FAIRMODE Technical meeting
Kjeller (Oslo) 28-29/04/2014

The meeting was attended by about 75 participants from most of the EU Member States and was held in parallel working group sessions (see Agenda). The summary below is structured according to these WG sessions. Action points and associated deadlines are highlighted in bold.

1. WG1: Assessment

WG1 was attended in average by 25-30 participants

Benchmarking

Part of the WG1 session was devoted to the applications of the DELTA tool and its performance report on different regions in Europe. There is in general an increased confidence in the proposed MQO and in the overall methodology to evaluate model performances for a given model application. During the discussion a number of possible improvements (tool and methodology) have been discussed, e.g. improved user's guide, complementary evaluation of the model with respect to threshold limit values (i.e. annual statistics related to the number of hourly or daily exceedances), improved statistical basis for the MQO… While the performance report is seen as a useful source of information for models delivering daily/hourly output, its usefulness for models delivering yearly averages has been questioned. A list of "need to have" and "nice to have" improvements to the DELTA tool will be the basis for the new version 4.0.

Follow-up actions

- **RIVM to propose (based on participants inputs) a list of improvements to the DELTA tool and performance report (May 2014)**
- **JRC to integrate these (part or all) proposed improvements in the DELTA tool version 4.0 (Nov 2014)**

Model Quality Objectives (MQO)

The JRC presented 1) some robustness tests (extended time coverage datasets, tests of specific assumptions…) regarding the MQO previously set for NO2 and PM10, and 2) MQO proposition for new species/variables (e.g. PM2.5, meteorological variables…). A working note on these two aspects had been distributed to interested participants before the meeting and their feedback was then discussed. There is in general agreement on the proposed formulation although some aspects still require further development (inclusion of uncertainties specific to measurement methods (e.g. TEOM or beta-ray instruments for PM10), development of a model quality criteria for threshold value which are key for the Air Quality Directive). A simplified and equivalent formulation of the MQO has been presented by RIVM. This simplified formulation has received high interest from the audience as it might become a useful alternative to discuss with policy makers.

Follow-up actions

- **AEA Ricardo to prepare a summary list of possible changes to the current MQO formulation (May 2014)**
- **JRC to come up with a proposal for including threshold values in the performance report (Dec 2014)**

DELTA database & MDS

The JRC is currently collecting DELTA datasets for "bug-solving" issues. A proposal has been made to share these datasets among the FAIRMODE participants to increase transparency and allow meaningful comparisons with their own datasets. This proposal was well received and the JRC will take the necessary steps to develop a FAIRMODE restricted-access interface. The need to include a minimum amount of information (model short description, contact point, reference year…) accompanying each model application was also discussed and agreed.

Further to the discussions held during the plenary meeting in Baveno, the future use of the Model Documentation System (MDS) in the frame of FAIRMODE has been briefly discussed. The MDS is owned by the Aristotle University of Thessaloniki. The MDS is useful, widely used and would be a complement to e-reporting (see below) and to the DELTA application database mentioned above. The main issue, however, is maintenance and especially the efforts required to maintain its high quality review process. It was agreed that FAIRMODE would wait until more knowledge about e-reporting practices for modelling are gained to proceed further with possible links to the MDS. In the meantime, contacts will be taken with the University of Thessaloniki to investigate possible future collaborations. An alternative approach based on wiki-technologies will also be investigated further. The main advantage of this wiki approach would be its automatic updating based on participant contributions but with the obvious drawback of a limited (or inexistent) review process.

Follow-up actions

- **JRC to develop an interface for dataset exchanges and propose a template for simplified model meta-data (Dec 2014)**
- **VITO to establish contacts with University of Thessaloniki for possible collaborations (Dec 2014)**
- **U. Arhus to assess the feasibility and pros and cons of a wiki approach (Dec 2014)**

MQO & Benchmarking Guidance

Information about MQO and benchmarking is currently scattered in various documents (peer-reviewed publications, working notes…). WG1 is proposing to develop a guidance document on these aspects based on the various sources of information. The document would include both an up-to-date description of the MQO formulation and associated parameters as well as examples of benchmarking applications (best-practices). This proposal was agreed and contributors to writing (AEA Ricardo, RIVM, U. Arhus, IRCEL, U. Brescia…) and reviewing volunteered. The deadline for delivering the guidance is end 2016.

Follow-up action

- **VITO and JRC to come up with a guidance document outline, including possible contributors (Sep 2014)**

Cross-cutting issues as discussed in WG1

Modeling & Monitoring: The discussions focused on two main aspects: (1) the available methodologies to evaluate model applications when monitoring data are assimilated and (2) the need of adapting the current MQO for these model applications. Regarding the second point it was generally agreed that there was no need for an adapted (or more stringent) MQO. Regarding the first point, the results of the evaluation highly depend on the methodology used and further work on these aspects is required.

Follow-up action

- **U. Brescia to investigate further the usefulness of monte-carlo approaches to assess the sensitivity of the evaluation to the choice of the assimilated data sub-set (Jun 2015)**

Spatial representativeness: The discussions focused on three aspects: (1) the methodologies to assess the spatial representativeness of the monitoring stations, (2) the way this information can be accounted for in the model evaluation, and (3) the methodologies to define outliers in the monitoring network. The approaches presented in relation to points (1) and (3) were extremely varied and application-dependent. No recommendation of good-practices or common principles directing towards a unified approach could be identified at this stage. Also for point (2) current approaches are not considered versatile and mature enough to be recommended for universally applicable routine practice.

Follow-up action

- **JRC will investigate the possibility of introducing spatial representativeness into benchmarking applications by using a simplified approach based on geo-statistical methods (Jun 2015). In this attempt variography will be used to quantify the uncertainty component associated to the spatial separation of a model grid point and a monitoring station position.**

Forecasting: The discussions focused on two aspects: (1) the use of the DELTA forecast indicator (based on the persistence model assumption) and (2) The need for additional indicators/diagrams. Regarding the first point, more work is necessary to review the formulation and testing the indicator. Regarding the second point, other indicators currently developed in other projects (e.g. PASSODOBLE) should be considered. One of the main goals of FAIRMODE is however to provide a MQO (i.e. a threshold for a given indicator providing insight on whether the model is good enough) for forecasting and it should avoid duplication with existing work on forecasting indicators.

Follow-up actions

- **JRC to review the forecast target indicator formulation (Dec 2014)**
- **INERIS to test the target-forecast indicator and assess its usefulness in regards of the existing forecasting indicators (Jun 2015)**

2. WG2: Emissions

WG2 was attended in average by 15-20 participants

WG2 is dedicated to the compilation of emission data understanding the processes responsible for emissions. Current WG2 work focuses on mobile emission sources. The first session was dedicated to the presentation of current methodologies to compile urban traffic emission and subsequent identification of areas where further competence is necessary. We had in all six presentations in this session. Three of them focused on the compilation of emission factors for mobile sources and emphasized the importance of real world emission measurements (both for shipping and road traffic). The other three presentations showed examples of bottom-up inventories compiled in Milano, Barcelona, Flanders and Brussels.

The discussion identified the need for guidance in several methodological aspects. In particular, emission factor information for new components like LNG, SVOC and BC is presently missing at COPERT and HBEFA. There is also need for information on the temporal distribution of emission profiles and general process understanding studies to characterize re-suspension and non-exhaust emissions. The group recommended to pursue such guidance and information through cooperation with ERMES and WG3 (see below "Other Cooperation"). It also recommended that FAIRMODE through the benchmarking activities in WG2 provide guidance on which dependencies are more relevant for the urban traffic emissions, and how to secure consistency between BU (bottom-up) and TD (top-down) inventories. The group agreed on the need to begin the compilation of current good practices for urban traffic emissions as a result from WG2 benchmarking activities in 2014.

Follow-up actions:

- **Half-day meeting on good practices for urban traffic emission compilation (Feb 2015)**
- **NILU to coordinate a peer-reviewed article on good practices for mobile emissions (Dec 2015)**

• Benchmarking

The second session was dedicated to the review of the new JRC tool for emission benchmarking and the proposed benchmarking indicators for emission inventories. The JRC presented interesting new indicators and associated diagrams that aim at supporting the review of existing inventories built-up with different methodologies (Bottom-up or top-down) in terms of geographical area, pollutant and sectors. The tool developed by the JRC to manage these emission data was introduced to the participants of WG2. Regional and city datasets were collected before the meeting and preliminary results were discussed during the meeting. The discussion focused on the advantages and disadvantages of this approach and on its feasibility.

The group concluded that the benchmarking tool presently developed at JRC can be very useful to determine the consistency and comparability of urban emission inventories. The capabilities of the tool to compare bottom-up and top-down inventories were especially welcome. Additional developments were identified during the meeting, such as further disaggregation of traffic emission and the need to introduce validation requirements to allow for accuracy checks in the future.

The JRC tool demands some initial upgrading in order to be tested by the FAIRMODE WG2 community. We decided to form a working group for the development of the emission benchmarking tool that will identify the items to prioritize in 2014 and work to produce a first version of the tool by November 2014. This benchmarking development team is formed by NILU, JRC, LWA, AMAT and U. Strasbourg). We also identified a testing group that would both download and test their data in the benchmarking tool and send urban emission data to a common repository. The testing group had many voluntaries to test the approach on their specific region/city inventories, including BSC, NILU, VITO, U. Aveiro, PL, SE, …).

Follow-up actions:

- **Development group to deliver the tool to the participants, including a list of priority items identified during the meeting (Nov 2014).**
- **Testing group (and all interested) to deliver datasets to NILU and JRC (Jan 2015)**
- **½ dayworkshop in Baveno previous to the Plenary meeting to discuss results and next steps (Feb 2015)**

Cross-cutting issues as discussed in WG2

The third session was dedicated to the discussion of cross-cutting issues.

Station representativeness: Progress with different methods pursuing the characterization of station representativeness was presented in this session. The aim was to identify the type of emission information required by some of the methods. VITO uses emission information in a way that is relevant for monitoring station classification but it requires very detailed emission data with 75m resolution (!). We agreed to promote communication between the emission experts and VITO to allow for exchange of emission data where available.

Follow-up action

- **Introduce a list of contact points in the WG2 website for urban scale detailed emissions**

Forecasting: The work carried out at the cross-cutting activity on forecasting have several aspects of great relevance to emissions. The issues identified by the forecasting activity are all in the WG2 work plan and are important to set priorities to WG2 work. The main issues are: I. the comparability of bottom up approaches and top down because this is a problem affecting forecasting cascade activities; II. the temporal distributions of the emission with special focus on the interactions with meteorology; III. the description of vertical profiles of the emission data as they are also interactive to meteorology (injection heights); IV. The characterization of re-suspension processes that are also meteorology dependent ; V. the need for near real time emission data to feed in AQ forecasting. Cooperation with the cross-cutting activity can also in return provide more insight in emission processes no less concerning forecasted natural emissions like natural dust, sea-salt or biomass burning episodes.

Follow-up action

- **Inform the forecasting activity on comparability results from benchmarking in WG2 in a cross-cutting session (Technical meeting 2015)**

Model and Measurements: The activities on model and measurements are very relevant to the study of accuracy of emission data. In 2015, the goal for WG2 is to work further to identify good practices for validating the accuracy of emission data, including the identification of real world emission measurements. This activity links to the work under this M&M activity as well as the work of WG3.

Follow-up action:

- **Involve the M&M activity at the common session between WG2 and WG3 with the aim to identify methods for validating the accuracy of emission data (Technical meeting 2015)**

- ### Other cooperation

The meeting agreed to pursue cooperation with ERMES program with focus on testing their emission factors (EF) for mobile sources. FAIRMODE can contribute to ERMES by providing feedback to ERMES labs on the use of their EF in calculating real world urban emissions. FAIRMODE can also carry out comparability analysis of the data from COPERT and HBEFA and contribute to ERMES with requests for new EFs as these become more relevant.

The WG2 on emissions will focus first on the consistency of emission inventories built up with different methodologies and the comparability of bottom-up and top-down emission inventories. Another issue is however to check the accuracy of the emission inventory, i.e. its validation against measurements. In this respect source apportionment is one potential approach to achieve this goal. Other relevant aspects are the availability of real world emission measurements and the initial ideas about a repository of European source profiles such as shipping emissions, crustal emissions, etc. It has been agreed that a joint WG2-WG3 session would be organized at the next technical meeting to start discussing these aspects and identify future potential collaborations between the two WGs.

Follow-up actions

- **Participation of WG2 chairs at the next ERMES meeting**
- **Common session between WG2 and WG3 with the aim to identify methods for validating the accuracy of emission data (Technical meeting 2015)**

3. WG3: Source apportionment

WG3 was attended by an average of 30-35 participants

The activities carried out by the group in the first three years' work plan were summarized and deliverables already published and those being finalized were explained. J. Watson and J. Chow (Desert Research Institute) delivered the keynote speech: "The Role of Receptor Models in Creating a Weight-of-Evidence Emission Reduction Strategy". Overviews on three challenging types of sources that are currently receiving the attention of the scientific community: vehicle non-exhaust, biomass burning,

ships were delivered. Methodologies for the identification and results in different areas were presented, including a comparison between RMs and CTMs.
A synthesis of the recent Robotic CMB tool was presented. The second part of the session focused on the studies dealing with the organic fraction of PM and the implication for source apportionment. An inter-comparison organized by PSI and LSCE was presented. Different experiences combining CTM and RMs were presented. There was a general agreement that comparing RMs and CTMs provides valuable insights for both model communities. Nevertheless comparison between source contributions is not straightforward due to the different source definition. The outline of the next inter-comparison exercise for RMs and CTMs was presented and discussed with participants.

Follow-up action

- **13 participants gave a preliminary availability for a follow up meeting in September-October 2014.**

Benchmarking and technical work

The working group activity program 2014-2016 including the comments received during the Plenary meeting was illustrated. The new scheme is a continuation of the previous activities combined with an increased attention to the dissemination of results and the feed-back from final users. A new inter-comparison exercise is planned in collaboration with Eurodelta. It is planned to include different sites and source estimation to be carried out with receptor models and chemical transport models. Required input data for the different type of models and potential providers were identified. At present, 18 groups expressed their interest in participating to the inter-comparison. In addition, a repository of source profiles is under development. Participants agreed to contribute with own data or to link this activity with similar ones already running in their countries. Common interest with WG2 was identified on this topic and has been hypothesized a joint session between the two WGs for the next technical meeting.

Follow-up actions

- **LGGE provides additional data for the primary site (Jun 2014)**
- **JRC and TNO take necessary steps to make EI available (Jun 2014)**
- **INERIS, retrieve meteorological data, Warsaw University of Technology converts into WRF (Oct 2014)**
- **INERIS, retrieve boundary conditions from global model (Oct 2014)**
- **U. Genoa, U Athens, CSIC, U. Florence, Warsaw Univ. of Tech., ENEL, FMI, UoB check availability of local datasets (Jun 2014)**

- ## Cross-cutting issues as discussed in WG3

Measurement and Modelling. Availability of advanced monitoring data either for input or for validation of source apportionment output was identified as one of the areas in which work is needed

Spatial representativeness. The discussion conclusions are: a) Due to the characteristics of source apportionment data available, an a posteriori analyses of spatial representativeness based on these data themselves is currently not feasible (limited spatio-temporal coverage). Thus, an estimation of spatial representativeness based on a-priori available information (e.g., emissions, population density, topography, …) seems to be better suited for understanding the representativeness of the sources derived from measurements in one single point; b) A geostatistical approach would require many contemporaneous measurements. Few examples are available; work on these datasets could be of interest.

Follow-up action

- **Check the availability of data suitable for the SR existing methodologies. Identification of possible future activities in MM (Oct 2014)**

4. WG4: Planning

WG4 was attended by an average of 15-20 participants

This was the first meeting for this Working Group.

- ## Benchmarking

The U. Strasbourg presented possible indicators to be used for planning purposes. These indicators and associated diagrams are aiming at reporting in a common and simple way a maximum of information on the model behavior when used to assess the impact of emission reduction scenarios. A tool to manage the scenario simulations has been developed by the JRC and has been presented. VITO and U. Aveiro gave two presentations to interpret these indicators on their own regions (Flanders and Porto area). The discussions mostly focused on the pros and cons of these indicators and understand if these could be considered a good first step forward. Although the preliminary analysis of the results provided insight, participants need to get more acquainted with this methodology. For the next step participants are invited to produce the necessary simulations over their regions and deliver them to U. Strasbourg. These results will be discussed at the end of 2014. A second step consisting in the comparison of different models over the same area has also been proposed but faced some reluctance as this was seen as too much work intensive.

Follow-up actions

- **JRC to deliver a user-friendly version of the planning tool (Sep 2014)**
- **Participating group (BSC, NILU, MetNo, INERIS, VITO, Aveiro…) to deliver scenarios (Oct 2014)**
- **U. Strasbourg to deliver interpretation of the results and decide on usefulness of meeting (Dec 2014)**

5. Common topics

• Standardisation

During the plenary meeting in Baveno held in February the possibility of launching a standardisation process for some of the issues currently addressed within FAIRMODE has been discussed. This discussion was triggered by the fact that future work items related to FAIRMODE had been proposed for vote within CEN/TC 264 on "Air quality:

Topic (n) Modeling air quality: performance requirements, validation, QA/QC; relation with FAIRMODE

Topic (o) Representativeness, classification, siting of monitoring stations; relation with AQUILA, FAIRMODE

Topic (t) Source apportionment (receptor models) to explain limit value exceedances; relation with FAIRMODE and JRC initiative

The result of the vote highlighted a high interest for these FAIRMODE related topics from the standardisation national offices. If this interest is confirmed during the next CEN meeting in May 2014, a process to set-up specific working groups on these topics will be launched.

During the technical meeting in Oslo (28-29/04) this standardisation potential process was further discussed. Although a few participants expressed the need to further discuss their position with their competent Authorities, this standardisation initiative received overall support as it was seen as a potential way to conclude the work performed so far in some areas (e.g. the derivation of the model quality objectives) but also as a good way to better support legislation regarding air quality modelling in the future. The main concern raised during the discussion was the need to keep strong connections between a possible CEN working group and the FAIRMODE community to avoid having two groups working in parallel on a similar topic. Regarding the three above mentioned topics, the discussion led to the following considerations:

- FAIRMODE work is central to the work on Topic (1). FAIRMODE recommends to focus on the work on the FAIRMODE development of model quality objectives for the air quality directive,

- FAIRMODE should be an observer in the work with Topic (2). Although relevant the work on spatial representativeness is currently under development and considered not mature enough for standardisation,

- FAIRMODE has gathered considerable expertise on topic (3) on source apportionement. The FAIRMODE contribution can focus on a technical protocol, including quality assurance steps, supported by the results of the benchmarking/intercomparisons.

The FAIRMODE SG sent an email to the National Contact Points to inform them about the process and to get feed-back. If no strong objections are received to this process FAIRMODE will confirm its interest to these topics at the next CEN meeting (May 2014), taking into consideration the above outlined points and stressing the need to ensure the participation of FAIRMODE representatives in the potential CEN working group. If a CEN working group is set up, the FAIRMODE national contact points

should contact their Standardisation Offices (http://www.cen.eu/cen/Members/Pages/default.aspx) to discuss their nomination in this WG.

- ## e-reporting (plenary discussion)

After a presentation of UK highlighting their experience with e-reporting, the EEA introduced a list of specific questions/topics for which the support of the FAIRMODE community would be appreciated. These questions/topics are mainly focusing on the content and format of the modelling data to be reported. Some Fairmode participants (so far INERIS (FR), U. Aveiro (PT), CERC (UK), NILU (NO), SHMI (SE), CIEMAT (ES) IRCEL (BE), Ekonometria (PL), VITO (BE) and JRC) volunteered to support this process. The focus will initially be on assessment topics with the first output to be provided by June and November 2014 (dates of the next two IPR meetings). This activity will be jointly coordinated by EEA, JRC and VITO.

Follow-up actions

- **EEA to send a list of questions/topics to be addressed (May 2014)**
- **JRC and VITO (together with EEA) to coordinate the outputs for the next two IPR meetings (Jun and Nov 2014)**

- ## web-site

A new FAIRMODE web-interface (**fairmode.jrc.ec.europa.eu**) has been developed by the JRC and has been presented briefly. It is intended to supplement the current site managed by the EEA. This new JRC site will be operational at the beginning of May. The Fairmode WG leaders were invited to identify their needs with respect to their WG web pages (contents, format…). The WG leaders will propose and agree on a common template.

Follow-up actions

- **WG leaders to send a template to the JRC for their own WG page (Jun 2014)**
- **All participants to send feedback (Jan 2015)**

- ## LIFE+

The synergies between the new LIFE+ programme and FAIRMODE were highlighted. Participants who are setting up or participating to the call are invited to contact FAIRMODE to ensure links are established and allow mutual benefit for FAIRMODE and the potential LIFE+ project.