Noise Contours around Brussels Airport for the Year 2015

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1 Introduction

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. These noise contours reflect the evolutions of the number of movements and fleet changes, and also the actual usage of runways for take-off and landing. Weather conditions and coincidental events also affect this actual usage. The effect of new measures is also assessed. To check their accuracy, 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 KULeuven. 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. 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.

1.1 Required calculations

In accordance with the VLAREM environmental legislation, the operator of an airport classified in category[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 highly annoyed;
- 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:

[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 judgement 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 license 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 .

[3] Class 1 airports: airports that meet the requirements of the Chicago Convention of 1944 on the establishing of the International Civil Aviation Organisation and with a take-off and arrival runway of at least 800 metres

- L_{night} and L_{den} noise contours such as required by the present VLAREM obligation;
- Frequency contours for 70 dB(A) and 60 dB(A); as in preceding years, Brussels Airport Company requested UGent to calculate the following frequency contours:
    - Frequency contours for 70 dB(A) during the day 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 day 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 highly annoyed 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.

1.2 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 day was used (day: 06:00 – 23:00; night: 23:00 – 06:00). Since VLAREM was adjusted in accordance with the guideline, the noise contours reports are calculated officially according to the division 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 KULeuven but by the WAVES research group of the Ghent University. During this transition of executing party, it has been verified that the calculation models and assumptions do not lead to discontinuities in the results.

1.3 INM: Integrated Noise Model

For the calculation of the noise contours since 2011, the latest version of the INM calculation model, i.e. INM 7 (subversion INM 7.0b) has been used. For the years 2000 to 2010, model version 6.0c was always used for the officially reported noise contours. 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 for the years 2006 to 2010 were recalculated with 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.

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

1.4 Population data

The most recent population data available is used to determine the number of inhabitants living inside the contour zones and the number of people who are potentially highly annoyed. Based on inquiries with the Office for Statistics and Economic Information (also called National Institute for Statistics), these were revealed to be the population figures as of 1 January 2011.

1.5 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 5.7.

1.6 INM study

Brussels Airport Company was also provided with the following files in digital format by way of appendices to the report:

- UGENT_EBBR15_INM_studie.zip (the INM study used)
- UGENT_EBBR15_noise contours.zip (the contours as calculated in shape format)
- UGENT_EBBR15_opp_inw.zip (the number of inhabitants and the surface area as calculated within the noise contours)

2 Definitions

2.1 Explanation of a few frequently-used terms

2.1.1 Noise contours

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

The noise contours with the highest values are those situated closest to the noise source. Further 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 an entire fleet. 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

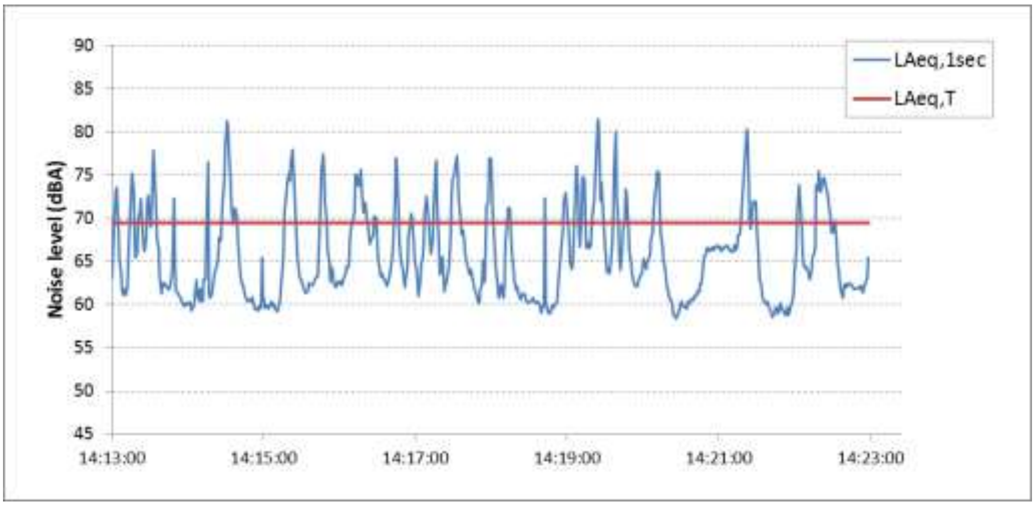
A noise zone is the zone delimited by two successive noise contours. The noise zone 60-65 dB(A) is, for example, the zone delimited by the noise contours of 60 and 65 dB(A).

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. To represent the noise impact at a specific place and as a result of fluctuating sounds over a period, the A-weighted equivalent sound pressure level $L_{Aeq,T}$ is used (see Figure 1).

[5] The INM calculation program 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 level ($L_{Aeq,1sec}$) 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, or is a representation of the average quantity of acoustic energy observed over the period T per second. 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}

To obtain an overall picture of the annoyance around the airport, it is usually opted not to use the equivalent sound pressure level over 24 hours, or $L_{Aeq,24h}$. Noise during the evening or night period is always perceived as more annoying than the same noise during the daytime period. $L_{Aeq,24h}$, for example, does not take this difference into account at all.

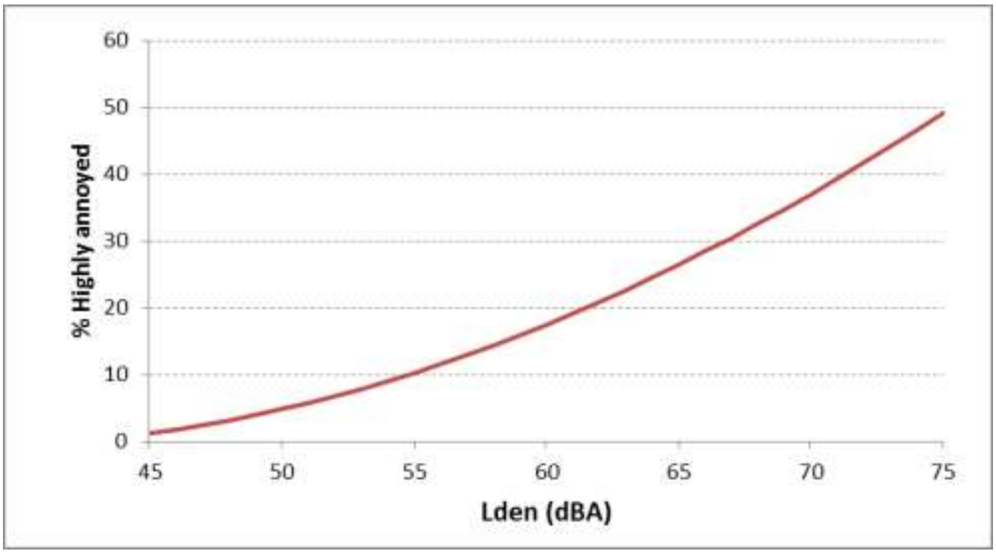
The European directive on the control and assessment of environmental noise (transposed in VLAREM), recommends using the L_{den} parameter to determine the annoyance. The L_{den} (**L**evel **D**ay-**E**vening-**N**ight) is the A-weighted equivalent sound pressure level over 24 hours, with a (penalty) 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 division used by section 57 of VLAREM is used, with the evening period from 19:00 to 23:00 and the night period from 23:00 to 07:00.

2.2 Link between annoyance and noise impact

A dose response relationship is imposed by VLAREM to determine the number of people who are potentially highly annoyed within the L_{den} noise contour of 55 dB(A). This equation shows the percentage of the population that is highly annoyed by the noise impact expressed in L_{den} (Figure 2).

% highly annoyed = $-9.199*10^{-5}(L_{den}-42)^3+3.932*10^{-2}(L_{den}-42)^2+0.2939(L_{den}-42)$

Figure 2: Percentage of people who are potentially highly annoyed 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].

[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

3 Methodology

Determining noise contours implies the calculation of lines with the same noise impact. An internationally recognised method is used to do this which is implemented in standardised software.

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.
- Post-processing of the contours into 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 is not a 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 movements in that year into the calculation, and then dividing it by the number of days in the 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 Instrument Arrival) 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. Runway usage and flight paths depend on the time of day and are influenced by weather conditions: taking off and landing is with maximum headwind to increase the lift of the wings. This documentation may change over time.

3.1.1 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 on type, engines, registration, etc. In most cases, the aircraft types are present in INM or in the standardised list with valid alternatives. For a minority of aircraft that cannot yet be identified in INM, an equivalent is sought based on other data (the number and type of engines and the MTOW (maximum take-off weight), etc.).

Helicopters are not included specifically in the calculations but they are added proportionally to the movement type (landing/take-off) and the time of day. Helicopter flights represent about 1% of movements. A SID is not available for some departures (usually domestic flights with smaller aircraft). These flights are also added proportionally to the flight data (about 0.8 %).

3.1.2 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 the destination) and on 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.

A method is available in INM to take this distribution into account. This manual method (one action per bundle) is automated in this version of the noise calculations without using the internal method in INM.

The SIDs are grouped together for the departure movements in a number of larger bundles and a static division is used for those bundles based on the actual flown paths. This static method is an improvement compared to the built-in methodology of INM which uses a symmetrical distribution of the actual flown paths while the distribution of the paths in bundles is generally asymmetrical. For a number of frequently-used SIDS, the movements are divided further by aircraft category.

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 from longer distances aligned with the runway. No distinctions are made by aircraft type for approaches because the approach path is not influenced by this factor.

3.1.3 Meteorological data

For the calculation of the contours for 2015, the actual average meteorological conditions are used. The weather data are available via Brussels Airport Company every twenty 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.

The wind speed is provided in accordance with the calculation method and converted to knots (kn). The meteorological parameters for 2015 are:

- Average headwind (annual average across all runways, take-off and landing): 5.0 kn

- Average temperature: 11.9 °C or 53.4 °F.
- Average headwind per runway:
    - 25R: 5.0 kn
    - 25L: 5.1 kn
    - 07R: 4.6 kn
    - 07L: 4.4 kn
    - 19: 5.7 kn
    - 01: 4.9 kn

3.1.4 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 (INM parameter stage). 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 co-ordinates 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 calculated noise contours, 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. For example, the noise calculations group flight movements and do not consider the actual height of an aircraft flying over (this is determined by the assigned INM standard departure profile, not by the actual radar data). The noise measurements are influenced by varying meteorological conditions that change the noise propagation conditions between the aircraft and the measuring station, and this may lead to significant level variations. The measuring stations are unmanned because they are monitored continuously throughout the year. Local deviations caused by local noise events for example may affect the measured levels. Although these deviations are removed from the measurements as much as possible, their contribution to the measurements recorded cannot always be avoided.

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 9 and tolerance 0.5 within a grid from 8 nmi[8] northwards and southward in relation to the airport reference measuring point, and 18 nmi westwards and 16 nmi eastwards. 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 in GIS to calculate frequency contours with standard functionality.

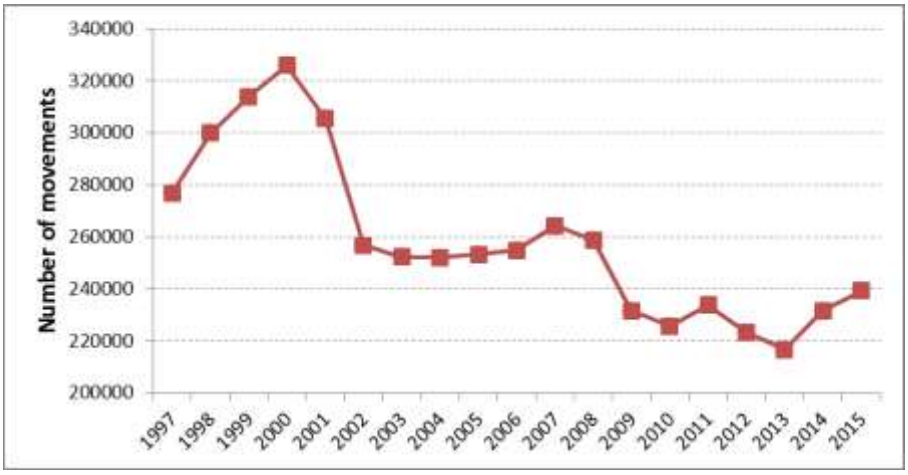
4 Results

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, and an increase of 6.9% in 2014, the number of movements rose again in 2015 by 3.4% (from 231,528 to 239,349).

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



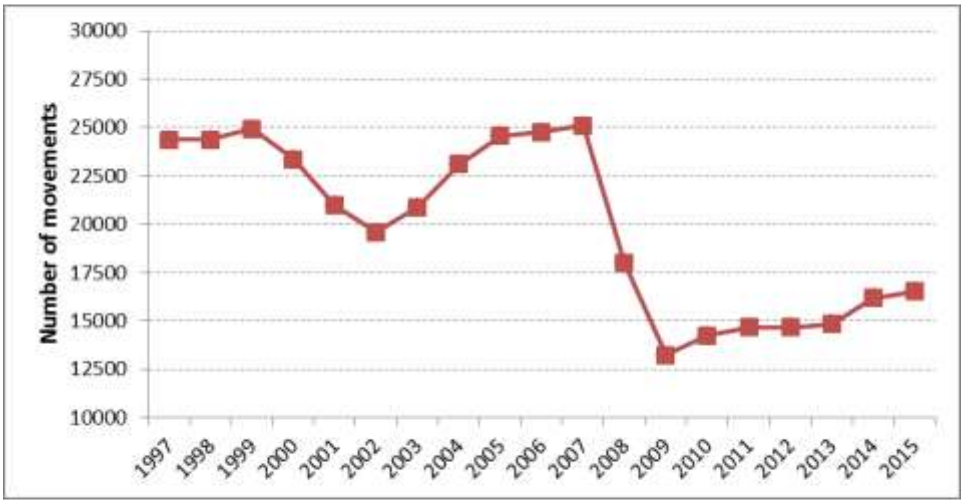
[8] 1 nmi (nautical mile) = 1.852 km (kilometre)

The number of night-time movements (23:00-06:00) rose in 2015 by 2.1% from 16,187 to 16,521 (including 4,981 take-offs). This includes helicopter movements and the movements exempt from slot co-ordination such as government flights, military flights, etc.

In 2015, the number of assigned night slots[9] for aircraft movements remained at 15,869, including 4,463 for departures, within the limitations imposed on the slot co-ordinator of Brussels Airport who since 2009 has been authorised to distribute a maximum of 16,000 night slots, of which a maximum of 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) rose by 3.5% from 215,341 in 2014 to 222,828 in 2015.

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 period (23:00 - 07:00). The number of movements in 2015, the data for 2014 and the trend are shown in Table 1. The numbers for the night period are broken down further by operational nights (23:00 - 06:00) and the morning period (06:00 - 07:00).

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

Table 1: Number of movements (incl. helicopter movements) in 2015 and the change vs.2014 (VLAREM division of the day).

	2014			2015			Relative change versus 2014		
period	landings	departures	total	landings	departures	total	landings	departures	total
day (07:00 - 19:00)	77,841	77,064	154,905	80,036	80,219	160,255	2.8%	4.1%	3.5%
evening (19:00 - 23:00)	24,726	24,967	49,693	26,188	25,681	51,869	5.9%	2.9%	4.4%
night (23:00 - 07:00)	13,196	13,734	26,930	13,456	13,769	27,225	2.0%	0.3%	1.1%
00:00 - 24:00	115,763	115,765	231,528	119,680	119,669	239,349	3.4%	3.4%	3.4%
06:00 - 23:00	104,258	111,083	215,341	108,140	114,688	222,828	3.7%	3.2%	3.5%
23:00 - 06:00	11,505	4,682	16,187	11,540	4,981	16,521	0.3%	6.4%	2.1%
06:00 - 07:00	1,691	9,052	10,743	1,916	8,788	10,704	13.3%	-2.9%	-0.4%

For the daytime period (07:00 - 19:00), the number of movements has increased by 3.5% compared to 2014. This increase is greater for the number of departures (+4.1%) than for the number of landings (+2.8%).

For the evening period (19:00 - 23:00), the number of departures increased by 2.9% and the number of landings by about 5.9%.

For the night period (23:00 - 07:00), the number of departures increased by 0.3% and the number of landings by 2.0%. The number of departures increased by 6.4% during the operational night (23:00 - 06:00). The number of departures dropped in the period between 06:00 and 07:00 (-2.9%). The number of landings rose during the night period (23:00 - 07:00) by 2.0%. During the morning hour (06:00 – 07:00), the number of landings rose by 13.3%, and during the operational night (23:00 - 06:00) by only 0.3%.

4.1.2 Other important evolutions

In addition to the number of movements, a number of other parameters also determine the size and the position of the noise contours, such as the runway and 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 most frequently used aircraft during the operational night period (23:00 - 06:00) in 2015 is the A320 (19.4% of movements in 2015), followed by the B752 (15.6%), the A319 (8.9%), the A306 (8.9%), the B738 (6.8%) and the B763 (6.0%). The portion of the A306 rose sharply between 2014 and 2015 while the portion of the B738 dropped sharply.

The ratio is clearly different for departures during the operational night. The B752 is the aircraft that takes off the most frequently (25.7%), followed by the A306 (14.45%), the A320 (9.8%), the B763 (9.6%) and the B733 (9.2%). The movements by the A306 as well as the A320 rose sharply in 2015 compared to 2014.

The number of movements in the year 2015 involving aircraft with an MTOW in excess of 136 tonnes (heavy aircraft) during the operational night period is 4,056, an increase of 18.5% compared to 2014 (3,422 movements). Departures of heavy aircraft most frequently involve the A306 (from 551 to 720), the B763 (from 510 to 480) and the B77L (from 152 to 157). The least frequently used heavy aircraft are deployed even less frequently for departures during the night period compared to 2014.

The fleet replacement operation by DHL (A30B to A306) has been completed. The evolution of the most frequently used aircraft types during the operational night period are set out in Table 2 (heavy aircraft) and Table 3 (lighter aircraft).

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

	Landings				Departures			
MTOW > 136 ton	2014	2015	Evolution	Evolution (%)	2014	2015	Evolution	Evolution (%)
A333	655	858	203	31%	3	3	-	0%
A306	563	746	183	33%	551	720	169	31%
B763	494	518	24	5%	510	480	-30	-6%
A332	323	379	56	17%	4	8	4	100%
B744	24	40	16	67%	25	14	-11	-44%
B772	22	3	-19	-86%		1	1	
A310	17	4	-13	-76%	17	4	-13	-76%
B788	16	29	13	81%	1	-	-1	-100%
B748	10	9	-1	-10%	7	9	2	29%
MD11	5	-	-5	-100%	4	-	-4	-100%
A343	4	4	-	0%	1	4	3	300%
DC10	2	1	-1	-50%	1	-	-1	-100%
B762	2	22	20	1000%	1	23	22	2200%
A346	1	-	-1	-100%		-	-	
B77W	1	2	1	100%		-	-	
C17	-	3	3		4	3	-1	-25%
B77L	-	9	9		152	157	5	3%
A30B	-	-	-		2	-	-2	-100%

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	2014	2015	Evolution	Evolution (%)	2014	2015	Evolution	Evolution (%)
A320	2,729	2,711	-18	-1%	318	486	168	53%
B738	1,559	987	-572	-37%	193	142	-51	-26%
B752	1,177	1,299	122	10%	1,204	1,282	78	6%
A319	1,104	1,320	216	20%	230	154	-76	-33%
B733	505	460	-45	-9%	502	458	-44	-9%
B734	459	638	179	39%	154	274	120	78%
A321	363	169	-194	-53%	57	113	56	98%
B737	295	284	-11	-4%	7	13	6	86%
E190	293	285	-8	-3%	3	5	2	67%
ATP	187	209	22	12%	404	316	-88	-22%
RJ1H	145	93	-52	-36%	21	26	5	24%
DH8D	114	31	-83	-73%	10	9	-1	-10%
EXPL	113	115	2	2%	63	56	-7	-11%
C130	28	19	-9	-32%	2	2	-	0%
E135	20	11	-9	-45%	10	5	-5	-50%
C25A	20	10	-10	-50%	18	6	-12	-67%
RJ85	20	-	-20	-100%	-	1	1	
F2TH	19	15	-4	-21%	11	12	1	9%
C56X	15	25	10	67%	8	10	2	25%
FA7X	12	12	-	0%	9	14	5	56%
F900	12	17	5	42%	13	18	5	38%
E170	11	24	13	118%	4	5	1	25%
GLF4	10	4	-6	-60%	6	6	-	0%
C25B	10	7	-3	-30%	5	2	-3	-60%

4.1.2.2 Runway and route usage

Preferential route usage

The preferential runway usage, published in the AIP (Belgocontrol), shows which runway should preferably be used, depending on the time when the movement occurs, and in some cases on the destination and the MTOW of the aircraft. This scheme did not change during the year 2015 (see Table 4).

If the preferential runway configuration cannot be used (for example due to meteorological conditions, works on one of the runways, etc.), then Belgocontrol will choose the most suitable alternative configuration, taking account the weather conditions, the equipment of the runways, the traffic density, etc. In this respect, conditions are tied to the preferential runway usage arrangements, including wind limits expressed as a 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 for gusts is 7 kt and the maximum crosswind is 20 kt. In the event of alternative runway usage, the maximum speeds for gusts 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 11/12/2014 to 10/12/2015)

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

(1) Runway 25R for traffic via ELSIK, NIK, HELEN, DENUT, KOK and CIV / Runway 19 for traffic via LNO, SPI, SOPOK, PITES and ROUSY (aircraft with MTOW between 80 and 200 tonnes can use runway 25R or 19, aircraft with MTOW > 200 tonnes must use runway 25R, regardless of their destination).

(2) Runway 25L only if air traffic control considers this necessary.

(3) Between 01:00 and 06:00, no slots may be allocated for departures.

(4) Between 00:00 and 06:00, no slots may be allocated for departures.

Runway usage

The portion of departures on runway 25R drops significantly from 82% in 2014 to 73% in 2015. This decrease was mainly caused by the major maintenance works to runway 25L-07R during the period 27 May 2015 to 19 August 2015. During this period, runway 25R was used under normal conditions to handle all landings and some of the departures were consequently moved to runway 19. This explains the sharp increase of the number of departures on runway 19 from 4,702 to 14,447 (nearly tripled). These maintenance works also resulted in fewer departures on runway 07R from 12.1% to 9.8% and runways 01 and 07L were also used less frequently. These movements are similar for day, evening and night flights. 25R is used relatively less during the night (see also the preferential runway usage diagram in the previous paragraph).

Landings were also subject to significant changes due mainly to the aforementioned maintenance works to runway 25L-07R. The closure of the main runway 25L resulted in landings being moved to runway 25R. The portion of the number of landings in 2014 is 54.6% for 25L and 27.4% for runway 25R. In 2015, these percentages are 42.2% for 25L and 40.3% for runway 25R. The number of landings on runway 19 dropped by nearly 50% (4,641 to 2,897). The changes are different for day, evening and night.

A complete overview of runways used in 2015 is included in appendix 5.1.

Changes in the SIDs

On 2/4/2015, several changes were made to the SIDs of runways 25R/25L as a result of a moratorium imposed by the Federal Government, and the situation was rolled back to that of 6/2/2014. An overview of all flown SIDs per month, runway and time of day can be found in appendix 5.1.

4.2 Noise measurements - $L_{Aeq,24h}$

The INM software enables a number of acoustic parameters to be calculated at a specified location around the airport By performing this calculation at the locations of the measuring stations of the Noise Monitoring System(NMS), it can be examined to what extent the calculated values correspond to the values registered and processed by the measuring system. Different data sources are used in the NMS system and 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 events are correlated.

The system of correlation is definitely not perfect and events are regularly 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 only expected 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. On that occasion, the maximum duration of an event was increased from 75 s (for 2014) to 125 s. The probability that this is caused by an aircraft is very small for longer events. Note that a correlation is also necessary with a registered aircraft movement besides the conditions relating to the event duration and trigger level.

The table below compares the calculated values at the different measuring station locations and the values calculated on the basis of the correlated events for the parameters $L_{Aeq,24h}$, L_{night} and L_{den}. The results of the LNE measuring stations (with codes NMT 40-1 and higher) of which the data are also available and linked to flight data in the NMS of the airport, are also recorded besides the measuring stations of Brussels Airport Company, . 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, or a combination of both. 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 these are consequently not considered in the comparison of simulations and measurements.

The fraction of time that the measuring system is active (so-called uptime) is very high with an average of 99.7 % across all measuring stations. It is expected that practically no noise events are missed when the measuring stations are off-line. The lowest uptime fraction was recorded at measuring station Wemmel (NMT14-1), but this is still 97.9 %.

The comparison between calculations and measurements based on the $L_{Aeq,24h}$ shows that the discrepancy between the calculated value and the measured value for all the measuring stations, except NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1 (see previous paragraph) remains limited to 2 dB(A). For more than half of the measuring stations, this discrepancy is even limited to less than 1 dB(A). The global discrepancy between simulations and measurements is 1.1 dB(A) (root-mean-square error, RMSE).

The measured value at the measuring station Bertem (NMT48-3) is lower than calculated (difference is 3.4 dB(A)). This location is characterised in 2015 by very low noise levels caused by aircraft movements; the aircraft noise is an irrelevant component of the environmental noise and this typically results in major discrepancies.

A slightly higher level is measured than predicted at measuring stations Nossegem (NMT04-1), Sterrebeek (NMT07-1), Sint-Pieters-Woluwe (NMT11-2) and Kraainem (NMT24-1) but this difference remains between 1 and 2 dB(A). The predictions do not show overall overestimates or underestimates across all measuring stations: the linear average between simulations and measurements is only 0.1 dB(A) (once again excluding measuring points NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1).

The overall deviation between measurements and simulations for L_{night} is slightly higher (1.5 dB(A) RMSE, excluding measuring points NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1). At one measuring location, namely Sterrebeek, a level is calculated that is lower than the measurements (between 2 and 3 dB(A)). At measuring locations Meise, Perk and Bertem, the predicted level is too high when compared with the measurements (more than 2 dB(A)). The simulations show a limited linear average difference globally across all measuring locations (0.2 dB(A), excluding measuring points NMT01-2, NMT03-3, NMT 15-3 and NMT 23-1).

The RMSE is 1.3 dB(A) for the noise indicator L_{den}. The measuring location Bertem shows a high overestimate of the measured levels. Only one location, namely Sterrebeek, has measurements which are underestimated by more than 2 dB(A).

The increase of the maximum noise event duration from 75 s (in 2014) to 125 s (in 2015) in the measurement network shows an average difference of 0.1 dB(A) for the considered noise level indicators. Maximum discrepancies between these event duration times across all measuring locations are 0.3 dB(A). This change consequently has only a limited effect on the measured levels.

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	58.4	63.4	-5.0
NMT02-2	KORTENBERG	67.3	67.0	0.3
NMT03-3	HUMELGEM – Airside	63.0	62.8	0.3
NMT04-1	NOSSEGEM	64.4	63.4	1.1
NMT06-1	EVERE	51.3	50.3	1.0
NMT07-1	STERREBEEK	52.0	50.6	1.5
NMT08-1	KAMPENHOUT	56.3	56.1	0.1
NMT09-2	PERK	47.4	49.7	-2.2
NMT10-1	NEDER-OVER-HEEMBEEK	55.2	55.3	-0.1
NMT11-2	SINT-PIETERS-WOLUWE	52.4	51.3	1.1
NMT12-1	DUISBURG	47.7	47.0	0.8
NMT13-1	GRIMBERGEN	45.7	46.7	-1.1
NMT14-1	WEMMEL	47.1	47.8	-0.7
NMT15-3	ZAVENTEM	45.5	55.6	-10.1
NMT16-2	VELTEM	56.4	55.4	1.0
NMT19-3	VILVOORDE	53.2	52.8	0.4
NMT20-2	MACHELEN	53.6	54.0	-0.3
NMT21-1	STROMBEEK-BEVER	51.1	50.8	0.4
NMT23-1	STEENOKKERZEEL	66.3	69.1	-2.8
NMT24-1	KRAAINEM	53.9	52.4	1.4
NMT26-2	BRUSSELS	48.1	48.2	-0.1
NMT40-1*	KONINGSLO	52.8	52.3	0.5
NMT41-1*	GRIMBERGEN	48.0	48.5	-0.5
NMT42-2*	DIEGEM	63.8	64.6	-0.8
NMT43-2*	ERPS-KWERPS	55.5	56.0	-0.5
NMT44-2*	TERVUREN	48.9	48.7	0.3
NMT45-1*	MEISE	45.8	46.1	-0.3
NMT46-2*	WEZEMBEEK-OPPEM	55.1	54.1	1.0
NMT47-3*	WEZEMBEEK-OPPEM	53.2	52.2	1.0
NMT48-3*	BERTEM	32.7	36.1	-3.4

* LNE noise data off-line correlated by the NMS

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	56.0	62.3	-6.3
NMT02-2	KORTENBERG	62.3	62.0	0.3
NMT03-3	HUMELGEM – Airside	57.1	57.7	-0.6
NMT04-1	NOSSEGEM	61.6	59.9	1.7
NMT06-1	EVERE	44.9	43.8	1.1
NMT07-1	STERREBEEK	51.4	48.9	2.5
NMT08-1	KAMPENHOUT	54.2	53.9	0.3
NMT09-2	PERK	44.0	46.1	-2.1
NMT10-1	NEDER-OVER-HEEMBEEK	51.0	50.4	0.6
NMT11-2	SINT-PIETERS-WOLUWE	47.9	46.7	1.2
NMT12-1	DUISBURG	45.2	44.0	1.2
NMT13-1	GRIMBERGEN	39.8	40.8	-1.0
NMT14-1	WEMMEL	40.9	42.8	-1.9
NMT15-3	ZAVENTEM	46.2	52.3	-6.1
NMT16-2	VELTEM	51.4	50.6	0.8
NMT19-3	VILVOORDE	49.3	48.3	1.0
NMT20-2	MACHELEN	50.5	50.3	0.2
NMT21-1	STROMBEEK-BEVER	46.8	46.8	0.0
NMT23-1	STEENOKKERZEEL	64.9	67.3	-2.4
NMT24-1	KRAAINEM	48.8	47.4	1.4
NMT26-2	BRUSSELS	44.6	44.5	0.1
NMT40-1*	KONINGSLO	48.4	48.0	0.4
NMT41-1*	GRIMBERGEN	42.3	43.1	-0.8
NMT42-2*	DIEGEM	59.3	59.2	0.1
NMT43-2*	ERPS-KWERPS	50.1	50.8	-0.7
NMT44-2*	TERVUREN	47.7	46.4	1.3
NMT45-1*	MEISE	37.7	39.8	-2.1
NMT46-2*	WEZEMBEEK-OPPEM	50.4	49.3	1.1
NMT47-3*	WEZEMBEEK-OPPEM	52.0	50.3	1.7
NMT48-3*	BERTEM	27.4	31.5	-4.1

* LNE noise data off-line correlated by the NMS

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	63.4	69.2	-5.8
NMT02-2	KORTENBERG	71.0	70.7	0.3
NMT03-3	HUMELGEM – Airside	66.4	66.4	0.1
NMT04-1	NOSSEGEM	69.2	67.8	1.4
NMT06-1	EVERE	54.6	53.5	1.1
NMT07-1	STERREBEEK	57.9	55.8	2.1
NMT08-1	KAMPENHOUT	61.4	61.2	0.2
NMT09-2	PERK	51.9	54.2	-2.3
NMT10-1	NEDER-OVER-HEEMBEEK	59.2	59.4	-0.2
NMT11-2	SINT-PIETERS-WOLUWE	56.4	55.3	1.1
NMT12-1	DUISBURG	52.5	51.6	0.9
NMT13-1	GRIMBERGEN	49.2	50.4	-1.1
NMT14-1	WEMMEL	50.6	51.8	-1.1
NMT15-3	ZAVENTEM	52.2	60.0	-7.8
NMT16-2	VELTEM	60.2	59.2	0.9
NMT19-3	VILVOORDE	57.4	57.0	0.5
NMT20-2	MACHELEN	58.2	58.3	-0.1
NMT21-1	STROMBEEK-BEVER	55.2	55.0	0.1
NMT23-1	STEENOKKERZEEL	71.8	74.4	-2.6
NMT24-1	KRAAINEM	57.7	56.2	1.5
NMT26-2	BRUSSELS	52.7	52.6	0.1
NMT40-1*	KONINGSLO	56.8	56.5	0.3
NMT41-1*	GRIMBERGEN	51.4	52.2	-0.8
NMT42-2*	DIEGEM	67.6	68.3	-0.7
NMT43-2*	ERPS-KWERPS	59.0	59.6	-0.6
NMT44-2*	TERVUREN	54.5	53.6	0.8
NMT45-1*	MEISE	48.5	49.6	-1.1
NMT46-2*	WEZEMBEEK-OPPEM	59.1	58.0	1.1
NMT47-3*	WEZEMBEEK-OPPEM	58.7	57.4	1.4
NMT48-3*	BERTEM	36.2	40.1	-3.8

* LNE noise data off-line correlated by the NMS

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 appendix 5.4 and appendix 5.5.

The surface area and the number of inhabitants are calculated for the noise contours, and the number of highly annoyed is determined according to the methods described in chapter 2.2. The results are available per municipality in appendix 5.4. The contours of 2014 and 2015 are compared in appendix 5.5. Appendix 5.6 contains the evolution of the surface area per contour zone and the number of inhabitants in the contour zones. The historical data were recalculated using the latest version of INM (7.0b) and applied to the population data of the year in question.

4.3.1 L_{day} contours

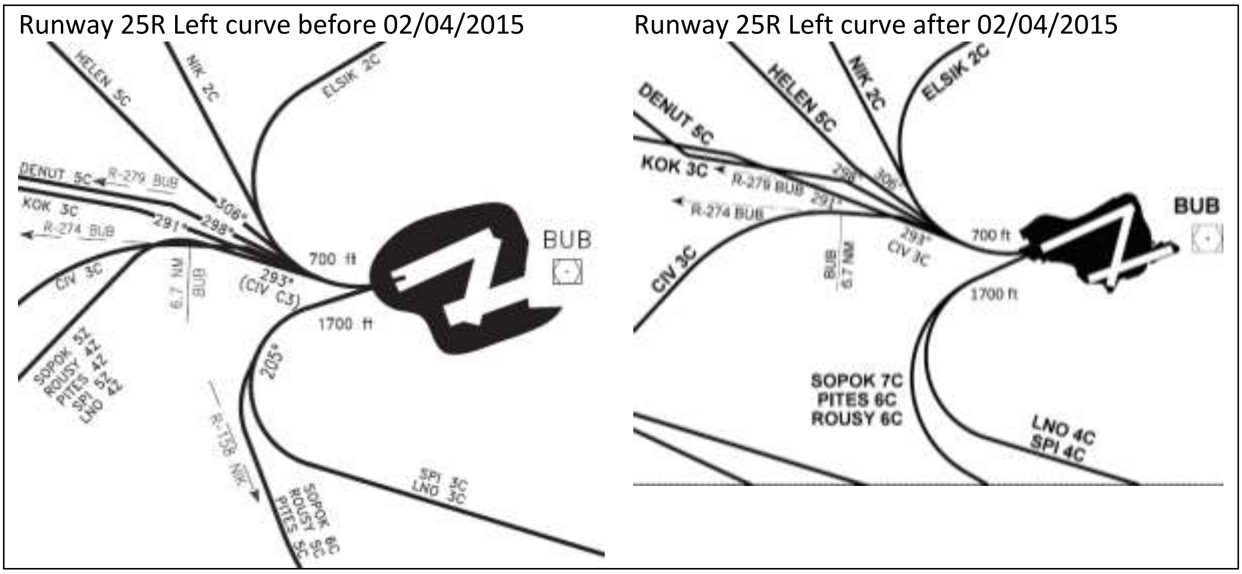
The L_{day} contours represent the A-weighted equivalent sound pressure level for the period 07:00 to 19:00 and are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A). The evolution of the contours for 2014 and 2015 is shown in Figure 6.

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 distributed over 25R and 19. When this preferential runway usage cannot be applied due to weather conditions (north-eastern wind), then the combination of departures from 07R/07L and landings on 01 is generally applied.

A shift of all contours is visible to the north-east of Brussels Airport. This is mainly explained by the shift of arrivals. Three are more arrivals on runway 25R (from 18,695 in 2014 to 30,832 in 2015) due to the temporary closure of runway 25L. On the other hand, the number of arrivals on runway 25L has dropped from 44,997 to 35,598. The limited decline of departures from 07R (from 10,402 to 8.491) may also have an effect.

Practically no changes in the contours for levels above 60 dB(A) are visible to the west of Brussels Airport, however, the 55 dB(A) contour seems to bulge wider to the north and the south while its range extends less far forward along the axis of the runway. The number of departures from runway 25R dropped slightly (from 62,149 in 2014 to 58,908 in 2015). This is also the consequence of the temporary closure of runway 25L whereby some of the departures were moved to runway 19. This reduction is partially compensated by more landings on 07L. The number of flights that take off from runway 25R and continue straight ahead has dropped significantly compared to 2014 as a result of the moratorium imposed on 2 April 2015. The number of flights that veer off to the right has practically remained the same and the number of flights that veer off to the left fell slightly; this is explained by the moving of departures to runway 19 while runway 25L was closed. The moratorium of 2 April 2015 also imposed other take-off procedures for departures from runway 25R with a curve to the left (see Figure 5). The standard procedure (SID) now has a shorter curve for some of these departures. The use of the new procedures can be seen in Table 13. This explains the minor shift of the 55 dB(A) contour to the south. No clear reason could be found for the minor shift of the 55 dB(A) contour to the north. This is probably caused by the combination of several minor effects, including an increase of departures from runway 19 that veer to the right and whose curve is concentrated in this zone, and minor changes of the aircraft used.

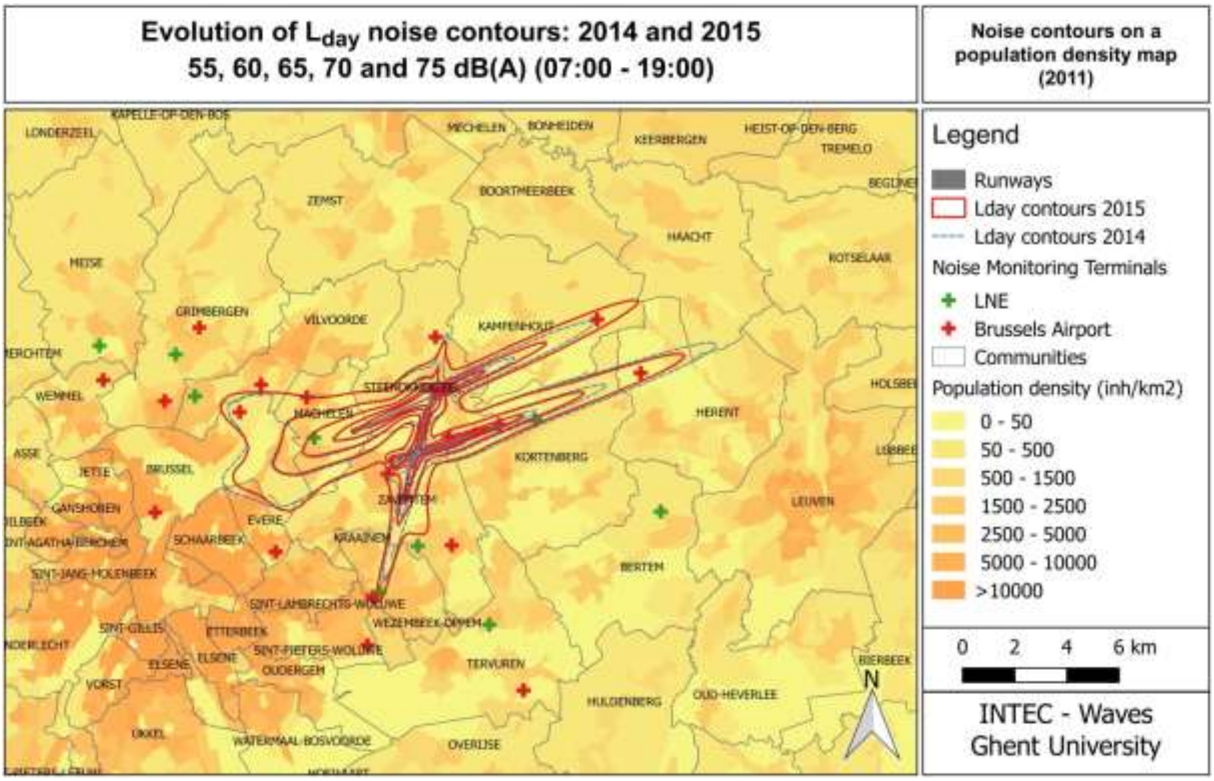
Figure 5: Changes in departure routes for the left curve from runway 25R from 02/04/2015 (source: AIP).



The eastward bulge in the 55 dB(A) contour and the overall increase of the surface area of all contours is the starkest change to the south of Brussels Airport. This is directly the consequence of the aforementioned increase in the use of runway 19 (9,180 departures in 2015 compared to 1,990 in 2014). The contours at this location are however still defined to a great extent by the landings on runway 01 (9,899 in 2015).

The impact zone to the north of Brussels Airport is limited. The small bulge in the contours is slightly wider than in 2014 but doesn't extend so far. This is easily explained by the reduction of arrivals on runway 19 (from 2,906 in 2014 to 1,497 in 2015) and the rise of the number of departures from runway 01 (from 525 to 2,177).

Figure 6: L_{day} noise contours around Brussels Airport in 2014 (dotted blue) and 2015 (solid red).



The total surface area inside the L_{day} contour of 55 dB(A) rose in 2015 by about 6.5% compared to 2014 (from 4,821 to 5,135 ha). The number of inhabitants inside the L_{day} contour of 55 dB(A) rose by 3.3% (from 33,920 to 35,056).

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 2014 and 2015 is shown in Figure 7. An additional contour is reported and this creates a visually enlarged effect. The 50 dB(A) contour has become equally significant for the calculation of the L_{den} as the L_{day} contour of 55dB(A) due to the 5 dB(A) correction.

The evaluation period for the $L_{evening}$ contours falls entirely within the operational daytime period (06:00 to 23:00) as specified at Brussels Airport. There are slightly fewer flights per hour during the evening than during the daytime period (-2.9%). During the evening period, the airport had an average of 17.6 departures per hour, slightly more than the 17.1 in 2014. There were 17.9 arrivals per hour in 2015, 5.9% more than the 16.9 in 2014.

Runway usage is similar to the daytime period. The drop in departures from runway 25R and the rise of departures from runway 19 is similar to the daytime period. More arrivals on runway 25R (from 6,462 in 2014 to 9,816 in 2015) were due to the temporary closure of runway 25L, as it was the case for the daytime period. The number of arrivals on runway 25L dropped from 13,882 to 11,540.

The location of the contours up to 55 dB(A) and the change of these contours compared to 2014 is consequently quite similar to the day contours.

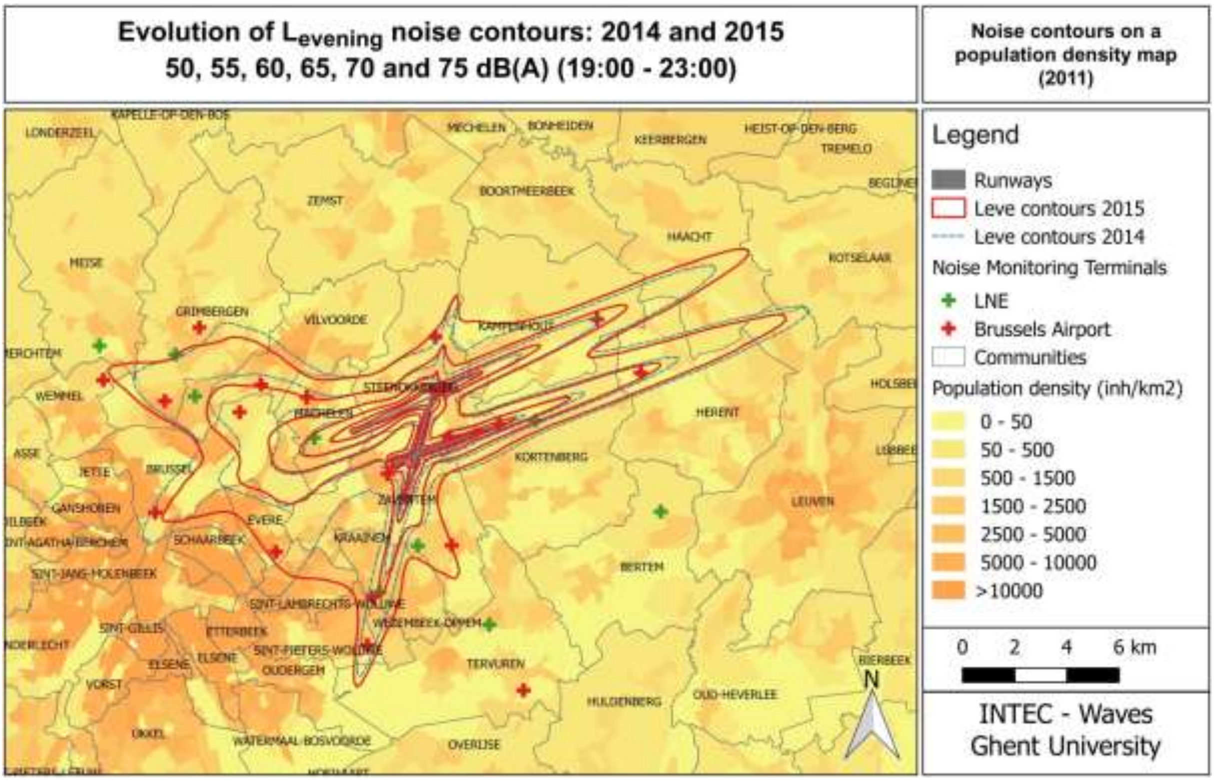
In particular, we see the expansion of the landing contour for runway 25R to the north-east of Brussels Airport. The smaller landing contour for runway 25L is less pronounced during the day.

The widening of the contours to 55 dB(A) to the west of Brussels Airport is due to the same effects that occur during the day. The northern lobe where departing flights from runway 25R veer to the right is located slightly more to the north than in 2014, while this is not the case during the day. This is the result of the more frequent use of standard departure procedures that make a slightly longer curve (DENUT5C) and the less frequent use of standard departure procedures that make a shorter curve (HELEN5C).

To the south of Brussels Airport, the bulge of the 55 dB(A) contour to the east is apparent, just like during the day. This is also caused by a rise of the number of departing flights from runway 19.

The pronounced expansion of the 50 dB(A) contour in the south-west direction can also be observed, and this means the bulge which was clearly visible in 2014 has now disappeared completely. This is also due mainly to the increased use of runway 19 for take-offs, and in particular to aircraft that veer right after take-off. The radar tracks show that different aircraft make this curve differently which means the 55 dB(A) contour has grown less than the 50 dB(A) contour. On the other hand, flights leaving from runway 25R that veer left in accordance with the new standard procedures from 2 April 2015, make the curve sharper (PITES6C, ROUSY6C, SOPOK7C). This also contributes to the increased expansion of the 50 dB(A) contour to the south-west of the airport. This benefits the contraction of the contour above the Brussels Capital Region.

Figure 7: $L_{evening}$ noise contours around Brussels Airport in 2014 (dotted blue) and 2015 (solid red).



The total surface area inside the $L_{evening}$ contour of 50 dB(A) rose in 2015 by about 7.0% compared to 2014 (from 12,283 to 13,147 ha). The number of inhabitants inside the $L_{evening}$ contour of 50 dB(A) dropped by 9.3% (from 223,324 to 202,444). The flight paths have been moved to less densely populated areas. The evening flight paths changed in the beginning of April 2015 so the flights were distributed. The effects of the changes to the flight routes on the contours will become stronger in the future if the policy remains unchanged.

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 for 2014 and 2015 is shown in Figure 8. An additional contour is reported and this creates a visually enlarged effect. 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 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).

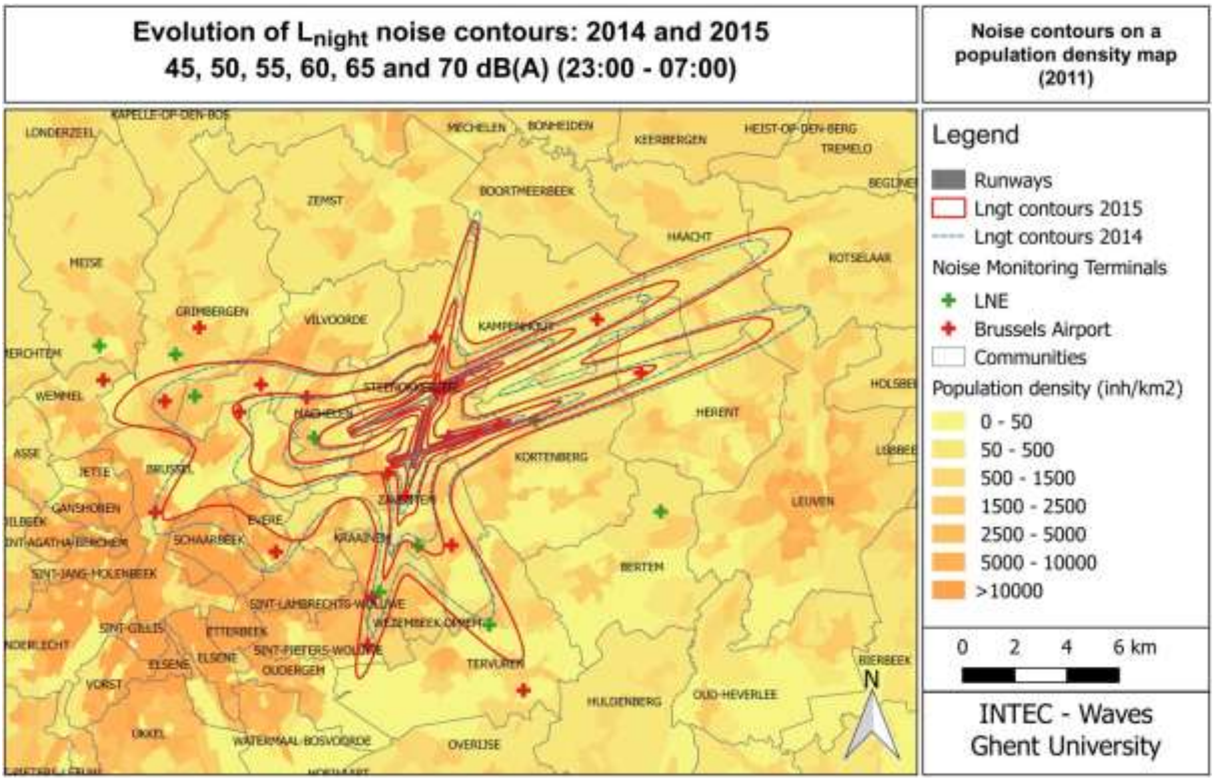
The evaluation period for the L_{night} contours does not coincide with the operational night period (23:00 to 06:00) and also comprises the flights of the operational daytime period between 06:00 and 07:00. The noise contours are a combination of the runway and route usage during the operational night and during the operational day. The number of flights per hour during the night is about 25% of the number of flights during the day. During the night period, an average of 4.7 departures were recorded per hour, only 0.3% more than in 2014. There were 4.6 arrivals per hour in 2015, 2.1% more than the 4.5 per hour in 2014.

The noise contours to the north-east of Brussels Airport reflect the changes resulting from the use of arrivals on 25L and 25R which can also be seen during the day.

The surface area of all contours to the south of Brussels Airport has increased as a result of the more frequent use of runway 19 for take-off, just like during the day. The rise between 2014 and 2015 is however not so pronounced as during the day and evening because runway 19 was already used more in 2014 during the night (2,015 departures in 2014 compared to 2,847 departures in 2015). Especially the eastern bulge in the contours was already visible in 2014.

The most noticeable change is the shift of the contours for L_{night} to the west of Brussels Airport. Both the 45 dB(A) and the 50 dB(A) contours have contracted significantly above the densely populated Brussels Capital Region. These contours are expanding mainly towards the west, above the northern edge of Brussels. The number of departures from runway 25R dropped from 10,504 in 2014 to 9,398 in 2015, and the portion of these flights that make a curve to the right has risen while the number of flights that continue to fly straight ahead dropped sharply (35.7% of all departures make a curve to the right compared to 30.4% in 2014, and 14.7% of all departures continue straight ahead compared to 19.7% in 2014). Many of these flights follow the standard departure route that veers around the northern edge of the Brussels Capital Region (SID CIV3C and to a lesser extent SOPOK5Z). This explains the expansion of the contours to the north of the Brussels Capital Region. The left curve is taken sharper with the new standard procedures (SID PITES6C, ROUSY6C, SOPOK7C) and this means the lobe of the 45 dB(A) contour which used to be located above the Brussels Capital Region has now shifted slightly to the west.

Figure 8: L_{night} noise contours around Brussels Airport in 2014 (dotted blue) and 2015 (solid red).



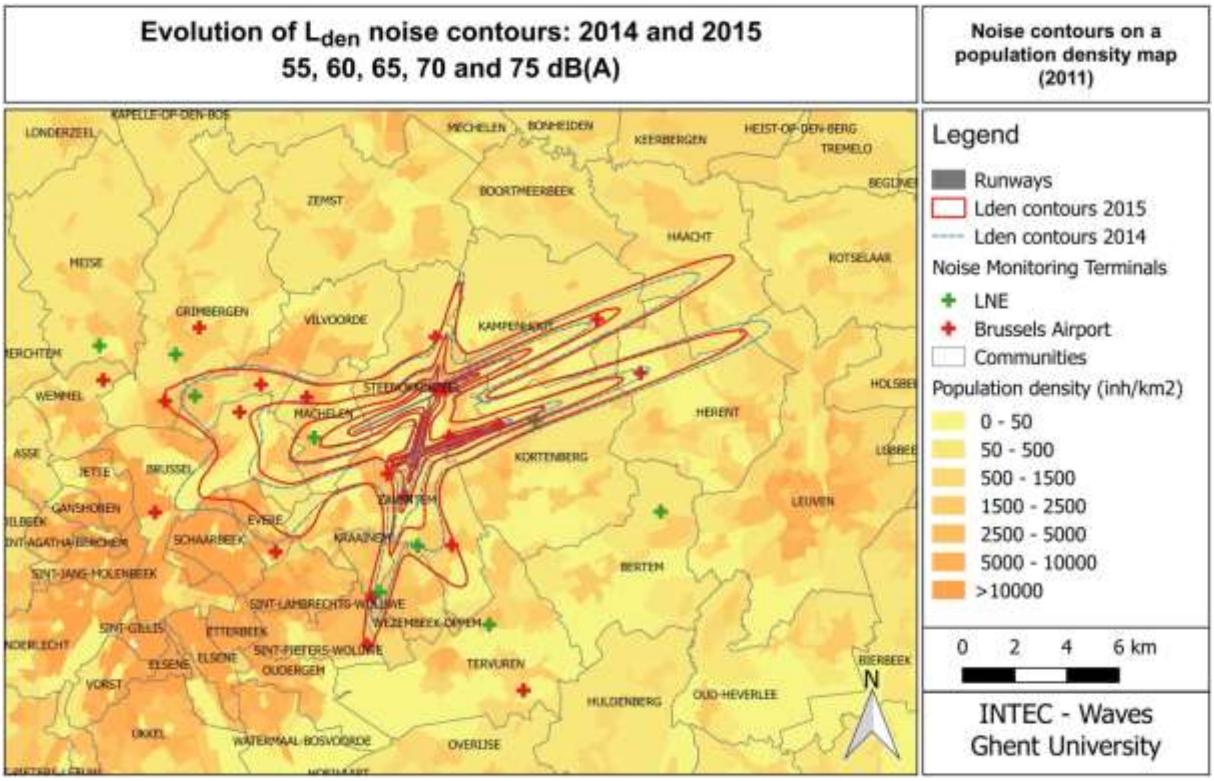
The busy hour from 06:00 and 07:00 contributes the most to the L_{night} contours. In 2015, this was 63.8% of departures, slightly less than the 65.9% in 2014. The night contours are therefore quite similar to the day contours.

The total surface area inside the L_{night} contour of 45 dB(A) rose in 2015 by 6.6% compared to 2014 (from 12,583 to 13,413 ha). The number of inhabitants inside the L_{night} contour of 45 dB(A) dropped sharply by 17.7% (from 196,362 to 161,524). The effect of the modified runway usage and the moving of flight routes is even greater at night than during the evening period.

4.3.4 L_{den} contours

The L_{den} quantity is a composition of L_{day}, $L_{evening}$ and L_{night} and this means an A-weighted equivalent level is obtained for the full 24 hours period. The evening movements are penalised with 5 dB(A), the night movements with 10 dB(A). 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). In Figure 9 you can see the evolution of the L_{den} contours for 2014 and 2015. The L_{den} contours are reported from 55 dB(A) to 75 dB(A) in steps of 5 dB(A).

Figure 9: L_{den} noise contours around Brussels Airport in 2014 (dotted blue) and 2015 (solid red).



The changed form is a weighted combination of all effects which clarified in detail in the discussion of L_{day}, $L_{evening}$ and L_{night} contours.

The total surface area inside the L_{den} noise contour of 55 dB(A) rose in 2015 by about 5.5% compared to 2014 (from 8,756 to 9,236 ha). The number of inhabitants inside the L_{den} contour of the 55 dB(A) noise contour dropped sharply by 10.0% (from 106,725 to 96,075).

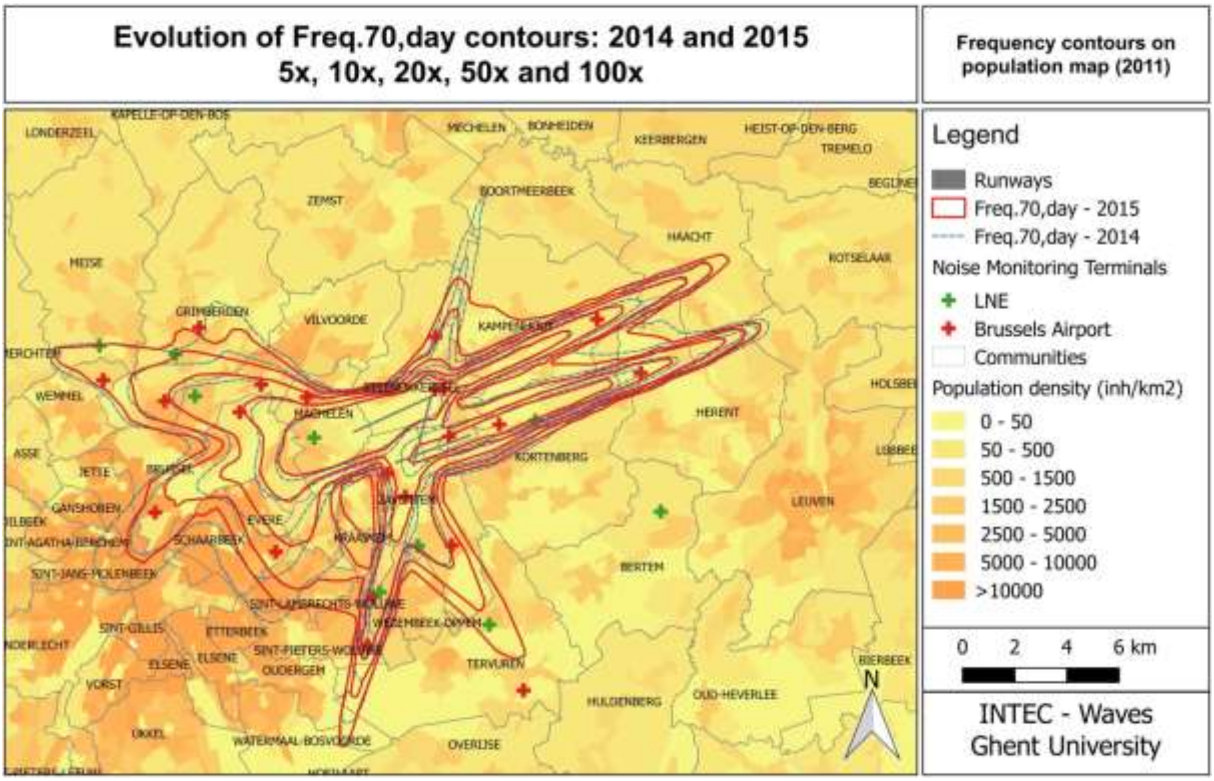
4.3.5 Freq.70,day contours (day 07:00 - 23:00)

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 to the routes.

The modified form is a combination of two effects. The main reason is the temporary closure of runway 25L and the shift of the departures to runway 19 as a direct consequence. There are clearly more departures from runway 19 and the sharp left curve from runway 19 is used more. In addition, the departure routes of runways 25R and 25L were modified on 2 April 2015 and the noise contours no longer extend so far in the Brussels Capital Region. The short left curve for flights using runway 25R is visible in the frequency contour. The shift from runway 25L to 25R is visible for landings in the contours but the differences are less pronounced in the evaluation of the events than in the noise contours.

The total surface area inside the contour of 5x above 70 dB(A) rose in 2015 by about 19.1% compared to 2014 (from 15,372 to 18,314 ha). The number of inhabitants inside the Freq.70,day contour of 5 events dropped sharply by 23.1% (from 434,746 to 334,264).

Figure 10: Freq.70,day frequency contours around Brussels Airport for 2014 and 2015.



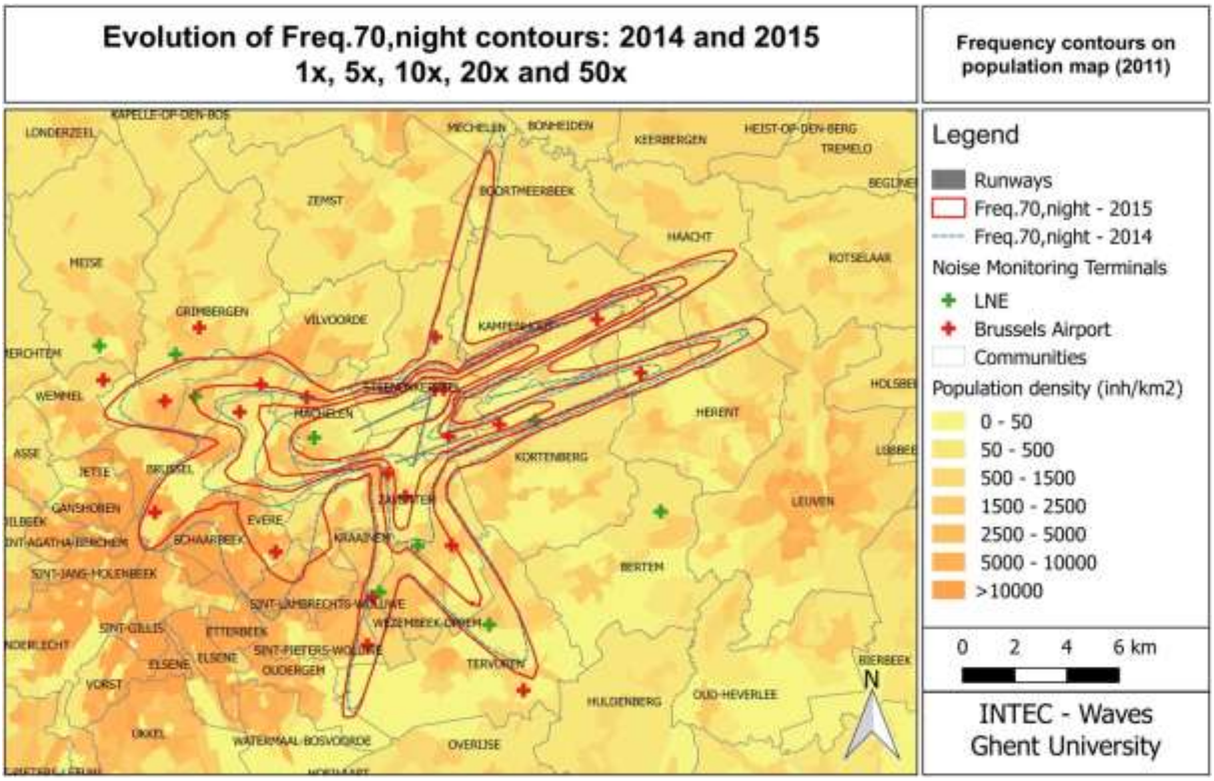
4.3.6 Freq.70,night contours (night 23:00-07:00)

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 usage and the changes to the routes.

The modified form is a combination of two effects. The first reason is the temporary closure of runway 25L and the shift of the departures to runway 19 as a direct consequence. More departures were recorded from runway 19 but the change is less pronounced in comparison with the day and evening periods. The impact on the frequency contour is smaller. In addition, the departure routes of runways 25R and 25L were modified on 2 April 2015 and the frequency contours no longer extend so far in the Brussels Capital Region. The short left curve for flights using runway 25R during the night period is clearly visible in the frequency contour. The shift from runway 25L to 25R is visible for landings in the contours but the differences are less pronounced than in the L_{night} noise contours.

The total surface area inside the 1x above the 70 dB(A) contour during the night rose in 2015 by only 0.5% compared to 2014 (from 13,813 to 13,885 ha). The number of inhabitants inside this contour dropped sharply by 24.5% (from 279,251 to 210,939).

Figure 11: Freq.70,night frequency contours around Brussels Airport for 2014 and 2015.

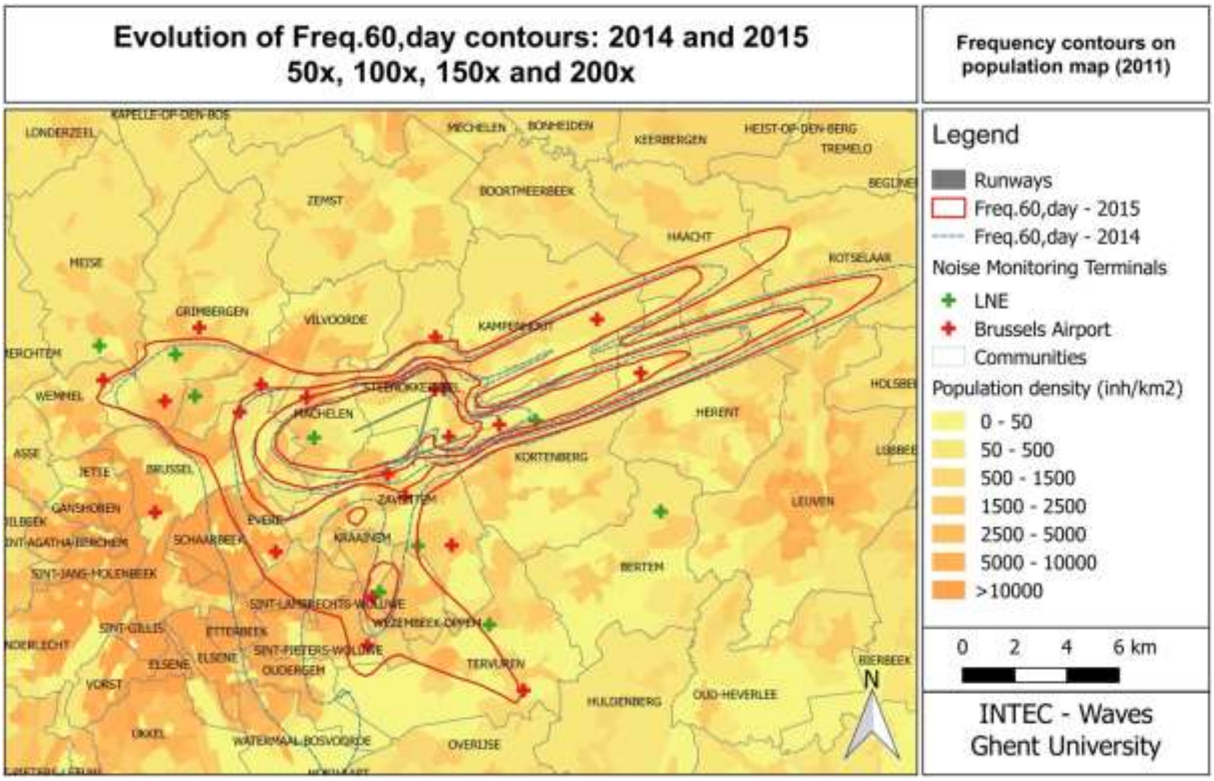


4.3.7 Freq.60,day contours (day 07:00-23:00)

The Freq.60,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.60,day contours reflects the changes in the runway usage and the changes to the routes. The shorter left curve from runway 25R crosses the take-off paths of runway 19 and locally increases the number of noise events above 60 dB(A). The difference between the noise contours of 2014 and 2015 is mainly the result of this change in routes during the day.

The total surface area inside the Freq.60,day contour of 50x above 60 dB(A) rose in 2015 by about 5.5% compared to 2014 (from 15,352 to 16,203 ha). The number of inhabitants inside the Freq.60,day contour of 50 times above the 60 dB(A) dropped by 24.5% (from 323,042 to 243,774).

Figure 12: Freq.60,day frequency contours around Brussels Airport for 2014 and 2015.

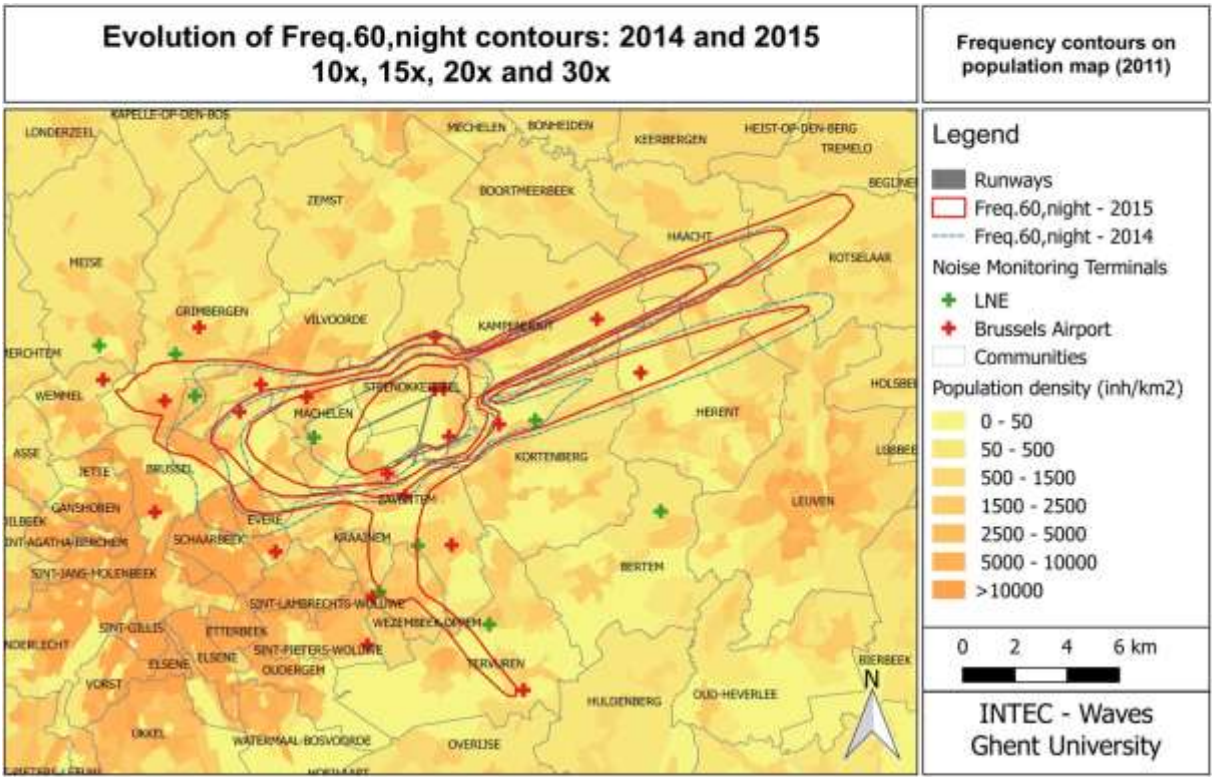


4.3.8 Freq.60,night contours (night 23:00-07:00)

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 usage and the changes to the routes. The specific use of the adjusted SIDs during the night are clearer in these contours than in the Freq.60,day contours. The contour has grown as a result of the increased use of runway 19. A small additional zone with 10x above 60 dB(A) is visible as a result of the concentration of flights from runway 25R that use the short left curve.

The total surface area inside the Freq.60,night frequency contour with 10x above 60 dB(A) rose in 2015 by about 10.1% compared to 2014 (from 10,864 to 11,964 ha). The number of inhabitants inside the Freq.60,night contour of 10x above 60 dB(A) dropped by 4.8% (from 138,420 to 131,736). The rise in the number of departures from runway 19 reached the threshold of 10 events and increases the surface area of the contour significantly. The reverse effect is visible for the landing contour of runway 25L where the number of events drops below the threshold of 15 events. Despite the strong expansion of the surface area, the exposed population is lower than in 2014.

Figure 13: Freq.60,night frequency contours around Brussels Airport for 2014 and 2015.



4.4 Potentially highly annoyed

The number of people who are potentially highly annoyed is determined on the basis of the calculated L_{den} and the exposure effect relationship for serious annoyance stipulated in VLAREM is (see 2.2). The number of highly annoyed is also reported by municipality.

For 2015, the total number of people who are potentially highly annoyed living inside the 55 dB(A) contour amounted to 13,965. This is 5.8% lower than in 2014.

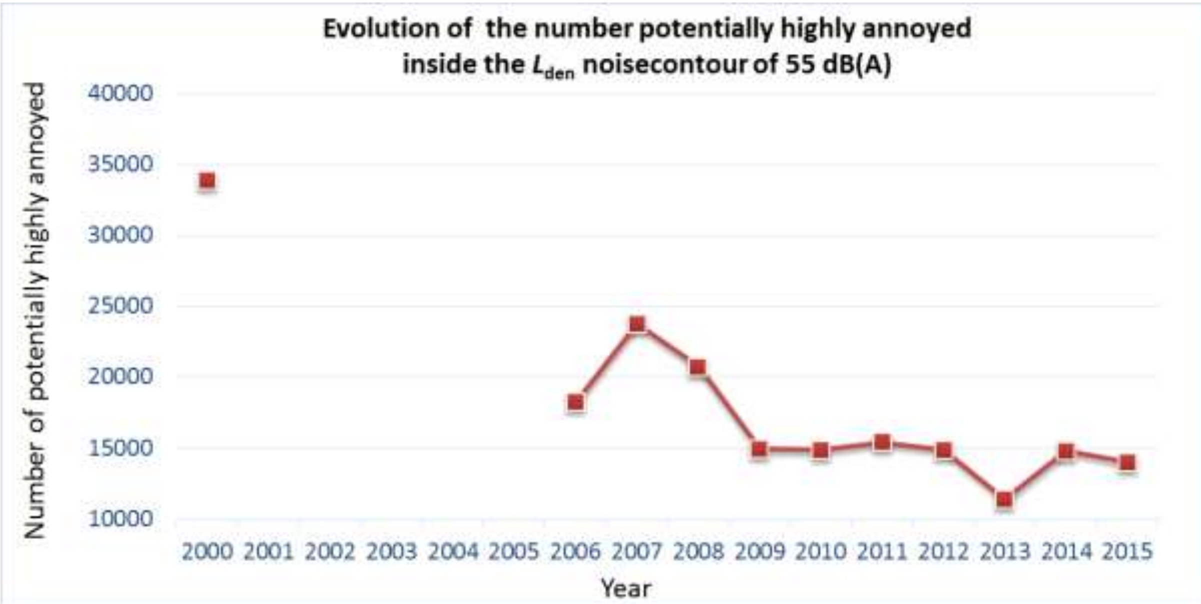
This decrease is in contrast with the increase of the number of movements between 2014 and 2015 by 3.4% (Section 4.1.1). This is mainly the result of the shift of standard flight routes away from the densely populated Brussels Capital Region and the larger portion of departures from runway 19 with a left curve in the south-easterly direction which are also above less populated zones. The location nor the total surface area of the L_{den} > 55dB(A) contour no longer increases proportionally with the number of flights. This is probably the result of a combination of the trend to deploy quieter aircraft and more refined departure and arrival procedures.

An overview is given by merged municipality in Table 8.

Table 8: Evolution of the number of people who are potentially highly annoyed inside the L_{den} 55 dB(A) noise contour.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
INM versie	7.0b						7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b	7.0b
Population data							1jan'03	1jan'06	1jan'07	1jan'07	1jan'08	1jan'08	1jan'10	1jan'10	1jan'10	1jan'11
Brussel	2,441						1,254	1,691	1,447	1,131	1,115	1,061	1,080	928	1,780	1,739
Evere	3,648						2,987	3,566	3,325	2,903	2,738	2,599	2,306	1,142	2,975	1,443
Grimbergen	3,111						479	1,305	638	202	132	193	120	0	175	428
Haacht	96						103	119	58	36	31	37	37	24	50	115
Herent	186						88	140	162	119	115	123	134	107	152	111
Huldenberg	112						0	0	0	0	0	0	0	0	0	0
Kampenhout	529						747	727	582	453	483	461	399	430	469	648
Kortenberg	664						548	621	604	512	526	497	422	603	443	366
Kraainem	1,453						934	1,373	1,277	673	669	667	500	589	111	368
Leuven	70							9	22	2	1	3	5	0	11	0
Machelen	3,433						2,411	2,724	2,635	2,439	2,392	2,470	2,573	2,278	2,505	2,598
Meise	506						0	0	0	0	0	0	0	0	0	0
Overijse	70						0	0	0	0	0	0	0	0	0	0
Rotselaar	9						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
Sint-L.-Woluwe	1,515						382	1,218	994	489	290	196	150	0	0	0
Sint-P.-Woluwe	642						411	798	607	396	477	270	82	390	0	79
Steenokkerzeel	1,769						1,530	1,584	1,471	1,327	1,351	1,360	1,409	1,455	1,439	1,675
Tervuren	1,550						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
Wemmel	142						0	0	0	0	0	0	0	0	0	0
Wezembeek-O.	1,818						739	878	670	359	425	408	399	457	172	282
Zaventem	5,478						3,490	3,558	3,628	2,411	2,152	2,544	2,716	2,618	1,884	2,638
ZEMST	0						0	0	0	0	0	0	0	0	0	0
Eindtotaal	**33,889**						**18,257**	**23,732**	**20,737**	**14,950**	**14,861**	**15,409**	**14,886**	**11,399**	**14,825**	**13,965**

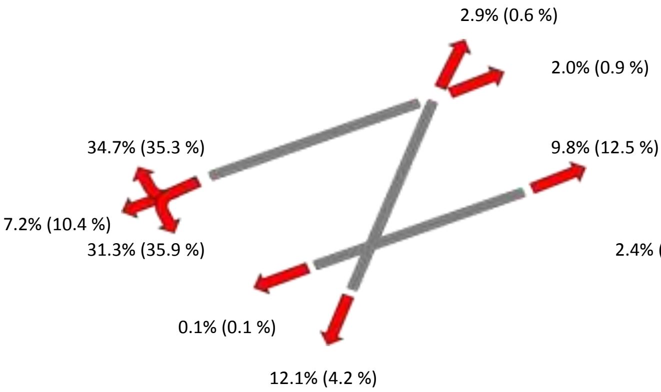
Figure 14: Evolution of the number of people who are potentially highly annoyed inside the L_{den} 55 dB(A) noise contour.

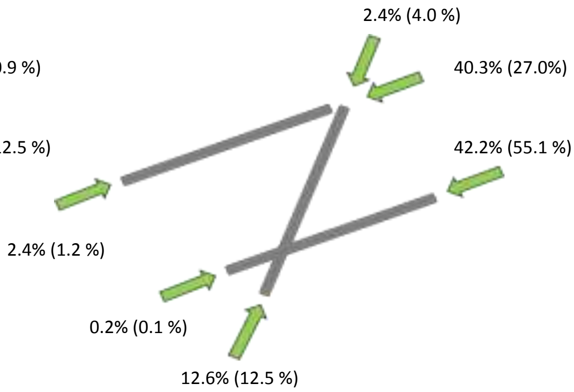


5 Appendices

5.1 Runway and route usage

Table 9: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year (all flights, day, evening and night). The figures between brackets are the data for 2014.

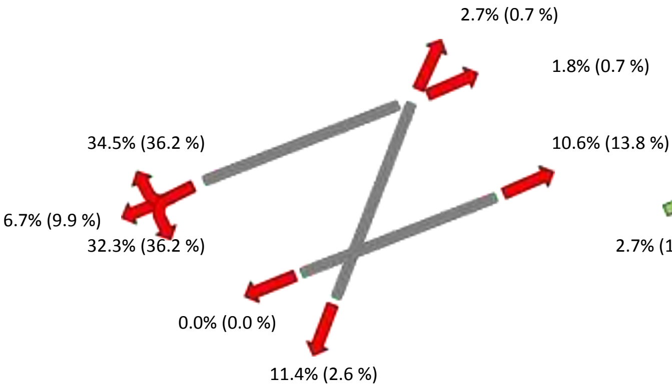


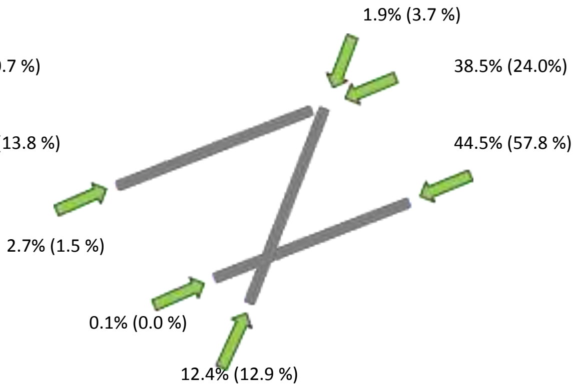


All flights (day, evening, night)				
Departures				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	734	3,430	0.6%	2.9%
07L	992	2,439	0.9%	2.0%
07R	14,226	11,724	12.5%	9.8%
19	4,713	14,447	4.2%	12.1%
25L	158	103	0.1%	0.1%
25R	92,647	87,529	81.6%	73.1%

All flights (day, evening, night)				
Landings				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	14,525	15,113	12.5%	12.6%
07L	1,380	2,814	1.2%	2.4%
07R	147	220	0.1%	0.2%
19	4,672	2,897	4.0%	2.4%
25L	63,814	50,454	55.1%	42.2%
25R	31,225	48,201	27.0%	40.3%

Table 10: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year: day. The figures between brackets are the data for 2014.

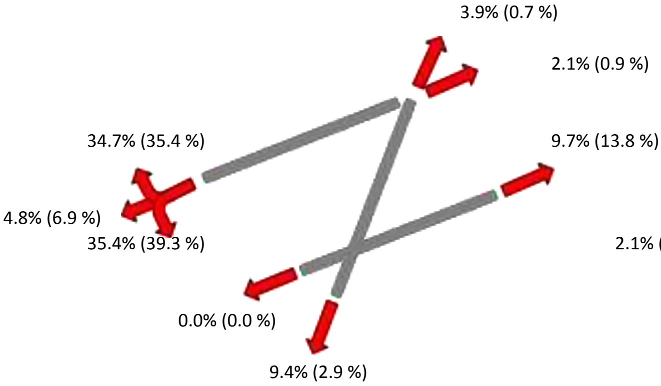


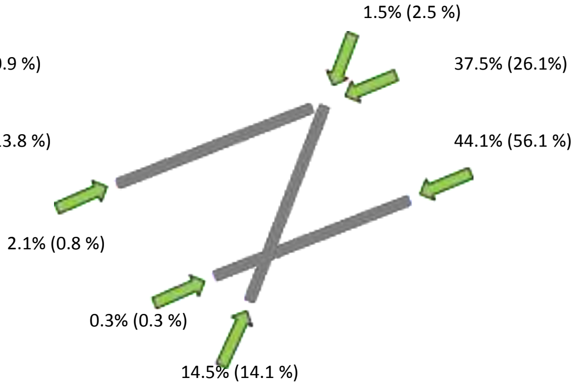


Flights day				
Departures				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	525	2,177	0.7%	2.7%
07L	499	1,440	0.7%	1.8%
07R	10,402	8,491	13.8%	10.6%
19	1,990	9,180	2.6%	11.4%
25L	8	23	0.0%	0.0%
25R	62,149	58,908	82.2%	73.4%

Flights day				
Landings				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	10,026	9,899	12.9%	12.4%
07L	1,180	2,168	1.5%	2.7%
07R	36	42	0.0%	0.1%
19	2,906	1,497	3.7%	1.9%
25L	44,997	35,598	57.8%	44.5%
25R	18,695	30,832	24.0%	38.5%

Table 11: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year: evening. The figures between brackets are the data for 2014.

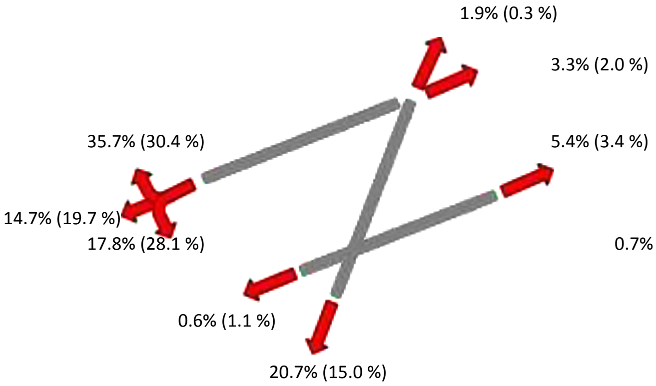


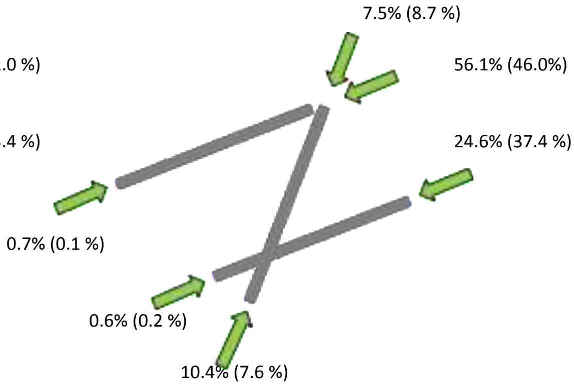


Flights evening				
Departures				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	168	996	0.7%	3.9%
07L	221	548	0.9%	2.1%
07R	3,368	2,490	13.8%	9.7%
19	708	2,420	2.9%	9.4%
25L	5	4	0.0%	0.0%
25R	19,994	19,223	81.7%	74.9%

Flights evening				
Landings				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	3,497	3,808	14.1%	14.5%
07L	193	549	0.8%	2.1%
07R	80	91	0.3%	0.3%
19	613	384	2.5%	1.5%
25L	13,882	11,540	56.1%	44.1%
25R	6,462	9,816	26.1%	37.5%

Table 12: Overview of the number of departures and arrivals annually per runway including changes vs. the previous year: night. The figures between brackets are the data for 2014.





Flights night				
Departures				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	41	257	0.3%	1.9%
07L	272	451	2.0%	3.3%
07R	456	743	3.4%	5.4%
19	2,015	2,847	15.0%	20.7%
25L	145	76	1.1%	0.6%
25R	10,504	9,398	78.2%	68.2%

Flights night				
Landings				
	Number		Percentage	
Runway	2014	2015	2014	2015
01	1,002	1,406	7.6%	10.4%
07L	7	97	0.1%	0.7%
07R	31	87	0.2%	0.6%
19	1,153	1,016	8.7%	7.5%
25L	4,934	3,316	37.4%	24.6%
25R	6,068	7,553	46.0%	56.1%

Table 13: Details of the number of flights per SID for runway 25R per period of the day and per month.

This illustrates the changes of the SIDs throughout the year.

Departures by SID from runway 25R by month, day, evening and night

		Day													Evening													Night													Total
Runway	Month	1	2	3	4	5	6	7	8	9	10	11	12	Sum	1	2	3	4	5	6	7	8	9	10	11	12	sum	1	2	3	4	5	6	7	8	9	10	11	12	sum	
RW25R	CIV1D				216	487	253	312	434	337	358	423	363	3183				51	111	52	43	90	73	66	101	78	665				69	135	139	185	164	119	185	161	143	1300	5148
	CIV1Y	421	314	329	4									1068	99	76	69	2									246	172	135	174	7									488	1802
	CIV3C	756	756	830	863	1016	247	258	1178	965	893	1032	1003	9797	212	188	224	194	234	73	51	253	203	196	239	212	2279	110	115	149	238	303	221	322	271	296	178	157	155	2515	14591
	DENUT5C	491	476	512	436	590	286	499	601	556	562	608	615	6232	191	169	188	132	188	106	144	182	153	171	208	175	2007	25	21	25	32	40	29	40	39	38	38	38	46	411	8650
	ELSIK2C	9	12	4	9	7	1	5	5	5	2	7	1	67	1							1		2	1	1	6					1	1			1				3	76
	HELEN4C					1								1																											1
	HELEN5C	447	390	408	324	378	173	307	372	316	352	443	434	4344	99	89	96	91	100	46	63	89	74	80	95	65	987	67	58	64	37	46	42	51	50	43	42	24	24	548	5879
	KOK3C	6	3	6	6	9	2	6	3	10	7	10	4	72	1	1	6	2	3	1	1		3	1	5	5	29		1	3				1		1		2		8	109
	LNO1Y	5	1	1										7	2	1	2										5	10		2										12	24
	LNO2D	1			2	1		1	6	3	1	6	5	26							1		2	2		1	6														32
	LNO3C	158	143	155	7									463	38	35	43	5									121	4	3	1										8	592
	LNO4C				163	194	52	68	150	165	167	216	226	1401				26	61	18	16	47	56	49	68	60	401				1	2			1	4	4	2		14	1816
	LNO4Q																															1								1	1
	LNO4Z																	8	11	6	10	22	10	6		1	74					1	1	1	1					4	78
	NAN	84	78	109	109	126	120	112	146	104	77	113	113	1291	21	20	25	20	22	25	22	10	35	26	24	33	283	5	4	8	8	9	10	7	13	13	7	7	10	101	1675
	NIK2C	561	563	632	502	610	228	348	540	517	612	745	680	6538	318	278	333	299	371	166	219	307	305	339	436	423	3794	55	60	64	36	47	46	32	35	52	55	61	56	599	10931
	NIK3L																				1						1														1
	PITES1Y	8	7	4										19	11	12	6										29		1	1										2	50
	PITES3D	2	4	1				1						8	3	2	2									1	8														16
	PITES4Z																	1	1	4	1	5	1				13			1		1			1		1	2		6	19
	PITES5C	110	100	76	2									288	87	68	71	2									228	18	10	24	1									53	569
	PITES6C				140	264	63	76	281	155	97	59	51	1186				86	115	38	27	134	63	40	42	34	579				30	78	2	2	128	85	43	17	8	393	2158
	ROUSY1Y	14	4	9										27	5	8	7	2									22	4	7	3	1									15	64
	ROUSY3D	41	16	18	3	5	1	5	4	5	7	7	8	120	1	1	1	1	1	1		4	2	1	4	3	20									1				1	141
	ROUSY4Z																	1	3	4	2	2	1			1	14				2	4	1		22	4	1	6		40	54
	ROUSY5C	555	504	532	14									1605	178	171	196	10									555	52	71	89	3									215	2375
	ROUSY6C				414	600	132	151	598	527	623	649	632	4326				176	254	82	32	214	201	200	232	233	1624				71	75	4	1	106	102	86	74	76	595	6545
	SOPOK1Y	72	59	42										173	50	39	39	2									130	31	19	18	4									72	375
	SOPOK3D	108	106	152	25	24	11	19	25	26	21	32	31	580	5	6	11	18	18	14	15	19	18	19	16	18	177				2	3	2	2						9	766
	SOPOK5Z																1	4	7	9	13	15	7	10	19	14	99			1	9	24	13	11	82	9	12	25	10	196	295
	SOPOK6C	930	908	1108	56									3002	393	344	386	22									1145	48	54	58	3									163	4310
	SOPOK7C				992	1271	242	288	1356	1324	1253	1502	1410	9638				316	435	116	55	367	427	421	523	433	3093				94	140	5	2	209	174	129	67	53	873	13604
	SPI1Y	5		3										8	3		4	1									8	3	1		1									5	21
	SPI2D	2	3	4	2	1		3	4		2	2		23			1					1					2														25
	SPI3C	339	320	344	16									1019	147	125	145	4									421	2		3	1									6	1446
	SPI4C				264	383	61	32	296	329	345	341	345	2396				98	128	27	12	100	103	97	131	105	801				18	19	1			19	20	2	2	81	3278
	SPI4L																		1								1														1
	SPI4Q																															1								1	1
	SPI5Z																	1		1		2					4					1		1	2	1	1			6	10
25R Total		5125	4767	5279	4569	5967	1872	2491	5999	5344	5379	6195	5921	58908	1865	1633	1856	1575	2064	789	728	1864	1737	1726	2144	1896	19877	606	560	688	668	931	517	658	1124	962	802	645	583	8744	87529

5.2 Location of the measuring stations

Figure 15: Location of the measuring stations.

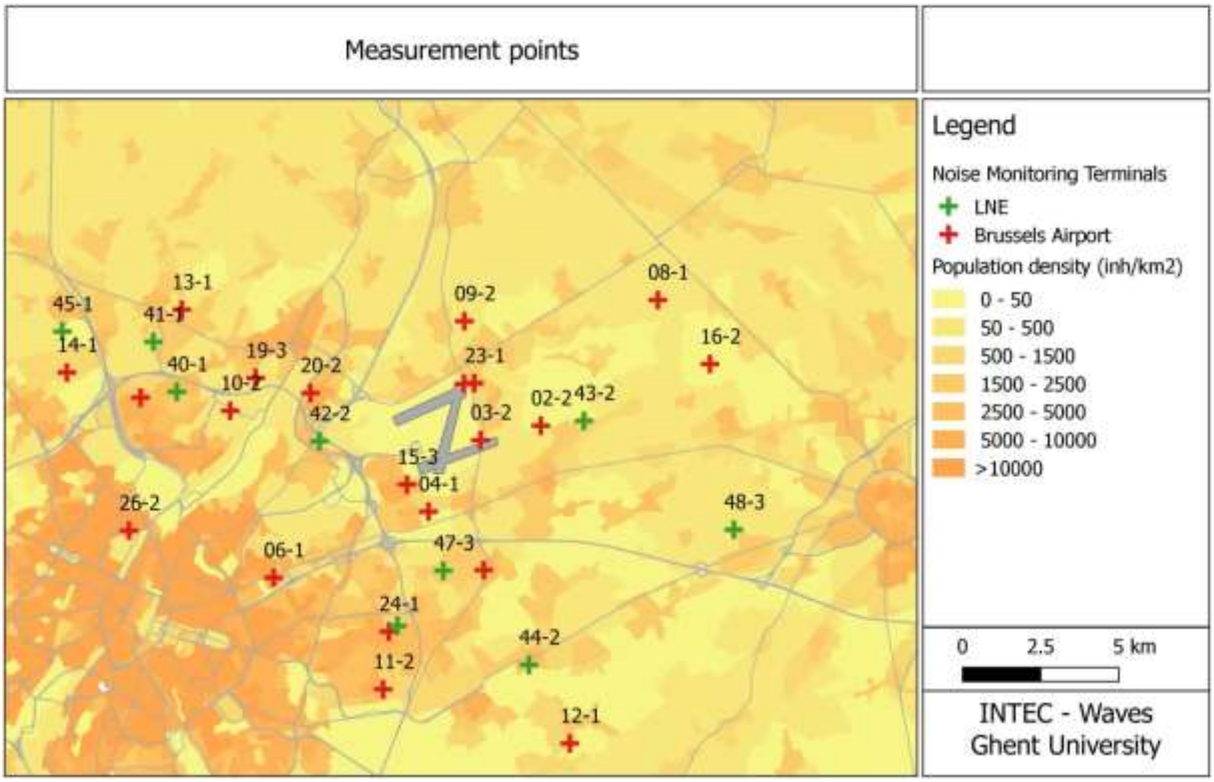


Table 14: Overview of the measuring points.

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
NMT10-1	NEDER-OVER-HEEMBEEK
NMT11-2	SINT-PIETERS-WOLUWE
NMT12-1	DUISBURG
NMT13-1	GRIMBERGEN
NMT14-1	WEMMEL
NMT15-3	ZAVENTEM
NMT16-2	VELTEM
NMT19-3	VILVOORDE

Code	Name
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

5.3 Technical information – inputting routes in INM

The radar tracks are divided into bundles of similar departure routes (SIDs). The grouping of the SIDs is documented per runway in the tables below. A distinction is made for the different aircraft types (7 categories) for the frequently-used grouped SIDS. Statistical tracks are calculated for each of these bundles (in addition to the functionality of INM).

The methodology has changed for the 2015 calculations for introducing radar tracks and the distribution of radar tracks. The new methodology (statistical radar tracks) calculates the distribution of bundles by means of an external GIS calculation outside INM. This method automates the built-in manual method available in INM and takes into account any asymmetry of the bundles. The number of bundles can be increased through the automation and this means that minor changes to the shift of arrival and departure routes can be included in the calculations. The method has been tested by comparing three scenarios: the actual radar tracks, the statistical radar tracks and the INM method. The actual radar tracks with individual information about the aircraft and the statistical tracks with the statistical distribution of the aircraft types are very similar (significantly less than 1 dB(A)) for all contours above 55 dB(A). Slightly greater discrepancies occur under 50 dB(A) but they are still less than 1 dB(A).

Table 15: overview of the grouping of SIDs.

01	
01DN7F	DENUT7F
	HELEN7F
	KOK2F
01NKF	NIK4F
01SK5F	CIV8F
	ELSIK2F
	PITES5F
	ROUSY5F
	SOPOK5F
01SP5F	HELEN1J
	LNO5F
	NAN
	SPI5F

07L	
07LCVH	CIV6H
07LCVP	CIV1P
	KOK1H
07LDNH	DENUT4H
	HELEN4H
07LNAN	HELEN1J
	NAN
07LNKH	ELSIK1H
	NIK1H
07LSKH	LNO4H
	PITES5H
	ROUSY5H
	SOPOK4H
	SPI5H

25L	
25LCVC	CIV3C
25LCVQ	CIV1Q
	CIV1W
	LNO1W
	SOPOK1W
25LDNC	DENUT5C
25LHLC	HELEN5C
25LLNQ	LNO4Q
25LNAN	LNO5L
	NAN
25LNKC	NIK2C
25LSKC	PITES6C
	ROUSY6C
	SOPOK7C
25LSKD	SOPOK3D
25LSKQ	SOPOK2Q

25R (part2)	
25PSKZ	LNO4Z
	PITES4Z
	ROUSY4Z
	SOPOK3D
	SOPOK5Z
	SPI4Q
	SPI5Z
25RCVD	CIV1D
	CIV1Y
25RCVQ	CIV3C
25RDNC	DENUT5C
25RHLC	HELEN4C
	HELEN5C
25RKOC	KOK3C
25RLSC	ELSIK2C
25RNAN	NAN
25RNKC	NIK2C
	NIK3L
25RSK6	PITES5C
	ROUSY5C
	SOPOK6C
25RSK7	PITES6C
	ROUSY6C
	SOPOK7C
25RSKD	LNO2D
	PITES3D
	ROUSY3D
	SOPOK3D
	SPI2D
25RSKY	LNO1Y
	PITES1Y
	ROUSY1Y
	SOPOK1Y
	SPI1Y
25RSPC	LNO3C
	LNO4C
	SPI3C
	SPI4C
	SPI4L

19	
19CV1L	CIV1L
19DNL	DENUT6L
	HELEN5L
19DNN	DENUT5N
	HELEN4N
19NAN	NAN
	NIK2C
19NIKL	NIK3L
19NIKN	KOK6L
	NIK3N
19SK5L	PITES6L
	ROUSY6L
	SOPOK5L
19SP4L	ELSIK2L
	LNO5L
	SPI4L

07R	
07RCVJ	CIV6J
07RCVU	CIV1U
	KOK1J
07RDNJ	DENUT1J
	HELEN1J
	NAN
	NIK1J
	ROUSY3C
07RSKJ	ELSIK1J
	LNO4J
	PITES5J
	ROUSY5J
	SOPOK4J
	SPI4J

25R (part1)	
25PCVC	CIV3C
25PCVD	CIV1D
	CIV1Y
	LNO1Y
	LNO4Q
	PITES1Y
	ROUSY1Y
	SOPOK1Y
	SPI1Y
25PDNC	DENUT5C
25PHLC	HELEN5C
25PNAN	NAN
25PNKC	NIK2C

5.4 Results of contour calculations – 2015

5.4.1 Surface area per contour zone and per municipality

Table 16: Surface area per L_{day} contour zone and municipality – 2015.

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	666	126	0	-	-	792
Evere	61	-	-	-	-	61
Herent	162	-	-	-	-	162
Kampenhout	432	102	4	-	-	538
Kortenberg	392	158	30	1	-	580
Kraainem	49	-	-	-	-	49
Machelen	321	279	193	55	11	858
Steenokkerzeel	473	317	202	128	82	1,203
Vilvoorde	64	-	-	-	-	64
Wezembeek-O.	34	-	-	-	-	34
Zaventem	489	199	59	46	-	793
Total	**3,143**	**1,180**	**489**	**230**	**93**	**5,135**

Table 17: Surface area per $L_{evening}$ contour zone and municipality – 2015.

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	470	701	163	3	-	-	1,336
Evere	412	29	-	-	-	-	440
Grimbergen	789	-	-	-	-	-	789
Haacht	567	-	-	-	-	-	567
Herent	605	79	-	-	-	-	684
Kampenhout	1,187	411	96	3	-	-	1,697
Kortenberg	426	340	112	19	-	-	898
Kraainem	403	44	-	-	-	-	447
Machelen	233	324	265	181	52	13	1,068
Meise	12	-	-	-	-	-	12
Rotselaar	0	-	-	-	-	-	0
Schaarbeek	109	-	-	-	-	-	109
Sint-Lambrechts-Woluwe	273	-	-	-	-	-	273
Sint-P.-Woluwe	176	-	-	-	-	-	176
Steenokkerzeel	478	488	310	195	114	75	1,661
Tervuren	31	-	-	-	-	-	31
Vilvoorde	492	185	-	-	-	-	677
Wemmel	40	-	-	-	-	-	40
Wezembeek-O.	166	26	-	-	-	-	192
Zaventem	1,375	424	161	49	39	-	2,049
Total	**8,244**	**3,051**	**1,108**	**450**	**205**	**89**	**13,147**

Table 18: Surface area per L_{night} contour zone and municipality – 2015.

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	4	-	-	-	-	-	4
Brussel	883	509	33	-	-	-	1,426
Evere	296	-	-	-	-	-	296
Grimbergen	570	-	-	-	-	-	570
Haacht	728	72	-	-	-	-	799
Herent	634	78	-	-	-	-	712
Kampenhout	1,015	507	172	24	-	-	1,717
Kortenberg	467	310	89	15	-	-	881
Kraainem	188	31	-	-	-	-	219
Machelen	277	352	304	135	30	8	1,107
Rotselaar	159	-	-	-	-	-	159
Schaarbeek	61	-	-	-	-	-	61
Sint-Lambrechts-Woluwe	1	-	-	-	-	-	1
Sint-P.-Woluwe	113	-	-	-	-	-	113
Steenokkerzeel	493	508	315	212	134	96	1,758
Tervuren	357	-	-	-	-	-	357
Vilvoorde	625	34	-	-	-	-	659
Wezembeek-O.	283	11	-	-	-	-	294
Zaventem	1,260	606	259	76	29	13	2,244
Zemst	36	-	-	-	-	-	36
Total	**8,451**	**3,019**	**1,172**	**460**	**194**	**117**	**13,413**

Table 19: Surface area per L_{den} contour zone and municipality – 2015.

Area (ha)	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	716	360	23	-	-	1,098
Evere	231	-	-	-	-	231
Grimbergen	122	-	-	-	-	122
Haacht	423	-	-	-	-	423
Herent	407	3	-	-	-	410
Kampenhout	753	328	73	1	-	1,154
Kortenberg	403	270	62	8	-	742
Kraainem	160	5	-	-	-	165
Machelen	295	326	258	110	27	1,016
Schaarbeek	27	-	-	-	-	27
Sint-P.-Woluwe	31	-	-	-	-	31
Steenokkerzeel	555	426	270	171	166	1,587
Vilvoorde	504	13	-	-	-	517
Wezembeek-O.	123	1	-	-	-	124
Zaventem	947	427	140	43	31	1,588
Total	**5,695**	**2,159**	**825**	**332**	**224**	**9,236**

Table 20: Surface area per Freq.70,day contour zone and municipality – 2015.

Area (ha)	Freq.70,day contour zone (07:00-23:00)					
Municipality	**5-10**	**10-20**	**20-50**	**50-100**	**>100**	**Total**
Brussel	466	365	413	377	105	1,725
Evere	25	284	203	-	-	512
Grimbergen	509	515	84	-	-	1,109
Haacht	133	170	140	-	-	443
Herent	261	127	193	112	-	693
Kampenhout	564	447	383	303	159	1,857
Kortenberg	212	154	231	206	300	1,103
Kraainem	185	272	161	-	-	617
Machelen	916	72	140	185	556	1,870
Meise	198	-	-	-	-	198
Merchtem	2	-	-	-	-	2
Oudergem	60	-	-	-	-	60
Schaarbeek	249	26	-	-	-	275
Sint-Jans-Molenbeek	83	-	-	-	-	83
Sint-Lambrechts-Woluwe	289	318	7	-	-	614
Sint-P.-Woluwe	114	93	53	-	-	260
Steenokkerzeel	168	263	249	294	650	1,624
Tervuren	373	47	-	-	-	420
Vilvoorde	106	153	391	23	-	672
WATERMAAL-BOSVOORDE	9	-	-	-	-	9
Wemmel	179	-	-	-	-	179
Wezembeek-O.	95	81	101	-	-	277
Zaventem	1,455	1,042	695	403	117	3,712
Total	**6,650**	**4,431**	**3,442**	**1,903**	**1,887**	**18,314**

Table 21: Surface area per Freq.70,night contour zone and municipality – 2015.

Area (ha)	Freq.70,night contour zone (23:00-07:00)				
Municipality	**1-5**	**5-10**	**10-20**	**>20**	**Total**
Boortmeerbeek	198	-	-	-	198
Brussel	859	501	242	17	1,618
Evere	466	26	-	-	491
Grimbergen	697	-	-	-	697
Haacht	364	116	22	-	502
Herent	353	225	1	-	579
Kampenhout	799	260	426	107	1,592
Kortenberg	357	383	131	-	870
Kraainem	241	3	-	-	244
Machelen	189	134	256	421	1,000
Mechelen	1	-	-	-	1
Oudergem	15	-	-	-	15
Schaarbeek	82	-	-	-	82
Sint-Jans-Molenbeek	13	-	-	-	13
Sint-Lambrechts-Woluwe	161	-	-	-	161
Sint-P.-Woluwe	168	-	-	-	168
Steenokkerzeel	553	243	369	511	1,675
Tervuren	693	-	-	-	693
Vilvoorde	438	228	11	-	677
Wemmel	0	-	-	-	0
Wezembeek-O.	288	21	-	-	309
Zaventem	906	790	418	78	2,192
Zemst	105	-	-	-	105
Total	**7,949**	**2,928**	**1,876**	**1,133**	**13,885**

Table 22: Surface area per Freq.60,day contour zone and municipality – 2015.

Area (ha)	Freq.60,day contour zone (day 07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	389	443	244	93	1,168
Evere	419	93	-	-	512
Grimbergen	1,014	-	-	-	1,014
Haacht	606	352	-	-	958
Herent	521	506	176	-	1,203
Kampenhout	597	963	6	-	1,566
Kortenberg	317	256	520	-	1,093
Kraainem	443	115	-	-	558
Machelen	112	134	241	621	1,108
Meise	5	-	-	-	5
Rotselaar	565	4	-	-	569
Schaarbeek	59	-	-	-	59
Sint-Lambrechts-Woluwe	550	-	-	-	550
Sint-P.-Woluwe	328	12	-	-	340
Steenokkerzeel	239	197	324	859	1,619
Tervuren	693	-	-	-	693
Vilvoorde	589	61	-	-	650
Wemmel	39	-	-	-	39
Wezembeek-O.	555	98	-	-	653
Zaventem	1,171	276	123	276	1,847
Total	**9,211**	**3,511**	**1,633**	**1,848**	**16,203**

Table 23: Surface area per Freq.60,night contour zone and municipality – 2015.

Area (ha)	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	390	478	362	-	1,231
Evere	165	3	-	-	168
Grimbergen	571	-	-	-	571
Haacht	372	362	222	-	955
Herent	651	27	47	-	726
Kampenhout	346	217	902	-	1,465
Kortenberg	750	52	5	-	808
Kraainem	138	-	-	-	138
Machelen	91	109	836	87	1,123
Rotselaar	462	129	-	-	590
Steenokkerzeel	144	185	468	904	1,701
Tervuren	230	-	-	-	230
Vilvoorde	584	50	4	-	637
Wezembeek-O.	331	-	-	-	331
Zaventem	594	174	218	303	1,290
Total	**5,819**	**1,786**	**3,064**	**1,295**	**11,964**

5.4.2 Number of inhabitants per contour zone and per municipality

Table 24: Number of inhabitants per L_{day} contour zone and municipality – 2015.

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	2,601	2,447	2	-	-	5,050
Evere	2,443	-	-	-	-	2,443
Herent	300	-	-	-	-	300
Kampenhout	1,462	353	34	-	-	1,849
Kortenberg	1,319	269	12	0	-	1,601
Kraainem	172	-	-	-	-	172
Machelen	4,226	3,539	2,017	16	-	9,798
Steenokkerzeel	4,655	1,486	258	83	-	6,483
Vilvoorde	229	-	-	-	-	229
Wezembeek-O.	647	-	-	-	-	647
Zaventem	5,609	850	26	-	-	6,485
Total	**23,662**	**8,945**	**2,350**	**99**	**-**	**35,056**

Table 25: Number of inhabitants per $L_{evening}$ contour zone and municipality – 2015.

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	14,281	3,170	3,289	12	-	-	20,753
Evere	30,291	1,009	-	-	-	-	31,300
Grimbergen	15,886	-	-	-	-	-	15,886
Haacht	1,502	-	-	-	-	-	1,502
Herent	1,463	30	-	-	-	-	1,493
Kampenhout	3,910	1,644	367	24	-	-	5,945
Kortenberg	2,263	1,014	123	8	-	-	3,407
Kraainem	11,928	139	-	-	-	-	12,067
Machelen	3,198	4,162	3,223	2,089	20	-	12,693
Meise	156	-	-	-	-	-	156
Rotselaar	0	-	-	-	-	-	0
Schaarbeek	20,491	-	-	-	-	-	20,491
Sint-Lambrechts-Woluwe	13,490	-	-	-	-	-	13,490
Sint-P.-Woluwe	7,270	-	-	-	-	-	7,270
Steenokkerzeel	3,006	4,730	1,374	278	68	-	9,456
Tervuren	1	-	-	-	-	-	1
Vilvoorde	13,347	1,986	-	-	-	-	15,334
Wemmel	347	-	-	-	-	-	347
Wezembeek-O.	3,696	450	-	-	-	-	4,146
Zaventem	22,022	4,259	414	12	-	-	26,707
Total	**168,549**	**22,593**	**8,790**	**2,424**	**88**	**-**	**202,444**

Table 26: Number of inhabitants per L_{night} contour zone and municipality – 2015.

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**
Boortmeerbeek	1	-	-	-	-	-	1
Brussel	21,183	4,338	202	-	-	-	25,723
Evere	18,115	-	-	-	-	-	18,115
Grimbergen	15,416	-	-	-	-	-	15,416
Haacht	2,573	71	-	-	-	-	2,644
Herent	1,586	31	-	-	-	-	1,617
Kampenhout	3,571	1,662	583	140	-	-	5,956
Kortenberg	2,123	862	76	6	-	-	3,067
Kraainem	4,474	81	-	-	-	-	4,555
Machelen	3,307	5,125	4,649	229	0	-	13,310
Rotselaar	237	-	-	-	-	-	237
Schaarbeek	11,126	-	-	-	-	-	11,126
Sint-Lambrechts-Woluwe	6	-	-	-	-	-	6
Sint-P.-Woluwe	3,630	-	-	-	-	-	3,630
Steenokkerzeel	2,671	4,704	1,798	355	159	2	9,689
Tervuren	3,133	-	-	-	-	-	3,133
Vilvoorde	13,744	87	-	-	-	-	13,832
Wezembeek-O.	5,664	154	-	-	-	-	5,818
Zaventem	12,799	9,840	929	33	-	-	23,601
Zemst	48	-	-	-	-	-	48
Total	**125,407**	**26,956**	**8,239**	**762**	**159**	**2**	**161,524**

Table 27: Number of inhabitants per L_{den} contour zone and municipality – 2015.

Number of Inhabitants	L_{den} contour zone in dB(A)					
Municipality	**55-60**	**60-65**	**65-70**	**70-75**	**>75**	**Total**
Brussel	7,180	4,058	164	-	-	11,402
Evere	12,818	-	-	-	-	12,818
Grimbergen	4,166	-	-	-	-	4,166
Haacht	1,051	-	-	-	-	1,051
Herent	920	1	-	-	-	922
Kampenhout	2,656	1,108	299	6	-	4,068
Kortenberg	1,844	638	26	3	-	2,512
Kraainem	3,201	12	-	-	-	3,213
Machelen	3,793	4,441	3,684	180	-	12,097
Schaarbeek	3,439	-	-	-	-	3,439
Sint-P.-Woluwe	766	-	-	-	-	766
Steenokkerzeel	4,174	3,645	871	238	55	8,983
Vilvoorde	9,634	33	-	-	-	9,667
Wezembeek-O.	2,288	19	-	-	-	2,307
Zaventem	14,697	3,766	201	0	-	18,664
Total	**72,628**	**17,721**	**5,244**	**428**	**55**	**96,075**

Table 28: Number of inhabitants per Freq.70,day contour zone and municipality – 2015.

Number of Inhabitants	Freq.70,day contour zone (07:00-23:00)					
Municipality	5-10	10-20	20-50	50-100	>100	Total
Brussel	41,078	7,145	995	2,460	1,951	53,629
Evere	2,823	24,899	9,652	-	-	37,374
Grimbergen	7,146	11,782	2,316	-	-	21,244
Haacht	507	408	198	-	-	1,113
Herent	397	216	625	94	-	1,332
Kampenhout	1,811	1,650	1,224	1,011	530	6,226
Kortenberg	1,123	1,161	1,263	918	574	5,039
Kraainem	3,821	8,392	3,134	-	-	15,346
Machelen	10,615	1,277	1,805	2,644	5,620	21,961
Meise	1,116	-	-	-	-	1,116
Merchtem	1	-	-	-	-	1
Oudergem	8	-	-	-	-	8
Schaarbeek	33,655	2,626	-	-	-	36,281
Sint-Jans-Molenbeek	19,634	-	-	-	-	19,634
Sint-Lambrechts-Woluwe	21,474	18,269	39	-	-	39,782
Sint-P.-Woluwe	5,795	3,599	1,831	-	-	11,226
Steenokkerzeel	641	2,060	2,550	1,772	1,804	8,828
Tervuren	2,772	5	-	-	-	2,777
Vilvoorde	3,842	3,909	7,366	58	-	15,174
WATERMAAL-BOSVOORDE	0	-	-	-	-	0
Wemmel	1,461	-	-	-	-	1,461
Wezembeek-O.	2,212	1,296	2,087	-	-	5,595
Zaventem	1,174	15,870	8,759	2,589	725	29,117
Total	**163,105**	**104,564**	**43,843**	**11,547**	**11,204**	**334,264**

Table 29: Number of inhabitants per Freq.70,night contour zone and municipality – 2015.

Number of Inhabitants	Freq.70,night contour zone (23:00-07:00)				
Municipality	1-5	5-10	10-20	>20	Total
Boortmeerbeek	1,605	-	-	-	1,605
Brussel	33,100	1,247	3,682	82	38,111
Evere	34,392	572	-	-	34,964
Grimbergen	16,246	-	-	-	16,246
Haacht	1,215	162	21	-	1,399
Herent	760	574	0	-	1,334
Kampenhout	2,662	1,019	1,424	375	5,479
Kortenberg	2,129	1,331	244	-	3,703
Kraainem	5,433	6	-	-	5,439
Machelen	2,430	2,077	3,536	3,852	11,895
Mechelen	20	-	-	-	20
Oudergem	2	-	-	-	2
Schaarbeek	14,964	-	-	-	14,964
Sint-Jans-Molenbeek	2,195	-	-	-	2,195
Sint-Lambrechts-Woluwe	8,331	-	-	-	8,331
Sint-P.-Woluwe	5,945	-	-	-	5,945
Steenokkerzeel	3,495	2,037	1,818	1,696	9,046
Tervuren	4,839	-	-	-	4,839
Vilvoorde	11,721	3,675	28	-	15,424
Wemmel	1	-	-	-	1
Wezembeek-O.	5,798	264	-	-	6,063
Zaventem	10,502	9,971	2,927	395	23,795
Zemst	140	-	-	-	140
Total	**167,925**	**22,934**	**13,681**	**6,400**	**210,939**

Table 30: Number of inhabitants per Freq.60,day contour zone and municipality – 2015.

Number of Inhabitants	Freq.60,day contour zone (07:00-23:00)				
Municipality	**50-100**	**100-150**	**150-200**	**>200**	**Total**
Brussel	17,730	1,112	2,367	1,735	22,944
Evere	32,931	4,443	-	-	37,374
Grimbergen	18,441	-	-	-	18,441
Haacht	2,603	659	-	-	3,262
Herent	1,690	1,172	356	-	3,218
Kampenhout	2,499	3,065	2	-	5,566
Kortenberg	1,383	1,195	1,678	-	4,256
Kraainem	10,231	3,124	-	-	13,356
Machelen	1,515	1,550	3,634	6,651	13,350
Meise	85	-	-	-	85
Rotselaar	2,251	18	-	-	2,269
Schaarbeek	6,367	-	-	-	6,367
Sint-Lambrechts-Woluwe	30,520	-	-	-	30,520
Sint-P.-Woluwe	13,416	838	-	-	14,254
Steenokkerzeel	1,785	1,124	2,083	4,480	9,473
Tervuren	8,514	-	-	-	8,514
Vilvoorde	13,759	159	-	-	13,918
Wemmel	242	-	-	-	242
Wezembeek-O.	10,866	2,424	-	-	13,290
Zaventem	14,434	2,927	1,985	3,730	23,076
Total	**191,263**	**23,810**	**12,105**	**16,596**	**243,774**

Table 31: Number of inhabitants per Freq.60,night contour zone and municipality – 2015.

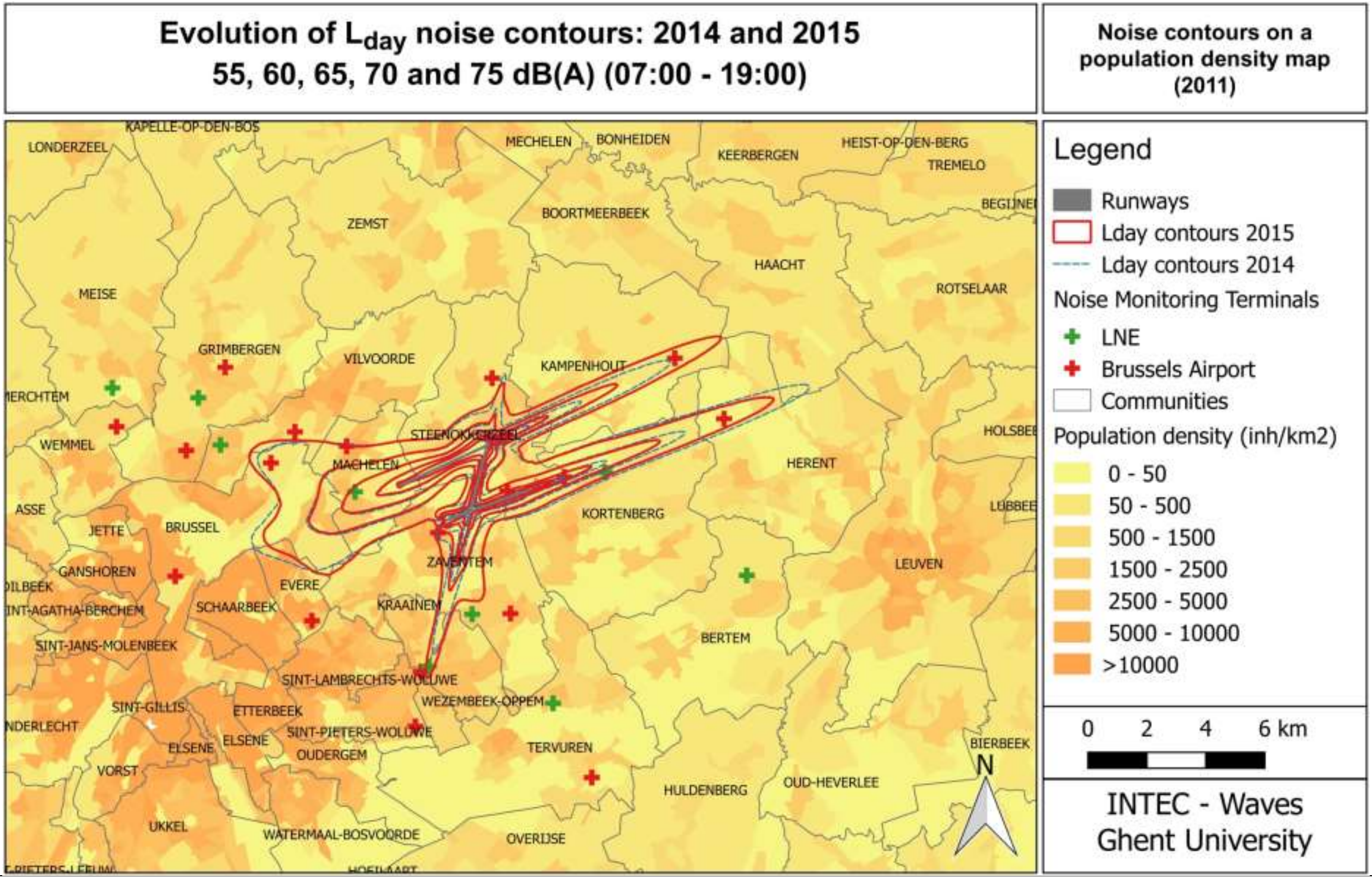
Number of Inhabitants	Freq.60,night contour zone (23:00-07:00)				
Municipality	**10-15**	**15-20**	**20-30**	**>30**	**Total**
Brussel	21,309	4,977	4,007	-	30,294
Evere	12,070	120	-	-	12,190
Grimbergen	13,677	-	-	-	13,677
Haacht	1,053	1,691	459	-	3,202
Herent	1,579	35	26	-	1,640
Kampenhout	1,359	1,041	3,186	-	5,587
Kortenberg	2,615	31	2	-	2,648
Kraainem	1,735	-	-	-	1,735
Machelen	1,058	1,241	11,047	88	13,435
Rotselaar	2,316	166	-	-	2,481
Steenokkerzeel	1,012	1,030	2,023	5,902	9,967
Tervuren	962	-	-	-	962
Vilvoorde	12,244	128	9	-	12,381
Wezembeek-O.	6,553	-	-	-	6,553
Zaventem	4,887	1,993	3,743	4,361	14,984
Total	**84,429**	**12,453**	**24,502**	**10,351**	**131,736**

5.5 Noise contour maps: evolution for 2014-2015

This appendix includes noise maps in A4 format.

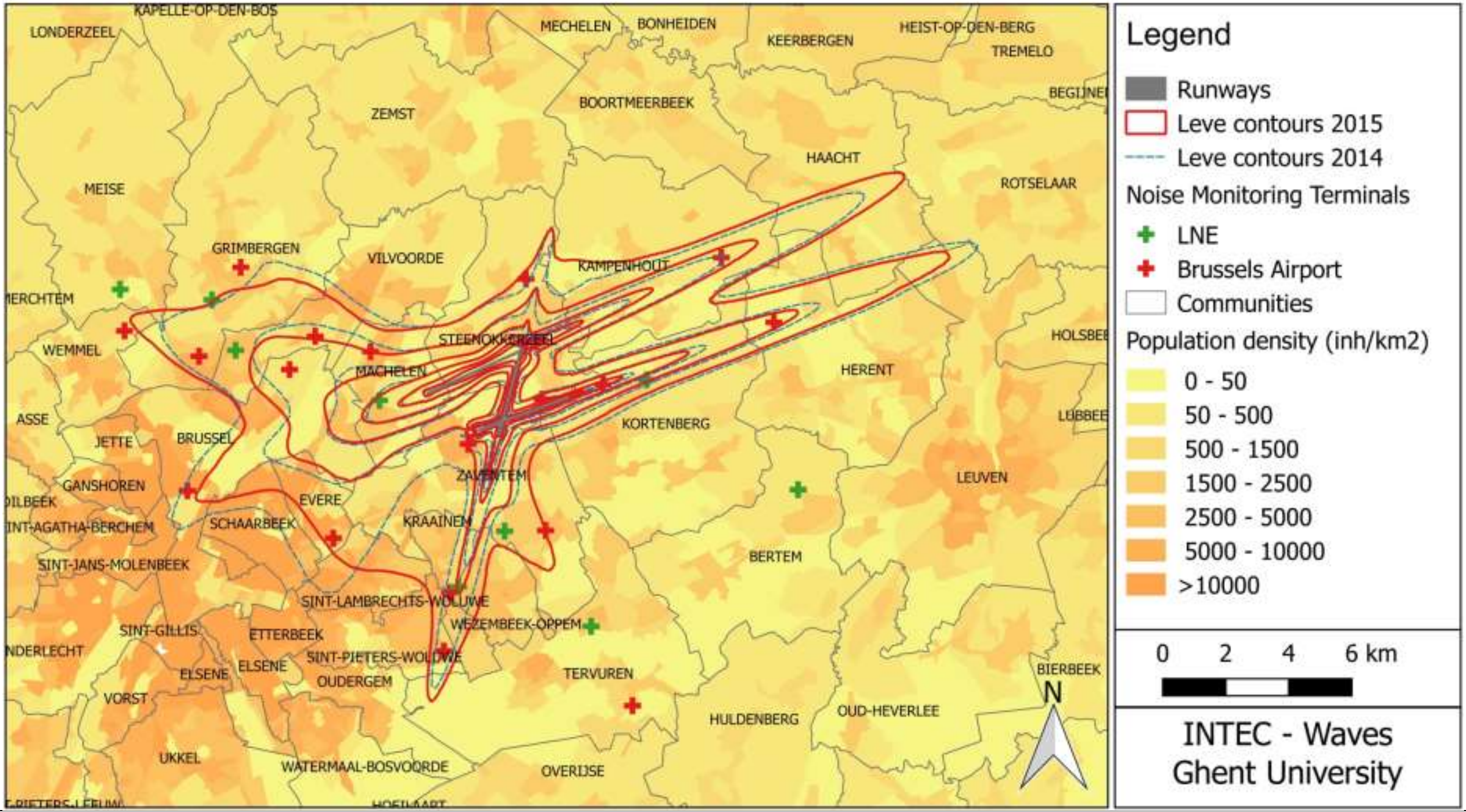
- L_{day} noise contours for 2014 and 2015, background population map – 2011
- $L_{evening}$ noise contours for 2014 and 2015, background population map – 2011
- L_{night} noise contours for 2014 and 2015, background population map – 2011
- L_{den} noise contours for 2014 and 2015, background population map – 2011
- Freq.70,day noise contours for 2014 and 2015, background population map – 2011
- Freq.70,night noise contours for 2014 and 2015, background population map – 2011
- Freq.60,day noise contours for 2014 and 2015, background population map – 2011
- Freq.60,night noise contours for 2014 and 2015, background population map – 2011

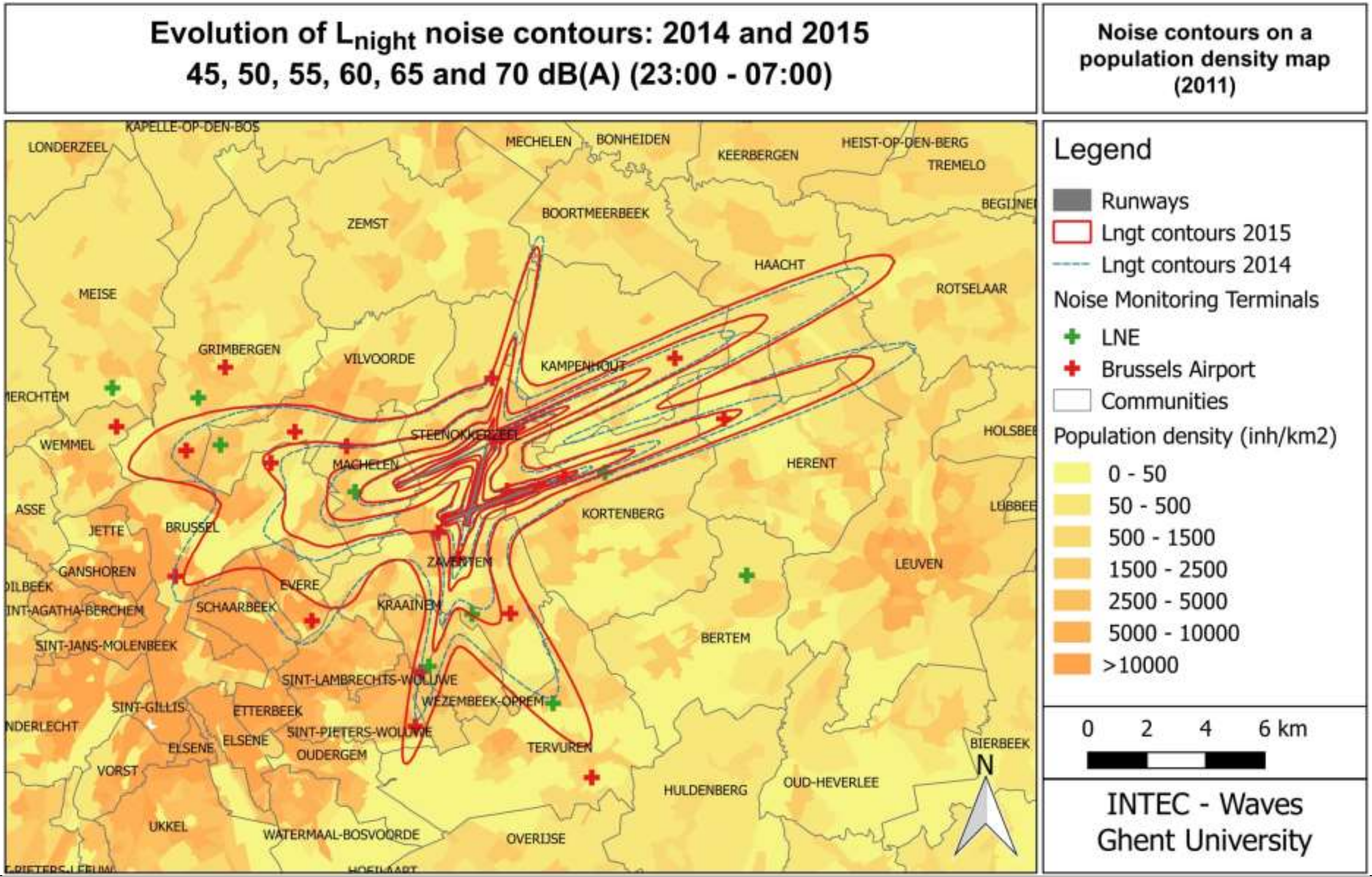
- L_{day} noise contours for 2014 and 2015, background NGI topographical map
- $L_{evening}$ noise contours for 2014 and 2015, background NGI topographical map
- L_{night} noise contours for 2014 and 2015, background NGI topographical map
- L_{den} noise contours for 2014 and 2015, background NGI topographical map
- Freq.70,day noise contours for 2014 and 2015, background NGI topographical map
- Freq.70,night noise contours for 2014 and 2015, background NGI topographical map
- Freq.60,day noise contours for 2014 and 2015, background NGI topographical map
- Freq.60,night noise contours for 2014 and 2015, background NGI topographical map


Evolution of L_{day} noise contours: 2014 and 2015
55, 60, 65, 70 and 75 dB(A) (07:00 - 19:00)
Noise contours on a population density map (2011)
Legend
Runways
Lday contours 2015
Lday contours 2014
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
ZAVENTEM
EVERE
LEUVEN
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
WEZEMBEEK-OPPEM
SINT-GILLIS
ETTERBEEK
SINT-PIETERS-WOLUWE
ELSENE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

Evolution of $L_{evening}$ noise contours: 2014 and 2015
50, 55, 60, 65, 70 and 75 dB(A) (19:00 - 23:00)

Noise contours on a population density map (2011)





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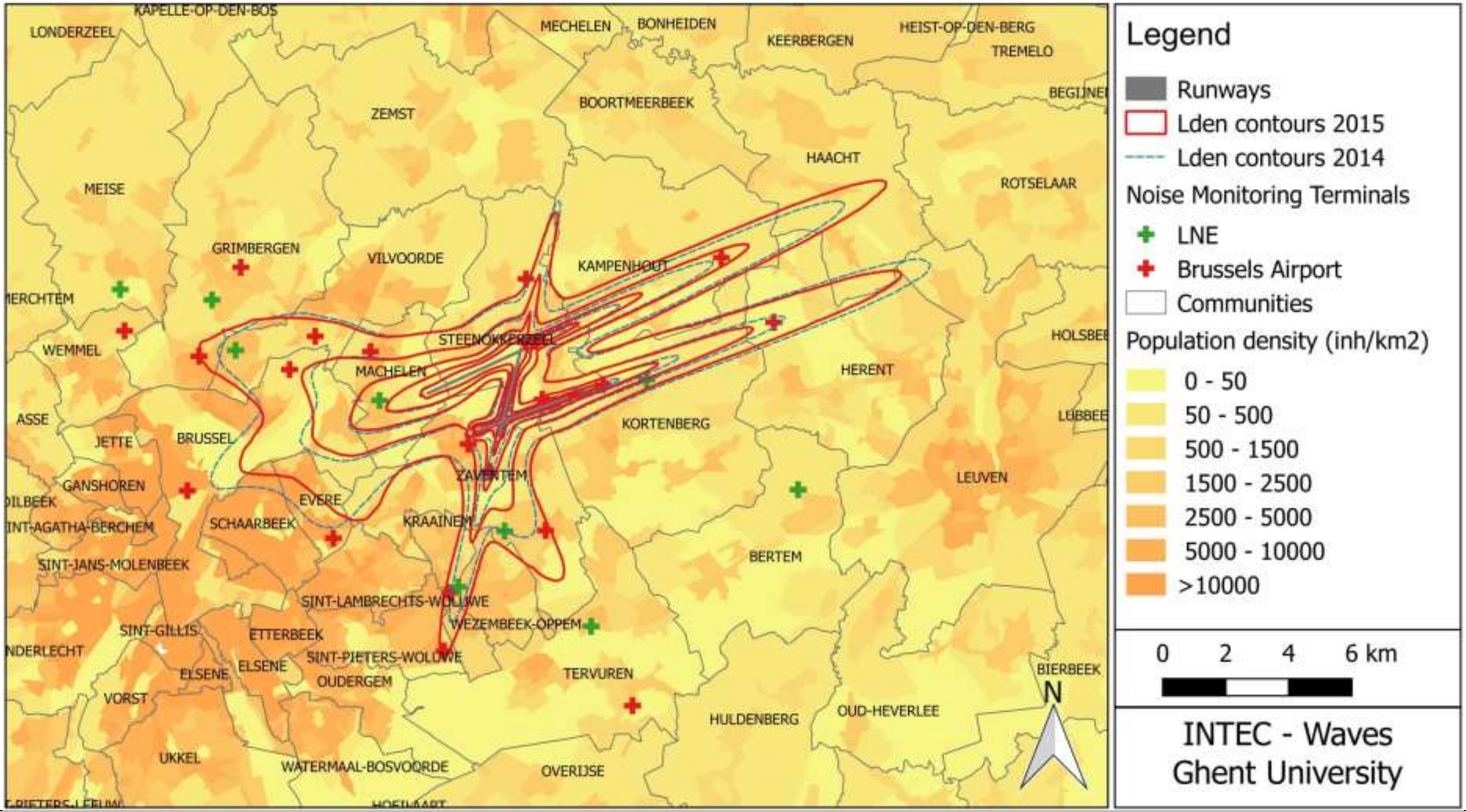
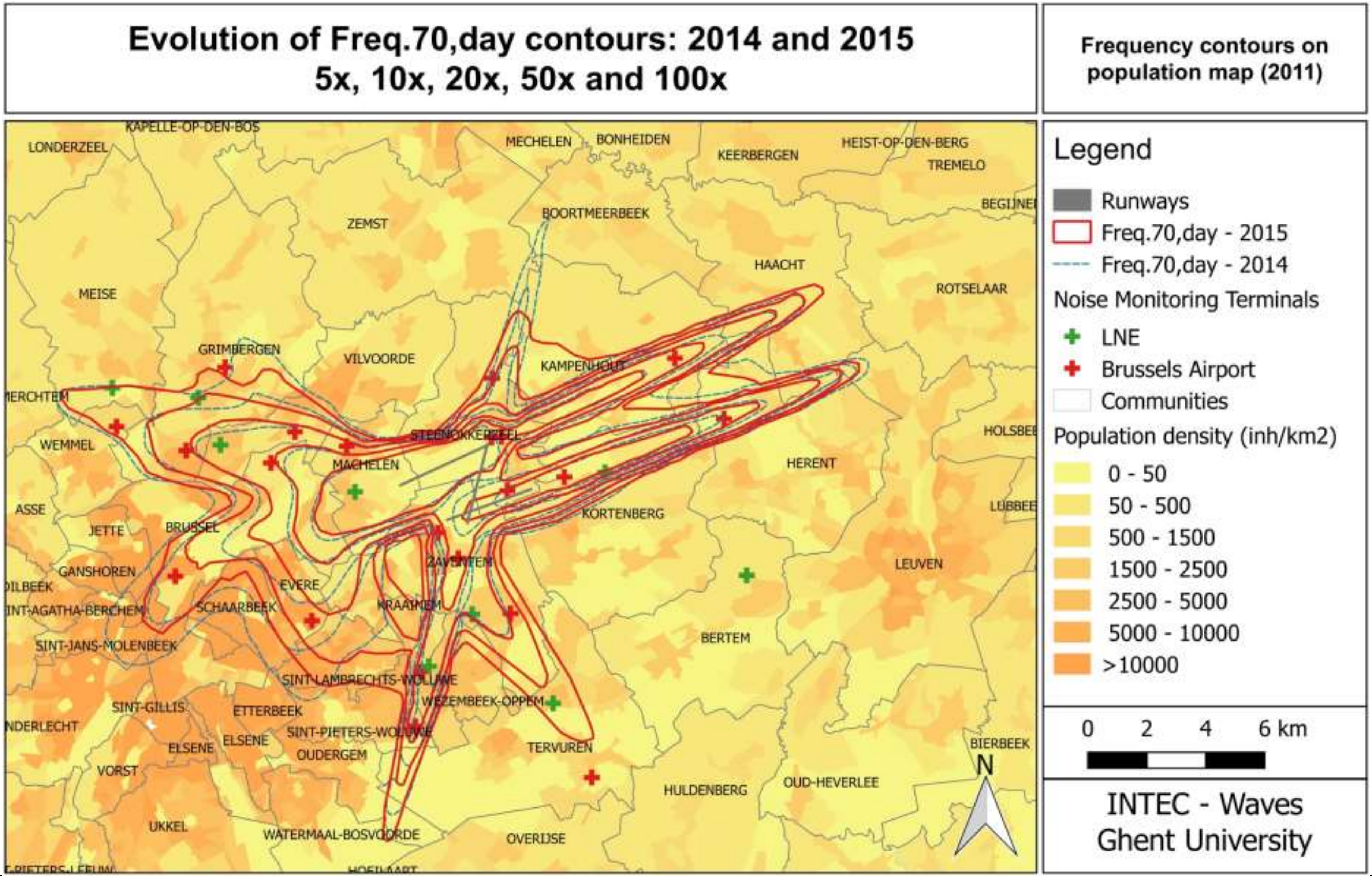
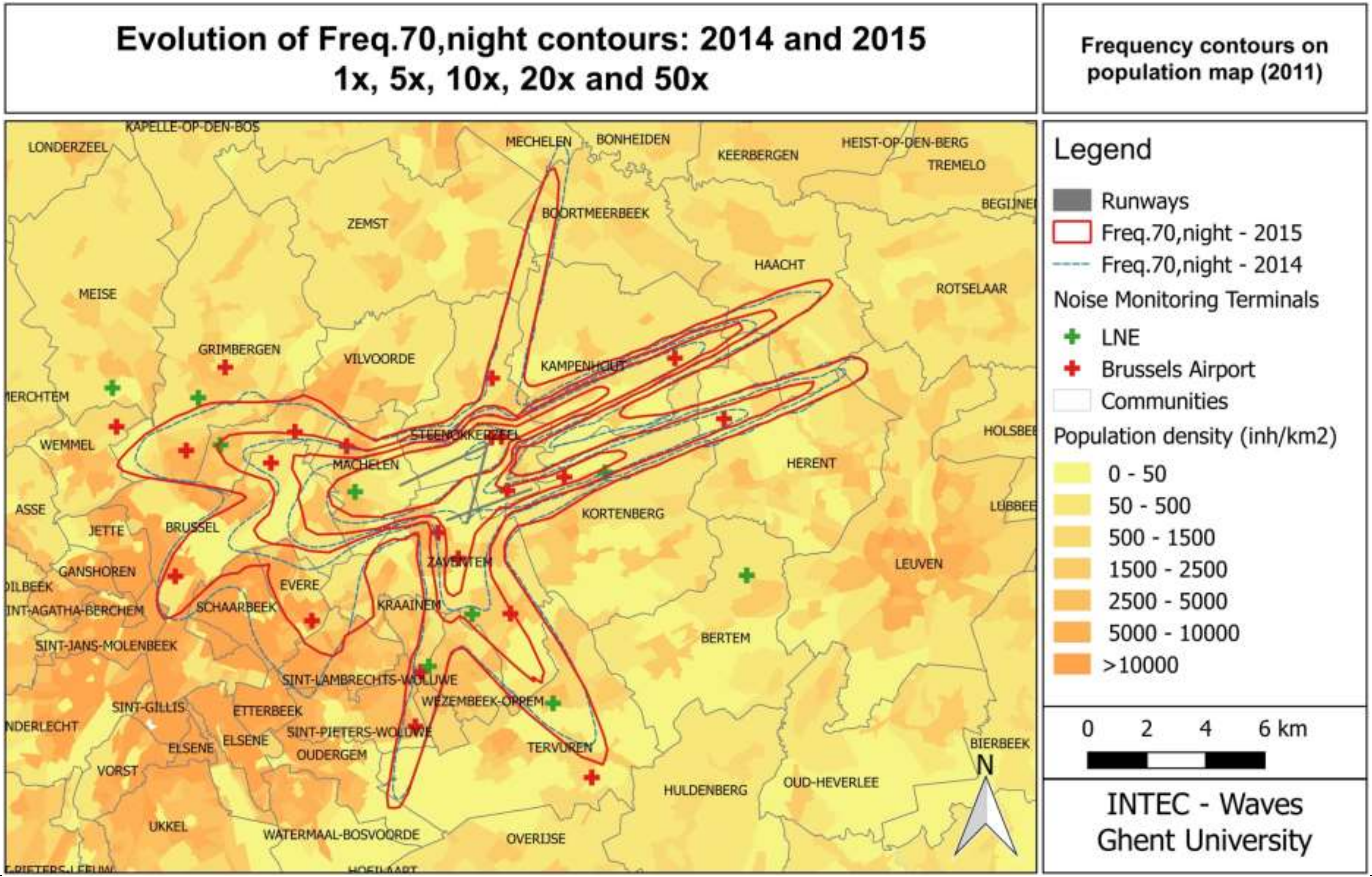
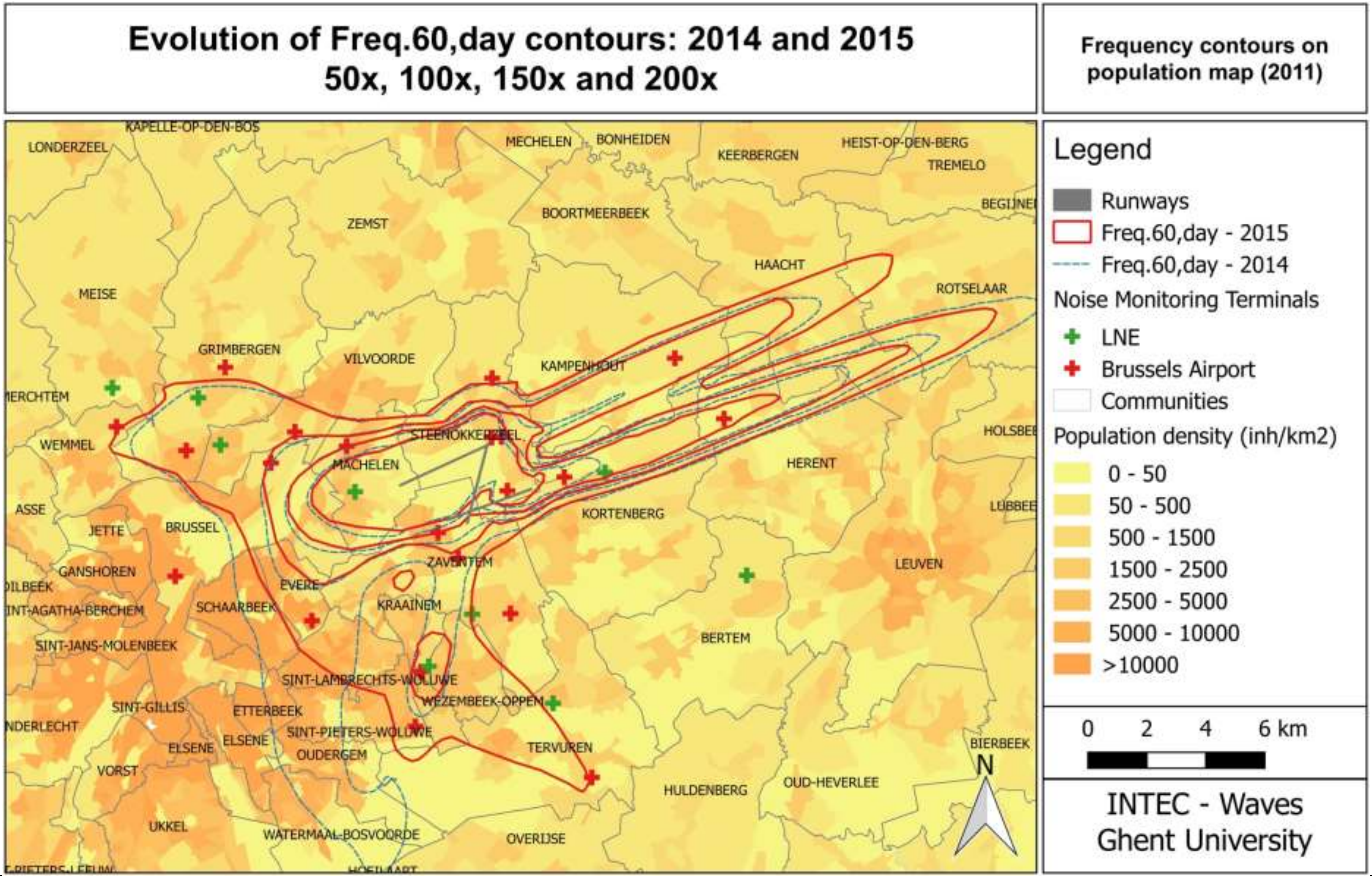
Evolution of L_{den} noise contours: 2014 and 2015
55, 60, 65, 70 and 75 dB(A)

Noise contours on a population density map (2011)



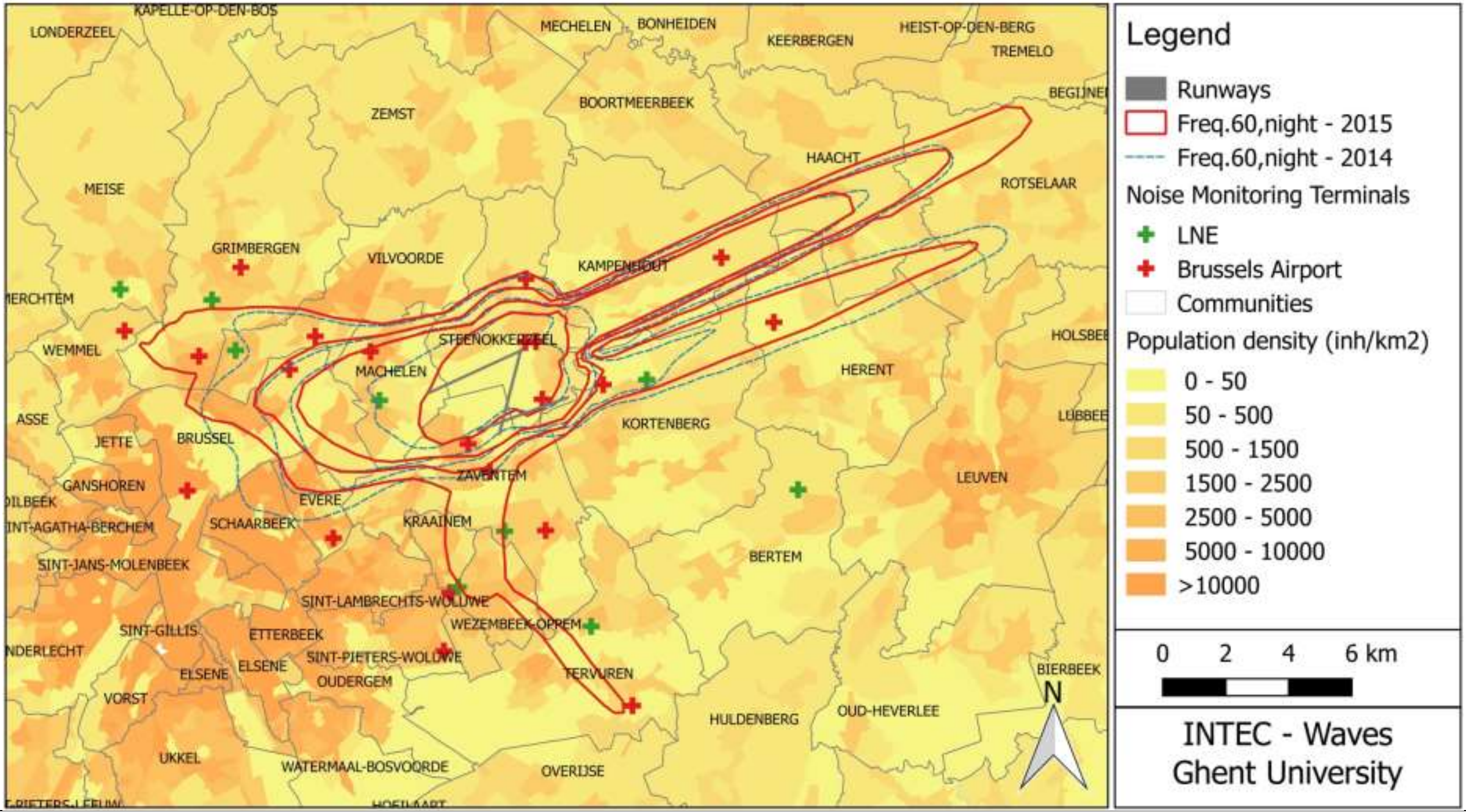

Evolution of Freq.70,day contours: 2014 and 2015
5x, 10x, 20x, 50x and 100x
Frequency contours on population map (2011)
Legend
Runways
Freq.70,day - 2015
Freq.70,day - 2014
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
HOLSBEE
ASSE
JETTE
BRUSSEL
KORTENBERG
LUBBEE
GANSHOREN
EVERE
ZAVENTEM
LEUVEN
SCHAARBEEK
KRAAINEM
BERTEM
SINT-JANS-MOLENBEEK
SINT-LAMBRECHTS-WOLUWE
WEZEMBEEK-OPPEM
SINT-GILLIS
ETTERBEEK
ELSENE
SINT-PIETERS-WOLUWE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

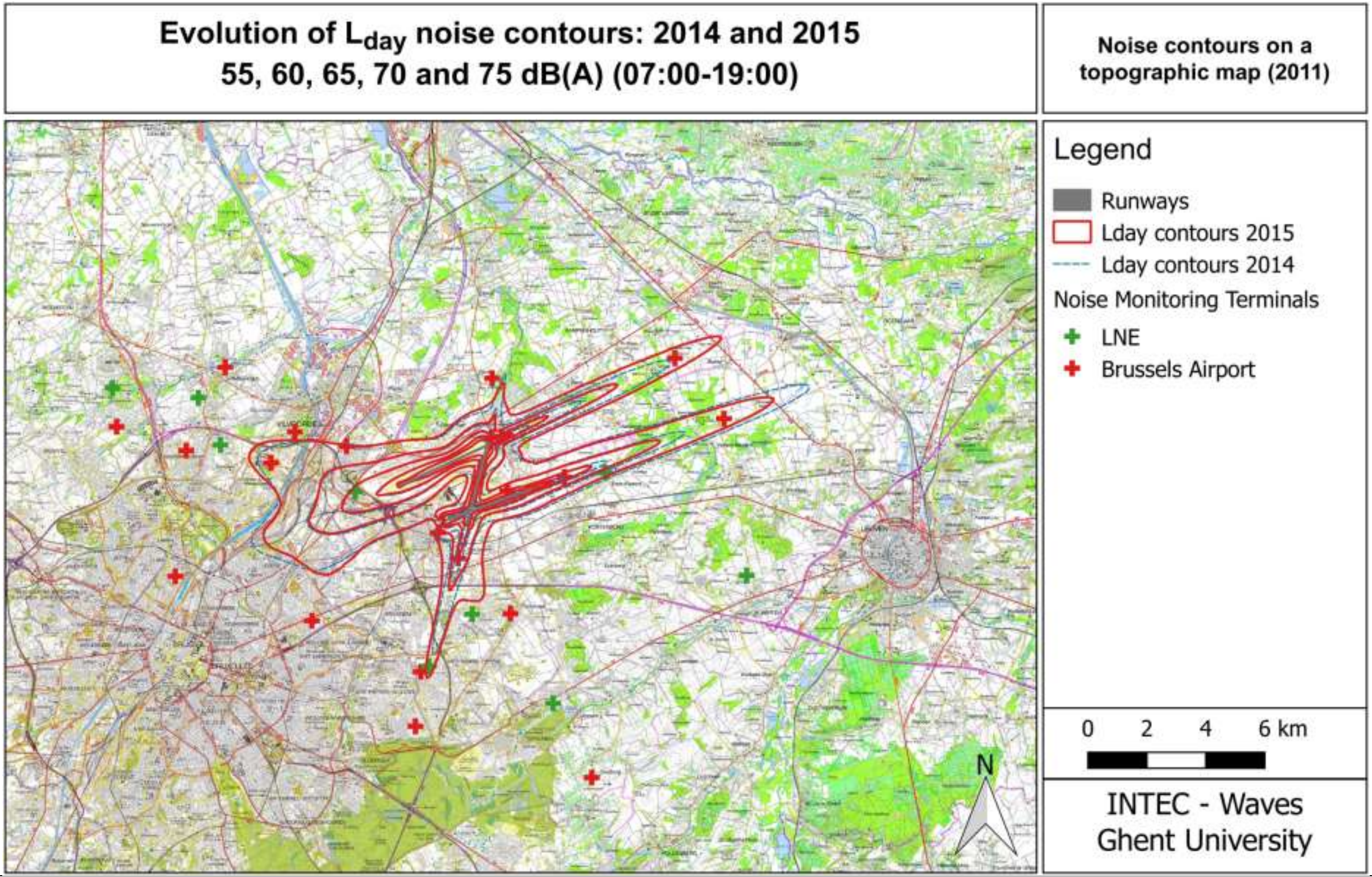

Evolution of Freq.70,night contours: 2014 and 2015
1x, 5x, 10x, 20x and 50x
Frequency contours on population map (2011)
Legend
Runways
Freq.70,night - 2015
Freq.70,night - 2014
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
WEMMEL
STEENOKKERZEEL
MACHELEN
HERENT
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
EVERE
ZAVENTEM
LEUVEN
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
WEZEMBEEK-OPPEM
SINT-GILLIS
ETTERBEEK
ELSENE
SINT-PIETERS-WOLUWE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

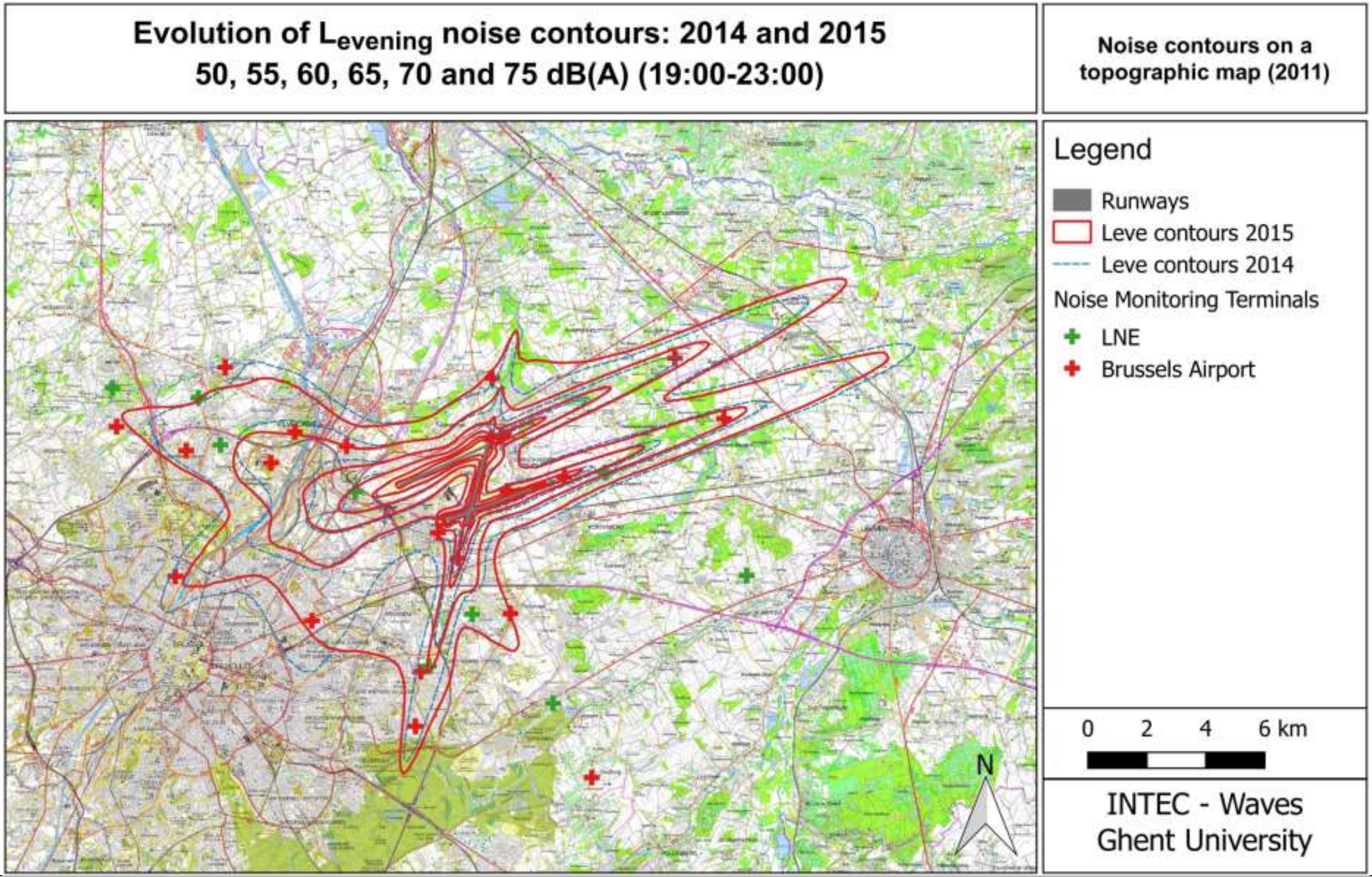

Evolution of Freq.60,day contours: 2014 and 2015
50x, 100x, 150x and 200x
Frequency contours on population map (2011)
Legend
Runways
Freq.60,day - 2015
Freq.60,day - 2014
Noise Monitoring Terminals
LNE
Brussels Airport
Communities
Population density (inh/km2)
0 - 50
50 - 500
500 - 1500
1500 - 2500
2500 - 5000
5000 - 10000
>10000
0 2 4 6 km
N
INTEC - Waves
Ghent University
KAPELLE-OP-DEN-BOS
LONDERZEEL
MECHELEN
BONHEIDEN
KEERBERGEN
HEIST-OP-DEN-BERG
TREMELO
ZEMST
BOORTMEERBEEK
HAACHT
ROTSELAAR
MEISE
GRIMBERGEN
VILVOORDE
KAMPENHOUT
STEENOKKERZEEL
MACHELEN
WEMMEL
HERENT
HOLSBEE
ASSE
JETTE
BRUSSEL
KORTENBERG
GANSHOREN
EVERE
ZAVENTEM
LEUVEN
SCHAARBEEK
KRAAINEM
SINT-JANS-MOLENBEEK
BERTEM
SINT-LAMBRECHTS-WOLUWE
WEZEMBEEK-OPPEM
SINT-GILLIS
ETTERBEEK
ELSENE
SINT-PIETERS-WOLUWE
OUDERGEM
TERVUREN
BIERBEEK
VORST
HULDENBERG
OUD-HEVERLEE
UKKEL
WATERMAAL-BOSVOORDE
OVERIJSE

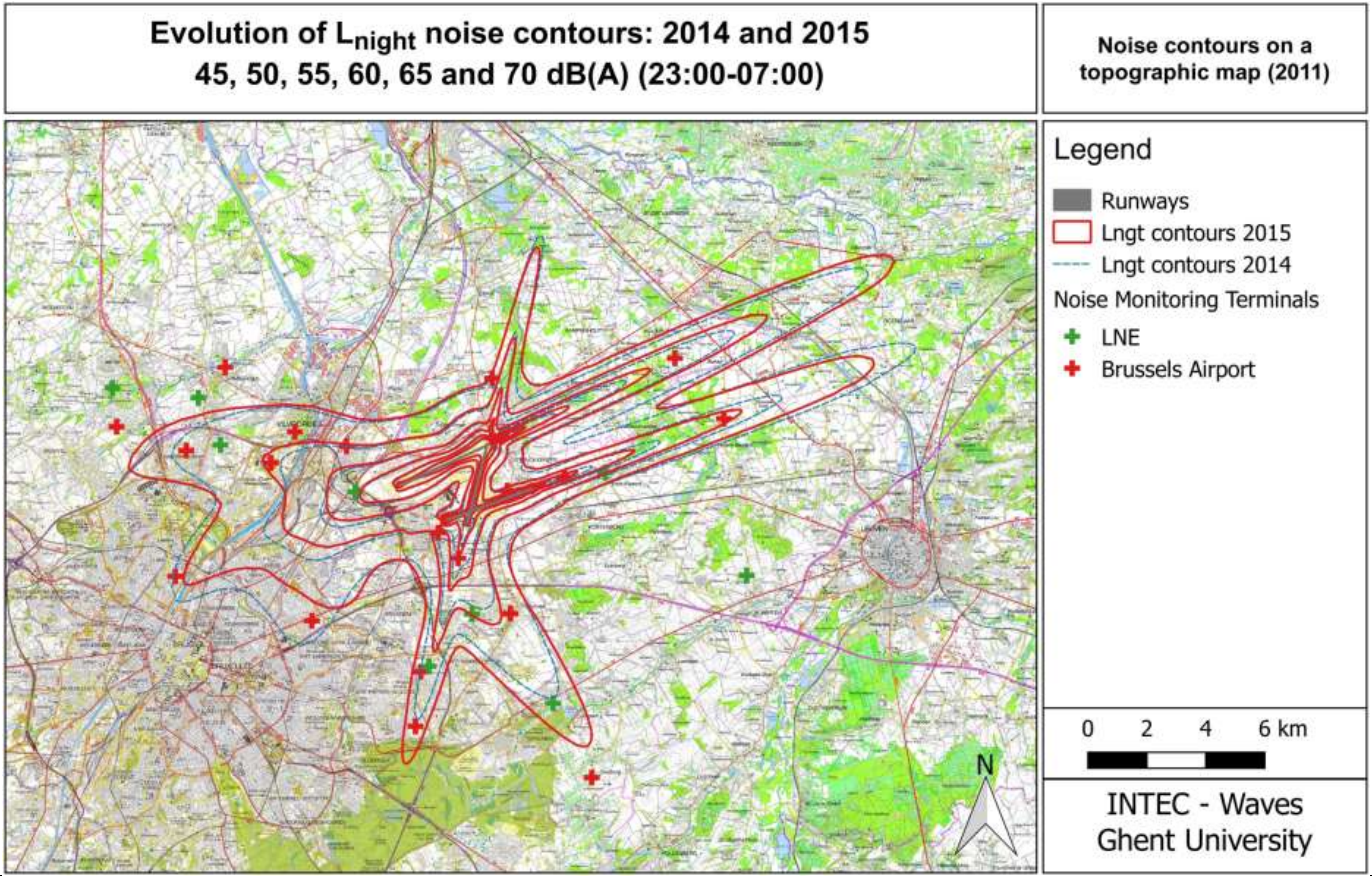
Evolution of Freq.60,night contours: 2014 and 2015
10x, 15x, 20x and 30x

Frequency contours on population map (2011)

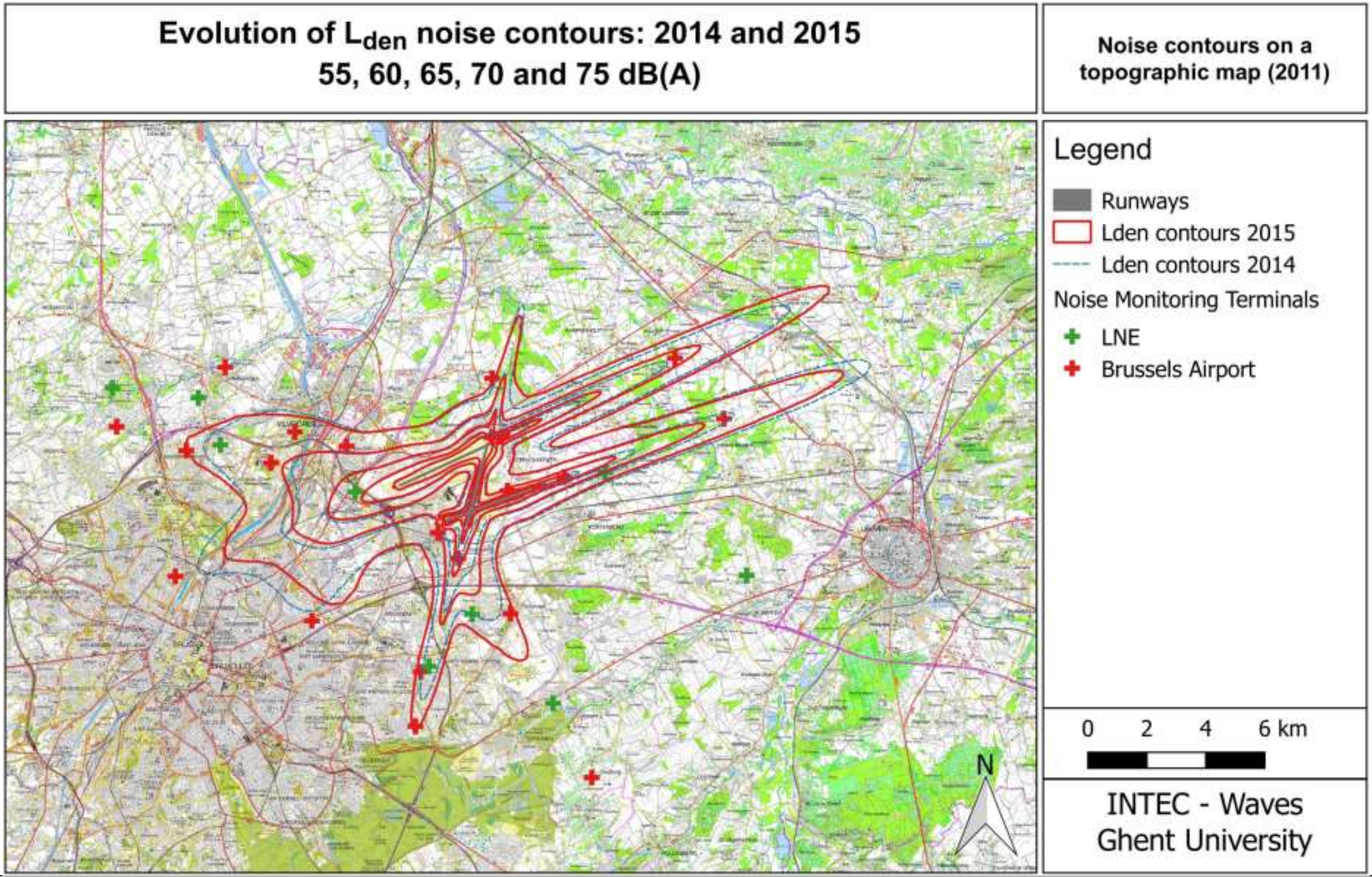



Evolution of L$_{day}$ noise contours: 2014 and 2015
55, 60, 65, 70 and 75 dB(A) (07:00-19:00)
Noise contours on a topographic map (2011)
Legend
Runways
Lday contours 2015
Lday contours 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University


Evolution of L_evening noise contours: 2014 and 2015
50, 55, 60, 65, 70 and 75 dB(A) (19:00-23:00)
Noise contours on a topographic map (2011)
Legend
Runways
Leve contours 2015
Leve contours 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University

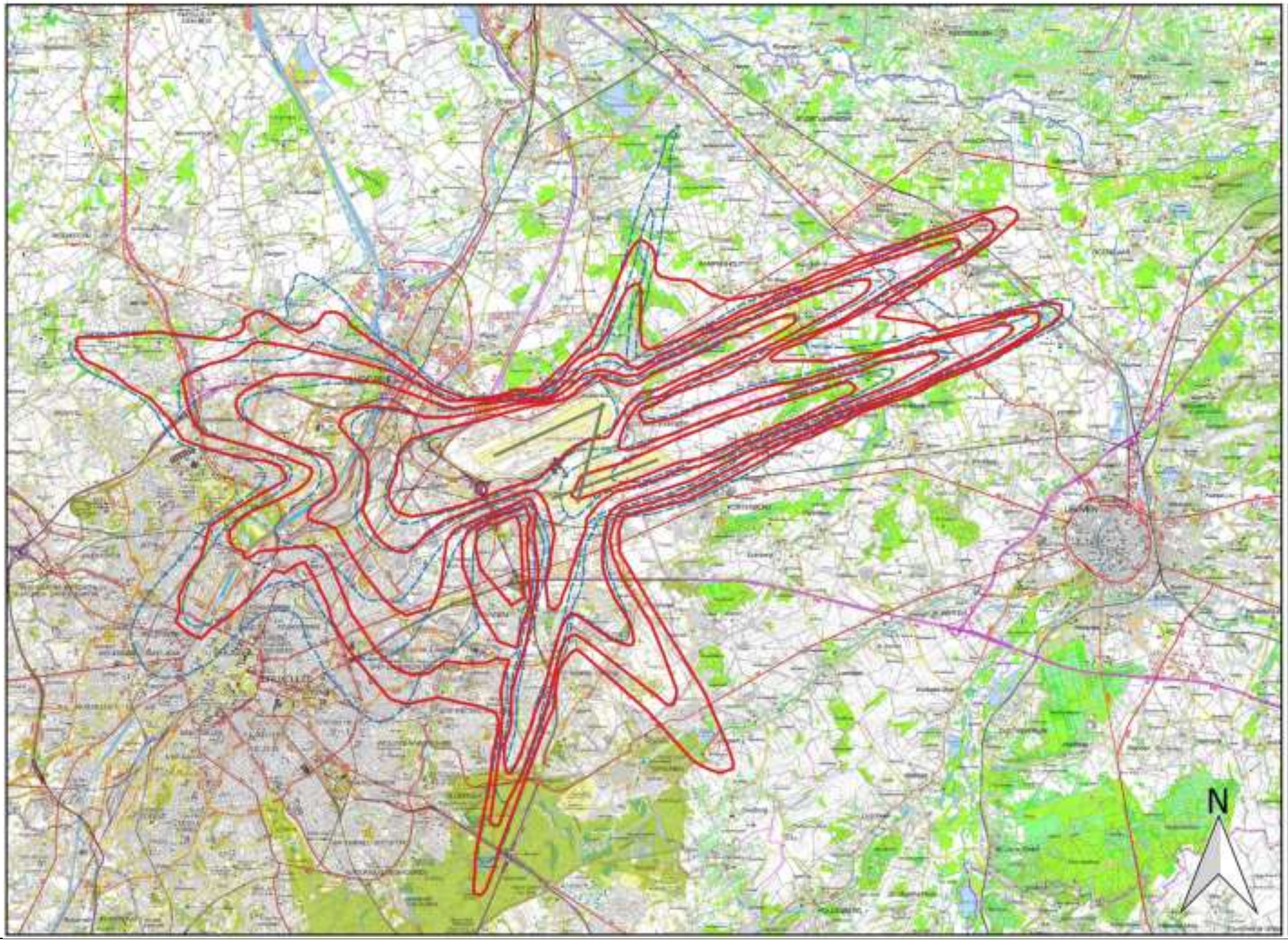


Evolution of Lnight noise contours: 2014 and 2015
45, 50, 55, 60, 65 and 70 dB(A) (23:00-07:00)
Noise contours on a topographic map (2011)
Legend
Runways
Lngt contours 2015
Lngt contours 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University


Evolution of Lden noise contours: 2014 and 2015
55, 60, 65, 70 and 75 dB(A)
Noise contours on a topographic map (2011)
Legend
Runways
Lden contours 2015
Lden contours 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University

Evolution of Freq.70,day contours: 2014 and 2015
5x, 10x, 20x, 50x and 100x

Frequency contours on topographique map (NGI)



Legend

- Runways
- Freq.70,day - 2015
- Freq.70,day - 2014

Noise Monitoring Terminals

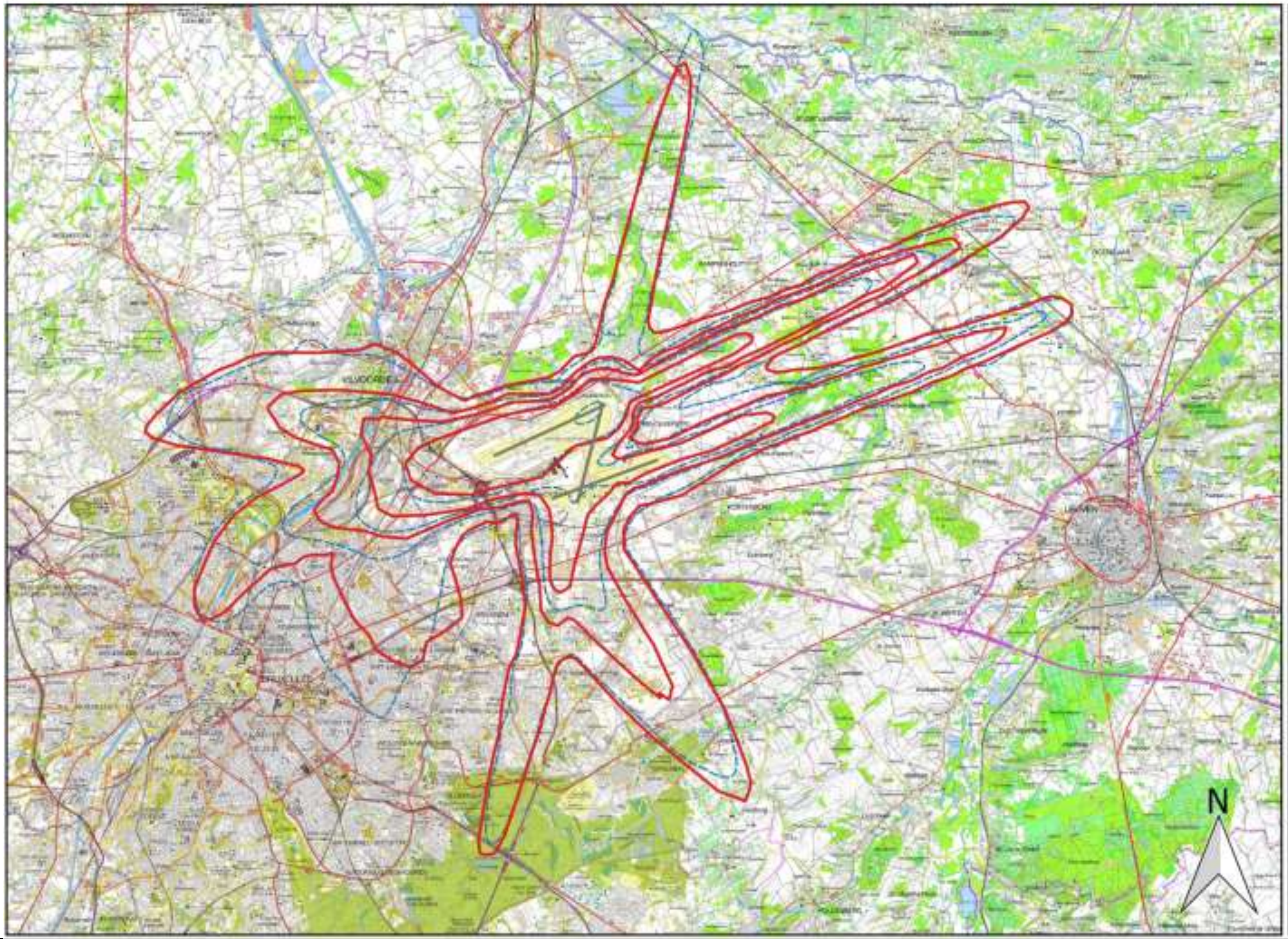
- LNE
- Brussels Airport

0 2 4 6 km

INTEC - Waves
Ghent University

Evolution of Freq.70,night contours: 2014 and 2015
1x, 5x, 10x, 20x and 50x

Frequency contours on topographique map (NGI)



Legend

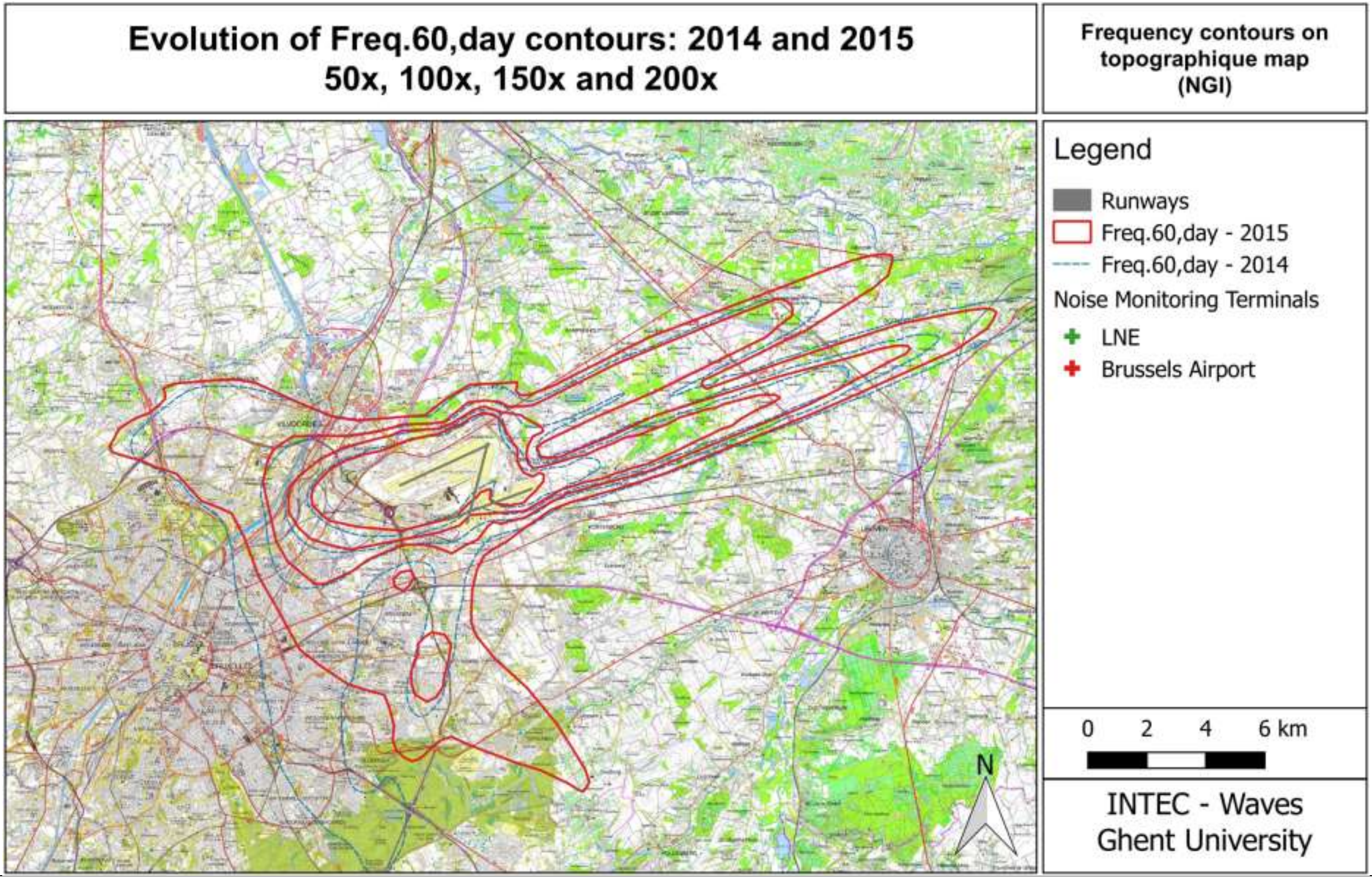
- Runways
- Freq.70,night - 2015
- Freq.70,night - 2014

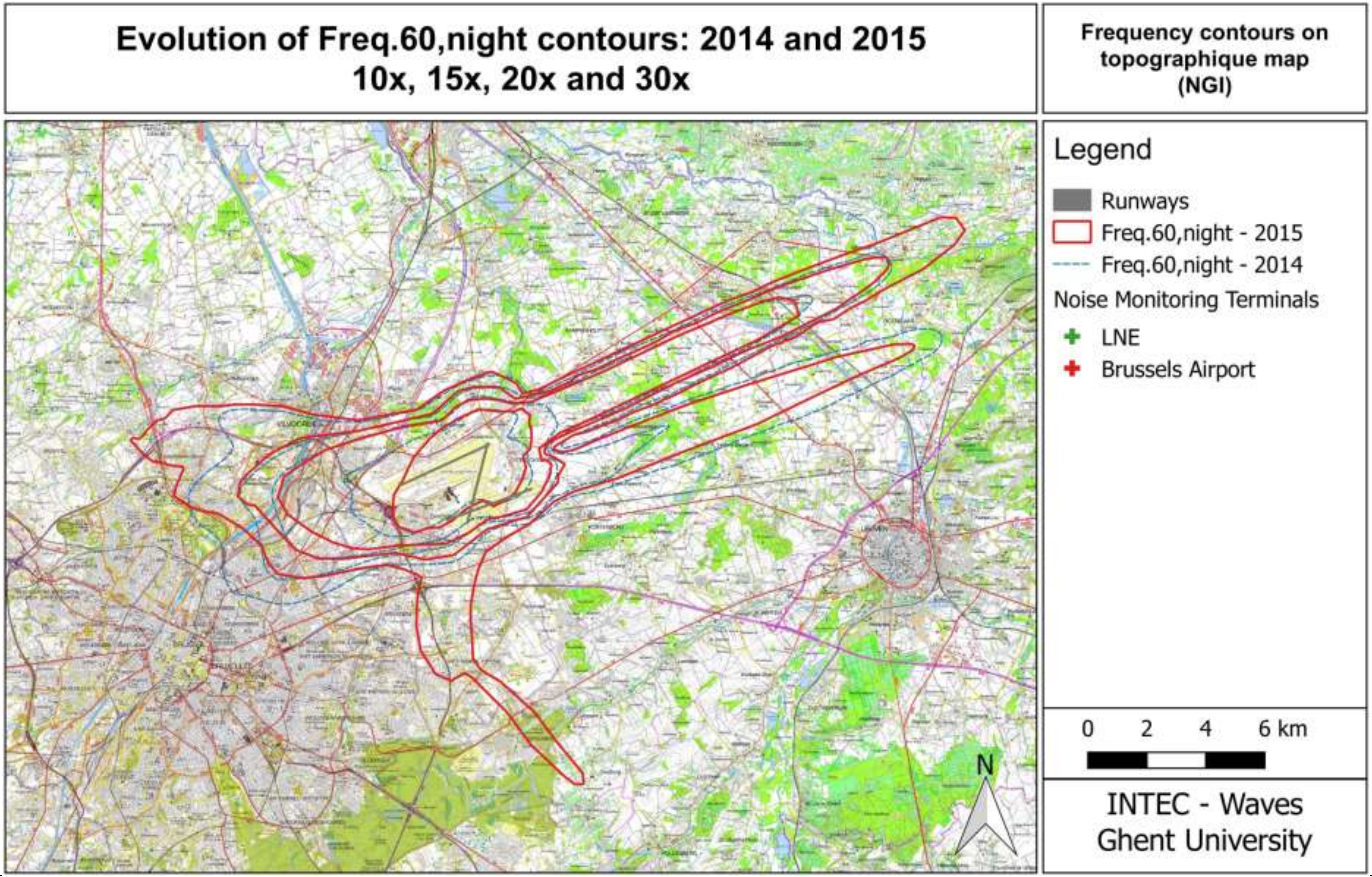
Noise Monitoring Terminals

- LNE
- Brussels Airport

0 2 4 6 km

INTEC - Waves
Ghent University


Evolution of Freq.60,day contours: 2014 and 2015
50x, 100x, 150x and 200x
Frequency contours on
topographique map
(NGI)
Legend
Runways
Freq.60,day - 2015
Freq.60,day - 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University


Evolution of Freq.60,night contours: 2014 and 2015
10x, 15x, 20x and 30x
Frequency contours on topographique map (NGI)
Legend
Runways
Freq.60,night - 2015
Freq.60,night - 2014
Noise Monitoring Terminals
LNE
Brussels Airport
0 2 4 6 km
N
INTEC - Waves
Ghent University

5.6 Evolution of the surface area and the number of inhabitants

5.6.1 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 32: Evolution of the surface area inside the L_{day} contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 16: Evolution of the surface area inside the L_{day} contours (2000, 2006-2015).

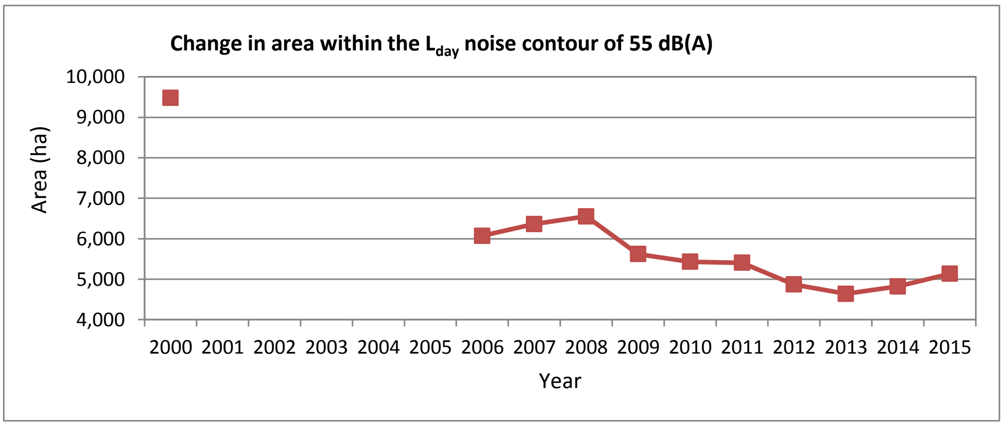


Table 33: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 17: Evolution of the surface area inside the $L_{evening}$ contours (2000, 2006-2015).

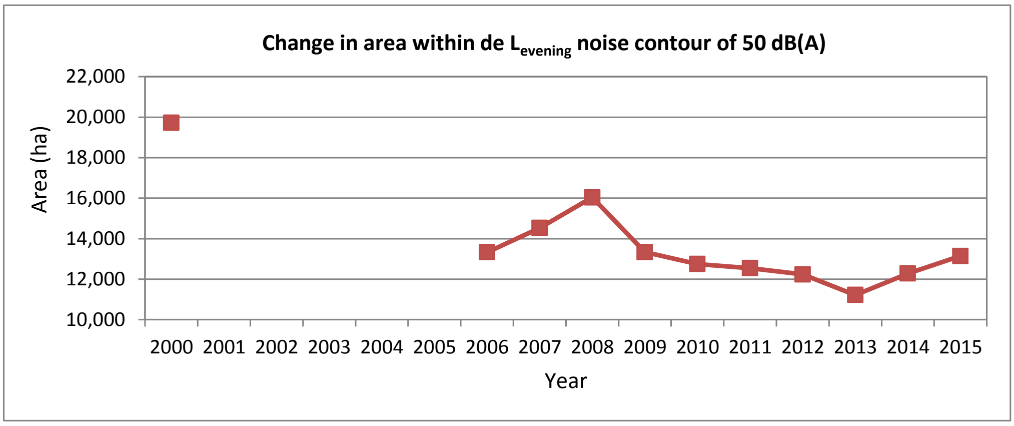


Table 34: : Evolution of the surface area inside the L_{night} contours (2000, 2006-2015).

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**

Figure 18: Evolution of the surface area inside the L_{night} contours (2000, 2006-2015).

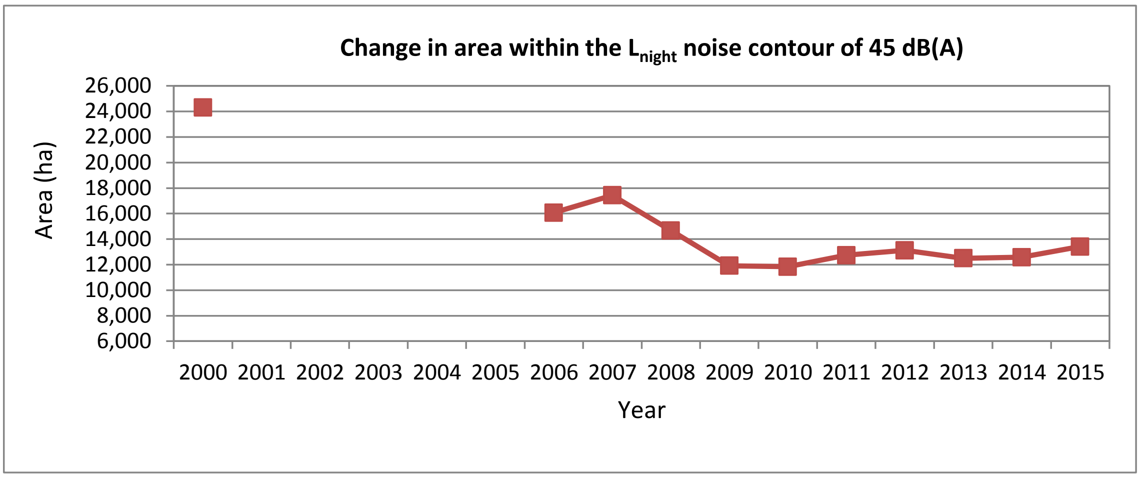


Table 35: : Evolution of the surface area inside the L_{den} contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 19: Evolution of the surface area inside the L_{den} contours (2000, 2006-2015).

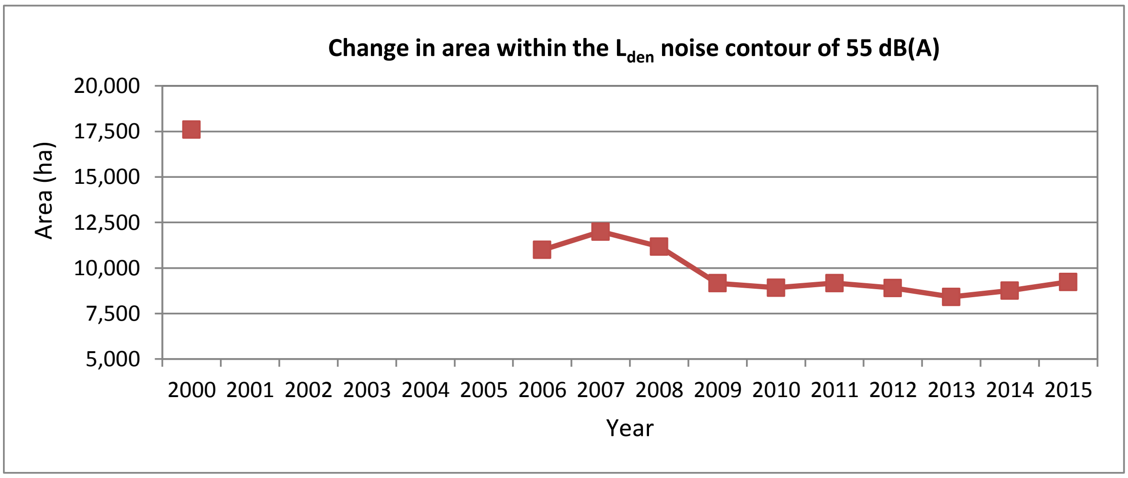


Table 36: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 20: Evolution of the surface area inside the Freq.70,day contours (2000, 2006-2015).

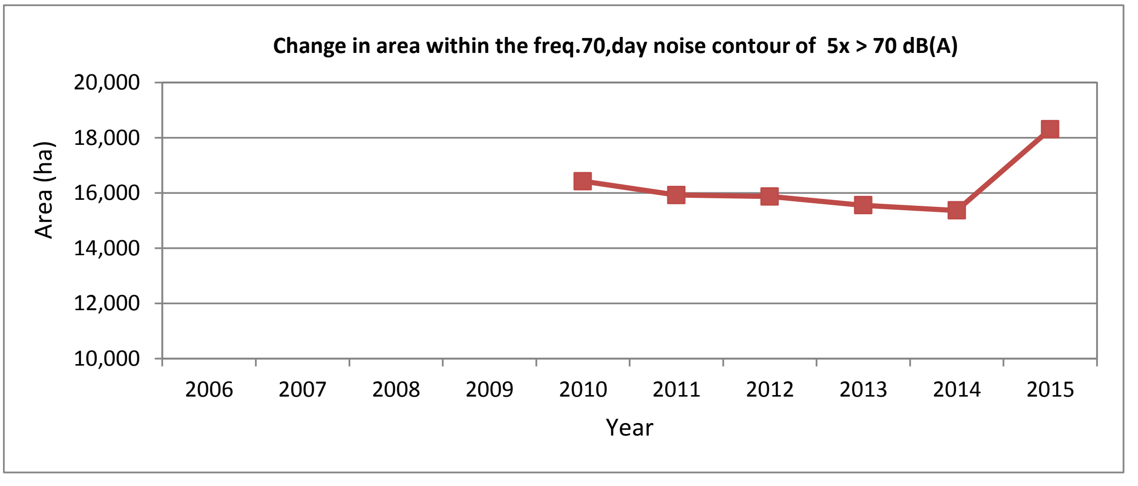


Table 37: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 21: Evolution of the surface area inside the Freq.70,night contours (2000, 2006-2015).

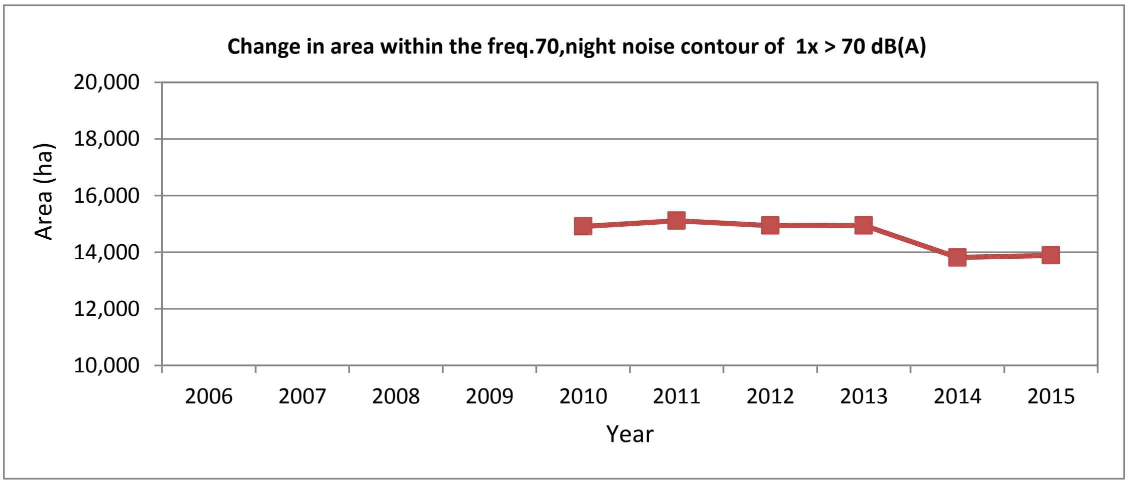


Table 38: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 22: Evolution of the surface area inside the Freq.60,day contours (2000, 2006-2015).

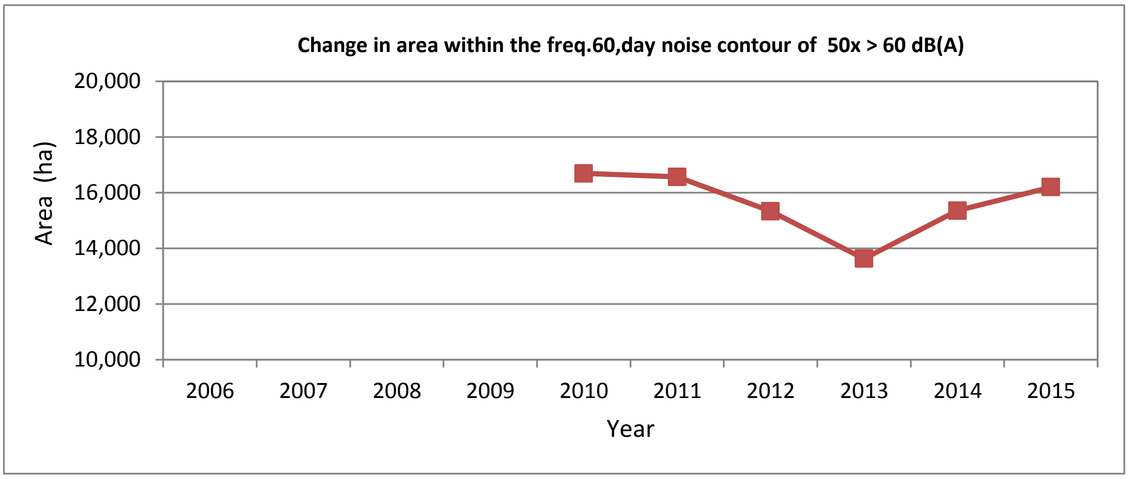
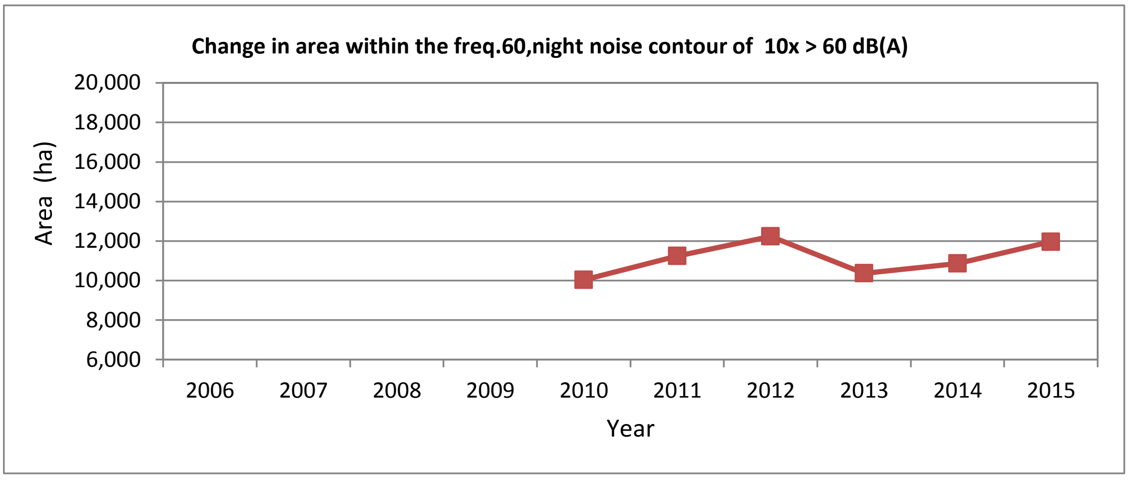


Table 39: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 23: Evolution of the surface area inside the Freq.60,night contours (2000, 2006-2015).



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

Table 40: Evolution of the number of inhabitants inside the L_{day} contours (2000, 2006-2015).

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	01jan10	22,998	8,649	2,249	22	2	**33,920**
2015		23,662	8,945	2,350	99	0	**35,056**

* Calculated with INM 7.0b

Figure 24: Evolution of the number of inhabitants inside the L_{day} contours (2000, 2006-2015).

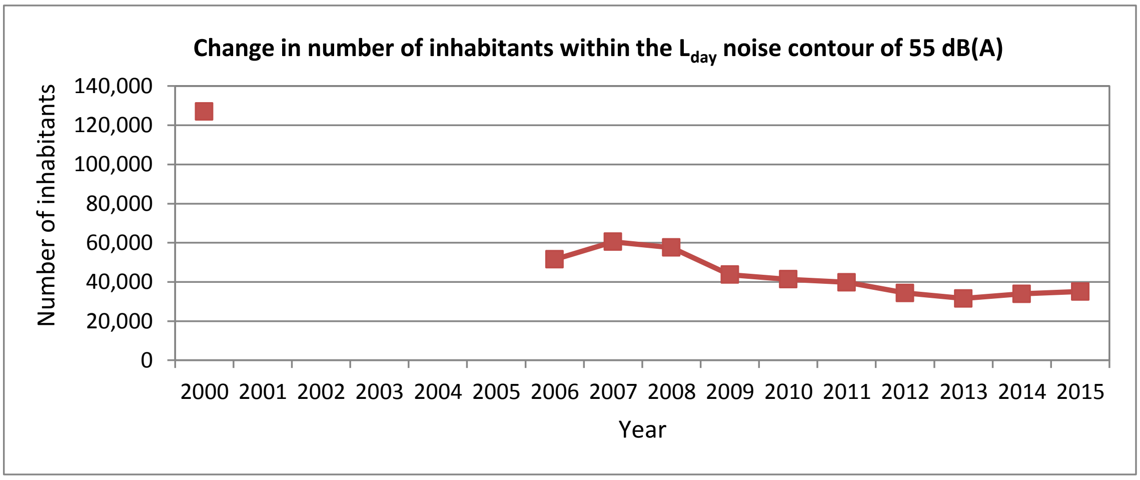


Table 41: Evolution of the number of inhabitants inside the $L_{evening}$ contours (2000, 2006-2015).

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	01jan10	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**

* Calculated with INM 7.0b

Figure 25: Evolution of the number of inhabitants inside the $L_{evening}$ contours (2000, 2006-2015).

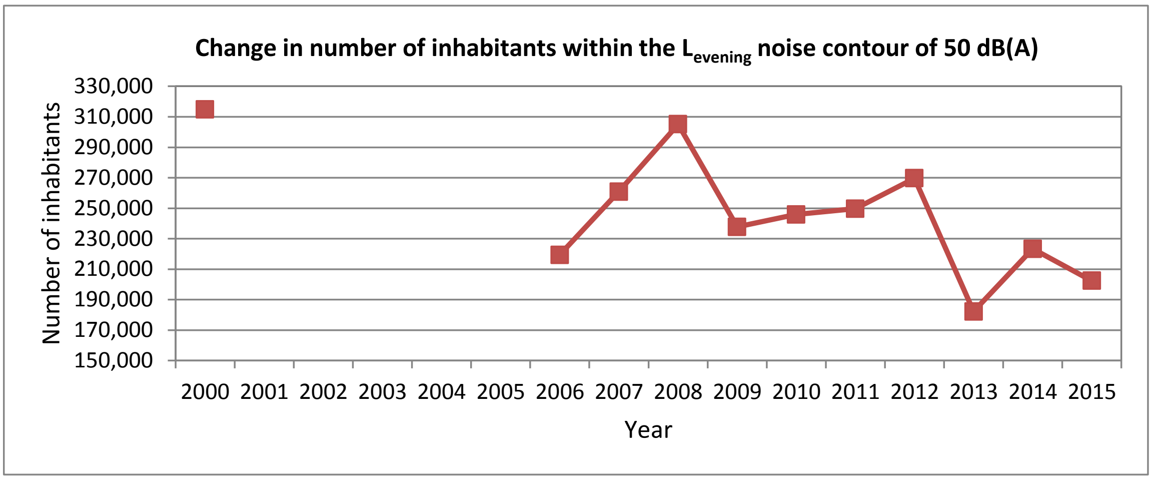


Table 42: Evolution of the number of inhabitants inside the L_{night} contours (2000, 2006-2015).

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	01jan10	163,270	24,221	7,889	869	110	3	**196,362**
2015	01jan11	125,407	26,956	8,239	762	159	2	**161,524**

* Calculated with INM 7.0b

Figure 26: Evolution of the number of inhabitants inside the L_{night} contours (2000, 2006-2015).

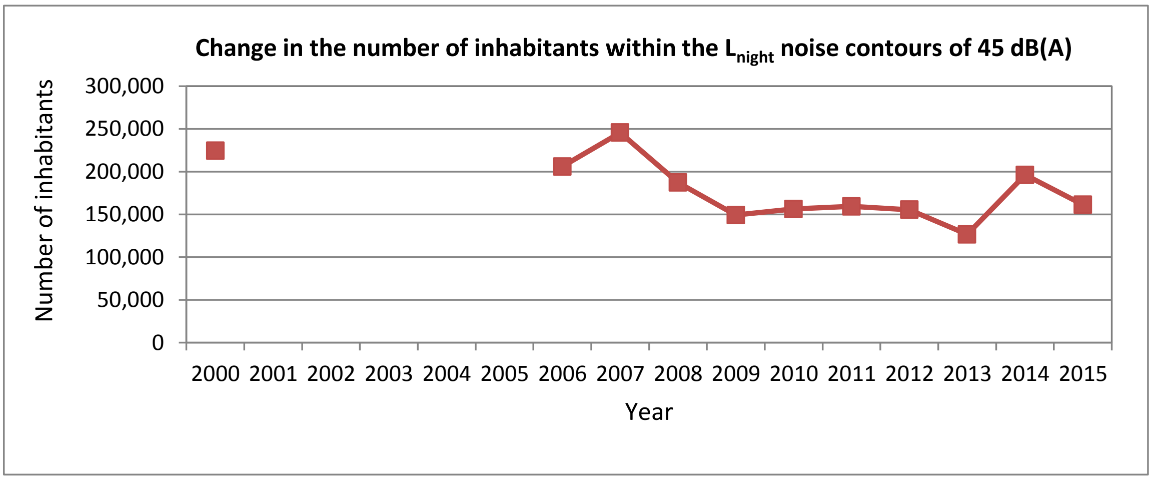


Table 43: Evolution of the number of inhabitants inside the L_{den} contours (2000, 2006-2015).

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**

* Calculated with INM 7.0b

Figure 27: Evolution of the number of inhabitants inside the L_{den} contours (2000, 2006-2015).

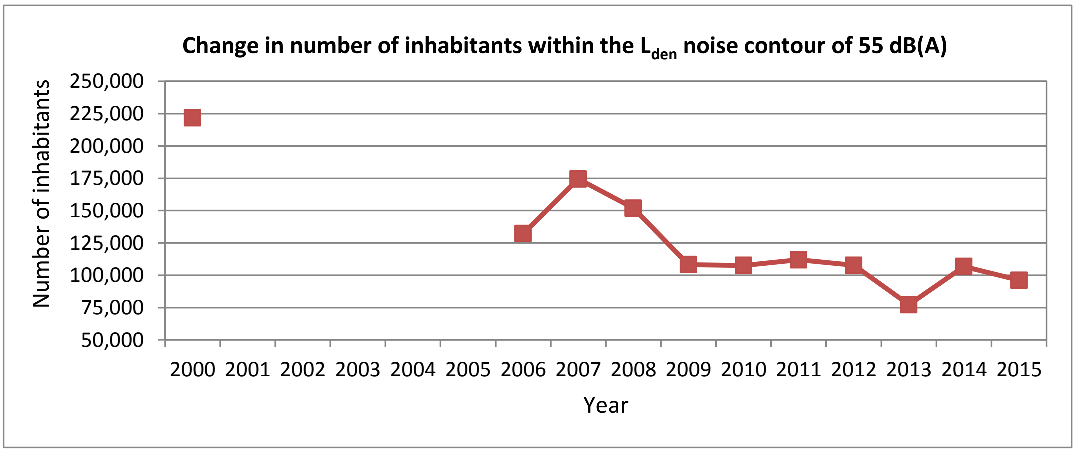


Table 44: Evolution of the number of inhabitants inside the Freq.70,day contours (2000, 2006-2015).

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	01jan10	226,319	139,618	47,774	10,655	10,379	**434,746**
2015	40,544	163,105	104,564	43,843	11,547	11,204	**334,264**

* Calculated with INM 7.0b

Figure 28: Evolution of the number of inhabitants inside the Freq.70,day contours (2000, 2006-2015).

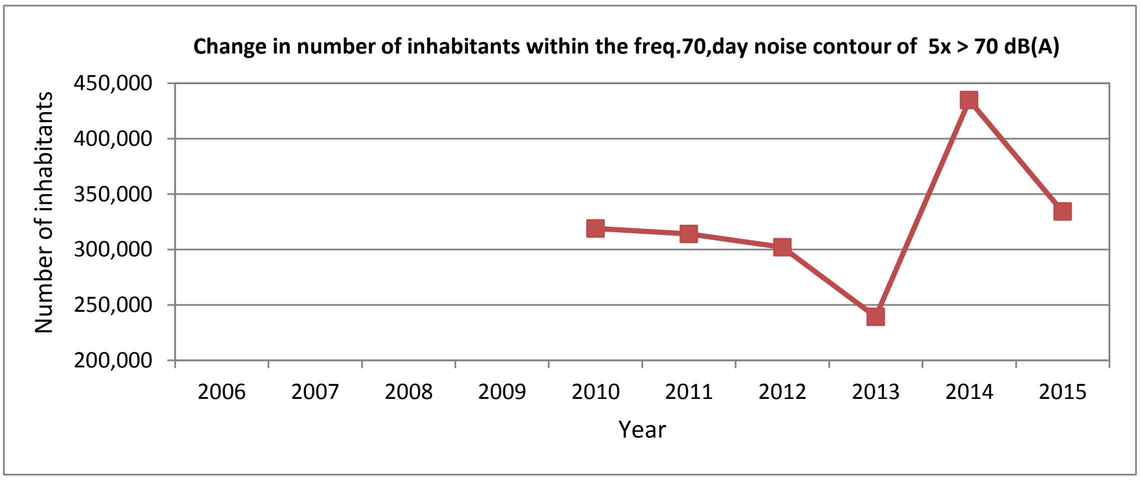


Table 45: Evolution of the number of inhabitants inside the Freq.70,night contours (2000, 2006-2015).

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	01jan10	240,106	19,794	13,018	6,333	0	**279,251**
2015	01jan11	167,925	22,934	13,681	6,400	0	**210,939**

* Calculated with INM 7.0b

Figure 29: Evolution of the number of inhabitants inside the Freq.70,night contours (2000, 2006-2015).

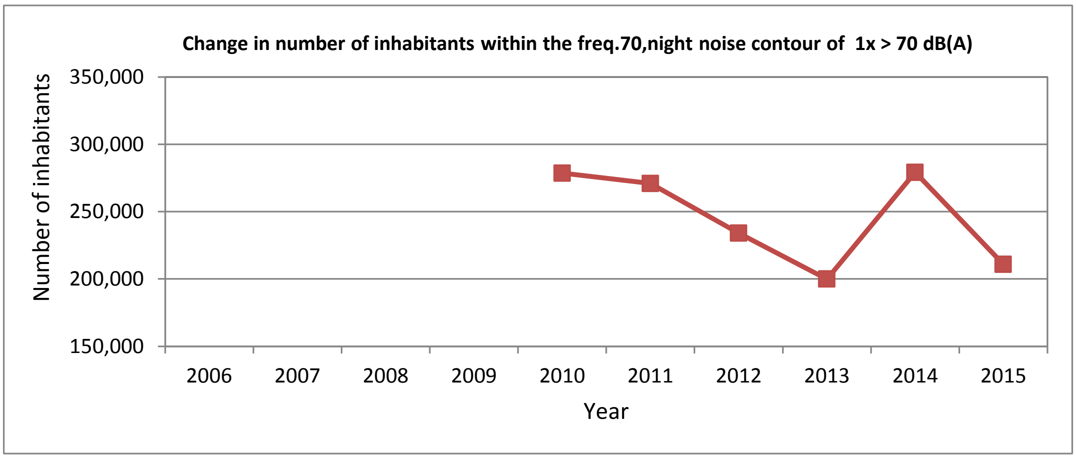


Table 46: Evolution of the number of inhabitants inside the Freq.60,day contours (2000, 2006-2015).

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	01jan10	273,603	22,036	10,282	17,121	**323,042**
2015	40544	191,263	23,810	12,105	16,596	**243,774**

* Calculated with INM 7.0b

Figure 30: Evolution of the number of inhabitants inside the Freq.60,day contours (2000, 2006-2015).

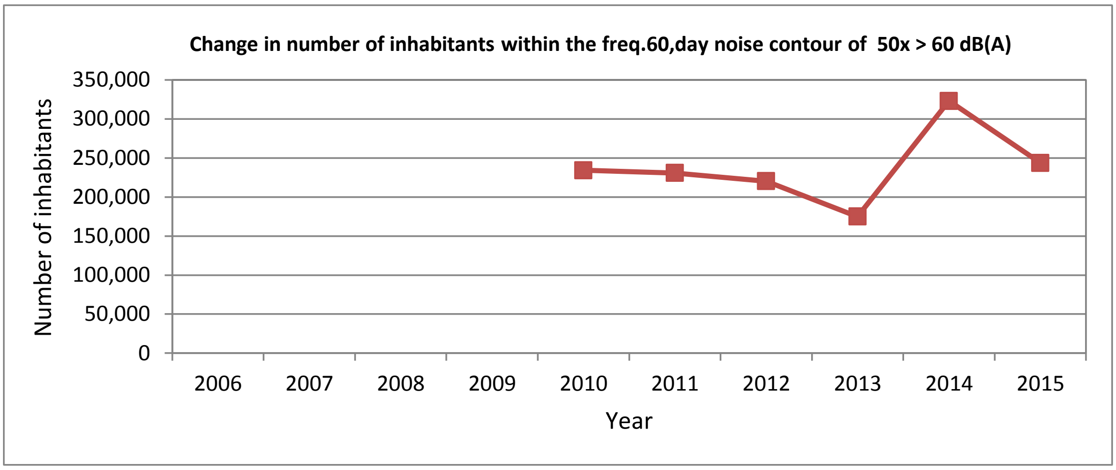
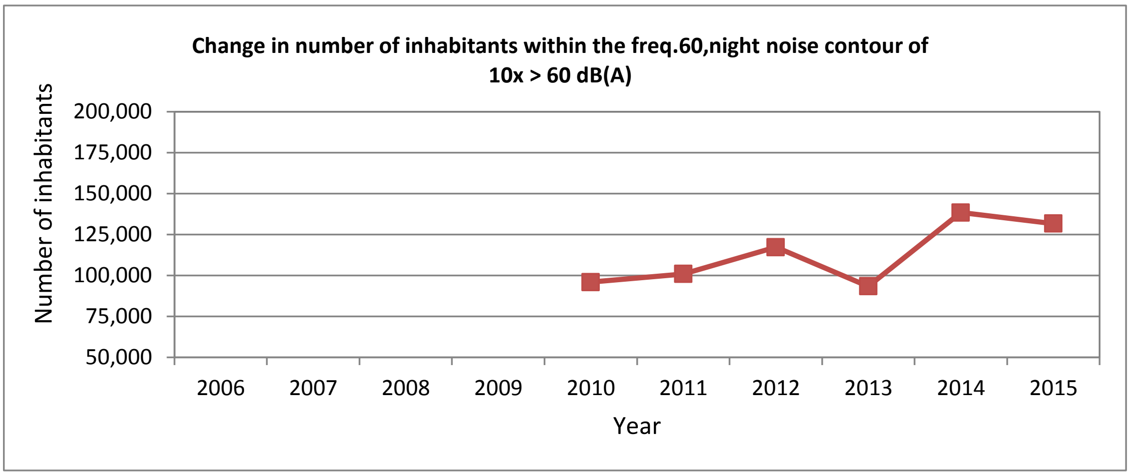


Table 47: Evolution of the number of inhabitants inside the Freq.60,night contours (2000, 2006-2015).

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	01jan10	79,725	27,741	18,637	12,317	**138,420**
2015	01jan11	84,429	12,453	24,502	10,351	**131,736**

* Calculated with INM 7.0b

Figure 31: Evolution of the number of inhabitants inside the Freq.60,night contours (2000, 2006-2015).



5.7 Documentation provided files

Radar data for the year 2015 (source: BAC-ANOMS)

radar_2015.zip	04/01/2016	604,119 KB

Flight data for the year 2015 (source: BAC-CDB)

cdb_2015_01_12.txt	04/01/2016	64,843 kB

Weather data for the year 2015 (source: BAC-ANOMS)

Meteo_2015.xlsx	06/01/2016	1781 kB

Noise events for the year 2015 (source: BAC-ANOMS)

noise_events_2015_01.csv	04/01/2016 13:35	10,740 KB
noise_events_2015_02.csv	04/01/2016 13:44	9,212 KB
noise_events_2015_03.csv	05/01/2016 14:27	10,798 KB
noise_events_2015_04.csv	04/01/2016 15:23	10,989 KB
noise_events_2015_05.csv	05/01/2016 08:49	11,340 KB
noise_events_2015_06.csv	05/01/2016 09:24	11,283 KB
noise_events_2015_07.csv	05/01/2016 09:38	10,569 KB
noise_events_2015_08.csv	05/01/2016 11:25	10,065 KB
noise_events_2015_09.csv	05/01/2016 11:38	12,436 KB
noise_events_2015_10.csv	05/01/2016 13:12	11,852 KB
noise_events_2015_11.csv	05/01/2016 13:21	11,776 KB
noise_events_2015_12.csv	05/01/2016 13:44	7,964 KB
2015-01-02_events_LNE.xlsx	01/03/2016 10:06	3,114 KB
04/03/2015_events_LNE.xlsx	01/03/2016 10:13	3,804 KB
2015-05-06_events_LNE xlsx	01/03/2016 10:20	3,700 KB
2015-07-08-09_events_LNE xlsx	01/03/2016 10:29	5,709 KB
2015-10-11-12_events_LNE.xlsx	01/03/2016 10:43	5,894 KB

1 h reports noise measuring network for the year 2015 (source: BAC-ANOMS / LNE)

hour-reports_2015-01-02-03.xlsx	22/12/2015 15:22	4,770 KB
hour-reports_2015-04-05-06.xlsx	29/12/2015 09:19	4,841 KB
hour-reports_2015-07-08-09.xlsx	29/12/2015 09:28	4,942 KB
hour-reports_2015-10-11-12.xlsx	04/01/2016 11:47	4,911 KB
status_LNE_2015.xls	07/01/2016 10:04	1,907 KB

24 h reports noise measuring network for the year 2015 (source: BAC-ANOMS)

24 h reports -2015.csv	06/01/2016 14:25	433 KB