



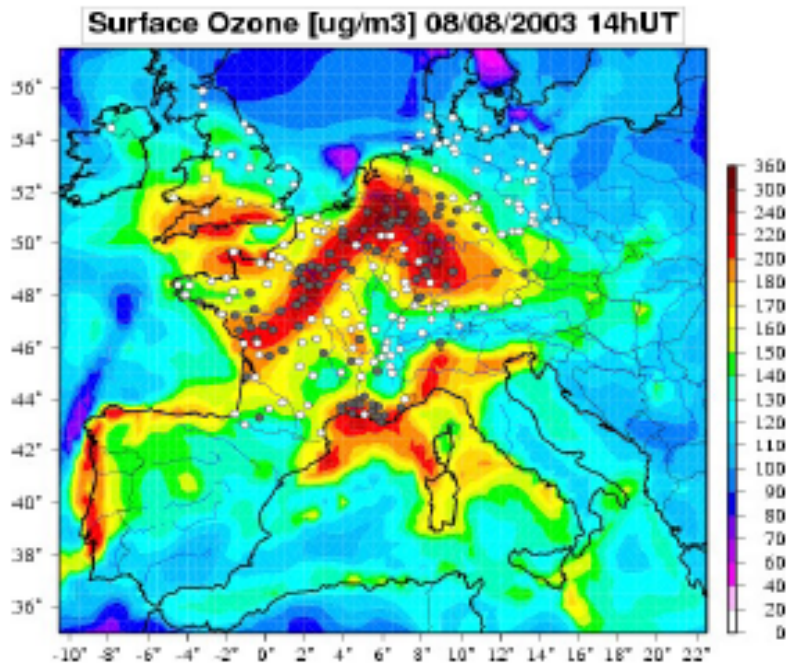
CHIMERE
For Nature Run
in
EUMETSAT/TNO project



Model Description

Objectives :

- **RT Forecasts** (PIONEER, PREV'AIR, GEMS; PROMOTE, GAS)
- **Analysis** (CAFE, CityDelta, EuroDelta)
- **Research** tools on processes (chemistry and transport)
- *In practice: compromises:*
 - Low vertical resolution (BL model)
 - Gas-phase or aerosol version, or aerosol+salt (inert or full)



On line, free access:

<http://euler.lmd.polytechnique.fr/chimere>

Users list, users workshop (every ? Years)

chimere@lmd.polytechnique.fr

Head of development team: Laurent Menut



Includes

- Gas-phase chemistry: MELCHIOR (44 species, 100 reactions, 22 primary species)
- Aerosols (see below)
- Transport using PPM on slow species, UPWIND otherwise
- Mixing Kz (Troen Mahrt), extra mixing below clouds
- TUV tabulated with « below cloud » attenuation
- TWOSTEP solver
- EMEP or other emissions (hourly, multi-level),

here TNO emissions



Aerosols (Bessagnet et al., 2004)

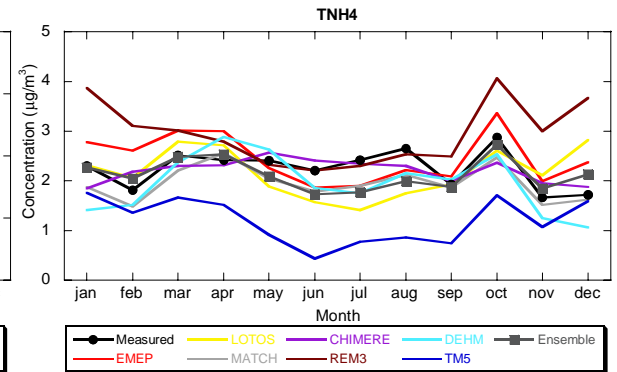
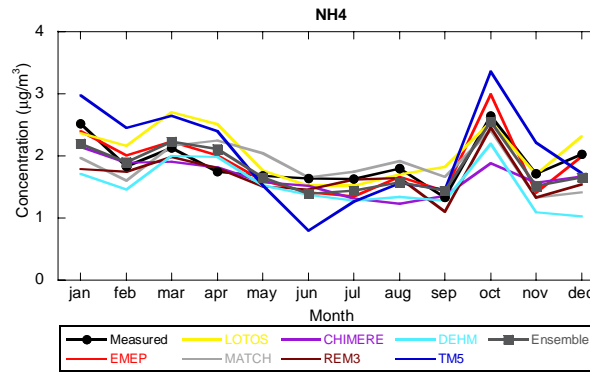
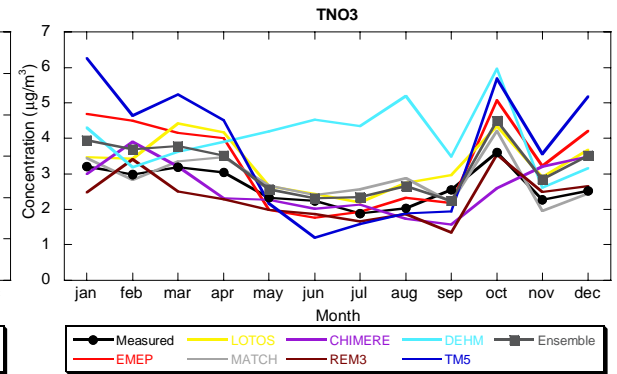
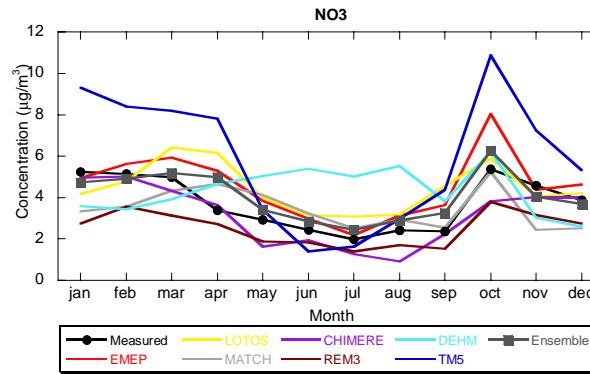
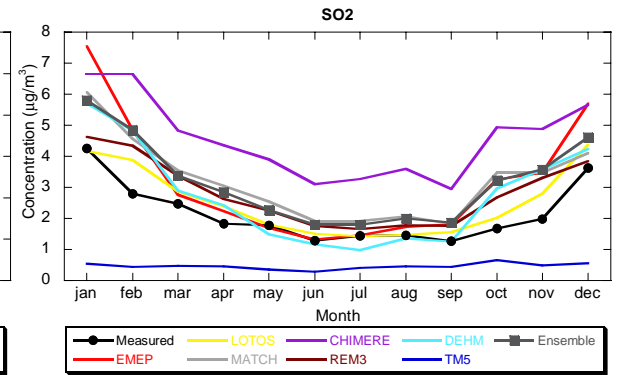
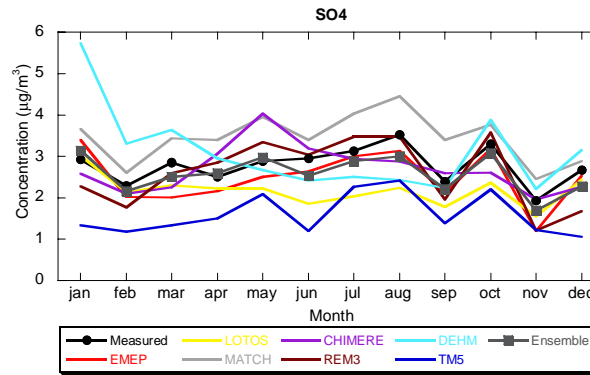
- 6 species: SO₄, NH₃, NO₃, SOA, DUST, PPM
- 6 size bins from 10 Nano to PM₁₀
- ISORROPIA tabulated
- Pankow equilibria for SOA
- Aqueous-phase chemistry

Aerosols	n	k
Primary Particulate Matter (PPM)	1.75	0.44
Secondary Organic Aerosol (SOA)	1.55	0.05
Water soluble (Sulfate, Nitrate, Ammonium)	1.53	$6 \cdot 10^{-3}$
Water	1.33	0



Model performance

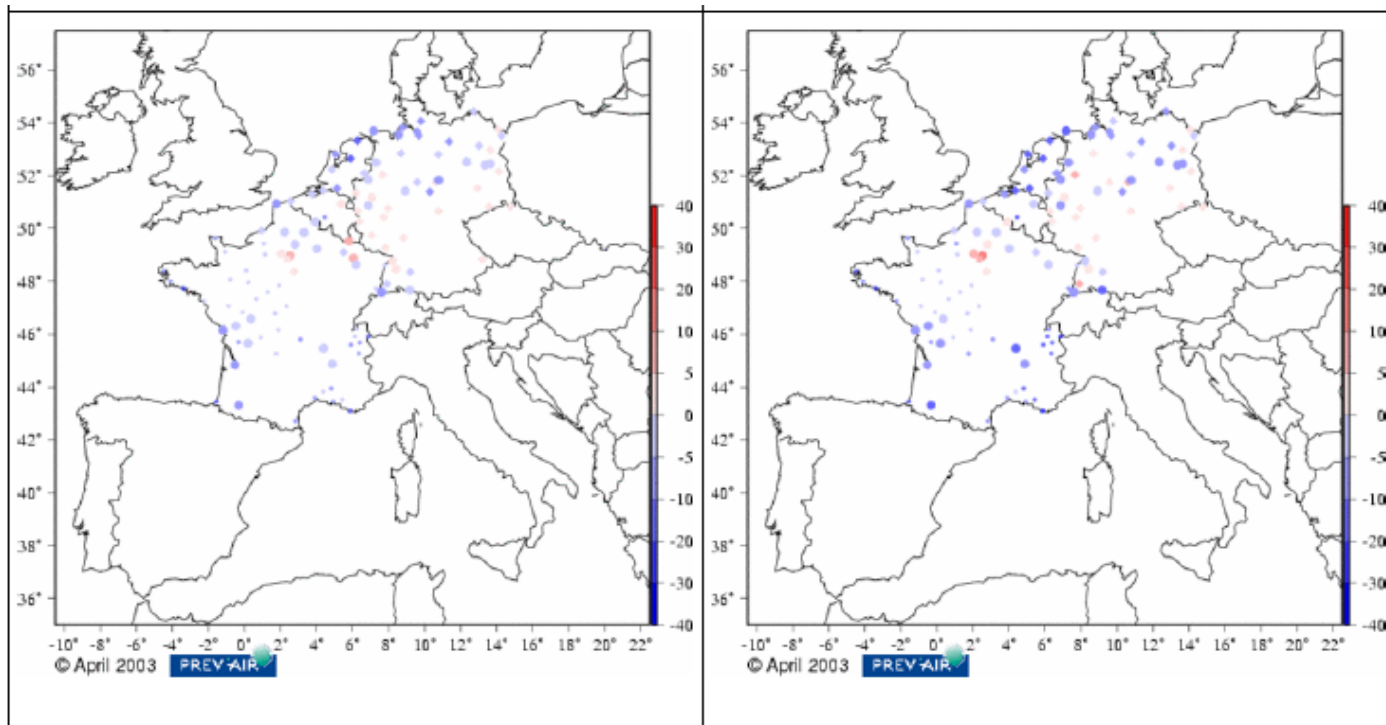
After
Schaap et al.
(2008), A.E.
Submitted





PREV'AIR real time forecasts, Day+1, 3 Year verification (2004-2006) **BIAS**

after Honoré et al., 2008, JGR

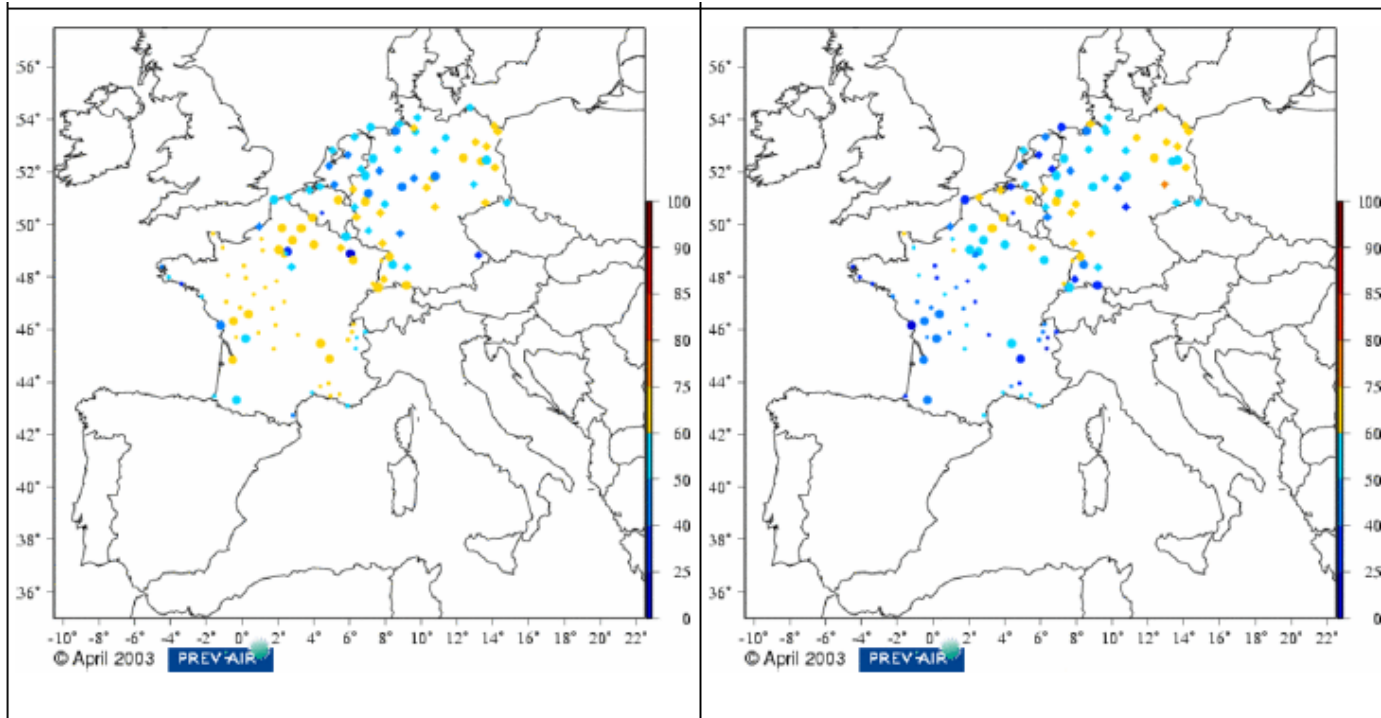


Spring-Summer

Fall-Winter



PREV'AIR real time forecasts, Day+1 3 Years verification (2004-2006) CORRELATION

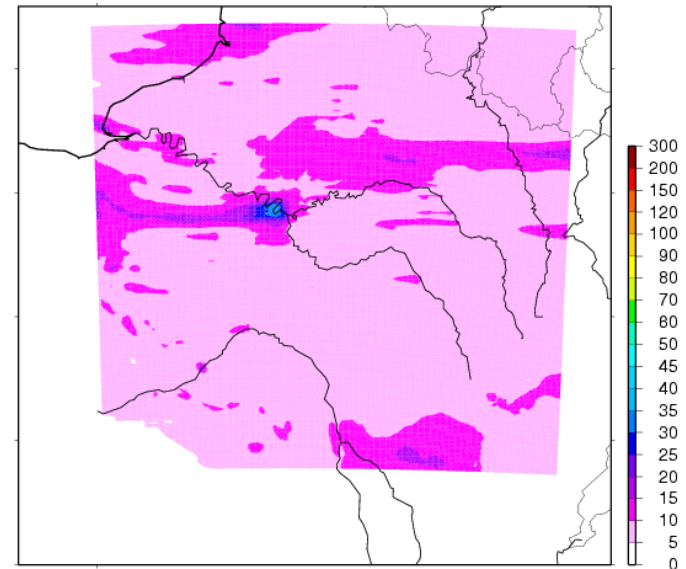
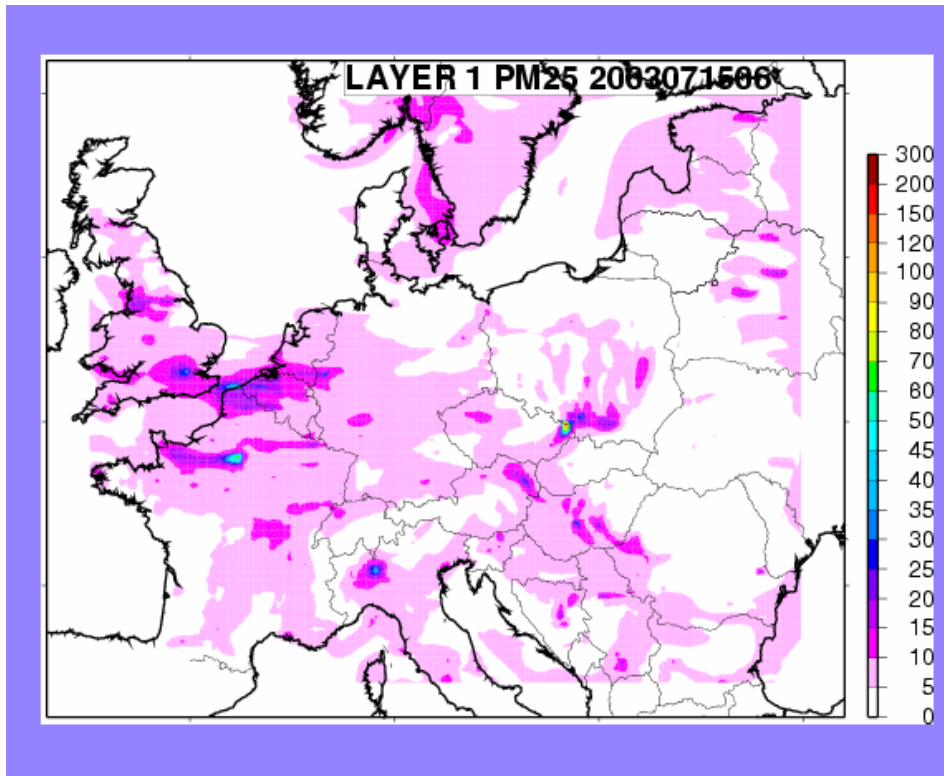


Spring-Summer

Fall-Winter



For EUMETSAT project



Simulation time
5 days: $\frac{1}{2}$ day for Europe; 3 days for GBP

Resolution:

Europe

With 10 vertical layers,
0.25x0.125 degrees (about
150x150)

Greater Paris: 3 km (about
150x150)



Runs

- Summer: 15 July → 15 August 2003
- Winter: 15 Feb → 15 March 2003

- Initialisation 10 days before for continental, 5 days for regional



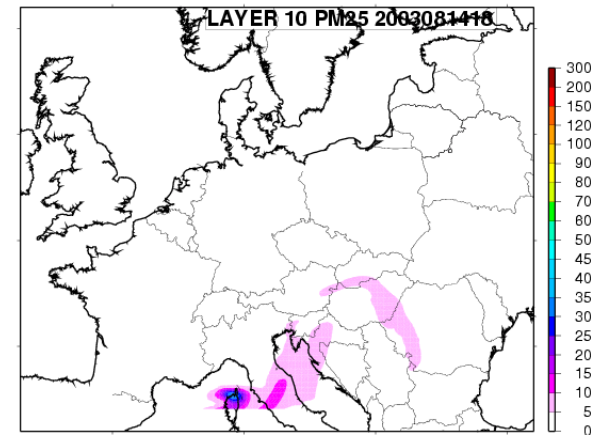
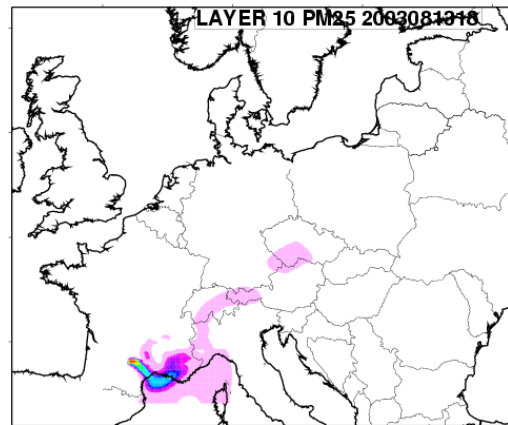
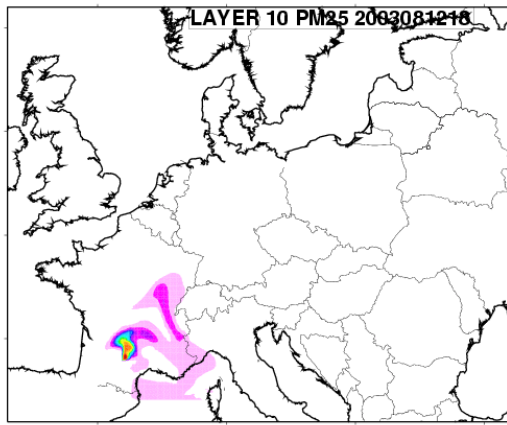
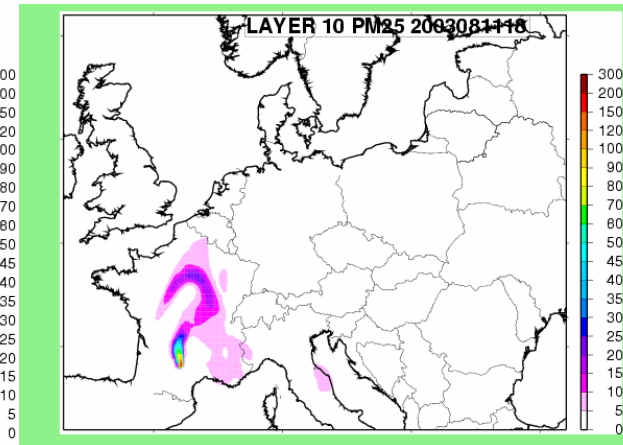
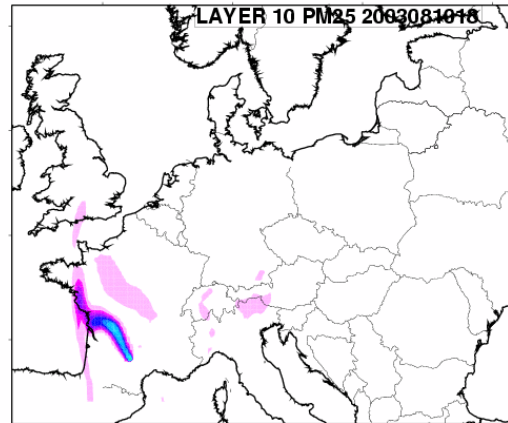
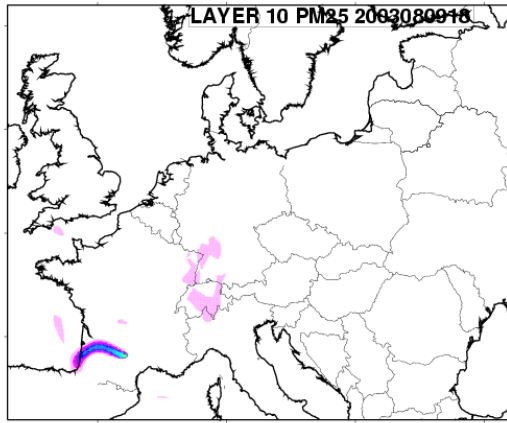
Emissions

- TNO (UBA exercise) for Europe
- AIRPARIF 2000 for Paris (1 km possible)
- Fire PM2.5 injection from 9 August to 14 August, continuous, 10th model layer (3500-5500m) in a grid cell in the South of France:

→ Find dates when the plume goes to Paris, not many trials possible because computer time...



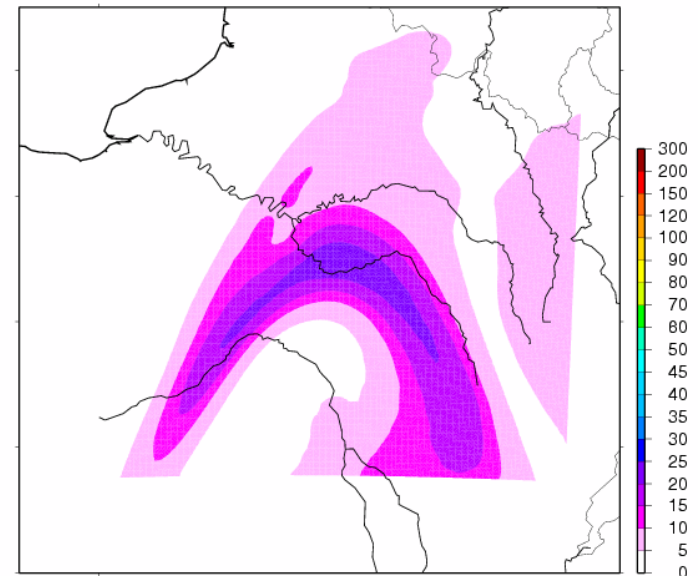
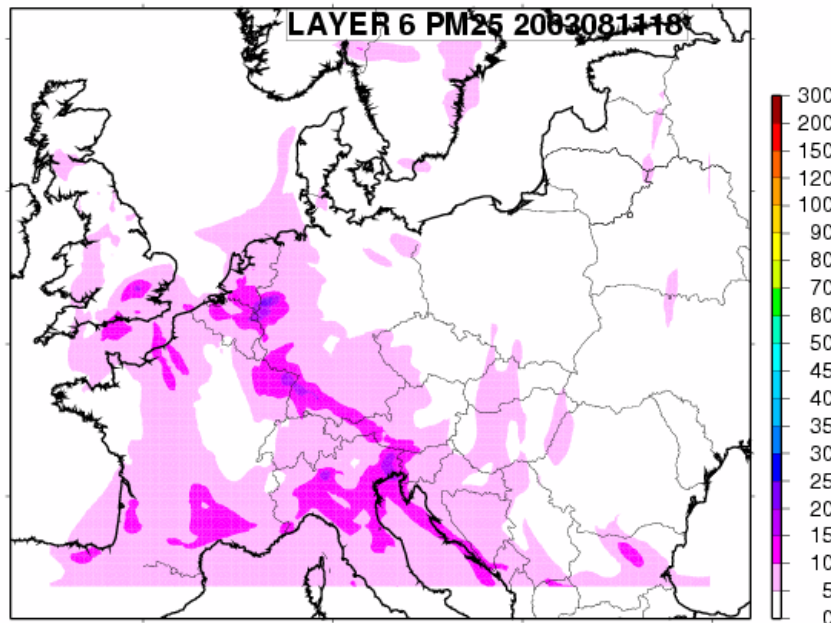
Fire plume





Fire Plume

- Not present in lower layers (only 3500-5000m)
- Present in fine-scale simulation





Other runs and processing

- Simulation without fire plume
- Winter simulation 15/02→16/03
- AOD calculation using previous formula
- Processing

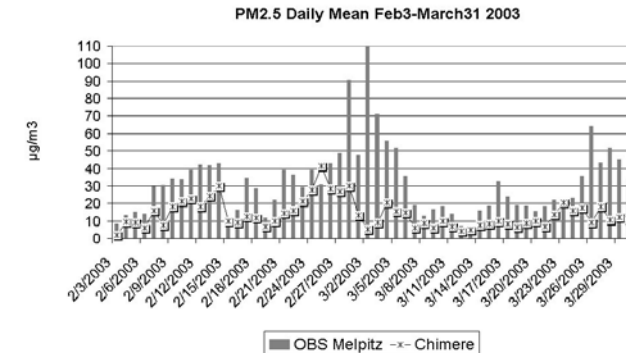
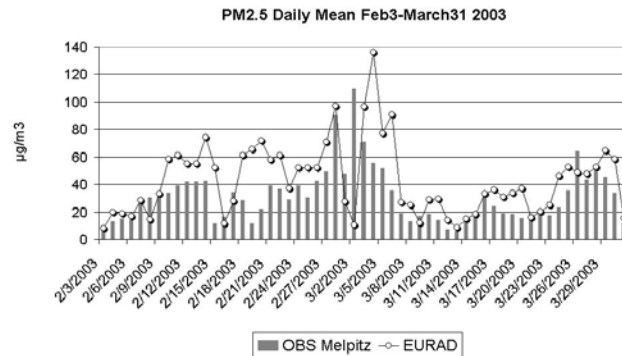
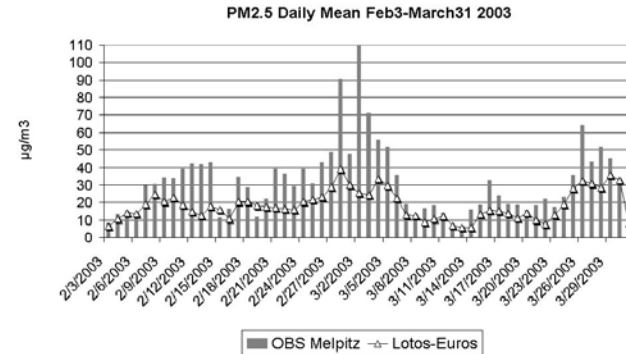
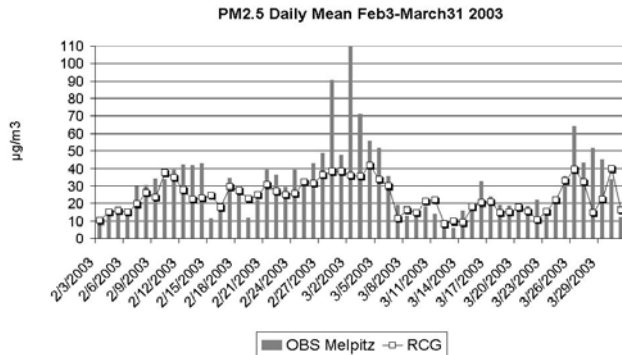


How can we validate the approach?

- Skill score comparisons LOTOSEUROS-CHIMERE and LOTOSEUROS-OBS with surface obs.
- Known limits: missing processes; improvement in 10 years expected, so intermodel skill > model-obs skill is fine



Limits of the approach: example of winter 2003; Stern et al., 2008, A.E.





Conclusion

- Observations have been simulated using the CHIMERE model, in a relatively high resolution configuration.
- Meteorology, chemistry and emissions (fire, high resolution) are different from the assimilation run. Meteorology a key factor?
- Concentrations were transformed into AOD, and provided to the project to produce pseudo-observations.