Noise Contours around Brussels Airport for the Year 2018

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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. 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.

[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 (B.I.A.C), Vooruitgangsstraat 80 bus 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 3070 Kortenberg, 30 December 2004

1.2 Compulsory calculations

In accordance with the VLAREM environmental legislation, the operator of an airport categorised as class 1[3] 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 United States Federal Aviation Administration (FAA), version 6.0c or later.

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.

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

[3] 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;

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[4]. 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

The most recent population data available is used to determine the number of residents living inside the contour zones and the number of people who are potentially seriously inconvenienced. In previous reports, 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 2017). In this way, the evolution of the population up to the level of the statistical sectors is taken into account.

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 residents over the surface area of the statistical sector. From 2017, the calculation method was further refined, which improves the 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

[4] 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.

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_EBBR18_INM_studie.zip (the INM study used)
- UGENT_EBBR18_geluidscontouren.zip (the calculated contours in shape format)
- UGENT_EBBR18_opp_inw.zip (the number of residents 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 ($L_{Aeq,1s,max}$)[5] 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

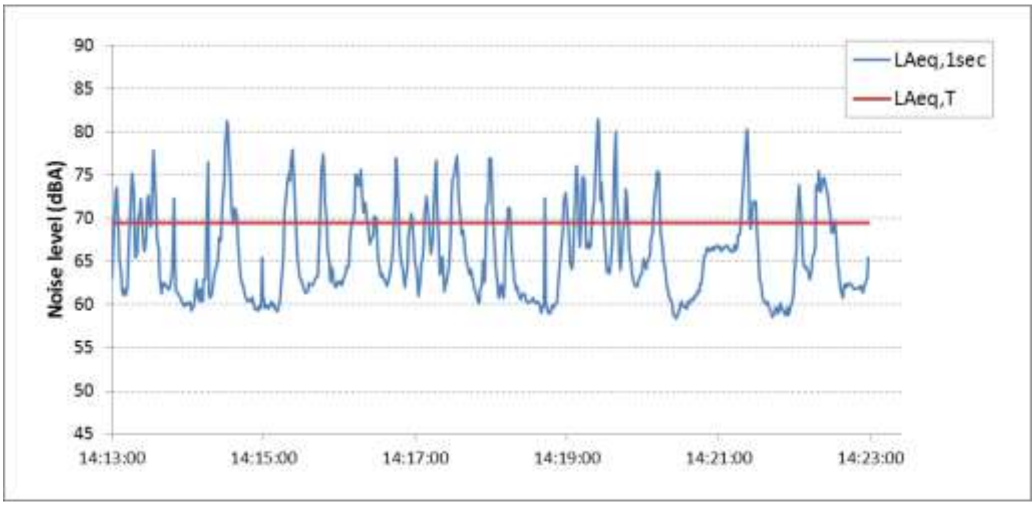
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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).

[5] 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}

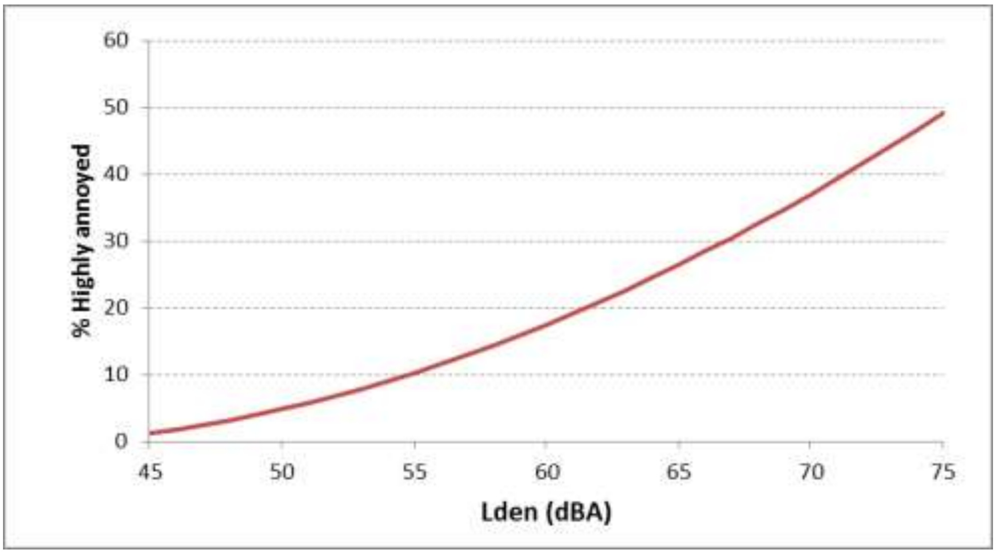
The European directive on the control and assessment of environmental noise (transposed in VLAREM 2), recommends using the L_{den} parameter to determine the exposure to noise over a longer period. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight) is the A-weighted equivalent sound pressure level 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 = $-9{,}199 \cdot 10^{-5}(L_{den}-42)^3 + 3{,}932 \cdot 10^{-2}(L_{den}-42)^2 + 0{,}2939(L_{den}-42)$

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[6], and was adopted by the WG2 Dose/Effect of the European Commission[7]. Note that L_{den} only determines around 30% of the variation in reported severe inconvenience[8,9].

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6 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.

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

8 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.

9 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.

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.

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 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 2018, 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 2018 are:

- Average headwind (annual average across all runways, take-off and landing): 4.1 kn.
- Average temperature: 12.1°C or 53.8 °F.

- Average headwind per runway:
  - 25R: 3.3 kn.
  - 25L: 3.1 kn.
  - 07R: 4.7 kn.
  - 07L: 4.4 kn.
  - 19: 3.4 kn.
  - 01: 4.6 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[10] 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.

[10] 1 nmi (nautical mile) = 1.852 km (kilometre)

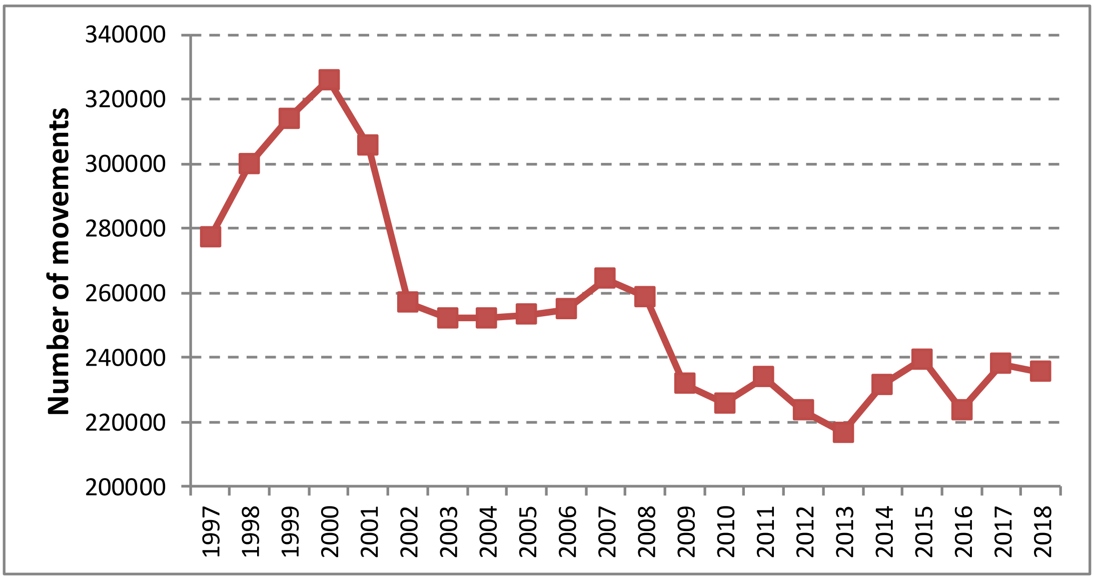
4 Results

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.

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



The number of night-time movements (23:00-06:00) rose by 5.2 % from 16,827 in 2017 to 17,898 in 2018 (including 5,379 take-offs). This includes helicopter movements and flight movements exempt from slot coordination, such as government and military flights.

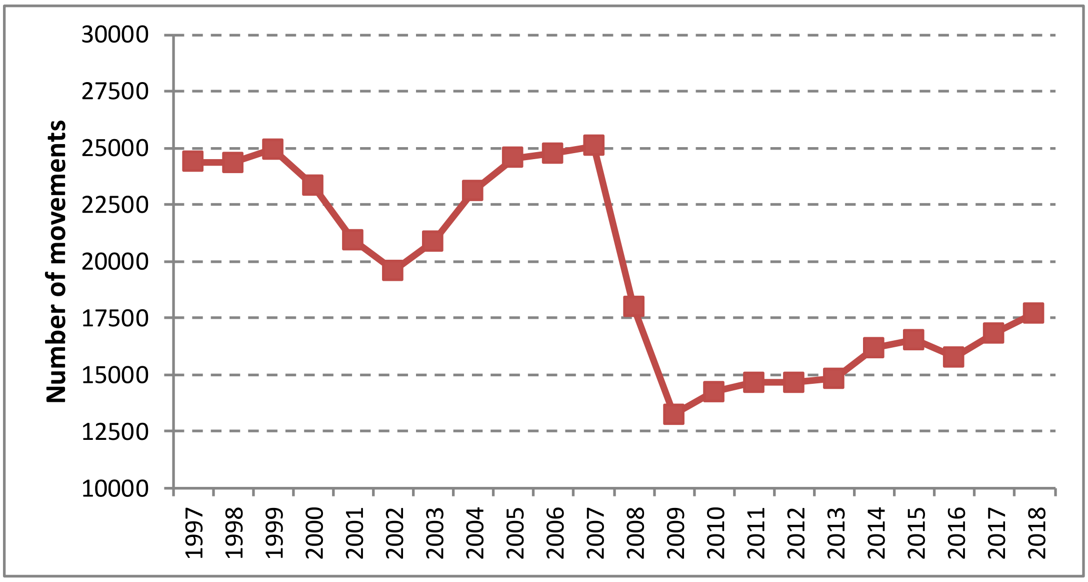
In 2018, the number of assigned night slots[11] for aircraft movements remained at 15,835, including 4,616 for departures, within the limitations imposed on the slot coordinator of Brussels Airport, who since 2009 has been authorised to distribute a maximum of 16,000 night slots, of which a maximum of

[11] 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 1.5% from 221,061 in 2017 to 217,761 in 2018.

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 2018, the data for 2017 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 2017 and the change in comparison to 2016 (VLAREM division of the day).

	2017			2018			Relative change versus 2017		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	77,829	79,903	157,732	75,182	78,436	153,618	-3.4%	-1.8%	-2.6%
evening (19:00 - 23:00)	27,312	26,616	53,928	27,684	26,574	54,258	1.4%	-0.2%	0.6%
night (23:00 - 07:00)	13,800	12,428	26,228	14,864	12,719	27,583	7.7%	2.3%	5.2%
00:00 - 24:00	118,941	118,947	237,888	117,730	117,729	235,459	-1.0%	-1.0%	-1.0%
06:00 - 23:00	107,196	113,865	221,061	105,411	112,350	217,761	-1.7%	-1.3%	-1.5%
23:00 - 06:00	11,745	5,082	16,827	12,319	5,379	17,698	4.9%	5.8%	5.2%
06:00 - 07:00	2,055	7,346	9,401	2,545	7,340	9,885	23.8%	-0.1%	5.1%

The general increase of 1.0% in the annual number of flight movements between 2018 and 2017 is evenly distributed throughout the day (-2.6%), evening (+0.6%) and night (+5.2%). Between 06:00 and 07:00 the increase in movements was (5.1%). The number of landings between 06:00 and 07:00 rose significantly (+23.8%).

4.1.2 Other important evolutions

In addition to the number of flight movements, there arre 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 2018 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 (18.7% of all movements in 2017), followed by the B752 (16.3%), the B734 (12.6%) and the A306 (10.1%). Four aircraft types make up between 5% and 10% (the A319, B738, A333 and B763) of all movements. These eight types are responsible for 84% of the night flights. This is the first year that the A320 is responsible for more movements than the B752. In terms of departures, the B752 is also the most frequently used aircraft overall (26.7%), followed by the B734 (18.1%), the A306 (16.0%), the B763 (8.7%), the A320 (8.1%) and the B738 (4.8%).

The number of movements in 2018 using heavy aircraft amounted to 4,446, an increase of 0.5% compared with 2017, when this number was 4,423. There was an increase of just 0.9% compared with 2017 for departing heavy aircraft. The segment for the B763 decreased sharply (-12%), but was compensated by the large Air Buses (A333, A306 and A332). The most common heavy aircraft used during the night are the A306 (from 821 to 863), the B763 (from 537 to 470) and the B77L (from 166 to 182).

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	2017	2018	Evolution	Evolution (%)	2017	2018	Evolution	Evolution (%)
A333	961	997	36	4%	2	40	38	1900%
A306	913	930	17	2%	821	863	42	5%
B763	498	350	-148	-30%	537	470	-67	-12%
A332	339	407	68	20%	48	61	13	27%
B744	38	14	-24	-63%	16	11	-5	-31%
B788	35	29	-6	-17%	4	10	6	150%
B77L	15	28	13	87%	166	182	16	10%
C17	9	5	-4	-44%	7	2	-5	-71%
B789	3	8	5	167%	0	4	4	
E3TF	1	0	-1		0	0	0	
DC10	1	0	-1		0	0	0	
B772	1	2	1		0	2	2	
A400	1	0	-1		0	1	1	
A345	1	0	-1		0	0	0	
A343	1	6	5		2	2	0	
B77W	0	2	2		2	4	2	
B762	0	3	3		0	2	2	
B748	0	0	0		0	2	2	
A359	0	6	6		0	1	1	
A346	0	0	0		1	0	-1	
A310	0	0	0		0	2	2	

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	2017	2018	Evolution	Evolution (%)	2017	2018	Evolution	Evolution (%)
A320	2312	2875	563	24%	250	435	185	74%
B752	1328	1446	118	9%	1296	1434	138	11%
B734	1234	1255	21	2%	923	973	50	5%
A319	1591	1391	-200	-13%	45	97	52	116%
B738	1164	1059	-105	-9%	350	258	-92	-26%
B737	189	266	77	41%	8	12	4	50%
B38M	0	251	251		0	3	3	
EXPL	113	140	27	24%	52	90	38	73%
E190	198	201	3	2%	15	8	-7	-47%
B733	13	105	92	708%	11	100	89	809%
A321	33	51	18	55%	110	112	2	2%
SU95	148	116	-32	-22%	14	29	15	107%
E145	22	27	5	23%	16	17	1	6%
F2TH	16	27	11	69%	3	7	4	133%
E195	3	22	19	633%	3	2	-1	-33%
C510	11	16	5	45%	7	7	0	0%
C130	6	21	15	250%	0	0	0	
E135	4	17	13	325%	7	4	-3	-43%
C56X	29	17	-12	-41%	13	4	-9	-69%
C25A	11	14	3	27%	9	6	-3	-33%
AT72	15	2	-13	-87%	40	16	-24	-60%
GLEX	5	13	8	160%	4	4	0	0%
C525	10	8	-2	-20%	4	9	5	125%
GLF5	13	11	-2	-15%	4	4	0	0%
F900	10	8	-2	-20%	11	5	-6	-55%
C425	4	5	1	25%	6	7	1	17%
E75S	0	10	10		0	1	1	
AT75	0	7	7		0	3	3	
FA7X	20	8	-12	-60%	9	1	-8	-89%
A20N	4	7	3	75%	0	1	1	
PC12	0	7	7		0	1	1	
GLF6	4	6	2	50%	4	2	-2	-50%
LJ45	12	5	-7	-58%	11	3	-8	-73%
CL60	7	4	-3	-43%	3	4	1	33%
C25B	9	7	-2	-22%	2	0	-2	-100%

4.1.2.2 Runway and route usage

Preferential runway usage

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 2018 (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)

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">Day</th><th>Night</th></tr>
<tr><th>06:00 to 15:59</th><th>16:00 to 22:59</th><th>23:00 to 05:59</th></tr>
<tr><td rowspan="2">Mon, 06:00 – Tues 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19[(1)]</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L[(2)]</td></tr>
<tr><td rowspan="2">Tues, 06:00 – Wedn 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19[(1)]</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L[(2)]</td></tr>
<tr><td rowspan="2">Wed, 06:00 – Thurs 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19[(1)]</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L[(2)]</td></tr>
<tr><td rowspan="2">Thurs, 06:00 – Fri 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R/19[(1)]</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R/25L[(2)]</td></tr>
<tr><td rowspan="2">Fri, 06:00 – Sat 05:59</td><td>Departure</td><td colspan="2">25R</td><td>25R[(3)]</td></tr>
<tr><td>Landing</td><td colspan="2">25L/25R</td><td>25R</td></tr>
<tr><td rowspan="2">Sat, 06:00 – Sun 05:59</td><td>Departure</td><td>25R</td><td>25R/19[(1)]</td><td>25L[(4)]</td></tr>
<tr><td>Landing</td><td>25L/25R</td><td>25R/25L[(2)]</td><td>25L</td></tr>
<tr><td rowspan="2">Sun, 06:00 – Mon 05:59</td><td>Departure</td><td>25R/19[(1)]</td><td>25R</td><td>19[(4)]</td></tr>
<tr><td>Landing</td><td>25R/25L[(2)]</td><td>25L/25R</td><td>19</td></tr>
</table>

(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 2018. Only runway 25R/07L was closed for maintenance for 4 consecutive weekends from 20-21 October 2018.

Weather conditions in 2018 caused more operations to be carried out using the 'alternate mode' than in 2017. A complete overview of runways used in 2018 and the evolution in runway usage in comparison with 2017 can be found in appendix 5.1.

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

While the BUB aircraft navigation beacon was temporarily out of use and was replaced by Skyeyes between 8 November and 15 December. 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 this calculation 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, these criteria were retained for 2018. 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 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 2018, two measuring stations were moved (the NMT in Sterrebeek (07-01 -> 07-02) and the NMT in Neder-over-heembeek (10-02 -> 10-03). 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 been made available to BAC). An overview of the locations of all measuring stations is included 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. The exceptions are Sterrebeek (72.9% at NMT07-1; and 26.2% at NMT07-2) and Neder-over-heembeek (44.6% at NMT10-02; 51.2 % at NMT10-03). Both are the result of the measurement stations being moved during 2018. Measuring station Rotselaar (NMT70-1) was active for 89.8% of the year (measurements available from February 2018). When these posts are disregarded, the average uptime is 98.9%, where Strombeek-bever (NMT21-1) had the lowest percentage of uptime (96.3%) amongst this set and Wezembeek-oppem (NMT46-2) the highest, with 99.97%.

Considering the simulations are repeatedly performed for a full year, the measurements from the aforementioned measuring stations with a low uptime fraction must be extrapolated. It is also assumed that during the periods lacking measurements, the same proportion of exposure to aircraft noise took place as during the periods in which the measuring post was active. Meetpunt Sterrebeek (NMT07-2) is disregarded given that measurements are available for only one quarter of the year, and a comparable method of extrapolation would lead to a large amount of uncertainty.

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]. These measuring stations have few overflights and belong then also to the two lowest-registered levels. The resulting margin for error is large and that is reflected in the comparison between the measurements and the calculations. At 11 measuring stations, the deviation is limited to up to 0.5 dB(A). At 17 measuring stations, the measurements are higher than the calculations, at 11 measuring stations the measurements are lower than the calculations, (in each case with an exclusion of measuring stations NMT01-2, NMT03-3, NMT15-3 en NMT23-1). 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 (1.2 dB(A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT15-3 and NMT23-1, NMT09-2, NMT48-3). The highest deviations (excluding NMT01-2, NMT03-3, NMT15-3 en NMT23-1) are at the Bertem en Perk measuring locations; the predicted level appears here to be more than 3 dB(A) higher than the measurements, which again can be explained by the very low levels measured at these locations. At all the other measuring stations, the deviations are within 2 dB(A), with the exception of Kraainem (NMT24-1), Wezembeek-Oppem (NMT47-3) en Rotselaar (NMT70-1), where the calculations are underestimated by between 2 and 3 dB(A).

For the noise indicator L_{den} the RMSE is 1.0 dB(A) (excluding NMT01-2, NMT03-3, NMT15-3, NMT23-1, as well as NMT09-2 en NMT48-3). At all the other measuring stations, the deviation was within 2 dB(A), except at Kraainem and Rotselaar, where the calculations produced an underestimate of 2.1 dB(A). Eleven measuring stations had a deviation of maximum 0.5 dB(A).

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	57.7	63.7	-6.0
NMT02-2	KORTENBERG	68.1	68.0	0.1
NMT03-3	HUMELGEM-Airside	63.7	64.8	-1.1
NMT04-1	NOSSEGEM	63.8	62.6	1.2
NMT06-1	EVERE	51.7	50.7	1.0
NMT07-1+	STERREBEEK	46.9	47.8	-0.9
NMT08-1	KAMPENHOUT	55.0	54.8	0.2
NMT09-2	PERK	43.5	47.6	-4.1
NMT10-2+	NEDER-OVER-HEEMBEEK	55.1	55.4	-0.3
NMT10-3+	NEDER-OVER-HEEMBEEK	55.5	54.9	0.6
NMT11-2	SINT-PIETERS-WOLUWE	53.2	51.9	1.3
NMT12-1	DUISBURG	46.2	46.4	-0.2
NMT13-2	GRIMBERGEN	45.5	46.1	-0.6
NMT14-1	WEMMEL	47.3	47.9	-0.6
NMT15-3	ZAVENTEM	46.5	56.4	-9.9
NMT16-2	VELTEM	57.1	56.3	0.8
NMT19-3	VILVOORDE	53.2	52.8	0.4
NMT20-2	MACHELEN	54.0	54.2	-0.2
NMT21-1	STROMBEEK-BEVER	51.9	50.9	1.0
NMT23-1	STEENOKKERZEEL	65.0	67.4	-2.4
NMT24-1	KRAAINEM	55.0	53.1	1.9
NMT26-2	BRUSSEL	47.6	47.2	0.4
NMT40-1*	KONINGSLO	53.5	52.5	1.0
NMT41-1*	GRIMBERGEN	48.4	48.5	-0.1
NMT42-2*	DIEGEM	64.7	64.7	0.0
NMT43-2*	ERPS-KWERPS	57.2	57.1	0.1
NMT44-2*	TERVUREN	45.9	46.6	-0.7
NMT45-1*	MEISE	45.6	45.8	-0.2
NMT46-2*	WEZEMBEEK-OPPEM	56.1	54.6	1.5
NMT47-3*	WEZEMBEEK-OPPEM	50.1	49.0	1.1
NMT48-3*	BERTEM	28.3	31.9	-3.6
NMT70-1*+	ROTSELAAR	50.7	49.1	1.6

* LNE noise data off-line correlated by the NMS

+ Measuring station with an uptime less 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	55.9	65.7	-9.8
NMT02-2	KORTENBERG	63.8	63.8	0.0
NMT03-3	HUMELGEM-Airside	58.3	59.0	-0.7
NMT04-1	NOSSEGEM	61.7	59.8	1.9
NMT06-1	EVERE	45.1	44.1	1.0
NMT07-1+	STERREBEEK	49.9	48.3	1.6
NMT08-1	KAMPENHOUT	53.3	53.1	0.2
NMT09-2	PERK	41.3	45.1	-3.8
NMT10-2+	NEDER-OVER-HEEMBEEK	50.4	50.2	0.2
NMT10-3+	NEDER-OVER-HEEMBEEK	51.1	49.7	1.4
NMT11-2	SINT-PIETERS-WOLUWE	49.2	47.7	1.5
NMT12-1	DUISBURG	43.8	43.5	0.3
NMT13-2	GRIMBERGEN	38.7	39.3	-0.6
NMT14-1	WEMMEL	41.5	42.9	-1.4
NMT15-3	ZAVENTEM	48.4	52.2	-3.8
NMT16-2	VELTEM	53.0	52.2	0.8
NMT19-3	VILVOORDE	49.1	48.2	0.9
NMT20-2	MACHELEN	50.2	50.4	-0.2
NMT21-1	STROMBEEK-BEVER	47.8	46.8	1.0
NMT23-1	STEENOKKERZEEL	64.1	66.2	-2.1
NMT24-1	KRAAINEM	50.8	48.5	2.3
NMT26-2	BRUSSEL	43.6	43.3	0.3
NMT40-1*	KONINGSLO	49.1	47.9	1.2
NMT41-1*	GRIMBERGEN	42.8	43.1	-0.3
NMT42-2*	DIEGEM	59.6	58.7	0.9
NMT43-2*	ERPS-KWERPS	51.9	52.2	-0.3
NMT44-2*	TERVUREN	46.2	45.4	0.8
NMT45-1*	MEISE	38.1	39.9	-1.8
NMT46-2*	WEZEMBEEK-OPPEM	52.0	50.3	1.7
NMT47-3*	WEZEMBEEK-OPPEM	50.9	48.8	2.1
NMT48-3*	BERTEM	22.4	28.2	-5.8
NMT70-1*+	ROTSELAAR	46.7	44.5	2.2

* LNE noise data off-line correlated by the NMS

+ Measuring station with an uptime less 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	63.1	71.6	-8.5
NMT02-2	KORTENBERG	72.2	72.2	0.0
NMT03-3	HUMELGEM-Airside	67.3	68.2	-0.9
NMT04-1	NOSSEGEM	69.0	67.4	1.6
NMT06-1	EVERE	55.0	54.1	0.9
NMT07-1+	STERREBEEK	55.7	54.4	1.3
NMT08-1	KAMPENHOUT	60.4	60.2	0.2
NMT09-2	PERK	48.4	52.6	-4.2
NMT10-2+	NEDER-OVER-HEEMBEEK	59.0	59.5	-0.5
NMT10-3+	NEDER-OVER-HEEMBEEK	59.5	59.0	0.5
NMT11-2	SINT-PIETERS-WOLUWE	57.4	56.1	1.3
NMT12-1	DUISBURG	51.1	51.1	0.0
NMT13-2	GRIMBERGEN	49.0	49.8	-0.8
NMT14-1	WEMMEL	51.1	51.8	-0.7
NMT15-3	ZAVENTEM	54.1	60.4	-6.3
NMT16-2	VELTEM	61.3	60.5	0.8
NMT19-3	VILVOORDE	57.4	57.0	0.4
NMT20-2	MACHELEN	58.3	58.5	-0.2
NMT21-1	STROMBEEK-BEVER	56.1	55.1	1.0
NMT23-1	STEENOKKERZEEL	70.9	73.1	-2.2
NMT24-1	KRAAINEM	59.2	57.1	2.1
NMT26-2	BRUSSEL	52.0	51.7	0.3
NMT40-1*	KONINGSLO	57.6	56.6	1.0
NMT41-1*	GRIMBERGEN	52.1	52.3	-0.2
NMT42-2*	DIEGEM	68.5	68.3	0.2
NMT43-2*	ERPS-KWERPS	60.8	60.9	-0.1
NMT44-2*	TERVUREN	52.4	52.2	0.2
NMT45-1*	MEISE	48.7	49.4	-0.7
NMT46-2*	WEZEMBEEK-OPPEM	60.3	58.7	1.6
NMT47-3*	WEZEMBEEK-OPPEM	56.9	55.2	1.7
NMT48-3*	BERTEM	31.3	36.2	-4.9
NMT70-1*+	ROTSELAAR	55.2	53.1	2.1

* LNE noise data off-line correlated by the NMS

\+ Measuring station with an uptime less 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 residents is calculated for each noise contour. The evaluation of the number of exposed residents 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 2017 and 2018 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 is generally applied.

There are two striking findings: In the first place, there was a reduction in the number of flights during the day (-3.4% for arrivals, -1.8% for departures). Moreover, there was in 2018 a significant rise in runway usage according to the non-preferential mode, a consequence of meteorological circumstances. This is mainly apparent in the number of departures from runway 07R: 18.8% in 2018, compared to 9.9% in 2017. This is also reflected in 20.0% of the arrivals on runways 01, 07L and 07R compared to 11.0% in 2017.

To the west of Brussels Airport, the 55 and 60 dB contours experienced slight shrinkage as a result of a decrease in the number of departures from runway 25R (from 68,582 to 59,645). The use of this runway as a take-off runway decreased from 85.8% to 76.0% chiefly due to the necessity of more deviation from the preferential runway use (more easterly wind in 2018). This change is proportionally evenly spread across the routes. The fraction of the flights on routes with a bend to the right decreased from 38.1% to 34.1%, on the straight routes from 6.7% to 5.8%, and on the routes with a bend to the left from 41.1% to 36.1%.

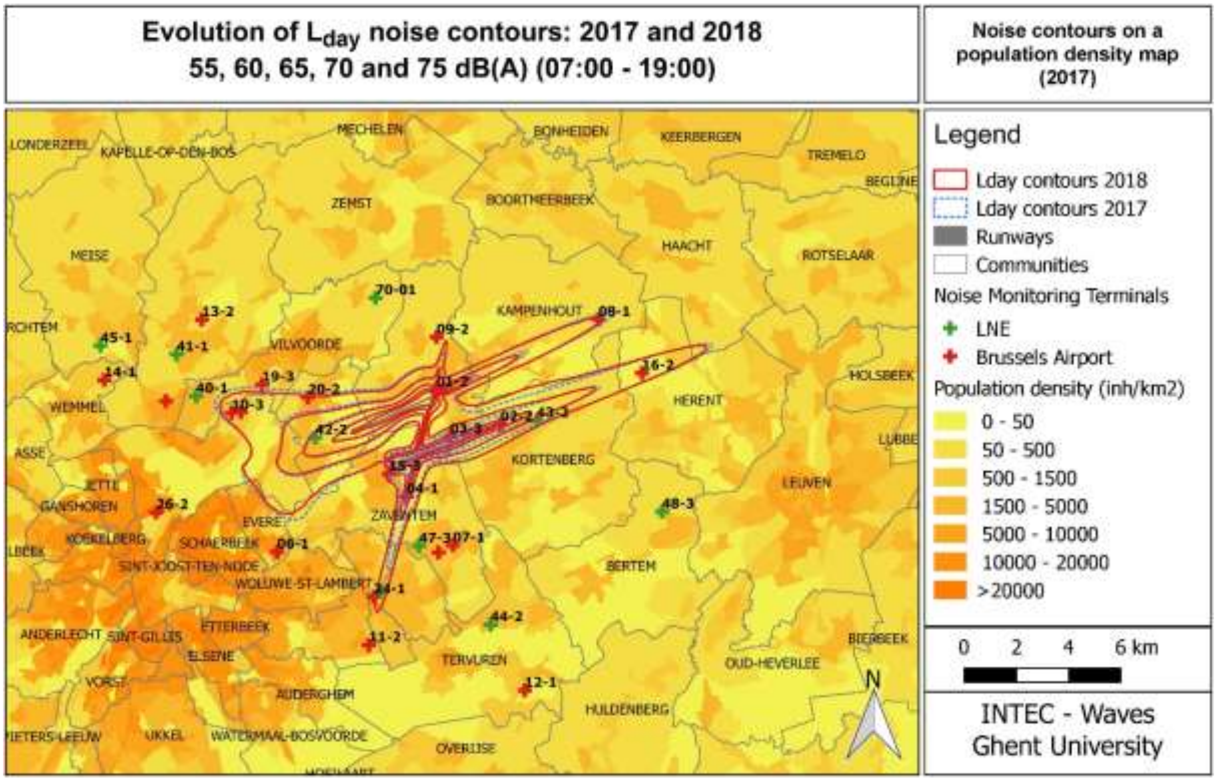
The noise contour in line with runway 25R remained approximately the same, despite this decrease, due to a greater number of landings on runway 07L (from 2,033 to 4,426), as this runway must be used during the 'alternate mode' with an easterly wind.

As a result of the decline in the number of landings on runways 25R (from 23,144 to 19,309) and 25L (from 44,769 to 38,564), the landing contours in line with these runways to the east of the airport became smaller. Due to the greater number of departures from runway 07R, the contour expanded to the level of the take-off runway, and the reduction in the length of this noise contour is also smaller than that of the 25R runway.

The number of departures from runway 19 rose from 2,479 to 2,761, which is just visible as a widening of the contour close to runway 19. The number of landings on runway 01 increased from 6,524 to 10,454 and is very apparent in line with runway 19 to the south of the airport.

There are no changes to the north of Brussels Airport. The number of departures from runway 01 remained constant, but the number of landings on runway 19 increased strongly (from 1,348 in 2017 to 2,298 in 2018).

Figure 5: L_{day} noise contours around Brussels Airport in 2017 (dotted blue) and 2018 (solid red).



The total surface area inside the L_{day} contour of 55 dB(A) rose in 2018 by about 2.3% compared to 2017 (from 4,876 to 4,987 ha). The number of residents inside the L_{day} contour of 55 dB(A) rose by 3.0% (from 34,062 to 35,083), and is comparable to the value for 2015 (30,056 residents).

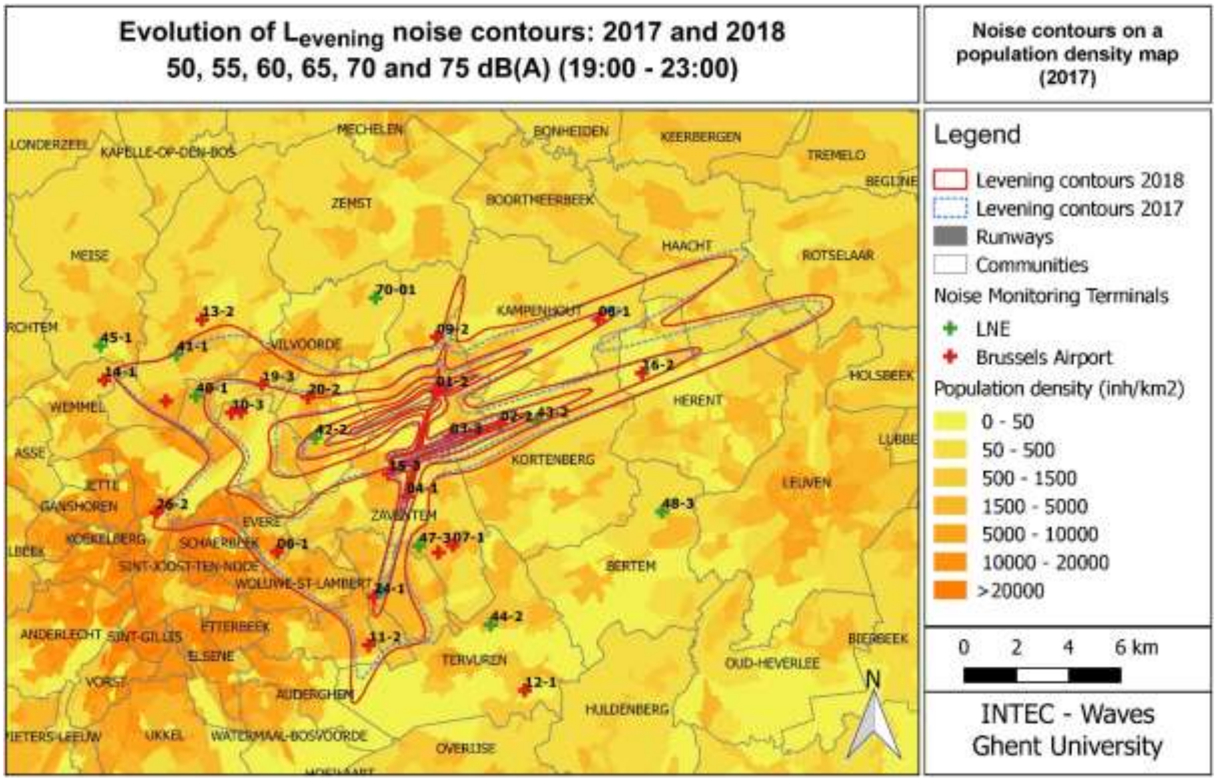
4.3.2 $L_{evening}$ contours

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 2017 and 2018 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. In contrast to the daytime period, the number of landings increased by 1.4%. The number of departures stayed approximately the same (-0.2%).

The number of departures during the evening shows a number of changes. This is complex interplay of numerous changes including a fraction of non-preferential runway use. There is also an enlargement of the noise contour in the area extending from runway 25R. The increase in the number of landings on runway 07L increased strongly, but the contribution of these landings is in 9 dB lower in absolute value than the contribution of the departures that fly straight ahead. This number (departures straight ahead) declined significantly on the whole (-17%), but the number of B744 flights, which was the largest contributor to the noise contour here, rose slightly. The contribution of the departures rose as a result by around 0.5 dB, despite the decrease in the number of flight movements. In October and November 2018, moreover, different landing procedures were temporarily used due to BUB beacon maintenance works, which meant that landing aircraft remained longer on the axis of the runway 07L than they would in normal circumstances.

Figure 6:$L_{evening}$ noise contours around Brussels Airport for 2017 (dotted blue) and 2018 (solid red).



Above Grimbergen and Vilvoorde there was a shift in the contour for departures from runway 25R that take a bend to the right. Above Grimbergen, the contour is growing due to an increase in the number of heavier aircraft on the route to Nicky. Above Vilvoorde the contour shrank in line with an absolute decrease in the number of flight movements (-6.0%), and as a result the heavy and mid-sized Boeings which flew the righthand bend in higher concentration in comparison to 2017.

Additionally, for departures from runway 25R with a bend to the left, there is an expansion in the contour despite a comparable absolute decrease (-6.0%) for such movements in relation to 2017. There are two contributions: the higher number of landings with an east wind on runway 07L and 07R, and the actually flown routes with a left-handed bend. Here a similar phenomenon can be observed as for the right-handed bend. The heavy and mid-sized Boeings took the bend a bit less sharply than in 2017. The change in the contour is mainly determined by the change in the routes flown and less changed by the additional landings.

The larger number of landings on runway 19 (from 233 to 676) and 01 (from 2,931 to 4,111) yielded an enlargement of the associated landing contours. The fall in the number of landings on runway 25L (15,489 to 14,518) did not translate into a fall in the $L_{evening}$ 50 dB noise contour due to the increase in the number of departures from runway 07R. The larger number of departures on runway 07R also caused a widening of the contour whereby the contours in line with the runways east of the airport blend together.

The total surface area inside the $L_{evening}$ contour of 50 dB(A) rose in 2018 by about 7.4% compared with 2017 (from 13,590 ha to 14,599 ha). The number of residents inside the $L_{evening}$ contour of 50 dB(A) increased by 11.6% (from 245,344 to 273,841). The relative increase in population is larger than it is in surface area, considering the expansion of the $L_{evening}$ contour is lying partly in the densely-populated zones.

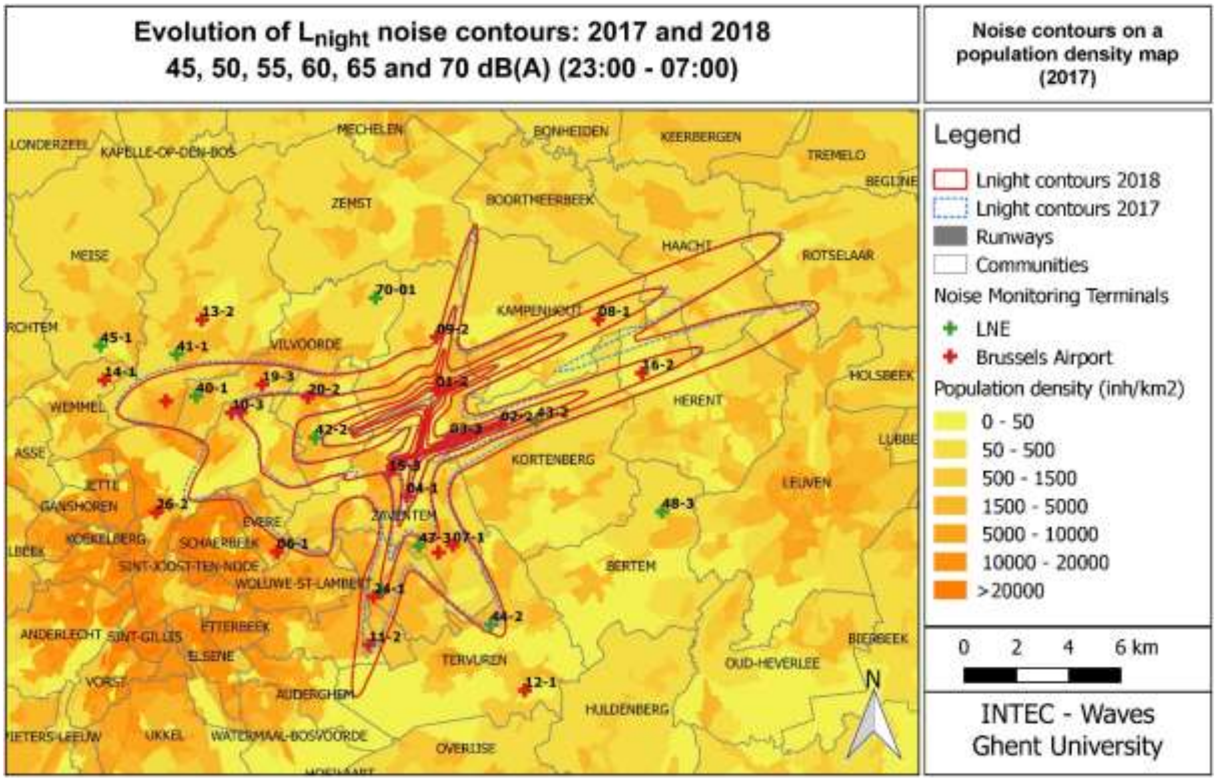
4.3.3 L_{night} contours

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 2017 to 2018 is shown in Figure 7. Due to an additional contour being reported, a magnifying effect between the day and the evening is created. As a result of the 10 dB(A) correction, the 45 dB(A) night contour is larger than the 55 dB(A) contour for daytime and is now at least equally significant for the calculation of L_{den} 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 rise in the number of departures during the night (+2.3%) and a strong increase in the number of landings (+7.7%). The busy departure hour from 06:00 and 07:00 contributes the most to the L_{night} contours, and this is comparable with 2017 (-0.1%). The number of landings between 06:00 and 07:00 rose sharply (+23.8%) and is in absolute value (+490) responsible for half of the increase during the night-time hours (+1,064).

Figure 7: L_{night} noise contours around Brussels Airport in 2017 (dotted blue) and 2018 (solid red).



The effect of the share of non-preferential runway usage is comparable, but less pronounced than for the day and evening periods. In the west, in line with runway 25R, the decrease in the number of departures straight ahead (-5.0%) is compensated for by the increase in the number of landings. The slight shift in the lobe is the result of the larger number of landings in line with the 07L runway, due to the maintenance works on the BUB navigation beacon. The number of flights that take a bend to the left is the same. The contour for this bend to the left is wider because the Boeings took the bend less sharply in comparison to 2017.

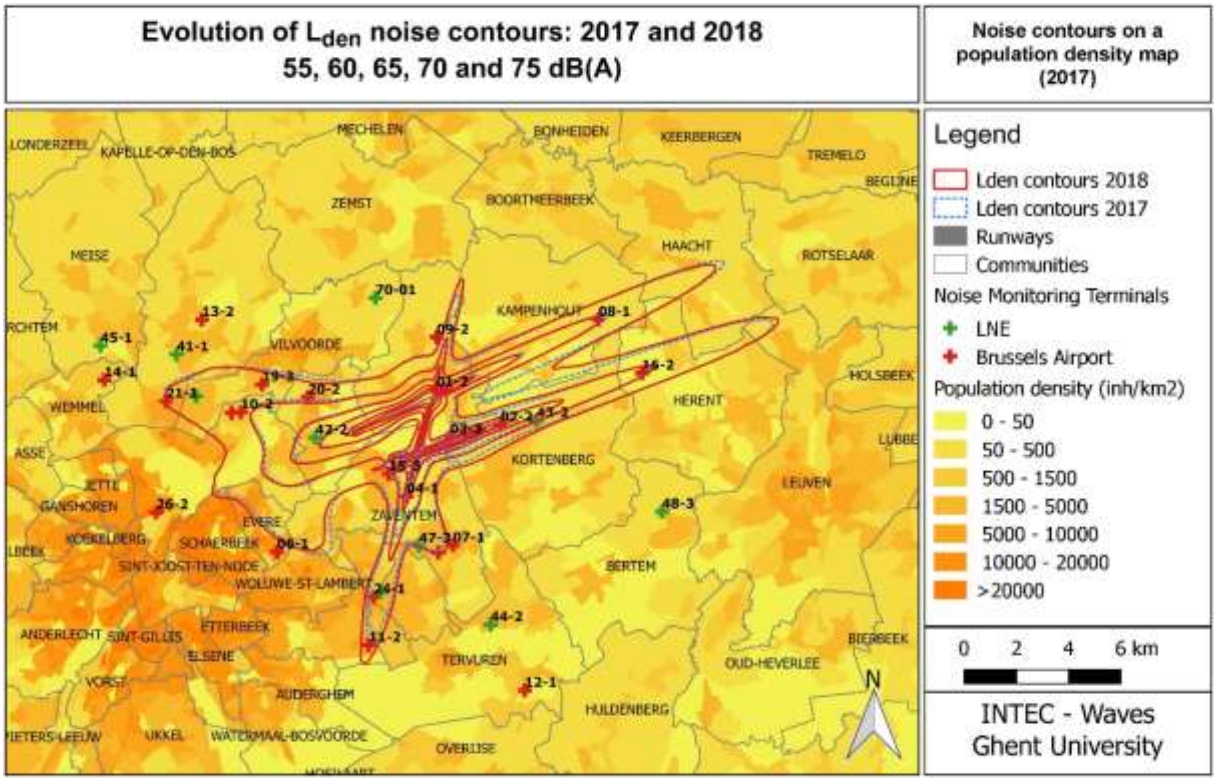
To the east of the airport the contours from runway 25L/07R and 25R/07L come together due to the 'alternate mode' being adopted more often in 2018. To the south of Brussels Airport, the surface area of all contours increased through the higher use of runway 01 for landings (from 936 in 2017 to 1,730 in 2018). To the north of the airport, noise contours rose as a result of an increase in the number of landings on runway 19 from 874 to 947.

The total surface area inside the L_{night} contour of 45 dB(A) rose in 2018 by 5.7% compared with 2017 (from 12,754 ha to 13,476 ha). The number of residents inside the L_{day} contour of 45 dB(A) grew by 12.7% (from 142,110 to 160,109); coming close to the value for 2016 (161,216).

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 2017 and 2018. 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 2017 (dotted blue) and 2018 (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 variations between the different periods offset one another to the west of the airport. In the southerly direction there is an expansion from the higher number of landings on runway 01. The further combining of the contours east of the airport is also striking due to the larger number of departures from runways 07R and 07L.

The total surface area inside the L_{den} noise contour of 55 dB(A) rose in 2018 by about 6.0% compared with 2017 (from 9,000 ha to 9,540 ha). The number of residents inside the L_{den} contour of 55 dB(A) rose by 10.6% (from 93,305 to 103,114) and rose by 3.4% in comparison to 2017.

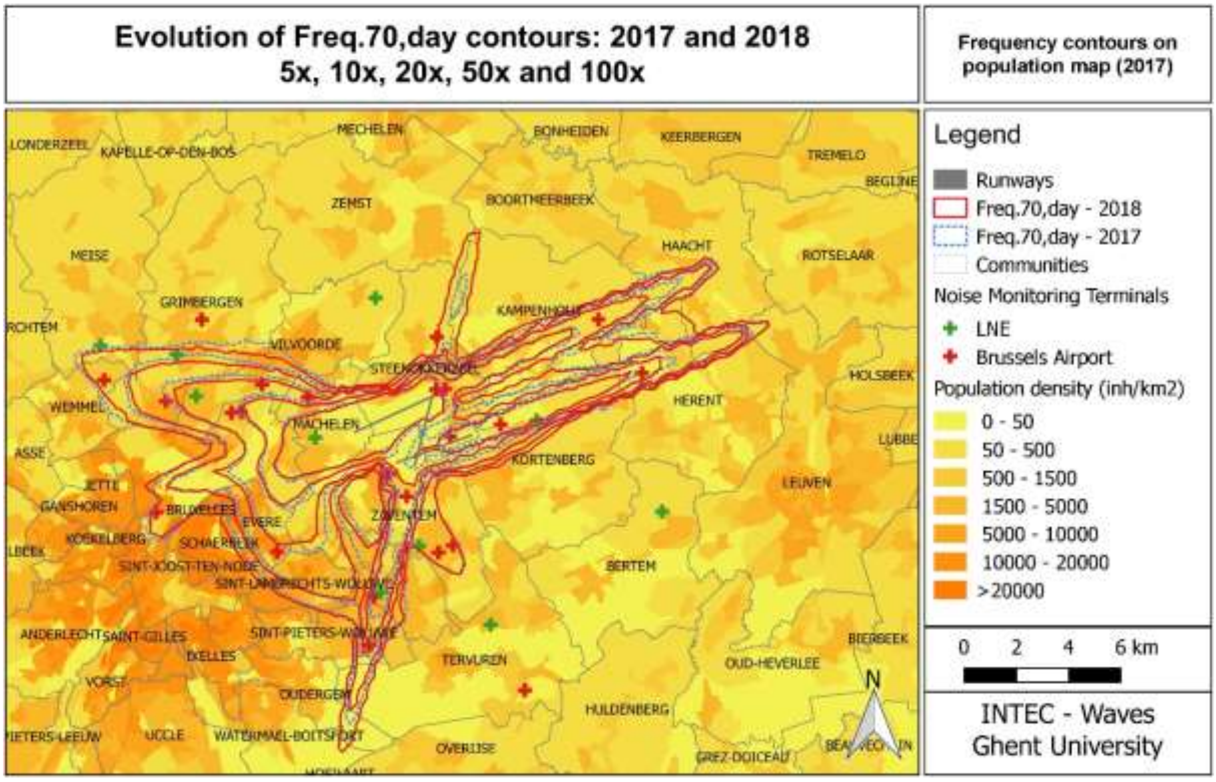
4.3.5 Freq.70,day contours (day 07:00 - 23:00)

The Freq.70,day contours are calculated for an evaluation period that consists of the evaluation periods of L_{day} and $L_{evening}$ together. 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).

There are minor reductions in the contour for departures from runway 25R for the right turns and for flights straight ahead. The turn to the left becomes a bit wider, but becomes shorter along the routes. The increase in the number of landings on runway 19 and runway 01 are visible in the contours. The contours to the west of the airport are little changed.

The total surface area inside the contour of '5x above 70 dB(A)' rose in 2018 by 4.0 % compared with 2017 (from 13,722 ha to 14,276 ha). The number of residents inside the Freq.70,day contour of 5 events increased sharply by 6.0% (from 266,238 to 282,289).

Figure 9: Freq.70,day frequency contours around Brussels Airport for 2017 and 2018.

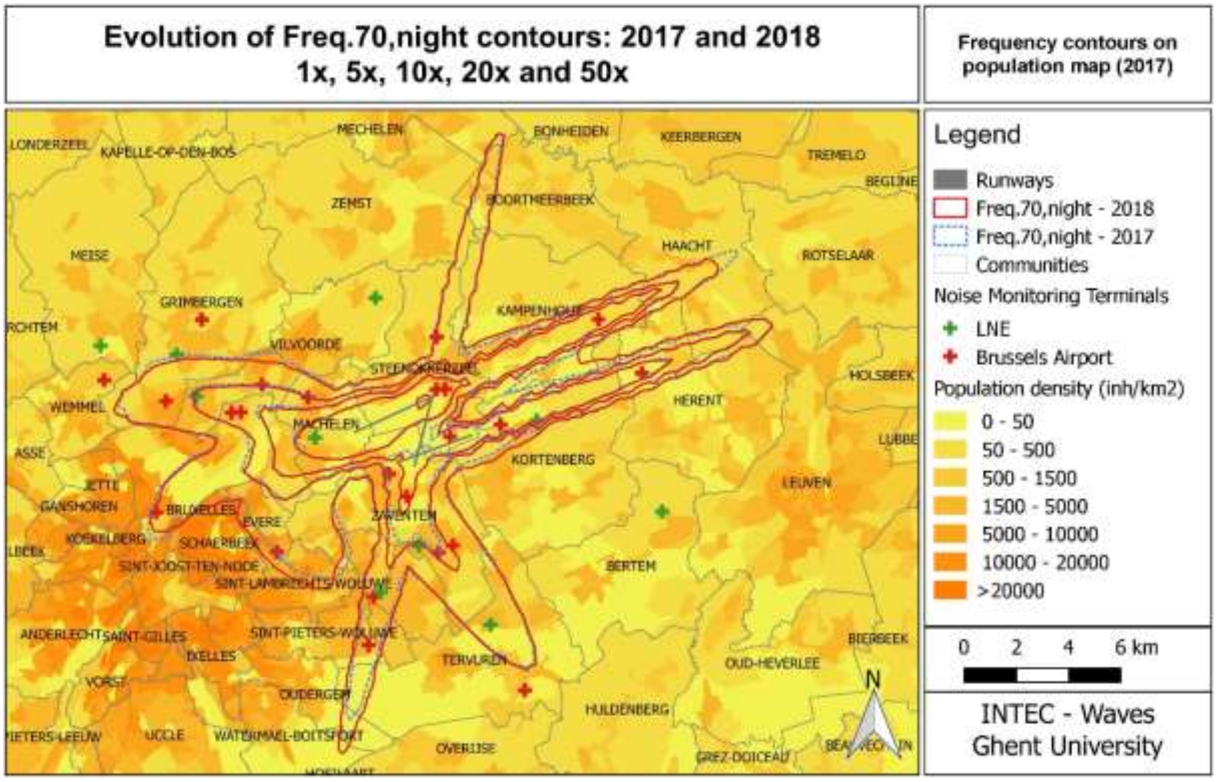


4.3.6 Freq.70,night contours (night 23:00-07:00)

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}. There is a slight shift in the contours for departures from runway 25R. The contour for the departures with a bend to the left has become wider in the southerly direction. The landing contour for runway 01 is larger (almost a doubling of the number of landings during the night on this runway). The increase in the number of departures from runway 07L and 07R is visible in the expansion of the associated contour.

The total surface area inside the 1x above the 70 dB(A) contour during the night dropped in 2018 by 4.5% compared with 2017 (from 13,427 ha to 14,034 ha). The number of residents inside the Freq.70,day contour rose by 10.4% (from 194,930 to 215,281), but remains 3.3% below the value for 2016 (222,622).

Figure 10: Freq.70,night frequency contours around Brussels Airport for 2017 and 2018.

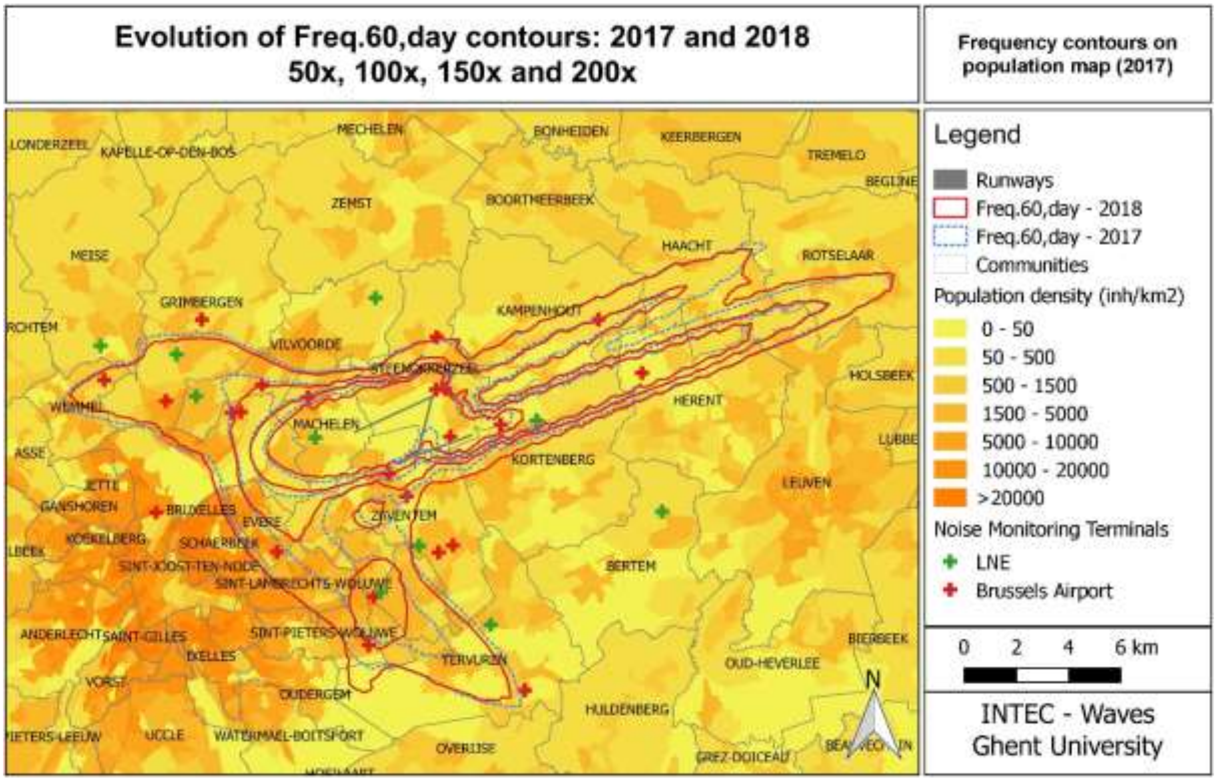


4.3.7 Freq.60,day contours (day 07:00-23:00)

The Freq.60,day contours are calculated for an evaluation period consisting of both the L_{day} and $L_{evening}$ evaluation periods. The 50x freq.60, day contour shows no bulge in line with runway 25R because there are not 50 flights a day that fly straight ahead. The evolution of the Freq.60,day contours reflects the changes in the runway usage and the changes that have been discussed The departures contour from 25R has shrunk slightly, but the leftward bend caused it to shift in a southerly direction. The 100x contour through the departures with a bend to the left from runway 25R is no longer linked to the landing zone on runway 01, and so is comparable to the situation in 2016 (not represented). The higher number of landings on runway 01 is also visible in the contour. The growth in the number of departures from runway 07R widens the associated contours. The 100x contour is for this reason less deeply incised between runways 07R and 07L.

The total surface area inside the Freq.60,day contour of 50x above 60 dB(A) rose in 2018 by about 3.1% compared to 2017 (from 16,192 ha to 16,629 ha). The number of residents inside the Freq.60,day contour of 50x above 60 dB(A) rose by 1.5% (from 269,167 to 273,238).

Figure 11: Freq.60,day frequency contours around Brussels Airport for 2017 and 2018.

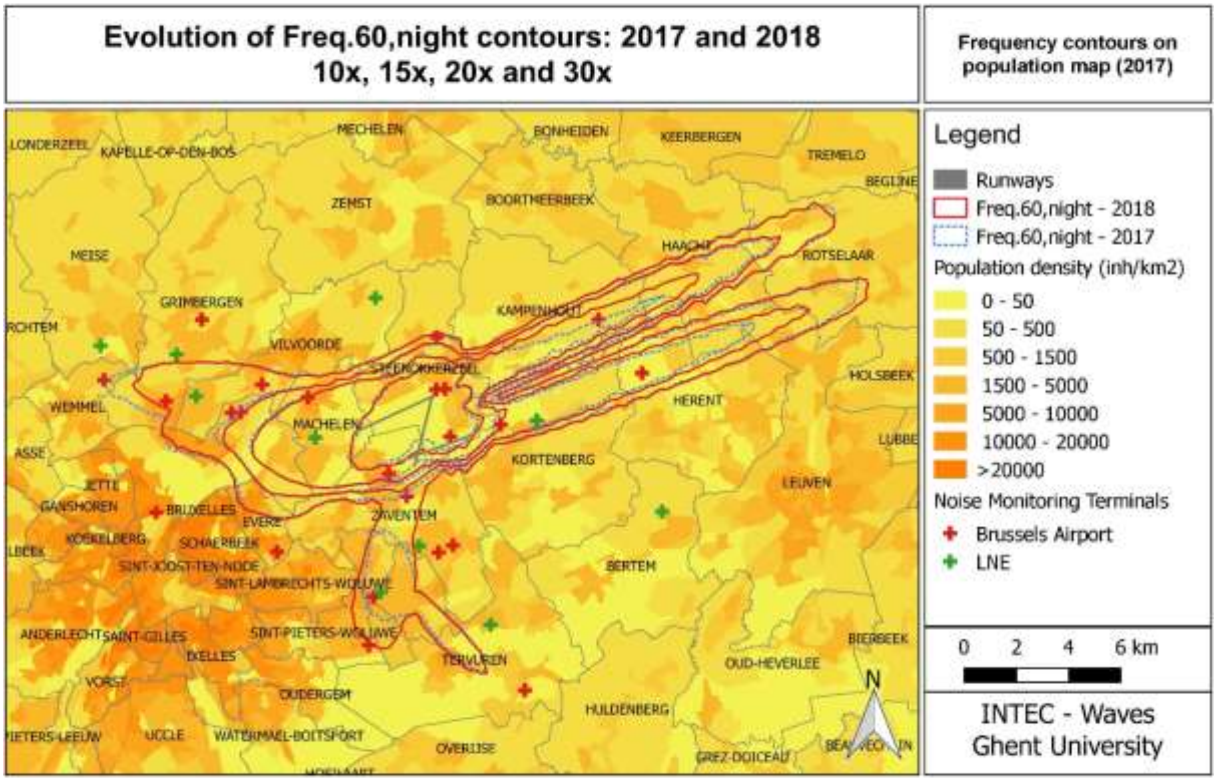


4.3.8 Freq.60,night contours (night 23:00-07:00)

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 right-hand bend from runway 25R shrank slightly. The higher number of approaches on runway 01 caused the merging of the 10x contour above Zaventem, comparable with the situation in 2015.

The total surface area inside the Freq.60,night frequency contour with 10x above 60 dB(A) rose in 2018 by about 4.9% compared with 2017 (from 12,454 ha to 13,061 ha). The number of residents inside the Freq.60,night contour of 10x above 60 dB(A) increased by 5.6% (from 142,245 to 150,202).

Figure 12: Freq.60,night frequency contours around Brussels Airport for 2017 and 2018.



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 (1 January 2017) 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.

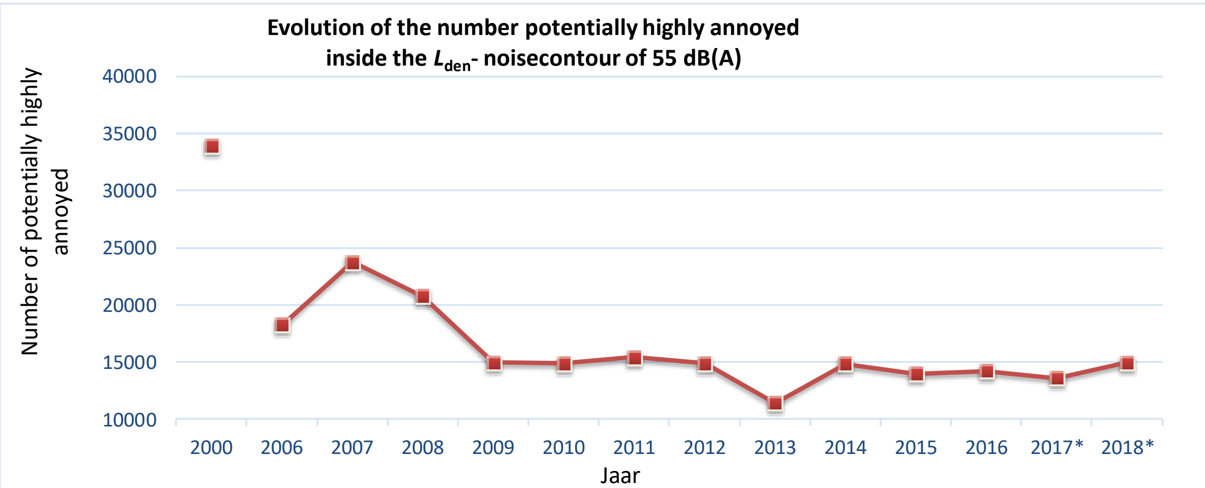
The total number of potentially highly inconvenienced persons in 2018 within the contour of 55 dB(A) is 14,948, an increase of 10.1% in comparison to 2017. The results for 2017 and 2018 are based on the same methodology for the allocation of the population (based on address points) and shows a real change in exposure, including the increase in the population density. This is chiefly the result of the larger number of flights during the evening and night, in combination with more operations taking place following the alternative mode (east wind). Slight shifts in the actual routes flown caused additional changes in the contours locally. Above Grimbergen a concentration of flights occurred in the evening hours, but this was not offset in the annoyance calculation based on L_{den}. Above Evere and Sint-Stevens-Woluwe (Zaventem), the contour has been enlarged by the spreading of the flights in the evening and night and this has a negative impact on the number of highly inconvenienced persons. Due to the high number of departures from runway 07R/07L and landings on runway 01, the inconvenience levels in the municipalities to the east and south of the airport has increased. Steenokkerzeel, Kampenhout, Kortenberg, Zaventem, Sint-Pieters-Woluwe, Wezenbeek-Oppem experience the largest effects as a result of the operations conducted under non-preferential conditions.

It is prudent to compare these results with 2015 and 2016, which were calculated using the same methodology for the population in 2017 and 2018 (see also Chapter 1.5). This results in 14,815 highly inconvenienced persons for 2016 and 14,560 highly inconvenienced persons in 2015. The number of flight movements in 2018 rose by 0.9% compared to 2016 and by 2.7% compared to 2015. The long-term trend is negative, but the increase from 10.1% between 2017 and 2018 is not representative for the long-term trend.

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

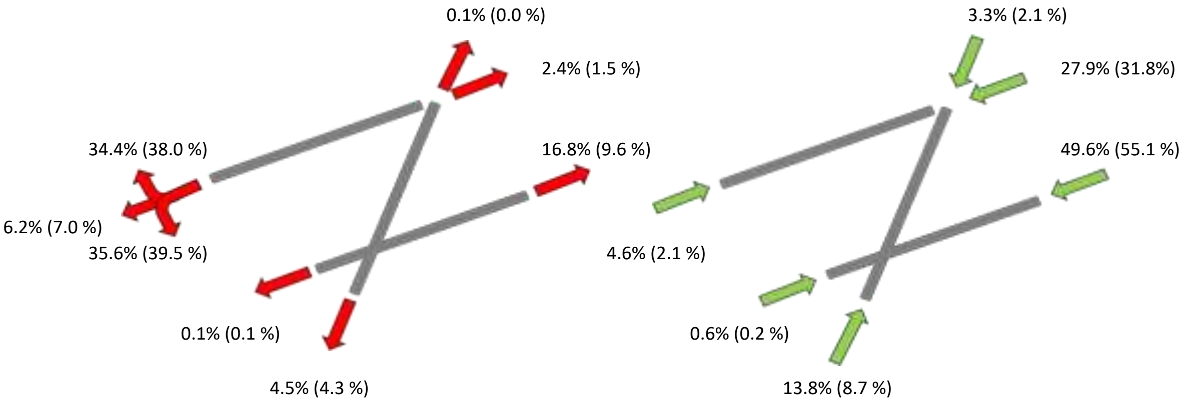
Figure 13: Evolution of the number of people who are potentially seriously inconvenienced inside the L_{den} 55 dB(A) noise contour. For 2017 and 2018, the new methodology is accented with * (use of the address points, including annual population evolution).



5 Appendices

5.1 Runway and route usage

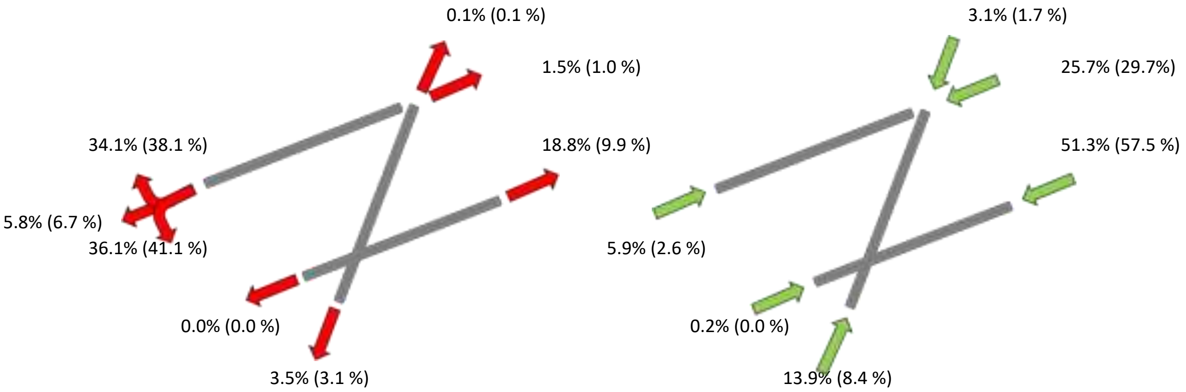
Table 9: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year (all flights, day, evening and night). The figures between brackets are the data for 2017.



All flights (day. evening. night)				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	57	76	0.0%	0.1%
07L	1,763	2,779	1.5%	2.4%
07R	11,376	19,760	9.6%	16.8%
19	5,104	5,352	4.3%	4.5%
25L	147	143	0.1%	0.1%
25R	100,487	89,619	84.5%	76.1%

All flights (day. evening. night)				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	10,391	16,295	8.7%	13.8%
07L	2,460	5,445	2.1%	4.6%
07R	271	734	0.2%	0.6%
19	2,455	3,921	2.1%	3.3%
25L	65,481	58,442	55.1%	49.6%
25R	37,878	32,893	31.8%	27.9%

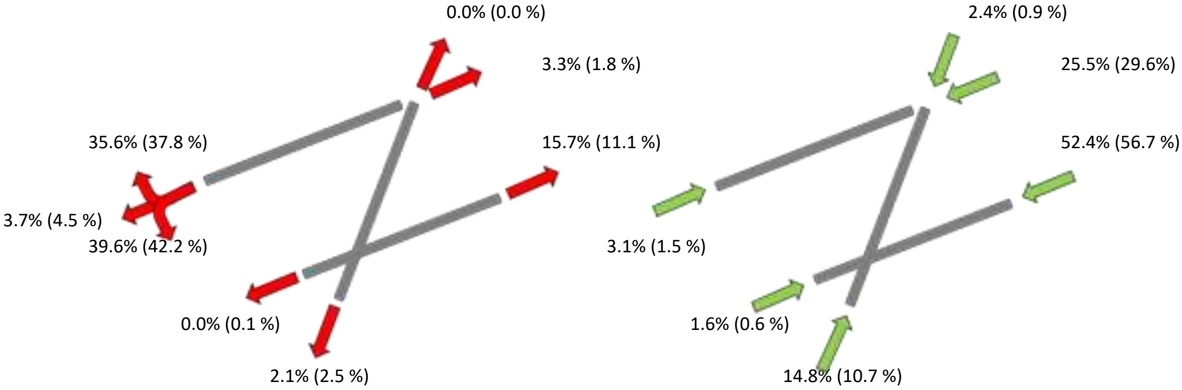
Table 10: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year: day. The figures between brackets are the data for 2017.



Flights day				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	53	61	0.1%	0.1%
07L	826	1,213	1.0%	1.5%
07R	7,926	14,729	9.9%	18.8%
19	2,479	2,761	3.1%	3.5%
25L	33	27	0.0%	0.0%
25R	68,582	59,645	85.8%	76.0%

Flights day				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	6,524	10,454	8.4%	13.9%
07L	2,032	4,426	2.6%	5.9%
07R	11	131	0.0%	0.2%
19	1,348	2,298	1.7%	3.1%
25L	44,769	38,564	57.5%	51.3%
25R	23,141	19,309	29.7%	25.7%

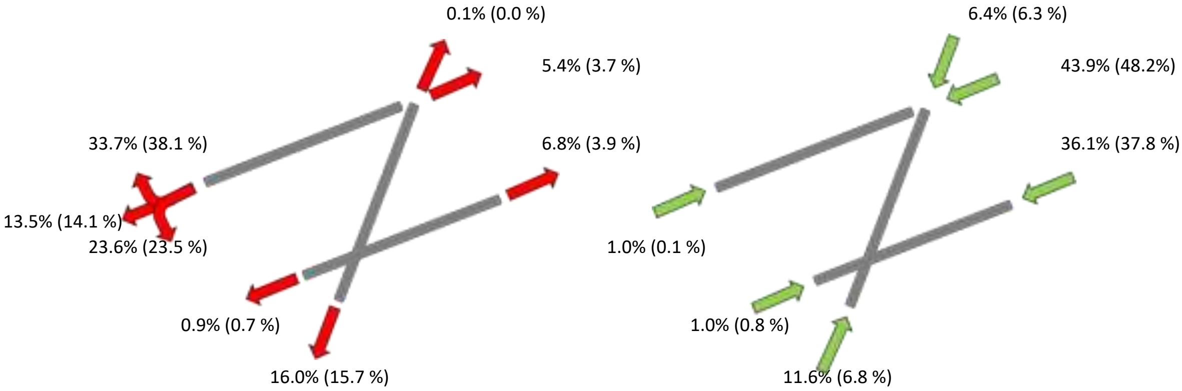
Table 11: Overview of the number of departures and arrivals annually and per runway, including changes in comparison to the previous year: evening. The figures between brackets are the data for 2017.



Flights evening				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	3	0	0.0%	0.0%
07L	472	877	1.8%	3.3%
07R	2,960	4,170	11.1%	15.7%
19	669	550	2.5%	2.1%
25L	21	0	0.1%	0.0%
25R	22,490	20,977	84.5%	78.9%

Flights evening				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	2,931	4,111	10.7%	14.8%
07L	412	865	1.5%	3.1%
07R	154	453	0.6%	1.6%
19	233	676	0.9%	2.4%
25L	15,489	14,518	56.7%	52.4%
25R	8,092	7,061	29.6%	25.5%

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 2017.



Flights night				
Departures				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	1	15	0.0%	0.1%
07L	465	689	3.7%	5.4%
07R	490	861	3.9%	6.8%
19	1,956	2,041	15.7%	16.0%
25L	93	116	0.7%	0.9%
25R	9,415	8,997	75.8%	70.7%

Flights night				
Landings				
	Number		Percentage	
Runway	2017	2018	2017	2018
01	936	1,730	6.8%	11.6%
07L	16	154	0.1%	1.0%
07R	106	150	0.8%	1.0%
19	874	947	6.3%	6.4%
25L	5,223	5,360	37.8%	36.1%
25R	6,645	6,523	48.2%	43.9%

5.2 Location of the measuring stations

Figure 14: Location of the measuring stations.

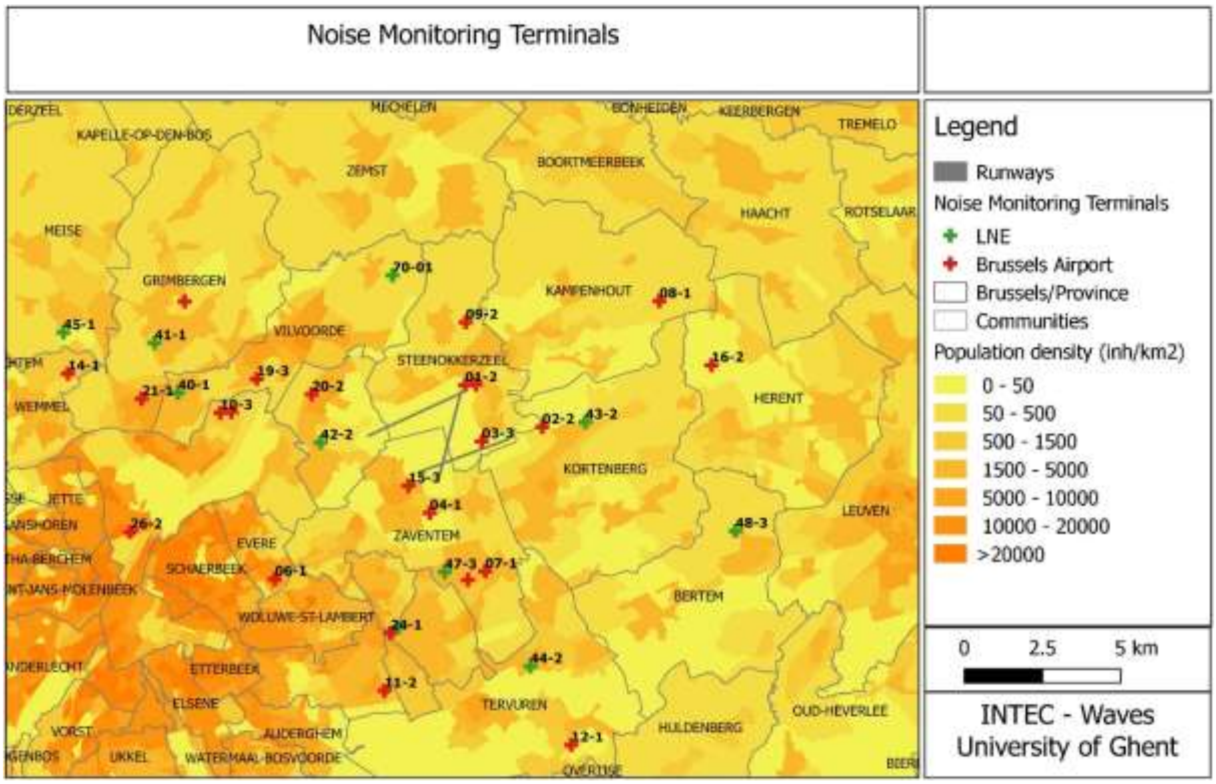


Table 13: Overview of the measuring points.

Code	Name
NMT01-2	STEENOKKERZEEL
NMT02-2	KORTENBERG
NMT03-3	HUMELGEM-Airside
NMT04-1	NOSSEGEM
NMT06-1	EVERE
NMT07-1+	STERREBEEK
NMT08-1	KAMPENHOUT
NMT09-2	PERK
NMT10-2+	NEDER-OVER-HEEMBEEK
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	VILVOORDE
NMT20-2	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*	WEZEMBEEK-OPPEM
NMT48-3*	BERTEM
NMT70-1*+	ROTSELAAR

5.3 Results of contour calculations for 2018

5.3.1 Surface area per contour zone and per municipality

Table 14: Surface area per L_{day} contour zone and municipality – 2018.

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	650	122	0	-	-	773
Evere	43	-	-	-	-	43
Haacht	18	-	-	-	-	18
Herent	223	-	-	-	-	223
Kampenhout	357	44	-	-	-	401
Kortenberg	432	211	43	3	-	688
Kraainem	53	-	-	-	-	53
Machelen	325	288	195	56	11	874
Steenokkerzeel	433	334	199	125	76	1,166
Vilvoorde	68	-	-	-	-	68
Wezembeek-Oppem	43	-	-	-	-	43
Zaventem	391	151	50	43	-	635
Totaal	**3,037**	**1,150**	**486**	**227**	**87**	**4,987**

Table 15: Surface area per $L_{evening}$ contour zone and municipality – 2018.

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	478	658	207	7	-	-	1,349
Evere	359	154	-	-	-	-	513
Grimbergen	925	-	-	-	-	-	925
Haacht	640	9	-	-	-	-	648
Herent	686	201	-	-	-	-	887
Kampenhout	1,155	403	67	-	-	-	1,625
Kortenberg	446	418	180	35	2	-	1,082
Kraainem	458	65	-	-	-	-	522
Leuven	234	-	-	-	-	-	234
Machelen	215	338	267	200	68	18	1,106
Meise	12	-	-	-	-	-	12
Oudergem	0	-	-	-	-	-	0
Rotselaar	112	-	-	-	-	-	112
Schaarbeek	252	-	-	-	-	-	252
Sint-Lambrechts-Woluwe	483	-	-	-	-	-	483
Sint-Pieters-Woluwe	324	-	-	-	-	-	324
Steenokkerzeel	445	485	346	202	118	81	1,676
Tervuren	108	-	-	-	-	-	108
Vilvoorde	432	244	-	-	-	-	676
Wemmel	28	-	-	-	-	-	28
Wezembeek-Oppem	267	49	-	-	-	-	316
Zaventem	1,074	423	139	45	37	-	1,717
Total	**9,134**	**3,445**	**1,207**	**489**	**225**	**99**	**14,599**

Table 16: Surface area per L_{night} contour zone and municipality – 2018.

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	1	-	-	-	-	-	1
Brussel	724	455	22	-	-	-	1,200
Evere	317	-	-	-	-	-	317
Grimbergen	534	-	-	-	-	-	534
Haacht	795	44	-	-	-	-	839
Herent	628	205	-	-	-	-	832
Kampenhout	1,007	492	141	14	-	-	1,654
Kortenberg	466	344	143	28	2	-	984
Kraainem	226	44	-	-	-	-	270
Leuven	215	-	-	-	-	-	215
Machelen	270	372	308	122	28	10	1,110
Rotselaar	138	-	-	-	-	-	138
Schaarbeek	31	-	-	-	-	-	31
Sint-Lambrechts-Woluwe	35	-	-	-	-	-	35
Sint-Pieters-Woluwe	168	-	-	-	-	-	168
Steenokkerzeel	470	496	317	213	124	105	1,725
Tervuren	195	-	-	-	-	-	195
Vilvoorde	601	32	-	-	-	-	633
Wezembeek-Oppem	245	33	-	-	-	-	278
Zaventem	1,397	568	219	65	24	13	2,286
Zemst	32	-	-	-	-	-	32
Total	**8,495**	**3,084**	**1,148**	**442**	**178**	**128**	**13,476**

Table 17: Surface area per L_{den} contour zone and municipality – 2018.

Area (ha)	L_{den} contour zone in dB(A)					
Municipality	55-60	60-65	65-70	70-75	>75	Total
Brussel	630	363	25	-	-	1,017
Evere	301	-	-	-	-	301
Grimbergen	149	-	-	-	-	149
Haacht	389	-	-	-	-	389
Herent	484	55	-	-	-	539
Kampenhout	968	271	47	-	-	1,285
Kortenberg	397	333	96	16	-	843
Kraainem	189	9	-	-	-	198
Leuven	72	-	-	-	-	72
Machelen	292	332	262	112	31	1,030
Schaarbeek	19	-	-	-	-	19
Sint-Lambrechts-Woluwe	14	-	-	-	-	14
Sint-Pieters-Woluwe	91	-	-	-	-	91
Steenokkerzeel	482	439	284	170	168	1,542
Vilvoorde	492	13	-	-	-	505
Wezembeek-Oppem	123	2	-	-	-	125
Zaventem	868	370	118	38	29	1,423
Total	**5,957**	**2,186**	**832**	**336**	**228**	**9,540**

Table 18: Surface area per Freq.70,day contour zone and municipality – 2018.

Area (ha)	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	400	290	362	377	137	1,566
Evere	3	251	257	2	-	513
Grimbergen	398	501	28	-	-	926
Haacht	151	183	109	-	-	444
Herent	280	215	206	103	6	811
Kampenhout	336	448	606	218	3	1,611
Kortenberg	118	187	229	220	372	1,125
Kraainem	197	88	146	-	-	431
Leuven	35	1	-	-	-	36
Machelen	50	80	146	176	572	1,024
Meise	84	-	-	-	-	84
Oudergem	71	0	-	-	-	71
Schaarbeek	219	43	-	-	-	262
Sint-Lambrechts-Woluwe	174	402	3	-	-	579
Sint-Pieters-Woluwe	129	118	42	-	-	289
Steenokkerzeel	234	109	209	416	584	1,552
Tervuren	83	57	-	-	-	139
Vilvoorde	112	174	363	20	-	669
Watermaal-Bosvoorde	17	-	-	-	-	17
Wemmel	163	-	-	-	-	163
Wezembeek-Oppem	58	45	96	-	-	199
Zaventem	502	360	483	281	98	1,723
Zemst	39	-	-	-	-	39
Total	**3,851**	**3,553**	**3,286**	**1,811**	**1,773**	**14,276**

Table 19: Surface area per Freq.70,night contour zone and municipality – 2018.

Area (ha)	Freq.70,night contour zone (23:00-07:00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	224	-	-	-	224
Brussel	777	475	214	10	1,477
Evere	472	3	-	-	476
Grimbergen	664	-	-	-	664
Haacht	254	149	19	-	422
Herent	262	206	106	-	574
Kampenhout	861	249	558	-	1,669
Kortenberg	311	177	429	-	918
Kraainem	251	21	-	-	272
Leuven	57	-	-	-	57
Machelen	212	158	262	399	1,030
Mechelen	19	-	-	-	19
Oudergem	70	-	-	-	70
Schaarbeek	63	-	-	-	63
Sint-Lambrechts-Woluwe	263	-	-	-	263
Sint-Pieters-Woluwe	182	-	-	-	182
Steenokkerzeel	501	200	471	482	1,654
Tervuren	698	-	-	-	698
Vilvoorde	391	231	5	-	628
Watermaal-Bosvoorde	20	-	-	-	20
Wezembeek-Oppem	272	17	-	-	289
Zaventem	1,291	622	298	66	2,277
Zemst	91	-	-	-	91
Total	**8,207**	**2,508**	**2,362**	**957**	**14,034**

Table 20: Surface area per Freq.60,day contour zone and municipality – 2018.

Area (ha)	Freq.60,day contour zone (day 07:00-23:00)				
Municipality	50-100	100-150	150-200	>200	Total
Brussel	369	400	252	167	1,189
Evere	332	182	-	-	513
Grimbergen	1,077	-	-	-	1,077
Haacht	789	112	143	-	1,043
Herent	444	228	373	-	1,045
Kampenhout	912	504	27	-	1,443
Kortenberg	353	194	567	96	1,210
Kraainem	319	264	-	-	583
Leuven	109	186	7	-	302
Machelen	102	118	198	702	1,120
Meise	13	-	-	-	13
Oudergem	2	-	-	-	2
Rotselaar	506	54	-	-	559
Schaarbeek	120	-	-	-	120
Sint-Lambrechts-Woluwe	530	10	-	-	540
Sint-Pieters-Woluwe	259	141	-	-	400
Steenokkerzeel	266	257	196	913	1,633
Tervuren	829	-	-	-	829
Vilvoorde	570	77	0	-	647
Wemmel	183	-	-	-	183
Wezembeek-Oppem	416	171	-	-	587
Zaventem	859	338	113	280	1,591
Total	**9,359**	**3,235**	**1,876**	**2,159**	**16,629**

Table 21: Surface area per Freq.60,night contour zone and municipality – 2018.

Area (ha)	Freq.60,night contour zone (23:00-07:00)				
Municipality	10-15	15-20	20-30	>30	Total
Brussel	397	403	324	-	1,124
Evere	186	1	-	-	187
Grimbergen	444	-	-	-	444
Haacht	365	617	108	-	1,091
Herent	346	537	35	-	918
Kampenhout	310	473	737	-	1,521
Kortenberg	223	691	62	-	976
Kraainem	358	-	-	-	358
Leuven	147	143	-	-	290
Machelen (Halle-Vilvoorde	99	121	821	78	1,120
Rotselaar	748	80	-	-	828
Sint-Lambrechts-Woluwe	1	-	-	-	1
Sint-Pieters-Woluwe	124	-	-	-	124
Steenokkerzeel	123	183	441	943	1,690
Tervuren	170	-	-	-	170
Vilvoorde	568	34	-	-	602
Wezembeek-Oppem	453	-	-	-	453
Zaventem	516	149	218	280	1,163
Total	**5,580**	**3,434**	**2,746**	**1,301**	**13,061**

5.3.2 Number of residents per contour zone and per municipality

Table 22: Number of residents per L_{day} contour zone and municipality – 2018.

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	3,969	2,869	12	-	-	6,851
Evere	983	-	-	-	-	983
Haacht	5	-	-	-	-	5
Herent	602	-	-	-	-	602
Kampenhout	802	159	-	-	-	961
Kortenberg	2,001	336	-	-	-	2,337
Kraainem	604	-	-	-	-	604
Machelen	4,187	4,118	2,691	3	-	10,998
Steenokkerzeel	4,734	1,229	95	-	-	6,058
Vilvoorde	141	-	-	-	-	141
Wezembeek-Oppem	971	-	-	-	-	971
Zaventem	4,288	283	-	-	-	4,571
Total	**23,289**	**8,993**	**2,798**	**3**	**-**	**35,083**

Table 23: Number of residents per $L_{evening}$ contour zone and municipality – 2018.

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	19,115	3,668	4,488	71	-	-	27,342
Evere	32,571	7,849	-	-	-	-	40,420
Grimbergen	19,193	-	-	-	-	-	19,193
Haacht	1,542	-	-	-	-	-	1,542
Herent	1,252	486	-	-	-	-	1,738
Kampenhout	4,397	1,269	208	-	-	-	5,874
Kortenberg	3,113	1,665	231	-	-	-	5,010
Kraainem	12,167	911	-	-	-	-	13,078
Leuven	822	-	-	-	-	-	822
Machelen	4,055	4,203	3,334	3,274	57	-	14,922
Meise	171	-	-	-	-	-	171
Rotselaar	260	-	-	-	-	-	260
Schaarbeek	45,432	-	-	-	-	-	45,432
Sint-Lambrechts-Woluwe	26,837	-	-	-	-	-	26,837
Sint-Pieters-Woluwe	13,699	-	-	-	-	-	13,699
Steenokkerzeel	2,730	5,199	1,525	193	-	-	9,646
Tervuren	89	-	-	-	-	-	89
Vilvoorde	14,528	2,060	-	-	-	-	16,588
Wemmel	303	-	-	-	-	-	303
Wezembeek-Oppem	6,586	1,074	-	-	-	-	7,659
Zaventem	17,240	5,729	246	-	-	-	23,215
Total	**226,101**	**34,113**	**10,033**	**3,538**	**57**	**-**	**273,841**

Table 24: Number of residents per L_{night} contour zone and municipality – 2018.

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	14,272	5,258	103	-	-	-	19,633
Evere	18,665	-	-	-	-	-	18,665
Grimbergen	15,101	-	-	-	-	-	15,101
Haacht	2,566	9	-	-	-	-	2,575
Herent	907	527	-	-	-	-	1,435
Kampenhout	3,886	1,379	282	132	-	-	5,679
Kortenberg	2,504	1,339	136	-	-	-	3,979
Kraainem	6,306	260	-	-	-	-	6,566
Leuven	647	-	-	-	-	-	647
Machelen	3,876	5,817	5,159	107	-	-	14,959
Rotselaar	84	-	-	-	-	-	84
Schaarbeek	4,248	-	-	-	-	-	4,248
Sint-Lambrechts-Woluwe	1,922	-	-	-	-	-	1,922
Sint-Pieters-Woluwe	6,138	-	-	-	-	-	6,138
Steenokkerzeel	2,506	5,082	1,793	262	64	-	9,707
Tervuren	1,850	-	-	-	-	-	1,850
Vilvoorde	13,908	139	-	-	-	-	14,047
Wezembeek-Oppem	5,154	648	-	-	-	-	5,803
Zaventem	17,980	8,896	128	0	-	-	27,004
Zemst	69	-	-	-	-	-	69
Total	**122,588**	**29,355**	**7,601**	**501**	**64**	**-**	**160,109**

Table 25: Number of residents per L_{den} contour zone and municipality – 2018.

Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	6,192	5,056	200	-	-	11,448
Evere	16,552	-	-	-	-	16,552
Grimbergen	4,274	-	-	-	-	4,274
Haacht	606	-	-	-	-	606
Herent	975	29	-	-	-	1,005
Kampenhout	3,054	741	161	-	-	3,957
Kortenberg	2,372	1,085	44	-	-	3,501
Kraainem	4,310	-	-	-	-	4,310
Leuven	170	-	-	-	-	170
Machelen	4,271	4,967	4,257	289	-	13,785
Schaarbeek	1,609	-	-	-	-	1,609
Sint-Lambrechts-Woluwe	430	-	-	-	-	430
Sint-Pieters-Woluwe	3,189	-	-	-	-	3,189
Steenokkerzeel	3,573	4,237	748	124	-	8,681
Vilvoorde	9,474	77	-	-	-	9,552
Wezembeek-Oppem	2,894	-	-	-	-	2,894
Zaventem	13,865	3,284	3	-	-	17,152
Total	**77,812**	**19,476**	**5,413**	**413**	**-**	**103,114**

Table 26: Number of residents per Freq.70,day contour zone and municipality – 2018.

Number of Inhabitants	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	26,153	4,590	2,018	5,687	-	38,448
Evere	511	27,475	12,455	9	-	40,450
Grimbergen	5,411	12,315	873	-	-	18,598
Haacht	552	196	118	-	-	867
Herent	762	204	692	42	-	1,699
Kampenhout	1,470	1,697	1,607	575	-	5,349
Kortenberg	1,164	1,157	1,695	1,059	874	5,951
Kraainem	7,444	1,879	3,238	-	-	12,561
Leuven	64	-	-	-	-	64
Machelen	774	1,874	2,130	8,894	-	13,672
Meise	890	-	-	-	-	890
Schaarbeek	32,182	2,556	-	-	-	34,738
Sint-Lambrechts-Woluwe	14,613	22,305	184	-	-	37,102
Sint-Pieters-Woluwe	6,243	4,963	1,503	-	-	12,709
Steenokkerzeel	1,284	972	2,244	3,839	150	8,489
Vilvoorde	5,083	4,542	6,875	79	-	16,579
Wemmel	1,369	-	-	-	-	1,369
Wezembeek-Oppem	1,345	1,203	2,175	-	-	4,722
Zaventem	14,707	6,197	4,650	2,385	-	27,938
Zemst	93	-	-	-	-	93
Total	**122,115**	**94,126**	**42,456**	**22,569**	**1,024**	**282,289**

Table 27: Number of residents per Freq.70,night contour zone and municipality – 2018.

Number of Inhabitants	Freq.70,night contour zone (23:00-07:00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	1,956	-	-	-	1,956
Brussel	25,147	2,808	4,113	76	32,144
Evere	36,137	-	-	-	36,137
Grimbergen	16,077	-	-	-	16,077
Haacht	666	127	2	-	795
Herent	315	658	63	-	1,035
Kampenhout	3,078	952	1,463	-	5,493
Kortenberg	1,829	1,267	1,115	-	4,211
Kraainem	6,450	96	-	-	6,546
Leuven	114	-	-	-	114
Machelen	3,083	2,668	3,838	4,095	13,684
Mechelen	128	-	-	-	128
Schaarbeek	12,376	-	-	-	12,376
Sint-Lambrechts-Woluwe	16,166	-	-	-	16,166
Sint-Pieters-Woluwe	6,840	-	-	-	6,840
Steenokkerzeel	3,155	2,028	2,461	1,680	9,324
Tervuren	4,242	-	-	-	4,242
Vilvoorde	10,936	3,108	48	-	14,092
Wezembeek-Oppem	5,724	269	-	-	5,994
Zaventem	18,280	7,497	1,846	169	27,793
Zemst	135	-	-	-	135
Total	**172,835**	**21,478**	**14,948**	**6,020**	**215,281**

Table 28: Number of residents per Freq.60,day contour zone and municipality – 2018.

Number of Inhabitants	Freq.60,day contour zone (07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	22,778	-	1,020	4,310	28,109
Evere	40,450	-	-	-	40,450
Grimbergen	19,730	-	-	-	19,730
Haacht	3,493	-	154	-	3,647
Herent	1,222	-	869	-	2,091
Kampenhout	4,593	-	-	-	4,593
Kortenberg	2,877	-	2,619	104	5,601
Kraainem	6,796	6,869	-	-	13,664
Leuven	1,302	-	3	-	1,304
Machelen	3,386	-	3,033	8,646	15,065
Meise	219	-	-	-	219
Rotselaar	3,466	-	-	-	3,466
Schaarbeek	15,709	-	-	-	15,709
Sint-Lambrechts-Woluwe	31,173	184	-	-	31,357
Sint-Pieters-Woluwe	10,270	7,392	-	-	17,662
Steenokkerzeel	3,396	-	1,591	4,509	9,496
Tervuren	9,118	-	-	-	9,118
Vilvoorde	14,824	-	-	-	14,824
Wemmel	1,464	-	-	-	1,464
Wezembeek-Oppem	7,777	4,540	-	-	12,317
Zaventem	17,373	-	2,065	3,914	23,352
Total	**221,416**	**18,985**	**11,353**	**21,484**	**273,238**

Table 29: Number of residents per Freq.60,night contour zone and municipality – 2018.

Number of Inhabitants	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	20,556	3,154	4,952	-	28,662
Evere	12,915	-	-	-	12,915
Grimbergen	10,005	-	-	-	10,005
Haacht	1,471	1,871	63	-	3,406
Herent	625	1,061	7	-	1,693
Kampenhout	1,494	1,891	2,169	-	5,555
Kortenberg	1,027	2,889	-	-	3,916
Kraainem	8,859	-	-	-	8,859
Leuven	922	311	-	-	1,232
Machelen	1,435	1,781	11,808	2	15,026
Rotselaar	4,194	10	-	-	4,203
Sint-Lambrechts-Woluwe	5	-	-	-	5
Sint-Pieters-Woluwe	6,466	-	-	-	6,466
Steenokkerzeel	869	1,127	1,949	6,016	9,961
Tervuren	2,045	-	-	-	2,045
Vilvoorde	12,585	139	-	-	12,724
Wezembeek-Oppem	9,545	-	-	-	9,545
Zaventem	3,593	2,615	3,780	3,998	13,985
Total	**98,609**	**16,849**	**24,728**	**10,016**	**150,202**

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

Table 30: Number of residents potentially highly inconvenienced contour zone and municipality – 2018.

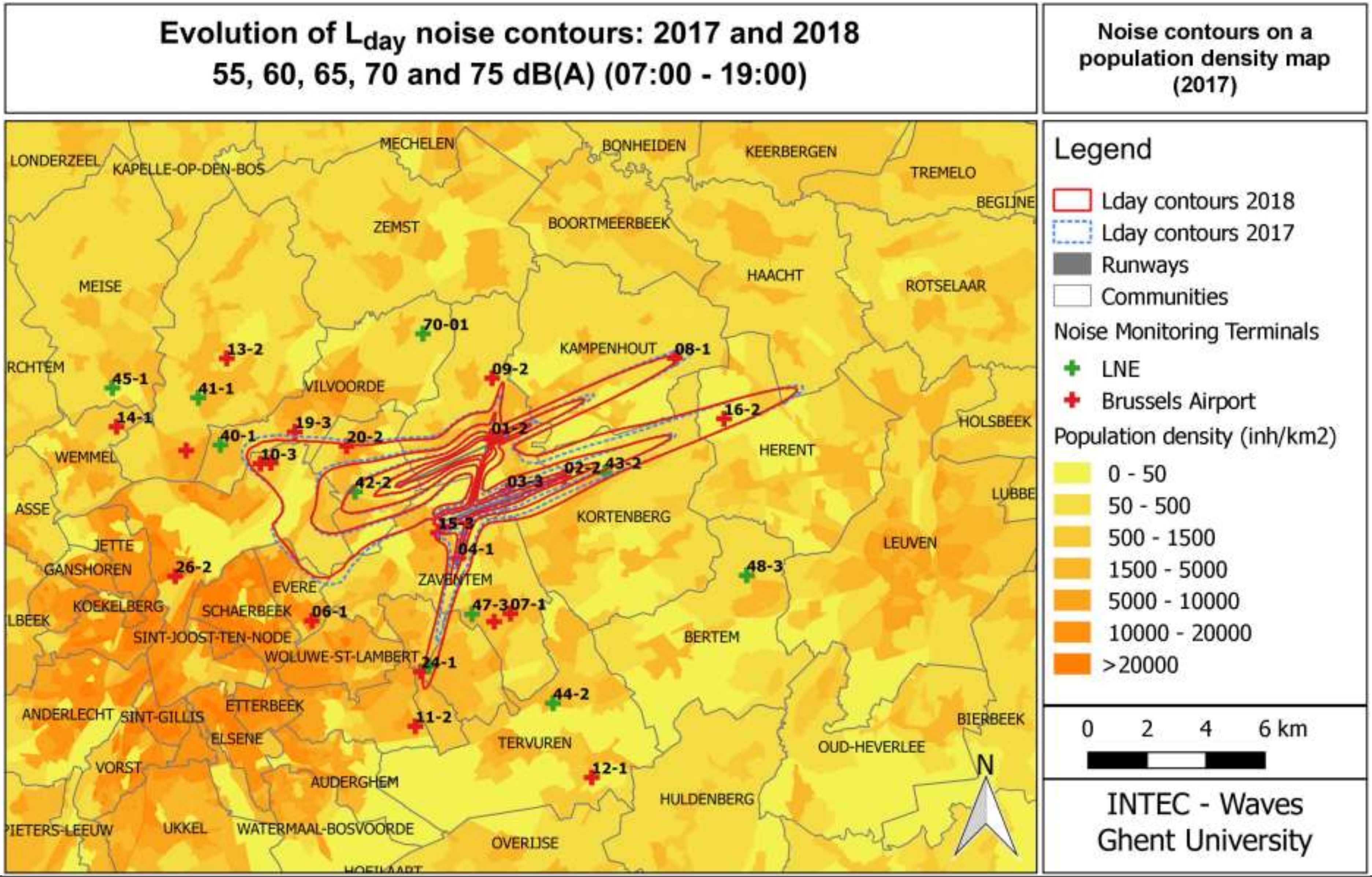
Number of Inhabitants	**L_{den} contour zone in dB(A)**					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	760	1,075	55	-	-	1,889
Evere	1,875	-	-	-	-	1,875
Grimbergen	440	-	-	-	-	440
Haacht	66	-	-	-	-	66
Herent	131	5	-	-	-	136
Kampenhout	367	146	50	-	-	563
Kortenberg	298	211	12	-	-	521
Kraainem	524	-	-	-	-	524
Leuven	18	-	-	-	-	18
Machelen	561	1,032	1,294	109	-	2,995
Schaarbeek	165	-	-	-	-	165
Sint-Lambrechts-Woluwe	44	-	-	-	-	44
Sint-Pieters-Woluwe	338	-	-	-	-	338
Steenokkerzeel	482	847	215	50	-	1,595
Vilvoorde	1,090	14	-	-	-	1,103
Wezembeek-Oppem	360	-	-	-	-	360
Zaventem	1,693	621	1	-	-	2,315
Total	**9,212**	**3,950**	**1,627**	**159**	**-**	**14,948**

5.4 Noise contour maps: evolution 2017-2018

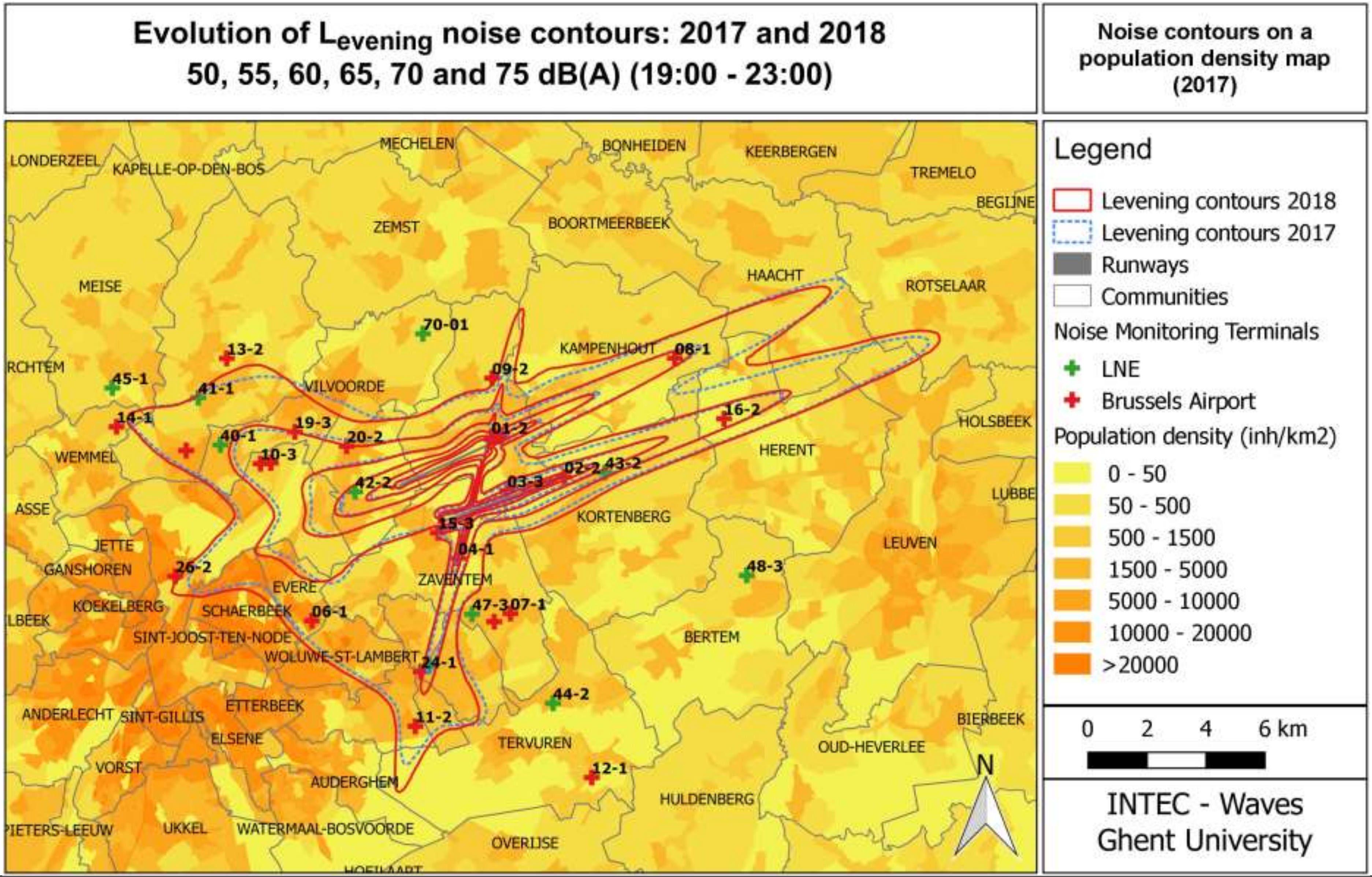
This appendix includes noise maps in A4 format.

- L_{day} noise contours for 2017 and 2018, background population map – 2017
- $L_{evening}$ noise contours for 2017 and 2018, background population map – 2017
- L_{night} noise contours for 2017 and 2018, background population map – 2017
- L_{den} noise contours for 2017 and 2018, background population map – 2017
- Freq.70,day noise contours for 2017 and 2018, background population map – 2017
- Freq.70,night noise contours for 2017 and 2018, background population map – 2017
- Freq.60,day noise contours for 2017 and 2018, background population map – 2017
- Freq.60,night noise contours for 2017 and 2018, background population map – 2017

- L_{day} noise contours for 2017 and 2018, background NGI topographical map
- $L_{evening}$ noise contours for 2017 and 2018, background NGI topographical map
- L_{night} noise contours for 2017 and 2018, background NGI topographical map
- L_{den} noise contours for 2017 and 2018, background NGI topographical map
- Freq.70,day noise contours for 2017 and 2018, background NGI topographical map
- Freq.70,night noise contours for 2017 and 2018, background NGI topographical map
- Freq.60,day noise contours for 2017 and 2018, background NGI topographical map
- Freq.60,night noise contours for 2017 and 2018, background NGI topographical map



Evolution of Lday noise contours: 2017 and 2018
55, 60, 65, 70 and 75 dB(A) (07:00 - 19:00)
Noise contours on a population density map (2017)
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
70-01
KAMPENHOUT
08-1
13-2
09-2
RCHTEM
45-1
41-1
VILVOORDE
14-1
19-3
01-2
16-2
HOLSBEEK
40-1
20-2
WEMMEL
10-3
HERENT
02-2
43-2
03-3
42-2
LUBBE
ASSE
KORTENBERG
15-3
JETTE
LEUVEN
04-1
GANSHOREN
26-2
48-3
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
06-1
47-3
07-1
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
WOLUWE-ST-LAMBERT
24-1
44-2
ETTERBEEK
ANDERLECHT
SINT-GILLIS
11-2
BIERBEEK
ELSENE
TERVUREN
OUD-HEVERLEE
VORST
12-1
AUDERGHEM
HULDENBERG
IETERS-LEEUW
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
Legend
Lday contours 2018
Lday contours 2017
Runways
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
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 Levening noise contours: 2017 and 2018
50, 55, 60, 65, 70 and 75 dB(A) (19:00 - 23:00)
Noise contours on a population density map (2017)
Legend
Levening contours 2018
Levening contours 2017
Runways
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
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
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
MEISE
HAACHT
ROTSELAAR
KAMPENHOUT
VILVOORDE
HOLSBEEK
WEMMEL
HERENT
ASSE
KORTENBERG
LUBBE
JETTE
GANSHOREN
LEUVEN
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
WOLUWE-ST-LAMBERT
ETTERBEEK
ANDERLECHT
SINT-GILLIS
ELSENE
TERVUREN
BIERBEEK
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
70-01
13-2
45-1
41-1
14-1
19-3
20-2
40-1
10-3
09-2
08-1
01-2
16-2
42-2
03-3
02-2
43-2
15-3
04-1
26-2
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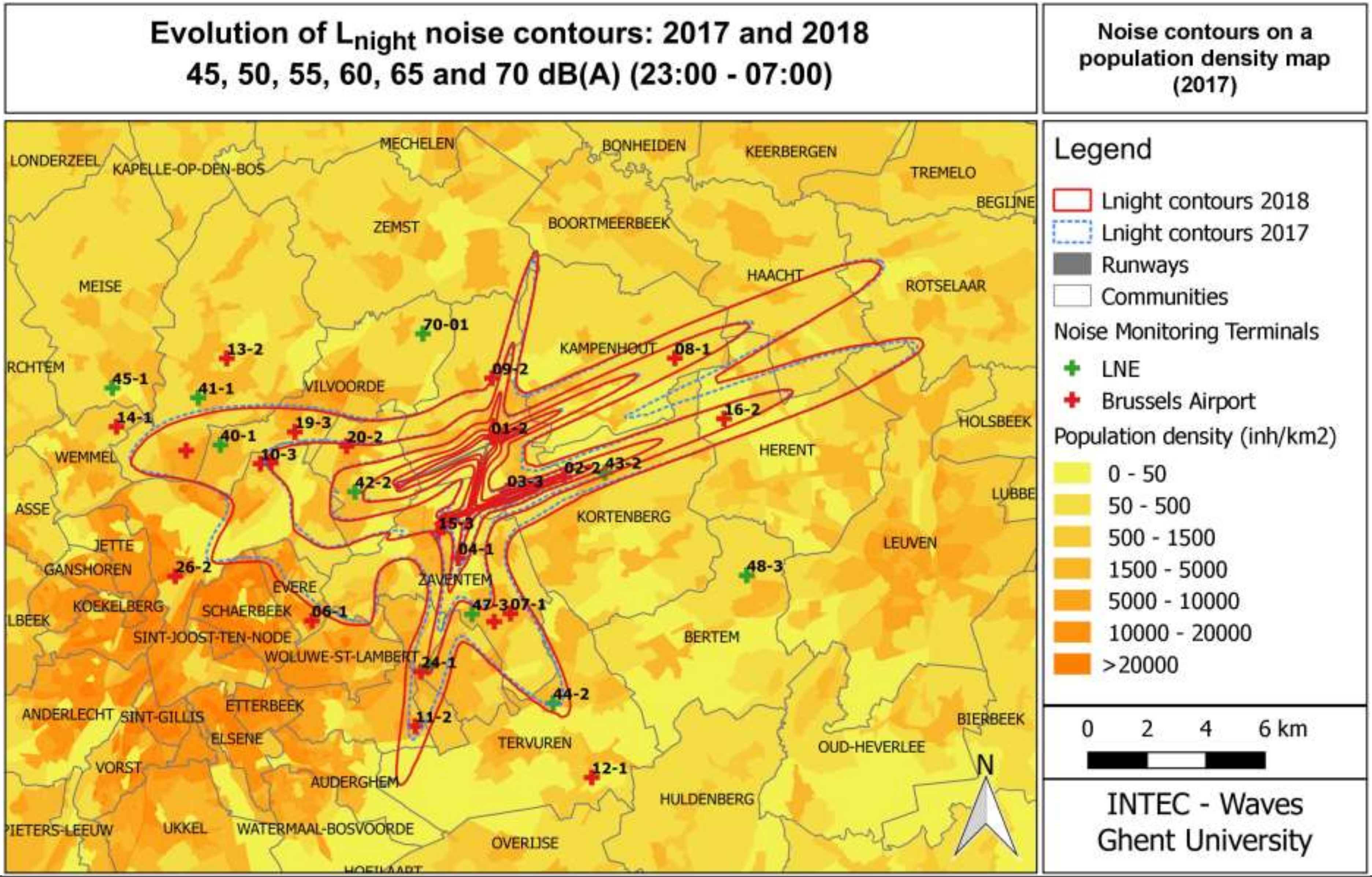
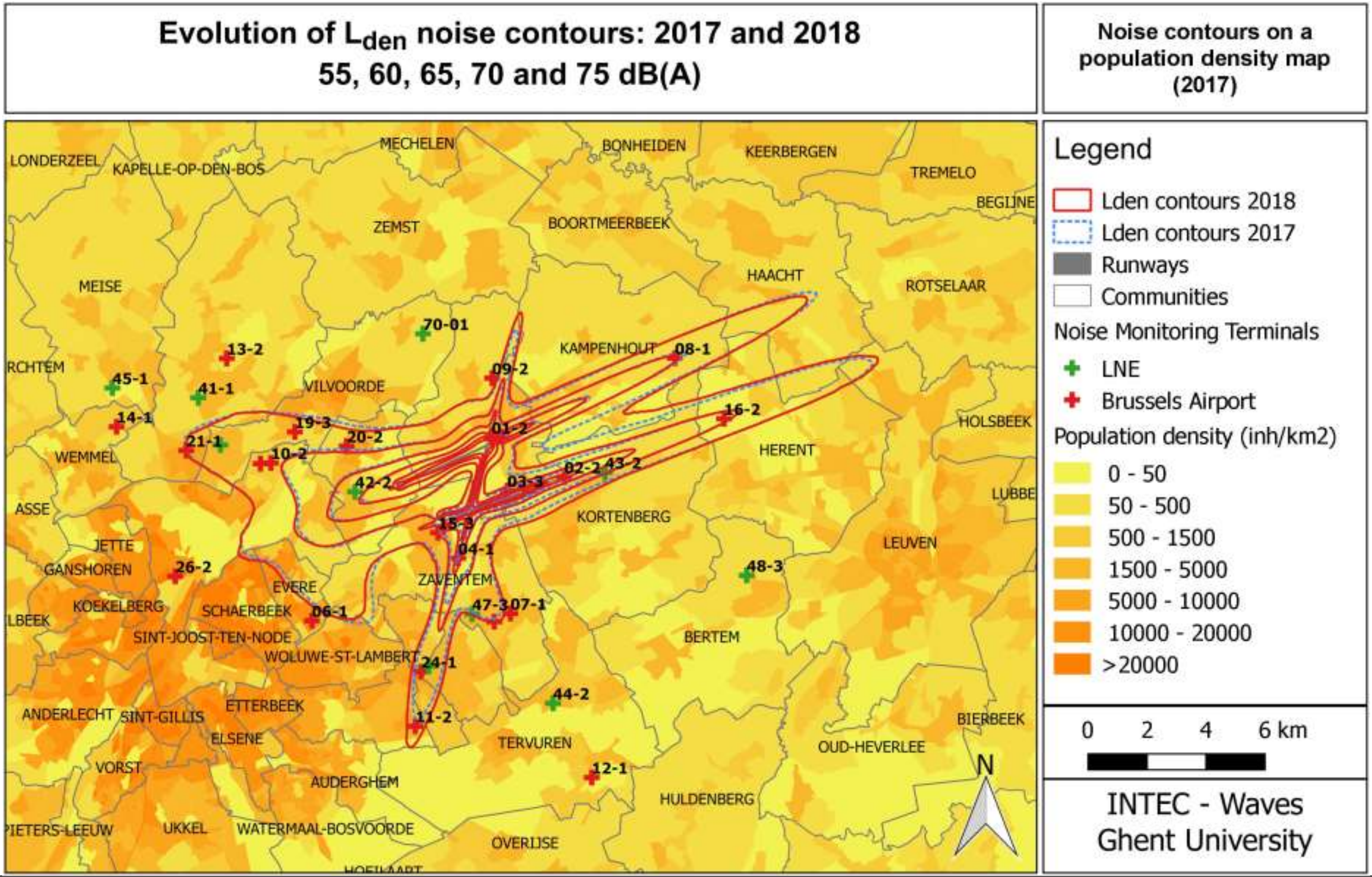
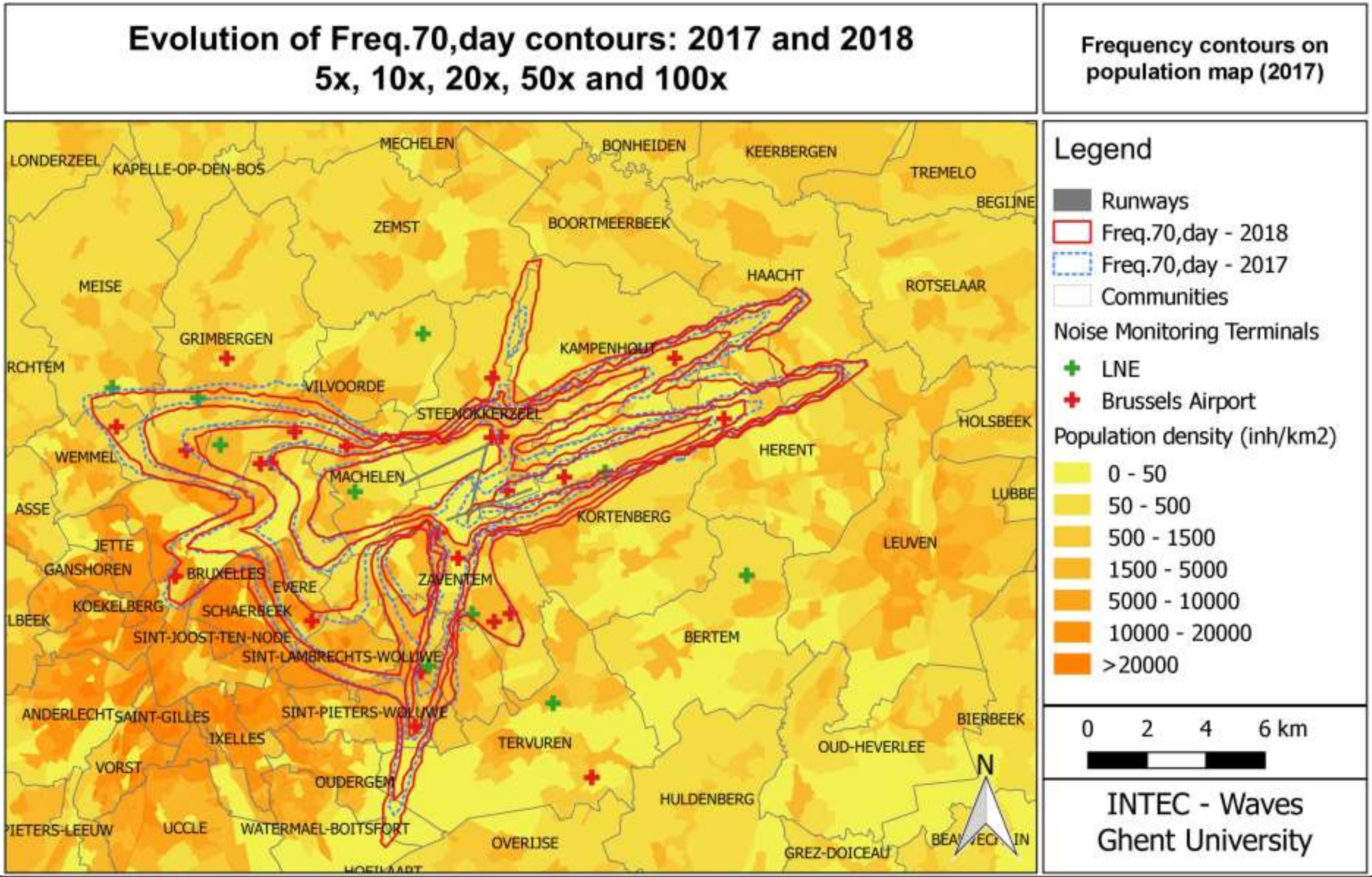
06-1
47-3
07-1
24-1
44-2
11-2
12-1

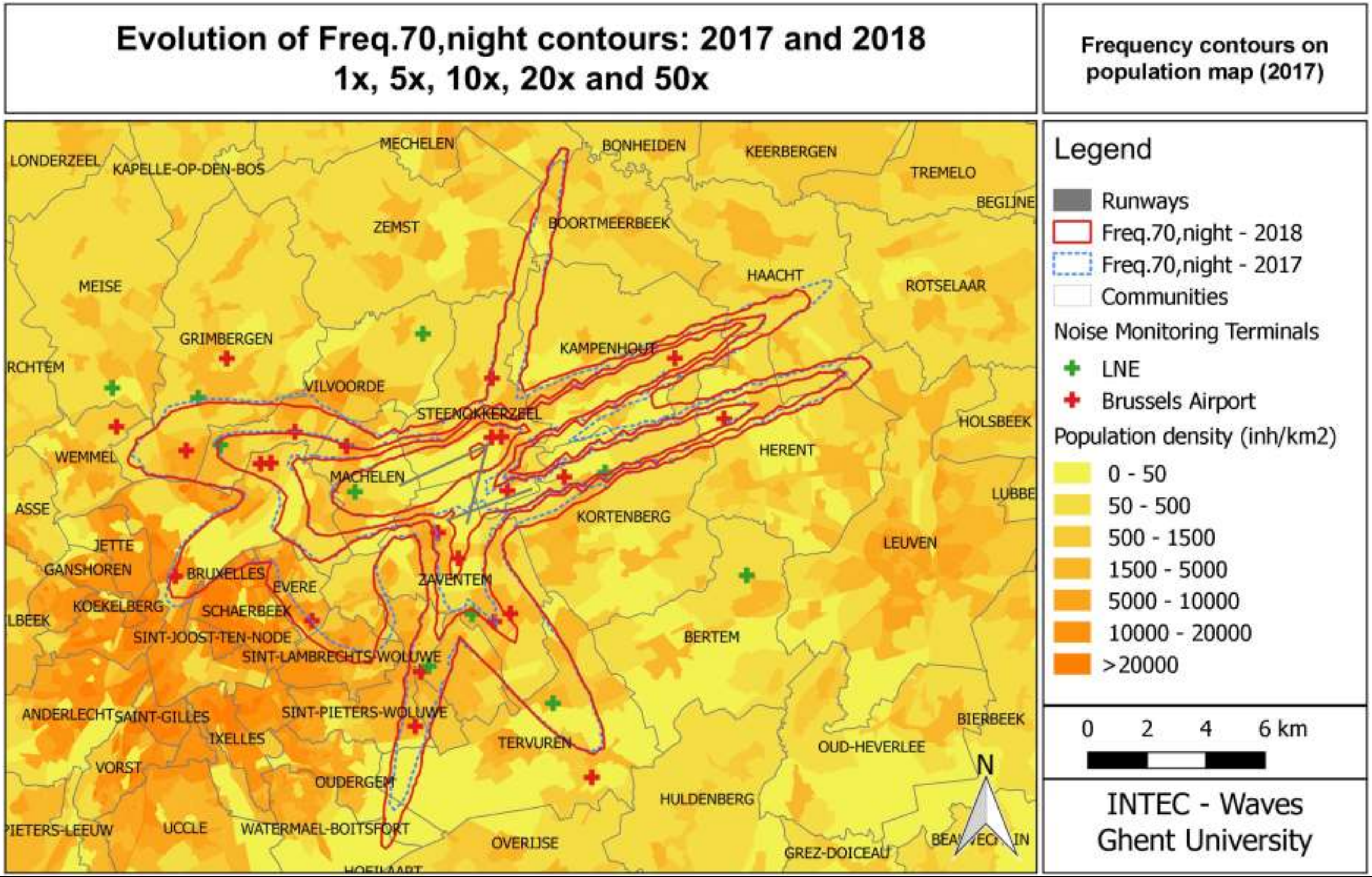


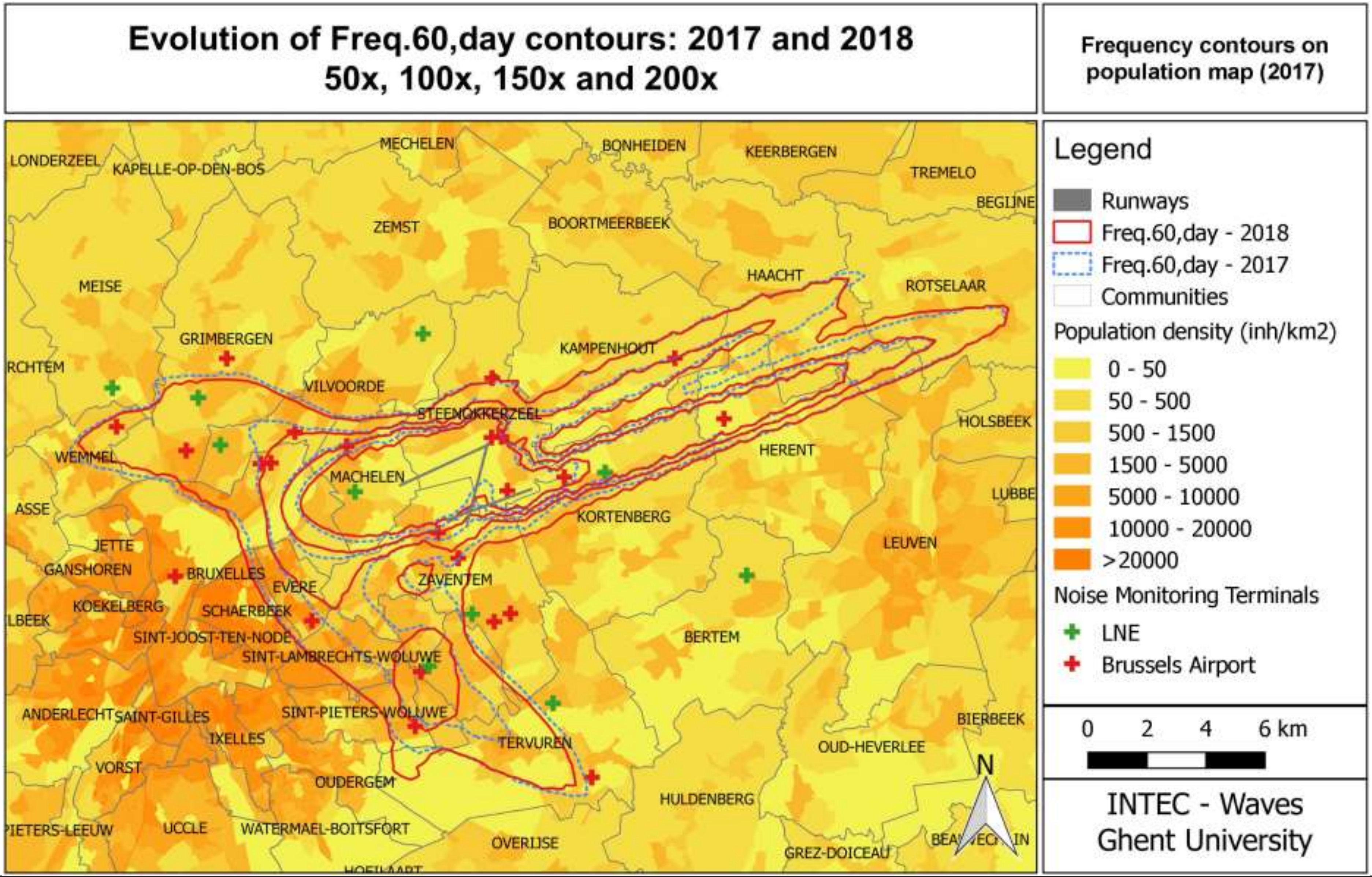
Evolution of Lnight noise contours: 2017 and 2018
45, 50, 55, 60, 65 and 70 dB(A) (23:00 - 07:00)
Noise contours on a population density map (2017)
Legend
Lnight contours 2018
Lnight contours 2017
Runways
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
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
SCHAERBEEK
SINT-JOOST-TEN-NODE
WOLUWE-ST-LAMBERT
BERTEM
ETTERBEEK
ANDERLECHT
SINT-GILLIS
ELSENE
TERVUREN
BIERBEEK
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
70-01
13-2
45-1
41-1
09-2
08-1
14-1
40-1
19-3
20-2
01-2
16-2
10-3
02-2
43-2
42-2
03-3
15-3
04-1
48-3
26-2
06-1
47-3
07-1
24-1
44-2
11-2
12-1

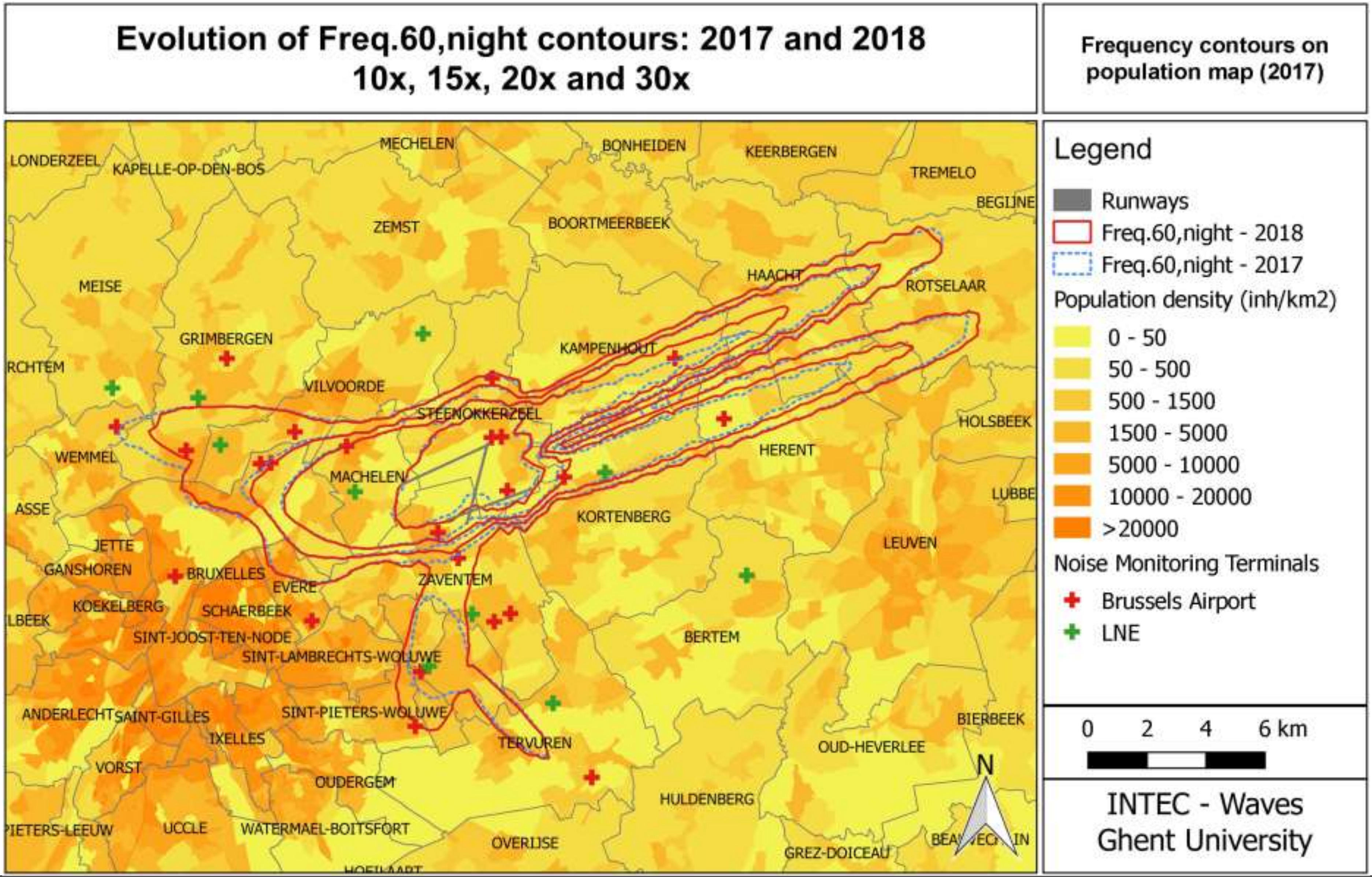


Evolution of Lden noise contours: 2017 and 2018
55, 60, 65, 70 and 75 dB(A)
Noise contours on a population density map (2017)
Legend
Lden contours 2018
Lden contours 2017
Runways
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
LONDERZEEL
KAPELLE-OP-DEN-BOS
MECHELEN
BONHEIDEN
KEERBERGEN
TREMELO
BEGIJNE
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
KAMPENHOUT
VILVOORDE
HOLSBEEK
HERENT
WEMMEL
KORTENBERG
LUBBE
ASSE
JETTE
GANSHOREN
LEUVEN
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
WOLUWE-ST-LAMBERT
ETTERBEEK
ANDERLECHT
SINT-GILLIS
ELSENE
BIERBEEK
TERVUREN
OUD-HEVERLEE
VORST
AUDERGHEM
HULDENBERG
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE
70-01
13-2
45-1
41-1
14-1
21-1
19-3
20-2
10-2
09-2
08-1
16-2
01-2
02-2
43-2
03-3
42-2
15-3
04-1
26-2
48-3
06-1
47-3
07-1
24-1
44-2
11-2
12-1


Evolution of Freq.70,day contours: 2017 and 2018
5x, 10x, 20x, 50x and 100x
Frequency contours on population map (2017)
Legend
Runways
Freq.70,day - 2018
Freq.70,day - 2017
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
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
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
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
PIETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

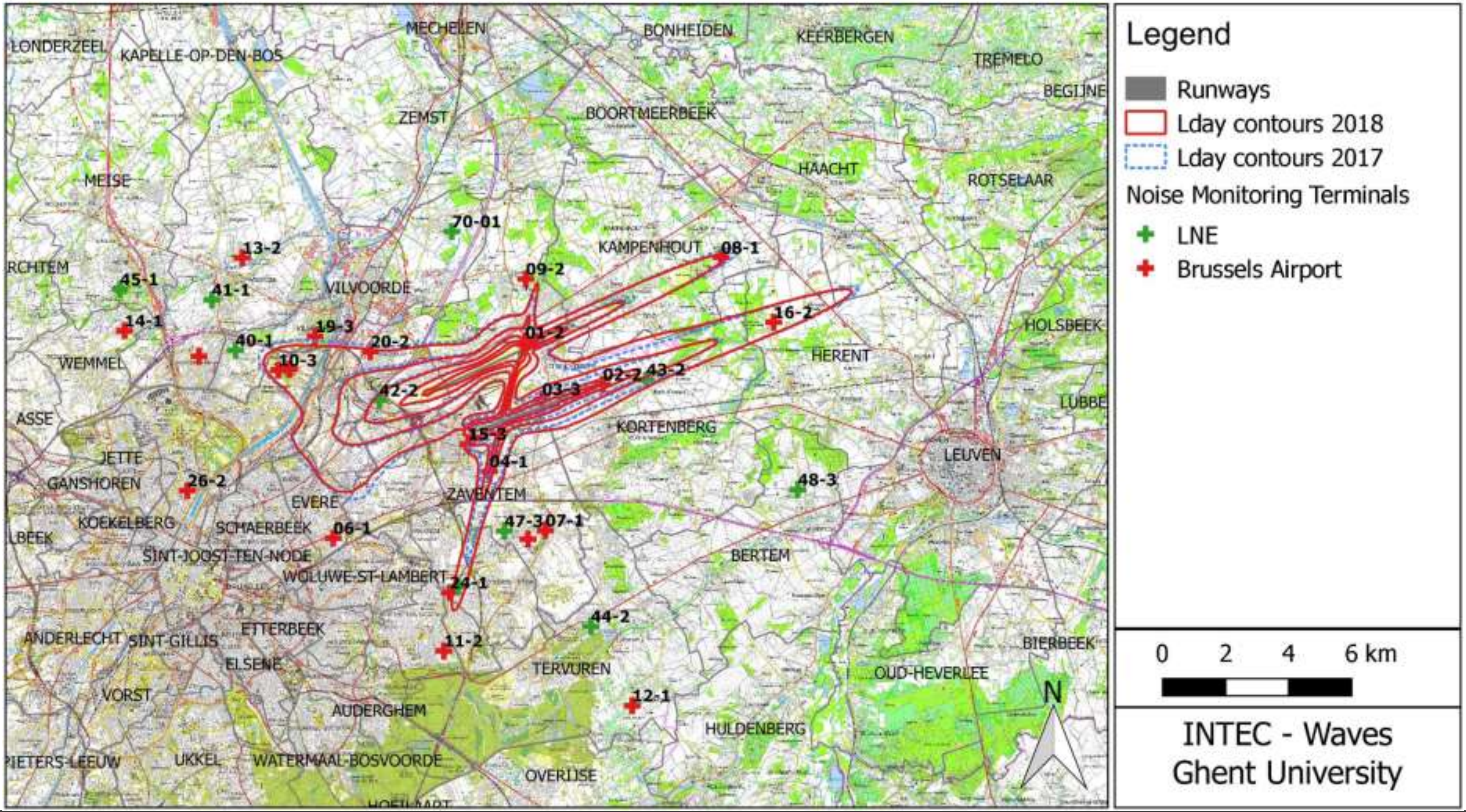

Evolution of Freq.70,night contours: 2017 and 2018
1x, 5x, 10x, 20x and 50x
Frequency contours on population map (2017)
Legend
Runways
Freq.70,night - 2018
Freq.70,night - 2017
Communities
Noise Monitoring Terminals
LNE
Brussels Airport
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
0 2 4 6 km
N
INTEC - Waves
Ghent University
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
LBEEK
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of Freq.60,day contours: 2017 and 2018
50x, 100x, 150x and 200x
Frequency contours on population map (2017)
Legend
Runways
Freq.60,day - 2018
Freq.60,day - 2017
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
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
MACHELEN
HERENT
ASSE
LUBBE
KORTENBERG
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU


Evolution of Freq.60,night contours: 2017 and 2018
10x, 15x, 20x and 30x
Frequency contours on population map (2017)
Legend
Runways
Freq.60,night - 2018
Freq.60,night - 2017
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 5000
5000 - 10000
10000 - 20000
>20000
Noise Monitoring Terminals
Brussels Airport
LNE
0 2 4 6 km
N
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
ASSE
KORTENBERG
LUBBE
JETTE
LEUVEN
GANSHOREN
BRUXELLES
EVERE
ZAVENTEM
KOEKELBERG
SCHAERBEEK
LBEEK
SINT-JOOST-TEN-NODE
BERTEM
SINT-LAMBRECHTS-WOLUWE
ANDERLECHT
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
IETERS-LEEUW
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

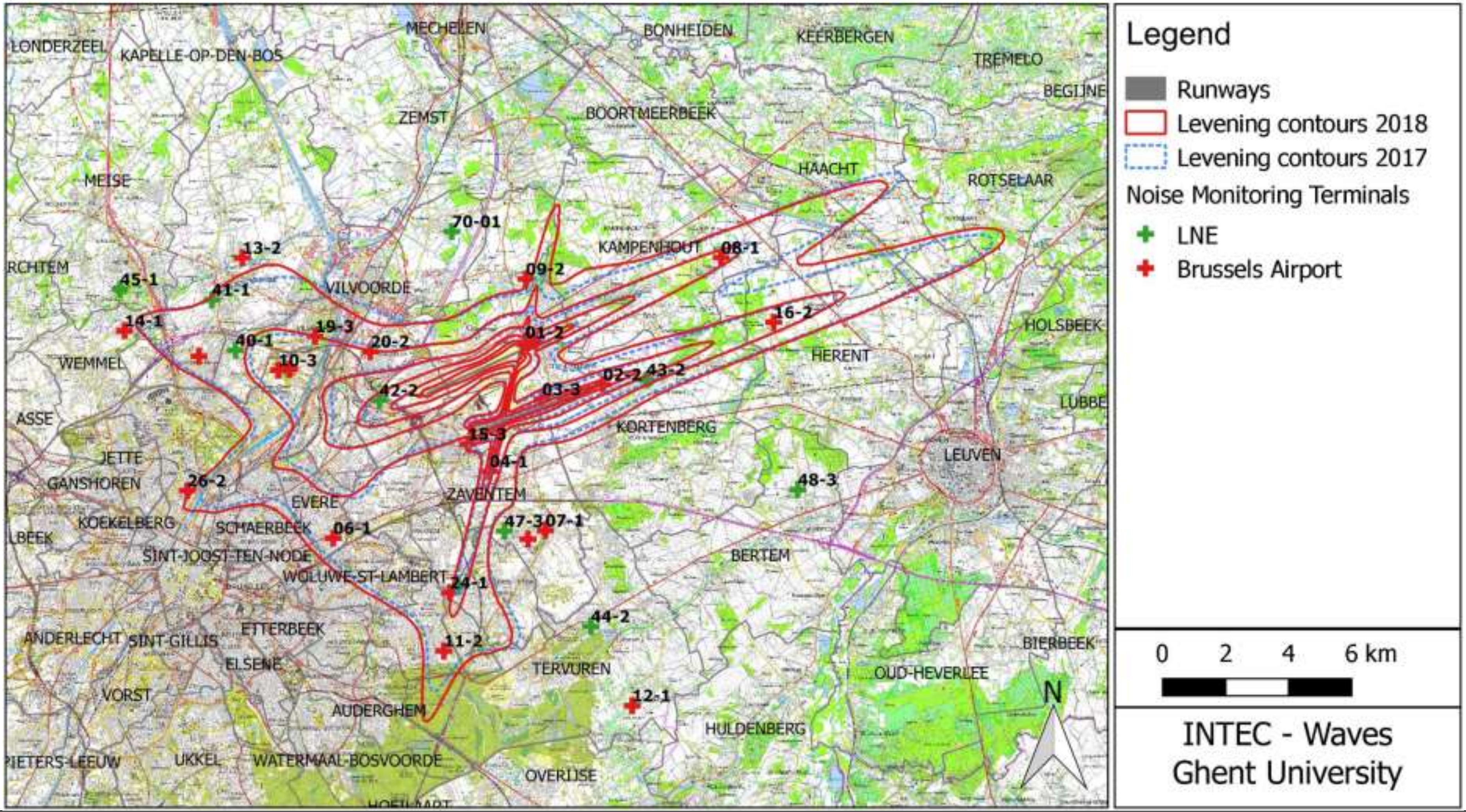
Evolution of L_{day} noise contours: 2017 and 2018
55, 60, 65, 70 and 75 dB(A) (07:00-19:00)

Noise contours on a topographic map (NGI)



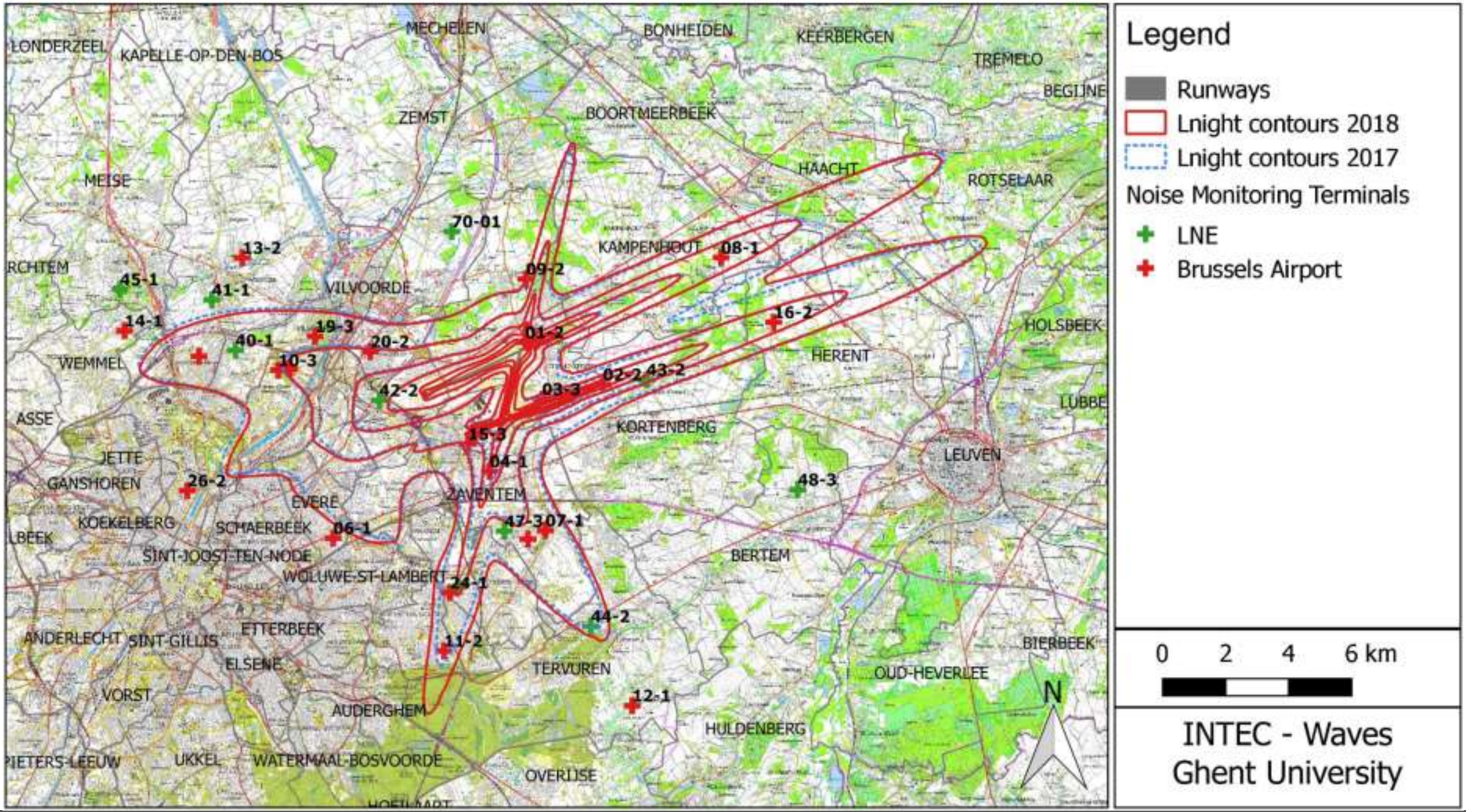
Evolution of $L_{evening}$ noise contours: 2017 and 2018
50, 55, 60, 65, 70 and 75 dB(A) (19:00-23:00)

Noise contours on a topographic map (NGI)



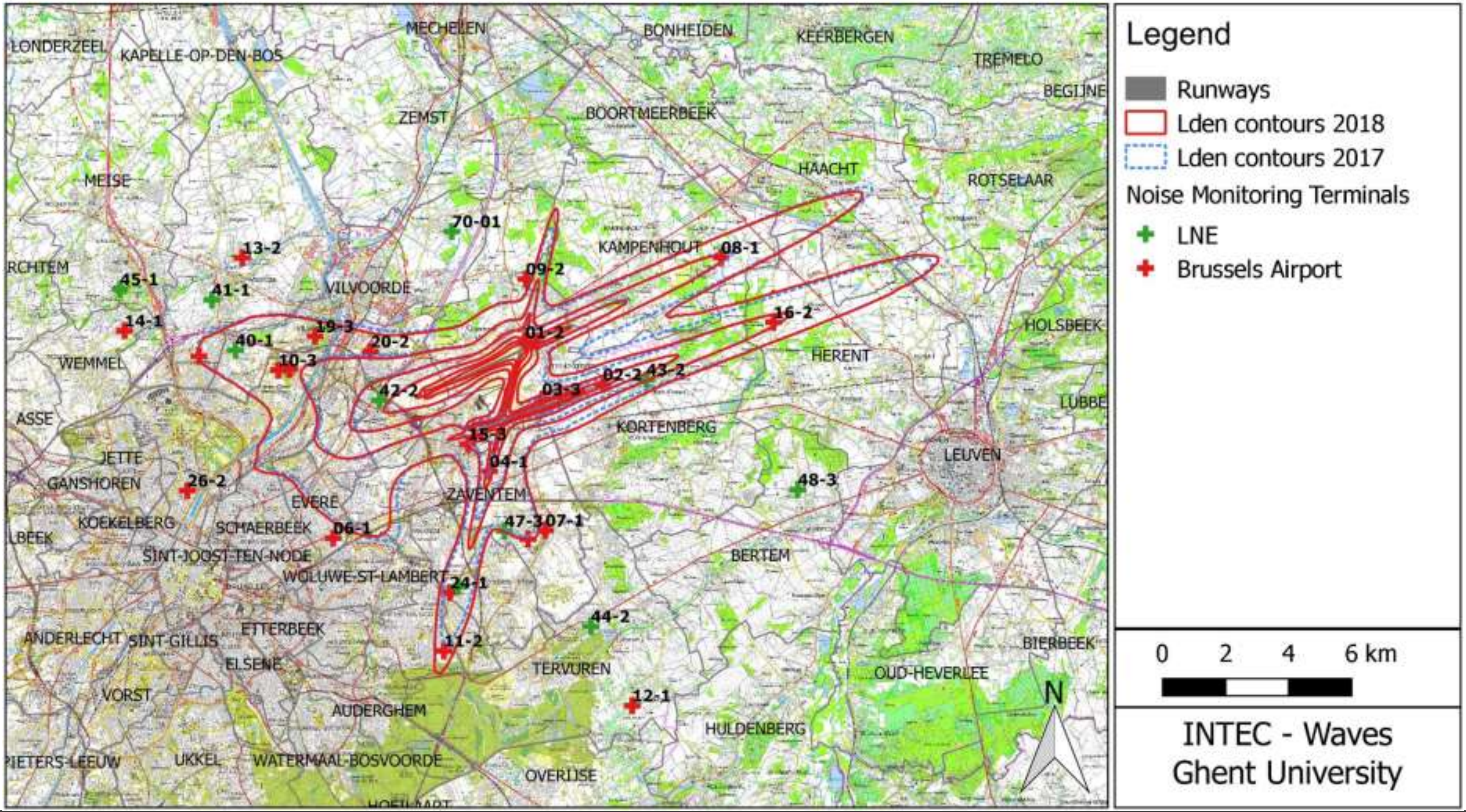
Evolution of L_{night} noise contours: 2017 and 2018
45, 50, 55, 60, 65 and 70 dB(A) (23:00-07:00)

Noise contours on a topographic map (NGI)



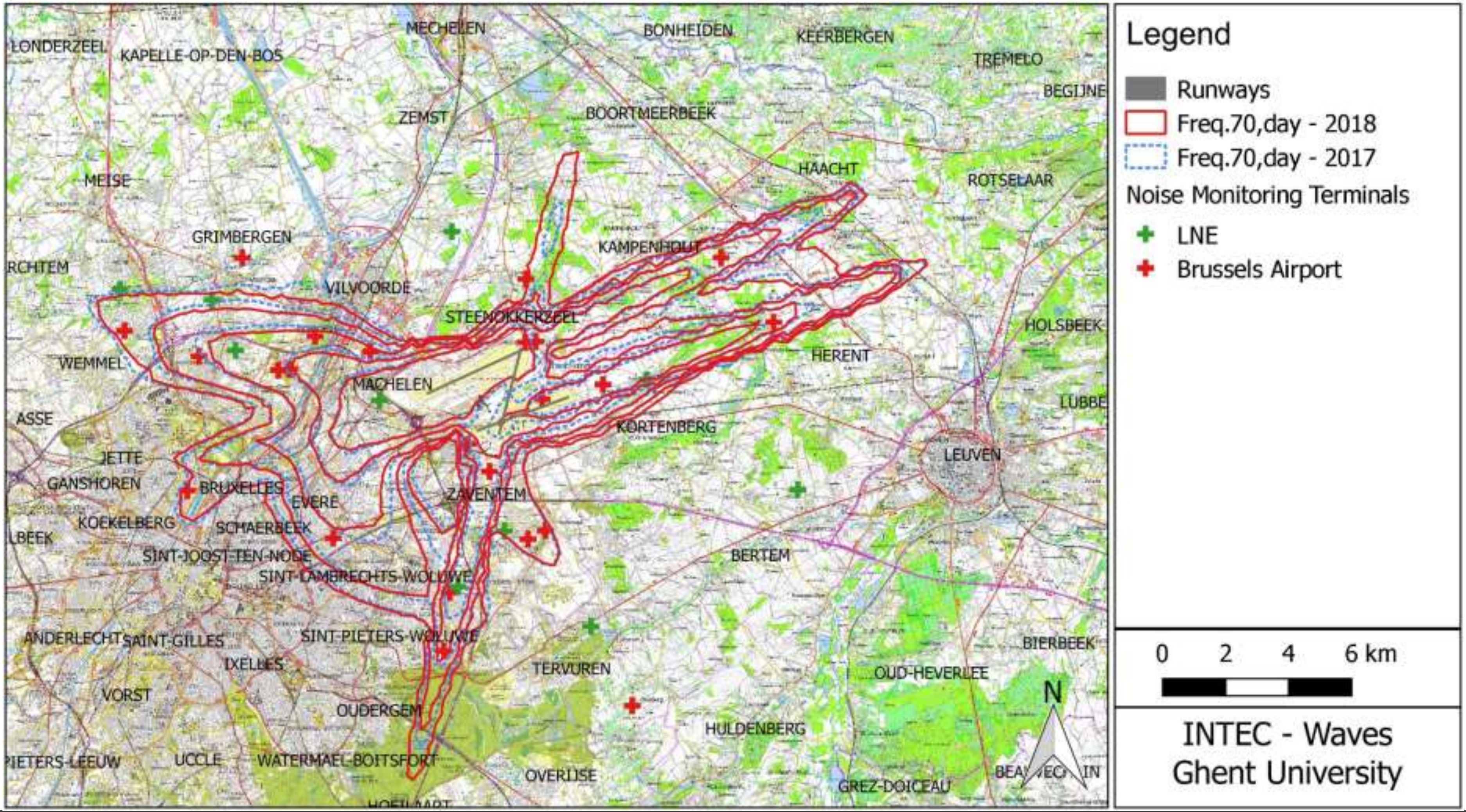
Evolution of L_{den} noise contours: 2017 and 2018
55, 60, 65, 70 and 75 dB(A)

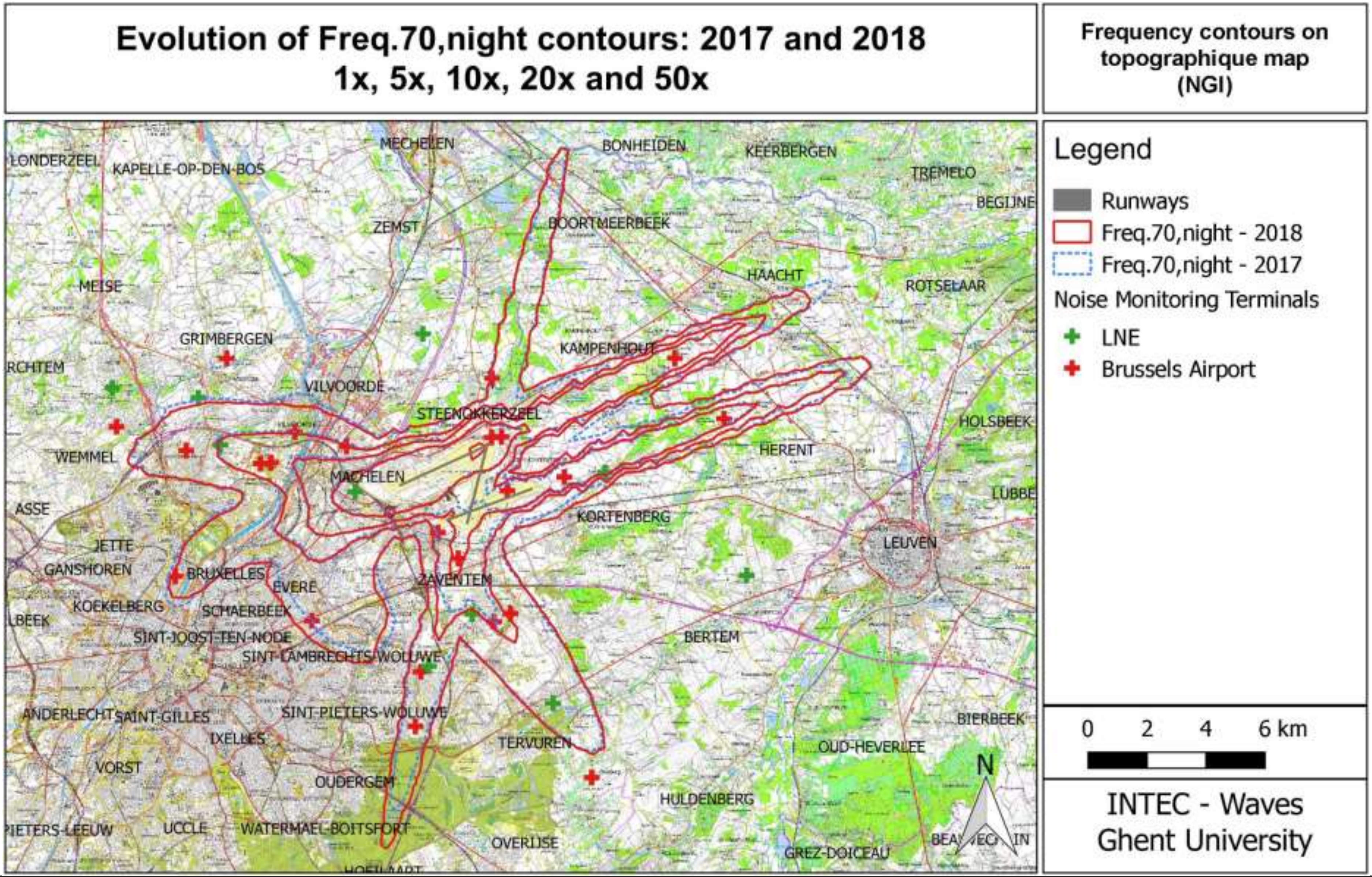
Noise contours on a topographic map (NGI)



Evolution of Freq.70,day contours: 2017 and 2018
5x, 10x, 20x, 50x and 100x

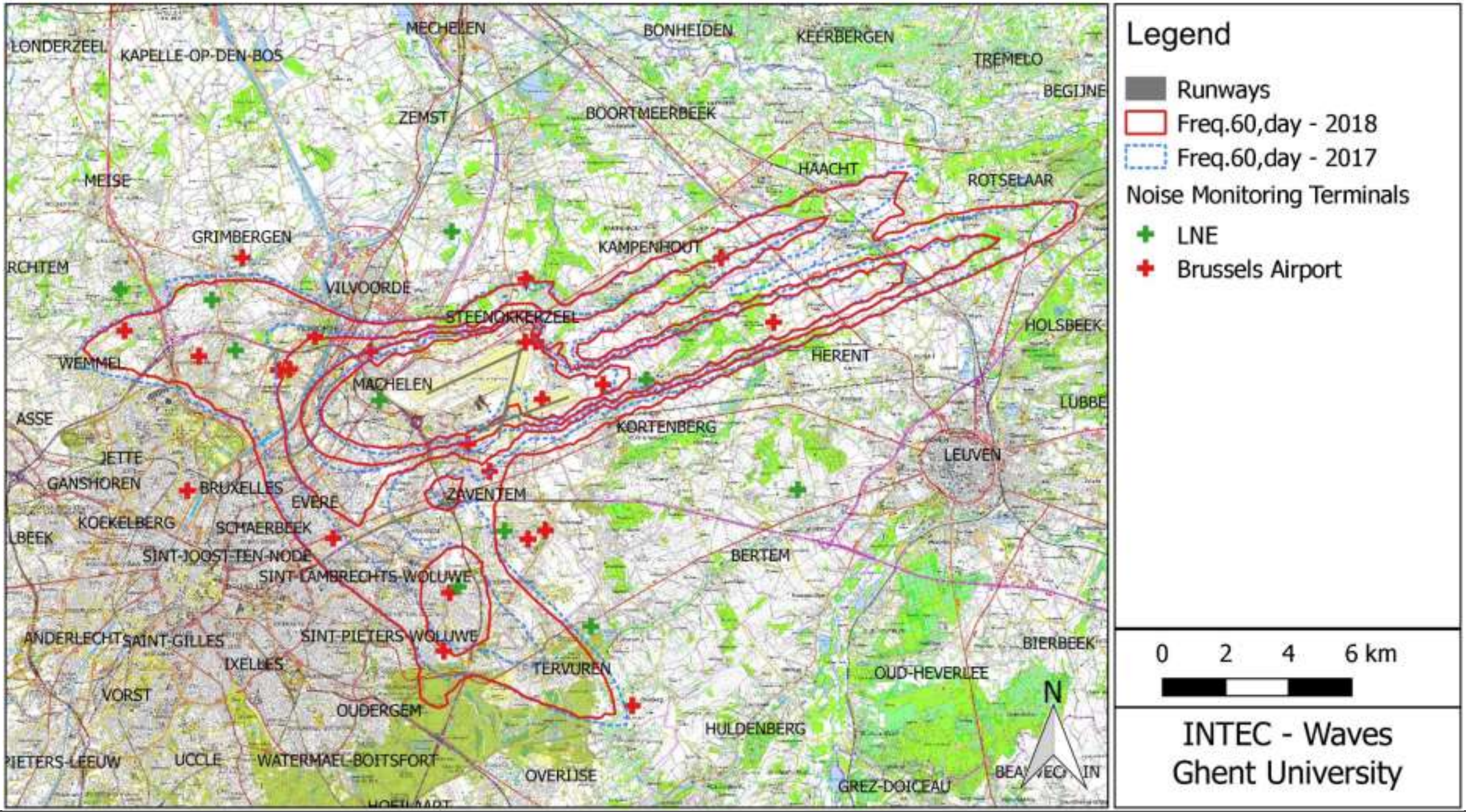
Frequency contours on topographique map (NGI)




Evolution of Freq.70,night contours: 2017 and 2018
1x, 5x, 10x, 20x and 50x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.70,night - 2018
Freq.70,night - 2017
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
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
SAINT-GILLES
SINT-PIETERS-WOLUWE
BIERBEEK
IXELLES
TERVUREN
OUD-HEVERLEE
VORST
OUDERGEM
HULDENBERG
UCCLE
WATERMAEL-BOITSFORT
OVERIJSE
GREZ-DOICEAU

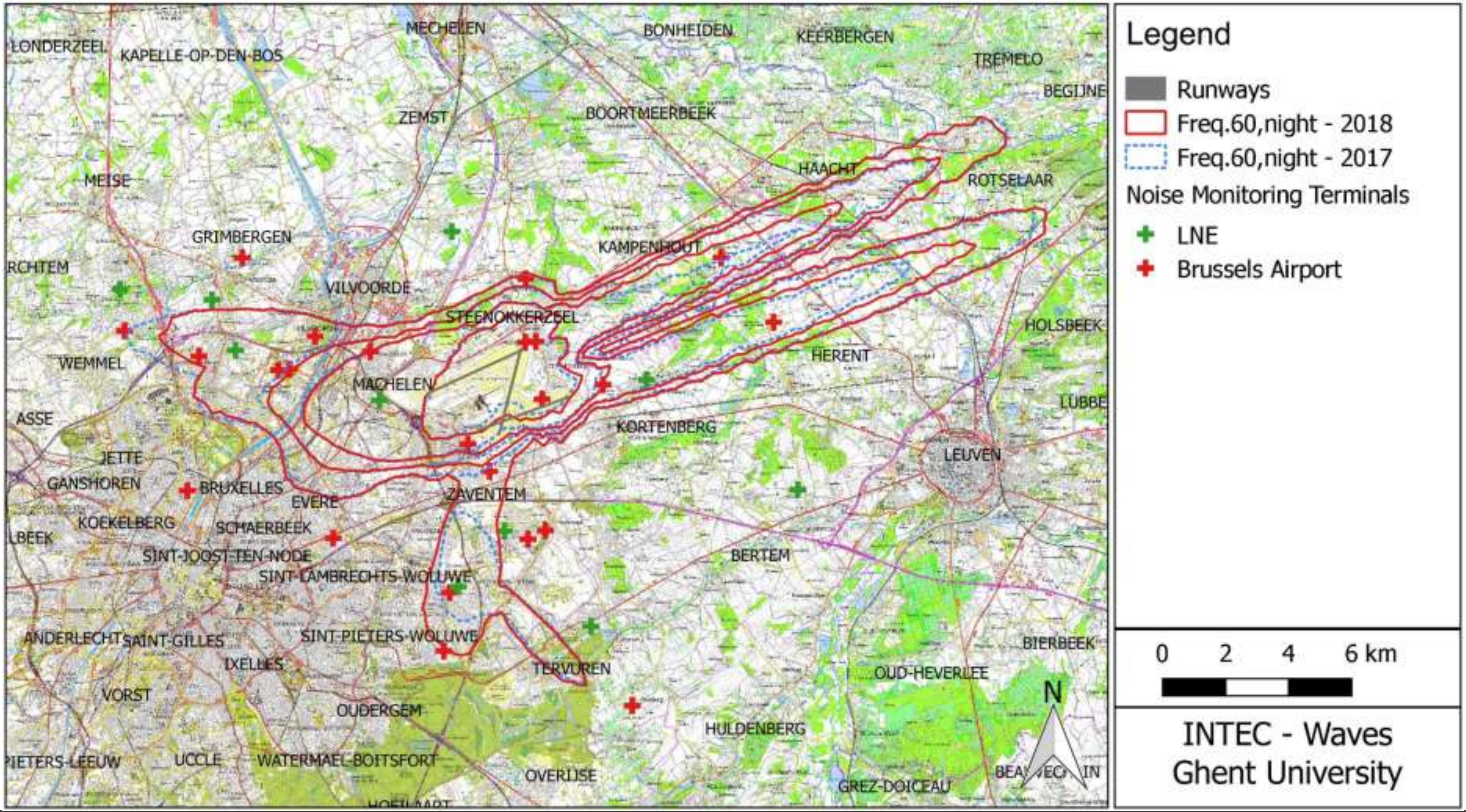
Evolution of Freq.60,day contours: 2017 and 2018
50x, 100x, 150x and 200x

Frequency contours on topographique map (NGI)



Evolution of Freq.60,night contours: 2017 and 2018
10x, 15x, 20x and 30x

Frequency contours on topographique map (NGI)



5.5 Evolution of the surface area and the number of residents

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, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 15: Evolution of the surface area inside the L_{day} contours (2000, 2006-2018).

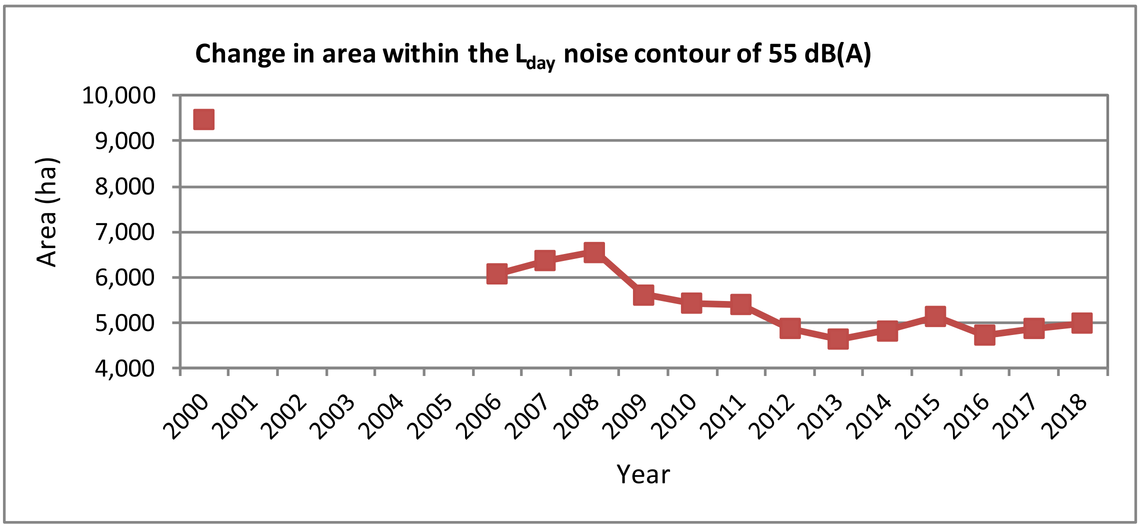


Table 32: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 16: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2018).

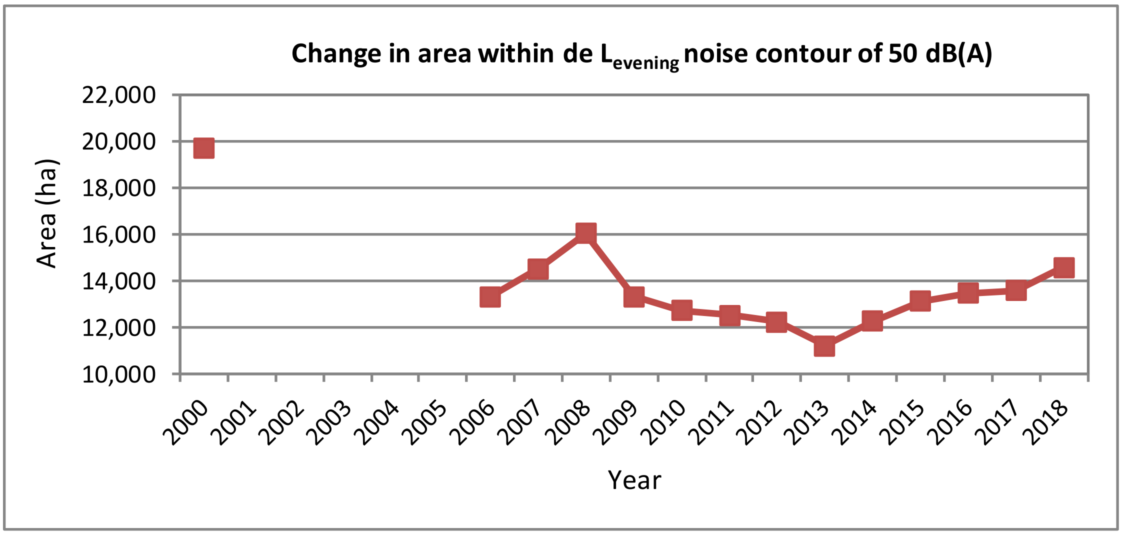


Table 33: : Evolution of the surface area inside the L_{night} contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 17: Evolution of the surface area inside the L_{night} contours (2000, 2006-2018).

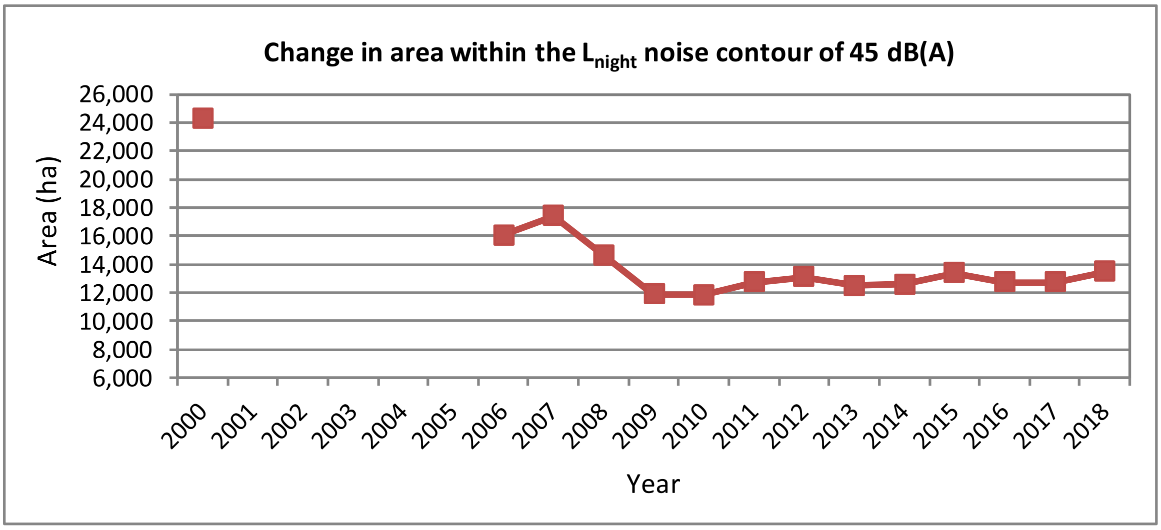


Table 34: : Evolution of the surface area inside the L_{den} contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 18: Evolution of the surface area inside the L_{den} contours (2000, 2006-2018).

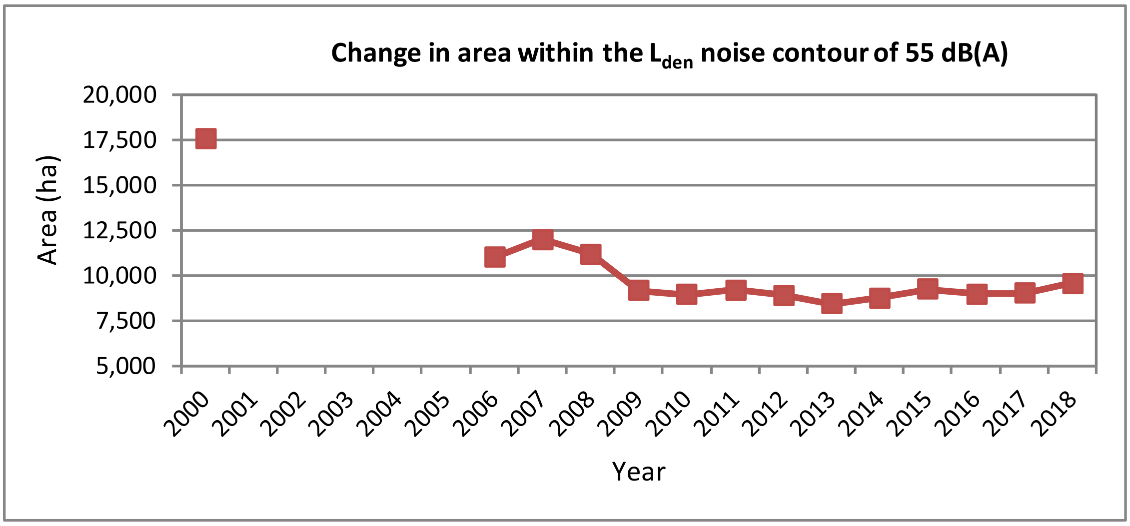


Table 35: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 19: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2018).

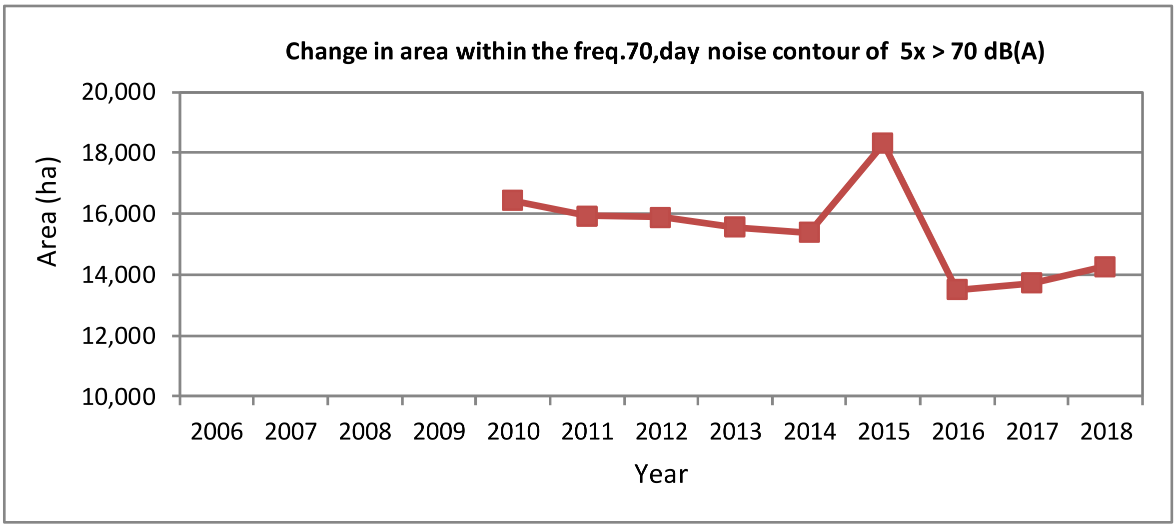


Table 36: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 20: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2018).

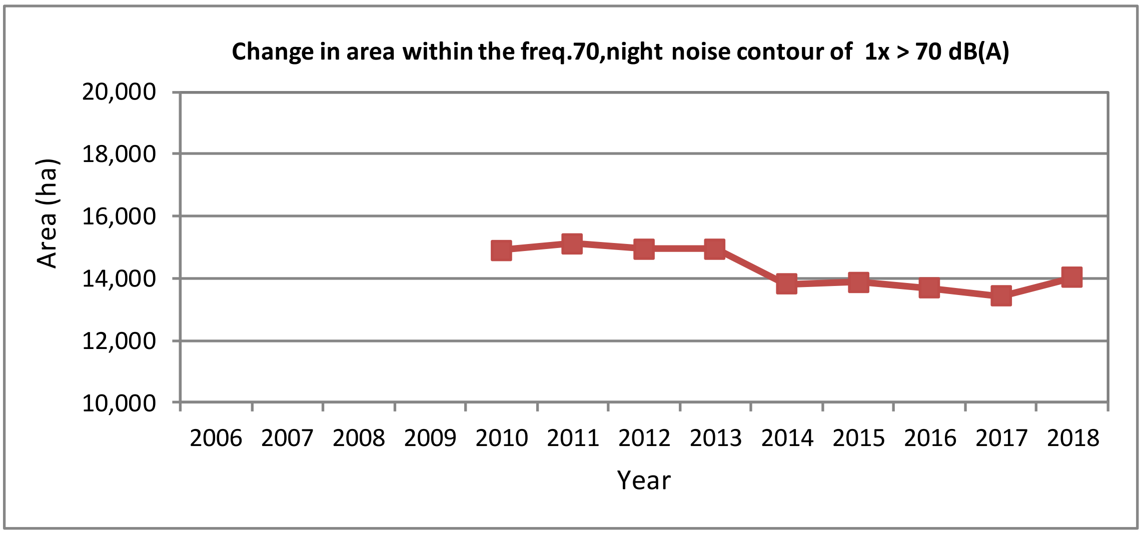


Table 37: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 21: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2018).

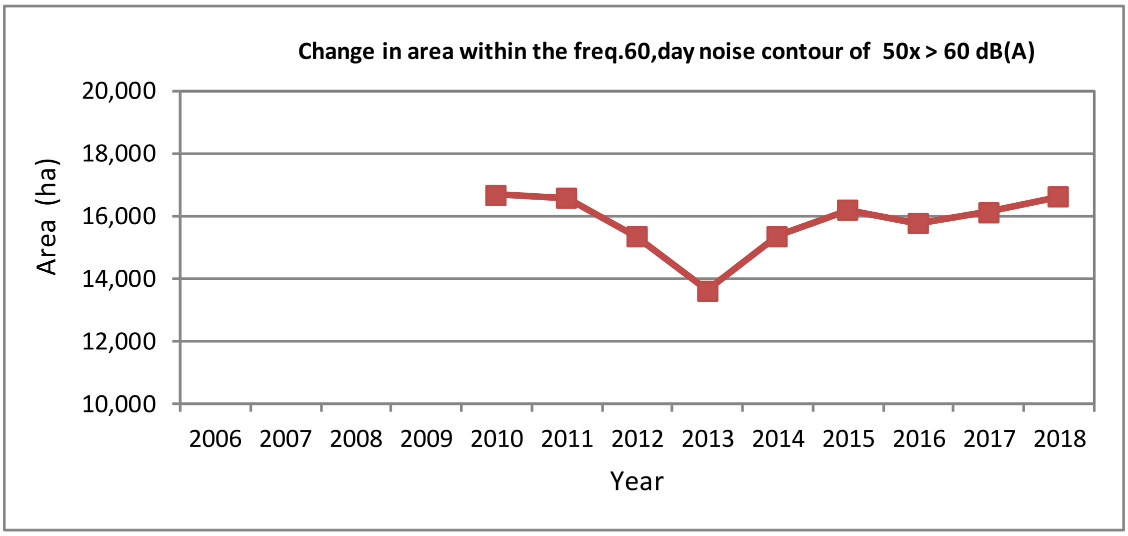
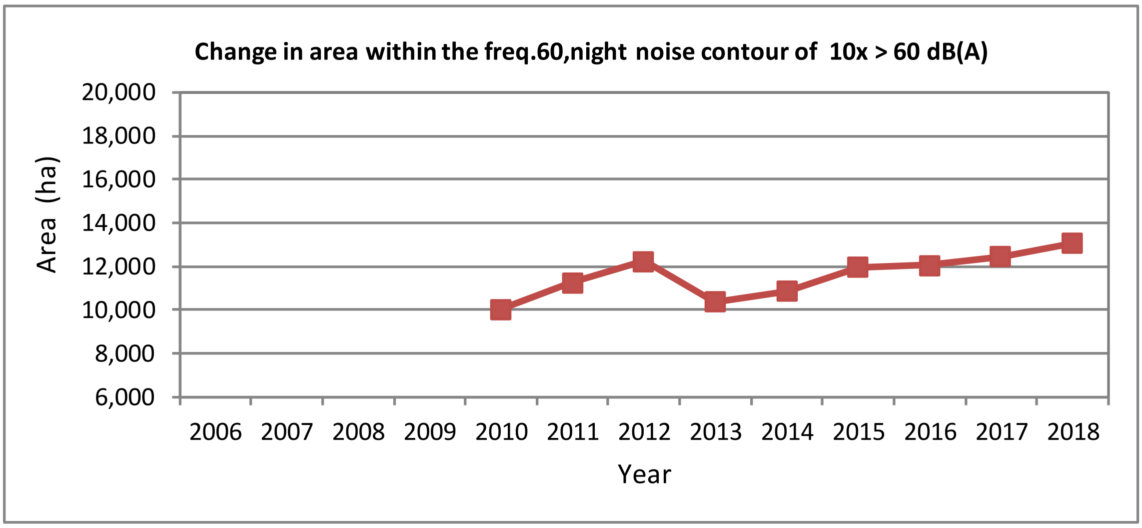


Table 38: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2018).

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**

* Calculated with INM 7.0b

Figure 22: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2018).



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

Table 39: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2018).

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**

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

Figure 23: Evolution of the number of residents inside the L_{day} contours (2000, 2006-2018).

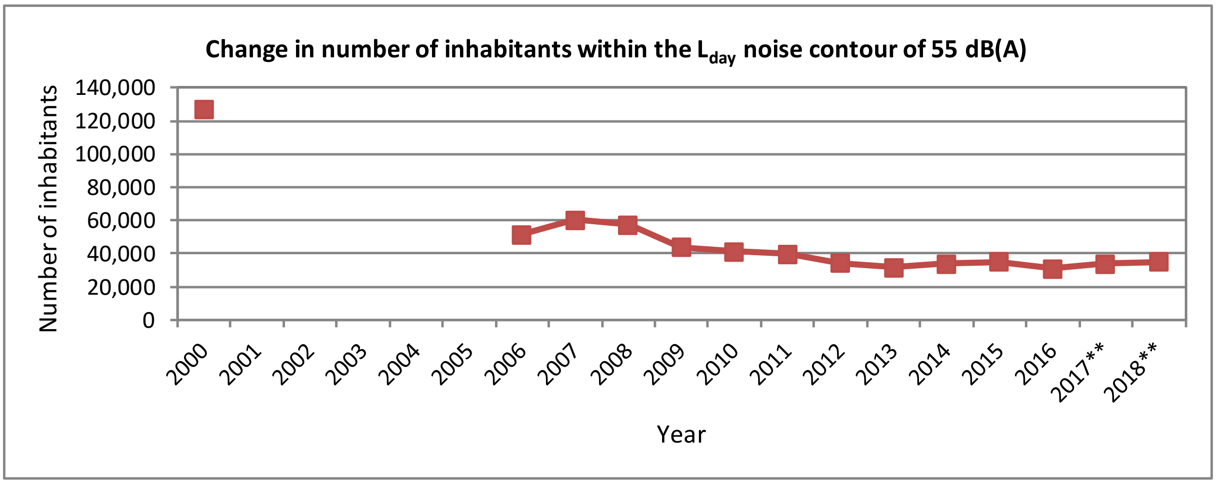


Table 40: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2018).

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**

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

Figure 24: Evolution of the number of residents inside the $L_{evening}$ contours (2000, 2006-2018).

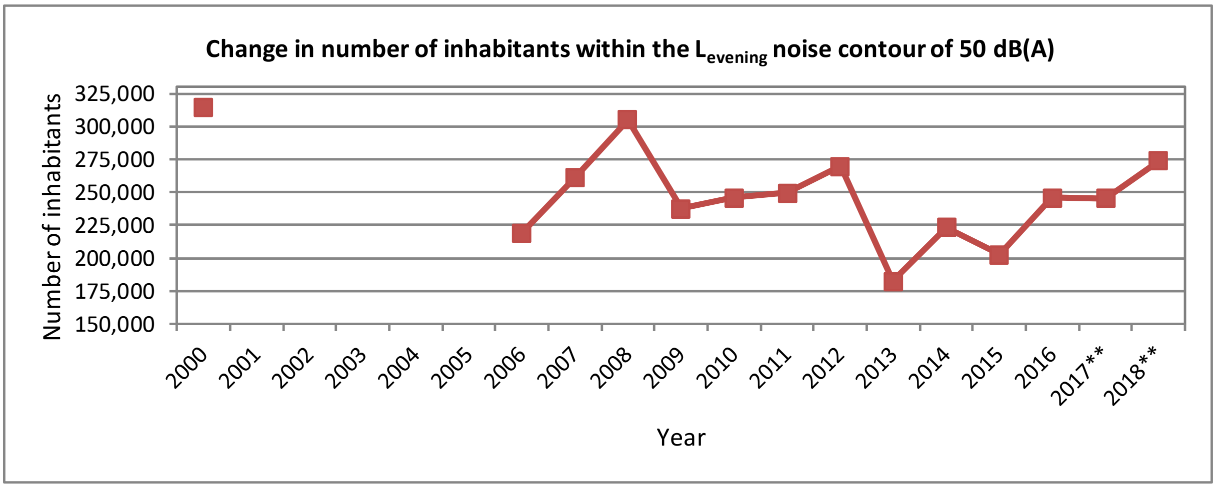


Table 41: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2018).

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**

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

Figure 25: Evolution of the number of residents inside the L_{night} contours (2000, 2006-2018).

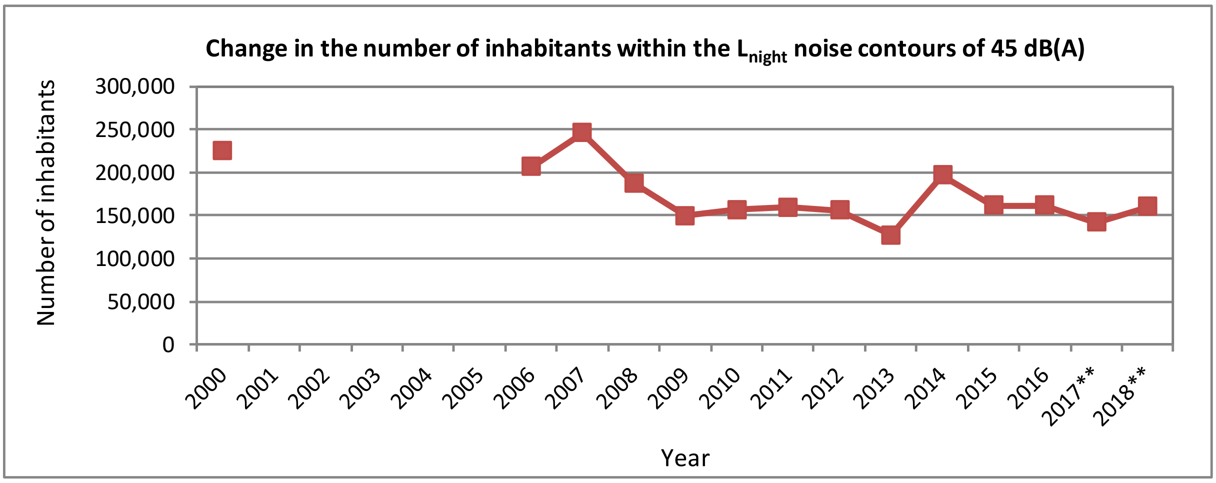


Table 42: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2018).

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**

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

Figure 26: Evolution of the number of residents inside the L_{den} contours (2000, 2006-2018).

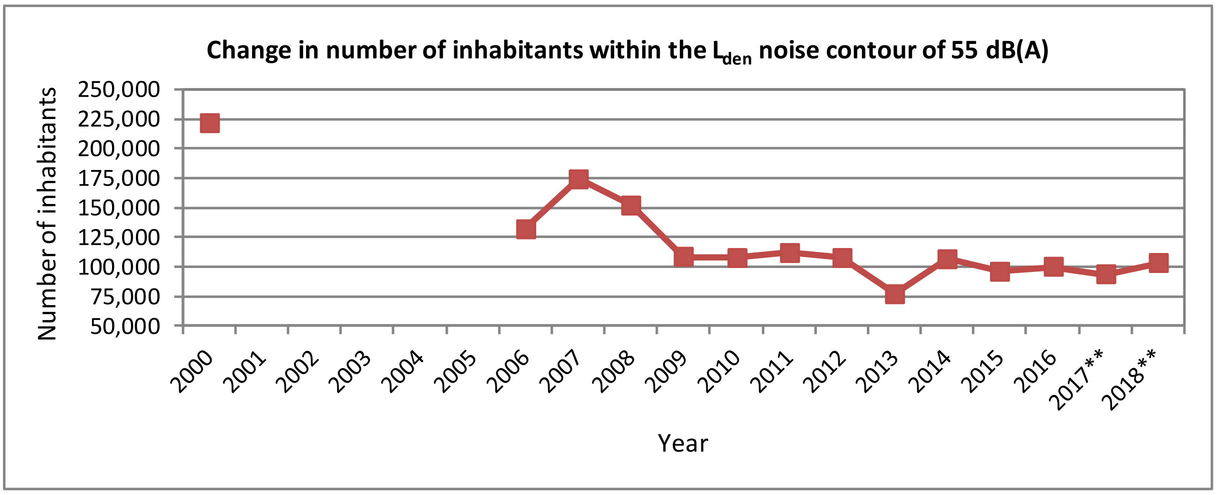


Table 43: Evolution of the number of residents inside the Freq.70,day contours (2000, 2006-2018).

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**

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

Figure 27: Evolution of the number of residents inside the Freq.70,day contours (2000, 2006-2018).

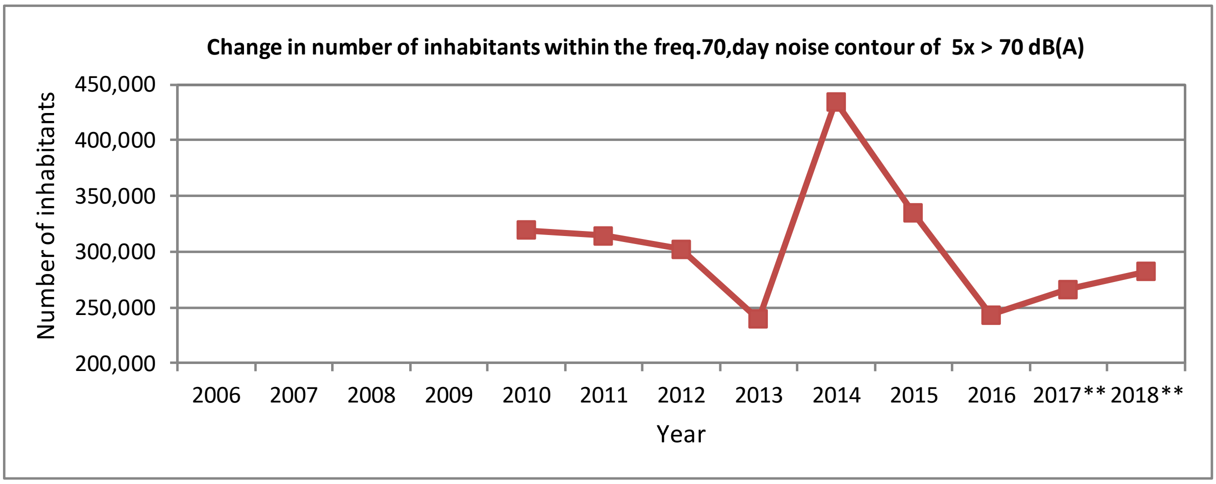


Table 44: Evolution of the number of residents inside the Freq.70,night contours (2000, 2006-2018).

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**

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

Figure 28: Evolution of the number of residents inside the Freq.70,night contours (2000, 2006-2018).

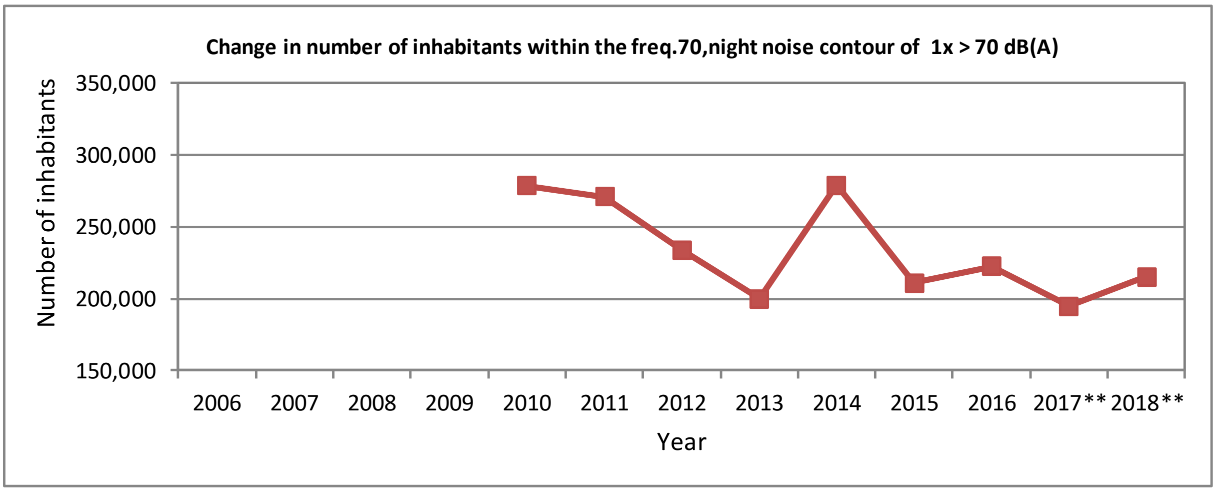


Table 45: Evolution of the number of residents inside the Freq.60,day contours (2000, 2006-2018).

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**

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

Figure 29: Evolution of the number of residents inside the Freq.60,day contours (2000, 2006-2018).

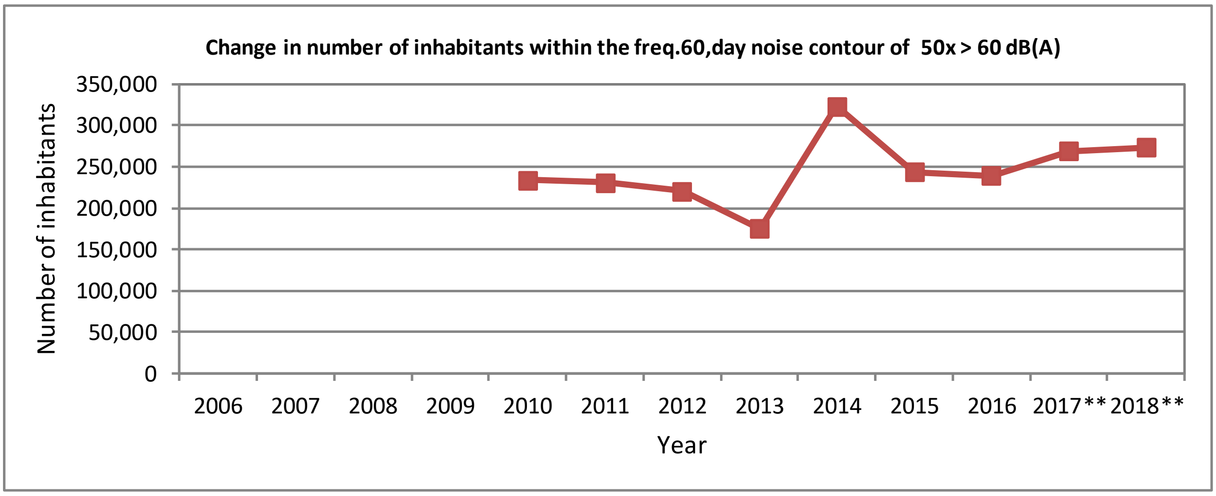
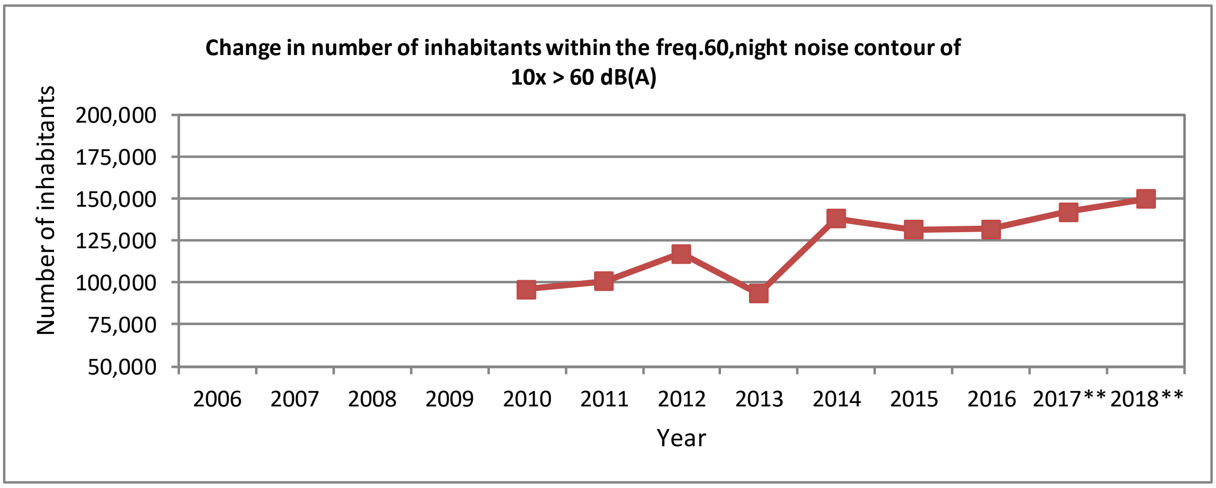


Table 46: Evolution of the number of residents inside the Freq.60,night contours (2000, 2006-2018).

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**

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

Figure 30: Evolution of the number of residents inside the Freq.60,night contours (2000, 2006-2018).



5.6 Documentatie aangeleverde bestanden

Radargegevens voor het jaar 2018 (bron BAC-ANOMS)

2018-JAN-JUN_flightlist.csv	09/01/2019	33.692 kB
2018-JAN-JUN_ops.csv	10/01/2019	1.204.503 kB
2018-JUL-DEC_flightlist.csv	09/01/2019	41.789 kB
2018-JUL-DEC_ops_.csv	10/01/2019	1.331.183 kB

Vluchtgegevens voor het jaar 2018 (bron BAC-CDB)

cdb_2018_01_12.txt	09/01/2019	64.251 kB

Meteogegevens voor het jaar 2018 (bron BAC-ANOMS / BAC-TANOS)

2018_meteo tot 20180920.xlsx	14/01/2019	1.229 kB
2018_meteo van 20180920.xlsx	14/01/2019	978 kB

Geluidsevents voor het jaar 2018 (bron BAC-ANOMS / BAC-TANOS / LNE)

2018-01_events ANOMS.xlsx	23/01/2019	9,132 kB
2018-02_events ANOMS.xlsx	23/01/2019	7,485 kB
2018-03_events ANOMS.xlsx	23/01/2019	8,400 kB
2018-04_events ANOMS.xlsx	23/01/2019	9,471 kB
2018-05_events ANOMS.xlsx	23/01/2019	10,375 kB
2018-06_events ANOMS.xlsx	23/01/2019	10,809 kB
2018-07_events ANOMS.xlsx	23/01/2019	5,777 kB
2018-08_events ANOMS.xlsx	23/01/2019	6,011 kB
2018-09_events TANOS.xlsx	23/01/2019	22,389 kB
2018-10_events TANOS.xlsx	23/01/2019	25,535 kB
2018-11_events TANOS.xlsx	23/01/2019	24,171 kB
2018-12_events TANOS.xlsx	23/01/2019	22,755 kB
2018-0103_events LNE TANOS.xlsx	11/03/2019	22952 kB
2018-0406_events LNE TANOS.xlsx	11/03/2019	29908 kB
2018-0709_events LNE TANOS.xlsx	11/03/2019	32560 kB
2018-1012_events LNE TANOS.xlsx	11/03/2019	29830 kB

1-uur rapporten geluidsmeetnet voor het jaar 2017 (BAC-ANOMS / BAC-TANOS / LNE)

uur-rapporten_2018-0104 ANOMS.xlsx	23/01/2019	4.585 kB
uur-rapporten_2018-0408 ANOMS.xlsx	23/01/2019	6.183 kB
uur-rapporten_2018-0809 ANOMS.xlsx	23/01/2019	2.286 kB
uur-rapporten_2018-0812 TANOS.xlsx	23/01/2019	18.511 kB
status_LNE_2018_all.xls	04/02/2019	2.022 kB

24-uurrapporten geluidsmeetnet voor het jaar 2017 (Bron BAC-ANOMS / BAC-TANOS)

24h-rapporten-2018 ANOMS 0108.xlsx	23/01/2018	317 kB
24h-rapporten-2018 TANOS 0912.xls	23/01/2018	705 kB