IOŚ-PIB
Instytut Ochrony Środowiska
Państwowy Instytut Badawczy

Air quality in Poland – Spatial Representativeness

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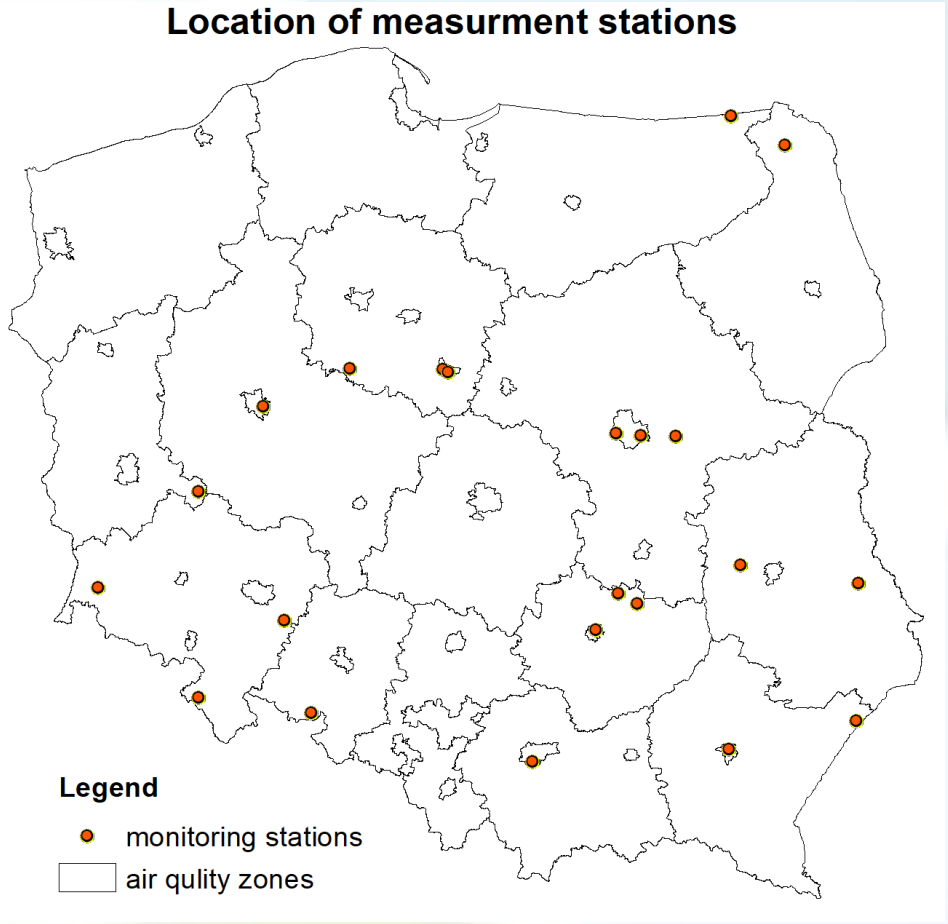
Monitoring stations for SR

1. Same set of monitoring stations as for our Annual report of Spatial Representativeness in 2020
2. PM10, PM2.5, Ozone, NO_2
3. Limiting criterion:

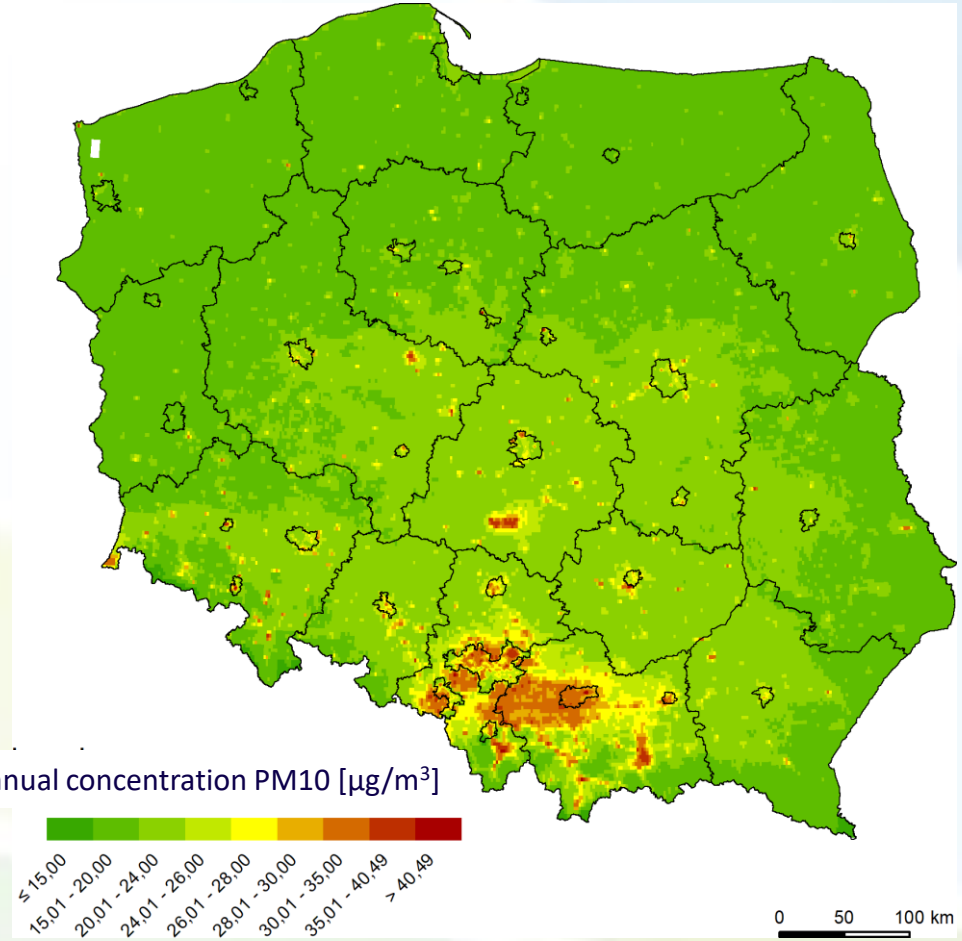
   ABS(observed value – modelled value) >RMSE

Number of stations			
Pollution	**rural**	**urban background**	**traffic**
PM10	2	11	1
PM2.5	2	10	1
NO_2	2	7	0
Ozone	1	6	0



Annual Air Quality Assessment - modeling data

1. Annual concertation (PM10, PM2.5, Ozone, NO_2 based on Annual Air Quality Assessment for Poland 2019)
2. Annual assessment (45 zones, including 29 urban areas)
3. Model: GEM-AQ
4. Resolution ~0,5 km over urban zones and ~2,5 km over other zones
5. Emissions: Bottom up inventory for Poland and EMEP for Europe
6. Meteorology 2019

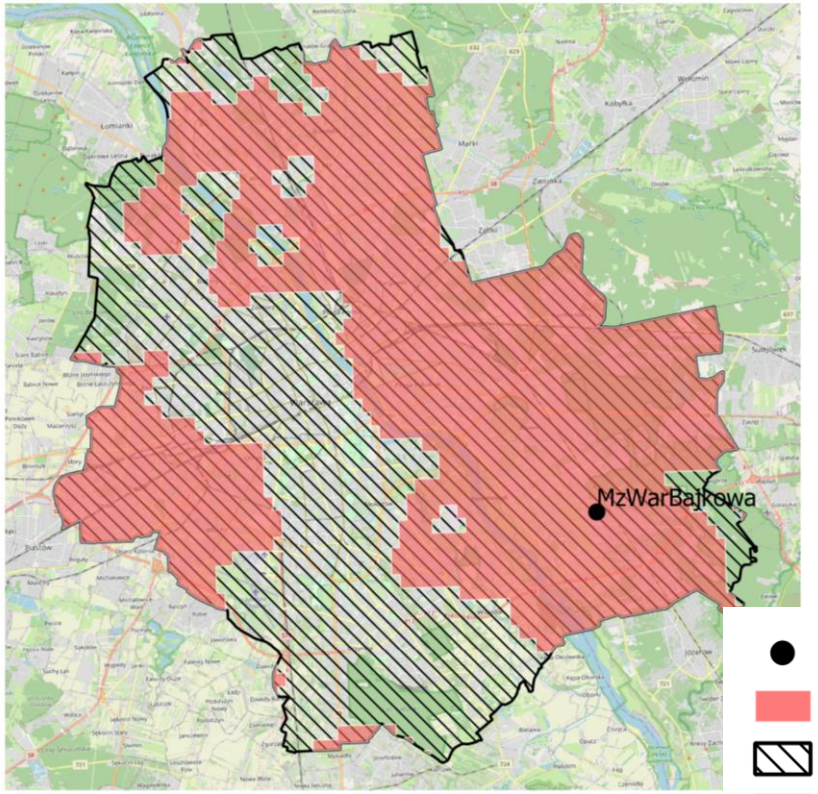


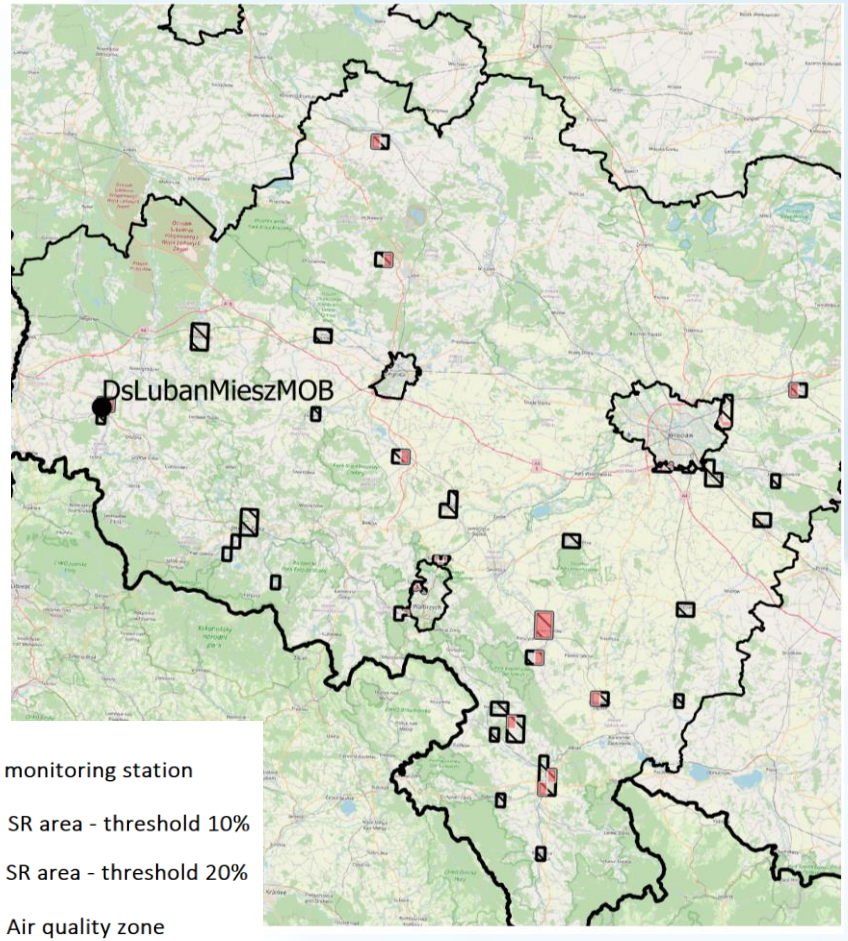
SR areas - criteria

1. Within the SR area a deviation from the modelled concentration at the monitoring stations is allowed within a threshold or tolerance level of 20% (Two thresholds tested **20% and 10%**)
2. Discontinuous approach
3. The boundaries of the Air Quality Zones are used as maximal extend of the SR area

SR areas –results PM10

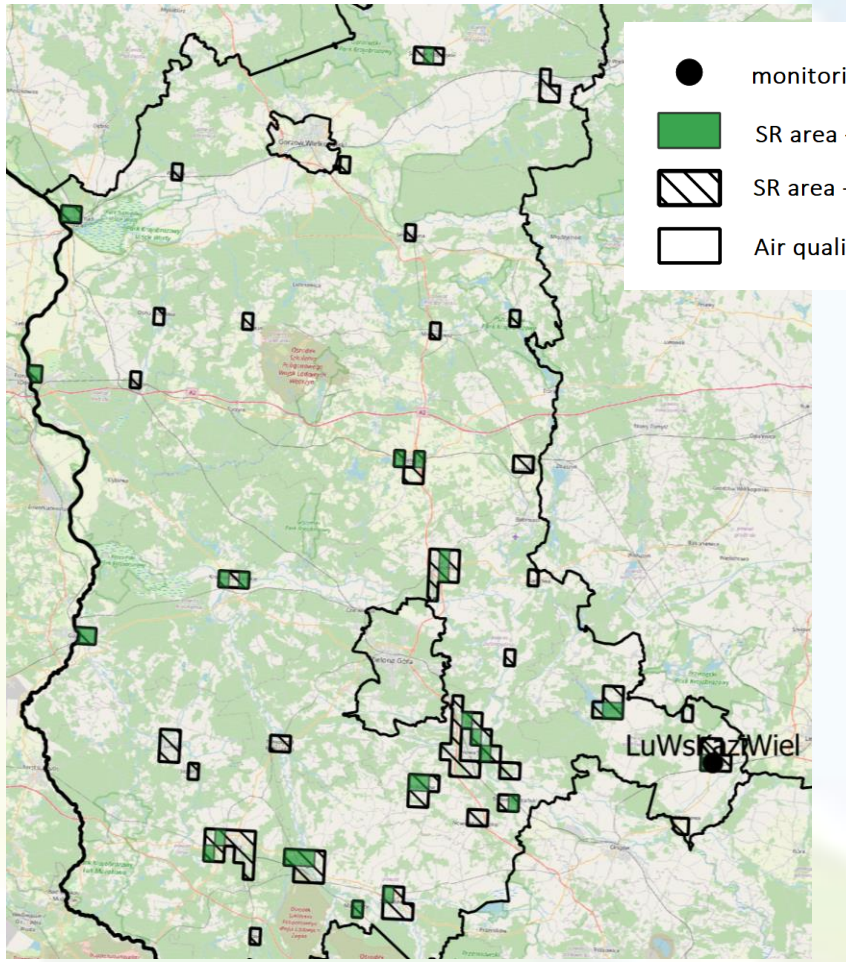
		threshold 20%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
MzWarBajkowa	27,9	22,32	33,48	100%	23,68
DsLubanMieszMOB	32,92	26,34	39,51	2%	21,08
		threshold 10%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
MzWarBajkowa	27,9	25,11	30,69	61%	23,68
DsLubanMieszMOB	32,92	29,63	36,22	1%	21,08

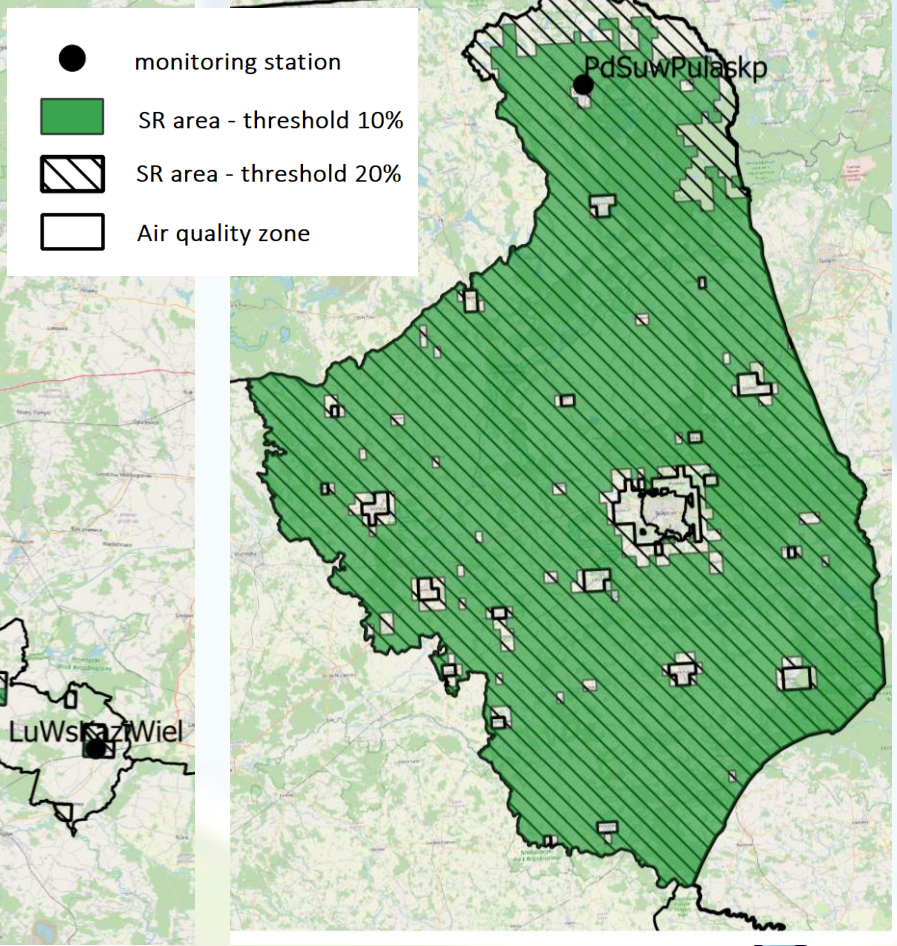




SR areas –results PM2.5

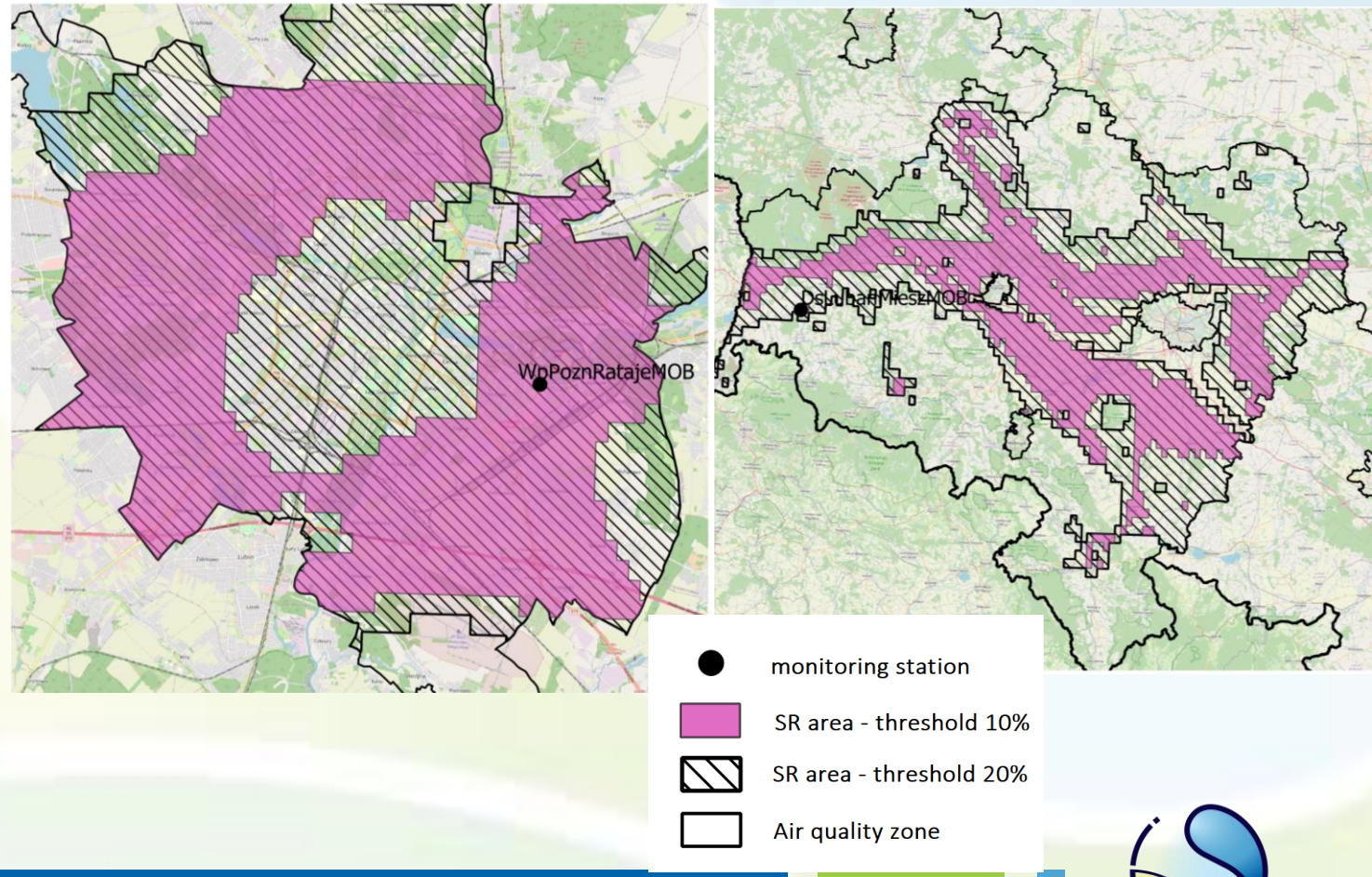
		threshold 20%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
PdSuwPulaskp	12,0	9,6	14,4	97%	12,6
LuWsKaziWiel	21,9	17,5	26,3	4%	12,2
		threshold 10%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
PdSuwPulaskp	12,0	10,8	13,2	88%	12,6
LuWsKaziWiel	21,9	19,7	24,1	1%	12,2





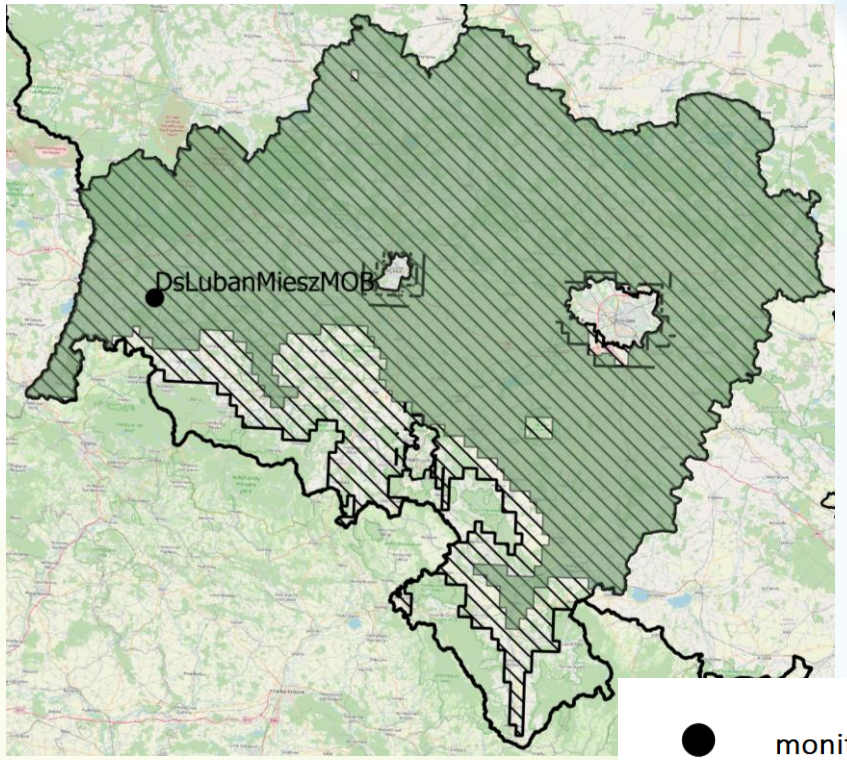
SR areas –results NO2

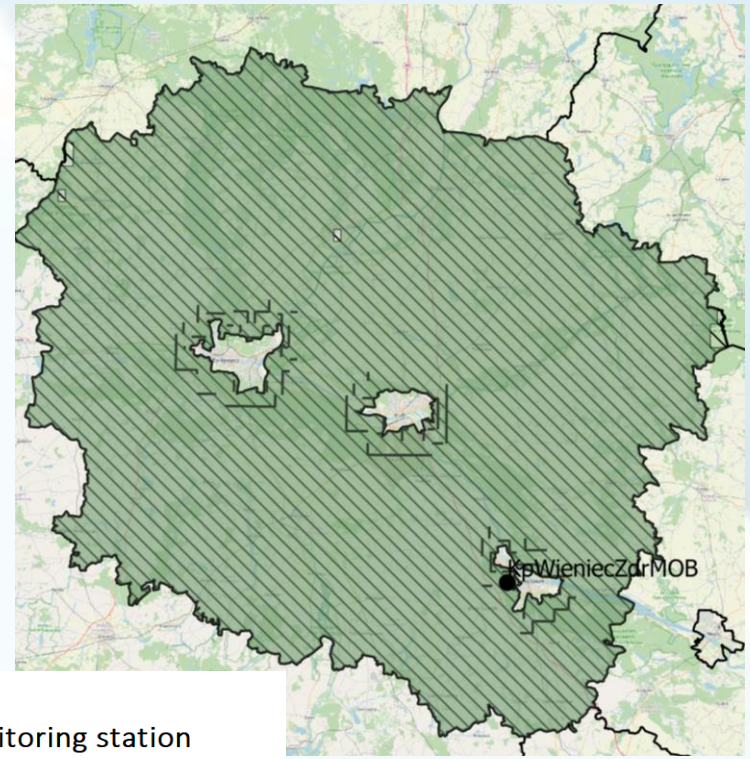
station name	annual concentration	threshold 20% min	threshold 20% max	threshold 20% part of the air quality zone [%]	annual concentration - Air Quality Zone
DsLubanMieszMOB	11,2	9,0	13,5	49%	11,6
WpPoznRatajeMOB	18,5	14,8	22,2	87%	17,6
station name	**annual concentration**	**threshold 10% min**	**threshold 10% max**	**threshold 10% part of the air quality zone [%]**	**annual concentration - Air Quality Zone**
DsLubanMieszMOB	11,2	10,1	12,4	23%	11,6
WpPoznRatajeMOB	18,5	16,6	20,3	54%	17,6



SR areas – results Ozone

		threshold 20%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
KpWieniecZdrMOB	50,2	40,2	60,2	100%	52,7
DsLubanMieszMOB	54,2	43,4	65,1	91%	56,3
		threshold 10%			annual concentration - Air Quality Zone
station name	annual concentration	min	max	part of the air quality zone [%]	
KpWieniecZdrMOB	50,2	45,2	55,2	100%	52,7
DsLubanMieszMOB	54,2	48,8	59,6	77%	56,3





monitoring station

SR area - threshold 10%

SR area - threshold 20%

Air quality zone

SR methodology in Poland

1. Autocorrelation

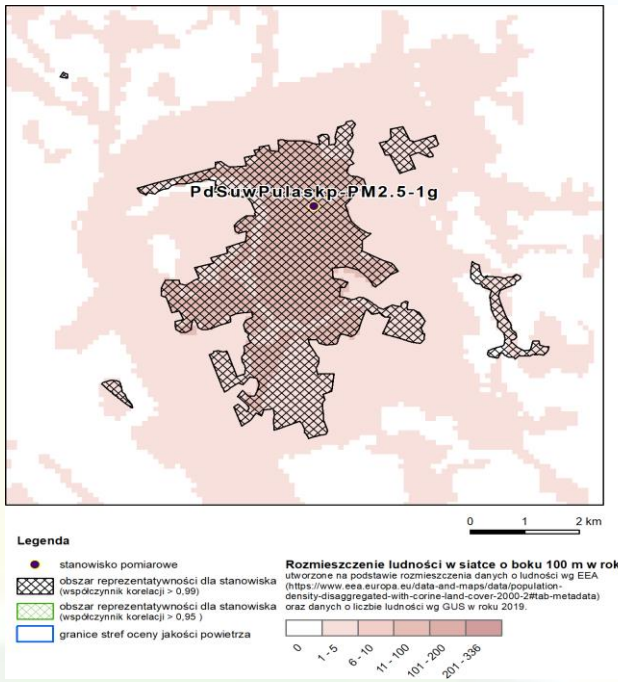
$$AF(i,j) = \frac{\sum_{time=1}^{nhours} Cst(t)\, C(i,j,t) - \overline{Cst}\;\overline{C(i,j)}}{(n-1)\sqrt{\frac{\sum_{time=1}^{nhours}\left(Cst(t) - \overline{Cs}\right)^2}{n-1}}\sqrt{\frac{\sum_{time=1}^{nhours}\left(C(i,j,t) - \overline{C(i,j)}\right)^2}{n-1}}}$$

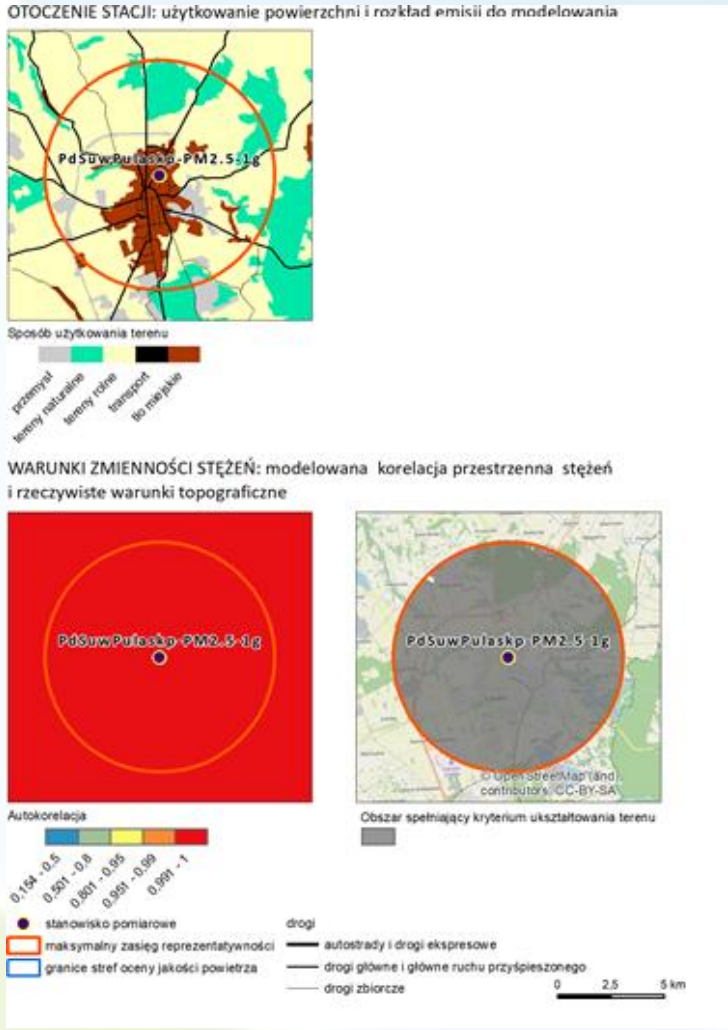
2. Land use according monitoring station type
3. Maximum area based on Polish regulations and boundaries of the Air Quality Zones
4. Topology criterion

Z < Zstation + 50 m, where:

Z – heigh of the terreain

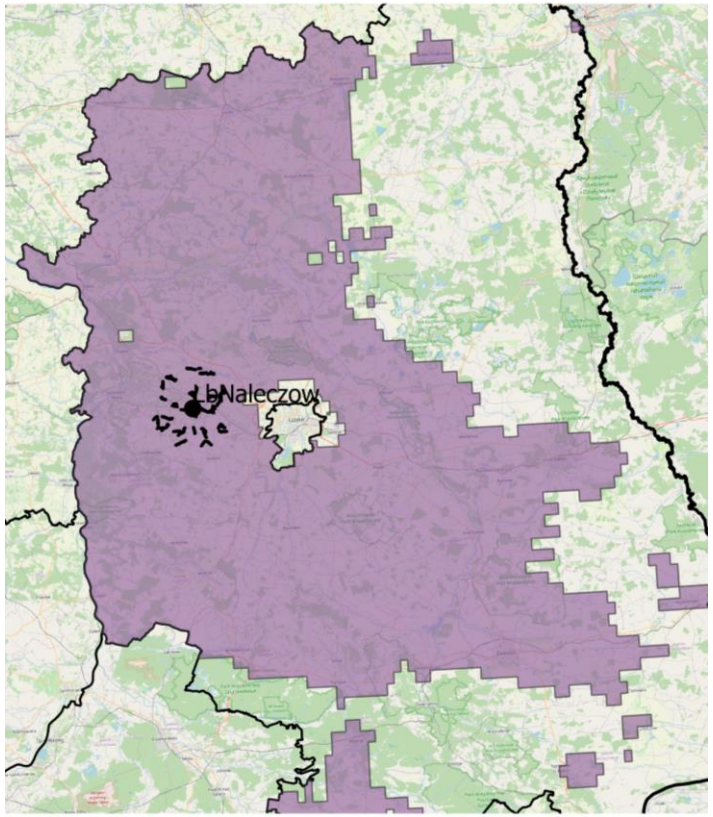
Zstation – heigh of the terreain at location of station



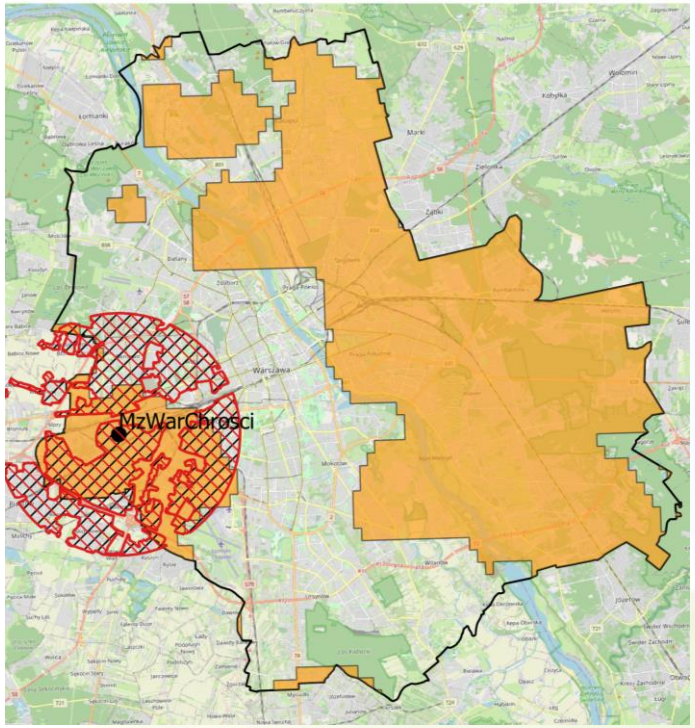


SR areas - comaprison

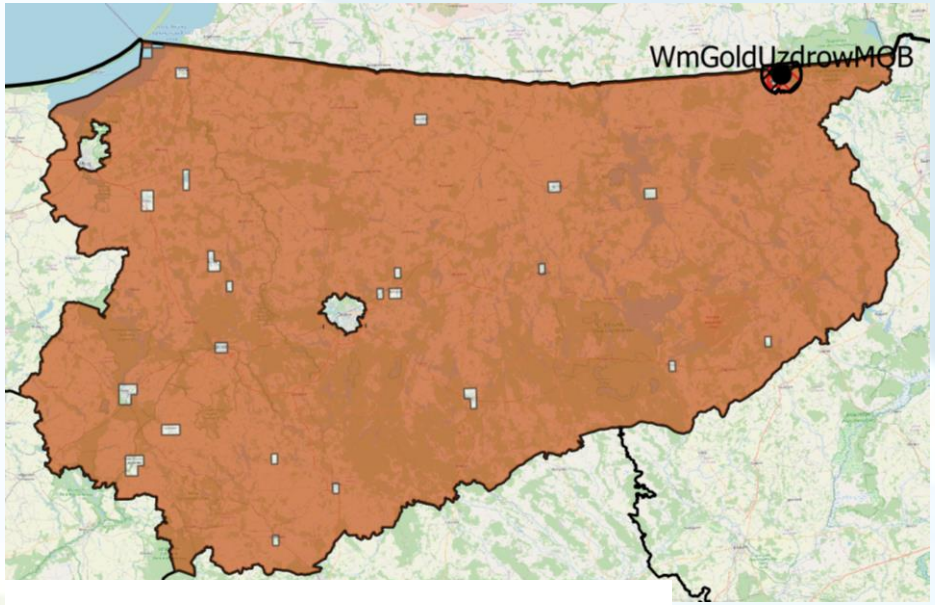
NO2



PM2.5



PM10



monitoring station

SR area - threshold 20%

SR area by our method

Air quality zone

Summary

Conclusions:

- SR methodology by FAIRMODE – fast result and easy to implement
- Much bigger SR areas than in our own methodology SR (often covering entire zone)
- If the concentration value at station location is closer to avg in the air quality zone - the area of SR is bigger (potentially covering locations of other stations)

To improve:

- Only one traffic station and no industrial station
- Criteria of margin (10%, 20%) is intuitive rather than scientifically justified

Questions

- What about other pollutions SO2, NOx, heavy metals, benzene, CO, BaP?
- What about station with huge bias (model vs measurement)?

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Thank you

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