

FAIRMODE Plenary meeting

Videoconference 01/03 – 02/03/21

About 180 participants from 25 countries registered to the plenary meeting that was held online (initially planned in Brussels) due to the COVID_19 situation. The meeting was organized in sessions, each dedicated to one of the FAIRMODE activities or crosscutting tasks (CT) that constitute the current work structure in FAIRMODE. This document summarizes the current status and next steps planned within each of the activities as reported and agreed during the 2021 plenary virtual meeting. The discussions in some of the sessions were supported by interactive polls, which results are annexed to this document for information. All presentations are available on the FAIRMODE web pages.

Air Quality: revision of EU Rules (DG ENV)

To frame the discussions in the Plenary meeting, T. Henrichs from DG ENV informed on the ongoing process of revision of the EU rules on air quality. The process focuses on three main policy areas: a closer alignment of the EU air quality standards with scientific knowledge including the latest the WHO recommendations; an improvement of the air quality legislative framework (including penalties and public information) and the strengthening of provisions related to air quality monitoring, modelling and plans. He highlighted the current shortcomings in legislation (health outcome, implementation and enforcement, governance, assessment and information) and their consequences in terms of health, social, economic and other impacts. A support contract has been launched to help in formulating technical suggestions to strengthen air quality monitoring, modelling and plans in the context of the AAQD.

T. Henrichs concluded by stressing the increased use and reporting of modelling results and the need for further harmonization (e.g. resolution) to ensure comparability and quality. FAIRMODE is invited to support the EU AAQD revision process as well as to highlight where further guidance is needed.

CT1. Source apportionment (SA) to support air quality management

The [fitness-for-purpose SA guide](#) serves as guideline for the activities in CT1. Among the remaining open issues highlighted in this guide, two were discussed in more details: the extension of the guide to other air pollutants (e.g. NO₂ and O₃) and the addition of recommendations for receptor modelling. G. Pirovano provided an overview of the status of the ongoing modelling exercise focusing on NO₂ in which about 8 groups participate with different SA approaches on their own datasets. S. Gilardoni introduced the main strengths and weaknesses associated to receptor modeling and the current efforts to add a simple description of their main assumptions in the guide based on simple theoretical tests. L. Rouil provided an overview of the SA activities in the context of CAMS. She highlighted the differences in results obtained with different methodologies (tagging and brute force impacts) and stressed the need for guidance on how to use methods in a complementary way. A. Clappier finally presented the

chronology of the main CT1 deliverables, from early technical reports to recent recommendations on fitness-for-purpose. He also listed the steps planned for 2021. The polls (see annex) highlighted a need for guidance to tackle the uncertainties associated to the SA results.

Next steps:

- Analysis of the NO₂ exercise results (First phase: Mar – Jun 21, sensitivity analysis Summer 21)
- Analysis of the receptor model test cases and proposed recommendations (Jun 21)
- Draft version of the fitness-for-purpose guide including updates on NO₂ and receptor models (summer 21)
- Presentation of the NO₂ and RMs exercise results during the Technical Meeting (Oct 21)
- Update of the fitness-for-purpose guide (Dec 21)

CT2. Towards an extended QA/QC protocol for air quality assessment

As a follow-up of the CEN TC264/WG43 on modelling quality objectives (MQO), the FAIRMODE community identified a need to develop an extended QA/QC protocol to ensure a more comprehensive evaluation of the quality of a modelling application beyond the current pass/fail MQO test. The protocol is based on two parts, one dealing with informative metadata attached to each modelling applications and the second focusing on a series of QA/QC checks supported by specific indicators. P. Thunis informed on the status of the protocol and noted in particular the addition in the Delta tool of new QA/QC indicators. Although tested by a few groups, these require further test to assess their robustness and level of stringency. L. Tarrason presented the protocol needs in terms of metadata to support the comparability of the results but also to help with the understanding of the modelling results. She introduced a proposal to complement with new fields the metadata request currently implemented in the composite mapping platform (CMP). A. Colette provided an overview of the QA/QC activities performed in the frame of CAMS. He mentioned in particular the ongoing developments to include the FAIRMODE MQI/MQO in their quarterly evaluation of operational analyses (both for the ENSEMBLE and individual models)

Next steps:

- Further testing of the spatial-temporal indicators and proposal for indicators related to emissions (in collaboration with CT7) and meteorology (summer 21)
- Revision (and testing) of the metadata requirements in the FAIRMODE composite mapping platform (CMP) (summer 21)
- Proposal for additional guidance on model validation with monitoring campaigns or alternative approaches (summer 21)
- Update of the QA/QC protocol document (Dec 21)

CT3. Quality control indicators for modelling of air quality forecast

This CT 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'). S. Janssen reported about the last "hackaton" during which new indicators have been proposed for testing. The challenge of beating the persistent model has been reminded with one main question mark: should we allow for some relaxation of the persistent benchmark? Apart this main question, he also stressed the need for further testing of the current set of indicators. A. Colette provided an overview of the QA/QC activities performed in the frame of CAMS. He stressed the fact that the persistent benchmark is very difficult to beat in terms of bias but not in terms of correlation, a more relevant parameter in terms of episode tracking. He also mentioned the plans to include the FAIRMODE forecast set of indicators in their evaluation.

Next steps:

- Hackaton dedicated to the analysis of further tests and finalization of the approach (Apr 21)
- Interim meeting (Sep 21)
- Update of the MQO guidance document (Dec 21)

CT4. Microscale air quality modelling

Microscale air quality modelling refers to air quality modelling at high spatial resolution (typically order of meter scale), usually focused on urban environments. Several groups currently participate in an inter-comparison exercise aiming at comparing the way statistics relevant to the AAQD are retrieved from microscale simulations and identifying best practices. The inter-comparison exercise would first focus on Antwerp (Belgium) in 2021 and be repeated for Győr (Hungary) in 2022.

Next steps:

- Delivering of modeling simulations and details on methodology computations (by Jun 21)
- Statistical analysis of the inter-comparison results (by Sep 21)

CT5. Best practices for local/regional air quality management

The objective of this CT 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. The structure of the document is based on key challenges collected from local, regional or national authorities. E. Pisoni presented the state of play of the guide, the underlying motivations as well as the specificities of this guide with respect to other initiatives (e.g. Partnership on air quality, Appraisal...). The guide focuses is on the "emission-measure-concentration-impact" (EMCI) pathway in the context of the AAQD. Description of key challenges, following a template that reflects the EMCI

pathway, will be collected from the participants to inform on and share best management practices. Challenges will be organized in two categories: pollutant specific and cross pollutants.

Next steps:

- Deadline for delivering contribution to the 'key challenges' chapter (Jun 21)
- Review of contributions (Aug 21)
- Draft report & possible scientific paper (Dec 21)

CT6. Near-real time assessment with sensors

The main objectives of this activity are to explore and compare results from different approaches using/exploiting sensor networks. J. Wesseling informed on the status of the benchmarking exercises to test/compare/develop different methods of using data from air quality sensors in a data fusion or data assimilation approach. Work starts with a PM_{2.5} benchmark based on real data from Dutch sensors (~1500 sensors). Work focuses on the selection and calibration of relevant sensors and their data fusion/assimilation with modelling results. He provided details on data format and availability. About 12 groups from some 10 countries are involved. Inter-comparison based on synthetic datasets for PM_{2.5} as well as inter-comparisons for NO₂ will be carried out at a later stage. M. Gerboles reported on the calibration process in the frame of the AQsens/SensEURCity project and on the standardization for sensor evaluation at CENT TC 264 WG 42.

Next steps:

- First results of the PM_{2.5} real data inter-comparison (spring 21)
- Work on benchmarks, regular meetings of CT6 (Jan-Sep 21).
- Technical results (Fall 21)
- Work on the NO₂ benchmark (Spring 22)
- Scientific publication on the PM_{2.5} case (Summer 22)

CT7. Compilation of urban scale emission inventories

S. Lopez Aparicio informed on the current FAIRMODE efforts to provide guidance on other sectors than transport and residential heating (topics covered in a first round of benchmarking and guidance). The sectors under scrutiny are the Non Road Mobile Machinery (NRMM) in construction and agriculture as well as shipping and recreational boats. She highlighted possible ways forward to provide guidance in these sectors with the aim of improving urban scale emissions. L. Tarrason reviewed the state of the Emission Composite Mapping (ECM) platform and stressed the need for increasing the Metadata information associated to the emission maps deliveries. The update of the ECM platform will include decision trees for both the residential and transport sectors, in order to collect this metadata in a structured and harmonized way.

Next steps

- Questionnaire on NRMM to be sent to CT7 participants (Mar-Jun 21)
- Revision of the metadata requirements in the ECM (by summer 21)
- Testing metadata for existing emission datasets.
- Analysis of the added value of decision trees to provide guidance on emissions (by summer 21)

CT8. Exposure & exceedance indicators and network optimization

S. Janssen first reviewed a proposed tier approach with different types of methodologies to assess the spatial representativeness (SR) of air quality sampling points. The recommendations on how to use a tier 3 approach, based on modelling results are detailed in a [recent DG ENV service contract](#) and require further testing to assess their robustness within FAIRMODE. An exercise is proposed to test the calculation of Spatial Representativeness of monitoring sampling points using Tier 3 approaches – modelling results. The exercise will include sensitivity test to provide recommendations in the following aspects: choice of the threshold values, contiguity vs. discontiguity, similarity criterion, lower cut off, station types...

Lessons learnt during the above-mentioned DG_ENV service contract show different practices for the calculation of exceedance indicators (EI). These exceedance indicators are very sensitive to (minor) changes in the methodology used for their calculation. To address some of these issues, it is proposed to review how exceedance situation indicators are currently assessed and reported under the e-Reporting in each region/country, to analyze potential issues and to propose options for improvements by organizing a Hackathon.

L. Tarrason presented the findings of a recent [DG ENV service contract](#) that discusses the application of siting criteria and sampling point classification. In this case, a similar tier approach is used to help improving the assessment of AQ in Europe, especially with respect to Network design & Model validation. She proposed a joint FAIRMODE-EEA-AQUILA exercise to test the suitability of the current monitoring network. To support this exercise, the Composite Mapping Platform could be extended (e.g. addition of monitoring station information, addition of clustering functionalities) for monitoring design purposes and add a useful instrument to foster interaction between experts, increase transparency and support the QA/QC processes of reporting

Next steps

- Inform on timing for user friendly “dendrograms” tool (Spring 21)
- Carry out a SR exercise with sensitivity test to identify FAIRMODE recommendations on the use of Tier 3 – models for SR purposes - Discuss findings at next Technical Meeting (Oct 21)
- Carry out a hackathon to identify practices for the calculation of exceedance indicators. (Summer 21)
- Initiate steps for a joint AQUILA-IPR_FAIRMODE evaluation of the AQ monitoring network
- FAIRMODE recommendations on SR and EI (to be elaborated in 2022)

CT9. Effectiveness and robustness of air quality projections

This CT is dedicated to 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. A. Monteiro informed on the status of the exercise to which about 15 groups currently participate. She presented some of the first results that will undergo further analysis before the next technical meeting. One of the aim is to publish on the first set of results by end 21.

Next steps

- Collecting simulation results (June 21)
- Analysis of the results (summer 21) and presentation at technical meeting (Oct 21)

Next meeting

The next technical meeting will take place in Oslo (Covid situation permitting), at the end of September 21.

FAIRMODE

01 Mar - 02 Mar 2021

Poll results

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- How do you interpret the definition of the population indicator?
- Which of the AQ exceedance indicators are relevant to you (multiple choice)?
- How are the exceedance indicators derived in your region/country?
- Do you use modelling information to support station representativeness calculations?
- Do you use modelling information to support monitoring network design ?
- Would you be interested in contributing to the activities in CT8?
- How should emission information be included in the QA/QC protocol?
- How to best ensure that emission data is consistent at regional and at urban level?
- How to best estimate emissions projections from identified measures?
- During this meeting, what are your main interests?
- Which consequences of air policy indicated above do the model(s) you work with address to a level that the models can support decision making?
- Should the (range of) spatial resolution used for reported data

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- from air quality modelling be limited? [for PM]
- If so, what resolution should be the lowest resolution allowed? [for PM]
- Is air quality modelling 'good enough' to identify exceedance situation without verifying these exceedances via sampling points?
- Do you agree with the QA/QC protocol being organized in two parts: (1) a check list for documentation and Metadata and (2) a proposal for QA/QC indicators?
- Is there something missing in the current QA/QC proposal ?
- What should we aim to as final form for the protocol ?
- In witch way are you involved in AQ forecasting?
- If developing or involved in forecast evaluation, do you have a procedure in place to validate the forecast model?
- The Persistence model is used as a benchmark for forecast models but seems hard to beat. Is there room for any relaxation?
- About the FAIRMODE MQO_forecast
- I can spend some time in the coming months to test the MQO_forecast on my own data set
- Do you have any experience with sensors?

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- Do you apply any calibration methodology on your sensor data?
- Do you “fuse” sensor data with modelling results?
- Do you want to participate in the FAIRMODE CT6 exercise?
- Are micro-scale models mature enough to assess the spatial representativeness of urban/traffic monitoring stations?
- Are micro-scale models mature enough to assess exceedance indicators (area, population, road length in exceedance of the limit value)?
- Are micro-scale models mature enough to assess the effectiveness of local mitigation measures to reduce exposure (solid barriers, vegetation, urban planning & design...)?
- If you use (or develop) source apportionment model/results, how do you use them for planning?
- If you use source apportionment, which method do you use?
- Which type of guidance is most lacking to support source apportionment

How do you interpret the definition of the population indicator?

0 3 4

Estimation of the exposure of the population in the AQ zone



Estimation of the population in the area above the limit value in the AQ zone



Estimation of the total population in the AQ zone



Which of the AQ exceedance indicators are relevant to you (multiple choice)?

0 4 2

Area in exceedance



Population in exceedance



Road length in exceedance



How are the exceedance indicators derived in your region/country? (1/2)

0 3 9

Tier 1: expert opinion



Tier 2a: proxy based information



Tier 2b: dedicated measurement campaigns



Tier 3: model analysis



Tier 4: modelling complemented by measurement campaigns



How are the exceedance indicators derived in your region/country?
(2/2)

0 3 9

We don't calculate/report these indicators



I don't know



Do you use modelling information to support station representativeness calculations?

0 2 4

Yes



No, because of lack of available fit-for-purpose model results



No, because of lack of guidance on how to use modelled data for this purpose



No. because of lack of resources



No, because is not mandatory



Do you use modelling information to support monitoring network design ?

0 2 6

(1/2)

Yes



No, because of lack of available fit-for-purpose model results



No, because of lack of guidance on how to use modelled data for this purpose



No. because of lack of resources



No, because is not mandatory



Do you use modelling information to support monitoring network design ?

0 2 6

(2/2)

(here let use 2 choices)

0 %

Would you be interested in contributing to the activities in CT8?

0 2 7

Yes, I would like to join the hackathon on exceedance indicators



Yes, I would like to join the inter-comparison exercise on monitoring design with AQUILA and EEA



Yes, I would like to join the inter-comparison exercise on station representativeness



No



How should emission information be included in the QA/QC protocol?

044

by providing results from the emission evaluation in the Δ -tool, and diamond diagrams

 7 %

as links to the metadata documentation and decision trees

 61 %

by developing new QA/QC indicators for emissions

 25 %

other

 7 %

How to best ensure that emission data is consistent at regional and at urban level?

by requiring local/urban emission data information compilation through legislation



by promoting dialogue between national and local inventory experts



by compiling evidence of gaps and inconsistencies



by extending guidance addressing and correcting gaps and inconsistencies



by all the above



How to best estimate emissions projections from identified measures?

050

by liaising more strongly with TFEIP experts and IAM modelers

 8 %

by including emission projection models in the AQ management modeling chains

 22 %

by providing extended guidance on how to calculate projections

 24 %

by all the above

 46 %

During this meeting, what are your main interests?

0 4 7

(1/2)

Source apportionment



QA/QC and Model Quality objectives



Forecast indicators



Microscale modelling



Air quality management practices



During this meeting, what are your main interests?

(2/2)

0 4 7

Sensors



High resolution emissions



Exceedance indicators and network design



Robustness of air quality projections



Which consequences of air policy indicated above do the model(s) you work with address to a level that the models can support decision making?

(1/3)

Concentration levels of air pollution



Health impacts



Ecosystem impacts



Links with climate change



Cost of air pollution to society



Which consequences of air policy indicated above do the model(s) you work with address to a level that the models can support decision making?

(2/3)

Measures & costs to address air pollution



Competitiveness



Exposure of sensitive populations



Inequalities and social sustainability



Employment



0 6 6

Which consequences of air policy indicated above do the model(s) you work with address to a level that the models can support decision making?

(3/3)

Synergies with other policies

 15 %

Administrative burden

 6 %

Should the (range of) spatial resolution used for reported data from air quality modelling be limited? [for PM]

0 6 1

Yes, only allow a specific resolution

8 %

Yes, to a range of factor of 2 (max)

15 %

Yes, to range of factor of 4 (max)

10 %

Yes, to range of factor of 10 (max)

2 %

No, leave it open but MQO should be fulfilled

66 %

If so, what resolution should be the lowest resolution allowed? [for PM]

059

(1/2)

Any resolution



10km x 10km



2.5km x 2.5km



1km x 1km



250m x 250m



If so, what resolution should be the lowest resolution allowed? [for PM]

(2/2)

100m x 100m



25m x 25m



10m x 10m



Other



Is air quality modelling 'good enough' to identify exceedance situation without verifying these exceedances via sampling points?

Yes, for most pollutants



Yes, for some pollutants



Partly, but only reliable enough to assess average indicators



Partly, but only good enough to suggest additional monitoring needs



No, modelling results show patterns and are indicative at best



Do you agree with the QA/QC protocol being organized in two parts: (1) a check list for documentation and Metadata and (2) a proposal for QA/QC indicators?

0 5 2

Yes



No

0 %

Other

0 %

Is there something missing in the current QA/QC proposal ?

0 1 8

(1/2)

- X
- What is the consequence if the test is failed
- technical and independant audits on each part of the modelling chain might reinforce QA.
- No
- .
- nothing comes to mind
- how do we deal with the fact that MQO depends on the stations used (= on the application domain)?
- no
- ?
- emission modelling has to be taken into account
- No
- How do we make sure providing the meta data is really increasing the QA/QC
- no
- Number of stations for validation in relation of the extension of the area or population, etc
- Not only deterministic models are used, so also datafusion etc. this should

Is there something missing in the current QA/QC proposal ? (2/2)

0 1 8

be taken into account when additional information has to be given

- No
- Validation of the model in areas with few measurements
- –
- No

What should we aim to as final form for the protocol ?

0 5 1

Check-list: A document listing what needs to be included

 12 %

Guidance: A document listing what needs to be included and specifying harmonized methods on how to proceed

 67 %

On-line system: Automatized tool based on harmonized processes to carry out the protocol

 22 %

In witch way are you involved in AQ forecasting?

0 5 1

I develop a forecast model myself



I'm involved in the validation of a forecast model



I use the results of a forecast model



None



If developing or involved in forecast evaluation, do you have a procedure in place to validate the forecast model?

0 3 8

No, we don't validate

 13 %

Yes, based on standard validation statistics (R^2 , bias, RMSE,...)

 79 %

Yes, based on the FAIRMODE MQO (assessment method)

 26 %

Yes, based on FAIRMODE MQO (forecast method)

 34 %

The Persistence model is used as a benchmark for forecast models but seems hard to beat. Is there room for any relaxation?

0 3 8

No, forecast models should do better than the Persistence model to be "good enough"



Yes, we could allow for a relaxation factor in an intermediate phase



Yes, doing better than the Persistence model doesn't make sense and another criteria should be developed



About the FAIRMODE MQO_forecast

0 3 5

I have already tested the method on my own data set



I don't see the added value of an additional MQO_forecast



I was not aware of the MQO_forecast



I can spend some time in the coming months to test the MQO_forecast on my own data set

0 4 0

Yes



No



Maybe



Do you have any experience with sensors?

0 4 5

Yes, but minor



Yes, a lot



No, not at all



Do you apply any calibration methodology on your sensor data?

039

Yes, based on meteo parameters



Yes, based on fixed measurement stations



Yes, calibration of hardware before deployment



Yes, other



No



Do you “fuse” sensor data with modelling results?

0 4 2

Yes, in the context of a research project



Yes, in the context of operation AQ assessment



No, not yet but I would like to do



No, I don't believe in the added value



Do you want to participate in the FAIRMODE CT6 exercise?

0 2 1

Yes, in the calibration part with existing data from NL



Yes, in the calibration part with my own data



Yes, in the data fusion part with existing data from NL



Yes, in the data fusion part with my own data



Are micro-scale models mature enough to assess the spatial representativeness of urban/traffic monitoring stations?

0 4 6

Yes



No



Yes but more guidance is needed



Are micro-scale models mature enough to assess exceedance indicators (area, population, road length in exceedance of the limit value)?

0 4 7

Yes



No



Yes but more guidance is needed



0 3 9

Are micro-scale models mature enough to assess the effectiveness of local mitigation measures to reduce exposure (solid barriers, vegetation, urban planning & design...)?

Yes



No



Yes but more guidance is needed



If you use (or develop) source apportionment model/results, how do you use them for planning?

0 3 8

To identify key sectors to target in air quality plans



45 %

To identify key sectors and quantify the impact of their reduction on concentration levels



55 %

Other

0 %

If you use source apportionment, which method do you use?

0 4 2

Source oriented modelling - Brute force scenarios



Source oriented modelling - tagging/labelling



Receptor modelling



Observation based approaches (e.g. increments)



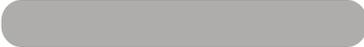
Other



Which type of guidance is most lacking to support source apportionment

038

Support to select a fit-for-purpose method
 39 %

Support to apply the method
 11 %

Support to interpret the results and use them to support air quality plans
 47 %

Support to estimate the uncertainty associated to the results
 61 %

Other
 3 %