



ExTraCar

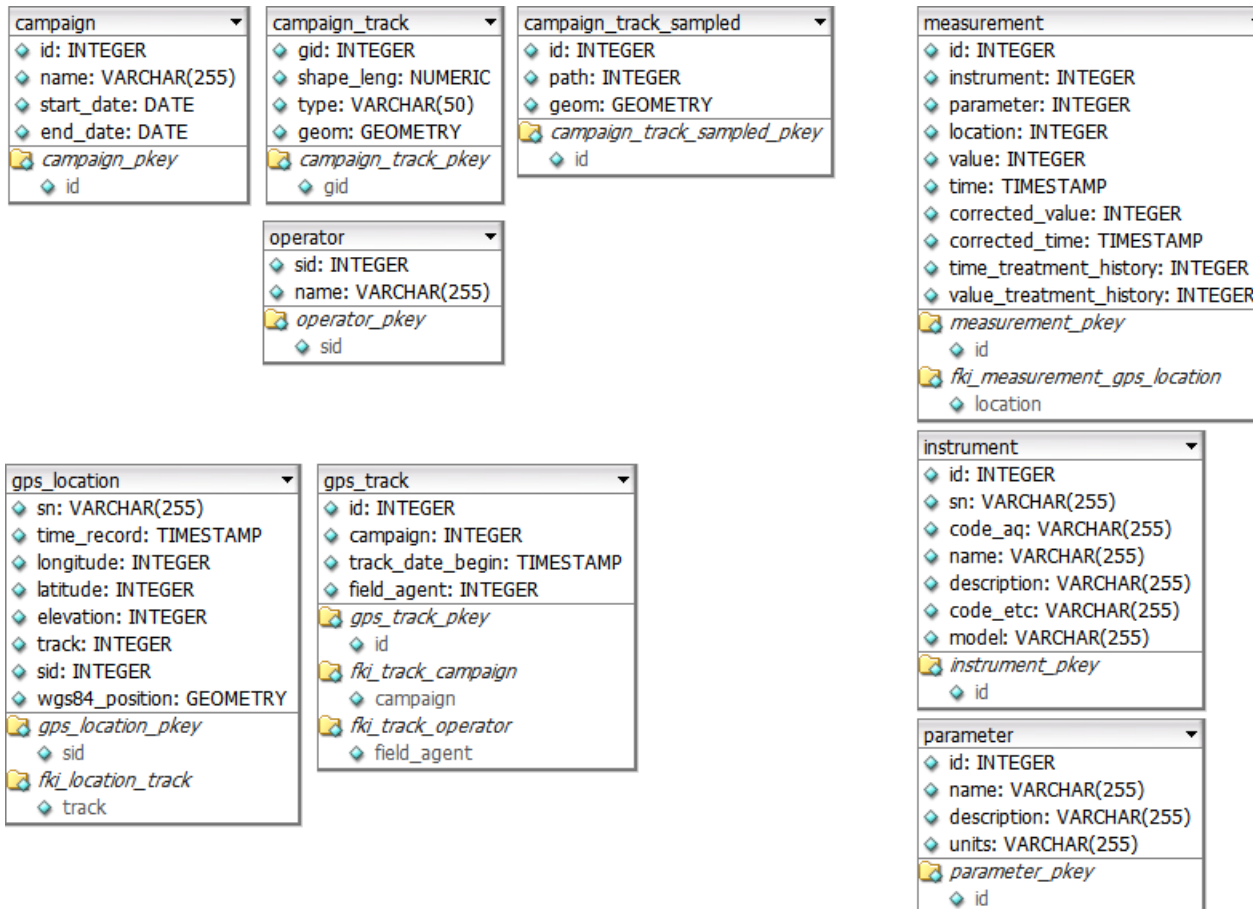
Modelling and simulations for Liège

F. Lenartz, Air Quality Department, ISSeP

Colloque ExTraCar
Palais des Congrès, 9 mai 2016



Data analysis



PostgreSQL

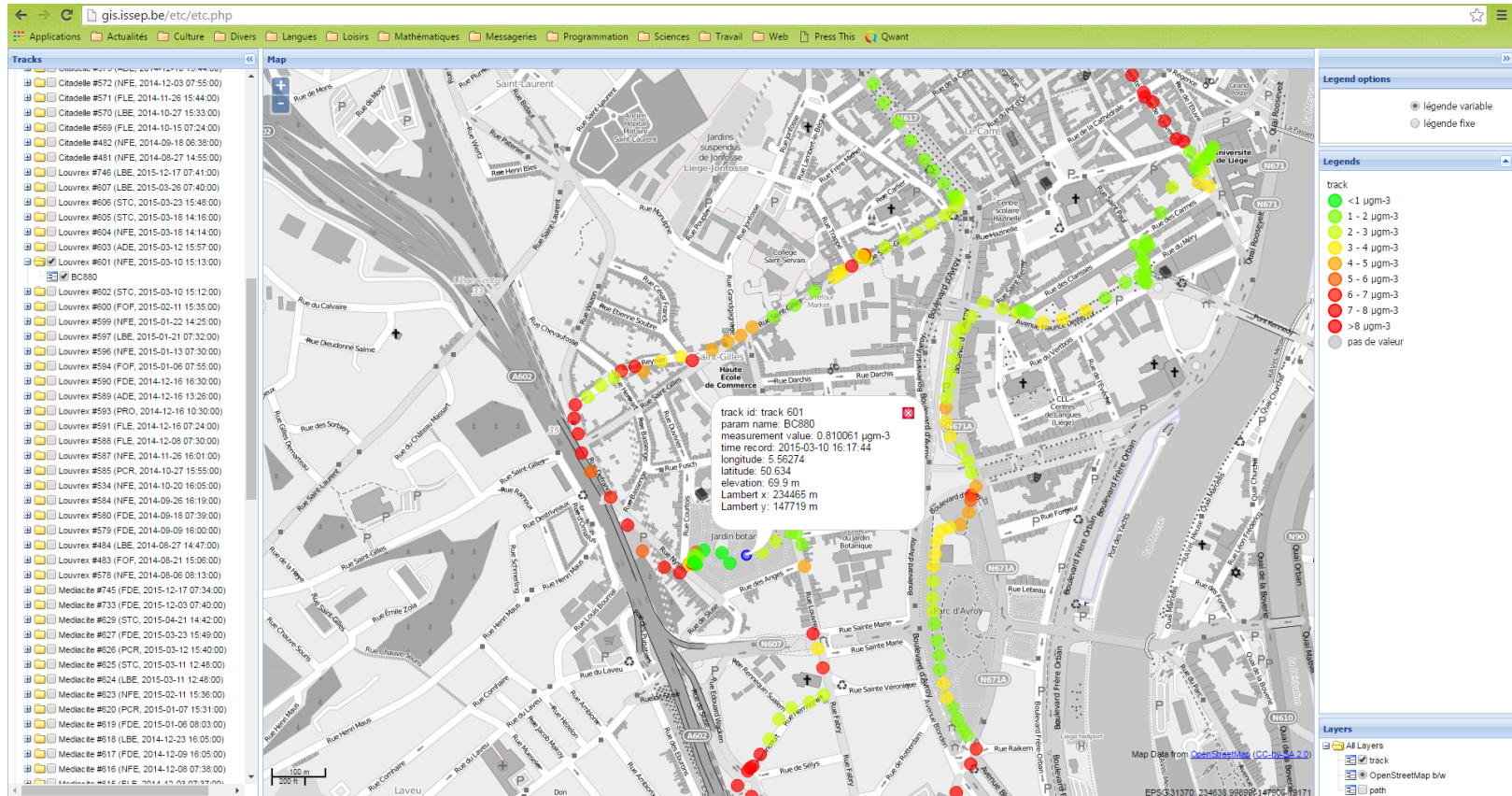


Geospatial Objects
for PostgreSQL

Data analysis

- 7759 km along the six loops within the city
- 862 km between Herstal and ISSeP
- 764 km between Soumagne and ISSeP
- 433 km between Micheroux and the Sart-Tilman
- 3117 km ridden by external volunteers
- No accident report or fine

Data analysis: Background values



Data analysis: Background values

	Médiacité	Louvrex	Citadelle
BCKGND	1.78	2.71	2.78
MEDIAN	3.50	4.11	4.54

Data analysis: Pasquill stability classes

	Daytime insolation			Night-time conditions	
Surface wind speed (m/s)	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

Pasquill Class	Sigma Theta (degrees)	Delta T/Delta Z (Deg C/100 m)
A	25	-1.9
B	20	-1.9 to -1.7
C	15	-1.7 to -1.5
D	10	-1.5 to -0.5
E	5	-0.5 to 1.5
F	2.5	1.5 to 4.0
G	1.7	>4.0

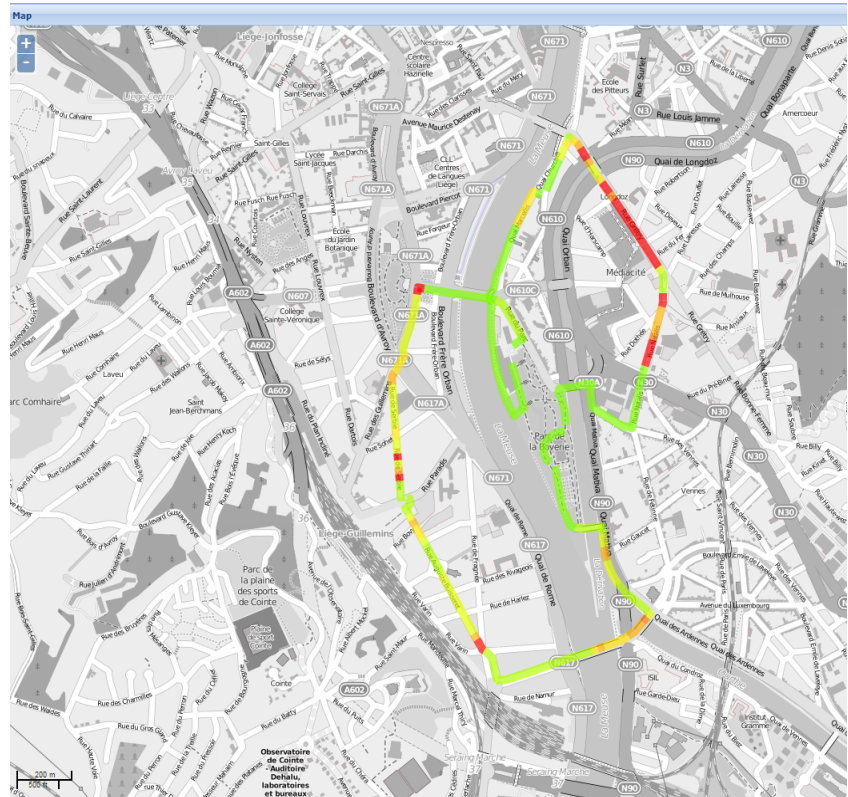
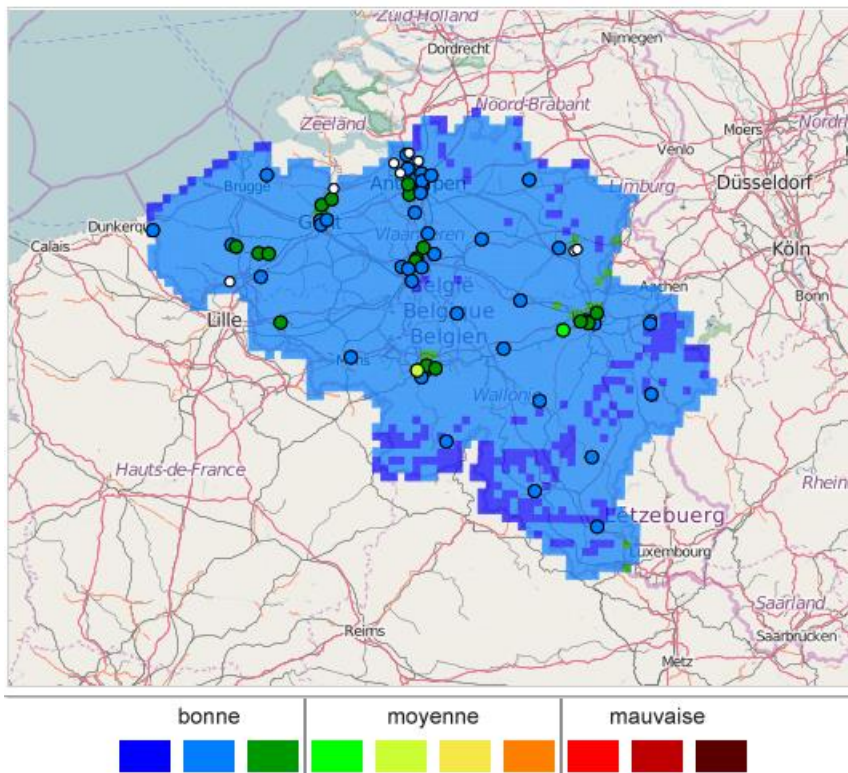
A: Extremely unstable
 B: Moderately unstable
 C: Slightly unstable
 D: Neutral
 E: Slightly stable
 F: Moderately stable
 G: Extremely stable

Data analysis: Pasquill stability classes

	Sclessin	Belle-Île – Chênée	Médiacité	Louvrex	Citadelle	Bressoux
D	1.48	2.90	3.53	3.89	4.69	3.88
E	1.74	2.22	3.39	4.30	4.55	5.80
F	6.71	4.47	4.40	7.73	6.12	-

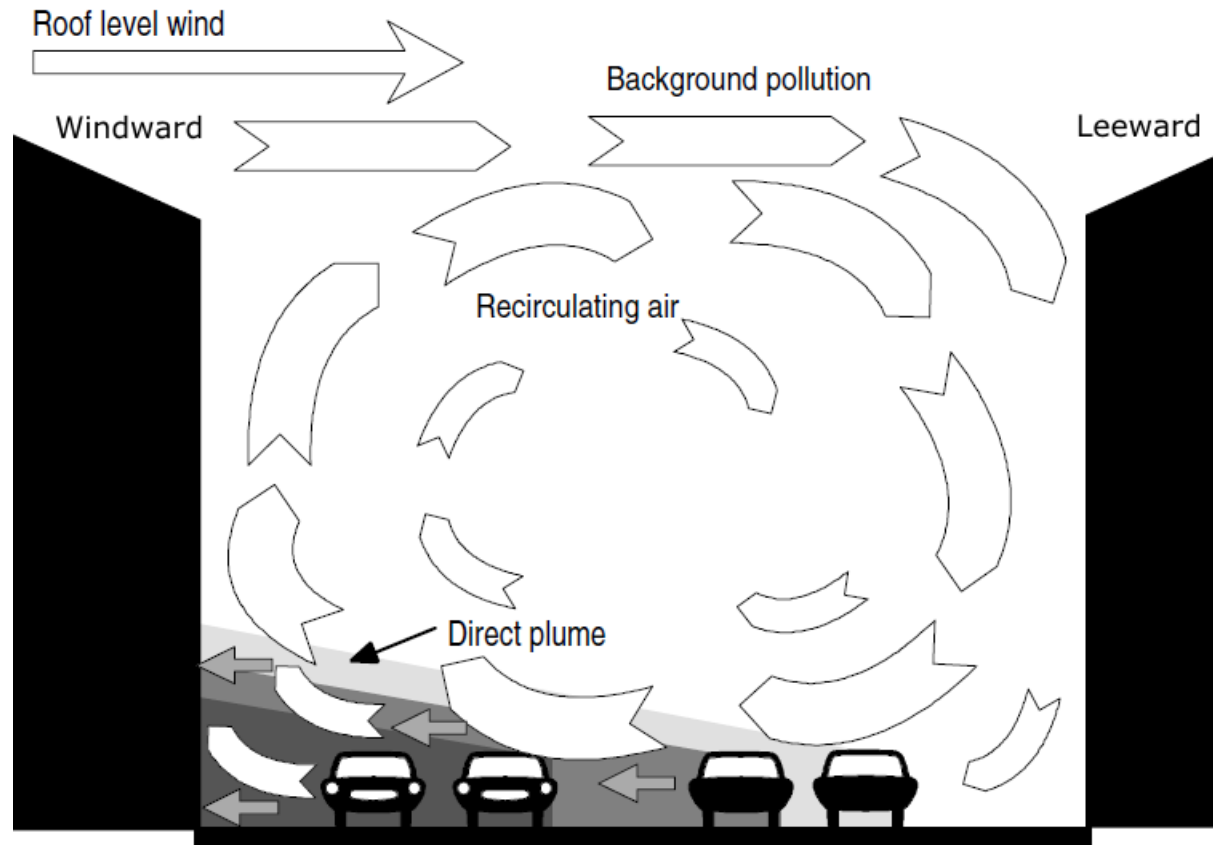
From geostatistical interpolation to deterministic modelling

Particules Fines (PM₁₀)
moyenne glissante sur 24 heures



Sources: [Left] Belgian Interregional Environment Agency (IRCEL - CELINE) [Right] ISSeP - ExTraCar

Street canyon modelling: theoretical aspects

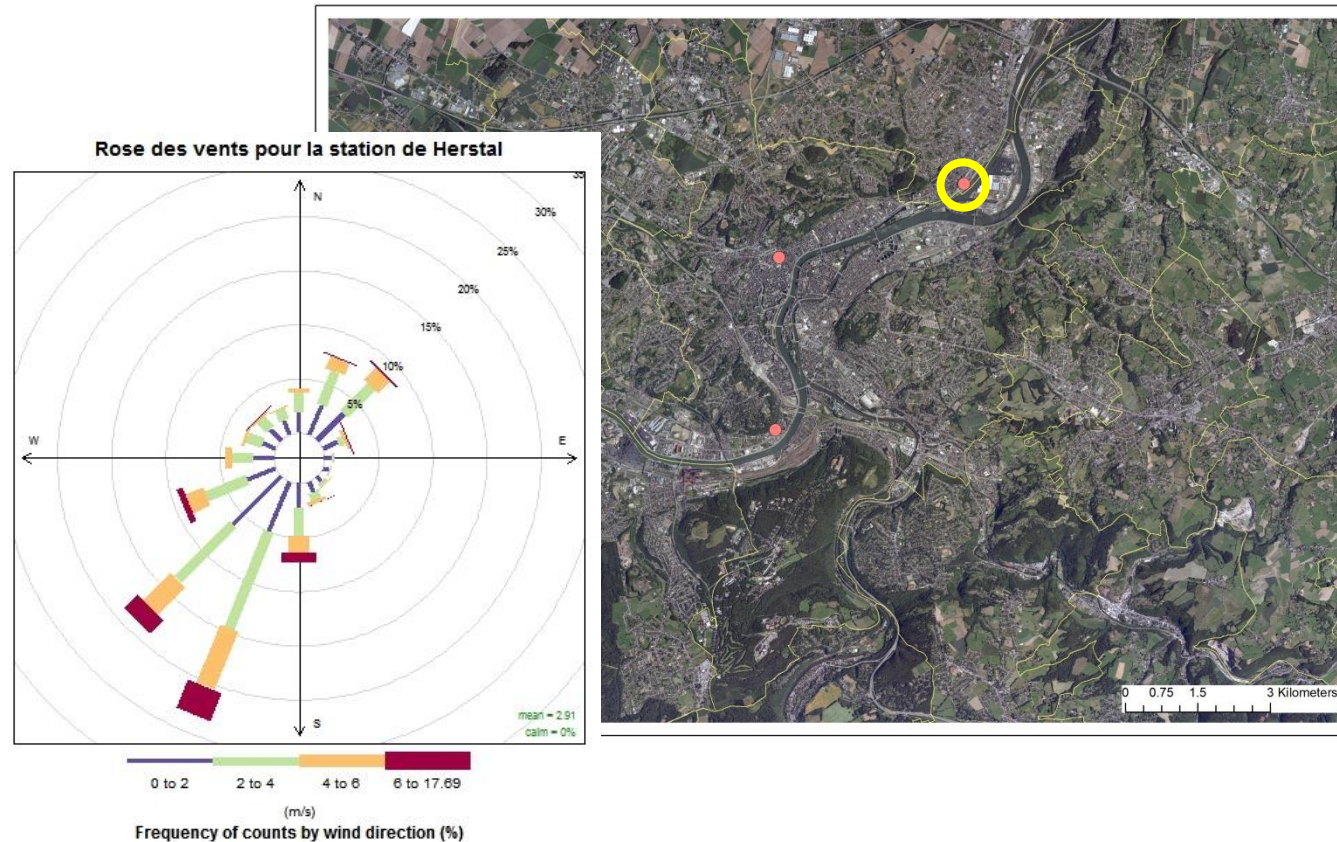


Source: Danish National Environmental Research Institute & the Ministry of Environment and Energy, Modelling traffic pollution in streets.

Street canyon modelling: input

- Wind speed and direction
- Background and *in situ* black carbon concentrations
- Street configuration
 - Width
 - Height of buildings on each side of the road
 - Angle
 - Number and location of lanes
- Traffic
 - Number of vehicles
 - Average speed of vehicles

Street canyon modelling: input



Source: ISSeP – Air Quality Monitoring Network

Street canyon modelling: input

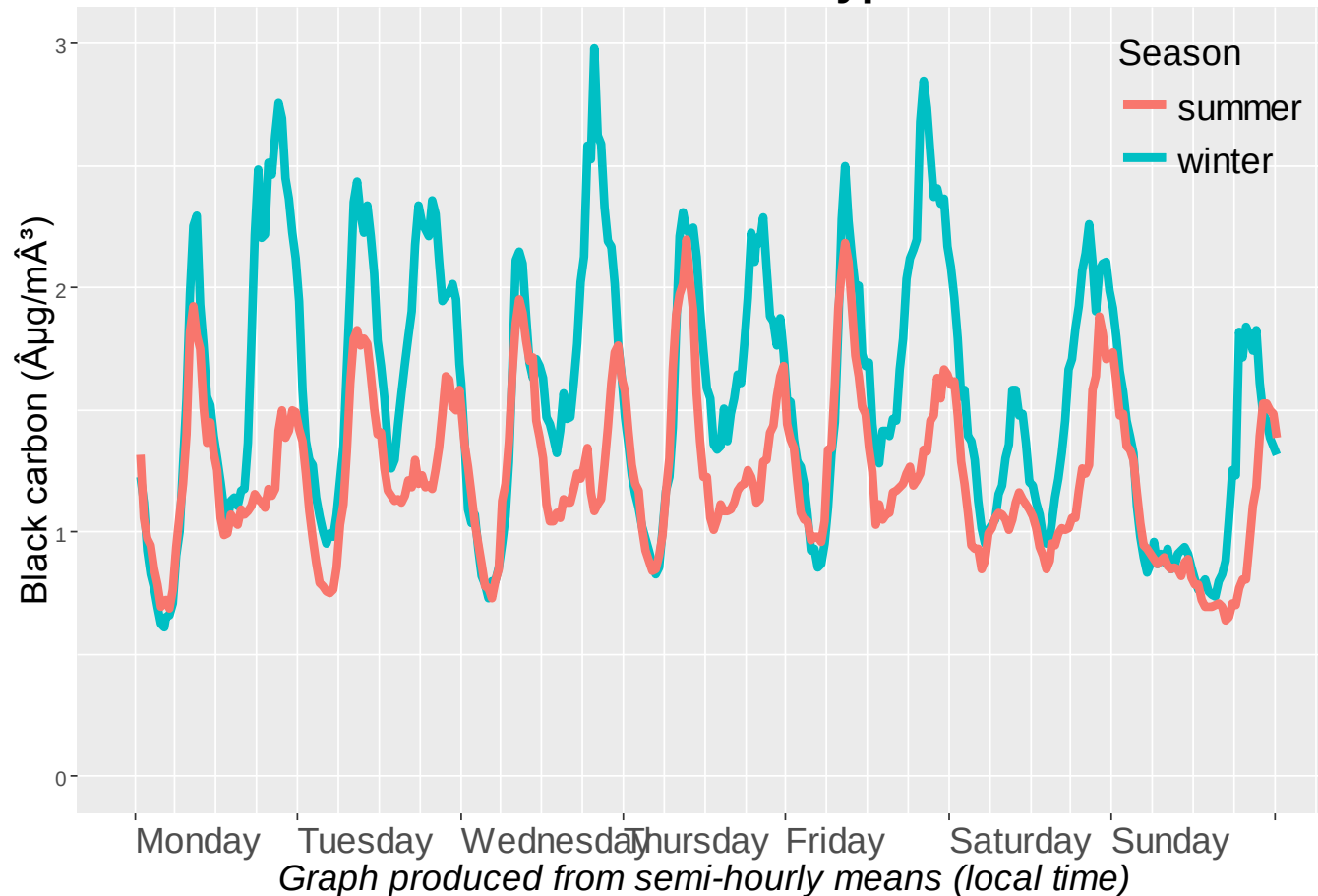
- Wind speed and direction ✓
- Background and *in situ* black carbon concentrations
- Street configuration
 - Width
 - Height of buildings on each side of the road
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 - Number and location of lanes
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 - Average speed of vehicles

Street canyon modelling: input



Street canyon modelling: input

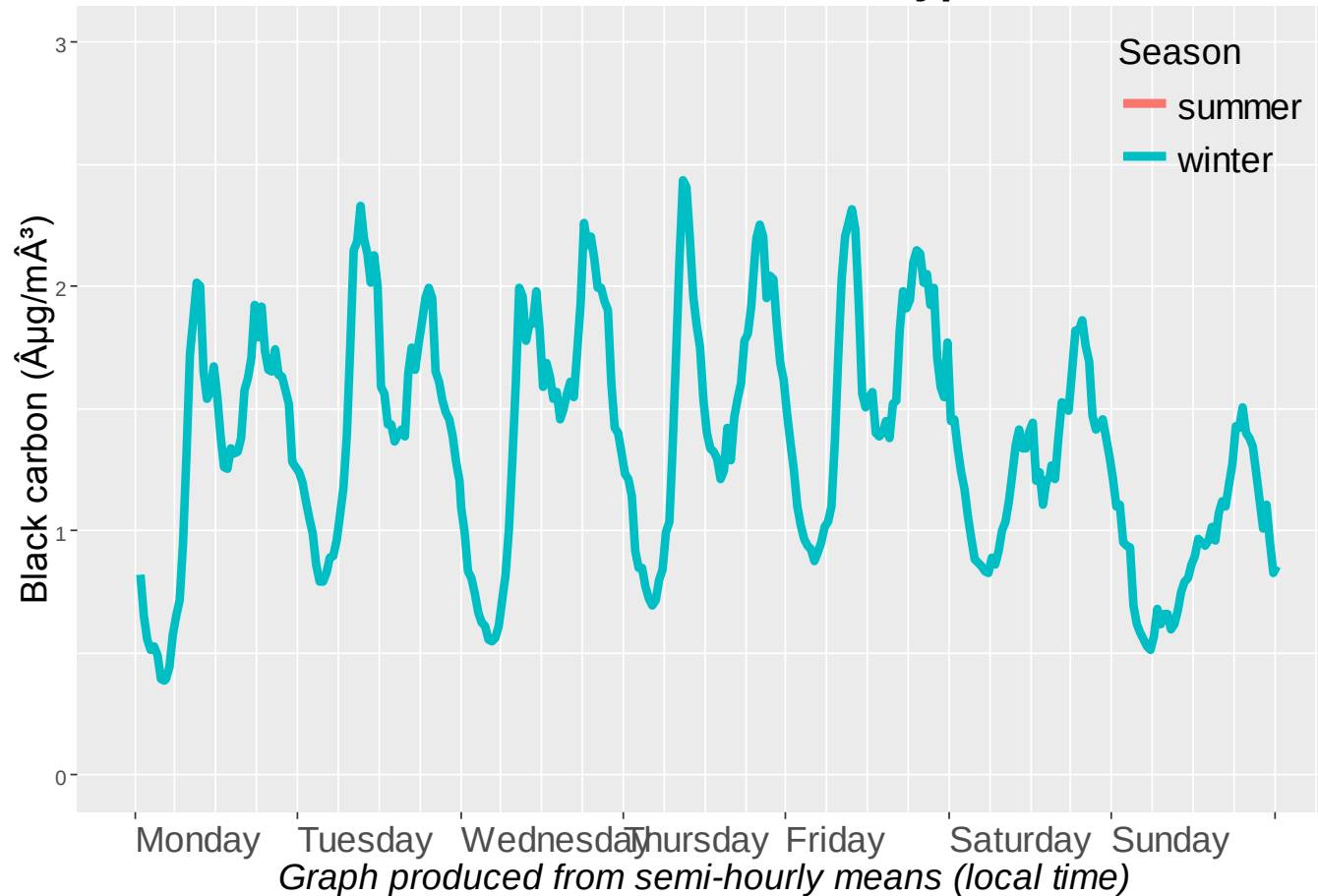
Herstal black carbon : typical week



Source: ISSeP – Air Quality Monitoring Network

Street canyon modelling: input

Saint Lambert black carbon : typical week

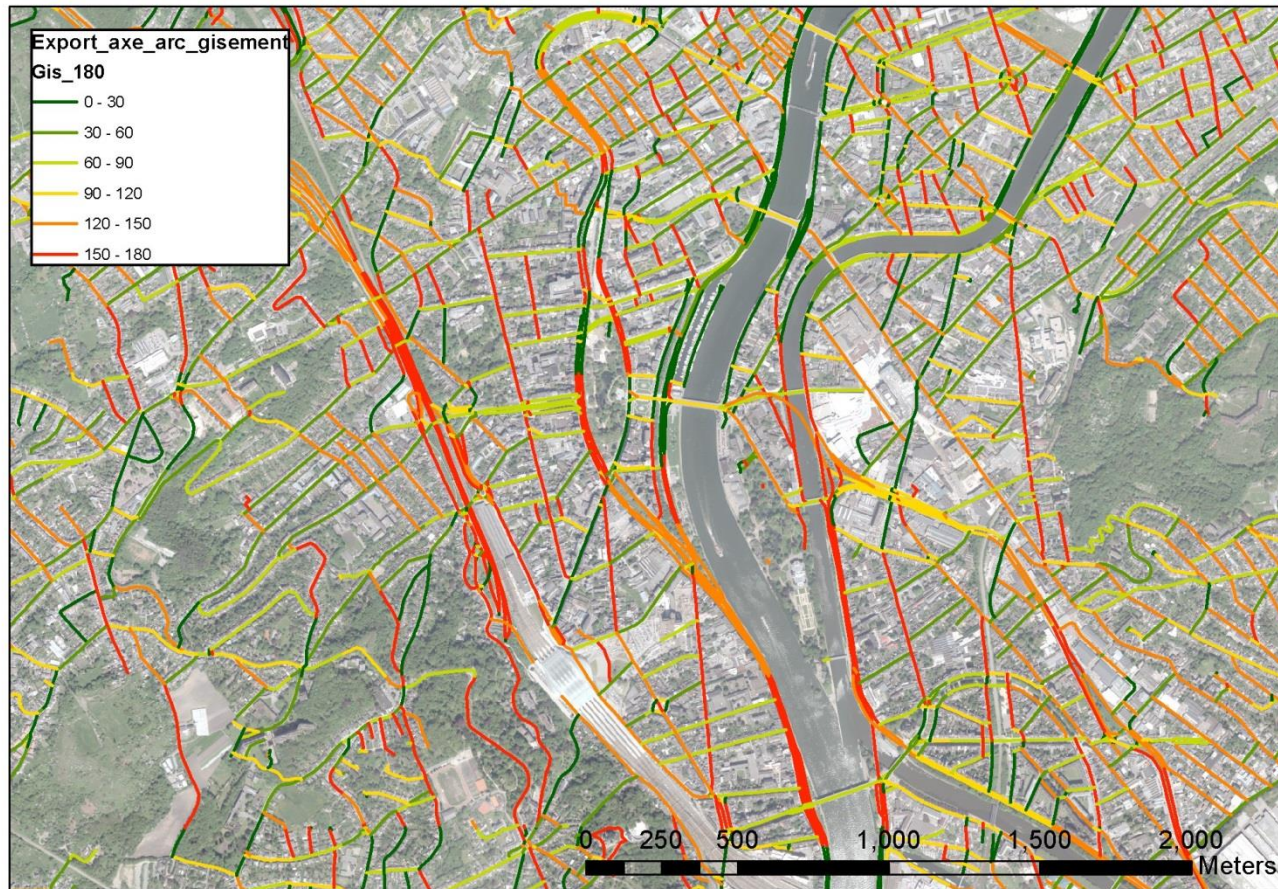


Source: ISSeP – Air Quality Monitoring Network

Street canyon modelling: input

- Wind speed and direction ✓
- Background and *in situ* black carbon concentrations ✓
- Street configuration
 - Width
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Street canyon modelling: input

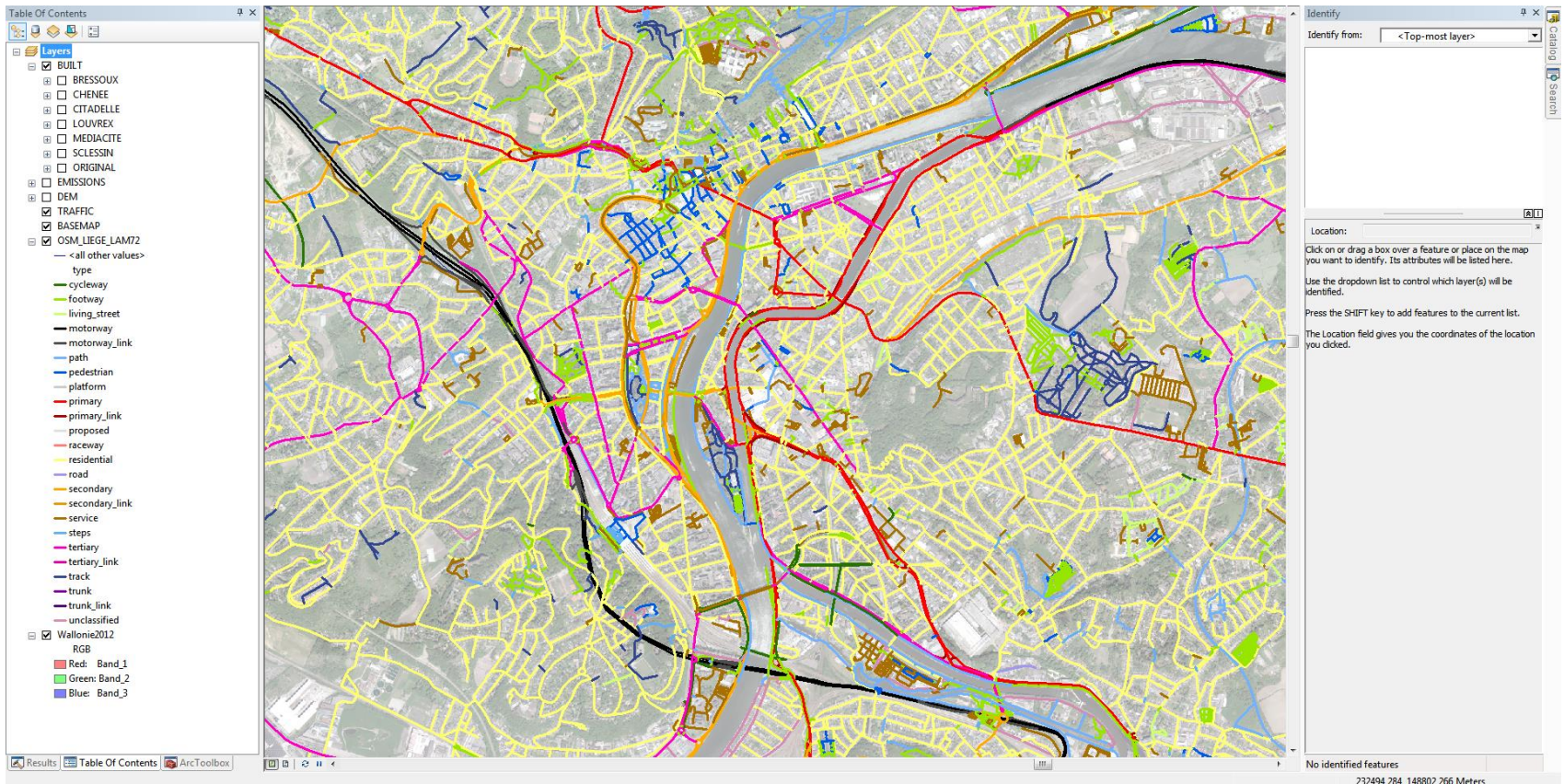


Source: SPW - PICC, ULg - Unité de Géomatique

Street canyon modelling: input

- Wind speed and direction ✓
- Background and *in situ* black carbon concentrations ✓
- Street configuration
 - Width ✓
 - Height of buildings on each side of the road ✓
 - Angle ✓
 - Number and location of lanes ✗
- Traffic
 - Number of vehicles
 - Average speed of vehicles

Street canyon modelling: input



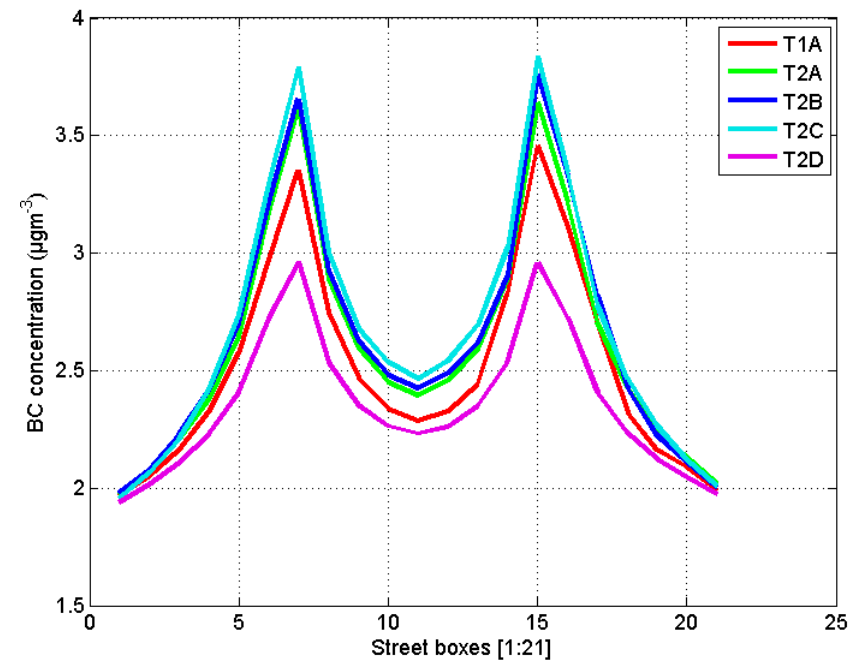
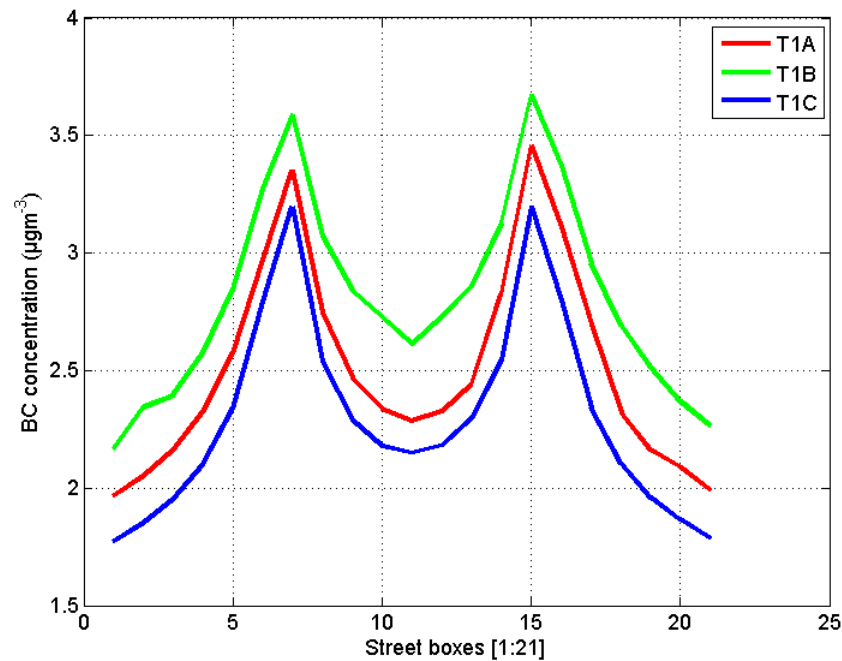
Source: SPW – PICC, OpenStreetMap

Street canyon modelling: input

- Wind speed and direction ✓
- Background and *in situ* black carbon concentrations ✓
- Street configuration
 - Width ✓
 - Height of buildings on each side of the road ✓
 - Angle ✓
 - Number and location of lanes ✕
- Traffic
 - Number of vehicles ✓
 - Average speed of vehicles ✓

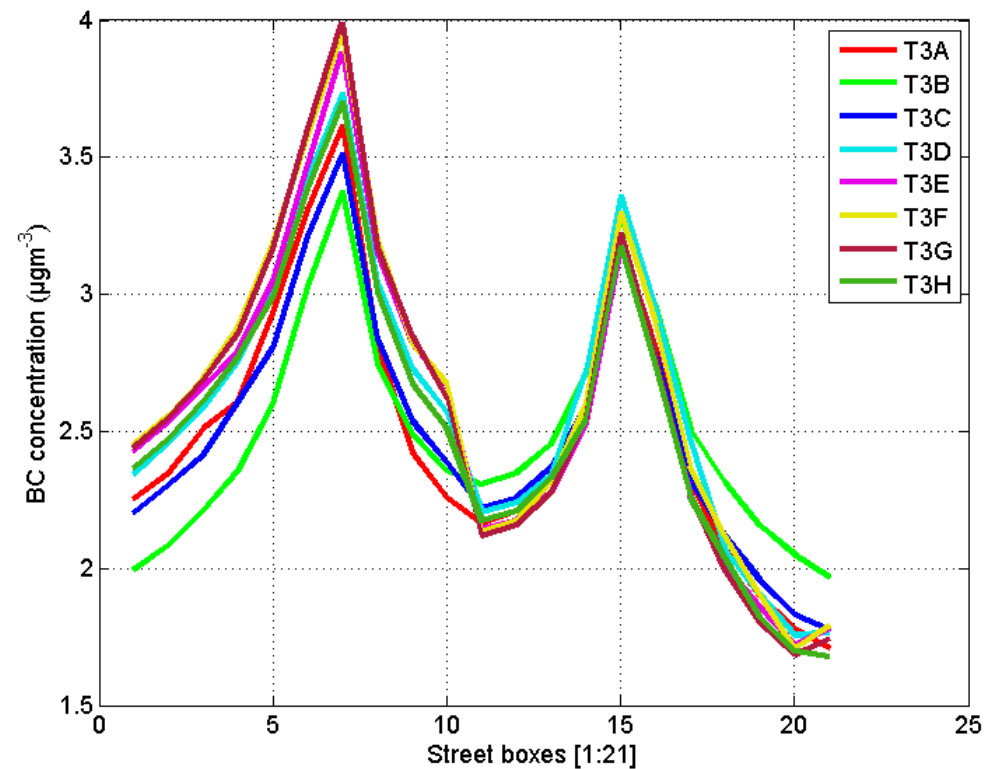
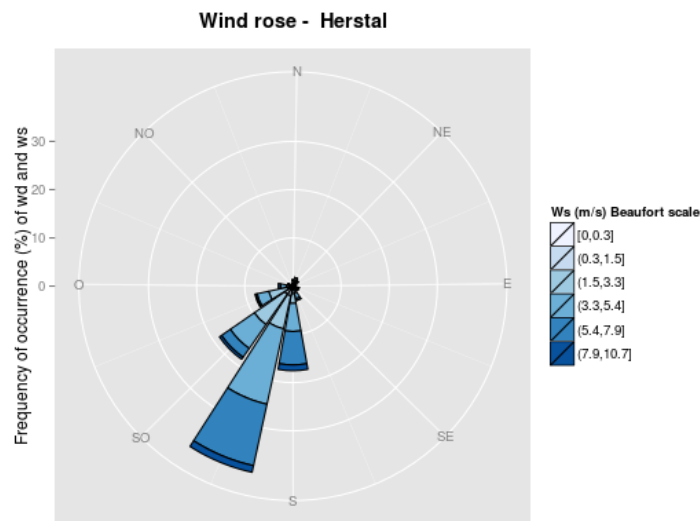
Street canyon modelling: test cases

Height:Width



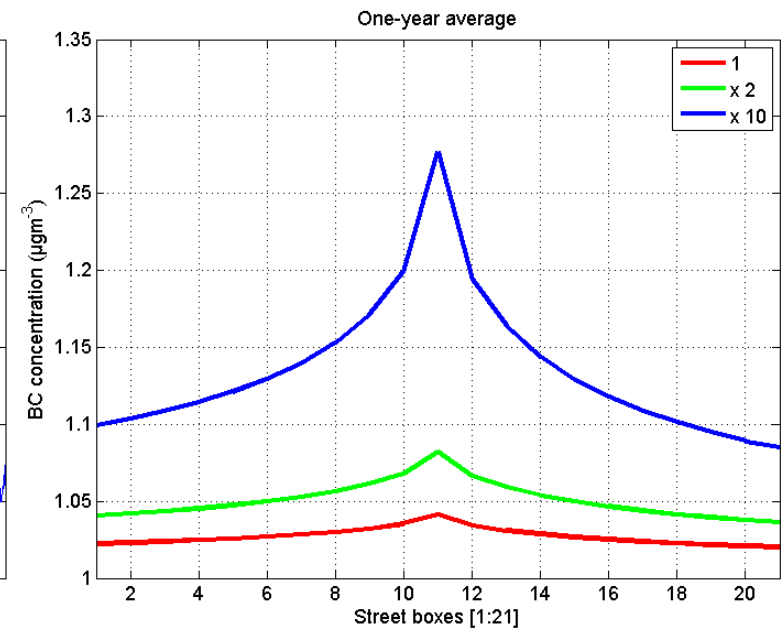
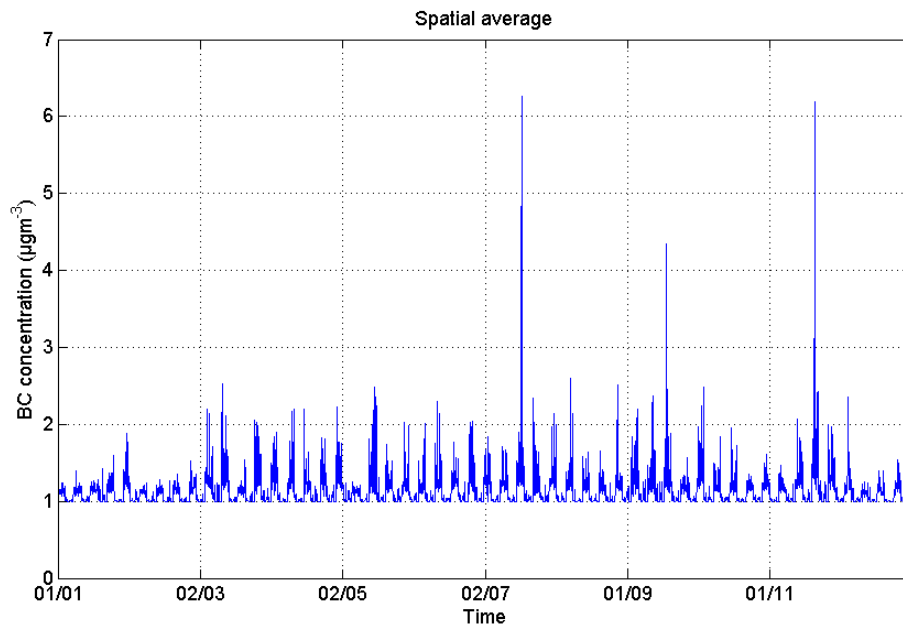
Street canyon modelling: test cases

Angle



Street canyon modelling: test cases

Wind speed and traffic intensity

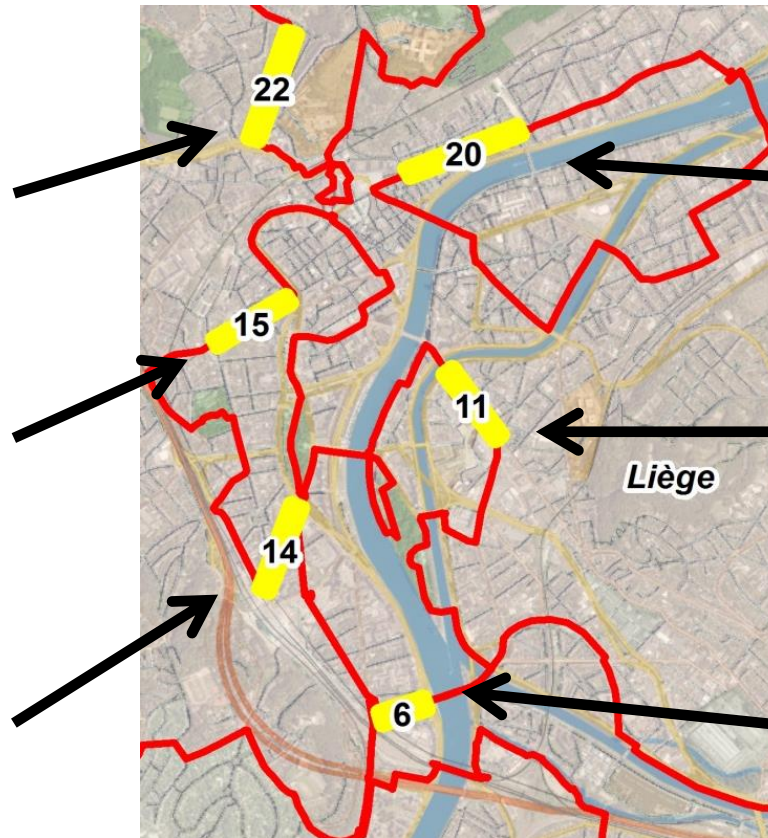


Street canyon modelling: real test cases

Rue de Campine
2 lanes
2 directions
2 obs. + 1 cycl.

Rue St-Gilles
1 lane
1 direction
1 obs. + 1 cycl.

Rue des Guillemins
2 lanes
2 directions
1 obs. + 1 cycl.

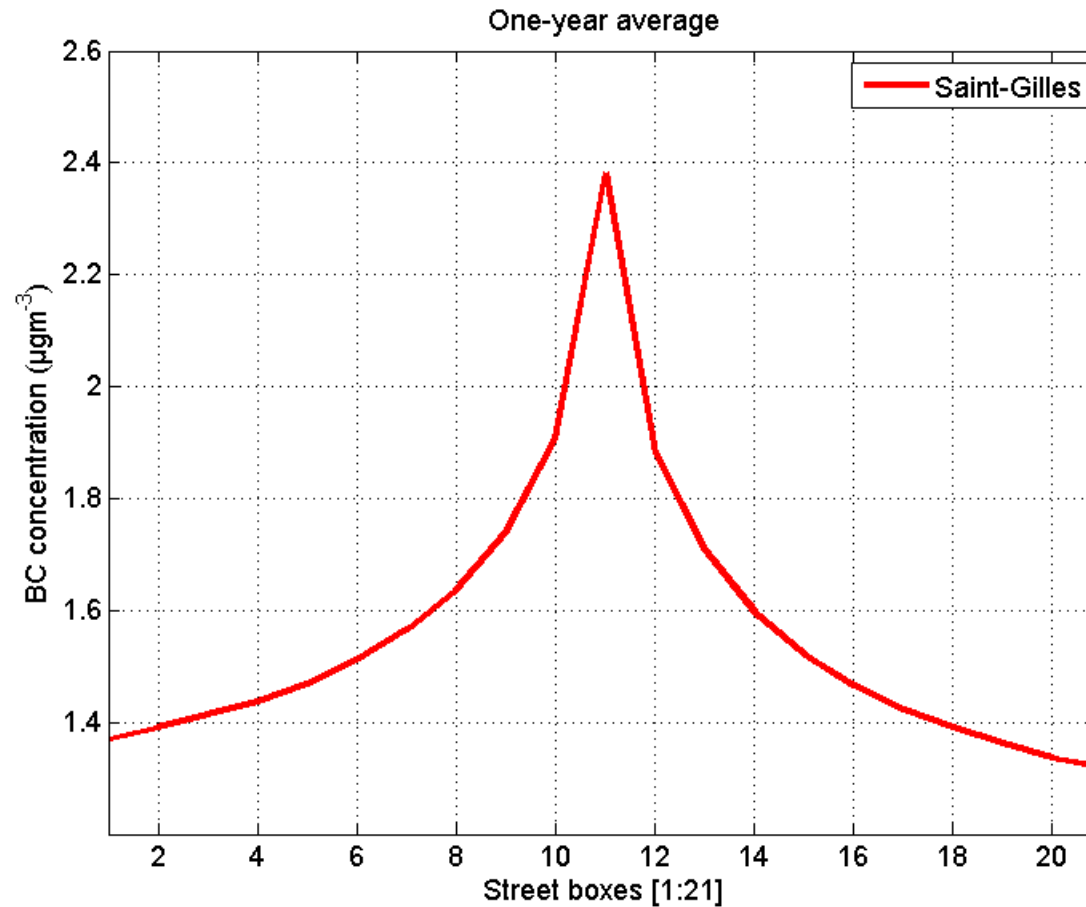


En Féronstrée
1 lane
1 direction
1 obs. + 1 cycl.

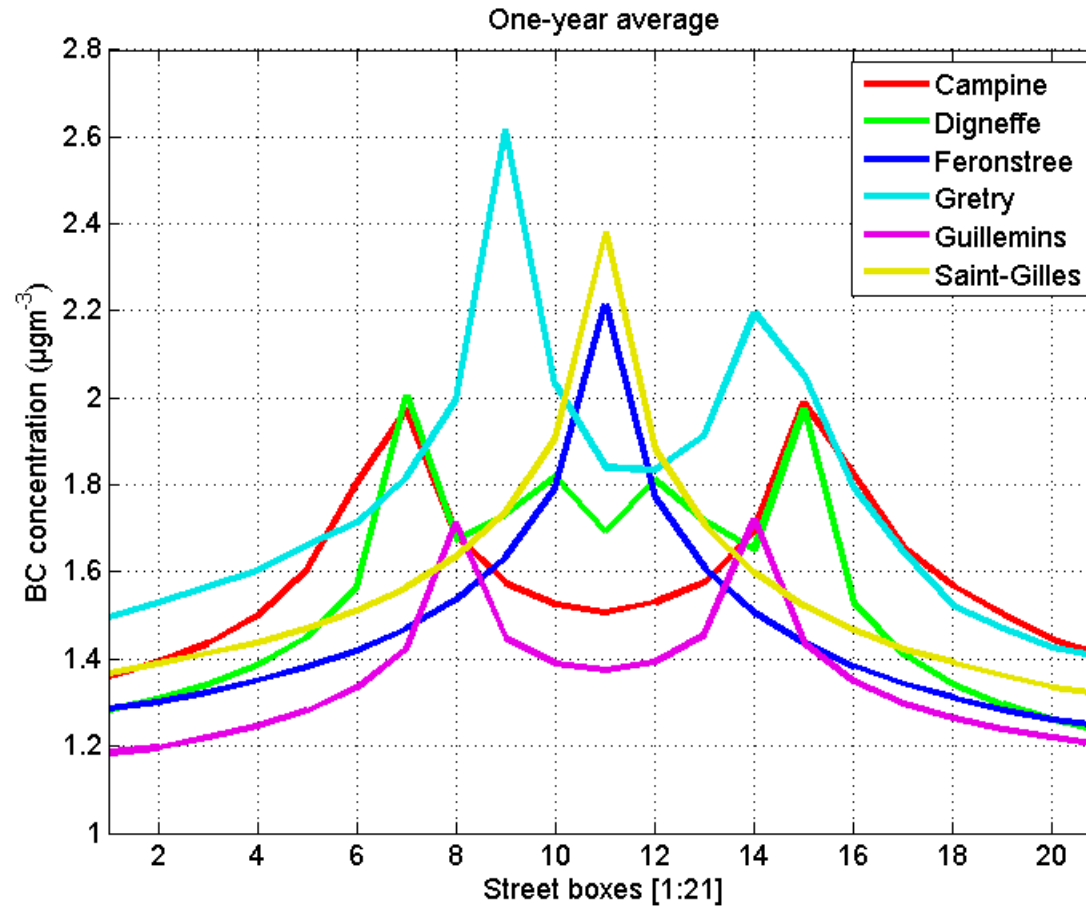
Rue Grétry
2 lanes
2 directions
2 obs. + 1 cycl.

Avenue Émile Digneffe
2 x (1 lane + 1 bus lane)
2 directions
2 obs. + 1 cycl.

Street canyon modelling: real test cases



Street canyon modelling: real test cases



Conclusions and perspectives

- Set up of an open source georeferenced data base adapted for spatial analysis (ISSeP)
- Grip on the model (Brussels-Environment)
- Procedures to generalize the input generation (ULg)
- Prepare a more detailed description of traffic (ABEONA)
- Create the first complete black carbon map over the city (ISSeP)
- Write the report (ISSeP)

ExTraCar team at ISSeP

Core:

Luc Bertrand, François Detalle, Nicolas Fernémont & Fabian Lenartz

Developers:

Alain Caprioli (ETCUpload, ETCManagement, ETCStats & ETCTEC) & Pierre Crespín (GIS web interface)

Regular commuters:

Yves Jean-Pierre, François Idczak, Philippe Roelandt, Arnould Defossa & Fabrice Offredi

Scientists in charge of passive sampler analyses :

Marie Gohy (COV) & Isabelle Minet (NO₂)

Support for monitoring network data analysis:

Laurent Spanu & René Posset

Partners

Geomatics Unit (University of Liège):

Yves Cornet & Jean-Paul Kasprzyk

Brussels-Environment :

Olivier Brasseur, Priscilla Declerck, Thierry Devos & Billie Heene

ABEONA:

Davy Janssens

Trainees:

Sylviane Tchiaye Dongmo (2015), Christophe Louis (2015) & Ibrahim El Ghazi (2014)

Agence wallonne de l'Air et du Climat :

Wim Verhoeve, Pascal Théate & Xavier Fripiat

... and probably a few other persons