

AIR QUALITY MONITORING IN AUVERGNE-RHÔNE-ALPES

Air quality monitoring agency

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Expert engineer of Air Innovation Unit



Who are we?





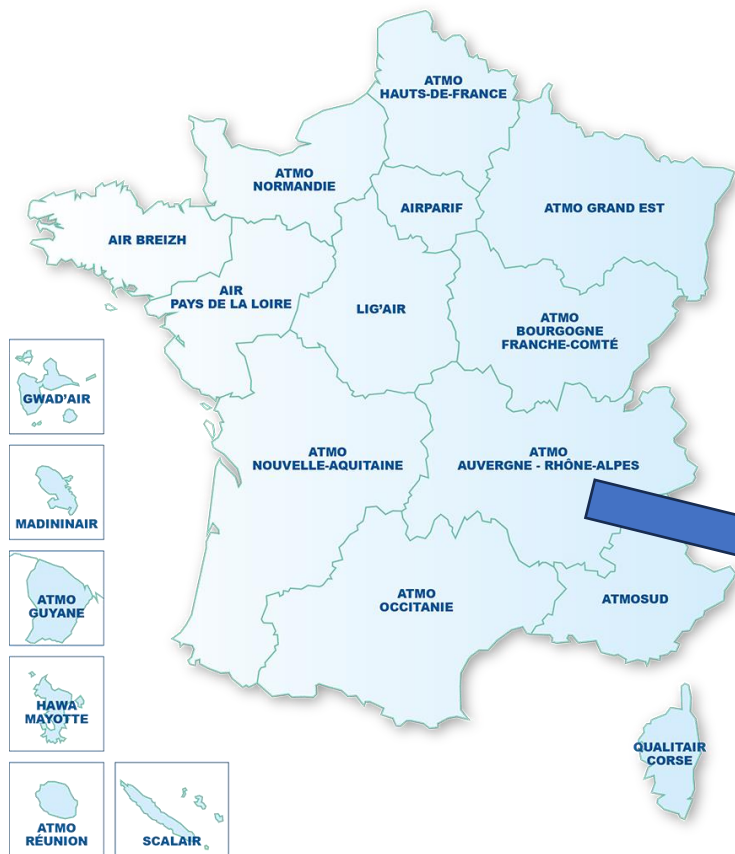
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THE OBSERVATORY AND ITS MISSIONS

Atmo presentation video

<https://youtu.be/Ec5Q1kxnlhE>

A part of the French Observatories for Air Quality Monitoring



The ATMO federation unites certified Air Quality Monitoring Agencies in France (AASQA)

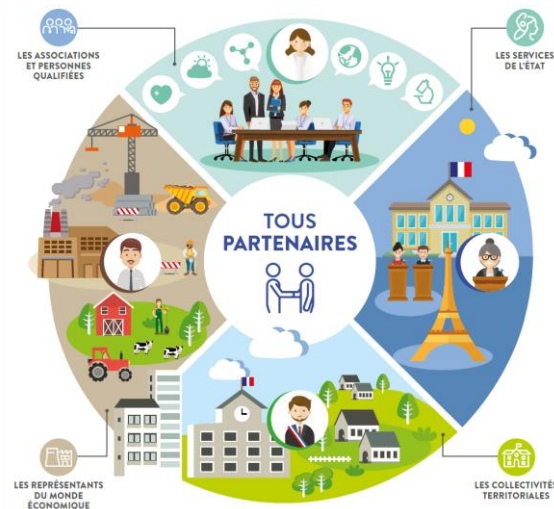
Non-profit organisations (law of 1901 or 1908)

Certified by the Ministry of Ecology, Sustainable Development, and Energy

► 500 experts in France

IN AUVERGNE RHÔNE ALPES
245 MEMBERS

MORE THAN 80 THEMATIC
PARTNERS



THE ATMO-AUVERGNE-RHÔNE-ALPES TEAM (100 EMPLOYEES)



Auvergne-Rhône-Alpes, a mountain region

2/3 of the region in
mountain areas

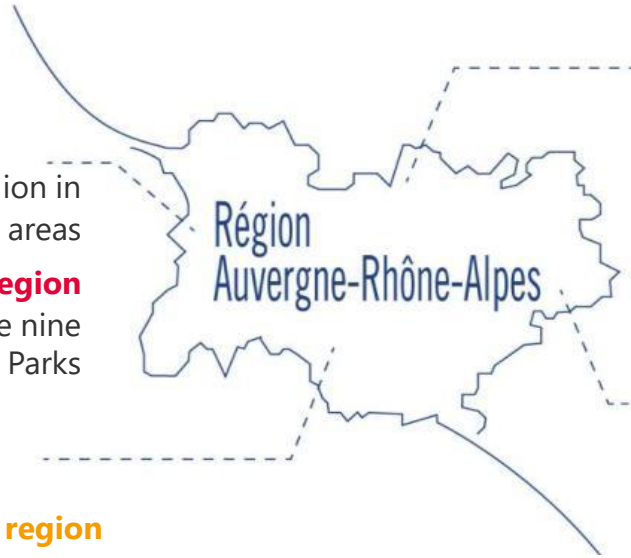
22% of the region
is in one of the nine
Natural Parks

No.1 industrial region
in France

No. 1 tourist region
in France

No. 1 mountain region
in Europe

**No. 1 French region for air
quality infringement
proceedings**



2nd most populated region
in France

8 million inhabitants

70,000 km²
surface area

The challenges to overcome

- **Health: Improve** air quality in over-exposed areas (large urban centres and major trunk roads)
- **Regulations: Resolve** legal proceedings
- **Economics: Maintain** attractiveness

MAIN MISSIONS

- **Monitor and inform of the regulatory state of air quality in the Auvergne-Rhône-Alpes region.**
- **Support decision-makers in the development and monitoring of action plans to improve air quality.**
- **Provide technical support to its members and diagnostic elements in emergency situations: pollution episodes, industrial incidents or accidents.**
- **Improve knowledge of phenomena related to air pollution.**
- **Encourage action to improve air quality.**



The monitoring system

NETWORK OF ONGOING MEASUREMENTS

- European directive and environmental code
- 90 fixed stations
- 24 hours a day/7 day a week

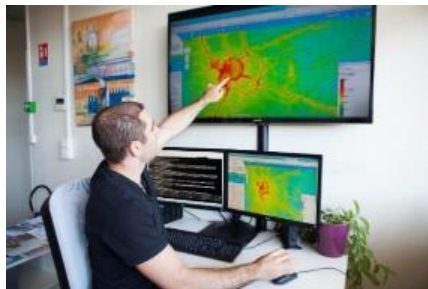


MEASUREMENT CAMPAIGNS

- European directive, the environmental code and local/regional needs
- Mobile laboratories

MODELLING & MAPPING

- Short-term forecasts
- Annual analysis
- Forward-looking scenarios



EMISSIONS REGISTRY

- Simulation/ forecasting
- Decision aids, forward-looking scenarios



COMMUNICATION

- Inform
- Support action
- Incite changes

In 2023: Illumination of the Bastille in the colours of the Atmo index in a permanent way.

A project welcomed and supported by the Régie du téléphérique de la Bastille, the City of Grenoble and the Metropolis.



OVERSIGHT: REGULATORY AND COMPLEMENTARY



- **13 Polluants soumis à des valeurs réglementaires**
- **54 Polluants soumis à une obligation de surveillance**
 - Précurseurs de l'ozone (COV)
 - Pollution transfrontalière longue distance
 - Spéciation chimique des particules fines PM2,5 (anions/cations, carbone organique, carbone élémentaire)
 - Certains HAP
 - Certains Métaux Lourds

- **87 Polluants d'intérêt national**
(stratégie nationale de surveillance)
 - Pesticides
 - Espèces chimiques majeures des particules (programme CARA)
- **57 Composés émergents et suivis spécifiques**
 - Particules très fines (PM1, PUF)
 - Autres HAP
 - Autres Métaux Lourds
 - Autres COV
 - Autres pesticides
 - Dioxines et furanes
 - Autres composés recommandés par l'ANSES
 - Méthane
 - Ammoniac
 - Pollens

13 pollutants regulatory being monitored, including 4 that are problematic



PM10
PM2.5

**12,000 people
exposed PM10**

Emissions didn't
exceed regulatory
limits, but were
above WHO limits

NO₂ (year) **BAP**

**121,000 people
exposed**

Urban centres
were most
affected

**30,000 people
exposed**

From different
sources, mainly wood
heating and industry

O₃

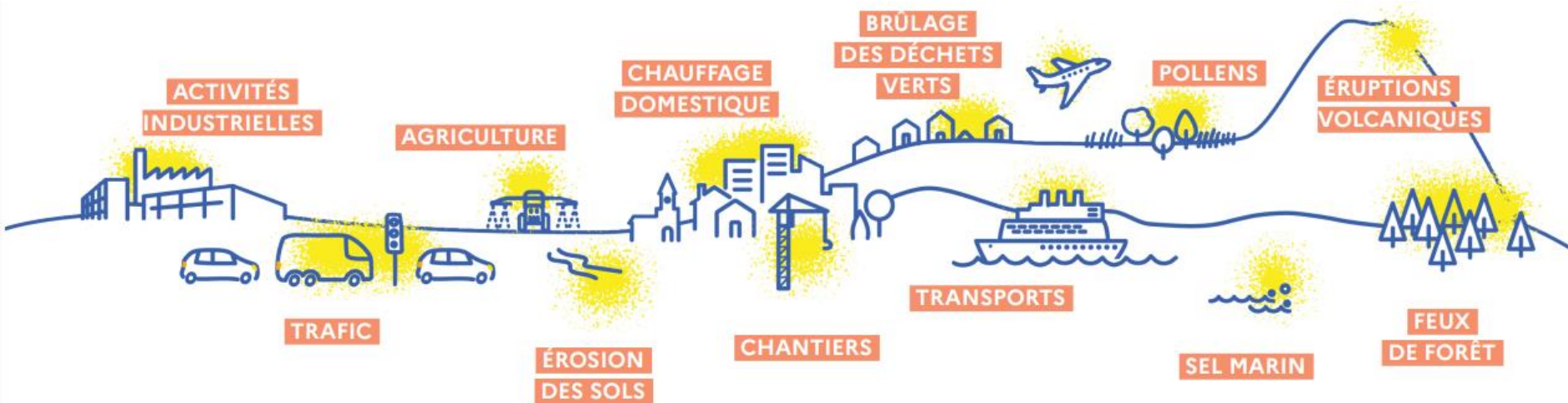
**1,600,000 people
exposed (200,000 in
2014)**

Increased exposure due
to the difference in
meteorological conditions
between the two
summers

All other regulated pollutants comply with standards

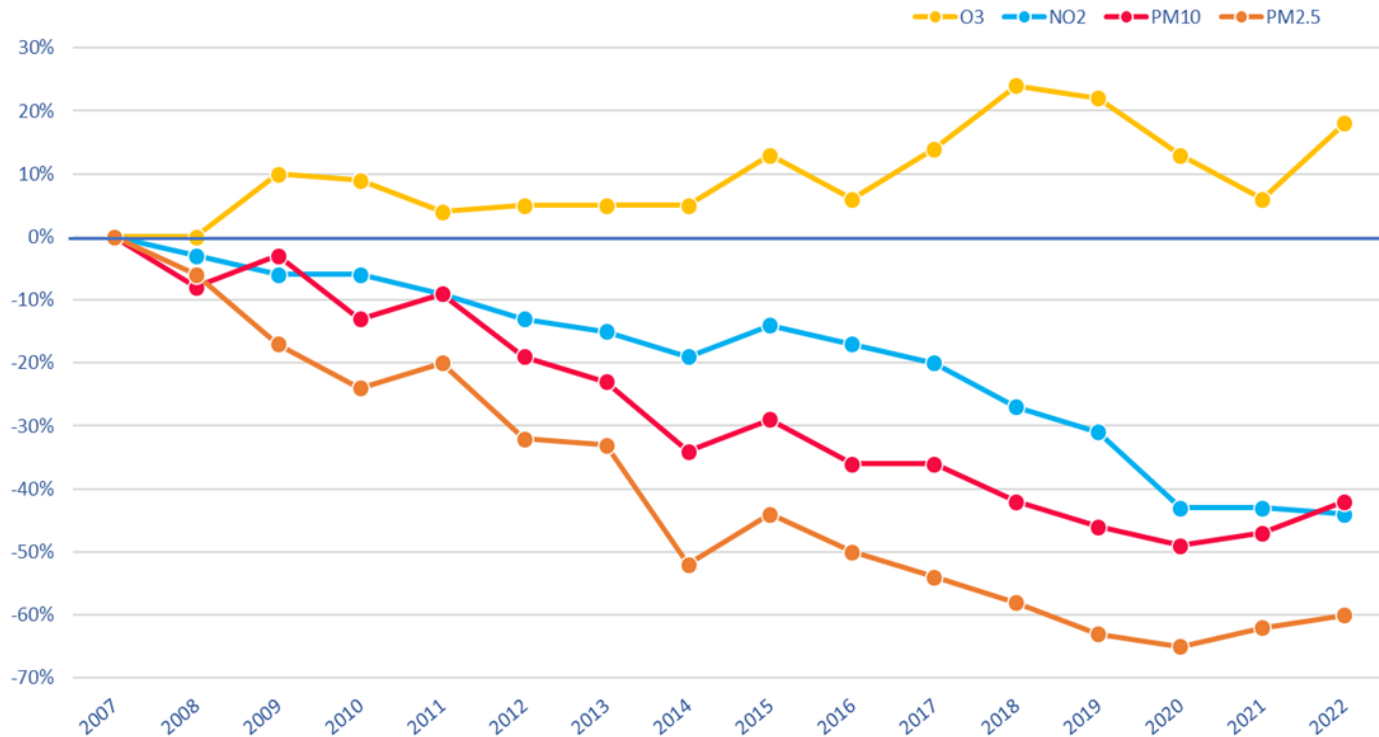
A WIDE VARIETY OF EMISSION SOURCES

Great diversity of air pollutants and sources, many chemical reactions and interactions.
There are natural sources of pollution and anthropogenic sources of pollution.
All sectors of activity (industry, transport, residential, agriculture) contribute to air pollution.

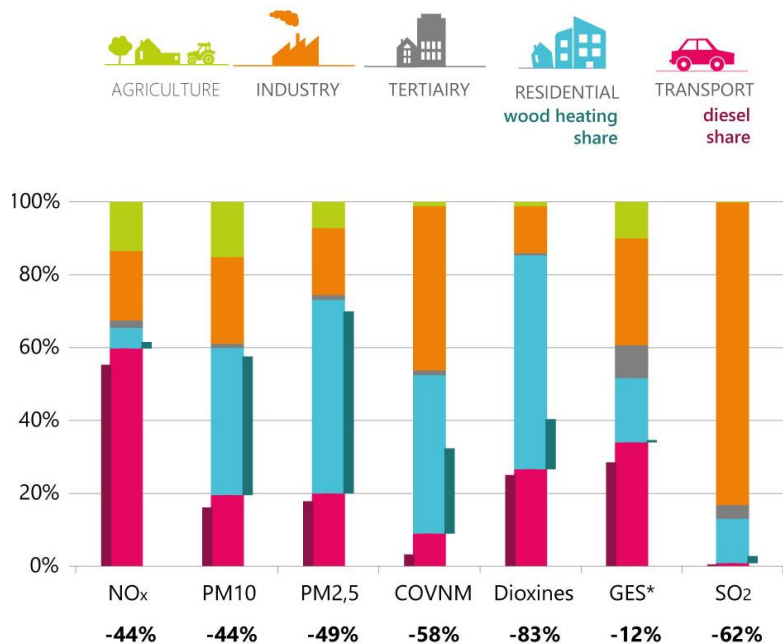


CHANGES IN AIR QUALITY

Ecart relatif des concentrations moyennes annuelles aux stations depuis 2007



What action levers are there?



TRANSPORT : The main source of NO_x emissions (60% including more than 90% from diesel vehicles) and GHGs, related to the consumption of fossil fuels almost exclusively.

INDUSTRY : The main source of SO₂ emissions (50% reduction since 2000) and NMVOCs (chemical industry, use of solvents, etc.). 2nd largest emitter of NO_x and PM₁₀.

RESIDENTIAL: Individual wood heating is the largest emitter of particulate matter (40% of PM₁₀ emissions and half of PM_{2.5} emissions). This sector emits NMVOCs (use of solvents), dioxins (open burning of electrical cables), and GHGs (heating oil, mains gas).

TERTIARY : Low impact, primarily on GHGs

AGRICULTURE : Lower contribution than the other sectors; mainly NO_x, particulate matter, and GHGs.

LES POLLUANTS SELON LES SAISONS



HIVER - Les températures froides et l'absence de vent sont propices à l'accumulation de polluants. Durant cette période les émissions proviennent principalement du chauffage individuel au bois non performant.



PRINTEMPS - Les températures froides le matin et douces l'après-midi favorisent la concentration et l'accumulation des particules formées par les nitrates (liés aux épandages agricoles) et des oxydes d'azote émis majoritairement par le trafic routier.



ÉTÉ - La chaleur et l'ensoleillement sont propices aux transformations chimiques qui conduisent à la formation d'ozone.



INVERSION DE TEMPERATURE, UN PHÉNOMÈNE COURANT EN HIVER



When the temperature of the ground is colder than that of the air (thermal inversion), it blocks the dispersion of pollutants under the inversion layer (hot air cover).

A circular inset image on the left side of the slide. It shows a bright sun in the upper left corner, partially obscured by clouds, creating a lens flare effect. A small rainbow is visible in the sky. The foreground shows dark silhouettes of trees and a distant mountain range under a blue sky with scattered white clouds.

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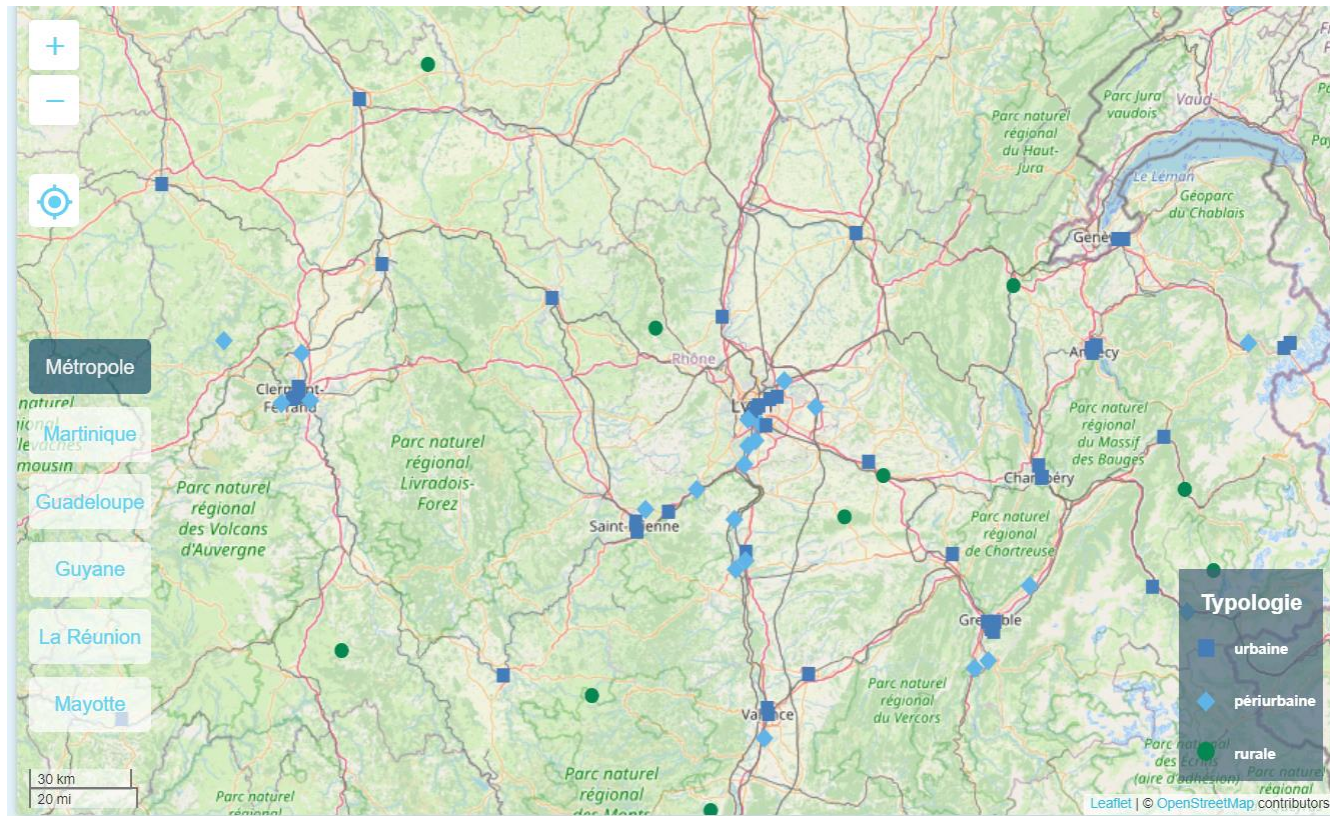
DATA PRODUCTION AND DISSEMINATION

DATA PRODUCTION

Atmo AuRA produces a lot of data that comes from the various air quality monitoring tools:

- **Automatic measurement data** : fixed stations and mobile measuring devices
- Modelling/mapping data: concentration maps, forecast maps, simulation of improvement actions
- More recently: pollutant data produced by microsenors or satellites
- Etc...

DATA PRODUCTION : MAP OF MEASUREMENT STATIONS



Pour consulter la carte
des stations :
<https://www.atmo-auvergnerhonealpes.fr/carte/stations-et-points-de-mesure-par-polluant-en-service-et-historiques>

OR

<https://www.geodair.fr/donnees/referentiel-mesure>

DATA DISSEMINATION AND VALIDATION

Open data (obligation for air quality observatories)

Access to data via APIs and digital services

Access to data via the www.atmoauvergnerhonealpes.fr website

Everything is available on our website, you can test it !

Every day, Atmo technicians and engineers validate the measurement data and carry out these operations via a graphical interface.

The validation action is performed by reviewing all the curves:

- This human validation takes time
- needs to be optimized to better detect drifts and breakdowns



API et Webservices

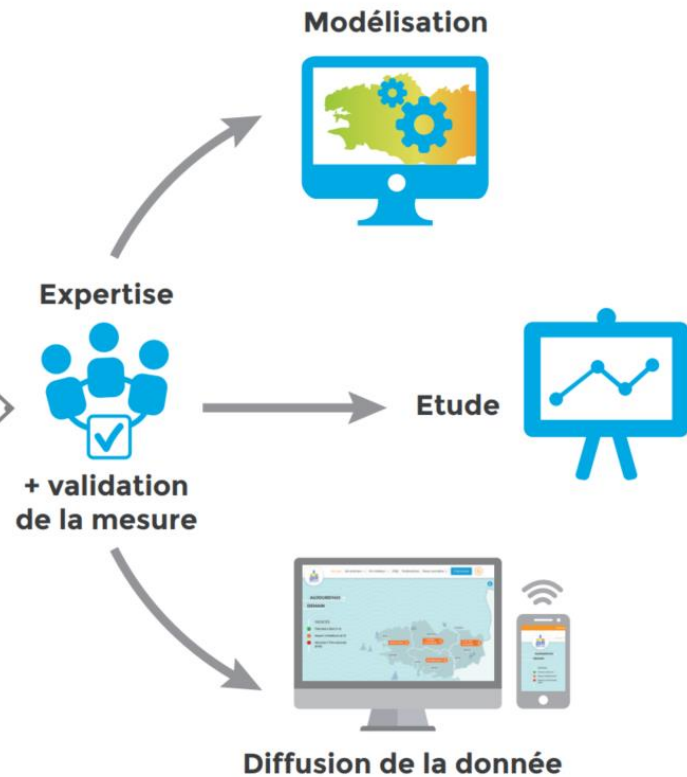
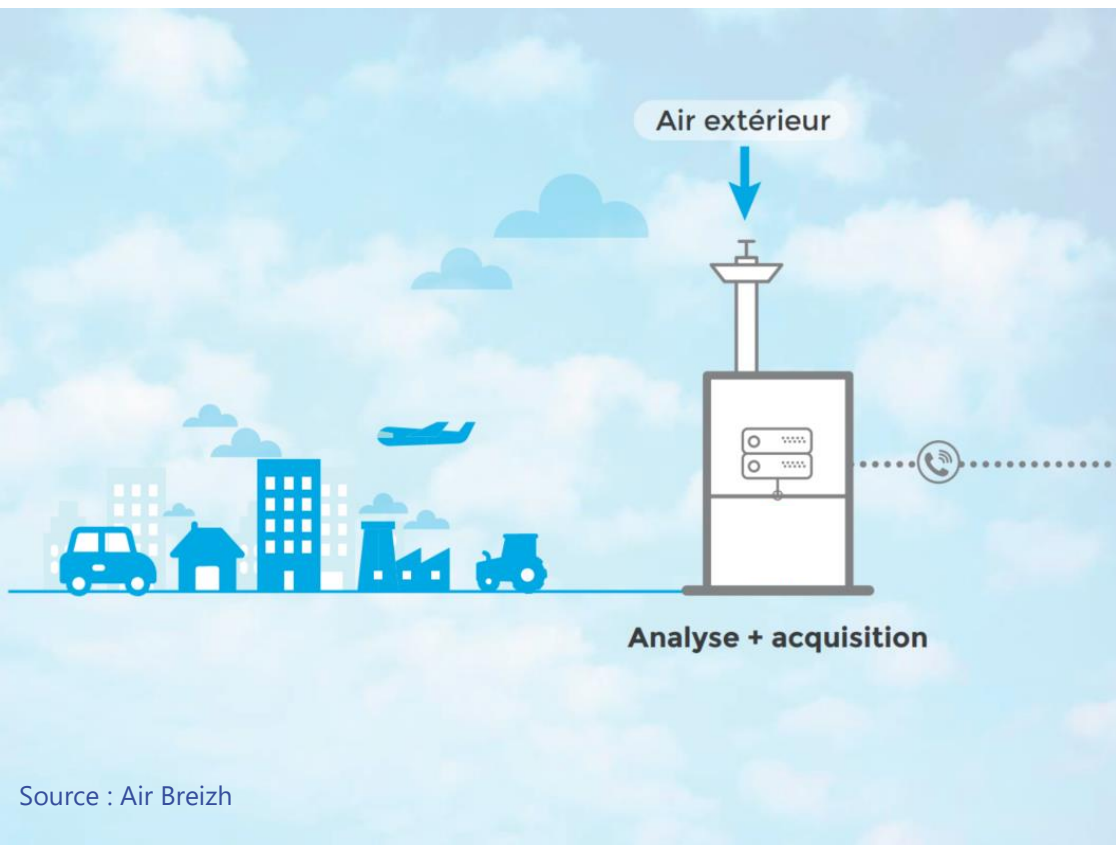
Développez vos services grâce à nos données. Utilisez librement nos données pour développer des services à fortes valeurs ajoutée.



Open Data

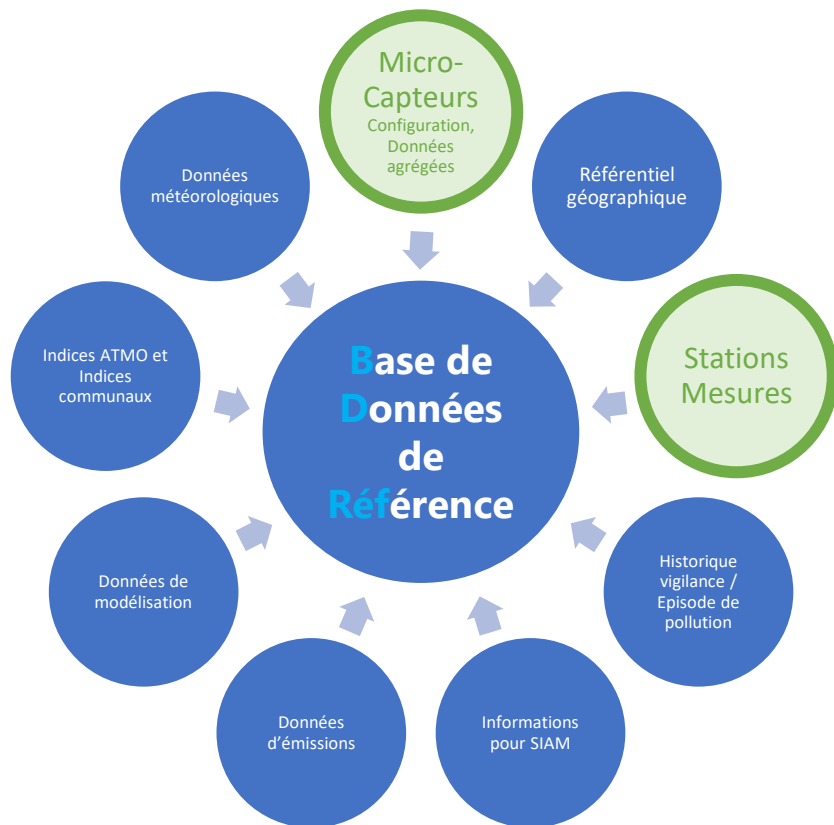
Injectez de la qualité de l'air dans vos outils : nous mettons à disposition un ensemble de jeu de données disponible sous formats exploitables par vos services.

the measurement and data transmission process



Source : Air Breizh

The Reference Database (BDREF)...



What's in it?

The goal is to centralize as much information as possible in this database.



Statutory air quality measurement station



microsensor

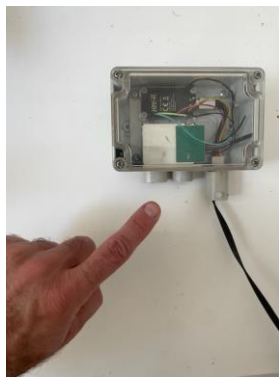
DATA CHALLENGE

VALIDATION OF AIR QUALITY DATA

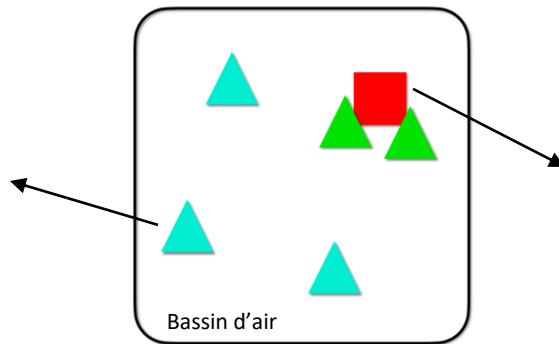
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Types de capteurs



Micro-capteur



Capteur de référence

DATA CHALLENGE

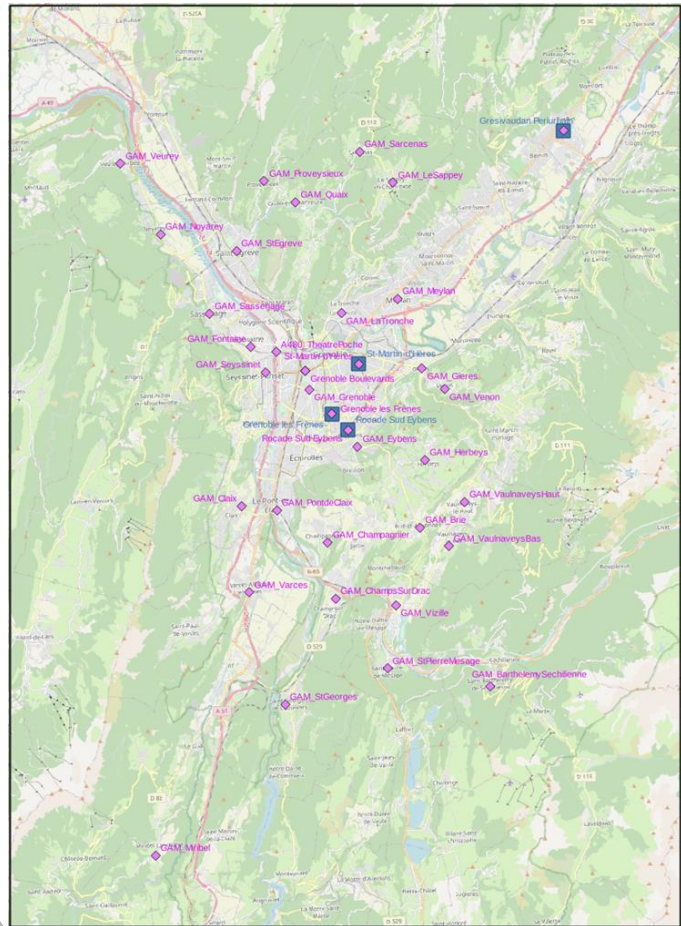
Development of a validation aid for air quality microsensor data

The proposed challenge is to devise data processing tools and methods for automatically validating micro-sensor data in real time, based on regulatory reference data collocated with certain micro-sensors.

The subject will involve 3 main stages:

1. Study of the variability of the sensor compared to a collocated regulatory analyser
2. Invalidation of microsensor data in comparison with a co-located analyser
3. Invalidation of micro-sensors throughout the network, and in particular sensors that are not co-located with a regulatory analyser

Le terrain d'expérimentation



➤ 40 micro-captors « fixis » sur des bâtiments publics

○ Un protocole d'installation basé sur des critères

- L'absence de sources majeures de particules fines proches
- La hauteur du point de mesure par rapport au sol
- L'orientation et l'exposition au soleil
- La position générale par rapport aux infrastructures et aux aménagements urbains
- La bonne aérologie au niveau du site
- Campagne inter comparaison avant déploiement

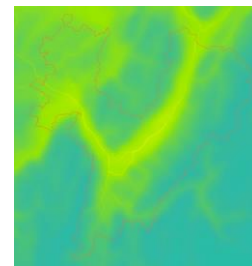
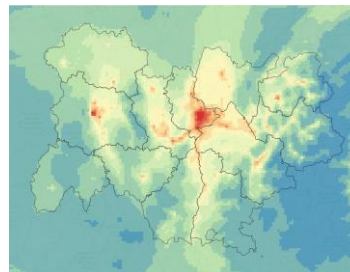


➤ 10 micro-captors fixis « citoyens »

➤ 3 stations références



➤ Modélisations déterministes et statistiques de 3kmx3km à 10m



- station réglementaire de référence
- ◆ micro-captors Fixi

L'installation des capteurs



Venon – Ecole primaire



Pont-de-Claix – Maison des habitants

DATA CHALLENGE

DATA :

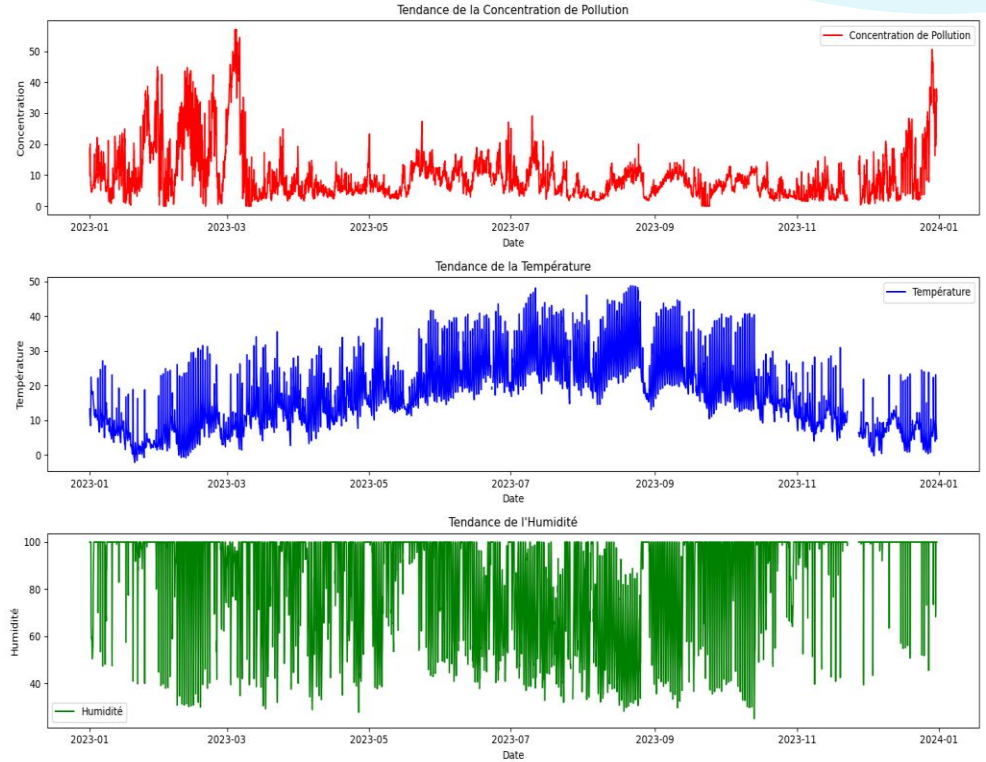
- 2 years of PM2.5 fine particle data measured by 40 microsensors at hourly intervals in the Grenoble area (data to be validated). Data available from 01/01/2023.
- 2 years of technical data measured by the 40 micro-sensors: temperature and relative humidity. Data available from 01/01/2023
- 2 years series of measurements at 3 regulatory stations in the Grenoble area on the pollutants NO2, O3 and particulate matter (PM10 and PM2.5) :
 - Saint Martin d'Heres
 - Les Frenes
 - Rocade Sud
- 2 years of meteorological measurements (Atmo AuRA and météoFrance)
- Documentary resources and access to Atmo AuRA experts to answer questions

Données utilisées

- Données horaires

3 mesures :

- Concentration de microparticules
- Température
- Humidité relative



To understand the process

Data Validation



Guide de validation des données de mesures automatiques (janvier 2016)

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DATA & RESOURCES



DATA AND RESOURCES

Ressources :

Drive : [2024 DATASciences Challenge](https://airrhonealpes-my.sharepoint.com/:f:/r/personal/atmoaura_atmo-aura_fr/Documents/Partage/D21-Innovation%20et%20nouvelles%20technologies/2024_DATASciences_Challenge?csf=1&web=1&e=iAfzwe) (https://airrhonealpes-my.sharepoint.com/:f:/r/personal/atmoaura_atmo-aura_fr/Documents/Partage/D21-Innovation%20et%20nouvelles%20technologies/2024_DATASciences_Challenge?csf=1&web=1&e=iAfzwe)

- Corporate video: <https://youtu.be/Ec5Q1kxnlhE>
- Data validation guide
- Internship report by J Dutroncy (Campus numérique in the alps)
- Access to data via API:
 - o pollutants, technical parameters, meteorology, geographical location
 - o API Atmo AuRA: <https://api.atmo-aura.fr/documentation>



Register now to API with your e-mail address sent to your teachers (Public data)
18 novembre : opening up access rights to specific data with your e-mail

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