

Forest fires impact on air quality over Portugal using an ensemble of model results

**A.I. Miranda, A. Monteiro, V. Martins, C. Borrego,
M. Schaap, P. Builtjes**

CESAM, University of Aveiro, Portugal
TNO, Environmental Quality Dep. Apeldoorn, The Netherlands

Workshop GLOREAM/ACCENT 2007
November 27-30, Berlin, Germany

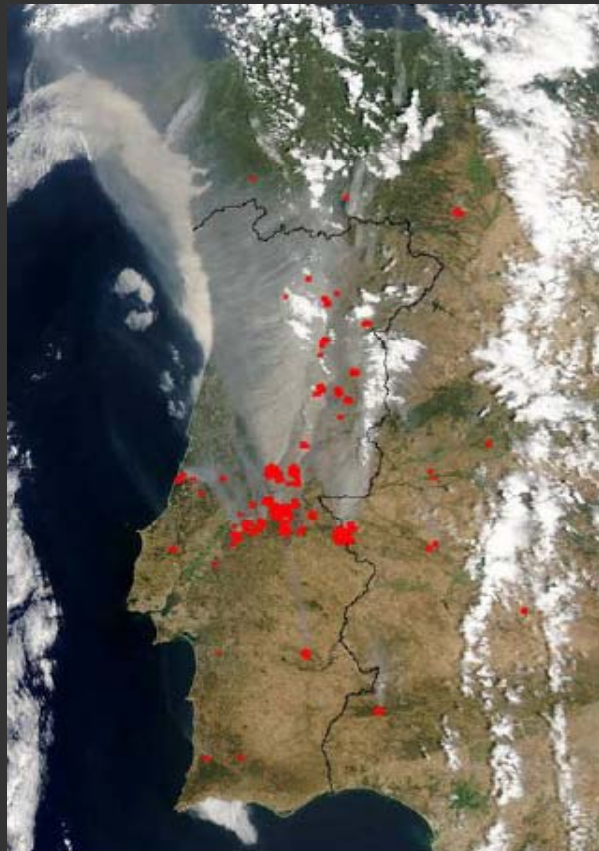
Scope

estimate the air pollution effects of 2003 forest fires
through the application of two air quality modelling systems
- CHIMERE and LOTOS-EUROS

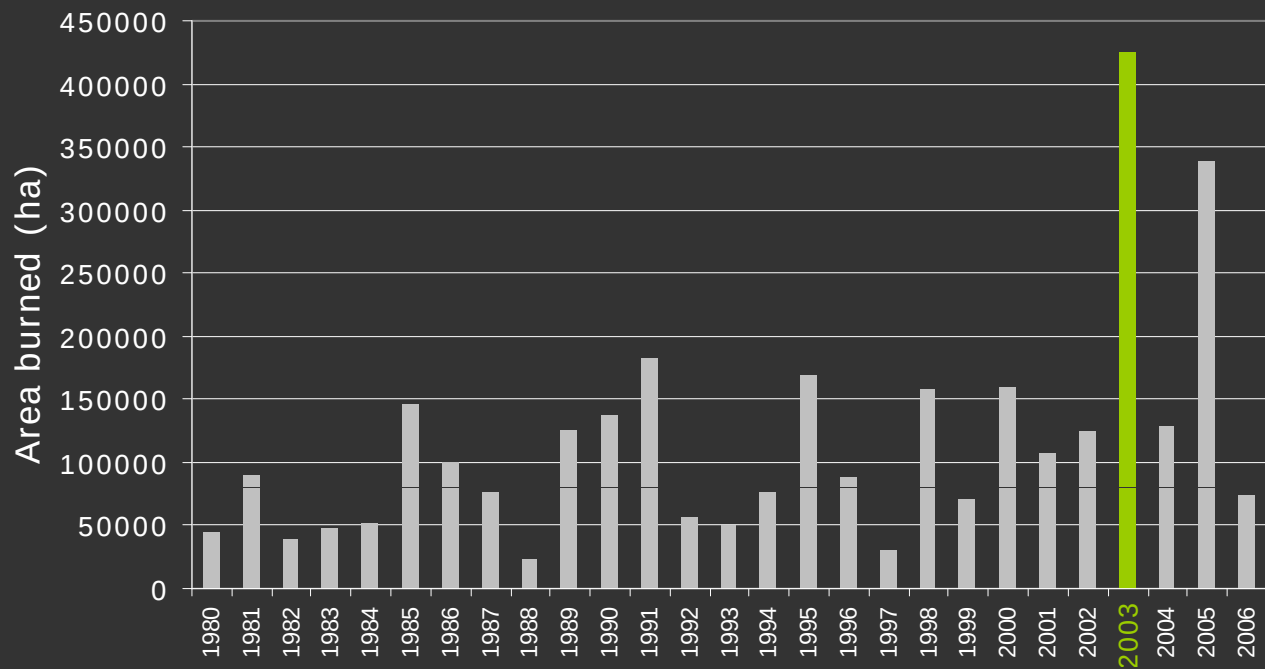


1. Air quality modelling
2. Ensemble results

forest fires: the year 2003



3 August 2003



86% of the area burned in August

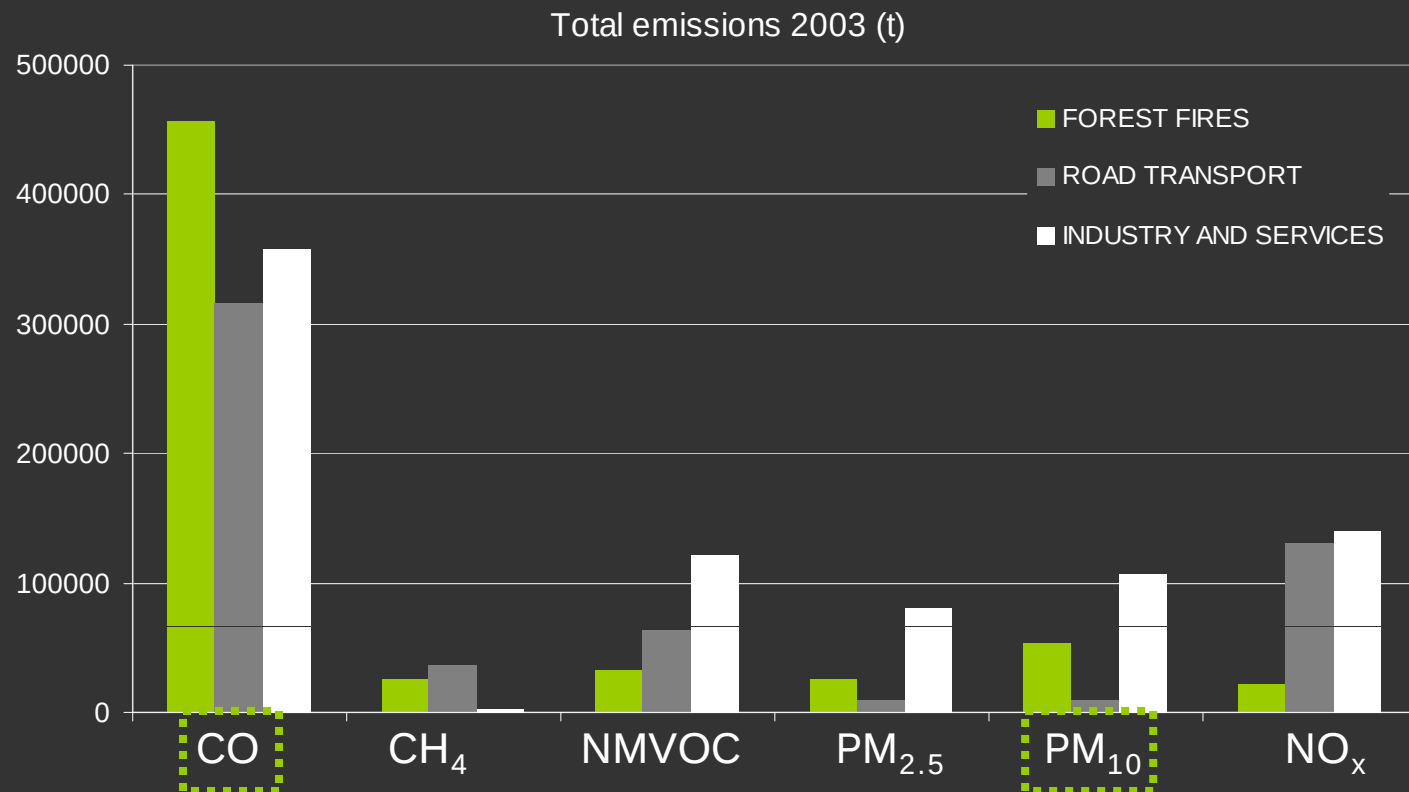
forest fire emissions: 2003

Method

$$E_i = EF_i \times \beta \times B \times A$$

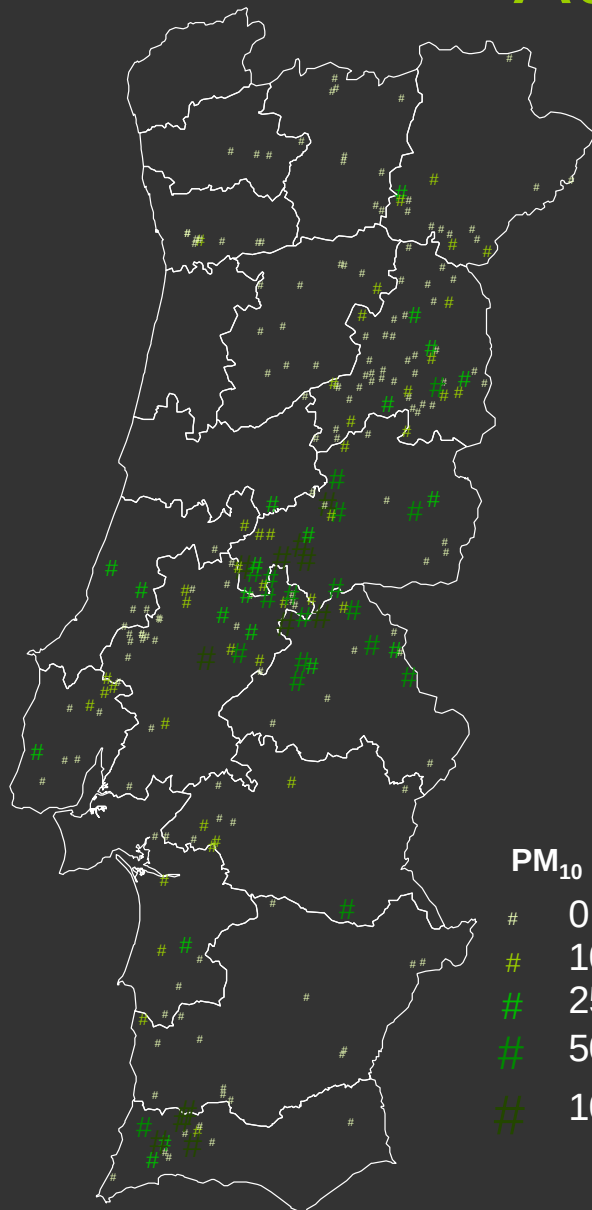
emission factor - EF
global burning efficiency - β
fuel load - B
area burned - A

Results



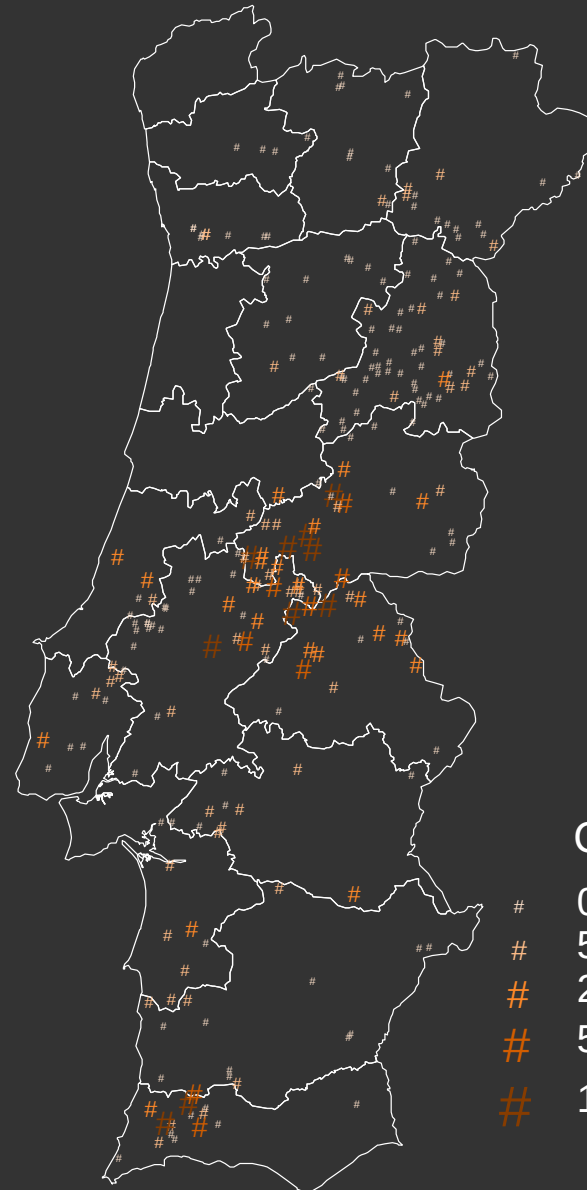
forest fire emissions

August 2003



PM₁₀ (t)

- # 0 - 100
- # 100 - 250
- # 250 - 500
- # 500 - 1000
- # 1000 - 3000



CO (t)

- # 0 - 500
- # 500 - 2500
- # 2500 - 5000
- # 5000 - 10000
- # 10000 - 20000

air quality modelling: August 2003

CHIMERE

Boundary conditions

MOZART and GOCART climatological models

Emissions

EMEP and Portuguese inventory

Vertical structure

8 layers (up to 3000 m)

Chemical mechanism

MELCHIOR

Horizontal grid resolution

10 x 10 km²

LOTOS-EUROS

Boundary conditions

Logan climatological datasets

Emissions

TNO inventory

Vertical structure

3 layers (up to 3500 m)

Chemical mechanism

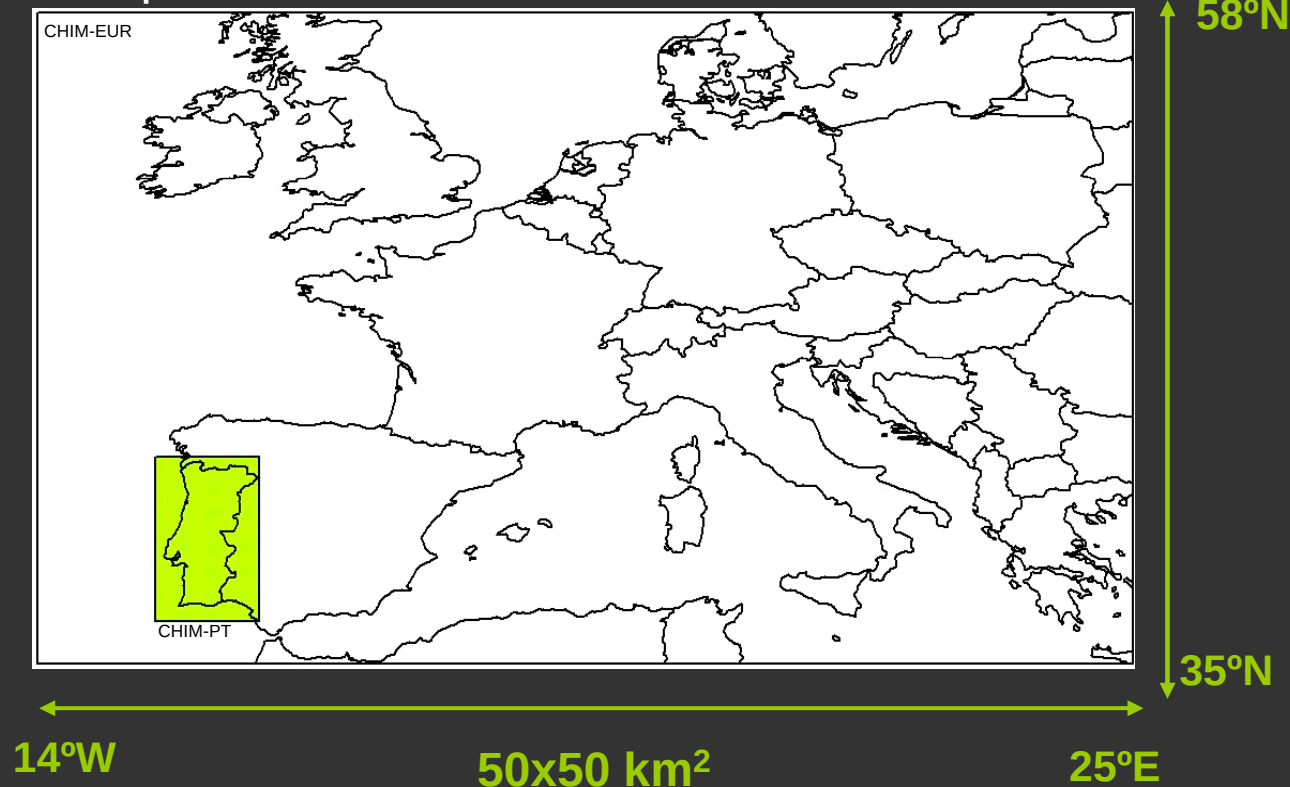
CBM-IV

Horizontal grid resolution

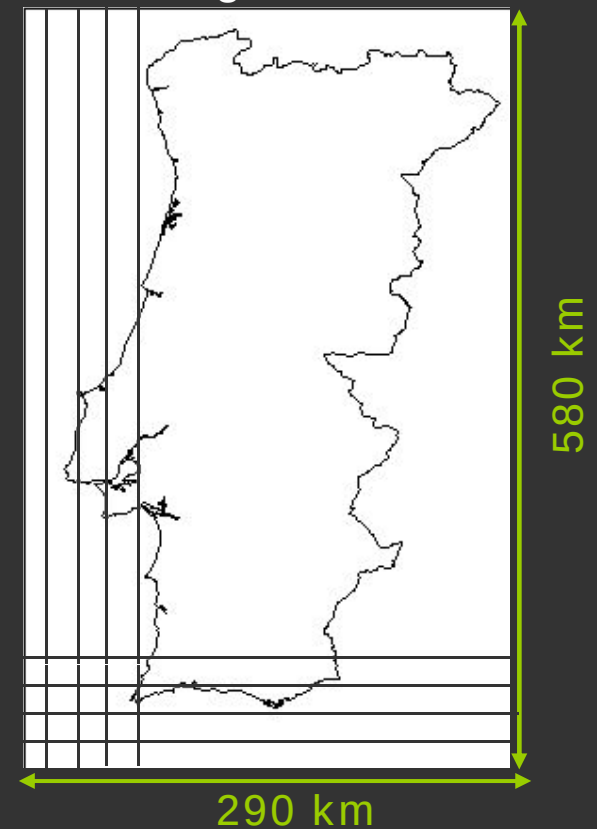
17.5 x 12.5 km²

air quality modeling: domains

European domain

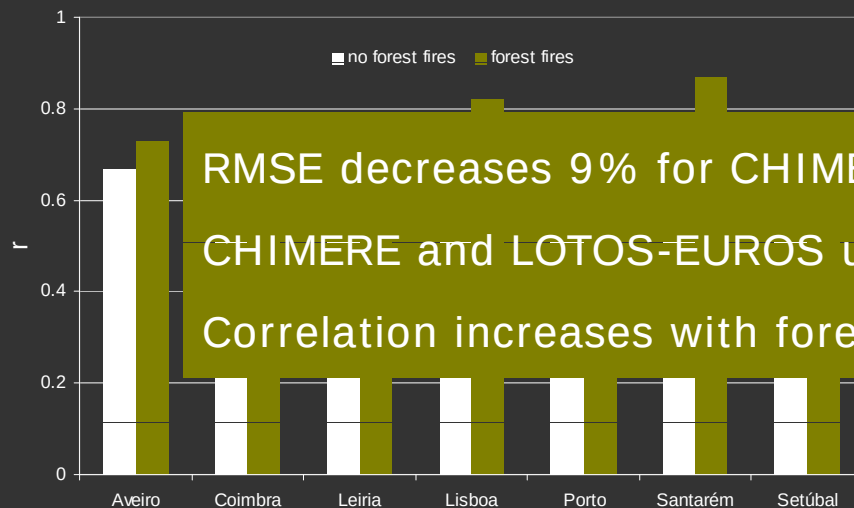
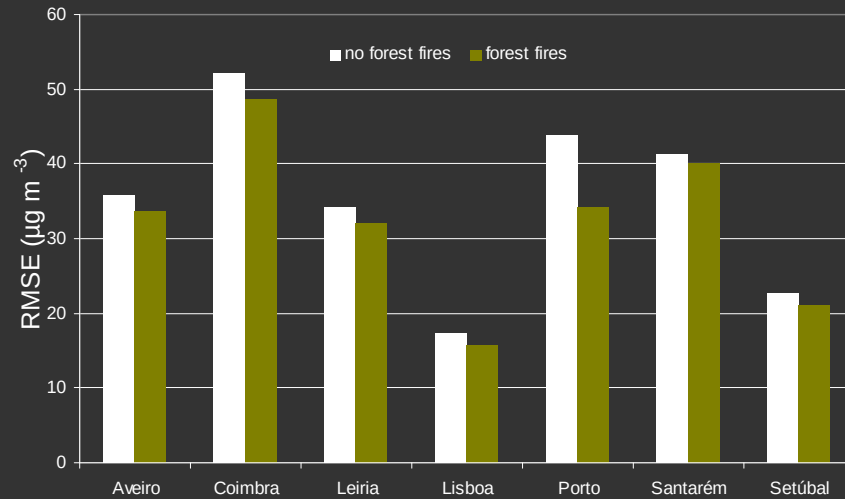


Portugal domain

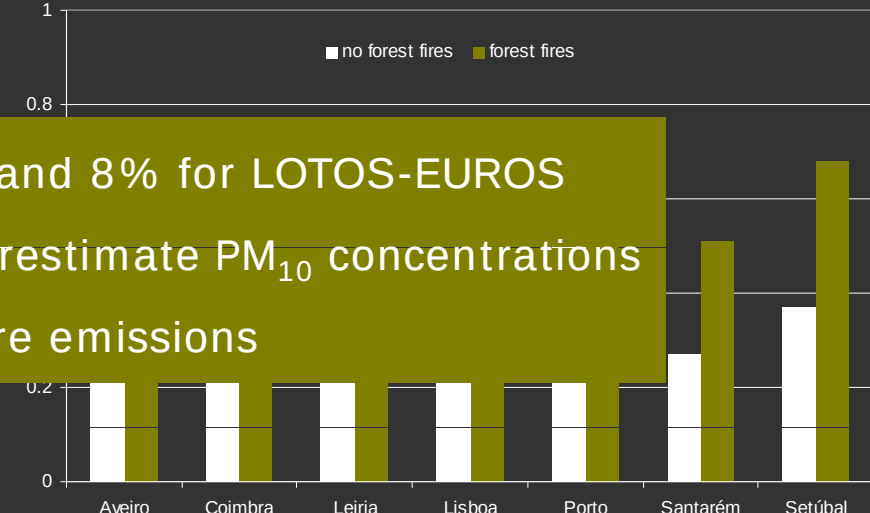
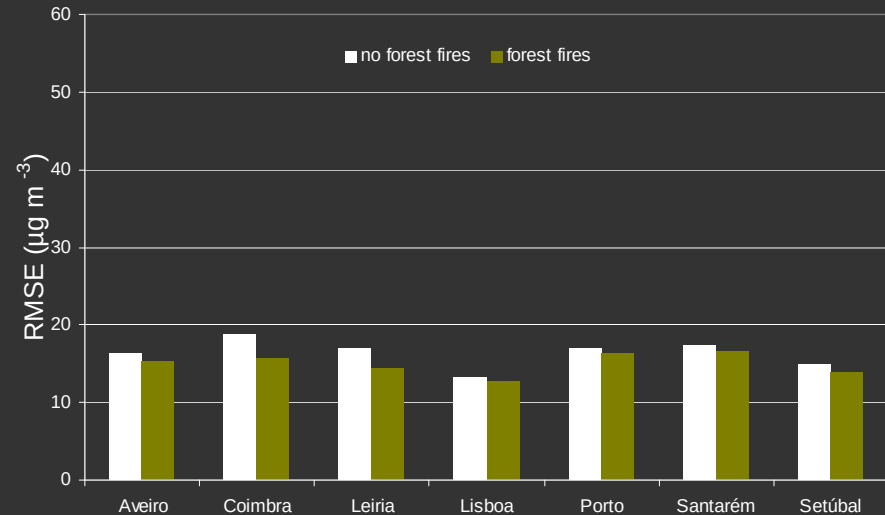


air quality modeling: PM_{10}

CHIMERE



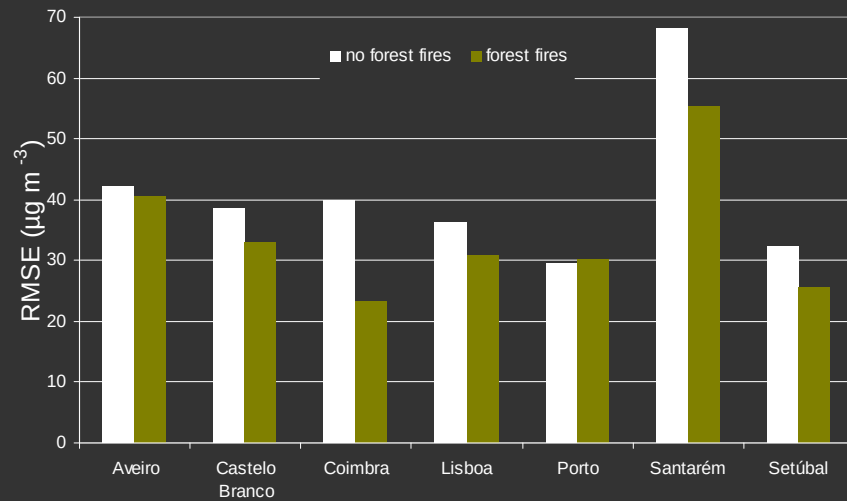
LOTOS-EUROS



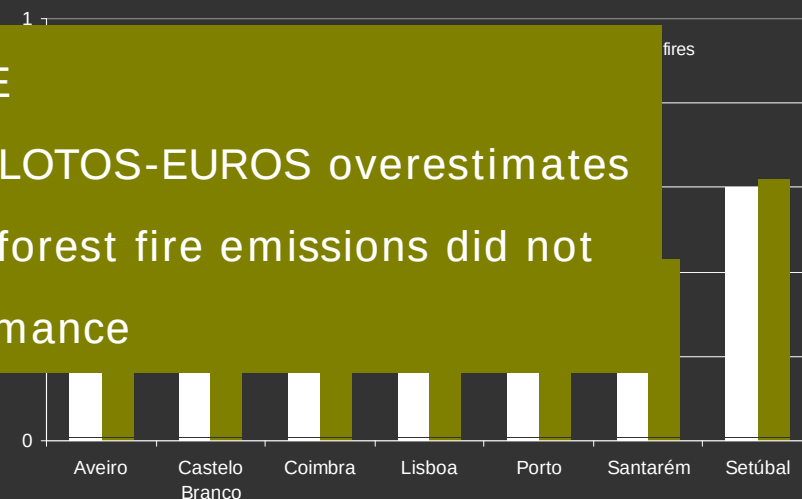
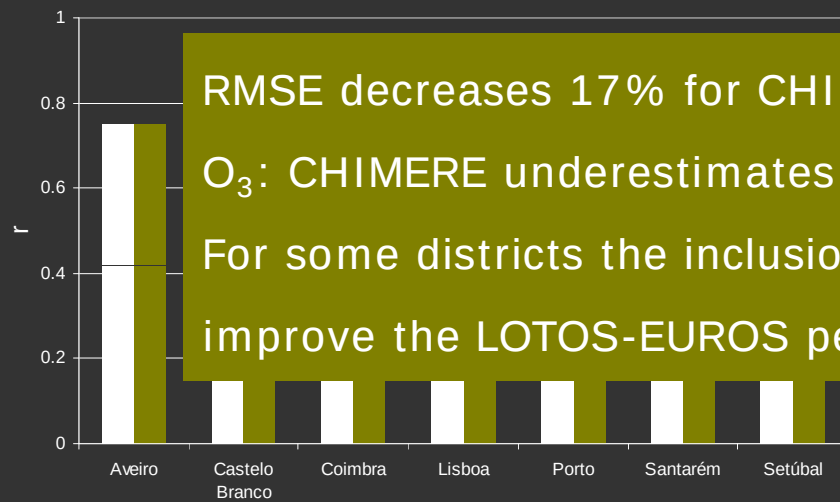
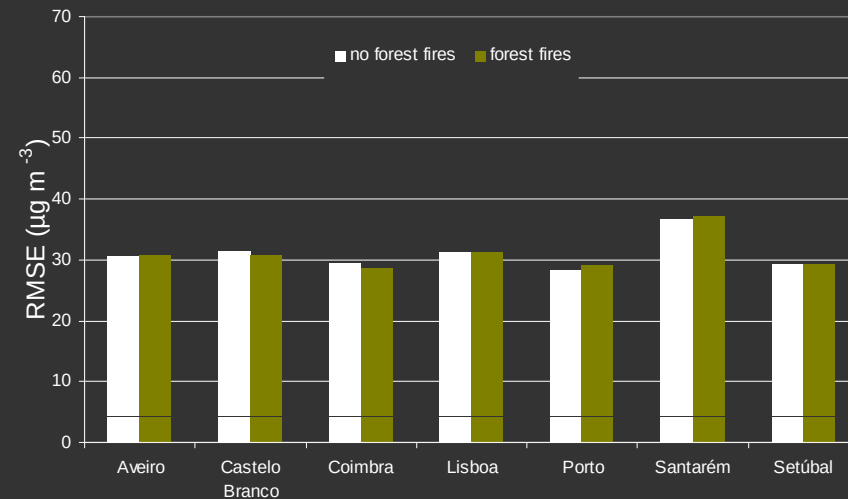
RMSE decreases 9% for CHIMERE and 8% for LOTOS-EUROS
CHIMERE and LOTOS-EUROS underestimate PM_{10} concentrations
Correlation increases with forest fire emissions

air quality modeling: O_3

CHIMERE



LOTOS-EUROS



RMSE decreases 17% for CHIMERE

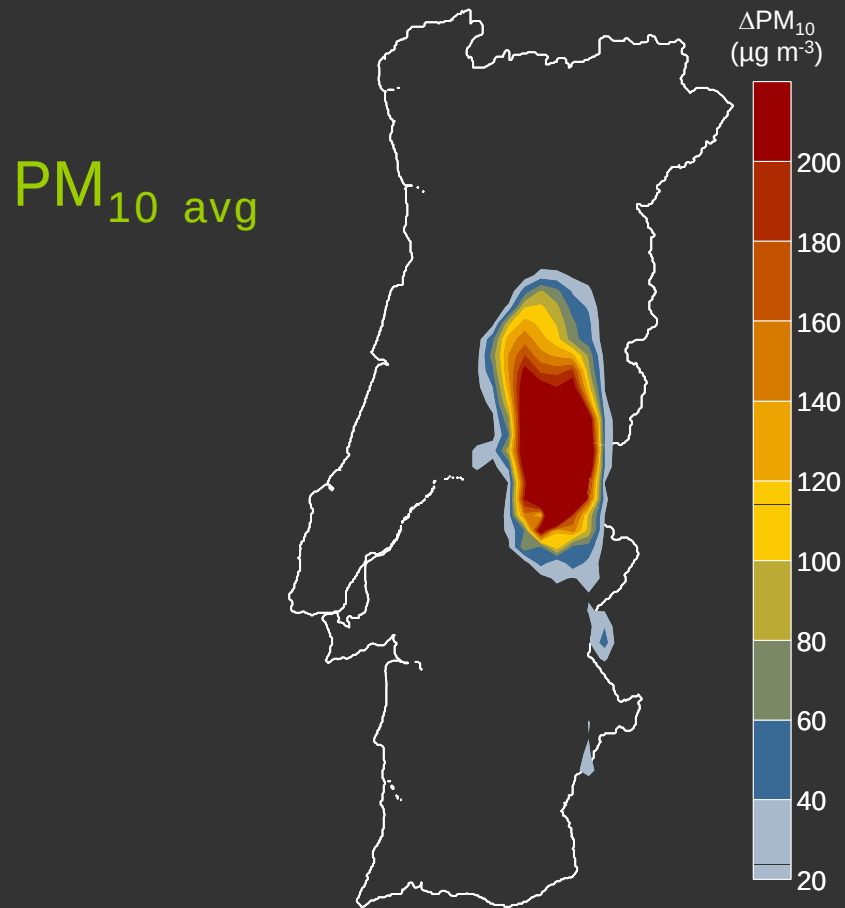
O_3 : CHIMERE underestimates and LOTOS-EUROS overestimates

For some districts the inclusion of forest fire emissions did not improve the LOTOS-EUROS performance

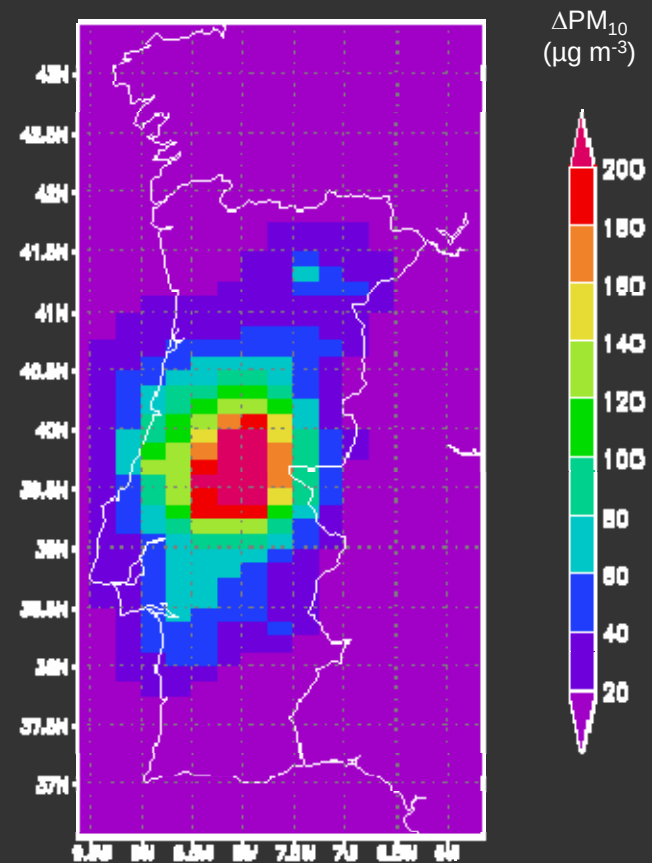
air quality modeling

with - without forest fires...

CHIMERE



LOTOS-EUROS



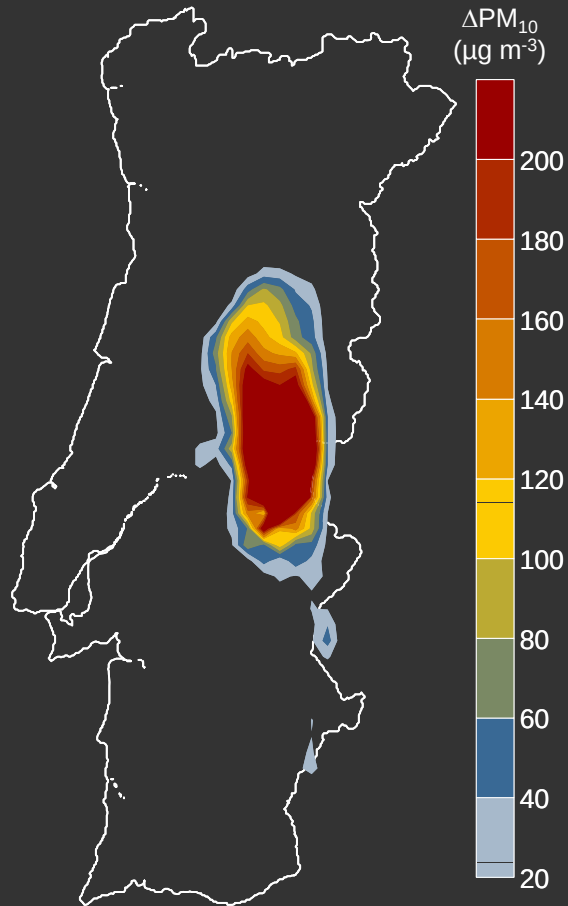
August, 3rd

air quality modeling

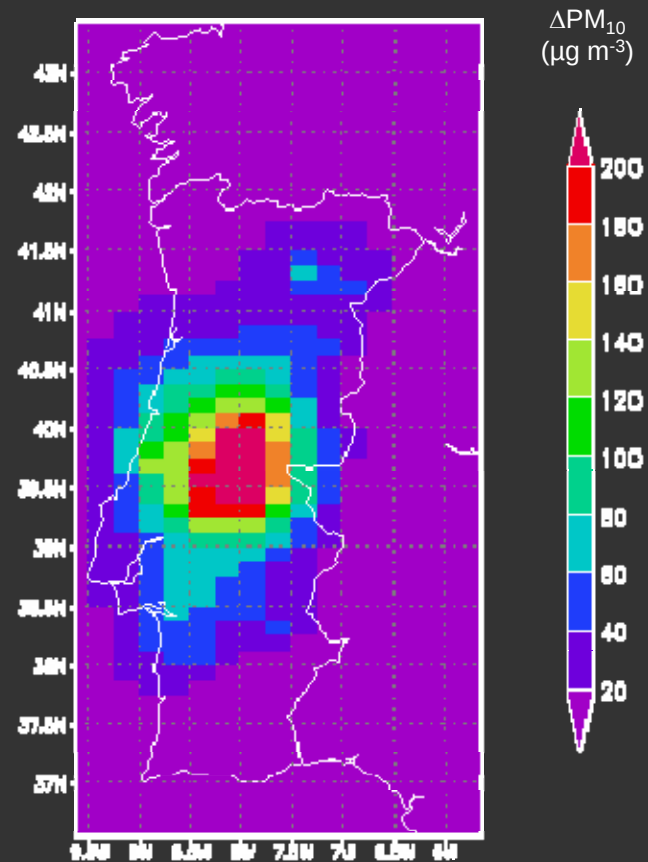
with - without forest fires...

CHIMERE

PM_{10} avg



LOTOS-EUROS



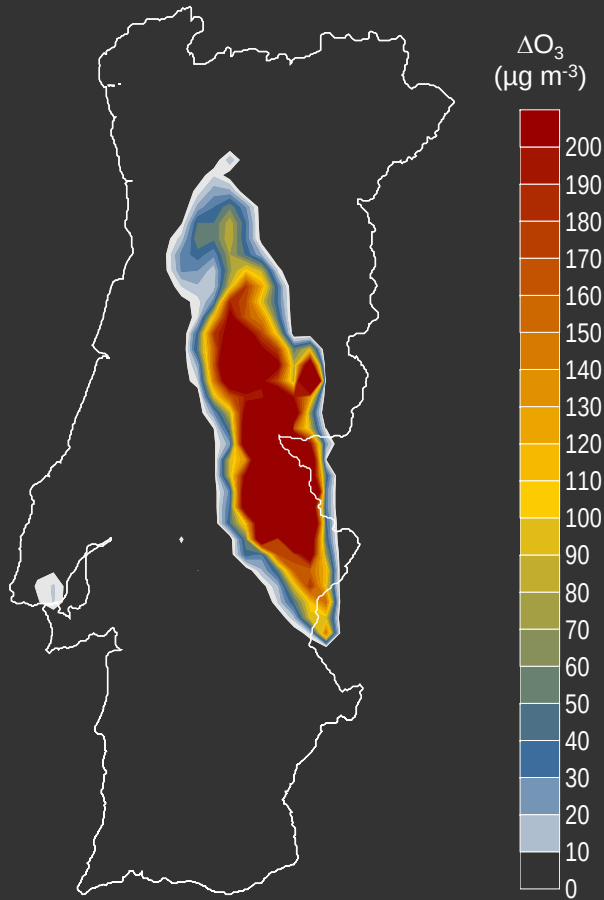
August, 3rd

air quality modeling

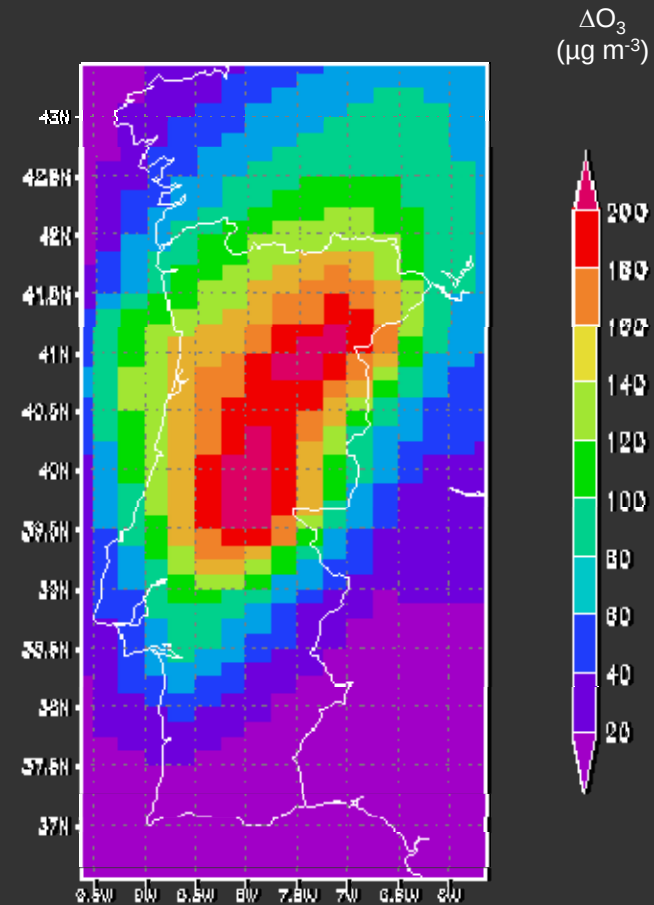
with - without forest fires...

O_3 max

CHIMERE



LOTOS-EUROS



August, 3rd

air quality modelling: August 2003

CHIMERE

Run 1

Forest fire emissions distributed in the first 3 Layers + MELCHIOR2 chemical mechanism

Run 2

3 Layers + MELCHIOR1

Run 3

8 Layers (3 000 meters) + MELCHIOR2

Run 4

8 Layers (3 000 meters) + MELCHIOR1

LOTOS-EUROS

Run 1

Resolution (17.5 x 12.5 km²) + no SOA chemistry included

Run 2

Resolution (17.5 x 12.5 km²) + SOA

Run 3

Resolution (8.75 x 6.25 km²) + no SOA

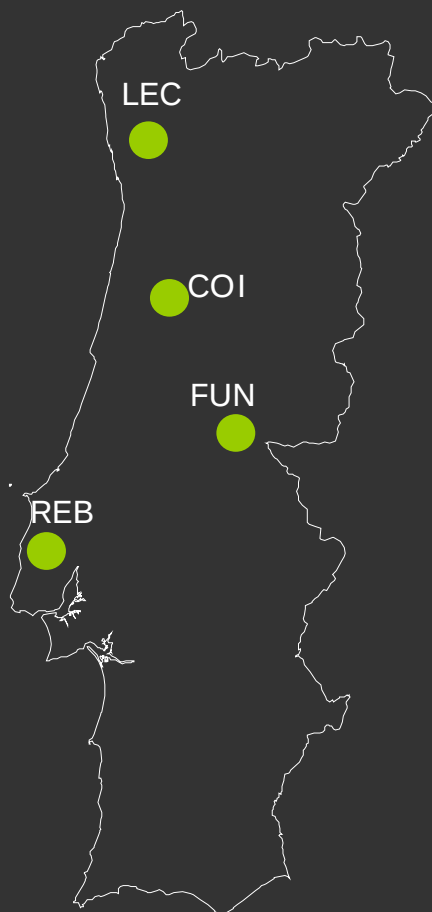
Run 4

Resolution (8.75 x 6.25 km²) + SOA

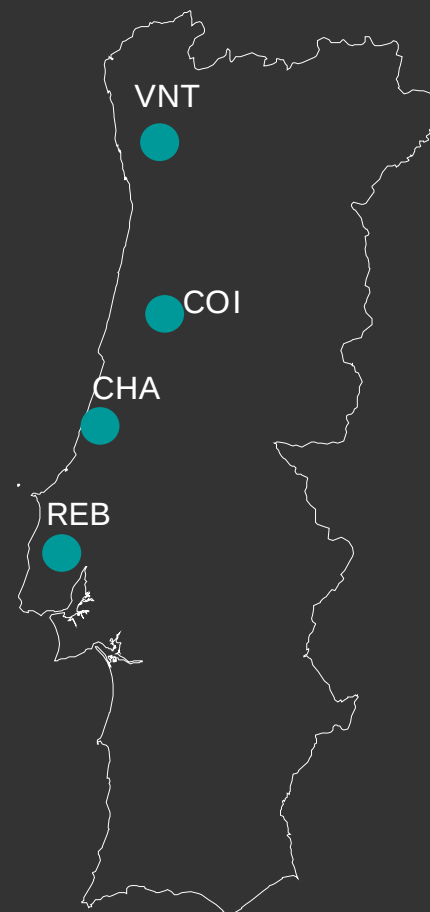
Model validation

Background air quality stations

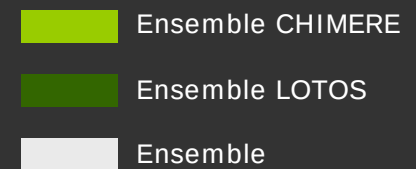
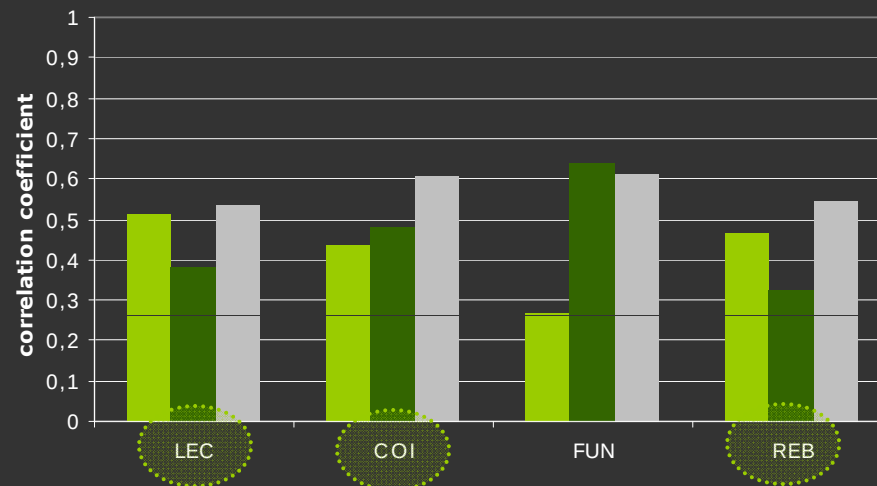
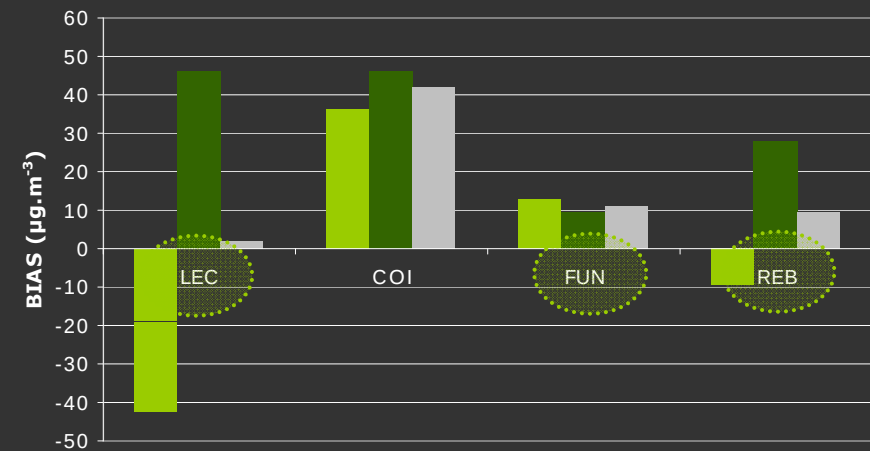
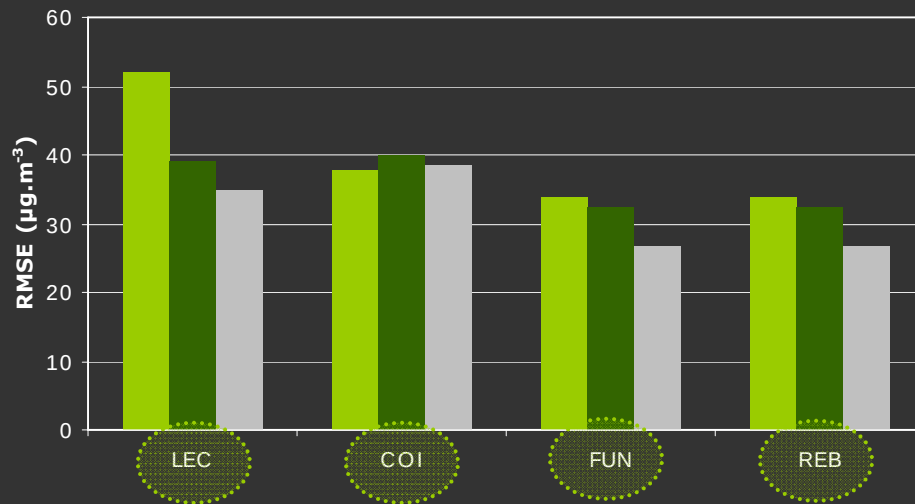
PM_{10}



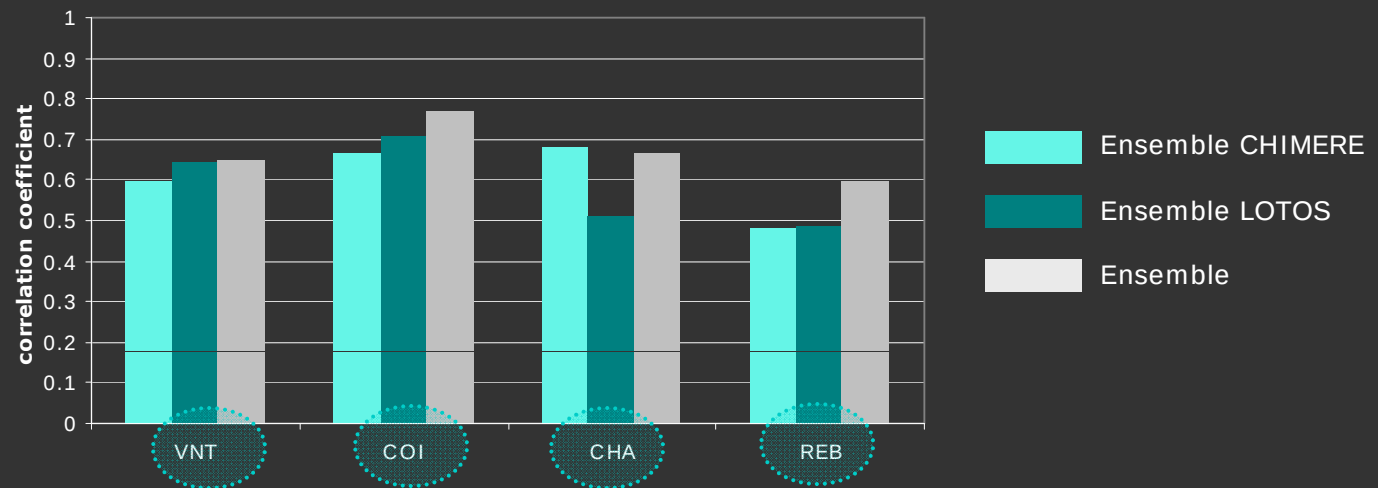
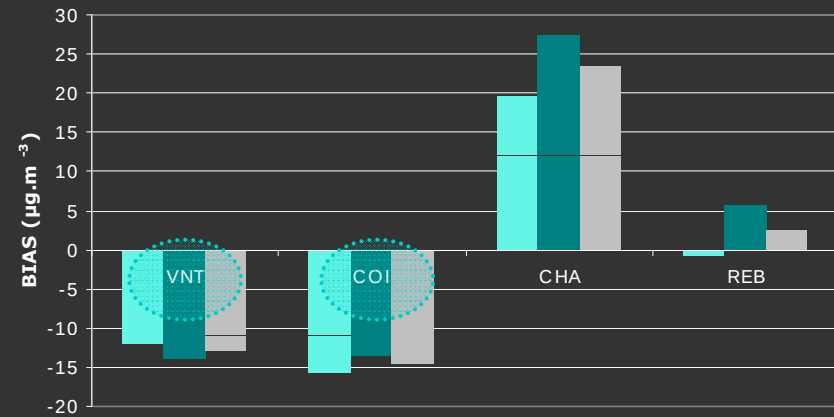
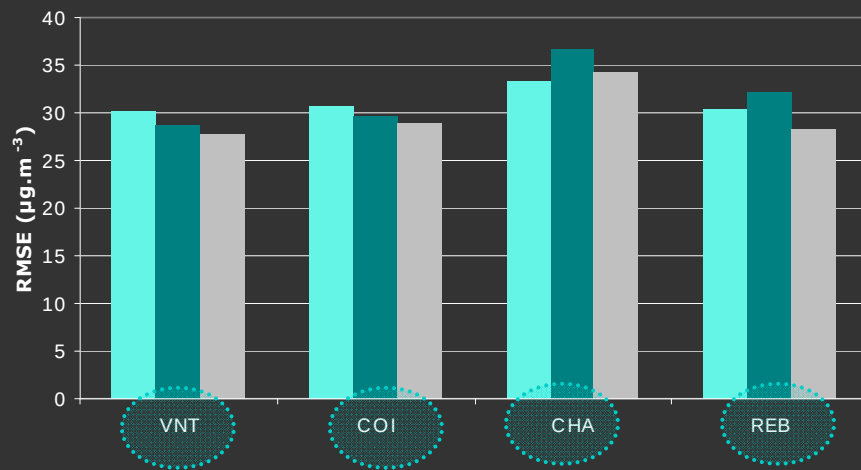
O_3



air quality modeling: PM_{10}



air quality modeling: O_3



Some comments

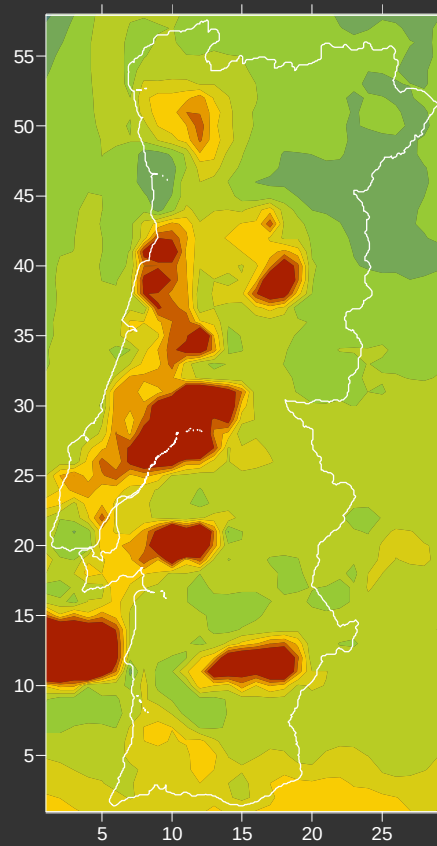
Forest fire emissions can represent an important source of air pollutants to the atmosphere

Models performance increase when forest fire emissions are considered.

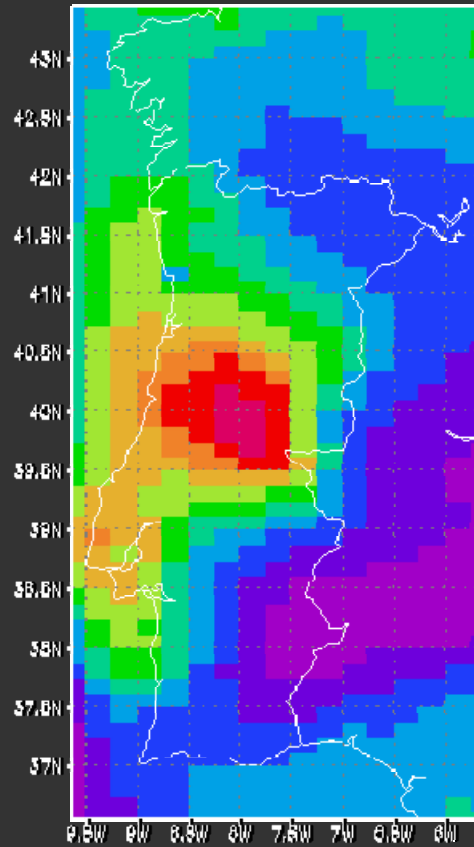
There is no clear trend for best model performance between CHIMERE and LOTOS.

Model results increase when ensemble techniques are applied.

ensemble



+



=

?

Questions

Ensemble modelling or selecting the best model?

Many could be better than one. Instead of losing potential sources of information, models could be combined to yield better performance.

How to select models/runs for final ensemble?

Cross validation can be used for model training/selection and the estimation of the expected classification error. The models are initialized with different model parameters and cross validation helps us to find proper values for these parameters and to select the best performing models for the final ensemble.

How to choose model/run weights?

How to perform spatial model ensemble?

Obrigada!!!