



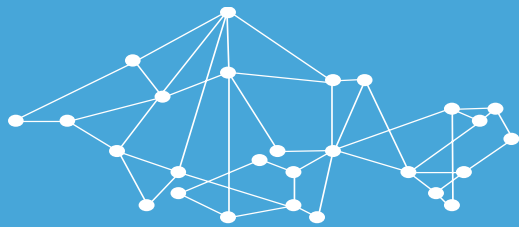
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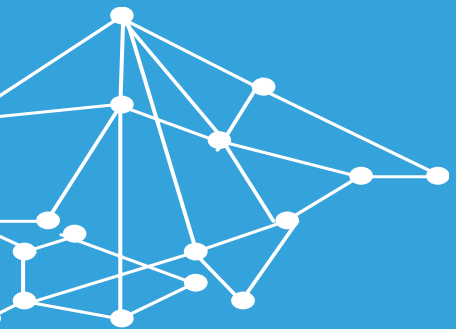
# SPATIAL REPRESENTATIVENESS, EXCEEDANCE SITUATION INDICATORS & MONITORING DESIGN

PLENARY MEETING, 27<sup>TH</sup> FEBRUARY 2024

LEONOR TARRASON & MATT ROSS-JONES



- Status update
  - WG8 subtopics:
    - Results from further testing on spatial representativeness
    - Development of a guidebook on network Design
    - Input from the EEA related to Exceedance Situation Indicators
  - Links to revision of the AAQD, SR9 guidance, IPR & AQUILA
- Discussion
  - Remaining open issues on spatial representativeness
  - Development of a guidebook on network design, including use of the MoNET tool & good practice examples
  - Exceedance indicators – ideas for testing different exceedance indicators
- FAIRMODE-CAMS joint exercise on natural dust



# Spatial Representativeness

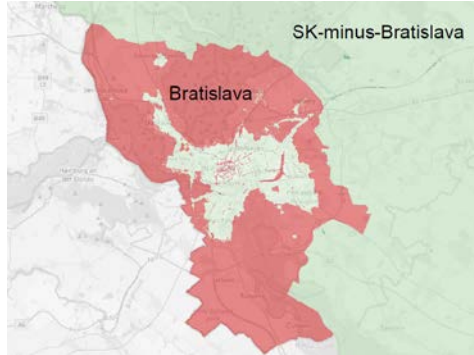
### *Dedicated workshops on testing of SR methodology*

- Two online workshops in Dec 2023 and Jan 2024
- Checklist to guide testing
- Large number of contributions from WG members
  - Dec 2023: VITO (IE, BE, SK, HR), SE, WG4, DE, FR, IT
  - Jan 2024: AT, DE x2, SK
  - Written contribution from IT

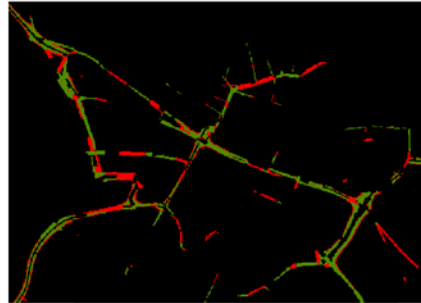


# SPATIAL REPRESENTATIVENESS

## Results from testing of SR methodology



Station : FR25054  
(Petit-Quevilly Sud 3-Traffic)  
Annual mean in NO<sub>2</sub>: 41 µg/m<sup>3</sup>  
Model : SIRANE with data fusion

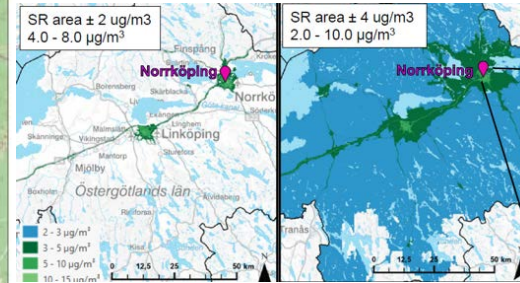
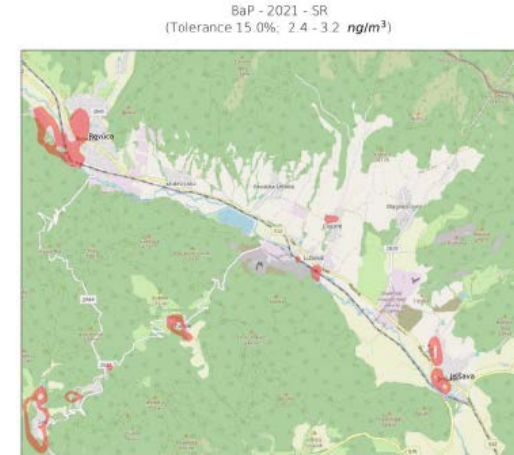
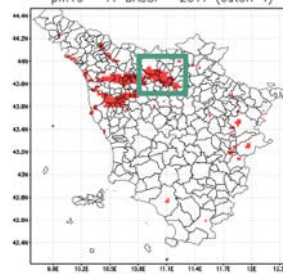
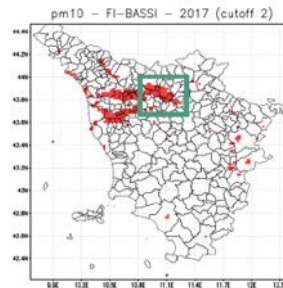
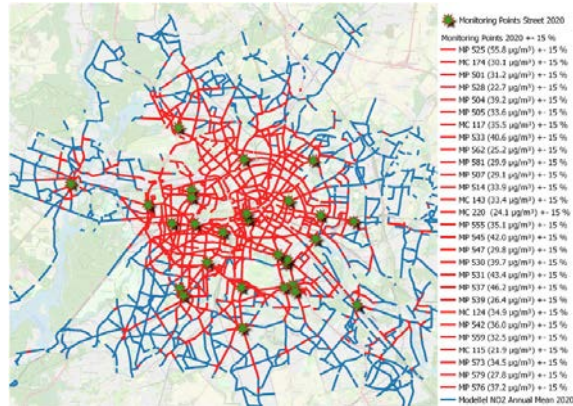
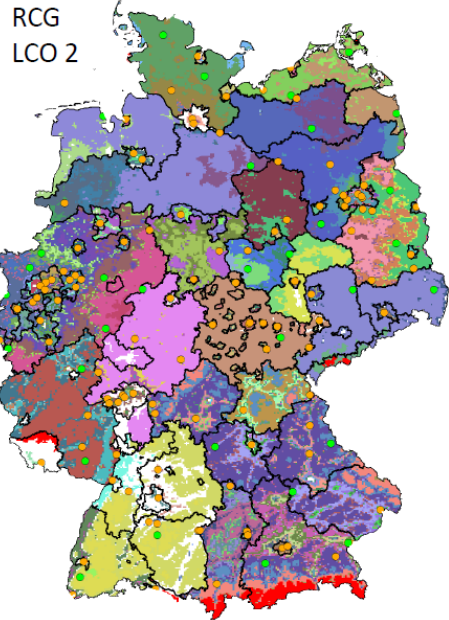
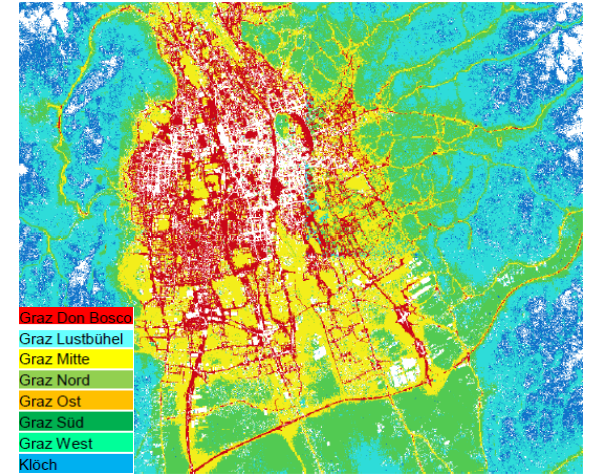
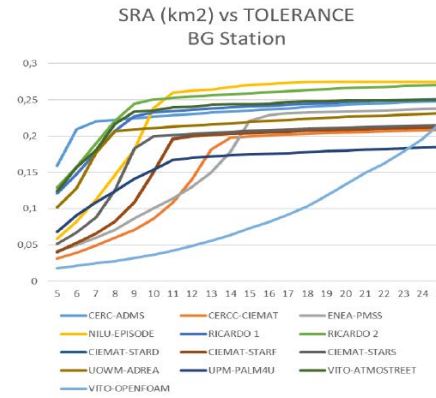


for a TL of 15 %, SR Range : 34.85 - 47.15 µg/m<sup>3</sup>  
for a TL of 20 %, SR Range : 32.8 - 49.2 µg/m<sup>3</sup>

	Surface in Exceedance (km <sup>2</sup> )	SRA at TL = 15 % (km <sup>2</sup> )	SRA at TL = 20 % (km <sup>2</sup> )
SE or SR	1.21	1.50	2.24
% of the assessment zone	0.17 %	0.21 %	0.31 %

Surface in exceedance lower than SR values

TL 15 - 20 %  
TL 0 - 15 %



### *Decisions made on key aspects of the SR methodology*

- Remove the AQ zone limitation of the SR area for rural background stations
  - Use an alternative limit? (question for the discussion!)
- Use a uniform tolerance level of  $\pm 15\%$  for all measurement stations
- Reformulate the definition of the lower cut-off value
  - Use  $\pm$
  - Provide clear examples in guidance
  - Clearer name? (question for the discussion!)
- Agreement on the following lower cut-off values:
  - $\pm 2 \mu\text{g}/\text{m}^3$  for PM10, NO<sub>2</sub>, O<sub>3</sub>
  - $\pm 1 \mu\text{g}/\text{m}^3$  for PM2.5

A number of remaining open issues identified - needing further testing / discussion!



### *Overview of relevant requirements in the proposal for a revised AAQD*

- Significantly increased role of spatial representativeness in proposal for a revised AAQD
  - Definition of SR
  - Criteria for determining SR areas
  - Requirement to provide SR areas for all sampling points in zones where concentrations are >Assessment Thresholds
  - Role in relocation of sampling points
- Design and regular review (at least every 5 years) of monitoring networks shall be supported by modelling and/or indicative measurements



### *Overview of relevant requirements in the proposal for a revised AAQD*

- Different positions in the Council & EP negotiating positions on need for zones to be covered by SR areas of sampling points (Annex IV, B.2(g))
  - EP position (unchanged from COM proposal)  
shall be clearly defined. **The whole zone shall be covered by the different areas of representativeness defined for each sampling points;**
  - Council position:  
shall be clearly defined. **The whole zone shall, where possible, be covered by the different areas of representativeness defined for these each sampling points. Concentrations in areas in a zone that are not covered by that zone's sampling points, shall be assessed with appropriate methods.**





## LINKS TO OTHER ONGOING ACTIVITIES

### *SR9 technical guidance document on AQ modelling*

- Chapter 2 on spatial representativeness & network design
  - Methodology & step-by-step guidance for determining SR areas of sampling points
  - Use of modelling, SR areas & MoNET tool for design & review of monitoring networks
- Chapter 3 on assessment
  - Exceedance situation indicators

### *AQUILA*

- Presentation of WG8 activities during AQUILA meeting in September 2023
- Continued cooperation on monitoring network design / MoNET

### *IPR*

- Presentation of WG8 activities during IPR technical meeting in March 2023



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## Planned next steps

- Continue testing / discussing remaining open issues
- *Review WG8 guidance document – clear links to SR9 guidance*
- *Produce a document with country experiences / good practice*

### **FAIRMODE WG8 – Guidance Document on the estimation of Spatial Representativeness and of Exceedance Situation Indicators**

*Authors: Stijn Janssen, Leonor Tarrason, Matthew Ross-Jones on behalf of the WG8 community  
Version 3: including output of the discussion during the Technical Meeting in Oslo, 18 October 2022  
Date: 21/02/2023*

This Guidance Document summarizes the recent work of the FAIRMODE WG8 community. It provides recommendations for the estimation of Spatial Representativeness of monitoring stations and the estimation of the Exceedance Situation Indicators, both relevant parameters when reporting under the Ambient Air Quality Directives (AAQD). Note that this guidance focuses on the methodologies to be used for estimation of these parameters and provides recommendations on their estimation. In its current version, this guidance does not identify the best ways of reporting those methodologies and their results under the Implementing Provisions on Reporting (IPR).

The recommendations on spatial representativeness have to some extent been taken into account in the EC proposal for the new AAQD. The recommendations on the Exceedance Situation Indicators can serve as a basis for the upcoming review of the IPR.

#### **I. Recommendations on Spatial Representativeness estimation**

##### **Context**

The assessment of the spatial representativeness (SR) of monitoring stations has been discussed within the air quality community for a long time. SR is an essential indicator of any sampling point location and relevant for further interpretation of its measurement data in the context of the EU AAQD. It also plays a crucial role in the characterization of exceedance situations, the evaluation of modelling results and in the design and evaluation of the monitoring network. Therefore, SR is requested to be reported under the IPR and the related e-Reporting system under Data Flow D.

FAIRMODE has been involved in the discussion of SR assessment since the early days, given the potential role of modelling in this assessment process and the relevance of SR in any process where observations from monitoring stations are combined with modelling (validation, data fusion or data assimilation...).

For a better understanding of the concept of SR, it is essential to clearly specify the various application domains of SR. These include:

1. Assessment of population exposure based on monitoring data
2. Assessment of exceedance situations based on monitoring data
3. Monitoring network design
4. Use of monitoring data for model validation and data fusion/data assimilation



# SPATIAL REPRESENTATIVENESS - DISCUSSION

## Remaining open issues

- Relevant size limit for rural background stations?
  - Use NUTS1 (and/or NUTS2) units
  - Use relevant requirements in AAQD on station density.
  - Use expert judgement and limit SRAs based on the conditions present in each country
  - Other suggestions?



### NUTS units in EU-27

NUTS1: 92 units  
average size ~43 000 km<sup>2</sup>

NUTS2: 242 units  
average size ~16 000 km<sup>2</sup>

Source: [Eurostat](http://ec.europa.eu/eurostat)

### Relevant requirements in the AAQD proposal\*

Min station density	Monitoring requirement (RB)
20 000 km <sup>2</sup>	If critical level for NO <sub>2</sub> / SO <sub>2</sub> is exceeded
25 000 km <sup>2</sup>	Ozone in complex terrain
40 000 km <sup>2</sup>	If assessment threshold for NO <sub>2</sub> / SO <sub>2</sub> (related to critical level) is exceeded
50 000 km <sup>2</sup>	Ozone
100 000 km <sup>2</sup>	Rural supersites

\*Also 1 000 km<sup>2</sup> and 10 000 km<sup>2</sup> as max representativeness for different rural ozone stations



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### *Remaining open issues*

- Lower cut-off values for remaining pollutants. Suggestions so far:
  - ± 1 µg/m<sup>3</sup> for SO<sub>2</sub>
  - ± 0.025 mg/m<sup>3</sup> for CO
  - ± 0.2 ng/m<sup>3</sup> for B(a)PNo suggestions so far for benzene, As, Cd, Ni, Pb - less relevant due to generally low concentrations?
- Alternative name for the lower-cut off value?
  - Lower fixed tolerance threshold
  - Minimum cut-off
  - minimum tolerance level
  - minimum concentration interval for the tolerance level



### *Remaining open issues*

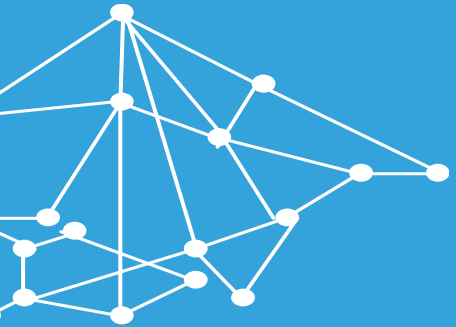
- Handling of overlapping SR areas. Possible solutions:
  - Use proximity to sampling points
  - Sampling point with the most similar concentration
  - Use of source-related criteria
  - Other ideas?
- Bias correction / use of observed or modelled values
  - OK to recommend use of “best available AQ map”, which can include use of data assimilation and data fusion?
  - Always use modelled value or OK to use observed value in some cases? E.g. if significant bias remains.
  - Other issues needing further consideration?



### *Further development of guidance*

- WG8 guidance will largely be replaced by the SR9 guidance document
  - Produce a new WG8 document focusing on country contributions & good practice examples? IT's written contribution provides a template.
- Other issues
  - Need for recommendations on minimum model resolution to assess SRAs for different station types?
  - How to deal with cases where we have two different types of modelling (e.g. regional and local scale models) that cover the same area?
  - Recommendations on documentation, reporting and regular review (at least every 5 years?)
  - Need for more guidance / examples on using lower-tier methods?



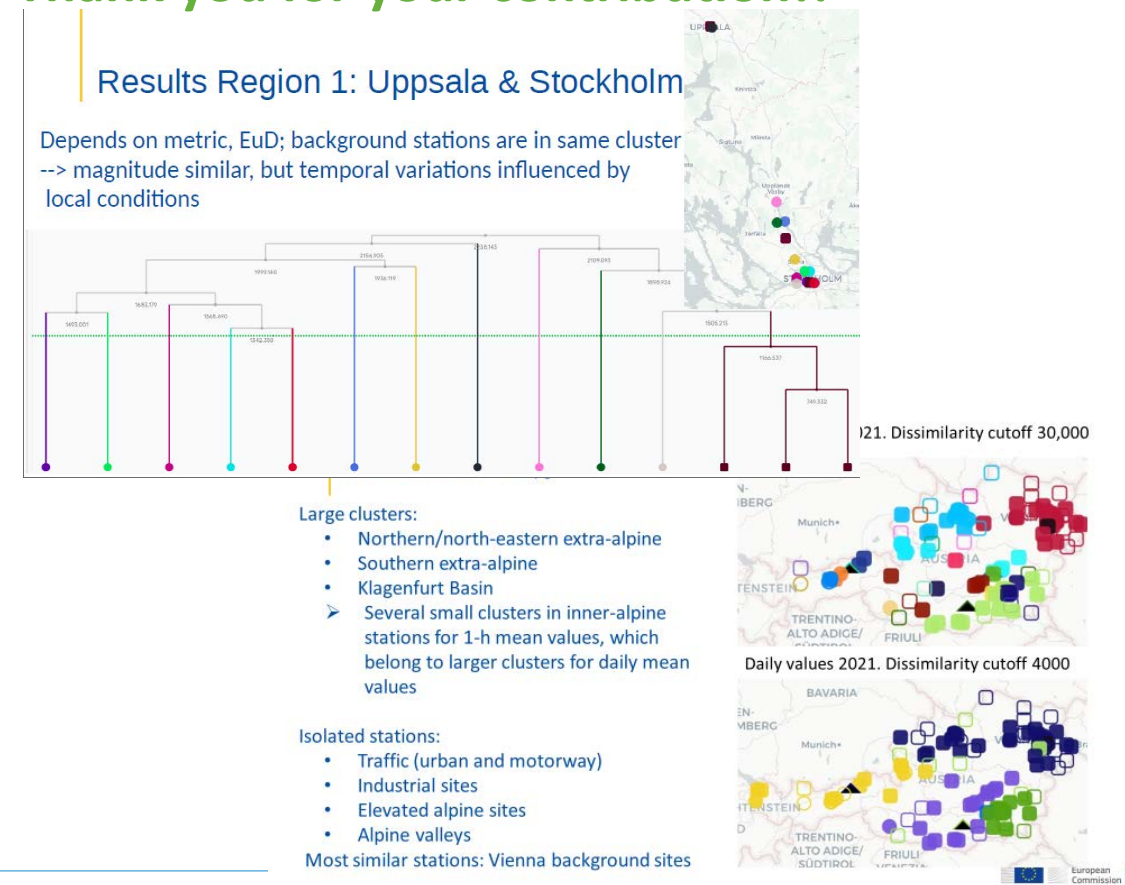


# Monitoring Network Design

# MONITORING NETWORK EVALUATION EXERCISE - FAIRMODE & AQUILA COOPERATION

- FAIRMODE & AQUILA cooperation 45 participants from 10 countries: 15 presentations sharing experience in two sessions:
  - Austria (1), Germany (1), Ireland (1), Italy (4), the Netherlands (1), Norway (1), Portugal (1), Slovakia (1), Spain (2), Sweden (2)
    - Focused on two domains: country, region/AQ zone
    - Used for PM10 and/or NO2 (some in PM2.5 and O3 in addition)
    - Mostly hourly data, few daily (PM10)
- Useful exercise to
  - ✓ Identify inconsistencies in the monitoring sites classification
  - ✓ Revise the validity of the current air quality zone definition
  - ✓ Evaluate the optimisation of the monitoring network
- Coordinated by Norway(NILU) using the MoNet clustering tool

**Thank you for interest!!**  
**Thank you for your contribution!!**

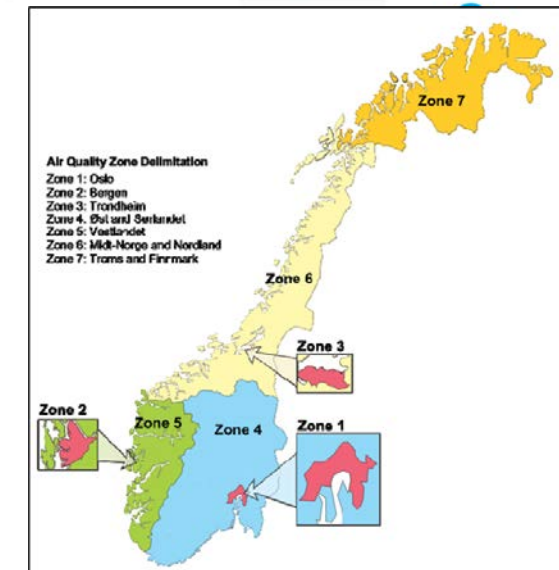
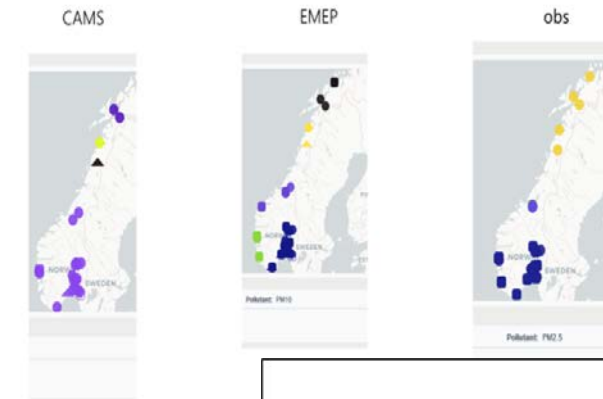




## Planned next steps

- Initiation of the elaboration of a Monitoring Network Design Evaluation **Guidebook**
- *Additional exercises with focus on the air quality zones using monitoring and modelling data*

Clustering based on modelling and observations – PM10



- 1 Introduction
- 2 Monitoring Network design: the legal framework
- ▲ 3 Recommended methodology for evaluating the monitoring network representativity
  - 3.1 Hierarchical clustering analysis
  - ▲ 3.2 Monitoring Network webtool (MoNET)
    - 3.2.1 System
    - 3.2.2 Input data requirements
    - 3.2.3 How to use the tool
  - 3.3 How to interpret the results
- ▲ 4 Evaluation of the representativity of the air quality network: country experiences
  - 4.1 Flagging of potential outliers and redundancies
  - 4.2 Identification of inconsistencies in sampling point classification
  - 4.3 Assessing gaps
  - 4.4 Evaluation of air quality zones
- 5 Support to monitoring design: a cookbook
- 6 Conclusions

*Development of a guidebook on network design*

**Presented at the workshop on SR 29<sup>th</sup> Jan**

**Co-ordinated with development of SR9 guidance on network design**

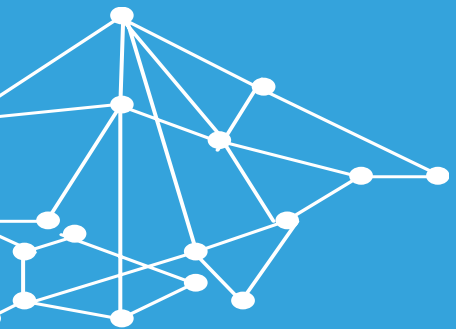
**Countries' contributions have been requested by 15<sup>th</sup> April.**

**First draft for revision by summer**

**The final document before FAIRMODE technical meeting 2024**

- *How do you recommend to add the country experiences in the guidance document on monitoring design? As figures illustrating conclusions or as formulated examples in an appendix?*
- *For the chapter on the evaluation on the air quality zone, will you be willing to carry out additional exercises using monitoring and modelling data? The exercises are to be ready by august 2024*





# Exceedance Situation Indicators

## EXCEEDANCE SITUATION INDICATORS

*Current guidance / recommendation from WG8*

- Proposal for a 2 staged approach:
  - Exceedance Flagging Indicator (EFI): qualitative indicator to flag the severity of the exceedance (compliance purpose) → year X+1
  - Exceedance Situation Indicator (ESI): quantitative indicator that identifies all the “hot spot areas” in the air quality zone (planning purpose) → year X+2

Guidance document:

[https://fairmode.jrc.ec.europa.eu/document/fairmode/WG8/WG8\\_Guidance\\_Document\\_VS3.pdf](https://fairmode.jrc.ec.europa.eu/document/fairmode/WG8/WG8_Guidance_Document_VS3.pdf)

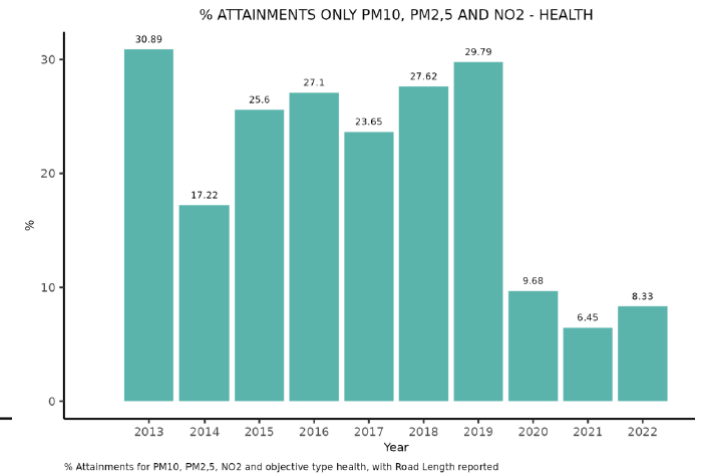
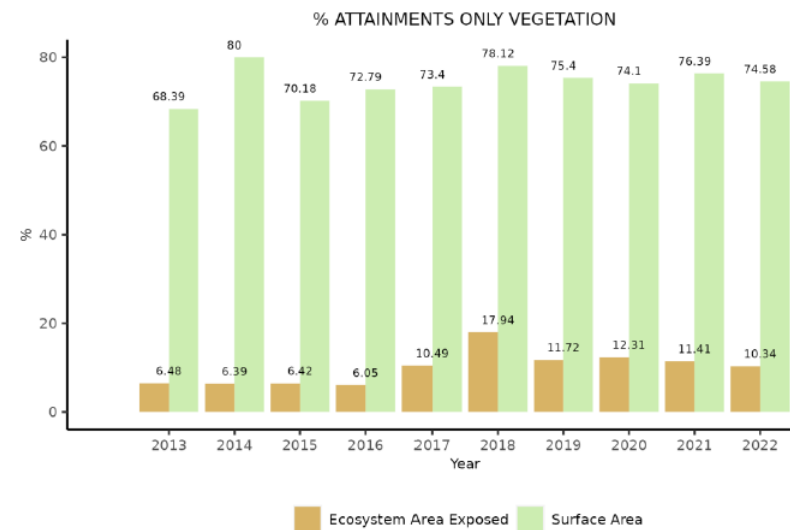
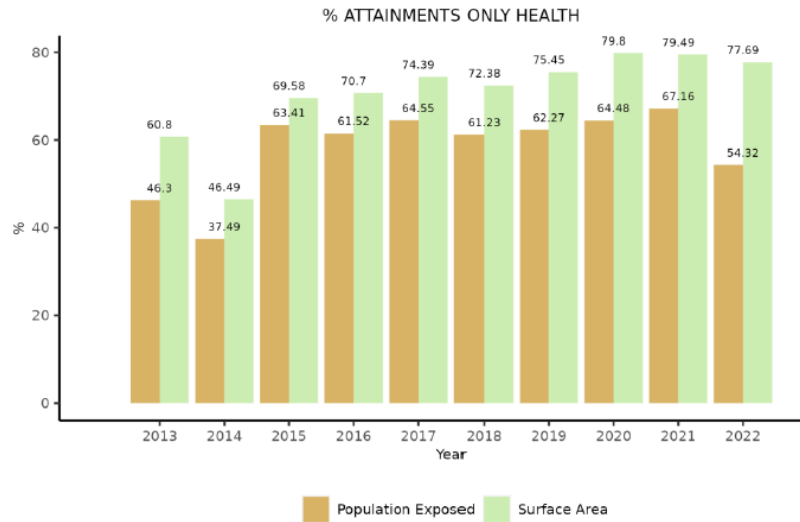


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# EXCEEDANCE SITUATION INDICATORS

## EEA input & quantitative analysis of IPR reporting



Relevant input from EEA's preliminary ideas for the future IPR revision:

- » Question need for an Exceedance Flagging Indicator (EFI)
- » Use spatial representativeness for first estimate of exceedance indicators instead of EFI
- » Use model results for the final Exceedance Situation Indicator (ESI) when drafting / reporting AQ plans.
- » Report SRAs and exceedance areas using a common European grid, instead of polygons.



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### *Ideas for further testing during 2024 & 2025*

- Test feasibility and usefulness of the EFI vs exceedance indicators estimated from SRAs for existing exceedances
- Test the ESI with modelling data for these same exceedances
- Based on the results produce guidelines / best practice on how this information should be produced, documented & reported
- Interest in participating in such an activity?
  - » Possible to present some first results at the FAIRMODE technical meeting?

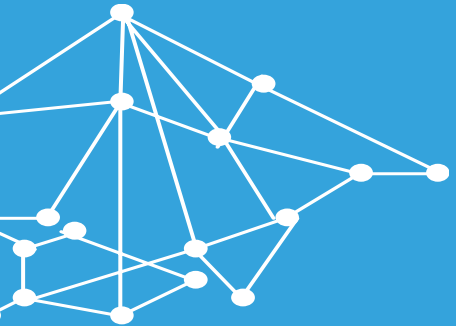


- *How to deal with gaps in the SRA of the stations in a single zone? Should we aim for full coverage of the AQ zone?*
- *How to deal with redundancies?*
- *How to proceed when we identify exceedances in very small areas in the modelling results (like tunnel or street canyon situations)*





# Thank you!



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