



Niveles y composición de material particulado atmosférico: Situación respecto a los límites de la Directiva Europea

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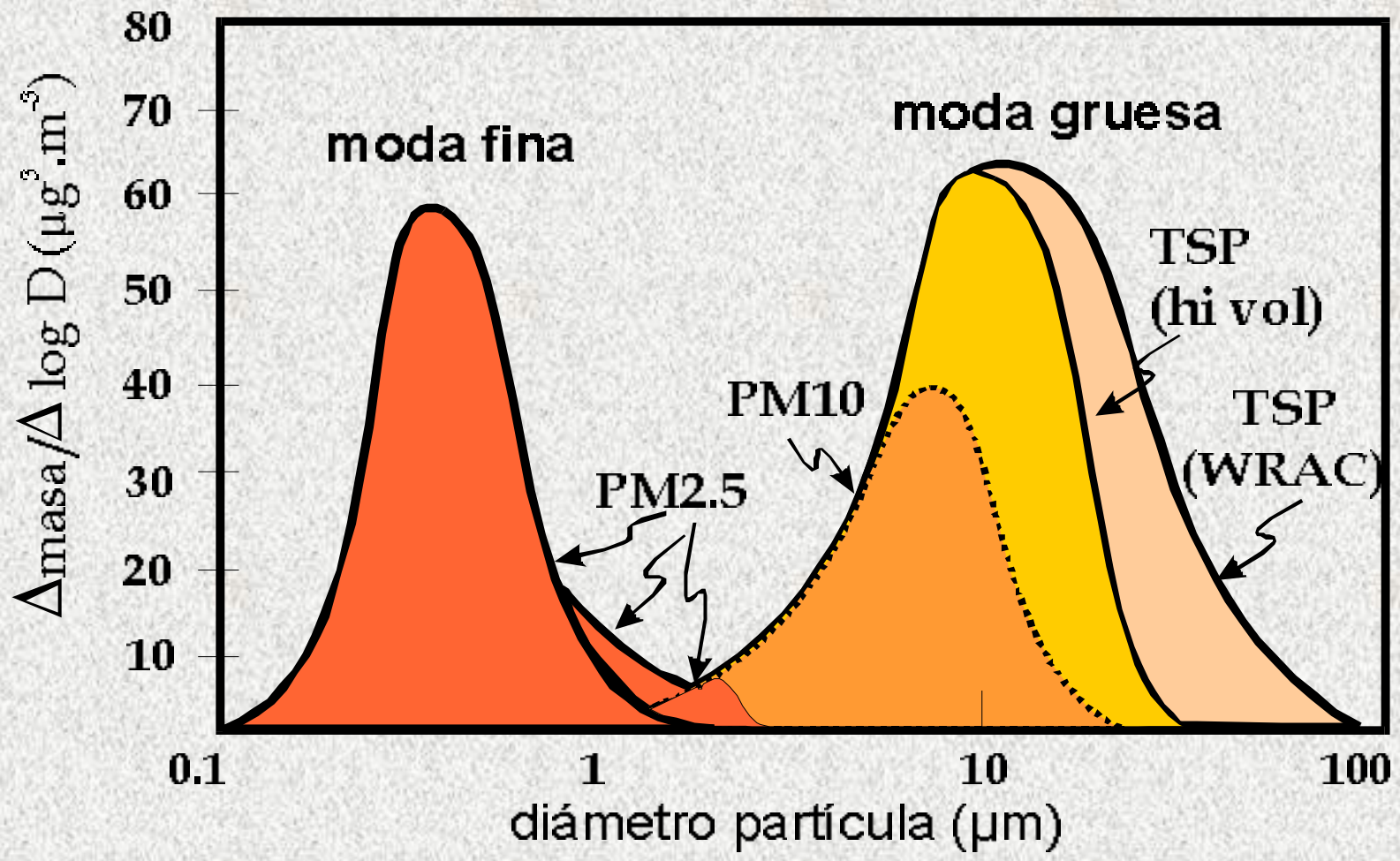
nppgiibi@lg.ehu.es

- **¿QUE ES PM?**
- **LEGISLACIÓN**
- **PM10 Y PM2.5: NIVELES Y COMPOSICIÓN**
- **FUENTES**
- **COMPARACIÓN EUROPA CENTRAL**
- **ESTUDIOS EN DESARROLLO**
- **CONCLUSIONES**

EFFECTOS DEL MATERIAL PARTICULADO

- **Impacto en la salud**
- **Impacto en ecosistemas**
- **Cambio climático**
- **Degradación materiales**
- **Disminución de la visibilidad**

(Wilson and Suh, 1996)



PRIMARIAS

- **Naturales**
resuspensión local/externa
evaporación/precipitación
- **Antropogénicas**
emisiones directas
emisiones fugitivas

$\text{SiO}_2, \text{Al}_2\text{O}_3, \text{Fe}_2\text{O}_3, \text{TiO}_2$

$\text{CaCO}_3, \text{NaCl}, \text{C}, \text{metales}$

0.1 μm 1.0 μm 10 μm 25 μm



(Soot)

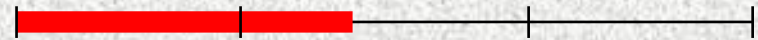
SECUNDARIAS

- **Naturales**
sulfatos naturales
emisiones biogénicas
- **Antropogénicas**
emisiones gaseosas:
nucleación, condensación
evaporación

$\text{SO}_4^=, \text{NO}_3^-, \text{NH}_4^+, \text{H}^+$

$\text{C}_{\text{org}}, \text{metales}$

0.1 μm 1.0 μm 10 μm 25 μm

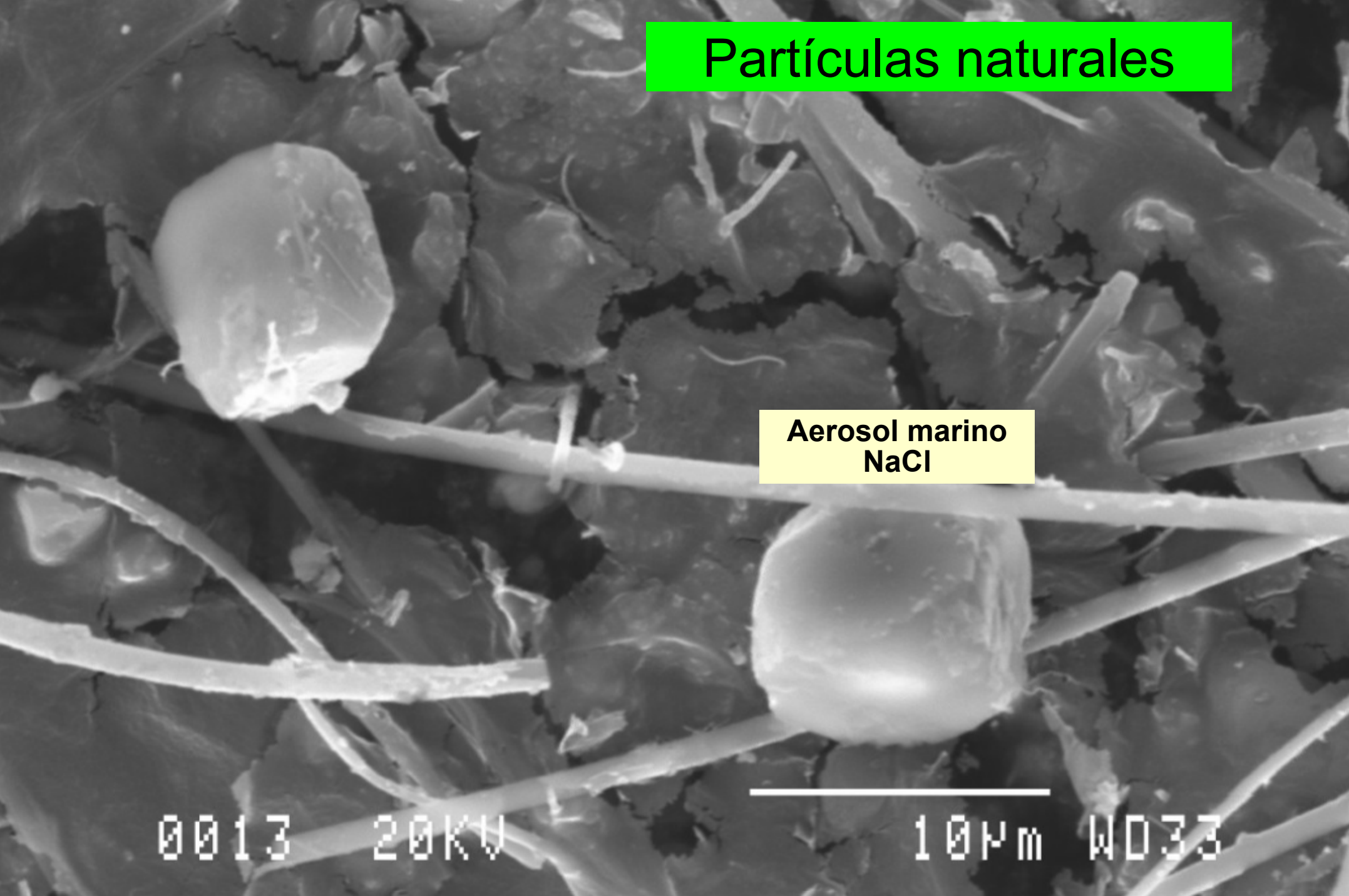


Partículas naturales

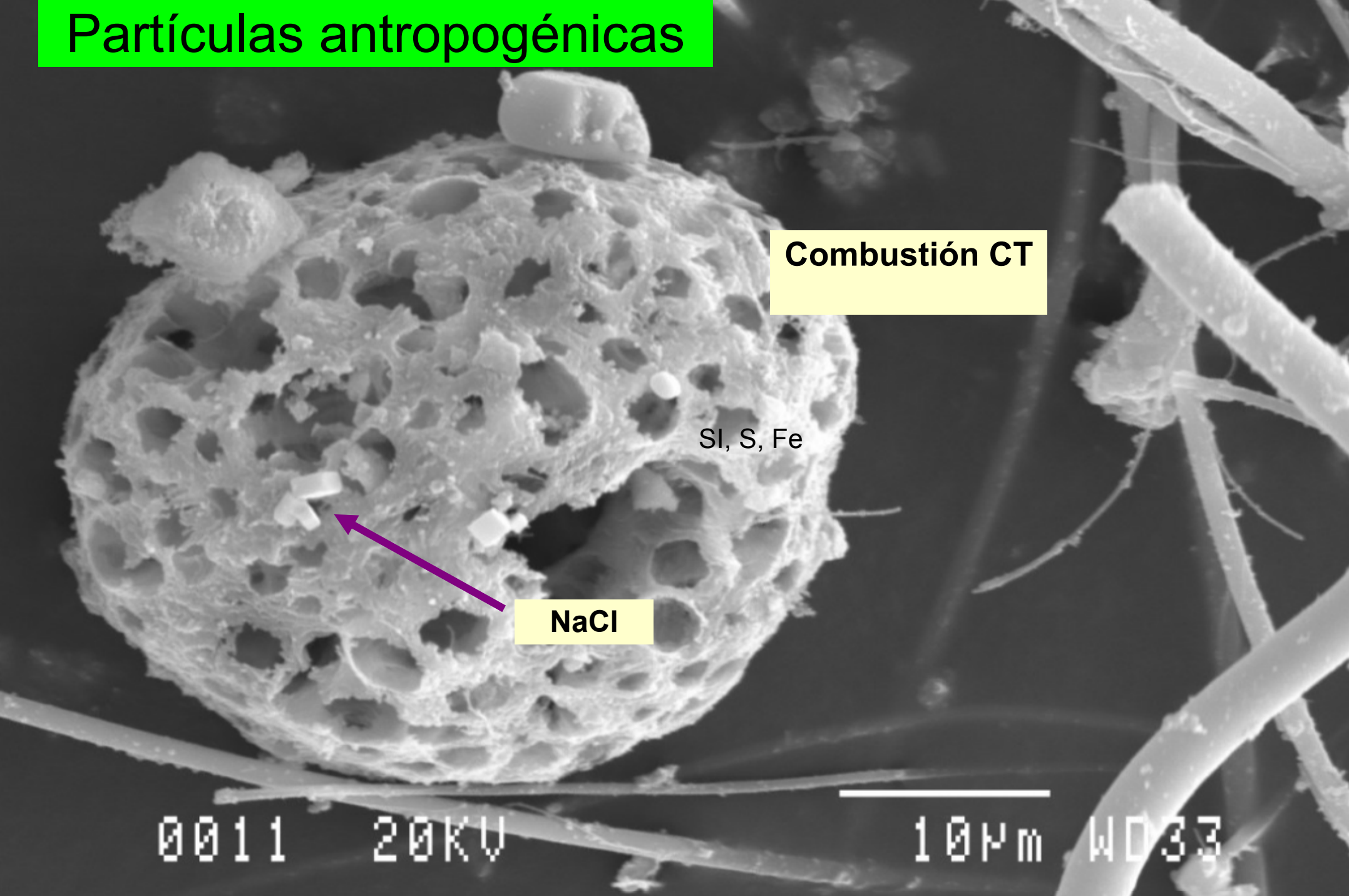
Aerosol marino
NaCl

0013 20KV

10µm WD33



Partículas antropogénicas



Combustión CT

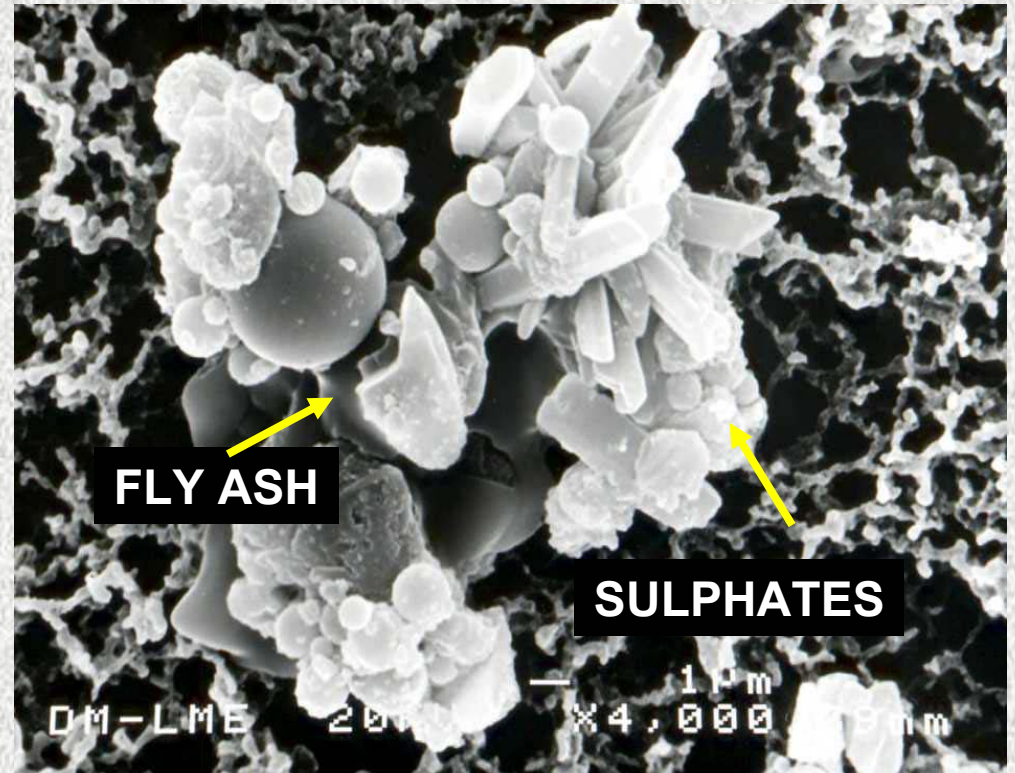
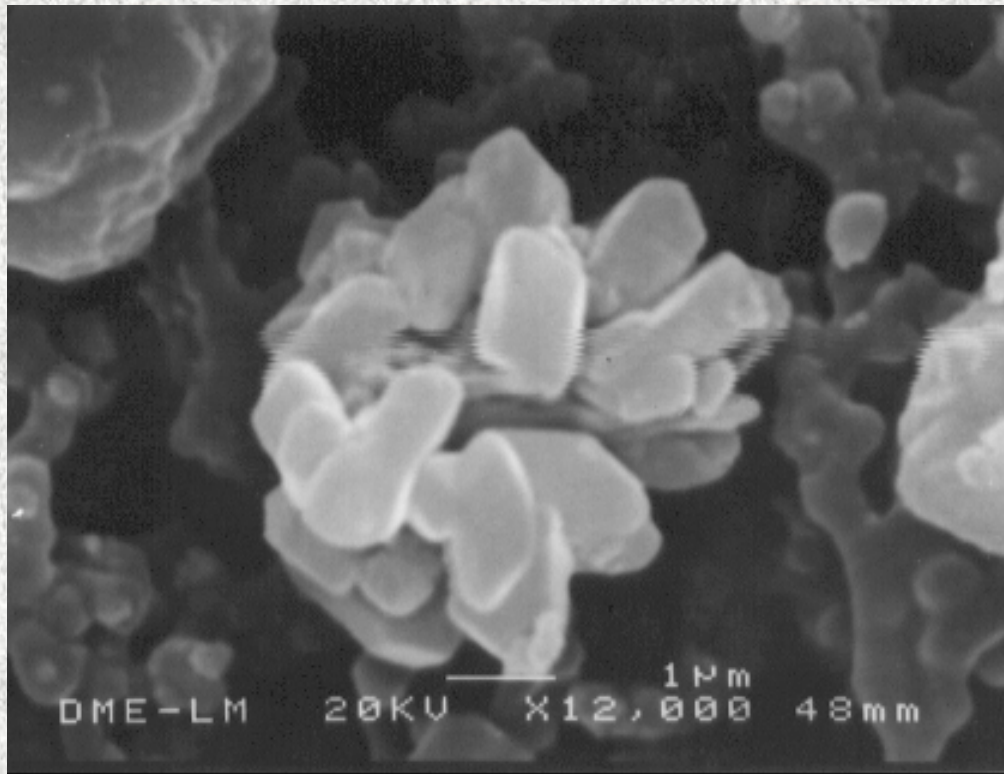
Si, S, Fe

NaCl

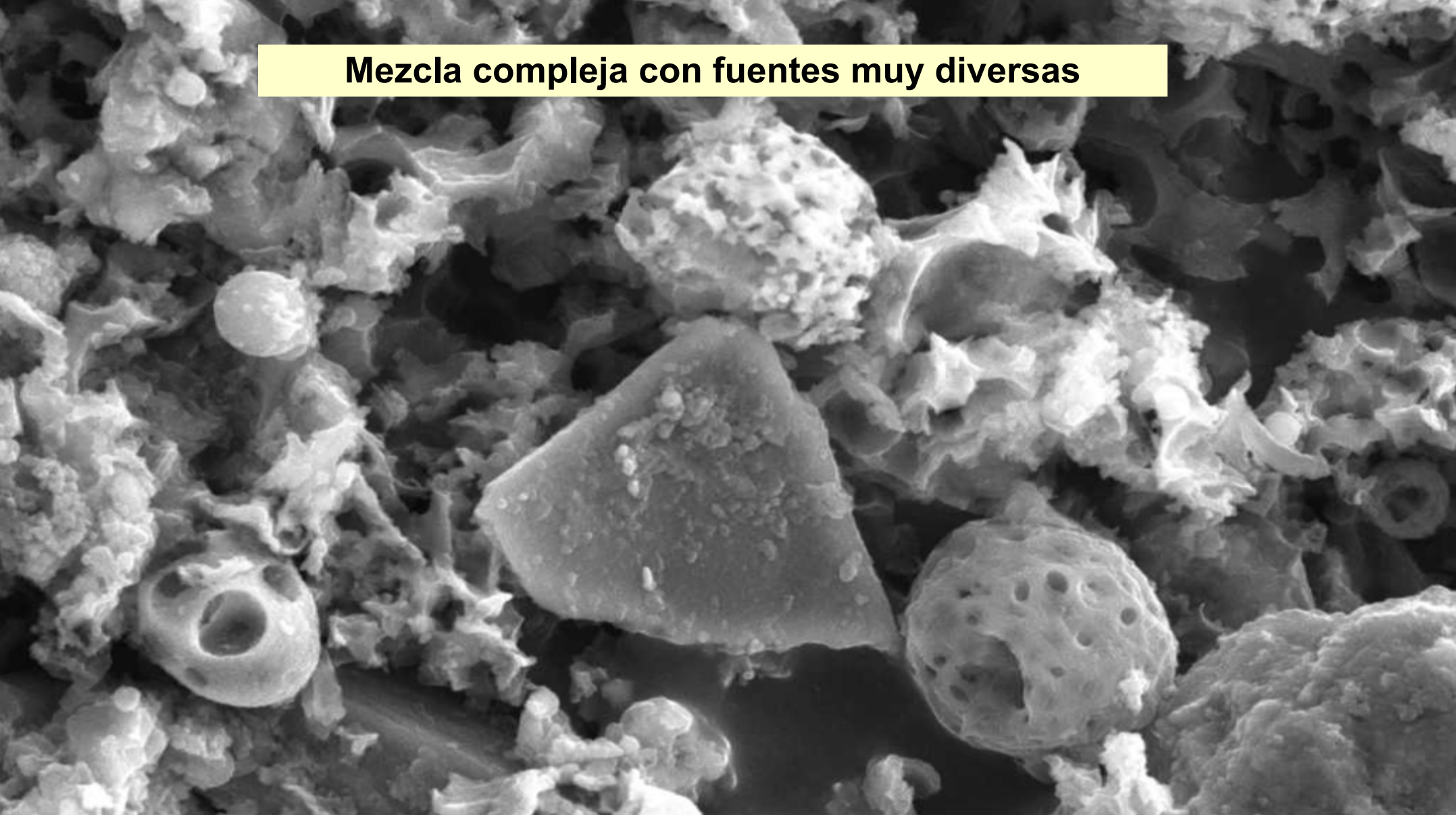
0011 20KV

10µm WD33

Partículas antropogénicas



Mezcla compleja con fuentes muy diversas



0011 20KV



10µm WD37

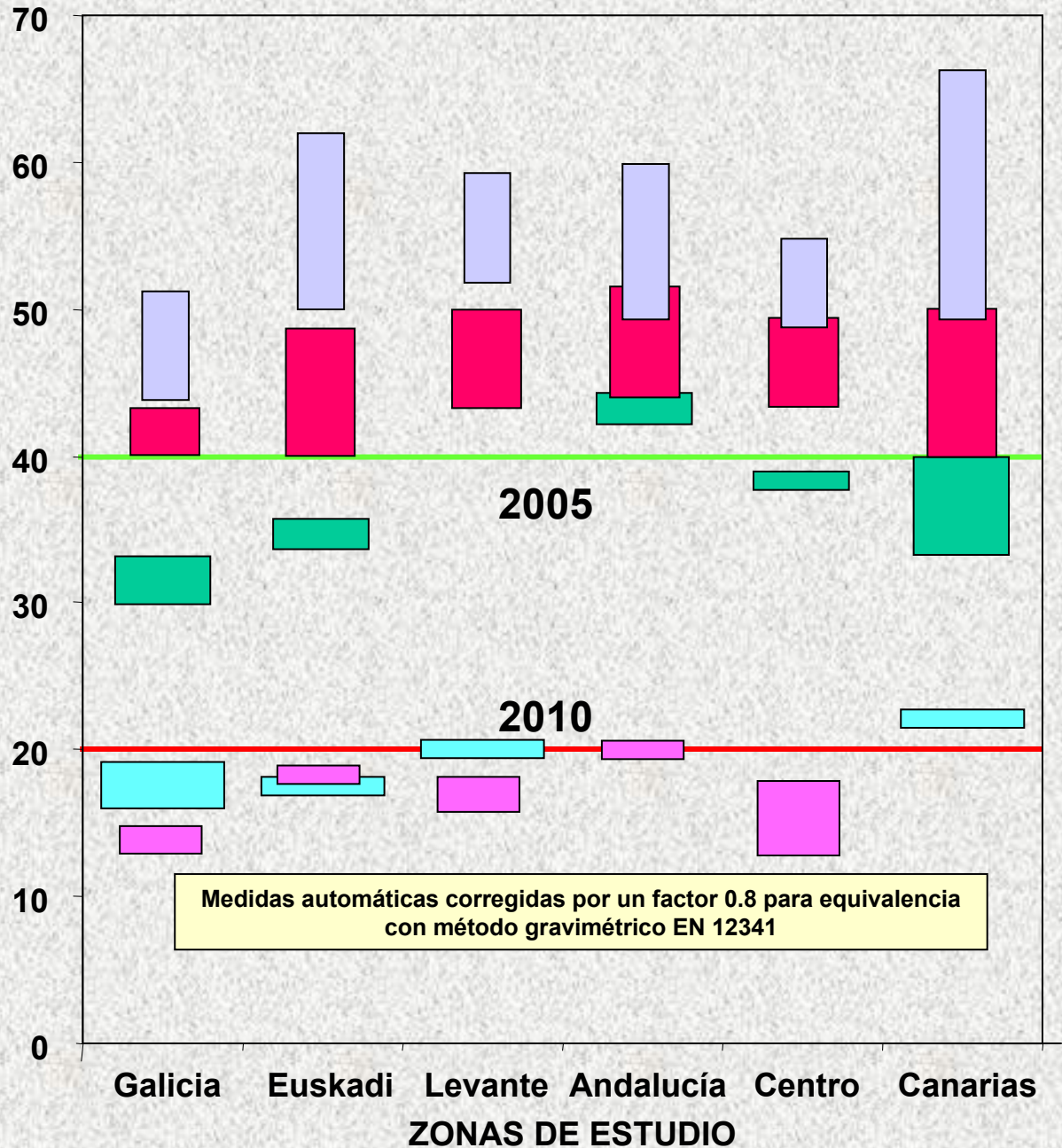
LIMITES DE LA DIRECTIVA EUROPEA

	Normativa anterior					Directiva 1999/30/CE	
	E	C1	C2	C3	C4	Euskadi	UE
Rural	16	3	19	0	8	4	97
Urban	13	45	29	6	84	5	417
Traffic	66	8	6	3	24	10	293
Industrial	23	4	1	1	19	10	77
ND	8	0	0	0	2	0	32
% hotspots Over all stations	71%	20%	13%	40%	31%	69%	40%

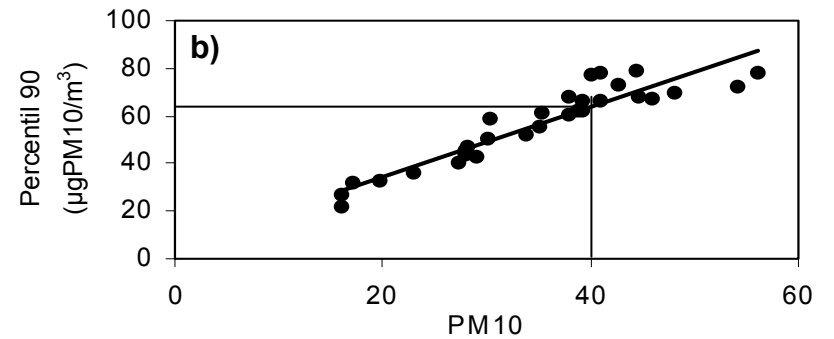
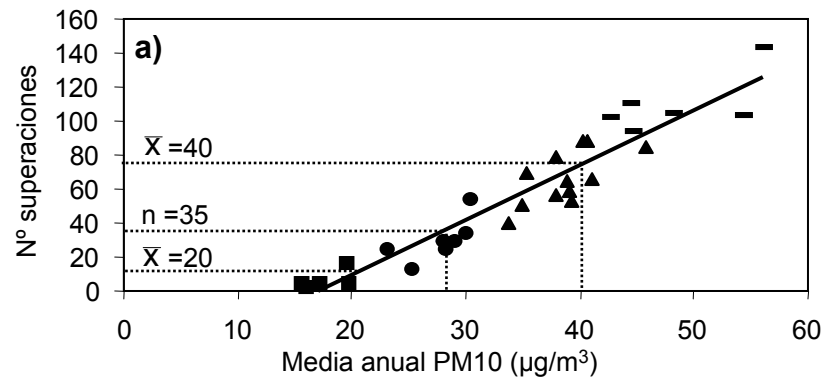
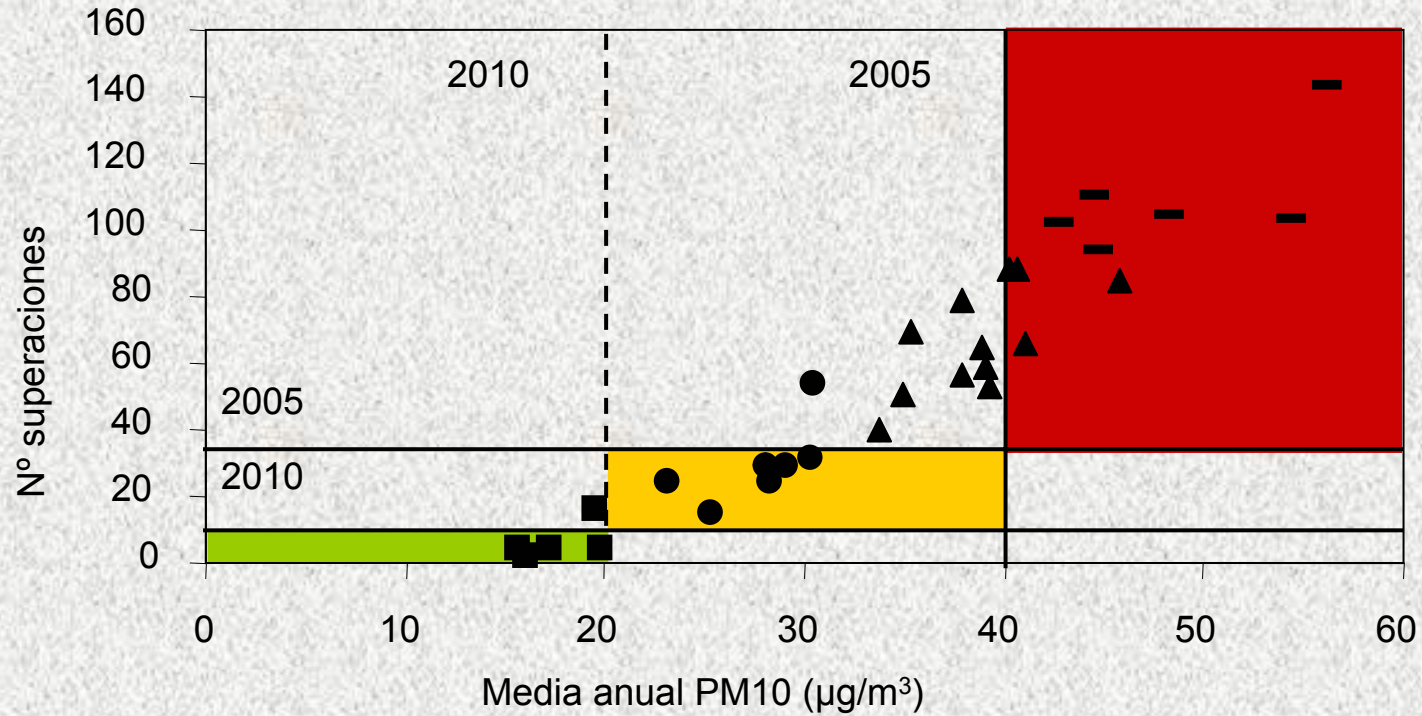
AirBase, 2001 data

Niveles medios PM10 desde 1996

- Tráfico
- Industrial ó T. intenso
- Fondo rural
- Fondo urbano
- Estaciones EMEP, 2001

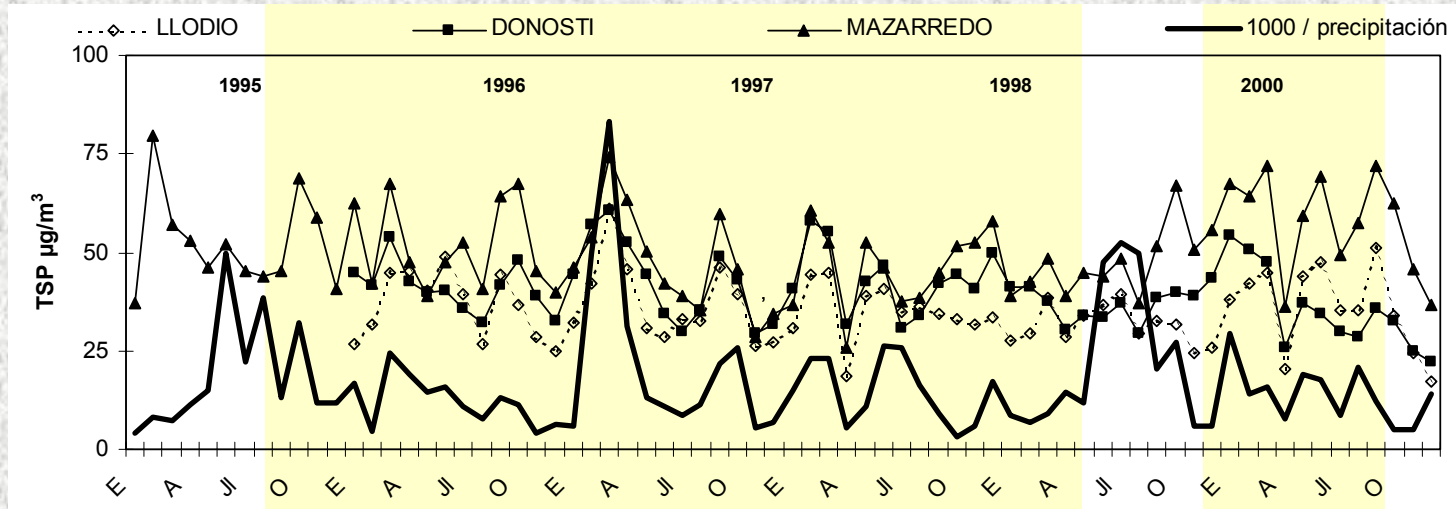
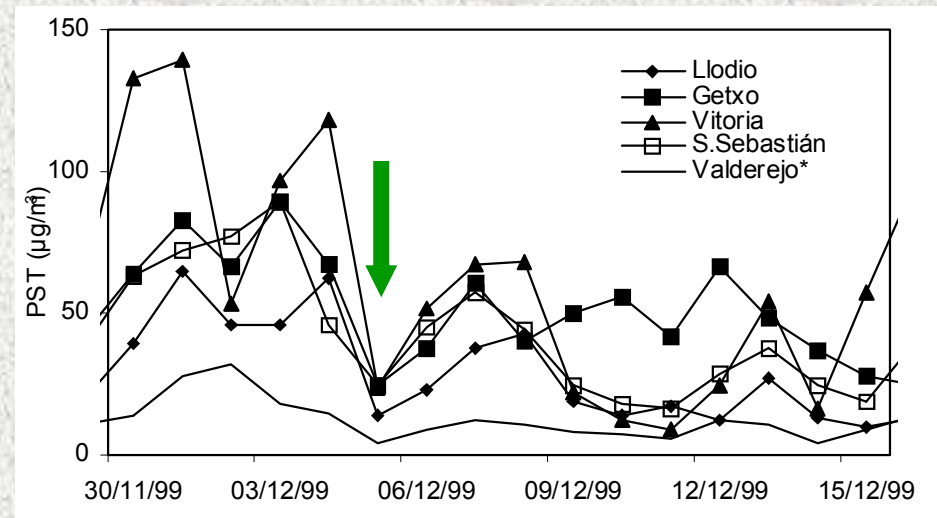
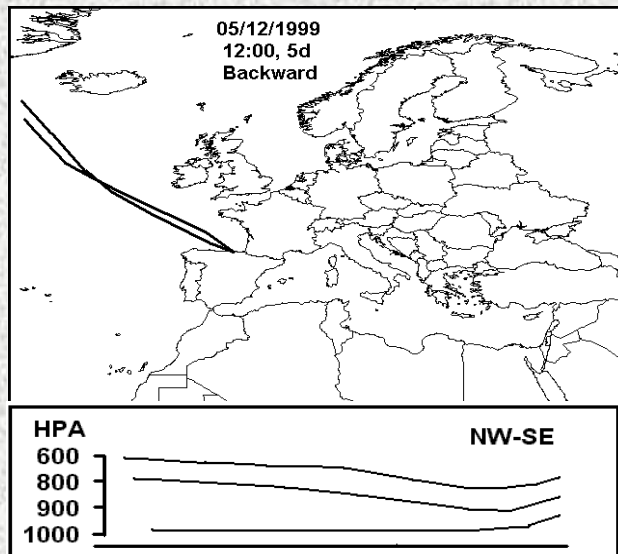


EUSKADI DATOS 1996-2001

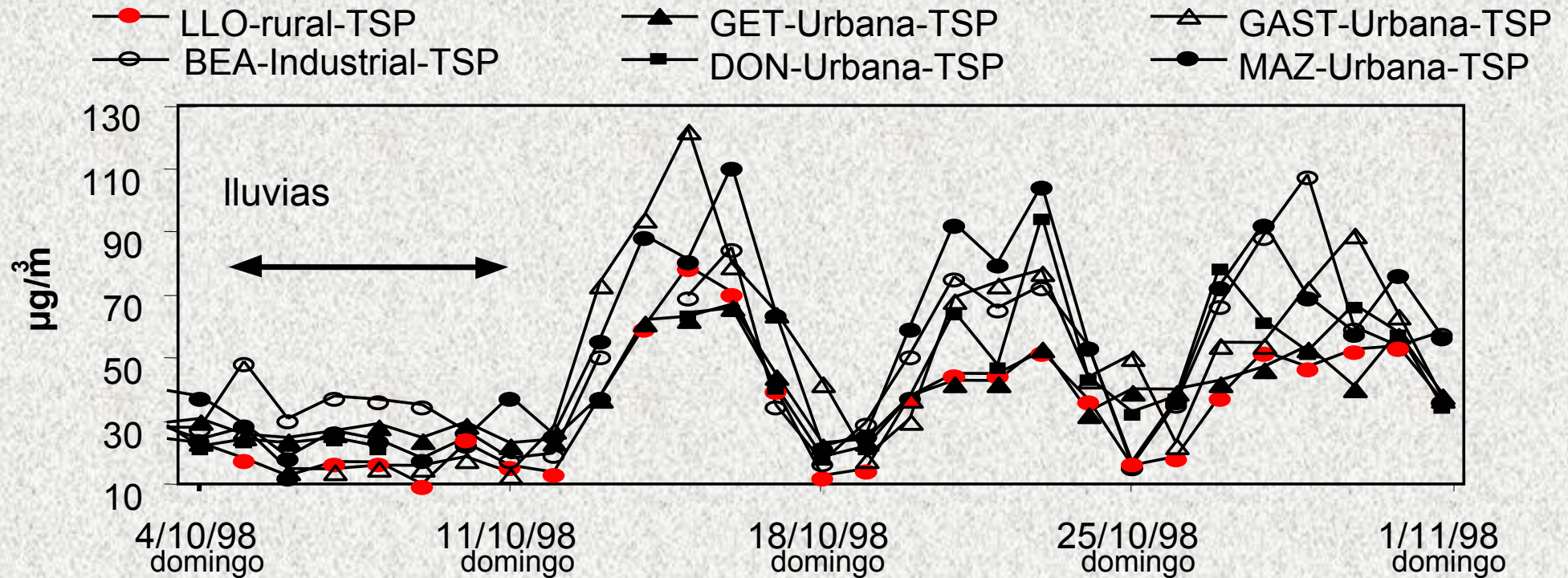


EPIODIOS DE PARTÍCULAS: INTERPRETACION SERIES PM

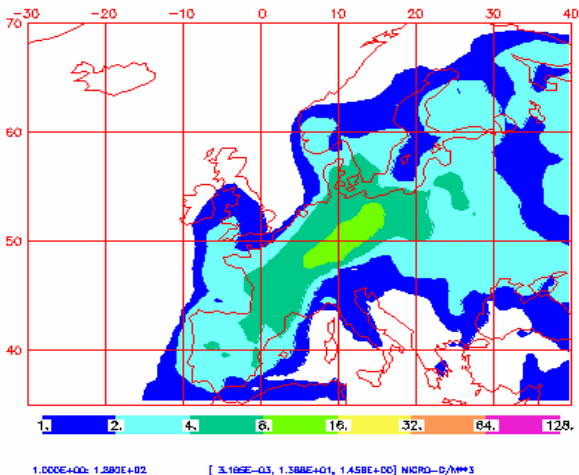
NIVELES BAJOS DE PM: ADVECCIÓN ATLÁNTICA



EPISODIOS ANTROPOGENICOS LOCALES

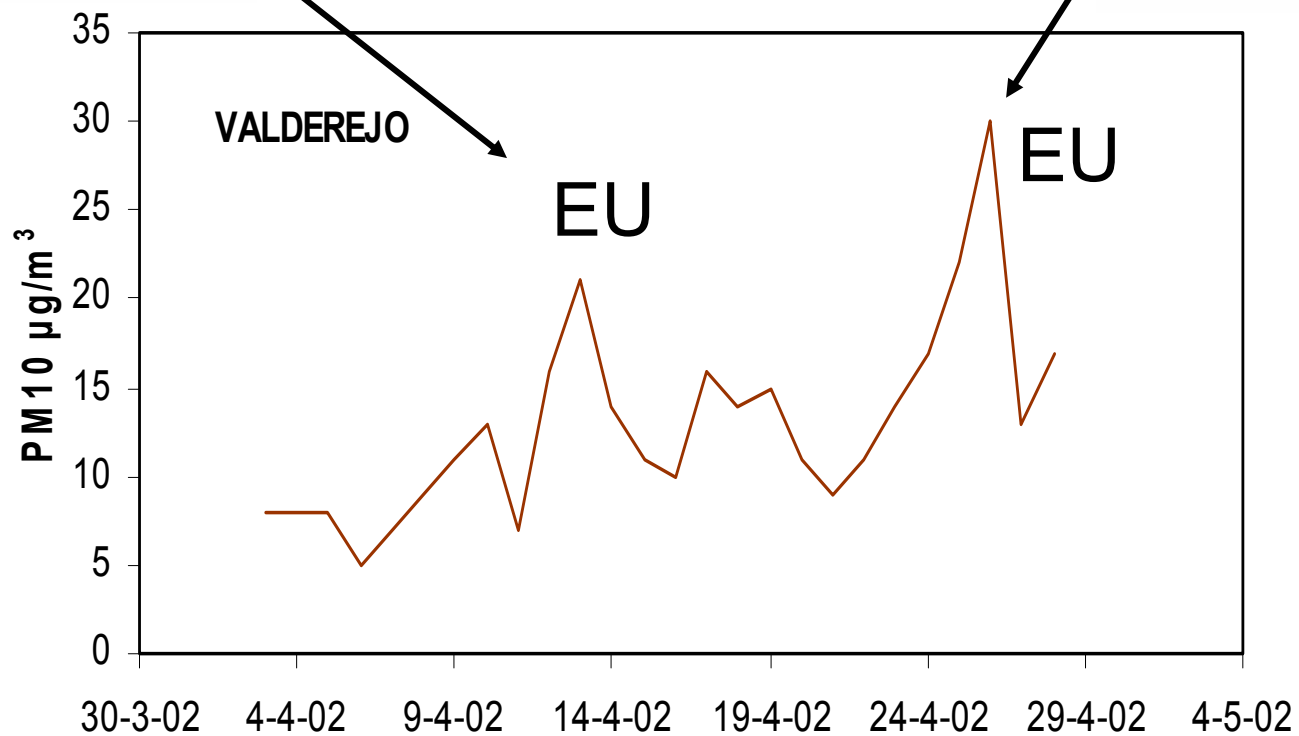
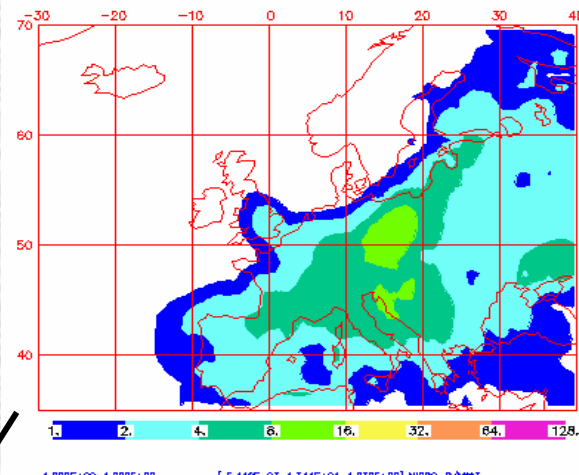


NAAPS Surface Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)
for 12:00Z 13 Apr 2002 Sulfate

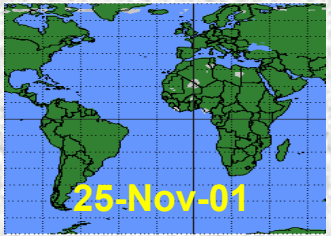
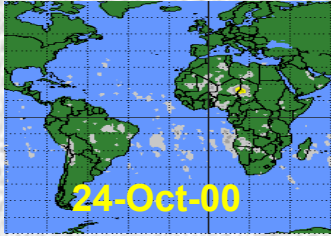
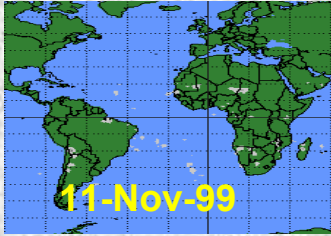
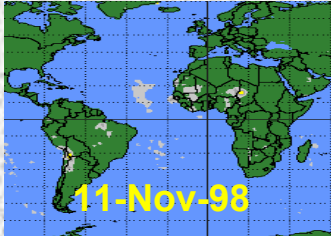
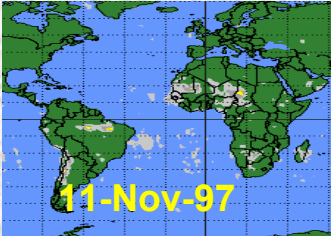
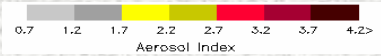


EPISODIOS EU

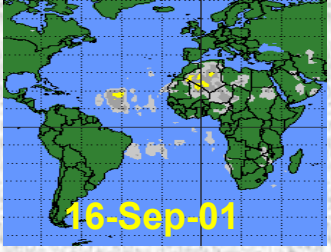
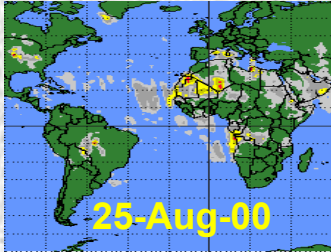
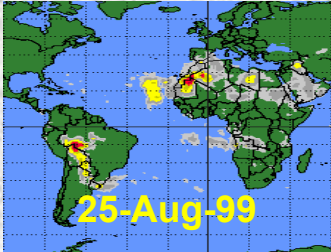
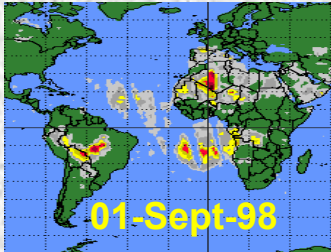
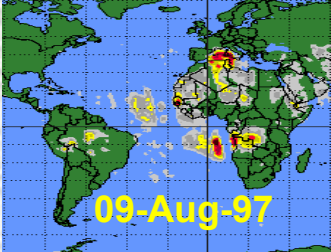
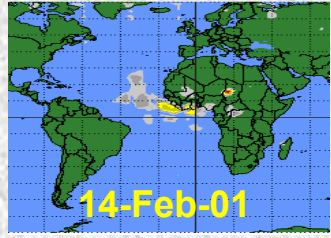
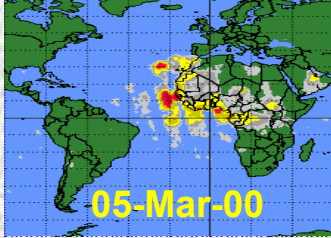
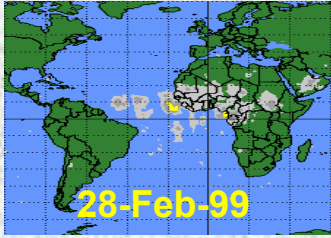
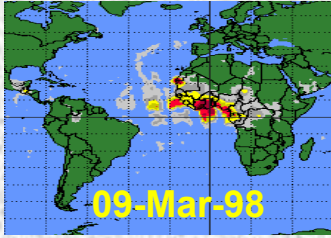
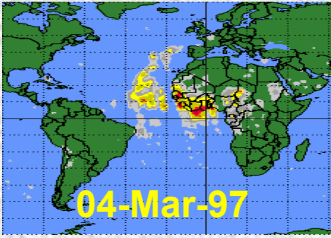
NAAPS Surface Concentration ($\mu\text{g}\cdot\text{m}^{-3}$)
for 12:00Z 23 Apr 2002 Sulfate

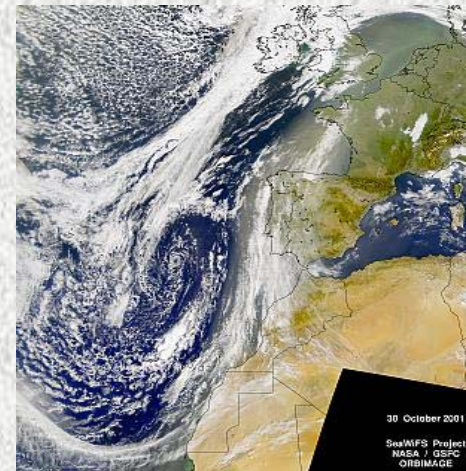
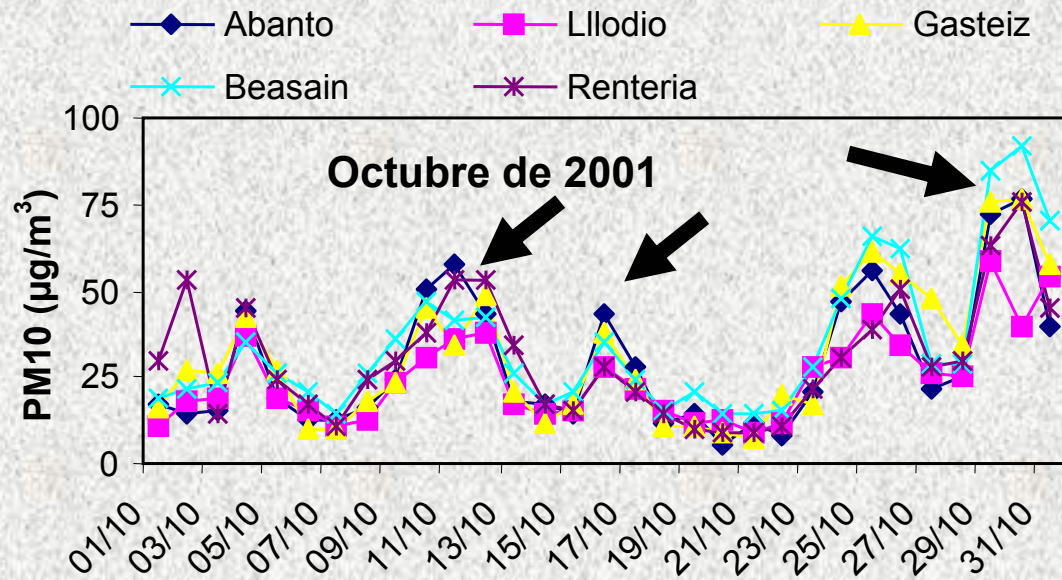


EPISODIOS AFRICANOS

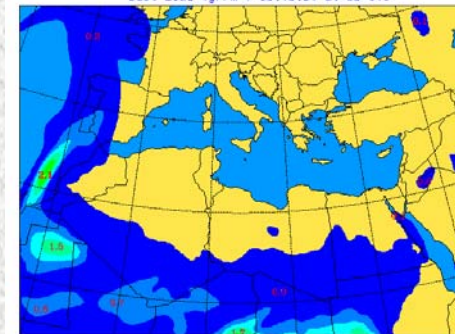


ZONA DE CONVERGENCIA INTER-TROPICAL (ITCZ)





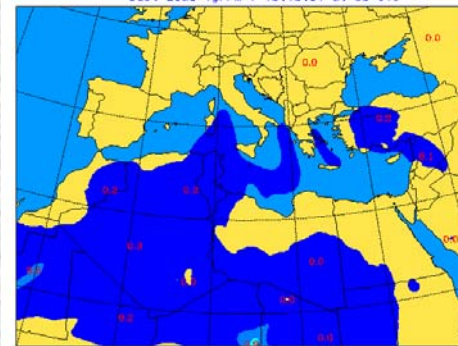
University of Athens (IAM&VFG) SKIRON Forecast
 Dust Load (gr/m^2) 30.10.01 at 00 UTC



0.0 0.4 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.4 2.8 3.2 3.6 4.0 4.4 4.8 5.2 5.6

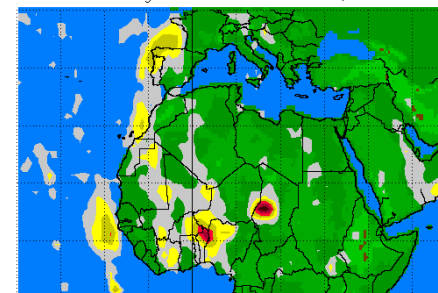


University of Athens (IAM&VFG) SKIRON Forecast
 Dust Load (gr/m^2) 10.10.01 at 00 UTC



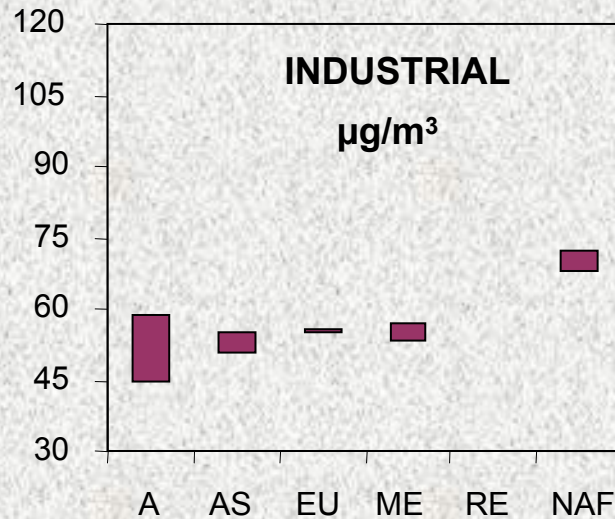
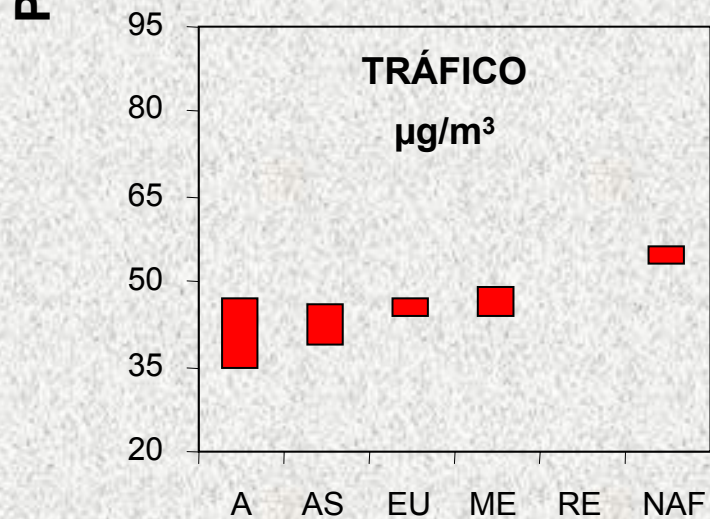
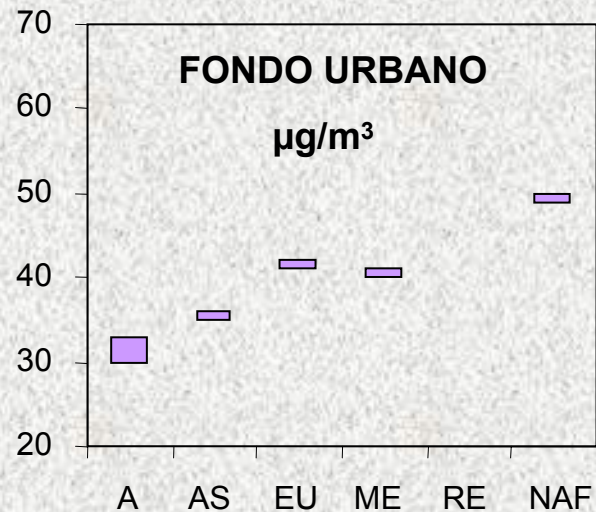
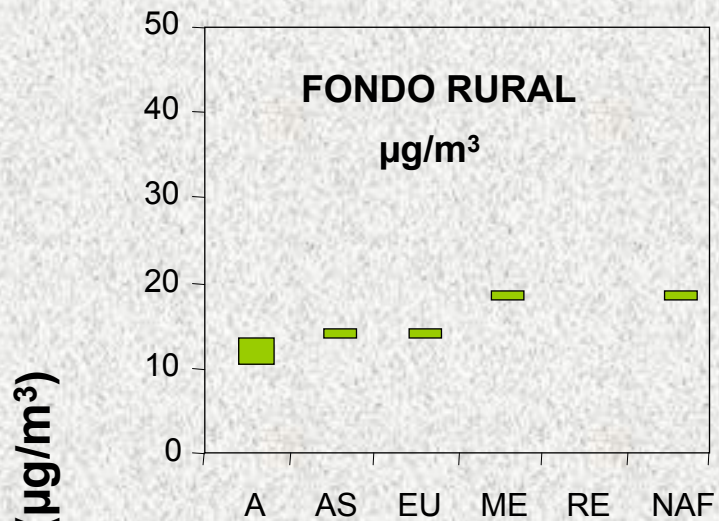
0.0 0.4 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.4 2.8 3.2 3.6 4.0 4.4 4.8 5.2 5.6

Earth Probe TOMS
 Absorbing Aerosol Index for Oct 30, 2001



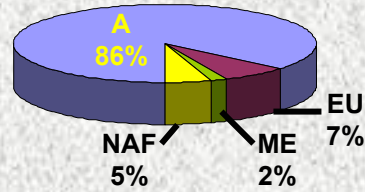
0.7 1.1 1.5 1.9 2.3 2.7 3.1+
 Aerosol Index

EUSKADI 1996-2001

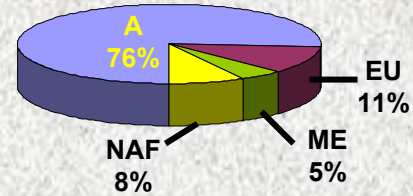


**MEDIA ANUAL
1996-2002**

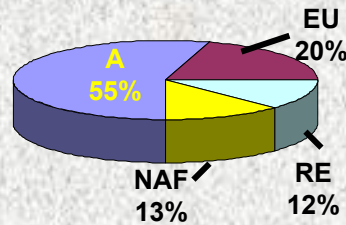
GALICIA



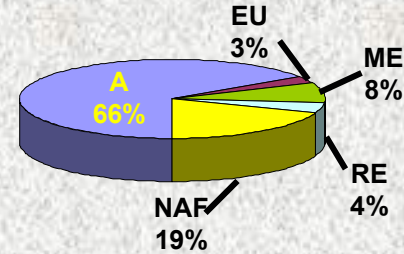
EUSKADI



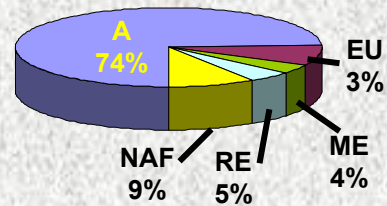
LEVANTE



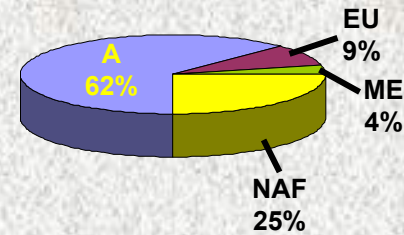
ANDALUCIA



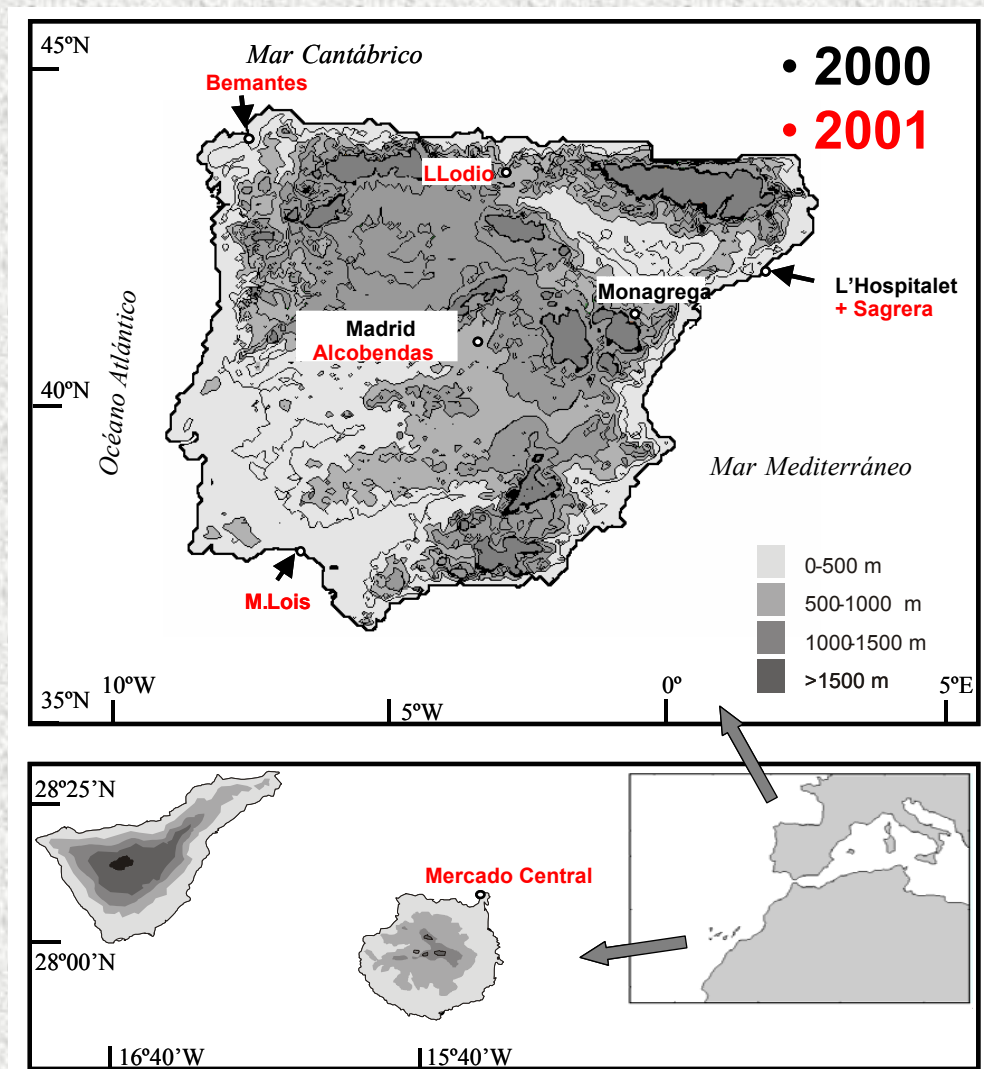
CENTRO



CANARIAS



ORIGEN COMPONENTES PM



ESTACIONES DE FONDO URBANO



ESTACIONES DE FONDO URBANO



ESTACIONES DE FONDO REGIONAL

ESTACIONES DE MEDIDA Y MUESTREO DE PM

Análisis

57 parámetros/filtro, N= PM10 775 filtros, PM2.5 390 filtros

Crustal-mineral

Al ₂ O ₃	ICP-AES
Ca	ICP-AES
K	ICP-AES
Mg	ICP-AES
Fe	ICP-AES
Ti	ICP-AES
P	ICP-AES
CO ₃ ²⁻	ind. Ca
SiO ₂	ind. 3*Al ₂ O ₃

Aerosol marino

Na ⁺	ICP-AES
Cl ⁻	Cromat. Ion.
SO ₄ ²⁻	ind. Na

Antropogénicos

Cnm A. Elemental

Secundarios inorgánicos

NH₄⁺ C.FIA

SO₄²⁻ Cromat. Ion.

NO₃⁻ Cromat. Ion.

40 Metales (ICP-MS)

As, Ba, Bi, **Cd**, Ce, Co, Cr, Cs, Cu, Dy, Er, Ga, Gd, Ge, Hf, La, Li, Mn, Mo, Nd, **Ni**, **Pb**, Pr, Rb, Sb, Sc, Se, Sm, Sn, Sr, Ta, Th, Ti, Tl, U, V, W, Yb, Zn, Zr,

Determinado

75-85 % masa PM

	Monagrega	Bemantes	Tarragona	Huelva	Alcobendas	Llodio	Las Palmas	Madrid	L'Hospitalet	Barcelona
	Fondo Rural		Fondo Urbano					Estaciones de Tráfico		
AÑO	1999-2000	2001	2001	2001	2001	2001	2001	1999-2000	1999-2000	2001
PM10 ($\mu\text{g}/\text{m}^3$)	20.7	18.9	37.4	37.5	32.2	31.7	44.4	47.7	49.8	46.2
N	Valores límite (2005) PM10: $40 \mu\text{g}/\text{m}^3$								15	90
OM+EC										
Mineral	5.2	2.5	9.2	11.8	8.6	7.3	11.6	15.2	12.9	15.2
Marino	0.7	2.6	2.3	2.8	1.2	2.3	11.5	0.8	2.3	2.4
Indeterminado	5.0	3.5	6.6	8.0	8.4	4.7	6.7	7.5	7.2	6
Secundarios Inorgánicos	7.5	5.2	10.2	7.9	6.4	8.7	4.9	7.7	15.3	10.8
nmSO_4^{2-}	3.7	3.0	4.9	4.7	2.9	5.4	2.7	4.4	6.8	4.9
NO_3^-	2.5	0.9	3.9	1.8	2.0	1.5	1.6	2.1	5.8	3.9
NH_4^+	1.3	1.3	1.5	1.5	1.5	1.6	0.8	1.2	2.7	2.0
PM2.5 ($\mu\text{g}/\text{m}^3$)	Nd	13.5	21.8	19.3	24.9	23.9	18.4	34.1	34.5	27.6
N	Valores límite (2010) PM2.5: $15-20 \mu\text{g}/\text{m}^3$								63	45
OM+EC										
Mineral	Nd	1.5	1.9	2.7	2.7	2.3	3.0	5.6	4.2	4.2
Marino	Nd	1.0	1.0	0.8	0.6	1.2	1.6	0.5	0.9	0.7
Indeterminado	Nd	2.0	3.8	4.7	5.0	4.2	2.8	5.8	4.2	2.7
Secundarios Inorgánicos	Nd	4.4	7.2	5.5	5.3	7.4	3.0	6.5	13.0	8.6
nmSO_4^{2-}	Nd	2.9	3.9	3.6	2.7	4.9	1.9	3.8	5.8	4.2
NO_3^-	Nd	0.4	1.9	0.5	1.3	0.8	0.4	1.3	4.0	2.3
NH_4^+	Nd	1.2	1.4	1.4	1.4	1.7	0.7	1.4	3.2	2.0

ng/m³

	PM 10						
	Sagrera	Llodio	Bemantes	Alcobendas	Huelva	Canarias	Tarragona
Li	0.7	0.4	0.1	0.4	0.3	0.3	0.4
Sc	0.2	0.1	0.1	0.3	0.2	0.2	0.3
Ti	84	25	7	34	60	52	23
V	15	8	5	4	7	8	8
Cr	8	25	1	2	2	2	3
Mn	23	87	5	10	11	11	9
Co	0.4	0.5	0.1	0.2	0.4	0.3	0.2
Ni	7	33	3	2	4	4	4
Cu	49	33	8	31	70	23	33
Zn	98	420	16	84	51	14	35
Ga	0.3	0.4	0.2	0.3	0.3	0.2	0.2
Ge	0.3	0.2	0.2	0.2	0.2	0.1	0.1
As	1.5	1.8	0.4	0.7	5.4	0.3	0.8
Se	1.1	2.8	0.5	0.5	1.8	0.3	0.5
Rb	1.8	1.1	0.6	1.4	1.5	0.8	0.8
Sr	6	3	1	4	4	6	5
Zr	4	3	3	4	3	3	2
Mo	4	16	3	3	5	2	2
Cd	0.7	1.2	0.2	0.3	0.8	0.2	0.3
Sn	4	38	1	2	2	0.5	2
Sb	10	2	1	7	4	3	7
Cs	0.1	0.1	0.04	0.1	0.1	0.1	0.1
Ba	41	14	7	29	16	18	12
La	0.58	0.28	0.14	0.29	0.47	0.51	0.20
Ce	1.31	0.39	0.24	0.66	0.89	1.05	0.62
Pr	0.14	0.06	0.06	0.07	0.11	0.13	0.11
Nd	0.55	0.15	0.18	0.29	0.47	0.47	0.29
Sm	0.09	0.03	0.04	0.07	0.10	0.08	0.06
Gd	0.12	0.09	0.05	0.10	0.15	0.11	0.12
Dy	0.10	0.04	0.04	0.06	0.12	0.09	0.08
Er	0.08	0.04	0.06	0.04	0.10	0.04	0.05
Yb	0.06	0.05	0.05	0.05	0.11	0.04	0.07
Hf	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Ta	0.2	0.05	0.05	0.1	0.2	0.1	0.1
W	0.3	0.7	0.04	0.4	0.1	0.1	0.2
Tl	0.3	0.4	0.1	0.1	0.2	0.1	0.3
Pb	57	103	9	24	37	15	26
Bi	0.4	0.5	0.1	0.1	1.7	0.1	0.2
Th	0.3	0.1	0.1	0.3	0.4	0.3	0.2
U	0.2	0.3	0.2	0.4	0.5	0.3	0.3



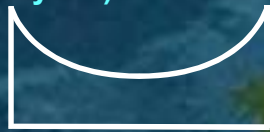
Major specie (excluding Canary Isl.)



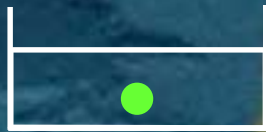
(Thermal instability of NH_4NO_3 along the year)



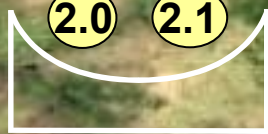
1.6



0.9



1.5



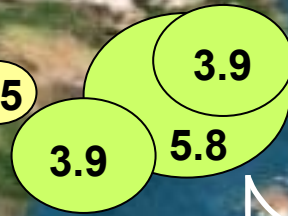
2.0

2.1



1.8

2.5



3.9

3.9

5.8



NO_3^- ($\mu\text{g}/\text{m}^3$) PM10

Seasonal trend

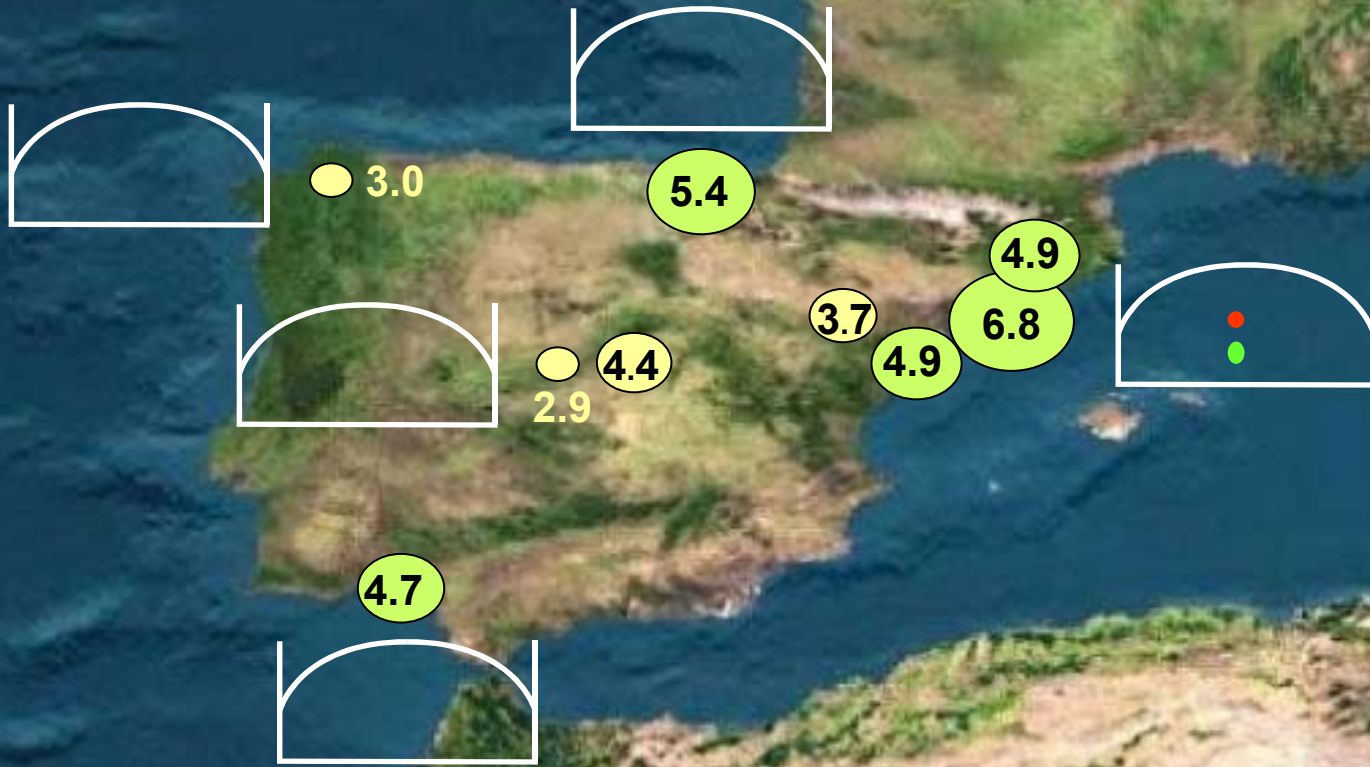


JFMAMJJASOND

$(\text{NH}_4)_2\text{SO}_4$
Major specie

Na_2SO_4

CaSO_4



External origin



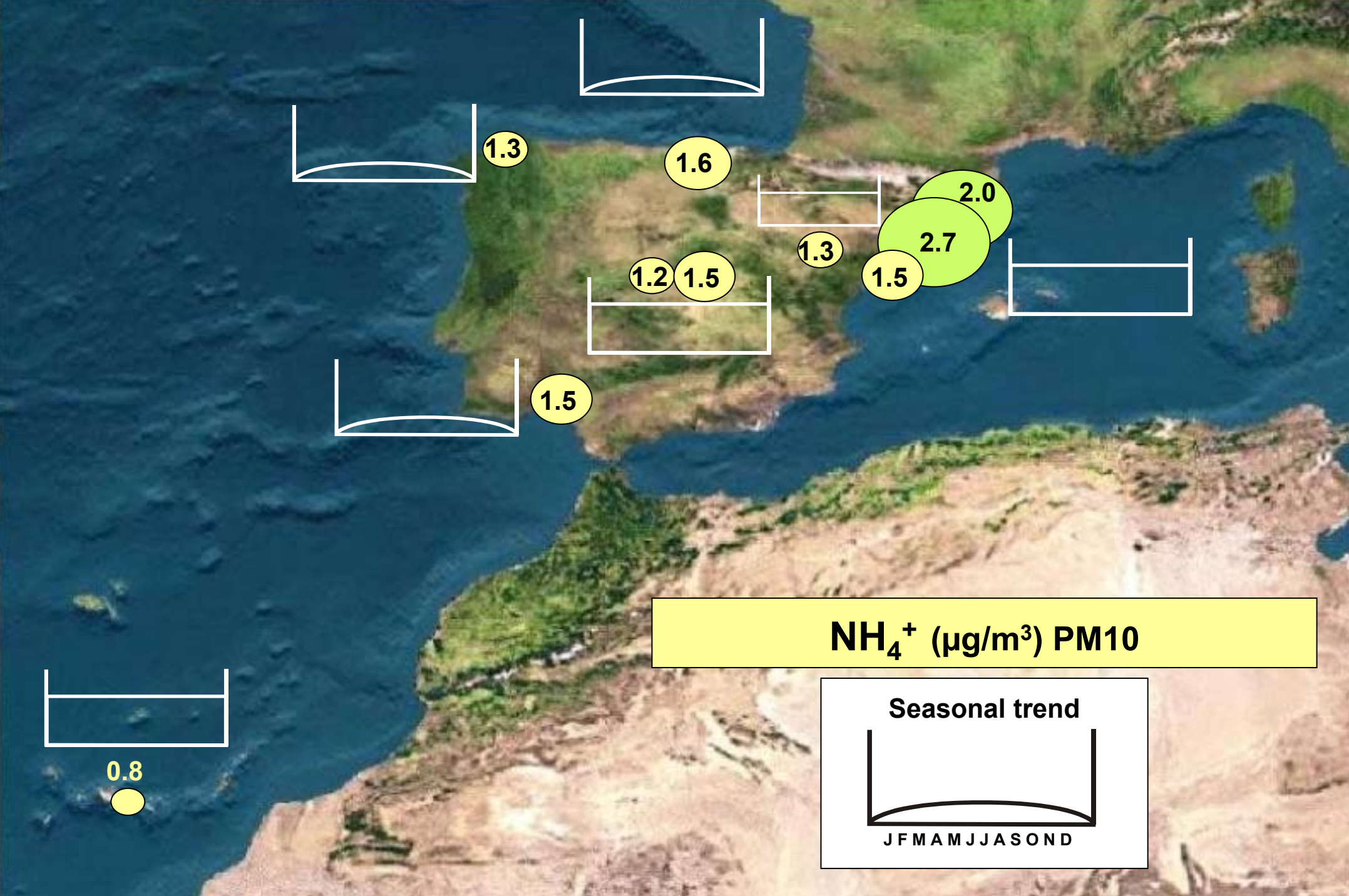
2.7

nmSO_4^{2-} ($\mu\text{g}/\text{m}^3$) PM_{10}

Seasonal trend



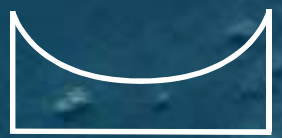
JFMAMJJASOND



NH_4^+ ($\mu\text{g}/\text{m}^3$) PM_{10}



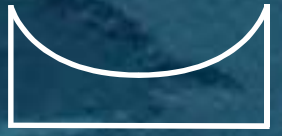
Maximal dispersion, Trade winds



7.9



5.0



8.1



18.1

10.4



6.4

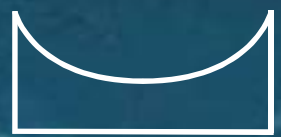
2.5



8.8

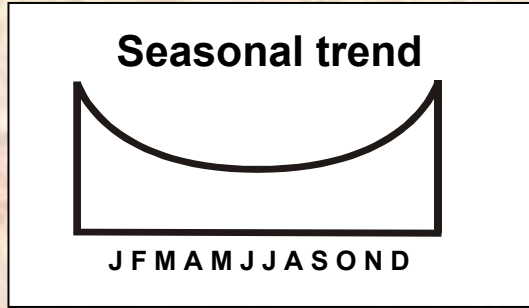
13.3

11.3



No local C sources

OM+EC ($\mu\text{g}/\text{m}^3$) PM10



[Low resuspension]

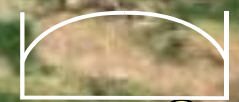


2.5



7.3

15.2



8.6

5.2

9.2

12.9

15.2



[Influence from traffic]

[Influence from traffic]



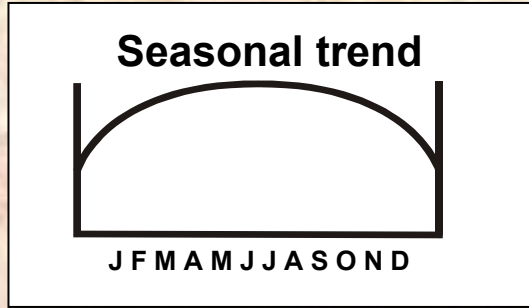
11.8

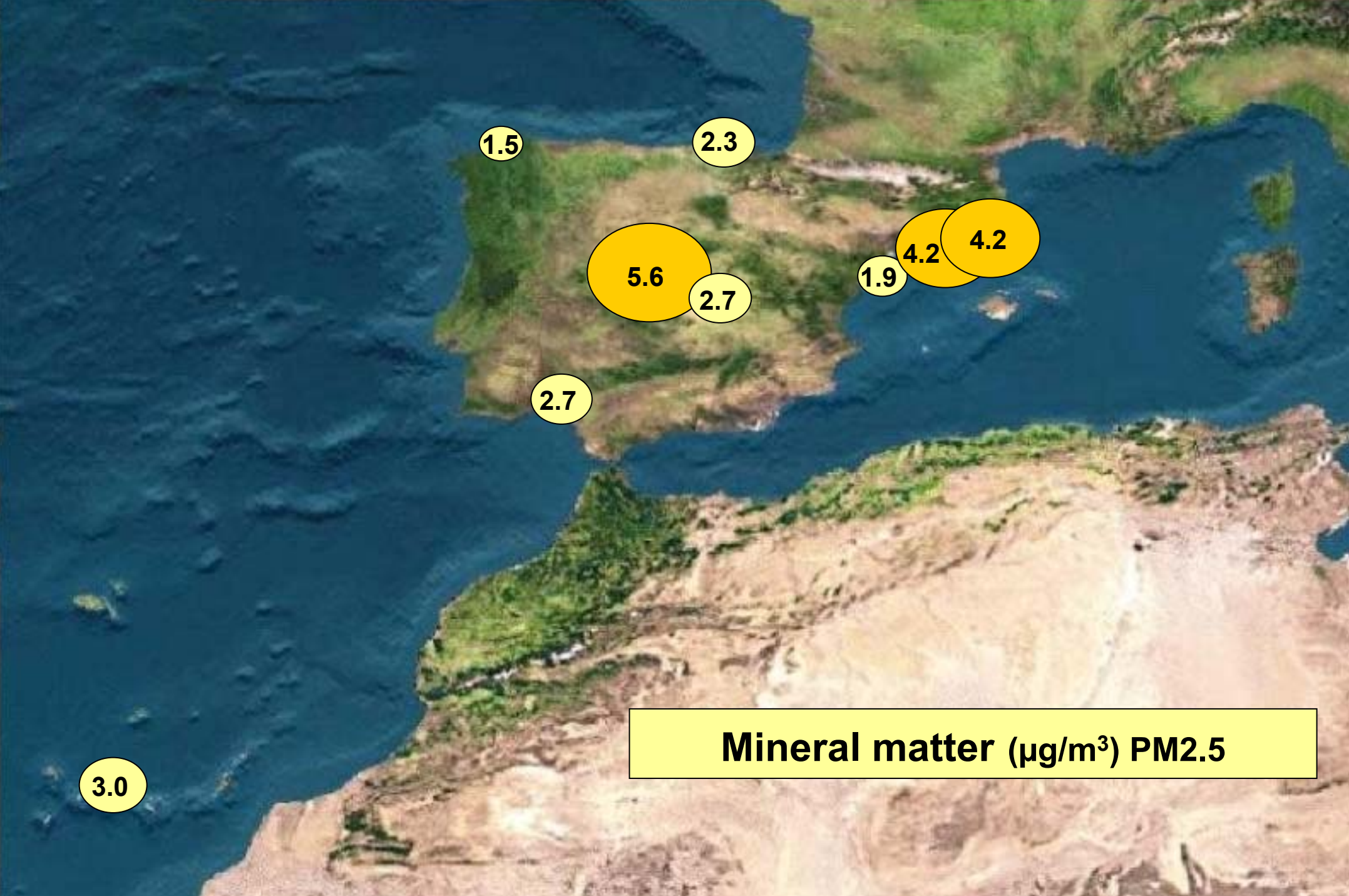
[African contribution]



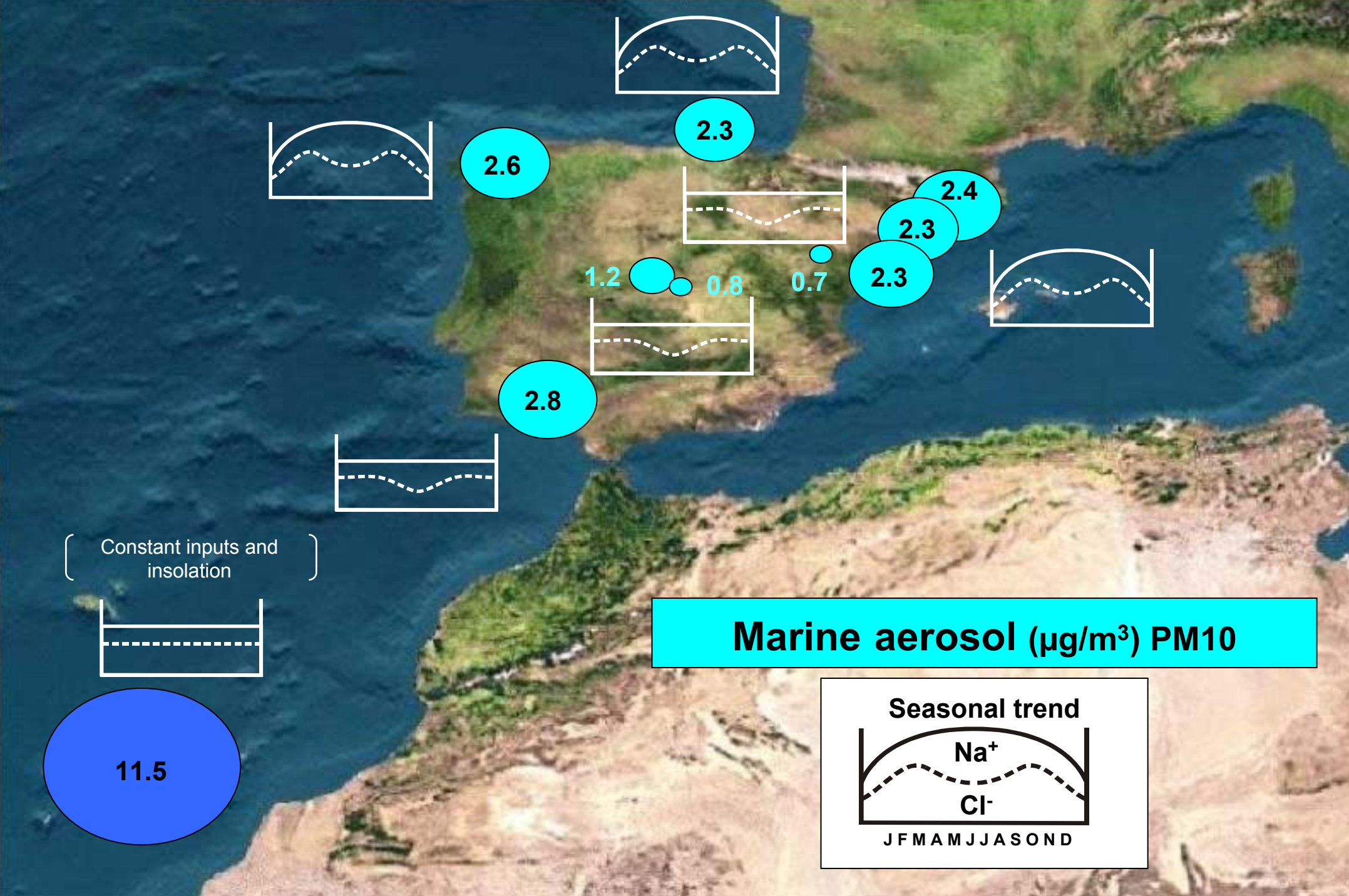
11.6

Mineral matter ($\mu\text{g}/\text{m}^3$) PM10



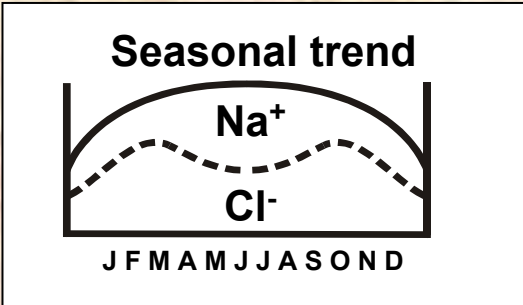
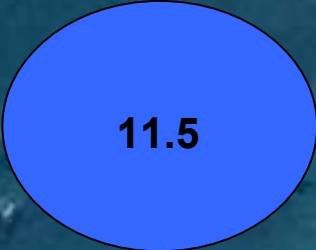
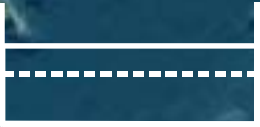


Mineral matter ($\mu\text{g}/\text{m}^3$) PM2.5



Marine aerosol ($\mu\text{g}/\text{m}^3$) PM10

Constant inputs and insolation

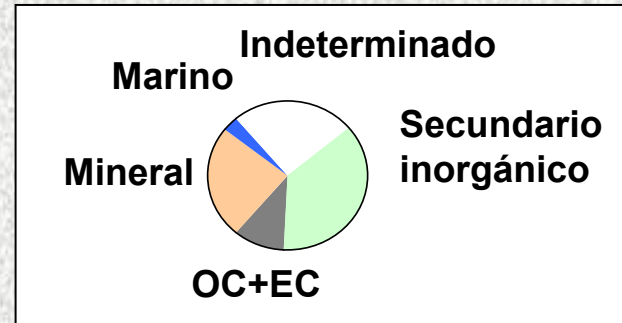




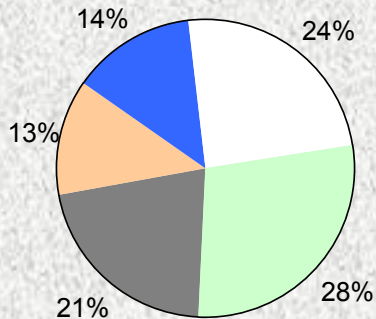
Marine aerosol ($\mu\text{g}/\text{m}^3$) PM2.5

GEOQUÍMICA

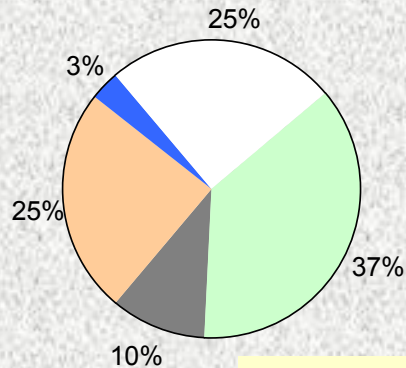
PM10



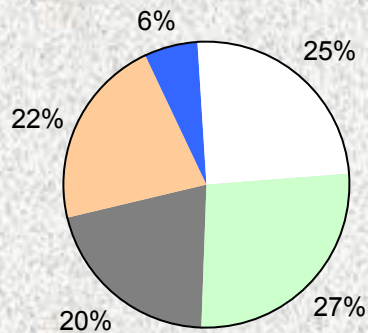
Bemantes



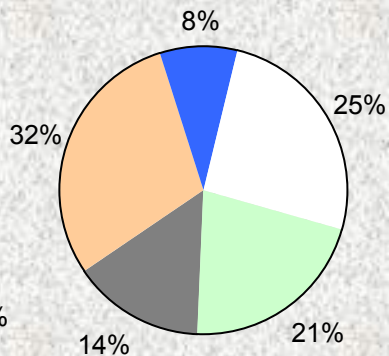
Monagrega



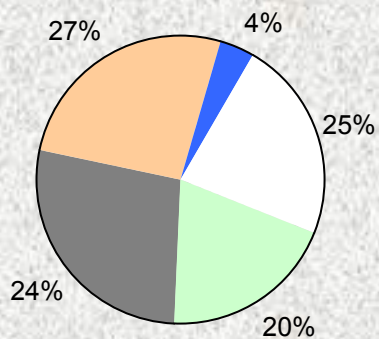
Tarragona



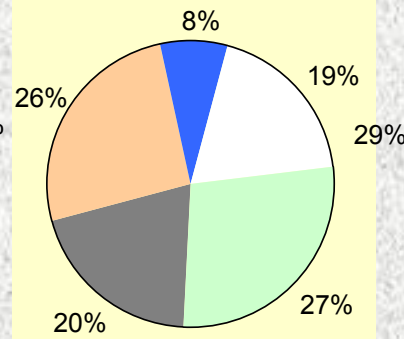
Huelva



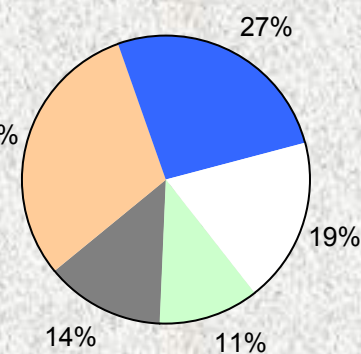
Alcobendas



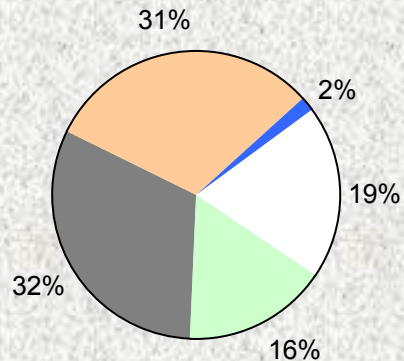
Llodio



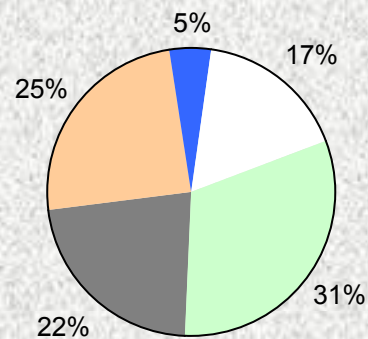
Canary Isl.



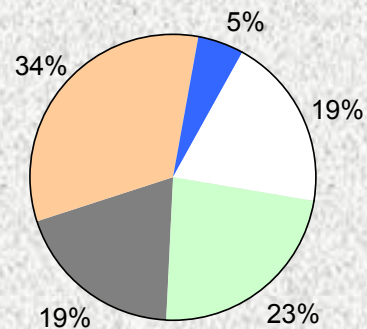
Madrid



L'Hospitalet

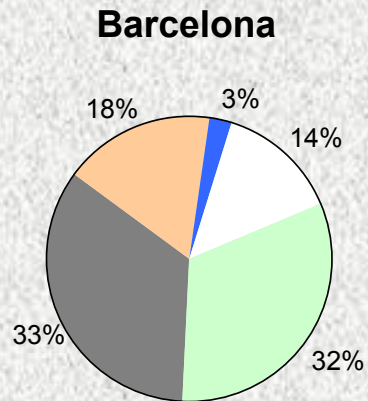
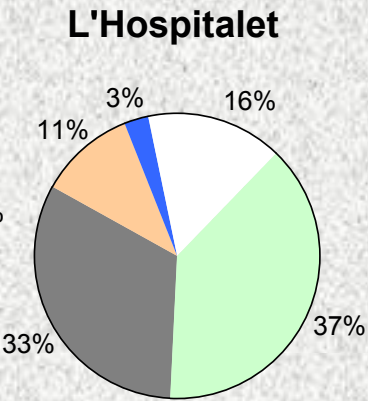
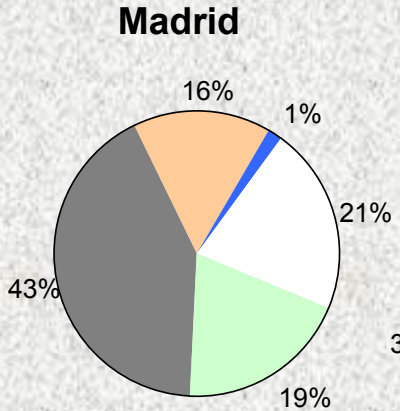
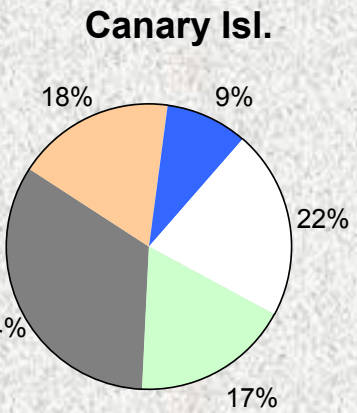
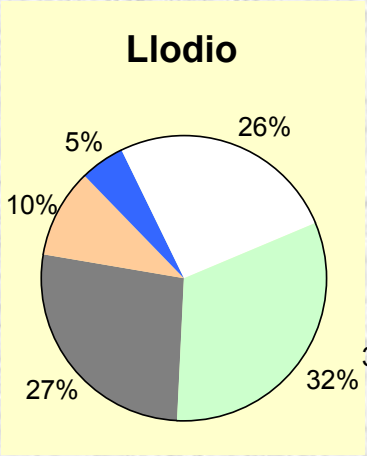
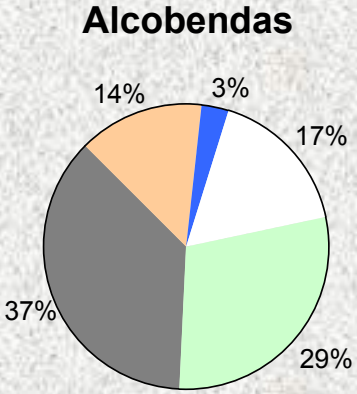
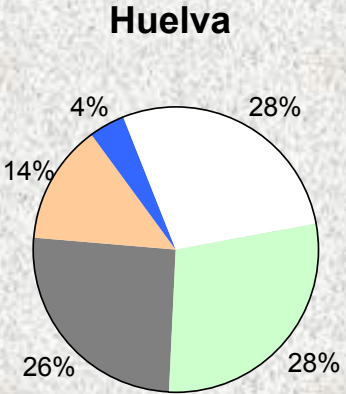
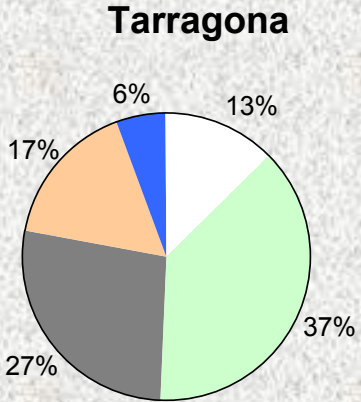
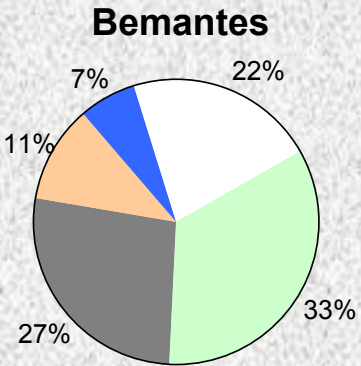
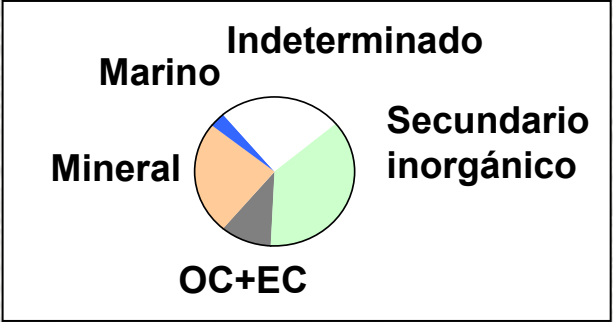


Barcelona



GEOQUÍMICA

PM2.5



□ Indeterminado

■ metales

■ OC+EC

■ marino

■ mineral

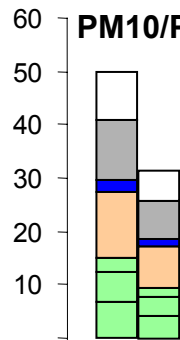
■ NH4+

■ NO3-

■ nmSO42-

µg/m³

PM10/PM2.5



Berlin
40/26 µg/m³

Berlin
29/22 µg/m³

Vienna
53/38 µg/m³

Illmitz
24/20 µg/m³

Basel
28/- µg/m³

Helsinki
14/8 µg/m³

Helsinki
25/12 µg/m³

Bemantes
19/14 µg/m³

Llodio
33/24 µg/m³

Alcobendas
29/17 µg/m³

Barcelona
47/28 µg/m³

Huelva
36/19 µg/m³

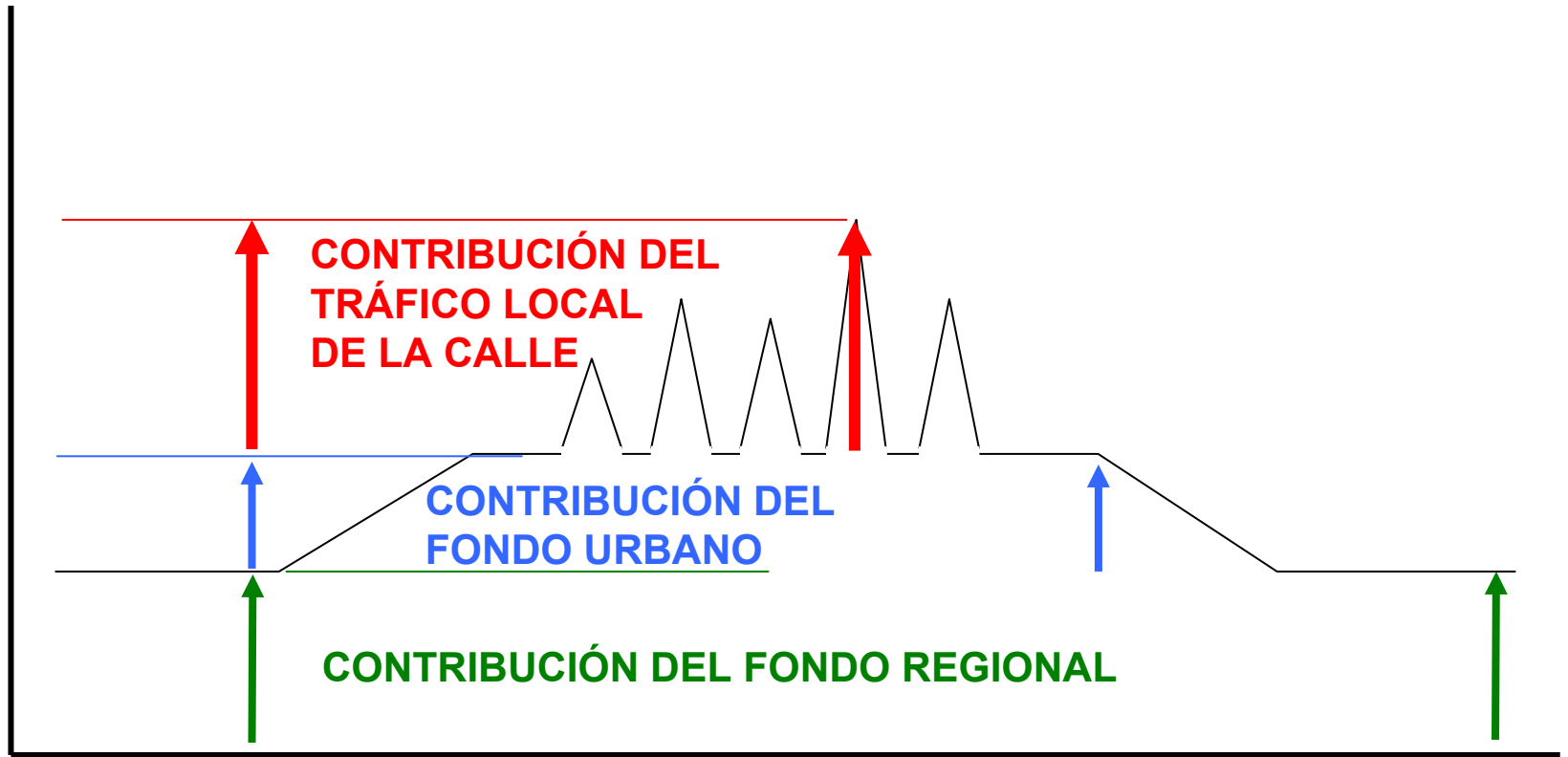
Las Palmas
48/18 µg/m³

Estaciones de tráfico

Fondo Urbano

Fondo Rural

PM10 ($\mu\text{g}/\text{m}^3$)

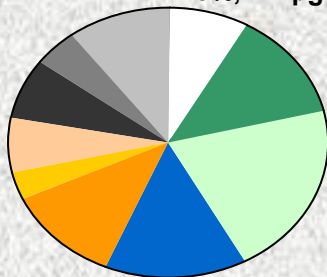


TRÁFICO-URBANO PM10

Amsterdam

22%, 6.8 $\mu\text{g}/\text{m}^3$
 11%, 3.3 $\mu\text{g}/\text{m}^3$
 4%, 1.3 $\mu\text{g}/\text{m}^3$
 7%, 2.2 $\mu\text{g}/\text{m}^3$

8%, 2.4 $\mu\text{g}/\text{m}^3$



21%, 6.4 $\mu\text{g}/\text{m}^3$
 6%, 1.9 $\mu\text{g}/\text{m}^3$
 3%, 1.0 $\mu\text{g}/\text{m}^3$
 12%, 3.5 $\mu\text{g}/\text{m}^3$

14%, 4.3 $\mu\text{g}/\text{m}^3$

30 $\mu\text{gPM10}/\text{m}^3$

OC+EC
 Regional back.
 Urban back
 Local Traffic at kerbsides

Unaccounted

14%, 6.3 $\mu\text{g}/\text{m}^3$

Secondary inorganics

35%, 10.3 $\mu\text{g}/\text{m}^3$

13%, 4.0 $\mu\text{g}/\text{m}^3$

22%, 6.3 $\mu\text{g}/\text{m}^3$

City & Industrial back
 Regional background

21%, 9.2 $\mu\text{g}/\text{m}^3$

4%, 1.7 $\mu\text{g}/\text{m}^3$

17%, 7.5 $\mu\text{g}/\text{m}^3$

Marine aerosol

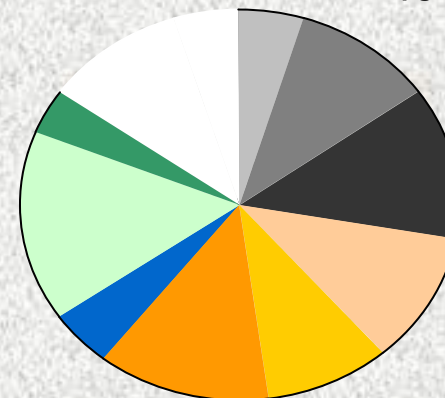
5%, 2.2 $\mu\text{g}/\text{m}^3$

Mineral

Regionaal back.
 Urban back (demolition & road)
 Local Traffic at kerbsides

Barcelona

27%, 12.2 $\mu\text{g}/\text{m}^3$
 5%, 2.3 $\mu\text{g}/\text{m}^3$
 10%, 4.5 $\mu\text{g}/\text{m}^3$
 12%, 5.4 $\mu\text{g}/\text{m}^3$



33%, 14.9 $\mu\text{g}/\text{m}^3$

12%, 5.4 $\mu\text{g}/\text{m}^3$

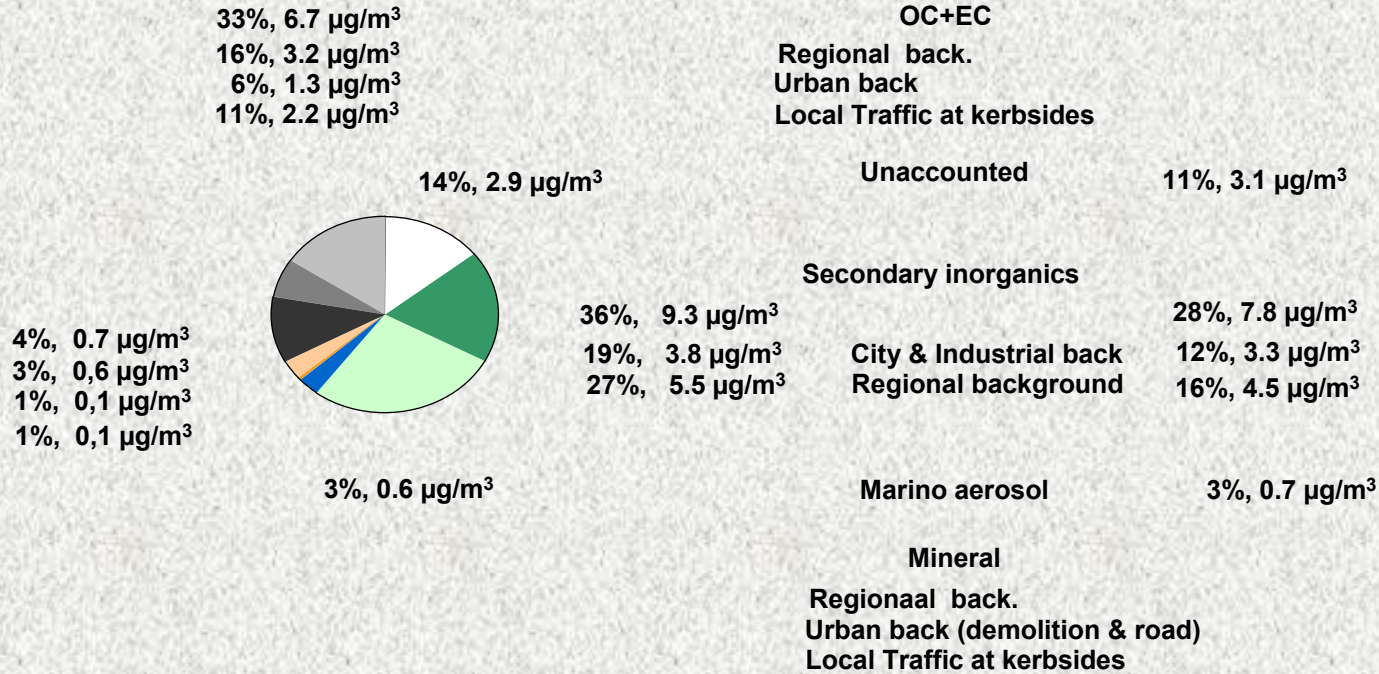
9%, 4.1 $\mu\text{g}/\text{m}^3$

12%, 5.4 $\mu\text{g}/\text{m}^3$

45 $\mu\text{gPM10}/\text{m}^3$

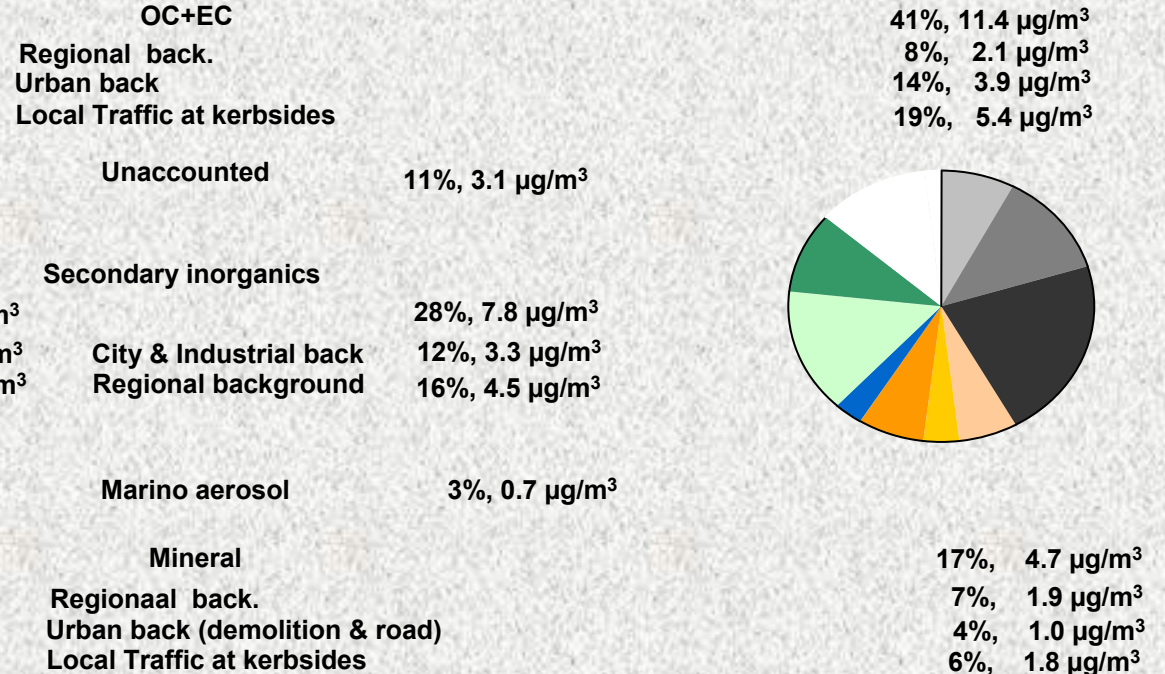
TRÁFICO-URBANO PM2.5

Amsterdam



20 µgPM2.5/m³

Barcelona



28 µgPM2.5/m³

FONDO URBANO PM10

Holanda
25 $\mu\text{gPM}_{10}/\text{m}^3$

12%, 3.1 $\mu\text{g}/\text{m}^3$

22%, 5.5 $\mu\text{g}/\text{m}^3$

15%, 3.8 $\mu\text{g}/\text{m}^3$

7%, 1.7 $\mu\text{g}/\text{m}^3$

12%, 2.9 $\mu\text{g}/\text{m}^3$

8%, 1.9 $\mu\text{g}/\text{m}^3$

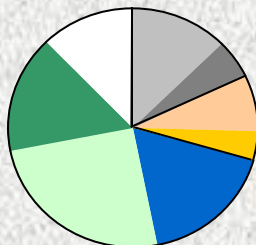
4%, 1.0 $\mu\text{g}/\text{m}^3$

17%, 4.3 $\mu\text{g}/\text{m}^3$

41%, 10.3 $\mu\text{g}/\text{m}^3$

25%, 6.3 $\mu\text{g}/\text{m}^3$

16%, 4.0 $\mu\text{g}/\text{m}^3$



Llodio
31 $\mu\text{gPM}_{10}/\text{m}^3$

16%, 5.1 $\mu\text{g}/\text{m}^3$

27%, 8.3 $\mu\text{g}/\text{m}^3$

13%, 4.0 $\mu\text{g}/\text{m}^3$

14%, 4.3 $\mu\text{g}/\text{m}^3$

23%, 7.3 $\mu\text{g}/\text{m}^3$

8%, 2.5 $\mu\text{g}/\text{m}^3$

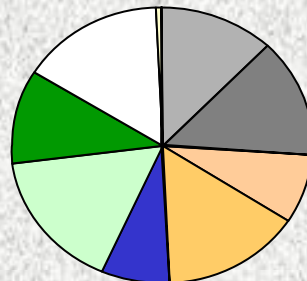
15%, 4.8 $\mu\text{g}/\text{m}^3$

7%, 2.3 $\mu\text{g}/\text{m}^3$

27%, 8.7 $\mu\text{g}/\text{m}^3$

16%, 5.2 $\mu\text{g}/\text{m}^3$

11%, 3.5 $\mu\text{g}/\text{m}^3$



Tarragona
37 $\mu\text{gPM}_{10}/\text{m}^3$

18%, 6.6 $\mu\text{g}/\text{m}^3$

22%, 8.8 $\mu\text{g}/\text{m}^3$

7%, 2.5 $\mu\text{g}/\text{m}^3$

17%, 6.3 $\mu\text{g}/\text{m}^3$

25%, 9.2 $\mu\text{g}/\text{m}^3$

14%, 5.2 $\mu\text{g}/\text{m}^3$

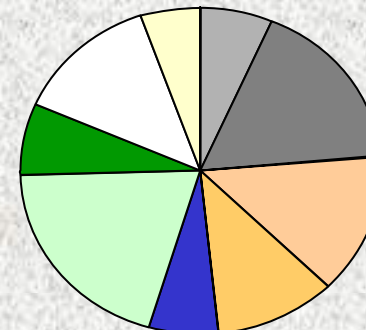
11%, 4.0 $\mu\text{g}/\text{m}^3$

6%, 2.3 $\mu\text{g}/\text{m}^3$

27%, 10.2 $\mu\text{g}/\text{m}^3$

20%, 7.5 $\mu\text{g}/\text{m}^3$

7%, 2.7 $\mu\text{g}/\text{m}^3$



Indeterminado

OM+EC

fondo regional

fondo urbano

Materia mineral

fondo regional

fondo urbano

Aerosol marino

Inorgánicos secundarios

fondo regional

fondo urbano

FONDO URBANO PM2.5

Holanda
18 $\mu\text{gpm}2.5/\text{m}^3$

12%, 2.0 $\mu\text{g}/\text{m}^3$

22%, 5.5 $\mu\text{g}/\text{m}^3$

15%, 3.8 $\mu\text{g}/\text{m}^3$

7%, 1.7 $\mu\text{g}/\text{m}^3$

6%, 0.6 $\mu\text{g}/\text{m}^3$

8%, 0.6 $\mu\text{g}/\text{m}^3$

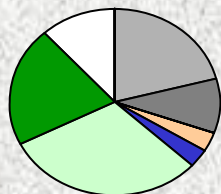
0%, 0.0 $\mu\text{g}/\text{m}^3$

3%, 0.6 $\mu\text{g}/\text{m}^3$

52%, 9.3 $\mu\text{g}/\text{m}^3$

31%, 5.5 $\mu\text{g}/\text{m}^3$

21%, 3.8 $\mu\text{g}/\text{m}^3$



Llodio
24 $\mu\text{gPM}2.5/\text{m}^3$

15%, 4.2 $\mu\text{g}/\text{m}^3$

36%, 8.3 $\mu\text{g}/\text{m}^3$

13%, 4.0 $\mu\text{g}/\text{m}^3$

19%, 4.3 $\mu\text{g}/\text{m}^3$

11%, 2.8 $\mu\text{g}/\text{m}^3$

6%, 1.5 $\mu\text{g}/\text{m}^3$

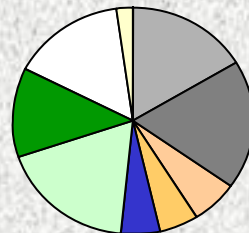
5%, 1.3 $\mu\text{g}/\text{m}^3$

5%, 1.2 $\mu\text{g}/\text{m}^3$

31%, 7.3 $\mu\text{g}/\text{m}^3$

16%, 4.4 $\mu\text{g}/\text{m}^3$

11%, 3.0 $\mu\text{g}/\text{m}^3$



Tarragona
22 $\mu\text{gPM}10/\text{m}^3$

18%, 4.0 $\mu\text{g}/\text{m}^3$

34%, 7.8 $\mu\text{g}/\text{m}^3$

7%, 2.5 $\mu\text{g}/\text{m}^3$

17%, 5.3 $\mu\text{g}/\text{m}^3$

9%, 2.1 $\mu\text{g}/\text{m}^3$

7%, 1.6 $\mu\text{g}/\text{m}^3$

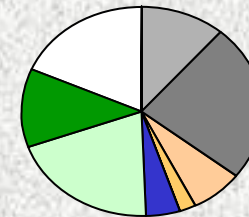
2%, 0.5 $\mu\text{g}/\text{m}^3$

5%, 1.0 $\mu\text{g}/\text{m}^3$

32%, 7.2 $\mu\text{g}/\text{m}^3$

20%, 4.5 $\mu\text{g}/\text{m}^3$

12%, 2.7 $\mu\text{g}/\text{m}^3$



Indeterminado

OM+EC

fondo regional

fondo urbano

Materia mineral

fondo regional

fondo urbano

Aerosol marino

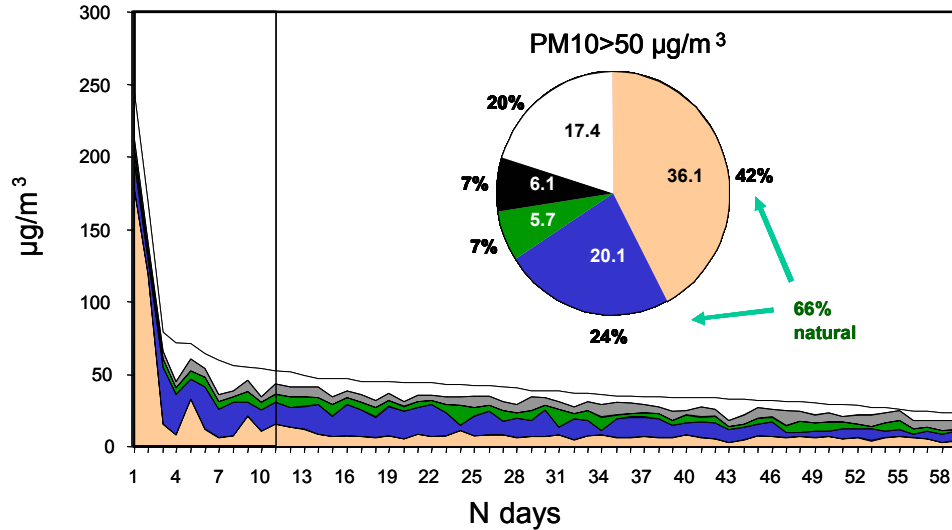
Inorgánicos secundarios

fondo regional

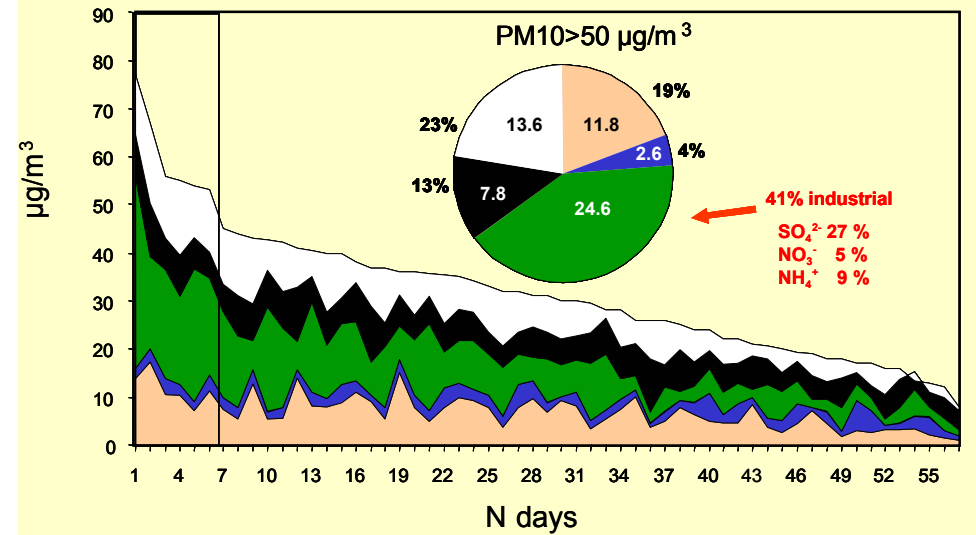
fondo urbano

Crustal Marine Secondary OC+BC Unaccounted

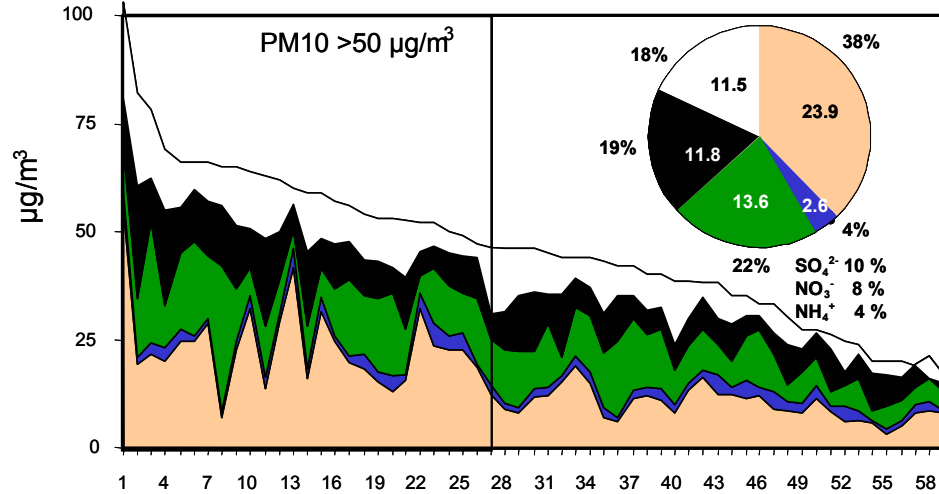
CANARY ISLANDS (URBAN BACKGROUND)



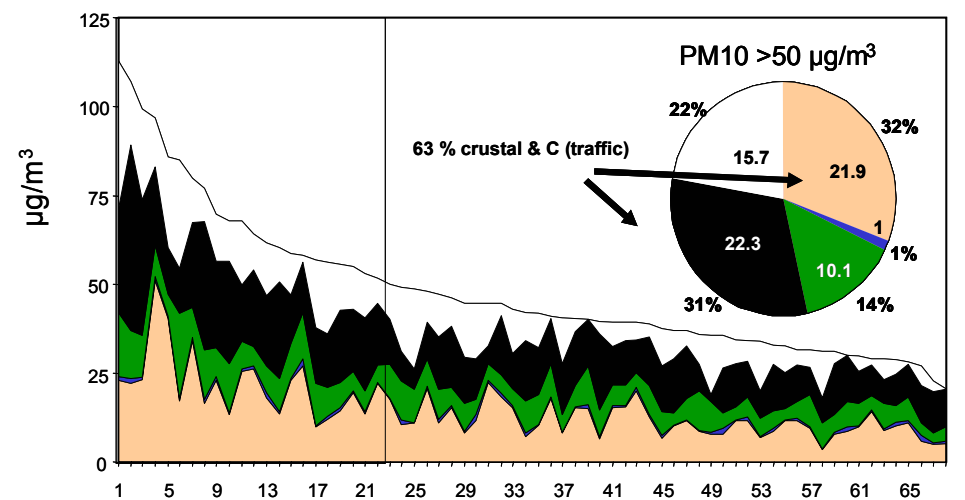
LLODIO (URBAN BACKGROUND INDUSTRIAL SITE)



BARCELONA (KERBSIDE SITE WITH INDUSTRIAL INFLUENCE)

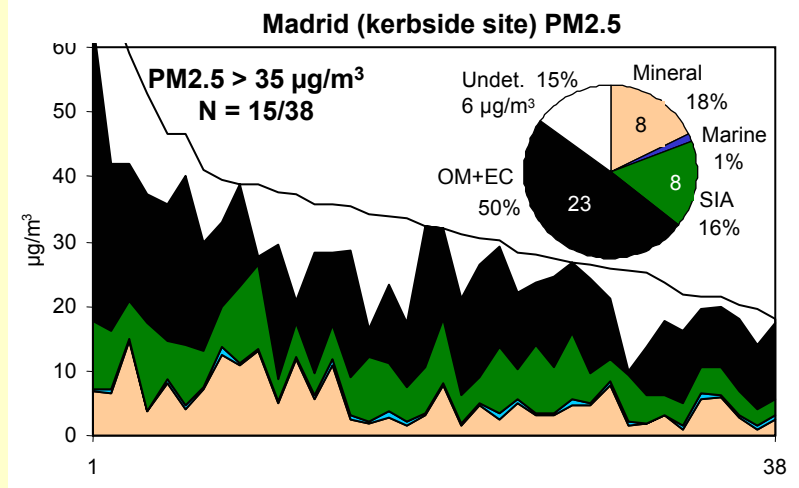
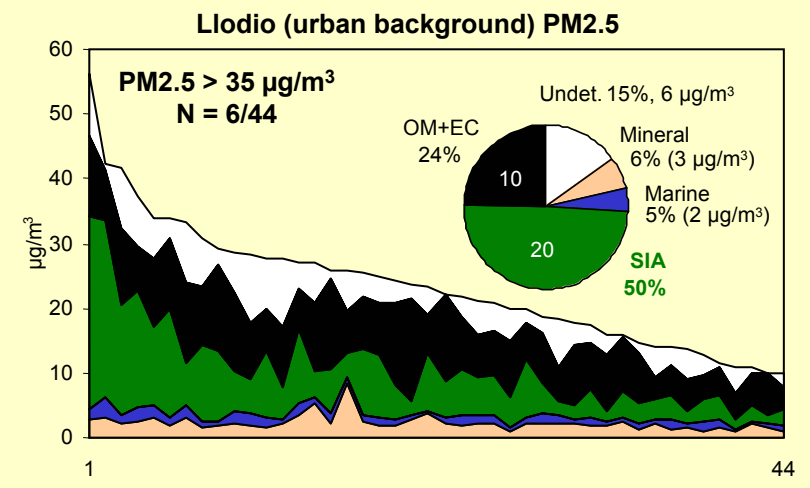
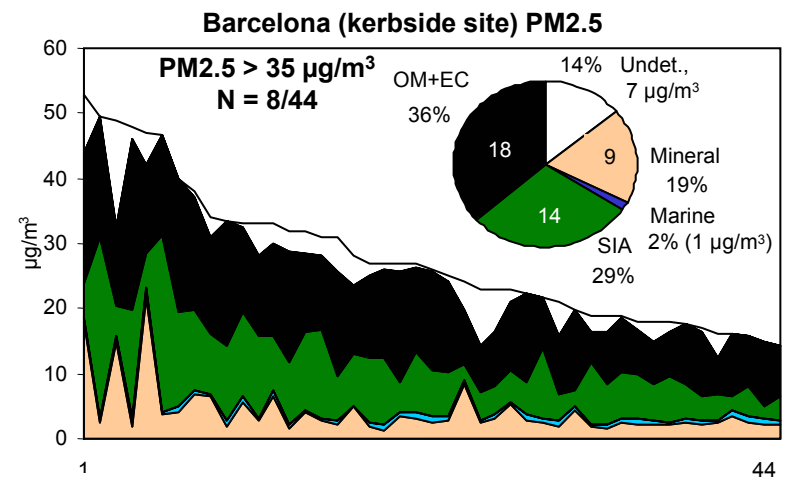
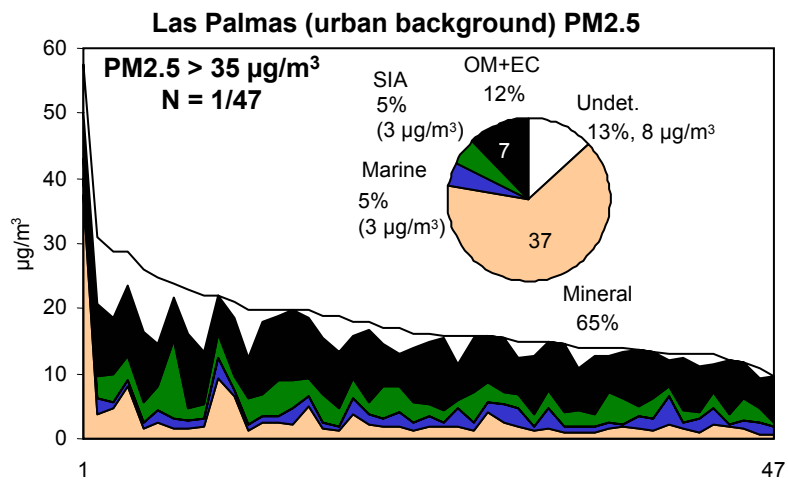


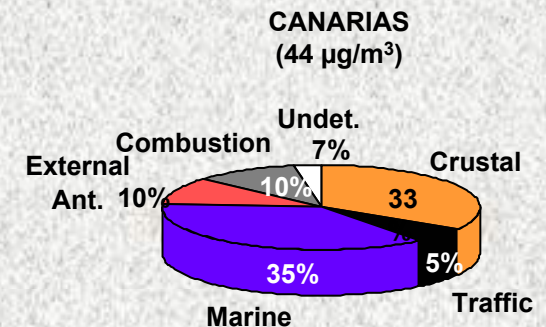
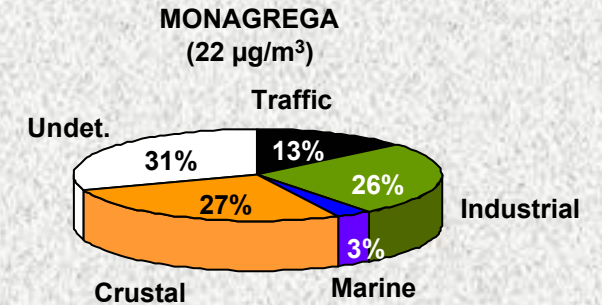
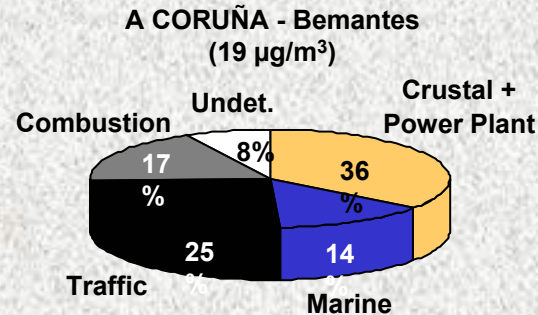
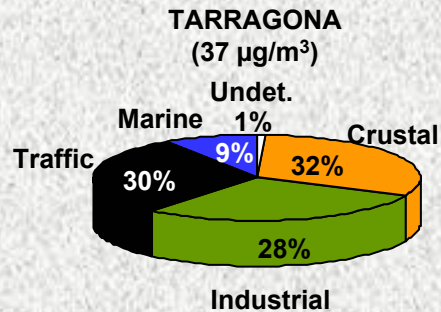
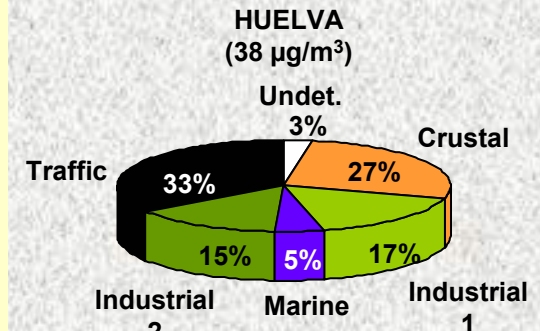
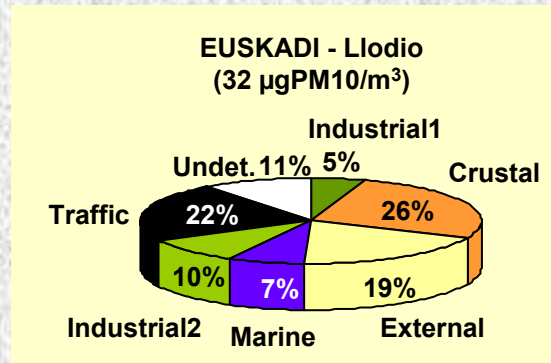
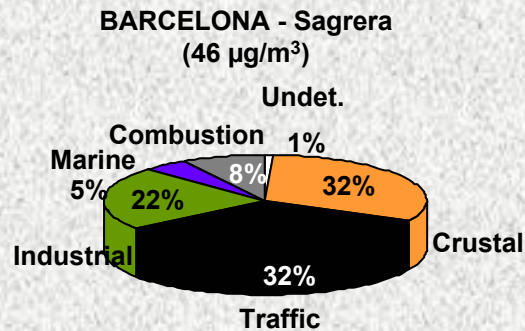
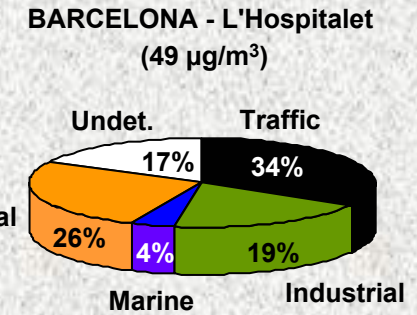
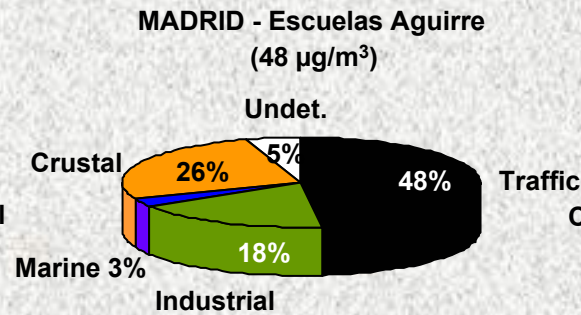
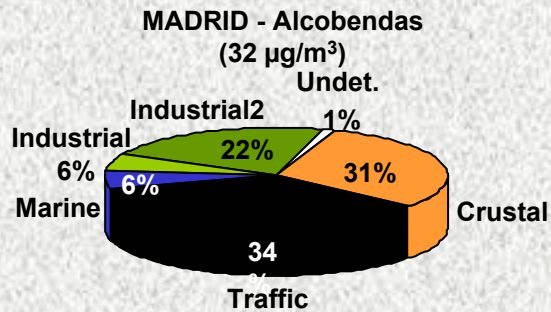
MADRID (KERBSIDE SITE)



Superaciones valor límite PM10

Superaciones valor límite PM2.5



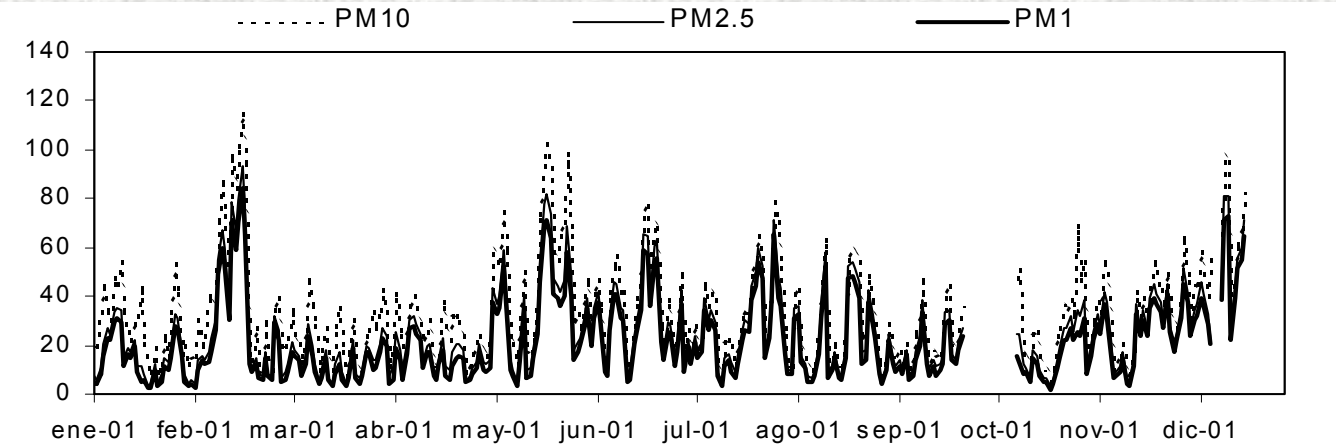
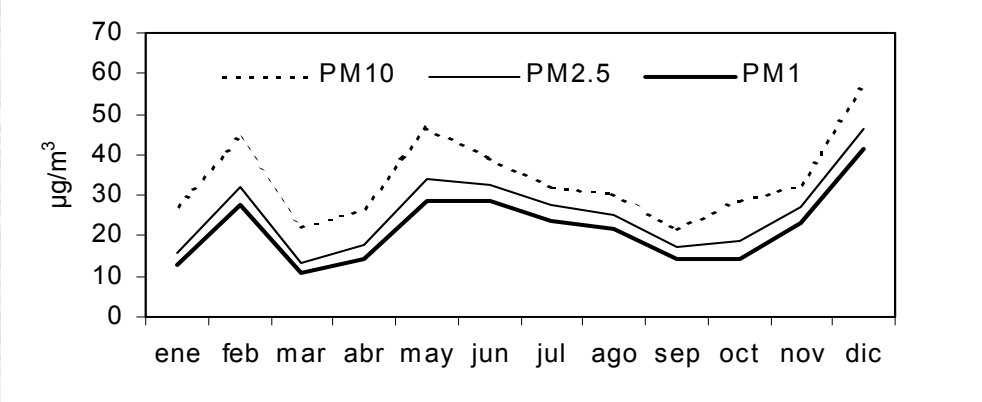


CONTRIBUCIÓN DE FUENTES EN PM10 (MODELO RECEPTOR)

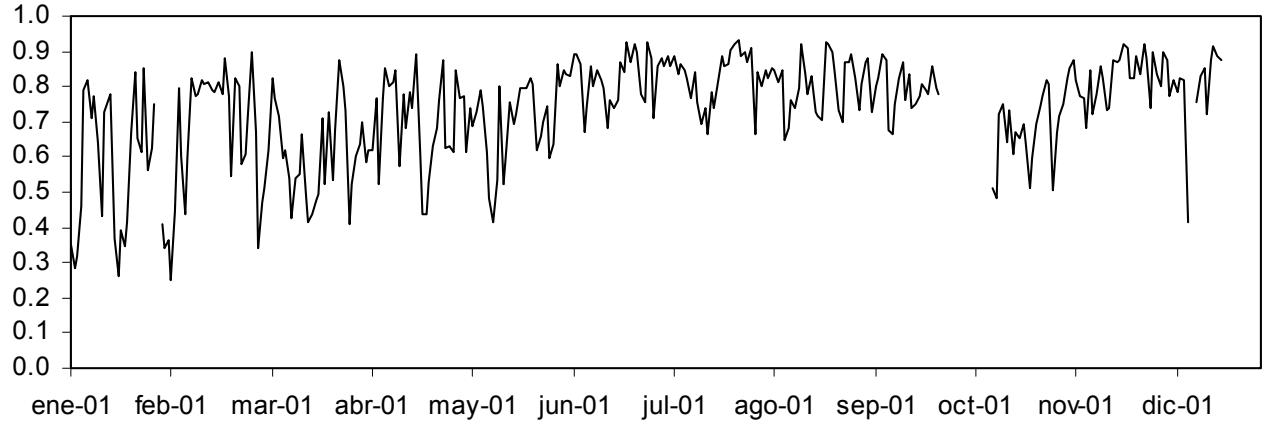
PM10 CONTRIBUCIÓN DE FUENTES: MODELO RECEPTOR (Análisis factorial y regresión multi-lineal)

	Mon	Bem	Hue	Alc	Llo	Tarr	Can	Es.A	L'Ho	Sag
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³
PM10	22.0	18.9	38.0	32.2	31.7	37.4	43.9	47.7	49.5	46.2
<i>n</i>	132	87	91	84	85	91	88	69	115	90
Tráfico	2.9	4.8	12.9	10.7	6.9	11.2	2.3	22.9	16.5	14.8
Industrial 1-5	5.7	3.3	11.9	8.9	10.8	10.5	4.5	8.6	9.5	14.0
Externo							4.5			
Marino	0.7	2.6	1.7	1.8	2.3	3.4	15.8	1.4	2.0	2.2
Crustal	5.8	6.7**	10.0	9.6	8.2	11.5	14.7	12.4	13.0	14.6
No determinado	6.6	1.5	1.1	0.3	3.3	0.4	2.9	2.4	8.5	0.3
	%	%	%	%	%		%	%	%	%
Tráfico	13	25	33	34	22	30	5	48	33	32
Industrial 1-5	26	17	32	28	34	28	10	18	20	30
Externo							10			
Marino	5	14	5	6	7	9	35	3	4	5
Crustal	26	36	27	31	26	32	33	26	26	32
No determinado	30	8	3	1	11	1	7	5	17	1

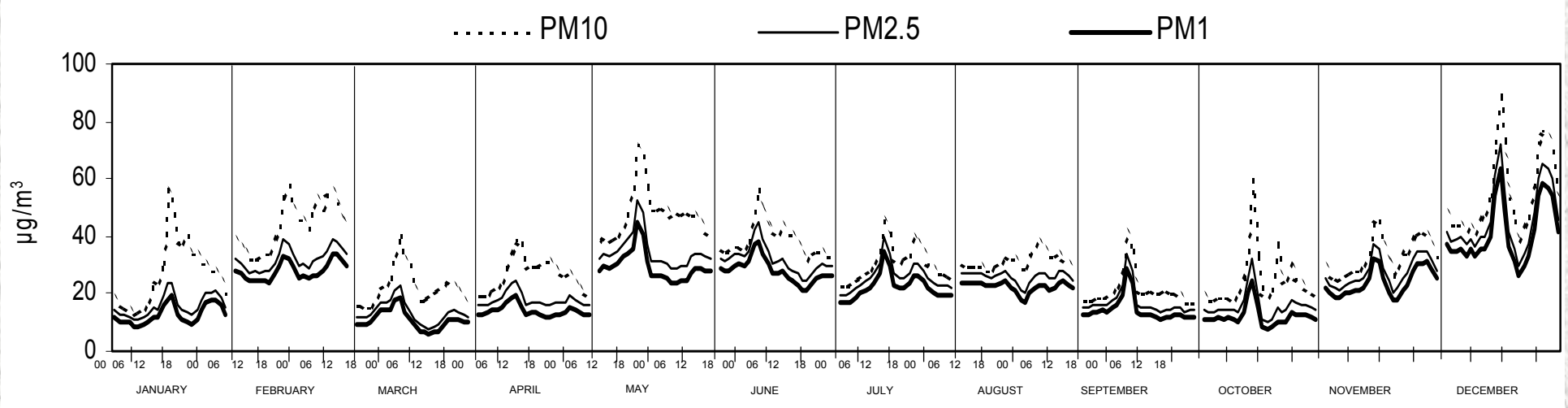
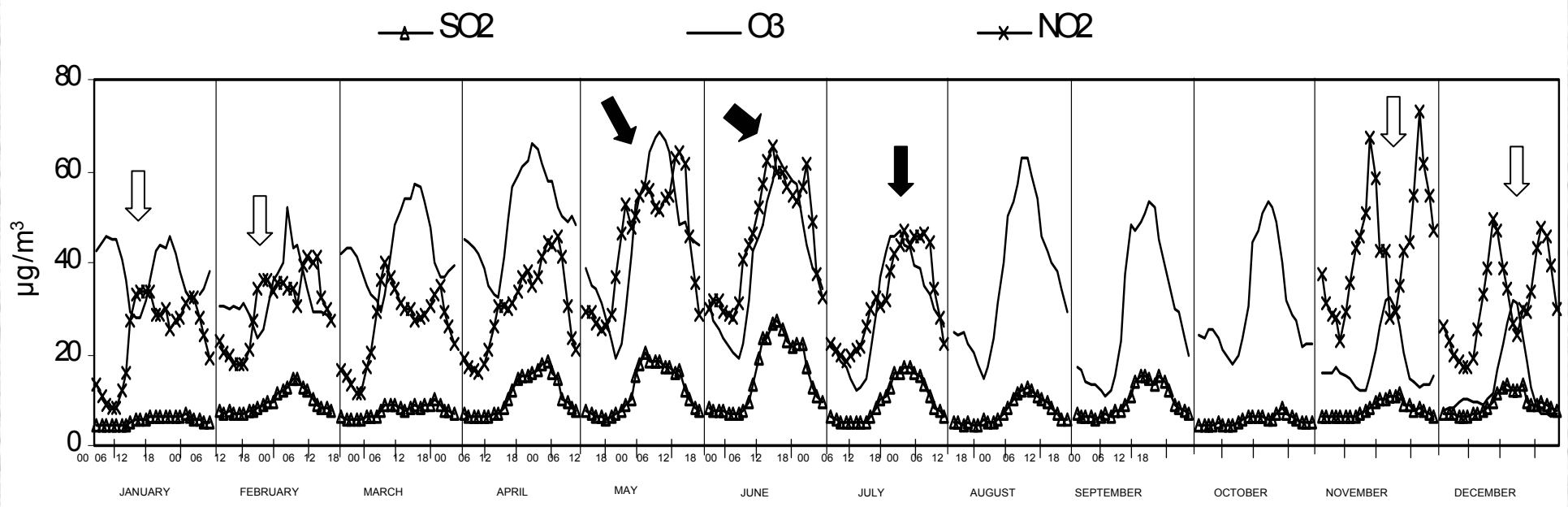
LLODIO



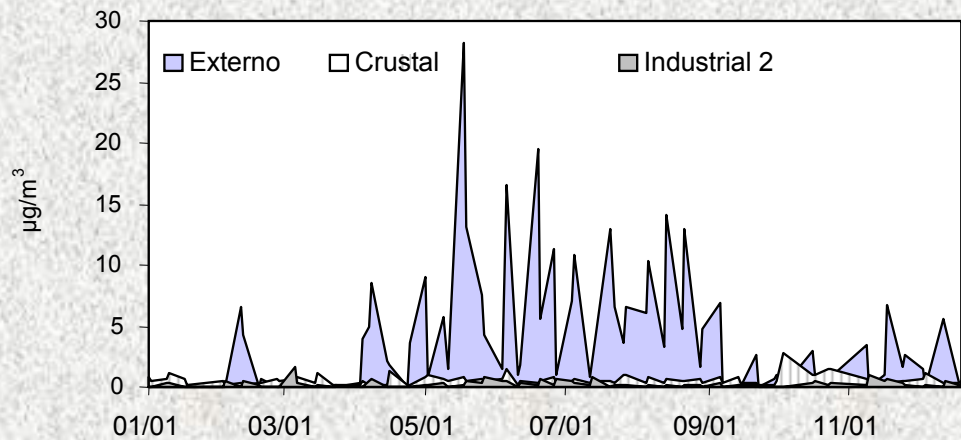
PM2.5/PM10



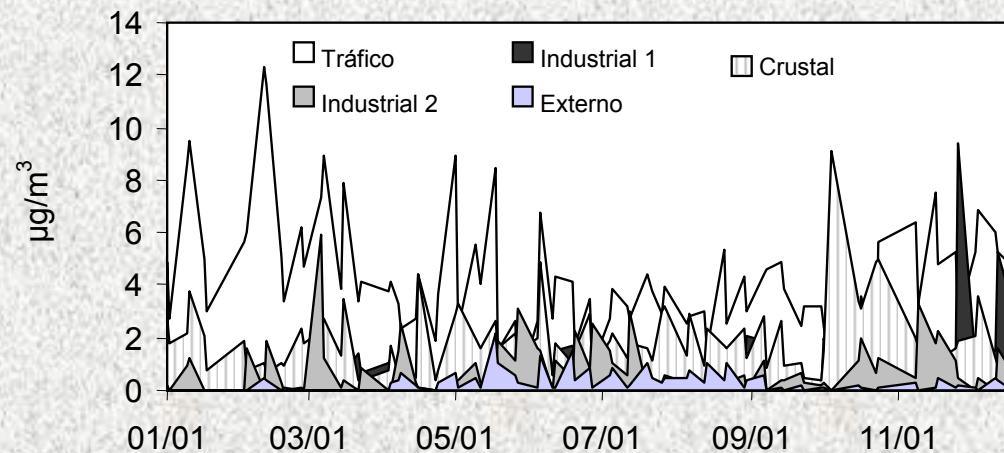
LLODIO



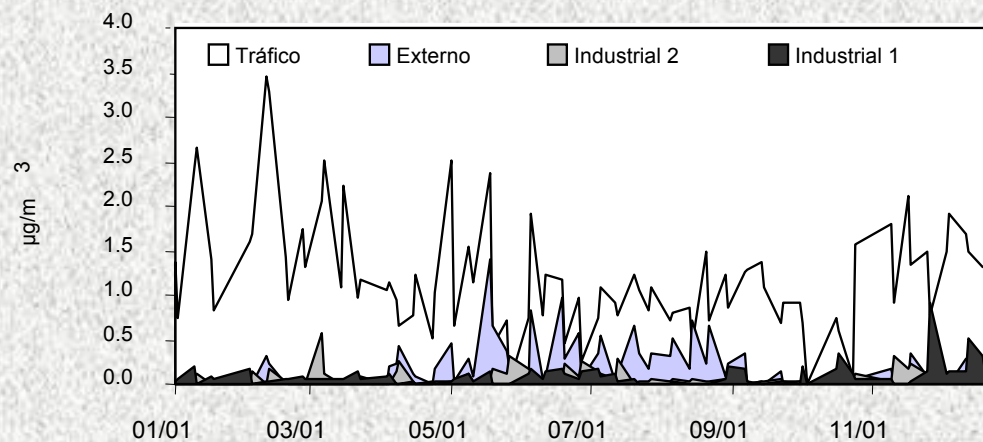
SO₄²⁻



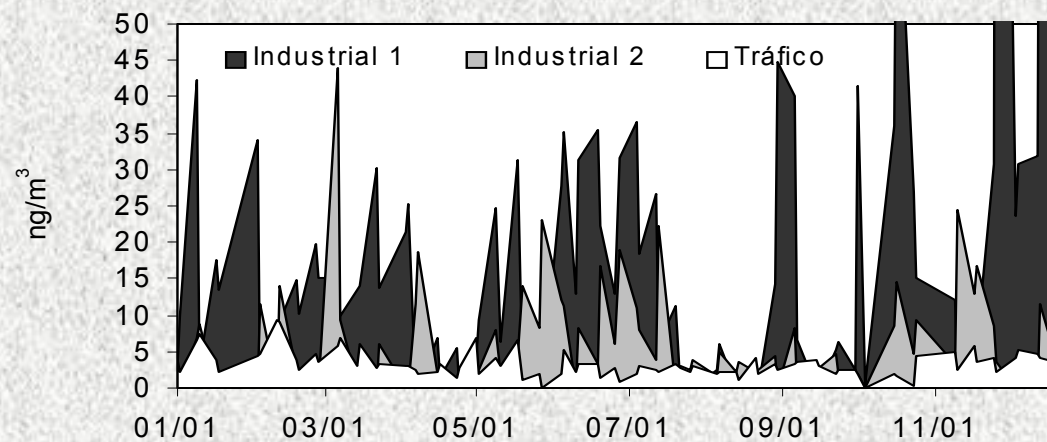
OM+EC



NO₃⁻



Cr



Análisis de contribución de fuentes en PM10 y PM2.5 en Abanto

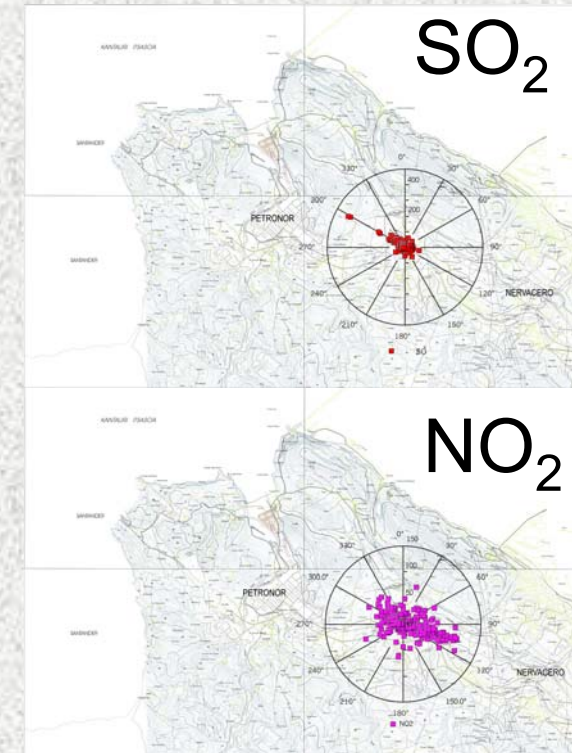
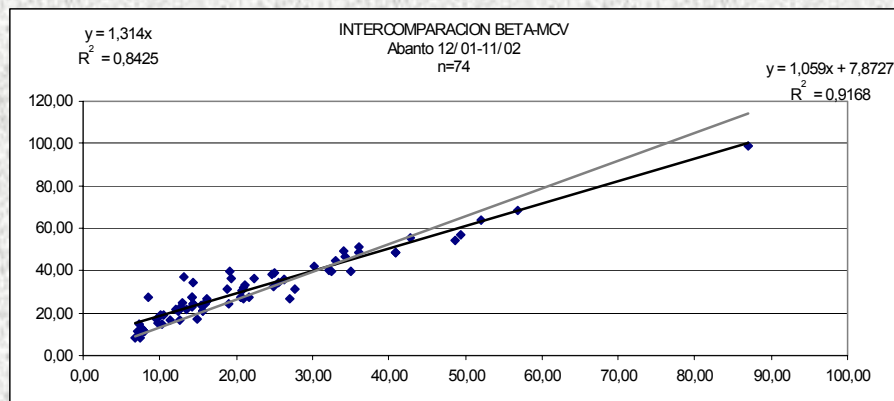
Departamento de Mineralogía y Petrología (UPV/EHU)



- 32 $\mu\text{g}/\text{m}^3$ de PM10 (77/365)
- 21 $\mu\text{G}/\text{m}^3$ de PM2.5 (44/365)
- PM2.5/10 0.66

N > 50 $\mu\text{gPM10}/\text{m}^3$

46 (16 NAF)



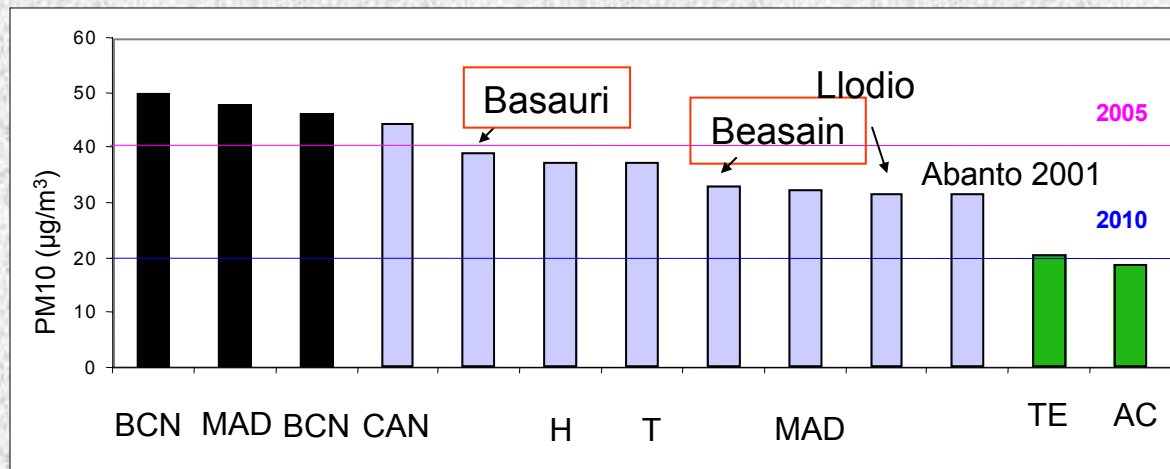
Acciones próximas: análisis químico, contribución fuentes

PM10 registrados en dos estaciones urbanas con influencia industrial siderometalúrgica

Beasain-Basauri

Marina Menéndez, J. I. Gil Ibarguchi y Luis A. Ortega
Departamento de Mineralogía y Petrología, UPV/EHU

2002 Beasain PM10 $33 \mu\text{g}/\text{m}^3$ (corregido) $n > 50 \mu\text{g}/\text{m}^3 = 53$
2002 Basauri PM10 $39 \mu\text{g}/\text{m}^3$ (corregido) $n > 50 \mu\text{g}/\text{m}^3 = 88$



Acciones próximas: análisis químico, contribución fuentes

CONCLUSIONES

- **Gran variación de niveles y composición PM en EU, y entre CCAA**
- **Variación estacional marcada de las contribuciones de fuentes a PM**
- **La contribución natural a PM10 puede alcanzar valores muy elevados, se aportan datos cuantitativos**
- **Componentes antropogénicos en concentraciones similares a Europa central**
- **PM2.5 composición mucho más homogénea que PM10 en las diferentes regiones estudiadas**
- **PM2.5 refleja con menos interferencias la influencia industrial y del tráfico**
- **PM2.5, la contribución natural y mineral antropogénica se reduce respecto a PM10, pero aún elevada en términos relativos**



AGRADECIMIENTOS:

Gobierno Vasco

ENDESA

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Euskadi

Andalucía

Canarias

Catalunya

Galicia

Madrid