

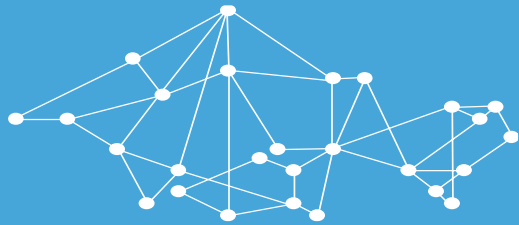


FAIRMODE

Forum for air quality modelling in Europe

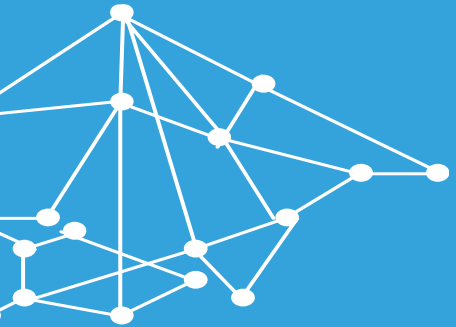
CT8:
SPATIAL REPRESENTATIVENESS,
EXCEEDANCE SITUATION INDICATORS &
MONITORING DESIGN

STIJN JANSSEN & LEONOR TARRASON - OCTOBER 18, 2022



AGENDA

Time	Topic	Speaker
9:20 – 9:30	Exceedance Situation Indicators (ESI) - CT8 proposal	Stijn Janssen
9:30 – 9:50	MS Feedback on ESI	Elke Trimpeneers (IRCEL, BE) Florian Pfäfflin (IVU, DE - online) Matt Ross-Jones (EPA, SE - tbc)
9:50 – 10:15	Discussion on ESI	All
10:15 – 10:30	Spatial Representativeness (SR) – CT8 proposal	Stijn Janssen
10:30 – 11:00	Coffee break	
11:00 – 11:30	MS Feedback on SR	Wolfgang Spangl (UBA, Austria - online) Bruce Denby (MetNo, NO) Bart Degraeuwe/Stijn Vranckx (VITO, BE)
11:30 – 11:50	Discussion on SR	All
11:50 – 12:05	Network design – a proposal for an intercomparison exercise	Joana Soares (NILU, NO)
12:05 – 12:15	Discussion on network design	All
12:15 – 12:30	Next steps for CT8 – priorities for next years	Leonor Tarrason



Exceedance Situation Indicators

Context

- Exceedance Situation Indicators:
 - Additional information about **extent and severity** of the observed exceedances
 - Purpose is dual: **compliance** checking & input for **AQ planning**
- Exceedance Situation Indicators (year X) reported via e-Reporting Data Flow G in September X+1
 - **Too early** for a comprehensive analysis in many MS!



New proposal

- 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



EXCEEDANCE FLAGGING INDICATORS

- Qualitative additional information about severity of the observed exceedance
- **Class based** indicator that can be easily assessed
- Assessment based on **available data sources** (e.g. existing modelling results) and **expert judgement**
- Can be reported in **year X+1** via Data Flow G
- (*Assessment method should be documented via Data Flow D?*)

Ranges require reality check!

Class	Fraction of area/population in exceedance in the AQ Zone [%]	Description
1	< 1%	A few exceedances are estimated in the AQ zone
2	1% - 10%	A significant number of exceedances are estimated in the AQ zone
3	10% – 50%	A large part of the AQ zone is in exceedance
4	> 50%	Very widespread exceedances in the AQ zone

EXCEEDANCE SITUATION INDICATORS

- Comprehensive and quantitative indicator
- Provides **full understanding** of the exceedances in the air quality zone
- Input for the design of an **air quality plan**
- ESI for **area** (km²) and **population** (#residents) in exceedance
 - Relevance of **road length** (km) is questioned
- Assessment based on fit-for-purpose **modelling**
- Reporting under IPR (via e-Reporting):
 - ESI via Data Flow H-K
 - Assessment method via Data Flow D?5
- Timing: **year X+2** → Too late?



Considerations & Open issues

- Indicator type:
 - What about the road length in exceedance? Still relevant for urban situations?
- Model resolution:
 - Spatial: what about **street canyons**? → mandatory for e.g. NO₂?
 - Temporal: time aggregation given by the limit value (annual, percentile...)
- Input data:
 - **Resolution** of population data should be **aligned** with the model resolution
 - Can be extended with info on **sensitive groups** (info for AQP)
- Concerns:
 - A binary threshold indicator is very sensitive to methodology and input data → be aware of it



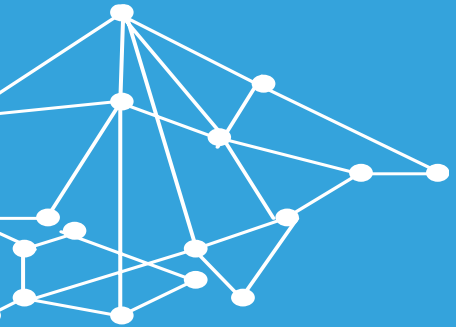


Member State feedback on Exceedance Situations Indicators:

- Elke Trimpeneers (IRCEL, BE)
- Florian Pfäfflin (IVU, DE - online)
- Matt Ross-Jones (EPA, SE)

- » Is the proposed timing of the reporting of the indicators more realistic and in line with current practices in Member States?
- » What are relevant Exceedance Situations Indicators to be reported under the AAQD?
 - » Area, Population, Road length,...
- » What additional guidance is needed for the estimation of the indicators?
- » Do we need additional intercomparison studies?

Spatial Representativeness – CT8 proposal



- » **Spatial representativeness (SR)** is an essential indicator of any monitoring site
- » SR is relevant for various applications under the AAQD:
 - » Assessment of **population exposure** based on monitoring data
 - » Assessment of **exceedance situations** based on monitoring data
 - » **Monitoring network design**
 - » Use of monitoring data for **model validation and data fusion**

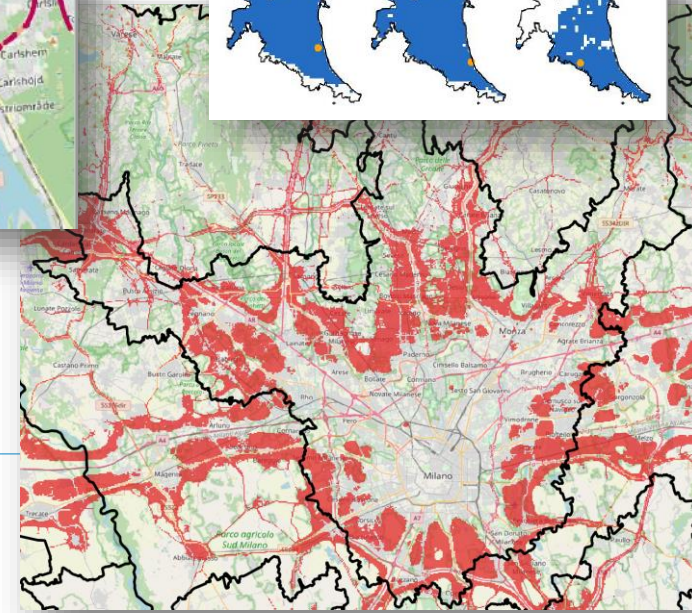
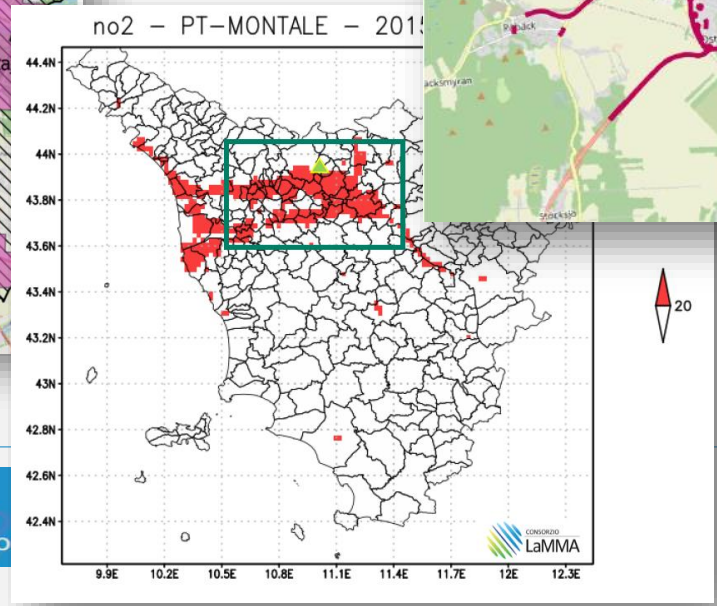
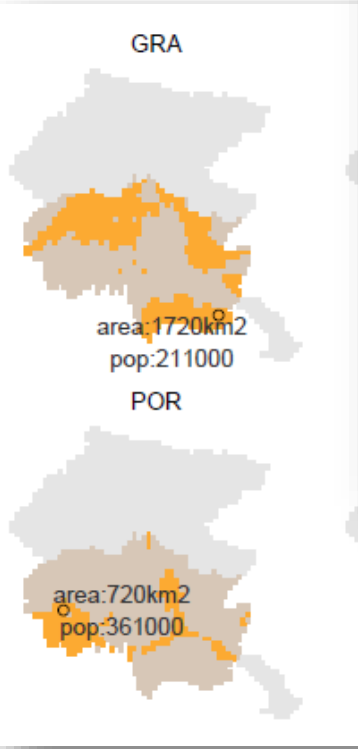
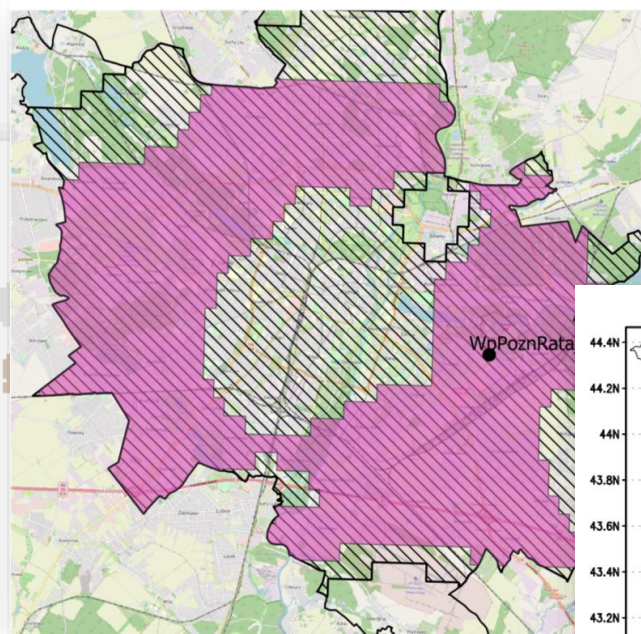
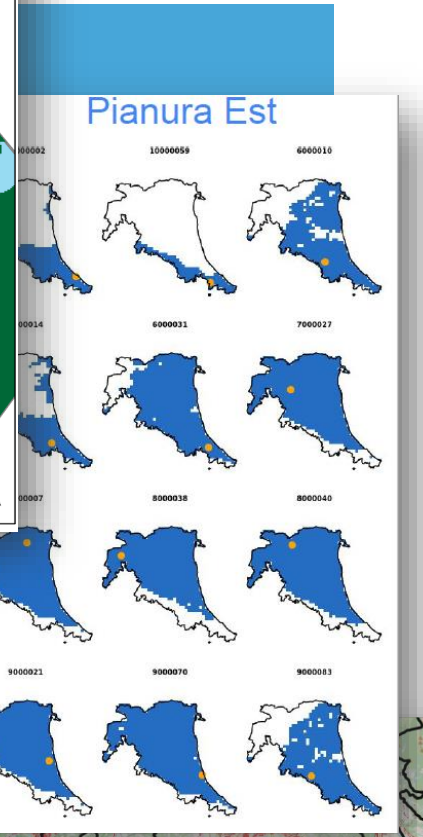
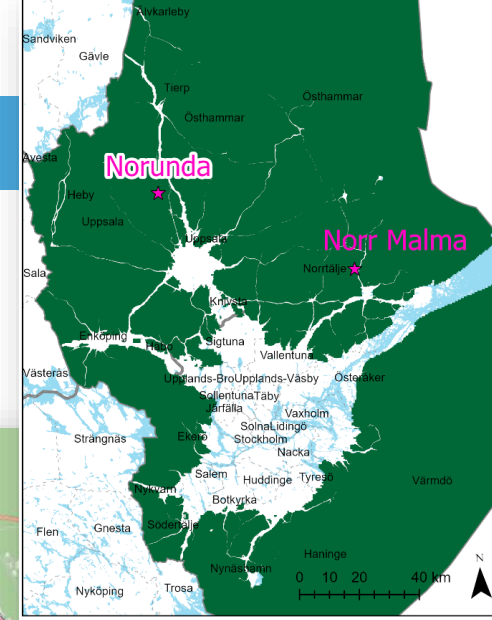
PARTICIPANTS CT8.1

Name	Country/Region/City
Vasiliki Assimakopoulou, Kyriaki-Maria Fameli	Athens
Doreen Schneider, Christiane Lutz-Holzhauer	Baden-Württemberg
Andreas Kerschbaumer	Berlin
Michele Stortini, Roberta Amorati	Emila Romagna
Bruce Rolstad Denby, Eivind Grøtting Wærsted	Norway / Europe
Hans Hooyberghs, Bart Degraeuwe, Stijn Vranckx	Flanders, Belgium
Alicia Gressent	France
Bonafè Giovanni	Friuli Venezia Giulia
Stephan Nordmann	Germany
Antonio Piersanti, Lina Vitali	Italy
Jutta Geiger	North Rhine-Westphalia
Grzegorz Jeleniewicz	Poland
Alexandra Monteiro	Portugal
Angela Morabito, Ilenia Schipa, Francesca Intini	Puglia
Susanne Bastian, Uwe Wolf, Martina Strakova	Saxony
Katrin Zink	Schleswig-Holstein (Northern Germany)
Fernando Martin	Spain
Kristina Eneroth	Stockholm County
Matthew Ross-Jones, Hilma Engholm	Sweden
Bianca Patrizia Andreini, Chiara Collaveri, Francesca Calastrini, Caterina Busillo, Francesca Guarnieri	Tuscany



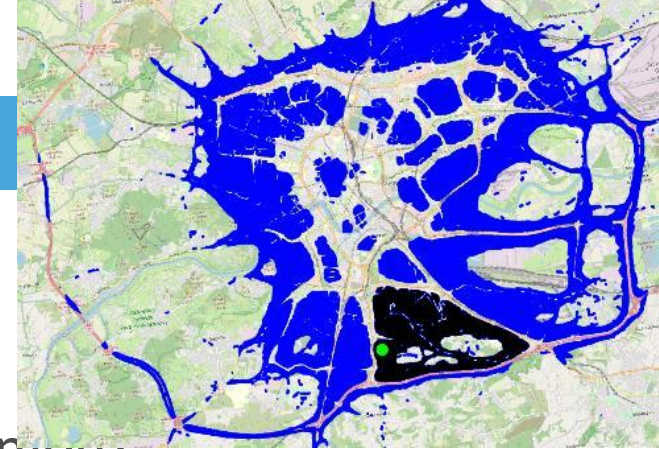
CT8 EXERCISE ON SR

» Models become fit-for-purpose to assess SR at all spatial scales and all station types



- » (Dis)contiguity
 - » Similarity criterion
 - » Tolerance (or threshold) level
-
- » Important note: no objective criteria to define the concept → need for **consensus** based on **expert judgement**

- » **Discontiguous SR area**, limited by the IPR AQ zone
 - » If needed the area can be reduced (e.g. based on expert opinion)
- » Similarity criterion: **annual mean concentrations**
- » **Tolerance level** (tested for NO_2 , PM_{10} , $\text{PM}_{2.5}$, O_3):
 - » $\pm 10\%$ for rural & urban background stations
 - » $\pm 20\%$ for traffic stations
 - » Absolute lower cut-off of $2 \mu\text{g}/\text{m}^3$
- » Use **modelled** concentrations at station location (assuming bias is small \rightarrow fit-for-purpose model)



FURTHER REFINEMENTS...

- » Evaluate the effect of different **lower cut-off** values
 - » Especially relevant for rural stations, some pollutants (e.g. O₃)
- » SR similarity criterion based on annual mean concentration (for the time begin), but:
 - » Develop similarity criteria for **percentiles** → important for AAQD limit values
 - » Test the possibility of a **source specific SR** → important for e.g. AQ planning
- » SR **inter-annual variability** (e.g. due to meteo effects) is a reality, but:
 - » Relevance depends on the application domain → more testing to assess the impact
- » SR of **industrial sites** only poorly analyzed for now
- » SR assessment requires a fit-for-purpose model with low model bias
 - » What is an **acceptable bias** at individual station location?
- » SR area can be reported as a shape file in the **e-Reporting**
 - » Realistic to request from MS under the IPR? (is already “mandatory, if available”!)



- » Is the guidance achieved satisfactory and useful?
- » How do we consolidate its use in reporting under AAQDs?
- » What are the remaining open issues that have to be tackled?
- » Is there use for a Composite Mapping exercise?



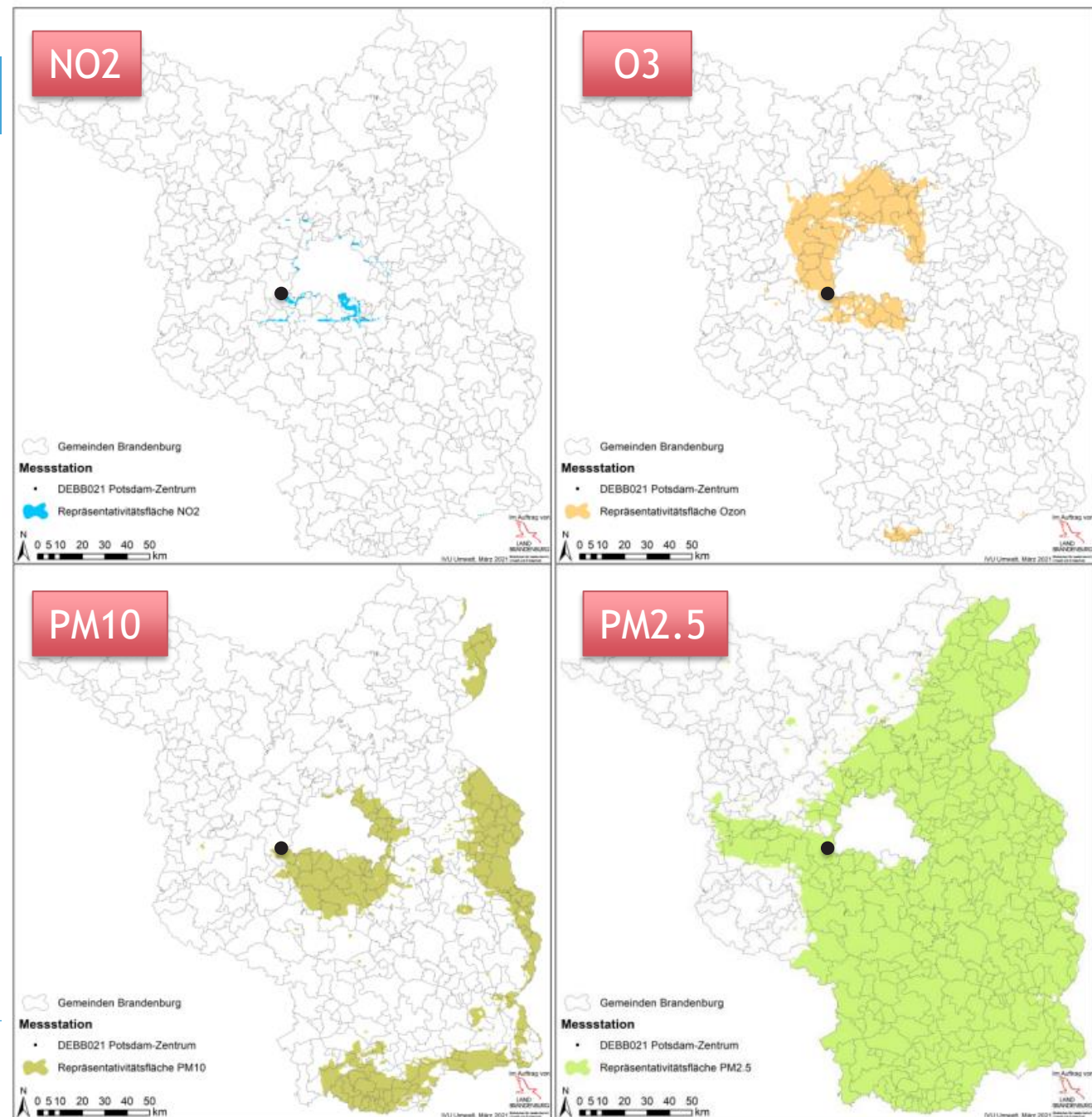
Member State feedback on Spatial Representativeness

- Florian Pfäfflin (IVU, DE - online)
- Wolfgang Spangl (UBA, Austria - online)
- Bruce Denby (MetNo, NO)
- Bart Degraeuwe/Stijn Vranckx (VITO, BE)

FEEDBACK FLORIAN PFÄFFLIN

- » SR analysis for the urban background station in Potsdam-Zentrum
- » Analysis based on modelling results (250m resolution)
- » Tolerance level of $1 \mu\text{g}/\text{m}^3$

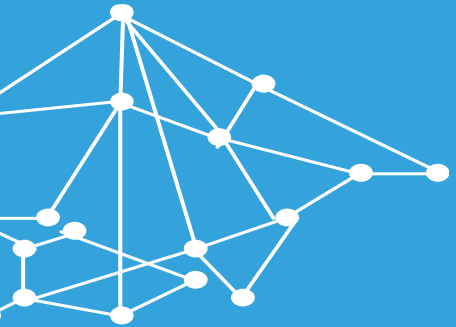
- » Observations:
 - » Large differences between pollutants (as expected)
 - » Isn't a tolerance of $1 \mu\text{g}/\text{m}^3$... already enough?
 - » Is this still "representativeness" or rather "similarity"



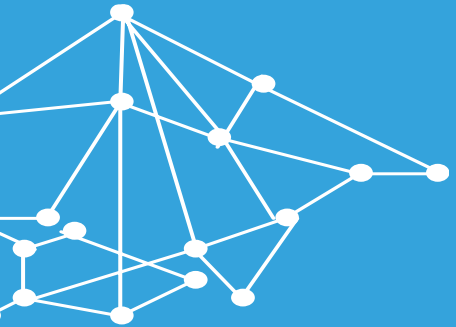
some more reflections on the document

„similarity“ is not „representativeness“

- Exceedances for traffic stations are caused by various reasons
 - traffic volume
 - share of HDV
 - level of service (flow conditions), traffic lights, ...
 - inclination
 - orientation w. r. t. main wind direction
 - building-situation
 - background concentration
 - ...
- $x \mu\text{g}/\text{m}^3$ measured at station u are only representative for station/location v with $x \pm 2 \mu\text{g}/\text{m}^3$ if all of these criteria are similar, otherwise, it is just a **coincidence!**
(to a lesser extent, a similar argument holds in principle also for background stations)



Monitoring network design by Joana Soares



Preliminary conclusions after discussion

CONCLUSIONS OF THE CT8 SESSION

Spatial Representativeness:

- » Agreement on the general formulation of the SR concept:

FAIRMODE proposes an SR assessment methodology following a discontinuous approach to delineate an SR area. The simple and robust model-based assessment method identifies the annual averaged concentration fields within a given margin of tolerance as SR area. Thus, enhancing the ability to interpret measurement data in a spatial context supporting e.g. the identification of hot spots and areas in risk of exceedance.

- » Open issues:
 - » A pollutant specific lower cut-off value ($2\mu\text{g}/\text{m}^2$ is too high)
 - » Station type specific tolerance level (10% rural/urban background; 20% traffic) vs. one-fits-all (15%)?

CONCLUSIONS OF THE CT8 SESSION

Exceedance indicators

- » Agreement on a 2 staged approach:
 - » Exceedance Flagging indicator (EFI) → compliance checking
 - » Exceedance Situation indicator (ESI) → input for air quality planning

- » Open issues:
 - » EFI based on absolute population in exceedance of the limit value (details tbd!)
 - » Provide Guidance on ESI assessment method

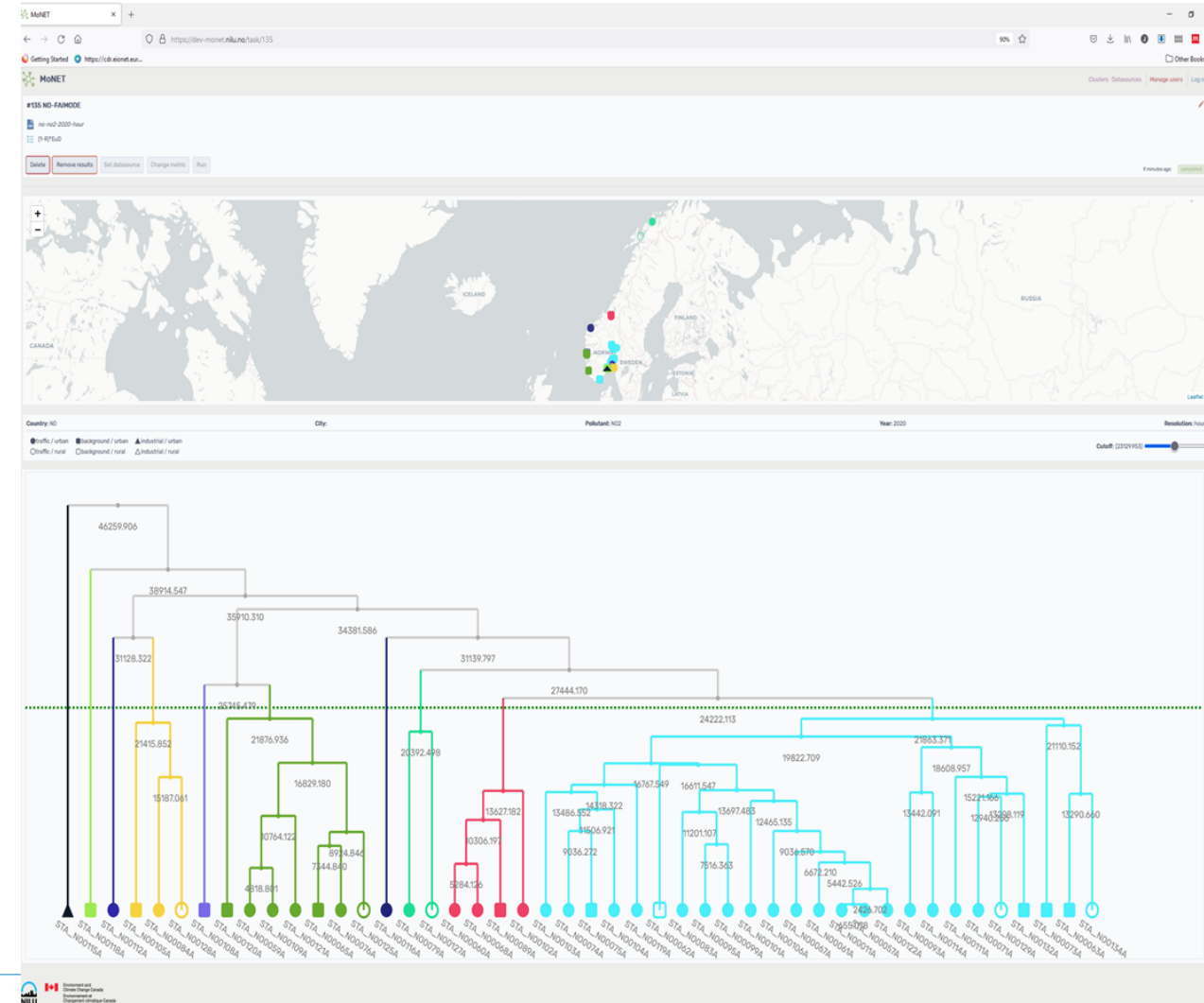
Class	Number of residents above limit value	State of the exceedances
1	< 100	Very few
2	100 - 1000	Some
3	1000 - 100.000	Many
4	> 100.000	Widespread









CONCLUSIONS OF THE CT8 SESSION

Network design

- » Proposal for a new intercomparison on monitoring network design
- » Online MONET tool for cluster analysis via dendrograms
- » Launch of the exercise: end October 2022
- » Evaluation workshop: November - December



CT8: What did we achieve (2020-2022)?

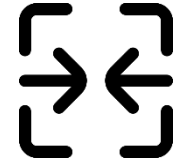
- Provide guidance on the assessment of spatial representativeness of monitoring stations depending of the context of the application domain. This can involve/require network optimization, selection of stations for model validation and assimilation or exceedances estimated. 
- Define specific methods to assess the estimation of areas and population exposed to exceedances.  
- Provide guidance on fit-for-purpose modelling approaches to assess exposure and exceedances indicators.  
- Support the e-reporting process in relation to the “Exceedance situation” data type 

CT8: Priorities for 2023-2025

1. Finetune and further test SR methods in view of e-Reporting
2. Define the details of Exceedance Flagging Indicator
3. Provide guidance on fit-for-purpose modelling approaches to assess Exceedance Situation Indicator
4. Setup and Intercomparison Exercise on network design
5. Provide recommendations on network design



Go for another round



Merge with other CT
(existing/new)



Stop / hibernate