Supplementary file to "European heatwaves in present and future climate simulations: A Lagrangian analysis"

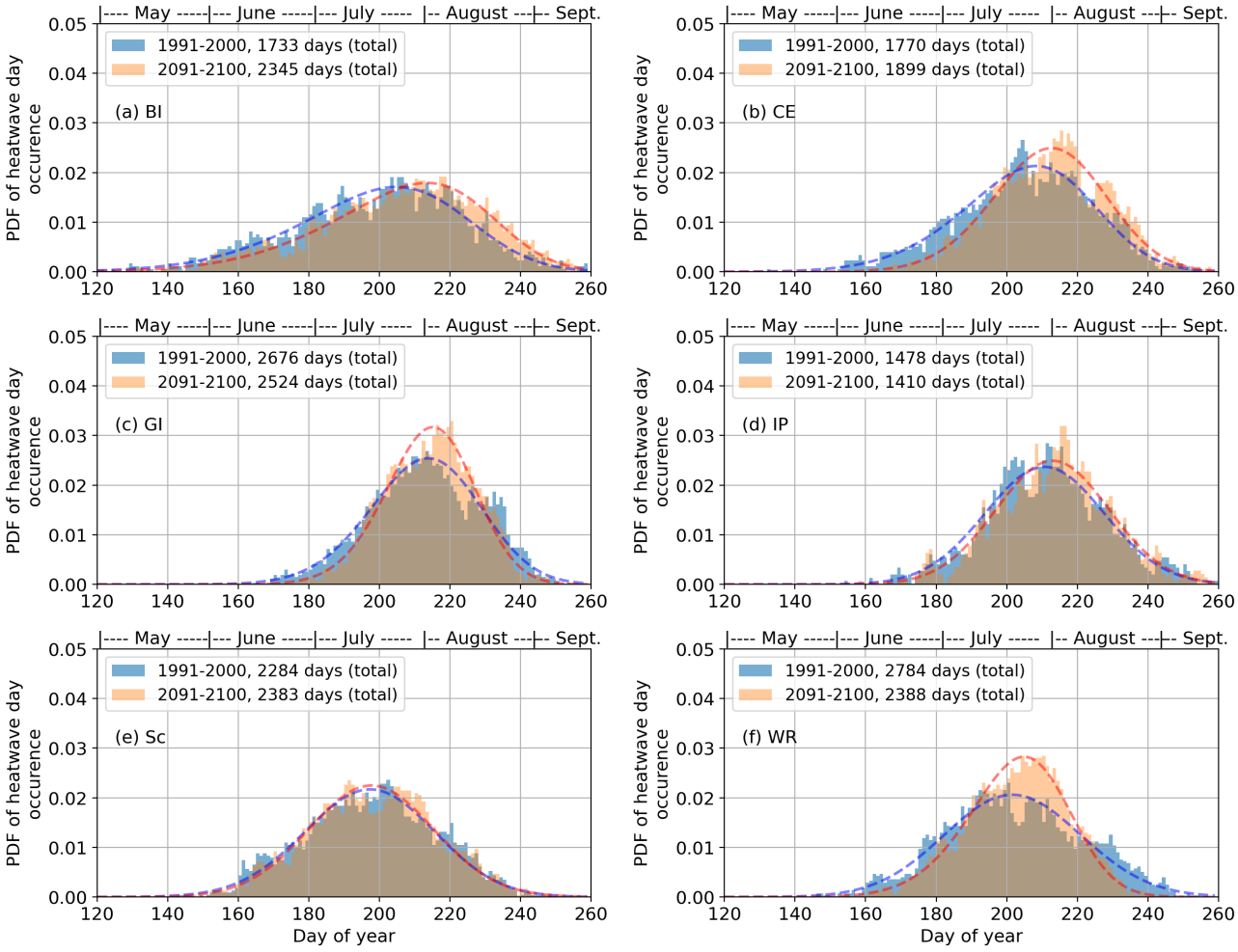
by Lisa Schielicke[1,2] and Stephan Pfahl[1]

[1]Institut für Meteorologie, Freie Universität Berlin, Berlin, Germany
[2]Institut für Geowissenschaften, Abteilung Meteorologie, Universität Bonn, Bonn, Germany

Distribution of heatwave day of occurrence in present and future simulations

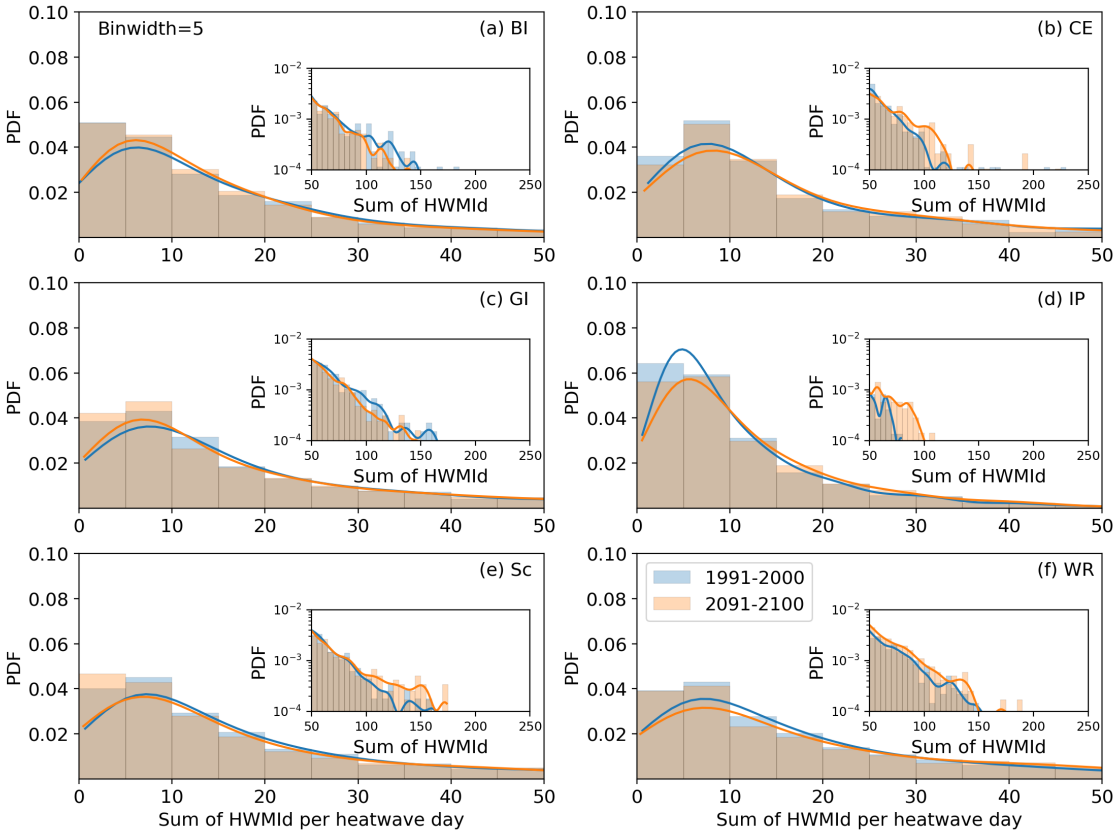
Supplementary Table T1: Parameters of fitted distributions to the number of heatwave days with respect to the day of year, they occurred. The abbreviation *Std* stands for standard deviation. Significant differences between means and variances per region are printed in bold. These have been calculated by a Mann-Whitney U-test and a Levene's test, respectively, and significance is assumed for p-values smaller than 0.0001.

Region	Simulation	Skew normal distribution			Normal distribution		Total number of days
		Shape	Location	Scale	Mean	Std	
BI	20C	-1.97564	223.26	34.58	**198.57**	24.21	1733
	RCP8.5	-2.37201	231.27	34.70	**205.64**	23.39	2345
CE	20C	-1.67227	222.65	26.41	**204.52**	**19.21**	1770
	RCP8.5	-0.98093	222.53	19.44	**211.66**	**16.12**	1899
GI	20C	-1.09779	224.02	19.63	212.46	**15.84**	2676
	RCP8.5	-1.19259	223.67	16.11	213.81	**12.74**	2524
IP	20C	0.00005	210.75	16.85	**210.75**	16.85	1478
	RCP8.5	0.24860	209.87	16.32	**213.01**	16.02	1410
Sc	20C	-0.61132	205.44	20.28	197.00	18.44	2284
	RCP8.5	0.00005	197.71	17.77	197.71	17.77	2383
WR	20C	0.48901	194.53	20.70	201.78	**19.39**	2784
	RCP8.5	-1.51499	215.43	19.38	202.50	**14.43**	2388
ALL	20C	-1.55772	222.19	26.83	**204.15**	**19.86**	12725
	RCP8.5	-1.65094	223.82	24.83	**206.88**	**18.15**	12949



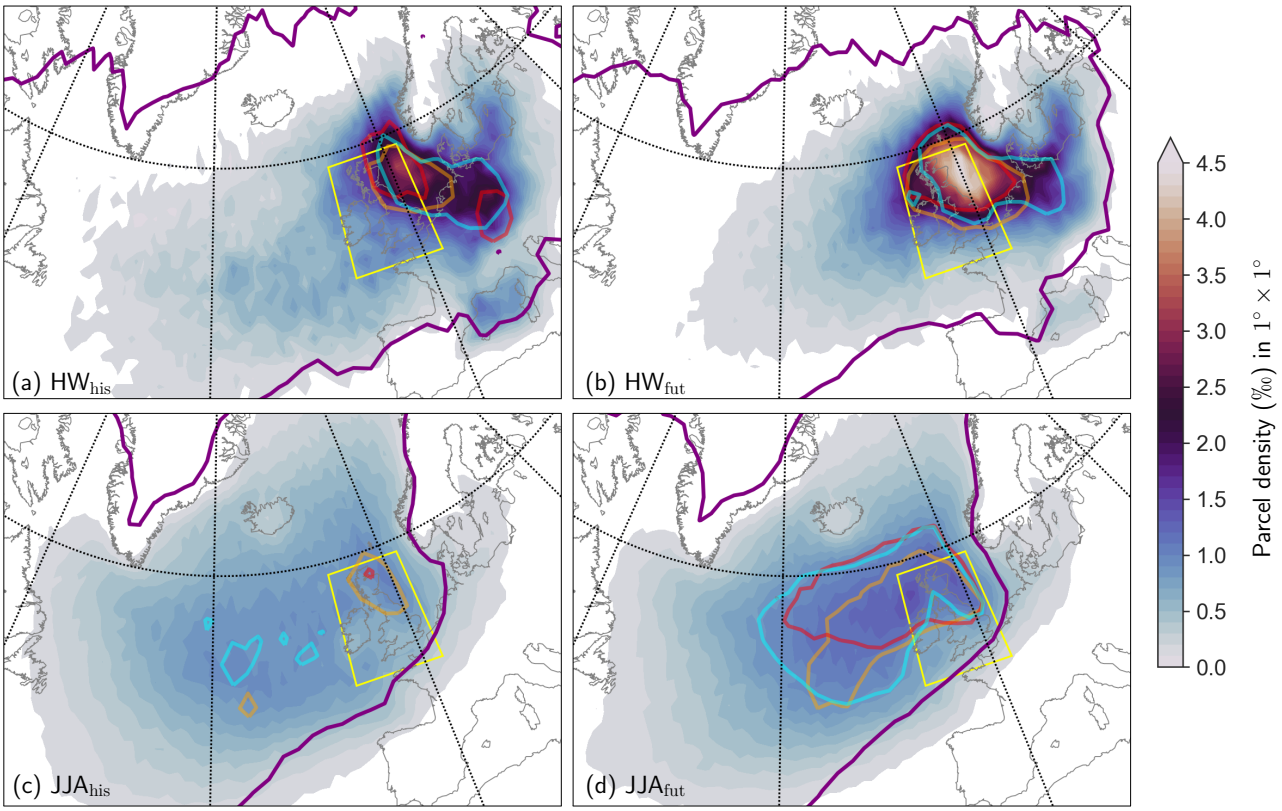
Supplementary Figure S1: Probability density function (PDF) of heatwave day occurrence in different regions with respect to the day of the year: blue bars (1991-2000); orange (2091-2100); brownish colours: overlap of both. Dashed lines show fitted skew normal distributions; for parameters of the respective distributions see Supplementary Table T1.

Distribution of HWMId values of present and future heatwaves



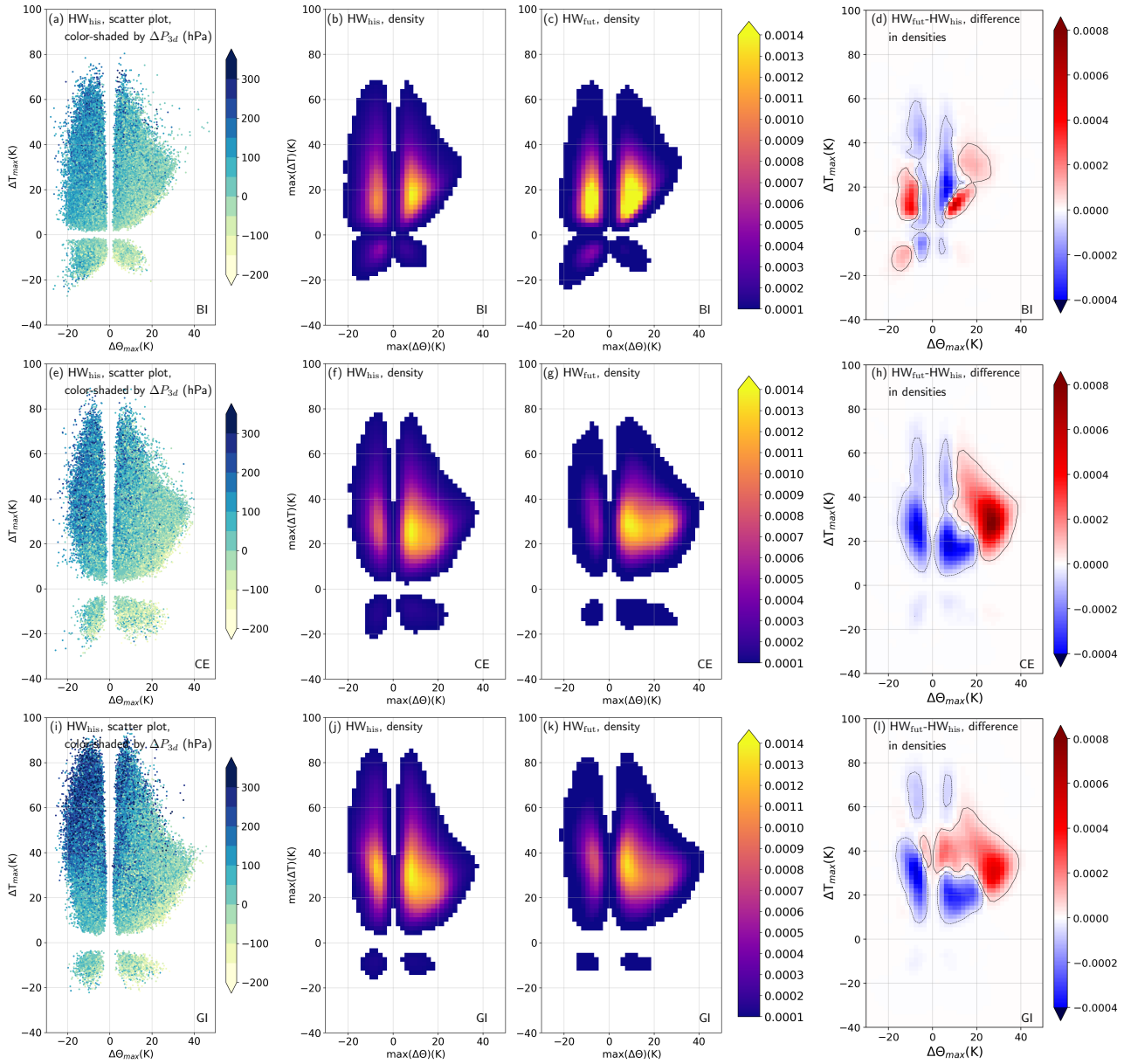
Supplementary Figure S2: Probability density function (PDF) of the sum of the HWMId values in each region per heatwave day: blue bars (1991-2000); orange (2091-2100); brownish colours: overlap of both; bin width is 5. Insets show the tail of the histograms.

Spatial distribution of trajectories 3 days prior to the arrival in the British Isles (BI) region

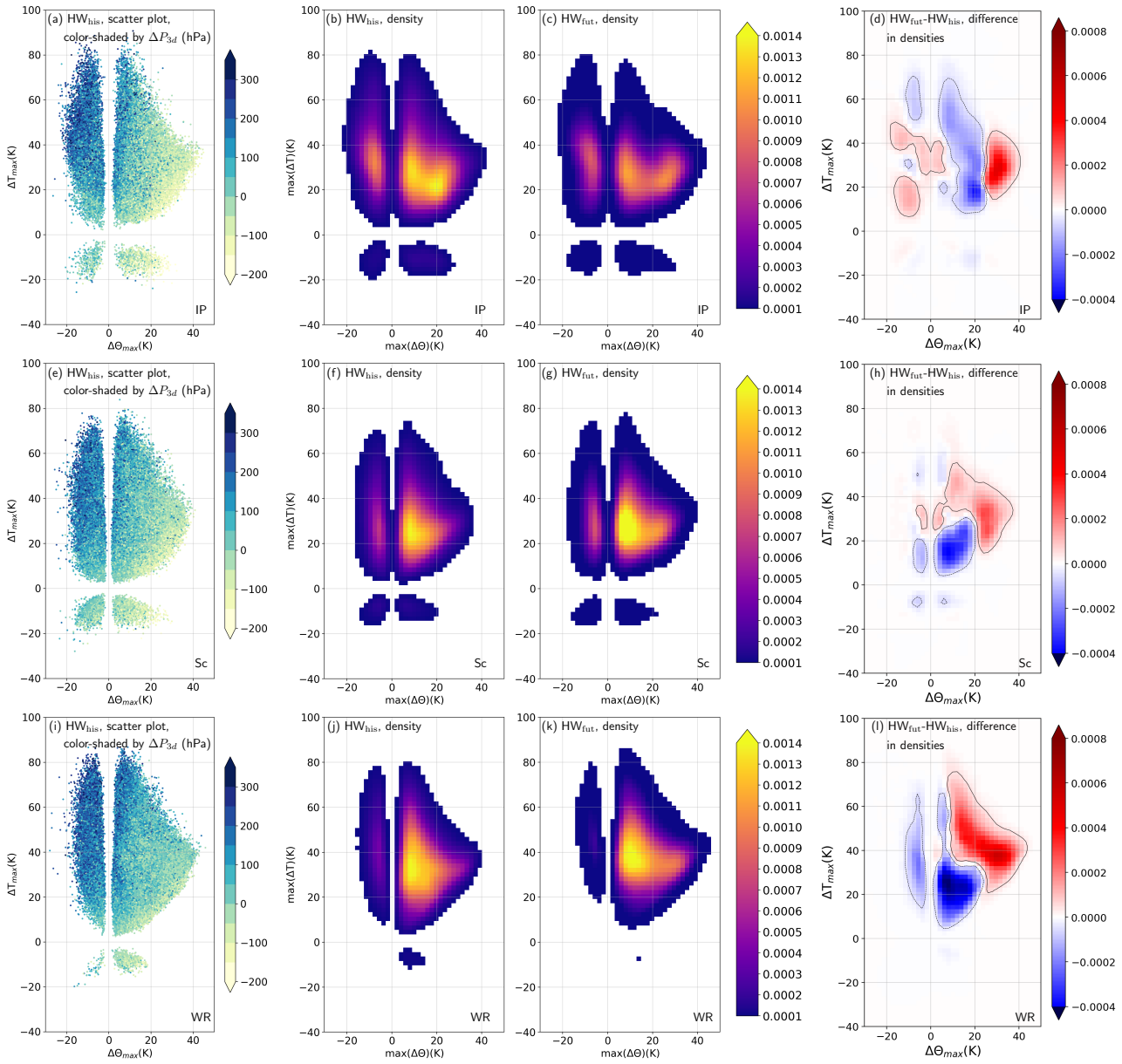


Supplementary Figure S3: Spatial distribution of trajectories 3 days prior to the arrival in BI: (a) heatwaves in the historic time slice (b) heatwaves in the future time slice (c) JJA climatology, historic (d) JJA climatology, future. Colored lines represent the 2.2‰ for heatwave parcels and 1‰ (for JJA climatology),respectively: orange: parcels in category A; red: Bsd; cyan: Bwd. Violet contour represents the 0.1‰ density of backward trajectories seven days before initiation (a) in BI.

Thermodynamic properties of the trajectories



Supplementary Figure S4: Thermodynamic properties of trajectories in regions (a)-(d) BI, (e)-(h) CE and (i)-(l) GI: (a,e,i) Scatterplot of properties, each dot represents the properties of one trajectory, descent/ascent in the three days prior to the heatwave ΔP_{3d} are given by colors; (b,c,f,g,j,k) Probability density function (Gaussian kernel-density estimate determined with Python function scipy.stats.gaussian_kde()) of trajectory counts in CE for heatwaves (b,f,j) in the historic simulations and (c,g,k) in the future simulations. Violet to yellow colors give the probability in grids of $2K \times 2K$. Probabilities < 0.00001 are omitted; (d,h,l) Difference between PDFs shown in third minus second column; absolute values of probability differences smaller than < 0.000001 are omitted. Solid (dashed) black contour in (d), (h), (l) marks a value of $+0.00005$ (-0.00005) of the difference in PDFs.



Supplementary Figure S5: As in Fig. S4, but for (a)-(d) IP, (e)-(h) Sc and (i)-(l) WR.