AGENDA - WG8 SESSIONS - FAIRMODE PLENARY - 27TH FEBRUARY 2024

09:35 - 11:05	**Monit. Design, Spat. Rep. and Exceed indicators (WG8)** • Discussion on the feedback received relating to spatial representativeness in the draft technical guidance document • Overview of written contributions received and plan for elaboration of a new FAIRMODE document collating experiences from testing the SR methodology • Discussion on remaining open issues
	Coffee break
11:30 – 13:00	**Monit. Design, Spat. Rep. and Exceed indicators (WG8)** • CAMS-FAIRMODE Natural Dust Exercise • Feedback to the draft technical guidance document
	Coffee Break
16:30-18:00	**Monit. Design, Spat. Rep. and Exceed indicators (WG8)** • Feedback on the draft guidance document on the use of the MoNET tool • Feedback to the draft technical guidance document

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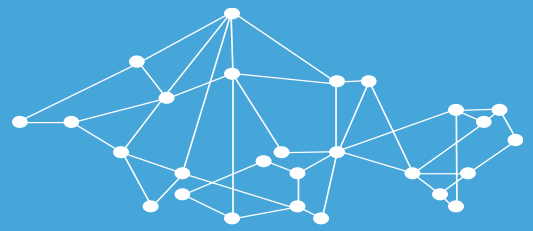
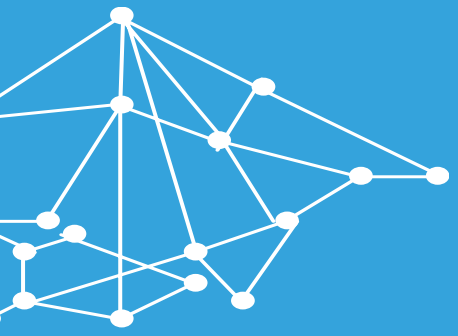
WG8: SESSION ON SPATIAL REPRESENTATIVENESS

TECHNICAL MEETING, 7TH OCTOBER 2024

MATT ROSS-JONES & LEONOR TARRASON





Draft technical guidance document

SPATIAL REPRESENTATIVENESS - DRAFT TECHNICAL GUIDANCE DOCUMENT

Structure of the chapter/sub-chapter on spatial representativeness

- Relevant AAQD requirements

- SR methodology
  - » Criteria for assessment of SRAs of sampling points
  - » Tiered approach
  - » Step-by-step methodology

- QA/QC process and fitness for purpose

Feedback received from the FAIRMODE survey

- Large number of comments on a range of different aspects
- Some covering issues where recent decisions have been made within FAIRMODE
- Some contradictory
  - » E.g. more restrictive/prescriptive guidance VS more flexibility in the methodology
- Clear requests for further practical examples
- Planned changes / additions:
  - » Make clearer that SRAs are only indicative/estimations and have uncertainties
  - » Highlight potential use of SRAs to aid delimitation of AQ zones
  - » Removed the option for using observed values for SRAs, e.g. at rooftop UB stations

Discussion: Key issues identified from the FAIRMODE feedback

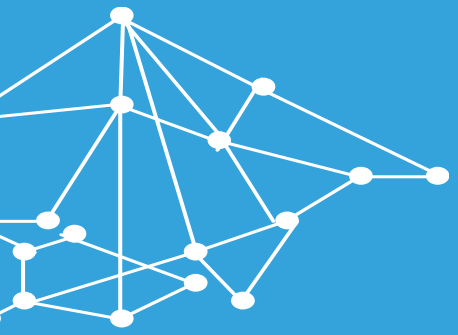
- Source-related criteria
  - » Need for concrete examples of their application

- Geographical limits of SRAs
  - » Stricter limits for urban sampling points? E.g. boundaries of the city/urban area
  - » Further elaboration on the criteria / examples for limiting regional background stations?

- Interannual variability of SRAs
  - » Use average of 3 – 5 years of meteorology? Concrete examples? Other alternatives?

- Use of alternative metrics (e.g. %-iles) - clearer criteria/requirements or flexible guidance?
  - » Different minimum tolerance levels (lower cut-offs) for these?

- Use of raw vs corrected data – restrictive or flexible guidance?



New document with country experiences / good practice examples

Written country contributions

- Request for contributions sent out on 11th June

- Contributions received from:
  - » Italy
  - » WG4
  - » Austria
  - » VITO (IE, HR, SK, BE)

- Contributions expected from DE & Berlin, Stockholm, FR (in 2025). SK?

Plan for the new document

- Proposed structure
  - » Key criteria for the SR methodology
  - » Open issues
  - » Annex with country experiences / good practice examples

- Aim for a first draft by the 2025 plenary meeting

- Comments / ideas regarding the structure & timeframe?

Need for further testing / examples relating to open issues

- Scope for further testing to produce examples relating to open issues?
  - » Source-related criteria
  - » Different approaches for setting geographical limits of SRAs?
  - » Interannual variability
  - » Use of alternative metrics & need for alternative minimum tolerance levels for these
  - » Raw vs corrected data
  - » Examples for B(a)P, CO, SO_2, benzene, metals
  - » Use of lower-tier methods

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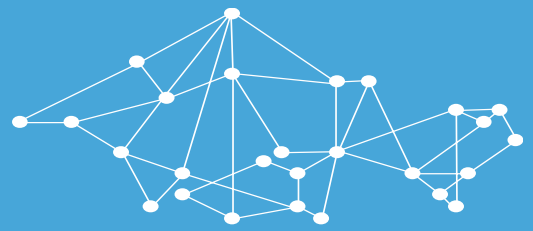
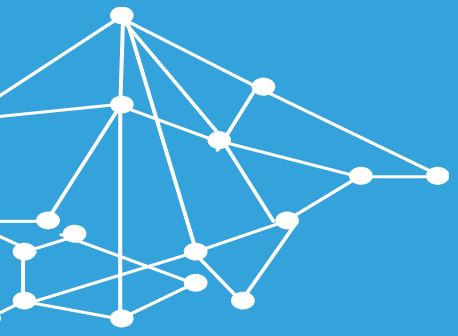
WG8: SESSION ON EXCEEDANCE INDICATORS

TECHNICAL MEETING, 7TH OCTOBER 2024

LEONOR TARRASON, MATT ROSS-JONES & ALEXANDRA MONTEIRO

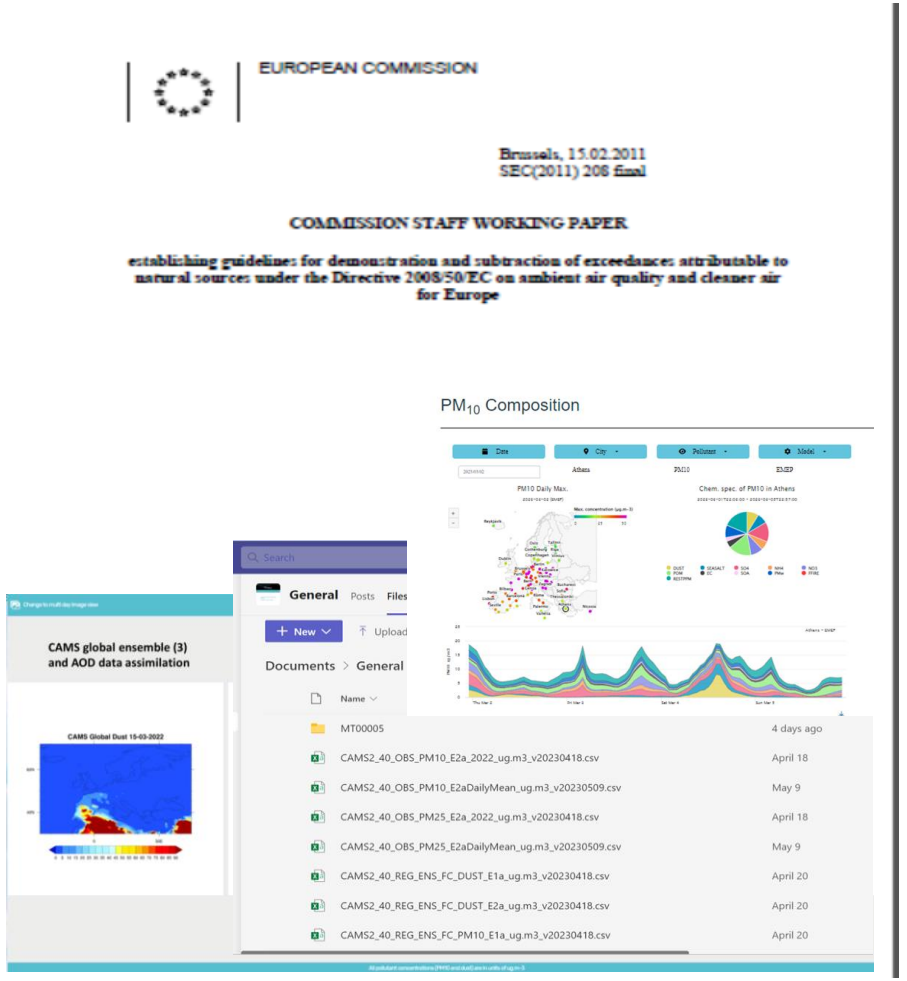




CAMS-FAIRMODE Natural Dust Exercise

EVALUATION OF EXCEEDANCES – DEDUCTION OF NATURAL DUST CONTRIBUTIONS

- Joint CAMS - FAIRMODE WG8 exercise
  - **40 participants from 14 countries**: Austria, Belgium, Bulgaria, Croatia, Cyprus, France, Hungary, Italy, Malta, Norway, Poland, Portugal, Spain and Turkey
  - **ECMWF, WMO and EEA** follow closely this exercise
- Purpose of the exercise
  - Identify **best practices** for use of CAMS modelling dust products when deducing natural contribution from exceedances in the context of the AAQD
  - Prepare **recommendations for the inclusion** of reference to **CAMS dust products** in a possible revision of the 2011 guidelines for the deduction of natural contributions to exceedances
- Added value:
  - Promote the use of CAMS dust products for the exceedance analysis
  - Compile experiences of use of CAMS dust products for exceedance analysis
  - Provide recommendations for the evolution and documentation of the CAMS dust products valuable for exceedance evaluation and analysis
- Started in April 2023 - final report in October 2024
  - ✓ CAMS Natural Dust viewer at https://cams271.nilu.no available and sharing of actual data at monitoring stations facilitated in Shaprepoint
  - ✓ Final report aimed by the FAIRMODE 2024 Technical meeting



Atmosphere Monitoring

For use in policy applications, model accuracy is important!

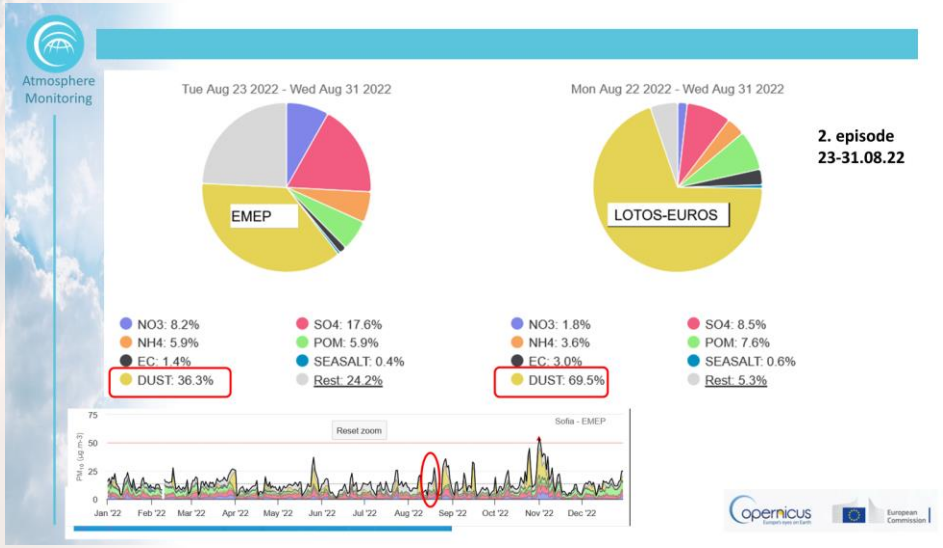
Experience from CAMS2_71 dust episodes studies indicates:

- Regional CAMS dust forecast performs more accurately
  - closer to major dust sources, e.g. dust intrusions from African deserts in the Mediterranean (esp. if dust plumes are wide)
  - more challenging are the cases of relatively ‘slim’ dust plume (Ex. 1)
- It’s more challenging to accurately model PM events due to African dust in Europe, away from the sources (Ex. 2)
- Most typical reasons for mismatch between models and observations:
  - Inaccuracies in boundary conditions (IFS) and model generated windblown dust in N. Africa (amount & location of dust emissions)
  - Dust gets removed from the air too fast (dry deposition - dust size distribution)
  - Modelled plume does not exactly hit the site (shifted in space/time) - Ex. 1
  - Inaccuracy in the transport heights of dust plume

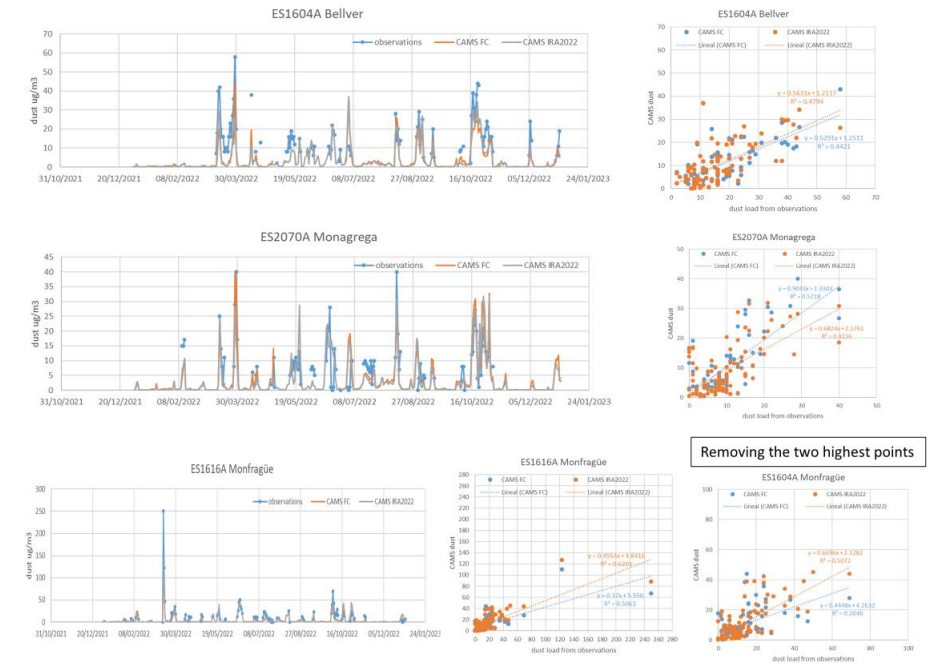
https://policy.atmosphere.copernicus.eu/reports/episodes_analysis.php

Lessons learned (I)

- ✓ IRA results from CAMS with in better agreememt with observations than FC and global model
- ✓ Still large differences in the performance of CAMS in different areas
- ✓ Chemical composition data from CAMS shows large differences between models – may be used as indication of dust episode – not for quantification

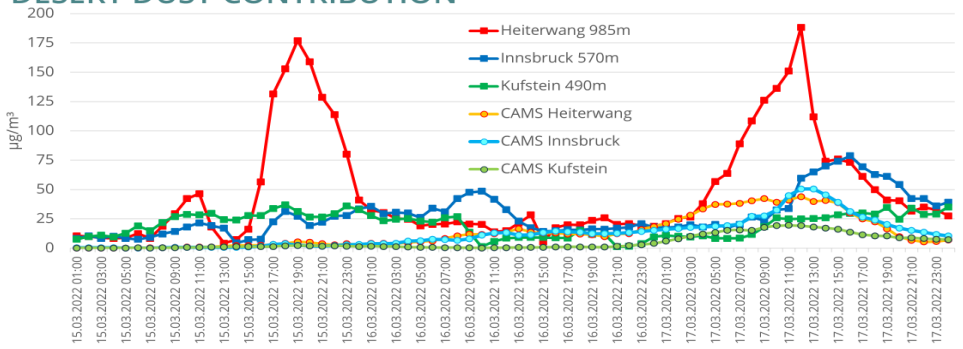


Results: comparison of observations with CAMS natural dust products



umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

MEASURED PM_{10} CONCENTRATIONS, CAMS MODELLED DESERT DUST CONTRIBUTION



Lessons learned (II)

Atmosphere Monitoring

- ✓ Best approaches based on bias corrections instead of direct use of the CAMS PM10 dust products
- ✓ Links to DIAPASON methodology worth investigating further (fed with CAMS RIA and with Lidar data)
- ✓ Combined use of in-situ dust measurements highly recommended

Portugal

- Proposed methodology using CAMS dust products
- $dust\ component = (1 - \frac{PM10_{CAMS} - PM10_{obs}}{PM10_{CAMS}}) \times DUST10_{CAMS}$

			current method P40		CAMS based method	
		PM10 obs (µg.m⁻³)	dust component (µg.m⁻³)	PM10 after dust deduction (µg.m⁻³)	dust component (µg.m⁻³)	PM10 after dust deduction (µg.m⁻³)
SCO	15 mar	423.3	416.2	7.1	349.6	73.7
	16 mar	266.8	259.6	7.1	222.5	44.2
FRN	15 mar	293.8	290.4	3.4	203.7	90.0
	16 mar	582.7	579.3	3.4	375.4	207.3
CHA	15 mar	216.8	206.9	10.0	137.6	79.2
	16 mar	215.5	205.5	10.0	131.7	83.8
CER	16 mar	173.3	166			
	17 mar	115.7	109			

Malta

Malta has applied three different methodologies:

1) Assumption that the DUST data is made up of Saharan dust only without the inclusion of anthropogenic dust (resuspension), agricultural dust, etc.

$PM_{NDD} = PM_{10}total - PM_{10}DUST$

2) Estimating the share of natural dust in the FC and IRA using actual monitored Saharan dust fractions by dividing the monitored Saharan dust by Malta's monitored total PM_{10}, apply that % share to the IRA/FC PM_{10} total and subtracting the estimated Saharan dust fraction.

$PM_{ratio} = (MT_{Sahara}/MT\_PM_{10}total)$

$PM_{NDD} = PM_{10}total - PM_{ratio}$

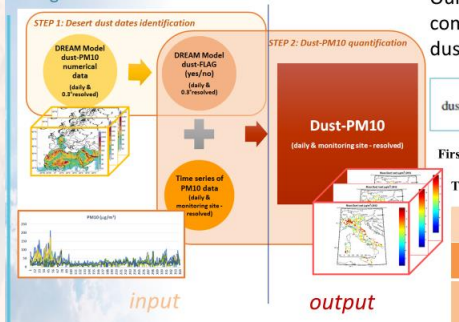
3) Calculating a bias between Malta monitored data vs PM_{10} total and deducting that same bias from the PM_{10} total.

$PM_{BIAS} = MT\_PM_{10}total - PM_{10}total$

$PM_{NDD} = PM_{10}total - PM_{BIAS}$

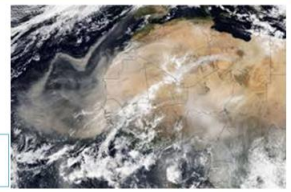
Italy

Explain the dust deduction methodology currently used: DIAPASON



Our method is a modification of the EC-Methodology combining **modelled** dust-PM10 fields (only to flag dust presence) and **PM10 measurements**

$dust\text{-}PM10_{MS}(dust\ day) = \Delta PM10 = PM10_{MS}(dust\ day) - \langle PM10_{MS}(out\text{-}of\text{-}dust) \rangle$



First difference: run over ALL sites, not only over RB sites

Third difference: fully automatic, no supervision needed

The second is that the out-of-dust reference value is computed using the 50th percentile over a shorter temporal window of ±3 days from the dust-affected dates.

In our original methodology, we used the **BSC Dream8bV2** (no more available)

*For this exercise we used the **BSC NMMB model***

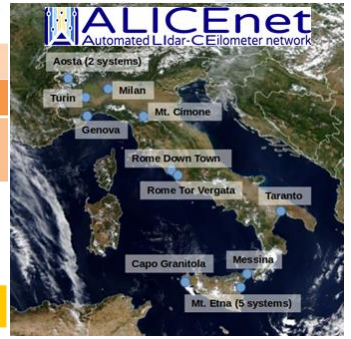
***Acknowledgement: NMMB data were provided by** the WMO Barcelona Dust Regional Center and the partners of the Sand and Dust Storm Warning Advisory and Assessment System **(SDS-WAS)** for Northern Africa, the Middle East and Europe.*

IMPORTANT:

1) **We use <u>daily average</u> PM10 values** (modelled and measured), **as this is the metric currently legislated by EC**
2) **What do we obtain: <u>daily and site resolved dust-PM10</u>**

For the requested exercise we also run the methodology using CAMS

France



LCSQA

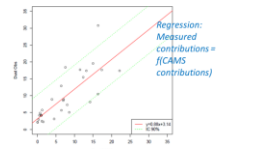
Using CAMS data to quantify dust contributions

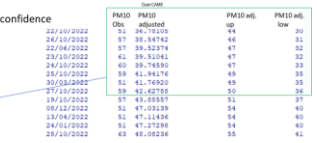
Test : correction of CAMS regional reanalysis data

1) CAMS regional data vs measurements (**assuming they are not influenced by local sources**) : slight negative bias
→ definition of a correction function (by linear regression) to compensate for the bias

2) Application of the correction to all exceedance days
→ Corrected CAMS contribution values + 90% confidence interval

3) Calculation of the adjusted concentrations and related confidence intervals





The adjusted concentration is below the daily limit value with high level of confidence.

Atmosphere Monitoring

Summary and conclussions

- For use in policy applications, model accuracy is important and CAMS is working to countinously to improve and document the the accuracy of our model results
- A detailed guidance on how to best use CAMS products for the identification and deduction of natural dust contribution ot exceedance on the making
  - To be feed on the planned revision of EU 2011 Guidance document
- The CAMS FARMODE Natural dust episode exercise has also helped the CAMS policy product team to identify ways to improve
  - Developement of natural dust viewer with daily and hourly data –new service ?
  - Distinction between natural and anthropogenic dust componets - Documentation of differences between individual CAMS model
  - Identification of approaches to improve the regional IRA dust product

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Atmosphere Monitoring

Contributions- 10 countries

- **Austria** (Wolfgang Spangl, UBA-Viena)
- **Cyprus** (Jonilda Kusta,CYI)
- **Bulgaria** (Emilia Georgieva and Hristina Kirova, National Institute of Meteorology and Hydrology- Bulgaria)
- **France** (Laure Malherbe and Laurent Latenois, INERIS)
- **Hungary** (Anita Tóth, Hungarian Meteorological Service)
- **Italy - Tuscany** (Guglielmo Tanganelli and Francesca Guarneri, ARPAT)
- **Italy** - Diapason (Francesca Barnaba, Cnr-isac, Andrea Bolignano, Enea, and Giorgio Cattani, Ispra).
- **Malta** (Ariana Schembri and Ruth Borg, ERA)
- **Poland** (Joanna Strużewska, IOS, Poland)
- **Portugal** (Carla Gama, University of Aveiro)
- **Portugal** (Joana Monjardino, FCT NOVA, Portugal)
- **Spain** (Noemi Perez, CSIC)

- **FAIRMODE Guidance document**
- **Peer review publication**

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Atmosphere Monitoring

Proposed procedure

1) Measured exceedance at sampling point

Evidence of dust intrusion - CAMS + additional measurement data

2) Check CAMS service for ocurrence of dust intrusion episode (IRA maps as evidence of intrusion)
3) Check CAMS modelled values for the episode at sampling point
4) Review additional sampling evidence in nearby sampling points

Evaluation of contribution of natural dust to the exceedance (possible method)

5) Apply bias correction to measured data from CAMS modelling

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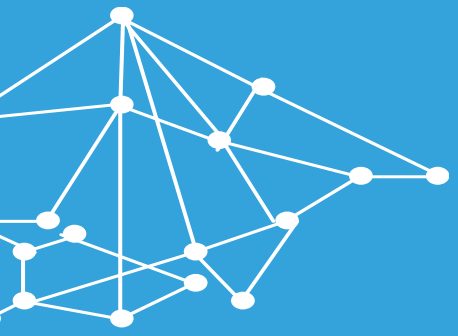
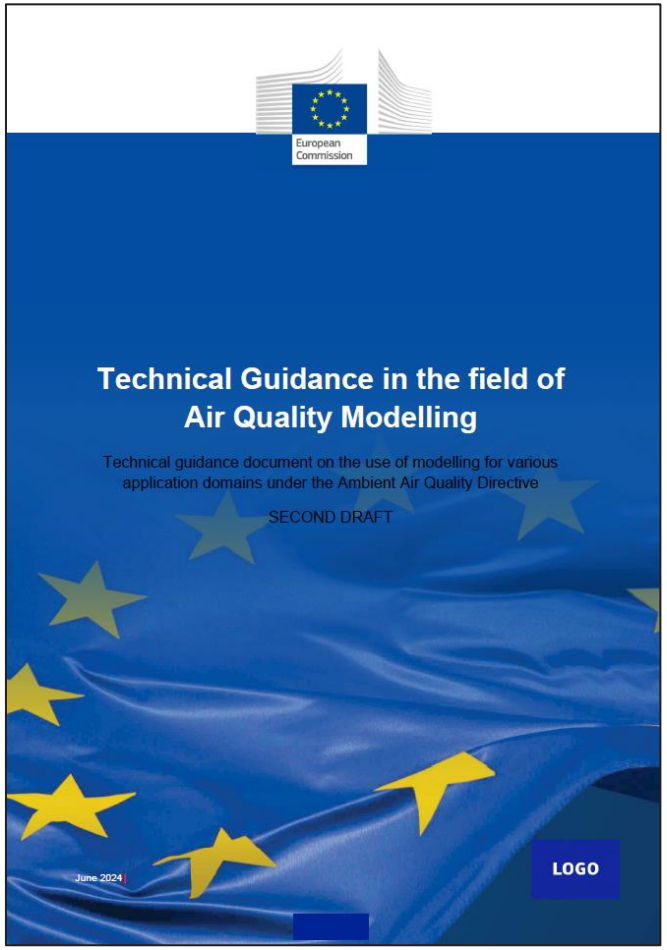


Draft technical guidance document

EXCEEDANCE INDICATORS - DRAFT TECHNICAL GUIDANCE DOCUMENT

Structure of the chapter/sub-chapter on exceedance situation indicators

- Relevant AAQD requirements
- Overview of the ESI's
- Step-by-step methodology for estimating ESIs
- Population exposure modelling
- Recommendations for natural source contribution estimation



Feedback received from the FAIRMODE survey

- Majority of comments related to estimating exposed population

- Number of comments out of scope – e.g.
  - » Indoor air quality
  - » Detailed guidance/examples on the use of dynamic population data
  - » More detailed methodologies for estimating natural source contributions

- Planned changes / additions:
  - » Add some guidance on what to do when only low quality population data is available (?)

Discussion: Key issues identified from the FAIRMODE feedback

- Spatial extent of exceedances:
  - » What to do when a measurement station shows an exceedance but the modelled concentrations do not?

- Exposed population:
  - » What to do when you only have top-down/coarse population data and do not have accurate data on number of residents in specific buildings (for exceedances at hotspots)?
  - » Suggestion to change the recommended minimum resolution from 1km2 to “0.5 km2 or finer” to avoid significant underestimates of the population exposure (based on studies by CIEMAT)

- Road length in exceedance:
  - » How to interpret street/road segments? E.g. Is a road with 4 lanes one segment or 4?
  - » What if there is an exceedance on one side of the street but not the other?

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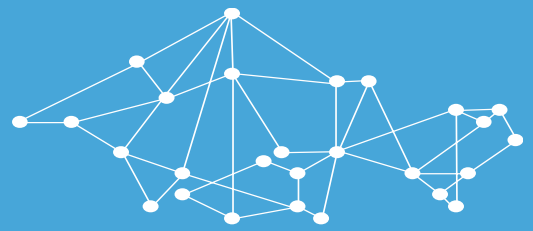
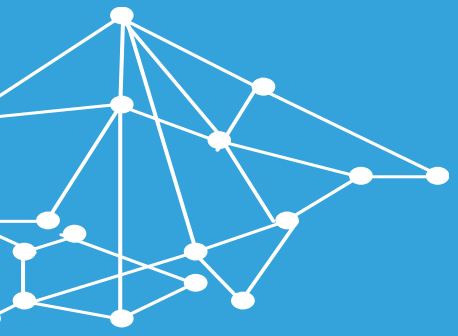
WG8: SESSION ON MONITORING NETWORK DESIGN

TECHNICAL MEETING, 7TH OCTOBER 2024

JOANA SOARES, MATT ROSS-JONES & LEONOR TARRASON

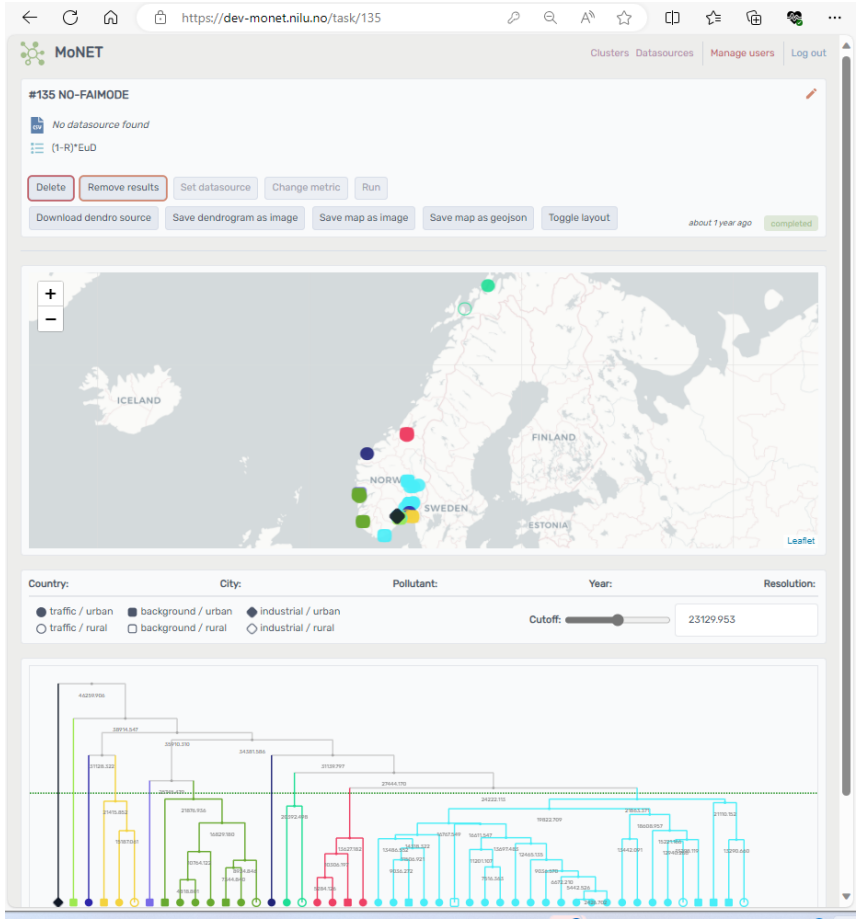




Draft guidance document on the use of the MoNET tool

MONITORING NETWORK DESIGN - DRAFT GUIDANCE DOCUMENT ON MONET

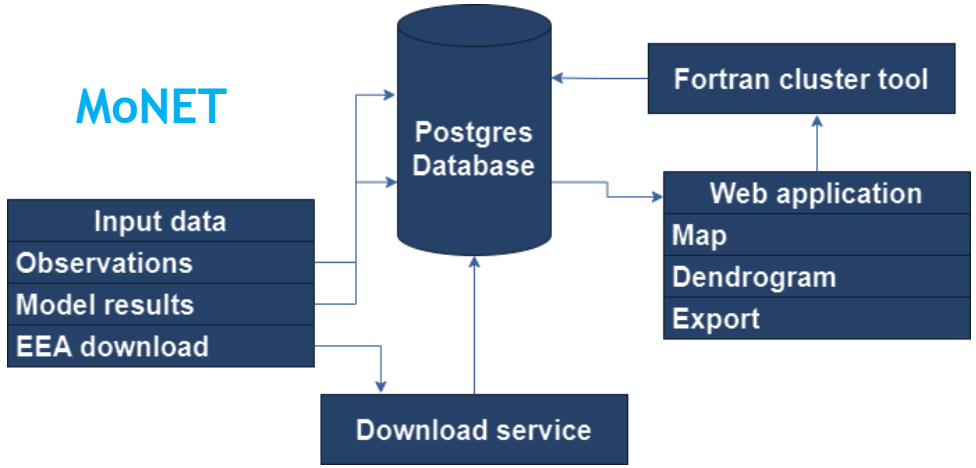
- Guidance document on how to use MoNET for monitoring network desing was drafted
- Eight contributions from the AQUILA-FAIRMODE workshop were included in this document to demonstrate how the MoNET tool can be used to assess the AQMN's representativity
- The document was available for review by the FAIRMODE community until the end of August

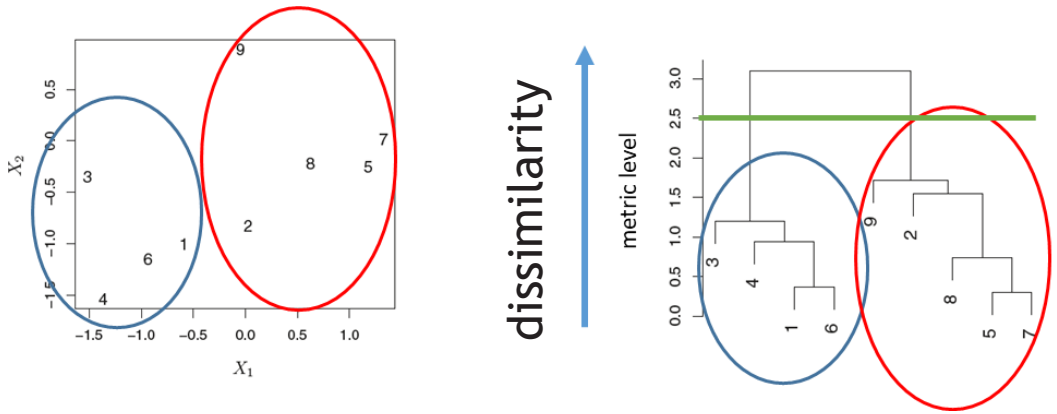


Chapter 2 of the Guidance Document

Methodology for evaluating monitoring representativity

- Statistical method
- Software design
- How to use the tool
- Visualisation and interpretation of the results

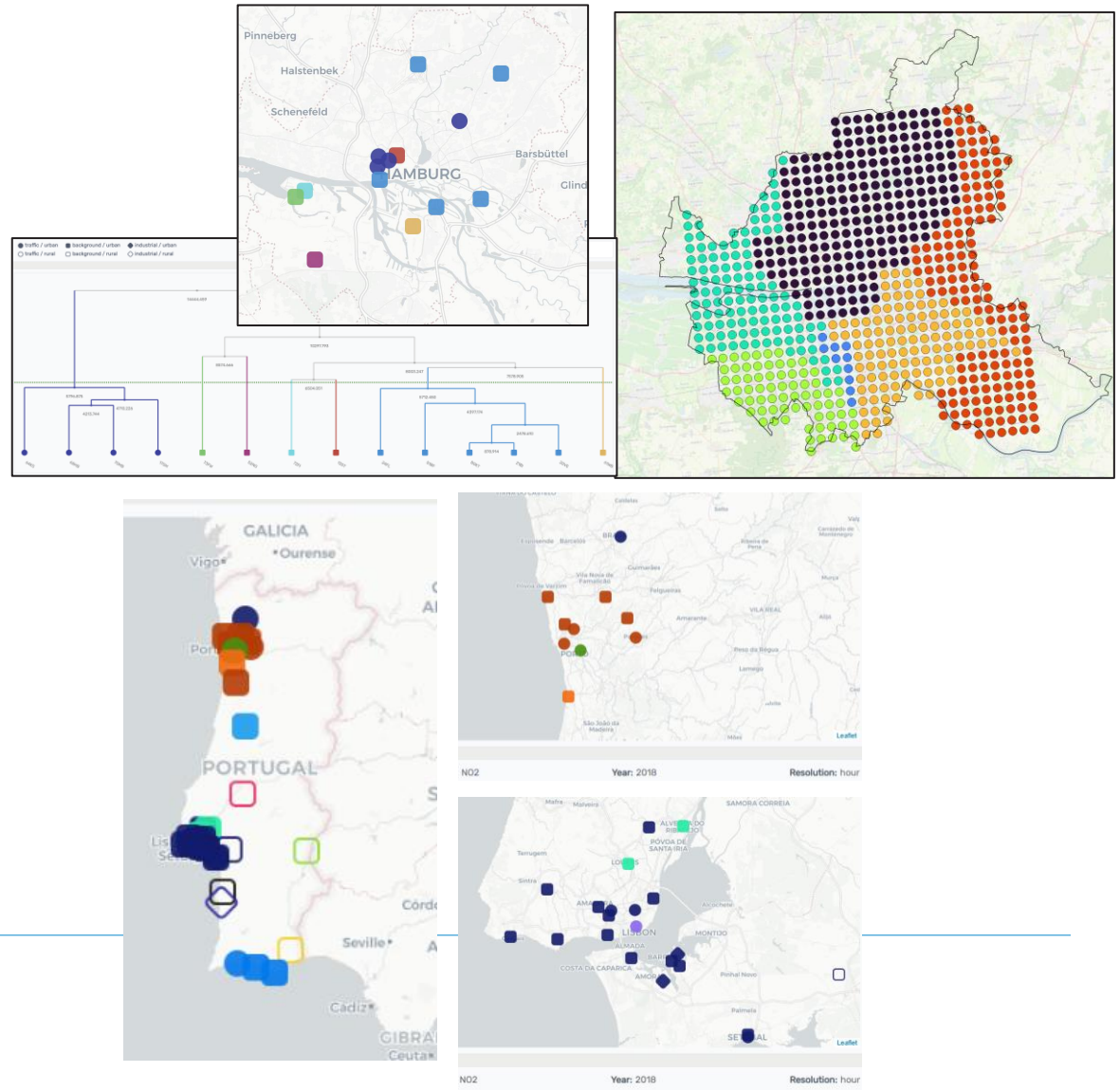




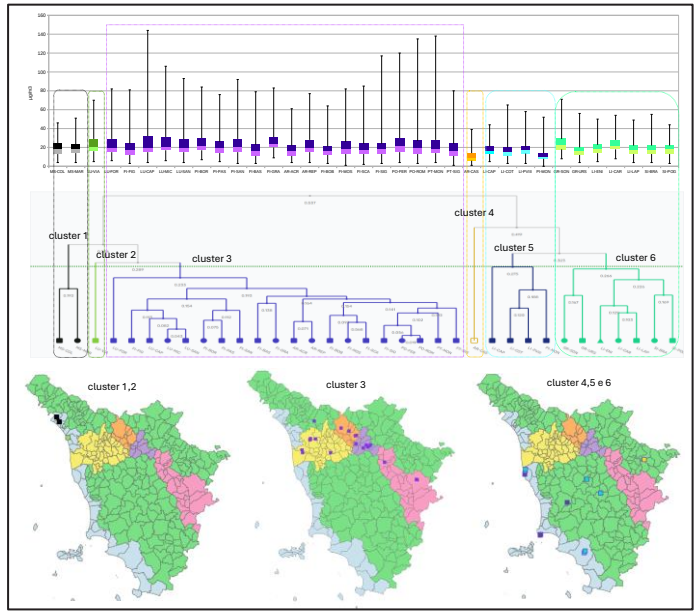
Chapter 3 of the Guidance Document

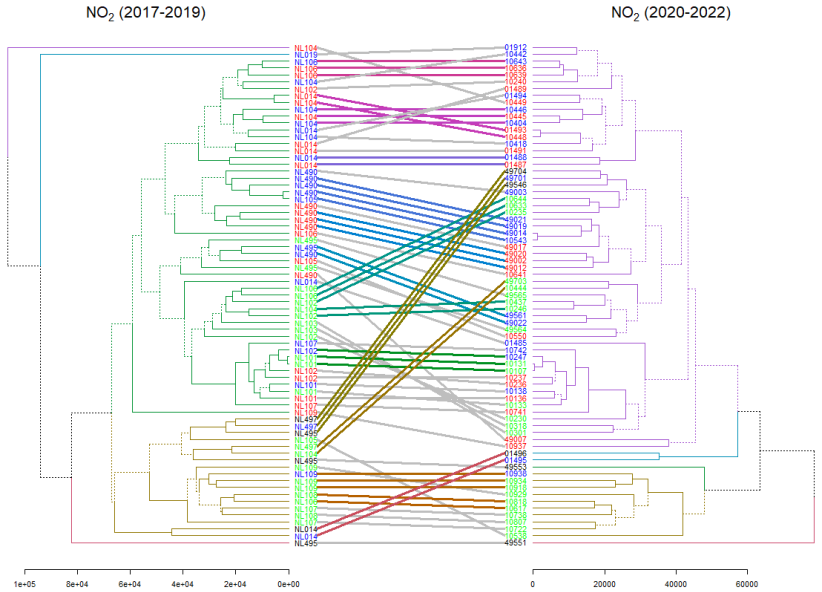
Evaluation of the representativity of the air quality network:

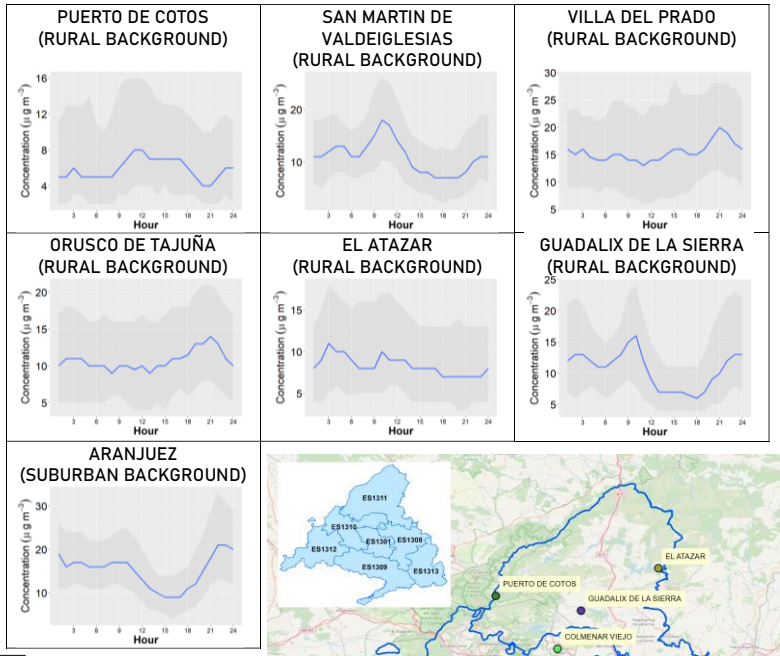
- Pollution regimes
- Flagging of potential outliers and redundancies
- Identification of inconsistencies in sampling point classification
- Assessing spatial gaps
- Evaluation of Air Quality Zones

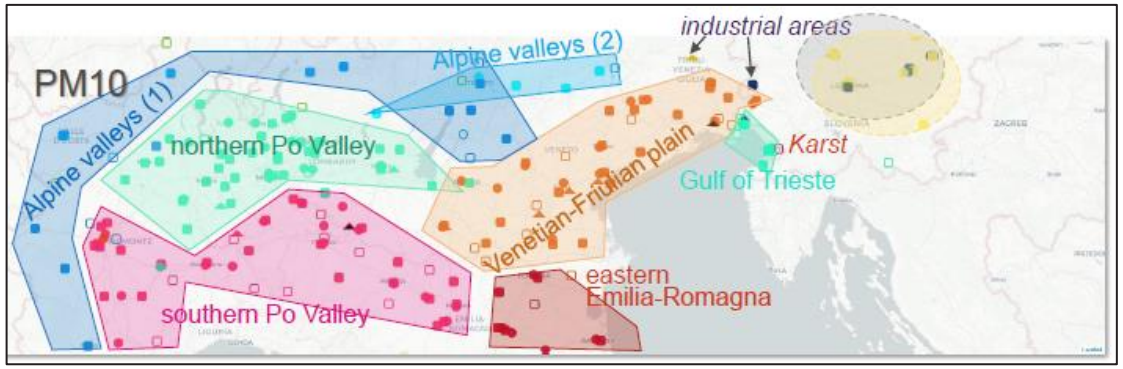


MONITORING NETWORK DESIGN - DRAFT GUIDANCE DOCUMENT ON MONET









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Chapter 4 of the Guidance Document:

Support to monitoring design: a cookbook

- how can we structure this chapter or should we just expand the previous one?
- what information we should include? – this may reflect on the previous chapters
- What is the hardest to make sense of when looking at the results
- Shall it be per topic?

Chapter 4 of the Guidance Document:

Support to monitoring design: a cookbook

- how can we structure this chapter or should we just expand the previous one?
- what information we should include? – th
  the previous chapters
- What is the hardest to make sense of wh
  results
- Shall it be per topic?

Outliers:

1. the first bifurcations of the dendrogram results in a cluster with a single time series or a cluster of a few time series (always relative to the number of time series assessed)
2. Did you expect the time series to be outliers?
   i. Yes – great!
   ii. No – explore the time series and see if there are any differences from the data reported in previous years – new source, issue with the equipment, almost not covering the temporal coverage requested
   iii. Not sure – check the time series, sources, etc.

MONITORING NETWORK DESIGN - DRAFT GUIDANCE DOCUMENT ON MONET

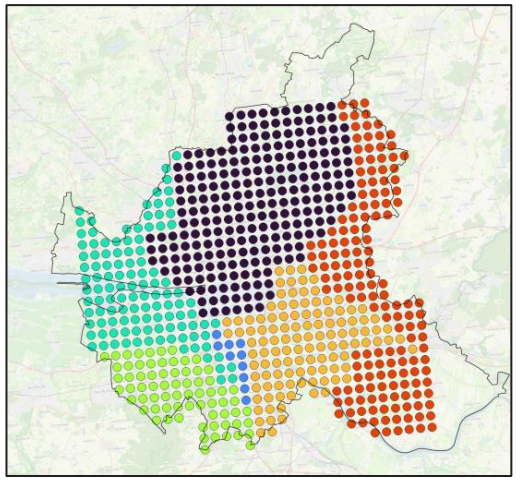
Next steps

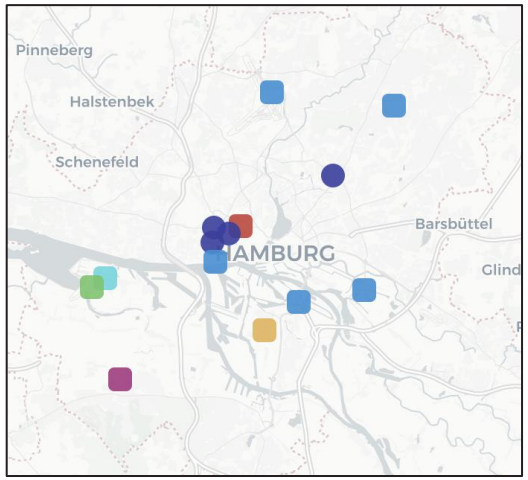
- Write the chapter
- Review of the cooking book chapter – 2 weeks review period
- Finalising the document by the next plenary 2025
- Finish a paper on the tool before the guideline is published

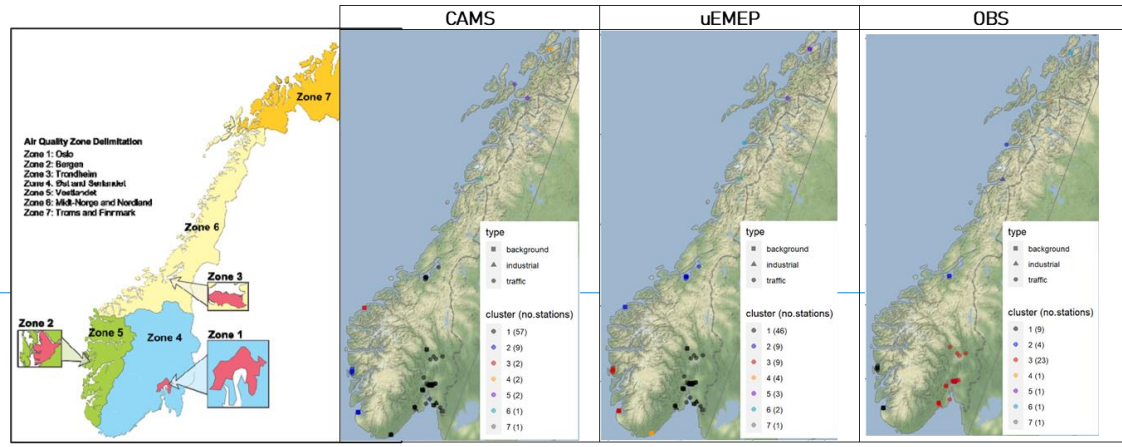
- Next exercises?
  1. Can clustering of model data support the SRA in a city ?

     Comparison of AQ Mon+ AQ model + SRA calculations in a city
  2. Can clustering of model data serve to define the AQzones?

     Comparison of AQ Mon+ AQ model + the countries AQ zone definition







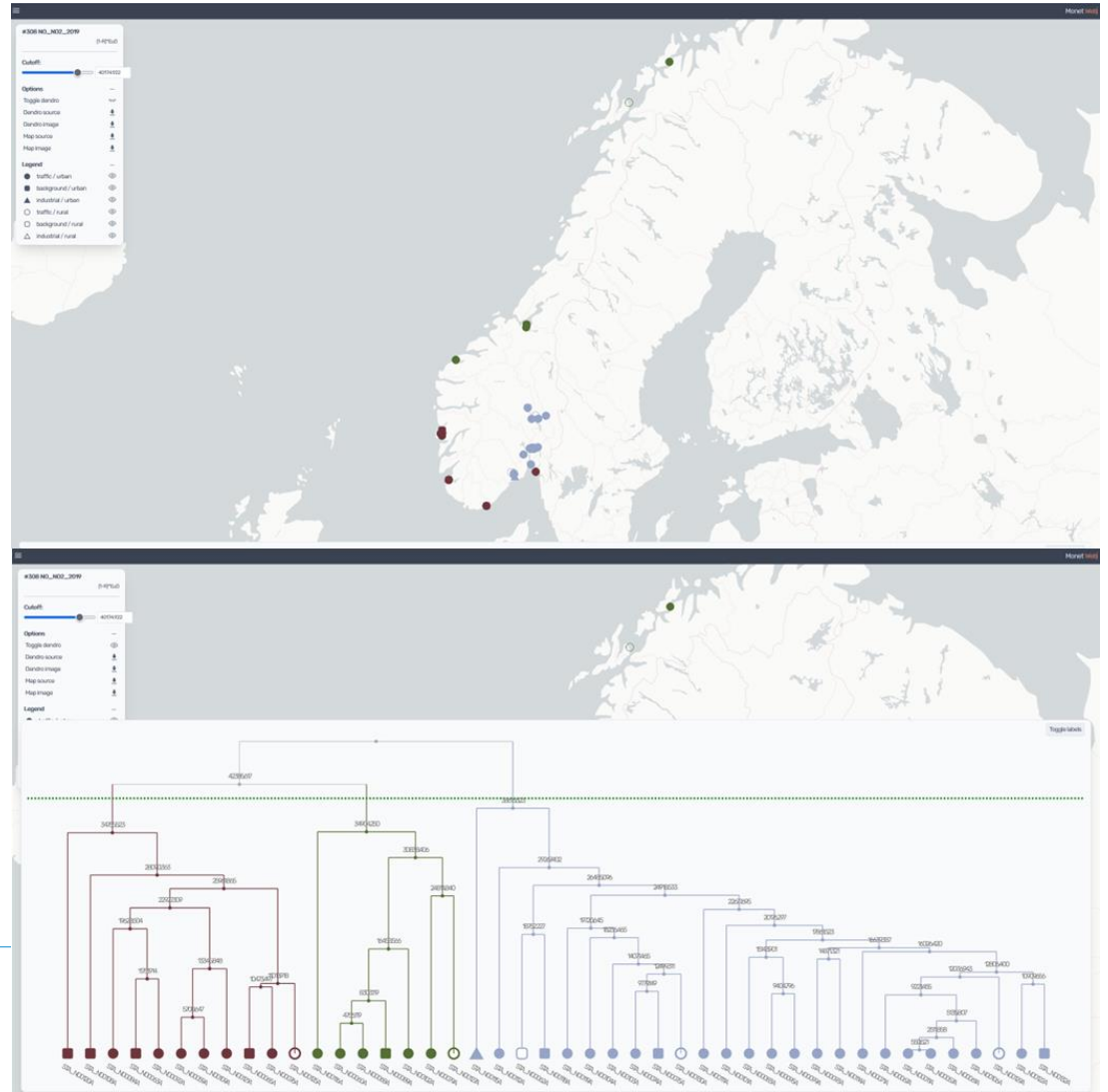
FAIRMODE
Forum for air quality modelling in Europe

MONITORING NETWORK DESIGN - DRAFT GUIDANCE DOCUMENT ON MONET

New version of MoNET available at https://dev-monet2.nilu.no (you can use the same credentials as before)

- Improved visualization of the output, with more features to toggle dendrograms, station types, etc
- Compatible with the new EEA downloading system
- Preprocessor to ensure temporal coverage requirements (75% and gaps)

- Allow model results in NetCDF format
- Improved visualization for model results
- Allow other outputs such as a comparison between 2 case studies



MONITORING NETWORK DESIGN - DRAFT GUIDANCE DOCUMENT ON MONET

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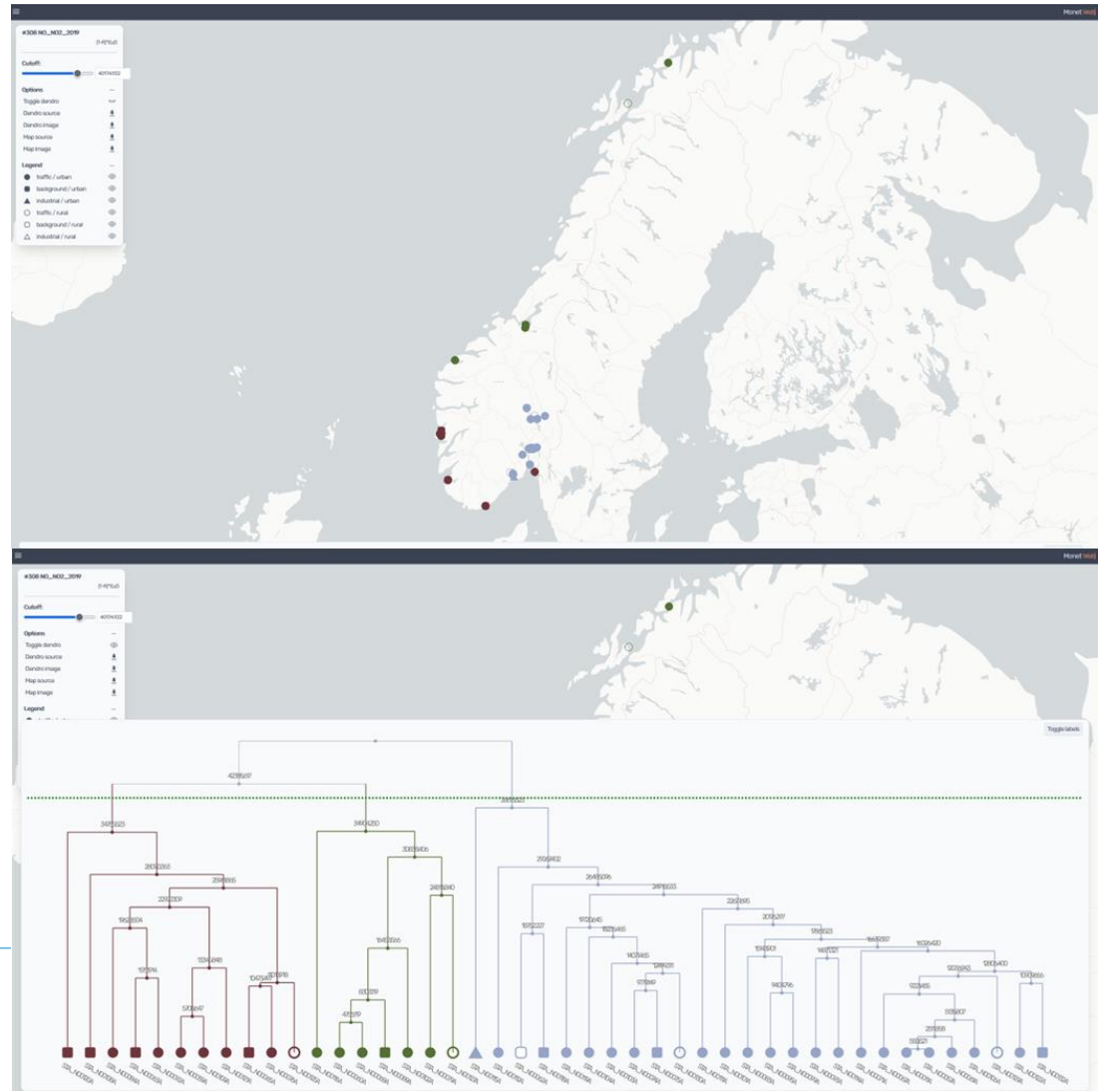
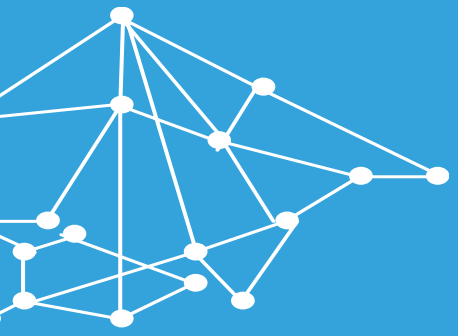
Feedback welcome!

- the new visualization
- Improvements

New to the tool and want to try it?

- Send me an email: jos@nilu.no





Draft technical guidance document

Structure of the chapter/sub-chapter on monitoring network design

- Relevant AAQD requirements

- Methodology for using modelling to aid network design:
  - » Identification of hotspot locations
  - » Identification of background locations
  - » Supplementary methods for reducing min number of fixed measurements

- Regular review of monitoring network design

- QA/QC process and fitness for purpose

Feedback received from the FAIRMODE & AQUILA survey

- Range of comments from both FAIRMODE and AQUILA members
- Clear requests for more guidance on siting criteria, including the monitoring perspective (AQUILA community)
- Number of comments out of scope – e.g.
  - » Detailed guidance on use of other methods (e.g. measurement campaigns)
  - » Require consideration of AQ on carriageways of roads & indoors.
- Planned changes / additions:
  - » Make clear that this guidance does not cover all aspects of network design / siting criteria
  - » Link to MoNET guidance once published
  - » Clearer guidance on addressing potential redundancies

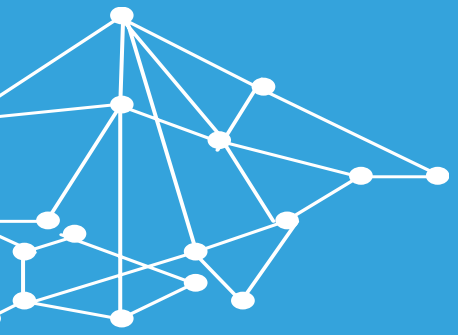
Discussion: Key issues identified from the FAIRMODE & AQUILA feedback

- What guidance is appropriate / useful where potential redundancies are identified?

- Identification of hotspots
  - » How to prioritise hotspots? E.g. highest concentrations or largest exposure?

- Scope for new collaboration/activity with AQUILA to produce more comprehensive guidance on siting criteria / network design, including the monitoring perspective?

Thank you!



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