

Rapid Climate Action is Needed: Comparing Heat vs. COVID-19-related Mortality

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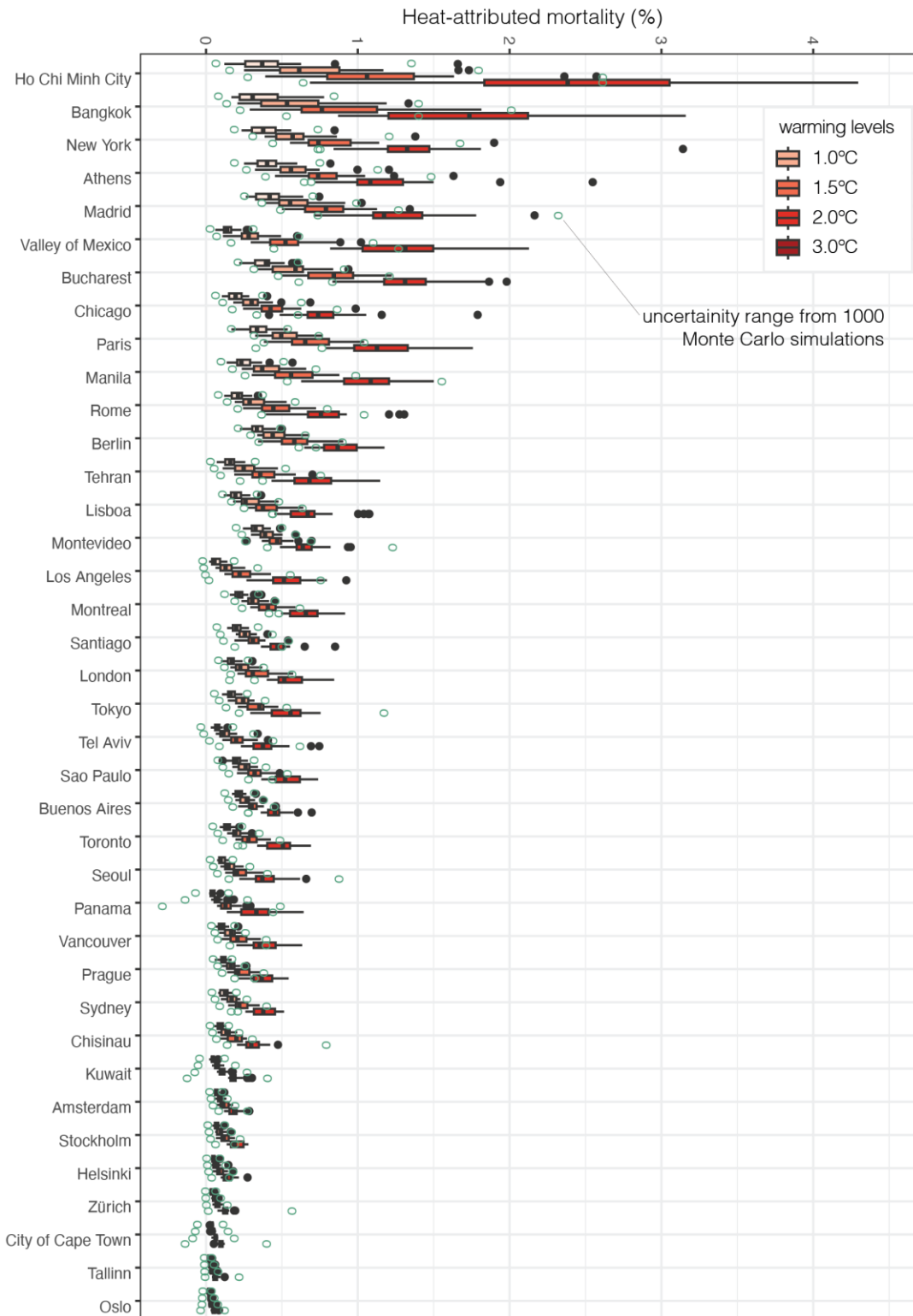
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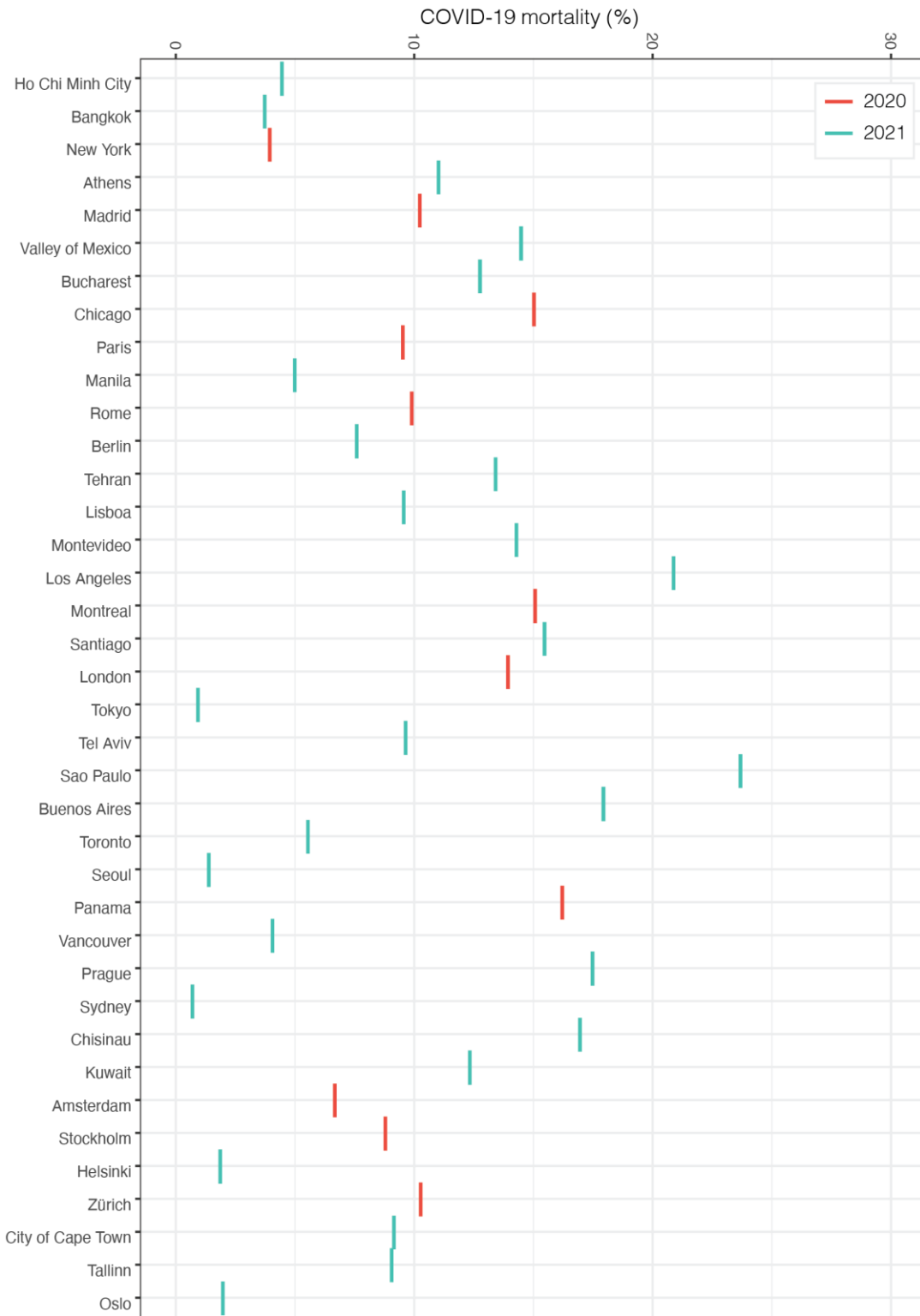
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Supplementary Figure 1. Mortality due to heat for 4 GWLs is shown in boxplots, highlighting the range of 31 CMIP6 GCMs. The 95% confidence intervals (CIs) calculated for the 31 GCMs is indicated by green circles. The values have been obtained by dividing COVID-19-related mortality in 2020/2021 by the average heat-related mortality for each global warming level (GWL), expressed as attributable mortality fraction (%).



Supplementary Figure 2. Maximum mortality due to COVID-19 in either 2020 or 2021.

Supplementary Table 1. The number of years required for heat-related mortality to reach COVID-19 mortality in years at four global warming levels. The values represent median of 31 models. 95% confidence intervals are represented in the parenthesis.

Country	City	+1.0 °C	+1.5 °C	+2.0 °C	+3.0 °C
Argentina	Buenos Aires	84 [55-105]	67 [48-93]	60 [39-85]	40 [26-50]
Australia	Sydney	6 [4-10]	5 [3-8]	4 [2-5]	2 [2-3]
Brazil	Sao Paulo	118 [86-217]	91 [69-136]	74 [49-116]	46 [32-65]
Canada	Montreal	70 [42-97]	50 [34-65]	37 [26-52]	23 [17-31]
Canada	Toronto	41 [26-62]	29 [18-40]	20 [13-29]	11 [8-17]
Canada	Vancouver	40 [20-65]	25 [18-47]	20 [11-43]	12 [7-21]
Chile	Santiago	78 [55-111]	61 [38-79]	50 [29-83]	33 [18-43]
Czech Republic	Prague	156 [104-302]	107 [66-166]	83 [50-126]	48 [32-82]
Estonia	Tallinn	486 [226-767]	341 [152-611]	267 [123-537]	156 [74-234]
Finland	Helsinki	38 [21-65]	29 [13-52]	23 [11-42]	15 [7-20]
France	Paris	29 [18-57]	19 [12-30]	15 [9-25]	9 [5-12]
Germany	Berlin	23 [15-34]	17 [11-23]	13 [8-22]	9 [7-12]
Greece	Athens	28 [14-44]	20 [9-34]	15 [7-24]	10 [4-16]
Iran	Tehran	85 [52-190]	54 [28-122]	38 [19-72]	20 [12-31]
Israel	Tel Aviv	136 [69-304]	84 [29-150]	49 [24-90]	26 [13-42]
Italy	Rome	47 [29-83]	35 [19-53]	23 [14-41]	13 [8-25]
Japan	Tokyo	6 [4-10]	4 [3-7]	3 [2-5]	2 [1-3]
Kuwait	Kuwait	274 [157-590]	179 [103-307]	120 [70-173]	69 [41-85]
Mexico	Valley of Mexico	104 [52-236]	52 [24-131]	28 [14-49]	11 [7-18]
Moldova	Chisinau	184 [128-360]	126 [83-226]	85 [63-181]	57 [36-83]
Netherlands	Amsterdam	99 [56-145]	75 [50-130]	59 [38-97]	37 [24-56]
Norway	Oslo	126 [70-188]	91 [48-185]	71 [31-137]	42 [24-67]
Panama	Panama	429 [171-760]	228 [89-476]	127 [56-221]	49 [25-119]
Philippines	Manila	22 [9-37]	14 [8-21]	9 [6-17]	5 [3-8]
Portugal	Lisboa	50 [27-82]	37 [20-54]	26 [15-35]	14 [9-21]
Romania	Bucharest	32 [21-59]	22 [14-37]	15 [11-26]	10 [6-15]
South Africa	City of Cape Town	240 [190-374]	186 [140-336]	142 [117-255]	90 [75-179]
South Korea	Seoul	15 [10-20]	10 [6-16]	7 [4-12]	4 [2-7]
Spain	Madrid	25 [14-39]	19 [10-26]	13 [8-21]	9 [5-14]
Sweden	Stockholm	130 [75-212]	91 [55-146]	75 [47-135]	47 [32-65]
Switzerland	Zürich	283 [189-497]	191 [123-293]	144 [86-245]	86 [54-136]
Thailand	Bangkok	12 [5-23]	7 [3-18]	5 [2-13]	2 [1-4]
UK	London	83 [46-141]	62 [38-87]	45 [24-68]	27 [17-35]
Uruguay	Montevideo	44 [29-59]	37 [24-48]	31 [21-54]	23 [15-30]
USA	Chicago	77 [37-144]	50 [22-84]	36 [15-62]	20 [8-36]

USA	Los Angeles	382 [149-990]	163 [81-332]	95 [49-172]	41 [23-78]
USA	NewYork	11 [5-17]	7 [3-10]	5 [2-7]	3 [1-5]
Vietnam	Ho Chi Minh City	12 [3-37]	7 [3-18]	4 [2-12]	2 [1-7]

Supplementary Table 2. Description of the observed temperature and mortality data in the MCC locations.

Country	City	Data period	Mortality data origin	Temperature data origin	Notes on data
Netherland	Amsterdam	1995 - 2016	All causes provided by Statistics Netherlands	Mean daily temperature (in °C) and relative humidity (%) were obtained from the Royal Dutch Meteorological Institute (KNMI) as 24-hour average based on hourly measurements	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
Greece	Athens	2001- 2010	All causes provided by Hellenic Statistical Authority	Mean daily temperature (in °C) and relative humidity (%) were computed as the 24-h average based on hourly measurements collected from the National observatory of Athens (http://www.noa.gr/) from site "Thisio" located in the city of Athens.	Missing data amount for 0.00% and 7.05% of the mortality and temperature series, respectively.
Thailand	Bangkok	1999 - 2008	Non-external (ICD-9: 0-799; ICD-10: A00-R99) mortality, provided the Ministry of Public Health, Thailand.	Mean daily temperature (in °C) and relative humidity (in %), computed as the average between daily minimum and maximum, were obtained from the Meteorological Department, Ministry of Information and Communication Technology, Thailand.	Missing data amount for 0.00% and 4.99% of the mortality and temperature series, respectively. The region of Phetchabun was excluded because of high percentage of missing data.
Germany	Berlin	1993 - 2015	All causes provided by Research Data Centres of the Federation and the Federal States of	Mean daily temperature (in °C), computed as the 24-h average based on	Missing data amount for 0.00% and 0.00% of the

			Germany (Forschungsdatenzentrum der Statistischen Ämter des Bundes und der Länder),	hourly measurements, was obtained from the Climate Data Centre of the German National Meteorological Service (Deutscher Wetterdienst).	mortality and temperature series, respectively
Romania	Bucharest	1994 - 2016	All causes provided by Romanian National Institute of Statistics	Meteorological data (temperature and relative humidity) were obtained from stations operated by the National Meteorological Administration of Romania (NMA RO) (measurements in standard climatic terms, mean daily) by https://www.ecad.eu/	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
Argentina	Buenos Aires	2005 - 2015	Non-external causes only (ICD-9: 0-799; ICD-10: A00-R99) from National Ministry of Health.	Mean daily temperature (in °C) and relative Humidity (in %), computed as the 24-hour average based on hourly measurements from one meteorological station in each city provided by the National Weather Service.	Missing data amount for 0.91% and 0.00% of the mortality and temperature series, respectively
USA	Chicago Los Angeles New York	1991 - 2006	All causes provided by the National Center for Health Statistics (NCHS).	Mean daily temperature (in °C) and relative humidity (%), computed as the 24-hour average based on hourly measurements, were obtained from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA).	Missing data amount for 2.65% and 2.70% of the mortality and temperature series, respectively. 1 city was excluded (Nampa) because of high percentage of missing.
Moldova	Chisinau	2001-2010	All causes provided by National Centre for Health Management.	Mean daily temperature (in °C) computed as the average between daily minimum and maximum, were obtained from State	Missing data amount for 0.00% and 0.00% of the mortality and

				Hydrometeorological Service, Moldova. A single weather station was selected for each city	temperature series, respectively
South Africa	City of Cape Town	1997-2013	All causes provided by Statistics South Africa	Mean daily temperature (in °C) was computed as the average between daily minimum and maximum collected from the Agricultural Research Council of South Africa and the National Oceanic and Atmospheric Administration (NOAA).	Missing data amount for 0.00% and 12.27% of the mortality and temperature series, respectively 7 locations were excluded because of a high % of missing data or unstable temporal patterns in the mortality data, possibly due to problems with data collection.
Finland	Helsinki	1994 - 2014	All causes provided by Statistics Finland	Mean daily temperature (in °C), Finnish Meteorological Institute. The weather stations around the country were interpolated onto a 10Å~10 km grid covering the whole of Finland, using a Kriging model.	Missing data amount for 0.00% and 4.88% of the mortality and temperature series, respectively
Vietnam	Ho Chi Minh City	2010 - 2013	All causes provided by Provincial Department of Health.	Mean daily temperature (in °C), and relative humidity (in %) computed as computed from the 24-h average of hourly measurements, were obtained from National Oceanic and Atmospheric Administration's (NOAA) National	Missing data amount for 0.00% and 0.57% of the mortality and temperature series, respectively

				Climate Data Center (NCDC). A single weather station was selected for each city.	
Kuwait	Kuwait	2000 - 2016	Non-external causes only (ICD-9: 0-799; ICD-10: A00-R99) provided by the National Center for Health Information, Ministry of Health, Kuwait	Mean daily temperature (in °C) and relative humidity. (in %), computed as the 24-hour average based on hourly measurements from two sources: the Directorate General of Civil Aviation (Kuwait Airport) and Kuwait's Environmental Public Authority.	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
Portugal	Lisboa	1991 - 2018	All causes provided by Statistics Portugal.	Mean daily temperature (in °C) was computed as the 24-hour average based on hourly measurements collected from the National Oceanic and Atmospheric Administration (NOAA)	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
UK	London	1991 - 2019	All causes provided by the Office of National Statistics.	Mean daily temperature (in °C) and relative humidity (%) were computed as the 24-hour average based on hourly measurements from UKCP09 5kmx5km product	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
Spain	Madrid	1991 - 2014	Non-external causes (ICD-9: 0-799; ICD-10: A00-R99) from the Spain National Institute of Statistics.	Mean daily temperature (in °C), computed as the 24-hour average based on hourly measurements, and was obtained from weather stations of the Spain National Meteorology Agency. A single weather station, located within the urban area or at the near airport, was selected for each city	Missing data amount for 0.00% and 0.84% of the mortality and temperature series, respectively
Philippines	Manila	2006 - 2019	All causes provided by Philippine Statistics Agency	Mean daily temperature (in °C), computed as 24-hour average based on hourly measurements, were obtained from	Missing data amount for 0.04% and 0.00% of the mortality and

				National Oceanic and Atmospheric Administration (NOAA).	temperature series, respectively
Uruguay	Montevideo	2012 - 2016	Non-external causes are provided by the Ministerio de Salud Publica (MSP).	Temperature data are provided by the Instituto Uruguayo de Meteorología (INUMET)	Missing data amount for 0.00% and 0.00% of the mortality and temperature series, respectively
Canada	Montreal Toronto Vancouver	1991 - 2015	All causes collected from Canadian Mortality Database.	Mean daily temperature (in °C) and relative humidity (in %), computed as the 24-hour average based on hourly measurements, were obtained from Environment Canada collected from monitoring stations located closest to the CMA centre.	Missing data amount for 0.82% and 2.79% of the mortality and temperature series, respectively
Norway	Oslo	1991 - 2018	All causes provided by Norwegian Cause of Death registry	Mean daily temperature (in °C) based on an observational modeled dataset from the Norwegian Meteorological Institute.	Missing data amount for 2.02% and 3.85% of the mortality and temperature series, respectively
Panama	Panama	2013 - 2016	All causes provided by Instituto Nacional de Estadística y Censo, Centro de Información Estadística.	Temperature data are provided by the Empresa de Transmisión Eléctrica, S.A. (ETESA). Open Access.	Missing data amount for 0.00% and 10.66% of the mortality and temperature series, respectively
France	Paris	2000 - 2017	All causes provided by French National Institute of Health and Medical Research (CepiDC),	Mean daily temperature (in °C), computed as the mean of the minimal and maximal temperature, were obtained from the Meteo France. A single weather station was selected for each city.	Missing data amount for 0.25% and 0.04% of the mortality and temperature series, respectively
Czech Republic	Prague	1994 - 2019	All causes provided by the Czech Statistical	Meteorological data (temperature and	Missing data amount for 0.00% and

			Office and the Institute of Health Information and Statistics	relative humidity) were obtained from stations operated by the Czech Hydrometeorological Institute (measurements in standard climatic terms 7:00, 14:00 and 21:00 local time, and daily means)	0.00% of the mortality and temperature series, respectively
Italy	Rome	2006 - 2015	All causes provided by the obtained from local mortality registries and from the rapid mortality surveillance system	Mean daily temperature (in °C) was computed as the 24-h average based on 6-h measurements obtained from the Meteorological Service of the Italian Air Force. A single weather station was selected for each city, using the airport monitoring station located closest to the city center.	Missing data amount for 1.26% and 2.34% of the mortality and temperature series, respectively. Data on 12 cities were initially collected, but 1 (Rieti) was excluded because of potential problems in data collection (strange temporal patterns).
Chile	Santiago	2008 - 2014	All causes provided by the Departamento de Estadísticas e Información de Salud (Ministerio de Salud)	Mean daily temperature (in °C), computed as 24-hour average based on hourly measurements, were obtained from Sistema de Información Nacional de Calidad del Aire (SINCA), Ministerio del Medio Ambiente.	Missing data amount for 0.15% and 9.7% of the mortality and temperature series, respectively
Brazil	Sao Paulo	1997 - 2018	Non-external causes only (ICD-9: 0-799; ICD-10: A00-R99) from the Ministry of Health.	Mean daily temperature (in °C) and relative humidity (in %), computed from the 24-h average of hourly measurements, from weather stations located within the urban area provided by National Institute of	Missing data amount for 1.85% and 3.21% of the mortality and temperature series, respectively

				Meteorology of Brazil	
South Korea	Seoul	1997 - 2018	All causes provided by Korea Bureau of Statistics	Mean daily temperature (in °C) and relative humidity (in %), computed as the 24-hour average based on hourly measurements, were obtained from weather stations located within the urban area managed by Korea Meteorological Administration.	Missing data amount for 0.00% and 0.01% of the mortality and temperature series, respectively
Sweden	Stockholm	1991 - 2016	All causes provided by the Swedish Cause of Death Register at the Swedish National Board of Health and Welfare	Mean daily temperature (in °C) and relative humidity (%), computed as the 24-hour average based on hourly measurements, were obtained from the Environment and Health Administration.	Missing data amount for 0.00% and 2.06% of the mortality and temperature series, respectively
Australia	Sydney	1991 - 2009	Non-external causes only (ICD-9: 0-799; ICD-10: A00-R99) from Australian Bureau of Statistics.	Mean daily temperature (in °C) and relative humidity (in %), computed as the 24-hour average based on hourly measurements from meteorological stations located within ≤30 km of each city provided by Australian Bureau of Meteorology.	Missing data amount for 0.18% and 0.00% of the mortality and temperature series, respectively
Estonia	Tallinn	1997 - 2019	All causes provided by Estonian Causes of Death Registry	Mean daily temperature (in °C) and relative humidity (%) were computed as the 24-h average of hourly measurements collected from Estonian Environment Agency.	Missing data amount for 0.0% and 0.0% of the mortality and temperature series, respectively
Iran	Tehran	2004-2013	All causes provided by the Ferdows organization of Mashhad Municipality	Mean, Max, Min daily temperature (in °C) and relative humidity (in %), computed as the 24-hour average based on hourly measurements collected from IRAN Meteorological Organization (IRIMO) (http://www.irimo.ir)	Missing data amount for 0.00% and 0.00% of the mortality and temperature series respectively

Israel	Tel Aviv	1991 - 2019	All causes provided by the Israeli Central Bureau of Statistics	Israel Meteorological Service (the most representative station for Tel Aviv, selected after consulting with the meteorological service experts)	Missing data amount for 1.45% and 0.38% of the mortality and temperature series, respectively
Japan	Tokyo	1991 - 2019	All causes provided by Ministry of Health, Labour and Welfare.	Weather station located within the urban area of the capital city (Japan Meteorology Agency)	Missing data amount for 0.00% and 0.04% of the mortality and temperature series, respectively
Canada	Toronto	1991 - 2015	All causes collected from Canadian Mortality Database.	Mean daily temperature (in °C) and relative humidity (in %), computed as the 24-hour average based on hourly measurements, were obtained from Environment Canada collected from monitoring stations located closest to the CMA centre.	Missing data amount for 0.82% and 2.79% of the mortality and temperature series, respectively.
Mexico	Valley of Mexico	1998 - 2014	All causes provided by National Institute of Statistics, Geography and Informatics	Mean daily temperature (in °C) and relative humidity (%) were computed as the 24-hour average based on hourly measurements collected through the Servicio Meteorológico Nacional (SMN) and the Instituto Nacional de Ecología y Cambio Climático (INECC).	Missing data amount for 0.00% and 27.03% of the mortality and temperature series, respectively
Switzerland	Zürich	1995 - 2013	Non-external causes only other than accidents (ICD-10codes A00-R99, V01-V99, W00-X59) provided from Federal Office of Statistics (Switzerland)	Mean daily temperature (in °C) and relative humidity (%), computed as the 24-hour average based on hourly measurements, were obtained from the IDAWEB database (a service provided by MeteoSwiss, the Swiss Federal Office of Meteorology and	Missing data amount for 0.0% and 0.0% of the mortality and temperature series, respectively

				Climatology). A single weather station located within or near the urban area was selected for each city.	
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Supplementary Table 3. National COVID-19 mortality, total mortality and average mortality fraction in 2020 and 2021. Percentage is represented by % in the table.

Country name	City	COVID-19 in 2020	COVID-19 in 2021	Total mortality in 2020	Total mortality in 2021	% in 2020	% in 2021	Used COVID-19 %
Netherland	Amsterdam	11,432	9,492	169,182.55	171,823.83	6.76	5.52	6.76
Greece	Athens	4,838	15,952	130,522.91	143,656.48	3.71	11.10	11.10
Thailand	Bangkok	61	21,637	521,772.35	567,223.94	0.01	3.81	3.81
Germany	Berlin	33,071	78,531	989,614.36	1,023,311.76	3.34	7.67	7.67
Romania	Bucharest	15,767	42,985	298,611.38	334,597.90	5.28	12.85	12.85
Argentina	Buenos Aires	43,245	73,924	386,110.88	410,217.33	11.20	18.02	18.02
USA	Chicago	7,860	4,126	52,037.00	47,077.00	15.10	8.76	15.10
Moldova	Chisinau	2,985	7,290	38,064.45	42,784.66	7.84	17.04	17.04
South Africa	City of Cape Town	28,469	62,676	554,208.16	678,972.26	5.14	9.23	9.23
Finland	Helsinki	592	1,122	55,295.43	57,626.58	1.07	1.95	1.95
Vietnam	Ho Chi Minh City	35	32,359	596,225.74	713,173.57	0.01	4.54	4.54
Kuwait	Kuwait	934	1,534	14,188.88	12,350.83	6.58	12.42	12.42
Portugal	Lisboa	6,906	12,049	123,564.97	124,934.28	5.59	9.64	9.64
UK	London	94,998	82,399	677,520.46	650,155.11	14.02	12.67	14.02
USA	Los Angeles	10,359	17,278	81,783.00	82,411.00	12.67	20.97	20.97
Spain	Madrid	50,837	38,568	492,602.81	450,449.63	10.32	8.56	10.32
Philippines	Manila	9,244	42,260	624,454.98	832,579.08	1.48	5.08	5.08
Uruguay	Montevideo	181	5,989	32,343.14	41,670.17	0.56	14.37	14.37
Canada	Montreal	8,356	3,368	55,142.00	55,142.00	15.15	6.11	15.15
USA	New York	3,338	1,391	82,952.00	82,952.00	4.02	1.68	4.02
Norway	Oslo	436	869	40,346.06	42,184.90	1.08	2.06	2.06
Panama	Panama	4,022	3,406	24,679.89	26,399.14	16.30	12.90	16.30
France	Paris	64,267	56,934	668,953.96	657,171.43	9.61	8.66	9.61
Czech Republic	Prague	11,580	24,549	129,444.08	139,726.77	8.95	17.57	17.57
Italy	Rome	74,159	63,243	742,985.64	709,316.02	9.98	8.92	9.98
Chile	Santiago	16,608	22,507	139,367.57	144,756.38	11.92	15.55	15.55
Brazil	Sao Paulo	19,5072	424,262	1,581,916.58	1,784,480.13	12.33	23.78	23.78
South Korea	Seoul	917	4,708	305,833.81	320,818.23	0.30	1.47	1.47
Sweden	Stockholm	8727	6,583	98,357.70	91,659.14	8.87	7.18	8.87
Australia	Sydney	909	1,344	161,628.32	172,110.13	0.56	0.78	0.78
Estonia	Tallinn	229	1,703	15,821.31	18,633.05	1.45	9.14	9.14
Iran	Tehran	55,223	76,383	485,944.50	565,963.13	11.36	13.50	13.50
Israel	Tel Aviv	3,325	4,918	48,840.03	50,569.38	6.81	9.73	9.73
Japan	Tokyo	3,492	14,900	1,401,497.10	1,470,474.64	0.25	1.01	1.01

Canada	Toronto	4,530	5,664	100,681.00	100,681.00	4.50	5.63	5.63
Mexico	Valley of Mexico	125,807	17,3621	1,175,564.16	1,191,788.53	10.70	14.57	14.57
Canada	Vancouver	901	1522	36,759.00	36,759.00	2.45	4.14	4.14
Switzerland	Zürich	7873	4344	76,015.87	71,367.92	10.36	6.09	10.36

Supplementary Table 4. List of CMIP6 GCMs.

No	GCM Name	Resolution	Ensemble
1	ACCESS-CM2	native atmosphere N96 grid (144x192 latxlon); N96 192 x 144 longitude/latitude 85 levels top level 85 km	r1i1p1f1
2	ACCESS-ESM1-5	native atmosphere N96 grid (145x192 latxlon); r1.1, N96 192 x 145 longitude/latitude 38 levels top level 39255 m	r1i1p1f1
3	AWI-CM-1-1-MR	All grid attributes are set for the native grid; T127L95 native atmosphere T127 gaussian grid 384 x 192 longitude/latitude 95 levels top level 80 km	r1i1p1f1
4	BCC-CSM2-MR	T106 (320 x 160 longitude/latitude) 46 levels top level 1.46 hPa	r1i1p1f1
5	CAMS-CSM1-0	T106 (320 x 160 longitude/latitude) 31 levels top level 10 mb	r2i1p1f1
6	CESM2-WACCM	native 0.9x1.25 finite volume grid (192x288 latxlon); 0.9x1.25 finite volume grid 288 x 192 longitude/latitude 70 levels top level 4.5e-6 mb	r2i1p1f1
7	CESM2	native 0.9x1.25 finite volume grid (192x288 latxlon); 0.9x1.25 finite volume grid 288 x 192 longitude/latitude 70 levels top level 4.5e-6 mb	r1i1p1f1
8	CMCC-CM2-SR5	native atmosphere regular grid 1-degree 288 x 192 longitude/latitude	r1i1p1f1
9	CMCC-ESM2	native atmosphere regular grid 1deg; 288 x 192 longitude/latitude; 30 levels; top at ~2 hPa	r1i1p1f1
10	CNRM-CM6-1-HR	data regridded to a 359 gaussian grid (360x720 latlon) from a native atmosphere T359I reduced gaussian grid	r1i1p1f2
11	CNRM-CM6-1	data regridded to a T127 gaussian grid (128x256 latlon) from a native atmosphere T127I reduced gaussian grid	r1i1p1f2
12	CNRM-ESM2-1	data regridded to a T127 gaussian grid (128x256 latlon) from a native atmosphere T127I reduced gaussian grid; atmos: Arpege 6.3 (T127 Gaussian Reduced with 24572 grid points in total distributed over 128 latitude circles (with 256 grid points per latitude circle between 30degN and 30degS reducing to 20 grid points per latitude circle at 88.9degN and 88.9degS) 91 levels top level 78.4 km)	r1i1p1f2
13	CanESM5	T63L49 native atmosphere, T63 Linear Gaussian Grid 128 x 64 longitude/latitude 49 levels top level 1 hPa	r1i1p1f1
14	EC-Earth3-CC	T255L91; IFS cy36r4 (TL255, linearly reduced Gaussian grid equivalent to 512 x 256 longitude/latitude 91 levels top level 0.01 hPa)	r1i1p1f1
15	EC-Earth3	T255L91; IFS cy36r4 (TL255, linearly reduced Gaussian grid equivalent to 512 x 256 longitude/latitude; 91 levels; top level 0.01 hPa)	r1i1p1f1
16	FGOALS-g3	native atmosphere area-weighted latxlon grid (80x180 latxlon); (180 x 90 longitude/latitude 26 levels top level 2.19hPa)	r1i1p1f1
17	GFDL-CM4	Cubed-sphere (c96) – 1-degree nominal horizontal resolution; 360 x 180 longitude/latitude; 33 levels; top level 1 hPa	r1i1p1f1
18	GFDL-ESM4	atmos data regridded from Cubed-sphere (c96) to 180,288 interpolation method: conserve_order2; (Cubed-sphere (c96) - 1	r1i1p1f1

		degree nominal horizontal resolution 360 x 180 longitude/latitude 49 levels top level 1 Pa)	
19	INM-CM4-8	gs2x1.5 2x1.5; 180 x 120 longitude/latitude; 21 levels; top level sigma = 0.01	r1i1p1f1
20	INM-CM5-0	gs2x1.5 2x1.5; 180 x 120 longitude/latitude; 73 levels; top level sigma = 0.0002	r1i1p1f1
21	IPSL-CM6A-LR	LMDZ grid NPv6, N96; 144 x 143 longitude/latitude; 79 levels; top level 40000 m	r1i1p1f1
22	KIOST-ESM	atmos data regridded from Cubed-sphere (c48) to 94X192; (cubed sphere (C48) 192 x 96 longitude/latitude 32 vertical levels top level 2 hPa)	r1i1p1f1
23	MIROC6	native atmosphere T85 Gaussian grid T85; 256 x 128 longitude/latitude; 81 levels; top level 0.004 hPa	r1i1p1f1
24	MIROC-ES2L	native atmosphere T42 Gaussian grid; (T42 128 x 64 longitude/latitude 40 levels top level 3 hPa)	r1i1p1f2
25	MPI-ESM1-2-HR	spectral T127; 384 x 192 longitude/latitude; 95 levels; top level 0.01 hPa	r1i1p1f1
26	MPI-ESM1-2-LR	spectral T63; 192 x 96 longitude/latitude; 47 levels; top level 0.01 hPa	r1i1p1f1
27	MRI-ESM2-0	native atmosphere TL159 gaussian grid (160x320 lat x lon) TL159; 320 x 160 longitude/latitude; 80 levels; top level 0.01 hPa	r1i1p1f1
28	NESM3	T63; (T63 192 x 96 longitude/latitude 47 levels top level 1 Pa)	r1i1p1f1
29	NorESM2-LM	finite-volume grid with 1.9x2.5 degree lat/lon resolution; (2 degree resolution 144 x 96 32 levels top level 3 mb)	r1i1p1f1
30	NorESM2-MM	finite-volume grid with 0.9x1.25 degree lat/lon resolution; (1 degree resolution 288 x 192 32 levels top level 3 mb)	r1i1p1f1
31	TaiESM1	finite-volume grid with 0.9x1.25 degree lat/lon resolution; (0.9x1.25 degree 288 x 192 longitude/latitude 30 levels top level ~2 hPa)	r1i1p1f1

Supplementary Table 5. COVID-19- and heat-related mortalities (% of total mortality) at four global warming levels for 38 cities. 95% confidence intervals are represented in the parenthesis.

City	COVID-19	+1.0 °C	+1.5 °C	+2.0 °C	+3.0 °C
Buenos Aires	18.02	0.22 [0.13-0.33]	0.27 [0.16-0.39]	0.30 [0.19-0.46]	0.45 [0.29-0.69]
Sydney	0.78	0.13 [0.05-0.21]	0.17 [0.07-0.28]	0.22 [0.10-0.41]	0.38 [0.18-0.63]
Sao Paulo	23.78	0.20 [0.09-0.33]	0.26 [0.12-0.40]	0.32 [0.16-0.55]	0.52 [0.29-0.84]
Montreal	15.15	0.22 [0.13-0.36]	0.30 [0.20-0.47]	0.41 [0.25-0.63]	0.66 [0.43-0.95]
Toronto	5.63	0.14 [0.05-0.25]	0.19 [0.09-0.36]	0.28 [0.12-0.50]	0.51 [0.22-0.80]
Vancouver	4.14	0.10 [0.05-0.20]	0.17 [0.07-0.27]	0.21 [0.09-0.41]	0.35 [0.17-0.69]
Santiago	15.55	0.20 [0.08-0.35]	0.26 [0.10-0.45]	0.31[0.12-0.55]	0.47 [0.20-0.84]
Prague	17.57	0.11 [0.06-0.18]	0.16 [0.09-0.27]	0.21 [0.12-0.39]	0.37 [0.20-0.58]
Tallinn	9.14	0.02 [0.00-0.05]	0.03 [0.00-0.06]	0.03 [0.00-0.09]	0.06 [0.00-0.13]
Helsinki	1.95	0.05 [0.01-0.10]	0.07 [0.02-0.14]	0.09 [0.03-0.19]	0.13 [0.05-0.27]
Paris	9.61	0.34 [0.18-0.55]	0.50 [0.33-0.75]	0.65 [0.39-1.05]	1.13 [0.77-1.69]
Berlin	7.67	0.33 [0.22-0.50]	0.44 [0.30-0.66]	0.58 [0.36-0.91]	0.87 [0.62-1.24]
Athens	11.10	0.40 [0.20-0.76]	0.56 [0.28-1.14]	0.74 [0.40-1.49]	1.08 [0.66-2.33]
Tehran	13.50	0.16 [0.04-0.33]	0.25 [0.06-0.53]	0.36 [0.11-0.77]	0.68 [0.23-1.29]

Tel Aviv	9.73	0.07 [-0.02-0.19]	0.12 [-0.01-0.32]	0.20 [0.03-0.45]	0.37 [0.10-0.82]
Rome	9.98	0.21 [0.09-0.38]	0.29 [0.15-0.60]	0.44 [0.22-0.81]	0.76 [0.38-1.40]
Tokyo	1.01	0.16 [0.07-0.28]	0.25 [0.10-0.40]	0.35 [0.14-0.54]	0.56 [0.23-0.89]
Kuwait	12.42	0.05 [-0.03-0.13]	0.07 [-0.04-0.20]	0.10 [-0.06-0.28]	0.18 [-0.11-0.46]
Valley of Mexico	14.57	0.14 [0.04-0.32]	0.28 [0.08-0.62]	0.52 [0.18-1.11]	1.31 [0.46-2.51]
Chisinau	17.04	0.09 [0.04-0.16]	0.14 [0.05-0.23]	0.20 [0.08-0.31]	0.30 [0.15-0.50]
Amsterdam	6.76	0.07 [0.03-0.12]	0.09 [0.04-0.15]	0.11 [0.06-0.20]	0.18 [0.09-0.30]
Oslo	2.06	0.02 [-0.01-0.05]	0.02 [-0.01-0.06]	0.03 [-0.02-0.09]	0.05 [-0.03-0.13]
Panama	16.30	0.04 [-0.06-0.16]	0.07 [-0.13-0.28]	0.13 [-0.28-0.50]	0.33 [-1.05-1.17]
Manila	5.08	0.23 [0.11-0.52]	0.37 [0.18-0.73]	0.56 [0.27-1.00]	1.08 [0.54-1.72]
Lisboa	9.64	0.19 [0.12-0.35]	0.26 [0.18-0.49]	0.37 [0.26-0.64]	0.67 [0.45-1.11]
Bucharest	12.85	0.40 [0.22-0.62]	0.59 [0.33-0.92]	0.84 [0.48-1.22]	1.31 [0.84-1.98]
City of Cape Town	9.23	0.04 [-0.05-0.12]	0.05 [-0.06-0.15]	0.06 [-0.08-0.20]	0.10 [-0.13-0.31]
Seoul	1.47	0.10 [0.04-0.19]	0.15 [0.06-0.30]	0.20 [0.08-0.42]	0.37 [0.16-0.72]
Madrid	10.32	0.42 [0.26-0.71]	0.55 [0.38-1.00]	0.79 [0.50-1.28]	1.17 [0.75-2.06]
Stockholm	8.87	0.07 [0.02-0.13]	0.10 [0.03-0.18]	0.12 [0.04-0.23]	0.19 [0.07-0.35]
Zürich	10.36	0.04 [0.01-0.07]	0.05 [0.01-0.11]	0.07 [0.01-0.15]	0.12 [0.02-0.24]
Bangkok	3.81	0.31 [0.09-0.85]	0.53 [0.15-1.41]	0.76 [0.23-2.02]	1.73 [0.54-3.65]
London	14.02	0.17 [0.09-0.29]	0.23 [0.13-0.39]	0.31 [0.17-0.58]	0.52 [0.33-0.90]
Montevideo	14.37	0.33 [0.21-0.51]	0.39 [0.25-0.60]	0.47 [0.27-0.70]	0.64 [0.41-1.00]
Chicago	15.10	0.19 [0.07-0.38]	0.30 [0.12-0.64]	0.42 [0.18-0.87]	0.74 [0.34-1.56]
Los Angeles	20.97	0.05 [-0.01-0.20]	0.13 [-0.01-0.35]	0.22 [0.01-0.56]	0.51 [0.03-1.18]
New York	4.02	0.38 [0.20-0.75]	0.57 [0.32-1.22]	0.74 [0.45-1.68]	1.32 [0.76-2.82]
Ho Chi Minh City	4.54	0.37 [0.07-1.36]	0.61 [0.17-1.81]	1.06 [0.29-2.62]	2.38 [0.65-4.50]