



Informing you on ambient air quality  
in the Belgian Regions

**HALE for e-reporting, Shiny/R for  
advanced interactive analyses and a  
Cordova mobile app:  
a fully open source SDI for Belgian air quality data**

Olav Peeters  
[peeters@irceline.be](mailto:peeters@irceline.be)

Belgian Interregional Environment Agency (IRCEL – CELINE)

# Content

- Who are we (IRCEL – CELINE) and what do we do?
- Our spatial data infrastructure (SDI)
- HALE and e-reporting
  - OGC-services (SOS & WFS) for e-reporting
  - HALE as general purpose ETL
  - HALE transformation as (queryable) service
- Shiny webapps with (real-time) data via a REST-api
- A Cordova mobile app

# IRCEL – CELINE

**Intergewestelijke** Cel voor het Leefmilieu (IRCEL)

Cellule Interrégionale de l'Environnement (CELINE)

Belgische Interregionale Umweltagentur (IRCEL - CELINE)

Belgian Interregional Environment Agency (IRCEL - CELINE)

Cooperation agreement between the three Belgian regions

VLAAMSE  
MILIEUMAATSCHAPPIJ

(VMM)



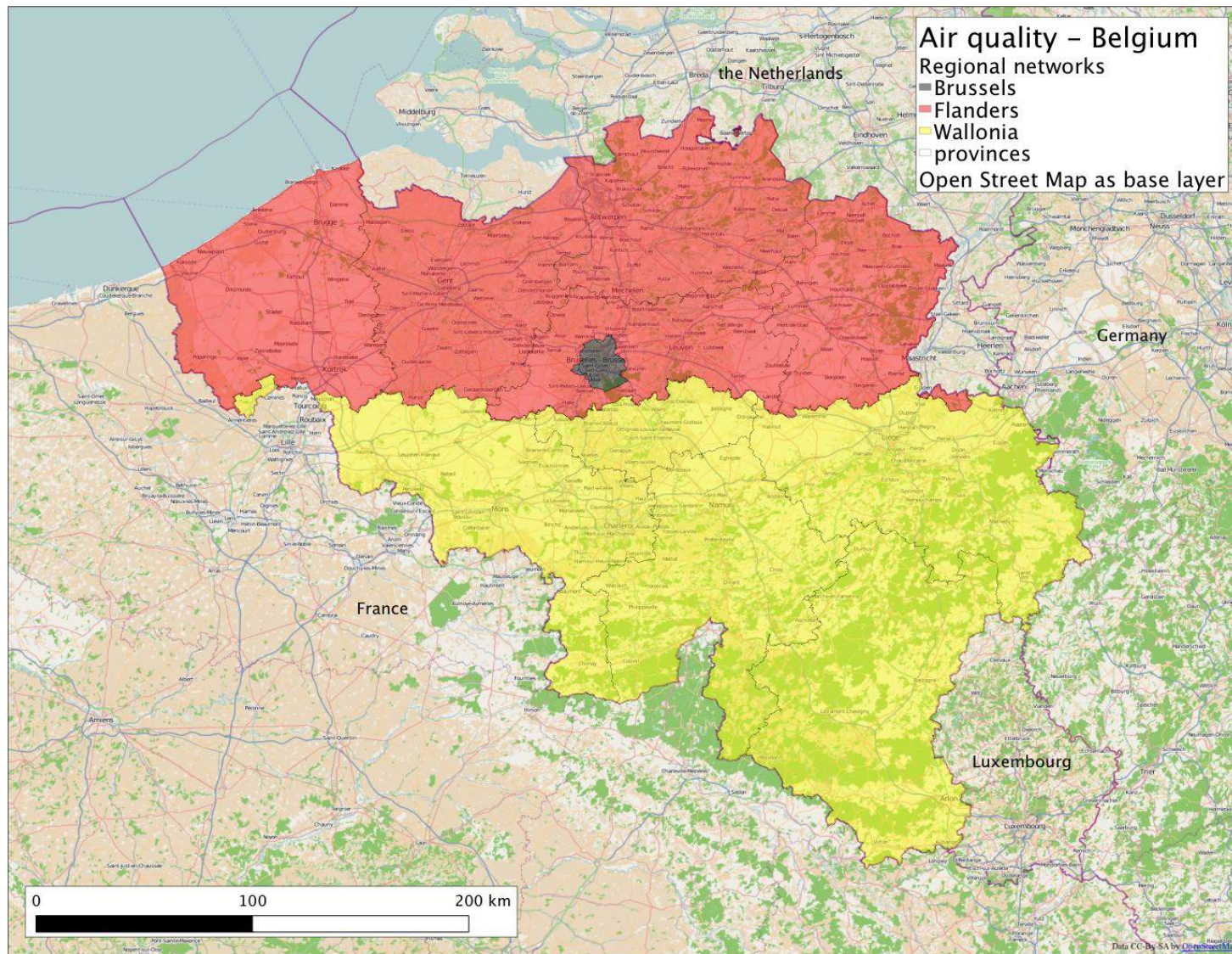
Leefmilieu Brussel -  
Bruxelles Environnement



Agence wallonne de l'Air et du  
Climat (AWAC)



# IRCEL – CELINE



The three Belgian networks

# IRCEL – CELINE



- Most important functions of IRCEL - CELINE (air quality):
  - Continuous forecasts (cf SMOG alert)
  - Informing the public on air quality (real-time and assessment)
  - National report under the air quality directive (2004/107/EC)
  - Enforcing a common scientific basis between monitoring networks
  - Interregional calibration laboratory
  - Interregional data processing centre (IDPC) - real-time database
- National Focal Point (Eionet)
- Compilation GHG inventory



irCELline Informing you on ambient air quality in the Belgian Regions

NL EN FR DE

Search Site

Air Quality Documentation About Us Forum

You are here: Home

### Belgian Interregional Environment Agency (IRCEL - CELINE)

#### Current Air Quality Measurements:

Last update: Wednesday 25 June 2014, 13:00

<< change time >>

NO<sub>2</sub> - hourly mean

PM<sub>10</sub> - running 24 hour mean

O<sub>3</sub> - hourly mean

good moderate bad

#### The BelATMO index

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

#### Forecast

today:

NO<sub>2</sub> (maximum daily 1-hour mean)

PM<sub>10</sub> (daily mean)

O<sub>3</sub> (maximum daily 1-hour mean)

tomorrow:

NO<sub>2</sub> (maximum daily 1-hour mean)

PM<sub>10</sub> (daily mean)

O<sub>3</sub> (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 29, 2013

More...

#### Subscribe to our mailing list

Email Address

First Name

Last Name

SMOG

☐ English

☐ Nederlands

☐ Français

☐ Deutsch

Email Format

☐ html

☐ text

Subscribe

#### Tweets

Follow

IRCEL-CELINE @SMOG\_BE 12 Jun

Wm vorige tweet over NEC: zie ook tweets van 24 maart jongstleden

IRCEL-CELINE @SMOG\_BE 12 Jun

België haalt #NEC emissieplafond voor SO<sub>2</sub>, NMVOS en NH<sub>3</sub>, maar is voor NO<sub>x</sub> nog 17% van doel verwijderd goo.gl/WHAX

EU EnvironmentAgency @EUEnvironment 12 Jun

EU air pollutant emissions have decreased over the last decades but some are still being emitted above legal limits: goo.gl/WHAX

IRCEL-CELINE @SMOG\_BE 9 Jun

Météo instable. La prévision d'ozone s'avère particulièrement délicate. Concentrations d'ozone prévues entre 130 et 180 µg/m<sup>3</sup>

IRCEL-CELINE @SMOG\_BE 9 Jun

Tweet to @SMOG\_BE

Site Map Accessibility Contact

The Plone® Open Source CMS/WCM is © 2000-2014 by the Plone Foundation and friends. Distributed under the GNU GPL license.

This Plone Theme brought to you by Simples Consultants.

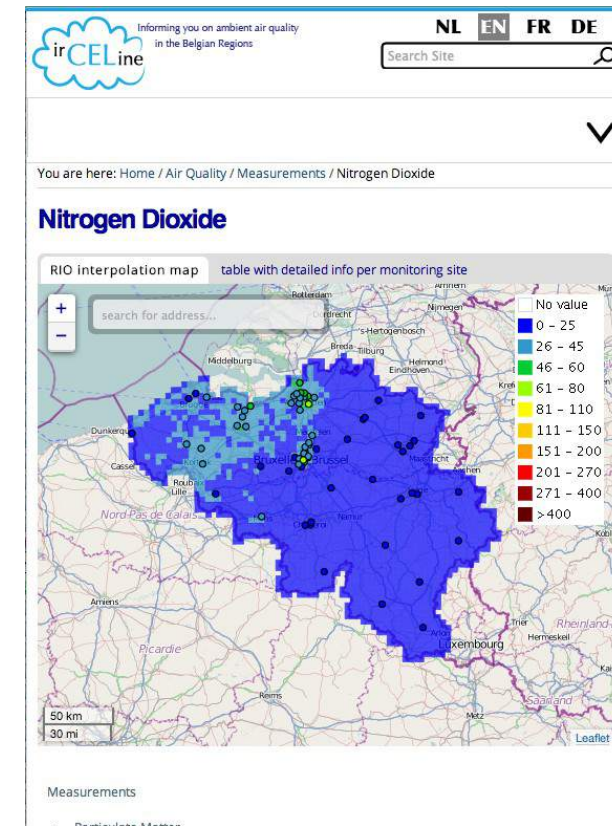
# IRCEL – CELINE

<http://www.irceline.be>

- Real-time data
- All major pollutants (incl. BC)
- Forecasts
- Information about pollutants
- Publications
- etc.

Integration of OGC-services into website (leaflet.js)

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



## Nitrogen Dioxide

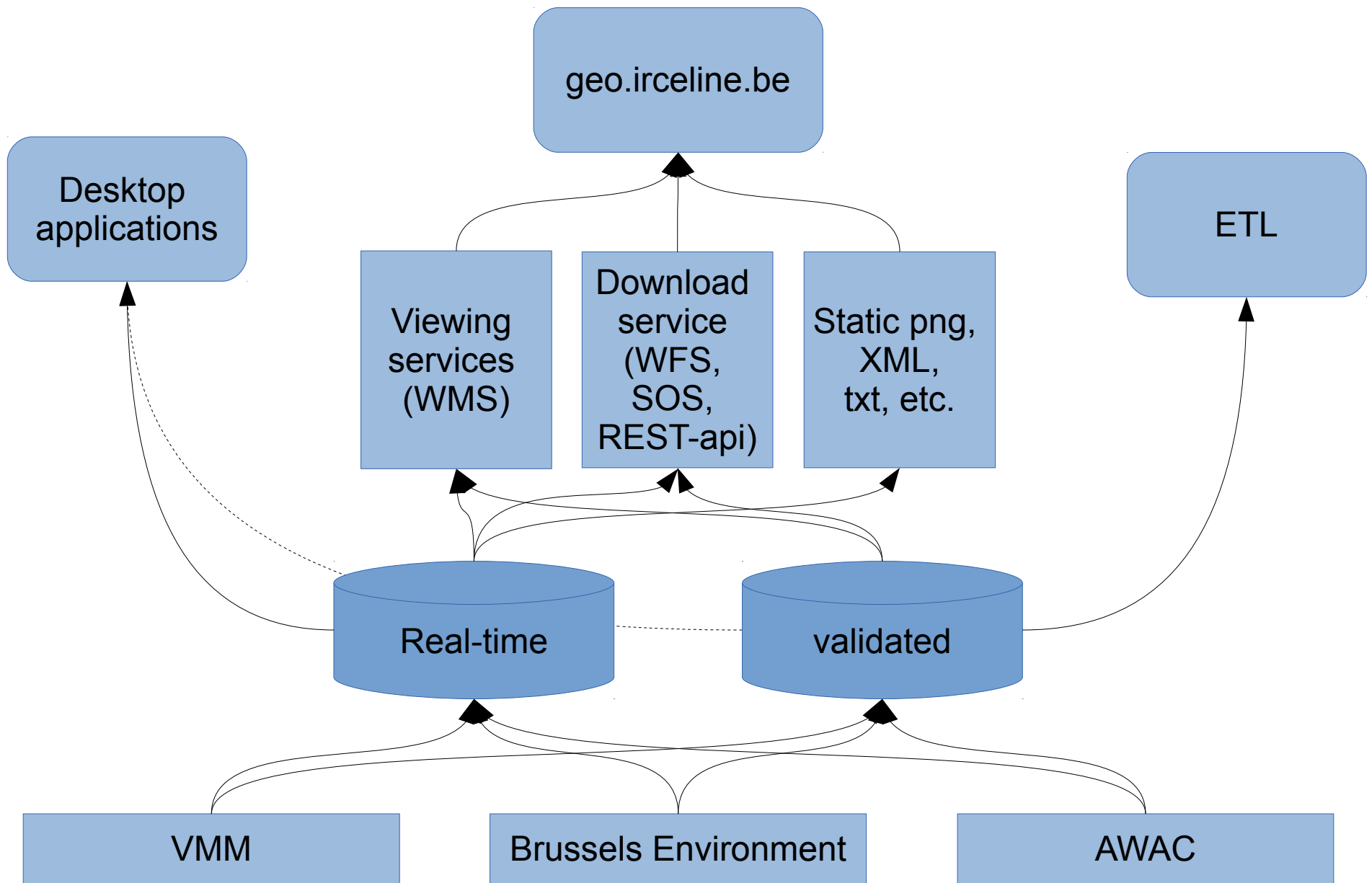
RIO interpolation map table with detailed info per monitoring site

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

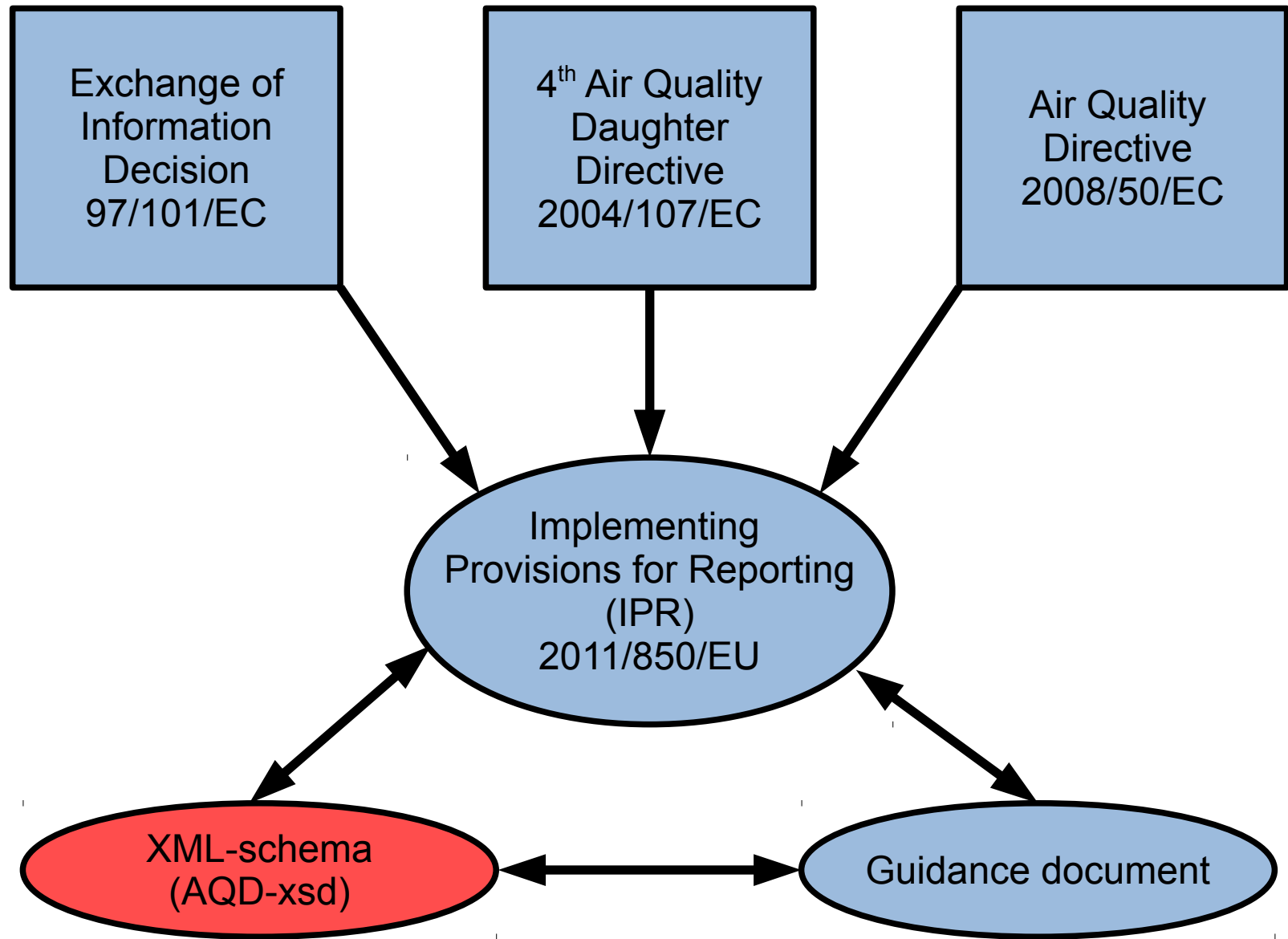
STATION		Actual values	highest 1-hour average today	data received
code	city	µg/m <sup>3</sup>	at (local time)	
41B004	Brussel (Sint-Katelijne)	Bxl	45 70 10:00	16:00
41B006	Brussel (EU Parlement)	Bxl	53 65 11:00	16:00
41B008	Brussel (Belardstraat)	Bxl	81 95 10:00	16:00
41B011	Sint-Agatha-Berchem	Bxl	34 47 10:00	16:00
41MEU1	Neder-Over-Heembeek	Bxl	49 10:00	14:30
41N043	Voorhaven (Haren)	Bxl	43 81 09:00	16:00
41R001	Sint-Jans-Molenbeek	Bxl	58 69 10:00	16:00
41R002	Elsene	Bxl	84 91 10:00	16:00
41R012	Ukkel	Bxl	34 53 11:00	16:00
41WOL1	Sint-Lambrechts-Woluwe	Bxl	58 71 10:00	16:00
47E013	Vorst	Bxl	39 52 10:00	16:00
40OB01	Oostrozebeke	Vla	18 33 01:00	16:00



# Overview SDI @ IRCEL - CELINE



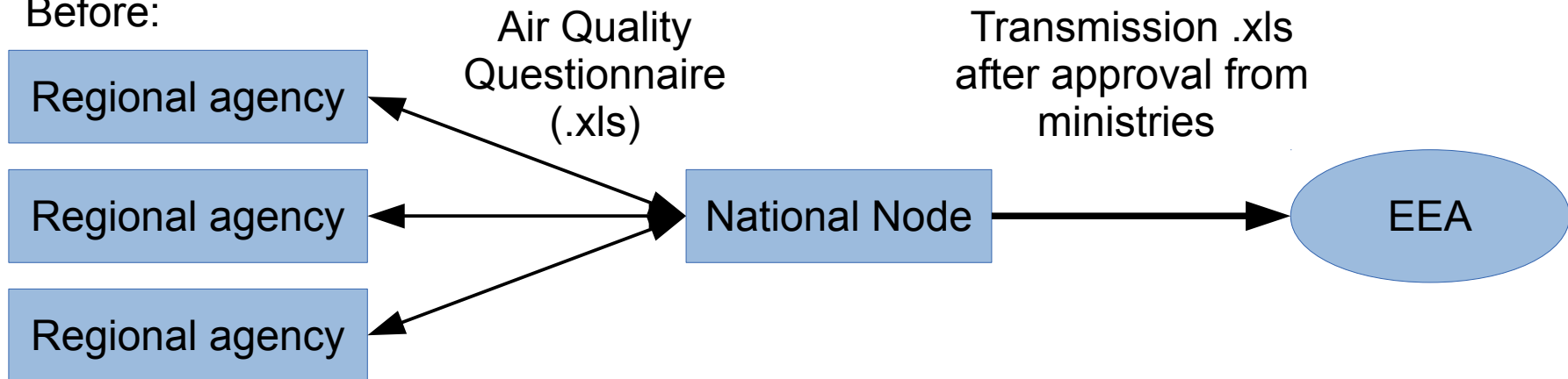
# E-reporting and Air Quality



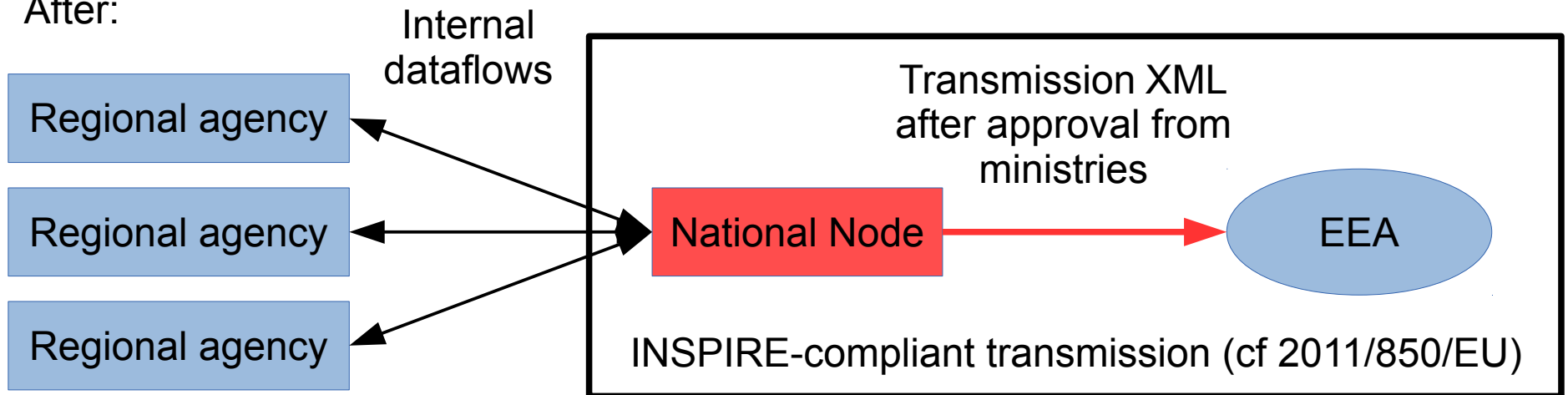


# E-reporting under the IPR

Before:



After:



# E-reporting: the data flows involved

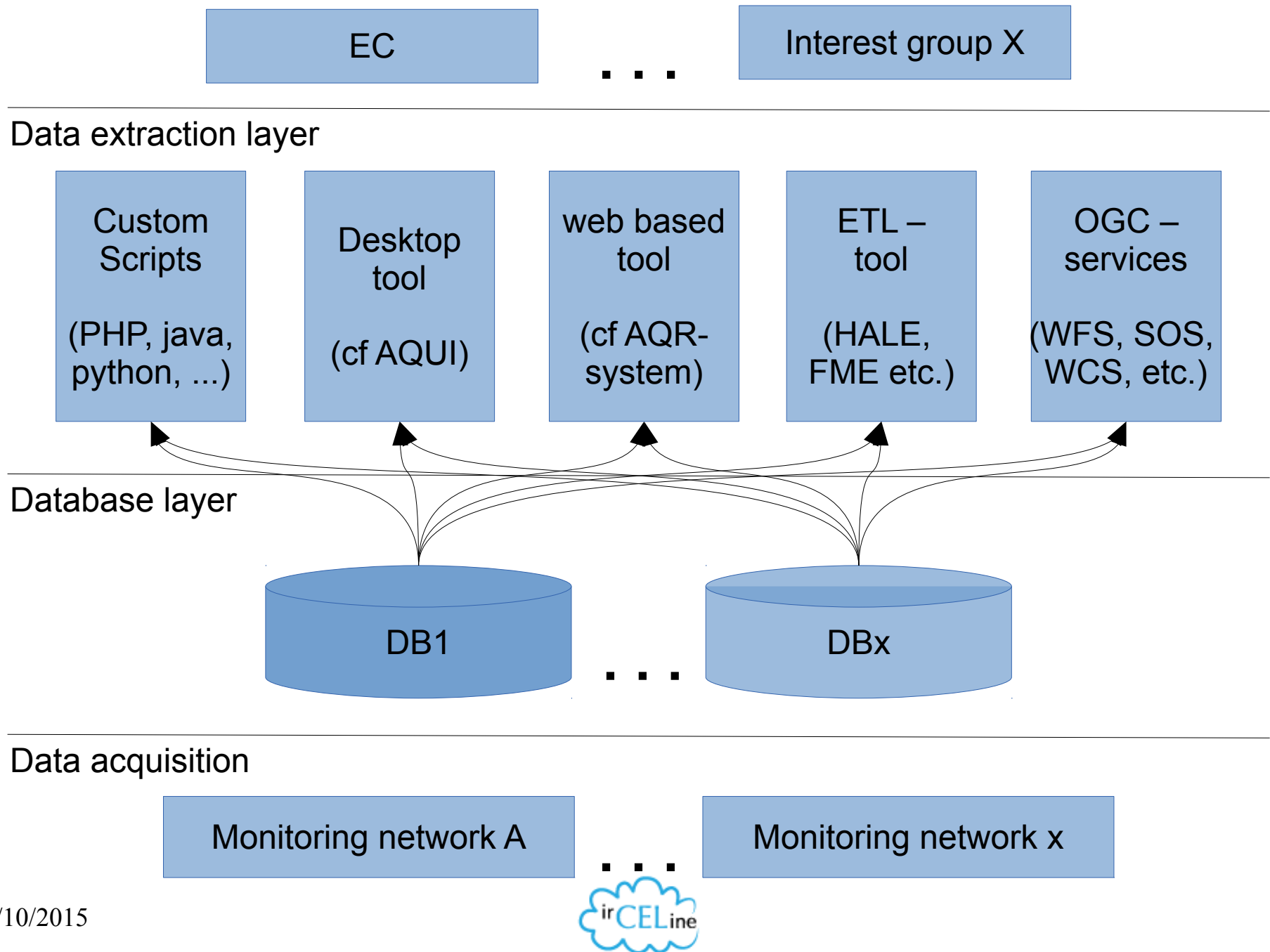
(cf Implementing Provisions for Reporting (IPR) 2011/850/EU)

INPIRE Data Theme	Content
III.11.AM	Dataset B – "zones and agglomerations"
III.11.AM	Dataset C – "assessment regime"
III.11.AM	Dataset D – "assessment methods"
III.7. EF	Dataset E1a – "primary validated assessment data – measurements"
III.13 AC	Dataset E1b – "primary validated assessment data – modelled"
III.7. EF	Dataset E2a – "primary up-to-date assessment data – measurements"
III.13 AC	Dataset E2b – "primary up-to-date assessment data – modelled"
III.7. EF	Dataset F1a – "aggregated data - primary validated measurements"
III.13 AC	Dataset F1b – "aggregated data - primary validated modelled"
III.7. EF	Dataset F2 – "aggregated data - primary up-to-date measurements"
III.11.AM	Dataset G – "attainment of environmental objectives"
III.11.AM	Dataset H – "air quality plans"
III.11.AM	Dataset I – "source apportionment"
III.11.AM	Dataset J – "scenario for the attainment year"
III.11.AM	Dataset K – "measures"

+ a header transmitted with every separate submission

colours represent similar data types

# E-reporting: plenty of ways to skin the cat



# Sensor observation services (SOS)

... an INSPIRE compliant downloading service

<http://sos.irceline.be>

- Efficient transmission of time series

```
<swe:encoding>
  <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator=";"/>
</swe:encoding>
<swe:values>
  2013-02-12T12:00:00.000+01:00,19.0;2013-02-12T13:00:00.000+01:00,24.0;2013-02-
  12T14:00:00.000+01:00,28.0;2013-02-12T15:00:00.000+01:00,23.0;2013-02-
  12T16:00:00.000+01:00,21.0;2013-02-12T17:00:00.000+01:00,19.0;2013-02-
  12T18:00:00.000+01:00,18.0;2013-02-12T19:00:00.000+01:00,22.0;2013-02-
  12T20:00:00.000+01:00,14.0;2013-02-12T21:00:00.000+01:00,21.0;2013-02-
  12T22:00:00.000+01:00,21.0;2013-02-12T23:00:00.000+01:00,21.0;2013-02-
  13T00:00:00.000+01:00,20.0;2013-02-13T01:00:00.000+01:00,23.0;2013-02-
  13T02:00:00.000+01:00,18.0;2013-02-13T03:00:00.000+01:00,11.0;2013-02-
  13T04:00:00.000+01:00,2.0;2013-02-13T05:00:00.000+01:00,1.5;2013-02-
  13T06:00:00.000+01:00,1.0;2013-02-13T07:00:00.000+01:00,1.0;2013-02-
  13T08:00:00.000+01:00,1.0;2013-02-13T09:00:00.000+01:00,1.0;2013-02-
  13T10:00:00.000+01:00,1.5;
</swe:values>
```

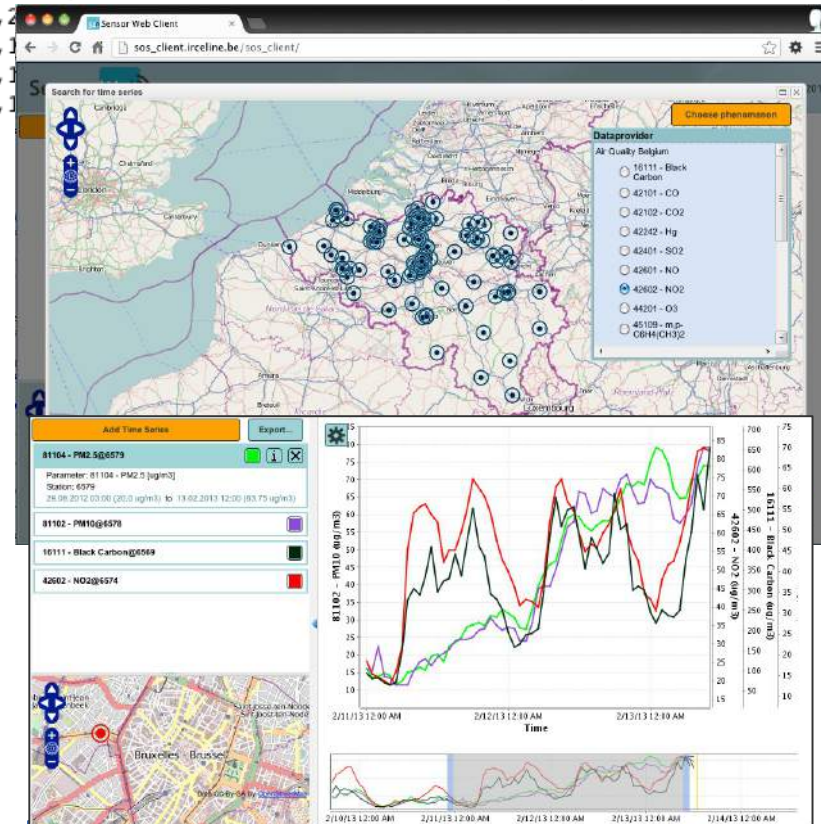
Geographic position

- queryable:

Extended for  
e-reporting  
since version  
4.3.x

Timestamp & measured concentrations (e.g. 24 hours)

```
<swe:values>
  2013-02-12T12:00:00.000+01:00,19.0;2013-02-12T13:00:00.000+01:00,24.0;2013-02-
  12T14:00:00.000+01:00,28.0;2013-02-12T15:00:00.000+01:00,23.0;2013-02-
  12T16:00:00.000+01:00,21.0;2013-02-12T17:00:00.000+01:00,19.0;2013-02-
  12T18:00:00.000+01:00,18.0;2013-02-12T19:00:00.000+01:00,22.0;2013-02-
  12T20:00:00.000+01:00,14.0;2013-02-12T21:00:00.000+01:00,21.0;2013-02-
  12T22:00:00.000+01:00,21.0;2013-02-12T23:00:00.000+01:00,21.0;2013-02-
  13T00:00:00.000+01:00,20.0;2013-02-13T01:00:00.000+01:00,23.0;2013-02-
  13T02:00:00.000+01:00,18.0;2013-02-13T03:00:00.000+01:00,11.0;2013-02-
  13T04:00:00.000+01:00,2.0;2013-02-13T05:00:00.000+01:00,1.5;2013-02-
  13T06:00:00.000+01:00,1.0;2013-02-13T07:00:00.000+01:00,1.0;2013-02-
  13T08:00:00.000+01:00,1.0;2013-02-13T09:00:00.000+01:00,1.0;2013-02-
  13T10:00:00.000+01:00,1.5;
</swe:values>
```





# Sensor observation services (SOS)

- SOS is an OGC-standard
  - components:
    - DB with O&M data model (PostgreSQL, but also MySQL, Oracle, MS SQL server)
    - Java runtime environment (JRE)
    - Servlet Container (e.g. Apache Tomcat)
    - WAR file (<http://52north.org/downloads/sensor-web/sos>)
    - Web server (Apache or Nginx)
  - GetCapabilities, GetObservation, DescribeSensor
  - RegisterSensor, InsertObservation
  - GetFeatureOfInterest, GetObservationById, GetResult
- <https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation>  
<http://52north.org/communities/sensorweb/sos/>

# SOS and the IPR (and INSPIRE)

- The IPR data model expects some extra elements
  - startTime and endTime
  - Validity and verification flag
  - The IPR header
- More convenient to have IPR specific interpretation of standard SOS elements
  - e.g. URI's as pollutant names
- INSPIRE specifications for downloading services
  - Service has to be able to handle multilingual
  - Return geometry in multiple coordinate systems
  - Some extra metadata elements


See: [https://ies-svn.jrc.ec.europa.eu/projects/download-services-tg/wiki/ARE3NA\\_SOS\\_study](https://ies-svn.jrc.ec.europa.eu/projects/download-services-tg/wiki/ARE3NA_SOS_study)

# SOS and the IPR (and INSPIRE)

[Home](#) [Client](#) [Documentation](#) [Admin](#)

## 52°North SOS Test Client

Choose a request from the examples or write your own to test the SOS.



### Examples

**NOTE:** Requests use example values and are not dynamically generated from values in this SOS. Construct valid requests by changing request values to match values in the Capabilities response.

**NOTE:** For security reasons, the transactional SOS operations are disabled by default and the *Transactional Security* is activated by default with allowed IPs *127.0.0.1*. The transactional operations can be activated in the [Operations settings](#) and the *Transactional Security* can be deactivated in the [Transactional Security tab of the settings](#).

AQD

Any Service

AQD

SOS

Any Version

Any Binding

GetObservation

### Service URL

http://geo.irceline.be/sos/service

### Request

GET

Content-Type

Accept

Permalink

Syntax

1

Send

http://geo.irceline.be/sos/client

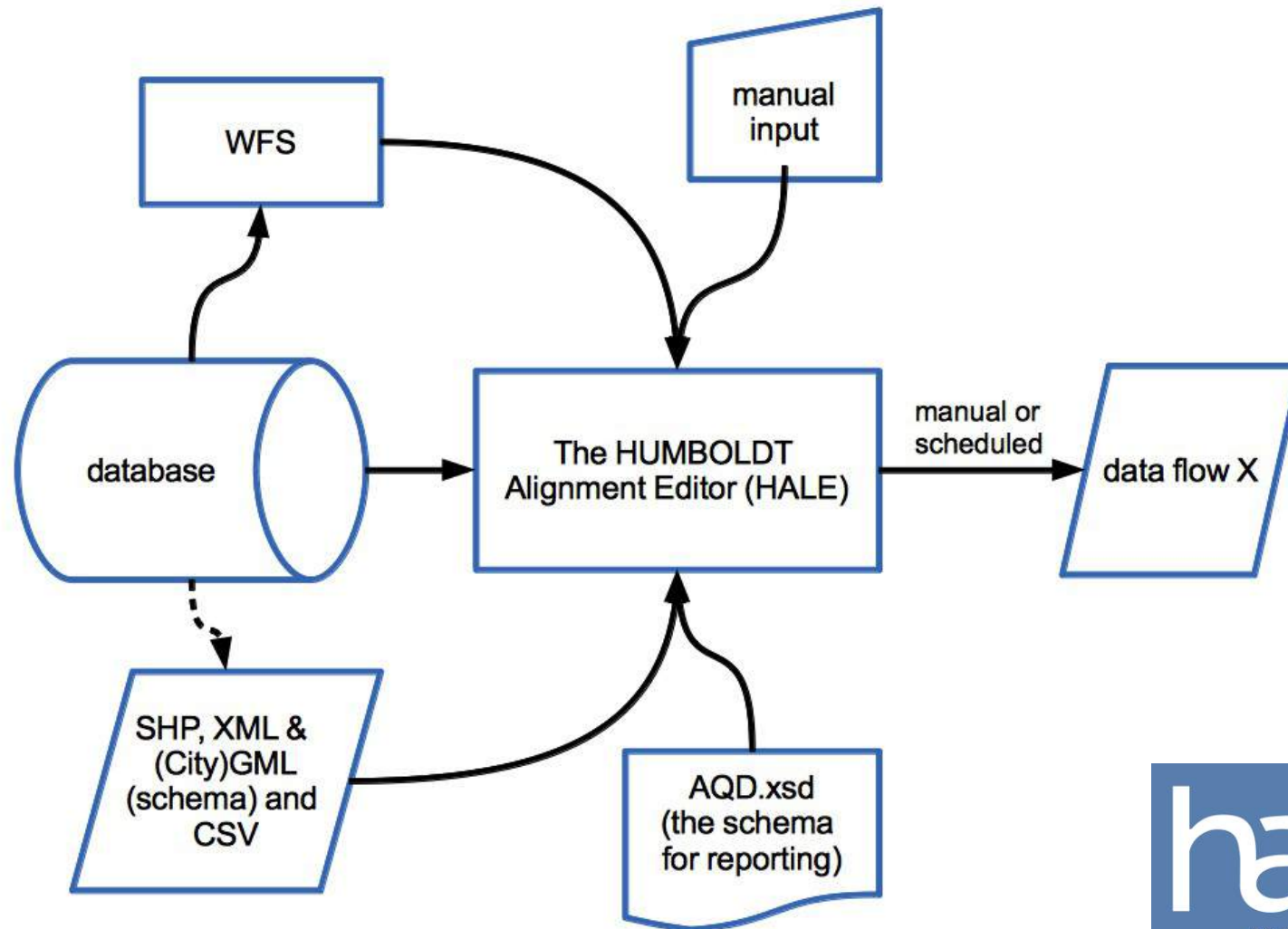
# Documentation

- General documentation SOS server
  - <https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation>
- INSPIRE Download Service extension
  - [https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation#INSPIRE\\_Download\\_Service\\_extension](https://wiki.52north.org/bin/view/SensorWeb/SensorObservationServiceIVDocumentation#INSPIRE_Download_Service_extension)
- About the additional elements/functionalities for e-reporting
  - <https://wiki.52north.org/bin/view/SensorWeb/AqdEReporting>
- Flexible identifiers
  - <https://wiki.52north.org/bin/view/SensorWeb/FlexibleIdentifier>



# E-reporting via an ETL-tool

ETL = Extract, Transform and Load



<http://www.esdi-community.eu/projects/hale>  
<https://github.com/igd-geo/hale>



HUMBOLDT Alignment Editor



# HALE - the GUI

The screenshot displays the HALE Alignment Editor 2.9.3 interface. The window title is "HUMBOLDT Alignment Editor 2.9.3 - dataflow B - AQD.xsd v1.0 - /Users/olavpeeters/Desktop/IPR\_2015/B/B\_wfs\_ST\_geoint.halez\*".

**Source Panel:** Lists properties from the "dataflow\_B" schema, including "location", "name", "ab\_name", "ab\_zone\_code", "aqd\_address\_number", "aqd\_address\_place", "aqd\_address\_postal\_code", "aqd\_address\_street", "aqd\_begin\_lifespan\_version", "aqd\_email", "aqd\_end\_lifespan\_version", "aqd\_first\_name", "aqd\_is\_agglomeration", "aqd\_last\_name", "aqd\_organisation\_name", "aqd\_phone\_number", "aqd\_website", "component\_code", "current\_time", "description", "id", "metaDataProperty", "notation", "population", "protection\_target\_code", "saroad\_code", "the\_geom", and "year".

**Target Panel:** Lists properties from the "AQD" schema, including "AQD\_ReportingHeader", "AQD\_Zone", "location", "aqdZoneType", "area", "beginLifespanVersion", "boundedBy", "changeDocumentation", "competentAuthority", "description", "descriptionReference", "designationPeriod", "endLifespanVersion", "environmentalDomain", "geometry", "id", "inspireId", "legalBasis", "metaDataProperty", "name", "plan", "pollutants", "predecessor", "relatedZone", "residentPopulation", "residentPopulationYear", "shapefileLink", "specialisedZoneType", "thematicId", "timeExtensionExemption", "zoneCode", and "zoneType".

**Mapping Panel:** Shows the alignment between Source and Target properties. A central "Merge" button is visible. The mapping includes various transformations like "Rename", "Formatted string", "Classification", and "id".

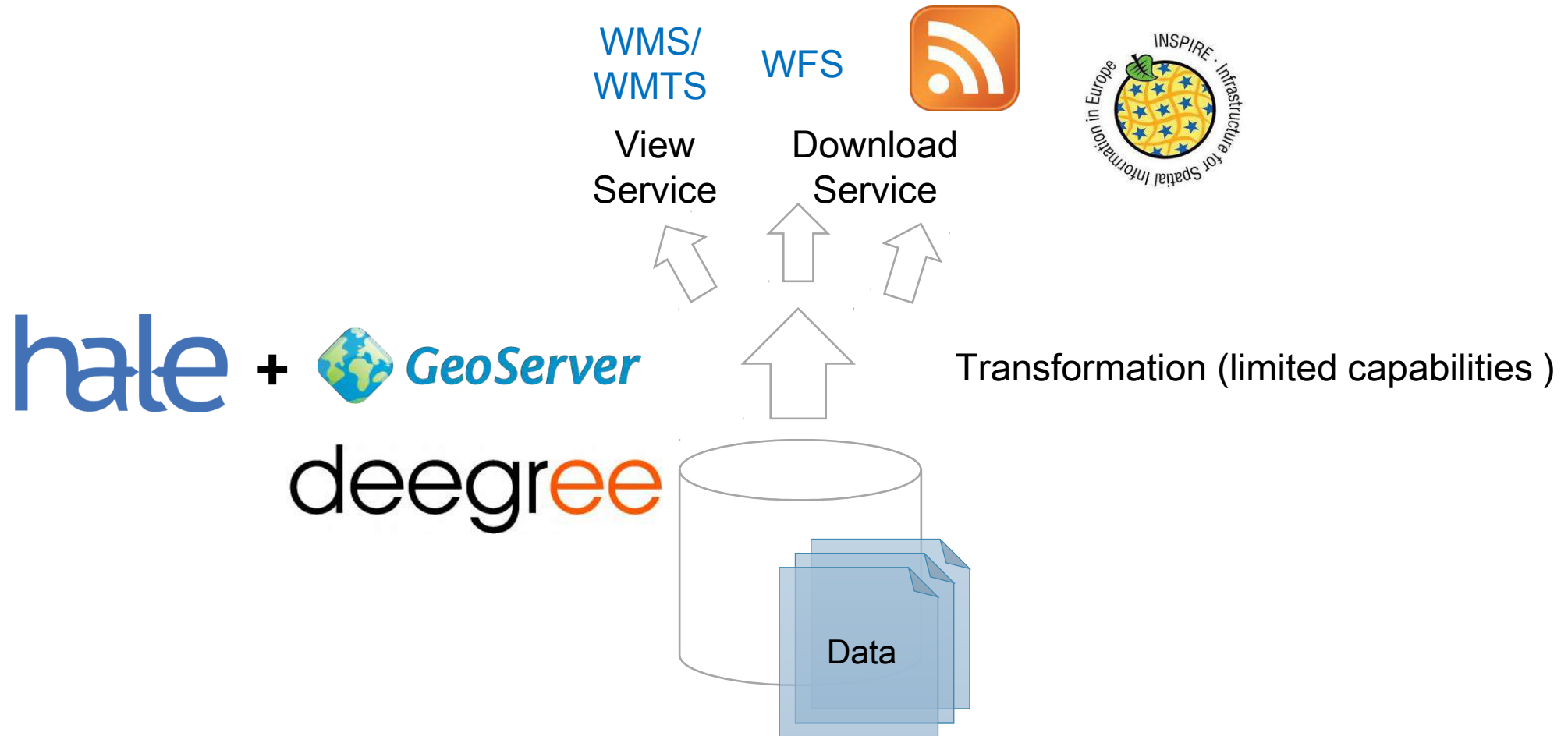
**Properties Panel:** Shows the "id" property with a list of values: ZON-BEB10A, ZON-BEF01S, ZON-BEF02A, ZON-BEF03S, ZON-BEF04A, ZON-BEF05S, ZON-BEF06S, ZON-BEF07S, ZON-BEF08S, ZON-BEF09S, ZON-BEF19S, ZON-BEF20S, ZON-BEF21A, ZON-BEF23S, ZON-BEF24S, and ZON-BEW11S.

**Preview data values:** A section at the bottom left showing the "id" property values.

**The alignment:** A central area showing the mapping between Source and Target properties.

**Specific mapping:** A section at the bottom right showing a specific mapping for the "ab\_zone\_code" property.

# A HALE transformation as a queryable service



For GeoServer see:  
<http://geoserver.geo-solutions.it/complexfeatures/intro/index.html>

But you can also export transformation to JDBC database (incl. SpatiaLite, PostgreSQL etc.)

# Why use HALE?

- Intuitive GUI for mapping data from you database to the schema
- You can execute HALE from the command line (meaning you can do a crontab on Linux), e.g.:

```
[hale@hale ~]$ HALE -nosplash -application de.fhg.igd.hale.fme.app.exec -project <URI-to-project> -source <URI-to-source-data> -out <Path-to-target-file>
```

## Optional parameters:

- reportsOut <Path-to-report-file> (Write report of transformation to a file)
- validate (Enable XML validation)
- format <format> (Its either 'GML' or 'XML', with 'GML' set as default)
- root <root-element-name> (The name of the root element to use when using 'XML' as format)
- root-ns <root-element-namespace> (The namespace of the root element to use if using 'XML' as format)
- Can be used as an XSLT-editor (cf XSLT-extention for GeoServer)
- Versatility of the tool (incl. cross-platform)





# <https://www.wetransform.to/>

by the developers of HALE

## Online Collaboration Platform **we»Exchange**

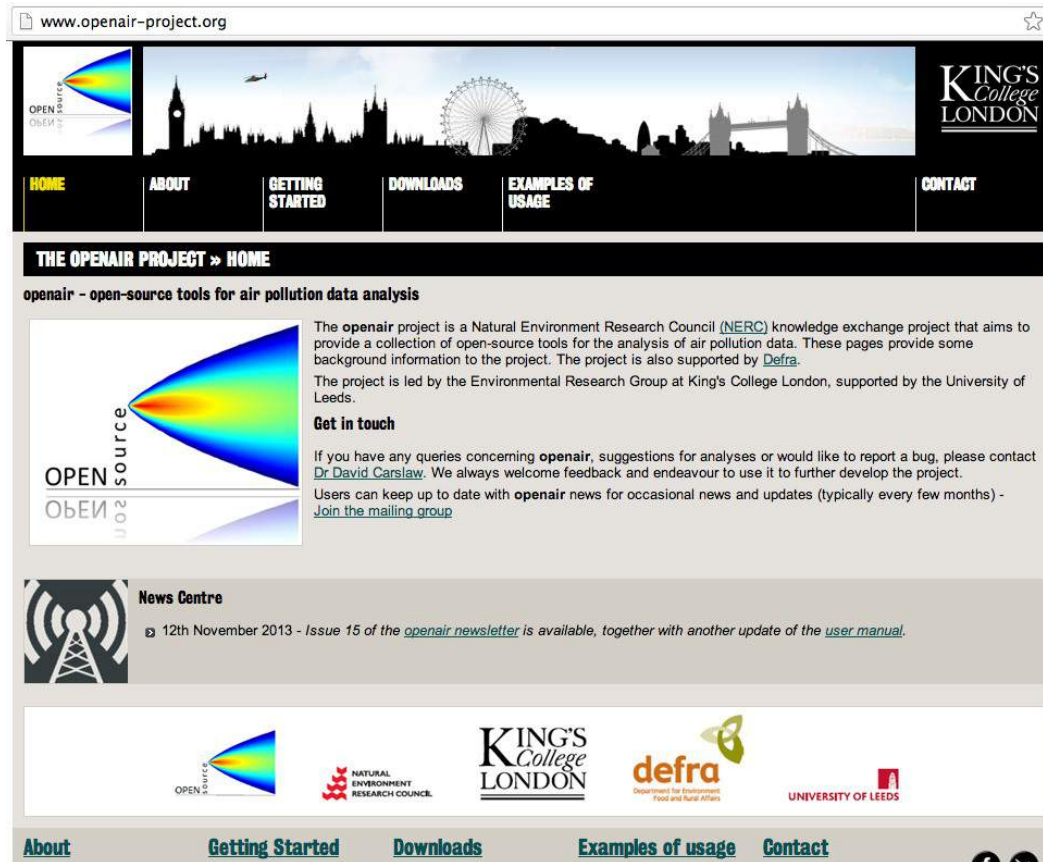
- Extend and adapt models
- Develop transformations projects
- Transform and validate data
- Publish services
- Fork, Diff, Merge
- Comment, Discuss, Annotate

The screenshot displays the we»transform.to web application interface. The top navigation bar includes links for News, Team, Network, Prices, Products, Services, and a search bar. Below this, a secondary bar shows Communities, Projects, and Tasks. The main content area is titled "Project" and lists several mapping tasks, including "Example: PLU Province of Trento mapped to INSPIRE PLU". The selected task, "[T] uso\_pol\_part2 to SpatialPlan", shows a flow diagram with nodes for "uso\_pol\_part2", "Merge", and "SpatialPlan". The "Merge" node has parameters: Aut... false, Mer\_NAME, Mer\_FROM, and Mer\_name. Below the diagram, a text box explains that it merges different instances of the type "uso\_pol\_part2" based on its properties "PLAN\_NAME" being equal. The bottom section, titled "What to use as a classification def...", shows a "Mapping cell" with a flow diagram involving "uso\_pol\_part2", "COD\_YOT", "Classification", and "ZoningElement". A "Solution proposed by Thorsten Reitz" is shown, including a table of classification rules and a "Classification table" with 10 rows of mappings.

Parameter name	Value
If not classified	null
1	→ 3_3_PermanentResidentialUse
101	→ 4_3_1_RoadTransport
102	→ 4_3_2_RailwayTransport
103	→ 4_3_1_RoadTransport
2	→ 2_SecondaryProduction
3	→ 3_4_4_OpenAgriculturalAreas
4	→ 1_3_1_CommercialAgriculturalProduction
5	→ 6_3_1_LandAreasNotInOtherEconomicUse
6	→ 5_3_OtherResidentialUse
7	→ 4_3_3_WasteTreatment
8	→ 3_4_3_SportsInfrastructure
9	→ 1_2_Forestry

# Shiny webapps for advanced interactive R-analyses

<http://www.openair-project.org>



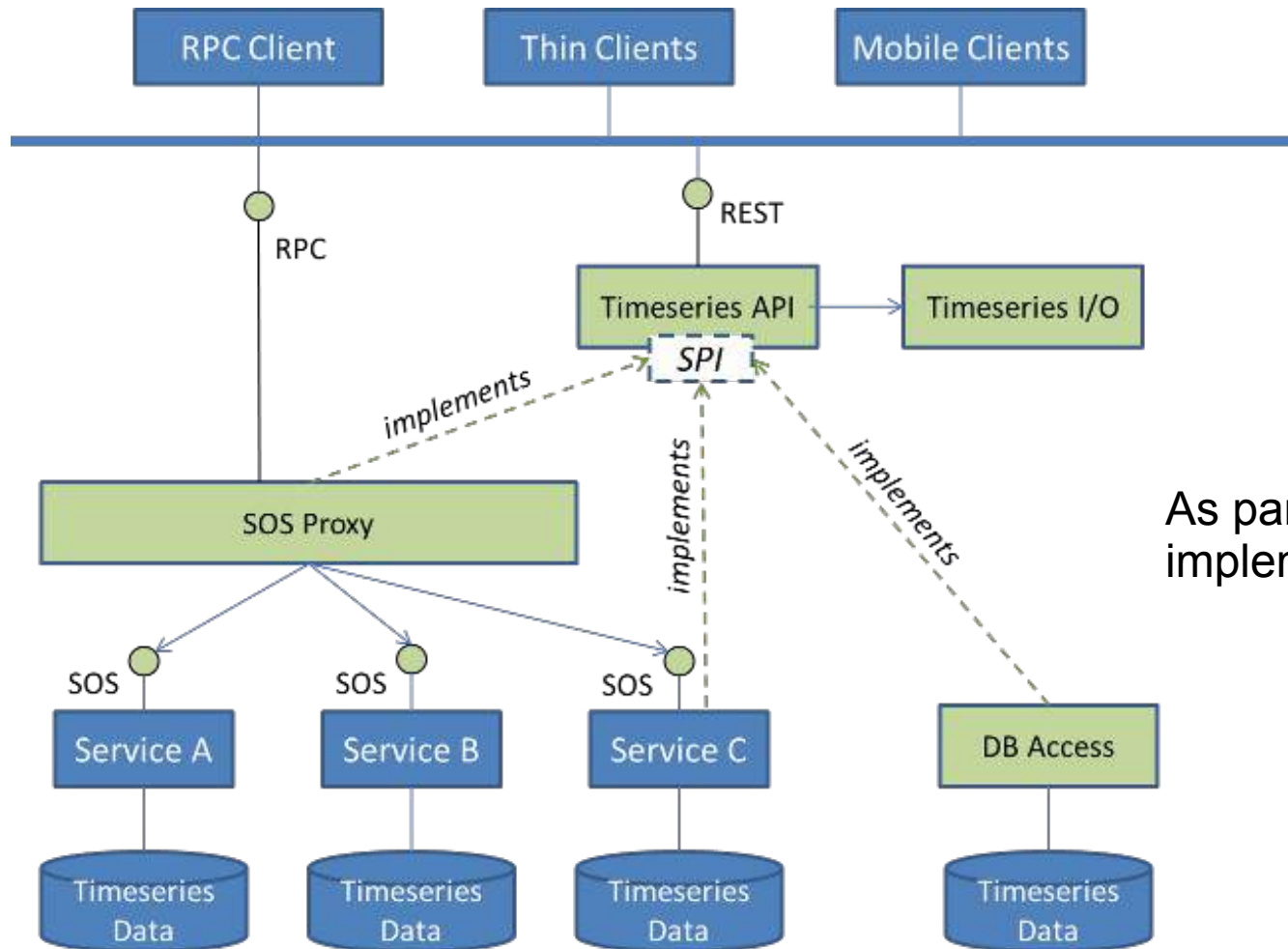
A package for R specifically for the **air quality** community

How to integrate the power of R into an SDI?

- SOS4R: existing SOAP (xml) based implementation → too slow for longer time series



# Faster data access via a REST-api

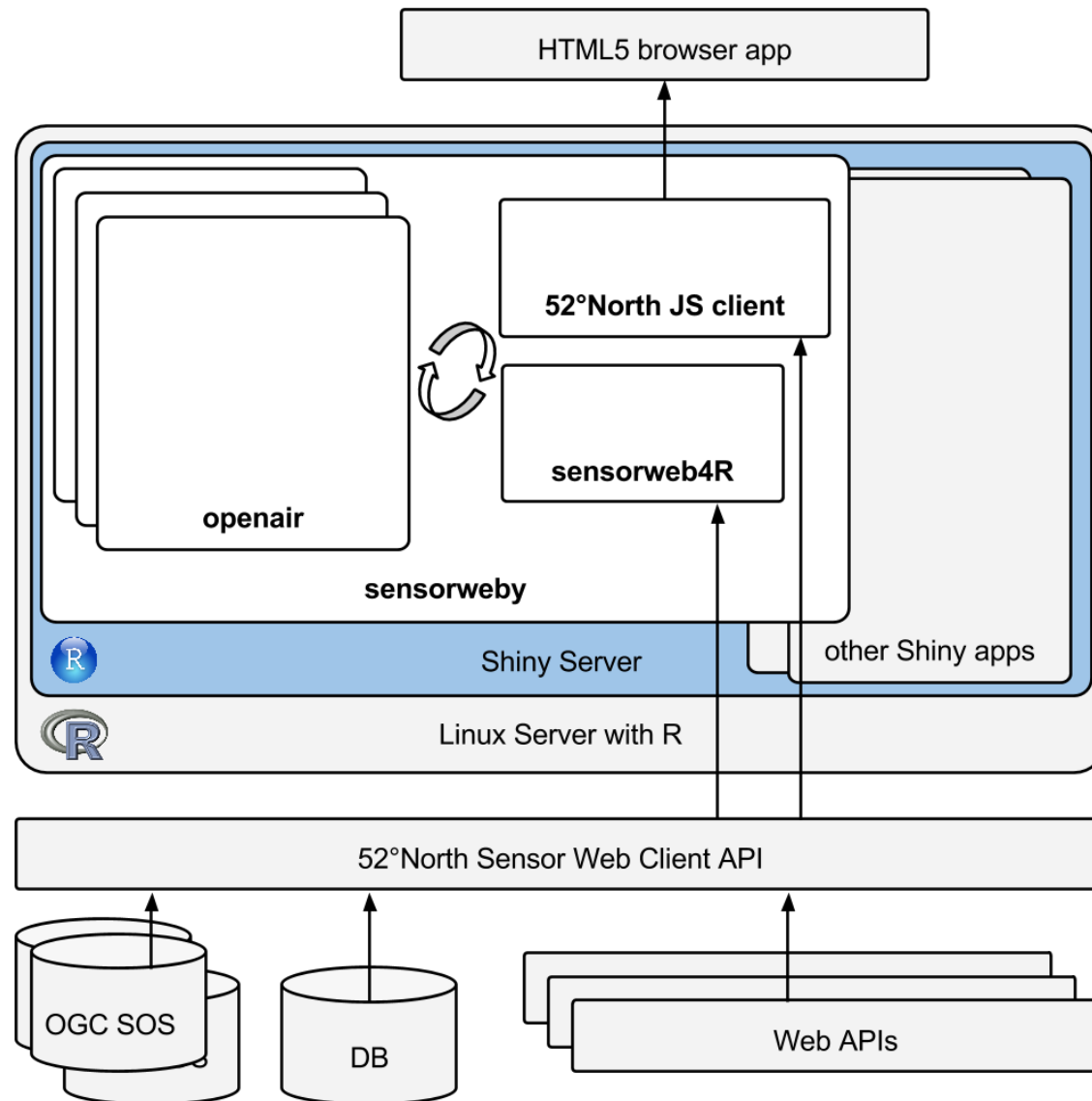


As part of the SOS implementation of 52°North



<http://52north.github.io/sensorweb-rest-api/>  
<http://52north.github.io/js-sensorweb-client/>

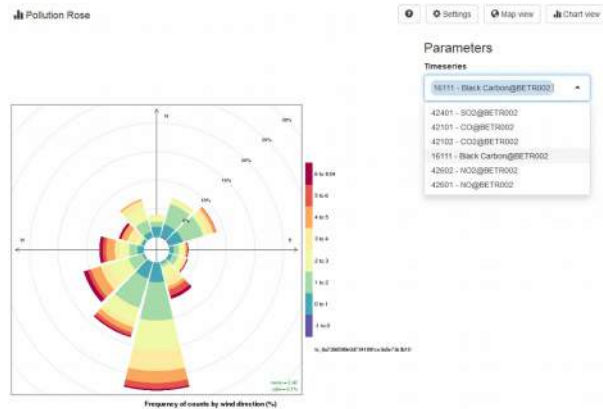
# Shiny webapps for advanced interactive R-analyses



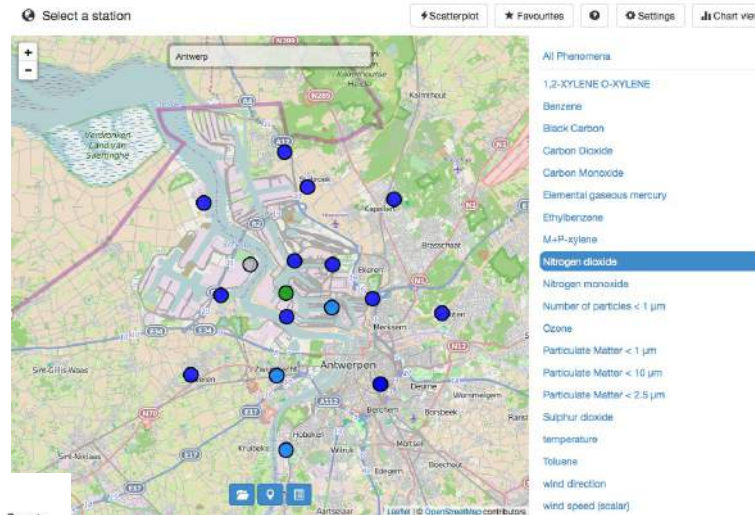


# Shiny webapps for advanced interactive R-analyses

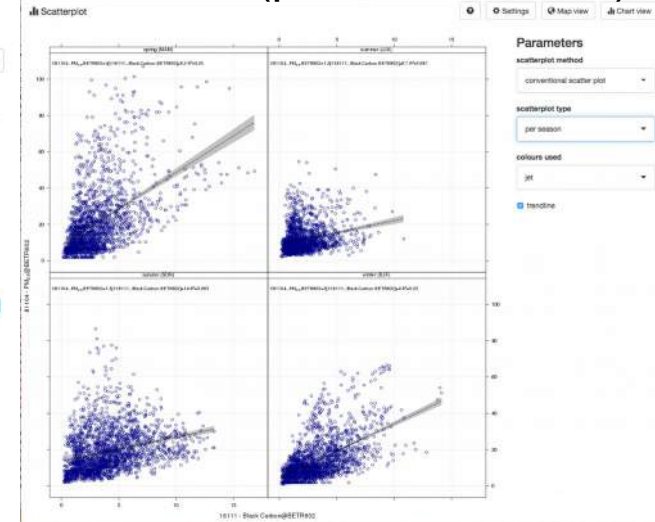
## PollutionRose



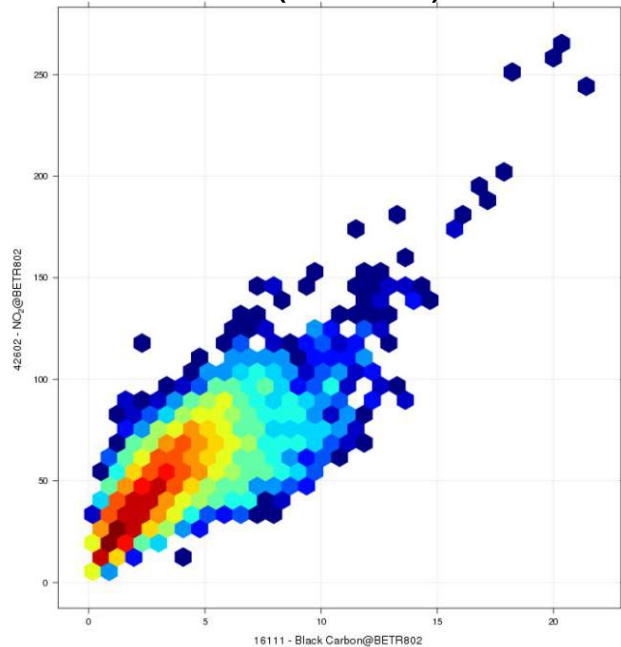
## Select time series (jsClient)



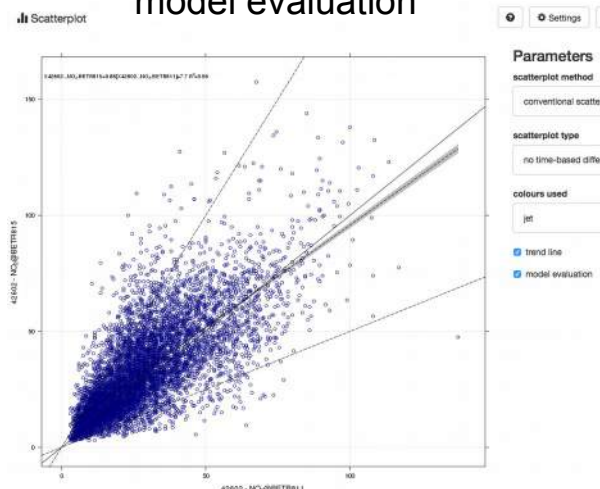
## scatterPlot (per season, etc.)



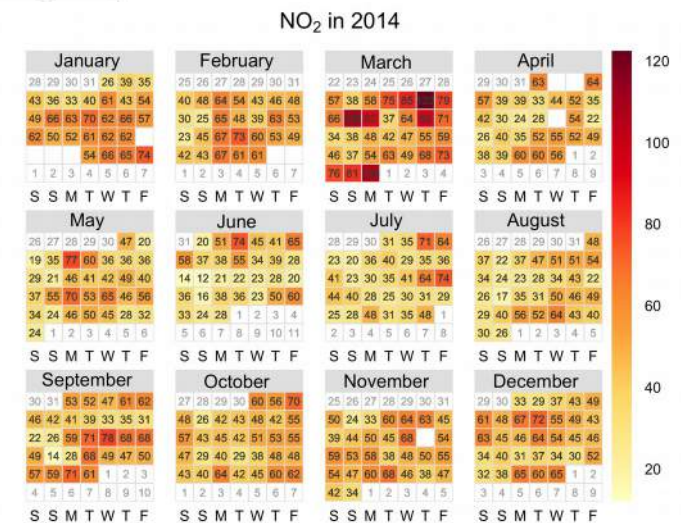
## ScatterPlot (hexbin)



## scatterPlot with model evaluation



## calendarPlot



# Shiny webapps for advanced interactive R-analyses

- <https://github.com/52North/sensorweb4R>
- <https://github.com/52North/sensorweby>
- <http://blog.52north.org/2015/04/22/advanced-time-series-analysis-on-the-web-with-r/>  
(google “blog sensorweby”)
- You can run this locally in R-Studio or on a remote Shiny server
- Example apps: <http://shiny.irceline.be/examples/>
- Better security since there is no direct DB-connection
- REST is still very fast data access

# A Cordova mobile app

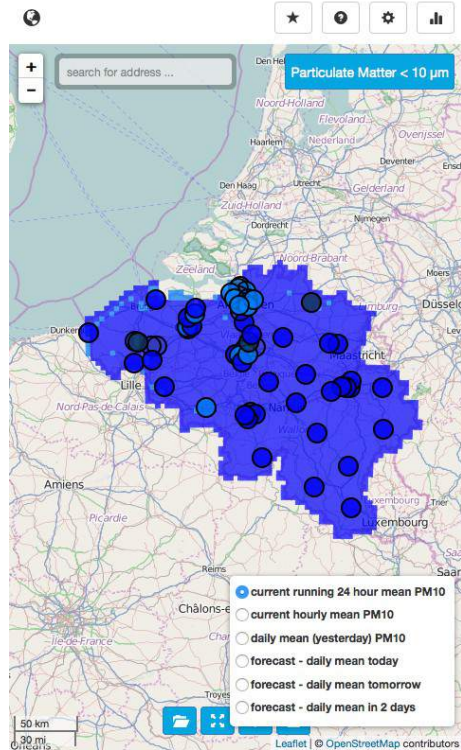


- Apache Cordova is the open source project behind Adobe PhoneGap
- Build apps with HTML, CSS and JavaScript
- Does not have the best reputation, but we don't have any complaints (google for “tips cordova”)
- Online build via <https://build.phonegap.com>
- Android, iOS and Windows Phone
- We hooked the JsClient for time series data into Cordova
- Added WMS layers to the Leaflet.js map view + other JavaScript customisations

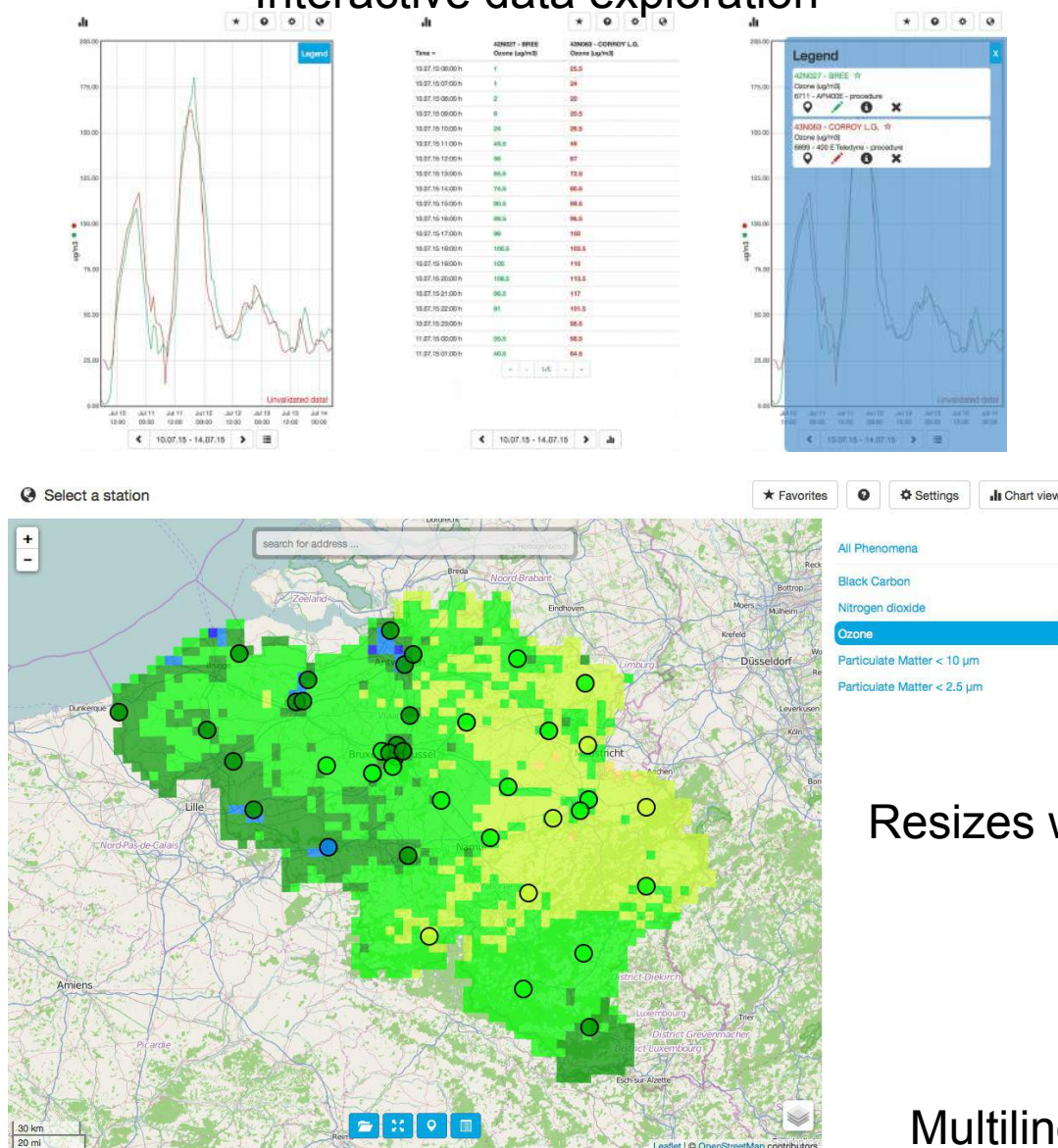


# A Cordova mobile app

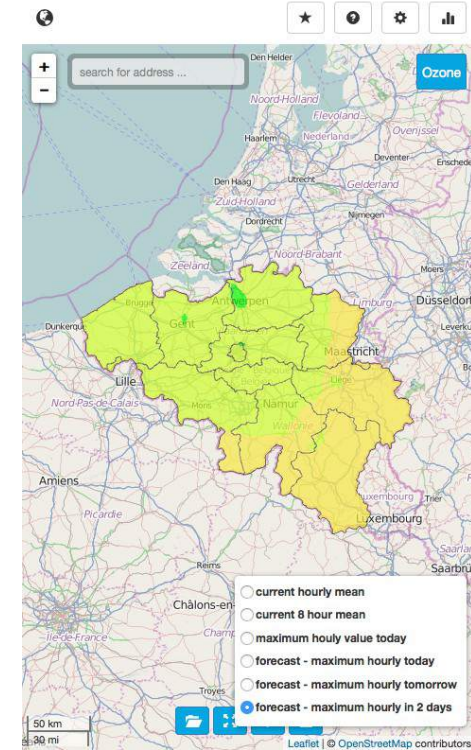
## Real-time data



## Interactive data exploration



## Forecasts



Resizes well for tablets

Multilingual (EN, NL, FR, DE)

eENVplus

<http://www.eenvplus.eu/>

29/10/2015



# A Cordova mobile app

<https://github.com/irceline/air-quality-belgium-app>  
<https://github.com/irceline/js-sensorweb-client-app> (generic)

The screenshot shows the GitHub repository page for 'irceline / air-quality-belgium-app'. The repository description states: 'An app for consulting air quality data in Belgium based on the js-sensorweb-client for Android, iOS and Windows Phone - Edit'. It shows 46 commits, 1 branch, 0 releases, and 2 contributors. The 'air-quality-belgium-app' branch is selected, showing a commit by 'opeeters' from 4 months ago. The README.md file is displayed, containing the title 'air-quality-belgium-app', a description of the app, and a list of customisations. A note mentions a warning message from PhoneGap Build about using an outdated version. An acknowledgement section at the bottom credits the eENVplus project and Sinergis srl.

**air-quality-belgium-app**

This repository contains a customised version of 52°North JavaScript Sensor Web Client app specifically for air quality data in Belgium.

The package can be pulled into Adobe® PhoneGap™ Build to compile for Android, iOS and Windows Phone.

**Customisations**

customisations are marked in ja/js-1.0.0.js with:

```
// customIRCELINE
```

- upgrade leaflet.js 0.7.1 > 0.7.3 (see ja/js-1.0.0.deps.js)
- added layers (see customIRCELINE.js)
- added custom styling (see customIRCELINE.css)
- double-click on phenomenon in listing to zoom to extend of specific phenomenon
- limit number of phenomena listed in navigation (still available via listed search timeseries)
- added zoom to full extent button

**Note**

in config.xml keep phonegap version at 3.7.0, like so:

```
<preference name="phonegap-version" value="3.7.0" />
```

ignore message in <https://build.phonegap.com/>:

This app isn't using the latest version of PhoneGap. We recommend upgrading to cli-5.2.

There are still some unresolved compilation issues in this version of phonegap build.

**Acknowledgement**

This app was created within the eENVplus project funded by European Union under the Competitiveness and Innovation Framework Programme - Information and Communication Technologies Policy Support Programme (CIP-ICT-PSF) grant No. 325232.

The development was performed by Sinergis srl and IRCEL-CELINE

<https://build.phonegap.com/apps/1509550/builds>

The screenshot shows the PhoneGap Build interface for the 'Air Quality Belgium' app. The app is identified by ID 1509550, version 0.1.8, and is owned by 'opeeters@gmail.com'. It is built for iOS, Android, and Windows. The interface shows build options for each platform, including 'Rebuild', 'Log', and download links for 'ipa', 'apk', and 'xap'. A warning message states: 'This app isn't using the latest version of PhoneGap. We recommend upgrading to cli-5.2.0.' The footer includes copyright information for Adobe Systems Incorporated, 2013, and links to 'Terms of Use', 'Privacy Policy', and 'Cookies'.

**Air Quality Belgium**

Realtime and forecast air quality information - Belgium

Feedback

Install

Update code Rebuild all

This app isn't using the latest version of PhoneGap. We recommend upgrading to cli-5.2.0.

**Builds** Plugins Collaborators Settings

App ID	Version	Owned by	PhoneGap (iOS / Android / Windows)	Source	Tag / Branch
1509550	0.1.8	opeeters@gmail.com	3.7.0 / 3.7.0 / 3.7.0	<a href="https://github.com/irceline/air-quality-belgium-app.git">https://github.com/irceline/air-quality-belgium-app.git</a>	master

Commit: 5c9c29 Last built (213) 1 minute

**iOS** irceline\_2015\_4 Rebuild Log ipa

**Android** irceline\_2015\_android Rebuild Log apk

**Windows** IRCEL - CELINE Rebuild Log xap

Language: English Powered by Adobe® PhoneGap®

Navigation: Apps Plugins Docs Blog Help Account (opeeters@gmail.com) Sign out

Find out more

Copyright © 2013 Adobe Systems Incorporated. All rights reserved.

PhoneGap is a trademark of Adobe. You may not use PHONEGAP or GAP in the title of any application built using PhoneGap or the PhoneGap Build service.

[Terms of Use](#) | [Privacy Policy](#) and [Cookies](#)



# Conclusion

- All of this is 100% open source
- Interlinkage of different elements was only possible due to open source
- Fetching data via services (instead of straight from a DB) improves security
- There often is a trade-off between interoperability and usability (speed, adapted to the purpose, etc.)
- Think in terms of reusable lego blocks
- Get the right people involved to make, polish and maintain ... per lego block



Informing you on ambient air quality  
in the Belgian Regions

# Thank you!

Olav Peeters  
[peeters@irceline.be](mailto:peeters@irceline.be)

Belgian Interregional Environment Agency (IRCEL – CELINE)