An operational system for air quality monitoring and forecasting over Europe


1 Ineris; 2 LMD/IPSL; 3 LISA; 4 ADEME; 5 Meteo-France

This platform is proposed by the PREV'AIR consortium - http://www.prevair.org

Questions about PREV'AIR? Please send an e-mail to frederik.meleux@ineris.fr

Two main objectives

• Diagnostic and prospective studies in the field of atmospheric air pollution at the European scale
  ▪ Technical support to the French Ministry for Ecology in the framework of international negotiations about transboundary air pollution (implementation of integrated policies aiming at reducing pollutant emissions in Europe)

• Delivery of a daily information related to air quality over France and Europe
  ▪ To complement the national air quality monitoring network (~40 AASQA, ~2000 sensors, ~700 stations)
Modeling platform architecture

3D Chemistry Transport Models...
- CHIMERE / IPSL-CNRS-INERIS
- MOCAGE / METEO-FRANCE
  ... Driven by meteorological forecasts
- AVN / NCEP global data (+ MM5 higher resolution forecasts)
- ARPEGE, ALADIN

Other input data
- Emissions inventory
  - EMEP
  - EDGAR
- Boundary concentrations
  - MOZART+GOCART
  - LMDz-INCA
  - MOCAGE
- NRT observations data from local AQ monitoring associations
  (BASTER / ADEME database...)

Meteorological forecasts

Chemical forecasts

Input data (other than meteo.)

Chemical forecasts

CHIMERE / IPSL-CNRS-INERIS
MOCAGE / METEO-FRANCE

Forecasts maps

« Real-time » observations

Scores

The CHIMERE Model Set-Up in PREV’AIR

- Domains
  - Over Europe
    - Horizontal resolution: 0.5°x 0.5°
    - Vertical resolution: 8 levels from surface pressure up to 500 hPa
  - Over France
    - Horizontal resolution: 0.15° x 0.1°

- Meteorological forecast data
  - AVN / NCEP for initialisation and boundary conditions
  - MM5 higher resolution forecasts (36km)

- Chemical scheme
  - MELCHIOR reduced (~45 species, ~120 reactions)
  - Aerosol module
    - Dust, PPM, SOA, nitrates, sulphates, ammonium, Water Contents
    - 25 reactions (aqueous and heterogeneous phase)

Other model configurations:
- meteorology: ECMWF, ARPEGE / ALADIN
- BC: MOZART, LMDZ-INCA, GOCART
- See http://euler.lmd.polytechnique.fr/chimere

HARMO-10 Crete 2005
The MOCAGE Model Set-Up in PREV’AIR

- Domains
  - Global Model / Over Europe / Over France
    - Horizontal resolution: 4° x 4° 0.5° x 0.5° 0.1° x 0.1°
    - Vertical resolution: 47 levels from surface pressure up to 5hPa
  - Meteorological forecast data
    - ARPEGE and ALADIN
  - Chemical scheme
    - RACMOBUS (118 species, 381 reactions)
  - No aerosol module

The Observation Network

- 41 French AQ related organisms
  (AASQA)
  - 680 monitoring stations
  - O₃ NO₂ SO₂ PM10 PM2.5
  - Collected in real time to the national AQ database
  - BASTER
  - Downloaded for being used by PREV’AIR for correction and evaluation processing
> **PREV’AIR Outputs: Daily Forecasts**

- Available at D+0, 01-06 h LT
- Daily peak and averaged concentration maps
  - D+0, D+1, D+2
- Pollutants: O3, NO2, particulate matter
- Global scale, Europe, France

> **Other Products**

> **“Analysed” ozone maps**

- Modelled concentrations corrected with observations:
  - Observations collected in real-time for 150 stations
  - Statistical adaptation: kriging method
  - Available at D+0 for D+0 and D-1

> **Statistical adaptation**

- Modelled concentrations corrected with climatology – over the last past years:
  - Statistical adaptation: kriging method
  - Available at D+0 for D+0 D+1 and D+2
>Statistics and Scores

<table>
<thead>
<tr>
<th>DATE</th>
<th>Rural (microg/m³)</th>
<th>Suburban(microg/m³)</th>
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<tr>
<td></td>
<td>obs</td>
<td>forecast</td>
</tr>
<tr>
<td>D-1</td>
<td>103</td>
<td>105.4</td>
</tr>
<tr>
<td>D+0</td>
<td>103</td>
<td>104.9</td>
</tr>
<tr>
<td>D+1</td>
<td>103</td>
<td>104.3</td>
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<tr>
<td>D+2</td>
<td>103</td>
<td>103.9</td>
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<table>
<thead>
<tr>
<th></th>
<th>Normal bias (%)</th>
<th>Normal SE(%)</th>
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<tbody>
<tr>
<td>D-1</td>
<td>5.5</td>
<td>20.3</td>
</tr>
<tr>
<td>D+0</td>
<td>5.2</td>
<td>21.0</td>
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<tr>
<td>D+1</td>
<td>4.8</td>
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</tr>
<tr>
<td>D+2</td>
<td>4.8</td>
<td>22.7</td>
</tr>
</tbody>
</table>

For ozone the model slightly overestimates the peak values. The correlation decreases but slowly highlighting the robustness of the model.

> User Information Exchange

Since the information is daily published on Internet and filed in a database, the Prev ’Air system is opened to all persons and organisation that would like to, personally or professionally, be informed on the continent-wide evolution and trends of pollutant behaviour in the short and medium term.

- PREV ’AIR numerical data
  - Extraction over user-defined domains
  - Available through internet for Air Quality Institutions (user accounts)
- Applications
  - 3D data: Boundary Conditions for Air quality simulations at a local scale
  - 2D data: for Air Quality monitoring and forecast

⇒ Feedback from Prev ’Air Users
**Future developments**

- To improve the system in complex area (mountain, coastal area)
  - increasing the horizontal resolution
  - using local emission inventories
- To enlarge the European domain
  - to take into account Greece and Scandinavian countries
- To develop our observation network
  - with surrounding countries
  - with vertical measurements
- To use an hybrid models
  - coupling Chimere and Mocage models
- To use meteorological data from Meteo–France
  - more accurate forecast over Europe
- To improve the aerosol module
  - with a more detailed chemical scheme

**Ozone map on French public television**

- For the summer 2005, 18 days with ozone forecasting broadcast
- Up to 6 bulletins a day