



# FDES: Chapter 3.4

## Extreme Events and Disasters

FDES: Framework for the Development of  
Environment Statistics



<http://www.unescap.org/our-work/statistics>



## Outline

### Extreme events and disasters

#### Level 1 (45min)

1. Overview
2. Sub-components 4.1, 4.2  
(Natural, Technological)
3. Group exercise

#### Level 2 (15min)

1. Data sources and issues
2. Group discussion




[dreamstime.com](http://dreamstime.com)


## Learning objectives

- Level 1 & 2
  - Understand the concepts of extreme events and disasters
  - Learn about the main data sources and issues
  - Learn the basics of compiling disaster indicators


## Links to international goals and frameworks




**1 NO POVERTY**




**2 NO HUNGER**



**11 SUSTAINABLE CITIES AND COMMUNITIES**



**13 CLIMATE ACTION**




- Number of deaths, missing persons and persons affected by disaster per 100,000 people
- Direct disaster economic loss in relation to global GDP, including disaster damage to critical infrastructure and disruption of basic services

**Sendai Framework for Disaster Risk Reduction**

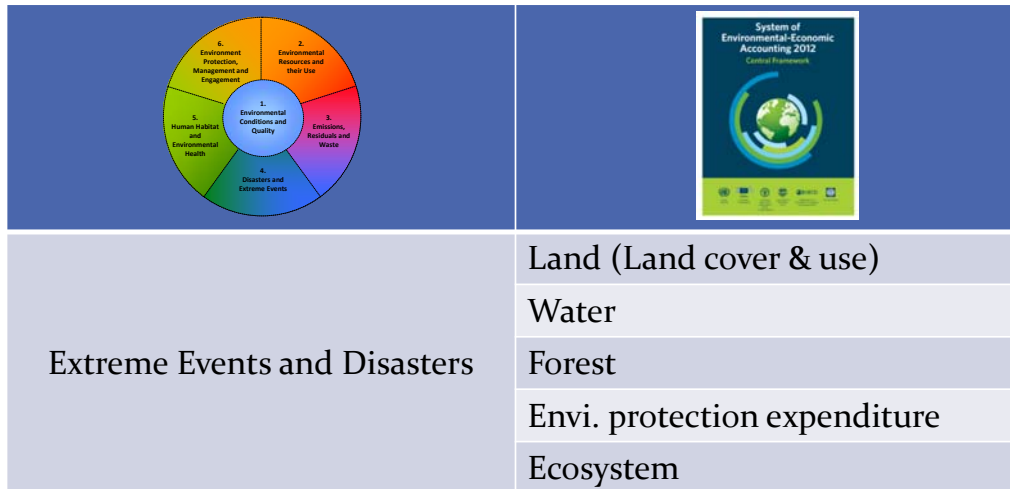
**2015 - 2030**

- Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality rate in the decade 2020-2030 compared to the period 2005-2015
- Substantially reduce the number of affected people globally by 2030, aiming to lower average global figure per 100,000 in the decade 2020 -2030 compared to the period 2005-2015
- Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030
- Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030

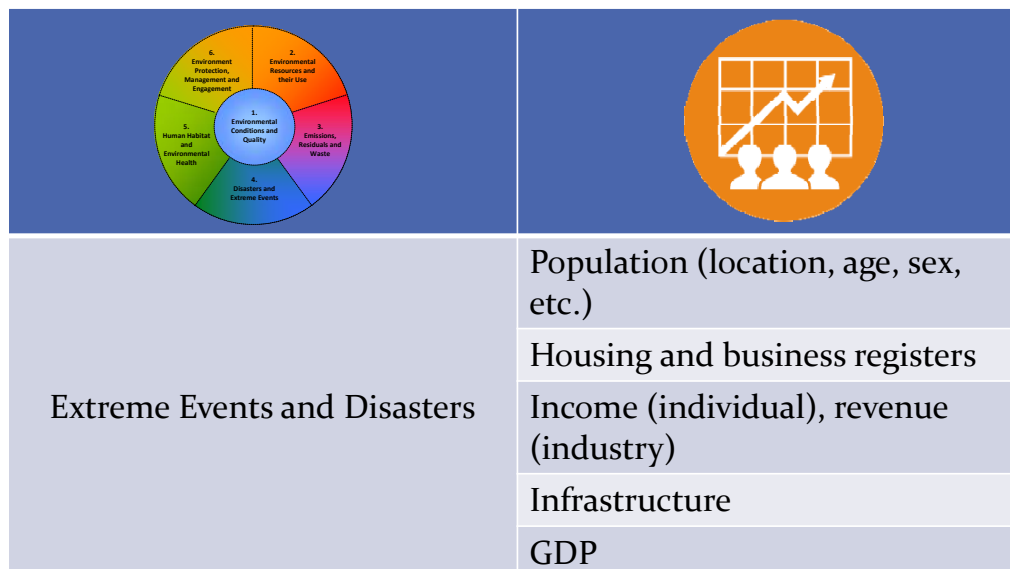




## Links to the SEEA



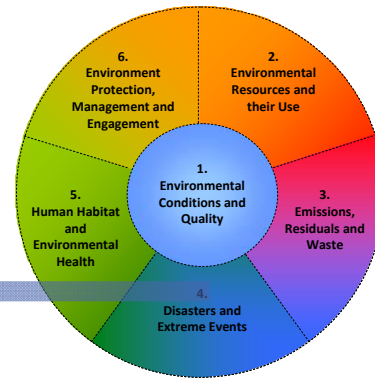
## Links to other basic statistics (baseline)



# FDES Components

## Component 4: Extreme events and disasters

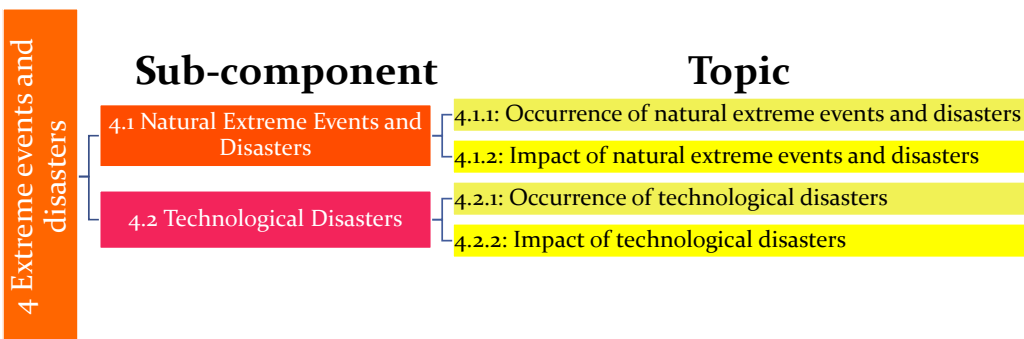
- 4.1 Natural extreme events and disasters
- 4.2 Technological disasters



### Examples of Core Set Statistics

Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters	<b>1. Type of natural extreme event and disaster</b> (geophysical, meteorological, hydrological, climatological, biological)
		<b>2. Location</b>
Topic 4.1.2: Impact	a. People affected by	<b>1. Number of people killed</b>

# What are extreme events and disasters?



- Extreme events → event rare within its statistical reference distribution at a particular location (10<sup>th</sup> or 90<sup>th</sup> percentile)
- Disaster → often described as a result of exposure to an extreme event
  - CRED/EM-DAT → unforeseen and often sudden event that causes great damage, destruction and human suffering.
    - Ten (10) or more people reported killed
    - One hundred (100) or more people reported affected,
    - Declaration of a state of emergency, or
    - Call for international assistance

## 4.1 Natural extreme events and disasters

### 4.1 Natural Extreme Events and Disasters

4.1.1: Occurrence of natural extreme events and disasters

4.1.2: Impact of natural extreme events and disasters

- 4.1 Natural extreme events and disasters
  - Frequency, intensity, impact of extreme events and disasters deriving from natural phenomena
- 4.1.1 Occurrence of natural extreme events and disasters
  - **Type** (Geophysical, Meteorological, Hydrological, Climatological, Biological, Extraterrestrial), **location**, magnitude, date, duration



\* **Bold text = Core Set/Tier I**

### • The indicators

Table 3.4.1.1: Statistics and Related Information for Topic 4.1.1

Component 4: Extreme Events and Disasters			
Sub-component 4.1: Natural Extreme Events and Disasters			
Topic 4.1.1: Occurrence of natural extreme events and disasters			
Statistics and Related Information ( <b>Bold Text</b> - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text</i> - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a. Occurrence of natural extreme events and disasters		<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> <li>• Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>• Centre for Research on the Epidemiology of Disasters Emergency Events Database (CREM-EM-DAT)</li> <li>• UN Economic Commission for Latin America and the Caribbean (UNECLAC) Handbook for Estimating the Socio-economic and Environmental Effects of Disasters</li> <li>• The United Nations Office for Disaster Risk Reduction (UNISDR)</li> </ul>
1. <b>Type of natural extreme event and disaster</b> (geophysical, meteorological, hydrological, climatological, biological)	Description		
2. <b>Location</b>	Location		
3. Magnitude (where applicable)	Intensity		
4. Date of occurrence	Date		
5. Duration	Time period		

## 4.1 Natural extreme events and disasters

### 4.1 Natural Extreme Events and Disasters

4.1.1: Occurrence of natural extreme events and disasters

4.1.2: Impact of natural extreme events and disasters

- 4.1.2 Impact of natural extreme events and disasters
  - Number of people: **killed**, injured, homeless and affected
  - **Economic losses**
    - e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption
      - *Handbook for Estimating the Socio-economic and Environmental Effects of Disasters*
  - Physical losses/damages
    - e.g., area and amount of crops, livestock, aquaculture, biomass
  - Effects on integrity of ecosystems
    - Area affected, loss of vegetation cover, area of watershed affected, others
  - External assistance received

\* **Bold text = Core Set/Tier I**

## • The indicators

Table 3.4.1.2: Statistics and Related Information for Topic 4.1.2

Component 4: Extreme Events and Disasters			
Sub-component 4.1: Natural Extreme Events and Disasters			
Topic 4.1.2: Impact of natural extreme events and disasters			
Statistics and Related Information ( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a. <b>People affected by natural extreme events and disasters</b>		<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> <li>• Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>• CRED EM-DAT</li> <li>• UNECLAC Handbook for Estimating the Socio-economic and Environmental Effects of Disasters</li> <li>• UNISDR</li> </ul>
1. <b>Number of people killed</b>	Number		
2. <b>Number of people injured</b>	Number		
3. <b>Number of people homeless</b>	Number		
4. <b>Number of people affected</b>	Number		
b. <b>Economic losses due to natural extreme events and disasters</b> (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption)	Currency	<ul style="list-style-type: none"> <li>• By event</li> <li>• By ISIC economic activity</li> <li>• National</li> <li>• Sub-national</li> </ul>	
c. <b>Physical losses/damages due to natural extreme events and disasters</b> (e.g., area and amount of crops, livestock, aquaculture, biomass)	Area, Description, Number		
d. <b>Effects of natural extreme events and disasters on integrity of ecosystems</b>		<ul style="list-style-type: none"> <li>• By event</li> <li>• By ecosystem</li> <li>• National</li> <li>• Sub-national</li> </ul>	
1. <b>Area affected by natural disasters</b>	Area		
2. <b>Loss of vegetation cover</b>	Area		
3. <b>Area of watershed affected</b>	Area		
4. <b>Other</b>	Description		
e. <b>External assistance received</b>	Currency	<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> </ul>	

## 4.2 Technological Disasters

- 4.2 Technological Disasters {
  - 4.2.1: Occurrence of technological disasters
  - 4.2.2: Impact of technological disasters

- 4.2 Technological disasters
  - Arise as a result of human intent, negligence or error, or faulty or failed technological applications
- 4.2.1 Occurrence of technological disasters
  - Type (industrial, transport, miscellaneous), location, magnitude, date, duration
- 4.2.2 Impact of technological disasters
  - Same as 4.1.2 but no Tier I indicators



### • The indicators

Table 3.4.2.1: Statistics and Related Information for Topic 4.2.1

Component 4: Extreme Events and Disasters			
Sub-component 4.2: Technological Disasters			
Topic 4.2.1: Occurrence of technological disasters			
Statistics and Related Information ( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a. Occurrence of technological disasters		<ul style="list-style-type: none"> <li>• By event</li> <li>• By ISIC economic activity</li> <li>• National</li> <li>• Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>• CRED EM-DAT</li> <li>• UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters</li> </ul>
1. Type of technological disaster (industrial, transportation, miscellaneous)	Description		
2. Location	Location		
3. Date of occurrence	Date		
4. Duration	Time period		

## • The indicators

Table 3.4.2.2: Statistics and Related Information for Topic 4.2.2

Component 4: Extreme Events and Disasters			
Sub-component 4.2: Technological Disasters			
Topic 4.2.2: Impact of technological disasters			
Statistics and Related Information ( <b>Bold Text</b> - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text</i> - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a. People affected by technological disasters		<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> <li>• Sub-national</li> </ul>	<ul style="list-style-type: none"> <li>• CRED EM-DAT</li> <li>• UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters</li> </ul>
1. Number of people killed	Number		
2. Number of people injured	Number		
3. Number of people homeless	Number		
4. Number of people affected	Number		
b. Economic losses due to technological disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption)	Currency	<ul style="list-style-type: none"> <li>• By event</li> <li>• By ISIC economic activity</li> <li>• National</li> <li>• Sub-national</li> <li>• By direct and indirect damage</li> </ul>	
c. Physical losses/damages due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass)	Area, Description, Number		
d. Effects of technological disasters on integrity of ecosystems		<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> <li>• Sub-national</li> </ul>	
1. Area affected by technological disasters	Area		
2. Loss of vegetation cover	Area		
3. Area of watershed affected	Area		
4. Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)	Description		
e. External assistance received	Currency	<ul style="list-style-type: none"> <li>• By event</li> <li>• National</li> </ul>	

## Questions/comments?

- Next: Group exercise
  - 20 minutes to prepare
  - 10 minutes to report answers



## Group exercise

- Situation
  - Have administrative records of disaster events
  - Have disaster definition and criteria
- Objective (Groups of 3-5 persons; 20min to prepare)
  - Compile statistics on extreme events and disasters by province and event for two reporting periods (2014&2015)
    - Number of occurrences, deaths, missing persons and persons affected
  - Calculate SDG indicator 1.5.1 for 2014 and 2015
    - Number of deaths, missing persons and persons affected by disaster per 100,000 people
    - Total population: 24.5 million in 2014 and 25.0 million in 2015
  - Analyze the results
- Report & discuss answers (10min)

## Group exercise

- Reporting table

Province	Disaster occurrences	Deaths	Missing persons	Persons affected
A1				
A2				
.				
.				
H4				
<b>Grand Total</b>				

Disaster event	Disaster occurrences	Deaths	Missing persons	Persons affected
Earthquake				
Flood				
Flood and landslide				
Forest fire				
Landslide				
Storm				
Strong wind				
Volcanic eruption				
Industrial accident				
Transport accident				
Urban fire				
<b>Grand Total</b>				

## Group exercise

- Is everyone clear on the objectives?
- 20 minutes group work
- Please ask questions
- Results:
  - Report number of occurrences, deaths, missing persons and persons affected by province and event (2014 and 2015)
  - SDG indicator 1.5.1 for 2014 and 2015
  - Report key conclusions from your analysis

## The answers

Province	2014			
	Disaster occurrences	Deaths	Missing persons	Persons affected
A1	1	0	0	141
A2	1	0	0	192
A4	1	2	0	1696
A5	1	11	0	48
A9	1	3	0	1050
B1	1	0	16	0
C2	5	4	24	5375
C3	4	2	1	1723
C5	2	5	0	8690
C6	2	0	11	5351
E2	2	0	63	0
F1	1	1	0	50920
F4	2	28	1	1182
G4	1	3	0	1677
G5	2	4	0	1263
G6	1	13	2	2
G7	3	37	59	11
H1	1	0	12	0
H4	1	0	14	0
<b>Grand Total</b>	<b>33</b>	<b>113</b>	<b>203</b>	<b>79321</b>

Province	2015			
	Disaster occurrences	Deaths	Missing persons	Persons affected
A1	4	37	2	24818
A2	1	0	0	152
A4	1	20	0	6
C1	3	20	35	12513
C2	2	55	35	23
C3	2	14	0	174
C4	1	0	22	0
C5	4	3	124	41020
C6	1	2	0	17272
E3	2	6	3	11163
F2	1	1	0	245
F3	1	1	11	6308
F4	5	62	5	9377
F5	1	13	0	0
G1	1	20	0	2
G2	2	2	0	3468
G3	1	1	0	2450
G5	1	1	5	263
G6	2	5	159	1688
G7	1	11	0	8
H4	1	28	0	0
<b>Grand Total</b>	<b>38</b>	<b>302</b>	<b>401</b>	<b>130950</b>

## The answers

2014				
Disaster event	Disaster occurrences	Deaths	Missing persons	Persons affected
Earthquake	2	0	30	500
Flood	13	25	20	69165
Flood and landslide	4	20	0	3148
Forest fire	1	2	0	1696
Landslide	2	12	1	182
Storm	5	1	65	4388
Transport accident	4	42	87	2
Volcanic eruption	1	0	0	192
Urban fire	1	11	0	48
<b>Grand Total</b>	<b>33</b>	<b>113</b>	<b>203</b>	<b>79321</b>

2015				
Disaster event	Disaster occurrences	Deaths	Missing persons	Persons affected
Earthquake	2	36	2	5488
Flood	19	51	5	115243
Flood and landslide	2	20	159	695
Industrial accident	2	28	124	0
Landslide	2	34	3	29
Storm	2	0	57	0
Strong wind	1	1	11	6308
Transport accident	6	127	37	35
Volcanic eruption	2	5	3	3152
<b>Grand Total</b>	<b>38</b>	<b>302</b>	<b>401</b>	<b>130950</b>

SDG 1.5.1*		
	2014	2015
Deaths	0.46	1.21
Missing persons	0.83	1.60
Persons affected	323.76	523.80

SDG 1.5.1* (Natural disasters)		
	2014	2015
Deaths	0.24	0.59
Missing persons	0.47	0.96
Persons affected	323.56	523.66

\* Number of deaths, missing persons and persons affected by disaster per 100,000 people

## The answers: *some data issues*

- Might double count the same disaster events (e.g., storm, flood) that affect more than one provinces
- Flood, landslide vs. flood and landslide
- Deaths due to a disaster?

The classifications to be used in the FDES to organize statistics on natural disasters are based on the CRED EM-DAT Database. The types of data to be registered in this component of environment statistics, at the most disaggregated variable level, may include, for each calendar year or other appropriate time frame:

*Table D.7: Record for individual natural disaster occurrence*

<b>1. Identification</b>	<b>1.1 Name or denomination (if any)</b>
	<b>1.2 Location and course, spatial trajectory or occurrence</b>
	<b>1.3 Magnitude (scale)</b>
	<b>1.4 Date</b>
	<b>1.5 National declaration of disaster</b>
	<b>1.6 Maps and pictures - hyperlink</b>
	<b>1.7 Appeal for international assistance</b>
<b>2. Type of natural disaster</b>	<b>2.1 Disaster sub-group</b>
	<b>2.2 Disaster main type</b>

*Table D.8: CRED EM-DAT classification of disasters<sup>232</sup>*

Disaster Sub-group		Disaster Main Type		Disaster Sub-type	
<b>1</b>	<b>Geophysical</b>	1.1	Earthquake	1.1.1	Ground shaking
				1.1.2	Tsunami
		1.2	Mass movement		
		1.3	Volcanic activity	1.3.1	Ash fall
				1.3.2	Lahar
				1.3.3	Pyroclastic flow
				1.3.4	Lava flow
<b>2</b>	<b>Meteorological</b>	2.1	Storm	2.1.1	Extra-tropical storm
				2.1.2	Tropical storm
				2.1.3	Convective storm
		2.2	Extreme temperature	2.2.1	Cold wave
				2.2.2	Heat wave
				2.2.3	Severe winter conditions
	2.3	Fog			

Table D.8: CRED EM-DAT classification of disasters<sup>232</sup>

Disaster Sub-group		Disaster Main Type		Disaster Sub-type	
3	Hydrological	3.1	Flood	3.1.1	Coastal flood
				3.1.2	Riverine flood
				3.1.3	Flash flood
				3.1.4	Ice jam flood
		3.2	Landslide	3.2.1	Avalanche (snow, debris, mudflow, rockfall)
				3.3	Wave action
		3.3.1	Rogue wave	3.3.2	Seiche
4	Climatological	4.1	Drought		
				4.2	Glacial lake outburst
		4.3	Wildfire	4.3.1	Forest fire
				4.3.2	Land fire: brush, bush, pasture

Table D.8: CRED EM-DAT classification of disasters<sup>232</sup>

Disaster Sub-group		Disaster Main Type		Disaster Sub-type	
5	Biological	5.1	Epidemic	5.1.1	Viral disease
				5.1.2	Bacterial disease
				5.1.3	Parasitic disease
				5.1.4	Fungal disease
				5.1.5	Prion disease
		5.2	Insect infestation	5.2.1	Grasshopper
				5.2.2	Locust
		5.3	Animal accident		
6	Extraterrestrial	6.1	Impact	6.1.1	Airburst
				6.2	Space weather
		6.2.1	Energetic particles	6.2.2	Geomagnetic storm
				6.2.3	Shockwave



- Welcome to Level 2!
  - Main data sources
  - Common data issues



## Main data sources

- The most common data providers for disaster occurrence and impacts are national and sub-national authorities responsible for disaster management.
  - For major disasters, disaster impact assessments are carried out → providing detailed information on disaster impacts.
- Information from optical and radar satellite operators and seismic monitoring and research centres are useful for specifying disaster location, magnitude, date and duration.
- In some countries, insurance companies can provide reliable appraisals of the impacts.



## Common data issues

- Different definitions of “disaster” and disaster types
- Different disaster classifications
- Different scope of damage and losses
- Data entry issues
  - Beginning and end of a disaster event
  - Combined (cascading, linked) disasters
  - Affected population
    - “Death” as a consequence of a disaster
    - “Affected” vs. “Victims”
  - One large event affected different areas as discreet events
- Translation between local language and English

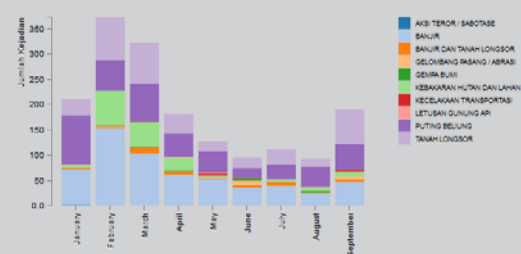


### Statistic of Disasters in Indonesia 2016

<http://dibi.bnpp.go.id/>

Until September 2016, disaster event data recorded as follow:

Number of Event	1,707
Death & Missing	411
Affected & Evacuated	2,214,256
Housing	25,578



### Total of Disaster, Victims and the Impact until September 2016

Disaster Type	Number of Event	Victims (people)			Damage (unit)							
		Death & Missing	Injured	Affected & Evacuated	House				Health Facilities	Worship Facilities	Education Facilities	
					Heavy Damage	Moderate Damage	Lightly Damage	Inundated				
AKSI TEROR / SABOTASE	1	7	20	0	0	0	0	0	0	0	0	0
BANJIR	584	128	102	2,053,108	1,858	823	5,108	187,029	15	197	209	
BANJIR DAN TANAH LONGSOR	47	43	4	35,557	361	150	1,063	7,166	8	5	8	
GELOMBANG PASANG / ABRASI	19	0	0	831	12	13	17	589	0	0	1	
GEMPA BUMI	10	2	42	872	380	1,036	3,036	0	3	8	10	
KEBAKARAN HUTAN DAN LAHAN	170	2	1	4	0	0	0	0	0	0	0	
KECELAKAAN TRANSPORTASI	12	83	19	0	0	0	0	0	0	0	0	
LETUSAN GUNUNG API	7	7	2	86,654	0	0	0	0	0	0	0	
PUTING BELUNG	400	15	128	0,184	1,149	1,210	0,841	0	2	22	44	
TANAH LONGSOR	384	144	77	30,781	919	793	782	303	9	23	26	
<b>TOTAL</b>	<b>1,704</b>	<b>411</b>	<b>335</b>	<b>2,213,861</b>	<b>4,689</b>	<b>4,031</b>	<b>16,858</b>	<b>195,627</b>	<b>37</b>	<b>252</b>	<b>357</b>	



- Base Layer**
- Show Label
  - # of Event
  - Death
  - Missing
  - Injured
  - Evacuated
  - Affected
  - Heavily Damage Houses
  - Lightly Damage Houses

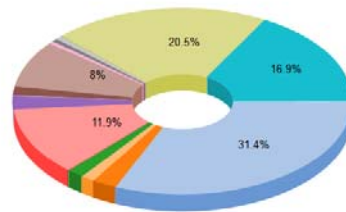
- Second Layer**
- # of Event
  - Death
  - Missing
  - Injured
  - Evacuated
  - Affected
  - Heavily Damage Houses
  - Lightly Damage Houses

Year  
1815 until 2016  
SUBMIT RESET

Hover the mouse over the map to see province name and the data.



- LAYER DASAR**
- 0 / Tidak ada data
  - 4k - 107
  - 108 - 214
  - 215 - 321
  - 322 - 428
  - 429 - 535
  - 536 - 642
  - > 643
- LAYER KEDUA**
- # of Event



- AKSI TEROR / SABOTASE
- BANJIR
- BANJIR DAN TANAH LONGSOR
- GELOMBANG PASANG / ABRASI
- GEJERA BUMI DAN TSUNAMI
- HAMA TANAMAN
- KEBAKARAN
- KEBAKARAN HUTAN DAN LAHAN
- KECELAKAAN INDUSTRI
- KECELAKAAN TRANSPORTASI
- KEKERINGAN
- KELAPARAN
- KLB
- KONFLIK / KERUSAKAN SOSIAL
- LETSIAN GUNUNG API
- PERUBAHAN IKLIM
- PUTING BELIUNG
- TANAH LONGSOR
- TSUNAMI

- Terrorism/sabotage
- Flood
- Flood and landslide
- Tidal wave/erosion
- Earthquake
- Earthquake and tsunami
- Plant pests
- Fire
- Fire: Forest and land
- Fire: Industrial
- Accident: Transport
- Drought
- Famine
- Unusual occurrence
- Conflict/Social unrest
- Volcanic eruption
- Climate change
- Tornado
- Landslide
- Tsunami

<http://dibi.bnpb.go.id/>

## Group discussion

- What is the definition of a disaster in your country?
- Should an event that adversely affects the environment/ecosystem, but does not directly or immediately affect people and/or the economy, be considered as a disaster (disaster vs. hazard)?
- What are some other challenges in producing disaster statistics?
- What can you do about it?



## Acknowledgements

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    - Tanzania:  
[http://unstats.un.org/unsd/environment/unsd\\_EAC\\_Project.html](http://unstats.un.org/unsd/environment/unsd_EAC_Project.html)
    - Togo:  
[http://unstats.un.org/unsd/environment/unsd\\_TogoWorkshop.html](http://unstats.un.org/unsd/environment/unsd_TogoWorkshop.html) (aussi en Français)