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Participative pilot study at the vicinity of airports for the construction of a noise point counter integrating instantaneous annoyance at overflight

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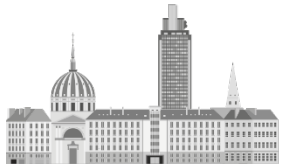

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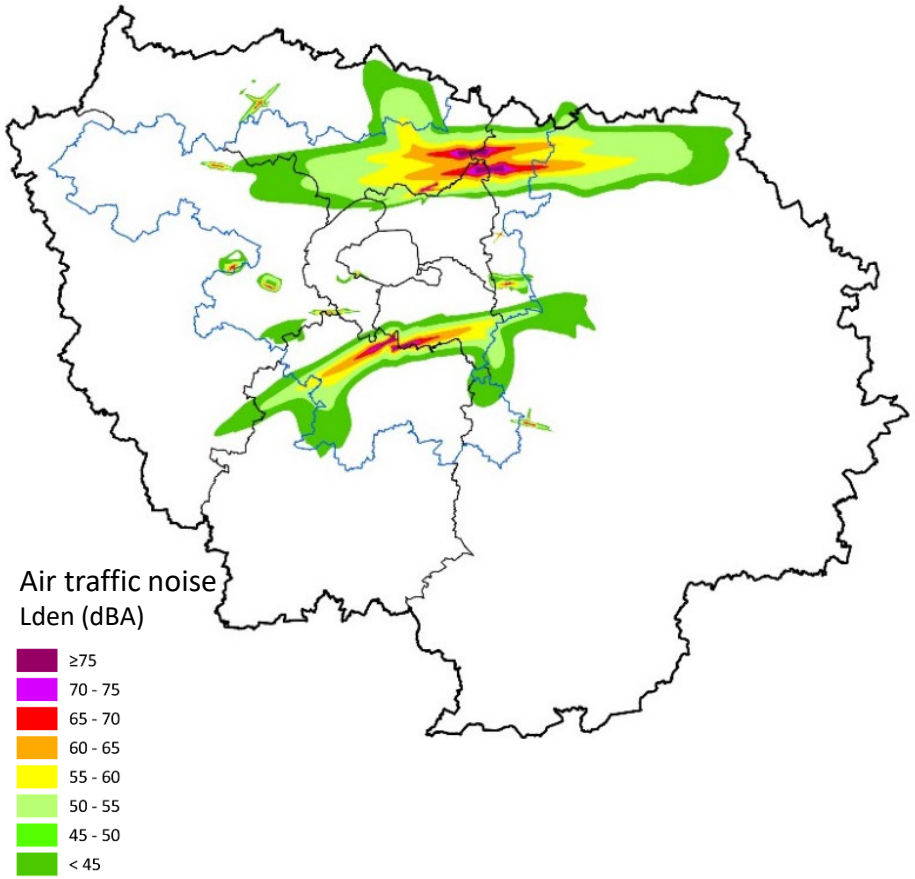
Key figures on air traffic noise issue

Air traffic noise in France costs 6.1 billion euros a year,
mainly linked to the health impacts (source: Ademe 2021)

A particularly sensitive issue in Ile-de-France region:

- 2 major international airports (Paris-Charles de Gaulle and Paris-Orly) and 1 business airport (Le Bourget) leading to **654,000 aircraft movements in 2023**
- **For 7% of the inhabitants, air traffic noise is the most annoying source of noise among transport noise sources** (source: Credoc/Bruitparif, 2021)
- **480,000 people** (3.9% of Ile-de-France population) exposed above French **limit value** of 55 dB(A) Lden
- **2.2 million people** (17.7% of Ile-de-France population) exposed above **WHO recommendation** of 45 dB(A) Lden
- **460,000 HA** and **175,000 HSD** due to air traffic noise



Air traffic noise indicators issue

- **Specific air traffic noise indicators (PNL and EPNL)** are **complex to understand by general public** and **difficult to use operationnaly** (modelling especially)
- Use of **Lden and Ln indicators required by the END,** with the **possibility of using additional indicators** if required
- Exposure-response functions (WHO, 2018) highlight that **noise with a strong event component**, such as air or rail traffic, **has more marked health effects** than road traffic noise, for the same equivalent mean level expressed in Lden or Ln.
- Recent scientific publications confirm that certain **biological effects**, such as changes in heart rate at night and sleep disturbance, **are more closely linked to noise events than to average noise**
- People living near airports claim for greater consideration to be given to the **number and characteristics of noise peaks**, using event-based indicators
- Event-based indicators such as **LAmax and SEL** (for individual peaks) as well as **NAX indicators** are now used operationally in the field of air traffic noise

Shortcomings of NAX-type indicators

- **The threshold effect**. The choice of threshold (NA62, NA65, NA70, etc.) is relatively arbitrary. In a context of expected growth in air traffic combined with fleet renewal, resulting in an increase in the number of overflights by aircraft generating slightly less noise than before, NAX-type indicators could prove inadequate to reflect changes in people's perceptions.

Example of a theorical change (growth in air traffic combined with fleet renewal)

BEFORE	AFTER
100 with LAmax=66 dB(A)	160 with LAmax=64 dB(A)
LAeq-type indicator (Lden, Ln) unchanged	
NA65=100	NA65=0 (no more problems?)
NA62=100	NA62=160 (+60%)

But what about annoyance?

- **The 0 or 1 effect.** This does not allow to see detailed changes in the situations

All events with a LAmax value >= the X threshold count as 1

All events with a LAmax value < the X threshold count as 0

Principle of the point-based noise event counter

- **Alternative idea of indicator: Noise Point Counter (NPC)**

Principle : count all noise peaks generated by aircraft overflights, weighting each peak according to its acoustic characteristics and period of occurrence which can influence annoyance

- **1st stage: Assign a number of points (NP) to each noise peak**

A first proposal, convert the SEL to NP: $NP = 2^{(SEL-SELref)/X}$ (X and SELref to be specified)

Principle of a doubling of the instantaneous annoyance associated with an X dB increase in SEL

2nd stage: Sum the points assigned to events over periods of time of interests for each day (day, evening, night)

$NPC_d = \sum_{i=1}^{Nd} NPi$

$NPC_e = \sum_{i=1}^{Ne} NPi$

$NPC_n = \sum_{i=1}^{Ne} NPi$

- **3rd stage: Build an aggregate counter using a set of weightings by period of appearance** (day, evening, night), possibly also taking into account a distinction between working days and weekend days, or even by season.

$$NPC_{den} = NPC_d + \propto * NPC_e + \beta * NPC_n$$

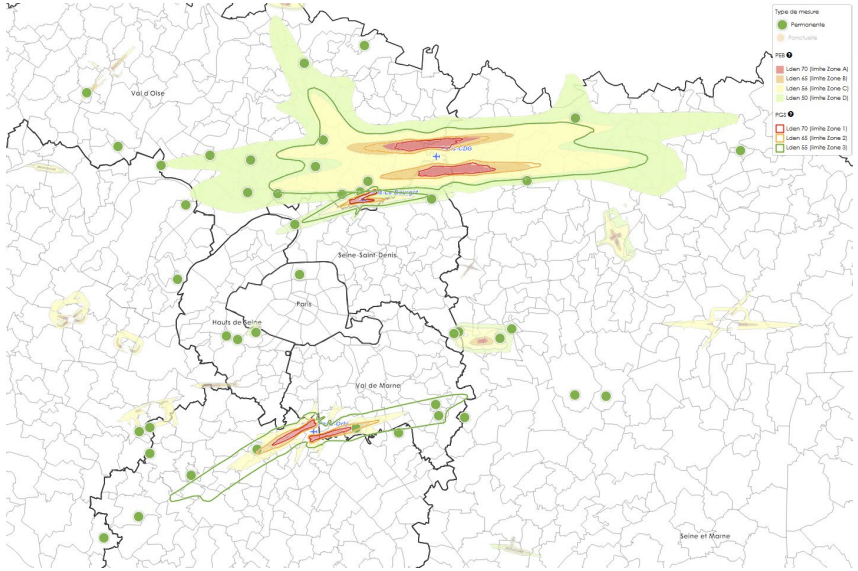
Aim of the COGEN'AIR study

- **A faisability study**
- **To validate the interest in developing the Noise Point Counter (NPC)**
- **To propose an adjustment of the formula**

  Main challenges to be overcome
  - Relevance of the **SEL** indicator as a reference index for acoustic characterization of noise peaks
  - Proposed values for parameters **X** and **SELref** for adjustment of the SEL to NP conversion formula
  - Determination of weighting coefficients **α, β** for different periods
- **By involving local residents in the development of the indicator**

Outline of the COGEN'AIR study protocol

- **Coordination by Bruitparif, the noise observatory for Ile-de-France region**
  - A large noise measurement network (>200 permanent monitoring sites, including 40 related to air traffic noise)
  - Participation in research projets
  - Support for local and regional public policies on noise abatement
  - A collegial governance bringing together different stakeholders
- **Where?** In areas exposed to air traffic noise in the Ile-de-France region
- **Involve citizen participation**
- **Duration : 2 years** (2025-2026)

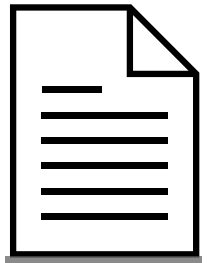


- **Project supported by French public authorities** (ANSES, ARS IdF, Region IdF)
- **4 phases**

Phase 1:
Preparation of the framework for citizen contribution

- **Selection of 3 pilot sites**
  - Various contexts in terms of exposure to air traffic noise
  - Sector where a Bruitparif measuring station has been in operation for several years
  - Site with low noise from other sources
- **Participants recruitment**
  - Among residents at the pilot sites
  - By the way of a call for volunteers relayed by the municipality or local associations
  - Objective: 30 participants at each pilot site → around 90 participants

Phase 2:
Data collection in 3 complementary ways



Forms

- **General questionnaire to characterize the long-term annoyance**
  - Face-to-face at each participant's home
  - Gather information on the participant's profile, housing, appreciation of their neighborhood and environment, living habits, annoyance linked to noise in general and aircraft noise in particular, individual sensitivity to noise and perception of air transport
- **Dashboard to collect daily information on short-term annoyance during a 15-day period**
  - For each period of the day (day, evening, night), the participant will record main activities carried out, main location, average level of annoyance in relation to air traffic noise (scale 0-10 ISO-15666), specific observations…
  - Air traffic noise will be measure simultaneously
- **Collective rating sessions**
  - In outdoor spaces located in the immediate vicinity of the permanent noise stations
  - By use of remote notation devices to record, for each participant, the rating of instantaneous annoyance generated by aircraft overflights

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Phase 3:
Data analysis

- **Long-term annoyance**
  - Descriptive analysis of answers provided in the general questionnaire
  - Assessment of factors significantly associated with long-term annoyance
- **Short-term annoyance**
  - Analysis of variations in short-term annoyance in order to determine the weighting coefficients (α, β) to be applied to a point-based noise event counter to take account of sensitivity as a function of period.
- **Instantaneous annoyance**
  - Instantaneous annoyance ratings will be associated with the acoustic characteristics of overflights
  - The aim is to validate whether SEL descriptor best correlates with instantaneous annoyance, and to determine the coefficients (X, SEL_{ref}) to be applied to the calculation of the number of points (NP).

Phase 4:
Evaluation of the proposed point-based noise event counter via focus groups

- **Adjustment of the formula for calculating NPC** according to results from analysis
- **Operational implementation of the NPC** + a posteriori recalculation on available historical noise measurement data
- **Focus groups** with participants at each site to share the results of the NPC, and to gather feedback on its ability to accurately reflect the variability of air traffic noise annoyance according to overflight periods and conditions

Originality, expected outcomes and impacts

- **Originality:**
  - **Innovative approach**
  - Instantaneous ratings of annoyance generated by aircraft overflights **in situ and by residents,** and not under laboratory conditions
  - **Attention paid to variations of short-term annoyance** with overflight conditions and periods
  - **Citizen participation** in the co-construction of the indicator
- **Main expected outcomes:**
  - **Validate the feasibility** of developing an operational indicator to better consider variability of residents' annoyance as a function of air traffic conditions and the period of occurrence of overflights
  - **Experiment a protocol**
  - **Give recommendations** to carry out a larger scale study deployed in vicinity of different airports at national or European level
- **Expected impact:**
  - Provide an **operational tool to assess and monitor air traffic noise evolutions**

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Thanks a lot!

Any questions?

To contact us, send a mail to: demande@bruitparif.fr

Visit our website: https://www.bruitparif.fr

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