



Informing you on ambient air quality
in the Belgian Regions

The BelAir app: communicating air quality data to a broad audience

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Belgian Interregional Environment Agency (IRCEL - CELINE)

Content

- Existing geodata services
- The (long) history of an air quality app
- If we still have time:
 - quick mention of other developments:
 - Cleanest air route
 - Engaging with citizen science

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Informing you on ambient air quality in the Belgian Regions

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Belgian Interregional Environment Agency (IRCEL - CELINE)

Current Air Quality Measurements:
Last update: Wednesday 25 June 2014, 13:00

change time

NO₂ - hourly mean PM₁₀ - running 24 hour mean O₃ - hourly mean

good moderate bad

The **BelATMO index**

	yesterday (observation)	today (forecast)	tomorrow (forecast)
Belgium	very good - 4	very good - 4	very good - 4
Flanders	very good - 4	very good - 4	moderate - 5
Brussels	very good - 4	very good - 4	moderate - 5
Wallonia	moderate - 5	very good - 4	moderate - 5

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SMOG

English
 Nederlands
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 Deutsch

Email Format

html
 text

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Today:

NO₂ (maximum daily 1-hour mean) PM₁₀ (daily mean) O₃ (maximum daily 1-hour mean)

Tomorrow:

NO₂ (maximum daily 1-hour mean) PM₁₀ (daily mean) O₃ (maximum daily 1-hour mean)

News - nieuws - nouvelles - Neuigkeiten

Gaat het met luchtkwaliteit in ons land effectief de slechte kant op?

May 04, 2014

Annual Report Air Quality in Belgium 2011

Mar 26, 2013

More...

Tweets

IRCEL-CELINE @ISMOG_BE
I'm vorige tweet over NEC: zie ook tweets van 24 maart jongstleden

IRCEL-CELINE @ISMOG_BE
België haast #NEC emissieplafond voor SO2, NMVOS en NH3, maar is voor NOx nog 17% van doel verwijderd goo.gis/wpaX Expand

EU EnvironmentAgency @EUEnvironment
EU air pollutant emissions have decreased over the last decades but some are still being emitted above legal limits: goo.gis/wpaX 13 Retweeted by IRCEL-CELINE Expand

IRCEL-CELINE @ISMOG_BE
Météo instable. La prévision d'ozone s'avère particulièrement délicate. Concentrations d'ozone prévues entre 130 et 180 µg/m³

IRCEL-CELINE @ISMOG_BE
Tweet to @ISMOG_BE

IRCEL – CELINE

- <http://www.irceline.be>
- Real-time data
 - All major pollutants (incl. BC)
 - Forecasts
 - Information about pollutants
 - Publications
 - etc.

Integration of OGC-services (download and viewing) into website

... and tables with (real-time) data:

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NL EN FR DE
Search Site

You are here: Home / Air Quality / Measurements / Nitrogen Dioxide

Nitrogen Dioxide

RIO interpolation map table with detailed info per monitoring site

search for address...

Measurements

Nitrogen Dioxide

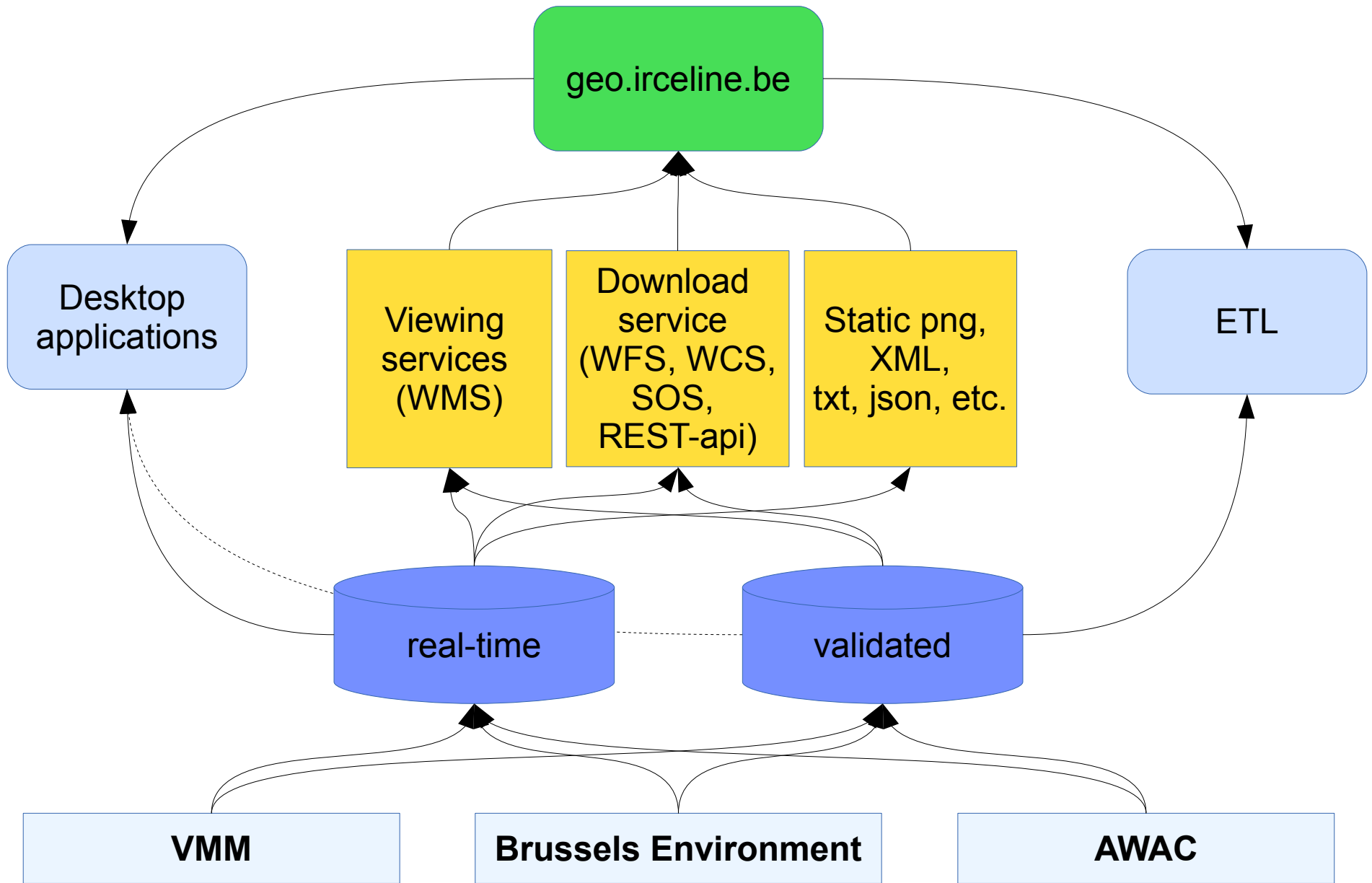
RIO interpolation map table with detailed info per monitoring site

Tuesday 19/11/2013: 16u00 update (local time)
for detailed information click on station codes

STATION		Actual values	highest 1-hour average today	data received
code	city	µg/m ³	at (local time)	till (local time)
41B004	Brussel (Sint-Katelijne)	45	70	10:00 16:00
41B006	Brussel (EU Parlement)	53	65	11:00 16:00
41B008	Brussel (Bellardstraat)	81	95	10:00 16:00
41B011	Sint-Agatha-Berchem	34	67	10:00 16:00
41MEU1	Neder-Over-Heembeek		89	10:00 14:30
41N043	Voorhaven (Haren)	43	81	09:00 16:00
41B001	Sint-Jans-Molenbeek	58	69	10:00 16:00
41B002	Elsene	84	91	10:00 16:00
41B012	Ukkel	34	53	11:00 16:00
41W011	Sint-Lambrechts-Woluwe	58	71	10:00 16:00
42E013	Vorst	39	52	10:00 16:00
40C001	Oostrozebeke	18	33	01:00 16:00



The SDI at IRCEL-CELINE



Documentation open data endpoints

<http://www.irceline.be/en/documentation/open-data>
https://github.com/irceline/open_data

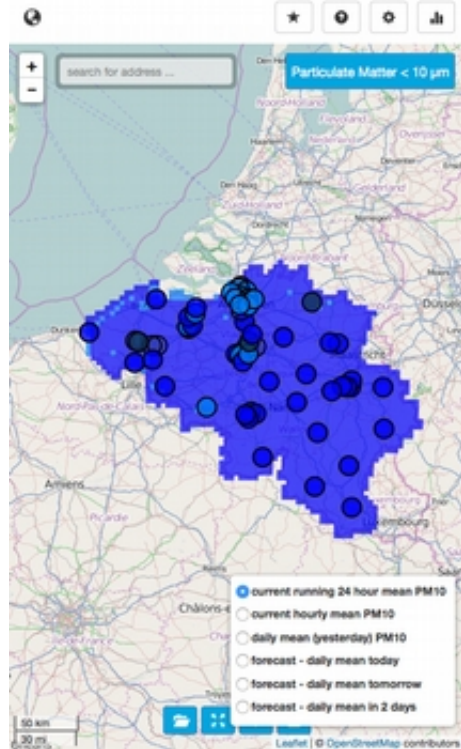
The screenshot shows the irCEline website's documentation page for open data. The header includes the irCEline logo, navigation links for Air Quality, Documentation, About Us, and Forum, and a search bar. The main content area is titled "open data" and provides information on data availability, including Creative Commons Attribution 4.0 license details and a list of data viewers. It also includes a list of abbreviations and a code snippet for embedding a data viewer. The footer contains logos for Air Climat, the Flemish Environment and Nature Agency, and the Flemish Environmental Movement.

The screenshot shows the GitHub repository page for "irceline / open_data". The repository is currently empty, with no description, website, or topics provided. It shows 16 commits, 1 branch, 0 releases, and 1 contributor. The commit history includes "opeeters add link measurements.md" and "datasets update datasets/rrio.md". The repository contains a "readme.md" file, which is displayed below. The README content includes the title "Open (geo)data IRCEL-CELINE", the license "https://creativecommons.org/licenses/by/4.0/", and the title "Catalog Service for the Web (CSW)". It also lists metadata sources and documentation links.



An air quality app (first attempt – Est. 2016)

Real-time data



Interactive data exploration



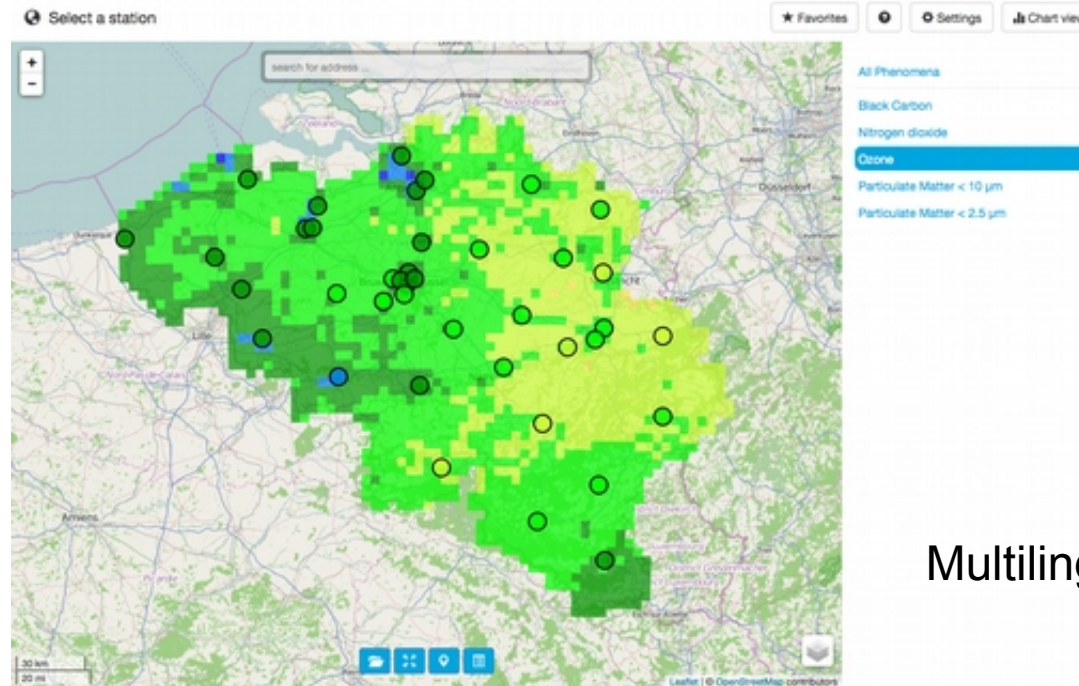
Forecasts



- Cordova
- Android, iOS & Windows Phone

Multilingual (EN, NL, FR, DE)

eENVUplus

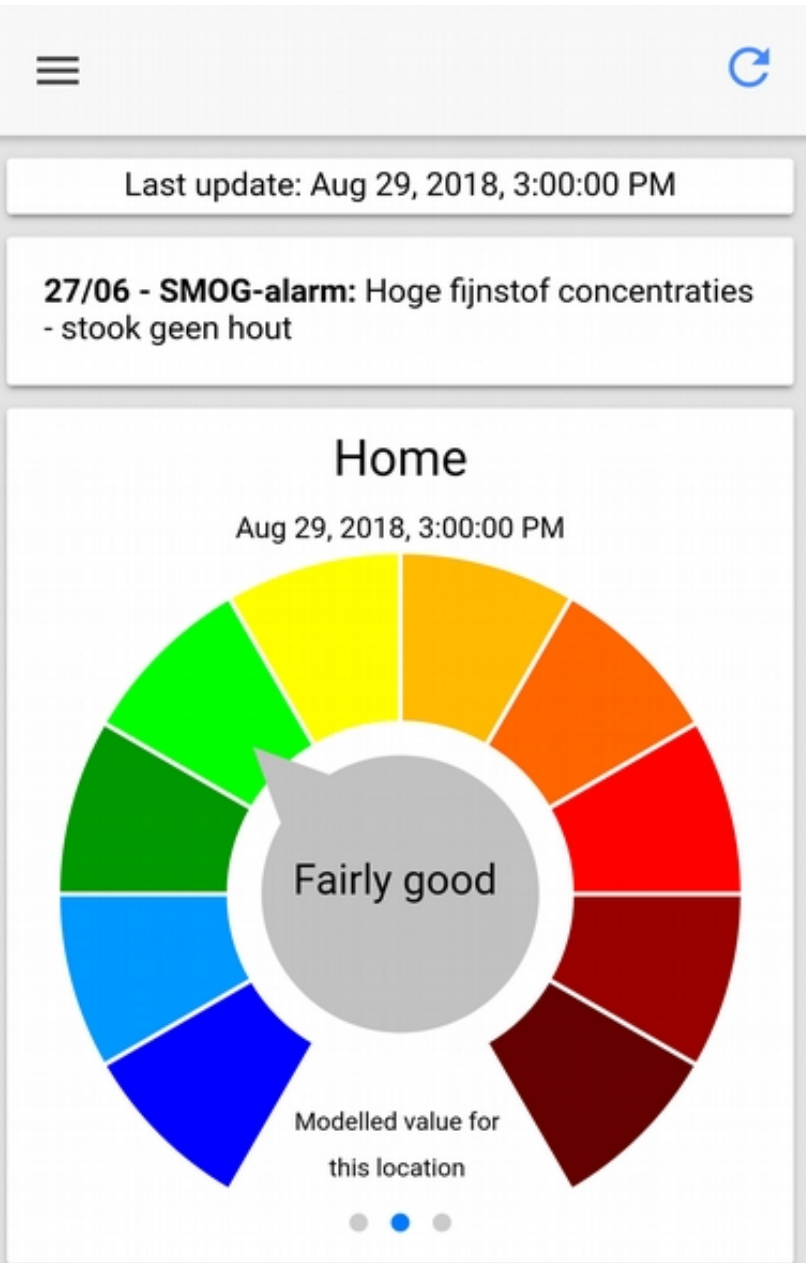


<https://github.com/irceline/air-quality-belgium-app>

Lessons learnt

- It is becoming possible to develop for multiple mobile platforms using one framework
- It was possible to use SWE-client elements on a mobile, but to make it feel more native deeper OS-integration was needed
- OGC-viewing-service (e.g. WMS) are fine as data endpoint for rendered data
- OGC-download service are to be avoided
- The (non-standardised) 52 North REST-api was a perfect addition to our SDI for high performance access to time series

An air quality app (new version – Est. 2018)



- Ionic framework (more “native” feeling on Android and iOS)
- Based real-time RIO-IFDM (hi-resolution modelled values)
- Alerting (different user profiles + user defined thresholds)
- “Street level” personalised information
- Potentially add cleanest air route functionality later



Nearest measuring station				
BC 0.7µg/m ³ 15.5km 40SZ01 - STEENOKKERZEEL	NO2 31µg/m ³ 13.8km 42N035 - AARSCHOT	O3 26µg/m ³ 13.8km 42N035 - AARSCHOT	PM10 20.7µg/m ³ 13.8km 42N035 - AARSCHOT	PM2.5 13.5µg/m ³ 13.8km 42N035 - AARSCHOT



Health related messages

WHO "health"- concentration class	BelAQI	general	sensitive groups
A	1	It is very healthy today to be physically active outside.	
	2	By reducing emissions, we get more of these healthy days and also decrease the effects of the low-term exposure.	
B	3	You do not have to adjust your usual physical activities because of the air quality.	If you experience discomfort, you can reduce heavy/long physical effort.
	4		
C	5	You do not have to adjust your usual physical activities because of the air quality.	Reduce your physical effort. Consult your doctor about appropriate changes to medication you might be taking.
	6		
	7		
D	8	Consider reducing heavy/long physical exertion.	Limit physical exertion. Consult your doctor about appropriate changes to medication you might be taking.
	9		
	10		

By the time of the release with news event

The image displays five screenshots of an air quality monitoring application interface. The top row shows the 'Home' screen with a circular air quality index (AQI) gauge and a line graph of PM2.5 levels. The middle row shows a 'Location list' for Hasselt, a 'Current location' map, and an 'Annual mean map - 2017' heatmap. The bottom row shows a detailed time-series graph for Haren, a 'Personal alerts' settings screen, and a 'Notifications' settings screen.

Home Screen (Left): Last update: 11 January 2019, 12:00. AQI: Fairly good. Modellered air quality index for this location.

Home Screen (Middle-Left): Last update: 11 January 2019, 12:00. AQI: good. Modellered air quality index for this location.

Home Screen (Middle-Right): Last update: Jan 17, 2019, 00:00. Particulate Matter < 2.5 µm. Nearest station: Haren (41N043).

BC	NO2	O3	PM10	PM2.5
3.5 µg/m³	53.5 µg/m³	6 µg/m³	31.1 µg/m³	17.5 µg/m³
22.4km	14.3km	15.9km	14.3km	14.3km
Haren	Steenokkerzeel	Aarschot	Steenokkerzeel	Steenokkerzeel
41N043	40S202	42N035	40S202	40S202

Home Screen (Right): Last update: Jan 11, 2019, 12:00. Particulate Matter < 2.5 µm.

Location list (Middle-Left): Hasselt. Modellered annual mean value for this location: NO2, O3, PM10, PM2.5, BC.

Current location (Middle-Left): Hasselt. The location where you are currently...

Annual mean map - 2017 (Middle-Right): Heatmap showing annual mean values for 2017.

Time-series graph (Bottom-Left): Last update: Jan 15, 2019, 15:00. Graph showing concentration (µg/m³) over time for Haren. Legend: Ozone @ 41B004 - Bruxelles (Sainte-Catherin...), Particulate Matter < 10 µm @ 41R001 - Mole..., Particulate Matter < 2.5 µm @ 41R001 - Mole..., Nitrogen dioxide @ 41B004 - Bruxelles (Sai...), Black Carbon @ 41N043 - Haren.

Personal alerts (Bottom-Right): Notification above BelaAQI L... 5 - Moderate. Activate: On. Alert interval: an hour. Notification above BelaAQI L... 5 - Moderate.

Notifications (Bottom-Right): Flanders - Vlaamse Milieumaatschappij (VMM) - NL. Wallonia - Agence wallonne de l'air et du climat (AwAC) - FR. Brussels - Brussels Environment - NL/FR.

About the app (Bottom-Right): Version: 0.6.6. Show introduction.

Releases

- First public release during a work shop (November 2018)
→ did not attract enough attention – only feedback from people with the same mindset (AQ-people)
- Second public release got a lot of media coverage → allot of negative feedback by a new group of users, but let's not forget positive feedback too
- Confusion:
 - Modelled versus measured
 - Nearest station versus calculated index + forecast for your location
 - To many lines on one graph
- Technical hick-ups during launch



The communication people

Their analysis

IMG_0500.PNG

- Topbar is niet Adeer-variabelijk
- Verandering 'gemiddelde ...'
- Waarom hangen niet verlaten
- Grafiek is verticaal gericht: Wat is een goed ontwerp? Is elk goed ontwerp gelijk? Wat is de prijs?
- Overlapping van elementen
- Afhankelijk van de manier: - Afhankelijk van de manier gebruiken (de eerste manier) - Niet duidelijk dat dit verlaten is - Afhankelijk van de manier gebruiken 'wat wil het voor mij zeggen'
- Spatiaal verspreiden

IMG_0501.PNG

- Waarom hangen niet verlaten

IMG_0502.PNG

- Verandering (minder wetenschappelijk)
- Deze inhoud is irrelevant tot de app. Maar moet deze info hebben voor dit scherm.
- Link en 'leeg' area verlaten

IMG_0503.PNG

- Verandering
- Show, don't tell with QR / link moet dit dragen, geen moet aan 'verticale' blokkeer zijn...

IMG_0504.PNG

- Deze verandering is enige duiding van alle info.
- First-time user kaart PNG is niet, hoogste kan hier helpen.

IMG_0505.PNG

- Waar is mijn huidige locatie?
- Consistent of getuik, toggle in top, eenheden teken?

IMG_0506.PNG

- Waarom hangen niet verlaten, update data minder relevant dan titel
- Volgende elementen
- Kaart skimmer in app-stijl
- Kaart interface stijgen voor mobile

IMG_0507.PNG

- Wat zijn de behoeftes? Als dit meerpunten zijn, dan zijn deze belangrijkste info.
- Waarom kan user dit toggle? Op locatie verberg dit alles

IMG_0508.PNG

- Level van inkomsten zorgt voor verlies context: Als data zichtbaar veranderd op 'stratificaties, is dit handig. Indien de data eerder over schied van provincies veranderd, dan kan gemeente beter met 'tag' aangegeven worden in provincie / land-context

IMG_0509.PNG

- Wat is de waarde van deze info? Als dit de enige meerpunten zijn, dan kan heb je hier niet veel van als meerpunt van weg is?
- Een user moet gemakkelijk antwoord krijgen binnen 3 seconden.

IMG_0510.PNG

- Hoe is 'vandaag' anders dan 'actueel'?

IMG_0511.PNG

- Hoe is 'morgen' anders dan 'vandaag'? Dit kan eventueel als repetitieve animatie opvangen worden (zoals weerbericht)

IMG_0512.PNG

- Waarom moet user hier pixels ingeven? Gebruik data van eerste tabelblad

IMG_0513.PNG

- Level van inkomsten zorgt voor verlies context: Als data zichtbaar veranderd op 'stratificaties, is dit handig. Indien de data eerder over schied van provincies veranderd, dan kan gemeente beter met 'tag' aangegeven worden in provincie / land-context

IMG_0514.PNG

- Deze weergave is niet leesbaar
- Dit lijkt een data-dump! Een standaard user kan dit niet lezen / interpreteren.

IMG_0515.PNG

- Klikbaar maken van grafiek heeft geen meermassie

IMG_0516.PNG

- Dit is herhaling info vorige scherm?
- Deze functionaliteit verwijzdi diagram? Waarom is deze toggle nodig?

IMG_0517.PNG

- Kiezen van een periode lijkt overbodig? Als de tool een 'huidige weergave' is, heeft user geen nood aan data van 'huidig jaar'. Als een user in de toekomst wilt kijken, dan is dit via kaart => +2 dagen?
- Niet beschikbaar maken van deze data kan misleiden beter in een archief / verlaten? Of is de app om geschiedenis te bekijken?

IMG_0518.PNG

- Tijdschaal versus 'tag'?

IMG_0519.PNG

- Dit is nuttige en duidelijke info. Is dit mijn positie, en meten ook waar dit gemeten wordt.
- Waarom kan ik nu nog locatie ingeven?

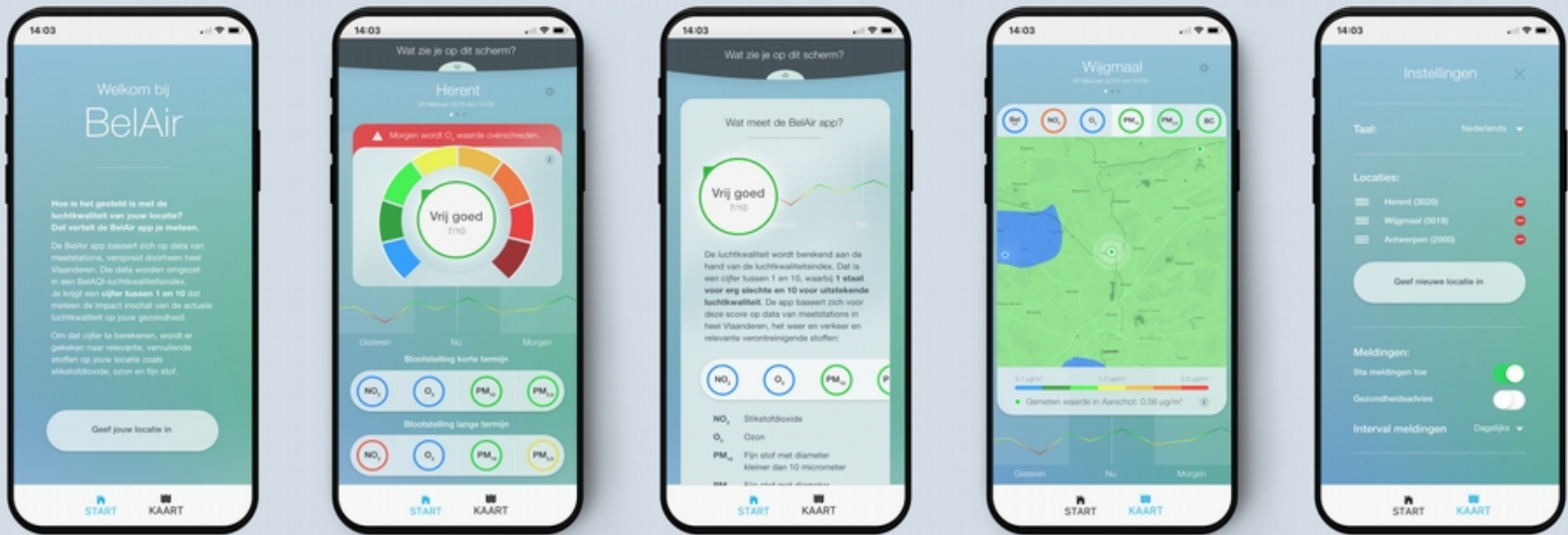
The communication people

The proposal



The communication people

The proposal



This is what we made of it..



Settings

User locations

- Current location: Activate this option to display air quality data for your current location.
- Leuven:
- Antwerpen ring:
- [CREATE NEW LOCATION](#)

Notifications

- Flanders - Vlaamse Milieumaatschappij (VMM) - NL:
- Wallonia - Agence wallonne de l'air et du climat (AwAC) - FR:
- Brussels - Brussels Environment - NL/FR:

Common

- Select a language: English
- Clear cache:

About the app

- Version: 0.9.8
- [SHOW INTRODUCTION](#)

Settings start page

- Show nearest measuring stations on start page:
- Show BelAQI subindices on start page:
- Show annual mean on start page:

Antwerpen ring

Last update: 3 September 2019, 07:00

Nitrogen dioxide

The impact of air quality is calculated on the basis of the air quality index. That is a figure between 1 and 10, where 10 stands for very poor and 1 for excellent air quality. For this score, the app is based on data from monitoring stations throughout Belgium, weather and traffic and relevant pollutants.

The index for the chosen location is updated every hour. The app also gives you a forecast of the BelAQI index for the next few hours and days.

The air quality index reflects the impact on health in the short term. This impact can vary from hour to hour and lead to temporary health problems. At higher concentrations of air pollutants, acute effects can occur, such as an asthma or

The map gives you an overview of the air quality in Belgium. Using a colour code, you can compare the air quality at your location with that of other locations. Red is very bad, while blue stands for excellent air quality.

- 1 - excellent
- 2 - very good
- 3 - good
- 4 - fairly good
- 5 - moderate
- 6 - poor
- 7 - very poor
- 8 - bad
- 9 - very bad
- 10 - horrible

Still to come..

- Personalised push notifications:
 - GDPR proof
 - { "lat": "50.878564", "lng": "4.655987", "language": "de", "key": "autogenerated_key_unique_per_location" }
 - fcm_<lat>_<lng>_<language>
- BelAir 2.0 based on results of a user questionnaire

https://github.com/irceline/aq-mobile-be

This repository Search Pull requests Issues Marketplace Explore

irceline / aq-mobile-be Unwatch 2 Star 0 Fork 1

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

App for consulting air quality data in Belgium using the ionic framework for Android and iOS Edit

Add topics

91 commits 2 branches 0 releases 2 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

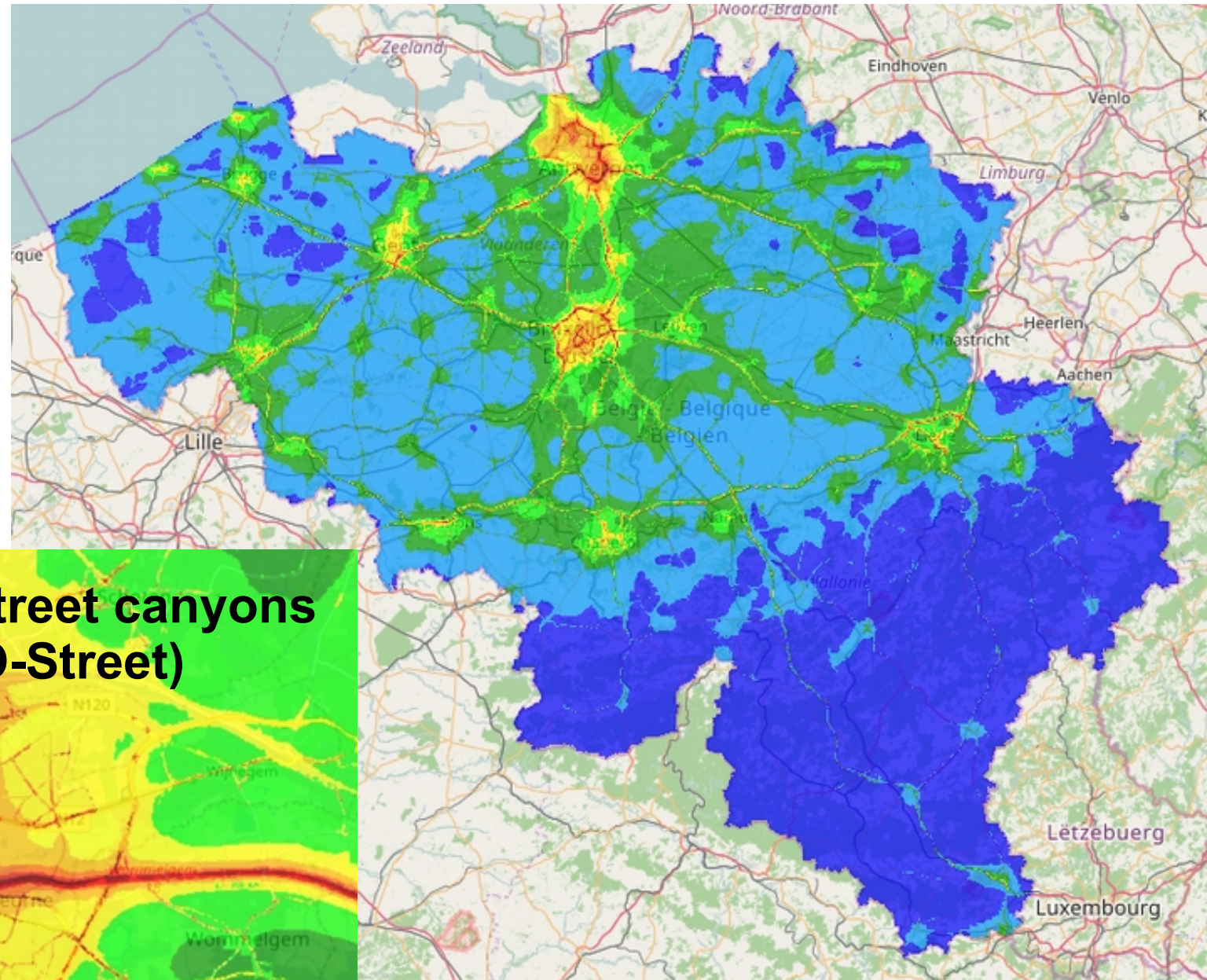
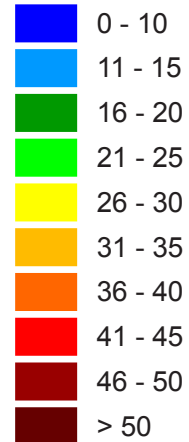
Commit	Message	Time
opeeters	bugfix: remove double "Currently:"	Latest commit 92d360 7 minutes ago
config	adjust to new toolbox versions	a month ago
resources	adjust app icon	a month ago
src	bugfix: remove double "Currently:"	7 minutes ago
.editorconfig	Initial commit	5 months ago
.gitignore	add push-notification	a month ago
config.xml	add offline/online hint	9 hours ago
ionic.config.json	introduce android build	5 months ago
package-lock.json	update 'hoek' 2.16.3 -> 4.2.1	15 minutes ago
package.json	upgrade ionic scripts	7 hours ago
readme.md	add OSX specific build instructions	4 days ago
tsconfig.json	fix undefined types issue while compiling	5 months ago
tslint.json	Initial commit	5 months ago

readme.md

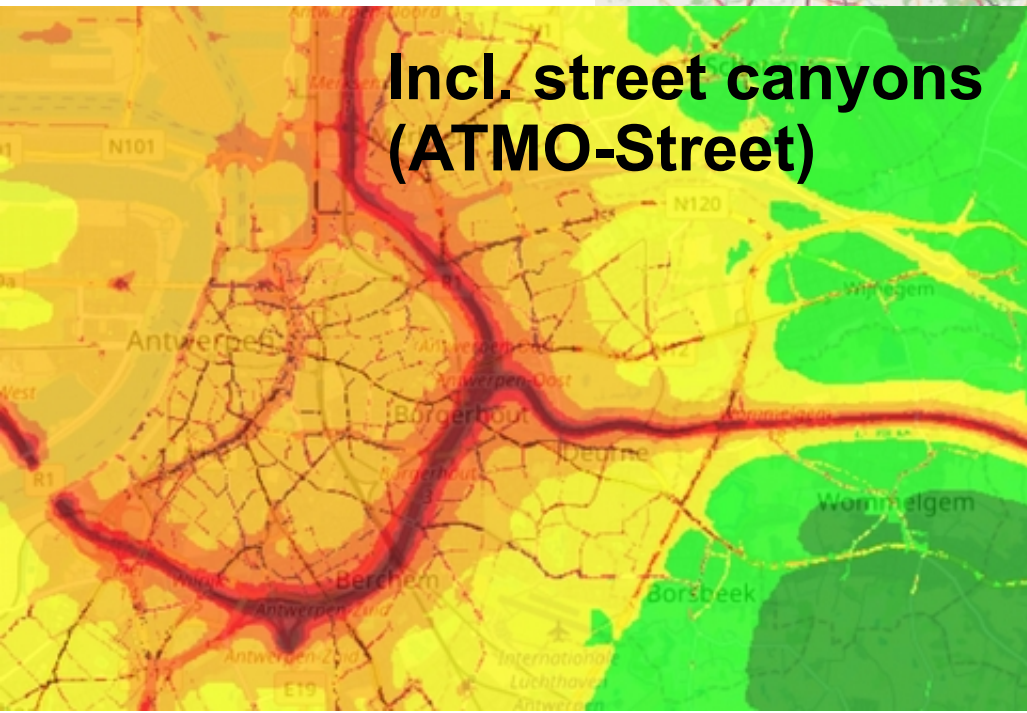
Hi resolution model (RIO-IFDM)

Nitrogen dioxide
(NO₂)
annual mean

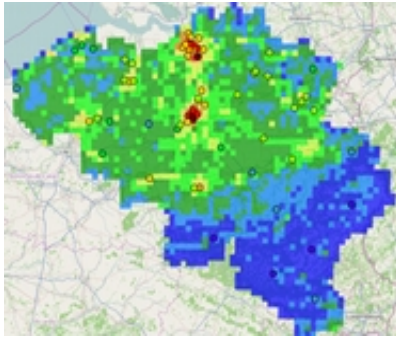
microgram/m³



**Incl. street canyons
(ATMO-Street)**

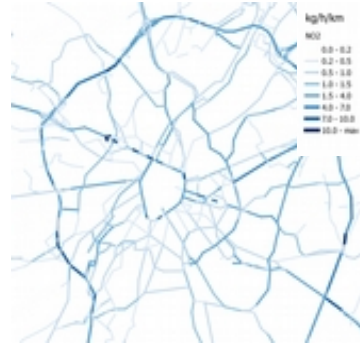


Hi resolution air quality model

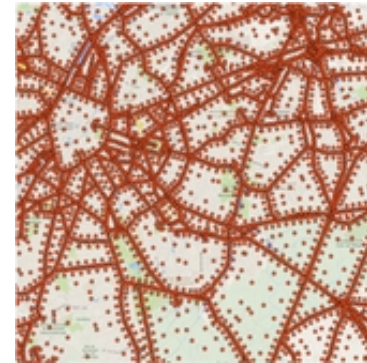


RIO
background

+

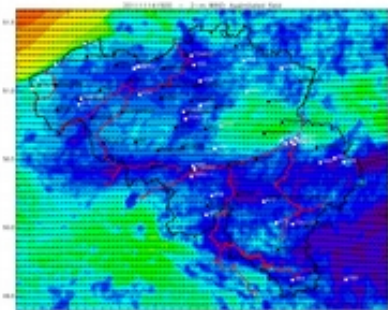


Line source
emissions



Grid of receptor
points

+

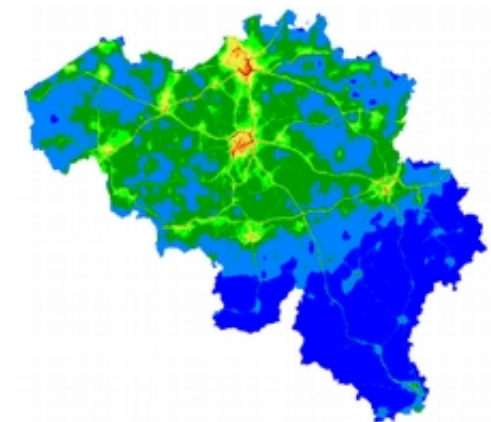


Assimilated meteo

+

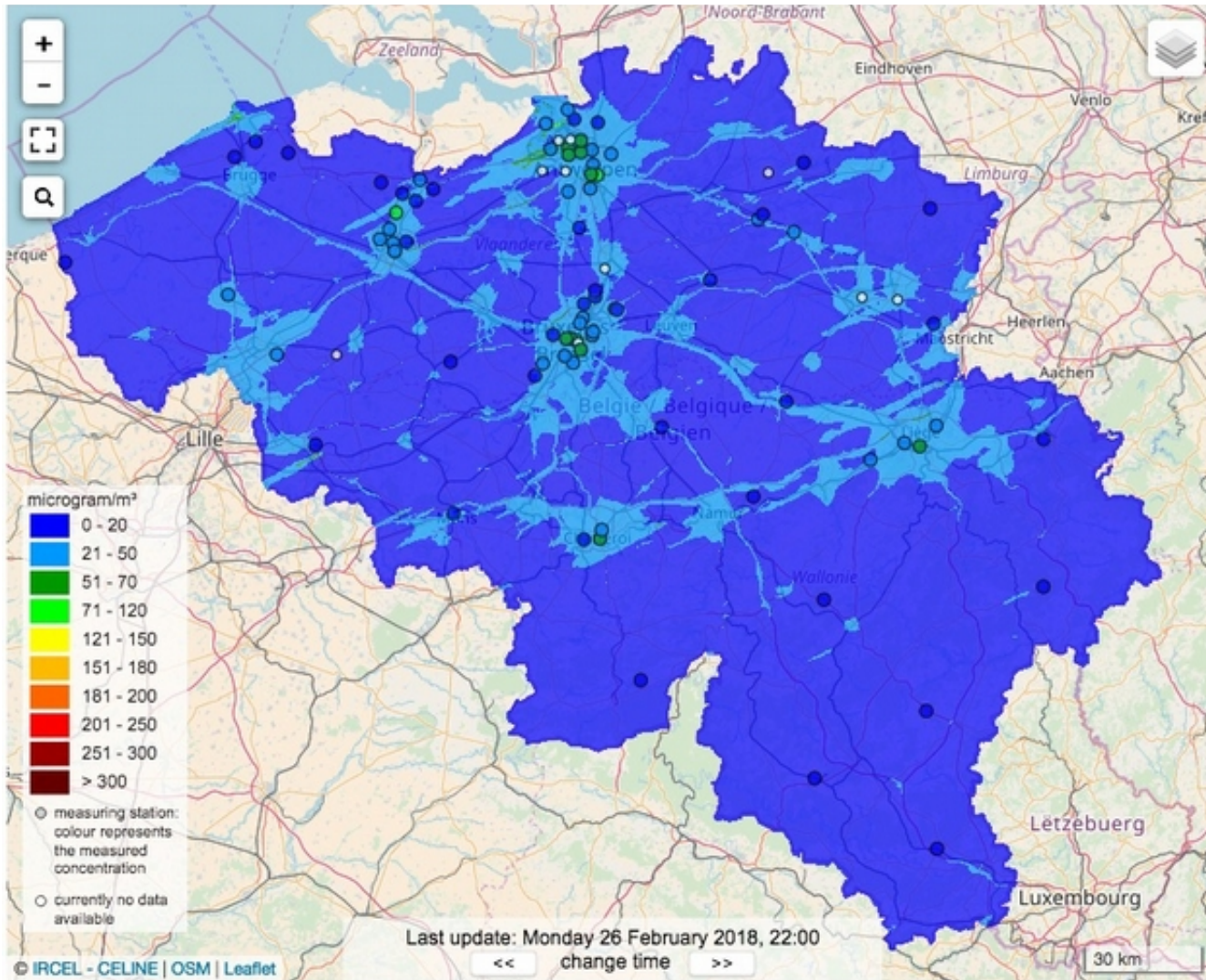


Point source
emissions



Hourly RIO-IFDM
Air Quality Index

real-time RIO-IFDM



Population Exposure Nitrogen Dioxide (NO₂)

concentration class	percentage inhabitants	cumulative percentage inhabitants
0 - 20	52.3	100
21 - 50	47.2	47.7
51 - 70	0.4	0.4

For the following pollutants:
BC, NO₂, O₃, PM₁₀ & PM_{2.5}

BUMBAir.be

<http://www.bumbair.be>

03/09/2019

last update: 2018-02-26 19:00:00+01

20

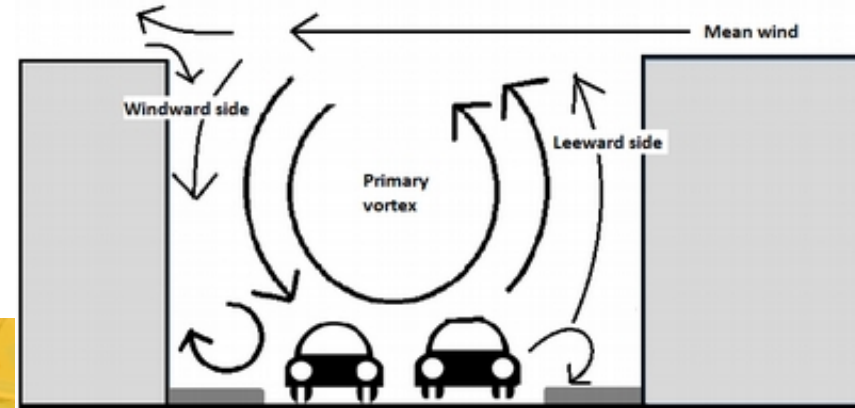
RIO-IFDM

versus

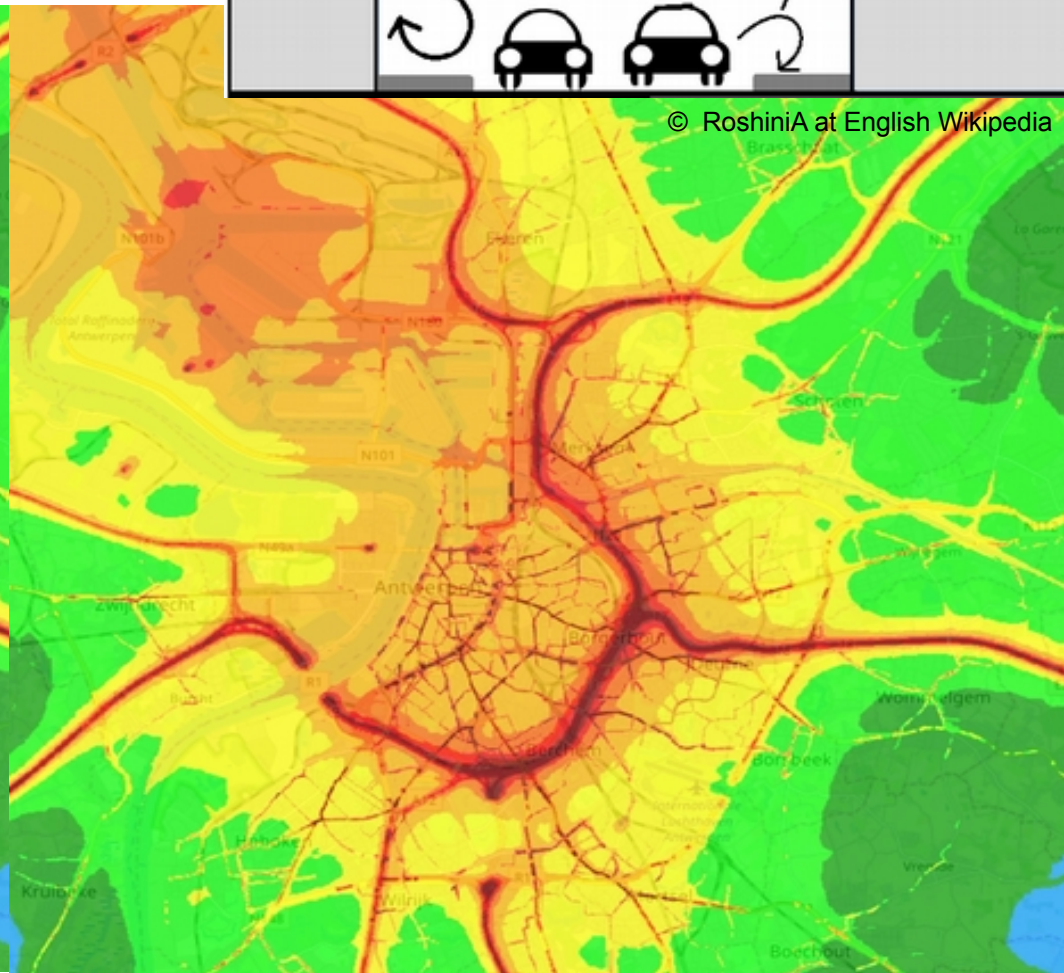
ATMO-Street

- “open street”
- difficult but feasible real-time chain
- performs very well in “open street” situations
- underestimation in busy road in an urban context

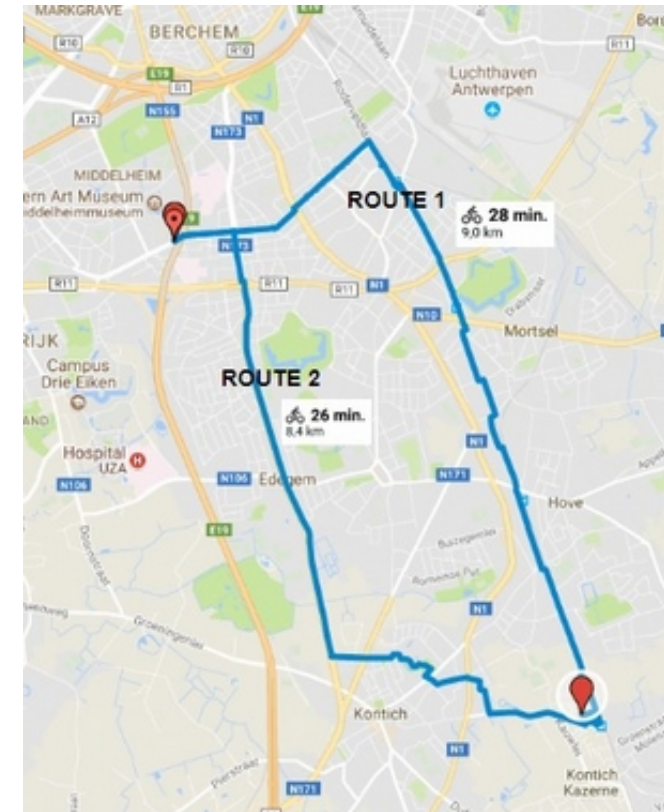
- “street canyon” effects
- technically not yet feasible in real-time



© RoshiniA at English Wikipedia



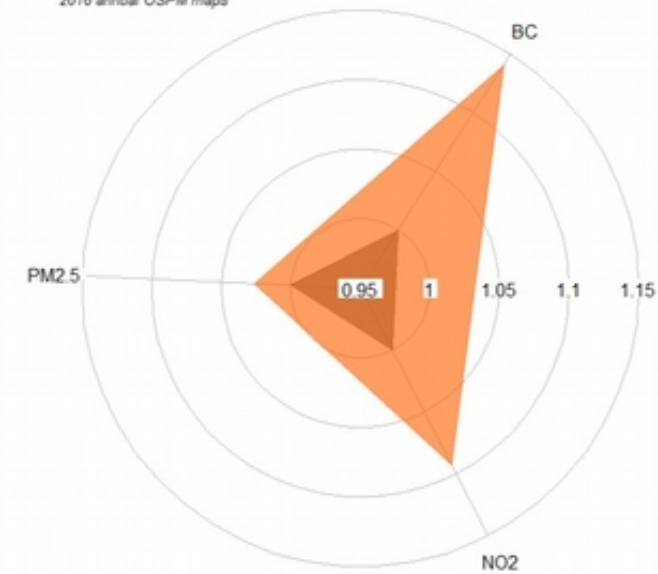
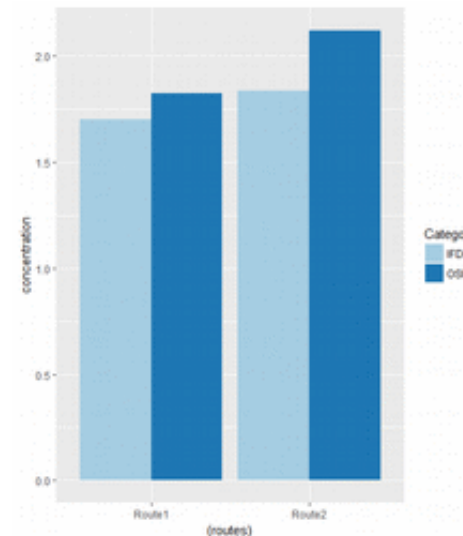
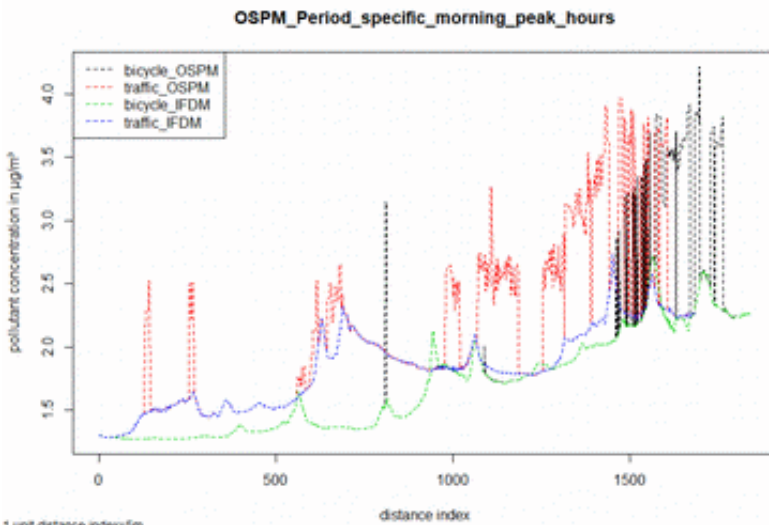
Validation of the route evaluation



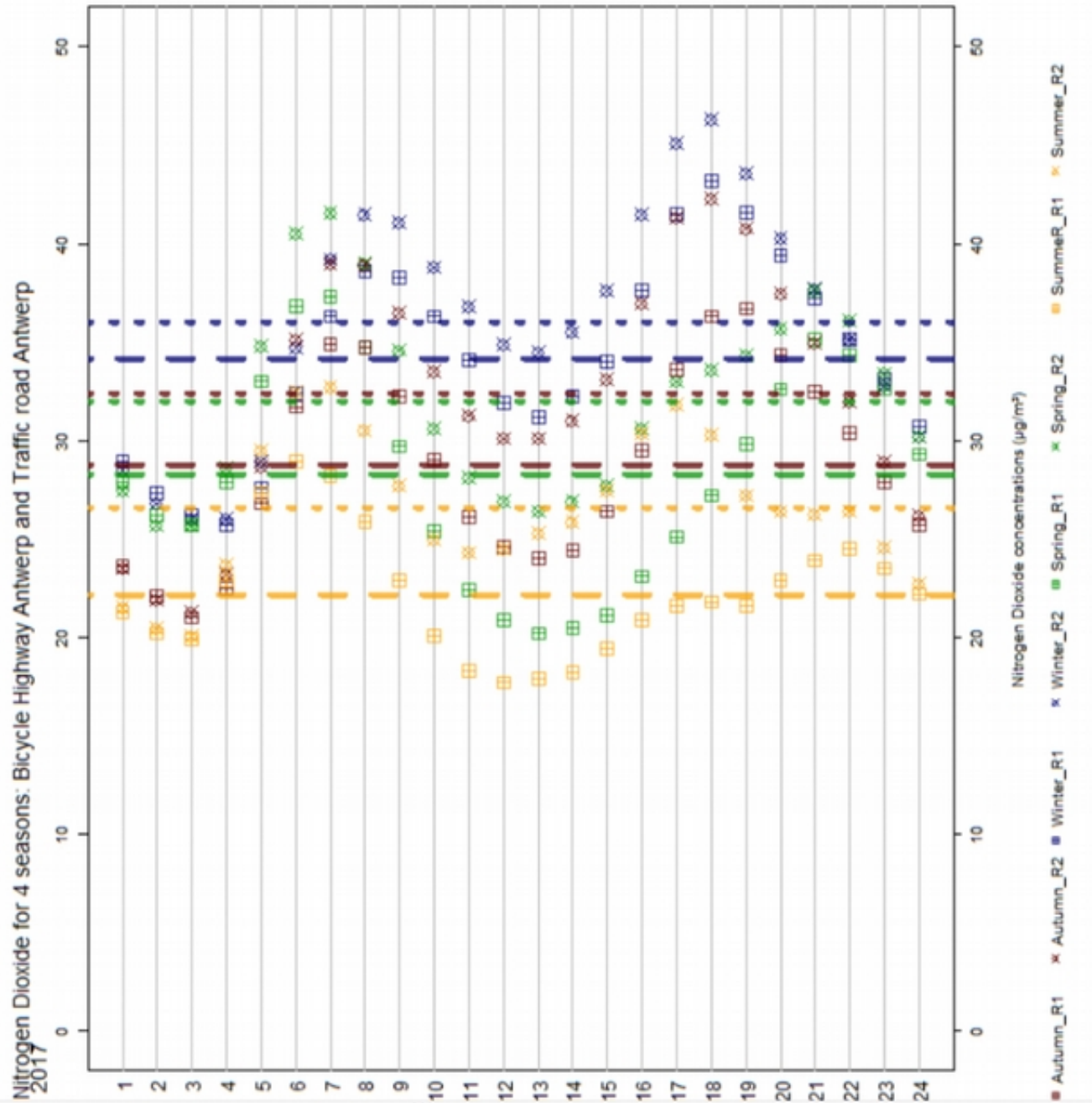
Bicycle highway=1.0 for each pollutant
 Air pollution: Traffic road and bicycle highway by comparison
 2016 annual OSPM maps

Comparing with results of:

Hofman, J. *et al.* "Cyclist exposure to black carbon, ultrafine particles and heavy metals: An experimental study along two commuting routes near Antwerp, Belgium." Environmental Research. Volume 164, July 2018, Pages 530-538



Comparing different time aggregations

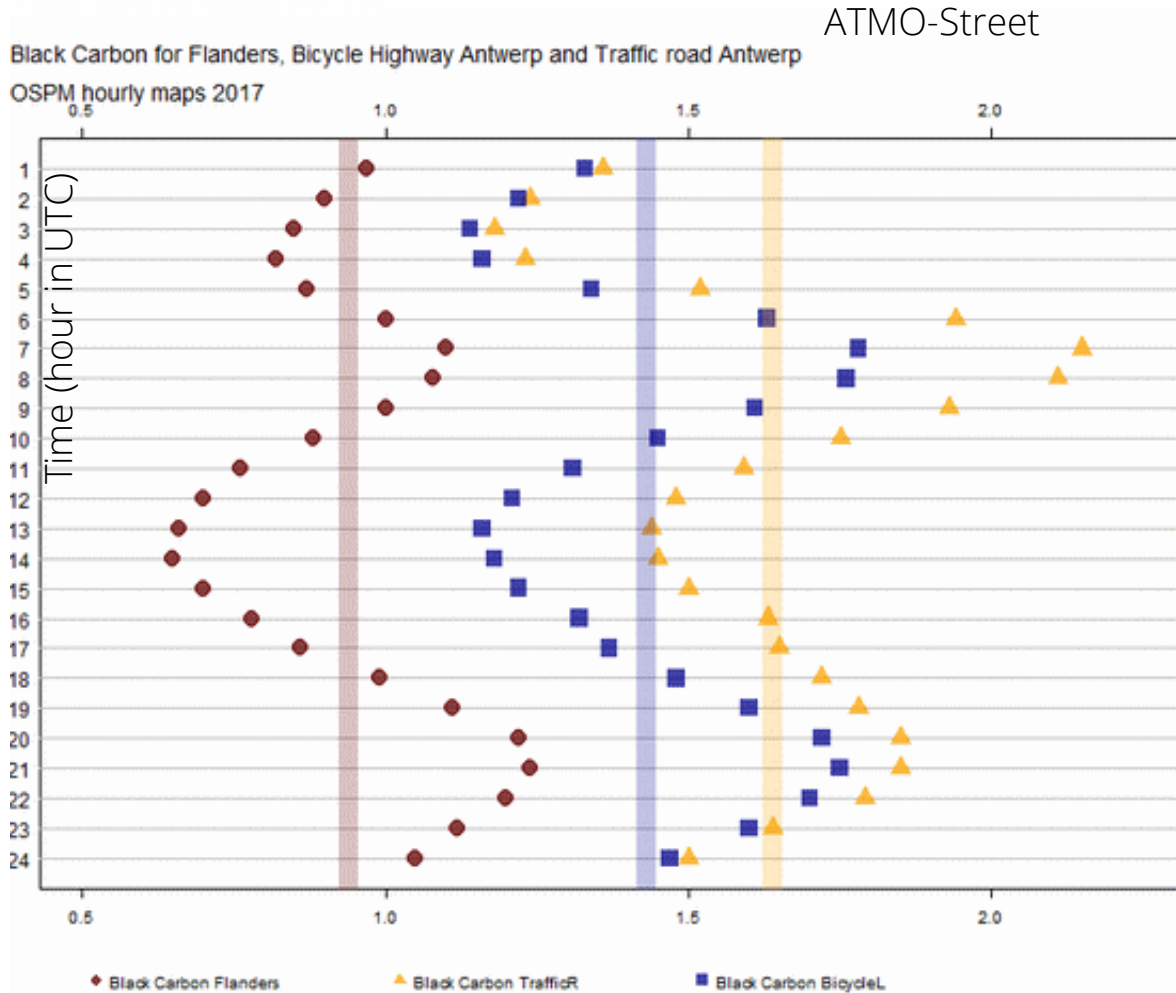


- **Annual-hourly** maps: better than annual 24h maps

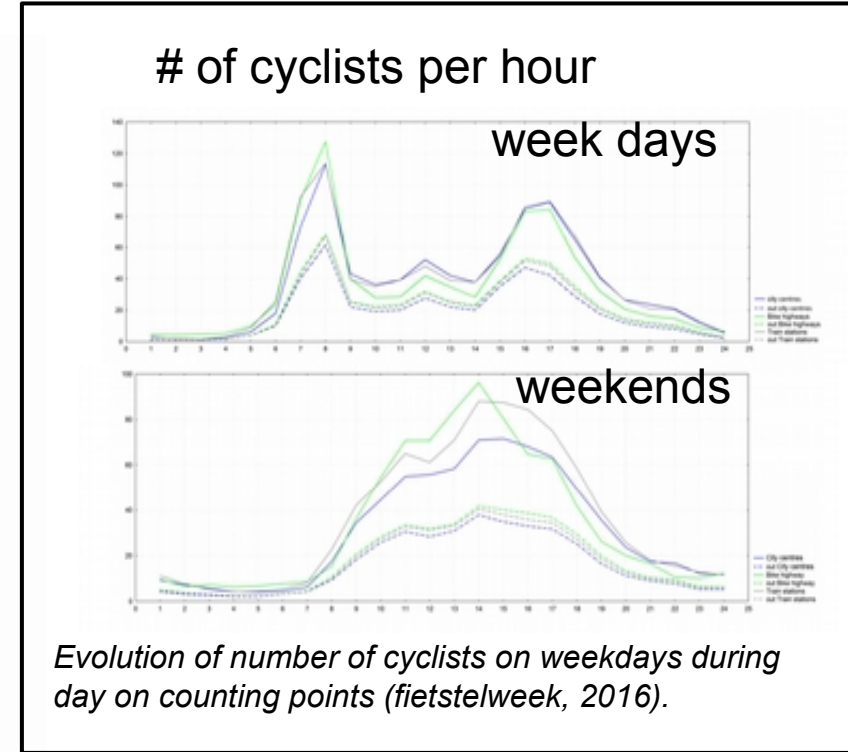
- **Seasonal-hourly** maps: better than annual-hourly maps

- **Monthly-hourly** maps: no advantage compared to seasonal-hourly maps

Daily pattern of air pollution concentrations

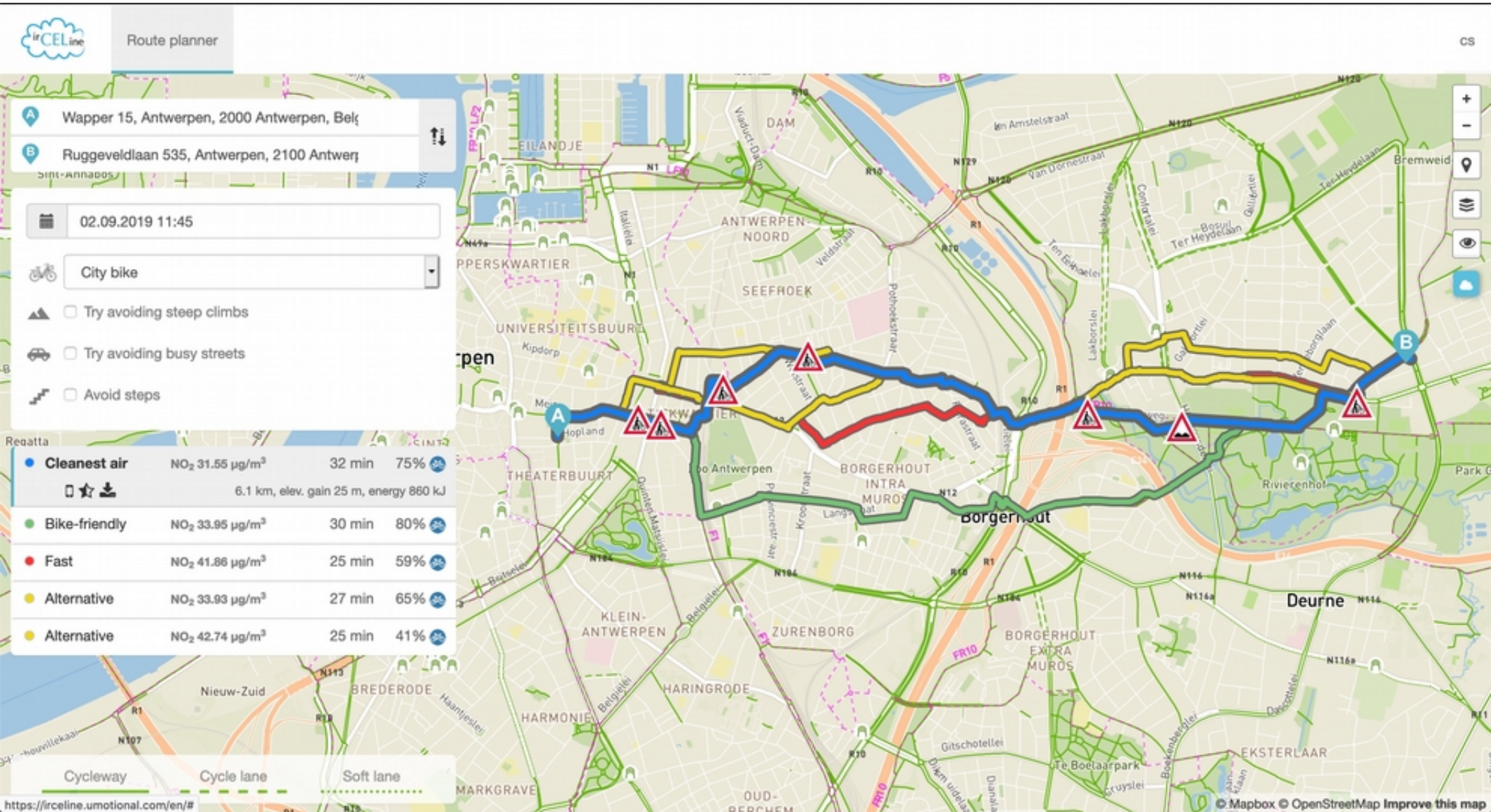


Average hourly Black Carbon (BC) concentrations in $\mu\text{g}/\text{m}^3$ for 2016 of Flanders (brown), a cycle-highway in Antwerp (blue) and a traffic-busy road in Antwerp (yellow). The vertical bars represent the daily average.



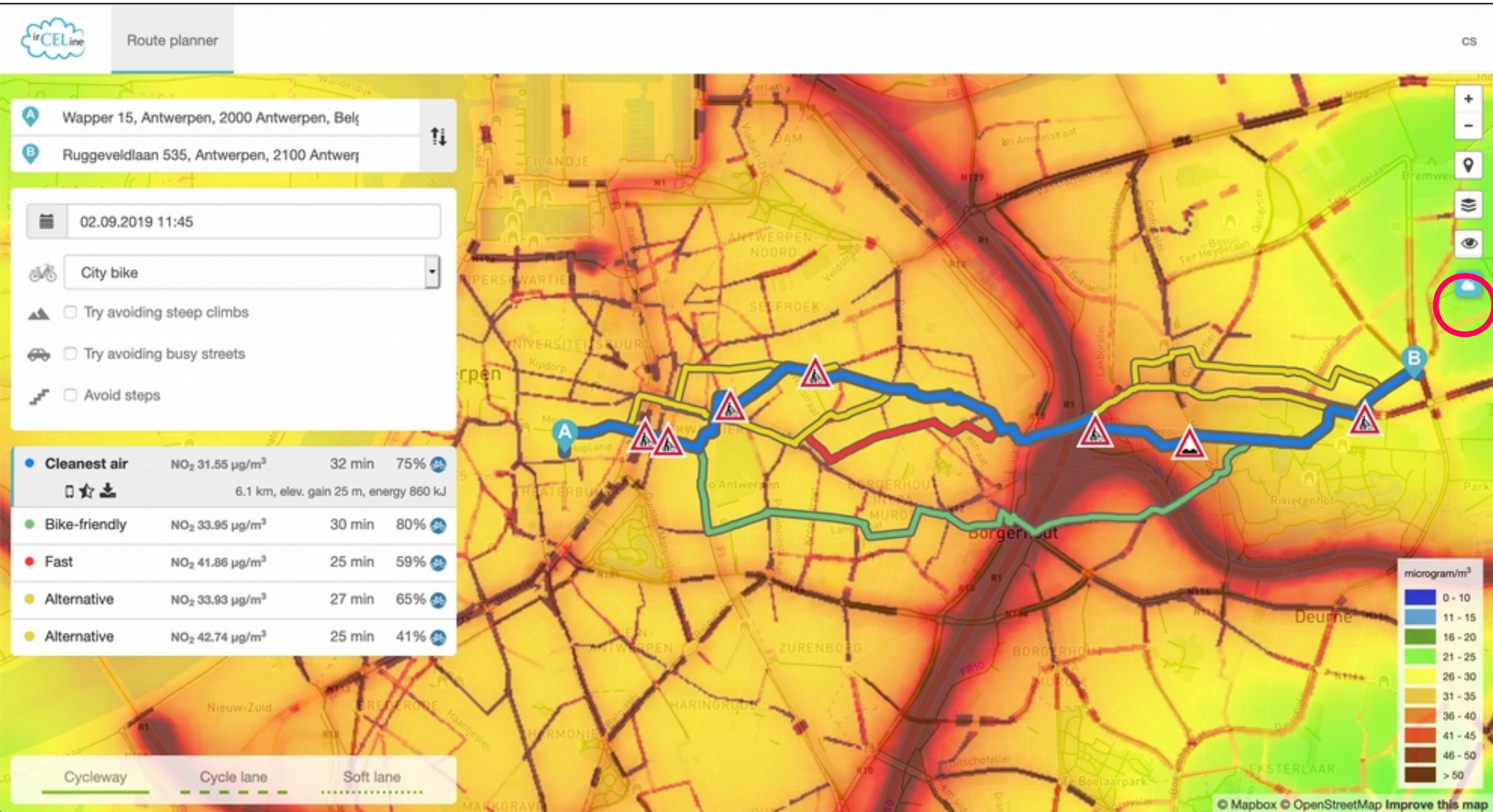
Demo implementation – cleanest air route

<https://irceline.umotional.com>



Demo implementation – cleanest air route

<https://irceline.umotional.com>





Informing you on ambient air quality
in the Belgian Regions

Vielen Dank!

Olav Peeters
peeters@irceline.be

Bram Vandeninden
vandeninden@irceline.be

Belgian Interregional Environment Agency (IRCEL - CELINE)