



UNIVERSITAS
GADJAH MADA



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A recent decade of Indonesian Flash Flood Disaster: Potential and Risk Reductions

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OUTLINE

- ❑ **INTRODUCTION** (Geographical Condition of Indonesia, Hydrometeorological Condition, Population (Growth and Density).
- ❑ **NATURAL DISASTERS IN INDONESIA** (Types of Disasters, Frequencies, Triggers, and Intensities,)
- ❑ **FLASH FLOODS IN INDONESIA** (Types of Floods, Potentiality, Efforts on Its Risk Mitigation)
- ❑ **FLASH FLOODS MITIGATION MANAGEMENT** (Platforms for Education and Research Dissemination of Flash Floos)
- ❑ **REMARKS** (Sequence, Anticipation and Focus on Flash Flood Occurrence)

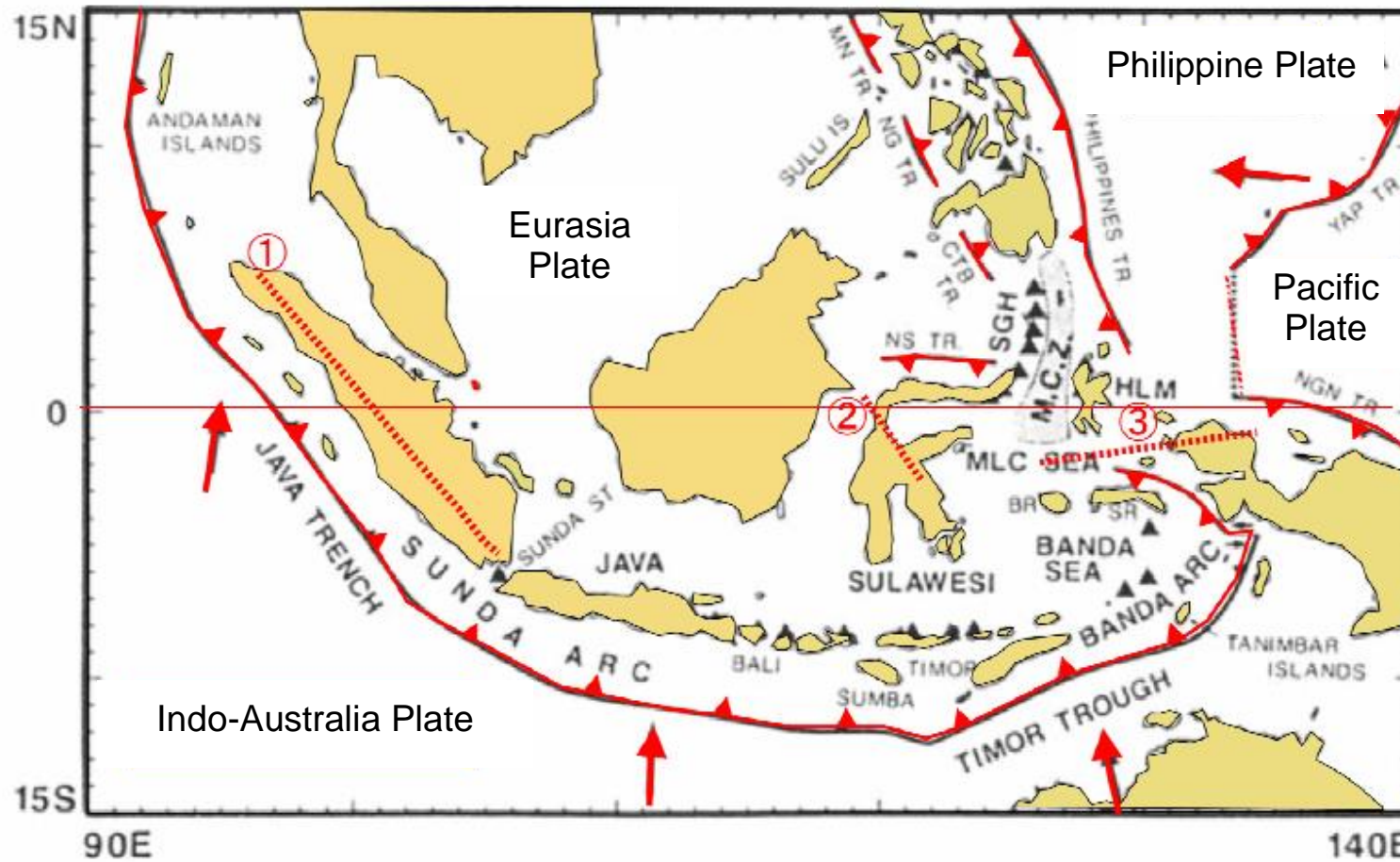




INTRODUCTION



INTRODUCTION



GEOGRAPHICAL
Total area : 1,811,570 Km²,
Islands : More than 17,000 islands,
Length of Coastline : 54,716 Km,
Latitude : between 7° N and 11° S,
Longitude : between 95° E and 140° E,

<https://www.worldometers.info/world-population/>

DEMOGRAPHY
Population : 274,858,76 (18 December 2020)
Population Density: 151 people per Km²

HYDROCLIMATOLOGY
Wet Season (Oct - Mar); 2000-4000 mm
Dry Season (Apr - Sep); < 200 mm

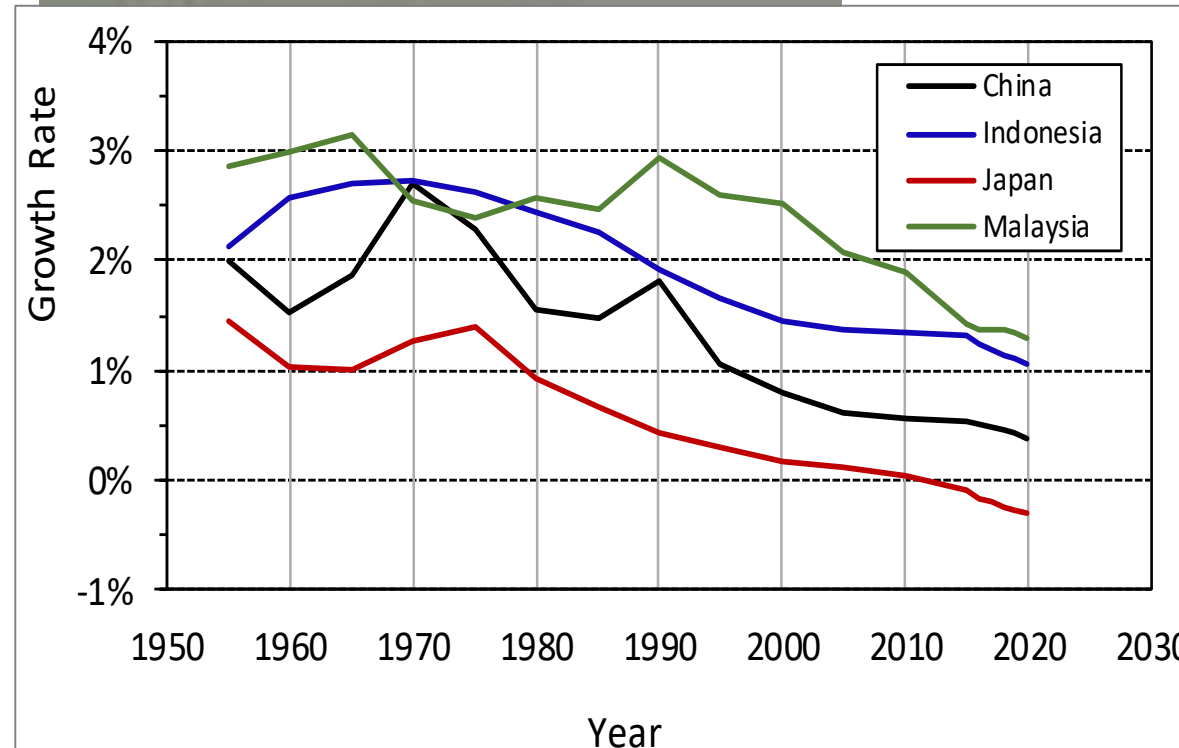
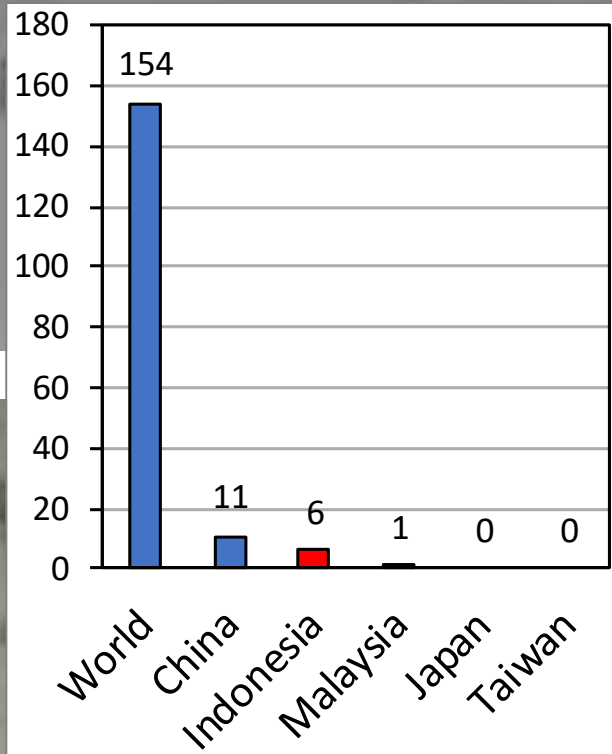


Current World Population
7,830,881,760

Indonesia Population
274,819,439

Population growth per minute as 7 December 2020 (13.00-15.00)

<https://www.worldometers.info/world-population/>

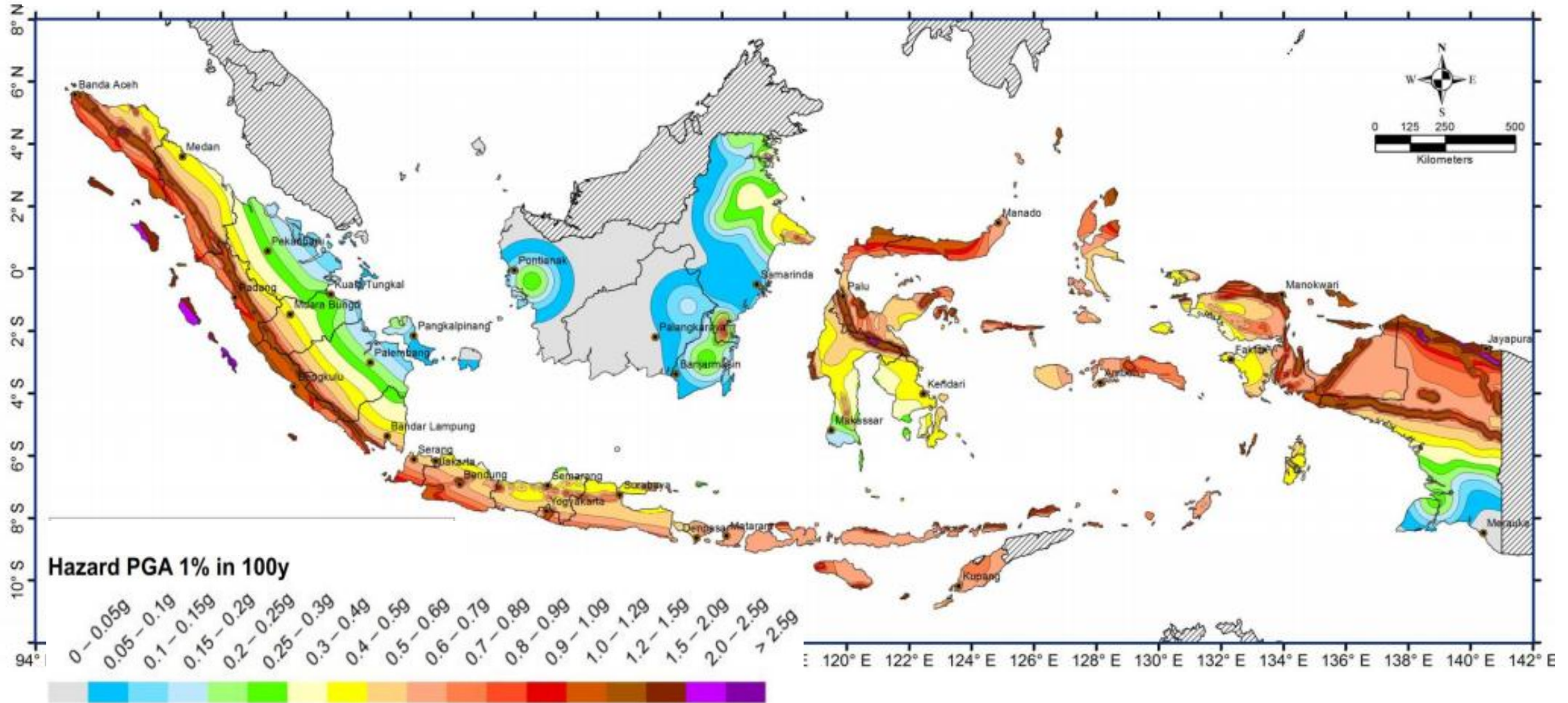


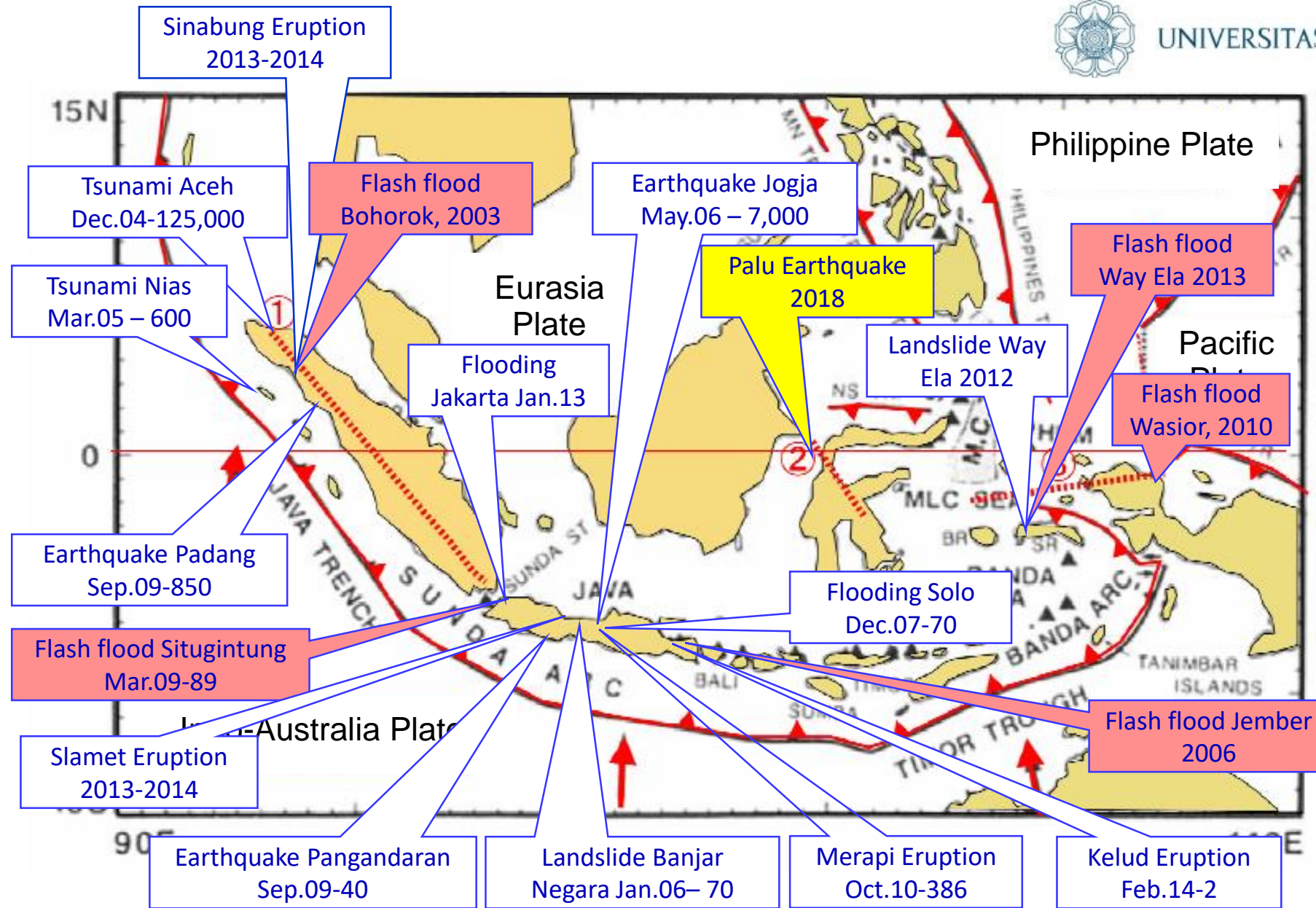


NATURAL DISASTERS IN INDONESIA

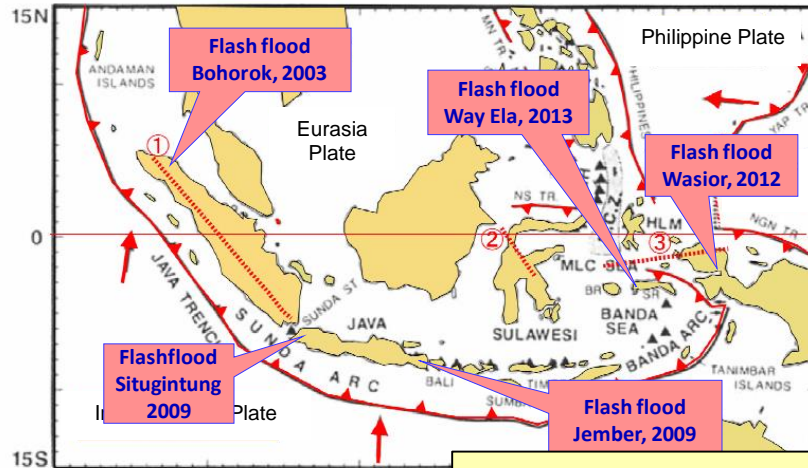
PGA Map at Soil Based for 1% probability of exceedance in 100 years,

<http://litbang.pu.go.id/puskim/source/pdf/Peta-Gempa-31-Jan-2018.pdf>





Worst cases of natural phenomena in Indonesia



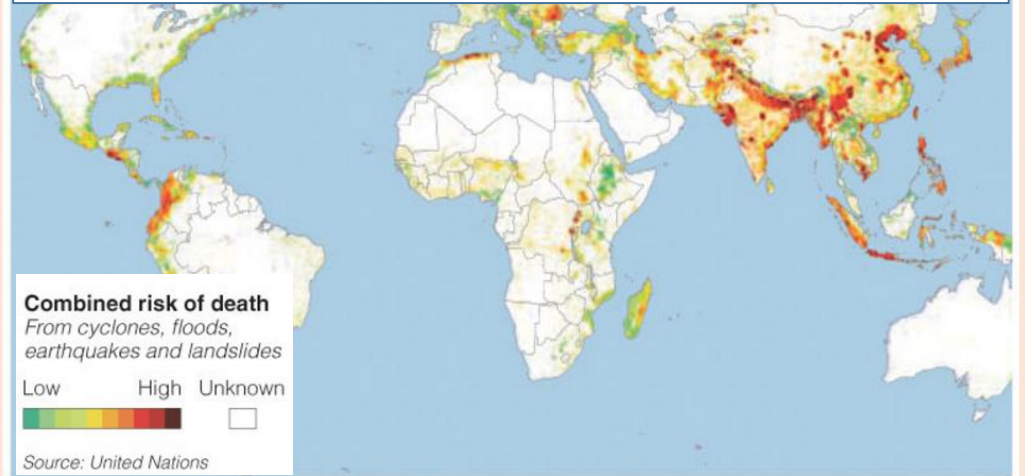
Heavy Rainfall
Huge Earthquake
Huge Eruption

TRIGGERS

Floods
Flash Floods
Debris Flows
Lava Flows
Landslides
Droughts
Tsunami
Liquefaction
Cyclone, etc.

NATURAL PHENOMENA

Map of Disaster Risks world-wide
(<http://dotearth.blogs.nytimes.com/?s=disasters+crowding+planet>) - The New York Times, 7 May 2009



Disaster	# of Events	Total killed	Avg.# Killed	Total Affected	Avg.# Affected
Cyclone	10	1,992	199	19,698	1,872
Drought	11	9,329	848	4,894,220	444,929
Earthquake	78	21,856	280	1,723,756	18,180
Flood	93	4,296	46	5,069,306	49,643
Volcano	43	17,945	417	981,853	22,351

Indonesian natural disasters (1907-2004), Center for Hazards and Risk Research at Columbia University, 2004

NATURAL DISASTERS



FLASH FLOODS IN INDONESIA



What is the difference between:

- Common Flood,
- Flash Flood
- Debris Flood



Solo River, Central Java



Gendol River, Yogyakarta Province



Way Ela, Maluku Province

Common Flood

Debris Flood
(*Banjir Lahar*)

Flash Flood
(*Banjir Bandang*)



Flash floods by definition (*DWRG, 2011*):

A flood that occurs suddenly and powerful. Flash floods are formed in the range of a few minutes to several hours after a heavy rain in a short time on the watershed or on a narrow river channel on the upstream. The flow to the river has a short time of concentration, so that runoff can quickly accumulate in the river channel (JICA, 2011)

Flash flood by characteristics (*DWRG, 2011*):

- has a peak discharge which jumped suddenly and subsided again quickly;
- has a big volume and high flow rate;
- has a very big flow transport capacity and erosion power, so can bring the material erosion toward downstream direction;
- the flow that bring debris material can lead to catastrophic sediment in downstream areas after the apex point.



Flash flood by causes (*DWRG, 2011*):

- Accumulation of heavy rainfall that fell in a short time duration on river upstream watershed, where then the volume of water collected in a short time into the river channel, causing a large spike and sudden discharge exceeds the capacity of the flow path downstream.
- The collapse of dam, levee or natural dam that occur because of the accumulation of landslide material on river channel.

Flash flood by features (*writter perception, 2014*):



Flash flood by features *(writer perception, 2014)*:

Type of Floods	Arrival time	Velocity	Destructive Power	Evacuation Time
Common Flood	Relatively Slowly	Slow	Medium to High	More Chance
Flash Flood	Very Quickly	High	Very High	Less Chance
Debris Flood	Medium/Very Quickly	Medium/High	Very High	Less Chance



Bohorok Flash Flood

(North Sumatera Province, 2 November 2003):

- The flash flood was caused by the failure of the **natural dam** (by suspects) as formed by the accumulation of debris (trees, woods, and sediment) resulted from **forest logging activities** at upstream of Bohorok River.
- Triggered by **three days consecutive rainfall at 200-300 mm/day** intensities.
- Around 400 houses, 3 mosques, 8 bridges, 280 kiosks and food stalls, 35 hotels, and guest houses were destroyed by the flood, **155 people** were killed and around 1,400 locals lost their homes.

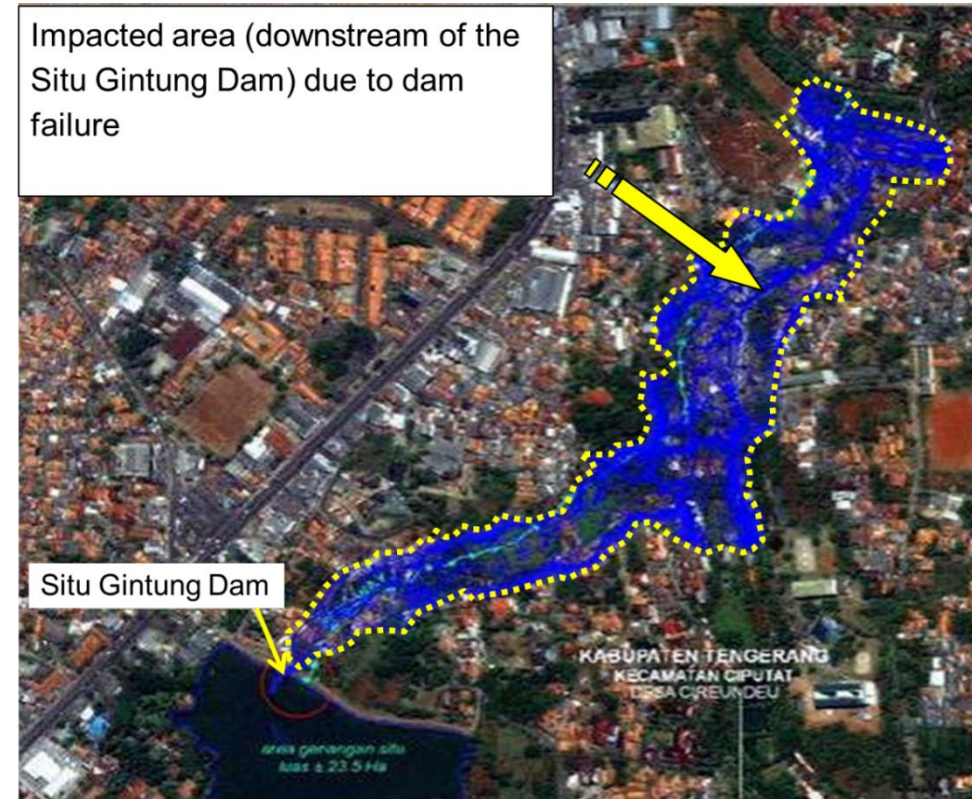


Situ Gintung Dam Failure

(Special Territory of Jakarta Province,
27 March 2009)



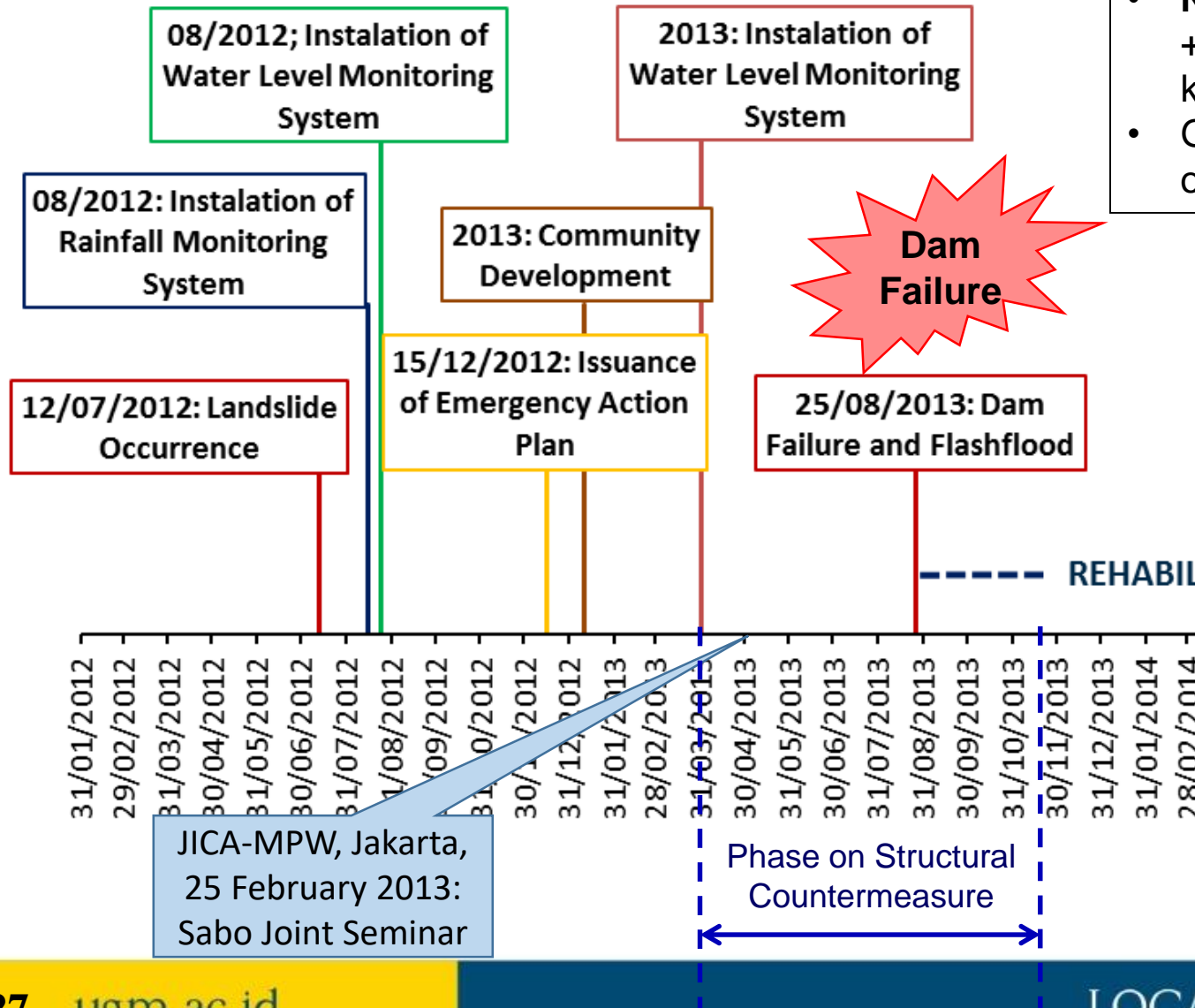
- Heavy rainfall (accompanied by ice fall) took place in the catchment area of Situ Gintung on 26 March 2009 at 16.00 – 19.00 at 70 mm/hr intensity



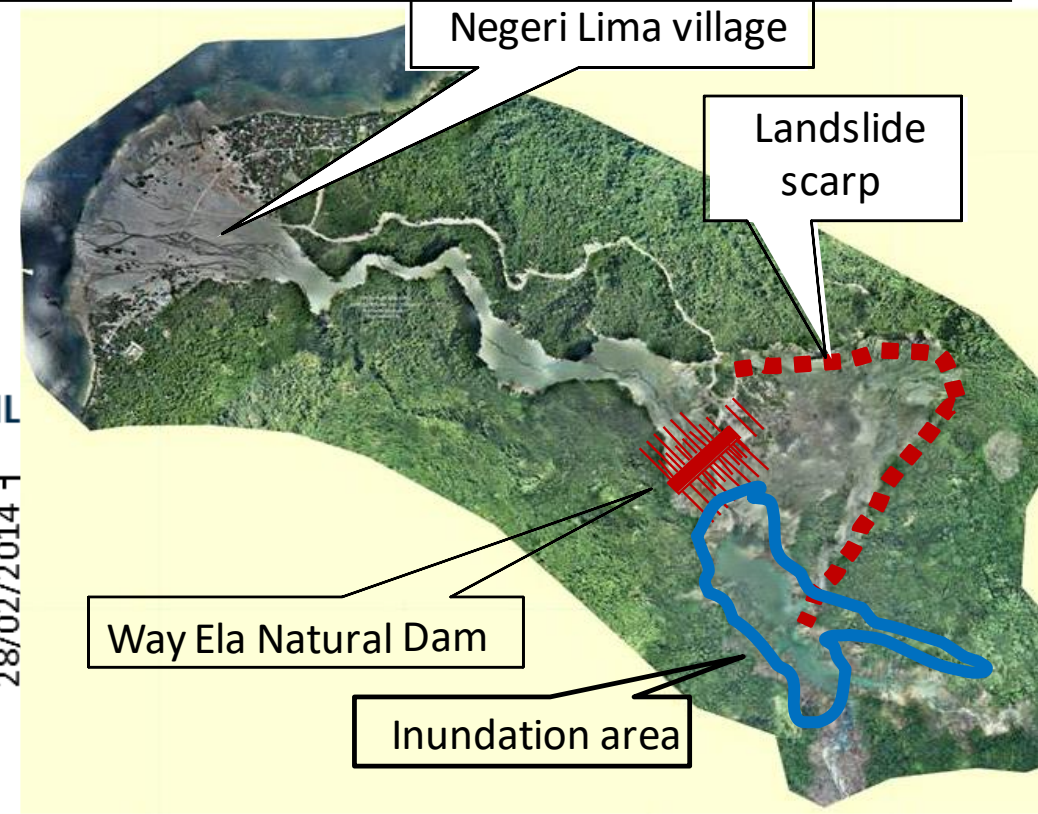
- More than 100 person were reported dead and another several persons were missing.
- No clear evident whether the failure was initiated by breaching or overtopping phenomenon.

Way Ela Flash Flood

(Maluku Province, 25 August 2013)



- Landslide occurrence: 12 July 2012, i.e., within the rainy season of 2012, **triggered by continuous rainfall** since several days before.
- **Natural Dam** formation at crest dam elevation at +205 m above msl, dam height 90m; dam length 1 km; dam width 300 m
- Gradual filling of the **Reservoir** until 16 m³ millions of water and inundation of 1.42 km².





Emergency Action Plan of Way Ela Flash Flood

Emergency Action Plan against the possible failure of Way Ela Dam was issued (DGWR, 2012).

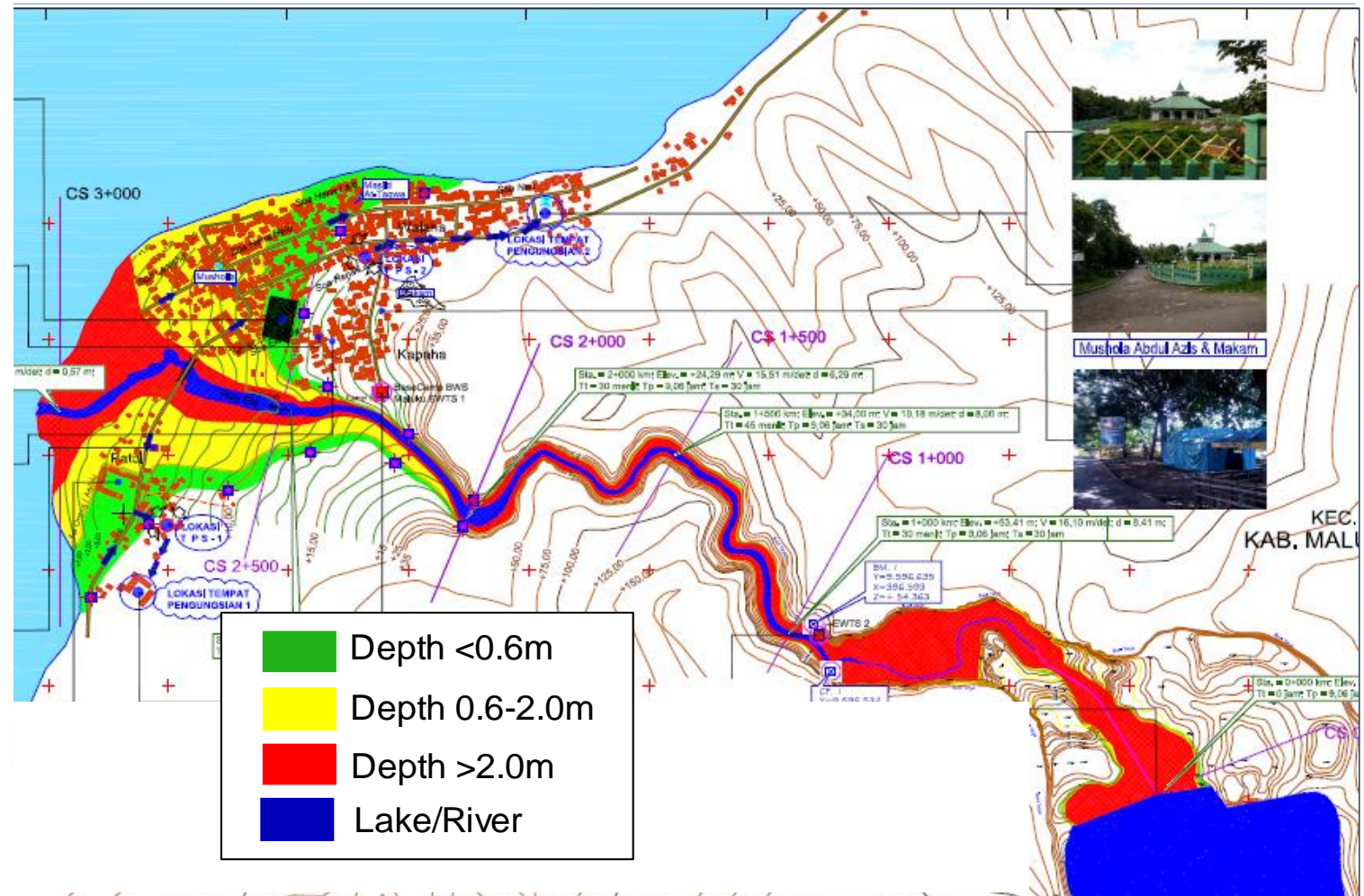
WARNING CRITERIA

Reservoir Water Level	Rainfall	Alerts Intensity
+197.00	20mm/hr	Caution
+198.00	40mm/hr	Warning
+ 200.00	60mm/hr	Evacuate

Such alerts were informed by the authority to the publics based on monitoring on various parameters (mainly rainfall occurrence and reservoir water level).

Hazard Map of Way Ela Flash Flood

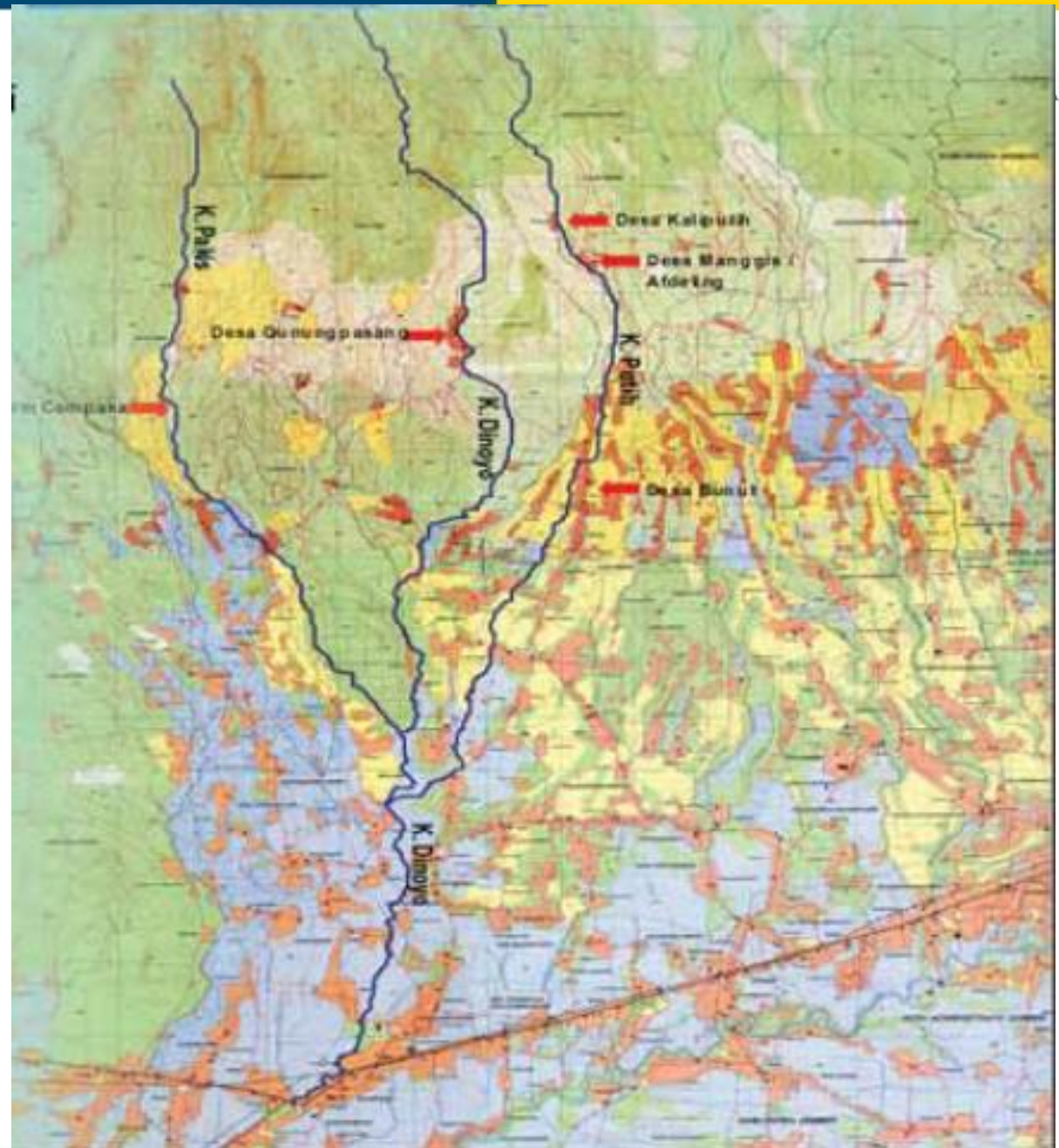
(RTD, DGWR, Ministry of Publics Works, Desember 2012)



Jember Flash Flood

(East Java Province, 1 January 2006)

Triggered by 10 days consecutive rainfall of 100-200 mm/day



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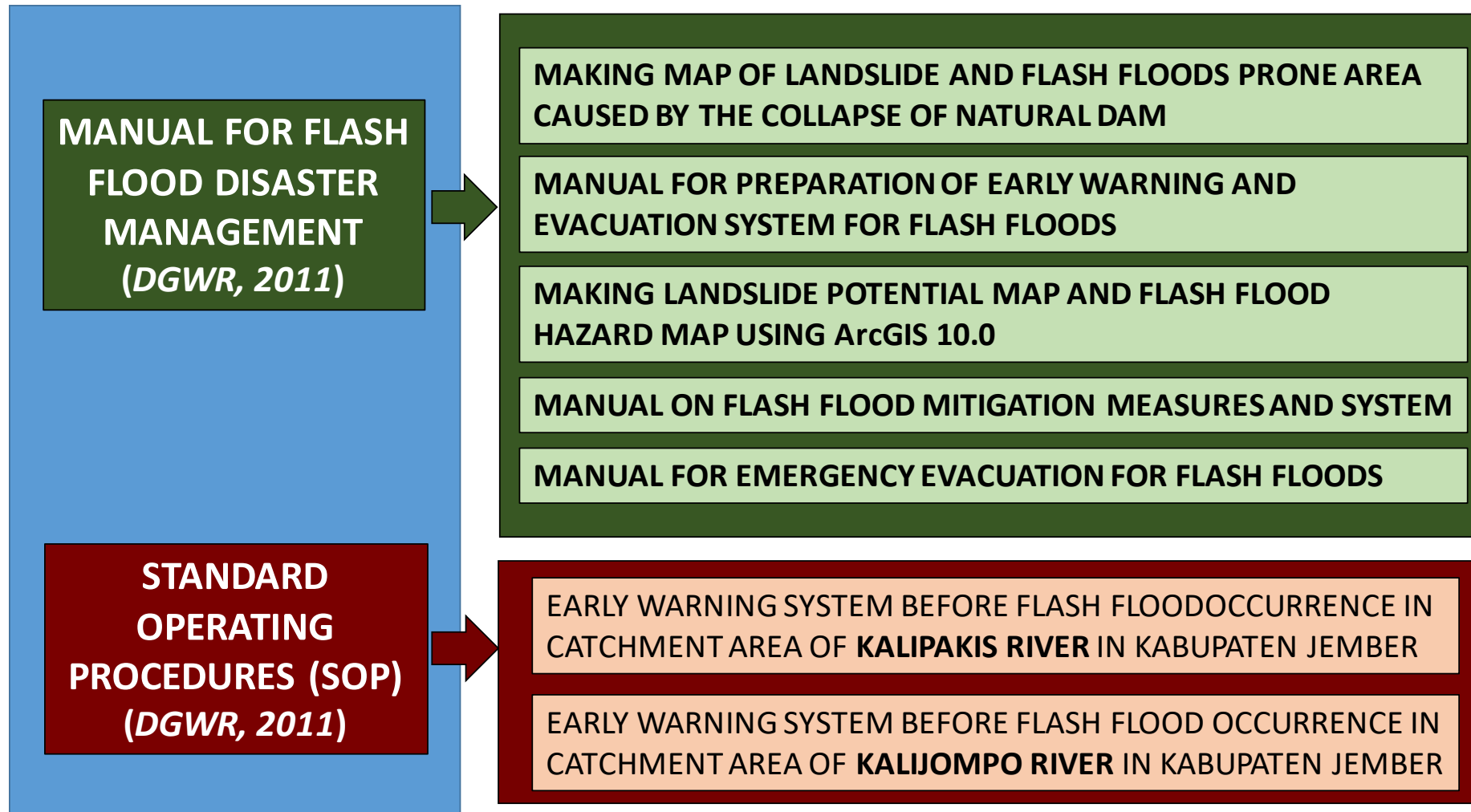


FLASH FLOOD MITIGATION MANAGEMENT



INTEGRATED DISASTER MITIGATION MANAGEMENT FOR FLASH FLOOD

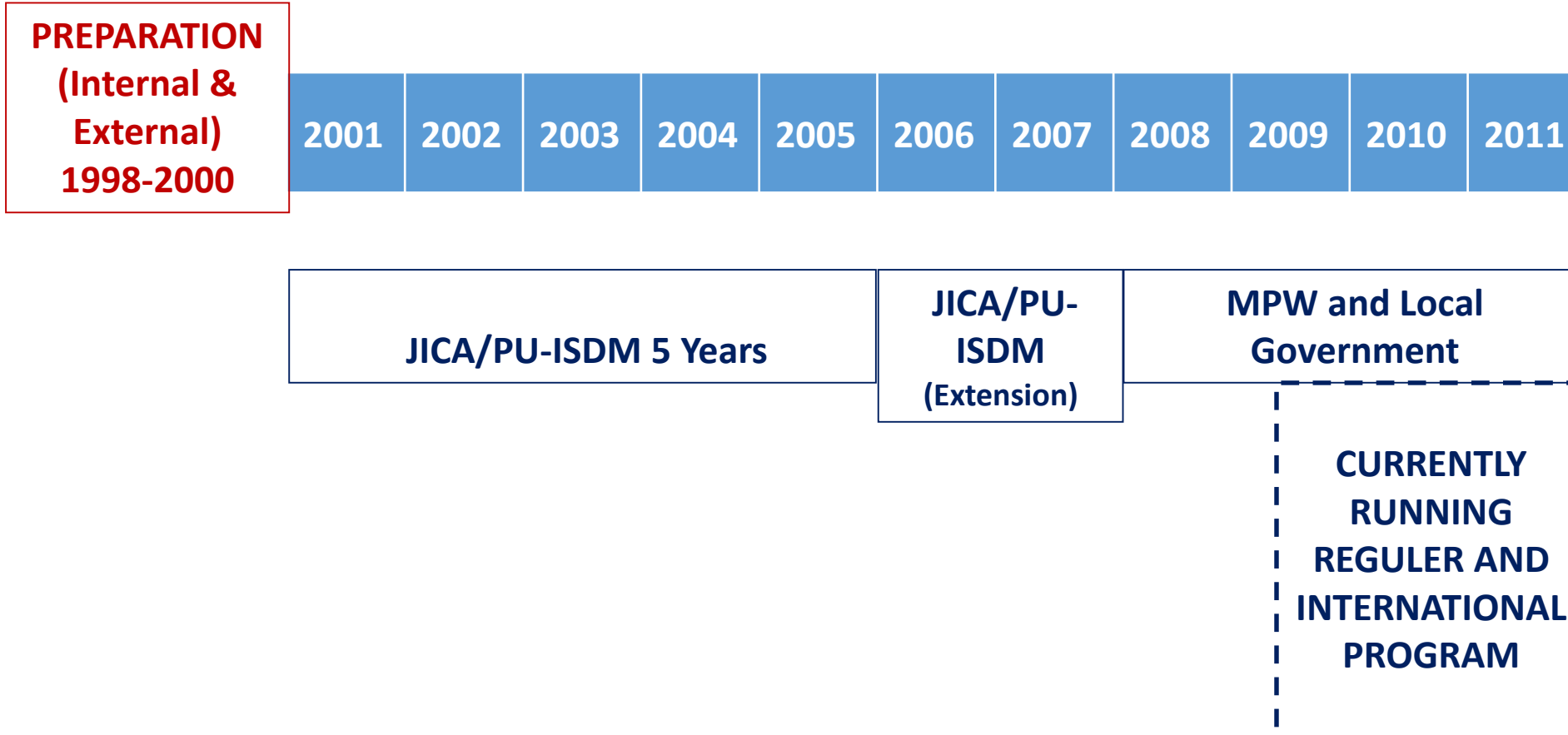
<https://www.jica.go.jp/project/english/indonesia/0800040/materials/index.html>





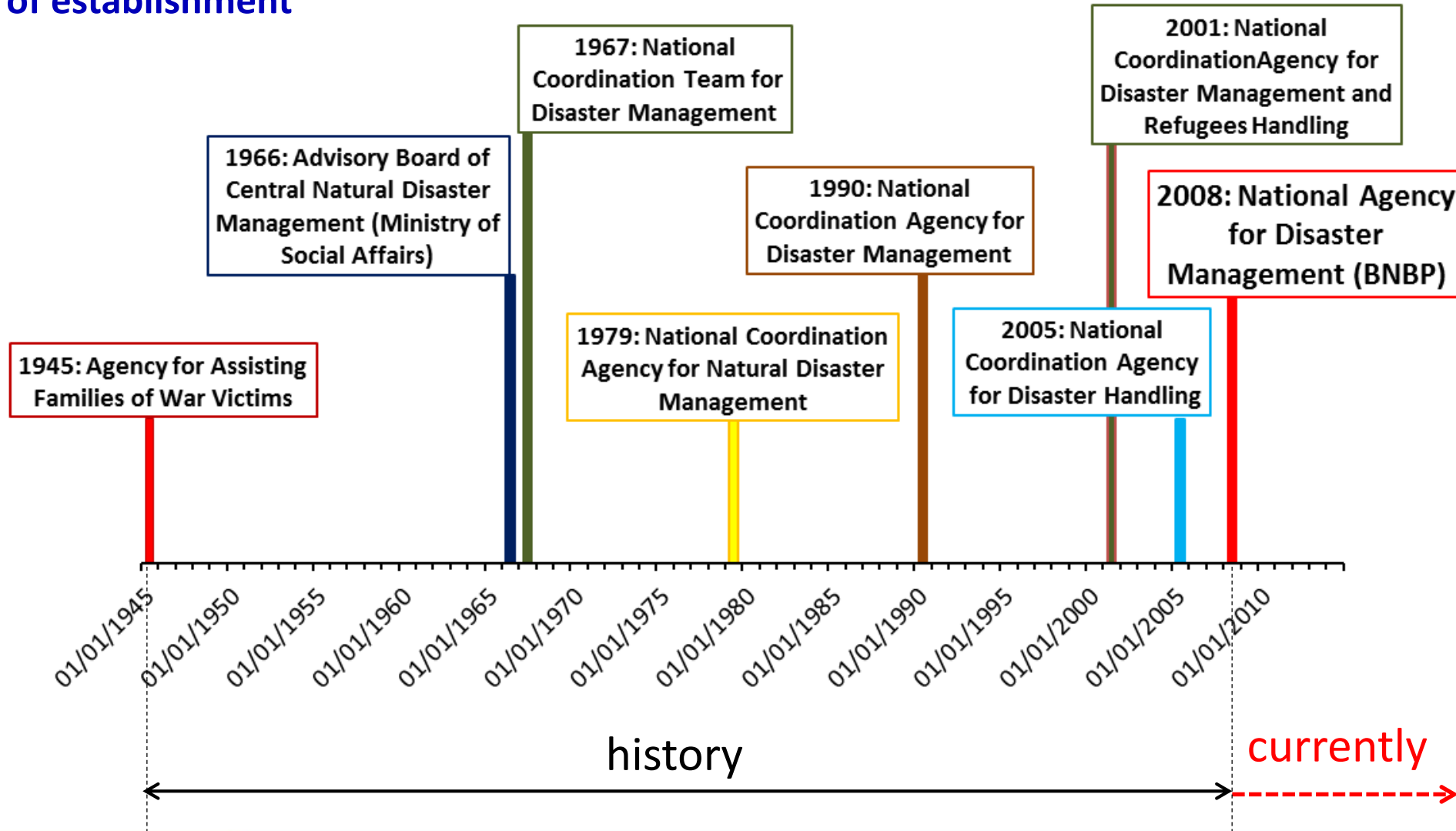
Currently Available Platforms of Disaster Mitigation Management are MTPBA and BNPB

Master Program in Natural Disaster Management (MTPBA)
Universitas Gadjah Mada – History of establishment





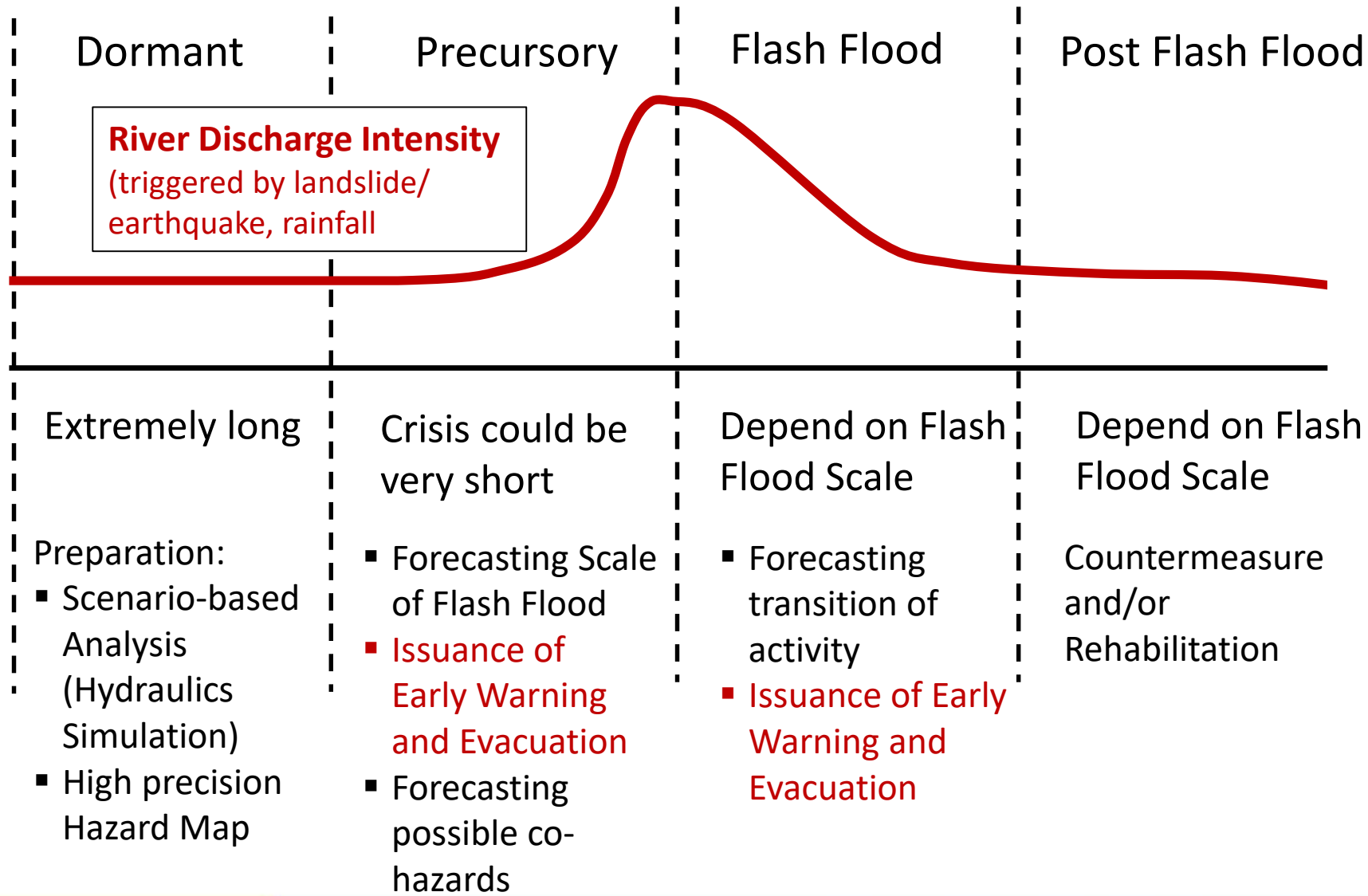
National Agency for Disaster Management (Badan Nasional Penanggulangan Bencana Alam – BNPB) History of establishment





REMARKS

FLASH FLOOD OCCURRENCE (Sequence and response/anticipation)





CONCLUSSIONS

- 1) Same level attention for both small-scale and large-scale flood disaster including **flash flood disaster**.
- 2) Same level of attention for **both structural and non-structural approach** (community-based approach, proper early warning system, etc) are considered necessary as it may increase resilience).
- 3) Better techniques on identifying disaster source potential area (such as **natural dam formation**), particularly at remote area.
- 4) Easier access for community to obtain accurate and timely **warning information** to support their self-first action against flash flood disaster necessarily.
- 5) Further activation of FFP could be more activated through platform of Education (MTPBA-UGM) and Research Dissemination (BNPB).



THANK YOU