

# National monitoring of the background impregnation of pesticides in ambient air in France

***Aude Bourin, IMT Nord Europe/LCSQA***

***Caroline Marchand and Fabrice Marlière, INERIS/LCSQA***

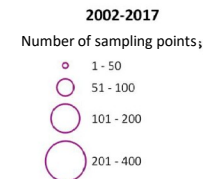
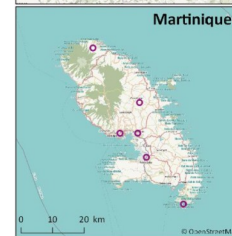
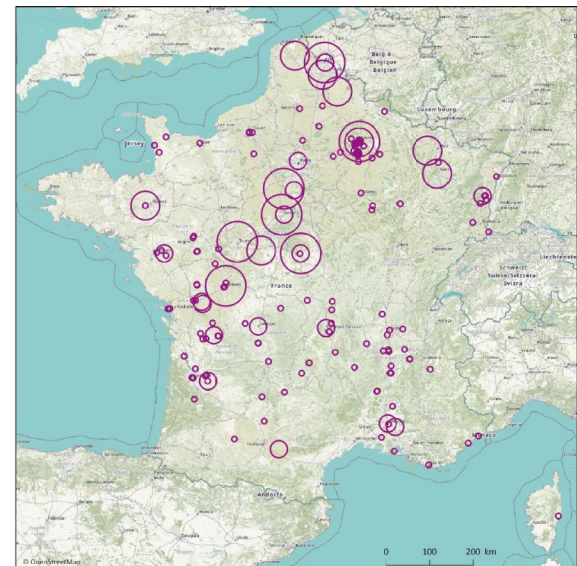
Groupement d'intérêt scientifique

- 90's: wonderings about transfer of pesticides in air
- Since 2000: developments of sampling and analysis methods  
French standardisation in 2007 (XP X43-058 & 059)
- 2001: beginning of measurement campaigns by local networks

**PhytAtmo database which aggregates about 7000 samples**

**176 sites : [urban/rural] [background/proximity] [permanent/spot]**

**321 active substances (AS) / all agricultural activities**



## Goals

- first **national and harmonised inventory** of pesticides levels in ambient air all over France, in a synchronized way and according to a common protocol
- **To study influence factors on sampling strategy** to help to define the design of pesticides periodic monitoring of on a national scale

- **Choice of measurement sites**
- **Sampling duration and frequency**
- **Analysis methods**



*French Ministry  
of Environment*



*French local air  
quality monitoring  
networks*



*French National  
Reference Laboratory  
for air quality  
monitoring*



*French National Agency  
of Sanitary Safety*

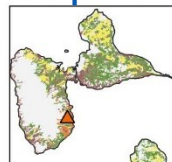
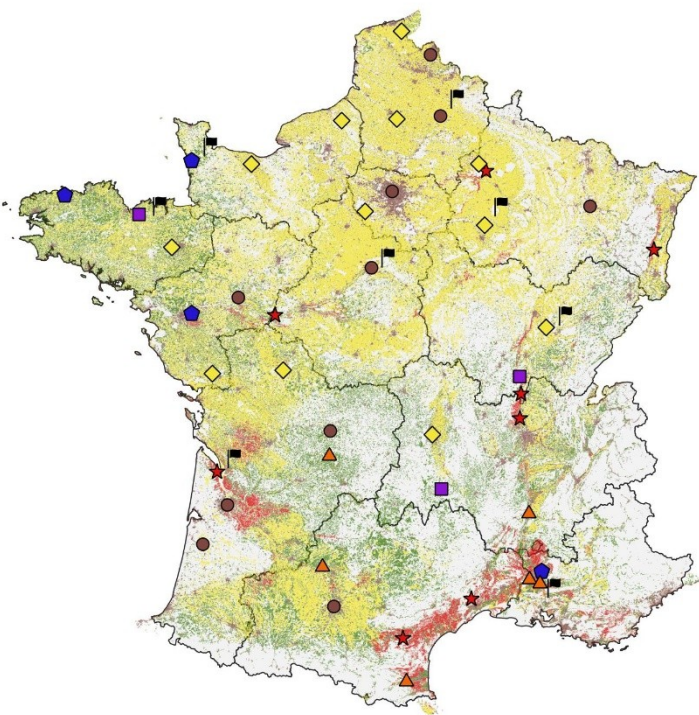
Link to the report :

<https://www.lcsqa.org/fr/rapport/resultats-de-la-campagne-nationale-exploratoire-de-mesure-des-residus-de-pesticides-dans>

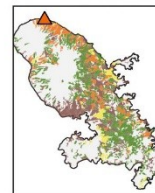
# Overview of the CNEP campaign

- Duration of the campaign: 1 year from June 2018 - June 2019
  - Where: 50 stations working with local networks (DROM and mainland)
  - More than 1800 samples analysed by a common analytical lab with high-performance quantitation limits (national laboratory intercomparisons 2015 and 2022)
  - 75 studied substances (insecticides, fungicides et herbicides)
    - 72 semi-volatiles
    - 3 polar
- **List of the substances acquired by a selection process**

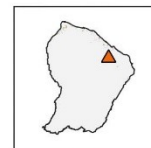
located out of the proximity or direct influence of a single crop



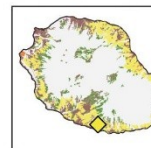
Guadeloupe



Martinique



Guyane



La Réunion

### Main agricultural activity of sites

- Livestock
- ◆ Field crops
- ◆ Market gardening
- ▲ Arboriculture
- ★ Wine-growing
- No major culture
- Glyphosate monitoring

### Type of land use

- Vineyards
- Orchards
- Urban
- Field crops
- Complex crops
- Others



- Depending on **residential areas**:
  - 50% of urban/peri-urban sites
  - 50% of rural sites
- Depending on **major agricultural activities**:
  - 26% of field crop sites,
  - 18% of wine-growing sites,
  - 20% of arboricultural sites,
  - 10% of market-gardening sites
  - 6% of livestock sites
  - 20% of sites with no major agricultural activity

- 1 to 6 sites per region  
France

➔ 50 sampling sites distributed all over France (mainland + overseas (DROM))

## 2 pre-campaign were done to test the influence

- Type of active sampling techniques : low/high volume samplers
- Fraction of PM
- Type of sampler and the use of XAD-2 resin
- Analytical laboratory techniques (LC-MS/MS ESI+ or GCMS/MS)
- Gas/particle phase: global quantification or separate analysis



## Recommendations


- Partisol or DAH80 with PM<sub>10</sub> cut-off
- One unique analytical lab
- Sampling frequency : 1 month to 1 week
- Sampling duration : 2 to 7 days
- List of metadata to be provided (met parameters)

- Quantification rate

FQ>20%	FQ>30%	FQ>40%	FQ>50%	FQ>60%	FQ>70%	FQ>80%	FQ>90%
<b>9 substances</b>	<b>6 substances</b>	<b>4 substances</b>	<b>3 substances</b>	<b>2 substances</b>	<b>1 substances</b>	<b>0 substance</b>	<b>0 substance</b>
Chlorothalonil	S-Metolachlore	Triallate (*)	Glyphosate	Pendimethaline	Lindane (*∅)		
Chlorpyriphos methyl (*)	Prosulfocarbe	Glyphosate	Pendimethaline	Lindane (*∅)			
Folpel	Triallate (*)	Pendimethaline	Lindane (*∅)				
S-Metolachlore	Glyphosate	Lindane (*∅)					
Prosulfocarbe	Pendimethaline						
Triallate (*)	Lindane (*∅)						
Glyphosate							
Pendimethaline							
Lindane (*∅)							

- Annual means

≥2 ng/m3	≥ 1 ng/m3	≥0,5 ng/m3	≥0,2 ng/m3	≥0,1 ng/m3	≥0,05 ng/m3	≥0,02 ng/m3	≥0,01 ng/m3
1 substance	2 substances	3 substances	6 substances	8 substances	11 substances	17 substances	25 substances
Prosulfocarbe	Prosulfocarbe Folpel	Folpel Pendimethaline Prosulfocarbe	Chlorothalonil Chlorpyriphos m Folpel Pendimethaline Prosulfocarbe Triallate	Chlorothalonil Chlorpyriphos methyl (* Fenpropidine (* Folpel Pendimethaline Prosulfocarbe Pyrimethanil Triallate (*)	Chlorothalonil Chlorpyriphos methyl (* Fenpropidine (* Folpel Lindane (*Ø) S-Metolachlore Pendimethaline Prosulfocarbe Pyrimethanil Spiroxamine (* Triallate (*)	Chlorothalonil Chlorprophame Chlorpyriphos methyl (* Cyprodinil Diflufenicanil Fenpropidine (* Fluazinam Folpel Glyphosate Lindane (*Ø) S-Metolachlore Pendimethaline Propyzamide (* Prosulfocarbe Pyrimethanil Spiroxamine (* Triallate (*)	2,4-D Chlorothalonil Chlorprophame Chlorpyriphos ethyl Chlorpyriphos methyl (* Clomazone (* Cypermethrine Cyprodinil Deltamethrine Diflufenicanil Fenpropidine (* Fluazinam Fluopyram Folpel Glyphosate Lindane (*Ø) S-Metolachlore Pendimethaline Pentachlorophenol (Ø) Propyzamide (* Prosulfocarbe Pyrimethanil Spiroxamine (* Tebuconazole Triallate (*)

 substance quantifiée à plus de 20 %



## Goals

- **Periodic update** of the national « photography » of the CNEP
- Evolution of concentrations **over years**

## Measurement strategy

- Substances : CNEP (75 substances : 72 semi-volatiles, 3 polars)
- Measurement methods: CNEP
- Measurement frequency:
  - semi-volatiles: between 18 and 26 weekly samplings per year
  - polars: 40 samplings of 48h per year

## Site selection for semi-volatile substances

- 1 site per region : 18 sites
- a minimum number of inhabitants within 5km : >20 000 in mainland
- distance from sampling point to 1st plot: > 200m (min 150m )
- agricultural profiles : field crops, viticulture, arboriculture, market gardening (no livestock)

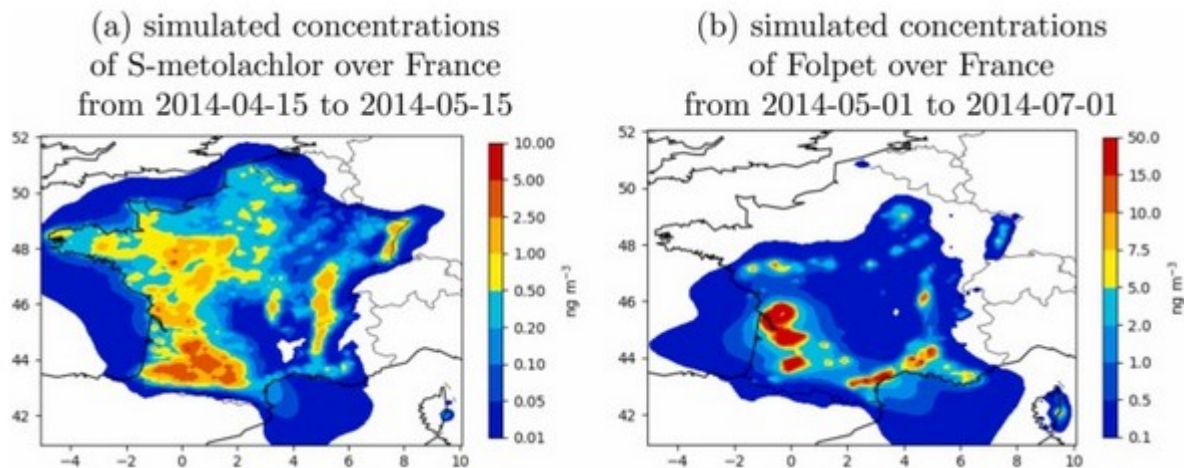


- 29 substances are not detected
- 46 substances are detected and quantified
- Highest FQ : glyphosate (75%), lindane (62%), metolachlor (47%), pendimethalin (74%), prosulfocarb (37%) and triallate (43%) -- consistent with CNEP results
- Highest concentration (>5 ng/m<sup>3</sup>) : deltamethrin, folpel, metolachlor, pendimethalin, prosulfocarb and triallate -- consistent with CNEP results

Consolidation of these results in progress

Detailed comparative study with the data obtained during the CNEP 2018-2019 (LCSQA report in 2023)

- a CHIMERE version accounting for pesticide volatilization from soil and crops
- Application of the model for two pesticides



Couvidat et al., 2022 <https://doi.org/10.1016/j.jhazmat.2021.12749>

- **Difficulties : coupling spatiotemporal data of pesticide application to a model of pesticide volatilization from soil and canopy**

- National strategy adopted based on feedback from the CNEP
- Data from the long-term monitoring since 2021 : comparative study, modelling
- Laboratory intercomparison at the national scale
- Need to make some clarifications and methodological additions through the revision of the NF XP X 43-059 standard

# Thanks for your attention

Anses contact : [fabrizio.botta@anses.fr](mailto:fabrizio.botta@anses.fr)

Local network contact: [emmanuelle.drab-sommesous@atmo-grandest.eu](mailto:emmanuelle.drab-sommesous@atmo-grandest.eu), [colin@ligair.fr](mailto:colin@ligair.fr),  
[ssocquet@atmo-aura.fr](mailto:ssocquet@atmo-aura.fr)

LCSQA/Ineris contact : [fabrice.marliere@ineris.fr](mailto:fabrice.marliere@ineris.fr), [caroline.marchand@ineris.fr](mailto:caroline.marchand@ineris.fr)

Groupement d'intérêt scientifique