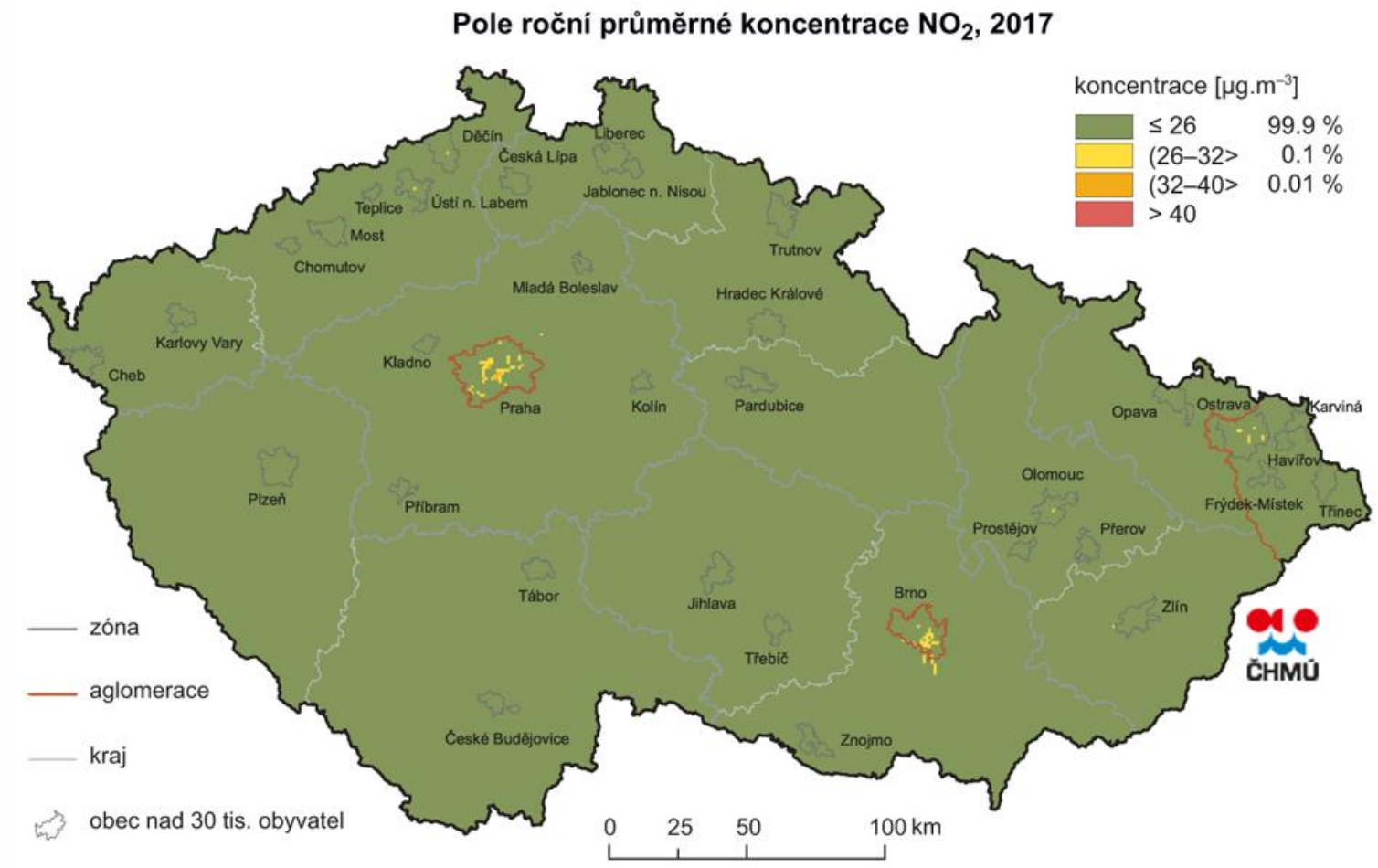
Ostrava, Ostrava University |
19.11. 2018

Technical and technological possibilities to reduce pollution from the steelworks – the story of Ostrava

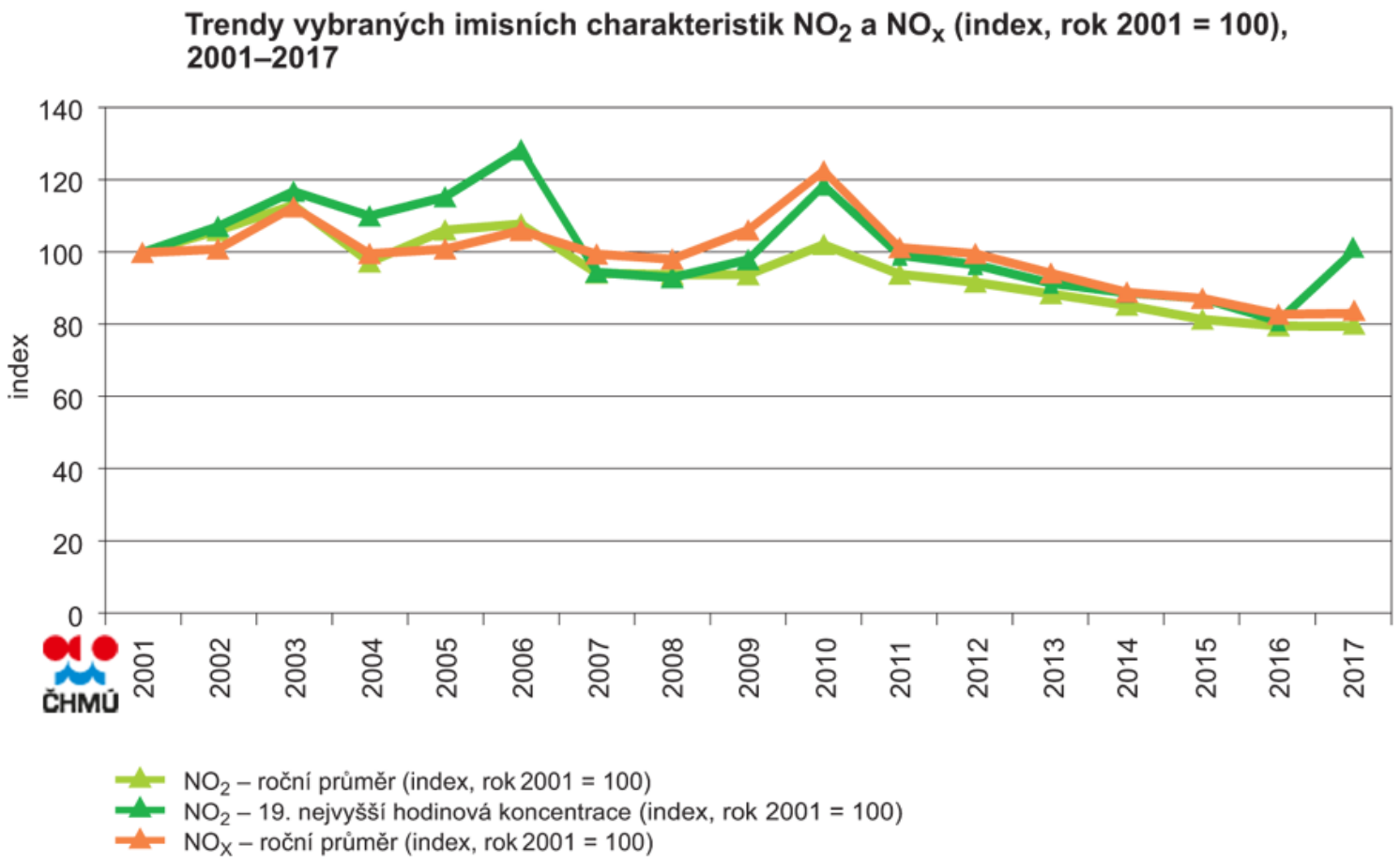
AIR TRITIA | VŠB – TU OSTRAVA | Petr Jančík, Jan Bitta, Irena Pavlíková

AIR POLLUTION IN CZECH REPUBLIC (2017)



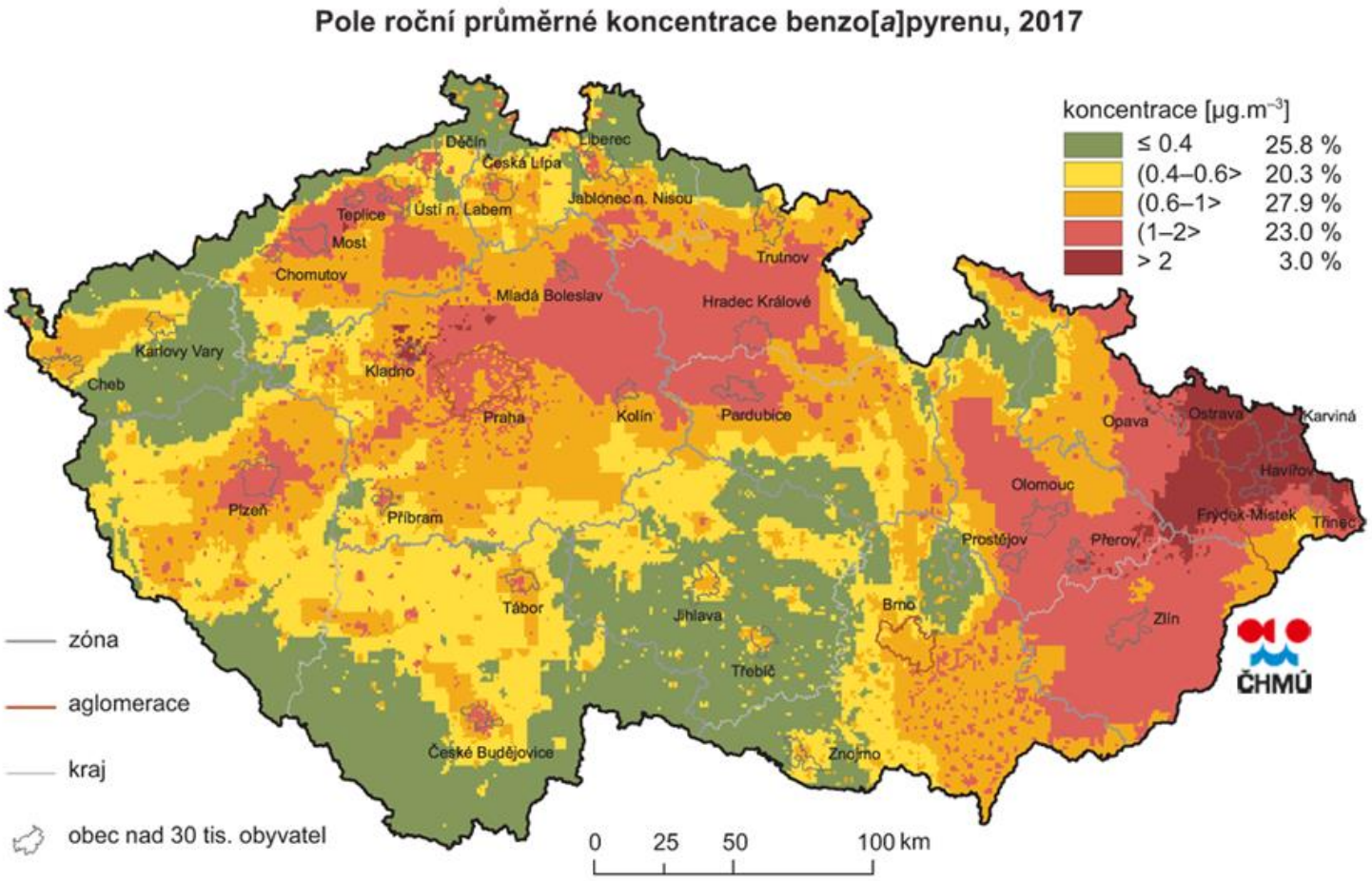
Average year concentration of NO_2

AIR POLLUTION IN CZECH REPUBLIC (2017)



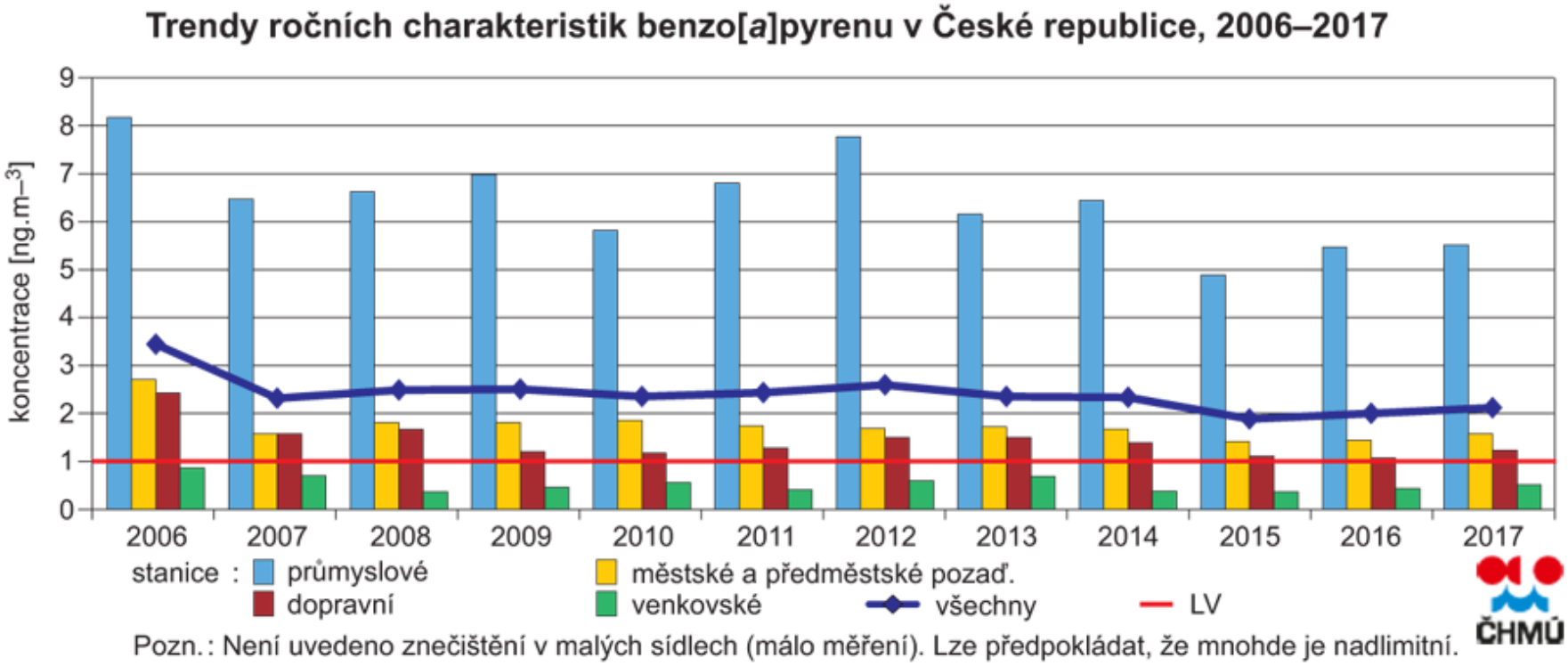
Average year concentration of NO_2 - trends

AIR POLLUTION IN CZECH REPUBLIC (2017)



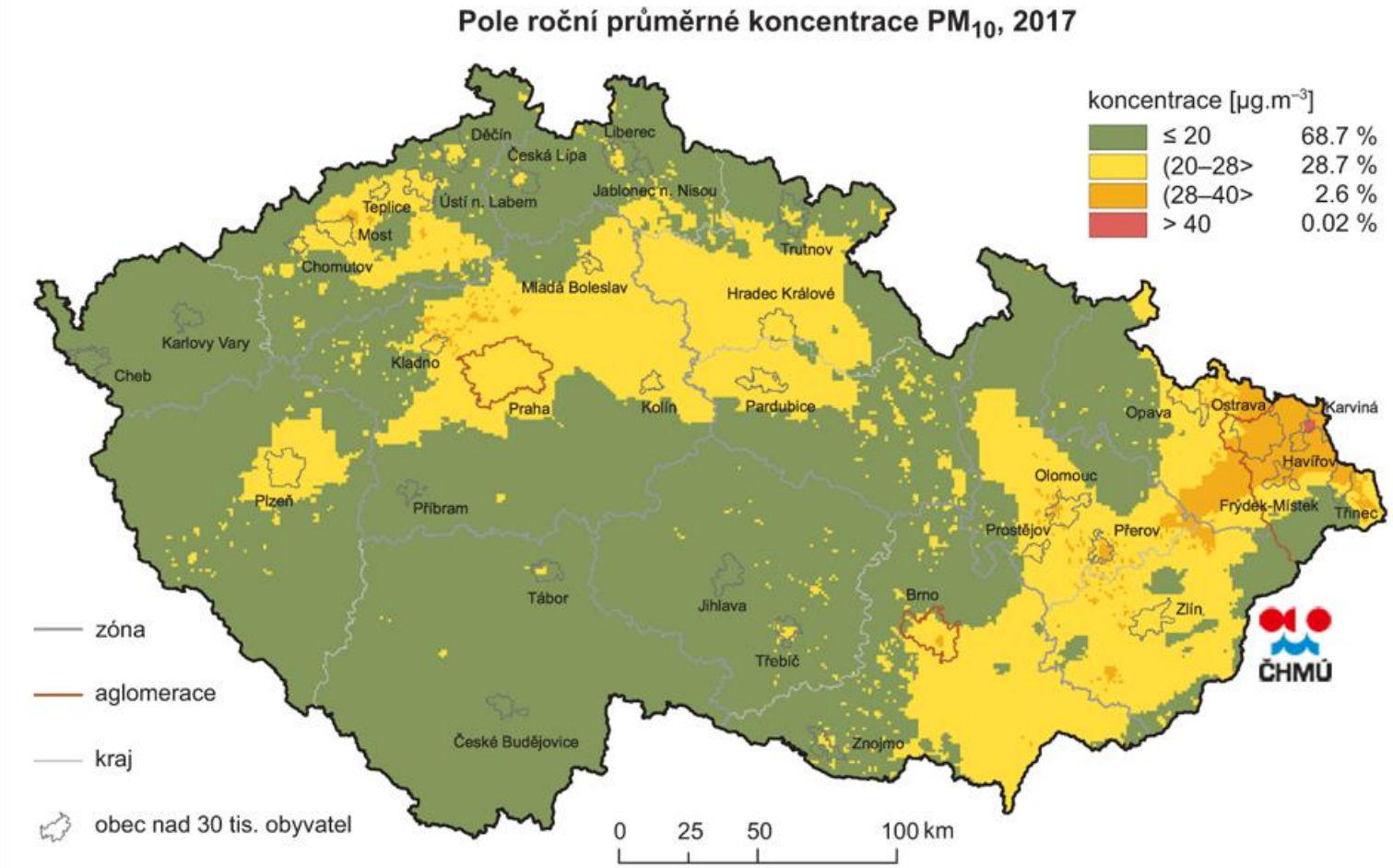
Average year concentration of benzo(a)pyren

AIR POLLUTION IN CZECH REPUBLIC (2017)



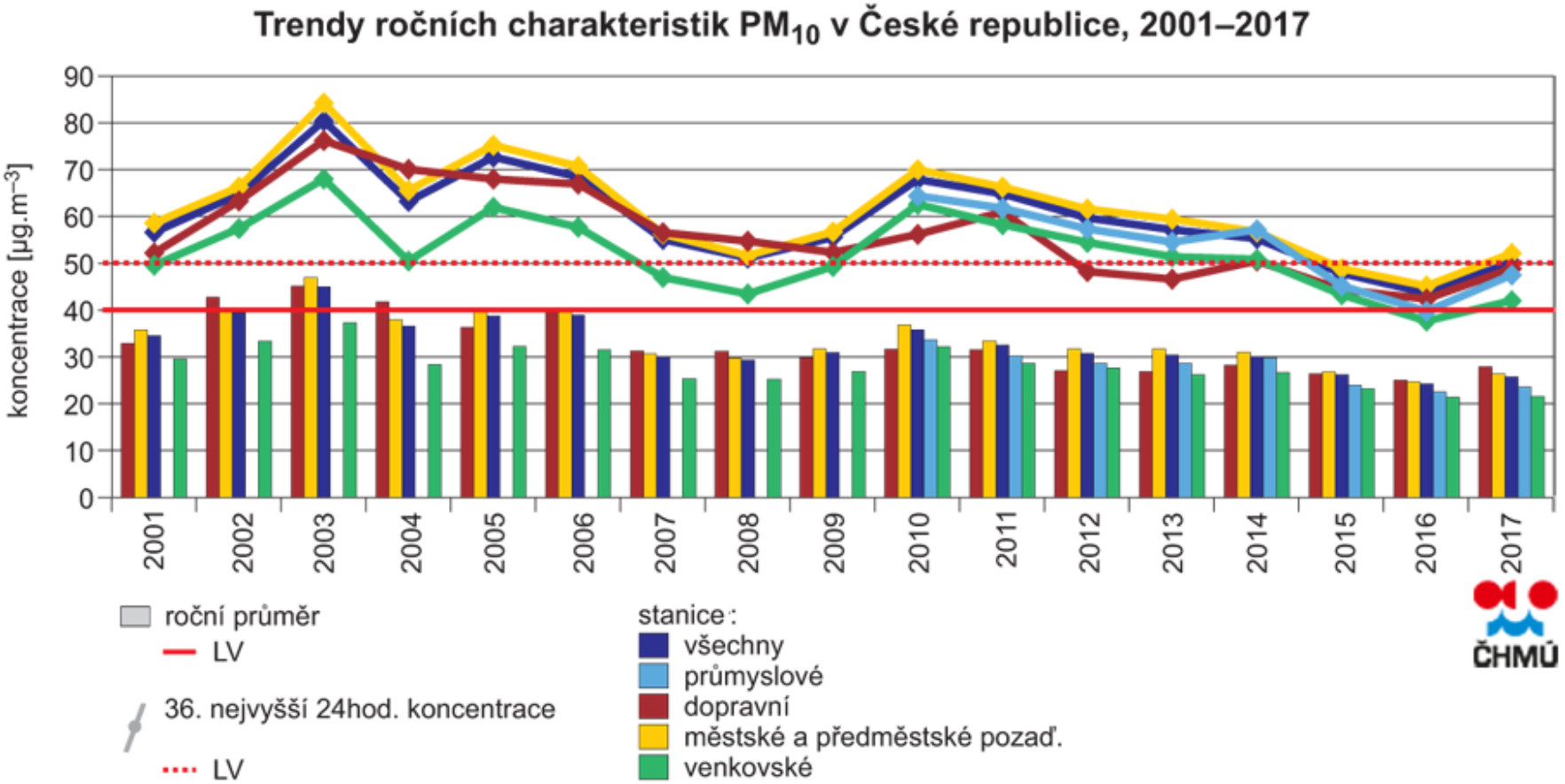
Average year concentration of PM_{10} - trends

AIR POLLUTION IN CZECH REPUBLIC (2017)



Average year concentration of PM_{10}

AIR POLLUTION IN CZECH REPUBLIC (2017)



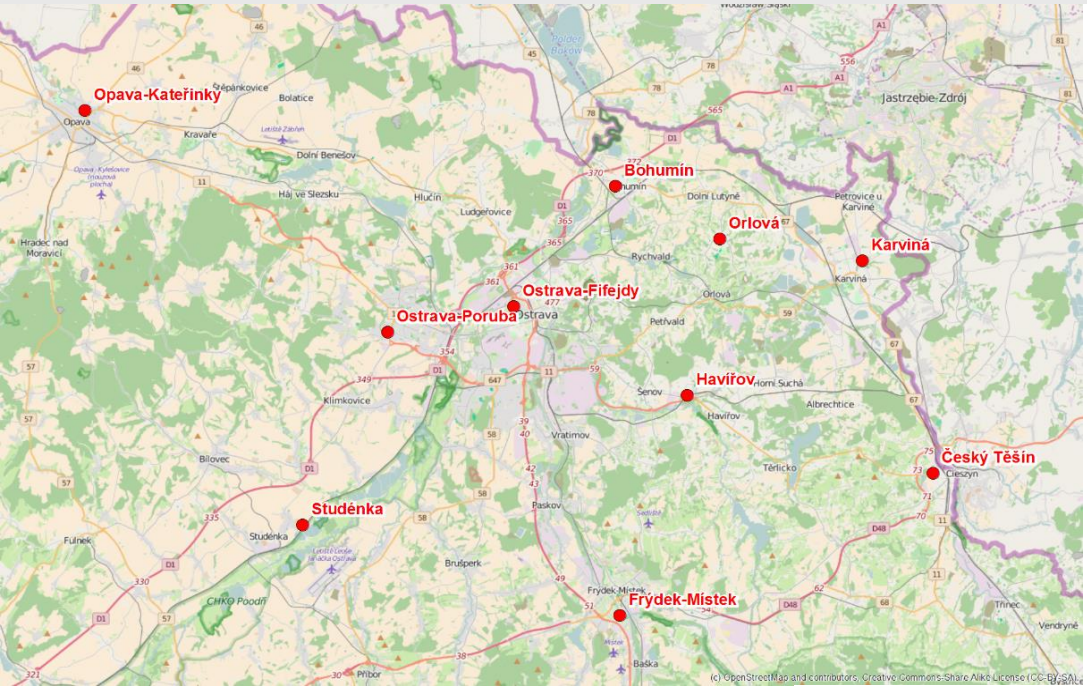
Average year concentrations of PM_{10} - trends

CHANGE OF AVERAGE YEAR CONCENTRATION OF PM_{10} IN OUR REGION

Stanice IM	2006	2016	2017
O.-Radvanice, ZÚ	63.7	41.0	43.9
O.-Poruba, ČHMÚ	37.5	27.3	27.4
Studénka	41.1	27.3	29.3
Opava-Kateřinky	44.4	24.7	26.8
Čeladná	30.8	21.5	20.1*

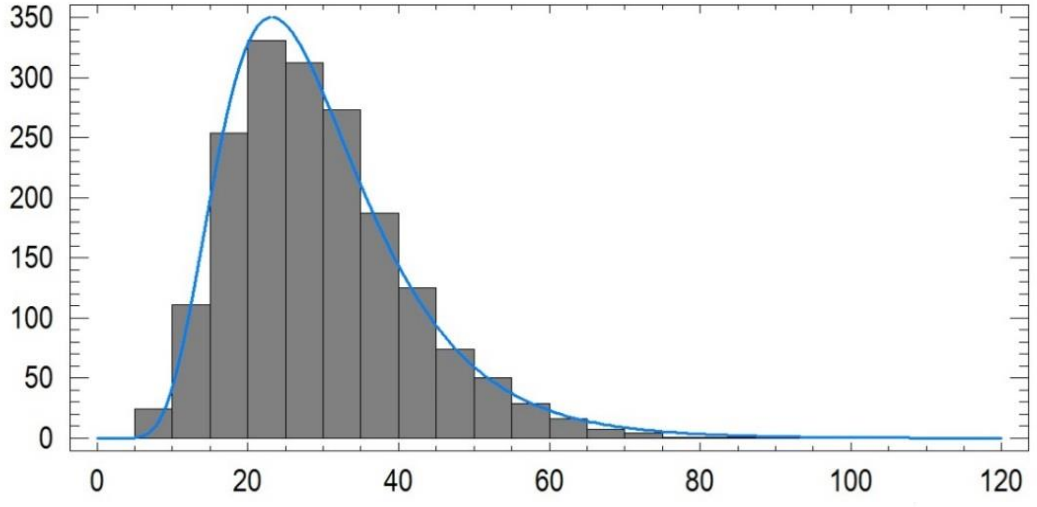
*Průměrné roční koncentrace PM_{10} [µg/m³], * - Ostravice-golf*

LONG TERM AIR POLLUTION TRENDS ANALYSES IN OSTRAVA REGION

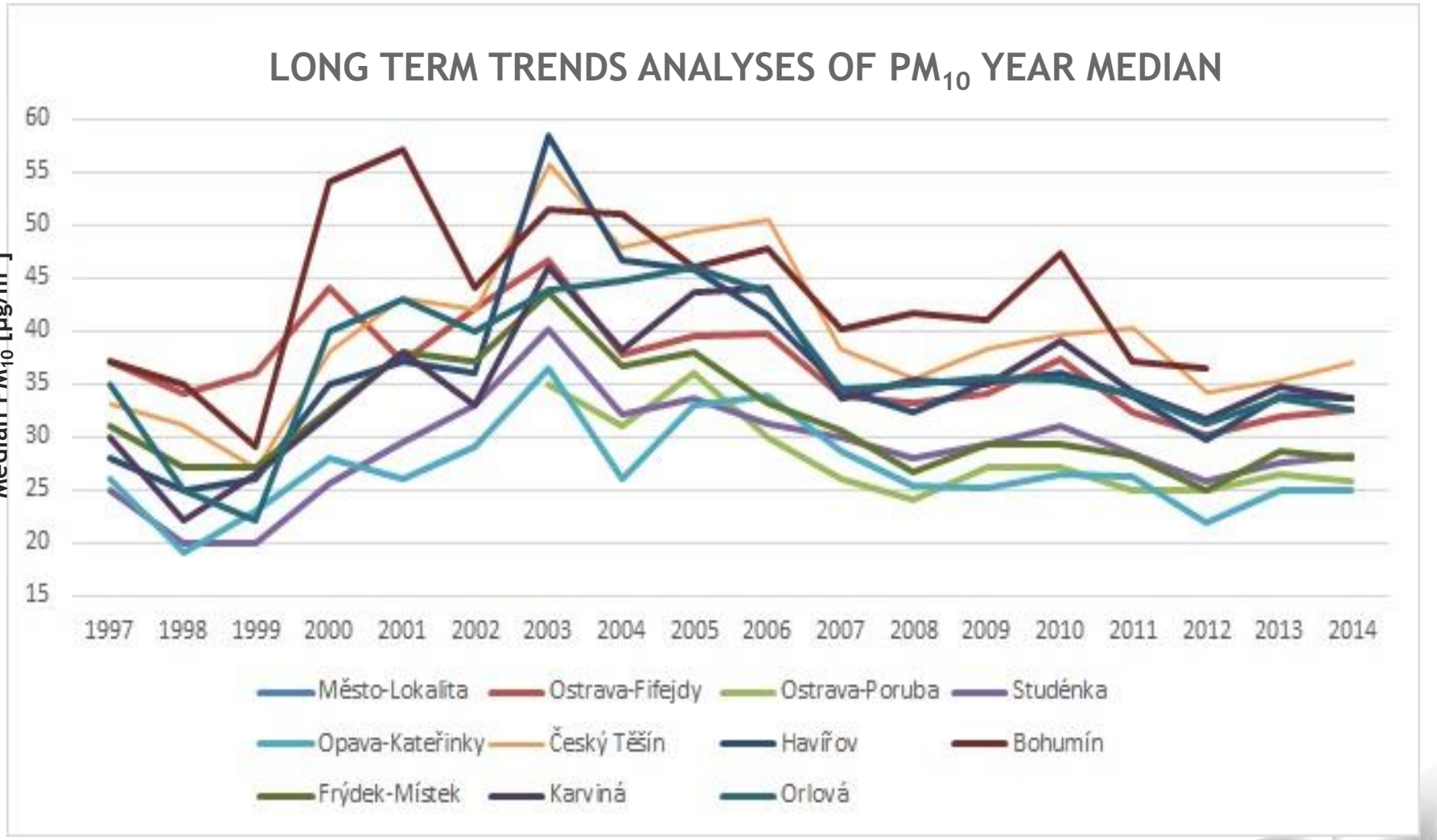


- Behaviour of air pollution monitoring in Ostrava region is like one common system
- Statistic distribution of air pollution concentrations

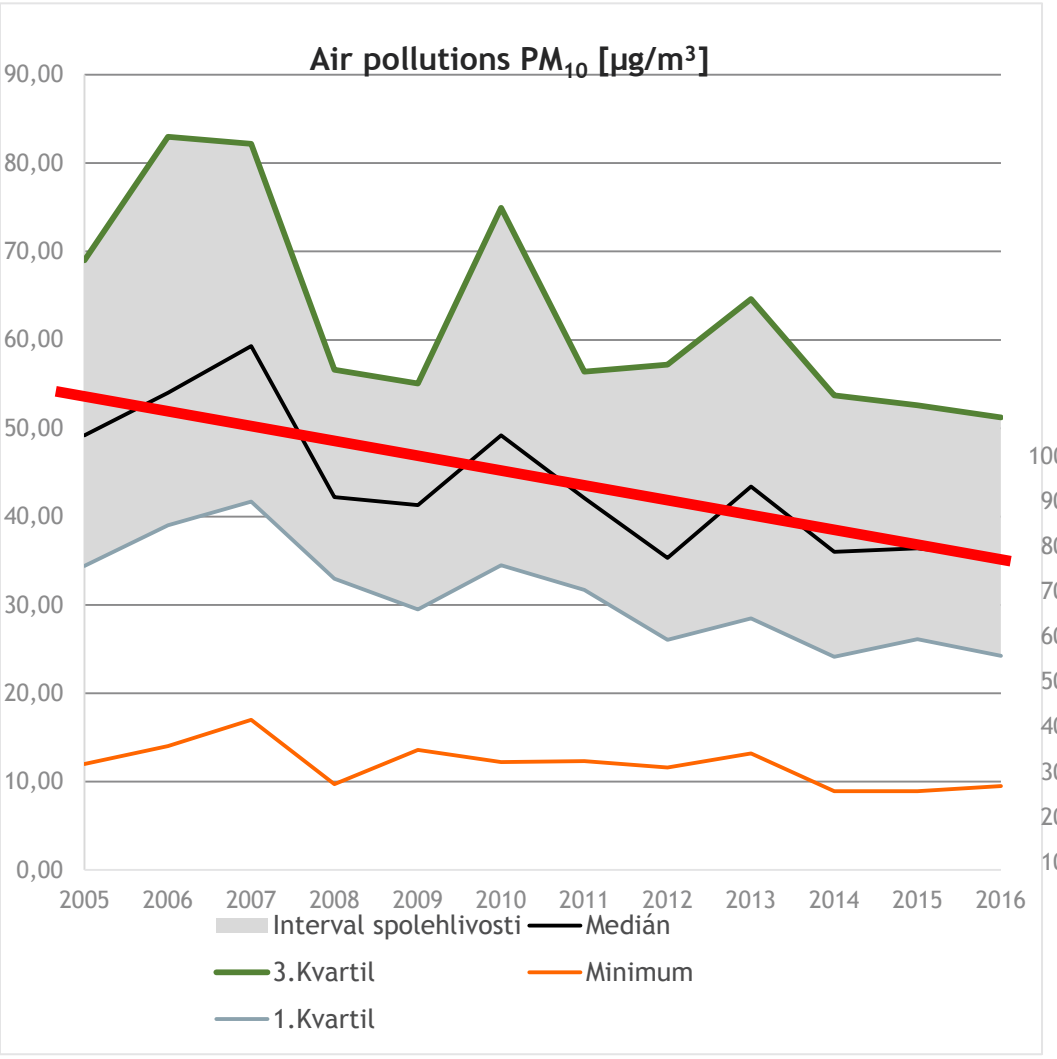
Probably regional impact of important AP sources



AIR POLLUTION IN OSTRAVA REGION (2017)



LONG TERM TRENDS ANALYSES OF PM_{10} MEDIAN IN OSTRAVA RADVANICE

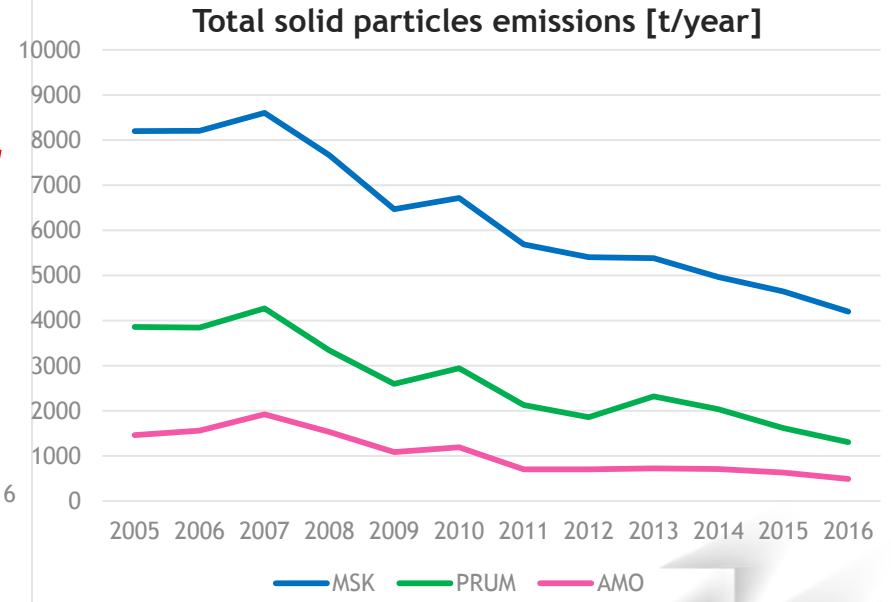


Correlation with AMO emission is 92%

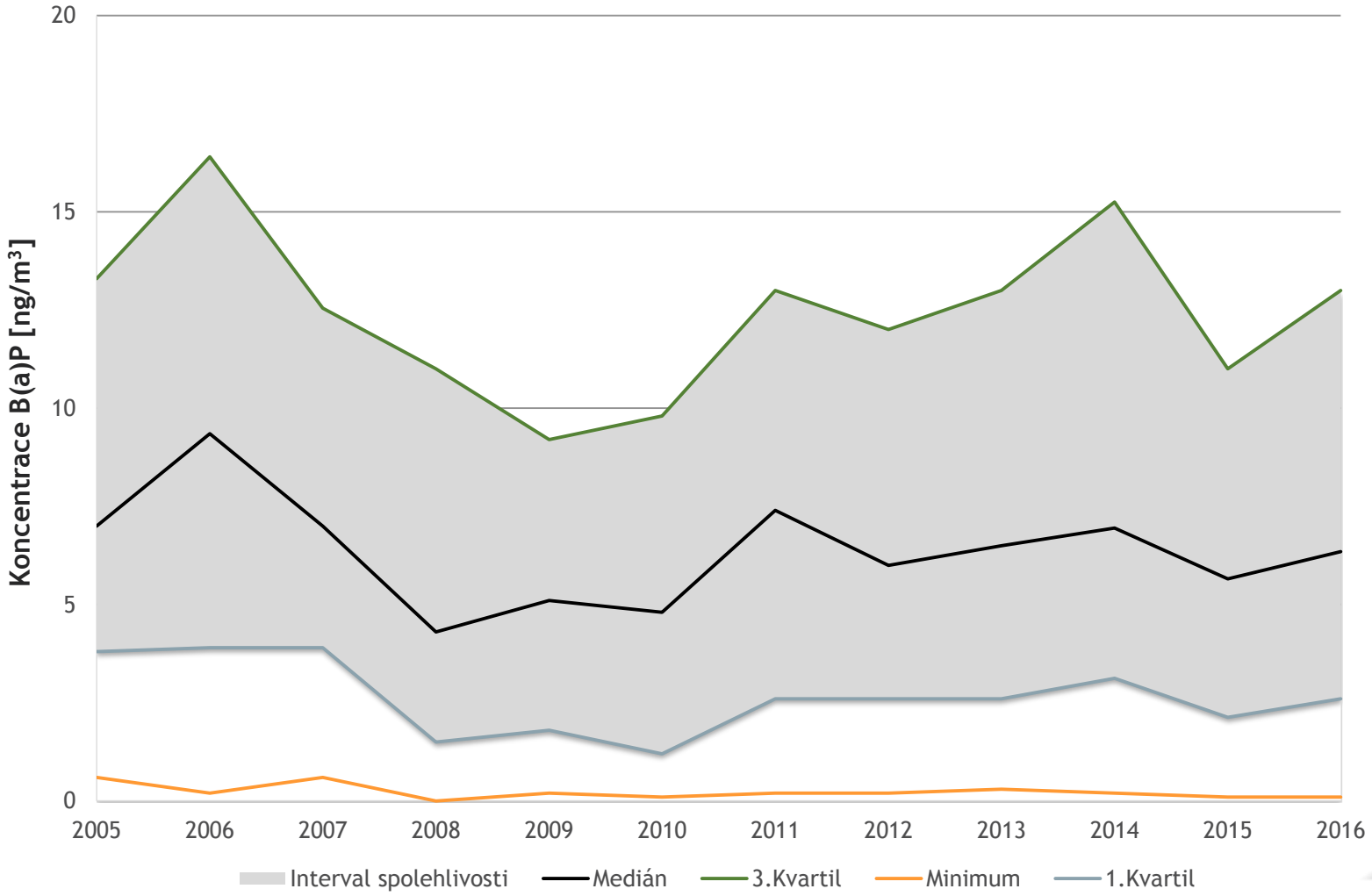
-100 t/year AMO = -1.72 µg/m^3

- Correlation with regional emission is 91%

-1000 t/year in MSK -> - 6.22 µg/m^3



LONG TERM TRENDS ANALYSES OF B(A)P MEDIAN IN OSTRAVA RADVANICE



CONCLUSION OF THE DATA ANALYSE

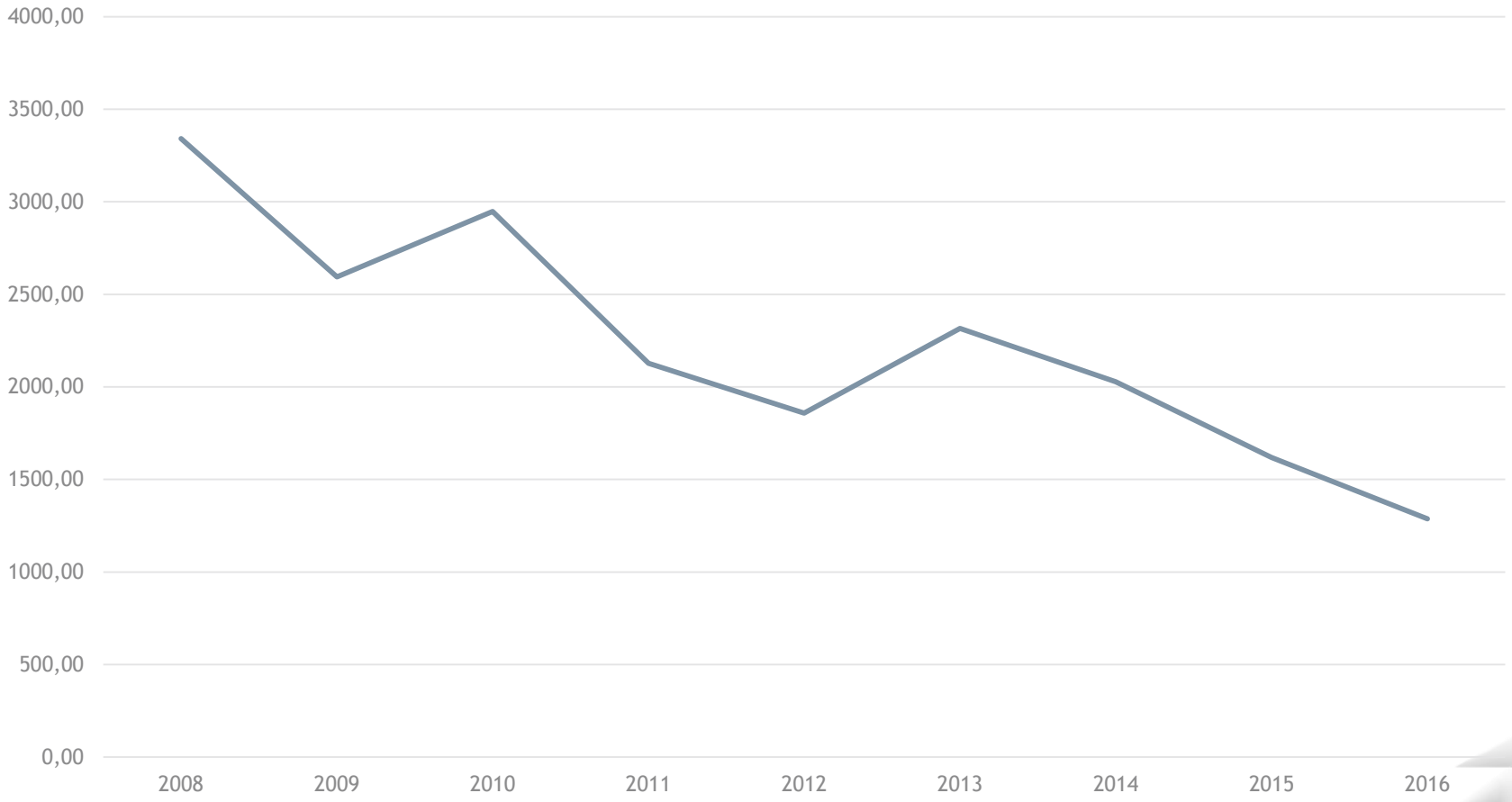
- Trend for Ostrava region is positive for PM_{10} in last 5 years.
  (And emissions from metallurgical sources was significantly reduced by application of number of technical solutions.)

- Trend for Ostrava region for B[a]P is neutral – remains extremely high.
  (And emissions from coke oven plants was reduced theoretically 10x, but it was only by change of methodology of assessment.)

See next sample:
In summer, when values of all Czech stations remains under detection limit (0,04 ng.m^{-3}), values on stations under influence of coke plants exceeds 1 ng.m^{-3} .
Ostrava-Radvanice ZÚ 19,0 ng.m^{-3} (25. 7. 2017),
Ostrava-Radvanice OZO 15,0 ng.m^{-3} (19. 7. 2017),
Ostrava-Přívoz 2,5 ng.m^{-3} (19. 7. 2017) and
Český Těšín 1,2 ng.m^{-3} (30. 8. 2017).

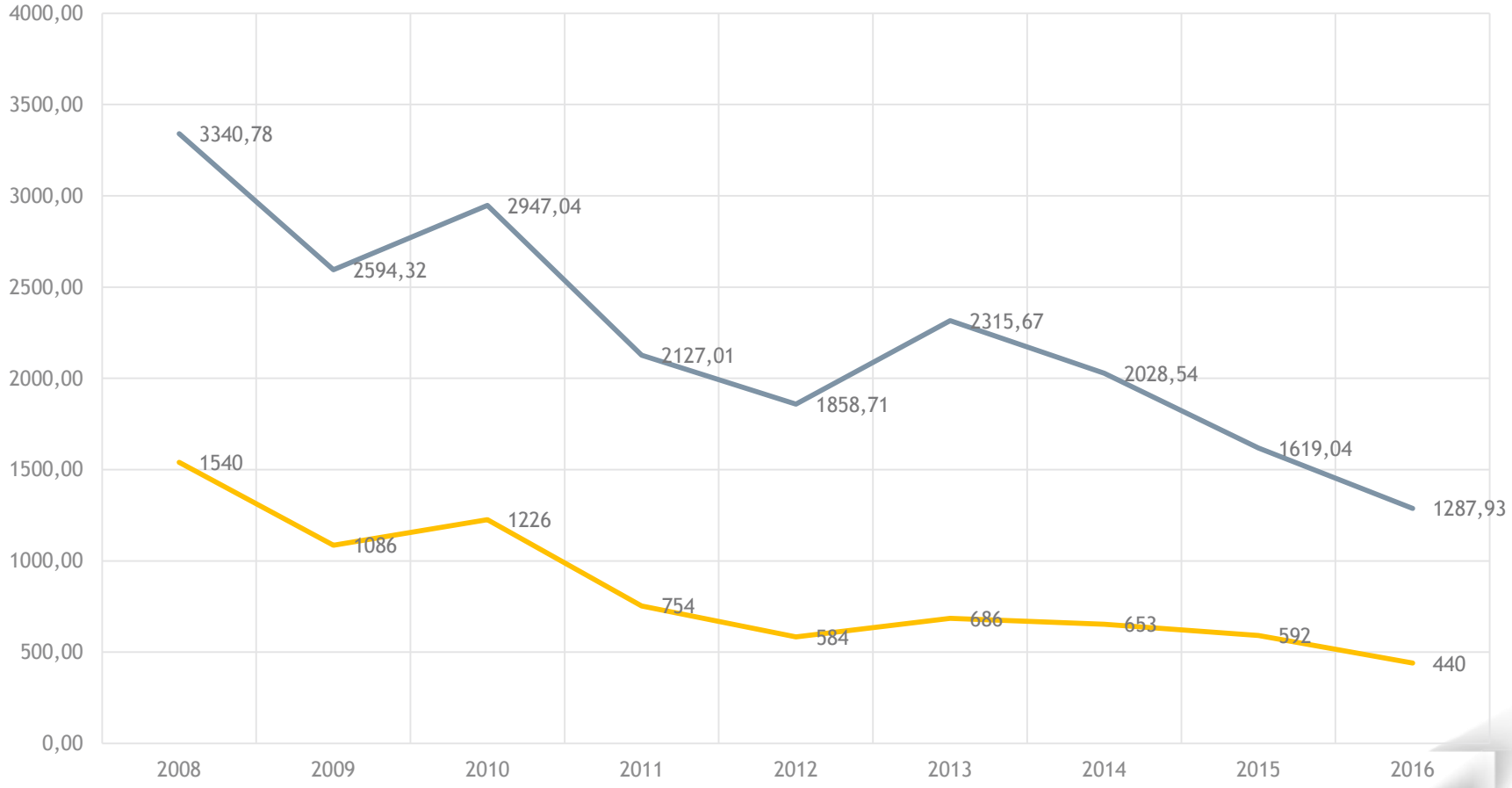
TREND IN EMISSIONS OF TSP

Emissions of TSP in Moravia Silesian Region [t/years]



WHAT'S HAPPENED IN THE MOST IMPORTANT OSTRAVA METALLURGICAL PLANT ?

Emissions of TSP in ArcelorMittal Ostrava [t/years]



THE MOST IMPORTANT OSTRAVA METALLURGICAL PLANT

ArcelorMittal Ostrava:
topically in operation

1. Coke Oven Plant (1,5 Mt of coke per year)
2. Sinter Plant (< 2 Mt of sintered iron ores)
3. Blast Furnances Plant - 3 Blast Furnances (max 3Mt of liquid iron)
4. Steel Plant - 3 tandem furnaces (2,1 Mt of steel per year)
5. Energy complex TAMEH Czech s.r.o. (daughter enterprise, new modern gas boiler 254 MWe, 248 MWth steam)
6. Secondary metallurgy (Rolling Mils, Tubular Products)

BRIEFLY CHARACTERISTICS

Ad 1. Coke Oven Plant - **needs to be modernised or removed (unacceptable emissions of B[a]P and other hydrocarbons)**
Ad 2. Sinter Plant - **modernised (new hi-tech textile end of pipe filters, fugitive emissions filters)**
Ad 3. Blast Furnaces Plant - **modernised (fugitive emissions filters, coal injection)**
Ad. 4. Steel Plant - 3 tandem furnaces - **ancient technology, needs to be modernised or removed**
Ad. 5. Energy complex - **new modern gas boiler instead of old coal ones**
Ad. 6. Other secondary products - not big problems to compare with primary metallurgy and Steel Plant.

WHAT THEY IMPROVED FOR TSP REDUCTION?

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Blast Furnaces Plant:

- iron ore manipulation fugitive emissions
- wagons cleaning
- hot iron casting
- filling of blast furnaces

Sinter Plant:

- South - textile filter (-97 t/Year)
- North - textile filter (-265 t/Year)
- fugitive emissions from sintering belts
- fugitive emissions from raw materials manipulations

Coke Oven Plant:

- improving of cooling tower construction

Steel Plant:

- limestone manipulation fugitive emissions

IS IT POSSIBLE TO VERIFY, WHAT WILL BE RESULT OF THIS BIG INVESTMENT?

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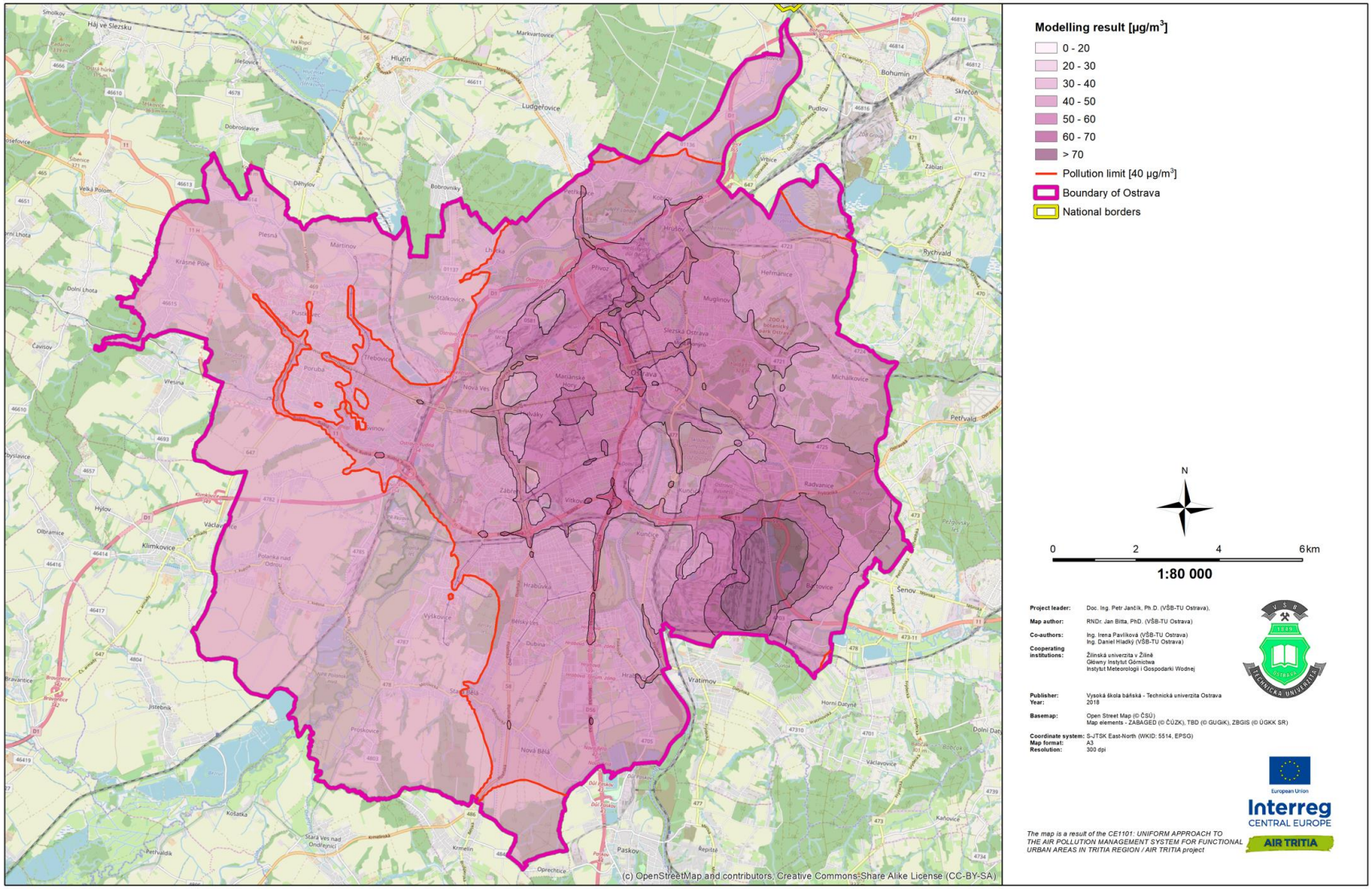
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2003



IS IT POSSIBLE TO VERIFY, WHAT WILL BE RESULT OF THIS BIG INVESTMENT?

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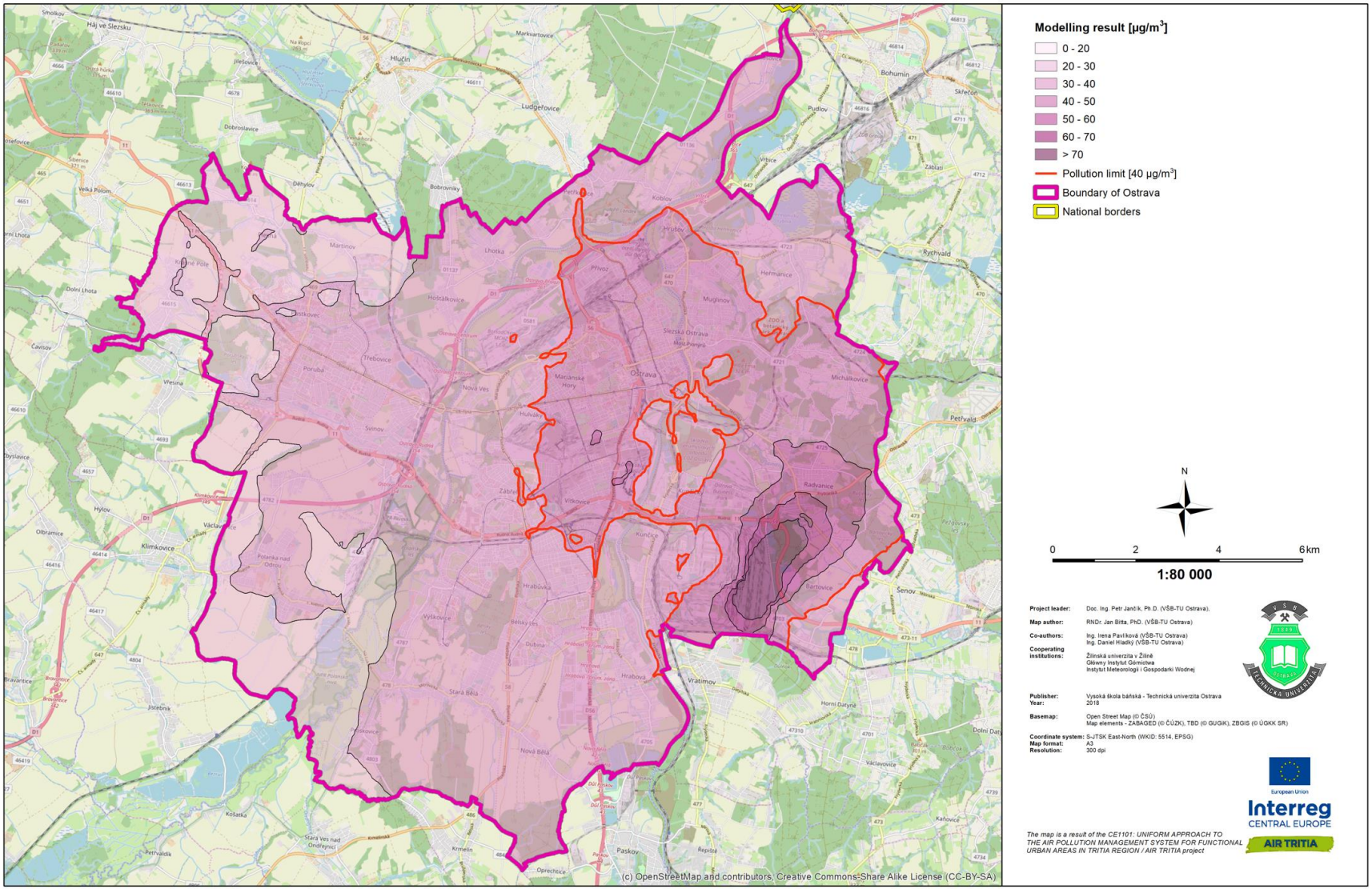
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Changes in traffic, new roads, model SYMOS'97 with correction by pollution monitoring, year 2007



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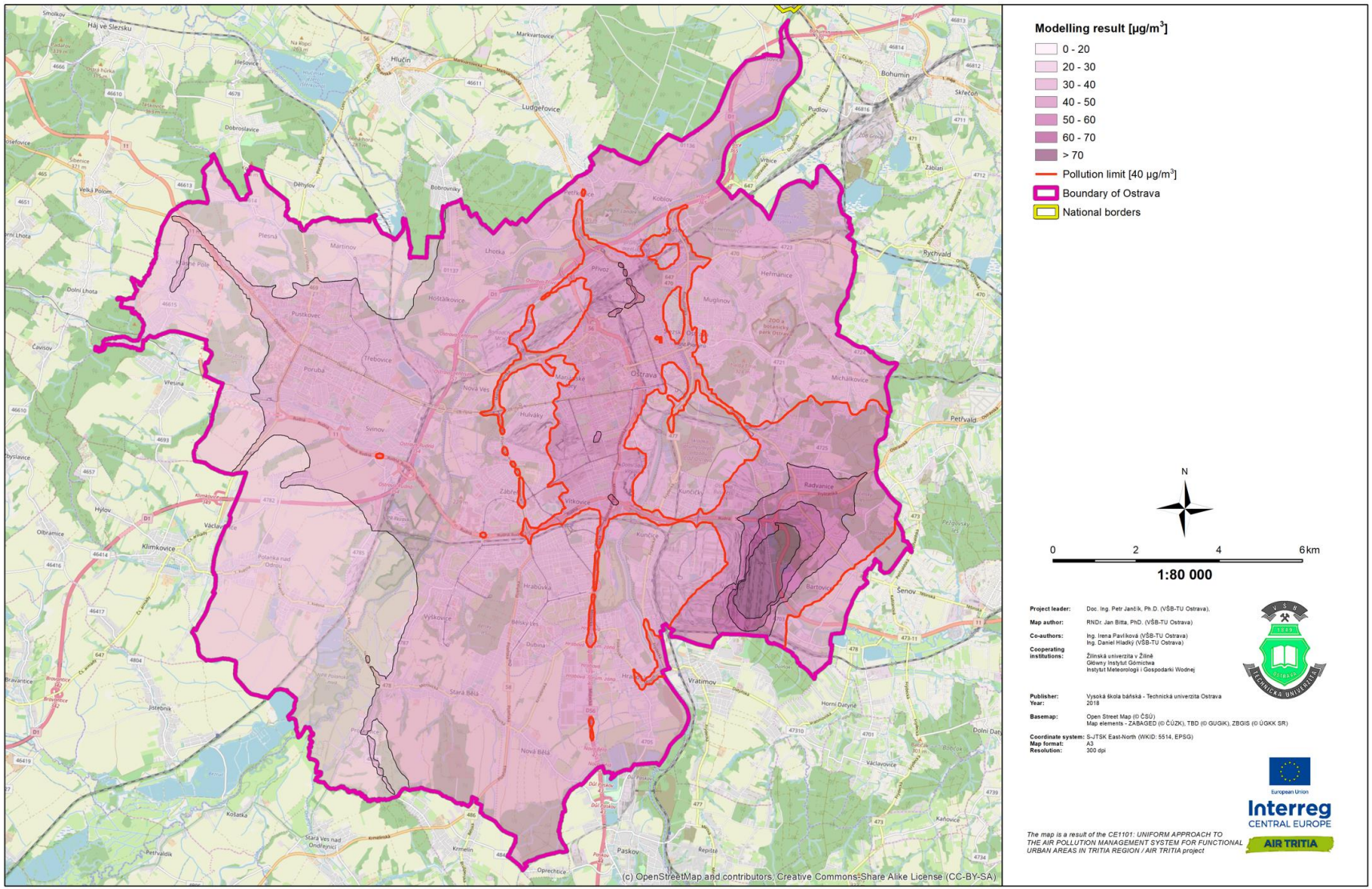
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Solid fuel replacement in domestic heating, model SYMOS'97 with correction by pollution monitoring, year 2007



IS IT POSSIBLE TO VERIFY, WHAT WILL BE RESULT OF THIS BIG INVESTMENT?

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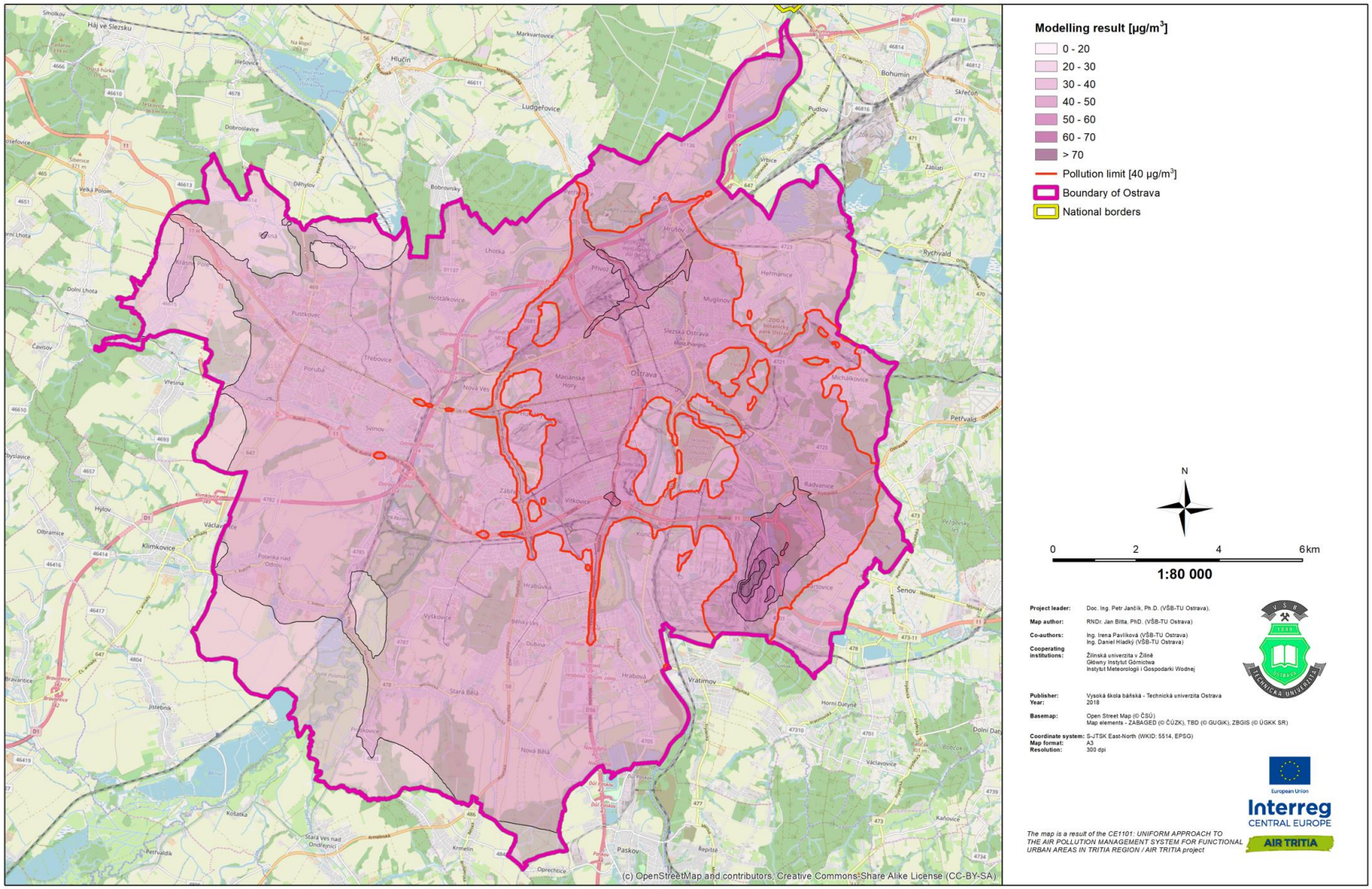
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Emission ceiling for industrial sources, model SYMOS'97 with correction by pollution monitoring, year 2007



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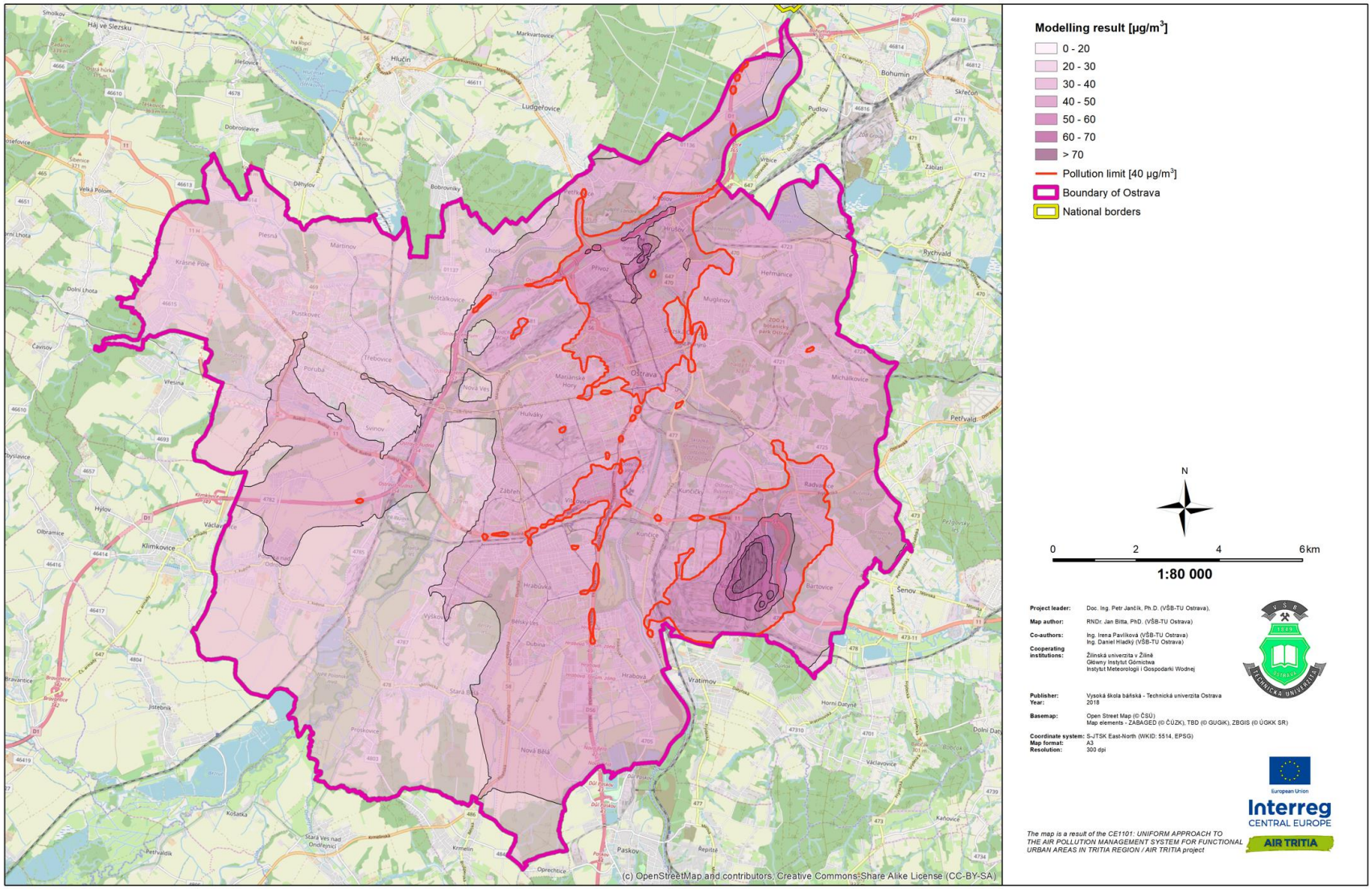
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2009



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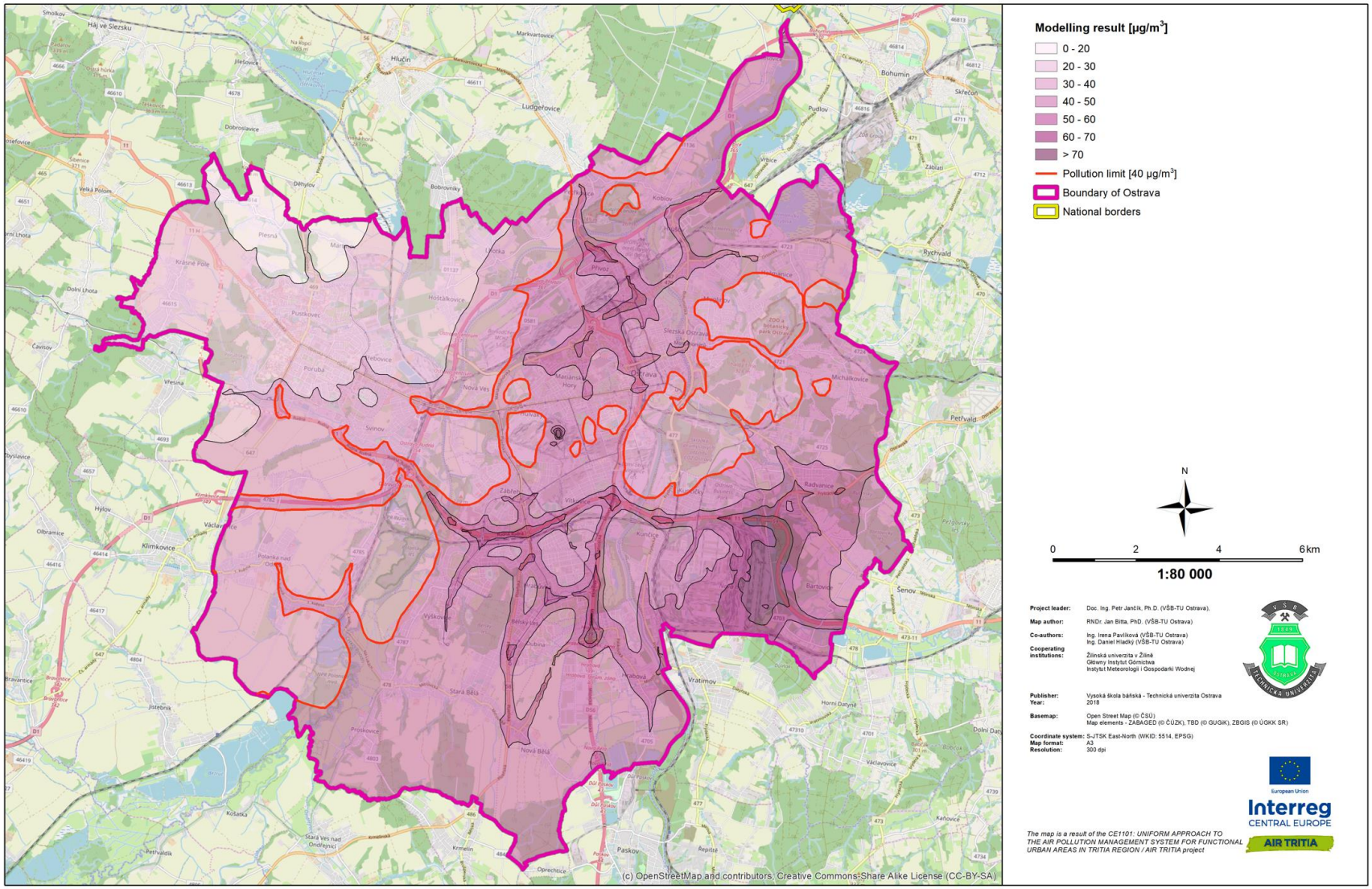
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2010



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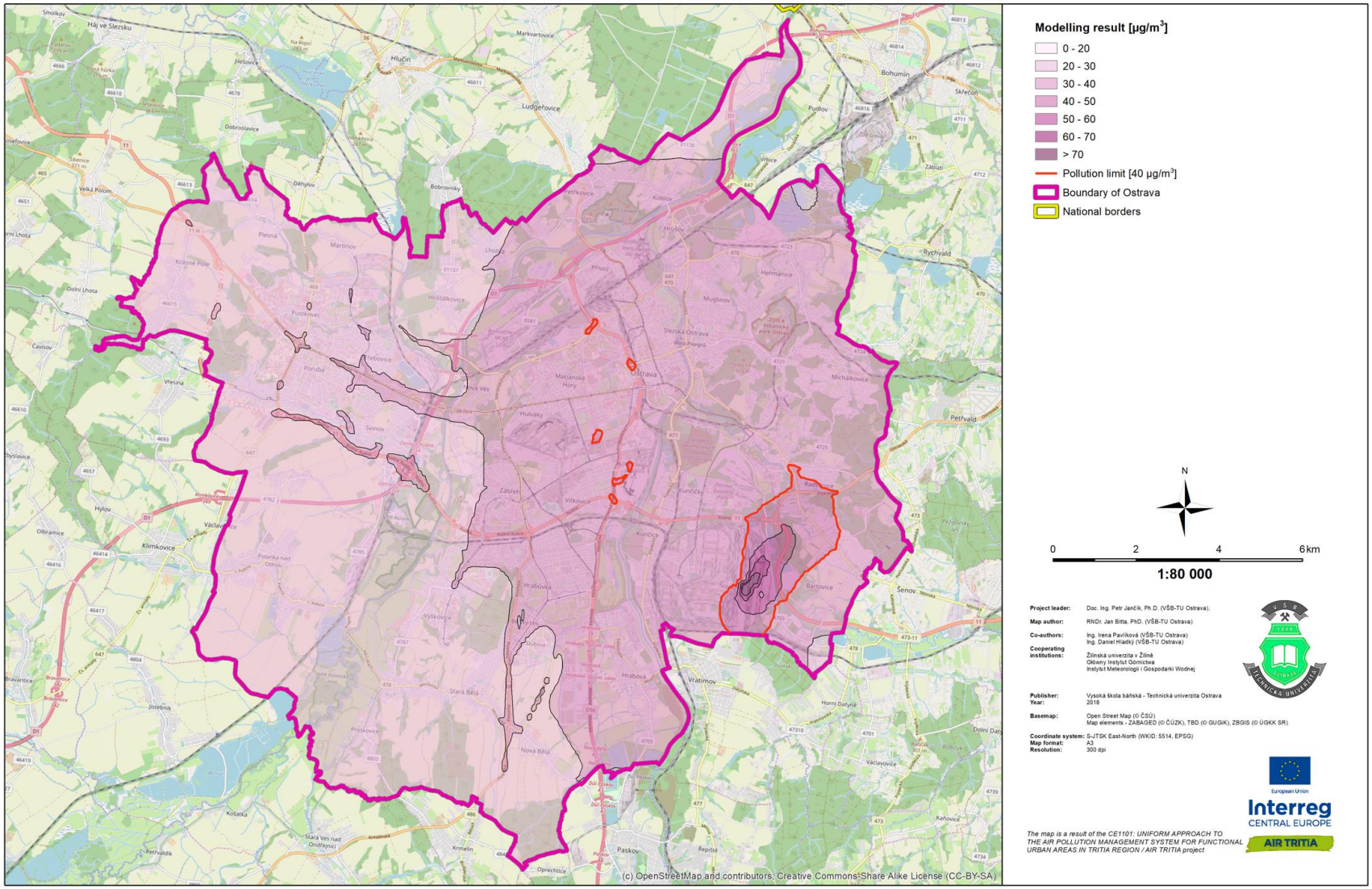
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

All pollution limiting provisions, model SYMOS'97 with correction by pollution monitoring, year 2007



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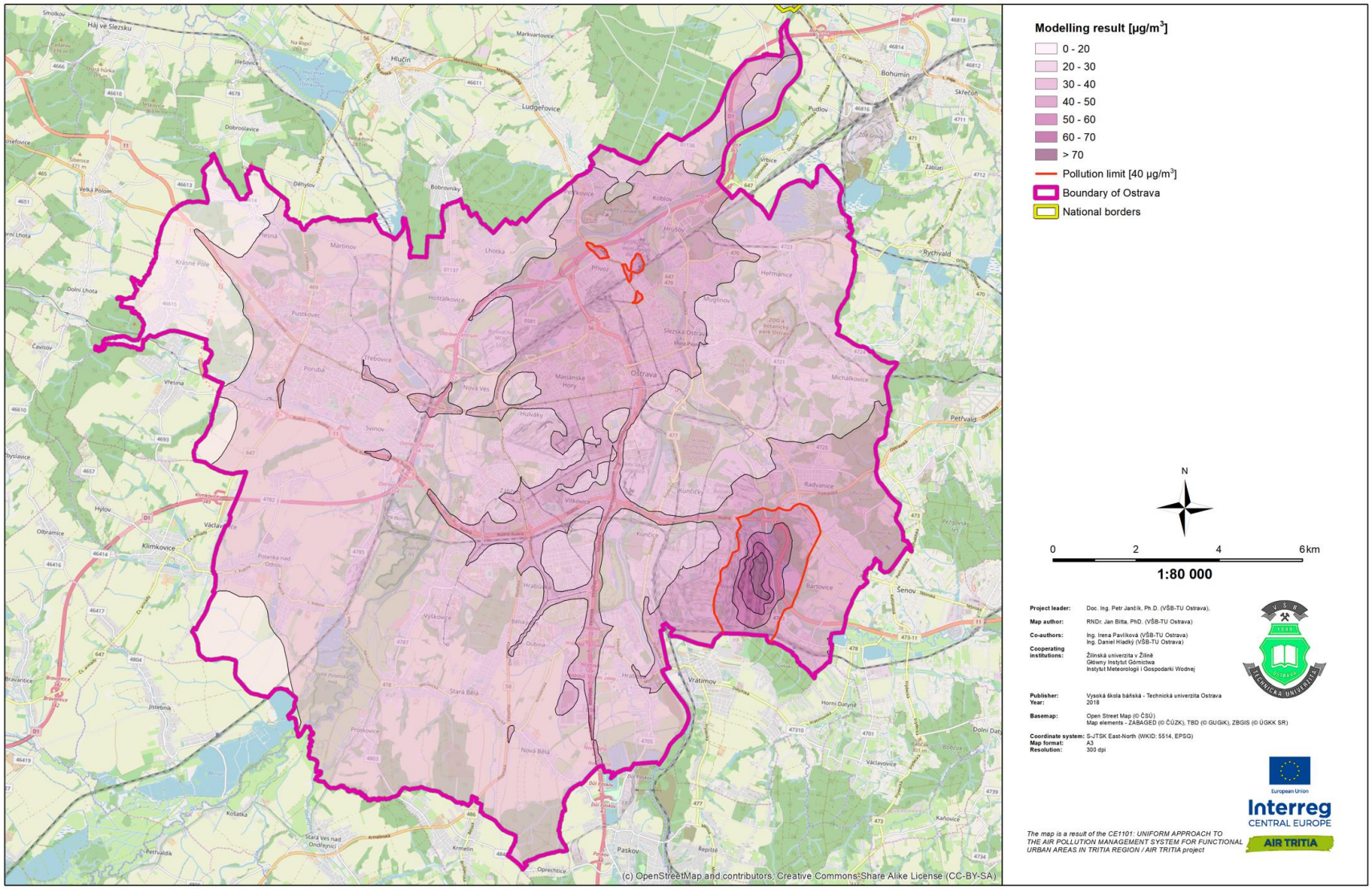
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN OSTRAVA

Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2015

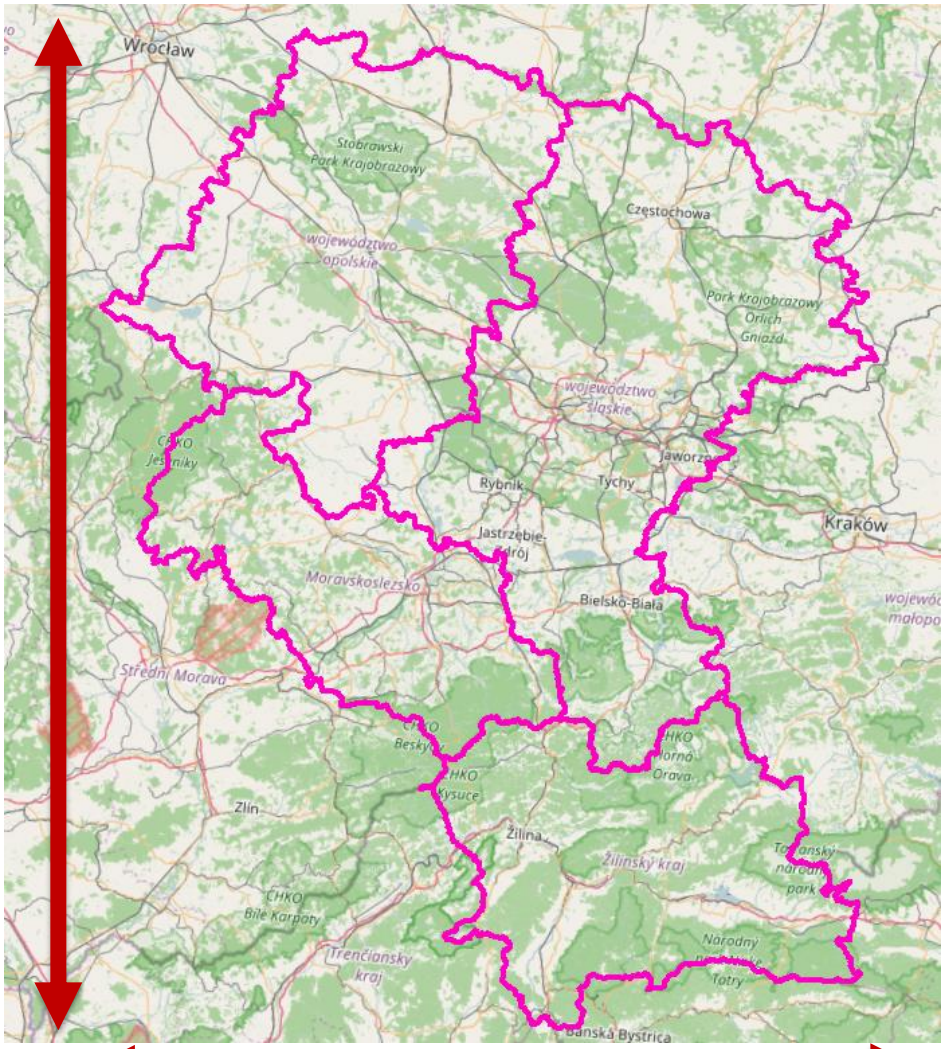


WHAT IS POSSIBLE TO DO FOR AIR POLLUTION MANAGEMENT IN WHOLE AREA ?

1. Collect good and fresh data about situation (APM).
2. Collect good and fresh data about emission sources.
3. Made connection between them.
4. Made mathematical modelling with verified model. of relations between sources and air quality.
5. Made modelling of many cases of potential improvement.
6. Evaluate those results to combine them with socioeconomic, health impact and costs data.
7. This way is possible to design some potential strategies for air quality improvement and to chose the optimal from them.
8. So we are doing in frame of project AIR TRITIA.
9. Result will be the easy accessible Air Pollution Management System for urban areas of big industrial region.

AREA OF INTEREST

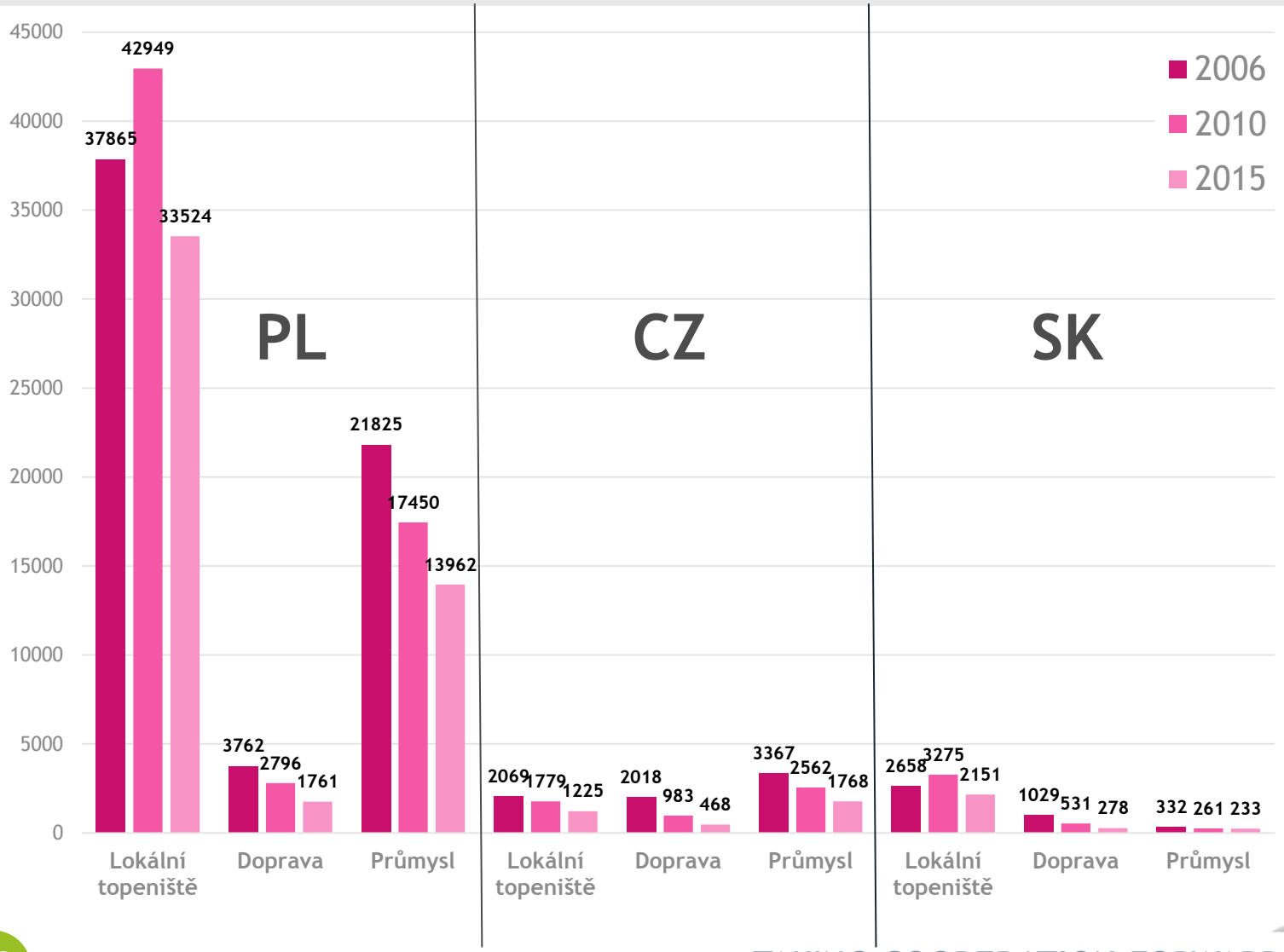
220 km



280 km

34 000 km²
7 550 000 citizens

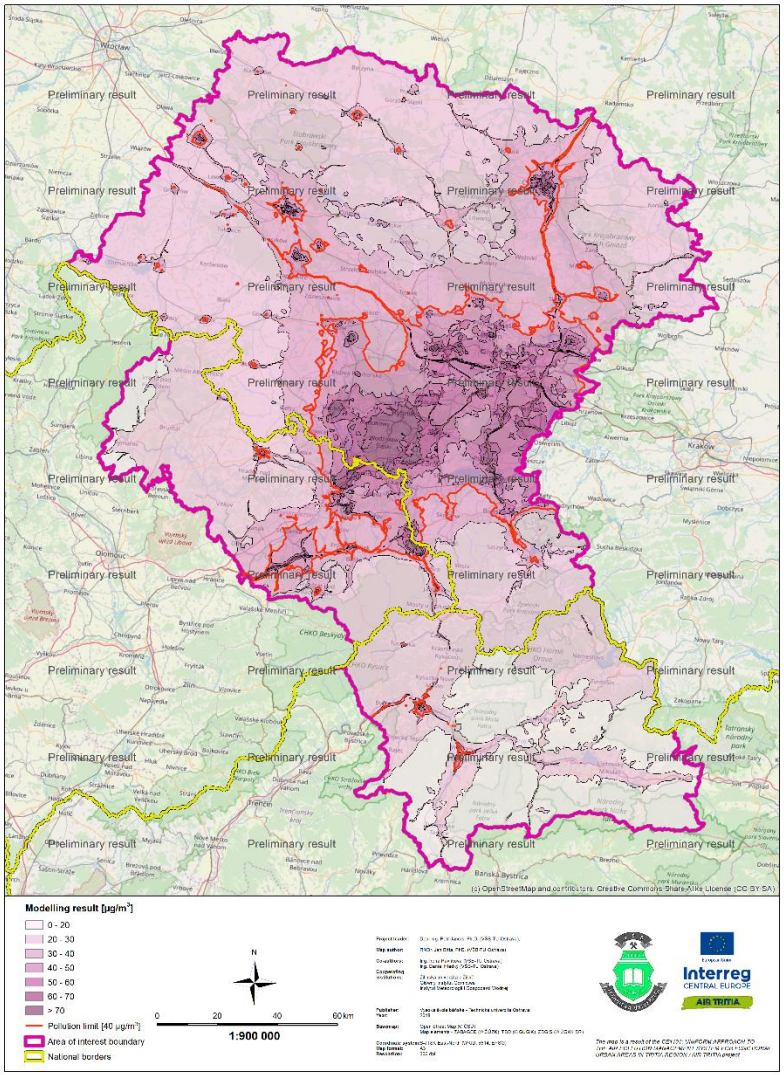
EMMISSIONS OF PM_{10}



MATHEMATICAL MODELLING PRELIMINARY RESULTS

AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN THE AREA OF INTEREST

Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2006



MATHEMATICAL MODELLING PRELIMINARY RESULTS

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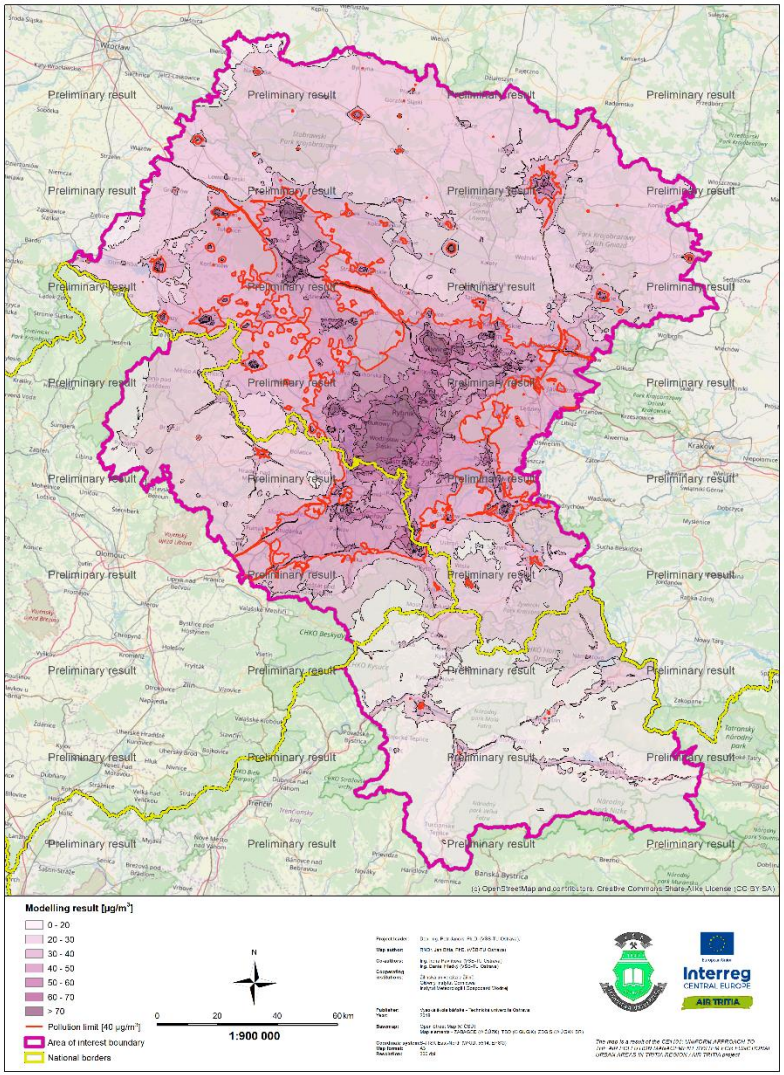
AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN THE AREA OF INTEREST

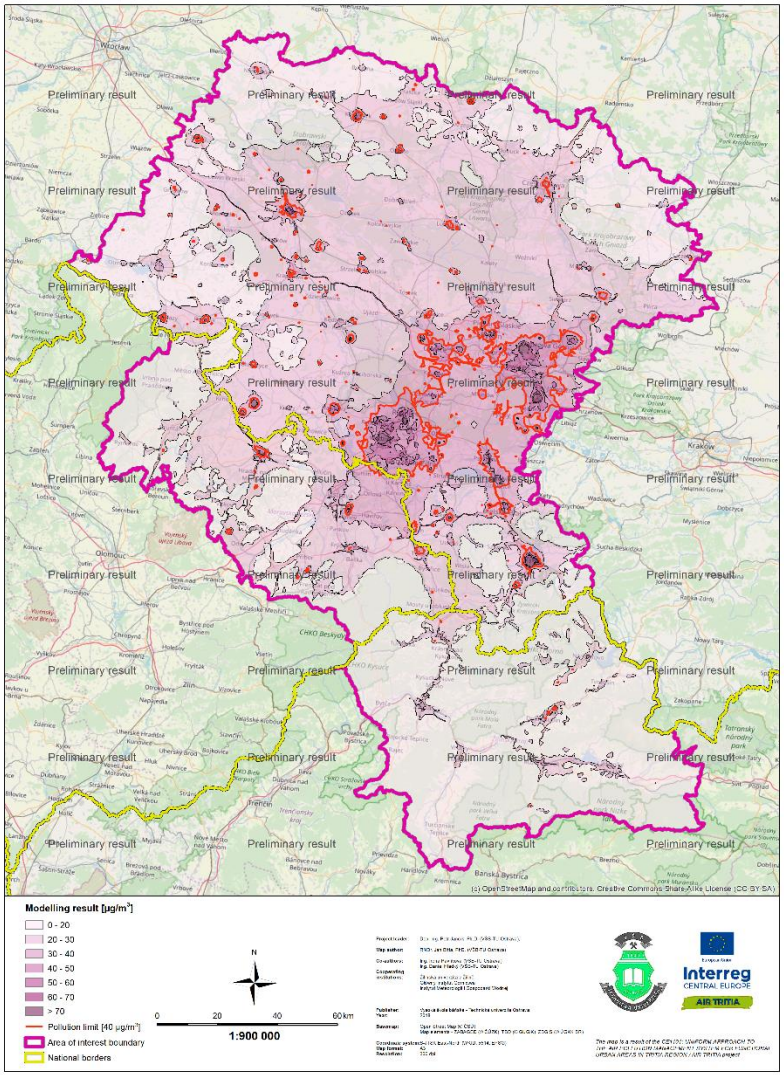
Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2010



MATHEMATICAL MODELLING PRELIMINARY RESULTS

AVERAGE ANNUAL CONCENTRATION OF PM_{10} IN THE AREA OF INTEREST

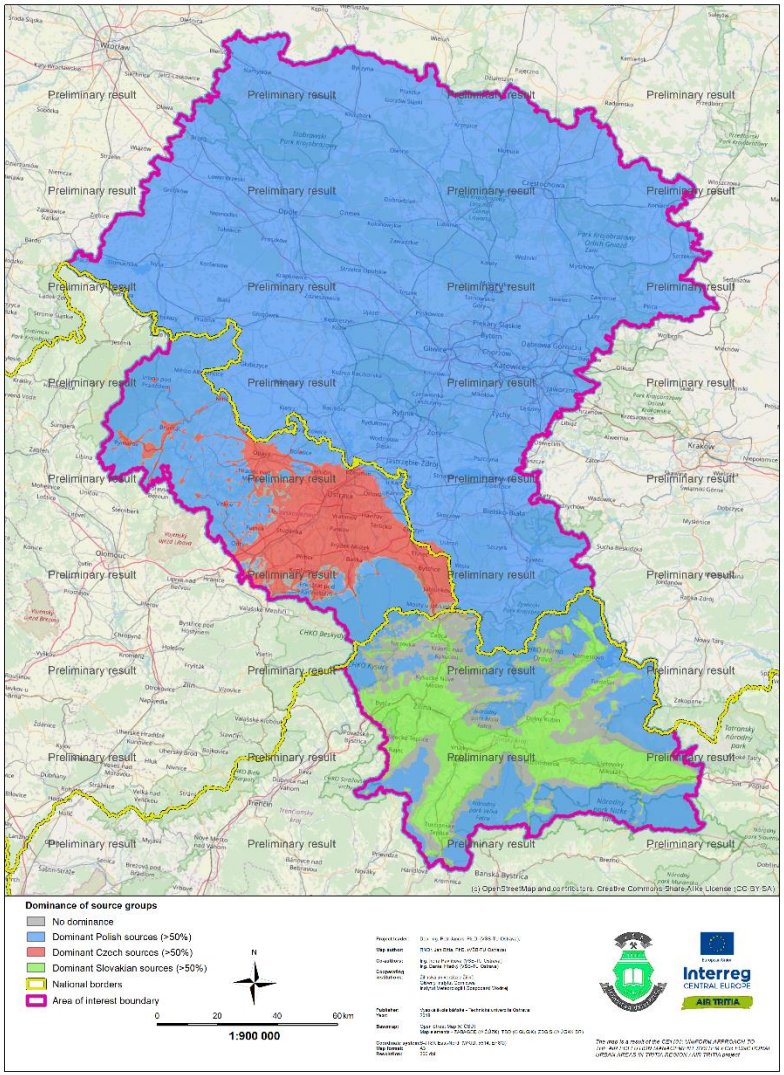
Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

DOMINANCE BY COUNTRY OF ORIGIN FOR PM_{10} IN THE AREA OF INTEREST

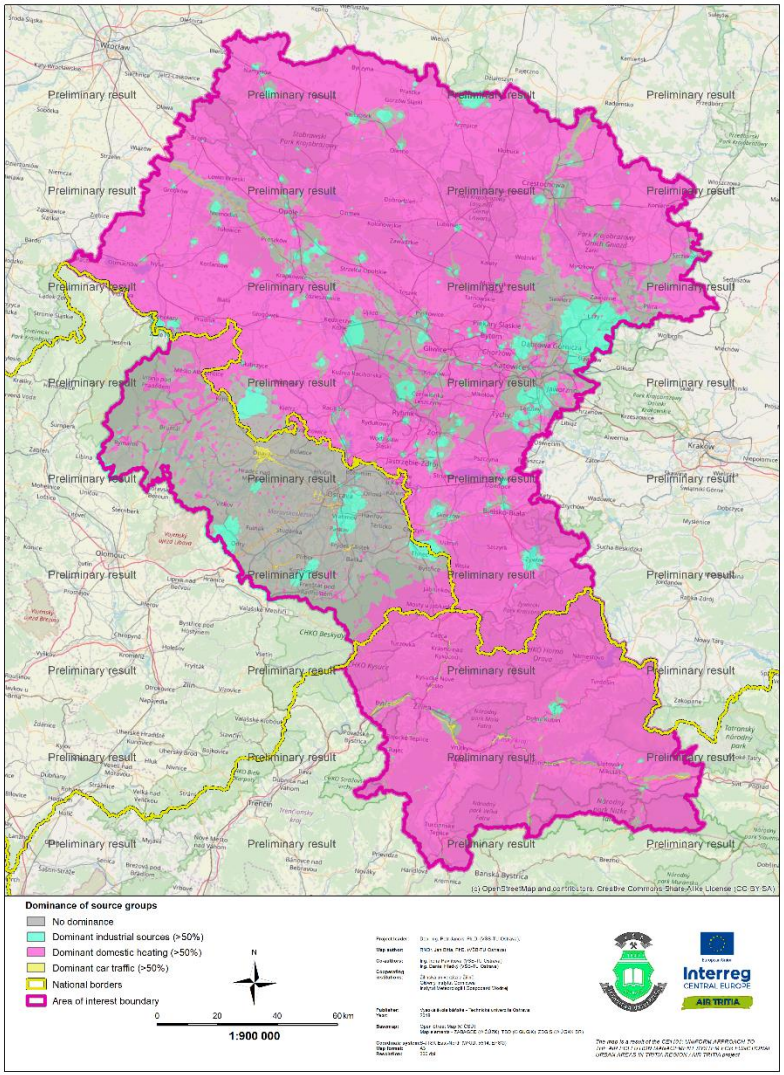
Model SYMOS'97, annual concentration, year 2010



MATHEMATICAL MODELLING PRELIMINARY RESULTS

DOMINANCE BY SOURCE GROUPS FOR PM_{10} IN THE AREA OF INTEREST

Model SYMOS'97, annual concentration, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

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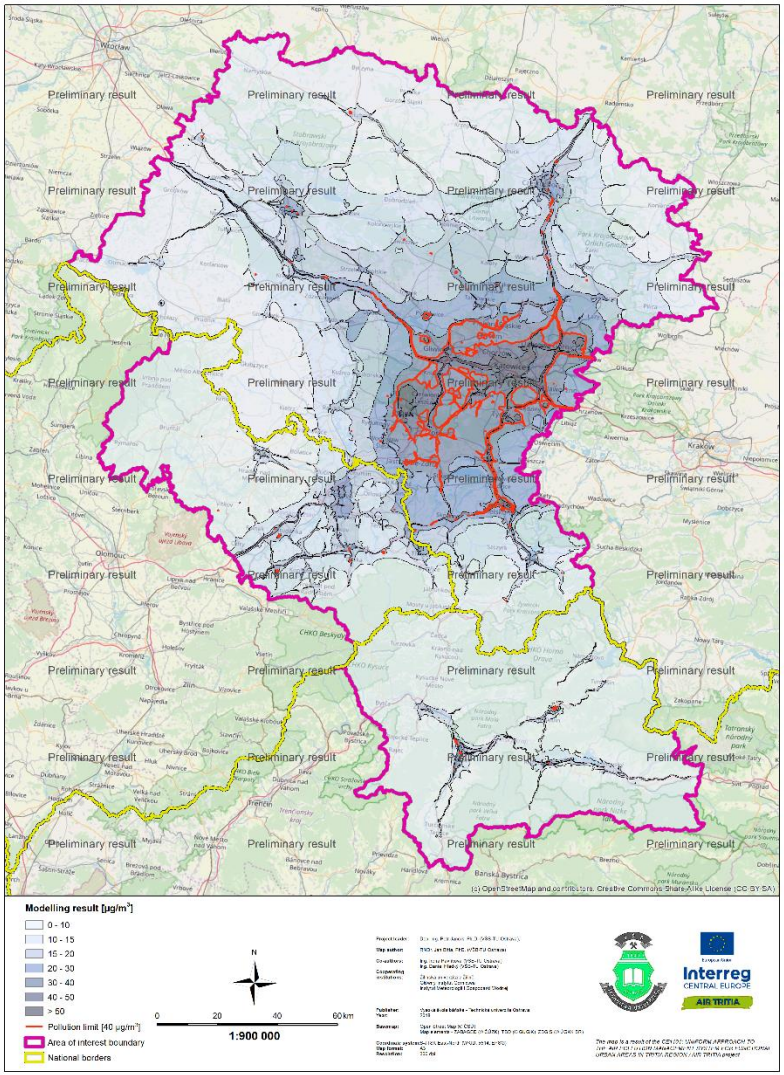
AVERAGE ANNUAL CONCENTRATION OF NO_2 IN THE AREA OF INTEREST

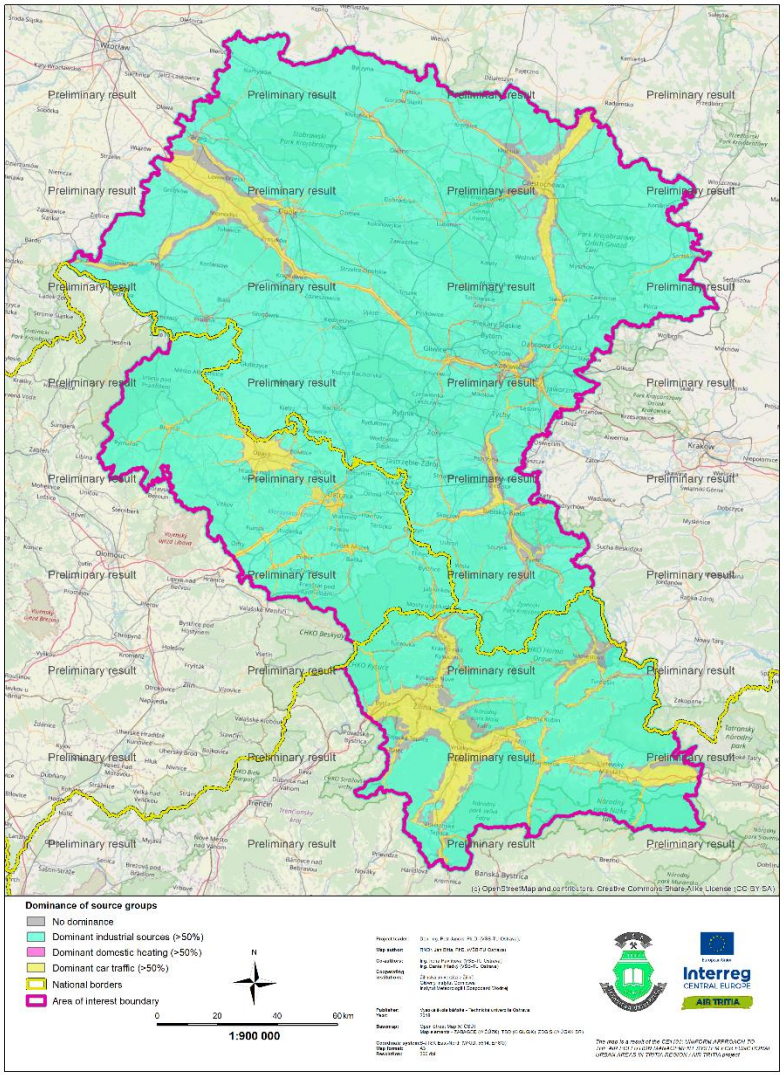
Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

DOMINANCE BY SOURCE GROUPS FOR NO_2 IN THE AREA OF INTEREST

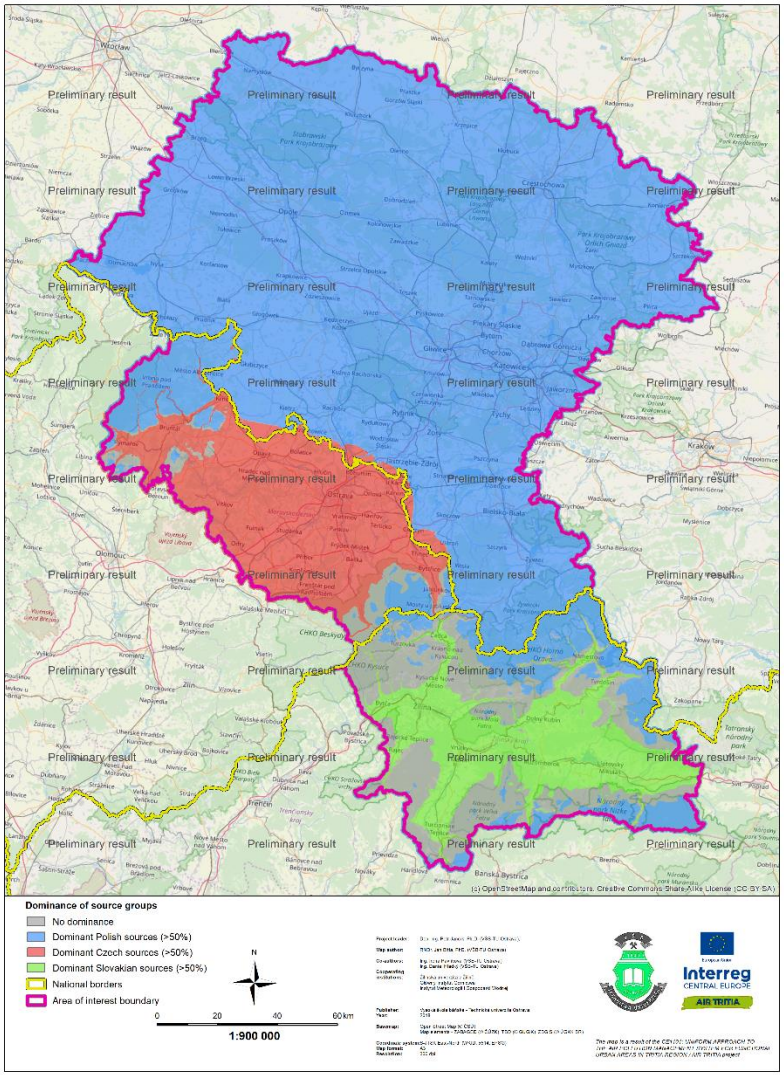
Model SYMOS'97, annual concentration, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

DOMINANCE BY COUNTRY OF ORIGIN FOR NO_2 IN THE AREA OF INTEREST

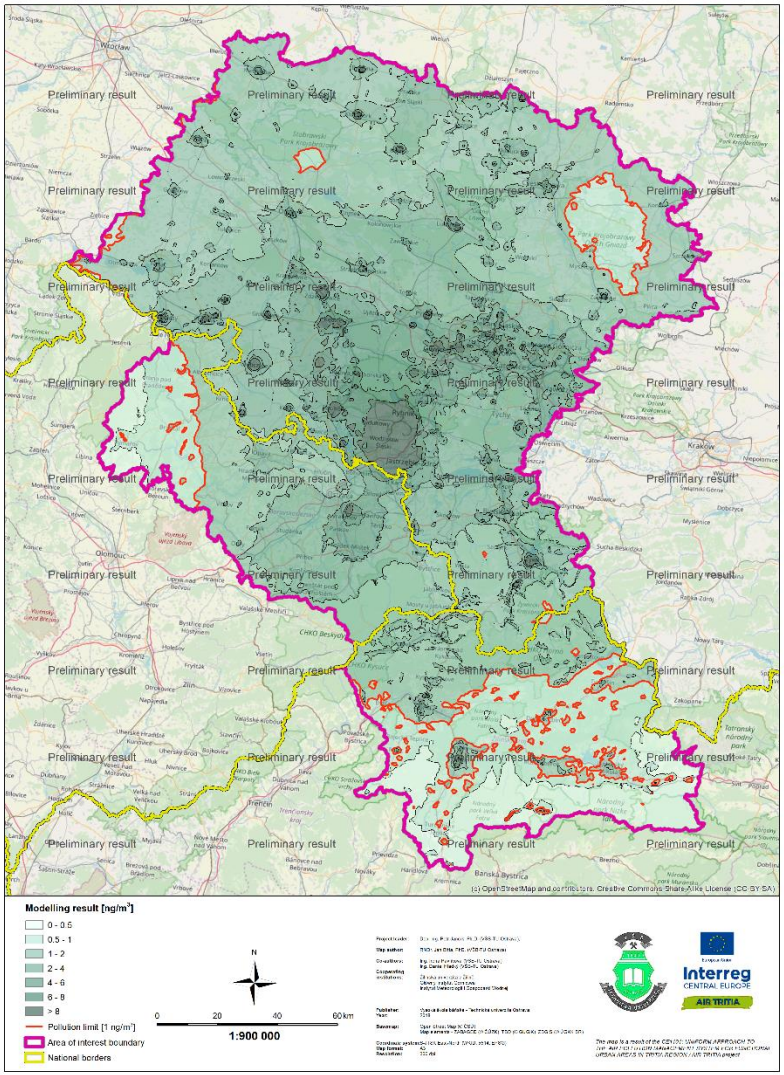
Model SYMOS'97, annual concentration, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

AVERAGE ANNUAL CONCENTRATION OF B(A)P IN THE AREA OF INTEREST

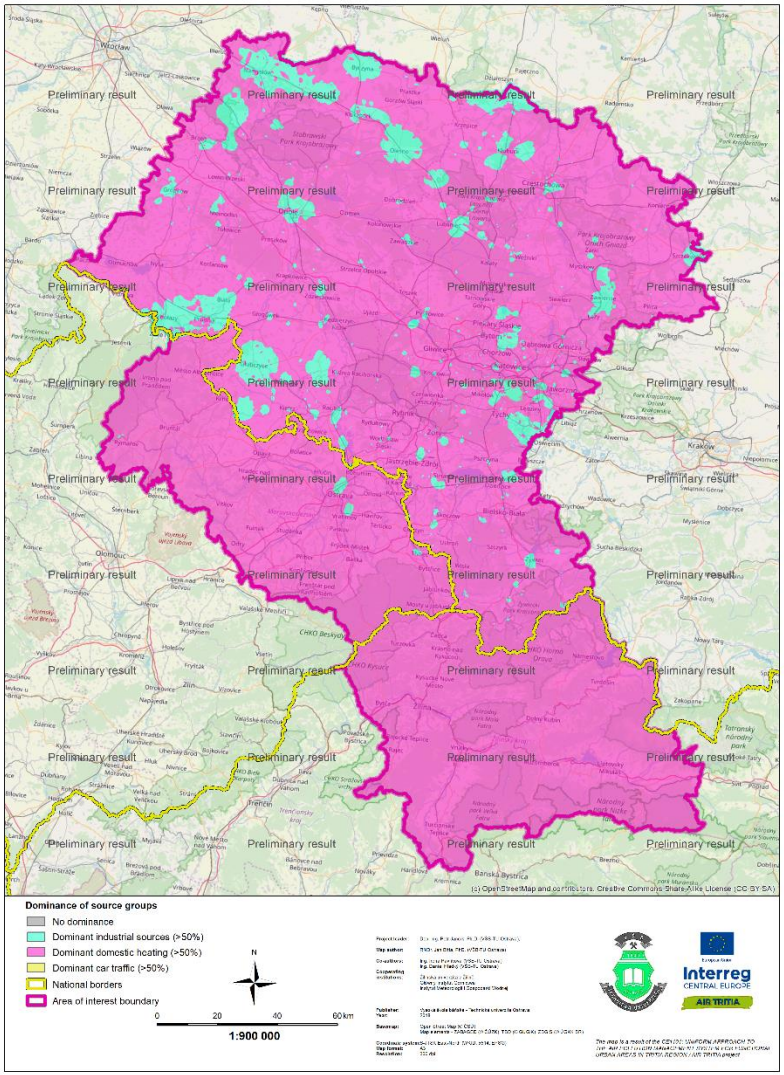
Total concentration, model SYMOS'97 with correction by pollution monitoring, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

DOMINANCE BY SOURCE GROUPS FOR B(A)P IN THE AREA OF INTEREST

Model SYMOS'97, annual concentration, year 2015



MATHEMATICAL MODELLING PRELIMINARY RESULTS

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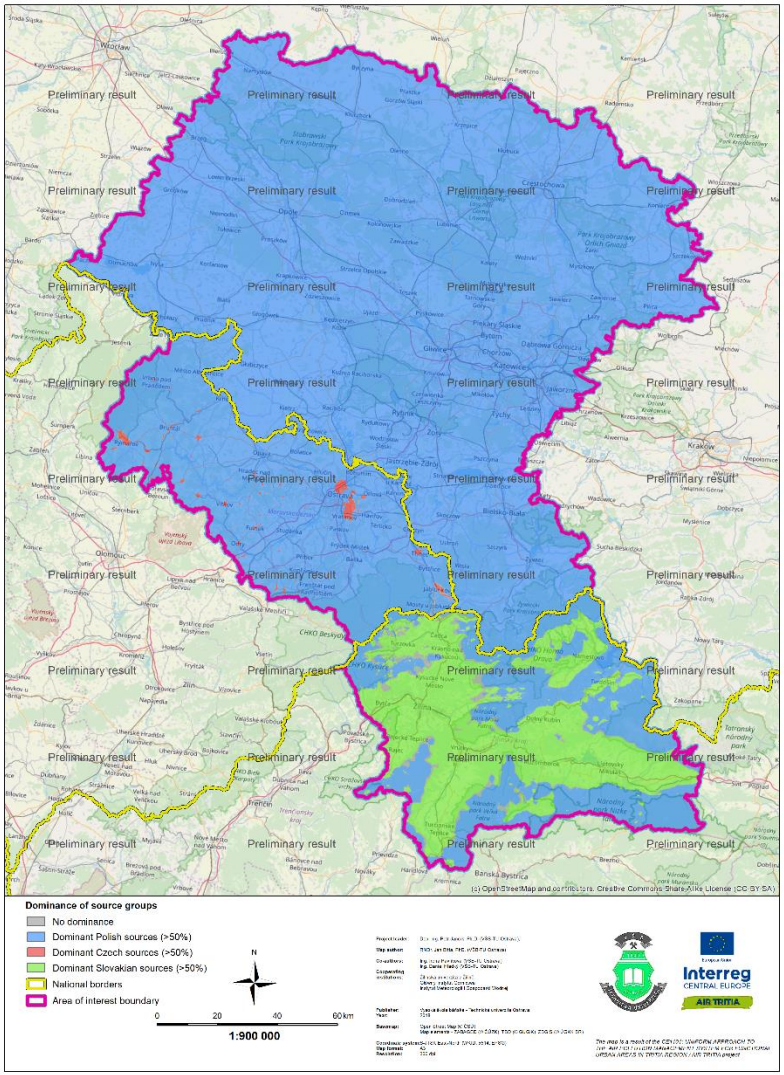
DOMINANCE BY COUNTRY OF ORIGIN FOR B(A)P IN THE AREA OF INTEREST

Model SYMOS'97, annual concentration, year 2015



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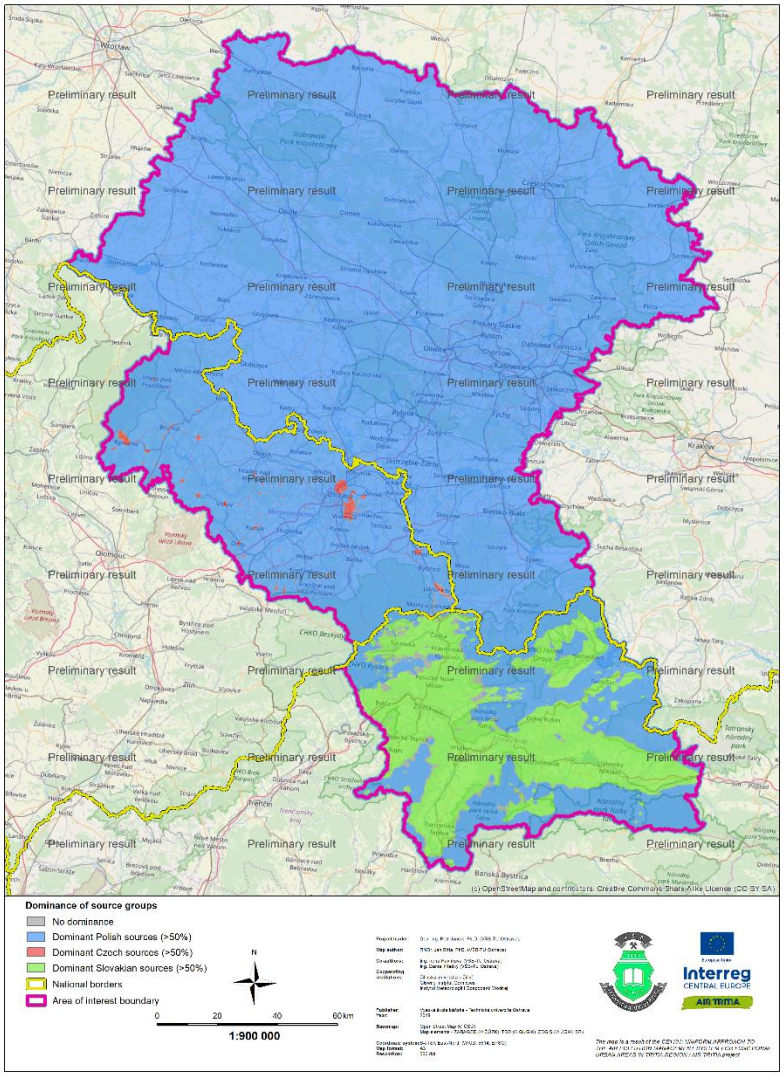
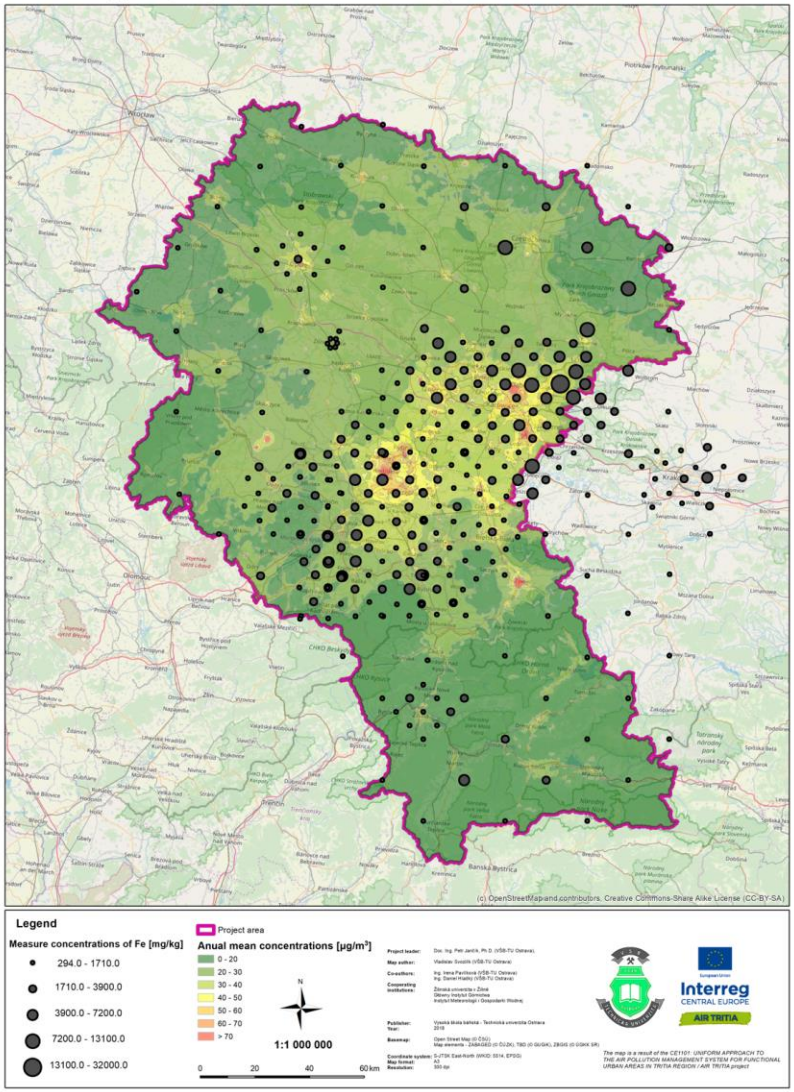


MATHEMATICAL MODELLING PRELIMINARY RESULTS AND RESULTS OF MOSS SAMPLES NAA

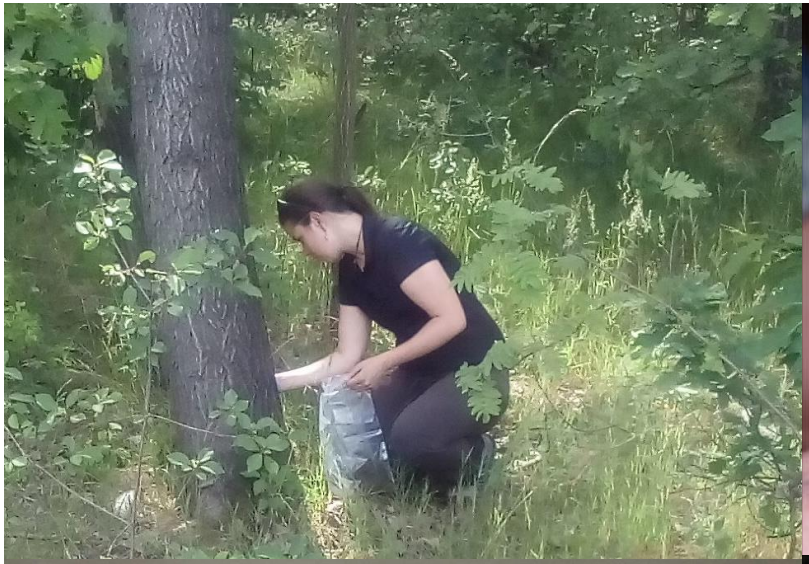
ELEMENTS IDENTIFIED BY NEUTRON ACTIVATION ANALYSIS IN FRAME OF AIR TRITIA

Moss biomonitoring year 2015, 2016, 2017; Total concentrations model SYMOS'97,year 2015



Evaluation of model results by moss biomonitoring using neutron activation analysis

MOSS SAMPLING AND PREPARING FOR ANALYSIS



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JINR (ОИЯИ)

- **1956 - 2018**

International Research Centre (1992)

18 member countrees:

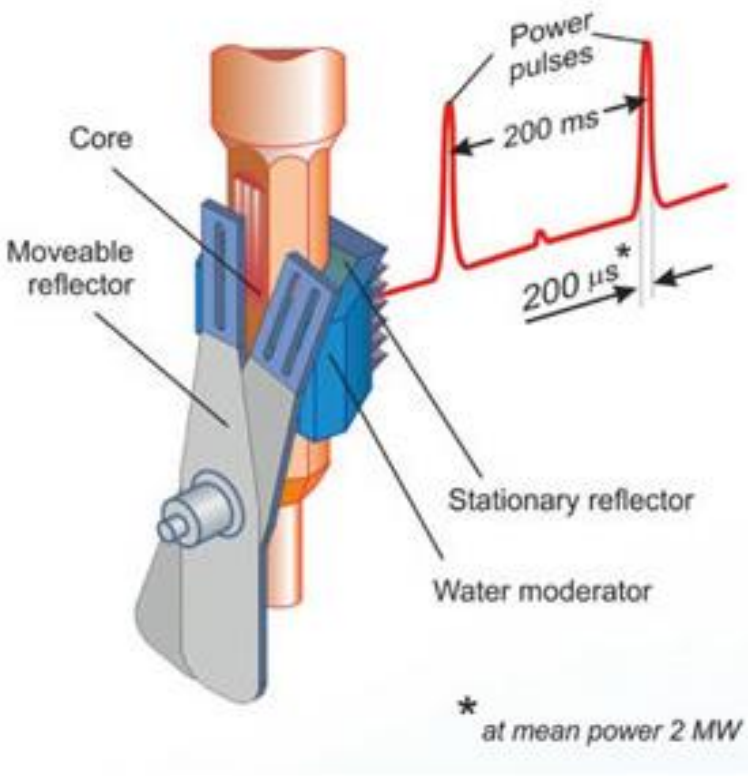
Azerbaijan, Armenia, Belarus, Bulgaria, Vietnam, Georgia, Kazakhstan, North Korea, Cuba, Moldova, Mongolia, Poland, Russia, Romania, Slovakia, Uzbekistan, Ukraine, Czech Republic

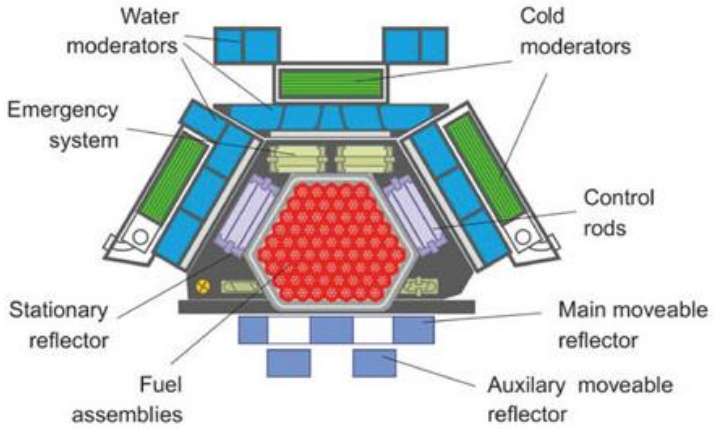
8 laboratories and University Centre:

- Bogoliubov Laboratory of Theoretical Physics (BLTP)
- Veksler and Baldin Laboratory of High Energies (VBLHE)
- Laboratory of Particle Physics (LPP)
- Dzhelepov Laboratory of Nuclear Problems (DLNP)
- Flerov Laboratory of Nuclear Reactions (FLNR)
- Frank Laboratory of Neutron Physics (FLNP)
- Laboratory of Information Technologies (LIT)
- Laboratory of Radiation Biology (LRB)University Centre (UC)

ANALYSIS BY NAA

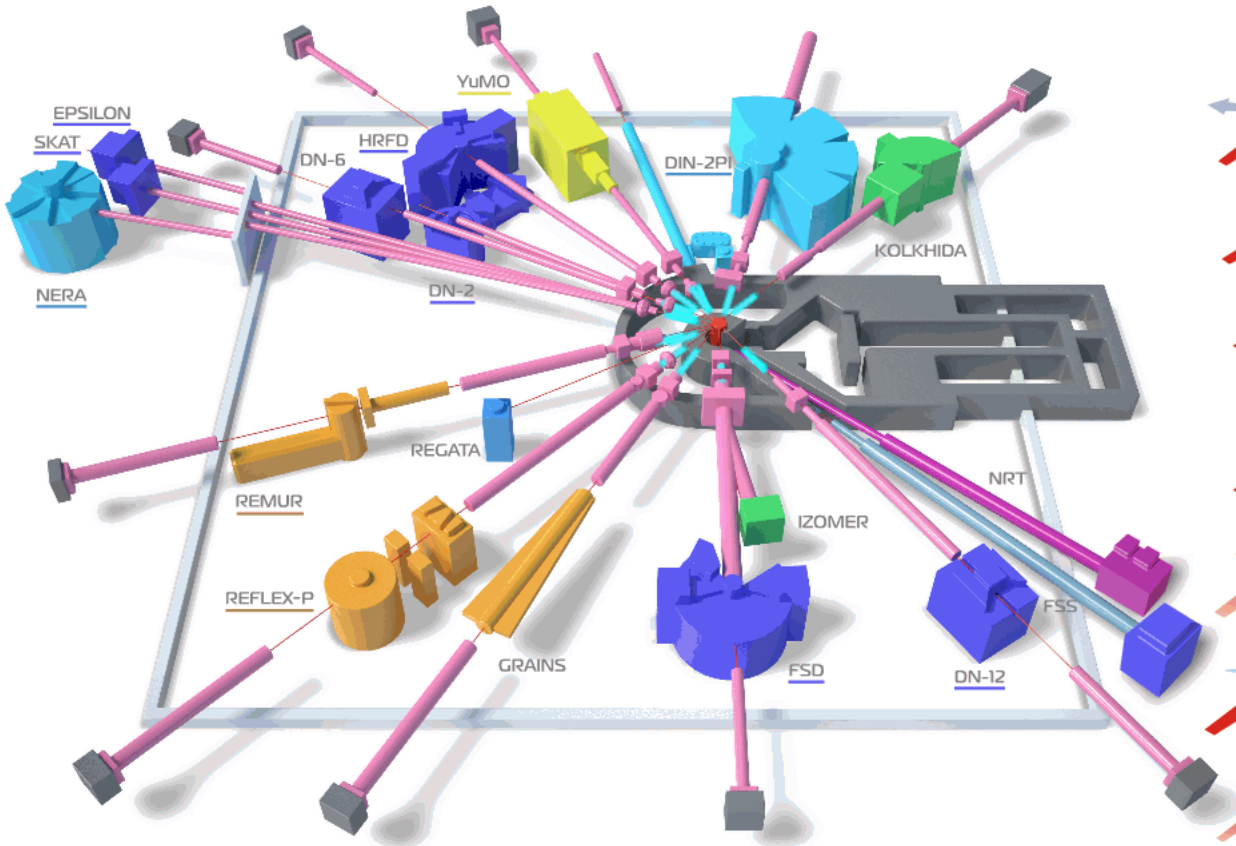
Pulse reactor IBR 2 in Frank Laboratory of Neutron Physics





REACTOR IBR2

Experimental facilities



Diffraction
DN-2, DN-12, DN-6, FSD, FSS, HRFD, SKAT, EPSILON

Small-angle scattering
YuMO

Reflectometry
GRAINS, REFLEX-P, REMUR

Inelastic scattering
DIN-2PI, NERA

Nuclear Physics
ISOMER, KOLKHIDA

Neutron Activation Analysis
REGATA

Neutron imaging
NRT

Ostrava, Ostrava University |
19.11. 2018

Technical and technological possibilities to reduce pollution from the steelworks – the story of Ostrava

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