



Composite Mapping exercise

WG2: QA/QC protocol

Agenda WG2

14:00 – 14:15: SR9 Assessment (L. Tarrason)

14:15 – 14:25: CEN 264/43- Country feedback

14:25 – 14:50: QA/QC protocol applied to CAMS data (A. De Meij)

14:50 – 16:00: Composite Mapping

Presentation of first results

Discussion under way of presentation

Next steps

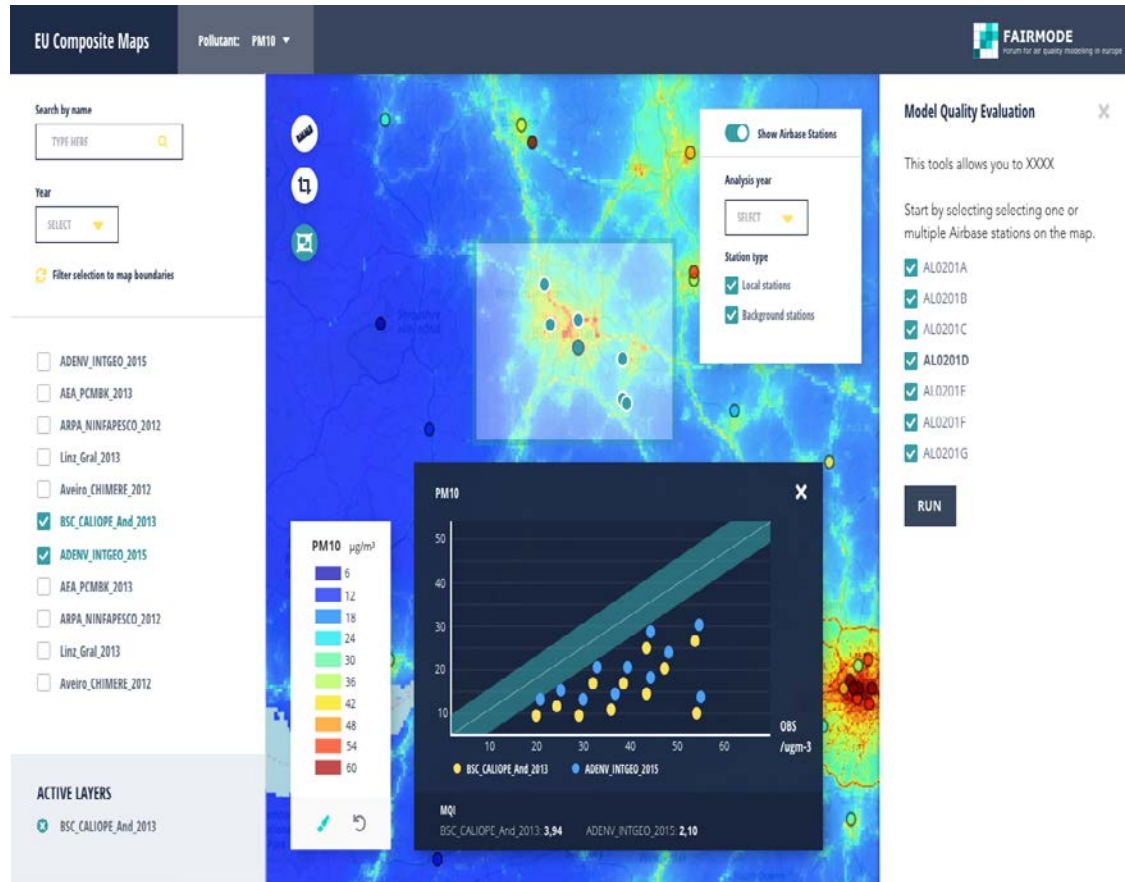
Composite Mapping MPI exercise

The initial plan

Two main interfaces

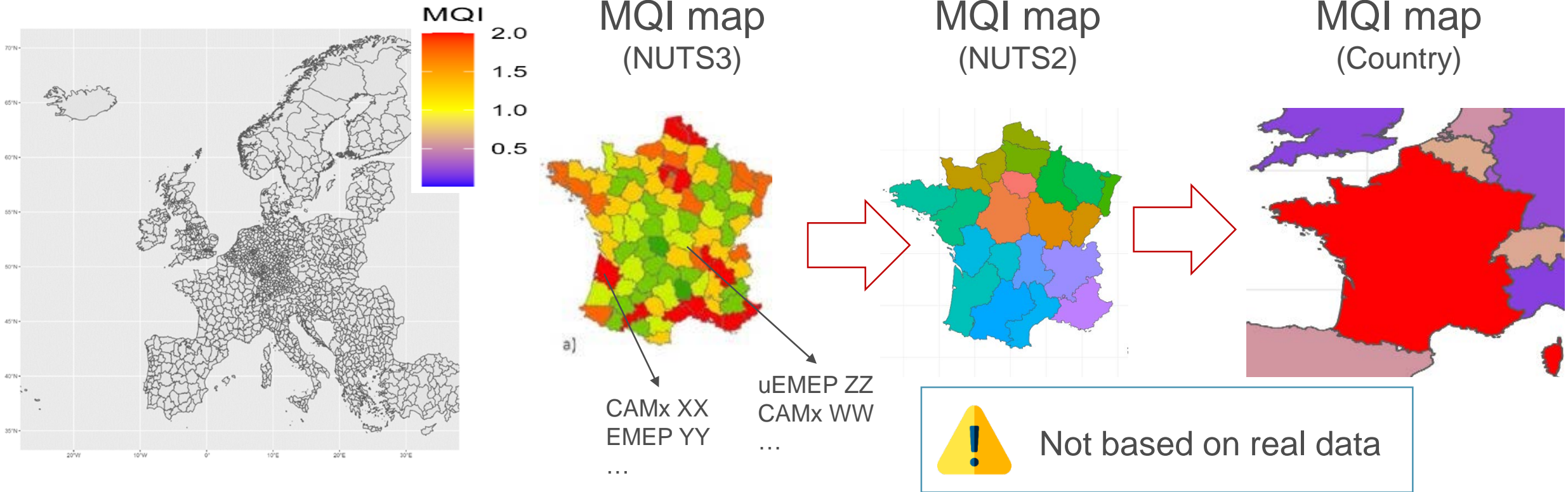
1. **Flexible**: On-the-fly MQI evaluation - to test MQI/MPI robustness
2. **Fixed**: Composite mapping with MQI - to visualize overview MQI (and associated) maps (year=2019)

1. Flexible interface: on-the-fly MQI



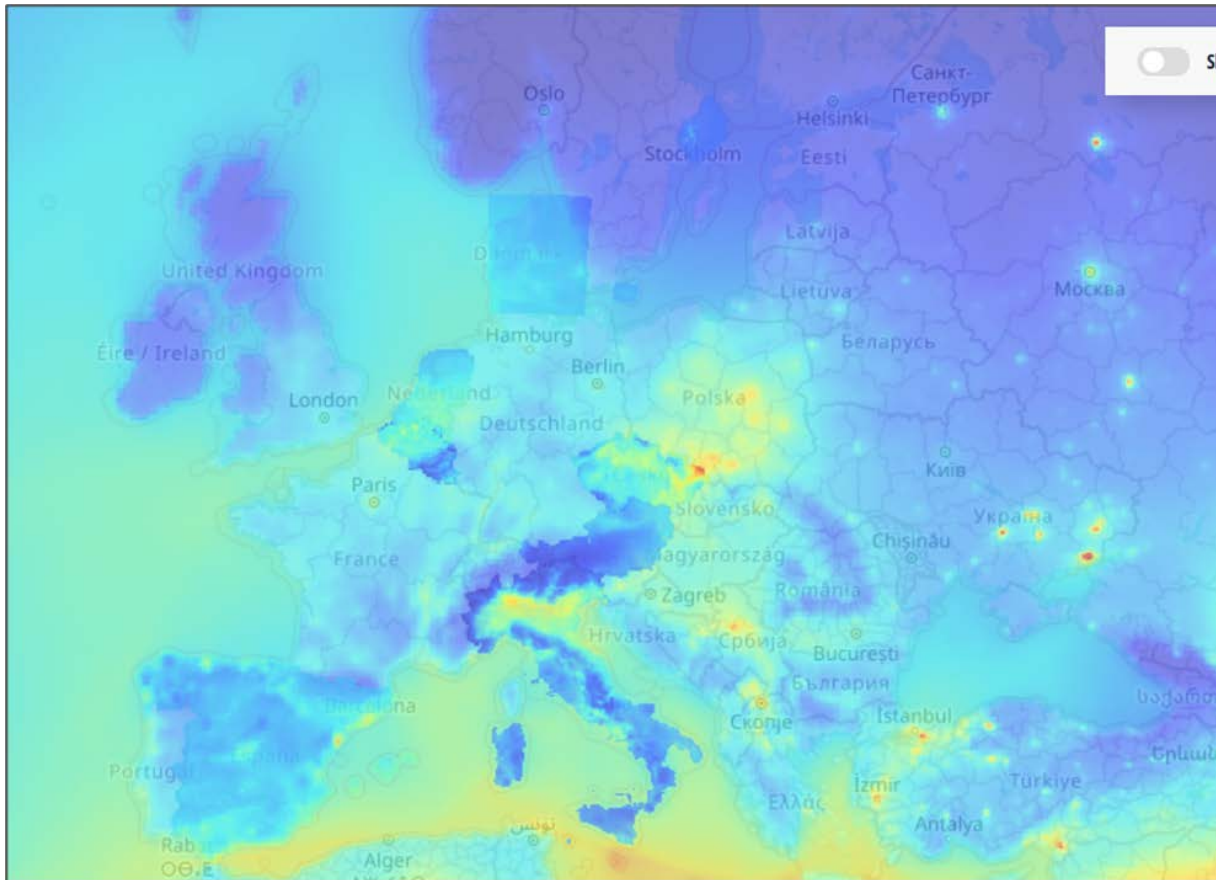
- ❖ Available for NO_2 , PM_{10} , $\text{PM}_{2.5}$ and O_3
- ❖ Only possible for the annual MQI, based on hourly, daily and 8h daily maximum values for NO_2 , $\text{PM}_{10/2.5}$ and O_3 , respectively.
- ❖ Calculates FAIRMODEs MQI values based on user-defined:
 - Set of AIRBASE stations by classification
 - Geographical area (from NUTS3, AQ zone, to country)
 - Optional number of stations – it is possible to remove specific stations
 - CEN/FAIRMODE vs AAQD formulations

2. Fixed interface – Maps (MQI, Conc, Best model)



- Look at MQI results aggregated to regional or country scale based on aggregation of best performing models
- Option to select or not models based on data-assimilation

2. Fixed interface – Maps (MQI, C, Best model)

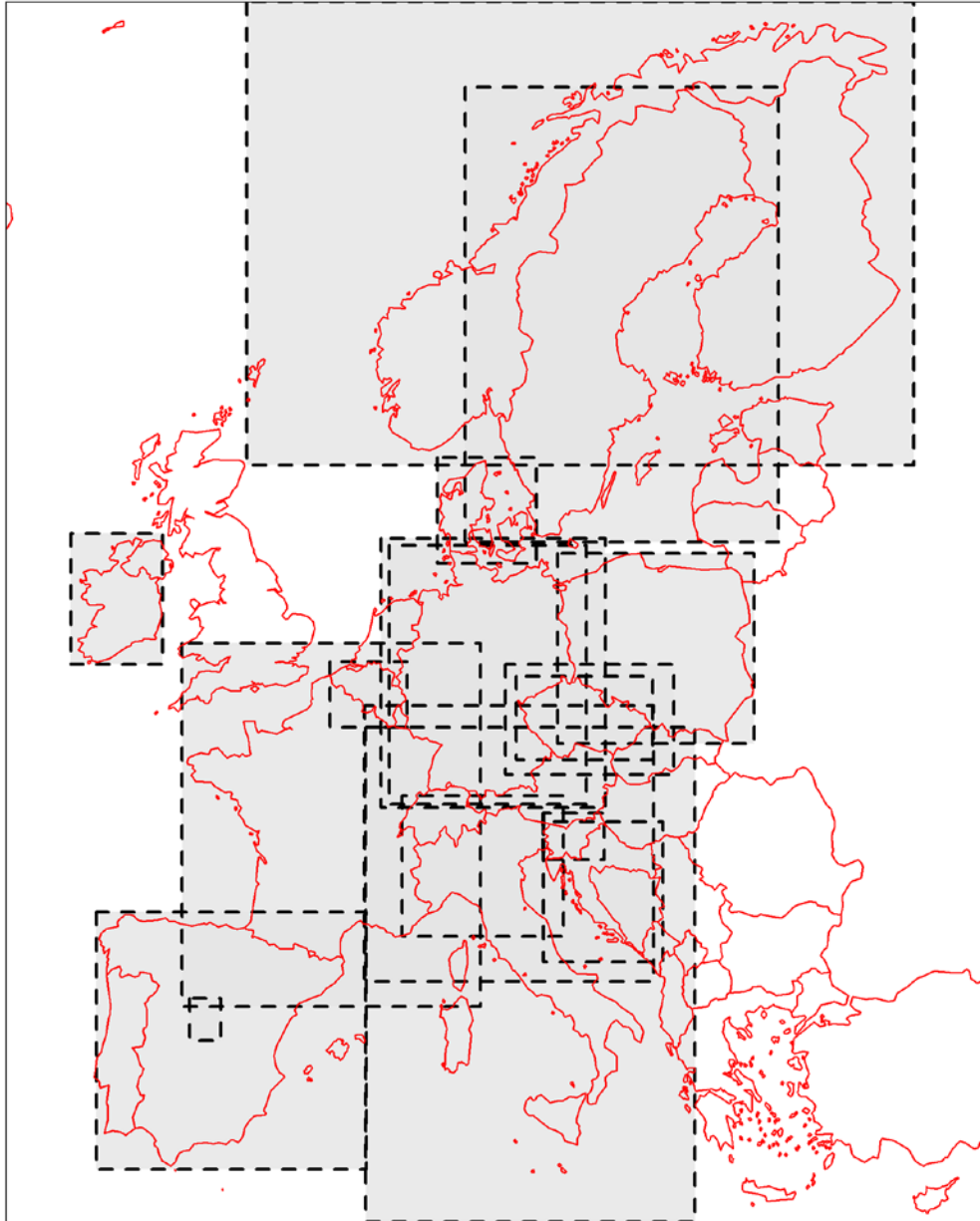


- Based on best performing results at NUTS3/2 level
- Keep analysis tools as in previous CM (transects, measurements...)

Composite Mapping MPI exercise

First results (without interface ☹)

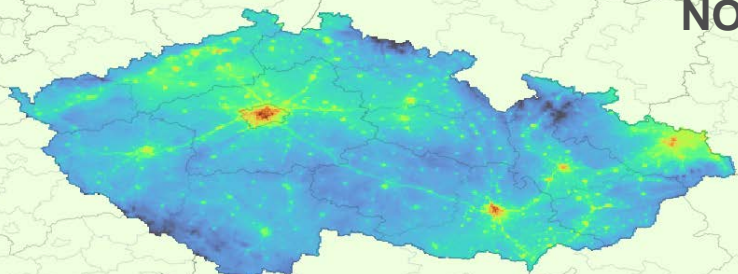
Status of deliveries



		Emissions	resolution
Croatia	Milic Velimir	X	10 km
Po Valley	Michele Stortini	X	6 km
Italy	Antonio Piersanti	X	5 km
Spain	Mark Theobald		5 km
Austria	Claudia Flandorfer	X	4 km
Poland	Pawel Durka	X	2.5 km
Germany	Stephan Nordmann	X	2 km
Czech republic	Nina Benesova		1 km
Madrid	Rafael Borge	X	1 km
Denmark	Matthias Ketzler	X	1 km
Slovenia	Luka Matavz	X	1 km
France	Elsa Real		1 km
Sweden	Helen Alpfjord	X	250 m
Norway	Bruce Denby	X	100 m
Ireland	Kate Johnson	X	25 m
Belgium	Frans Fierens		10 m
Catalonia	Marc Guevara		
Finland	Michael Sofiev, Ari Karpinen		
Greece	John Bartzis		
Portugal	Alexandra Monteiro		
Stockholm	Kristina Eneroth		
Spain	Roberto San Jose		
Germany	Martin Ramacher		

CZ – 1 km

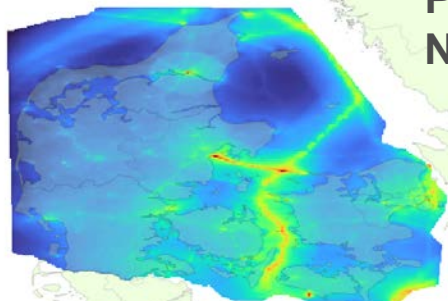
PM10
PM25
NO2



NA / A

DK – 1 km

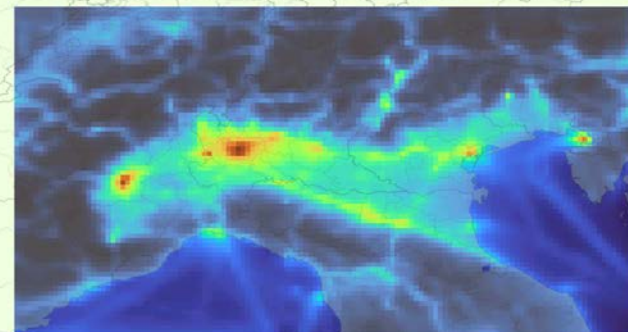
PM10
PM25
NO2



NA

Po V – 6 km

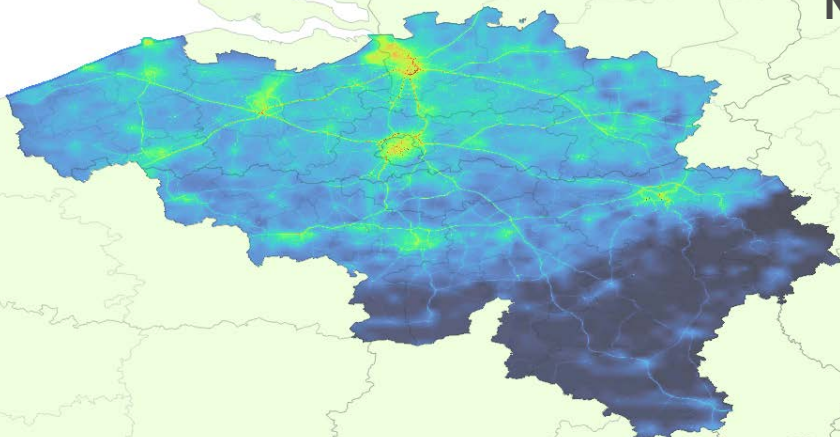
PM10
NO2



NA

BE – 10 m

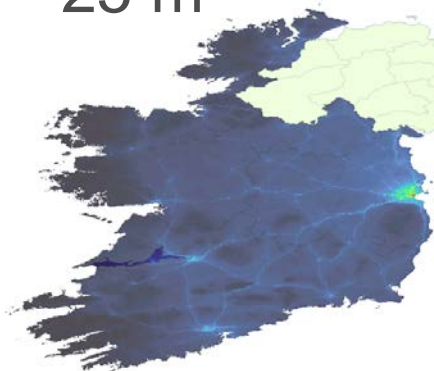
PM10
PM25
NO2



A

IE – 25 m

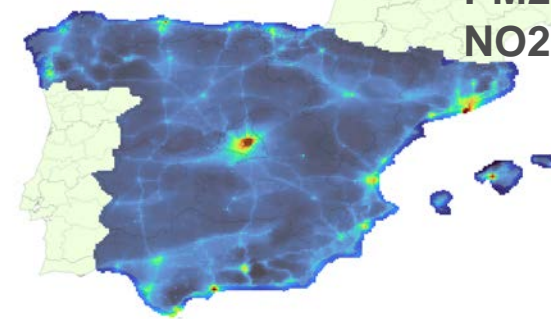
PM10
PM25
NO2
O3



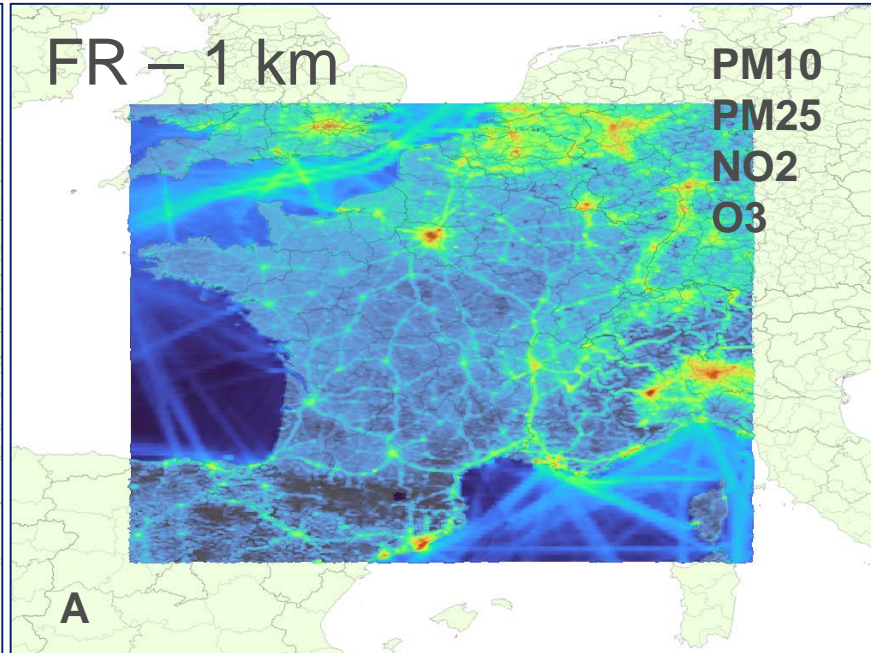
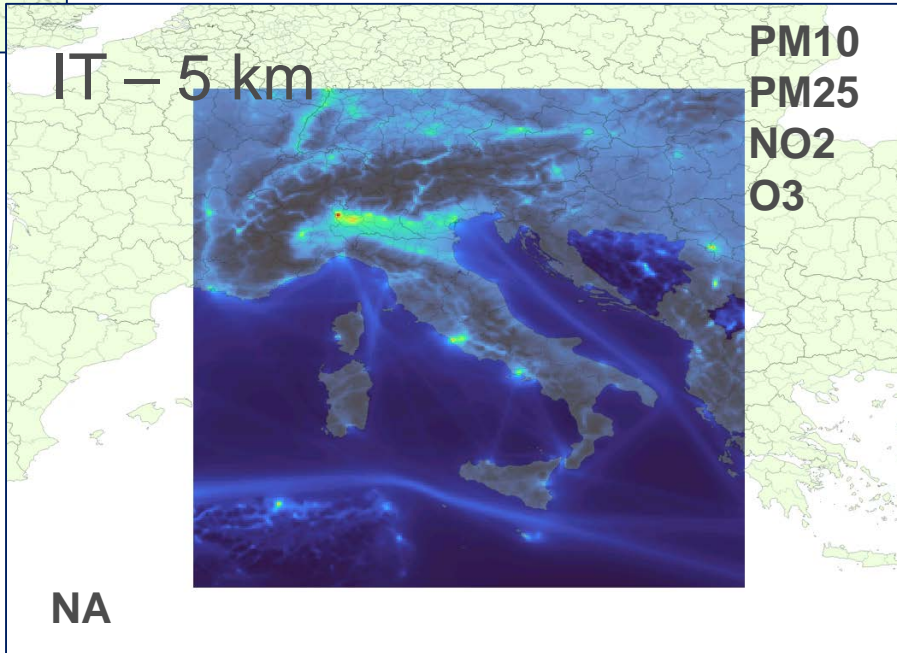
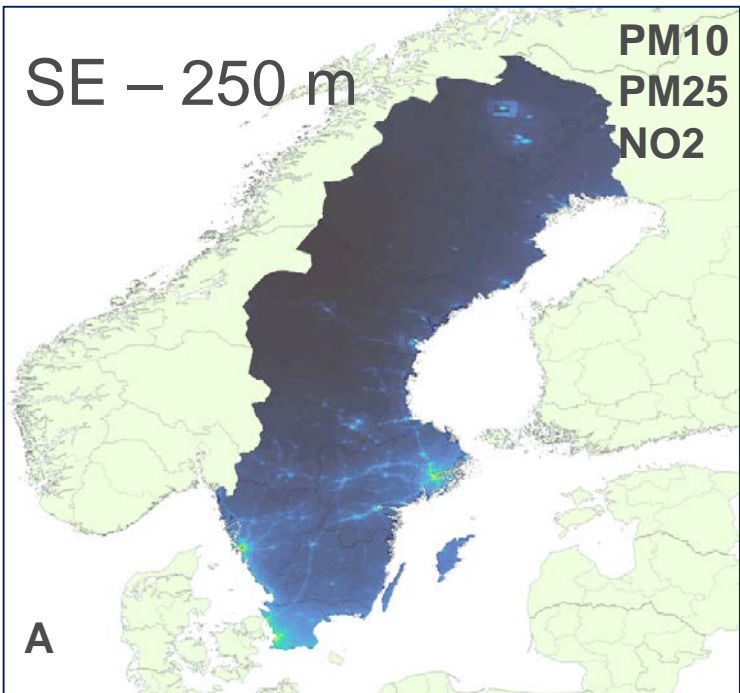
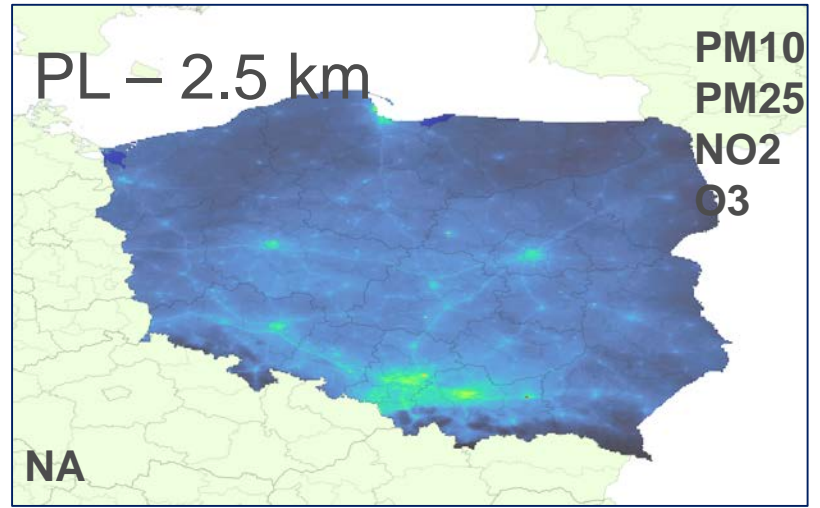
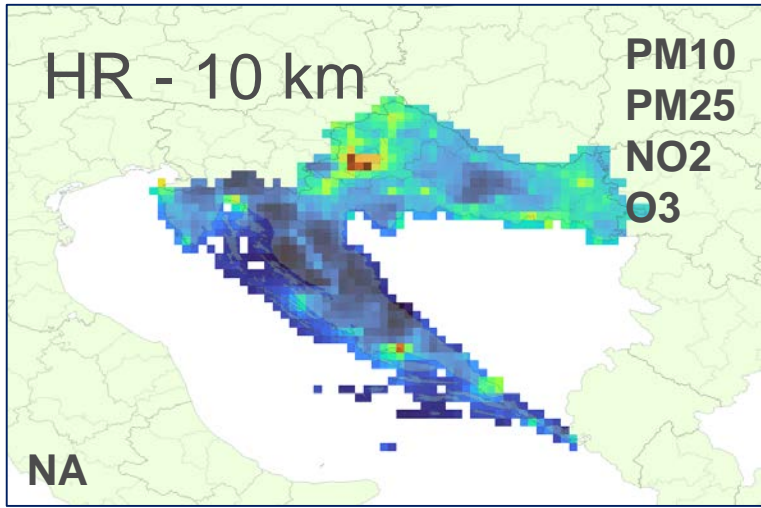
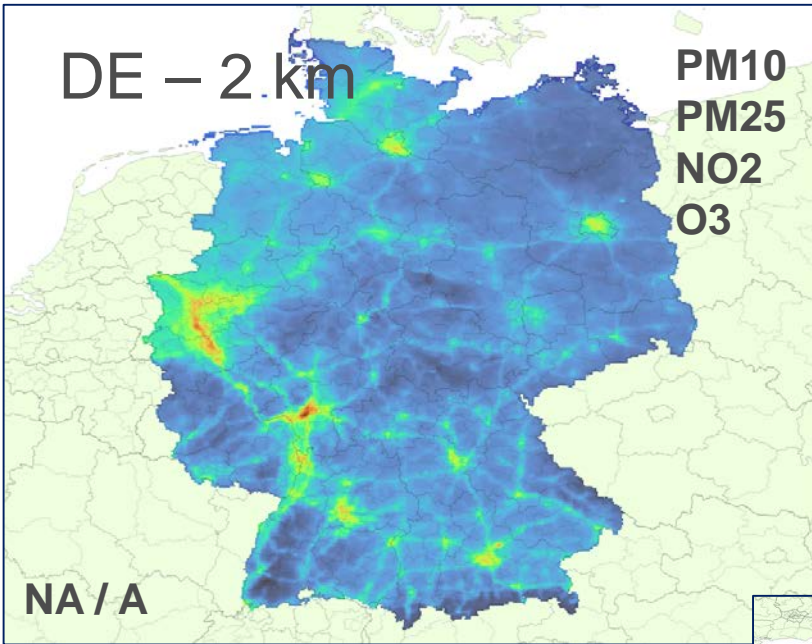
NA

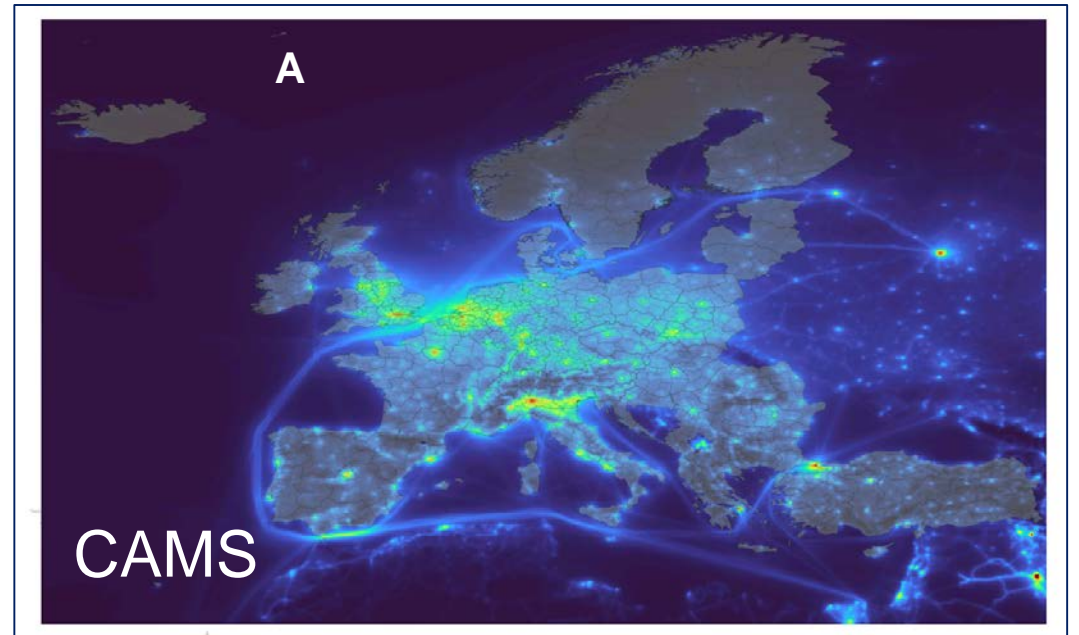
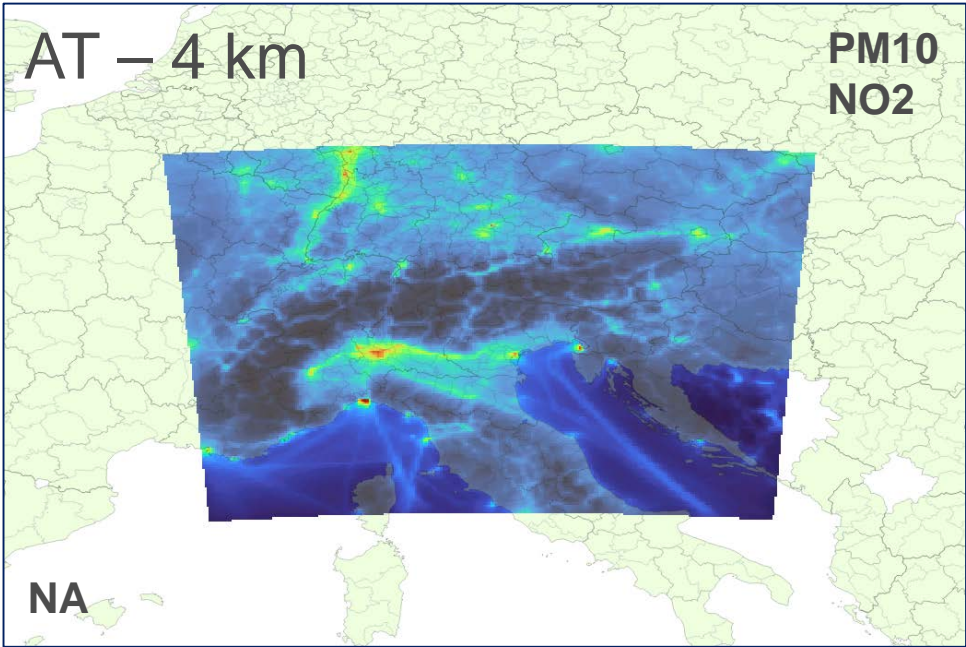
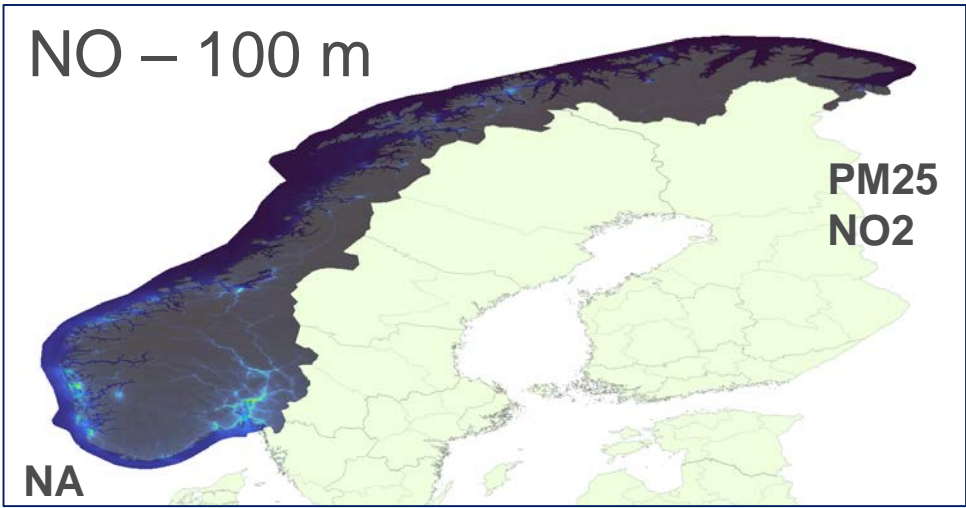
ES – 5 km

PM10
PM25
NO2

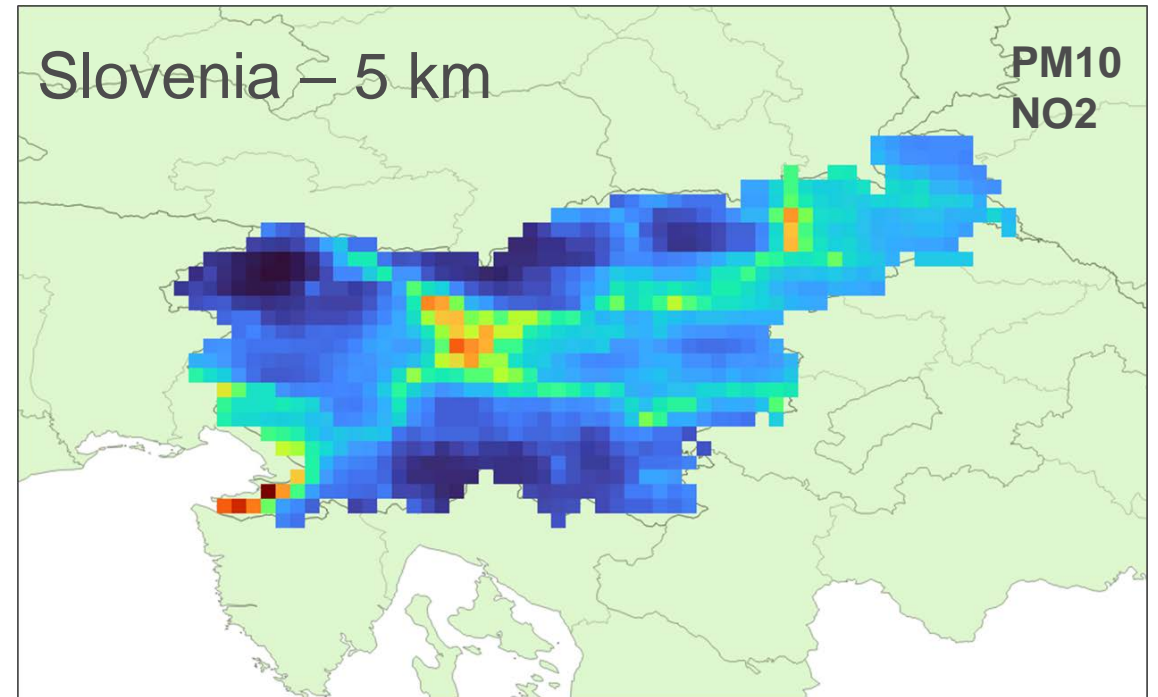
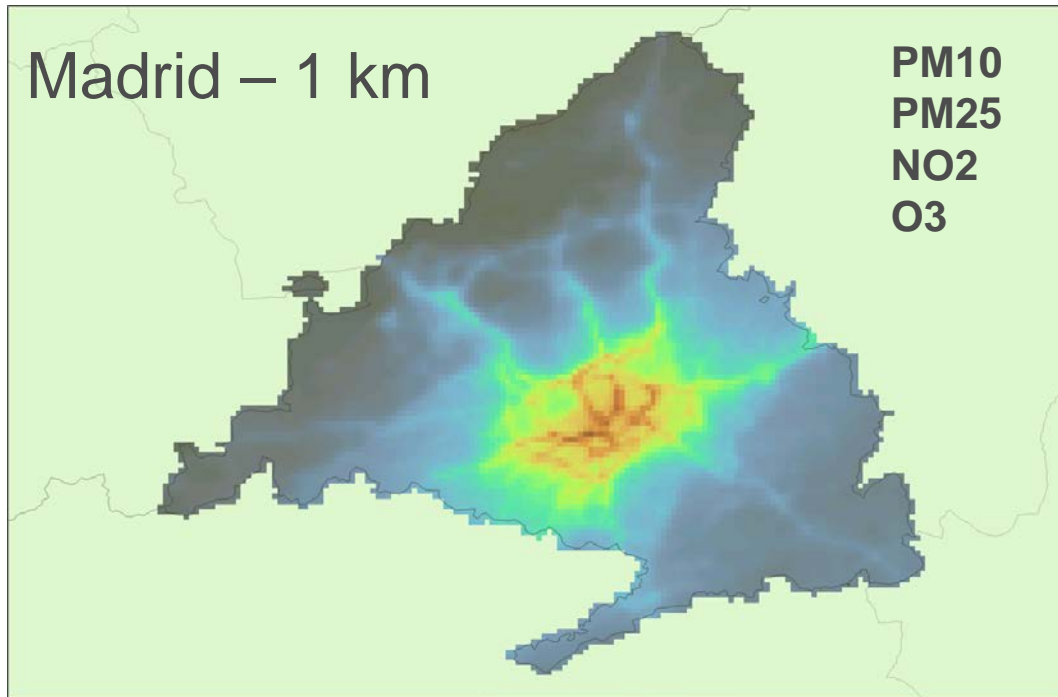


A





Delivered for other years than 2019

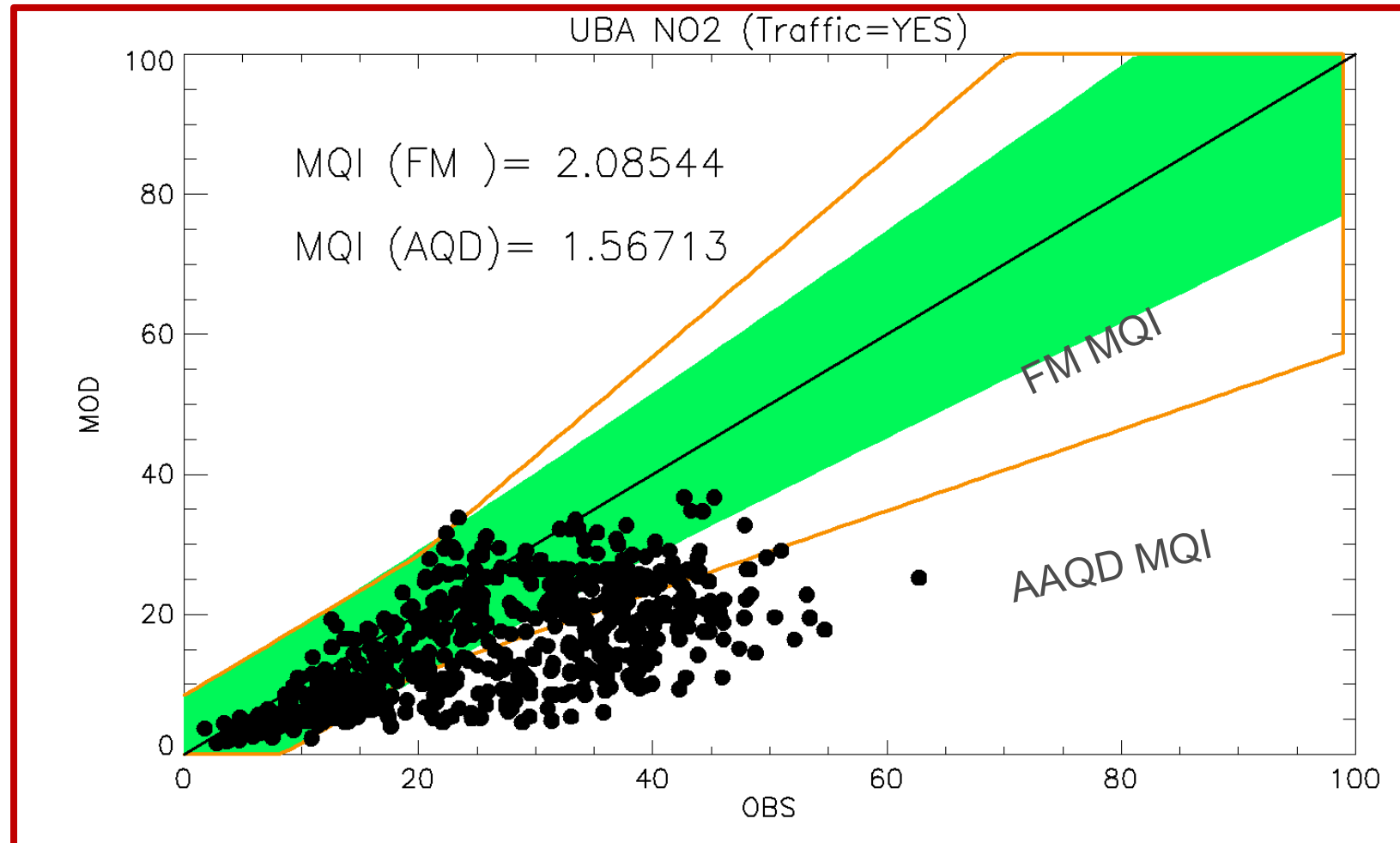
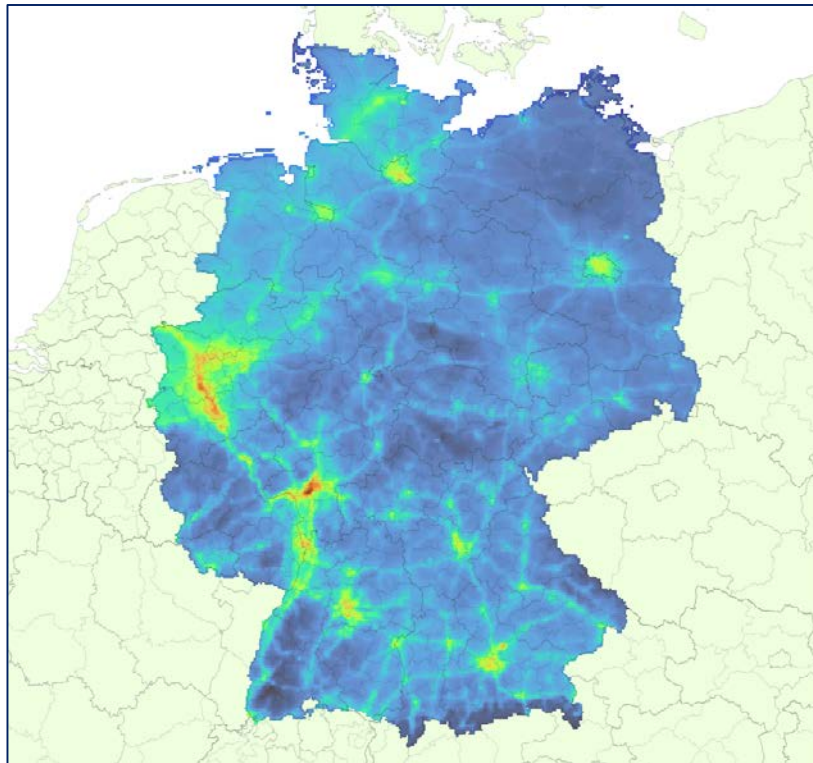


One example

Germany

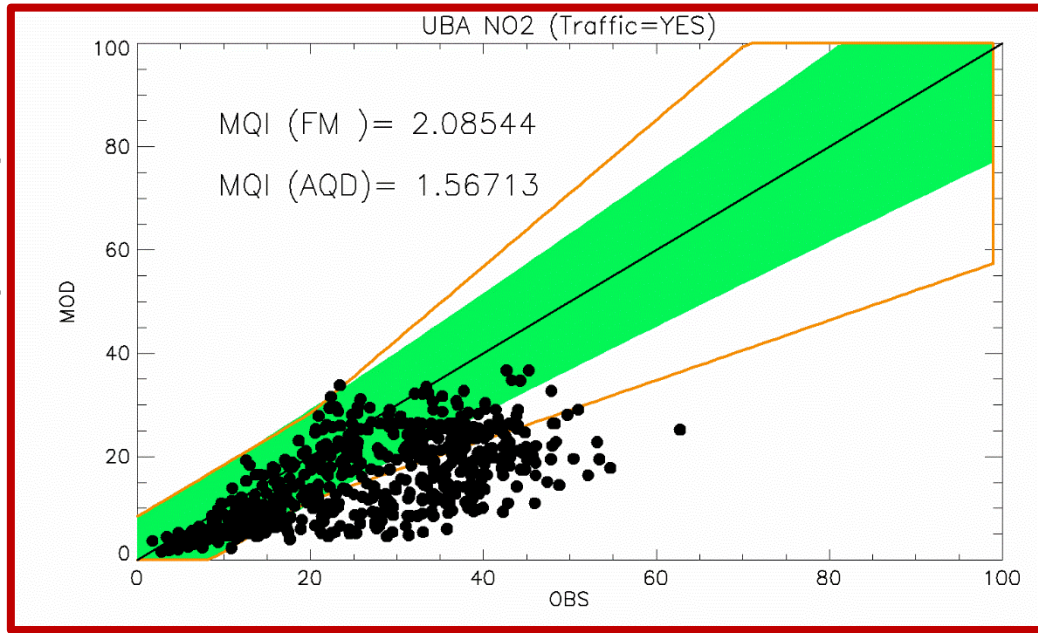
Germany

Spatial resolution: 2 km.
Pollutants: NO₂, O₃, PM₁₀ and PM_{2.5}.
Data assimilation: Yes/No
Year: 2019

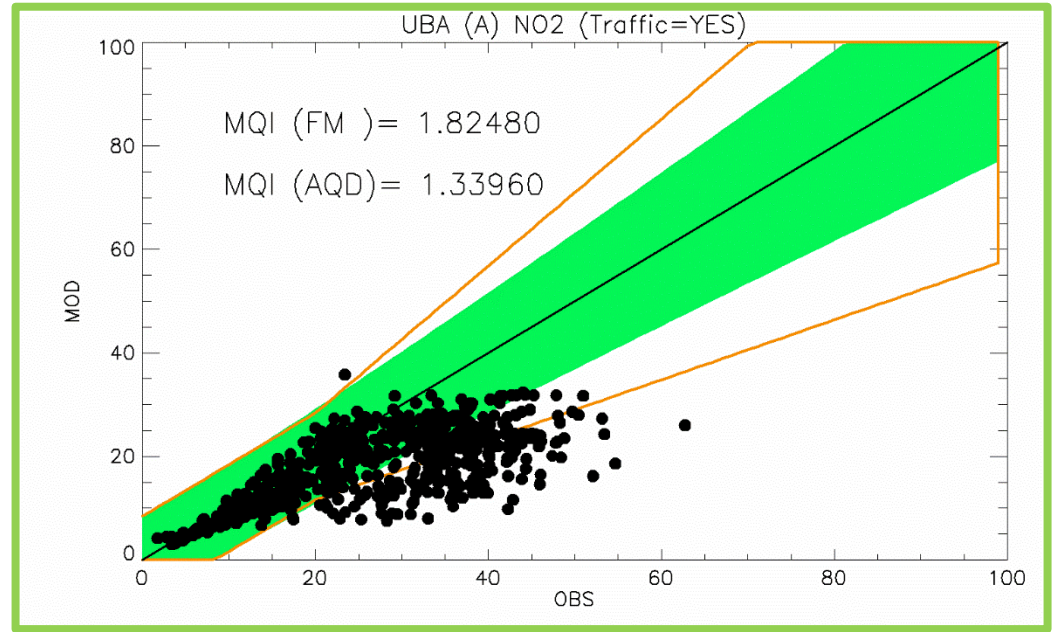


Non-assimilated

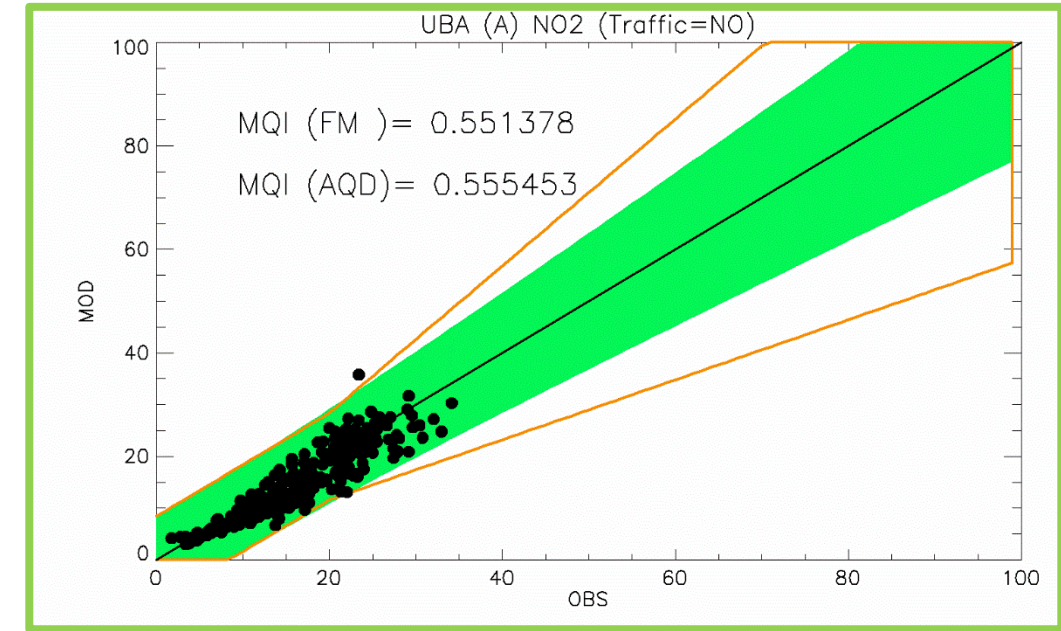
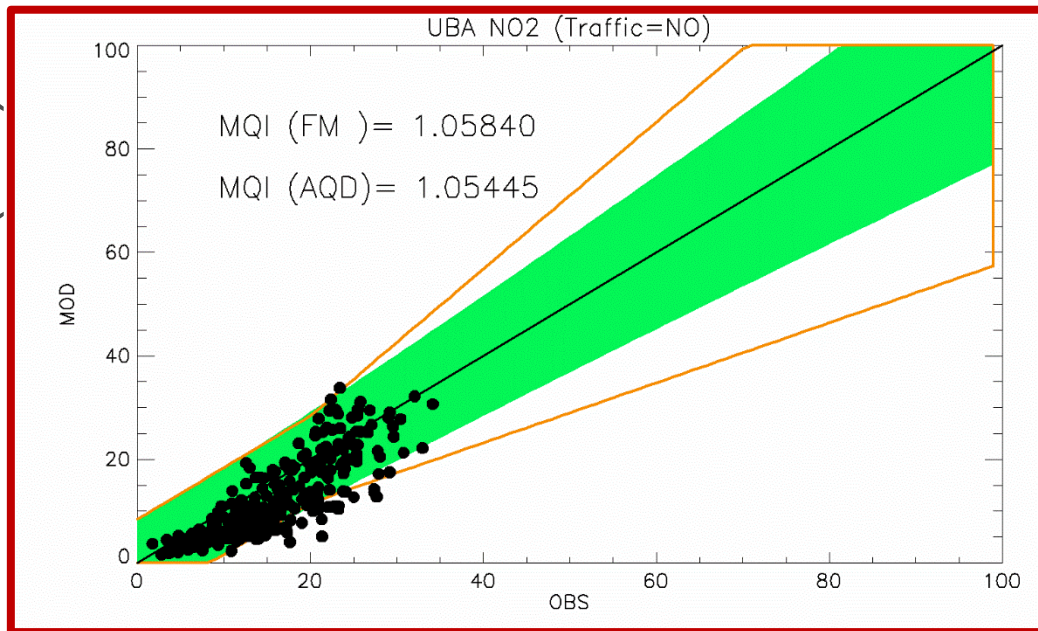
Traffic (Yes)



Assimilated



Traffic (No)



NO2

All results

Without traffic stations

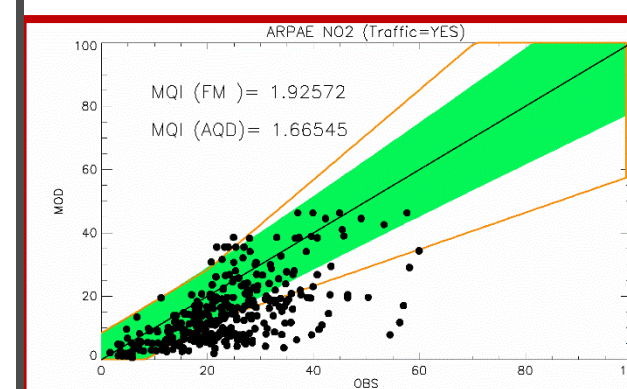
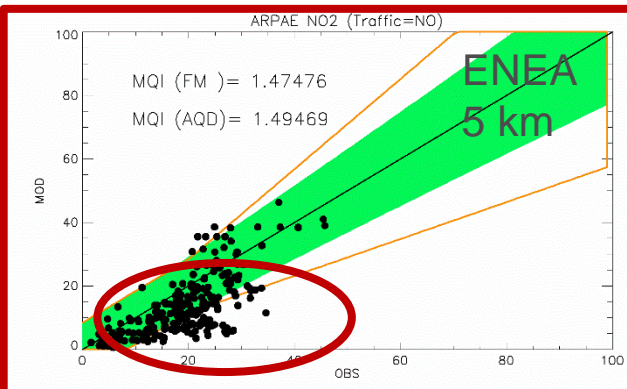
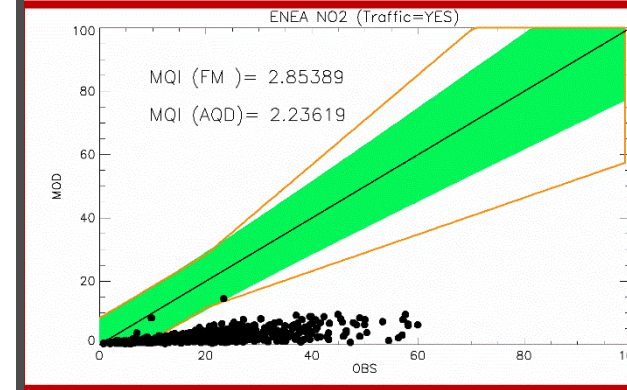
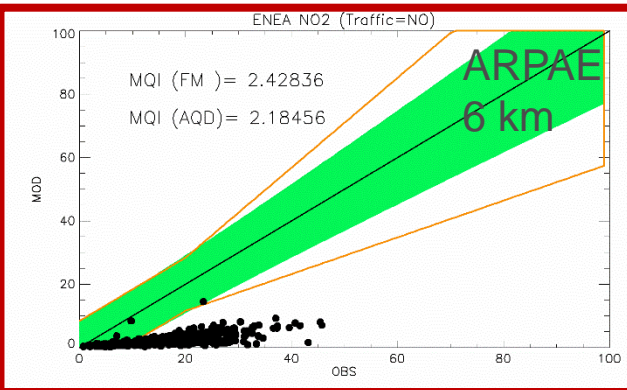
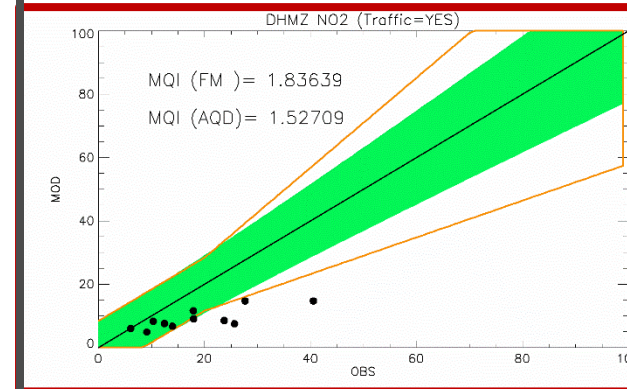
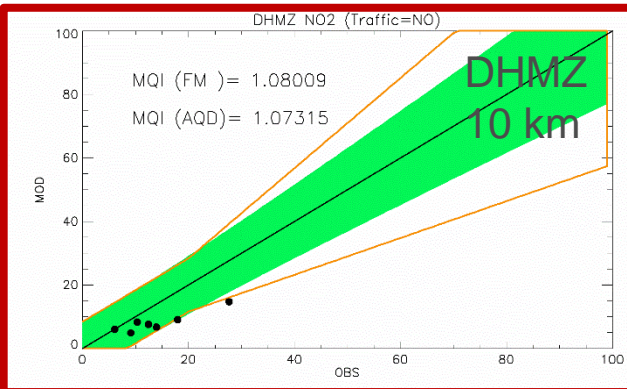
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

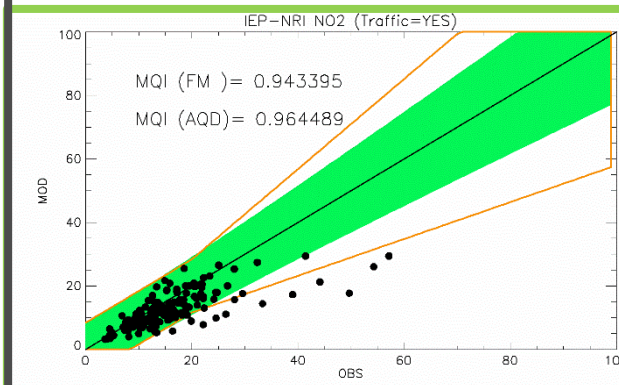
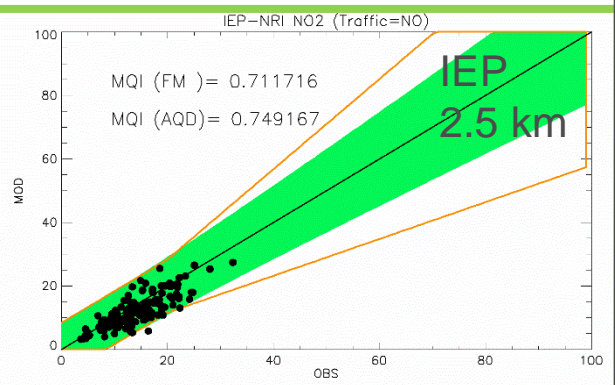
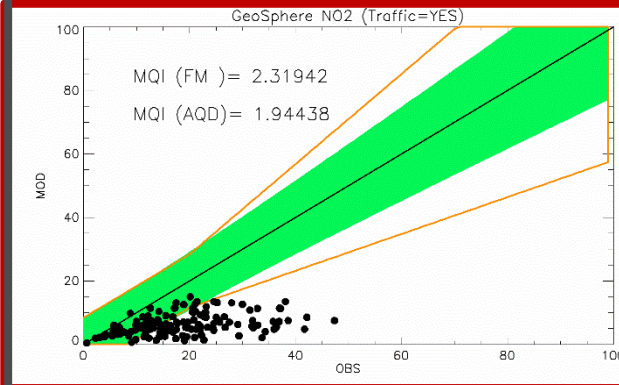
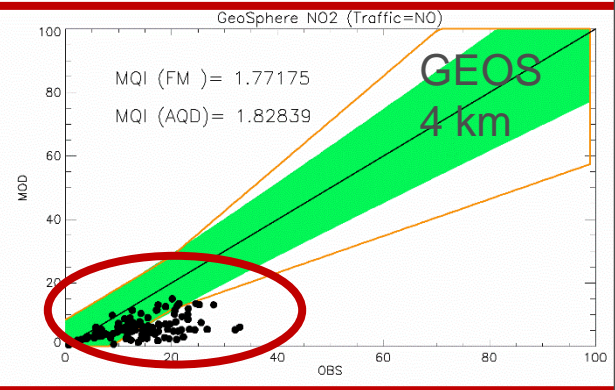
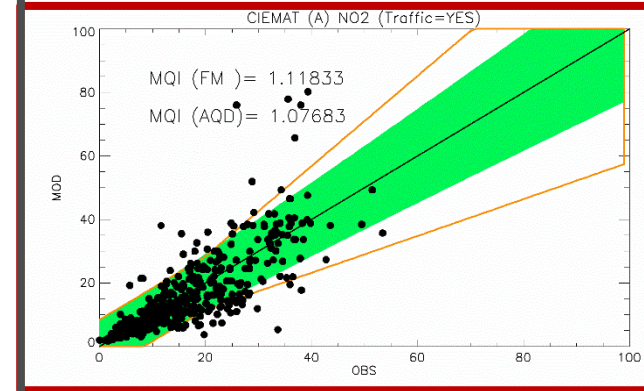
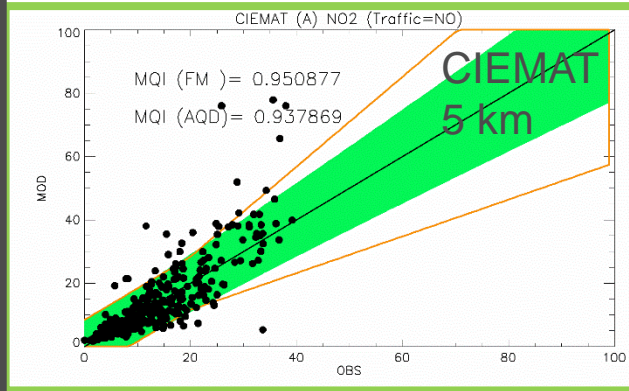
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

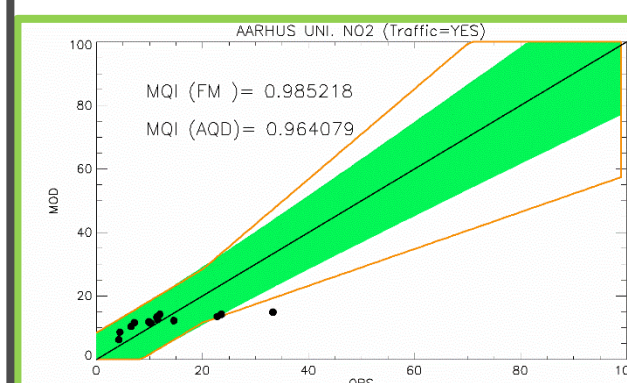
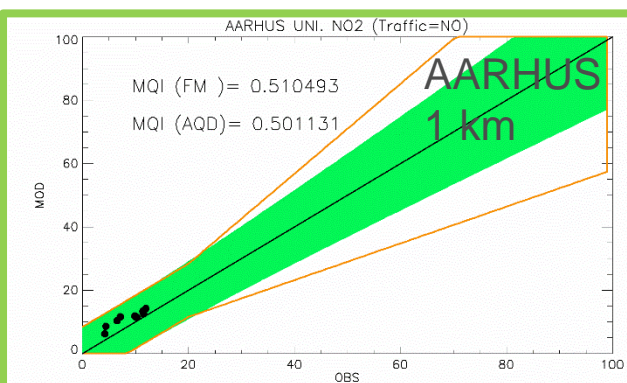
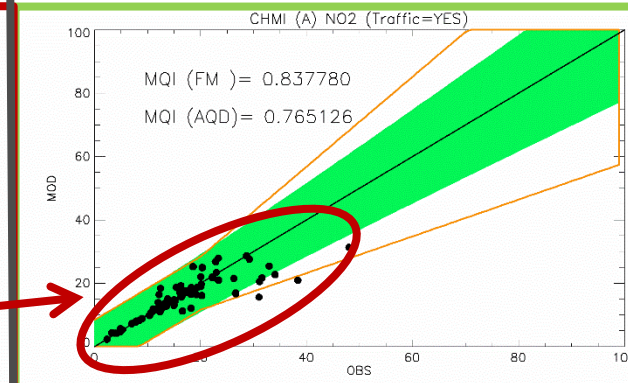
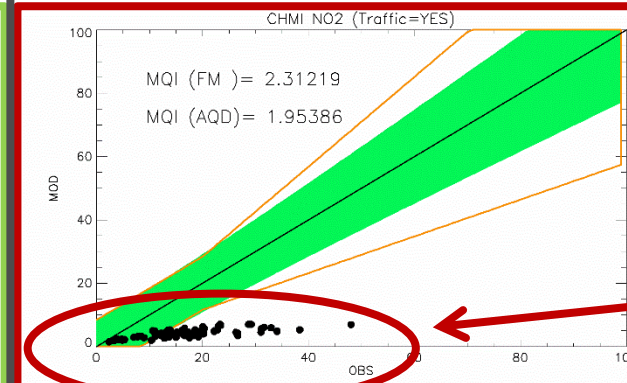
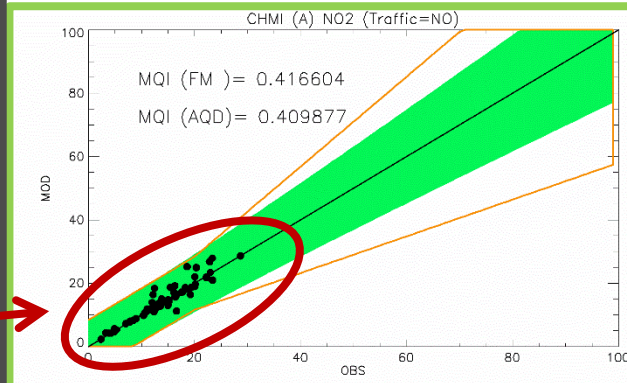
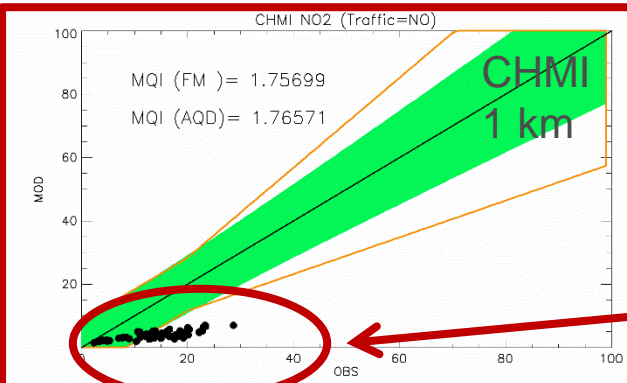
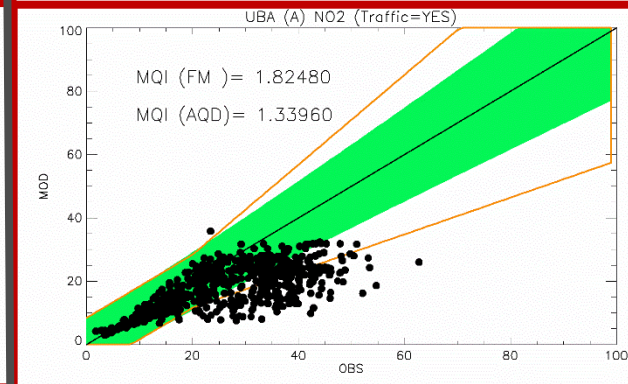
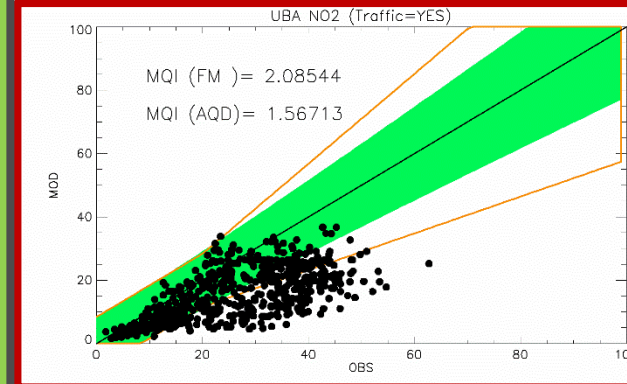
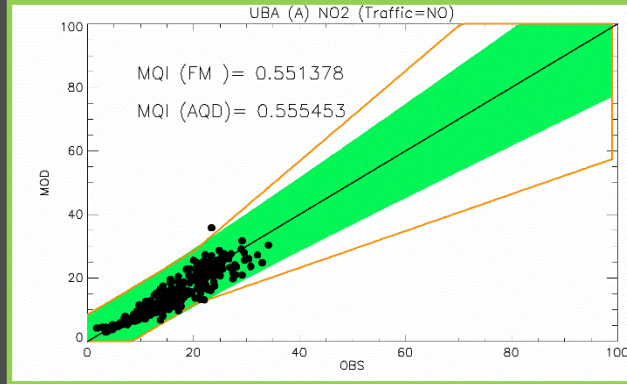
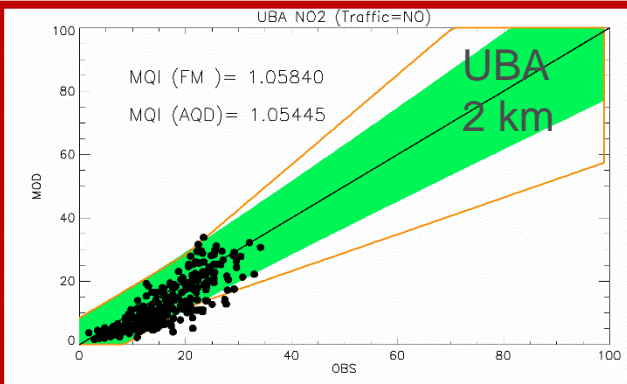
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

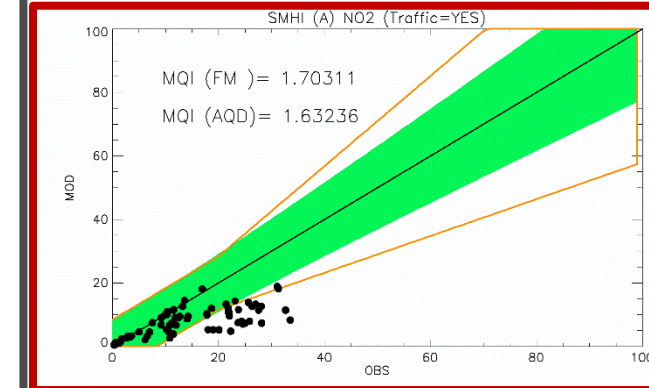
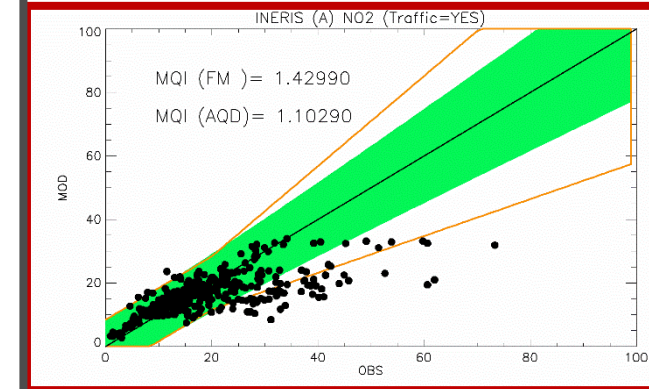
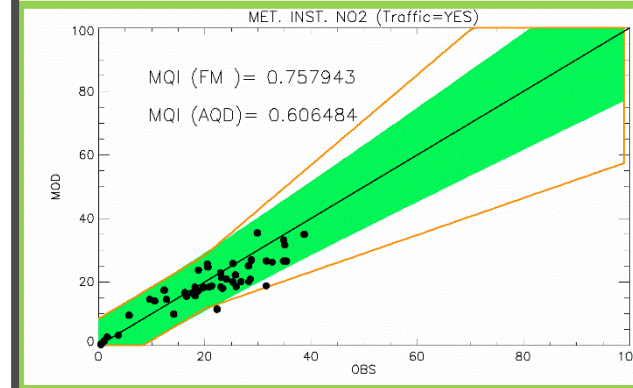
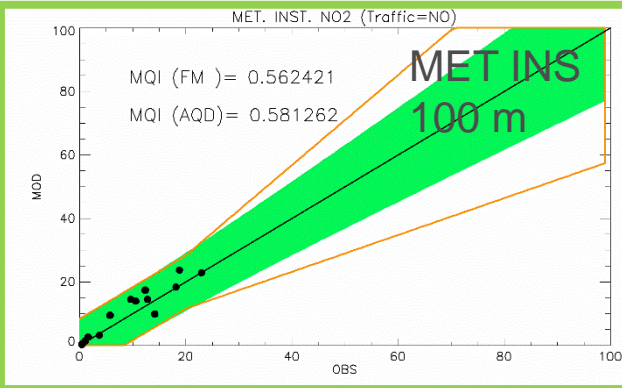
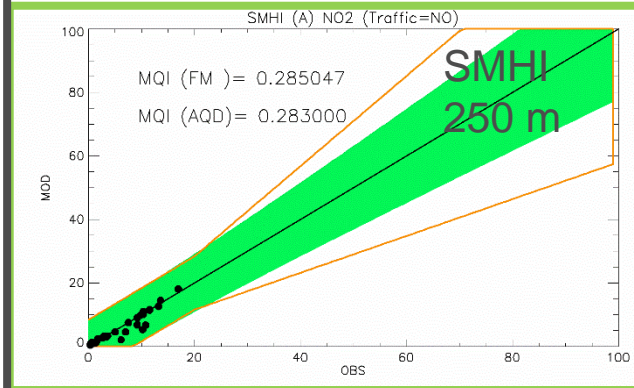
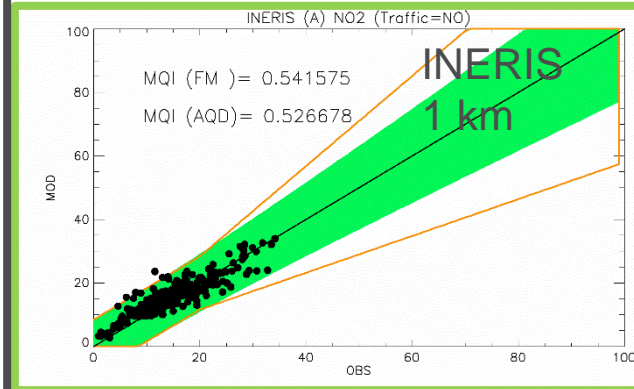
Non-assimilated

Assimilated

With traffic stations

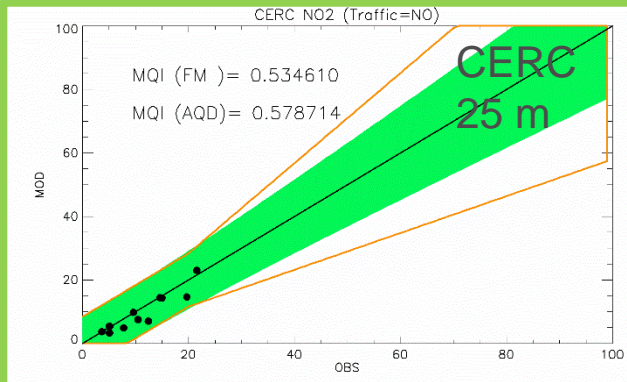
Non-assimilated

Assimilated

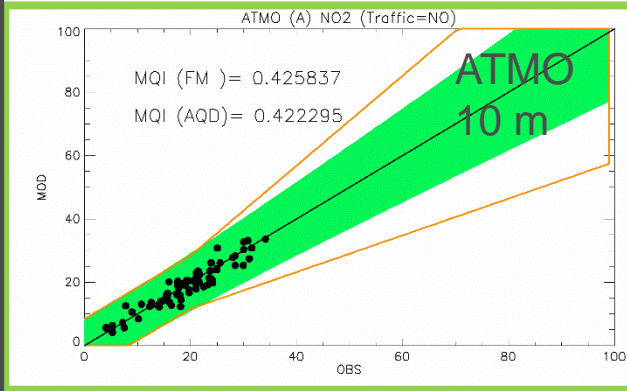


Without traffic stations

Non-assimilated

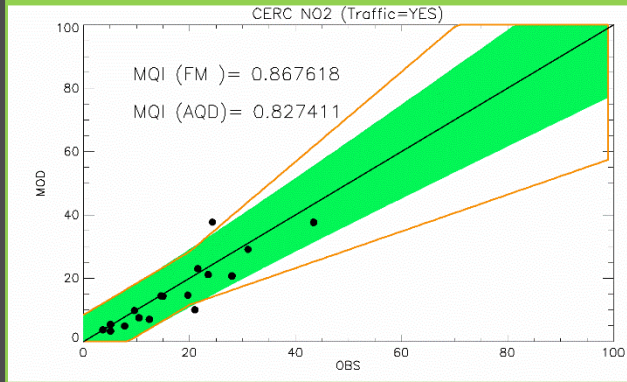


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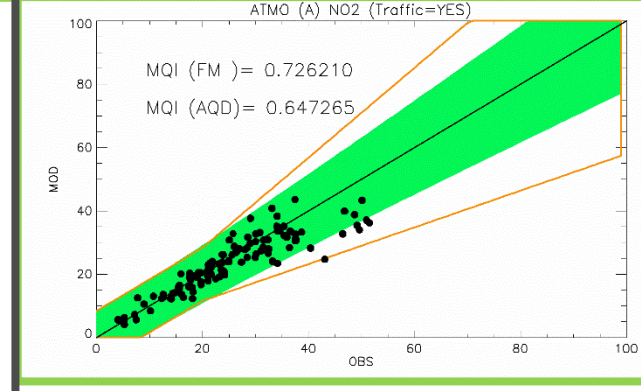


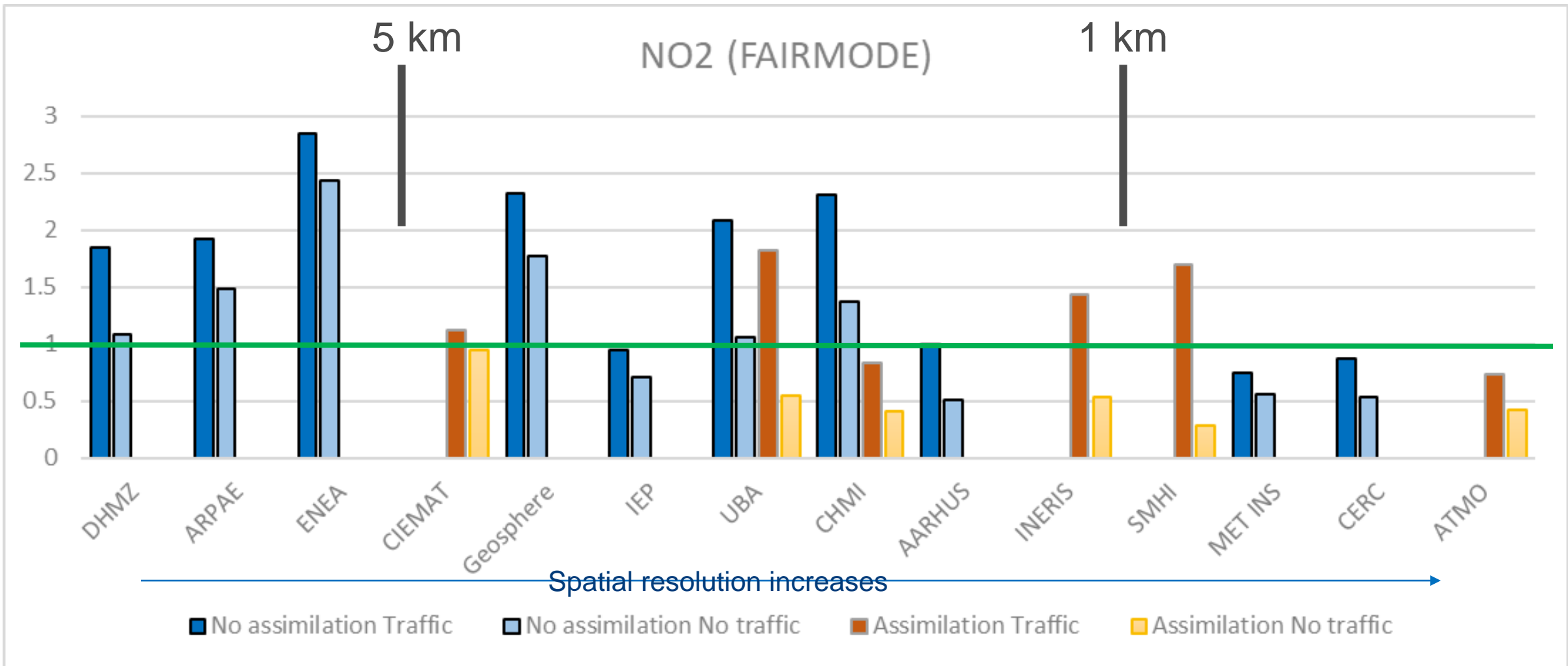
With traffic stations

Non-assimilated



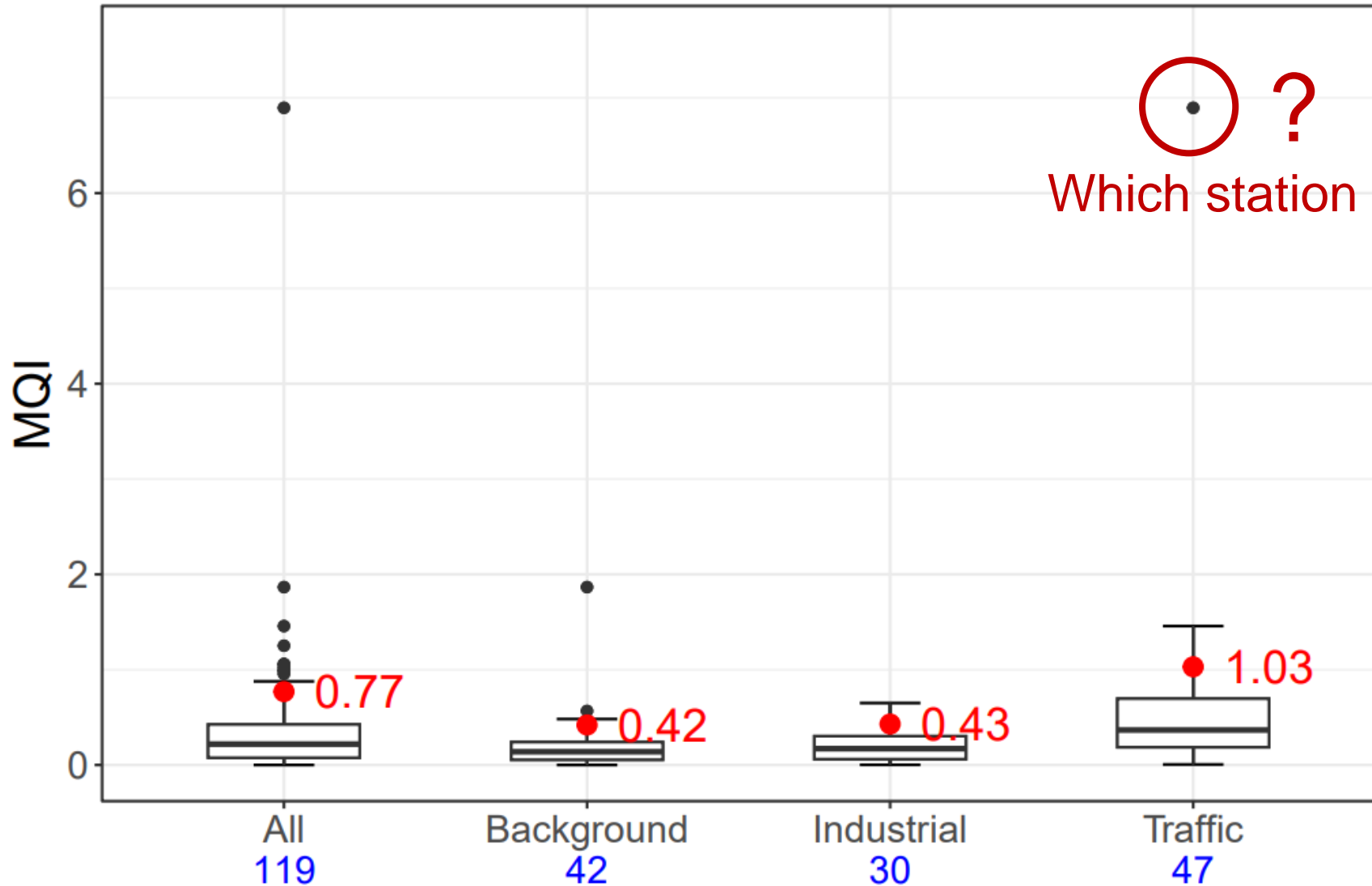
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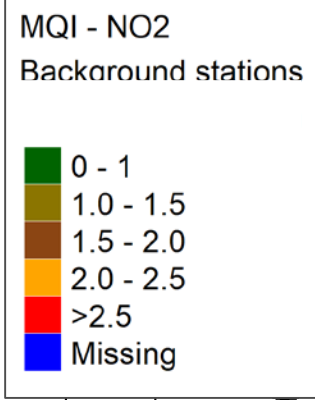
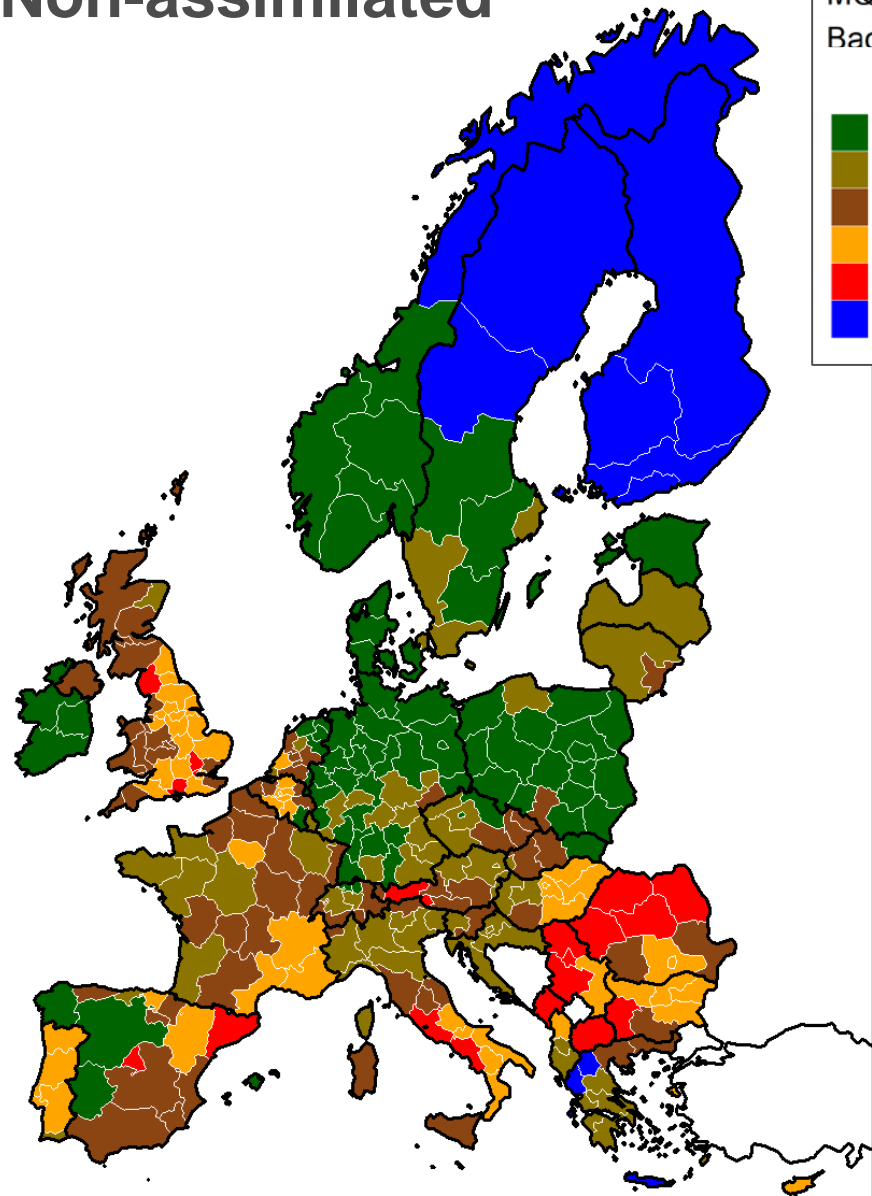


- Excluding traffic stations always improves performances
- Assimilation always improve results (but only based on 2 models)
- Assimilation of traffic stations can lead to non-passing the test (e.g. Aarhus)
- Some non-assimilated results are very good on traffic stations despite resolution (IEP, AARHUS)!

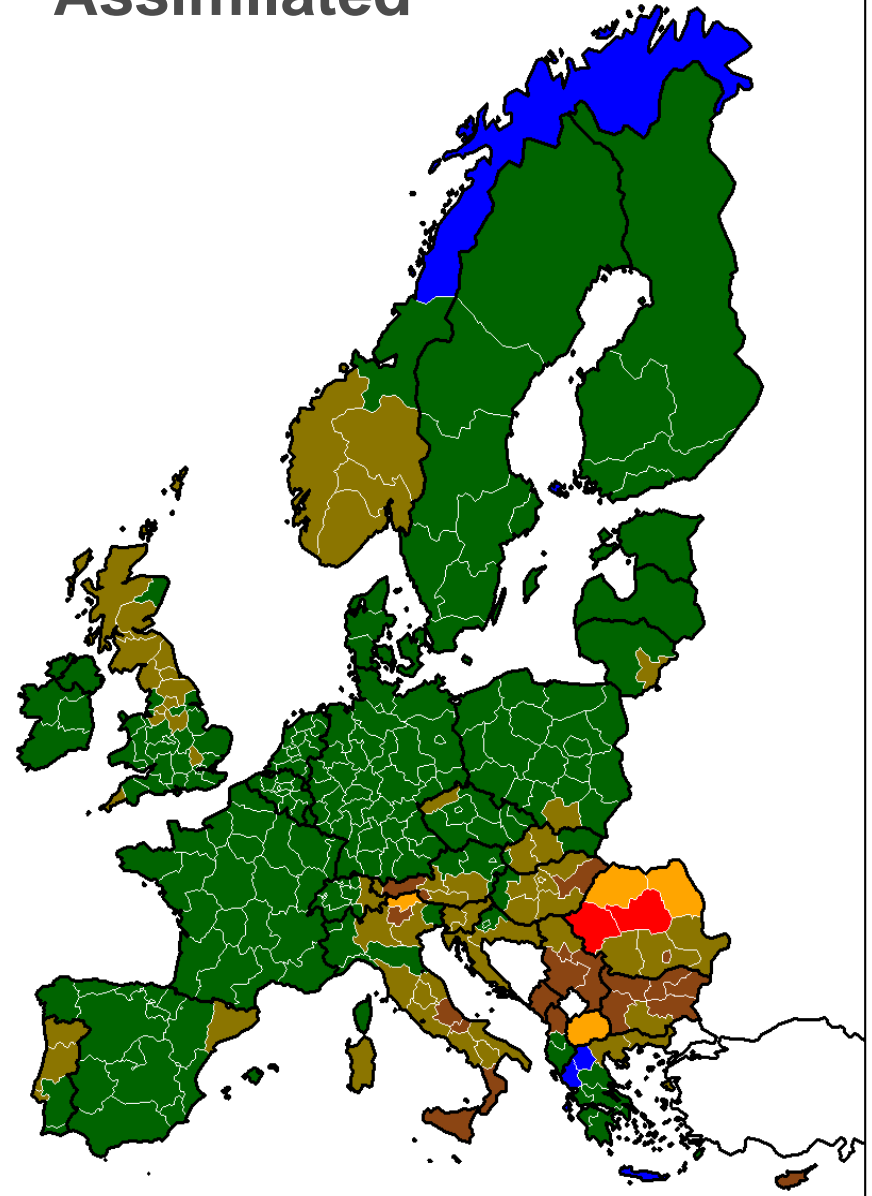
NO2 - ATMO - Belgium (A)



Non-assimilated



Assimilated



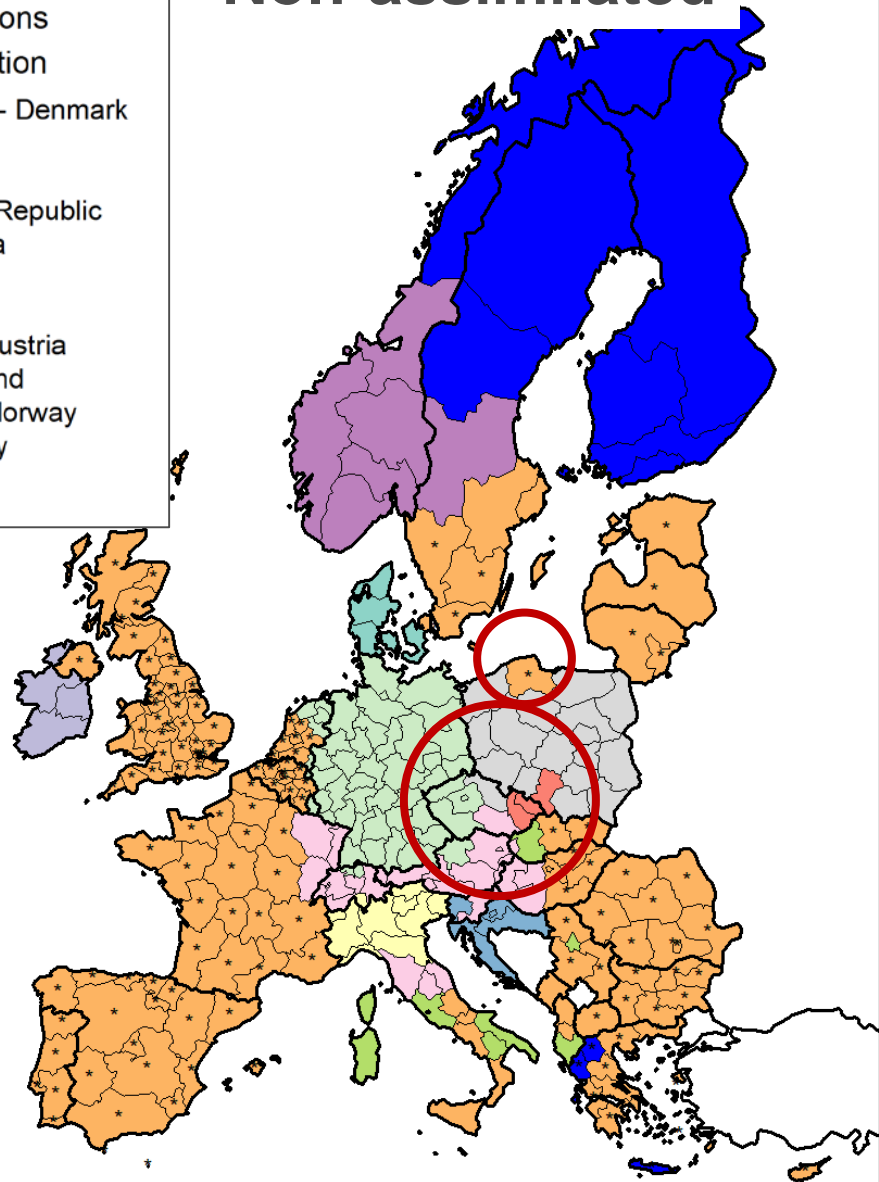
Best model - NO2

Background stations

No data assimilation

- AARHUS UNI. - Denmark
- ARPAE - Italy
- CERC - Ireland
- CHMI - Czech Republic
- DHMZ - Croatia
- EMEP - EU
- ENEA - Italy
- GeoSphere - Austria
- IEP-NRI - Poland
- MET. INST. - Norway
- UBA - Germany
- Missing

Non-assimilated



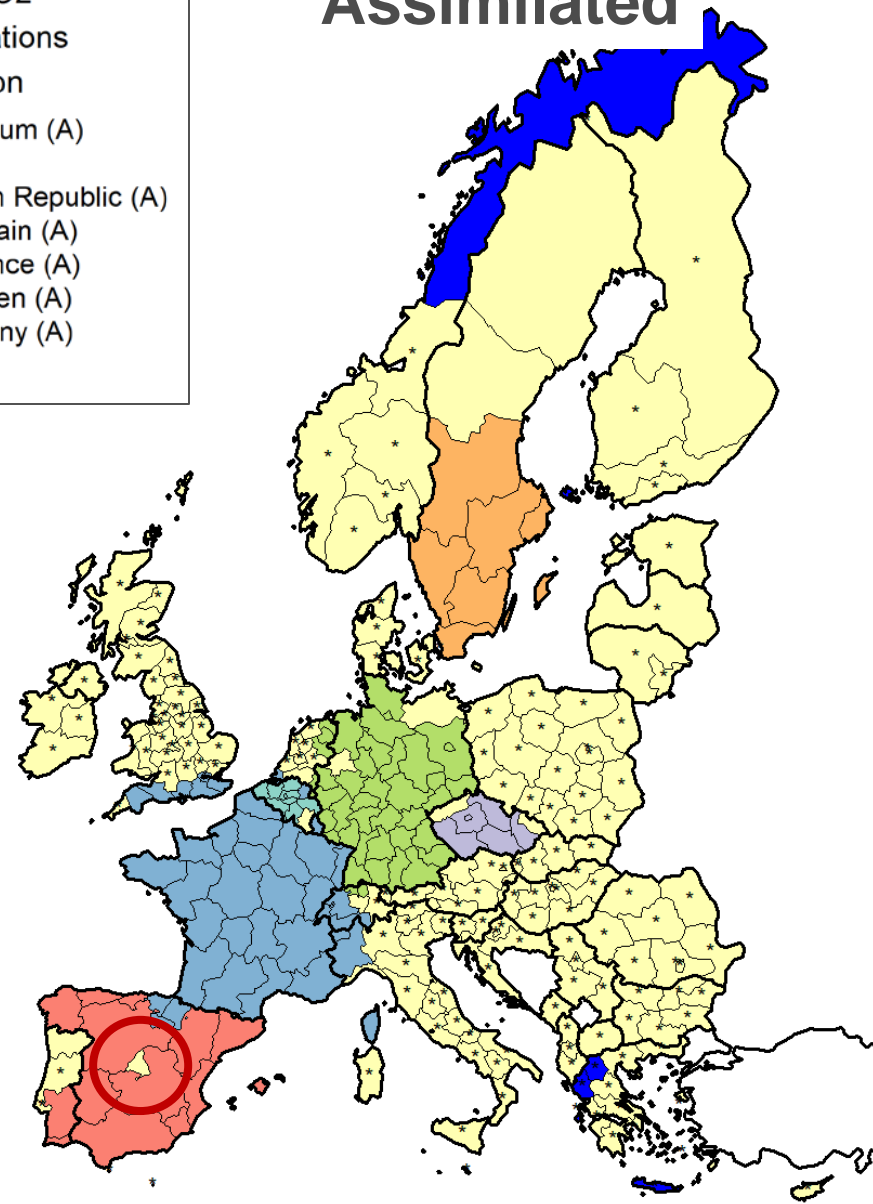
Best model - NO2

Background stations

Data assimilation

- ATMO - Belgium (A)
- CAMS - EU
- CHMI - Czech Republic (A)
- CIEMAT - Spain (A)
- INERIS - France (A)
- SMHI - Sweden (A)
- UBA - Germany (A)
- Missing

Assimilated



What can we learn from this NO₂ analysis?

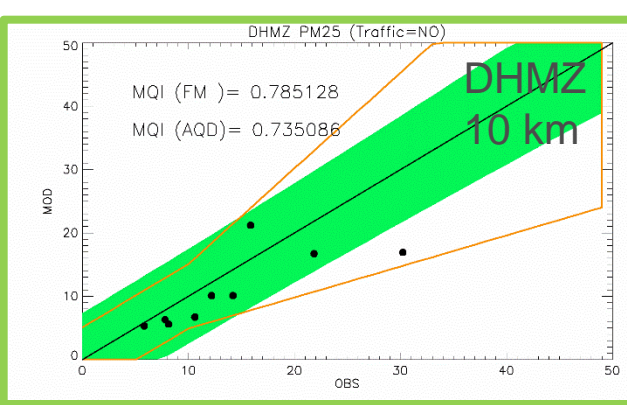
- Model Quality performance improves when we using data assimilation - can we trust this with 2 models?
- Model Quality performance increases with finer resolution
- Model Quality performance degrades when traffic ststions are included (except for IEP;AARHUS ?)
- National modelling results have generally higher the MQI than European- wide models – can we explain the outliers?

PM2.5

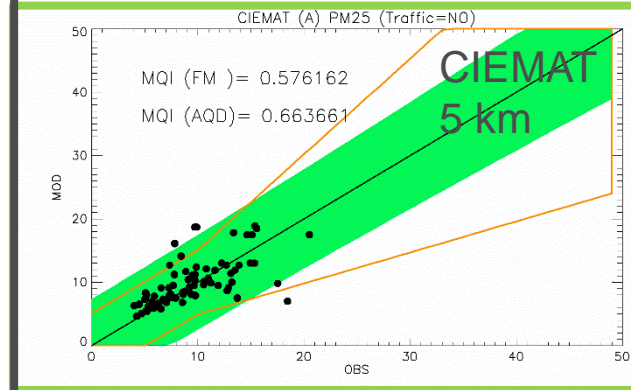
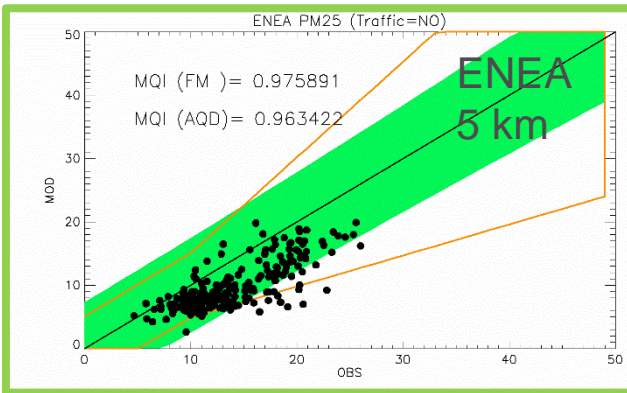
All results

Without traffic stations

Non-assimilated

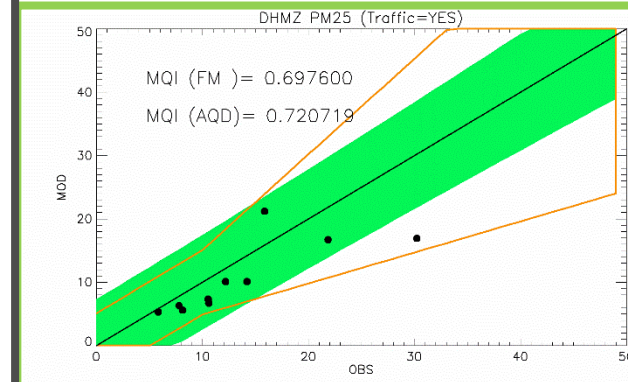


Assimilated

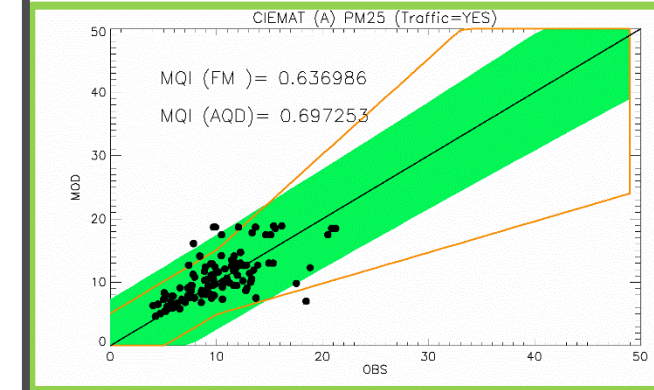
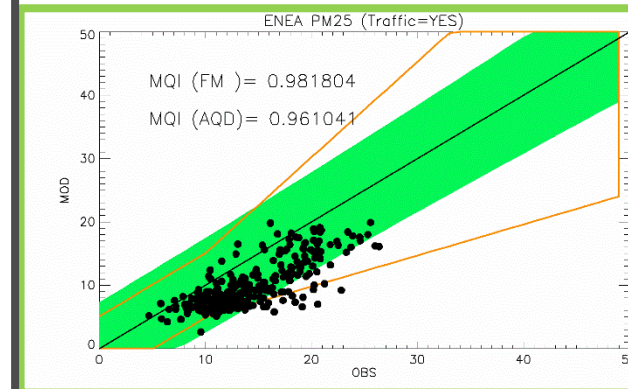


With traffic stations

Non-assimilated

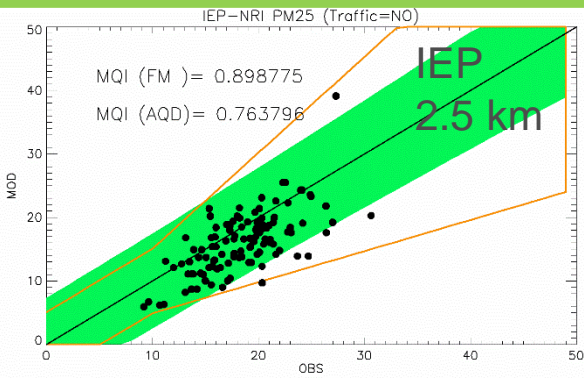


Assimilated

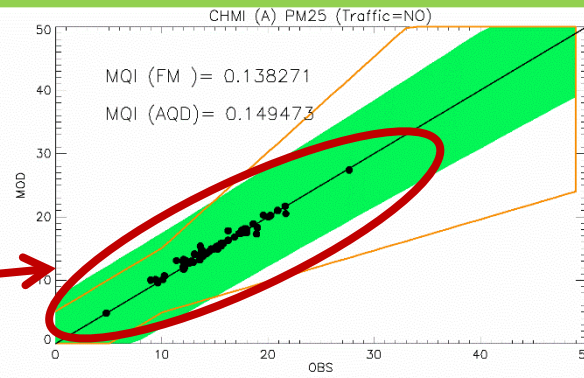
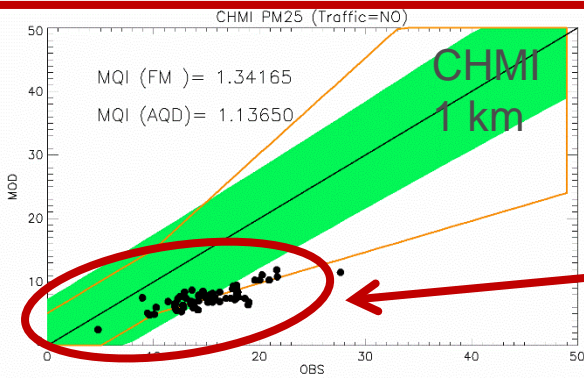
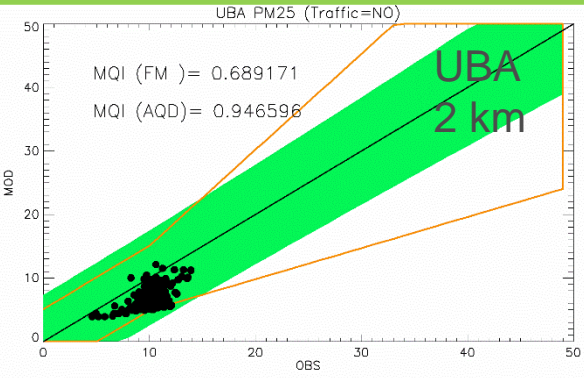
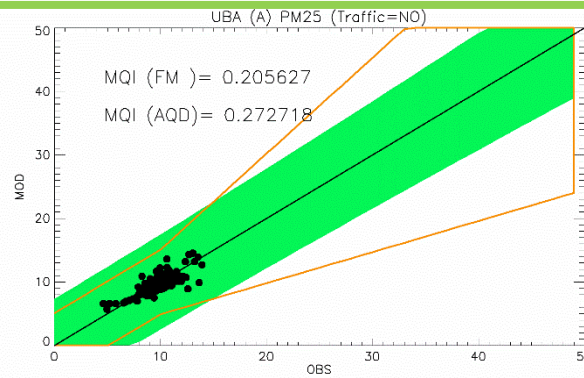


Without traffic stations

Non-assimilated

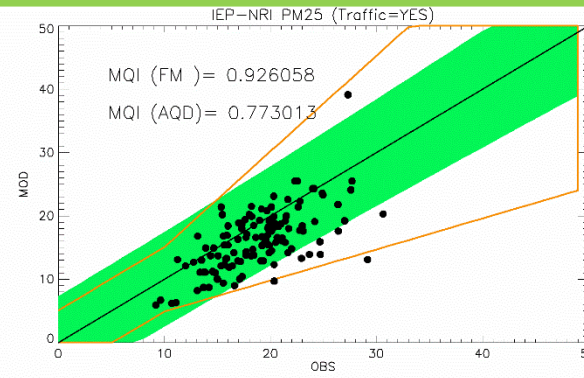


Assimilated

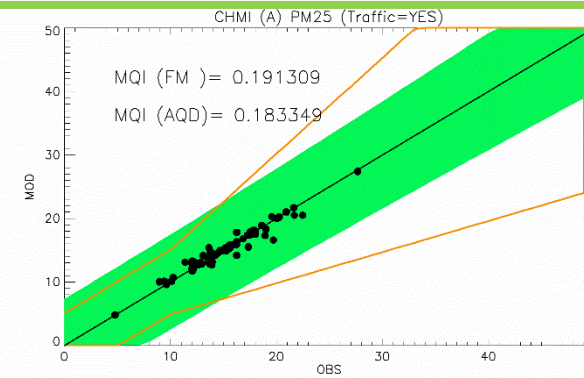
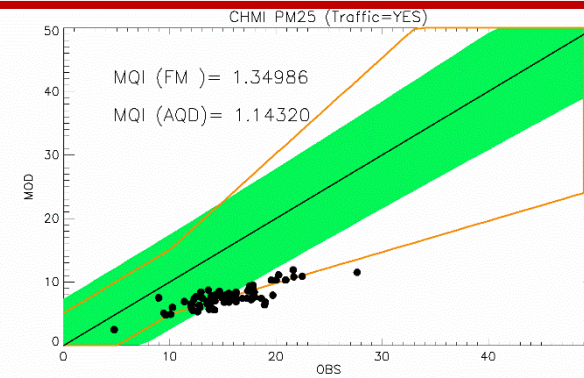
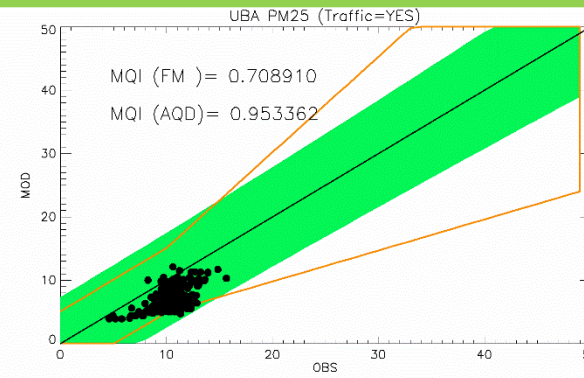
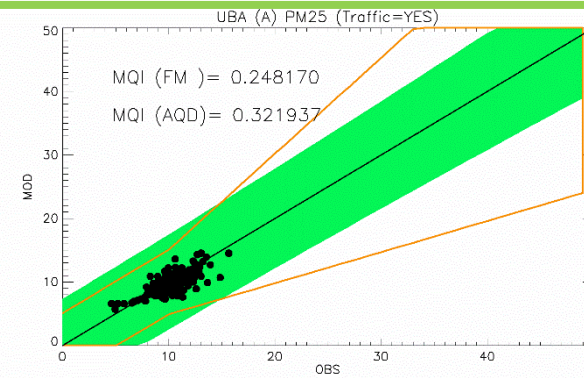


With traffic stations

Non-assimilated

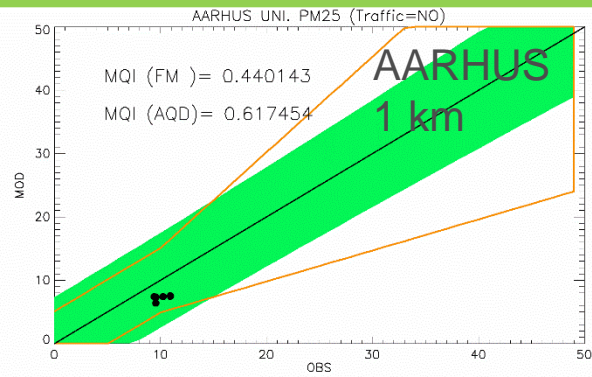


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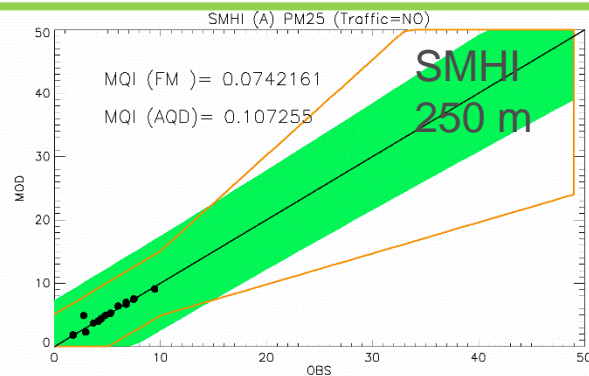
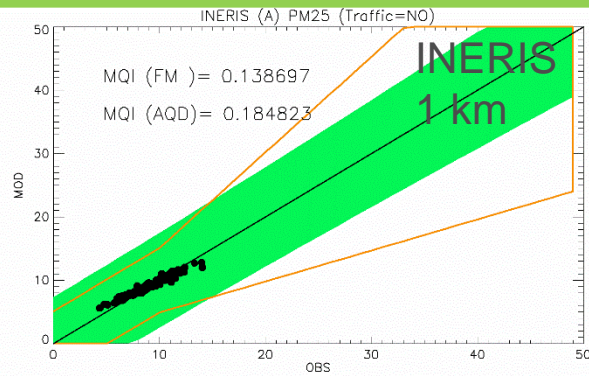


Without traffic stations

Non-assimilated

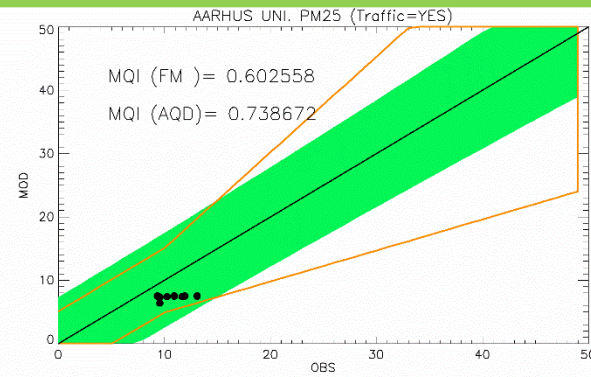


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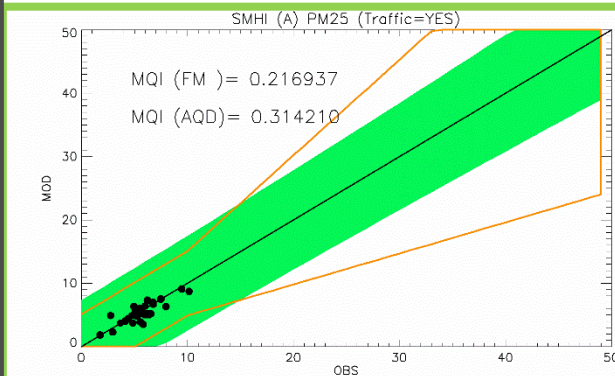
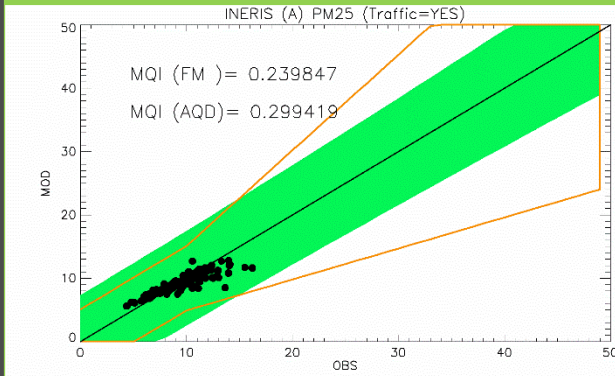


With traffic stations

Non-assimilated

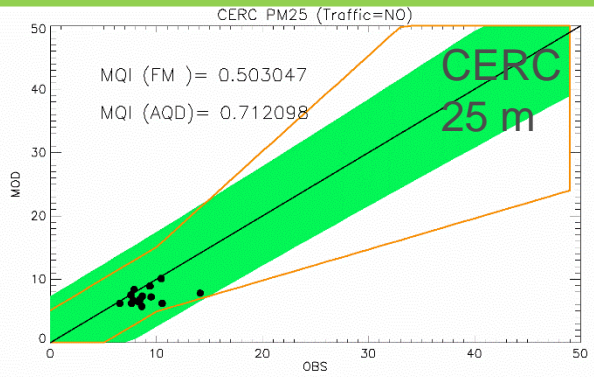
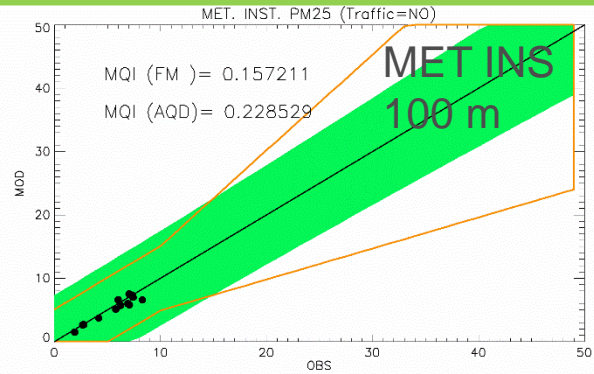


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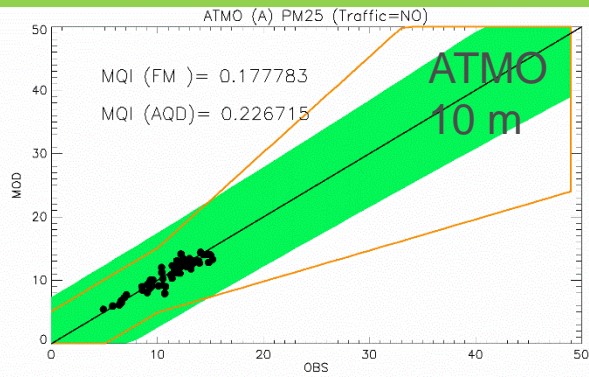


Without traffic stations

Non-assimilated

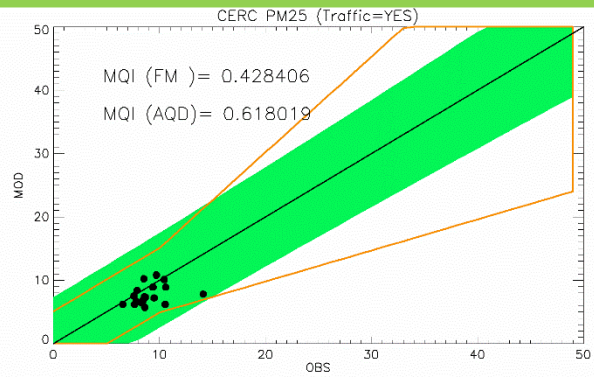
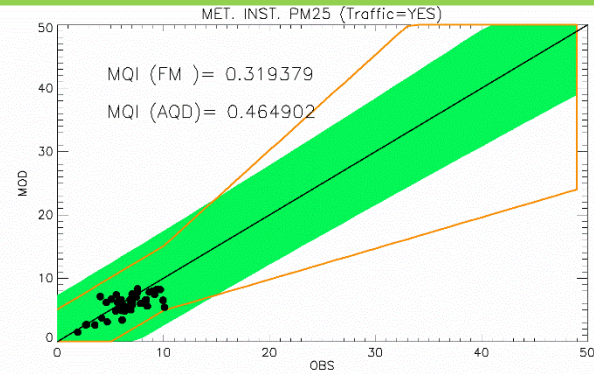


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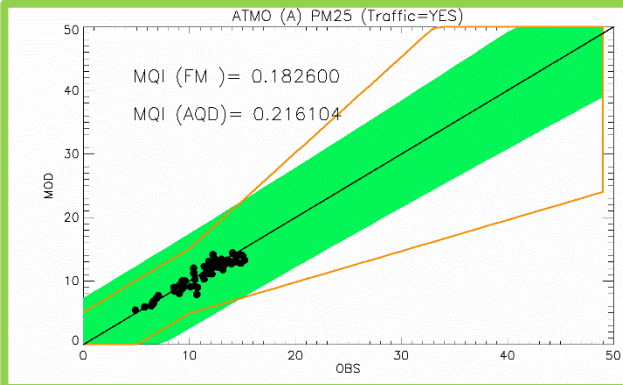


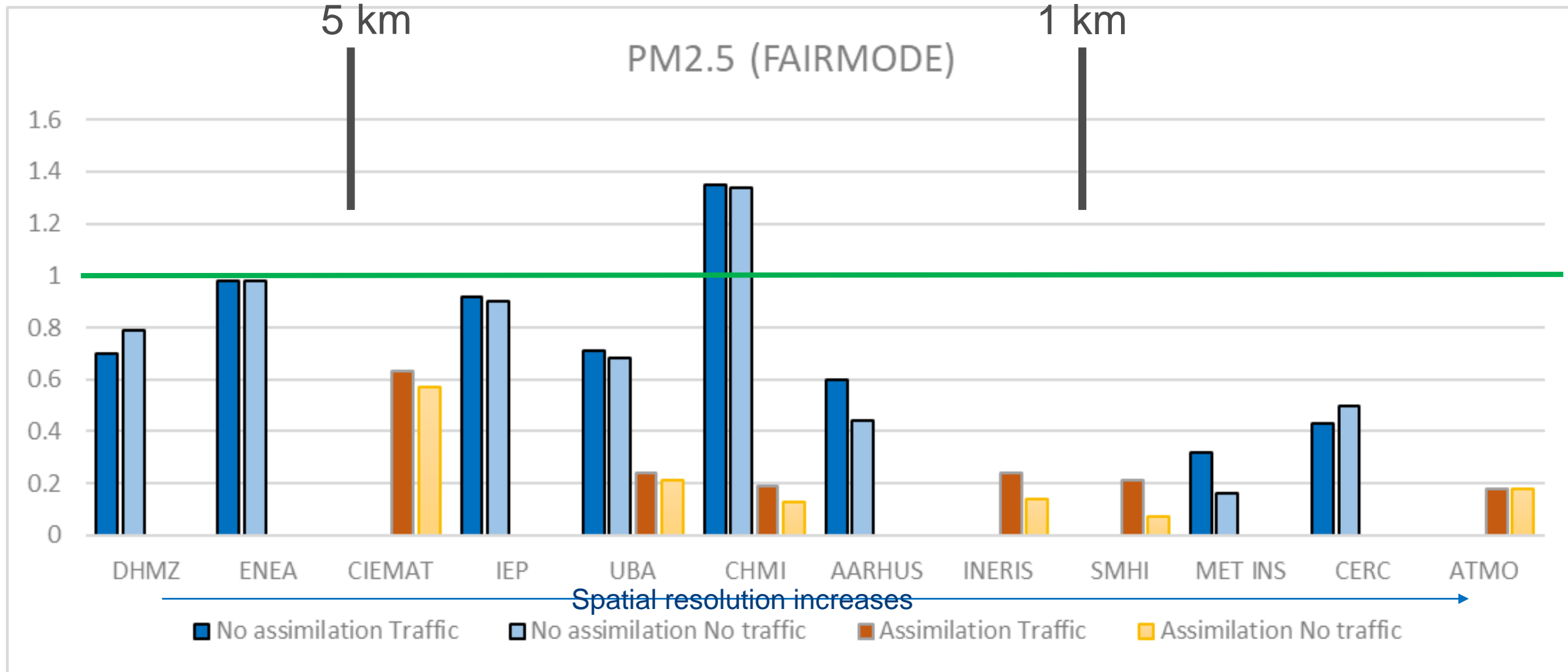
With traffic stations

Non-assimilated



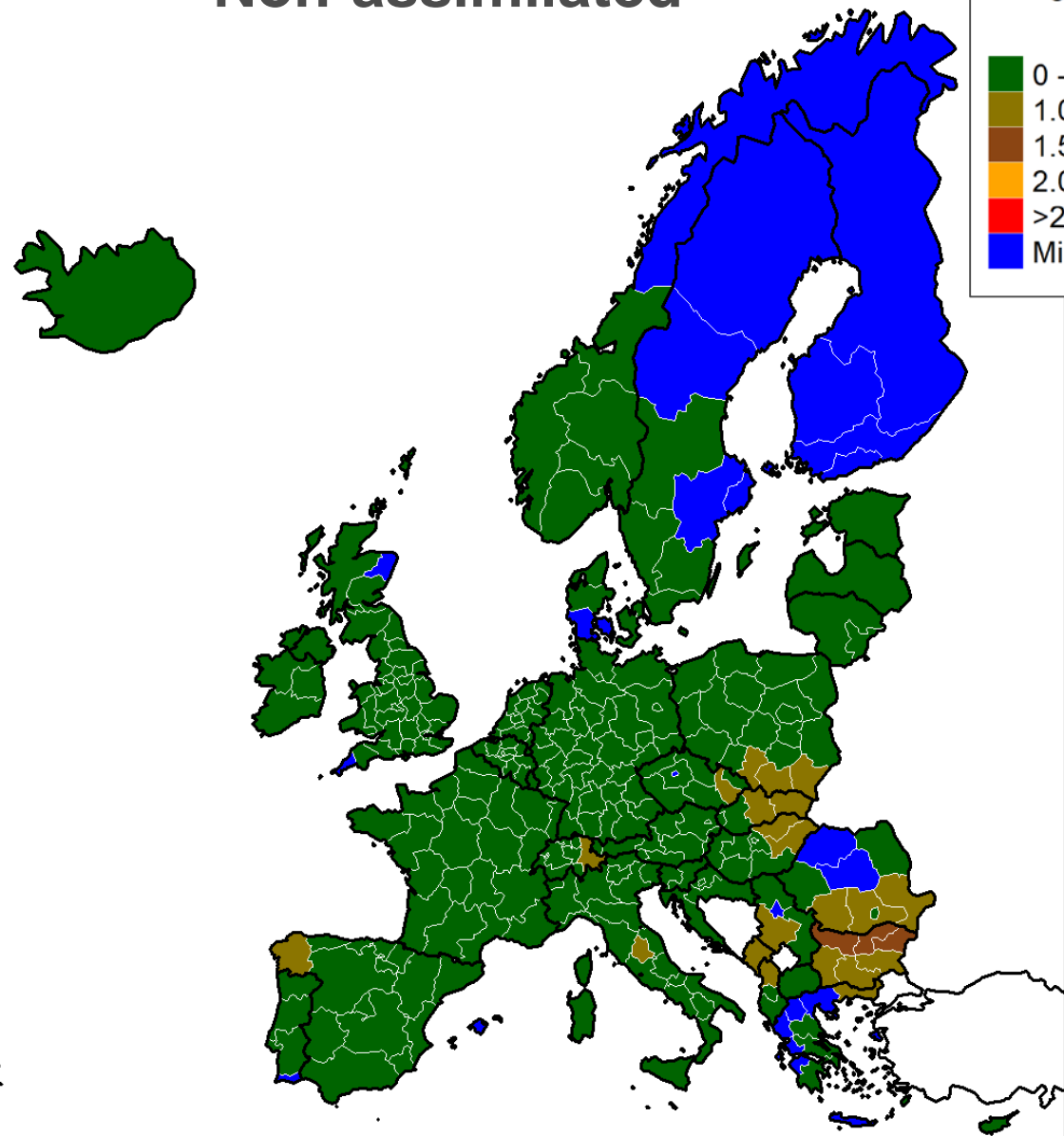
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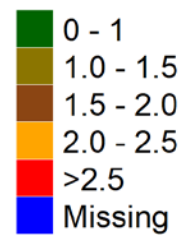


- Most models fulfill the MQO even at coarse resolution
- Little difference between results including traffic and non-traffic stations
- Large impact of assimilation but only two test cases
- Higher resolution improves the results but is not key

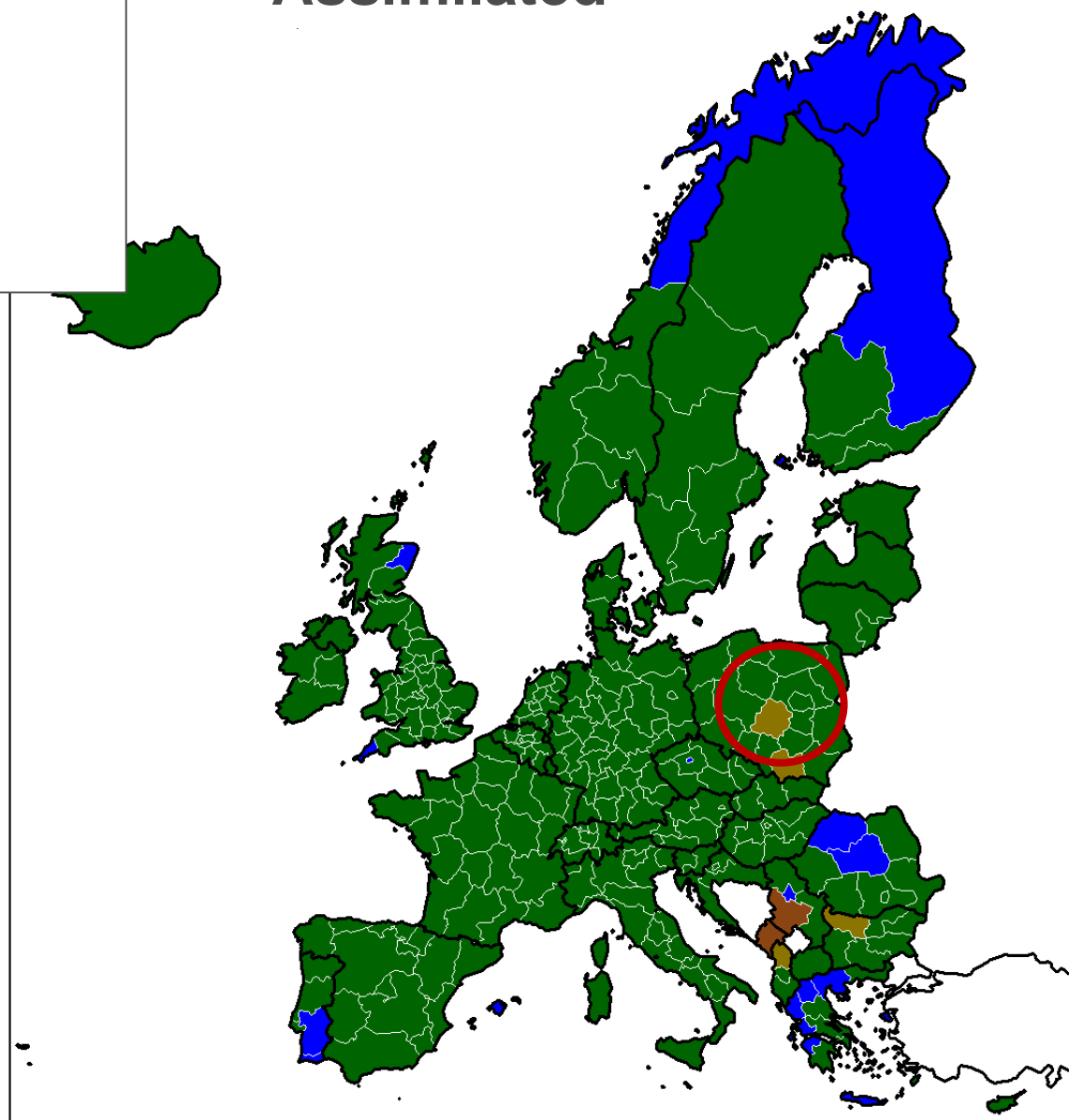
Non-assimilated



MQI - PM2.5
Background stations



Assimilated



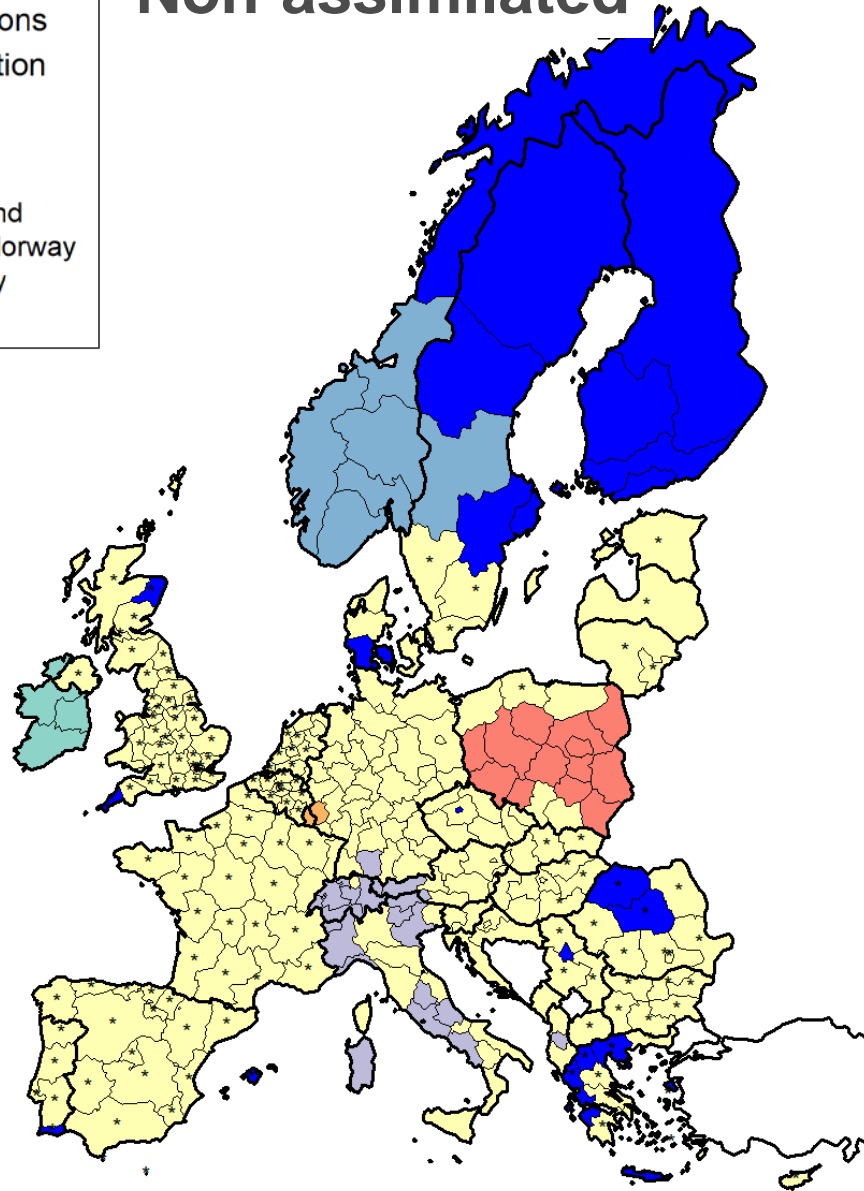
Best model - PM2.5

Background stations

No data assimilation

- CERC - Ireland
- EMEP - EU
- ENEA - Italy
- IEP-NRI - Poland
- MET. INST. - Norway
- UBA - Germany
- Missing

Non-assimilated



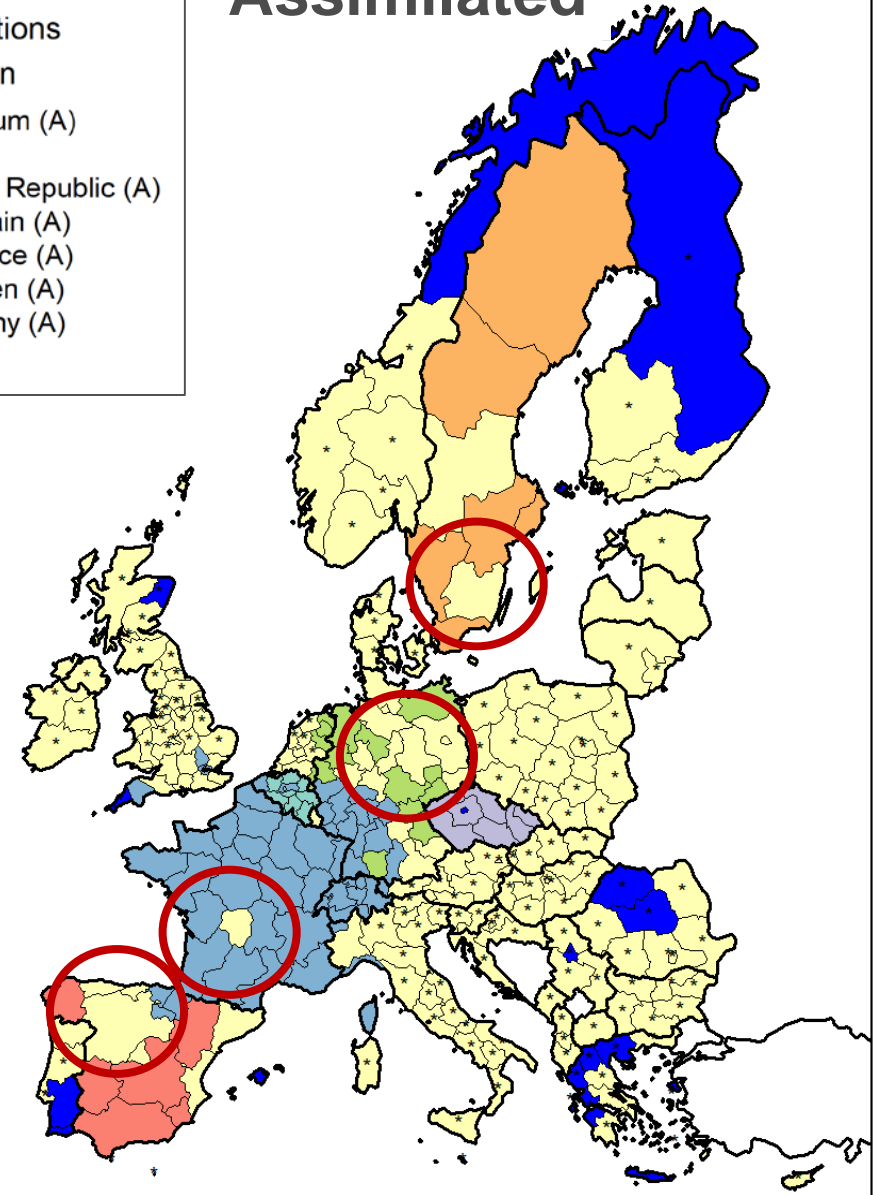
Best model - PM2.5

Background stations

Data assimilation

- ATMO - Belgium (A)
- CAMS - EU
- CHMI - Czech Republic (A)
- CIEMAT - Spain (A)
- INERIS - France (A)
- SMHI - Sweden (A)
- UBA - Germany (A)
- Missing

Assimilated



What can we learn from this PM2.5 analysis?

- Similar conclusion on the effect of data assimilation, spatial resolution as for NO₂
- However, the degradation when traffic monitoring stations are included on the MQI is not so obvious here for PM_{2.5}
- The MQI for PM_{2,5} is generally better over Europe than the MQI for NO₂
- The MQI is driven by the performance of EMEP (nDA) and CAMS (DA)
- National modelling generally improves MQI with respect to European – wide models - What is the reason for outliers / departures from expected behaviour?

PM10

All results

Without traffic stations

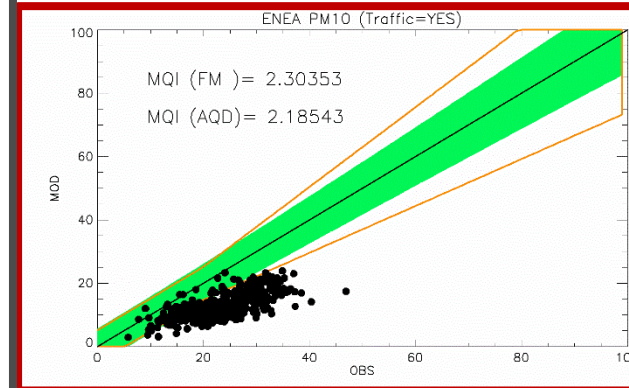
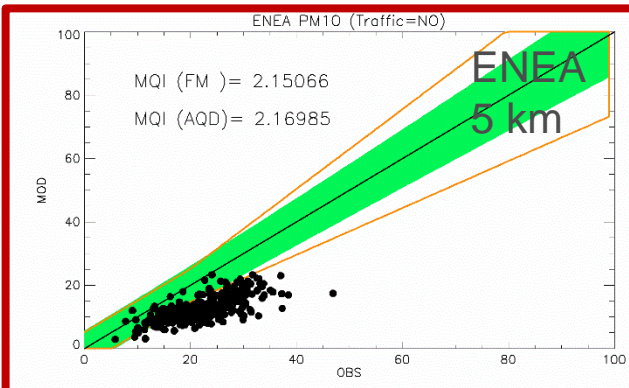
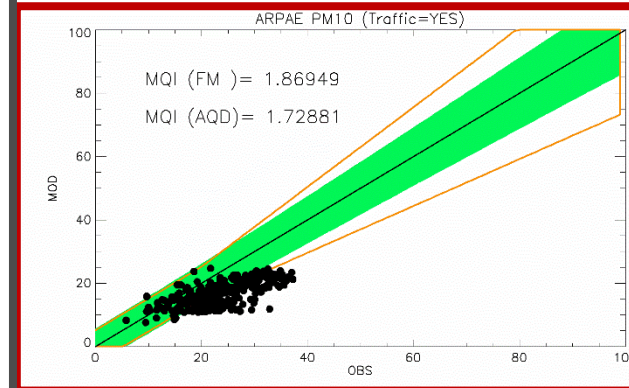
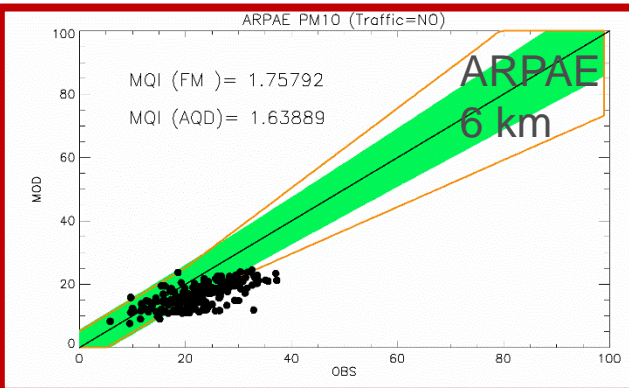
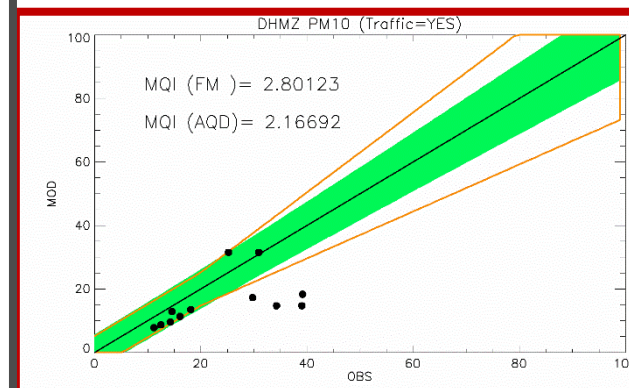
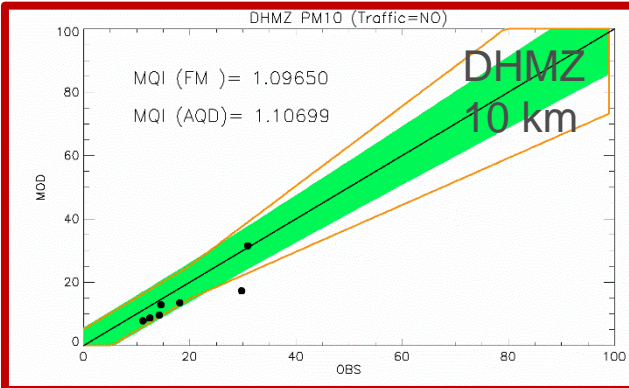
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

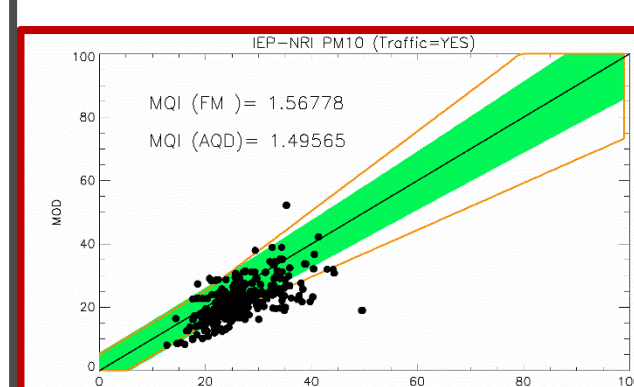
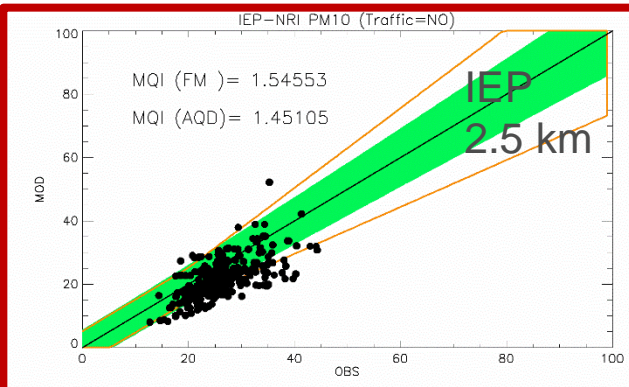
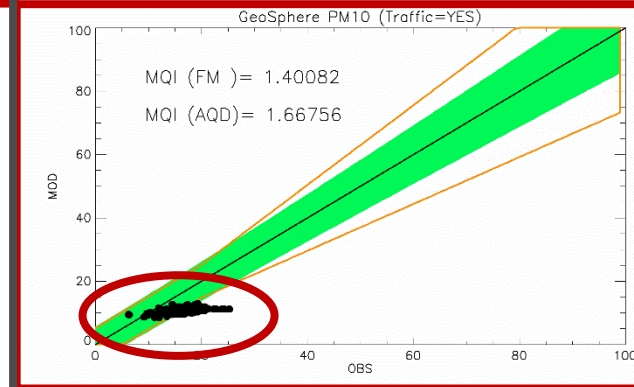
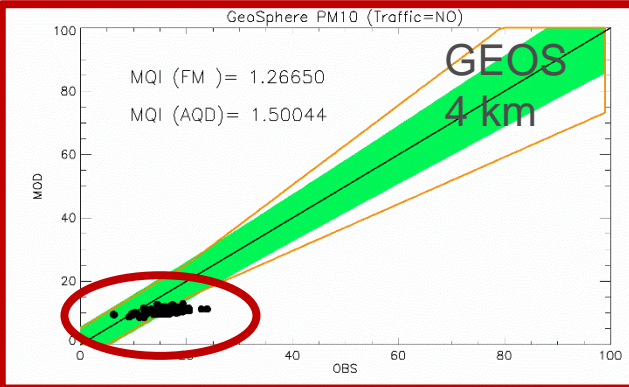
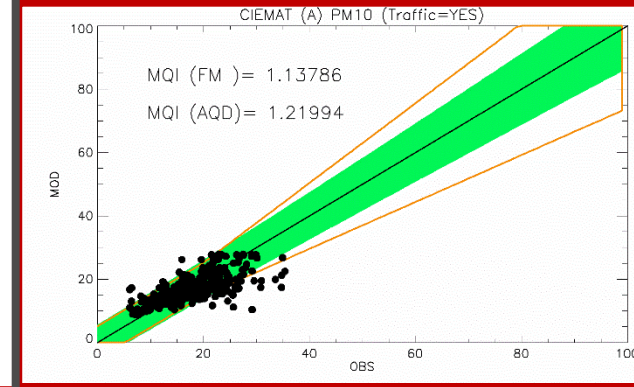
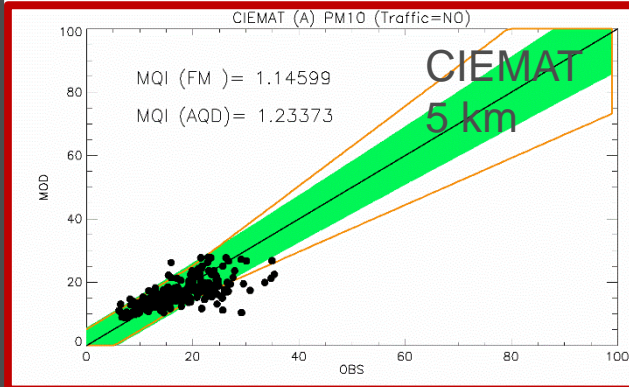
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

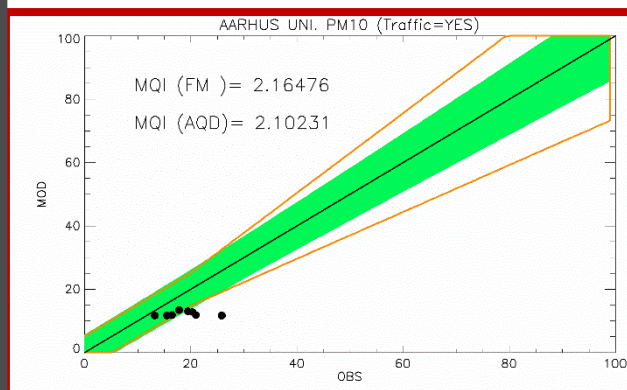
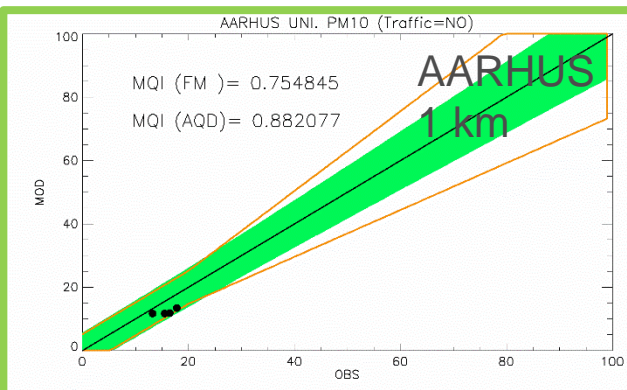
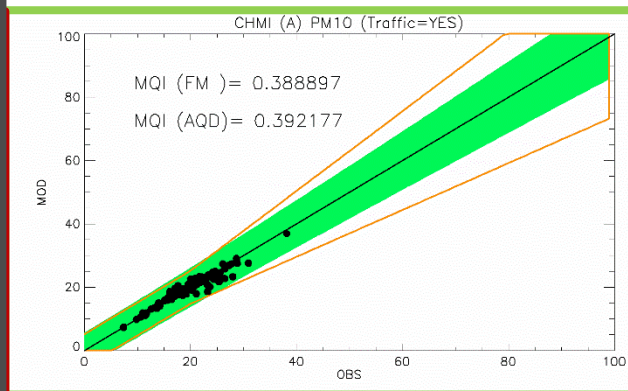
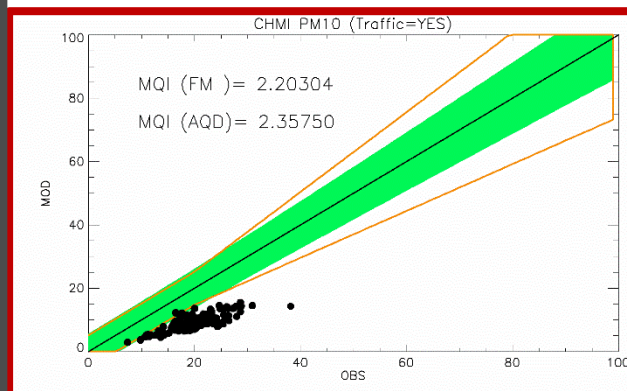
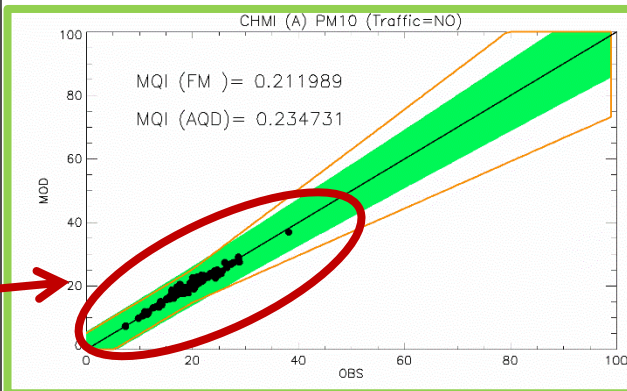
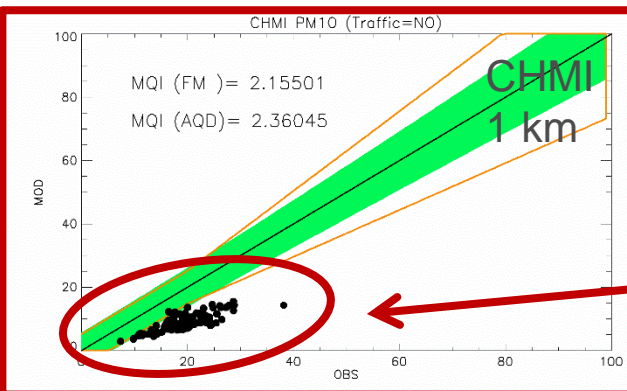
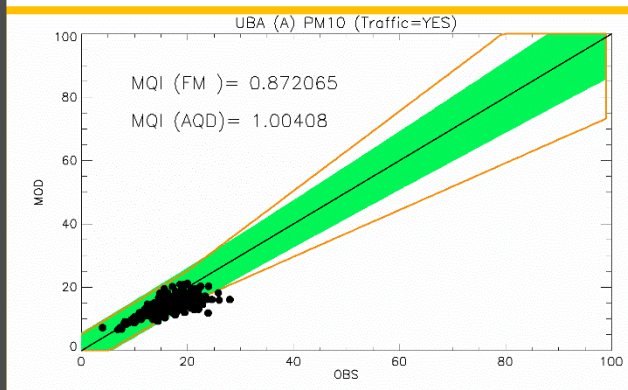
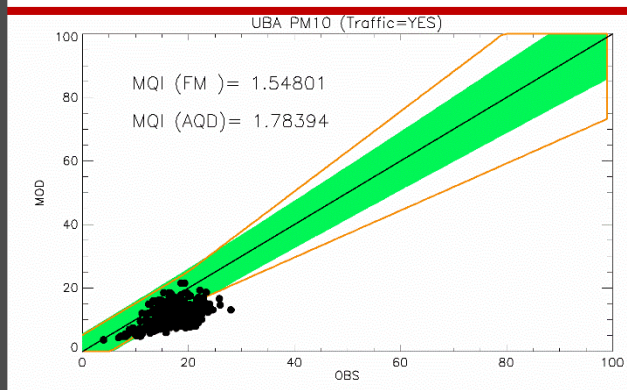
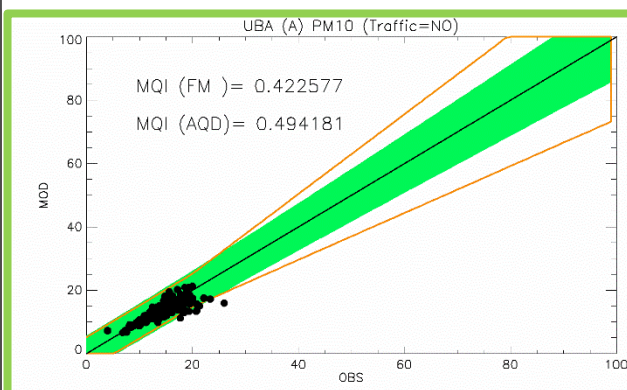
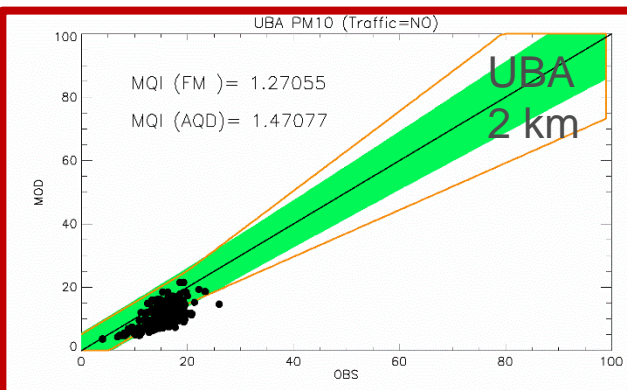
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

Assimilated



Without traffic stations

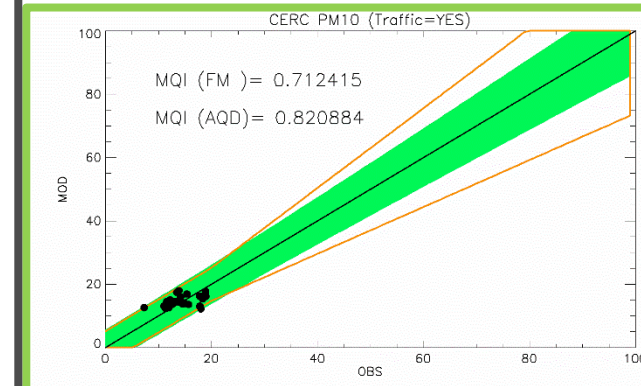
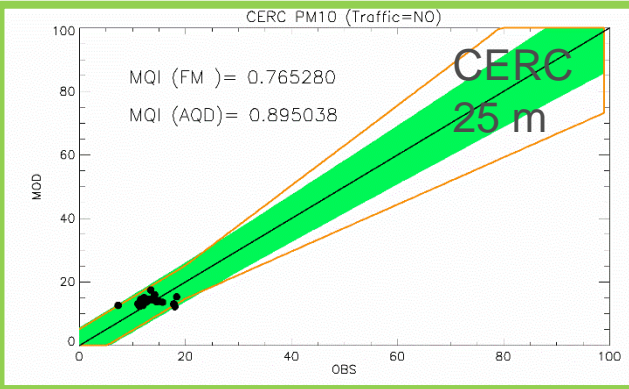
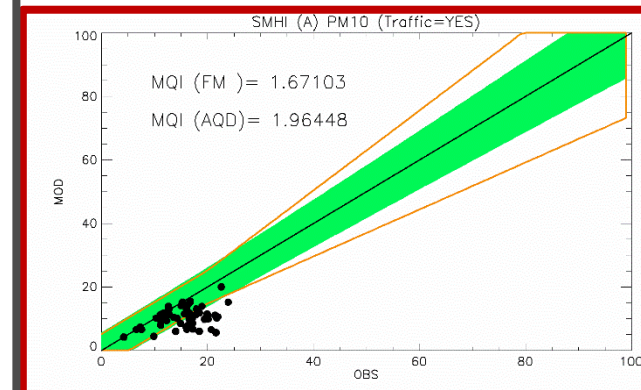
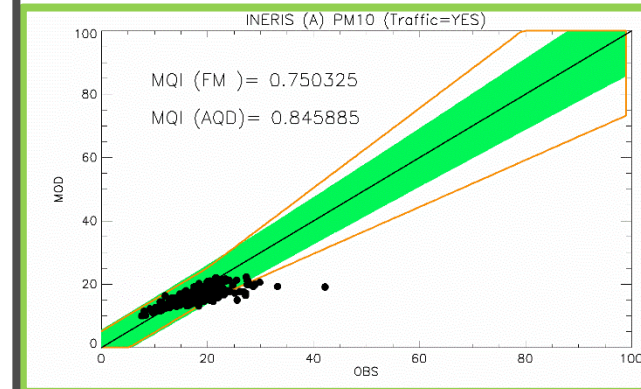
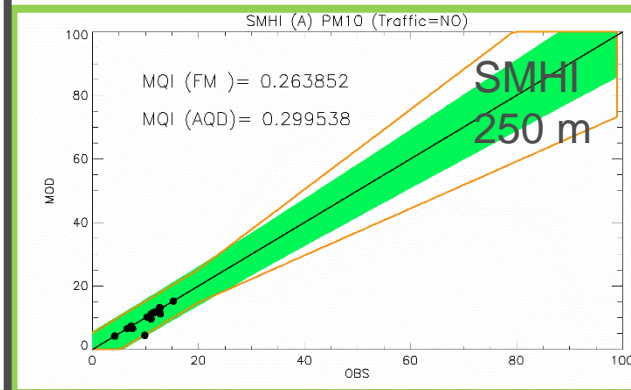
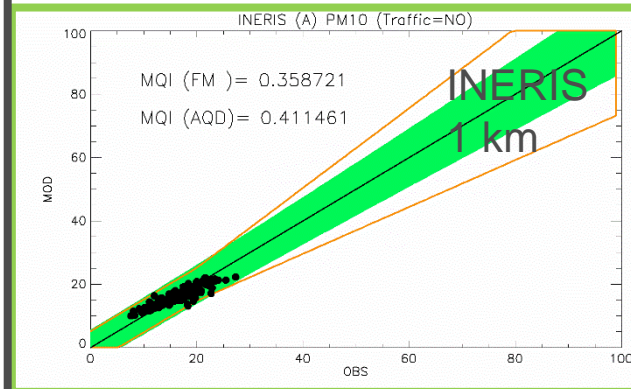
Non-assimilated

Assimilated

With traffic stations

Non-assimilated

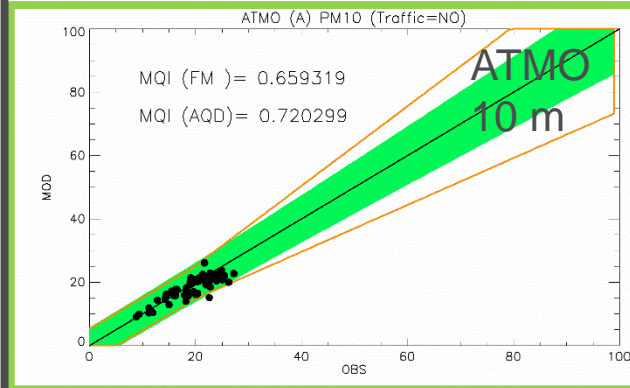
Assimilated



Without traffic stations

Non-assimilated

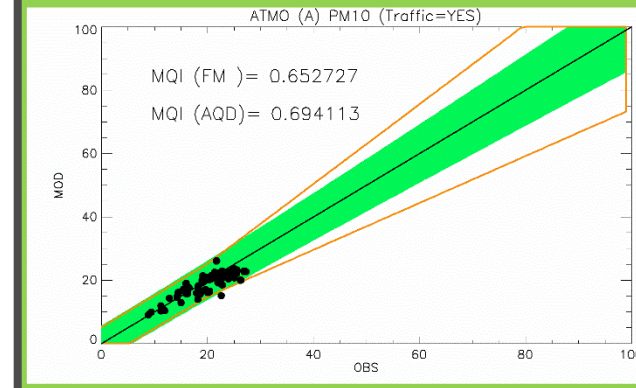
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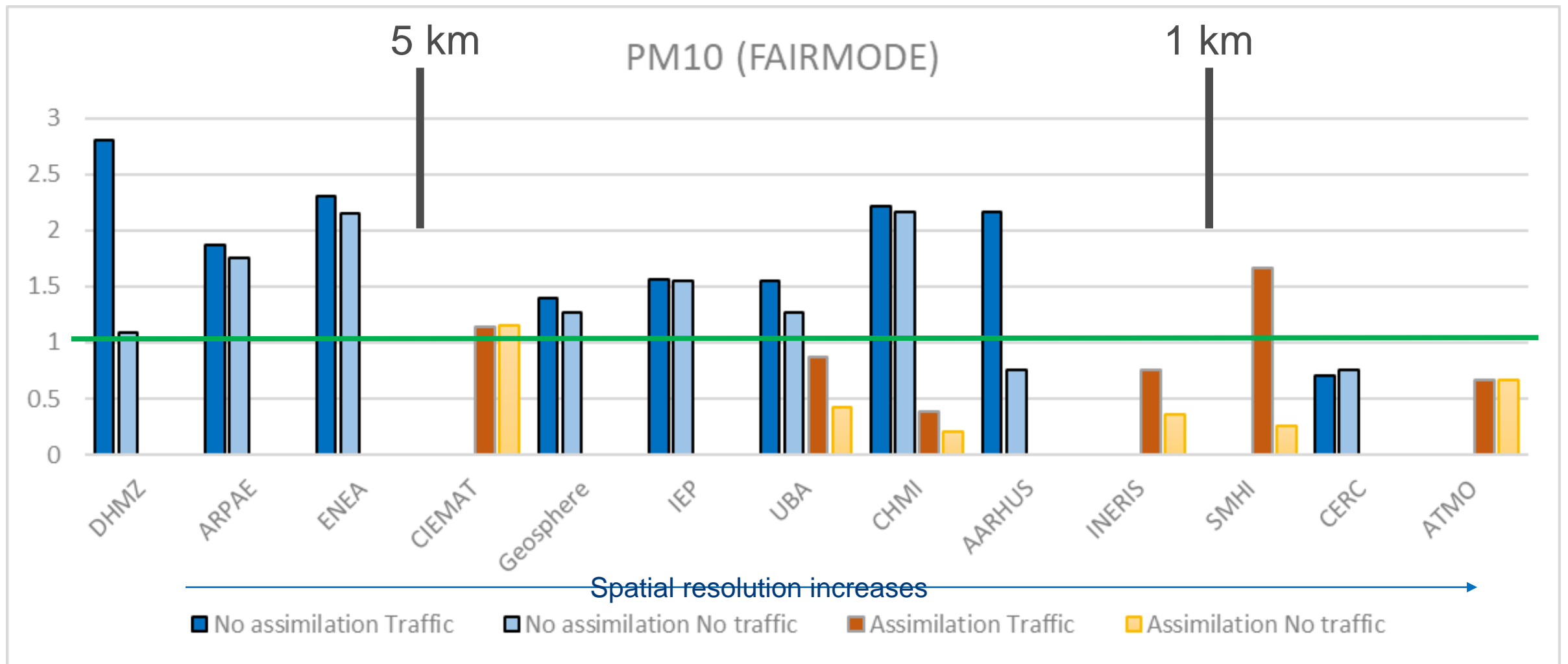


With traffic stations

Non-assimilated

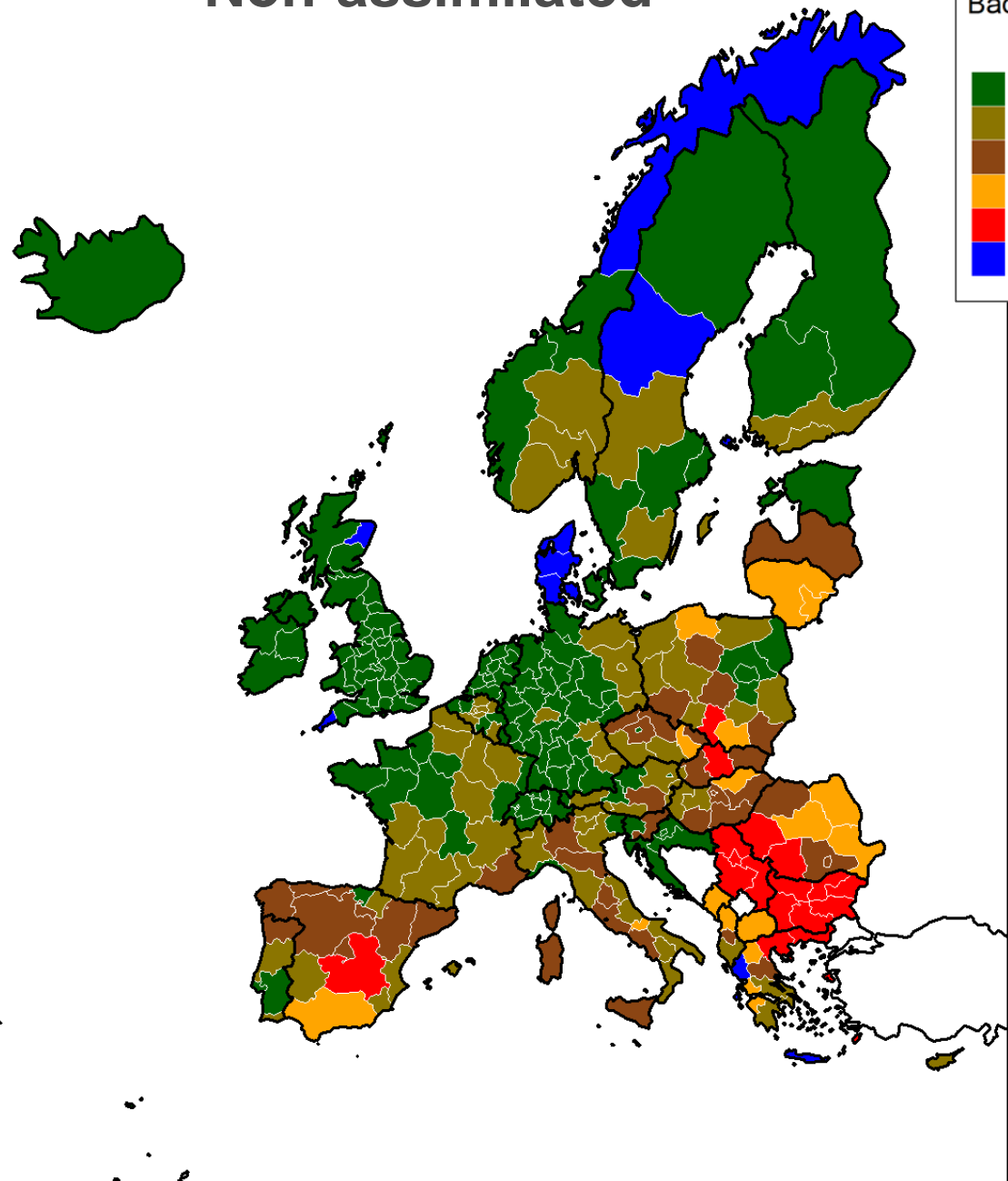
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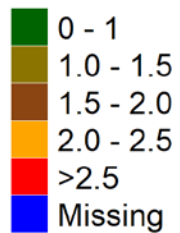


- Including traffic stations has in some cases a large impact on results (DHMZ, AARHUS), in some others not
- Most models at coarse resolution fail the MQO test

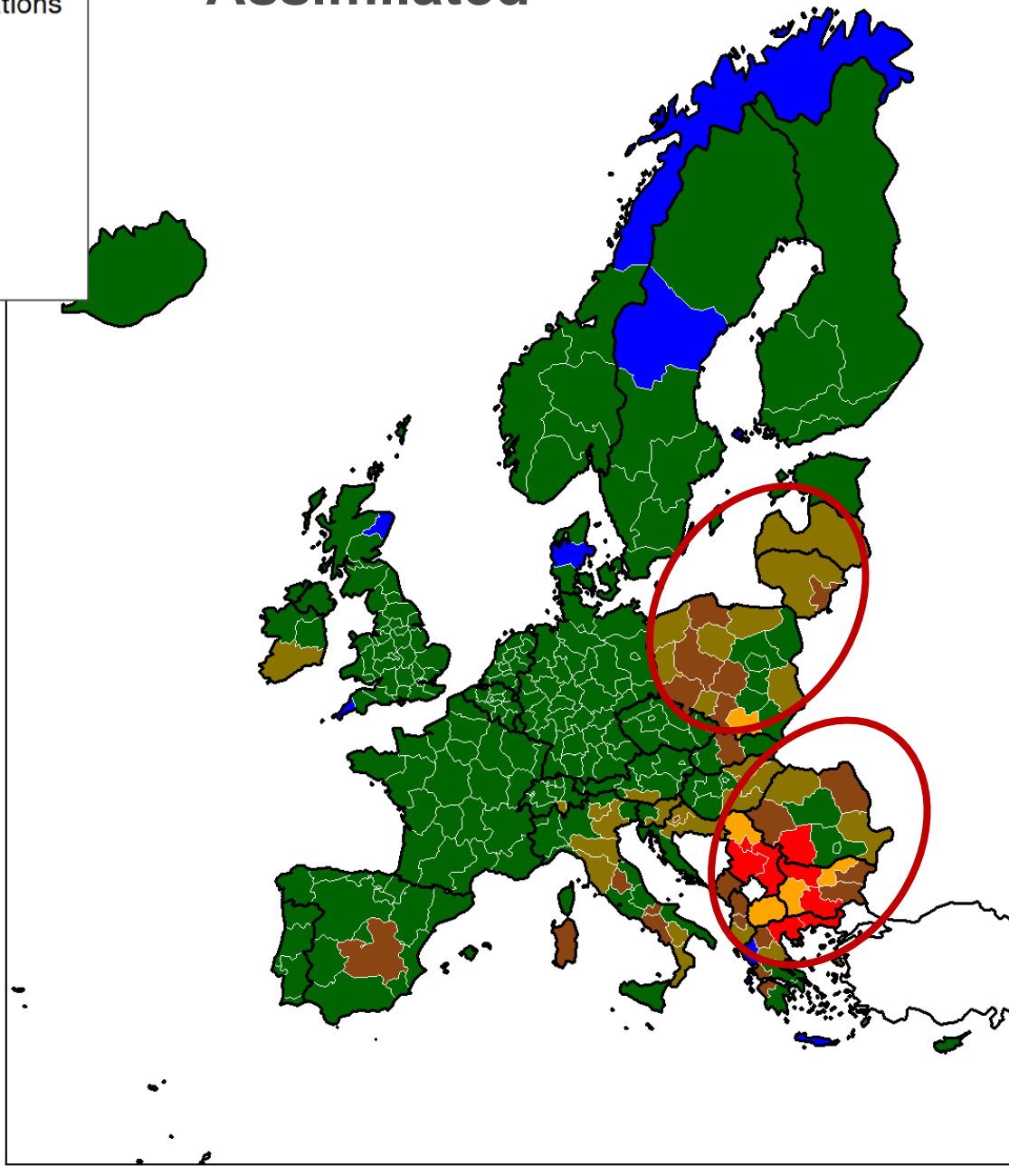
Non-assimilated



MQI - PM10
Background stations



Assimilated



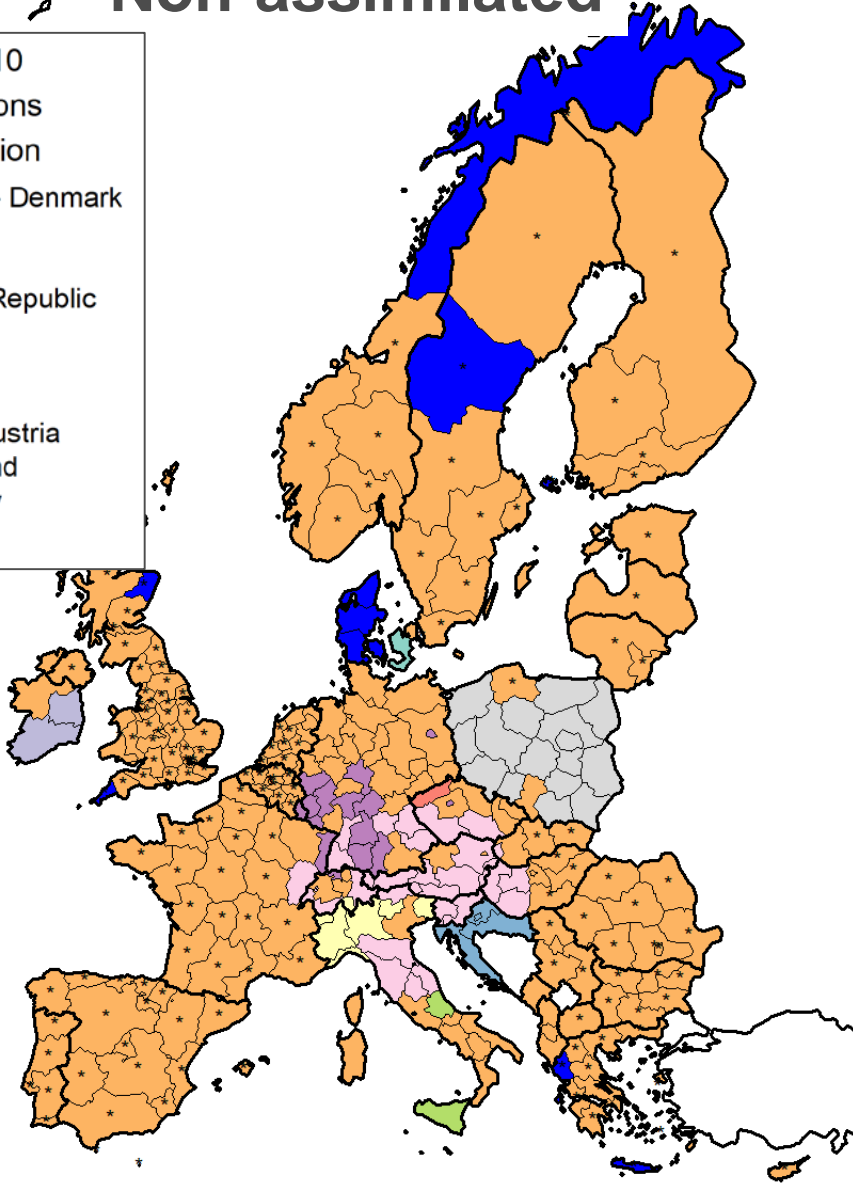
Non-assimilated

Best model - PM10

Background stations

No data assimilation

- AARHUS UNI. - Denmark
- ARPAE - Italy
- CERC - Ireland
- CHMI - Czech Republic
- DHMZ - Croatia
- EMEP - EU
- ENEA - Italy
- GeoSphere - Austria
- IEP-NRI - Poland
- UBA - Germany
- Missing



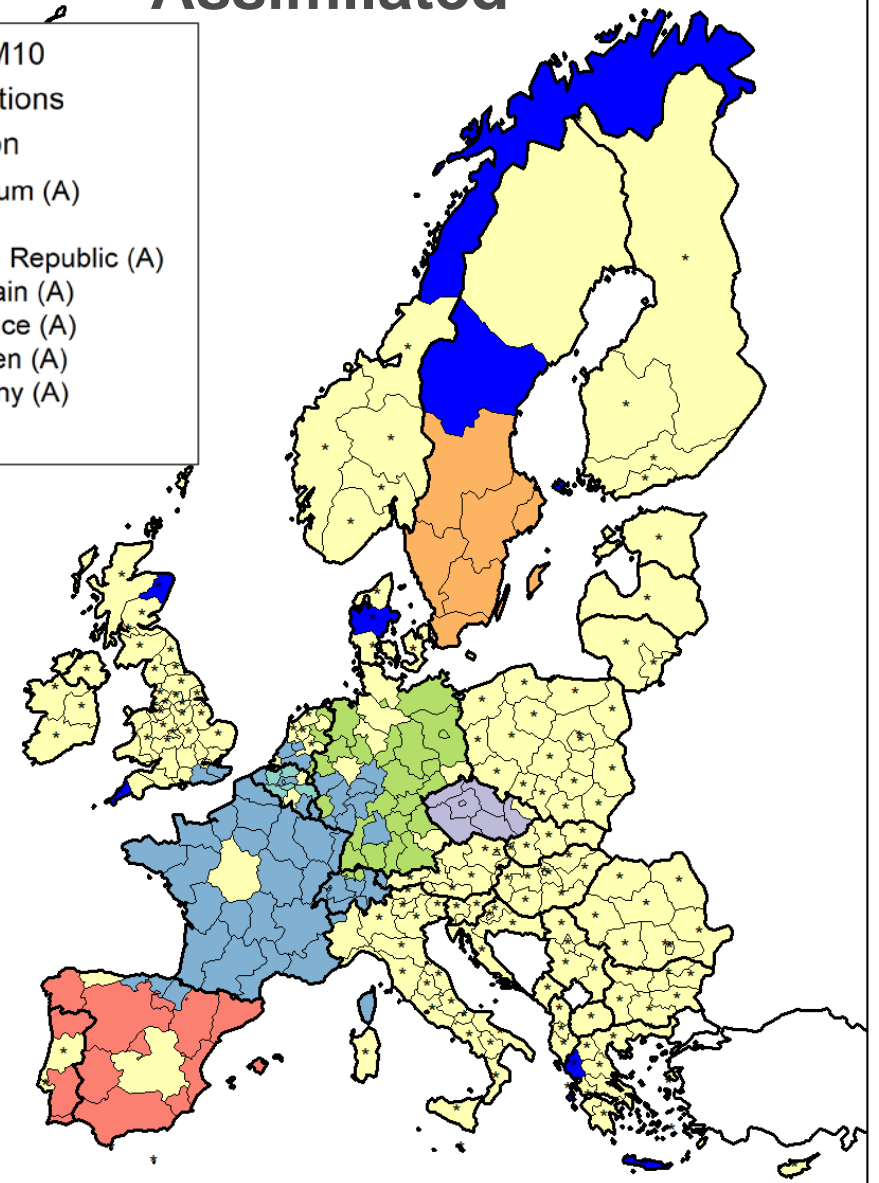
Assimilated

Best model - PM10

Background stations

Data assimilation

- ATMO - Belgium (A)
- CAMS - EU
- CHMI - Czech Republic (A)
- CIEMAT - Spain (A)
- INERIS - France (A)
- SMHI - Sweden (A)
- UBA - Germany (A)
- Missing



What can we learn from this PM10 analysis?

- Similar conclusion on the effect of data assimilation, spatial resolution and the degradation when traffic monitoring stations are included on the MQI
- The MQI for PM10 is generally worse over Europe than the MQI for PM2.5 – only slightly better than for NO2
- The MQI is driven by the performance of EMEP (nDA) and CAMS (DA)
- National modelling results generally better than European-wide models for PM10
- Most coarse models do not reach the MQO

Composite Mapping MPI exercise

Next steps

How to proceed with the exercise – analysis to be carried out

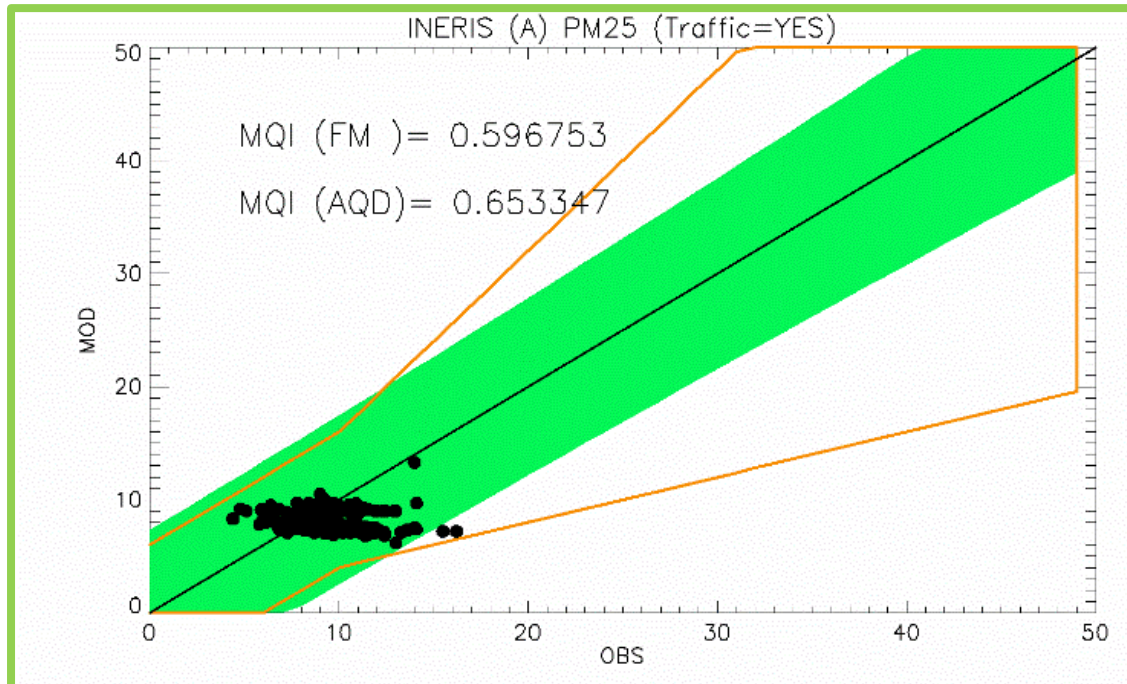
In this initial stage – the purpose of the exercise is to understand the robustness of the MQI results

Q1 Does FAIRMODE's on-the-fly MQI fit with own home calculation?

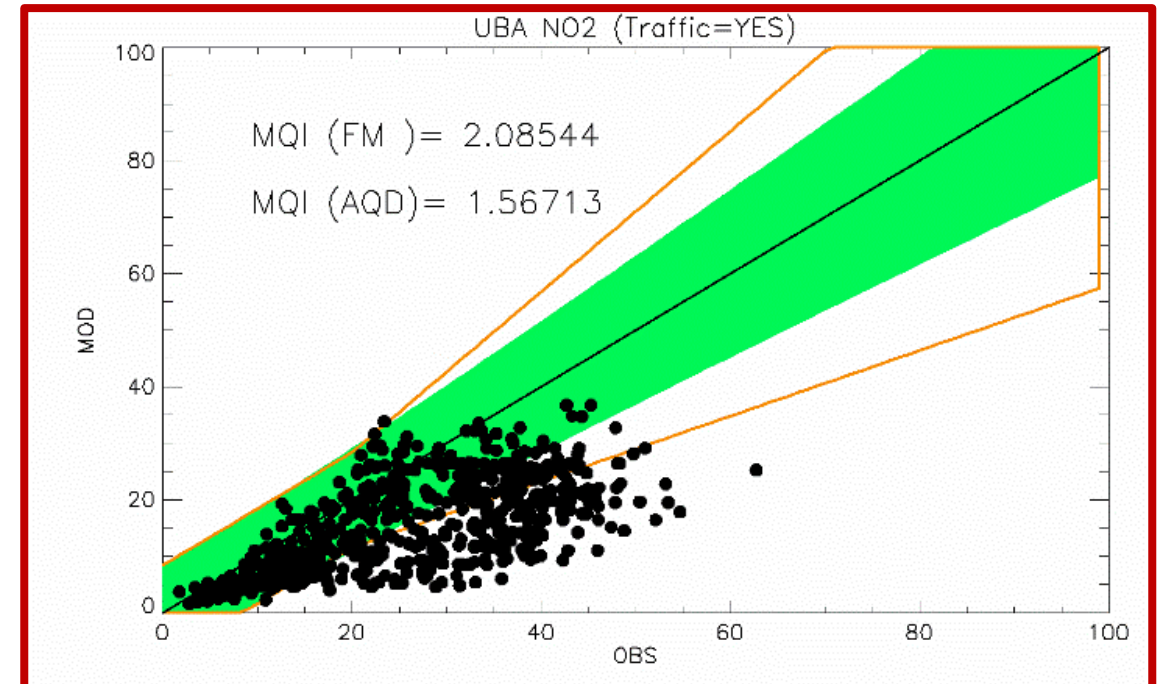
1. Choose and document the data and stations you want to use for the MQI analysis
2. Compare FAIRMODEs on-the-fly MQI with own home calculation
3. Carry out ONE analysis of your choice
 - Check robustness of your MQI with respect to the number of stations
 - Check robustness of your MQI with respect to aggregation area (NUTS3 vs. NUTS2 vs. country)
 - Check robustness of your MQI across pollutants
 - Compare your MQI with others MQI
 - Check MQI ability to assess specific modelling purpose
4. Report back to us

Q2 - Are the MQI stringent enough and consistent among pollutants?

Based on wrong submission, results still pass the MQO for PM2.5. Should it be so or is the PM25 MQI too flexible?



For NO2, we would expect the MQO to fail on traffic stations when large resolution modeling is used. Does it always?



Q3 Data assimilation

- Information on stations used for assimilation is needed
- Results show MQI of 0 for some stations! These should most probably be taken out from the MQI calculation
- Can we apply the “leave one out” approach?
- Can those who delivered only data-assimilated results, deliver raw results as well (CHMI, CIEMAT, INERIS, SMHI, ATMO?)

Q4 Links to emissions

- Can those who delivered only concentrations so far, deliver emissions as well (BE, CZ, FR, ES, SE)?
- Where out-performed by CAMS, can local modellers check inconsistencies in the emissions benchmark comparison

Time schedule for activities in 2023/2024

- Availability of the interface **Fall 2023**
- Interim meeting (Online) **December 2023**
- Presentation of results and discussion **Plenary meeting 2024**

Thank-you