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Noise contours around Brussels Airport

for the year 2023

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Report

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1 Introduction

1.1 Background

The Government imposes an obligation on Brussels Airport Company to annually calculate noise contours in order to perform an assessment of the noise impact caused by departing and landing aircraft on the area surrounding the airport. For Brussels Airport, these calculations are imposed in the Environmental Legislation (VLAREM).

These noise contours are calculated according to a strictly-defined methodology (see §1.3) and reflect evolutions in the number of movements and fleet changes, as well as the actual use of runways and flight paths. Weather conditions and other events in the year affect this actual use.

To check their accuracy of the calculations, the noise contours are compared with the sound measurements at a number of locations around the airport.

Between 1996 and 2014, these contours were calculated by the Acoustics and Thermal Physics Laboratory of the Belgian university KU Leuven. Between 2015 and 2020, this assignment was carried out by the WAVES research group of the Ghent University (UGent). From 2021, these calculations have been carried out by To70. The calculations are commissioned by the airport operator, Brussels Airport Company.

1.2 Disclaimer

This assignment is performed by recognised sound experts working at To70 with the explicit assignment to submit a report in compliance with the legal obligations imposed on Brussels Airport Company pertaining to the applicable legislation. The recognised sound experts at To70 are responsible for the conformity of this result, but are not responsible for the quality and comprehensiveness of the raw data provided to them.

This report does not contain information, opinions or advice on the applicable (environmental) legislation at federal or regional level and is not suitable to be used for this purpose.

1.3 Mandatory calculations

The operator of an aerodrome classified as first class[1] is required by VLAREM environmental legislation to have the following noise contours calculated annually:

- L_{den} noise contours of 55, 60, 65, 70 and 75 dB(A) to show noise impact over 24 hours, and to determine the number of people who are potentially seriously inconvenienced;
- L_{day} noise contours of 55, 60, 65, 70 and 75 dB(A) to show noise impact during the day from 07:00 to 19:00;
- $L_{evening}$ noise contours of 50, 55, 60, 65, 70 and 75 dB(A) to show noise impact during the evening from 19:00 to 23:00;
- L_{night} noise contours of 45, 50, 55, 60, 65 and 70 dB(A) to show noise impact at night from 23:00 to 07:00;

[1] Class 1 Airports: airports that comply with the definition of the 1944 Chicago Convention establishing the International Civil Aviation Organization and have a runway of at least 800 metres

The VLAREM environmental legislation stipulates that the noise contours are calculated using a calculation model that is compatible with the methodology, as stated in ECAC Doc. 29, 3rd edition (2005) or a later edition. On 7 December 2016, the 4th edition of ECAC Doc. 29 was adopted. The 4th edition is thus decisive for the method of calculation.

Supplementary to the VLAREM obligations, the environmental permit of Brussels Airport Company imposes extra noise contour calculations for:

- L_{den} and L_{night} noise contours, such as are required by the present VLAREM obligation;
- Frequency contours for 70 dB(A) and 60 dB(A). As in preceding years, Brussels Airport Company asked To70 to discuss the following frequency contours:
  - Frequency contours for 70 dB(A) during the daytime period (07:00 to 23:00) with frequencies 5x, 10x, 20x, 50x and 100x
  - Frequency contours for 70 dB(A) at night (07:00 to 23:00) with frequencies 1x, 5x, 10x, 20x and 50x
  - Frequency contours for 60 dB(A) during the daytime period (07:00 to 23:00) with frequencies 50x, 100x, 150x, and 200x
  - Frequency contours for 60 dB(A) at night (23:00 to 07:00) with frequencies 10x, 15x, 20x, and 30x

The number of potentially severely inconvenienced people within the different L_{den} contour zones should be determined on the basis of the dose-response relationship included in the VLAREM.

The noise zones must be shown on a 1/25 000 scale map.

1.4 History of noise contours

The annual calculation of noise contours started in 1996. Until VLAREM was amended to comply with the European guideline on environmental noise (2002/49/EG) in 2005, the following division of the operational day was used (day: 06:00 – 23:00; night: 23:00 – 06:00). Following the adaptation of VLAREM to the Directive, the officially reportable noise contours are calculated according to the day format of the Directive (day: 07:00 – 19:00; evening: 19:00 – 23:00; night: 23:00 – 07:00).

Since 2011 the INM 7 model (sub-version INM 7.0b) has been used for the calculation of the noise contours. Model version 6.0c was used for the officially-reported noise contours every year from 2000 to 2010. As the model used and the associated aircraft database affect the calculated noise contours, the sound contours for the year 2000 and for the years 2006 to 2010 were recalculated with the version 7.0b[2]. In this way, the evolution of the sound contours since the year 2000 can be mapped without the influence of the calculation model used.

From the beginning of 2021, the calculations are made with the Echo calculation model, developed by AerLabs B.V. With Echo, the calculations are performed according to the methodology stated in ECAC Doc.

[2] For the frequency contours of 60 and 70 dB(A), only the year 2010 was calculated using the version 7.0b of the INM calculation model

29 4th edition. In addition to this, refinements have been implemented since 2021 with respect to previous annual calculations in the data used and the input data in the calculations. In addition, the year 2019 has also been recalculated in the context of the EIA, using the updated calculation model. Further explanations of the changes in the method of calculation and the effects on the calculated noise levels are described in Appendix F.

1.5 Noise calculation model: Echo

From 2021, the calculation of the noise contours has been performed with the Echo noise calculation model. Echo is configured according to the specifications of ECAC Doc. 29, 4th edition (2016). Echo has been verified on the basis of the verification framework of ECAC Doc. 29, 4th edition, Volume 3. Echo makes use of ANP database version 2.3.

This software meets the conditions stated in Vlarem: "The noise contours are calculated using a calculation model compatible with the methodology, as stated in ECAC Doc. 29, 3rd edition (2005) or a later edition." The software also complies with the European Environmental Noise Directive 2002/49/EC.

1.6 Population data

The most recent population data available is used to determine the number of residents living inside the contour zones and the number of people who are potentially seriously inconvenienced. For the calculation of the exposure figures in this report use is made of the population data on 1 January 2024. By using the population data on 1 January 2024 instead of those on 1 January 2023, the analysis takes into account the general increase in the number of people living in the vicinity of the airport.

For 2017 , the noise contours reports determined the exposed population on the basis of a homogeneous distribution of population over the area of the statistical sector . From 2017, the calculation method was refined, whereby the actual location of the address points were included. Based on the address files in the Brussels-Capital Region and Flanders, in combination with the population information per statistic sector, the number of persons is calculated for each address location. This is done by uniformly distributing the number of persons per statistic sector over the number of address locations. In Flanders, address locations on business estates were excluded, unless there are several address locations in a statistical sector on business estates. The above is only applicable to locations in Flanders since an address file for industrial parks within the Brussels-Capital Region was not available.

1.7 Source data

For the calculation of the noise contours, and in order to be able to compare the results against those of the noise monitoring network, Brussels Airport Company has made source data available. A complete overview of this source data with references to the relevant files can be found in Appendix G.

2 Definitions

2.1 Explanation of a few frequently-used terms

2.1.1 Noise contours

As a result of flight traffic, noise impact is either observed or calculated for every point around the airport. Due to a difference in distance from the noise source, these values may vary sharply from one point to another. Noise contours are isolines or lines of equal noise impact. These lines connect together points where equal noise impact is observed or calculated.

The noise contours with the highest values are those situated closer to the noise source. Further from the sound source, the value of the sound contours is lower.

2.1.2 Frequency contours

The acoustic impact of overflight by an aircraft can be characterised at every point around the airport by, for example, the maximum noise level observed during overflight. This maximum noise level can be determined, for example, as the maximum of the equivalent sound pressure levels over 1 second ($L_{Aeq,1s,max}$) during this overflight.

The number of times that the maximum sound pressure level exceeds a particular value can be calculated for the passage of all aircraft overflights during a year. The number of times on average that this value is exceeded each day is the excess frequency. Frequency contours connect locations where this number is equal.

2.1.3 Noise zones

A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

2.1.4 The A-weighted equivalent sound pressure level $L_{Aeq,T}$

The noise caused by overflying aircraft is not a constant noise, but has the characteristic of rising sharply to a maximum level and thereafter declining sharply again. Noise impact at a specific place resulting from fluctuating sounds over a period is represented by the A-weighted equivalent sound pressure level $L_{Aeq,T}$.

The A-weighted equivalent sound pressure level $L_{Aeq,T}$, over a period T, is the sound pressure level of the *constant* sound that contains the same acoustic energy as the fluctuating sound during the same period. The unit for an A-weighted equivalent sound pressure level is the dB(A).

The designation A-weighted (index A) means that an A-filter is used to determine the sound pressure levels. This filter reflects the pitch sensitivity of the human ear. Sounds at frequencies to which the ear is sensitive are weighted more than sounds at frequencies to which our hearing is less sensitive. Internationally, A-weighting is accepted as the standard measurement for determining noise impact around airports. This A-weighting is also applied in the VLAREM legislation on airports.

This report calculates 3 types of $L_{Aeq,T}$contours, namely:

- L_{day}: the A-weighted equivalent sound pressure level for the daytime period, defined as the period between 07:00 and 19:00;
- $L_{evening}$ means the A-weighted equivalent sound pressure level for the evening period, defined as the period between 19:00 and 23:00;
- L_{night}: means the A-weighted equivalent sound pressure level for the night period, defined as the period between 23:00 and 07:00.

2.1.5 L_{den}

The European directive on the control and assessment of environmental noise (transposed in VLAREM II), recommends using the L_{den} parameter to determine the exposure to noise over a longer period. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight) is the A-weighted equivalent sound pressure level over 24 hours, with a (penalty) correction of 5 dB(A) applied for noise during the evening period (equivalent to an increase of the number of evening flights by a factor of 3.16), and 10 dB(A) during the night (equivalent to an increase of the number of night flights by a factor of 10). For the calculation of the L_{den} noise contours, the day is divided as per section 57 of VLAREM II, with the evening period from 19:00 to 23:00 and the night period from 23:00 to 07:00. L_{den} is the weighted energetic sum of these three periods with a weighting according to the number of hours in each period (12 hours for the day, 4 hours for the evening and 8 hours for the night).

2.2 Link between annoyance and noise impact

An exposure-effect relationship is imposed by VLAREM II to determine the number of people who are potentially seriously inconvenienced within the L_{den} noise contour of 55 dB(A). This formula gives the percentage of the population that is potentially severely inconvenienced in terms of the noise level expressed in L_{den} (Figure 1).

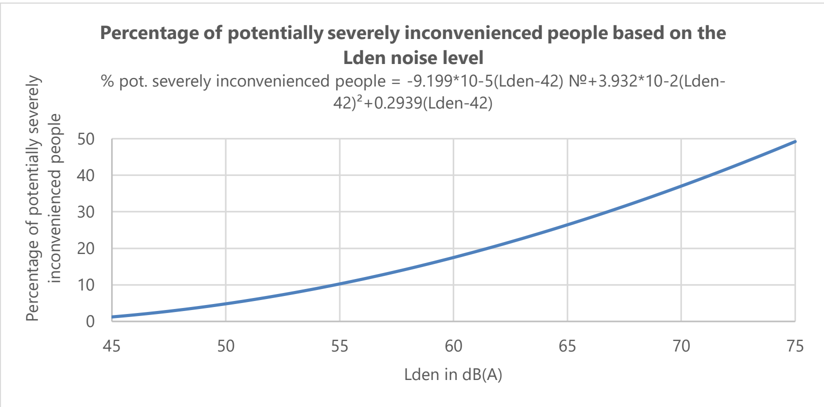

Figure 1: Percentage of potentially severely inconvenienced people as a function of L_{den} for airplane noise

(Source: VLAREM – environmental legislation based on Miedema 2000)

The above formula derives from a synthesis-analysis of various noise studies conducted by Miedema around several European and American airports[3] and was adopted by the WG2 Dose/Effect of the European Commission[4]. Note that L_{den} only determines about 30% of the variance in reported severe inconvenience[5,6]

European environmental noise directive

In October 2018, a WHO report appeared in which new exposure-effect relationships were proposed. The guideline value for observed health effects is set at 45 dB L_{den} and 40 dB L_{night}[7]. In a recent extension of the European Environmental Noise Directive (EU Directive 2002/49/EC)[8] , the new WHO exposure-effect relationships are adopted in the EU Directive. With a decision of the Government of Flanders dated 28/01/2022 this was transposed to the Flemish legislation with regard to the reporting in the framework of the European environmental noise directive. No changes were implemented to the provisions in Vlarem II Chapter 5.57 Airports. The same exposure-effect relationship for determining the number of potentially severely inconvenienced people remains applicable for this report (Figure 1).

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[3] Miedema H.M.E., Oudshoorn C.G.M., Elements for a position paper on relationships between transportation noise and annoyance, TNO report PG/VGZ/00.052, July 2000

[4] European Commission, WG2 – Dose/effect, Position paper on dose response relationships between transport noise and annoyance, 20 February 2002

[5] Van Kempen EEMM et al.. Selection and evaluation of exposure-effect relationships for health impact assessment in the field of noise and health, RIVM Report No. 630400001/2.005. Bilthoven: RIVM; 2005.

[6] Kroesen M, Molin EJE, by Wee B. Testing a theory of aircraft noise annoyance: a structural equation analysis. J Acoust Soc Am 2008;123:4250–60.

[7] WHO Europe, Environmental Noise Guidelines for the European Region (2018), ISBN 978 92 890 5356 3http://www.euro.who.int/en/publications/abstracts/environmental-noise-guidelines-for-the-european-region-2018,

[8] COMMISSION DIRECTIVE (EU) 2020/367 of 4 March 2020 amending Annex III to Directive 2002/49/EC of the European Parliament and of the Council as regards the determination of methods for determining the harmful effects of environmental noise.

3 Methodology

From the start of 2021, use has been made for the calculation of noise contours of the Echo calculation model, developed by AerLabs B.V. This model and the methodology used comply with the methodology prescribed in the VLAREM legislation (Chapter 5.57 Airports). 29, 4th edition (2016). Supplementary to this, several details have been implemented in the calculation method distinguishing these from previous year calculations. This chapter gives a description of the working method.

The procedure for calculating noise contours consists of three phases:

- Collection of information concerning the flight movements, the routes flown, aircraft characteristics and meteorological data.
- Performing the noise calculations with the Echo calculation model.
- Processing of the contours using a Geographic Information System (GIS).

3.1 Data input

The year calculations are based on the actual number of flights, divided into the number of flights during the day (07:00 - 19:00), evening (19:00 - 23:00) and night (23:00 - 07:00).

The following data is required to specify aircraft movements:

- Aircraft type
- Time
- Nature of the movement (departure/arrival)
- Destination or origin
- Landing/take-off runway used
- Flight path followed

The flight information is provided by Brussels Airport Company as an export of the flight movements from the central database (CDB). All the necessary information is stored in this database. The quality of the data is very good.

Each aircraft type is linked to an aircraft type for which the noise and performance data needed for noise calculations are included in the Aircraft Noise and Performance (ANP) database, see §3.2. In most cases, the aircraft type is present in the ANP database. For a small fraction of aircraft that cannot be directly linked, a suitable type is sought based on number of type of engines and starting weight.

Helicopters are not included specifically in the calculations, but they are added proportionally to the flight movement type (landing/take-off) and the time of day. In 2023, helicopter flights were responsible for about 1.2% of movements.

3.1.1 Radar data

Aircraft follow certain routes which are essentially determined by the runway used and the SID flown (Standard Instrument Departure) for take-offs, or by the runway used and the STAR ('Standard Arrival Route') for arrivals. The existing SIDs and STARs are shown in the AIP ('Aeronautical Information

Publication'). This official documentation specifies the procedures to be followed for the flight movements at a specific airport.

These descriptions for departure are not strict spatial specifications but established procedures. For example, when reaching a certain height or orientation point, a manoeuvre must be performed. Reaching this height and/or geographical location depends on the aircraft type, weight (and indirectly on the destination), as well as weather conditions. This may result in a very large geographical distribution of the actual flight paths for the same SID. This creates bundles of movements that use the same or similar SIDs.

In the reporting up to and including 2020, a statistical division of the routes actually flown was used in the noise calculations per bundle based on radar data and translated to representative flights paths with a distribution of the traffic over these paths. For commonly used SIDs, these were further refined by a further breakdown based on aircraft type. The representation of the flight paths was thus a statistical approach to the actual flights paths.

Noise calculations since 2021 have been based on the actual flight paths of the flights, using radar data directly. This radar data gives the position of the aircraft every 4 seconds. Based on these data, the flight path can be accurately represented.

Various start points (position where the aircraft comes onto the runway) are available on one runway. This start point is available for each flight based on information that originates from skeyes and is supplied by Brussels Airport Company. In the noise calculations, take-offs are modelled from the actual start point on the runway. Approaches are modelled on the basis of the runway threshold, whereby a flight height is assumed of 50 foot above the runway threshold.

3.1.2 Meteorological data

For the calculation of the noise contours, the actual average meteorological conditions are used. These meteorological conditions are available for each thirty minutes (METAR) via Brussels Airport Company. The wind direction, wind speed and temperatures are linked to the individual flight movements. The headwind is calculated for each individual flight movement and for the runway used. In this way, an annual averaged meteorological condition, which is weighted for the number of flights under each meteorological condition, is obtained.

The wind speed is provided in accordance with the calculation method and converted to knots (kn). The meteorological parameters for 2023 are:

- Average headwind (annual average across all runways, take-off and landing): 7.8kn.
- Average temperature: 12.0°C.
- Average humidity: 78%.
- Average air pressure: 1014.52 mBar.

3.1.3 Take-off profile

The weight of the aircraft at departure influences the take-off profile. Given that this actual weight is not available in the CDB, a method proposed by ECAC Doc. 29 is used to take into account this effect ('stage length'). The Aircraft Noise and Performance (ANP) database gives an assumed take-off weight per stage length. It is assumed that the greater the distance from Brussels Airport to the destination, the more this aircraft will operate at its maximum take-off weight. This is justified, inter alia, by the fact that the kerosene constitutes a significant part of the total weight of an aircraft. This complies with the methodology of the preceding annual reports.

The coordinates of all airports have been collected on the website 'http://openflights.org/data. This list is used to calculate the distance to Brussels Airport from any airport.

The profiles for take-offs are modelled according to the Noise Abatement Departure Procedure (NADP) 1, with acceleration at a height of 3000 foot. This corresponds with the stipulated take-off procedure on Brussels Airport.

3.1.4 Approach profiles

Flights approaching Brussels Airport descend in practice from a great height in a continuous descent to the runway or fly before the final approach for a while at a fixed height. Until 2020, one standard approach profile for approaching traffic was used in the noise calculations. In order to take into account the impact of the different approaches on noise, three approach profiles have been made available for approaching traffic for the calculation from 2021, and thus also this year:

- An approach profile with a continuous descent.
- An approach profile with a horizontal segment at c. 560 metres above the airport. This corresponds with an approach altitude of 2,000 foot above sea-level.
- An approach profile with a horizontal segment at c. 870 metres above the airport. This corresponds with an approach altitude of 3,000 foot above sea-level.

The allocations of the most appropriate approach profile for a flight is based on the radar data. Based on this coupling, 37.2% of approaching traffic is linked to a continuous descent, 39.4% to a descent with a horizontal segment at 2,000ft and 23.5% to a descent with a horizontal segment at 3,000ft.

3.2 Aircraft source data

Alongside the relevant data about aircraft movements, runway use and flight paths, the calculation of the noise impact also demands appropriate noise and performance data for the aircraft concerned. The source of the information is the international Aircraft Noise and Performance (ANP) databased, approved by the ECAC.

The ANP database gives noise and performance data of aircraft. The data in the database cover most larger, modern aircraft models and variants. Aircraft models and variants that are not included in the ANP database must be represented by substitutes (often designated as 'proxy' aircraft): aircraft with comparable noise and performance characteristics that are included in the ANP database, whereby a correction is applied based on the difference in noise impact based on noise certification data.

For the year calculation, use is made of ANP version 2.3 (October 2020). In 2022, seven aircraft types were added as 'proxy' aircraft to the ANP database, including NEO variants of the A320 and A321. These types have been considered in the performance of the annual calculations from 2022 onwards.

For the annual calculation, all registered passages are linked to a 'proxy' based on the 'ANP Aircraft Substitution Tables'.[9] The link is made based on aircraft type and engine type. A number of aircraft types cannot be linked on the basis of the substitution list. For those types, the allocation of the proxy aircraft is done based on the number and type of engines and start weight.

With regard to the proxy aircraft, a correction factor is applied in the noise calculations for the difference in noise impact between the actual aircraft type and the proxy aircraft. This correction is made on the basis of noise certification data. For most movements (98.83%), Brussels Airport Company has the noise certification data of the aircraft concerned. For the movements for which this is not the case, the correction is based on the correction in the ANP substitution list. That correction is each time based on the most noisy model variant of the aircraft concerned.

3.3 Match between measurements (NMS) and calculations (INM)

Echo enables calculations at specific locations around the airport. To check the assumptions concerning the input data and the accuracy of Echo, the calculated noise impact is compared with sound measurements taken at 31 locations.

The comparison with measurements provides a validation of the calculations. Both the noise calculations as well as the noise measurements imply limitations and uncertainties. The noise calculations do not, for example, take the actual height at which an aircraft flies overhead into account (this is determined by the assigned standard departure and approach profiles, not by the actual radar data). The measuring stations are unmanned because they are monitored continuously throughout the year. Local deviations caused by local noise events or background noise, for example, may affect the measured levels. Although these are removed as far as possible from the measurements (for example, through an automatic link between noise events and aircraft, based on the radar data), such contributions to the measured levels cannot be completely excluded.

If there is a sufficient correspondence between the annual averages of the measured noise vents and the annual average forecast based on the average day, over a sufficient number of measuring units, confidence can still be gained regarding the calculation method.

3.4 Technical data

The calculations are performed with Echo within a grid of 70 x 70 kilometres around the airport, with a mesh size of the grid of 250 metres. The altitude of the airport reference measuring point in relation to sea level is 175 ft.

[9] The ANP substitution list has been prepared for ANP version 2.2. In ANP version 2.3, the noise and performance data has been added for several new aircraft types. These types were added to the substitution list by To70.

3.5 Changes in the calculation method in respect to previous years

An overview of the main changes in the method of calculation applied since the 2021 calculations and their effects on the results is described in Appendix F.

4 Results

4.1 Background information about interpreting the results

This section describes a number of air traffic statistics in order to get a better picture of the evolution in the traffic picture of 2023 compared to previous years. For this, information such as the number of movements, the evolution of the fleet, and runway usage has been mapped.

4.1.1 Number of flight movements

One of the most important factors for the annual noise contours around an airport is the number of movements which occurred during the past year. Following the decline of the number of movements between 2011 and 2013, there was an increase of 6.9% in 2014 and a further increase of 3.4% in 2015. In 2016 the number of aircraft movements fell to 223.688 (-6.5%). This is largely a result of a temporary closure following the attacks on the airport on 22 March 2016. In 2017, the number of movements increased by 6.3% to 237.888. In 2018, the number of movements increased by 1.0% to 235.459. In 2019 there was one again a slight decline of 0.4% and the total number of movements was 234.460. In 2020, the picture was entirely defined by the impact of the global pandemic and the consequences for international travel. The number of flight movements fell by 59.1% to 95,811. In 2022 there were 178,930 airport movements, which is an increase of 50.7% compared to 2021. In 2023, the number of flight movements increased by 7.4% compared to 2022, to 192.257 movements. The airport is thus still recovering from the impact of the pandemic. The number of movements in 2023 is still 18.0% lower than in 2019.

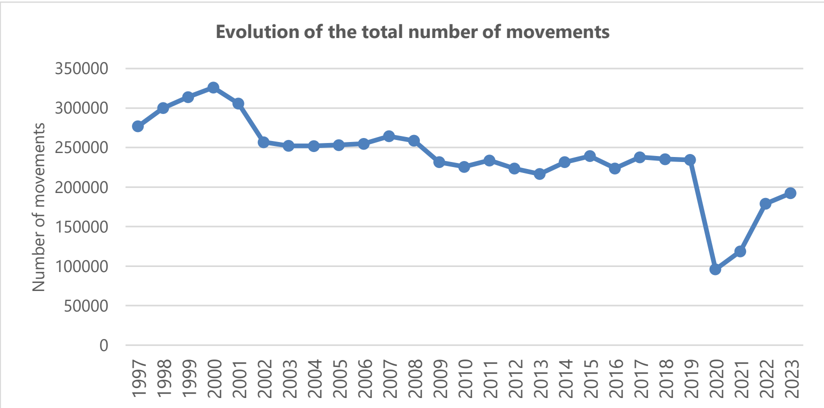


Figure 2: Evolution of flight traffic (all movements) at Brussels Airport.

The number of night movements (23:00 to 06:00 hours) decreased by 2.0% from 16,916 in 2022 to 16,573 in 2023, shown in Figure 3. Due to this decrease, the number of night movements is still below the number in 2019 (17,347 night movements). In 2023, there were 5,046 night-time departures. This includes helicopter movements and flight movements exempt from slot coordination, such as government and military flights.

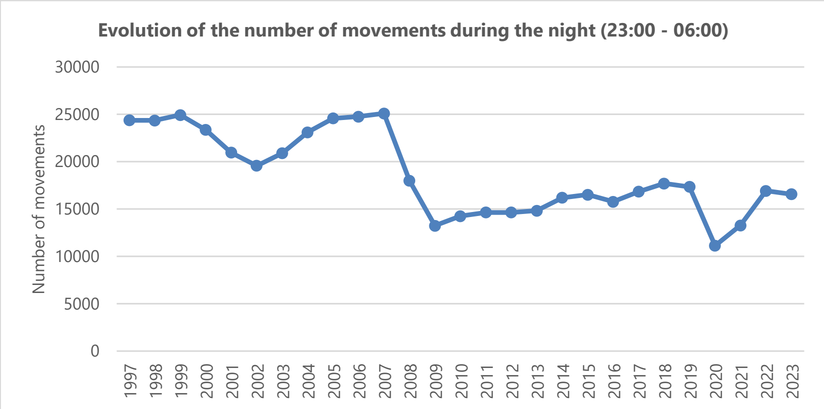


Figure 3: Evolution of flight traffic during the night (23:00-06:00) at Brussels Airport.

The number of night slots allocated for aircraft movements for the year 2023 remained within the limits imposed on the Brussels Airport slot coordinator at 15,733 (15,773 in 2022) of which 4,496 for departure (4,732 in 2022) for which a maximum of 16,000 night slots have been allocated[10] annually since the year 2009, of which a maximum of 5,000 for departure (MB 21/1/2009, official change of environmental permit).

The number of movements during the operational day period (06:00 to 23:00) rose by 8.4% from 162,014 in 2022 to 175,684 in 2023.

The evolution of the number of movements in 2023 compared to 2022 is reflected in Table 1. The numbers for the night period are further broken down into operational night (23:00 - 06:00) and the morning period (06:00 - 07:00).

Table 1: Number of movements (including helicopter movements) in 2023 and evolution compared to 2022

	2022			2023			relative difference compared to 2022		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	57,981	58,694	116,675	62,396	62,833	125,229	+7.6%	+7.1%	+7.3%
evening (19:00 - 23:00)	18,097	19,438	37,535	20,161	21,498	41,659	+11.4%	+10.6%	+11.0%
night (23:00 - 07:00)	13,385	11,335	24,720	13,579	11,790	25,369	+1.4%	+4.0%	+2.6%
00:00 - 24:00	89,463	89,467	178,930	96,136	96,121	192,257	+7.5%	+7.4%	+7.4%
06:00 - 23:00	77,906	84,108	162,014	84,609	91,075	175,684	+8.6%	+8.3%	+8.4%
23:00 - 06:00	11,557	5,359	16,916	11,527	5,046	16,573	-0.3%	-5.8%	-2.0%
06:00 - 07:00	1,828	5,976	7,804	2,052	6,744	8,796	+12.3%	+12.9%	+12.7%

The general increase of 7.4% in the number of movements on an annual basis between 2023 and 2022 is evenly distributed throughout the day (+7.3%) and evening (+11.0%). The relative increase in the number

[10] Night slot: By the coordinator of Brussels-National airport , in accordance with Council Regulation (EEC) No 95/93 of 18 January 1993 on common rules for the allocation of slots at Community airports, permission granted to use the entire infrastructure necessary for the operation of an air service at Brussels National airport at a specified date and time of landing or take-off during the night as allocated by the coordinator.

of night-time flights (between 23:00 and 07:00) is considerably lower (+2.6%). The number of movements in the operational night period (between 23:00 and 06:00) has decreased by 2.0%.

4.1.2 Other important evolutions

In addition to the number of flight movements, there are a number of other parameters that also determine the size and the position of the noise contours, such as the runway and the route used, flight procedures and the deployed fleet. The most important changes are summarised in the following paragraphs.

Fleet changes during the day and in the evening (07:00 and 23:00).

Figure 4 reflects the evolution of the most commonly used aircraft types during the day and evening (between 7:00 and 23:00:00) for heavy aircraft (starting weight from 136 tons, heavy aircraft) and Figure 5 for lighter aircraft (starting weight up to 136 tons). Shown are the aircraft types in 2022 and 2023 that on average have flown 1x per day.

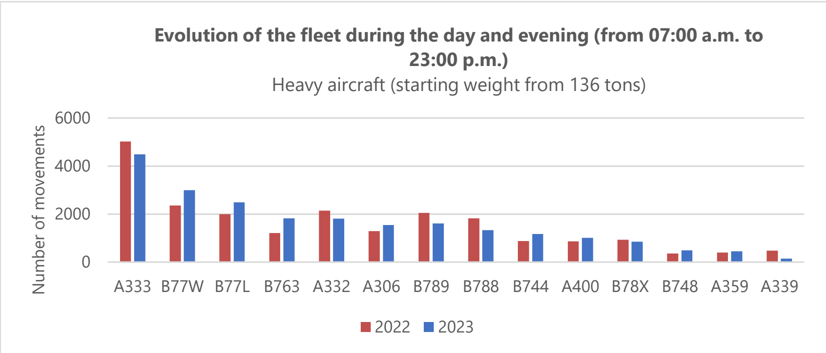


Figure 4: Evolution of the number of aircraft movements with heavy aircraft between 07:00 and 23:00.

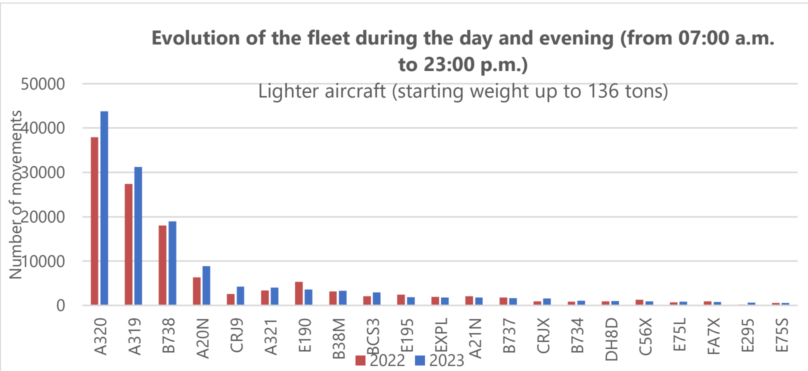


Figure 5: Evolution of the number of aircraft movements with lighter aircraft between 07:00 and 23:00.

In general, the most-used aircraft were the A320, the A319 and the B738 (together responsible for 56.3% of all movements in 2023 between 07:00 and 23:00). The number of movements with these aircraft increased with 12.7% compared to 2022. In addition, the fleet's development in 2023 relative to 2022 is visible with the increase in the number of movements with aircraft types A20N (6.366 movements in 2022 and 8.827 movements in 2023), CRJ9 (2,591 movements in 2022 and 4,218 movements in 2023) and the E295 (171 movements in 2022 and 643 movements in 2023). In contrast, the use of E190 and E195 has decreased by 31.9% and 25.6% respectively. Despite an 11% decrease, the A333 remains the most common heavy aircraft, followed by the B77W and the B77L, whose movements have increased compared to 2022. Furthermore, an increasing number of movements is also visible for the B763 (+51.0%), the A306 (+20.3%) and the B744 (+33.1%). A drop in the number of movements with heavy aircraft is visible for the A332, the B789 and the B788.

Fleet changes in the night period (from 23:00 to 07:00)

The evolution of the most commonly used aircraft types in the night (between 23:00 and 07:00) is available in Figure 6 for arrivals and in Figure 7 for departures. Shown are the aircraft types in 2022 and 2023 that on average flew a minimum of 1 flight per week.

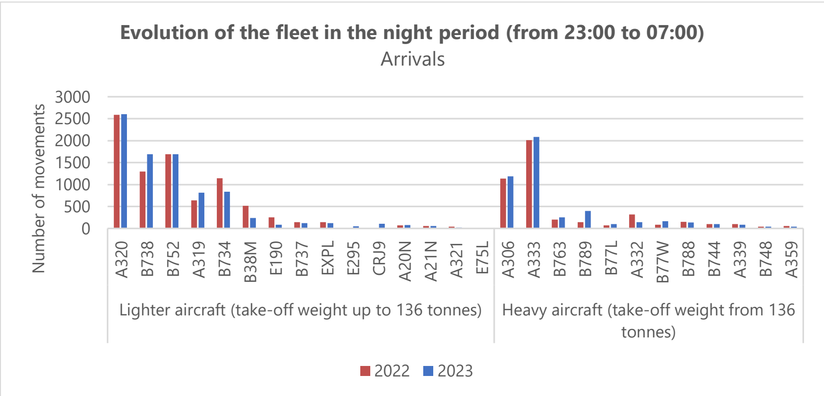


Figure 6: Evolution of the number of arrivals in the night period (from 23:00 to 07:00).

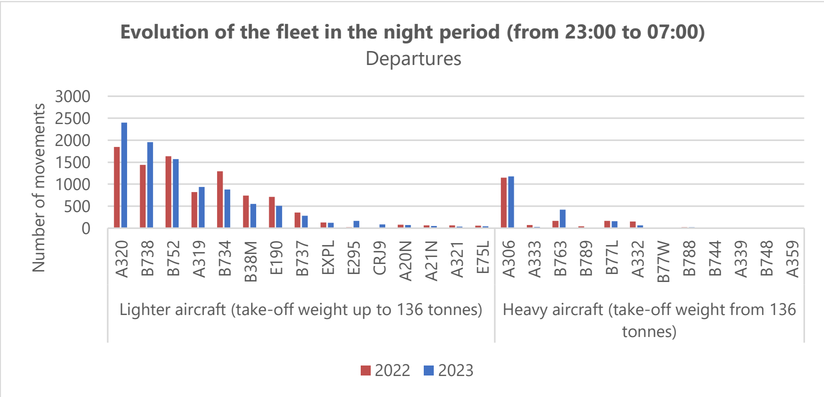


Figure 7: Evolution of the number of departures in the night period (from 23:00 to 07:00 hours).

The number of arrivals with lighter aircraft at night has slightly decreased by 1.2% compared to 2022. However, the number of departures increased by 3.7%, mainly to be allocated to an increasing number of departures between 6:00 and 7:00 with the most frequently used aircraft in the night: the A320 (+29.7%) and B738 (+35.7%). On the other hand, the use of the B734, B38M, E190 and the B737 has decreased. The number of arrivals with heavy aircraft in the night increased by 6.7% compared to 2022. The B789 has a large share of this, with an increase of 257 movements (142 arrivals in 2022 and 399 arrivals in 2023). The number of departures with heavy aircraft in the night has increased by 5.9% compared to 2022. The increase in the number of departures with the B763 contributes most to this (169 departures in 2022 and 419 departures in 2023).

Runway and route usage

Preferential runway usage

The preferential runway usage, published in the AIP (Skeyes), shows which runway should preferably be used, depending on the time that the movement occurs, and in some cases on the destination and the maximum take-off weight of the aircraft. No changes were made to this scheme during 2023 (see

Table 2).

If the preferential runway configuration cannot be used (e.g. due to meteorological conditions, runway maintenance, etc.), skeyes will choose the most appropriate alternative configuration, taking into account weather conditions, runway equipment, traffic demand, etc. For this purpose, the preferential runway usage scheme includes wind limits, expressed as maximum crosswinds and maximum tailwind for each runway. To prevent these limits being exceeded, air traffic control must, when the situation arises, switch to an alternative configuration. Under preferential runway usage conditions, the maximum tailwind is 7 kt and the maximum crosswind is 20 kt. In the event of alternative runway usage, the maximum speeds are also 20 kt for crosswind but only 3 kt for tailwind.

Table 2: Preferential runway use since 19/09/2013 (local time) (source: AIP)

		Day		Night
		06:00 to 15:59	16:00 to 22:59	23:00 to 05:59
Mon, 06:00 – Tu 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Tue, 06:00 – Wed 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Wed, 06:00 – Thu, 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Thurs, 06:00 – Fri 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Fri, 06:00 – Sat 05:59	Departure	25R		25R(3)
	Landing	25L/25R		25R
Sat, 06:00 – Sun 05:59	Departure	25R	25R/19(1)	25L(4)
	Landing	25L/25R	25R/25L(2)	25L
Sun, 06:00 – Mon 05:59	Departure	25R/19(1)	25R	19(4)
	Landing	25R/25L(2)	25L/25R	19

(1) Runway 25R for traffic via ELSIK, NIK, HELEN, DENUT, KOK and CIV / Runway 19 for traffic via LNO, SPI, SOPOK, PITES and ROUSY (aircraft with MTOW between 80 and 200 tonnes can use runway 25R or 19, aircraft with MTOW > 200 tonnes must use runway 25R, regardless of their destination).
(2) Runway 25L only if air traffic control considers this necessary.
(3) Between 01:00 and 06:00, no slots may be allocated for departures.
(4) Between 00:00 and 06:00, no slots may be allocated for departures.

4.2.2 Wind Criteria

In selecting the runway combination to be used, the following wind components shall be applied:

Runway-in-use: wind components are exceeded at:

	RWY 25L/R	RWY 19 (TKOF only)
Tailwind MAX	7KT	7KT
Crosswind MAX	20KT	20KT

	RWY 01	RWY 07L/R	RWY 19 (TKOF and ARR)
Tailwind MAX	0KT - 3KT (incl)	0KT - 3KT (incl)	0KT - 3KT (incl)
Crosswind MAX	20KT	20KT	20KT

Note: (incl) means that the wind component threshold is exceeded when the component exceeds 3 KT.

Use of the runways

In comparison with 2022, the number of movements has increased on virtually all runways. This is shown in Figure 8 for the daytime and evening period (from 07:00 to 23:00) and in Figure 9 for the night period (from 23:00 to 07:00). A complete account of the runway use is given in appendix A.1.

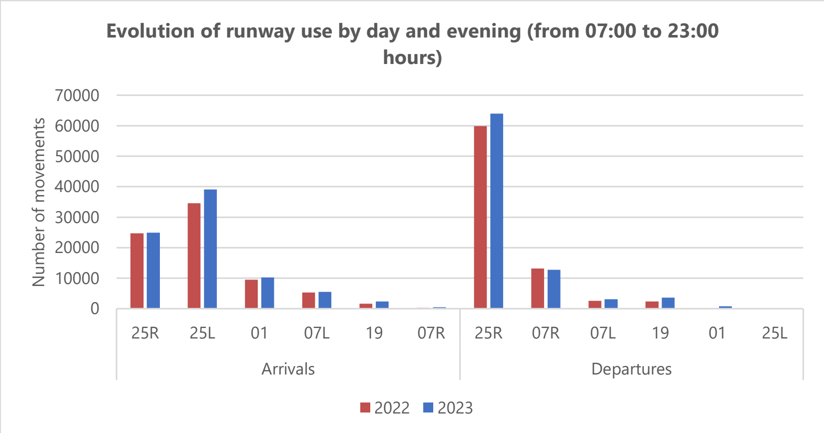


Figure 8: Evolution of the runway use between 07:00 and 23:00.

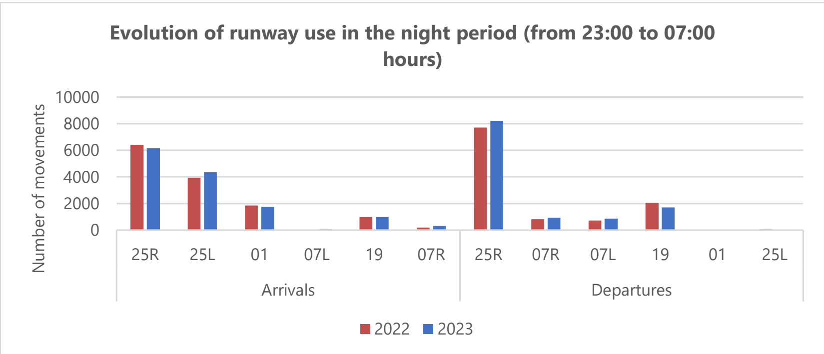


Figure 9: Evolution of the runway use in the night period (from 23:00 to 07:00).

Runway 25R remains the most used runway direction for departures in 2023 due to the preferential runway use and the prevailing wind conditions. The use of 07R for departures has decreased by 2.9% during the day and evening period, while for both 07L (+19.2%) and 19 (+52.3%) an increasing number of departures is visible. Runway 25L is with a relative increase of 13.3% the most commonly used runway for arrivals in the day- and evening periods. Whereas runway 19 is more frequently used in the day and evening period, it is less frequently used during the night in 2023 compared to 2022 (-16.1%). Furthermore, the number of arrivals on runway 25R during the night has decreased by 4.2% and the number of arrivals on runway 25L has increased by 10.3%.

4.2 Comparison of measurements and calculations

Echo enables a number of acoustic parameters to be calculated at a specified location around the airport The extent to which the calculated values correspond to the values registered and processed by the measuring system can be evaluated by performing these calculations at the Noise Monitoring System (NMS) measuring station locations. Different data sources are used in the NMS system and are correlated with each other: noise measurements, flight lists (cdb), radar tracks and weather. The comparison between measurements and calculations is made for the level indicators $L_{Aeq,24h}$, L_{night} and L_{den}.

The calculated values are compared with the values of the aircraft correlated measured noise events. These are noise events whereby an automatic link could be made in the NMS with the flight and radar data.

The system of correlation is imperfect and it is possible for events to be incorrectly attributed to overflying traffic and vice versa. To minimise the contribution of such incorrect classifications, a trigger level is set with a minimum duration time: an event is expected only when the trigger level of 10 s is exceeded. The event ends when the trigger level is not achieved during 5 s. The trigger levels are set for each measuring station and depend on the local noise in the area. These trigger levels were evaluated in the beginning of 2015 and adjusted for several measuring stations. At that time, the maximum duration of an event was increased from 75 s (for 2014) to 125 s. As in previous years, this criterion was retained for 2023. In events of even longer duration, the chance of this being caused by an airplane is quite small. Note that beyond the conditions relating to the event duration and trigger level, a correlation with a registered aircraft movement is also necessary based on its radar track results.

In the table below, a comparison is made between the values simulated with Echo at the different measuring station locations and the values measured/calculated on the basis of the correlated events for the chosen parameters. Aside from data from the measuring stations of Brussels Airport Company, results from the Environment, Nature and Energy Department (LNE) measuring stations (with codes NMT 40-2 and higher) are also recorded. The measurement data from these measuring stations are input and linked to flight data in the NMS of the airport.

For the measurement stations of the OIM in the Brussels-Capital Region, the above procedure is not possible because the measurement data are not provided to BAC (until 2009 the measurement data of the OIM for two measuring stations- Haren and Evere - were provided). An overview of the location of all measuring stations is given in Appendix B.

The measuring stations NMT01-2, NMT03-3, NMT15-3 and NMT23-1 are located at the airport site and/or in the immediate vicinity of the runway system and airport installations. The flight-correlated noise events comprise contributions from ground noise as well as overflights. The link to specific flight movements is not always equally reliable for these measuring stations. For these reasons, the measured values at these measuring stations are less relevant for assessing noise emission from overflying aircraft, and while they are reported, they are not considered in the assessment of the accuracy of the simulations.

Measurement station 17 has been changed during the year. Until 19 September it was located at location 26-02/Laken, after which an inactive period followed. On 8 November, the NMT became active again at location 26-03/Schaarbeek. For the calculation of the noise levels at both locations, the corresponding active period is calculated, 262 days (26-02) and 53 days (26-03) .

The fraction of the time the measuring system was active (so-called "uptime") was lower in 2023 than in 2022, but still very high. The average uptime for the BAC measurement units was 97.99%, the measurement stations of the Department of Environment were active 99.96% of the time. The overall average is thus 98.60%. Some downward outliers are location 26-02 (85.78%) and location 19-3 (89.93%). For the comparison of the measurements with the calculations (for a whole year), a correction is made per measuring stations for the uptime fraction. It is also assumed that during the periods lacking measurements, there was the same proportion of exposure to aircraft noise as during the periods in which the measuring station was active. The correction is, as a consequence of the high uptime, virtually negligible.

The comparison between calculations and measurements based on the $L_{Aeq,24h}$ shows that the discrepancy between the calculated values and the measured values across all measuring stations, except NMT09-2 (Perk), NMT20-3 (Machelen), NMT42-2 (Diegem) and NMT48-3 (Bertem), is smaller than 2 dB(A) (after also excluding the measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1 as discussed above). Measuring stations Perk and Bertem have few overflights and have a relatively low measured noise pressure level (49.7 and 30.6 dB(A) L Aeq,24h respectively) which results in a higher error rate in comparison with the calculated noise pressure levels. At 12 measuring stations, the deviation is limited to up to 0.5 dB(A). At 16 measuring stations, the measurements are higher than the calculations, at 11 measuring stations the measurements are lower than the calculations (in each case with the abovementioned exclusions). The global discrepancy between simulations and measurements is 1.0 dB(A) (“root-mean-square error” or RMSE), when Perk and Bertem are excluded from this evaluation.

For L_{NIGHT} , equivalent limited deviations between measurements and simulations are obtained globally (1.4 dB(A) RMSE, excluding measurement points NMT01-2, NMT03-3, NMT15-3, NMT23-1, Perk and Bertem). At 7 measuring stations, the differences are smaller than 0.5 dB(A).

For the noise indicator L_{den} the RMSE is 1.2 dB(A) (excluding NMT01-2, NMT03-3, NMT15-3, NMT23-1, Perk and Bertem). At most of the other measuring stations, the deviations were within 2 dB(A). Eight measuring stations give a deviation of up to 0.5 dB(A). At 16 measuring stations the calculations result in an underestimation of the measured levels, at 11 measuring stations they lead to an overestimation (excluding NMT01-2, NMT03-3, NMT15-3, and NMT23-1).

Table 3: Correspondence between calculations and measurements for noise indicator $L_{Aeq,24h}$ (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

NMT	Location code	Location name	Measurements 2023 (dB(A))	Calculations 2023 (dB(A))	Difference (dB(A))
1	01-2	STEENOKKERZEEL	58.6	65.1	-6.5
2	02-2	KORTENBERG	66.3	66.9	-0.6
3	03-3	HUMELGEM-Airside	62.1	62.4	-0.3
4	04-1	NOSSEGEM	61.9	59.6	2.3
5	24-1	KRAAINEM	53.4	52.4	1.0
6	06-1	EVERE	50.1	49.2	0.9
7	07-2	STERREBEEK	48.2	47.4	0.8
8	08-1	KAMPENHOUT	55.1	55.1	0.0
9	09-2	PERK	45.1	47.9	-2.8
10	10-3	NEDER-OVER-HEEMBEEK	53.7	52.6	1.1
11	11-2	SINT-PIETERS-WOLUWE	53.5	51.7	1.8
12	12-1	DUISBURG	45.3	44.9	0.4
13	13-2	GRIMBERGEN	43.0	44.0	-1.0
14	14-1	WEMMEL	47.2	46.3	0.9
15	15-3	ZAVENTEM	44.8	54.0	-9.2
16	16-2	VELTEM	56.1	56.2	-0.1
17[i]	26-02	LAKEN	46.9	46.5	0.4
17[i]	26-03	SCHAARBEEK	49.4	48.7	0.7
19	19-4	VILVOORDE	51.0	50.6	0.4
20	20-3	MACHELEN	52.0	52.1	-0.1
21	21-1	STROMBEEK-BEVER	51.3	49.5	1.8
23	23-1	STEENOKKERZEEL	64.9	65.0	-0.1
40	40-2*	KONINGSLO	51.9	51.1	0.8
41	41-1*	GRIMBERGEN	46.3	46.5	-0.2
42	42-2*	DIEGEM	62.8	60.4	2.4
43	43-2*	ERPS-KWERPS	55.4	56.8	-1.4
44	44-2*	TERVUREN	45.5	45.3	0.2
45	45-1*	MEISE	43.7	43.9	-0.2
46	46-2*	WEZEMBEEK-OPPEM	54.6	54.1	0.5
47	47-3*	WEZEMBEEK-OPPEM	48.6	48.1	0.5
48	48-3*	BERTEM	28.4	33.9	-5.5
70	70*	ROTSELAAR	49.3	49.8	-0.5

The NMT 17 was moved from location 26-02 to 26-03 in 2023

* noise data Department of the Environment, off-line correlated by the NMS

Table 4: Correspondence between calculations and measurements for L_{night} sound indicator (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

NMT	Location code	Location name	Measurements 2023 (dB(A))	Calculations 2023 (dB(A))	Difference (dB(A))
1	01-2	STEENOKKERZEEL	55.5	63.1	-7.6
2	02-2	KORTENBERG	62.1	62.8	-0.7
3	03-3	HUMELGEM-Airside	57.8	56.4	1.4
4	04-1	NOSSEGEM	60.3	57.5	2.8
5	24-1	KRAAINEM	49.5	49.1	0.4
6	06-1	EVERE	44.4	43.8	0.6
7	07-2	STERREBEEK	49.2	47.2	2.0
8	08-1	KAMPENHOUT	53.4	53.5	-0.1
9	09-2	PERK	42.2	45.7	-3.5
10	10-3	NEDER-OVER-HEEMBEEK	50.0	48.5	1.5
11	11-2	SINT-PIETERS-WOLUWE	49.3	48.6	0.7
12	12-1	DUISBURG	42.8	41.6	1.2
13	13-2	GRIMBERGEN	37.2	39.0	-1.8
14	14-1	WEMMEL	41.5	41.8	-0.3
15	15-3	ZAVENTEM	45.6	50.6	-5.0
16	16-2	VELTEM	52.2	52.3	-0.1
17[i]	26-02	LAKEN	42.0	42.5	-0.6
17[i]	26-03	SCHAARBEEK	45.5	44.9	0.6
19	19-4	VILVOORDE	47.7	47.1	0.6
20	20-3	MACHELEN	49.2	49.0	0.2
21	21-1	STROMBEEK-BEVER	47.6	45.4	2.2
23	23-1	STEENOKKERZEEL	63.1	63.5	-0.4
40	40-2*	KONINGSLO	48.1	47.0	1.1
41	41-1*	GRIMBERGEN	42.8	42.6	0.2
42	42-2*	DIEGEM	58.4	55.8	2.6
43	43-2*	ERPS-KWERPS	50.6	52.5	-1.9
44	44-2*	TERVUREN	45.6	43.4	2.2
45	45-1*	MEISE	36.9	39.3	-2.4
46	46-2*	WEZEMBEEK-OPPEM	51.4	51.1	0.3
47	47-3*	WEZEMBEEK-OPPEM	49.5	47.5	2.0
48	48-3*	BERTEM	19.3	28.6	-9.3
70	70*	ROTSELAAR	45.3	46.0	-0.7

The NMT 17 was moved from location 26-02 to 26-03 in 2023

* noise data Department of the Environment, off-line correlated by the NMS

Table 5: Correspondence between calculations and measurements for noise indicator L_{den} (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

NMT	Location code	Location name	Measurements 2023 (dB(A))	Calculations 2023 (dB(A))	Difference (dB(A))
1	01-2	STEENOKKERZEEL	63.2	70.3	-7.1
2	02-2	KORTENBERG	70.4	71.0	-0.6
3	03-3	HUMELGEM-Airside	66.1	65.8	0.3
4	04-1	NOSSEGEM	67.4	64.8	2.6
5	24-1	KRAAINEM	57.8	57.0	0.8
6	06-1	EVERE	53.7	53.0	0.7
7	07-2	STERREBEEK	55.3	53.6	1.7
8	08-1	KAMPENHOUT	60.4	60.5	-0.1
9	09-2	PERK	49.7	52.9	-3.2
10	10-3	NEDER-OVER-HEEMBEEK	57.8	56.6	1.2
11	11-2	SINT-PIETERS-WOLUWE	57.7	56.4	1.3
12	12-1	DUISBURG	50.2	49.5	0.7
13	13-2	GRIMBERGEN	46.6	47.9	-1.3
14	14-1	WEMMEL	50.5	50.2	0.3
15	15-3	ZAVENTEM	51.7	58.3	-6.6
16	16-2	VELTEM	60.3	60.4	-0.1
17[i]	26-02	LAKEN	50.6	50.6	0.0
17[i]	26-03	SCHAARBEEK	53.5	52.9	0.6
19	19-4	VILVOORDE	55.6	55.1	0.5
20	20-3	MACHELEN	56.8	56.8	0.0
21	21-1	STROMBEEK-BEVER	55.5	53.5	2.0
23	23-1	STEENOKKERZEEL	70.2	70.5	-0.3
40	40-2*	KONINGSLO	56.1	55.1	1.0
41	41-1*	GRIMBERGEN	50.6	50.7	-0.1
42	42-2*	DIEGEM	66.8	64.3	2.5
43	43-2*	ERPS-KWERPS	59.2	60.8	-1.6
44	44-2*	TERVUREN	51.9	50.6	1.3
45	45-1*	MEISE	46.6	47.7	-1.1
46	46-2*	WEZEMBEEK-OPPEM	59.3	58.9	0.4
47	47-3*	WEZEMBEEK-OPPEM	55.6	54.1	1.5
48	48-3*	BERTEM	30.6	37.6	-7.0
70	70*	ROTSELAAR	53.4	54.0	-0.6

The NMT 17 was moved from location 26-02 to 26-03 in 2023

* noise data Department of the Environment, off-line correlated by the NMS

4.3 Noise contours

This section gives the results of the noise contour calculations for the parameters described above (L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70,day freq.70,night, freq.60,day and freq.60,night). These illustrations display the results for the years 2023, 2022 and 2019. In the contour report for 2019, the contours were still calculated with INM 7.0b. For the comparability of results, the contours of 2019 were re-modelled with the Echo calculation model (as used for contours from 2021), with the counts based on population figures from 1 January 2022. To aid legibility of the figures, two contour values are visualised for each figure. Appendix D displays the visualisation of all contour values for the years 2023 and 2022.

The surface area and the number of residents is calculated for each noise contour. On the basis of L_{den} contours, the number of potentially severely inconvenienced persons has been calculated according to the method described in Section 2.2. The appendices offer more details: per municipality (appendix C). Appendix D shows the visualisation of the contours. The evolution of the area and inhabitants per contour over several years is shown in Appendix E.

4.3.1 L_{day} – contours

The L_{day} contours give the A-weighted equivalent sound pressure level over the period 07:00 to 19:00 and are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A). The evolution of the contours for 2019, 2022 and 2023 is shown in Figure 10, where only the 55 dB(A) and 60 dB(A) contours are presented.

The evaluation period for the L_{day} contours falls entirely within the operational day period (06:00 to 23:00) as determined at Brussels Airport. This means that the 'Departure 25R – Landing 25L/25R' runway usage is to be preferred at all times, except at the weekend on Saturdays after 16:00 and on Sundays before 16:00, when departures are to be distributed over 25R and 19. When this preferential runway usage cannot be applied due to weather conditions (often with an easterly wind), then the combination of departures from 07R/07L and landings on 01 or 07L/07R is generally applied.

There are a number of relevant findings. Firstly, there is an increase in the number of landings (+7.6%) and the number of take-offs (+7.1%) during the day, which explains the overall increase in the size of the contours in 2023 compared to 2022. This increase in the number of movements is mainly due to the increase in the number of movements with lighter types of aircraft (+8.5% versus 2022), where the number of movements with heavy aircraft only increased by 0.7%.

There are also evolutions in the use of runways, with the number of landings during the day on almost all runways increasing. The largest relative increase is seen on runway 19, where the number of landings increased from 1.250 in 2022 to 1.878 in 2023. Furthermore, the number of arrivals at 25L increased (+12.2%), while the number of arrivals at 25R decreased slightly by 0.7%. Partly because of this, the size of the contour in the extension of 25L increases more than in the extension of 25R east of the airport.

During the day between 07:00 and 19:00, 25R remains the most commonly used runway. The number of departures on this runway increased by 6.1% from 44,875 departures in 2022 to 47,614 departures in 2023. On lane 07R, the number of departures decreased by 4.3%, while the number of departures from runway 07L and 19 increased.

In general, it can be observed that the 55 dB(A) contour as a whole has slightly increased, which is mainly attributable to the increase in the number of movements during the day.

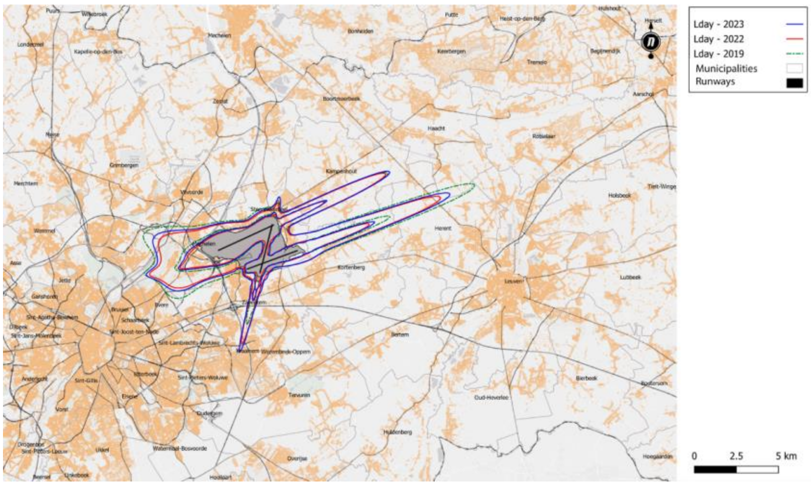


Figure 10: L_{day} noise contours of 55 and 60 dB(A) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total area within the L_{day} contour of 55 dB(A) in 2023 is 9.1% larger than 2022 (from 4.083 to 4.456 hectares). The number of residents inside the L_{den} contour of the 55 dB(A) noise contour rose by 11.6% (from 29,797 to 33,252). The number of inhabitants within the contour has increased by 530 (+1.6%) due to changes in population numbers. Compared to the year 2019, the total area is 8.8% smaller (area in 2019 was 4.886 ha) and the number of inhabitants is 5.0% lower (population in 2019 was 35.003, based on the population register of 1 January 2022).

4.3.2 $L_{evening}$ contours

The $L_{evening}$ contours give the A-weighted equivalent sound pressure level over the period 19:00 to 23:00 and are reported from 50 dB(A) to 75 dB(A) in steps of 5 dB(A). The evolution of the contours for 2019, 2022 and 2023 is shown in Figure 11, with only 50 dB(A) and 55 dB(A) contour presented. As a lower level is reported compared to L_{day}, there is a visually magnifying effect. The 50 dB(A) contour becomes as important as the L_{day} contour of 55 dB(A) by correcting 5 dB(A) for the calculation of L_{den} . The evaluation period for the $L_{evening}$ contours falls entirely within the operational daytime period (06:00 to 23:00) as determined at Brussels Airport.

There are a number of relevant findings, which are similar to those of the day period. In the first place, there was a slight increase in the number of landings during the evening (+11.4%) and in the number of departures (+10.6%). Even in the evening, the number of movements with lighter aircraft increases more (+11.8%) than the number of movements with heavy ones (+4.2%).

Also during the evening, the use of runway 25L (+16.9%) for arrivals increases more than the use of runway 25R (+5.1%). The number of arrivals in the evening on runway 07L decreased from 737 movements in 2022 to 691 movements in 2023. The number of departures increased on each runway, where the number of departures on runway 25R increased by 9.5% (14,960 departures in 2022 to 16,374 departures in 2023). Just as during the day, the relative share of runway 01 increased in 2023 compared to 2022 (4 departures in 2022 to 192 departures in 2023). This effect contributes to the increasing noise level of about 1 dB(A) north of the airport.

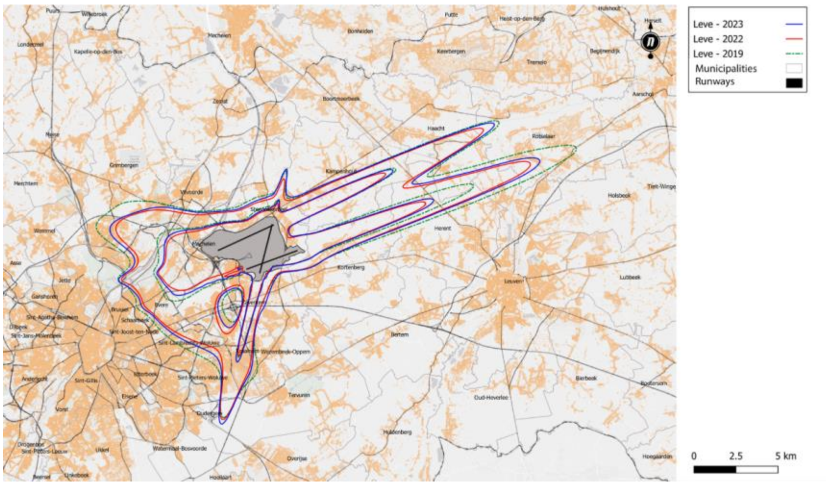


Figure 11: $L_{evening}$ noise contours of 50 and 55 dB(A) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total area within the $L_{evening}$ contour of 50 dB(A) in 2023 is 8.9% larger than 2022 (from 11.251 ha to 12.255 ha). The number of residents inside the $L_{evening}$ contour of 50 dB(A) increased by 20.0% (from 159,949 to 192,009). The relative increase in population is larger than the increase in surface area, considering the expansion of the $L_{evening}$ contour is lying partly in the densely-populated areas. The number of inhabitants within the contour has increased by 3.639 (+1.9%) due to changes in population numbers. Compared to 2019, the total area is 12.5% smaller (area in 2019 was 14,010 hectare) and the number of residents 14.6% lower (number of residents in 2019 was 224,882 based on the population file of 1 January 2022).

4.3.3 L_{night} contours

The L_{night} contours give the A-weighted equivalent sound pressure level over the period 23:00 to 07:00 and are reported from 45 dB(A) to 70 dB(A) in steps of 5 dB(A). The evolution of the contours for 2019, 2022 and 2023 is shown in Figure 12 where only the 45 dB(A) and 50 dB(A) contours are presented. By reporting an additional contour, there is a visually magnifying effect compared to the day and evening. The 45 dB(A) L_{night} contour is larger than the 55 dB(A) contour for the daytime and, by correcting 10 dB(A) for the calculation of L_{den}, becomes as important as the L_{day} contour of 55 dB(A) and the $L_{evening}$ contour of 50 dB(A) .

The evaluation period for the L_{night} contours does not concur with the operational night-time period (23:00 to 06:00) but also includes the flights of the operational daytime period between 06:00 and 07:00. The noise contours are a combination of the runway and route usage during the operational night and during the operational day.

The relative increase in the number of movements in the night is lower than the increase in the day and evening periods. The number of landings in the evening period increased by 1.4% and the number of departures increased by 4.0%. The number of movements with heavier aircraft increased by 6.5% and the number of movements with lighter aircraft increased by 1.3%. The A306 has, just as in 2022, the largest share of departing night flights with heavier aircraft.

Similarly to the day and evening periods, the share of runway 25L as a landing runway increases, while the share of runway 25R as a landing runway decreases. For example, the number of arrivals at runway 25L has increased from 3,944 arrivals in 2022 to 4,351 arrivals in 2023. The number of landings at 25R decreased from 6,401 in 2022 to 6,135 in 2023. The number of departures on runway 25R in the night increased by 6.5% in 2023, making it by far the most frequently used for departing traffic at night. By contrast on the other hand, the use of runway 19 has declined.. In 2022, 18.0% of outgoing traffic used runway 19, while in 2023 this relative share fell to 14.5%.

As a result of the increasing number of movements, noise pollution at night has increased almost everywhere. A reduction in noise pollution is visible to the south-east of the airport due to the decrease in the use of runway 19 for night departures.

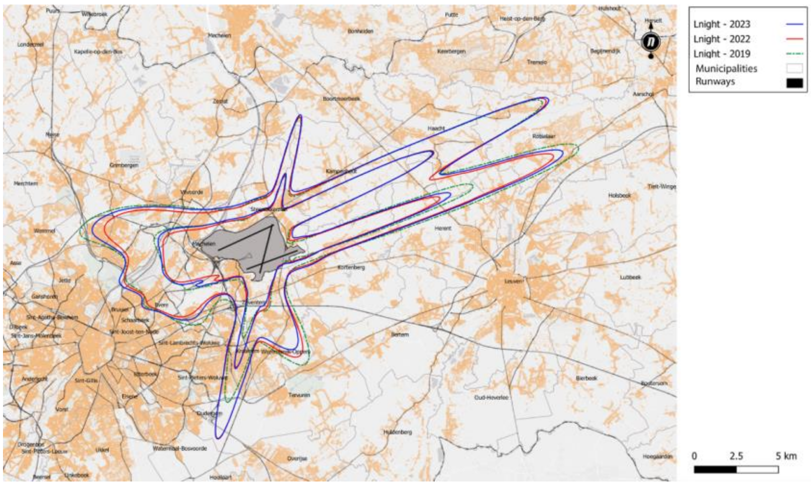


Figure 12: L_{night} noise contours of 45 and 50 dB(A) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total area within the L_{night} contour of 45 dB(A) in 2023 is 5.2% larger than in 2022 (from 13.572 ha to 14.271). The number of residents within the L_{night} contour of 45 dB(A) increased by 19.0% (from 151,901 to 180,793). The number of inhabitants within the contour has increased by 3.409 (+1.9%) due to changes in population numbers. Compared to the year 2019, the total area is 2.2% smaller (area in 2019 was 14.586 ha) and the population 1.0% higher (population in 2019 was 179,001, based on the population register of 1 January 2022).

4.3.4 L_{den} contours

The size of L_{den} is a combination of L_{day}, $L_{evening}$ and L_{night}. The evening flight movements are penalised with 5 dB(A) and the night flight movements with 10 dB(A). The evolution of the contours for 2019, 2022 and 2023 is shown in Figure 13 where only the 55 dB(A) and 60 dB(A) contours are presented.

The modified form is a weighted combination of all the effects that have been dealt with in detail in the discussion of the L_{day}, $L_{evening}$ and L_{night} contours. The findings for the different periods are confirmed.

In comparison with 2022, the noise impact to the east of the airport has increased more in the extension of runway 25L, which comes through a shift in runway usage where the relative share of landings on 25L has increased, while the share of 25R as landing runway has actually decreased. This is mainly due to the ongoing recovery period of passenger traffic after the COVID19 pandemic, with this traffic landing mainly at 25L. All other changes are the same for the day, evening and night, which is reflected in the L_{den} contour.

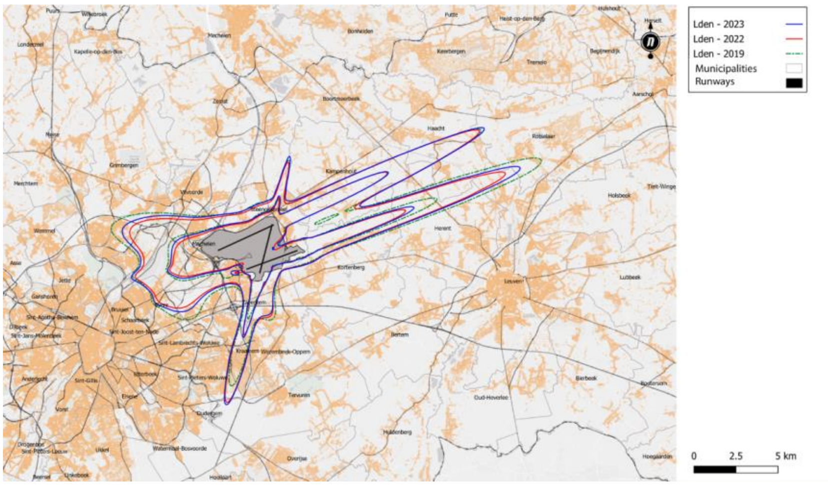


Figure 13: L_{den} noise contours of 55 and 60 dB(A) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total surface area inside the L_{den} noise contour of 55 dB(A) increased in 2023 by 7.3% compared with 2022 (from 8,648 ha to 9,282 ha). The number of residents within the L_{den} contour of 55 dB(A) increased by 13.9% (from 78,326 to 89,215). The number of inhabitants within the contour has increased by 1.993 (+2.3%) due to changes in population numbers. Compared to the year 2019, the total area is 4.3% smaller (area in 2019 was 9.701 ha) and the number of inhabitants is 8.0% lower (population in 2019 was 96,966, based on the population register of 1 January 2022).

4.3.5 Freq.70,day contours (day 07:00 - 23:00)

The Freq.70,day contours are calculated for an evaluation period consisting of both the L_{day} and $L_{evening}$ evaluation periods. The evolution of the Freq.70,day contours reflects the overall increase in traffic, changes in track usage and fleet changes (see Figure 14). The figure indicates the contours for 2019, 2022 and 2023 where on average a noise level of 70 dB(A) or more occurs 5x and 20x per day during the day period (07:00 to 23:00).

An increase in the size of the frequency contours is visible, similarly to the development of the L_{day} and $L_{evening}$ noise load. This increase is mainly visible north of the airport and south-east of the airport. This can therefore be attributed to the increasing use of runway 01/19 for both take-offs and landings during the day and evening.

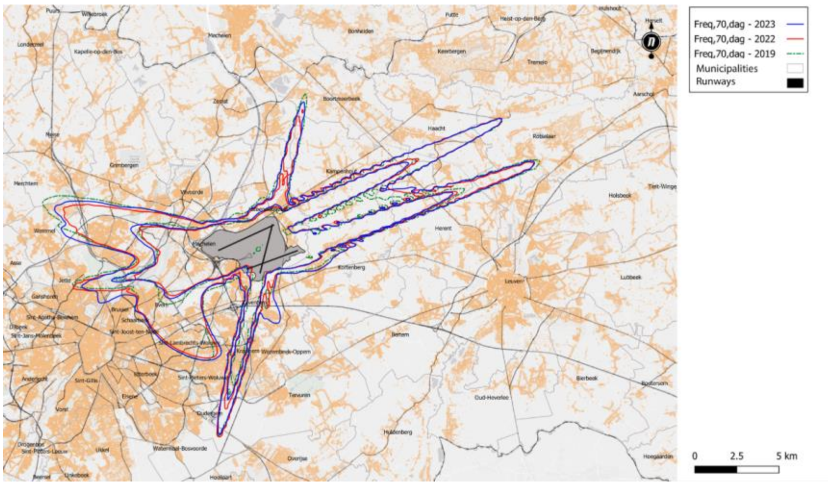


Figure 14: Freq.70,day contours (5x and 20x above 70 dB(A)) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total area within the contour of '5x above 70 dB(A)' in 2023 increased by 7.3% compared to 2022 (from 11.566 ha to 12.412 ha). The number of residents inside the Freq.70,day contour of five events increased by 14.8% (from 210,819 to 242,017). Compared to 2019, the total area is 2.6% smaller (area in 2019 was 12,097 ha) and the number of residents 12.8% lower (number of residents in 2019 was 214,528 based on the population file of 1 January 2022).

4.3.6 Freq.70,night contours (night 23:00-07:00)

The Freq.70,night contours are calculated for the same evaluation period as the L_{night}. The evolution of the Freq.70,night contours reflects the general changes in traffic numbers, the changes in the runway usage and the changes in the fleet that were discussed for L_{night}. The figure shows the contours of 2019, 2022 and 2023 where an average noise level of 70 dB(A) occurred 1x and 5x per day during the night period (23:00 to 7:00 hours).

The frequency concentrations of 2022 and 2023 are often overlapping, similarly to the development of the $L\text{-}_{night}$ noise levels. Due to an increase in the number of departures from 25R, the contours to the west of the airport are increasing. This is in contrast to the apparent decrease in the south-east of the airport due to the decreasing number of departures from runway 19 during the night.

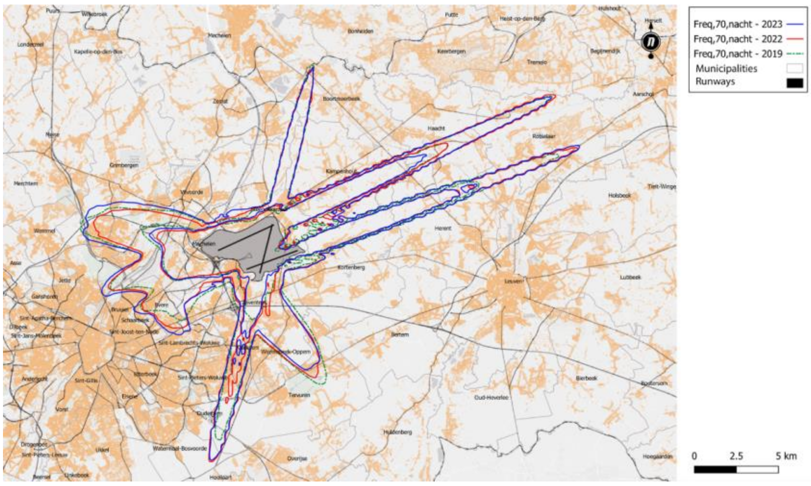


Figure 15: Freq.70,night contours (1x and 5x above 70 dB(A)) around Brussels Airport in 2019 (green), 2022 (red) and 2023 (blue).

The total surface area inside the contour of '1x above 70 dB(A)' increased in 2023 by 4.6% compared with 2022 (from 12,016 ha to 12,570). The number of residents within this contour has risen by 23.5% (from 154,700 to 191,060). Compared to 2019, the total area is 5.5% smaller (area in 2019 was 11,920 ha) and the number of residents 34.9% lower (number of residents in 2019 was 141,583 based on the population file of 1 January 2022).

4.3.7 Freq.60,day contours (day 07:00-23:00)

The Freq.60,day contours are calculated for an evaluation period consisting of both the L_{day} and $L_{evening}$ evaluation periods. The evolution of the Freq.60,day contours reflects the general changes in traffic numbers, the changes in the runway usage and the fleet changes that have already been discussed. The figure indicates the contours where on average a noise level of 60 dB(A) occurs 50x, 100x per day during the day period (07:00 to 23:00).

An increase in the size of the frequency contours is visible, similarly to the development of the L_{day} and $L_{evening}$ noise load. To the north of the airport, there are no contours of 50x or higher, since in all years there were on average fewer than 50 events per day between 07:00 and 23:00.

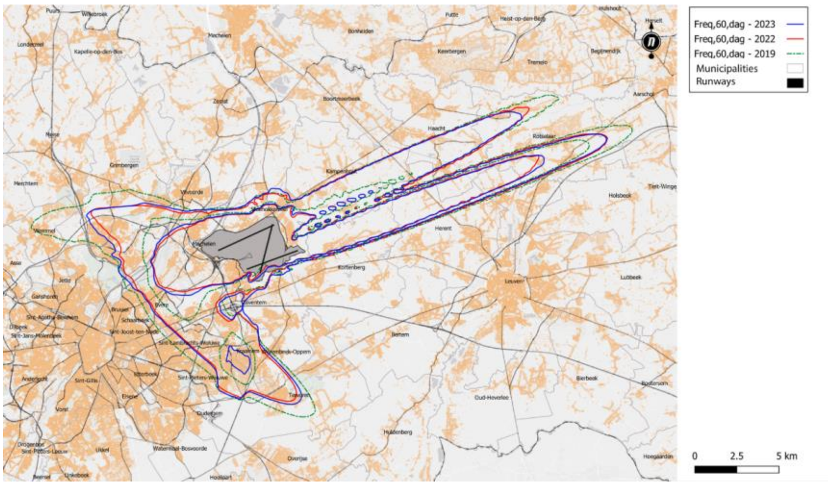


Figure 16: Freq.60,day contours (50x and 100x above 60 dB(A)) around Brussels Airport for 2019 (green), 2022 (red) and 2023 (blue).

The total surface area within the Freq.60,day-contour of 50x above 60 dB(A) rose in 2023 by 1.8% compared with 2022 (from 14,262 ha to 14.520 ha.). The number of inhabitants within the Freq.60.day contour of 50x above 60 dB(A) increases by 12.5% (from 202,942 to 228,244). Compared to 2019, the total area is 15.5% smaller (area in 2019 was 17,175 ha) and the number of residents 13.6% lower (number of residents in 2019 was 264,291 based on the population file of 1 January 2022).

4.3.8 Freq.60,night - contours (night 23:00-07:00)

The Freq.60,night contours are calculated for the same evaluation period as the L_{night}. The evolution of the Freq.60,night contours reflects the general changes in traffic numbers, changes in the runway usage and the changes in the fleet. The figure shows the contours where on average a noise level of 60 dB(A) occurs 10x and 15x per day during the night period (23:00 to 07:00).

East of the airport, it can be seen that the frequency contour of 15x or higher is nevertheless in line with 25L in 2023 whereas this was missing in 2022. The number of arrivals in the night at 25L plays a role here (3.944 arrivals in 2022 and 4.351 arrivals in 2023).

North of the airport there are no contours of 10x or higher as there were on average less than 10 events per day between 07:00 and 23:00 hours.

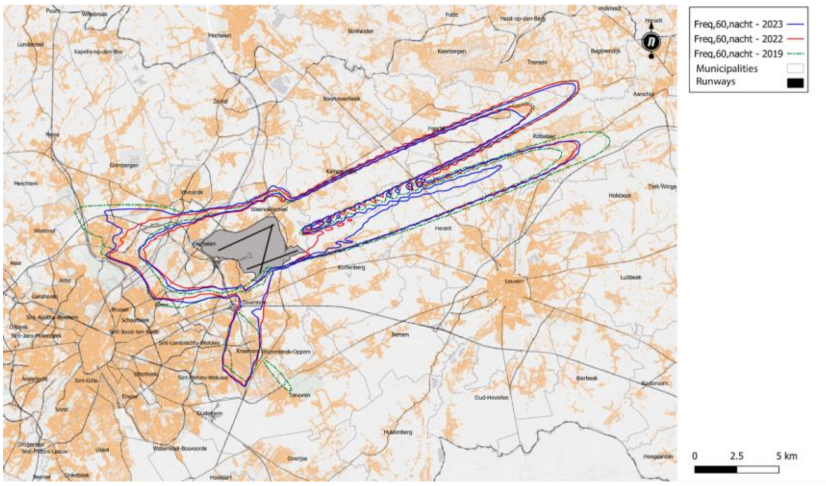


Figure 17: Freq.60,night contours (10x and 15x above 60 dB(A)) around Brussels Airport for 2019 (green), 2022 (red) and 2023 (blue).

The total surface area within the Freq.60,night contour with 10x above 60 dB(A) rose in 2023 by 1.4% compared with 2022 (from 12,796 ha to 12,980 ha). The number of residents inside the Freq.60,night contour of 10x above 60 dB(A) increased by 12.6% (from 123,293 to 138,855). Compared to 2019, the total area is 8.6% smaller (area in 2019 was 14,204 ha) and the number of residents 11.3% lower (number of residents in 2019 was 156,569 based on the population file of 1 January 2022).

4.4 Potentially severely inconvenienced

The number of people who are potentially seriously inconvenienced is determined on the basis of the calculated L_{den} and the exposure-effect relationship for serious inconvenience, as stipulated in VLAREM II (see paragraph 2.2). The number of potentially severely inconvenienced people is also reported per municipality. This report uses the most recent population figures (1 January 2024).

Table 6Shows the results for the number of potentially severely inconvenienced people. The results are also shown graphically in Figure 18. Table 6 shows that the year 2019 has been modelled both with INM7.0b (official noise contours reporting 2019) and later resumed with Echo (comparability with contours from 2021).

The total number of potentially highly inconvenienced persons in 2023 within the contour of 55 dB(A) is 13,432, an increase of 14.4% in comparison to 2022 but a decrease of 7.2% compared to 2019. The number of potentially seriously inconvenienced within the contour of 55 dB(A) increased by 271 (+2.1%) due to developments in the population numbers.

Commented [1]: 2022 -> 2023

Compared to 2019, many municipalities fall outside the L_{den} 55 dB contour, in particular: Grimbergen and Sint Lambrechts-Woluwe. In the other municipalities, the number of potentially highly inconvenienced people increased compared to 2022: The largest increases are in the municipalities of Evere (+305), Brussels (+267), Vilvoorde (+276), Machelen (+268), Zaventem (+186) and Steenokkerzeel (+138).

The most exposed municipalities in absolute numbers are Machelen, Zaventem, Steenokkerzeel, Brussels, Evere and Kampenhout, with in total 10.806 potentially seriously inconvenienced or 80.4% of the total number.

Table 6: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour

Year	2000	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019	2020	2021	2022	2023
Noise Model	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	INM 7.0b	Echo	INM 7.0b	Echo	Echo	Echo
Method	area	area	area	area	area	area	area	area	area	area	area	area	address	address	address	address	address	address	address	address
Population Data	1jan'00	1jan'03	1jan'06	1jan'07	1jan'07	1jan'08	1jan'08	1jan'10	1jan'10	1jan'10	1jan'11	1jan'11	1jan'16	1jan'17	1jan'19	1jan'22	1jan'20	1jan'22	1jan'23	1jan'24
Brussel	2,441	1,254	1,691	1,447	1,131	1,115	1,061	1,080	928	1,780	1,739	1,789	1,803	1,889	1,898	1,933	959	1,151	1,554	1,830
Evere	3,648	2,987	3,566	3,325	2,903	2,738	2,599	2,306	1,142	2,975	1,443	1,850	1,505	1,875	1,754	1,902	0	100	1,237	1,542
Grimbergen	3,111	479	1,305	638	202	132	193	120	0	175	428	517	449	440	485	8	0	0	0	0
Haacht	96	103	119	58	36	31	37	37	24	50	115	70	78	66	51	164	2	74	136	152
Herent	186	88	140	162	119	115	123	134	107	152	111	161	133	136	136	183	3	88	144	156
Huldenberg	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kampenhout	529	747	727	582	453	483	461	399	430	469	648	566	457	563	439	632	329	481	635	659
Kortenberg	664	548	621	604	512	526	497	422	603	443	366	438	431	521	495	654	101	301	571	618
Kraainem	1,453	934	1,373	1,277	673	669	667	500	589	111	368	379	388	524	393	400	22	256	487	524
Leuven	70		9	22	2	1	3	5	0	11	0	0	13	18	22	114	0	0	35	47
Machelen	3,433	2,411	2,724	2,635	2,439	2,392	2,470	2,573	2,278	2,505	2,598	2,649	3,015	2,995	3,032	2,872	2,194	2,242	2,557	2,825
Meise	506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Overijse	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rotselaar	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	0	0	2
Schaarbeek	2,026	995	1,937	1,440	603	1,153	1,652	1,703	76	1,647	354	956	6	165	0	0	0	0	0	0
Sint-L.-Woluwe	1,515	382	1,218	994	489	290	196	150	0	0	0	1	142	44	241	16	0	0	0	0
Sint-P.-Woluwe	642	411	798	607	396	477	270	82	390	0	79	102	90	338	85	78	0	7	284	356
Steenokkerzeel	1,769	1,530	1,584	1,471	1,327	1,351	1,360	1,409	1,455	1,439	1,675	1,525	1,506	1,595	1,545	1,583	1,388	1,298	1,587	1,725
Tervuren	1,550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vilvoorde	2,622	1,158	1,483	1,177	894	812	868	851	302	1,012	1,120	1,136	1,146	1,103	1,129	879	139	7	76	352
Wemmel	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wezembeek-O.	1,818	739	878	670	359	425	408	399	457	172	282	252	268	360	250	302	35	226	401	419
Zaventem	5,478	3,490	3,558	3,628	2,411	2,152	2,544	2,716	2,618	1,884	2,638	1,835	2,144	2,315	2,464	2,670	1,582	1,485	2,039	2,225
Zemst	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Grand Total	**33,889**	**18,257**	**23,732**	**20,737**	**14,950**	**14,861**	**15,409**	**14,886**	**11,399**	**14,825**	**13,965**	**14,226**	**13,575**	**14,948**	**14,420**	**14,469**	**6,756**	**7,716**	**11,744**	**13,432**

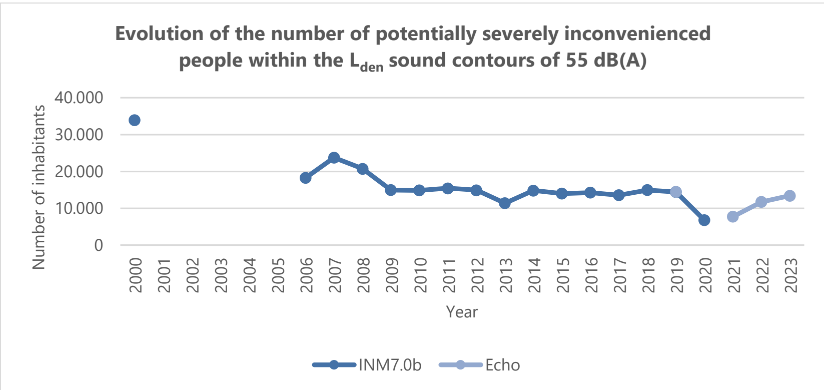


Figure 18: Evolution of the number of potentially severely inconvenienced people within the L_{den} sound contour of 55 dB(A).

Appendix A. Runway usage

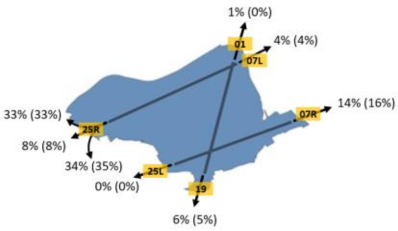
This appendix gives a complete description of the runway usage. The number of departures and arrivals are given for each runway, both absolute or percentage-wise, for 2023 and place against those for 2022, for:

- The total
- The day period, from 07:00 to 19:00
- The evening period, from 19:00 to 23:00
- The night period, from 23:00 to 07:00

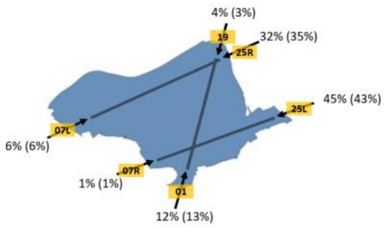
The figures give the share of departures and arrivals for each runway, with runway usage in 2022 between brackets. The tables also give the absolute number of movements.

Total runway usage: all flights day, evening and night.

Departures



Arrivals

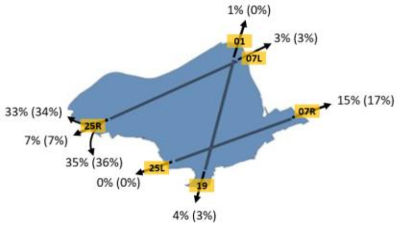


All flights (day, evening, and night)				
Departures				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	172	858	0.2%	0.9%
07L	3,326	3,977	3.7%	4.1%
07R	13,982	13,717	15.6%	14.3%
19	4,390	5,290	4.9%	5.5%
25L	50	77	0.1%	0.1%
25R	67,547	72,202	75.5%	75.1%

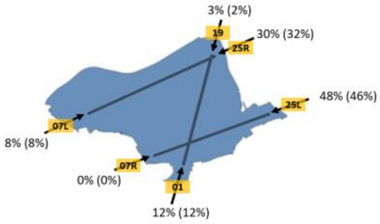
All flights (day, evening, and night)				
Arrivals				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	11,353	11,995	12.7%	12.5%
07L	5,362	5,523	6.0%	5.7%
07R	491	726	0.5%	0.8%
19	2,657	3,377	3.0%	3.5%
25L	38,475	43,474	43.0%	45.2%
25R	31,125	31,041	34.8%	32.3%

Runway usage for the day period, from 07:00 to 19:00

Departures



Arrivals

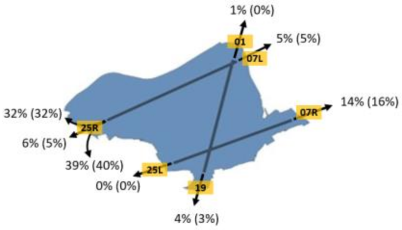


Day Flights				
Departures				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	165	637	0.3%	1.0%
07L	1,706	2,119	2.9%	3.4%
07R	10,144	9,707	17.3%	15.4%
19	1,798	2,711	3.1%	4.3%
25L	6	45	0.0%	0.1%
25R	44,875	47,614	76.5%	75.8%

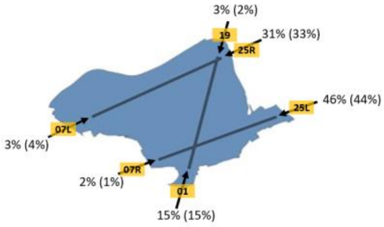
Day Flights				
Arrivals				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	6,769	7,280	11.7%	11.7%
07L	4,605	4,781	7.9%	7.7%
07R	82	64	0.1%	0.1%
19	1,250	1,878	2.2%	3.0%
25L	26,576	29,820	45.8%	47.8%
25R	18,699	18,573	32.3%	29.8%

Runway usage for the evening period, from 19:00 to 23:00

Departures



Arrivals

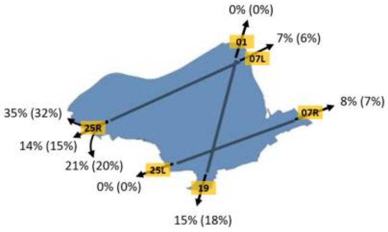


Evening Flights				
Departures				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	4	192	0.0%	0.9%
07L	907	997	4.7%	4.6%
07R	3,017	3,070	15.5%	14.3%
19	550	865	2.8%	4.0%
25L	0	0	0.0%	0.0%
25R	14,960	16,374	77.0%	76.2%

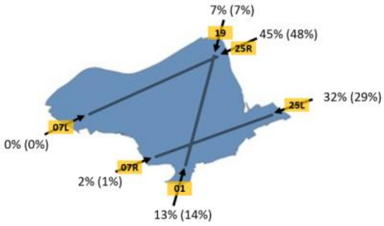
Evening Flights				
Arrivals				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	2,739	2,955	15.1%	14.7%
07L	737	691	4.1%	3.4%
07R	221	358	1.2%	1.8%
19	420	521	2.3%	2.6%
25L	7,955	9,303	44.0%	46.1%
25R	6,025	6,333	33.3%	31.4%

Runway usage for the night period from 23:00 to 07:00

Departures



Arrivals



Night Flights				
Departures				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	3	29	0.0%	0.2%
07L	713	861	6.3%	7.3%
07R	821	940	7.2%	8.0%
19	2,042	1,714	18.0%	14.5%
25L	44	32	0.4%	0.3%
25R	7,712	8,214	68.0%	69.7%

Night Flights				
Arrivals				
	Quantity		Proportion	
Runway	2022	2023	2022	2023
01	1,845	1,760	13.8%	13.0%
07L	20	51	0.1%	0.4%
07R	188	304	1.4%	2.2%
19	987	978	7.4%	7.2%
25L	3,944	4,351	29.5%	32.0%
25R	6,401	6,135	47.8%	45.2%

Appendix B. Location of the measuring stations

This appendix gives the locations of the measuring station.

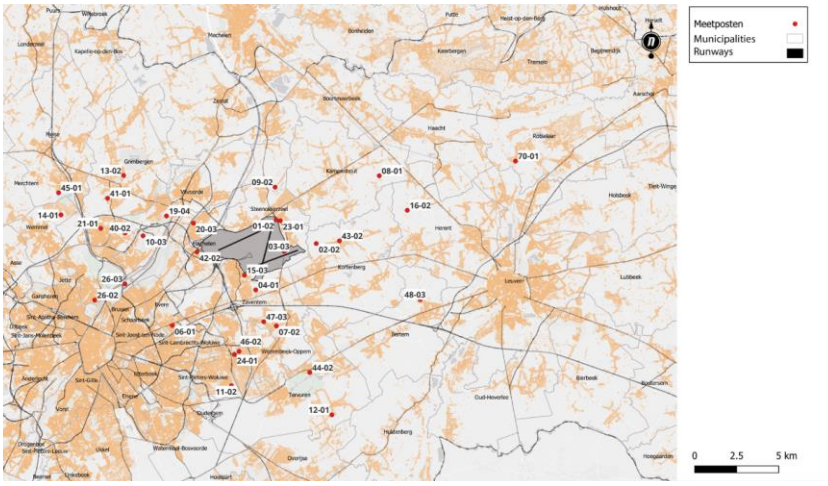


Figure 19: Location of the measuring stations

Table 7: Overview of the measuring stations

NMT	Location code	Location name
1	01-02	Steenokkerzeel
2	02-02	Kortenberg
3	03-03	Hummelgem
4	04-01	Nossegem
6	06-01	Evere
7	07-02	Sterrebeek
8	08-01	Kampenhout
9	09-02	Perk
10	10-03	Neder-Over-Heembeek
11	11-02	Sint-Pieters-Woluwe
12	12-01	Duisburg
13	13-02	Grimbergen
14	14-01	Wemmel
15	15-03	Zaventem
16	16-02	Veltem
19	19-04	Vilvoorde
20	20-03	Machelen
21	21-01	Strombeek-Bever
23	23-01	Steenokkerzeel
5	24-01	Kraainem
17	26-02	Laken
17	26-03	Schaarbeek

NMT	Location code	Location name
40*	40-02	Koningslo
41*	41-01	Grimbergen
42*	42-02	Diegem
43*	43-02	Erps-Kwerps
44*	44-02	Tervuren
45*	45-01	Meise
46*	46-02	Wezembeek-Oppem
47*	47-03	Sterrebeek
48*	48-03	Bertem
70*	70-01	De Wyngaert LNE

* noise data Department of the Environment, off-line correlated by the NMS

Appendix C. Results of contour calculations, 2023

This appendix gives the number of residents per contour zone and per municipality.

C.1 Surface area per contour zone and per municipality

Table 8: Surface area per L_{day} contour zone and municipality 2023

Area (ha)	Lday - contour zones in dB(A) (d. 07h-19h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	543	25	0	0	0	568
Evere	9	0	0	0	0	9
Haacht	23	0	0	0	0	23
Herent	233	0	0	0	0	233
Kampenhout	364	45	0	0	0	409
Kortenberg	430	169	29	0	0	628
Kraainem	30	0	0	0	0	30
Machelen	397	276	103	36	2	814
Steenokkerzeel	471	304	188	108	72	1,143
Vilvoorde	12	0	0	0	0	12
Wezembeek-Oppem	20	0	0	0	0	20
Zaventem	357	140	43	21	6	567
Total	**2,889**	**959**	**363**	**165**	**80**	**4,456**

Table 9: Surface area per $L_{evening}$ contour zone and municipality 2023

Area (ha)	Levening - contour zones in dB(A) (ev. 19h-23h)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	650	443	4	0	0	0	1,097
Evere	484	0	0	0	0	0	484
Grimbergen	17	0	0	0	0	0	17
Haacht	735	0	0	0	0	0	735
Herent	718	161	0	0	0	0	879
Kampenhout	1,034	377	55	0	0	0	1,466
Kortenberg	516	400	138	16	0	0	1,070
Kraainem	358	42	0	0	0	0	400
Leuven	249	0	0	0	0	0	249
Machelen	262	448	265	84	35	3	1,097
Rotselaar	226	0	0	0	0	0	226
Schaarbeek	58	0	0	0	0	0	58
Sint-Lambrechts-Woluwe	309	0	0	0	0	0	309
Sint-Pieters-Woluwe	247	0	0	0	0	0	247
Steenokkerzeel	458	474	301	186	103	69	1,591
Tervuren	91	0	0	0	0	0	91
Vilvoorde	524	2	0	0	0	0	526
Wezembeek-Oppem	151	47	0	0	0	0	198
Zaventem	910	402	143	39	15	5	1,514
Total	**7,997**	**2,796**	**906**	**325**	**153**	**77**	**12,254**

Table 10: Surface area per L_{night} contour zone and municipality 2023

Area (ha)	Lnight - contour zones in dB(A) (n. 23h-07h)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Boortmeerbeek	1	0	0	0	0	0	1
Brussel	787	383	0	0	0	0	1,170
Evere	369	0	0	0	0	0	369
Grimbergen	225	0	0	0	0	0	225
Haacht	983	100	0	0	0	0	1,083
Herent	745	249	0	0	0	0	994
Kampenhout	1,004	575	174	10	0	0	1,763
Kortenberg	506	363	146	22	0	0	1,037
Kraainem	214	65	0	0	0	0	279
Leuven	279	0	0	0	0	0	279
Machelen	262	529	241	63	28	3	1,126
Oudergem	26	0	0	0	0	0	26
Rotselaar	888	0	0	0	0	0	888
Schaarbeek	46	0	0	0	0	0	46
Sint-Lambrechts-Woluwe	4	0	0	0	0	0	4
Sint-Pieters-Woluwe	187	0	0	0	0	0	187
Steenokkerzeel	482	545	288	235	123	72	1,745
Tervuren	141	0	0	0	0	0	141
Vilvoorde	600	15	0	0	0	0	615
Wezembeek-Oppem	186	66	0	0	0	0	252
Zaventem	1,199	501	226	59	16	4	2,005
Zemst	36	0	0	0	0	0	36
Total	**9,170**	**3,391**	**1,075**	**389**	**167**	**79**	**14,271**

Table 11: Surface area per L_{den} contour zone and municipality 2023

Area (ha)	Lden - contour zones in dB(A) (d. 07h-19h, ev. 19h-23h, n. 23h-07h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	798	176	0	0	0	974
Evere	229	0	0	0	0	229
Haacht	575	0	0	0	0	575
Herent	552	54	0	0	0	606
Kampenhout	981	327	47	0	0	1,355
Kortenberg	458	313	87	5	0	863
Kraainem	173	14	0	0	0	187
Leuven	182	0	0	0	0	182
Machelen	384	405	170	53	19	1,031
Rotselaar	39	0	0	0	0	39
Sint-Pieters-Woluwe	101	0	0	0	0	101
Steenokkerzeel	542	410	279	165	141	1,537
Tervuren	8	0	0	0	0	8
Vilvoorde	265	0	0	0	0	265
Wezembeek-Oppem	122	7	0	0	0	129
Zaventem	678	357	120	34	12	1,201
Total	**6,087**	**2,063**	**703**	**257**	**172**	**9,282**

Table 12: Surface area per Freq.70,day contour zone and municipality 2023

Area (ha)	Freq.70,day - contour zones (day 07h-23h)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Boortmeerbeek	25	0	0	0	0	25
Brussel	273	309	675	151	6	1,414
Evere	78	378	57	0	0	513
Grimbergen	523	168	0	0	0	691
Haacht	305	182	27	0	0	514
Herent	245	103	93	94	37	572
Kampenhout	555	346	271	304	0	1,476
Kortenberg	250	123	199	144	322	1,038
Kraainem	29	43	132	0	0	204
Leuven	161	2	0	0	0	163
Machelen	54	86	212	210	403	965
Meise	25	0	0	0	0	25
Oudergem	8	0	0	0	0	8
Rotselaar	139	0	0	0	0	139
Schaarbeek	201	3	0	0	0	204
Sint-Lambrechts-Woluwe	433	57	0	0	0	490
Sint-Pieters-Woluwe	56	54	47	0	0	157
Steenokkerzeel	236	164	374	312	481	1,567
Tervuren	65	34	0	0	0	99
Vilvoorde	121	347	57	0	0	525
Wemmel	99	0	0	0	0	99
Wezembeek-Oppem	18	31	87	0	0	136
Zaventem	466	250	415	141	67	1,339
Zemst	49	0	0	0	0	49
Total	**4,414**	**2,680**	**2,646**	**1,356**	**1,316**	**12,412**

Table 13: Surface area per Freq.70,night contour zone and municipality 2023

Area (ha)	Freq.70,night - contour zones (night 23h-07h)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	156	0	0	0	156
Brussel	857	291	78	0	1,226
Evere	488	0	0	0	488
Grimbergen	476	0	0	0	476
Haacht	423	111	0	0	534
Herent	221	175	117	0	513
Kampenhout	640	183	533	0	1,356
Kortenberg	268	141	416	0	825
Kraainem	192	38	0	0	230
Leuven	163	0	0	0	163
Machelen	229	212	294	265	1,000
Oudergem	88	0	0	0	88
Rotselaar	520	0	0	0	520
Schaarbeek	76	0	0	0	76
Sint-Lambrechts-Woluwe	52	0	0	0	52
Sint-Pieters-Woluwe	166	0	0	0	166
Steenokkerzeel	612	198	433	416	1,659
Tervuren	262	0	0	0	262
Vilvoorde	545	18	0	0	563
Watermaal-Bosvoorde	43	0	0	0	43
Wezembeek-Oppem	166	41	0	0	207
Zaventem	1,181	428	217	60	1,886
Zemst	81	0	0	0	81
Total	**7,905**	**1,836**	**2,088**	**741**	**12,570**

Table 14: Surface area per Freq.60,day contour zone and municipality 2023

Area (ha)	Freq.60,day - contour zones (day 07h-23h)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Aarschot	3	0	0	0	3
Brussel	605	410	170	0	1,185
Evere	416	23	0	0	439
Grimbergen	327	0	0	0	327
Haacht	743	243	0	0	986
Herent	322	630	0	0	952
Kampenhout	1,336	121	3	0	1,460
Kortenberg	191	729	75	0	995
Kraainem	470	65	0	0	535
Leuven	60	259	0	0	319
Machelen	147	229	668	69	1,113
Rotselaar	946	212	0	0	1,158
Schaarbeek	16	0	0	0	16
Sint-Lambrechts-Woluwe	373	0	0	0	373
Sint-Pieters-Woluwe	281	14	0	0	295
Steenokkerzeel	345	325	500	425	1,595
Tervuren	311	0	0	0	311
Vilvoorde	588	9	0	0	597
Wezembeek-Oppem	469	51	0	0	520
Zaventem	818	205	182	136	1,341
Total	**8,767**	**3,525**	**1,598**	**630**	**14,520**

Table 15: Surface area per Freq.60,night contour zone and municipality 2023

Area (ha)	Freq.60,night - contour zones (night 23h-07h)				
Municipality	10-15	15-20	20-30	>30	Total
Begijnendijk	7	0	0	0	7
Brussel	461	460	184	0	1,105
Evere	147	0	0	0	147
Grimbergen	103	0	0	0	103
Haacht	350	762	28	0	1,140
Herent	799	134	54	0	987
Kampenhout	292	848	437	0	1,577
Kortenberg	492	464	14	0	970
Kraainem	317	0	0	0	317
Leuven	269	48	0	0	317
Machelen	124	174	828	0	1,126
Rotselaar	1,151	337	0	0	1,488
Sint-Pieters-Woluwe	70	0	0	0	70
Steenokkerzeel	155	186	636	654	1,631
Tremelo	87	0	0	0	87
Vilvoorde	473	21	0	0	494
Wezembeek-Oppem	259	0	0	0	259
Zaventem	525	123	297	210	1,155
Total	**6,081**	**3,557**	**2,478**	**864**	**12,980**

C.2 Number of residents per contour zone and per municipality

Table 16: Number of inhabitants per L_{day} contour zone and municipality 2023

Number of inhabitants	Lday - contour zones in dB(A) (d. 07h-19h)					
Municipality	55-60	60-65	65-70	70-75	>75	Total
Brussel	6,676	500	0	0	0	7,176
Evere	49	0	0	0	0	49
Haacht	2	0	0	0	0	2
Herent	627	0	0	0	0	627
Kampenhout	850	165	0	0	0	1,015
Kortenberg	2,064	285	0	0	0	2,349
Kraainem	185	0	0	0	0	185
Machelen	5,844	4,541	81	0	0	10,466
Steenokkerzeel	5,260	1,014	134	6	0	6,414
Vilvoorde	57	0	0	0	0	57
Wezembeek-Oppem	232	0	0	0	0	232
Zaventem	4,355	325	0	0	0	4,680
Total	**26,201**	**6,830**	**215**	**6**	**0**	**33,252**

Table 17: Number of inhabitants per $L_{evening}$ contour zone and municipality 2023

Number of inhabitants	Levening - contour zones in dB(A) (ev. 19h-23h)						
Municipality	50-55	55-60	60-65	65-70	70-75	>75	Total
Brussel	10,094	6,764	97	0	0	0	16,955
Evere	41,739	0	0	0	0	0	41,739
Grimbergen	570	0	0	0	0	0	570
Haacht	2,060	0	0	0	0	0	2,060
Herent	1,393	272	0	0	0	0	1,665
Kampenhout	4,124	931	191	0	0	0	5,246
Kortenberg	3,386	1,697	187	0	0	0	5,270
Kraainem	10,476	368	0	0	0	0	10,844
Leuven	890	0	0	0	0	0	890
Machelen	5,830	6,234	4,111	25	0	0	16,200
Rotselaar	790	0	0	0	0	0	790
Schaarbeek	11,340	0	0	0	0	0	11,340
Sint-Lambrechts-Woluwe	18,217	0	0	0	0	0	18,217
Sint-Pieters-Woluwe	11,051	0	0	0	0	0	11,051
Steenokkerzeel	3,353	5,153	996	159	0	0	9,661
Vilvoorde	10,826	1	0	0	0	0	10,827
Wezembeek-Oppem	4,036	960	0	0	0	0	4,996
Zaventem	17,537	5,894	257	0	0	0	23,688
Total	**157,712**	**28,274**	**5,839**	**184**	**0**	**0**	**192,009**

Table 18: Number of inhabitants per L_{night} contour zone and municipality 2023

Number of inhabitants	Lnight - contour zones in dB(A) (n. 23h-07h)						
Municipality	45-50	50-55	55-60	60-65	65-70	>70	Total
Brussel	17,139	6,190	0	0	0	0	23,329
Evere	27,993	0	0	0	0	0	27,993
Grimbergen	11,108	0	0	0	0	0	11,108
Haacht	4,103	19	0	0	0	0	4,122
Herent	1,286	620	0	0	0	0	1,906
Kampenhout	4,413	1,638	373	107	0	0	6,531
Kortenberg	2,863	1,619	200	0	0	0	4,682
Kraainem	5,792	918	0	0	0	0	6,710
Leuven	1,098	0	0	0	0	0	1,098
Machelen	4,994	8,915	2,531	11	0	0	16,451
Rotselaar	4,565	0	0	0	0	0	4,565
Schaarbeek	8,095	0	0	0	0	0	8,095
Sint-Lambrechts-Woluwe	271	0	0	0	0	0	271
Sint-Pieters-Woluwe	7,004	0	0	0	0	0	7,004
Steenokkerzeel	2,374	5,834	1,659	340	0	0	10,207
Vilvoorde	13,270	65	0	0	0	0	13,335
Wezembeek-Oppem	3,917	1,417	0	0	0	0	5,334
Zaventem	19,067	8,659	258	1	0	0	27,985
Zemst	67	0	0	0	0	0	67
Total	**139,419**	**35,894**	**5,021**	**459**	**0**	**0**	**180,793**

Table 19: Number of inhabitants per L_{den} contour zone and municipality 2023

Number of inhabitants	Lden - contour zones in dB(A) (d. 07h-19h, ev. 19h-23h, n. 23h-07h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	7,191	4,712	0	0	0	11,903
Evere	13,151	0	0	0	0	13,151
Haacht	1,326	0	0	0	0	1,326
Herent	1,077	24	0	0	0	1,101
Kampenhout	3,550	761	165	0	0	4,476
Kortenberg	2,778	1,184	33	0	0	3,995
Kraainem	3,925	88	0	0	0	4,013
Leuven	418	0	0	0	0	418
Machelen	6,914	7,492	774	5	0	15,185
Rotselaar	19	0	0	0	0	19
Sint-Pieters-Woluwe	3,173	0	0	0	0	3,173
Steenokkerzeel	4,509	3,825	750	138	0	9,222
Vilvoorde	3,241	0	0	0	0	3,241
Wezembeek-Oppem	3,120	7	0	0	0	3,127
Zaventem	11,033	3,827	5	0	0	14,865
Total	**65,425**	**21,920**	**1,727**	**143**	**0**	**89,215**

Table 20: Number of residents per Freq.70,day contour zone and municipality 2023

Number of inhabitants	Freq.70,day - contour zones (day 07h-23h)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	23,657	5,012	3,913	4,035	113	36,730
Evere	7,696	34,609	1,787	0	0	44,092
Grimbergen	6,524	10,141	0	0	0	16,665
Haacht	1,085	127	4	0	0	1,216
Herent	222	210	493	105	19	1,049
Kampenhout	1,972	1,095	998	634	0	4,699
Kortenberg	2,018	1,608	1,143	1,032	619	6,420
Kraainem	947	1,115	2,741	0	0	4,803
Leuven	353	0	0	0	0	353
Machelen	1,544	1,957	2,911	3,319	4,261	13,992
Meise	409	0	0	0	0	409
Rotselaar	42	0	0	0	0	42
Schaarbeek	27,233	10	0	0	0	27,243
Sint-Lambrechts-Woluwe	31,455	2,730	0	0	0	34,185
Sint-Pieters-Woluwe	3,208	2,358	791	0	0	6,357
Steenokkerzeel	1,302	1,229	3,710	2,368	581	9,190
Vilvoorde	2,726	8,813	245	0	0	11,784
Wemmel	1,046	0	0	0	0	1,046
Wezembeek-Oppem	683	1,052	1,853	0	0	3,588
Zaventem	9,696	3,198	2,789	1,628	750	18,061
Zemst	93	0	0	0	0	93
Total	**123,911**	**75,264**	**23,378**	**13,121**	**6,343**	**242,017**

Table 21: Number of residents per Freq.70,night contour zone and municipality 2023

Number of inhabitants	Freq.70,night - contour zones (night 23h-07h)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	1,373	0	0	0	1,373
Brussel	12,371	4,760	1,334	0	18,465
Evere	42,976	0	0	0	42,976
Grimbergen	15,600	0	0	0	15,600
Haacht	1,369	22	0	0	1,391
Herent	327	608	103	0	1,038
Kampenhout	2,728	722	1,368	0	4,818
Kortenberg	2,228	993	1,215	0	4,436
Kraainem	5,190	233	0	0	5,423
Leuven	362	0	0	0	362
Machelen	4,504	3,079	6,377	376	14,336
Rotselaar	2,894	0	0	0	2,894
Schaarbeek	12,128	0	0	0	12,128
Sint-Lambrechts-Woluwe	4,626	0	0	0	4,626
Sint-Pieters-Woluwe	6,491	0	0	0	6,491
Steenokkerzeel	3,955	2,022	2,708	1,081	9,766
Tervuren	1,823	0	0	0	1,823
Vilvoorde	12,933	68	0	0	13,001
Wezembeek-Oppem	3,997	613	0	0	4,610
Zaventem	17,999	4,796	2,413	184	25,392
Zemst	111	0	0	0	111
Total	**155,985**	**17,916**	**15,518**	**1,641**	**191,060**

Table 22: Number of residents per Freq.60,day contour zone and municipality 2023

Number of inhabitants	Freq.60,day - contour zones (day 07h-23h)				
Municipality	50-100	100-150	150-200	>200	Total
Brussel	19,634	2,051	5,200	0	26,885
Evere	35,468	1,069	0	0	36,537
Grimbergen	9,034	0	0	0	9,034
Haacht	2,951	334	0	0	3,285
Herent	760	1,097	0	0	1,857
Kampenhout	4,993	22	0	0	5,015
Kortenberg	746	3,735	0	0	4,481
Kraainem	10,707	2,972	0	0	13,679
Leuven	420	915	0	0	1,335
Machelen	2,852	4,394	9,155	0	16,401
Rotselaar	6,371	1,203	0	0	7,574
Schaarbeek	1,582	0	0	0	1,582
Sint-Lambrechts-Woluwe	22,293	0	0	0	22,293
Sint-Pieters-Woluwe	12,667	1,031	0	0	13,698
Steenokkerzeel	2,043	3,285	3,902	0	9,230
Tervuren	7,605	0	0	0	7,605
Vilvoorde	12,832	32	0	0	12,864
Wezembeek-Oppem	9,867	1,545	0	0	11,412
Zaventem	15,232	2,433	5,812	0	23,477
Total	**178,057**	**26,118**	**24,069**	**0**	**228,244**

Table 23: Number of residents per Freq.60,night contour zone and municipality 2023

Number of inhabitants	Freq.60,night - contour zones (night 23h-07h)				
Municipality	10-15	15-20	20-30	>30	Total
Begijnendijk	11	0	0	0	11
Brussel	18,951	4,171	4,924	0	28,046
Evere	12,404	0	0	0	12,404
Grimbergen	1,303	0	0	0	1,303
Haacht	1,256	2,586	102	0	3,944
Herent	1,593	347	19	0	1,959
Kampenhout	1,413	3,095	1,510	0	6,018
Kortenberg	2,791	1,381	5	0	4,177
Kraainem	7,826	0	0	0	7,826
Leuven	1,222	87	0	0	1,309
Machelen	1,760	3,029	11,683	0	16,472
Rotselaar	8,014	1,126	0	0	9,140
Sint-Pieters-Woluwe	4,390	0	0	0	4,390
Steenokkerzeel	931	1,025	3,898	4,116	9,970
Tremelo	173	0	0	0	173
Vilvoorde	9,095	69	0	0	9,164
Wezembeek-Oppem	6,883	0	0	0	6,883
Zaventem	3,974	2,834	6,138	2,720	15,666
Total	**83,990**	**19,750**	**28,279**	**6,836**	**138,855**

C.3 Number of persons who are potentially highly inconvenienced per contour zone and per municipality.

Table 24: Number of residents potentially highly inconvenienced contour zone and municipality 2023

Number of potentially highly annoyed people	Lden - contour zones in dB(A) (d. 07h-19h, ev. 19h-23h, n. 23h-07h)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	931	899	0	0	0	1,830
Evere	1,542	0	0	0	0	1,542
Haacht	152	0	0	0	0	152
Herent	152	4	0	0	0	156
Kampenhout	452	157	50	0	0	659
Kortenberg	368	241	9	0	0	618
Kraainem	508	16	0	0	0	524
Leuven	47	0	0	0	0	47
Machelen	965	1,640	218	2	0	2,825
Rotselaar	2	0	0	0	0	2
Sint-Pieters-Woluwe	356	0	0	0	0	356
Steenokkerzeel	657	789	225	54	0	1,725
Vilvoorde	352	0	0	0	0	352
Wezembeek-Oppem	418	1	0	0	0	419
Zaventem	1,465	759	1	0	0	2,225
Total	**8,367**	**4,506**	**503**	**56**	**0**	**13,432**

Appendix D. Noise contour maps: evolution for 2022-2023

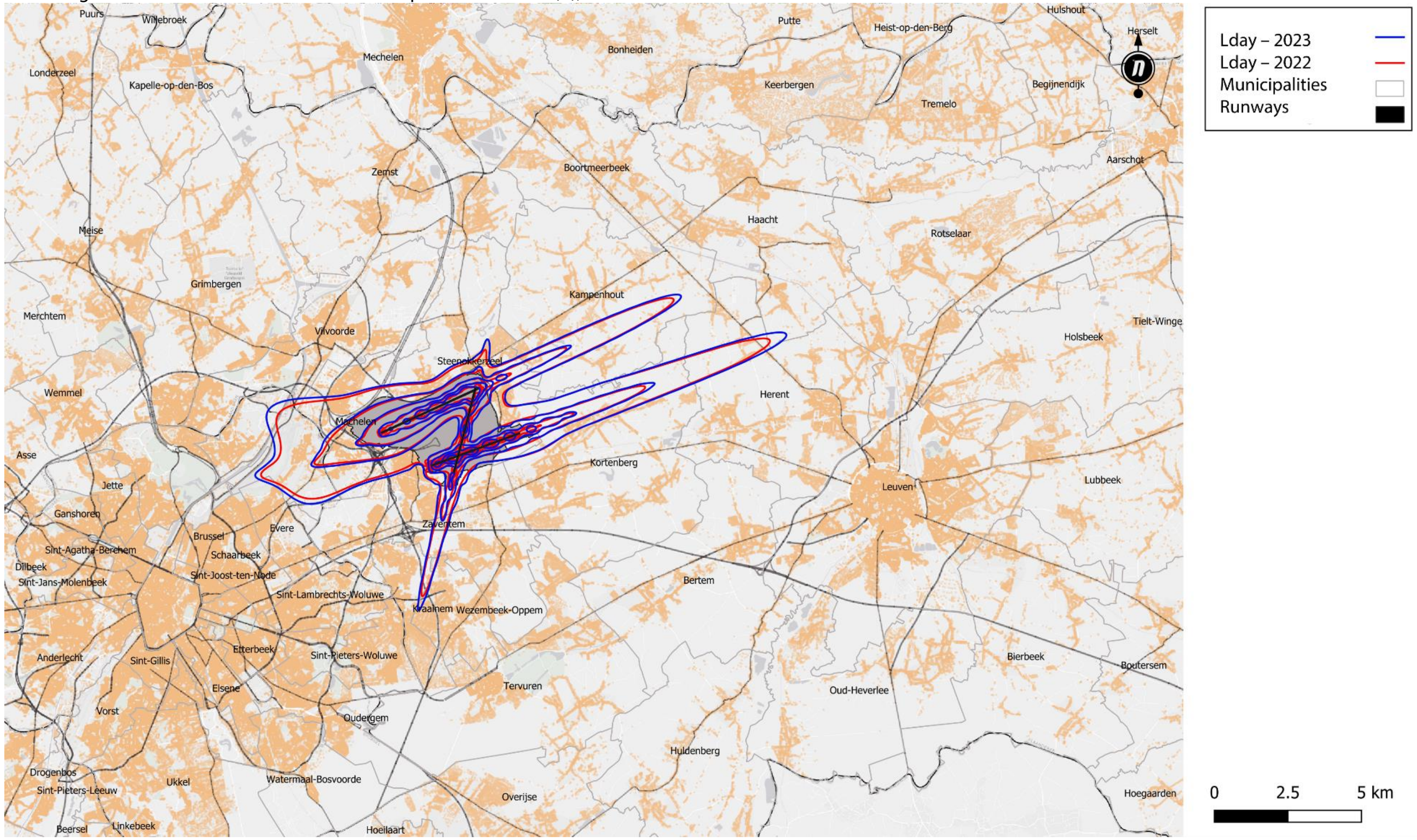
In this appendix the noise maps are available in A4 format.

- L_{day} – sound contours for 2022 and 2023, background population map 2023
- $L_{evening}$ noise contours for 2022 and 2023, background population map 2023
- L_{night} – Sound contours for 2022 and 2023, background population map 2023
- L_{den} – Sound contours for 2022 and 2023, background population map 2023
- Freq.70, Day – sound contours for 2022 and 2023, background population map 2023
- Freq.70, Night – sound contours for 2022 and 2023, background population map 2023
- Freq.60, Day – Sound contours for 2022 and 2023, background population map 2023
- Freq.60, Night – sound contours for 2022 and 2023, background population map 2023

- L_{day} – Sound contours for 2022 and 2023, background NGI topographic map
- $L_{evening}$ – Sound contours for 2022 and 2023, background NGI topographic map
- L_{night} – Sound contours for 2022 and 2023, background NGI topographic map
- L_{den} – Sound contours for 2022 and 2023, background NGI topographic map
- Freq.70,day noise contours for 2022 and 2023, background NGI topographical map
- Freq.70,night noise contours for 2022 and 2023, background NGI topographical map
- Freq.60,day noise contours for 2022 and 2023, background NGI topographical map
- Freq.60,night noise contours for 2022 and 2023, background NGI topographical map

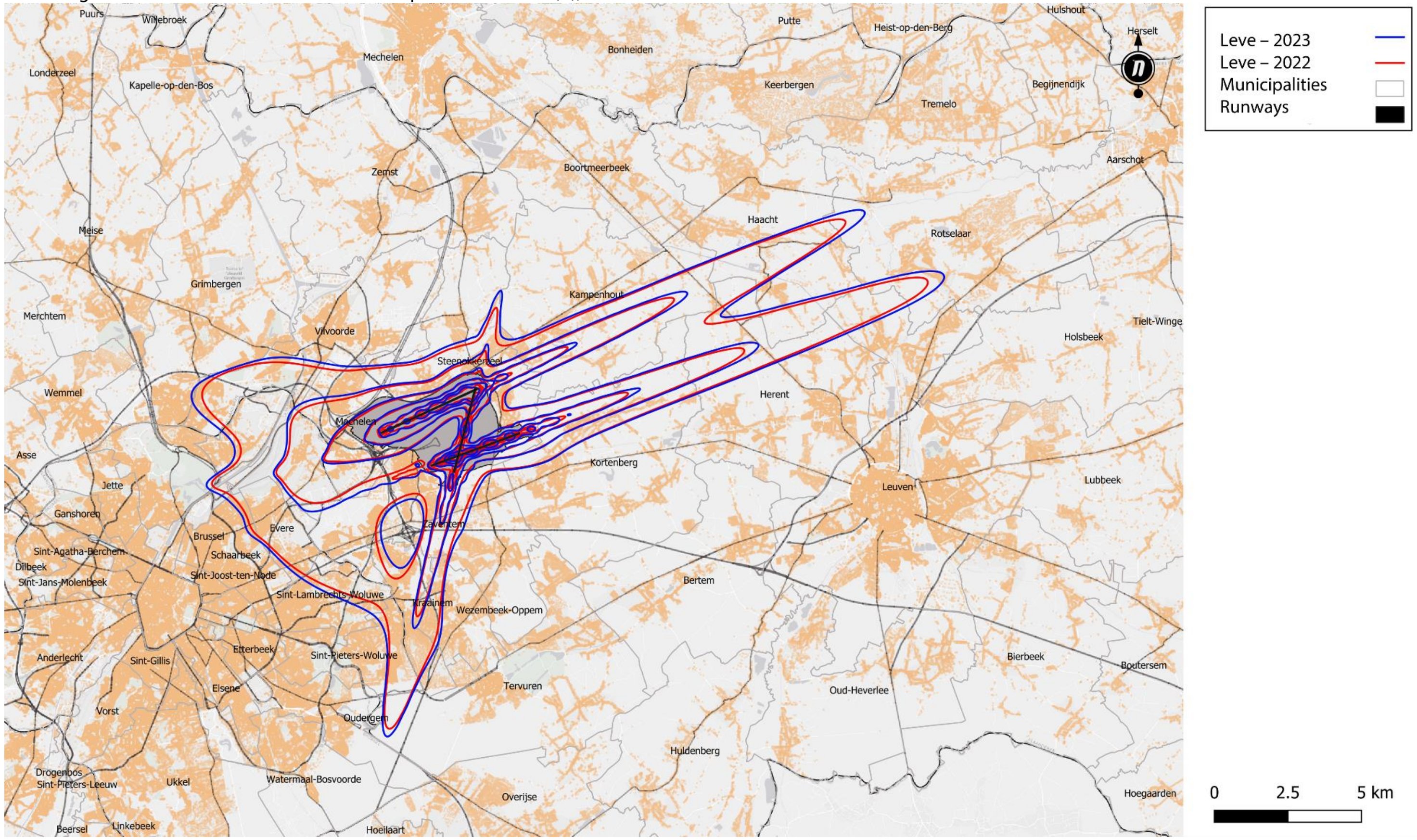
Evolution of L_{day} (07:00 to 19:00) sound contours – background population map 2023

The contours are shown here for 2022 and 2023 where, between 07:00 and 19:00, the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



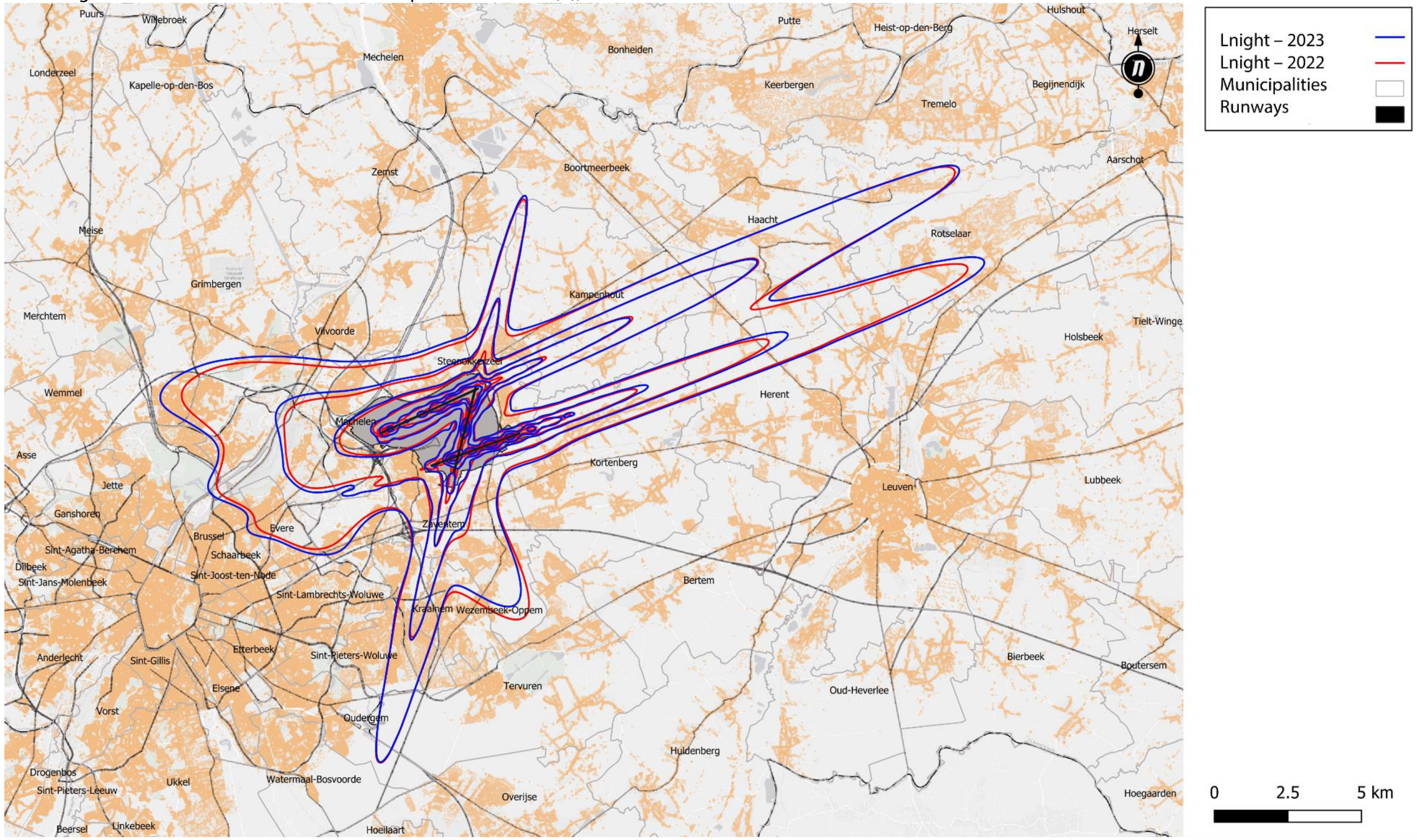
Evolution of $L_{evening}$ (19:00 to 23:00) sound contours – background population map 2023

The contours are shown here for 2022 and 2023 where, between 19:00 and 23:00, the noise impact by air traffic is, on average, 50, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 50 dB(A), etc.



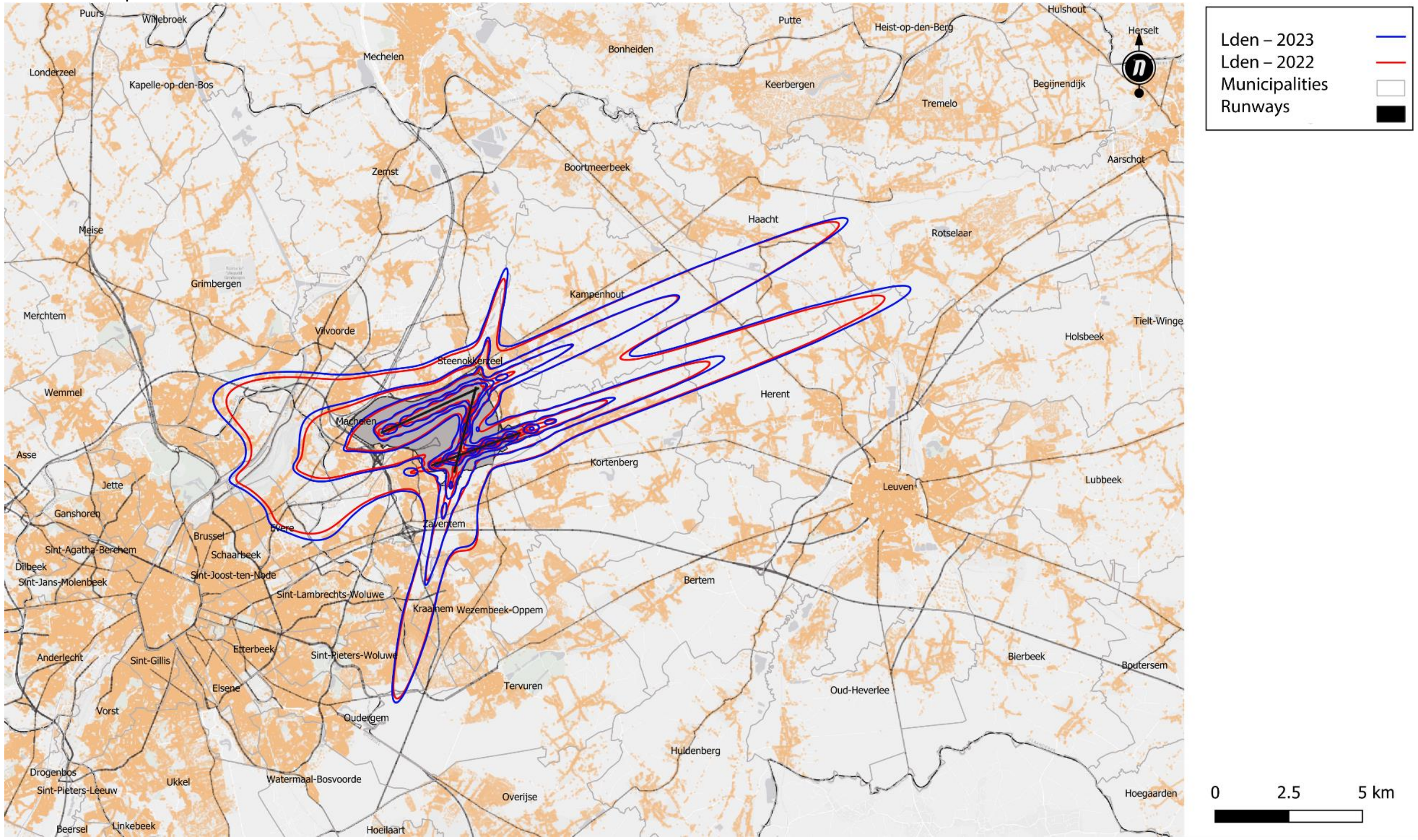
Evolution of L_{night} (23:00 to 7:00) sound contours – background population map 2023

The contours are shown here for 2022 and 2023 where, between 23:00 and 07:00, the noise impact by air traffic is, on average, 45, 50, 55, 60, 65 and 70 dB(a). The values are ascending inwards: the outermost contour corresponds with 45 dB(A), etc.



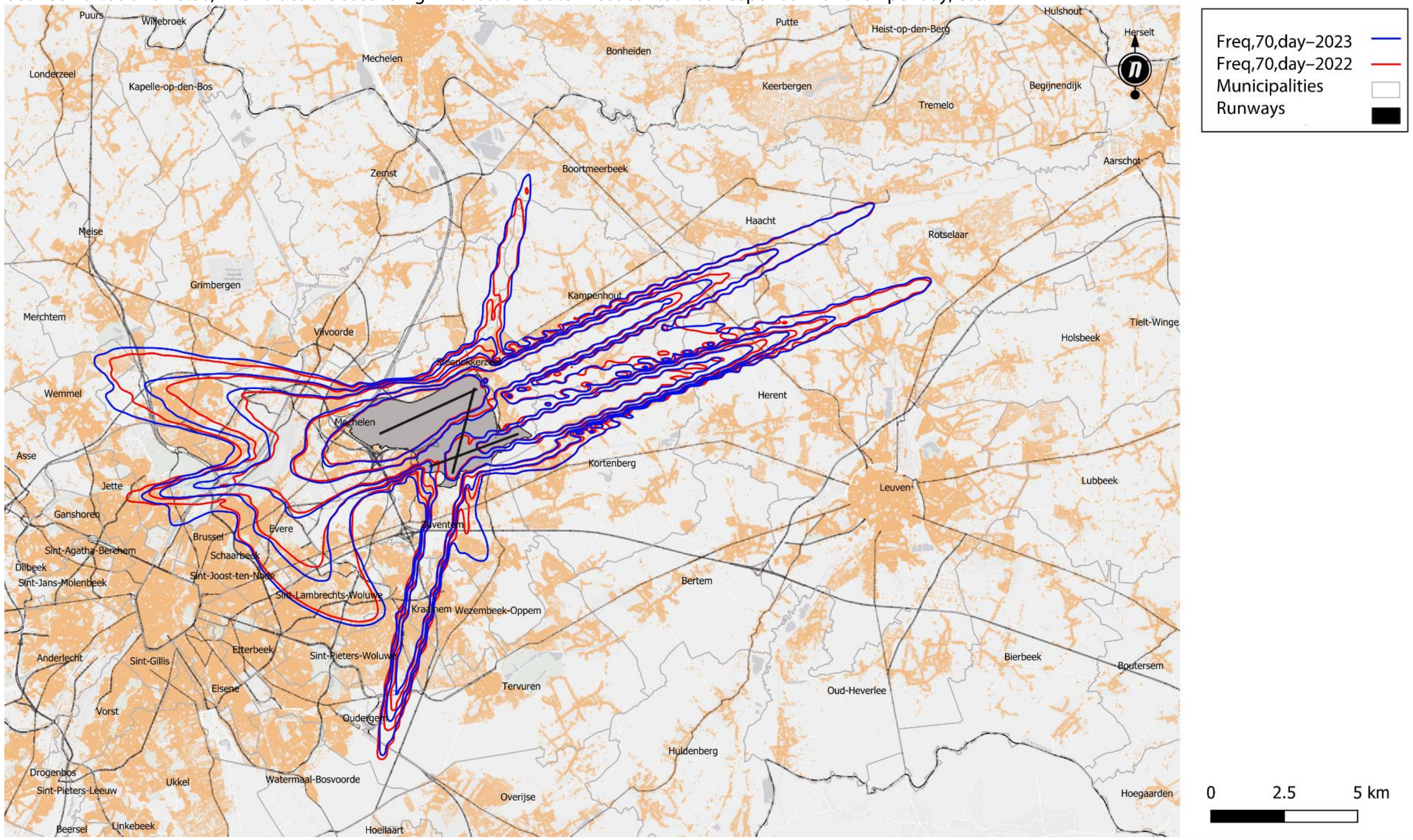
Evolution of L_{den} sound contours – background population map 2023

The contours are shown here for 2022 and 2023 where the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



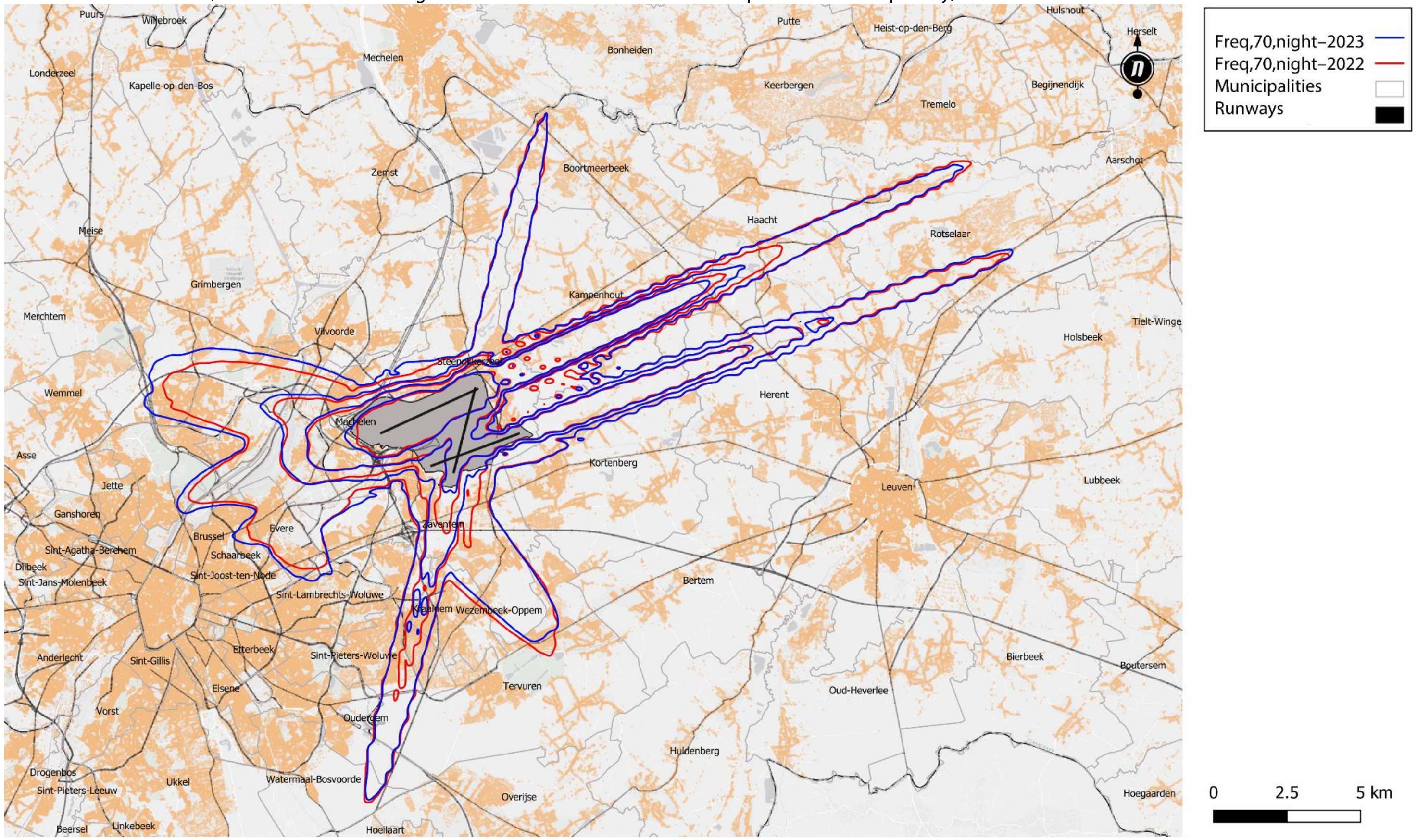
Evolution of Freq.70,day - background population map 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 70 dB or higher is observed 5x, 10x, 20x, 50x and 100x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 5x per day, etc.



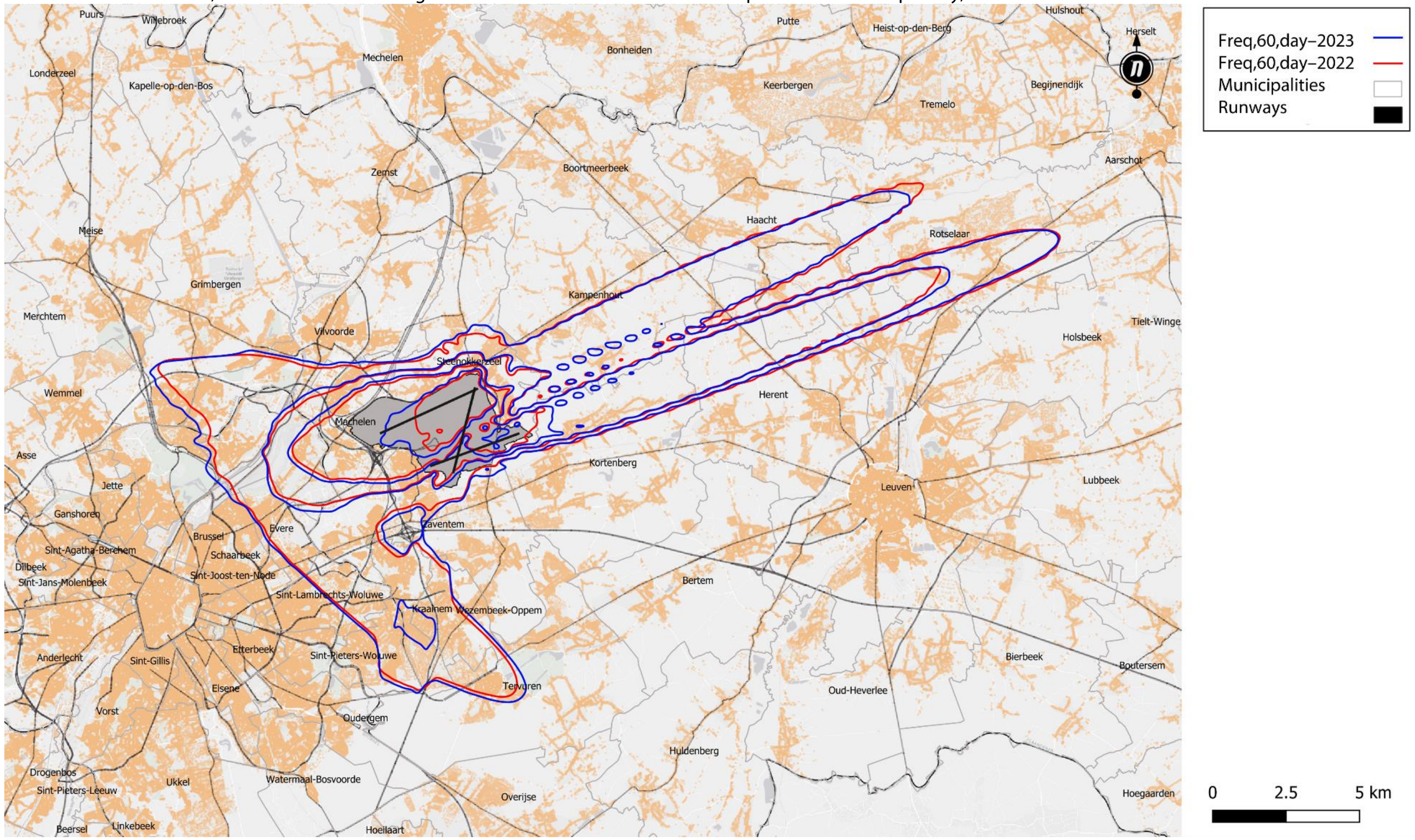
Evolution of Freq.70, night - background population map 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 70 dB or higher is observed 1x, 5x, 10x, 20x and 50x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 1x per day, etc.



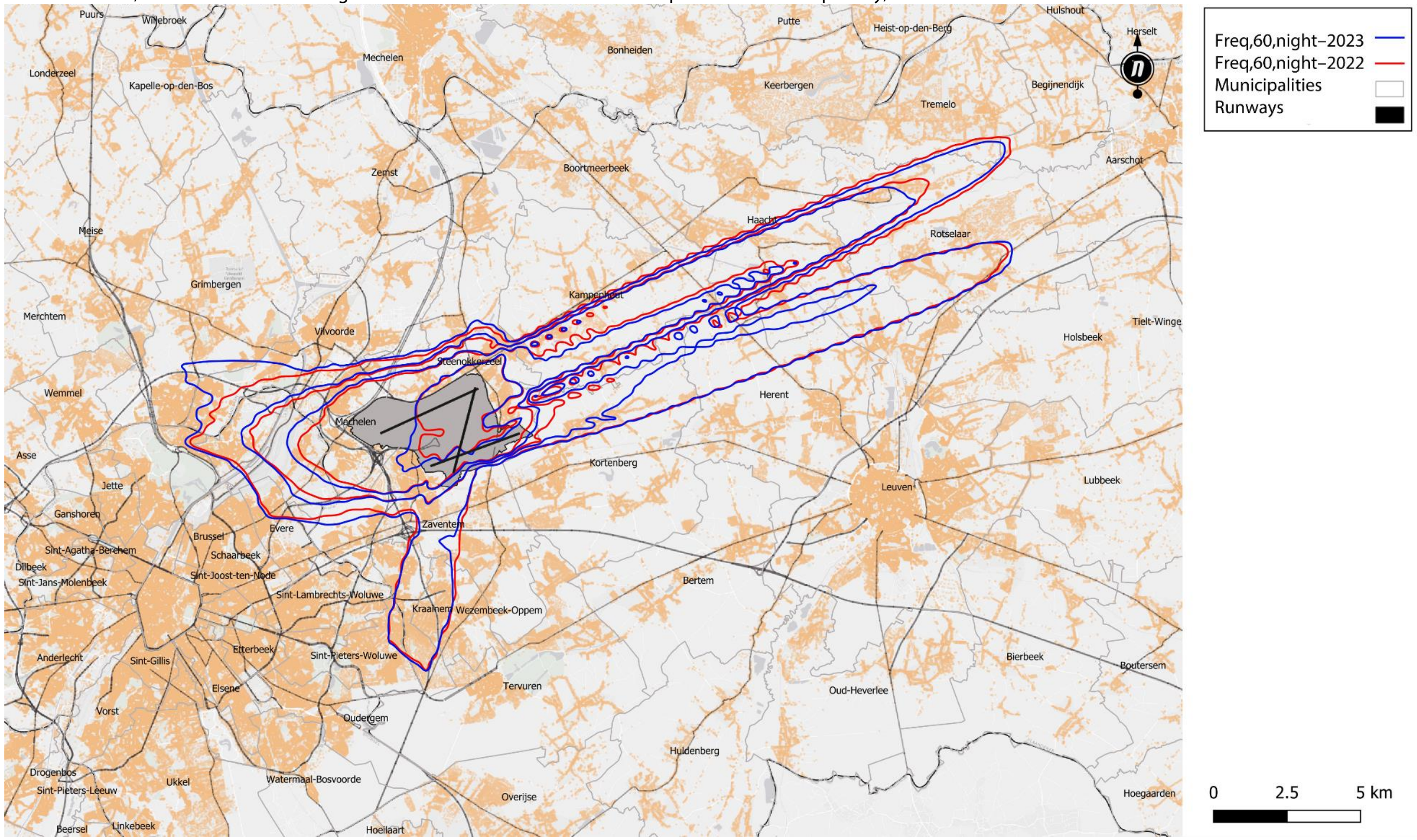
Evolution of Freq.60,day - background population map 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 60 dB or higher is observed 50x, 100x, 150x and 200x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 50x per day, etc.



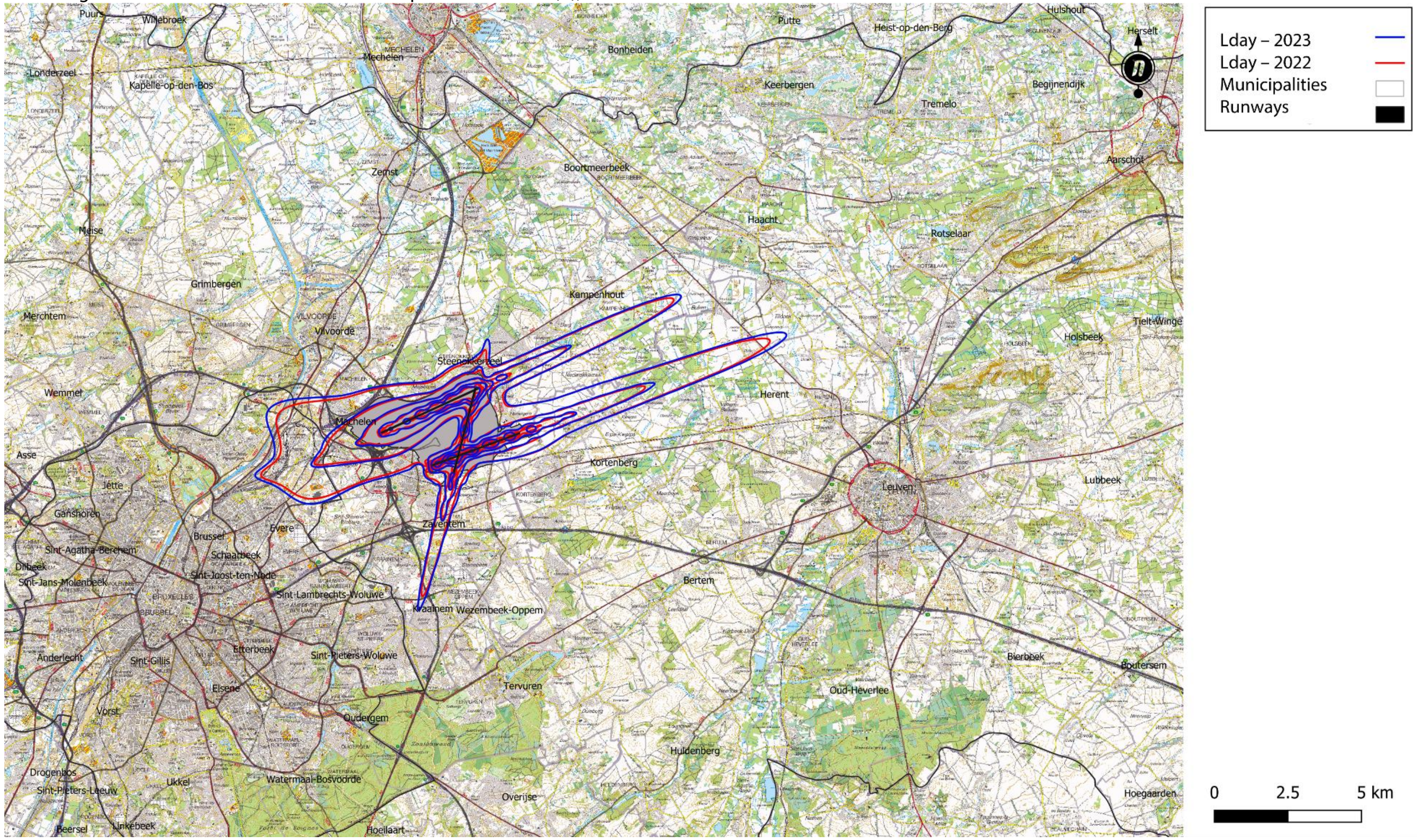
Evolution of Freq.60, night - background population map 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 60 dB or higher is observed 10x, 15x, 20x and 30x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 10x per day, etc.



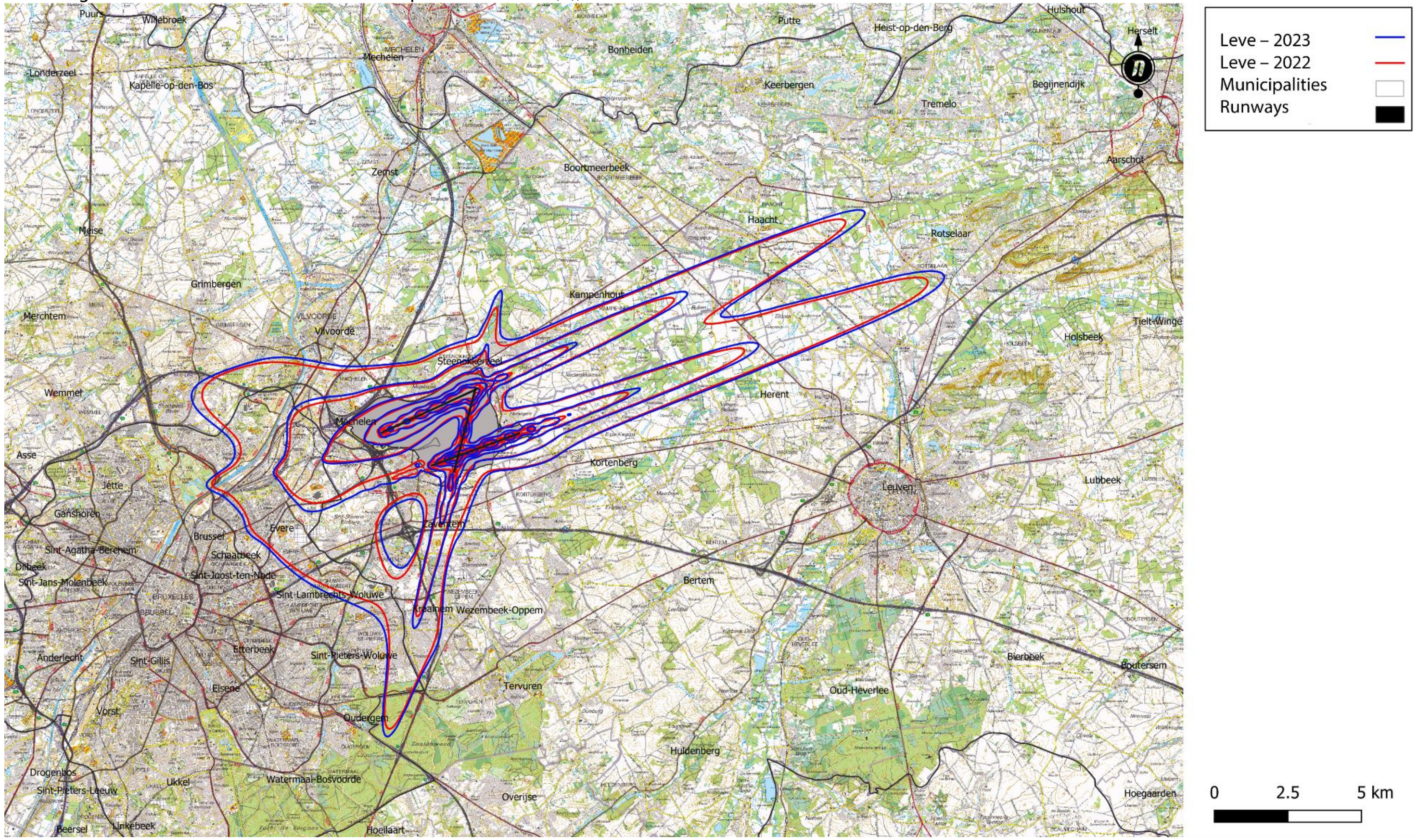
Evolution of L_{day} (07:00 to 19:00) sound contours – background NGI topographic 2023

The contours are shown here for 2022 and 2023 where, between 07:00 and 19:00, the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



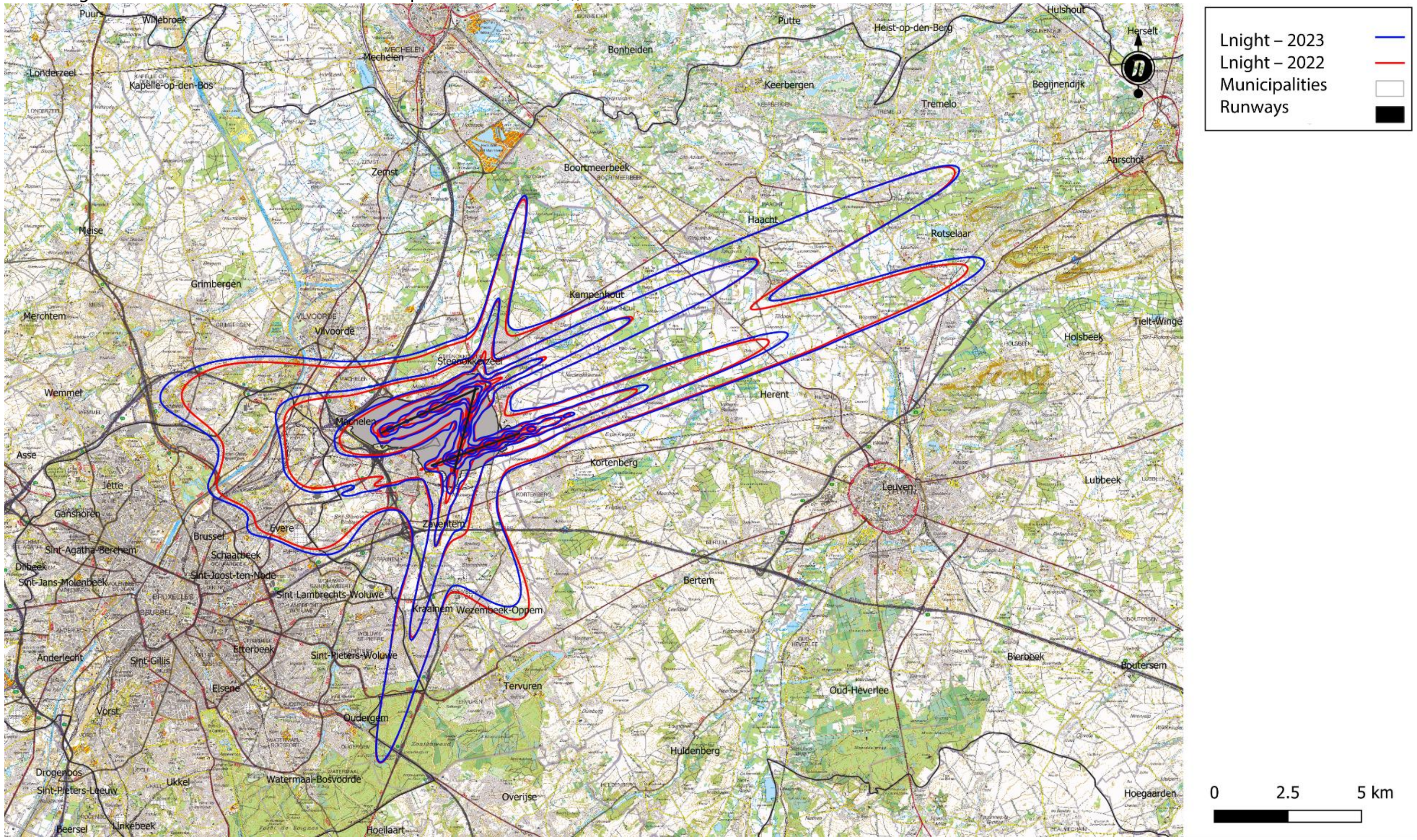
Evolution of $L_{evening}$ (19:00 to 23:00 hours) sound contours – background NGI topographic map 2023

The contours are shown here for 2022 and 2023 where, between 19:00 and 23:00, the noise impact by air traffic is, on average, 50, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 50 dB(A), etc.



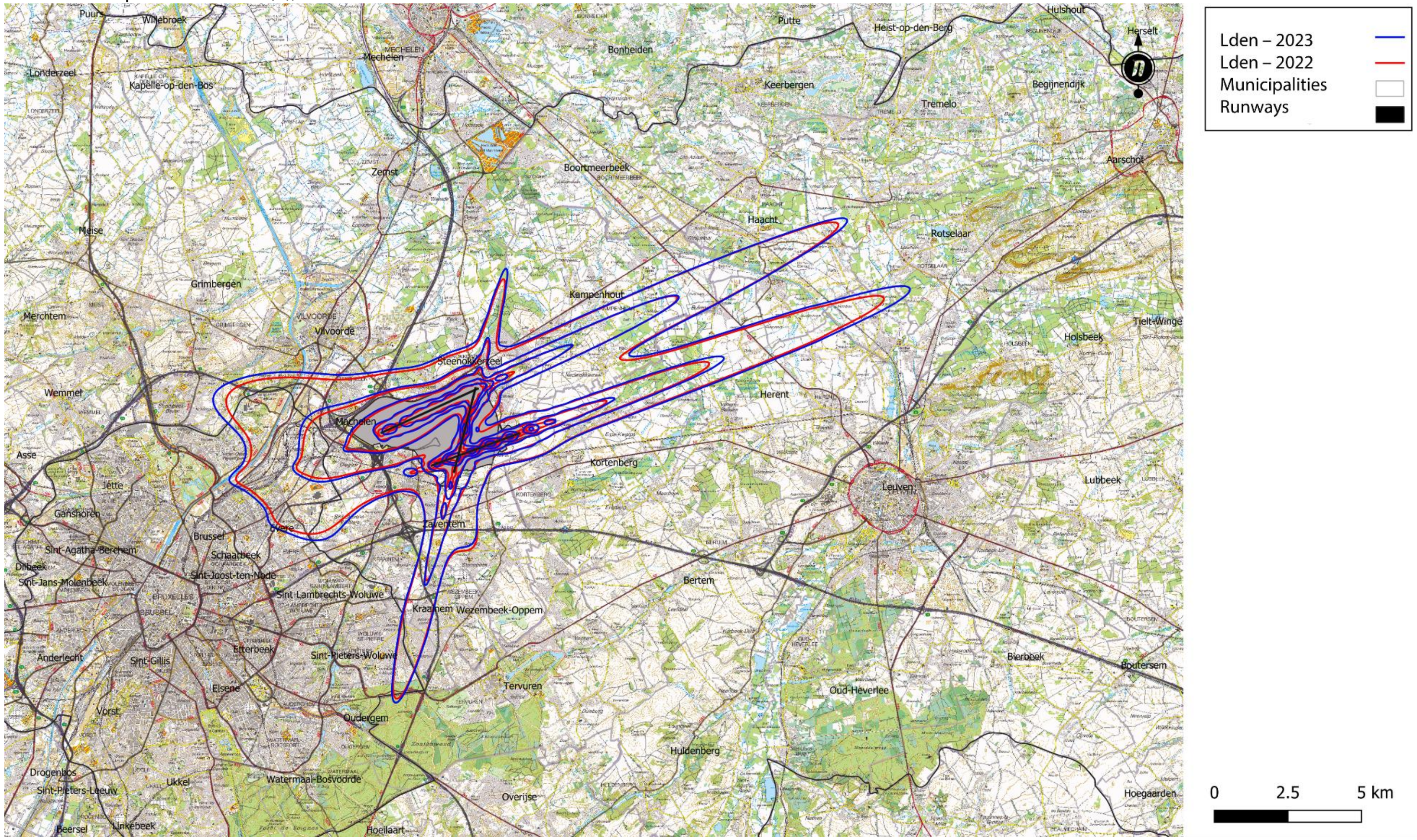
Evolution of L_{night} (23:00 to 7:00 hours) sound contours – background NGI topographic 2023

The contours are shown here for 2022 and 2023 where, between 23:00 and 07:00, the noise impact by air traffic is, on average, 45, 50, 55, 60, 65 and 70 dB(a). The values are ascending inwards: the outermost contour corresponds with 45 dB(A), etc.



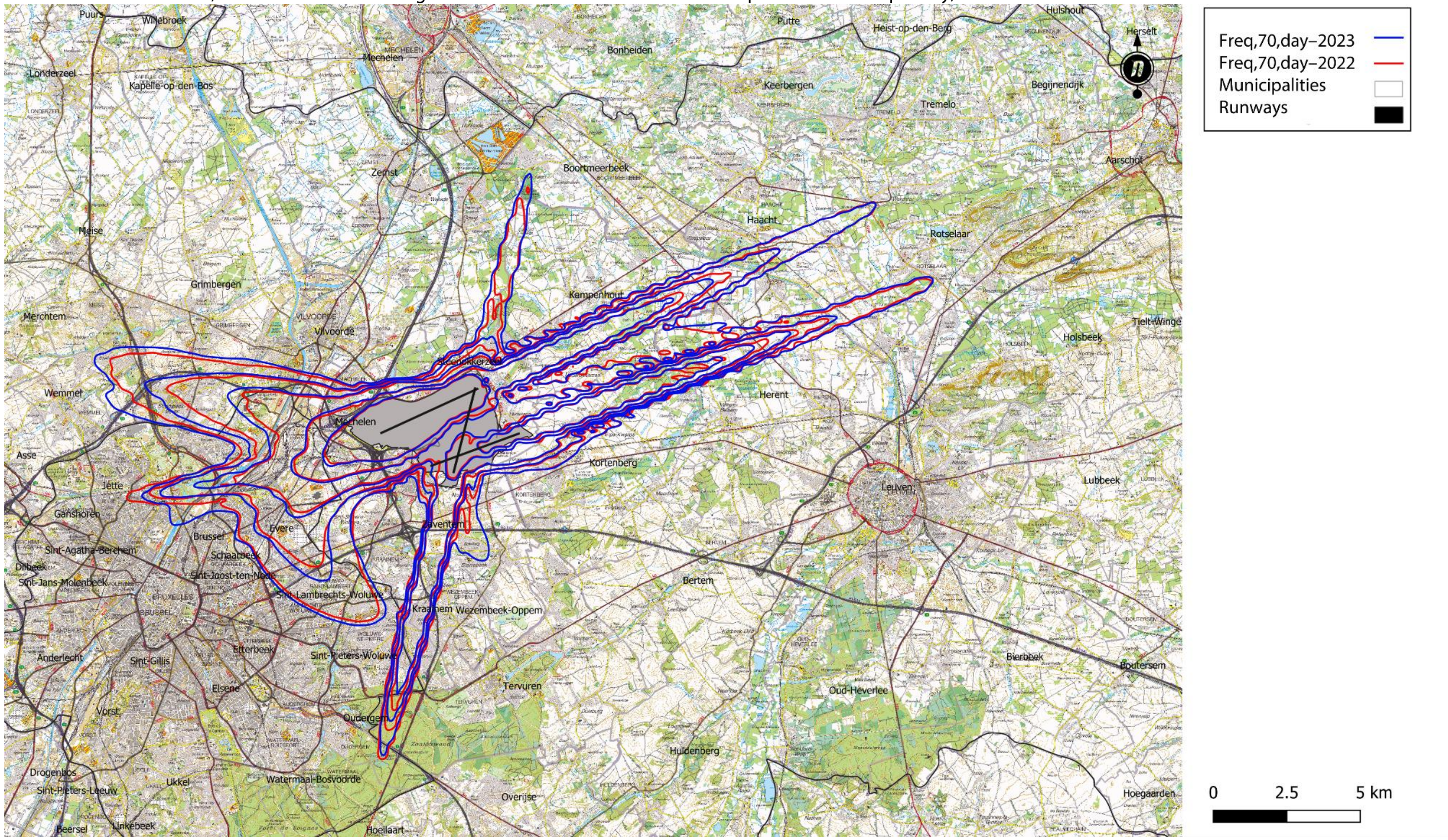
Evolution of L_{den} sound contours – background NGI topographic 2023

The contours are shown here for 2022 and 2023 where the noise impact by air traffic is, on average, 55, 60, 65, 70 and 75 dB(a). The values are ascending inwards: the outermost contour corresponds with 55 dB(A), etc.



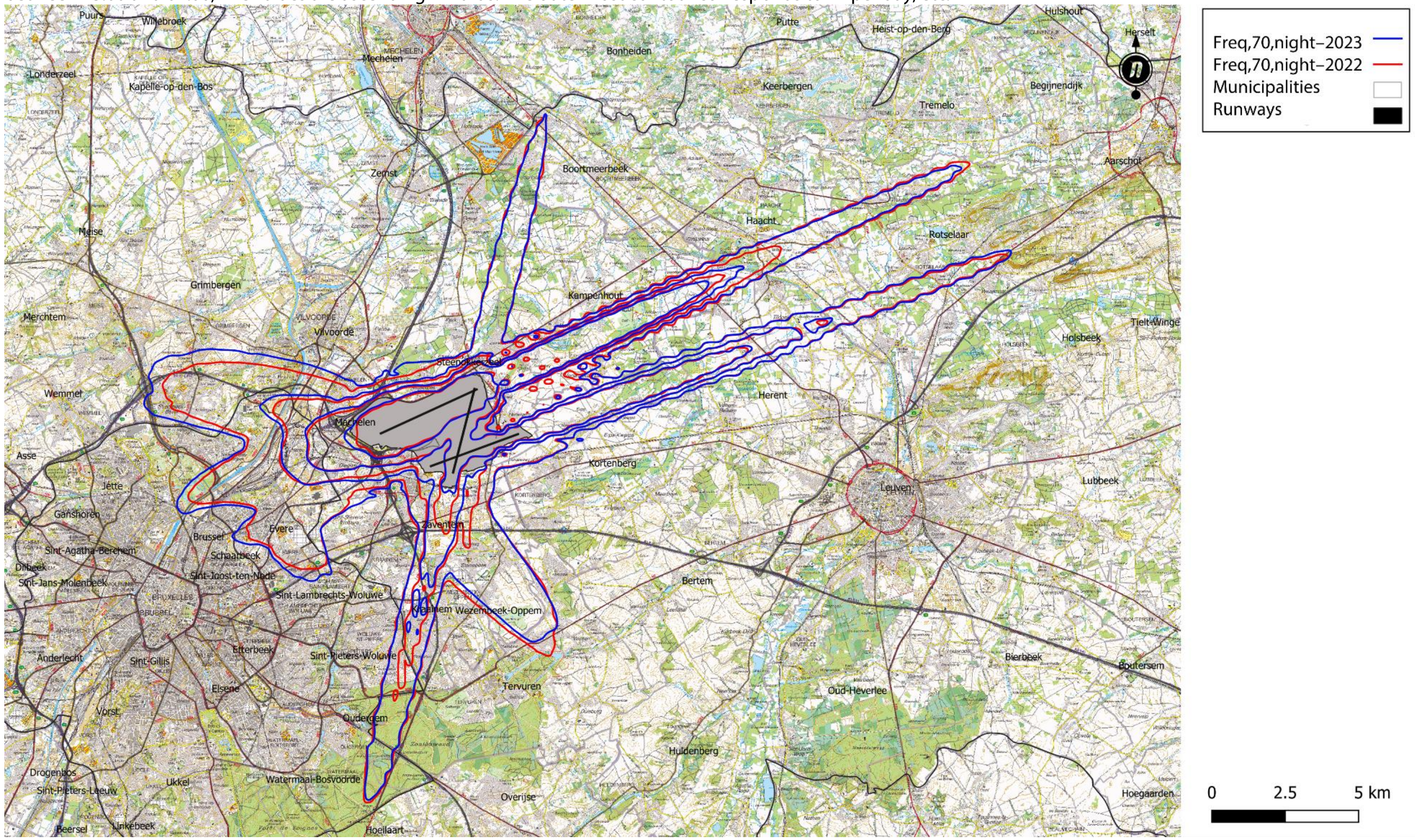
Evolution of Freq.70,day - background NGI topographical 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 70 dB or higher is observed 5x, 10x, 20x, 50x and 100x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 5x per day, etc.



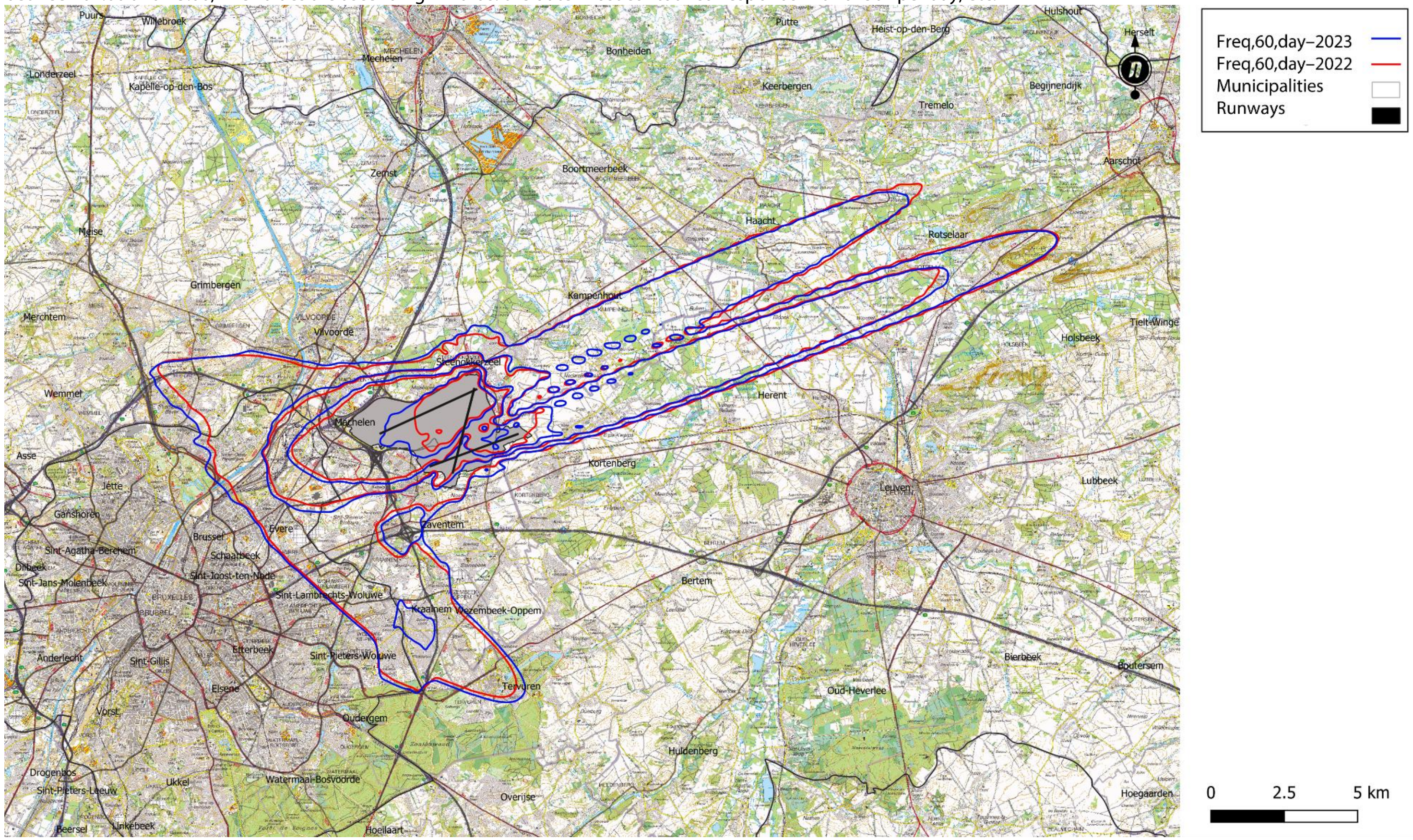
Evolution of Freq.70, night - background NGI topographical 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 70 dB or higher is observed 1x, 5x, 10x, 20x and 50x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: The outermost contour corresponds to 1x per day, etc.



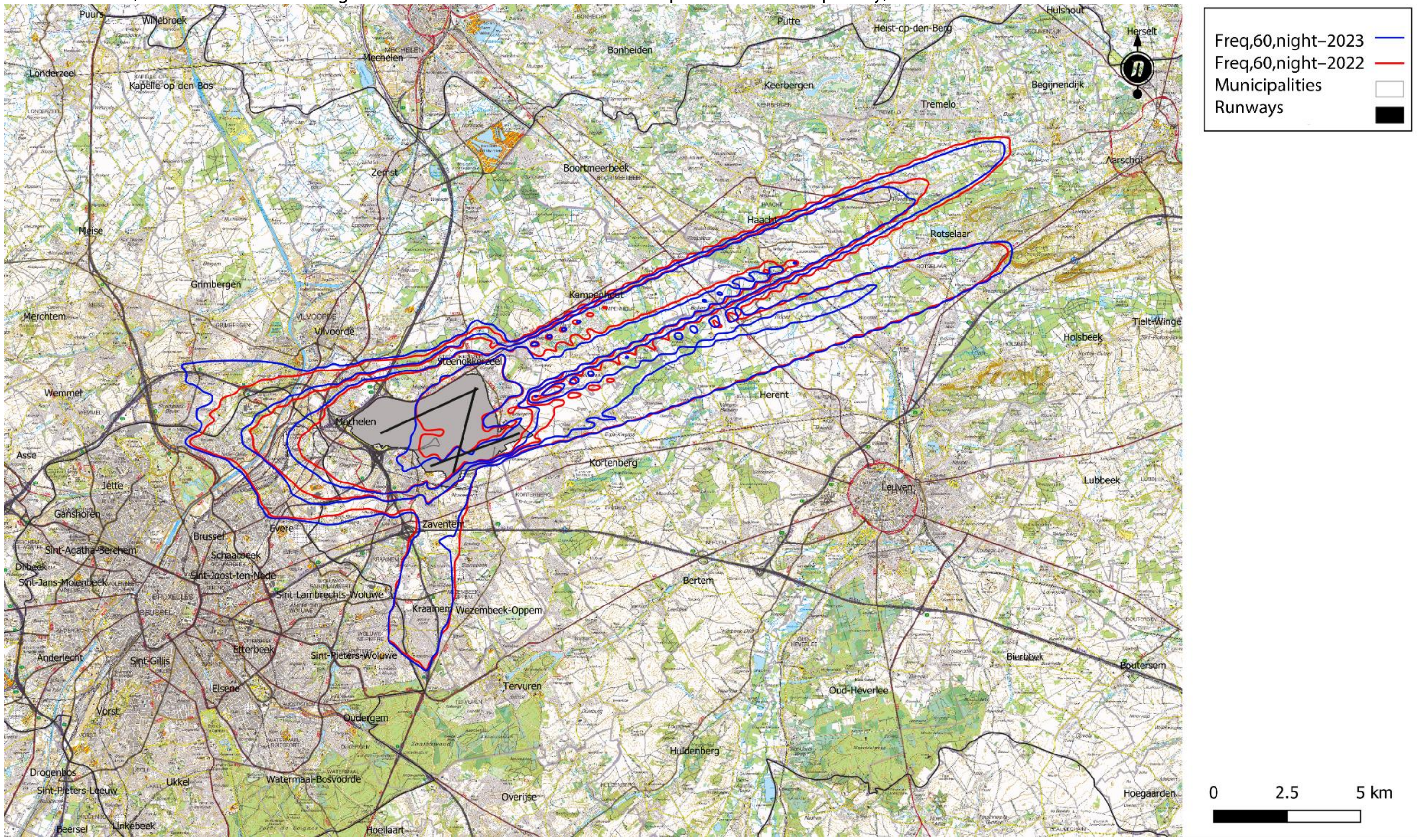
Evolution of Freq.60,day - background NGI topographical 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 60 dB or higher is observed 50x, 100x, 150x and 200x per day during an aircraft passage between 07:00 and 23:00, The values are ascending inwards: the outermost contour corresponds with of 50x per day, etc.



Evolution of Freq.60, night - background NGI topographical 2023

The contours are shown here for 2022 and 2023 where on average a noise level of 60 dB or higher is observed 10x, 15x, 20x and 30x per day during an aircraft passage between 23:00 and 07:00, The values are ascending inwards: the outermost contour corresponds with of 10x per day, etc.



Appendix E. Evolution of the surface area and the number of residents

E.1 Evolution of the surface area per contour zone: L_{day}, $L_{evening}$, L_{night}, Freq.70,day, Freq.70,night, Freq.60,day, Freq.60,night

Table 25: Evolution of the surface area inside the L_{day} contours (2000, 2006-2023).

Area (ha)	Lday - contour zones in dB(A) (d. 07h-19h)					
Year	55-60	60-65	65-70	70-75	>75	Total
2000*	5,919	2,113	827	383	242	**9,485**
2001						
2002						
2003						
2004						
2005						
2006*	3,787	1,379	545	213	150	**6,073**
2007*	3,978	1,431	575	227	153	**6,364**
2008*	4,072	1,492	596	232	161	**6,553**
2009*	3,461	1,300	523	206	133	**5,622**
2010*	3,334	1,261	514	196	126	**5,431**
2011*	3,330	1,241	509	199	127	**5,406**
2012*	2,978	1,121	466	189	117	**4,871**
2013*	2,779	1,106	455	176	121	**4,637**
2014*	2,924	1,120	474	187	116	**4,821**
2015*	3,143	1,180	489	230	93	**5,135**
2016*	2,886	1,087	545	123	82	**4,723**
2017*	2,990	1,109	471	216	90	**4,876**
2018*	3,037	1,150	486	227	87	**4,987**
2019*	2,963	1,105	554	138	91	**4,851**
2020*	1,521	602	247	176	0	**2,547**
2021**	1,936	649	258	115	65	**3,024**
2022**	2,647	881	330	143	82	**4,083**
2023**	2,889	959	363	165	80	**4,456**

* Calculated with INM 7.0b, ** Calculated with Echo

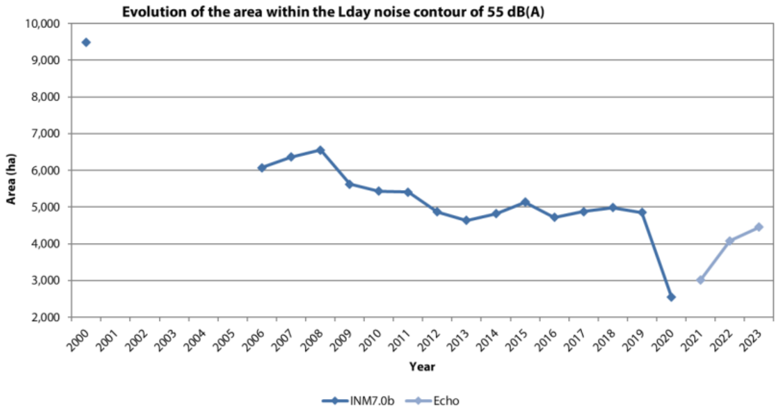


Figure 19: Evolution of the surface area inside the L_{day} contours (2000, 2006-2023).

Table 26: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2023).

Area (ha)	Levening - contour zones in dB(A) (ev. 19h-23h)						
Year	50-55	55-60	60-65	65-70	70-75	>75	Total
2000*	11,266	5,265	1,889	741	346	216	**19,723**
2001							
2002							
2003							
2004							
2005							
2006*	8,483	3,000	1,106	449	178	113	**13,329**
2007*	9,106	3,369	1,223	506	200	124	**14,528**
2008*	10,052	3,730	1,354	548	218	135	**16,037**
2009*	8,313	3,126	1,146	463	178	109	**13,336**
2010*	7,821	3,073	1,124	452	171	106	**12,747**
2011*	7,711	3,004	1,106	446	175	105	**12,547**
2012*	7,608	2,881	1,046	427	171	103	**12,237**
2013*	6,998	2,668	994	401	161	104	**11,222**
2014*	7,421	3,087	1,106	445	175	50	**12,283**
2015*	8,244	3,051	1,108	450	205	89	**13,147**
2016*	8,402	3,188	1,137	536	135	91	**13,488**
2017*	8,556	3,172	1,108	457	205	92	**13,590**
2018*	9,134	3,445	1,207	489	225	99	**14,599**
2019*	8,836	3,283	1,138	542	142	97	**14,038**
2020*	4,440	1,751	621	441	0	0	**7,252**
2021**	5,117	1,637	632	213	91	67	**7,757**
2022**	7,425	2,512	802	304	133	75	**11,251**
2023**	7,997	2,796	906	325	153	77	**12,254**

* Calculated with INM 7.0b, ** Calculated with Echo

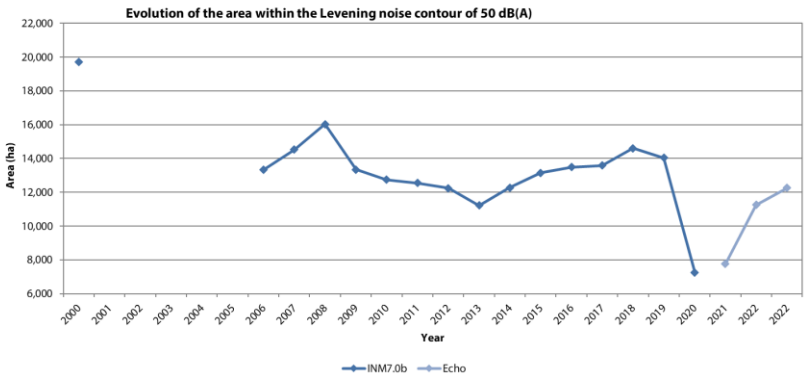


Figure 20: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2023).

Table 27: Evolution of the surface area inside the L_{night} contours (2000, 2006-2023)

Area (ha)	Lnight - contour zones in dB(A) (n. 23h-07h)						
Year	45-50	50-55	55-60	60-65	65-70	>70	Total
2000*	13,927	6,145	2,366	1,090	492	290	**24,310**
2001							
2002							
2003							
2004							
2005							
2006*	10,135	3,571	1,450	554	211	153	**16,075**
2007*	10,872	3,936	1,597	625	236	165	**17,430**
2008*	9,375	3,232	1,260	495	189	123	**14,673**
2009*	7,638	2,613	1,014	397	155	96	**11,913**
2010*	7,562	2,633	999	390	154	96	**11,835**
2011*	8,184	2,803	1,066	413	164	106	**12,736**
2012*	8,525	2,827	1,074	419	168	105	**13,118**
2013*	7,817	2,857	1,525	172	130	0	**12,501**
2014*	7,800	2,921	1,120	448	179	115	**12,583**
2015*	8,451	3,019	1,172	460	194	117	**13,413**
2016*	7,969	2,930	1,111	441	188	109	**12,748**
2017*	7,995	2,929	1,112	427	186	104	**12,754**
2018*	8,495	3,084	1,148	442	178	128	**13,476**
2019*	8,172	3,016	1,124	437	190	105	**13,044**
2020*	5,418	2,016	756	308	193	0	**8,691**
2021**	7,129	2,428	840	282	123	68	**10,870**
2022**	8,817	3,160	1,010	351	158	77	**13,572**
2023**	9,170	3,391	1,075	389	167	79	**14,271**

* Calculated with INM 7.0b, ** Calculated with Echo

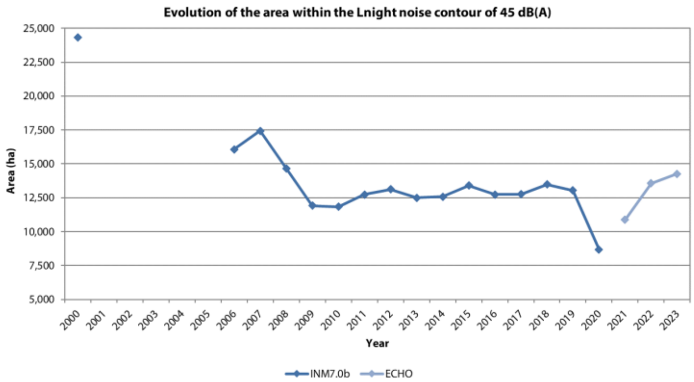


Figure 21 : Evolution of the surface area inside the L_{night} contours (2000, 2006-2023)

Table 28: Evolution of the surface area inside the L_{den} contours (2000, 2006-2023)

Area (ha)	Lden - contour zones in dB(A) (d. 07h-19h, ev. 19h-23h, n. 23h-07h)					
Year	55-60	60-65	65-70	70-75	>75	Total
2000*	10,664	4,063	1,626	745	497	**17,594**
2001						
2002						
2003						
2004						
2005						
2006*	6,963	2,448	957	373	251	**10,992**
2007*	7,632	2,640	1,036	416	271	**11,996**
2008*	7,118	2,483	953	379	246	**11,178**
2009*	5,771	2,077	797	316	203	**9,163**
2010*	5,576	2,052	782	308	199	**8,917**
2011*	5,767	2,076	800	316	208	**9,167**
2012*	5,623	1,998	771	308	205	**8,905**
2013*	5,152	1,981	767	299	216	**8,415**
2014*	5,429	2,066	800	325	136	**8,756**
2015*	5,695	2,159	825	332	224	**9,236**
2016*	5,554	2,085	797	326	213	**8,974**
2017*	5,579	2,088	795	325	213	**9,000**
2018*	5,957	2,186	832	336	228	**9,540**
2019*	5,646	2,115	802	331	220	**9,115**
2020*	3,445	1,270	494	208	133	**5,549**
2021**	4,290	1,378	543	176	132	**6,520**
2022**	5,681	1,935	622	247	163	**8,648**
2023**	6,087	2,063	703	257	172	**9,282**

* Calculated with INM 7.0b, ** Calculated with Echo

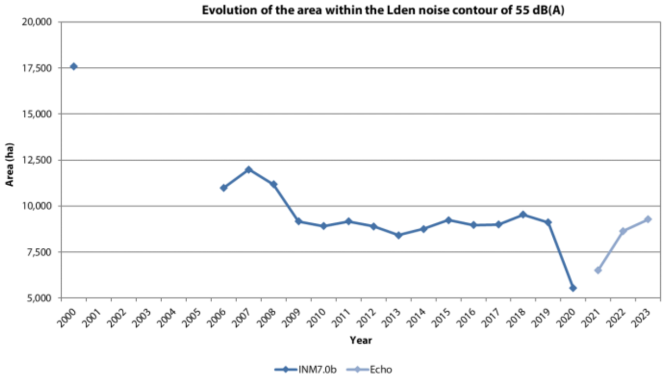


Figure 22: Evolution of the surface area inside the L_{den} contours (2000, 2006-2023)

Table 29: Evolution of the surface area inside the Freq.70,day contours (2006-2023)

Area (ha)	Freq.70,day - contour zones (day 07h-23h)					
Year	5-10	10-20	20-50	50-100	>100	Total
2006						
2007						
2008						
2009						
2010*	5,171	3,164	4,119	2,097	1,877	**16,428**
2011*	4,933	2,989	4,216	1,934	1,854	**15,926**
2012*	5,155	3,662	3,797	1,578	1,684	**15,877**
2013*	4,660	3,915	3,154	1,879	1,503	**15,557**
2014*	4,809	3,745	3,465	1,631	1,722	**15,372**
2015*	6,650	4,431	3,442	1,903	1,887	**18,314**
2016*	3,331	3,407	3,372	1,715	1,666	**13,491**
2017*	3,556	3,415	3,375	1,625	1,750	**13,722**
2018*	3,851	3,553	3,286	1,811	1,773	**14,276**
2019*	3,489	3,432	3,249	1,607	1,844	**13,621**
2020*	4,334	2,988	2,600	958	156	**11,036**
2021**	3,408	2,402	2,386	1,333	469	**9,998**
2022**	3,845	2,470	2,579	1,430	1,242	**11,566**
2023**	4,414	2,680	2,646	1,356	1,316	**12,412**

* Calculated with INM 7.0b, ** Calculated with Echo

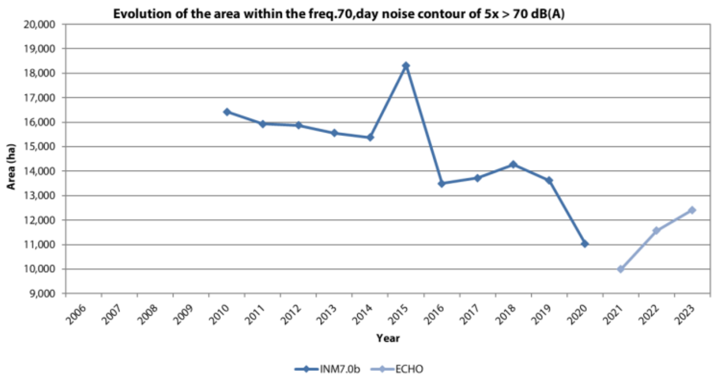


Figure 23: Evolution of the surface area inside the Freq.70,day contours (2006-2023).

Table 30: Evolution of the surface area inside the Freq.70,night contours (2006-2023).

Area (ha)	Freq.70,night - contour zones (night 23h-07h)					
Year	1-5	5-10	10-20	20-50	>50	Total
2006						
2007						
2008						
2009						
2010*	9,535	2,679	1,948	748	0	**14,910**
2011*	9,557	2,662	2,095	801	0	**15,115**
2012*	9,226	2,846	2,005	861	0	**14,938**
2013*	9,083	2,821	2,223	723	0	**14,944**
2014*	8,169	2,586	2,030	1,001	27	**13,813**
2015*	7,949	2,928	1,876	1,133	0	**13,885**
2016*	8,104	2,439	2,149	998	0	**13,690**
2017*	7,813	2,512	2,142	959	0	**13,427**
2018*	8,207	2,508	2,362	957	0	**14,034**
2019*	7,834	2,345	2,299	1,012	0	**13,489**
2020*	7,397	1,990	1,385	204	0	**10,976**
2021**	6,797	2,475	1,627	188	0	**11,087**
2022**	7,015	2,098	2,217	686	0	**12,016**
2023**	7,905	1,836	2,088	741	0	**12,570**

* Calculated with INM 7.0b, ** Calculated with Echo

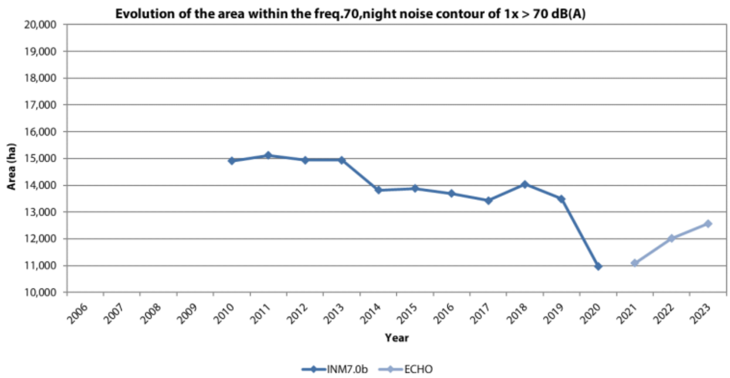


Figure 24: Evolution of the surface area inside the Freq.70,night contours (2006-2023).

Table 31: Evolution of the surface area within the Freq. 60,day contours (2006-2023)

Area (ha)	Freq.60,day - contour zones (day 07h-23h)				
Year	50-100	100-150	150-200	>200	Total
2006					
2007					
2008					
2009					
2010*	9,288	3,313	1,681	2,409	**16,692**
2011*	9,112	3,405	1,476	2,579	**16,572**
2012*	9,007	2,691	1,754	1,885	**15,337**
2013*	8,005	1,958	2,053	972	**13,632**
2014*	9,329	2,112	1,865	2,050	**15,357**
2015*	9,211	3,511	1,633	1,848	**16,203**
2016*	9,256	2,670	1,918	1,916	**15,760**
2017*	8,315	3,795	1,795	2,223	**16,129**
2018*	9,359	3,235	1,876	2,159	**16,629**
2019*	8,816	3,495	1,916	2,239	**16,467**
2020*	3,072	635	117	0	**3,824**
2021**	7,255	1,514	190	0	**8,959**
2022**	8,875	3,449	1,540	398	**14,262**
2023**	8,767	3,525	1,598	630	**14,520**

* Calculated with INM 7.0b, ** Calculated with Echo

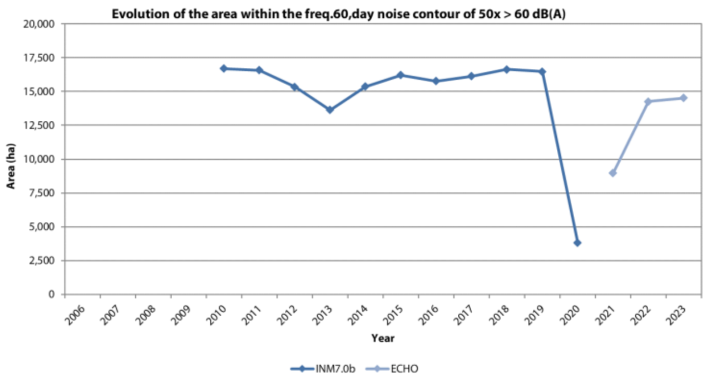


Figure 25: Evolution of the surface area inside the Freq.60,day contours (2006-2023)

Table 32: Evolution of the surface area inside the Freq.60,night contours (2006-2023).

Area (ha)	Freq.60,night - contour zones (night 23h-07h)				
Year	**10-15**	**15-20**	**20-30**	**>30**	**Total**
2006					
2007					
2008					
2009					
2010*	5,577	1,797	1,930	725	**10,030**
2011*	6,436	1,972	1,930	905	**11,242**
2012*	7,522	1,778	1,932	1,004	**12,236**
2013*	5,083	2,367	1,888	1,031	**10,369**
2014*	4,807	2,542	1,845	1,670	**10,864**
2015*	5,819	1,786	3,064	1,295	**11,964**
2016*	5,142	3,635	2,053	1,222	**12,052**
2017*	5,612	3,310	2,349	1,183	**12,454**
2018*	5,580	3,434	2,746	1,301	**13,061**
2019*	5,802	3,774	2,480	1,296	**13,352**
2020*	4,111	882	567	267	**5,827**
2021**	2,845	3,459	869	318	**7,491**
2022**	6,584	2,884	2,597	732	**12,796**
2023**	6,081	3,557	2,478	864	**12,980**

* Calculated with INM 7.0b, ** Calculated with Echo

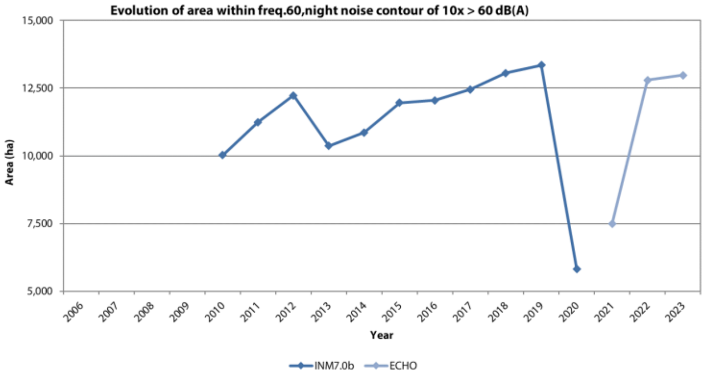


Figure 26: Evolution of the surface area inside the Freq.60,night contours (2006-2023).

E.2 Evolution of the number of residents per contour zone: L_{day}, $L_{evening}$, L_{night}, Freq.70,day, Freq.70,night, Freq.60,day, Freq.60,night

Table 33: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2023).

Number of inhabitants		Lday - contour zones in dB(A) (d. 07h-19h)					
Year	Population data	55-60	60-65	65-70	70-75	>75	Total
2000*	01jan00	106,519	13,715	5,660	1,134	20	**127,048**
2001							
2002							
2003							
2004							
2005							
2006*	01jan03	39,478	9,241	2,714	74	3	**51,511**
2007*	01jan06	47,260	9,966	3,168	102	3	**60,499**
2008*	01jan07	44,013	10,239	3,217	101	4	**57,575**
2009*	01jan07	32,144	8,724	2,815	58	3	**43,745**
2010*	01jan08	30,673	8,216	2,393	35	7	**41,323**
2011*	01jan08	28,828	8,486	2,460	46	7	**39,828**
2012*	01jan10	23,963	8,277	2,110	22	2	**34,375**
2013*	01jan10	22,737	7,482	1,318	7	2	**31,546**
2014*	01jan11	22,998	8,649	2,249	22	2	**33,920**
2015*	01jan11	23,662	8,945	2,350	99	0	**35,056**
2016*	01jan11	20,554	8,380	2,094	28	0	**31,057**
2017[1]*	01jan16	21,950	9,003	3,108	0	0	**34,062**
2018[1]*	01jan17	23,289	8,993	2,798	3	0	**35,083**
2019[1]*	01jan19	21,875	9,342	3,270	3	0	**34,489**
2020[1]*	01jan20	14,195	4,191	122	0	0	**18,507**
2021[1]**	01jan22	17,686	3,670	45	0	0	**21,401**
2022[1]**	01jan23	24,080	5,570	148	0	0	**29,797**
2023[1]**	01jan24	26,201	6,830	215	6	0	**33,252**

[1] evaluation according to address

* Calculated with INM 7.0b, ** Calculated with Echo

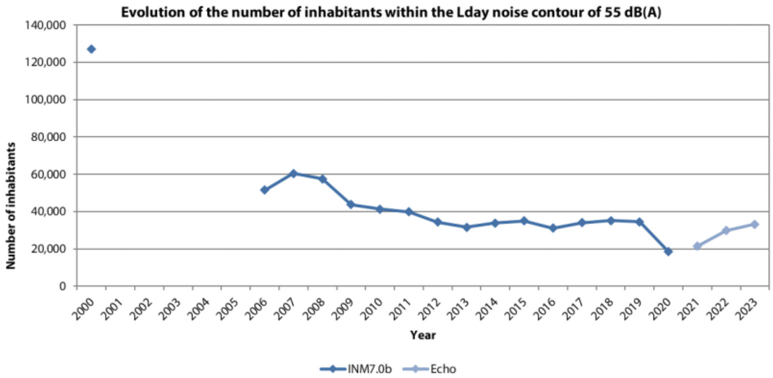


Figure 27: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2023).

Table 34: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2023).

Number of inhabitants		Levening - contour zones in dB(A) (ev. 19h-23h)						
Year	Population data	50-55	55-60	60-65	65-70	70-75	>75	Total
2000*	01jan00	209,265	86,637	13,246	4,990	602	9	**314,750**
2001								
2002								
2003								
2004								
2005								
2006*	01jan03	185,699	24,488	7,138	2,030	28	3	**219,386**
2007*	01jan06	214,616	35,445	8,217	2,583	38	2	**260,901**
2008*	01jan07	249,024	43,589	9,514	2,969	52	3	**305,152**
2009*	01jan07	198,351	29,774	7,448	2,186	32	2	**237,793**
2010*	01jan08	198,934	37,729	7,127	2,057	25	5	**245,878**
2011*	01jan08	198,540	41,951	7,110	2,077	32	5	**249,716**
2012*	01jan10	213,799	46,427	7,309	2,072	27	1	**269,635**
2013*	01jan10	148,866	25,888	6,432	1,054	7	1	**182,247**
2014*	01jan11	187,698	23,913	9,632	2,052	29	0	**223,324**
2015*	01jan11	168,549	22,593	8,790	2,424	88	0	**202,444**
2016*	01jan11	204,319	29,643	9,140	2,796	52	0	**245,949**
7[1]*	01jan16	206,220	26,880	9,055	3,173	5	0	**245,334**
3[1]*	01jan17	226,101	34,113	10,033	3,538	57	0	**273,841**
)[1]*	01jan19	213,243	28,965	9,814	3,531	5	0	**255,558**
)[1]*	01jan20	54,642	16,266	5,093	261	0	0	**76,262**
2021**	01jan22	56,816	16,283	3,676	37	0	0	**76,812**
2[1]**	01jan23	130,068	24,876	4,859	145	0	0	**159,949**
3[1]**	01jan24	157,712	28,274	5,839	184	0	0	**192,009**

aluation according to address
* Calculated with INM 7.0b, ** Calculated with Echo

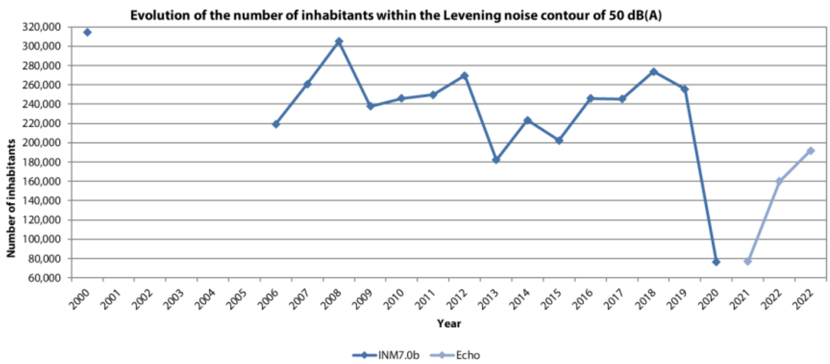


Figure 28: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2023).

Table 35: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2023).

Number of inhabitants		Lnight - contour zones in dB(A) (n. 23h-07h)						
Year	**Population data**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
2000*	01jan00	139,440	57,165	18,384	8,394	1,325	72	**224,779**
2001								
2002								
2003								
2004								
2005								
2006*	01jan03	167,033	28,985	8,836	1,167	174	8	**206,202**
2007*	01jan06	199,302	32,473	11,607	2,185	181	26	**245,772**
2008*	01jan07	151,736	26,450	7,985	1,017	133	3	**187,323**
2009*	01jan07	122,871	19,528	6,303	622	92	2	**149,418**
2010*	01jan08	129,820	19,986	6,077	571	89	5	**156,548**
2011*	01jan08	129,969	22,490	6,414	622	94	5	**159,594**
2012*	01jan10	124,012	24,015	6,963	585	78	2	**155,655**
2013*	01jan10	91,140	28,407	7,152	51	3	0	**126,754**
2014*	01jan11	163,270	24,221	7,889	869	110	3	**196,362**
2015*	01jan11	125,407	26,956	8,239	762	159	2	**161,524**
2016*	01jan11	128,939	23,476	7,954	715	131	0	**161,216**
[1]*	01jan16	106,964	27,127	7,484	469	66	0	**142,110**
[1]*	01jan17	122,588	29,355	7,601	501	64	0	**160,109**
[1]*	01jan19	127,079	27,978	8,065	529	66	0	**163,718**
[1]*	01jan20	60,530	18,372	2,217	390	57	0	**81,566**
[1]**	01jan22	77,128	25,889	1,479	412	0	0	**104,908**
[1]**	01jan23	113,796	34,494	3,200	386	25	0	**151,901**
[1]**	01jan24	139,419	35,894	5,021	459	0	0	**180,793**

luation according to address
* Calculated with INM 7.0b, ** Calculated with Echo

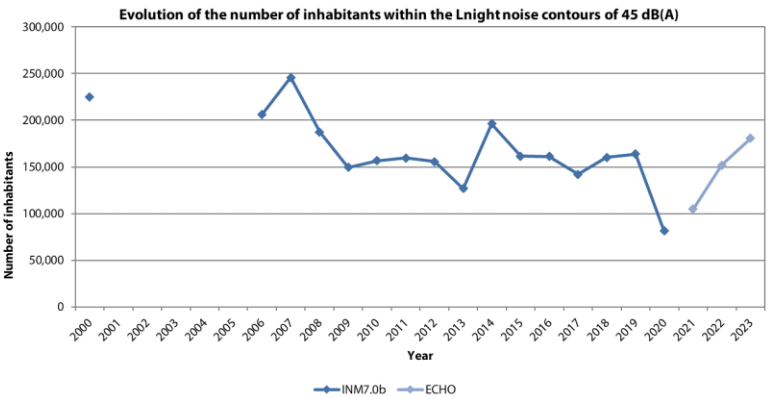


Figure 29: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2023).

Table 36: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2023).

Number of inhabitants		Lden - contour zones in dB(A) (d. 07h-19h, ev. 19h-23h, n. 23h-07h)				
Year	**Population data**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
2000*	01jan00	166,767	36,797	14,091	3,952	264	**221,871**
2001							
2002							
2003							
2004							
2005							
2006*	01jan03	107,514	18,697	5,365	560	63	**132,198**
2007*	01jan06	147,349	19,498	6,565	946	82	**174,442**
2008*	01jan07	125,927	19,319	5,938	717	24	**151,925**
2009*	01jan07	87,766	15,105	4,921	404	9	**108,205**
2010*	01jan08	87,083	15,619	4,506	337	11	**107,556**
2011*	01jan08	90,988	15,941	4,664	362	13	**111,969**
2012*	01jan10	86,519	16,220	4,617	319	6	**107,680**
2013*	01jan10	56,516	16,517	3,994	197	5	**77,229**
2014*	01jan10	84,747	16,525	5,076	368	9	**106,725**
2015*	01jan11	72,628	17,721	5,244	428	55	**96,075**
2016*	01jan11	77,229	16,694	5,284	450	23	**99,680**
	01jan16	70,139	17,645	5,264	257	0	**93,305**
	01jan17	77,812	19,476	5,413	413	0	**103,114**
	01jan19	72,561	19,231	5,448	383	0	**97,624**
	01jan20	34,236	9,801	1,361	110	0	**45,508**
	01jan22	40,787	9,371	931	30	0	**51,119**
	01jan23	58,491	18,472	1,245	117	0	**78,326**
	01jan24	65,425	21,920	1,727	143	0	**89,215**

on according to address
* Calculated with INM 7.0b, ** Calculated with Echo

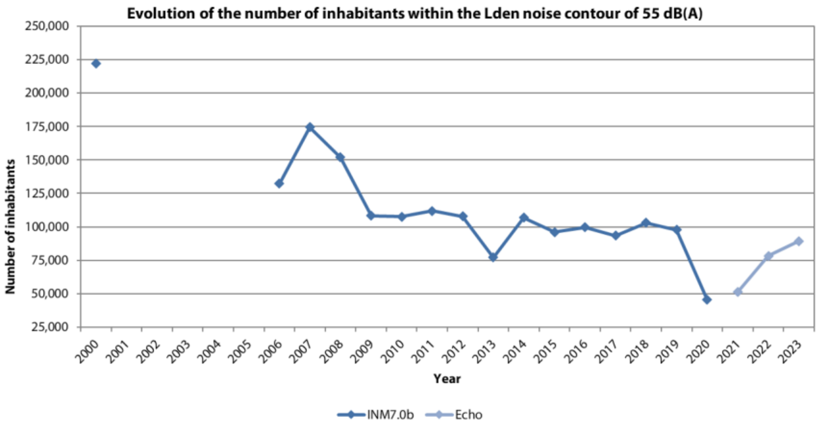


Figure 30: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2023).

Table 37: Evolution of the number of residents inside the Freq.70,day contours (2006-2023).

Number of inhabitants		Freq.70,day - contour zones (day 07h-23h)					
Year	Population data	5-10	10-20	20-50	50-100	>100	Total
2006							
2007							
2008							
2009							
2010*	01jan08	133,468	77,606	82,703	15,348	9,874	**318,999**
2011*	01jan08	133,014	80,395	78,893	11,783	10,018	**314,103**
2012*	01jan10	128,971	95,435	58,279	10,112	9,339	**302,136**
2013*	01jan10	94,888	84,745	33,045	14,225	6,554	**239,376**
2014*	01jan11	226,319	139,618	47,774	10,655	10,379	**434,746**
2015*	01jan11	163,105	104,564	43,843	11,547	11,204	**334,264**
2016*	01jan11	95,084	86,813	40,288	10,509	10,541	**243,235**
2017[1]*	01jan16	111,019	92,035	40,125	10,365	12,694	**266,238**
2018[1]*	01jan17	122,115	94,126	42,456	22,569	1,024	**282,289**
2019[1]*	01jan19	108,714	110,676	42,207	21,742	1,088	**284,427**
2020[1]*	01jan20	102,799	31,056	17,647	8,250	0	**159,753**
2021[1]**	01jan22	90,050	30,752	20,878	9,446	325	**151,451**
2022[1]**	01jan23	116,993	53,182	22,683	12,324	5,637	**210,819**
2023[1]**	01jan24	123,911	75,264	23,378	13,121	6,343	**242,017**

[1] evaluation according to address

* Calculated with INM 7.0b, ** Calculated with Echo

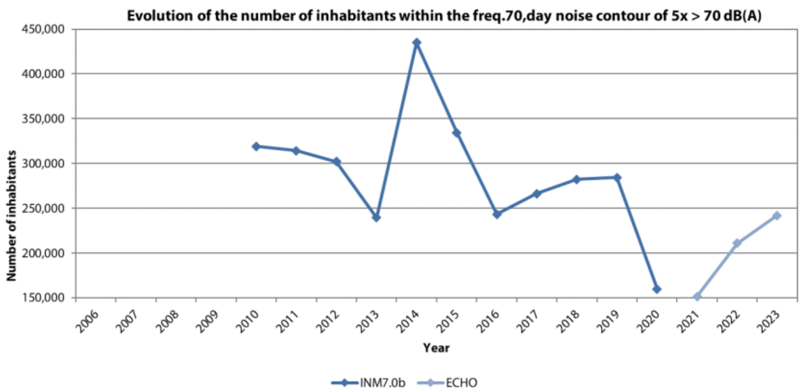


Figure 31: Evolution of the number of residents inside the Freq.70,day contours (2006-2023).

Table 38: Evolution of the number of residents inside the Freq.70,night contours (2006-2023).

Number of inhabitants		Freq.70,night - contour zones (night 23h-07h)					
Year	Population data	1-5	5-10	10-20	20-50	>50	Total
2006							
2007							
2008							
2009							
2010*	01jan08	239,529	23,583	12,968	2,597	0	**278,677**
2011*	01jan08	232,090	22,587	13,071	3,261	0	**271,010**
2012*	01jan10	195,400	21,774	12,858	4,078	0	**234,110**
2013*	01jan10	158,701	22,985	15,876	1,774	0	**199,913**
2014*	01jan11	240,106	19,794	13,018	6,333	0	**279,251**
2015*	01jan11	167,925	22,934	13,681	6,400	0	**210,939**
2016*	01jan11	183,776	18,616	14,079	6,151	0	**222,622**
17[1]*	01jan16	155,257	19,411	14,408	5,854	0	**194,930**
18[1]*	01jan17	172,835	21,478	14,948	6,020	0	**215,281**
19[1]*	01jan19	184,024	20,072	15,028	6,574	0	**225,698**
20[1]*	01jan20	89,653	17,902	6,243	496	0	**114,295**
21[1]**	01jan22	80,278	18,228	10,346	0	0	**108,852**
22[1]**	01jan23	117,025	21,970	14,417	1,288	0	**154,700**
23[1]**	01jan24	155,985	17,916	15,518	1,641	0	**191,060**

valuation according to address

* Calculated with INM 7.0b, ** Calculated with Echo

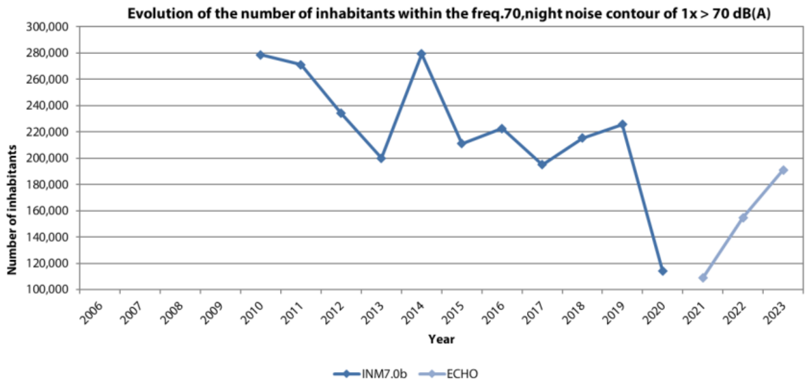


Figure 32: Evolution of the number of residents inside the Freq.70,night contours (2006-2023).

Table 39: Evolution of the number of residents inside the Freq.60,day contours (2006-2023).

Number of inhabitants		Freq.60,day - contour zones (day 07h-23h)				
Year	Population data	50-100	100-150	150-200	>200	Total
2006						
2007						
2008						
2009						
2010*	01jan08	154,110	49,587	14,723	15,834	**234,253**
2011*	01jan08	152,727	50,646	8,604	18,816	**230,793**
2012*	01jan10	158,634	35,632	10,547	15,498	**220,312**
2013*	01jan10	123,956	12,877	18,257	3,603	**174,921**
2014*	01jan11	273,603	22,036	10,282	17,121	**323,042**
2015*	01jan11	191,263	23,810	12,105	16,596	**243,774**
2016*	01jan11	179,841	31,127	10,476	17,495	**238,939**
2017[1]*	01jan16	174,069	62,701	9,661	22,736	**269,167**
2018[1]*	01jan17	221,416	18,985	11,353	21,484	**273,238**
2019[1]*	01jan19	200,841	55,497	10,932	23,645	**290,915**
2020[1]*	01jan20	32,599	4,191	0	0	**36,790**
2021[1]**	01jan22	61,144	16,500	0	0	**77,644**
2022[1]**	01jan23	162,012	20,522	20,401	7	**202,942**
2023[1]**	01jan24	178,057	26,118	24,069	0	**228,244**

[1] evaluation according to address

* Calculated with INM 7.0b, ** Calculated with Echo

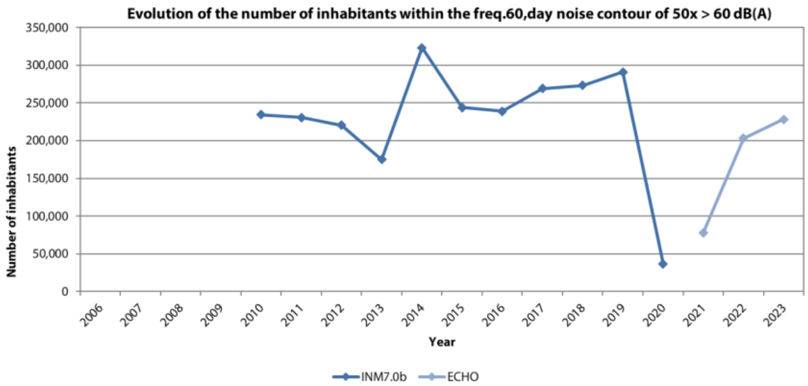


Figure 33: Evolution of the number of residents inside the Freq.60,day contours (2006-2023).

Table 40: Evolution of the number of residents inside the Freq.60,night contours (2006-2023).

Number of inhabitants		Freq.60,night - contour zones (night 23h-07h)				
Year	Population data	10-15	15-20	20-30	>30	Total
2006						
2007						
2008						
2009						
2010*	01jan08	62,090	9,411	21,231	3,262	**95,994**
2011*	01jan08	65,246	9,522	20,695	5,450	**100,913**
2012*	01jan10	80,911	8,723	20,642	7,009	**117,284**
2013*	01jan10	52,151	14,679	20,269	6,340	**93,438**
2014*	01jan11	79,725	27,741	18,637	12,317	**138,420**
2015*	01jan11	84,429	12,453	24,502	10,351	**131,736**
2016*	01jan11	81,235	20,356	21,869	8,779	**132,238**
2017[1]*	01jan16	93,532	15,687	23,488	9,538	**142,245**
2018[1]*	01jan17	98,609	16,849	24,728	10,016	**150,202**
2019[1]*	01jan19	110,835	17,770	24,096	10,817	**163,518**
2020[1]*	01jan20	30,334	10,565	4,365	539	**45,803**
2021[1]**	01jan22	26,888	28,001	10,397	740	**66,026**
2022[1]**	01jan23	73,064	19,541	26,822	3,866	**123,293**
2023[1]**	01jan24	83,990	19,750	28,279	6,836	**138,855**

[1] evaluation according to address

* Calculated with INM 7.0b, ** Calculated with Echo

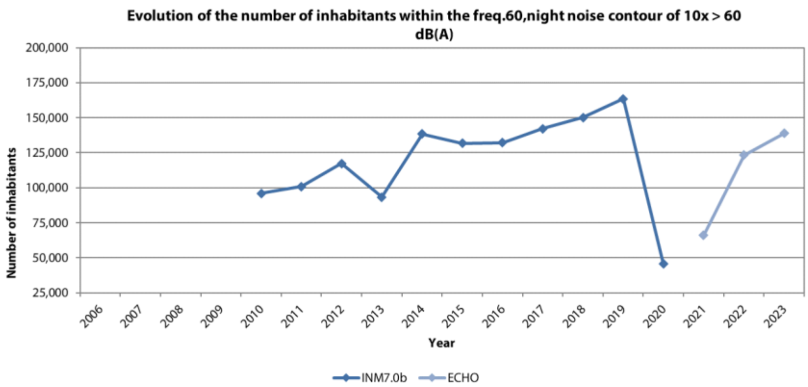


Figure 34: Evolution of the number of residents inside the Freq.60,night contours (2006-2023).

Appendix F. Impact change to calculation method

The following table shows the impact on the calculated noise load for the main changes in the calculation method.

Table 41: Description of the impact per change in the calculation method of the contours.

Change	Impact on the noise levels
Changes calculation model: INM → Echo	The most significant change as a consequence of applying Doc. 29 calculation method, is the advice for the use of a more recent method to determine atmospheric absorption. This leads to a rise in the noise levels. The impact close to the airport is small, farther away the differences can be 1 to 2 dB.
Updating source data	The correction of the noise levels for approaches by Airbus aircraft lead to higher noise levels for approaches. The noise impact for Brussels Airport thus increases to the order of 1 dB (larger contours). The addition of data of a number of aircraft has a marginal effect.
Correction factor compared to the proxy aircraft type	The application of the factor 'corrects' for the differences in noise levels of the proxy aircraft type in the calculation and the actual aircraft type. The application of the correction factor leads to around 1 dB lower noise level for departures and 0.5 dB for arrivals and thus to smaller contours.
Modelling based on actual flight paths	A calculation based on the actual flight paths is locally more accurate and can have an effect on the location of the contours. The impact overall is, however, marginal.
Modelling departures based on NADP1 procedure	In line with the prescribed departure procedure at Brussels Airport, departures are modelled based on the NADP 1 instead of the NADP2 procedure. The calculated noise levels for take-offs are thus 1 to 3 dB lower in the area under the flight path at c. 5 to 10 km measured from the beginning of the runway and around 1 dB higher in the area to the side of the flight path.
Distinction in approach profiles	By taking account of the 'level flying' (whereby a section of the approach is flown at a fixed altitude) in the modelling, the calculated noise levels for approaches is somewhat higher. The impact is only visible at a greater distance (10+ km) before the runway.

Appendix G. Documentation provided files

Radar data for the year 2023 (source: BAC-TANOS)

2023-JAN-APR_flights.xlsx	16/01/2024	25.128 KB
2023-JAN-JUN_ops.csv	16/01/2024	1,114,858 KB
2023-JUL-DEC_flights.xlsx	16/01/2024	27.564 KB
2023-JUL-DEC_ops.csv	16/01/2024	1,203,550 KB

Flight data for the year 2023 (source: BAC-CDB)

ENV002_AT_202301_202312.csv	16/01/2024	67.024 KB

Data entry point per flight for 2023 (source Skeyes)

EBBR_2023_DEP.xlsx	17/01/2024	8.424 KB

Weather data for the year 2023 (source: BAC-TANOS)

2023_meteo.xls	16/01/2024	1.018 KB

Noise events for the year 2023 (source: BAC-TANOS / dOMG)

2023-01_03_events TANOS.xlsx	16/01/2024	76.517 KB
2023-01_06_events TANOS_VO.xlsx	16/01/2024	49.559 KB
2022-04_06_events TANOS.xlsx	16/01/2024	62.036 KB
2023-07_09_events TANOS.xlsx	16/01/2024	66.387 KB
2023-07_12_events OMGEVING.xlsx	16/01/2024	61.478 KB
2022-09_12_events TANOS.xlsx	16/01/2024	71.210 KB

hour reports noise measuring network for the year 2023 (BAC-TANOS / dOMG)

status_2023.xls	16/01/2024	1.057 KB
time-reports_2023_0107_TANOS.xls	16/01/2024	11.270 KB
uur-rapporten_2023_0812_TANOS.xls	16/01/2024	9.816 KB

Adress files Flanders and Brussels

Centraal Referentieadressenbestand (CRAB)	01-01/ 2024	Government of Flanders
OSLO business estates	01-01/ 2024	Government of Flanders
UrBis-Adm	01/01/2024	CIBG