



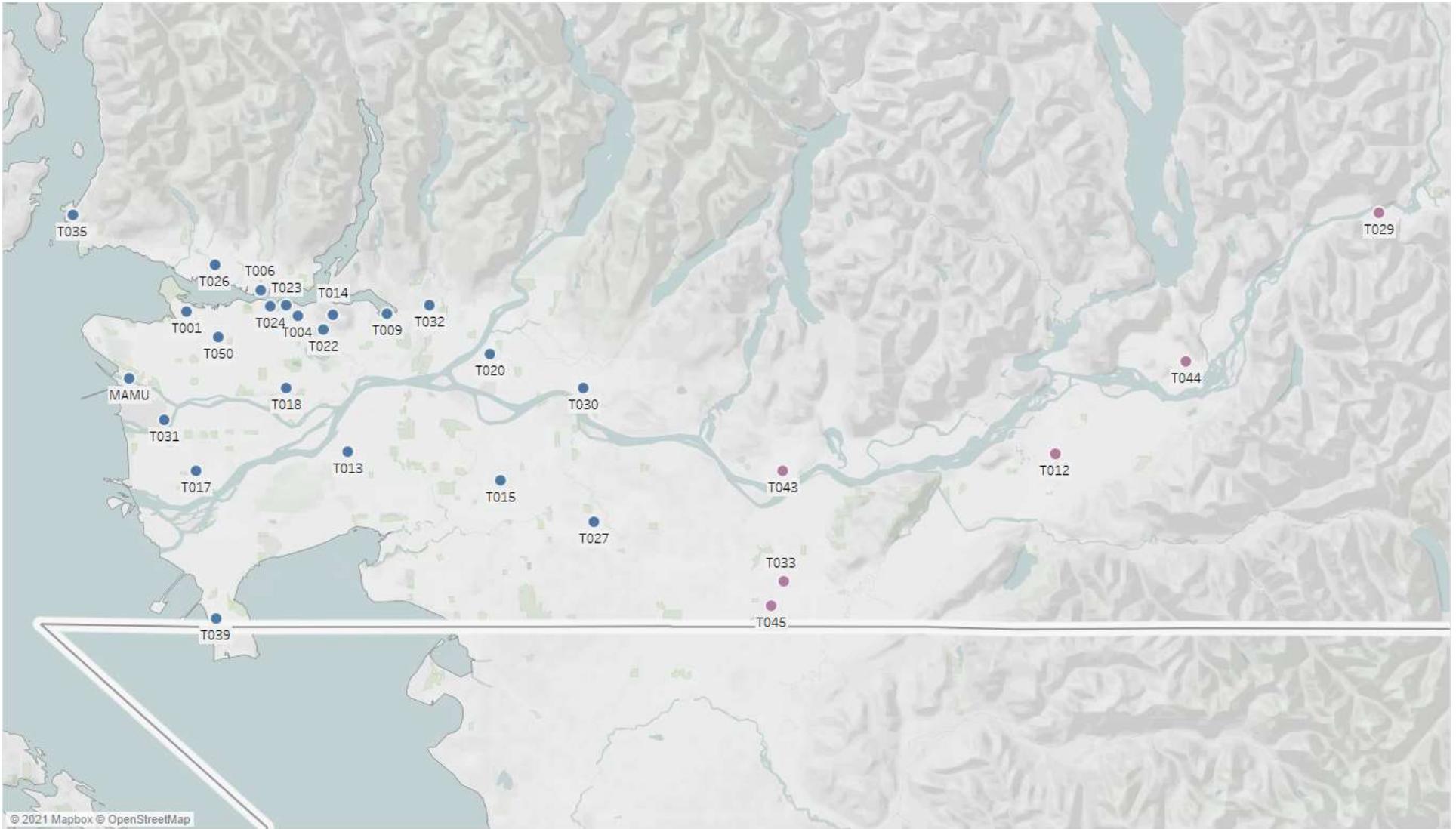
COVID-19 Impacts on Air Quality in Metro Vancouver

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IAS Coordinating Committee Meeting – June 9, 2021

metrovancouver



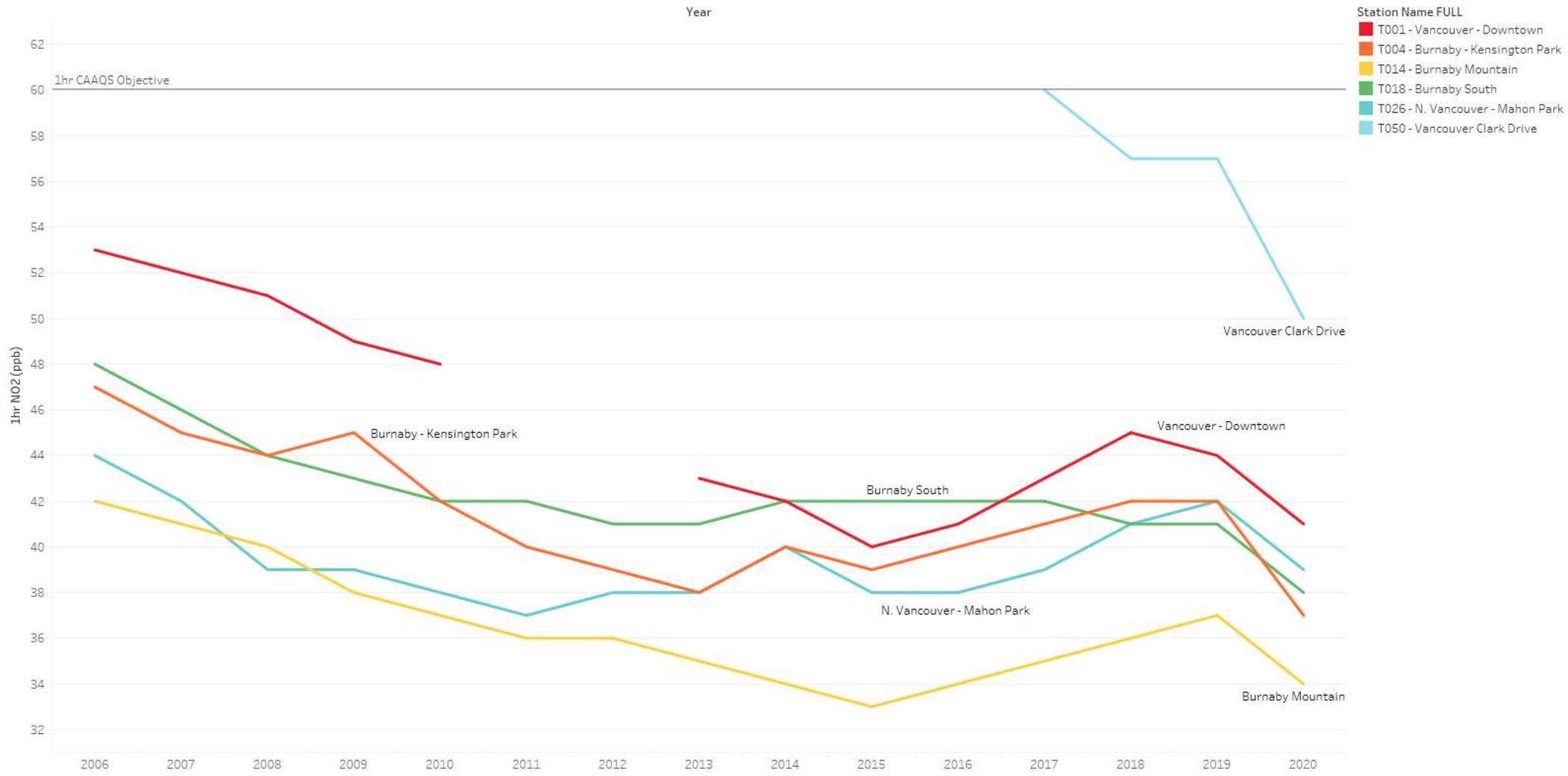
COVID-19 TIMELINE IN BC - 2020

- March 11, 2020 – WHO declares pandemic
- March 16, 2020 – Strict physical distancing begins in BC
- March 17, 2020 – Public health emergency declared in BC
- March 21, 2020 – Business shutdown
- May 19, 2020 – Phase 2 of BC reopening plan (2020)
- June 24, 2020 – Phase 3
- October 19, 2020 – COVID-19 second wave

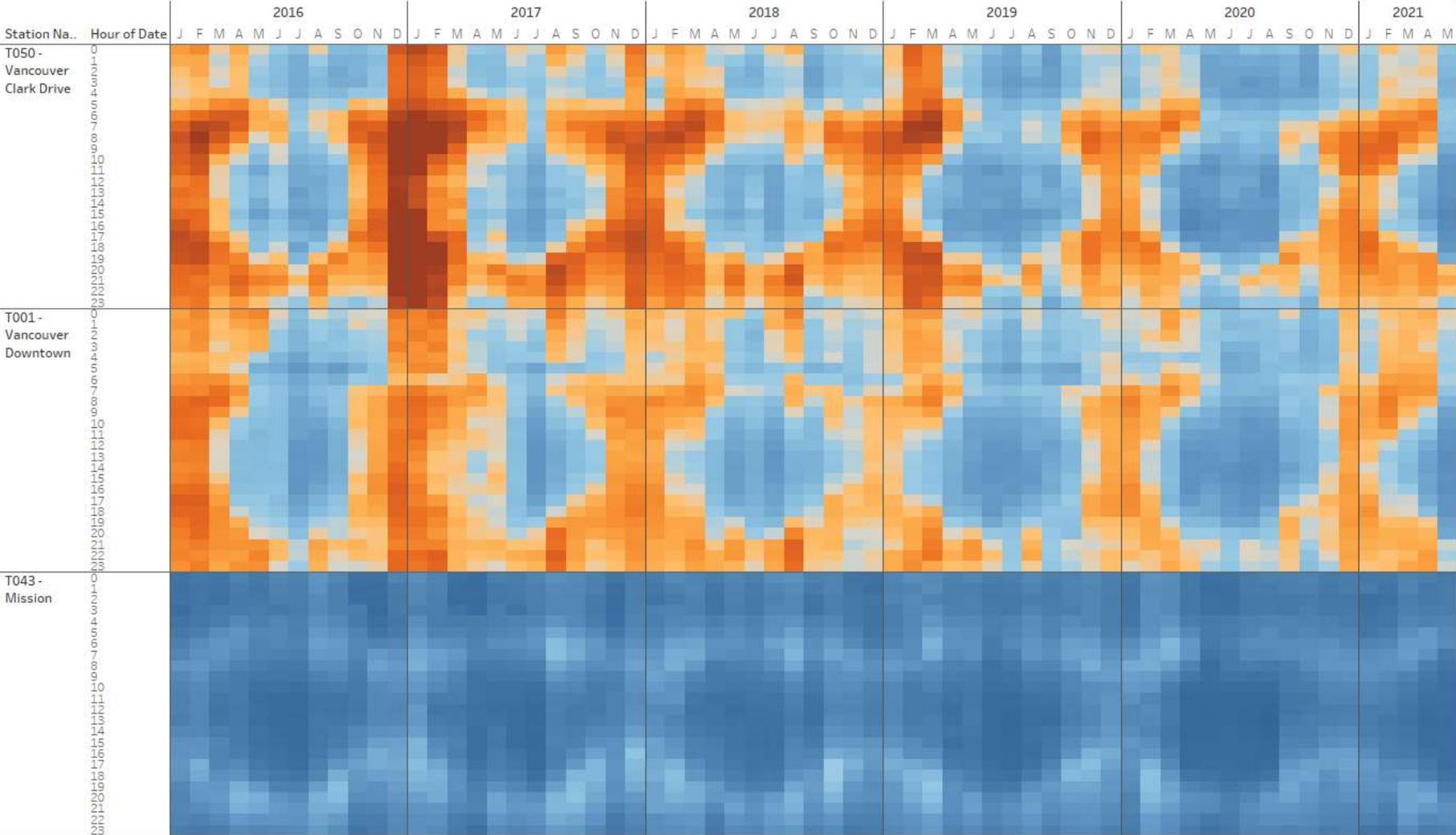
COVID-19 IMPACTS ON AIR QUALITY

- Involuntary experiment with impacts on emissions
- Differences between urban influenced stations and rural stations
- Different contaminants tell different stories
- Focus on NO₂ and PM_{2.5}
- Meteorological influences can be significant and can outweigh changes in emission
- NO₂ CAAQS for 2020 are below objective

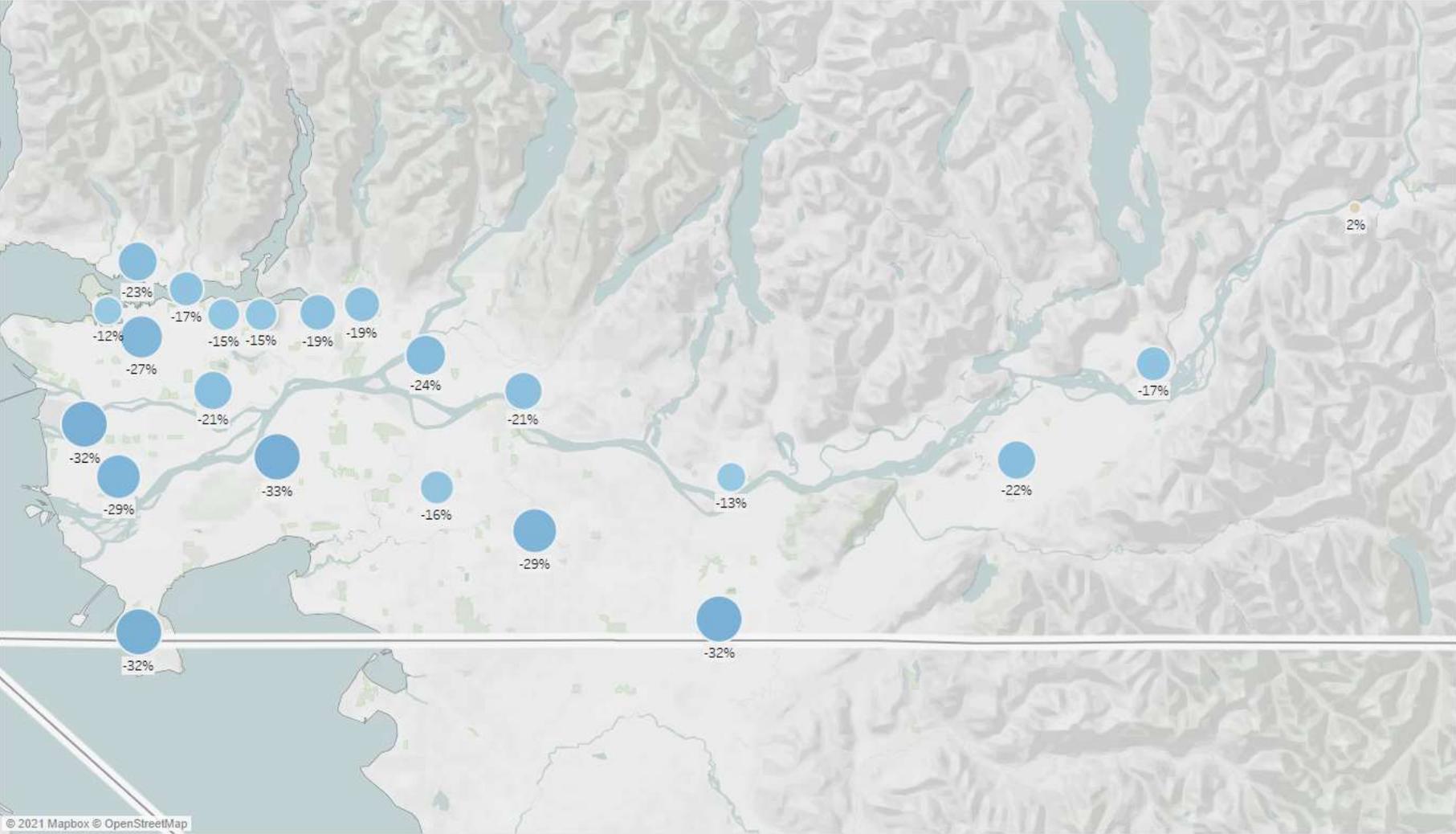
1-hour NO2 CAAQS



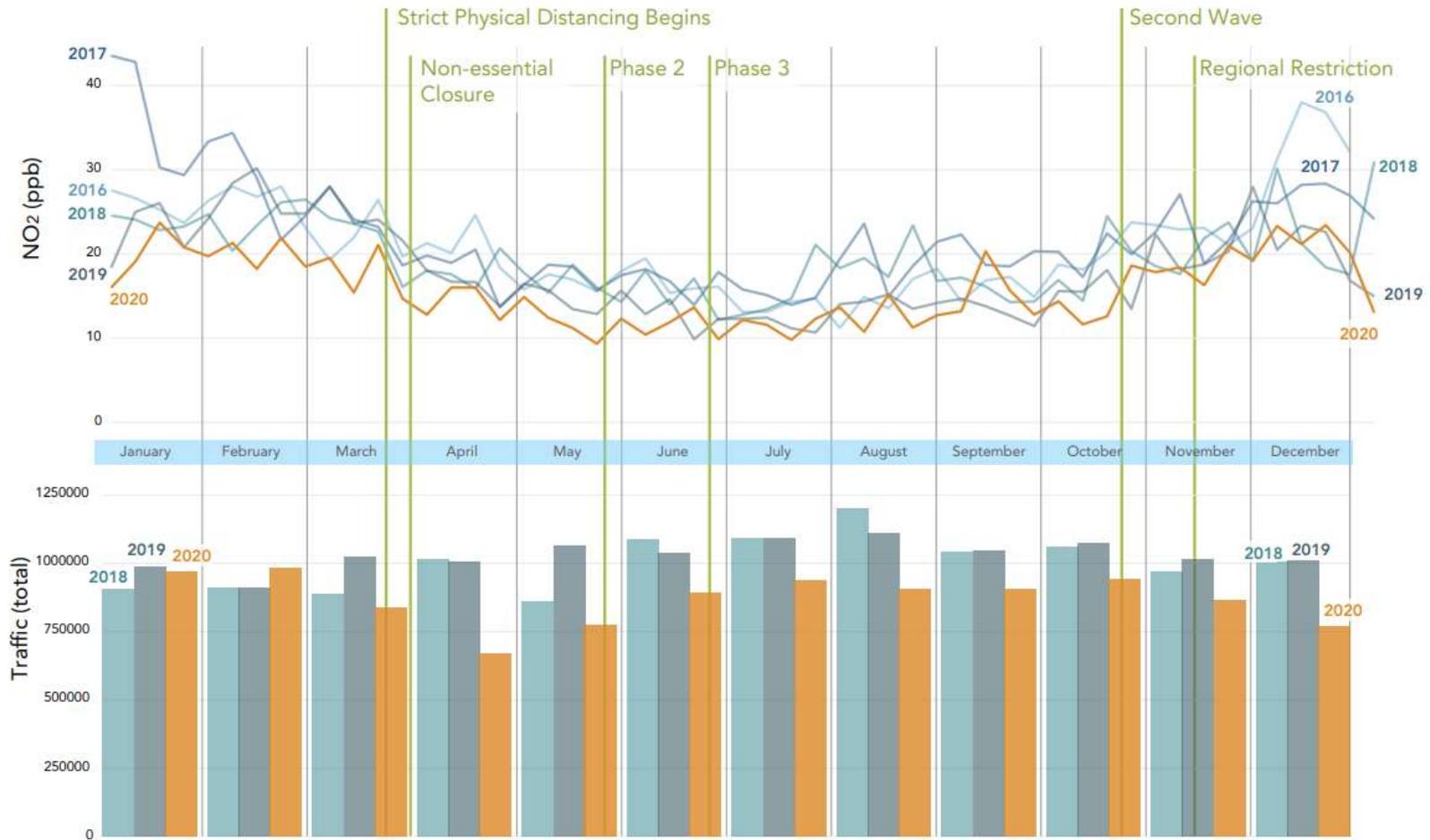
Dirunal NO2 by month at T050 - Vancouver Clark Drive, T001 - Vancouver Downtown, T043 - Mission



Change in average monthly NO2 between 2019 and 2020 - March

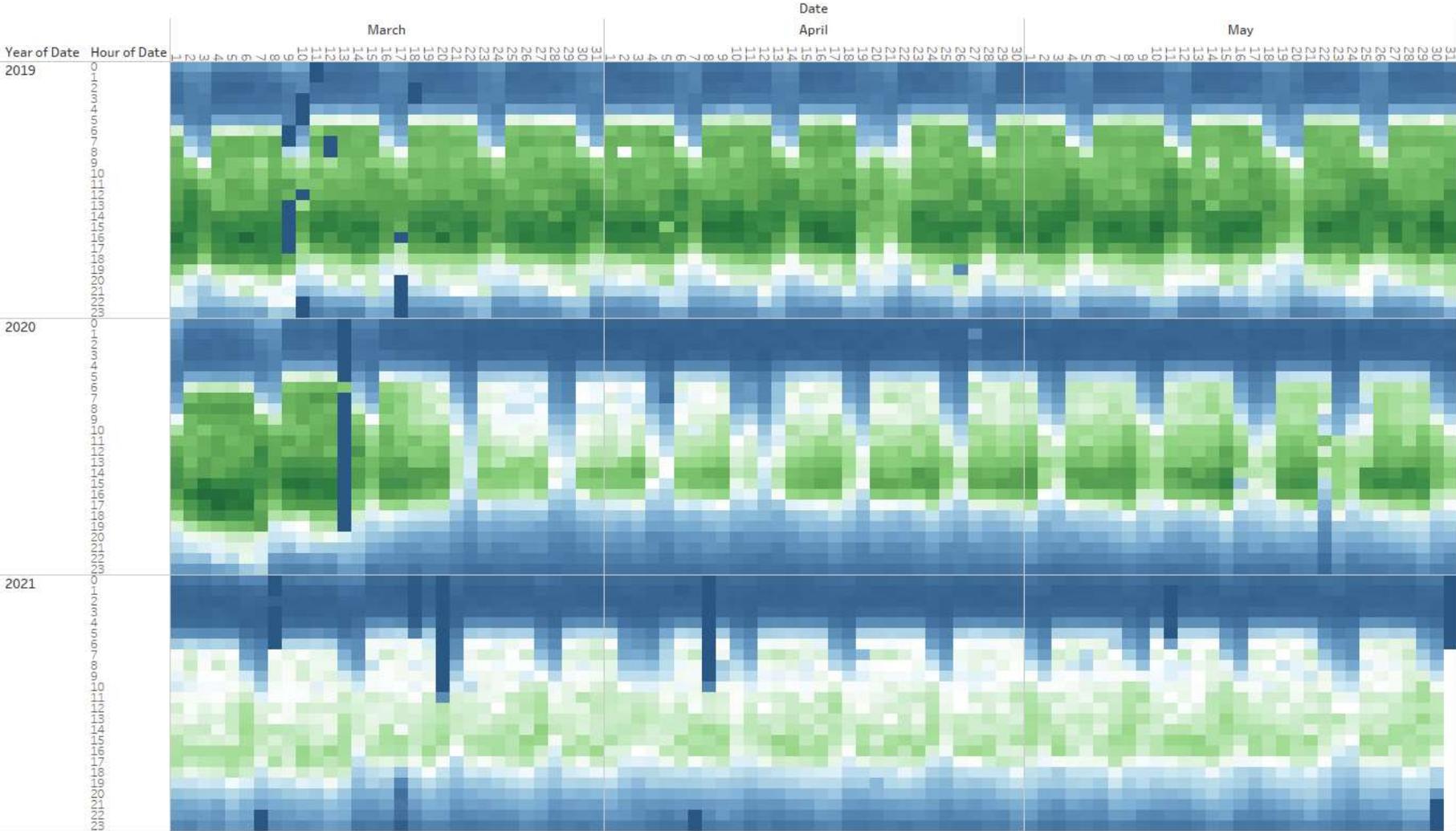


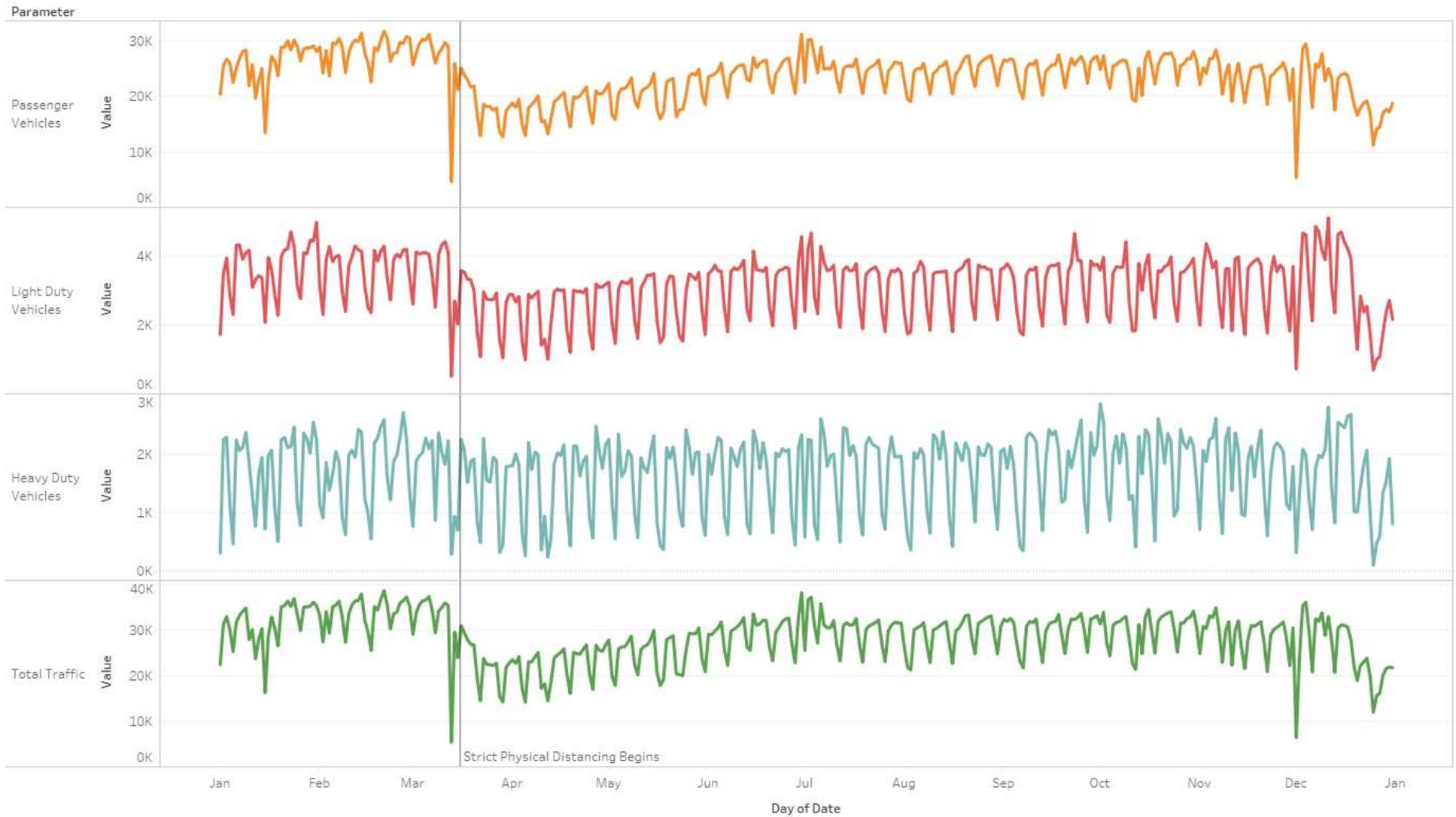
Monthly average nitrogen dioxide (NO₂) concentrations by year at Vancouver's Clark Drive air monitoring station.



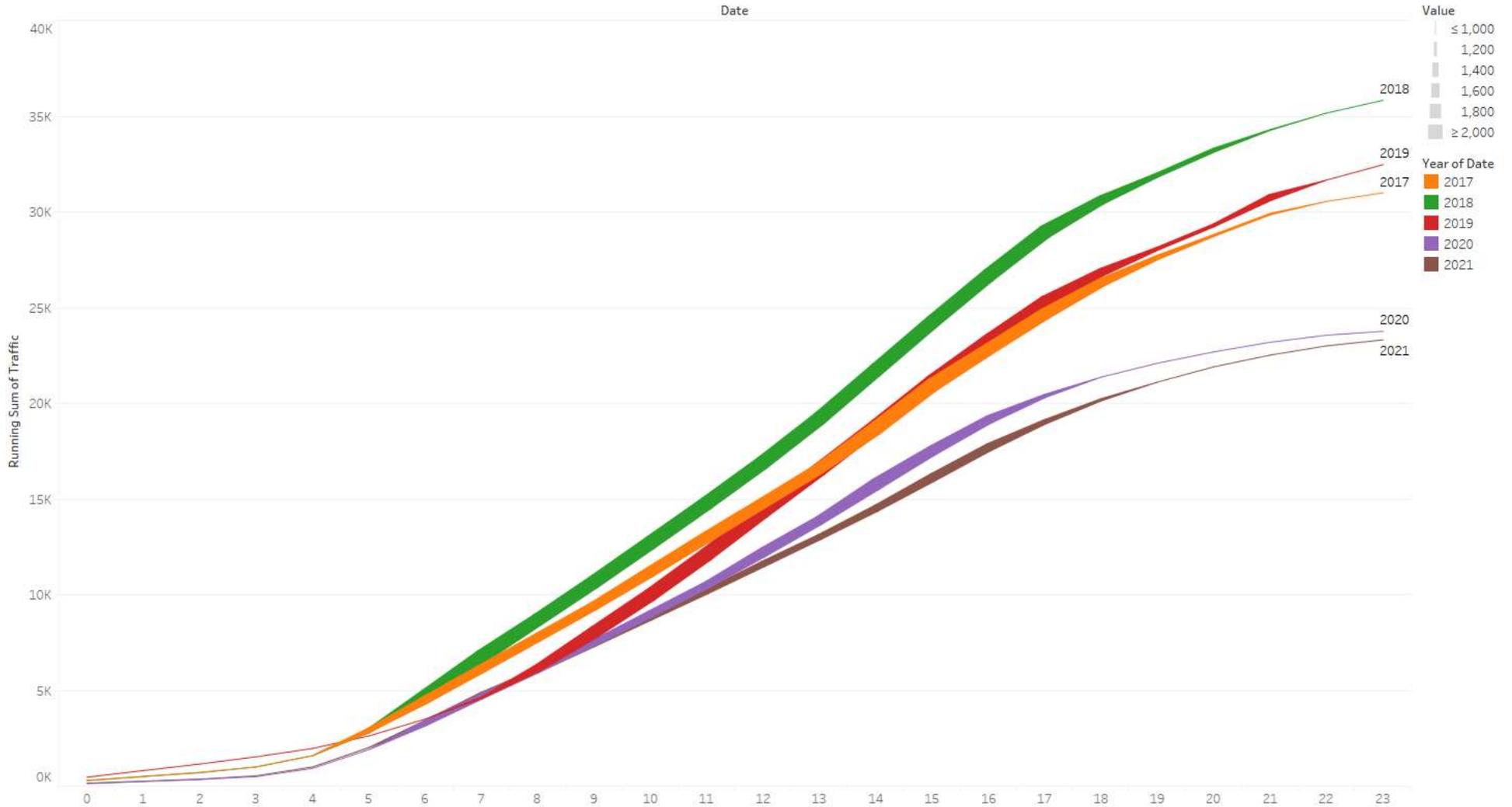
Monthly traffic counts by year at Vancouver's Clark Drive station.

T050 Vancouver Clark Drive - Hourly Total Traffic



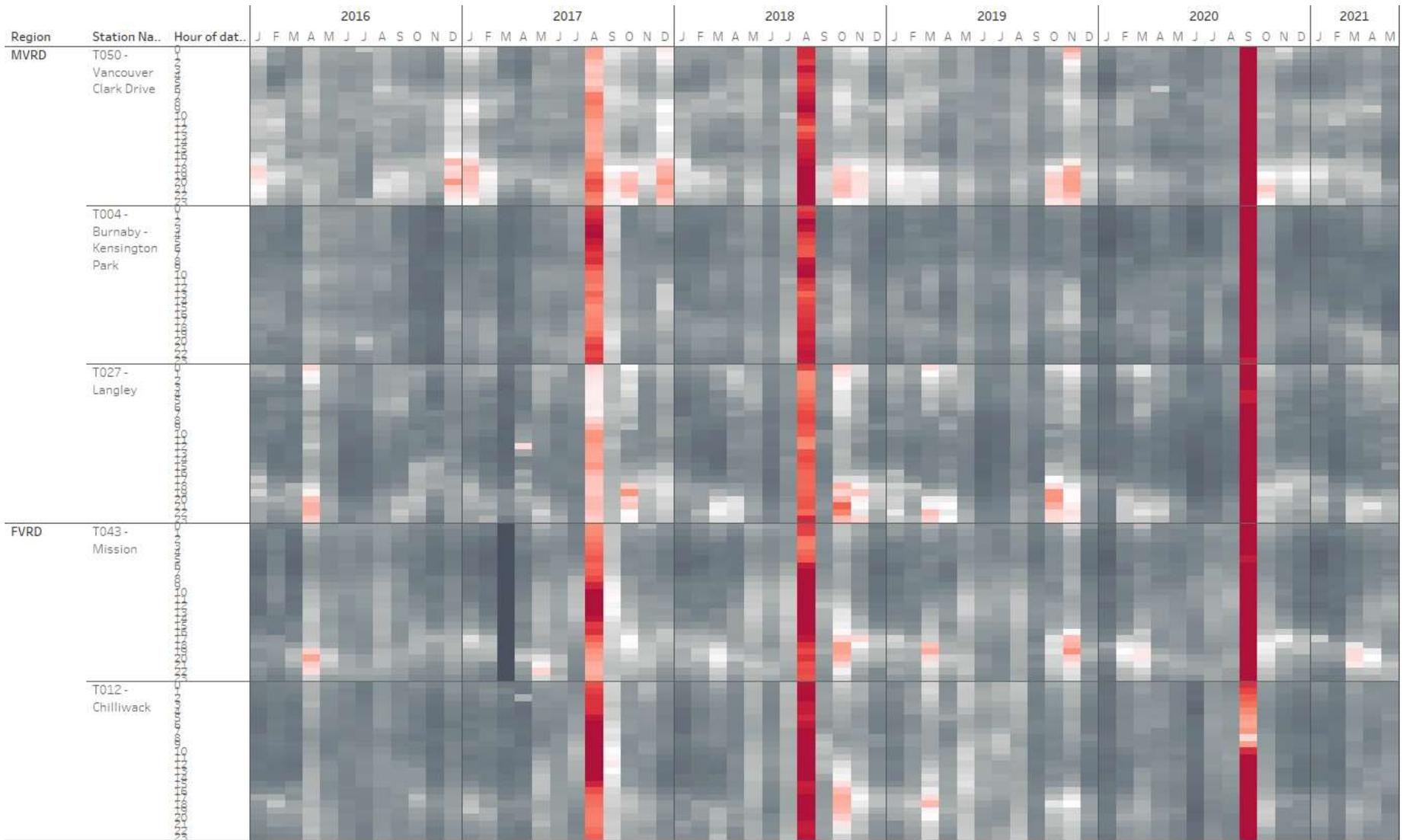


Clark Drive Total Cumulative Traffic - March 23

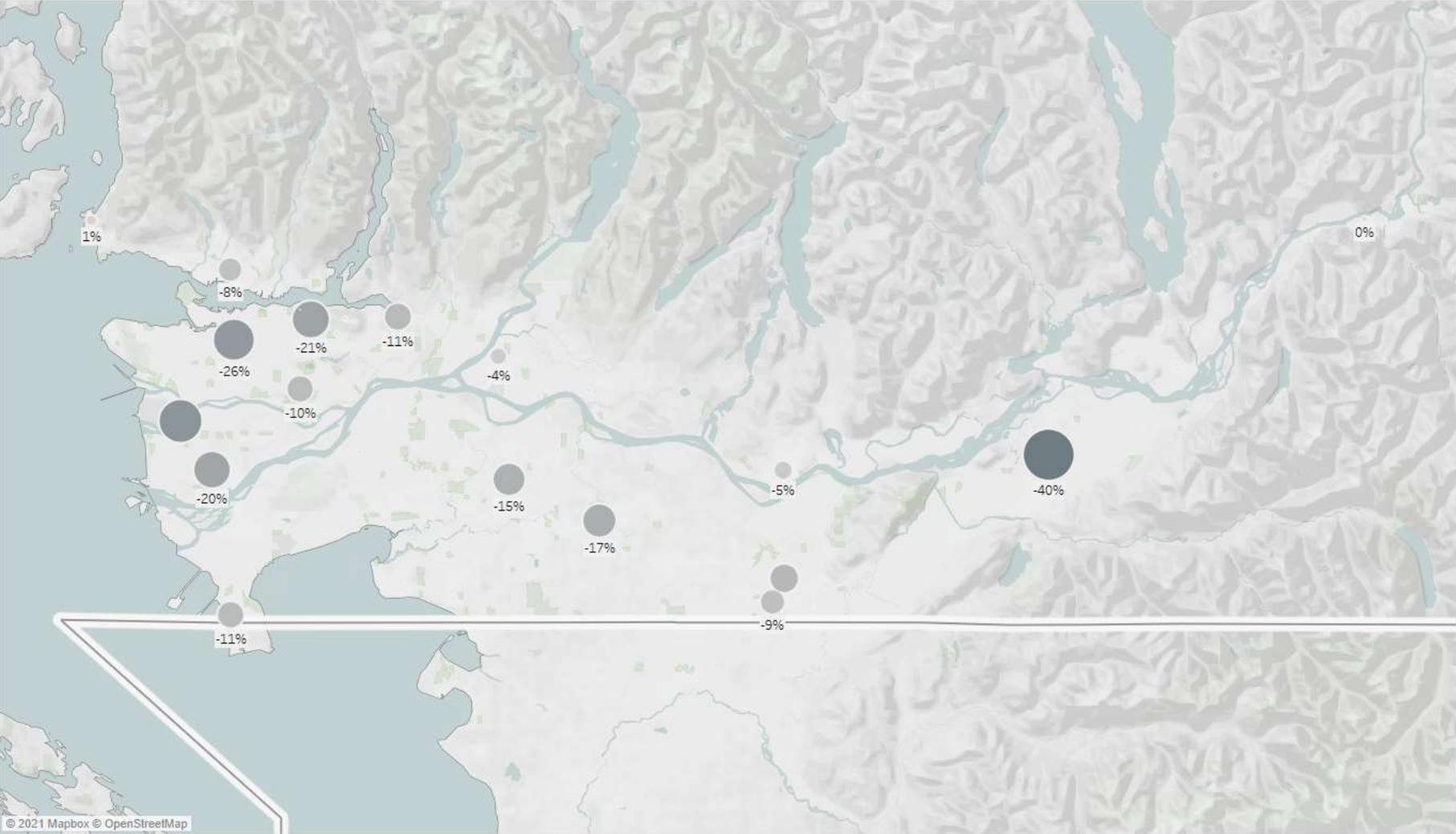


COVID-19 IMPACTS ON PM2.5

- Less clear how fine particulate concentrations have been impacted
- It is possible that more residential wood burning occurred in March – May 2020 since more people were at home
- Difficult to analyze the data due to wildfire influences in summer months



Change in average monthly PM2.5 between 2019 and 2020 - March



CURRENT RESEARCH

- Complicating factor in LFV: anomalous ridge of high pressure during initial lockdown
 - Stagnant conditions persisted which offset the reductions in emissions
 - Measurements indicated higher concentrations compared to previous years
- After ridge passed, reductions in NO₂ concentrations of up to 30% were observed compared to previous years at urban stations
 - Reductions were in line with other major urban areas in North America and Europe

CURRENT RESEARCH

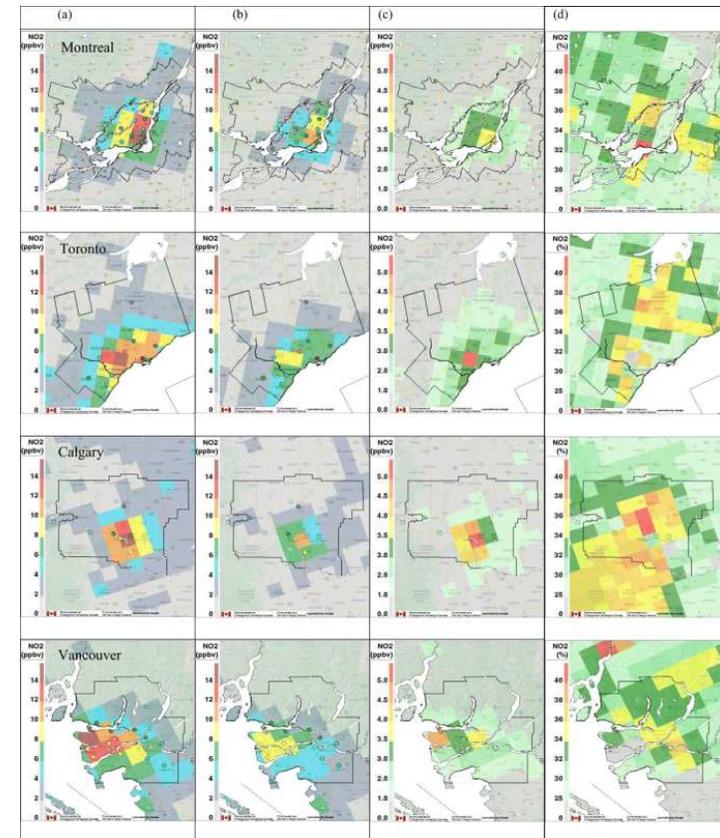
- Preliminary studies focused on satellite measurements
 - Found that for many regions, large reduction in concentrations
 - In LFV, typically these studies did not find reduction
- NAPS has done great work comparing various methodology:
 - Year over year comparison
 - Pre and post lockdown comparison
 - Machine learning

Table 1 Mean hourly observed NO₂, PM_{2.5}, and O₃ concentrations averaged over the pre-lockdown and lockdown periods in 2020 and 2010–2019 for the four CMA

	NO ₂ (ppbv)			PM _{2.5} (µg m ⁻³)			O ₃ (ppbv)			
	Pre-lockdown	Lockdown	% change ²	Pre-lockdown	Lockdown	% change ²	Pre-lockdown	Lockdown	% change ²	
Montreal (14 stations for NO ₂ , 15 for PM _{2.5} , and 13 for O ₃)	2010–2019	12.7	8.5	-33.1	9.8	6.7	-31.6	27.5	31.7	15.3
	2020	9.4	4.7	-50.0	8.5	5.5	-35.3	30.0	33.3	11.0
	% change ¹	-26.0	-44.7	-13.3	-17.9	9.1				
Toronto (9 stations for NO ₂ , PM _{2.5} , and O ₃)	2010–2019	13.4	10.9	-18.7	7.5	5.9	-21.3	28.1	31.7	12.8
	2020	9.3	7.0	-24.7	6.8	5.6	-17.6	29.9	31.7	6.0
	% change ¹	-30.6	-35.8	-9.3	-5.1	6.4				
Calgary (4 stations for NO ₂ , PM _{2.5} , and O ₃)	2010–2019	18.9	11.4	-39.7	8.7	7.2	-17.2	23.1	31.4	35.9
	2020	13.0	6.9	-46.9	5.6	5.1	-8.9	27.3	36.1	32.2
	% change ¹	-31.2	-39.5	-35.6	-29.2	18.2				
Vancouver (12 stations for NO ₂ , 11 for PM _{2.5} , and 12 for O ₃)	2010–2019	11.8	8.6	-27.1	4.3	4.5	4.7	21.1	27.1	28.4
	2020	10.5	7.0	-33.3	4.3	4.6	7.0	21.4	27.6	29.0
	% change ¹	-11.0	-18.6	0.0	2.2	1.4				

¹ % change in 2020 compared to 2010–2019

² % change in lockdown period compared to pre-lockdown period



Mashayekhi, R., Pavlovic, R., Racine, J. *et al.* Isolating the impact of COVID-19 lockdown measures on urban air quality in Canada. *Air Qual Atmos Health* (2021). <https://doi.org/10.1007/s11869-021-01039-1>

FUTURE WORK

- Continued monitoring through 2021
- Metro Vancouver 2019 GHG and 2020 airshed emissions inventories
- Will changes in regional emissions be sustained?



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Together we make our region strong