



**European Network on New Sensing Technologies for Air Pollution
Control and Environmental Sustainability - *EuNetAir*
COST Action TD1105**

**INTERNATIONAL WG1-WG4 MEETING on
*New Sensing Technologies and Methods for Air-Pollution Monitoring***

**European Environment Agency - EEA
Copenhagen, Denmark, 3 - 4 October 2013**

**Ambient air measurements of PM and black carbon
at air quality stations in Spain**



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Scientific context and objectives

- **Action's objectives (from MoU) matching partner activities:**
 - Implementing field validation at outdoor and indoor levels
 - Harmonising environmental measurements
 - Training students and early stage researchers
 - Assessing on guidelines for outdoor/indoor AQC
- **WG and SIG in which we participate:**
 - WG3: Environmental Measurements and Air-Pollution Modeling
 - SIG4: Expert Comments for the Revision of the Air Quality Directive (AQD)

Current activities / Outline

- **Critical air quality parameters**
- **Particulate matter (PM) trends**
- **Mineral matter**
- **Secondary aerosols**
- **Carbonaceous aerosols**
- **Black carbon**
- **Ultrafine particles**

- **General conclusions**

Research Facilities

- **Air quality monitoring network**, 3 sampling sites: urban, regional and continental/remote.
- **Instruments:**
 - High and low volume samplers for PM₁₀, PM_{2.5} and PM₁
 - Optical particle counters
 - Absorption photometers, Aethalometers, Nephelometers
 - Condensation particle counters (CPC)
 - Scanning mobility particle sizers (SMPS)
 - Aerosol chemical speciation monitor (ACSM)
 - Conventional NO₂, O₃ and CO monitors



Hi-vol



CPC



MAAP



Aethalometer



ACSM

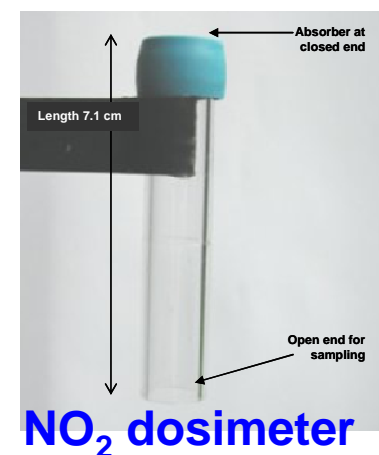
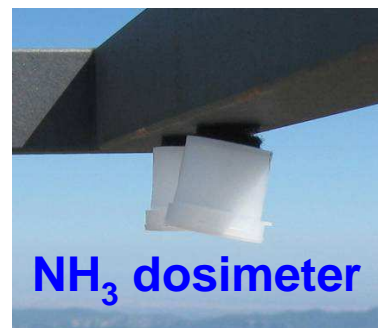
Research Facilities

- **Laboratories/analysis techniques:**

- Passive dosimeters (NH_3 , NO_2)
- ICP-AES and ICP-MS
- Liquid chromatography
- Gravimetric analysis
- OC and EC (thermal-optical)

- **Sensors:**

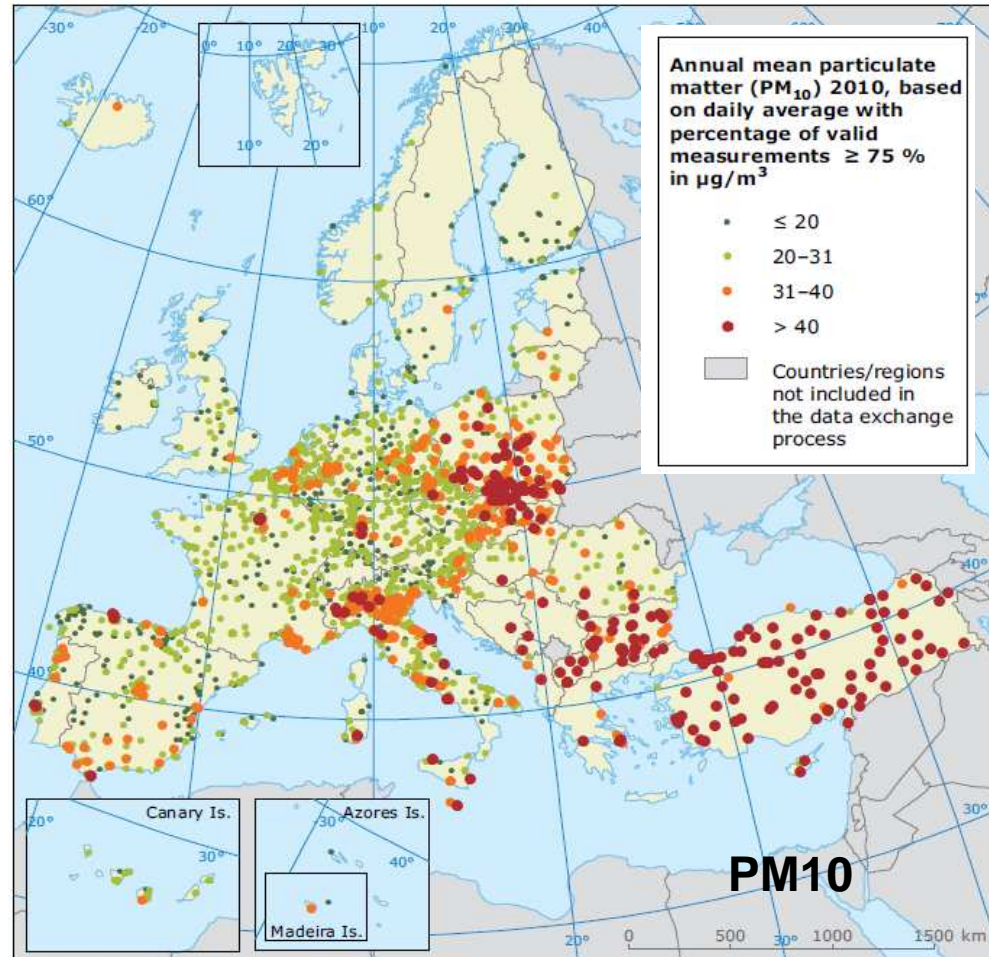
- Airbase sensors (O_3 , NO_2 , Total VOC, TSP, noise, RH, T)
- Environmental (NO_2 , O_3 , CO)



Airbase sensors



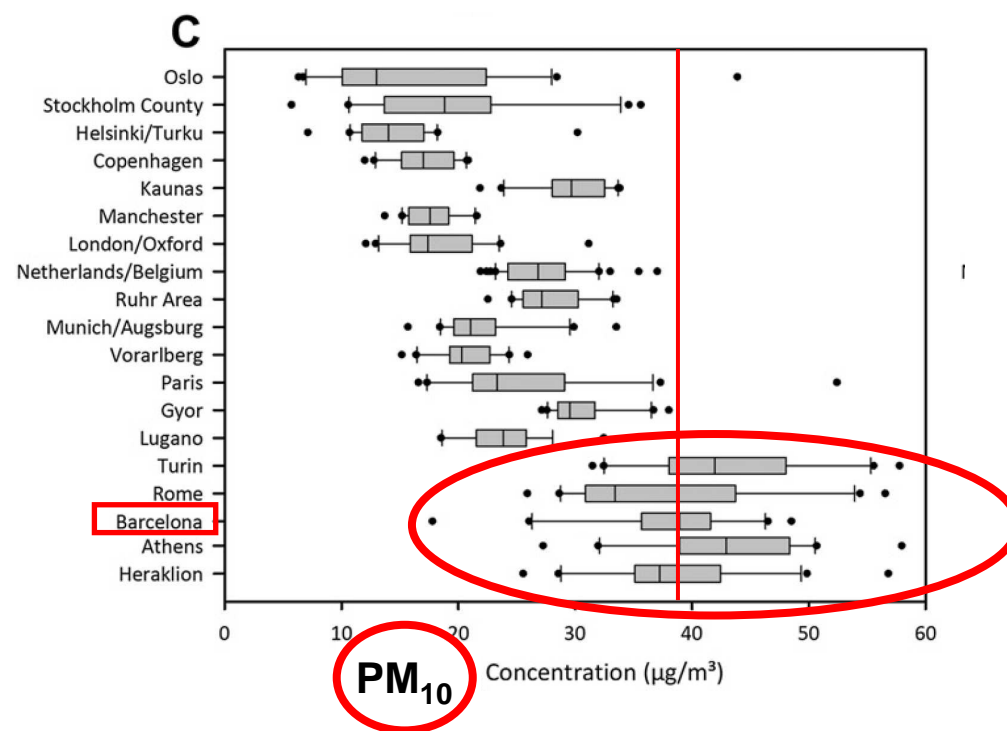
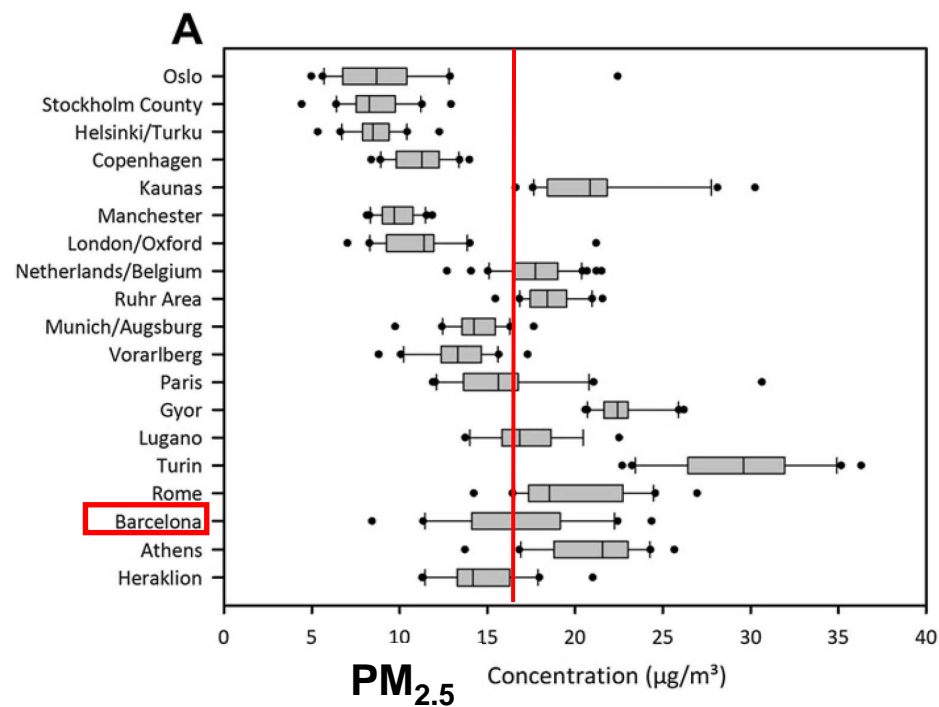
Critical parameters



EEA Report | No 4/2012

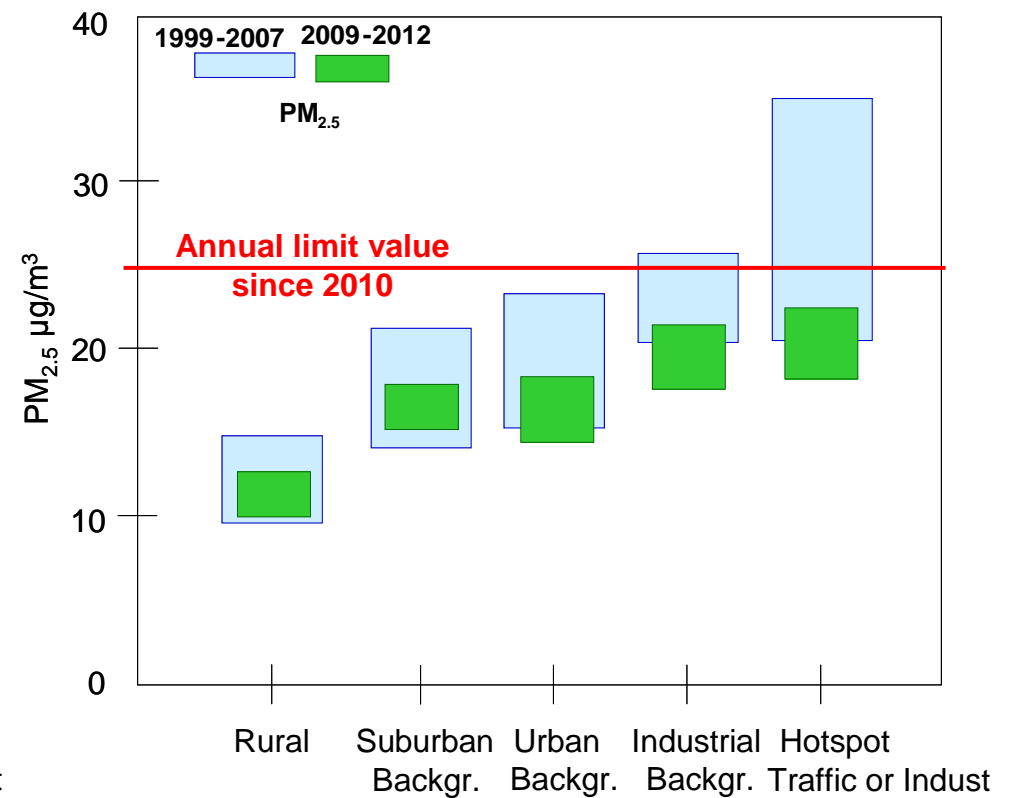
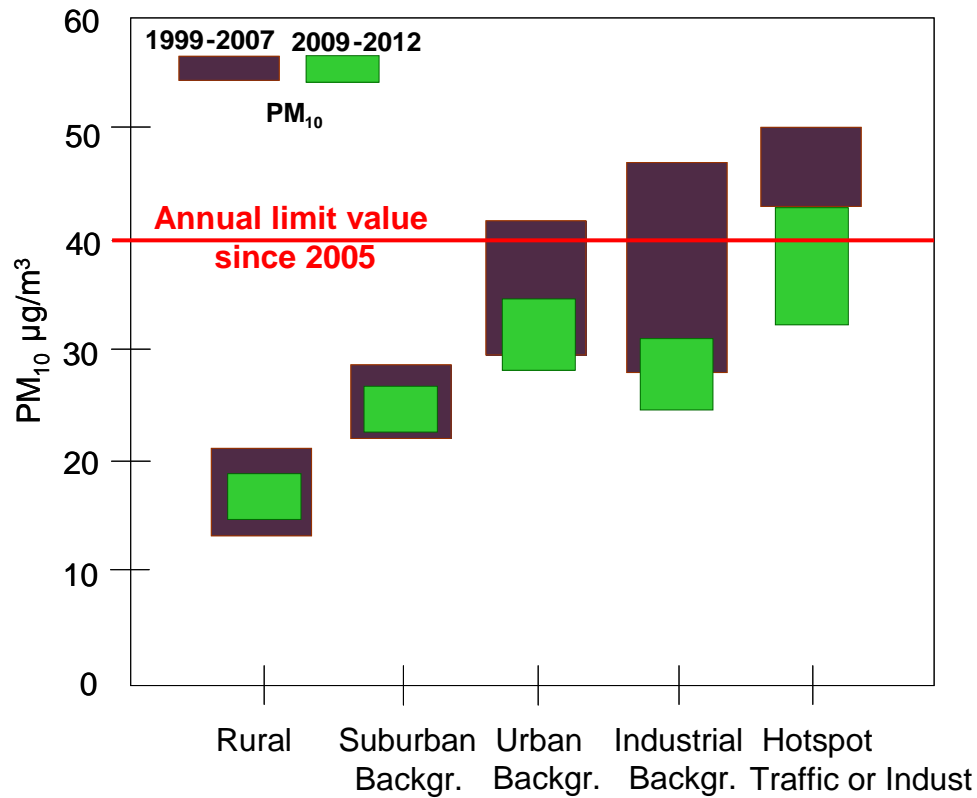
European Environment Agency 

PM_{2.5} and PM₁₀ in Europe

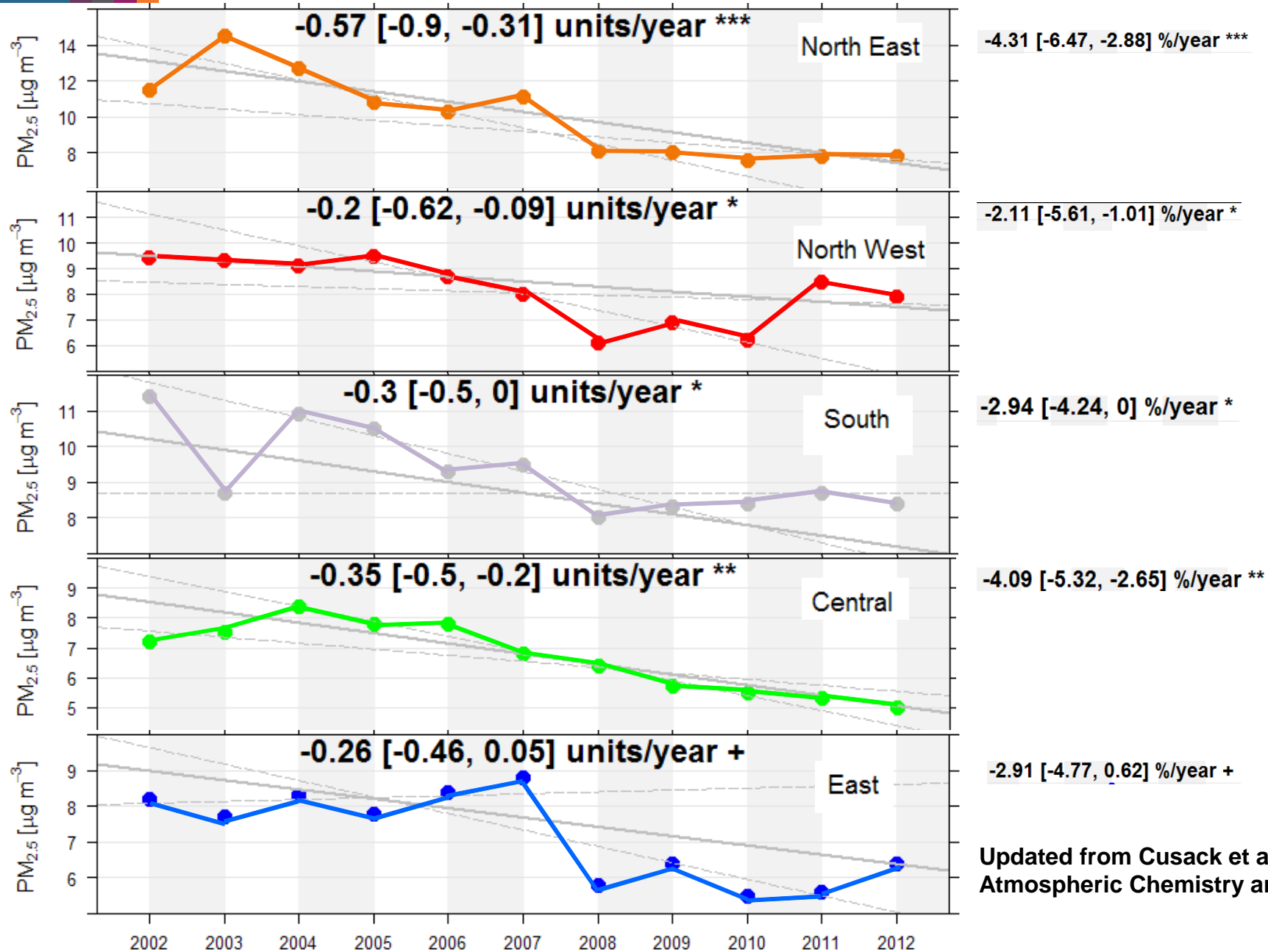


Eeftens et al. (2012). Atmospheric Environment. ESCAPE project

PM_{2.5} and PM₁₀ in Spain



PM_{2.5} regional background in Spain (2002-2012)

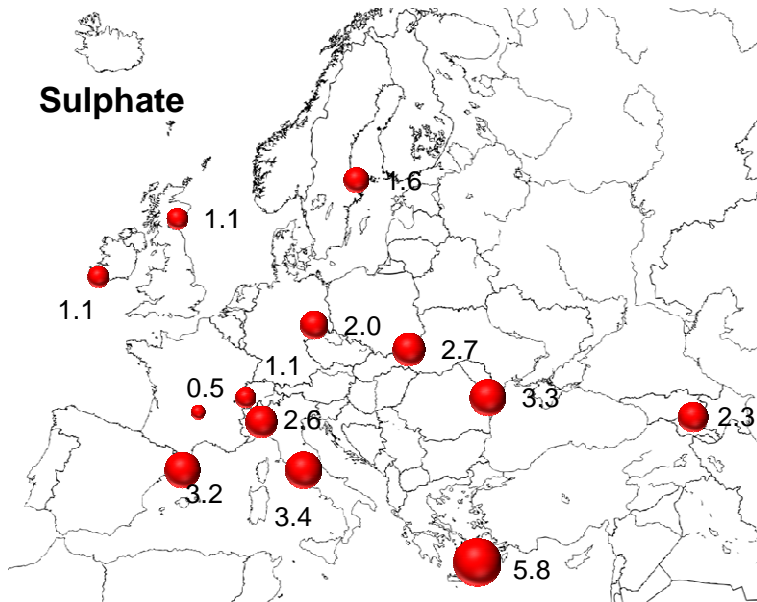


Updated from Cusack et al. (2012)
Atmospheric Chemistry and Physics

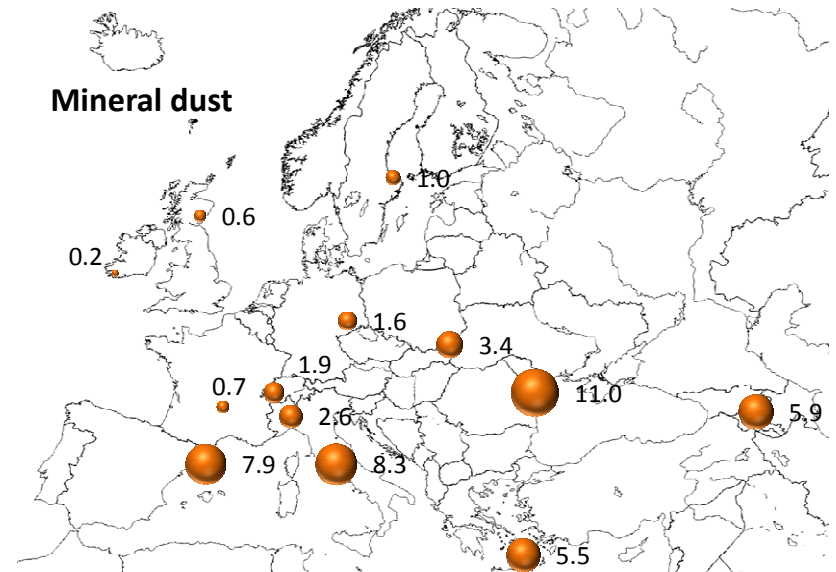
PM chemical composition

Key components in the South of Europe

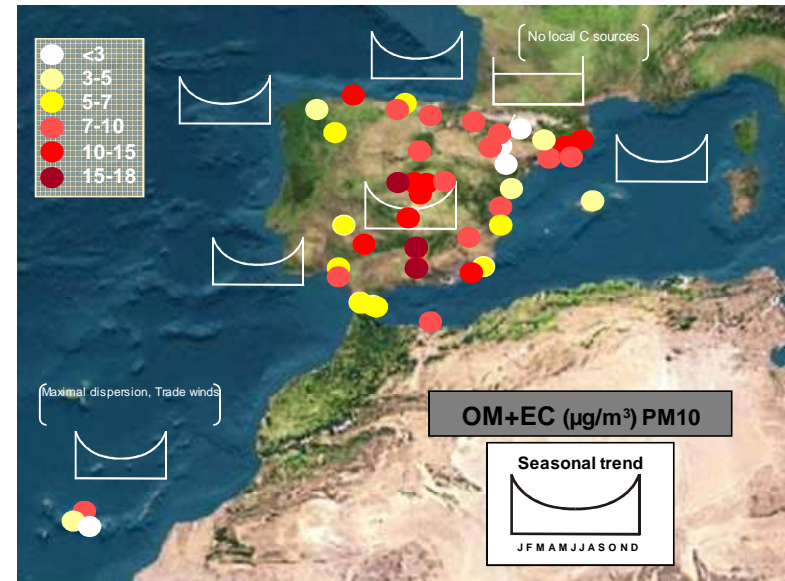
- Mineral matter
- Secondary aerosols
- Carbonaceous aerosols



Alastuey et al. (2013). EMEP report 4/2013



Alastuey et al., 2013. EMEP report 4/2013

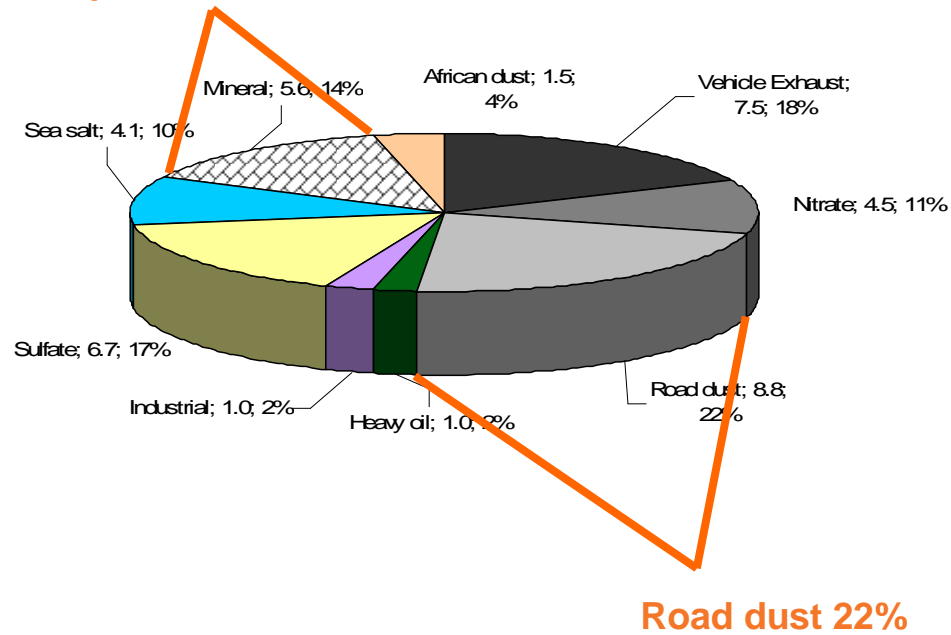


Mineral matter

Source apportionment. Barcelona

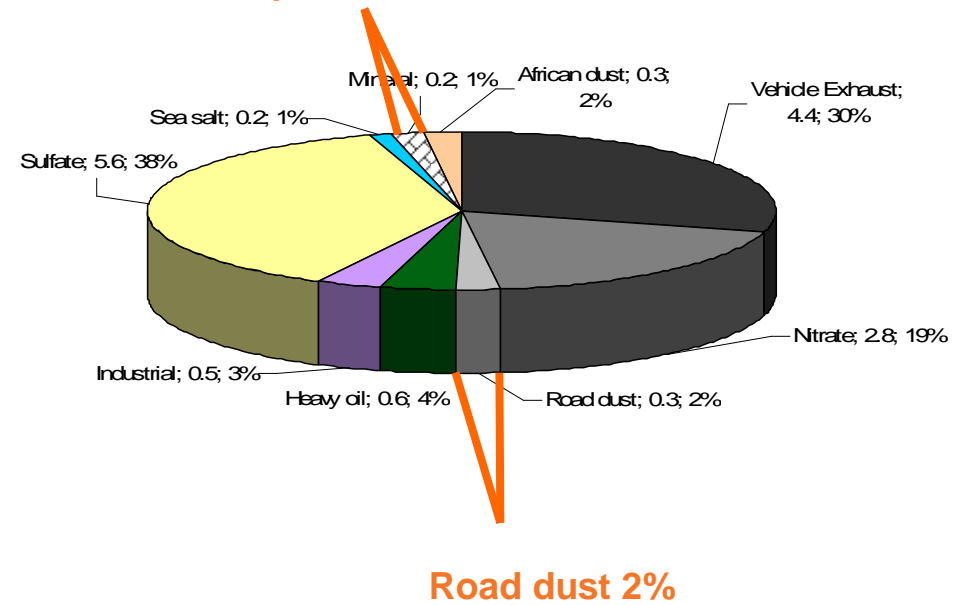
PM₁₀

Non road
resuspension 14%



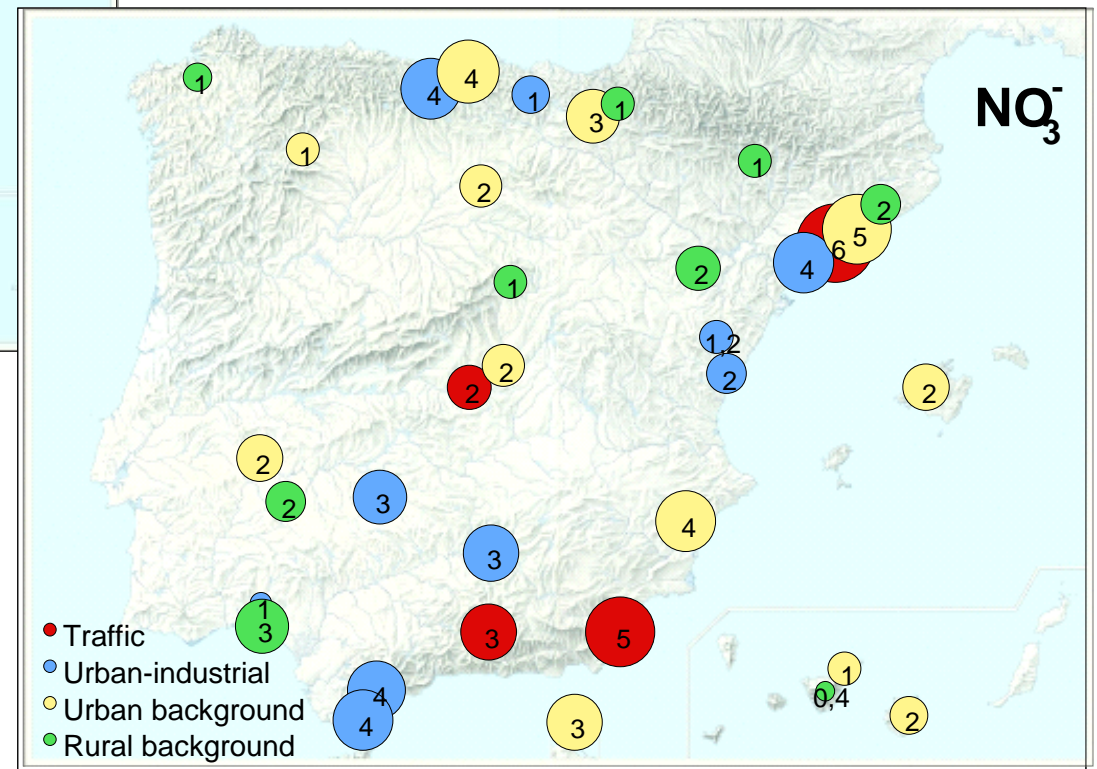
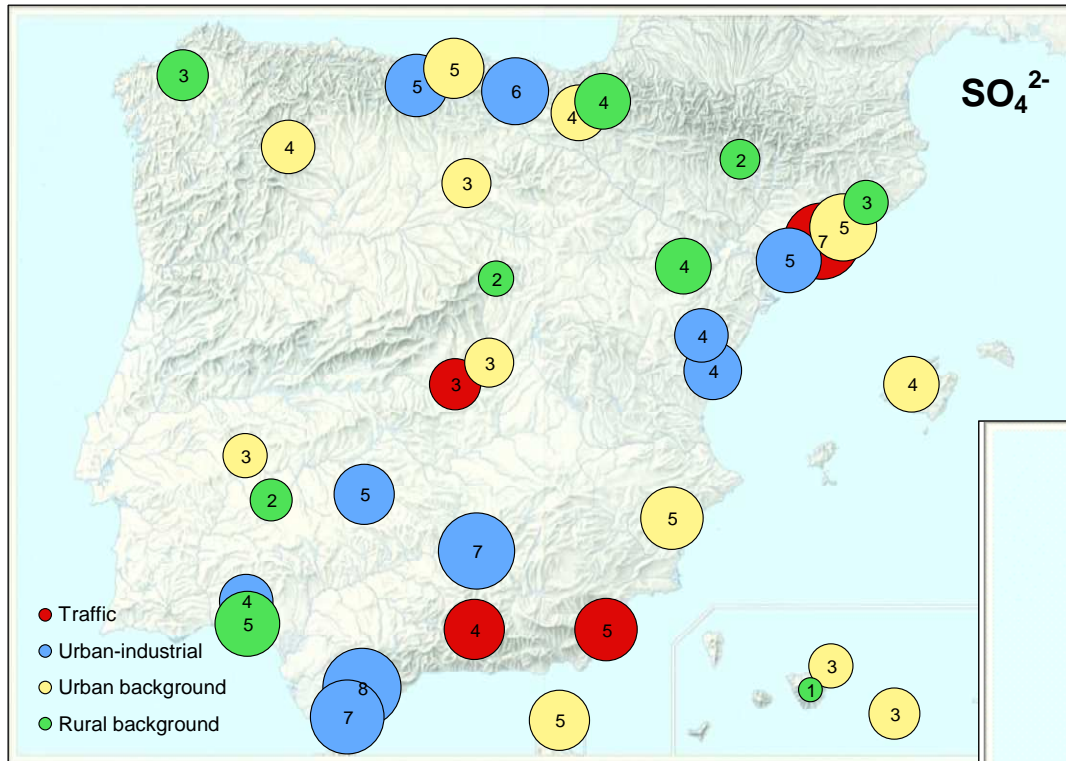
PM₁

Non road
resuspension 1%

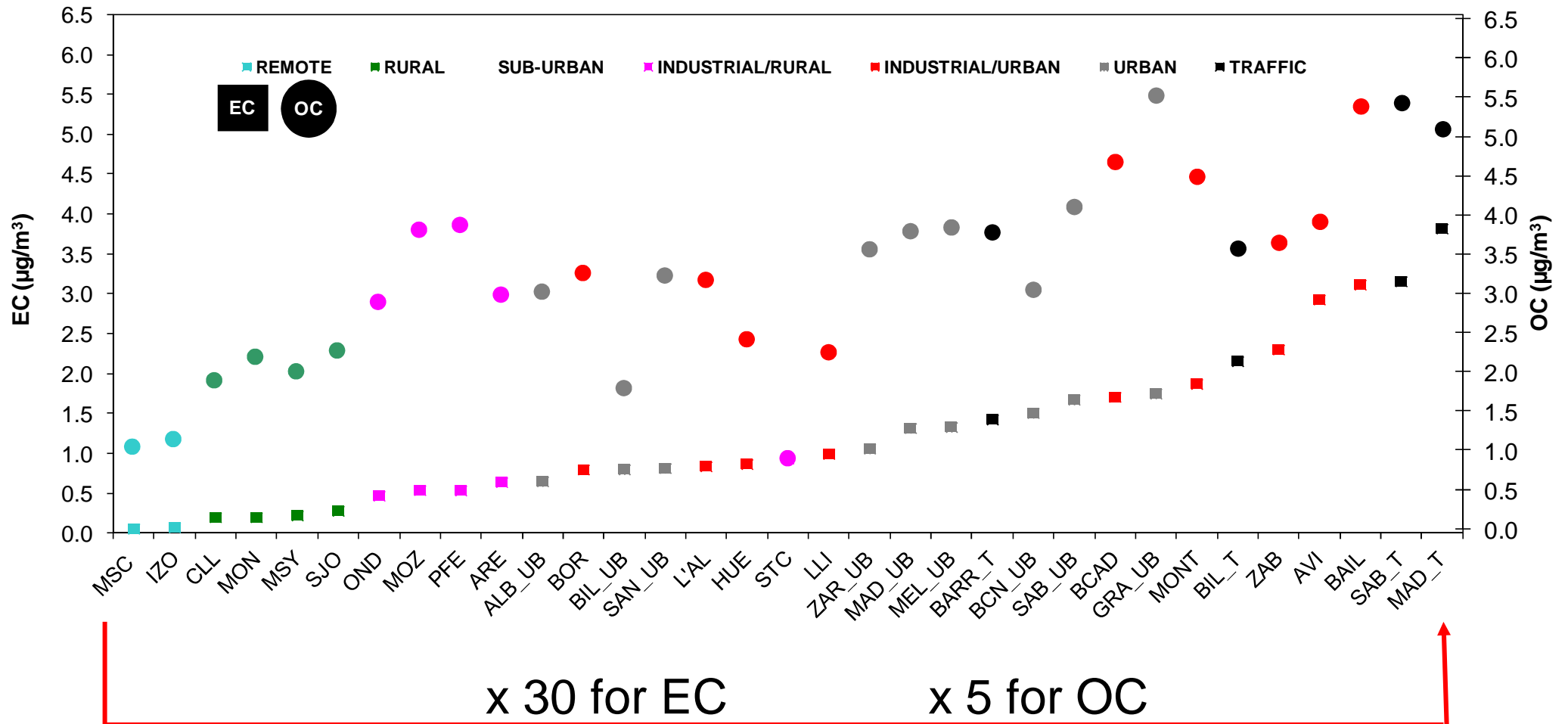


Amato et al. (2009). Atmospheric Environment

Secondary aerosols

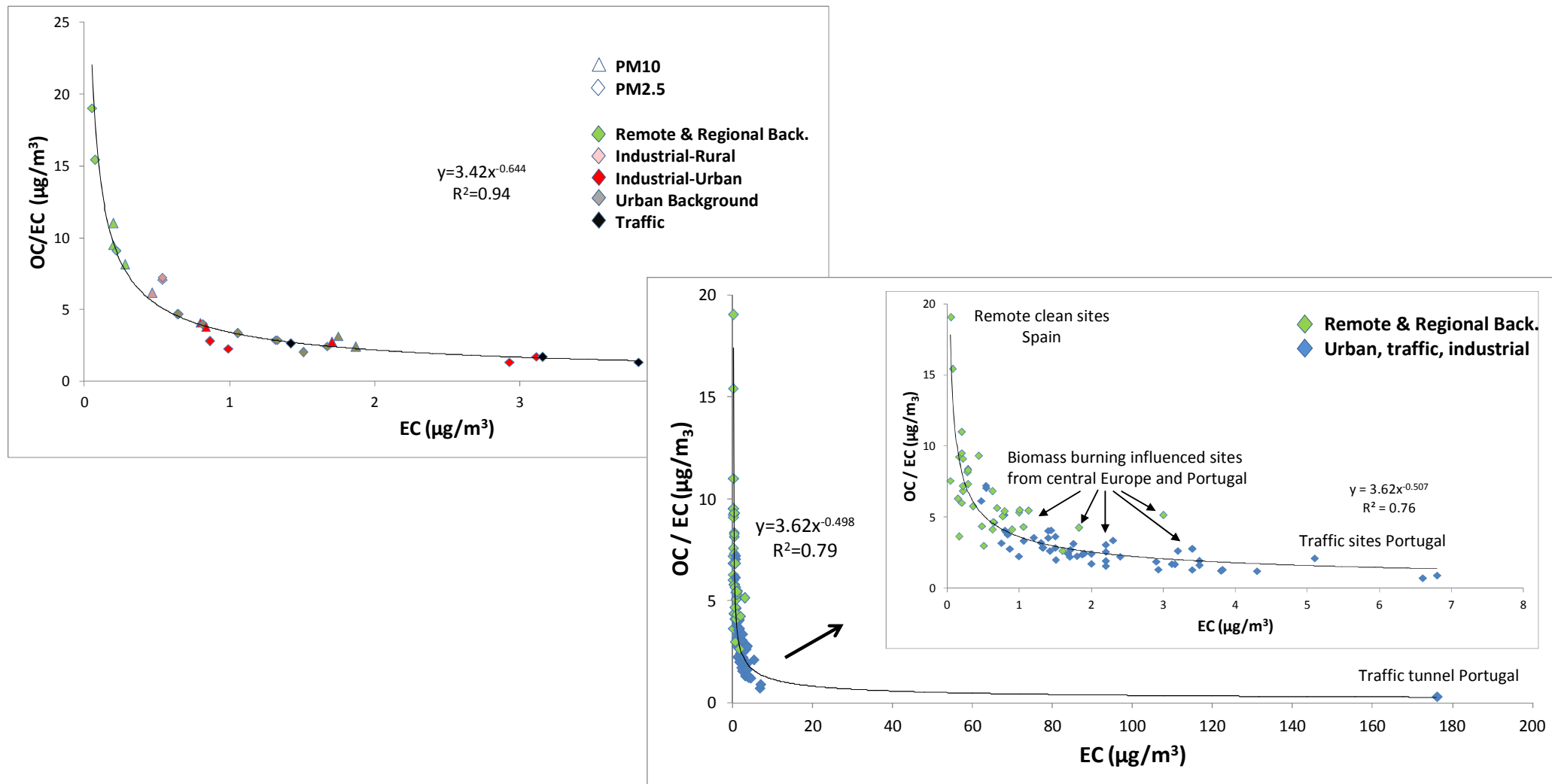


Carbonaceous aerosol in Spain

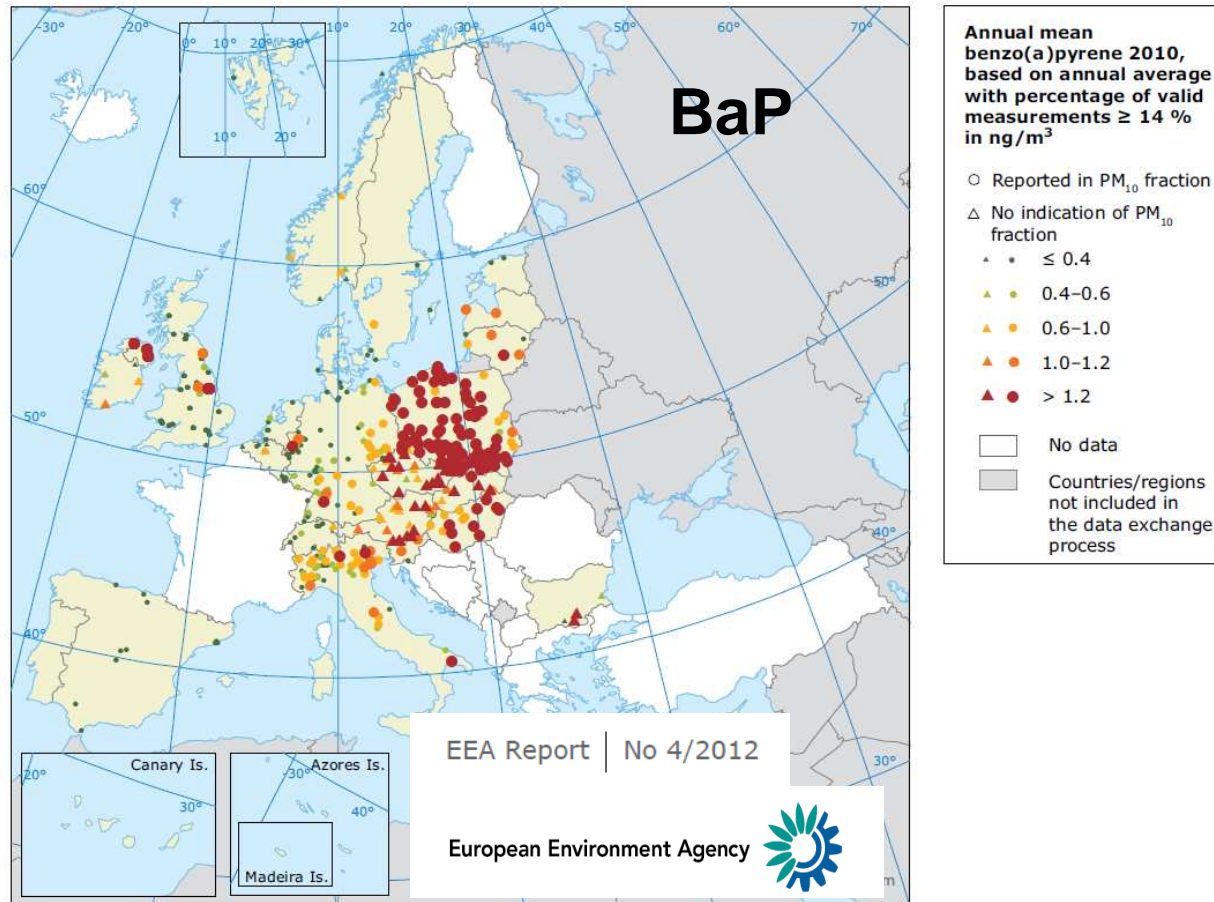


Querol et al. (2013). Atmospheric Chemistry and Physics

Carbonaceous aerosol in Spain and Europe



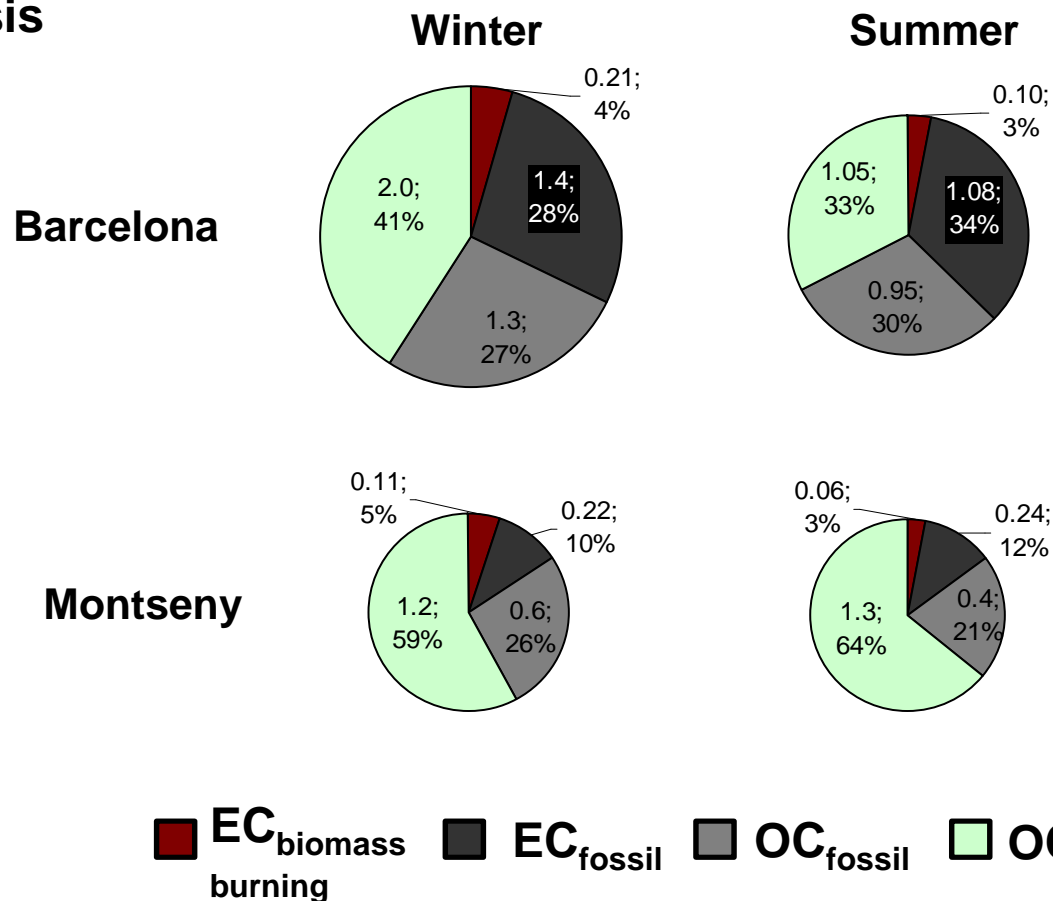
Benzo(a)pyrene in Europe



Source: AirBase v. 6.

Source apportionment to carbonaceous aerosol

¹⁴C analysis

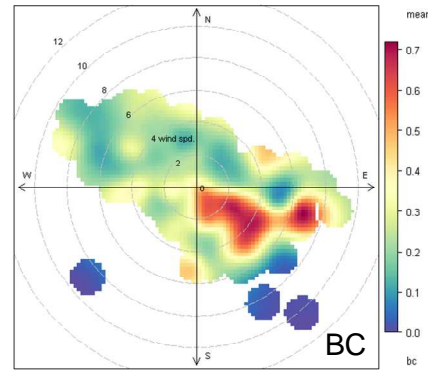


Minguillón et al. (2011). Atmospheric Chemistry and Physics

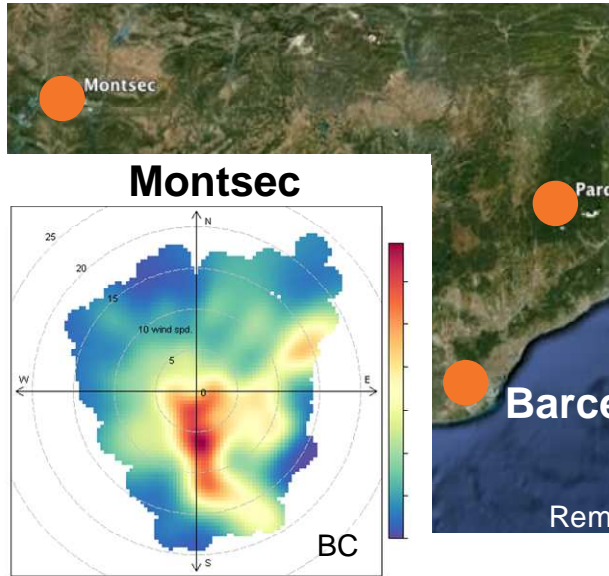
Black carbon



Montseny

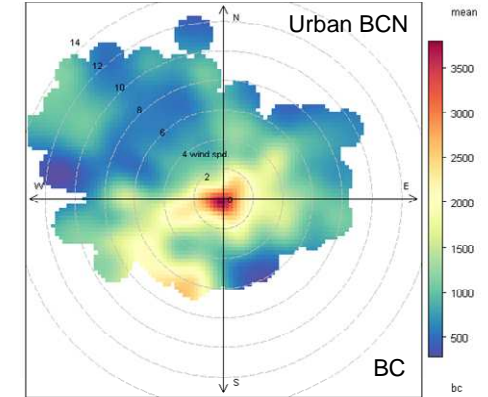
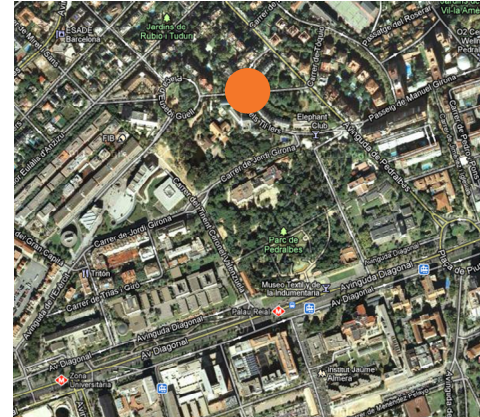


mean
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
bc



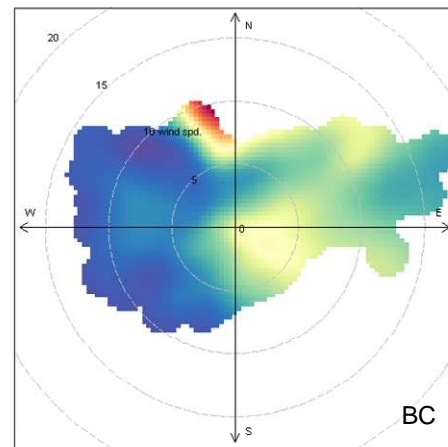
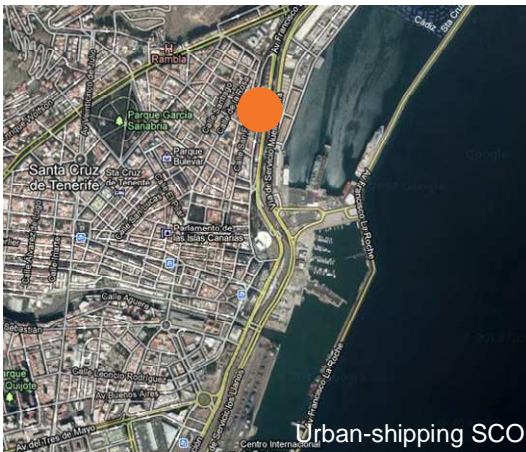
Barcelona
Remote and Rural site

Barcelona



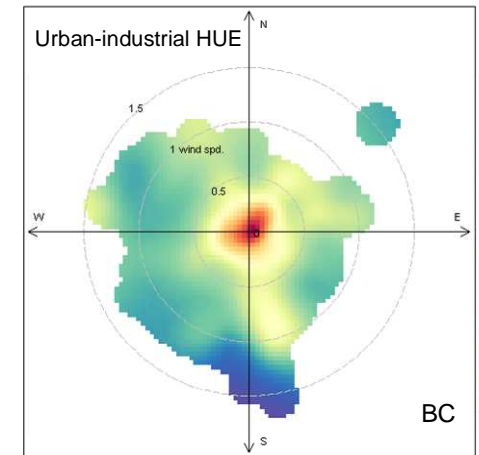
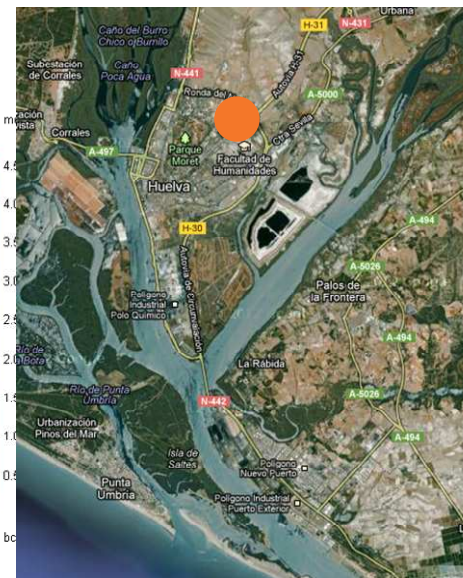
mean
3500
3000
2500
2000
1500
1000
500
bc

Santa Cruz de Tenerife



4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
bc

Huelva

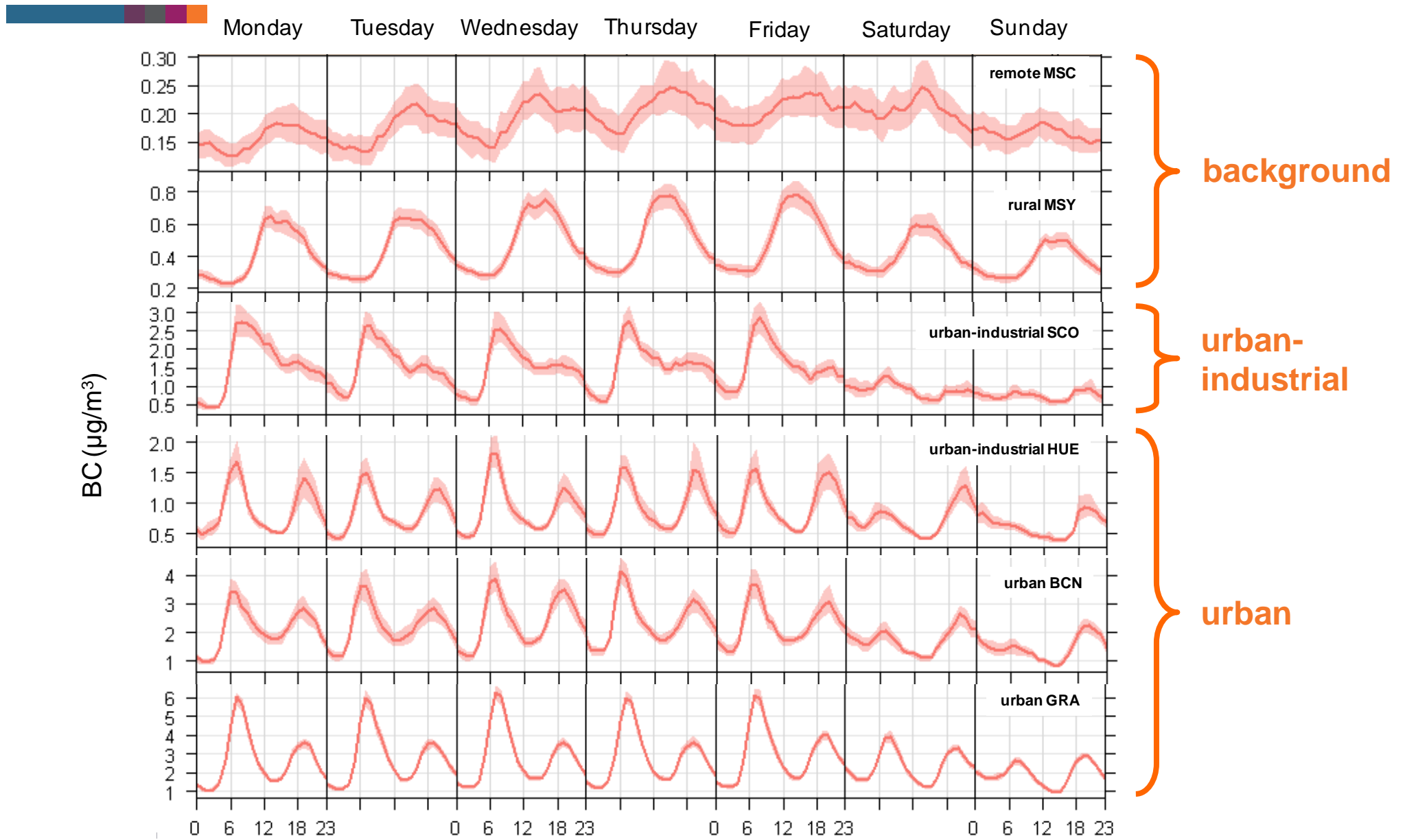


mean
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
bc



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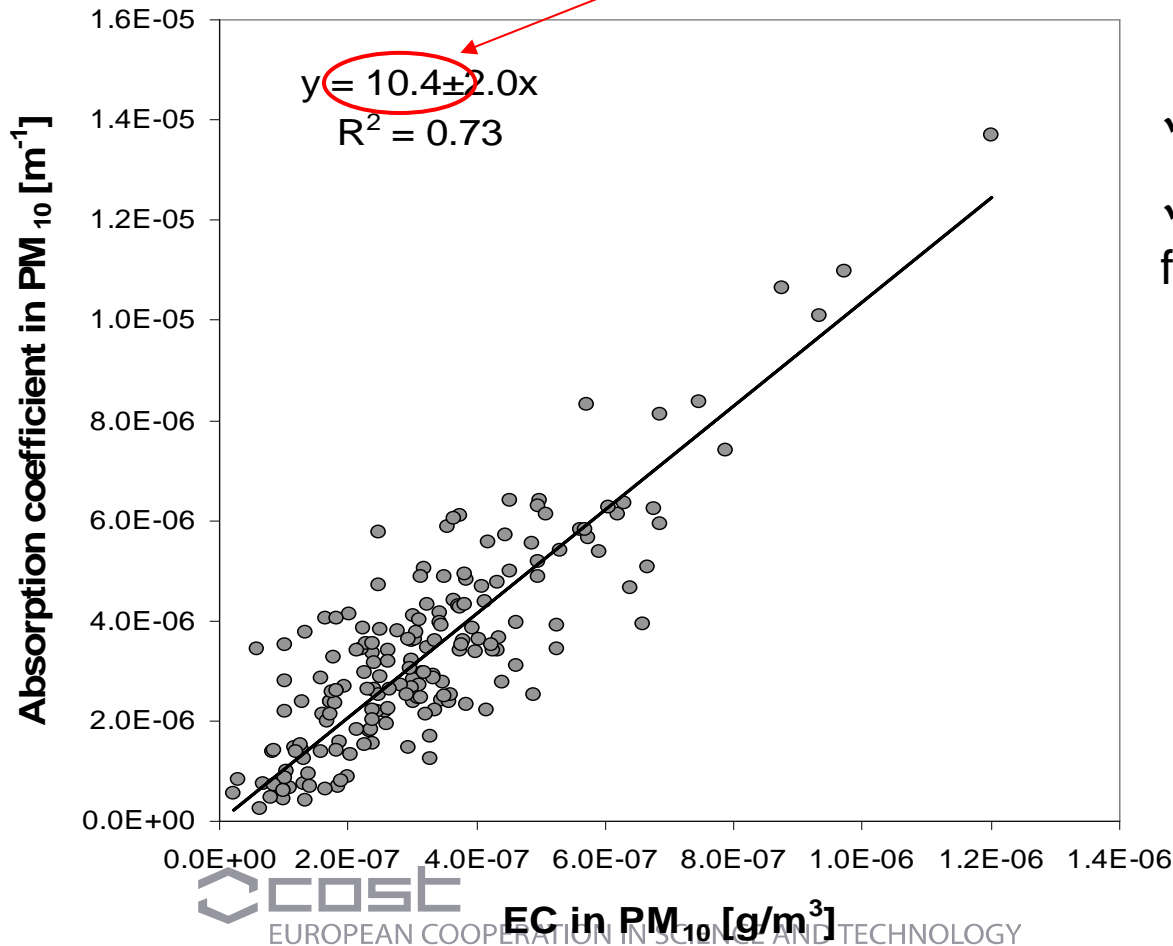
Black carbon



Mass absorption cross section (MAC) and BC

$$Abs_{BC}^{\lambda} (m^{-1}) = \sigma_{BC}^{\lambda} (m^2 g^{-1}) \cdot [BC] (gm^{-3})$$

(MAAP) MAC (EC; SUNSET)



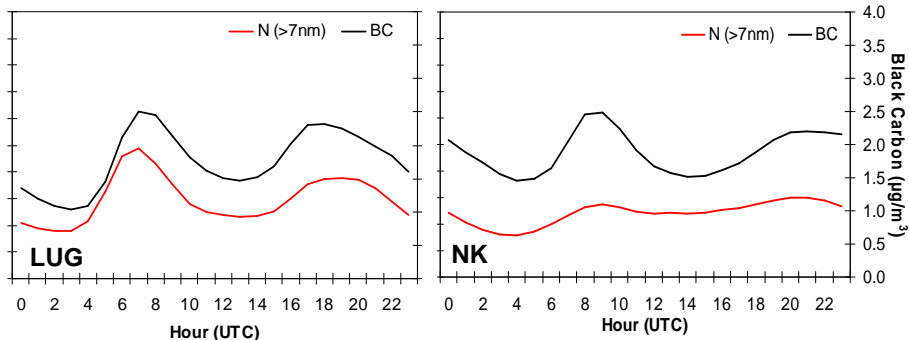
- ✓ Absorption measurements from MAAP
- ✓ EC off-line measurements from 24h-filters (SUNSET)

Data from MSY
(04/2008 – 02/2010)

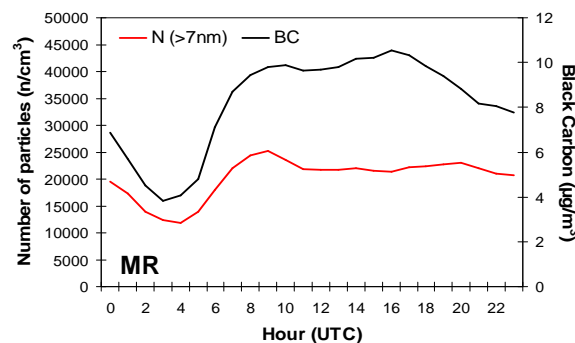
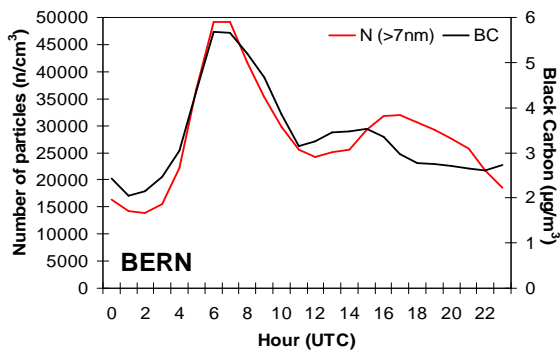
Particle number (N) and Black carbon (BC)

— N
— BC

Number of particles (n/cm³)



N does not always co-vary with traffic



Conclusions

Air quality characteristics in the South of Europe

- PM is a critical air quality parameter
- PM concentrations decreased in the last years
- PM critical components:
 - Mineral matter (with road dust influence)
 - Secondary aerosols
 - Carbonaceous aerosols (includes black carbon) (low biomass burning influence)
- Ultrafine particles have high influence of photochemistry



Thank you for your attention

Acknowledgements

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Regional Air Quality monitoring networks: Catalunya, Valencia, Aragón, Melilla, Navarra, Andalucía, Baleares, Cantabria, Canarias, Castilla León, Castilla la Mancha, Euskadi, Extremadura, Galicia, Madrid, Murcia, Asturias.