

Interactive comment on “Meteorology-normalized impact of COVID-19 lockdown upon NO₂ pollution in Spain” by Hervé Petetin et al.

Anonymous Referee #2

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This work by Petetin et al., deals with the hot topic of variation of pollutants during the lockdown measures against the COVID19 pandemic. More specifically it focuses on the NO₂ and the area of the Spanish state. Transports are the main source of NO₂ in the troposphere, thus the reduction of traffic is estimated to lower significantly the emissions. Though the decrease of the emissions was very clear during the lockdown, the actual concentration in various areas is also dependent on meteorological parameters that rule the dispersion and the chemical processes of the gas. In order to better estimate the expected concentrations, based on meteorology, authors have trained a machine learning algorithm, to simulate the business as usual conditions, using as input meteorological variables. The work is generally well presented and should be accepted for publication in ACP after minor revisions.

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Specific comments

L10 It would be better to provide some quantitative measure of the performance of the model. L77 Please provide some bibliographical reference for the uncertainty of these NO₂ measurements. L100 The selection of variables to feed the ML algorithm is very crucial and implies the physical and chemical processes that should be associated with the gas' concentration. My thought is that the photochemical cycle is implied by cloud coverage, which indirectly influences the irradiance which drive the photolysis. Since daily values are used, it is imperfectly fed to the algorithm, since nighttime cloud coverage would no affect NO₂ concentration. Thus, some irradiance related variable from ERA-5 seems a better choice (SSI is a good one to investigate first). Since the results are satisfactory even using the cloud coverage proxy, I suggest to add some discussion on the selection of the variables and probable investigate other ones in the future. Figure 1. I think it is somehow difficult to understand the map, probably a different selection of colorbar would make it easier to figure out the conditions. L.119 ERA-5 spatial resolution is around 30km. Are there stations that correspond to the same grid point of the database? Please discuss the uncertainty introduced by the problem of non-colocation of ERA-5 and actual measuring stations. L130 Is that the case in any of the data used here? Are there any stations with significant trends in the training period? L141 Following the arguments deployed in previous paragraphs, it seems preferable to test the validity in the same period of the year, as the one of interest (March-May), than in January -February. L159 Figure 1 shows that a number of stations have mean concentrations ~5ppvb. Thus these intervals are very huge, making the result not reliable. I suggest to present these intervals in a different way and not averaging all the data. L167-168 This argument is note clear. Please explain in detail Table1 The test cases N seems very low, are these implying number of stations or total number of test days for all stations? L255 In some cities, such zones, resulted in much higher traffic in peripheral road networks. Thus the stations at 3 and 9 km, might experiencing heavier traffic due to LEZ in the center. This should be answered locally by explaining the main routes and the traffic of each city. L263 "Statistically significant" should not be used

without proper definition and explanation. Explain which significance tests you used, what was the outcome and then provide such conclusions. 3.3 I think it is important to present some representative cases of other stations' timeseries in figures similar to 3 and 4. These provide a very clear picture of the conditions during the lockdown phases. Are there any periods of higher than business as usual concentration, probably in the stations with low mean values (Granada and Murcia probably)? 3.5 A figure showing all three timeseries (climatological, business as usual and measured) would be very useful, at least for some representative stations. L.384-387 This is a very important finding at should be highlighted more and included in the conclusions, because it is general for future application of climatological values. L.445 It is not clear if all the flagged data were removed for the process or if different flags were treated differently.

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