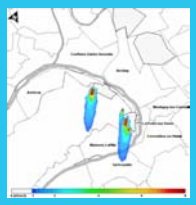
SYPROS
A tool for predicting and monitoring the odour impact of wastewater treatment plants



3rd European Water and Wastewater Management Conference
Birmingham, 23rd September 2009

SIAAP
Fluidyn - France
SETUDE Ingénieur Conseil

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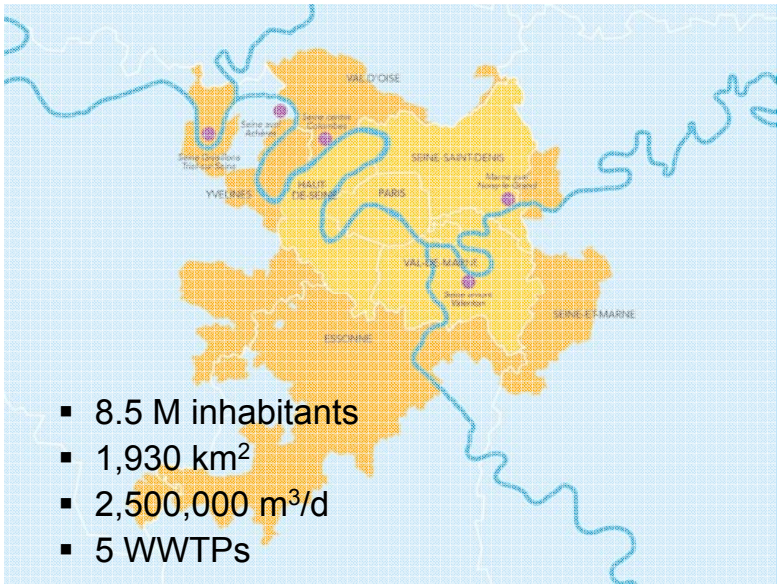
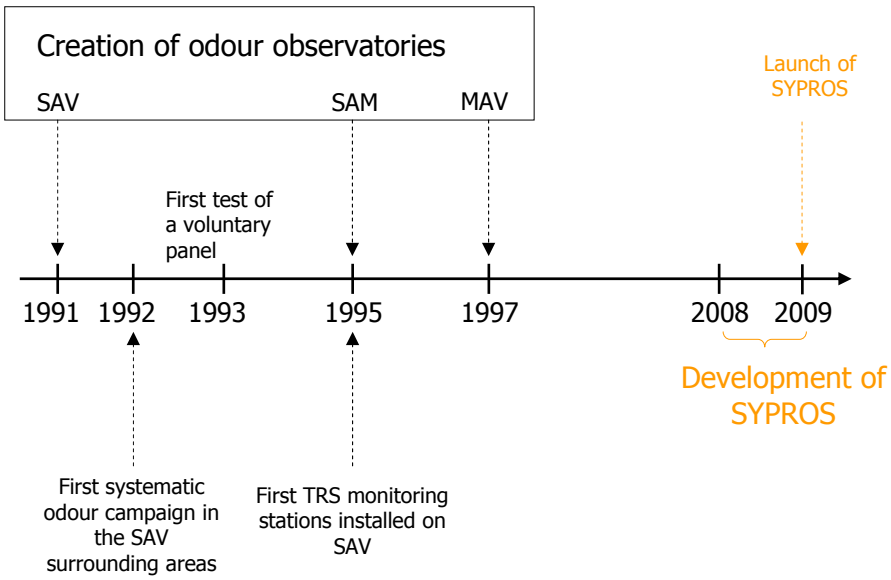
1. SIAAP



- 8.5 M inhabitants
- 1,930 km^2
- 2,500,000 m^3/d
- 5 WWTPs

1. Evolution of SIAAP odour monitoring



1. Context

SYPROS:

Integrates the existing tools that have been in use since the beginning of the 1990's: it gathers data and optimises existing tools for globally managing the odour problem.

Based on all the data that has been gathered over the years since then.

1. Objectives

➔ **Real time monitoring and prediction of odour impacts**

SYPROS is used to model the dispersion of predicted and real-time odours measured in the urban areas surrounding the WWTPs.

➔ **Estimates WWTPs odour impacts both on-site and on the surrounding urban areas**

- helps on-site operations
- provides a new medium for communicating with the surrounding cities

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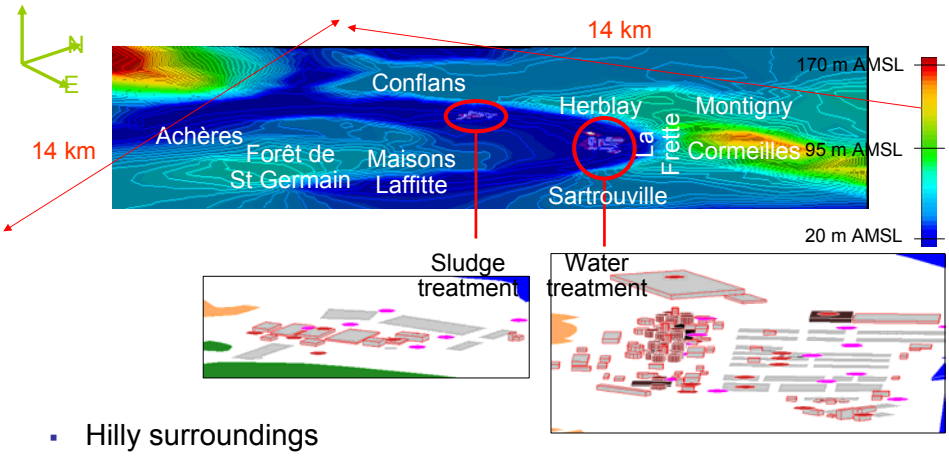
2. Constraints



- Hilly surroundings
- Numerous odour sources
- Wind speeds < 1 m/s
- No direct monitoring of odour emissions from processing facilities

2. Technical selection

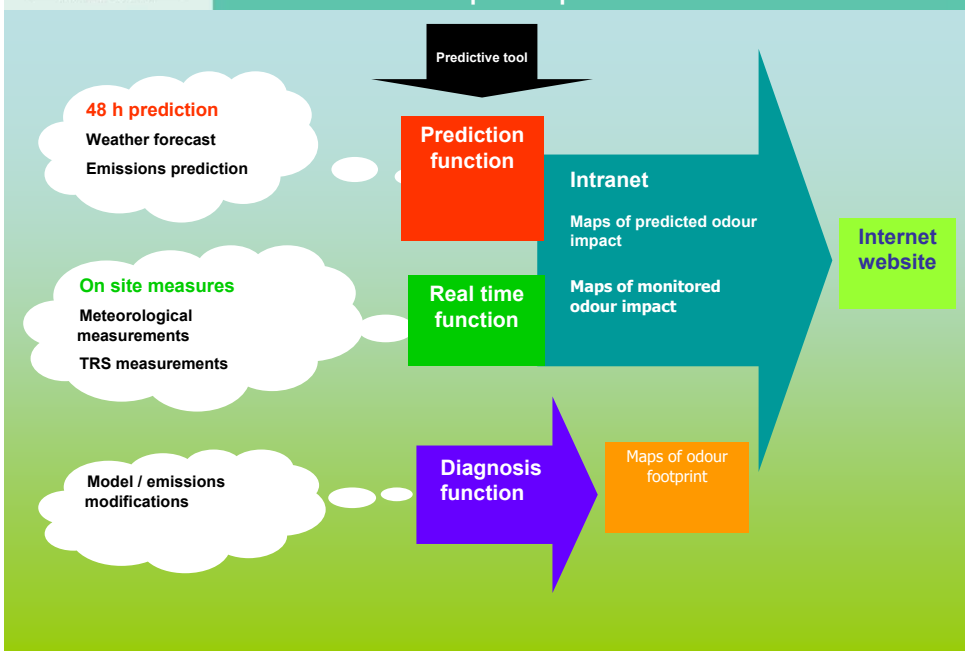
- Due to physical constraints and expected results:
  - Representation of rugged surroundings
  - Numerous sources
  - Real-time evaluation of odour emissions
  - Occurrence frequency of wind speed < 1 m/s

➔ **Use of a deterministic atmospheric dispersion solver**

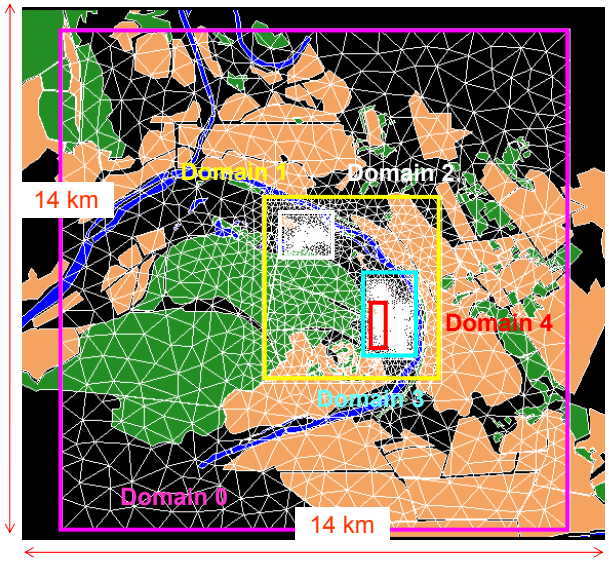
- Lagrangian puffs
- Pre-calculated wind field database

➔ **Specific IT development to build new software**

2.SYPROS principle



2. Model features



- Steep slopes (1:3)
- 150 m height differential
- 5 domains
- Full domain: 14 km x 14 km
- Domain height: 250 m
- Numerous source groups (81)

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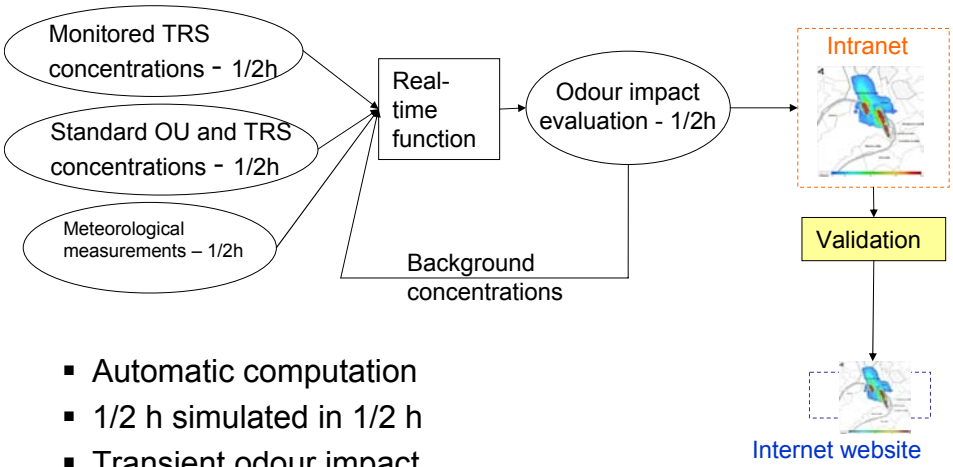
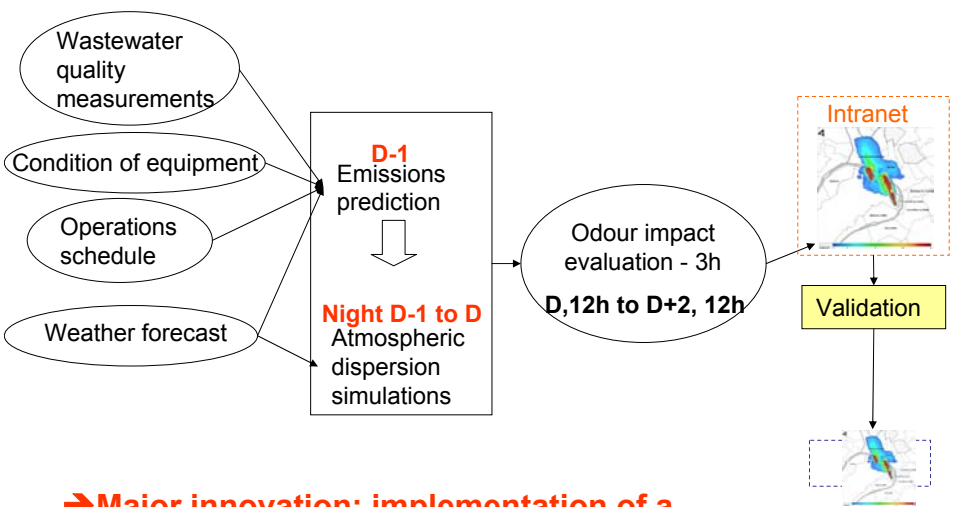
3. Real time function



- Automatic computation
- 1/2 h simulated in 1/2 h
- Transient odour impact
- Puff rate depending on wind speed

➔ **Major innovation: Sources remapping**

3. Prediction function



➔**Major innovation: implementation of a predictive system for odour emissions**

3. Fitting with experimental data

- Specific operations involving ‘environment messengers’ in the surrounding urban areas

- Comparison between results generated by the tool and odour perceptions recorded in the WWTP surrounding areas (complaints from residents, voluntary odour monitors, observations by environment messengers, TRS monitoring in the WWTP surrounding areas)

➔ **First adjustments leading to reasonable assessment of the global WWTP odour impact**

- Need for a follow-up when using the tool

➔ **Ongoing adaptation for improving the tool’s reliability**

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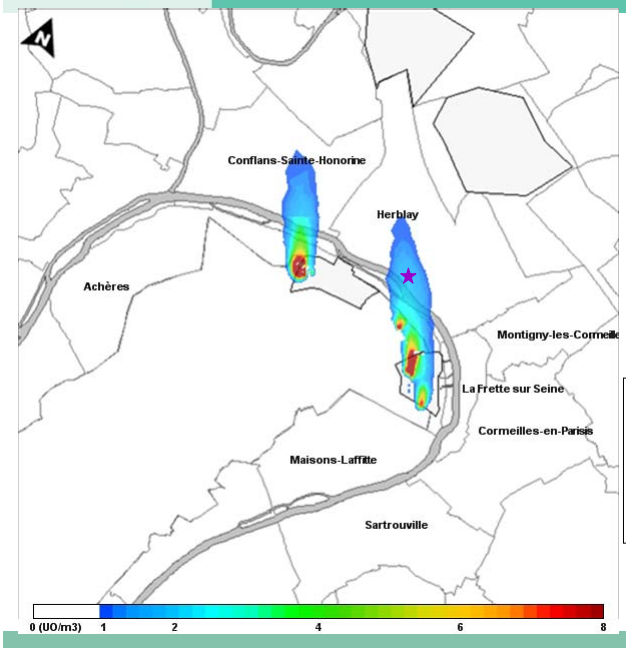
4. Experimental results



4:30pm – 5:00pm

18th August 2009

- Nothing registered by the 'Environmental messenger'
- ★ Complaint

Contents

1. Background
2. SYPROS architecture and how it works
3. Innovative features
4. Discussion
5. Conclusions

5. Conclusions and future developments

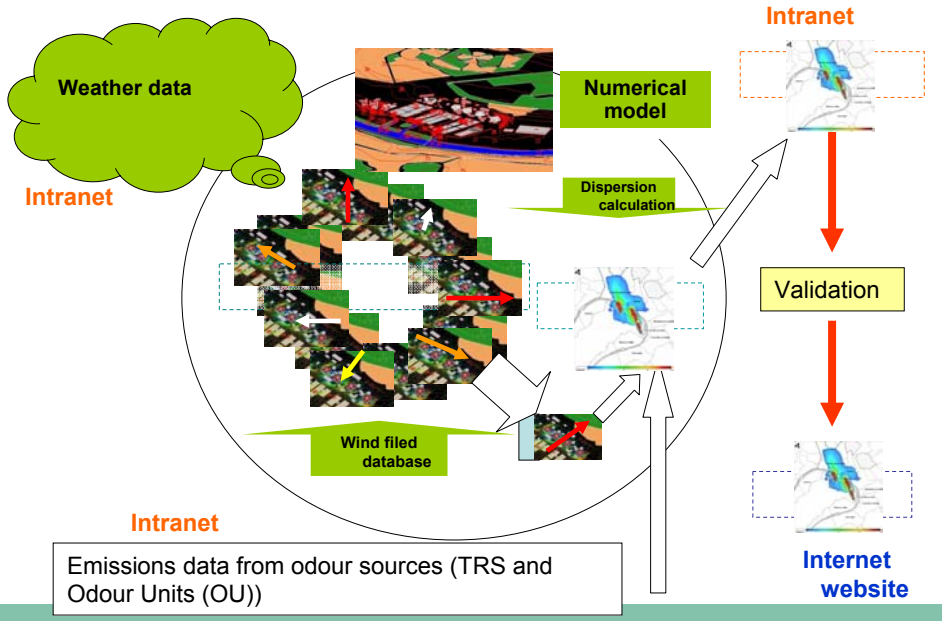
- Odour impacts from 3 WWTPs are monitored and predicted using SYPROS
- First months of implementation:
  - Technical validation of a number of tool parameters
  - Integration into the information and decision-making system for WWTPs operations
- Next steps:
  - Continuous improvement of the tool
  - Public access via a website

1. Seine aval

Site picture

- Built in 1940
- One of the largest European WWTP (1,800 000 m^3/d)
- Odour emissions are mostly Total Reduced Sulfurs (TRS)
- Odour monitoring via TRS monitors located in the vicinity of the processing facilities

2.SYPROS architecture



3. Remapping odour emissions

➔ **Major innovation: real-time odour emissions remapping**

- Study of contribution and dilution factors between odour sources and TRS monitors
- Use of assumptions based on our experience of this site monitoring
- Setting of a remapping matrix:
  - relationships between TRS concentrations measured at monitors and estimates of TRS concentrations emitted from the sources
  - for all wind field conditions in the weather database.

3. Predicting odour emissions

➔Major innovation: implementation of a predictive system for odour emissions

- Identification of contributing factors among:
  - Weather conditions
  - On-site operations
  - Wastewater quality parameters

Eg.: DO values and variations, COD, redox potential, etc.

- Feasibility study for predicting contributing factors
- Evaluation of combined factors contributing to emissions levels generated by processing facilities

4. Limitations

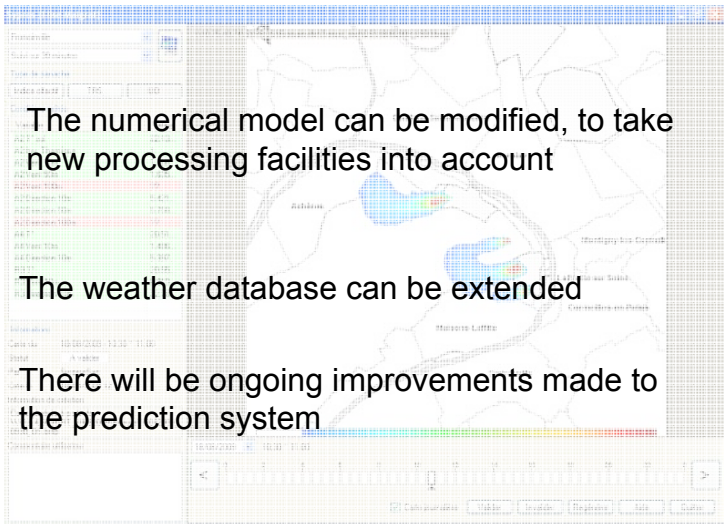
- No continuous UO measurement.
- Fewer TRS monitors than odour sources.
- Only main sources could be evaluated in real time.

➔ Need for manual monitoring and information about on-going maintainance operations

- Weather forecast reliability
- Difficulty in predicting odour emissions
  - Much data is needed (wastewater quality, maintainance schedule, etc.)
  - Some events occurring on-site cannot be foreseen
  - Variations in odour production

➔ On-going analysis + the development of other tools will help improve emissions levels predictions

5. Future steps



- The numerical model can be modified, to take new processing facilities into account
- The weather database can be extended
- There will be ongoing improvements made to the prediction system

5. SYPROS use

- Well-established links with **WWTP workers** for increased reliability:

  ← SYPROS relies on the information provided by WWTP operators on current and scheduled on-site operations

  ➔ They receive odour impact information to help them adapt their work practices in an effort to reduce (when possible) odour nuisances.

  Next step… implementation of an alert system based on modelled impacts.

- A tool also dedicated to the **neighbourhood**:

  ➔ After on-site validation, results generated by the tool could eventually be published on the SIAAP website.