

La contaminación urbana procedente del transporte y la salud. La situación actual en España

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IDAEA-CSIC

Índice

- Contaminación atmosférica: qué es y legislación
- Situación en Europa y España: contaminantes críticos
 - El problema del NO₂
 - El problema de las partículas PM₁₀ / PM_{2.5}
- Efectos de la contaminación atmosférica en la salud: PM, UFP, BC
- Medidas de calidad del aire en el transporte urbano

¿Que es la contaminación atmosférica?

Directiva 1999/30/CE sobre Calidad del Aire y la Protección de la Atmósfera:

“Contaminación atmosférica”: Presencia en la atmosfera de materia, sustancias o energía que pueden suponer un riesgo o daño para la seguridad de las personas, medio ambiente...”

Tener en cuenta:

- No conocemos todas las sustancias que tienen efecto negativo en la salud
- Para algunos contaminantes no hay umbral de protección

Las escalas de la contaminación atmosférica



Contaminación atmosférica

Escala global

Meso-escala

Escala local

Cambio climático

Ozono estratosférico

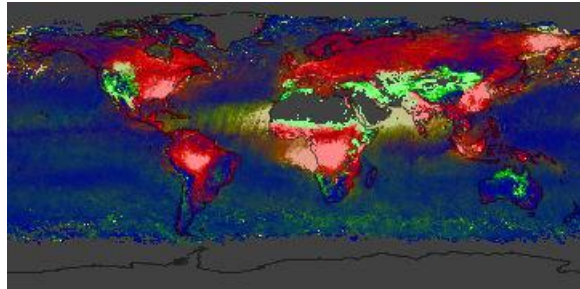
Acidificación y eutrofización

Ozono Troposférico

Salud humana

Materiales de construcción

Visibilidad



Calidad del aire



Valores límite / objetivo EU y OMS

		EU Directiva 2008/50/EC RD102/2011	WHO Guidelines (2006)		
PM ₁₀	Media anual	40 µg m ⁻³	No exceder	20 µg m ⁻³	No exceder
	Media diaria	50 µg m ⁻³	<35 d/año	50 µg m ⁻³	<3 d/año
PM _{2,5}	Media anual	25 µg m ⁻³	No exceder	10 µg m ⁻³	No exceder
SO ₂	Media diaria	125 µg m ⁻³	<3 d/año	20 µg m ⁻³	No exceder 1d
	Media horaria	350 µg m ⁻³	<24 h/año	500 µg m ⁻³	10 min. No exceder
NO ₂	Media anual	40 µg m ⁻³	No exceder	Coincide	No exceder
	Media horaria	200 µg m ⁻³	<18 h/año	Coincide	No exceder
O ₃	Media max 8h 3y	120 µg m ⁻³	<25 d/año	100 µg m ⁻³	No exceder 8h
Pb	Media anual	0,5 µg m ⁻³	No exceder	Coincide	No exceder
CO	Media max 8h	10 mg m ⁻³	No exceder	Coincide	No exceder
C ₆ H ₆	Media anual	5 µg m ⁻³	No exceder	Coincide	No exceder
BaP	Media anual	1 ng m ⁻³	No exceder	0,12 ng m ⁻³	No exceder
As	Media anual	6 ng m ⁻³			
Cd	Media anual	5 ng m ⁻³	VALORES OBJETIVO		
Ni	Media anual	20 ng m ⁻³			

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As	Media anual	6 ng m ⁻³			
Cd	Media anual	5 ng m ⁻³	VALORES OBJETIVO		
Ni	Media anual	20 ng m ⁻³			

Población expuesta a contaminación atmosférica

Table ES.1 Percentage of the urban population in the EU-28 exposed to air pollutant concentrations above certain EU and WHO reference concentrations (minimum and maximum observed between 2014 and 2016)

Pollutant	EU reference value ^(a)	Exposure estimate (%)	WHO AQG ^(a)	Exposure estimate (%)
PM _{2.5}	Year (25)	6-8	Year (10)	74-85
PM ₁₀	Day (50)	13-19	Year (20)	42-52
O ₃	8-hour (120)	7-30	8-hour (100)	95-98
NO ₂	Year (40)	7-8	Year (40)	7-8
BaP	Year (1)	20-24	Year (0.12) RL	85-90
SO ₂	Day (125)	< 1	Day (20)	21-38

Key



EEA Report / No 12/2018

European Environment Agency



<https://www.eea.europa.eu/publications/air-quality-in-europe-2018>

EGAR

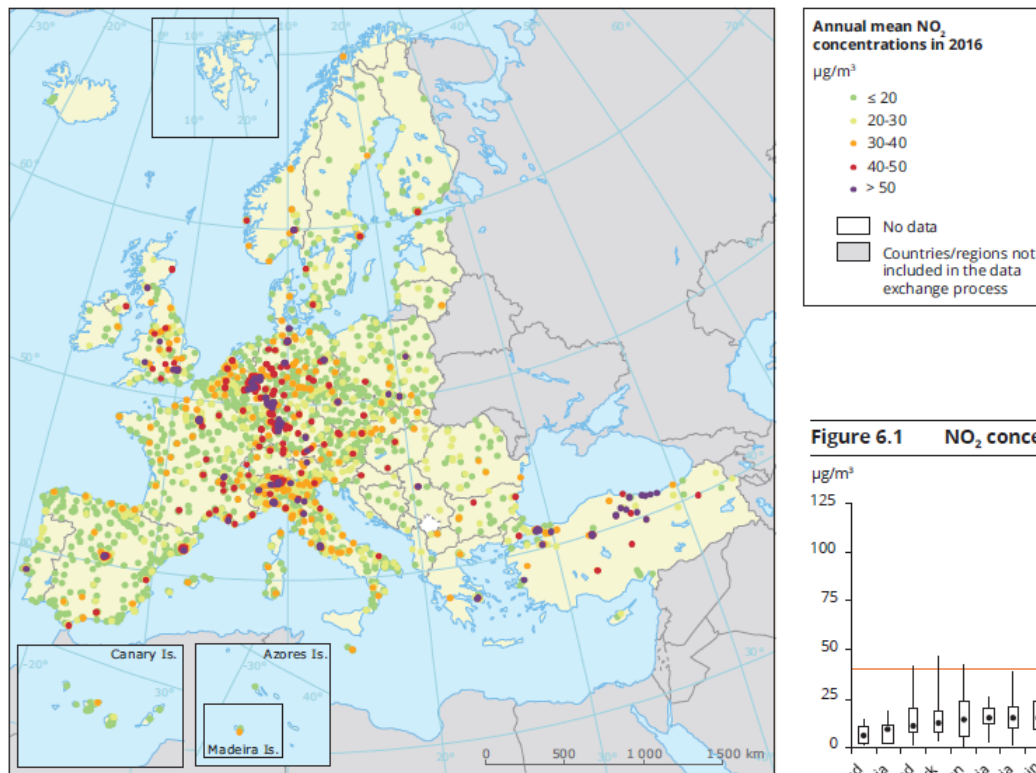
Muertes prematuras debido a la exposición a la contaminación atmosférica

Table 10.1 Premature deaths attributable to PM_{2.5}, NO₂ and O₃ exposure in 41 European countries and the EU-28, 2015

Country	Population (1 000)	PM _{2.5}		NO ₂		O ₃	
		Annual mean ^(a)	Premature deaths ^(b)	Annual mean ^(a)	Premature deaths ^(b)	SOMO35 ^(a)	Premature deaths ^(b)
Austria	8 576	13.3	5 900	19.8	1 200	6 170	380
Belgium	11 237	13.0	7 400	20.9	1 500	2 790	220
Bulgaria	7 202	24.1	14 200	16.1	640	4 180	350
Portugal	9 870	9.8	5 500	15.7	890	3 990	300
Romania	19 871	18.1	25 400	14.9	1 300	2 950	580
Slovakia	5 421	19.1	5 200	16.9	240	5 460	210
Slovenia	2 063	17.4	1 800	16.7	160	6 650	100
Spain	44 154	12.7	27 900	21.2	8 900	5 820	1 800
Sweden	9 747	5.9	3 000	10.8	110	2 080	140
United Kingdom	64 875	9.4	31 300	19.7	9 600	1 290	590
EU-28	506 030	13.9	391 000	18.9	76 000	4 250	16 400
Total	538 278	14.1	422 000	18.8	79 000	4 310	17 700

El problema del NO₂

Map 6.1 Concentrations of NO₂, 2016



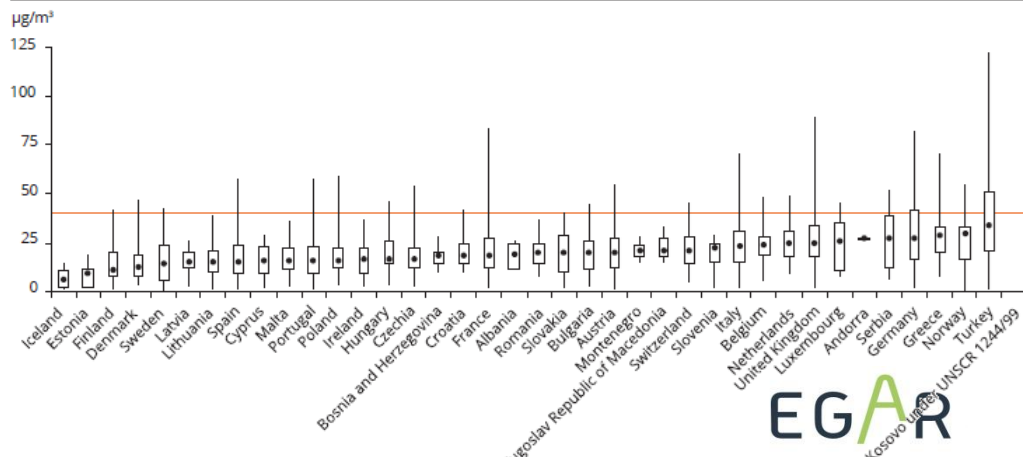
Emisiones de combustión

El transporte terrestre es la fuente más importante en áreas urbanas (mayor exposición)

11.5% de las estaciones >VLA; tráfico

1.3% de las estaciones >VLH; tráfico

Figure 6.1 NO₂ concentrations in relation to the annual limit value in 2016

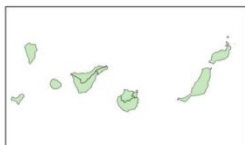


El problema del NO₂: España 2017

Zonas > VLA: 40 µg m⁻³

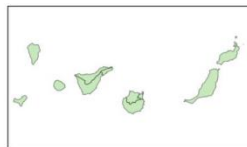
Zonas > VLH: 200 µg m⁻³ NO₂ < 18 veces/año

NO₂ VL Anual
40 µg/m³
■ <VLA
■ >VLA

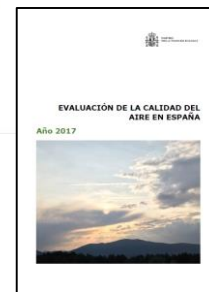


- Área de Barcelona
- Vallès - Llobregat
- Madrid
- Corredor del Henares
- Granada y Área Metropolitana
- Bajo Nervión

NO₂ VL Horario
200 µg/m³ no más de 18 ocasiones
■ <VLH
■ >VLH



- Madrid



Evaluación de la calidad del aire en España 2017



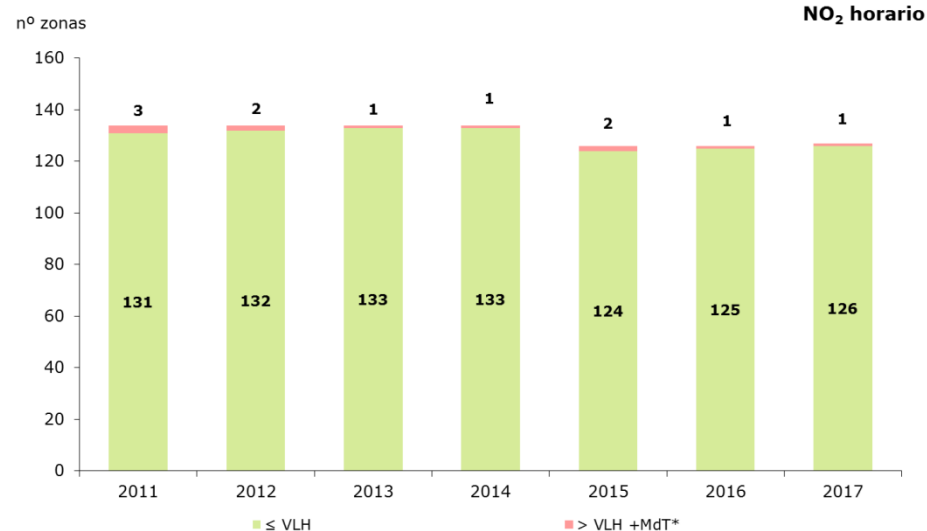
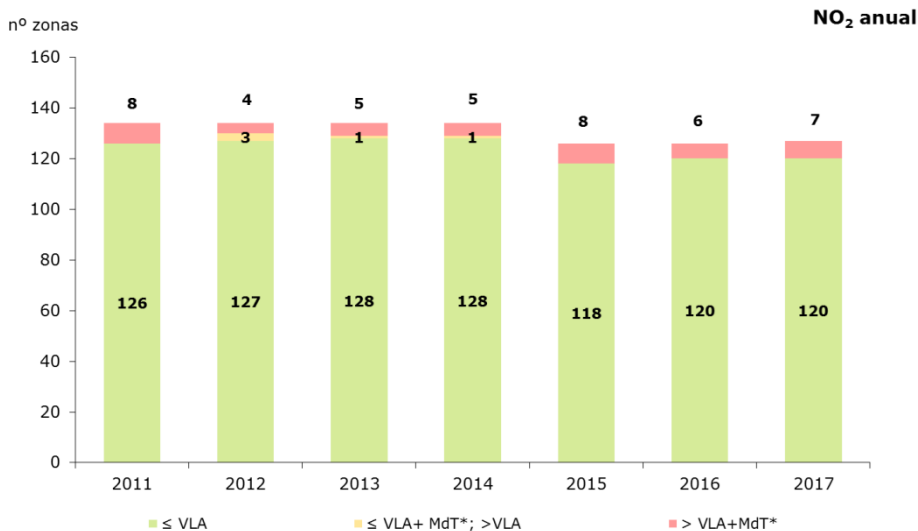
MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA

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El problema del NO₂: España 2011-2017

Zonas > VLA: 40 µg m⁻³

Zonas > VLH: 200 µg m⁻³ NO₂, < 18 veces/año



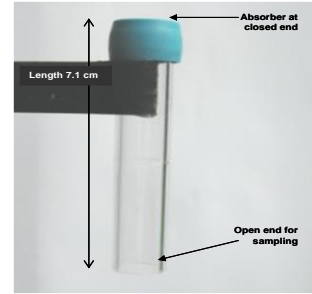
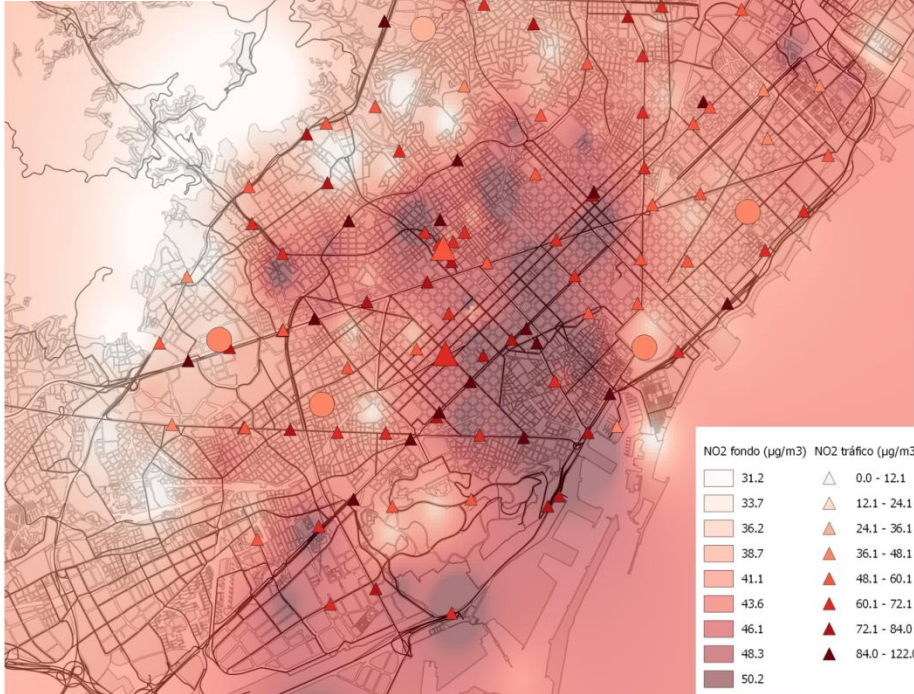
Evaluación de la calidad del aire en España 2017

El problema del NO₂: Barcelona ZQA1

NO₂ invierno 2017 – verano 2018
225 dosímetros pasivos

Generalitat de Catalunya
Departament de Medi Ambient
i Habitatge

CSIC



- Dosímetro NO₂ Palmes
- Difusión molecular
- Absorbente = 20% TEA en H₂O
- Análisis: colorimetría

Invierno 2017

Fondo: 43 µg/m³; Tráfico: 66 µg/m³

Verano 2018

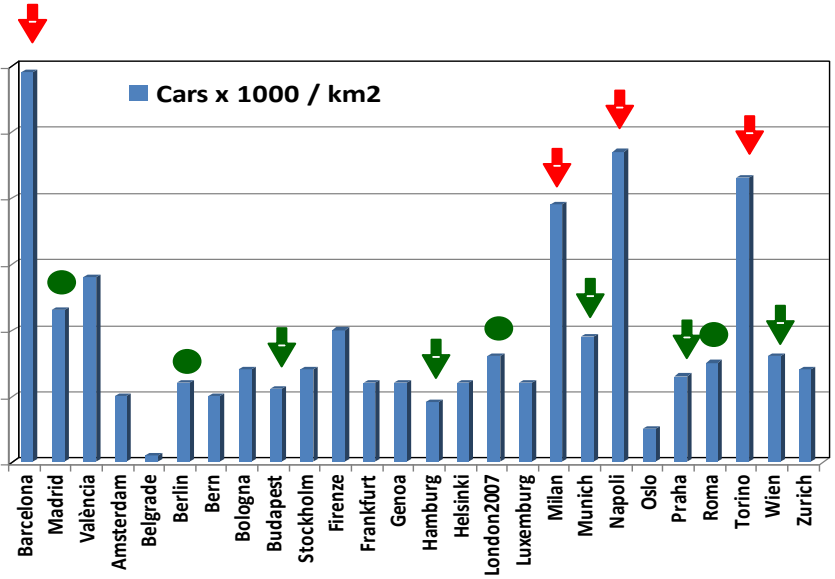
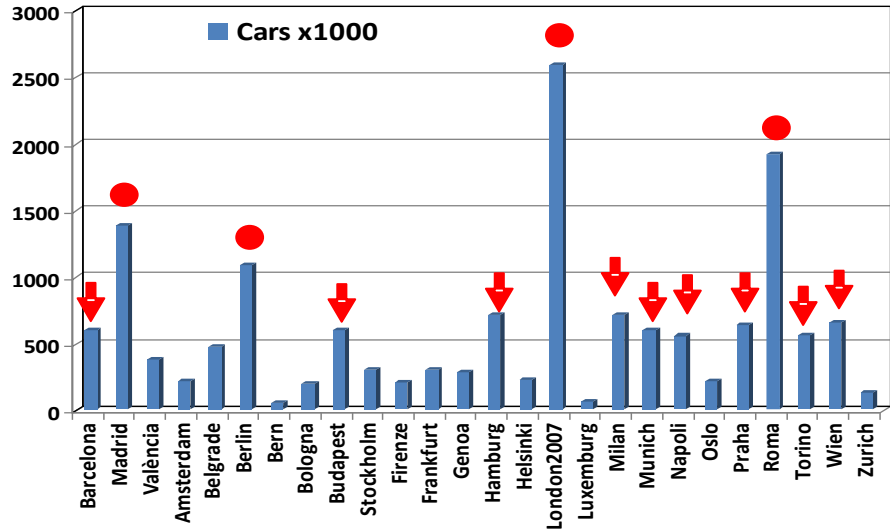
Fondo: 41 µg/m³; Tráfico: 66 µg/m³

Generalitat de Catalunya
Departament de Territori
i Sostenibilitat

EGAR

Contaminantes críticos: NO₂

Why so high NO₂?



**Very high density of vehicles (#/km²),
But also >50% of vehicles circulating in the city come from outside**

Contaminantes críticos: NO₂

Why so high NO₂?



Ámsterdam



Madrid



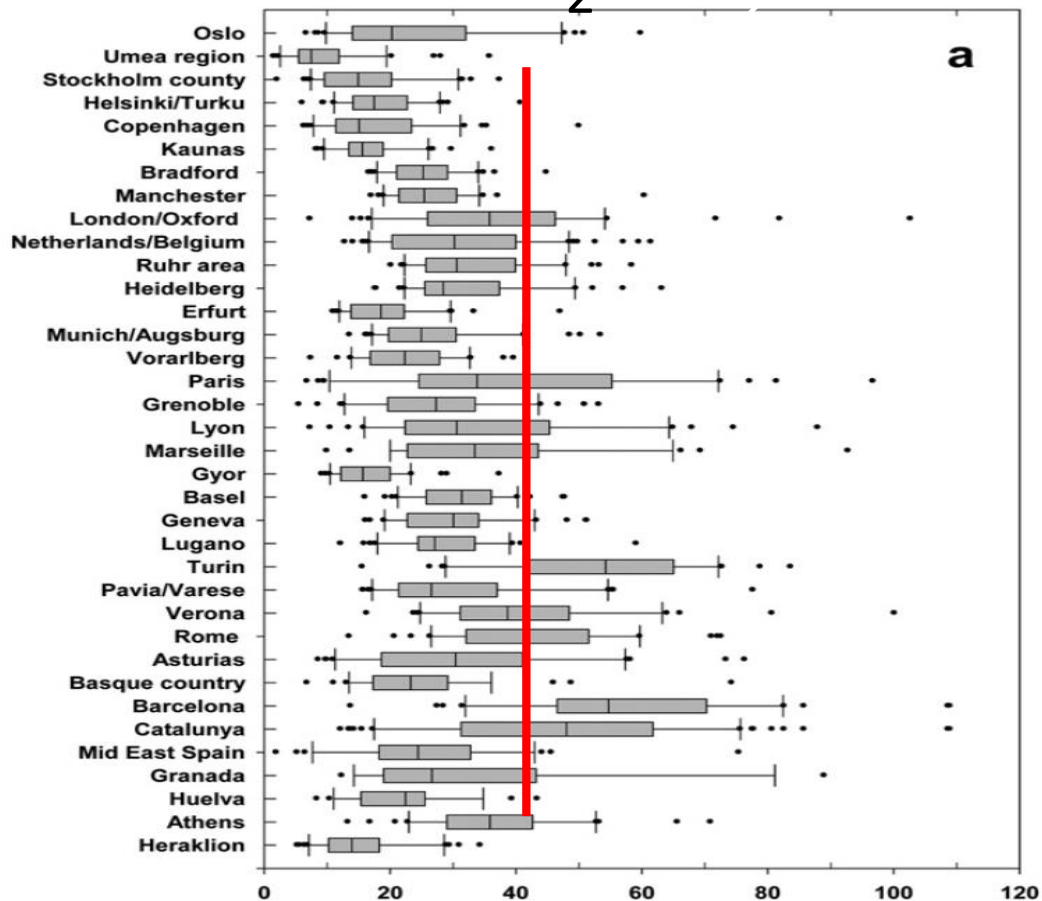
Barcelona



Napoli

Contaminantes criticos: NO₂

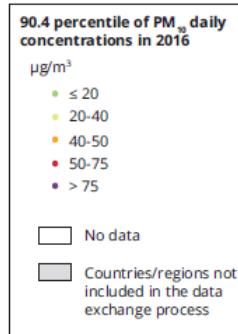
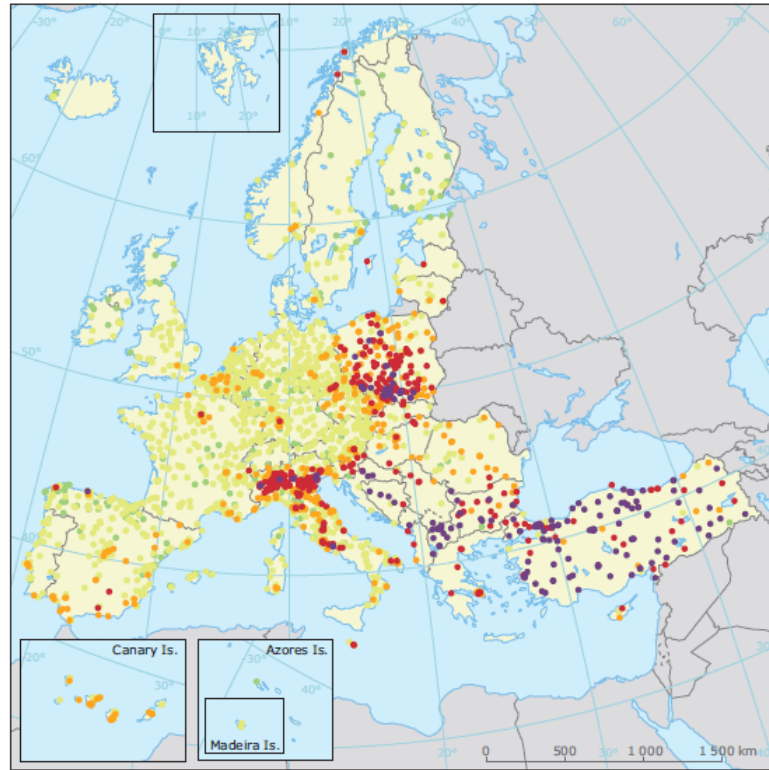
Why so high NO₂?



J. Cyrus et al. / Atmospheric Environment 62 (2012) 374–390

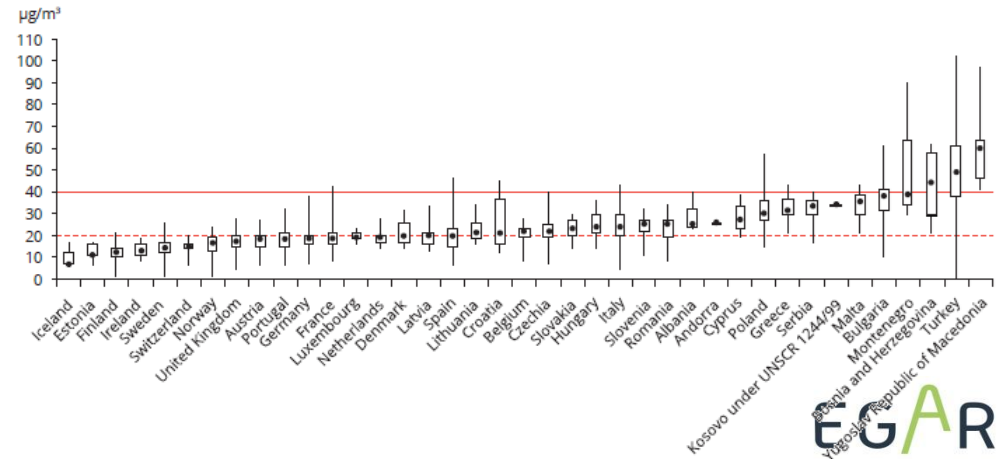
El problema de las partículas: PM₁₀

Map 3.1 Concentrations of PM₁₀, 2016 — daily limit value



- 19% estaciones >VLD
- 6% estaciones >VLA (0.5% población)
- 48% estaciones > WHO AQG (45% EU población)

Figure 3.2 PM₁₀ concentrations in relation to the annual limit value in 2016



El problema de las partículas: PM₁₀ España 2017

Zonas > VLA

PM10 VL Anual
40 µg/m3

- <VLA
- <VLA tras descuentos
- >VLA



>VLA

- Avilés

Zonas > VLD

PM10 VLD
50 µg/m3 no más de 35 ocasiones

- <VLD
- <VLD tras descuentos
- >VLD



>VLD

- Granada y Área Metropolitana
 - Málaga y Costa del Sol
- Zona Villanueva del Arzobispo
 - Avilés
- Plana de Vic

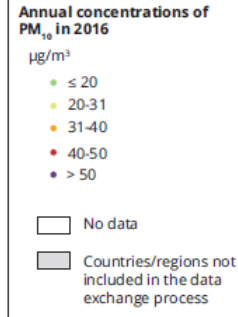
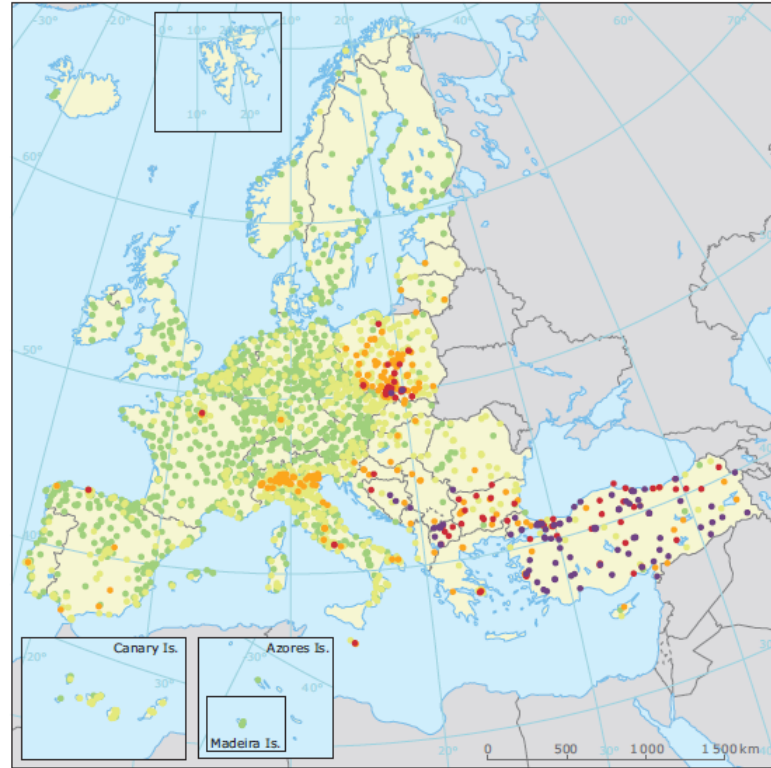
< VLD tras descuento

- Islas Canarias (5 zonas)
- Zona industrial Bailén
- Nueva zona Sevilla y Área Metropolitana
 - Comarca de Puertollano
- Zona industrial del Norte CLM
- A Coruña + Área Metropolitana
 - Ciudad de Murcia

Evaluación de la calidad del aire en España 2017

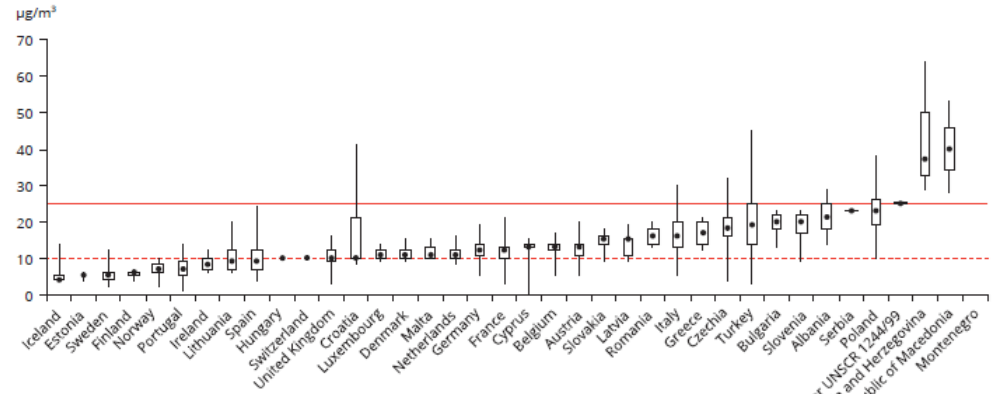
El problema de las partículas: PM_{2.5}

Map 3.2 Concentrations of PM₁₀, 2016 — annual limit value

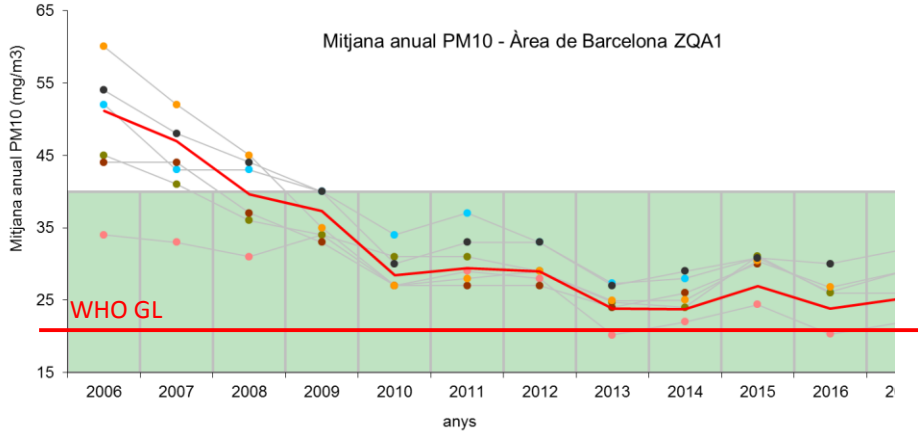


- 5% estaciones >VLA (6% EU población)
- 68% estaciones > WHO AQG (81% población)

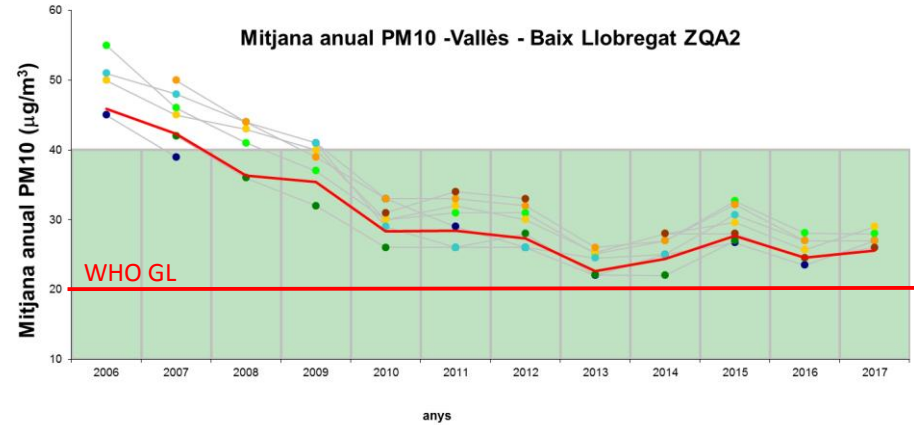
Figure 3.3 PM_{2.5} concentrations in relation to the annual limit value in 2016



El problema de les partícules: PM₁₀



- VLa
- Barcelona (Zona Universitària)
- Santa Coloma de Gramenet (Ajuntament)
- Mitjana anual Àrea de Barcelona
- Barcelona (pl. Universitat)
- L'Hospitalet de Llobregat
- Sant Feliu de Llobregat (Eugeni d'Ors)
- Sant Vicenç dels Horts (Verge del Rocío)



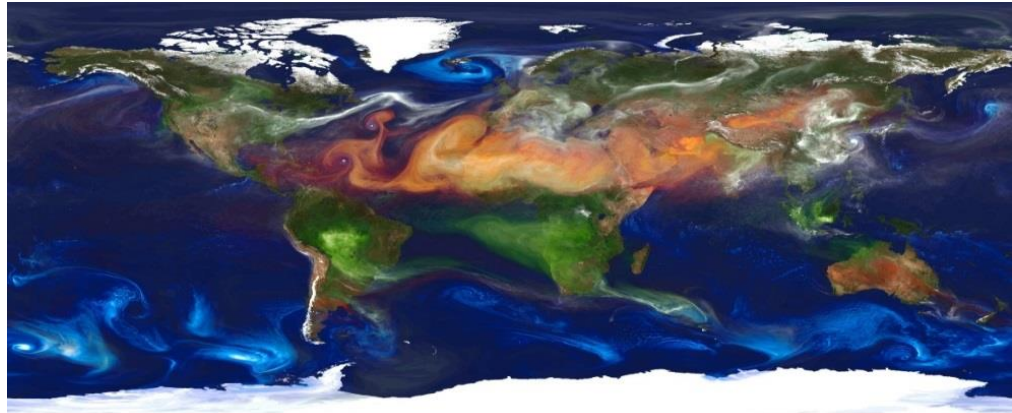
- VLa
- Mollet del Vallès (Pista Municipal d'Atletisme)
- Sabadell (Escola Industrial)
- Santa Perpètua de Mogoda
- Mitjana anual Vallès-Baix Llobregat
- Barberà del Vallès (Ajuntament)
- Montcada i Reixac (Ajuntament)
- Sabadell (Gran Via - cra. de Prats)
- Montcada i Reixac (Can Sant Joan)



■ Zones sense superacions

El problema de las partículas: PM₁₀ / PM_{2.5}

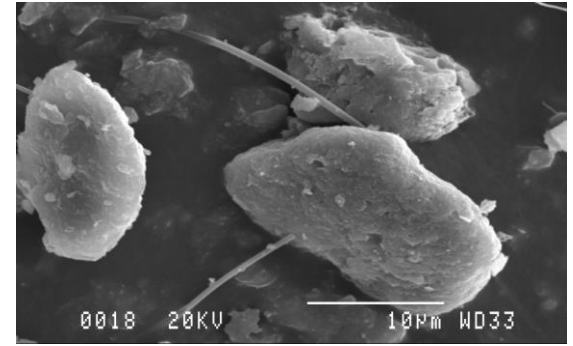
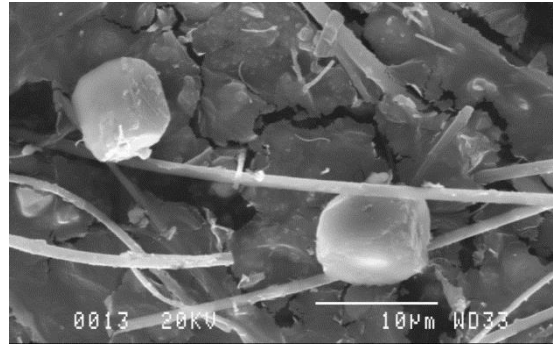
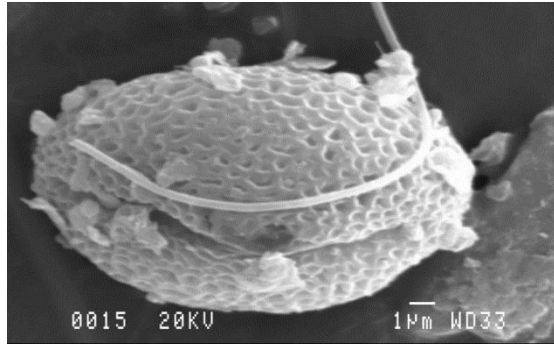
Material particulado atmosférico (PM) es un material heterogéneo, sólido y/o líquido en suspensión en la atmósfera



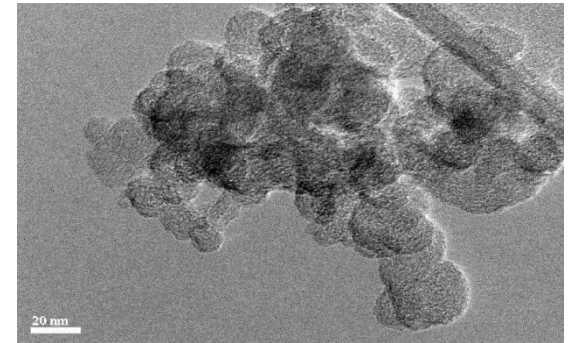
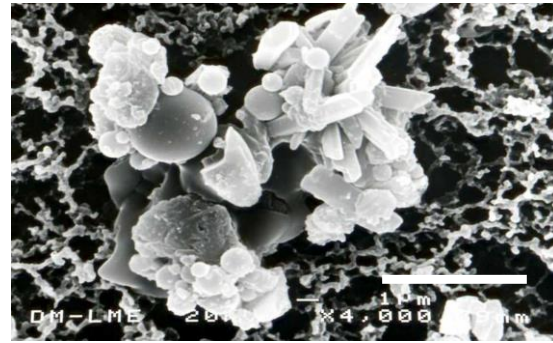
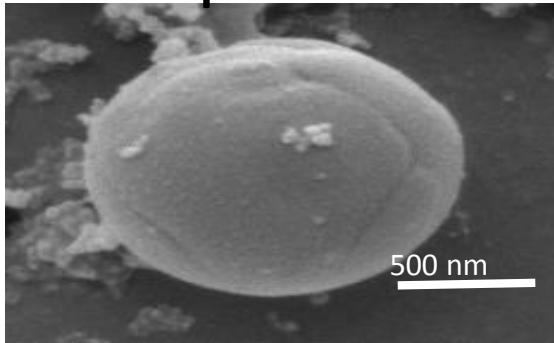
- Contaminante complejo
- Gran variedad de fuentes (naturales / antrópicas)
- Partículas primarias / secundarias (a partir de precursores gaseosos)
- Gran variedad de componentes
- Rango de tamaños de 2 nm - 20 μm

El problema de las partículas: PM₁₀ / PM_{2.5}

Naturales

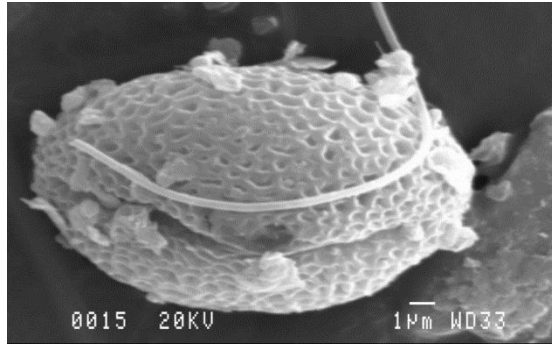


Antrópicas

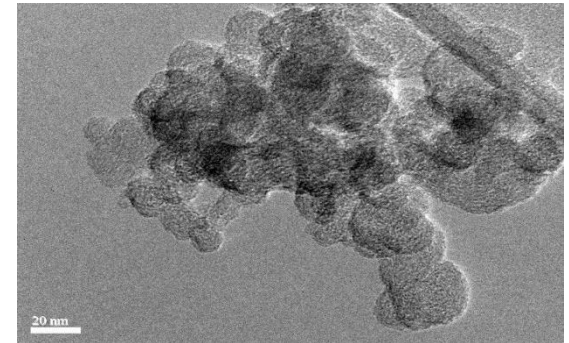


El problema de las partículas: PM_{10} / $PM_{2.5}$

Naturales



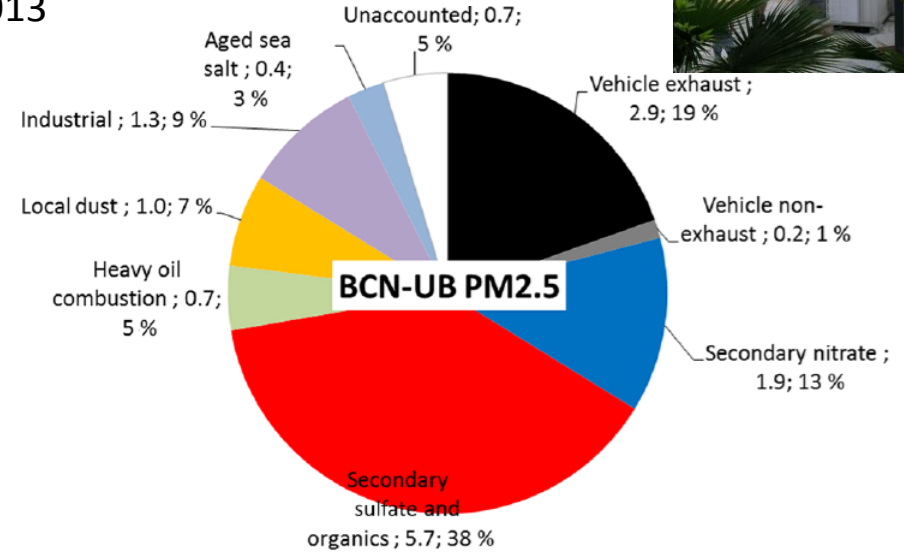
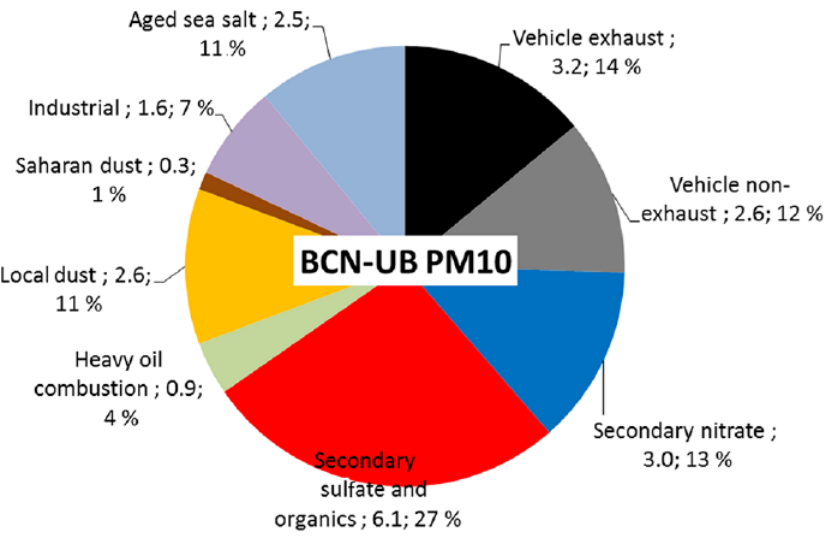
Antrópicas





Contribución de Fuentes en PM₁₀ / PM_{2.5}

Barcelona 2013



Tráfico >40% de la masa de PM



AIRUSE

<http://airuse.eu/>

Atmos. Chem. Phys., 16, 3289–3309, 2016
 www.atmos-chem-phys.net/16/3289/2016/
 doi:10.5194/acp-16-3289-2016
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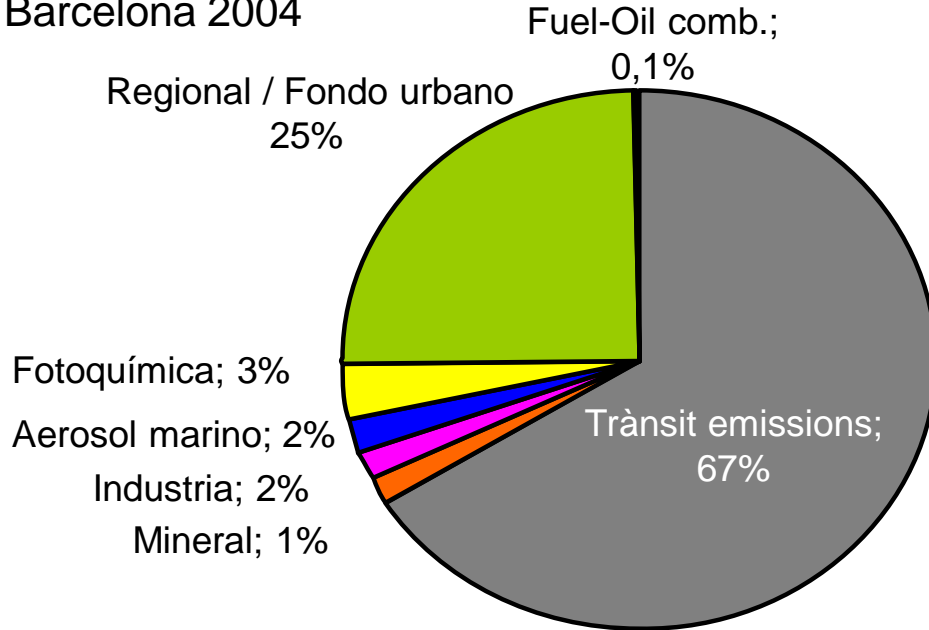
AIRUSE-LIFE+: a harmonized PM speciation and source apportionment in five southern European cities

Fulvio Amato¹, Andrés Alastuey¹, Angeliki Karanasiou¹, Franco Lucarelli², Silvia Nava², Giulia Calzolari², Mirko Severi³, Silvia Becagli⁴, Vorne L. Gianelle⁴, Cristina Colombi⁴, Celia Alves⁵, Danilo Custódio⁵, Teresa Nunes⁵, Mario Cerqueira⁶, Casimiro Pio⁶, Konstantinos Eleftheriadis⁶, Evangelia Diapoulis⁶, Cristina Reche⁷, Maria Cruz Mingüellón¹, Manoussos Ioannis Manoussakakos⁸, Thomas Maggos⁹, Stergios Vratolis⁹, Roy M. Harrison¹⁰, and Xavier Querol¹



Contribución de fuentes al número de partículas

Contribución de fuentes a la media anual de N13-800 nm
Barcelona 2004



Tráfico >60% del
número de
partículas – UFP –

Atmospheric Environment 43 (2009) 4407–4415

Contents lists available at ScienceDirect



Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

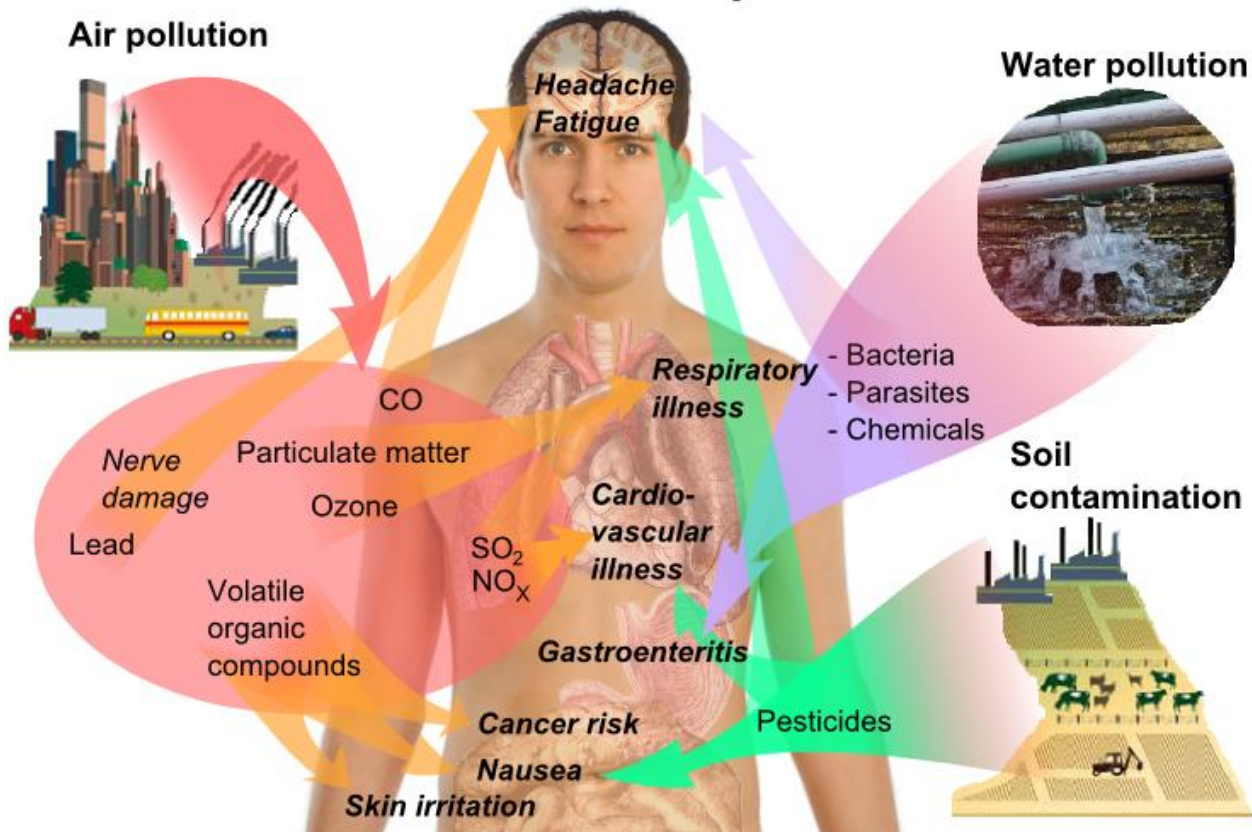


Source apportionment of urban fine and ultra-fine particle number concentration in a Western Mediterranean city

Jorge Pey^{a,*}, Xavier Querol^a, Andrés Alastuey^a, Sergio Rodríguez^{b,c}, Jean Philippe Putaud^d, Rita Van Dingenen^d

Efectos en la salud de la contaminación atmosférica

Health effects of pollution



Efectos en la salud: tamaño de partículas atmosféricas

Fraction	Respiratory mortality (Lag2)	Cardiovascular mortality (Lag1)	Cerebrovascular mortality (Lag1)
PM _{10-2.5}	1.033 (0.980-1.089)	1.059 (1.026-1.094)	1.098 (1.030-1.171)
PM _{2.5-1}	1.206 (1.028-1.416)	0.984 (0.892-1.086)	0.905 (0.743-1.102)
PM ₁	1.010 (0.963-1.059)	1.028 (1.000-1.058)	1.063 (1.004-1.124)

Odds ratio per 10 ug/m³

Environ. Sci. Technol. 2009, 43, 4707-4714

Size Fractionate Particulate Matter, Vehicle Traffic, and Case-Specific Daily Mortality in Barcelona, Spain

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N. KUNZLI,^{*,†} A. ALASTUEY,[‡] J. PEY,[§]
N. PÉREZ,[§] R. GARCÍA,[†] A. TOBIAS,[¶]
X. QUEROL,[¶] AND J. SUNYER[†]

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Received November 7, 2008. Revised manuscript received February 9, 2009. Accepted February 24, 2009.

Introduction

Past research demonstrates consistent associations among exposure to airborne particulate matter (PM) and mortality and morbidity and other markers of pathologic processes (1-3). Adverse short-term effects of PM are reported for PM with a diameter less than 10 μm (PM₁₀). Recent research suggests that effects may be driven mainly by fine PM with a diameter less than 2.5 μm (PM_{2.5}), generated by combustion processes (4).

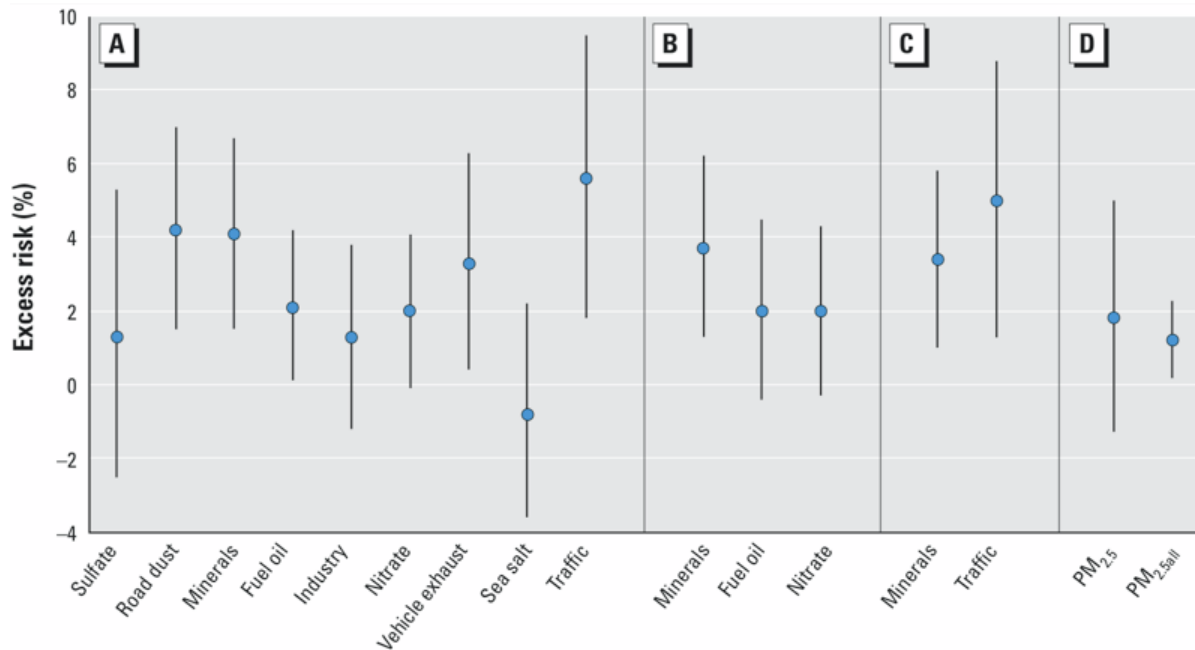
The effects of coarse PM with a diameter between 10 and 2.5 μm (PM_{10-2.5}) are less clear. Coarse PM has typically been associated with terrigenous sources (5). However, recent studies have shown that a large fraction of coarse PM in urban areas is formed by resuspended tire, brake, and pavement residue, and that some of these components are similar to components found in combustion PM (6-10).

Several epidemiological studies have detected short-term effects of PM_{10-2.5} in urban areas (1, 2, 5, 11, 12), but these studies provide limited information about the relationship between PM sources and health effects. For example, sources of PM_{10-2.5} can vary considerably across and within areas;

Efectos en la salud: fuentes de partículas atmosféricas

The Effects of Particulate Matter Sources on Daily Mortality: A Case-Crossover Study of Barcelona, Spain

Barcelona 2003-2007 data



The Effects of Particulate Matter Sources on Daily Mortality: A Case-Crossover Study of Barcelona, Spain

Bart Ostro,¹ Aurelio Tobias,² Xavier Querol,² Andrés Alastuey,² Fulvio Amato,² Jorge Pey,² Noemi Pérez,² and Jordi Sunyer¹

¹Centre for Research in Environmental Epidemiology, Barcelona, Spain; ²Institute of Environmental Assessment and Water Research, Spanish Research Council, Barcelona, Spain

BACKGROUNDS: Dozens of studies link acute exposure to particulate matter (PM) air pollution with premature mortality and morbidity, but questions remain about which species and sources in the vast PM mixture are responsible for the observed health effects. Although a few studies exist on the effects of species and sources in U.S. cities, European cities—which have a higher proportion of diesel engines and denser urban populations—have not been well characterized. Information on the effects of specific sources could aid in targeting pollution control and in articulating the biological mechanisms of PM.

OBJECTIVES: Our study examined the effects of various PM sources on daily mortality for 2003

in epidemiologic studies to determine their impact on various health outcomes.

Although several studies have been conducted in the United States, few have examined sources in Europe, where the PM composition and exposure patterns are quite different. For example, most major European cities tend to be more densely populated than

Environmental Health Perspectives • VOLUME 119 | NUMBER 12 | December 2011

Significant health effects in Barcelona resulting from exposure to PM_{2.5}

- mobile sources (both exhaust and road dust emissions)
- sulfate from shipping
- construction dust

Efectos en la salud: emisiones del tráfico rodado

el Periódico SOCIEDAD
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MELENDI
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PORTADA | INTERNACIONAL | POLÍTICA | ECONOMÍA | SOCIEDAD | BARCELONA | DEPORTES | OCIO Y CULTURA

ESTUDIO EN COLEGIOS DE BARCELONA

La contaminación del tráfico reduce la capacidad infantil de aprendizaje

- Los niños de las escuelas de los distritos con más contaminados sufren mermas cognitivas
- Los investigadores proponen limitar los coches alrededor de los centros educativos

ÁNGELS GALLARDO / BARCELONA

MIÉRCOLES, 4 DE MARZO DEL 2015



COMENTARIOS 0



ENVÍA UNA CARTA DEL LECTOR

Los niños que estudian en **escuelas de zonas de Barcelona** con alta contaminación

ambiental causada por el tráfico, como el Eixample, Sants, Sant Martí y Sant Andreu, experimentan un retraso en su desarrollo cognitivo, que afecta a la inteligencia práctica

necesaria para tomar decisiones inaplazables. Así lo constata una investigación realizada por el **Centre de Recerca Epidemiològica Ambiental** (CREA), que entre el 2012 y el 2013 analizó a 2.897 niños de 7 a 10 años que acuden a 39 escuelas de Barcelona y Sant Cugat del Vallés.



Clase en una escuela de Barcelona.

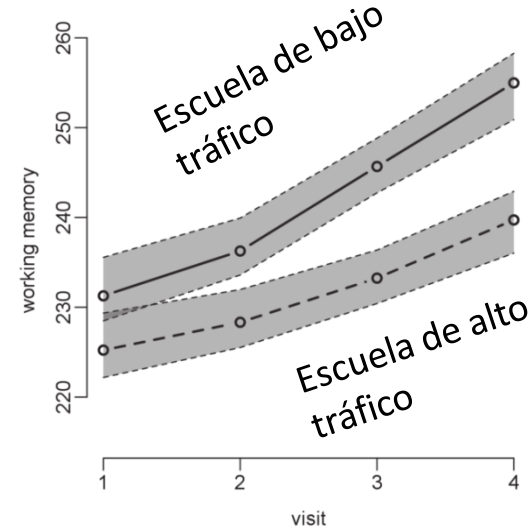


Fig 2. Working memory development by high- or low-traffic-air-pollution school. Dashed line = high traffic air pollution; continuous line = low traffic air pollution; gray shading indicates 95% CIs. Adjusted for age, sex, maternal education, residential neighborhood socioeconomic status, and air pollution exposure at home; school and individual as nested random effects in 2,715 children and 10,112 tests from 39 schools.

PLOS MEDICINE

RESEARCH ARTICLE

Association between Traffic-Related Air Pollution in Schools and Cognitive Development in Primary School Children: A Prospective Cohort Study

Jordi Sunyer^{1,2,3,4}, Mikel Esnaola^{1,2,3}, Mar Alvarez-Pedrerol^{1,2,3}, Joan Forns^{1,2,3}, Ioar Rivas^{1,2,3,5}, Mónica López-Vicente^{1,2,3}, Elisabet Suedes-González^{1,2,3,4}, Maria Foraster^{1,2,3}, Raquel Garcia-Esteban^{1,2,3}, Xavier Basagaña^{1,2,3}, Mar Viana⁶, Marta Cirach^{1,2,3}, Teresa Moreno⁷, Andrés Alastuey⁸, Núria Sebastian-Galles⁹, Mark Nieuwenhuijsen^{1,2,3}, Xavier Querol⁹



EGAR

Efectos en la salud: emisiones tráfico/ N de partículas

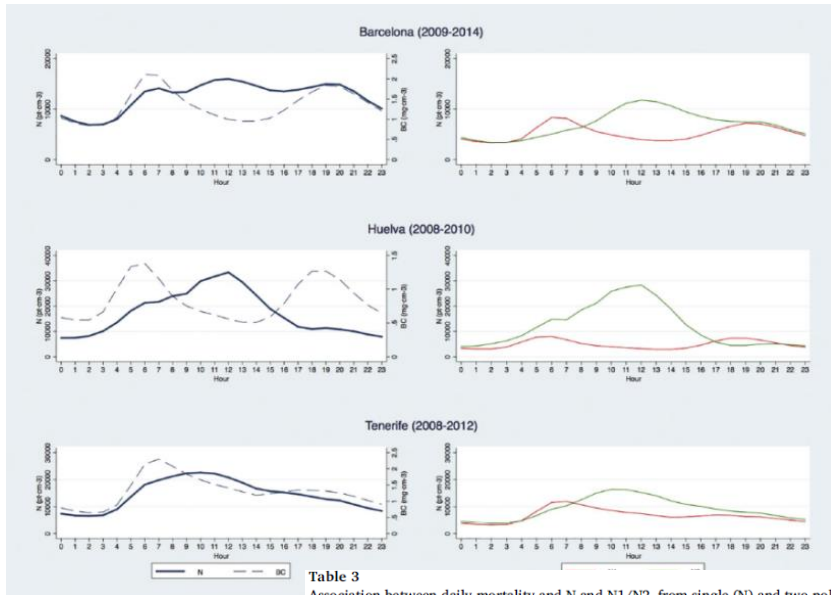


Table 3
Association between daily mortality and N and N1/N2, from single (N) and two-pollutant (N1 and N2) models, in the three study areas: percentage increases of mortality risk (%IR), and 95% CIs, per interquartile range (IQR) in cm^{-3} in particulate number concentration at lags of 0, 1 and 2 days.

City	Lag	N			N1			N2		
		IQR	%IR	(95% CI)	IQR	%IR	(95% CI)	IQR	%IR	(95% CI)
Barcelona	0	6870.5	0.30	(- 0.87, 1.49)	3277.4	1.63	(0.74, 2.52)	5857.8	- 0.67	(- 1.86, 0.54)
	1		0.97	(- 0.23, 2.18)		1.52	(0.61, 2.44)		- 0.43	(- 1.68, 0.84)
	2		0.78	(- 0.45, 2.02)		1.39	(0.47, 2.33)		- 0.60	(- 1.88, 0.69)
Huelva	0	14,036.7	3.14	(- 0.92, 7.36)	2759.5	- 1.66	(- 5.38, 2.22)	12,032.9	3.95	(0.10, 7.95)
	1		0.78	(- 3.30, 5.03)		- 1.10	(- 4.81, 2.75)		1.09	(- 2.79, 5.13)
	2		- 0.98	(- 5.10, 3.33)		1.31	(- 2.43, 5.18)		- 1.94	(- 5.77, 2.06)
Tenerife	0	12,332.9	2.04	(- 1.27, 5.46)	5341.6	1.73	(- 1.56, 5.13)	7584.2	0.63	(- 2.42, 3.77)
	1		0.86	(- 2.47, 4.30)		2.07	(- 1.59, 5.86)		- 0.14	(- 3.27, 3.10)
	2		- 0.93	(- 4.24, 2.51)		- 1.05	(- 4.78, 2.84)		0.32	(- 3.04, 3.79)



Short-term effects of ultrafine particles on daily mortality by primary vehicle exhaust versus secondary origin in three Spanish cities

Aurelio Tobías^{a,*}, Ioar Rivas^b, Cristina Reche^b, Andrés Alastuey^a, Sergio Rodríguez^c, Rocío Fernández-Camacho^d, Ana M. Sánchez de la Campa^d, Jesús de la Rosa^d, Jordi Sunyer^{b,c,e,g}, Xavier Querol^h

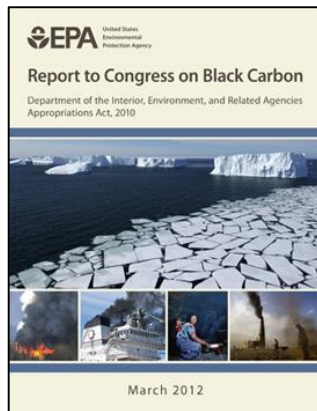
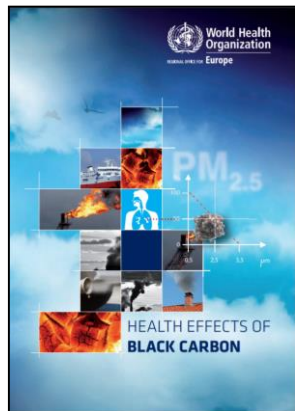
The pattern and origin of UFP determines their short-term effect on human health.

BC is possibly the better parameter to evaluate the health effects of particulate vehicle exhaust emissions, although in areas influenced by domestic solid fuel combustion this should also be taken into account.

Efectos en la salud: emisiones tráfico/ BC

BC: se define según criterios operacionales

Origen por combustión incompleta: emisiones diesel, combustion doméstica (calefacciones, cocina...), emisiones industriales, incendios



Health outcomes associated with exposure to PM_{2.5} or thoracic particles (PM₁₀) are usually also associated with BC (and vice versa) in the epidemiological studies reviewed. Effects estimates (from both short- and long-term studies) are much higher for BC compared to PM₁₀ and PM_{2.5} when the particulate measures are expressed per unit of mass concentration ($\mu\text{g}/\text{m}^3$). Effect estimates are, however, generally similar per inter-quartile range in pollutant levels. Studies of short-term health effects show that the associations with BC are more robust than those with PM_{2.5} or PM₁₀, suggesting that BC is a better indicator of harmful particulate substances from combustion sources (especially traffic) than undifferentiated PM mass. In multi-pollutant models used in these studies, the BC effect estimates are robust to adjustment for PM mass, whereas PM mass effect estimates decreased considerably after adjustment for BC. The evidence from long-term studies is inconclusive: in one of the two available cohort studies, using multi-pollutant models in the analysis, the effect estimates for BC are stronger than those for sulfates, but an opposite order in the strength of relationship is suggested in the other study.

Efectos en la salud: emisiones tráfico/ BC

Table 2
Associations between exposure to air pollutants and the risk of AIS/TIA per lag periods studied and by stroke subtype per every lag period studied.

	PM 2.5		BC	
	OR (95% CI)	P value	OR (95% CI)	P value
AIS/TIA				
Lag 0-23	0.989 (0.928-1.053)	0.731	1.047 (0.968-1.129)	0.254
Lag 24-47	0.983 (0.922-1.047)	0.589	0.981 (0.909-1.061)	0.644
Lag 48-72	1.001 (0.940-1.067)	0.996	1.031 (0.956-1.112)	0.431
TOAST subtype				
Large-artery atherosclerosis				
Lag 0-23	0.996 (0.817-1.214)	0.967	1.160 (0.930-1.444)	0.189
Lag 24-47	0.980 (0.810-1.187)	0.839	1.251 (1.001-1.552)	0.042
Lag 48-72	1.048 (0.868-1.264)	0.628	1.211 (0.988-1.484)	0.065
Small-vessel occlusion				
Lag 0-23	0.872 (0.758-1.002)	0.054	1.045 (0.887-1.227)	0.544
Undetermined (two causes)				
Lag 0-23	1.066 (0.811-1.400)	0.647	0.953 (0.673-1.351)	0.789
Lag 24-47	0.912 (0.685-1.214)	0.529	0.977 (0.689-1.385)	0.895
Lag 48-72	0.944 (0.974-1.02)	0.668	0.932 (0.668-1.301)	0.682

- No evidence of an association between PM2.5 or BC and risk of IS symptom onset in the subsequent 72 h.
- Exposure to BC, the main traffic-related air pollutant in our area, is associated with a higher risk of arteriosclerotic stroke.
- Setting BC air quality standards in the forthcoming revision of the EC Directive on air quality could have valuable health benefits.

PM_{2.5} 2.5 μ particulate matter; BC = black carbon; AIS/TIA = acute ischemic stroke / transient ischemic stroke.
Lag periods expressed in hours. OR and 95% CI expressed per IQR change (0.9-2.4 μg/m³).



Short-term exposure to traffic-related air pollution and ischemic stroke onset in Barcelona, Spain

Rosa María Vivanco-Hidalgo^{a,*}, Gregory A. Wellenius^b, Xavier Basagaña^{c,d,1}, Marta Cirach^e, Alejandra Gómez González^a, Pablo de Ceballos^a, Ana Zabalza^a, Jordi Jiménez-Conde^a, Carolina Soriano-Tarraga^a, Eva Giral-Steinhauer^a, Andrés Alastuey^a, Xavier Querol^a, Jordi Sunyer^{a,d}, Jaume Roquer^a

Efectos en la salud: emisiones tráfico/ BC

Highway proximity and black carbon from cookstoves as a risk factor for higher blood pressure in rural China

Jill Baumgartner^{a,b,1}, Yuanxun Zhang^c, James J. Schauer^d, Wei Huang^c, Yuqin Wang^c, and Majid Ezzati^e

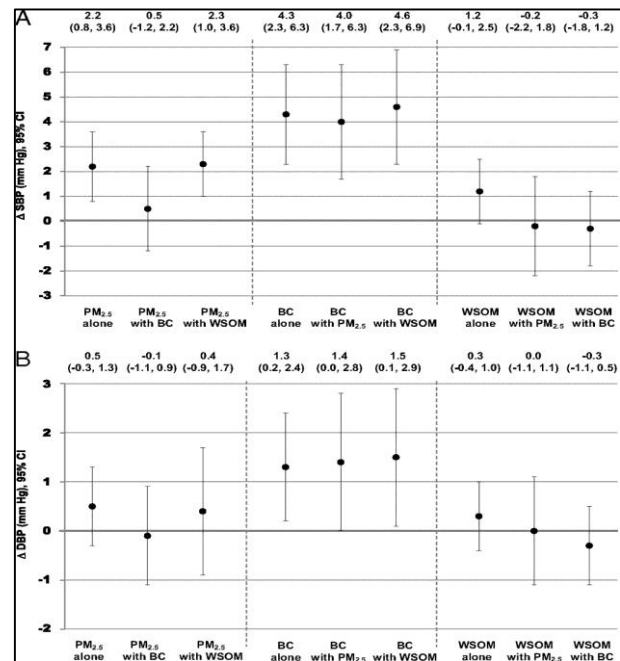
^aInstitute for Health and Social Policy and Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, Montreal, QC, Canada H3A 1A3; ^bInstitute on the Environment, University of Minnesota, St. Paul, MN 55108; ^cCollege of Resources and Environment, University of Chinese Academy of Sciences, Beijing 100049, China; ^dEnvironmental Chemistry and Technology Program, Department of Civil and Environmental Engineering, University of Wisconsin-Madison, Madison, WI 53706; and ^eMRC-PHE Centre for Environment and Health, Department of Epidemiology and Biostatistics, School of Public Health, Imperial College London, London W2 1PG, United Kingdom

Edited by Barry R. Bloom, Harvard School of Public Health, Boston, MA, and approved July 29, 2014 (received for review September 13, 2013)



They also observed that the effect of BC on SBP was almost three times greater in women living near the highway than BC effect in women just exposed to cookstove

So, is it BC or is BC indicator of something else in traffic emissions?



Efectos en la salud: emisiones tráfico/ BC



ARTICLE

<https://doi.org/10.1038/s41467-019-11654-9> OPEN

Ambient black carbon particles reach the fetal side of human placenta

Hannelore Bové^{1,2,3,6}, Eva Bongaerts^{1,6}, Eli Slenders², Esmée M. Bijmens¹, Nelly D. Saenen¹, Wilfried Gyselaers⁴, Peter Van Eyken⁴, Michelle Plusquin¹, Maarten B.J. Roeffaers³, Marcel Ameloot² & Tim S. Nawrot^{1,5}

NATURE COMMUNICATIONS | (2019) 10:3866

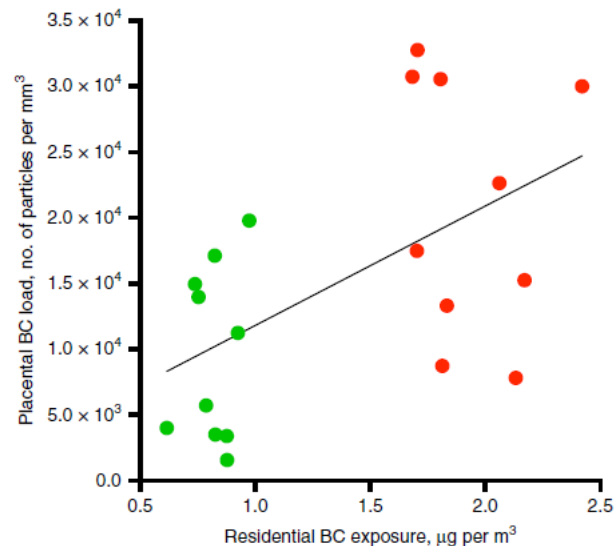
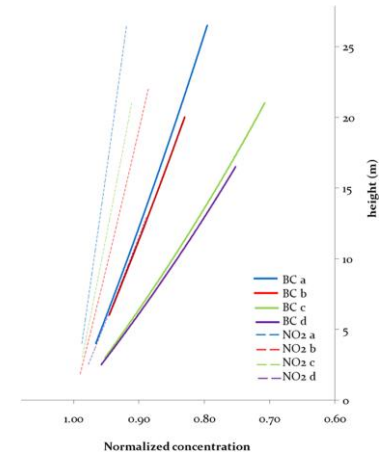
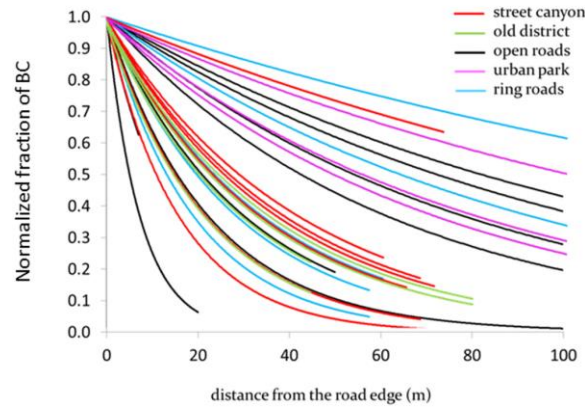
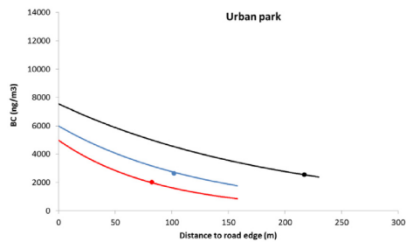
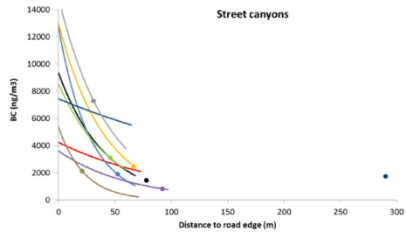
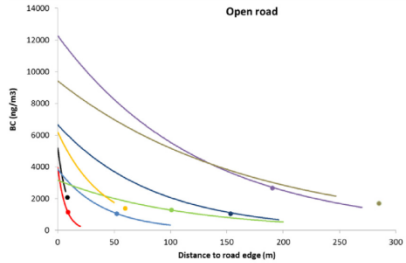


Fig. 4 Correlation between placental BC load and residential BC exposure averaged over the whole pregnancy. The line is the regression line. Green and red dots indicate low ($n = 10$ mothers) and high ($n = 10$ mothers) exposed mothers. Pearson correlation $r = 0.55$, $P = 0.012$ and corresponding Spearman's Rank correlation $r = 0.43$, $P = 0.06$. Source data are provided as a Source Data file

Variación horizontal y vertical de BC y NO₂



- En la horizontal, disminución de BC y NO₂ siguiendo curvas exponenciales
- BC alcanzó la mitad del valor a una distancia media de 25m
- En la vertical, la reducción fue menos marcada, sin alcanzarse valores de fondo.



Vertical and horizontal fall-off of black carbon and NO₂ within urban blocks

F. Amato ^{a,*}, N. Pérez ^a, M. López ^a, A. Ripoll ^a, A. Alastuey ^a, M. Pandolfi ^a, A. Karanasiou ^a, A. Salmatoniadis ^a, E. Padoan ^{a,b}, D. Frasca ^c, M. Marcoccia ^c, M. Viana ^a, T. Moreno ^a, C. Reche ^a, V. Martins ^a, M. Brines ^a, M.C. Minguillón ^a, M. Ealo ^a, I. Rivas ^a, B. van Drooge ^a, J. Benavides ^c, J.M. Craviotto ^d, X. Querol ^a



Medidas móviles

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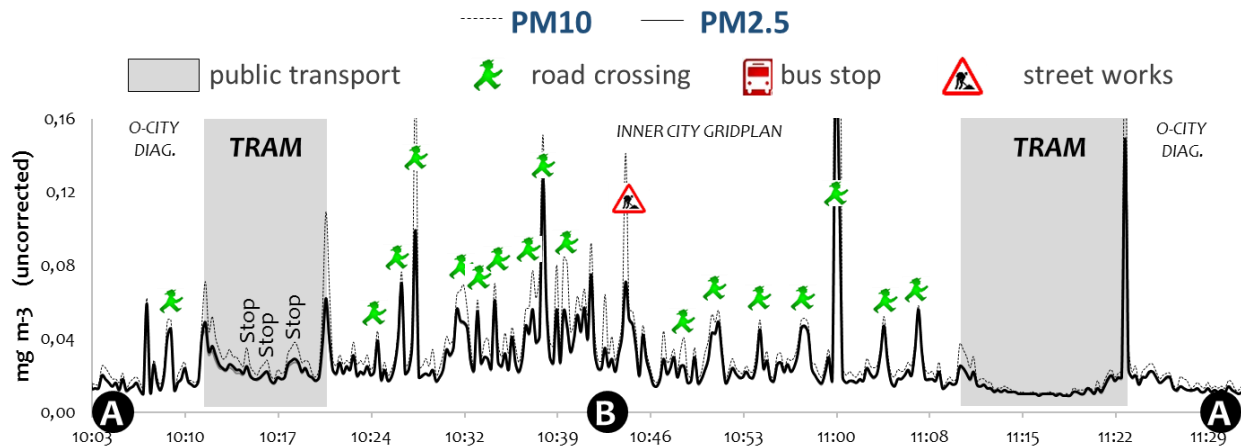
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Urban air quality comparison for bus, tram, subway and pedestrian commutes in Barcelona

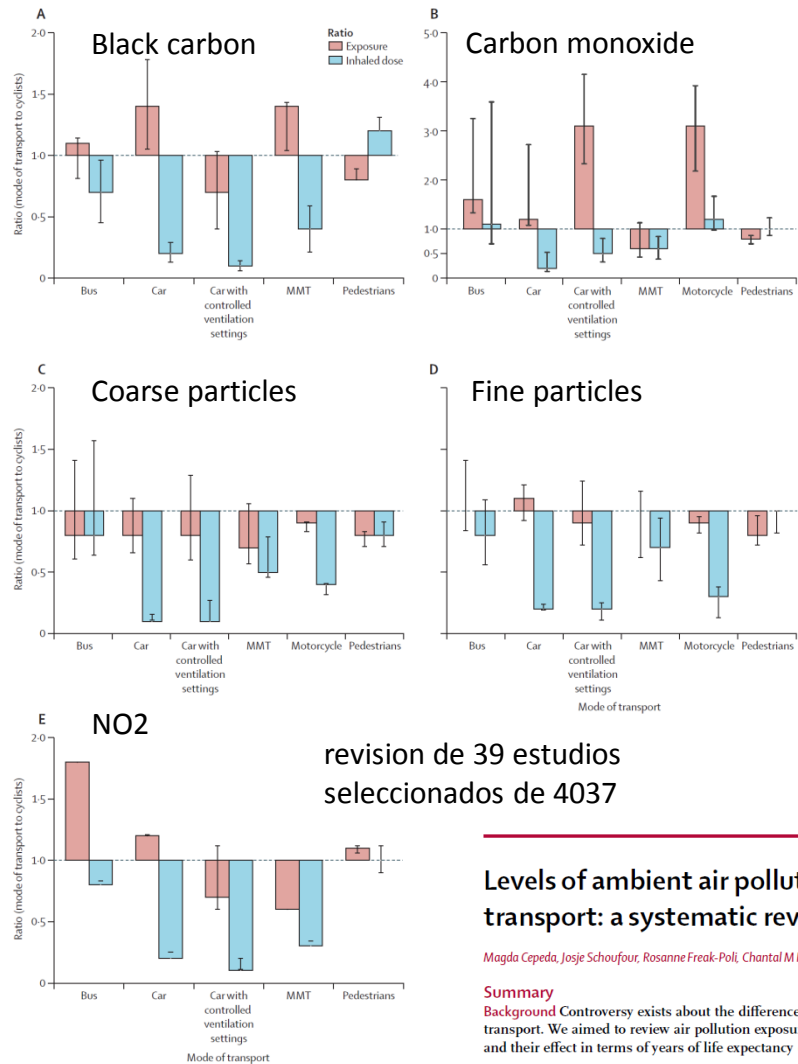


Teresa Moreno^{a,*}, Cristina Reche^a, Ioar Rivas^a, Maria Cruz Minguillón^a, Vânia Martins^a, Concepción Vargas^b, Giorgio Buonanno^{b,c}, Jesus Parga^a, Marco Pandolfi^a, Mariola Brines^a, Marina Ealo^a, Ana Sofia Fonseca^a, Fulvio Amato^a, Garay Sosa^a, Marta Capdevila^d, Eladio de Miguel^d, Xavier Querol^a, Wes Gibbons^e



Exposición y dosis según modo de transporte

Comparison of ratio of exposure to pollutants with ratio of inhaled dose of pollutants according to mode of transport and pollutant to that of cyclists



revisión de 39 estudios
seleccionados de 4037

Levels of ambient air pollution according to mode of transport: a systematic review

Magda Cepeda, Josje Schoufour, Rosanne Freak-Poli, Chantal M Koolhaas, Klodian Dhana, Wichor M Bramer, Oscar H Franco

Summary

Background Controversy exists about the differences in air pollution exposure and inhalation dose between mode of transport. We aimed to review air pollution exposure and inhaled dose according to mode of transport and pollutant and their effect in terms of years of life expectancy (YLE).



Lancet Public Health 2017;
2: e23-34
Published Online
November 25, 2016



Exposición y dosis según modo de transporte

Gains of YLE per age group due to air pollution exposure and physical activity compared between any mode of transport and (A) cyclists

- En comparación con las personas que viajan en automóvil y en motocicleta, el efecto negativo en YLE del aumento de la dosis inhalada no superó el efecto positivo de la actividad física cuando viaja activamente.
- La exposición disminuye al aumentar la distancia de las emisiones de tráfico, y al reducir el intercambio de aire con el exterior y al elegir rutas con menor emisión y mayor dispersión.

Levels of ambient air pollution according to mode of transport: a systematic review

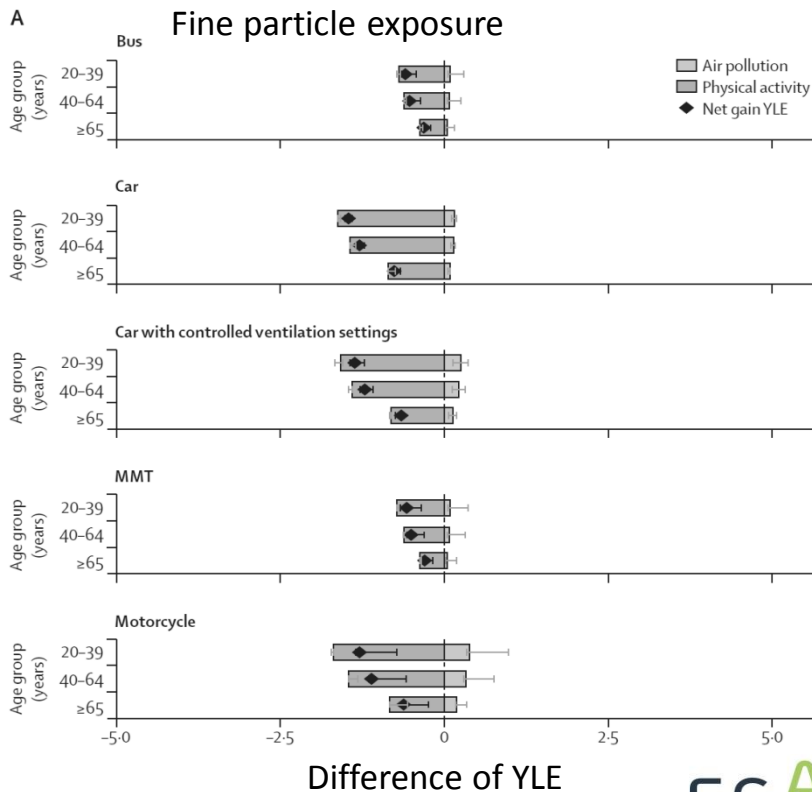
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YLE: años de esperanza de vida

Medidas de calidad del aire en el transporte urbano

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 with priority to pedestrians and green areas

vi

vii

vi. Remediation measures

vii. Other non-technological measures

i. Improving public transport

Consideraciones finales

- La calidad del aire en Europa y España ha mejorado en los últimos años, gracias a las mejoras ambientales pero también a la crisis económica.
- Los valores límite y objetivo de NO_2 , PM_{10} y $\text{PM}_{2.5}$ se superan, especialmente en áreas con altas densidades de tráfico, y en algunas zonas industriales.
- El clima y la arquitectura urbana de las ciudades españolas favorecen la acumulación de contaminantes y, consecuentemente, se requieren medidas específicas.
- El PM es un contaminante complejo, con una gran variedad de fuentes, composición y, consecuentemente, de efectos. Evaluar otros parámetros como el carbono negro (BC) y las partículas ultrafinas (UFP) para calidad del aire.
- El tráfico rodado es la fuente más importante de NO_x y PM_x en entornos urbanos: responsable de la mayor exposición de los ciudadanos a valores elevados de contaminación.
- La contaminación atmosférica tiene efectos en la salud: más evidentes para partículas atmosféricas con especial interés en el caso de las emisiones del tráfico en entornos urbanos.
- Las medidas móviles realizadas durante cortos periodos de tiempo cerca de los focos de emisión no son representativas de la exposición real de los ciudadanos. Estas medidas no pueden compararse con las medidas de las redes de calidad del aire ni pueden utilizarse con fines preceptivos.
- Las medidas no-tecnológicas del tráfico (la reducción del número de automóviles privados en el centro de la ciudad en favor del uso del transporte público R.E.E.C.) son las más efectivas para reducir la contaminación atmosférica.



GAW

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