Noise Contours around Brussels Airport for the Year 2019

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1 Introduction

The Government imposes an obligation on Brussels Airport Company to calculate noise contours are calculated every year in order to perform an assessment of the noise impact caused by departing and landing aircraft on the area surrounding the airport. The calculations are imposed on Brussels Airport pursuant to Flemish environmental legislation (VLAREM) which was amended in 2005[1] in accordance with the European guideline on the assessment and control of environmental noise, and the environmental permit[2] of Brussels Airport Company. In 2019, the 'Airports' section in VLAREM was adjusted[3]. This recent change has had no impact on this report (see 1.2).

These noise contours are calculated according to a strictly-defined methodology (see 1.2) 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 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. This assignment has been carried out by the WAVES research group of the Ghent University (UGent) since 2015. The calculations are commissioned by the airport operator, which is currently Brussels Airport Company.

1.1 Disclaimer

This assignment is performed by recognised sound experts working at the Ghent University with the explicit order 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 the Ghent University are responsible for the conformity of this result, but are not responsible for the quality and comprehensiveness of the raw data provided to them. The following limitations apply with regard to the use of this report:

- This report contains no information, judgment or opinion about the applicable (environmental) legislation at federal or regional level, and is not suitable to be used for this purpose.
- This report may not be interpreted as an opinion or action plan to minimise exposure, sleep disruption or nuisance among the public.

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[1] Belgian Official Gazette, Decision by the Flemish Government on the evaluation and control of environmental noise, amending the decision of the Flemish Government of 1 June 1995 on the general and sector-specific rules on environmental health, 31 August 2005.

[2] AMV/0068637/1014B AMV/0095393/1002B; Decision by the Flemish Minister of Public Works, Energy, Environment and Nature, containing the judgment relating to the appeals lodged against the Decision with reference D/PMVC/04A06/00637 of 8 July 2004 by the Provincial Executive of the Provincial Council of Flemish Brabant, on granting of the environmental licence for a period expiring on 8 July 2024 to NV Brussels International Airport Company In Chapter 5.57. AIRPORTS (B.I.A.C.), Vooruitgangsstraat 80 box 2, 1030 Brussels, to continue operating and to alter (by adding to it) an airport located at Brussels National Airport in 1930 Zaventem, 1820 Steenokkerzeel, 1830 Machelen and 5.57 Kortenberg, 30 December 2004

[3]Chapter 5.57. AIRPORTS, Section 5.57.1.2. General provisions § 3. 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

1.2 Compulsory calculations

In accordance with the VLAREM environmental legislation, the operator of an airport categorised as class 1[4] must 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;

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

- L_{night} and L_{den} 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 UGent to calculate 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 calculation of the noise contours must be carried out in accordance with the 'Integrated Noise Model' (INM) of the American Federal Aviation Administration (FAA), version 6.0c. This software meets the conditions stated in Vlarem (ECAC Doc. 29, 3rd edition (2005) or a later edition).

The number of people who are potentially seriously inconvenienced within the various L_{den} contour zones must be determined on the basis of the dose-response relationship laid down in VLAREM.

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

[4] Class 1 airports: airports that meet the definition of the Chicago Convention of 1944 on the establishing of the International Civil Aviation Organisation, and having a take-off and arrival runway of at least 800 metres;

1.3 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 in 2005, the following division of the operational day was used (day: 06:00 – 23:00; night: 23:00 – 06:00). Since VLAREM was adjusted in accordance with the guideline, the noise contours reports are calculated officially according to the breakdown of the day in the guideline (day: 07:00 – 19:00; evening: 19:00 – 23:00; night: 23:00 – 07:00). Since 2015, the annual calculation is no longer carried out by the Acoustics and Thermal Physics Laboratory of KU Leuven, but by the WAVES research group at the Ghent University. During this transition of implementing institution, it was verified that the calculation models and assumptions would not lead to discontinuities in the results.

1.4 INM: Integrated Noise Model

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. Because the model used and the related aircraft database have an impact on the calculation of the noise contours, the noise contours for the year 2000 and from 2006 to 2010 were recalculated using version 7.0b[5]. In this way, it is possible to assess the evolution of the noise contours since 2000 without being affected by the calculation model used.

1.5 Population data

Since the noise contours of 2017, the most recent population data available is used to determine the number of inhabitants living inside the contour zones and the number of people who are potentially seriously inconvenienced. In the reports prior to 2017, population information was used in accordance with the 10-year population census to determine the population by statistical sector (most recent population as of 1/1/2011). Annually adjusted population figures at the level of the statistical sectors are now available through the open data section of the Office for Statistics and Economic Information (also known as the National Institute for Statistics). The most recent dataset available is used to calculate the exposure figures in this report (that is, the population as of 01 January 2019). In this way, the evolution of the population up to the level of the statistical sectors is taken into account. Note that the report with the noise contours for 2018 uses population data for 1 January 2017. The population data were updated faster in 2019 so that the data for 1 January 2019 were used in this report. This means that the results for 2019 have been charged with a population growth for the last two years.

In noise contour reports prior to and including 2016, the exposed population was determined on the basis of a homogeneous distribution of the number of inhabitants over the surface area of the statistical sector. From 2017, the calculation method was further refined, which improves the

[5] With regard to the frequency contours of 60 and 70 dB(A), only the year 2010 was calculated with version 7.0b of the INM calculation model.

geographical distribution within the statistical sector. Based on the address files in the Brussels-Capital Region and Flanders, the number of persons is calculated for each address location.

The information on the number of housing units is different in the Brussels-Capital Region and Flanders. In Flanders the number of housing units for each address is known, whereas in the Brussels-Capital Region this information is not available. In Flanders, this makes the exposure more sensitive to apartment buildings within a statistical sector. Not all address points are dwellings. In Flanders the addresses are categorised and, based on this information, the specific addresses of companies are removed. The population in a statistical sector is divided equally between the number of dwellings for the Flemish territory and the number of address points for the Brussels-Capital Region.

1.6 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 comprehensive summary of these source data carrying references to the corresponding files has been included in Appendix 5.6.

1.7 INM Study results

Brussels Airport Company was also provided with the following files in digital format, as appendices to the report:

- UGENT_EBBR19_INM_studie.zip (the INM study used)
- UGENT_EBBR19_geluidscontouren.zip (the calculated contours in shape format)
- UGENT_EBBR19_opp_inw.zip (the number of inhabitants and the surface area, as calculated within the noise contours)

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 closest to the noise source. Farther away from the noise source, the value of the noise 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 ($L_{Aeq,1s,max}$)[6] 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

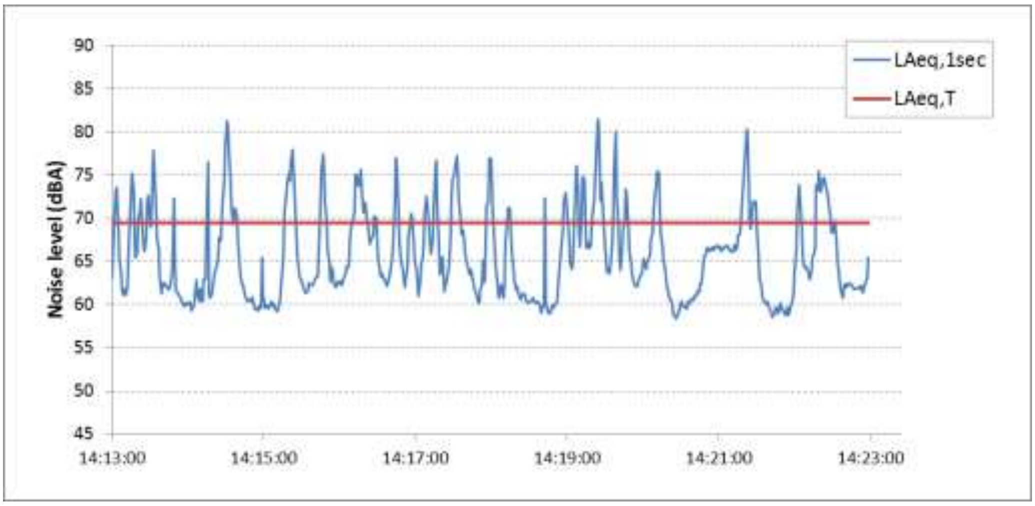
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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 $L_{Aeq,T}$ (see Figure 1).

[6] The INM calculation programme calculates the quantity $L_{Amax,slow}$. However, the values for this quantity are similar to those for the quantity $L_{Aeq,1s,max}$.

Figure 1: Graph of the A-weighted equivalent sound pressure level ($L_{Aeq,T}$) for a period T=10 minutes, together with the instantaneous ($L_{Aeq,1sec}$) from which this is derived.



The A-weighted equivalent sound pressure level $L_{Aeq,T}$, over a period T, is the sound pressure level of the *constant* sound containing the same acoustic energy in that same period as the fluctuating sound. 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.

Three types of $L_{Aeq,T}$ contours are calculated in this report:

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

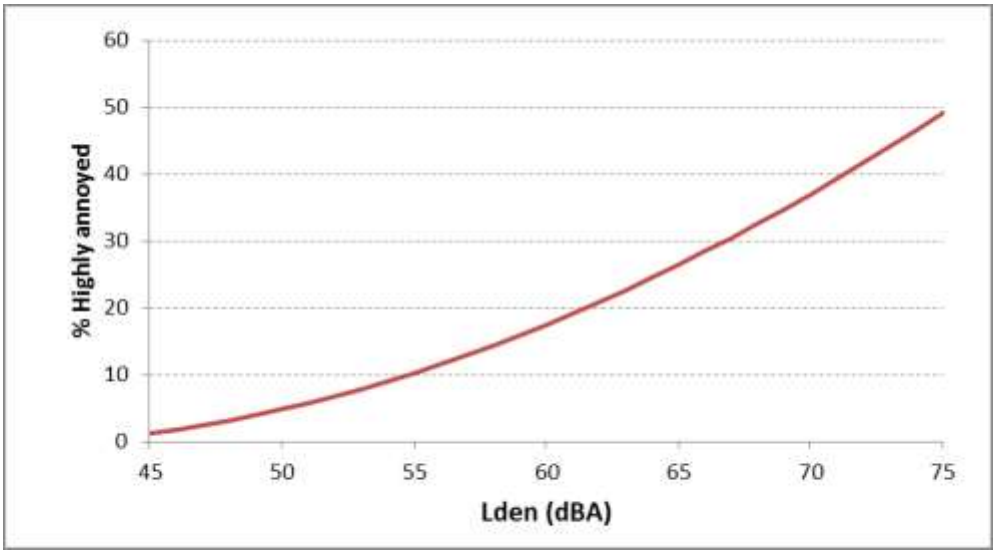
2.1.5 L_{den}

The European directive on the control and assessment of environmental noise (transposed in VLAREM 2), 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 2, 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 for 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 relationship is imposed by VLAREM 2 to determine the number of people who are potentially seriously inconvenienced within the L_{den} noise contour of 55 dB(A). This equation shows the percentage of the population that is potentially seriously inconvenienced by the noise impact expressed in L_{den} (Figure 2). % of seriously inconvenienced persons = $-9{,}199*10^{-5}(L_{den}-42)^3+3{,}932*10^{-2}(L_{den}-42)^2+0{,}2939(L_{den}-42)$

Figure 2: Percentage of people who are potentially seriously inconvenienced due to L_{den} for aircraft noise.



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

The aforementioned equation was established from a synthesis/analysis of various noise annoyance studies at various European and American airports carried out by Miedema[7], and was adopted by the WG2 Dose/Effect of the European Commission[8]. Note that L_{den} only determines around 30% of the variation in reported severe inconvenience[9,10].

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7 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.

8 European Commission, WG2 – Dose/Effect, Position paper on dose response relationships between transportation noise and annoyance, 20 February 2002

9 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.

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

Future developments

In October 2018, a WHO report appeared in which new exposure-effect relationships were proposed. The target value for observed health effects was lowered to 45 dB L_{den} and 40 dB L_{night}[11]. In a recent adaptation to the Environmental Noise Directive (END-Directive 2002/49/EC)[12] a number of the exposure-effect relationships proposed by WHO were adopted in the END. Alternative exposure-effect can be used as long as they are based on high-quality and statistically significant studies. The authorities involved should implement these adjustments no later than 31 December 2021.

3 Methodology

Noise contours are calculated using the 'Integrated Noise Model' (INM) of the United States Federal Aviation Administration (FAA). This model and the methodology used comply with the methodology prescribed in the VLAREM legislation (Chapter 5.57 Airports).

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.
- Execution of the calculations.
- Processing of the contours using a Geographic Information System (GIS).

3.1 Data input

INM calculates noise contours around the airport based on an average day/evening/night input file. An average day does not mean a selected, typical day on which the airport is used normally. It is based on the data for a complete year, where an average twenty-four hour period is determined by bringing all flight movements in that year into the calculation, and then dividing it by the number of days in that year.

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.

[11] 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,

[12] COMMISSION DIRECTIVE (EU) 2020/367 of 4 March 2020 amending annex III to directive 2002/49/EG of the European Parliament and the Council concerning the method of determining the damaging effects of ambient noise.

Information about aircraft movements

The following data is required to specify aircraft movements:

- Aircraft type
- Time
- Nature of the movement (departure/arrival)
- Destination or origin
- Runway used
- SID 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.

A matching INM aircraft type is linked to every aircraft type based data such as on type, engines, registration. In most cases, the aircraft types are present in INM, or in the standardised list with valid alternatives. For a small fraction of aircraft that cannot be directly identified in INM, an equivalent is sought based on other data, for example, the number and type of engines and the MTOW (maximum take-off 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. Helicopter flights represent about 1% of movements. A SID is not available for some aircraft departures (usually domestic flights with smaller aircraft). These flights are also added proportionally to the flight data (about 0.4%).

3.1.1 Radar data

A number of SIDs are given per runway in the Aeronautical Information Publication (AIP). These departure descriptions are not geographical stipulations, but are laid down as procedures. They must be followed when a certain height or geographical location is reached. 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.

Taking into account each individual radar track results in an enormously long calculation time. A method is therefore available in INM to take this distribution into account. This manual method (one action per bundle) has been automated since 2015, without making use of the internal method in INM.

The SIDs that fall inside the zone of the sound contours are grouped together for the take-off movements in a number of larger bundles, and a static division is used for those bundles based on the actual routes flown. This statistical method is an improvement compared to the built-in methodology of INM, which uses a symmetrical distribution around the average route of the actual routes flown, whereas the distribution of the paths in bundles is generally asymmetrical. For a number of frequently-used SIDS, the calculations are refined by a further subdivision based on aircraft type.

Grouping by approach path is not possible for arrivals using the information in the CDB. For this reason, the bundles for arrivals are divided on the basis of geographical data. Approaches for runways 25R and 25L are from the south-east, north or north-west, or in line with the runway from longer distances. No distinctions are made by aircraft type for approaches because the approach path is not influenced by this factor.

3.1.2 Meteorological data

For the calculation of the contours for 2019, the actual average meteorological conditions are used. The weather data are available via Brussels Airport Company every thirty minutes. 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 2019 are:

- Average headwind (annual average across all runways, take-off and landing): 4.1 kn.
- Average temperature: 12.5°C.
- Average headwind per runway:
  - 25R: 4.2 kn.
  - 25L: 4.1 kn.
  - 07R: 4.1 kn.
  - 07L: 4.2 kn.
  - 19: 4.4 kn.
  - 01: 3.5 kn.

3.1.3 Take-off profile

The weight of the aircraft influences the take-off profile at departure. Given that this actual weight is not available in the CDB, a method proposed by INM is used to factor in this effect (the INM 'stage' parameter). 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, among others, by the fact that the kerosene constitutes an important part of the total weight of an aircraft. This complies with the methodology of the preceding annual reports.

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

3.2 Execution of the contour calculations

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

INM enables calculations at specific locations around the airport. To check the assumptions concerning the input data and the accuracy of the INM, the calculated noise impact is compared with sound measurements taken at 30 locations.

The comparison with measurements provides a validation of the calculations. Note that the noise calculations as well as the noise measurements imply specific uncertainties. The noise calculations group, flight movements for example, without taking the actual height of an aircraft flying overhead into account (this is determined by the assigned INM standard departure profile, 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.

Reliability of the calculation method can however be achieved when there is sufficient matching between the annual averages of the measured noise events and the annual average forecast based on the average day, across a sufficient number of measuring stations.

3.2.2 Technical data

The calculations are carried out with INM 7.0b with a 'refinement 11' and 'tolerance 0.5' within a grid which is 8 nmi westwards, 16 nmi eastwards and 8 nmi[13] northwards and southward in relation to the airport reference measuring point. The altitude of the airport reference measuring point in relation to sea level is 184 ft.

3.2.3 Calculation of frequency contours

The noise contours are calculated directly in INM. Frequency contours show the number of times a certain value is exceeded; these contours cannot be provided directly by INM.

INM is able to calculate the maximum noise pressure on a regular grid per aircraft movement. This information is input into a GIS to calculate frequency contours with standard functionality.

[13] 1 nmi (nautical mile) = 1.852 km (kilometre)

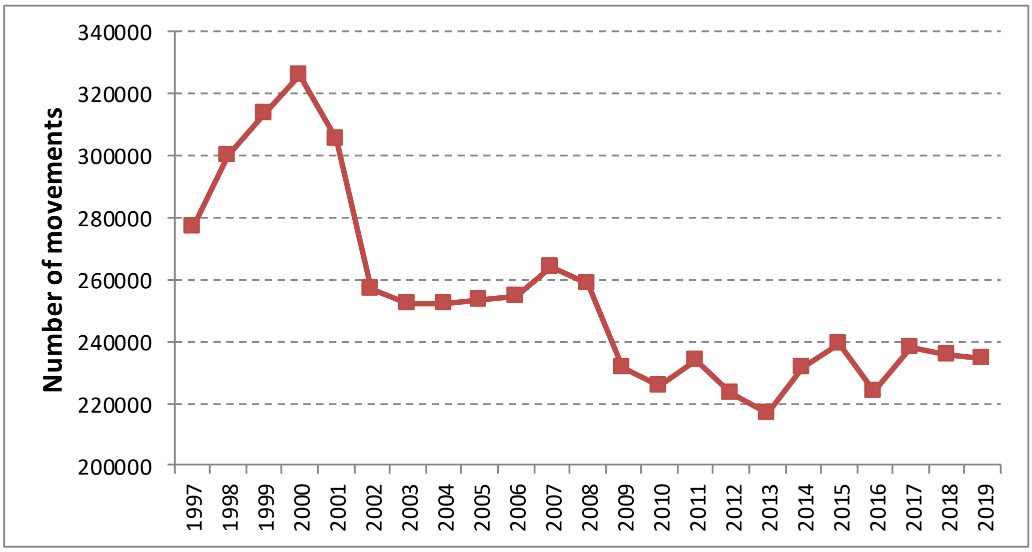
4 Results

4.1 Background information about interpreting the results

4.1.1 Number of flight movements

One of the most important factors in the calculation of 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.

Figure 3: Evolution of flight traffic (all movements) at Brussels Airport.



The number of night-time movements (23:00-06:00) rose by 2.0 % from 17,698 in 2018 to 17,347 in 2019 (5,319 of which were take-offs). This includes helicopter movements and flight movements exempt from slot coordination, such as government and military flights.

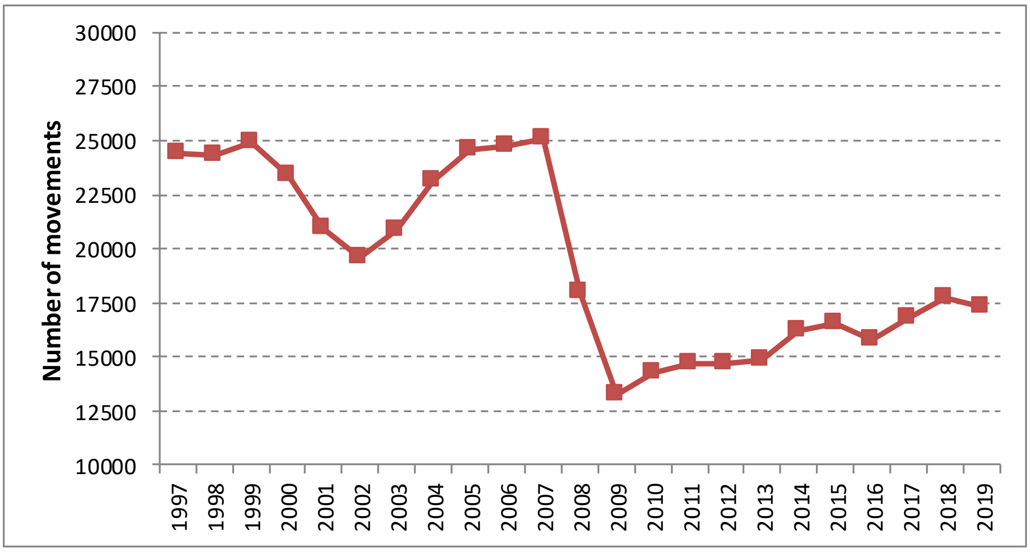
In 2019, the number of assigned night slots[14] for aircraft movements remained at 15,780, including 4,581 for departures, within the limitations imposed on the slot coordinator of Brussels Airport, who since 2009 has been authorised to distribute a maximum of 16,000 night slots, of which a maximum of

[14] night slot: permission given by the coordinator of the Brussels National Airport, pursuant to Regulation (EEC) No. 95/93 of the Council of 18 January 1993 concerning common rules for the allocation of slots at community airports, to use the entire infrastructure required for the exploitation of an air service at the Brussels National Airport on a specified date and at a specified landing and take-off time during the night, as assigned by the coordinator;

5,000 may be allocated to departures (MD 21/01/2009, official amendment to the environmental permit).

The number of movements during the operational day period (06:00 to 23:00) dropped by 0.3% from 217,761 in 2018 to 217,113 in 2019.

Figure 4: Evolution of flight traffic during the night (23:00-06:00) at Brussels Airport.



As a result of changes to the Vlarem legislation in 2005, noise contours are no longer measured based on a daily breakdown that coincides with the operating schedule at Brussels Airport, but rather, the day is split up into a daytime period (07:00 - 19:00), an evening period (19:00 - 23:00) and a night-time period (23:00 - 07:00). The number of movements in 2019, the data for 2018 and the trend are shown in Table 1. The numbers for the night period are further broken down into operational nights (23:00 - 06:00) and the morning period (06:00 - 07:00).

Table 1: Number of movements (incl. helicopter movements) in 2019 and the change in comparison to 2018 (VLAREM division of the day).

	2018			2019			Relative change versus 2018		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	75,182	78,436	153,618	74,788	78,564	153,352	-0.5%	0.2%	-0.2%
evening (19:00 - 23:00)	27,684	26,574	54,258	27,756	25,976	53,732	0.3%	-2.3%	-1.0%
night (23:00 - 07:00)	14,864	12,719	27,583	14,689	12,687	27,376	-1.2%	-0.3%	-0.8%
00:00 - 24:00	117,730	117,729	235,459	117,233	117,227	234,460	-0.4%	-0.4%	-0.4%
06:00 - 23:00	105,411	112,350	217,761	105,205	111,908	217,113	-0.2%	-0.4%	-0.3%
23:00 - 06:00	12,319	5,379	17,698	12,028	5,319	17,347	-2.4%	-1.1%	-2.0%
06:00 - 07:00	2,545	7,340	9,885	2,661	7,368	10,029	4.6%	0.4%	1.5%

The general increase of 0.4% in the annual number of flight movements between 2019 and 2018 is evenly distributed throughout the day (-0.2%), evening (-1.0%) and night (-0.8%). The decline is greater during the evening and the night. Between 06:00 and 07:00 there is an increase in movements of 1.5%. This is largely due to the growing number of landings between 06:00 and 07:00. This trend began in 2018 (+ 23.8%) and continued in 2019 albeit it at a lower tempo (+ 4.6%). The increase between 06:00 and 07:00 is compensated by a decrease of 2.0% during the operational night.

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 below.

4.1.2.1 Fleet changes during the operational night

The evolution of the most frequently used aircraft types during the operational night (23:00-06:00) in 2019 is available in Table 2 for heavy aircraft (MTOW > 136 tonnes, 'heavies') and in Table 3 for lighter aircraft (MTOW < 136 tonnes).

The most commonly used aircraft is the A320 (17.3% of all movements in 2019), followed by the B752 (16.3%), the B734 (13.6%) and the A306 (11.0%). Four aircraft types make up between 6% and 10% (the B738, A319, A333 and A332) of all movements. These eight types are responsible for 87% of the night flights. The most important change is the disappearance of the B763 from this top 8 as a result of the considerable decline in the number of landings (- 315). In terms of departures, the B752 is also the most frequently used aircraft overall (26.3%), followed by the B734 (19.4%), the A306 (17.3%), the B738 (9.2%), the A332 (6.5%) and the A320 (3.6%).

The number of movements in 2019 using heavy aircraft amounted to 4,627, an increase of 4.1% compared with 2019, when this number was 4,446. There was an increase of 2.4% compared with 2018 for departing heavy aircraft. The most common heavy aircraft used during the night are the A306 (from 863 to 922), the A332 (from 61 to 344), the B77L (from 182 to 149) and the B763 (from 470 to 127).

Table 2: Evolution of the number of flight movements per aircraft type during the operational night period (23:00-06:00) for the (MTOW > 136 tonnes) aircraft types.

	Landings				Departures			
MTOW > 136 ton	2018	2019	Evolution	Evolution (%)	2018	2019	Evolution	Evolution (%)
A333	997	1042	45	5%	40	33	-7	-18%
A306	930	978	48	5%	863	922	59	7%
A332	407	729	322	79%	61	344	283	464%
B788	29	83	54	186%	10	64	54	540%
B763	350	35	-315	-90%	470	127	-343	-73%
B789	8	23	15	188%	4	47	43	1075%
B77L	28	14	-14	-50%	182	149	-33	-18%
B744	14	6	-8	-57%	11	4	-7	-64%
C17	5	4	-1	-20%	2	0	-2	-100%
A310	0	3	3		2	4	2	100%
A343	6	3	-3	-50%	2	1	-1	-50%
A359	6	2	-4	-67%	1	0	-1	-100%
A346	0	1	1		0	0	0	
A400	0	1	1		1	0	-1	-100%
B74S	0	1	1		0	0	0	
B762	3	1	-2	-67%	2	1	-1	-50%
B77W	2	1	-1	-50%	4	3	-1	-25%
K35R	0	1	1		0	0	0	

Table 3: Evolution of the number of flight movements per aircraft type during the operational night period (23:00-06:00) for the most common, light (MTOW < 136 tonnes) aircraft types.

	Landings				Departures			
MTOW < 136 ton	2018	2019	Evolution	Evolution (%)	2018	2019	Evolution	Evolution (%)
A320	2875	2817	-58	-2%	435	191	-244	-56%
B752	1446	1426	-20	-1%	1434	1398	-36	-3%
B734	1255	1324	69	5%	973	1030	57	6%
A319	1391	1265	-126	-9%	97	80	-17	-18%
B738	1059	1029	-30	-3%	258	489	231	90%
B737	266	317	51	19%	12	7	-5	-42%
E190	201	210	9	4%	8	28	20	250%
EXPL	140	121	-19	-14%	90	77	-13	-14%
CRJ9	0	102	102		5	17	12	240%
A321	51	52	1	2%	112	96	-16	-14%
B733	105	47	-58	-55%	100	44	-56	-56%
A20N	7	45	38	543%	1	8	7	700%
B38M	251	40	-211	-84%	3	0	-3	-100%
C56X	17	27	10	59%	4	7	3	75%
E195	22	17	-5	-23%	2	0	-2	-100%
A21N	2	14	12	600%	1	10	9	900%
F2TH	27	13	-14	-52%	7	4	-3	-43%
C130	21	13	-8	-38%	0	1	1	
C510	16	12	-4	-25%	7	5	-2	-29%
C25A	14	12	-2	-14%	6	4	-2	-33%
GLF6	6	9	3	50%	2	4	2	100%
E75S	10	9	-1	-10%	1	2	1	100%
F900	8	9	1	13%	5	8	3	60%
GLF5	11	9	-2	-18%	4	7	3	75%
C425	5	8	3	60%	7	8	1	14%
BCS3	4	8	4	100%	0	2	2	
E135	17	8	-9	-53%	4	3	-1	-25%
LJ45	5	7	2	40%	3	4	1	33%
FA8X	3	7	4	133%	0	0	0	
E145	27	7	-20	-74%	17	4	-13	-76%

4.1.2.2 Runway and route usage

<u>Preferential runway usage</u>

The preferential runway usage, published in the AIP (Skyeyes), shows which runway should preferably be used, depending on the time that the movement occurs, and in some cases on the destination and the MTOW of the aircraft. This scheme did not change during the year 2019 (see Table 4).

If the preferential runway configuration cannot be used (for example due to meteorological conditions or maintenance on one of the runways), Skyeyes will then choose the most suitable alternative configuration, taking account of factors including the weather conditions, runway equipment and traffic demand. In this respect, conditions are tied to the preferential runway usage arrangements, including wind limits expressed as the maximum crosswind and maximum tailwind at which each runway can be used. If these limits are exceeded, air traffic control must 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 4: Preferential runway usage 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 – Tues 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Tues, 06:00 – Wedn 05:59	Departure	25R		25R/19(1)
	Landing	25L/25R		25R/25L(2)
Wed, 06:00 – Thurs 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.

Runway usage

No physical modifications of significant duration were made to the take-off and landing runways in 2019.

Weather conditions in 2019 caused more operations to be carried out using the 'non-preferential runway use' than in 2018. A complete overview of runways used in 2019 and the evolution in runway usage in comparison with 2018 can be found in appendix 5.1.

Changes to the departure routes (SIDs) and landing routes (STAR)

The second stage of maintenance work on the BUB aircraft navigation beacon was undertaken by skeyes between 27 August and 16 September, which meant this beacon was temporarily unavailable. As a consequence, a number of flight procedures for departure and landing could no longer be flown in the conventional way, and temporary procedures were provided on the basis of satellite technology (PBN). Departure procedures based on this satellite technology were adjusted to the current procedures. PNB approach procedures were temporarily published for approaches on runways 07L and 07R. The approach corridor for landings on runway 07L were moved slightly with respect to the conventional procedure due to the conditions which are linked to this type of procedure (landing in the axis of the runway).

These changes to the routes flown are included in the calculations.

4.2 Comparison of measurements and calculations

The INM software 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, CDB, radar tracks and weather. Measurements and calculations are compared for the parameters $L_{Aeq,24h}$, L_{night} and L_{den}.

The calculated values are compared with the values resulting from correlated measured events. Only the acoustic parameters of an event are recorded by the monitoring network. To select the events resulting from aircraft, an automatic link is made in the NMS to the flight and radar data; these are the so-called correlated events.

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 2019. 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.

In the table below, a comparison is made between the values simulated in the INM 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 40-1 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.

In 2019, two measuring stations were moved, namely the NMT in Vilvoorde (19-03 to 19-04) and Machelen (20-02 to 20-03). As these are relatively small moves, with little impact on the measured and predicted noise levels, these were taken together for further analysis.

For measuring stations of the BIM in the Brussels-Capital Region, this procedure is not possible because the measurement data is not supplied to BAC (until 2009, the measurement data from the BIM for two measuring stations - Haren and Evere - had in fact been made available to BAC). An overview of the locations of all measuring stations can be found in Appendix 5.2.

The measuring stations NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1 are situated on the airport site and/or in the immediate vicinity of the runway system and the airport facilities. 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.

The fraction of time that the measuring system is active (so-called 'uptime') is high for the majority of the measuring stations. Only two measuring stations, namely Machelen (NMT20-2/3, 89.13%) and Strombeek-Bever (21-1, 84.23 %) achieve a value that is less than 90 %. When stations that are operational for less than 90% are ignored, the average uptime in 99.14%.

Since the simulations are repeatedly performed for a full year, the measurements from the aforementioned measuring stations with a lower uptime fraction must be extrapolated. 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 post was active. For most measuring stations, this correction is 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) 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 mentioned in the previous paragraph]. The measuring stations of Perk and more particularly Bertem have few overflights and thus belong to the two lowest registered noise levels (<43 dB(A) $L_{Aeq,24h}$). The resulting margin for error is large and that is reflected in the comparison between the measurements and the calculations. At 7 measuring stations, the deviation is limited to up to 0.5 dB(A). At 11 measuring stations, the measurements are higher than the calculations, at 9 measuring stations the measurements are lower than the calculations (in each case with the abovementioned exclusions). The global discrepancy between simulations and measurements is 0.9 dB(A) ("root-mean-square error" or RMSE), when Perk and Bertem are excluded from this evaluation.

The overall deviation between measurements and simulations for L_{night} is slightly higher (1.3 dB(A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1, and also NMT48-3). The highest deviations (excluding NMT01-2, NMT03-3, NMT15-3 en NMT23-1) are found at the Bertem en Perk measuring locations; the predicted level appears here to be more than 3 dB(A) higher than the measurements. The large deviation at Bertem can be explained by the very low levels that were measured here (<20 dB(A) L_{night} by aircraft movements). At all other measuring stations, the deviations are within 2 dB(A), except at Strombeek-Bever (NMT21-1, namely 2.3 (dB(A)).

For the noise indicator L_{den} the RMSE is 1.2 dB(A) (excluding NMT01-2, NMT03-3, NMT15-3, NMT23-1, as well as NMT48-3). At all the other measuring stations, the deviation was within 2 dB(A), except at Perk and Strombeek-Bever. Nine measuring stations had a deviation of maximum 0.5 dB(A). At 15 measuring stations the calculations result in an underestimation of the measured levels, at 10 measuring stations they lead to an overestimation (excluding NMT01-2, NMT03-3, NMT15-3 and NMT23-1, as well as NMT48-3).

Table 5: Match 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).

Location code	location name	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	56.5	63.4	-6.9
NMT02-2	KORTENBERG	67.7	68.2	-0.5
NMT03-3	HUMELGEM-Airside	62.2	63.6	-1.4
NMT04-1	NOSSEGEM	60.4	60.1	0.3
NMT06-1	EVERE	51.8	50.7	1.1
NMT07-2	STERREBEEK	48.1	48.0	0.1
NMT08-1	KAMPENHOUT	55.0	54.7	0.3
NMT09-2	PERK	42.4	47.4	-5.0
NMT10-1	NEDER-OVER-HEEMBEEK	55.3	55.0	0.3
NMT11-2	SINT-PIETERS-WOLUWE	51.0	50.3	0.7
NMT12-1	DUISBURG	46.1	46.5	-0.4
NMT13-2	GRIMBERGEN	45.5	46.0	-0.5
NMT14-1	WEMMEL	48.7	48.1	0.6
NMT15-3	ZAVENTEM	45.9	55.4	-9.5
NMT16-2	VELTEM	54.8	56.6	-1.8
NMT19-3/4	VILVOORDE	53.0	53.0	0.0
NMT20-2/3	MACHELEN	53.7	54.5	-0.8
NMT21-1 +	STROMBEEK-BEVER	52.9	51.1	1.8
NMT23-1	STEENOKKERZEEL	64.8	66.6	-1.8
NMT24-1	KRAAINEM	53.5	52.0	1.5
NMT26-2	LAKEN	46.8	46.7	0.1
NMT40-1*	KONINGSLO	53.0	52.7	0.3
NMT41-1*	GRIMBERGEN	47.8	48.6	-0.8
NMT42-2*	DIEGEM	64.2	64.6	-0.4
NMT43-2*	ERPS-KWERPS	56.2	57.1	-0.9
NMT44-2*	TERVUREN	45.3	46.4	-1.1
NMT45-1*	MEISE	44.5	45.8	-1.3
NMT46-2*	WEZEMBEEK-OPPEM	53.9	53.1	0.8
NMT47-3*	STERREBEEK	48.9	48.4	0.5
NMT48-3*	BERTEM	24.5	31.8	-7.3

*noise data Environment Department off-line correlated by the NMS
+Measuring station with an uptime smaller than 90%

Table 6: Match between calculations and measurements for noise indicator L_{night} (in dB(A)). The grey rows in the table indicate comparisons between measurements and calculations which are difficult to perform (see text).

Location code	location name	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	54.6	65.8	-11.2
NMT02-2	KORTENBERG	63.5	64.0	-0.5
NMT03-3	HUMELGEM-Airside	58.0	58.3	-0.3
NMT04-1	NOSSEGEM	59.1	58.2	0.9
NMT06-1	EVERE	45.8	44.5	1.3
NMT07-2	STERREBEEK	50.2	48.9	1.3
NMT08-1	KAMPENHOUT	53.1	53.1	0.0
NMT09-2	PERK	41.3	44.7	-3.4
NMT10-1	NEDER-OVER-HEEMBEEK	51.1	49.8	1.3
NMT11-2	SINT-PIETERS-WOLUWE	46.8	45.8	1.0
NMT12-1	DUISBURG	43.7	43.6	0.1
NMT13-2	GRIMBERGEN	38.8	39.1	-0.3
NMT14-1	WEMMEL	43.1	42.9	0.2
NMT15-3	ZAVENTEM	49.0	51.7	-2.7
NMT16-2	VELTEM	50.8	52.4	-1.6
NMT19-3/4	VILVOORDE	49.1	48.0	1.1
NMT20-2/3	MACHELEN	49.9	50.3	-0.4
NMT21-1 +	STROMBEEK-BEVER	49.2	46.9	2.3
NMT23-1	STEENOKKERZEEL	63.4	65.5	-2.1
NMT24-1	KRAAINEM	48.4	47.1	1.3
NMT26-2	LAKEN	42.6	42.5	0.1
NMT40-1*	KONINGSLO	49.1	47.9	1.2
NMT41-1*	GRIMBERGEN	43.1	43.2	-0.1
NMT42-2*	DIEGEM	59.4	58.8	0.6
NMT43-2*	ERPS-KWERPS	51.1	52.3	-1.2
NMT44-2*	TERVUREN	46.1	45.4	0.7
NMT45-1*	MEISE	37.7	39.6	-1.9
NMT46-2*	WEZEMBEEK-OPPEM	49.5	48.5	1.0
NMT47-3*	STERREBEEK	50.6	48.8	1.8
NMT48-3*	BERTEM	19.4	27.7	-8.3

*noise data Environment Department off-line correlated by the NMS
+Measuring station with an uptime smaller than 90%

Table 7: Match 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).

Location code	location name	measurements (dB(A))	calculations (dB(A))	difference (dB(A))
NMT01-2	STEENOKKERZEEL	62.0	71.5	-9.5
NMT02-2	KORTENBERG	71.8	72.4	-0.6
NMT03-3	HUMELGEM-Airside	66.3	67.2	-0.9
NMT04-1	NOSSEGEM	66.1	65.5	0.6
NMT06-1	EVERE	55.3	54.2	1.1
NMT07-2	STERREBEEK	55.9	55.0	0.9
NMT08-1	KAMPENHOUT	60.3	60.2	0.1
NMT09-2	PERK	48.0	52.3	-4.3
NMT10-1	NEDER-OVER-HEEMBEEK	59.4	58.9	0.5
NMT11-2	SINT-PIETERS-WOLUWE	55.4	54.6	0.8
NMT12-1	DUISBURG	51.0	51.2	-0.2
NMT13-2	GRIMBERGEN	49.0	49.5	-0.5
NMT14-1	WEMMEL	52.3	51.9	0.4
NMT15-3	ZAVENTEM	54.5	59.7	-5.2
NMT16-2	VELTEM	59.0	60.8	-1.8
NMT19-3/4	VILVOORDE	57.3	57.0	0.3
NMT20-2/3	MACHELEN	58.0	58.6	-0.6
NMT21-1 +	STROMBEEK-BEVER	57.3	55.2	2.1
NMT23-1	STEENOKKERZEEL	70.4	72.4	-2.0
NMT24-1	KRAAINEM	57.4	56.0	1.4
NMT26-2	LAKEN	51.0	50.9	0.1
NMT40-1*	KONINGSLO	57.3	56.6	0.7
NMT41-1*	GRIMBERGEN	51.8	52.3	-0.5
NMT42-2*	DIEGEM	68.0	68.2	-0.2
NMT43-2*	ERPS-KWERPS	59.9	60.9	-1.0
NMT44-2*	TERVUREN	52.2	52.1	0.1
NMT45-1*	MEISE	47.8	49.2	-1.4
NMT46-2*	WEZEMBEEK-OPPEM	58.1	57.2	0.9
NMT47-3*	STERREBEEK	56.4	55.0	1.4
NMT48-3*	BERTEM	28.2	36.0	-7.8

*noise data Environment Department off-line correlated by the NMS
+Measuring station with an uptime smaller than 90%

4.3 Noise contours

The results of the noise contour calculations for the parameters described above (L_{day}, $L_{evening}$, L_{night}, L_{den}, freq.70 and freq.60) are presented in this section.

The surface area and the number of inhabitants is calculated for each noise contour. The evaluation of the number of exposed inhabitants has been performed since 2017, and will be carried out according to a more refined method (see 1.5). On the basis of the L_{den} contours, the number of potentially seriously inconvenienced persons is calculated according to the method described in chapter 2.2. More information is available in the appendices: per municipality in appendix 5.3, the evolution of the contours over multiple years in appendix 5.5. Appendix 5.4 contains the maps.

4.3.1 L_{day} contours

The L_{day} contours represent the A-weighted equivalent sound pressure level for 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 2018 and 2019 is shown in Figure 5.

The evaluation period for the L_{day} contours falls entirely within the operational daytime period (06:00 to 23:00) as specified 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. In the first place, there was a reduction in the number of landings during the day (-0.5%), but a slight increase in the number of departures (+0.2%). Moreover, the meteorological conditions in 2019 allowed the preferential runway to be used more often in comparison with 2018. This is mainly apparent in the number of departures from runway 07R, the runway that is used most for departure when it is necessary to deviate from the preferential runway usage: 12.7% in 2019, compared to 18.8% in 2018. There are, however, significantly fewer departures on 19 (from 2,761 to 1,906). For the landings during non-preferential runway use (using runways 01, 07L and 07R), it is striking that the relative share on runways 07L and 07R has increased. Although there was less need to deviate from the preferential runway use, the number of landings increased on runways 07R and 07L (from 4426 to 5809 and 131 to 240 respectively). This was compensated by far fewer landings on runway 01 (from 10,454 to 4,670).

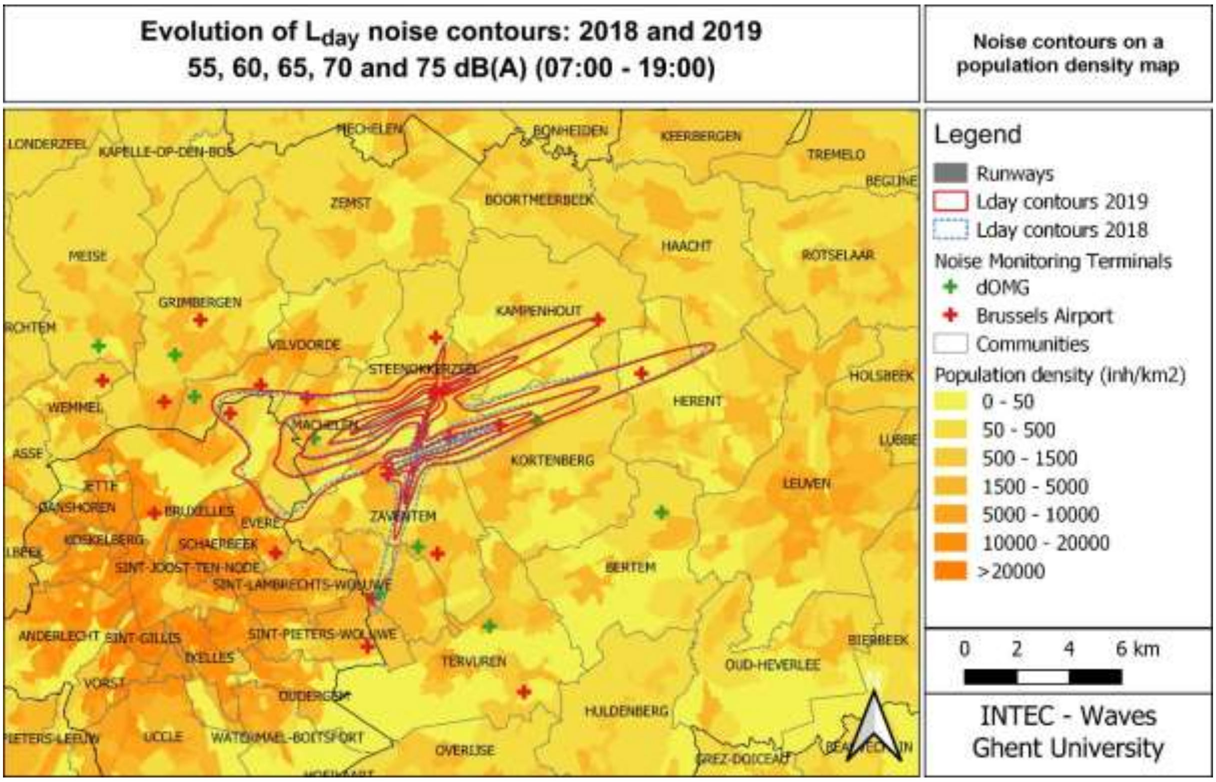
To the west of Brussels Airport, the 55 and 60 dB contours experienced slight enlargement as a result of an increase in the number of departures from runway 25R (from 59,645 to 65,342). The lobe before both the turn to the left and to the right grow as a direct result of the increased prevalence of preferential runway use. The fraction of the flights on routes with a turn to the right increased from 34.1% to 37.4%, on the straight ahead routes from 5.8% to 6.4%, and on the routes with a turn to the left from 36.1% to 39.4%. The increase of the number of arrivals on 07L made a significant contribution and caused the growth for the lobe in the extension of runway 25R/07L.

To the east of Brussels Airport, the number of departures on runway 07L (from 1213 to 1126) and the number of arrivals on 25R (from 19,309 to 20,975) are virtually identical in 2019, s that the lobe of this runway hardly changes. There are, on the other hand, significantly fewer departures from runway 07R (from 14,729 to 10,006) but the number of arrivals on runway 25L rose from 38,564 to 41,258. This lobe becomes narrower thanks to the lower number of departures but becomes longer due to the increasing number of landings.

To the south of Brussels Airport, the contour shrank through the decrease in the number of arrivals on runway 01 (from 10,454 to 4,670). The number of landings on runway 19 also dropped (from 2,761 to 1,906).

There are no changes to the north of Brussels Airport. The number of departures on runway 01 rises slightly (from 61 to 167) but the contour in this zone is determined by the landings on runway 19. This total decreased (from 2298 to 1836) causing the contour to shrink slightly.

Figure 5: L_{day} noise contours around Brussels Airport in 2018 (dotted blue) and 2019 (solid red).



The total surface area inside the L_{day} contour of 55 dB(A) declined in 2019 by about 2.7% compared to 2018 (from 4,987 to 4,851 ha). The number of inhabitants inside the L_{den} contour of the 55 dB(A) noise contour dropped by 1.7% (from 35,083 to 34,489).

4.3.2 $L_{evening}$ contours

The $L_{evening}$ contours represent the A-weighted equivalent sound pressure level for 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 2018 and 2019 is shown in Figure 6. Due to a lower level being reported in comparison with L_{day}, there is a visually magnifying effect. By correcting 5 dB(A), the 50 dB(A) contour becomes as important for the calculation of L_{den} as the 55 dB(A) L_{day} contour. The evaluation period for the $L_{evening}$ contours falls entirely within the operational daytime period (06:00 to 23:00), as specified at Brussels Airport.

There are a number of relevant findings: In the first place, there was a slight increase in the number of arrivals during the evening (+0.3%), but a decrease in the number of departures (-2.3%). Furthermore, there was less need to deviate from the preferential runway use in 2019. This meant more departures from runway 25R (from 20,977 to 21,799) and fewer departures from runway 07R (from 4,170 to 2,702). For runway 07L and runway 19, the number of both departures and arrivals was virtually identical for 2018 and 2019. There are, however, significantly fewer departures on runway 01 (from 4,111 to 2,576).

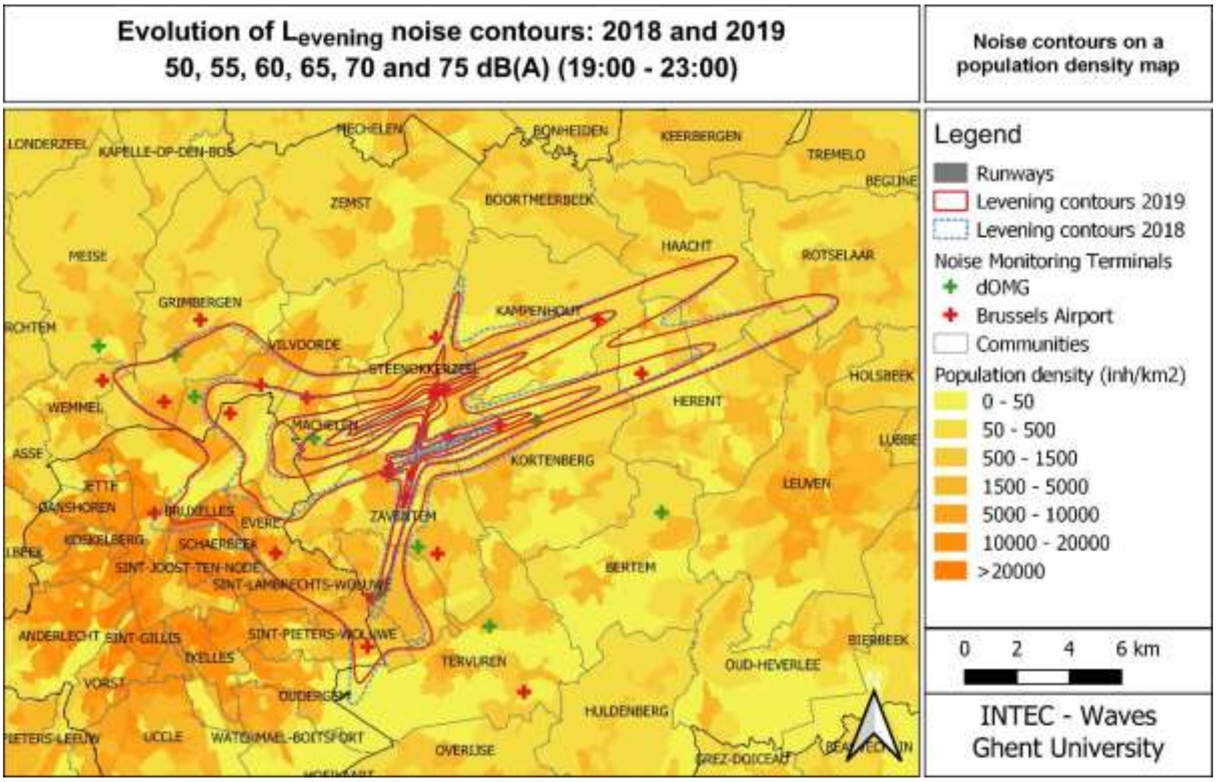


Figure 6: $L_{evening}$ noise contours around Brussels Airport for 2018 (dotted blue) and 2019 (solid red).

To the west of Brussels Airport, the contours hardly change, both for the turn to the right and the turn to the left, notwithstanding the increase in the number of departures on runway 25R by almost 5%. In the extension of runway 25R, a significant decline was found in the noise contour, notwithstanding the fact that the straight ahead traffic increased on this runway. This is explained by the reduction by around 1/3rd of the number of B747 flights on the straight ahead route (delta routes). The shape of the lobe straight ahead changes slightly through an increased, but not dominant, contribution of the landings on 07L.

There are also small changes to the east of Brussels Airport. With the considerable decrease in the number of departures on runway 07R, the contours are less wide close to the airport. Since the number of landings on runways 25L and 25R has increased slightly, the length of the contours in these zones has remained as long. Because of these developments (more landings, fewer departures in these zones), the lobes in the extension of runways 25R and 25L are more distinct than in 2018.

To the south of Brussels Airport, the contain shrinks through the decrease in the number of arrival on runway 01 (from 4,111 to 2,576) and the decrease in the number of departures on runway 19 (from 676 to 581). Both the lobe for arrivals (extension of the runway) and for departures (protrusion to the east due to the turning flight paths) shrink.

There are no changes to the north of Brussels Airport. There is a slight increase in the number of departures on runway 01 (from 0 to 46), but the evolution of the contour is determined by the decline in the number of arrivals on runway 19 (from 676 to 581), which causes this contour to shrink somewhat.

The total surface area inside the $L_{evening}$ contour of 50 dB(A) dropped in 2019 by about 3.8% compared with 2018 (from 14,599 ha to 14,038 ha). The number of inhabitants inside the $L_{evening}$ contour of 50 dB(A) dropped by 6.7% (from 273,841 to 255,558). The relative decline in population is larger than it is in surface area, considering the reduction of the $L_{evening}$ contour is partly in the densely-populated zones.

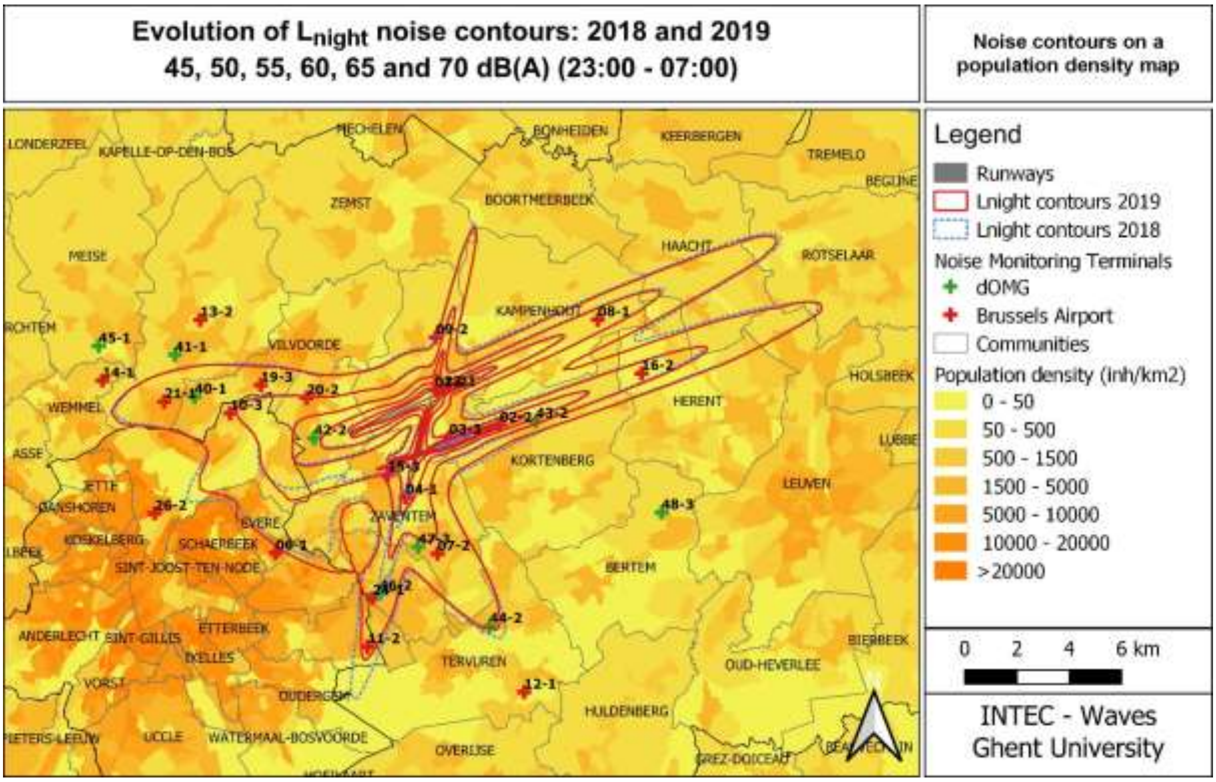
4.3.3 L_{night} contours

The L_{night} contours represent the A-weighted equivalent sound pressure level for 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 from 2018 to 2019 is shown in Figure 7. Due to an additional contour being reported, a magnifying effect between the day and the evening is created. The 45 dB(A) L_{night} contour is larger than the 55 dB(A) contour for daytime and is now, due to the correction of 10 dB(A) for the calculation of L_{den}, just as significant 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 coincide with the operational night period (23:00 to 06:00) and also consists of the flights during 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.

There is a slight decline in the number of departures during the night (-0.3%) and a somewhat larger increase in the number of landings (-1.2%). The busy departure hour from 06:00 and 07:00 contributes the most to the L_{night} contours, and here there is a slight increase in the number of movements (from 9,885 to 10,029). The number of landings between 06:00 and 07:00 increased by 4.6%, the number of departures by 0.4%. This increase is offset by a decrease during the operational night (-2.4% for landings and -1.1% for departures).

Figure 7: L_{night} noise contours around Brussels Airport in 2018 (dotted blue) and 2019 (solid red).



As was the case with the day and evening period, the meteorological conditions allowed the preferential runway scheduling to be applied more frequently in 2019 than in 2018. Because of this, the number of departures on runway 25R rises by 6.2%, the number of landings on runways 25R and 25L rises by 1.8% and 8.7%. The number of landings on runway 19 is stable (2,041 to 2,010). Accordingly, the number of departures on runways 07R and 07L dropped from 1,550 to 1,023 (-34%), whereby the decrease is larger on runway 07R (-42.6%) than on runway 07L (-23.2%). The number of landings on runway 01/07R/07L (non-preferential runway usage) also dropped from 2034 to 1258 (-38.2%). This demonstrates a shift whereby runway 07R is used, relatively speaking, more than runway 01 (and 07L) when compared with previous years. As a result, there were fewer landings from runway 01 from 1730 to 939 (-45.7%) and the number of landings on runway 07R doubled from 150 to 300.

To the west, in the extension of runway 25R, the lobe straight ahead is less pronounced. This is the result of a small drop in the emissions of the departures on runway 25R (-0.2 dB) and a sharp drop of a non-dominant contribution by the landings on 07L (-5.7 dB). The lobe before the turn to the right does not change despite a 4.6% increase in traffic on these routes, the lobe before the turn to the left grows because this is where the number of departures is largest (+12.7%). During the night period, this turn to the left is only used between 06:00 and 07:00. The increase in the number of landings on runway 07R can be seen in the changed shape of the 50 dB contour and in the small bulge on the 45 dB contour in the extension of runway 07R. The contribution made by the landings is not dominant but it is significant in the noise contour.

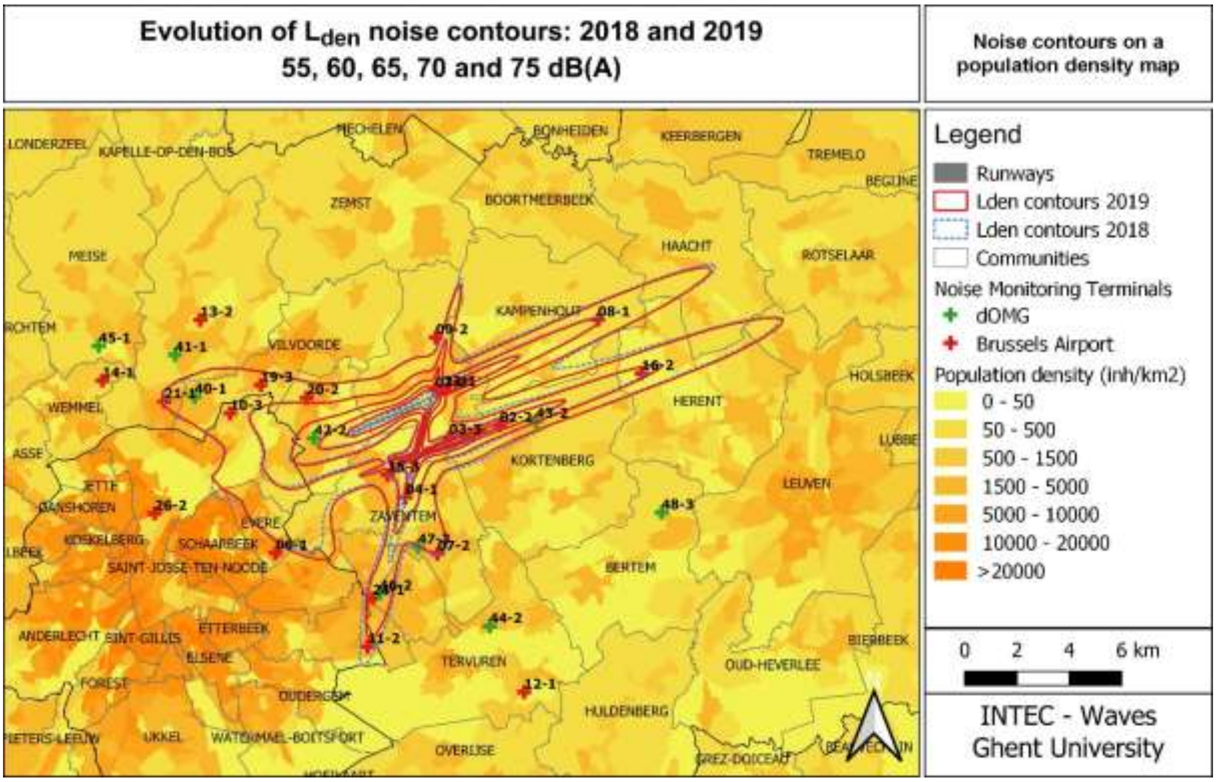
To the east of the airport the contours from runway 25L/07R and 25R/07L merge less due to the lower number of departures. The surface area of all contours to the south of Brussels Airport has decreased as a result of few arrivals on runway 01. There are no changes in the noise contour to the north of Brussels Airport.

The total surface area within the L_{night} contour of 45 dB(A) dropped in 2019 by 3.2% compared with 2018 (from 13,476 ha to 13,044 ha). The number of inhabitants inside the L_{night} contour of 45 dB(A) rose by 2.3% (from 160,109 to 163,718). Since the increase in contours is mainly located above the more densely populated areas below the turn to the left of runway 25R, there is an increase of the total number of inhabitants despite the decrease in surface area.

4.3.4 L_{den} contours

The quantity of the L_{den} unit 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). In Figure 8 you can see the evolution of the L_{den} contours for 2018 and 2019. The L_{den} contours are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A).

Figure 8: L_{den} noise contours around Brussels Airport in 2018 (dotted blue) and 2019 (solid red).



The changed form is a weighted combination of all effects which are outlined in detail in the discussion of L_{day}, $L_{evening}$ and L_{night} contours. The findings for the various periods to the west of the airport are confirmed in a status quo for the turn to the right, a changed shape of the lobe straight ahead and an enlargement of the lobe before the turn to the left. In the southerly direction the contour shrinks due to the lower number of landings on runway 01. The merging of the contours to the east of the airport is eliminated due to the lower number of departures from runways 07R and 07L.

The total surface area inside the L_{den} noise contour of 55 dB(A) dropped in 2019 by 4.5% compared with 2018 (from 9,540 ha to 9,115 ha). The number of inhabitants inside the L_{den} contour of 55 dB(A) dropped by 5.3% (from 103,114 to 97,624).

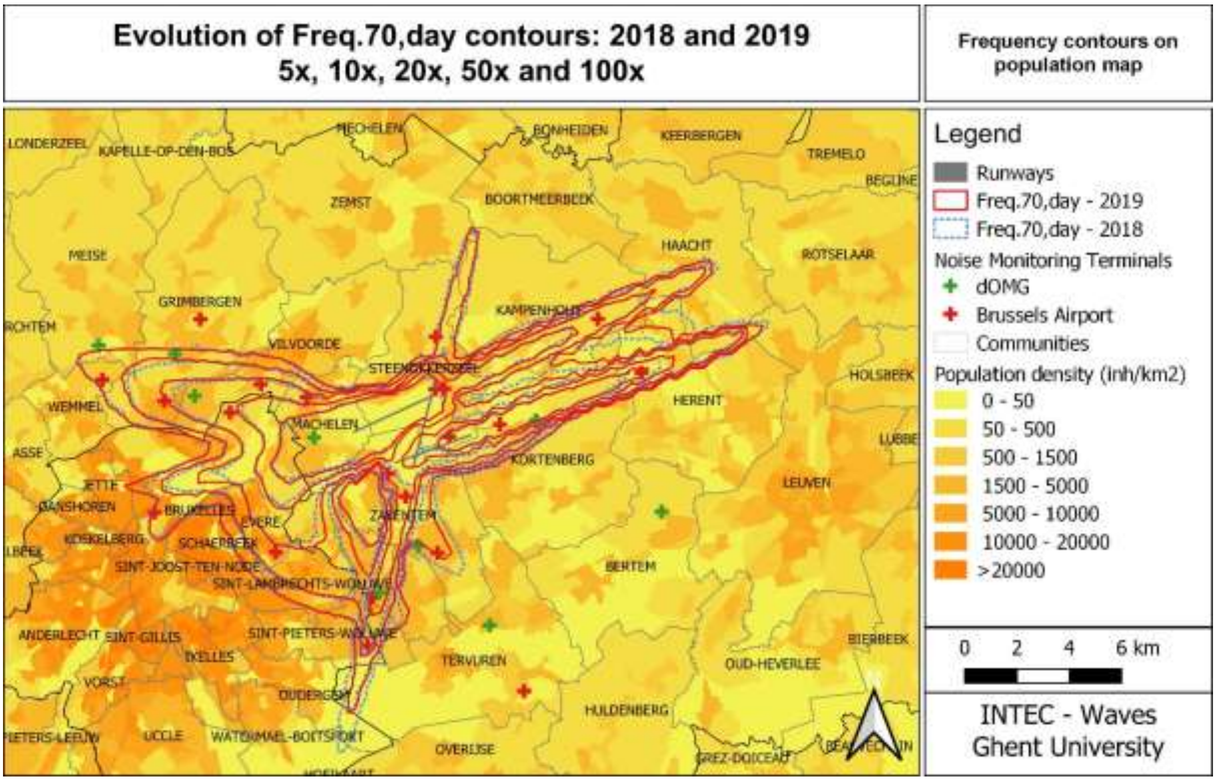
4.3.5 Freq.70,day contours (day 07:00 - 23:00)

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 changes in the runway usage and the changes in the use of routes (see Figure 9).

The contours have also grown in line with the increase in the number of departures on runway 25R. The contour for the departures with a turn to the left has become wider in the northerly direction. The landing contour for runway 01 is getting smaller. The increase in the number of landings on runway 07L causes a sharp lobe in the direction of Jette. The drop in the number of departures from runway 07L and 07R is visible in the further split of the associated contours. The lobe for the departures from runway 19 shrinks in line with the decrease of the number of departures on this runway.

The total surface area inside the contour of '5x above 70 dB(A)' rose in 2019 by 4.6 % compared with 2018 (from 14,276 ha to 13,621 ha). The number of inhabitants inside the Freq.70,day contour of 5 events rose by 0.8% (from 282,289 to 284,427), because the expansion took place partly in the more densely populated area.

Figure 9: Freq.70,day frequency contours around Brussels Airport for 2018 and 2019.



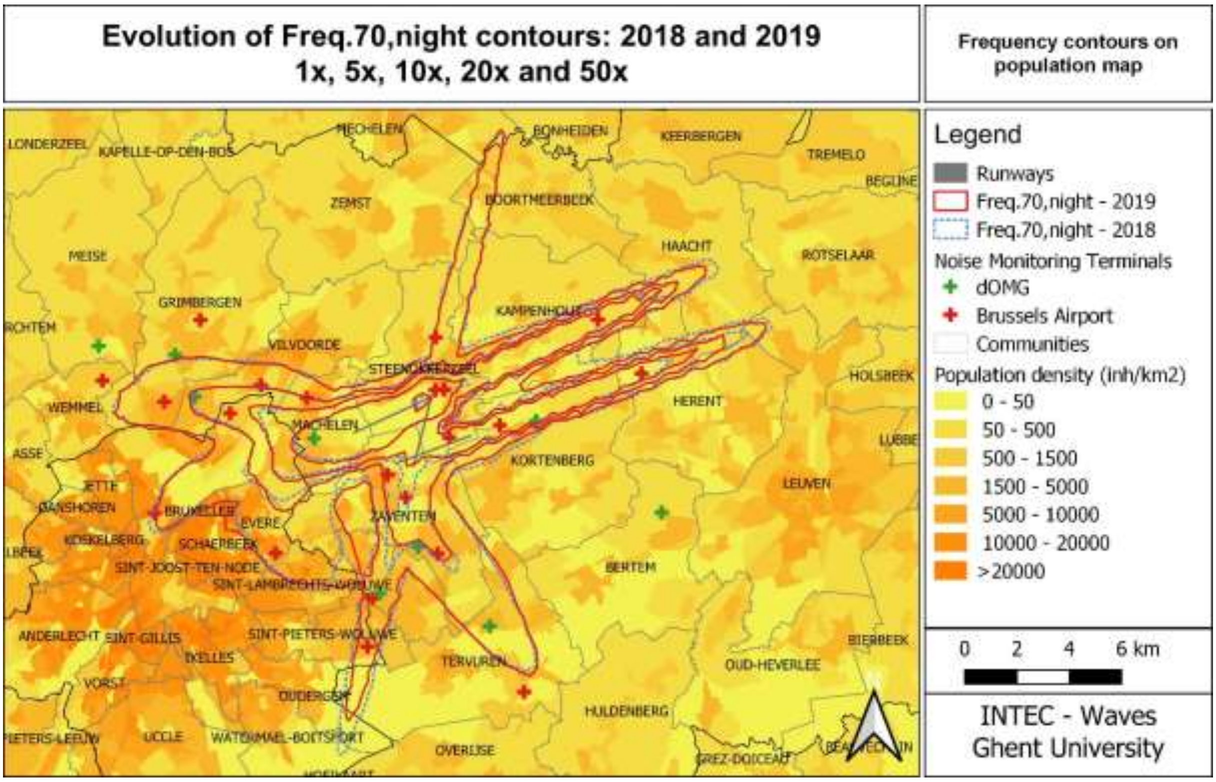
4.3.6 Freq.70,night contours (night 23:00-07:00)

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 changes in the runway and route usage that were discussed for

L_{night}. The contour for departures with a left turn from runway 25R is growing, the lobe with a turn to the right remains stable and the lobe for flights straight ahead shows a small shrinkage. Here again, a small bulge on the outer contour is visible due to the landings on runway 07R. The landing contour for runway 01 is getting smaller. The drop in the number of departures from runway 07L and 07R is visible in the splitting and narrowing of the associated contours.

The total surface area inside the 1x above the 70 dB(A) contour during the night declined in 2019 by 3.9% compared to 2018 (from 14,034 to 13,489 ha). The number of inhabitants inside this contour rose by 4.8% (from 215,281 to 225,698).

Figure 10: Freq.70,night frequency contours around Brussels Airport for 2018 and 2019.

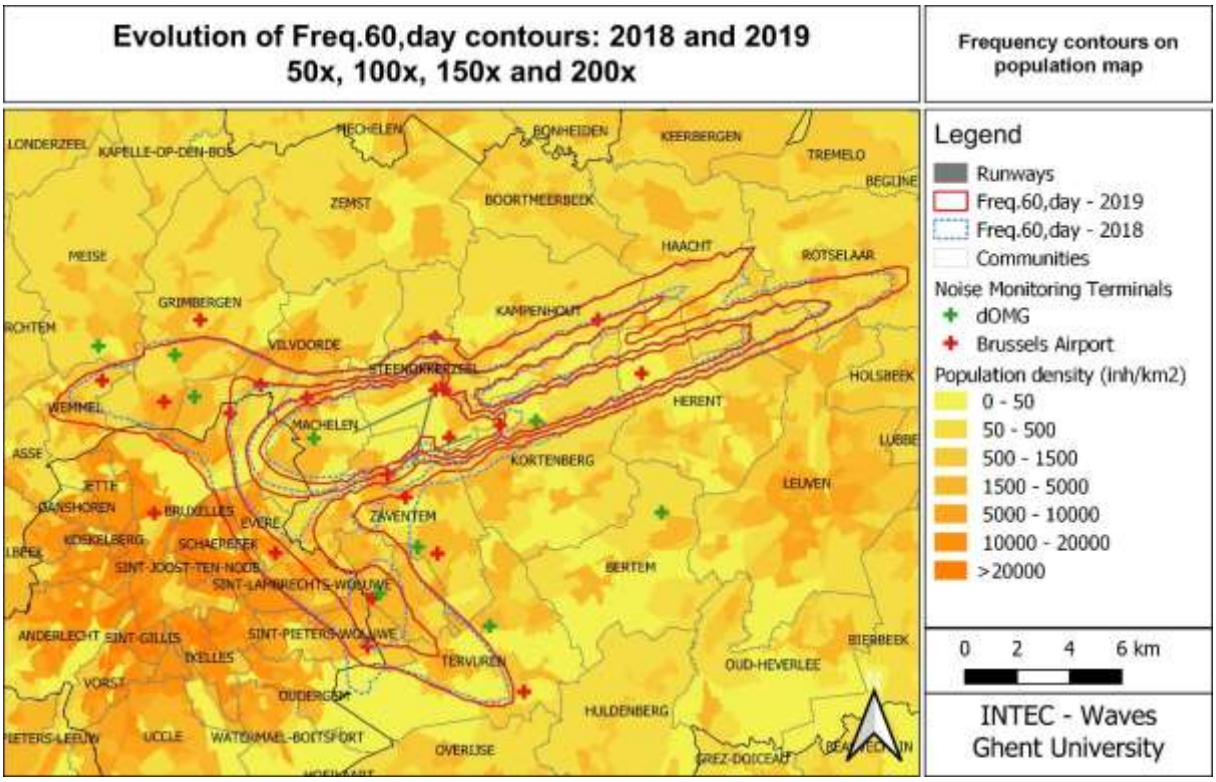


4.3.7 Freq.60,day contours (day 07:00-23:00)

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 changes in the runway usage and the changes that have been discussed With the increase in the number of departures on runway 25R, there is a growth in the contour lobe before both the turn to the left and the turn to the right. Before the turn to the left, there is a greater concentration of flight paths, which is shown by two phenomena: (1) the connection of the 100x contour with the landing contour of runway 01, (2) the contour before the turn to the left is not growing in a southerly direction. The lower number of landings on runway 01 is also visible in the contour. The decline in the number of departures from runway 07R narrows the associated contours. The 100x contour is more deeply incised between runways 07R and 07L.

The total surface area inside the Freq.60,day-contour of 50x above 60 dB(A) dropped slightly in 2019 by 1.0% compared with 2018 (from 16,629 ha to 16,467). The number of inhabitants inside the Freq.60,day contour of 50x above 60 dB(A) rose by 6.5% (from 273,238 to 290,915).

Figure 11: Freq.60,day frequency contours around Brussels Airport for 2018 and 2019.

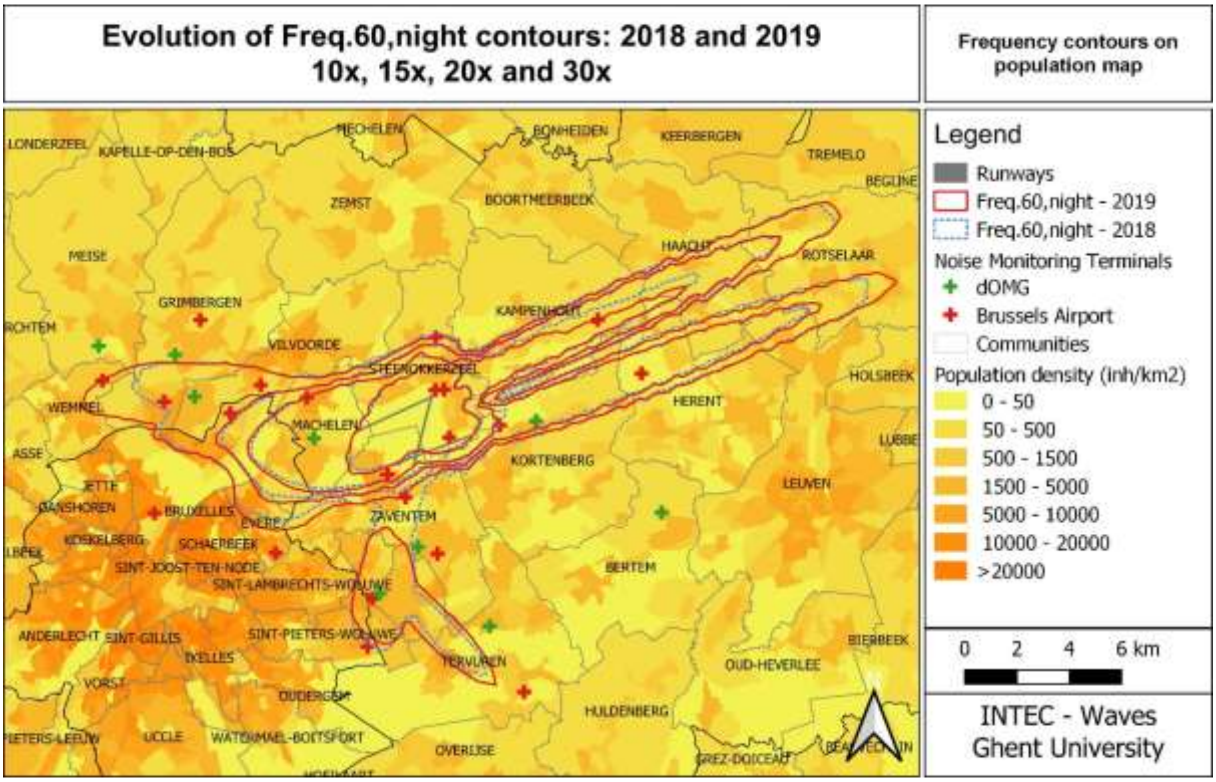


4.3.8 Freq.60,night contours (night 23:00-07:00)

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 changes in the runway and route usage. The outer contour for the turn to the right and the turn to the left from runway 25R has grown. With the decline in the number of landings on runway 01, the contour in the extension of this runway is no longer connected to the other contours.

The total surface area inside the Freq.60,night frequency contour with 10x above 60 dB(A) rose in 2019 by 2.2% compared with 2018 (from 13,061 ha to 13,352 ha). The number of inhabitants inside the Freq.60,night contour of 10x above 60 dB(A) rose by 8.9% (from 150,202 to 163,518).

Figure 12: Freq.60,night frequency contours around Brussels Airport for 2018 and 2019.



4.4 Number of people who are potentially highly 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 2 (see 2.2). Number of people who are potentially seriously inconvenienced is also reported per municipality. The most recent population numbers available (01 January 2019) are used in this report.

Table 8 shows the results for the number of potentially highly inconvenienced persons. The results are also shown graphically in Figure 13.

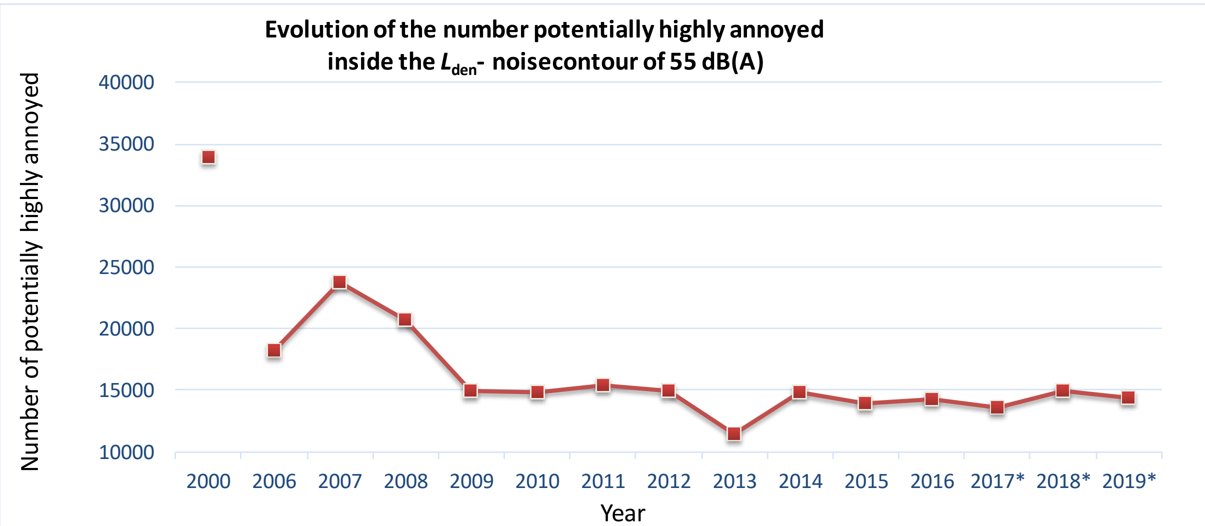
The total number of potentially highly inconvenienced persons in 2019 within the contour of 55 dB(A) is 14,420, a decrease of 3.5% in comparison to 2018. The results are based on the same methodology for the allocation of the population (based on address points) and show a real change in exposure, including the increase in the population density. Without population growth, the number of people potentially inconvenienced would be 14,229. The population growth since 1/1/2017 is responsible for an increase of 1.3%

In Evere and Schaerbeek, the decline in the number of inconvenienced persons is due to the change in the lobe straight ahead (287). In Kraainem, Sint-Pieters-Woluwe and Wezembeek-Oppem, the contour is smaller due to the lower number of landings on runway 01 (-494). In Sint-Lambrechts-Woluwe there is an increase in departures from runway 25R with a turn to the left (+197). The shift in the landing contours for runways 25R and 25L (smaller contribution from departures on runways 07R and 07L because preferential runway use could be applied more) has a positive effect in Haacht, Kampenhout, Steenokkerzeel and Kortenberg (-215) but there is a status quo in Herent. There are small negative effects (+107) in Grimbergen, Machelen and Vilvoorde.

Table 8: 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
INM version	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b
Method	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	opp	adres	adres	adres
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
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
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
Grimbergen	3,111	479	1,305	638	202	132	193	120	0	175	428	517	449	440	485
Haacht	96	103	119	58	36	31	37	37	24	50	115	70	78	66	51
Herent	186	88	140	162	119	115	123	134	107	152	111	161	133	136	136
Huldenberg	112	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
Kortenberg	664	548	621	604	512	526	497	422	603	443	366	438	431	521	495
Kraainem	1,453	934	1,373	1,277	673	669	667	500	589	111	368	379	388	524	393
Leuven	70		9	22	2	1	3	5	0	11	0	0	13	18	22
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
Meise	506	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
Rotselaar	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schaarbeek	2,026	995	1,937	1,440	603	1,153	1,652	1,703	76	1,647	354	956	6	165	0
Sint-L.-Woluwe	1,515	382	1,218	994	489	290	196	150	0	0	0	1	142	44	241
Sint-P.-Woluwe	642	411	798	607	396	477	270	82	390	0	79	102	90	338	85
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
Tervuren	1,550	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
Wemmel	142	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
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
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**

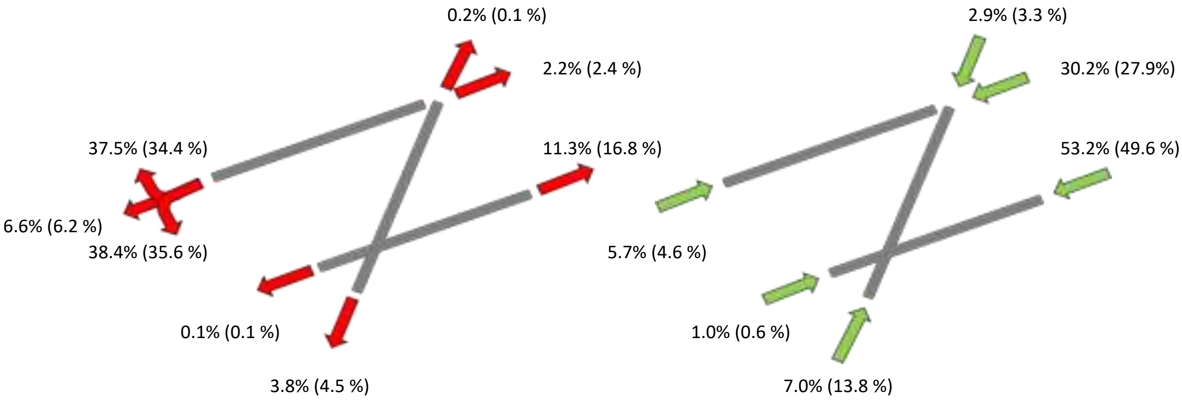
Figure 13: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour. From 2017, the new methodology is accented with * (use of the address points, including annual population evolution).



5 Appendices

5.1 Runway and route usage

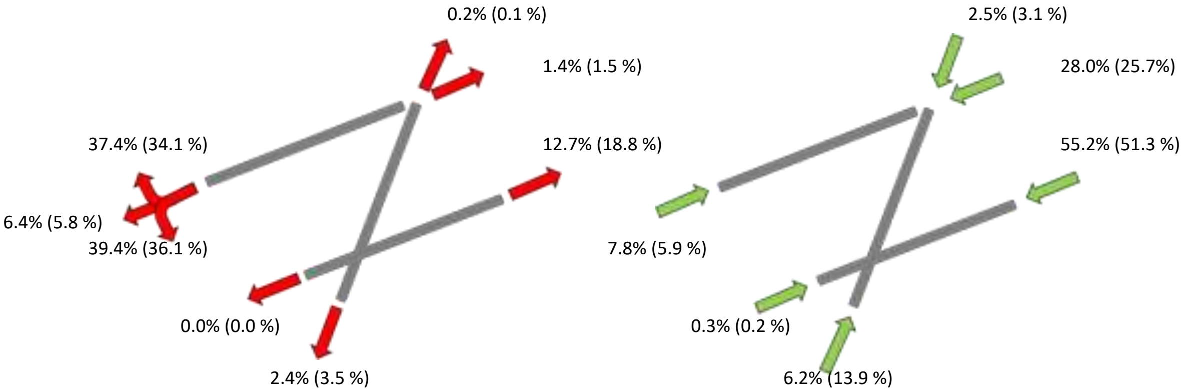
Table 9: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year (all flights, day, evening and night). The figures between brackets are the data for 2018.



All flights (day. evening. night)				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	76	213	0.1%	0.2%
07L	2,779	2,546	2.4%	2.2%
07R	19,760	13,202	16.8%	11.3%
19	5,352	4,451	4.5%	3.8%
25L	143	121	0.1%	0.1%
25R	89,619	96,694	76.1%	82.5%

All flights (day. evening. night)				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	16,295	8,185	13.8%	7.0%
07L	5,445	6,640	4.6%	5.7%
07R	734	1,176	0.6%	1.0%
19	3,921	3,384	3.3%	2.9%
25L	58,442	62,399	49.6%	53.2%
25R	32,893	35,449	27.9%	30.2%

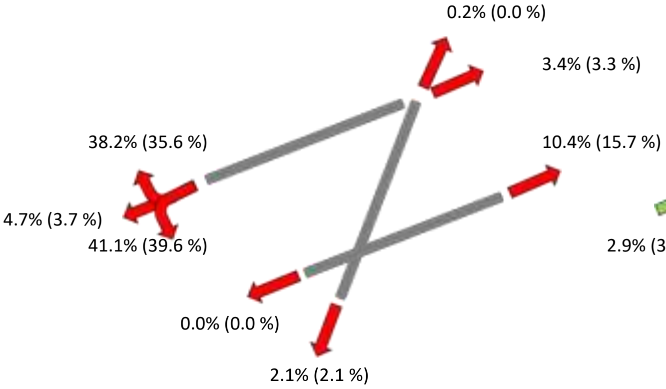
Table 10: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year: day. The figures between brackets are the data for 2018.

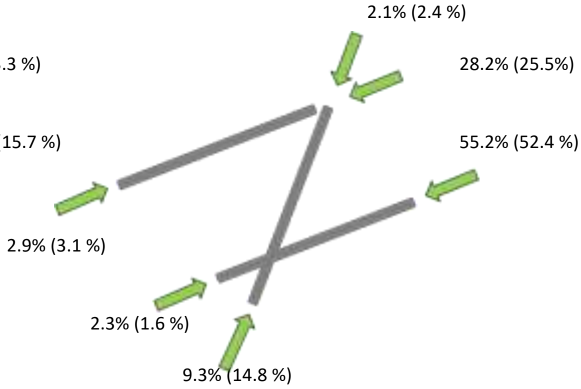


Flights day				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	61	167	0.1%	0.2%
07L	1,213	1,126	1.5%	1.4%
07R	14,729	10,006	18.8%	12.7%
19	2,761	1,906	3.5%	2.4%
25L	27	17	0.0%	0.0%
25R	59,645	65,342	76.0%	83.2%

Flights day				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	10,454	4,670	13.9%	6.2%
07L	4,426	5,809	5.9%	7.8%
07R	131	240	0.2%	0.3%
19	2,298	1,836	3.1%	2.5%
25L	38,564	41,258	51.3%	55.2%
25R	19,309	20,975	25.7%	28.0%

Table 11: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year: evening. The figures between brackets are the data for 2018.

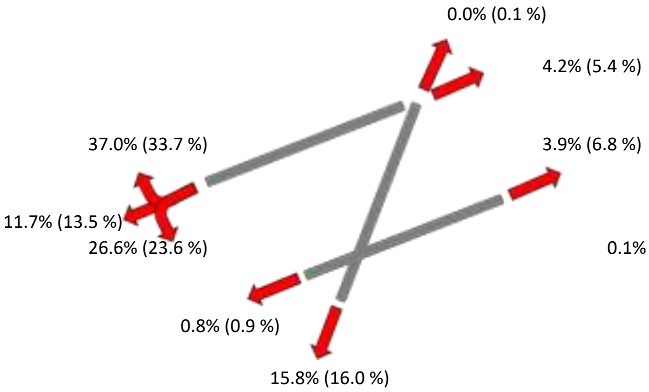


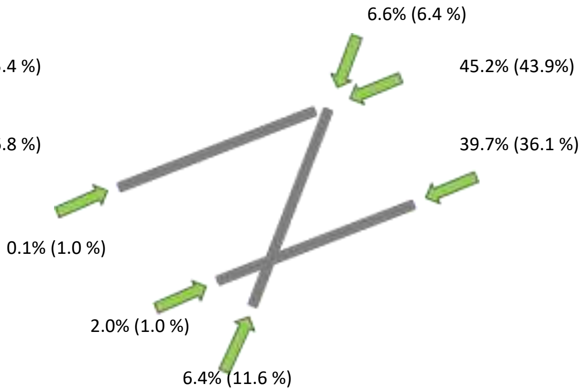


Flights evening				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	0	46	0.0%	0.2%
07L	877	891	3.3%	3.4%
07R	4,170	2,702	15.7%	10.4%
19	550	535	2.1%	2.1%
25L	0	3	0.0%	0.0%
25R	20,977	21,799	78.9%	83.9%

Flights evening				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	4,111	2,576	14.8%	9.3%
07L	865	812	3.1%	2.9%
07R	453	636	1.6%	2.3%
19	676	581	2.4%	2.1%
25L	14,518	15,315	52.4%	55.2%
25R	7,061	7,836	25.5%	28.2%

Table 12: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year: night. The figures between brackets are the data for 2018.





Flights night				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	15	0	0.1%	0.0%
07L	689	529	5.4%	4.2%
07R	861	494	6.8%	3.9%
19	2,041	2,010	16.0%	15.8%
25L	116	101	0.9%	0.8%
25R	8,997	9,553	70.7%	75.3%

Flights night				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	1,730	939	11.6%	6.4%
07L	154	19	1.0%	0.1%
07R	150	300	1.0%	2.0%
19	947	967	6.4%	6.6%
25L	5,360	5,826	36.1%	39.7%
25R	6,523	6,638	43.9%	45.2%

5.2 Location of the measuring stations

Figure 14: Location of the measuring stations.

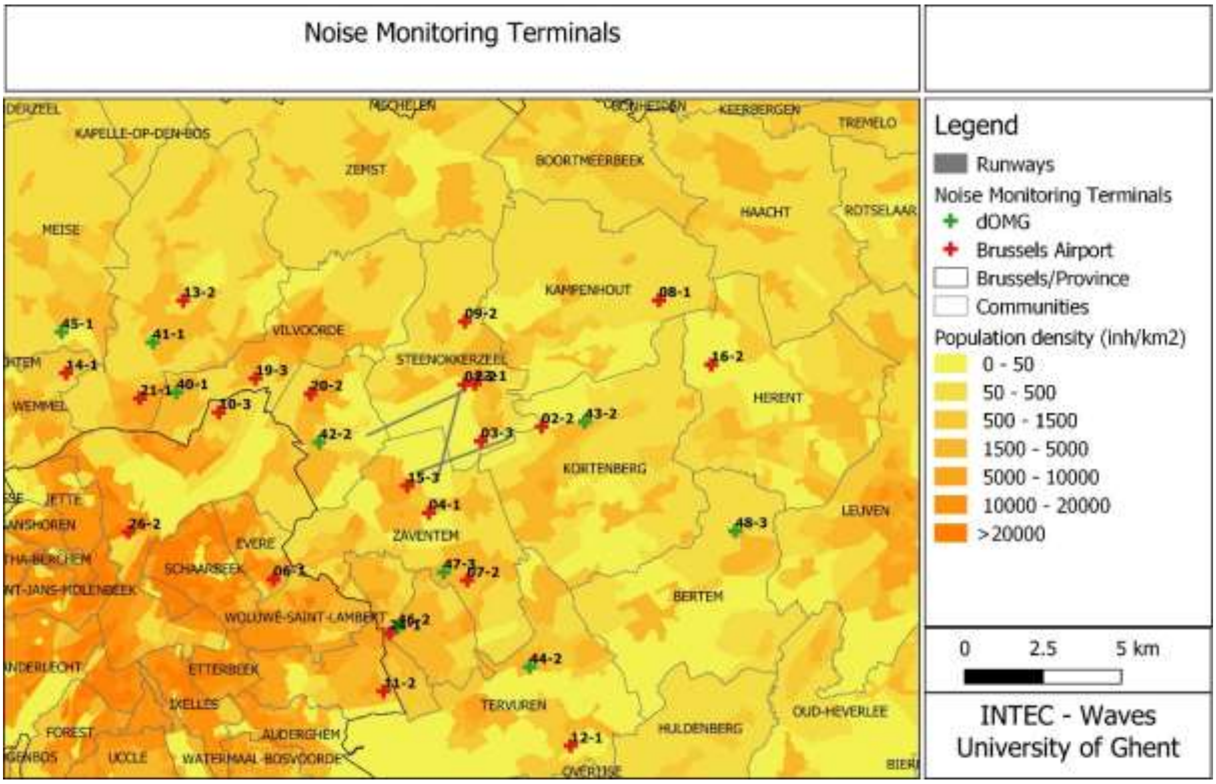


Table 13: Overview of the measuring points.

Code	Name
NMT01-2	STEENOKKERZEEL
NMT02-2	KORTENBERG
NMT03-3	HUMELGEM-Airside
NMT04-1	NOSSEGEM
NMT06-1	EVERE
NMT07-2	STERREBEEK
NMT08-1	KAMPENHOUT
NMT09-2	PERK
NMT10-3	NEDER-OVER-HEEMBEEK
NMT11-2	SINT-PIETERS-WOLUWE
NMT12-1	DUISBURG
NMT13-2	GRIMBERGEN
NMT14-1	WEMMEL
NMT15-3	ZAVENTEM
NMT16-2	VELTEM

Code	Name
NMT19-3/4	VILVOORDE
NMT20-2/3+	MACHELEN
NMT21-1	STROMBEEK-BEVER
NMT23-1	STEENOKKERZEEL
NMT24-1	KRAAINEM
NMT26-2	BRUSSEL
NMT40-1*	KONINGSLO
NMT41-1*	GRIMBERGEN
NMT42-2*	DIEGEM
NMT43-2*	ERPS-KWERPS
NMT44-2*	TERVUREN
NMT45-1*	MEISE
NMT46-2*	WEZEMBEEK-OPPEM
NMT47-3*	STERREBEEK
NMT48-3*	BERTEM

5.3 Results of contour calculations for 2019

5.3.1 Surface area per contour zone and per municipality

Table 14: Surface area per L_{day} contour zone and municipality – 2019.

Area (ha)	L_{day} contour zone in dB(A) (day 07:00-19:00)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	672	131	0	-	-	803
Evere	62	-	-	-	-	62
Haacht	34	-	-	-	-	34
Herent	235	-	-	-	-	235
Kampenhout	287	42	-	-	-	329
Kortenberg	408	193	43	-	-	645
Machelen	324	298	206	66	12	905
Steenokkerzeel	450	318	232	72	79	1,151
Vilvoorde	117	-	-	-	-	117
Zaventem	373	122	73	-	-	568
Totaal	**2,963**	**1,105**	**554**	**138**	**91**	**4,851**

Table 15: Surface area per $L_{evening}$ contour zone and municipality – 2019.

Area (ha)	$L_{evening}$ contour zone in dB(A) (evening 19:00-23:00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	433	670	169	2	-	-	1,274
Evere	408	104	-	-	-	-	512
Grimbergen	935	-	-	-	-	-	935
Haacht	557	34	-	-	-	-	591
Herent	566	229	-	-	-	-	795
Kampenhout	1,073	348	64	-	-	-	1,485
Kortenberg	453	368	177	39	-	-	1,037
Kraainem	485	31	-	-	-	-	516
Leuven	253	-	-	-	-	-	253
Machelen	202	343	283	201	67	16	1,113
Meise	9	-	-	-	-	-	9
Rotselaar	130	-	-	-	-	-	130
Schaarbeek	185	-	-	-	-	-	185
Sint-Lambrechts-Woluwe	476	-	-	-	-	-	476
Sint-Pieters-Woluwe	298	-	-	-	-	-	298
Steenokkerzeel	450	489	319	230	75	81	1,644
Tervuren	57	-	-	-	-	-	57
Vilvoorde	484	214	-	-	-	-	698
Wemmel	23	-	-	-	-	-	23
Wezembeek-Oppem	338	15	-	-	-	-	353
Zaventem	1,020	438	126	69	-	-	1,653
Total	**8,836**	**3,283**	**1,138**	**542**	**142**	**97**	**14,038**

Table 16: Surface area per L_{night} contour zone and municipality – 2019.

Area (ha)	L_{night} contour zone in dB(A) (night 23:00-07:00)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Boortmeerbeek	0	-	-	-	-	-	0
Brussel	636	487	20	-	-	-	1,143
Evere	363	-	-	-	-	-	363
Grimbergen	560	-	-	-	-	-	560
Haacht	714	44	-	-	-	-	758
Herent	549	212	-	-	-	-	761
Kampenhout	940	472	138	15	-	-	1,565
Kortenberg	418	313	139	28	2	-	901
Kraainem	274	7	-	-	-	-	281
Leuven	218	-	-	-	-	-	218
Machelen	225	403	314	131	28	8	1,109
Rotselaar	120	-	-	-	-	-	120
Schaarbeek	10	-	-	-	-	-	10
Sint-Lambrechts-Woluwe	101	-	-	-	-	-	101
Sint-Pieters-Woluwe	85	-	-	-	-	-	85
Steenokkerzeel	491	469	302	206	140	89	1,696
Tervuren	86	-	-	-	-	-	86
Vilvoorde	591	28	-	-	-	-	619
Wezembeek-Oppem	249	2	-	-	-	-	251
Zaventem	1,514	579	210	58	19	8	2,388
Zemst	27	-	-	-	-	-	27
Total	**8,172**	**3,016**	**1,124**	**437**	**190**	**105**	**13,044**

Table 17: Surface area per L_{den} contour zone and municipality – 2019.

Area (ha)	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	632	354	19	-	-	1,005
Evere	300	-	-	-	-	300
Grimbergen	157	-	-	-	-	157
Haacht	353	-	-	-	-	353
Herent	468	70	-	-	-	538
Kampenhout	724	258	47	-	-	1,028
Kortenberg	385	303	93	16	-	797
Kraainem	157	-	-	-	-	157
Leuven	81	-	-	-	-	81
Machelen	280	339	270	118	30	1,037
Schaarbeek	0	-	-	-	-	0
Sint-Lambrechts-Woluwe	44	-	-	-	-	44
Sint-Pieters-Woluwe	15	-	-	-	-	15
Steenokkerzeel	507	415	265	165	169	1,521
Vilvoorde	497	14	-	-	-	511
Wezembeek-Oppem	96	-	-	-	-	96
Zaventem	949	362	108	32	22	1,473
Total	**5,646**	**2,115**	**802**	**331**	**220**	**9,115**

Table 18: Surface area per Freq.70,day contour zone and municipality – 2019.

Area (ha)	Freq.70,day contour zone (07:00-23:00)					
Municipality	5-10	10-20	20-50	50-100	>100	Total
Brussel	393	279	384	391	162	1,609
Evere	8	242	255	8	-	513
Grimbergen	326	517	84	-	-	926
Haacht	97	172	111	-	-	381
Herent	240	122	188	109	33	693
Jette	4	-	-	-	-	4
Kampenhout	341	458	477	239	3	1,517
Kortenberg	188	127	222	192	377	1,107
Kraainem	151	210	74	-	-	435
Leuven	21	1	-	-	-	21
Machelen	46	72	141	173	596	1,027
Meise	84	6	-	-	-	90
Oudergem	1	-	-	-	-	1
Schaarbeek	219	19	-	-	-	238
Sint-Lambrechts-Woluwe	174	388	11	-	-	572
Sint-Pieters-Woluwe	139	116	-	-	-	255
Steenokkerzeel	216	131	261	338	574	1,520
Tervuren	71	-	-	-	-	71
Vilvoorde	100	159	394	22	-	676
Wemmel	156	6	-	-	-	161
Wezembeek-Oppem	93	65	56	-	-	214
Zaventem	392	343	592	134	99	1,561
Zemst	28	-	-	-	-	28
Total	**3,489**	**3,432**	**3,249**	**1,607**	**1,844**	**13,621**

Table 19: Surface area per Freq.70,night contour zone and municipality – 2019.

Area (ha)	Freq.70,night contour zone (23:00-07:00)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	223	-	-	-	223
Brussel	684	466	253	17	1,420
Evere	494	11	-	-	505
Grimbergen	680	-	-	-	680
Haacht	200	105	21	-	325
Herent	216	142	151	-	509
Kampenhout	616	220	545	-	1,382
Kortenberg	248	159	424	-	830
Kraainem	309	-	-	-	309
Leuven	37	-	-	-	37
Machelen	194	155	248	428	1,026
Mechelen	19	-	-	-	19
Oudergem	7	-	-	-	7
Schaarbeek	84	-	-	-	84
Sint-Lambrechts-Woluwe	314	-	-	-	314
Sint-Pieters-Woluwe	137	-	-	-	137
Steenokkerzeel	494	182	468	498	1,642
Tervuren	698	-	-	-	698
Vilvoorde	375	234	10	-	619
Wezembeek-Oppem	270	0	-	-	270
Zaventem	1,453	671	180	68	2,372
Zemst	83	-	-	-	83
Total	**7,834**	**2,345**	**2,299**	**1,012**	**13,489**

Table 20: Surface area per Freq.60,day contour zone and municipality – 2019.

Area (ha)	Freq.60,day contour zone (day 07:00-23:00)				
Municipality	50-100	100-150	150-200	>200	Total
Brussel	448	357	272	231	1,309
Evere	265	249	-	-	513
Grimbergen	1,129	-	-	-	1,129
Haacht	633	68	145	-	846
Herent	367	213	400	-	980
Kampenhout	1,011	400	17	-	1,428
Kortenberg	263	187	611	46	1,107
Kraainem	338	246	-	-	584
Leuven	105	200	6	-	311
Machelen	100	100	153	771	1,124
Meise	20	-	-	-	20
Rotselaar	558	64	-	-	622
Schaarbeek	127	-	-	-	127
Sint-Lambrechts-Woluwe	339	218	-	-	557
Sint-Pieters-Woluwe	251	130	-	-	381
Steenokkerzeel	287	254	210	908	1,659
Tervuren	784	56	-	-	840
Vilvoorde	511	153	2	-	665
Wemmel	360	-	-	-	360
Wezembeek-Oppem	363	227	-	-	589
Zaventem	557	373	101	283	1,314
Total	**8,816**	**3,495**	**1,916**	**2,239**	**16,467**

Table 21: Surface area per Freq.60,night contour zone and municipality – 2019.

Area (ha)	Freq.60,night contour zone (23:00-07:00)				
Municipality	10-15	15-20	20-30	>30	Total
Brussel	355	414	379	-	1,148
Evere	242	13	-	-	255
Grimbergen	736	-	-	-	736
Haacht	330	662	26	-	1,018
Herent	296	581	29	-	907
Kampenhout	271	632	527	-	1,430
Kortenberg	191	733	34	-	958
Kraainem	344	-	-	-	344
Leuven	121	172	-	-	293
Machelen	92	103	834	83	1,112
Meise	6	-	-	-	6
Rotselaar	830	115	-	-	946
Sint-Lambrechts-Woluwe	1	-	-	-	1
Sint-Pieters-Woluwe	93	-	-	-	93
Steenokkerzeel	119	170	456	924	1,669
Tervuren	271	-	-	-	271
Vilvoorde	551	38	0	-	589
Wemmel	106	-	-	-	106
Wezembeek-Oppem	527	-	-	-	527
Zaventem	319	141	195	289	944
Total	**5,802**	**3,774**	**2,480**	**1,296**	**13,352**

5.3.2 Number of inhabitants per contour zone and per municipality

Table 22: Number of inhabitants per L_{day} contour zone and municipality – 2019.

Number of Inhabitants	L_{day} contour zone in dB(A) (day 07:00-19:00)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	4,267	3,085	28	-	-	7,380
Evere	1,328	-	-	-	-	1,328
Haacht	7	-	-	-	-	7
Herent	619	-	-	-	-	619
Kampenhout	629	158	-	-	-	787
Kortenberg	1,819	307	5	-	-	2,130
Machelen	4,322	4,164	3,136	3	-	11,625
Steenokkerzeel	4,822	1,053	100	-	-	5,975
Vilvoorde	378	-	-	-	-	378
Zaventem	3,685	576	-	-	-	4,261
Total	**21,875**	**9,342**	**3,270**	**3**	**-**	**34,489**

Table 23: Number of inhabitants per $L_{evening}$ contour zone and municipality – 2019.

Number of Inhabitants	$L_{evening}$ contour zone in dB(A) (evening 19:00-23:00)						
Municipality	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	13,422	4,099	4,094	63	-	-	21,677
Evere	36,285	4,667	-	-	-	-	40,952
Grimbergen	19,126	-	-	-	-	-	19,126
Haacht	1,282	7	-	-	-	-	1,290
Herent	644	604	-	-	-	-	1,248
Kampenhout	4,173	987	195	-	-	-	5,354
Kortenberg	2,779	1,582	238	5	-	-	4,603
Kraainem	12,903	190	-	-	-	-	13,093
Leuven	975	-	-	-	-	-	975
Machelen	3,780	4,365	3,575	3,312	5	-	15,036
Meise	125	-	-	-	-	-	125
Rotselaar	272	-	-	-	-	-	272
Schaarbeek	33,181	-	-	-	-	-	33,181
Sint-Lambrechts-Woluwe	26,569	-	-	-	-	-	26,569
Sint-Pieters-Woluwe	13,056	-	-	-	-	-	13,056
Steenokkerzeel	2,832	5,246	1,231	151	-	-	9,460
Tervuren	182	-	-	-	-	-	182
Vilvoorde	15,825	1,446	-	-	-	-	17,271
Wemmel	235	-	-	-	-	-	235
Wezembeek-Oppem	8,306	219	-	-	-	-	8,524
Zaventem	17,291	5,553	482	-	-	-	23,326
Total	**213,243**	**28,965**	**9,814**	**3,531**	**5**	**-**	**255,558**

Table 24: Number of inhabitants per L_{night} contour zone and municipality – 2019.

Number of Inhabitants	L_{night} contour zone in dB(A) (night 23:00-07:00)						
Municipality	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**>70**	**Total**
Brussel	14,648	5,402	123	-	-	-	20,173
Evere	23,620	-	-	-	-	-	23,620
Grimbergen	15,612	-	-	-	-	-	15,612
Haacht	2,192	7	-	-	-	-	2,199
Herent	725	556	-	-	-	-	1,281
Kampenhout	3,507	1,293	257	123	-	-	5,180
Kortenberg	2,197	1,298	148	-	-	-	3,642
Kraainem	7,006	-	-	-	-	-	7,006
Leuven	699	-	-	-	-	-	699
Machelen	4,058	5,349	5,432	153	-	-	14,992
Rotselaar	70	-	-	-	-	-	70
Schaarbeek	177	-	-	-	-	-	177
Sint-Lambrechts-Woluwe	4,440	-	-	-	-	-	4,440
Sint-Pieters-Woluwe	3,241	-	-	-	-	-	3,241
Steenokkerzeel	2,555	4,955	1,690	254	66	-	9,519
Tervuren	1,462	-	-	-	-	-	1,462
Vilvoorde	13,500	130	-	-	-	-	13,630
Wezembeek-Oppem	5,211	-	-	-	-	-	5,211
Zaventem	22,094	8,989	415	-	-	-	31,498
Zemst	65	-	-	-	-	-	65
Total	**127,079**	**27,978**	**8,065**	**529**	**66**	**-**	**163,718**

Table 25: Number of inhabitants per L_{den} contour zone and municipality – 2019.

Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	6,035	4,951	143	-	-	11,129
Evere	15,225	-	-	-	-	15,225
Grimbergen	4,706	-	-	-	-	4,706
Haacht	457	-	-	-	-	457
Herent	954	32	-	-	-	986
Kampenhout	2,128	616	164	-	-	2,908
Kortenberg	2,202	1,014	58	-	-	3,274
Kraainem	3,550	-	-	-	-	3,550
Leuven	213	-	-	-	-	213
Machelen	4,241	4,916	4,427	271	-	13,855
Sint-Lambrechts-Woluwe	2,420	-	-	-	-	2,420
Sint-Pieters-Woluwe	803	-	-	-	-	803
Steenokkerzeel	3,987	3,763	656	112	-	8,518
Vilvoorde	9,642	79	-	-	-	9,721
Wezembeek-Oppem	2,151	-	-	-	-	2,151
Zaventem	13,849	3,860	1	-	-	17,710
Total	**72,561**	**19,231**	**5,448**	**383**	**-**	**97,624**

Table 26: Number of inhabitants per Freq.70,day contour zone and municipality – 2019.

Number of Inhabitants	Freq.70,day contour zone (07:00-23:00)					
Municipality	5-10	10-20	20-50	50-100	>100	Total
Brussel	32,043	5,453	2,059	6,066	-	45,621
Evere	1,213	26,846	12,863	64	-	40,985
Grimbergen	4,668	11,757	2,431	-	-	18,856
Haacht	402	266	87	-	-	755
Herent	470	138	733	-	24	1,366
Jette	529	-	-	-	-	529
Kampenhout	1,201	1,491	1,391	559	-	4,641
Kortenberg	1,338	1,041	2,408	-	980	5,767
Kraainem	814	10,357	1,410	-	-	12,582
Leuven	54	-	-	-	-	54
Machelen	827	1,458	2,440	9,031	-	13,756
Meise	828	76	-	-	-	904
Schaarbeek	31,016	1,015	-	-	-	32,032
Sint-Lambrechts-Woluwe	14,755	21,732	242	-	-	36,729
Sint-Pieters-Woluwe	5,797	5,974	-	-	-	11,771
Steenokkerzeel	1,362	1,019	2,629	3,304	84	8,398
Vilvoorde	4,899	4,315	7,706	74	-	16,994
Wemmel	1,318	45	-	-	-	1,364
Wezembeek-Oppem	2,402	1,625	1,245	-	-	5,273
Zaventem	2,715	16,068	4,562	2,643	-	25,988
Zemst	62	-	-	-	-	62
Total	**108,714**	**110,676**	**42,207**	**21,742**	**1,088**	**284,427**

Table 27: Number of inhabitants per Freq.70,night contour zone and municipality – 2019.

Number of Inhabitants	Freq.70,night contour zone (23:00-07:00)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	1,981	-	-	-	1,981
Brussel	21,460	3,031	4,473	120	29,084
Evere	39,759	82	-	-	39,841
Grimbergen	16,072	-	-	-	16,072
Haacht	442	66	2	-	511
Herent	220	463	232	-	915
Kampenhout	1,827	809	1,422	-	4,057
Kortenberg	1,283	1,002	1,198	-	3,482
Kraainem	11,935	-	-	-	11,935
Leuven	72	-	-	-	72
Machelen	3,179	2,464	3,534	4,508	13,685
Mechelen	119	-	-	-	119
Schaarbeek	15,368	-	-	-	15,368
Sint-Lambrechts-Woluwe	17,255	-	-	-	17,255
Sint-Pieters-Woluwe	4,853	-	-	-	4,853
Steenokkerzeel	3,377	1,767	2,318	1,651	9,114
Tervuren	4,995	-	-	-	4,995
Vilvoorde	10,171	3,515	61	-	13,747
Wezembeek-Oppem	5,351	6	-	-	5,357
Zaventem	24,185	6,868	1,787	295	33,135
Zemst	120	-	-	-	120
Total	**184,024**	**20,072**	**15,028**	**6,574**	**225,698**

Table 28: Number of inhabitants per Freq.60,day contour zone and municipality – 2019.

Number of Inhabitants	**Freq.60,day contour zone (07:00-23:00)**				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	27,302	2,116	1,275	4,881	35,573
Evere	28,018	12,967	-	-	40,985
Grimbergen	21,342	-	-	-	21,342
Haacht	2,123	122	156	-	2,401
Herent	801	150	893	-	1,844
Kampenhout	3,799	689	-	-	4,487
Kortenberg	879	872	2,795	-	4,547
Kraainem	7,081	6,626	-	-	13,707
Leuven	814	515	-	-	1,330
Machelen	1,450	1,894	2,140	9,645	15,129
Meise	408	-	-	-	408
Rotselaar	4,673	76	-	-	4,749
Schaarbeek	16,062	-	-	-	16,062
Sint-Lambrechts-Woluwe	23,826	9,711	-	-	33,537
Sint-Pieters-Woluwe	10,892	7,478	-	-	18,369
Steenokkerzeel	2,045	1,322	1,651	4,720	9,737
Tervuren	9,213	505	-	-	9,717
Vilvoorde	13,990	1,411	-	-	15,401
Wemmel	7,866	-	-	-	7,866
Wezembeek-Oppem	7,603	5,130	-	-	12,733
Zaventem	10,656	3,914	2,022	4,399	20,991
Total	**200,841**	**55,497**	**10,932**	**23,645**	**290,915**

Table 29: Number of inhabitants per Freq.60,night contour zone and municipality – 2019.

Number of Inhabitants	**Freq.60,night contour zone (23:00-07:00)**				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	22,423	3,871	5,338	-	31,633
Evere	15,760	531	-	-	16,291
Grimbergen	15,081	-	-	-	15,081
Haacht	1,339	1,857	7	-	3,203
Herent	600	1,094	5	-	1,699
Kampenhout	1,333	2,190	1,597	-	5,120
Kortenberg	924	2,941	-	-	3,865
Kraainem	8,535	-	-	-	8,535
Leuven	884	397	-	-	1,281
Machelen	1,284	1,800	11,893	2	14,979
Meise	52	-	-	-	52
Rotselaar	4,897	41	-	-	4,939
Sint-Lambrechts-Woluwe	5	-	-	-	5
Sint-Pieters-Woluwe	5,731	-	-	-	5,731
Steenokkerzeel	834	1,008	2,038	5,971	9,850
Tervuren	3,413	-	-	-	3,413
Vilvoorde	12,635	130	-	-	12,765
Wemmel	658	-	-	-	658
Wezembeek-Oppem	11,808	-	-	-	11,808
Zaventem	2,639	1,910	3,219	4,844	12,612
Total	**110,835**	**17,770**	**24,096**	**10,817**	**163,518**

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

Table 30: Number of inhabitants potentially highly inconvenienced contour zone and municipality – 2019.

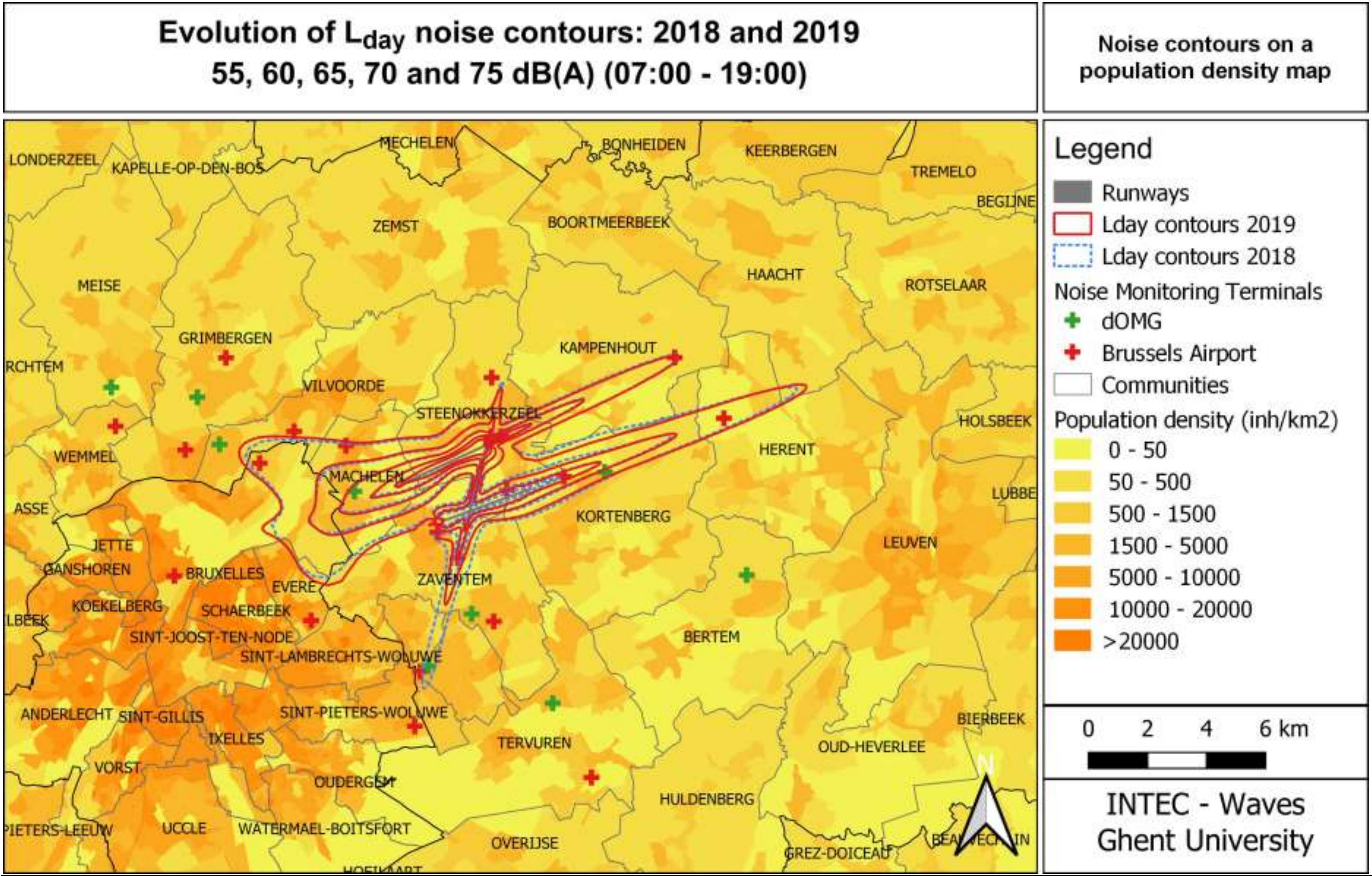
Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	768	1,082	48	-	-	1,898
Evere	1,754	-	-	-	-	1,754
Grimbergen	485	-	-	-	-	485
Haacht	51	-	-	-	-	51
Herent	131	5	-	-	-	136
Kampenhout	268	122	50	-	-	439
Kortenberg	279	199	17	-	-	495
Kraainem	393	-	-	-	-	393
Leuven	22	-	-	-	-	22
Machelen	562	1,018	1,351	101	-	3,032
Sint-Lambrechts-Woluwe	241	-	-	-	-	241
Sint-Pieters-Woluwe	85	-	-	-	-	85
Steenokkerzeel	547	764	189	46	-	1,545
Vilvoorde	1,116	13	-	-	-	1,129
Wezembeek-Oppem	250	-	-	-	-	250
Zaventem	1,705	759	0	-	-	2,464
Total	**8,656**	**3,962**	**1,655**	**147**	**-**	**14,420**

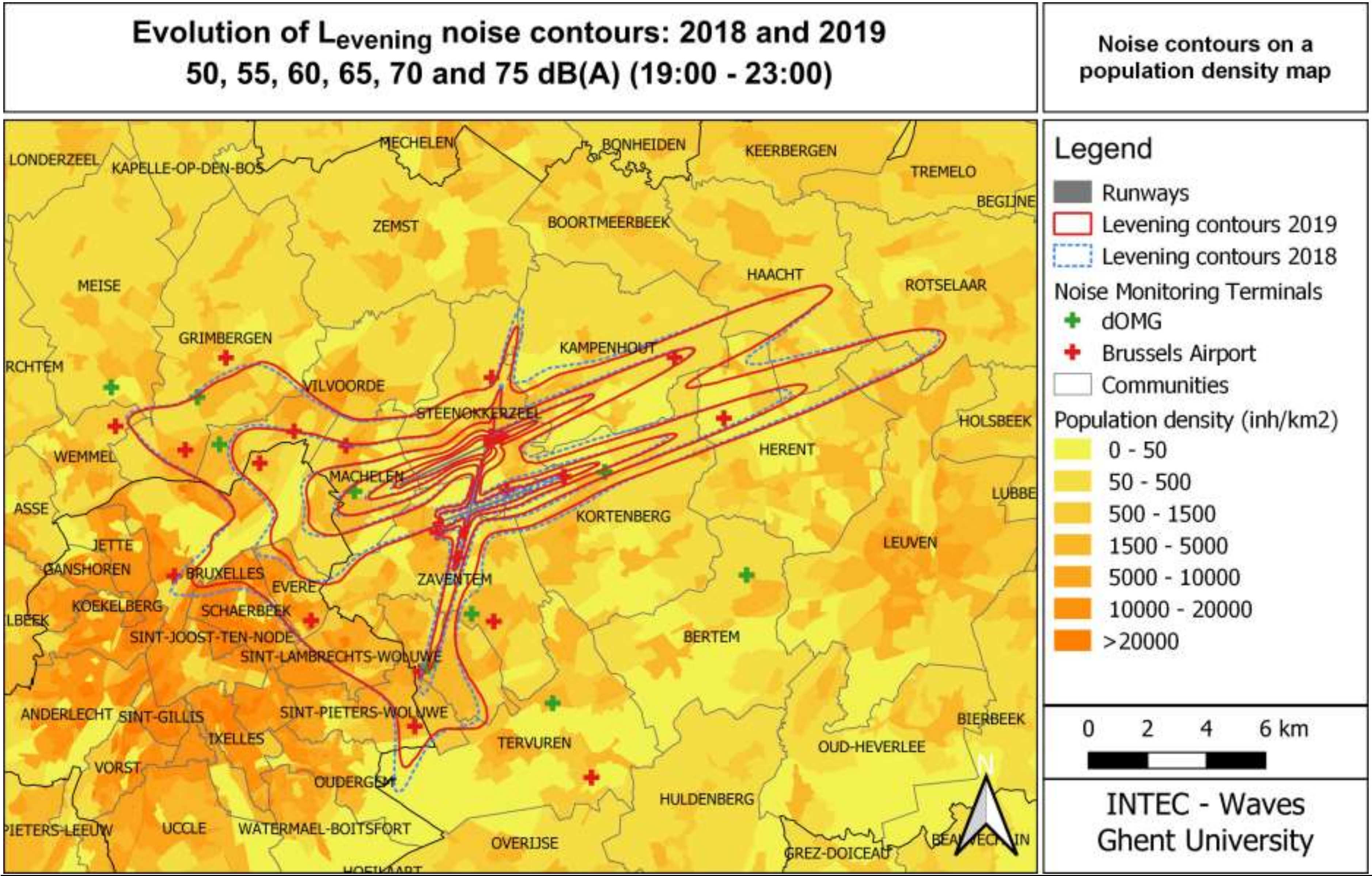
5.4 Noise contour maps: evolution 2018-2019

This appendix includes noise maps in A4 format.

- L_{day} noise contours for 2018 and 2019, background population map – 2019
- $L_{evening}$ noise contours for 2018 and 2019, background population map – 2019
- L_{night} noise contours for 2018 and 2019, background population map – 2019
- L_{den} noise contours for 2018 and 2019, background population map – 2019
- Freq.70,day noise contours for 2018 and 2019, background population map – 2019
- Freq.70,night noise contours for 2018 and 2019, background population map – 2019
- Freq.60,day noise contours for 2018 and 2019, background population map – 2019
- Freq.60,night noise contours for 2018 and 2019, background population map – 2019

- L_{day} noise contours for 2018 and 2019, background NGI topographical map
- $L_{evening}$ noise contours for 2018 and 2019, background NGI topographical map
- L_{night} noise contours for 2018 and 2019, background NGI topographical map
- L_{den} noise contours for 2018 and 2019, background NGI topographical map
- Freq.70,day noise contours for 2018 and 2019, background NGI topographical map
- Freq.70,night noise contours for 2018 and 2019, background NGI topographical map
- Freq.60,day noise contours for 2018 and 2019, background NGI topographical map
- Freq.60,night noise contours for 2018 and 2019, background NGI topographical map


Evolution of Lday noise contours: 2018 and 2019
55, 60, 65, 70 and 75 dB(A) (07:00 - 19:00)
Noise contours on a population density map
Legend
Runways
Lday contours 2019
Lday contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
N


Evolution of Levening noise contours: 2018 and 2019
50, 55, 60, 65, 70 and 75 dB(A) (19:00 - 23:00)
Noise contours on a population density map
Legend
Runways
Levening contours 2019
Levening contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
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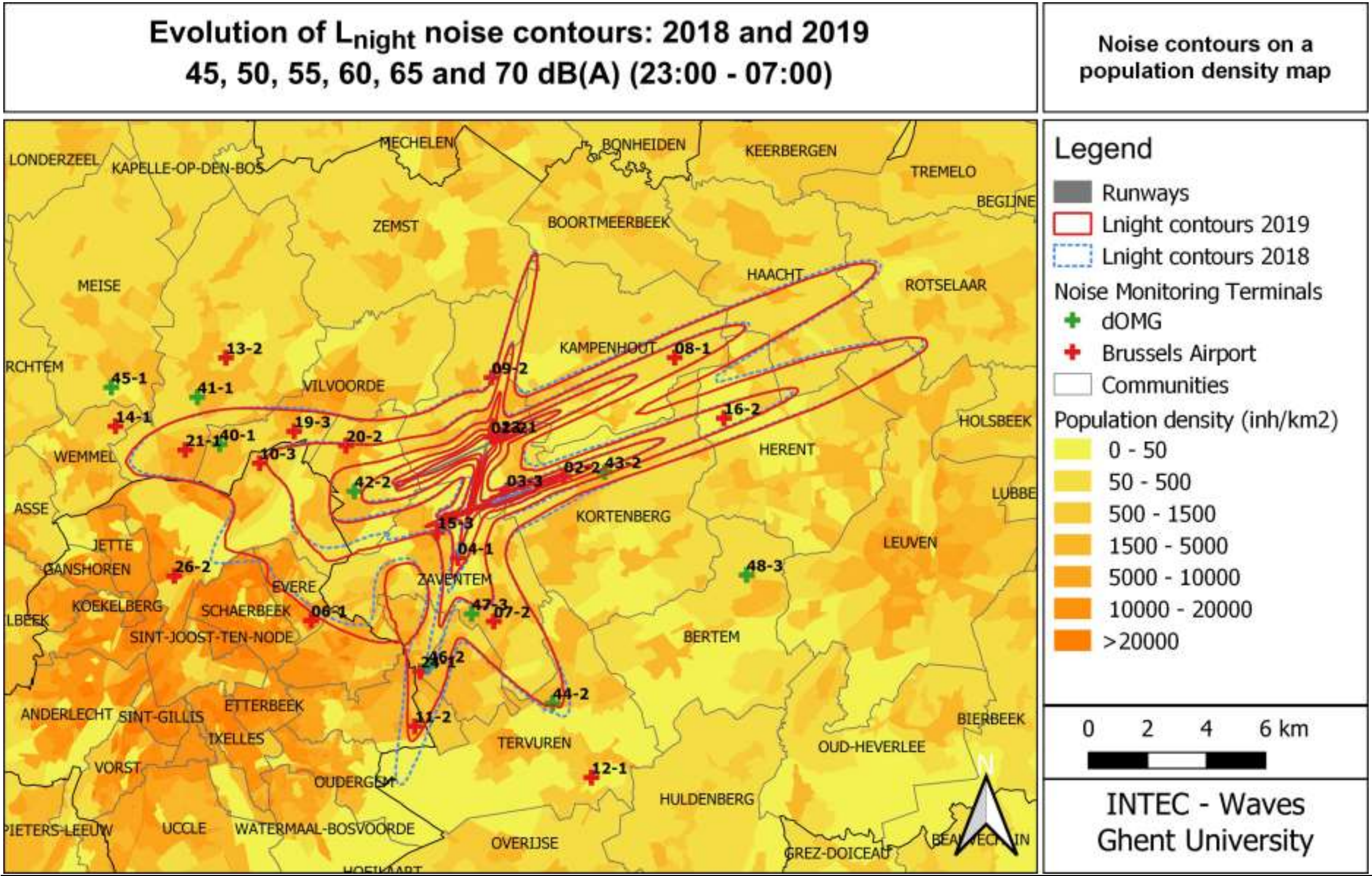
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
N



Evolution of Lnight noise contours: 2018 and 2019
45, 50, 55, 60, 65 and 70 dB(A) (23:00 - 07:00)
Noise contours on a population density map
Legend
Runways
Lnight contours 2019
Lnight contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
KAMPENHOUT
VILVOORDE
HOLSBEEK
HERENT
WEMMEL
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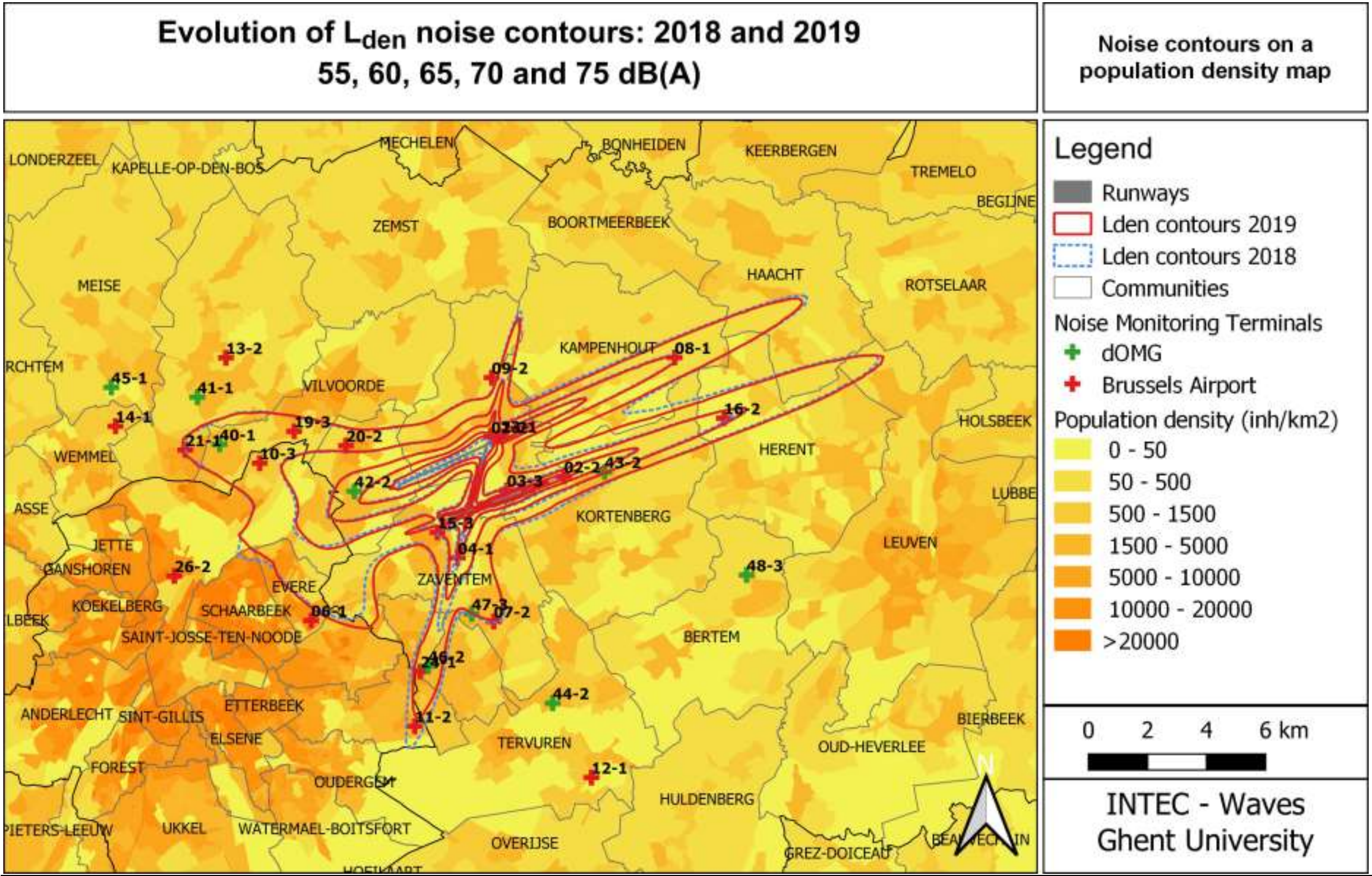
KORTENBERG
LUBBE
JETTE
GANSHOREN
EVERE
ZAVENTEM
LEUVEN
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
ETTERBEEK
ANDERLECHT
SINT-GILLIS
IXELLES
TERVUREN
BIERBEEK
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAAL-BOSVOORDE
OVERIJSE
GREZ-DOICEAU
13-2
45-1
41-1
14-1
21-1
40-1
19-3
20-2
10-3
09-2
08-1
16-2
42-2
03-3
02-2
43-2
15-3
04-1
26-2
06-1
47-3
07-2
46-2
44-2
11-2
12-1
48-3


Evolution of L_{den} noise contours: 2018 and 2019
55, 60, 65, 70 and 75 dB(A)
Noise contours on a population density map
Legend
Runways
Lden contours 2019
Lden contours 2018
Communities
Noise Monitoring Terminals
dOMG
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
KAMPENHOUT
VILVOORDE
HOLSBEEK
HERENT
WEMMEL
ASSE
KORTENBERG
LUBBE
LEUVEN
JETTE
GANSHOREN
EVERE
ZAVENTEM
KOEKELBERG
SCHAARBEEK
SAINT-JOSSE-TEN-NOODE
BERTEM
ANDERLECHT
SINT-GILLIS
ETTERBEEK
ELSENE
TERVUREN
BIERBEEK
OUD-HEVERLEE
FOREST
OUDERGEM
HULDENBERG
UKKEL
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
13-2
45-1
41-1
14-1
21-1
40-1
10-3
19-3
20-2
09-2
08-1
16-2
42-2
03-3
02-2
43-2
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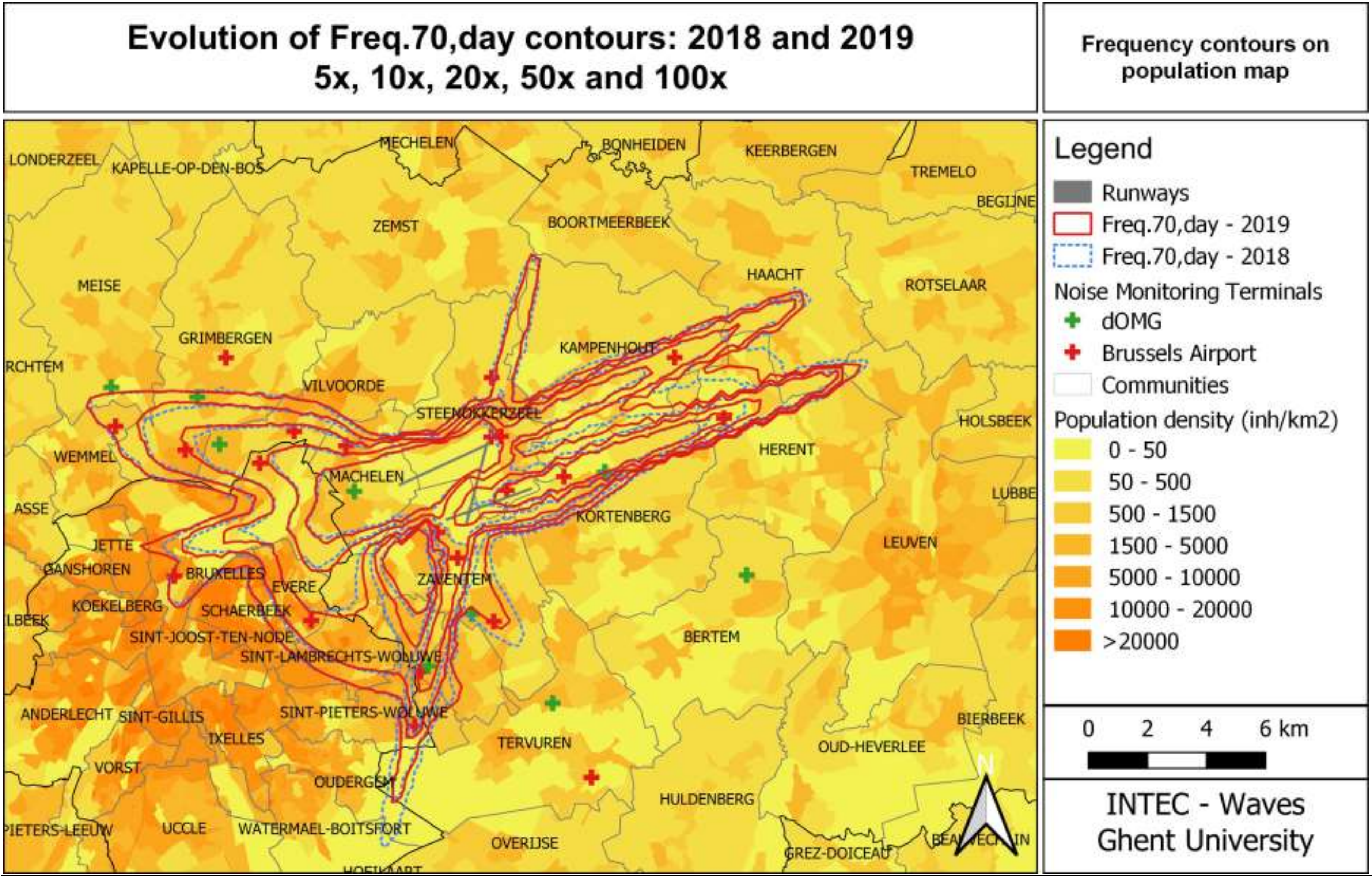
11-2
44-2
48-3
12-1
N


Evolution of Freq.70,day contours: 2018 and 2019
5x, 10x, 20x, 50x and 100x
Frequency contours on population map
Legend
Runways
Freq.70,day - 2019
Freq.70,day - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
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KEERBERGEN
TREMELO
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
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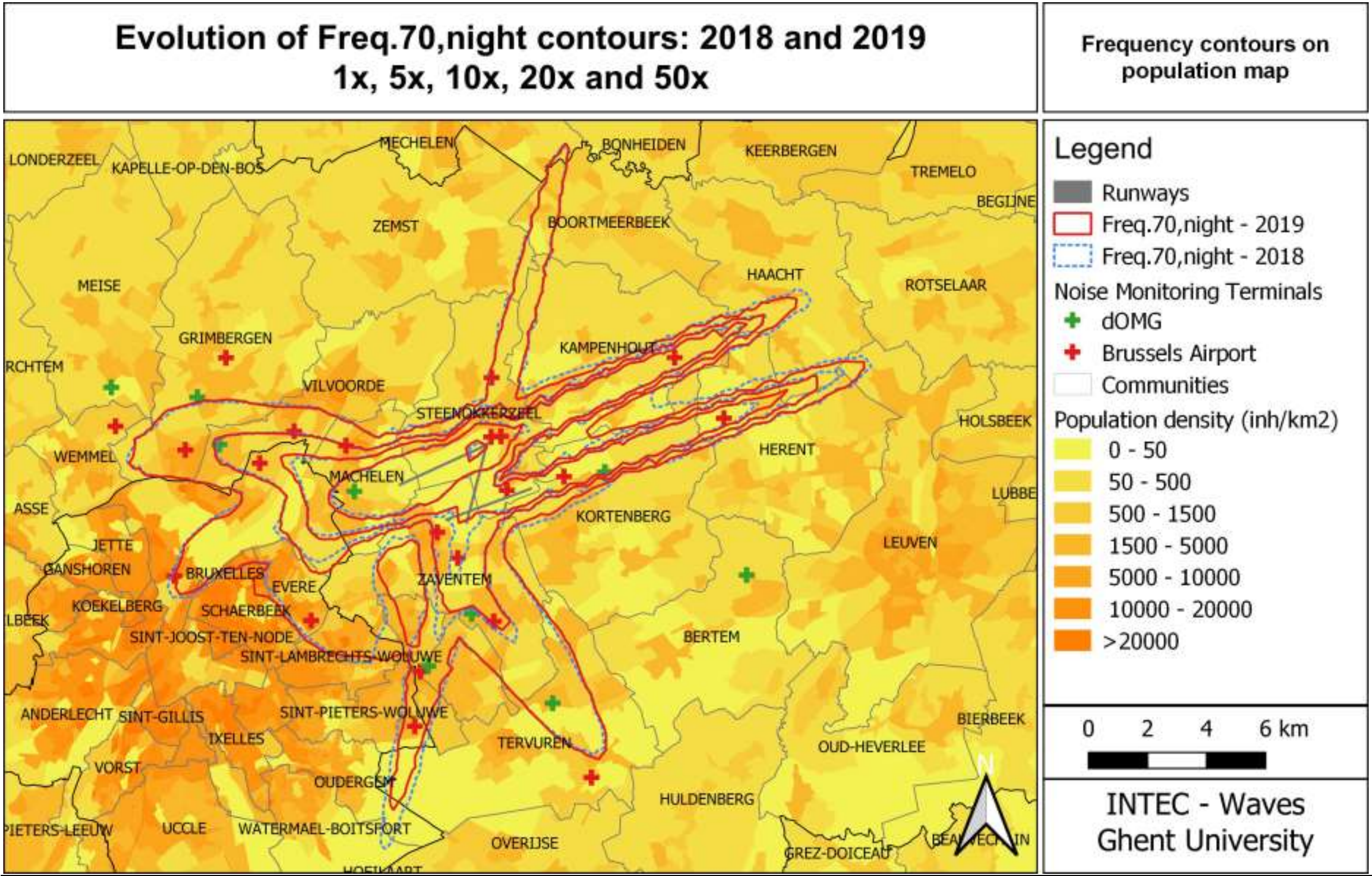
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
N


Evolution of Freq.70,night contours: 2018 and 2019
1x, 5x, 10x, 20x and 50x
Frequency contours on population map
Legend
Runways
Freq.70,night - 2019
Freq.70,night - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
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BOORTMEERBEEK
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GRIMBERGEN
KAMPENHOUT
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
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KORTENBERG
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BRUXELLES
EVERE
ZAVENTEM
LEUVEN
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
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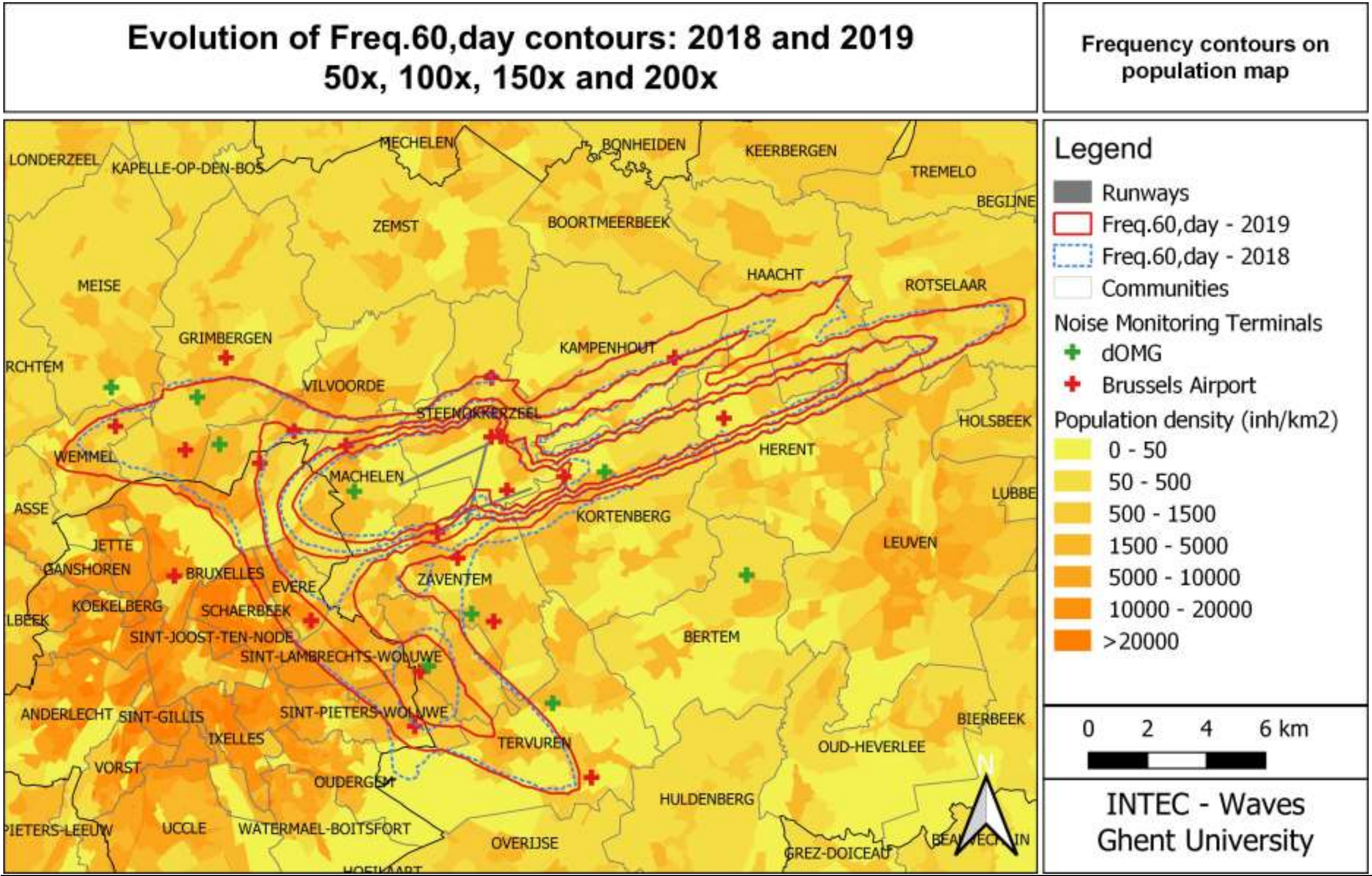
Evolution of Freq.60,day contours: 2018 and 2019
50x, 100x, 150x and 200x
Frequency contours on population map
Legend
Runways
Freq.60,day - 2019
Freq.60,day - 2018
Communities
Noise Monitoring Terminals
dOMG
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
MACHELEN
HERENT
ASSE
KORTENBERG
JETTE
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
LEUVEN
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
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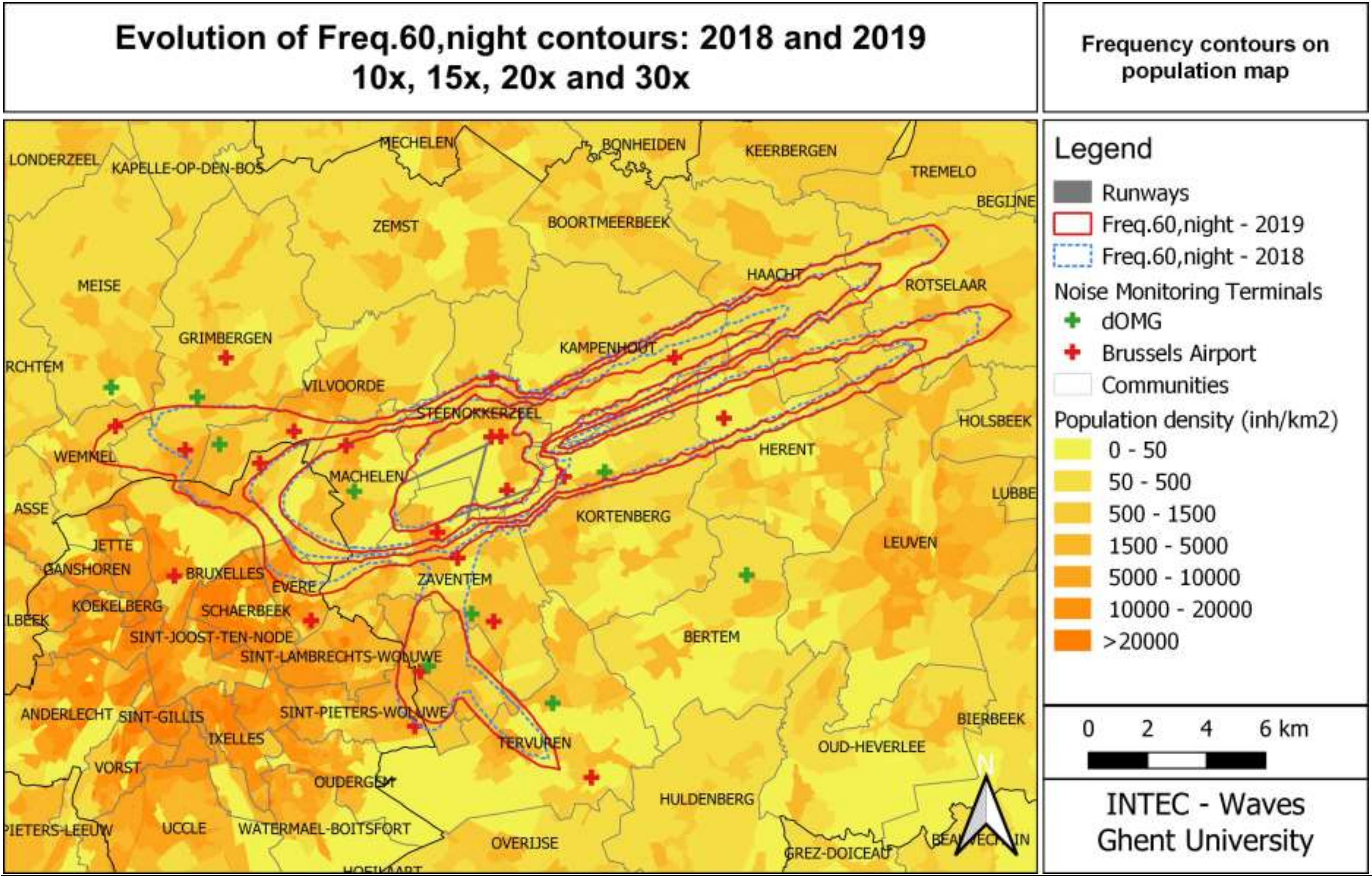
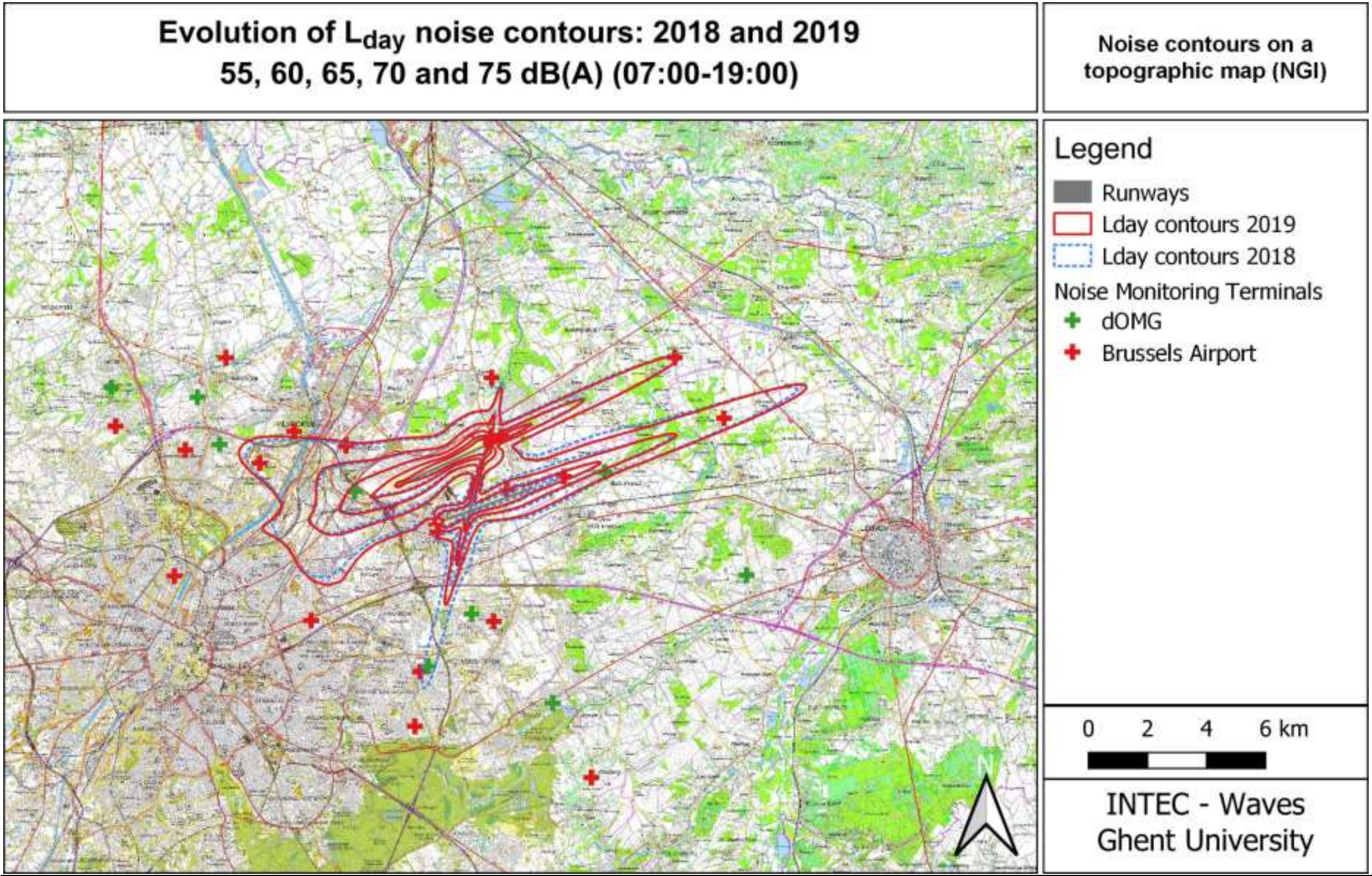
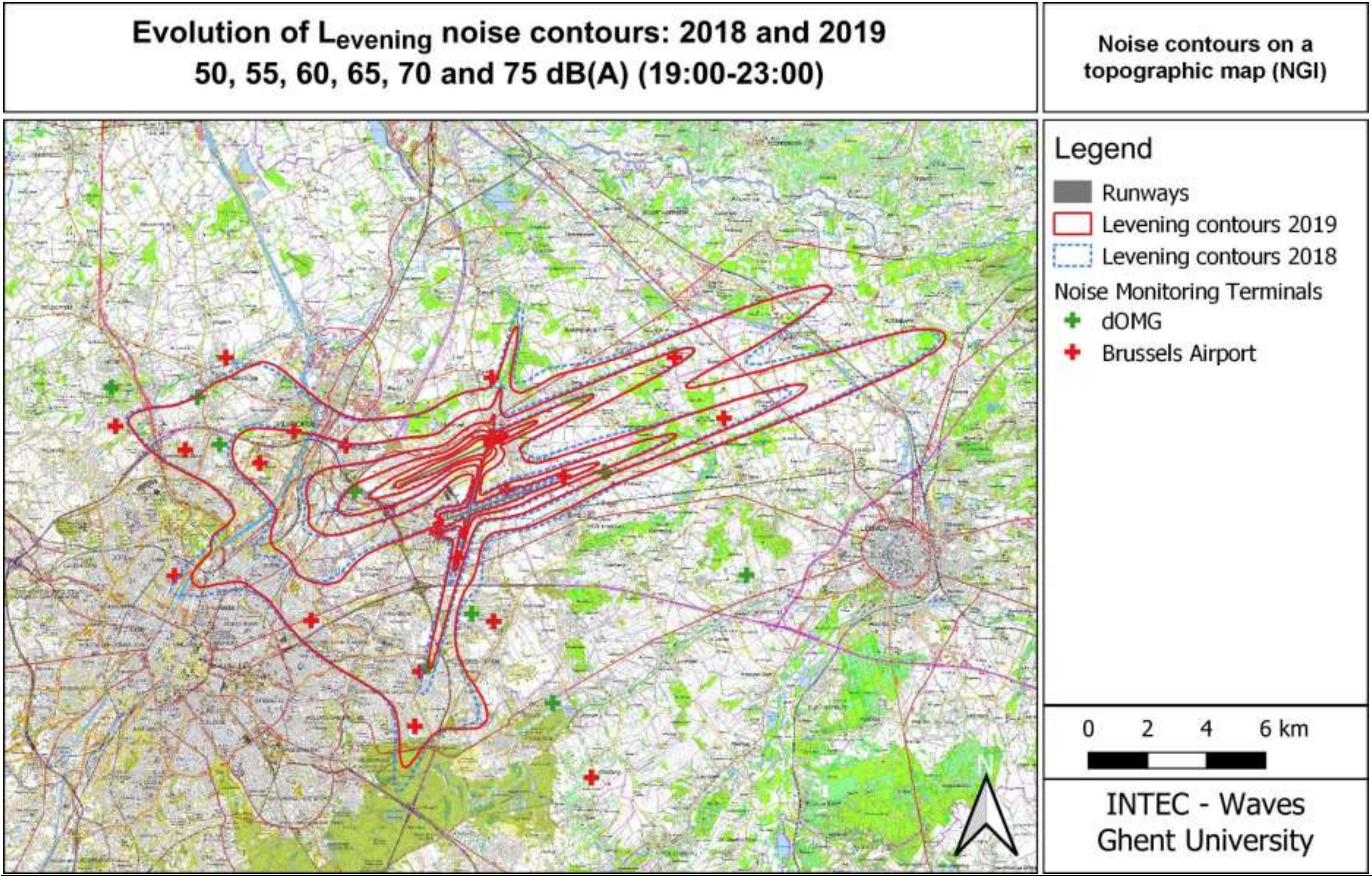
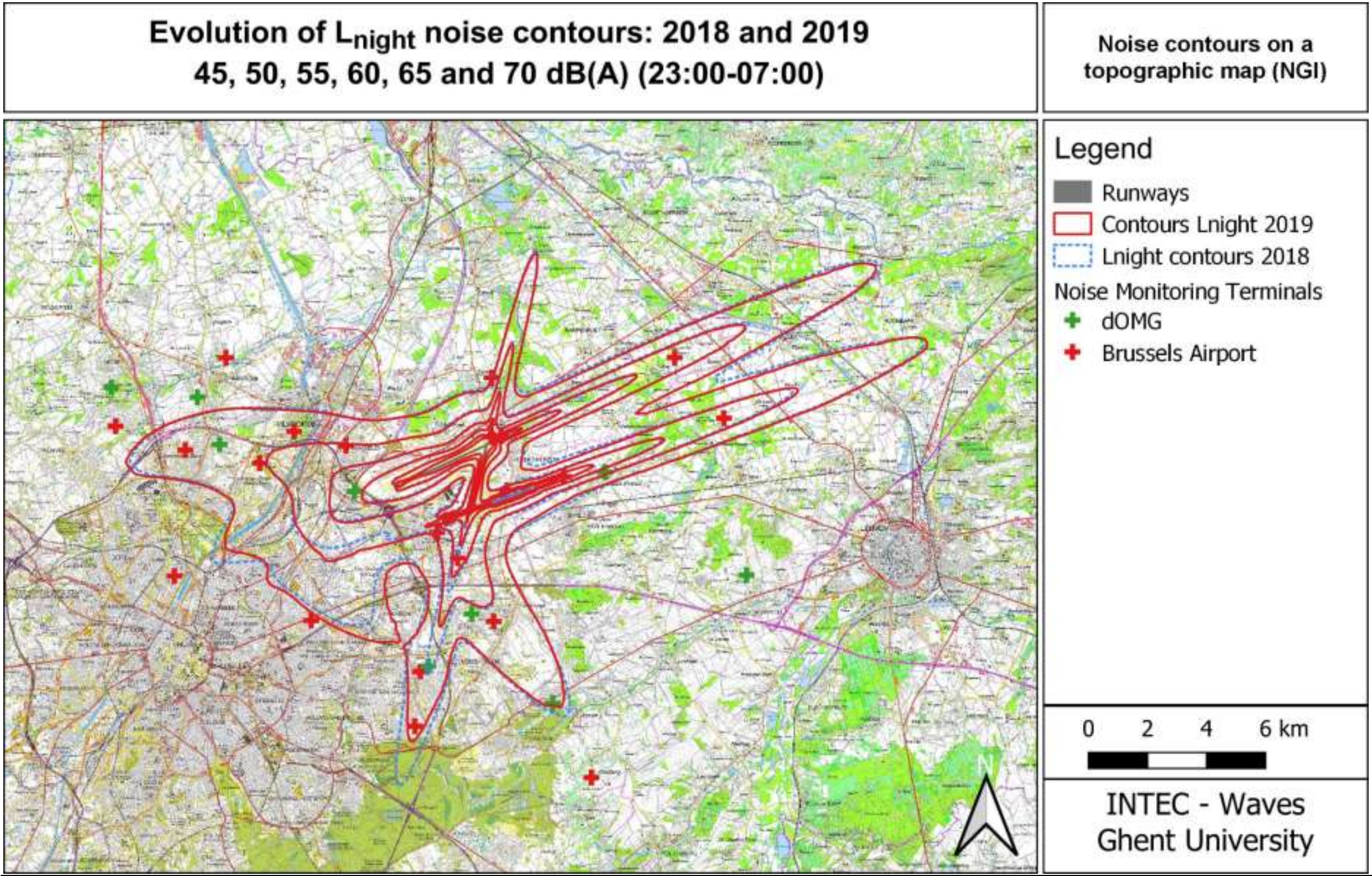
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU



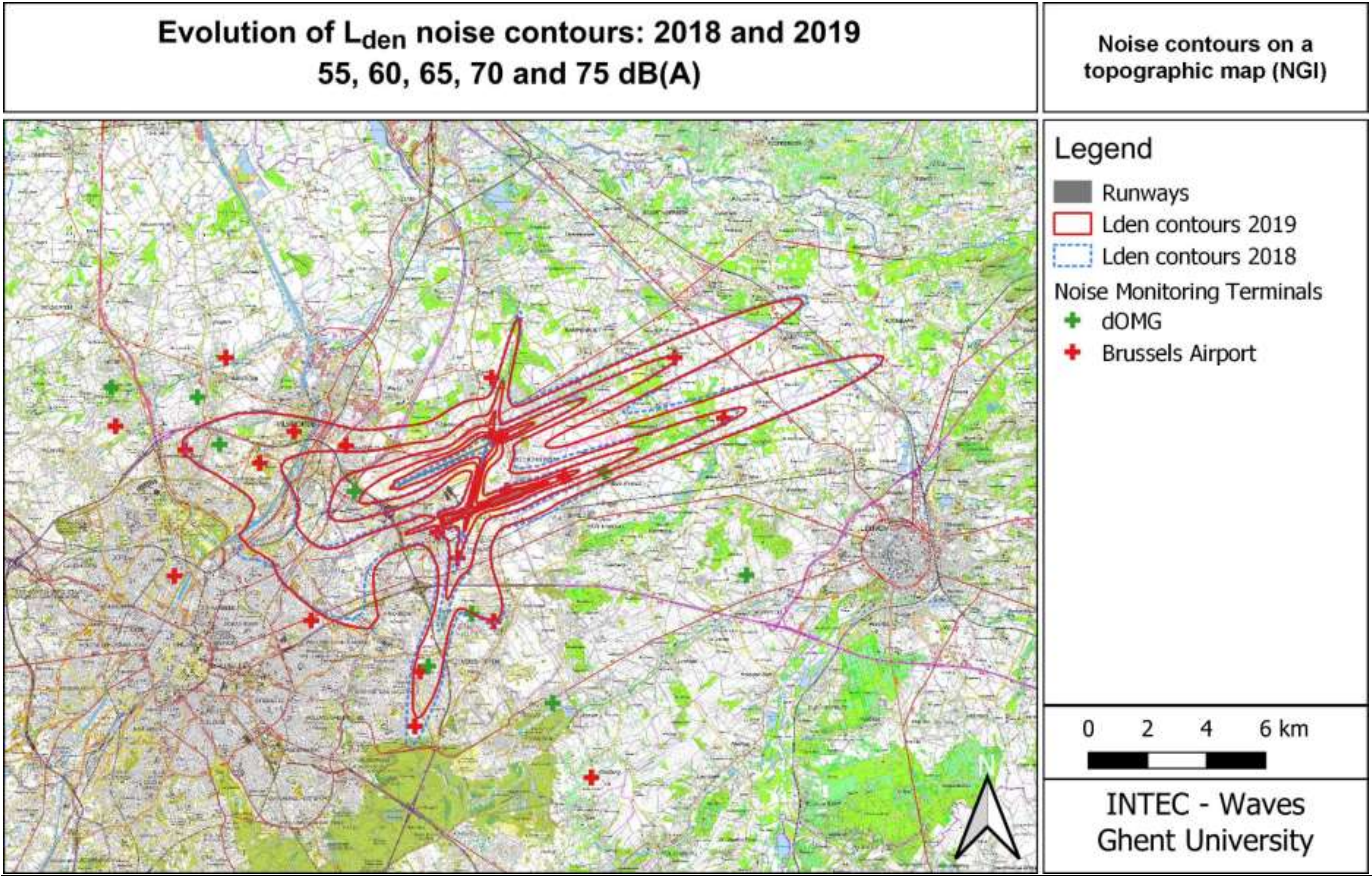
Evolution of Freq.60,night contours: 2018 and 2019
10x, 15x, 20x and 30x
Frequency contours on population map
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
MACHELEN
HERENT
ASSE
KORTENBERG
LUBBE
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU
Legend
Runways
Freq.60,night - 2019
Freq.60,night - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University

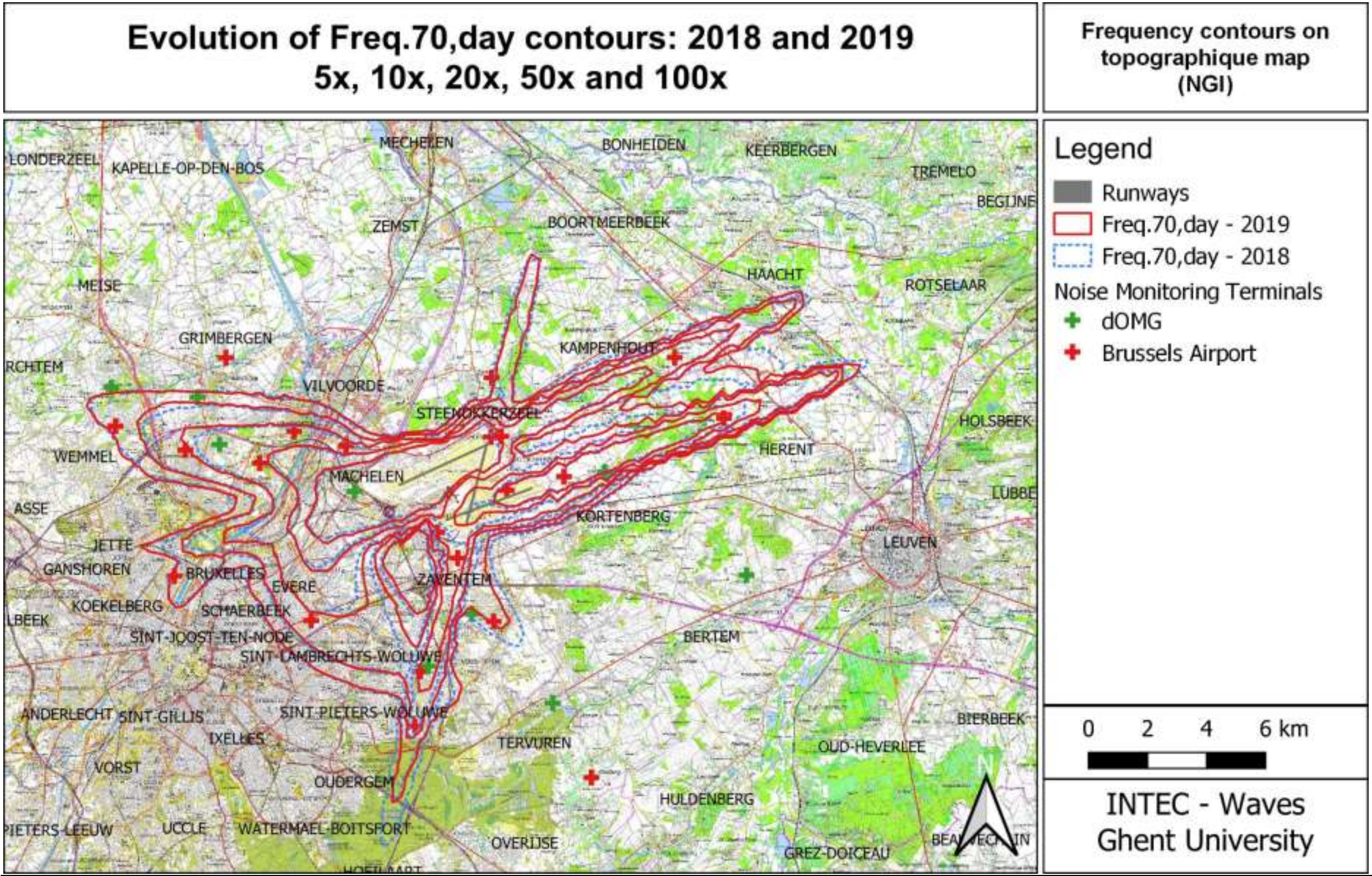

Evolution of L_day noise contours: 2018 and 2019
55, 60, 65, 70 and 75 dB(A) (07:00-19:00)
Noise contours on a topographic map (NGI)
Legend
Runways
Lday contours 2019
Lday contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University

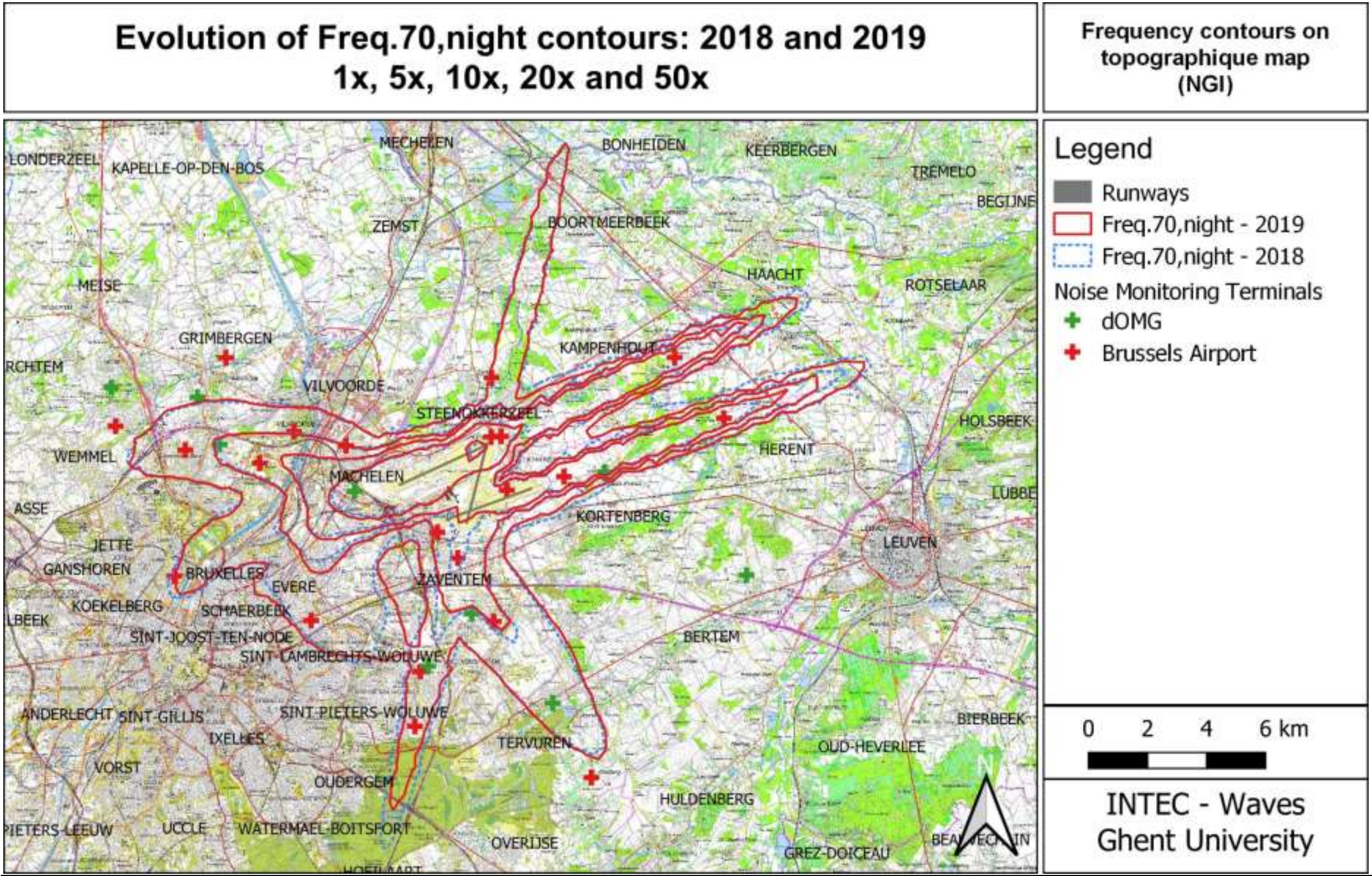

Evolution of Levening noise contours: 2018 and 2019
50, 55, 60, 65, 70 and 75 dB(A) (19:00-23:00)
Noise contours on a topographic map (NGI)
Legend
Runways
Levening contours 2019
Levening contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University

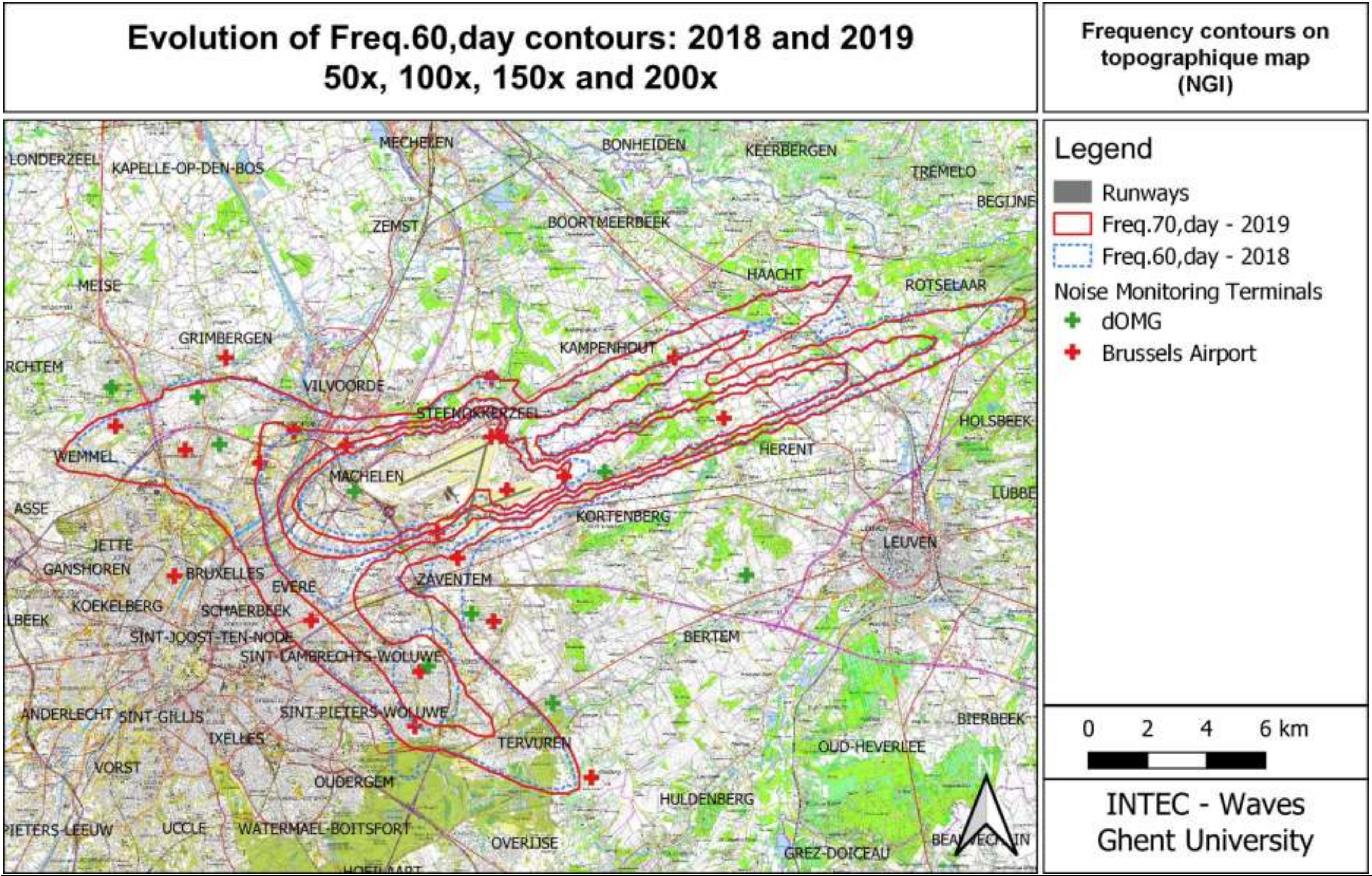


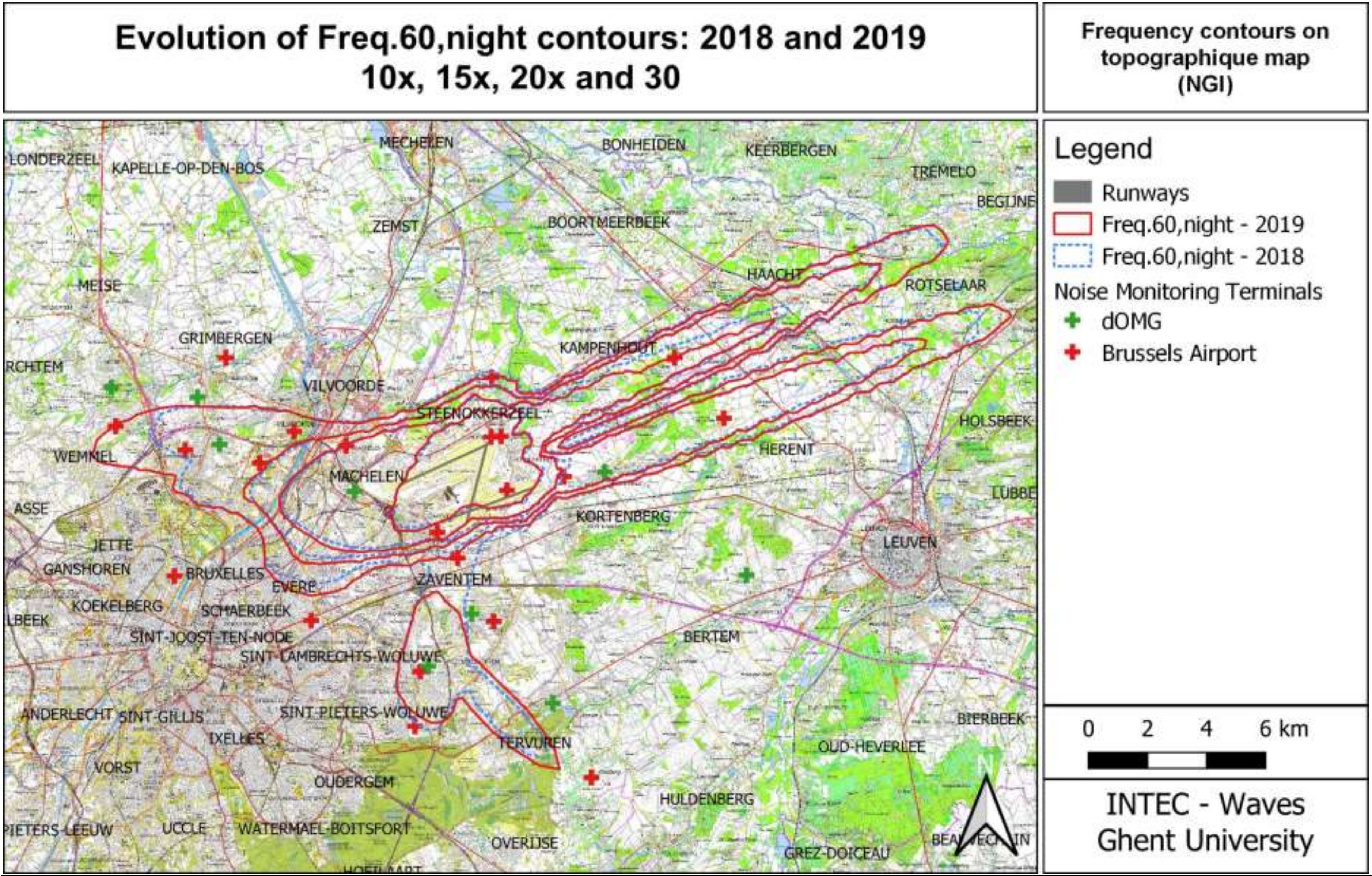
Evolution of Lnight noise contours: 2018 and 2019
45, 50, 55, 60, 65 and 70 dB(A) (23:00-07:00)
Noise contours on a topographic map (NGI)
Legend
Runways
Contours Lnight 2019
Lnight contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University


Evolution of L_den noise contours: 2018 and 2019
55, 60, 65, 70 and 75 dB(A)
Noise contours on a topographic map (NGI)
Legend
Runways
Lden contours 2019
Lden contours 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University


Evolution of Freq.70,day contours: 2018 and 2019
5x, 10x, 20x, 50x and 100x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.70,day - 2019
Freq.70,day - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of Freq.70,night contours: 2018 and 2019
1x, 5x, 10x, 20x and 50x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.70,night - 2019
Freq.70,night - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
BERTEM
SINT-JOOST-TEN-NODE
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of Freq.60,day contours: 2018 and 2019
50x, 100x, 150x and 200x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.70,day - 2019
Freq.60,day - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
GRIMBERGEN
KAMPENHOUT
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of Freq.60,night contours: 2018 and 2019
10x, 15x, 20x and 30
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.60,night - 2019
Freq.60,night - 2018
Noise Monitoring Terminals
dOMG
Brussels Airport
0 2 4 6 km
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
KAMPENHOUT
RCHTEM
VILVOORDE
STEENOKKERZEEL
HOLSBEEK
WEMMEL
HERENT
MACHELEN
LUBBE
ASSE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SINT-GILLIS
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

5.5 Evolution of the surface area and the number of inhabitants

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

Table 31: Evolution of the surface area inside the L_{day} contours (2000, 2006-2019).

Area (ha)	L_{day} contour zone in dB(A) (day 07.00-19.00)*					
Year	55-60	60-65	65-70	70-75	>75	Totaal
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**

* Calculated with INM 7.0b

Figure 15: Evolution of the surface area inside the L_{day} contours (2000, 2006-2019).

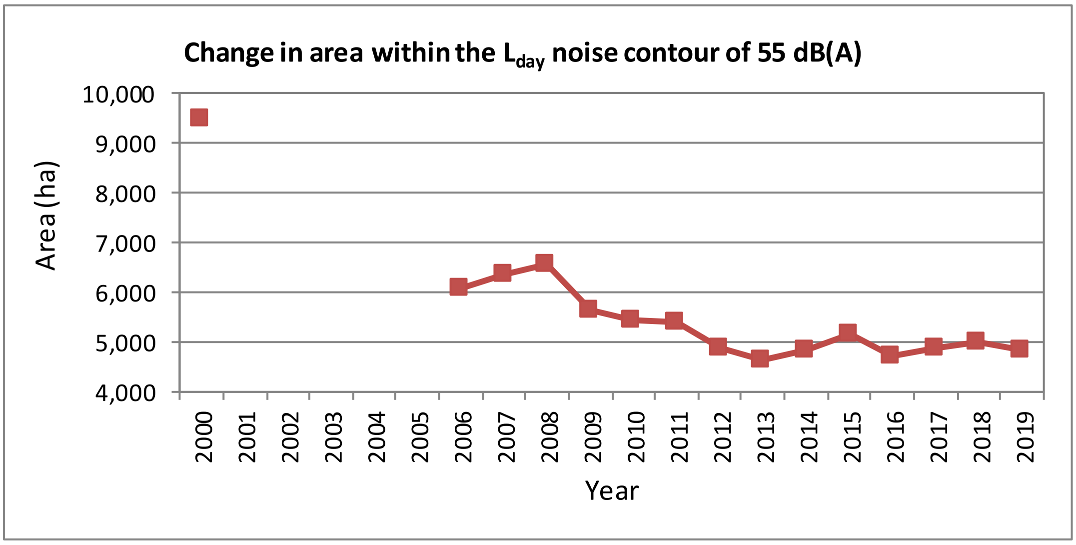


Table 32: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2019).

Area (ha)	$L_{evening}$ contour zone in dB(A) (evening 19.00-23.00)*						
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**

* Calculated with INM 7.0b

Figure 16: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2019).

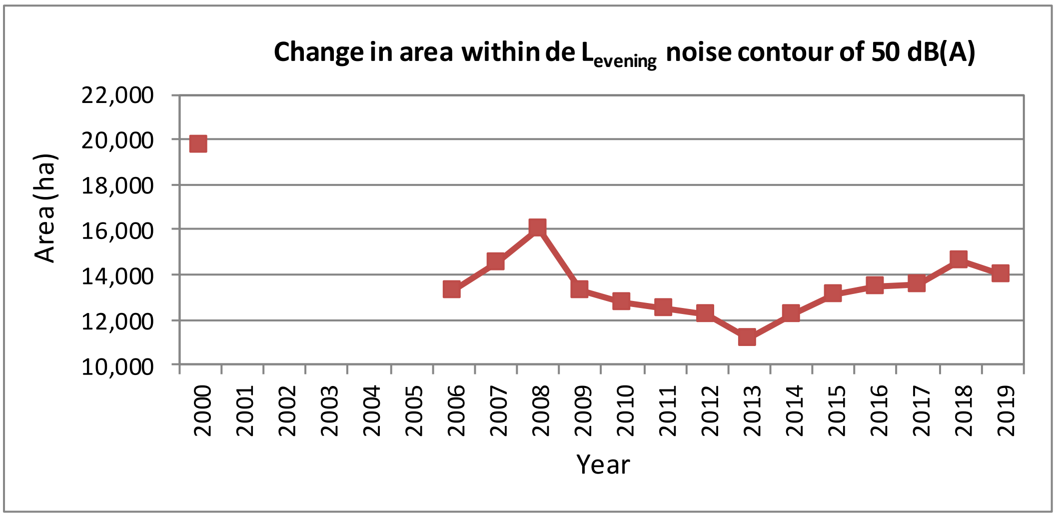


Table 33: : Evolution of the surface area inside the L_{night} contours (2000, 2006-2019).

Area (ha)	L_{night} contour zone in dB(A) (night 23.00-07.00)						
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**

* Calculated with INM 7.0b

Figure 17: Evolution of the surface area inside the L_{night} contours (2000, 2006-2019).

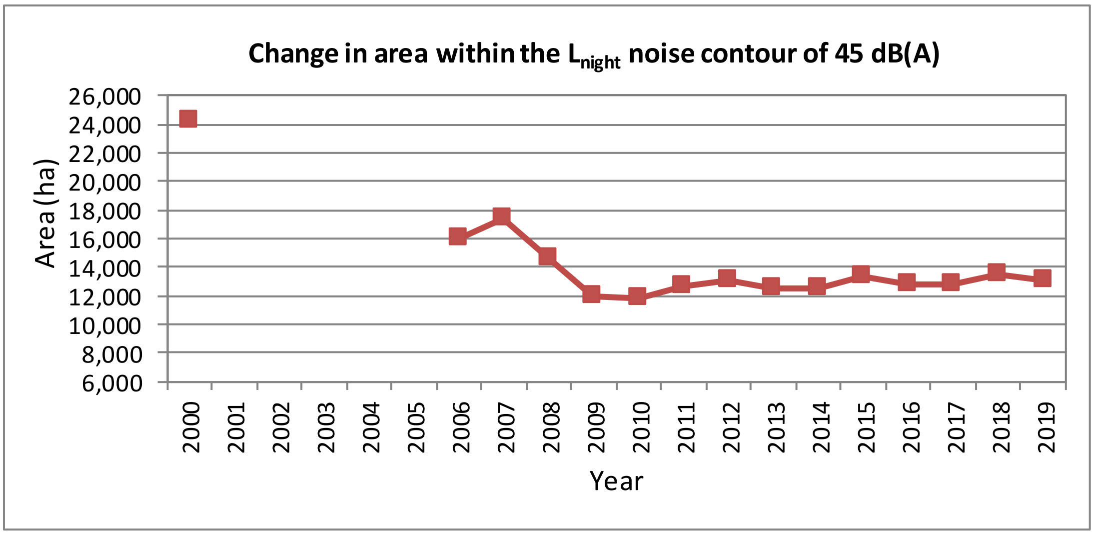


Table 34: : Evolution of the surface area inside the L_{den} contours (2000, 2006-2019).

Area (ha)	L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)*					
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**

* Calculated with INM 7.0b

Figure 18: Evolution of the surface area inside the L_{den} contours (2000, 2006-2019).

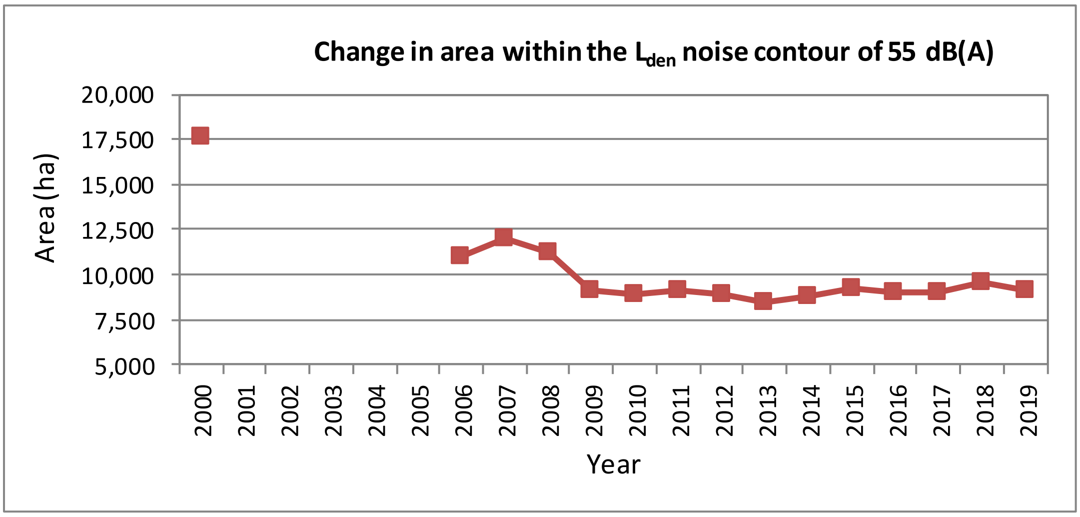


Table 35: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2019).

Area (ha)	Freq.70,day contour zone (day 07.00-23.00)*					
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**

* Calculated with INM 7.0b

Figure 19: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2019).

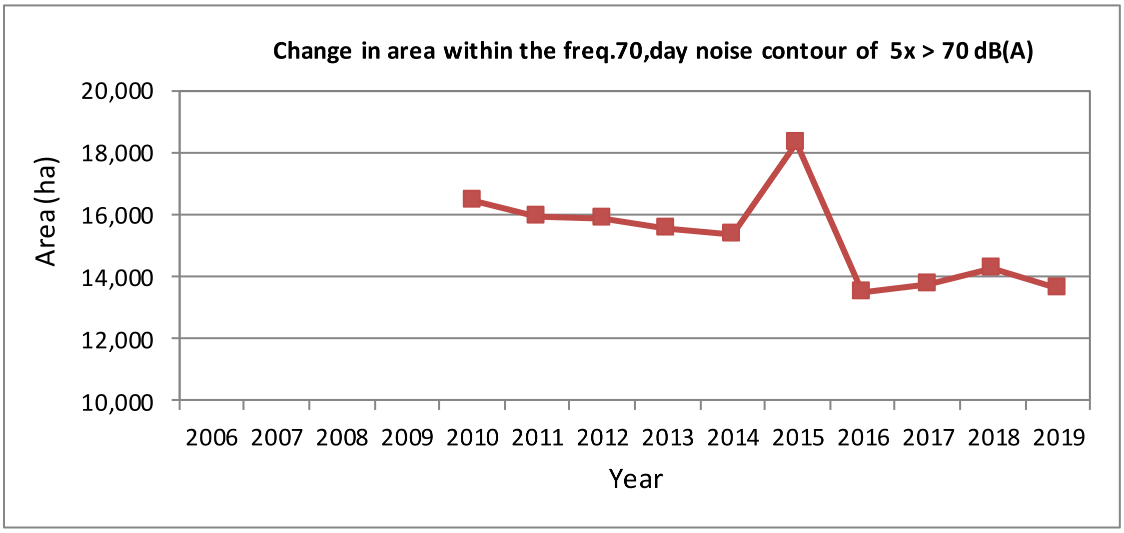


Table 36: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2019).

Area (ha)	Freq.70,night contour zone (night 23.00-07.00)*					
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**

* Calculated with INM 7.0b

Figure 20: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2019).

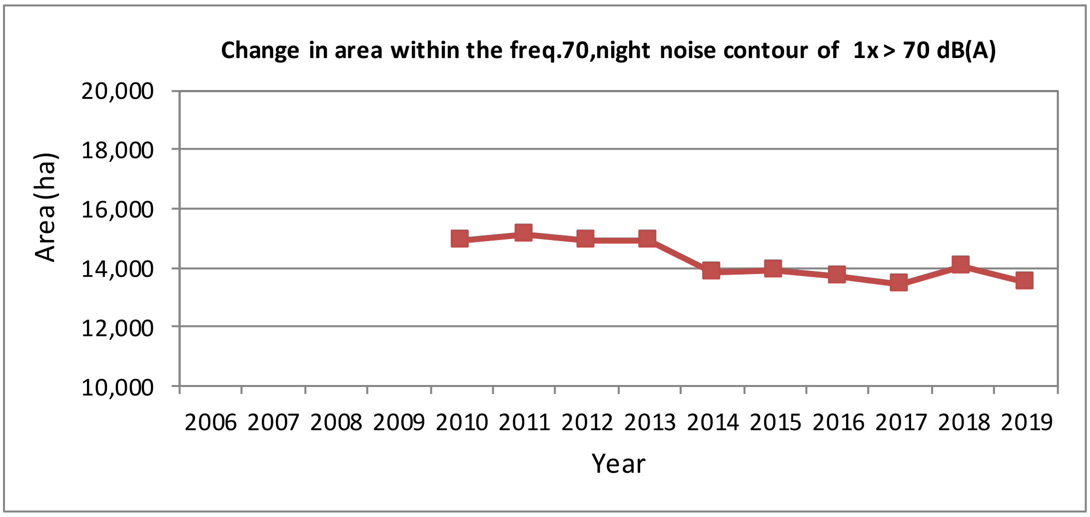


Table 37: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2019).

Area (ha)	Freq.60,day contour zone (day 07.00-23.00)*				
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**

* Calculated with INM 7.0b

Figure 21: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2019).

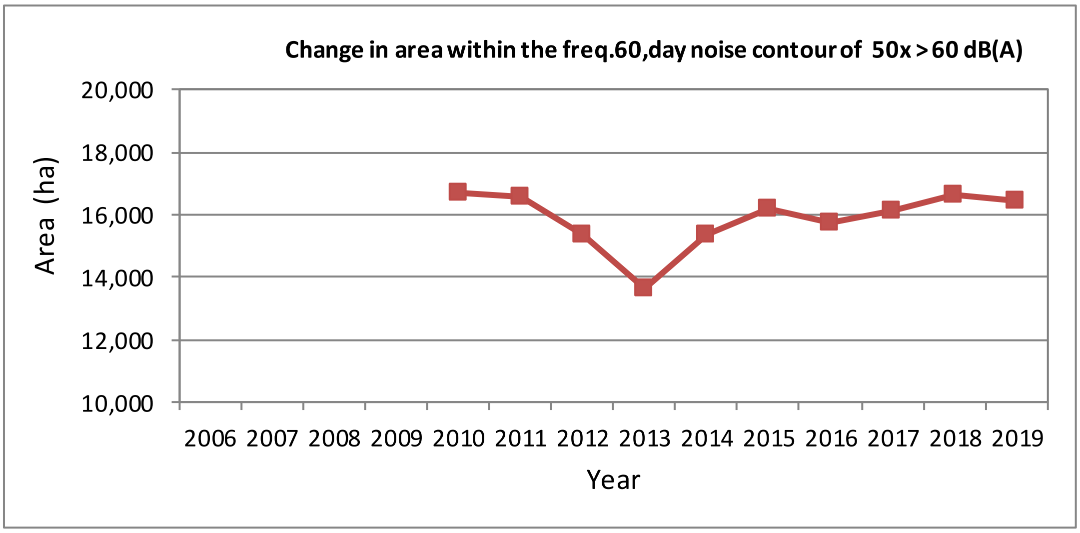
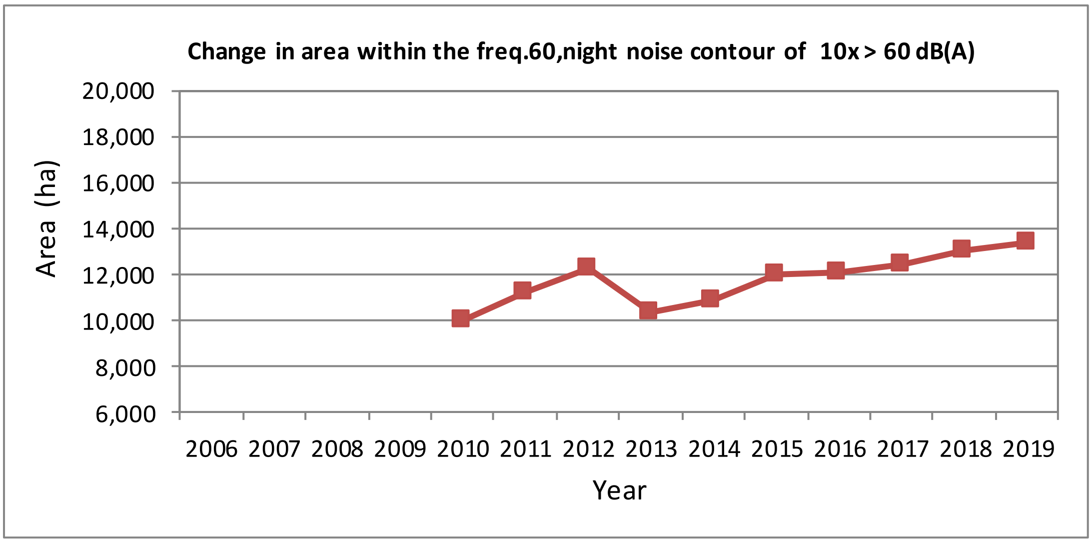


Table 38: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2019).

Area (ha)	Freq.60,night contour zone in dB(A)*				
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**

* Calculated with INM 7.0b

Figure 22: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2019).



5.5.2 Evolution of the number of inhabitants per contour zone: L_{day}, $L_{evening}$, L_{night}, Freq.70,day, Freq.70,night, Freq.60,day and Freq.60,night.

Table 39: Evolution of the number of inhabitants inside the L_{day} contours (2000, 2006-2019).

Number of inhabitants		**L_{day} contour zone in dB(A) (day 07.00-19.00)***					
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**	01jan16	21,950	9,003	3,108	0	0	**34,062**
2018**	01jan17	23,289	8,993	2,798	3	0	**35,083**
2019**	01jan19	21,875	9,342	3,270	3	0	**34,489**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 23: Evolution of the number of inhabitants inside the L_{day} contours (2000, 2006-2019).

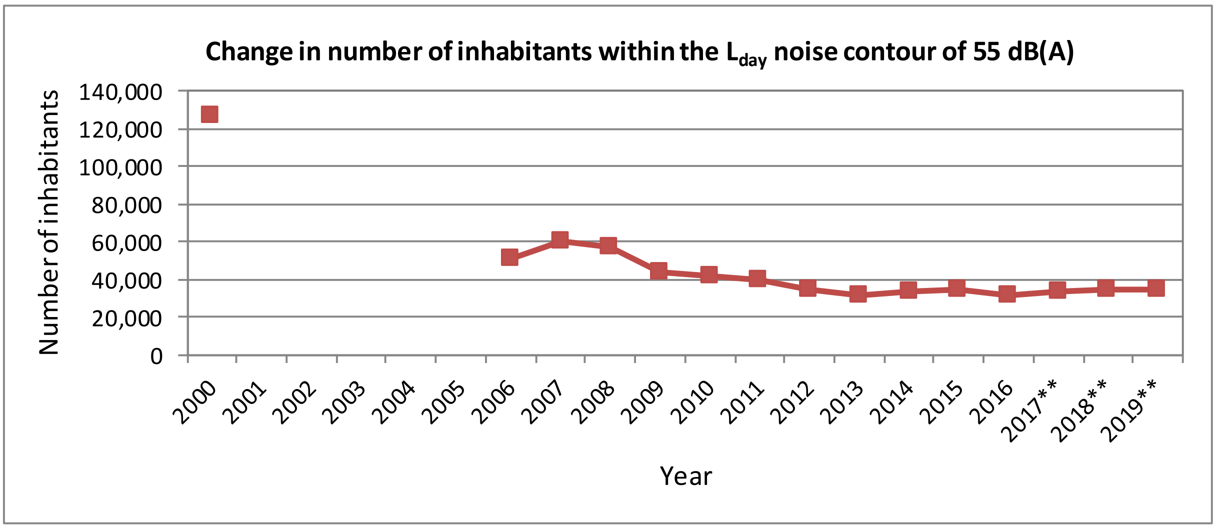


Table 40: Evolution of the number of inhabitants inside the $L_{evening}$ contours (2000, 2006-2019).

Number of inhabitants		$L_{evening}$ contour zone in dB(A) (evening 19.00-23.00)*						
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**
2017**	01jan16	206,220	26,880	9,055	3,173	5	0	**245,334**
2018**	01jan17	226,101	34,113	10,033	3,538	57	0	**273,841**
2019**	01jan19	213,243	28,965	9,814	3,531	5	0	**255,558**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 24: Evolution of the number of inhabitants inside the $L_{evening}$ contours (2000, 2006-2019).

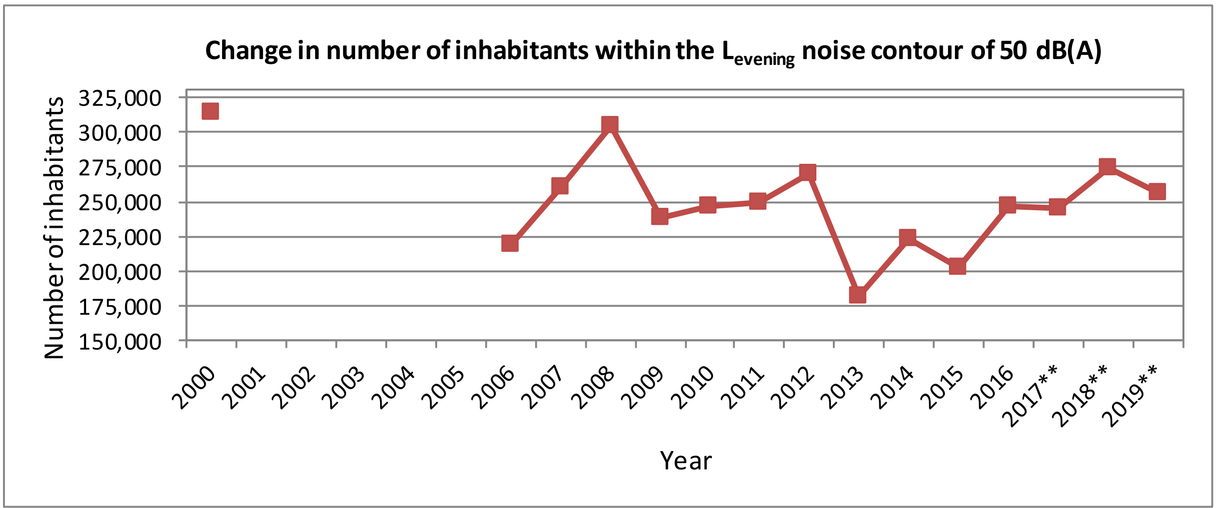


Table 41: Evolution of the number of inhabitants inside the L_{night} contours (2000, 2006-2019).

Number of inhabitants		L_{night} contour zone in dB(A) (night 23.00-07.00)						
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**
2017**	01jan16	106,964	27,127	7,484	469	66	0	**142,110**
2018**	01jan17	122,588	29,355	7,601	501	64	0	**160,109**
2019**	01jan19	127,079	27,978	8,065	529	66	0	**163,718**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 25: Evolution of the number of inhabitants inside the L_{night} contours (2000, 2006-2019).

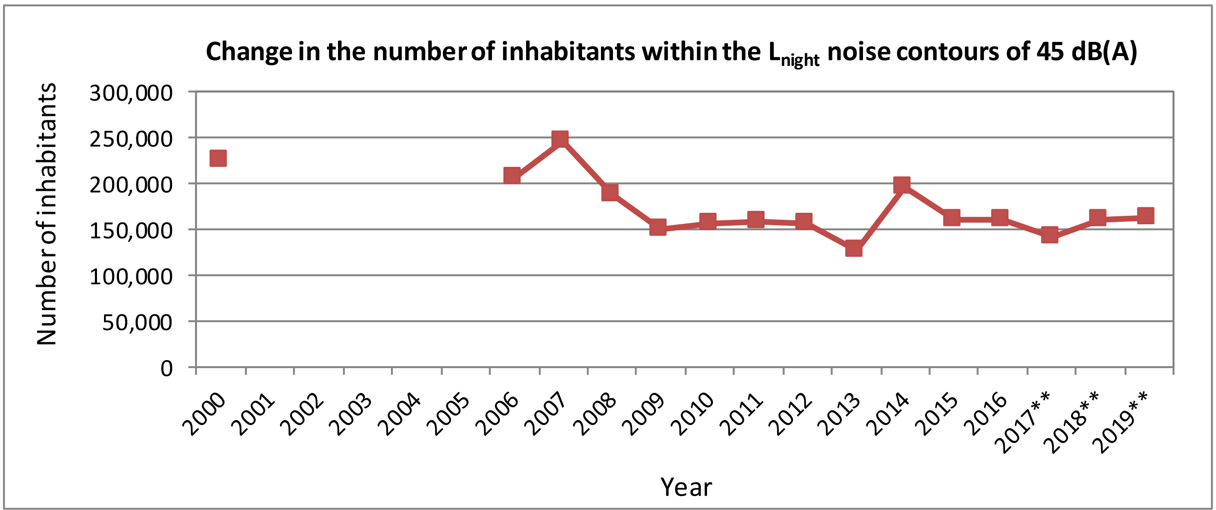


Table 42: Evolution of the number of inhabitants inside the L_{den} contours (2000, 2006-2019).

Number of inhabitants		L_{den} contour zone in dB(A) (d. 07-19, ev. 19-23, n. 23-07)*					
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**
2017**	01jan16	70,139	17,645	5,264	257	0	**93,305**
2018**	01jan17	77,812	19,476	5,413	413	0	**103,114**
2019**	01jan19	72,561	19,231	5,448	383	0	**97,624**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 26: Evolution of the number of inhabitants inside the L_{den} contours (2000, 2006-2019).

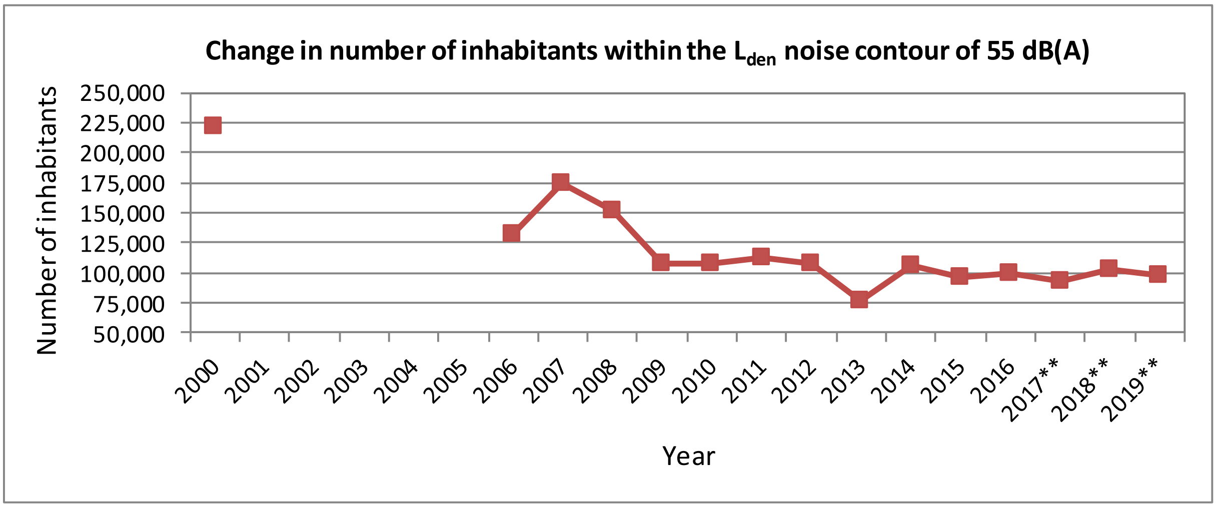


Table 43: Evolution of the number of inhabitants inside the Freq.70,day contours (2000, 2006-2019).

Number of inhabitants		Freq.70,day contour zone (day 07.00-23.00)*					
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**	01jan16	111,019	92,035	40,125	10,365	12,694	**266,238**
2018**	01jan17	122,115	94,126	42,456	22,569	1,024	**282,289**
2019**	01jan19	108,714	110,676	42,207	21,742	1,088	**284,427**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 27: Evolution of the number of inhabitants inside the Freq.70,day contours (2000, 2006-2019).

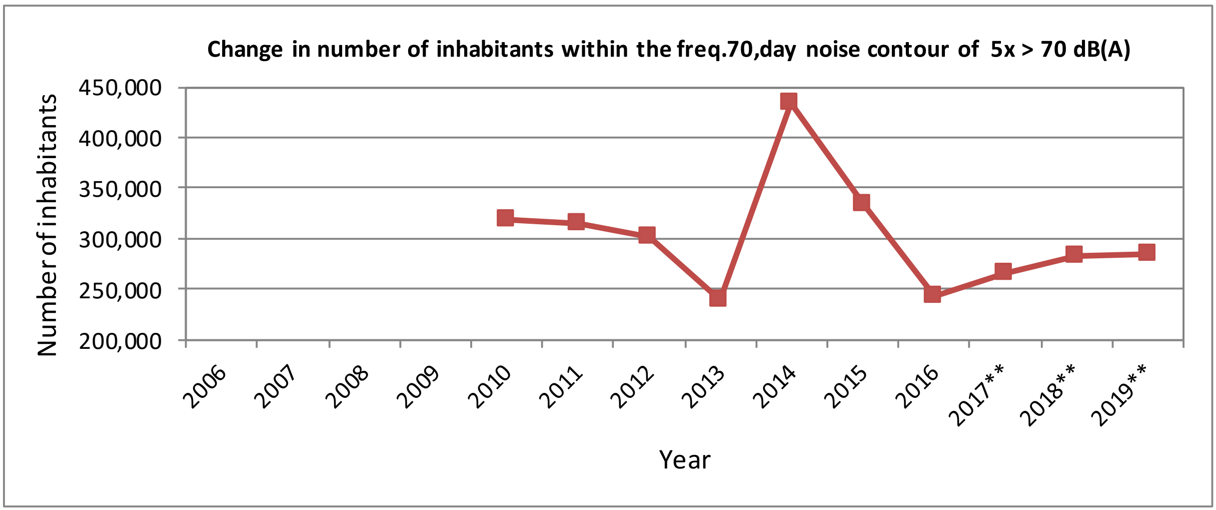


Table 44: Evolution of the number of inhabitants inside the Freq.70,night contours (2000, 2006-2019).

Number of inhabitants		Freq.70,night contour zone (night 23.00-07.00)*					
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**
2017**	01jan16	155,257	19,411	14,408	5,854	0	**194,930**
2018**	01jan17	172,835	21,478	14,948	6,020	0	**215,281**
2019**	01jan19	184,024	20,072	15,028	6,574	0	**225,698**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 28: Evolution of the number of inhabitants inside the Freq.70,night contours (2000, 2006-2019).

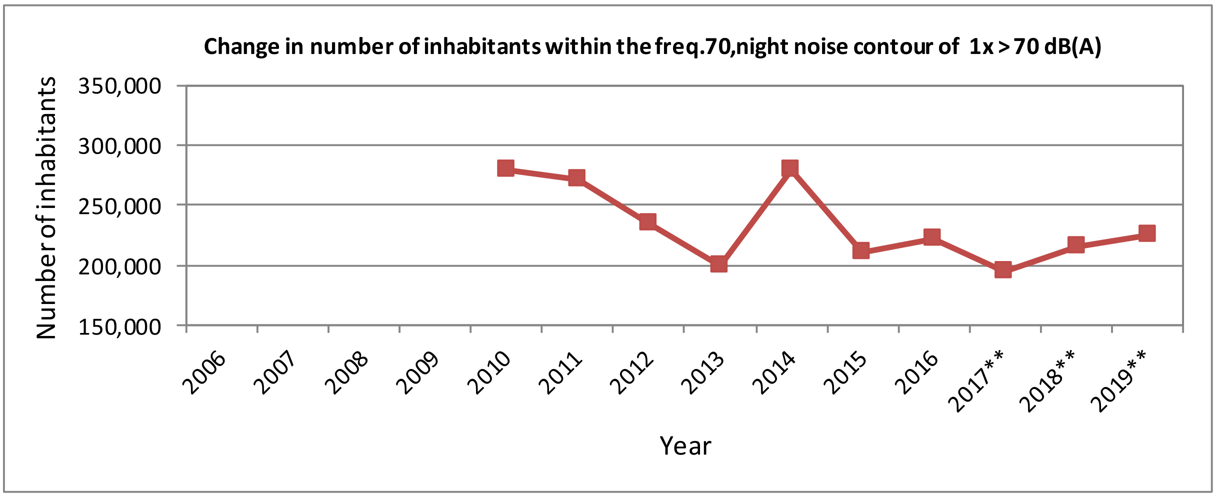


Table 45: Evolution of the number of inhabitants inside the Freq.60,day contours (2000, 2006-2019).

Number of inhabitants		Freq.60,day contour zone (day 07.00-23.00)*				
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**	01jan16	174,069	62,701	9,661	22,736	**269,167**
2018**	01jan17	221,416	18,985	11,353	21,484	**273,238**
2019**	01jan19	200,841	55,497	10,932	23,645	**290,915**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 29: Evolution of the number of inhabitants inside the Freq.60,day contours (2000, 2006-2019).

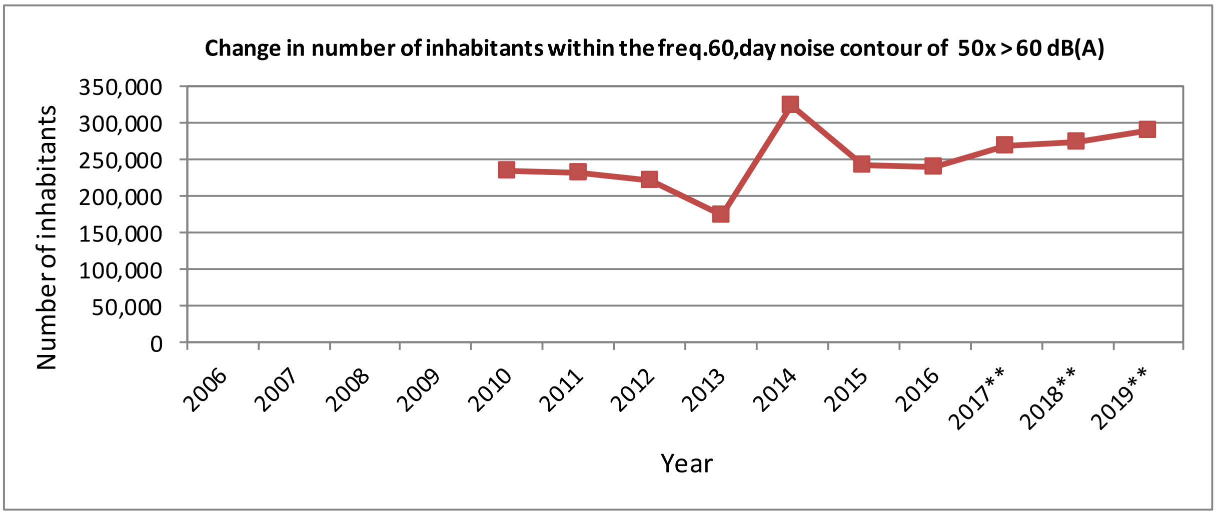
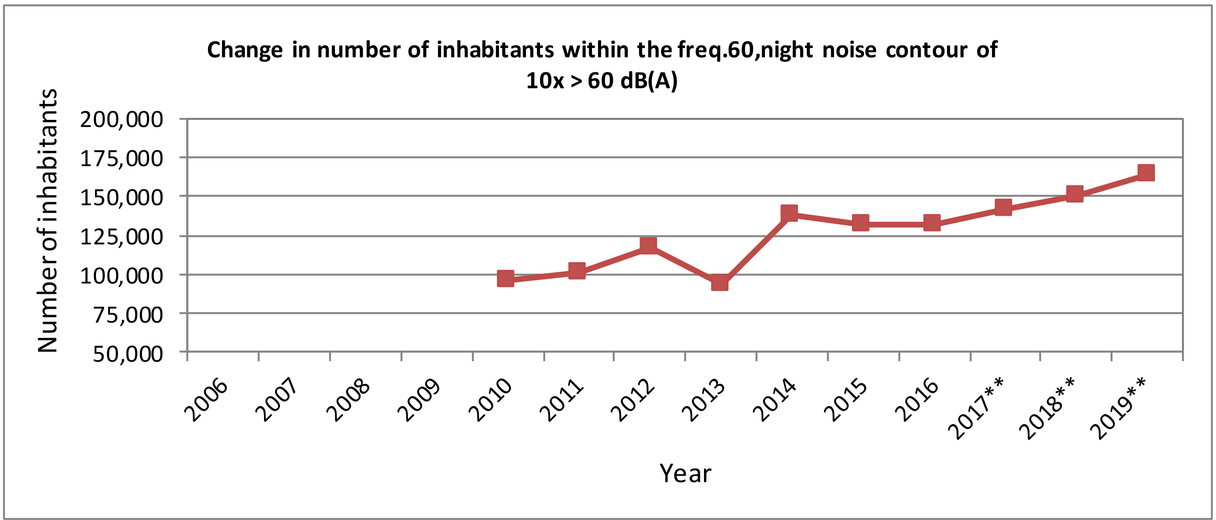


Table 46: Evolution of the number of inhabitants inside the Freq.60,night contours (2000, 2006-2019).

Number of inhabitants		Freq.60,night contour zone in dB(A)*				
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**	01jan16	93,532	15,687	23,488	9,538	**142,245**
2018**	01jan17	98,609	16,849	24,728	10,016	**150,202**
2019**	01jan19	110,835	17,770	24,096	10,817	**163,518**

* Calculated with INM 7.0b, , ** evaluation by address

Figure 30: Evolution of the number of inhabitants inside the Freq.60,night contours (2000, 2006-2019).



5.6 Documentation provided files

Radar data for the year 2019 (source: BAC-TANOS)

2019-JAN-JUN_flightlist.csv	10/01/2020	47.512 kB
2019-JAN-JUN_ops.csv	10/01/2020	1.298.664 kB
2019-JUL-DEC_flightlist.csv	10/01/2020	51.518 kB
2019-JUL-DEC_ops.csv	10/01/2020	1.404.145 kB

Flight data for the year 2019 (source: BAC-CDB)

cdb_2019_01_12.txt	07/01/2020	64.325 kB

Weather data for the year 2019 (source: BAC-TANOS)

2019_meteo.xlsx	7/01/2020	3.323 kB

Noise events for the year 2019 (source: BAC-TANOS / dOMG)

2019-01_events TANOS.xlsx	24/02/2020	32.561kB
2019-02_events TANOS.xlsx	24/02/2020	28.930 kB
2019-03_events TANOS.xlsx	24/02/2020	35.196 kB
2019-04_events TANOS.xlsx	24/02/2020	30.717 kB
2019-05_events TANOS.xlsx	24/02/2020	35.054 kB
2019-06_events TANOS.xlsx	24/02/2020	35.468 kB
2019-07_events TANOS.xlsx	24/02/2020	35.831 kB
2019-08_events TANOS.xlsx	24/02/2020	36.734 kB
2019-09_events TANOS.xlsx	24/02/2020	36.102 kB
2019-10_events TANOS.xlsx	24/02/2020	39.807 kB
2019-11_events TANOS.xlsx	24/02/2020	32.863 kB
2019-12_events TANOS.xlsx	24/02/2020	33.891 kB

1 h reports noise measuring network for the year 2019 (BAC-TANOS / dOMG)

uur-rapporten_2019-0106 TANOS.xlsx	24/02/2020	22.564 kB
uur-rapporten_2019-0712 TANOS.xlsx	24/02/2020	24.109 kB
status_LNE_2019_all.xls	24/02/2020	1.059 kB

24 h reports noise measuring network for the year 2018 (source: BAC-ANOMS / BAC-TANOS)

24h-rapporten-2019 TANOS 0112.xls	21/02/2020	3.187 kB