

Part of: Kreibich, Heidi; Schröter, Kai; Di Baldassarre, Giuliano; Van Loon, Anne; Mazzoleni, Maurizio; et al. (2022): Panta Rhei benchmark dataset: socio-hydrological data of paired events of floods and droughts. GFZ Data Services. <https://doi.org/10.5880/GFZ.4.4.2022.002>

**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.**

Indicator	Definitions	Example description or measurement for floods	Example description or measurement for droughts
<b>Impact</b>			
Number of fatalities (only floods)	Number of fatalities due to the direct impact of a hazard.	Number of fatalities, e.g. reported in newspapers	<i>Not relevant</i>
Direct economic impacts	Direct economic impacts are due to the direct physical effect of a hazard on economic assets <sup>14</sup>	Flood damage to buildings expressed in Euros, e.g. recorded by insurance companies	Drought damage to crops expressed in Euros, e.g. quantified by compensation programmes
Indirect impacts	Indirect impacts occur inside or outside the hazard area, often with a time lag. They are commonly induced by direct impacts <sup>14</sup>	Disturbance of supply chains, e.g. described in economic reports	Loss of livelihoods, job loss in agriculture, e.g. described in governmental reports
Intangible impacts	Intangible impacts refer to damage to people, goods and services that are not easily measurable in monetary terms because they are not traded on a market (these can be direct or indirect impacts) <sup>14</sup>	Damage to cultural heritage, e.g. described by authorities	Damage to ecosystems, e.g. described by authorities
<b>Drivers of impact</b>			
<b>Hazard</b>			
Severity of flood/drought	Severity of the event in terms of hydro-meteorological processes, i.e. hazard	Maximum discharge measured at gauging station	Standardized Precipitation Evapotranspiration Index (SPEI), estimated based on the water balance
Duration of drought (only droughts)	Number of months in drought conditions <sup>54</sup>	<i>Not relevant</i>	Drought starts in the month when Standardized Precipitation Index falls below –1 and it ends when SPI returns to positive values
Precipitation / weather severity (only floods)	Heavy precipitation or severe weather that triggered the flood	Precipitation measured at weather stations	<i>Not relevant</i>
Antecedent conditions (only pluvial and riverine floods)	Conditions at the onset of an event that may exacerbate or mitigate the event <sup>55</sup>	Antecedent precipitation index, which is the weighted sum of past daily precipitation amounts, used as a proxy for soil moisture or: as an indicator for catchment wetness	<i>Not relevant</i>
Tidal level (only coastal floods)	Tidal water level at the time of coastal flood occurrence	Tidal water level measured at tide gauges	<i>Not relevant</i>

Storm surge (only coastal floods)	Rise in sea or estuary water level caused by the passage of a low pressure centre <sup>55</sup>	Sea water level measured at tide gauges	<i>Not relevant</i>
<b>Exposure</b>			
People/area/assets exposed	Number of people, size of area (e.g. settlement area, agricultural area) or number/value of assets located in affected areas <sup>9</sup>	Number of buildings in inundated area, e.g. estimated from satellite imagery	Number of inhabitants in drought affected area, e.g. from population statistics
Exposure hotspots	Areas of particularly high exposure affected during an event	Large scale industrial facility affected by flood	Hydraulic energy production affected by drought
<b>Vulnerability</b>			
Lack of awareness and precaution	Lack of understanding of the risk (e.g. sources, hazards, potential consequences, etc.) and implementation of suitable precautionary measures. Depends e.g. on experience, risk communication campaigns, incentives to implement precautionary measures	Ineffective risk communication, lack of guidelines and incentives for private precaution	Lack of drought experience
Lack of preparedness	Lack of knowledge and capacities developed by communities and individuals to effectively anticipate and respond to an event, e.g. via private emergency measures	Late early warning, insufficient resources like pumps, shutters, sandbags	Lack of water shortage response plans
Insufficient official emergency/crisis management	Organisational emergency or crisis management before or during an event was insufficient to optimally mitigate impacts	Lack of emergency plans, non-effective governance	Ineffective water demand management
Insufficient coping capacity	Coping capacity, which is the ability of communities using available skills and resources, to manage an event was insufficient due to a lack of funding (insurance, risk transfer), resources or skills	Low or lacking public flood compensation to individuals and businesses	Insufficient governmental aid or compensation
<b>Management shortcomings</b>			
Problems with water management infrastructure	Water management infrastructures such as levees, reservoirs, sewage systems, etc. failed or did not work optimally during an event due to deficits in maintenance, sub-optimal design, etc.	Number of levee breaches	Lack of water in reservoirs, insufficient storage capacity
Non-structural risk management shortcomings	Non-structural risk management measures, e.g. spatial planning that avoids increase of exposure in hazard-prone areas and private property level risk mitigation measures were not optimally implemented	Lack of hazard and risk maps	Ineffective water use restrictions