The following supplement accompanies the article

Changes in intensity of high temporal resolution precipitation extremes in Romania: implications for Clausius-Clapeyron scaling

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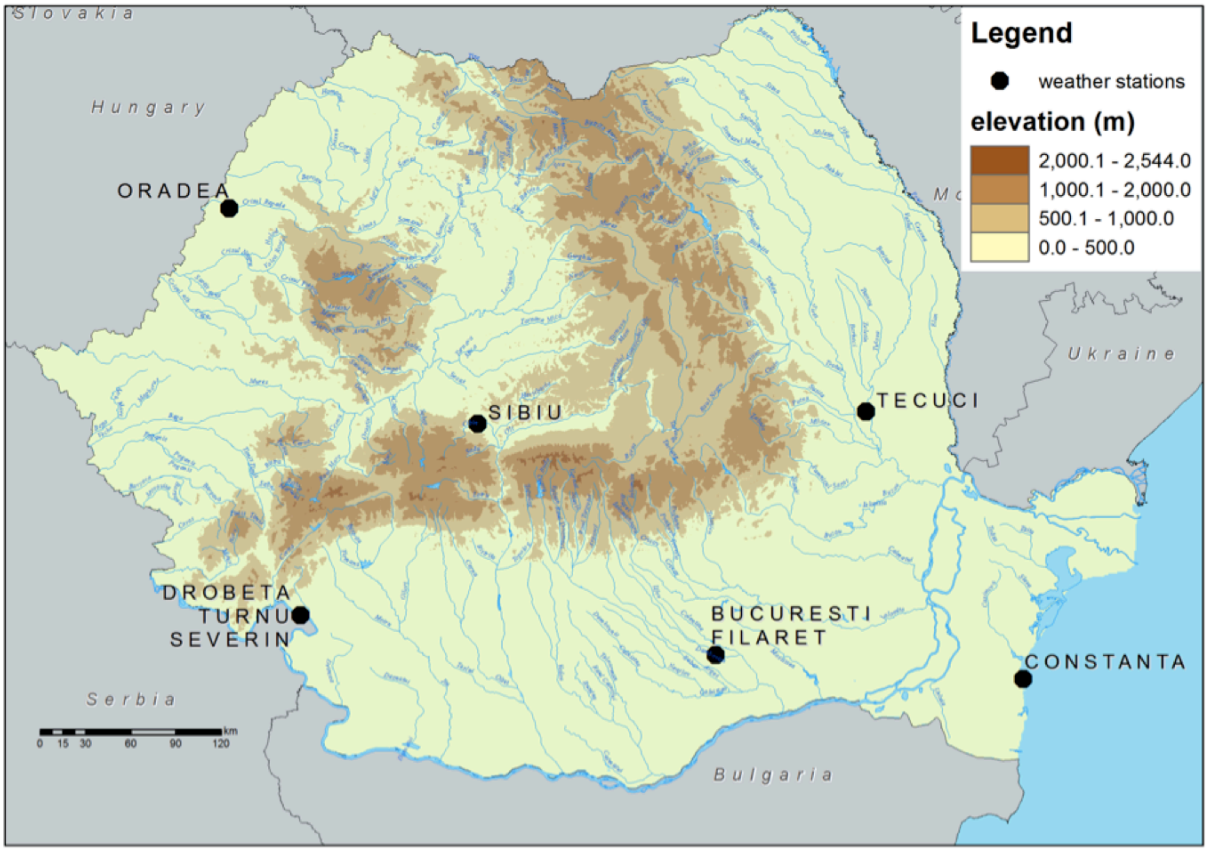

Fig. S1. The location of six stations analysed in this study.

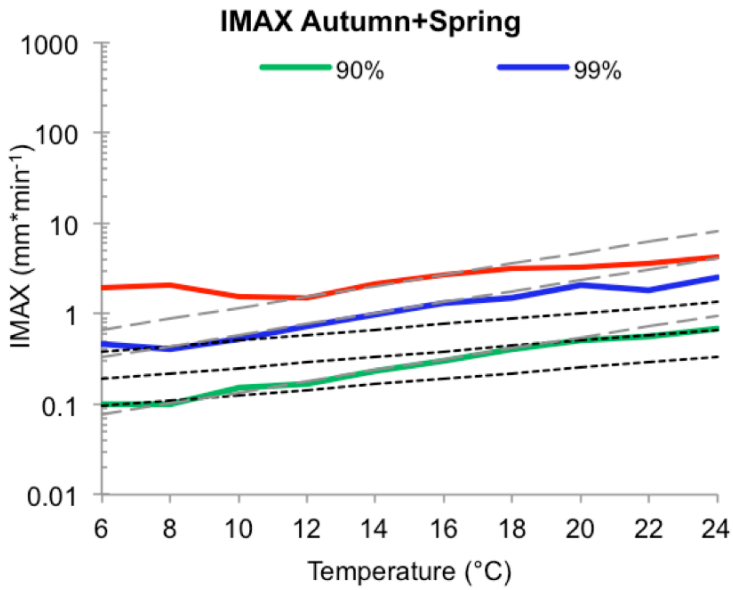

Fig. S2. Scaling of observed extreme rainfall intensity IMAX with temperature for six stations mixed up together for spring and autumn seasons. Shown are different percentiles (90th to 99.9^{th}) of IMAX for each temperature bin. The CC and 2CC scaling are presented through the black and grey dotted lines, respectively. Due to the logarithmic y-axis these exponential relations are shown as straight lines.

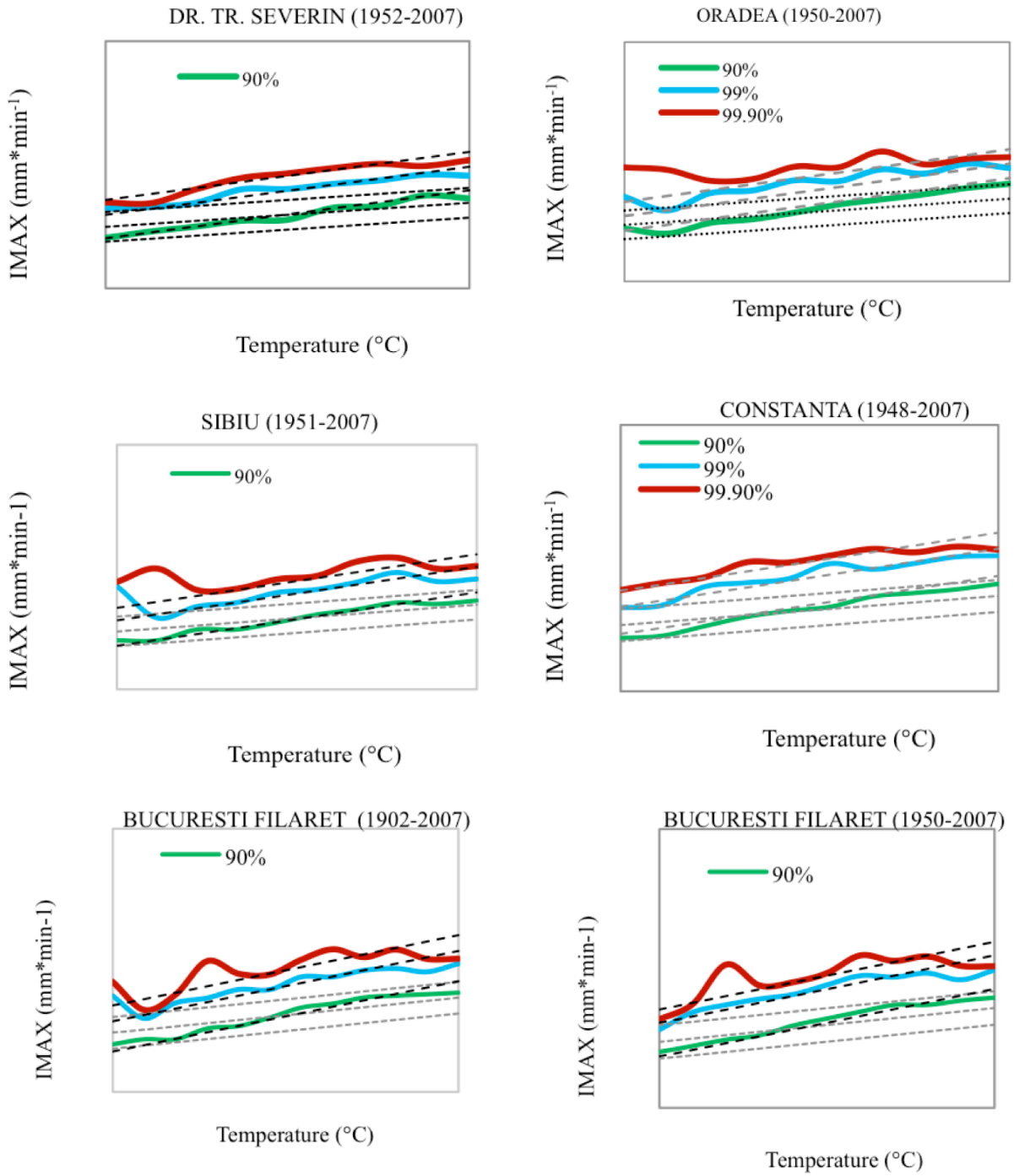

Fig. S3. Scaling of observed extreme rainfall intensity (IMAX) with temperature for five stations pooling all data together from April to October. For Bucuresti-Filaret station a longer period is also considered. Shown are different percentiles (90th to 99.9^{th}) of IMAX distribution for each temperature bin. Exponential relation given by a 7% increase per degree and 14% per degree are rendered through the grey and black dotted lines, respectively. Note the logarithmic y-axis, due to which these exponential relations appear as straight lines.

Table S1. Number of values in each temperature bins for the two precipitation indices (hourly precipitation amount and IMAX values) in Spring (April-May), Summer (June-July) and Autumn (September-October).

	Temperature bins													
	0-2	**2-4**	**4-6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**18-20**	**20-22**	**22-24**	**24-26**	**26-28**
Hourly precipitation														
Spring	216	810	1790	2958	4807	5758	5380	4037	2622	1444	518	170		
Summer							3865	7373	10682	10318	7276	4062	1418	358
Autumn	167	447	866	1779	2399	3815	4059	3276	2597	1397	519	131		
IMAX														
Spring	78	189	416	859	1435	1964	2214	1960	1480	802	320	103		
Summer						184	677	1700	3093	3794	3356	2040	793	198
Autumn		93	246	389	778	1128	1321	1303	1158	724	327	84		

Annex 1

This annex presents an example for the computation of the slope of the linear dependence between the natural logarithm of the three IMAX percentiles (abbreviated here as LN(Q90), LN(Q99, LN(Q99.9)) and temperature variation. Results are included in Table S2. The temperature intervals 2ºC-wide are noted as T1,....,T12 (first column). Temperature at the end of each interval (considered as representative for each temperature bin as rendered in Figure 4) is presented in the second column. This example refers to the spring season (Table S2a) for which the graph representation of the relation between the exponential variation of IMAX percentiles and temperature increase is presented in Figure 4 (left column, top).

Due to the logarithmic y-axis in Figure 4, these relations are shown as straight lines. The slope (m) of these lines is calculated as the slope of a straight line determined by two points (x1,y1) and (x2,y2) using the following known formula: $m = (y2 - y1)/(x2 - x1)$. In our case, yi are LN(Qi) for the three percentiles (last three columns) and xi are the corresponding temperatures represented in the second column. For example, to calculate the slope corresponding to Q90 (e.g. 90th percentile) percentile for the interval between 20°C (T10) and 8°C (T4), the following formula is used: $m = (-0.63 - (-2.30))/(20 - 8) = 1.6733/12 = 0.139$, corresponding to the first row and the first column in the second part of Table S2 (b). The m values correspond to selected temperature bins so that the corresponding lines are close to the CC or 2CC lines. The bolded values represent the slopes that are best fitted to the CC or 2CC lines. This way, the temperature range for which the IMAX percentiles fit better with CC and 2CC lines can be selected. We can see that, in the selected example, the 90th and 99th percentiles in spring follow the 2CC scaling for the temperature range of 8°C–20°C, while the 90th percentile after 18°C follows the CC scaling. The 99.9^{th} percentile follows approximately the 2CC scaling for the temperature range of 12–18°C. This conclusion can also be drawn from the graph representation in Figure4. This procedure has been used to calculate the slopes for all IMAX and hourly percentiles presented in this study and allows to numerically select the optimum temperature ranges for which the IMAX (hourly) extremes follow a CC or 2CC scaling. The results for summer and autumn IMAX percentile are also included in Table S2 (b).

Table S2. a) Intervals 2°C - wide, corresponding temperature (°C) and natural logarithm of the three IMAX percentiles (LN(Q90), LN(Q99, LN(Q99.9)) for spring; b) The temperature range and corresponding temperature variations (first and second column, respectively) for which the slope (m) of the linear dependence between LN(Q) and temperature variation for the three IMAX percentiles (Q) are computed (last three columns) for the three seasons . The order of the IMAX percentiles are the same as in a). Various temperature ranges are presented to highlight the selection of the optimum slope (bolded values) for each IMAX percentile and each season, which are close to the CC relation (about 0.07) or the 2CC relation (about 0.14).

a)

Intervals	Temperature(˚ C)	LN(Q90)	LN(Q99)	LN(Q99.9)
T1	2	-2.86	-1.74	-1.62
T2	4	-2.54	-0.52	0.53
T3	6	-2.30	-0.36	0.77
T4	8	-2.30	-0.92	0.98
T5	10	-1.90	-0.69	0.37
T6	12	-1.63	-0.33	0.34
T7	14	-1.43	0.00	0.84
T8	16	-1.10	0.30	0.85
T9	18	-0.82	0.54	1.14
T10	20	-0.63	0.69	1.19
T11	22	-0.56	0.51	0.88
T12	24	-0.42	0.40	0.84

b)

Temperature intervals (^{0}C)	Temperature variation (^{0}C)	Slope		
Spring				
8-20	12	**0.14**	**0.13**	0.02
10-12	8	0.13	0.15	0.10
12-18	6	0.14	0.15	**0.13**
18-24	6	**0.07**	-0.02	-0.05
Summer				
14-26	12	**0.09**	**0.06**	0.06
16-24	8	0.09	0.07	0.02
Autumn				
8-20	12	**0.13**	**0.12**	**0.13**
6-12	6	**0.07**	0.16	0.24
12-18	6	**0.14**	0.11	0.11
8-18	10	0.12	0.11	**0.15**
18-24	6	0.12	**0.14**	**0.06**