



FAIRMODE

2017-2019 roadmap

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Introduction

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). Its aim is to bring together air quality modelers and users in order to promote and support the harmonized use of models by EU Member States, with emphasis on model application under the European Air Quality Directives. FAIRMODE is currently chaired by the Joint Research Centre of the European Commission. This document summarizes the FAIRMODE work-plan for the years 2017-2019. The terms of reference of the network are first recalled before introducing the structure and work-plan and associated deliverables. The connections between FAIRMODE and other activities are finally discussed to provide a view of the network in a broader context.

Terms of reference

FAIRMODE is a Forum for Air Quality Modeling created for exchanging experience and results from air quality modeling in the context of the Air Quality Directives (AQD) and for promoting the use of modeling for air quality assessment and management in a harmonized manner between Member States. Its main objectives are:

- To provide a permanent European Forum for air quality modelers, to address air quality modelling issues
- To study and set-up a system (protocols and tools) on the quality assurance and the continuous improvement of air quality models and input data operating at different spatial scales from national to urban and local.
- To provide guidance, support the standardization and evaluate the fitness-for-purpose of air quality models and input data, for assessing current and future air quality within the framework of implementing the EU's Air Quality Directives.
- To support air quality management (at the national, regional and local level) in developing and implementing plans and measures to improve air quality with efficient modelling tools.
- To promote capacity building activities aiming at ensuring an optimum use of the proposed common methodologies and guidance and to promote good practice among the EU Member States.
- To make recommendations on future priorities, research activities and other relevant initiatives to secure Air Quality improvements.

Users of the network

The FAIRMODE network intends to support model users at all administrative levels (national, regional urban and local) in their policy-related model applications. The network aims at establishing tools and

mechanisms to enhance communication and promote good modeling practice. The network provides a framework for exchanging experience at all levels of application, including electronic interfaces, databases and tools as well as workshops, seminars and common projects/activities.

In addition to its national contact points, FAIRMODE is also open to the participation and contribution of regional/local air quality managers (e.g. French ASPA's (Association pour la Surveillance et l'étude de la Pollution atmosphérique), Italian ARPA's (Agenzia Regionale per la Protezione dell' Ambiente)"... and air quality modelling groups in order to cover a wider range of model applications, in particular to cover the urban/regional aspects.

Organisation of work

FAIRMODE structure

The structure of FAIRMODE intrinsically reflects the main recommendations on the use of models identified by the forum already in 2011¹. FAIRMODE identified then the following major applications of models within the Air Quality Directive and agreed to organize its work around these applications:

- Application 1: Assessment of air quality levels to establish the extent of exceedances and establish the population exposure
- Application 2: Forecasting air quality levels for short term mitigation and public information and warnings
- Application 3: Source allocation to determine the origin of AQ standard exceedances and provide a knowledge basis for planning strategies
- Application 4: Development of plans and measures to control AQ exceedances

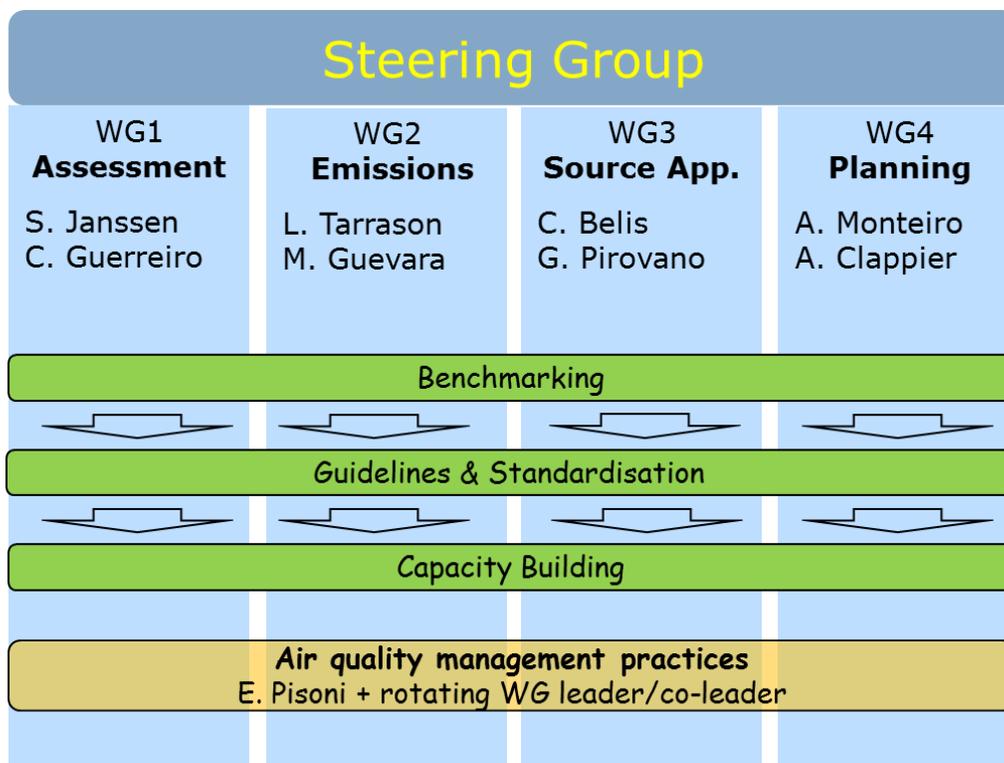
The figure below provides an overview of the organization of work and proposed FAIRMODE structure. The work is organized around four main working groups (WGs), following three of the identified applications above: Assessment, source apportionment and planning. The fourth WG on emissions is present to provide support to the three other WGs as all WGs highly depend on the quality of the emission input data. The fourth AQD model application type mentioned above, i.e. forecasting is included in the WG on assessment. A Cross-cutting activity (in yellow) is aiming at fostering interactions across WG with the particular aim of improving air quality management modelling practices.

FAIRMODE's implementation strategy

It is common to each WG and is highlighted in green in the figure. The implementation strategy is to secure a three-step working process based on 1) Benchmarking, 2) Guidance and 3) Capacity building and Communication. Benchmarking is intended here as the compilation of different approaches and the subsequent development and testing of a standardized evaluation/inter-comparison methodology for collecting and reporting model inputs/outputs in a way that enables relevant comparisons. The aim is to identify good practices and propose ways to diagnose problems in performance. Once a common evaluation/inter-comparison methodology, possibly supported by common tools and/or common

¹ <http://www.eea.europa.eu/publications/fairmode>

datasets is agreed upon, guidance documents can be drafted setting the path to capacity building with the overall objective of promoting good modelling practices among and within Member States. One advantage of this structure is that it guarantees guidance being produced within the FAIRMODE network. Communicate these good practices, identified by expert groups to the broader FAIRMODE community that includes also national and local authorities in charge of the application of models for regulatory purposes, is also a key task.



Meetings

The meetings include a yearly plenary meeting devoted to national contact points and local policy makers where the main focus is to review the progress made and discuss strategic options and a yearly technical meeting dedicated to model experts to develop and agree on common methodologies, carry out actual benchmarking and establish good procedures and guidance. Independently of these two meetings, capacity-building workshops are organized on specific tools/guidance (e.g. DELTA, DELTA SA, emission benchmarking, SHERPA...).

Plenary meeting: This meeting focuses on policy aspects with the following objectives:

- Review the progress made in each of the working groups
- Communicate good practices for each of the existing applications
- Discuss strategic options

- Approve plans for further developments related to all WG and the cross-cutting activity.
- Gather information from related projects
- Discuss the most efficient way to support DG ENV (e.g. IPR of the AQD, INSPIRE, etc.)
- Explore potential collaborations and funding mechanisms

Technical meeting: This meeting focuses on benchmarking and guidance drafting. The main purposes of this expert meeting is to:

- Identify expert approaches to the activities in the WG work plan
- Report about developments in benchmarking methodologies and indicators
- Report on progress of benchmarking activities
- Formulate good practices in different Tier approaches
- Plan and discuss progress in the preparation of guidance
- Report the feedback of the Plenary meeting to the experts

Training workshops: Once matured, the methodologies and guidance developed within the technical groups can be presented and promoted to a wider audience of (potential) model users. These meetings (devoted to model users/experts applying modeling techniques in the frame of the AQD) can be organized as stand-alone or combined with technical ones.

Expected Deliverables

Although all WGs follow a three-step strategy as mentioned above, all WGs are not at the same level of progress. Some WG will therefore devote more time to the development of benchmarking methodologies than others. This reflects in the detailed work-plan proposed below.

WG1 – Assessment (Lead: VITO, co-Lead: NILU)

The activities within WG1 will be focused around some key tasks:

- WG1 has been working for a long time on a methodology to benchmark model performance. This resulted in the proposing of a Modelling Quality Objective (MQO), which has been extensively tested over the recent year and eventually reached a certain level of maturity and consensus within the community. In order to further consolidate the MQO, it was decided to establish a CEN working group that has the mandate to develop a European standard for this quality objective. One of the main objectives of WG1 is to further support the ongoing CEN work, to perform further testing of proposed modifications in the MQO and to tackle major “open issues” which are identified by the CEN work group or the FAIRMODE community (e.g. high percentiles, limited number of stations available for evaluation...). Other less mature topics outside the scope of CEN will be further investigated such as an MQO for forecasting...

- WG1 has initiated an exercise in which national, regional or local air quality maps are collected and assembled into an EU Composite Mapping Platform. This mapping exercise will be further elaborated as common platform within FAIRMODE and will be used as a catalyst to trigger discussions, such as:
 - border effects which will become visible between neighboring regions/countries,
 - use of data assimilation or data fusion techniques to produce air quality maps,
 - quality and consistency of underlying emission inventories,
 - choice of an adequate spatial resolution for a particular application.
 - applied modelling methodology and approach
 - ...

Furthermore, the exercise can also be used to convince countries or regions that are not yet using models on a regular basis to participate in the process. The platform will improve comparability of assessment methodologies and will make it easier to learn from each other. The platform is hosted in a “safe space” without any link to the formal compliance checking processes.

- Up to now, no well-established procedure has been identified to assess the Spatial Representativeness (SR) of monitoring stations. However, it is recognized that SR is a crucial quantity in the interface between models and monitoring data (e.g. in data assimilation procedures, in model validation...). WG1 will further explore this topic and aims to make progress in the assessment procedure of SR via an inter-comparison exercise and other benchmarking activities.
- The AQD offers the opportunity for MS to report on the air quality status via the use of modelling results. The Implementing Provision on Reporting (IRP) and related e-Reporting process have accelerated and strengthen this possibility and more and more MS are reporting modelling data to date. However, there is still a clear lack of guidance on the use of model results in the formal reporting cycle (e.g. estimation of exceedances, data formats...). It is WG1’s ambition to prepare the ground for a more harmonized approach and to contribute to reporting guidelines.
- WG1 will support pilot regions/cities in their various assessment tasks (QA/QC of modelling results, making sure an application is fit-for-purpose, estimation of exceedances & population exposer, contribute to the e-Reporting process...)

WG2 – Emissions (Lead: NILU, co-Lead: BSC)

The main focus for the next three years will remain on the evaluation of urban emissions. This is because the compilation of urban emissions has very irregular practices across European cities and it uses systematically different practices from emission compilation at national level. This is the case in particular for the residential and industrial sectors which have been identified in past benchmarking activities as the sectors where the largest inconsistencies occur. One of the main aims of WG2 will be to provide guidance on emissions from those two urban sectors but other key issues like agriculture or re-suspension will also be focus of the work.

WG2 will further provide local emission knowledge to the compilation of urban, regional, national and European emission inventories to support air quality assessments and the elaboration of national plans and program under EU legislation.

WG2 will also continue its benchmarking activities, i.e. the comparison of urban against EU wide or national inventories with a view of proposing possible improvements to large scale top-down inventories on the basis of local knowledge. This will be achieved through applying the benchmarking methodology (quality assurance) to a larger number of datasets to capture local specificities across Europe. The extension of the assessment composite mapping platform to emissions will support this benchmarking activity by allowing additional screening, in particular in terms of gridded data.

The future activities of the WG will focus on the following aspects:

- Benchmark local/regional against national/EU inventories, with a view of improving both “top-down” and “bottom-up” regional/local estimates
- Provide relevant feedback to improve European inventories used for regulatory purposes (i.e. EMEP), monitoring services (i.e. TNO-MACC) and integrated assessment (i.e. EC4MACS)
- Provide guidance and identify best practices on local emission compilation with a focus on residential and industrial combustion as well as agriculture and re-suspension.
- Develop the composite mapping exercise for emissions to support emission benchmarking and the interpretation of CTM results and differences between countries (assessment process, WG1)
- Promote the use of the Delta emission tool (e.g. training videos and training presentations on how to interpret the results from the tool) and identify appropriate fora to report and disseminate the knowledge gained (e.g. GEIA, TFEIP...)
- Support pilot regions/cities in the evaluation of their emissions (national plans & programs, emission share...)

WG3 – Source Apportionment (Lead: JRC, co-lead: RSE)

The great deal of information and the experience gained so far with the inter-comparisons and guidance development constitute the starting point for future activities. The last inter-comparison aimed at characterizing a wider range of tools, with particular reference to Receptor Models (RM) and Chemical and Transport Models (CTM). The specific performance indicators developed to assessing model performances in the field of source apportionment have been implemented into the tool Delta SA with the objective to graphically summarize the overall performance to support the users in the assessment of their solutions and to better communicate the reliability of results to the end users. In addition, the web-

based data repository SPECIEUROPE provides ready-to-use input data for source apportionment models (e.g. chemical fingerprints).

The future activities of the WG will focus on the following aspects:

- Develop comprehensive guidelines for RM and CTM approaches on the basis on the inter-comparison exercise and other scientific evidence.
- Promote the integration between RM and CTM in order to take advantages of the strengths of both approaches.
- Develop methodologies to support the evaluation of CTM models, with a particular focus on spatial issues.
- Support to the e-Reporting process (built-in SHERPA report facility)
- Support pilot regions/cities in their source-apportionment estimates (first stage of an air quality plan)
- Perform training activities to disseminate harmonized best practices
- Interact with CEN to take advantage of synergies and contribute to standardization
- A fruitful collaboration has been carried out between WG3 and the IAEA regional projects on source apportionment. This has led to a more efficient dissemination of the FAIRMODE methodologies to countries and experts that were not involved in FAIRMODE (Eastern Europe) and to joint efforts for training and inter-comparison exercises. This collaboration will be continued.

WG4 – Planning (Lead: U. Aveiro, co-lead: JRC)

The activities carried out by WG4 so far led to the development of a methodology to assess the robustness of models when used in a dynamic mode, i.e. when used to assess the impacts of emission scenarios air quality. Specific indicators have been developed as part of a common evaluation methodology (benchmarking) to quantify (1) the absolute response strength in terms of precursor or/and sectors of activity for emission reduction measures within a given spatial domain and (2) the degree of non-linearity of the response. WG4 will focus its activities on:

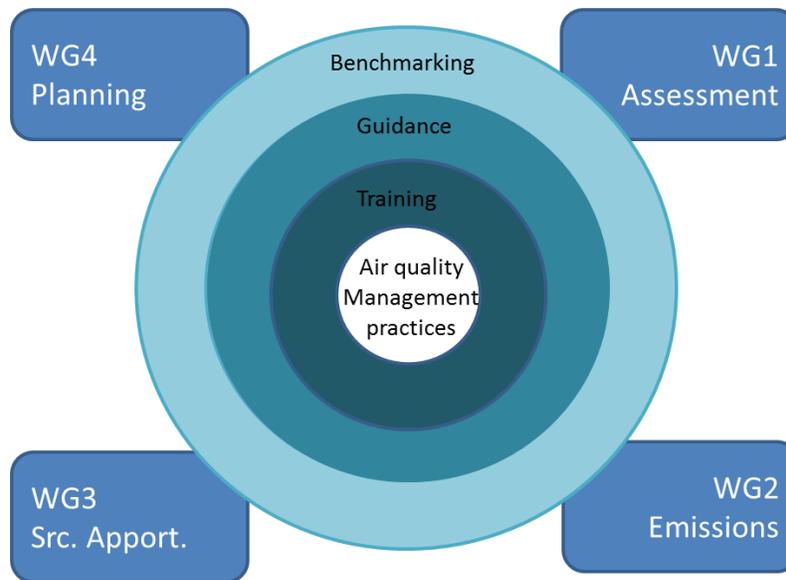
- Further develop the dynamic benchmarking methodology and generalize its application to available datasets. The SHERPA tool (Screening for High Emission Reduction Potentials on Air quality) will be used to support this activity. SHERPA which indeed provides indicators quantifying the response

strength to emission reductions per activity sectors or/and precursors over any area in Europe can be used as a benchmark for this activity.

- In collaboration with WG3 on source apportionment, develop methodologies to identify the spatial origin of air pollution, i.e. quantify the emission contributions from each spatial scales (urban, regional, national, European and extra-European) to the air pollution levels at any given site. These methodologies will be used to validate air quality model estimations.
- Support the e-reporting process, particularly with respect to the estimation of emission contributions from diverse activity sector from various spatial scales (e-Reporting channels H to K)
- Contribute to the harmonization of the specifications used to classify abatement measures that can be selected at the regional/local scales. The identified abatement measures will be classified according to their impacts on emission and concentration reductions.
- To provide overall support to model users (SHERPA, air quality models...) in their planning activities (measures, model scenarios).

CCA – Air Quality Management Practices

The main aim of the CCA is to promote an efficient use of the methodological approaches and guidance developed so far in the various FAIRMODE working groups to support and improve air quality management practices. Pilot regions/cities are invited in the frame of this activity to apply and test the methodologies/guidance (assessment, source-apportionment...) developed within FAIRMODE to their local environment and associated data. Pilot cities/regions will be supported in these tasks by the CCA chair, seconded by the WG chair/co-chair in charge of the applied methodology/guidance. The feedback received from the pilot regions/cities during this process will serve to improve the methodologies and guidance. The overall process is depicted in the “FAIRMODE wheel” below where the “benchmarking-guidance-training” approach common to each WG is applied to specific regions/cities with the aim of improving local air quality management practices.



The CCA work-plan include the following tasks:

- Identify and contact regional/city pilots
- Support regional/city pilots through the 4 WG activities (use of FAIRMODE tools & methodologies)
- Provide ad-hoc support to WG when needed
- Identify success stories& good practices of FAIRMODE work
- Support and link e-reporting activities across WGs

FAIRMODE in the broader context

The figure below illustrates the connections between FAIRMODE and other networks and working groups.

FAIRMODE <--> CAMs

Since the FAIRMODE launch, searching for possible synergies with the Copernicus Atmosphere Service, CAMS, has been a key issue. While CAMS contributes with a series of products and information that may be relevant for all activities under FAIRMODE, it is not always clear how these products can be directly used for the assessment of air quality levels to establish the extent of exceedances, the forecasting of urban air quality levels for short term mitigation and public information and warning, determining origin of exceedances or providing a knowledge basis for national planning strategies. FAIRMODE through its guidance and benchmarking activities can play an essential facilitator role assessing the capabilities of use of CAMS products for regulatory purposes. Experiences of use of CAMS products compiled under the technical FAIRMODE working group activities are to be communicated to the CAMS steering group and effectively contribute to improve the CAMS policy products. In this way, both projects can benefit from each other. Good communication between the two programs is secured by the participation of key scientists in the both groups.

FAIRMODE <--> EMEP Task Forces (TF)

EMEP can support FAIRMODE by helping identifying key problematic areas for which developments in terms of benchmarking are needed. In return the available FAIRMODE methodologies can be used in support the QAQC process of EMEP work, in particular related to assessment (TFMM), emissions (TFEIP) and/or planning (TFIAM). FAIRMODE can contribute to EMEP as by identifying the main reasons driving inconsistencies and differences between national scale assessment versus regional and local assessments, as a result of its benchmarking activities across its working groups.

FAIRMODE <--> AQUILA

Some topics are recognized of being of common interest to both the FAIRMODE and AQUILA community (e.g. spatial representativeness, detection of outlying measurements, measurement uncertainty, assimilation of monitoring data with modeling studies...). Ad-hoc workshops or common sessions on one of these specific themes took place in past meetings and will continue in future.

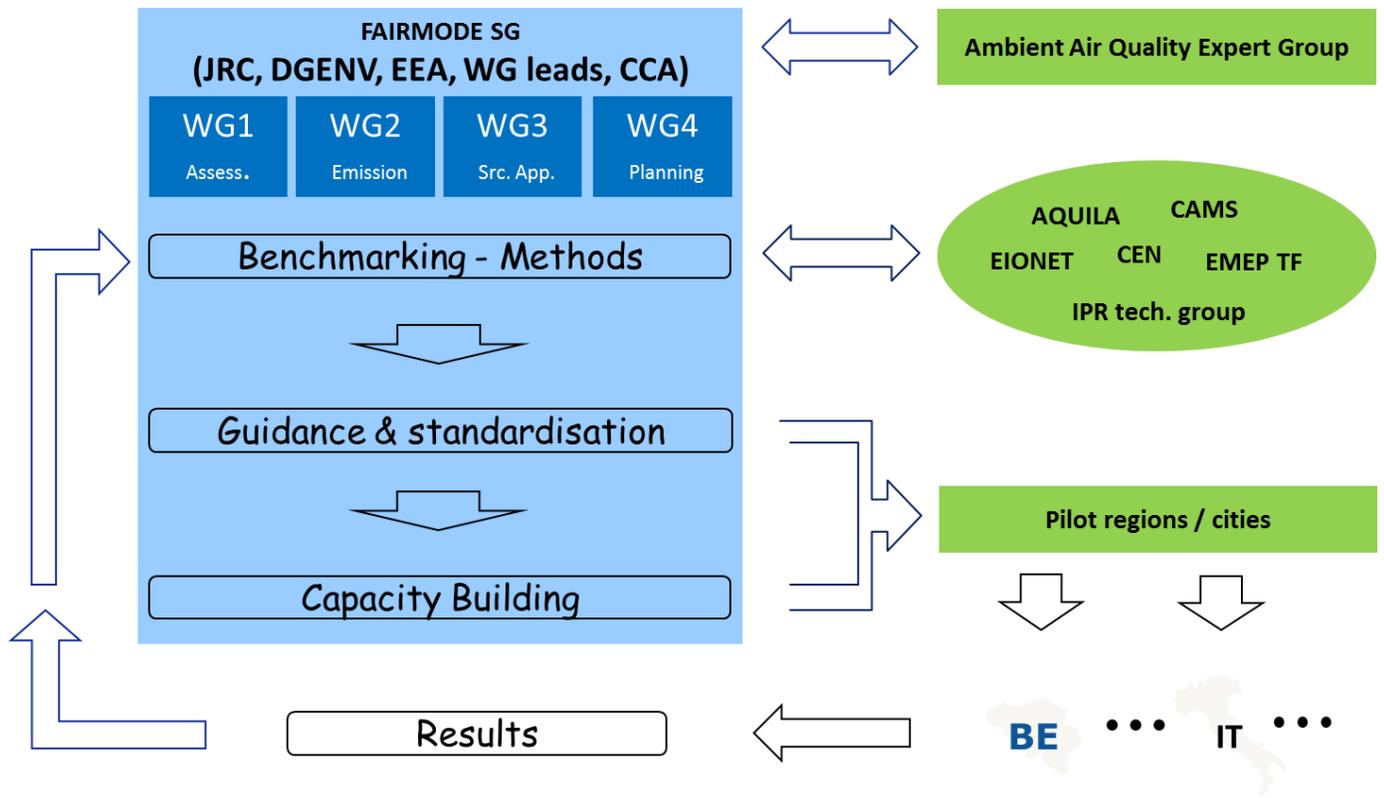
FAIRMODE <--> EIONET

The European Environment Information and Observation Network (EIONET) brings together some of the main potential users of the models results (AQ managers and EEA) with some of the model developers and modelling groups (for instance national groups and some of the partners in the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM)).

AQ managers can be supported in both their assessment and their management practices (since they implement all the activities for which models applications are identified, see “proposed structure”) and also in their reporting obligations. At the same time their feedback and their specific needs are drivers for future FAIRMODE work.

FAIRMODE <-> CEN

The harmonization in the methodologies to assess model performance developed in FAIRMODE are being used in the standardization process started in 2015 with the creation of WG 43 on Model Quality Objectives and WG 44 on Source apportionment. The close collaboration between these two working groups is essential to increase the efficiency of the work and to ensure full coherence between guidance and CEN standards for a better support to the environmental policy.



Mandate and governance

- 1) The Ambient Air Quality Expert Group endorses the FAIRMODE work plan and supports the participation of relevant national/regional representatives to achieve the FAIRMODE work plan goals.
- 2) The FAIRMODE network is chaired by the JRC with the support of DG ENV and EEA. Representatives of these three Institutions form the FAIRMODE Steering Group (SG) together with the chairs of each Working Groups (WG) and the chair of the Cross-Cutting Activity (CCA).
- 3) The SG has the mandate to define and implement the FAIRMODE strategy, communicate to the broader community and contribute to the organization of the FAIRMODE meetings. The SG also secures that activities in the different WG are coordinated. Within the SG, DG ENV ensures that the topics identified in need for further research are included in the priorities of its non-regulatory support actions (e.g. LIFE+ program) and further set-up the frame for relations with the Ambient Air Quality Expert group. EEA supports networking and ensures that experiences and results gained from work within the EIONET network are conveyed to the FAIRMODE community, and vice versa. Both EEA and DG ENV supports FAIRMODE by actively contributing to the review of guidance documents with the focus of strengthening and emphasizing policy relevant aspects of FAIRMODE products. Working Group (WG) leaders share their WG experience and discuss the most effective way of fostering interactions among them.
- 4) The WG and CCA chairs are seconded by co-chairs. Candidates for Chairs and co-chairs are proposed for nomination to the SG by their members for a period of 3 years. The SG can do so at any time either because a current member steps down or because the composition of the team needs to be adapted to the objectives. After their term ends, they may decide to continue as chair/co-chair or they may step down. They are welcome to continue for additional 3-year terms as long as their participation contributes to fulfill FAIRMODE's goals.
- 5) The WG chairs/co-chairs have the mandate to:
 - a. Coordinate the work of the WG by promoting the participation of the experts and distributing relevant information to the WG members
 - b. participate to the FAIRMODE plenary and technical meetings, serving as chairs and providing session summaries
 - c. Continuously monitor the status of the WG activities to ensure high quality meetings
 - d. Contribute to focusing the WG on relevant activities and making recommendations on best practices
 - e. Link to activities and projects that can be relevant to FAIRMODE
 - f. Identify future needs and organize responses to tackle them

Contact points

WG1: Assessment

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WG3: Source Apportionement

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