Progress of task 2.1.

Health effects

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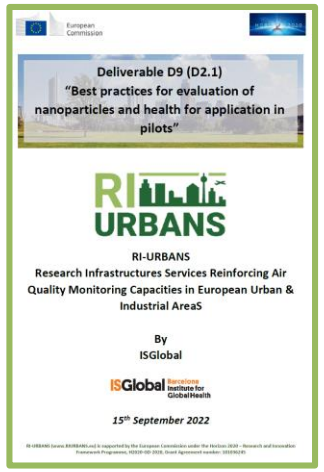
1st Science Meeting, 19th October 2022

T2.1. Improved evaluation of health effects in epidemiologic time series studies (M02-M36)

- **Objective:** link the time series of new air quality metrics (e.g. nanoparticles, BC, source contributions) to those of daily mortality and hospital admissions and meteorological parameters



WP2 Deliverables

D2.1: Best practices for evaluation of nanoparticles and health for application in pilots (ISGlobal, M12)

Data availability (PNSD & Health)

City (Country)	Station Name	Station Type	Population Inhab. (2018)	Period	UFP	BC	PM	Gases	Meteorology	Mortality	Hospitalization	Detection limit (nm)	PNSD Data availability (%)
Barcelona (ES)	Palau Reial	Urban	1.620.343	2013-2019	✓	✓	10, 2.5, 1	SO_2, NO, NO_2, O_3, CO	T, RH, P, RAD, WS, WD, RAIN	✓	✓	12.2	80
Madrid (ES)	CIEMAT-Moncloa	Urban	3.223.334	2009-2019	✓	✓	10, 2.5	SO_2, NO, NO_2, O_3, CO	T, RH, P, RAD, WS, WD, RAIN	✓	✓	15.1	53
Granada (ES)	UGR	Urban	232.208	2017-2019	✓	✓	10	SO_2, NO, NO_2, O_3, CO	T, RH, P, RAD, WS, WD	✓	✓	10.9	82
Budapest (HU)	CAAG	Urban	1.749.734	2013-2019	✓	No	10, 2.5	SO_2, NO, NO_2, O_3, CO	T, RH, P, RAD, WS, WD	✓	unavailable	10 (6)	88
Helsinki (FI)	Kumpula Campus	Urban	635.181	2009-2019	✓	✓	10, 2.5	SO_2, NO, NO_2, O_3, CO	T, RH, P, RAD, WS, WD	✓	request	10 (3)	98
	Mäkelänkatu	Traffic		2015-2019	✓	✓	10, 2.5	NO, NO_2, O_3, CO	T, RH, P, WS, WD			10 (6)	83
London (GB)	North Kensington	Urban	8.866.541[a]	2009-2019	✓	✓	10, 2.5, 1	SO_2, NO, NO_2, O_3, CO	T, RH, P	✓	✓	17	66
	Honor Oak Park	Urban		2018-2019	✓	✓	10, 2.5, 1	NO, NO_2, O_3	T, RH, P			17	31
	Marylebone Road	Traffic		2010-2019	✓	✓	10, 2.5, 1	SO_2, NO, NO_2, O_3, CO	T, RH, WS, WD			17	68

Data availability (PNSD & Health)

City (Country)	Station Name	Station Type	Population Inhab. (2018)	Period	UFP	BC	PM	Gases	Meteorology	Mortality	Hospitalization	Detection limit (nm)	PNSD Data availability (%)
Marseille (FR)	Longchamp	Urban	862.211	2018-2019	✓	✓	10, 2.5, 1	SO_2, NO, NO_2, O_3	T, WS, WD	request	request	15.1	26
Lille (FR)	Villeneuve d'Ascq	SubUrban	232.440	2017-2019	✓	✓	10, 2.5	NO, NO_2, O_3	T, RH, P, RAD, WS, WD, RAIN	request	request	20.2	51
Mülheim an der Ruhr (DE)	Mülheim an der Ruhr (DE)	Urban	171.265	**2009-2019**	✓	✓	10, 1	NO, NO_2	T, RH, RAD, WS, WD, RAIN	request	request	14.1	89
Paris (FR)	SIRTA	SubUrban	2.190.327	**2012-2019**	request	request	request	request	request	request	request	10.9	92*
Dresden (DE)	Winckelmann straβe	Urban	551.072	2010-2019	✓	request	request	request	request	request	unavailable	10	74
	North	Traffic		**2009-2019**	✓	request	request	request	request			10 (5)	79
Leipzig (DE)	Mitte	Traffic	581.980	2010-2019	✓	✓	request	request	request	request	unavailable	10	77
	Eisenbahnstraβe	Traffic		2011-2019	✓	✓	request	request	request			10	76
	TROPOS	Urban		**2010-2019**	✓	✓	request	request	request			10	84
Rochester NY (US)	NYS DEC	Urban	210.606	**2009-2019**	request	request	request	request	request	request	request	11.1	90*
Zurich (CH)	Kaserne	Urban	402.762	**2010-2019**	request	request	request	request	request	✓	✓	16.8	34*
Stockholm (SE)	Hornsgatan	Traffic	949.761	**2010-2019**	Only CPC	request	10, 2.5, 1	NO, NO_2, CO	request	✓	✓	10	47*
Prague (CZ)	Schudol	SubUrban	1.294.513	**2009-2019**	request	ND	10, 2.5	NO, NO_2, NO_X, SO_2, O_3, CO	request	✓	unavailable	10	86*
Athens (GR)	Thissio	Urban	664.046	2015-2019	request	request	request	request	request	✓	unavailable	10	64*
	Demokritos	Suburban		**2009-2019**	request	request	request	request	request			10	74*

Data availability (Air pollutants & Health)

Other Air Quality datasets:

- Black Carbon (BC)
- Offline PM chemistry (OC, EC, Va, Cu, Sn, mineral matter, levoglucosan, etc)
- Online chemistry with ACSM (SO_4^{2-}, NO_3^-, NH_4^+, Cl^-, HOA, BBOA, COA, SOA)
- Volatile Organic Compounds (VOCs) form PTRMS
- Oxidative Potential (OP)
- Sources of PM, including PNSD.

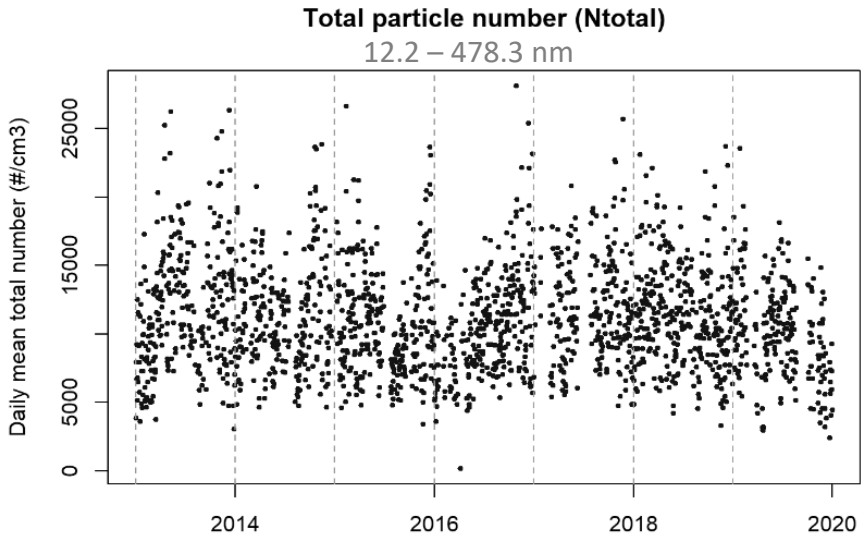
Descriptive analysis for Barcelona, Helsinki and Madrid

Availability of Total number Unit = % of valid daily data per year

Year	BCN	HEL_KC	MAD
2009	0.0	98.6	34.8
2010	0.0	96.2	53.4
2011	0.0	91.8	69.6
2012	0.0	98.9	42.6
2013	80.3	95.6	67.9
2014	71.5	95.1	47.1
2015	82.2	99.2	65.8
2016	77.0	99.2	52.7
2017	64.7	96.7	33.4
2018	91.8	95.6	35.6
2019	66.3	97.0	50.4

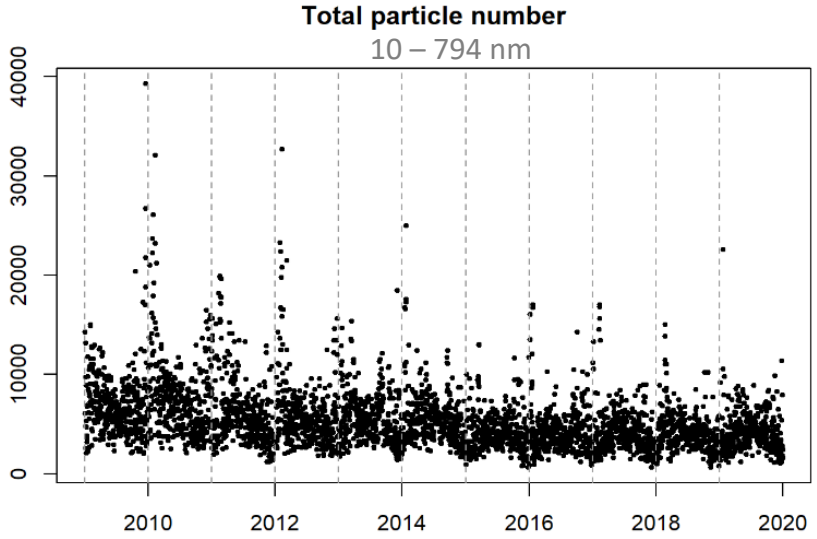
Descriptive analysis for Barcelona, Helsinki and Madrid

BCN



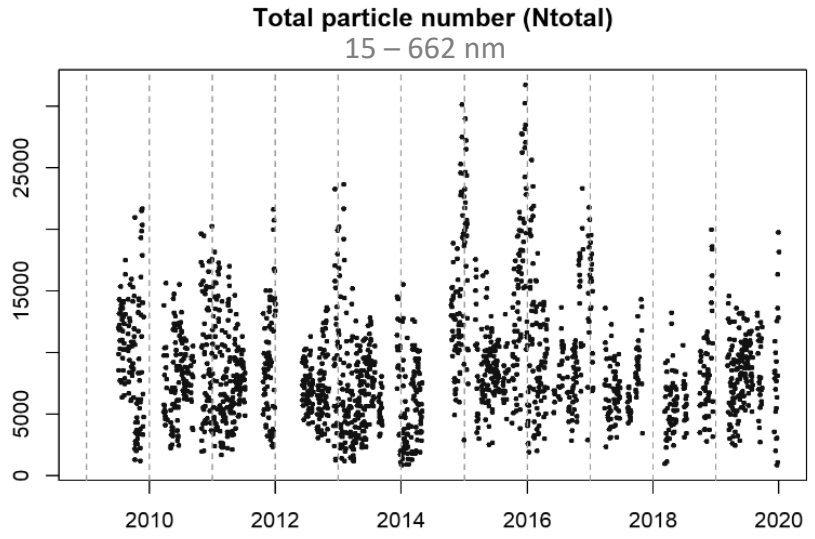
	Mean	SD	Median	IQR
Ntotal	11164	3951	10709	5223
Nucleation	3951	1726	3759	2475
Aitken	5773	2313	5383	2910
Accum	1440	703	1347	890

HSK



	Mean	SD	Median	IQR
Ntotal	5367	3059	4708	3082
Nucleation (3-25)	2323	1642	1839	1902
Nucleation	1664	1237	1286	1361
Aitken	2804	1756	2449	1790
Accum	900	627	744	710

MAD



	Mean	SD	Medain	IQR
Ntotal	8802	4618	8016	5392
Nucleation	2044	1646	1692	1615
Aitken	5414	2964	4968	3498
Accum	1447	1160	1197	1055

European Commission

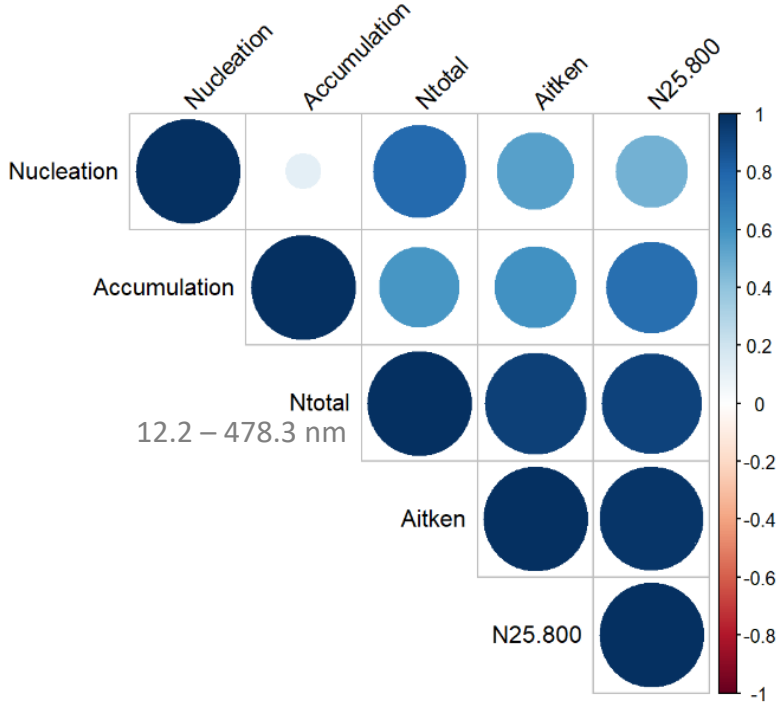
HORIZON 2020

ISGlobal Barcelona Institute for Global Health

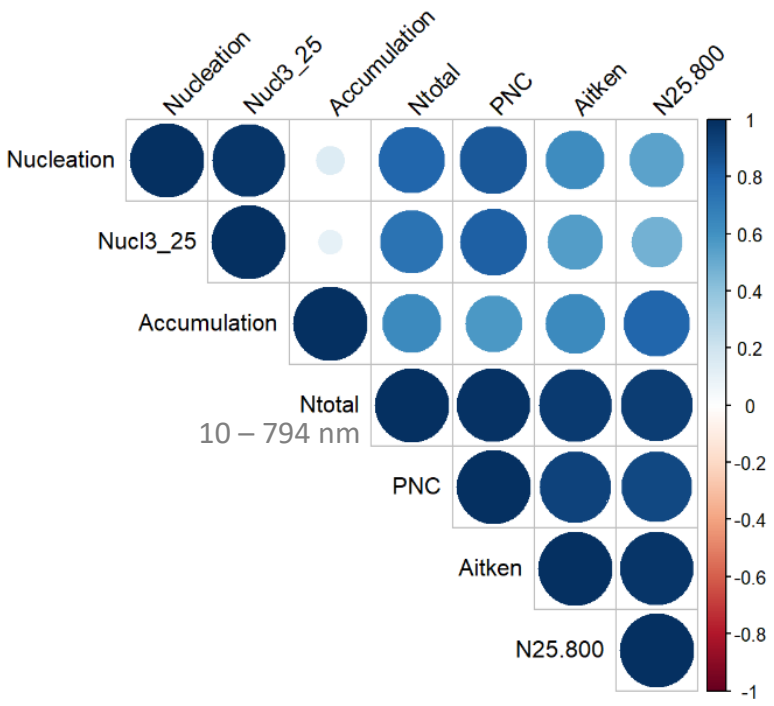
RI URBANS

Correlation between the different PNSD modes

BCN



HSK



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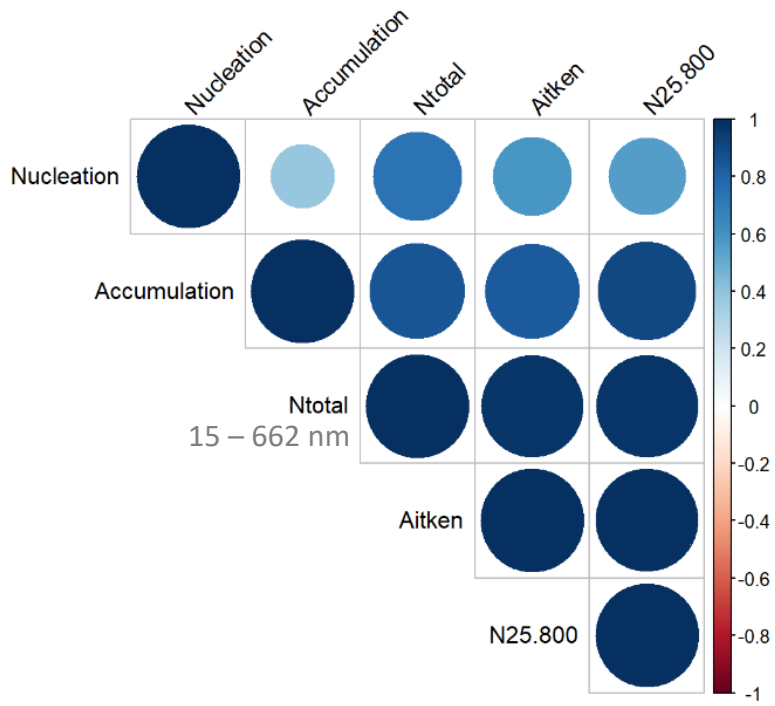
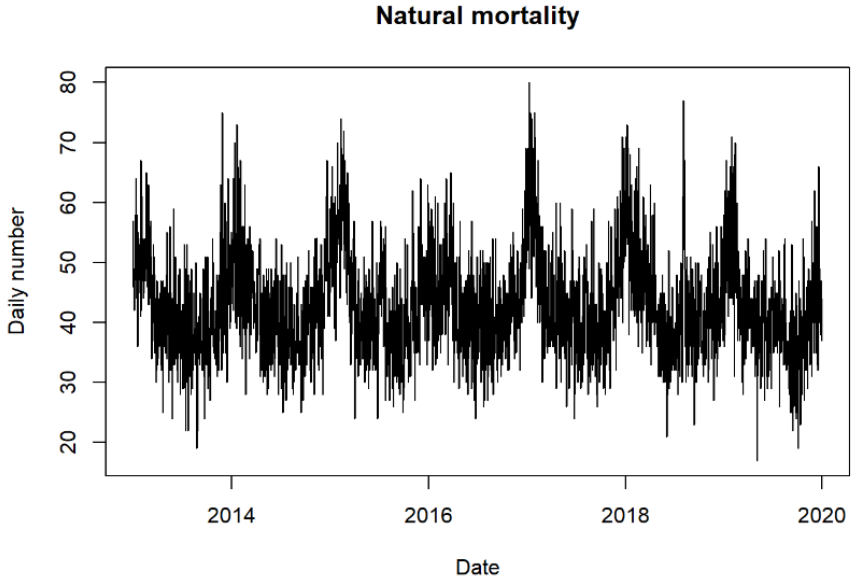
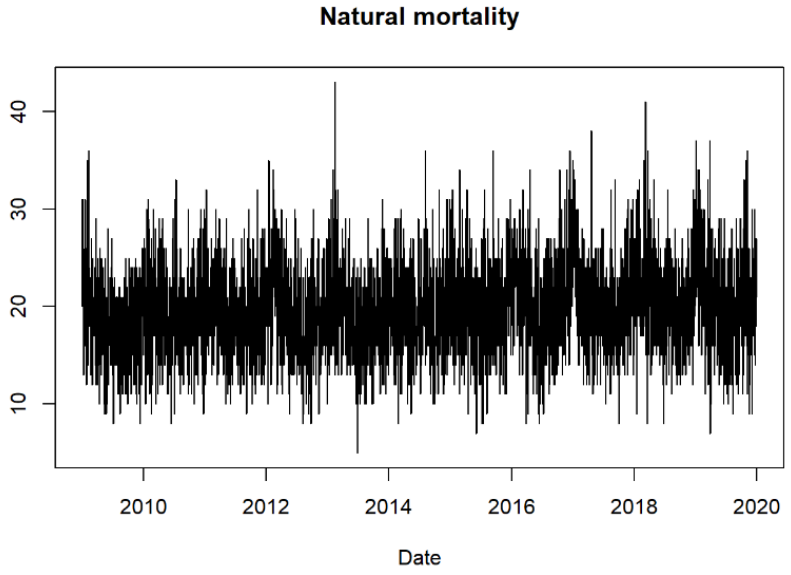


Descriptive analysis for Barcelona, Helsinki and Madrid

BCN



HSK



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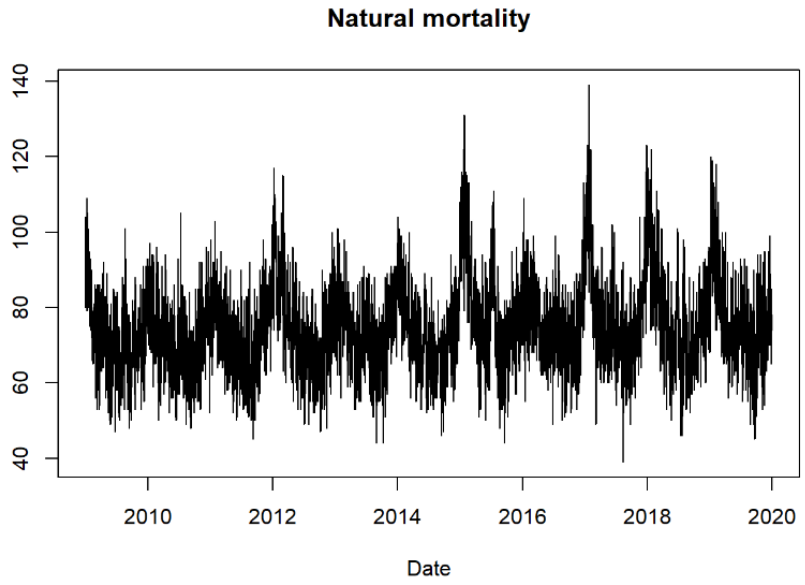


Preliminary Results

Model used for the time series analysis:

Single pollutant GLM with quasi Poisson regression adjusted for:
- Seasonality (natural spline with 7 df/year)
- temperature (a spline for cold and a spline for hot temperatures)
- relative humidity (natural spline with 3 df)
- bank holiday
- day of the week

Things pending to be addressed in the analysis

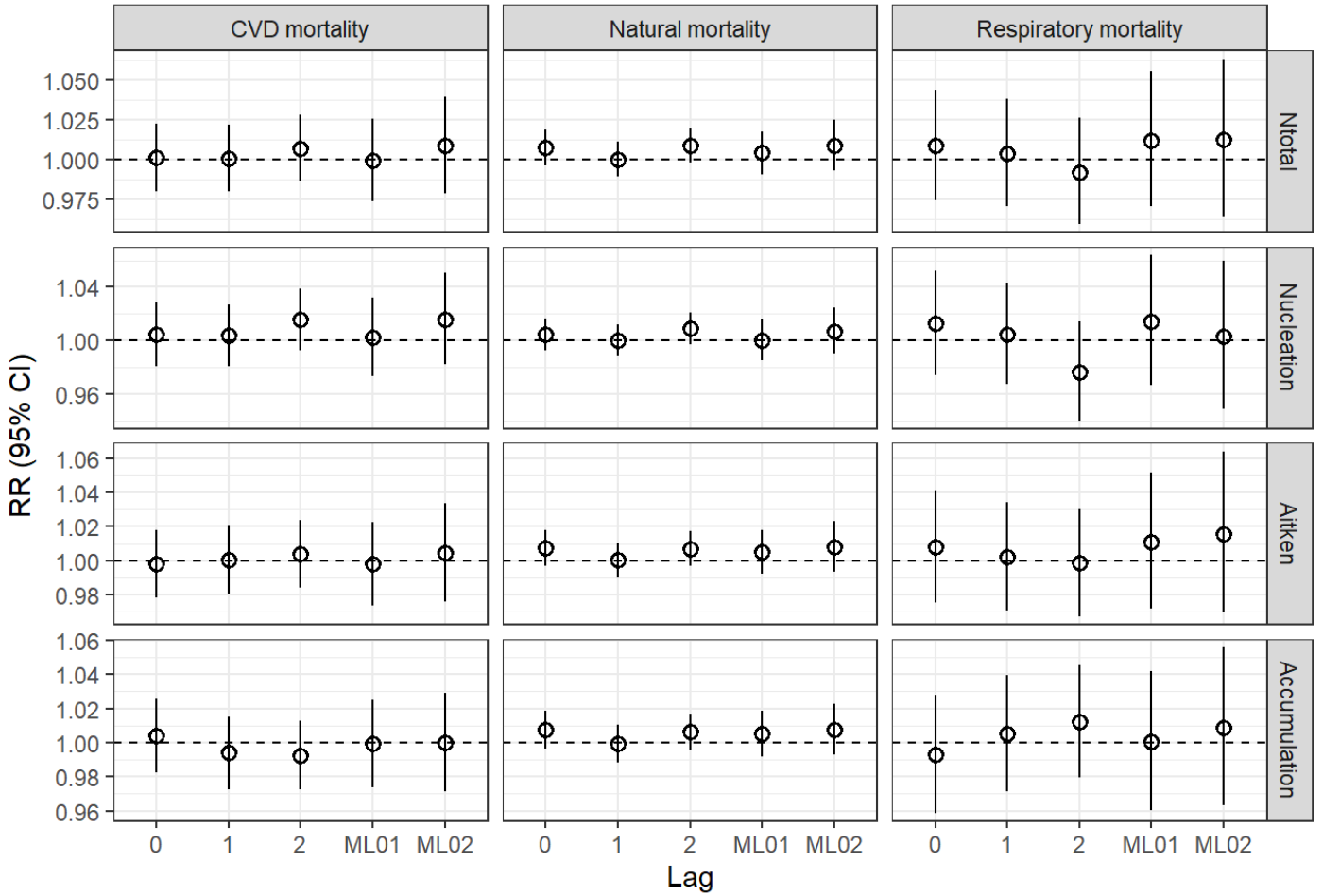
- Analyses were carried out excluding periods with missing values in AQ metrics:
  - Imputation of missing data
  - Block approach (different spline for the different blocks)

- Constrains to account for correlation effect in multipollutant models.

Excluding periods with missing values

Preliminary Results

BCN



barcelona, Sex: all_sex; Age group: all_ages; Temp model: 2 splines; others: XB, unconstr

Size range: 12.2 – 478.3 nm

IQR: 5223 pt·cm^{-3}

IQR: 2475 pt·cm^{-3}

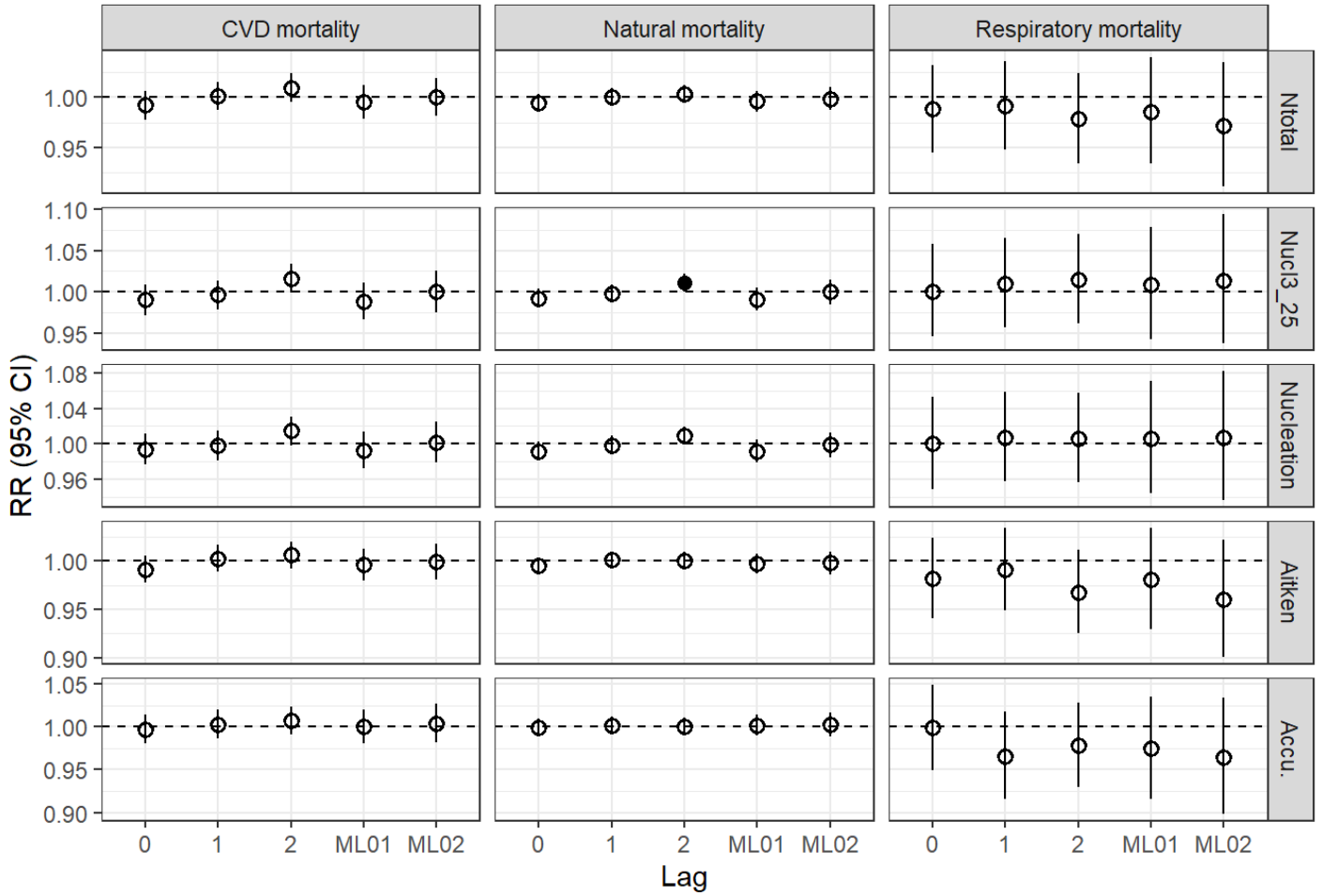
IQR: 2910 pt·cm^{-3}

IQR: 890 pt·cm^{-3}

Excluding periods with missing values

Preliminary Results

HSK



Size range: 10 – 794 nm

IQR: 3082 pt·cm^{-3}

IQR: 1902 pt·cm^{-3}

IQR: 1361 pt·cm^{-3}

IQR: 1790 pt·cm^{-3}

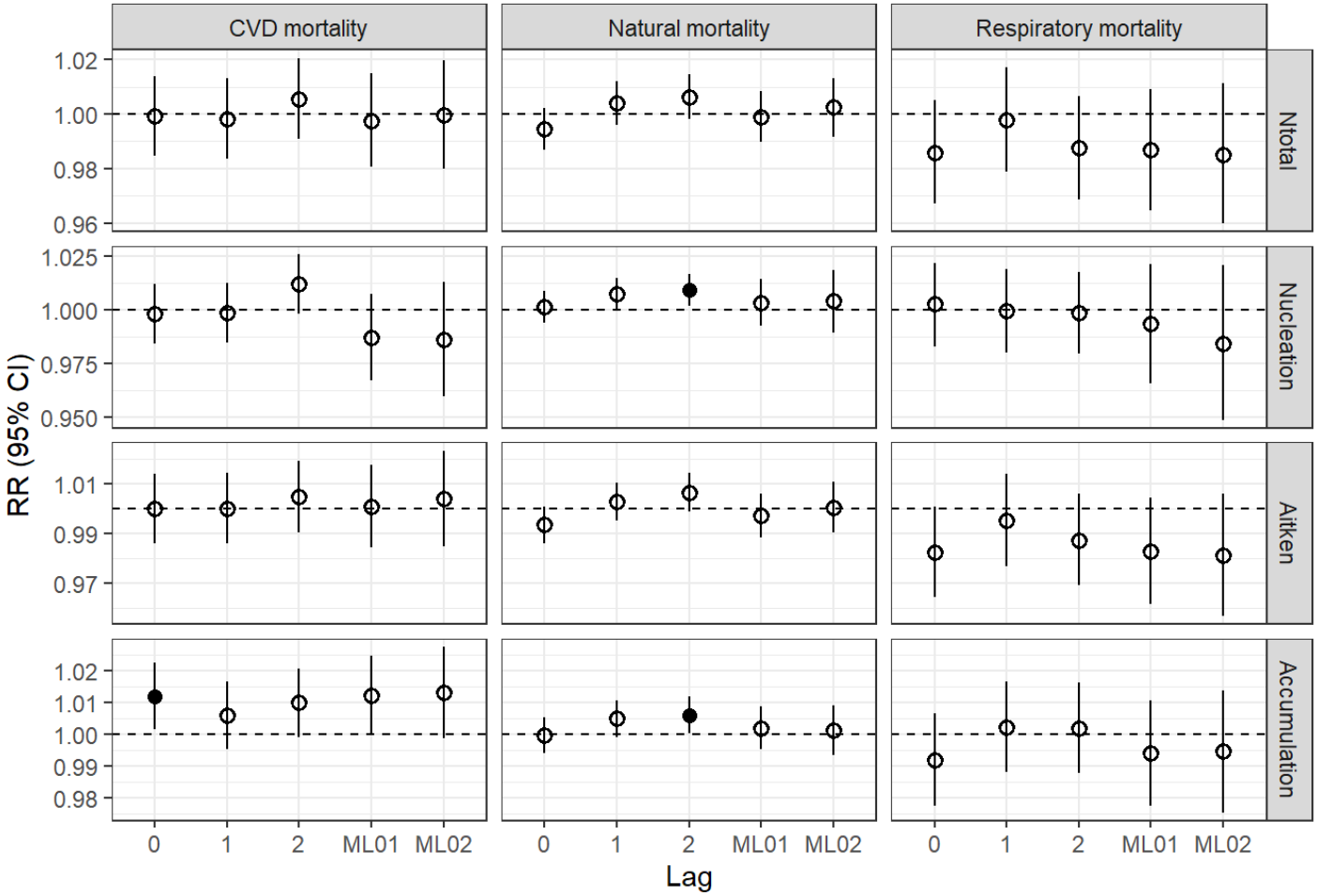
IQR: 710 pt·cm^{-3}

helsinki, Sex: all_sex; Age group: all_ages; Temp model: 2 splines; others: XB, unconstr

Excluding periods with missing values

Preliminary Results

MAD



Size range: 15 – 662 nm

IQR: 5392 pt·cm^{-3}

IQR: 1615 pt·cm^{-3}

IQR: 3498 pt·cm^{-3}

IQR: 1055 pt·cm^{-3}

madrid, Sex: all_sex; Age group: all_ages; Temp model: 2 splines; others: Single poll, XB, unconstr

Summary

Task 2.1 is progressing smoothly. We can now start with the time series analysis while waiting for the air pollution data and finalising the health data requests.

Preliminary results for Barcelona, Helsinki and Madrid:

- For Natural and CVD mortality, we observed an increasing risk pattern from lag0 to lag2 for most of the ultrafine particles modes and cities. For respiratory mortality, often either lag0 or lag1 were showing the highest risk. In general, most results were not statistically significant.

- At Helsinki, a city with very low levels of air pollution, a significant association was observed at lag2 only when the smallest particles were taken into account (nucleation 3 to 25).

We expect to have more robust estimates when combining the results of all cities

Progress of task 2.1.

Health effects

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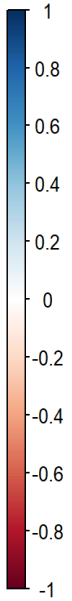
1st Science Meeting, 19th October 2022

Extra slides

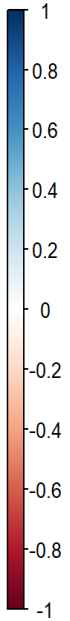
HSK

	Nucleation	Aitken	Accumulation	N25.800	Ntotal	Nucl3_25	PNC
Nucleation	1.00	0.63	0.15	0.54	0.79	0.97	0.84
Aitken	0.63	1.00	0.64	0.98	0.96	0.56	0.93
Accumulation	0.15	0.64	1.00	0.79	0.63	0.11	0.58
N25.800	0.54	0.98	0.79	1.00	0.94	0.47	0.90
Ntotal	0.79	0.96	0.63	0.94	1.00	0.74	0.99
Nucl3_25	0.97	0.56	0.11	0.47	0.74	1.00	0.81
PNC	0.84	0.93	0.58	0.90	0.99	0.81	1.00



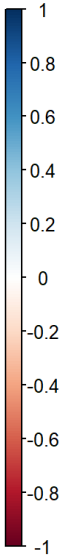
BCN

	Nucleation	Aitken	Accumulation	N25.800	Ntotal
Nucleation	1.00	0.54	0.12	0.48	0.78
Aitken	0.54	1.00	0.61	0.98	0.94
Accumulation	0.12	0.61	1.00	0.76	0.59
N25.800	0.48	0.98	0.76	1.00	0.92
Ntotal	0.78	0.94	0.59	0.92	1.00

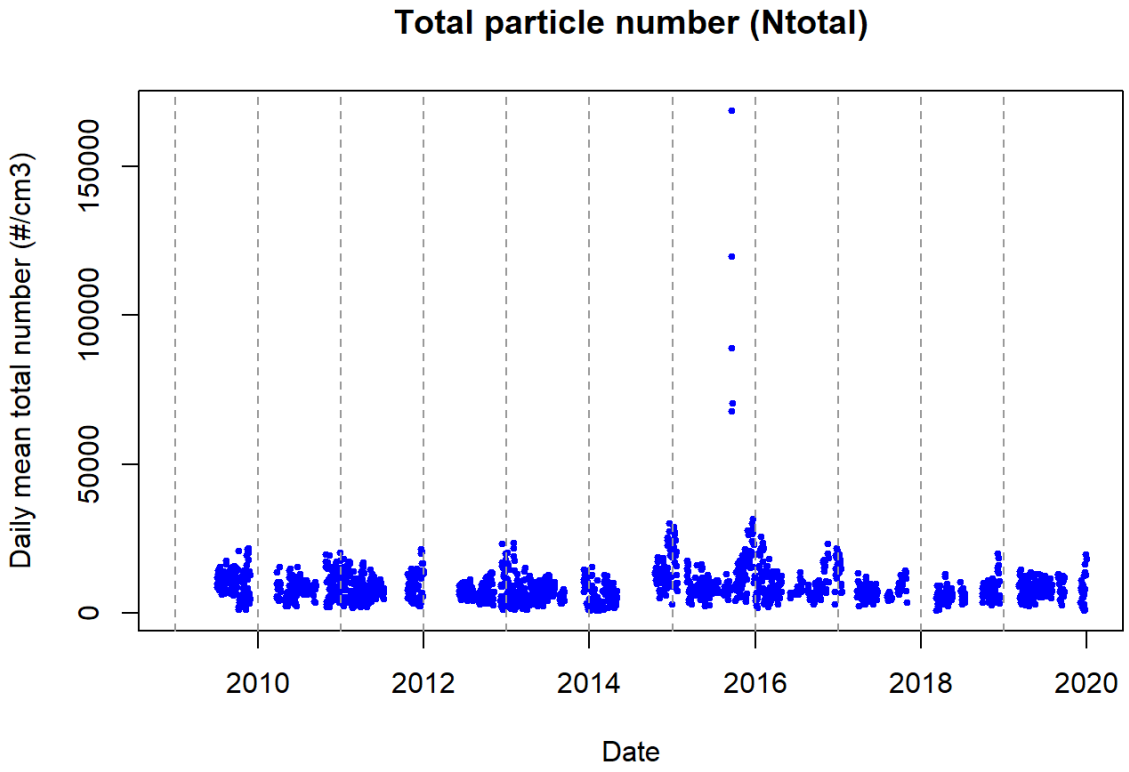


MAD

	Nucleation	Aitken	Accumulation	N25.800	Ntotal
Nucleation	1.00	0.58	0.38	0.55	0.73
Aitken	0.58	1.00	0.83	0.99	0.97
Accumulation	0.38	0.83	1.00	0.90	0.85
N25.800	0.55	0.99	0.90	1.00	0.97
Ntotal	0.73	0.97	0.85	0.97	1.00



Outliers?


Total particle number (Ntotal)
Daily mean total number (#/cm3)
0
50000
100000
150000
2010
2012
2014
2016
2018
2020
Date