AIR CENTRE

FINDINGS REPORT #3-2020
COVID-19 OBSERVATORY

REPORT SUMMARY

Historical comparison of weekly average of key air quality parameters of Particulate Matter Aerosol <10µm (PM10) and Nitrogen Dioxide (NO_2) for **Lisbon**, **Porto** and **Madrid** for 2018, 2019 and 2020:

- PM10: **Lisbon** and **Porto** are at their 2-year lowest level of about 20% and a drop of 33% since COVID lock-down. **Madrid** has a significant drop since lockdown with current vales much below 2018 but still close to 2019.
- NO_2: **Lisbon** has an historical minimum of the last 2 years, dropping more than 40% during most of the month of April 2020. In April, **Porto** is higher than the last two years but with a 50% reduction since lockdown. **Madrid** with a 2-year lowest level down to more than 30% and 50% since lockdown.

PARTICULATE MATTER AEROSOL < 10µM (PM10) are microscopic particles of solid or liquid matter suspended in the air. These are measured in g/m^3. Main sources include i) human origin such as industrial processes and product use, agriculture, commercial, residential and households; ii) natural our semi-natural sources such as desert dust, biomass burning and sea salts. The EU Ambient Air Quality Directives limits the daily average (with no more than 35 days per year) below 50 µg/m^3 and annual average below 40 µg/m^3. PM10 affects cardiopulmonary and respiratory health, the immune system and in last instance can cause lung cancer.

Tropospheric Monitoring Instrument (TROPOMI) data is used by CAMS service for PM10 analysis. The results were obtained with a 7 days average based on daily value determined at 14h at surface level.

Recent studies found evidence of SARS-Cov-2 RNA on PM10 air samples and other studies are pointing towards a relation between PM10 and increased mortality rate. The concentration of PM10 was analyzed in three cities (Figure 1): Lisbon, Porto and Madrid, for the period of January-April 2020, and compared with the same period in 2019 and 2018.

Comparing the results, it can be stated that for **Porto**, the PM10 levels are lower in 2020 than in the past two years for the end of March and April. For the last day analyzed (30 April 2020) there is a reduction of approximately 22,9% for 2019 and 2018. For **Lisbon**, the PM10 levels are lower in 2020 than in the past two years for April, even though there is a slight increase in some days of analysis, matching the values of 2019, but then there was a further drop in PM10 levels (reduction of 20% for 2019 and 2018, April 30). In the case of **Madrid**, the reduction is only being verified from the second week of April, and even so, in day 30 there was a slight increase of PM10 comparing to 2019. The main conclusion verified for the tree cities is that the concentrations of PM10 in the air are lower since the lockdown due to COVID-19 in March (33,3% for Lisbon, 33,3% for Porto and 52,6% for Madrid).

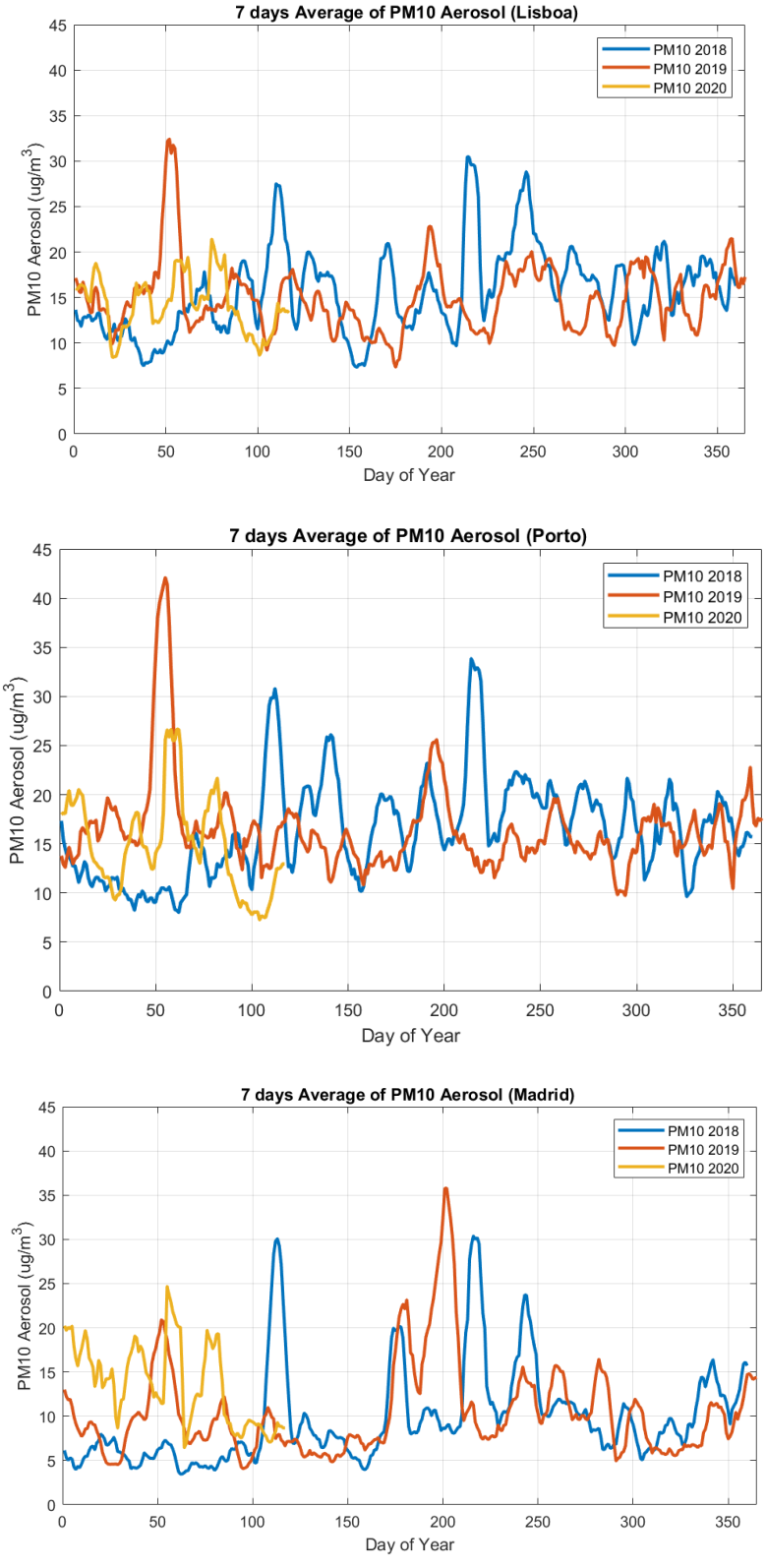


Figure 1 : a) to c) – Yearly PM10 evolution in 2018 (blue), 2019 (orange) and 2020 (yellow) for Lisbon, Madrid and Porto, respectively.

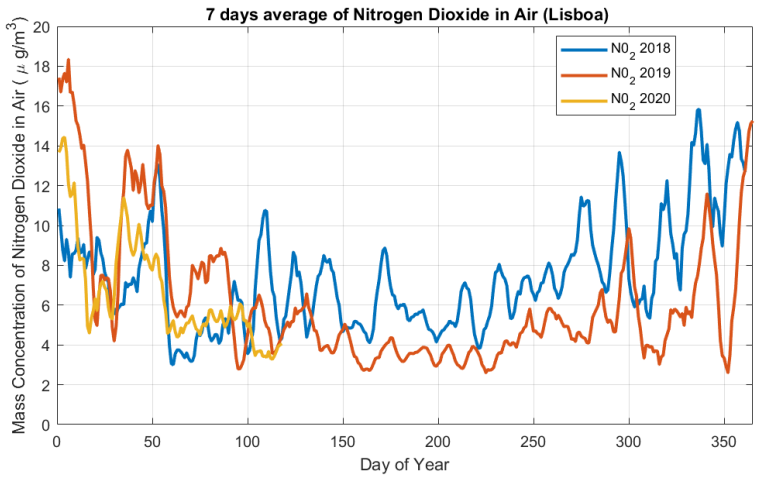
NITROGEN DIOXIDE (NO_2) is generated by vehicles, heavy industry and power plants, some of which have been shut down during the corona virus pandemic. The EU Ambient Air Quality Directives limits the concentration of 200 µg/m^3 (not to be exceeded more than 18 hours per year) and annual average below 40 µg/m^3. The main effects of breathing NO_2 relates to the increase of probability of respiratory problems as in high doses it could inflame the lining of the lungs and reduce immunity to lung infections, causing problems like coughing, colds and bronchitis.

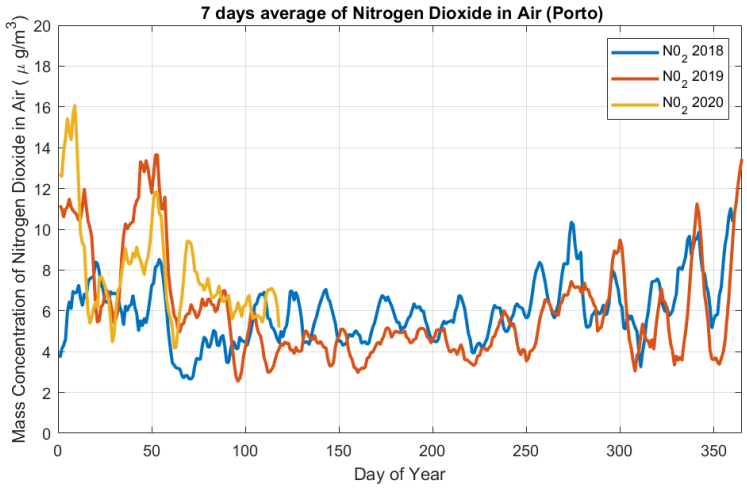
Tropospheric Monitoring Instrument (TROPOMI) data is used by CAMS service for NO_2 analysis. The results were obtained with a 7 days average based on daily value determined at 14h at surface level.

The following images (Figure 2) depict yearly NO_2 emissions for Lisbon, Porto and Madrid generated using a 7-day average for daily values determined at surface level at 22h UTC using CAMS service.

On April 30, NO_2 emissions are at their historical minimum since 2018 in **Lisbon** (reduction of approximately 4,8% for 2019 and 2018 and more than 40% in the first weeks of April) and **Madrid** (30,2% for 2019 and 45,5% for 2018). However, in **Porto** there is a significant drop in NO_2 emissions, but the current level is still above 2019 and 2018, which might be explained due to several factors such as a different rainy season. Similarly, as for the concentration of PM10, the concentrations of NO_2 in the air are lower since the lockdown due to COVID-19 in March for the three cities (20% for Lisbon, 30,7% for Porto and 50% for Madrid).

Meteorological conditions such as wind, rain and seasonal variations of boundary layer have significant impact on the concentrations of these air quality parameters.





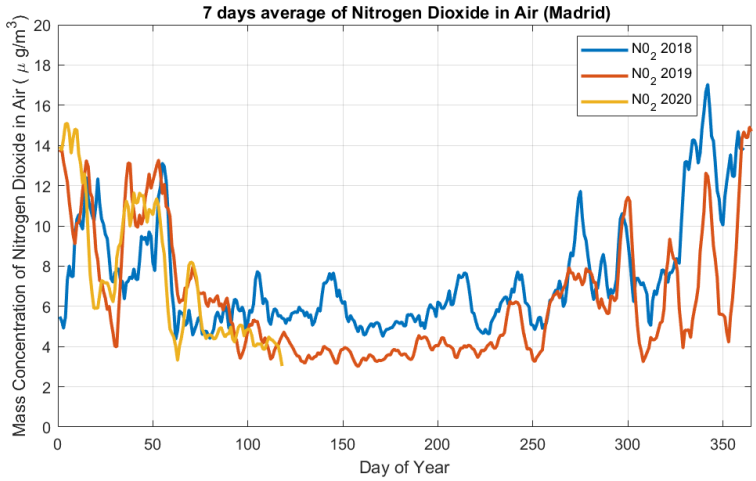


Figure: 2 a) to b) – Historical mass concentration of Nitrogen Dioxide in air for Lisbon, Porto and Madrid for 2018 (blue), 2019 (orange) and 2020 (yellow).

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