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Disasters in ASEAN Countries: Current Status and Research Needs

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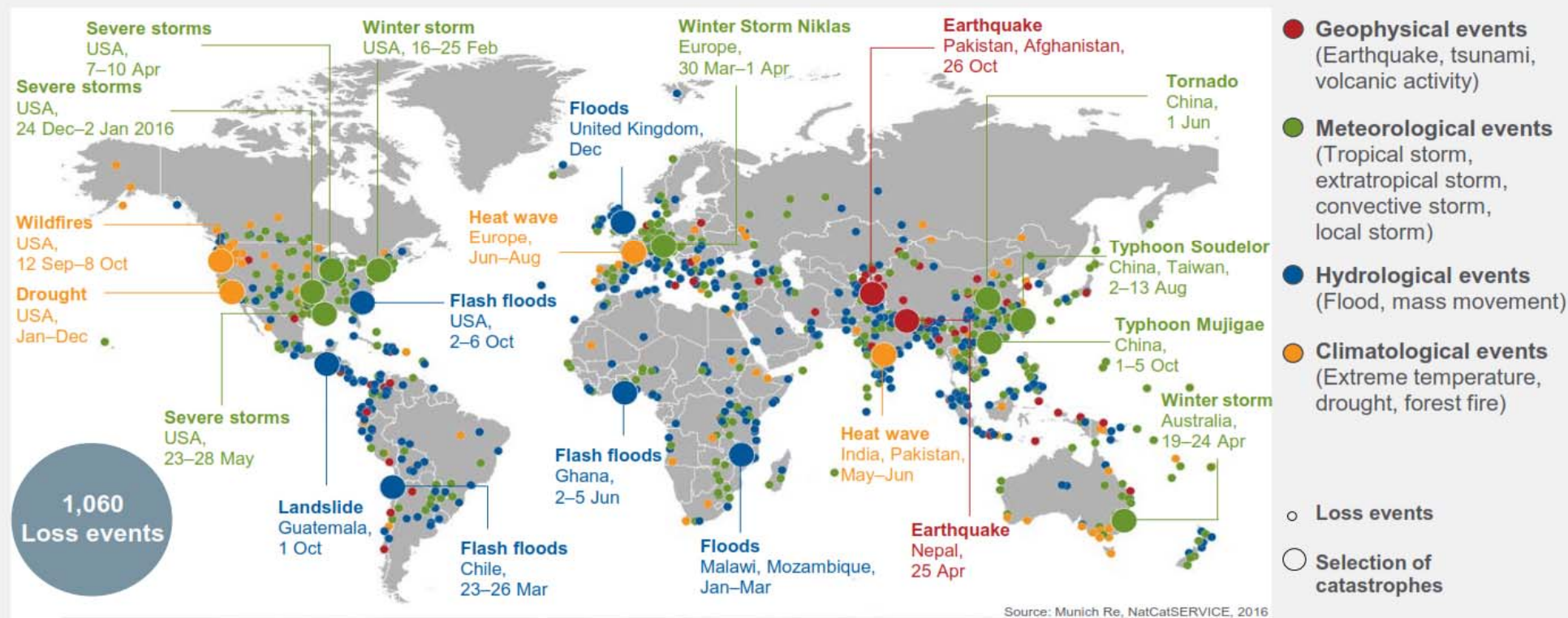
Outline

- Disasters: Global overview
- Disaster risk profile of ASEAN region
- Hydro-met disasters:
 - Global scenario
 - ASEAN region
 - Climate change
 - Responding to hydro-met disasters
- Sendai framework for DRR
- Challenges of managing hydro-met disasters

Disasters: Global overview

Natural loss events worldwide 2015

Geographical overview



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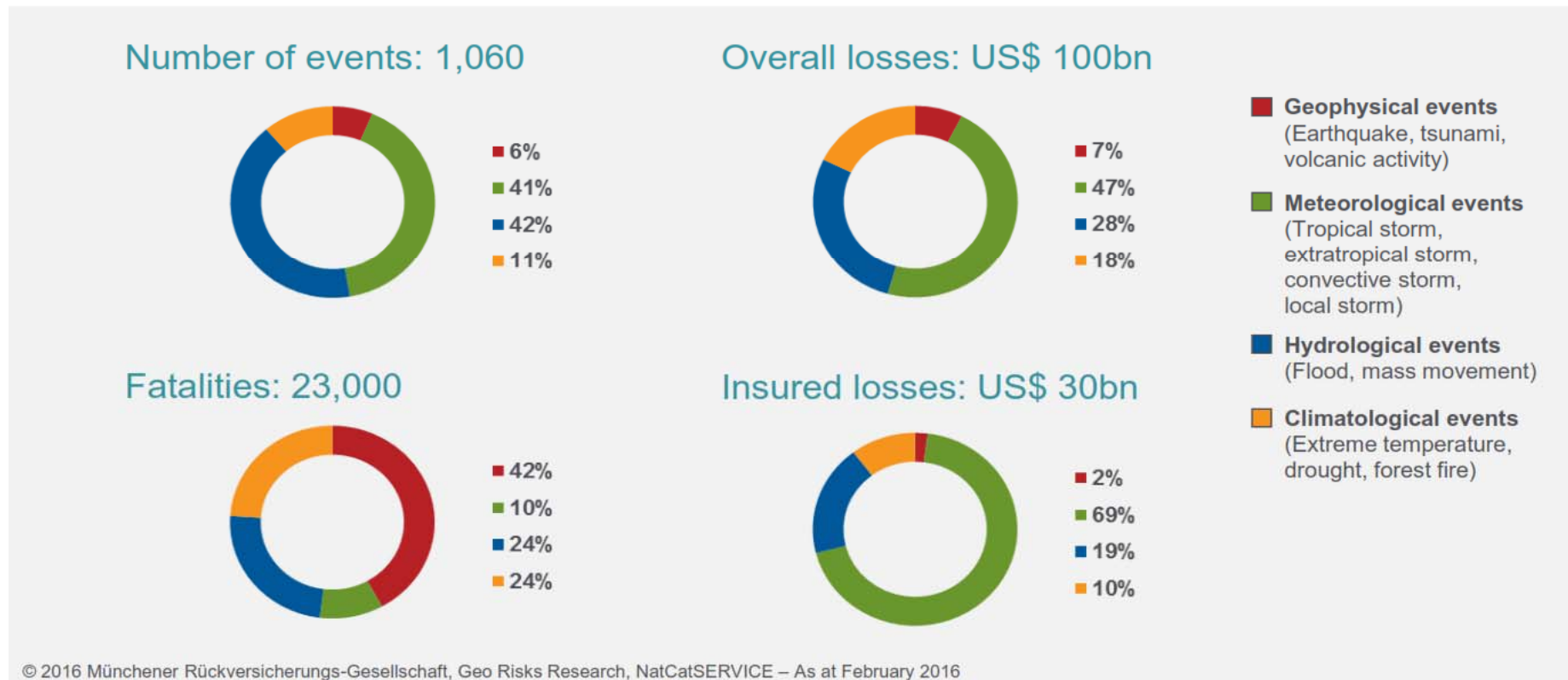
(Source: NatCatSERVICE, Munich Re 2016)

Disasters: Global overview

NatCatSERVICE

Loss events worldwide 2015 Percentage distribution

Munich RE 



(Source: NatCatSERVICE, Munich Re 2016)

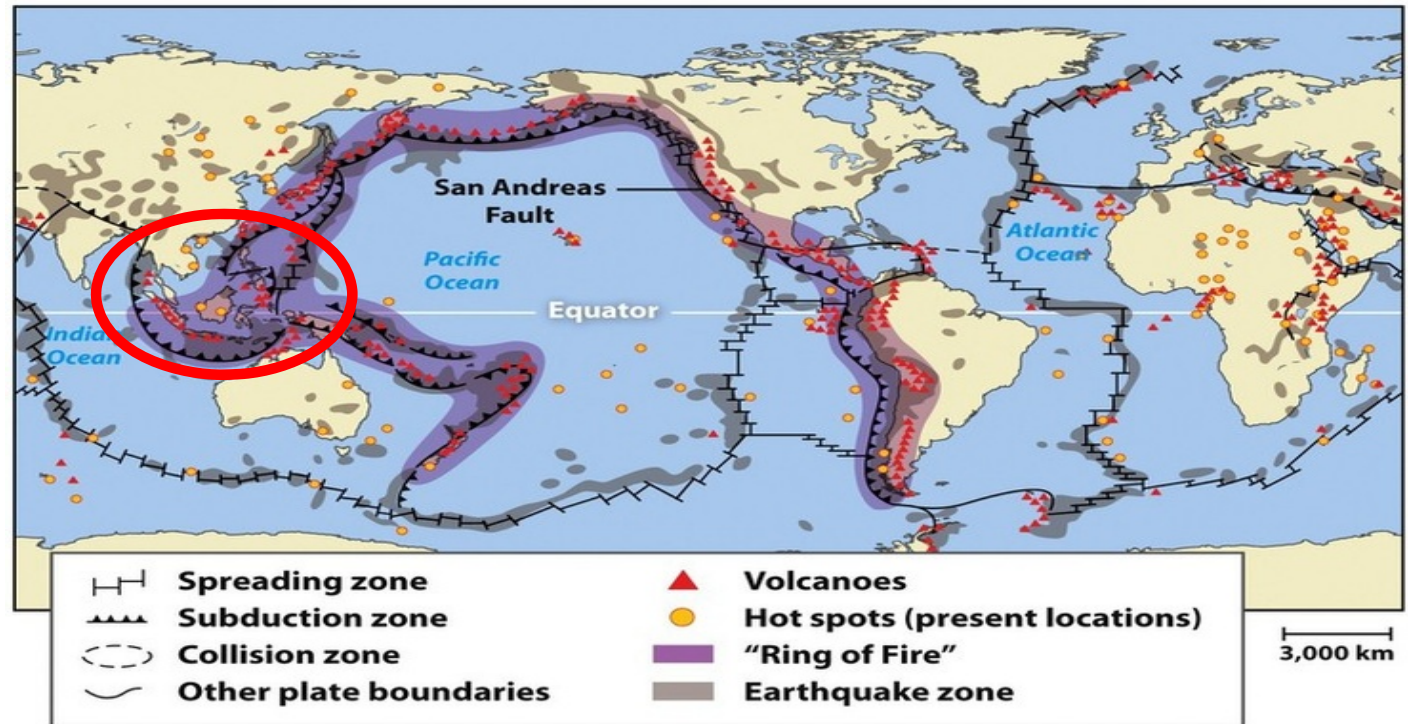
Top 10 Global risks for 2015

In terms of Likelihood	In terms of Impact
1. Large-scale involuntary migration	1. Failure of climate-change mitigation and adaptation
2. Extreme weather events	2. Weapons of mass destruction
3. Failure of climate-change mitigation and adaptation	3. Water crisis
4. Interstate conflict	4. Large scale involuntary migration
5. Major Natural catastrophes	5. Severe energy price shock
6. Failure of national governance	6. Biodiversity loss and ecosystem collapse
7. Unemployment or underemployment	7. Fiscal crises
8. Data fraud or theft	8. Spread of infectious diseases
9. Water crisis	9. Asset bubble
10. Illicit trade	10. Profound social instability

(Source: World Economic Forum)

Disaster risk profile of ASEAN region

- Located between two oceans resulting in high risk of seasonal typhoons and tsunami
- Located between several tectonic plates with high risk of earthquake, volcanic eruption and tsunami



(Picture source: <http://www.westcoastplacer.com>)

Disaster risk profile of ASEAN region

Country	Hazards							
	Earthquake	Flood	Landslide	Drought	Storm (typhoon/ cyclones)	Volcano	Forest Fire	Tsunami
Brunei	X	X	X	X	X		X	
Cambodia	X	XXX	X	XX	X		X	
Indonesia	XXX	XXX	XXX	XX	XX	XXX	XX	XXX
Laos	X	XXX	XX	XX	XX	X	X	
Malaysia	X	XXX	XX	X	X		XX	X
Myanmar	XX	XXX	XX	XX	XXX		X	X
Philippines	XXX	XXX	XXX	XX	XXX	XX	X	X
Singapore	X	XX			X			
Thailand	X	XXX	XX	XX	XX		X	X
Vietnam	X	XXX	XX	XX	XXX		X	X
ASEAN	XX	XXX	XX	XX	XXX	XX	XX	XX

Disaster matrix by ASEAN countries. Disaster incidence ranges from XXX “high” to X “low”

(Source: UNISDR, 2010)

Disaster risk profile of ASEAN region

Country	City	Dominant disaster	Risk Ranking
Philippines	Manila	Cyclone, flood, earthquake, volcanos	1
Indonesia	Jakarta	Earthquake, tsunami, wild fire	2
Thailand	Bangkok	Flood, cyclone, drought	3
Vietnam	Ha Noi	Cyclone, flood	4
Singapore	Singapore	Flash flood	5
Malaysia	Kuala Lumpur	Flood, tsunami, cyclone	6
Myanmar	Naypyidaw	Cyclone, floods	7
Cambodia	Phnom Penh	Flood	8
Laos	Vientiane	Cyclone, flood	9
Brunei	Bandar Seri Begwan	-	10

(Source: UNISDR, 2010)

Hydro-met disaster?



Processes or phenomena of
atmospheric, hydrological or
oceanographic nature

that may cause
loss of life, injury or other health
impacts,
property damage,
loss of livelihoods and services,
social and economic disruption, or
environmental damage

Examples

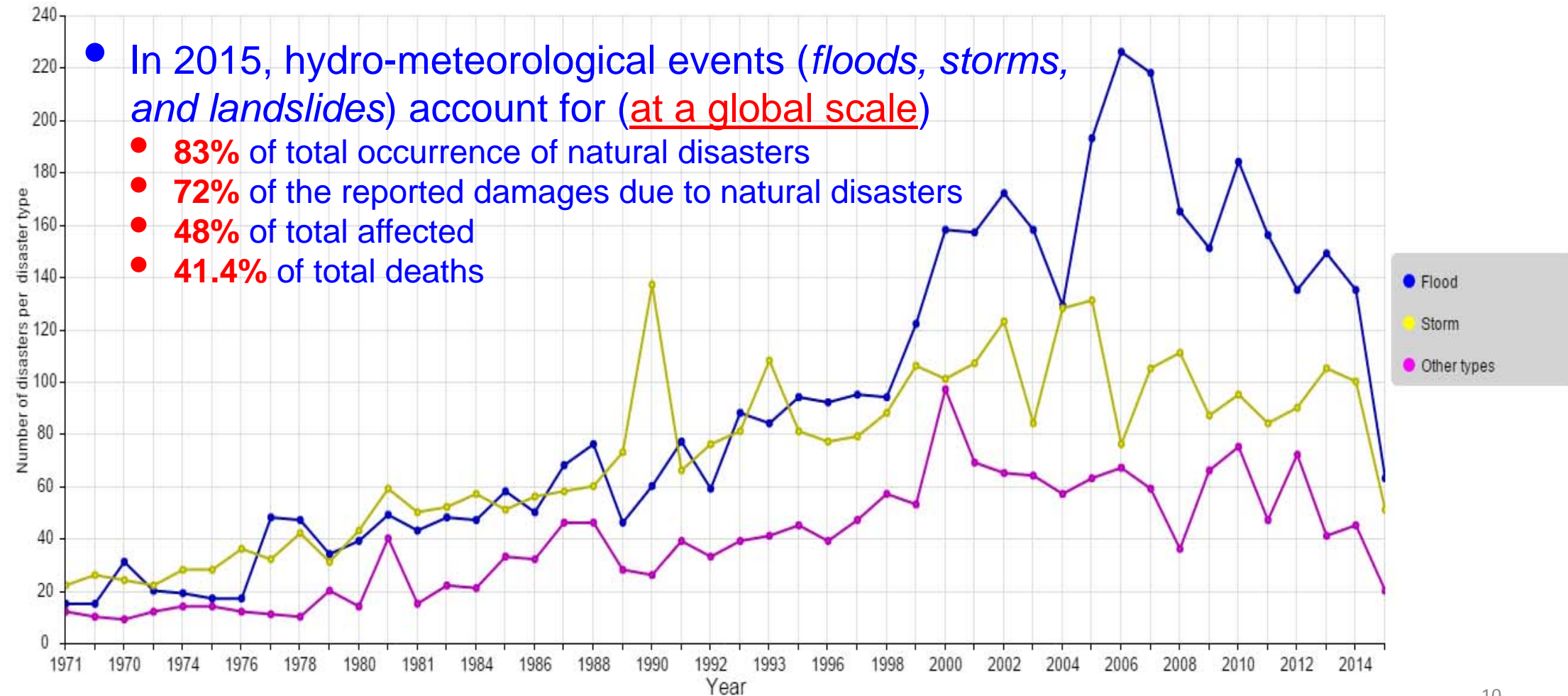
Tropical cyclones (typhoons and hurricanes), thunderstorms, hailstorms, tornados, blizzards, heavy snowfall, avalanches, coastal storm surges, floods including flash floods, drought, heatwaves and cold spells.

Hydro-met conditions can also be a **FACTOR** in other hazards such as landslides, wildland fires, epidemics etc.
and
in the transport and dispersal of toxic substances and volcanic eruption material.

Hydro-met disasters: Global scenario

- In 2015, hydro-meteorological events (*floods, storms, and landslides*) account for (at a global scale)

- **83%** of total occurrence of natural disasters
- **72%** of the reported damages due to natural disasters
- **48%** of total affected
- **41.4%** of total deaths



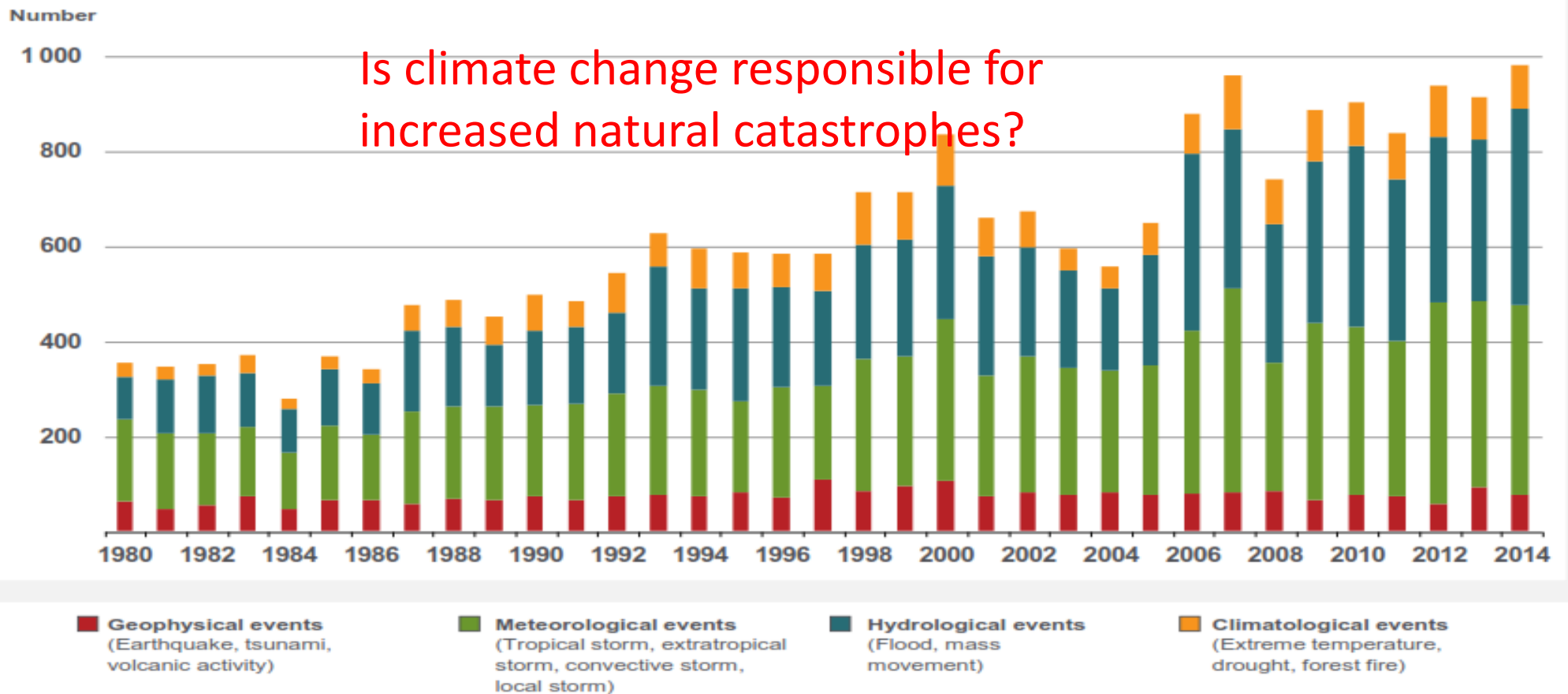
Hydro-met disasters: Global scenario

- Examples of recent large floods
 - Mississippi Flood (2011)
 - Thailand Great Flood (2011)
 - Kashmir Flood (2014)
 - South India Flood (2015)
 - Missouri Flooding (2015-2016)



Hydro-met disasters: Global trend

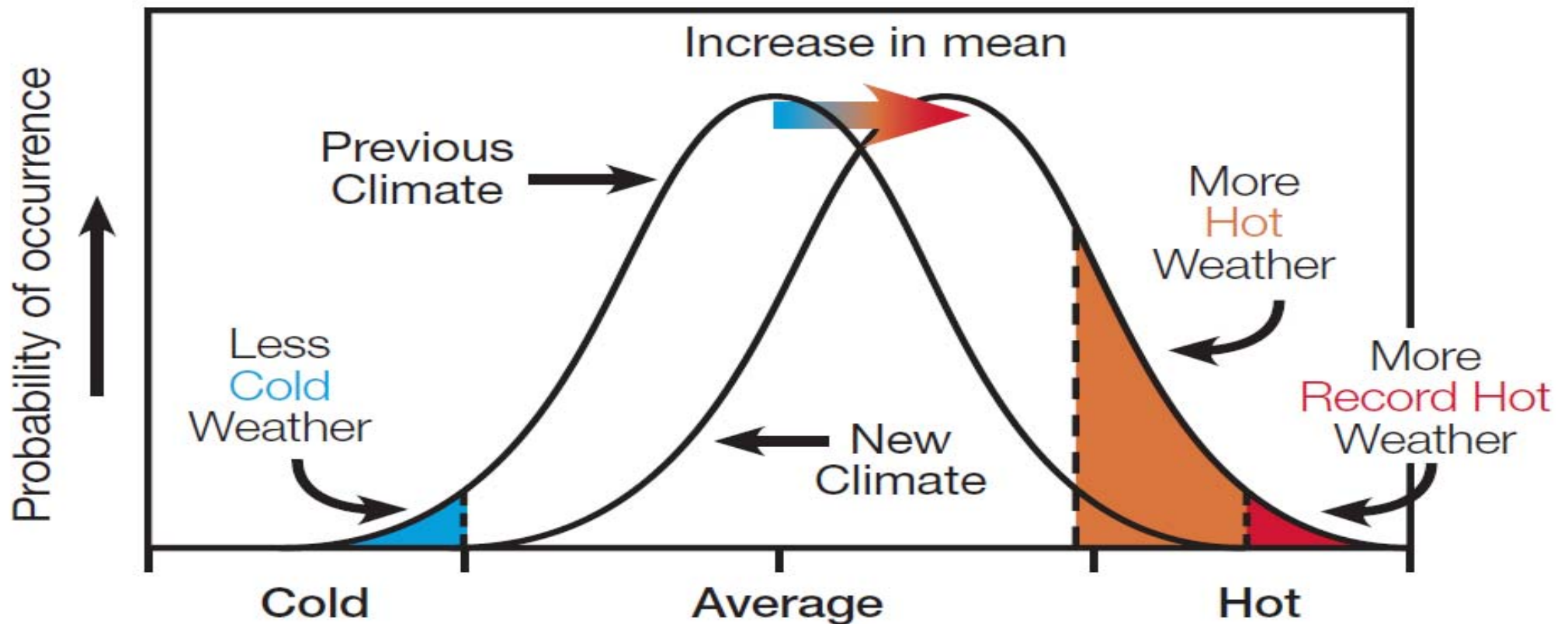
Number of natural catastrophes worldwide, 1980 to 2014



(Source: NatCatSERVICE, Munich Re 2015)

Hydro-met disasters: Climate change

Effect of increase in average temperature on extreme temperature



Source: IPCC (2012)

Hydro-met disasters: Recent trend

Record breaking meteorological events in the last decade

Region	Meteorological record breaking event	Confidence in attribution to climate change	Impact costs
England and Wales (2000)	Wettest autumn since 1766 ¹	Medium ^{2,3}	£ 1.3 Billion ²
Europe (2003)	Hottest summer in 500 years ⁴	High ^{5,6}	Death toll >70,000 ⁷
Pakistan (2010)	Rainfall records ⁸	Low to medium ^{9,10}	Worst flooding in its history; 3000 deaths; 20M people affected ¹¹
Eastern Mediterranean and Middle East (2008)	Driest winter since 1902	High ¹²	Substantial damage to cereal production ¹³
4 US states (TX, OK, NM, LA) (2011)	Summer heat and drought since 1880 ¹⁴	High ¹⁴	Wildfires burning 3 M acres (preliminary impact of \$6 to \$8 B) ¹⁵

Source: World Bank (2012)

¹Alexander and Jones (2001) ²Min et al. (2011) ³Kay et al. (2011) ⁴Luterbacher (2004) ⁵Della-Marta et al. (2007); Stott et al. (2004) ⁶Coumou et al. (in review); Hansen et al. (2012) ⁷Robine et al. (2008) ⁸Webster et al. (2011) ⁹Trenberth et al. (2012); ¹⁰Lau and Kim (2012); ¹¹Hong et al. (2011); ¹²Hoerling et al. (2012); ¹³Ricardo et al. (2010); ¹⁴Rupp et al. (2012); ¹⁵NOAA (2011)

Hydro-met disaster : ASEAN region

- From 2000 to 2015



**Climate related
disasters
637**



**Affected people
200 million**



**Death toll
173519**

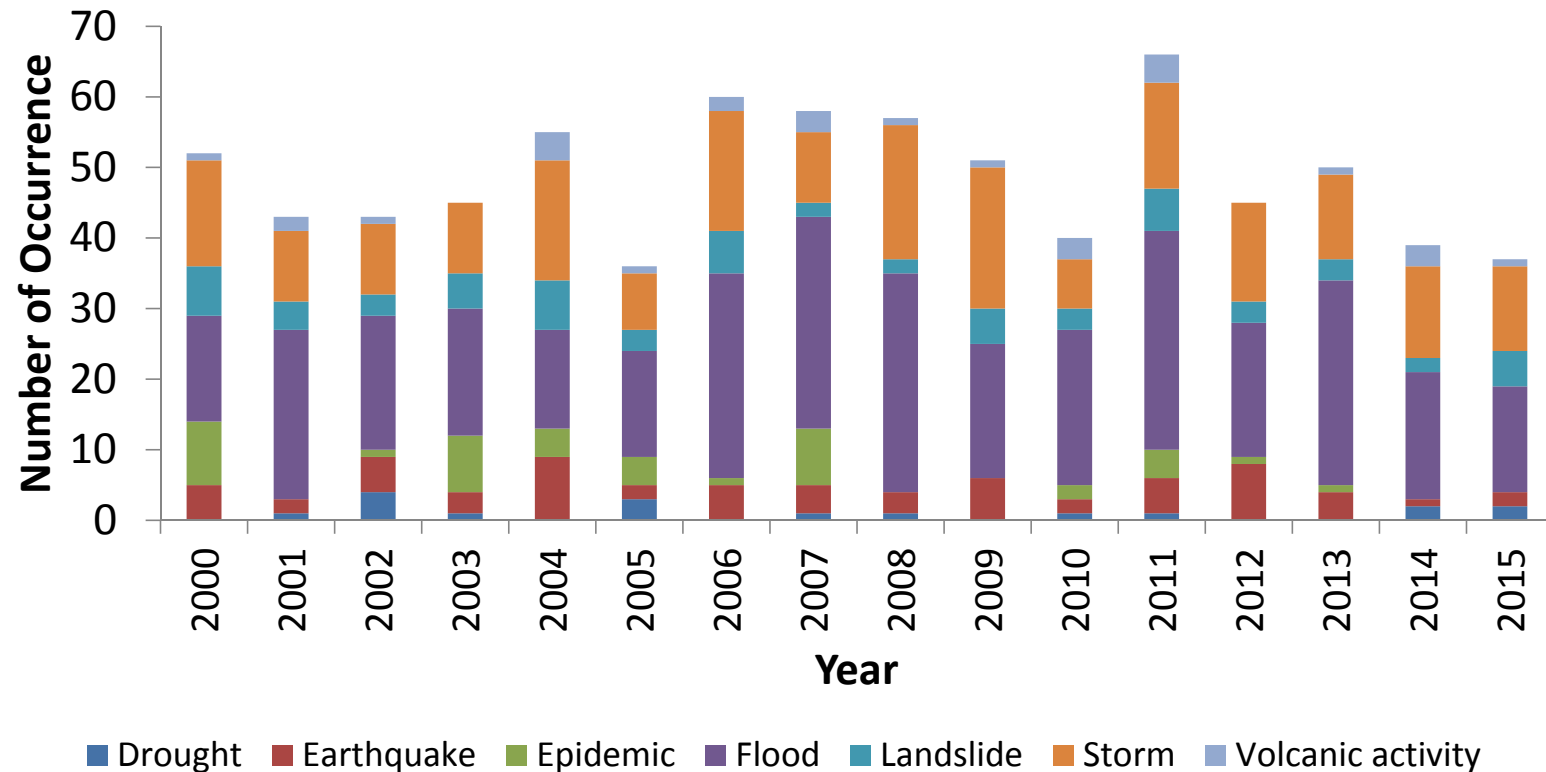


**Economic loss
\$ 8 trillion**

(Source: EM-DAT, 2016)

Hydro-met disaster : ASEAN region

Recent trend of disasters

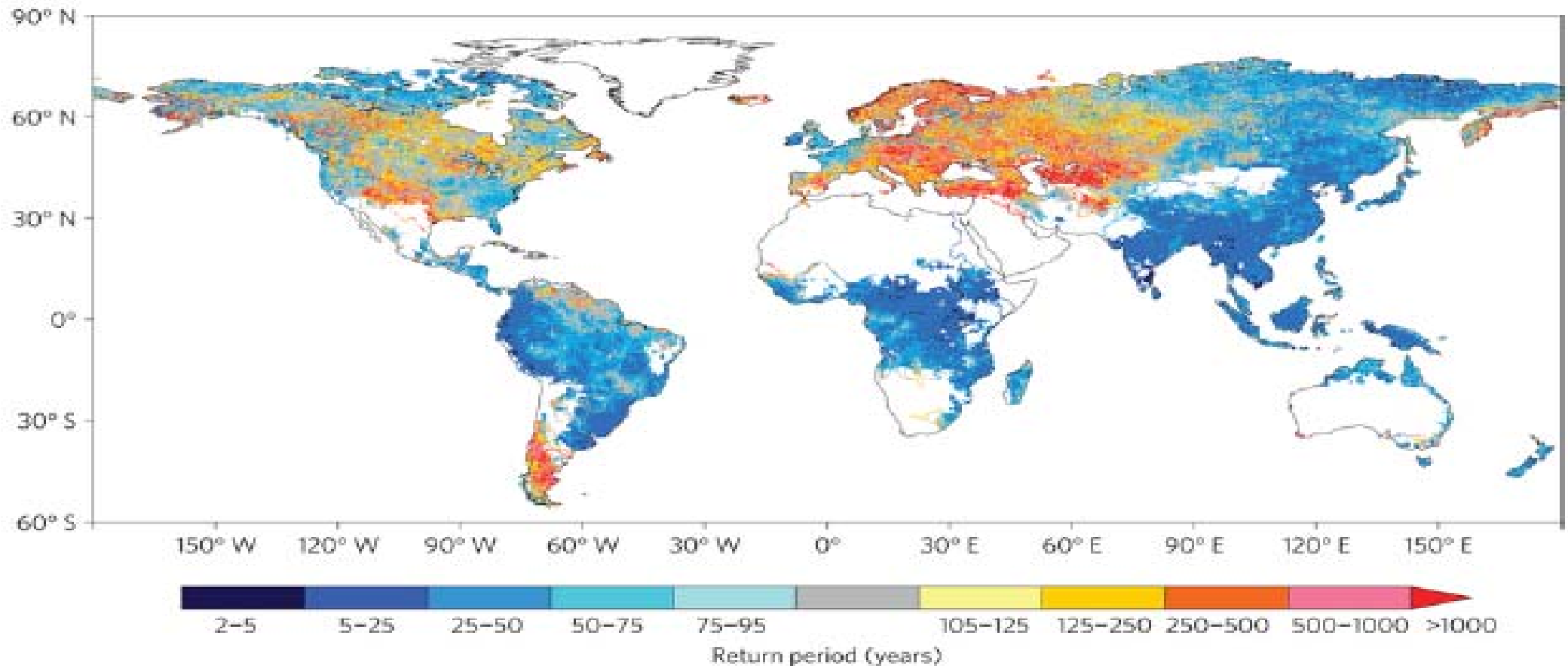


In ASEAN countries during 2000-2015, **Flood, drought, storm and landslide** accounted for:

- **more than 80%** of total occurrences of natural disasters
- **48%** of total deaths due to disasters
- **More than 90%** of total affected persons

(Data Source: EM-DAT, 2016)

Projections for ASEAN: Flood frequency

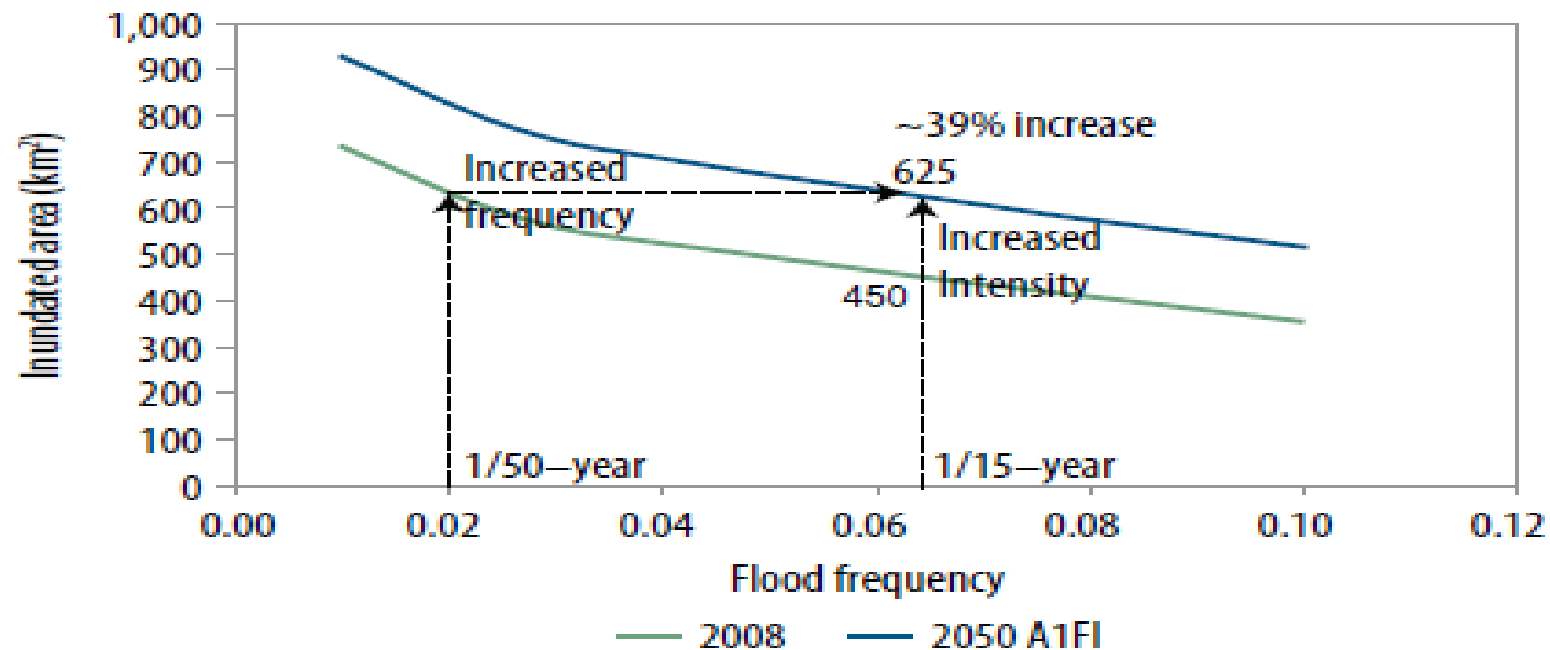


The 100-year return period flood is expected to occur with 5- to 25-year return period in 21st Century in South and SE Asia for RCP8.5

Source: Hirabayashi et al. (2013)¹⁷

Hydro-met disaster: Hydrological extremes in changing climate

FIGURE 3.4 ■ **Bangkok Flood Hazard Relationship**



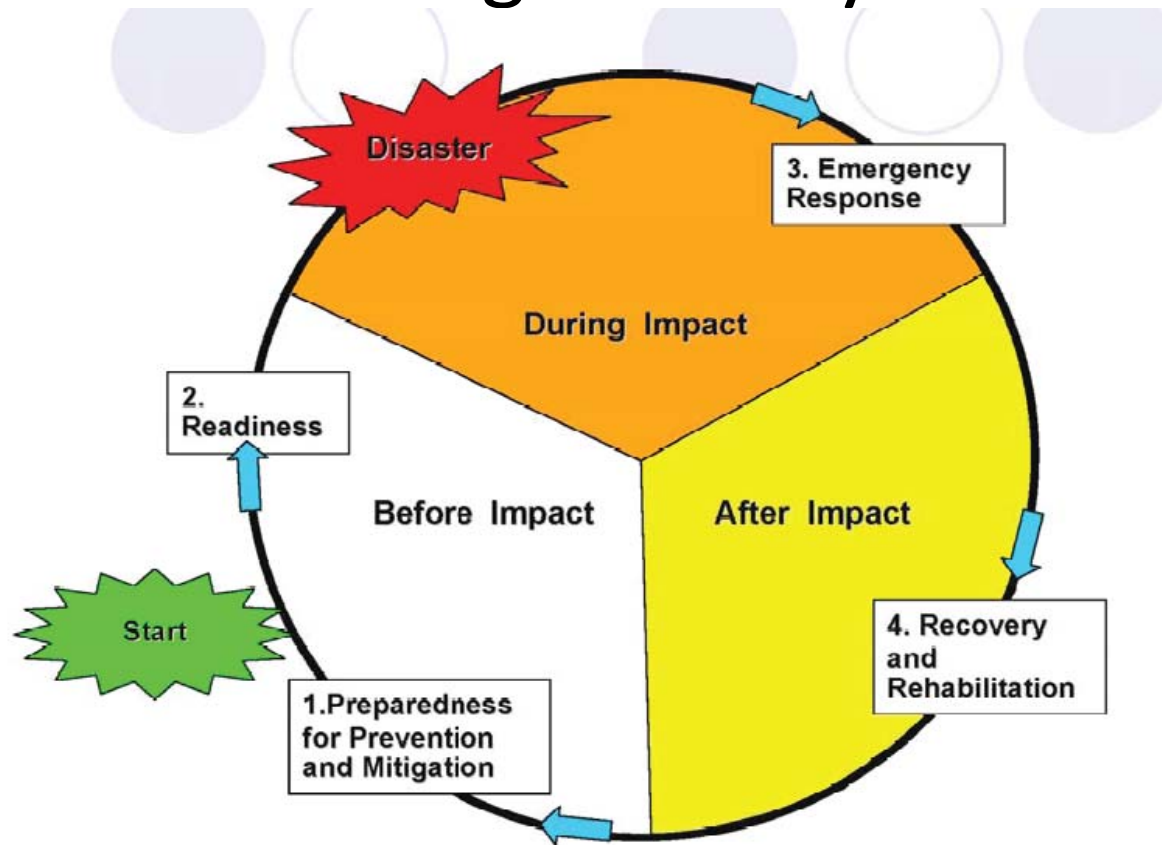
Source: Panya Consultants (2009).

Hydro-met disasters: Thailand flood, 2011

- The 4th costliest disaster in the world (as of 2011); worst in last 50 years in Thailand
- Duration: 5 months (from July, 2011)
- Deaths: 800+
- Affected people: 13.6m
- **Estimated cost**: US\$ 45.5 billion
 - 13% of national GDP in losses and damages (*World Bank, 2012a*)
- Cause: Heavy consecutive rainfall events in northern part for a longer duration, low drainage capacity, reservoir mismanagement



Responding to hydro-met disasters: disaster management cycle



(Flood) Disaster Management Cycle

Responding to hydro-met disasters: Experiences

Vietnam

- Structural measures: dams, dikes, sluices, and canals to protect crops and properties; but equal emphasis on implementation of non-structural measures
- “Living with flood” policy of flood risk management – has been a success in Vietnam
 - Philosophy: Flooding neither can nor should be completely controlled to protect people and maintain normal lives during inundation

Thailand

- Planned to spend US\$10 B in 5 years on a new flood management project in the Chao Phraya Basin as a direct result of the 2011 great flood. It has:
 - U/S measures: reforestation and construction of reservoirs
 - M/S measures: construct retention facility with a capacity of 3 BCM; and rehabilitation of old river channels for flood diversion
 - D/S measures: construction of bypass channels and 2 main flood channels

Responding to hydro-met disasters: Need of a multi-pronged approach

Hard-core approaches:

- Construction of engineering structures (e.g. dams, levees etc.) to retain the flood and protect nearby areas

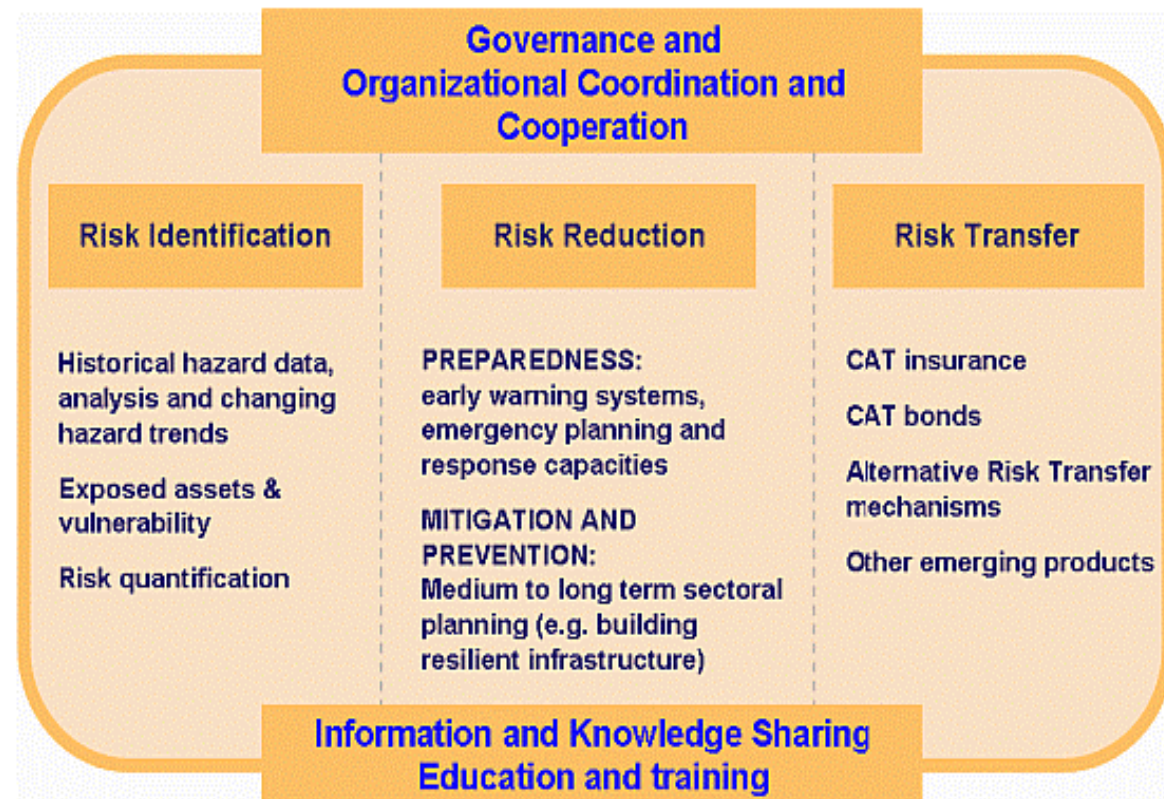
Implications: *high cost; controlling flood at one location may impact D/S*

Soft approaches:

- Continuous and participatory process
- Philosophy: **Living with flood**
- Focus on preparedness
- Transform: **at-risk communities** → **disaster-resilient communities**

Responding to hydro-met disasters: Need of a multi-pronged approach

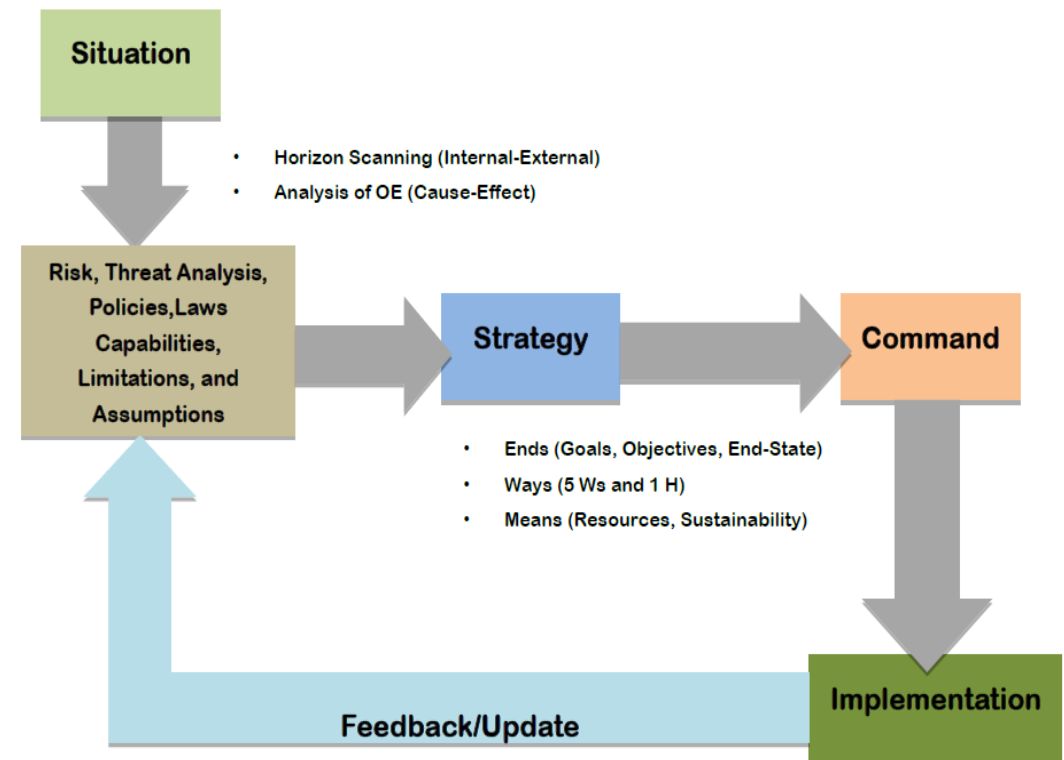
- Multi-pronged soft- approaches required:
 - Science and Technology:
Research; Monitoring system; Database; and Early Warning System (EWS)
 - Enabling environment
(policies and institutions)
 - Capacity building
 - International cooperation



Various types of soft-approaches

Responding to hydro-met disasters: Need of a multi-pronged approach → Enabling Environment

- Policies and institutions
- Feedback mechanisms
- Public participation
- Awareness raising programs
- Risk sharing/transfer: disaster insurance



Responding to hydro-met disasters: Need of a multi-pronged approach → Enabling environment

- Example from Philippines: National Disaster Response Plan (NDRP) of Philippines (2014)
- It envisions having a close and effective **4Cs – coordination, collaboration, communication and cooperation** – among all concerned responding government and non-government agencies

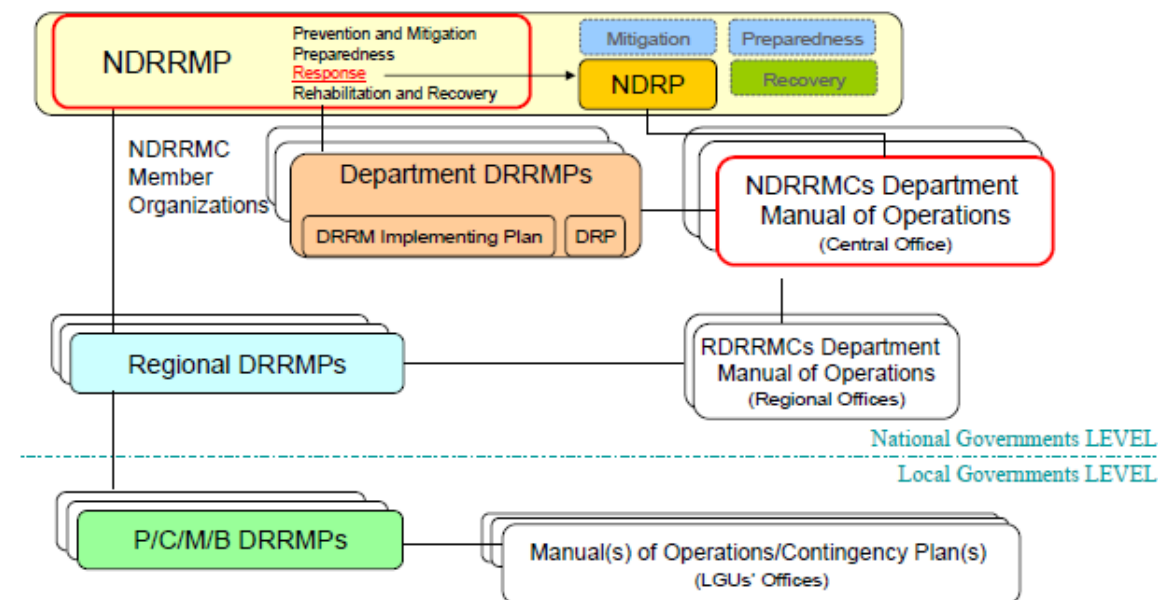


Figure 1.3.1 NDRP in Perspective

Hyogo Framework of Action (2005 – 2015)

- **Build institutional capacity:** Ensure that DRR is a national and local priority with a strong institutional basis for implementation
- **Know your risks:** Identify, assess and monitor disaster risks and enhance early warning
- **Build understanding and awareness:** Use knowledge, innovation and education to build a culture of safety and resilience at all levels
- **Reduce risk:** Reduce the underlying risk factors through land-use planning, environmental, social and economic measures
- **Be prepared and ready to act:** Strengthen disaster preparedness for effective response at all levels

Sendai Framework for DRR (2015 – 2030)

- Sendai Framework: **1 Goal, 7 Global Targets, 13 Guiding Principles, 4 Priorities for Action**, at **4 levels (Local, National, Regional and Global)**
- Sendai Framework focuses on **disaster risks** while the HFA focuses on **disaster losses**.
- Sendai Framework focuses more on “the how” while the HFA focuses more on “the what”
- Sendai Framework puts more emphasis on the means for implementation

Sendai Framework for DRR (2015 – 2030)

Priority 1 Understanding disaster risk

Priority 2 Strengthening disaster risk governance to manage disaster risk

Priority 3 Investing in disaster risk reduction for resilience

Priority 4 Enhancing preparedness for effective response, and to “**Build back Better**” in recovery, rehabilitation and reconstruction

Challenges of managing hydro-met disasters

Research

- Reducing uncertainty in hydro-met forecasting of extreme events (several sources of uncertainties exists and they are inherent in nature)
 - Past is not a good indicator of future
 - Frequency, location, magnitude, duration of extremes may change
 - Chance of extreme event is not the same from one year to next and is strongly related to large-scale climate drivers like ENSO
- Early warning system with sufficient lead time (week vs season)
- Translating the impacts to societal implications (vulnerability and risks)
- Suitable climate change adaptation and mitigation strategies

Challenges of managing hydro-met disasters

Capacity building and financial support

- Building technical capacity at all levels and at all scales
- Enhancing the risk perception of stakeholders
- Science-policy dialogue
- Enhancing financial capacity



Challenges of managing hydro-met disasters

Enabling environment

- Risk governance and implementation of plans, policies, laws and regulation in practice
- Provision of hydro-met services
- Stakeholders participation

POLICY & PLANNING

International cooperation

- Data, knowledge and information sharing
- Lack of technology and infrastructure in developing countries
- How global and local communities can more meaningfully be brought together?



Hydro-met extremes: Current research at AIT

Analysis of climatological and hydrological extreme events in Upper Ayerawaddy River Basin, Myanmar

Impact of climate change on design flood discharges: An application to Rasool Barrage, Jhelum River Basin, Pakistan

Assessment of wetland vulnerability to climate change: A case study of Moeyungyi Wetland, Myanmar

Effects of climate change on water scarcity in Hub River Basin, Pakistan

Concluding remarks

- ASEAN region is vulnerable to natural disasters
- Single approach cannot address disaster problems → multi-pronged approach is required
- Success in dealing with disasters also depends on success in implementing soft-approaches
- Addressing disaster challenges needs focus on:
 - Advancement of science and technology
 - Commitments of all stakeholders: for enabling environment
 - Investment in capacity building activities
 - A high level of international cooperation

Thank you very much
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