

Supplementary material to: Socio-economic
sensitivity to weather extremes: A scoping review
of European research

S1 Auxiliary search

To ensure the robustness of our evidence base, we conducted a supplementary search using an alternative query specification. This secondary search was designed to capture relevant studies that might have been overlooked by the primary search string due to variations in terminology or indexing. All records identified through this complementary process were screened against the same inclusion and exclusion criteria outlined in the main protocol. This strategic addition resulted in the identification of 13 further studies that met all eligibility requirements and were integrated into the final corpus. The search query used in this supplementary phase is shown in Figure S1.

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(weather OR climate OR rain* OR precipitation OR temperature) AND  
(shock* OR extreme OR variability) AND  
(economic* OR "socio-economy*" OR "sectoral impact*" OR "macroecon-  
omy*" OR inflation*) AND  
("Europe*" OR "Eurozone" OR "Austria*" OR "Belgium*" OR "Bul-  
garia*" OR "Croatia*" OR "Cyprus*" OR "Czech Republic*" OR "Den-  
mark*" OR "Estonia*" OR "Finland*" OR "France*" OR "Germany*" OR  
"Greece*" OR "Hungary*" OR "Iceland*" OR "Ireland*" OR "Italy*" OR  
"Latvia*" OR "Lithuania*" OR "Luxembourg*" OR "Malta*" OR  
"Netherlands*" OR "Norway*" OR "Poland*" OR "Portugal*" OR  
"Romania*" OR "Slovakia*" OR "Slovenia*" OR "Spain*" OR "Swe-  
den*" OR "Switzerland*" OR "United Kingdom*" OR "England*" OR  
"Scotland*" OR "Wales*" OR "Northern Ireland*")
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Fig. S1: Auxiliary search query applied to Scopus and Web of Science databases.

047 **S2 Scoping review framework**

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Table S1: Population–Concept–Context criteria for this review

PCC element	Definition
<i>Population</i>	Economic agents and systems in Europe: households, workers, firms, sectors, municipalities, regions, and countries. Studies with or without comparator groups; comparators may be temporal (before–after, anomalies) or cross-sectional (treated versus control areas).
<i>Concept</i>	Sensitivity of the socioeconomic system to realised weather shocks or short-run weather variability; weather is treated as an explanatory factor for socioeconomic outcomes. Eligible study types: empirical primary studies (quantitative or mixed-methods) that estimate or describe realised impacts; multi-country panels and single-country studies are both eligible; systematic reviews are not included as primary evidence. Socioeconomic outcomes include, for example, prices and inflation, employment and unemployment, productivity and output, sectoral activity (e.g., agriculture, energy, transport, tourism), health service utilisation, crime, and financial market responses. Ineligible concepts: exposure-only assessments without sensitivity or realised impact; adaptation or forward-looking policy analyses without realised impacts; long-run climate trend analyses without a discrete shock; non-weather hazards (e.g., earthquakes, volcanic eruptions); methods/framework papers without empirical application; greenhouse-gas or air-pollution studies without a weather-shock link.
<i>Context</i>	European settings: European Union member states, EEA, Schengen, the United Kingdom, and candidate or associated states; Russia and Turkey included. Global or multi-region studies are eligible when a European subsample or estimates are identifiable. Weather shocks/hazards operationalised as short-run extremes or anomalies, for example heatwaves, cold spells, storms, droughts, floods, extreme precipitation, and temperature anomalies, often defined relative to local historical distributions (e.g., tails such as 10th/90th percentiles) or via discrete event designations.

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Concept	Definition
Socio-economic outcome	A measurable effect on economic or social well-being, including but not limited to income, prices, employment, productivity, sectoral activity, health service use, crime, and financial market responses.
Sensitivity	The degree to which a system is affected, adversely or beneficially, by weather variability or extremes through direct or indirect pathways.
Exposure	The presence of people, livelihoods, assets, or infrastructure in places that could be affected by weather or climate events.
Vulnerability	The propensity to be adversely affected as a function of exposure, sensitivity, and adaptive capacity; in this review we map sensitivity and realised impacts rather than construct composite vulnerability indices.
Europe	European Union member states, EEA, Schengen, the United Kingdom, and candidate or associated states; Russia and Turkey are included; global or multi-region studies are eligible when European estimates are identifiable.
Weather shock	A short-run extreme or unusual realisation of weather or climate relative to local history, often operationalised by thresholds such as values beyond the 10th or 90th percentile or by discrete hazard events whose rarity and intensity vary by location and season.

S2.1 Journal selection criteria

To identify the most impactful and rigorous research within the broad search results, we applied a quality filter based on journal rankings. Specifically, we restricted inclusion to journals ranked in the first quartile (Q1) of the Scimago Journal Rankings (SJR) in their year of publication. If a ranking was unavailable for the specific publication year, the ranking from the nearest available year was used. This criterion ensures that the review captures studies that have met high standards of peer review and disciplinary impact, while also serving as a practical heuristic to manage the volume of records returned by the broad search string. The SJR data were retrieved from <https://www.scimagojr.com/journalrank.php>.

S3 Supplementary Tables

Table S3: Summary of study characteristics: publication, region, and sector

Publication	Region	EU region	Sector
Achebak et al. (2024)	Spain	Spain	Health
Ahmed et al. (2024)	London	United Kingdom	Financial markets

139 **Table S3:** Summary of study characteristics: publication, region, and sector (contin-
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142	Publication	Region	EU region	Sector
143	Bastos et al. (2013)	Global	Global	Agriculture
144	Beirne et al. (2024)	Eurozone	Eurozone	Macroeconomy
145	Berg et al. (2024)	Global	Global	Macroeconomy
146	Bigerna (2018)	Italy	Italy	Energy
147	Bigler and Janzen (2024)	Germany	Germany	Health
148	Black et al. (2013)	Global	Global	Review
149	Blumenthal and Nyberg (2019)	Sweden	Sweden	Economy
150	Boccard (2018)	France	France	Economy
151	Cai et al. (2016)	OECD	OECD	Migration
152	Cashin et al. (2017)	Global	Global	Macroeconomy
153	Cevik and Gwon (2024)	China, Japan, Korea, United Kingdom, United States	Eurozone, Eurozone, United States	Macroeconomy
154	Chabot and Bertrand (2023)	Europe	Europe	Financial markets
155	Chambru (2020)	Switzerland	Switzerland	Crime and conflict
156	Chen et al. (2023)	Global	Global	Health
157	Chen et al. (2021)	Global	Global	Energy
158	Ciccarelli et al. (2024)	Germany, Italy, Spain	France, Germany, Italy, Spain	France, Macroeconomy
159	Colelli et al. (2023)	Europe, India	Europe	Energy

Publication	Region	EU region	Sector
Crispino and Loberto (2024)	Italy	Italy	Politics
Díaz et al. (2015)	Madrid	Spain	Health
Donadelli et al. (2021)	G7, OECD	G7, OECD	Economy
Donadelli et al. (2022)	Global	Global	Macroeconomy
Drescher and Janzen (2025)	Switzerland	Switzerland	Health
Ellena et al. (2022)	Turin	Italy	Health
Falk (2013)	Austria	Austria	Tourism
Felbermayr et al. (2022)	Global	Global	Economy
Gössling et al. (2023)	Global	Global	Review
Gupta et al. (2023)	France, Netherlands, Japan, Spain, Kingdom, States	Germany, Italy, United Kingdom	France, Netherlands, Spain, United Kingdom, Germany, Italy, United States
Hoffmann et al. (2022)	Europe	Europe	Politics
Huang and Hong (2024)	Global	Global	Health
Jennings and Gray (2015)	Netherlands	Netherlands	Migration
Kahn et al. (2021)	Global	Global	Economy
Karlsson and Ziebarth (2018)	Germany	Germany	Health
Khan et al. (2017)	Global	Global	Economy
Kotz et al. (2021)	Global	Global	Economy

231 **Table S3:** Summary of study characteristics: publication, region, and sector (contin-
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234	Publication	Region	EU region	Sector
235	Kotz et al. (2024)	Global	Global	Economy
236	Letta and Tol (2019)	Global	Global	Macroeconomy
237	Linsenmeier (2023)	Global	Global	Economy
238	Lis and Nickel (2010)	Global	Global	Macroeconomy
239	Lpez-Bueno et al. (2019)	Madrid	Spain	Health
240	Lpez-Bueno et al. (2020b)	Madrid	Spain	Health
241	Lpez-Bueno et al. (2021)	Madrid	Spain	Health
242	Lpez-Bueno et al. (2020a)	Madrid	Spain	Health
243	Lpez-Bueno et al. (2022)	Spain	Spain	Health
244	Lucidi et al. (2024)	Belgium, Germany, Italy, Spain	France, Belgium, Greece, Germany, Italy, Spain	France, Greece, Macroeconomy
245	Mannell et al. (2024)	Global	Global	Crime and conflict
246	Marinaccio et al. (2019)	Italy	Italy	Health
247	Martnez-Solanas and Basagaa (2019)	Spain	Spain	Health
248	Middelanis et al. (2023)	Global	Global	Macroeconomy
249	Miller et al. (2021)	Global	Global	Macroeconomy
250	Mosquera-Lpez et al. (2024)	Denmark, Germany, Norway, Spain	France, Denmark, Italy, Germany, Norway, Spain	France, Italy, Energy
251	Mukherjee and Ouattara (2021)	Global	Global	Macroeconomy

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Publication	Region	EU region	Sector	
Mumtaz and Theophilopoulou (2024)	Global	Global	Economy	277 278 279 280 281 282 283 284
Otrachshenko and Popova (2022)	Russia	Russia	Economy	285 286 287
Otrachshenko et al. (2021)	Russia	Russia	Crime and conflict	288 289
Otrachshenko et al. (2017)	Russia	Russia	Health	290 291
Pablo-Romero et al. (2019)	Spain	Spain	Energy	292 293 294
Paglialunga et al. (2022)	Global	Global	Inequality	295 296
Peillex et al. (2021)	France	France	Financial markets	297 298
Quante et al. (2024)	Global	Global	Economy	299 300 301
Rubio-Cabaez (2024)	Spain	Spain	Health	302 303 304
Russ (2020)	Global	Global	Economy	305
Saucy et al. (2021)	Zurich	Switzerland	Health	306 307
Schleypen et al. (2022)	European Union, United Kingdom	European Union, United Kingdom	Economy	308 309
Schmitt et al. (2022)	Germany	Germany	Agriculture	310 311
Semenova (2024)	Global	Global	Review	312 313
Sheng et al. (2023)	United Kingdom	United Kingdom	Inequality	314 315
Tol (2024)	Global	Global	Review	316
Ubilava (2017)	Global	Global	Agriculture	317 318
Ubilava and Abdolrahimi (2019)	Global	Global	Agriculture	319 320 321 322

323 **Table S3:** Summary of study characteristics: publication, region, and sector (contin-
 324 ued)
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326	Publication	Region	EU region	Sector
327	Verschuur et al. (2023)	Global	Global	Supply chains, Econ- omy
328	Vielma et al. (2024)	Spain	Spain	Health
329	von Möllendorff and Hirschfeld (2016)	Germany	Germany	Well-being
330	Waldinger (2024)	France	France	Crime and conflict
331	Wasko et al. (2021)	Global	Global	Economy
332	Zou et al. (2024)	Global	Global	Agriculture

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 346 **Table S4:** Summary of study characteristics: publication, outcomes, and data
 347 granularity

348	Publication	Outcome studied	Temp. period.	Spatial res.
349	Achebak et al. (2024)	hospitalisation	daily	province
350	Ahmed et al. (2024)	stock returns, daily FTSE100 stock index	daily	-
351	Bastos et al. (2013)	economic , macroeconomic , agriculture	annual	country
352	Beirne et al. (2024)	economic, macroeconomic, inflation	monthly	country
353	Berg et al. (2024)	gdp per capita	annual	country
354	Bigerna (2018)	electricity prices	hourly	-
355	Bigler and Janzen (2024)	sleep	daily	NUTS 3
356	Black et al. (2013)	-	-	-

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Publication	Outcome studied	Temp. period.	Spatial res.	
				369
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Blumenthal and Nyberg (2019)	insurance, flood damage	daily	-	375
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Boccard (2018)	economic, insurance	annual	country	377
Cai et al. (2016)	migration , agriculture , GDP	annual	country	378
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Cashin et al. (2017)	inflation , GDP , exchange rates , interest rates	quarterly	country	380
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Cevik and Gwon (2024)	inflation , supply chains	monthly	country	382
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Chabot and Bertrand (2023)	financial stability, gdp	monthly	country	384
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Chambru (2020)	crime , prices , migration	annual	region	387
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Chen et al. (2023)	meningitis	annual	country	389
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Chen et al. (2021)	energy	annual	country	391
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Ciccarelli et al. (2024)	inflation	monthly	country	393
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Colelli et al. (2023)	electricity load	monthly	country	395
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Crispino and Loberto (2024)	awareness to climate change	weekly	NUTS 3	397
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Díaz et al. (2015)	mortality	daily	city	399
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Donadelli et al. (2021)	R & D	annual	country	401
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Donadelli et al. (2022)	gdp , capital , productivity	daily	country	403
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Drescher and Janzen (2025)	occupational injuries	annual	canton	405
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Ellena et al. (2022)	mortality	daily	-	407
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Falk (2013)	tourist stays	annual	-	409
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Felbermayr et al. (2022)	economic activity	annual	grid	411
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415 **Table S4:** Summary of study characteristics: publication, outcomes, and data
416 granularity (continued)
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418	Publication	Outcome studied	Temp. 419 period.	Spatial res.
420	Gössling et al. - 421 (2023)		-	-
422	Gupta et al. 423 (2023)	real gdp	annual	country
424	Hoffmann et al. 425 (2022)	politics, voting	annual	NUTS 3
426	Huang and 427 Hong (2024)	adult obesity rate, inequality	annual	country
428	Jennings and 429 Gray (2015)	human migration	annual	municipality
430	Kahn et al. 431 (2021)	real gdp per capita	annual	country
432	Karlsson 433 and Ziebarth 434 (2018)	mortality	daily	county
435	Khan et al. 436 (2017)	per capita gdp growth, gdp, inequality	annual	country- 437 basin unit
438	Kotz et al. 439 (2021)	Gross Regional Product	annual	subnational
440	Kotz et al. 441 (2024)	inflation	monthly	country
442	Letta and Tol 443 (2019)	total factor productivity, inequality	annual	country
444	Linsenmeier 445 (2023)	economic activity	daily	country
446	Lis and Nickel 447 (2010)	government budget balance, fiscal policy	annual	country
448	Lpez-Bueno 449 et al. (2019)	mortality	daily	city
450	Lpez-Bueno 451 et al. (2020b)	mortality	daily	district
452	Lpez-Bueno 453 et al. (2021)	mortality	daily	municipality
454	Lpez-Bueno 455 et al. (2020a)	mortality	daily	district
456	Lpez-Bueno 457 et al. (2022)	mortality rate	monthly	municipality
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Publication	Outcome studied	Temp. period.	Spatial res.	
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Lucidi et al. (2024)	inflation, energy prices, food prices	monthly	NUTS 2	467
Mannell et al. (2024)	violence, intimate partner violence	annual	country	468
Marinaccio et al. (2019)	occupational injuries	daily	municipality	469
Martnez-Solanas and Basagaa (2019)	mortality	daily	province	470
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Middelanis et al. (2023)	economy , prices , consumption	daily	country	473
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Miller et al. (2021)	per-capita GDP, agriculture, crop production	annual	country	475
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Mosquera-Lpez et al. (2024)	energy , electricity	daily	country	477
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Mukherjee and Ouattara (2021)	inflation , real gdp , government spending , monetary aggregate	annual	country	479
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Mumtaz and Theophilopoulou (2024)	per capita gdp , inequality	annual	country	482
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Otrachshenko and Popova (2022)	real per capita gdp, inequality, income	annual	regional	485
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Otrachshenko et al. (2021)	violence, homicides	annual	regional	487
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Otrachshenko et al. (2017)	mortality	annual	regional	489
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Pablo-Romero et al. (2019)	electricity consumption, tourism	annual	province	491
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Paglalunga et al. (2022)	gini index	annual	municipality	493
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Peillex et al. (2021)	finance , stock market	daily	country	495
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Quante et al. (2024)	income, consumption, inequality	daily	country	497
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Rubio-Cabaez (2024)	birth weights	monthly	municipality	499
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507 **Table S4:** Summary of study characteristics: publication, outcomes, and data
508 granularity (continued)
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510	Publication	Outcome studied	Temp. 511 period.	Spatial res.
512	Russ (2020)	economic activity, agricultural productivity, 513 agriculture	annual	country
514	Saucy et al. 515 (2021)	mortality	daily	grid
516	Schleypen et al. 517 (2022)	gross value-added , labour productivity	annual	NUTS 2
518	Schmitt et al. 519 (2022)	agriculture, crop yield	annual	municipality
520	Semenova 521 (2024)	-	-	-
522	Sheng et al. 523 (2023)	wealth inequality	monthly	country
524	Tol (2024)	-	-	-
525	Ubilava (2017)	wheat prices, agriculture	monthly	country
526	Ubilava and 527 Abdolrahimi	agriculture, crop yields, inequality	annual	country
528	(2019)			
529	Verschuur et al. 530 (2023)	ports , shipping	annual	country
531	Vielma et al. 532 (2024)	occupational injuries	daily	NUTS 3
533	von 534 Möllendorff and Hirschfeld 535 (2016)	life satisfaction	annual	NUTS 3
536	Waldinger 537 (2024)	conflict, politics	annual	canton
538	Wasko et al. 539 (2021)	insurance, economic loss	annual	country
540	Zou et al. 541 (2024)	agricultural total factor productivity, 542 inequality	annual	country

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Table S5: Weather variables and methods used in the reviewed studies				553
Publication	Weather studied	Weather measure	Methodology	554
Achebak et al. (2024)	temperature, humidity	cross-basis function of temperature	quasi-Poisson generalized linear regression, distributed lag non-linear model, multilevel meta-analysis	555 556 557 558 559 560 561 562
Ahmed et al. (2024)	temperature, humidity, clouds, visibility	moving average of weather variables, moving standard deviation, extreme above-average, extreme below-average	GARCH, logit model, OLS regression	563 564 565 566 567
Bastos et al. (2013)	precipitation	annual precipitation	fixed effects panel regression, Tobit random effects estimator	568 569 570
Beirne et al. (2024)	extreme weather events	extreme weather events	panel structural VAR	571 572
Berg et al. (2024)	temperature	population weighted temperature, two-factor decomposition of temperature, cold days, hot days, normal days	local projections	573 574 575 576 577
Bigerna (2018)	temperature	hourly temperature, cooling degree hours, heating degree hours	VAR	578 579 580
Bigler and Janzen (2024)	temperature, precipitation, cloud cover	discretised bins of minimum daily temperature	fixed effects panel regression	581 582 583
Black et al. (2013)	-	-	-	584 585
Blumenthal and Nyberg (2019)	precipitation	precipitation	linear regression	586 587 588
Boccard (2018)	extreme weather events	floods, droughts, heatwaves	fixed effects panel regression	589 590 591
Cai et al. (2016)	temperature, precipitation	annual mean monthly total precipitation, annual mean temperature	fixed effects panel regression	592 593 594 595
Cashin et al. (2017)	ENSO	southern oscillation index anomaly	local projections, VARX, global VAR	596 597 598

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600 **Table S5:** Weather variables and methods used in the reviewed studies (continued)

601 Publication	602 Weather stud- ied	603 Weather measure	604 Methodology
603 Cevik and Gwon (2024)	604 temperature	605 temperature anomaly	606 structural VAR, local 607 projections
608 Chabot and Bertrand (2023)	609 temperature, 610 precipitation, 611 extreme 612 weather events	613 temperature anomaly, 614 number of floods, 615 number of heatwaves, 616 number of droughts, 617 number of coldwaves	618 fixed effects panel regres- 619 sion
620 Chambru (2020)	621 temperature	622 precipitation anomaly, 623 temperature anomaly, 624 mean seasonal annual 625 temperature, mean 626 seasonal annual 627 precipitation	628 fixed effects panel regres- 629 sion
630 Chen et al. (2023)	631 temperature, 632 precipitation, 633 wind speed	634 maximum temperature, 635 average precipitation, 636 temperature variability	637 generalized linear model
638 Chen et al. (2021)	639 temperature, 640 precipitation	641 extreme temperature 642 events, droughts, floods	643 fixed effects panel quan- 644 tile regression
645 Ciccarelli et al. (2024)	646 temperature	647 temperature anomaly 648 from historical mean	649 Bayesian VAR
650 Colelli et al. (2023)	651 temperature	652 30-year moving aver- 653 age of the daily maxi- 654 mum temperature, tem- 655 perature anomaly, daily 656 temperature bins	657 fixed effects panel regres- 658 sion
659 Crispino and Loberto (2024)	660 temperature	661 temperature anomaly	662 fixed-effects Poisson 663 panel regression
664 Díaz et al. (2015)	665 temperature, 666 pressure, 667 humidity	668 cold waves, mean daily 669 air pressure, mean 670 daily relative humidity, 671 daily minimum and 672 maximum temperature	673 Poisson regression
674 Donadelli et al. (2021)	675 temperature	676 global annual tempera- 677 ture, mean annual tem- 678 perature	679 panel VAR, stochastic 680 endogenous growth model
681 Donadelli et al. (2022)	682 temperature	683 annual temperature 684 volatility	685 panel VAR

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Table S5: Weather variables and methods used in the reviewed studies (continued)

Publication	Weather studied	Weather measure	Methodology
Drescher and Janzen (2025)	temperature, precipitation, solar radiation, wind speed	temperature bins	Poisson fixed effects model
Ellena et al. (2022)	temperature	daily mean temperature	quasi-Poisson generalized linear regression, distributed lag non-linear model
Falk (2013)	temperature, clouds, snow depth, clear skies	average monthly temperatures, maximum monthly snow depth, percentage of days with clear skies, cloud cover	panel error correction model
Felbermayr et al. (2022)	temperature, precipitation, wind speed	precipitation anomalies, SPEI, cold spells, storms	spatial Durbin model, fixed effects panel regression
Gössling et al. (2023)	-	-	-
Gupta et al. (2023)	temperature	global temperature anomaly	probit
Hoffmann et al. (2022)	temperature, precipitation, evapotranspiration, UTCI	temperature anomaly, heatwaves, cold spells, hot days, cold days, dry spells, wet spells	fixed effects panel regression
Huang and Hong (2024)	temperature	annual mean temperature, temperature bins, seasonal mean temperature, temperature anomaly, temperature shocks	fixed effects panel regression
Jennings and Gray (2015)	temperature, riverine flooding, precipitation	mean annual temperature, tropical days, cold days, riverine flooding, total annual precipitation	multinomial logit model

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692 **Table S5:** Weather variables and methods used in the reviewed studies (continued)
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Publication	Weather stud- ied	Weather measure	Methodology		
Kahn et al. (2021)	temperature, precipitation	mean annual temper- ature, mean annual precipitation, pre- cipitation anomaly, temperature anomaly	panel ARDL		
Karlsson and Ziebarth (2018)	temperature, precipitation	hot days, cold days, temperature bins	fixed effects panel regres- sion, random effects Pois- son models		
Khan et al. (2017)	temperature, precipitation, runoff	weighted anomaly stan- dardized precipitation, weighted anomaly stan- dardized runoff, mean annual precipitation, mean annual temper- ature, squared annual temperature, mean annual runoff	fixed effects panel regres- sion		
Kotz et al. (2021)	temperature, precipitation	annual average intra- monthly standard devi- ation of daily tempera- ture	fixed effects panel regres- sion		
Kotz et al. (2024)	temperature, precipitation	average temperature, temperature standard deviations, 99th per- centile of daily rainfall, SPEI	fixed effects panel regres- sion		
Letta and Tol (2019)	temperature, precipitation	annual temperature change, annual change in precipitation lev- els, squared annual temperature change	fixed effects panel regres- sion		

Table S5: Weather variables and methods used in the reviewed studies (continued)				737
Publication	Weather stud- ied	Weather measure	Methodology	738
Linsenmeier (2023)	temperature, precipitation, humidity, radiation	mean temperature, day-to-day temperature variability, seasonal temperature variability, annual total precipitation, seasonal precipitation variability, interannual variability of temperature and precipitation, annual mean relative humid- ity, annual mean solar radiation	spatial first differences	739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754
Lis and Nickel (2010)	extreme weather events	extreme weather events	fixed effects panel regres- sion	755 756
Lpez-Bueno et al. (2019)	temperature	cold waves	generalized linear models	757 758
Lpez-Bueno et al. (2020b)	temperature	cold wave	generalized linear models	759 760
Lpez-Bueno et al. (2021)	temperature	cold wave	generalized linear models	761 762
Lpez-Bueno et al. (2020a)	temperature	heatwaves	generalized linear models	763 764
Lpez-Bueno et al. (2022)	temperature	minimum daily temper- ature	mixed generalized linear model	765 766
Lucidi et al. (2024)	temperature	temperature anomaly	local projections	767 768
Mannell et al. (2024)	extreme tem- peratures, droughts, floods, storms, wildfire	count of climate shock indicators	structural equation model, exploratory factor analysis	769 770 771 772 773 774
Marinaccio et al. (2019)	temperature	daily mean temperature	Poisson generalized linear regression, distributed lag non-linear model, multi- variate meta-regression	775 776 777 778
Martnez- Solanas and Basagaa (2019)	temperature	daily maximum temper- ature, heatwaves	distributed lag non-linear model, multivariate meta- regression	779 780 781 782

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784 **Table S5:** Weather variables and methods used in the reviewed studies (continued)

785 Publication	786 Weather studied	787 Weather measure	788 Methodology
788 Middelanis et al. (2023)	789 heat stress, - 790 floods, tropical 791 cyclones	787 -	788 global agent-based loss 789 propagation model
791 Miller et al. (2021)	792 temperature, 793 precipitation	794 annual precipitation, 795 average annual 796 temperature, heatwaves	797 fixed effects panel regres- 798 sion
794 Mosquera-Lpez et al. (2024)	795 temperature, 796 wind speed, 797 precipitation, 798 solar irradiance	799 daily temperature, daily 800 wind speed, daily pre- 801 cipitation, daily solar 802 irradiance	803 distributed lag non-linear 804 model
798 Mukherjee and Ouattara (2021)	799 temperature	800 temperature change	801 panel VAR
801 Mumtaz and Theophilopoulou (2024)	802 temperature, 803 precipitation	804 annual mean tempera- 805 ture, annual precipita- 806 tion	807 Bayesian panel VAR
804 Otrachshenko and Popova (2022)	805 temperature, 806 precipitation	807 precipitation bins, tem- 808 perature bins	809 fixed effects panel regres- 810 sion
807 Otrachshenko et al. (2021)	808 temperature, 809 precipitation	810 precipitation bins, tem- 811 perature bins	812 fixed effects panel regres- 813 sion
810 Otrachshenko et al. (2017)	811 temperature, 812 precipitation	813 cooling degree days, 814 heating degree days, 815 squared cooling degree 816 days, squared heating 817 degree days	818 fixed effects panel regres- 819 sion
816 Pablo-Romero et al. (2019)	817 temperature	818 cooling degree days, 819 heating degree days, 820 squared cooling degree 821 days, squared heating 822 degree days	823 fixed effects panel regres- 824 sion
817 Paglialunga et al. (2022)	818 temperature, 819 precipitation	820 average monthly tem- 821 perature, heatwave 822 dummy, SPI precipi- 823 tation anomalies, 824 increasing precipitation 825 anomalies	826 fixed effects panel regres- 827 sion
823 Peillex et al. (2021)	824 temperature	825 hot days, temperature 826 bins	827 OLS regression

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Table S5: Weather variables and methods used in the reviewed studies (continued)				829
Publication	Weather studied	Weather measure	Methodology	830
Quante et al. (2024)	temperature, precipitation	daily temperature anomaly, daily rainfall exceeding 99th percentile, wet day, rainfall anomaly, daily extreme temperature threshold	Acclimate	831
Rubio-Cabaez (2024)	temperature	daily average temperature, extremely hot day, extremely cold day, number of extreme temperature days, cold season, hot season	fixed effects difference-in-differences	832
Russ (2020)	runoff, temperature, precipitation	runoff shocks, annual temperature shocks, annual precipitation shocks	fixed effects panel regression	833
Saucy et al. (2021)	temperature, precipitation	daily outdoor temperature, daily maximum, minimum, mean temperature, daily mean precipitation	distributed lag non-linear model	834
Schleypen et al. (2022)	temperature, precipitation	mean annual temperature, total annual precipitation, total annual precipitation, temperature shock, warm-spell duration index, maximum annual temperature	non-linear panel regression, spatial Durbin model	835
Schmitt et al. (2022)	soil moisture, extreme weather events	drought, soil moisture, waterlogging, black frost, spring chill, heat	fixed effects panel regression	836
Semenova (2024)	-	-	-	837
Sheng et al. (2023)	temperature	year-on-year temperature growth, temperature volatility	local projections	838
Tol (2024)	-	-	-	839
Ubilava (2017)	sea surface temperature	Nio index, sea surface temperature anomaly	vector smooth transition autoregression	840

875 **Table S5:** Weather variables and methods used in the reviewed studies (continued)
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877 Publication	878 Weather studied	879 stud-	880 Weather measure	881 Methodology
882 Ubilava and Abdolrahimi (2019)	883 sea surface temperature	884 surface	885 sea surface temperature anomaly	886 fixed effects panel regression
887 Verschuur et al. (2023)	888 temperature, extreme weather events	889 -	890 -	891 OLS regression
892 Vielma et al. (2024)	893 temperature	894 cross-basis function of	895 temperature	896 quasi-Poisson generalized linear regression, distributed lag non-linear model
897 von Möllendorff and Hirschfeld (2016)	898 extreme weather events	899 extreme weather events	900 extreme weather events	901 fixed effects panel regression
902 Waldinger (2024)	903 temperature, precipitation, droughts	904 deviations from long-term mean of temperature and precipitation	905 -	906 fixed effects panel regression
907 Wasko et al. (2021)	908 precipitation, temperature	909 drought	910 -	911 linear regression
912 Zou et al. (2024)	913 temperature, precipitation	914 annual average of day-to-day temperature variability, wet days, extreme rainfall days, monthly rainfall deviations	915 -	916 random effects panel regression

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 908 **Table S6:** Weather data features and controls used in the reviewed studies
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910 Publication	911 Weighted	912 Weather data source	913 Controls used
914 Achebak et al. (2024)	915 No	916 E-OBS	917 day of the week, day of the season, year squared
918 Ahmed et al. (2024)	919 No	920 Visual Crossing Weather	day of the week
921 Bastos et al. (2013)	922 Yes	923 Terrestrial Air Temperature and Precipitation	924 industry FE, country FE, year FE
925 Beirne et al. (2024)	926 No	927 EM-DAT	928 -

Table S6: Weather data features and controls used in the reviewed studies (continued)			921	
Publication	Weighted	Weather data source	Controls used	922
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Berg et al. (2024)	No	Terrestrial Air Temperature and Precipitation, Berkeley Earth Global Daily Land Average Temperature	-	924
Bigerna (2018)	Yes	Italian Military Airforce General Office for Meteorology	-	925
Bigler and Janzen (2024)	No	ERA5	district FE, state-year-month FE, day-of-week FE, holiday FE	926
Black et al. (2013)	-	-	-	927
Blumenthal and Nyberg (2019)	No	State Meteorological Agency	-	928
Boccard (2018)	No	CATNAT	-	929
Cai et al. (2016)	Yes	NASA	country pair FE, origin country-specific linear time trend, destination country-specific linear time trend	930
Cashin et al. (2017)	No	National and Oceanic Atmospheric Administration	-	931
Cevik and Gwon (2024)	No	World Bank Climate Change Knowledge Portal	-	932
Chabot and Bertrand (2023)	Yes	State Meteorological Agency	-	933
Chambru (2020)	No	European Seasonal Temperature and Precipitation Reconstruction	province FE, time FE	934
Chen et al. (2023)	No	CMIP6, TerraClimate	-	935
Chen et al. (2021)	No	International Disasters Database	cross-specific FE	936
Ciccarelli et al. (2024)	Yes	ERA5	seasonal dummy variables	937
Colelli et al. (2023)	Yes	ERA5	time FE, region FE, day-of-year FE, weekly FE, monthly FE, yearly FE	938
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967 **Table S6:** Weather data features and controls used in the reviewed studies (continued)
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969	Publication	Weighted	Weather data source	Controls used
970	Crispino and	No	E-OBS, European	Severe region FE, week-year FE
971	Loberto (2024)		Weather Dataset	
972	Díaz et al. (2015)	No	State Meteorological	-
973			Agency	
974	Donadelli et al. (2021)	No	World Bank Climate Change Knowledge Portal, Climatic Research Unit	country FE
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976	Donadelli et al. (2022)	No	World Bank Climate Change Knowledge Portal	country FE
977				
978	Drescher and	No	State Meteorological	zip-code-by-week FE,
979	Janzen (2025)		Agency	region-by-year-month FE,
980				day of the week, holiday
981	Ellena et al. (2022)	No	UERRA Regional Reanalysis Dataset	day of week
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983	Falk (2013)	No	Central Institute for Meteorology and Geodynamics (ZAMG Austria)	-
984				
985	Felbermayr et al. (2022)	No	Climatic Research Unit	cell FE
986				
987	Gössling et al. (2023)	-	-	-
988				
989	Gupta et al. (2023)	No	National and Atmospheric Administration	-
990				
991	Hoffmann et al. (2022)	No	ERA5	region FE, time-period FE, season FE
992				
993	Huang and Hong (2024)	Yes	Climatic Research Unit, CMIP6, World Bank Climate Change Knowledge Portal	country FE, country-specific time trends, year squared
994				
995	Jennings and	No	State Meteorological	province-level FE,
996	Gray (2015)		Agency	quadratic time trend
997	Kahn et al. (2021)	Yes	Terrestrial Air Temperature and Precipitation	country FE, time FE
998				
999	Karlsson and Ziebarth (2018)	Yes	State Meteorological Agency	country FE, week FE, year-month FE, splines of the date
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1001	Khan et al. (2017)	No	ERA-Interim, MacPDM	country-basin FE, year FE
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Table S6: Weather data features and controls used in the reviewed studies (continued)						1013
Publication	Weighted Weather data source		Controls used			1014
Kotz et al. (2021)	No	ERA5	region FE, year FE, time trend			1015
Kotz et al. (2024)	Yes	ERA5	country FE, time FE, country-month FE			1016
Letta and Tol (2019)	Yes	Terrestrial Air Temperature and Precipitation	country FE, region-year FE			1017
Linsenmeier (2023)	No	ERA5	country FE, country-pair border FE			1018
Lis and Nickel (2010)	No	EM-DAT	time FE, country FE			1019
Lpez-Bueno et al. (2019)	No	State Agency	Meteorological	seasonality, month, year, time trend		1020
Lpez-Bueno et al. (2020b)	No	State Agency	Meteorological	-		1021
Lpez-Bueno et al. (2021)	No	State Agency	Meteorological	time trend, month-year, seasonality		1022
Lpez-Bueno et al. (2020a)	No	State Agency	Meteorological	-		1023
Lpez-Bueno et al. (2022)	No	State Agency	Meteorological	seasonality		1024
Lucidi et al. (2024)	Yes	-	country FE, country time-varying trend			1025
Mannell et al. (2024)	No	EM-DAT	-			1026
Marinaccio et al. (2019)	No	NASA	municipality FE, year FE, month, day of the week, holiday			1027
Martnez-Solanas and Basagaa (2019)	No	European Climate Assessment Dataset	-			1028
Middelanis et al. (2023)	No	CMIP5	-			1029
Miller et al. (2021)	Yes	Climate Prediction Center	country FE, year FE, linear and quadratic country time trends			1030
Mosquera-Lpez et al. (2024)	No	Bloomberg	-			1031
Mukherjee and Ouattara (2021)	Yes	UN Climate Database	country FE, year FE			1032

1059 **Table S6:** Weather data features and controls used in the reviewed studies (continued)
 1060

1061	Publication	Weighted	Weather data source		Controls used
1062	Mumtaz and Theophilopoulou (2024)	No	Climatic Research Unit		country FE, region FE, time FE
1063	Otrachshenko and Popova (2022)	Yes	State Agency	Meteorological	regional FE, time FE, time trend, region-specific linear trend
1064	Otrachshenko et al. (2021)	Yes	State Agency	Meteorological	regional FE, time FE, time trend, region-specific linear trend
1065	Otrachshenko et al. (2017)	Yes	State Agency	Meteorological	regional FE, time FE, time trend, region-specific linear trend
1066	Pablo-Romero et al. (2019)	No	State Agency	Meteorological	province FE, time FE
1067	Paglalunga et al. (2022)	No	Climatic Research Unit		country FE, time FE
1068	Peillex et al. (2021)	No	Infoclimat		month, day of the week, year
1069	Quante et al. (2024)	Yes	CMIP6		-
1070	Rubio-Cabaez (2024)	Yes	State Agency	Meteorological	municipality FE, time FE
1071	Russ (2020)	No	Global Water Availability Model, Terrestrial Air Temperature and Precipitation		grid FE, year FE, country time trends
1072	Saucy et al. (2021)	Yes	State Agency	Meteorological	country FE
1073	Schleypen et al. (2022)	Yes	Global Land Assimilation System		region FE, time FE
1074	Schmitt et al. (2022)	No	State Agency	Meteorological	farm-level FE, year FE
1075	Semenova (2024)	-	-	-	-
1076	Sheng et al. (2023)	No	State Agency	Meteorological	-
1077	Tol (2024)	-	-	-	-
1078	Ubilava (2017)	No	National and Administration	Oceanic and Atmospheric	-

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Table S6: Weather data features and controls used in the reviewed studies (continued)							1105
Publication	Weighted	Weather data source	Controls used				1106
Ubilava and Abdolrahimi (2019)	No	National and Administration	Oceanic and Atmospheric	country FE, country trend	quadratic		1107
Verschuur et al. (2023)	No	-	-	-	-		1108
Vielma et al. (2024)	Yes	E-OBS (European Climate Assessment and Dataset)	smooth functions of time, day of the week, holidays, Easter, Christmas, August, 11 March				1109
von Möllendorff and Hirschfeld (2016)	No	-	-	individual FE, time FE			1110
Waldinger (2024)	No	-	-	region FE			1111
Wasko et al. (2021)	No	Sigma	-	-			1112
Zou et al. (2024)	No	20CRv3-W5E5	-	region RE, time RE			1113
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1151 **Table S7:** Publications broken down by use of population weight for aggregation of
 1152 weather data
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1154		Publications	NP
1155	Do not use	Achebak et al. (2024), Ahmed et al. (2024), Beirne	51
1156	population-weighted	et al. (2024), Berg et al. (2024), Bigler and Janzen	
1157	data	(2024), Blumenthal and Nyberg (2019), Boccard	
1158		(2018), Cashin et al. (2017), Cevik and Gwon	
1159		(2024), Chambru (2020), Chen et al. (2023), Chen	
1160		et al. (2021), Crispino and Loberto (2024), Díaz	
1161		et al. (2015), Donadelli et al. (2021), Donadelli	
1162		et al. (2022), Drescher and Janzen (2025), Ellena	
1163		et al. (2022), Falk (2013), Felbermayr et al. (2022),	
1164		Gupta et al. (2023), Hoffmann et al. (2022), Jen-	
1165		nings and Gray (2015), Khan et al. (2017), Kotz	
1166		et al. (2021), Linsenmeier (2023), Lis and Nickel	
1167		(2010), Lpez-Bueno et al. (2019), Lpez-Bueno	
1168		et al. (2020b), Lpez-Bueno et al. (2021), Lpez-	
1169		Bueno et al. (2020a), Lpez-Bueno et al. (2022),	
1170		Mannell et al. (2024), Marinaccio et al. (2019),	
1171		Martnez-Solanas and Basagaa (2019), Middelanis	
1172		et al. (2023), Mosquera-Lpez et al. (2024), Mum-	
1173		taz and Theophilopoulou (2024), Pablo-Romero	
1174		et al. (2019), Paglialunga et al. (2022), Peillex	
1175		et al. (2021), Russ (2020), Schmitt et al. (2022),	
1176		Sheng et al. (2023), Ubilava (2017), Ubilava	
1177		and Abdolrahimi (2019), Verschuur et al. (2023),	
1178		von Möllendorff and Hirschfeld (2016), Waldinger	
1179		(2024), Wasko et al. (2021), Zou et al. (2024)	
1180	Use population-	Bastos et al. (2013), Bigerna (2018), Cai et al.	22
1181	weighted	(2016), Chabot and Bertrand (2023), Ciccarelli	
1182	data	et al. (2024), Colelli et al. (2023), Huang and Hong	
1183		(2024), Kahn et al. (2021), Karlsson and Ziebarth	
1184		(2018), Kotz et al. (2024), Letta and Tol (2019),	
1185		Lucidi et al. (2024), Miller et al. (2021), Mukher-	
1186		jee and Ouattara (2021), Otrachshenko and Popova	
1187		(2022), Otrachshenko et al. (2021), Otrachshenko	
1188		et al. (2017), Quante et al. (2024), Rubio-Cabaez	
1189		(2024), Saucy et al. (2021), Schleypen et al. (2022),	
1190		Vielma et al. (2024)	
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 1193 Note: NP refers to Number of Publications.
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