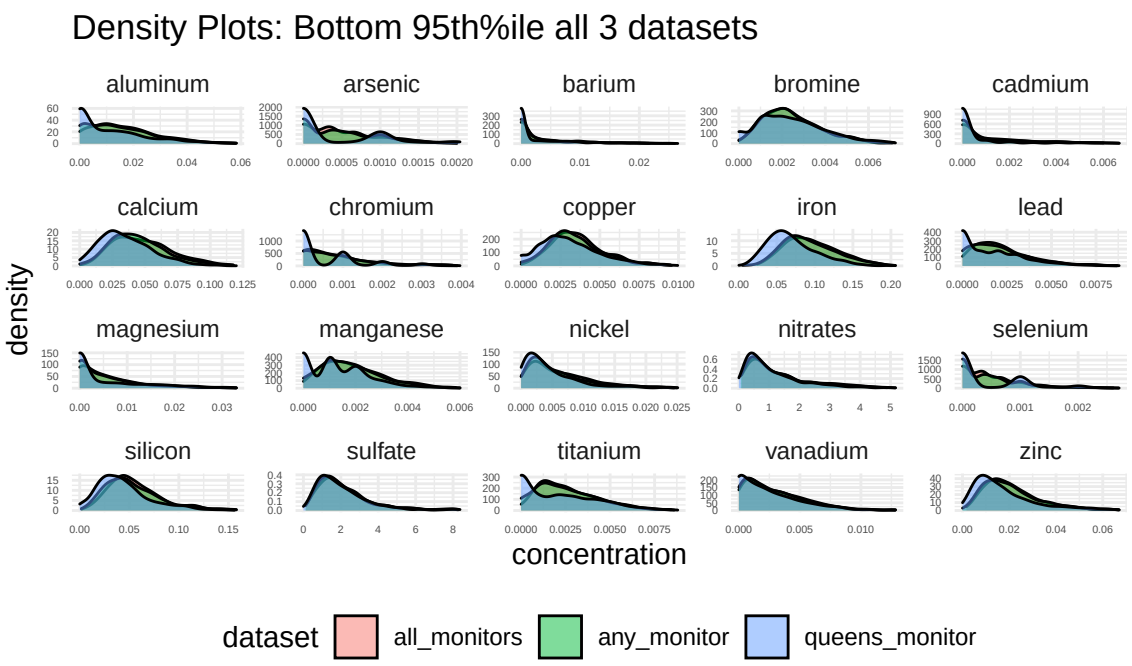
As a first pass, we can look at the distributions of each dataset side-by-side for each chemical:



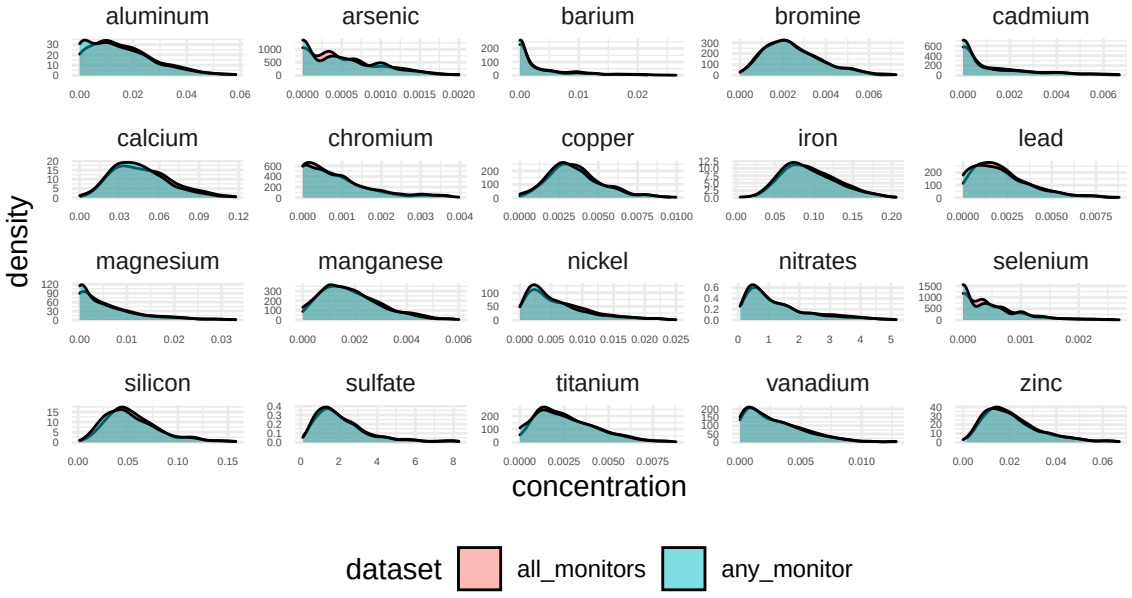
Now, let's try an overlaid density plot to get a better sense of the distributions:



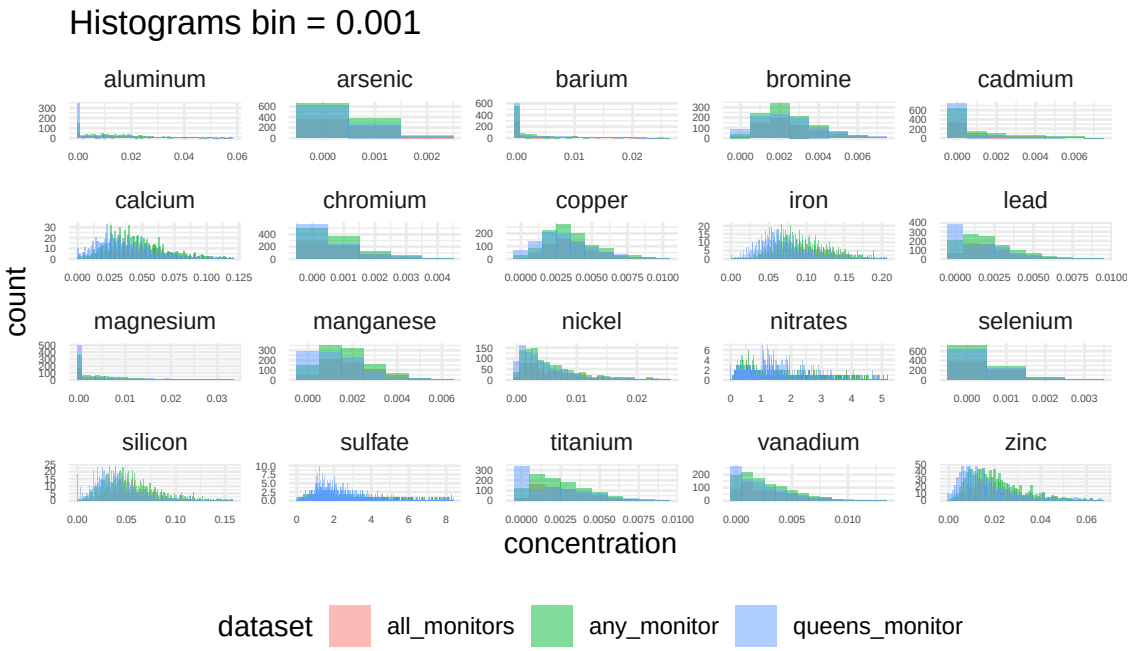
The full distributions for many chemicals have long right tails, so it might be easier to visualize if we just take the bottom 95th%ile:



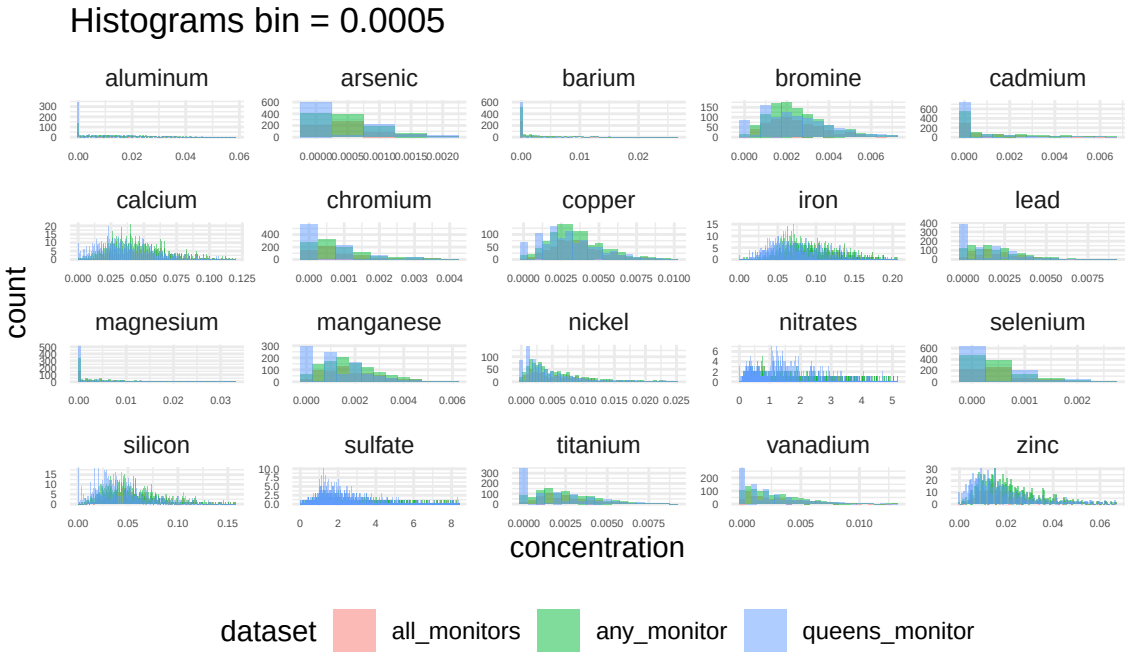
It looks like the Queens monitor is the only one that has a slightly different distribution across pollutants. Let's compare just the 'any' and 'all' datasets to see if their distributions match up when we remove the queens monitor's distribution:



Some of the density plots (especially for the low-concentration pollutants at the queens monitor) have 'bumpy' distributions. Is this a true signal or is it because the unit of measurement is 0.0001?



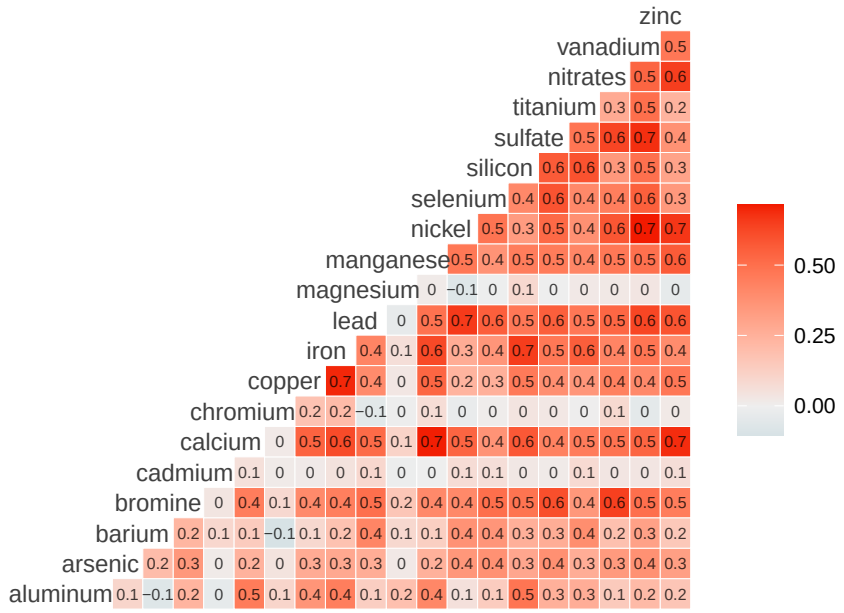
Although these histograms make it difficult to see the distributions for higher-concentration pollutants, we can see that the pollutants with lower concentrations no longer have the 'bumpy' distributions. Using a smaller bin size, we see similar patterns as in the density plot:



Based on the density plots, the 'any monitor available' and the 'all monitors' datasets appear to have similar distributions for all chemicals. The queens monitor has a slightly different distribution. Since the queens monitor has data availability for the entire study period, and the 'any monitor' dataset has variable numbers of observations per date, so we can use the 'any monitor' dataset for analyses and do a sensitivity analysis using the queens monitor dataset.

Correlation Matrix

Any available monitor



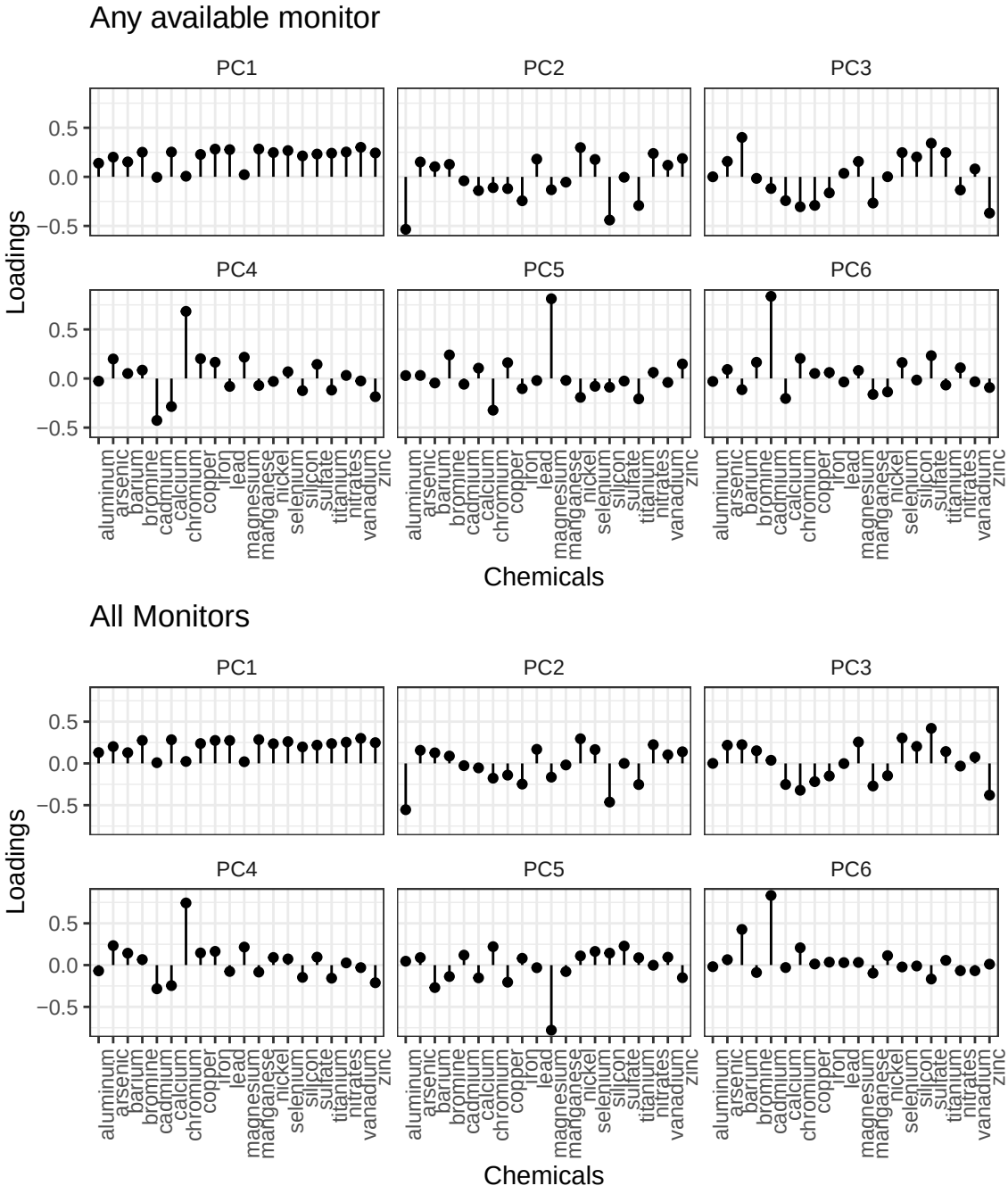
Correlations range from -0.1 to 0.7.

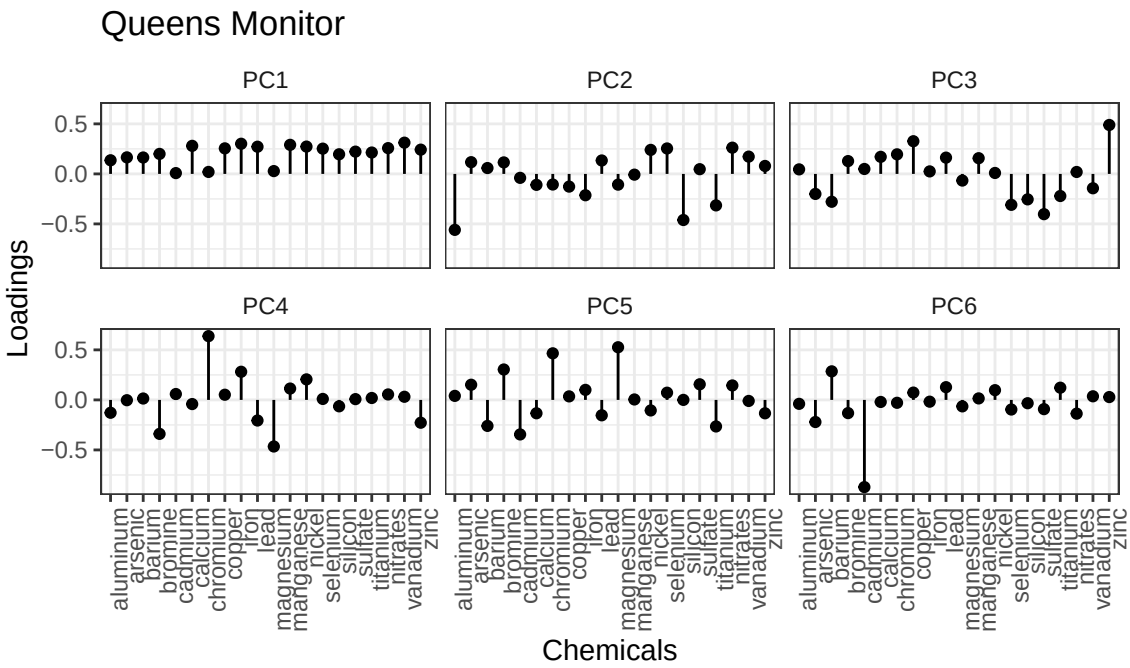
Principal Components Analysis

Component	PCA_any	PCA_all	PCA_124
1	35.4789	38.7839	32.4709
2	9.8944	9.8258	8.5485
3	7.4585	7.0660	7.4785
4	5.5362	5.5295	5.8968
5	5.3023	5.3064	5.2608
6	4.9079	5.1109	5.0224
7	4.6035	4.7310	4.7076
8	3.5436	3.3772	4.4343
9	3.4844	3.2771	4.0378
10	3.1811	2.7232	3.3867
11	2.5340	2.3665	2.7550
12	2.2020	2.2429	2.6578
13	2.0519	1.9412	2.3841
14	1.9714	1.5346	2.2065
15	1.9182	1.5025	2.0763
16	1.6861	1.3150	1.9266
17	1.4058	1.2262	1.7192
18	1.1684	0.9097	1.1812
19	0.9302	0.6898	1.0010
20	0.7409	0.5407	0.8480

The proportion of variation for each component is similar across datasets. This suggests that it is likely reasonable to assume that when use other dimensionality reduction techniques with the 'any monitor' dataset, the results would be similar if we used the 'all monitors' dataset or the queens dataset. The loadings are also similar across datasets.

Loadings


Any available monitor
PC1
PC2
PC3
PC4
PC5
PC6
Loadings
0.5
0.0
−0.5
aluminum
arsenic
barium
bromine
cadmium
calcium
chromium
copper
iron
lead
magnesium
manganese
nickel
selenium
silicon
sulfate
titanium
nitrates
vanadium
zinc
Chemicals
All Monitors
PC1
PC2
PC3
PC4
PC5
PC6
Loadings
0.5
0.0
−0.5
aluminum
arsenic
barium
bromine
cadmium
calcium
chromium
copper
iron
lead
magnesium
manganese
nickel
selenium
silicon
sulfate
titanium
nitrates
vanadium
zinc
Chemicals



Most chemicals load on the first component for all 3 monitors.