Mass reconstruction and chemical composition of PM2.5 in Buenos Aires

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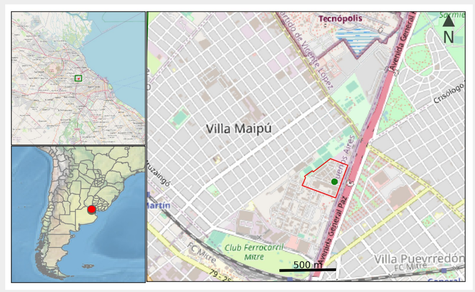
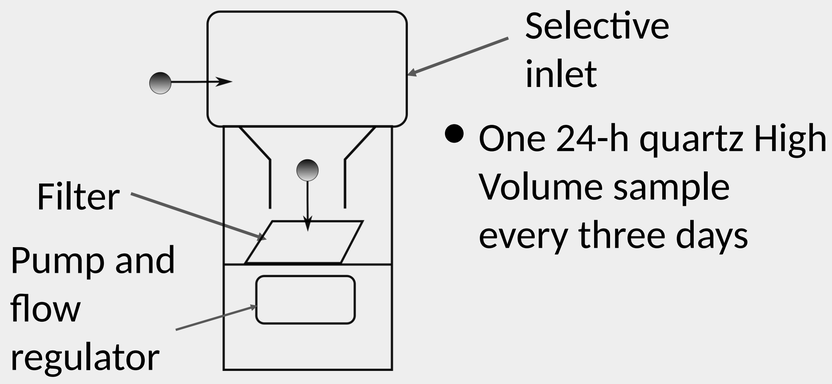
Experimental design

- 100 samples of PM2.5 (Ap 2019-March 2020)
- Full chemical composition (EC/OC, IC, ICP-MS)
- Definition of a mass reconstruction strategy and analysis of probable sources



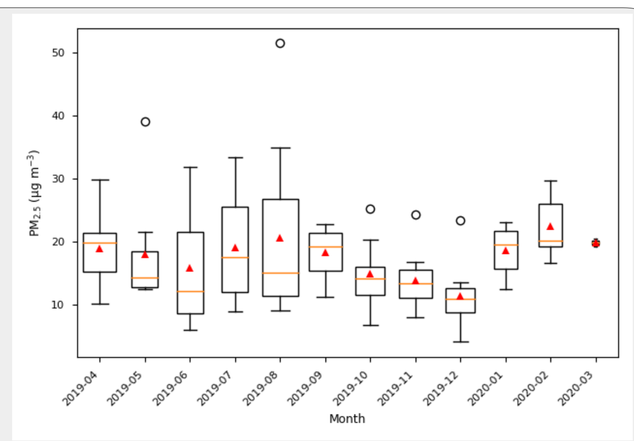


- One 24-h quartz High Volume sample every three days

Results: PM2.5 total mass, exceedances vs. guidelines

- As a megacity, PM2.5 levels in Buenos Aires are not particularly high
- There are still many exceedances compared to the 2021 WHO Air Quality Guidelines.

Target	Samples exceeding (%)
Interim target 1 (75 μg/m^3)	0
Interim target 2 (50 μg/m^3)	1
Interim target 3 (37.5 μg/m^3)	2
Local regulations (35 μg/m^3)	2
Interim target 4 [1] (25 μg/m^3)	14
AQG level (15 μg/m^3)	54
Yearly average (μg m^{-3})	17.5



Mass reconstruction strategy

Generalized mass reconstruction equation: $\mathrm{PM}_{2.5} = \beta_{OC}\mathrm{OC} + \sum_i \beta_i \mathrm{II}_i + \beta_{GM}\mathrm{GM} + \{\mathrm{SSA}\} + \{\mathrm{Trace}\} + \mathrm{EC} + \{\mathrm{KNON}\}$

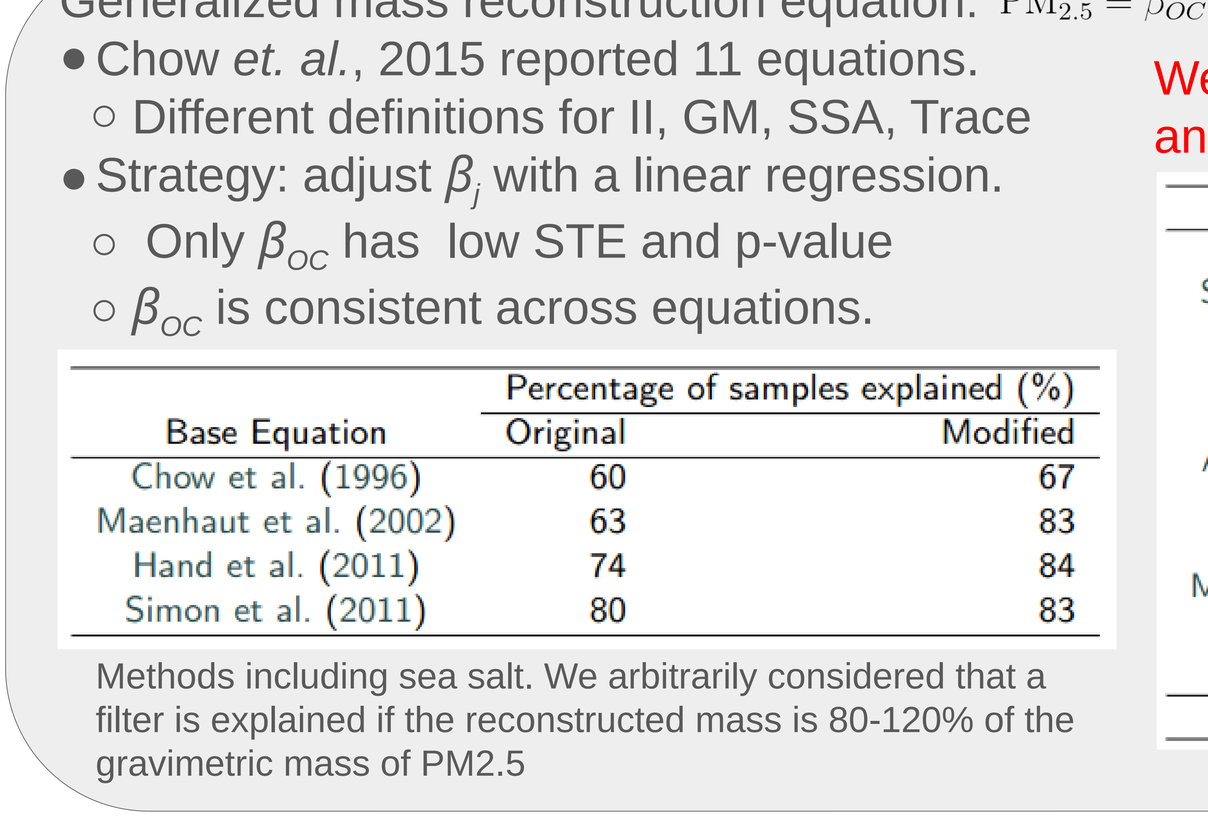
- Chow *et. al.*, 2015 reported 11 equations.
  - Different definitions for II, GM, SSA, Trace
- Strategy: adjust β_j with a linear regression.
  - Only β_{OC} has low STE and p-value
  - β_{OC} is consistent across equations.

We analyzed separately days with regional smoke events, and found a different β_{OC}

	Percentage of samples explained (%)	
Base Equation	Original	Modified
Chow et al. (1996)	60	67
Maenhaut et al. (2002)	63	83
Hand et al. (2011)	74	84
Simon et al. (2011)	80	83

Methods including sea salt. We arbitrarily considered that a filter is explained if the reconstructed mass is 80-120% of the gravimetric mass of PM2.5

Base Equation	$\beta_{OC}^{no\ event}$	SE	p-value	β_{OC}^{event}	SE	p-value
Macias et al. (1981)	2.04	0.25	2e-10	2.61	0.30	5e-09
Solomon et al. (1989)	1.97	0.26	1e-09	2.65	0.31	7e-09
Chow et al. (1994)	1.97	0.26	1e-09	2.65	0.31	7e-09
Malm et al. (1994)	2.09	0.23	7e-12	2.77	0.19	4e-14
Chow et al. (1996)	1.97	0.26	1e-09	2.65	0.31	7e-09
Andrews et al. (2000) Malm et al. (2000)	1.97	0.26	1e-09	2.65	0.31	7e-09
DeBell et al. (2006)	2.01	0.26	4e-10	2.61	0.29	2e-09
Maenhaut et al. (2002)	2.00	0.26	9e-10	2.60	0.32	2e-08
Hand et al. (2011)	1.97	0.25	5e-10	2.66	0.30	2e-09
Simon et al. (2011)	2.01	0.25	3e-10	2.61	0.31	7e-09
Sample size		68			31	



Conclusions

- The organic mass explains 40-60% of the total filter mass. The rest is explained by inorganic ions and geological minerals, with only minor elemental carbon and sea salt aerosol concentrations.
- Every equation performed better with β_{OC} = 2 if there is no event, β_{OC} = 2.6 if there is a smoke event.

Acknowledgements

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