Panta Rhei benchmark dataset: socio-hydrological data of paired events of floods and droughts
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1. Licence

2. Citation

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3. Data Description

As the negative impacts of hydrological extremes increase in large parts of the world, a better understanding of the drivers of change in risk and impacts is essential for effective flood and drought risk management and climate adaptation. However, there is a lack of comprehensive, empirical data about the processes, interactions and feedbacks in complex human-water systems leading to flood and drought impacts. To fill this gap, we present an IAHS Panta Rhei benchmark dataset containing socio-hydrological data of paired events, i.e. two floods or two droughts that occurred in the same area (Kreibich et al. 2017, 2019). The contained 45 paired events occurred in 42 different study areas (in three study areas we have data on two paired events), which cover different socioeconomic and hydroclimatic contexts across all continents. The dataset is unique in covering floods and droughts, in the number of cases assessed and in the amount of qualitative and quantitative socio-hydrological data contained.

References to the data sources are provided in **2022-002_Kreibich-et-al_Key_data_table.xlsx** where possible.

3.1. Sampling method

Based on templates, we collected detailed, review-style reports describing the event characteristics and processes in the case study areas, as well as various semi-quantitative data, categorised into management, hazard, exposure, vulnerability and impacts. Sources of the data were classified as follows: scientific study (peer-reviewed paper and PhD thesis), report (by governments, administrations, NGOs, research organisations, projects), own analysis by authors, based on a database (e.g. official statistics, monitoring data such as weather, discharge data, etc.), newspaper article, and expert judgement.

The campaign to collect the information and data on paired events started at the EGU General Assembly in April 2019 in Vienna and was continued with talks promoting the paired event data collection at various conferences. Communication with the Panta Rhei community and other flood and drought experts identified through snowballing techniques was important. Thus, data on paired events were provided by professionals with excellent local knowledge of the events and risk management practices.

3.2. Data processing

From the detailed review-style reports about the paired events, key data (qualitative and quantitative) characterising impacts, hazard, exposure, vulnerability and risk management of the paired events is extracted. On this basis, indicators-of-change that represent the differences between the first event used as baseline, and the second event are developed. The indicators-of-change are categorised as large decreases/increases (-2/2), small decreases/increases (-1/1) and no change (0). To minimise the subjectivity and uncertainty of indicator assignment, a quality assurance protocol is implemented. The quality assurance process was driven by a core group (HK, AvL, KS, PW, GdB) and was undertaken in the following steps: (a) on the basis of the detailed report a core group member suggested values for all indicators-of-change for a paired event; (b) a second member of the core group reviewed these suggestions. In case of doubt, both core group members rechecked the paired event report, and provided a joint suggestion; (c) all suggestions for the indicators-of-change for all paired events were discussed in the core group to improve consistency across paired events; (d) the suggested values of the indicators-of-change were reviewed by the paired event report authors; (e) finally, the complete table of indicators-of-change was reviewed by all authors to ensure consistency between the paired events.

4. File description

4.1. File inventory

The dataset contains the following five files:

- **2022-002_Kreibich-et-al_PairedEventReports.pdf:** PDF document containing the paired event reports (346 pages). The paired event reports are between 3 and 18 pages long and are structured in the following sections: 1) short description of events with a focus on impacts; 2) descriptions of processes between events with a focus on risk management 3) event comparison in respect to hazard; 4) event comparison in respect to exposure; 5) event comparison in respect to vulnerability; 6) summary; 7) references. For each paired event report, 1-4 co-authors are responsible, they are the experts best placed to answer specific questions about the events. They are listed at the beginning of the individual paired event reports.
- **2022-002_Kreibich-et-al_Key_data_table.xlsx**: Excel file containing the key data separated into the following 4 spreadsheets: 1) key data of drought paired events, 2) references for the drought events, 3) key data of flood paired events, 4) references for the flood events.

- **2022-002_Kreibich-et-al_Definitions_Examples.pdf**: PDF document containing definitions and examples of description or measurement of indicators characterising the impacts, hazard, exposure and vulnerability as well as the management shortcomings for floods and droughts.
- **2022-002_Kreibich-et-al_Indicators_of_change.CSV**: CSV file containing the indicators-of-change for the drought and flood paired events. These indicators-of-change represent the differences between the first event used as baseline to the second event, categorised as large decreases/increases (-2/2), small decreases/increases (-1/1) and no change (0). Examples of how these indicators are assigned are provided in Examples_indicator_of_change_assignment.docx.
- **2022-002_Kreibich-et-al_Examples_indicator_of_change_assignment.pdf**: PDF document containing representative examples from flood and drought paired events of quantitative variables and textual descriptions corresponding to the five classes of change ranging from large decrease (-2) to large increase (+2) from the first event used as baseline to the second event of a pair.

4.2. Description of data tables

4.2.1. 2022-002_Kreibich-et-al_Key_data_table.xlsx

Spreadsheets: drought and flood

1. line: ID of paired event.

2. line: Text describing the event type (e.g. pluvial flood, meteorological drought).

3. line: Text describing the catchment or region and country of paired event occurrence.

4. line: Year(s) of event occurrence.

5-37 lines (uneven line numbers): Quantitative or qualitative (textual descriptions) data characterizing the sub-indicators for management, hazard, exposure, vulnerability and impacts. Citations of the sources of data are provided where possible. Definitions of these sub-indicators as well as examples of how they are measured or characterised are provided in 2022-002_Kreibich-et-al_Definitions_Examples.pdf; NA: not available (unknown, not measured).

6-38 lines (even line numbers): “source of data” classified as follows: scientific study (peer reviewed paper and PhD thesis), report (by governments, administrations, NGOs, research organisations, projects), own analysis by authors, based on database (e.g. official statistics, monitoring data such as weather, discharge data, etc.), newspaper article, and expert judgement.

Spreadsheets: drought_references and flood_references

Column: ID of Paired event (used to link the citations to the references provided separately per paired events (columns) in lines 5-37 (uneven line numbers) in spreadsheets: drought and flood).

Column: References (references for the citations provided in lines 5-37 (uneven line numbers) in spreadsheets: drought and flood).

4.2.2. 2022-002_Kreibich-et-al_Indicators_of_change.CSV

Column header	**Description**
Paired event ID	ID of paired event
Event type	Text describing the event type (e.g. pluvial flood, meteorological drought)
Area: Catchment/region	Text describing the catchment or region of paired event occurrence
Area: Country	Text describing the country of paired event occurrence

Years of events	Years when the two events occurred
Management: Problems with water management infrastructure	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Management: Non-structural risk management shortcomings	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Management: Summary management shortcomings	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Duration of drought (only droughts)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Severity of drought (only droughts)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Tidal level (only coastal floods)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Storm surge (only coastal floods)	Indicator of change: -2: large decrease -1: small decrease

	0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Antecedent conditions (only pluvial & riverine floods)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Precipitation / weather severity (only floods)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Severity of flood (only floods)	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Hazard: Summary hazard	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Exposure: People/area/assets exposed	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Exposure: Exposure hotspots	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured)

	NR: not relevant (for the specific event type)
Exposure: Summary exposure	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Vulnerability: Lack of awareness and precaution	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Vulnerability: Lack of preparedness	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Vulnerability: Imperfect official emergency / crisis management	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Vulnerability: Imperfect coping capacity	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Vulnerability: Summary vulnerability	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Impacts: Number of fatalities (only floods)	Indicator of change: -2: large decrease -1: small decrease

	0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Impacts: Direct economic impacts	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Impacts: Indirect impacts	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Impacts: Intangible impacts	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)
Impacts: Summary impacts	Indicator of change: -2: large decrease -1: small decrease 0: no change +1: small increase +2: large increase NA: not available (unknown, not measured) NR: not relevant (for the specific event type)

5. References

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