

NOISECAPTURE VS NOISEMODELLING:

*A test case on Sherbrooke
university campus*

Léonor Rimani¹, Lucie Devocelle-Chavanel¹, Olivier Robin¹

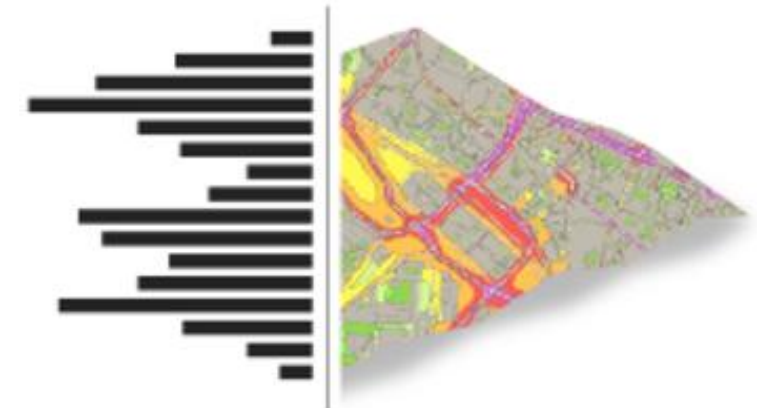
¹ CRASH, Faculté de Génie, Université de Sherbrooke

INTRODUCTION

- Objectives:
 - Creation of a true-to-life numerical model thanks to periodic measurements
 - Comparison of numerical model and measurements thanks to:



NoiseCapture



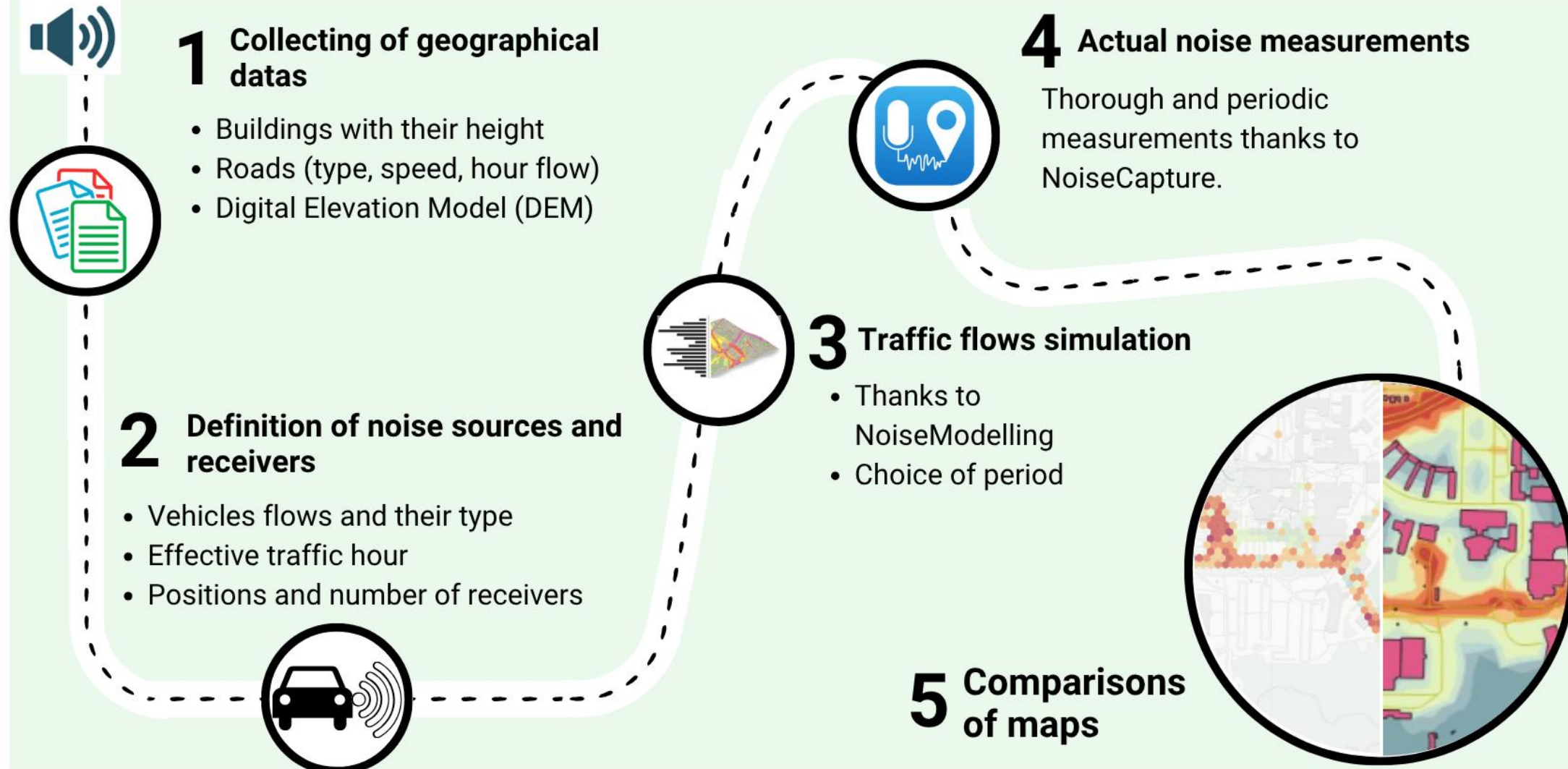
NoiseModelling



MIXED METHODOLOGY

- Simulation methodology
- Measurements methodology
- Studied area

METHODOLOGY

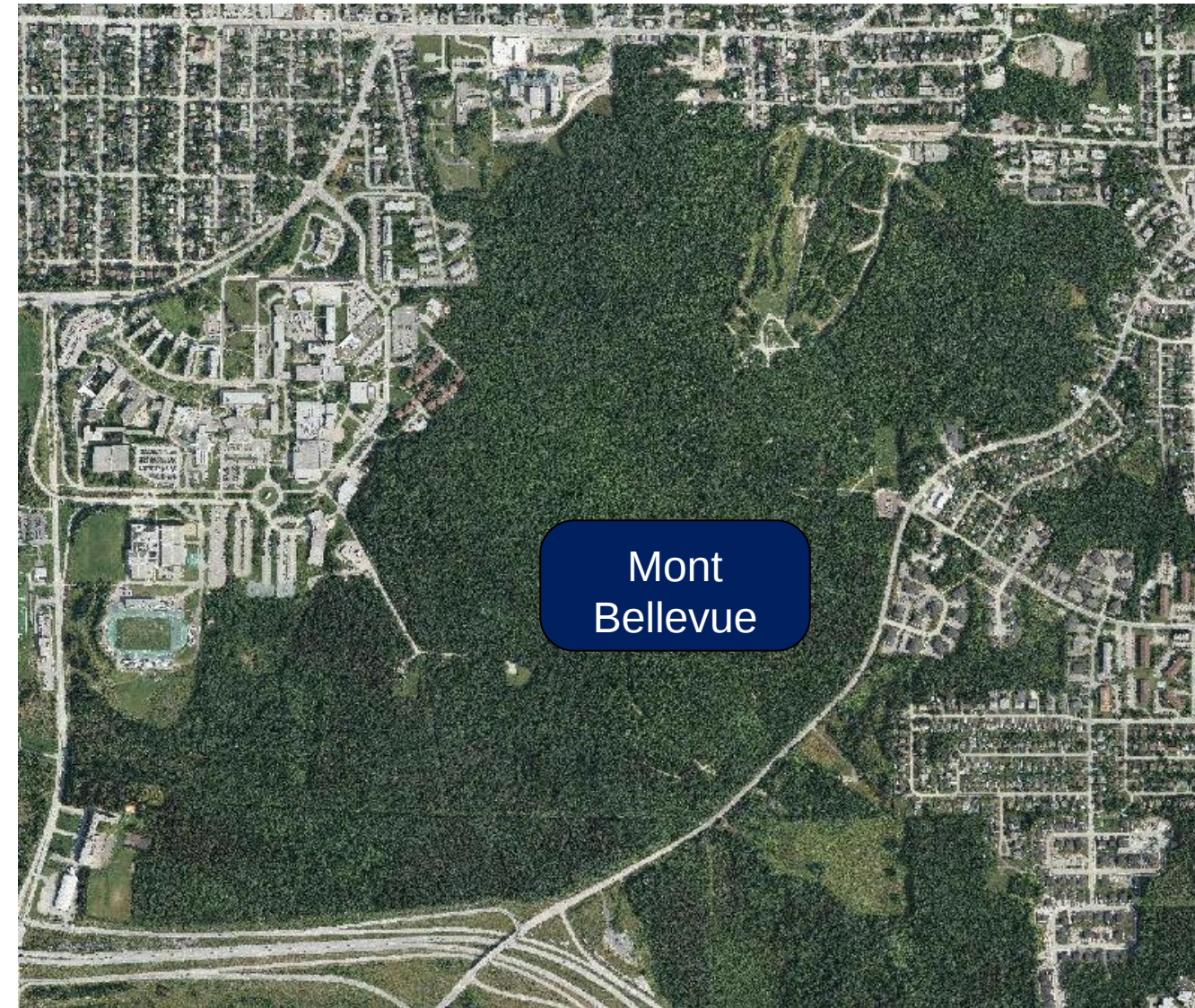


STUDIED AREA



STUDIED AREA

- Easy to take measurements whenever we want
- A well known area
- Different type of places :
 - university campus, highway, forest...



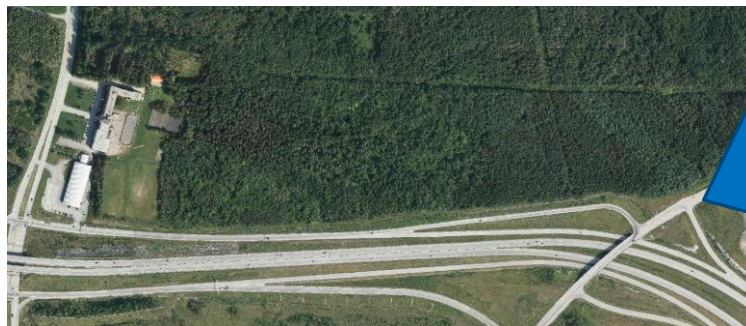
*Aerial view of Sherbrooke around Mont Bellevue
(ville de Sherbrooke)*

STUDIED AREA

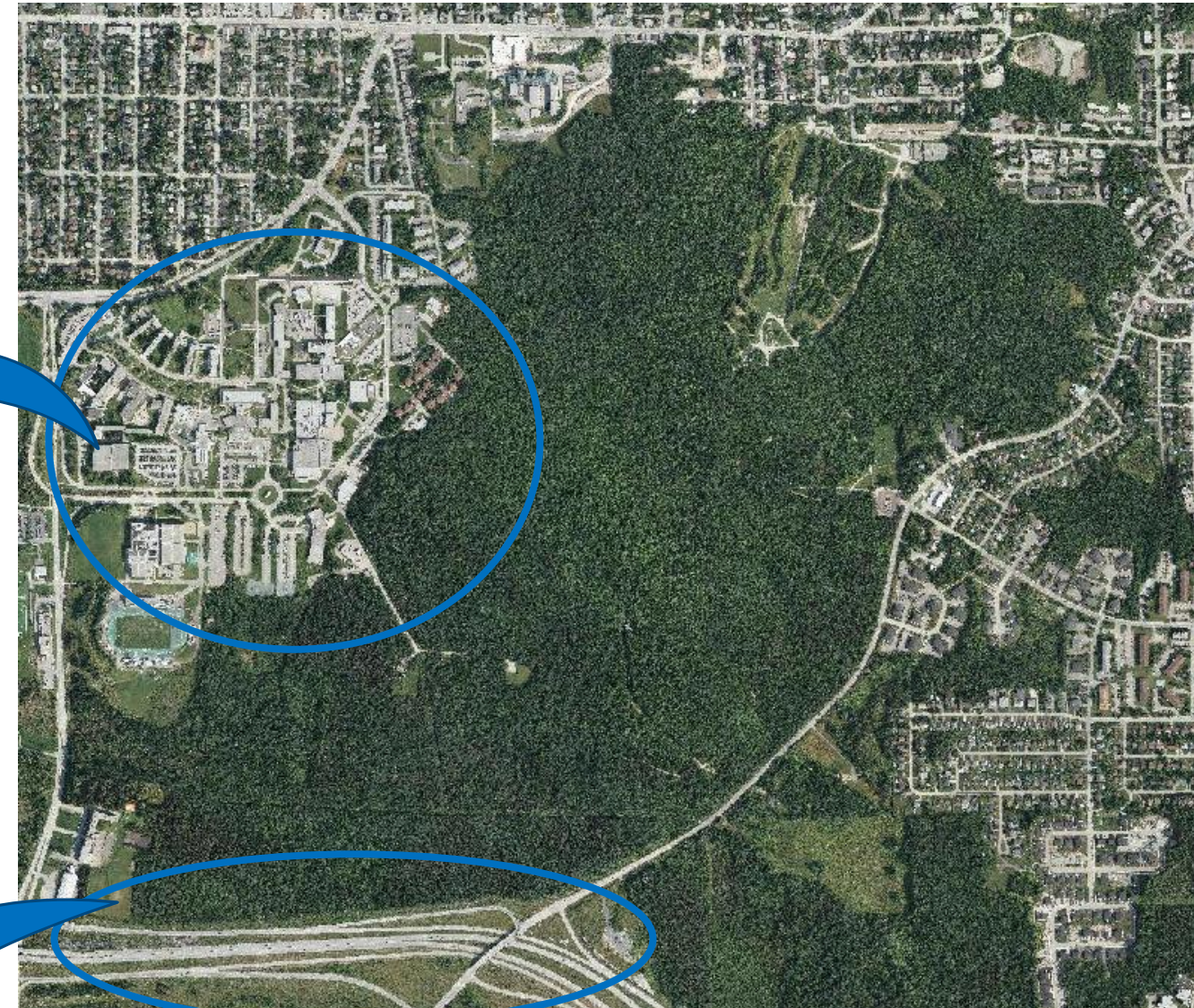
- Easy to take measurements whenever we want
- A well known area
- Different type of places :
 - university campus, highway, forest...



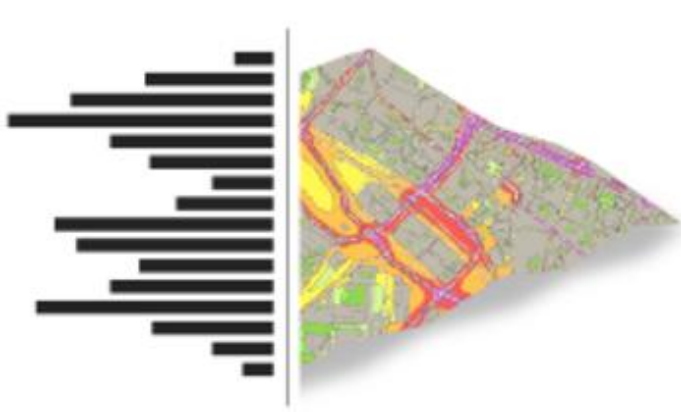
Aerial the University (ville de Sherbrooke)



Aerial the highway (ville de Sherbrooke)



Aerial view of Sherbrooke around Mont Bellevue (ville de Sherbrooke)



NOISEMODELLING: STATIC STUDIES

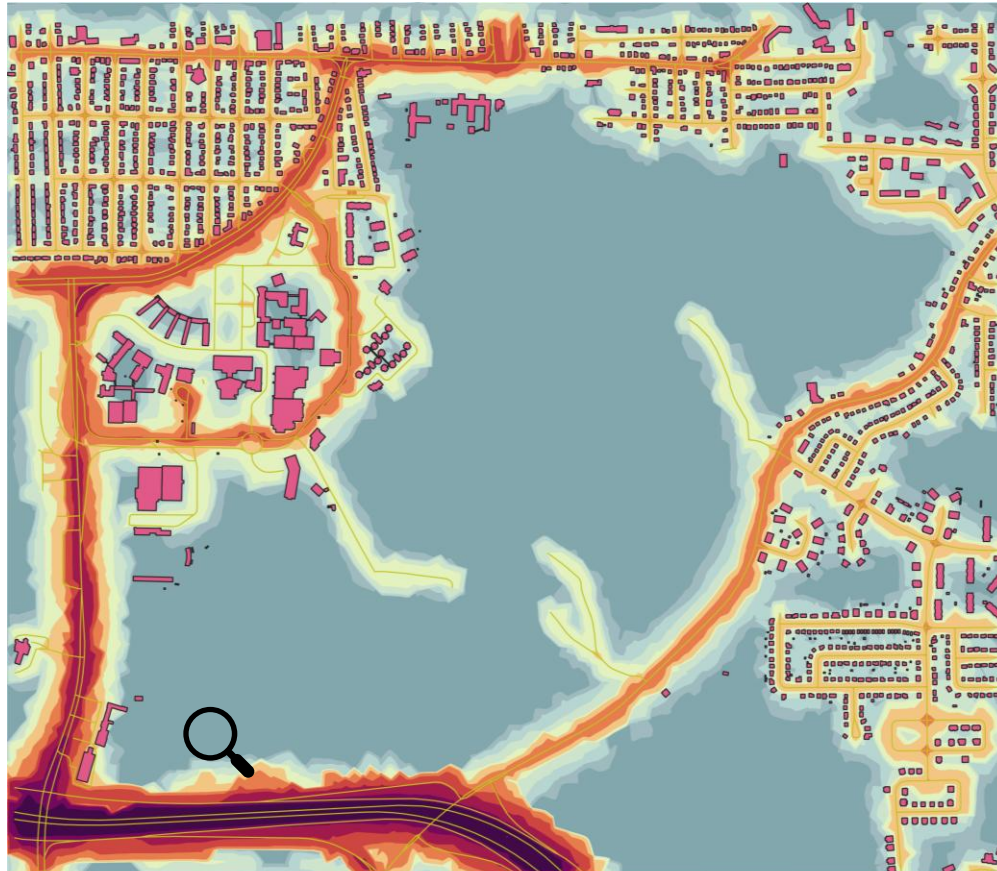
- Number of vehicles per roads : equivalence model
- Digital Elevation Model's influence (DEM)
- Comparison Day VS. Night

STATIC MAP: MODEL DEFINITION

- **Hypothesis:**
 - Flows hour data: donneesquebec.ca (only few axes)
 - Buses flows estimation
 - Week vs weekend
 - Fixed humidity and temperature (for now)
 - Receivers at 4 meters
- **Equivalence model (study in progress):**
 - Association of vehicles number's per roads type for the Canadian roads



DIGITAL ELEVATION MODEL (DEM): A KEY POINT



LDay map focus on mont Bellevue **WITH DEM**
taking into account



LDay map focus on mont Bellevue **WITHOUT DEM**
taking into account



Sherbrooke isosurfaces' map
around the highway

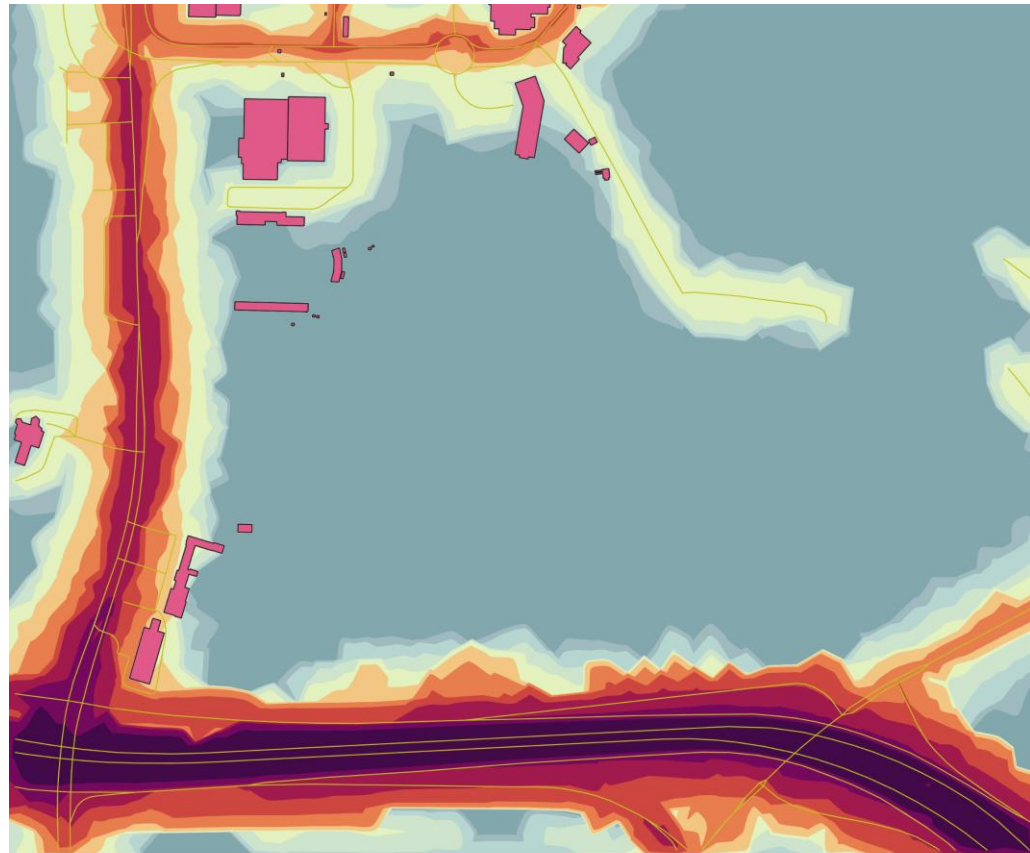
Key :

Buildings (pink)

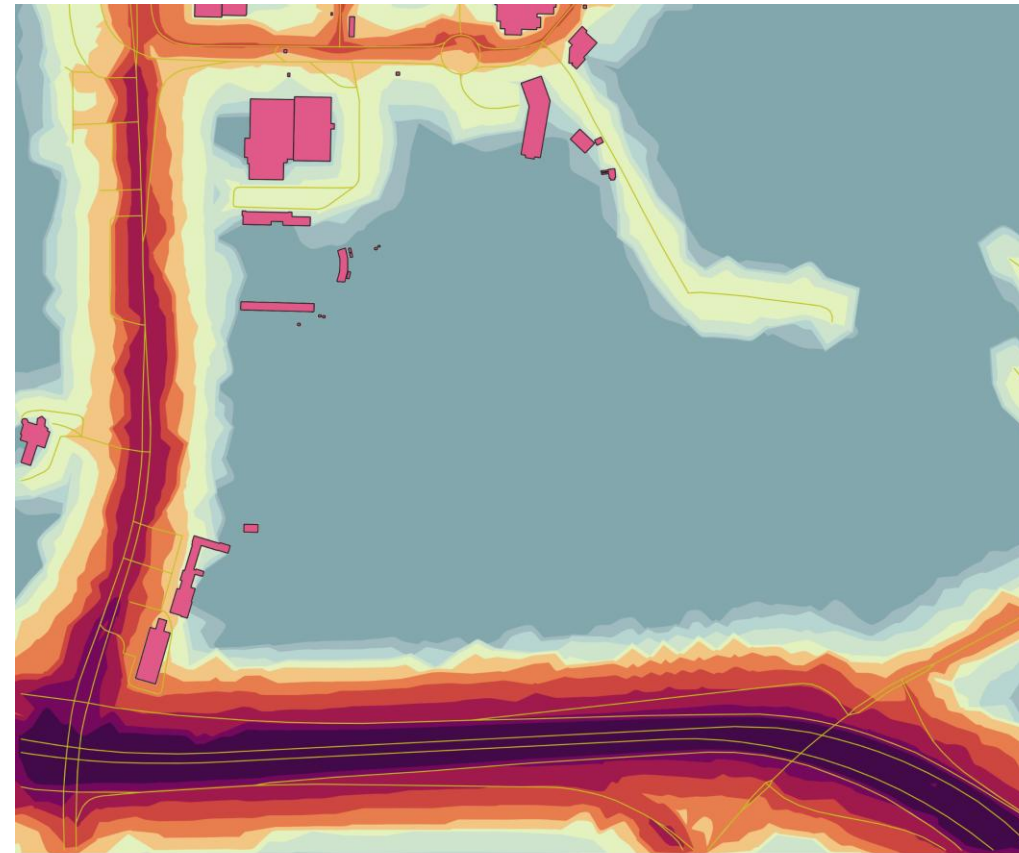
isodB below (level in dBA):

✓ inf. 35	✓ 40-45
✓ 35-40	✓ 45-50
✓ 50-55	✓ 60-65
✓ 55-60	✓ 65-70
✓ 70-75	✓ sup. 80
✓ 75-80	

DIGITAL ELEVATION MODEL (DEM): LAYOUT'S IMPACT



0 100 200 m
LDay map focus on the highway **WITH** DEM taking into account



0 100 200 m
LDay map focus on the highway **WITHOUT** DEM taking into account

Key :

Buildings (pink)

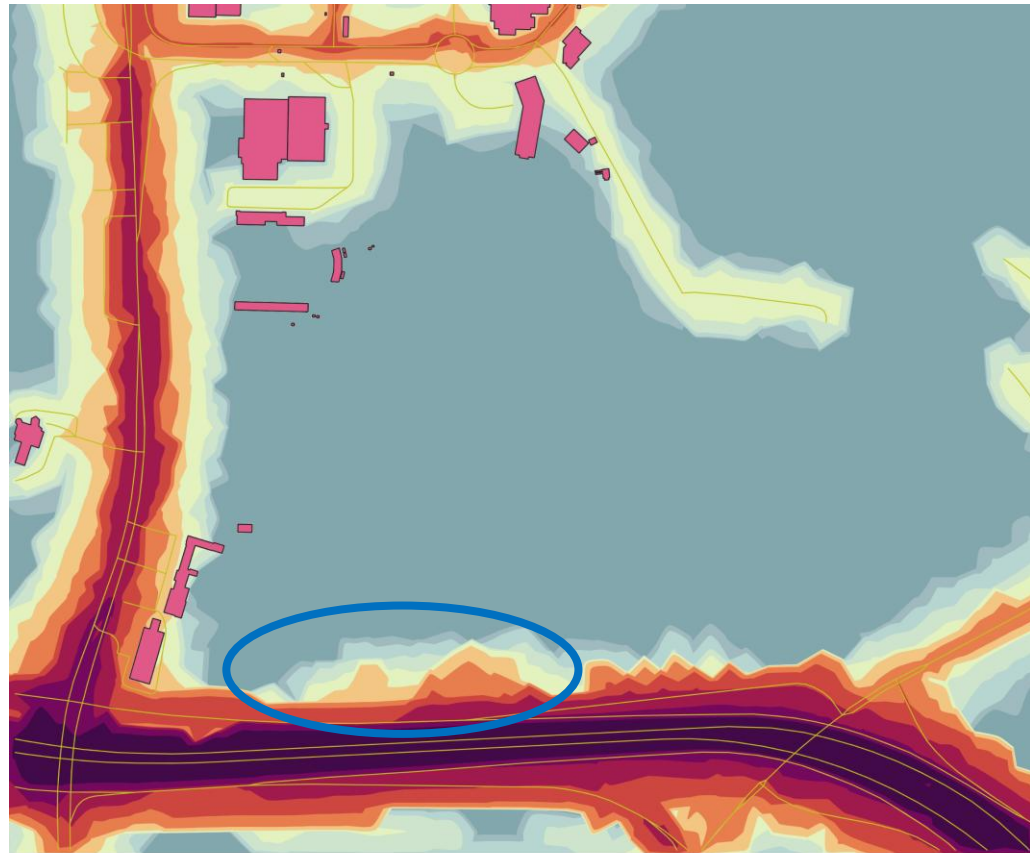
isodB below (level in dBA):

✓ inf. 35	✓ 40-45
✓ 35-40	✓ 45-50
✓ 50-55	✓ 60-65
✓ 55-60	✓ 65-70
✓ 70-75	✓ sup. 80
✓ 75-80	

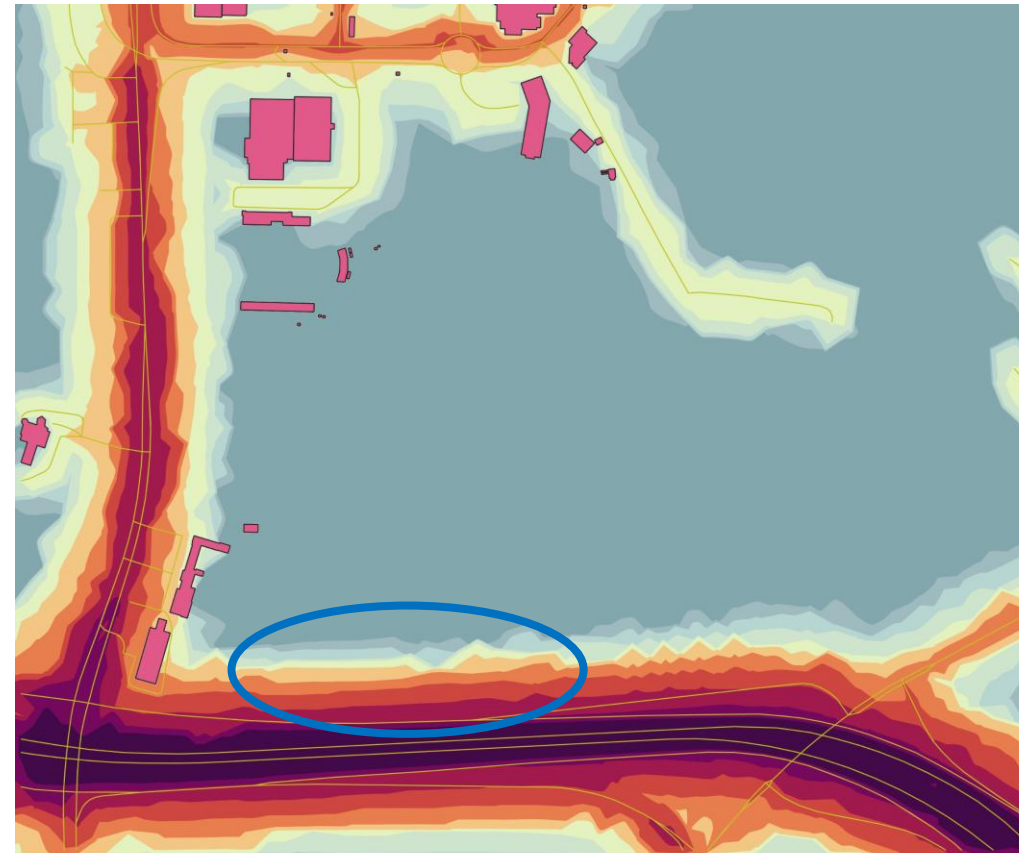


Sherbrooke isosurfaces's map around the highway

DIGITAL ELEVATION MODEL (DEM): LAYOUT'S IMPACT



0 100 200 m
LDay map focus on the highway **WITH** DEM taking into account



0 100 200 m
LDay map focus on the highway **WITHOUT** DEM taking into account

Key :

Buildings (pink)

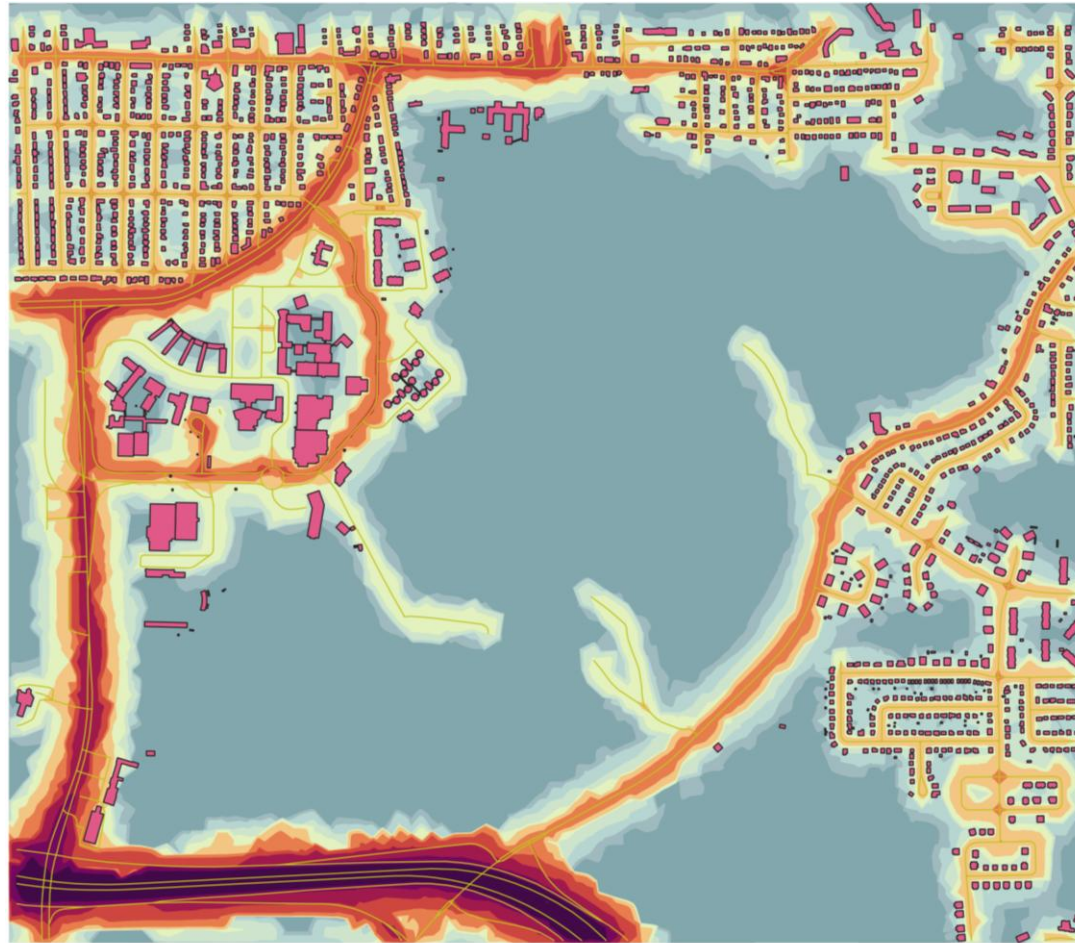
isodB below (level in dBA):

✓ inf. 35	✓ 40-45
✓ 35-40	✓ 45-50
✓ 50-55	✓ 60-65
✓ 55-60	✓ 65-70
✓ 70-75	✓ sup. 80
✓ 75-80	

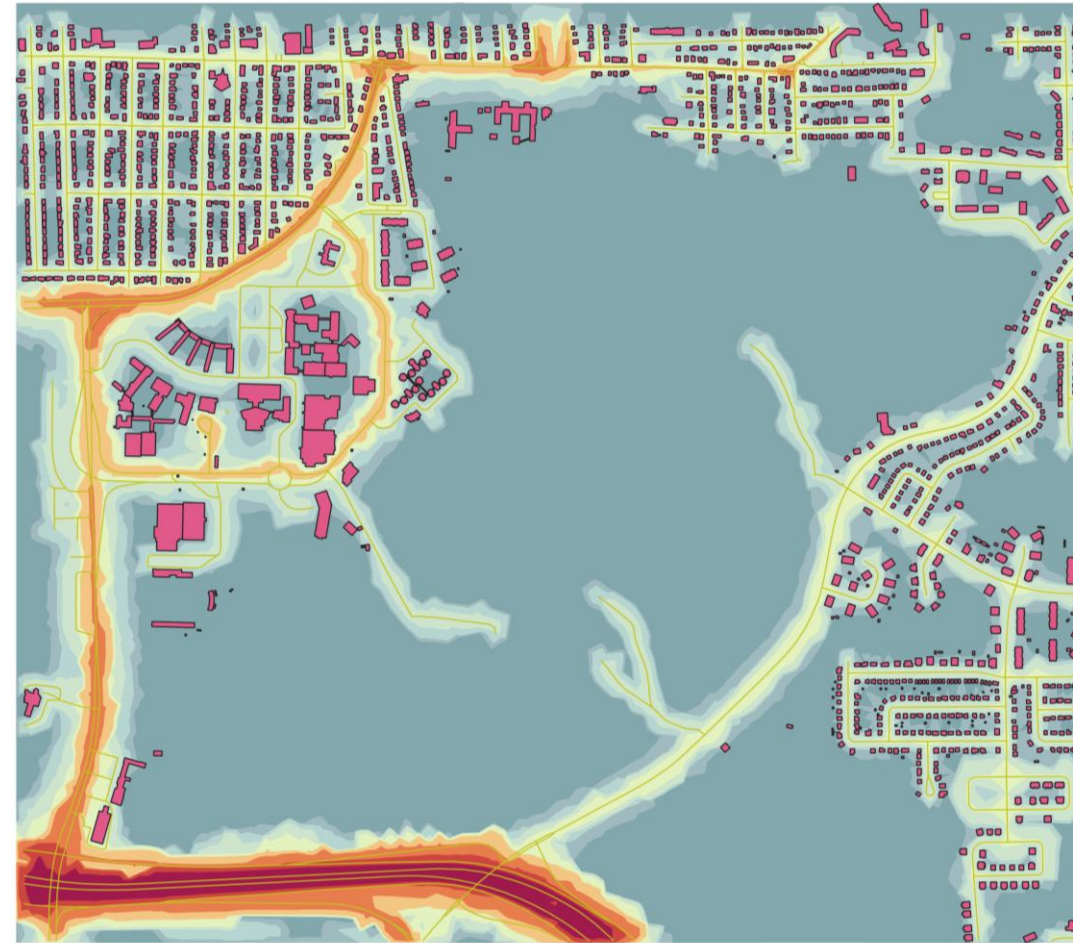


Sherbrooke isosurfaces's map around the highway

COMPARISON DAY VS. NIGHT



LDay map focus on mont Bellevue with DEM taking into account



LNight map focus on mont Bellevue with DEM taking into account

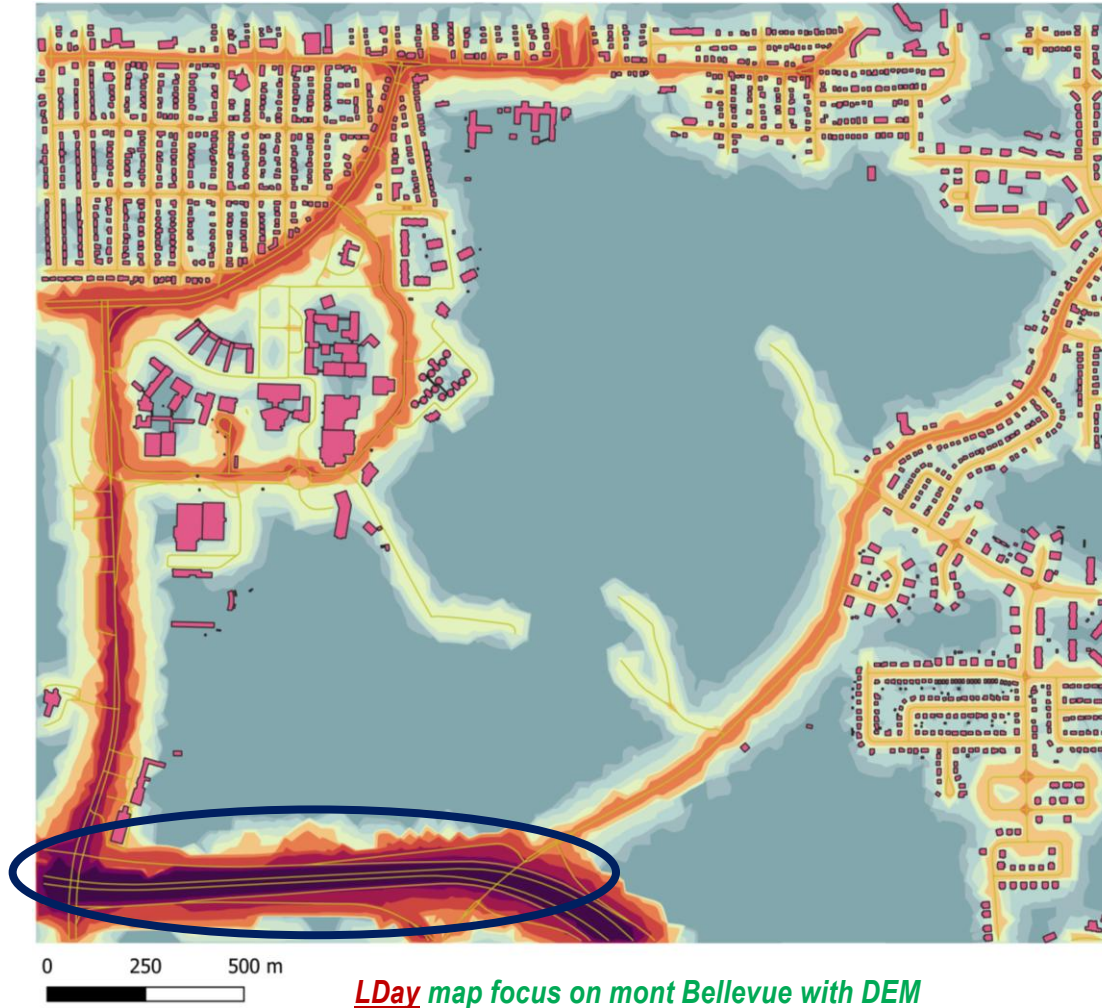
Key :

Buildings (pink)

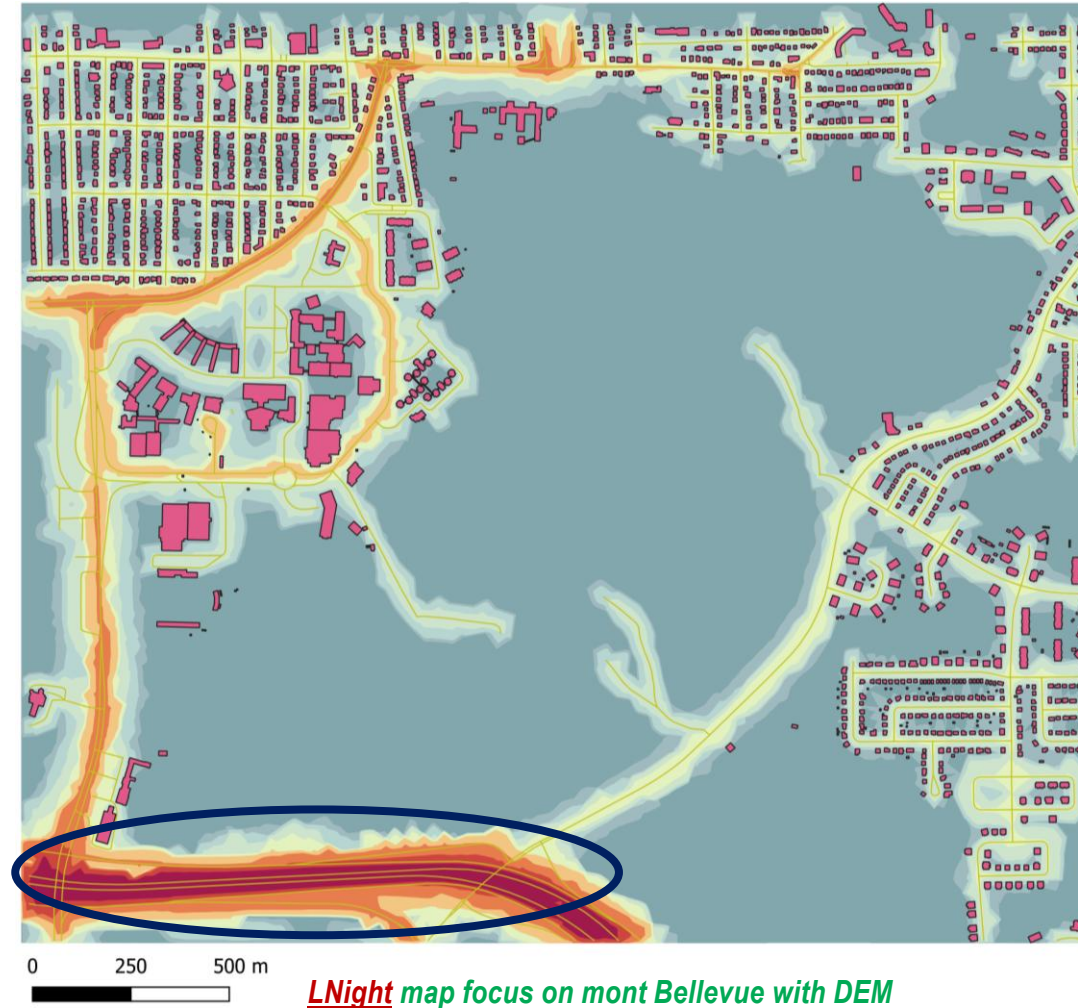
isodB below (level in dBA):

✓	inf. 35	✓	40-45
✓	35-40	✓	45-50
✓	50-55	✓	60-65
✓	55-60	✓	65-70
✓	70-75	✓	sup. 80
✓	75-80		

COMPARISON DAY VS. NIGHT



LDay map focus on mont Bellevue with DEM taking into account

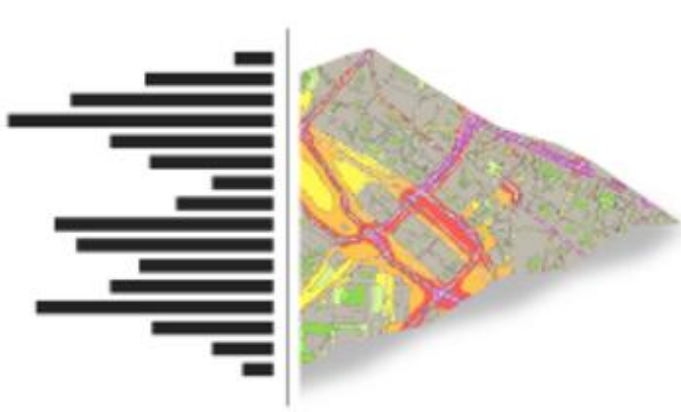


LNight map focus on mont Bellevue with DEM taking into account

Key :

Buildings (pink)
isodB below (level in dBA):

✓	inf. 35	✓	40-45
✓	35-40	✓	45-50
✓	50-55	✓	60-65
✓	55-60	✓	65-70
✓	70-75	✓	sup. 80
✓	75-80		



NOISEMODELLING: DYNAMIC STUDIES

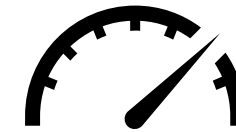
- Model definition
- Evolution of traffic flows at regular intervals



DYNAMIC MAP: MODEL DEFINITION

- **Hypothesis:**

- Buses flows only
- Speed variation according to the road segment
- Receivers every 10 meters

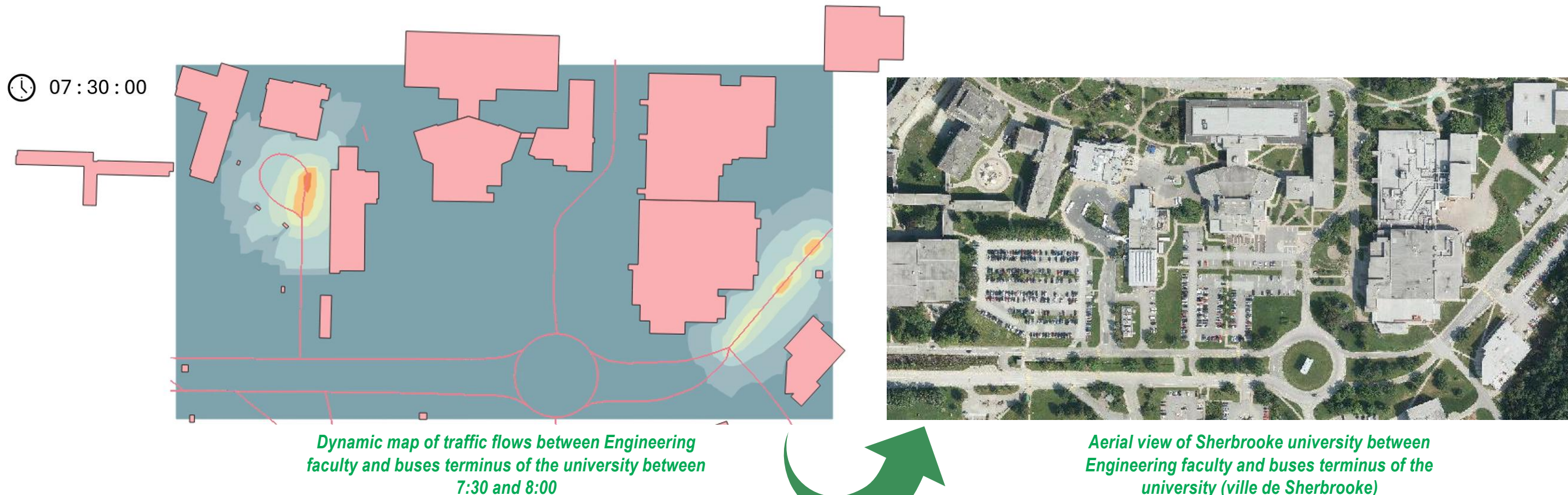


- **Model:**

- simulation of stop ?



DYMANIC MAP: EVOLUTION OF TRAFFIC FLOWS AT REGULAR INTERVALS



Key :

Buildings (pink)

isodB on the right (level in dBA):

✓ inf. 35	✓ 40-45	✓ 50-55
✓ 35-40	✓ 45-50	✓ 55-60
✓ 60-65	✓ 70-75	✓ sup. 80
✓ 65-70	✓ 75-80	

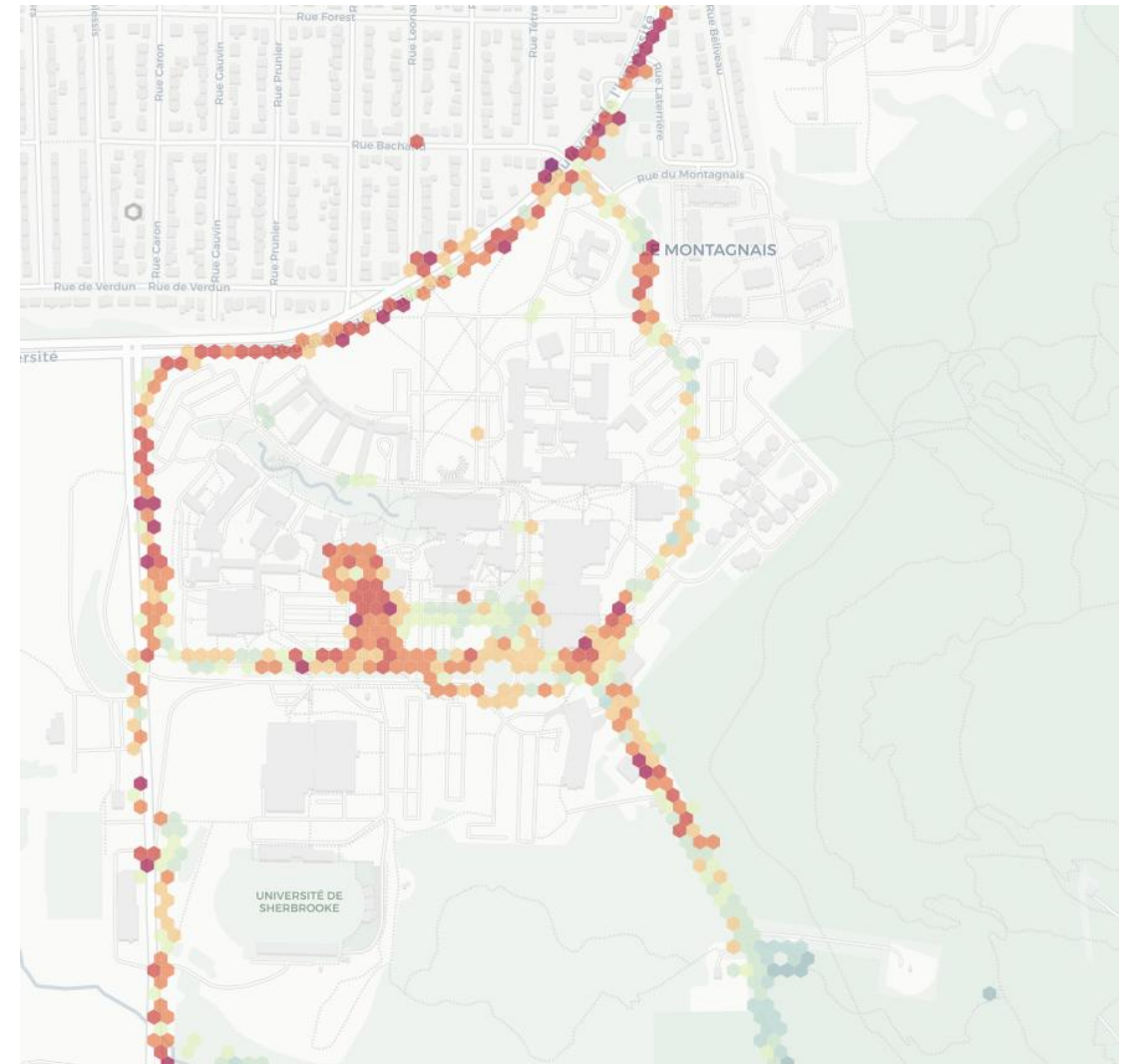


NOISECAPTURE: MEASUREMENTS

- Protocol and map
- Data processing (Python programs)

NOISECAPTURE: PROTOCOL AND MAP

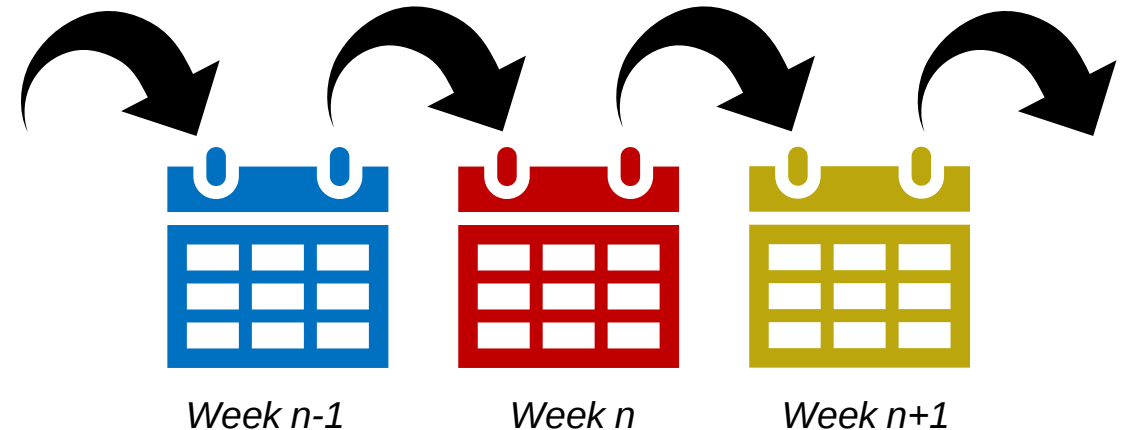
- **Protocol:**
 - Minimum 2 cellphones calibrated each weeks thanks to class two sonometer
 - Around the same hour each days
 - Define travel around the campus
 - Weather data acquisition (cellphones)



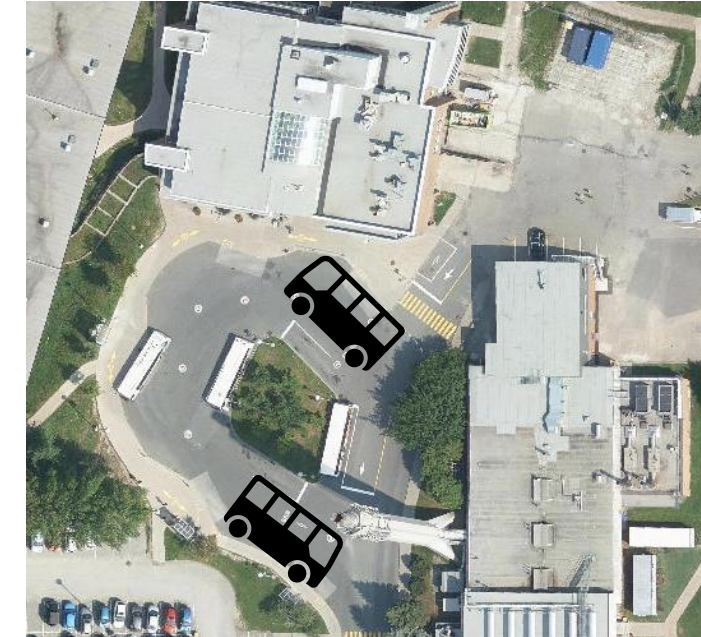
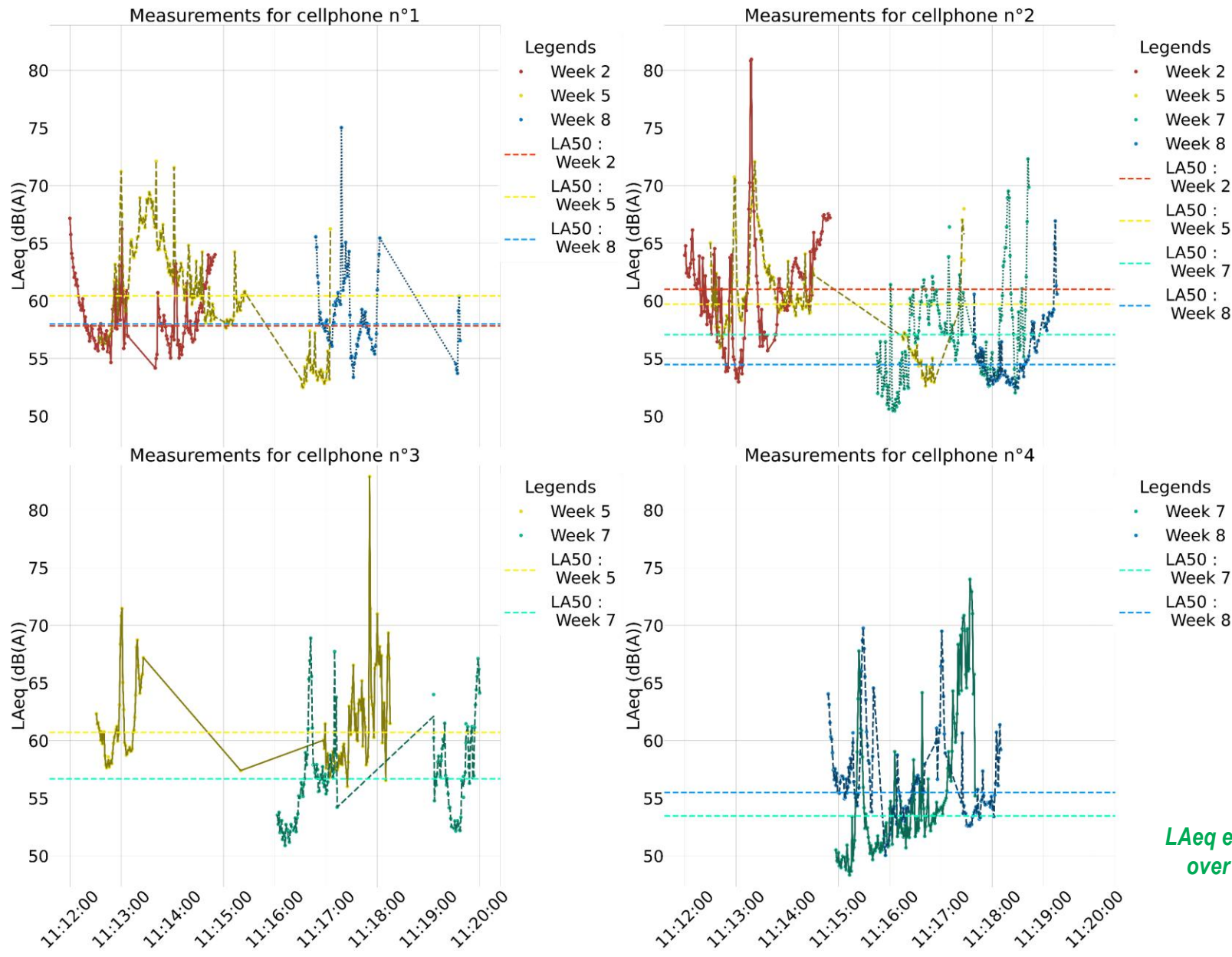
Participative and interactive map « NoiseCapture Party » for Sherbrooke University campus

NOISECAPTURE: DATA PROCESSING

- **Method:**
 - Definition of geographical aeras
 - Measurements gathered by these aeras
 - Comparison week after week
 - Comparison on the same week day after day
- **Parameters ?**
 - Wind influence
 - Temperature, humidity...



COMPARISON WEEK AFTER WEEK

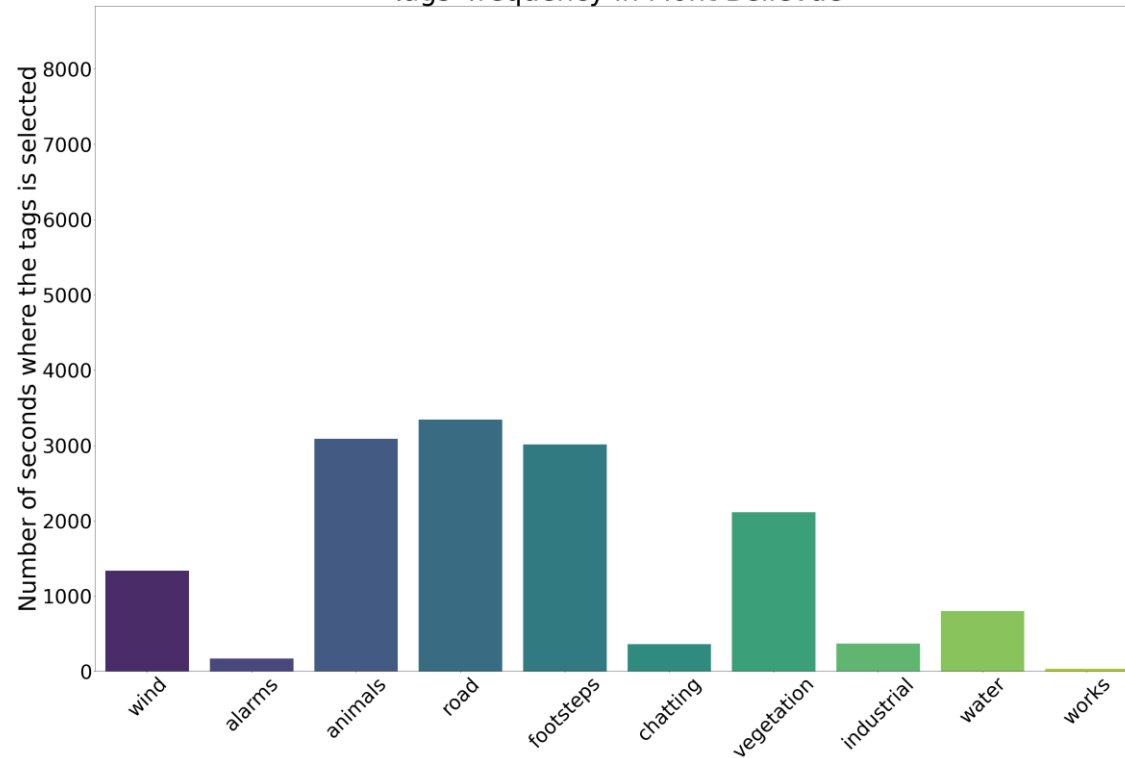


Aerial view of buses terminus area of Sherbrooke university (ville de Sherbrooke)

LAeq evolution in buses terminus area over the weeks for each cellphone

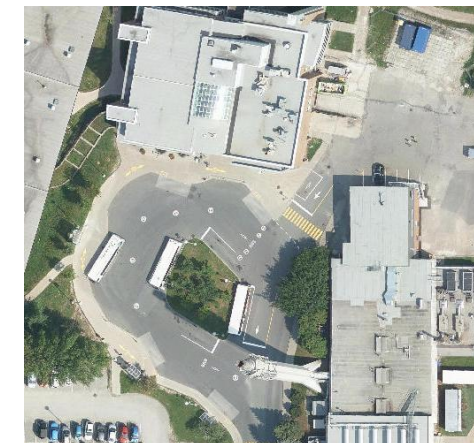
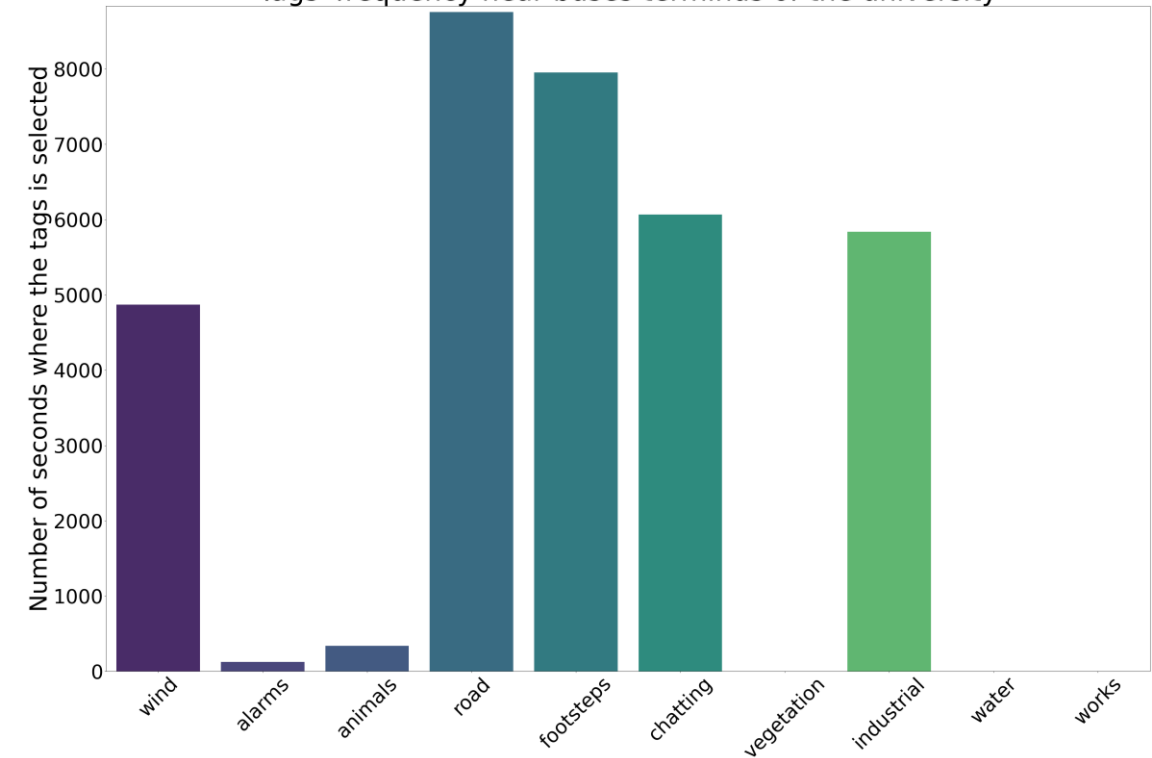
TAGS REPARTITION

Tags' frequency in Mont Bellevue



Aerial view of Mont Bellevue sector (ville de Sherbrooke)

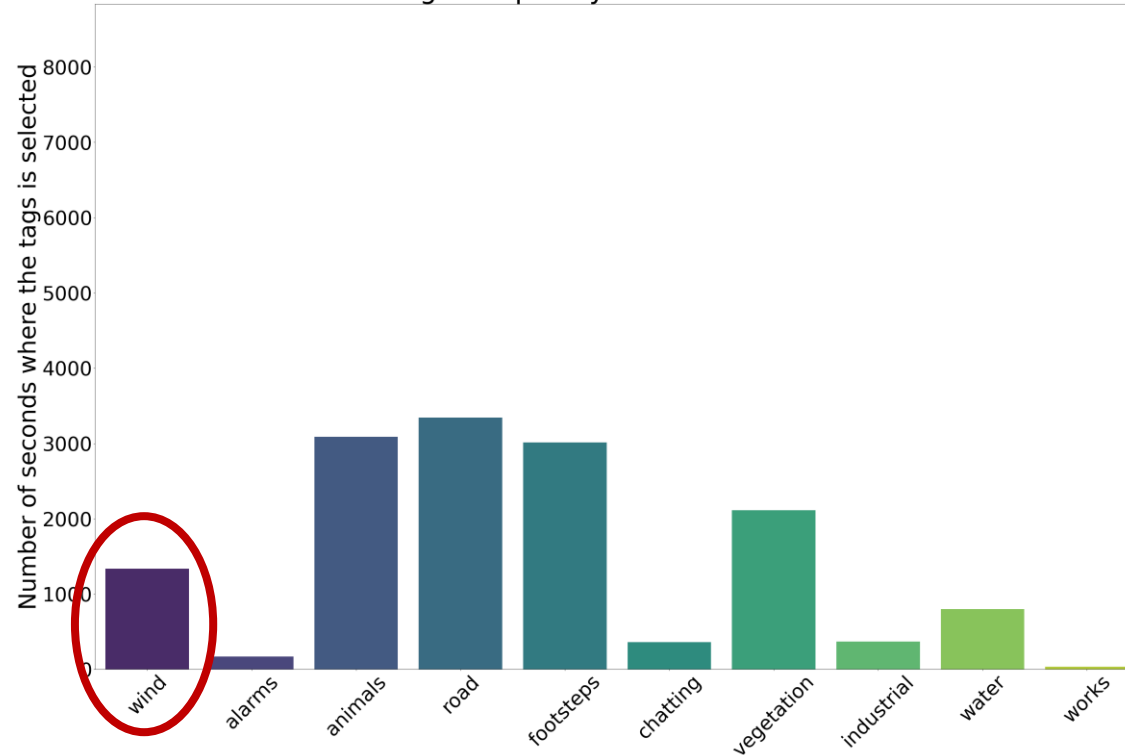
Tags' frequency near buses terminus of the university



Aerial view of buses terminus area of Sherbrooke university (ville de Sherbrooke)

TAGS REPARTITION

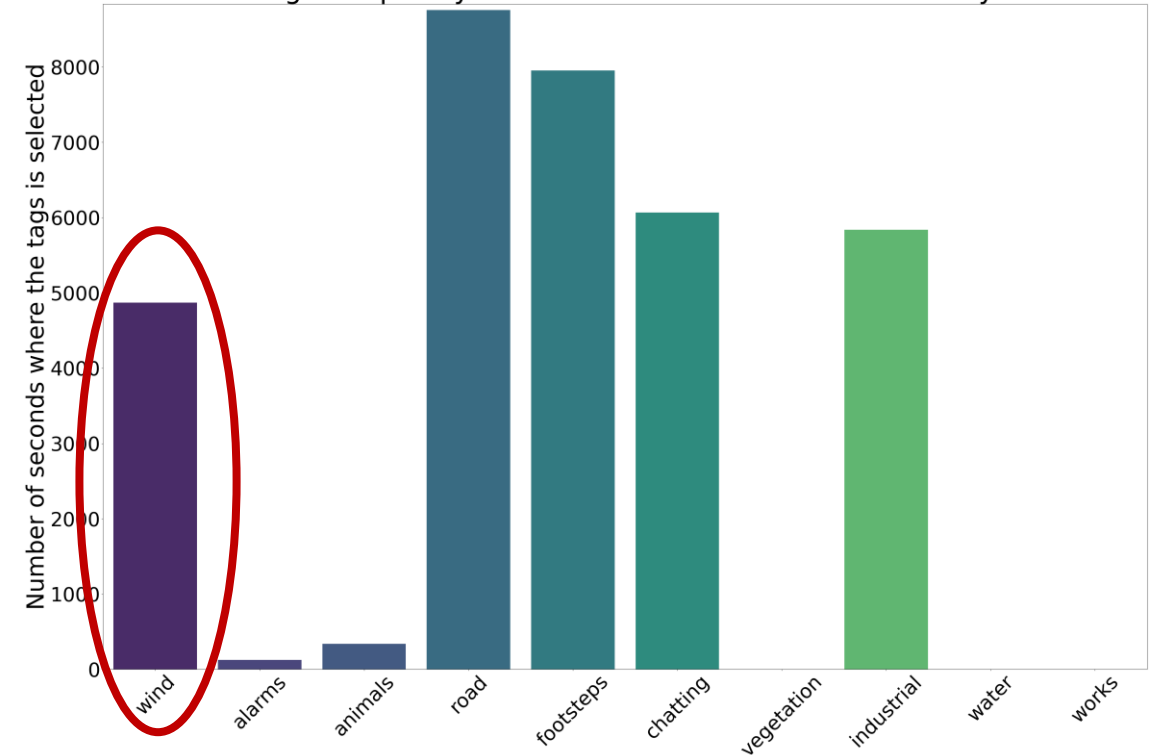
Tags' frequency in Mont Bellevue



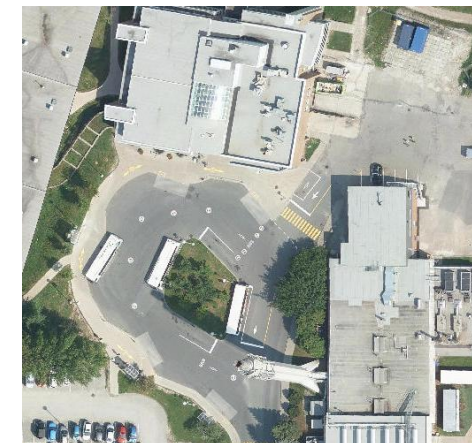
Aerial view of Mont Bellevue sector (ville de Sherbrooke)



Tags' frequency near buses terminus of the university

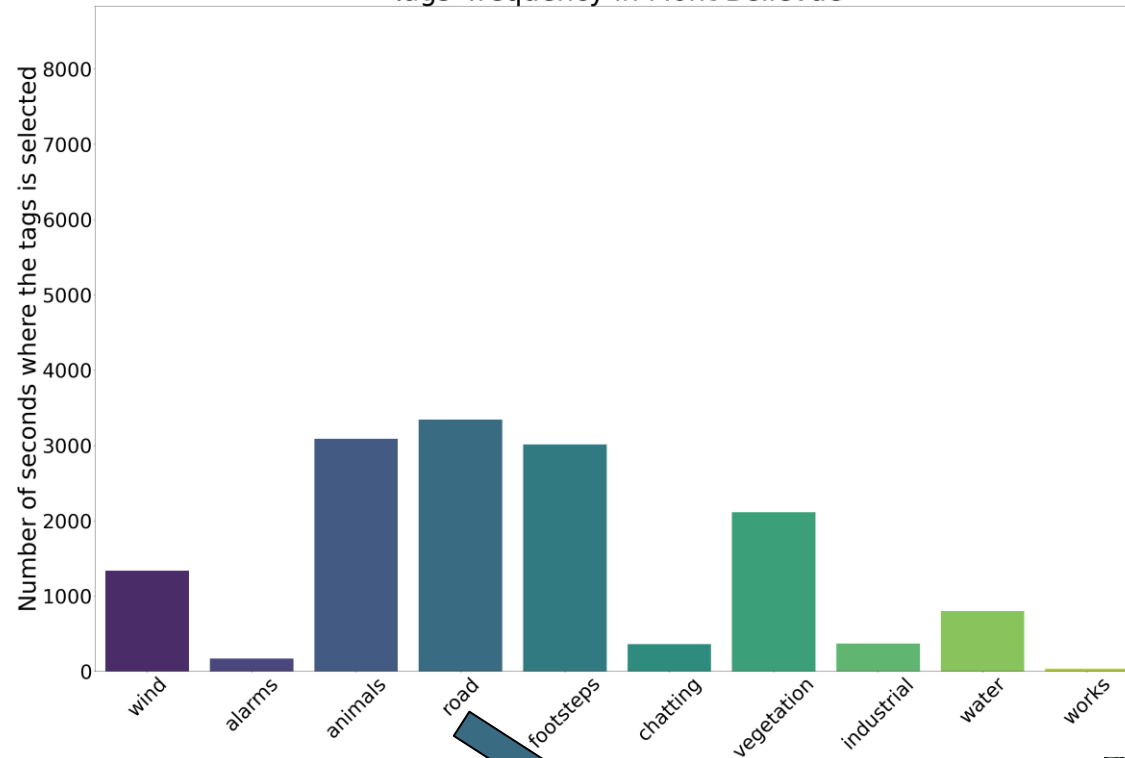


Aerial view of buses terminus area of Sherbrooke university (ville de Sherbrooke)



TAGS REPARTITION

Tags' frequency in Mont Bellevue

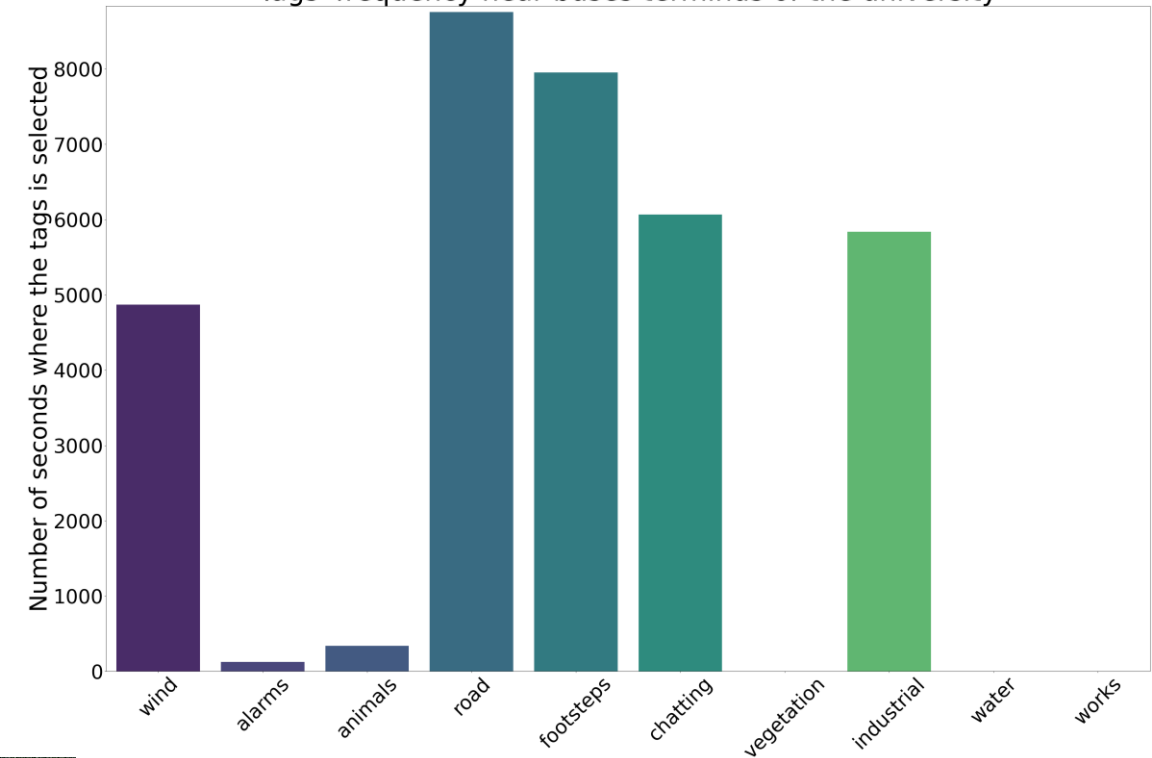


Aerial view of Mont Bellevue sector (ville de Sherbrooke)

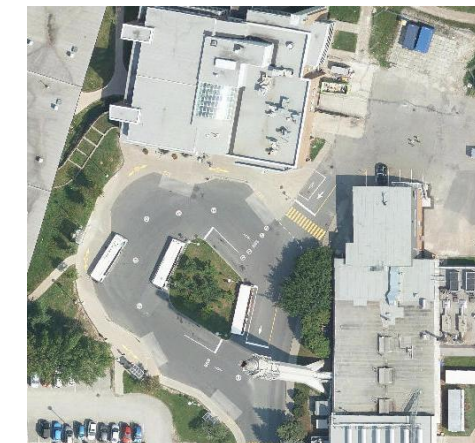


The highway

Tags' frequency near buses terminus of the university

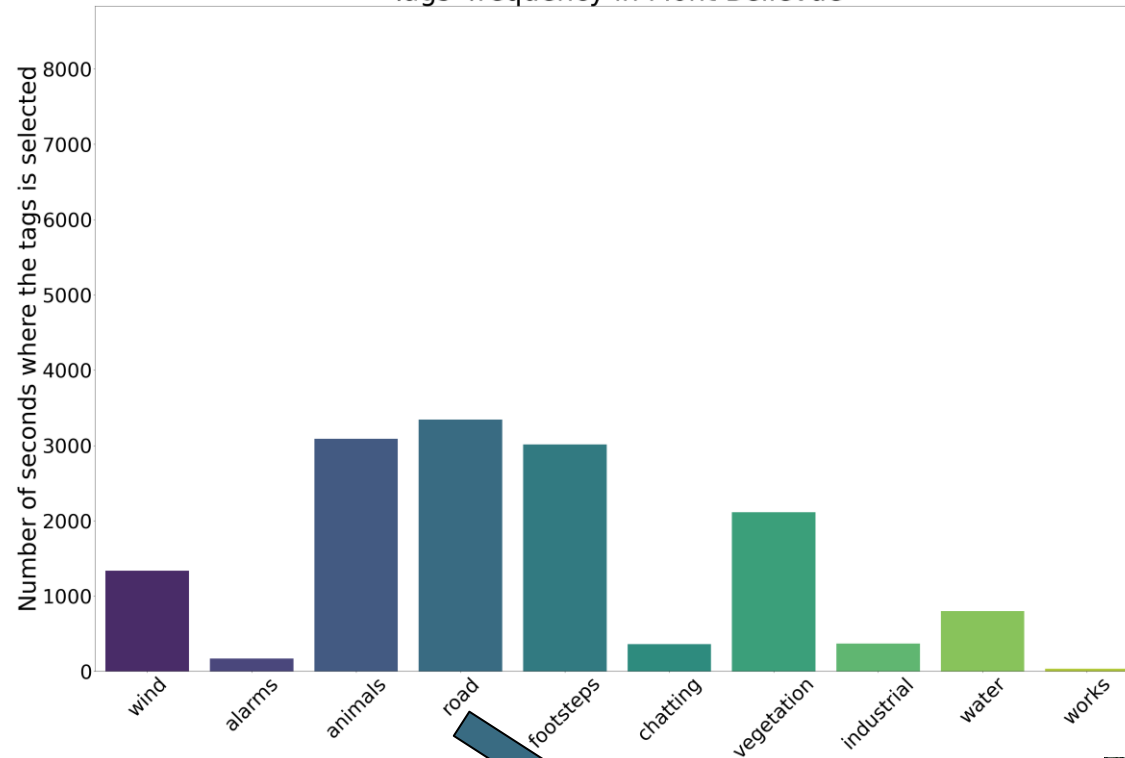


Aerial view of buses terminus area of Sherbrooke university (ville de Sherbrooke)



TAGS REPARTITION

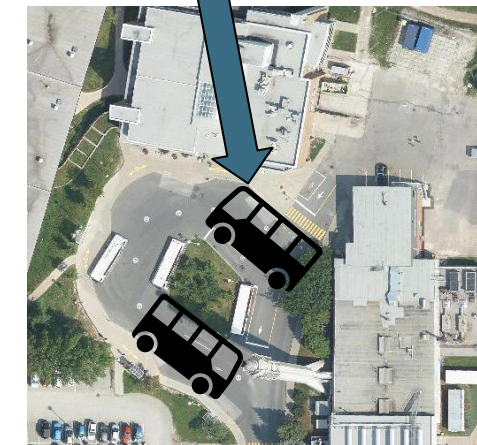
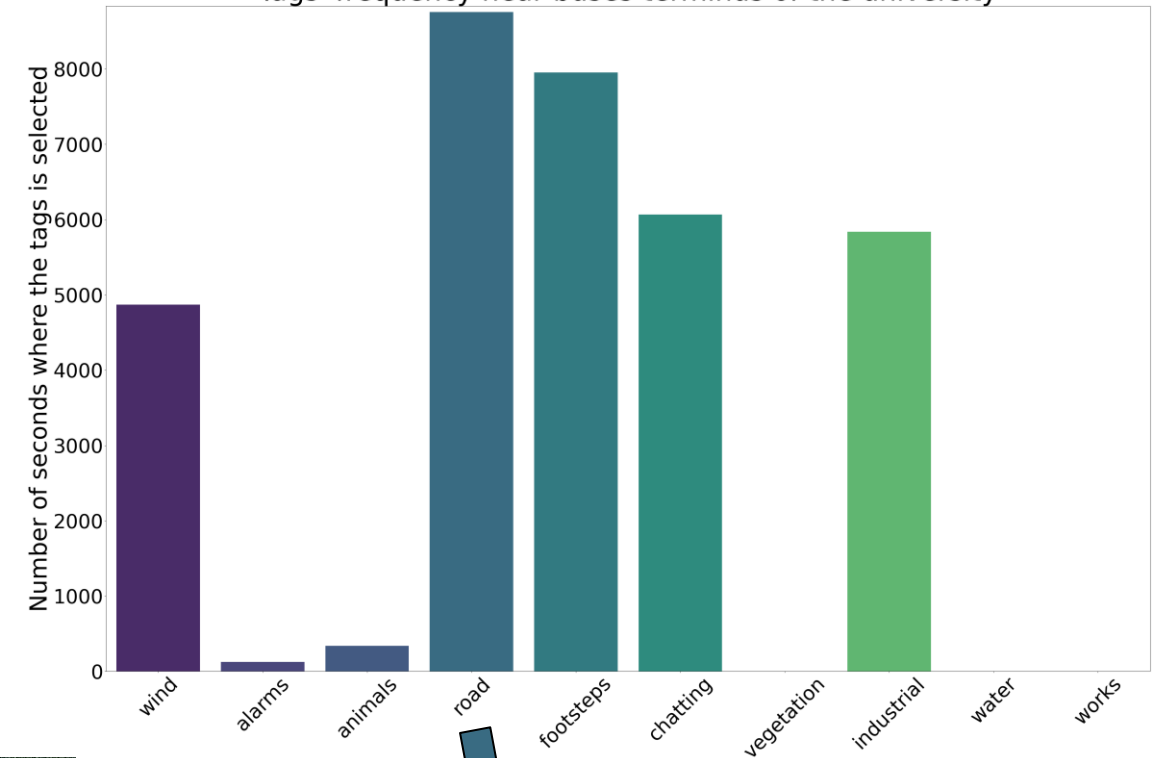
Tags' frequency in Mont Bellevue



Aerial view of Mont Bellevue sector (ville de Sherbrooke)



Tags' frequency near buses terminus of the university

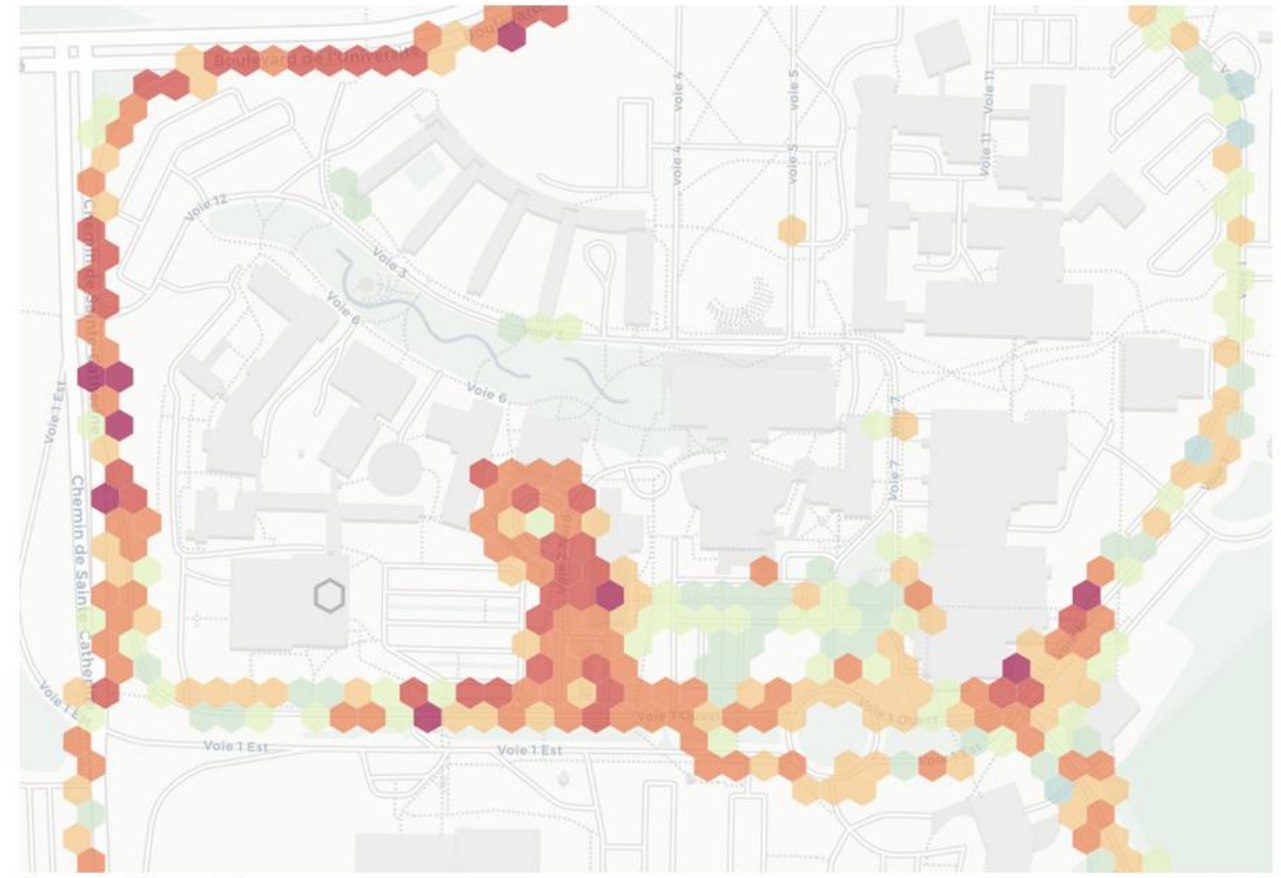


Aerial view of buses terminus area of Sherbrooke university (ville de Sherbrooke)

COMPARISON: NOISECAPTURE VS NOISEMODELLING



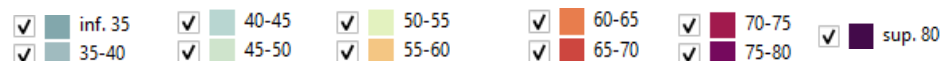
LDay map focus on Sherbrooke university campus with 1,5 m receivers



NoiseCapture map focus on Sherbrooke university campus

Key :

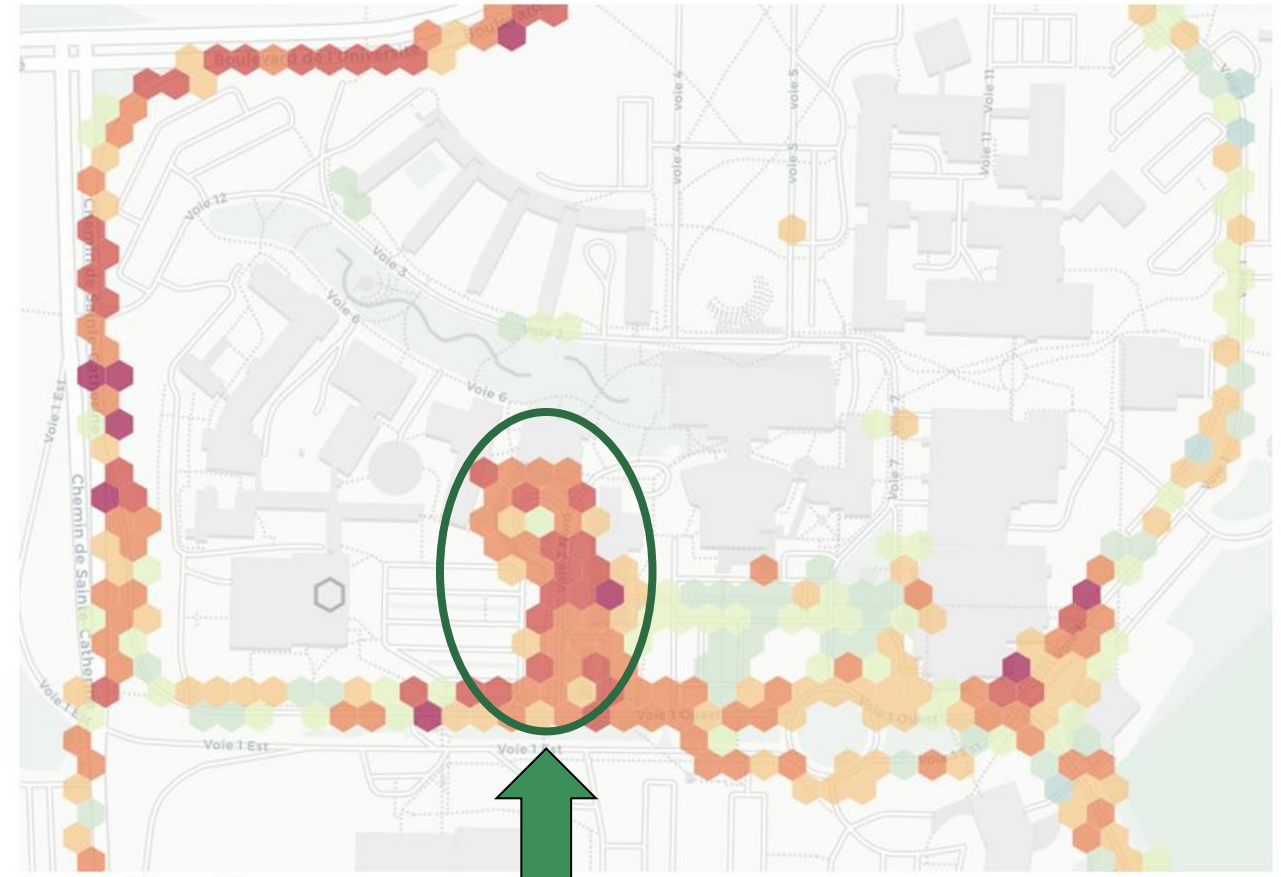
isodB on the right (level in dBA):



COMPARISON: NOISECAPTURE VS NOISEMODELLING



LDay map focus on Sherbrooke university campus with 1,5 m receivers

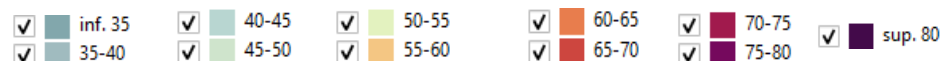


NoiseCapture map focus on Sherbrooke university campus

Between 60-70
dB(A)

Key :

isodB on the right (level in dBA):





PERSPECTIVES: WHAT'S NEXT ?

- **Data acquisitions**
- **Protocol Validation for NoiseCapture**
- **Static Model improvement**
- **Extension to unknown area with acoustical issues**

THANK YOU FOR YOUR LISTENING !

Do you have any question ?

To contact us: olivier.robin@usherbrooke.ca

*A special thanks to
Tristan and Jérôme for
their contribution to the
measurements !*