Assessment of the effect of Madrid Central

on the air quality in Madrid in 2019

ecologistas en acción Madrid

Title: Assessment of the effect of Madrid Central on the air quality in Madrid in 2019
Author: Juan Bárcena and Sustainable Mobility Commission- Ecologistas en Acción
Cover: Andrés Espinosa
Date: January 9, 2020

Assessment of the effect of Madrid Central on the air quality in Madrid in 2019

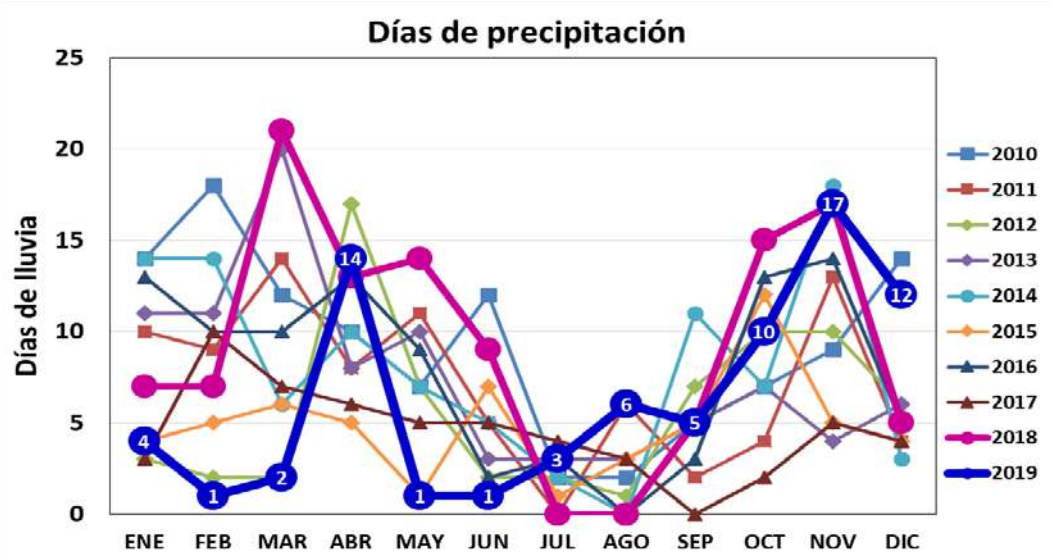
The following is an assessment of the air quality in the city of Madrid (based on data relating to nitrogen dioxide, NO_2) during 2019, the first full calendar year with Madrid Central in operation.

Meteorological context: precipitation in the city of Madrid in 2019

The first analysis relates to trends in precipitation data during 2019, in comparison with data for the years 2010 to 2018.

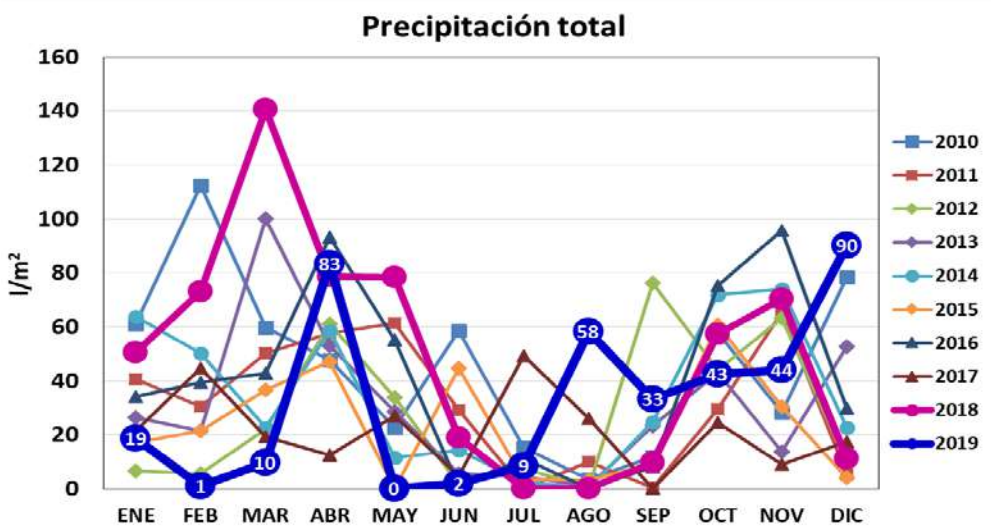
As can be seen in Figures 1 and 2 (data from the Retiro observatory, AEMET - the State Meteorological Agency), 2019 was characterised by a very dry first six months (with the exception of April), both in terms of the number of days with precipitation and in terms of total precipitation (in l/m^2), in comparison with previous years. The final six months saw more abundant rainfall, particularly in August (when storms caused flooding in various parts of the Autonomous Community of Madrid), and on the days of heavy rain recorded in November and December.

Figure 1. Number of days of precipitation per month in the years 2010-2019



* Number of days of precipitationof 0.1mm or more (Retiro Observatory, AEMET).

Figure 2. Total monthly precipitation in the years 2010-2019



Data from the Retiro Observatory (AEMET).

Figure 3. 3. Number of days of annual precipitation in the years 2010-2019

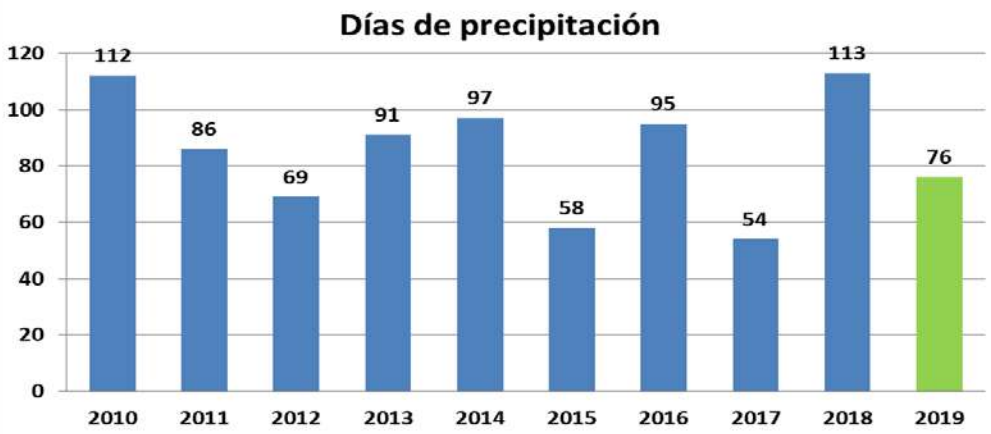
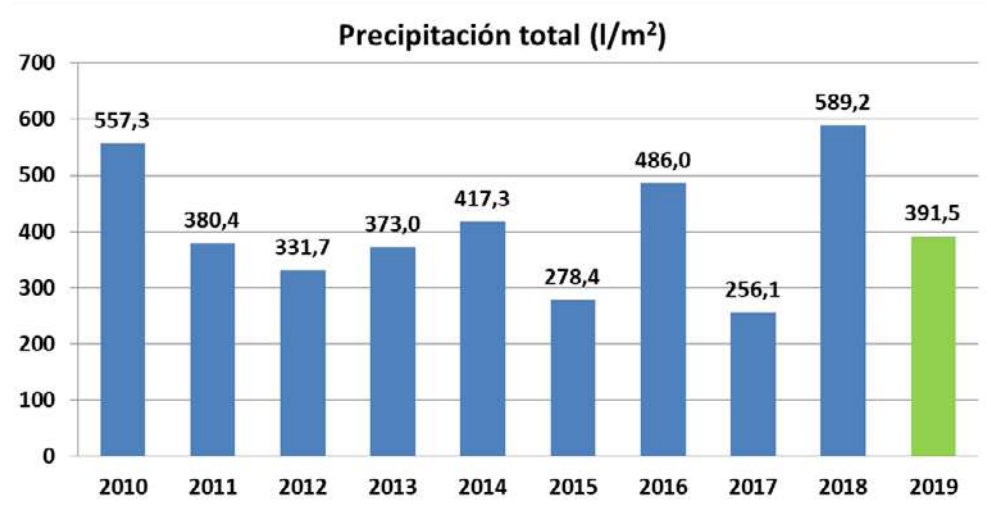


Figure 4. Total annual precipitation in the years 2010-2019



Data for the whole year, shown in Figures 3 and 4, suggest that 2019 was a year with relatively few days of rain in Madrid: 76 days, compared with an average of 86 days annually in the period 2010-2018, and with 2019 having the fourth-lowest number of days of rain in the last ten years (only 2012, 2015 and 2017 having fewer rainy days). In terms of total precipitation, the 391.5 l/m^2 recorded in the year 2019 was slightly below the annual average for the years 2010-2018 (407.7 l/m^2).

In conclusion, the year 2019 can be considered as a normal year in terms of total precipitation, although the distribution of that precipitation over the year was somewhat different from normal: less than is usual in the first half of the year, especially the first quarter, and with a greater number of rainy days in the second half, particularly in the final two months of the year. These meteorological conditions had an influence on the monthly levels of NO_2 pollution recorded by Madrid's air quality measurement network, as will be seen below.

Episodes of high NO_2 pollution

A significant statistic is the number of days of the year on which the protocol for episodes of NO_2 pollution was implemented. This protocol was approved by Madrid City Council aiming to tackle the spikes in air pollution which occur when meteorological conditions combine to slow down the dispersal of contaminants (conditions of atmospheric stability and temperature inversion). This statistic can be taken as an indicator of the number of days of adverse meteorological conditions in one year. As can be seen in Figure 5, in 2019 the protocol was implemented on 14 days (in the months of January and February). This number was appreciably lower than the 33 days of implementation in 2017 (the year with the lowest precipitation and the most occasions of adverse meteorogical conditions in recent years), but slightly higher than the number of days in 2018 (11 days) and 2016 (10 days). A similar analysis is not available for previous years because at that time, there was no action protocol for spikes in air pollution - or rather, the protocol which existed (in 2015, created by Ana Botella) was designed with activation levels which were so high that it was hardly ever implemented.

Figure 5. Number of days of the year with Protocol activated

NO_2 pollution data for the city of Madrid in 2019

Table 1 shows the average annual values of NO_2 recorded between the years 2010 and 2019 in the 24 stations of the City of Madrid's air quality measurement network.

Table 1. Average annual values of NO_2 ($\mu g/m^3$) in Madrid in the period 2010-2019

Estación	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Plaza de España	49	51	46	46	38	51	46	49	43	40
Escuelas Aguirre	54	60	51	43	51	58	57	62	55	51
Ramón y Cajal	55	54	46	41	38	46	44	46	43	39
Arturo Soria	44	44	39	34	36	43	38	42	37	34
Villaverde	37	46	40	37	37	46	43	48	37	39
Farolillo	42	40	35	33	33	40	39	42	34	33
Casa Campo	30	30	23	20	20	24	21	25	20	20
Barajas Pueblo	47	40	35	31	31	34	37	40	37	36
Plaza del Carmen	52	51	44	41	40	50	46	49	45	36
Moratalaz	49	48	41	32	35	41	38	43	39	36
Cuatro Caminos	54	55	44	43	42	45	43	46	42	38
Barrio del Pilar	43	49	45	41	41	45	40	43	39	36
Vallecas	43	45	38	35	43	40	40	42	37	36
Méndez Álvaro	47	48	39	32	33	39	38	43	35	34
Castellana	49	48	39	36	40	39	38	40	39	34
Retiro	35	37	32	28	24	34	32	32	29	25
Plaza de Castilla	53	52	47	43	44	46	43	41	40	37
Ensanche de Vallecas	41	40	31	26	32	44	36	40	37	37
Urb. Embajada	44	49	42	37	37	46	42	47	41	38
Plaza Elíptica	69	63	57	54	53	58	56	59	53	53
Sanchinarro	38	40	37	32	32	35	34	35	31	31
El Pardo	22	23	19	18	13	18	18	18	15	16
Juan Carlos I	27	28	22	19	20	23	21	29	25	26
Tres Olivos	41	39	32	29	29	38	36	36	28	25
RED (valor medio red)	44	45	39	35	35	41	39	42	37	35
Nº Estaciones que superan el VLA de NO_2	18	15	10	8	6	13	9	15	7	2

The values exceeding the Annual Limit Value (ALV) for NO_2 (40 $\mu g/m^3$) are shown in red.

The figures recorded in 2019 can be considered to be very positive in comparison with the figures recorded in previous years. The most striking statistic is the number of stations which exceeded the Annual Limit Value (ALV) for NO_2 as set out in European legislation (to comply with this legislation, no station should exceed 40 $\mu g/m^3$ as an average annual value). As can be observed, between the years 2010 and 2018, the number of stations exceeding the ALV for NO_2 (figures in red in Table 1) varied between 18 in 2010 and 6 in 2014. **On average, 11 out of 24 stations per year have exceeded the ALV for NO_2 in the last 9 years. However, in 2019 only 2 stations exceeded it: the stations at Plaza Elíptica (53 $\mu g/m^3$) and Escuelas Aguirre (51 $\mu g/m^3$).** This result was possible because during 2019 there were 6 stations which recorded the lowest average annual value of the last 10 years: Plaza del Carmen, Cuatro Caminos, Barrio del

Pilar, Castellana, Plaza de Castilla and Tres Olivos; and another 5 stations which equalled the lowest value recorded in previous years: Arturo Soria, Farolillo, Casa de Campo, Plaza Elíptica and Sanchinarro. The average network value in 2019 was also equal to the lowest value previously recorded (35 µg/m^3).

Regarding the data corresponding to Plaza del Carmen, the only station in the network located within the boundaries of Madrid Central, the value recorded in 2019 (36 µg/m^3) was for the first time comfortably below the ALV for NO_2. This was the lowest annual average value of NO_2 recorded since at least the year 2000 (and probably the lowest recorded annual value in the history of the station).

Table 2 shows the number of times the Hourly Limit Value (HLV) for NO_2 was exceeded in each station in the city of Madrid's air quality measurement network between 2010 and 2019. European legislation states that no network station should exceed the hourly value of 200 µg/m^3 more than 18 times a year.

Table 2. Number of times the Hourly Limit Value (HLV) for NO_2 was exceeded between 2010 and 2019

Estación	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Plaza de España	4	5	2	7	0	12	6	7	2	1
Escuelas Aguirre	33	34	11	4	36	39	36	41	5	7
Ramón y Cajal	68	86	22	29	29	65	39	49	24	15
Arturo Soria	17	20	3	4	2	18	0	12	1	4
Villaverde	4	17	3	13	6	64	13	19	0	0
Farolillo	0	1	0	0	0	6	1	1	0	0
Casa Campo	0	0	0	0	0	0	0	0	0	0
Barajas Pueblo	5	1	0	2	0	3	0	3	1	0
Plaza del Carmen	0	1	0	0	1	0	0	0	0	0
Moratalaz	0	0	5	3	6	6	0	0	0	0
Cuatro Caminos	22	22	0	3	9	29	15	20	11	1
Barrio del Pilar	32	98	52	36	45	95	29	23	13	6
Vallecas	3	3	0	2	3	4	0	0	0	0
Méndez Álvaro	12	20	2	2	0	10	3	11	0	0
Castellana	10	9	1	3	5	4	2	5	1	0
Retiro	0	0	0	0	0	2	0	0	0	0
Plaza de Castilla	6	15	0	0	2	6	4	2	2	0
Ensanche de Vallecas	25	29	5	0	24	71	13	22	4	8
Urb. Embajada	2	8	6	5	2	6	0	8	1	2
Plaza Elíptica	76	103	48	37	27	65	46	88	33	47
Sanchinarro	17	40	11	8	18	48	15	15	3	5
El Pardo	0	0	0	0	0	0	0	0	0	0
Juan Carlos I	0	1	0	0	0	1	0	0	1	0
Tres Olivos	0	0	0	0	0	0	0	0	0	0
Nº Total Sup VLH (200µg/m^3)	336	513	171	158	215	554	222	326	102	96
Nº Estaciones con > 18 Sup	6	9	3	3	5	8	4	7	2	1
Nº Estaciones sin Superaciones	8	5	11	9	9	4	11	8	10	14

Where the HLV for NO2 (200 µg/m^3) was exceeded >18 times, this is shown in red.

Once again, the figures recorded in 2019 are clearly positive compared with those recorded in previous years. First, **in 2019 only one station, Plaza Elíptica (HLV exceeded 47 times) went over the HLV for NO_2, while in previous years the number of stations exceeding the limit varied between 9 (in 2011) and 2 (in 2018)**. In addition, 2019 saw the lowest number of times the hourly value of 200 µg/m³ was exceeded across the network (96 times) in the last 10 years. This figure was five times lower than the figure for 2015 (limit exceeded 554 times) and three times lower than in 2017 (limit exceeded 326 times). It is true that both these years saw a high prevalence of adverse meteorological conditions. However, the 2019 figure was also lower than the figures for 2016 (limit exceeded 222 times) and 2018 (limit exceeded 102 times), even though the anti-pollution protocol was activated on more days in 2019 (Figure 5). **Finally, 2019 saw a new record set for the number of stations at which the HLV of 200 µg/m³ was not exceeded even once in the year: 14 stations.** In summary, in 2019, despite very adverse weather conditions in January and February which led to the activation of the anti-pollution protocol on 14 days, the hourly limit value for NO_2 (200 µg/m³) was observed to be exceeded a significantly smaller number of times than in previous years.

Table 3 shows the variation in average annual values for NO_2 pollution recorded in 2019, compared with the corresponding average annual values for the period 2010-2018, in all stations across the network. **The data suggest that in 2019, NO_2 pollution decreased in 22 of the 24 stations making up the network, as well as in terms of the average value for the entire network.**

Table 3. Average annual values of NO_2 (µg/m³)

Estación	Promedio 2010-2018	2019	Diferencia	% Variación
Plaza del Carmen	46	36	-10	-22
Tres Olivos	34	25	-9	-26
Cuatro Caminos	46	38	-8	-17
Plaza de Castilla	45	37	-8	-18
Plaza de España	47	40	-7	-15
Ramón y Cajal	46	39	-7	-15
Barrio del Pilar	43	36	-7	-16
Castellana	41	34	-7	-17
Retiro	32	25	-7	-22
Arturo Soria	40	34	-6	-15
Plaza Elíptica	58	53	-5	-9
Urb. Embajada	43	38	-5	-12
Moratalaz	41	36	-5	-12
Méndez Alvaro	39	34	-5	-13
Farolillo	38	33	-5	-13
Escuelas Aguirre	55	51	-4	-7
Vallecas	40	36	-4	-10
Sanchinarro	35	31	-4	-11
Casa Campo	24	20	-4	-17
Villaverde	41	39	-2	-5
El Pardo	18	16	-2	-11
Barajas Pueblo	37	36	-1	-3
Ensanche de Vallecas	36	37	+1	+3
Juan Carlos I	24	26	+2	+8
RED	39	35	-4	-10

Values exceeding the Annual Limit Value for NO_2 (40 µg/m³) are shown in red.

The most significant reduction was found in the station at Plaza del Carmen, which falls within the Madrid Central zone of operation, and where the average value went from 46 µg/m³ over the previous 9 years (appreciably higher than the ALV for NO_2) to 36 µg/m³ en 2019 (comfortably below the ALV for NO_2), this 10 µg/m³ drop representing a 22% reduction.

Very noticeable reductions were also seen in many other stations. **It is worth highlighting the fact that in 10 stations in the network, there was a reduction from an average value for the period 2010-2018 which exceeded the ALV for NO_2 to a value in 2019 which was below this limit. As well as in Plaza del Carmen, this was seen to occur in the stations at: Cuatro Caminos (a reduction of 8 µg/m³), Plaza de Castilla (8 µg/m³), Plaza de España (7 µg/m³), Ramón y Cajal (7 µg/m³), Barrio del Pilar (7 µg/m³), Castellana (7 µg/m³), Urbanización Embajada (5 µg/m³), Moratalaz (5 µg/m³) and Villaverde (2 µg/m³).**

The two stations in the network which had always been the most problematic, recording year after year the highest values of NO_2 in Madrid, were Plaza Elíptica and Escuelas Aguirre. As mentioned above, these two stations once again saw the ALV for NO_2 exceeded in 2019, although they did record significant reductions in measured NO_2 levels in 2019 compared with the average for previous years: 5 µg/m³ in Plaza Elíptica and 4 µg/m³ in Escuelas Aguirre.

Only two stations in the network recorded slight increases in the level of NO_2 pollution in 2019 compared with the levels recorded in previous years. These were two peripheral stations (very far from the Madrid Central zone): Ensanche de Vallecas (an increase of 1 µg/m³) and Parque Juan Carlos I (an increase of 2 µg/m³).

Overall, the average value for the network fell by 4 µg/m³ (a 10% reduction) compared with the average for the previous years.

In summary, data for the year 2019 confirm that there was an overall decrease in NO_2 pollution across the network, and that there was no "border effect" in the area around the Madrid Central zone. It would be more correct to speak of Madrid Central having a "contagion effect", in the form of a positive influence on air quality across the entire city, although it is true that this measure alone is not enough to ensure that the legal limits are always respected (so that no station in the network excedes either the hourly or annual limit values for NO_2).

Data on NO_2 pollution in the network of the Autonomous Community of Madrid in 2019

It is interesting to compare trends in NO_2 pollution levels in the city of Madrid with the equivalent data recorded by the pollution measurement network of the Autonomous Community of Madrid.

Table 4 shows the variation in levels of NO_2 pollution recorded in 2019, compared with average values for the period 2010-2018, in all stations across the network of the Community of Madrid (ie. it is analogous to Table 3 for the city of Madrid).

As Tables 3 and 4 show, a decreasing trend in levels of NO_2 pollution was observed across the network of the Community of Madrid in 2019, compared with the average for previous years. However, **the reduction in NO_2 pollution observed across the network of the Community was less marked than the reduction recorded in the capital.**

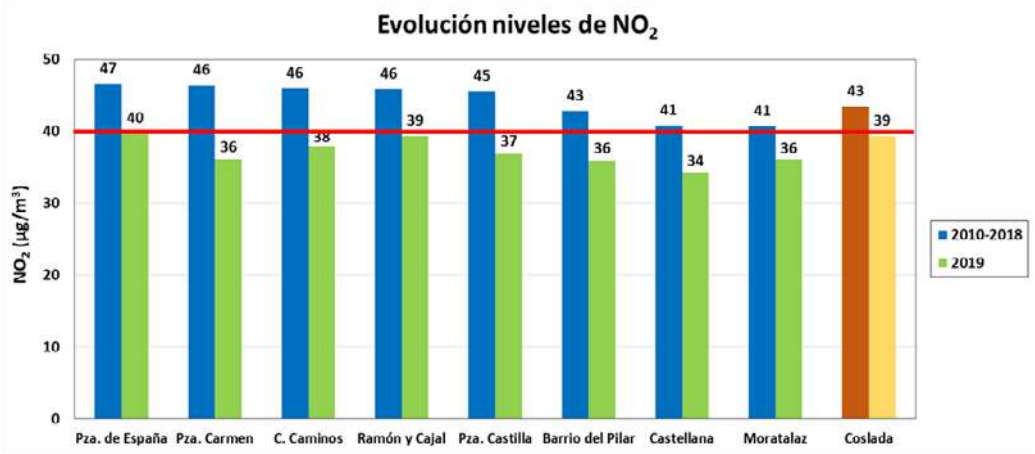
While in the city of Madrid, NO_2 levels decreased by 4 µg/ m³ or more in 19 of the 24 stations, as well as decreasing on average across the network, in the Community of Madrid this only occurred in 6 of the 23 stations in the network. In 5 stations no differences were recorded, and in two other stations there was a slight rise in NO_2 levels.

Table 4. Values of NO_2 (µg/m³) across the network of the Autonomous Community of Madrid

Estación	Promedio 2010-2018	2019	Diferencia	% Variación
Collado Villalba	33	27	-6	-18
Alcalá de Henares	33	28	-5	-15
Colmenar Viejo	28	23	-5	-18
Coslada	**43**	39	-4	-9
Leganés	40	36	-4	-10
Majadahonda	27	23	-4	-15
Getafe	37	34	-3	-8
Alcorcón	33	30	-3	-9
Alcobendas	30	27	-3	-10
Móstoles	29	26	-3	-10
Rivas Vaciamadrid	31	29	-2	-6
Arganda del Rey	20	19	-1	-5
Aranjuez	17	16	-1	-6
Villa del Prado	9	8	-1	-11
San Martín de Valdeiglesias	8	7	-1	-13
El Atazar	5	4	-1	-20
Valdemoro	22	22	0	0
Algete	16	16	0	0
Villarejo de Salvanés	15	15	0	0
Guadalix de la Sierra	11	11	0	0
Orusco de Tajuña	5	5	0	0
Fuenlabrada	32	33	+1	+3
Torrejón de Ardoz	27	29	+2	+7
RED	24	22	-2	-8

The values exceeding the Annual Limit Value for NO2 (40 µg/m3) are shown in red.

Figure 6. Comparison of trends in NO_2 levels in Coslada (CM) and in stations in the City of Madrid



It is interesting to compare trends at the station in Coslada, a station in the Community of Madrid network which has systematically exceeded the ALV for NO_2 over the last 4 years, with trends at the stations in the city of Madrid network which have also tended to exceed the limit and have recorded similar levels of NO_2 pollution. As can be seen in Figure 6, although at the

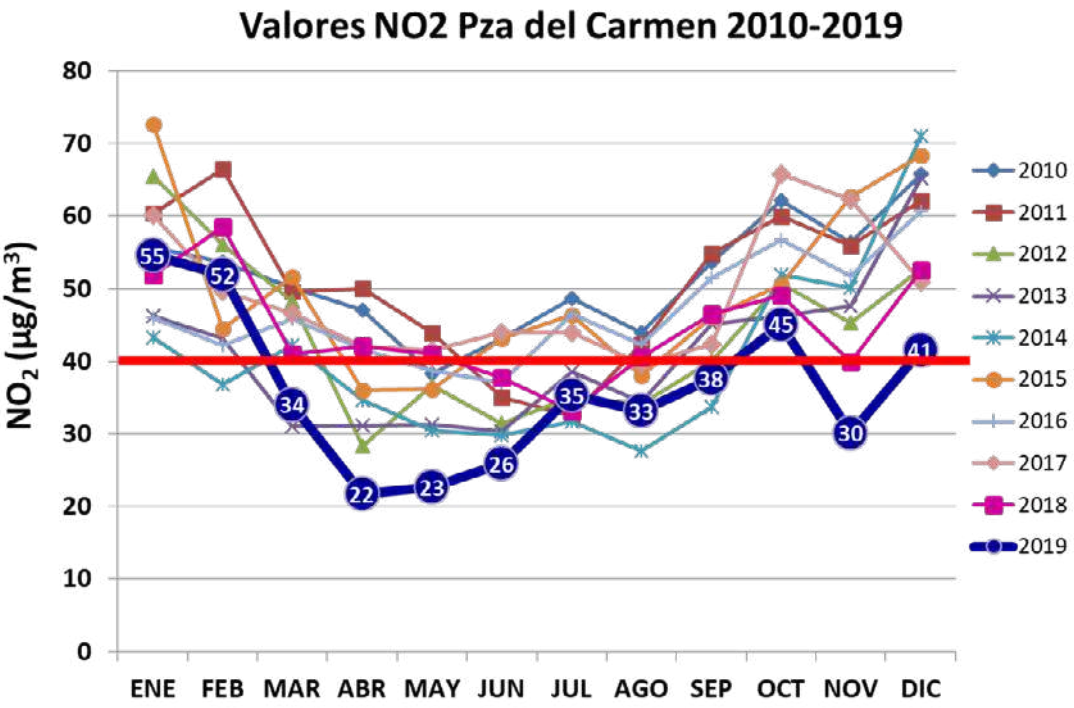
Coslada station there was a reduction in NO_2 levels in 2019 which meant the station found itself below the ALV for NO_2 for the first time since 2015, the value recorded was very close to this limit (at 39 µg/m³), and the reduction in NO_2 pollution compared with previous years was significantly smaller than that observed in the 8 stations in the City of Madrid network shown here.

In summary, it is clear that comparing the City and Autonomous Community of Madrid over the same period (the year 2019), under the same meteorological conditions, there is a noticeably greater reduction in NO_2 pollution in the capital than in the Community of Madrid.

Trends in monthly values for NO2 pollution in Madrid 2010-2019

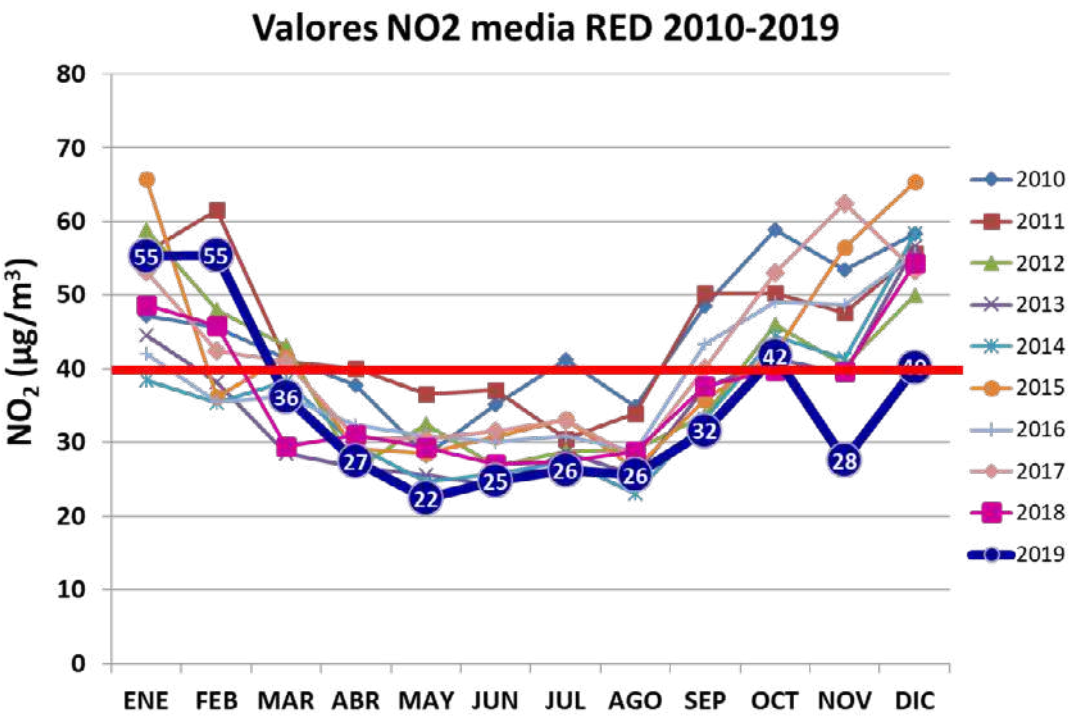
The figures below shows trends in average monthly values for NO_2 pollution over the last 10 years in Plaza del Carmen (Figure 7), and trends in the average values for the network (Figure 8). The graphs allow us to compare, month by month, the NO_2 levels recorded in 2019, the year of Madrid Central's operation, with the levels recorded in previous years.

Figure 7. Average monthly values of NO_2 in Plaza del Carmen in the years 2010-2019



The horizontal red line shows the Annual Limit Value for NO_2 (40 µg/m³).

Figure 8. Average monthly values of NO_2 across the network in the years 2010-2019



The horizontal red line shows the Annual Limit Value for NO_2 (40 µg/m³).

As can be seen, the data for Plaza del Carmen (Figure 7) clearly reflect the different phases which Madrid Central has undergone. At the beginning of the year 2019 (January and February), under particularly adverse meteorological conditions and with Madrid Central in a trial period, the values recorded in Plaza del Carmen were in line with the values recorded in previous years. In the month of March 2019, when Madrid Central's sanctions system came into force (on 16 March), the values recorded started to show an improvement on the average values recorded in previous years, and were clearly below the annual limit value for NO_2.

It is clear that the best results were obtained in the second quarter of the year, April-June; that is, the three months during which the Madrid Central sanctions system was fully operational, and also fully supported by the municipal authorities responsible for its management. During this time, the station saw the lowest levels of NO_2 pollution in the entire period studied (the years 2010 to 2019), with historically low average monthly values recorded (varying between 22 and 26 µg/m³).

In contrast, the values seen in the third quarter, July-September (varying between 33 and 38 µg/m³), while relatively low in comparison with the values recorded in the same months in previous years, are appreciably higher than those seen in the previous quarter.

October saw a further rise (45 µg/m³), although once again the 2019 value was below the corresponding values for the same month in previous years. Finally, in the last two months of the year, the values recorded were much lower than those generally seen previously. No doubt this result was influenced by the favorable meteorological conditions which predominated in those months in 2019 (Figures 1 and 2). However, the difference when compared with previous years is so large (in both months, 10 µg/m³ lower than the lowest figure recorded in the previous 9 years) that it is implausible to think that it can be attributed entirely to meteorological factors.

Overall, the values recorded in Plaza del Carmen in 2019 were lower than the ALV for NO_2 in 8 out of the 12 months of the year, a result which had never been seen before. There were

6 months (April-June and October-December) during which the 2019 values were lower than those recorded in the same months of all the previous 9 years.

With respect to average values for the network (Figure 8), it can be seen that the values remain at low levels compared to those recorded in previous years between April and December. The lowest value was observed in the month of May (22 µg/m^3, an all-time low for the pollution measurement network since it began to operate in January 2010). **The average network value also stayed below the ALV for NO_2 for 8 months, and there were 5 months (May, July, September, November and December) during which the 2019 values were lower than those recorded in the same months of all the previous 9 years.**

The conclusión is clear: the data from 2019 confirm that Madrid Central contributed to an overall reduction in NO_2 pollution across the city.

The Almeida effect

Although, as this report demonstrates, the overall picture of the operation of Madrid Central in 2019 is positive, it is clear that during the year there were times when Madrid Central was less effective. This has been shown in the previous section, and can also be observed in Figure 7 (comparison of data for the second and third quarters). The reason seems clear: the arrival in municipal government of Mayor Martínez Almeida, supported by the PP, Ciudadanos and Vox, parties which each established the end of Madrid Central (using various terms such as "suppression", "reversal" and "modification") as one of the pillars of their respective campaigns.

Since the beginning of the new municipal government's term in power, it has been manoeuvring with the aim of dismanteling Madrid Central. For example, on 17 June the intention to bring about the *de facto* termination of Madrid Central was made public through the establishment of a 3-month moratorium, starting on 1 July, on fines levied on vehicles infringing the limits. In other words, the city council made public its intention to offer a free pass to anyone driving an automobile in the Madrid Central zone, without the risk of incurring a penalty or any other consequences.

Then the month of July was marked by various (contradictory) political and legal decisions which had a huge impact on the operation of Madrid Central. Briefly, on 1st July, the moratorium on penalties for vehicles infringing Madrid Central regulations came into force, according to the decision of the new municipal government. On 5 July, a court in Madrid upheld an administrative appeal filed by Ecologistas en Acción along with Greenpeace and the Madrid Central Defence Platform, thereby imposing an injunction on the moratorium on fines from Madrid Central. Madrid City Council in turn appealed this decision in an attempt to keep the moratorium operational, but this appeal was dismissed by the court on 16th July, reaffirming the operational status of Madrid Central.

From July 2019, Madrid Central thus entered a period of uncertainty, with alternating periods when the sanctions system was suspended and then reinstated, with institutional messages coming from the new municipal government suggesting that the measure had proved counter-productive for the city's air quality (making "creative" use of the official statistics). They even suggested that it was prejudicial to the safety of citizens living in the Madrid Central zone (although this was denied by the police) and raised doubts about whether it would continue to exist in the near future. Of course, this context of uncertainty did not do anything to make Madrid Central more effective as an air quality improvement measure. Such a programme needs a clear operating framework, stability over time, and full institutional support if it is to achieve the commitment from the community necessary to help it meet its objectives.

It did not take long for the effects to be seen. Table 5 shows the variation in average values between the second and third quarters of 2019 in all stations across the network. As can be seen, **at the Plaza del Carmen station, NO_2 pollution levels shot up in the third quarter compared with the previous quarter, with an increase of 12 µg/m³ (52%). Nothing like this was observed at any other station in the network**, where changes varied between the 6-µg/m³ increase recorded in Méndez Alvaro and Barajas Pueblo, and the 2-µg/m³ decrease observed in Escuelas Aguirre. The average value for the network saw an increase of 3 µg/m³ between the second and third quarters of 2019.

Tablr 5. Variation in average quarterly values of NO_2 (µg/m³) in 2019

Estación	Media (Abr-Jun)	Media (Jul-Sep)	Diferencia	% Variación
Plaza del Carmen	**23**	**35**	+12	+52
Méndez Alvaro	**22**	**28**	+6	+27
Barajas Pueblo	**26**	**32**	+6	+23
Villaverde	**26**	**31**	+5	+19
Casa Campo	**12**	**16**	+4	+33
Juan Carlos I	**17**	**21**	+4	+24
Barrio del Pilar	**23**	**27**	+4	+17
Vallecas	**25**	**29**	+4	+16
Cuatro Caminos	**27**	**31**	+4	+15
El Pardo	**11**	**14**	+3	+27
Farolillo	**22**	**25**	+3	+14
Arturo Soria	**24**	**27**	+3	+13
Ensanche de Vallecas	**25**	**28**	+3	+12
Moratalaz	**25**	**28**	+3	+12
Ramón y Cajal	**30**	**33**	+3	+10
Retiro	**15**	**17**	+2	+13
Sanchinarro	**21**	**23**	+2	+10
Plaza Elíptica	**45**	**47**	+2	+4
Tres Olivos	**18**	**19**	+1	+6
Castellana	**23**	**24**	+1	+4
Urb Embajada	**28**	**29**	+1	+4
Plaza de Castilla	**29**	**29**	0	0
Plaza de España	**35**	**35**	0	0
Escuelas Aguirre	**44**	**42**	-2	-5
RED	**25**	**28**	+3	+12

In view of the striking difference between the second and third quarters of 2019 at the Plaza del Carmen station, the differences between the average values for these quarters were examined for the years 2010-2018, to see whether such variation was in fact normal at this station. The data shown in Table 6 and in Figure 9 allow us to rule out this possibility completely.

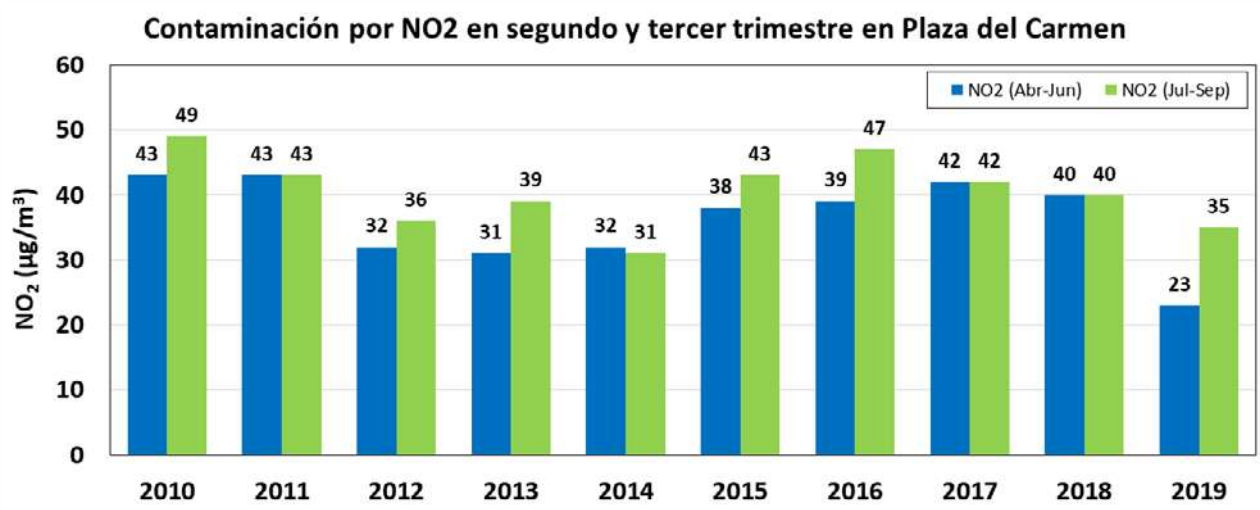
Table 6 shows that the average values for the years 2010-2018 at the Plaza del Carmen station showed similar patterns to the rest of the stations in the network, with a rise of 3 µg/m^3 between the second and third quarters. This was identical to the rise observed at 7 other stations as well as to the average rise across the network.

Figure 9 shows a graph comparing the quarterly variations in Plaza del Carmen in each year of the period 2010-2018, and illustrates the fact that in none of these years was there a rise in levels of NO_2 pollution from one quarter to the next as sharp as the rise seen in 2019.

Table 6. Variation in average quarterly values of NO_2 (µg/m^3) in 2010-2018

Estación	Media (Abr-Jun)	Media (Jul-Sep)	Diferencia	% Variación
Urb Embajada	**32**	**38**	+6	+19
Villaverde	**29**	**34**	+5	+17
Plaza Elíptica	**48**	**53**	+5	+10
Barajas Pueblo	**28**	**32**	+4	+14
Barrio del Pilar	**31**	**35**	+4	+13
Escuelas Aguirre	**47**	**51**	+4	+9
Casa Campo	**15**	**18**	+3	+20
Juan Carlos I	**17**	**20**	+3	+18
Sanchinarro	**24**	**27**	+3	+13
Méndez Alvaro	**29**	**32**	+3	+10
Vallecas	**30**	**33**	+3	+10
Ramón y Cajal	**37**	**40**	+3	+8
Plaza del Carmen	**38**	**41**	+3	+8
Plaza de España	**40**	**43**	+3	+8
El Pardo	**14**	**16**	+2	+14
Retiro	**23**	**25**	+2	+9
Ensanche de Vallecas	**27**	**29**	+2	+7
Farolillo	**28**	**30**	+2	+7
Arturo Soria	**30**	**32**	+2	+7
Moratalaz	**32**	**34**	+2	+6
Castellana	**32**	**34**	+2	+6
Cuatro Caminos	**36**	**38**	+2	+6
Tres Olivos	**25**	**26**	+1	+4
Plaza de Castilla	**37**	**38**	+1	+3
RED	**30**	**33**	+3	+10

Figure 9. Comparison of the variations in average quarterly values of NO_2 (µg/m³) in the years 2010-2019



We can therefore conclude that the 12 µg/m³ (52%) increase in NO_2 pollution between the second and third quarter, observed only at the Plaza del Carmen station and only in 2019, is an exceptional, unprecedented event: the Almeida effect.

The next significant step in the current municipal government's campaign to undermine and ultimately destroy Madrid Central was the public presentation on 30 September 2019 of the "Madrid 360" plan. The Almeida-Villacís administration presented this plan as an alternative to Madrid Central and to Plan A. The document was improvised over two months in the summer by an external consultancy firm, which was awarded the contract to produce it without any input from the council's technical staff with responsibility for air quality in Madrid, or from any recognised scientists or experts in the fields of transport and atmospheric pollution, and with no opportunity for public debate – in summary, with no input from anyone else.

What is clear from its implementation so far is that Madrid 360 has used measures which are irrelevant, or which were in fact taken some time ago, to disguise its one clear objective: to encourage the use of the car in the centre of Madrid by relaxing recent restrictions, reducing the amount of fines, increasing the amount of parking spaces and decreasing the price of parking; in short, by completely dismantling Madrid Central.

It is worth highlighting that Madrid 360 is not accompanied by any modelling of the proposed measures, which would allow us to estimate with some technical rigour what reduction in pollution these measures might lead to, and how long it might take to achieve the objective of at last complying with legal limits on NO_2 pollution in Madrid. This absence of modelling of the measures is not a trivial issue: modelling is required under both European and Spanish legislation, and its absence can therefore be the subject of legal action, if not remedied. It should be remembered that the European Commission still has proceedings pending relating to the systematic infringement since 2010 of legal limits on NO_2 pollution in Madrid, and that last July it took the decision to summon Spain to appear before the Court of Justice of the European Union, a step away from receiving a fine in the millions for systematic violation of the air quality directive.

While the presentation of Madrid 360 was a mere propaganda exercise in the context of an electoral campaign, and was in fact criticised as such by the Provincial Electoral Commission of Madrid, and while the Madrid 360 document is a long way from meeting the requirements for any pollution reduction plan, it has succeeded in generating a great deal of confusion (a common strategy of the municipal government in its attempts to undermine the effectiveness of Madrid

Central). With headlines along the lines of "Madrid Central is history, and the new anti-pollution plan is called Madrid 360" and with the abundant use of the Madrid 360 logo in public places (bus shelters, buses, information panels and social networks) the idea has been spread that Madrid Central is no longer in operation and has been replaced by a new strategy. It is believed, for example, that vehicles with environmental label C are allowed to cross the Madrid Central zone if they have two occupants, although in fact this violates Madrid Central rules which are still in effect. In this context, it is not surprising that official data from Madrid City Council show that in October 2019, for the first time, and in contrast to trends over the previous months, there was more traffic in the Madrid Central zone than there had been in October 2018, before Madrid Central came into operation. This could in turn explain at least part of the rise in NO_2 pollution observed in Plaza del Carmen in October 2019 (Figure 7).

For Ecologistas en Acción, given the positive results achieved by Madrid Central in 2019, it is completely absurd, and above all utterly immoral, to *de facto* dismantle this pollution reduction measure. It is has been shown to be effective in improving the city's air quality and helping us to comply with legal limits, and most importantly it allows us to improve public health in the city. **We need more of Madrid Central, not less.**