

Network Analysis and Data Visualization

Final Project

Air Quality in Madrid Metro Stations (2001 – 2018)

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Introduction

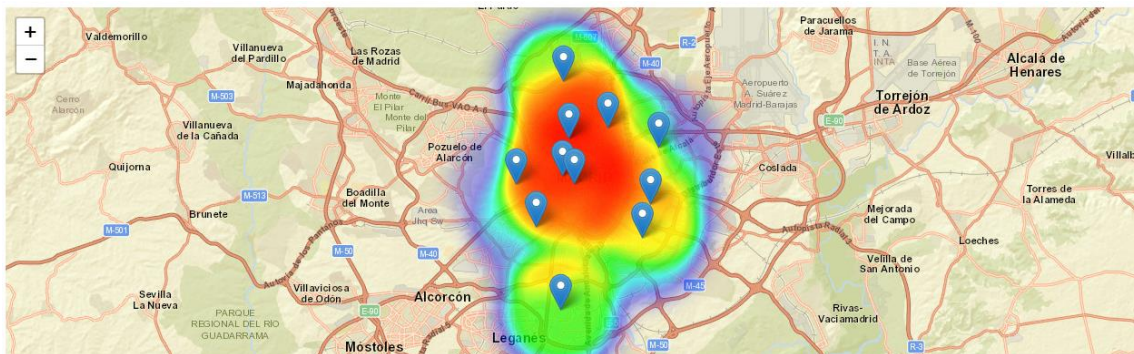
A Shiny app has been created in order to analyse the air quality in different metro stations in Madrid, spanning the years from 2001 until 2018. The dataset used to build the application was found in the public repository “Datos Abiertos” of Madrid (link [here](#)). The app will allow comparing the level of different types of gas in different stations during different periods – the end user can select the type of gas, the year and the month during which the levels were measured. The selections results in 3 visualisations: the heatmap displaying the levels in different stations geographically, the table of key statistics for monthly lowest, highest and average values and also a grid of time series showing daily levels of the gas for each station. The application can be found in the shinyapps.io repository using this link: <https://ks100392576.shinyapps.io/heatmapapp/>. Note, that the first time the application is launched, it takes a while, since the dataset used for this is quite large.

Main findings

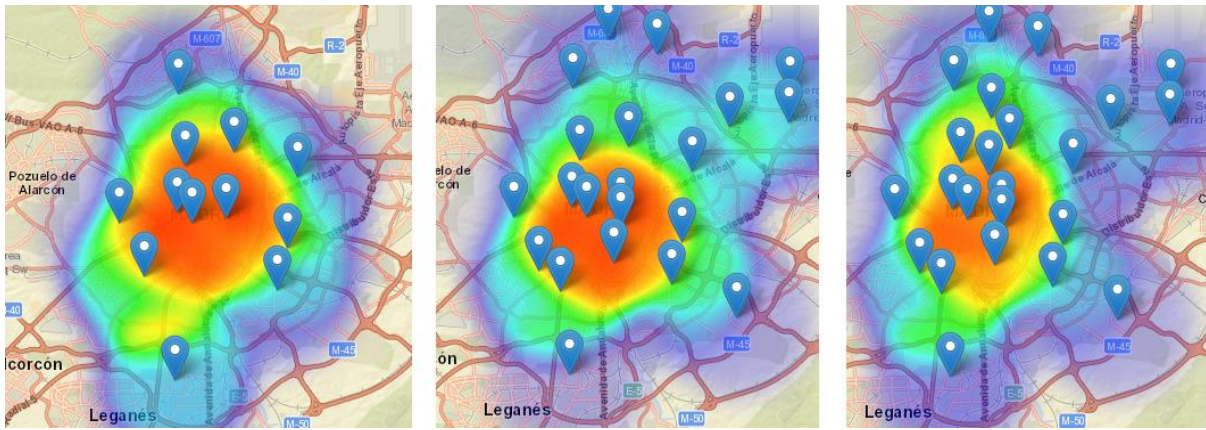
We can note 3 main findings going through analysing the data – and all three apply to the different types of gases, simply at different levels.

To present the main findings, we can select, say, nitrogen oxides (NO_x), which are a group of seven gases and compounds composed of nitrogen and oxygen. Some of the most common nitrogen oxides are also quite hazardous – they can cause both short-term issues (such as nausea, headache, abdominal pain, breathing issues) but long-term exposure to this can even lead to genetic mutations, or death [<https://toxtown.nlm.nih.gov/chemicals-and-contaminants/nitrogen-oxides>]. Hence this is really important that the levels of these gases are reduced, especially in the public transport sector, which is commonly used.

- 1) It is not a surprise, that it appears the highest levels of the nitrogen oxides particles are found in the central Madrid – since the traffic is the most active in there. We can see that, if we look into, say 2001, November. First, we can notice, that the highest average of the particles found during this month was in Plaza de Espana (with a bit over 331 $\mu\text{g}/\text{m}^3$), which is indeed a very central location. While the lowest average of these particles was found in Casa de Campo (with a bit over 93 $\mu\text{g}/\text{m}^3$). If we look into the map, we can see this more clearly:

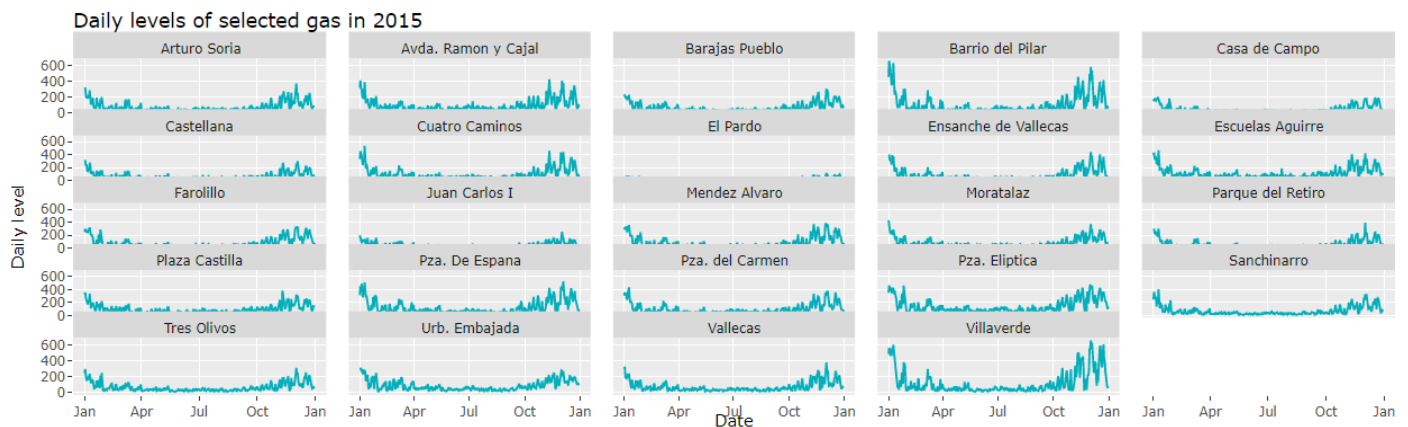


- 2) We can see that with the years, the levels of the nitrogen oxides particles are getting lower and lower – which is a very positive improvement. We can see that if we compare say, 2001, 2010 and 2018 (all in the month of January):

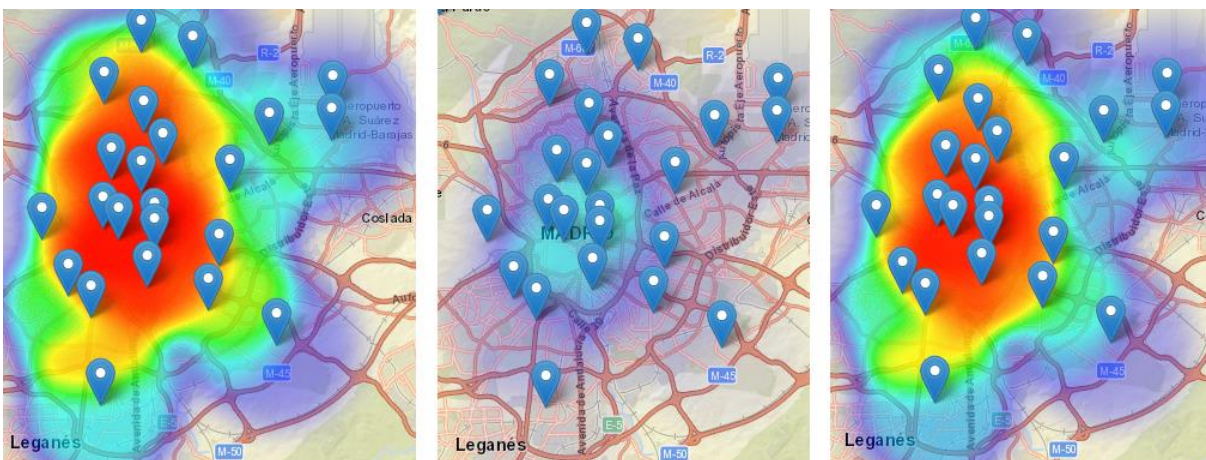


If we look into the numbers, we will notice that the highest average in 2001 was almost $300 \mu\text{g}/\text{m}^3$ in Villaverde station, while in 2010, the highest average was found in Moratalaz (however reaching only a bit over $144 \mu\text{g}/\text{m}^3$) and finally, in 2018, the highest average was found in Villaverde again, but this time, it reached only $152 \mu\text{g}/\text{m}^3$, which was a massive decrease from 2001.

3) Last but not the least, if we take, say 2018, we can see that the levels of the nitrogen oxides particles are lower during the summer months, than during other seasons. For example, if we look into 2015, we can see the following:



We can notice that for each and every station, a decrease in the level of the particles of nitrogen oxides is found during the summer months. If we try to view that in the map, and compare say the levels of these particles in the air in January, July and November, we can see the following trend:



Clearly, we can see a massive decrease in the levels during the summer months, which could be also due to the fact, that during the hot summer months, quite a lot of people are on holiday, hence the use of public transport is also reduced.

However, all in all, we can still conclude that the trend is quite positive, in the way that the levels of all the types of gases appear to be decreasing over the years – and that's all that we can hope for at the moment.