

“Supplementary Information”

Air Pollution in the Shadow of Global Crises: Lessons from a Small City in the Western Balkans

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1. Figures

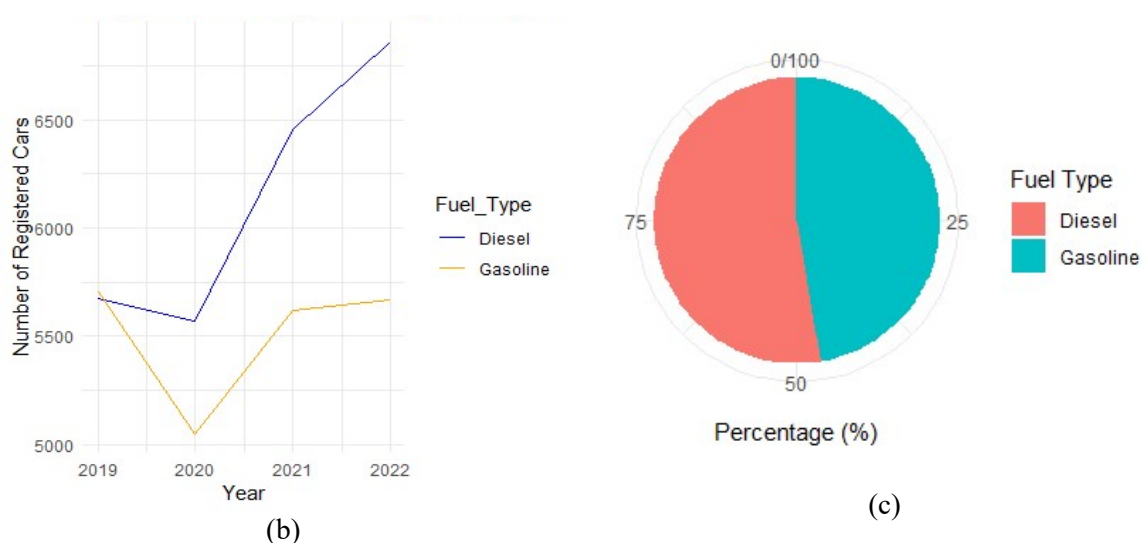
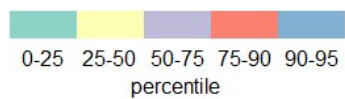
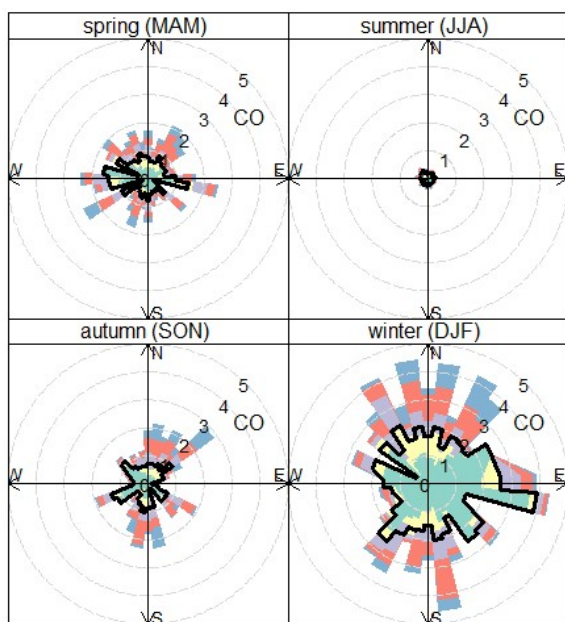
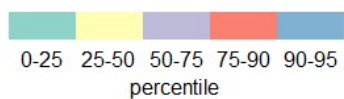
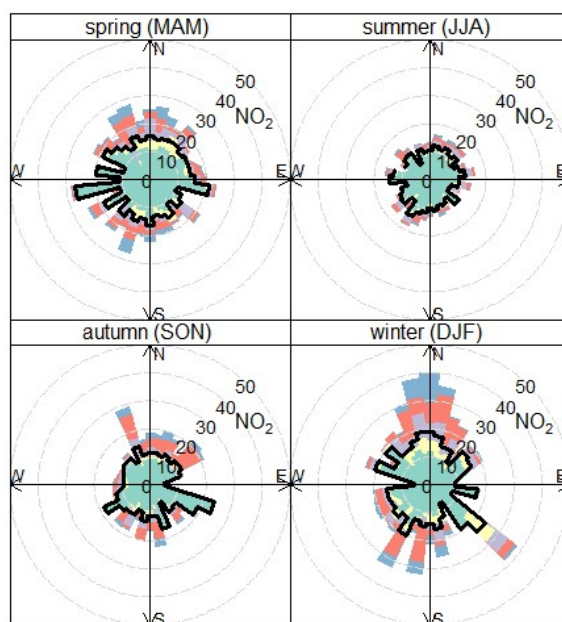


Figure S1. (a) Number and (b) distribution of registered passenger cars by fuel type (diesel and gasoline) over the studied period (2019–2022) within Kičevo.

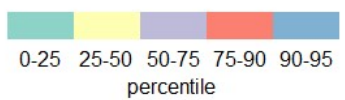
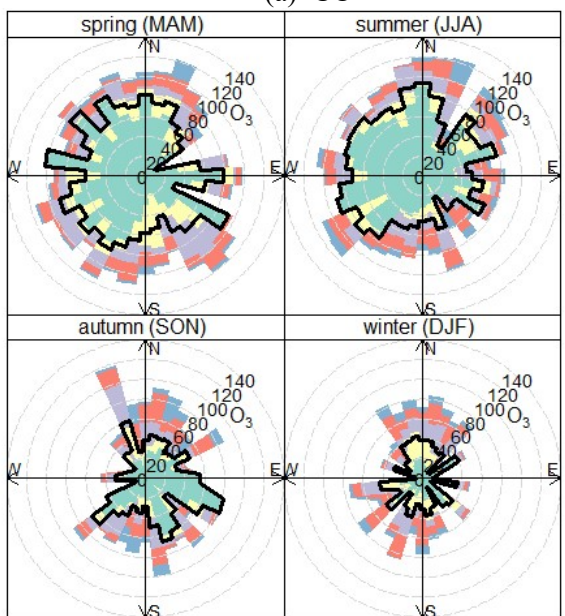
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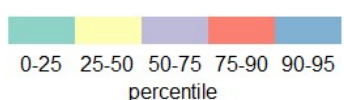
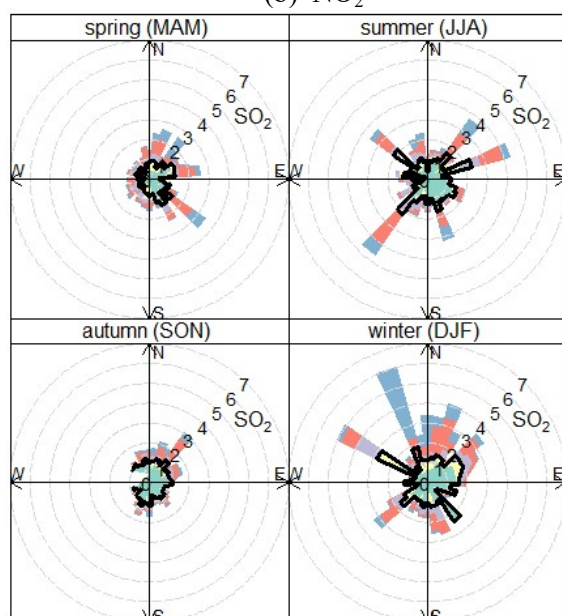
(a) CO



(b) NO₂



(c) O₃



(d) SO₂

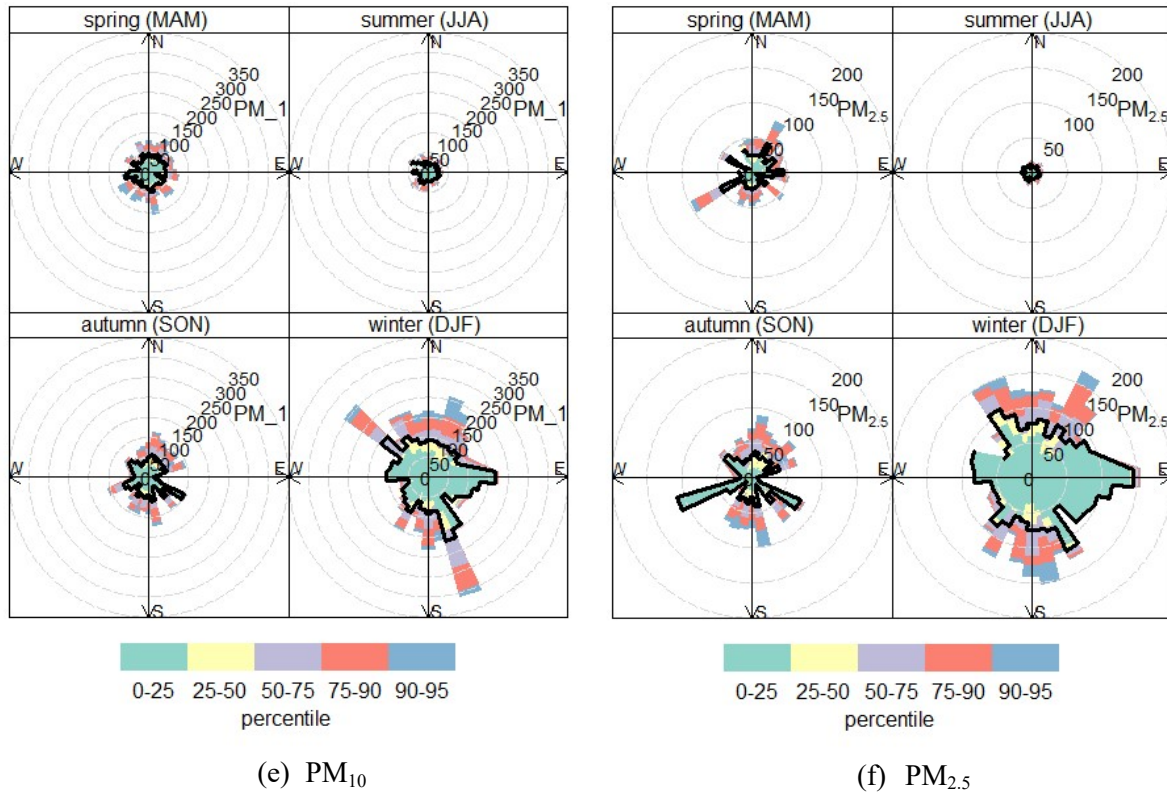


Figure S2. The percentile rose plots of (a) CO , (b) NO_2 , (c) O_3 , (d) SO_2 , (e) PM_{10} , and (f) $PM_{2.5}$ pollutant for Kičevo 2019-2023. The black line in the pollution rose plots is the mean concentrations for each directional sector, averaged across the different periods (spring, summer, autumn, winter).

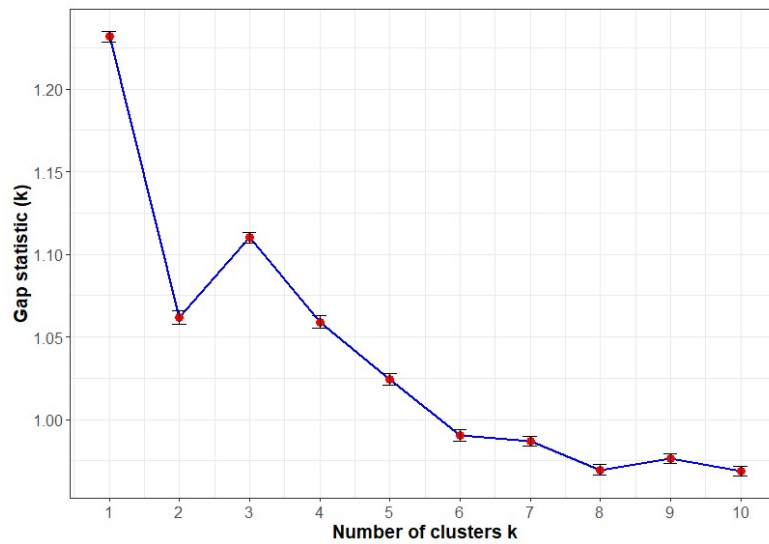


Figure S3. Gap statistic plot illustrating the optimal number of clusters (k) for air masses in Kičevo, based on pollutant concentrations, wind speed, and direction.

2. Tables

Table S1. Definition of analysis periods relative to the COVID-19 pandemic.

Period	Start	End	Notes
Pre-pandemic	Jan 2019	Jan 2020	Baseline conditions
Pandemic	Feb 2020	Apr 2022	Lockdowns and restricted mobility
Post-pandemic	May 2022	Dec 2023	Recovery phase; overlaps energy crisis

Table S2. Performance of deweathered models for daily pollutant concentrations.

Pollutant	R2	RMSE	MAE
NO ₂	0.40	5.47	3.96
CO	0.42	0.80	0.59
SO ₂	0.44	0.69	0.34
PM ₁₀	0.15	35.72	27.21
PM _{2.5}	0.32	29.39	23.49

Table S3. Monthly trends in electricity generation, coal consumption, and fuel oil (Mazut) consumption at the TE Oslomej power plant from 2018-2023.

Year	Month	Planned Energy Generation / MWh	Accomplished Energy Generation / MWh	Received Coal / tonne	Coal Consumption / tonne	Fuel Oil (Mazut) Consumption / tonne
2018	1		467.00	22289.00	1289.00	327.00
2018	2	31380.30	29216.00	19582.00	55582.00	1729.00
2018	3					9.00
2018	4			19500.00		
2018	5			10500.00		12.00
2018	6		3904.00	19822.00	5822.00	312.00
2018	7			23500.00		
2018	8			2500.00		
2018	9					
2018	10					
2018	11	47092.70	30307.00	18148.00	56148.00	1177.00
2018	12	25246.50	19169.00	57307.00	32307.00	361.80
2019	1			4000.00		163.00
2019	2		16496.00	14652.00	27652.00	878.00
2019	3					11.00
2019	4					
2019	5			7500.00		
2019	6			3000.00		4.00
2019	7			500.00		43.00
2019	8			1500.00		
2019	9					
2019	10					
2019	11	27768.90	36106.00	35507.00	61007.00	1721.00
2019	12	57782.40	51367.00	56791.00	82791.00	2215.00
2020	1		27704.00	38894.00	47894.00	1451.00
2020	2	54137.70		29000.00		78.00
2020	3		6974.00	22351.00	15351.00	1665.00
2020	4			4500.00		
2020	5			5500.00		
2020	6		26172.00	3754.00	48754.00	1675.00

2020	7			5500.00		25.00
2020	8		16015.00	23401.00	28701.00	1258.00
2020	9			14800.00		
2020	10			22000.00		
2020	11	56004.50		12000.00		
2020	12	57871.30	30672.00	27329.00	58329.00	1938.00
2021	1		29983.00	29790.00	46290.00	1854.00
2021	2	51770.80		2000.00		
2021	3		15935.00	26072.00	29572.00	559.00
2021	4		1337.00	25176.00	3176.00	46.00
2021	5			51000.00		
2021	6	44785.80	45608.00	15852.00	58852.00	272.13
2021	7	62005.00	30130.00	35774.00	36774.00	22.00
2021	8		20966.00	18789.00	30789.00	128.00
2021	9		53242.00	77026.00	90026.00	742.00
2021	10	55804.50	10087.00	19283.00	14583.00	659.00
2021	11	55926.70		38500.00		104.00
2021	12		31452.00	14166.00	43466.00	1244.00
2022	1	24742.00	25113.00	33513.00	43013.00	1272.00
2022	2	14934.50	12324.00	49066.00	20166.00	691.00
2022	3	34136.10	5185.00	36120.00	9520.00	502.00
2022	4	32002.60	33908.00	50661.00	46061.00	1748.00
2022	5		54995.00	28493.00	86093.00	788.00
2022	6	64005.10	24096.00	65553.00	44953.00	493.00
2022	7		30879.00	43287.00	55287.00	630.00
2022	8					
2022	9		20895.00	44113.00	37217.00	285.00
2022	10	66138.60	46696.00	64868.00	82368.00	972.00
2022	11	64005.10	12293.00	22840.00	17840.00	146.00
2022	12	66138.60	32507.00	63505.00	47505.00	1123.00
2023	1	42670.10	32094.00	50013.00	49013.00	1063.00
2023	2	38403.10	38329.00	70744.00	58744.00	1202.00
2023	3	42670.10	17347.00	34827.00	26827.00	628.00
2023	4		39969.00	56628.00	62628.00	1511.00
2023	5	42670.10	21617.00	48055.00	34055.00	756.00
2023	6	32002.60		8000.00		
2023	7		15565.00	1658.00	27658.00	534.00
2023	8		2595.00	2880.00	4880.00	236.00
2023	9					
2023	10	66556.40		30000.00		
2023	11	64044.20				26.00
2023	12	66149.70	28520.00	31962.00	52962.00	1650.00