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

2nd International Workshop *EuNetAir* on

New Sensing Technologies for Indoor and Outdoor Air Quality Control

Brindisi, Italy, 25 - 26 March 2014

AIR QUALITY IN SPANISH CITIES. FIRST STEPS IN SMART SENSORS VALIDATION

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WG Member

IDAEA-CSIC / Spain

COST is supported by the EU Framework Programme

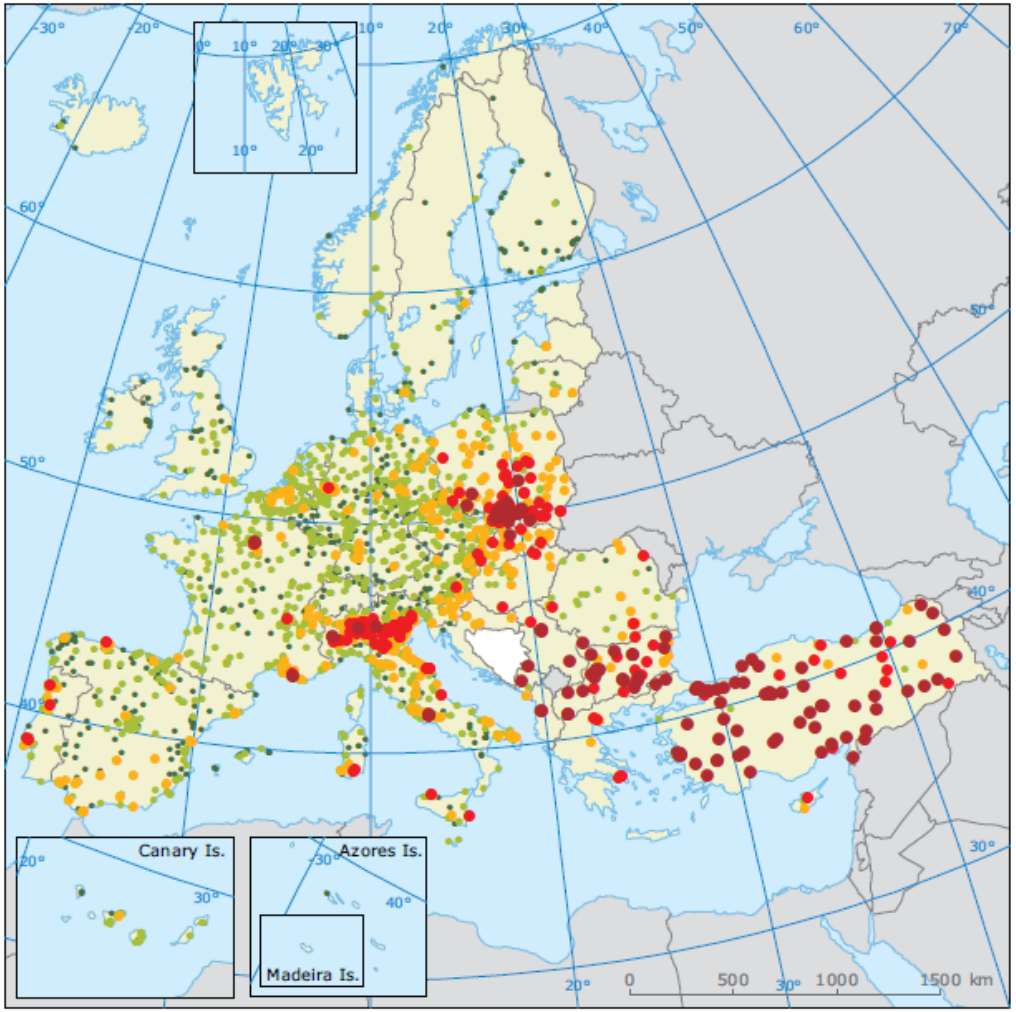
ESF provides the COST Office through a European Commission contract

Outline

- Critical parameters: PM_{10}, $PM_{2.5}$, NO_2
- Urban NH_3
- Indoor, outdoor and personal sampling
- Spatial distribution of trace elements within a city
- Indoor and outdoor school measurements
- Real world tests sensors performance
- Conclusions

Critical parameters

PM_{10}



Annual mean particulate matter (PM_{10}) 2011, based on daily average with percentage of valid measurements ≥ 75 % in µg/m³

- ≤ 20
- 20–31
- 31–40
- 40–50
- > 50

No data

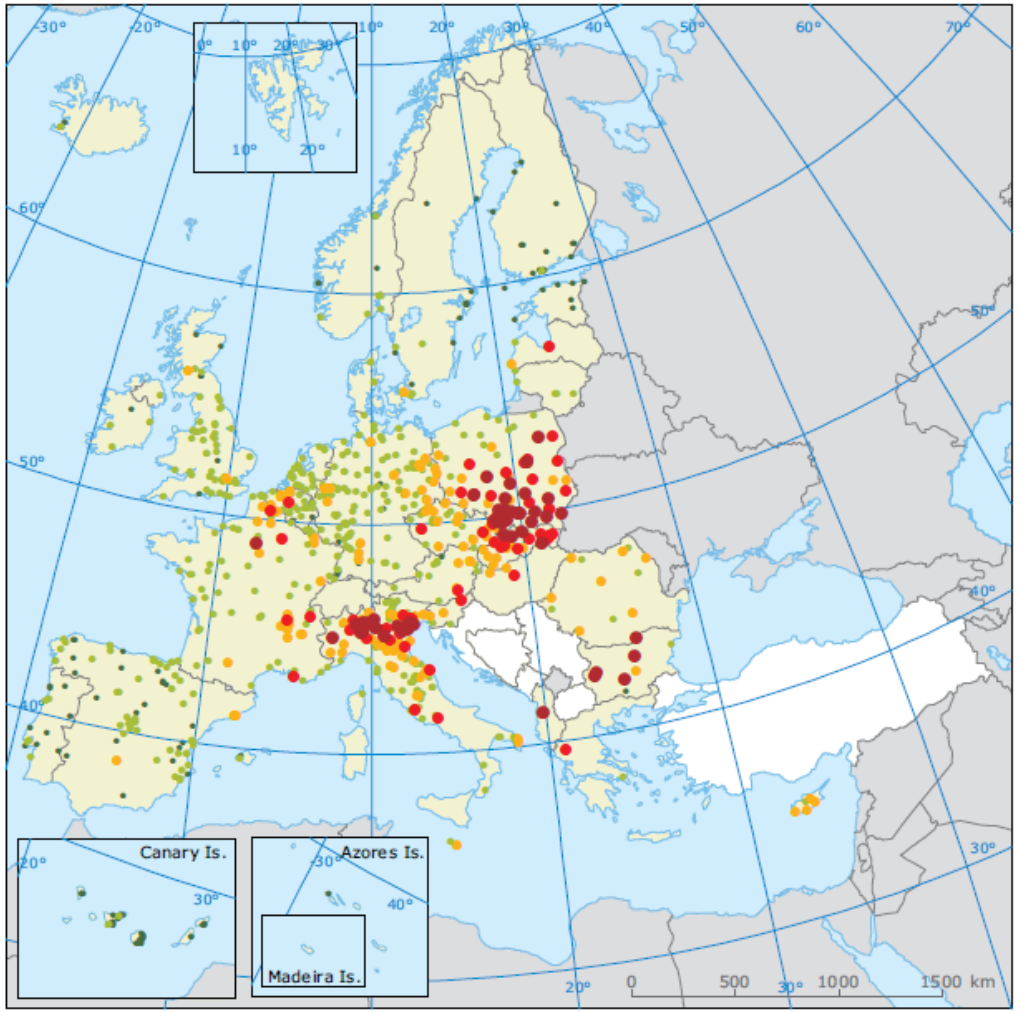
Countries/regions not included in the data exchange process

Report No 9/2013

European Environment Agency

Critical parameters

$PM_{2.5}$



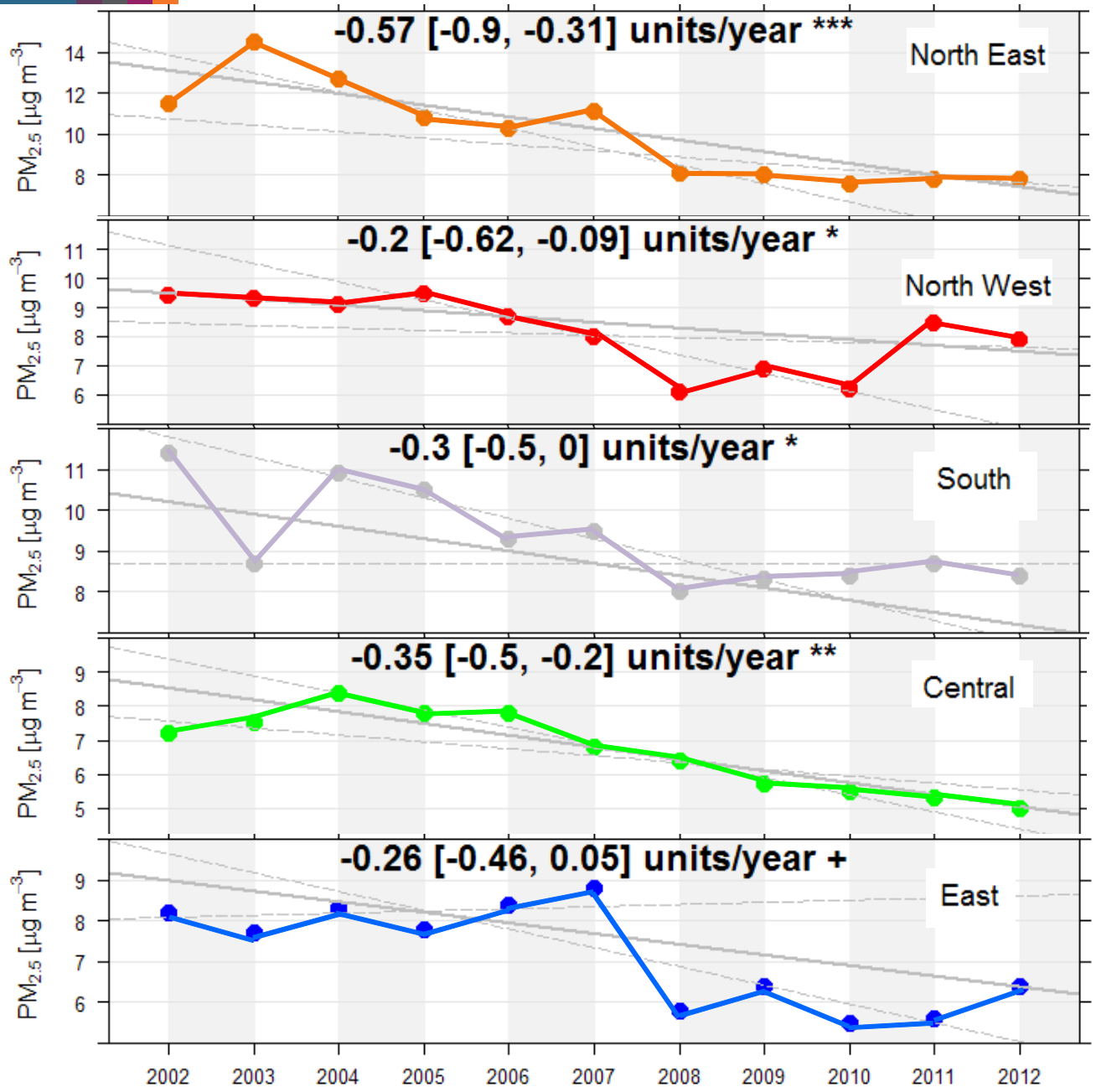
Annual mean fine particulate matter ($PM_{2.5}$) 2011, based on annual average with percentage of valid measurements ≥ 75 % in µg/m³

- ≤ 10
- 10–20
- 20–25
- 25–30
- > 30
- No data
- Countries/regions not included in the data exchange process

Report No 9/2013

European Environment Agency

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



-4.31 [-6.47, -2.88] %/year ***

-2.11 [-5.61, -1.01] %/year *

-2.94 [-4.24, 0] %/year *

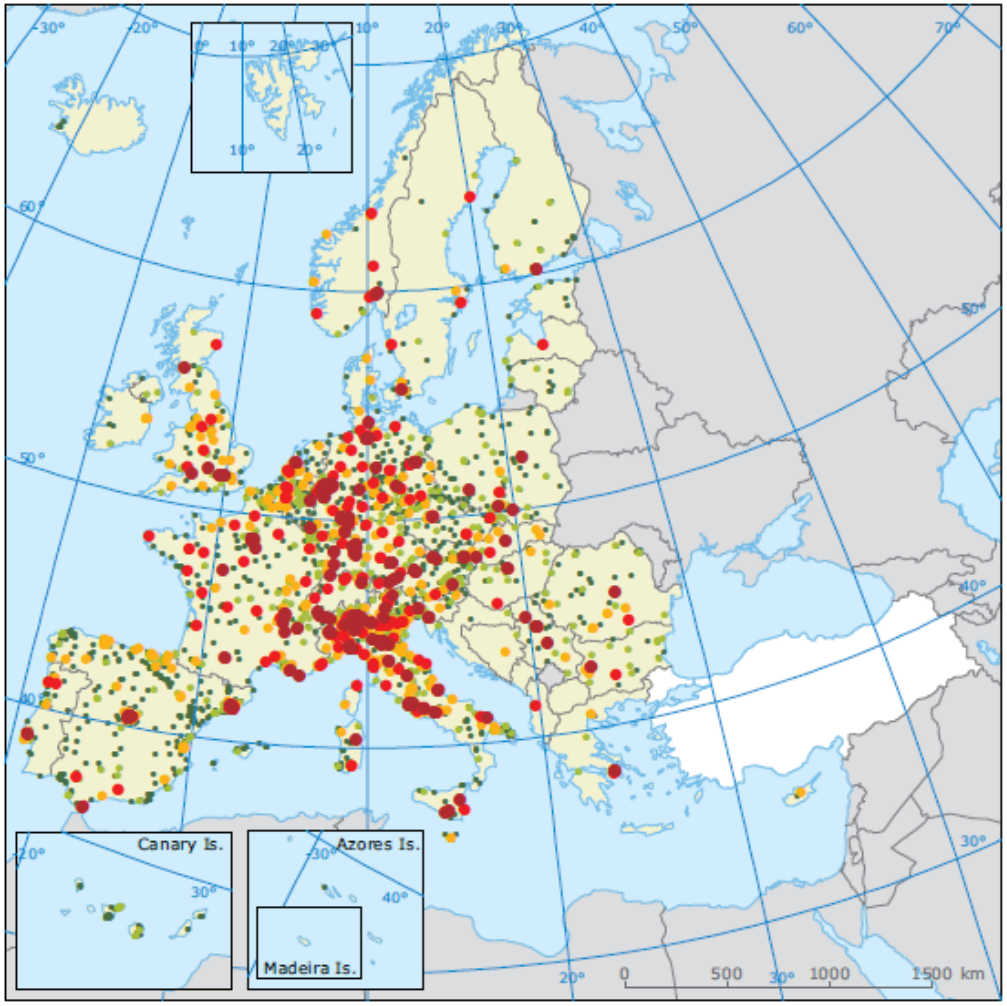
-4.09 [-5.32, -2.65] %/year **

-2.91 [-4.77, 0.62] %/year +

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

Critical parameters

NO_2



Annual mean nitrogen dioxide 2011, based on daily averages with percentage of valid measurements ≥ 75 % in µg/m³

- ≤ 20
- 20–30
- 30–40
- 40–50
- > 50

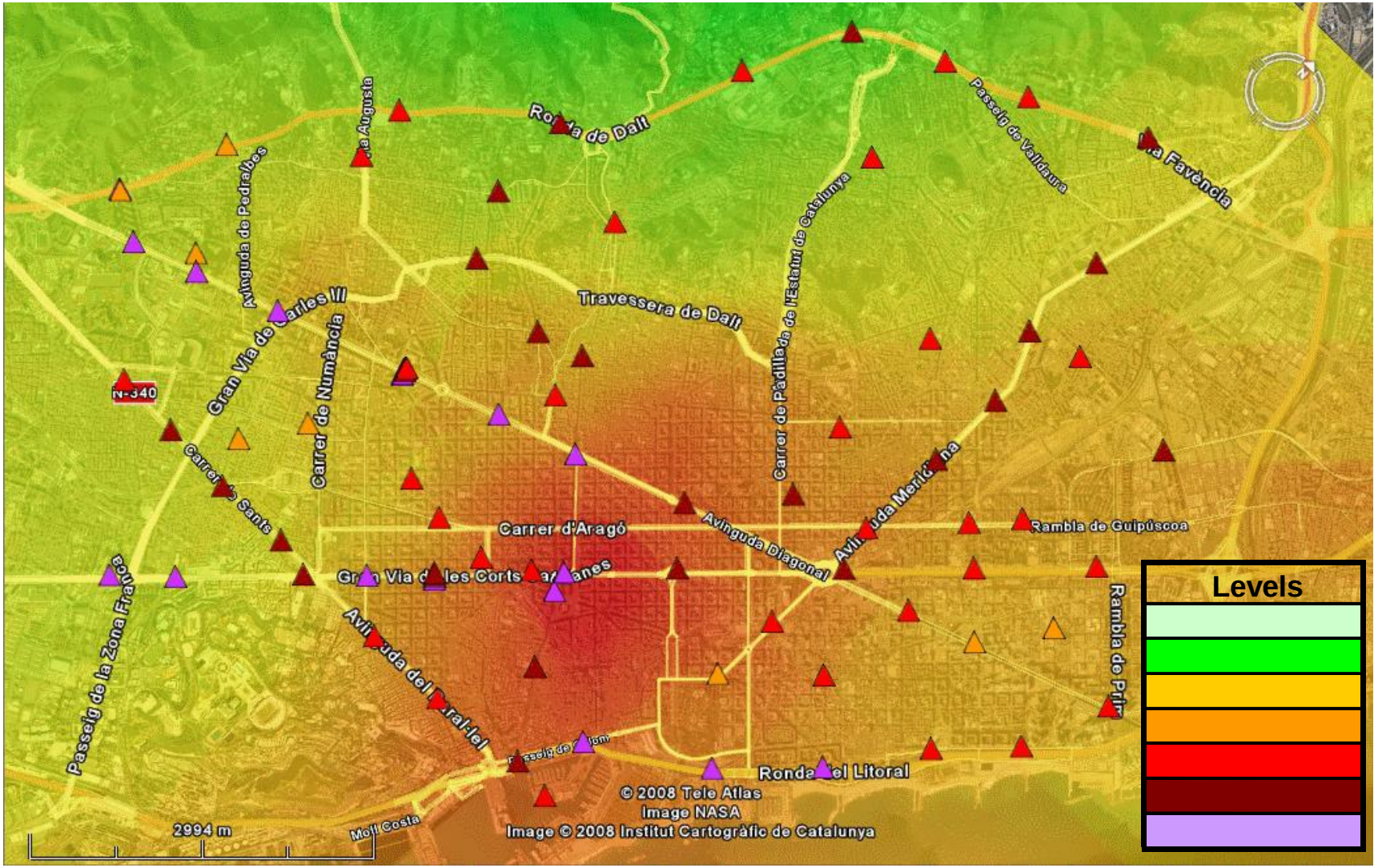
No data

Countries/regions not included in the data exchange process

Report No 9/2013

European Environment Agency

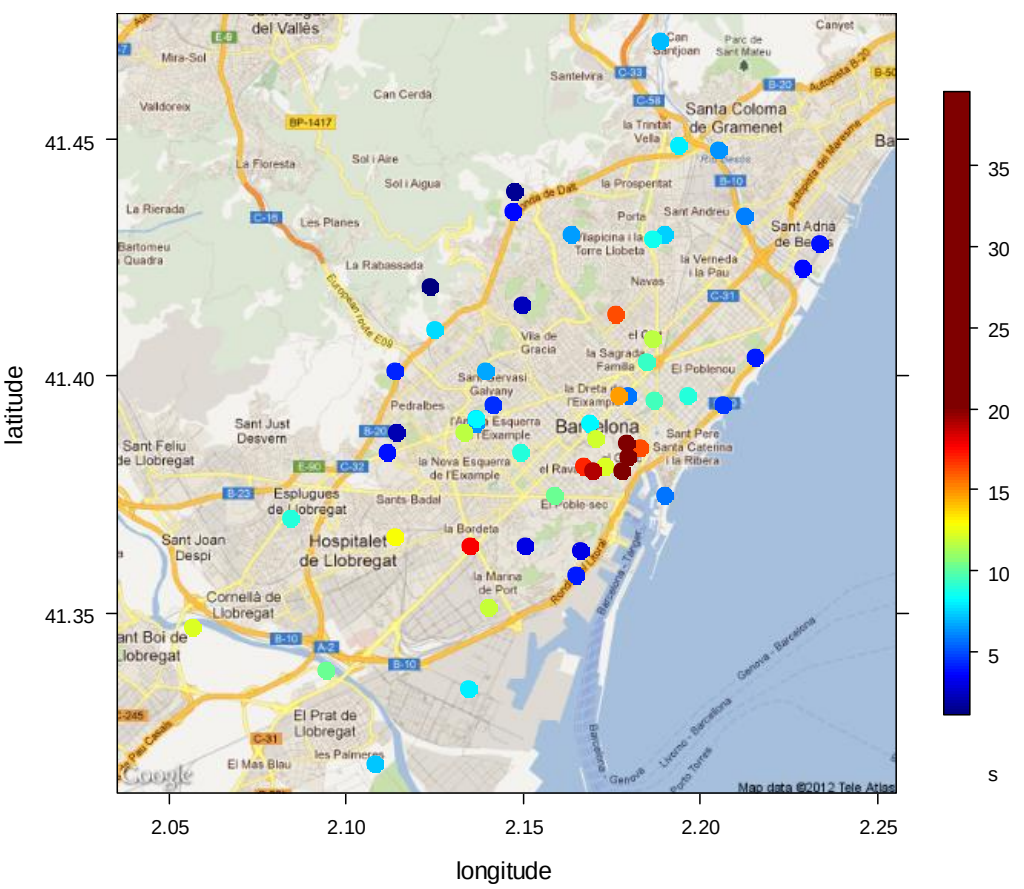
NO_2 May-June 2008 (120 passive dosimeters)



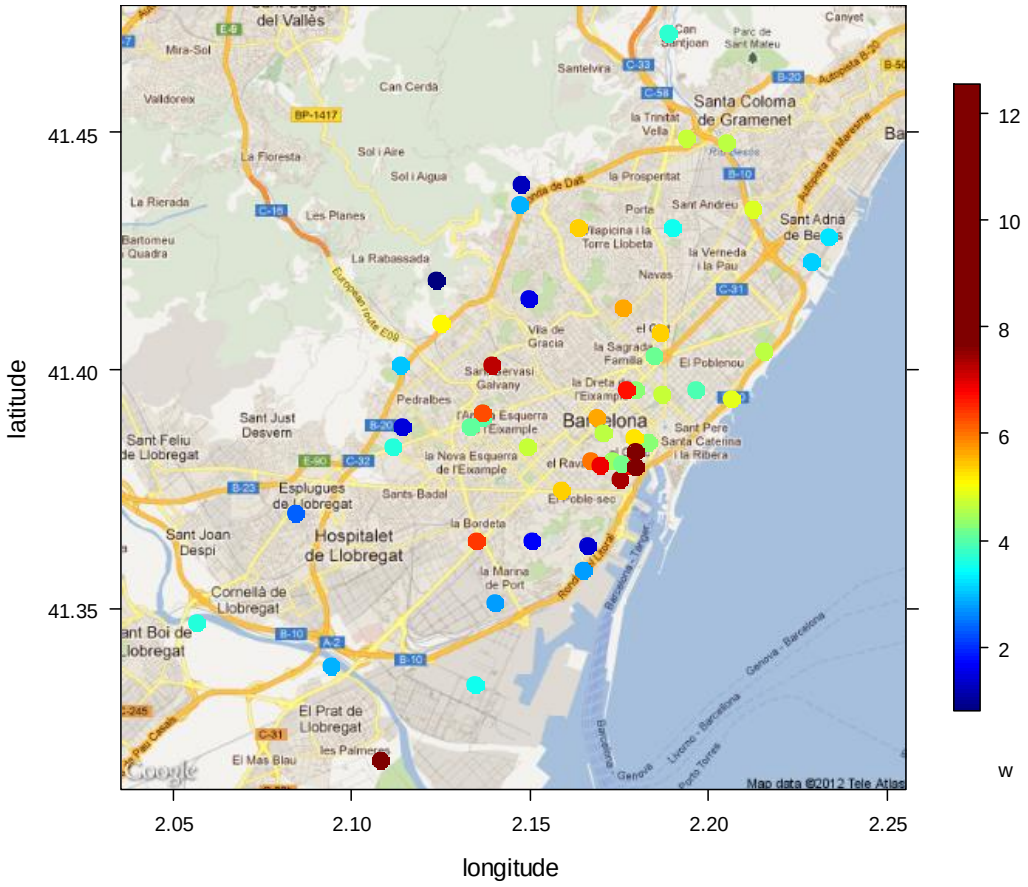
NO_2 May-June 2008 (120 passive dosimeters)

NH_3

NH_3 (μgm^{-3})
Summer 2010



NH_3 (μgm^{-3})
Winter 2010



NH_3 ($\mu g/m^3$)	Summer	Winter
Urban background	10.6	3.9
Traffic	7.6	4.6

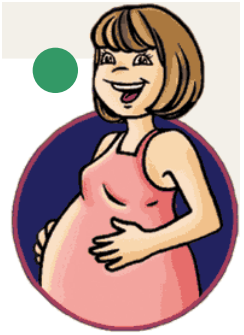
Sewer system and garbage influence

Road traffic influence

Reche et al. (2012) Atmospheric Environment

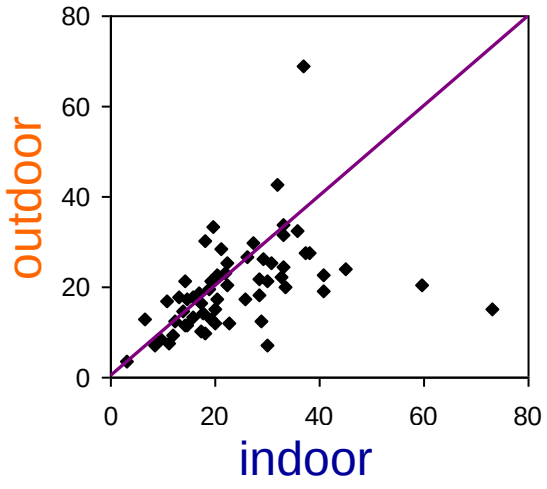
Indoor, outdoor and personal sampling

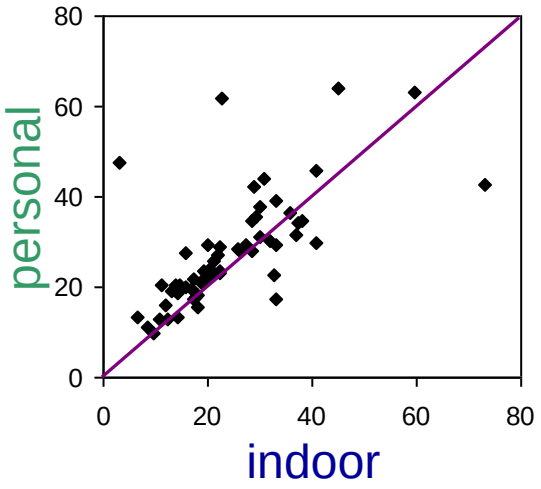
personal

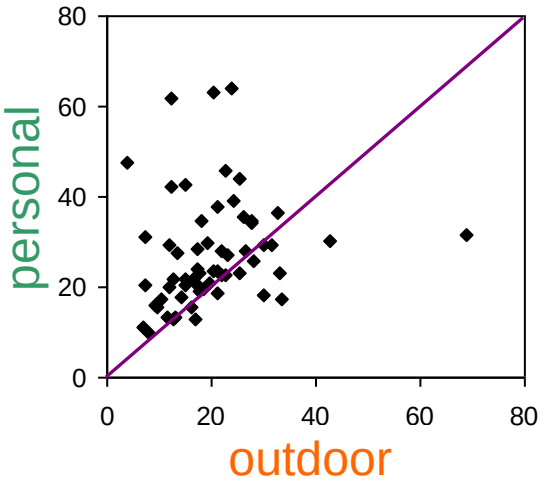


54 pregnant women

$PM_{2.5}$ (µg/m³):
personal > indoor > outdoor



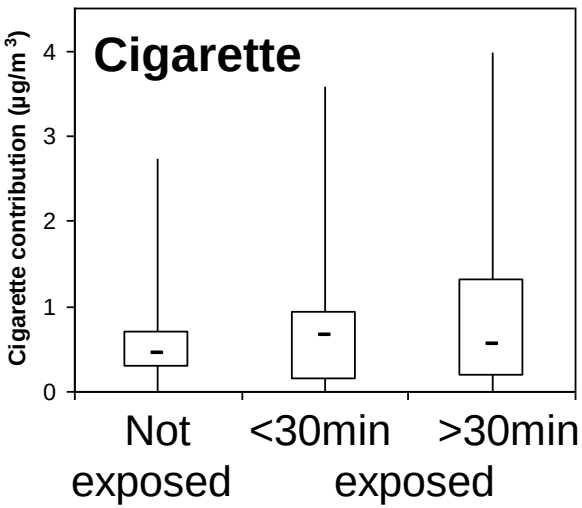


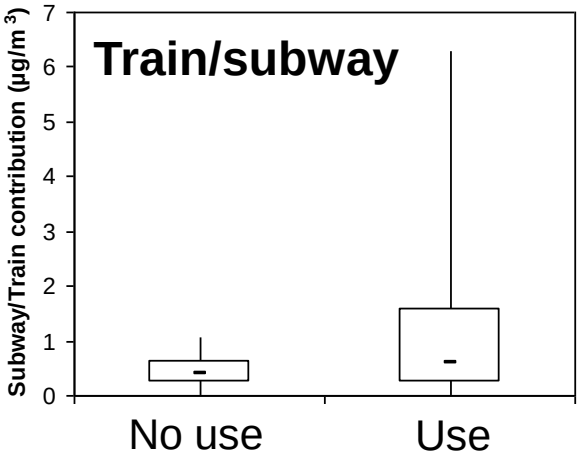


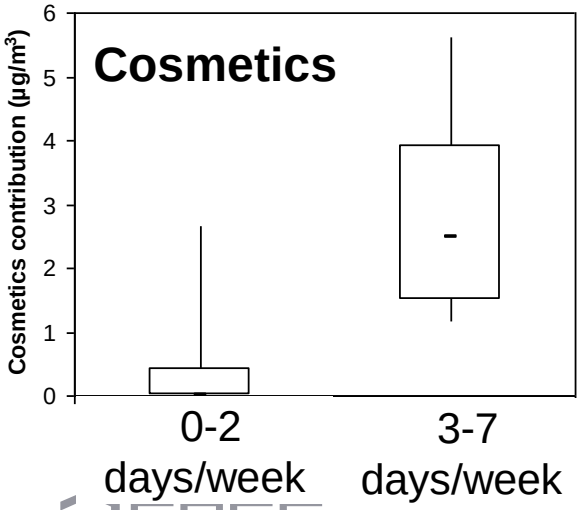
Minguillón et al. (2012) Atmospheric Environment

Source contribution. Personal sampling

Contribution for personal samples





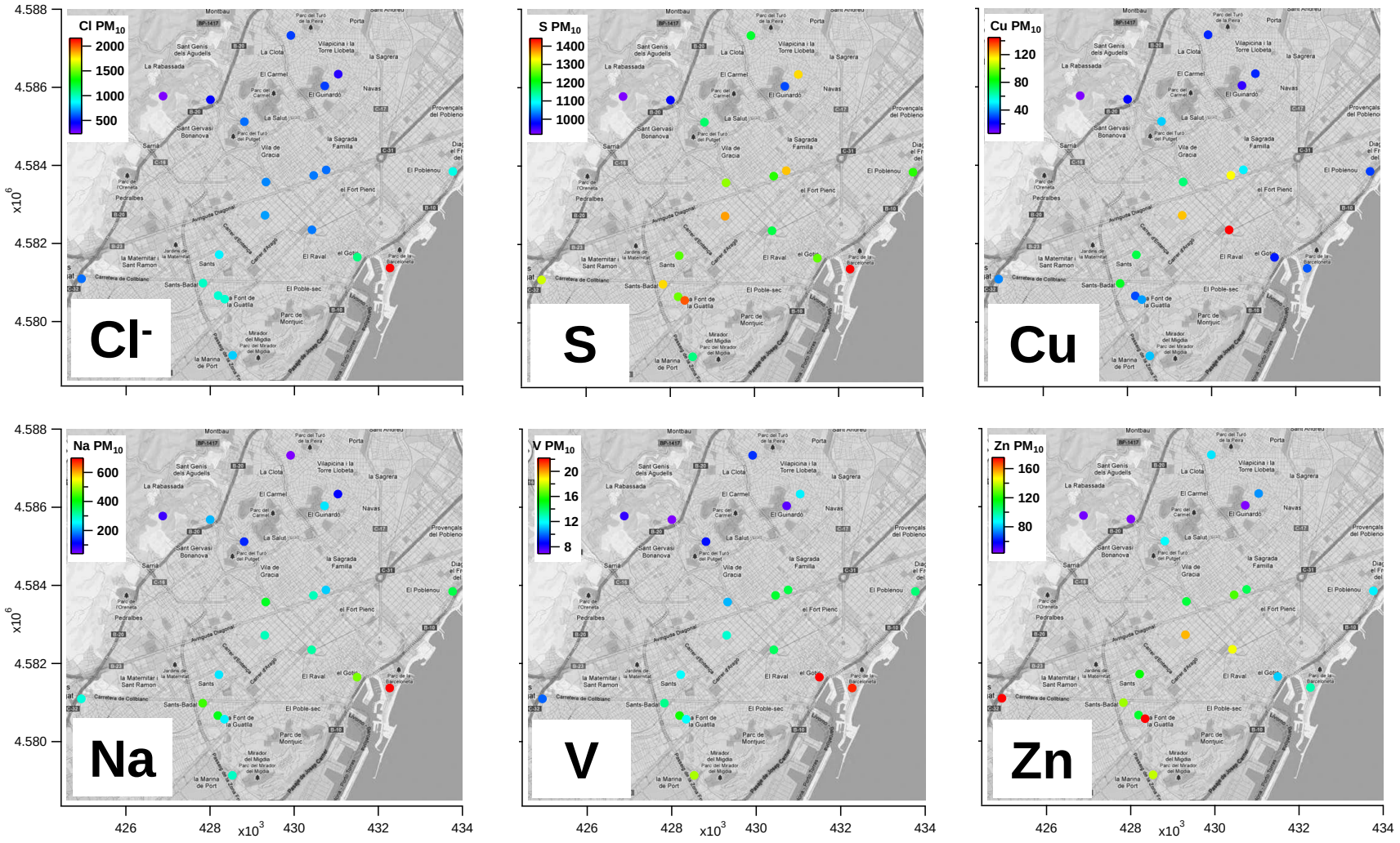


Not dependent on the time spent in train.

Highest exposure at the platforms
(in agreement with Querol et al., ACP 2012)

Minguillón et al. (2012) Atmospheric Environment

$PM_{2.5}$ and PM_{10} at 20 sites in Barcelona



Minguillón et al. (2014) Atmospheric Environment

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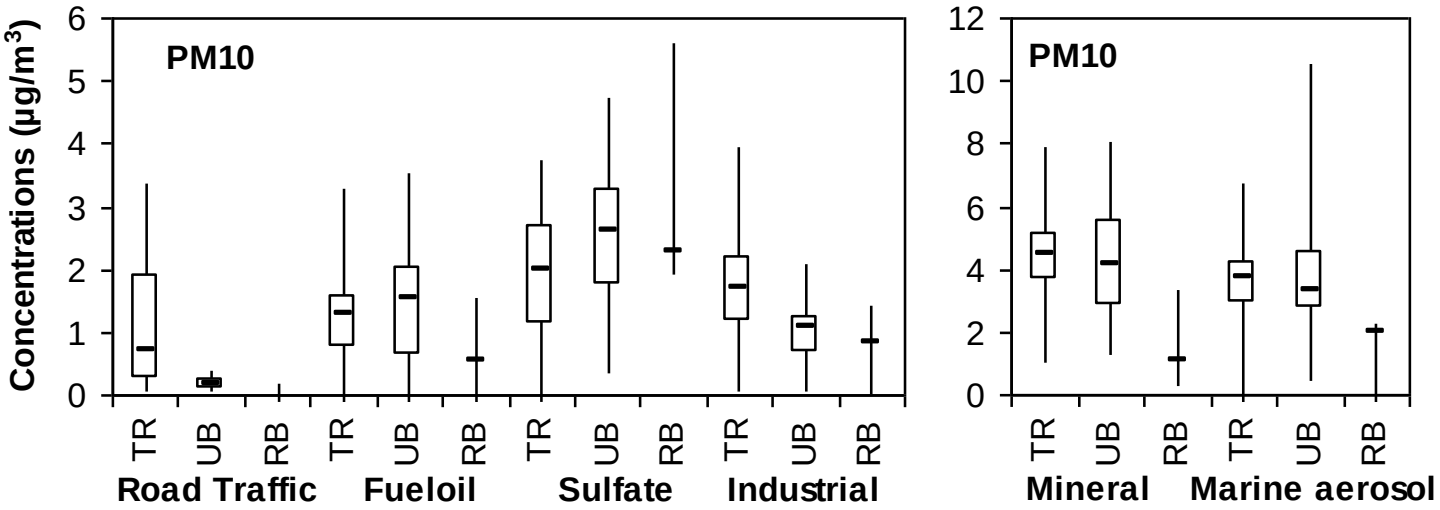


Minguillón et al. (2014) Atmospheric Environment

Indoor and outdoor school measurements

BREATHE project

	Schools		Reference site
	INDOOR	OUTDOOR	OUTDOOR
	Mean	**Mean**	**Mean**
NO_2 ($\mu g \cdot m^{-3}$)	32	**52**	42
$PM_{2.5}$ ($\mu g \cdot m^{-3}$)	51	**49**	18
BC ($\mu g \cdot m^{-3}$)	1.7	**2.0**	1.7
N ($pt \cdot cm^{-3}$)	17209	**23824**	15110

Rivas et al. (2014), submitted

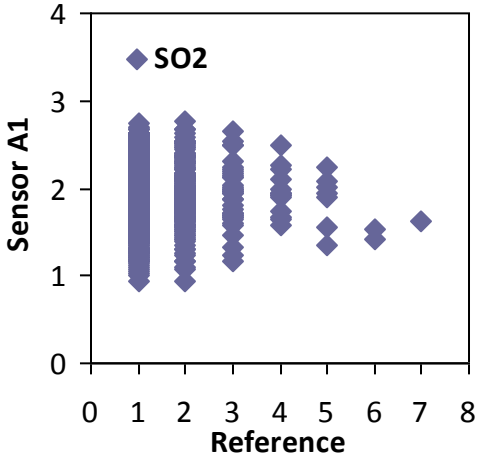
Real-world tests sensors performance

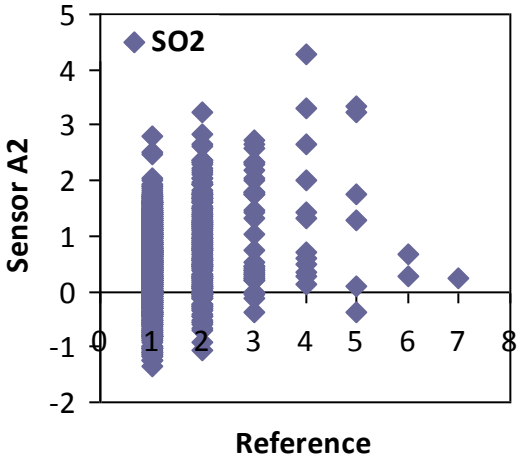
Sensors A: 3 units	**SO_2, NO_2, O_3, CO, T**
	1 month measurements
	30 min averages
Sensors B: 2 units	**SO_2, NO, NO_2, O_3, CO, T**
	1 month measurements
	30 min averages
Sensors C: 2 units	**NO_2, O_3, TotalVOC, Dust, T**
	5 months measurements
	30 min averages

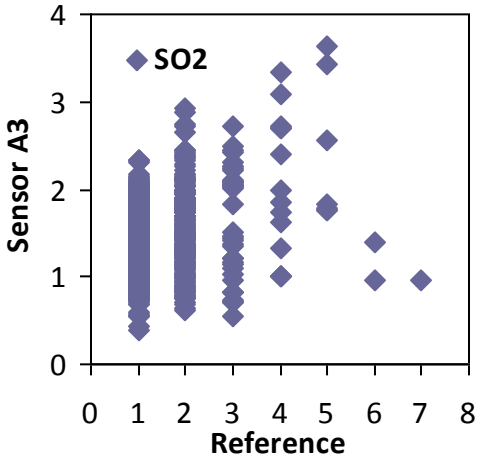
Real-world tests sensors performance

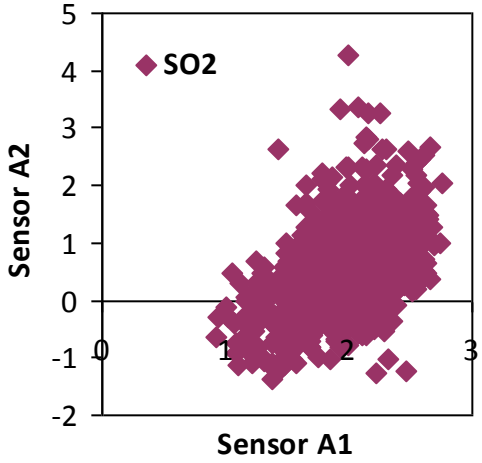
Sensors A: SO_2, NO_2, O_3, CO, T

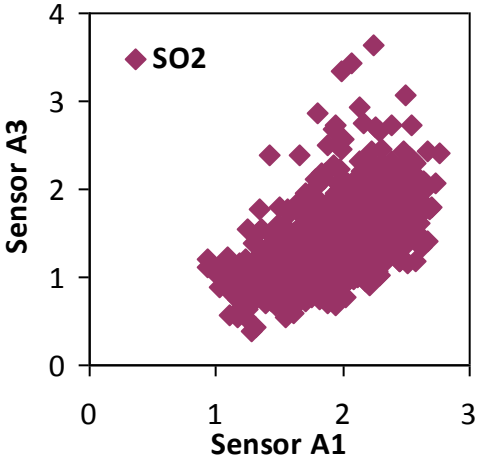
1 month measurements







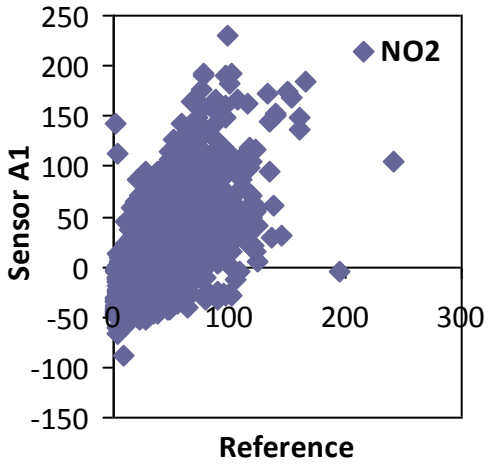


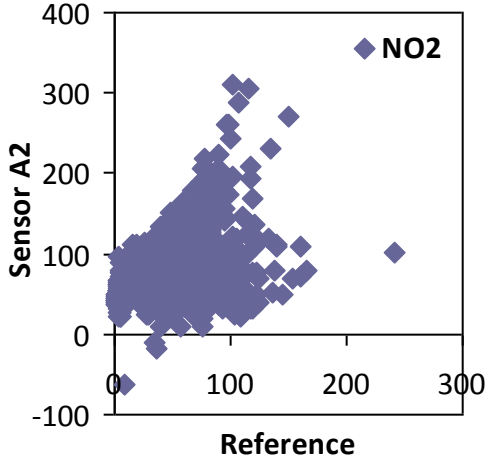


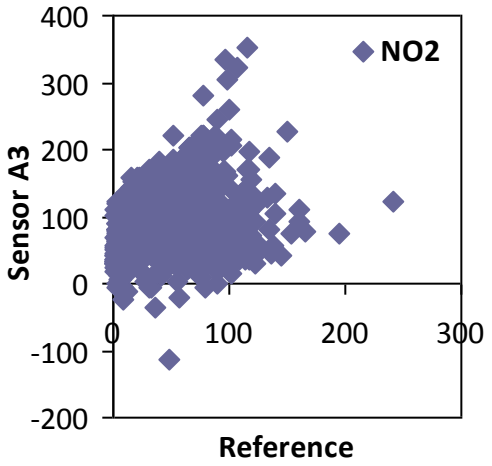
Real-world tests sensors performance

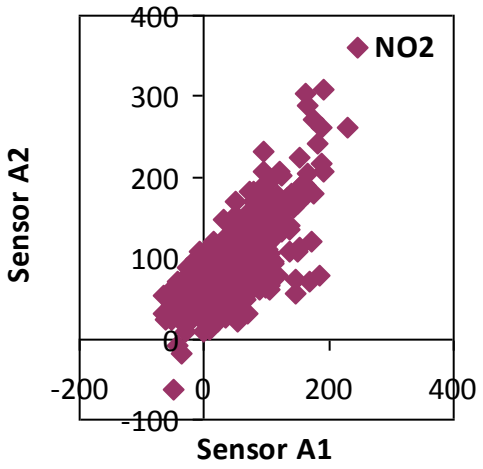
Sensors A: SO_2, NO_2, O_3, CO, T

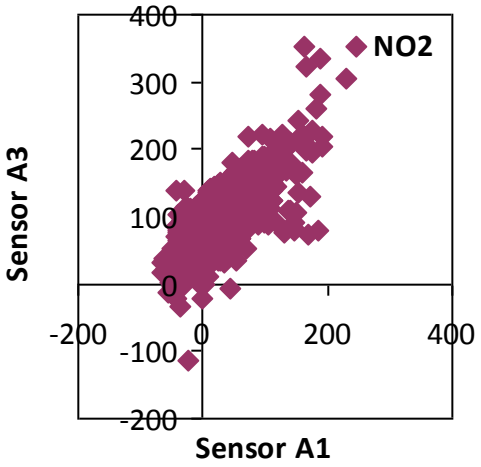
1 month measurements











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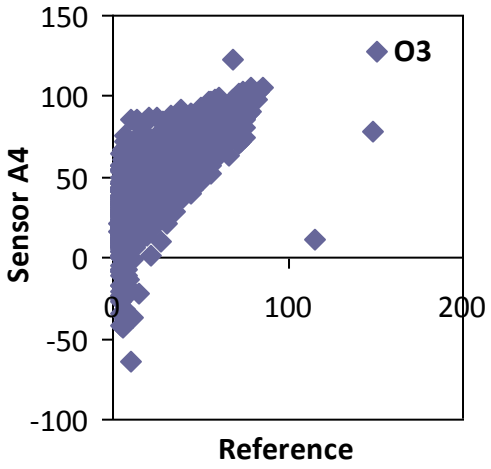
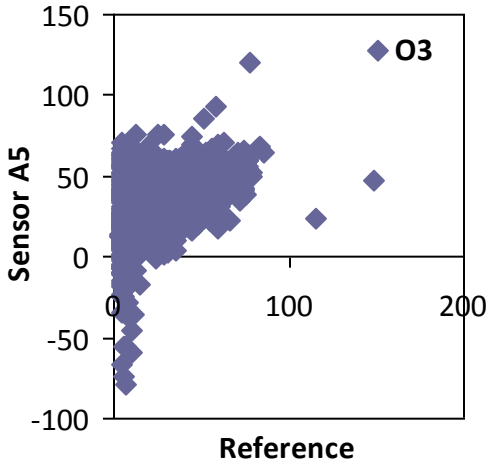
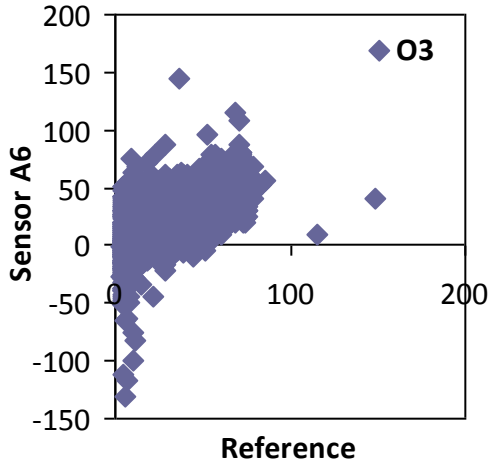
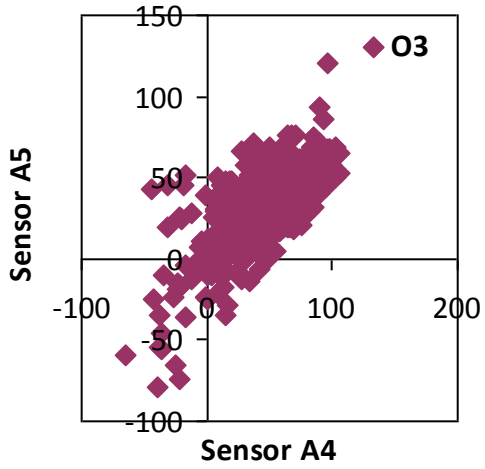
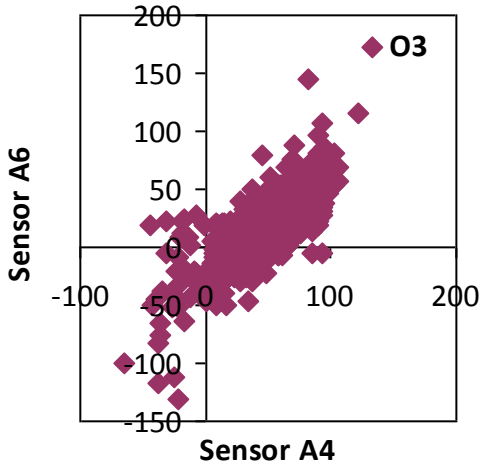






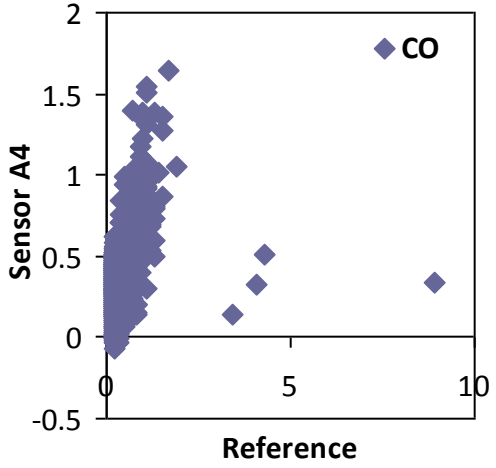


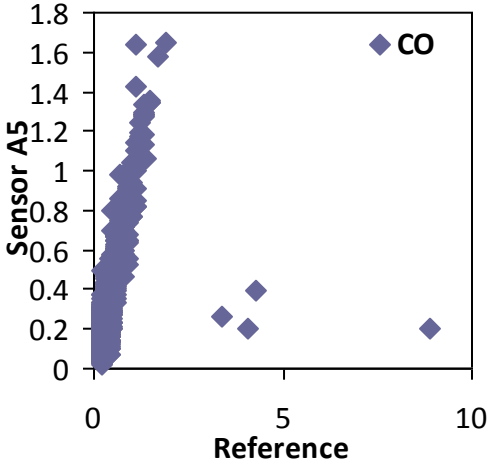


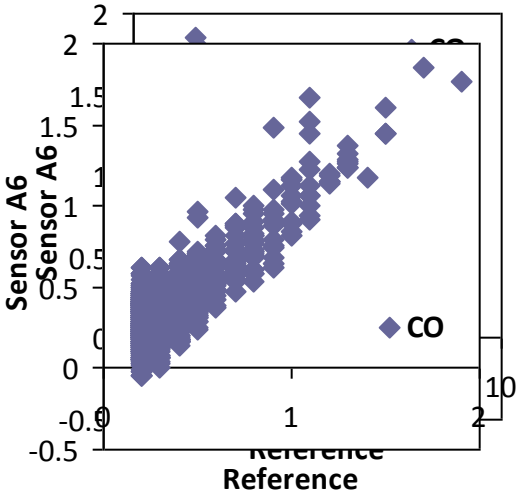
Real-world tests sensors performance

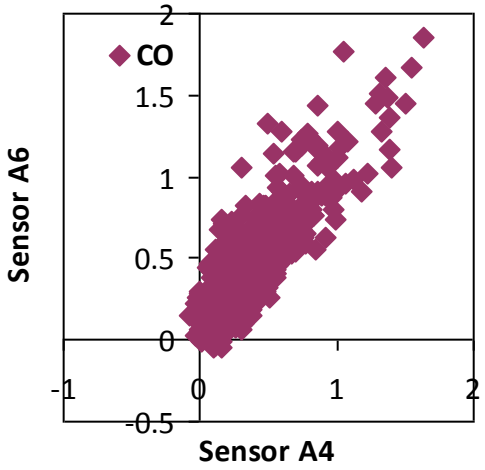
Sensors A: SO_2, NO_2, O_3, CO, T

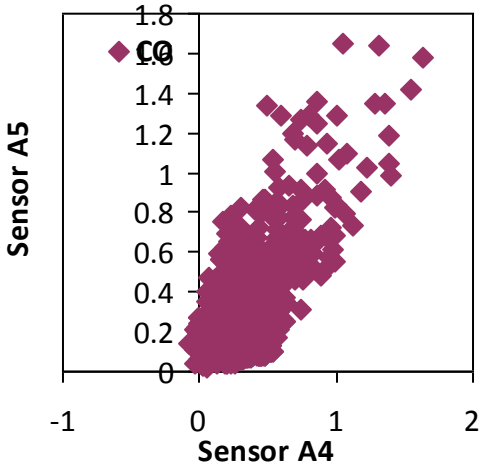
1 month measurements







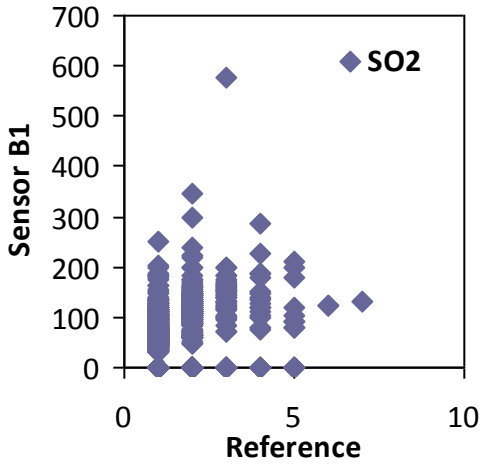


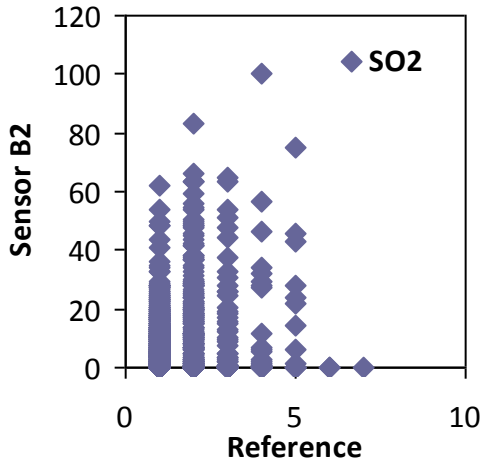


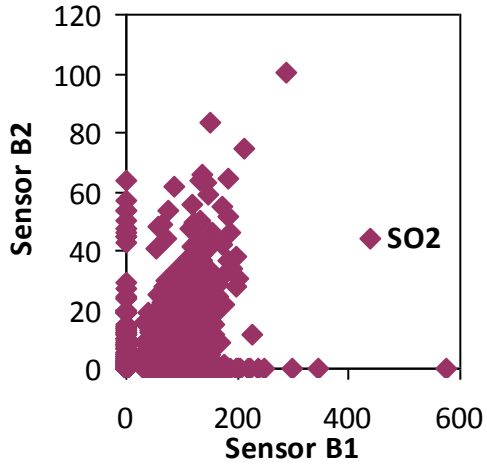
Real-world tests sensors performance

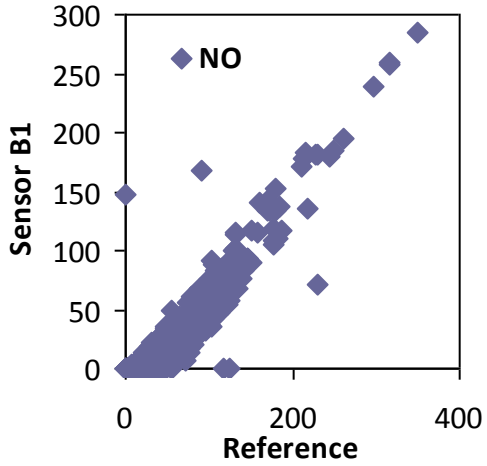
Sensors B: SO_2, NO, NO_2, O_3, CO, T

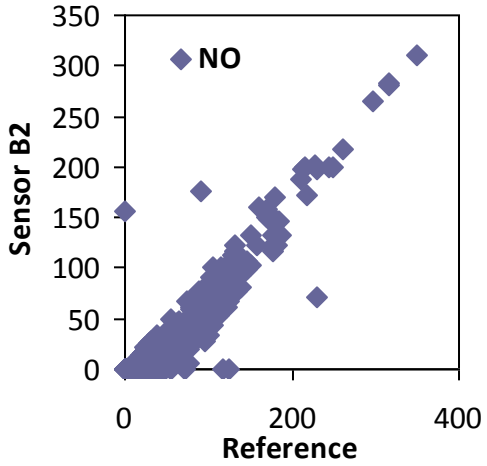
1 month measurements

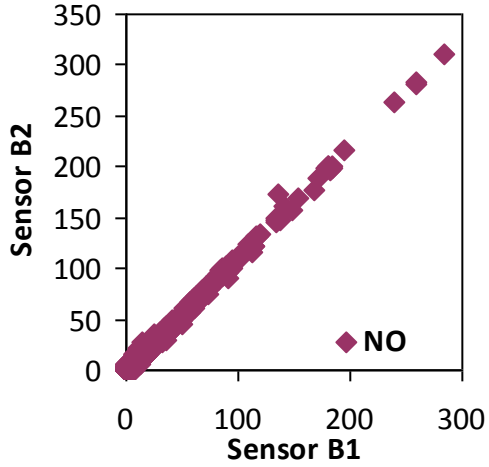








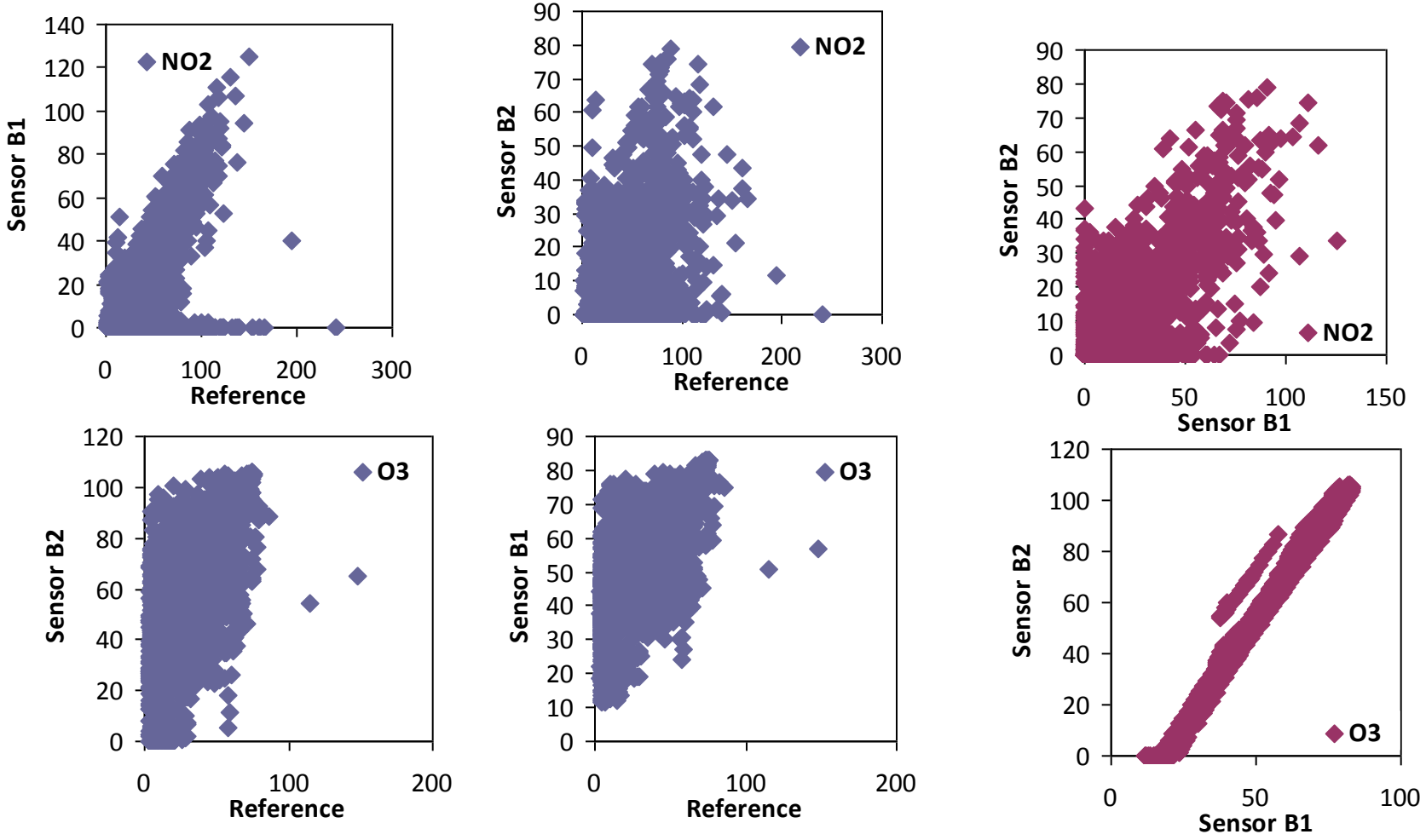




Real-world tests sensors performance

Sensors B: SO_2, NO, NO_2, O_3, CO, T

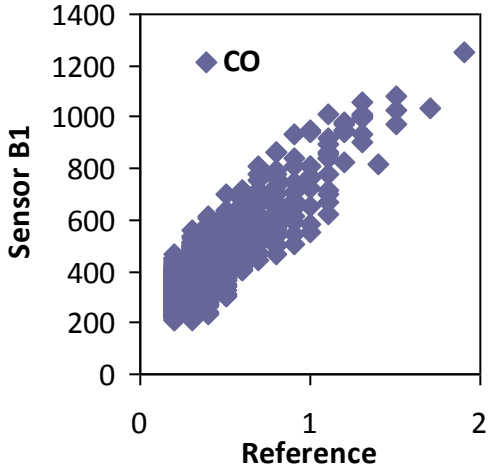
1 month measurements

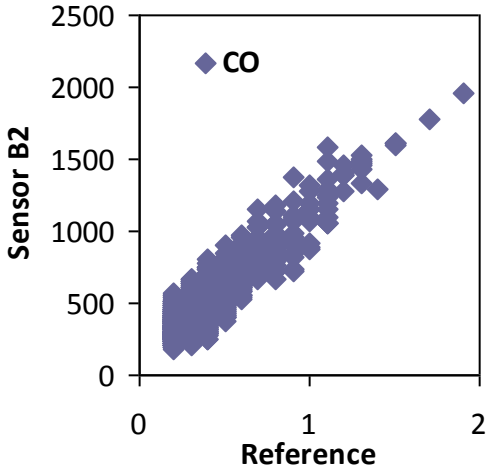


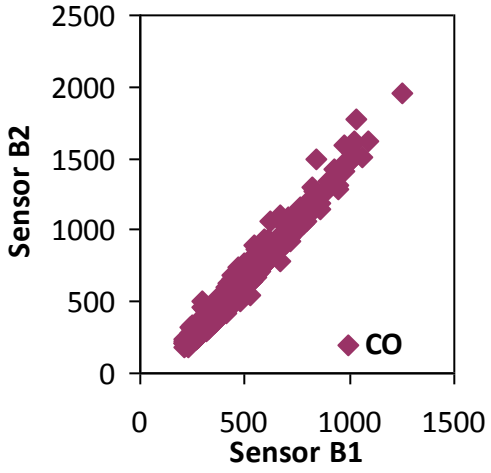
Real-world tests sensors performance

Sensors B: SO_2, NO, NO_2, O_3, CO, T

1 month measurements





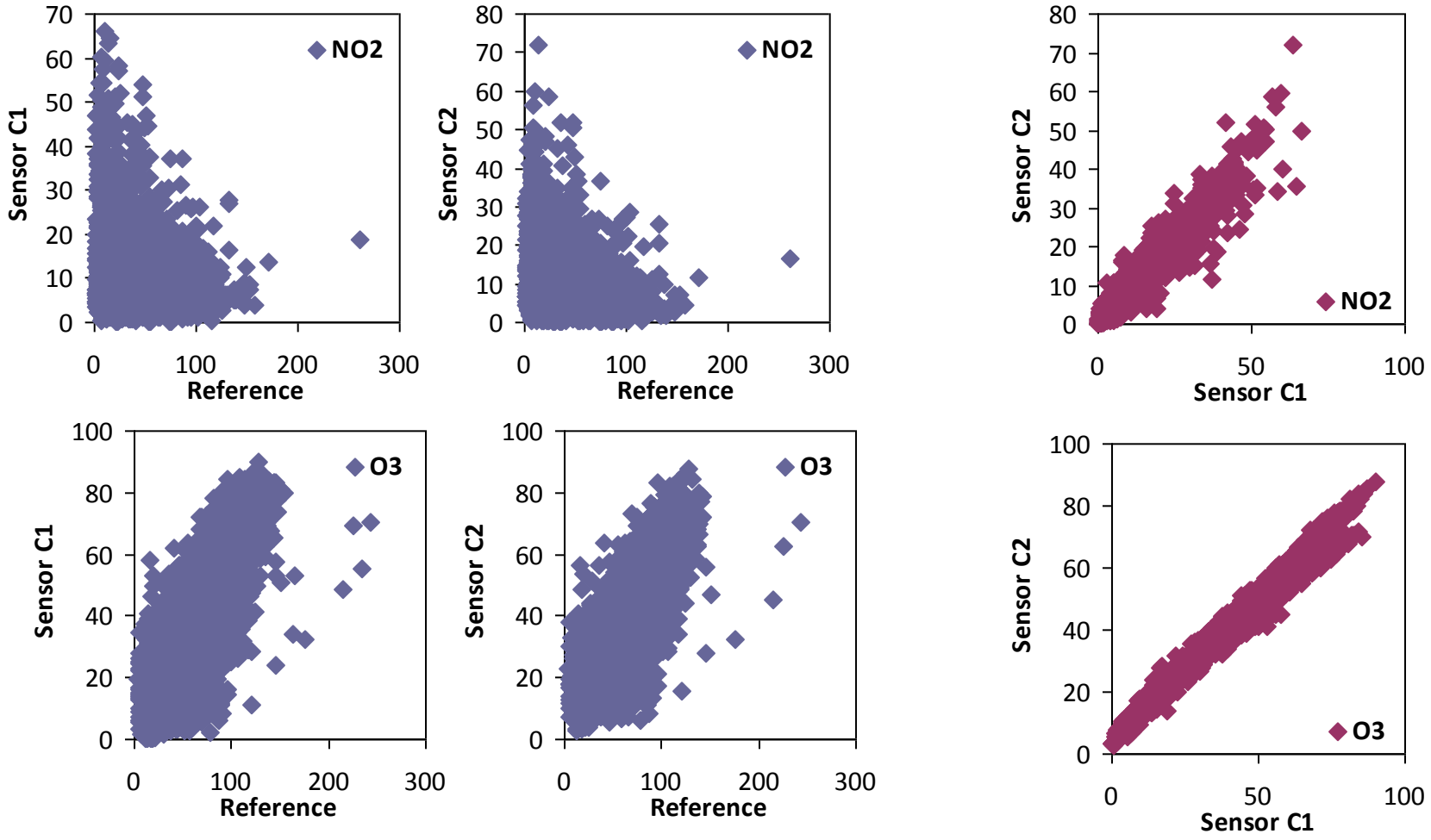


Some extra tunning ongoing in the post-processing method

Real-world tests sensors performance

Sensors C: NO_2, O_3, CO_2, TotalVOC, Dust, T

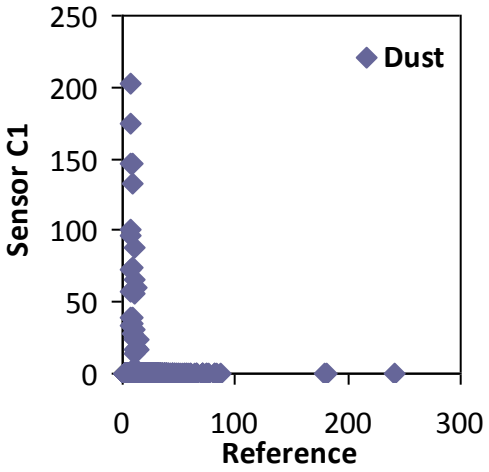
5 months measurements

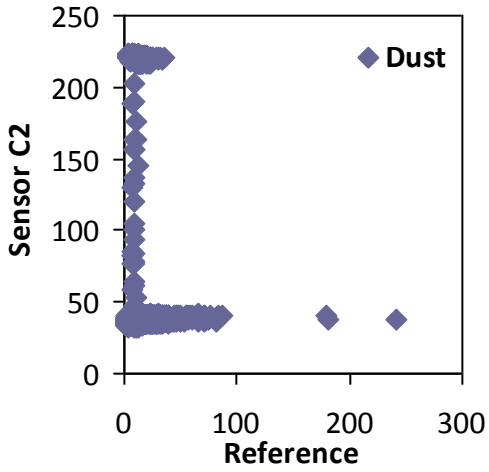


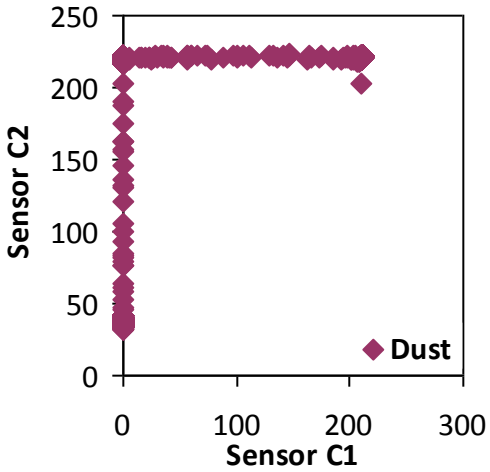
Real-world tests sensors performance

Sensors C: NO_2, O_3, CO_2,TotalVOC, Dust, T

5 months measurements







ETC/ACM Technical Paper 2013/16
Real-world application of new sensor technologies for air quality monitoring

European Topic Centre
on Air Pollution and
Climate Change Mitigation

CONCLUSIONS

- PM_{10}, $PM_{2.5}$ and NO_2 are critical parameters in air quality
- Decrease in PM in the last years in Europe
- Wide range of NO_2 and NH_3 concentrations within cities
- Wide range of concentrations of trace elements within a city
- Personal exposure > indoor > outdoor
- School concentrations higher than urban background
- Real-world sensors performance to be improved
- Sensors: great tool for real time and spatial-resolved data

THANK YOU FOR YOUR ATTENTION

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