(Sub)Task 1.2.1: Offline PMF

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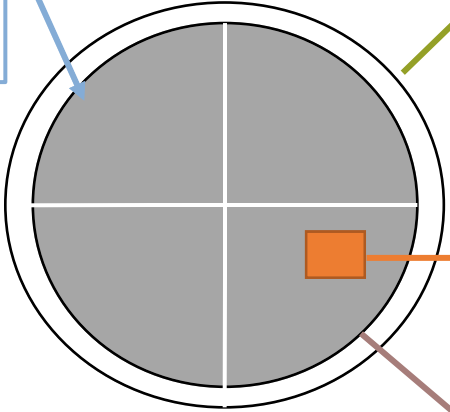
Offline PM filters speciation

- Objectives
  - Reccomend on the best procedure to perform PMF offline
  - Reccomend on the key species to be analyzed

	PM size	Years	Stations	Elements	OC-EC	Ions	PAHs	Sugars	Anhydro-sugars	Hopanes	Acids, polyols, methyltetrols	MSA, HULIS, Oxalate and Cellulose
Barcelona	PM10, PM1	2010, 2019, 2021	UB, Traffic	x	x	x	x	(x)	x	x	x	
Milan	PM10, PM2.5	2017-2019	UB	x	x	x			x			
Grenoble	PM10	2013	UB	x	x	x	x	x	x			x

Barcelona case study

Major and Trace elements
(ICP-MS)
(ICP-AES)



Organic markers
(GC-MS)

Organic Carbon &
Elemental carbon

Secondary
Inorganics:
*NH_4 (Electrode)
*SO_4, NO_3 & Cl (Ion
chromatography)

Ajuntament de Barcelona

TRAFFIC SITE
"EIXAMPLE"

BACKGROUND SITE
"PALAU REIAL"

3 campaigns:

2010
2019
2021

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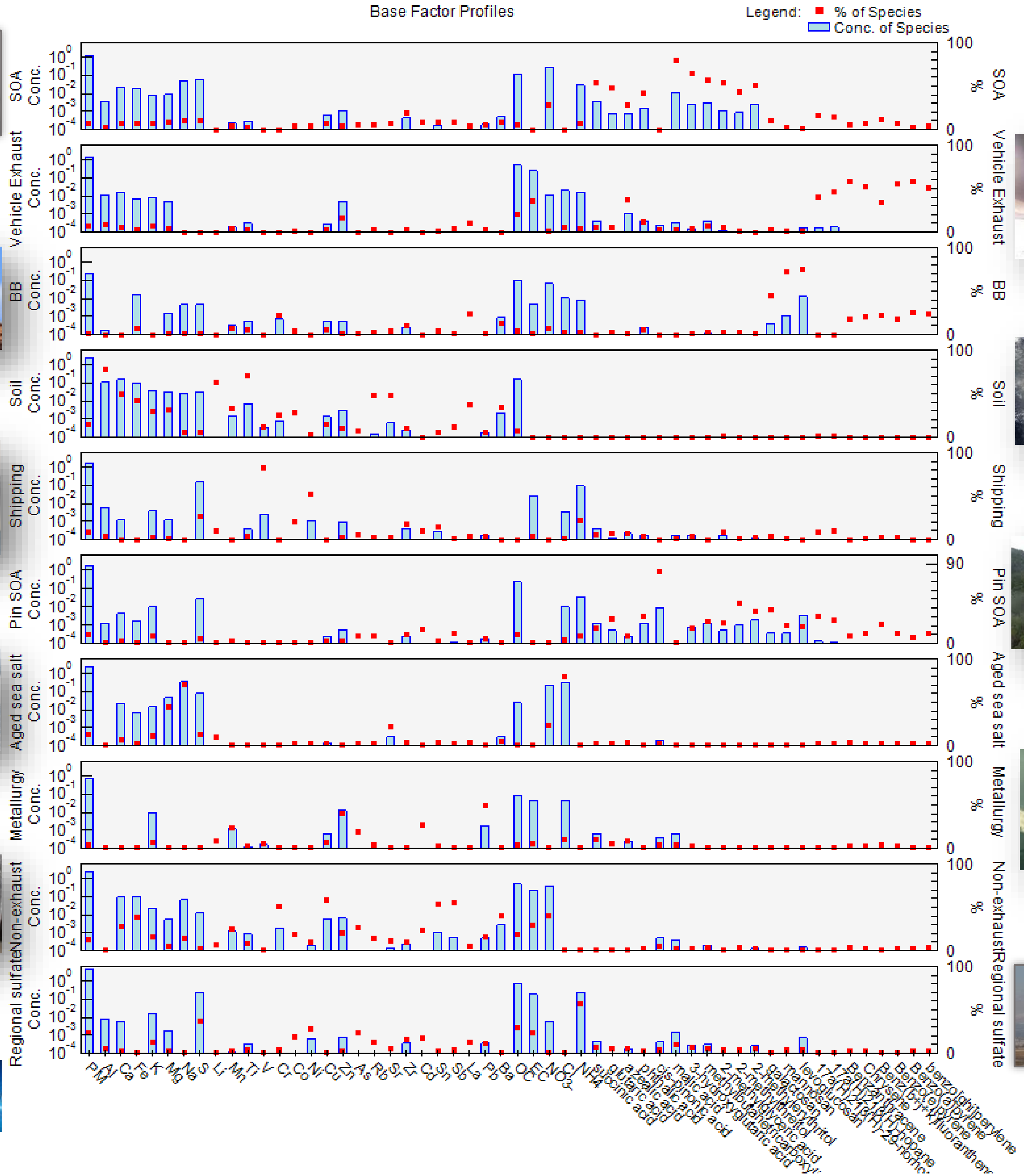
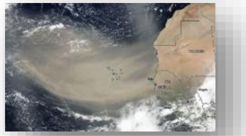
Aged SOA



Exhaust POA

Biomass burning



Soil

Shipping

Bio SOA

Aged sea salt

Metallurgy

Vehicle non-exhaust

Regional sulphate

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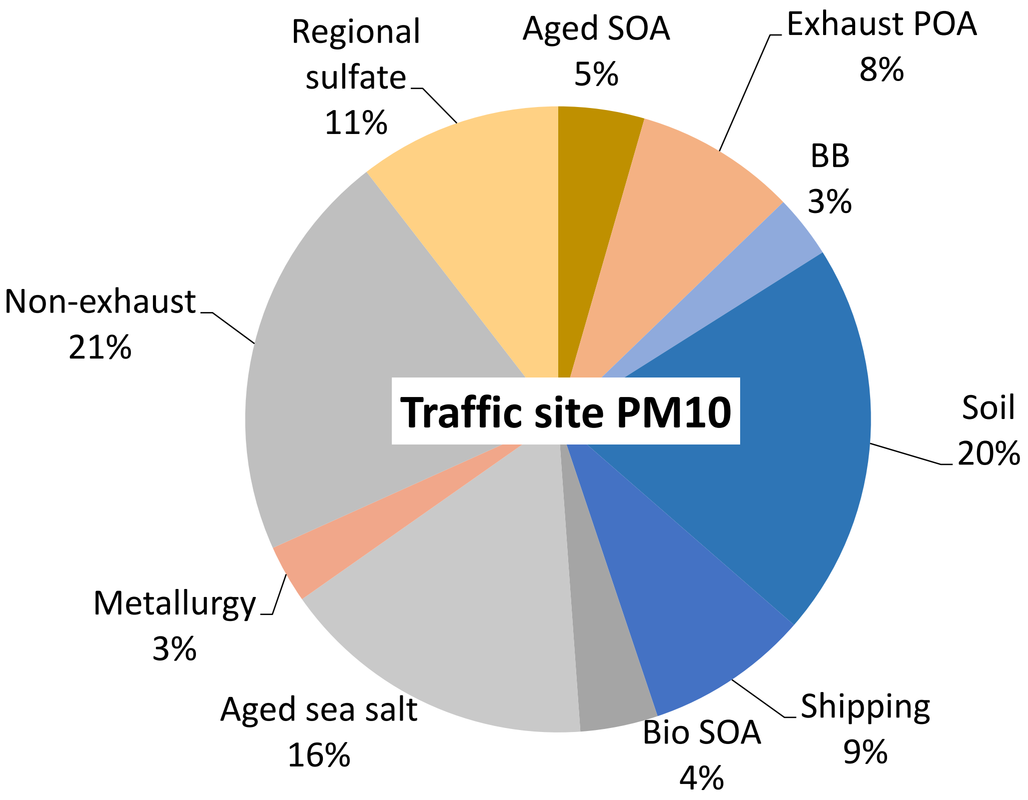
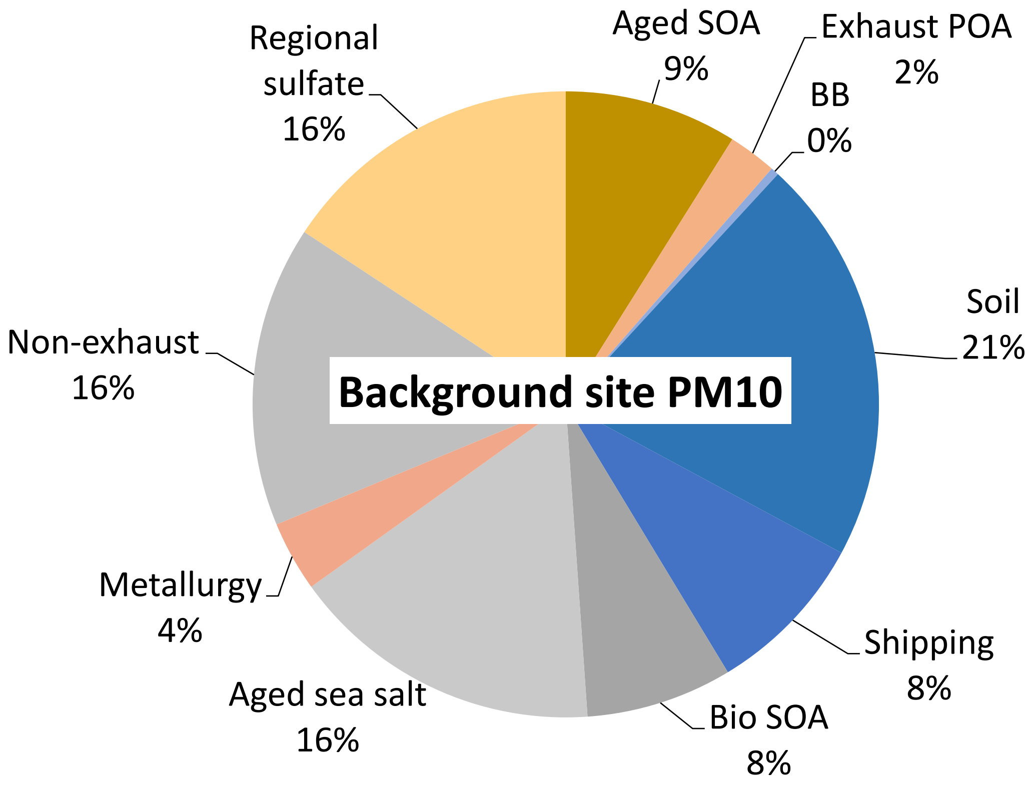
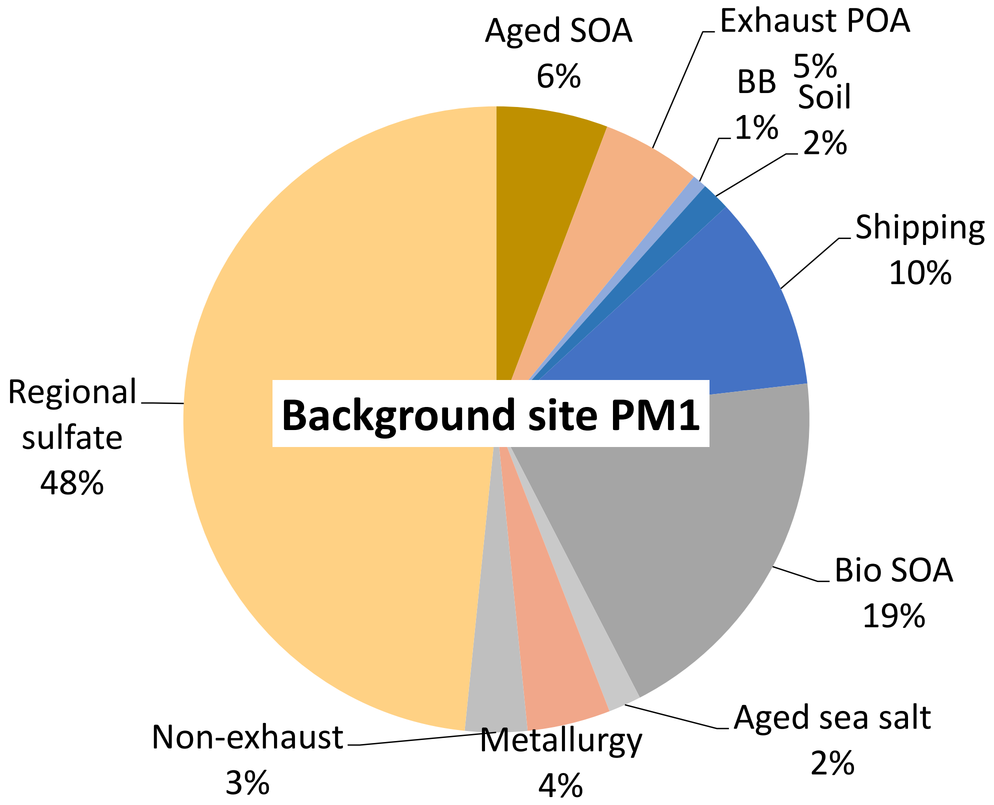

Regional sulfate 11%
Aged SOA 5%
Exhaust POA 8%
BB 3%
Soil 20%
Shipping 9%
Bio SOA 4%
Aged sea salt 16%
Metallurgy 3%
Non-exhaust 21%
Traffic site PM10
Aged SOA 6%
Exhaust POA 22%
BB 1%
Soil 1%
Shipping 13%
Bio SOA 13%
Aged sea salt 5%
Metallurgy 4%
Non-exhaust 2%
Regional sulfate 33%
Traffic site PM1

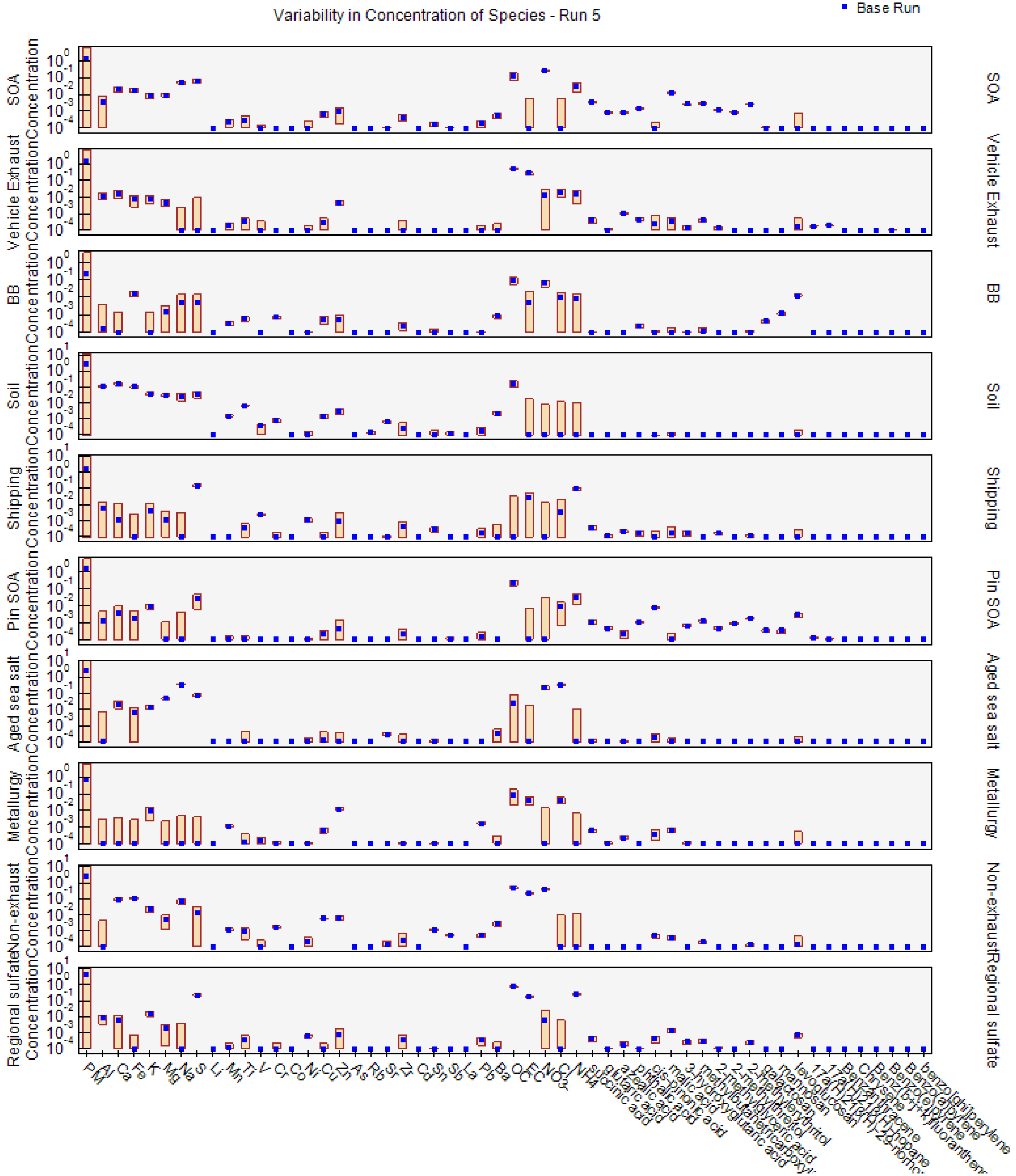

Background site PM10
Aged SOA 9%
Exhaust POA 2%
BB 0%
Soil 21%
Shipping 8%
Bio SOA 8%
Aged sea salt 16%
Metallurgy 4%
Non-exhaust 16%
Regional sulfate 16%


Background site PM1
Aged SOA 6%
Exhaust POA 5%
BB 1%
Soil 2%
Shipping 10%
Bio SOA 19%
Aged sea salt 2%
Metallurgy 4%
Non-exhaust 3%
Regional sulfate 48%

DISP analysis

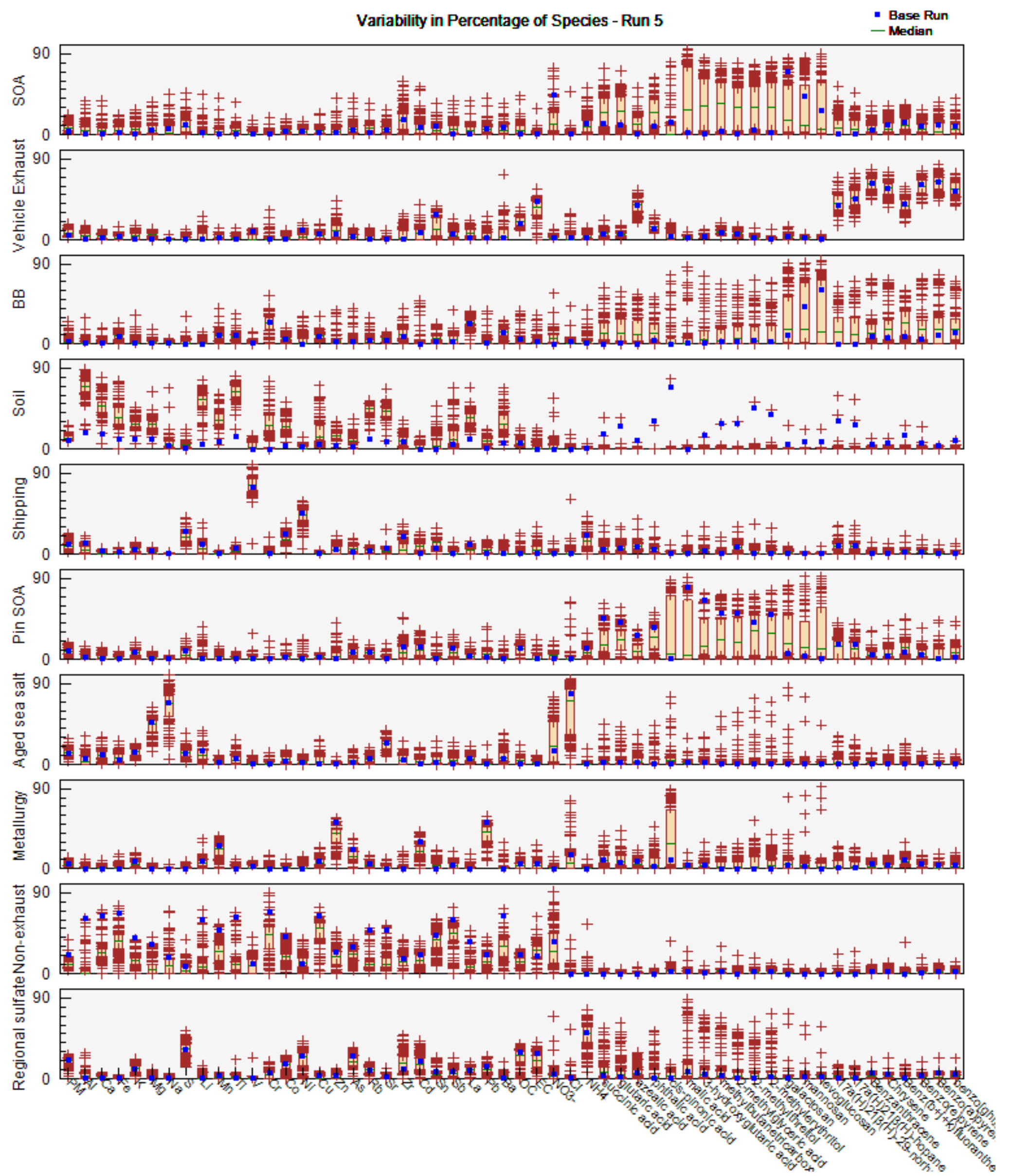
DISP Box Plots | DISP Summary

	0		-1.163						
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0



BS analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Unmapped
Boot Factor 1	70	0	1	0	1	5	1	1	6	8	7
Boot Factor 2	3	88	0	0	0	2	3	0	0	0	4
Boot Factor 3	12	0	79	0	0	2	0	0	2	0	5
Boot Factor 4	2	0	2	90	0	0	1	0	0	0	5
Boot Factor 5	0	0	0	0	99	0	0	0	1	0	0
Boot Factor 6	16	0	2	0	0	61	3	2	2	3	11
Boot Factor 7	0	0	0	0	0	0	100	0	0	0	0
Boot Factor 8	0	0	0	0	0	1	0	91	1	1	6
Boot Factor 9	1	0	1	0	0	0	1	1	92	1	3
Boot Factor 10	0	0	0	0	0	0	0	0	0	100	0



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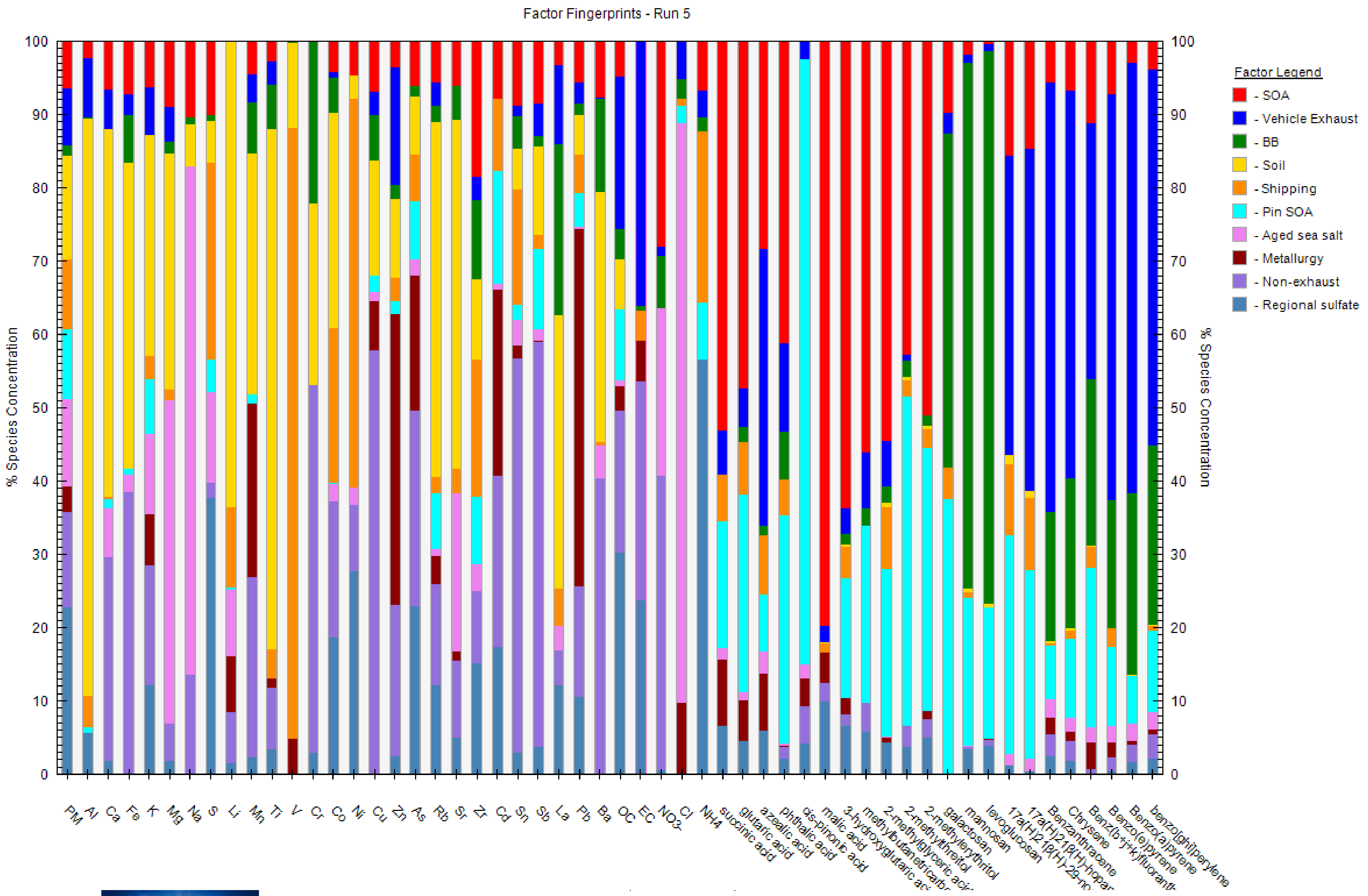

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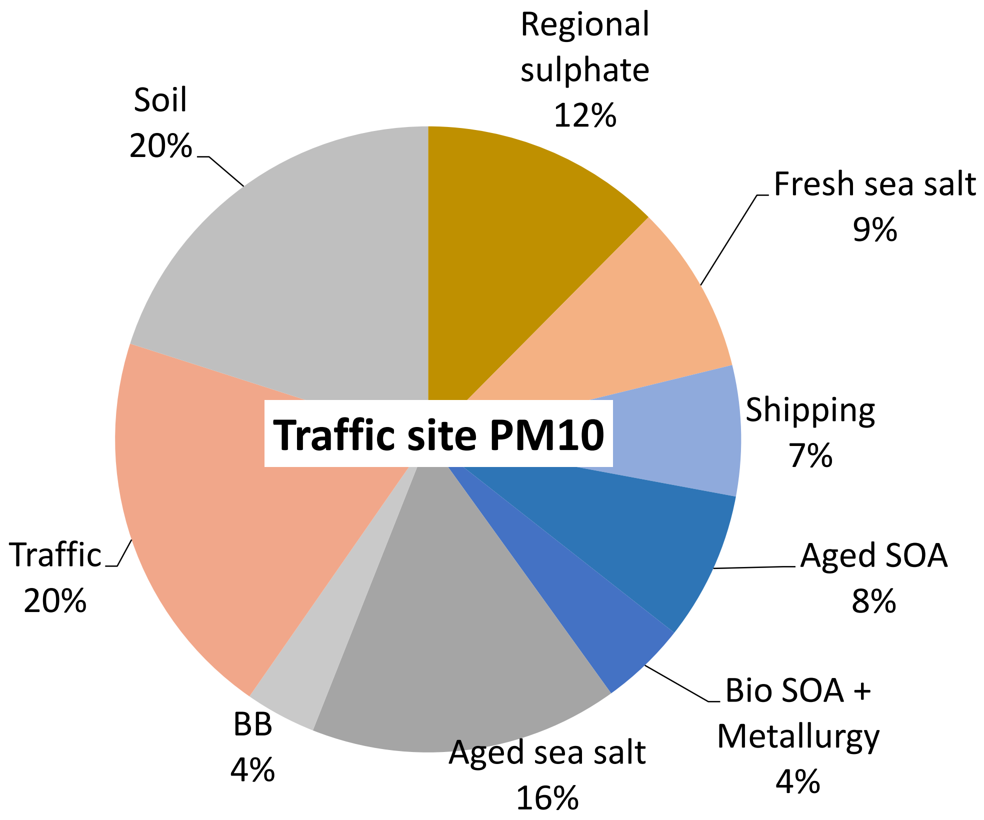
Excluding non-polar organics

9 factors only:

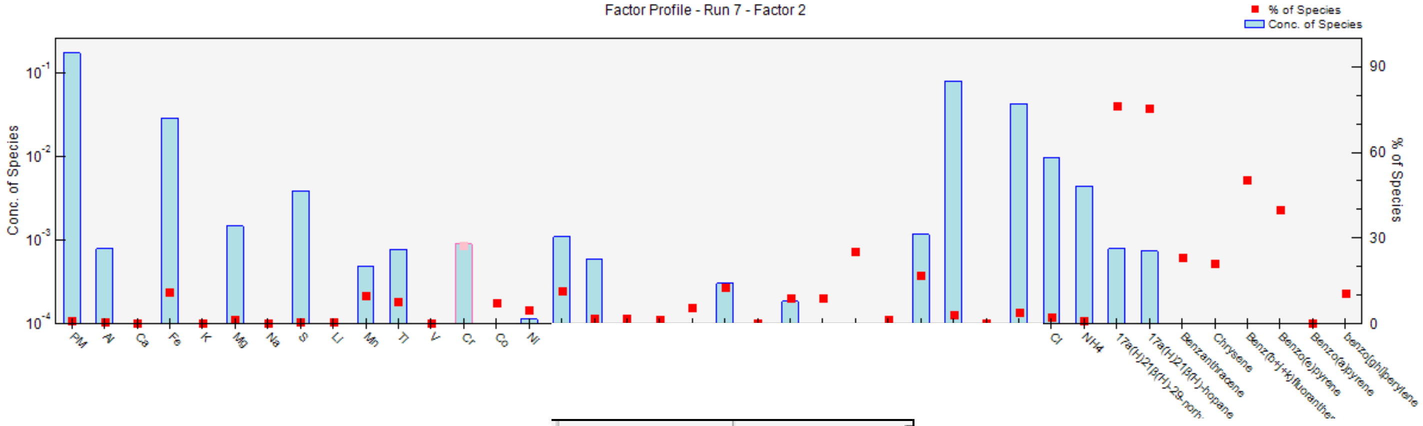
- Exhaust disappears
- Bio SOA is now merged with Metallurgy
- Sea salt (fresh and aged) contributions overestimated

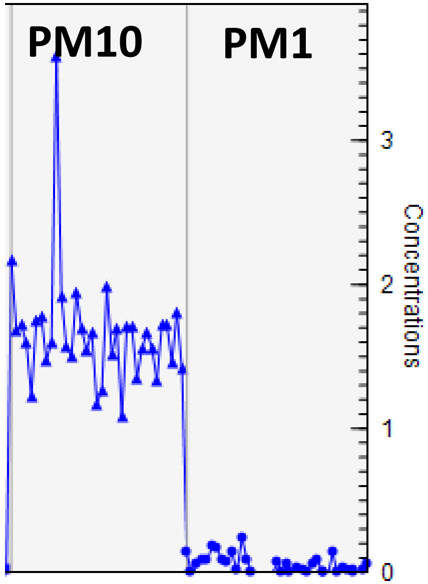


Excluding polar organics

9 factors:

- BB, Bio SOA and Aged SOA disappeared
- Hopanes from mineral lubricant wear appears
- Fresh and Aged sea salt separated





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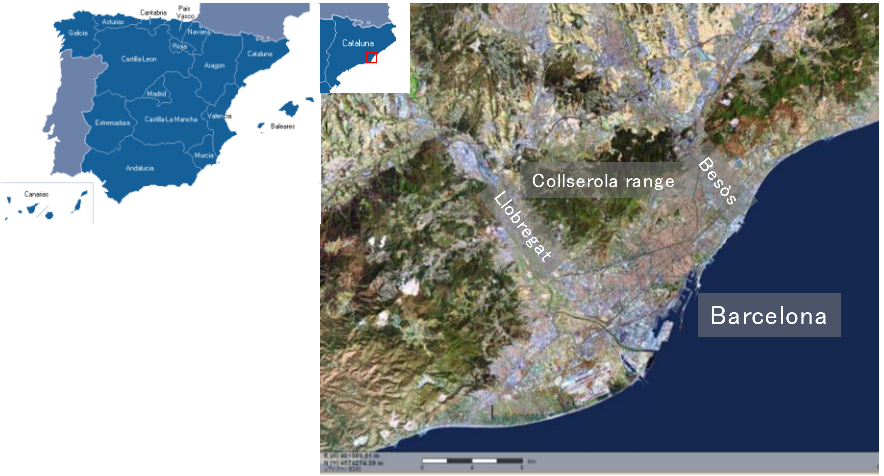
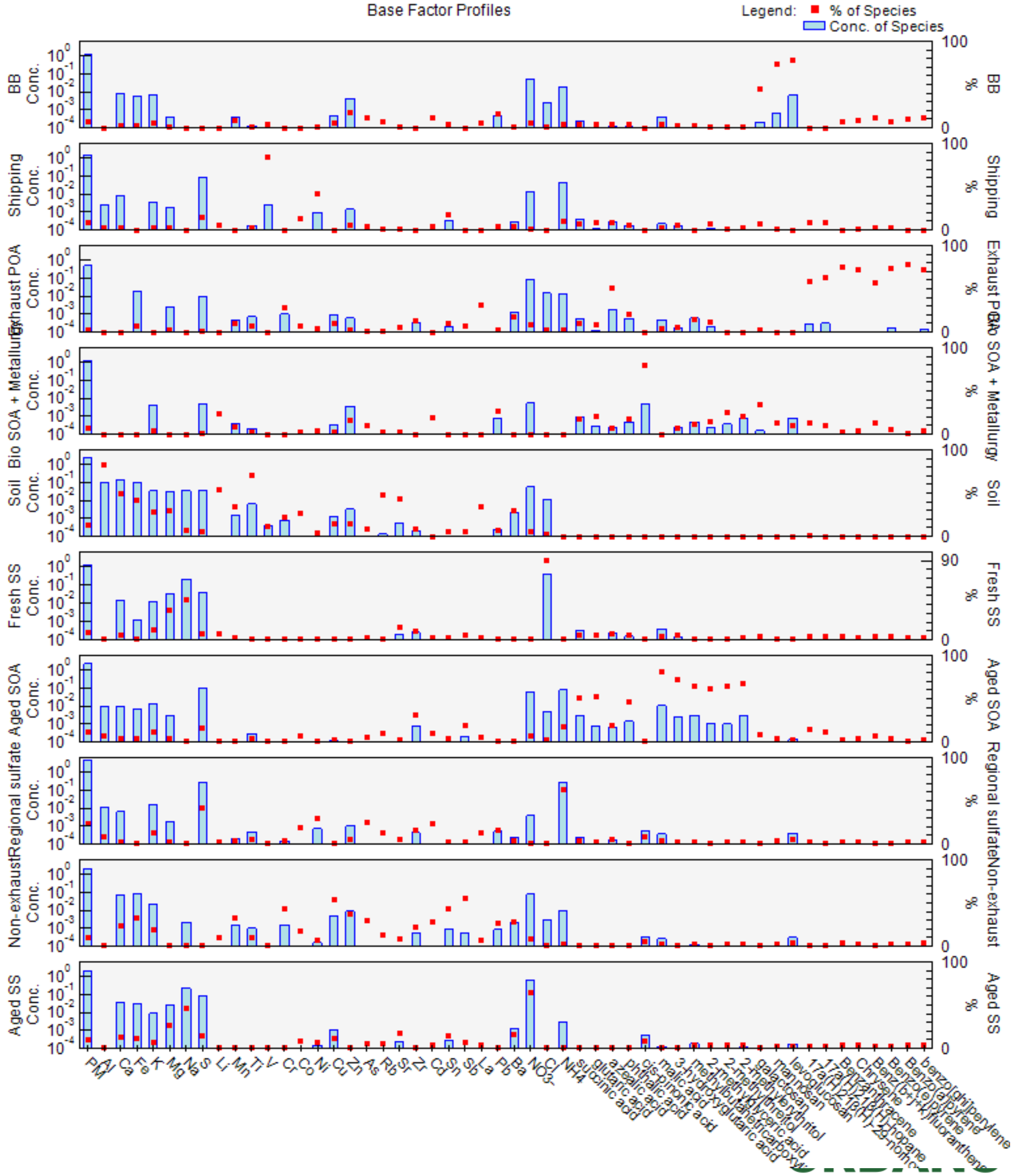
Excluding OC and EC

10 factors but:

- Bio SOA and Metallurgy are merged



- Aged sea salt and Fresh sea salt are separated



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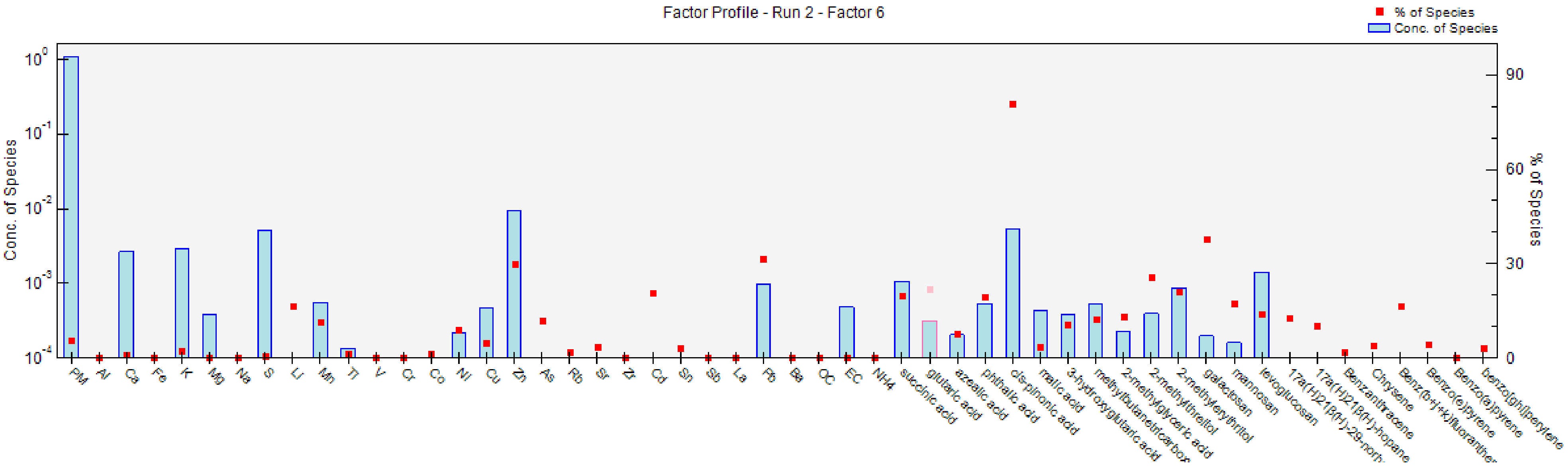
Excluding Ion chromatography (Cl^- and NO_3^-)

9 factors only

- Bio SOA mixed with Metallurgy (but no OC in the profile..)



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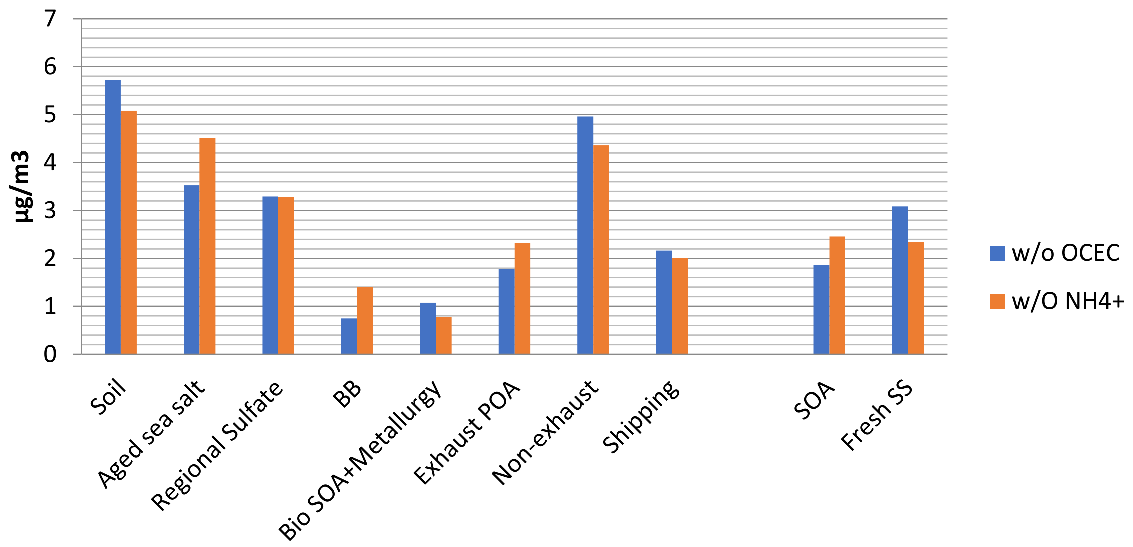
Excluding NH4+

Same result as if OC and EC were excluded:

- Bio SOA and Metallurgy are merged
- Aged sea salt and Fresh sea salt are separated



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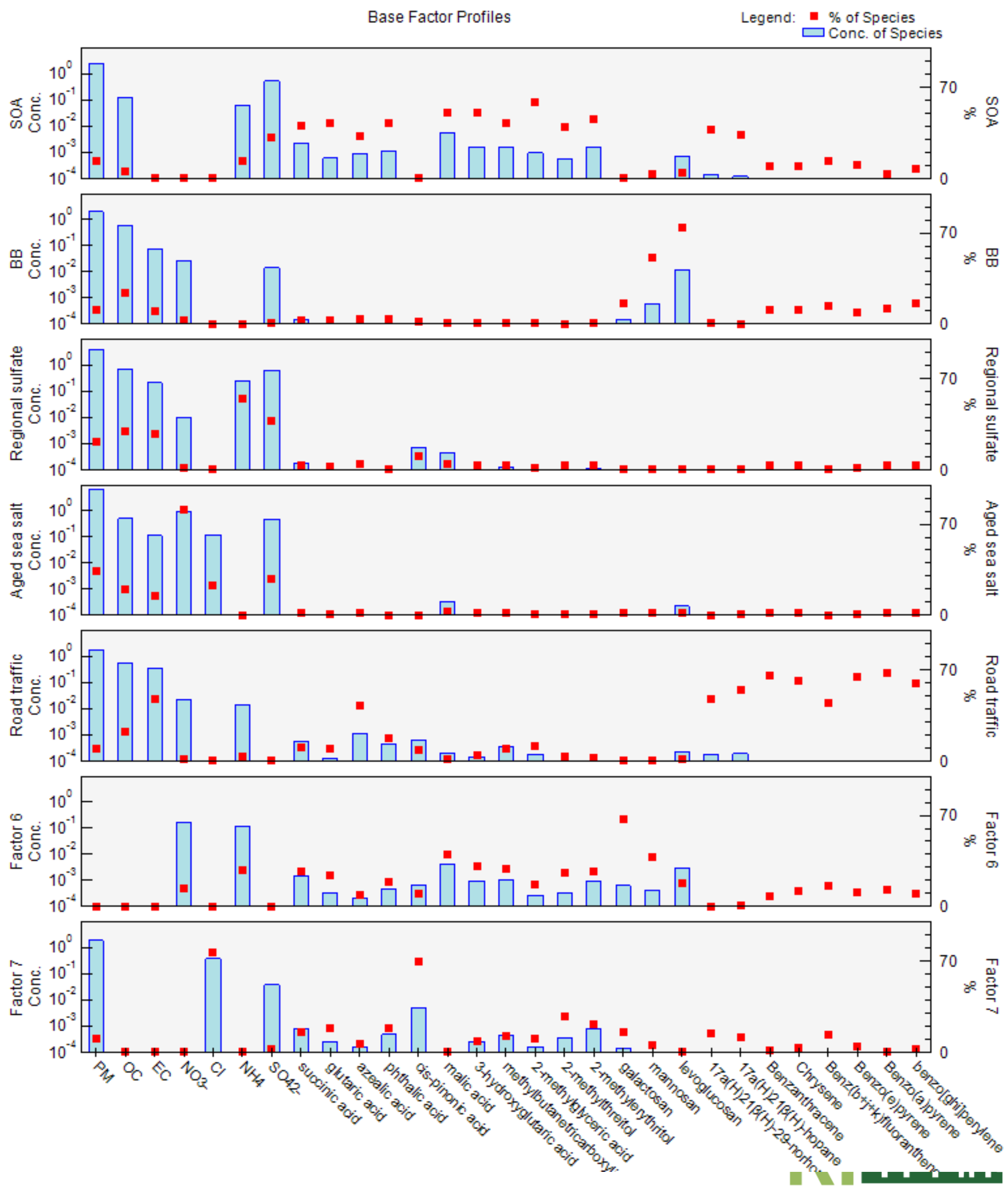
Excluding elements

6 factors only:

- Shipping, Metallurgy, Soil and Non-exhaust are missed



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Conclusions (for Barcelona case-study)

- All specie families resulted important
- Their absence can affect the whole source apportionment (not only the factor they trace)
- More affected factors: Bio SOA and Metallurgy
- Results are likely dataset-dependent. A meta-analysis among 3-4 sites will be more robust

Excluded species	Mass of input species (μg/m³)	Non-reconstructed mass (%)	# of factors
None	9.6	6	10
Non-polar organics	9.6	6	9
Polar organics	9.6	6	9
OC-EC	6.3	6	10
Cl- and NO3-	7.9	6	9
NH4+	9.2	6	10
Elements	7.4	11	6

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Thank you for your attention