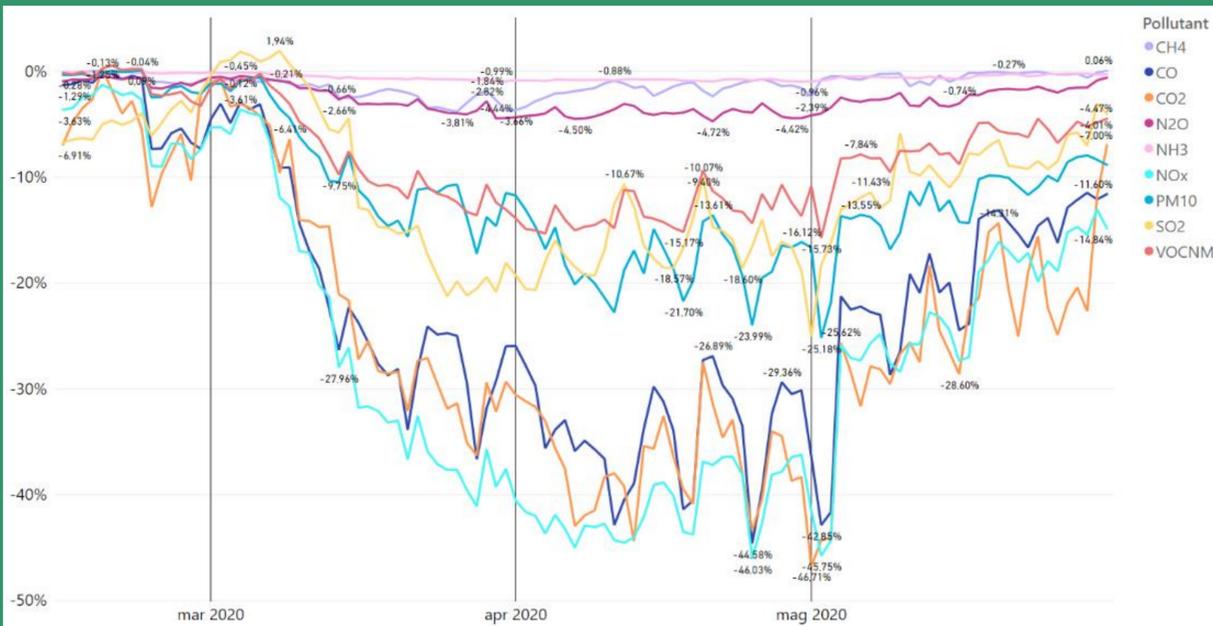


A. Marongiu, E. Angelino, G. Fossati, M. Moretti, E. Peroni, A. Pantaleo, G. Malvestiti, M. Abbattista, G. Lanzani, E. Bravetti
ARPA Lombardia, U.O. Modellistica della Qualità dell'Aria e Inventari, via Ippolito Rosellini 17, 20124, Milano



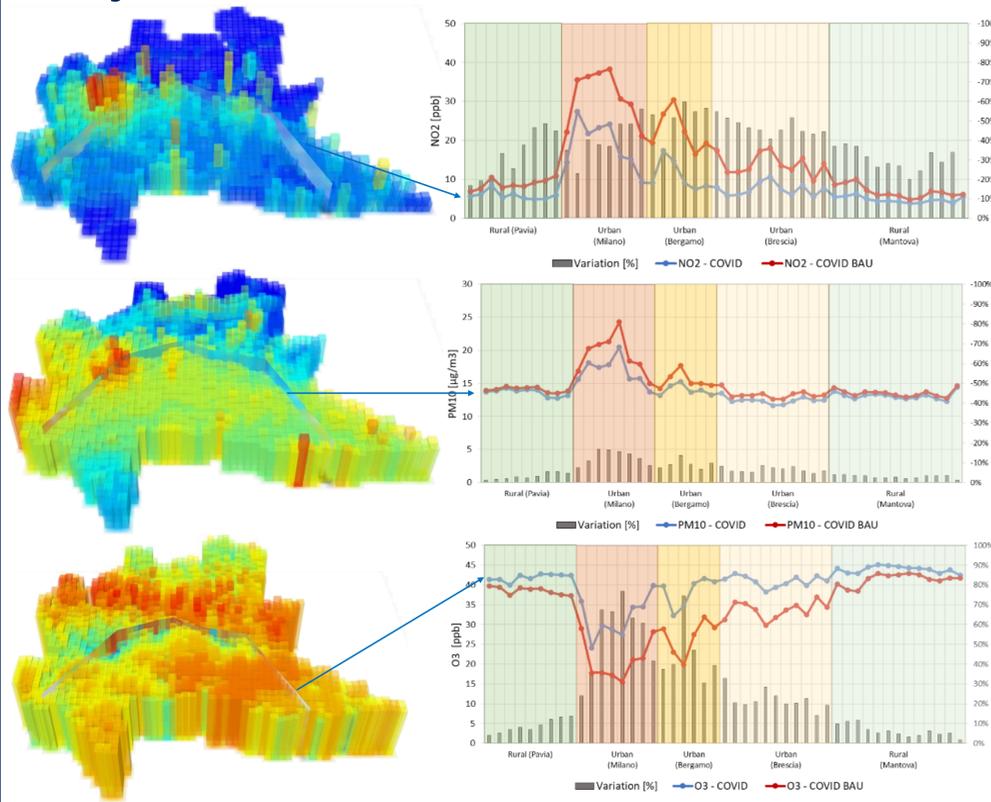
Daily Lombardy emission trends for primary emitted pollutants, calculated as (COVID-BAU)/BAU

The aim of this work is to evaluate the impact on air quality due to the introduction of measures for contrasting the diffusion of COVID-19 disease. This preliminary study describes the modelling system and the approach implemented and the results obtained about atmospheric concentration of the main pollutants: NO₂, O₃ and PM₁₀ comparing the impact of two different emission scenarios. The first refers to the emissions estimated business as usual (BAU) and represents the emissive situation that would have occurred in a non-COVID context. The second one, lockdown scenario (COVID), is based on the emissive estimates occurred during the period characterized by anti-COVID measures. The simulations refer to the period 15 March - 03 May 2020 and to the territory of Lombardy region, even the emission estimates have covered a larger period on the months of lockdown (ARPA Lombardia, 2020). The informative base for the emission estimates in Lombardy is the more recent edition available at the time of starting this study obtained by INEMAR database referring to 2017. The regional emission inventory gives an estimation of the primary emitted pollutant on year base.

The evolution of actions to contrast the COVID disease spreading during the month of March and April evolves in order of days and the average temperatures, connected to the heating demand, also shows daily changes. These factors have suggested an approach on a daily base for emission estimates and air quality simulations. The emission scenario calculation has been performed obtaining a dataset of the emission inventory on daily base for the main pollutants, for all categories and fuels estimated in the reference year for both the scenarios. Outside Lombardy territory, emission dataset of the PREPAIR Project based on 2013 is used on municipal scale, the national emission inventory ISPRA, update to 2010, gives emissions related to neighbouring Italian regions on provincial scale and EMEP 2012 provides Swiss emissions.

METHODS, RESULTS AND DISCUSSION

The air quality simulation on emission scenarios BAU and COVID have been performed by the modelling system implemented to evaluate impacts on air quality: ARIA Regional, developed by AriaNET srl and applied by ARPA Lombardia. The core of the system is the eulerian model FARM. The main emission trends estimated across the emission scenarios: BAU and COVID. The data on emission estimates are the input of the simulation performed by FARM. The resulting maps illustrate differences between concentrations in COVID scenario and concentrations in BAU scenario. Concentrations are average values on the simulation period 15/03/2020 - 03/05/2020 for each point grid of the domain, which covers an area of 236 x 244 km² set on Lombardy Region, with a horizontal resolution of 4 km and 13 terrain-following vertical levels.



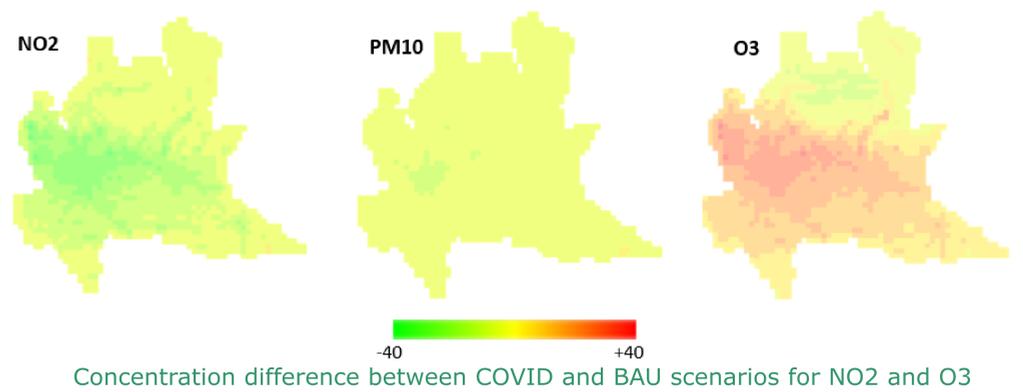
Concentration in COVID scenario

Average concentration on a slice on the territory of Lombardy, COVID and BAU scenarios

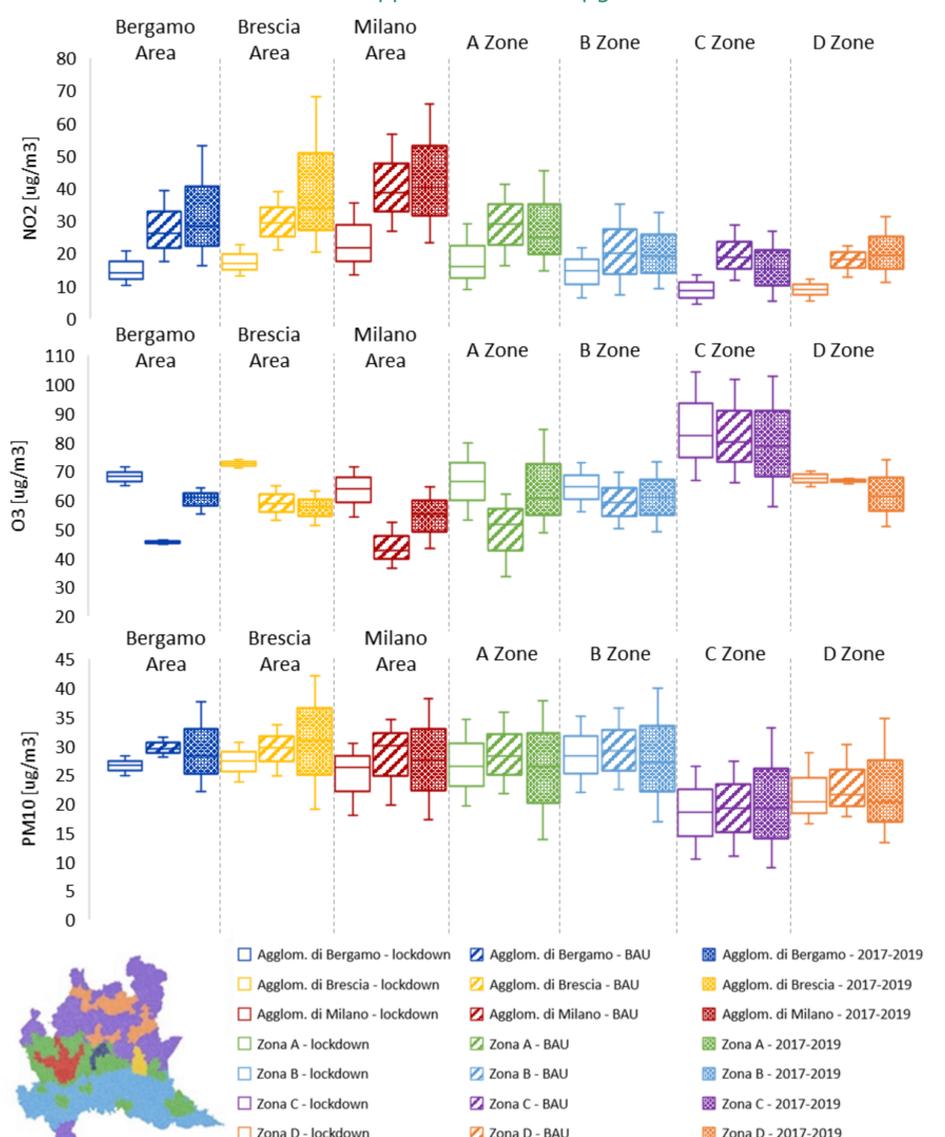
NO₂ concentrations reduction has shown quite a linear response to NO_x emissions reduction, while for O₃ opposite evolution is detected: decreasing in emissions corresponds to an increasing in concentrations. PM₁₀ atmospheric concentrations simulated by the model, confirm its nature of primary and secondary pollutant, showing quite an independent trend respect to the corresponding primary emission reduction. However, these results are affected by the sensibility of modelling simulation to input data.

For more details

https://www.arpalombardia.it/sites/DocumentCenter/Documents/Aria%20-%20Relazioni%20approfondimento/Emis-mod-report-stima-emissiva-COVID-19-lombardia_maggio20.pdf



Concentration difference between COVID and BAU scenarios for NO₂ and O₃ in ppb and PM₁₀ in µg m⁻³



Concentration of main pollutants in different areas of Lombardy, comparison between assimilated data to measurements and measured data in the three previous years 2017-2019 (ARPA Lombardia, 2020).