



Medio Ambiente y  
Desarrollo Territorial



# IMPLEMENTATION OF AN AIR QUALITY MODELING AND FORECASTING SYSTEM FOR THE CITY OF GUADALAJARA INVOLVING THE IMPLEMENTATION OF FIXED AND MOBILE MICRO-SENSORS ON VEHICLES

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**VIE, Coordination du projet**  
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**Chef de projet**  
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**Responsable commercial**  
**Jacques MOUSSAFIR**  
**PDG ARIA Technologies**



**Aired**  
Predicción y modelación atmosférica

# Who's part of this Project ?



Medio Ambiente y  
Desarrollo Territorial



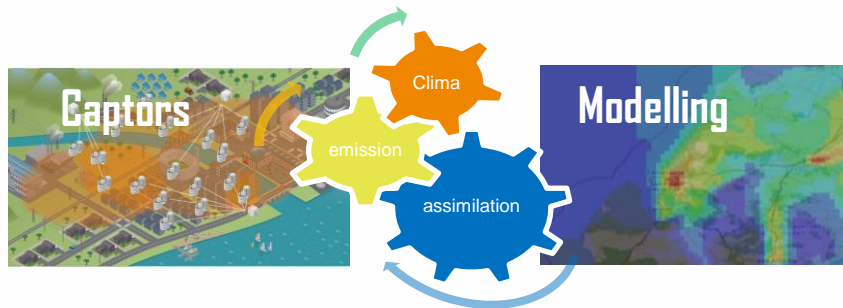
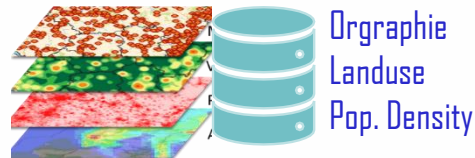
# The AIRED project

## Emissions



## Meteorological Data

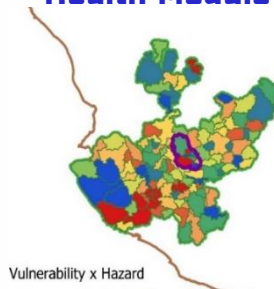
## Geographical Data



## Emission Scenari



## Health Module



## Web and phone API



# Area of study

## Estado de Jalisco



By TUBS - CC BY-SA 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=15994634>

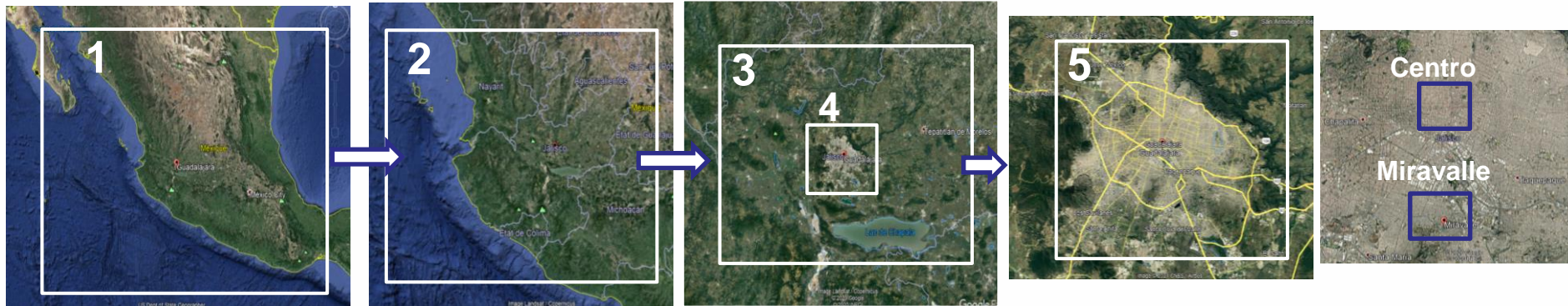


By Jpablo cad - Own work, CC BY 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=4926938>

- Area: 78,588 km<sup>2</sup>
- Population 8,348,151 (2020)
- Population density 110/km<sup>2</sup>



# Domains selection



WRF  
CHIMERE

WRF  
CHIMERE

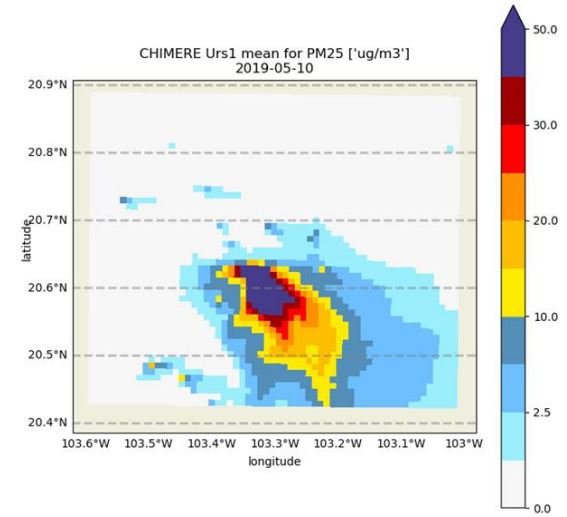
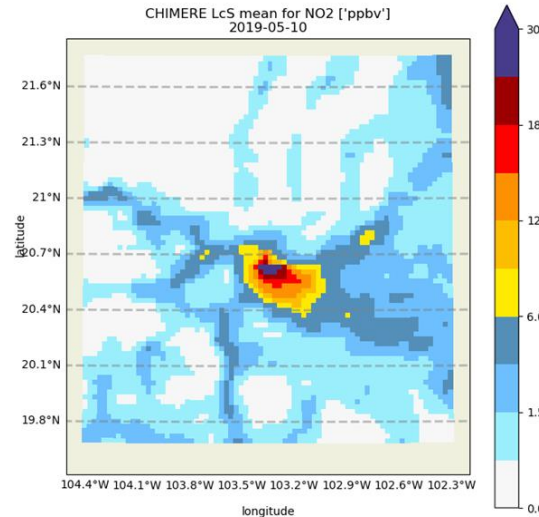
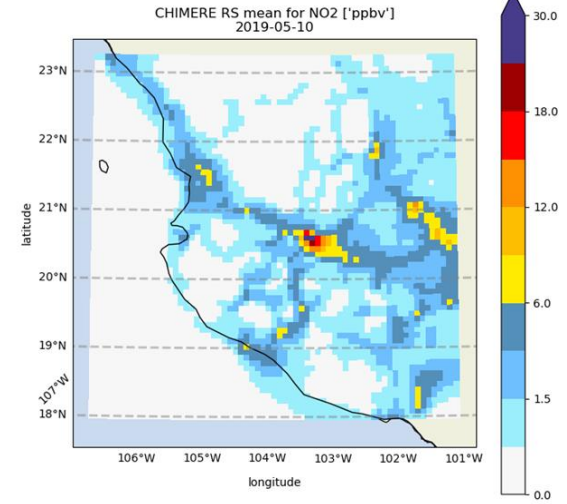
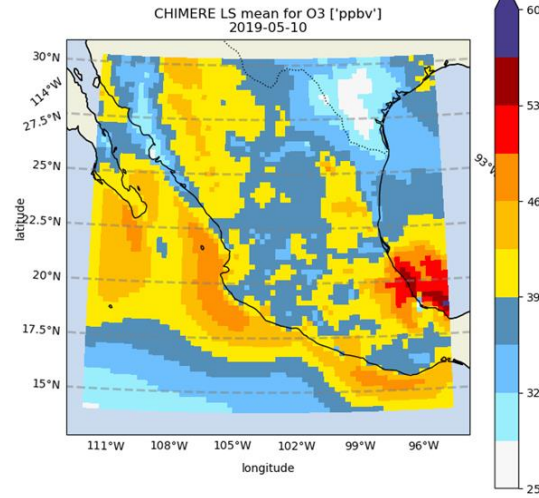
WRF / SWIFT  
CHIMERE /  
FARM

SIRANE

SWIFT/  
SPRAY

# Overview of results

- **CHIMERE multi-scale chemistry-transport model**  
(<https://www.lmd.polytechnique.fr/chimere/>)
- **FARM (Flexible Air quality Regional Model) three-dimensional Eulerian model** (<http://www.aria-net.it/qualearia/en/>)



# SIRANE model

- **SIRANE:**

- *Dispersion model combining*

- *A street network with several transport processes in the urban canopy.*
- *A parametrization of the atmospheric boundary layer coupled to a gaussian model.*

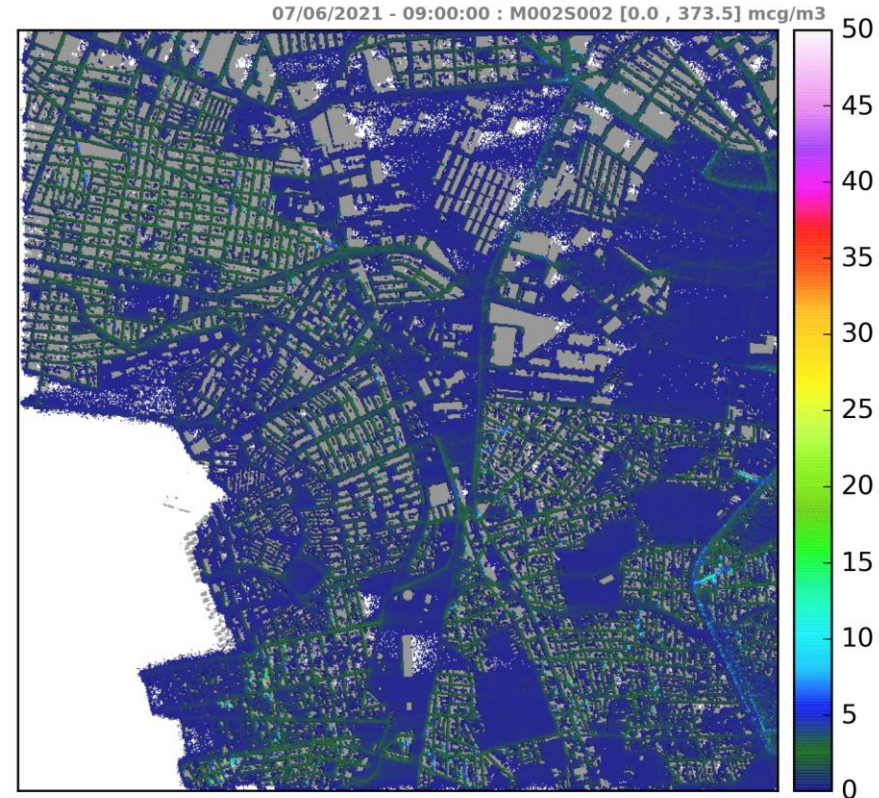
- [Soulhac, L., Salizzoni, P., Cierco, F.-X. et Perkins, R. J., 2011. The model SIRANE for atmospheric urban pollutant dispersion: PART I: presentation of the model. Atmospheric Environment. Volume 45, Issue 39, 7379-7395](#)



Guadalajara

# PMSS model

- **PMSS:**
  - *3D dispersion model*
  - *Building are considered*
  - *Adapted to Street level modelling*
- *PMSS name (Moussafir et al, 2013; Oldrini et al, 2017) is derived from Parallel Micro SWIFT SPRAY*
- *Moussafir, J., Olry, C., Nibart, M., and Albergel, A., 2013. Aircity, a very High-resolution 3D Atmospheric Dispersion Modeling System for Paris. In 15th Int. Conf. on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes.*
- *Oldrini, O., Armand, P., Duchenne, C., Olry, C., Moussafir, J., Tinarelli, G., 2017. Description and preliminary validation of the PMSS fast response parallel atmospheric flow and dispersion solver in complex built-up areas. Environ. Fluid Mech. 17, 997–1014. <https://doi.org/10.1007/s10652-017-9532-1>*

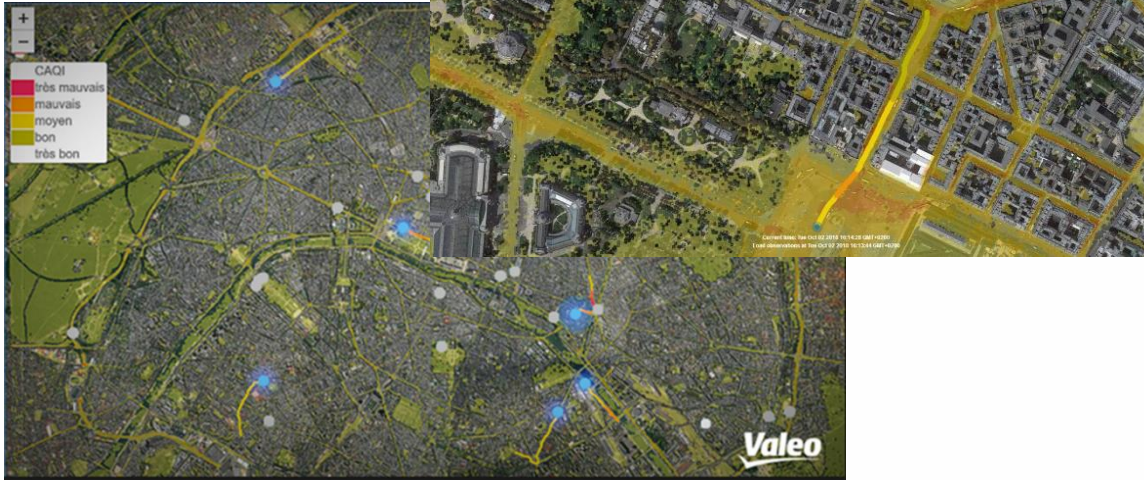


Miravalle



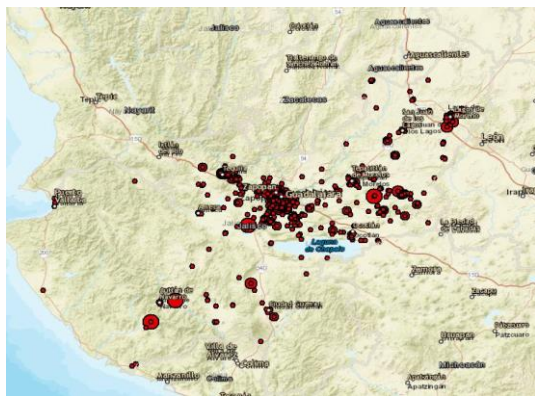
# Microcaptors network

- Purchase and installation of 32  $\mu$ -captors
  - *Will enable data assimilation for model outputs*
  - *24  $\mu$ -capteurs mobiles (ATMOTRACK) y 8 stations fixes (ENVEA)*

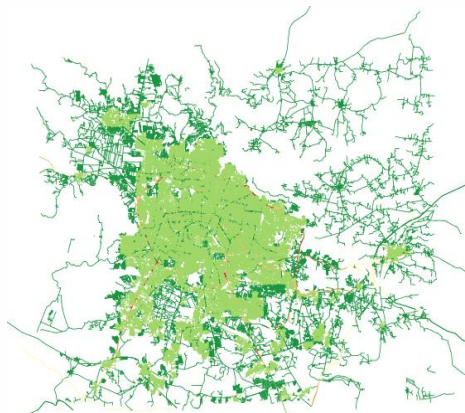


# Local emission inventory

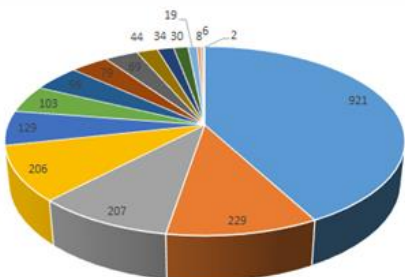
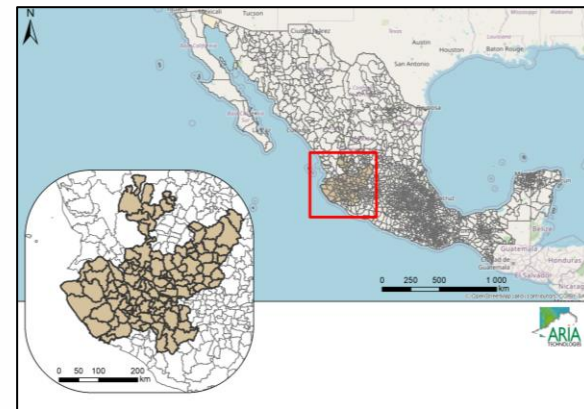
## Ponctual sources (SEMARNAT data)



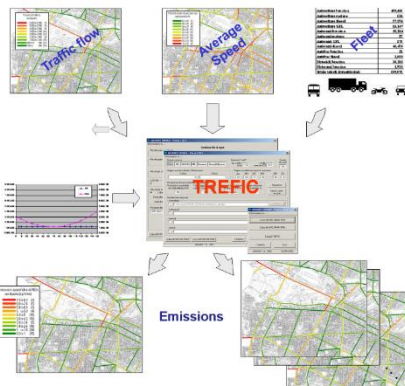
## Linear sources



## Surface sources (SEMARNAT Data)



- Alimentos y bebidas
- Metálico
- Cuero, piel y materiales sucedáneos
- Plástico y hule
- Industria de la madera
- Manejo de desechos y remediación
- Minerales no metálicos
- Industria textil
- Accesorios, aparatos eléctricos y equipos de generación eléctrica
- Mezclas químicas
- Derivados del petróleo y carbón
- Papel y cartón
- Impresión
- Extracción/Beneficio minerales no metálicos



# Local emission inventory

## Spatialized emissions PM 10

### Diffuse sources

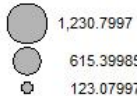
#### Sub-categories contributions



- 1 - Combustion in energy transformation industry
- 2 - Non-industrial combustion plants
- 3 - Combustion in manufacturing industry
- 4 - Production processes
- 7 - Road transport
- 8 - Other mobile sources and machinery
- 9 - Waste treatment and disposal
- 10 - Agriculture
- 11 - Other sources and sinks

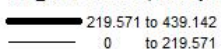
### Point sources

#### PPM\_coa emissions (ton/year)



### Line sources

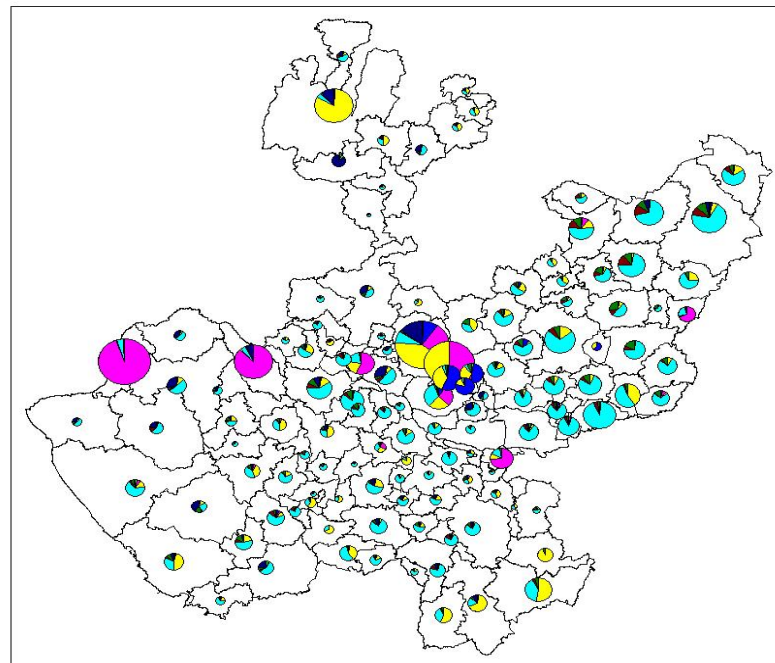
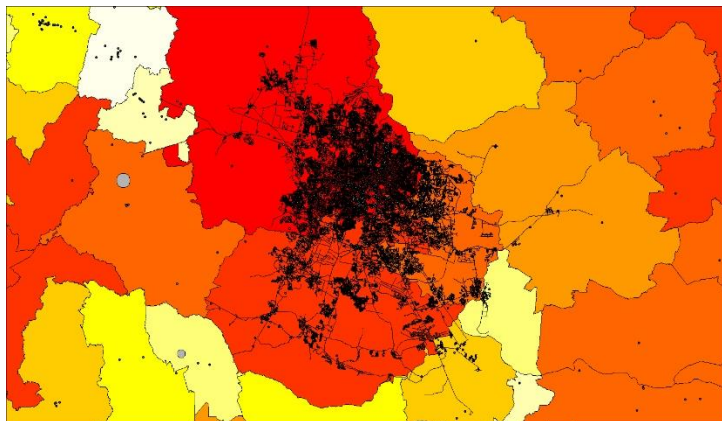
#### PPM\_coa emissions (ton/km/year)



### Diffuse sources

#### PPM\_coa emissions (ton/year)

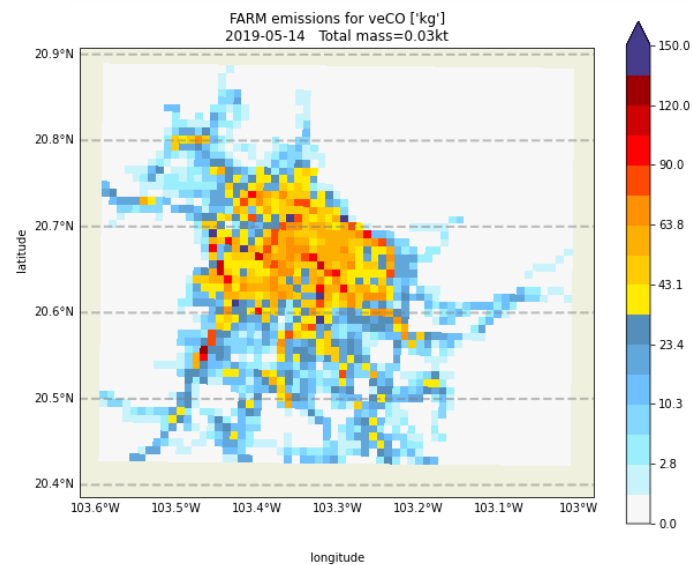
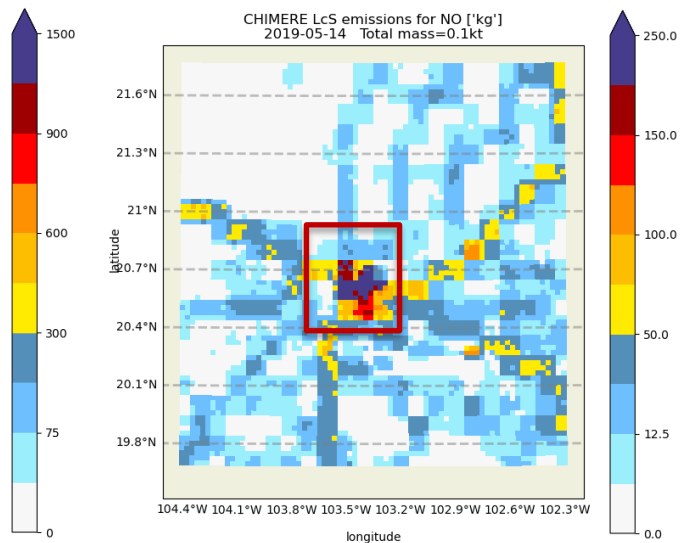
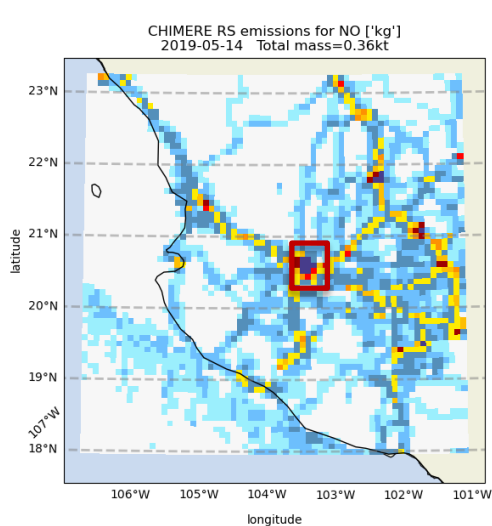
- from 492.2 to 890
- from 195.9 to 492.2
- from 128.7 to 195.9
- from 104.2 to 128.7
- from 87 to 104.2
- from 64.2 to 87
- from 48.3 to 64.2
- from 39.2 to 48.3
- from 27.8 to 39.2
- from 5.5 to 27.8



# From a global inventory to a local inventory

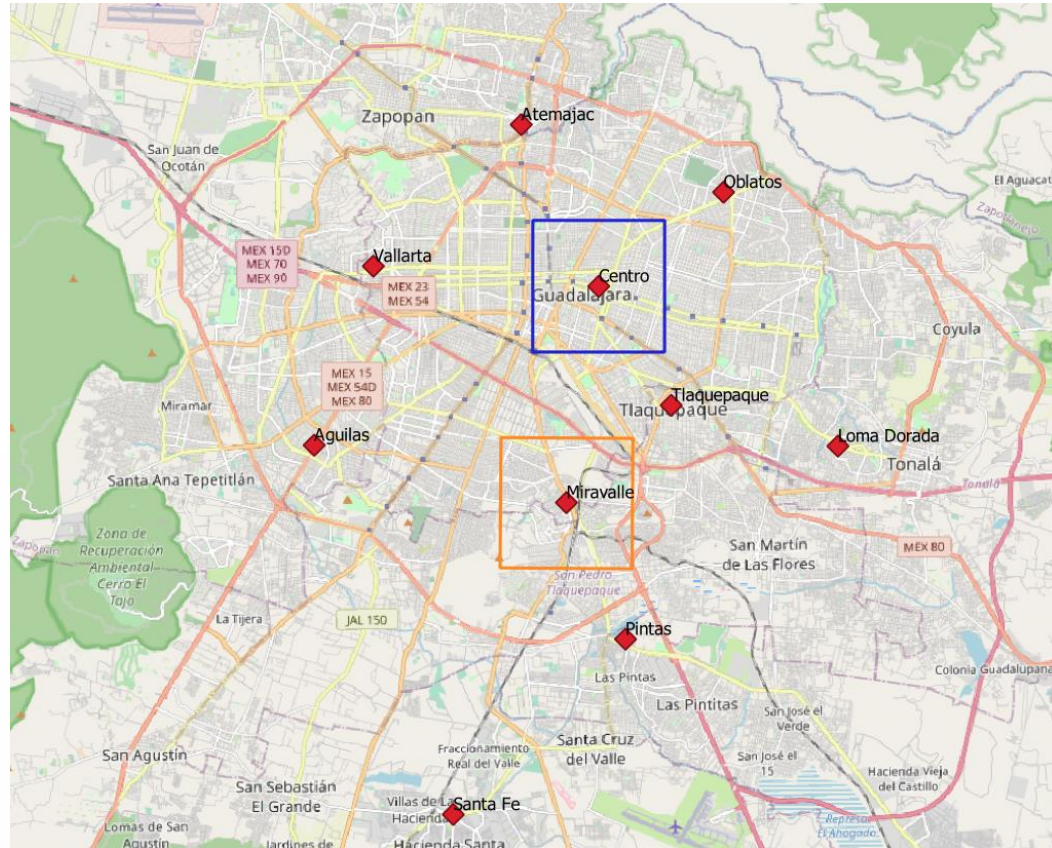
EDGARv5.0 0.1 x 0.1°

Local inventory emission



## Data available for evaluation

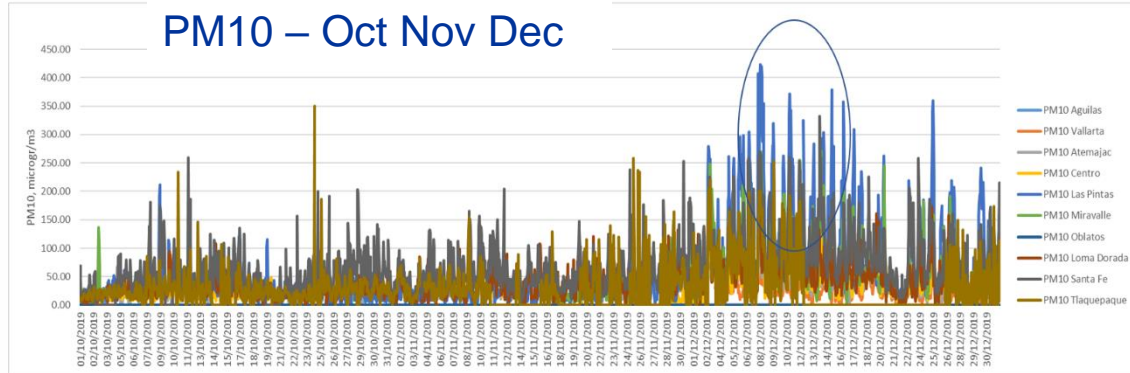
10 air pollution and meteorological monitoring stations are deployed in Guadalajara



# Episode selection for validation

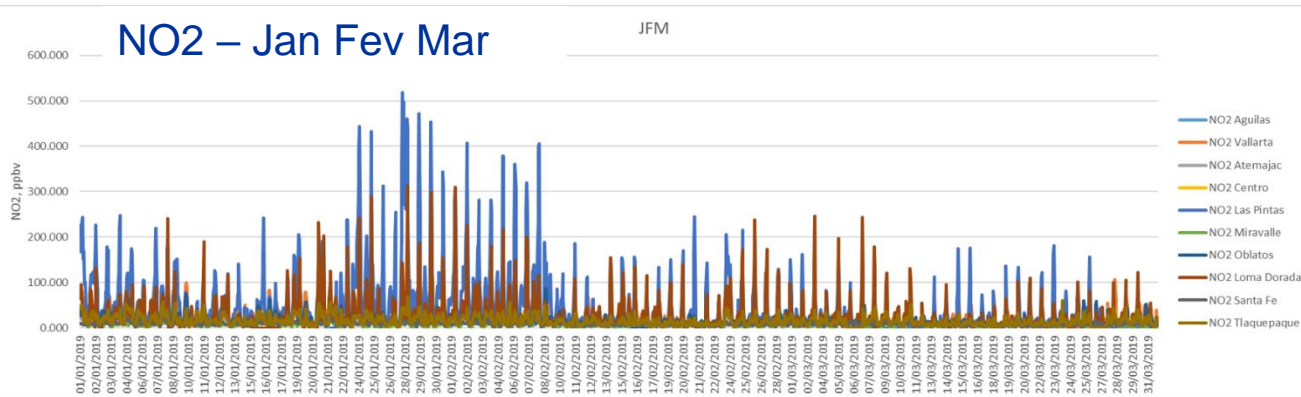
- 1<sup>st</sup> Episode : 27<sup>th</sup> - 31<sup>st</sup> January 2019
- 2<sup>nd</sup> Episode : 14<sup>th</sup> - 19<sup>th</sup> may 2019
- 3<sup>rd</sup> Episode : 29<sup>th</sup> july - 7<sup>th</sup> august 2019
- 4<sup>th</sup> Episode : 8<sup>th</sup> - 14<sup>th</sup> december 2019

## PM10 – Oct Nov Dec



## NO2 – Jan Feb Mar

JFM

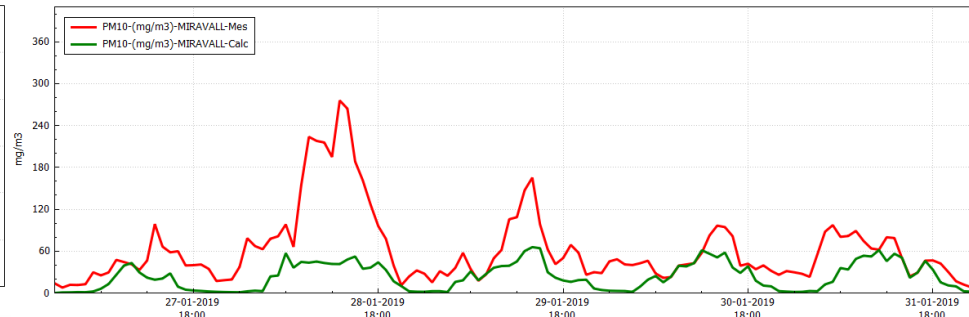
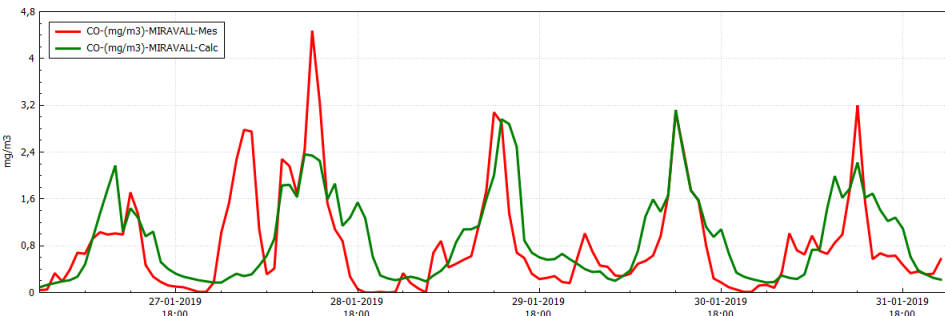


# Evaluation d'épisodes pour le modèle FARM

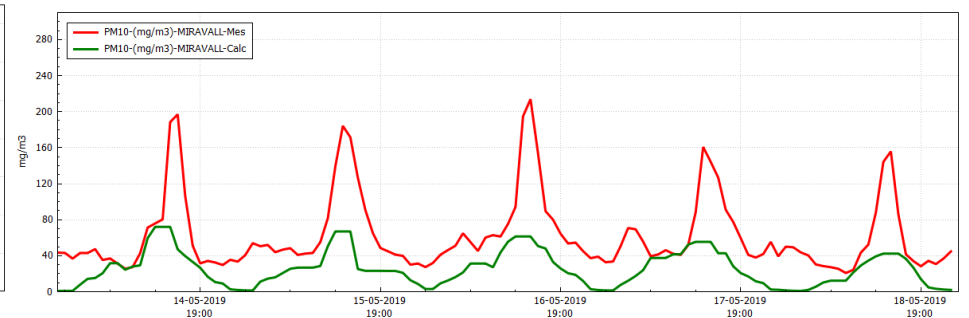
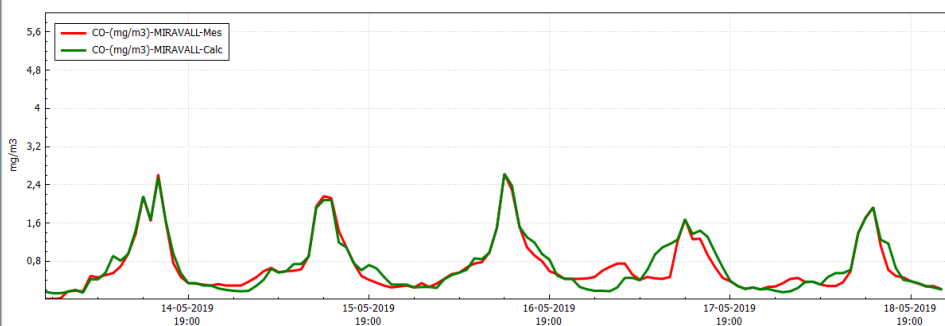
## CO - Miravalle

## PM10 - Miravalle

### Janvier



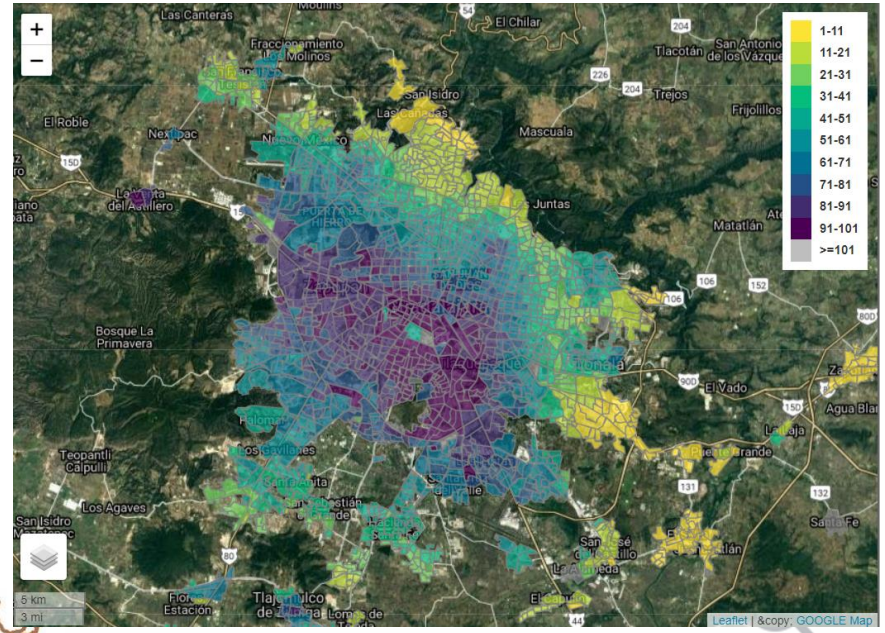
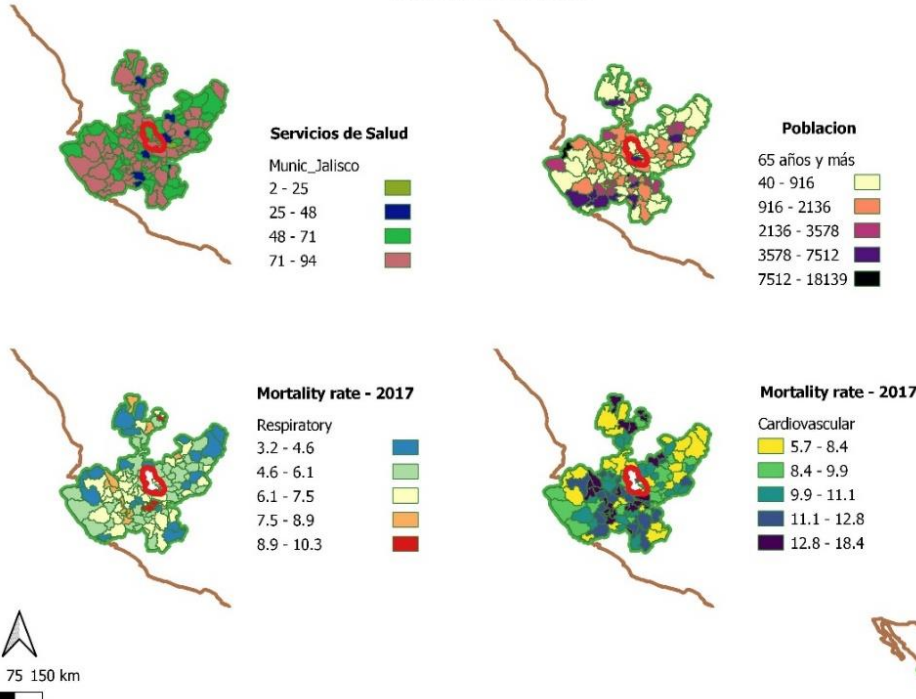
### Mai



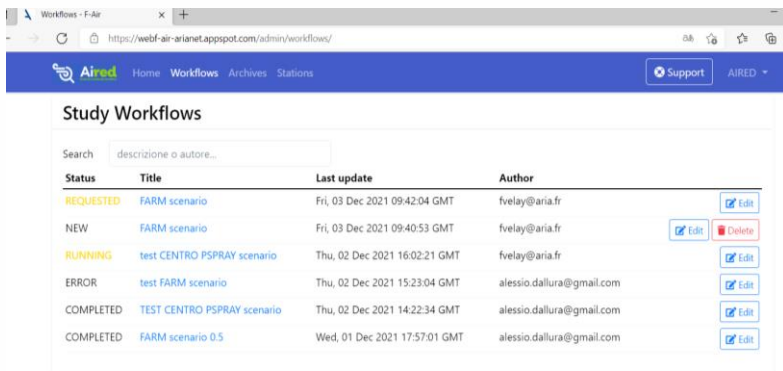
# Health module

- Specific factor were defined for the area

Risk Index - Indicators Examples  
Health and Social factors

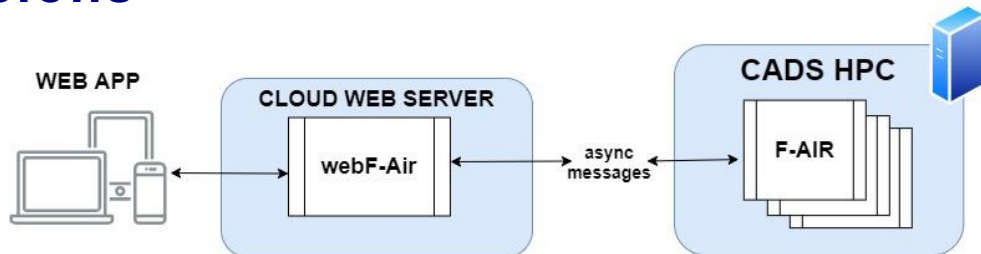






Study Workflows

Status	Title	Last update	Author
REQUESTED	FARM scenario	Fri, 03 Dec 2021 09:42:04 GMT	fvelay@aria.fr
NEW	FARM scenario	Fri, 03 Dec 2021 09:40:53 GMT	fvelay@aria.fr
RUNNING	test CENTRO PSPRAY scenario	Thu, 02 Dec 2021 16:02:21 GMT	fvelay@aria.fr
ERROR	test FARM scenario	Thu, 02 Dec 2021 15:23:04 GMT	alessio.dallura@gmail.com
COMPLETED	TEST CENTRO PSPRAY scenario	Thu, 02 Dec 2021 14:22:34 GMT	alessio.dallura@gmail.com
COMPLETED	FARM scenario 0.5	Wed, 01 Dec 2021 17:57:01 GMT	alessio.dallura@gmail.com




Aired Home Workflows Archives Stations Support AIRED

## images



Run Date: 30/11/2021 00:00:00 Domain: UrS1

BASE NO2 MAX 24H 24 SCENARIO NO2 MAX 24H 24






AIRED - FARM/ARIA Regional



AIRED - FARM/ARIA Regional

<https://webf-air-arianet.appspot.com/>

<  Aria Technologies Outil de visualisation  

Select a user case

FORECAST ▼

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Select dataset

Result Mexico ▼

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Liste des variables

NO2 ▼





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Select a date

2021-12-03 ▼


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Select a timeframe

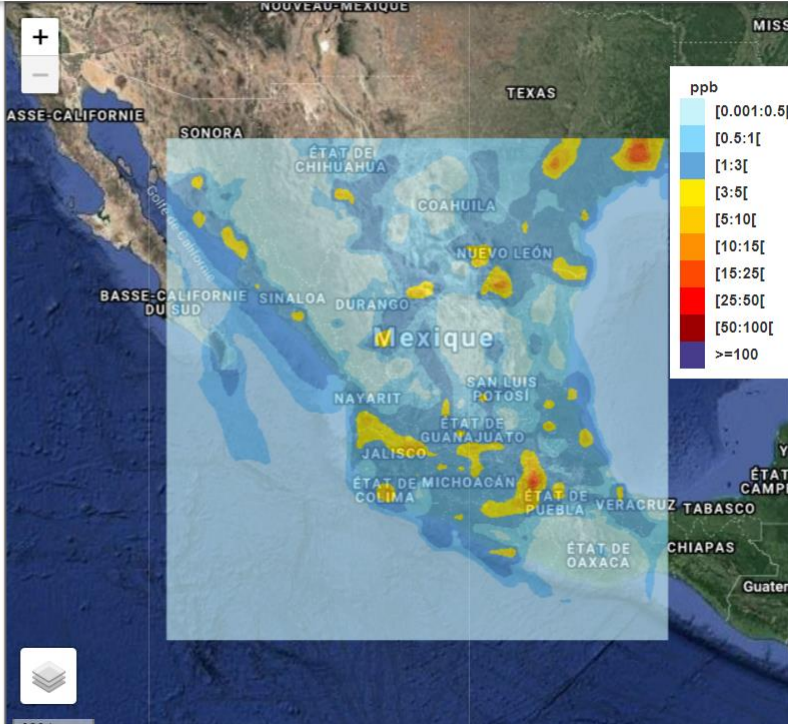
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Opacité 





**Grazie**



**Aired**  
Plataforma de análisis ambiental



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