Urban Single Precipitation Events: A Key for Characterizing Sources of Air Contaminants and the Dynamics of Atmospheric Chemistry Exchanges

Maciej Górka [1,*], Aldona Pilarz [1], Magdalena Modelska [1], Anetta Drzeniecka-Osiadacz [2], Anna Potysz [1] and David Widory [3,*]

[1]Institute of Geological Sciences, Faculty of Earth Sciences and Environmental Management, University of Wrocław, Cybulskiego 32, 50-205 Wrocław, Poland; aldona.pilarz@onet.pl (A.P.); magdalena.modelska@uwr.edu.pl (M.M.); anna.potysz@uwr.edu.pl (A.P.)

[2]Department of Climatology and Atmosphere Protection, Institute of Geography and Regional Development, University of Wrocław, Kosiby 8, 51-621 Wrocław, Poland; anetta.drzeniecka-osiadacz@uwr.edu.pl

[3]Department of Earth and Atmospheric Sciences, GEOTOP/The Université du Québec à Montréal (UQAM), Montreal, QC H2X 3Y7, Canada

[*]Correspondence: maciej.gorka@uwr.edu.pl (M.G.); widory.david@uqam.ca (D.W.)

SM - Content

Table S1 Air contaminant concentrations recorded by the official monitoring CIEP station (Wyb. J.Conrada-Korzeniowskiego 18 Str Wrocław – 51.129378N. 17.02925E) on 18.07.2018 and 21.02.2019.

Table S2 Meteorological parameters measured at the University of Wrocław (UWr) and IMWM stations and physio-chemical parameters for rain precipitations collected at UWr (Kosiby 18 Str Wrocław – 51.105357N, 17.088988E) on 18.07.2018 and 21.02.2019.

Table S1 Air contaminant concentrations recorded by the (Wyb. J.Conrada-Korzeniowskiego 18 Str Wrocław – 51.129378N. 17.02925E) on 18.07.2018 and 21.02.2019 (data retrieved from https://powietrze.gios.gov.pl/pjp/archives).

Data/Time UTC	SO_2 [$\mu g \cdot m^{-3}$]	$PM_{2.5}$ [$\mu g g \cdot m^{-3}$]	PM_{10} [$\mu g \cdot m^{-3}$]	CO [$\mu g \cdot m^{-3}$]	O_3 [$\mu g \cdot m^{-3}$]	NO_x [$\mu g \cdot m^{-3}$]	NO_2 [$\mu g \cdot m^{-3}$]	NO [$\mu g \cdot m^{-3}$]
18.07.2018								
18.07.2018 00:00	0.4	9.0	15.4	0.4	54.9	4.4	3.4	0.7
18.07.2018 01:00	0.5	8.6	12.6	0.4	53.8	4.8	3.3	1.0
18.07.2018 02:00	0.5	14.3	16.2	0.3	51.5	5.0	3.4	1.1
18.07.2018 03:00	0.5	12.1	12.7	0.4	53.1	5.6	3.9	1.1
18.07.2018 04:00	0.5	12.2	13.5	0.4	51.7	8.5	5.7	1.8
18.07.2018 05:00	0.3	9.4	12.7	0.4	49.8	11.3	7.8	2.3
18.07.2018 06:00	0.4	9.7	11.0	0.4	50.5	13.0	8.8	2.7
18.07.2018 07:00	0.3	9.5	9.5	0.4	51.2	13.9	10.2	2.4
18.07.2018 08:00	0.5	6.4	6.4	0.4	61.9	13.7	10.1	2.4
18.07.2018 09:00	0.3	1.7	6.4	0.4	63.7	12.9	9.4	2.3
18.07.2018 10:00	0.4	2.5	6.4	0.4	64.7	11.6	8.2	2.2
18.07.2018 11:00	0.5	5.7	6.4	0.4	66.2	10.9	7.8	2.0
18.07.2018 12:00	0.3	5.3	6.4	0.4	60.8	13.7	10.1	2.4
18.07.2018 13:00	0.4	3.9	6.4	0.4	61.3	15.1	11.0	2.6
18.07.2018 14:00	0.6	2.4	6.4	0.4	84.2	12.1	8.8	2.1
18.07.2018 15:00	0.5	2.6	6.4	0.4	74.0	14.8	11.0	2.5
18.07.2018 16:00	0.4	6.7	6.7	0.4	70.4	13.2	10.4	1.8
18.07.2018 17:00	0.4	6.7	9.0	0.4	70.1	11.0	8.4	1.7
18.07.2018 18:00	0.4	7.4	10.7	0.4	64.9	10.9	8.8	1.4
18.07.2018 19:00	0.4	9.5	11.9	0.4	64.5	11.2	8.9	1.5
18.07.2018 20:00	0.4	13.5	13.5	0.4	59.1	11.1	8.8	1.5
18.07.2018 21:00	0.5	10.4	20.3	0.4	60.5	8.3	6.9	0.9
18.07.2018 22:00	0.4	12.9	14.7	0.4	56.4	7.6	6.0	1.1
18.07.2018 23:00	0.4	13.4	13.4	0.4	57.3	6.5	5.3	0.8
21.02.2019								
21.02.2019 00:00	8.0	17.2	27.2	0.4	51.1	19.2	18.1	0.7
21.02.2019 01:00	8.1	21.2	32.4	0.4	53.5	16.0	15.1	0.6
21.02.2019 02:00	6.9	17.3	24.0	0.3	55.5	12.7	11.9	0.5
21.02.2019 03:00	5.8	13.2	20.8	0.3	54.5	12.8	12.1	0.5
21.02.2019 04:00	5.0	16.2	25.1	0.3	49.7	17.2	16.1	0.7
21.02.2019 05:00	5.0	18.4	26.1	0.4	44.8	22.9	20.9	1.3
21.02.2019 06:00	5.1	21.5	35.5	0.4	25.3	45.5	38.9	4.3
21.02.2019 07:00	5.6	24.0	39.5	0.5	14.2	66.2	50.7	10.1
21.02.2019 08:00	n.d.	21.6	46.8	n.d.	21.3	n.d.	n.d.	n.d.
21.02.2019 09:00	n.d.	23.2	42.4	n.d.	29.1	n.d.	n.d.	n.d.
21.02.2019 10:00	7.1	24.6	37.8	0.4	32.9	41.5	29.7	7.7
21.02.2019 11:00	6.8	25.6	35.1	0.4	37.6	36.6	28.4	5.3
21.02.2019 12:00	7.5	22.2	36.3	0.4	33.7	41.8	32.2	6.3
21.02.2019 13:00	7.5	24.5	36.1	0.4	40.6	33.0	26.4	4.3
21.02.2019 14:00	4.8	27.1	35.2	0.4	36.5	37.7	31.4	4.1
21.02.2019 15:00	4.0	28.5	39.2	0.5	26.4	49.3	40.6	5.6

21.02.2019 16:00	4.0	23.2	34.1	0.5	31.4	44.3	37.5	4.4
21.02.2019 17:00	4.1	20.5	20.5	0.4	38.2	37.0	32.6	2.9
21.02.2019 18:00	4.5	9.7	14.8	0.4	50.9	26.3	23.9	1.6
21.02.2019 19:00	4.8	20.5	20.5	0.4	47.8	22.8	21.1	1.1
21.02.2019 20:00	5.4	20.9	26.2	0.4	48.6	20.2	18.6	1.0
21.02.2019 21:00	4.5	19.4	25.5	0.4	50.5	16.9	15.8	0.7
21.02.2019 22:00	3.7	26.2	26.2	0.4	48.1	16.9	15.7	0.8
21.02.2019 23:00	3.4	23.7	59.7	0.4	46.9	16.0	14.8	0.8

n.d. – no data

Table S2 Meteorological parameters measured at the University of Wrocław (UWr) and IMWM stations and physio-chemical parameters for rain precipitations collected at UWr (Kosiby 18 Str Wrocław – 51.105357N, 17.088988E) on 18.07.2018 and 21.02.2019.

Data/Time UTC	Pressure [hPa]	O_3 [μg·m^3]	PM_{10} [μg·m^3]	$PM_{2.5}$ [μg·m^3]	T2m [◦C]	RH [%]	Rain KOSIBY [mm]	Velocity [m·s^{-1}]	Rain IMWM [mm]	*pH	*Conductivity [μS·cm^{-1}]	*HCO_3^- [mg·L^{-1}]	*F^- [mg·L^{-1}]	*Cl^- [mg·L^{-1}]	*NO_2^- [mg·L^{-1}]	*NO_3^- [mg·L^{-1}]	*PO_4^{3-} [mg·L^{-1}]	*SO_4^{2-} [mg·L^{-1}]	*Na^+ [mg·L^{-1}]	*NH_4^+ [mg·L^{-1}]	*K^+ [mg·L^{-1}]	*Mg^{2+} [mg·L^{-1}]	*Ca^{2+} [mg·L^{-1}]
18.07.2018																							
06:00	994.4	55.3	2.6	6.8	18.0	93.7	n.d.	0.5	0.4	7.1	23.0	15.87	0.08	0.06	0.01	0.14	n.d.	0.33	0.07	0.47	0.09	0.03	0.55
06:30	994.7	57.4	2.3	6.1	17.9	94.8	n.d.	1.5	0.3	6.7	16.0	13.42	0.09	0.12	0.01	0.13	0.02	0.58	0.17	0.43	0.05	0.05	0.61
07:00	995.0	59.5	4.3	5.1	17.8	95.6	n.d.	1.1	0.3	6.9	45.0	20.75	0.43	0.84	0.12	0.33	0.01	5.22	4.87	0.52	0.25	0.11	1.33
07:30	995.1	62.3	6.5	3.6	17.7	96.1	n.d.	1.4	0.5	6.8	24.0	18.31	0.16	0.08	0.01	0.52	0.02	0.76	0.11	0.84	0.14	0.03	0.48
08:30	995.4	71.9	4.5	2.9	17.7	94.6	n.d.	1.0	0.9	6.7	18.0	13.42	0.13	0.06	0.00	0.25	0.01	0.45	0.05	0.45	0.12	n.d.	0.24
09:00	995.6	70.6	5.2	1.3	17.7	93.3	n.d.	1.2	0.3	6.7	16.0	19.53	0.09	0.09	n.d.	0.14	0.01	0.39	0.09	0.26	0.12	0.02	0.16
09:30	995.9	70.7	8.3	6.1	17.8	93.9	n.d.	1.1	1.4	6.6	14.0	12.20	0.10	0.09	n.d.	0.20	0.02	0.37	0.07	0.28	0.10	n.d.	n.d.
10:30	996.2	80.3	21.5	7.8	17.8	91.0	n.d.	3.4	3.7	6.5	17.0	12.20	0.16	0.10	n.d.	0.43	0.02	0.68	0.11	0.70	0.11	n.d.	n.d.
11:00	996.5	74.1	6.5	3.5	18.0	92.2	n.d.	4.0	3.9	6.7	18.0	9.15	0.21	0.08	0.02	0.58	0.06	1.20	0.19	0.91	n.d.	n.d.	0.22
12:00	996.8	70.6	14.0	7.3	18.1	92.3	n.d.	4.0	1.2	6.6	16.0	17.09	0.13	0.06	n.d.	0.37	0.02	0.68	0.05	0.56	0.06	n.d.	0.22
12:30	997.1	73.7	10.5	2.4	18.2	91.3	n.d.	4.0	0.0	6.7	19.0	17.09	0.15	0.08	n.d.	0.67	0.02	0.64	0.09	0.62	0.09	n.d.	n.d.
13:00	997.2	78.2	11.4	6.9	18.1	92.0	n.d.	3.9	0.2	6.8	28.0	14.64	0.25	0.12	n.d.	1.65	0.02	0.81	0.07	0.88	0.18	n.d.	n.d.
14:00	997.6	95.2	18.9	4.6	18.1	87.8	n.d.	3.2	1.0	6.8	21.0	15.87	0.15	0.09	n.d.	0.90	0.01	0.60	0.11	0.57	0.10	n.d.	n.d.
14:30	997.8	88.2	15.4	8.7	17.9	90.4	n.d.	4.0	0.5	6.6	16.0	10.98	0.13	0.12	n.d.	0.64	0.01	0.46	0.11	0.48	0.11	n.d.	n.d.
14:45	997.9	83.7	8.3	5.2	18.0	91.8	n.d.	4.1	0.2	6.7	20.0	13.42	0.19	0.09	n.d.	1.05	0.01	0.90	0.13	0.41	0.09	n.d.	n.d.
21.02.2019																							
08:00	1009.7	26.2	28.3	14.8	6.9	57.9	0.0	3.6	0.0	7.0	98.0	8.58	0.20	6.87	0.17	4.46	0.23	17.92	3.65	2.98	0.74	0.89	6.86
08:40	1009.7	28.7	25.4	13.7	7.6	57.6	0.0	3.2	0.0	6.9	43.0	4.39	0.12	1.80	0.06	1.82	0.07	6.74	1.45	1.61	0.38	0.36	2.99
10:40	1009.4	32.6	20.1	13.1	8.2	58.8	0.2	3.2	0.0	6.9	48.0	3.42	0.12	1.21	0.06	5.97	0.08	6.44	3.92	3.96	2.64	0.26	2.56
11:00	1009.1	35.5	13.4	10.3	8.4	63.6	0.1	3.5	0.0	6.7	23.0	2.68	0.11	0.41	0.03	1.77	0.07	2.51	0.47	1.83	0.22	0.09	1.08
12:50	1008.4	33.5	13.4	11.1	8.7	62.8	0.1	3.3	0.2	6.8	17.0	2.68	0.11	0.28	0.04	1.53	0.07	2.00	0.38	1.73	0.19	0.04	0.71
13:05	1008.1	36.9	11.9	10.4	8.5	64.7	0.2	3.7	0.2	6.8	14.0	2.20	0.05	0.21	0.02	1.36	0.07	1.16	0.24	1.30	0.09	n.d.	0.37
13:20	1008.0	34.2	10.2	10.3	8.1	67.1	0.1	2.9	0.2	6.7	13.0	2.20	0.06	0.26	0.03	1.68	0.06	1.34	0.25	1.54	0.09	n.d.	0.17
13:35	1008.1	32.7	12.1	11.7	7.7	70.5	0.3	3.1	0.2	6.7	11.0	1.71	0.04	0.12	0.01	1.44	0.06	0.89	0.16	1.37	n.d.	n.d.	n.d.
13:45	1008.1	34.1	9.8	10.0	7.5	72.3	0.1	3.6	0.1	6.5	20.0	1.71	0.05	0.23	0.02	3.73	0.07	1.58	0.26	2.86	0.09	n.d.	n.d.
13:55	1008.1	31.7	9.7	10.2	7.3	73.6	0.3	2.9	0.2	6.6	17.0	1.71	0.05	0.17	0.02	2.14	0.05	1.55	0.22	2.01	n.d.	n.d.	n.d.
14:05	1008.1	26.5	11.5	11.9	7.1	75.3	0.1	3.9	0.2	6.6	12.0	1.46	0.03	0.14	0.01	1.84	0.05	1.01	0.16	1.69	n.d.	0.02	0.21
14:15	1008.1	24.5	11.6	11.2	7.1	75.9	0.1	1.9	0.3	6.6	9.0	1.46	0.03	0.09	0.01	1.18	0.04	0.65	0.12	1.22	n.d.	n.d.	0.17
14:25	1008.1	22.5	11.8	11.8	7.0	77.1	0.3	2.7	0.4	6.6	7.0	1.46	0.04	0.07	0.01	0.79	0.04	0.55	0.11	0.92	n.d.	0.02	0.20
14:40	1008.1	25.8	11.3	11.1	6.9	79.5	0.5	2.4	0.4	6.6	6.0	1.22	0.04	0.08	0.01	0.66	0.04	0.51	0.17	0.80	n.d.	0.03	0.14
14:50	1008.1	27.5	10.4	11.2	6.8	81.2	0.3	3.0	0.3	6.8	15.0	n.d.	0.03	0.19	0.02	1.25	0.04	0.80	0.19	1.22	0.10	0.04	0.30

n.d.: not determined.

*data from [46]