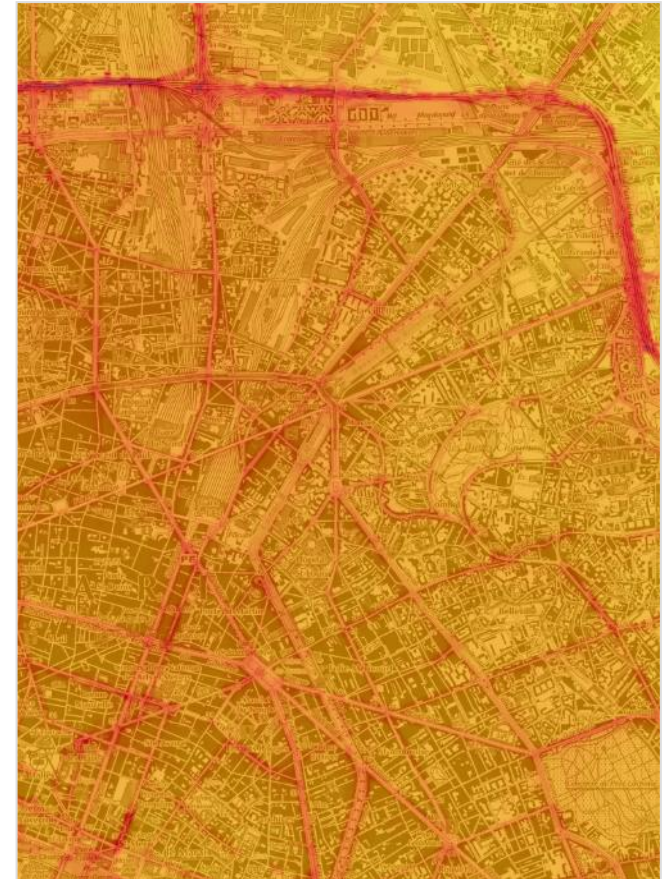




L'Observatoire de l'air en Île-de-France

Controlling Pollution Episodes In Paris

1. State of the air quality in Paris region
2. December 2016 PM pollution episode and emergency measures
3. Crit'Air framework
4. Perspectives



1 | State of the air quality in Paris Region



▶ **High population density and urbanised area**

▪ **Region:**

12 millions inhabitants, 12 000 km²

▪ **Paris agglomeration:**

9.6 millions inhabitants, 2 600 km²

4.5 millions cars and 600 000 LDV

128 millions km driven / day

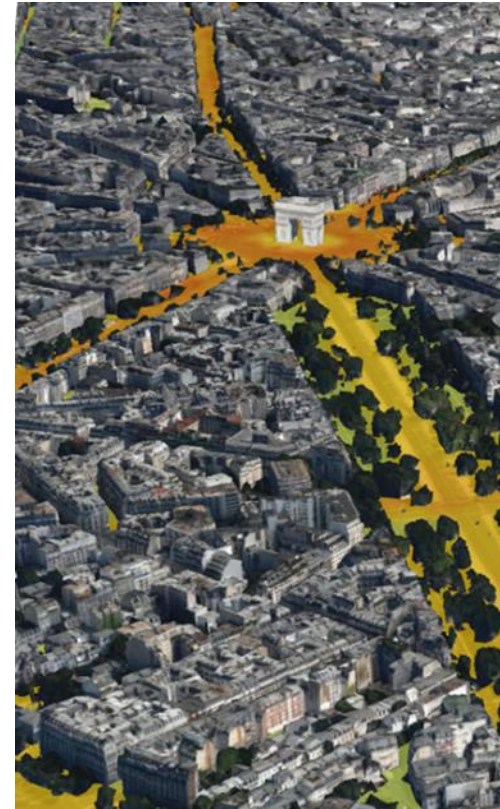
800 km highways

▪ **Municipality of Paris**

2.2 millions inhabitants, 105 km²

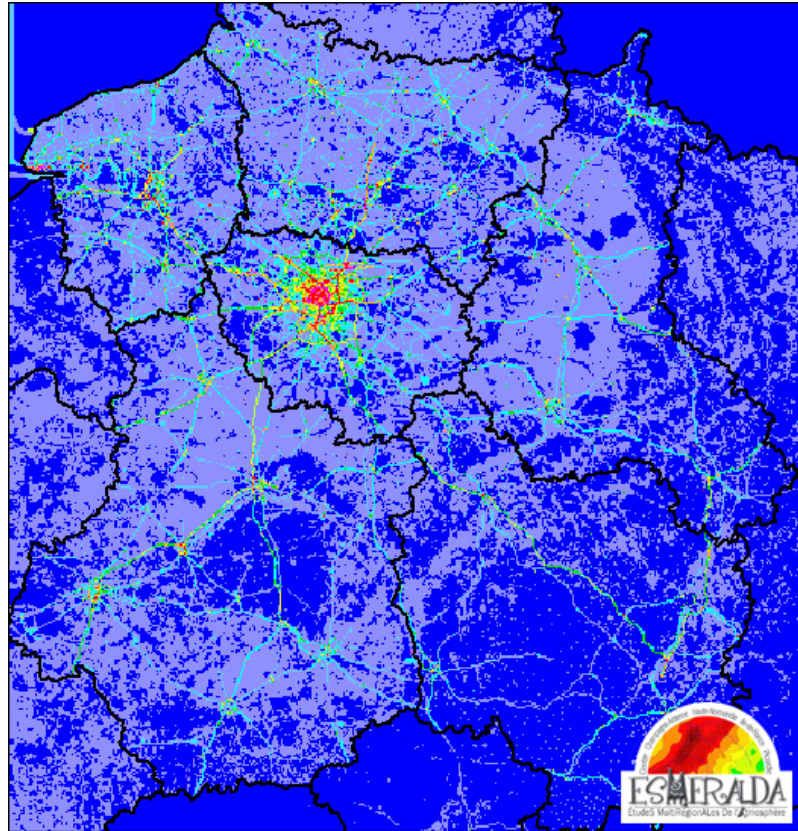
▶ **Quite similar to London**

▶ **Main sources of pollution : 1st traffic, 2nd heating**

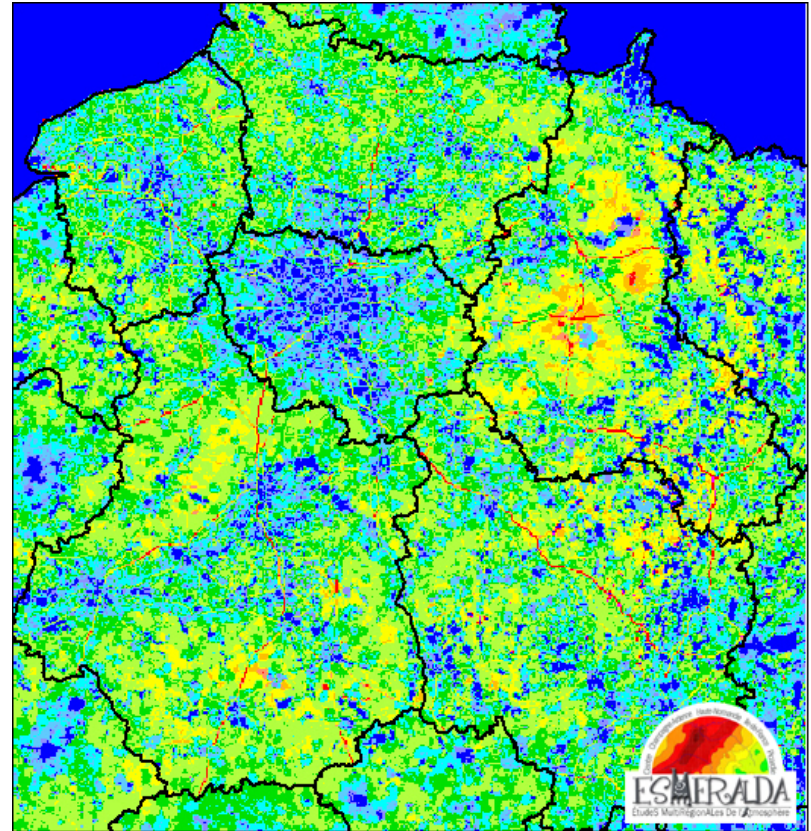


NO₂ hourly concentration
01/07/15/ Airparif
map: Google Earth & Landsat

Per km²

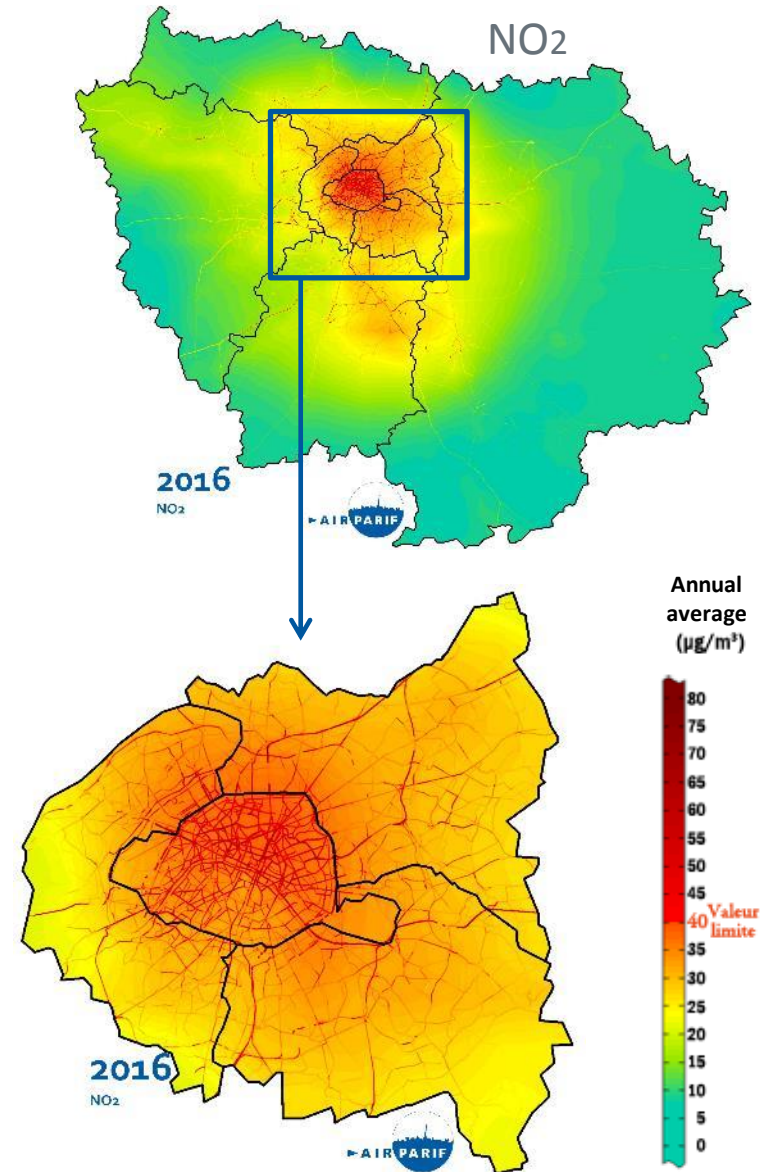


Per capita



- A lot of emissions in a small area
- Amount of emissions per capita globally weaker than in the rest of France
- Very dense traffic network

- ▶ **Still an issue for 5 pollutants**
- ▶ **Numerous inhabitants exposed to air pollution levels > regulation**
mainly in Paris agglomeration and along the busy streets (except for O₃)
- **NO₂**: 1.4 millions inhabitants
 > 40µg/m³
- **PM₁₀**: 200 000 inhabitants
 > 35 days above 50µg/m³
- **PM_{2,5}**: 11 millions inhabitants
 = 95% of the region
 > 10µg/m³ from WHO
- **O₃**: health protection threshold exceeded in the whole region, every year
 > 120 µg/m³, 8h average



▶ Ongoing legal action from the EU commission



	Standards to be met	Non-binding standards		Trend
	Limit value	Target value	Quality objective	2006-2016
PM ₁₀	Exceeded		Exceeded	↘
PM _{2.5}	Met	Exceeded	Exceeded	↘
NO ₂	Exceeded		Exceeded	↘
O ₃		Met	Exceeded	→
Benzene	Met		Exceeded	↘

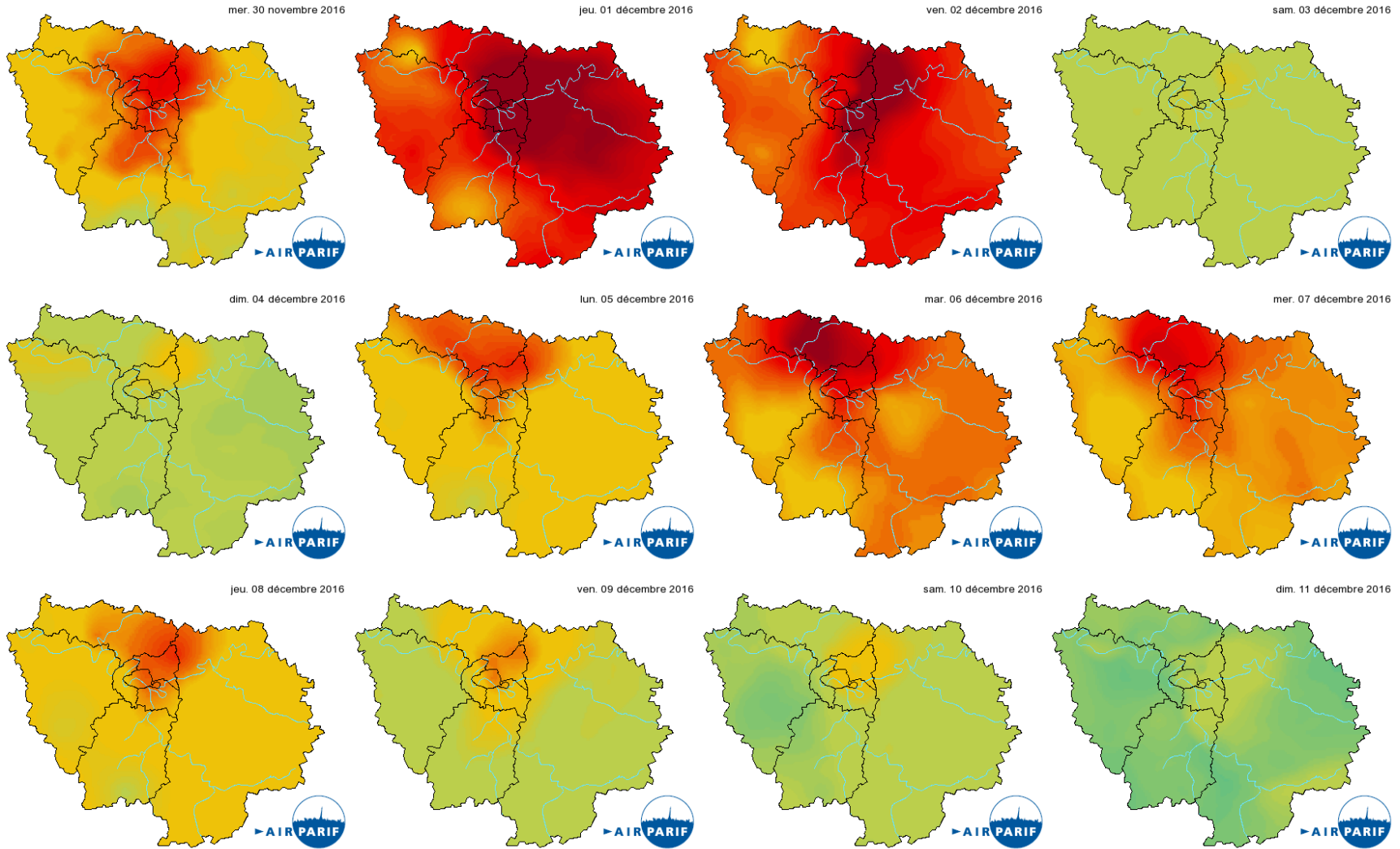
▶ Above the French and European standards (Limit values) for PM₁₀ and NO₂

Particulate Matter PM ₁₀	2016	2015	Record : 2007
Potentially exposed inhabitants	200 000	300 000	5.6 millions
Area over limit value	30 km ²	40 km ²	750 km ²
Nitrogen Dioxide (NO ₂)	2016	2015	Record : 2007
Potentially exposed inhabitants	1.4 millions	1.6 millions	3.8 millions
Area over limit value	80 km ²	90 km ²	330 km ²

3 | December 2016 PM pollution episode and emergency measures



December 2016 PM pollution episode: From November 11th to December 12th



Very low

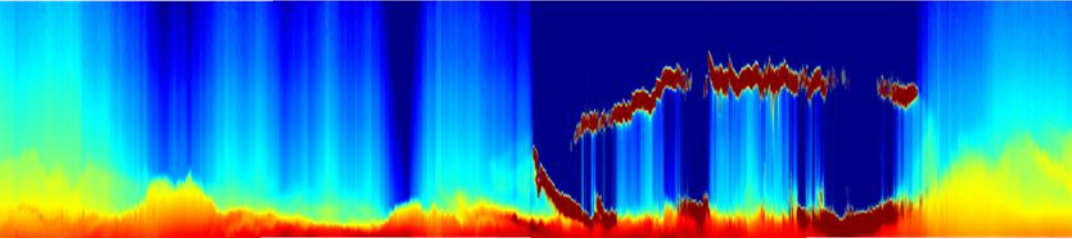
Low

Medium

High

Very high

European air quality index Citeair



e:
2th

- One of the **longest** and most **intense** pollution episode over the last 10 years
- **4 days** with average daily background concentrations $> 50\mu\text{g}/\text{m}^3$ (first information threshold)
- **4 days** with average daily background concentrations $> 80\mu\text{g}/\text{m}^3$ (alert threshold)
- Historic hourly concentration of **$259 \mu\text{g}/\text{m}^3$**
- NO_2 information threshold also exceeded on 2016/12/01

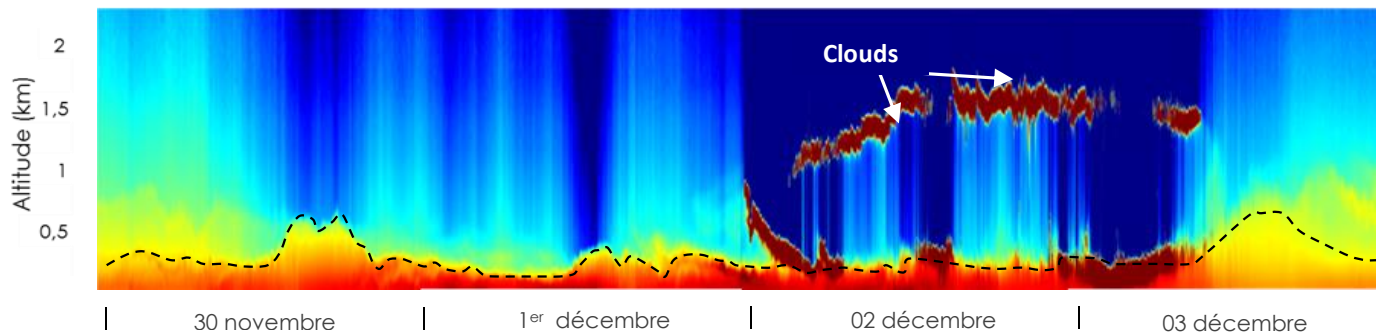
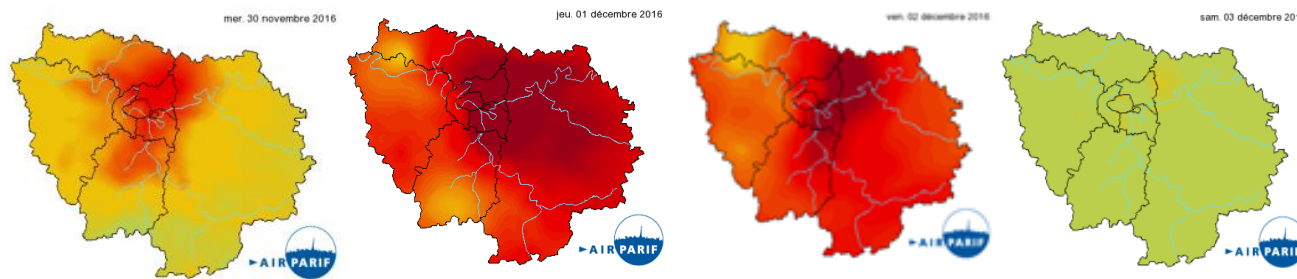
Caused by:

Local sources

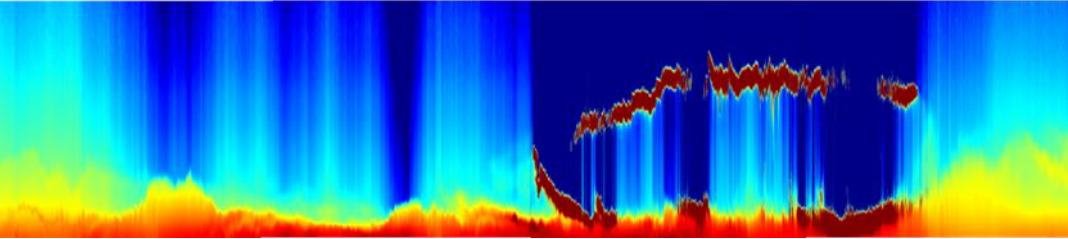
- Road traffic
- Wood heating (low temperatures)

Atmospheric situation

- Anticyclonic conditions (no wind, very low temperature inversion)



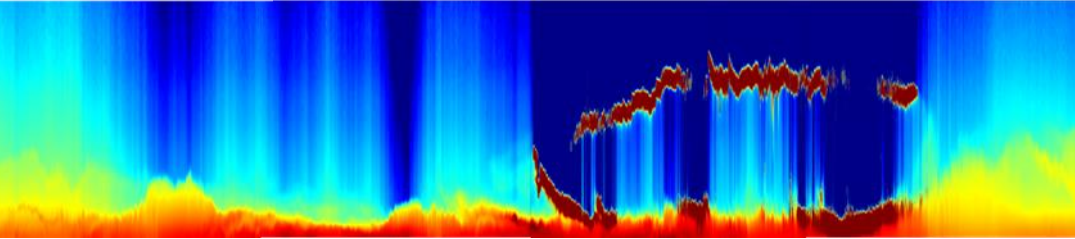
Mixed Layer (km) in Paris
(source : LSCE)



e:
2th

Emergency measures:

- Speed restriction (20 km/h lower than usual)
- Auxiliary wood heating forbidden
- High duty vehicles banned from the inner city
- Free public transportations
- Free residential parking
- Production volume cut for major industries
- **Alternate traffic circulation according to license plate number parity during 4 days**



Efficiency of emergency measures:

- Decrease in circulating vehicles during alternate traffic : **only 5% (potentially 40%)**
 - very low impact on emissions and concentrations (not estimated)

Why ?

- Not enough alternative solutions
- Few controls
- « Unfair » solution

Road traffic: -9 to -18% of vehicles on the road (daily average) depending on the area

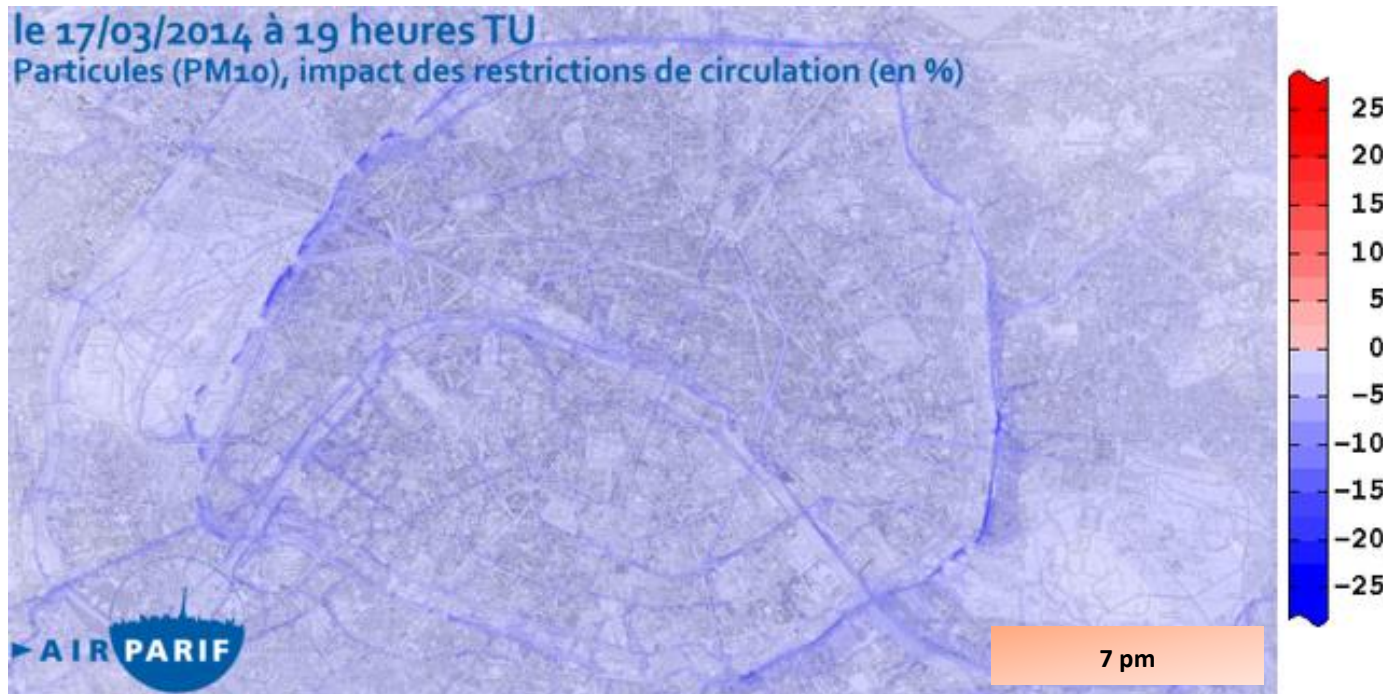
Area	Morning rush hour	Evening rush hour	Daily Average
Paris	-9%	-21%	-18%
Suburban area	-6%	-15%	-13%
Rural area	-4%	-10%	-9%

Source : Airparif, HEAVEN model (based on traffic count from Paris City Hall and DRIEA/DIRIF)

Average evolution of PM10 and NOx emissions during the restriction day, compared to a « normal » situation.

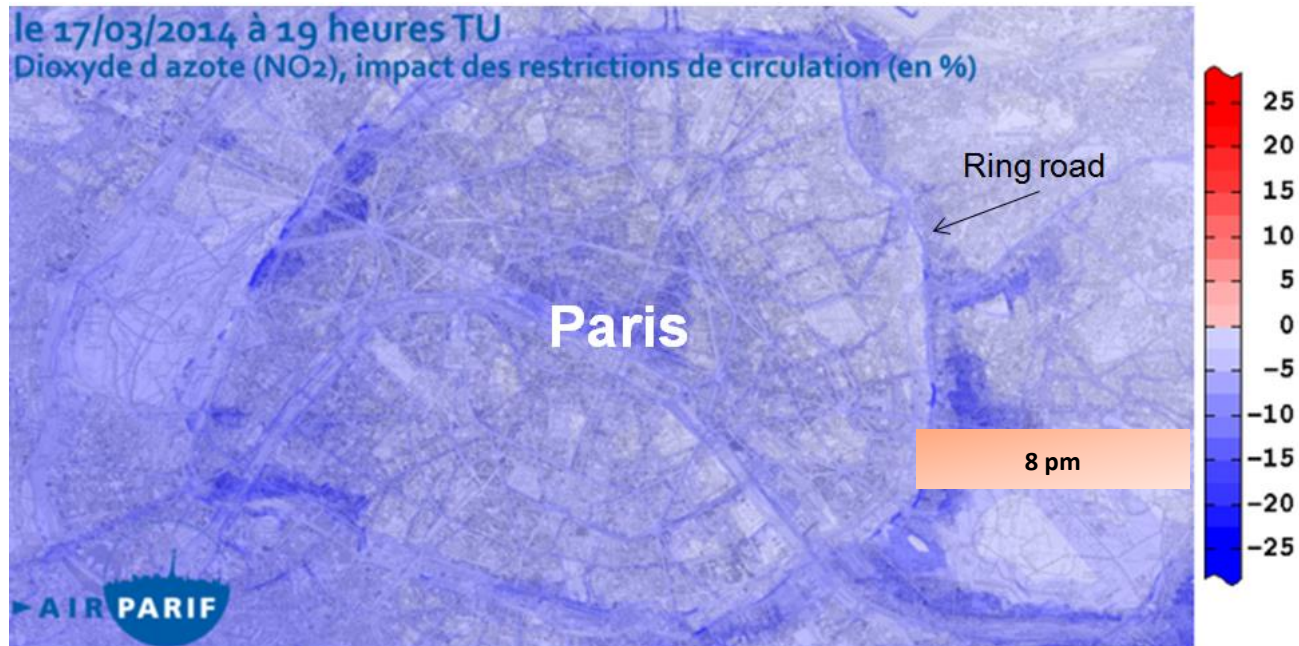
Zone	PM10 emissions	NOx emissions
Urban area covered by traffic restriction	- 15 %	- 20 %
Suburban area (not covered by traffic restriction)	- 8 %	- 13 %
Rural area	- 4 %	- 9 %

Situation	Average decrease in PM ₁₀	Average decrease in NO ₂
Background	- 2 %	- 7%
Traffic (ring road)	- 6 %	- 10%



PM₁₀: More significant drops at specific hours, during the evening rush hour → -10 % on the ring road (even -20 % for some sections)

Situation	Average decrease in PM ₁₀	Average decrease in NO ₂
Background	- 2 %	- 7%
Traffic (ring road)	- 6 %	- 10%



NO₂: More significant drops at specific hours, during the evening rush hour → -30 % on the ring road

3 Crit'Air Framework



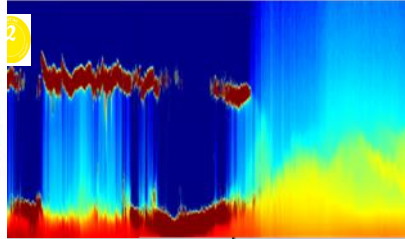


- Vehicles classification in 6 categories (by EURO standards)










Main objectives :

- Reduce emissions and concentrations
- Promote cleaner vehicles
- Anticipate technology park renewal

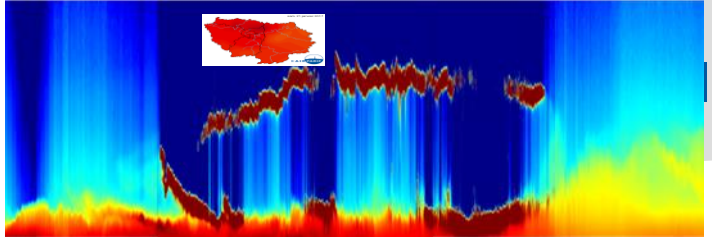
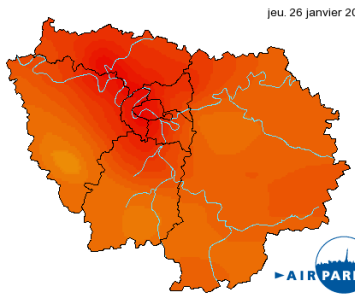


R. 318-1 et R. 318-2 du code de la route

	VÉHICULES UTILITAIRES LÉGERS	POIDS LOURDS, AUTOBUS ET AUTOCAR
	Véhicules électriques et hydrogène	
	Véhicules gaz Véhicules hybrides rechargeables	

Classe	DATE DE PREMIÈRE IMMATRICULATION ou NORME EURO						
	2 ROUES, TRICYCLES ET QUADRICYCLES À MOTEUR	VOITURES		VÉHICULES UTILITAIRES LÉGERS		POIDS LOURDS, AUTOBUS ET AUTOCAR	
		Diesel	Essence	Diesel	Essence	Diesel	Essence
	EURO 4 À partir du : 1 ^{er} janvier 2017 pour les motocycles 1 ^{er} janvier 2018 pour les cyclomoteurs	-	EURO 5 et 6 À partir du 1 ^{er} janvier 2011	-	EURO 5 et 6 À partir du 1 ^{er} janvier 2011	-	EURO VI À partir du 1 ^{er} janvier 2014
	EURO 3 du 1 ^{er} janvier 2007 au : 31 décembre 2016 pour les motocycles 31 décembre 2017 pour les cyclomoteurs	EURO 5 et 6 À partir du 1 ^{er} janvier 2011	EURO 4 du 1 ^{er} janvier 2006 au 31 décembre 2010	EURO 5 et 6 À partir du 1 ^{er} janvier 2011	EURO 4 du 1 ^{er} janvier 2006 au 31 décembre 2010	EURO VI À partir du 1 ^{er} janvier 2014	EURO V du 1 ^{er} octobre 2009 au 31 décembre 2013
	EURO 2 du 1 ^{er} juillet 2004 au 31 décembre 2006	EURO 4 du 1 ^{er} janvier 2006 au 31 décembre 2010	EURO 2 et 3 du 1 ^{er} janvier 1997 au 31 décembre 2005	EURO 4 du 1 ^{er} janvier 2006 au 31 décembre 2010	EURO 2 et 3 du 1 ^{er} octobre 1997 au 31 décembre 2005	EURO V du 1 ^{er} octobre 2009 au 31 décembre 2013	EURO III et IV du 1 ^{er} octobre 2001 au 30 septembre 2009
	Pas de norme tout type du 1 ^{er} juin 2000 au 30 juin 2004	EURO 3 du 1 ^{er} janvier 2001 au 31 décembre 2005	-	EURO 3 du 1 ^{er} janvier 2001 au 31 décembre 2005	-	EURO IV du 1 ^{er} octobre 2006 au 30 septembre 2009	-
	-	EURO 2 du 1 ^{er} janvier 1997 au 31 décembre 2000	-	EURO 2 du 1 ^{er} octobre 1997 au 31 décembre 2000	-	EURO III du 1 ^{er} octobre 2001 au 30 septembre 2006	-
Non classés	Pas de norme tout type Jusqu'au 31 mai 2000	EURO 1 et avant Jusqu'au 31 décembre 1996	EURO 1 et avant Jusqu'au 31 décembre 1996	EURO 1 et avant Jusqu'au 30 septembre 1997	EURO 1 et avant Jusqu'au 30 septembre 1997	EURO I, II et avant Jusqu'au 30 septembre 2001	EURO I, II et avant Jusqu'au 30 septembre 2001

jeu. 26 janvier 2017

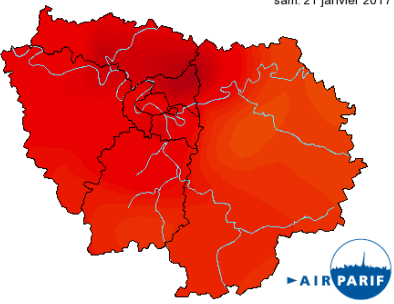


pollution episode



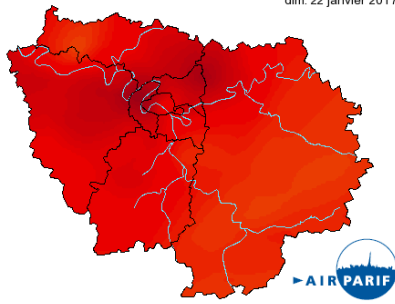
traffic circulation (2016) → Differentiated traffic circulation (2017)

sam. 21 janvier 2017



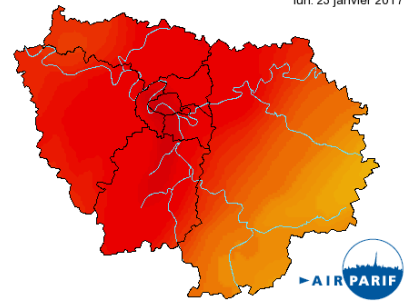
2017/01/21

dim. 22 janvier 2017



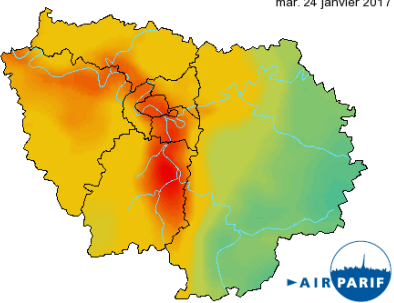
2017/01/22

lun. 23 janvier 2017



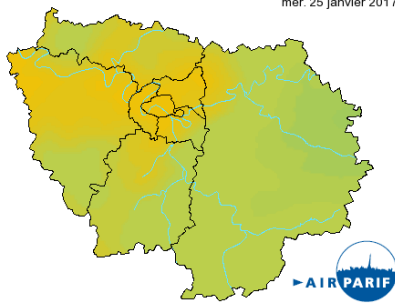
2017/01/23 : Differentiated traffic

mar. 24 janvier 2017



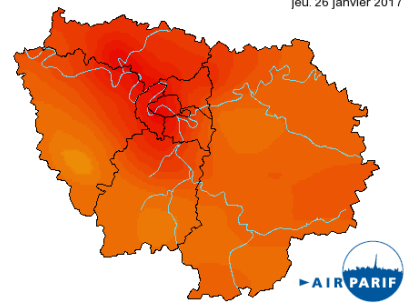
2017/01/24 : Differentiated traffic

mer. 25 janvier 2017



2017/01/25 : Differentiated traffic

jeu. 26 janvier 2017



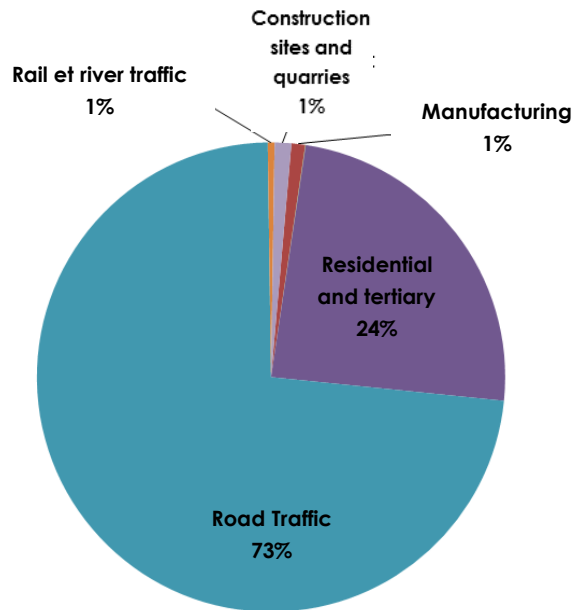
2017/01/26

Non classified & Crit'Air 5 forbidden inside second ring road

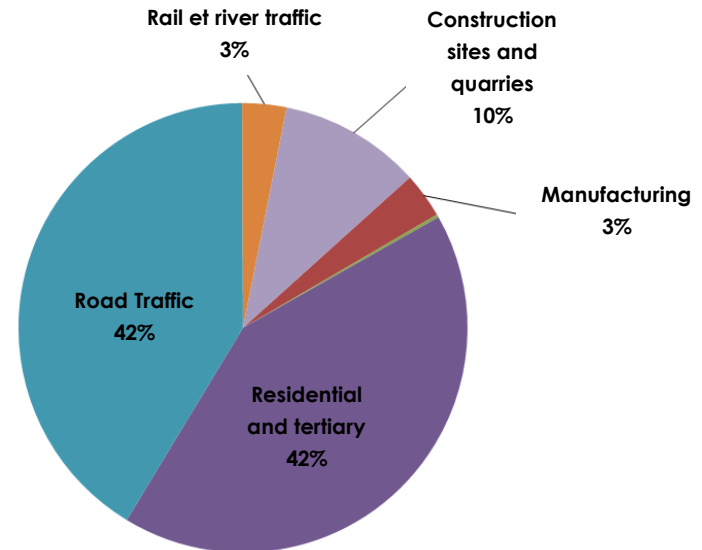


Conditions for a LEZ establishment ?

- Air pollution levels > regulation
- High contribution of traffic in total emissions (73% of NO_x in Paris, 60 % outside Paris)
- Estimation of the potential impact on emissions (and concentrations)



NO₂ emission sources - Paris - 2014

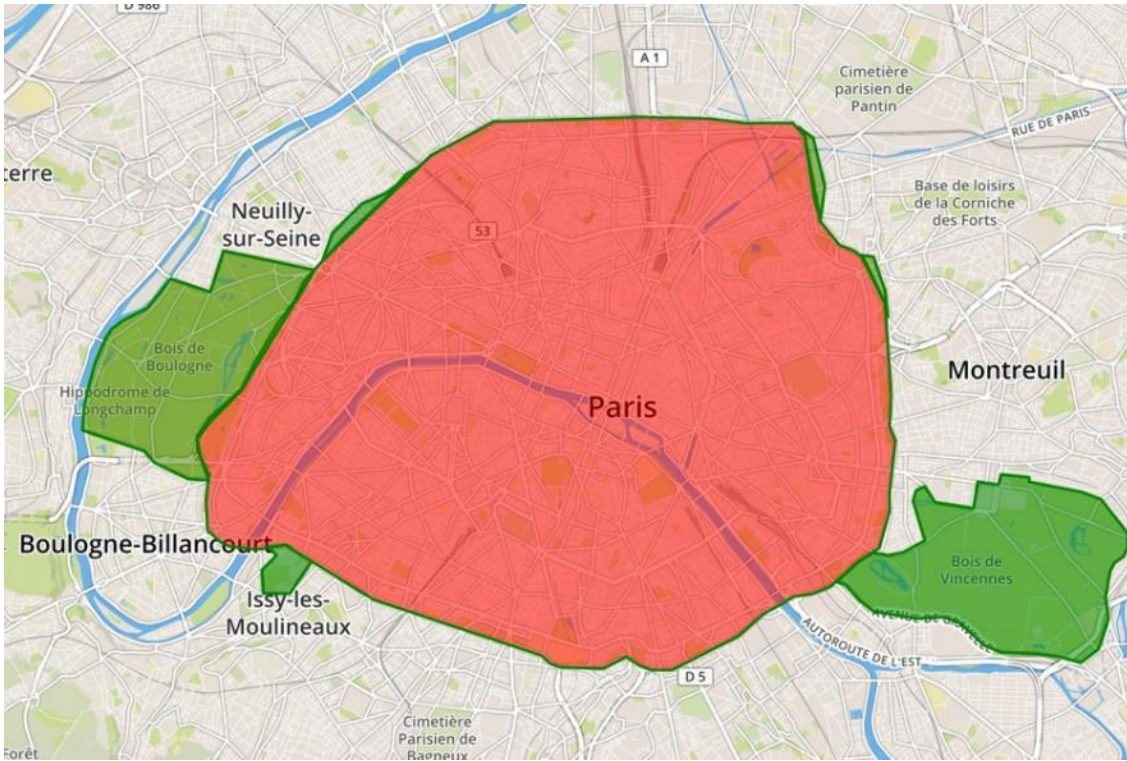


PM₁₀ primary emission sources - Paris - 2014



(Low Emission Zone)

LEZ 2017: Paris intra-muros (without ring road)



- 2.2 millions inhabitants
- 105 km²
- 1.2 million inhabitants exposed to air pollution levels > regulation (NO₂)
- LEZ, ring road excluded, in order to avoid traffic migration

First step
(since 2016/07/01):



Second step
(since 2017/07/01):



Third step:



Fourth step:



First step



-2%

**MOST
POLLUTING
VEHICLES**



=

-5% NO_x

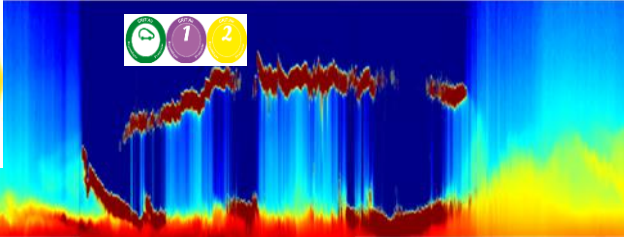
-3% PM₁₀

-4% PM_{2.5}



**Traffic
Emissions**





(Low Emission Zone)

Second step



-3%

MOST
POLLUTING
VEHICLES

=

-15% NO_x

-8% PM₁₀

-11% PM_{2.5}

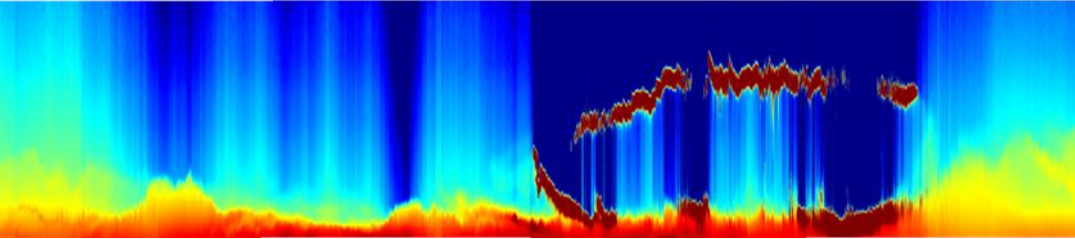


Traffic
Emissions



4 | Perspectives



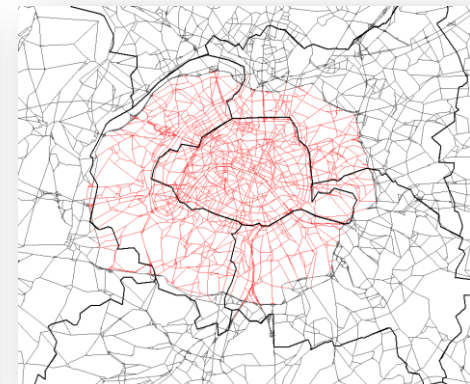
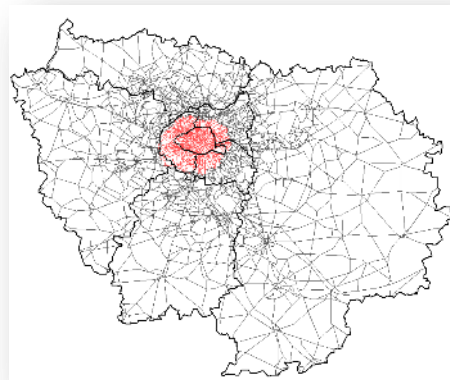


Pollution episodes:

- 2-day forecast to better anticipate episodes
- Emergency measures automation

LEZ:

- Estimation of LEZ impacts:
 - ➔ on concentrations
 - ➔ on exposed inhabitants to air pollution levels > regulation
- Steps 3 & 4
- Other estimated scenarios
 - ➔ LEZ, ring road included
 - ➔ Greater LEZ (inside A86)





L'Observatoire au service de la Santé
et de l'Action

airparif.fr



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