

# FAIRMODE Technical meeting

## Athens 04-06/10/2023

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About 100 participants from 25 countries registered to the technical meeting that was held in Athens, organized by the National Hellenic Research Foundation, organized back-to-back with the 7<sup>th</sup> CAMS policy user workshop. The FAIRMODE meeting was organized in sessions, each dedicated to one of the working groups (WG) that constitute the current work structure in FAIRMODE. WG sessions were held in plenary excepted for WG3, WG4, WG6 and WG8 that were run in parallel. This document summarizes the outcome of the discussions for each of these WG sessions. All presentations are available on the FAIRMODE web pages.

### **Modelling guidance in support to the Air Quality Directives**

S. Janssen (VITO) provided an introduction to the starting work to develop a technical guidance document on the use of modelling for various application domains under the Ambient Air Quality Directive, and the assurance of relevant data quality objectives for air quality assessments. The main purposes of this document are to (1) define how to apply modelling systems for various application domains under the Ambient Air Quality Directive; (2) provide an overview of a QA/QC protocol with recommendations to harmonize overall quality of modelling applications; (3) provide criteria to evaluate the overall fitness-for-purpose of modelling applications in the context of the AAQD and (4) to provide specific guidance on the appropriate spatial resolution of models for the various AAQD purposes.

S. Janssen provided an overview of the foreseen outline of the document and presented the lead authors of each chapters. Additional details regarding each of these chapters were discussed during the relevant WG session.

### **WG1. Source apportionment (SA) to support air quality management**

After a brief recap of the ongoing work in WG1 (finalization of the inter-comparison exercise on NO<sub>2</sub>, restart of the CEN WG44 on source apportionment) and an overview of the proposed outline of the chapter on source apportionment in the modelling guidance (MG), discussions focused around an interactive exercise. Three sub-groups discussed the issues of (1) complementarity among SA methods; (2) time and space considerations for SA and (3) how to define SA and interpret results. The main outcome of the discussion were the following. For sub-group (1), a possible complementarity between brute force and tagging approaches would be to use tagging to understand and explain the influence of the different sources (assessment) and brute force to evaluate the effect of emission reduction (planning). For sub-group (2), reducing peaks of exceedance requires the implementation of immediate reduction measures during (or before) the period of exceedance, while reducing annual averages requires implementing strategies over the entire year. Long-term emission reductions can potentially be used to assess the impact of shorter-term strategies, but only if a « short residence time for the impact of the emission

reductions » is fulfilled. For sub-group (3), one of the main challenges of SA methods is to find the best compromise between the most complete and simplest possible representation of the various relationships between emission sources and concentrations.

**Next steps:**

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| 1. Final review of the outline and drafting of the chapter on SA in the MG | End of 2023   |
| 2. Update of delivered data for NO2 SA intercomparison                     | November 2023 |
| 3. First draft of the paper on NO2 SA intercomparison                      | December 2023 |
| 4. WG44 – next meeting   | October 2023  |

## **WG2. Towards an extended QA/QC protocol for air quality assessment**

During the previous meeting, WG2 agreed to launch a second phase of the composite mapping exercise. The proposal includes (a) an on-the-fly Model Quality Indicator calculation; (b) the creation of a NUTS3 “Frankenstein” map constructed from the best (MQI based) available map for each NUTS3; (c) a proposed template to report metadata and (d) an emission dashboard to monitor the level of consistency of the underlying emissions (restricted to aggregated input) QA/QC process for emissions. The main purpose of this WG1 session was to share the first results of the exercise, especially regarding the above points 1 and 2. The presentation of the results was done in a static way as the interactive interface is not yet available. The discussions revealed the need to check some of the results but also to consider in a more meaningful way data-assimilated results.

**Next steps:**

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| 1. Availability of the interactive interface | Fall 2023     |
| 2. Technical online meeting                  | December 2023 |
| 3. Presentation of main results              | Plenary 2024  |

## **WG3. Quality control indicators for modelling of air quality forecast**

This WG aims at providing a specific benchmarking framework for modelled air quality forecasts. Performance indicators have been developed to provide additional information about the capability of the forecasting system to detect/anticipate regulatory threshold exceedances and to check its ability to provide accurate forecasts (more accurate than a ‘persistence model’). WG3 participants presented results of their further testing of the indicators, in particular looking at the following aspects: (1) what is the practical use of the Delta application? (2) which plots are the most useful? (3) are output clear to stakeholders? and (4) suggestions to improve AQI plots in the context of communicating to non-experts? Contributions were given by Poland, UK, Lombardy, Ireland and Kosovo, showing that the plots are useful for experts but less manageable for non experts (citizens, policymakers), being the target plot and the AQI barplots the potentially most useful for non-expert stakeholders. Some discussion was started on the possible ease to reach the MQO, on inconsistencies between MQI and target plot visualization and on potential developments and also on the inclusion of NO2 hourly exceedances. In the CAMS Policy Users

session, first results of the application of the MQIf (target plot) to the CAMS Regional Production (evaluation quarterly reports of June-July-August 2023) were presented and discussed.

**Next steps:**

1. Uptake of Tech Meeting feedbacks on inconsistencies and suggestions
2. Proposal for a 2024 roadmap, focusing on communication to non experts
3. Organization of an online meeting to discuss and prepare these future steps

## **WG4. Microscale air quality modelling**

WG4 session was organized around different sub-items: (1) feedback on the urban modeling intercomparison exercise (INERIS); (2) last findings of intercomparison exercise - Antwerp Case - First paper (U. Aveiro); (3) intercomparison of spatial representativeness/ exceedances areas - Antwerp Case (CIEMAT); (4) future recommendations/guidance Document (CIEMAT); (5) chemistry impact – how important is this topic at microscale? (U. Aveiro) and (6) setup a new intercomparison exercise at a new location (e.g., Gyor) (CIEMAT).

The session focused on the discussion of the ongoing activities of WG4, starting with a summary of the activities performed during the period 2020 to 2023.

After that, Frédéric Tognet (INERIS) presented the INERIS/LCSQA urban modeling Intercomparison exercise for the Anwerp City and using urban models covering all the city but with less resolution than the models used in the WG4 FAIRMODE Intercomparison Exercise, followed by a discussion with the audience.

The last findings of the WG4 Intercomparison Exercise (IE) were discussed, namely the first scientific paper under preparation by the IE participants. The most recent results were also presented and discussed for an intercomparison of the estimates of the spatial representativeness (SR) and exceedance areas to limit values (LVEA). A discussion took place about the importance of the computation of these areas excluding the area covered by buildings. The strong links with WG8 activities were highlighted.

The WG4 also discussed the importance of compiling the most relevant recommendations in a Guidance Document, following the FAIRMODE standards, starting from the document initiated in 2022 by the WG4 IE participants. During the session, it was also discussed the need to address the relevance of chemistry impacts at the microscale. The session was closed with a final topic about a new IE at a new location (Gyor, Hungary) for the current WG4 roadmap (2023-2025).

**Next steps:**

These last three topics (Guidance document, chemistry impacts at the microscale, new IE at a new location) will be tackled during 2024. Additionally, an online hackathon will be held in November 2023 for the final preparation and submission of the first paper with the results of the intercomparison exercise and for the preparation of a second paper related to the intercomparison of the spatial representativeness and exceedances areas estimates.

## **WG5. Best practices for local/regional air quality management**

The objective of this WG is to produce guidelines on air quality management practices, in particular to explain how to proceed from specific abatement measures, to evaluate consequent emissions and then concentrations.

To improve the reporting of measures in air quality plans, a draft template was shared prior to the meeting that was compiled by nine participants. Six among those have been selected as basis for an inter-active group discussion during the meeting with the aims to (1) understand whether the plan as reported shows missing elements or redundancies and (2) if the information allows for replicability, from a modelling perspective. The discussions led to a clear need to restructure the checklist, to make it more clear and simple. In addition, during the discussion, we agreed that the checklist should not aim at measures' replicability (too difficult to be reached, in terms of data needs) but it should mainly act as inspiration for others, to explore new air quality options having an idea of their potential impacts. Finally, we also clarified the main user of this checklist: environmental authorities at all scales (EU, national, local). The idea now is to revise the checklist, to be used to collect experiences from FAIRMODE users.

### **Next steps:**

1. Restructure the checklist following the meeting's discussion
2. Publish the new version of the checklist, asking for contributions, to collect plans and measures
3. Present the results of the collected measures during the next year's plenary meeting

## **WG6. Near-real time assessment with sensors**

WG6 organized an inter-comparison exercise on sensor/model integration. The exercise consisted in generating data sets with artificial/synthetic sensor data both for PM2.5 and for NO2. The objectives for the benchmark were to develop/test/compare methods to 1) select which sensors in the data sets to use for every hour; 2) to obtain best estimates for "calibrated"/ "corrected" sensor data and 3) to combine cleaned/calibrated sensor data with other info/model data (Data Fusion and/or Data Assimilation). The first part of the session was dedicated to a discussion of the effects of different calibration methods on pm25 sensors in the Netherlands. To assess the differences between three calibration methods, the methods were tested using a data set consisting of synthetic real concentrations as well as synthetic sensor data. It was concluded that although some the calibration methods are able to reduce a part of the measurement error, a significant uncertainty remains. There was some discussion on the use of synthetic data fed by worries that the way of generating the synthetic data would be more beneficial for a certain type of calibration method.

The second part of the session focused on the issue of data fusion approaches with presentations of VITO and RIVM. RIVM proposed to continue on doing data fusion using the generated synthetic data set for the Netherlands and add (standardized) synthetic model results to test different data fusion methods. This led to a discussion where it was argued that this approach could be too unpractical for parties, other than RIVM, because these models are predominantly fit for local application. It could be more practical

to keep using specific local data and local models for intercomparison. A quick pole among those present yielded a few (new) organizations that would be interested in joining a data fusion benchmark.

**Next steps:**

1. Form a new active group that is interested in actively comparing sensor-data fusion methods with others. (building on the existing sensor calibration benchmark)
2. Decision on which data sets to use for the sensor-model benchmark as well as initial ideas on a fair comparison between the available fusion methods

## **WG7. Compilation of urban scale emission inventories**

WG7 activities in 2023 focus on two main items: (1) benchmarking and creation of an emission dashboard (EU, bottom-up national and local inventories) to monitor progress and identify inconsistencies among inventories and (2) use the composite mapping exercise as spatial information support to evaluate specific sectors/ topics identified as inconsistency by the dashboard. The discussion focused on the second of these points with the presentation of the planned emission web interface / dashboard as well as the first set of results of the intercomparison. It was reminded that contributions to the exercise are still welcome.

**Next steps:**

1. Distribute available results to start interpreting results (November 2023)
2. Open the dashboard to the FAIRMODE community (end November 2023)
3. Organize a first online workshop to discuss inconsistencies (end december);
4. Start drafting lessons learned to draw «best practice and recommendations» for the development of emission inventories (2024)

## **WG8. Exposure & exceedance indicators and network optimization**

Activities in this working group bridge the use of models and measurements for reporting assessment and exceedances of limit values under the AAQDs. Much of the work is also relevant for colleagues at the AQUILA network. This year the work in WG8 has been organized around four different topics: 1) the joint CAMS-FAIRMODE evaluation of the use of CAMS natural dust of the products for reporting exceedances under the AAQD, 2) the evaluation practices to support monitoring network design to evaluate the current AQ monitoring networks, 3) the elaboration of guidance on the calculation of exposure indicators and 4) the elaboration of guidance on the determination of spatial representativeness for monitoring sites. In addition, activities under this last topic are to support the drafting of chapter 2 of the new modelling guidance on the use of models for the assessment of spatial representativeness of monitoring stations, linking also to monitoring design under topic 2. There were organized two different sessions under WG8, the first one under the CAMS Policy User Workshop collected experiences with the CAMS regional natural dust products by experts from 6 different countries, the second one with focus on activities directly supporting the modelling guidance with respect to the use of models to determine spatial representativeness and support monitoring network design.

## Next steps:

### *Natural Dust*

1. Compile the experiences reported to WG8 in 2023 on the use of CAMS **natural dust** data to report exceedances under the AAQD in a single document in order to identify possible best practices and lessons learnt.
2. Organize a follow-up WG8 on-line meeting to discuss the document on lessons learnt and identify how these can support a possible revision of the guidance on the deduction of **natural dust contribution to exceedances** under the AAQDs (January 18<sup>th</sup> 2024)

### *Spatial Representativeness*

3. Continue testing of the proposed checklist cookbook for calculating **spatial representativeness** with focus on open issues concerning specifically urban hotspots and choice of cut-offs for the different components. Examples from lower tier methods are most welcome. Results are to be presented in an on-line WG8 meeting on December 14<sup>th</sup> 2023.
4. Develop a technical guidance on **spatial representativeness & network design** that can feed into chapter 2 of the modelling guidance document. (First draft due spring 2024, final document early 2025)

### *Monitoring design*

5. Compile experiences with the MoNET tool so far to be send it out for comments in December 2023 for FAIRMODE and AQUILA experts to include additional best practice examples on the use of modelling for monitoring network design as well as links to any existing national guidance documents related to network design.
6. Further testing of MoNET at a later stage during 2024 with focus on the evaluation of monitoring network in relation to the current air quality zones.

### *Exceedance and Exposure indicators*

The need for the **Exceedance Flagging Indicator** may depend on the availability of information on SR areas in the future. Further testing is important, but we decided to prioritise testing related to SR first. To be revisited at a later stage during 2024.

## **WG9. Effectiveness and robustness of air quality projections**

The first part of the session was dedicated to review the main outcome of exercise on the assessment of the robustness of air quality projections. In practice, this assessment consists in analyzing the sensitivity of the model responses to emission reductions scenarios, when input data (emissions, meteorology...) or the model itself are changed. For this activity, a modeling inter-comparison was launched, with more than 10 modelling research groups participating already. B. Bessagnet (JRC) reviewed the main results and suggested following steps. In the future, the intercomparison tool will be transformed in a web application to facilitate its use.

During the second part of the session, a panel of experts was set up to steer the discussion about several challenges regarding the use of air quality modelling for planning applications (use of a calibrated base case for scenario applications, integration of local and national plans, assessment of compliance after plan implementation, time horizon of model simulation...). In future, these points of discussion will be turned into a discussion paper on best practices and possibly into a benchmark modelling activity.

**Next steps:**

1. Identify relevant and achievable next steps in the intercomparison exercise with interested modelling teams (Dec 2023).
2. Compilation of discussion paper on best practices for modelling in support of planning (Dec 2023)
3. Discussion of best practices and exploration of a benchmark activity (before Plenary meeting, Feb 2024)

**Next meeting**

The next plenary meeting will take in Paris on 26<sup>nd</sup> and 27<sup>th</sup> February 2024.