



# COVID & AIR QUALITY

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6 Ottobre 2021

# IMPACTS of the COVID-19 LOCKDOWN on AIR POLLUTION in the PO VALLEY

- The lockdown measures
  - Sources analysis
  - Impact on polluting emissions
  - Meteorological data analysis
  - Model analysis (NINFA-ER and FARM-PI)
  - RRQA data Analysis: PM and gas
  - PM10 chemical composition
- 
- 

Whole basin;  
1° and 2° report

5 sites; 3° report

[https://www.lifeprepair.eu/wp-content/uploads/2020/06/COVIDQA-Prepair-19Giugno2020\\_final.pdf](https://www.lifeprepair.eu/wp-content/uploads/2020/06/COVIDQA-Prepair-19Giugno2020_final.pdf) --> 1° Report

<https://www.lifeprepair.eu/wp-content/uploads/2020/09/COVIDQA-Prepair-2-17Settembre2020.pdf> --> 2° Report

[https://www.lifeprepair.eu/wp-content/uploads/2021/02/Prepair\\_covidQA\\_Report3\\_def2.pdf](https://www.lifeprepair.eu/wp-content/uploads/2021/02/Prepair_covidQA_Report3_def2.pdf) --> 3° Report

Analysis based on 3 indicators capable of providing a daily estimate of the atmosphere ability to favor the accumulation or dispersion of pollutants.

COSMO-5M meteorological model hourly analysis (Turin, Milan, Bologna, Padua and Trieste: 20 January to 31 May 2020)

### **Recirculation:**

identifies the wind regimes that keep pollutants in a limited area

### **Stagnation:**

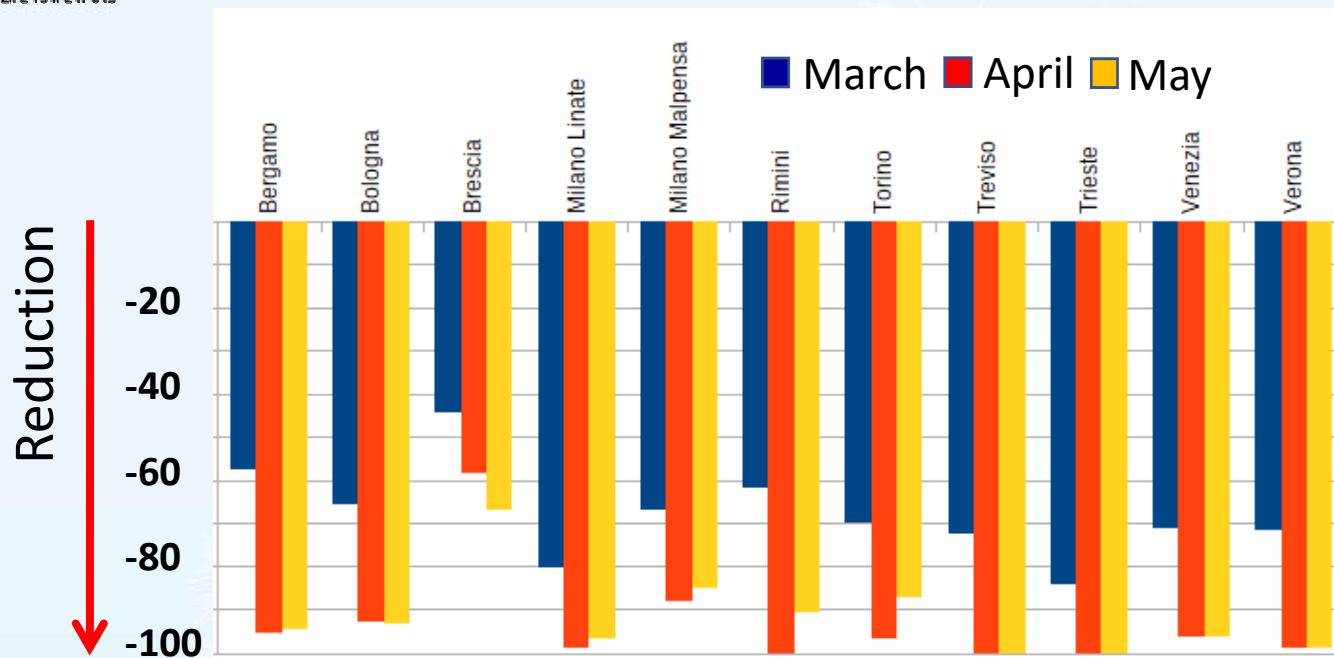
identifies days with very low wind

### **Ventilation:**

indicator of the ability to dilute pollutants

Mese	Periodo	Descrizione
gennaio	20-24	stabile per campo alta pressione
	25-27	debole perturbazione, correnti sud-occidentali con scarso rimescolamento del BL
	28-29	graduale aumento ventilazione per passaggio perturbazione
	30-31	Stabile
febbraio	1-3	stabilità per condizioni anticicloniche
	4-5	perturbazione da nord con irruzione aria artica, rinforzo della ventilazione (Foehn)
	6-10	stabilità per alta pressione
	11-12	onda depressionaria atlantica, aumento della ventilazione
	13-16	stabilità per alta pressione
	17-19	debole perturbazione, correnti da sw in quota, scarso rimescolamento dei bassi strati
	20-23	stabilità per alta pressione
	25-29	dispersione, aumento ventilazione per correnti settentrionali (Foehn)

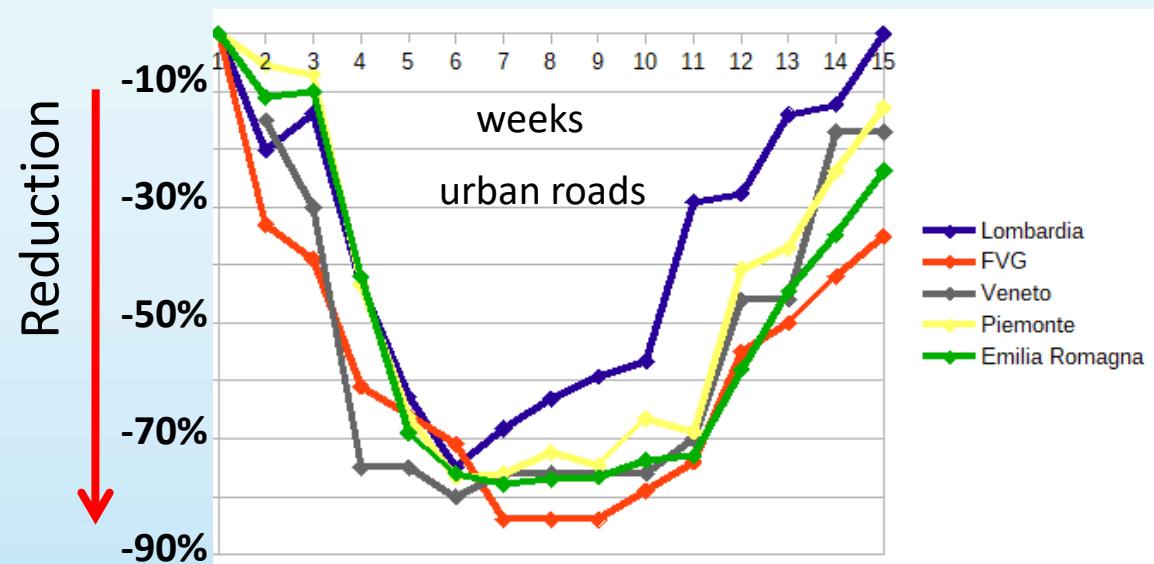
# COVID & AIR and ROAD TRANSPORT



Progressive reduction up to an almost total reduction

Reduction of light and heavy traffic over  $\approx 80\%$  and 50% for main roads and highway

<https://www.lifepreair.eu/>

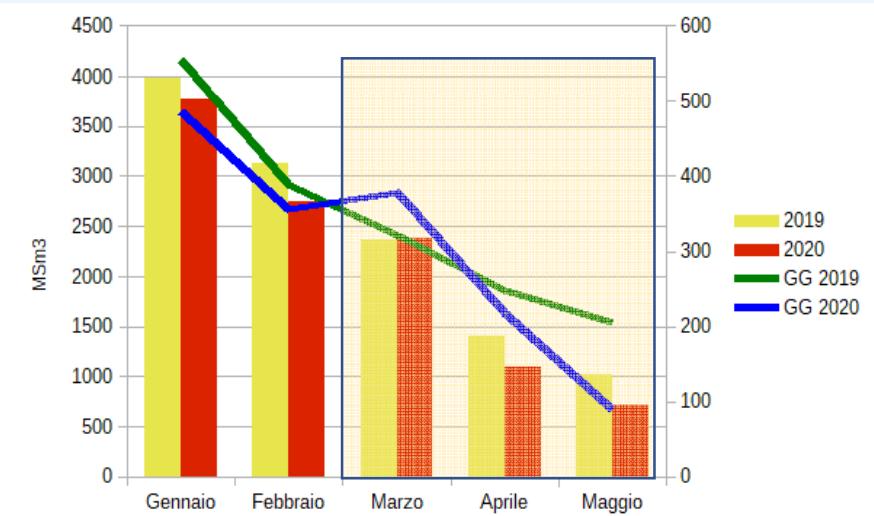


**Public or private services: reduction from 25% to 65%** (consistent with ISTAT data relating to the number of employees in the ATECO activities affected by lockdown)

**Domestic heating:** the normalized data with respect to the temperature trend, showing an **increase** from 5% to 15%

**Industry:** reduction from 6% to 35% (confirmed by the data collected in the SME emissions)

## NATURAL GAS basin area

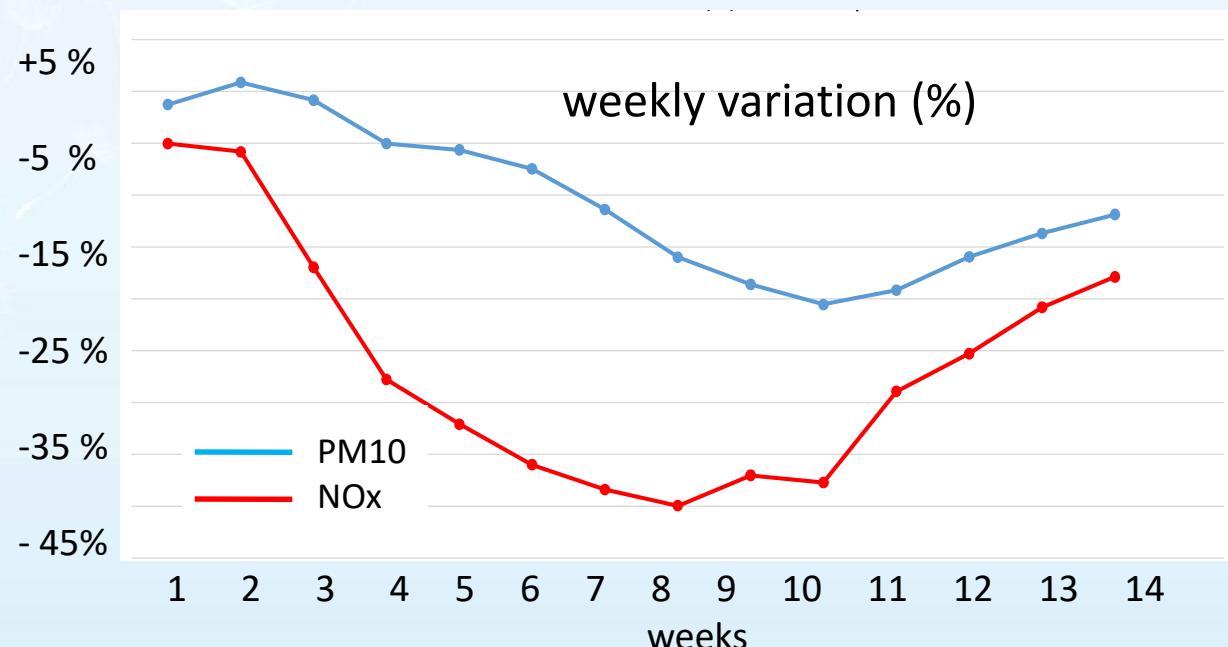


Based on natural gas distributed and electricity supplied from TERNA

# COVID & EMISSIONS

% reductions were assessed compared to a theoretical scenario without lockdown with weekly detail

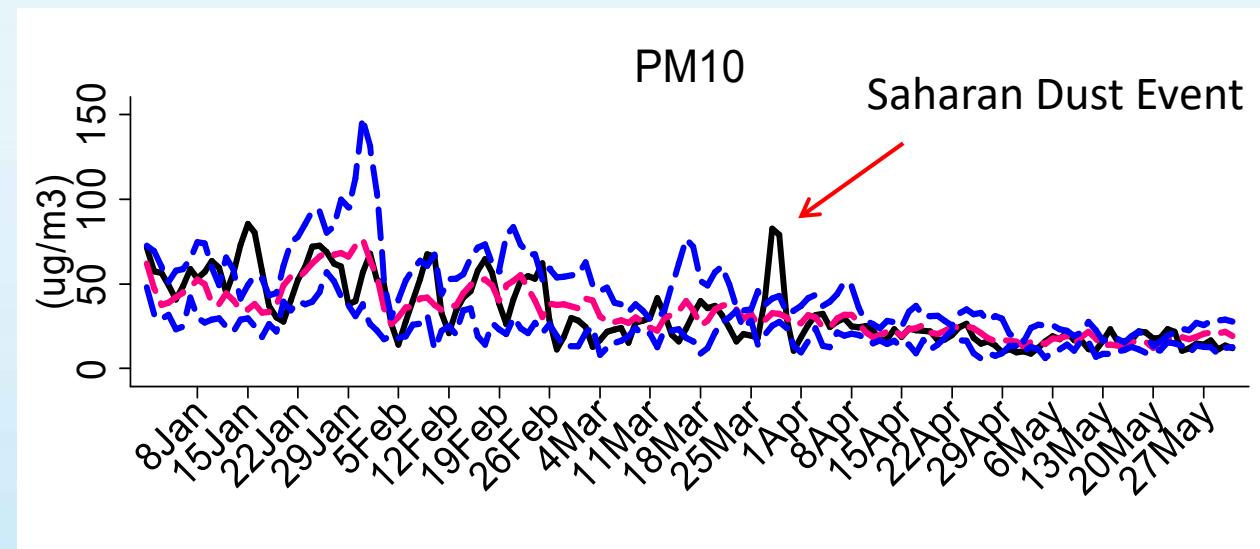
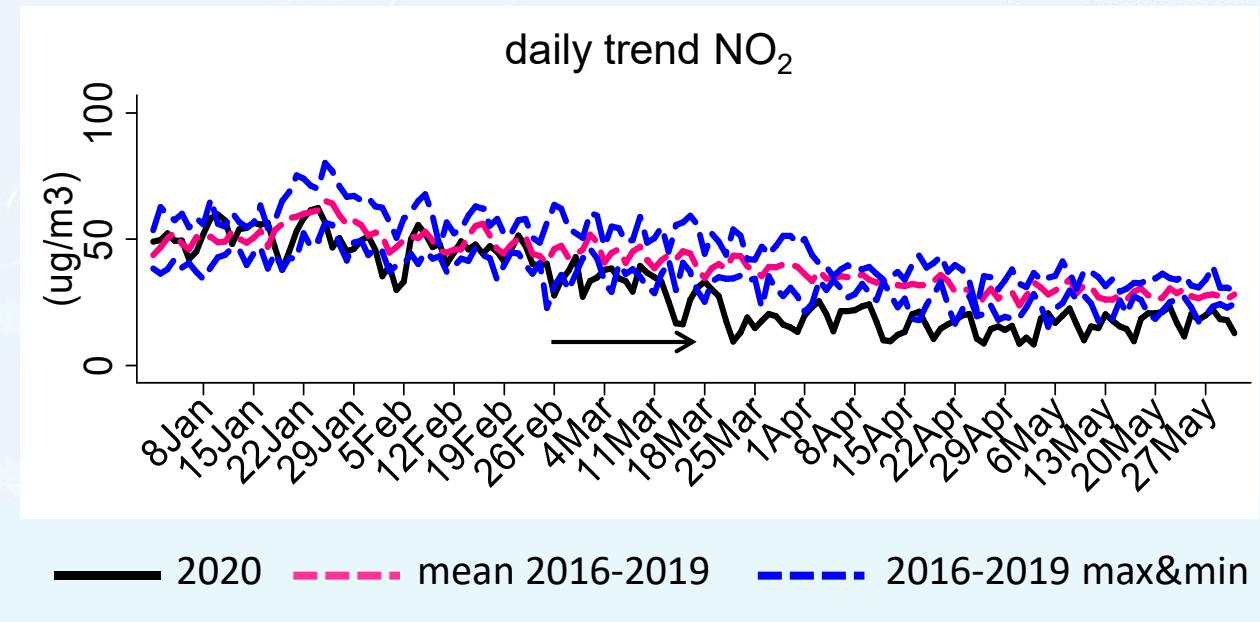
1° week  
22/02/2020 - 28/02/2020  
...  
...  
14° week  
23/05/2020 - 29/05/2020



# COVID & AIR QUALITY ANALYSIS

NO, C<sub>6</sub>H<sub>6</sub>, NO<sub>2</sub> gradually decrease as usual in the transition from January to March. The decrease is evident from March 2020 with concentrations well below the average for the reference period and **close to/below the minimum values.** PM shows a **trend more related to weather conditions** and with a variable spatial distribution on the basin.

SDE shows the strong contribution of natural event!



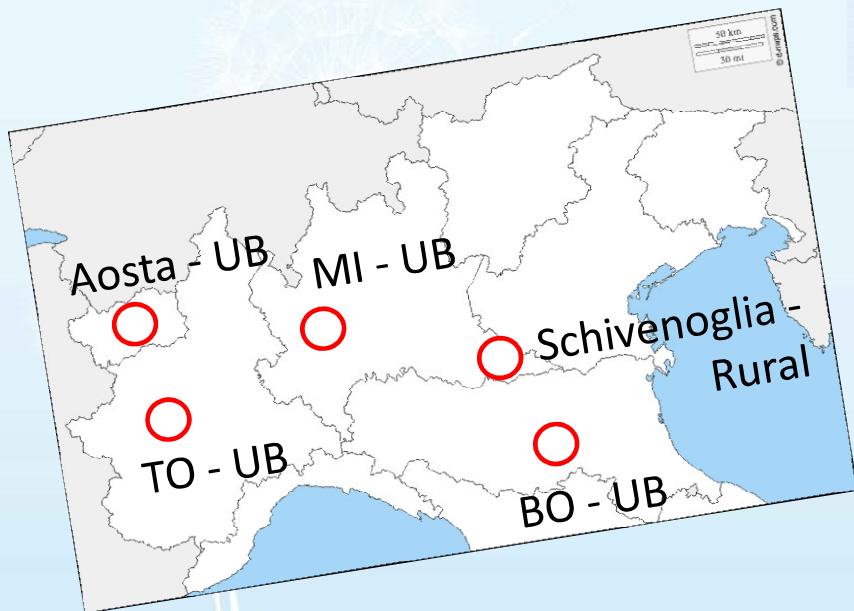
Similar results for model analysis

# PRIMARY POLLUTANTS REDUCTION

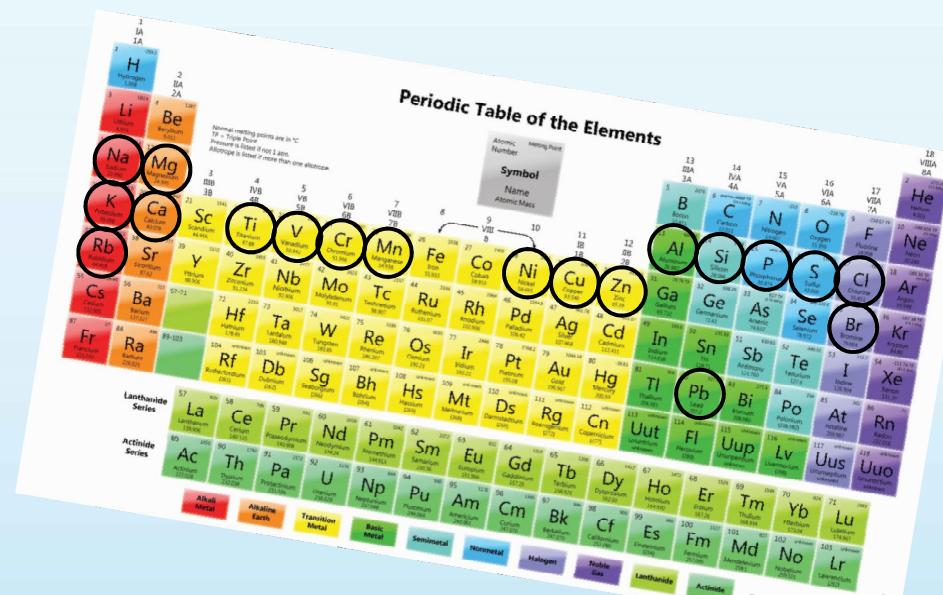
- drastic reduction of **determinants**
- **NO<sub>x</sub>** primary emission reduction (max weekly decrease 40%)
- **PM10** primary emission reduction (max weekly decrease 20%)
- important reduction of the gaseous concentrations (NO, benzene, NO<sub>2</sub>)
- variable behavior of the **PM10** concentration: **WHY?**



PM10 chemical composition analysis



<https://www.lifepreadir.eu/>

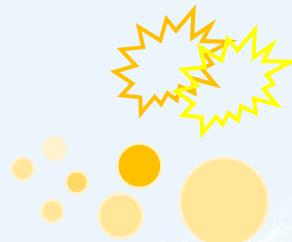


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# SUMMARY RESULTS

10 March-18 May: 2020 vs 2019

1) No reduction for secondary compounds in every site

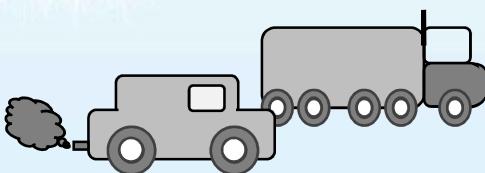


→ OC/EC increase, no significant variations in SIA

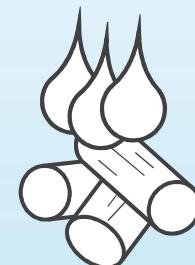
2) EC and Cu reduction in every site

→ traffic source

EC	Reduction in 2020 vs	
Milano P.	-31%	2013-2019
Aosta	-40%	2017-2019



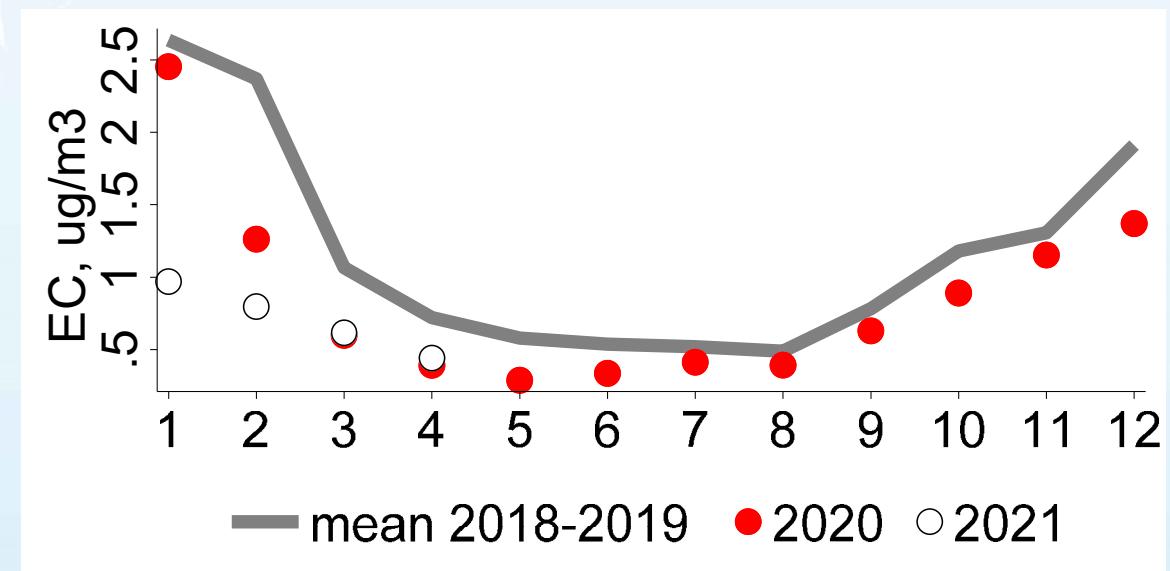
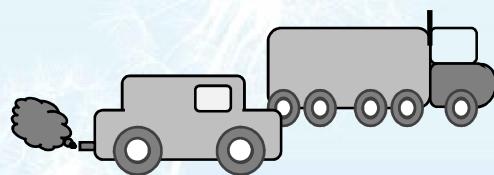
3) Levoglucosan increase in many sites → BB source



# SUMMARY RESULTS

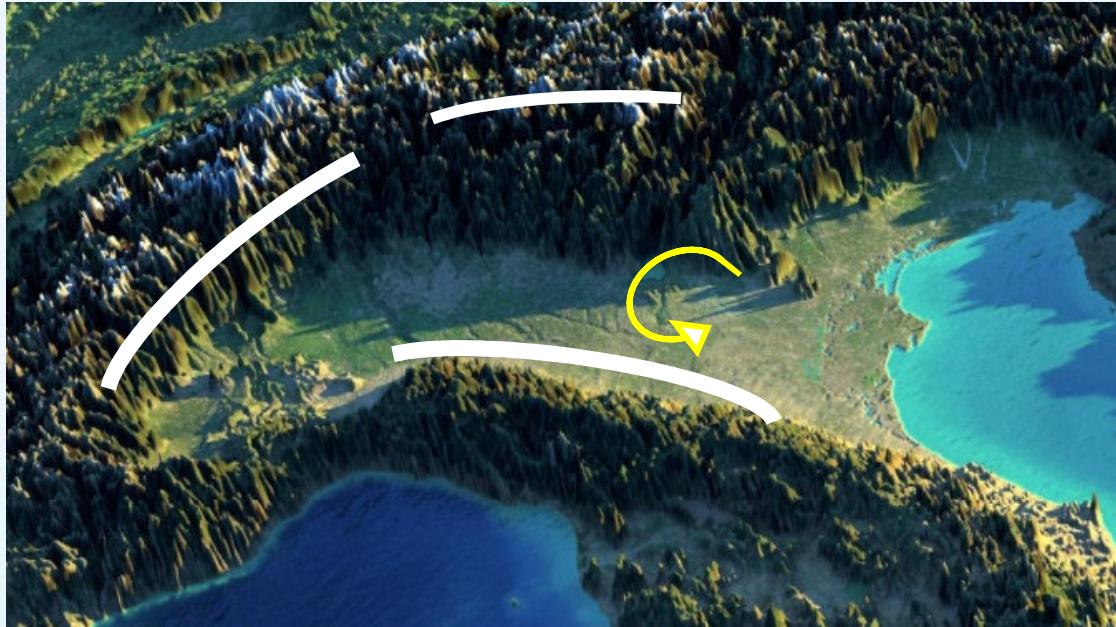
## 2) EC and Cu reduction in every site

→ traffic source



# THE PO VALLEY, HIGH VALUES of PM

<https://imgur.com/gallery/3kDqX>



Transport and dispersion of pollutants are strongly influenced by the morphological characteristics into the Basin



stagnant atmospheric conditions accumulation of particulate and gaseous pollutants

EMISSIONS

METEOROLOGIC CONDITIONS (low wind speeds, stable atmospheric stratification..)

Chemical reactions



→ cold period

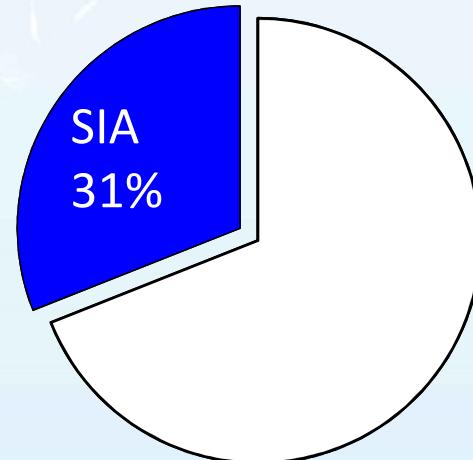


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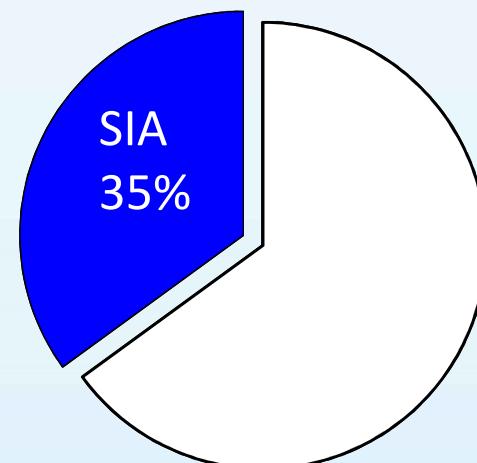
# INTERPRETATION

- The main precursors were available during “Covid time”, SO<sub>2</sub>, NH<sub>3</sub> .. and, despite a strong reduction, NOx → SECONDARY FORMATION

10 March -18 May 2019



10 March -18 May 2020



→ 4 urban sites

→ in the rural site  
SIA up to 54%  
during winter

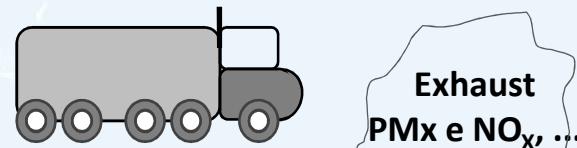
- BB could also have contributed, having increased in its tracer
- Need to investigate SOA

# TO GET OUT OF IT

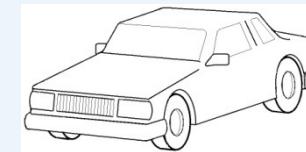
Need to reduce precursors in a coordinated, incisive and parallel way in the whole basin : **which ones and how much? Where?**

TO KNOW IT we must FIX the LACK of the INFORMATION necessary TO UNDERSTAND the SIA FORMATION and TO INVESTIGATE the SOA

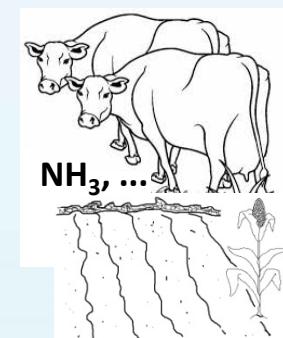
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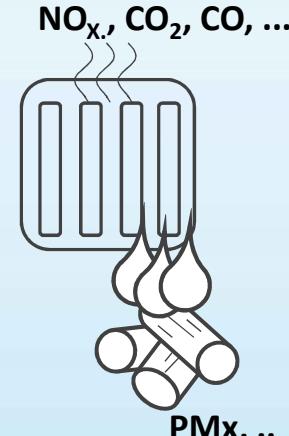
Exhaust  
PMx e NO<sub>x</sub>, ...



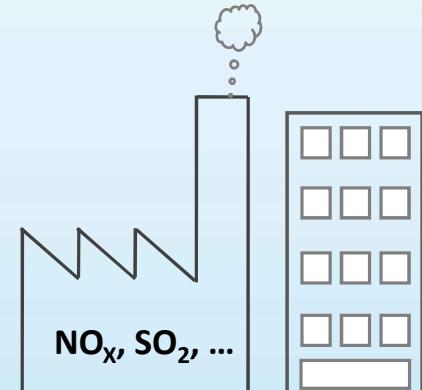
Non exhaust (freni,  
frizione, abrasione  
strada, pneumatici  
...) + risollevamento



NH<sub>3</sub>, ...



PMx, ..



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With the contribution  
of the LIFE Programme  
of the European Union

## 1° & 2° Report



**Emilia-Romagna Region:** Marco Deserti, Katia Raffaelli, Lucia Ramponi, Carmen Carbonara; Matteo Balboni; **ARPA Emilia-Romagna:** Chiara Agostini, Roberta Amorati, Barbara Arvani, Giulia Giovannini, Simona Maccaferri, Vanes Poluzzi, Michele Stortini, Arianna Trentini, Simonetta Tugnoli, Matteo Vasconi; **ARPA Valle d'Aosta:** Giordano Pession, Claudia Tarricone, Ivan Tombolato; **ARPA Friuli Venezia-Giulia:** Giovanni Bonafè, Francesco Montanari, Alessia Movia, Alessandra Petrini; **APPA Trento:** Selene Cattani, Gabriele Tonidandel ; **ARPA Veneto:** Ketty Lorenzet, Silvia Pillon, Laura Susanetti ; **ARPA Piemonte:** Stefano Bande, Francesca Bissardella, Monica Clemente

## 3° Report

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