



# IDENTIFICATION AND ANALYSIS OF PARTICULATE MATTER SOURCE CONTRIBUTIONS TO THE AIR QUALITY IN MAINLAND PORTUGAL

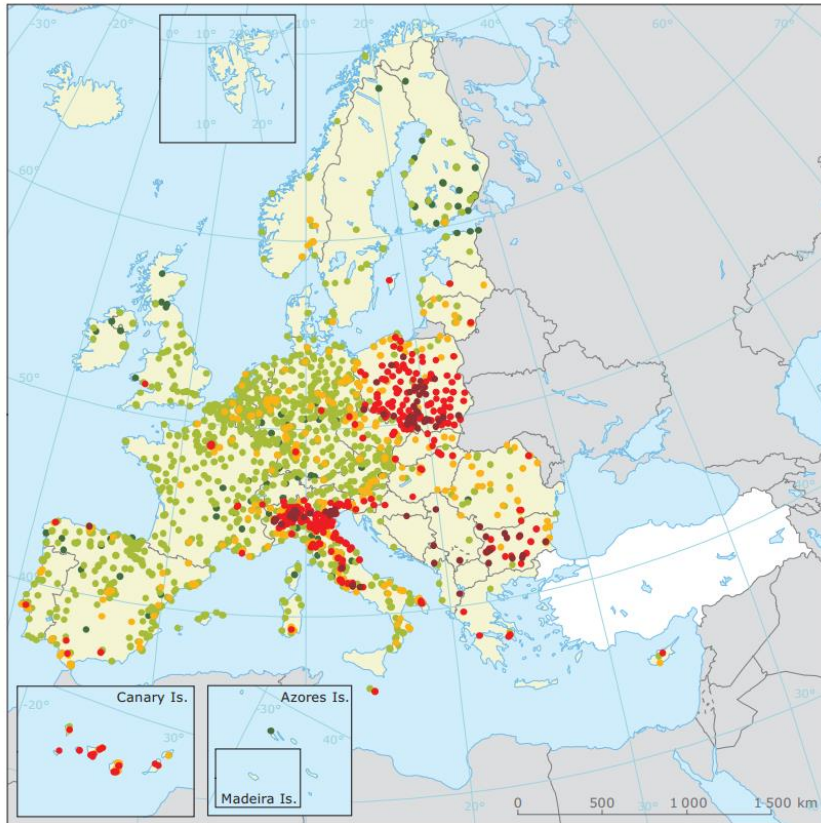
**Sílvia Coelho**

Joana Ferreira | Carlos Borrego | Myriam Lopes

University of Aveiro, Portugal

\* [silviacatarina@ua.pt](mailto:silviacatarina@ua.pt)

# AIR QUALITY



- PM10 concentrations above legislated limit values

EEA Report | No 13/2017

Air quality in Europe — 2017 report



# HEALTH PROBLEMS

- Heart attacks
- Strokes
- Heart disease
- Angina
- Lung cancer
- Lung conditions



# HOW TO SOLVE THE PROBLEM?

Atmospheric emissions need to be drastically reduced

Air quality should be improved

Citizens' exposure should be reduced

How can it be achieved ...

through technology? Yes

and citizens' behaviour?

# CLAIRCITY

Integrate and quantify citizens' behaviour and activities to enrich city, national and EU level policy-making



Improve air quality, reduce carbon emissions, improve public health outcomes and greater citizen awareness



- Putting citizens behaviour and practices at the heart of the debate
- Integrating citizens behaviours in city policies now and in the future
- Raising awareness of environmental changes and their solutions

Our PARTNER CITIES:



# SCOPE

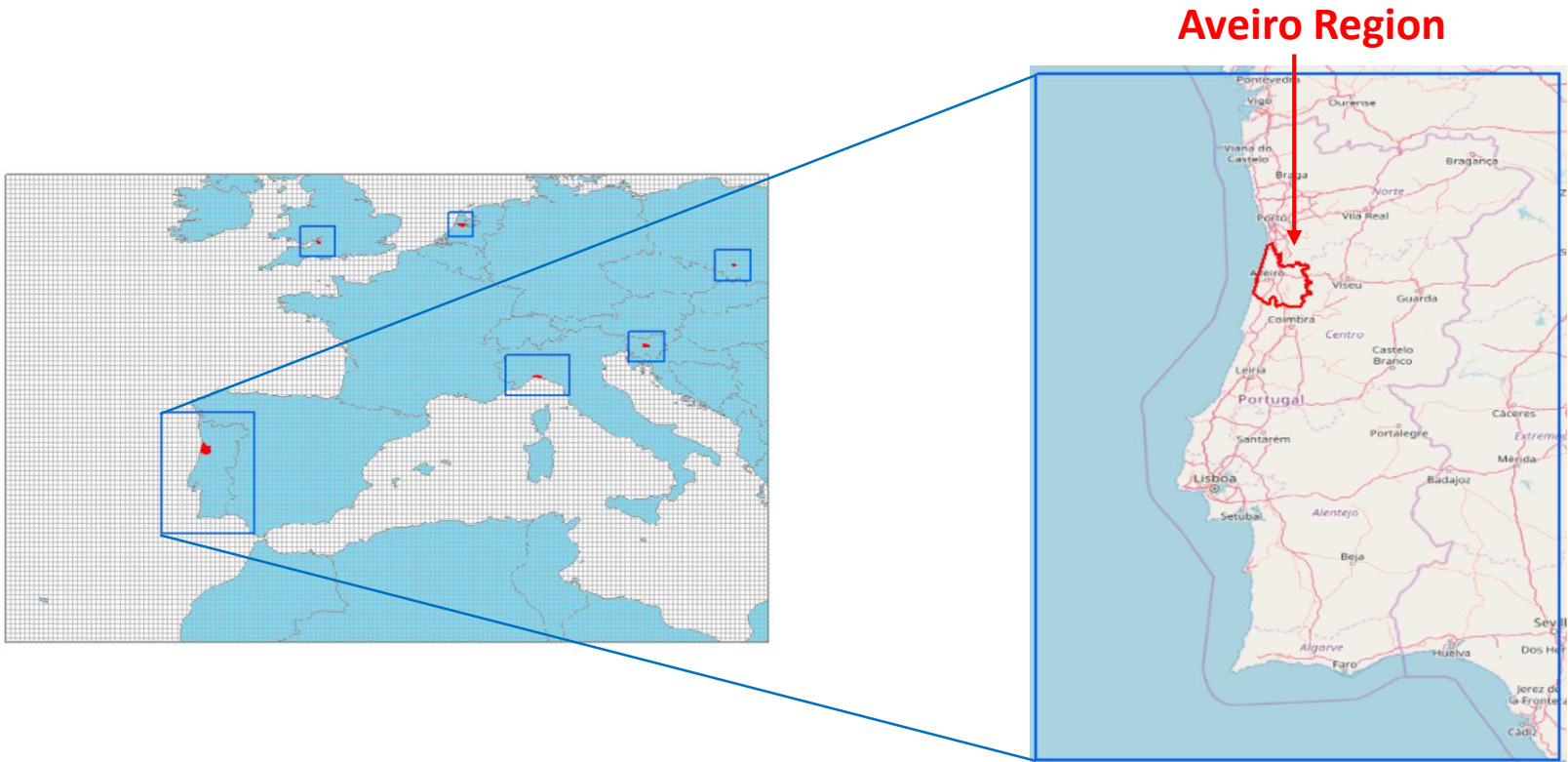
This study focuses on the **quantification of the source contributions to the PM10 levels**, based on the application of the **WRF-CAMx air quality source apportionment modelling system**, over mainland Portugal for the year of 2010.

# MODELLING APPLICATION

## Two-nesting approach:

European domain  
(0.25 degrees horizontal resolution)

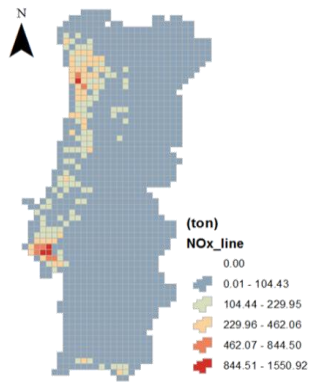
Regional domain  
(0.05 degrees horizontal resolution)



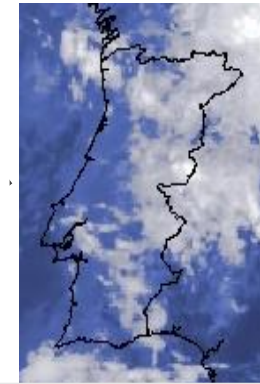
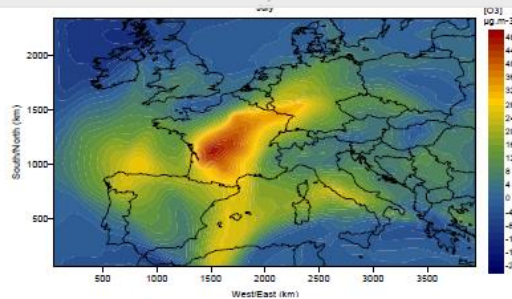
# MODELLING APPLICATION

## Inputs:

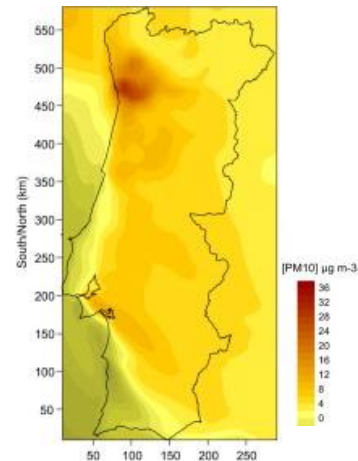
Initial & boundary conditions  
(MOZART global model)



Emissions  
(TNO-MACC\_II)



Meteorology  
(WRF model)



**CAMx** air quality model  
with PSAT (Particulate Source Apportionment Tool)

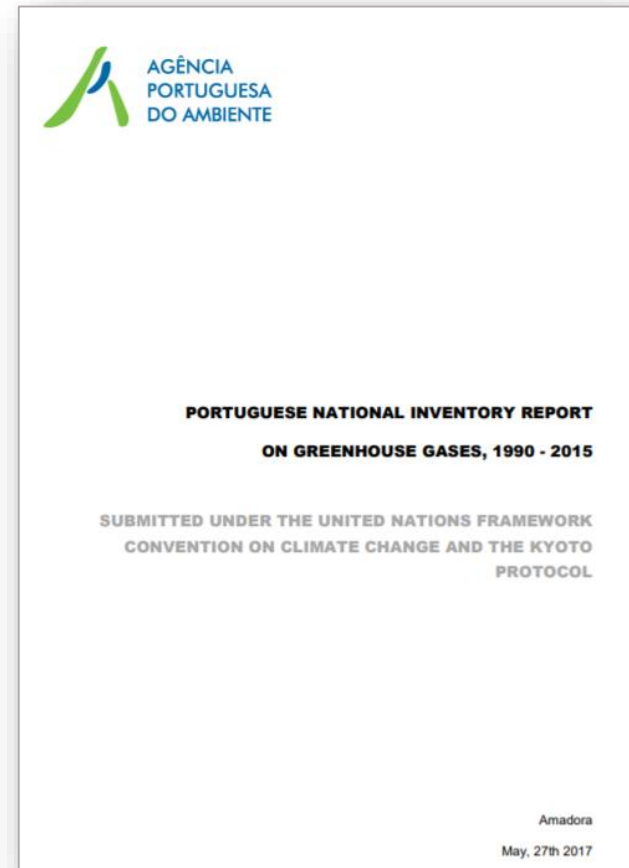


# MODELLING APPLICATION

The PSAT application requires the definition of source groups to be tracked.

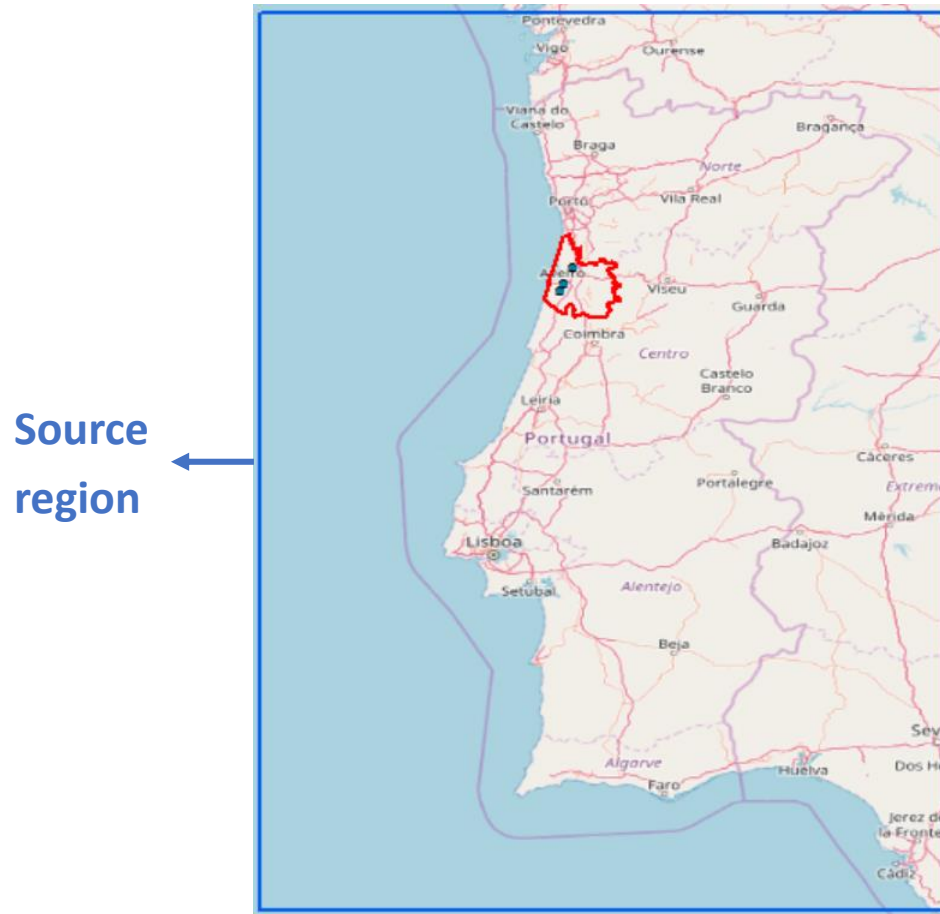
Based on Portuguese National Emission Inventory Report:

- residential & commercial combustion;
- road transport;
- industrial processes & combustion.



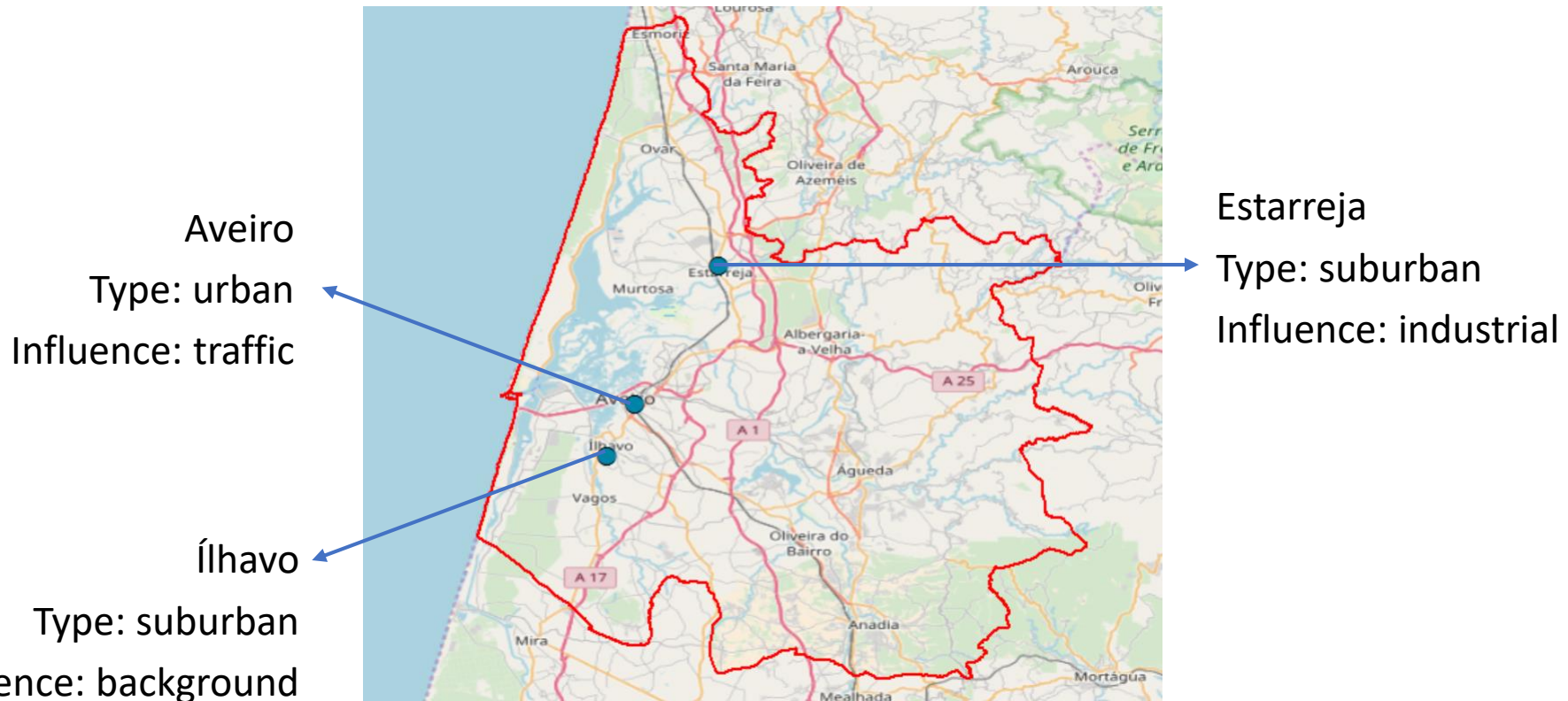
# MODELLING APPLICATION

The PSAT application requires also the definition of source regions.



# MODELLING APPLICATION

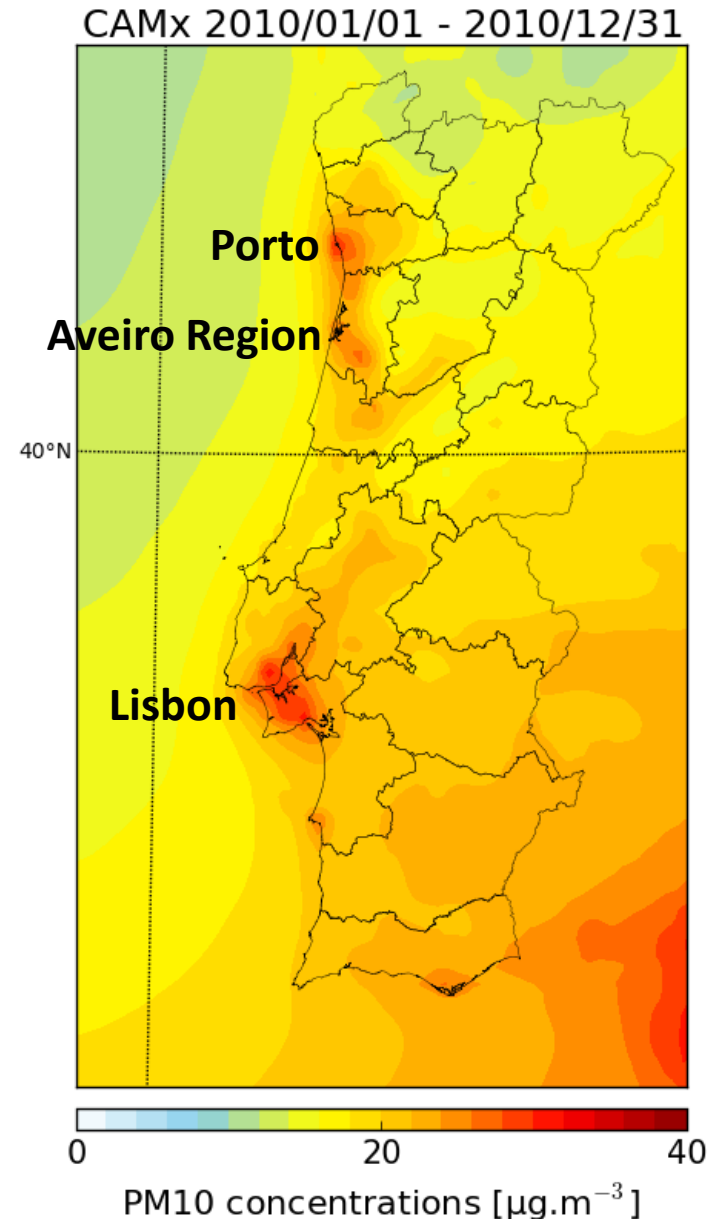
The PSAT application requires the definition of receptors.



# RESULTS: CONCENTRATION FIELDS

## Annual average:

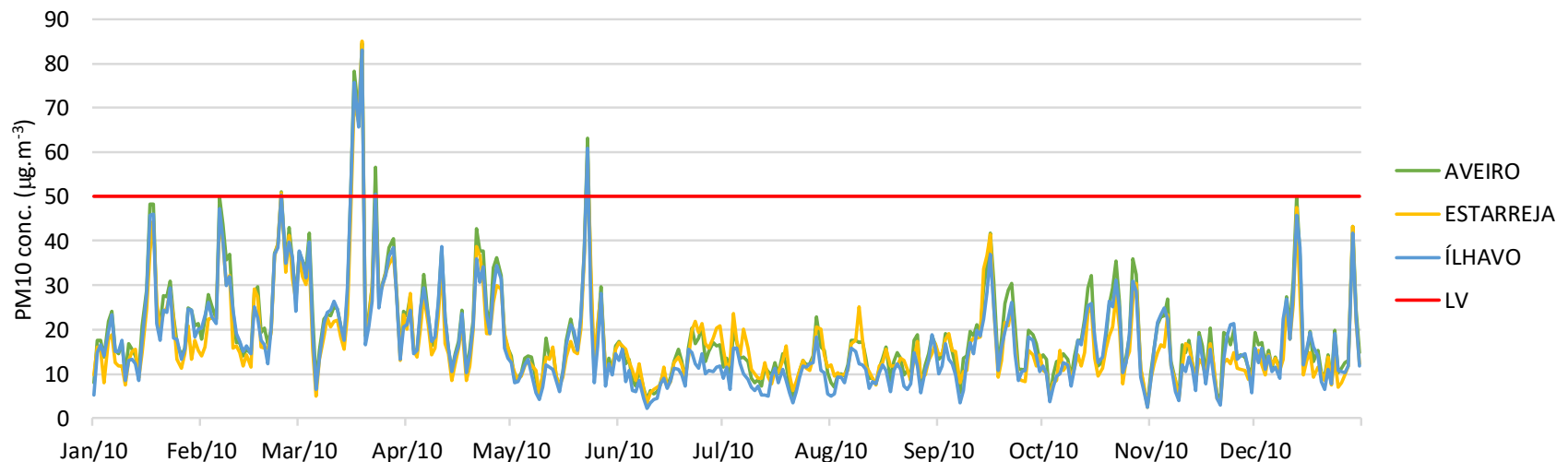
- PM10 annual average concentration below the limit value for the protection of human health ( $40 \mu\text{g}\cdot\text{m}^{-3}$ )
- Highest values recorded in Lisbon, Porto and Aveiro Region
- Concentration values increase from northwest to southeast, showing the influence of Sahara dust



# RESULTS: TIME SERIES

## Time series of daily average concentrations of PM10:

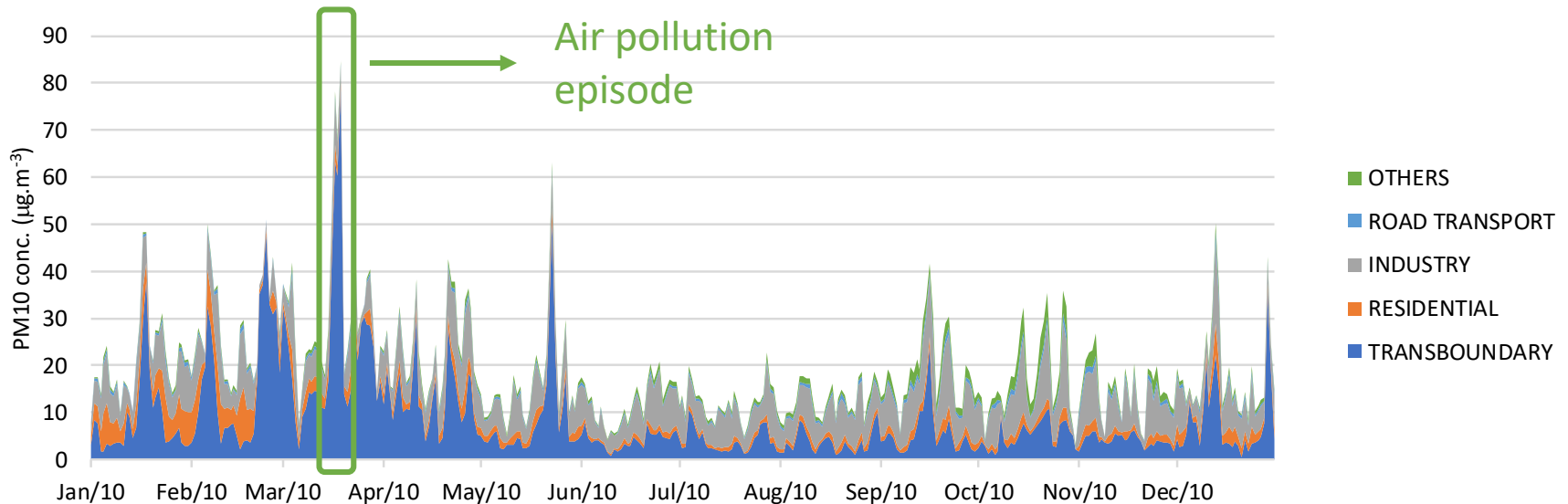
- The three receptors have similar values and behaviours
- PM10 concentrations are higher during the colder months due to residential combustion
- During the year, the daily limit value ( $50 \mu\text{g}\cdot\text{m}^{-3}$ ) was exceeded 8 times in Aveiro, 5 times in Estarreja and 7 times in Ílhavo.



# RESULTS: SOURCE CONTRIBUTION ANALYSIS

## Aveiro air quality station receptor:

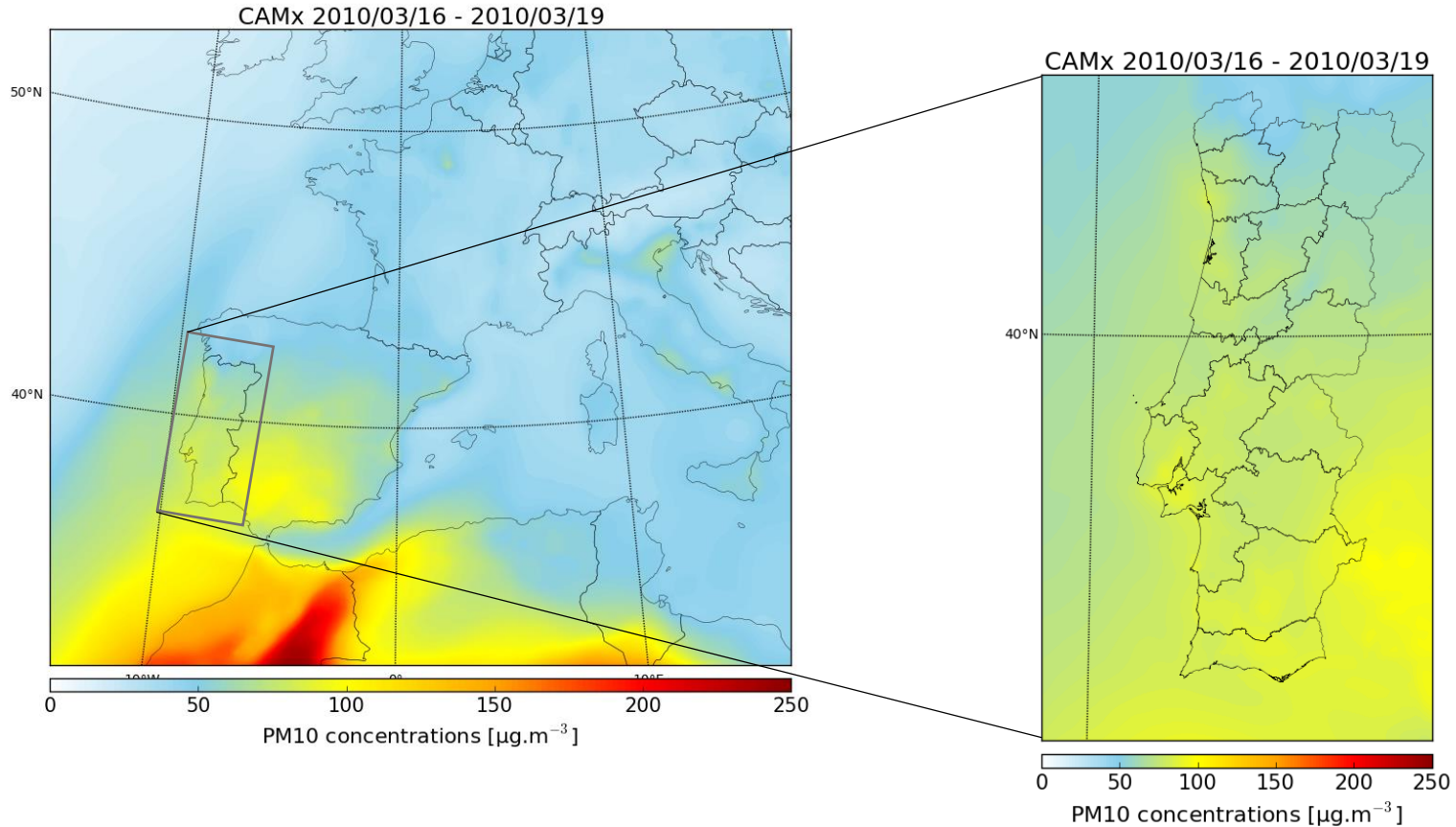
- The major contribution is from transboundary transport.
- The industrial processes and combustion has great influence on PM10 levels.
- During the winter, residential combustion has a relevant role.



Estarreja and Ílhavo air quality station receptors showed similar behaviours.

# RESULTS: EPISODE ANALYSIS

**PM10 average concentration between 16<sup>th</sup> and 19<sup>th</sup> of March:**



PM concentrations in Portugal are influenced by dust from the Sahara desert transported by southeast air masses.

# CONCLUSIONS

- Air quality modelling and source apportionment tools were used to assess the contribution of different types of emissions sources to the PM10 in mainland Portugal.
- Among the anthropogenic source groups, the industrial processes and combustion has the greatest influence on PM10 levels, followed by residential and commercial combustion.
- PM10 concentrations in Portugal are often considerably influenced by dust from the Sahara desert transported by southeast air masses.



# CONCLUSIONS

- These results are an important information to understand the contribution of individual sources to regional air pollution.
- Future developments under ClairCity project include a new perspective that intends to evaluate the impact of citizen's behaviour on air pollution.



# Thank you!

**Sílvia Coelho**

[silviacatarina@ua.pt](mailto:silviacatarina@ua.pt)

## Acknowledgments:



Horizon 2020  
European Union funding  
for Research & Innovation

**TNO** innovation  
for life

**FCT**  
Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR