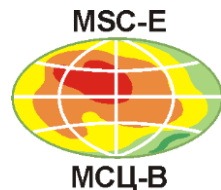


7th TF TEI Annual Meeting
29 October, 2021

Assessment of PAH pollution levels in the EMEP region: long-term trends, key sources, and exceedances of air quality guidelines

MSC-E: A. Gusev, N. Batrakova, M. Kleimenov, O. Rozovskaya, V. Shatalov, N. Vulyh

IOŚ-PIB (Poland): A. Degórska



Assessment of PAH pollution and population exposure

Contribution to analysis of **POP Protocol effectiveness**,
co-operation with TF TEI, TF Health (EMEP workplan 1.1.1.1)

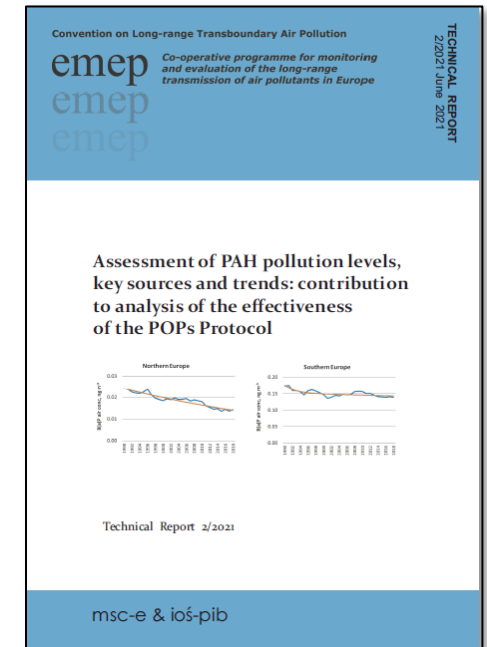
Long-Term Strategy for the Convention (2020-2030):

“unintentional releases of PAHs are still a concern”

“continue scientific research on POP transport and trends with a focus on PAHs”

Motivation of these activities:

- Residential combustion sector significantly contributes to the emissions of PAHs in the EMEP countries
- Emissions from Residential combustion did not changed significantly during two recent decades
- Contribute to the analysis of population exposure to PM and its toxic constituents

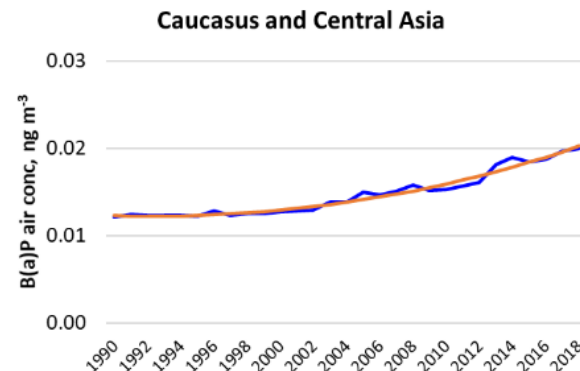
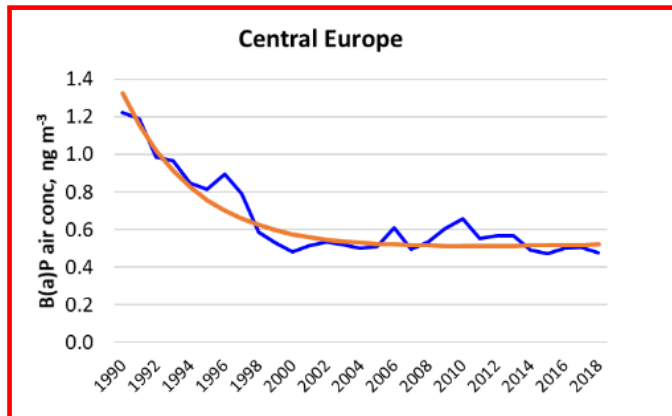
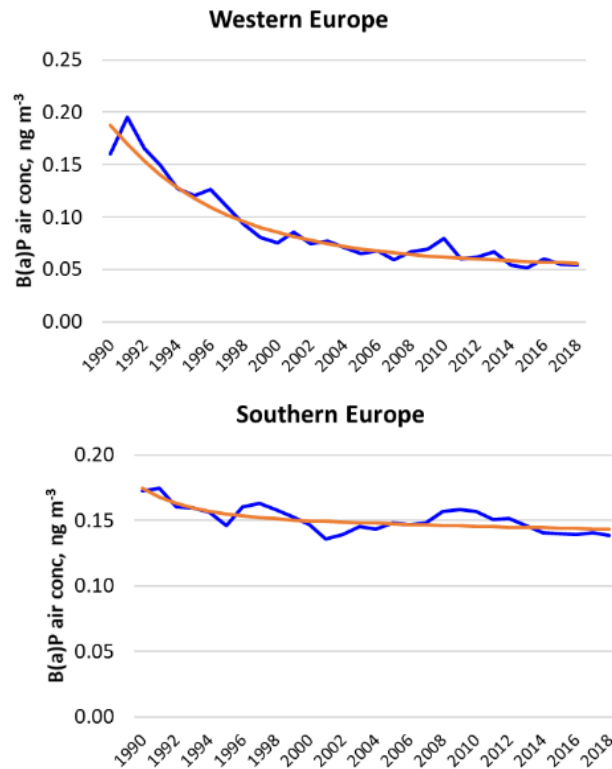


MSC-E Technical Report
on PAHs (2021)

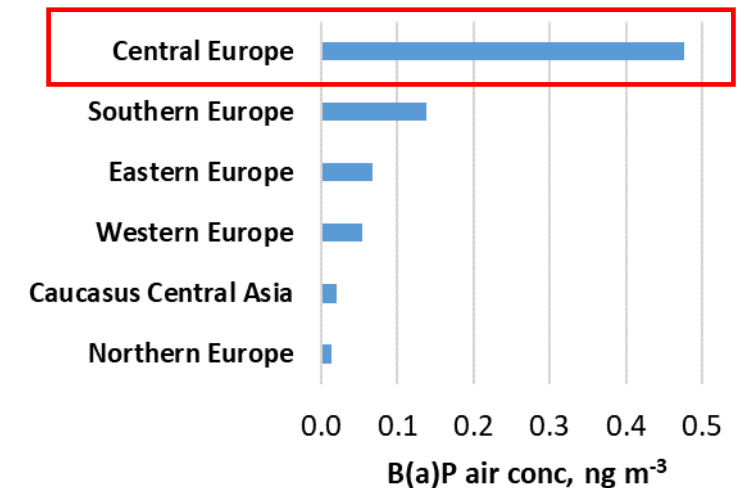
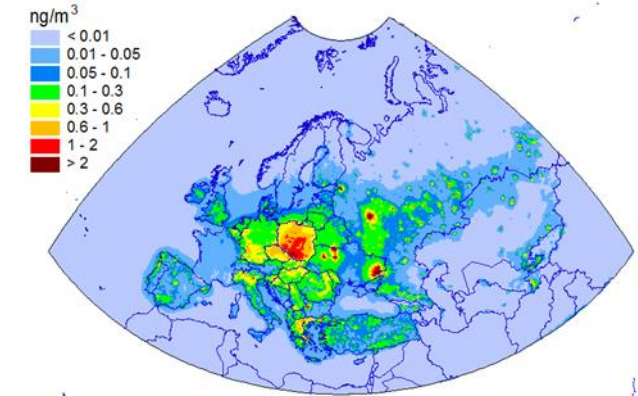
Long-term changes of PAH pollution in EMEP countries

Model estimates of B(a)P pollution trends (1990-2019):

- Significant decrease in Western Europe (65%)
- Small decrease/lack of changes in Central, Southern Europe after 2000
- Increase in Caucasus and Central Asia



Modelled B(a)P concentrations (2019)

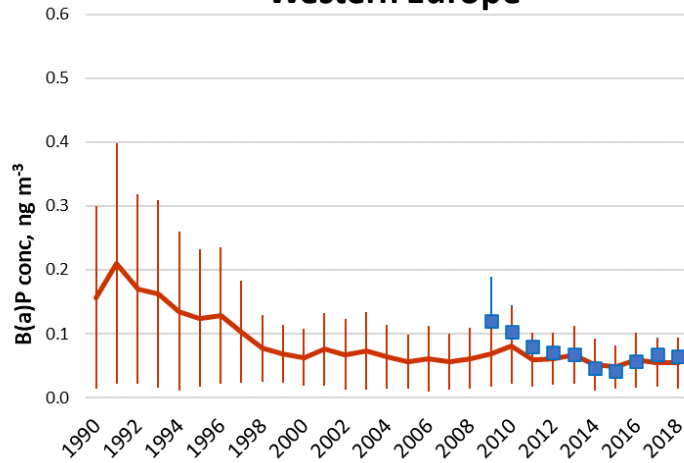


Long-term changes of B(a)P concentrations (**absolute values**)

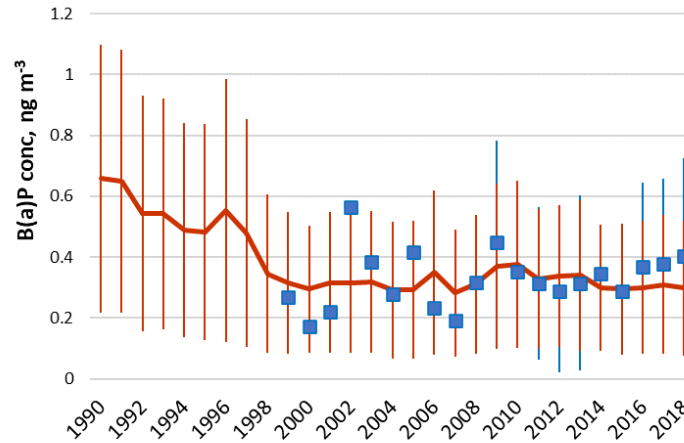
Modelled and observed B(a)P pollution trends

Evaluation of modelled B(a)P trends vs. long-term measurements (1990-2018):

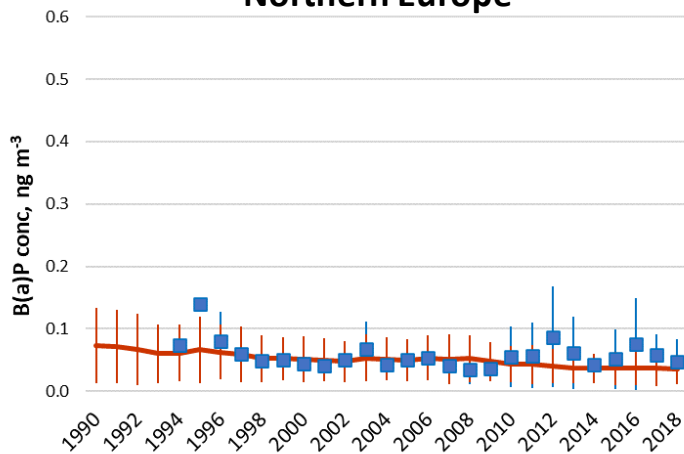
Western Europe



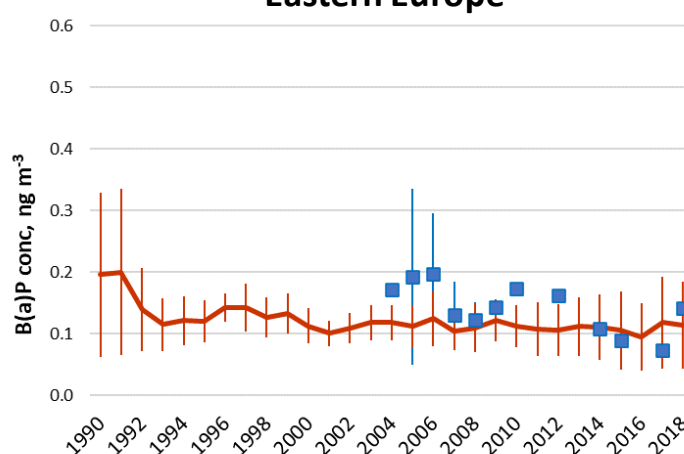
Central Europe



Northern Europe



Eastern Europe



EMEP monitoring stations (n = 40)

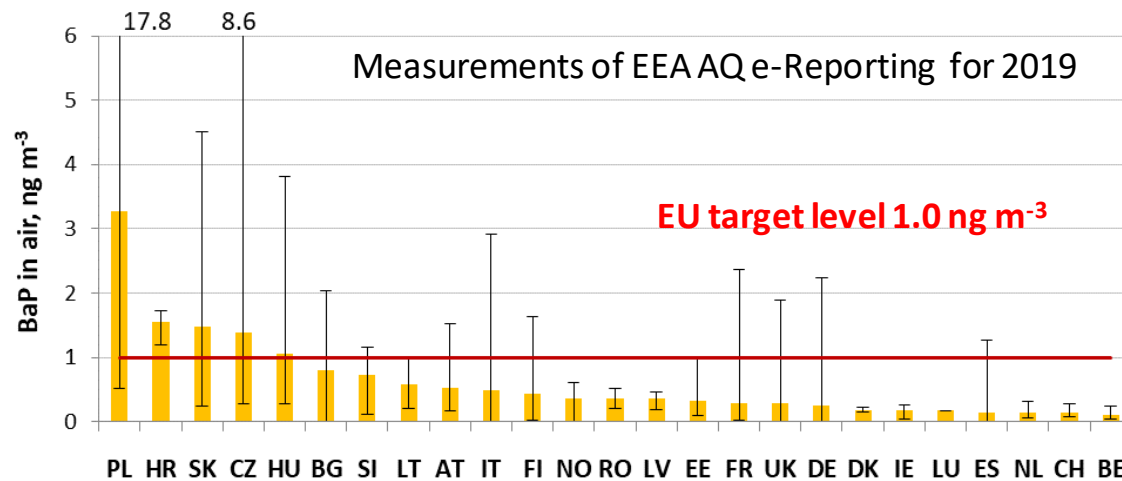


■ Observed B(a)P concentrations
— Modelled B(a)P concentrations

PAH pollution and population exposure

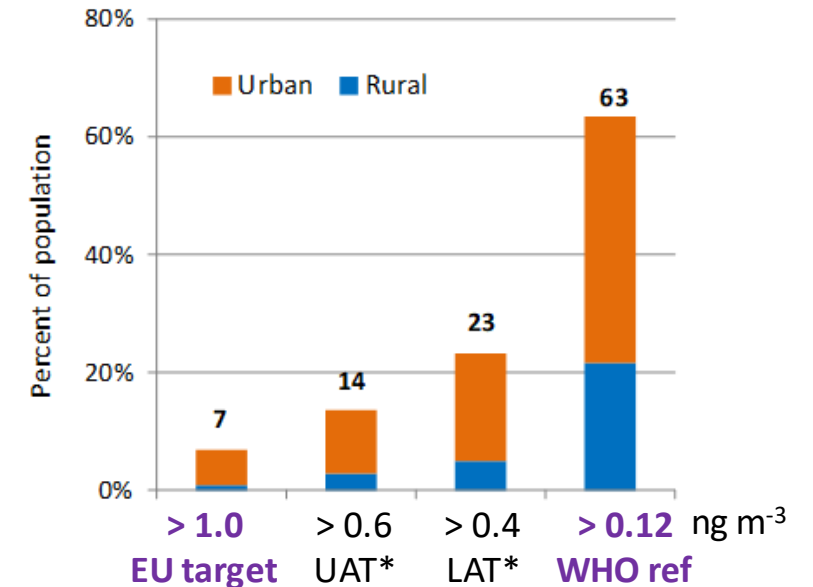
Observed and modelled B(a)P levels vs EU and WHO limits (2019):

- Exceedances of air quality guidelines still exist in some of EMEP countries (e.g. Central Europe)
- Most of exceedances of EU/WHO limits took place in urban areas
- In 2020, EC announced revision of EU air quality standards, including B(a)P, towards stricter guidelines recommended by WHO



Observed B(a)P concentrations vs EU target level

Population in areas with exceeded B(a)P limits

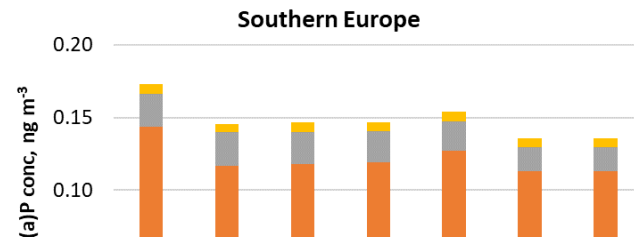
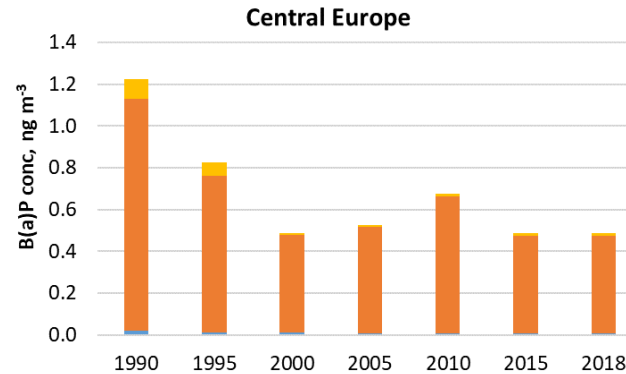
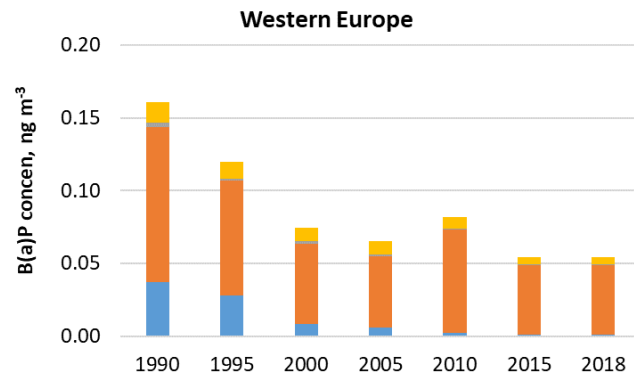


* UAT/LAT – Upper/Lower Assessment Threshold according to EU Air Quality Directive

Key source-categories of PAH pollution in EMEP countries

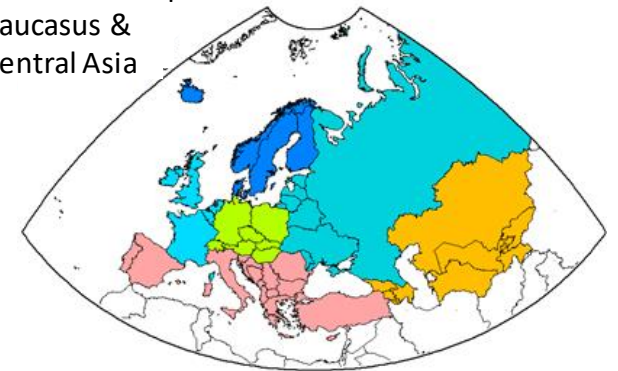
Model estimates of key sectors contributions and their long-term changes:

- Residential combustion sector is dominating in all the sub-regions
- Decline of Industry sector contribution in 1990s (e.g. Western Europe)
- Considerable contribution of Agriculture sector in Southern Europe



Sub-regions

- Northern Europe
- Western Europe
- Central Europe
- Southern Europe
- Caucasus & Central Asia



Key emission sectors

Industry

Agriculture

Results of B(a)P/PAH pollution assessment were discussed at the meeting of TF Health (11 May, 2021) and are included in the TF Health/B(a)P group's report

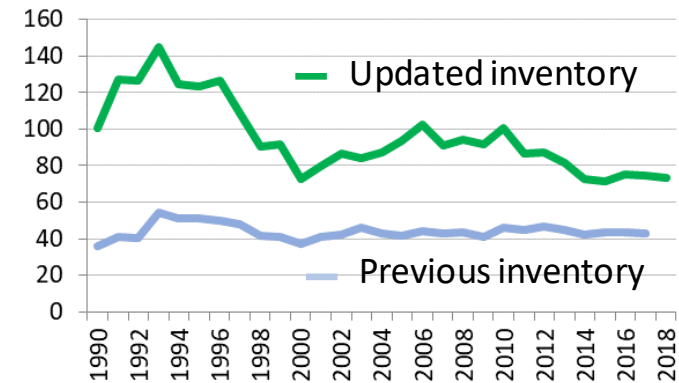
Case studies on B(a)P/PAH pollution: Poland

Joint research for Spain, France, and Poland to improve PAH pollution assessment (**TFMM**)

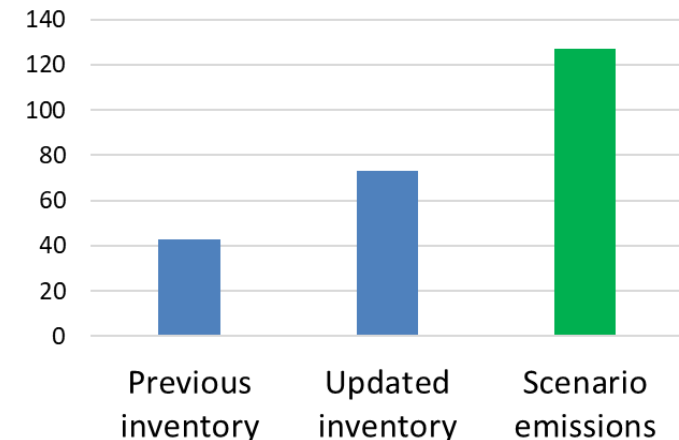
Program of the study (2020-2021):

- Model assessment of PAH in Poland involving detailed national emission and monitoring data
- Model simulations with the previous and updated national PAH emissions inventory
- Experimental model simulations using scenario of B(a)P emissions
- Estimation of exceedances of B(a)P air quality guidelines
- Inter-comparison of GLEMOS and GEM-AQ model results for B(a)P

B(a)P emissions in PL (t y⁻¹)



B(a)P emission in 2018 (t y⁻¹)

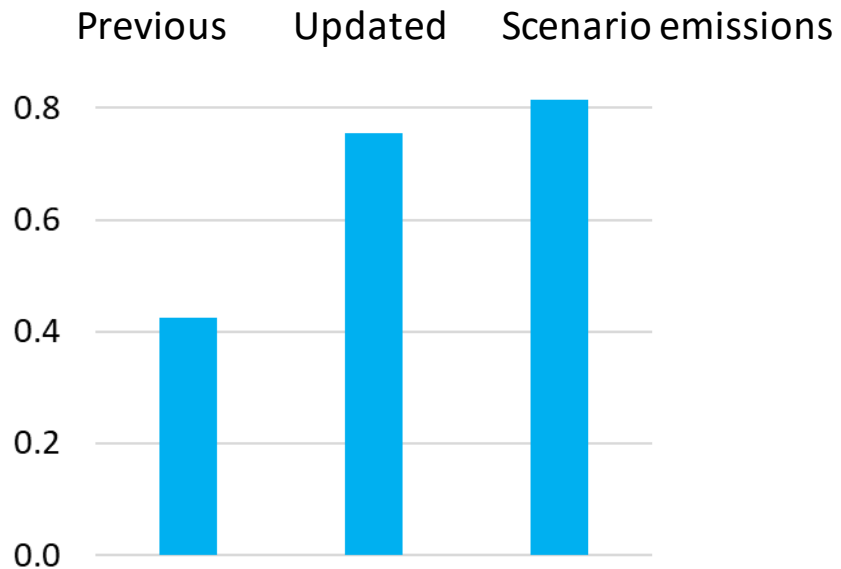


Modelled vs observed B(a)P pollution levels in Poland

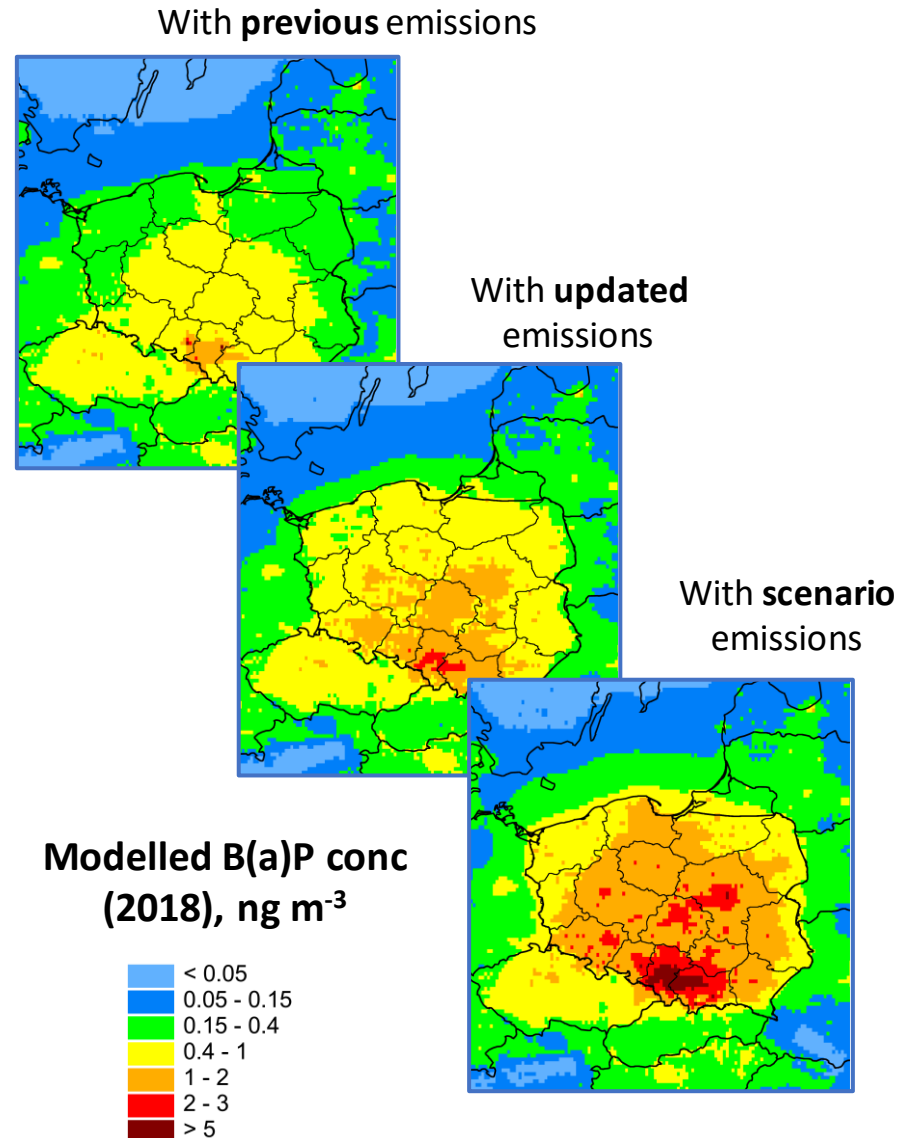
Comparison with data of **Background Rural + Suburban** stations:

- Decrease of model **bias** from -64% to -28%
- Increase of **correlation** from 0.42 to 0.82
- Increase of **Factor of 2** parameter from 30% to 70%

Correlation



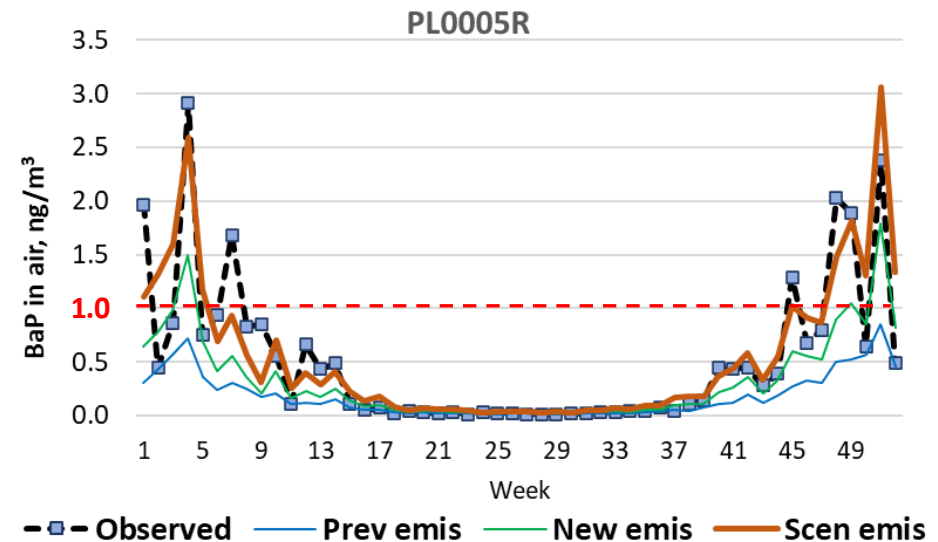
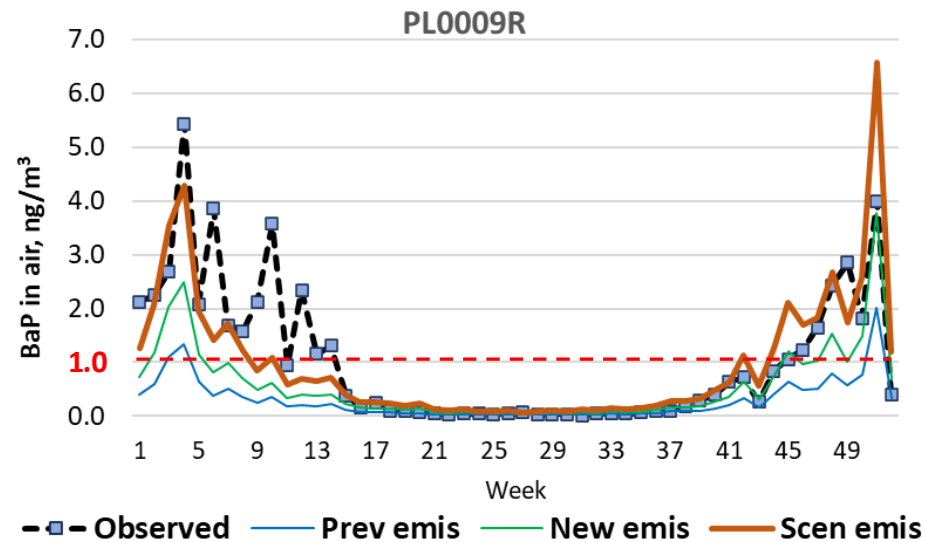
56 stations of EMEP and EEA networks (2018)



Modelled vs observed B(a)P pollution levels in Poland

Comparison with data of EMEP stations in Poland:

- Decrease of model **bias** from $\sim -70\%$ (previous emissions) up to $\sim -5\%$ (scenario emissions)



--- EU target level for B(a)P 1.0 ng m⁻³

- Updates of national PAH emission inventory allowed to noticeably improve B(a)P model assessment results
- Model simulations indicate significant exceedances of EU target level (especially in winter time) associated with the effect of Residential Combustion emissions

Further activities on PAHs: multi-model study of B(a)P pollution

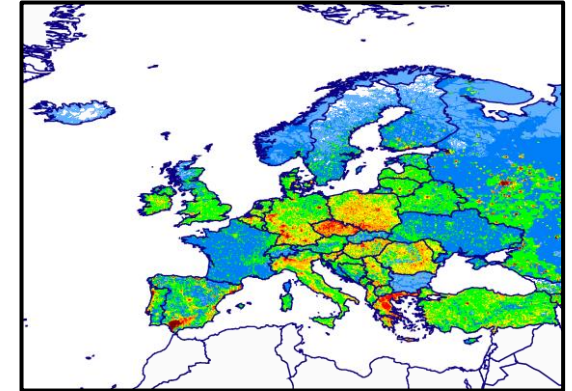
Contribution to EuroDelta-Carb project on PM/BC (TFMM)

Objectives:

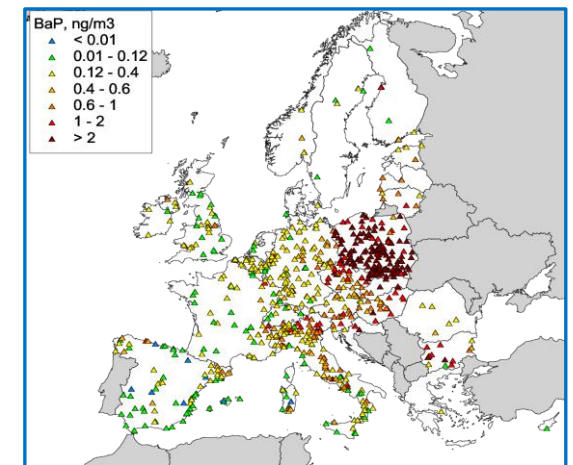
- **Model assessment** of B(a)P pollution levels and exceedances of air quality guidelines for 2017-2018
- Contribute to analysis of consistency of **Residential Combustion** emissions of PAHs/PM
- Analyzing relationship between **B(a)P** and **PM** transport and fate (including PM components – OC, EC)
- Use of EMEP and EEA AQ e-reporting **B(a)P** measurements

Modeling groups:

<i>Institution</i>	<i>Model</i>	<i>Experts</i>
EMEP/MSC-E	GLEMOS	Alexey Gusev
INERIS (France)	CHIMERE	Augustin Colette
FMI (Finland)	SILAM	Rostislav Kouznetsov, Evgeny Kadantsev
CIEMAT (Spain)	CHIMERE	Marta Garcia Vivanco
ENEA (Italy)	MINNI	Mihaela Mircea, Ilaria Delia, Mario Adani



Model domain and B(a)P emissions (2018)



B(a)P measurements (EMEP, EEA, 2018)

Directions of further work

(EMEP work-plan 2022-2023)

■ Research/co-operation activities

- Multi-model analysis of B(a)P pollution in 2017/2018 in framework of TFMM EuroDelta-Carb project
- Analysis of long-term changes and source-receptor relationships on global/regional scale in co-operation with TF HTAP (combustion-related POPs)
- Continuation of case study on B(a)P pollution in the EMEP countries (e.g. Spain, Poland)
- Data exchange with TF Health on B(a)P/PAH concentration and exceedances of target values to assess population exposure
- Contribution to the EU EEA assessment of B(a)P pollution in the EU countries