

Wrap-up and conclusions

Feedback from WGs



WG1 - Source apportionment for AQ assessment and planning

Roadmap 2026-2028 and WG1 Guidance

G. Pirovano, S. Zauli Sajani, P. Thunis

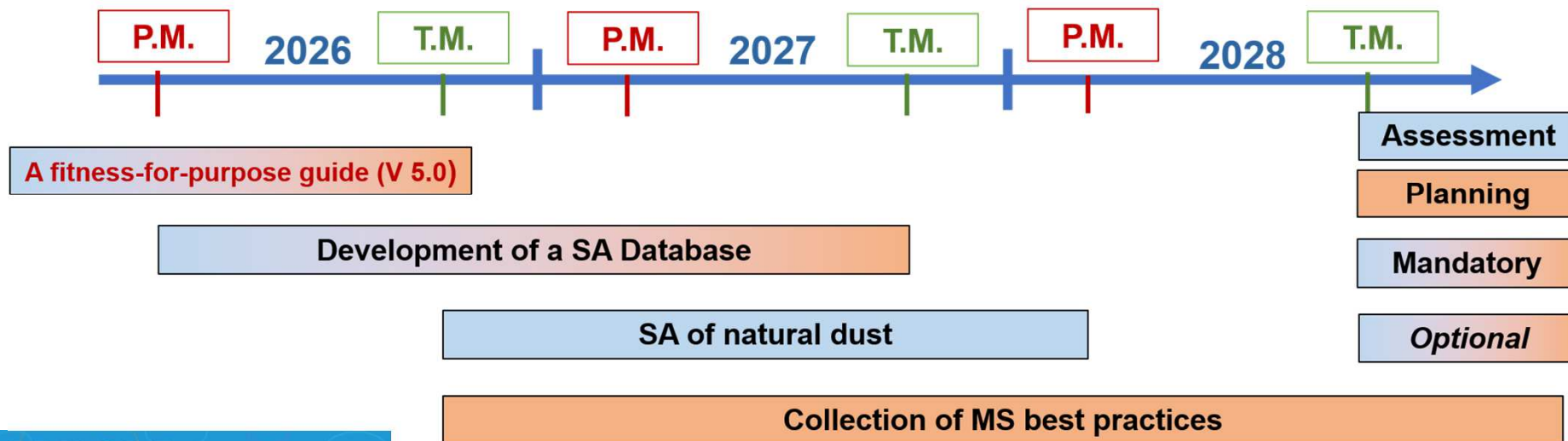
FAIRMODE TECHNICAL MEETING
Copenhagen - 30 September – 2 October 2026



WG1 – Agenda

1. Discussion on the Guidance Document
2. Presenting the v0 of the Source Apportionment Database
3. Collection of SA experiences
4. Joint "dust exercise"

WG1 - Timeline





Discussion on the Guidance Document

- Solved main issues on linearity concept, document structure and BFTD
- **Revised introduction will be shared with WG1**
- **Guidance will be published by the end of the year**

SA dashboard and database

- Collection of a test dataset almost completed
- **Data collection from European-scale models and improved dashboard (Jan 2027)**
- **Start of data collection from local models (offline) from Jan 2027**
- **First presentation and discussion of collected data at the plenary meeting (March 2027)**



Collection of SA experiences

- The joint survey from TFMM and FAIRMODE was presented
- Examples of SA experiences on transboundary pollution and local scale planning
- **Survey will be circulated by FAIRMODE and TFMM by the end of the year**
- **Feedback to FAIRMODE community during the next PM (March 2027)**
- **Analysis and report by TFMM with support from FAIRMODE (end of 2027)**

«Dust exercise»

- Presentation of the CAMS service on dust discounting TFMM dust modelling over Europe
- **CAMS service will be available by the beginning of 2027**
- **Proposal of a “two steps” exercise organized by CAMS, FAIRMODE and TFMM**
 - 1) **Comparison of CAMS methodology with EU experts (to be contacted by beginning of 2027)**
 - 2) **Intercomparison of dust modelling applications (Late 2027)**

FAIRMODE will contribute to contact people and support data collection and analysis

WG2 – session on MQIs and model benchmarking



FAIRMODE Technical Meeting
1st October 2026

WG2 adopted workplan



Updated guidance

Webinar on the new dashboard

2026 Q1-2

Baseline State-of-art MQO 2026

Minimum number of stations intercomparison

- Indicative measurements
- Extension of domain
- SPO multiple years

2026 Q3-4

Minimum number of stations intercomparison

- Indicative measurements

Stringency tests for PM_{2.5}

2027 Q1-2

Stringency tests for PM₁₀, O₃ and NO₂

2027 Q3-4

Intercomparison for data fusion MQO

2028 Q1-2



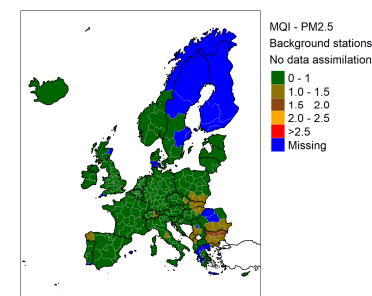
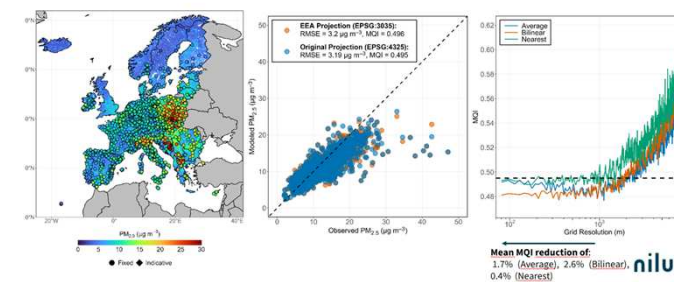
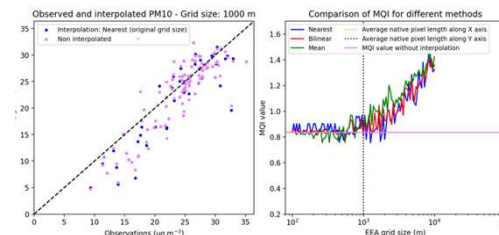
Revised MQO guidance document

2028 Q3-4

WG2 SESSION ON MODEL QUALITY OBJECTIVES - MQI

Session 1 - Making clarity on the existing tools and elaborating a baseline “State-of-art “ MQI mosaic

- Few countries have yet delivered data and/or tested the updated Composite Mapping Tools and Model Validation Tools
- Confidence building on reporting MQI using the EEA grid. Main recommendations:
 - ✓ Use the “nearest point” interpolation method
 - ✓ Use the EEA grid with the resolution closest to your original model resolution
 - ✓ Flexible EEA grid resolutions
 - Multiples of 10 from 10m to 100m (10,20, 30,...90, 100)
 - Multiples of 100 above 100m (100, 200, 300, ... 900, 1000, 1100, ...2500, 2600, ...10000,..)
- General agreement to compile a 2023 "state-of-the-art" of air quality modelling in Europe
 - ✓ **Next WG2 webinar in October to set up this experiment.**
 - Issues to agree upon
 - How should we compile the data from DA models ? identifying sampling points for validation?
 - What area to focus on? Model domain or NUTS 2 ? Should we use the EEA grid?
 - Which resolution to compile the data on? original resolution ? or on the EEA grid?
 - What indicator to use for the MQI for Ozone ?– percentiles ?
 - What format to report on ? Geotiff format?



WG2 SESSION ON MODEL QUALITY OBJECTIVES - MQI

Session 2 – Minimum number of stations - How to compute the MQI with less than 10 stations? (Joint WG2-WG4-WG6)

➤ Four different approaches discussed – all with their pros and cons

a. *Indicative measurements*

b. *Low cost sensors*

c. *Multi years analysis*

d. *Extension of the domain*

Option	Indicative measurements	Use of LCS	Multi-year analysis	Domain extension
PROs	✓ Low costs ✓ Compliance with the DQO ✓ High spatial coverage in few specific areas	✓ Low costs ✓ High spatial and temporal coverage in specific areas ✓ Innovative field covering several pollutants	✓ Low costs ✓ Can be used in all areas with a reduced number of sampling points ✓ Higher temporal coverage	✓ Low costs ✓ Can be used in areas where additional measurements area available ✓ Higher spatial coverage
CONs	• Can only be used for MQI_long but not for MQI_short • Only available in few areas • Only available for few pollutants	• Non compliant with the DQO • Requires further work to be used as indicative measurement or for model validation	• Requires further analysis of chemical regimes for different meteorological years • Requires further analysis of the minimum number of sampling points (3-4-5?)	• Requires further analysis of chemical regimes for different areas • Requires further analysis of the additional of sampling points

✓ *A probable useful approach is to welcome examples on the use of each of these methods and encourage reflections on how to best use the method to secure robust results – organising an open workshop where we can jointly identify best practices*

✓ **Next WG2 webinar in October to set up the main principles for the workshop and how to include the findings as FAIRMODE guidance**



WG3 Wrap-up

Paweł Durka
Alexandra Monteiro
Enrico Pisonni

Technical Meeting
Copenhagen 2026

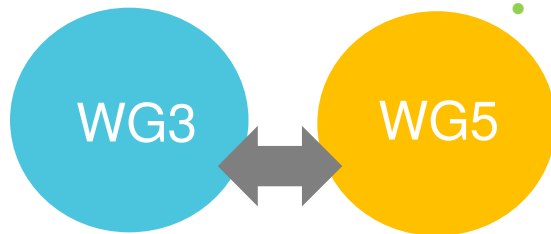
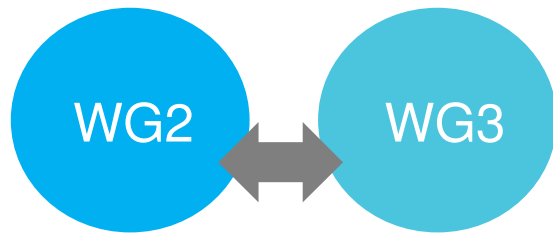


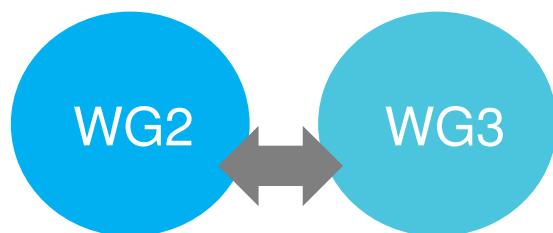
Activities

- **communication of forecast exceedances** to the citizens
- **evaluation of modelling systems performances** for exceedance forecasting, in line with AAQD requirements
- **assessment of AQ indices** due to their role to provide real time information to citizens
- **sharing of best practices** on the use of forecast models to support the development & evaluation of “short-term action plans”

Survey!

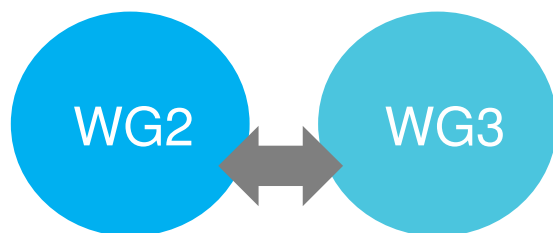
DeltaTool
Python





DELTA-Tool Python version

Davide De Marchi | JRC



The Survey

Fairmode WG3 survey on forecasted exceedance of air pollution.

Dear all!

Below is a survey about air pollution exceedances forecasted, predicted or measured in Your county. It shouldn't take more then 5-10 minutes to complete it. If You are aware of any people or organization that could be interested or have knowledge to fill it out feel free to share it. All contributions will help us greatly to understand role of exceedances in EU contries. Summary of survey will be shown during Fairmode technical meeting in Kopenhagen on 1.10.2026.

Thank You for contributions!

Pawel&Alexandra

WG3 Fairmode

July 2026

From the survey: what can we conclude?

- **No harmonised approach across Europe** – substantial differences exist between countries in forecasting systems, spatial coverage, communication procedures and institutional responsibilities.
- **National and regional systems coexist** – national forecasting platforms are often complemented by regional/local systems, with the latter playing an important role in communicating exceedances and managing pollution episodes.
- **Forecast information relies on multiple sources** – most systems integrate model forecasts and observations, often combining national/regional models with CAMS products.
- **Human expertise remains important** – although forecasting chains can be highly automated, expert judgement is still used to monitor and interpret forecasts and support episode communication and decisions.
- **Decision makers are mainly involved downstream** – their role is primarily related to activation/approval of measures, communication, implementation and enforcement, rather than forecast production itself.
- **STAP are predominantly regional/local and heterogeneous** – measures range from traffic restrictions and residential heating limitations to industrial/agricultural actions and public-health communication.
- **A major gap is the evaluation of STAP effectiveness** – there is little systematic evidence showing whether forecast-triggered short-term measures actually reduce pollutant concentrations or influence public behaviour and awareness.

Forecasting & communication systems exist, and STAP are implemented in several places, but their effectiveness is rarely evaluated.

WG3 next steps

- To test the new DeltaTool for forecast (next Technical!)
- To improve the new DTPy regarding exceedances analysis
- Assessment of forecasted AQ indices

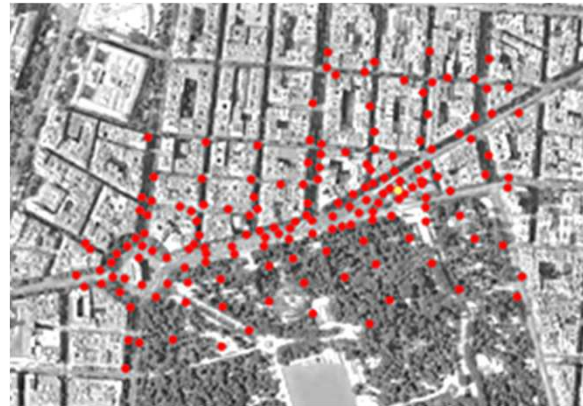
WG3-WG5

- **Collaboration:** Established to explore short-term action planning under the revised AAQD, including triggers, measures, impact assessment, links to long-term plans and reporting.
- **National/regional experience:** Emilia-Romagna (IT), France, Poland and Belgium presented existing approaches to triggering STAPs.
- **Key survey findings (survey >30 participants):** STAPs are already used in >50% of cases, typically based on **both forecasts and observations**; transport and residential sectors are the main targets. **85% report links with long-term plans, but 50% do not quantify impacts, and none currently report STAPs to the EEA/EC.**

Summary of WG4 Sessions

- An overview of the Madrid IE2 (focus on NO₂) was given:
 - **Status:** Discussion of preliminary results.
 - **Participants:** 14 groups (19 modelling systems)
 - **Types of modelling systems:** CFD, AI, Lagrangian, Gaussians, street networks, reduced-order models

C1: Campaign 2014



Winter

600 hours (25 days):

- November 6th 00h to December 1st 00h
- 171 samplers

C2: Campaign 2016



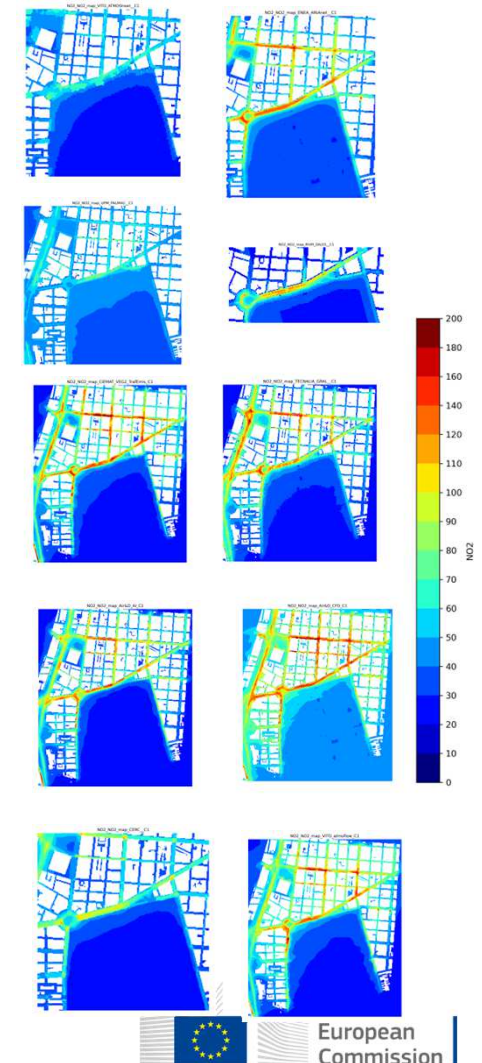
Summer

2016: 696 hours (29 days):

- June 15th 00h to July 14th 00h
- 229 samplers

Summary of WG4 Sessions

- Preliminary results were presented, including contributions from different groups on several aspects of their results and methodologies.
- Most modelling systems compare well with passive-sampler measurements in both campaigns and fulfil MQO in most cases.
- NO₂ time series at Traffic AQMS are reproduced slightly less well, with better performance in winter and poorer performance in summer.
- In general, more complex models provide better results (more analysis required).

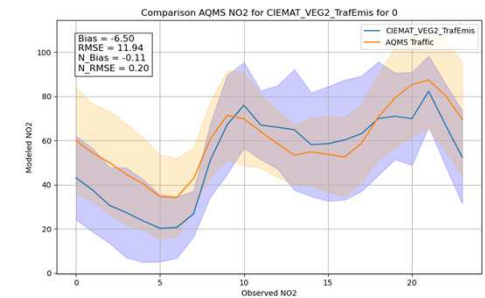


Summary of WG4 Sessions

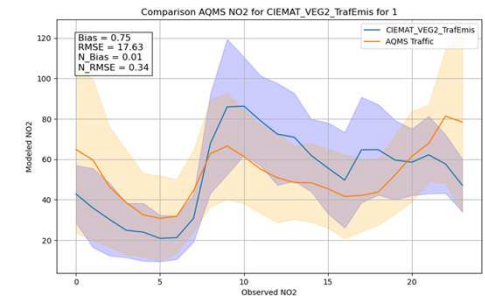
- Questions discussed:
 - Differences in model performance between winter and summer (chemistry, atmospheric stability) and across the domain.
 - Background concentration
 - Analysis in the frequency domain instead of time domain.
 - Required minimum spatial resolution.
 - Post-processing of modelling systems based on CFD-simulated scenarios.
 - Impact of vegetation.
 - The use of an emission proxy.
 - Grouping modelling systems for the analysis, and additional information required to characterize them.
- Next steps:
 - Receiving results from other groups or modelling systems as soon as possible.
 - Discussion of final results in Hackathon (end 2026 / beginning 2027)



Winter



Summer

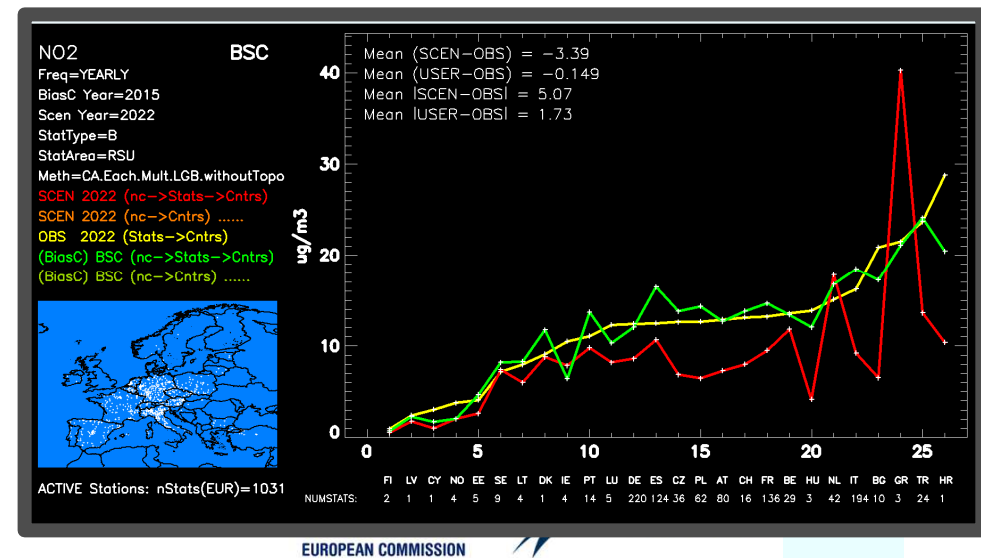


WG5 Summary

WG5 - Summary Bias Projection Exercise

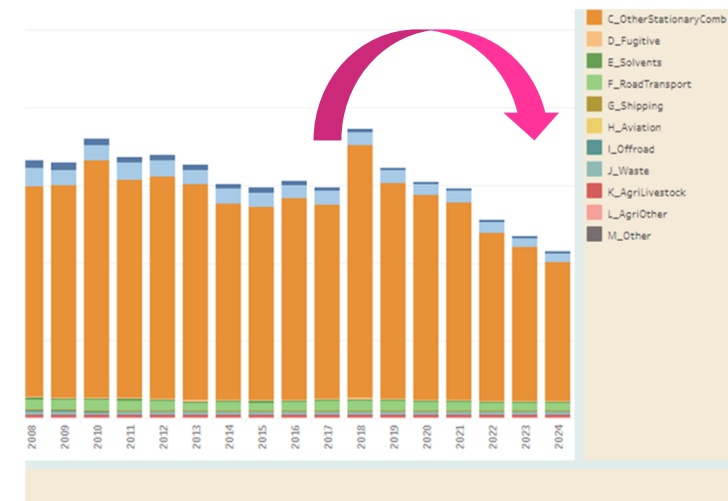
- Bias projection is something we have to deal with
- Phase 2 (based on real world EMEP model and EEA measurement data) delivered very interesting results
- Phase 1 (based on synthetic data) turned out to have less value given the synthetic nature of the data set. But the process was still very useful

General conclusion:
bias projections work and can bring
future estimates closer to the
(unknown) truth



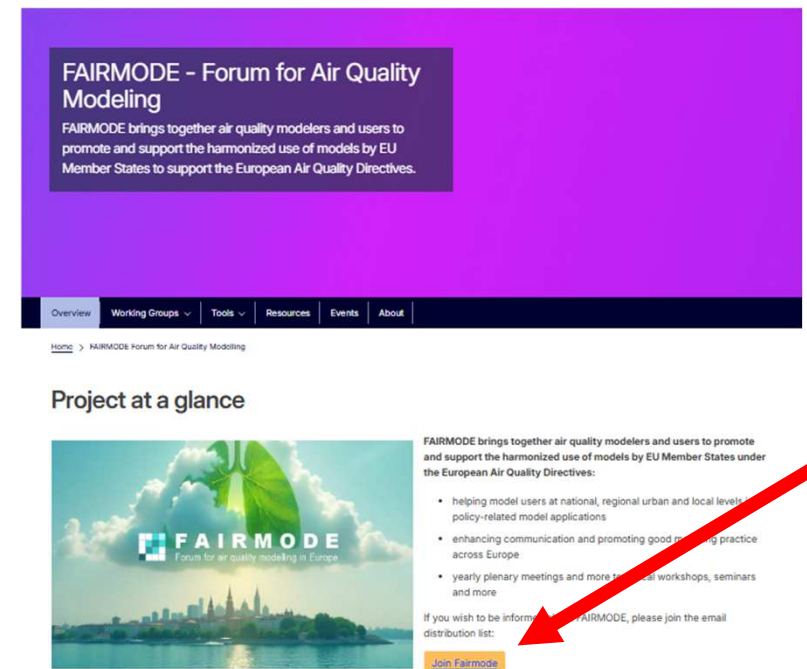
WG5 - Summary Bias Projection Exercise

- WG5 will wrap up the conclusions and provide recommendations in a report. To be seen if we can also compile a publication
- Inconsistencies in the PM2.5 emission time series nicely illustrated the importance of have internally consistent emission inventories



Art 18 Implementing Act on “Planning”

- WG5 wants to provide a platform to discuss the draft text of the IA on Planning
- IA will be available for public consultation as of 1st week of October
- Deadline for feedback: 4 weeks
- **Online meeting: Monday October 19, 13h – 15h**
- Link will be distributed to FAIRMODE WG5 mailing list



ReportNet3

- Template for **Planning** was not discussed today
- Should be ready by March 2027
- We will provide a draft (as for SRA and Assessment) to be discussed online during Winter 2026-2027

FAIRMODE



CERC

INERIS

maîtriser le risque
pour un développement durable



universidade
de aveiro



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport



AARHUS
UNIVERSITY
Copenhagen, 2 Oct 2026



Norwegian
Meteorological
Institute



Joint Research Centre
JRC



ISSEP
Institut scientifique
de service public

Summary WG6

PM_{2.5} sensors and data fusion

FAIRMODE, 2 October 2026

sensors and data fusion

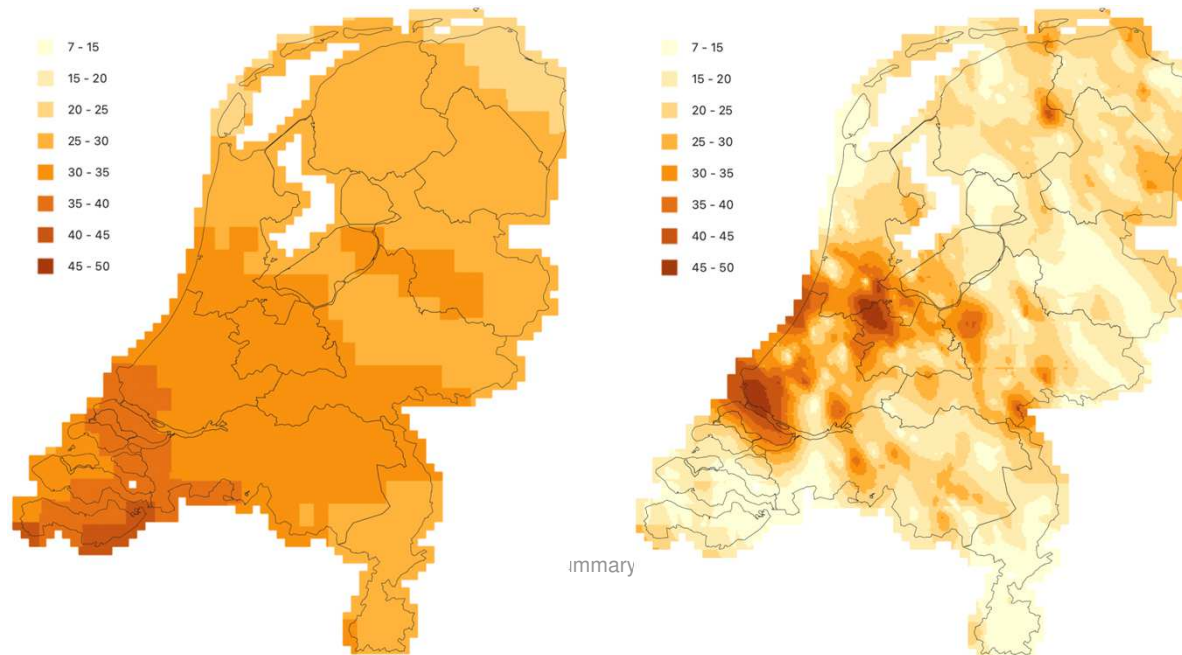


Sensors and data fusion in the Netherlands

Copenhagen, 2 Oct 2026

Summary WG6 Sensors and data fusion

Example spatial pattern before and after data fusion



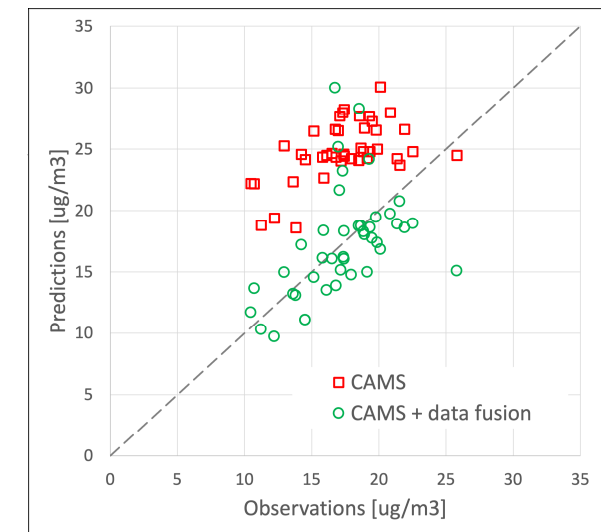
imaginary

PM_{2.5} concentrations
(µg/m³) in the
Netherlands.

Left: CAMS forecast
before data fusion

Right: CAMS forecast
after data fusion.

2–9 November 2024



ts

European
Commission

- Integrating well-calibrated sensors with modeled concentration fields can substantially improve spatial representation of PM2.5 concentrations
- Improvement on models that already partly contain observation (RIO) can be more difficult than (coarser) models without integration observations (CAMS forecast)
- Improvements are shown for periods with relatively high concentrations. Improvement expected to be smaller during periods with low concentrations

Copenhagen, 2 Oct 2026

Summary WG6 Sensors and data fusion

Use of sensors in forecasts using different modelling approaches

Plan your journey with
cleanairroutes.org



Challenges of applying data fusion to AQ forecasting

FAIRMODE Technical Meeting 2026
WG6 sensors and data fusion

Jenny Stocker
Copenhagen 30th September 2026

City of Westminster

CERC
Cambridge Environmental Research Consultants
Environmental Software and Services

AARHUS
UNIVERSITY

Operational Hourly UFP Predictions in Copenhagen using Machine Learning and Sensor Data

With data assimilation as an add-on bias correction

Jibran Khan, PhD
Aarhus University, Roskilde, Denmark.
E-mail: jk.envs@gmail.com & jibran@envs.au.dk

FAIRMODE Technical Meeting 2026, 30 September – 2 October, Copenhagen
Working Group 6

tecnal:a
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

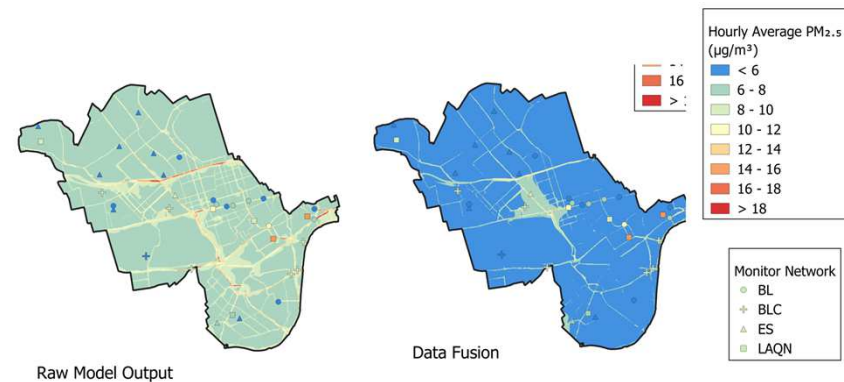
Leveraging station-model fusion tools for predictive urban air quality

FAIRMODE Working Group 6
Toward station-model fusion for AI predictive systems

EHU

Daniel Rodríguez-Rey, Javier del Ser
Work done in the framework of EHU postgraduate study "Applied AI and its Mathematical Foundations"

Jenny Stocker (CERC)



- Methods usually apply spatially homogeneous biases
- Possibly less common to apply spatial data fusion?
- AQ forecast metrics are daily (e.g. daily average, max daily). More challenging to get good performance for hourly forecasts
- Historic measurement of hourly flow hourly variations used as input to the model are only broadly representative on a road by road basis.
- Methodology could be **pollutant dependent**

AARHUS UNIVERSITY

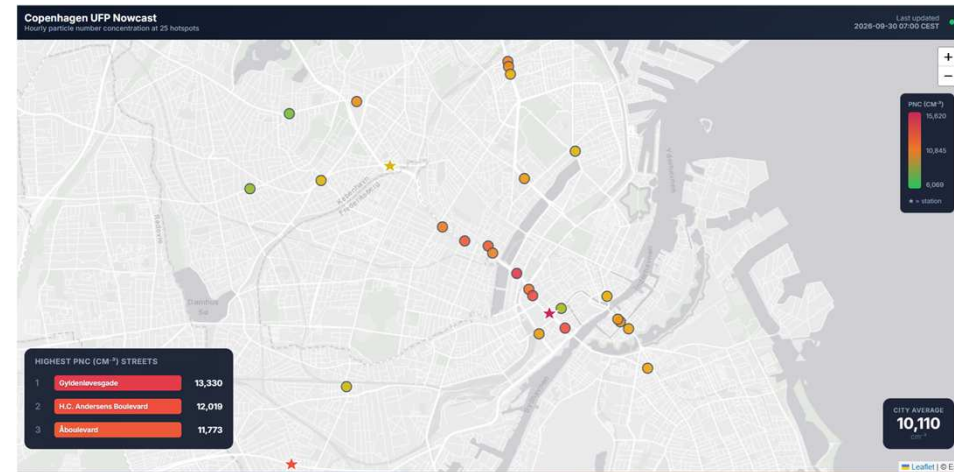
Operational Hourly UFP Predictions in Copenhagen using Machine Learning and Sensor Data

With data assimilation as an add-on bias correction

Jibran Khan, PhD
Aarhus University, Roskilde, Denmark.
E-mail: jk.envs@gmail.com & jibran@envs.au.dk

FAIRMODE Technical Meeting 2026, 30 September – 2 October, Copenhagen
Working Group 6

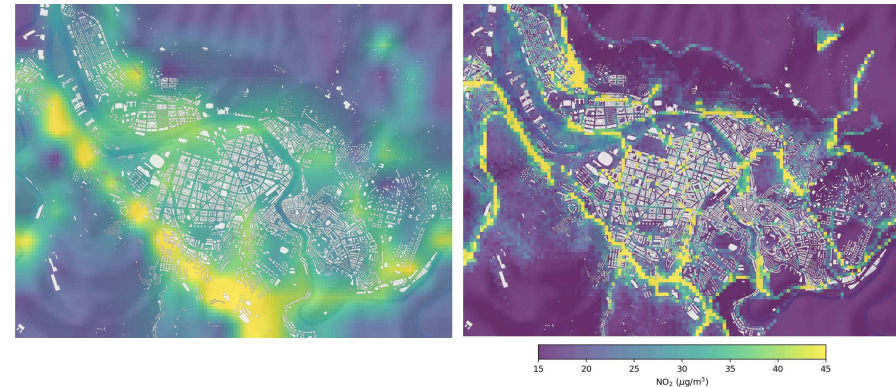
Jibran Khan (Aarhus University)



- Validation results:
ML model achieves comparable performance to a physics-based model (OSPM) evaluated over 18 years of measurements
- Operational model:
The model captures real atmospheric physics. Street geometry, background PNC, and meteorology explain 63% of hourly variance with daily $r = 0.92$. Possibilities for further improvement. The framework is feasible for operational deployment.



Daniel Rodriguez Rey (Tecnalia)



- The fusion of observations and deterministic models can be extended toward predictive AI systems
- A dispersion model can transfer urban morphology and dispersion gradients as a soft prior improving purely data-driven results without being the runtime engine

- Nowcast or forecast? WG 6 decision
- Include multiple other sources of information.
- Spatial representativeness and network design could be informed by data fusion systems.
- Use data fusion to estimate/correct model emissions.
- NO2 instead of PM2.5

Copenhagen, 2 Oct 2026

Summary WG6 Sensors and data fusion

- Satellite data is still improving. Keep up with the latest information.
- Deeper dive into existing models. Rely less on data fusion.
- Use of sensors for further downscaling (e.g. street level)
- Organize web meeting in ~ 1 month to find agreement along larger group.

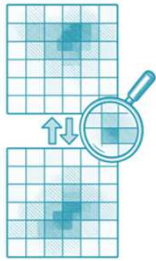


Action Plan _ TM

WG7 - Emission Inventories and Projections for modelling applications

Susana Lopez-Aparicio, Marc Guevara

WG7 – Action Plan



Benchmarking gridded emission inventories

- **December 2026** (most probably much earlier): the tool will be open for testing with some available metrics. Susana will inform WG7 participants;
- **January 2027**: Webinar will be organized with a group of interested participants to initiate a common exercise (Send interest to Susana with Marc in CC)
- **April 2027**: First results will be available (Webinar discussion)



Innovative approaches for emissions estimates (Kickoff)

We had two interesting presentations (ML and satellite-based emissions). We will have additional Webinars to share other methodological approaches that allow us to identify best practices in the near future. WG7 participants will inform Susana and Marc about new methods that can support this component within WG7.



CAPACITY BUILDING



[WG7-WG5] Emission projections for planning applications.

- [2026] Reflect on the feedback received both in plenum and face 2 face
- Map available information that support emission projections for planning applications (CAO, CAMS, NECD, individual teams) and evaluate their applicability (national -> subnational level)
 - [March 2027]

WG8

SUMMARY - WG8 SESSION ON SPATIAL REPRESENTATIVENESS AND NETWORK DESIGN

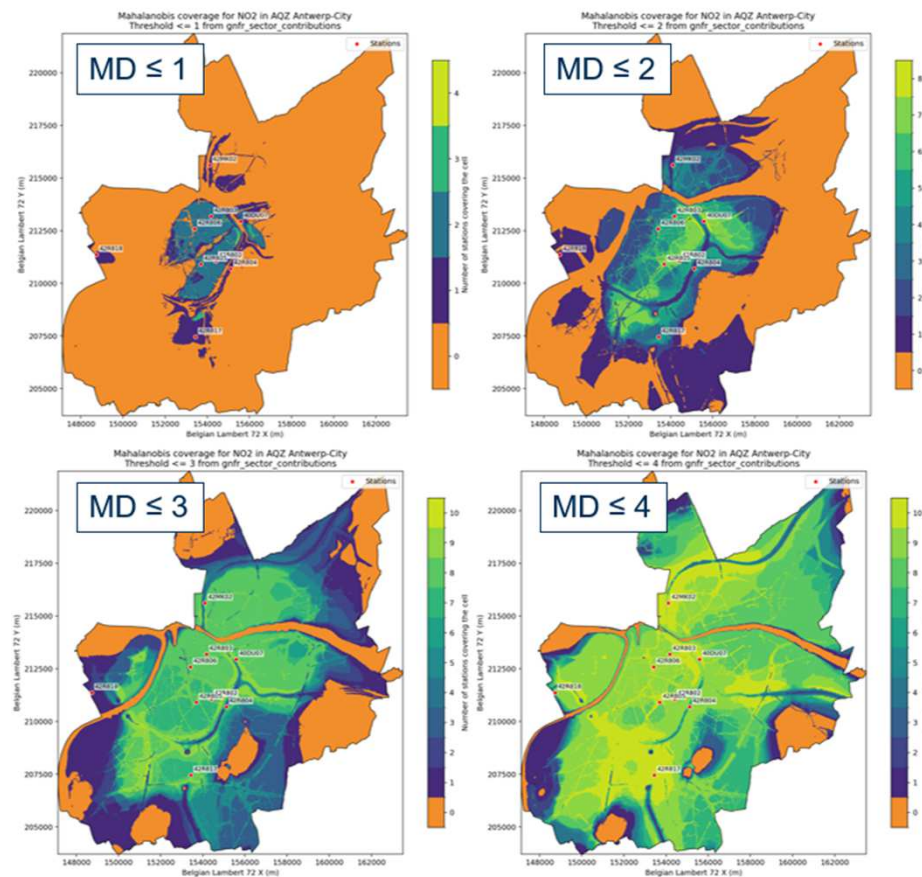
Source-related criteria

Using Mahalanobis distance for applying source-related



Detailed method descriptions to be uploaded to WG8 Teams page next week

WG8 Webinar 10th Nov to present results from further testing



FAIRMODE

Forum for air quality modelling in Europe

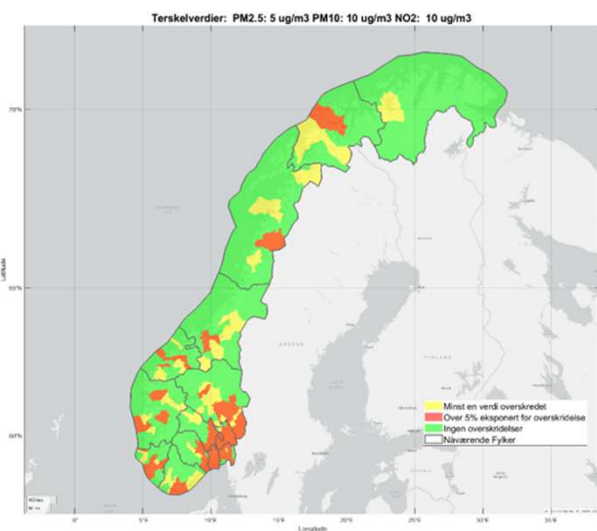


European
Commission

SUMMARY - WG8 SESSION ON SPATIAL REPRESENTATIVENESS AND NETWORK DESIGN

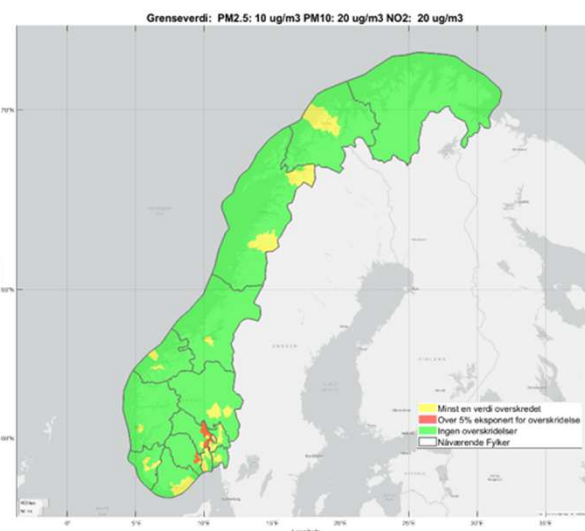
Network design and SRA coverage of AQ zones, exceedances

Exceedances of assessment threshold

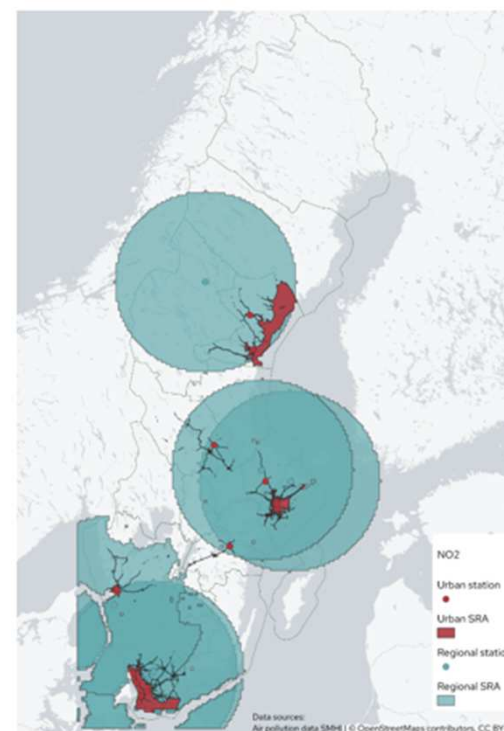


Requires air quality monitoring

Exceedances of annual limit value

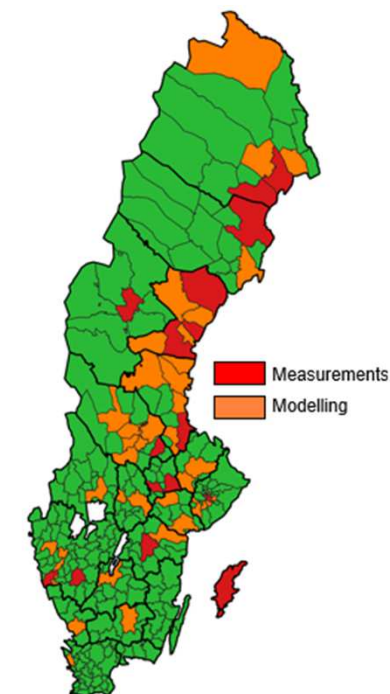


Requires development of air quality plans and roadmaps



NO₂ - zones on NUTS3 / county-level
SRA coverage in Sweden

Measured vs modelled
exceedances



Municipalities with >18 days >45 ug/m³



FAIRMODE

Forum for air quality modelling in Europe



European
Commission

SUMMARY - WG8 SESSION ON SPATIAL REPRESENTATIVENESS AND NETWORK DESIGN

Guidance needs from the AAQD Article 8 IA on modelling and SRAs

FAIRMODE WG	Issue from the IA requiring guidance	New / existing activity? Priority?
WG2	- Temporal resolution / percentile relationships - Spatial resolution, number stations - Review model if fail to show observed exceedance	
WG8	- Source-related criteria, exclusion of traffic locations from SRAs of UB stations - Overlapping SRAs - Inter-annual variability of SRAs - Use of other metrics than annual means - Use of modelling & SRAs for compliance checking	
(WG6 ?)	Use of indicative measurements for SRA assessment & combination with modelling	
(WG2 + 7 ?)	QA/QC of all input datasets, before each modelling application	



FAIRMODE
Forum for air quality modelling in Europe

➤ Ultimate aim: feed into future update of the technical support document on modelling?



Some important takeaways

- Need to review and re-prioritise FAIRMODE workplan for 2026 – 2028?
 - » Considering guidance needs results from the new Art 8 Implementing act
 - » Mainly WG8 and WG2, but also relevant for WG6 and 7.
- More focus on “good enough” practice
 - » E.g. needs of countries with lower capacity for AQ modelling
- Some interest in collaborating with AQUILA on network design / siting criteria
 - » Reporting template for network design document as a first activity?
 - » Need for an AQ assessment group (link to EUMonNet & EUModNet?)

Next year

About FAIRMODE

PAGE | LAST UPDATED: 07 NOV 2025

[FAIRMODE Forum for Air Quality Modelling](#)

Page contents

Who

What

When

The **Forum for Air quality Modeling (FAIRMODE)** was launched in 2007 as a joint response initiative of the European Environment Agency (EEA) and the European Commission Joint Research Centre (JRC) and is chaired by the latter.

FAIRMODE brings together air quality modelers and users in order to exchange experience and results from air quality modeling in the context of the European Air Quality Directives (AQD). Besides that it promotes and supports the harmonized use of models by EU Member States, with emphasis on model application under the European Air Quality Directives.

Next year: 20th anniversary -> need to celebrate FAIRMODE achievement !!!

Next year PM

- We still do not know how / what to do to celebrate, but
- 9-11 March 2027 we will have the PM
 - day1: 10:00-18:00 CAMS + social dinner
 - day2: 9:00-13:00 CAMS
 - day2: 14:00-18:00 FAIRMODE + social dinner
 - day3: 9:00-16:00 FAIRMODE
- Thanks to Marta García Vivanco (CIEMAT, Madrid, Spain) and all CIEMAT team for hosting us