



FAIRMODE

Forum for air quality modelling in Europe

Proposal for a more exhaustive composite mapping platform: monitoring design

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FAIRMODE CT2 Plenary - 8th October 2021



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Year

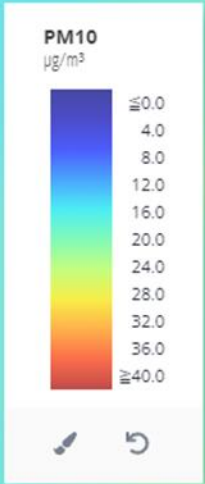
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Show Airbase Stations

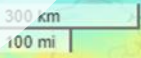
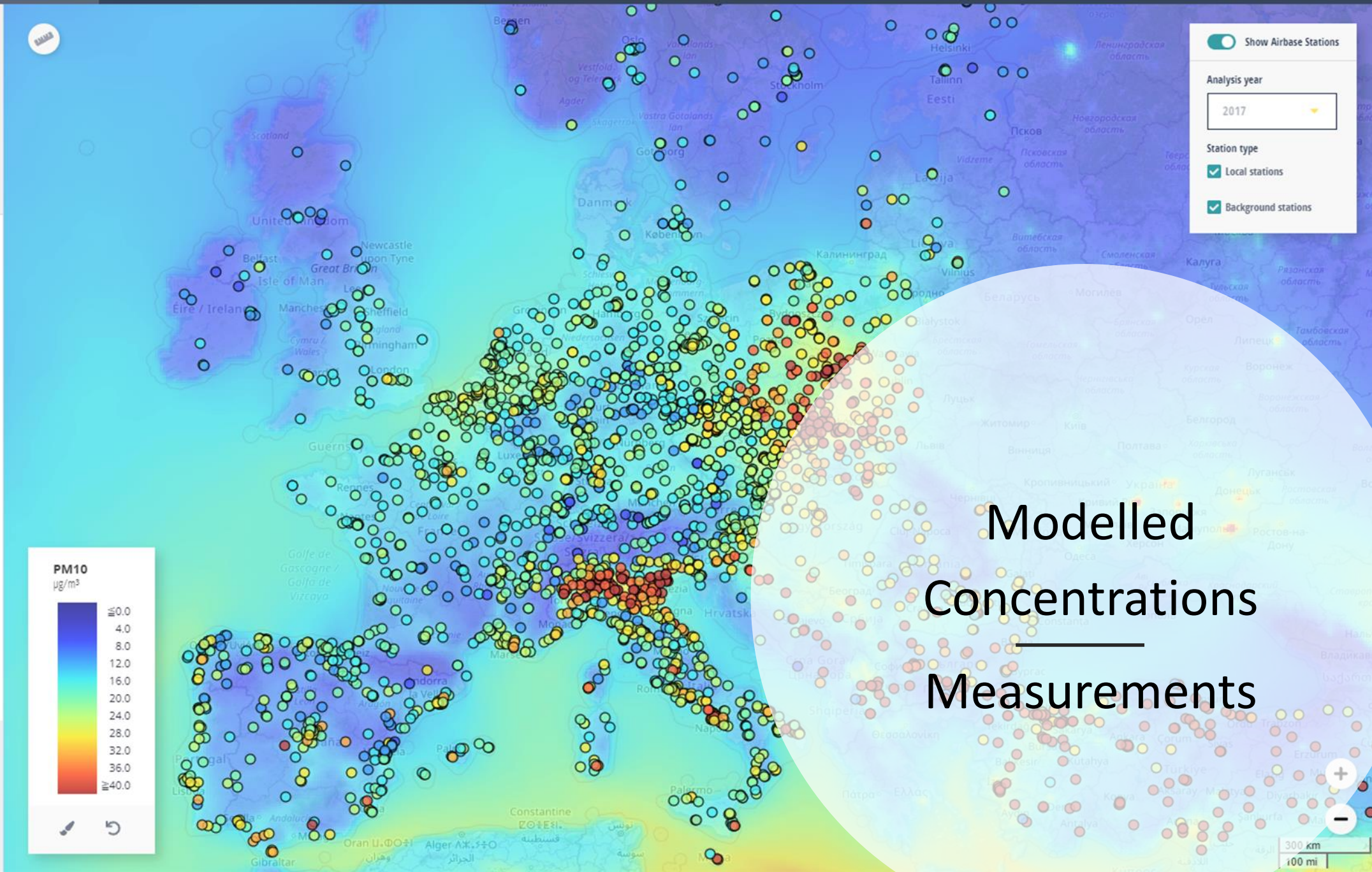
Analysis year

2017

Station type

- Local stations
- Background stations

Modelled
Concentrations
—
Measurements

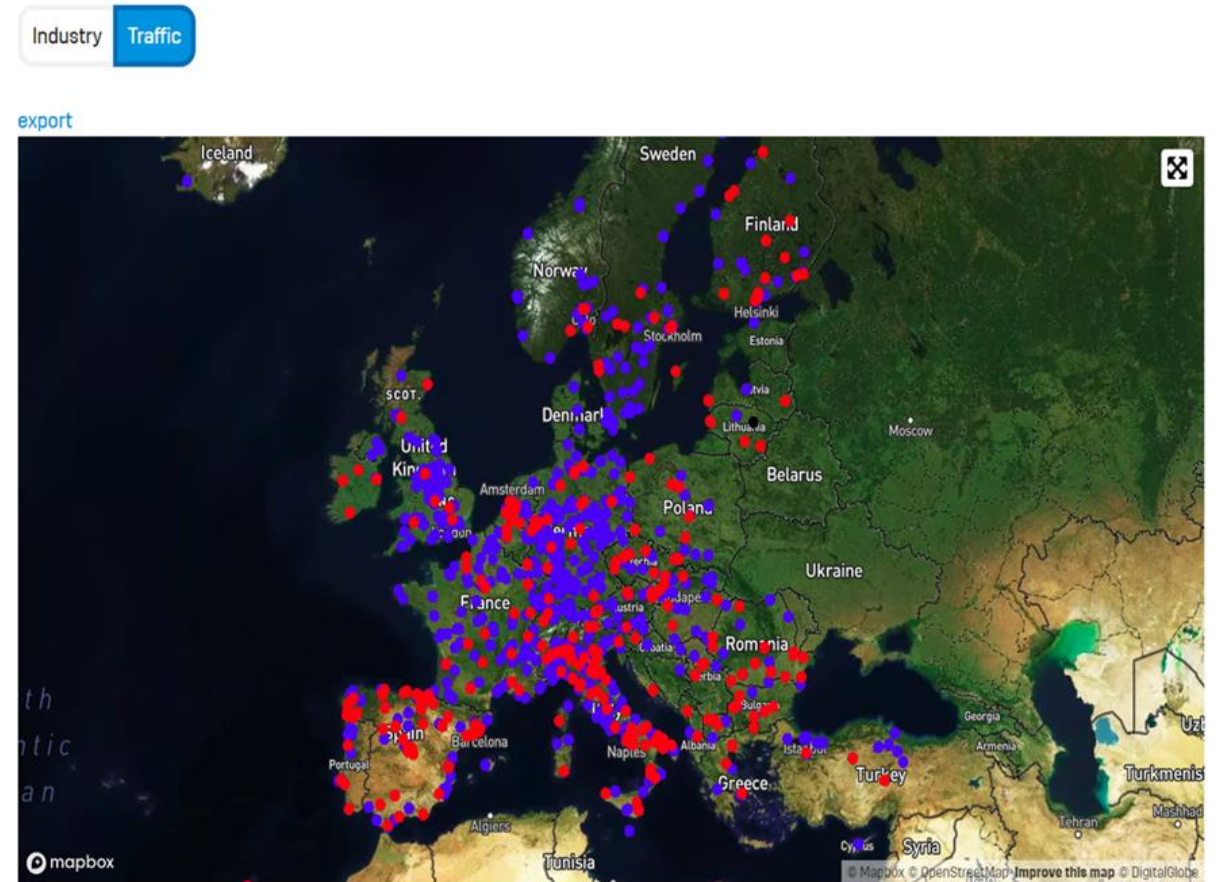


MONITORING NETWORK EVALUATION TOOL – SITING TOOL FOR SAMPLING POINTS

Interactive siting tool

Designed to investigate whether the given location of a sampling point is in line with two specific siting criteria under the **macroscale** and **microscale criteria in Annex III, AQDs**

- **For traffic-oriented sites**, sampling probes shall be at least 25m from the edge of major junctions and no more than 10m from the kerbside. (Microscale siting, Annex III C).
- **For industrial sites**, sampling points must be sited in such way that the air sampled is representative of air quality for at least an area of 250m x 250m (Macroscale siting, Annex III B (c)).



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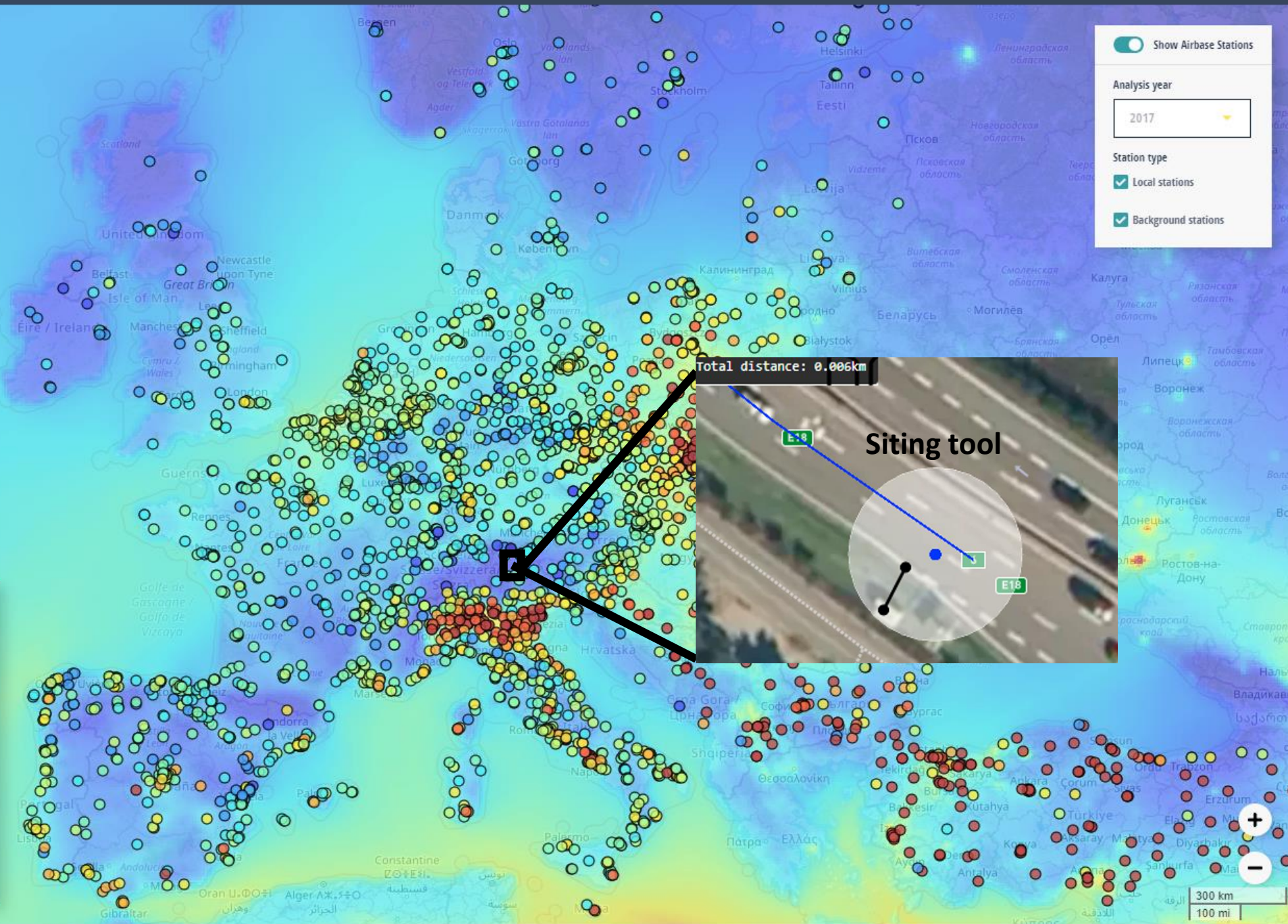
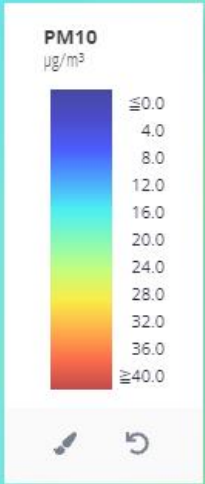
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ACTIVE LAYERS

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Show Airbase Stations

Analysis year

2017

Station type

- Local stations
- Background stations

Total distance: 0.006km

Siting tool



MONITORING NETWORK EVALUATION TOOL – CLUSTERING TOOL

A screening tool developed to assist on the monitoring network optimization decision-making process and model validation by:

- *assessing (dis)similarity between time series*
 - *ranking stations according to their similarity and indicate potential redundancies*
 - *inferring the area of representativeness for a single station in a large area*
- ✓ *The tool can be used for **model validation** purposes by comparing the (dis)similarity analysis based on modelling data and observations - **Links to CT2 activities – MQI & MPC***
- ✓ *The tool can be useful to **support monitoring network design** in a specific Air Quality Zone by identifying similarity clusters – **Links to CT8 activities***

Soares et al. (2018)



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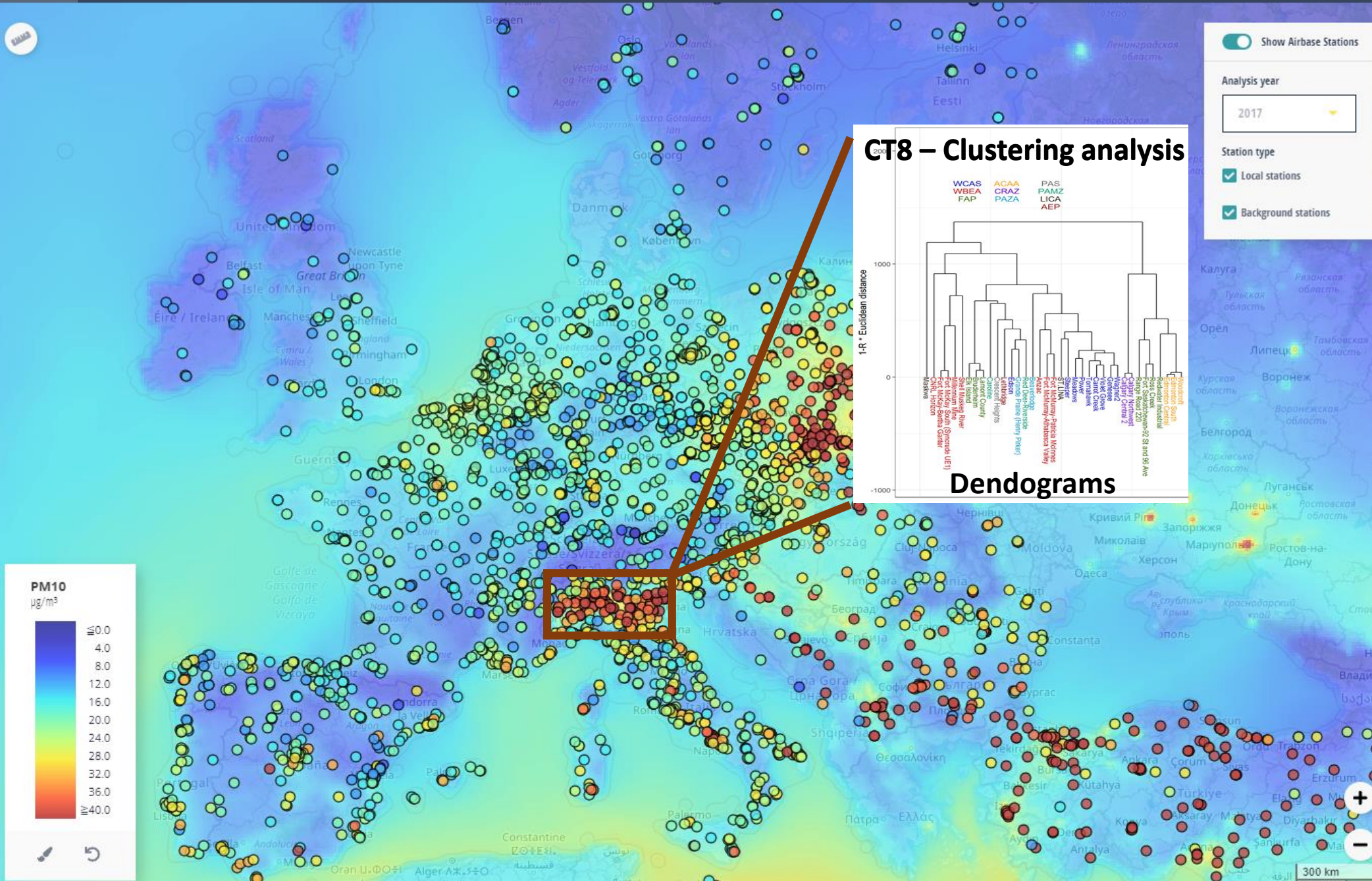
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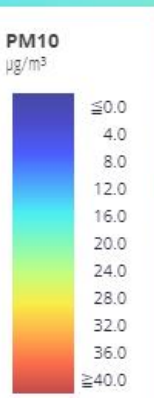
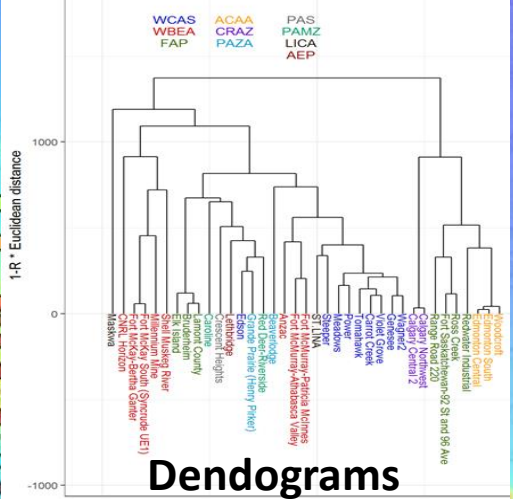
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ACTIVE LAYERS

- CAMS_ensemble_2018_EU



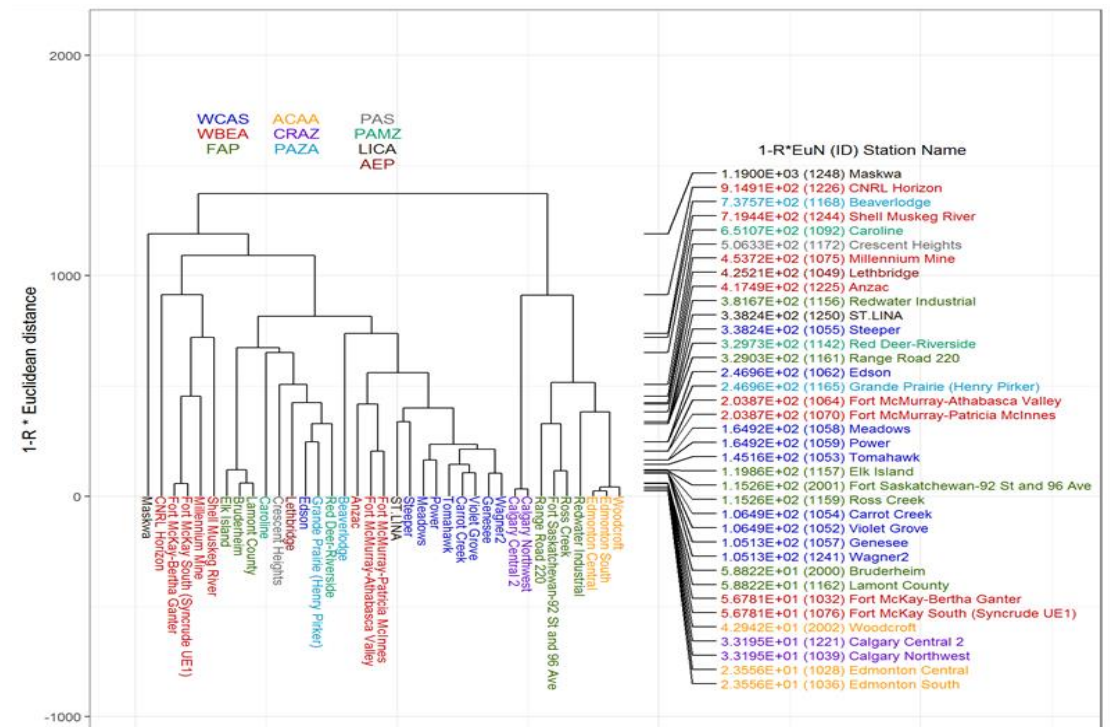
CT8 – Clustering analysis



USE OF MONITORING HOURLY DATA - CLUSTERING ANALYSIS

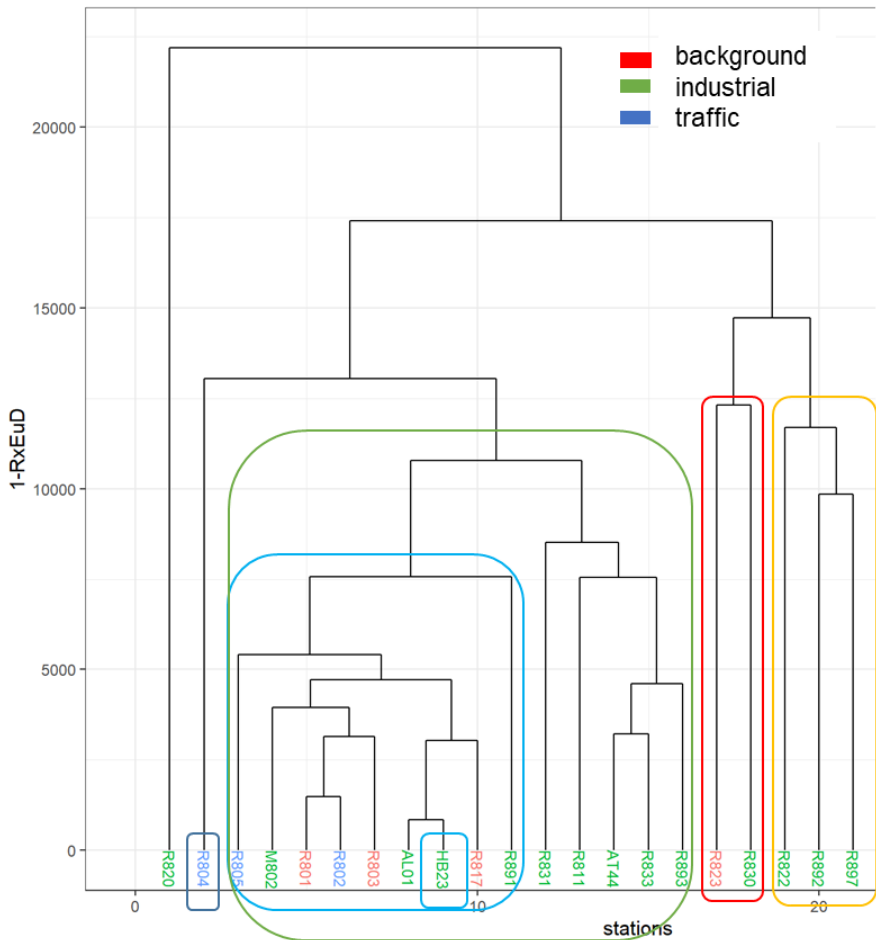
Monitoring network design – time averages

- Sampling point SR calculation based on similarity approaches for annual mean or other percentiles
- Clustering approach for hourly data – *information on different behaviour at site level based on topography, emission sources and air quality regime*

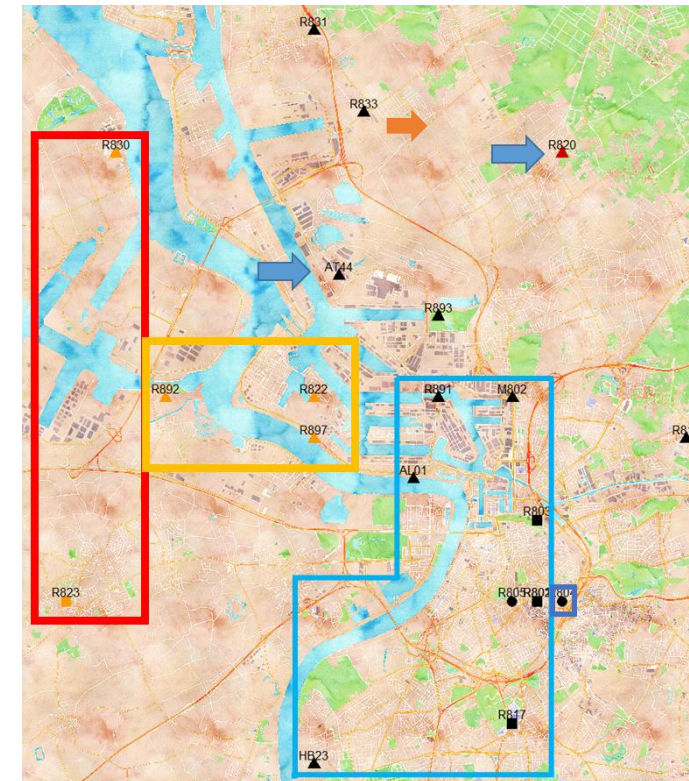
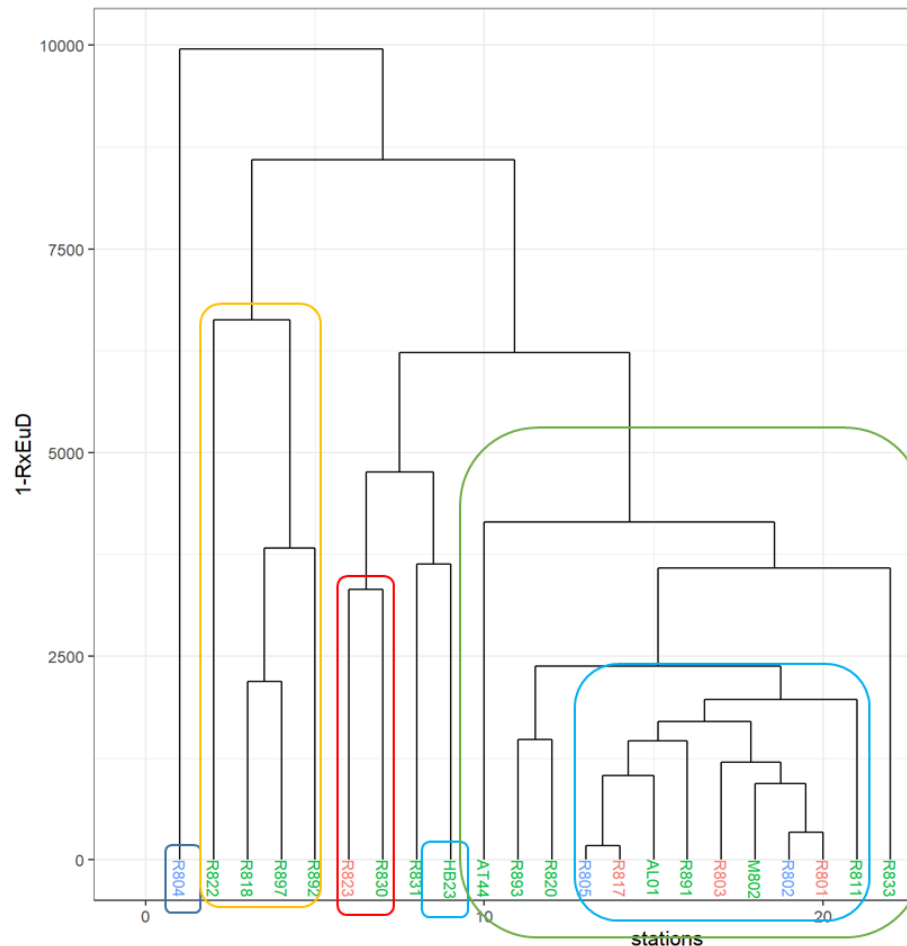


MONITORING NETWORK EVALUATION TOOL: MODEL VALIDATION (ANTWERP, NO₂)

NO₂ observations (1year), metric: 1-RxEuD



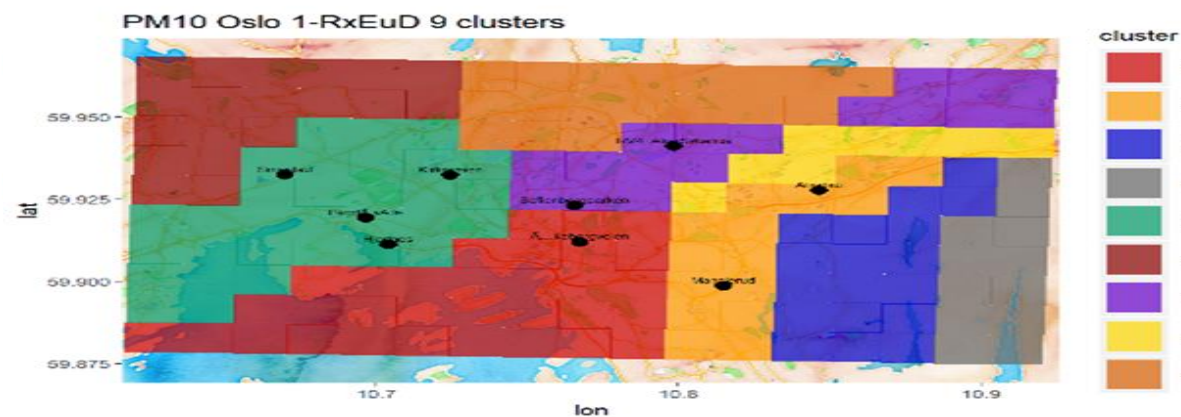
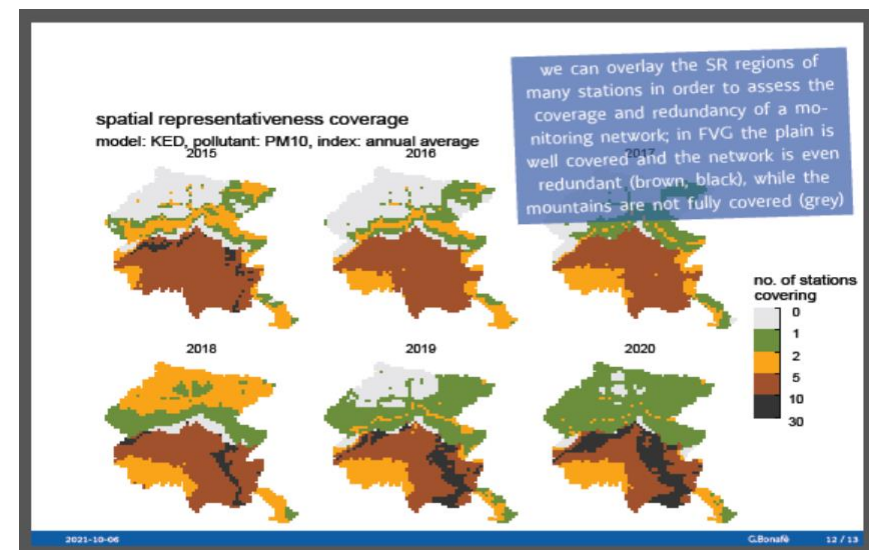
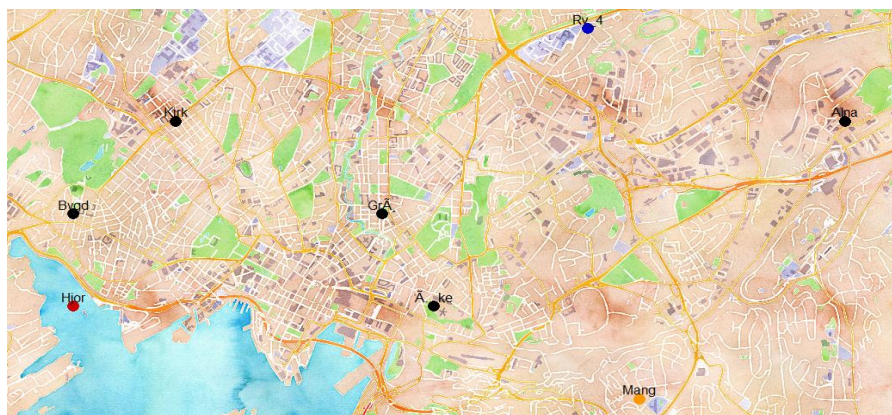
NO₂ model at station locations (1year), metric: 1-RxEuD



FIT FOR PURPOSE!

Similarity clusters and monitoring network design – choices of thresholds/clusters

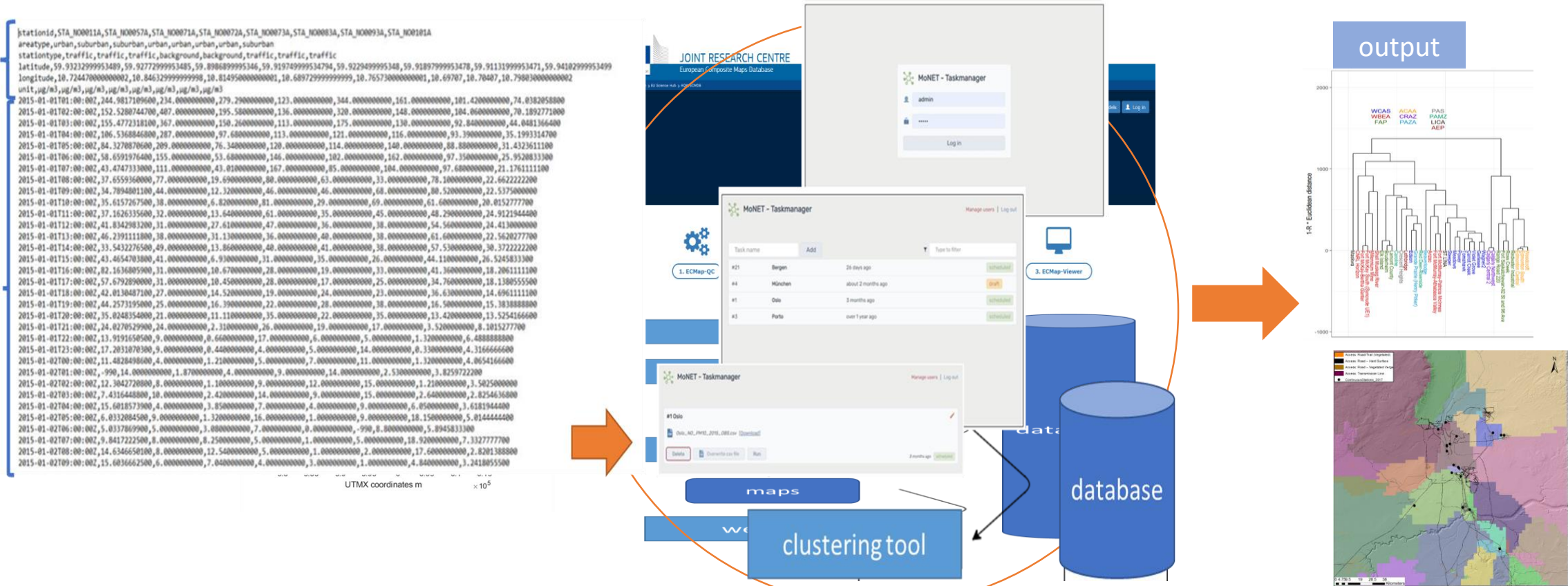
- Sampling point SR calculation based on similarity approaches for annual mean - **thresholds**
- Clustering approach for hourly data – **number of clusters**



MONITORING NETWORK EVALUATION TOOL – CLUSTERING TOOL

A web-based system to aid assessments for monitoring design and model validation applications.

The tool will initiate a task when the input data is uploaded to a database, run the clustering tool on the input data, and produce a dendrogram (2D representation of the hierarchical clustering). The user will then be able to request a set of maps (spatial distribution of clusters) based on the dendrogram.



MONITORING NETWORK EVALUATION TOOL – CLUSTERING TOOL



Caveats:

- *Outcome depends on the quality of the data: error in measurements, data accuracy different sampling technologies, outliers, temporal coverage*
- *Computationally demanding for large number of observations (> 1e4 hourly time series)*
- *Requires temporal and spatial (modelling) continuity*

PROPOSED EXTENSION OF EU CM FOR MONITORING NETWORK DESIGN

❖ The Composite Mapping Platform could be extended for monitoring design purposes adding a useful instrument to foster interaction between experts, increase transparency and support QA/QC processes in relation with e-reporting



- Finalization of the clustering tool interface to be accessible via FAIRMODE CM
- Use the proposed clustering tool to test model validation – (CT2)
- Use the clustering tool to test the suitability of the current monitoring network - Common FAIRMODE & EEA & AQUILA exercise – (CT8)
- ✓ Development of the set of questions for monitoring design exercise based on today's discussions – **Hackathon November 2021**
- ✓ Inter-comparison exercise on monitoring design with AQUILA and EEA to begin in **January 2022**