FAIRMODE Technical meeting Videoconference 06-08/10/2021

About 200 participants from 30 countries registered to the technical meeting that was held online (initially planned to take place in Oslo) due to the COVID 19 pandemic. The meeting was organized in sessions, each dedicated to one of the cross-cutting tasks (CTs) that constitute the current work structure in FAIRMODE. All CTs had a dedicated session attended by 60 to 80 participants. This document summarizes the outcome of the discussions for each of these CTs sessions. All presentations are available on the FAIRMODE web pages.

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

The discussions in CT1 focused on different aspects related to the extension of the guidance document. These include (1) the ongoing source-apportionment inter-comparison for NO2, also including presentations from the different teams contributing to the exercise, (2) the inclusion of a "dummy's guide" to receptor modelling', (3) the comparison of tagging and brute-force source apportionment results and discussions on the purpose of tagging and brute force. These questions were particularly addressed during the presentation: "Are these techniques similar, complementary or designed for different purposes? P. Thunis introduced a proposal of a harmonized nomenclature to report Source Apportionment results. G. Maffeis finally provided an overview of the LIFE-REMY (Reducing Emissions Uncertainty) project.

Actions:

1. Finalize data analysis and collection for NO2 SA exercise (end of November 2021)
2. Update the guidance document with information on receptor modelling and NO2 (January 2022)
3. Draft a proposal for reporting SA results in an harmonized way (December 2021)
4. Initiate discussions on the complementarity of SA methods, with the objective of a common publication (November 2021)
5. Continue the interactions with LIFE-REMY project

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 goals of this session were to discuss additional Model Quality Indicators and metadata, and to get User's feedback. A second session was organized around a proposal for future developments of the composite platform, focusing on (1) the implementation of a dynamic Model Quality Indicator calculation; (2) the addition of a QA/QC process for emissions and (3) information to support the monitoring design.

Actions

1. Revise and update the additional MQO related indicators in Delta (December 2021)
2. Prepare and share a proposal for metadata to be associated to the MQO
3. Explore technical options to extent the Composite mapping platform with a dynamic MQI functionality.

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'). After a welcome and introduction from the chair and co-chair, a recap of 2021 activities was made (two hackathons, February and May, and developments on the MQO formulation, considering uncertainty of observations, and on one new plot introducing the Mean Fractional Error as supporting evaluation criterion).

Then, some specific results were presented during the session in which the new evaluation framework was tested: forecast on Portugal, from CAMS regional production, and forecast on Kosovo. The presenting groups provide feedbacks and proposals for improving the indicator and the Delta-tool. As a general conclusion, it was confirmed that the modified MQI (including observation uncertainty) provide much more realistic results.

Final there was some discussion on the next steps.

Actions

1. Continue discussion on open issues, providing further results by ENEA and ARPAE and using a questionnaire via e-mail
2. Hackathon in the next months, aiming at finalizing the formulation and the supporting plots and to design the guidance and the scientific publication

CT4. Microscale air quality modelling

Microscale air quality modeling refers to air quality modeling at high spatial resolution (typically order of meter scale), usually focused on urban environments. There were two sessions. The first one focused on the status of the inter-comparison exercise. There were presentations from the modeling groups showing the methodology used for their results for the 'intercomparison exercisei and a first look at the very preliminary analysis of the obtained results.

Additionally, there was a discussion about the procedure to be applied for a detailed analysis of the results for the three steps of the intercomparison exercise using the data of a district of Antwerp in 2016. The procedure would be based on comparing model results with observations from stations for a one-day episode and passive samplers for the one-month campaign of 2016, and intercomparing the model results

for 3 steps (one-day episode, one-month campaign, and the complete 2016). The procedure would address the time and spatial variability of the NO_2 concentrations. Delta BM tool would be used to help this analysis.

Finally, there was a short wrap-up session summarizing the main outcomes of the former session and defining the next steps. A hackathon would be held by January 2022 or before, and the presentation of the main results would be ready for the Plenary Meeting of 2022. The submission of a specific paper about the results of the intercomparison exercise and the start of a new exercise for Gyor (Hungary) would be foreseen during 2022.

Actions

1. Complete analysis of the results of the intercomparison exercise (December 2021)
2. Organize hackathon to discuss results with the participants (January 2022)
3. Prepare next steps: joint publication, follow up exercise in Gyor,… (February 2022)

CT5. Best practices for local/regional air quality management

In CT5 there were two sessions.

In a first session the discussion was about the preparation of the guidance on air quality management best practices. For this activity, CT5 is working on a general section (presenting the results of EU wide activity on the topic, such as from EU projects etc…) and on specific best practices, as compiled by some the FAIRMODE community participants. On this second point (specific best practices) in the session there were various presentations, on:

- Implementing a low emission zone to reduce NO2 and BC
- Acting on non-exhaust traffic sources to reduce PM
- Domestic heating measures to reduce PM and Bap
- Measures on reduce ozone concentrations
- Considering NEC requirements and co-benefits (incl. GHG) in AQ plans

Finally, the next steps for this activity were discussed.

In the second session of CT5, the discussion was about the use of database of measures (as the 'Catalogue of measures' or the 'data flow K in official reporting') to help disseminate best practices. The discussion was about the existing database limitations, and on what and ideal database of measure should contain to be really used.

Actions

1. Finalize the review of the existing chapters of the guidance
2. Finalize the preparation of the additional missing chapters
3. Finalize the first release of the guidance by the next Plenary meeting
4. Start the discussion on the features that an 'ideal database of measures' should have

CT6. Near-real time assessment with sensors

CT6 is organizing an inter-comparison exercise on sensor/model integration. The exercise consists of analyzing the hourly data produced by of some 1500-2000 low-cost PM2.5 sensors in the Netherlands. The objectives for the benchmark are 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).

During the plenary meeting an overview was presented of the work performed by the CT6 participants. Most of the work was later presented in more detail during the CT6 technical session. During the overview a central message of the CT6 work was presented: "*The quality of the present generation of low-cost PM2.5 sensors is such that results of individual sensors have limited use. When the information of larger numbers of sensors is combined, meaningful results may be obtained. CT6 is working on different approaches to process sensor data and extract the most useful data.*" The use of synthetic data to test different approaches of data selection and calibration was discussed shortly.

Martine van Poppel (VITO) gave a presentation on the status of work in CEN/WG42 on sensors. Whereas the work in CT6 is mainly focused on networks of sensors and statistical methods to combine data, the work in WG42 is focused on the determination of the quality of individual sensors. The merits of both approaches, CT6 and WG42, should be discussed in the near future.

In the CT6 technical session there were several presentations from: INERIS, University of Aveiro, ISSeP, VITO and University College Cork. Presentations were about different approaches of using low-cost-sensors: outlier detection, calibration and data fusion of the results.

CT7. Compilation of urban scale emission inventories

Various sessions were organized in the emissions CT. After a brief introduction, there were sessions on:

Best practices with focus on off-road transport emissions, and temporal variability of emissions; current practices, the way forward and best practice document and recommendations were discussed.

- CT7 focused on non-road mobile machinery (NRMM) in construction as part of the off-road transport sector. We presented the results from the Questionnaire to map practices, distributed after the plenary meeting and the state of new developments at NILU. The lessons learn from the questionnaire were; I) NRMM in construction has received less attention than other sectors at urban scale; II) The contribution from this sector to total emissions shows a wide range of results; III) Spatial distribution; use of traditional proxies (population, land use data) in combination with more sector specific (employment data, building construction). IV) Temporal distribution; not addressed or simple approaches are applied; V) Important gaps concerning non-exhaust emissions.
- NILU presented the new developments for modelling emissions from NRMM in construction. The most relevant points from the discussions are; I) This sector present highly variability in space and

time. The data collection is a challenge in many locations; II) We need specific studies that establish the contribution from NRMM in construction (e.g., exceedances of PM10; exhaust vs non-exhaust contribution…). This is key to evaluate the level of resources dedicated to this sector. We will keep the development and benchmarking with downscaled emissions inventories to assess consistencies/inconsistencies.

- The topic on the temporal variability of emissions was introduced for the first time in CT7. Several contributions from CT7 participants were presented (UBA, TNO, CERC, NOA, NILU and BSC) focusing on the current practices used to estimate temporal profiles associated to different pollutant sources, including road transport, energy industry, residential combustion activities and agricultural activities (livestock and use of fertilizers). Several lessons learned were derived from the presentations:
    - Large impact of using dynamic versus static temporal profiles on NH3 emissions and concentrations
    - Need to consider not only sector-dependent profiles but also pollutant-dependent (e.g., NH3 from use of fertilizers versus PM10 from agricultural waste burning activities have a completely different seasonality but they both belong to the same GNFR sector)
    - Importance of the spatial variability on the residential heating season (linked to different climate zones)
    - Residential wood combustion versus cabin wood combustion: need to be treated separately as they occur differently on space and time
    - Need to use electricity generation data at the facility- or fuel-level to consider differences in the daily distribution between e.g., power plants versus heating plants and natural gas (usually linked to peaking power plants) versus coal (typically linked to base load power plants)

Update on the CAMS COVID-19 emission dataset: a new CAMS emission product to help quantifying the impact of COVID-19 restrictions was presented by BSC. The product consists on a dataset of daily country-, sector-, pollutant-dependent emission adjustment factors linked to the COVID-19 restrictions for the year 2020. The resulting dataset can be combined with the CAMS-REG European emissions for air quality modelling studies. INERIS is using actively this dataset with the CHIMERE model as part of a report for the European Topic Centre of EEA.

A proposal for an Emission QA-QC methodology: a new screening approach developed by JRC to flag large differences (inconsistencies) between emission inventories was presented. The strength of approach is in its flexibility to select sectors and/or species of interest, areas of study and an inconsistency threshold. The method allows performing comparisons between different emission inventories, different versions of the same inventory or different years of the same inventory. For illustration, results obtained from the comparison of different versions of the CAMS-REG-AP emission inventory were shown. Inconsistencies were found between versions of official reported emissions, which indicate the need to have a better connection between providers and users of national emission inventories (sometime the updates made are not clearly reflected in IRR reports).

The REMY (Reducing Emissions Uncertainty) project was finally presented. At the end of the meeting, summary and next steps were discussed.

Actions

CT7 is a forum to share methods and discuss best practice, and we will continue promoting the discussion of topics that contribute to the improvement of high-resolution emission inventories. In this sense:

- We will keep the development and benchmarking of emissions from on-road mobile machinery in construction with downscaled emissions inventories to assess consistencies/inconsistencies. Depending on the final results, we will evaluate the relevance of continuing investigating
- Considering the number of contributions received for the topic on emissions temporal variability, we will continue exchanging practices and discussing best methods. We expect that results and lessons learned derived from CT7 can be valuable for the improvement of current profiles used for AQ in several frameworks (including CAMS)

On the other hand, results from the new JRC screening approach can be an effective way to establish connection with providers of national emission inventories, and to have a consistent method for comparison between downscaling and urban scale inventories. Next steps should focus on including urban scale inventories in the comparison method.

CT8. Exposure & exceedance indicators and network optimization

With 58 participants, the CT morning session focused on the Spatial Representativeness (SR) inter-comparison. After a first presentation from S. Janssen, to frame the session, there were various presentations with SR analysis for:

- Emilia Romagna
- Poland
- Friuli Venezia Giulia
- Three cities in Sweden
- Spain
- Europe
- Various regions in Germany
- Tuscany

After these presentations on case studies, there was a discussion on the key results and next steps for the activity. In the afternoon the discussion was about the findings of the hackathon on 'exceedance situation indicators', on the lesson learnt from the SR inter-comparison, and on a proposal for a new exercise on network design.

Actions

1. Organize hackathon for further analyze the results of the SR exercise and compile a first set of recommendations (December 2021 – January 2022)

2. Organize a brainstorm to compile recommendation on the estimation of exceedance situation indicators (December 2021 – January 2022)
3. Launch an exercise on network design (November - December 2021)

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. For this activity, a modeling inter-comparison was launched. A. Monteiro detailed the status of the inter-comparison. The comparison of model responses is performed for a wide set of cities in Europe (mostly EU capitals) and two large regions in South Poland and North Italy, addresses PM, NO_2 and O_3 and includes both episodes and yearly averages responses. After the Monteiro's presentation, A. De Meij presented the status of the JRC modelling activities, and then there were presentations from the teams already contributing the inter-comparison, namely from LMD, CIEMAT, MET-NO, IRCELINE and UH. Finally, B. Bessagnet presented an overview of the already delivered results, and there was a final discussion on the next steps. From the discussion arose the need to frame the remaining simulations before the first in-depth analysis.

Actions:

1. As a priority B. Bessagnet will send to the modelling teams a road map for the simulation to be performed in order to complete the analysis. An email will be sent by B. Bessagnet the 14 October 2021 for a deadline to complete the database end of **November 2021**.
2. From December 2021, B. Bessagnet and the core team will finalise the first analysis and write a publication to present the CT9 exercise and illustrate the variability of model responses.
3. As a next step, a proposition to work in sub-group to understand the differences has been proposed through topics like emissions, resolutions, physics and chemistry parameterizations, model set-up.
4. In parallel, as it is an ongoing project, the CT9 platform will welcome new models and results in the coming months to enhance the robustness of the analysis.

Next meeting

The next plenary meeting will take place in spring 2022, tentatively in Brussels. Dates yet to be defined.