Supplementary Information to "A Simulation-Based Framework for Assessing Crisis-Response Capacity of Public Authorities and Emergency Response Organizations: A Heat-Drought Case Study"

1 Resource lists and mission types of the process model

The following tables list resources and mission types defined in the process simulation for the heat-drought scenario presented in the main text.

Table 1: Mission types and associated resource needs for the ambulance service.

Missions	**Required resources (type and quantity)**
Emergency call centre request	1 emergency call centre staff member
Intensive care transport helicopter deployment	1 intensive care transport helicopter (ITH); 1 emergency physician; 1 HEMS paramedic
Intensive care transport vehicle deployment	1 intensive care transport vehicle (ITW); 2 paramedics; 1 intensive care physician
Patient transport vehicle deployment	1 patient transport vehicle (KTW); 2 emergency medical technicians
Emergency physician deployment	1 emergency physician response vehicle (NEF); 1 emergency physician; 1 paramedic
Emergency ambulance deployment	1 emergency ambulance (RTW); 1 paramedic; 1 emergency medical technician
S-RTW deployment	1 S-RTW; 1 paramedic; 1 emergency medical technician
Tele-emergency deployment	1 tele-emergency physician

Note. Vehicle abbreviations follow German ambulance service nomenclature.

Table 2: Mission types and associated resource needs for the fire brigade.

Missions	Required resources (type and quantity)
Roll-off container deployment	1 swap-body carrier vehicle (WLF); 1 roll-off container (AB); 2 operational personnel
A-duty officer deployment	1 command vehicle (KdoW); 1 coordination staff member
B-duty officer deployment	1 command vehicle (KdoW); 2 coordination staff members
Aerial ladder deployment	1 aerial ladder vehicle (DLK); 2 operational personnel
Command and control vehicle deployment	1 command and control vehicle (ELW/KdoW); 2 coordination staff members
Equipment vehicle deployment	1 equipment vehicle (GW/GW San/GW-L/GW-ATF/GW-W/PSNV/Presse); 6 operational personnel
Fire engine deployment	1 fire engine (HLF/LF/LF-L/LF-KatS); 6 operational personnel
Technical rescue vehicle deployment	1 technical rescue vehicle (RW); 2 operational personnel
Wastewater transport deployment	1 fire tanker (TLF); 2 operational personnel
Support for drinking-water treatment	1 personnel transport or multi-purpose vehicle (MTF/MW); 1 coordination staff member; 8 operational personnel
Support for drinking-water distribution	1 truck or support truck (LKW/BtLKW); 1 personnel transport or multi-purpose vehicle (MTF/MW); 2 coordination staff members; 8 operational personnel
Response personnel supply deployment	1 truck or support truck (LKW/BtLKW); 1 passenger car (PKW); 4 operational personnel

Note. Vehicle abbreviations follow German fire service nomenclature.

Table 3: Mission types and associated resource needs for the THW.

Missions	Required resources (type and quantity)
Rescue and recovery group deployment	1 equipment truck; 1 trailer with a deployment scaffolding system (7 t payload); 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Rescue and recovery group deployment for timber operations	1 equipment truck; 1 trailer with a deployment scaffolding system (7 t payload); 1 platform trailer with stanchions (ASH; 12 t payload); 1 group leader (GrFü); 1 squad leader (TrFü); 10 specialist responders (FaHe)
Rescue diving deployment	1 crew cargo truck IV with tail lift; 1 trailer with a special body for the rescue-diving specialist unit (FGr BT); 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)

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Missions	Required resources (type and quantity)
Bridge construction deployment	1 mobile crane (50 t lifting capacity); 1 multi-purpose equipment vehicle with tail lift; 1 platform trailer with container mounts (12 t payload); 1 group leader (GrFü); 3 squad leaders (TrFü); 14 specialist responders (FaHe)
Post-incident support team deployment	3 psychosocial support specialists (psFK); 11 peer supporters (Peer)
Incident-site safety deployment	1 personnel transport vehicle; 1 transport box with an incident-site safety system; 1 squad leader (TrFü); 3 specialist responders (FaHe)
Emergency power supply deployment	1 truck with tail lift (7 t payload); 1 trailer-mounted emergency generator (approximately 200 kVA); 1 trailer-mounted emergency generator (approximately 650 kVA); 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Command and communications specialist unit: command support	1 command and communications vehicle; 1 command and situation-management trailer; 1 group leader (GrFü); 2 squad leaders (TrFü); 4 specialist responders (FaHe)
Command and communications specialist unit: communications A	1 personnel transport vehicle; 1 telecommunications vehicle; 1 trailer with a special body for the communications specialist unit (FGr K); 1 trailer (2 t payload); 1 group leader (GrFü); 2 squad leaders (TrFü); 6 specialist responders (FaHe)
Command and communications specialist unit: communications B	2 personnel transport vehicles; 1 telecommunications vehicle; 1 trailer with a special body for the communications specialist unit (FGr K); 1 trailer (2 t payload); 1 mast vehicle; 1 trailer with microwave radio equipment (2 t payload); 1 group leader (GrFü); 3 squad leaders (TrFü); 9 specialist responders (FaHe)
Command and communications specialist unit: staff deployment	6 command and staff group members (Fü/SGL)
Command and communications specialist unit: platoon command group	1 command vehicle; 1 platoon leader (ZFü); 1 platoon command group leader (ZTrFü); 2 specialist responders (FaHe)
Logistics specialist unit: catering deployment	1 personnel transport vehicle; 1 truck with tail lift (7 t payload); 1 trailer with tail lift (12 t payload); 1 refrigerated trailer; 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)

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Missions	Required resources (type and quantity)
Logistics specialist unit: material management	1 crew cargo truck IV with tail lift; 1 truck with loading crane (9 t payload); 1 platform trailer with container mounts (12 t payload); 1 trailer with a special body for the logistics material-management specialist unit; 1 trailer (5 t payload); 1 forklift (3 t lifting capacity); 1 workshop container; 1 all-terrain passenger vehicle; 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Logistics specialist unit: heavy transport	1 tractor unit; 1 flatbed semi-trailer with tail lift; 1 container-compatible semi-trailer; 1 squad leader (TrFü); 3 specialist responders (FaHe)
Logistics specialist unit: platoon command group	1 command vehicle; 1 platoon leader (ZFü); 1 platoon command group leader (ZTrFü); 2 specialist responders (FaHe)
Infrastructure group deployment	1 personnel transport vehicle; 1 crew cargo truck IV with tail lift; 1 trailer with a special body for the infrastructure specialist unit (FGr I); 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Media team deployment	1 personnel transport vehicle; 1 trailer with a special body for the media team; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Mobile flood-gauge deployment	1 all-terrain personnel transport vehicle; 1 transport box with a mobile flood gauge; 1 squad leader (TrFü); 3 specialist responders (FaHe)
Emergency supply deployment	1 multi-purpose equipment vehicle with tail lift; 1 forklift (3 t lifting capacity); 1 platform trailer with container mounts; 1 trailer-mounted emergency generator with a lighting mast (50 kVA); 1 small boat with trailer; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Search and detection deployment A	1 personnel transport vehicle; 1 transport box with search-and-detection equipment; 1 dog transport trailer; 1 rescue dog; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Search and detection deployment B	1 personnel transport vehicle; 1 dog transport trailer; 1 rescue dog; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Search and detection deployment C	1 personnel transport vehicle; 1 transport box with search-and-detection equipment; 1 group leader (GrFü); 1 squad leader (TrFü); 4 specialist responders (FaHe)
Local section command staff deployment	1 personnel transport vehicle; 1 local section commissioner (OB); 1 deputy local section commissioner (stv. OB); 2 technical advisers (Fachb); 6 responders (He)

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Missions	Required resources (type and quantity)
Clearance and debris-removal deployment A	1 excavator; 1 tipper truck (9 t payload); 1 low-loader trailer with container mounts (18 t payload); 1 compressed-air generator trailer; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Clearance and debris-removal deployment B	1 wheel loader; 1 tipper truck (9 t payload); 1 low-loader trailer with container mounts (18 t payload); 1 compressed-air generator trailer; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Clearance and debris-removal deployment C	1 telescopic handler; 1 tipper truck (9 t payload); 1 low-loader trailer with container mounts (18 t payload); 1 compressed-air generator trailer; 1 group leader (GrFü); 1 squad leader (TrFü); 7 specialist responders (FaHe)
Heavy rescue and recovery deployment A	1 multi-purpose equipment vehicle with tail lift; 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Heavy rescue and recovery deployment B	1 multi-purpose equipment vehicle with tail lift; 1 walking excavator; 1 platform trailer with container mounts; 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Blasting deployment	1 personnel transport vehicle; 1 trailer with a special body for the blasting specialist unit (FGr Sp); 1 group leader (GrFü); 1 squad leader (TrFü); 4 specialist responders (FaHe)
Technical unit deployment	1 command vehicle; 1 platoon leader (ZFü); 1 platoon command group leader (ZTrFü); 2 specialist responders (FaHe)
Generic THW personnel deployment	1 personnel transport vehicle; 1 group leader (GrFü); 1 squad leader (TrFü); 6 specialist responders (FaHe)
Drinking-water supply deployment	2 trucks with tail lifts (7 t payload each); 1 trailer for a drinking-water treatment plant; 1 drinking-water treatment plant; 1 all-terrain forklift (2 t lifting capacity); 1 drinking-water laboratory container; 1 drinking-water tank container; 1 BDF platform trailer; 1 group leader (GrFü); 2 squad leaders (TrFü); 15 specialist responders (FaHe)
Unmanned aerial systems deployment	1 personnel transport vehicle; 1 drone; 1 transport box for a drone; 1 squad leader (TrFü); 3 specialist responders (FaHe)
Virtual Operations Support Team deployment	1 platoon leader (ZFü); 13 subordinate unit leaders (UFü); 32 specialist responders (FaHe)
Water-damage response A	1 crew cargo truck IV with tail lift; 1 truck with tail lift (7 t payload); 1 trailer with container mounts (7 t payload); 1 wastewater pump trailer (5,000 l/min); 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)

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Missions	Required resources (type and quantity)
Water-damage response B	1 crew cargo truck IV with tail lift; 1 truck with tail lift (7 t payload); 1 trailer with container mounts (7 t payload); 1 wastewater pump trailer (15,000 l/min); 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Water-damage response C	1 crew cargo truck IV with tail lift; 1 truck with tail lift (7 t payload); 1 trailer with container mounts (7 t payload); 1 wastewater pump trailer (25,000 l/min); 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Water operations deployment A	1 all-terrain truck with loading crane (7 t payload); 2 trailers with multipurpose workboats; 1 material container; 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Water operations deployment B	1 all-terrain truck with loading crane (7 t payload); 1 platform trailer with container mounts (12 t payload); 1 material container; 4 half-pontoons (2 t); 1 group leader (GrFü); 2 squad leaders (TrFü); 9 specialist responders (FaHe)
Oil-spill response A	1 truck with loading crane (7 t payload); 1 swap-body carrier truck; 1 roll-off container with a separation plant (160 m^3/h); 1 platform trailer with container mounts (12 t payload); 1 material container; 1 group leader (GrFü); 3 squad leaders (TrFü); 14 specialist responders (FaHe)
Oil-spill response B	1 truck with loading crane (9 t payload); 1 swap-body carrier truck; 1 platform trailer with container mounts (12 t payload); 1 material container; 1 group leader (GrFü); 3 squad leaders (TrFü); 14 specialist responders (FaHe)
Oil-spill response C	1 swap-body carrier truck; 1 roll-off container with a separation plant (40 m^3/h); 1 material container; 1 platform trailer with container mounts (12 t payload); 1 all-terrain forklift (3 t lifting capacity); 1 group leader (GrFü); 3 squad leaders (TrFü); 14 specialist responders (FaHe)

Note. English labels are descriptive translations of THW personnel designations. GrFü = group leader; TrFü = squad leader; FaHe = specialist responder; ZFü = platoon leader; ZTrFü = platoon command group leader; UFü = subordinate unit leader; psFK = psychosocial support specialist; FGr = specialist unit.

Table 4: Mission types and associated resource needs for the BBK.

Missions	**Required resources (type and quantity)**
Citizen service deployment	1 citizen service staff member
Specialist department deployment	1 specialist department staff member
Joint Information and Situation Centre (GMLZ) deployment	1 GMLZ coordination staff member
Media team deployment	1 media team staff member

Table 5: Resource types and default quantities represented in the process model. Default quantities used in the calculations are given in parentheses. For fire brigade and ambulance service, no numbers are reported for vehicles and technical equipment since the used numbers were based on confidential internal inventory lists. The numbers for the technical equipment of the THW was set proportionally to their frequency of occurrence in the definitions of the technical units.

Resource category	**Resource type (default quantity)**
Ambulance service	
Consumables	Consumable materials (150).
Personnel	Emergency call centre staff (20); emergency physicians (7); paramedics (45); emergency medical technicians (110); intensive care physicians (1); HEMS paramedics (1); tele-emergency physicians (999).
Vehicles and modules	Emergency ambulance (RTW) (-); emergency physician response vehicle (NEF) (-); patient transport vehicle (KTW) (-); intensive care transport vehicle (ITW) (-); S-RTW ambulance (S-RTW) (-); ambulance service equipment vehicle (GW RD) (-); roll-off container for mass-casualty incidents (AB-MANV) (-); intensive care transport helicopter (ITH) (-).
Fire brigade	
Consumables	Consumable materials (150).
Personnel	Coordination staff (24); operational personnel (100).
Firefighting and technical-rescue fleet	Fire engines (HLF/LF/LF-L/LF-KatS) (-); fire tanker (TLF) (-); TKM vehicle (TKM) (-); technical rescue vehicle (RW) (-); civil-protection hose-laying vehicle (SW-KatS) (-); aerial ladder vehicle (DLK) (-).
Command, transport, and logistics fleet	Roll-off container (AB) (-); swap-body carrier vehicle (WLF) (-); command and control vehicle (ELW/KdoW) (-); passenger car (PKW) (-); truck or support truck (LKW/BtLKW) (-); command vehicle (KdoW) (-); additional command vehicle (KdoW, supplementary) (-); BtKombi vehicle (BtKombi) (-).
Medical and personnel-transport fleet	Patient transport vehicle (KTW) (-); ambulance and patient-transport fleet (RTW/ITW/ISW/SRTW/Rettungsbus) (-); emergency physician response vehicle (NEF) (-); personnel transport or multi-purpose vehicle (MTF/MW) (-).
Specialist support assets	Miscellaneous trailers, driver-training trailers, refrigeration units, and RBA assets (Anh. (div.)/Fahrsch.A./Kühlaggregat/RBA) (-); special-purpose vehicle and equipment pool (ABC-Erk./FÜKA/KW/Dek-LKW-P/TELA/Tela-ABZ/Trecker/Krad/LB/LW-Robotik/RTW-Schule/LKW) (-).
Equipment and light assets	Equipment vehicle (GW/GW San/GW-L/GW-ATF/GW-W/PSNV/Presse) (-); e-bike or bicycle (-); forklift (-); small incident response vehicle (KEF) (-).
Federal Agency for Technical Relief (THW)	
Consumables	Consumable materials (150).

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Table 5 – continued from previous page

Resource category	Resource type (default quantity)
Roll-off containers and basic trailers	Roll-off container with separation plant (160 m^3/h) (10); roll-off container with separation plant (40 m^3/h) (10); trailer with tail lift (12 t payload) (25); trailer (2 t payload) (25); trailer (5 t payload) (25); BDF platform trailer (25); compressed-air generator trailer (25).
Operational trailers	Command and situation-management trailer (10); dog transport trailer (5); trailer with container mounts (7 t payload) (25); trailer with a deployment scaffolding system (7 t payload) (25); trailer with a multipurpose workboat (4); trailer with a special body for the rescue-diving specialist unit (FGr BT) (5); trailer with a special body for the infrastructure specialist unit (FGr I) (5).
Specialist-unit and power-supply trailers	Trailer with a special body for the communications specialist unit (FGr K) (10); trailer with a special body for the logistics material-management specialist unit (FGr Log-MW) (5); trailer with a special body for the blasting specialist unit (FGr Sp) (5); trailer with a special body for the media team (MT) (5); trailer-mounted emergency generator (approximately 200 kVA) (5); trailer-mounted emergency generator (approximately 650 kVA) (5); trailer-mounted emergency generator with lighting mast (50 kVA) (5).
Platform, communications, and pump trailers	Platform trailer with container mounts (25); platform trailer with container mounts (12 t payload) (10); platform trailer with stanchions (ASH; 12 t payload) (5); trailer with microwave radio equipment (2 t payload) (5); wastewater pump trailer (15,000 l/min) (10); wastewater pump trailer (25,000 l/min) (10); wastewater pump trailer (5,000 l/min) (10).
Heavy transport and water-supply trailers	Low-loader trailer with container mounts (18 t payload) (20); trailer for a drinking-water treatment plant (5); container-compatible semi-trailer (30); flatbed semi-trailer with tail lift (50); refrigerated trailer (20).
Command, communications, and crew-transport vehicles	Telecommunications vehicle (20); command and communications vehicle (10); command vehicle (30); equipment truck (20); crew cargo truck IV with tail lift (30); personnel transport vehicle (20); all-terrain personnel transport vehicle (5); mast vehicle (5).
Freight and heavy-transport vehicles	Tipper truck (9 t payload) (10); truck with tail lift (7 t payload, type A) (10); truck with loading crane (7 t payload) (10); truck with loading crane (9 t payload) (10); all-terrain truck with loading crane (7 t payload) (10); truck with tail lift (7 t payload, type B) (15); swap-body carrier truck (15); all-terrain passenger vehicle (40); tractor unit (2).
Construction and material-handling assets	Excavator (10); mobile crane (50 t lifting capacity) (2); wheel loader (2); walking excavator (2); telescopic handler (5); forklift (3 t lifting capacity) (10); all-terrain forklift (2 t lifting capacity) (5); all-terrain forklift (3 t lifting capacity) (5); multi-purpose equipment vehicle with tail lift (25).
Water, aerial, and search-and-rescue assets	Drone (10); half-pontoon (2 t) (12); small boat with trailer (2); rescue dogs (5); drinking-water treatment plant (5); drinking-water tank container (15); drinking-water laboratory container (10).
Containers and transport boxes	Material container (30); transport box for a drone (10); transport box with an incident-site safety system (10); transport box with a mobile flood gauge (10); transport box with search-and-detection equipment (10); workshop container (10).
Personnel and leadership roles	Local section commissioner (OB) (1); deputy local section commissioner (stv. OB) (1); technical advisers (Fachb) (2); responders (He) (6); platoon leaders (ZFü) (4); platoon command group leaders (ZTrFü) (4); specialist responders (FaHe) (247); group leaders (GrFü) (27); squad leaders (TrFü) (54).
Specialist support roles	Psychosocial support specialists (psFK) (3); peer supporters (Peer) (11); command and staff group members (Fü/SGL) (6); subordinate unit leaders (UFü) (13).
Federal Office of Civil Protection and Disaster Assistance (BBK)	
Personnel	Joint Information and Situation Centre (GMLZ) coordination staff (25); specialist department staff (20); temporary support staff (60); media team staff (15); citizen service staff (3).

Note. (-) denotes a fire-brigade vehicle or equipment quantity that is not reported in the table. The two THW entries labelled "truck with tail lift (7 t payload)" represent separate resource pools in the supplied model input. German operational abbreviations are retained in parentheses.

2 Simulation parameters

Table 6: Model parameterization for routine events and scenario-driven operations. Preparation measures are reported as [implementation score, relevance]; all duration-related values are given in hours. In case durations are based on gaussian distributions, mean and standard deviation are given. In case durations are based on [min:max]-value-ranges, those ranges are given as [duration min; duration max]

Scenario / operation	Preparation measures [implementation score, relevance]	Event-generation setting	Duration setting [h]	Further parameters
A. Routine events – Fire brigade				
Critical residential fire	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.02 per time step	Mean: 3.0; Stand. dev.: 0.5	–
Critical residential fire (advanced)	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.005 per time step	Mean: 6.0; Stand. dev.: 0.5	–
Fire in a critical building	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.0025 per time step	Mean: 6.0; Stand. dev.: 0.5	–
Tanker vehicle accident	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.004 per time step	Mean: 6.0; Stand. dev.: 0.5	–
B. Routine events – Ambulance service				
Emergency call centre–emergency physician–emergency ambulance deployment	Emergency call centre: training level [8, 0.8]; equipment quality [8, 0.2]. Emergency physician: training level [8, 0.8]; equipment quality [8, 0.2]. Emergency ambulance (RTW): training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 1.0 per time step	Emergency call centre: [0.1, 0.8]. Emergency physician: [0.8, 1.6]. Emergency ambulance (RTW): [1.0, 2.0]	–
Emergency call centre–emergency ambulance deployment	Emergency call centre: training level [8, 0.8]; equipment quality [8, 0.2]. Emergency ambulance (RTW): training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 2.0 per time step	Emergency call centre: [0.1, 0.8]. Emergency ambulance (RTW): [1.0, 2.0]	–

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Scenario / operation	Preparation measures [implementation score, relevance]	Event-generation setting	Duration setting [h]	Further parameters
Emergency call centre–intensive care transport helicopter deployment	Emergency call centre: training level [8, 0.8]; equipment quality [8, 0.2]. Intensive care transport helicopter (ITH): training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.1 per time step	Emergency call centre: [0.1, 0.8]. Intensive care transport helicopter (ITH): [1.0, 1.5]	Commented alternative occurrence parameter: 0.0002
Patient transport vehicle deployment	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 2.0 per time step	[1.0, 2.0]	–
C. Routine events – Federal Agency for Technical Relief (THW)				
Random THW deployment	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 0.02 per time step	[24.0, 72.0]	–
D. Routine events – Federal Office of Civil Protection and Disaster Assistance (BBK)				
Citizen service operation	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 1.2 per time step	[0.2, 0.6]	–
Specialist department operation	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 1.5 per time step	[3.0, 6.0]	–
Joint Information and Situation Centre (GMLZ) operation	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 2.7 per time step	[4.0, 8.0]	–
Media-team operation	Training level [8, 0.8]; equipment quality [8, 0.2]	Occurrence parameter: 2.4 per time step	[2.0, 4.0]	–
E. Scenario-driven operations – Ambulance service				

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Scenario / operation	Preparation measures [implementation score, relevance]	Event-generation setting	Duration setting [h]	Further parameters
Heat-related ambulance service demand	Public-awareness activities [8, 0.1]; preparedness of social care facilities [5, 0.1]; availability of cool places [7, 0.1]; availability of temporary cooling measures [4, 0.1]; availability of public drinking fountains [8, 0.1]; implementation of temporary shading measures [6, 0.1]; urban heat-island factor [7, 0.5]; age structure [6, 0.4]	Base trigger number: 0.01	Emergency call: [0.1, 0.4]. Field deployment: [0.5, 0.5]	Probability that an emergency physician is required per ambulance deployment: 0.1
F. Scenario-driven operations – Fire brigade				
Drinking-water-related operation	Effectiveness of water-saving measures [8, 0.5]; effectiveness of climate-adaptation measures [8, 0.5]	Base trigger number: 0.075	Duration vector: [0.5, 0.025, 0.5, 0.5]	–
Heavy-rainfall operation	Training effectiveness [8, 0.5]; accessibility [8, 0.5]	Directly determined by scenario	Base: 0.5; SD: 0.05	–
Forest-fire and evacuation operation	*Forest-fire response:* forest-fire early detection [8, 0.5]; condition of access roads [8, 0.4]; availability of fire-water extraction points [8, 0.7]; fire-water supply planning [8, 0.3]; availability of contact details for forest managers [8, 0.2]; currency of forest-fire maps [8, 0.4]. *Evacuation response:* condition of access roads [8, 0.5]; currency of evacuation plans [8, 0.4]	Directly determined by scenario	Forest fire: 3.0 (SD: 0.25). Evacuation: 3.0 (SD: 0.25)	–
G. Scenario-driven operations – Federal Agency for Technical Relief (THW)				
Drinking-water-related operation	Effectiveness of water-saving measures [8, 0.5]; effectiveness of climate-adaptation measures [8, 0.5]	Base trigger number: 0.075	Duration vector: [0.5, 0.5, 0.5, 0.5]	–
Heavy-rainfall operation	Training effectiveness [8, 0.5]; accessibility [8, 0.5]	Directly determined by scenario	Mean: 0.5; stand.dev: 0.05	–

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Scenario / operation	Preparation measures [implementation score, relevance]	Event-generation setting	Duration setting [h]	Further parameters
Forest-fire and evacuation operation	*Forest-fire response:* forest-fire early detection [8, 0.5]; condition of access roads [8, 0.4]; availability of fire-water extraction points [8, 0.7]; fire-water supply planning [8, 0.3]; availability of contact details for forest managers [8, 0.2]; currency of forest-fire maps [8, 0.4]. *Evacuation response:* condition of access roads [8, 0.5]; currency of evacuation plans [8, 0.4]	Directly determined by scenario	Forest fire: Mean: 3.0, stand.dev: 0.25 Evacuation: Mean: 3.0, stand.dev: 0.25	–
H. Scenario-driven operations – Federal Office of Civil Protection and Disaster Assistance (BBK)				
Forest-fire support	Coordination efficiency [8, 0.5]; availability of technical aids [8, 0.4]	Base trigger number: 0.08	Mean: 0.5; stand.dev: 0.05	Resource relevance: GMLZ coordination staff: 0.55; specialist department staff: 0.40; media-team staff: 0; citizen-service staff: 0.05
Severe-weather support	Coordination efficiency [8, 0.5]; availability of technical aids [8, 0.4]	Base trigger number: 0.08	Mean: 0.5; stand.dev: 0.05	Resource relevance: GMLZ coordination staff: 0.70; specialist department staff: 0.30; media-team staff: 0; citizen-service staff: 0
Drinking-water support	Coordination efficiency [8, 0.5]; availability of technical aids [8, 0.4]	Base trigger number: 0.15	Mean: 1.0; stand.dev: 0.05	Resource relevance: GMLZ coordination staff: 0.20; specialist department staff: 0.10; media-team staff: 0.60; citizen-service staff: 0.10

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Scenario / operation	Preparation measures [implementation score, relevance]	Event-generation setting	Duration setting [h]	Further parameters
Heat-related support	Coordination efficiency [8, 0.5]; availability of technical aids [8, 0.4]	Base trigger number: 0.10	Mean: 0.5; stand.dev: 0.05	Resource relevance: GMLZ coordination staff: 0.55; specialist department staff: 0.40; media-team staff: 0; citizen-service staff: 0.05

3 Comparison good vs. bad preparation state including routine tasks

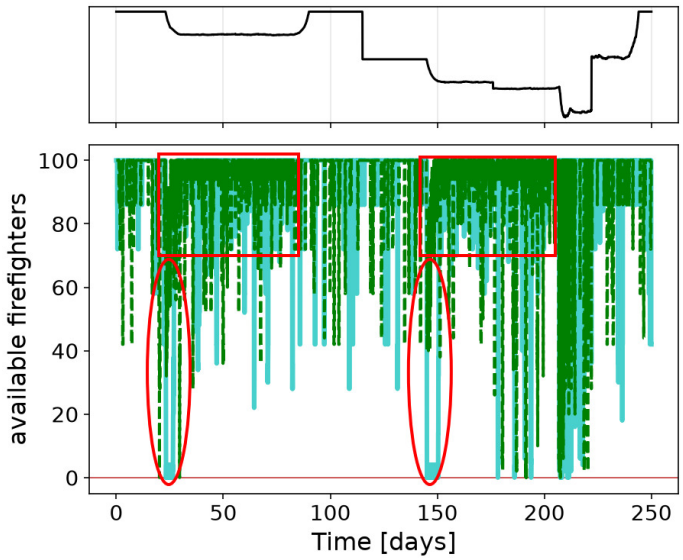


Fig. 1: Exemplary results of authority process modeling **including routine fire brigade tasks**. The number of available firefighters is shown, once with a good preparation state for forest fires (green) and once with a bad preparation state (cyan). Red boxes indicate the time intervals of the forest fires, red ellipses indicate the capacity shortages at the start of those time intervals for a bad preparation. Compared to the related plot in the main text, this plot includes routine tasks. The simulation time step is one hour. At the top, the plot shows the evolution of the heat drought crisis for comparison.