

# ENVIRONMENTAL GEOCHEMISTRY AND ATMOSPHERIC RESEARCH TEAM

Department of Geosciences

Institute of Environmental Assessment and Water Research



## Research focus:

Atmospheric pollution

Climate and air quality feedbacks

Urban and industrial geochemistry

## Research tools:

R&D projects in National and EC calls,  
& contracts with administrations  
& companies

# Research in the gap of science and policy

Working since 1994 in assessment working groups for:

## Spanish Ministry of the Environment 2001-currently

- Air Quality Standards (interaction with European Commission)
- Evaluation of the natural PM contributions to ambient PM
- Work in >40 cities to do source apportionment studies
- Elaboration of the National Air Quality Plans in 2011 and 2013
- Elaboration of the National Ozone Plan in 2024

## Regional Governments 1994-currently

- Measurements of advanced air quality
- Work in PM hotspots to do source apportionment studies
- Elaboration of Air Quality Plans

## City Councils 2001-currently

- Assessment for Air Quality Plans

## UN-ECE

- EMEP's Scientific Bureau (Vice-Chair 2010-2024, members)

## WHO 2010-currently

- WHO working groups on air quality (elaboration guidelines and WHO reports)
- Policy snapshots for air quality

## European Commission 2021-currently

- Air Quality Expert Groups for Standards
- Writing team of base documents for standards
- Natural Contributions
- New pollutants
- Non-exhaust vehicle emissions

## Observation supersites

- Barcelona urban background 1999-Present
- Regional background 2002-Present (Montseny)
- Remote background 2008-Present (Montsec)

# AIRUSE-LIFE PM<sub>x</sub> source apportionment and measures to abate urban air pollution in Southern Europe

BEST GREEN CITY PROJECT 2018 by DG ENV



# HARMONIZED PM10 & PM2.5 SOURCE APPORTIONMENT

## PM10 (annual mean)

- |  |   |
|--|---|
| 1. Road Traffic is the main source contributing to PM10: <b>31-38%</b> (ATH 23%)                                 | <b>36-45%</b> (ATH 15%)                               |
| 1.1. Vehicle exhaust + traffic related NO <sub>3</sub> <sup>-</sup> are the main causes: <b>21-29%</b> (ATH 15%) | <b>30-34%</b> (ATH 6%)                                |
| 1.2. Non-exhaust vehicle emissions are also relevant: <b>8-11%</b>   | <b>18-29%</b> (ATH 3%, POR 6%)                        |
| 2. Regional OC and/or SO <sub>4</sub> <sup>2-</sup> dominated pollution: <b>20-26%</b> (POR-TR 10%)              | BCN <b>19%</b> , 2-6%                                 |
| 3. Local dust : <b>10-19%</b>  | POR <b>27%</b> , 1-4%                                 |
| 4. Biomass burning very relevant in POR & FI ( <b>14-16%</b> ), less in ATH ( <b>7%</b> ) and negligible in BCN  | POR & FI ( <b>25-30%</b> ), ATH 1%, negligible in BCN |
| 5. Industry BCN <b>11%</b> , <b>4-5%</b> , ATH <1%   | BCN <b>17%</b> , <1-3%                                |
| 6. Non traffic-NO <sub>3</sub> <sup>-</sup> <b>6-8%</b> (2% POR)   | BCN & FI 7-9% (1-2% POR & ATH)                        |
| 7. Shipping <b>4%</b> in coastal sites   | 3-4% in coastal sites                                 |
| 8. African dust ATH <b>14%</b> , 1-4%  | ATH <b>52%</b> , 1%                                   |
| 9. Sea salt POR <b>13%</b> , <b>4-8%</b>   | ATH <b>7%</b> , 1-3%                                  |
| 10. Anthropogenic dust (Local dust + Non exhaust) reaches <b>19-25%</b>  | <b>11-33%</b> , ATH 4%                                |

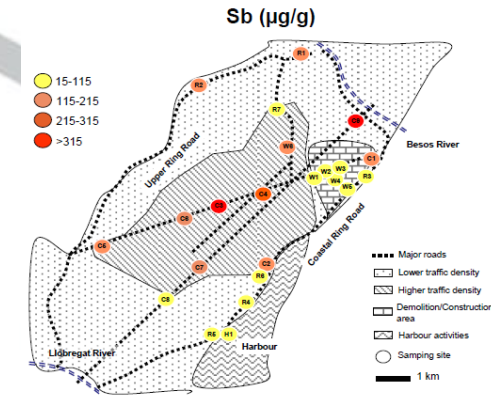
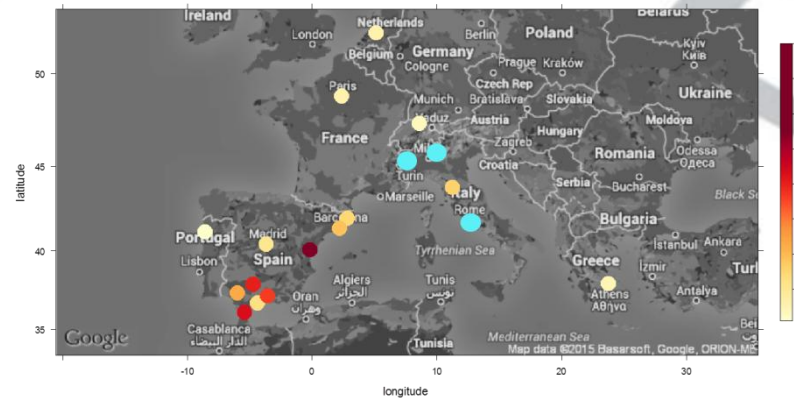
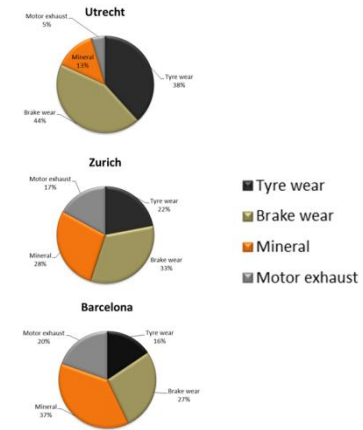
## PM10 (days of exceedance)

## PM2.5 (annual mean)

- |  |  |
|--|--|
| 1. Road Traffic is the main source contributing to PM2.5: <b>28-39%</b> (ATH <b>22%</b> )                        | <b>32-42%</b> (ATH 11%)                    |
| 1.1. Vehicle exhaust + traffic related NO <sub>3</sub> <sup>-</sup> are the main causes: <b>25-34%</b> (ATH 17%) | <b>31-40%</b> (ATH 10%)                    |
| 1.2. Non-exhaust vehicle emissions are also relevant: <b>5-7%</b> (BCN&FI 1-2% )                                 | <b>1-9%</b>                                |
| 2. Regional OC and/or SO <sub>4</sub> <sup>2-</sup> dominated pollution: <b>19-37%</b> (POR <b>13%</b> )         | BCN & MLN 11-22%, 2-6%                     |
| 3. Local dust: POR <b>16%</b> , <b>2-6%</b>  | POR <b>22%</b> , 1-2%                      |
| 4. Biomass burning very relevant in MLN, FI & POR ( <b>18-21%</b> ), less in ATH ( <b>10%</b> ) and not in BCN   | POR, FI & MLN ( <b>26-33%</b> ), <2%       |
| 5. Industry <b>5-12%</b> , ATH <1%   | BCN <b>18%</b> , <1-3%                     |
| 6. Non traffic-NO <sub>3</sub> <sup>-</sup> <b>3-6%</b> (POR <b>1%</b> )   | BCN, FI & MLN <b>6-9%</b> (1-3% POR & ATH) |
| 7. Shipping <b>5-7%</b> in coastal sites   | <b>6-10%</b> in coastal sites              |
| 8. African dust: ATH <b>6%</b> , <1%   | ATH <b>45%</b> , 1%                        |
| 9. Sea salt POR <b>5%</b> , <1-3%,   | <1%-1%                                     |
| 10. Anthropogenic dust (Local dust + Non exhaust) reaches <b>10-21%</b> , BCN <b>7%</b> , FI <b>4%</b>           | <b>POR 15</b> , 3-9%                       |

## PM2.5 (days of PM10 exceedance)

# PM10, PM4, PM2.5 deposited road dust, mining dust, urban dust



# AIRUSE STRATEGY FOR AIR QUALITY MEASURES ON ROAD TRAFFIC

0. Air quality plans should be devised at the scale of the metropolitan area

ii. Measures to reduce number of urban vehicles circulating

iii. Measures favoring renewal and transformation of urban vehicle fleets  
(LEZ, CAs, taxes,..)

iv. Urban distribution of goods (urban freight distribution) & taxis

v. Urban re-design: priority pedestrians and green areas

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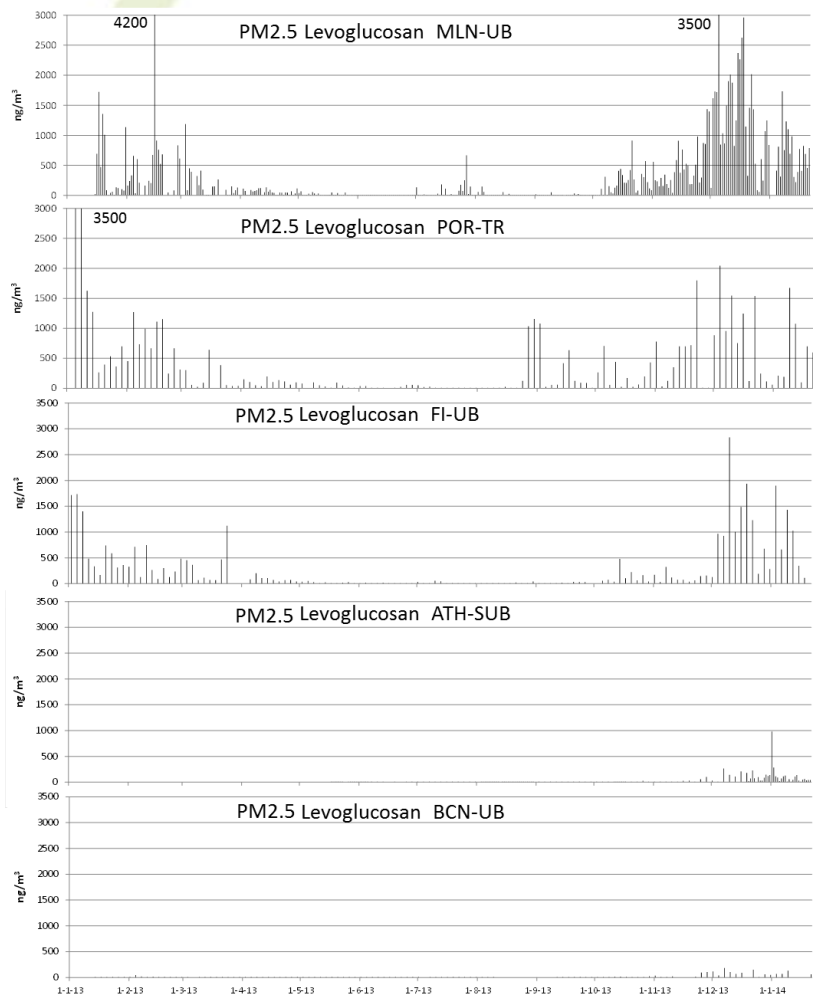
vii

i. Improving public transport

vi. Remediation measures

vii. Other non-technological measures

# AIRUSE BIOMASS BURNING PROFILES & RECOMMENDATIONS



## Biomass burning appliances



1

Traditional brick fireplace



2

Traditional cast iron wood stove



3

Eco-labelled chimney-type wood stove



4

Pellet stove



# FREE AVAILABLE REPORTS & GUIDES PRODUCED

 <p>GUIDEBOOK <b>BOOK</b> MEASURES TO IMPROVE URBAN AIR QUALITY AIRUSE</p> <p>DESCARGA</p>	 <p>CHAPTER 1 Case studies of atmospheric particulate matter (PM) trend analysis and source apportionment</p> <p>DESCARGA</p>	 <p>CHAPTER 2 Measures to reduce air pollutants emissions from construction/demolition works</p> <p>DESCARGA</p>	 <p>CHAPTER 3 Measures to reduce air pollutants emissions from the industrial sector</p> <p>DESCARGA</p>
 <p>CHAPTER 4 Measures to reduce air pollutants emissions from road dust resuspension</p> <p>DESCARGA</p>	 <p>CHAPTER 5 Measures to reduce air pollutants emissions from biomass burning</p> <p>DESCARGA</p>	 <p>CHAPTER 6 The experience of Northern and Central Europe in improving urban air quality</p> <p>DESCARGA</p>	 <p>CHAPTER 7 A proposed Eco-labelling scheme for European vehicles</p> <p>DESCARGA</p>



PLANES DE MEJORA DE LA CALIDAD DEL AIRE  
GUIA PARA LA ELABORACIÓN

2025

GOBIERNO DE ESPAÑA  
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO  
SECRETARÍA DE ESTADO DEL MEDIO AMBIENTE  
DIRECCIÓN GENERAL DE CALIDAD AMBIENTAL Y EVALUACIÓN AMBIENTAL

CSIC  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

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GUÍA PARA MEDIDAS DE CALIDAD DEL AIRE SOBRE EL TRÁFICO RODADO

2025

GOBIERNO DE ESPAÑA  
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

<https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/atmosfera-y-calidad-del-aire/documentacion-oficial.html>

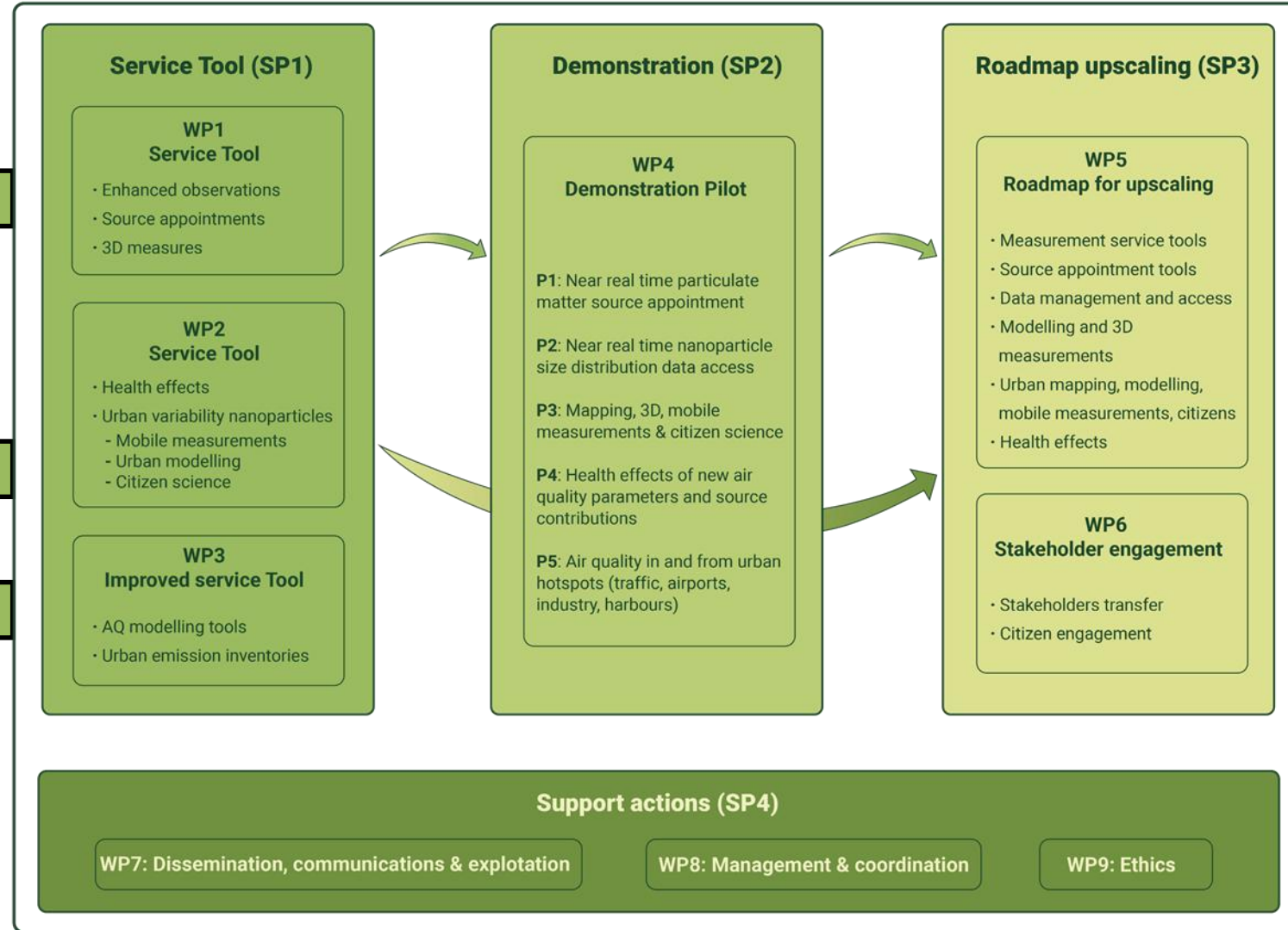
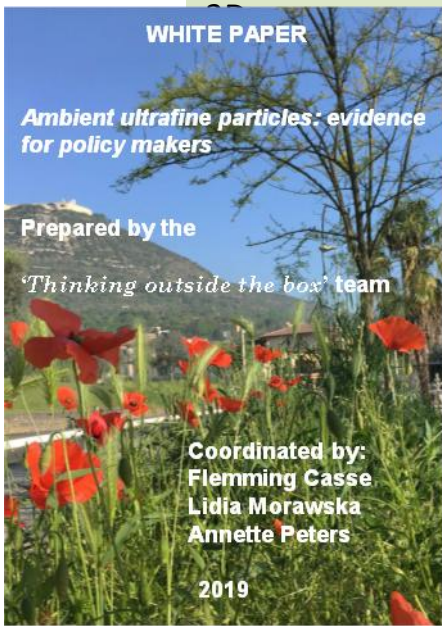
<http://www.cleanaircities.net/es/>

On the gap between air quality science and policy, EGAR-IDAEA-CSIC, PEEX online Seminar, 1st April 2026, Xavier Querol



# RI-URBANS' concept and service tools

UFP-PNSD  
 BC  
 Offline PM speciation  
 Online PM speciation  
 Source apportionment  
 NH<sub>3</sub>  
 VOCs





<https://riurbans.eu/project/#service-tools>

UFP, BC, OP, PM chemistry, VOCs, NH<sub>3</sub>, source apportionment mapping, 3D measurements recommended for supersites in 2021 to DG ENV

Recommendations sent to the drafts of the new AQD, with ACTRIS

Guidance documents elaborated & openly available, webinars for AQMN experts along 2024 & 2025  
**HIGHLY CITED IN THE REPORT ON MEASUREMENTS FROM DG-ENV**

To be published by DG ENV by the end of 2026

# Determination of contributions to air pollution attributable to natural sources

A technical support document on the demonstration and subtraction of exceedances attributable to natural sources under Directive (EU) 2024/2881

First draft

<Written by>  
<Month - 20XX>

LOGO

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Authors: Xavier Querol (CSIC), Jaume Targa (4sfera), María Colina (4sfera), Pedro Salvador (CIEMAT), Francisco Ferreira (FCT-NOVA), Augustin Collette (INERIS), Francesca Barnaba (ISAC), Claudia Di-Biagio (LISA), Dimitrios Melas (AUTH), György Varga (HUNREN), Jaume Archilés (4sfera)

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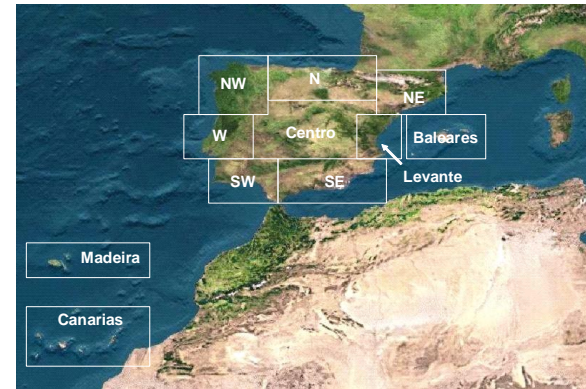
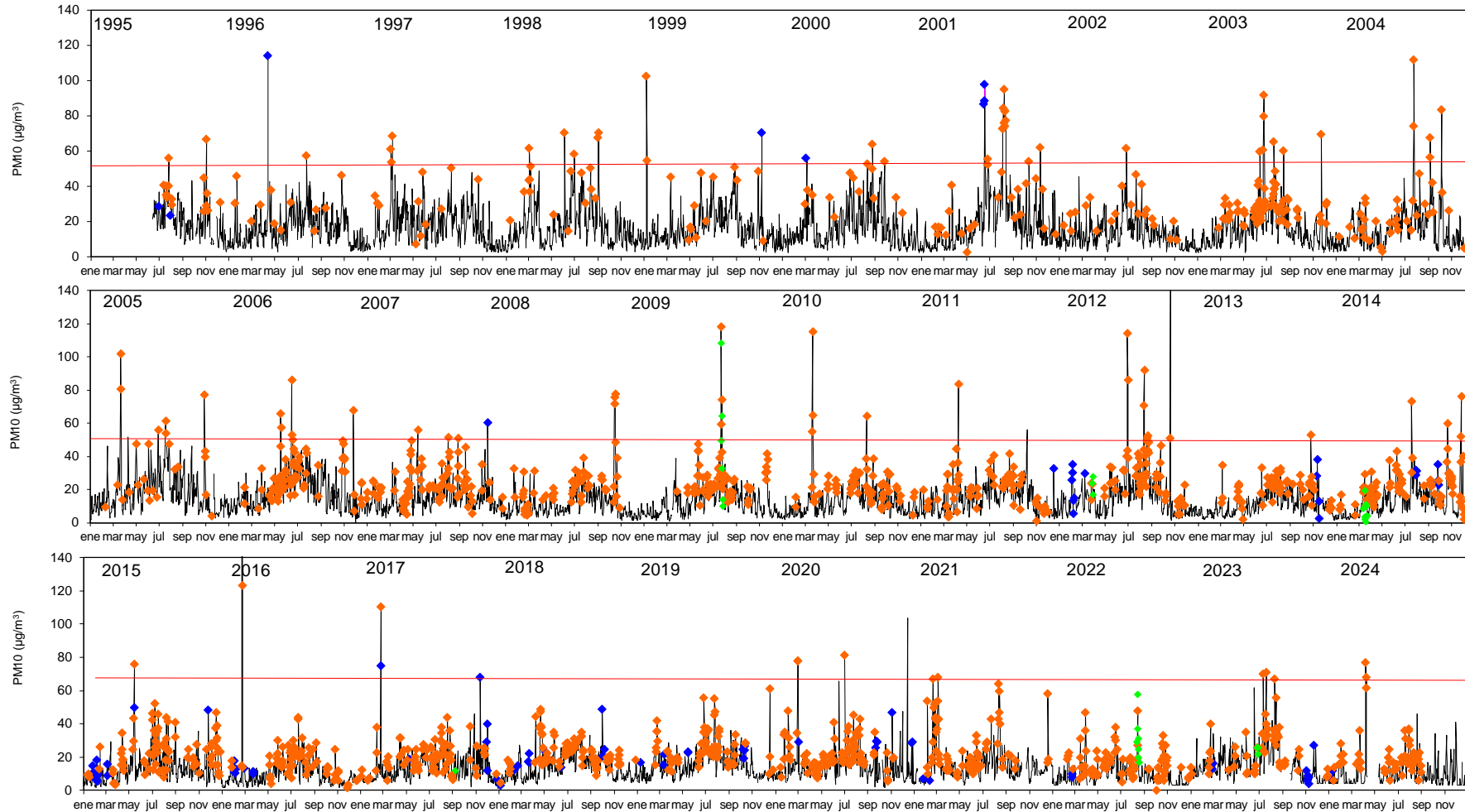
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# Daily African dust contributions to PM10 and PM2.5 in Spain

Alerts 24 h before dust events, 250 emails, annual reports



Daily dust contributions to PM: 2001-2025



- ◆ African dust outbreaks
- ◆ Local dust from Monegros
- ◆ Forest fires

# National Ozone Plan



BIODIVERSIDAD Y BOSQUES  
ABRIL 2025

MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

## Bases científicas para un Plan Nacional de Ozono

Resumen de los resultados de las investigaciones realizadas entre 2019 y 2024



The whole Spanish territory receives external contributions of transboundary  $O_3$ , even external to EU, R1 receives also diluted contributions from other Spanish basins, and relatively low local ones (low emissions of precursors and specific low  $O_3$  climate patterns):

- Asturias
- Canarias
- Cantabria
- Galicia

AS reported for R1 but contributions of neighbouring  $O_3$  hotspot basins (C. Madrid, Portugal, Barcelona, Tarragona) are higher:

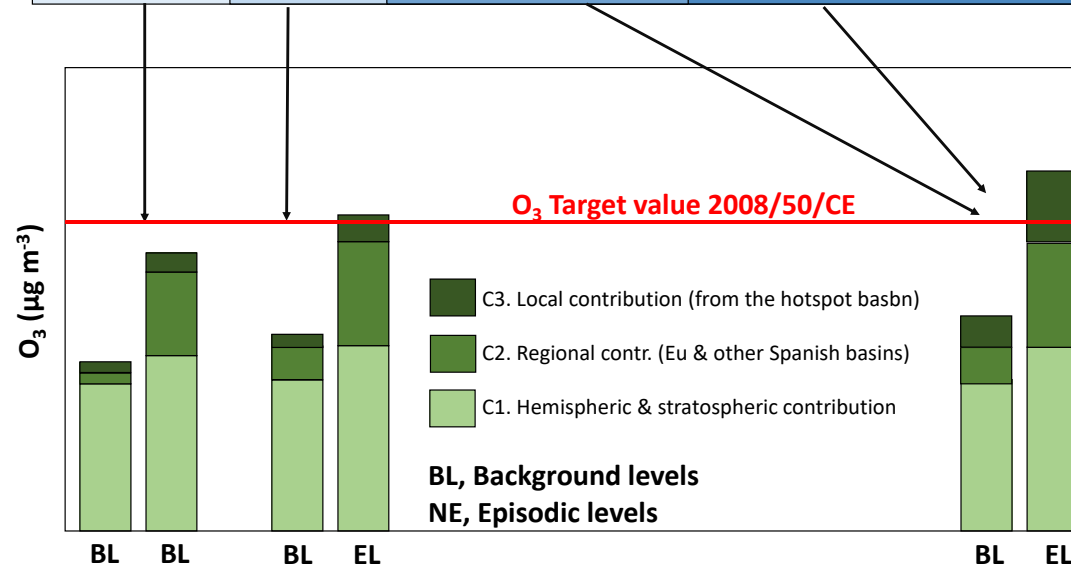
- País Vasco
- Extremadura
- Murcia
- Navarra
- CyL
- CLM
- Aragón
- Baleares
- Rioja

$O_3$  Hotspot basins with very relevant contributions of  $O_3$  generated into the basin from local precursors:

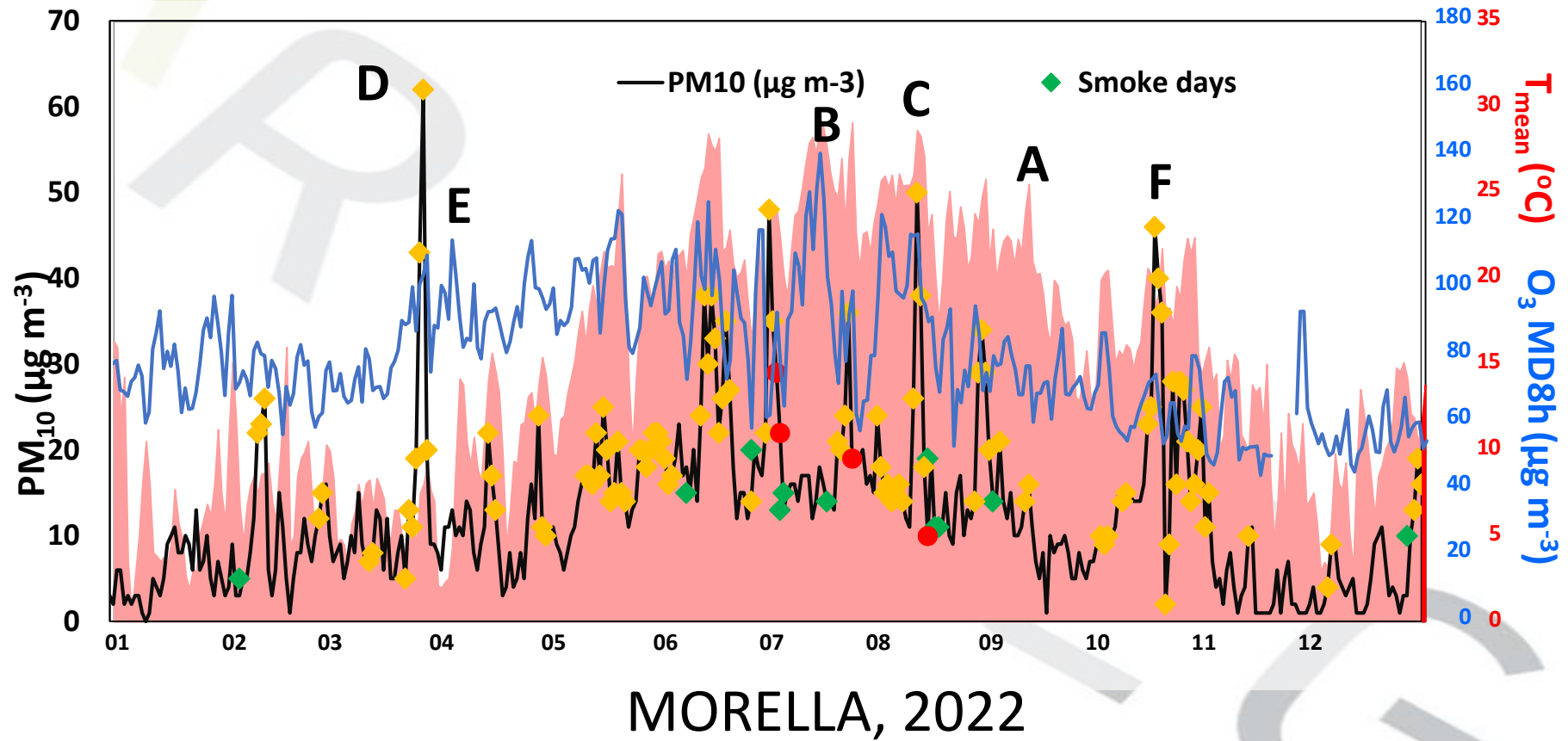
- Madrid
- N Barcelona, N Tarragona
- Guadalquivir B.
- Inner C. Valenciana

As for R3, but very specific local emissions of precursors causing the problem.:

- Puertollano



# Recent proposal on changes of PM and synergistic effects in T, PM/dust/fires, O<sub>3</sub> episodes



# Thank you for your attention!!!!!!

xavier.querol@idaea.csic.es



## Pan-Eurasian Experiment

# PEEX