

Analysis and perspectives of ozone pollution in Lombardia Region

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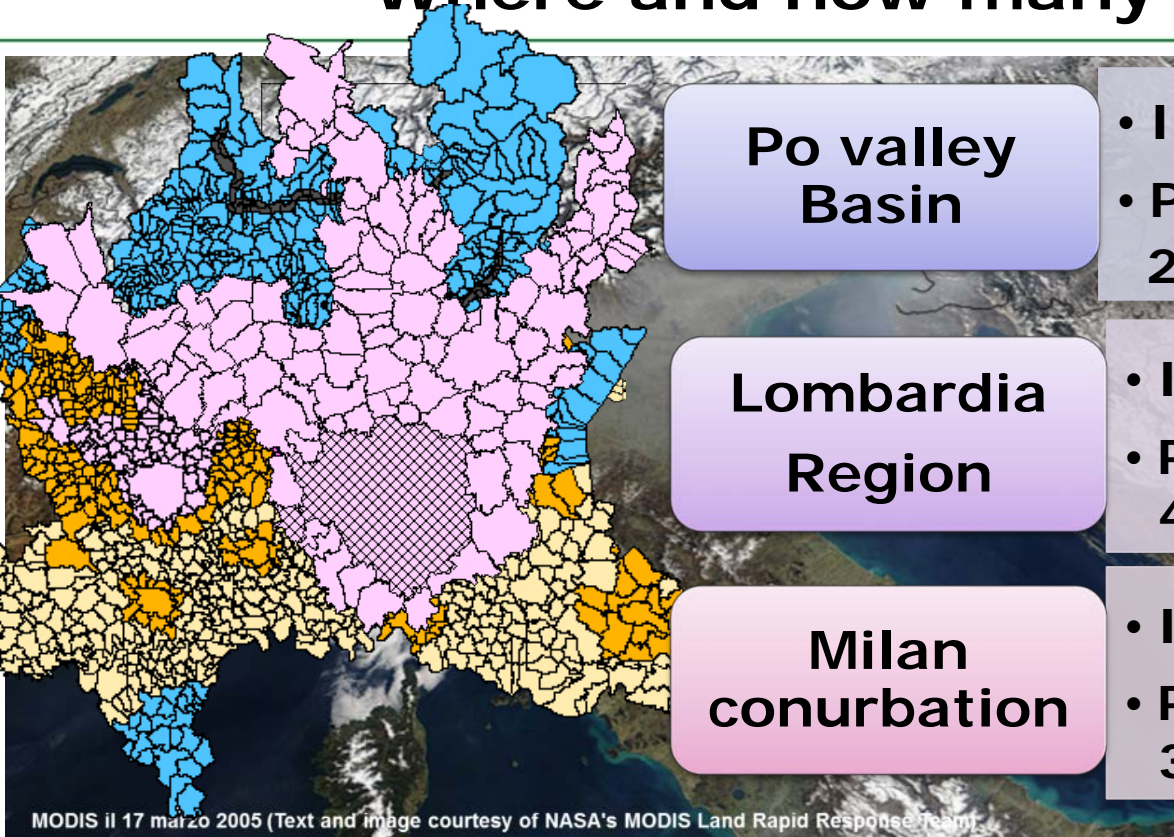
Matteo Lazzarini, Gian Luca Gurrieri

Lombardia Region

Workshop on air quality policy implementation related to ozone

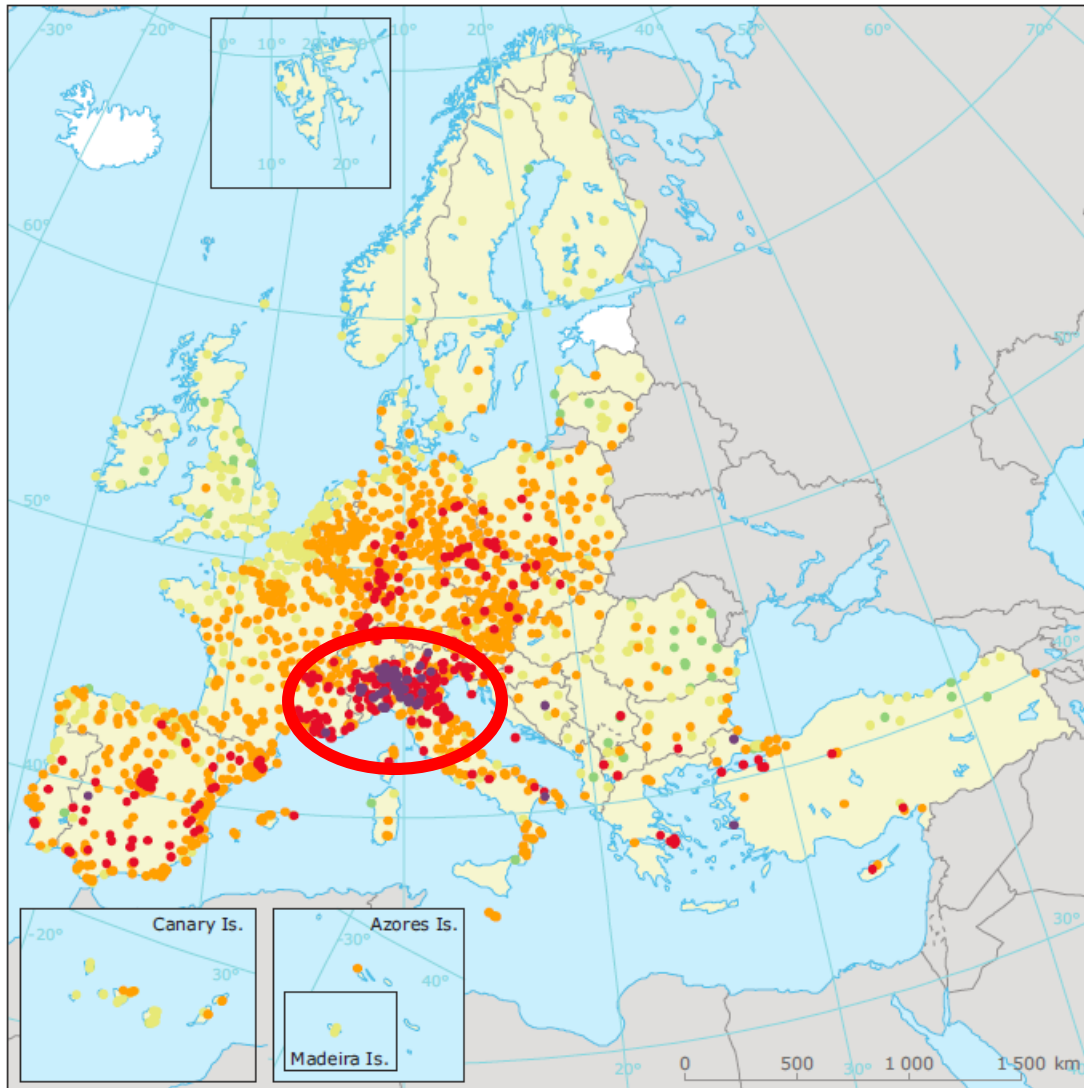
Madrid, Wednesday 21 - Thursday 22 November 2018

Milano and Lombardia: Where and how many



- Po Valley: closed by mountains exceeding 2500 m a.s.l. on three sides (highest peaks exceeding 4000 m a.s.l.)
- Meteorological conditions often adverse to air pollution dispersion: low average wind speed also during warm season

Concentrations of O₃ in 2016



93.2 percentile of O₃ maximum daily 8-hour mean in 2016

µg/m³

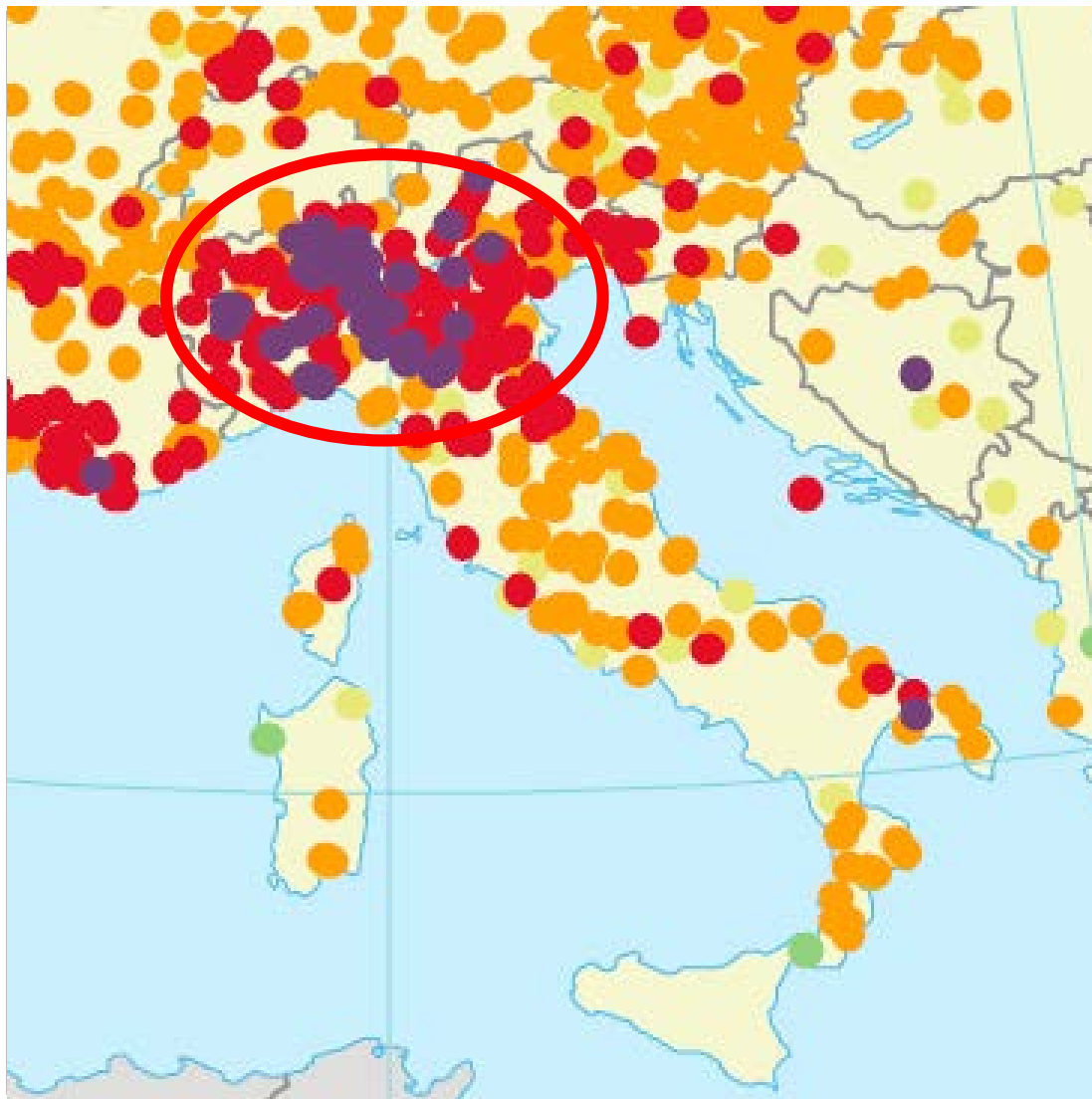
- ≤ 80
- 80-100
- 100-120
- 120-140
- > 140

- No data
- Countries/regions not included in the data exchange process

Source:
EEA Air Quality Report 2018

Widespread exceedances of both health and vegetation thresholds

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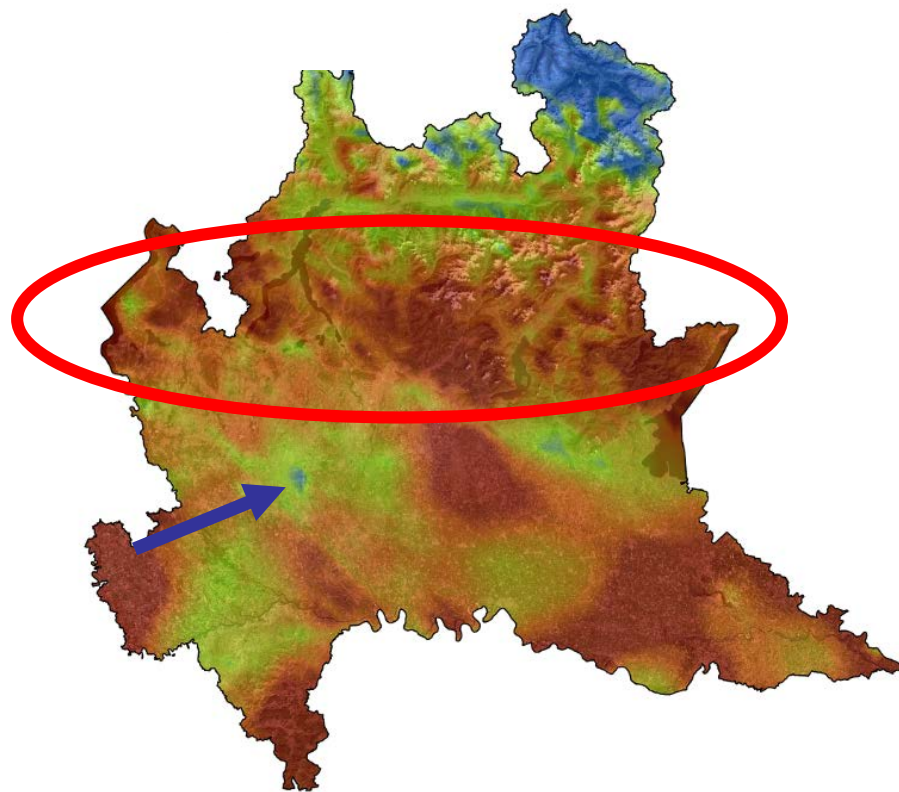
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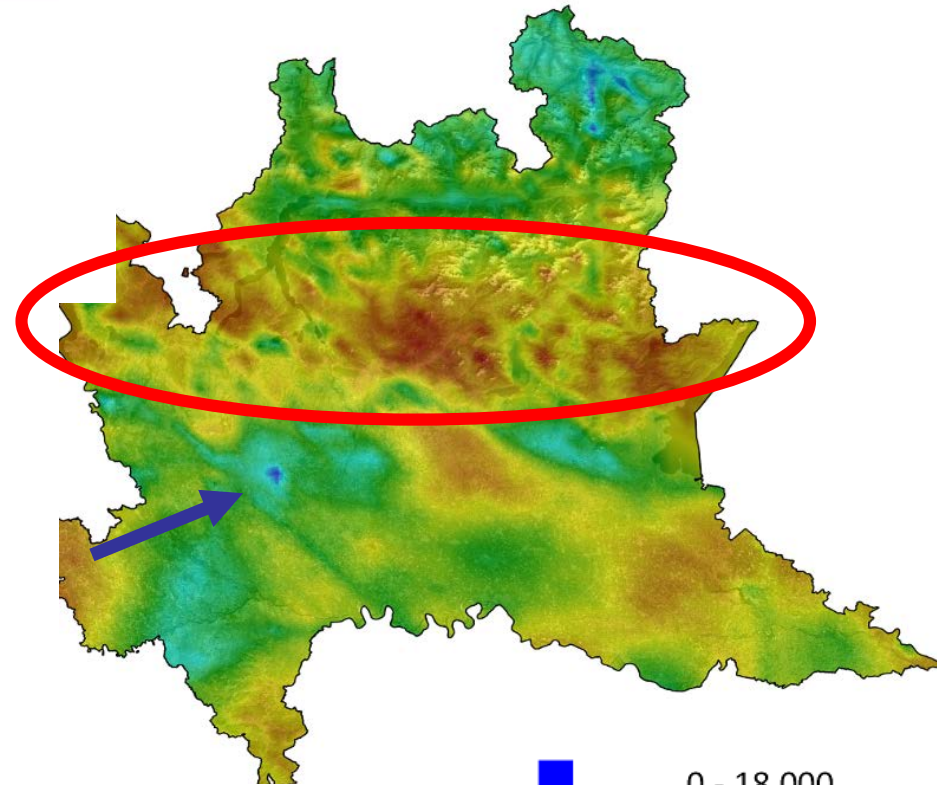
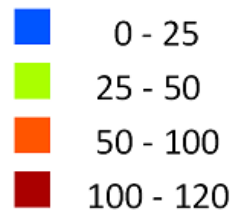
EEA Air Quality Report 2018

Widespread exceedances of both health and vegetation thresholds

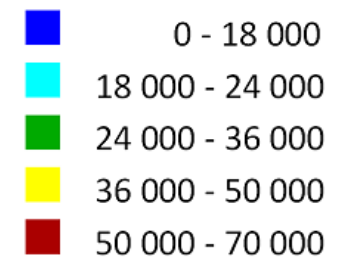
Concentrations of O₃ in 2017 Lombardia region



**Numbers of days
Maximum daily
8 hours average
> 120 µg/m³**



**AOT40
µg/m³ h**

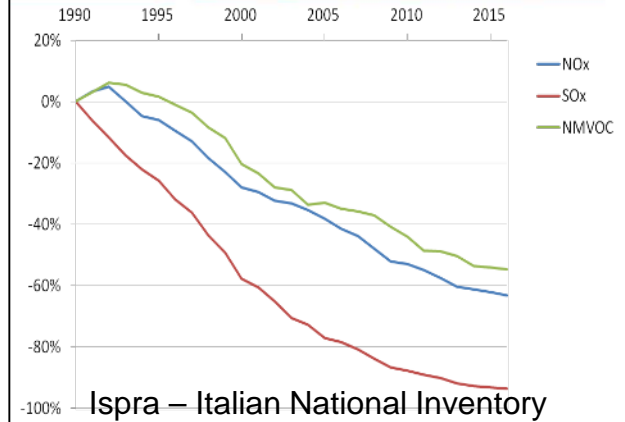
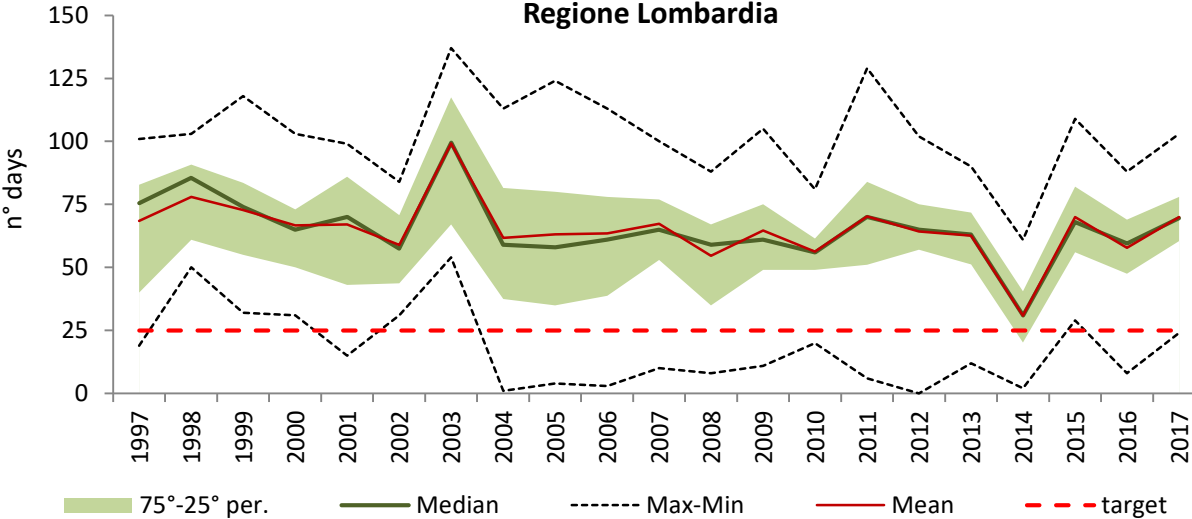


Widespread exceedances of both health and vegetation thresholds
Highest values in Prealpine areas, downwind to the areas with highest emissions.

Ozone Concentrations trends during years

N° of days with maximum 8h mean > 120 $\mu\text{g}/\text{m}^3$

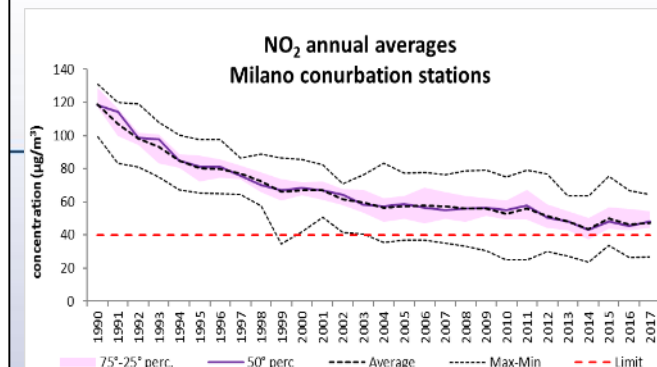
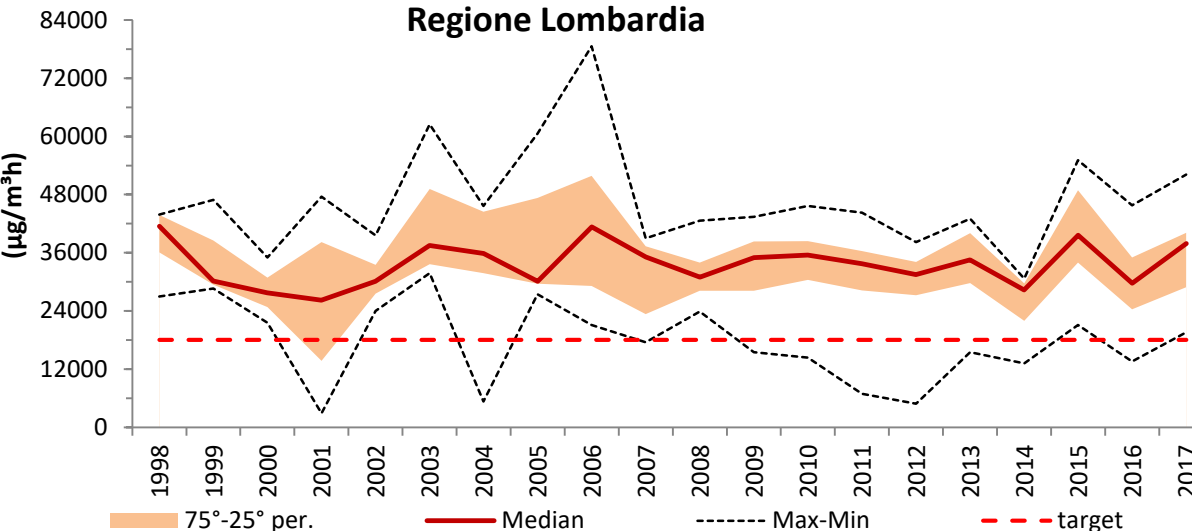
Regione Lombardia



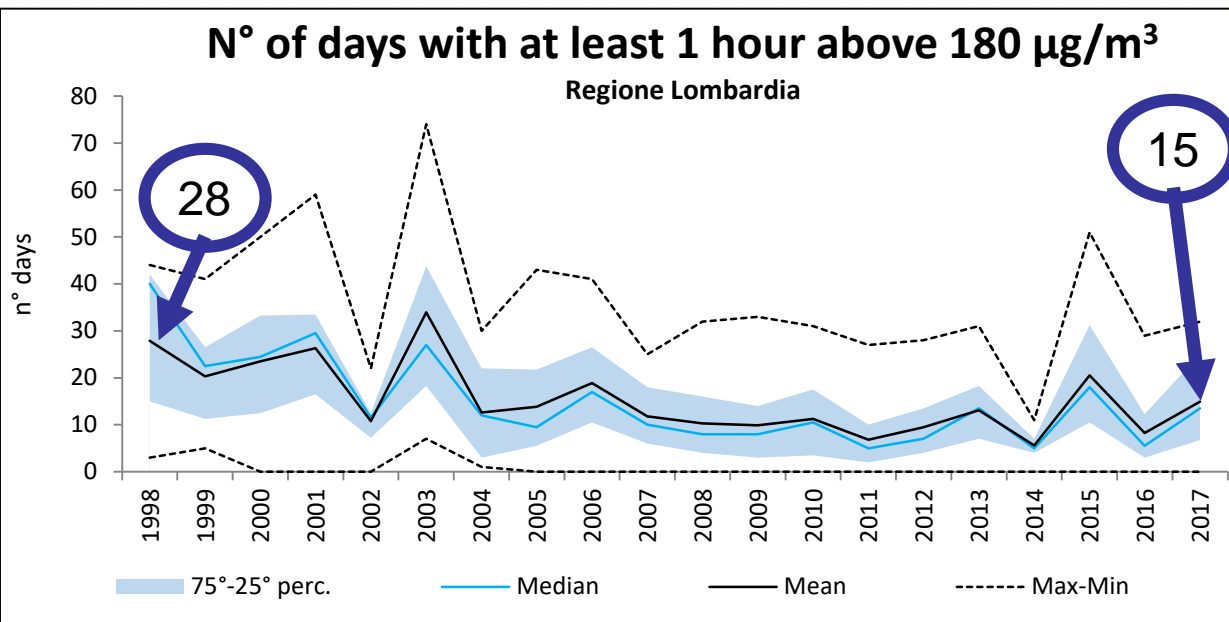
Despite the decrease of NOx and NMVOC emissions (and NO2 concentrations) for ozone the number of days above $120 \mu\text{g}/\text{m}^3$ and the AOT40 are quite stable

AOT40 (May-July)

Regione Lombardia



Ozone Concentrations trends during years

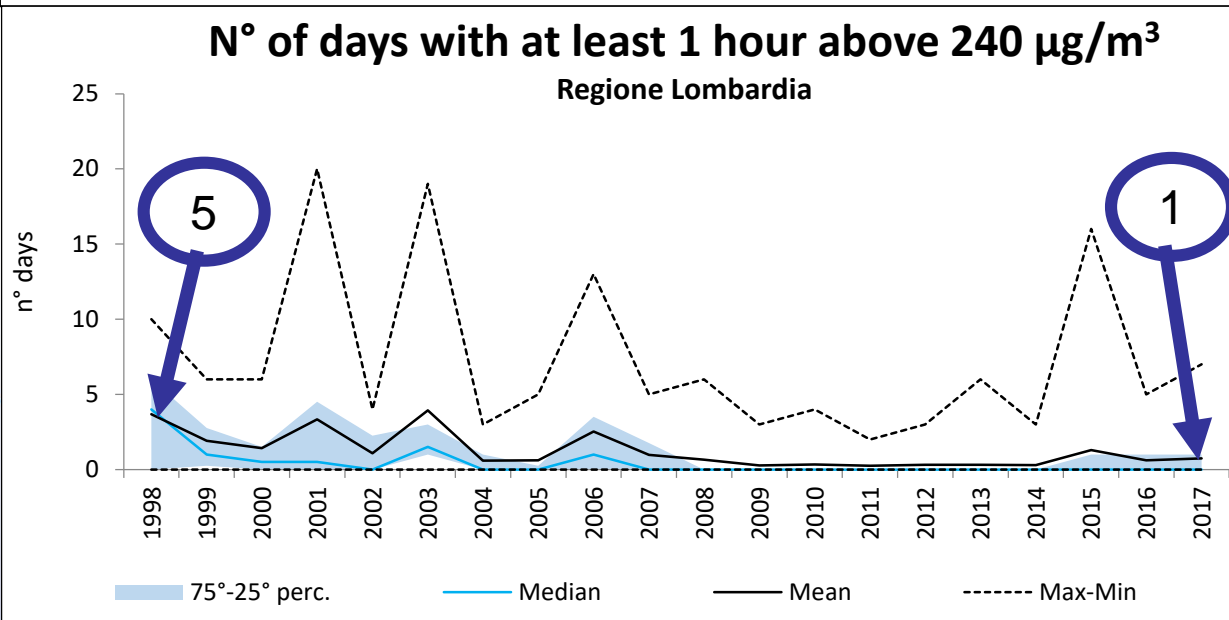


Is it detectable a decrease in the highest values?

Notice: these figures are referred to the 45 background stations of Lombardia Region.

On average:

Days with at least 1 hour > 180 $\mu\text{g}/\text{m}^3$:
 28 in 1998, 15 in 2017



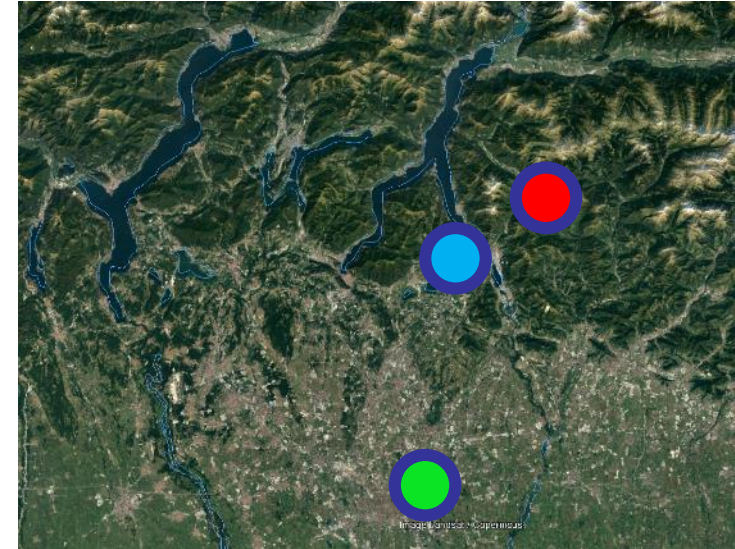
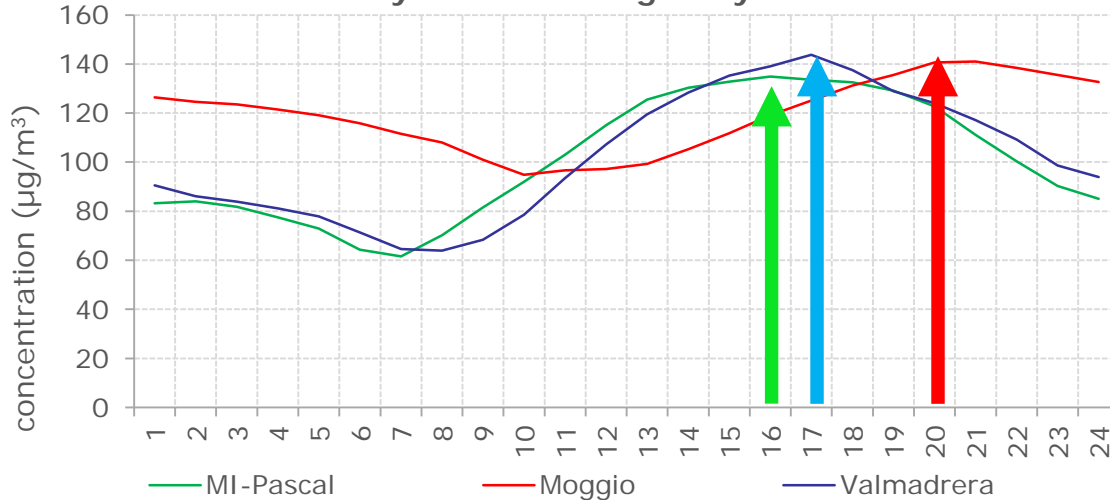
Days with at least 1 hour > 240 $\mu\text{g}/\text{m}^3$:
 5 in 1998, 1 in 2017

No trends for annual average

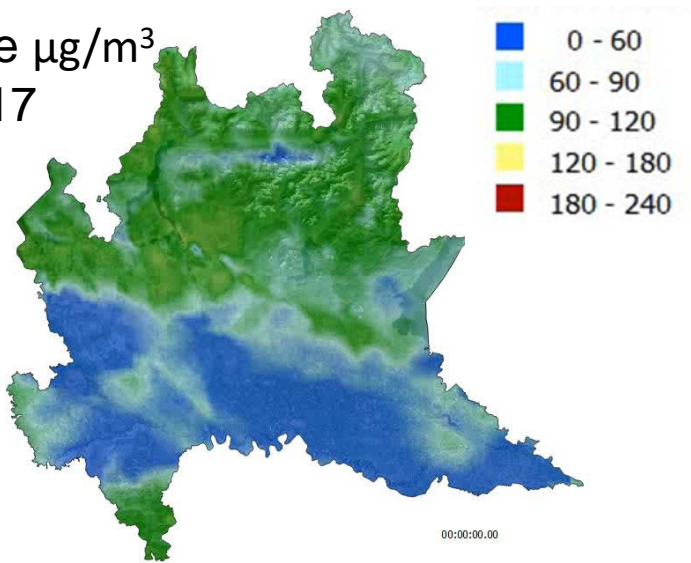
No differences among trends of urban and rural stations

The typical daily evolution

Daily trend - average July 2017



Ozone $\mu\text{g}/\text{m}^3$
 23.6.17



NO_x emissions of Milano and of the most populated area are transported to the mountains by the valley breeze.

Ozone begins its formation in Milan, and then it is transported step by step to the prealpine region, too

Emissions, key challenges Po Basin

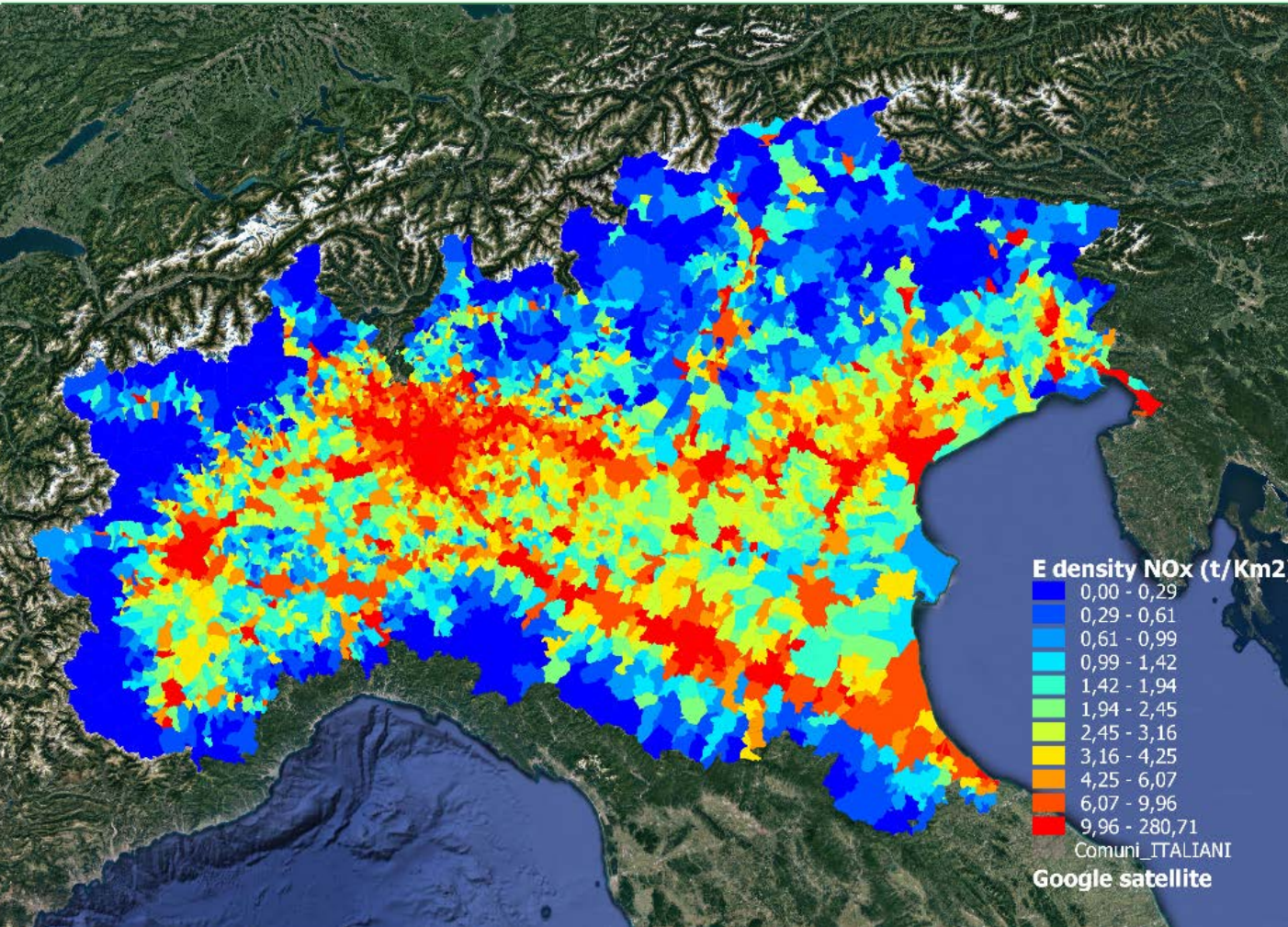
Sector	NO _x	NM VOC
Energy production and refineries	7 %	0 %
Residential combustion	9 %	8 %
Industrial combustion	15 %	1 %
Production processes	3 %	5 %
Extraction and distribution of fuels	0 %	3 %
Solvent use	0 %	25 %
Road Transport	53 %	7 %
Other mobile sources	11 %	1 %
Waste treatment and disposal	1 %	0 %
Agriculture	1 %	18 %
Other sources and sinks	0 %	32 %

Source:
Life project



It is important (and feasible) to reduce NO_x, in particular from traffic
NM VOC from «other sources and sinks» are mainly of natural origin (forest ..)

NOx Emissions density t/km2

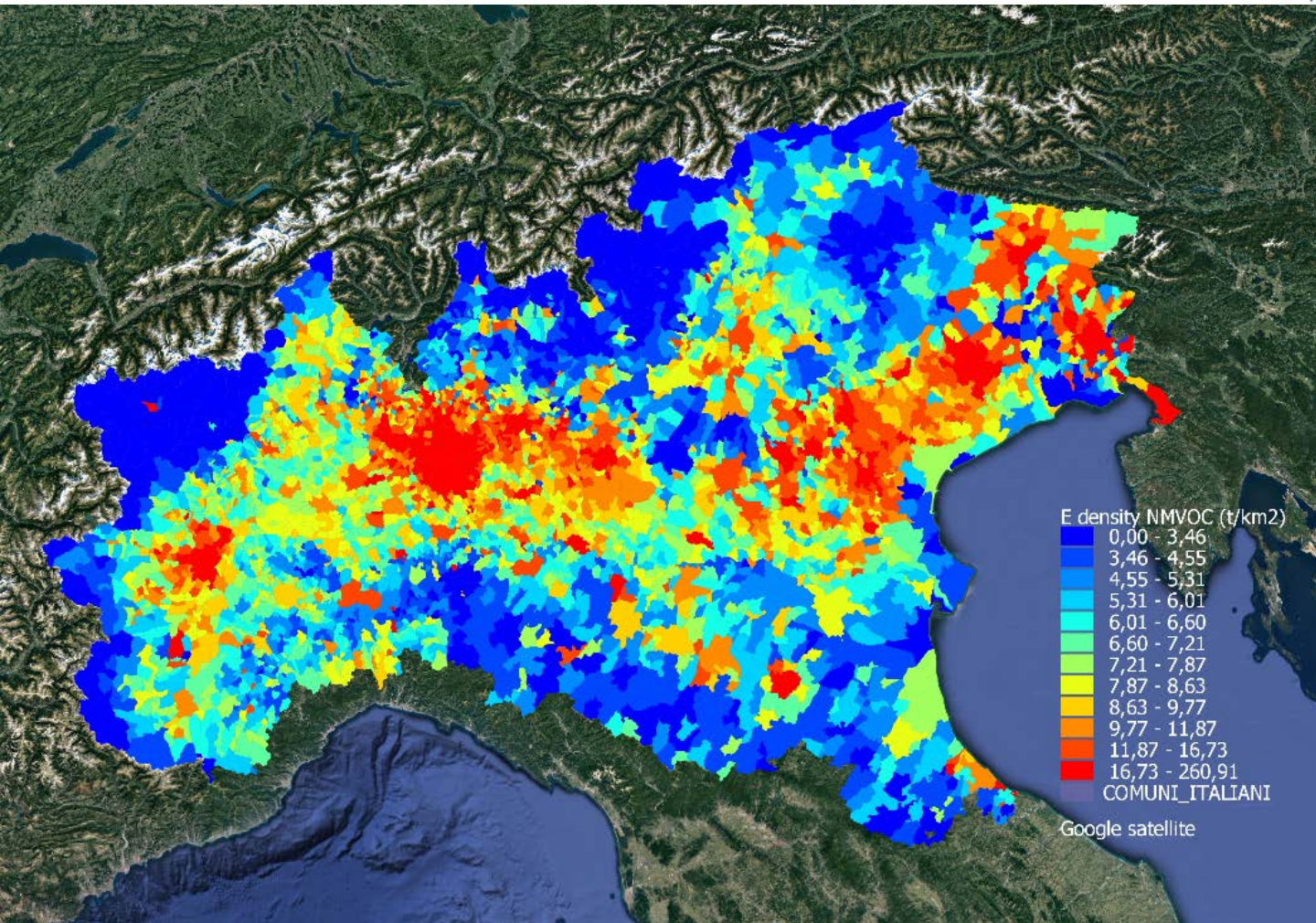


Source:
Data elaboration of
ARPA Lombardia
on
Life project
Prepair dataset A1



Milano area and the highways are clearly recognizable

NMVOC Emissions density t/km²

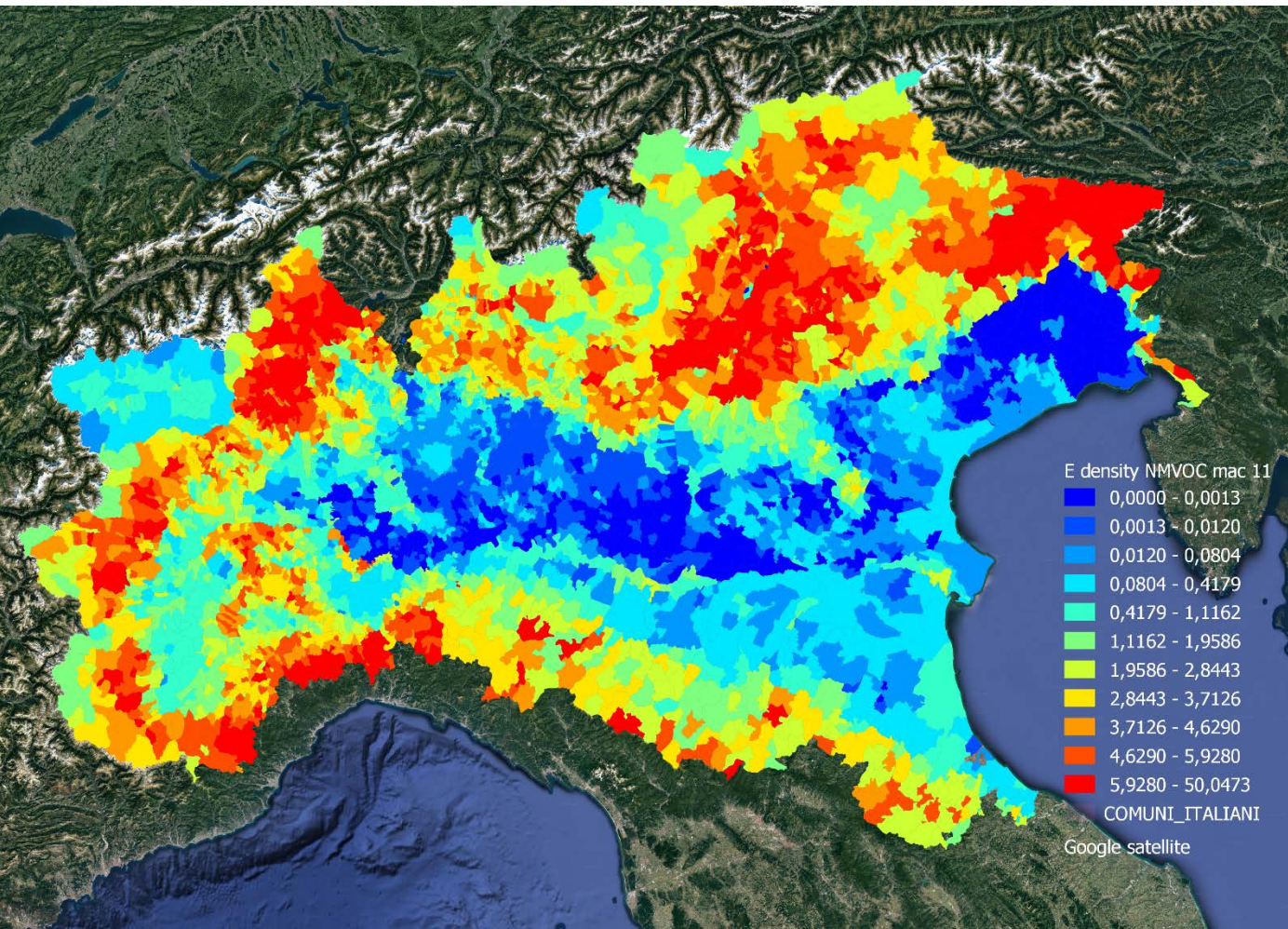


Source:
Data elaboration of
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Prepair dataset A1



Milano area is clearly recognizable but the distribution is different,
also the mountain area is (partially) recognizable

NMVOOC Emissions density t/km2 only from forests



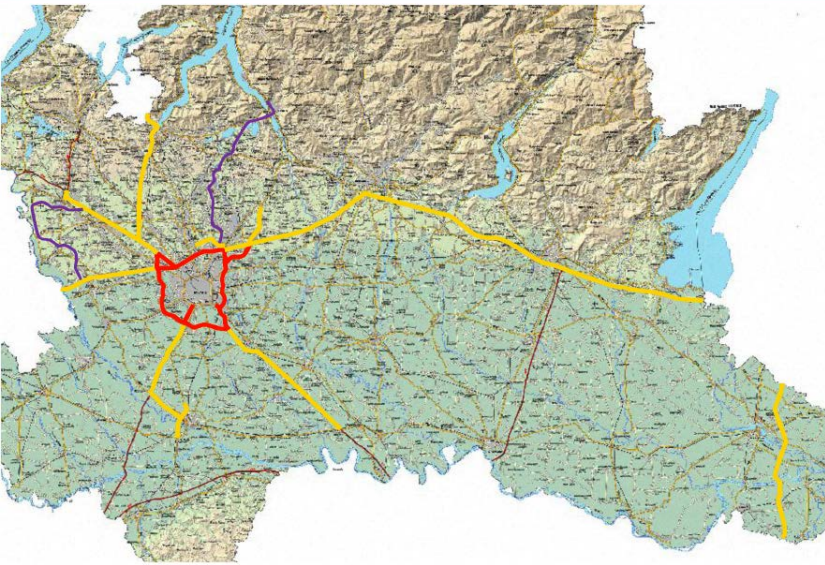
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(the scale is different)

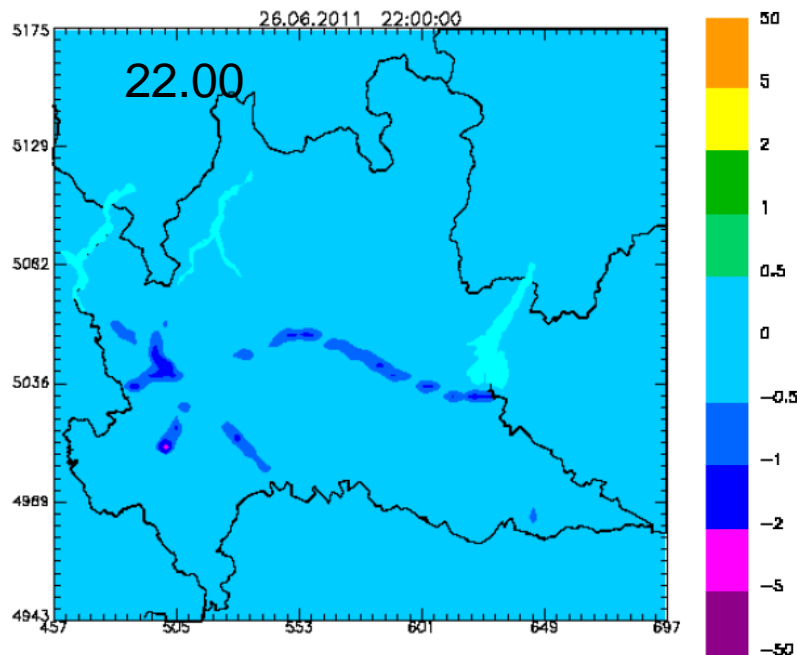
Short term measures?

The decrease of speed limits on highways



Hypothesis: to decrease from 130 km/h to 80 km/h the maximum allowed speed on Lombardia Region highways (413 km) from 4 days before the day with the forecasting of the maximum levels of ozone

Decrease of 2.6% of regional NOx emissions during that days (negligible for NMVOC)



Decrement of ozone concentrations comprised between $-0.5 \mu\text{g}/\text{m}^3$ and $+0.5 \mu\text{g}/\text{m}^3$ at 17.00
It is observable just a limited **increase** of ozone during the first hours of night near the highways

(it is a quite old study, referred to 2011)

What is it foreseen for the future?

Results of different structural measures

Update of regional air quality plan

- Measures on **transport and mobility**: ex.: big LEZ progressively to Euro 5 diesel cars (till to Euro 2 diesel and 0 gasoline also during summer), undergrounds, bike and car sharing
- Measures about **stationary sources**: ex: promotion of energy efficiency and rational use of energy; *Wood combustion rules and limitations*; Industrial plants and waste treatment: BAT and limitations to resettle of new plants
- *Measures about **agriculture**; ex: anaerobic digestion of manure and direct injection in the field*

Po valley agreement

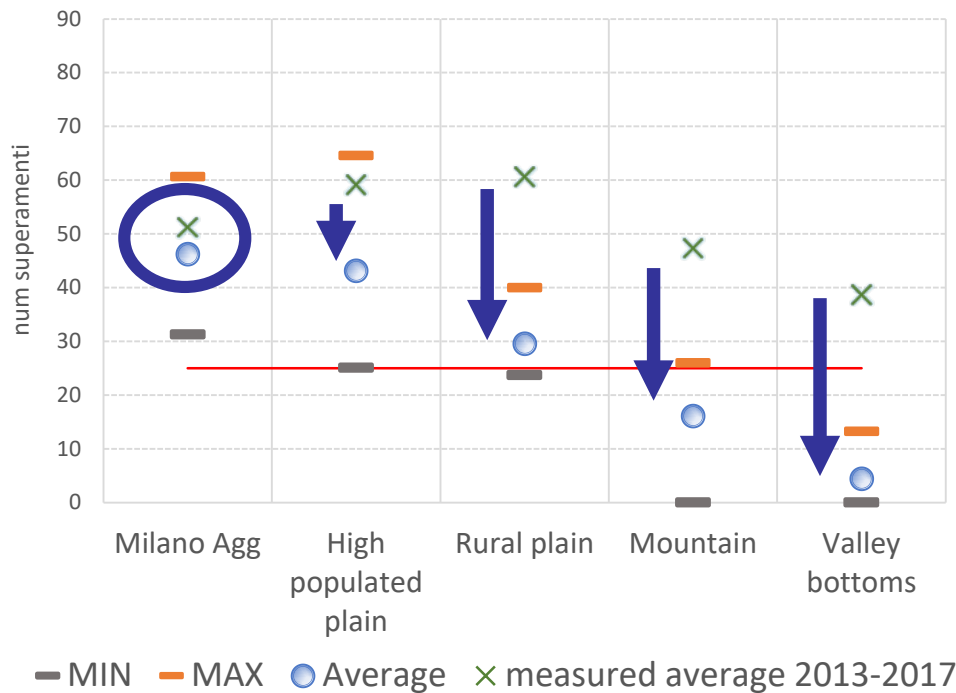
- Progressive Ban of Euro 4 and Euro 5 diesel cars and trucks in urban areas
- Decrease of max speed on highways from 130 to 100 km/h
- *Progressive ban of not ecodesign wood stoves*
- *Covering manure storage facilities*
- *Proper methods of spreading and burying of fertilizers (examples)*

Emission reductions Scenario- 2015

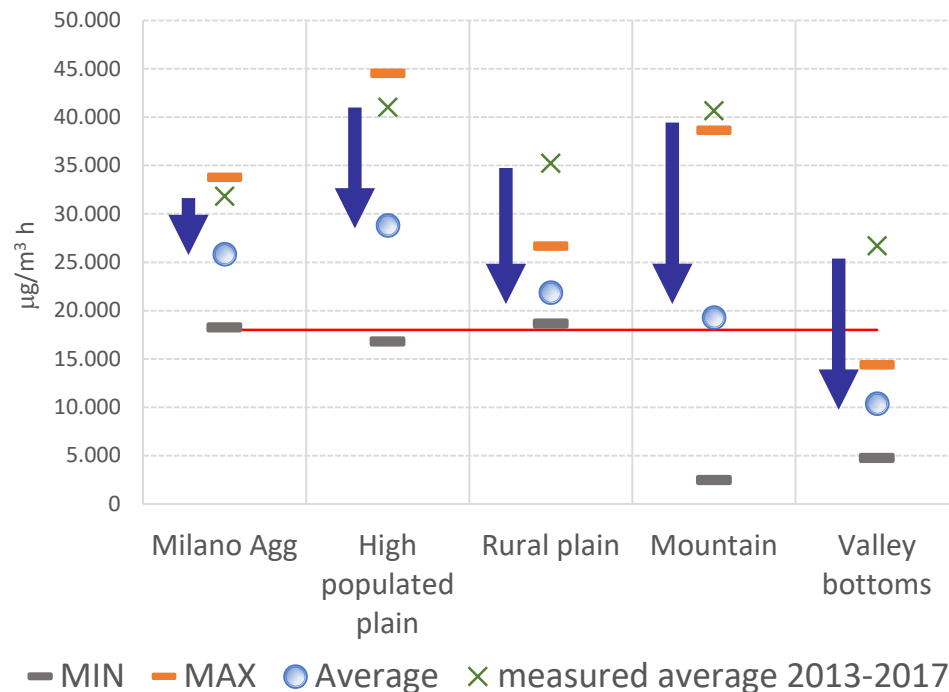
	SO2	NOx	VOC	CO	NH3	PM2.5	PM10
CLE 2020	3%	-21%	-3%	0%	-2%	-8%	-9%
CLE 2025	2%	-32%	-4%	0%	-2%	-13%	-14%
Update of Regional Air Quality Plan PRIA	-1%	-38%	-7%	-25%	-26%	-48%	-44%
Po valley agreement	2%	-48%	-6%	-21%	-29%	-45%	-42%

Ozone concentrations foreseen With updated regional air quality plan

N. days max 8h average >120 ug/m3



AOT40



Not many improvement in Milano agglomerate but important decreases in the mountains, in the rural plain and also in the high populated plain, downwind to the areas with the highest emissions – similar results for Po valley agreement scenario

- In Lombardia and in Po valley, the exceedances of ozone EU target values are important and widespread both for health and vegetation protection
- The highest values are measured downwind to the most populated areas
- Despite the important decrease of NO_x and NMVOC in the last 20 years the number of days with max 8h average >120 µg/m³ and AOT40 are quite stable
- The number of days with max 1h > 180 µg/m³ and 240 µg/m³ seems to decrease in the same period

- Ozone pollution is due to NO_x (in particular from diesel and industrial activities) and NMVOC (also of biogenic origin) emitted in the whole Po Valley.
- Short term/ local measures seem to be unproductive, while structural measures, on a large scale (like those of the regional updated air quality plan and of Po Valley agreement), seem to be more effective
- But, even with the important further NO_x reductions established, implemented in PRIA, in the biggest urban areas (like Milano agglomerate) foreseen ozone concentrations appear to be quite stable (they don't increase but don't decrease enough) while in the other areas, important decrement can be obtained

Acknowledgments

Without the work of our colleagues neither this presentation nor any of the presented results would have been possible. I really thank them:

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Thank you for your attention

Gracias por su atencion