Effectiveness of urban air quality measures (the cities)

LIFE-PLATFORM MEETING ON AIR QUALITY

ABATING URBAN EXPOSURE TO AIR POLLUTANTS

26-27 September 2017, BARCELONA, SPAIN

Ángeles Cristóbal López
Madrid City Council

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-DIAGNOSIS: current state and trends

-RESPONSE: Plans for improving Air Quality

City map and basic data

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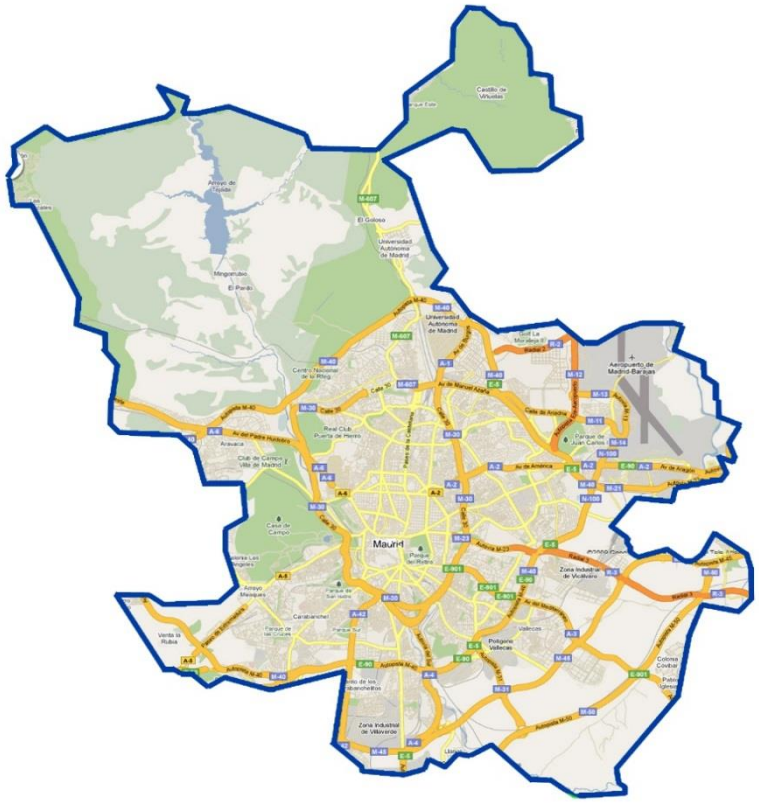
Region of Madrid



City of Madrid

Population:

- Municipality - 3.166.130

-More than 5 million people in the metropolitan area

- City centre - 1.006.086

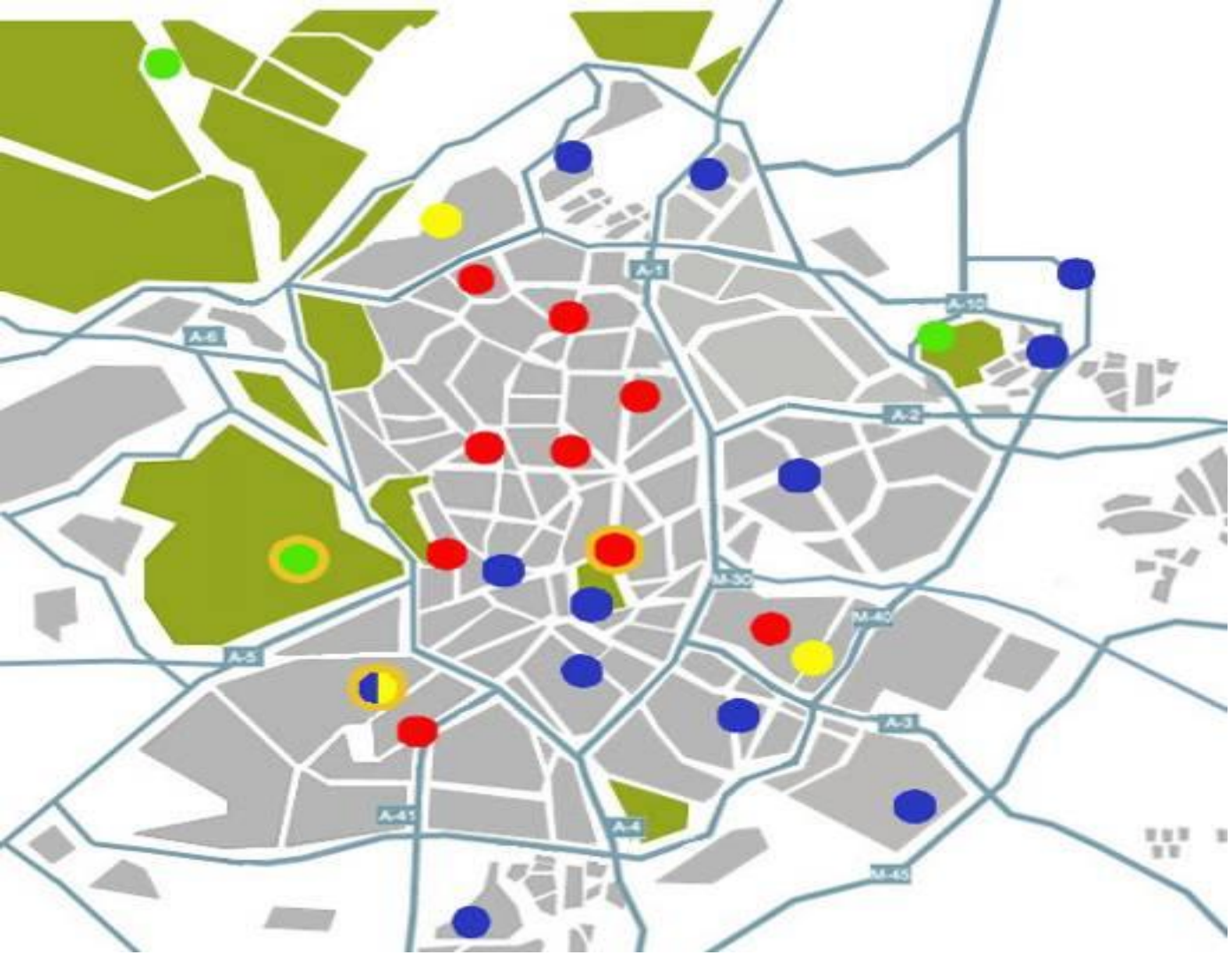
Surface: 604,31 (km^2)

Density: 5,239 (inh./km^2)

Car ownership rates:

404 (cars/1.000 inh.)

[Reference year: 2014]



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Air Quality Monitoring Network

Suburban

Traffic

Background

AEI (average exposure indicator) for PM2,5)

Super-sites

Sampling points by pollutant

NO2	PM10	PM2,5	Ozono	C6H6	SO2	CO
12 BG 9 T 3S	6 BG 5 T 1 S	4 BG 4 T 1 S	8 BG 3 T 3 S	2 BG 3 T 1 S	5 BG 4 T 1 S	4 BG 5 T 1 S

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Air Quality Assessment 2016

		Exceedance of limit/target value		
		Suburban	Background	Traffic
NO2	Hourly mean	No	No	Yes (4 out of 9)
	Annual mean	No	Yes (3 out of 12)	Yes (6 out of 9)
PM10	Daily mean	No Yes WHO	No Yes WHO	No Yes WHO
	Media anual	No	No Yes WHO	No Yes WHO
PM2.5	Media anual	No	No Yes WHO	No Yes WHO
O3	Maximum daily eight hours mean (2014-2016)	Yes (3 out of 3)	Yes (4 out of 8)	No
	Information threshold	Yes (3 out of 3)	Yes (4 out of 8)	No
C6H6	Annual mean	No	No	No
SO2	Hourly/Daily mean	No	No	No

No exceedances of heavy metals and benzo(a)pirene

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Exceedances of annual limit value for NO2

Año	2010	2011	2012	2013	2014	2015	2016
Nº estaciones	18	15	10	8	6	13	9

Exceedances of hourly limit value for NO2

Año	2010	2011	2012	2013	2014	2015	2016
Nº estaciones	6	9	3	3	5	8	4

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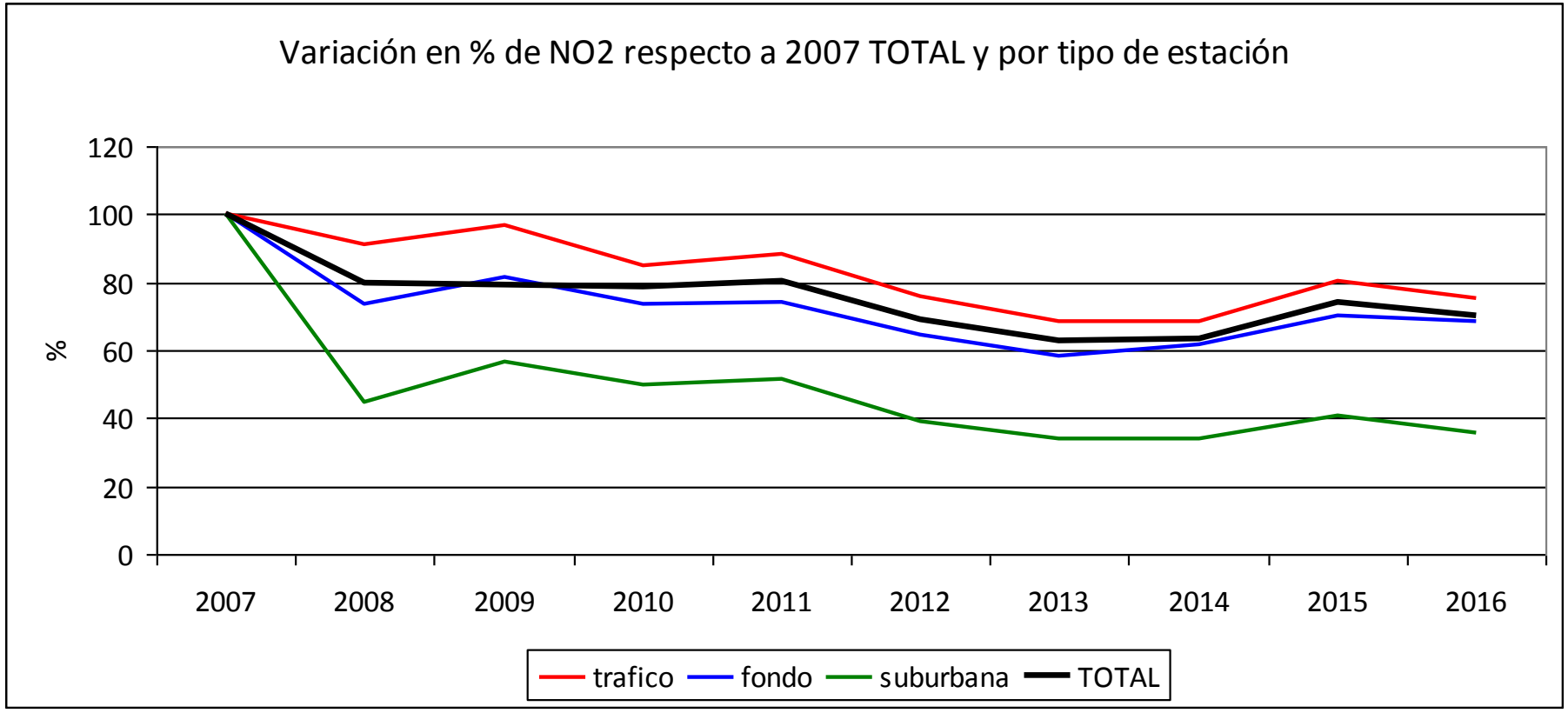
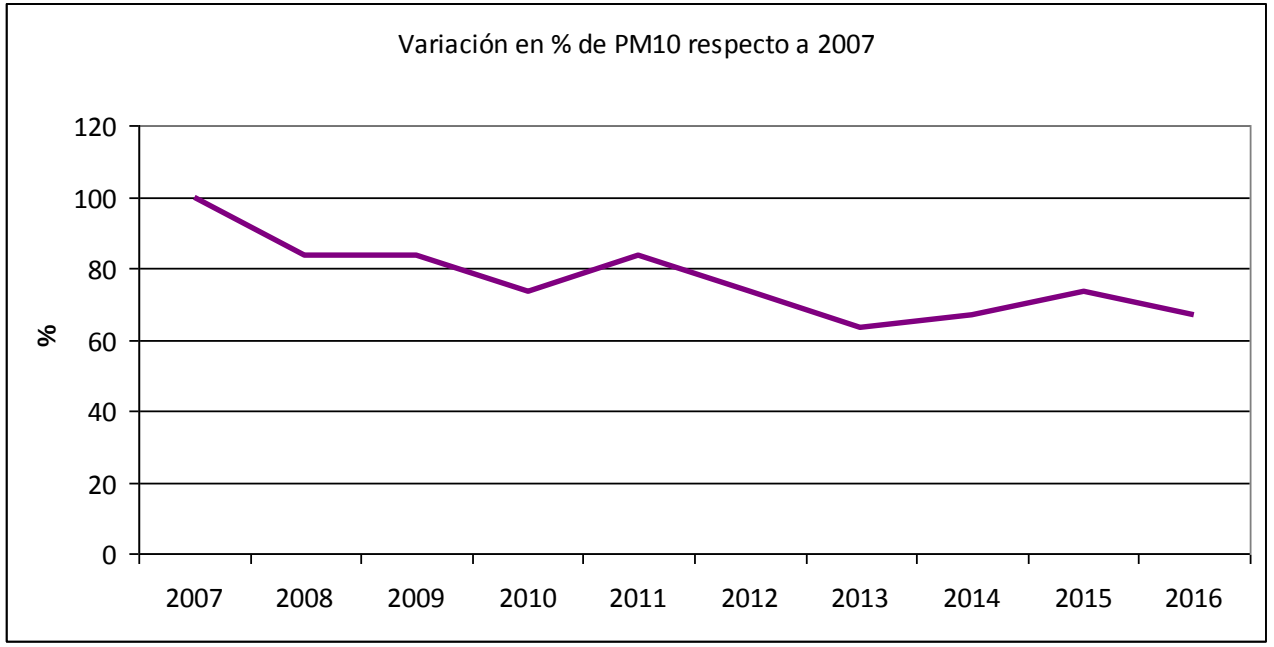
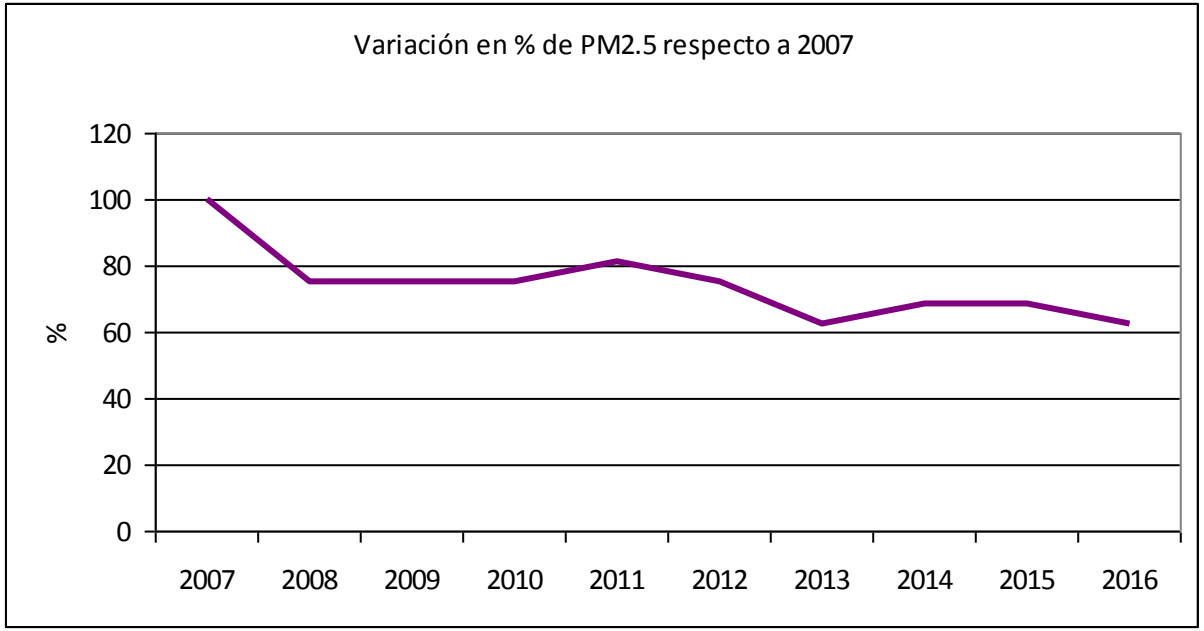
Annual evolution of NO_2 levels (total/traffic/background/suburban)

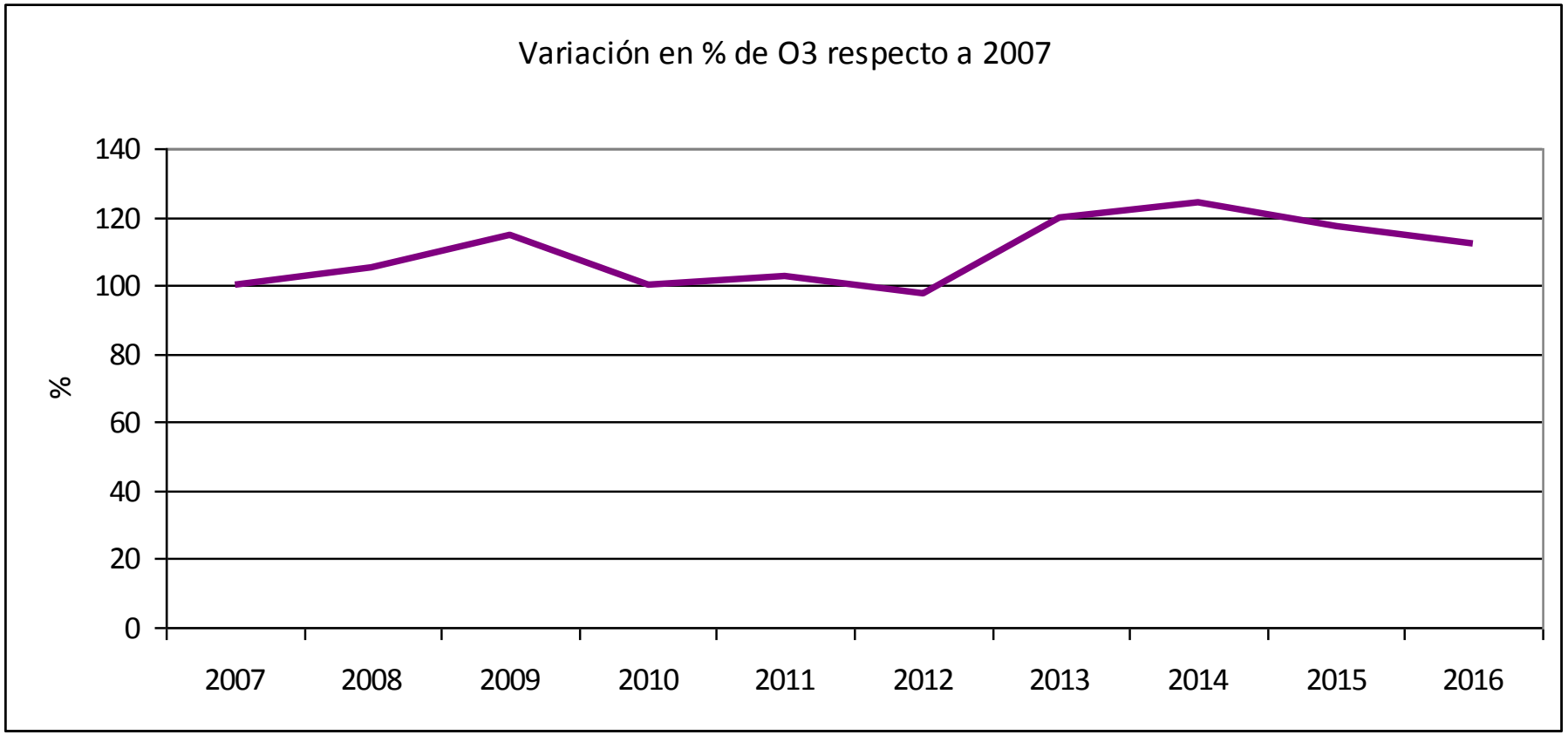


Annual evolution of PM10 and PM2.5 levels





Annual evolution of O_3 levels



Major sources of pollution

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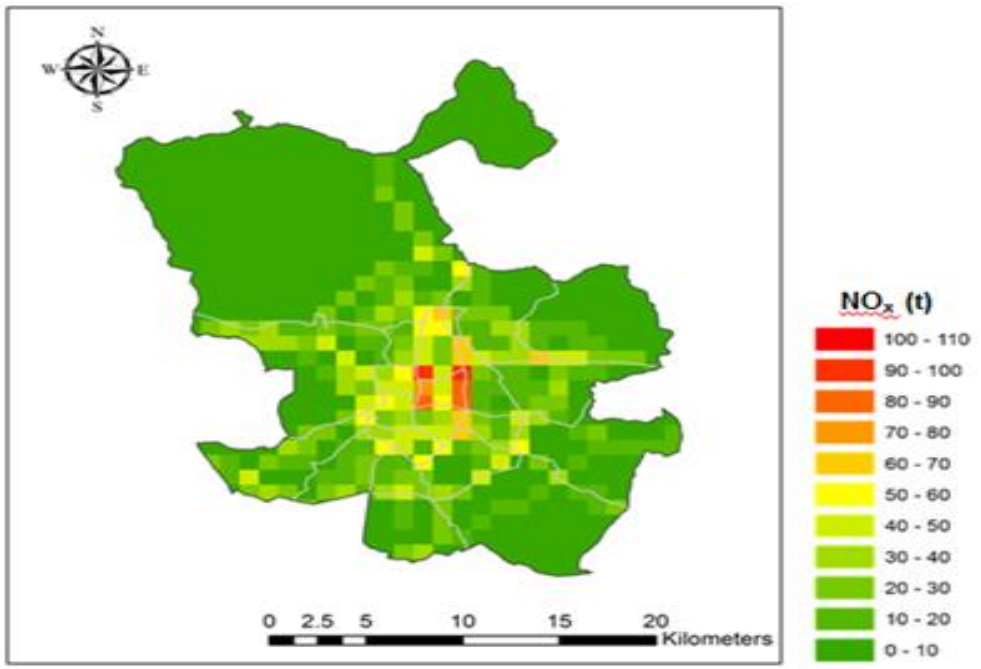
- **Road traffic** is the main contributor of emissions in Madrid city (year 2014):
  - 51.4 % of NO_X
    - 55.1 % of $PM_{2.5}$ (exhaust)
    - 40.3 % of CO_2
- Followed by *Non-road transport* (21,5% of NOx)
- And *Non-industrial combustion (RCI)* (18% of NOx)

Pollutant	Emission 2014	Ud.
CH_4	133	t
CO	6.234	t
CO_2	2.213	kt
COVNM	2.863	t
N_2O	81	t
NH_3	122	t
NO_X	7.012	t
PM_{10}	572	t
$PM_{2,5}$	428	t
PST	754	t
SO_2	14	t



NOx emissions by source

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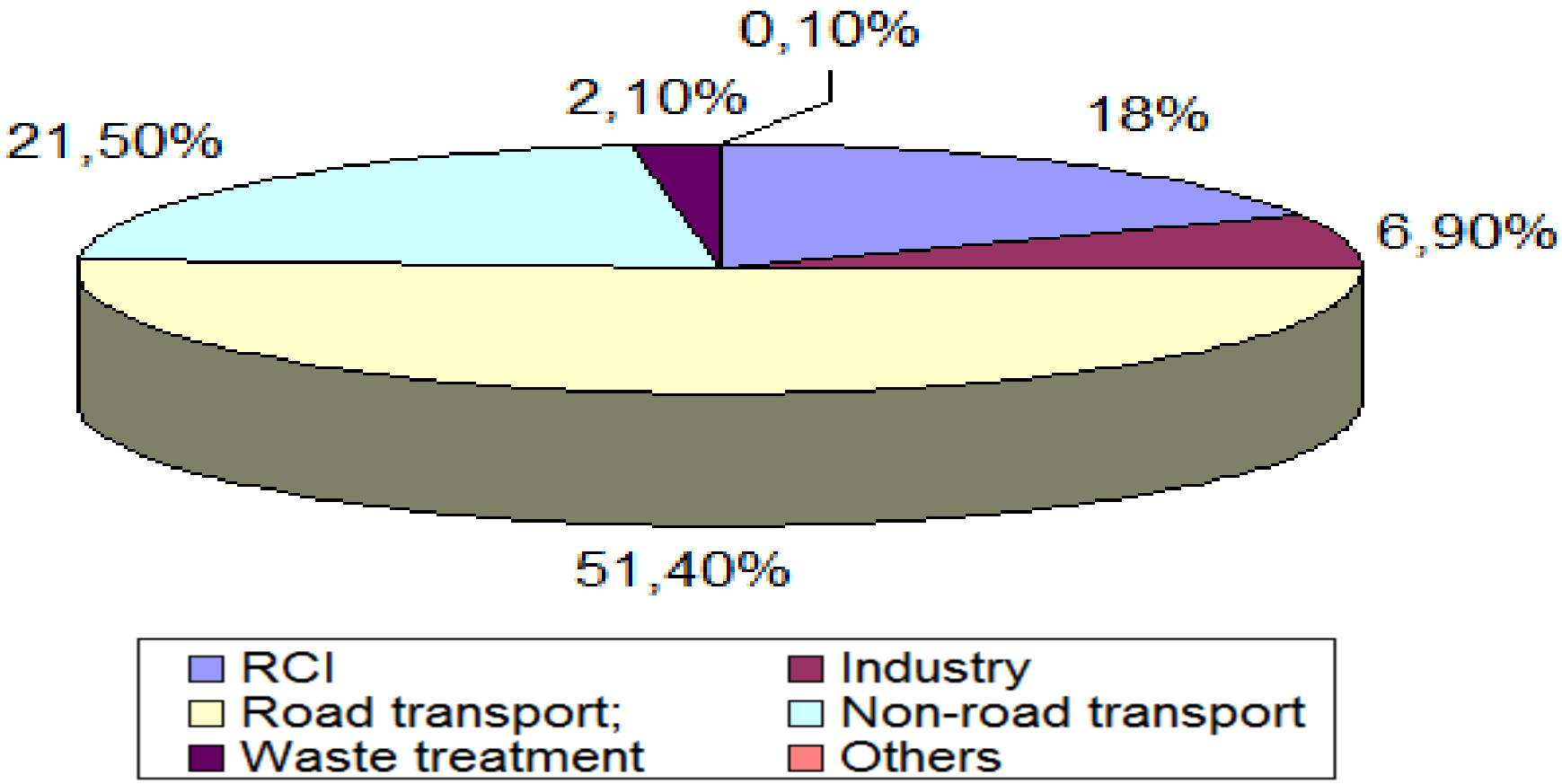

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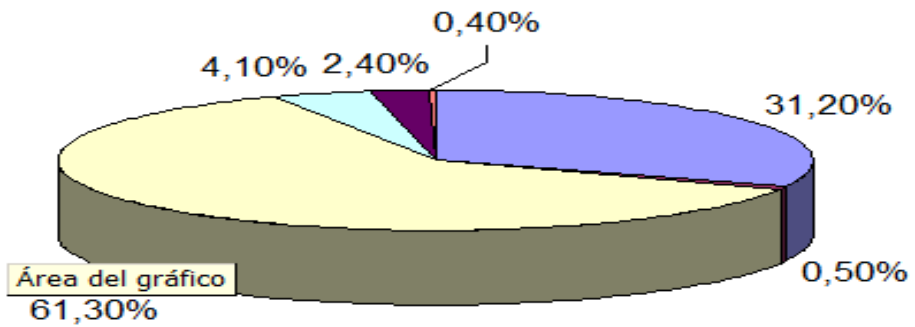
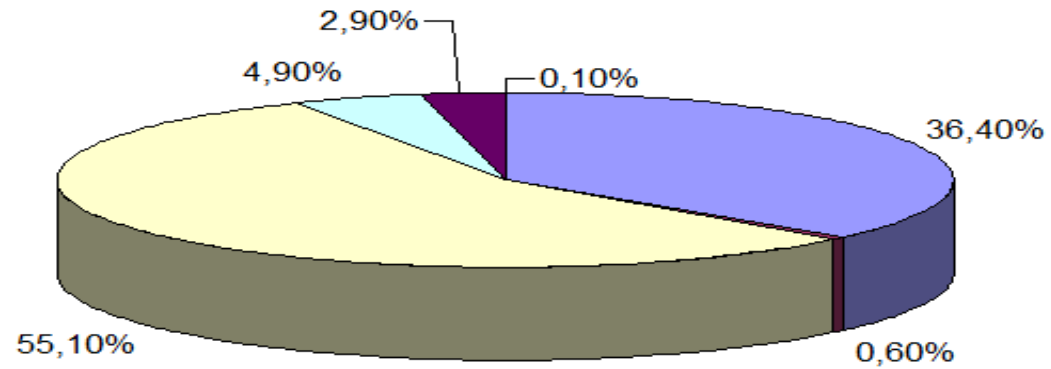
PM10 emissions by source



RCI
Industry
Road transport;
Non-road transport
Waste treatment
Others

PM2,5 emissions by source



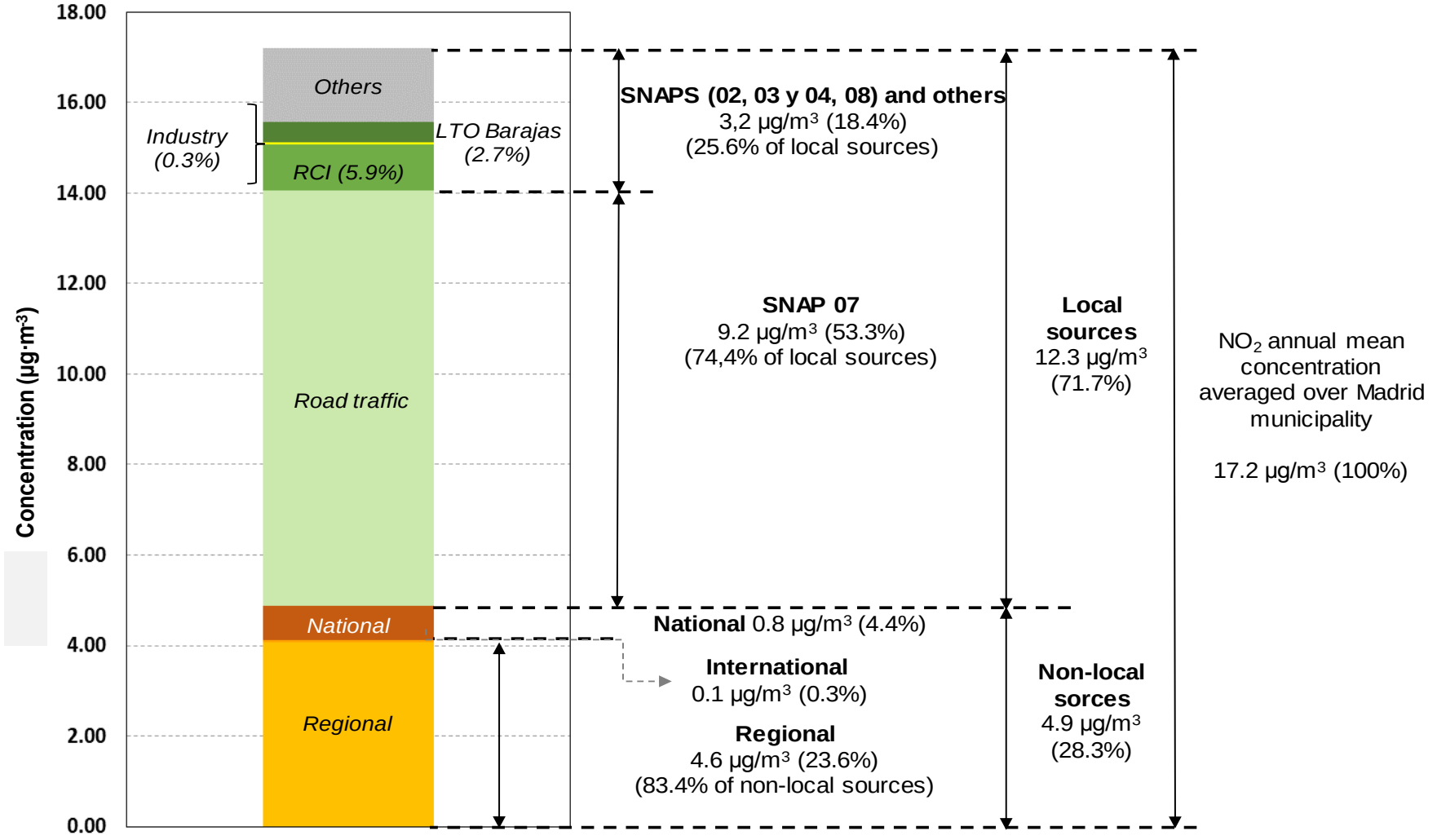
RCI
Industry
Road transport;
Non-road transport
Waste treatment
Others

SUMMARY: SOURCE APPORTIONMENT

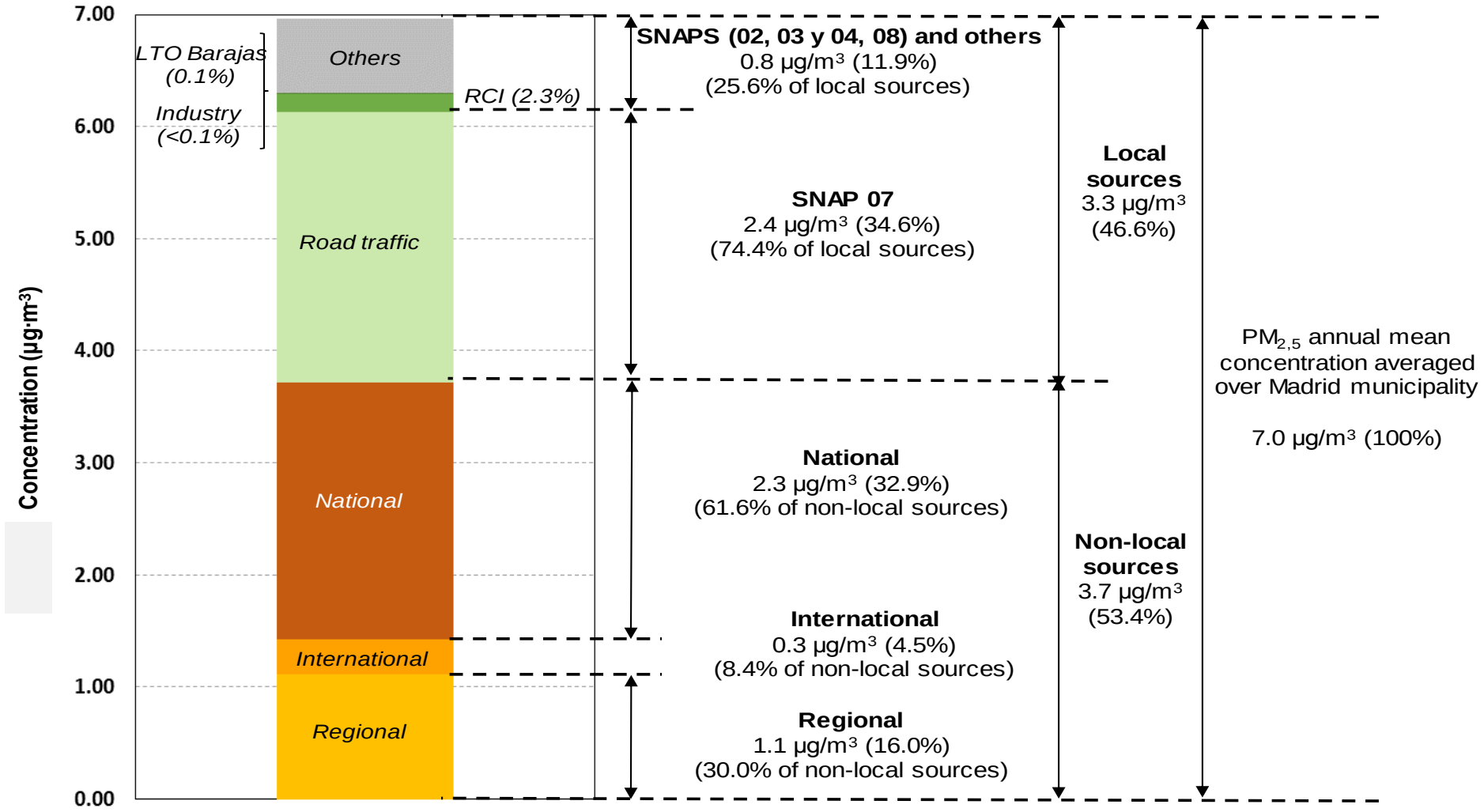
- Source apportionment of the main emitting sectors (SNAP group level) through a zero-out mesoscale modelling approach

SNAP group	Description	$PM_{2.5}$ and NO_x emission share (%)
01	Combustion in energy and transformation industries	-
02	**Non-industrial combustion plants**	35.9% ($PM_{2.5}$) and 17.5% (NO_x)
03	**Combustion in manufacturing industry**	0.9% ($PM_{2.5}$) and 6.1% (NO_x)
04	**Production processes**	
05	Extraction and distribution of fossil fuels	-
06	Solvent and other product use	-
07	**Road transport**	55% ($PM_{2.5}$) and 47.8% (NO_x)
08	**Other mobile sources and machinery (Barajas airport)**	±5% ($PM_{2.5}$) and ±17% (NO_x)
09	Waste treatment and disposal	-
10	Agriculture	-
11	Other sources and sinks (Nature)	-

SOURCE APPORTIONMENT. NO2 annual mean



SOURCE APPORTIONMENT. PM 2.5 annual mean



European Commission - Press release

Commission warns Germany, France, Spain, Italy and the United Kingdom of continued air pollution breaches

Brussels, 15 February 2017

The European Commission sends final warnings to Germany, France, Spain, Italy and the United Kingdom for failing to address repeated breaches of air pollution limits for nitrogen dioxide (NO2). NO2 pollution is a serious health risk. Most emissions result from road traffic.

The European Commission urges 5 Member States to take action to ensure good air quality and safeguard public health.

More than 400 000 citizens die prematurely in the EU each year as a result of poor air quality. Millions more suffer from respiratory and cardiovascular diseases caused by air pollution. Persistently high levels of nitrogen dioxide (NO2) caused almost 70 000 premature deaths in Europe in 2013, which was almost three times the number of deaths by road traffic accidents in the same year.

EU legislation on ambient air quality (Directive 2008/50/EC) sets limit values for air pollutants, including nitrogen dioxide. In case such limit values are exceeded, Member States are required to adopt and implement air quality plans that set out appropriate measures to bring this situation to an

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RESPONSE:

Plans for improving air quality: short and mid term measures

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Measures for NO2 exceedances episodes
Decree of January 21, 2016
(Short term approach)

Level of NO2 concentration

1. INFORMATION

NO_2 concentration > **180 µg/m³** .

2 consecutive hours in 2 stations in the same zone

2. PREALERT

NO2 concentration > **200 µg/m3**

2 consecutive hours in 2 stations in the same zone

3. ALERT

NO_2 concentration > **400 µg/m³**

3 consecutive hours in 3 stations in the same zone

Measures

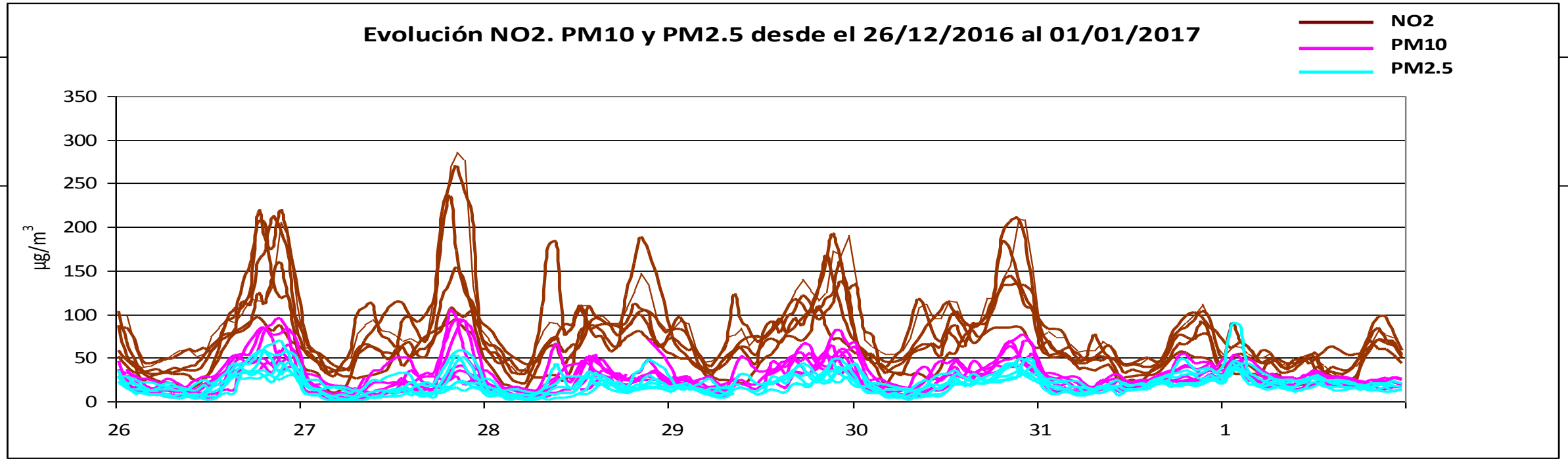
Information

Speed limit reduction in motorways

Parking ban (residents exempted)

Odd-even plate limitation

Episode 26 December 2016 to 1 January 2017



Public information

- Web
- Sms alert system
- Social networks
- Electronic displays units in bus stops
- Traffic information displays

Parquímetros:

Paneles Calle 30:

Pantallas metro de Madrid:

Mensajes SMS:

Marquesinas EMT:

Paseo de las DELICIAS. 29 December. 12 h

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Significant Media attention

Photograph: Paul Hanna/Reuters

Spain

Madrid bans half of cars from roads to fight air pollution

Odd- and even-numbered vehicles will swap use of roads in Spanish capital until smog eases

Madrid's deputy mayor said the car ban was not about traffic restrictions but about public health.

Cuando tu nave es par…

(When your spacecraft

is ODD…)

Plan de Calidad de aire y Cambio Climático

Plan

Plan de Calidad de aire y Cambio Climático

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September 2017

PLAN A

- Integration of AQ and CC policies
- Public health approach
- Combined actions for a new urban model

Long term approach

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AIR QUALITY AND CLIMATE CHANGE PLAN FOR THE CITY OF MADRID

Goal: Health protection, environmental quality, resilience

- GHG emissions reduction over 40% in 2030, whit respect to 1990 (European Climate Agenda)
- Fulfilment of the EU regulated values for all pollutants
- Fulfilment of the WHO guideline values for particulate material PM10 and PM2.5 (stricter than the European limits)
- Local commitment to get a 50% reduction of road traffic in 2030 with respect to 1990

30 measures

1: Mobility (21 measures)

2: Urban regeneration/ Low emissions urban management (7 measures)

3: Nature based solutions for Climate Change adaptation (1 measure)

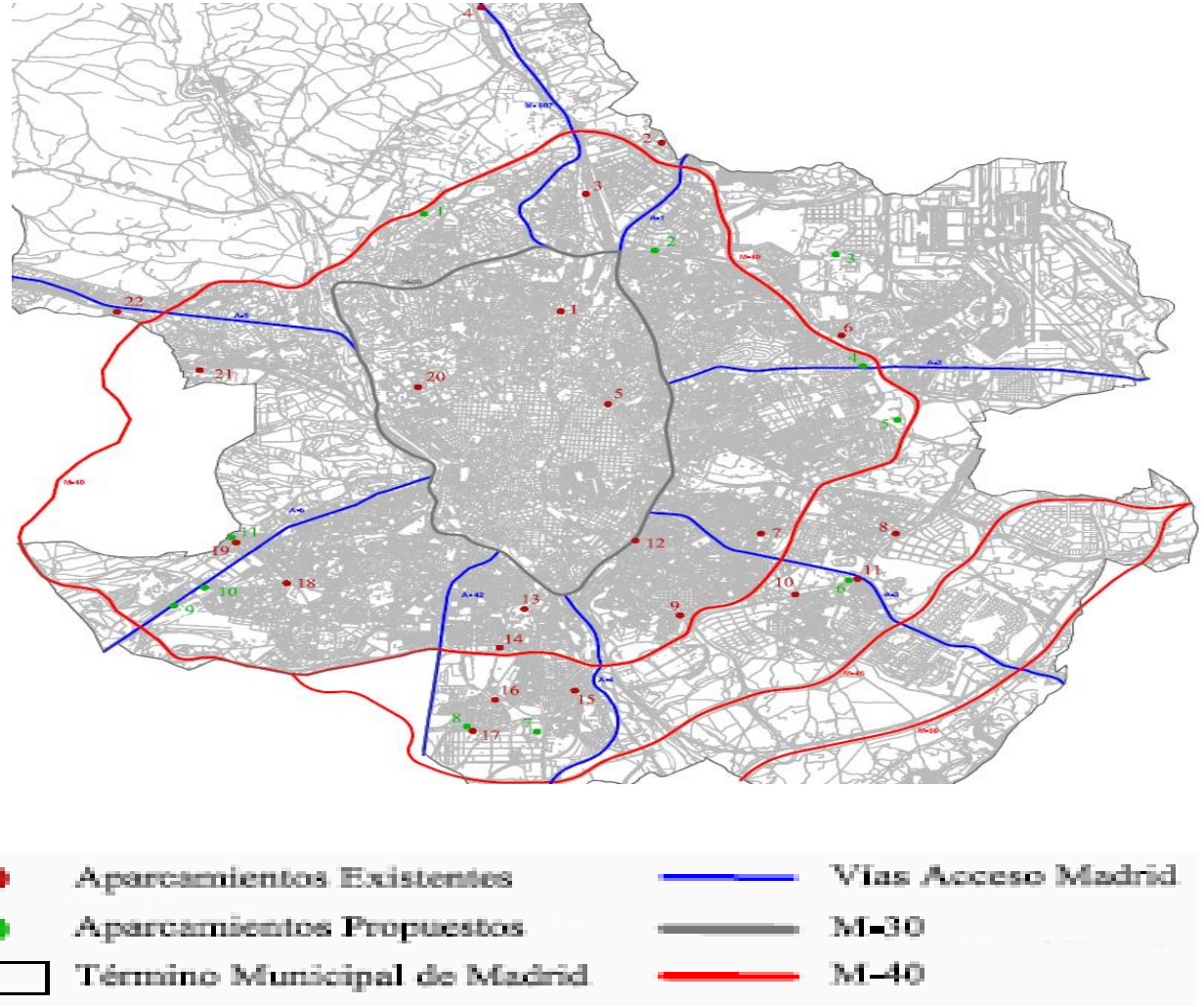
4: Information,raising public awareness and c Ooperations with others administrations (1 measure)

Actions related to PRINCIPAL ROADS INTO THE CITY

Park and Ride Carparks
Around the second ring belt M 40. Apps for spot reservation,…

Speed limit (70km/h)
in principal roads and ring belt M30

Dedicated platforms for bus and HOV in principal roads into the city



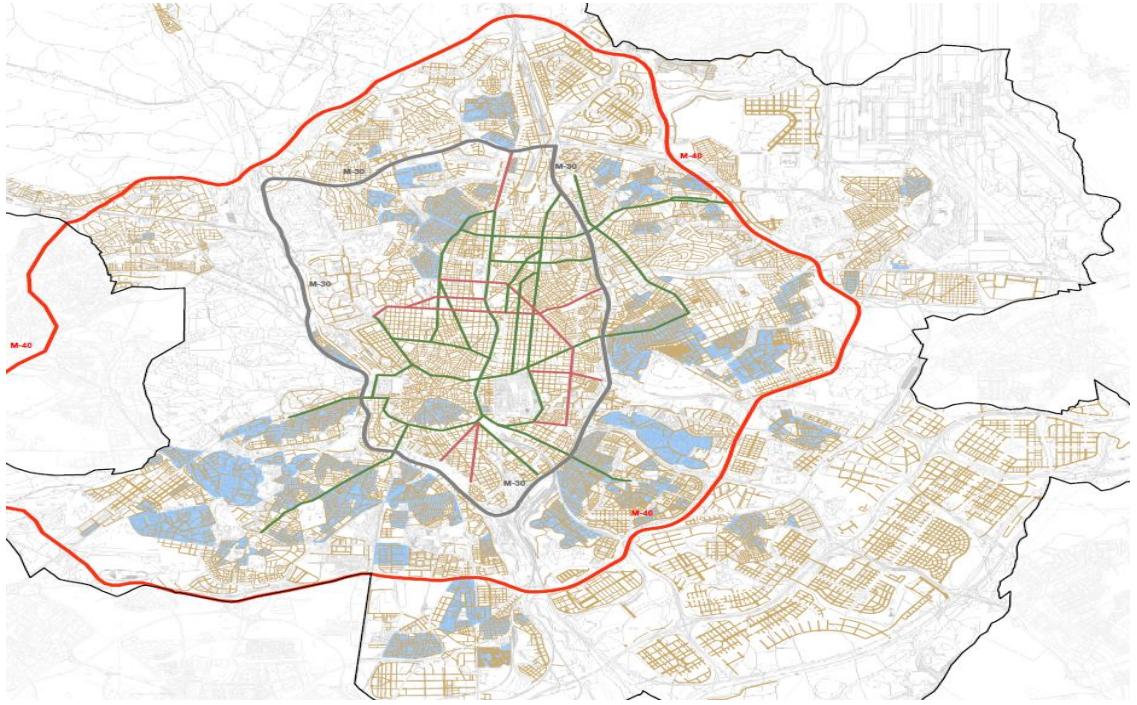
Motorized mobility reduction by redistributing on road public space and management tools

Redesigning of road sections in principal and traffic distributor roads as well as periphery and city center connecting roads

Pedestrian mobility prioritization and y neighborhood pedestrian networks. New public space model linked to urban regeneration in residential areas

Cyclist mobility prioritization and public bike system enlargement (transport hubs)

Reserved lanes for buses and streetlights prioritization



Bicycle lane network

Public Bike System

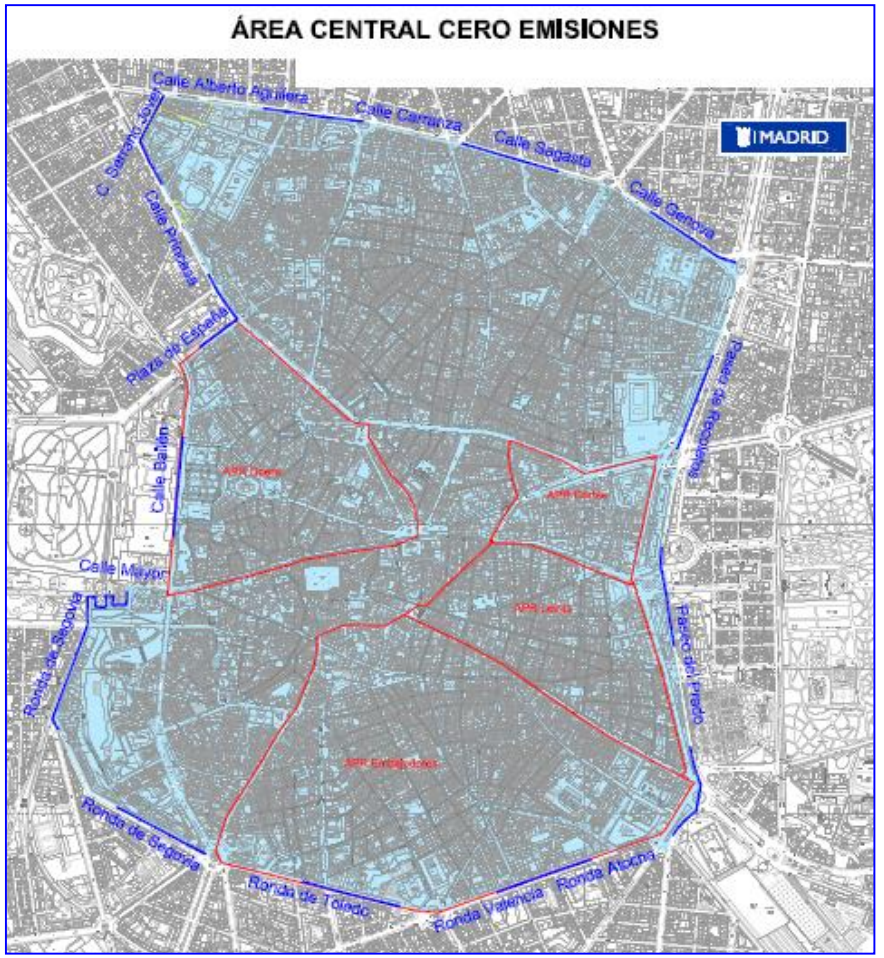
Inaugurated on June 2014

- 62.108 subscribers
- 9.000-10 uses/working day (winter)
- 3.000 uses/holiday
- Around 20.000 uses/working day (spring and summer)
- 5 daily uses/bike in working day and 3 in holiday

Central priority Area in the Central District

Enlarged management system that will cover the whole historic centre, removes the crossing traffic, facilitates deterrence and improves people's life and public spaces quality.

- Continuous perimeter
- No free driving roads
- Public transport, bike and pedestrian mobility prioritization
- Adequate space sharing among residents and other public uses
- Not on road parking allowance for non residents
- Limitation of points of access to public parking lots
- Optimization of urban freight
- Less pollutant technologies encouraged



On road parking regulation with air quality criteria (rotation and technology based fees)

M30 ring belt outer area: "on demand system" without cost for residents, for avoiding "border effect" and parking deterrence by no residents tariff payment

M30 ring belt inside area: limitation of maximum stay for no residents and significant increase of tariffs based on vehicle technology (and bonus for cleanest technologies)

-Cero emisiones:

- Battery Electric Vehicle (BEV)
- PLUGGED IN HIBRID (PHEV) Range > 40 km
- Electric Extended range vehicles Range > 40 km

-ECO:

LPG (Liquefied Petroleum Gas)

CNG (Compresed natural Gas

Electric Extended range vehicles Range > 40 km

Hibrid (HEV)

-C:

Petrol Cars and light Vans- Euro 4, 5, 6,

Diesel Cars and light Vans.- 6

Medium and Heavy trucks.- Euro VI

-B:

Petrol Cars and light Vans:- Euro 3

Diesel Cars and light Vans.- Euro 5, 6

Medium and Heavy trucks.- Euro IV and V

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Environmental classification:

(Approved April 2016)

- National initiative

- Derived from AQ National Plan

-Aimed to positive discrimination

- Based on technologies and EURO standards

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The vehicles with lowest NOx emissions benefit from a reduction in the parking fee while the most polluting vehicles are penalized with a higher fee, according to the 'polluter pays' principle. Electric vehicles are exempted.

-Cero emisiones:

-ECO:

-C:

-B:

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CERO: free parking, no rotation

Others: 2 hours maximum in a green spot or 4 hours maximum in a blue one

ECO 50% fee reduction

C: 10% fee reduction

B: ground fee

Those without label pay an overhead of 25%

Measures related to cleaner vehicles in key sectors (high impact on transport and mobility and air quality)

Public transport:

- Renewal and enlargement of the public buses fleet towards a 100% low emissions vehicles
- High capacity transport system
- Incentives for the transformation of taxi vehicles to less pollutant energies
- Measures to foster taxi fleet renovation to low emissions vehicles.

Enterprises and institutions

- Towards a low emission municipal fleets
  - Cars and motorbikes goal: 75% Cero or ECO in 2020 and 90% in 2030
  - Heavy vehicles (>3500kg) goal: 75% Cero or ECO in 2020 and 80% in 2030

- Sustainable Mobility Plans for industries and enterprises, minimizing trips and promoting public and collective transport

Less pollutant urban freight

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- Optimization of space dedicated to on road urban freight

- Prefered Access conditions and increased timetable for less pollutant vehicles

- Public-private cooperation for innovative and efficient urban logistics

Improvement of the recharging network for electric and cleaner alternative fuels (CNG, PLG)

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E-SHARED MOBILITY

FREE FLOATING SHARING SCHEMES

Urban regeneration/ Low emissions urban management

- Urban rehabilitation

- Municipal buildings: environmental audits, monitoring of energy consumption, thermal installation in buildings, energy management Systems, energy services enterprises,…

- Waste collection, waste management and waste to energy

- Clean energy – Renewables

- Nature-based solutions for CC adaptation and AQ

Madrid + Natural

High potential for "blue-green" infraestructures

1	green walls	
2	sustainable roofs	
3	resilient development	
4	cooling roofs	
5	greening infrastructure	
6	street greening	
7	river stream restoration	✓
8	permeable surfaces	✓
9	urban farming	
10	adaptative planting	
11	retrofitting derelict plots	
12	urban forest (1 MM trees in degraded areas)	
13	seasonal shading	
14	microclimates with water	✓
15	temporary flooding	✓
16	sustainable drainage	✓










- Actions focused on vulnerable population and sensitive groups aiming at exposure reduction

- Cooperation with other Administrations at national, regional and local levels

- Information and raising awareness

RESULTS OF PLAN A IN AMBIENT AIR CONCENTRATION

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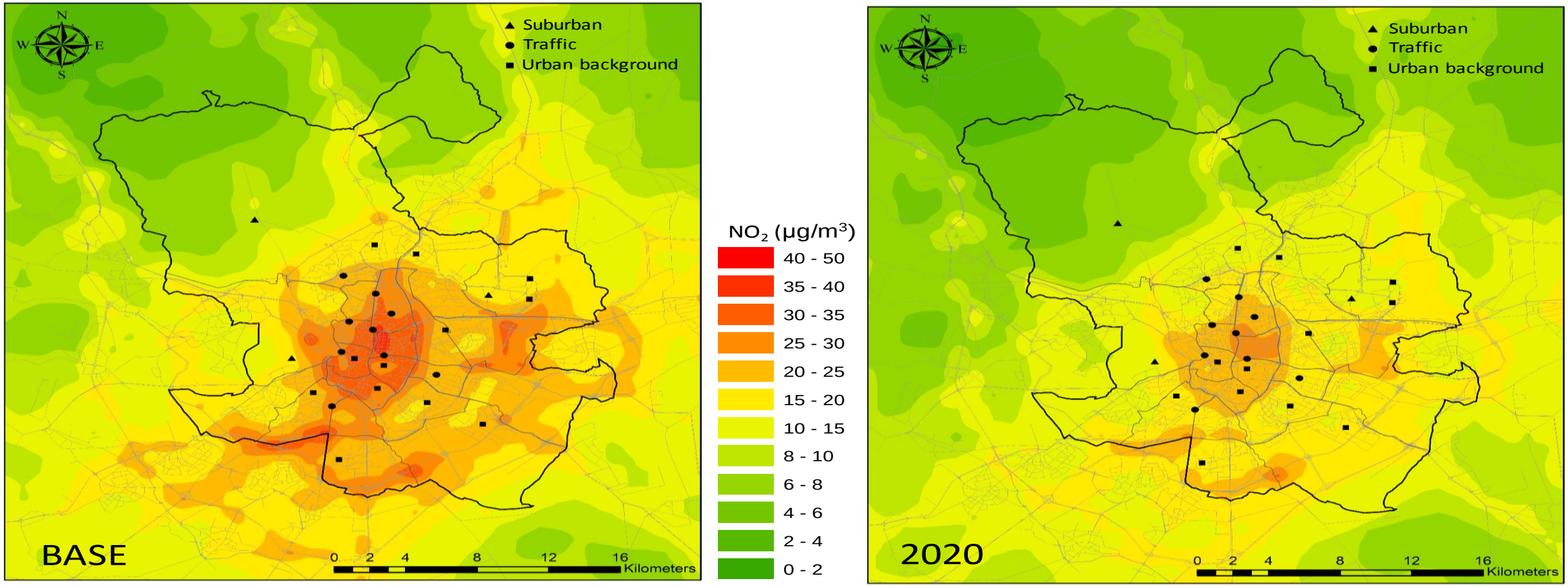
NO2 annual mean (annual limit value for the protection of human health). (Reduction of 23 %)



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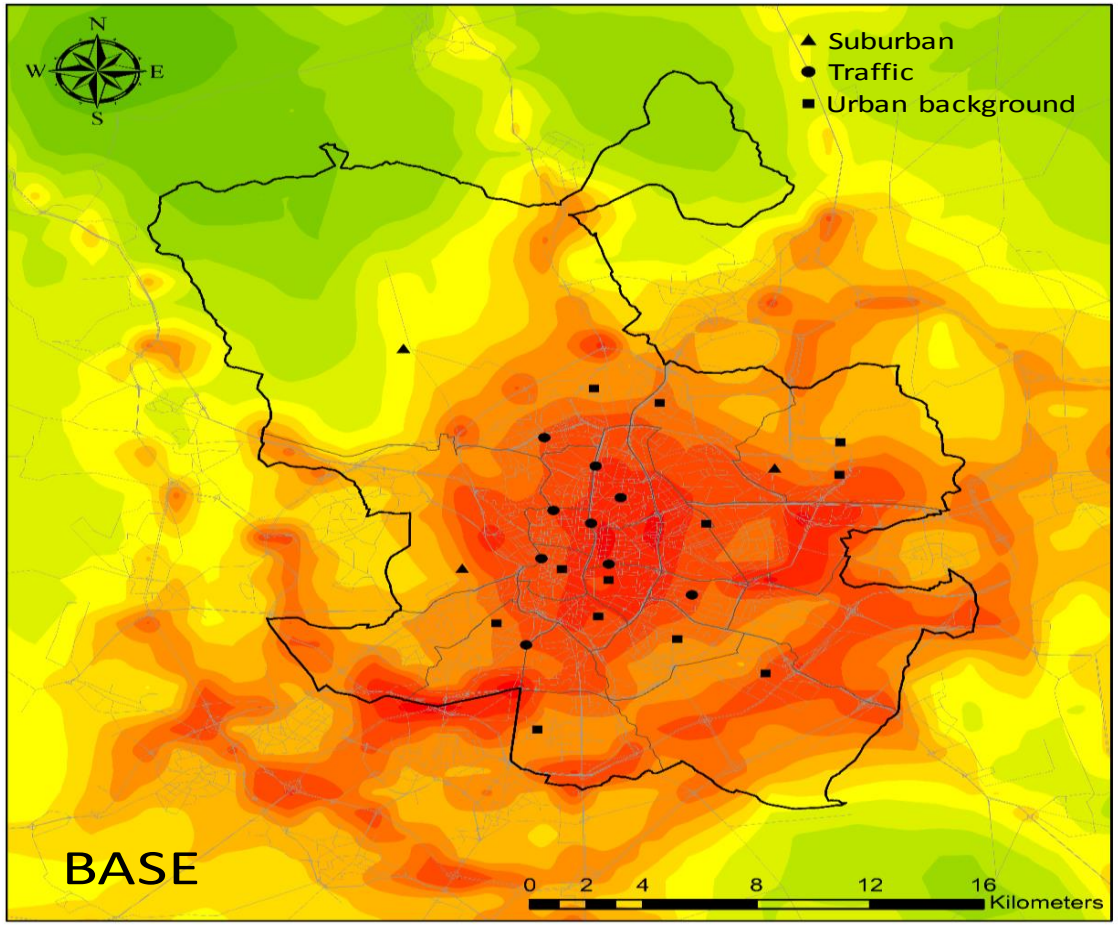
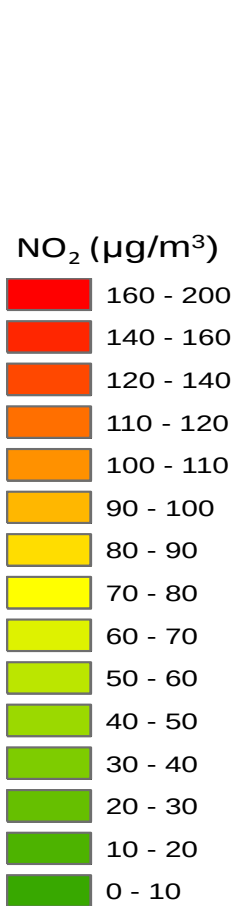
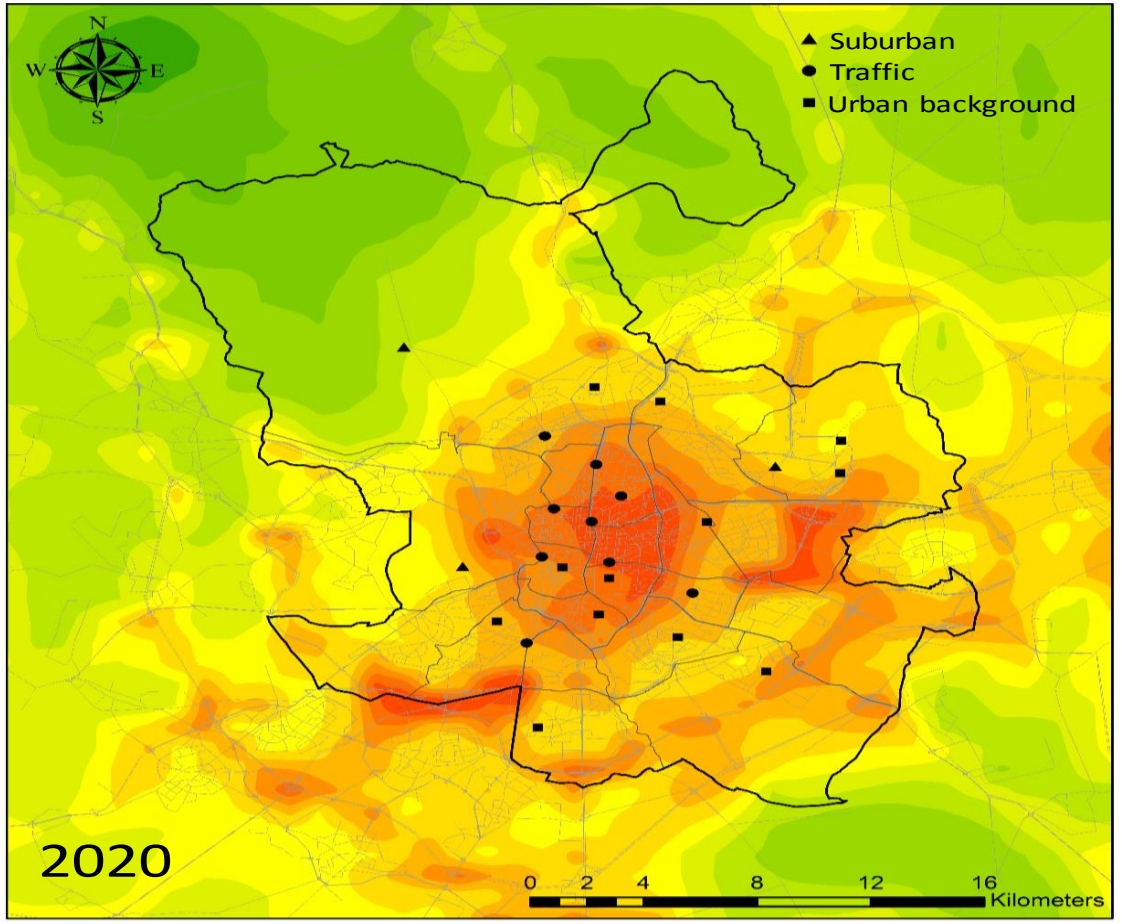
-19th highest NO2 1-h value (hourly limit value for the protection of human health)

(Reduction of 18 %)







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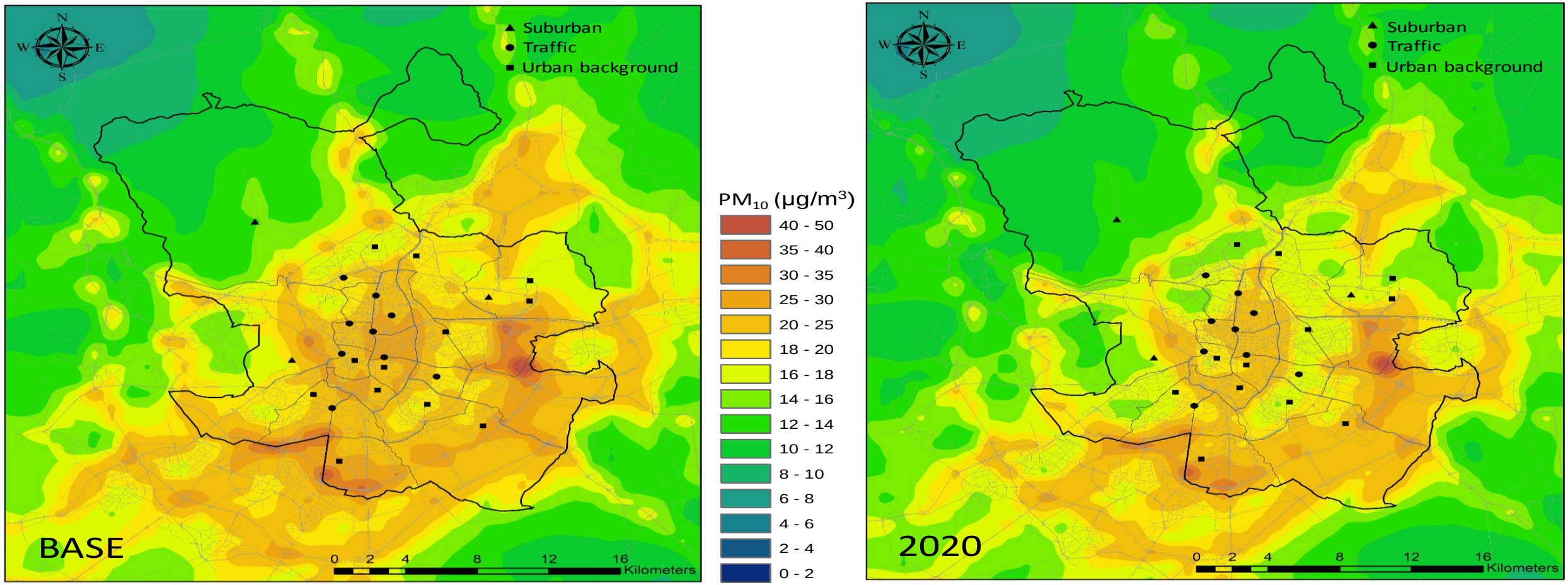
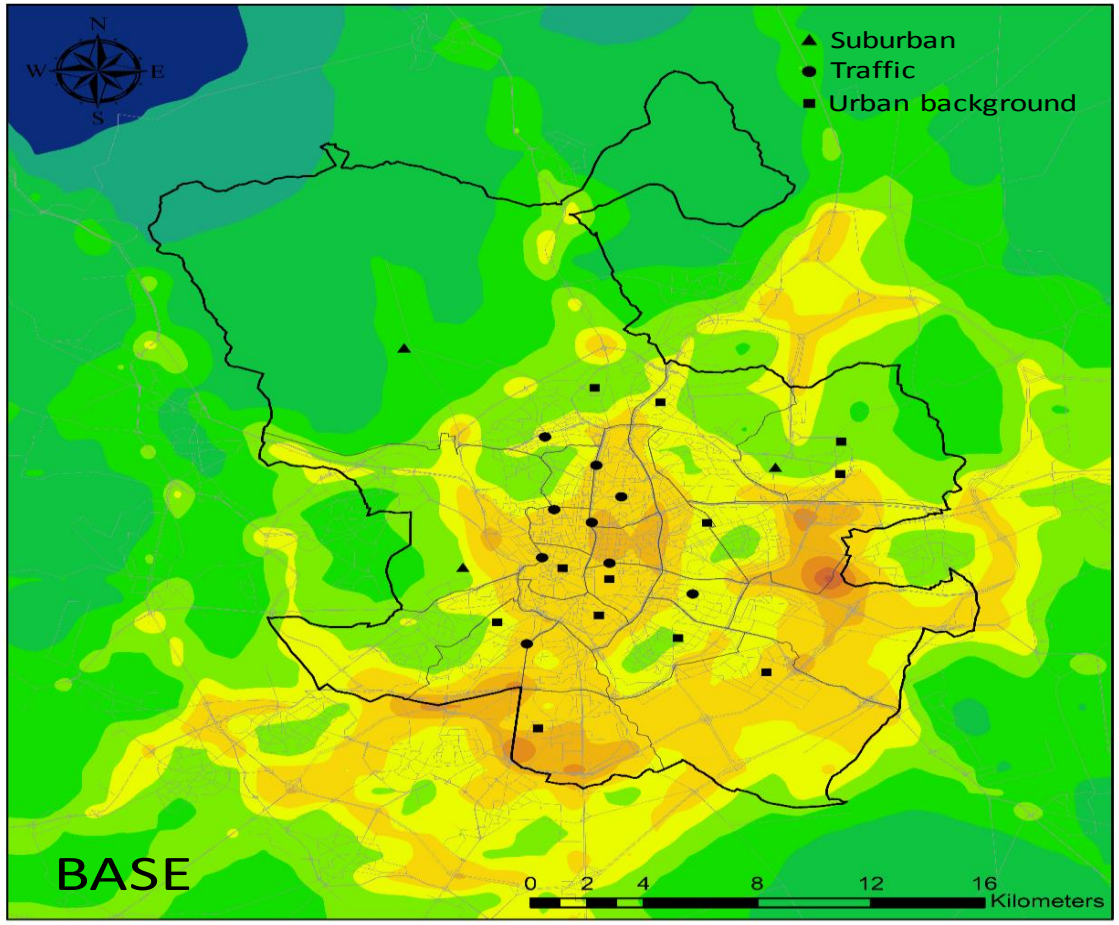
36th highest PM10 24-h value (daily limit value for the protection of human health

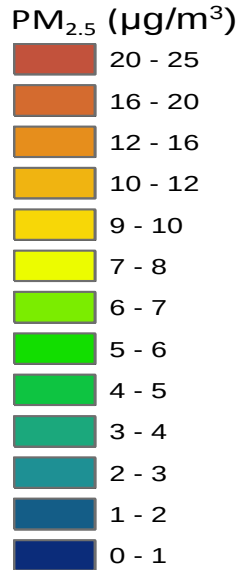
(Reduction of 9 %)

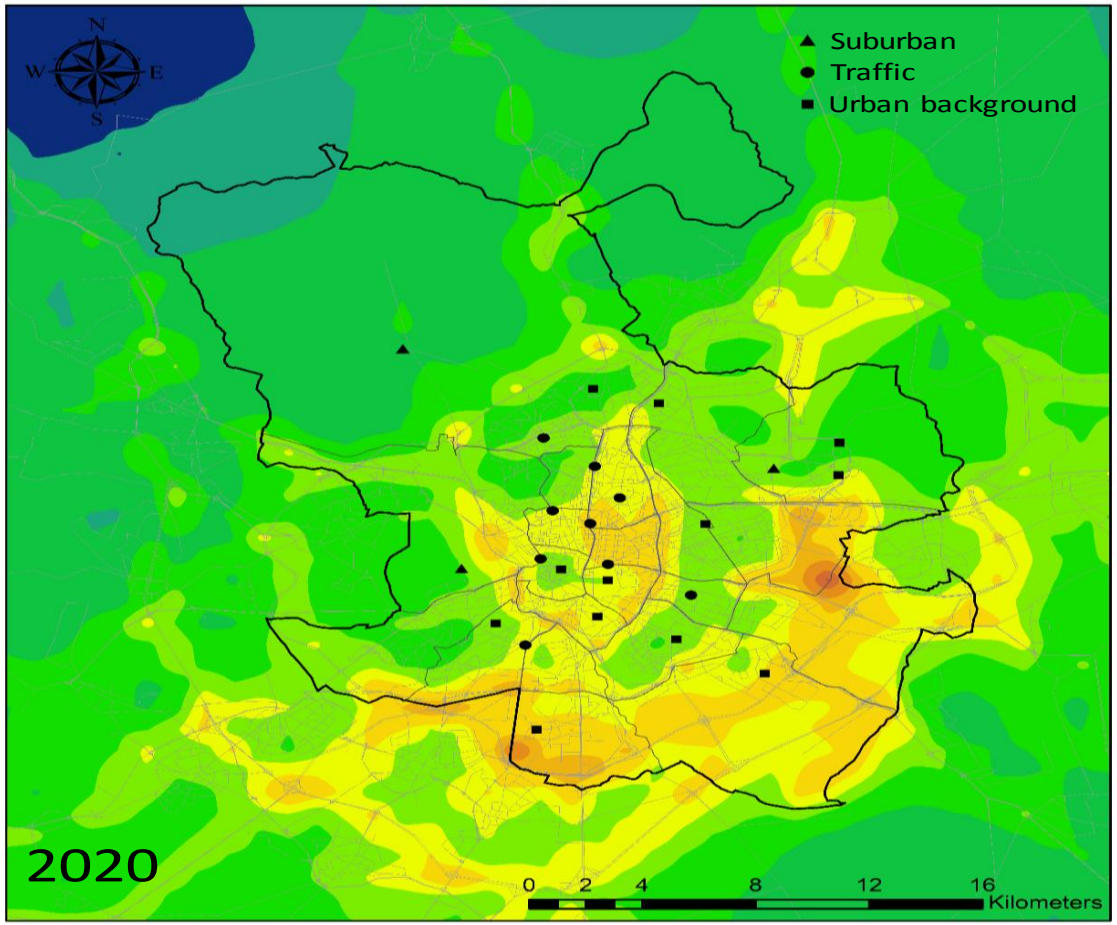


PM2.5 annual mean (annual limit value for the protection of human health)

(Reduction of 9 %)








Thank you very much for
your attention