WG4: Micro-scale assessment and planning

Plenary meeting 2026

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GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES
Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Layout

1) Roadmap

2) Guidance document

3) Intercomparison exercise in Madrid

4) AAQD as a stakeholder of Micro-scale modeling

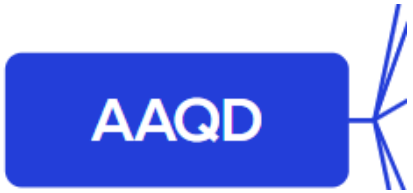
Roadmap WG4:

- **What is this WG about?**
  - WG4 deals with microscale modelling in the context of the AAQD (<100m)

- **When to use micro-scale:**
  - Air quality assessment and planning in urban hot spots

- **What are the challenges?**
  - Robustness of microscale modelling systems to estimate AAQD indicators.
  - Guidance and expertise.

WG4 Roadmap: Micro scale air quality modeling



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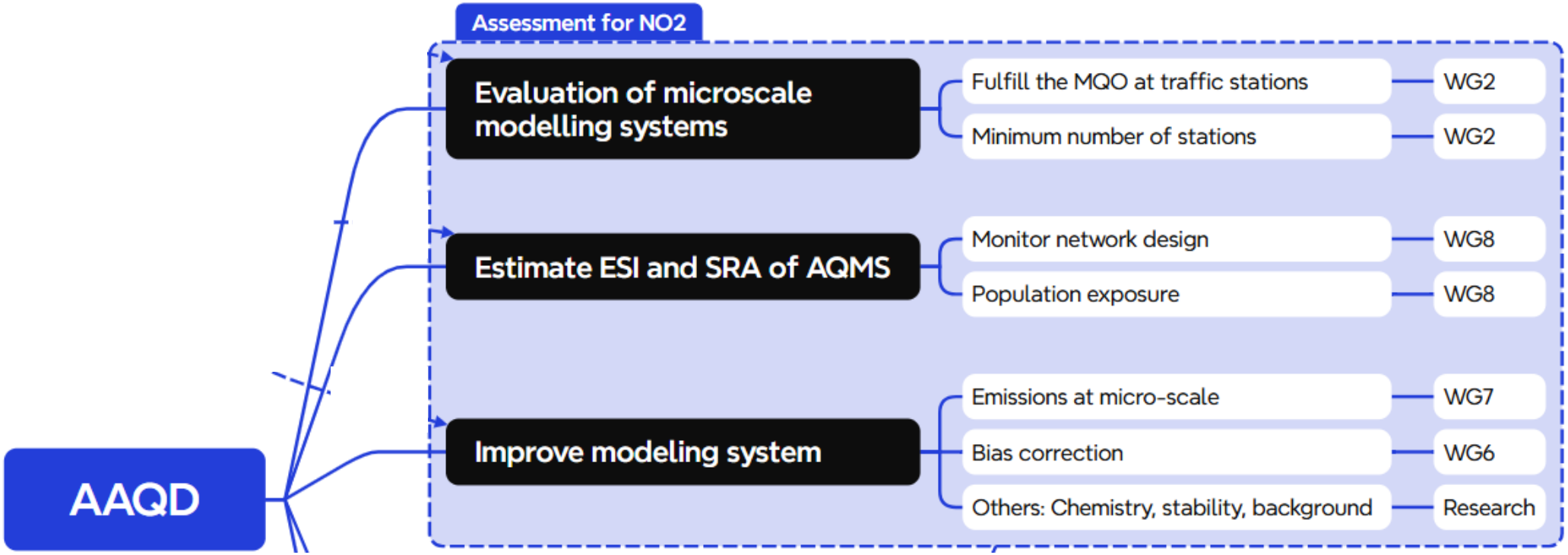

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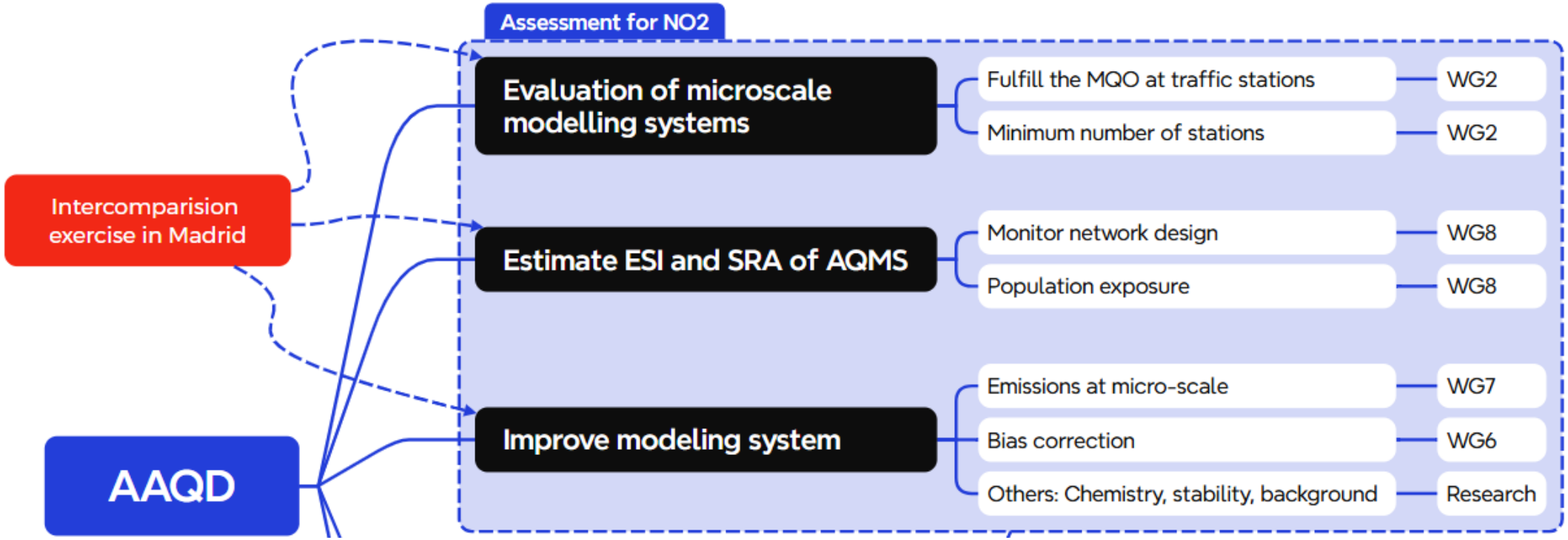

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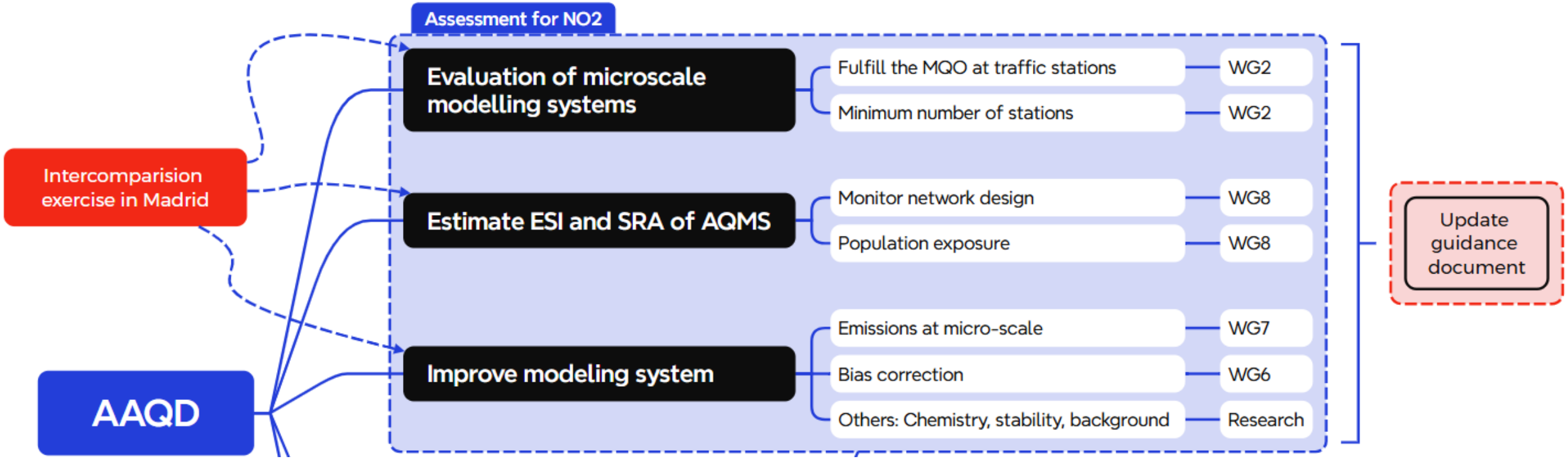

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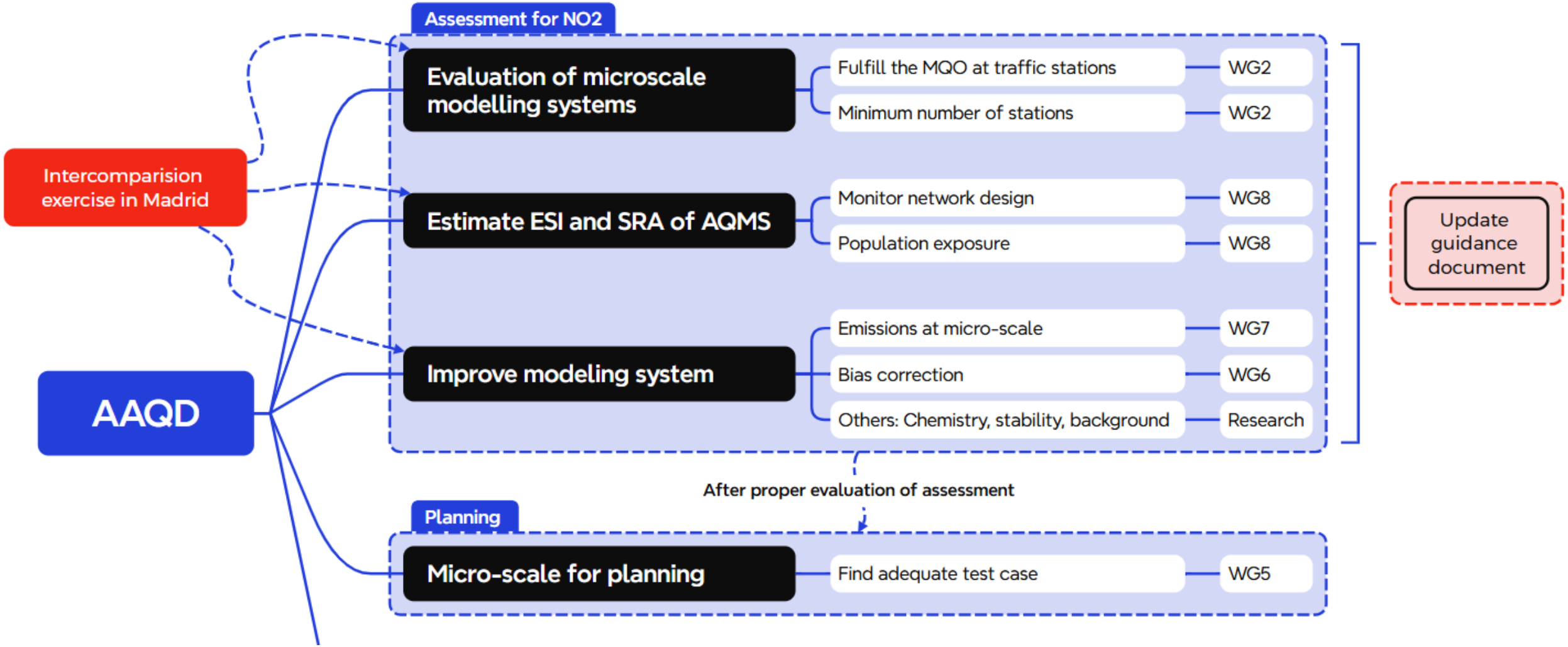

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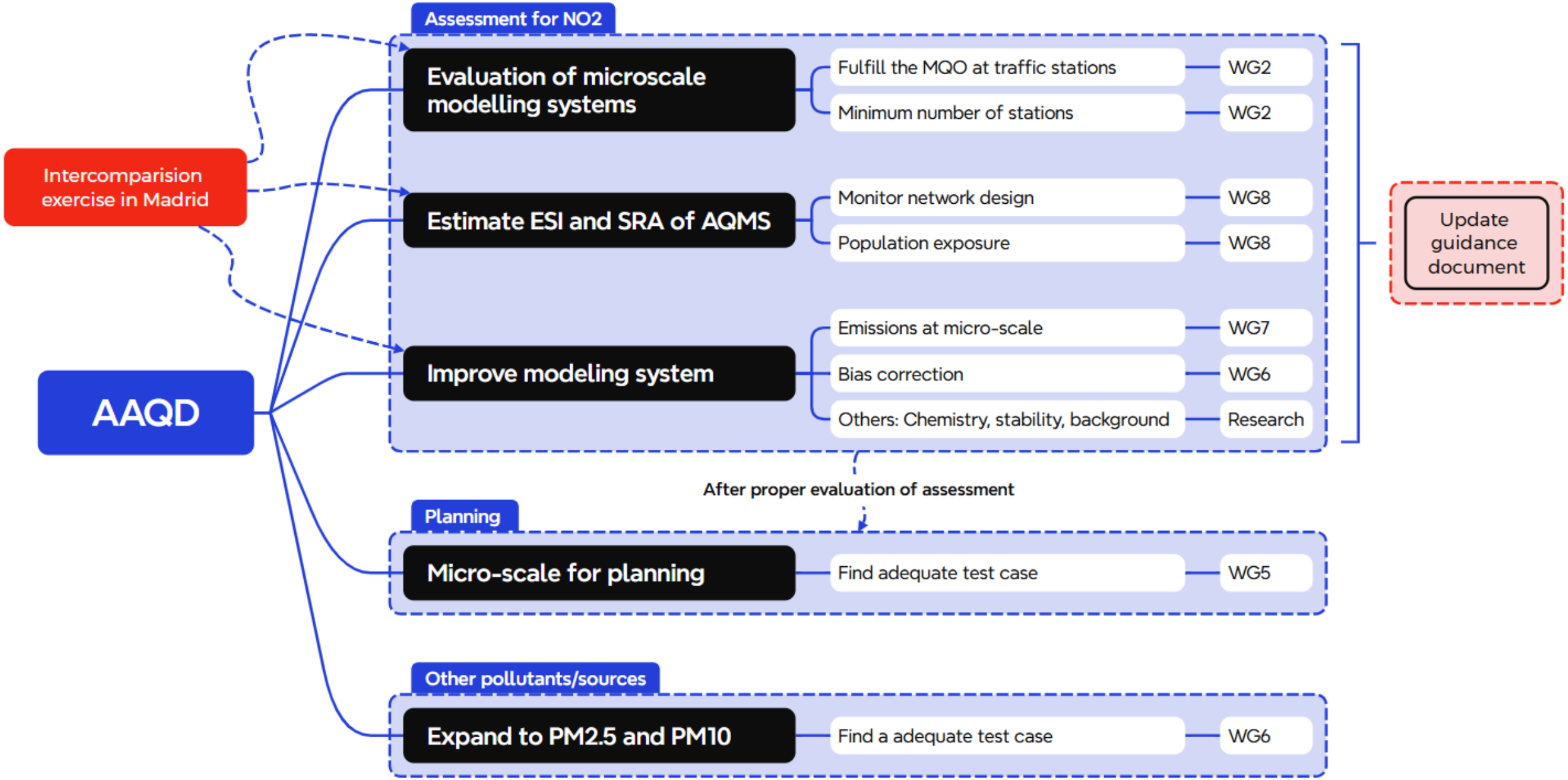
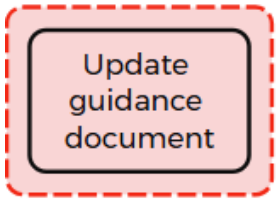


Points of discussion

1) Guidance document



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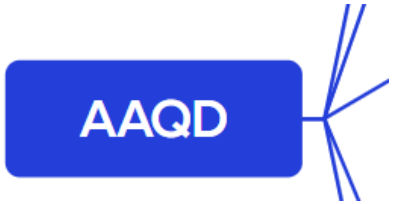

Guidance document: Best practice guidelines for air quality modelling at microscale for regulatory purposes

Best practice guidelines for air quality modelling at microscale for regulatory purposes

Authors:

Fernando Martín (CIEMAT, Spain), José Luis Santiago (CIEMAT, Spain), Jorge Sousa (VITO, Belgium) and Vera Rodrigues (UA, Portugal), on behalf of the WG4 Microscale Assessment of FAIRMODE (Forum for Air Quality Modelling in Europe)

With the contribution of:

S. Janssen (VITO, Belgium), J. Stocker (CERC, UK), R. Jackson (CERC, UK), F. Russo (ENEA, Italy), M.G. Villani (ENEA, Italy), G. Tinarelli (ARIANET, Italy), D. Barbero (ARIANET, Italy), R. San José (UPM, Spain), J.L. Pérez-Camanyo (UPM, Spain), G. Sousa-Santos (NILU, Norway), L. Tarrason (NILU, Norway), J. Bartzis (UOWM, Greece), I. Sakellaris (UOWM, Greece), Z. Horváth (SZE, Hungary), L. Környei (SZE, Hungary), X. Jurado (AIR&D, France), N. Reiminger (AIR&D and U. Strasburg, France), N. Masey (RICARDO, UK), S. Hamilton (RICARDO, UK), E. Rivas (CIEMAT, Spain), B. Sanchez (CIEMAT, Spain), C. Cuvelier (JRC, Italy), P. Thunis (JRC, Italy), Diogo Lopes (U. Aveiro, Portugal), A. Pineda-Rojas (UBA, Argentina), F. Pfäfflin (IVU Umwelt, Germany), C. Quassdorff, (CEAM, Spain), W. Spangl (EA- Austria), C. Nagl (EA, Austria), K. Sartelet (CEREA, France)

Version 1, 19/12/2025

Summary

This document presents a comprehensive set of recommendations for using microscale air quality models to estimate long-term pollutant concentrations at very high spatial resolution in urban areas. It aims to improve air quality assessments in urban hotspots, where pollutant concentrations can vary spatially over just a few meters. The present guidelines were developed by the members of WG4 on Microscale Modelling within FAIRMODE (Forum for Air Quality Modelling in Europe), based on the results of an extensive intercomparison exercise involving multiple microscale dispersion models, as well as on the results from several research projects carried out by the members of WG4.

1

Link: https://knowledge4policy.ec.europa.eu/fairmode/fairmode-guidance-documents_en
Published 12/2025

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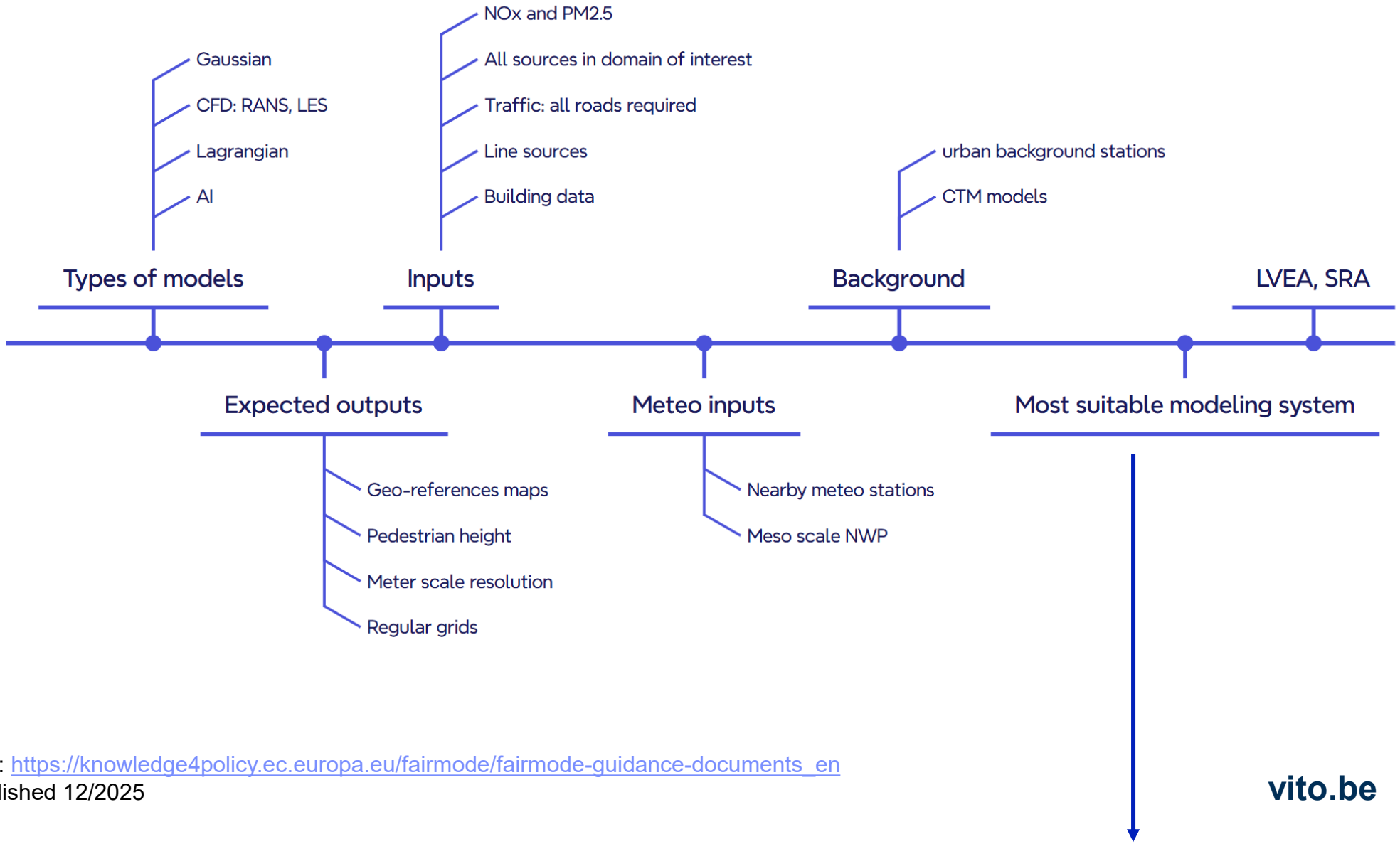

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Suitable model selection

Urban structure

- No complex adjacent buildings
- Symmetric street canyon
- Asymmetric street canyon
- Complex urban configuration

Suitable model selection

Urban structure

- No complex adjacent buildings
  - Concentration levels
    - Low conc./ Em.
      - Min. requirements:
        - Simple Gaussian
    - High Conc./Emi.
      - Gaussian + paramerization
- Symmetric street canyon
  - Low Em./Conc.
    - Gaussian + paramerization
  - High em/Conc
    - Gaussian + paramerization or more complex models
- Asymmetric street canyon
  - High or low conc/em.
    - CFD, AI-CFD based, Lagragian (and advanced Gaussian + param.)
- Complex urban configuration
  - High or low conc/em.
    - CFD, lagrangian

Intercomparison: Madrid

Micro-scale models:

- 19 groups
- 18 software's solver
- 25 model system outputs

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Gaussian Plumes:

- ADMS
- AtmoStreet
- AERMOD

Lagrangian:

- CalPuff
- QUIC
- PMSS
- GRAL

CFD:

- RANS (OpenFOAM, Fluent, STARCCM+, MISKAM, Code-Saturn, Envi-Met)
- LES (PALM4U, DALES*)

AI:

- CFD based AI models

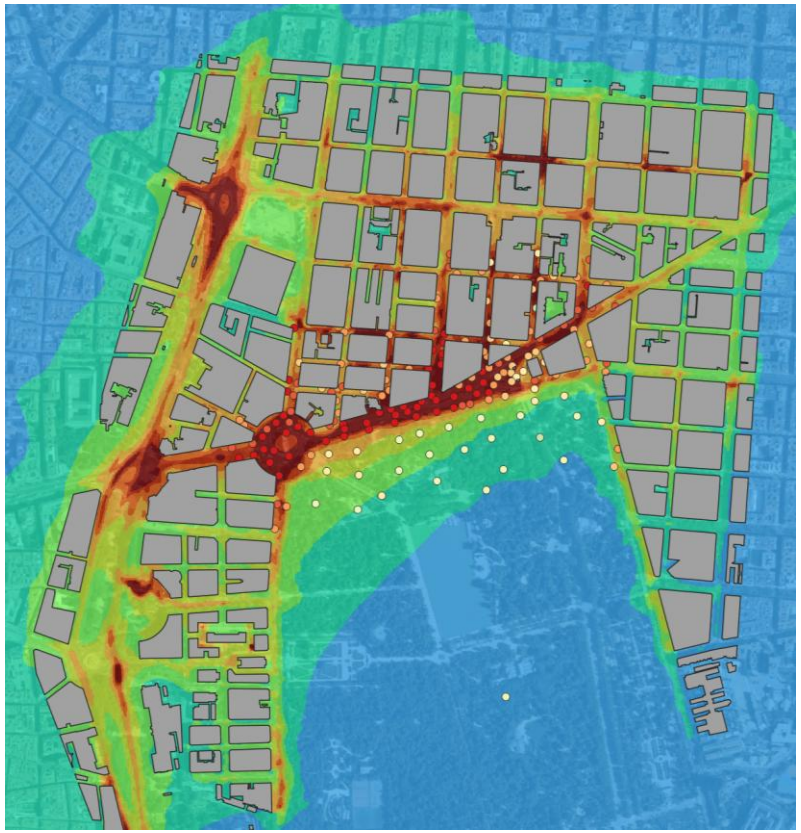
Reduced order models

- MUNICH
- DisperCity

Data provider: Universidad Politécnica de Madrid

Intercomparison: Madrid

C1: Campaign 2014



Winter

600 hours (25 days):

- 171 samplers

C2:Campaign 2016

Summer

696 hours (29 days):

- 229 samplers

Status of inter comparison exercise

- Results delivered: 4 model output (<20%)
- Results expected to be delivered by the **end of March**: 12 model outputs (~50%)
- **April begins** the analysis and comparison of the results.
- Some preliminary results to be shown at the **Air Quality conference (June)**
- **Final results** to be shown in the next Fairmode technical meeting **(October)**

Discussion: The role of micro-scale in the AAQD

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Objective:

- Identify situation where micro-scale has been applied for regulatory purposes or at least in a research context, but with close relation to the AAQD

Outcome:

- WG4 report with examples of the usage of micro-scale in direct or indirect relation to the AAQD

Modelling in support of the AAQD

Technical support document on the use of modelling for various application domains under the Ambient Air Quality Directive

1. **Assessment of the spatial representativeness** of sampling points and overall design of a monitoring network,

2. **Assessment of air pollutant concentration** levels

3. **Estimation of source apportionment** to assess the contribution of the relevant sources of air pollution

4. **Contribution to the design and selection of a set of measures** and the overall quantification of the impact and effectiveness of an air quality plan

5. **Short-term air quality forecasts** to warn the public about potential episodes and exceedances

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Rank micro-scale usage?

- Air quality assessment
- Spatial representativeness
- Short term forecast
- Support quality plans
- Source apportionment

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In your country are you aware of examples where micro-scale is used for:

Assessment

Planning

None

1 of 1

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What are the main challenges to run micro-scale models

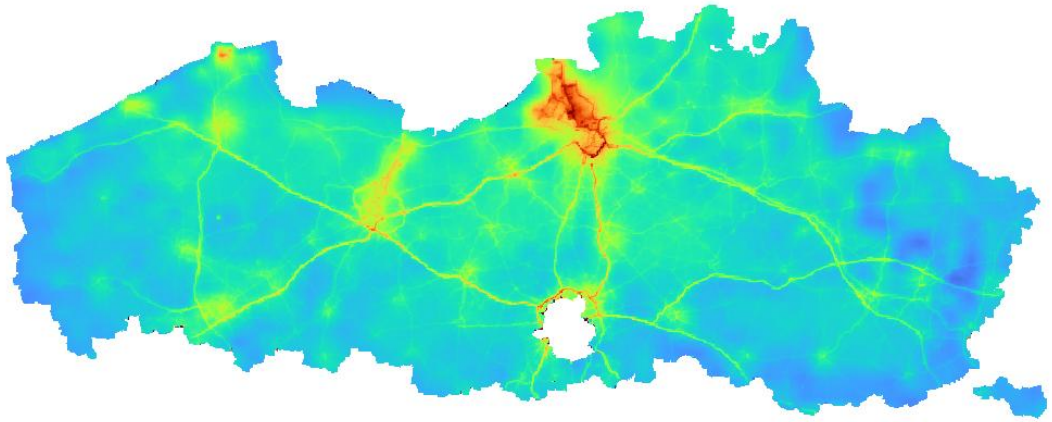
- None, its easy
- Input data: Emissions, buildings
- Computational resources
- Lack of expertise
- Not necessary, meso-scale is sufficient
- Not sufficiently robust
- others....

1 of 1

Examples of Micro-scale analysis in the context of the AAQD

Assessment:

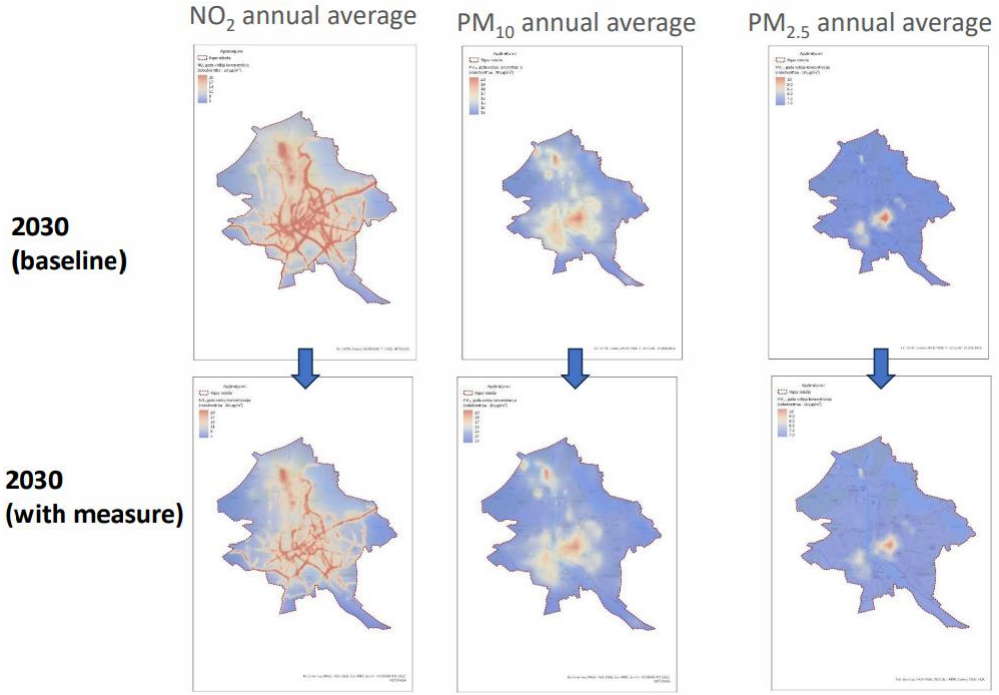
2024 Flanders – ATMO-STREET



- Only officially reported: Link: (E1b) Information on primary validated assessment data - modelled (Article 10)

Local Air Quality plans:

2030 Riga - ADMS

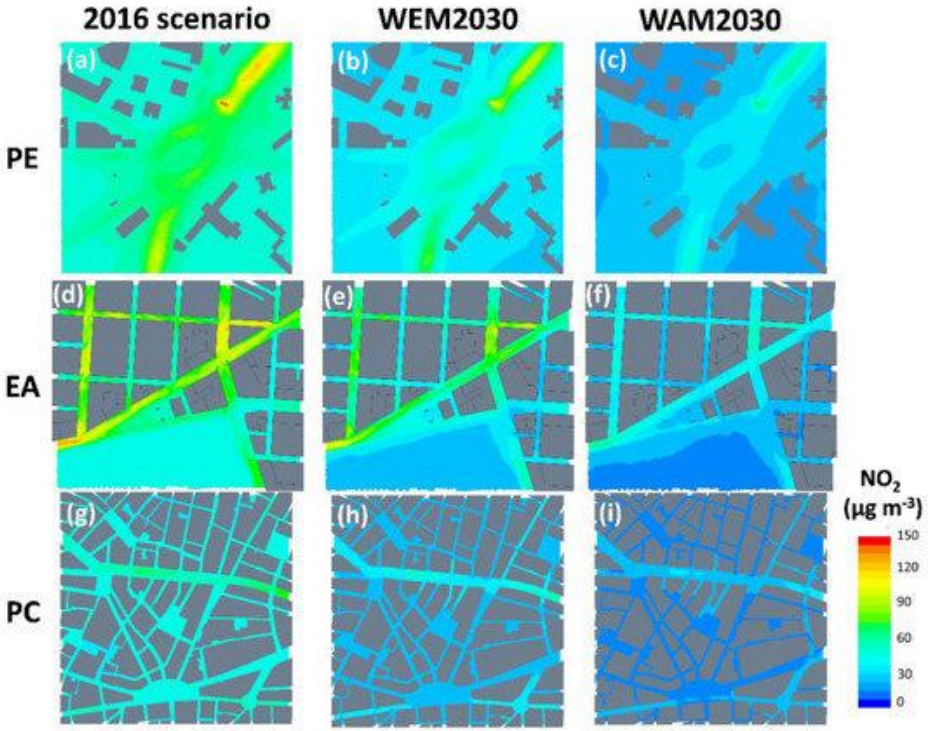


- Several other examples where micro-scale is used for air quality plans at city level

Examples of Micro-scale analysis in the context of the AAQD

Research purposes:

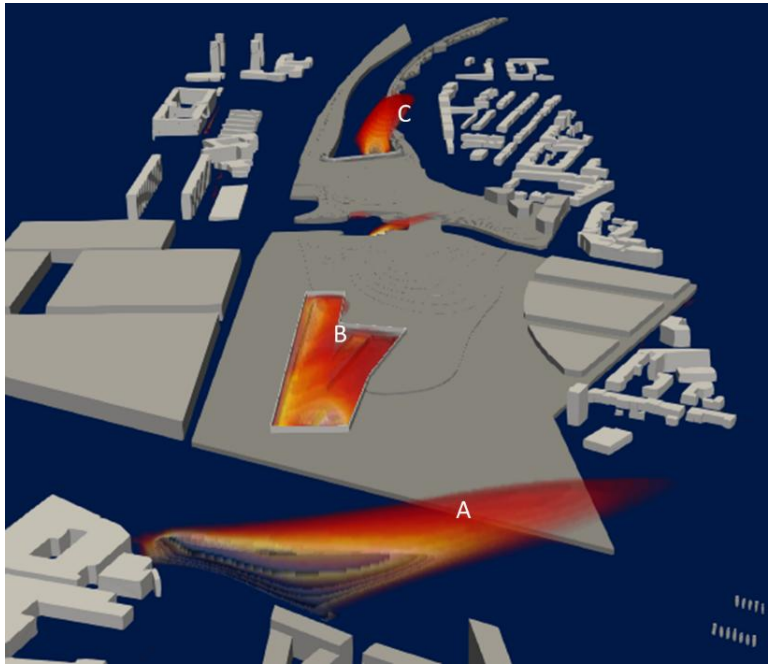
CIEMAT, Spain: Assessment and AQ planning



- Evaluation of emission reduction scenarios

Local environmental impact assessments

VITO, Belgium: Tunnel outlets



- Evaluation of hot spots due to new tunnel mouths

Take away messages

- WG4 roadmap as been defined.
  - First phase will focus on NO2 assessment supported by Madrid intercomparison exercise.
  - Second phase will focus on planning and other pollutants.

- Madrid intercomparison is well underway with 25 models system outputs expected. Results expected for the next technical meeting.

- We are looking for examples of micro-scale usage for regulatory purposes. Reach out if you can share some of those.

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