PILOT 4
Novel health indicators of nanoparticles and PM components and source contributions

RI-URBANS

Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial AreaS (Project n. 101036245)

20.10.2022 | 11:10 - 11:30

Kaspar Daellenbach | Andres Alastuey

PSI | CSIC

Oxidized gases

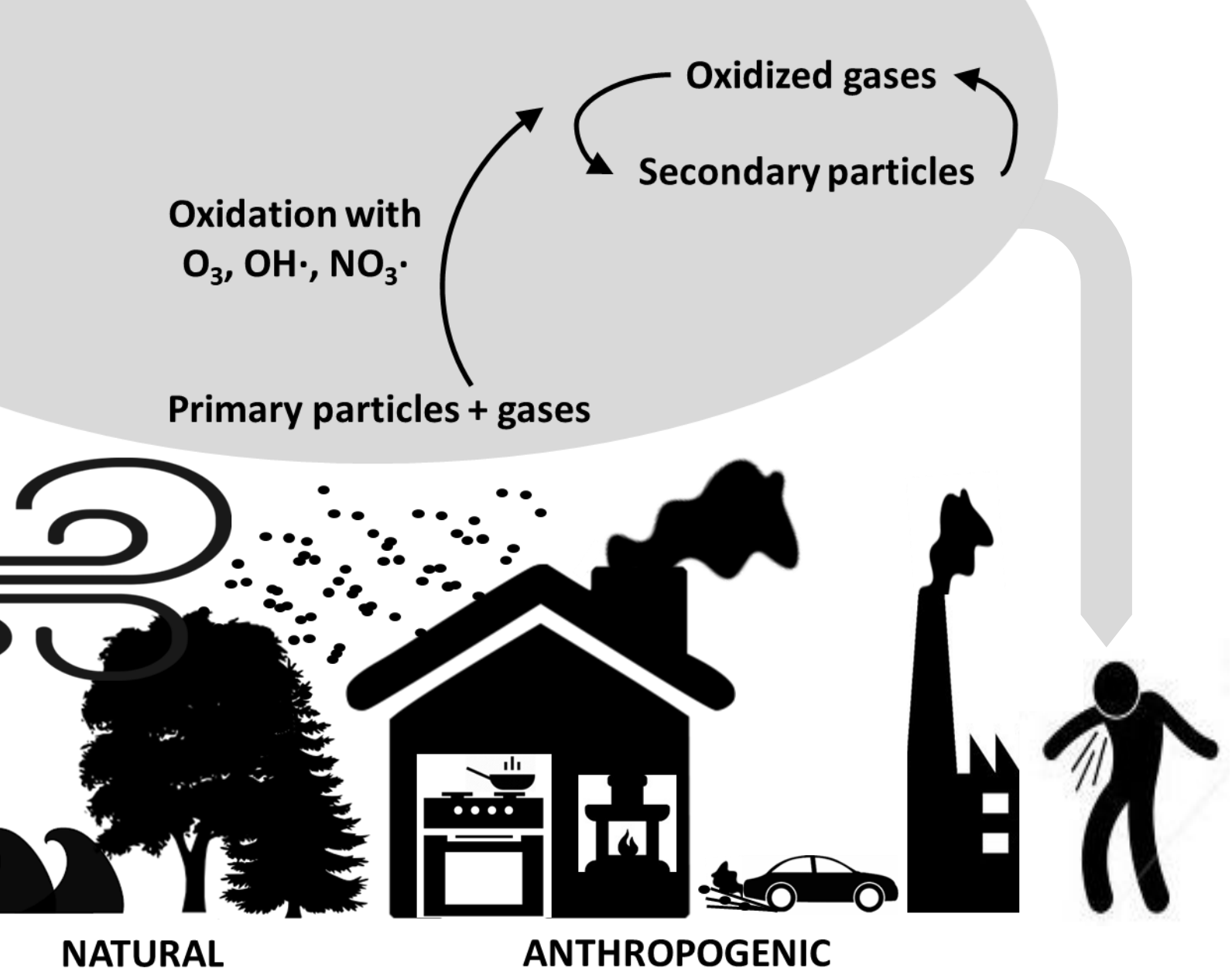
Secondary particles

Oxidation with
O_3, $OH\cdot$, $NO_3\cdot$

Primary particles + gases

NATURAL

ANTHROPOGENIC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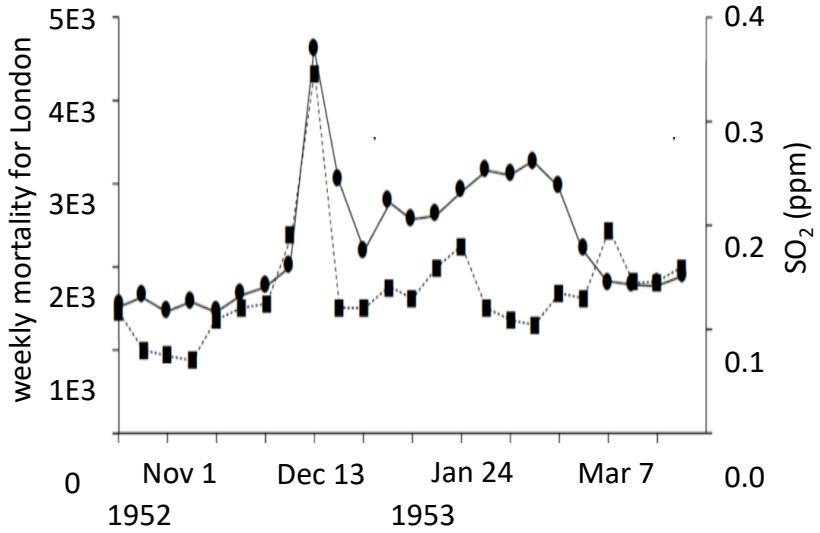


Oxidized gases

Secondary particles

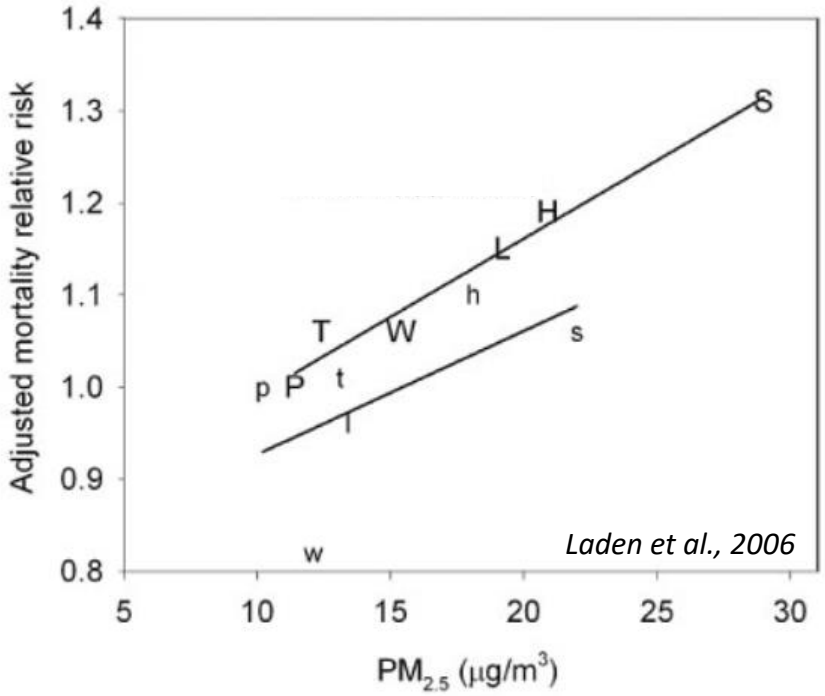
Oxidation with
O_3, $OH\cdot$, $NO_3\cdot$

Primary particles + gases

NATURAL

ANTHROPOGENIC

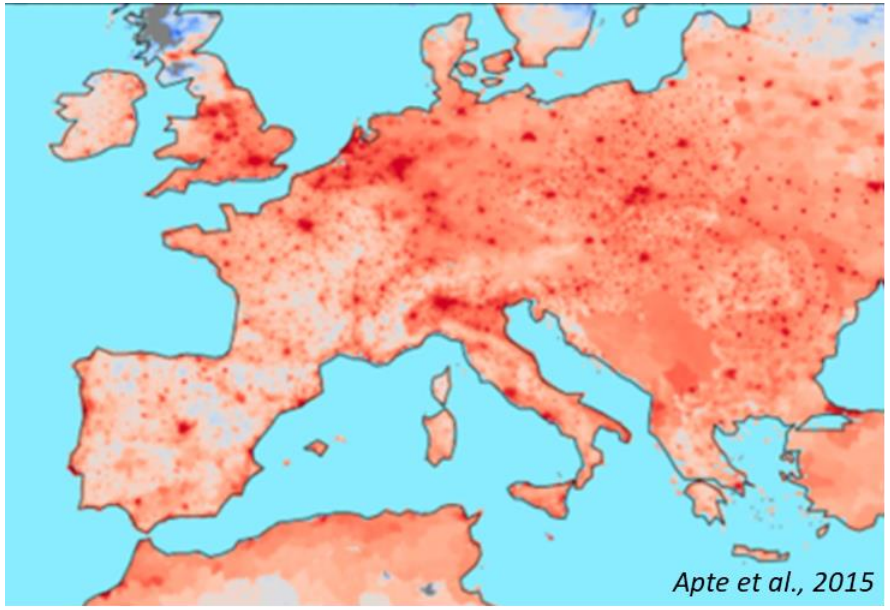
chronic



Laden et al., 2006

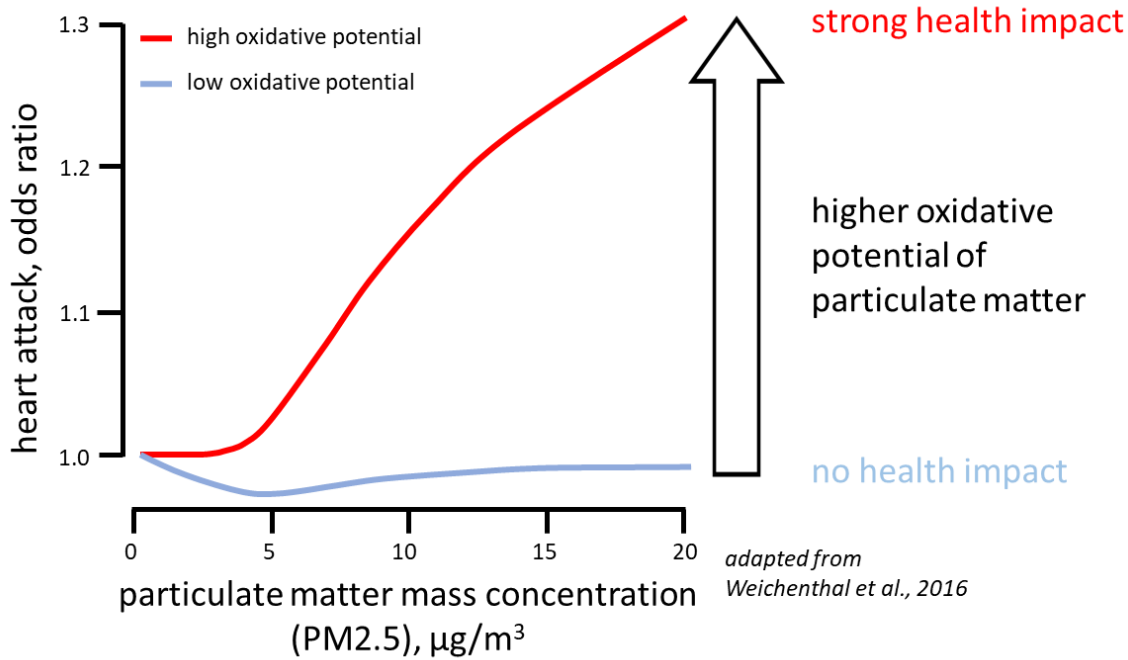
Health effects of Particulate Matter

Health impacts estimated based on **particulate matter (PM) mass concentration**.



Particulate matter's oxidative potential (OP):

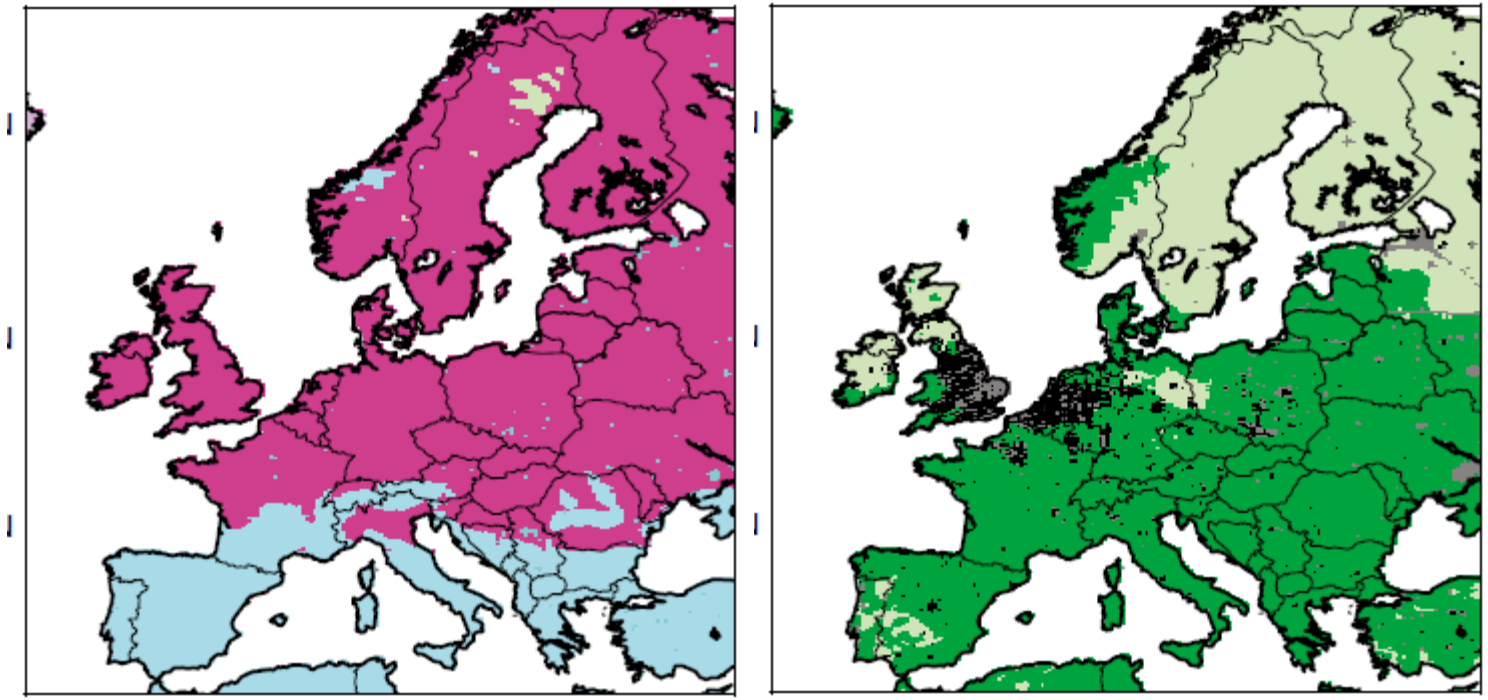
- PM's capacity to oxidize molecules by producing reactive oxygen species
- PM's OP depends on chemical composition of PM.
- What are the emission sources controlling PM's OP?



PM10 sources driving mass concentration and oxidative potential

PM10 mass concentration

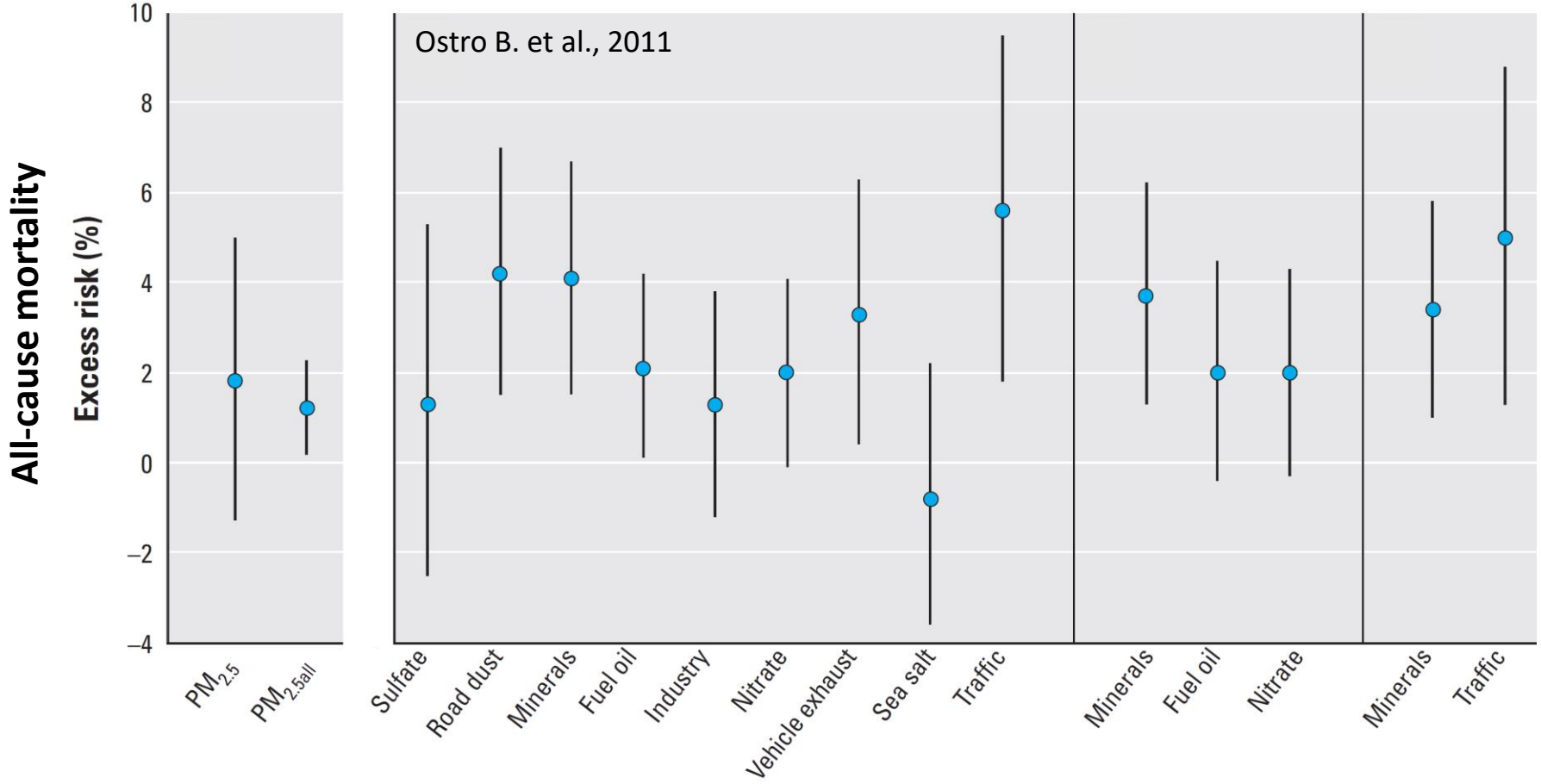
PM10 oxidative potential (DTT)



- Crustal material
- Secondary inorganic aerosol
- Vehicular wear
- Antrhopogenic SOA
- Biogenic SOA
- Traffic exhaust

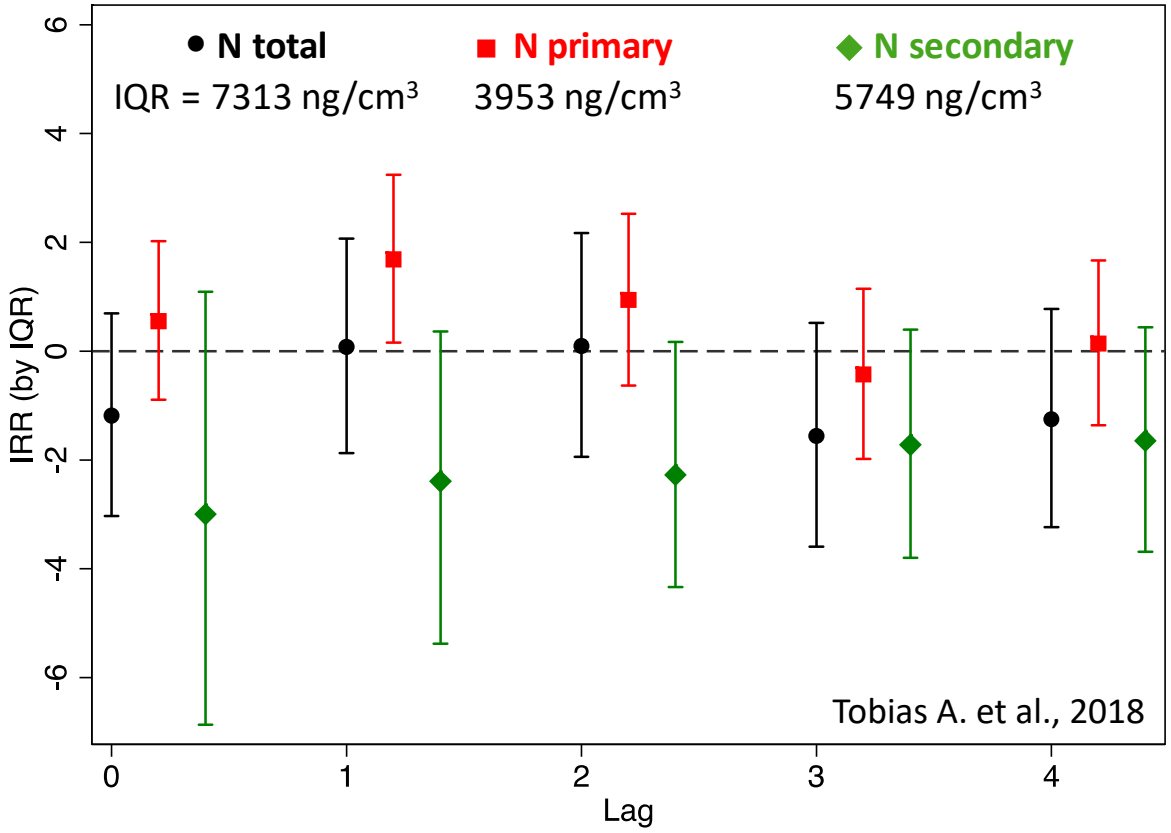
Daellenbach et al., 2020

Health effects of PM sources for Barcelona



Health effects of ultrafine particle types

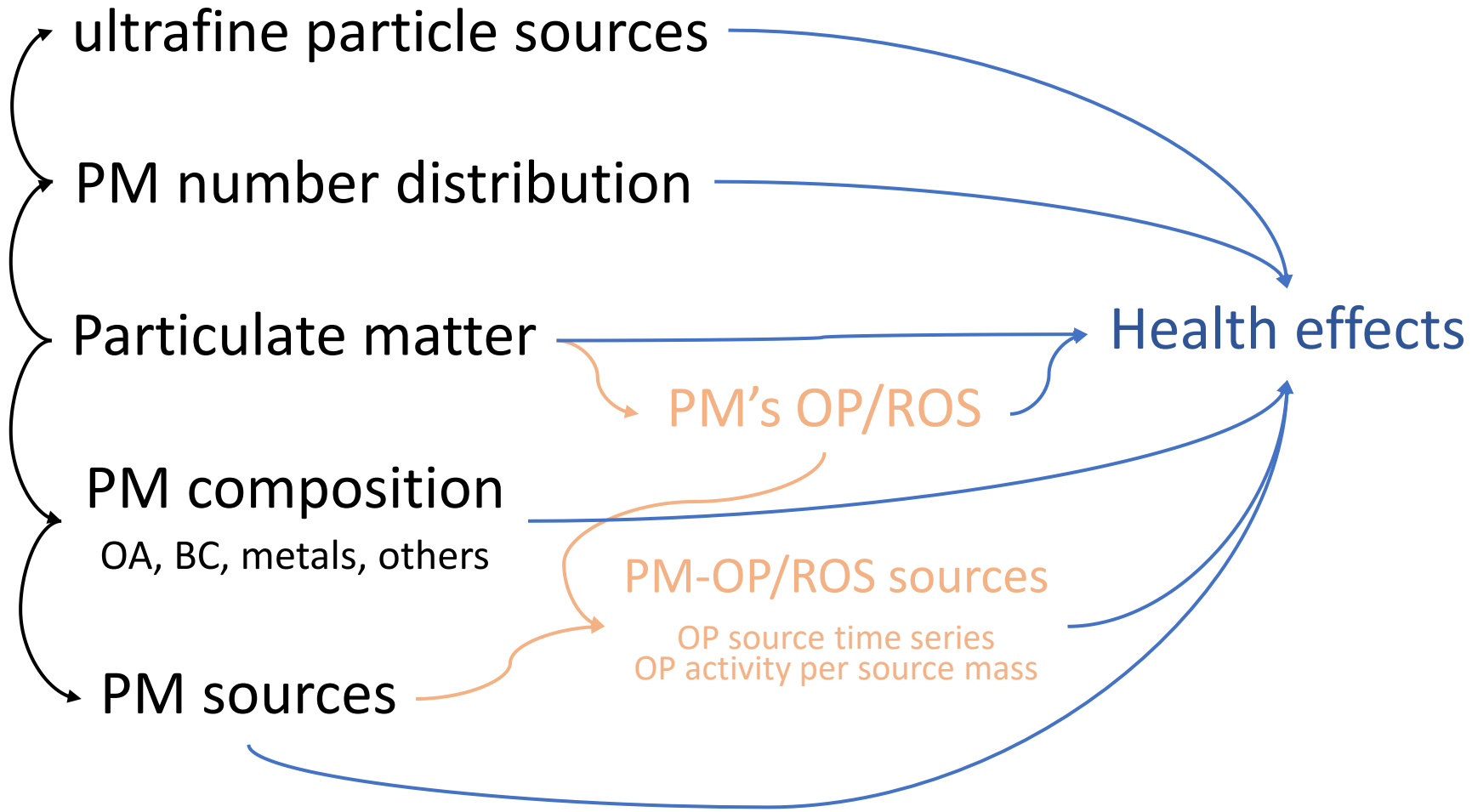
DAILY MORTALITY AND PRIMARY AND SECONDARY UFP IN BARCELONA 2009-2014



Pilot 4 - Goals

- Evaluate the **health** effects of **novel air quality** metrics and their **source** contributions using epidemiology and **oxidative potential** tools.
- Health effects of novel air quality metrics and their source contributions, including **PM components (mass concentrations)** and **nanoparticles (number concentrations)**.

Pilot 4 - steps



Pilot 4: Health effects of novel AQ metrics and their source contributions, including PM components and nanoparticles

1. Improved evaluation of health effects in epidemiologic time series studies

- Using long-term offline and online data:
  PM10 mass, PM2.5 mass, nanoparticles, organic + elemental/black carbon, trace elements, other constituents, oxidative potential.

2. Evaluation of the drivers of PM's oxidative potential

- 24h-resolution, filter-based (1 year) – PM10 vs PM2.5
  Water-soluble ions, trace metals, OC/EC, WSOC, sugars and polyols, other organic tracers, offline AMS, offline EESI, oxidative potential
- 1h-resolution, short-term, online instrumentation (months) - mostly fine PM:
  OA (ACSM), BC (Aethalometer), trace elements (Xact), online oxidative potential (sources from T4.1)

Pilot 4 - Study locations

Athens

Barcelona

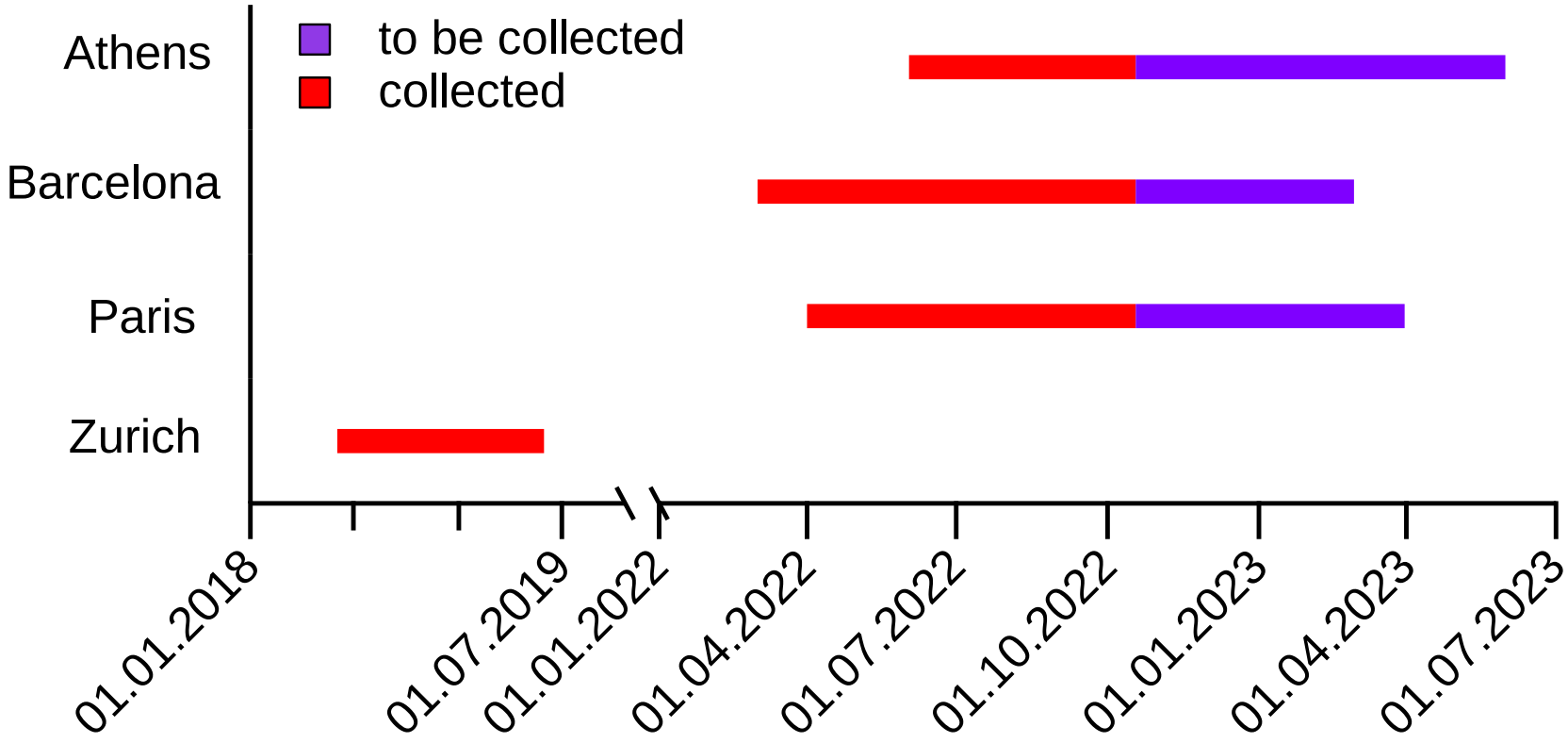
Paris

Zurich

Samples obtained at all cities will be analysed by the same institutes

Mortality data will be available for Athens, Barcelona and Paris

Simultaneous PM2.5 and PM10 collection



Pilot 4: Analytical program for offline filters

Analysis		Laboratory
Soluble ions	e.g. Ca^{2+}, NH_4^+, NO_3^-, SO_4^{2-}, etc.	NOA
Trace metals	e.g. Fe, Cu, Mn, Ti, etc.	CSIC
Tentative soluble metals?		NOA tests
OC/EC		CSIC
WSOC		PSI(/NOA)
Carbonates?		
Sugars and polyols	e.g. levoglucosan	Athens + Barcelona coordinate
Other organic tracers	SOA markers, e.g. MBTCA, phthalic acid	CSIC
Offline AMS/EESI	Non-targeted WSOA signatures	PSI
Oxidative potential	DTT, AA	Grenoble

Example outcome: preliminary results Zurich

Coarse sulfur containing POA
traffic-related?

Coarse other POA
unknown origin

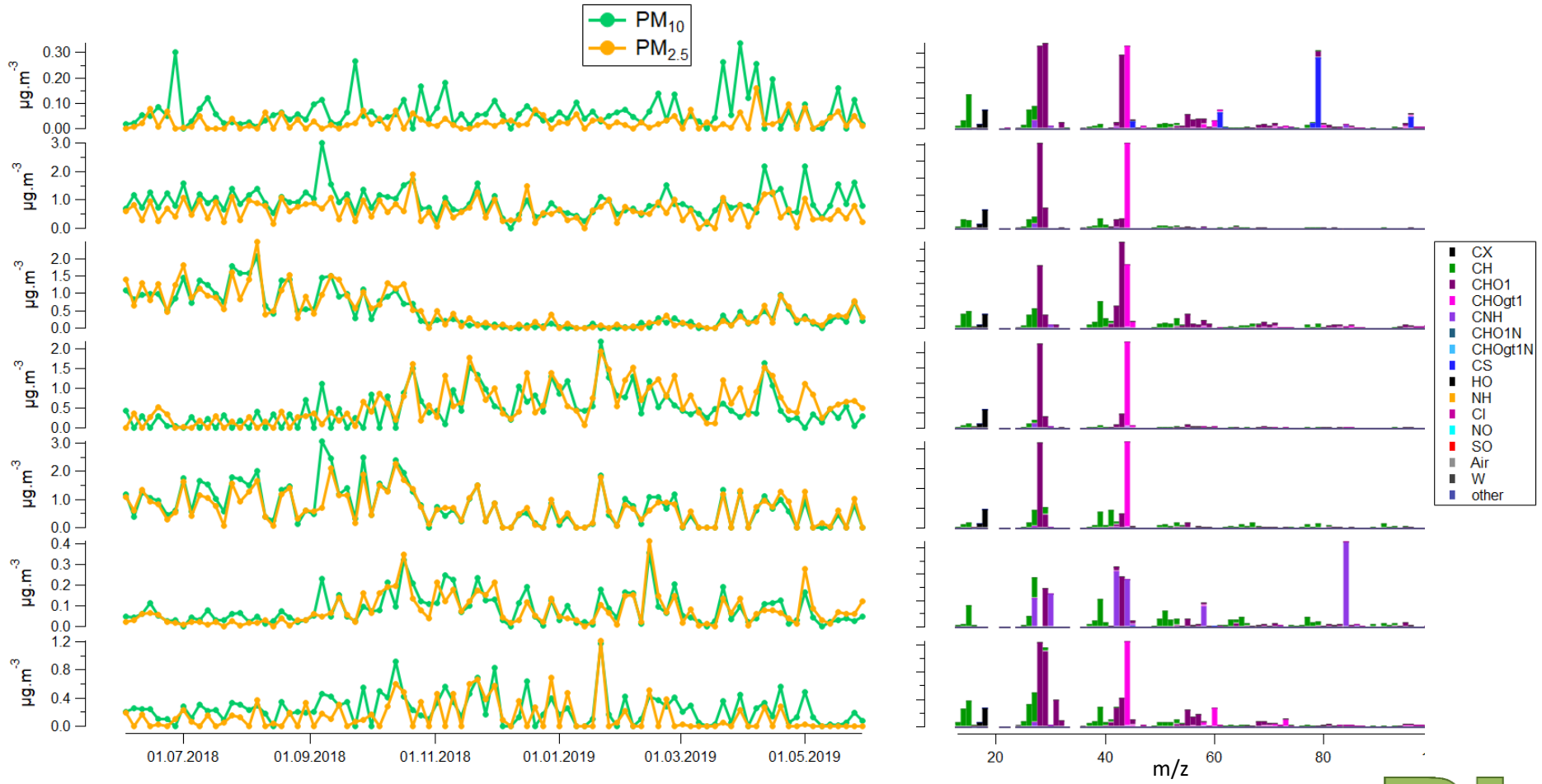
bioSOA

anthroSOA
aromatic SOA?

Other SOA
unknown origin?

Nitrogen OA
cigarette smoke?

Biomass burning POA
residential heating



Beltran Ortiz et al., in prep.

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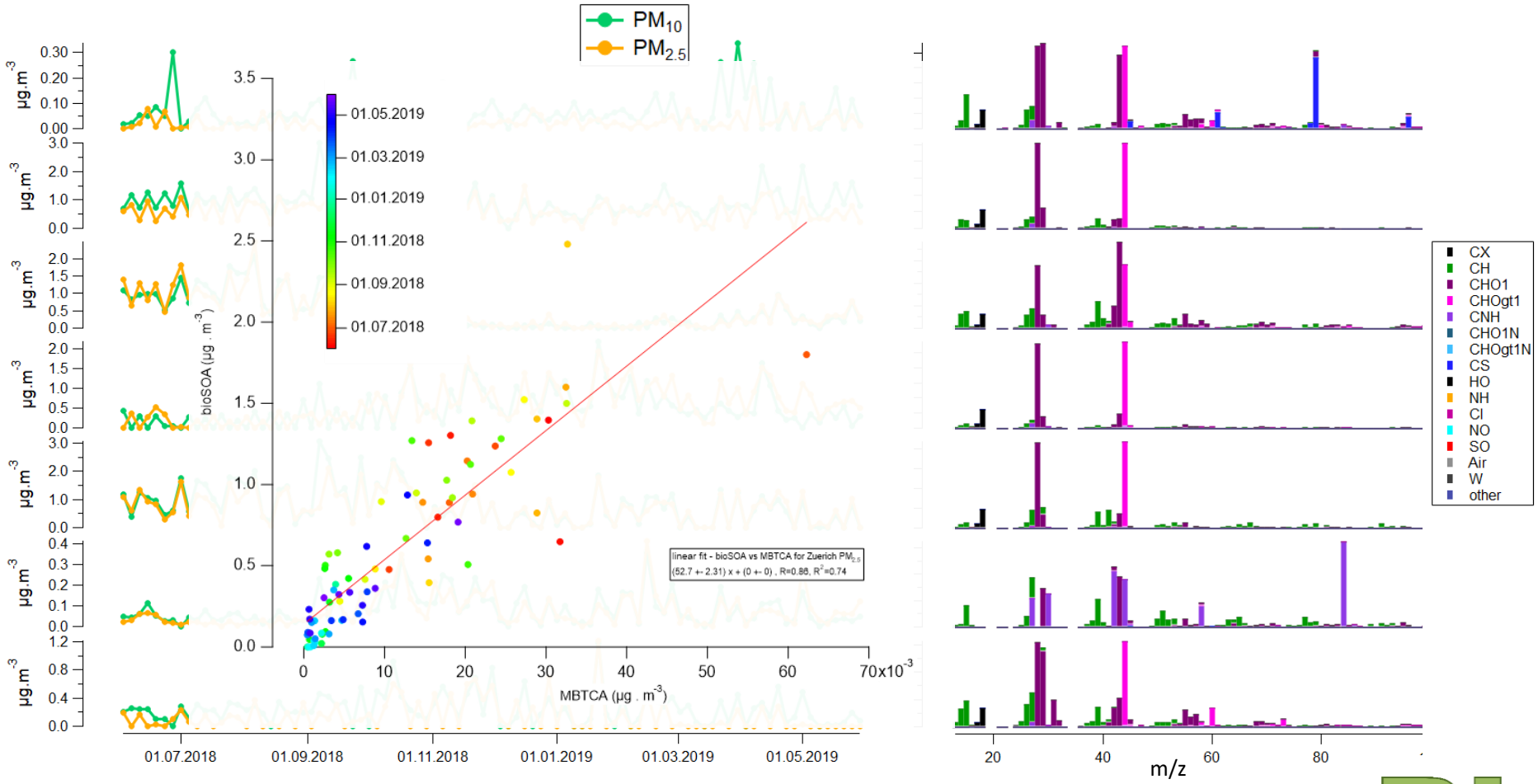

Beltran Ortiz et al., in prep.

Deliverables

- D4.8: Summary: health effects of novel AQ metrics, source contributions: epidemiology (ISGlobal, R/PU, Month 36)
- D4.9: Summary: OP of PM, PM components and PM source contributions (PSI, R/PU, Month 40)
- D4.10: Summary: novel health effect indicator pilots, sustainability, associated benefits (ISGlobal, R/PU, Month 40)

Thank you very much for your attention!!!

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