ACTION C.4
ROAD TRANSPORT EMISSION SCENARIOS

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27/11/2018

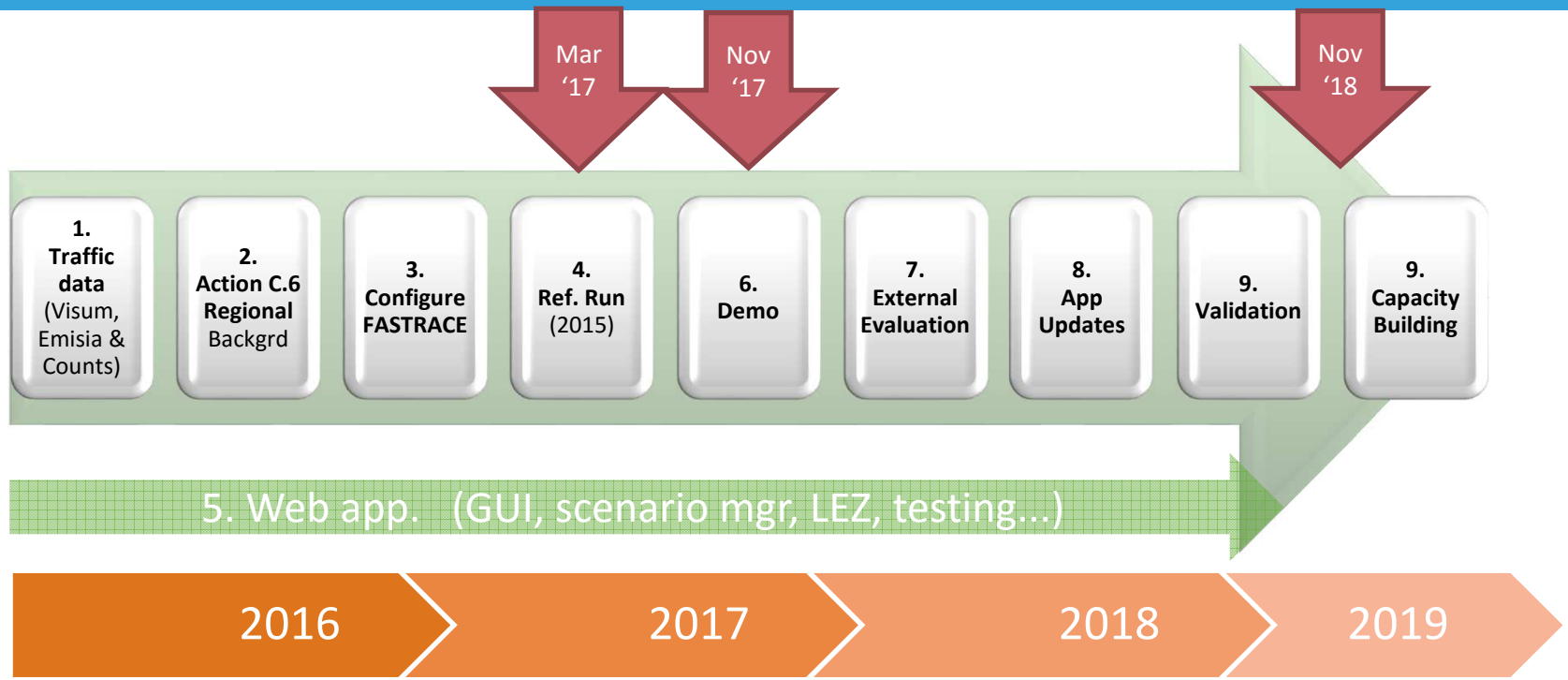
ACTION OVERVIEW

Goal Provision of an **air quality traffic planning modelling** platform to the Municipality of Krakow, Transport System Division to support their **decision-making** regarding their **long-term air quality strategy for transport**

How?

1. **Customize & implement the ATMOSYS (IFDM-traffic) air quality traffic application for Krakow.**
2. **Capacity building:**
   - ✓ Input data quality
   - ✓ Reference & suggested scenario data
   - ✓ Application functionality
   - ✓ Ongoing support & minor updates
3. **Validation:** 2017 measurement campaign.

ATMOSYS APPLICATION IMPLEMENTATION



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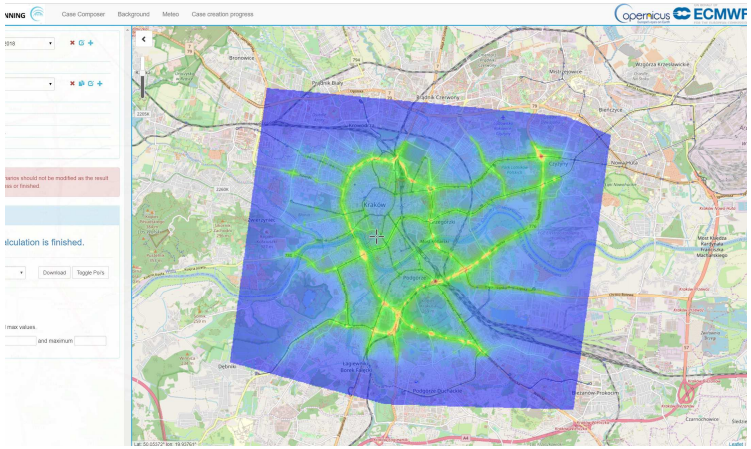


1. **Application Upgrade**
2. **Demonstration**
3. **Model validation**
4. **Evaluation Report**
5. **Questions?**

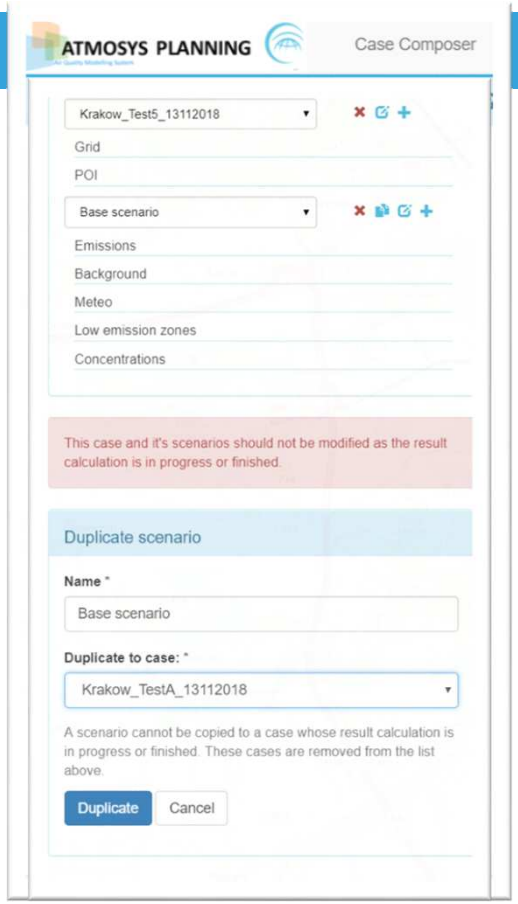
APPLICATION UPGRADE - KEY NEW FEATURES

Run set-up

1. Default grid values.

2. Introduction of a max limit (currently 3000) on the no. of line segments for the traffic network *(maybe removed!)*

3. Improved management of scenarios
   e.g. copy a (base case) scenario as input, delete scenarios.



APPLICATION UPGRADE - KEY NEW FEATURES

Error messages

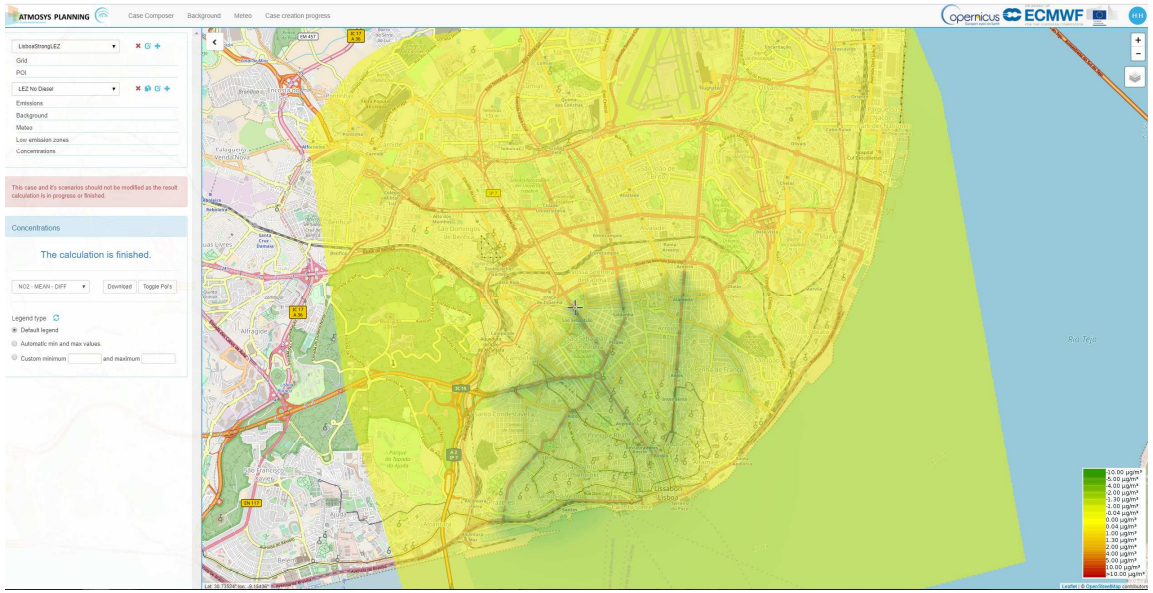
1. User receives an e-mail when the run is complete or failed.
2. Automatic run retries during network problems (so that whole run does not fail).

APPLICATION UPGRADE - KEY NEW FEATURES

Vizualization

1. **Visualization** of the 'relative difference maps' between scenario cases.

2. **Dynamic and manual max/min** map legends as well as the default version.



APPLICATION UPGRADE: EU-WIDE TRAFFIC SCREENING

Goal: Easier to 'Demonstrate' the application to Other Regions *(developed in other projects).*

1. **CAMS EU regional ensemble re-analysis dataset**
2. **ECMWF ERA-5 dataset.**
3. **Generic European wide traffic intensities:**

- estimates for the no. of vehicles on all EU roads –based on mileage data per country (COPERT 2014 dataset),
- a roadmap (OpenTransportMaps),
- and proxy data based on population data (JRC) and road typology (OpenStreetMaps).

Background concentrations

Meteorology

Traffic flows + fleet data

Atmosphere Monitoring Service

ECMWF ERA5 Reanalysis data

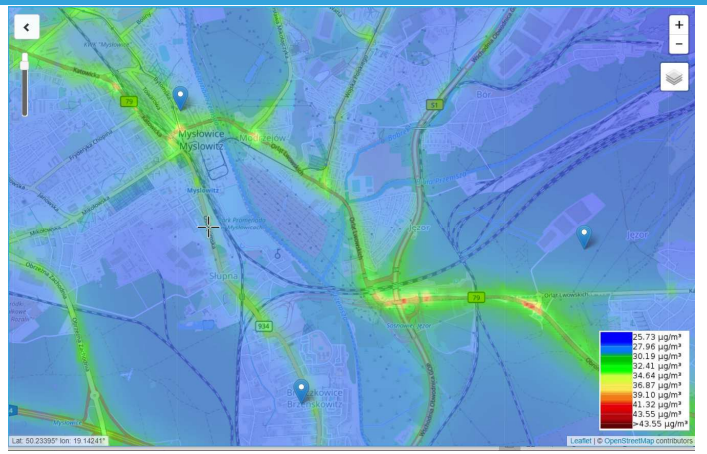
OpenStreetMap

OpenTransportMaps

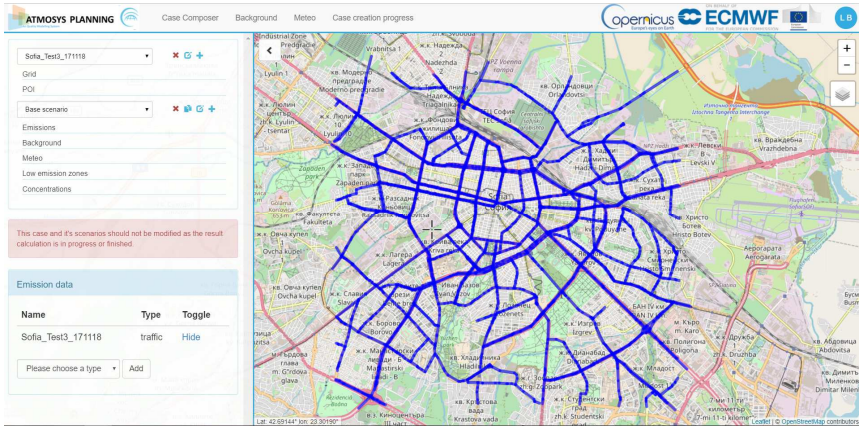
copert

EU-WIDE TRAFFIC SCREENING: DISSEMINATION TOOL

1. **CAMS+Local Traffic Emission Estimates:** can show NO2 air quality concentration maps for other PL regions.



2. Can use to **demonstrate to Bulgaria and other interested regions.**



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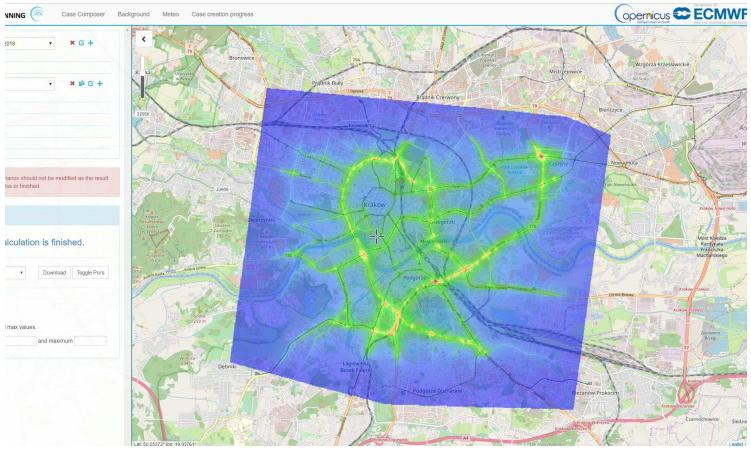

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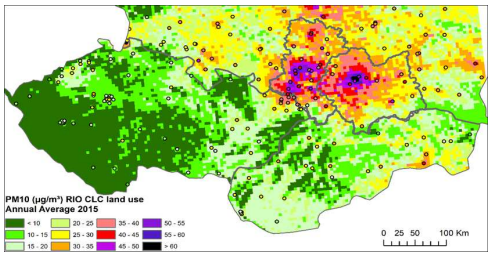
ATMOSYS PLANNING METHODOLOGY



RIO

Background concentration

Meteorology

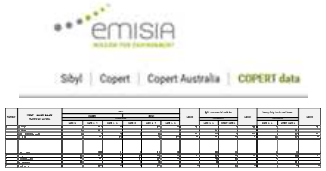
Receptor grid, select receptors configuration, ...

IFDM Gaussian Dispersion model

PTV VISUM

emisia

Sibyl | Copert | Copert Australia | COPERT data

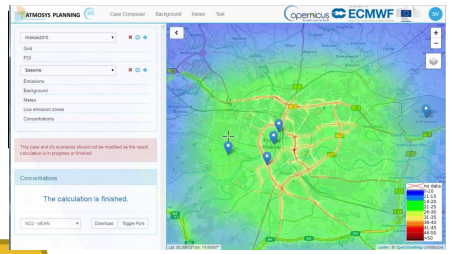


Traffic Flows & Fleet Data

FASTRACE Traffic Emission Model

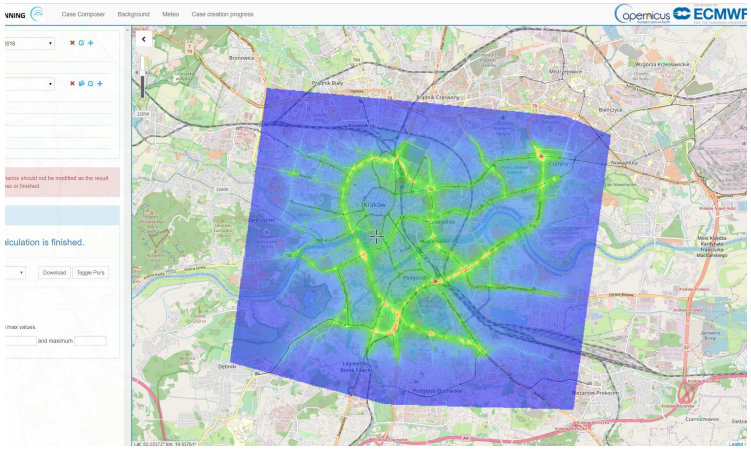
Local Traffic Emissions

Point Source Data



Model core | Configuration | User input | Output

AGENDA



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NO2 PASSIVE SAMPLER RESULTS 2017

- Step 1: comparison of passive sampler data with official monitoring stations Krakow

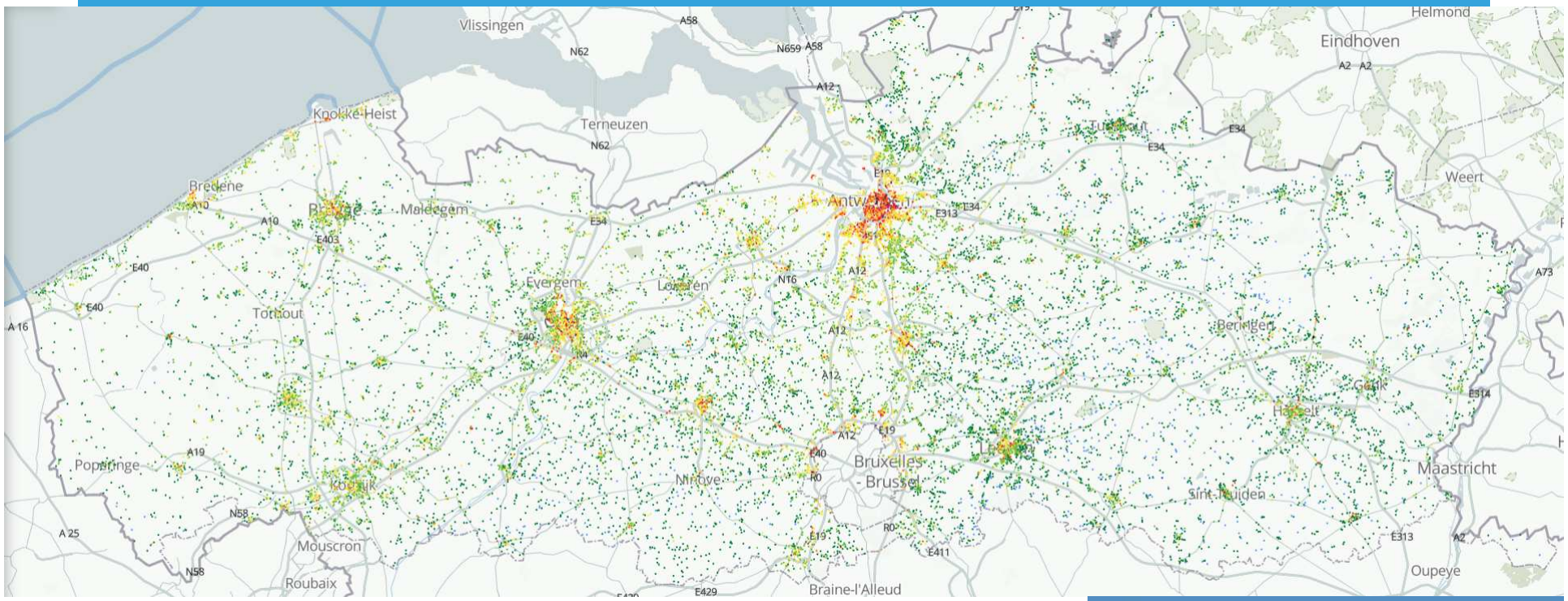
	Station	Latitude	Longitude	Rel. Diff. 28/5-25/6	Rel. Diff. 19/11-17/12	Abs. Diff. (µg/m³) 28/5-25/6	Abs. Diff. (µg/m³) 19/11-17/12
WiOŚ Bulwarowa	PL039A	50.06935	20.05354	19%	44%	4.86	15.48
WIOŚ BUJAKA	PL501A	50.01028	19.94934	16%	27%	4.37	9.60
WIOŚ Dietla	PL641A	50.05761	19.94563	1%	32%	0.57	12.62
WIOŚ Krasińskiego	PL012A	50.05797	19.92602	22%	33%	13.86	19.65
					AVERAGE	**5.92**	**14.34**

NO2 PASSIVE SAMPLER RESULTS 2017

- Two sensors have been located at identical location.

number	place	NO_2 [ug/m3] summer	NO_2 [ug/m3] winter
1	Szkoła Podstawowa nr 140	16	37
78	Szkoła Podstawowa nr 140	25	44
	Difference	9	7

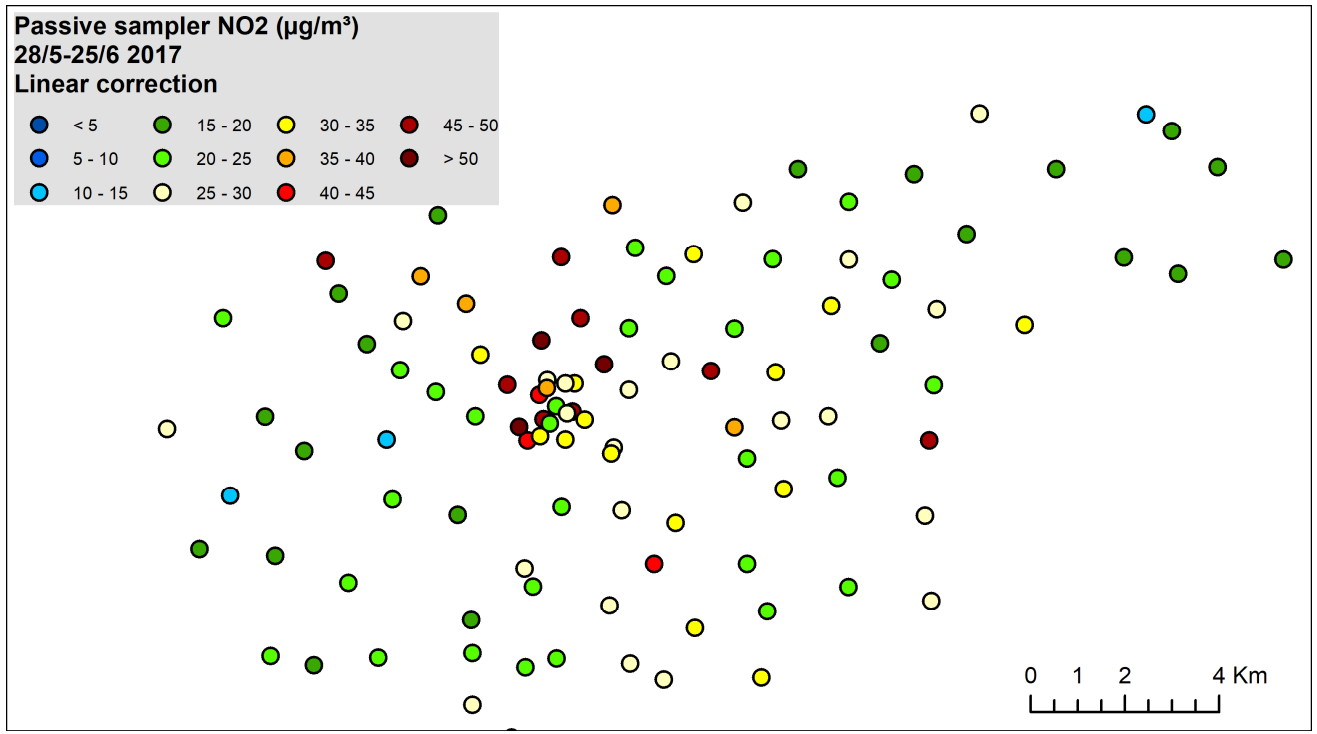
CURIEUZE NEUZEN FLANDERS – 20.000 NO2 PASSIVE SAMPLER RESULTS



CURIEUZE NEUZEN VLAANDEREN

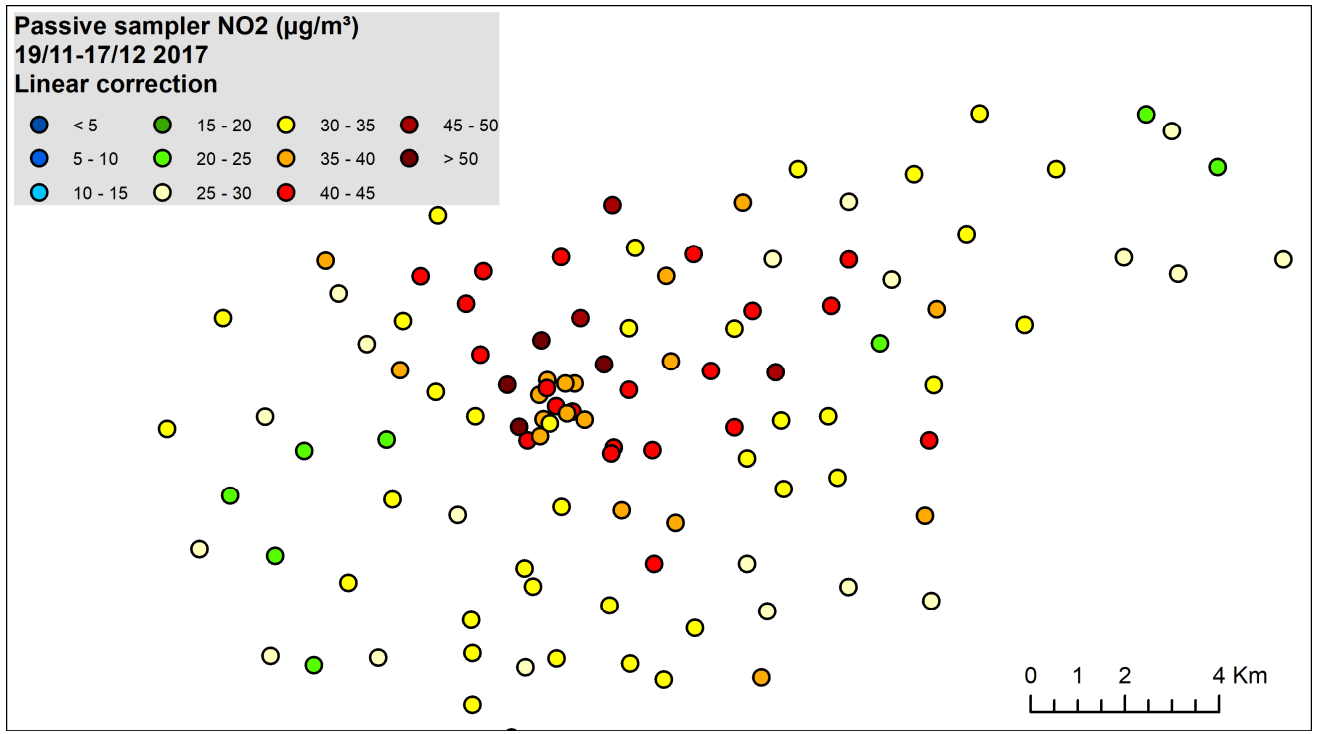
27/11/2018

NO2 PASSIVE SAMPLER DATA 28/5-25/6 2017 – LINEAR CORRECTION



High Spatial Variation!

NO2 PASSIVE SAMPLER DATA 19/11-17/12 2017 – LINEAR CORRECTION

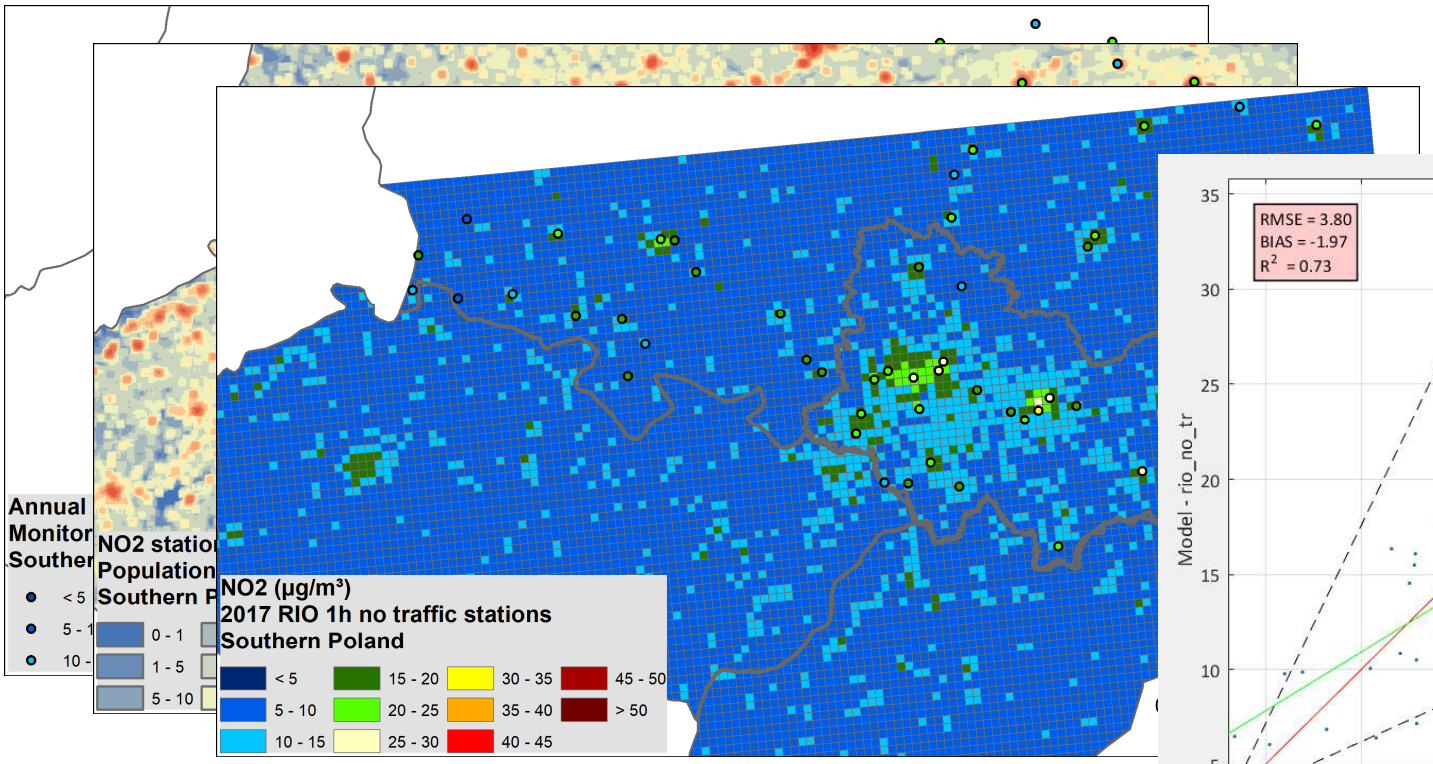


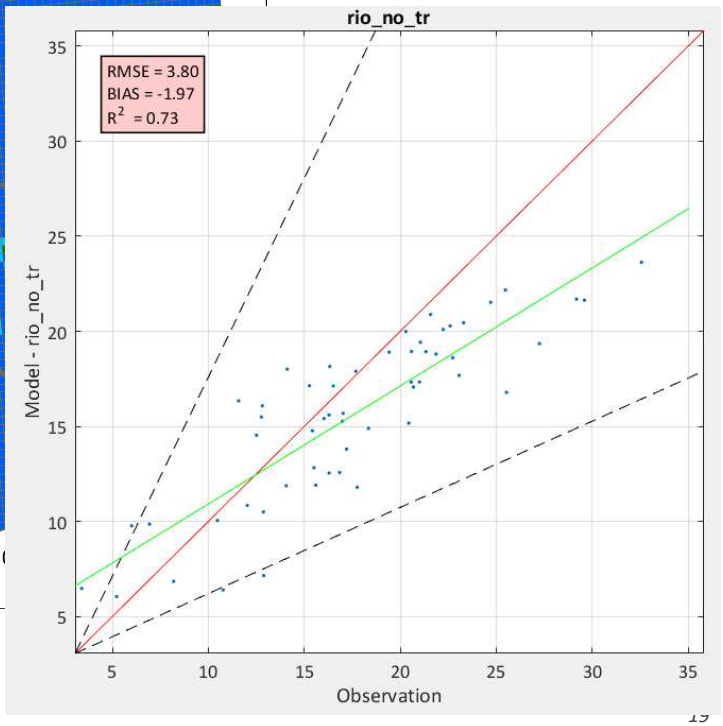
High Spatial Variation! High Temporal Variation!

MODEL VALIDATION 2017 VERSUS CORRECTED PASSIVE SAMPLER DATA

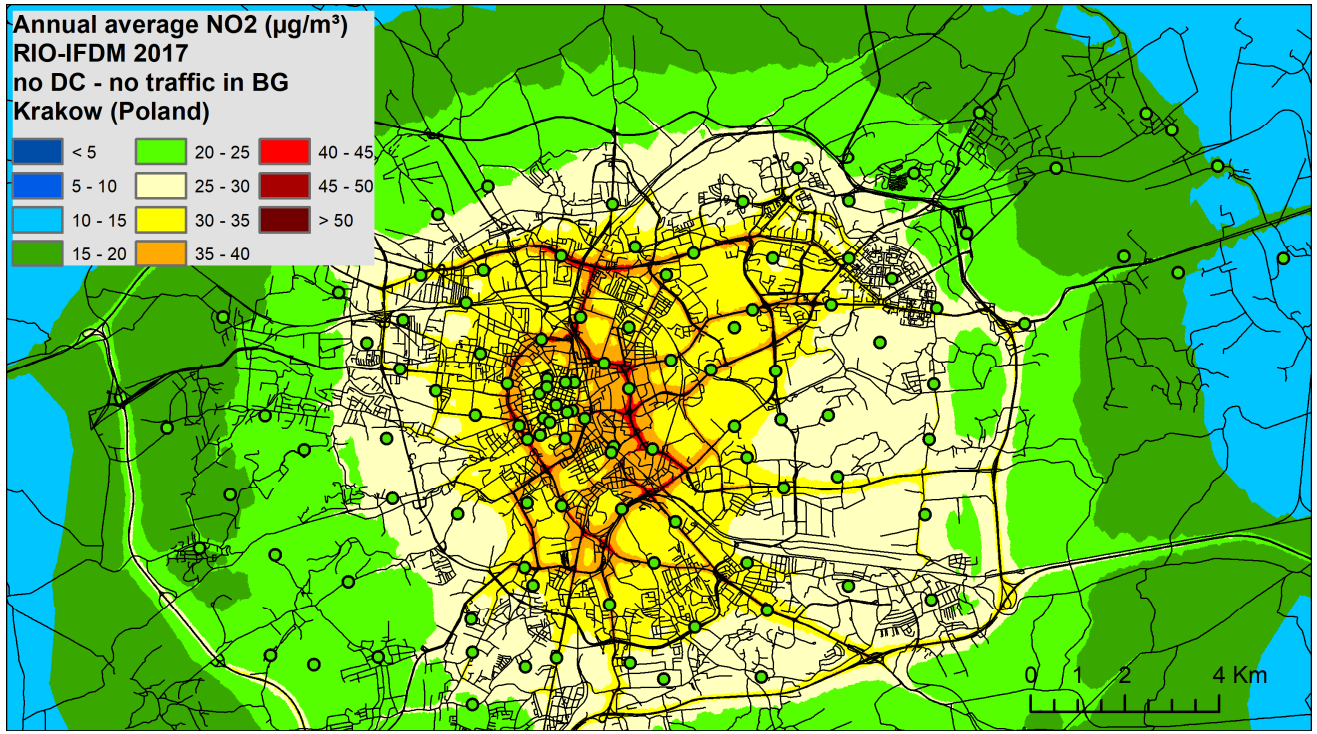
- RIO-IFDM 2017 versus passive sampler data
  - Option 1: model output versus raw sensor data
  - Option 2: model output versus corrected sensor data – absolute correction
  - **Option 3: model output versus corrected sensor data – correction linear fit**
- Monthly average values! RIO-IFDM hourly resolution
- Traffic emissions: **network 2017 (VISUM**) – **Fleet 2014**
- Meteo data 2017
- Background RIO 2017 - Option 1 **No double counting – no traffic in background**
  - Option 2 **Double counting – traffic stations in background**

NO2: RIO BACKGROUND MAPS 2017 – FOCUS SOUTHERN POLAND

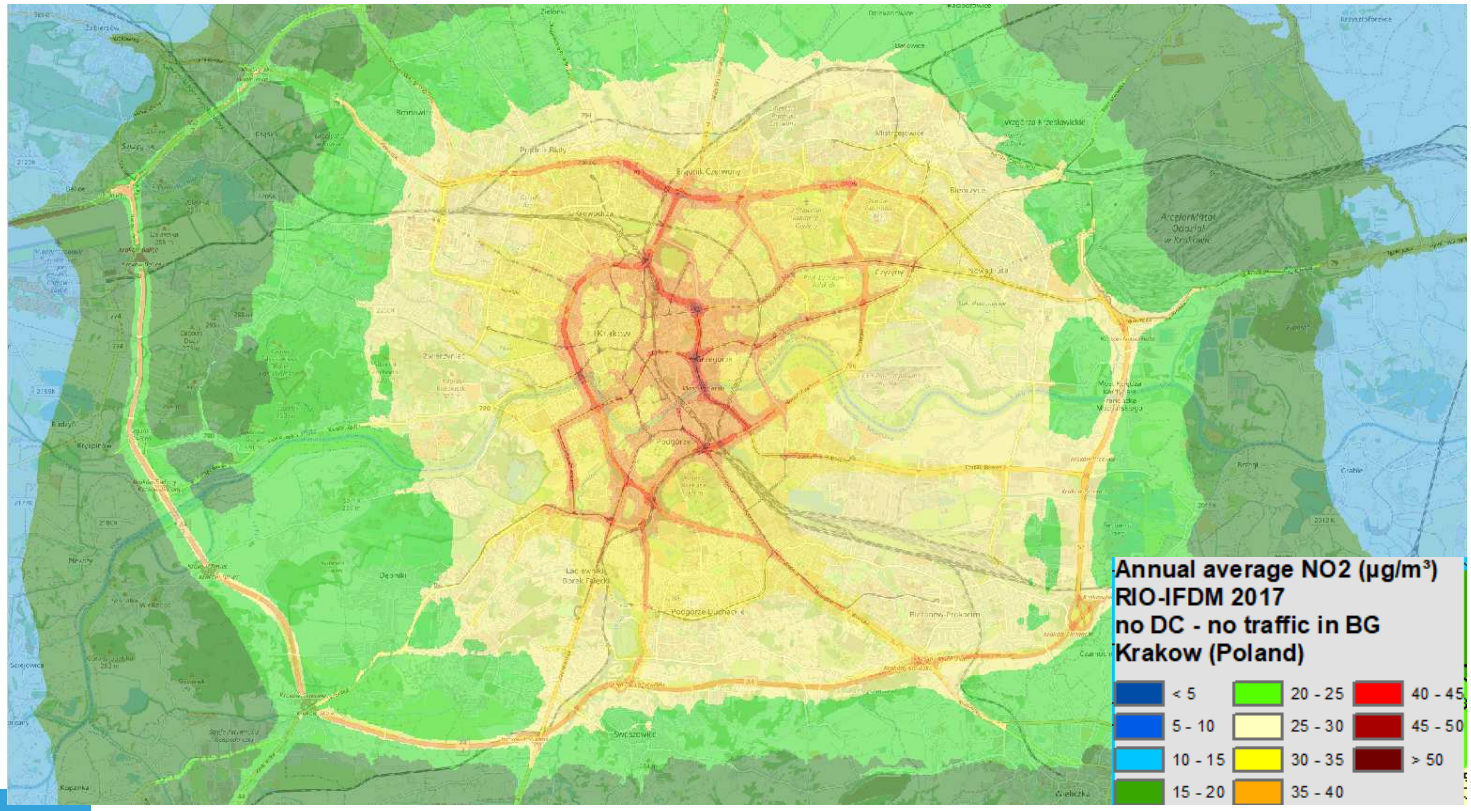




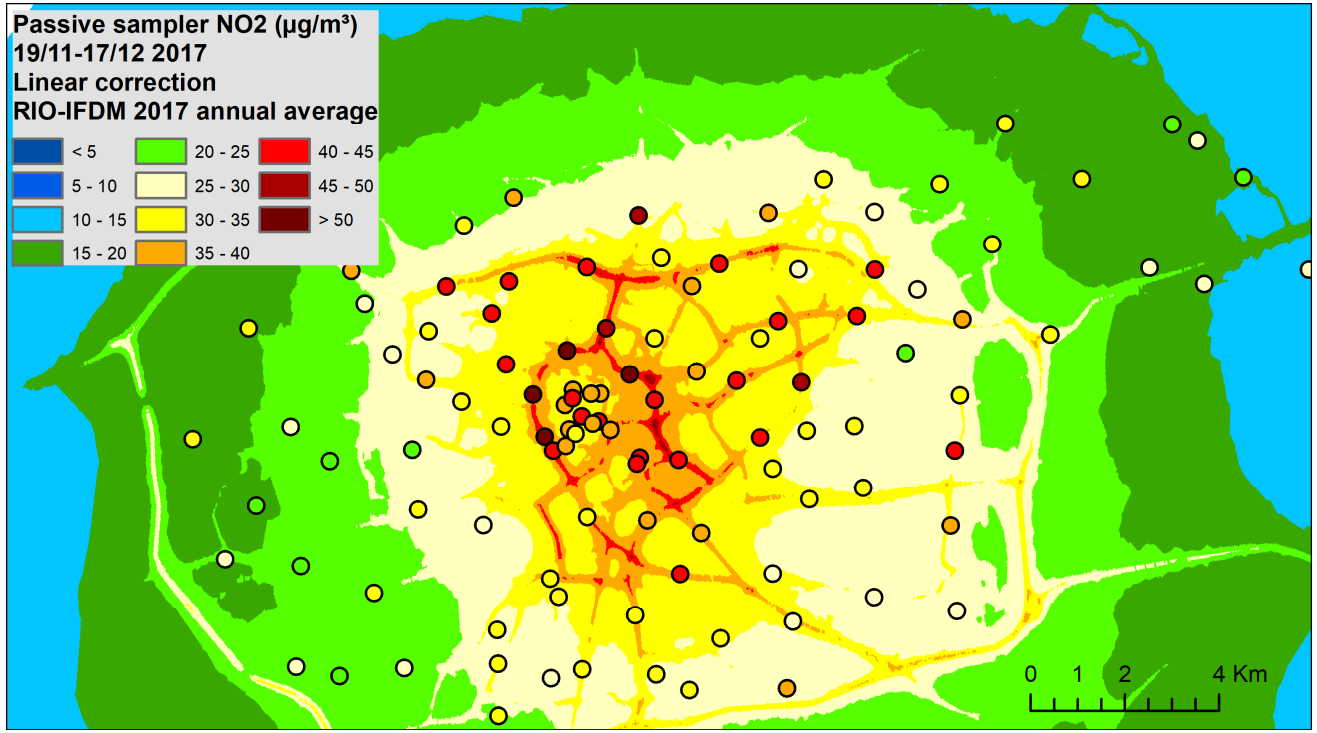
NO2: RIO - IFDM MAP 2017 – KRAKOW



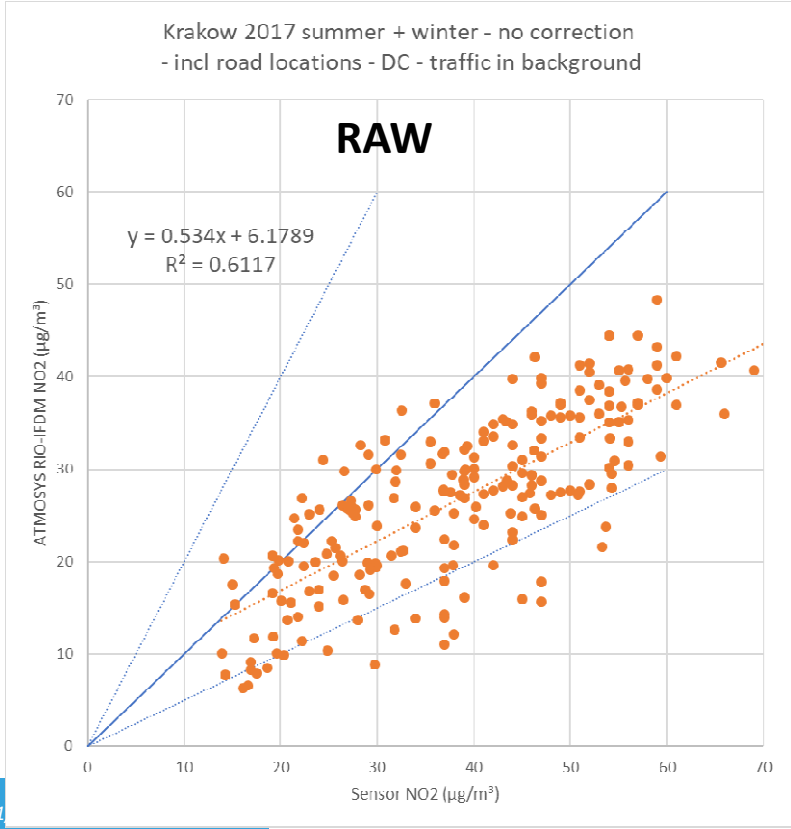
NO2: RIO - IFDM MAP 2017 – KRAKOW

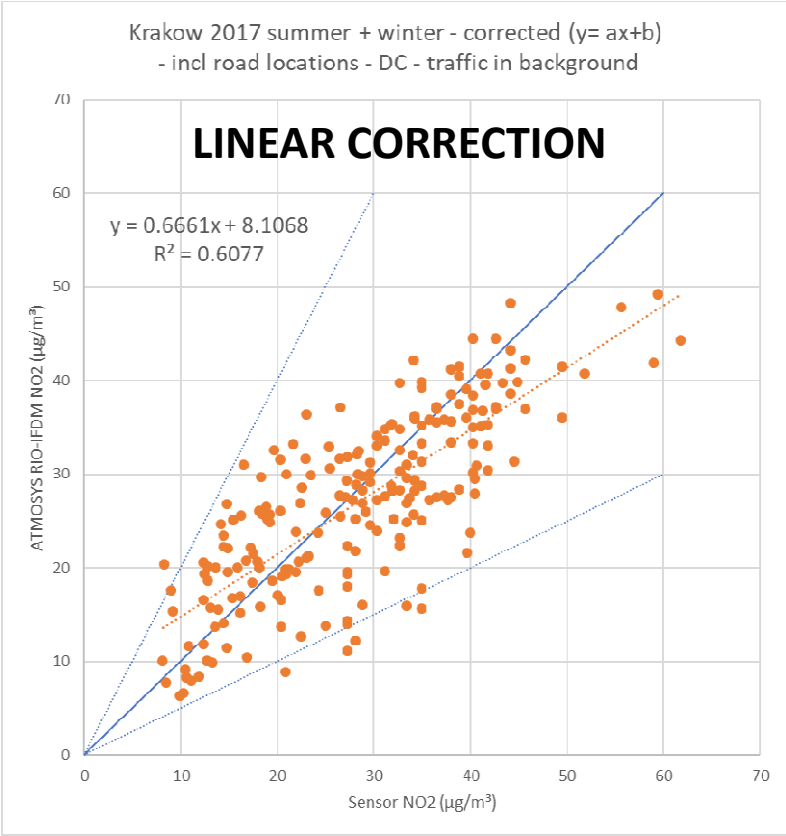


NO2 PASSIVE SAMPLER DATA 19/11-17/12 2017 – LINEAR CORRECTION



MODEL VALIDATION 2017 VERSUS PASSIVE SAMPLER DATA

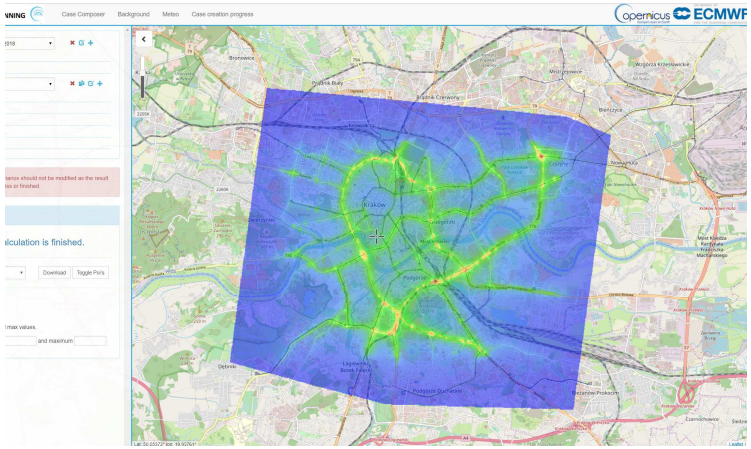




RIO-IFDM MODEL VALIDATION CONCLUSIONS

- Limitations in sensor data
- Need to correct sensor data based on monitor data
- New RIO background maps 2017
- Good validation – R^2 up 0.67
- Possible improvements
  - Currently fleet data 2014 used
  - Model output needs further validation (on-going)

AGENDA



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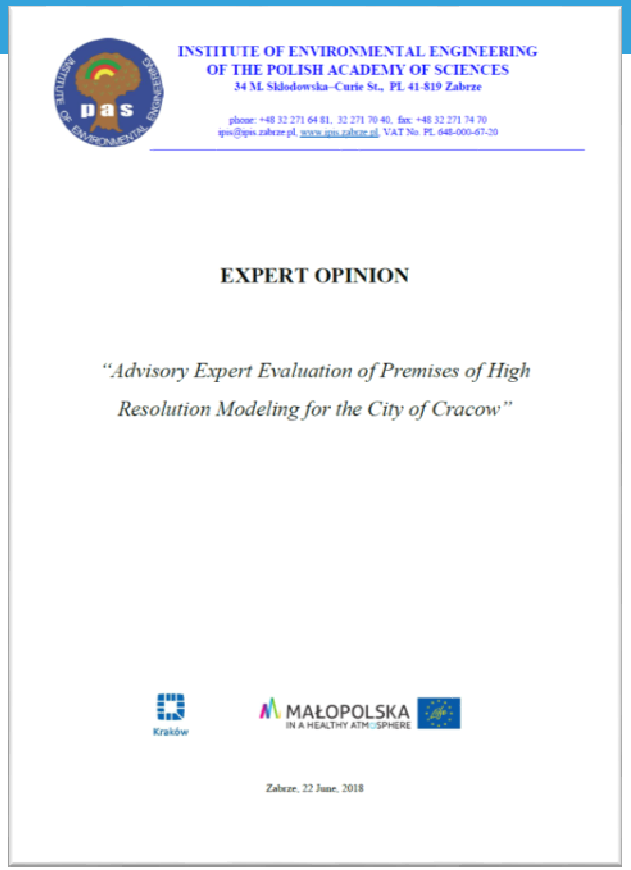
EVALUATION REPORT HIGHLIGHTS

1. **USING THE APPLICATION**
2. **EVALUATION OF THE FIT FOR PURPOSE**
3. **INPUT DATA**
4. **QUALITY OF THE MODELLING**



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EXPERT OPINION

"Advisory Expert Evaluation of Premises of High Resolution Modeling for the City of Cracow"

Kraków

MAŁOPOLSKA
IN A HEALTHY ATMOSPHERE

Zabrze, 22 June, 2018

USING THE APPLICATION – STARTING A CASE

"Within a case, the computation must be performed separately for each scenario, ***there is no possibility of batching the computation for the whole case****."*

"No messages on the ***computation stages*** *are displayed. After the program starts, the user has no possibility of controlling the process nor any information on its progress"*

"Points of interest (POI), practically additional receptors for which the whole-time series will be available after computations. POI is determined exclusively by indicating with the mouse cursor on the map. ***There is no possibility of giving exact coordinates****."*

"During the tests, ***errors occurred when some files were uploaded*** *("Shape collection with id 121572 not found"). Such an error entailed the necessity of removing the whole scenario (!) and starting construction of the case anew. Uploading of these files into another scenario did not cause any errors.*

- ***Flagged on 'wish' list***
- *Partly resolved: E-mail sent, flagged for improvement*
- *Flagged to update*
- *Resolved*

FIT FOR PURPOSE OF THE APPLICATION

1. **NO2, PM10, AND PM2.5 Annual Average Limits - AQ Directive**
2. **Short term traffic scenarios**
3. **Re-suspension**
4. **Varying Regional (Background) Maps**
5. **Residential emissions**

1. Purpose: long term traffic scenarios
2. **Assess further the requirements of Krakow.**
3. Common problem (Street Canyons). Not (yet) considered.
4. Spatially explicit background maps cannot be uploaded by user but VITO can upload maps
5. Large emission reductions are (only) considered in the background. **New backgrd from Action C.6 for 2023 scenarios. Will assess efforts to introduce local residential scenarios if required.**

TRAFFIC FLEET DATA & FORMATS

(Previous) Improvements Suggested:

- Better local fleet information – realistic mileage per car types & fuels
- More realistic emission factors from cars (removal of catalytic converters and particle filters)
- More traffic counts to check/improve the quality of visum traffic data
- The spatial allocation (the distribution) of the traffic volumes over the network

DELIVERABLES

Action	Name	Deliverable	Partner	Deadline from application form	Actual date of implementation	Description of implementation
C4	**FASTRACE traffic emission model available for the city of Krakow**	Milestone	VITO	2016-12-31	2017-06-01	This model is embedded in the application so that non-experts do not have to learn how to use the model.
C4	**IFDM modelling platform operational at the premises of the city of Krakow**	Products	VITO	2017-12-31	2017-11-20	The application is web based and is thus hosted at VITO and made available via the web for use by Krakow staff via their own log-in: https://atmosysplanningkrakow.marvin.vito.be/ Phase 1: At the end of 2017 the first prototype was ready. Testing. Phase 2: Further testing and improvements. Tested by external local contractors in Krakow. Nov 2018 – new release.
C4	**Staff at the city of Krakow is trained in the setup and use of the IFDM modelling system**	Milestone	VITO	2017-12-31	2018-03-01	Phase 1: Over the whole phase, the staff of the traffic department have received presentations on the underlying methodology, and the input data required to implement, test and run the application. Communications on the various data requirements, inputs and performances was predominantly by e-mail. A first demonstration of the application was provided on 29 Nov 2017. Phase 2: The application was demonstrated to the external local contractors asked to test the application (20th June 2018 via skype). Queries during the testing were handled by phone and e-mail. Further training has been offered and is available on request.

NEXT STEPS

- **VITO:**
  - Assess efforts to implement ‘updated’ user requirements
    - Local residential emissions (required?)
    - POI, batching runs, communications on computation time …..
    - Part of the remaining capacity building project budget could be used to cover some of these efforts
  - New run off-line with OSPM (3D-building)
  - Finalize validation based on report passive sampler campaigns
  - User support & further training if needed
  - Dissemination to other regions & hotspots