



**Australian Government**  
**Geoscience Australia**

# **Disaster Risk Reduction and Climate Change Adaptation in the Australia-Pacific Region**

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United Nations Regional Cartographic Conference for Asia-Pacific  
Bangkok Thailand, 26-29 October 2009 **GEOSCIENCE AUSTRALIA**

Presentation context...

# Disaster Risk Reduction

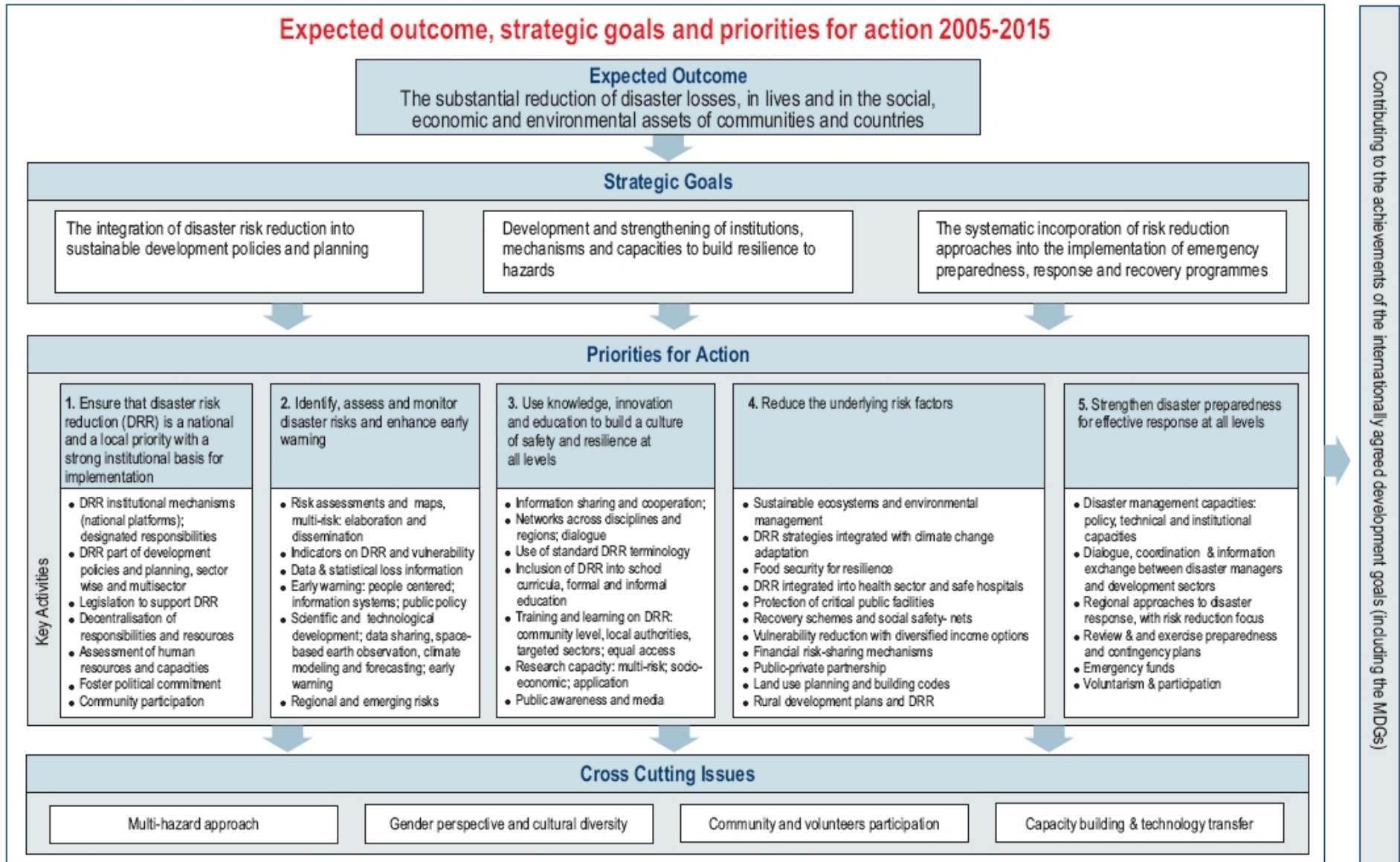
# UN World Conference on Disaster Reduction

Convened in Jan 2005 in Japan, 168 countries adopted the Hyogo Framework for Action 2005-2015 as a blueprint for global disaster reduction



## SUMMARY of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (Hyogo Framework)

### Expected outcome, strategic goals and priorities for action 2005-2015



Contributing to the achievements of the internationally agreed development goals (including the MDGs)

# UN World Conference on Disaster Reduction

Convened in Jan 2005 in Japan, 168 countries adopted the Hyogo Framework for Action 2005-2015 as a blueprint for global disaster reduction

UNISDR defined disaster risk reduction as:

*“the reduction of disaster **risks** and adverse **impacts** of natural **hazards**, through systematic efforts to analyse and manage the causal factors of disasters, including through reduced **exposure** to hazards, lessened **vulnerability** of people and property, wise management of land and the environment, and improved preparedness for adverse events”*

Presentation context...

# Climate Change Adaptation

# UN World Conference on Disaster Reduction

- The Hyogo Framework calls on countries to reduce underlying risks by integrating risk reduction measures and climate change adaptation
- This will enable current and future efforts for climate change adaptation to benefit from practical experience in disaster risk reduction (DRR)
- Climate change and DRR are closely linked. More extreme weather events in the future are likely to increase the number and scale of disasters
- The existing methods and tools of DRR provide powerful capacities for adaptation to climate change
- Climate change is but another layer of complexity in DRR

Presentation context...

## The Asia-Pacific Region



## Asia-Pacific context...

Why does the Asia-Pacific region increasingly experience some of the world's worst natural disasters?

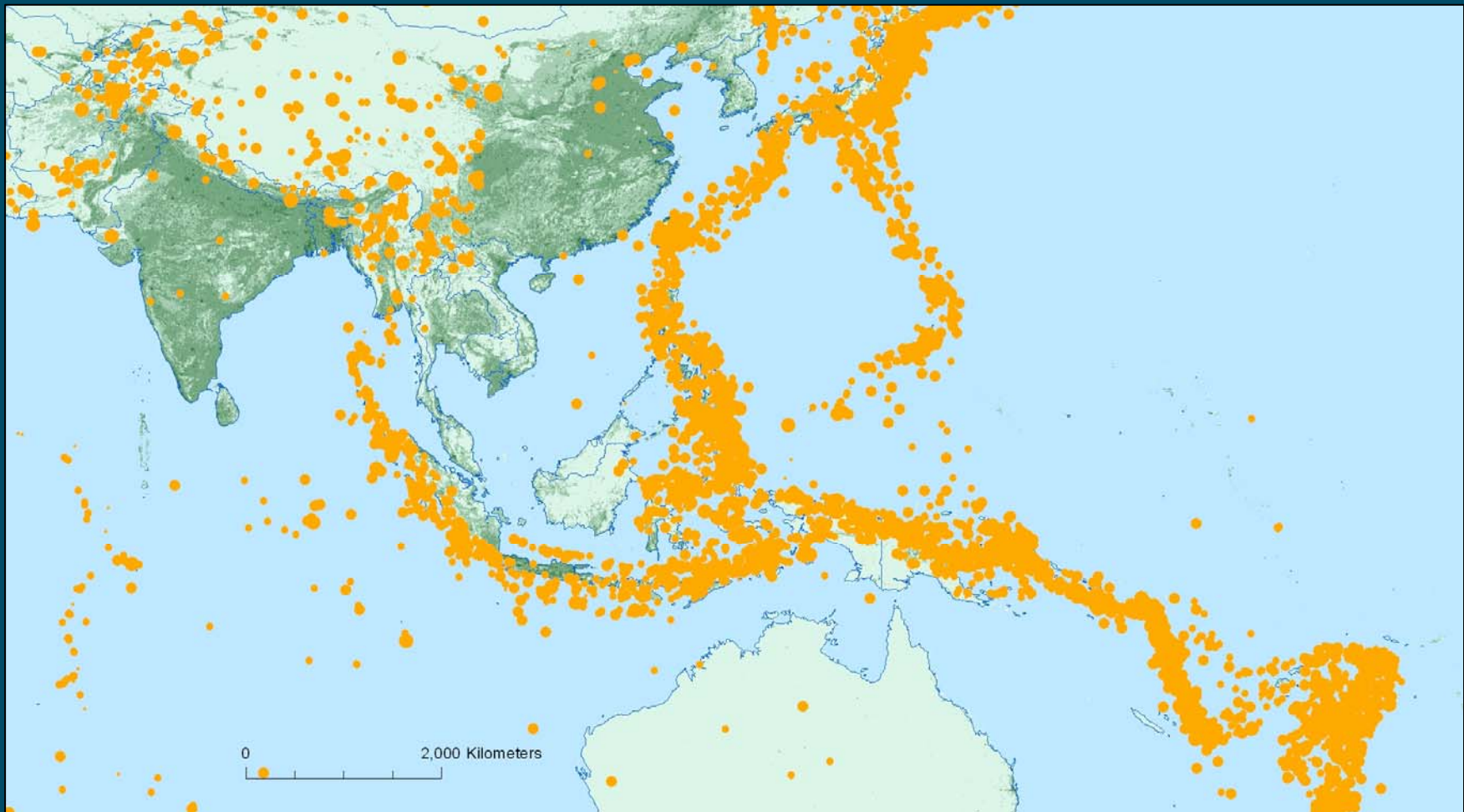
1. The region is subjected to many natural hazards

# Volcanoes



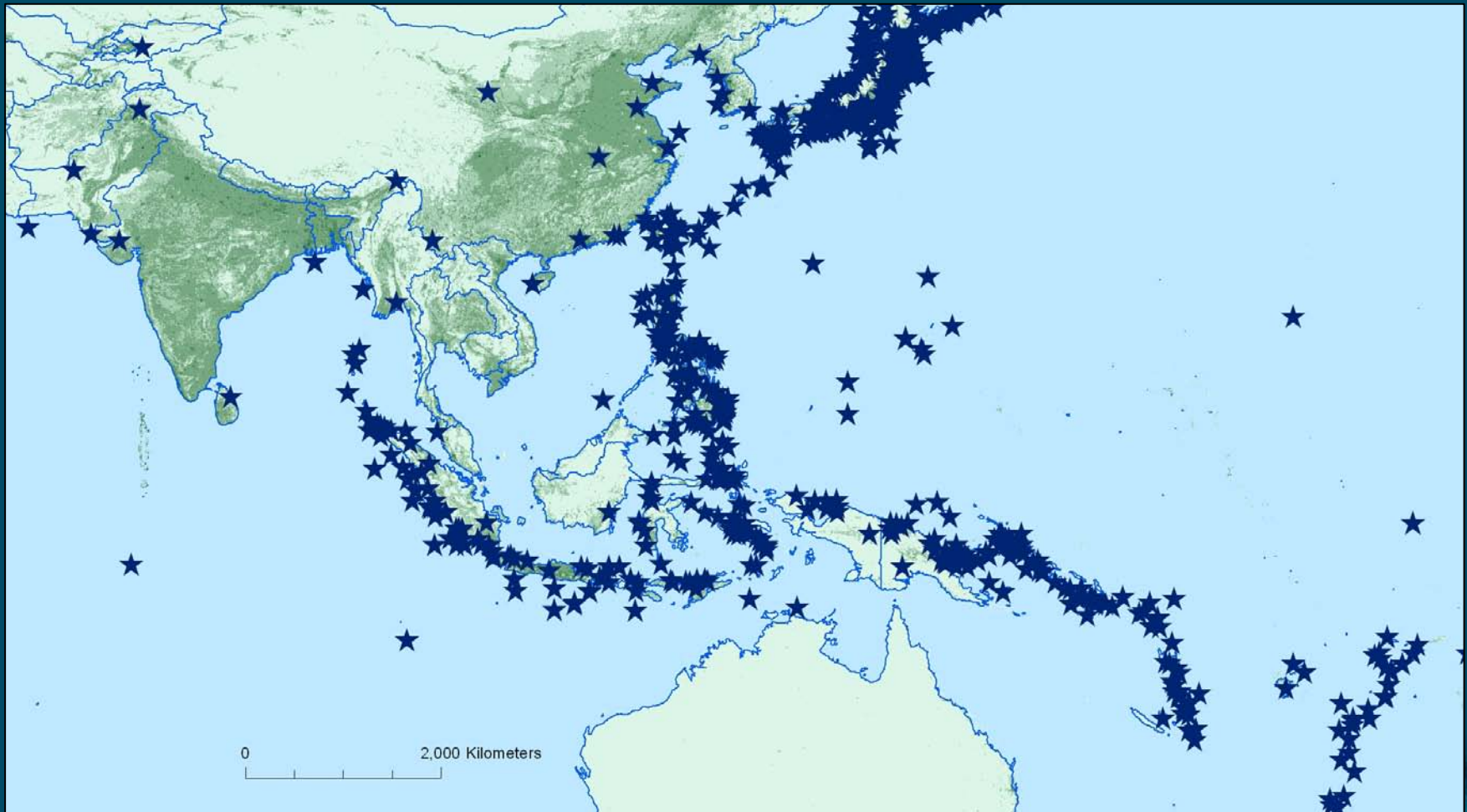
200 million people in developing countries in the Asia-Pacific live within 50 km of a volcano

# Earthquakes



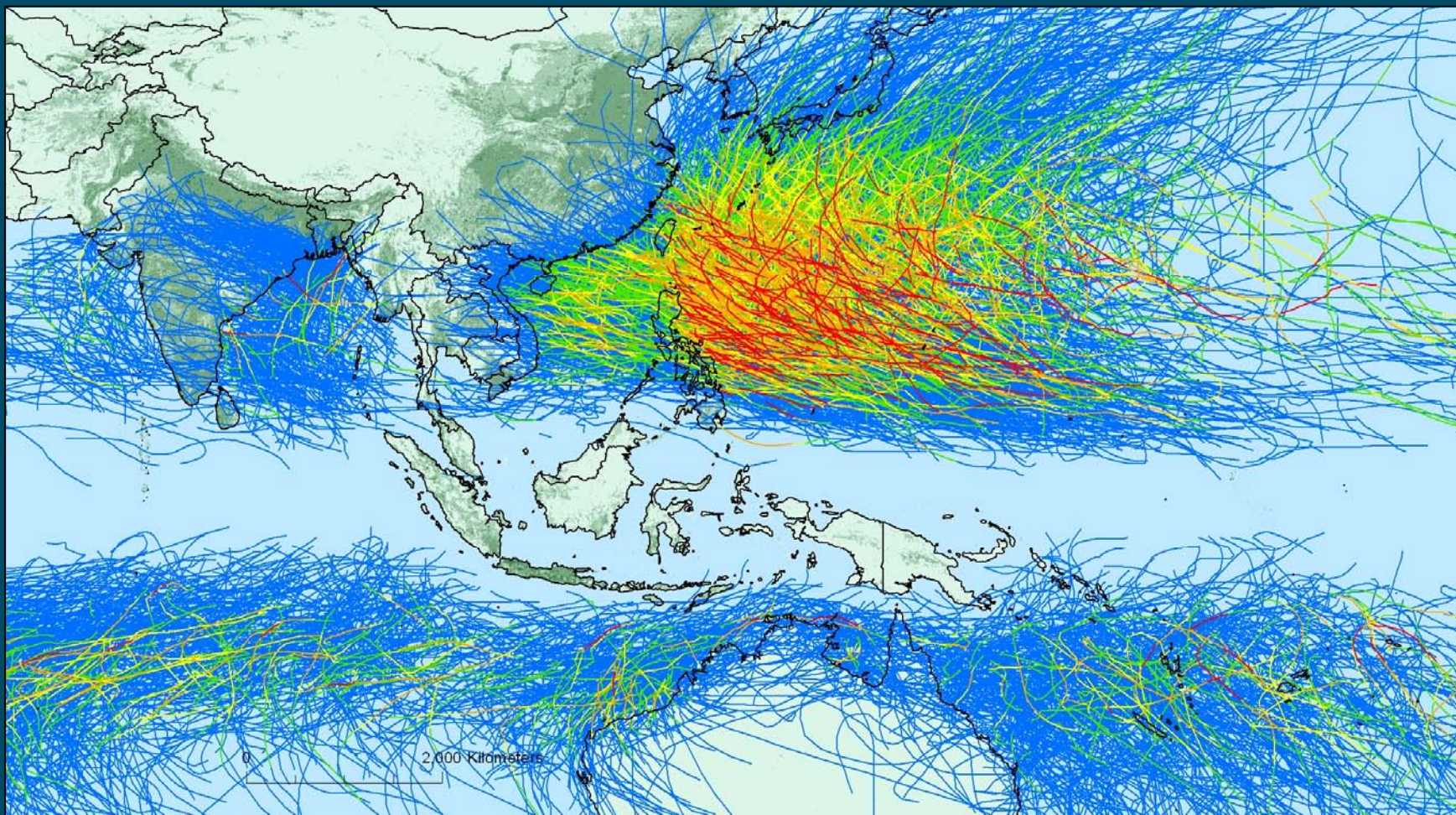
Earthquake events between 1900 and 2002 from USGS

# Tsunamis



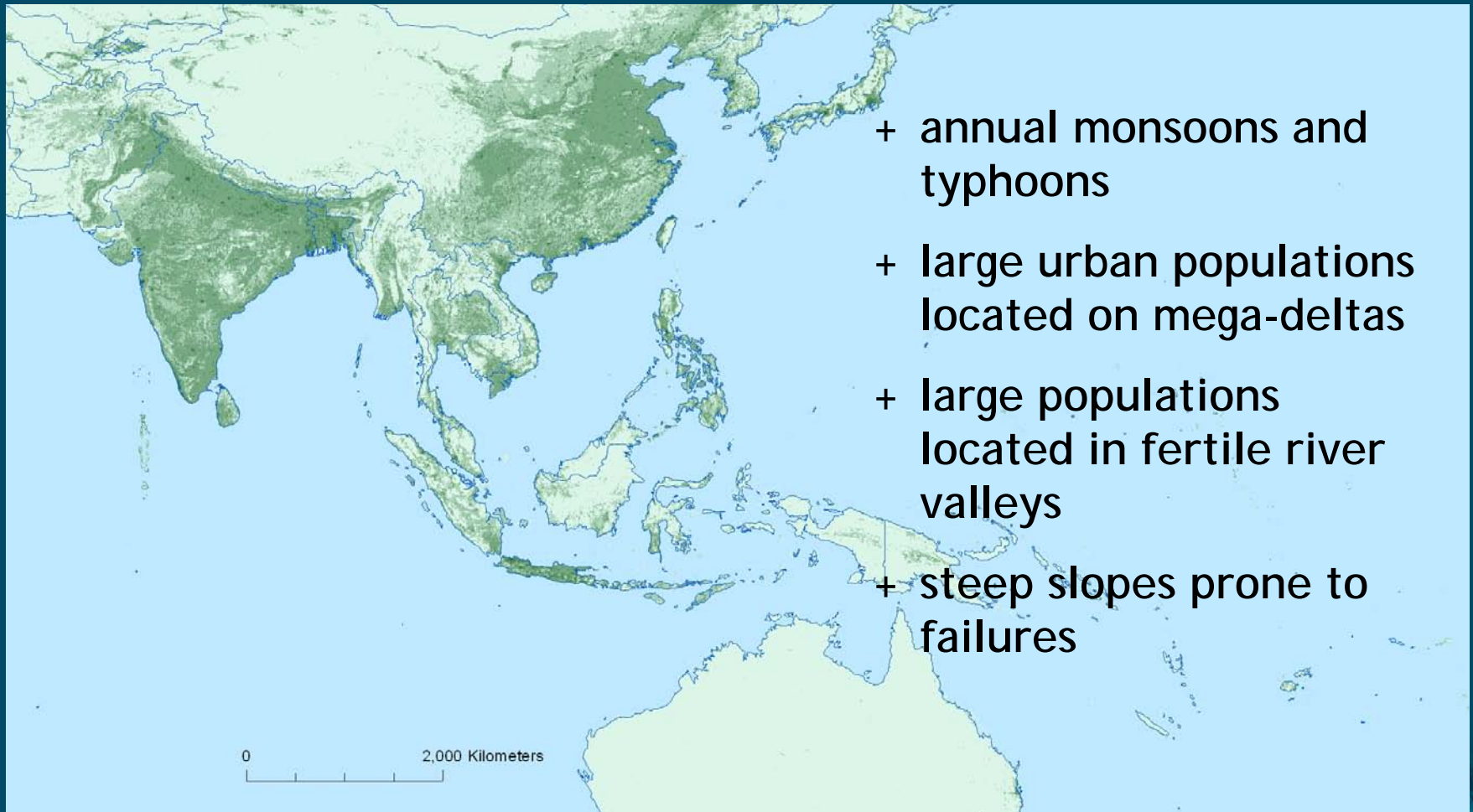
Tsunami events from NOAA Tsunami Database

# Cyclones



Cyclone tracks 1945-2006, source Unisys and Joint Typhoon Warning Centre

## Plus....

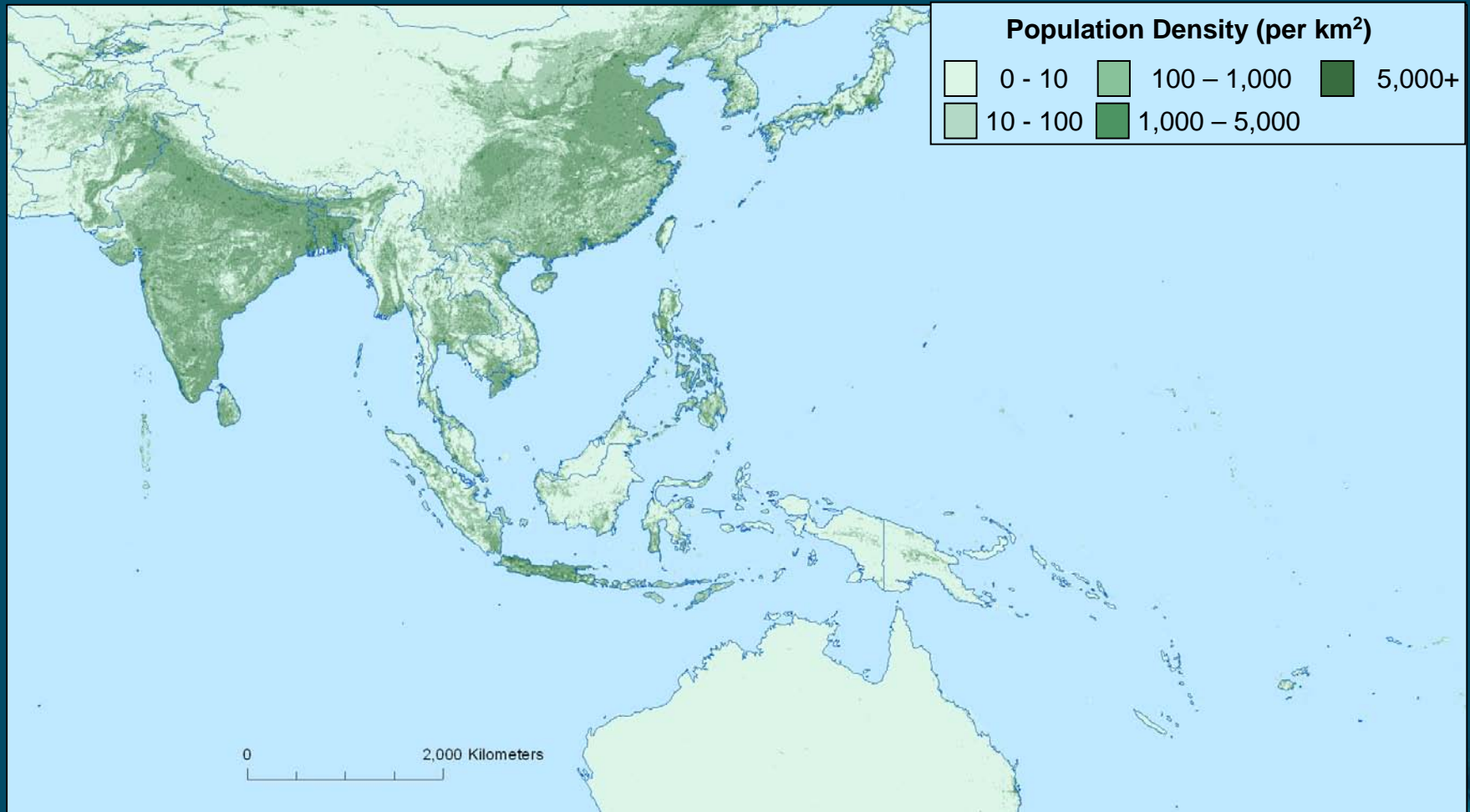


## Asia-Pacific context...

Why does the Asia-Pacific region increasingly experience some of the world's worst natural disasters?

## 2. The impact of population growth and urbanisation

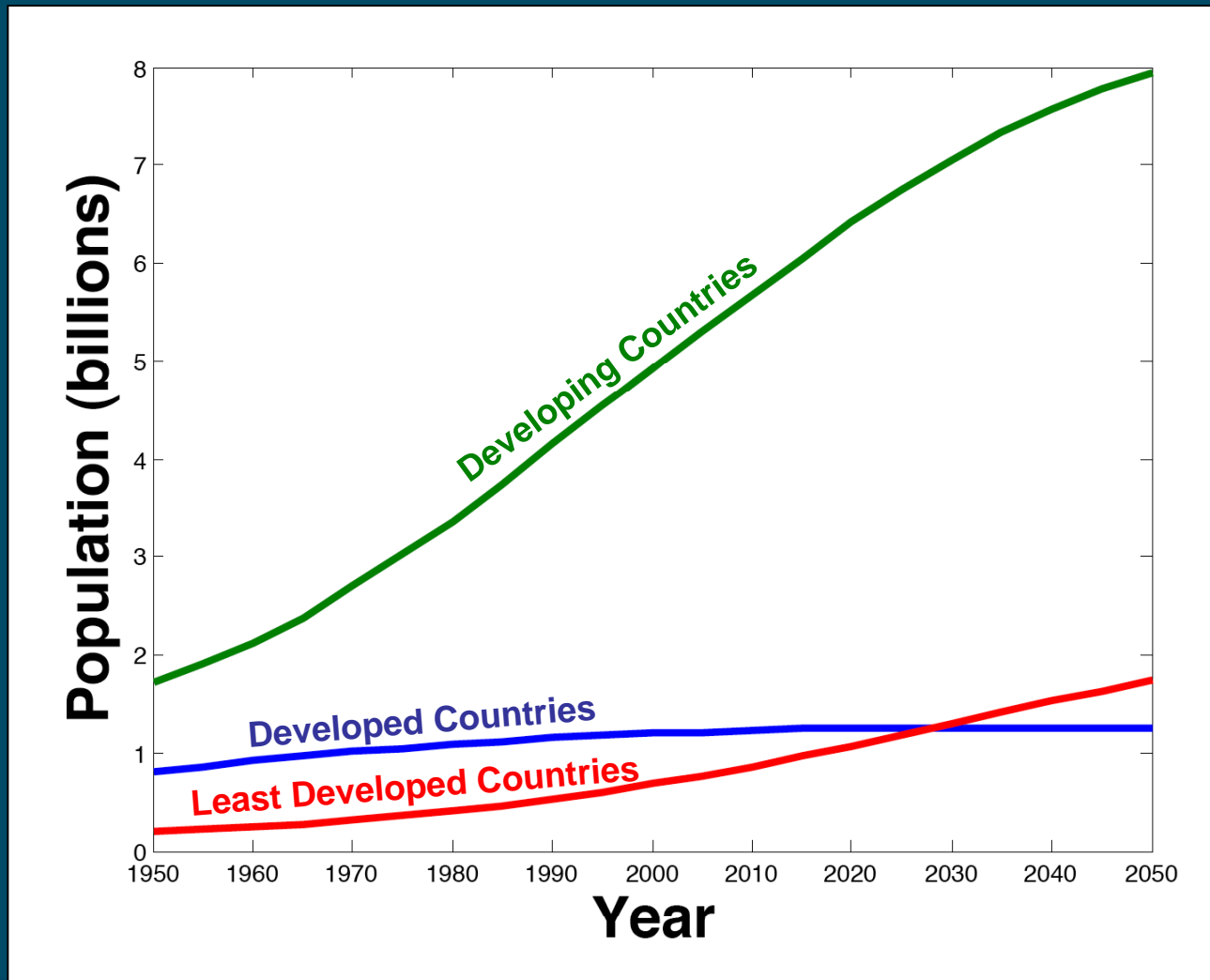
# Population



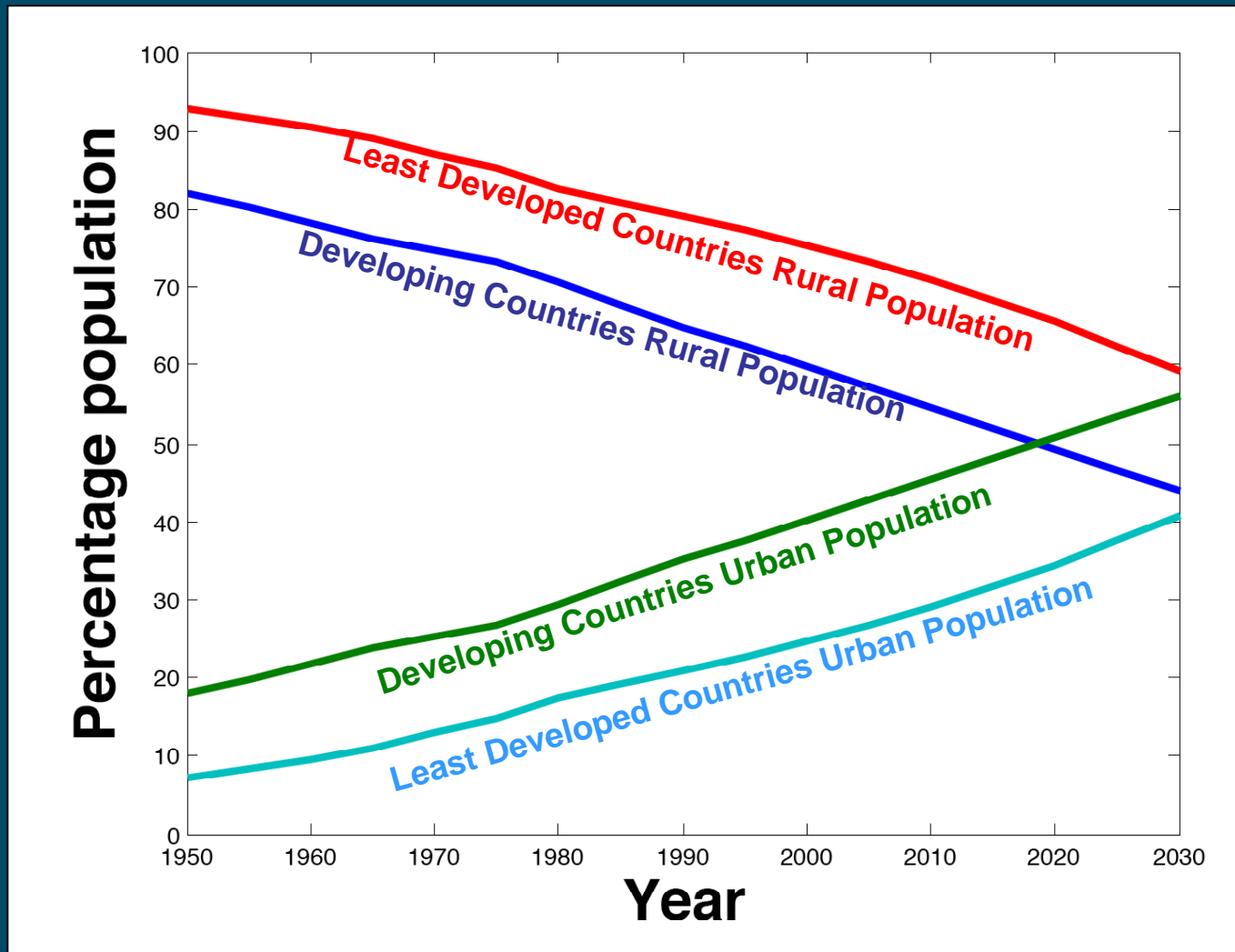
Population Density, source Landsat



# 20<sup>th</sup> century population explosion



# Increasing urbanisation

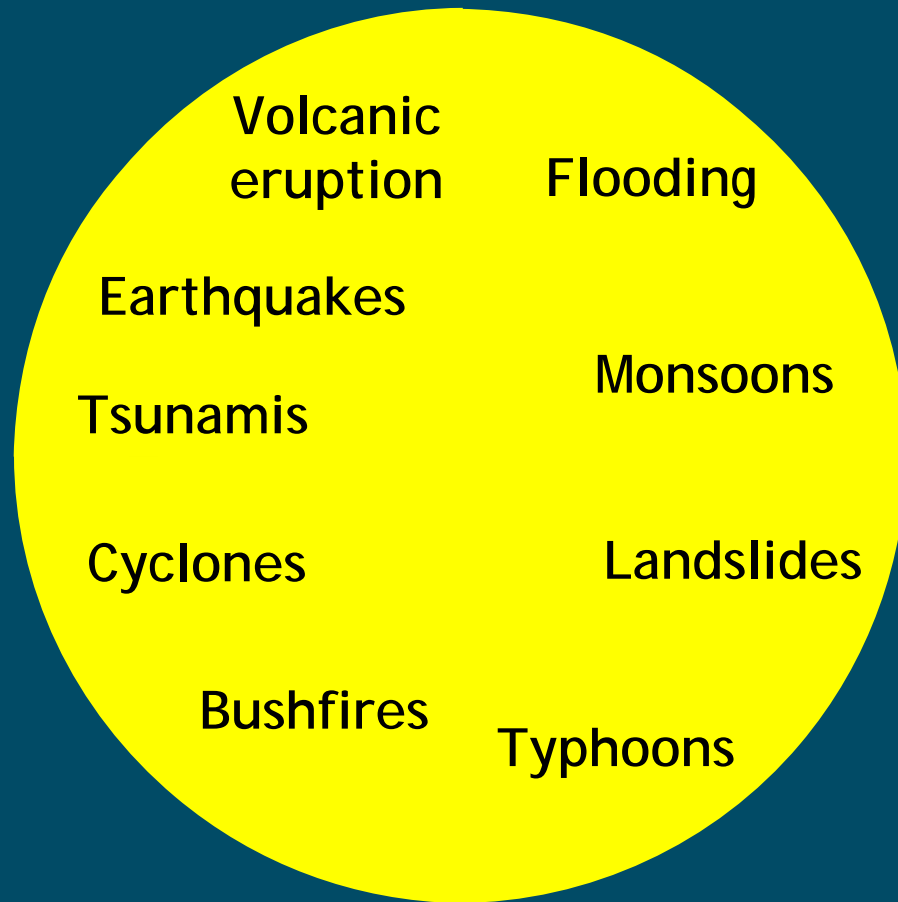


## Asia-Pacific context...

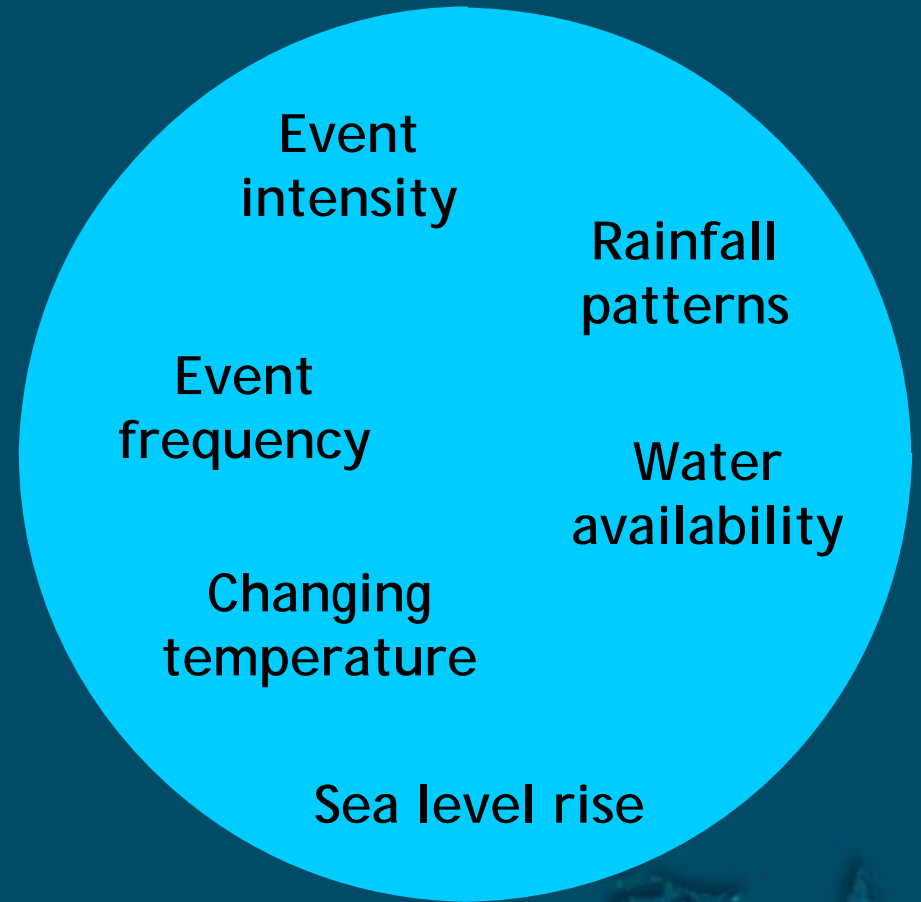
Why does the Asia-Pacific region increasingly experience some of the world's worst natural disasters?

### 3. The impact of climate change?

## Natural hazards

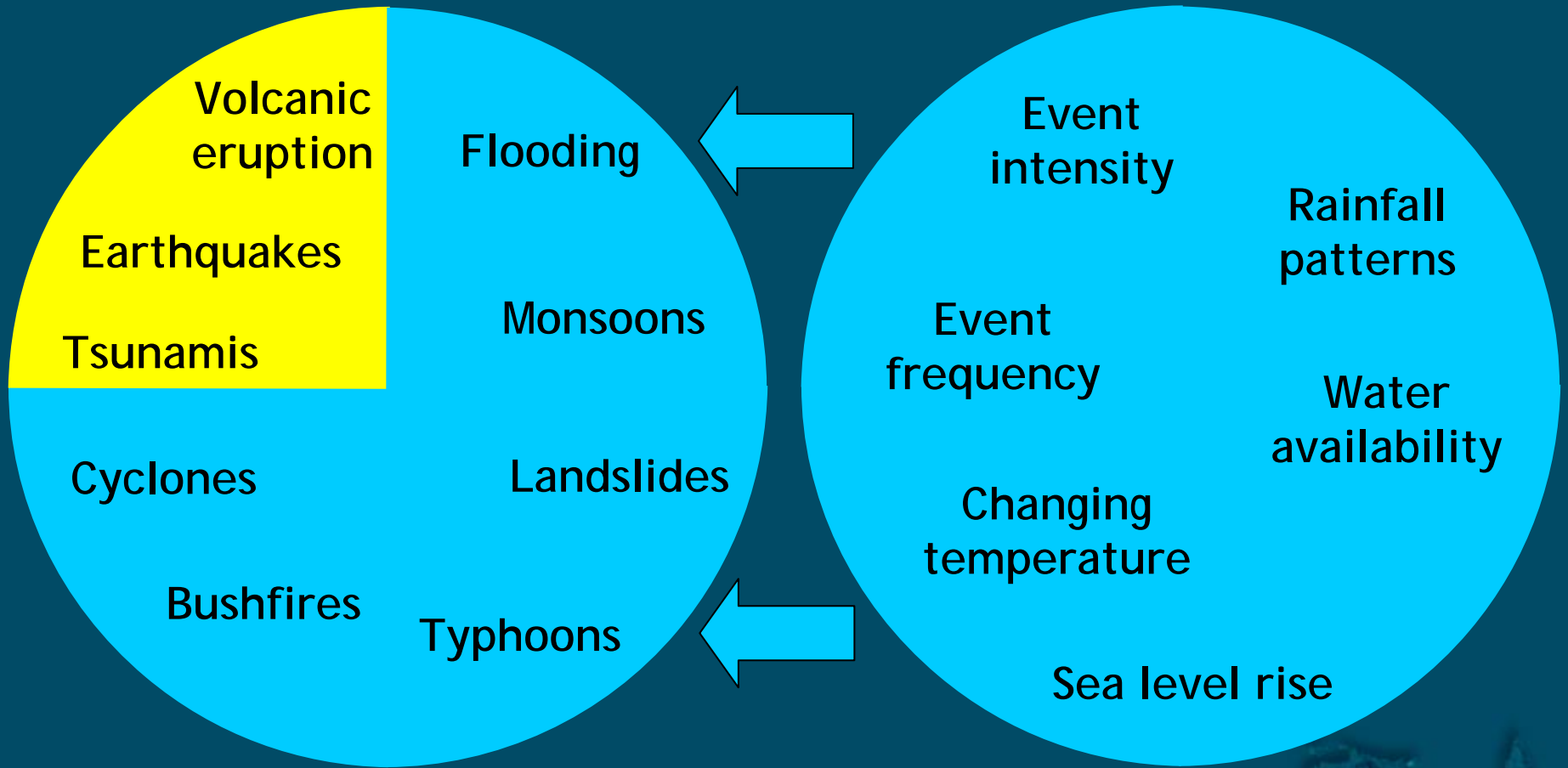


## Climate change



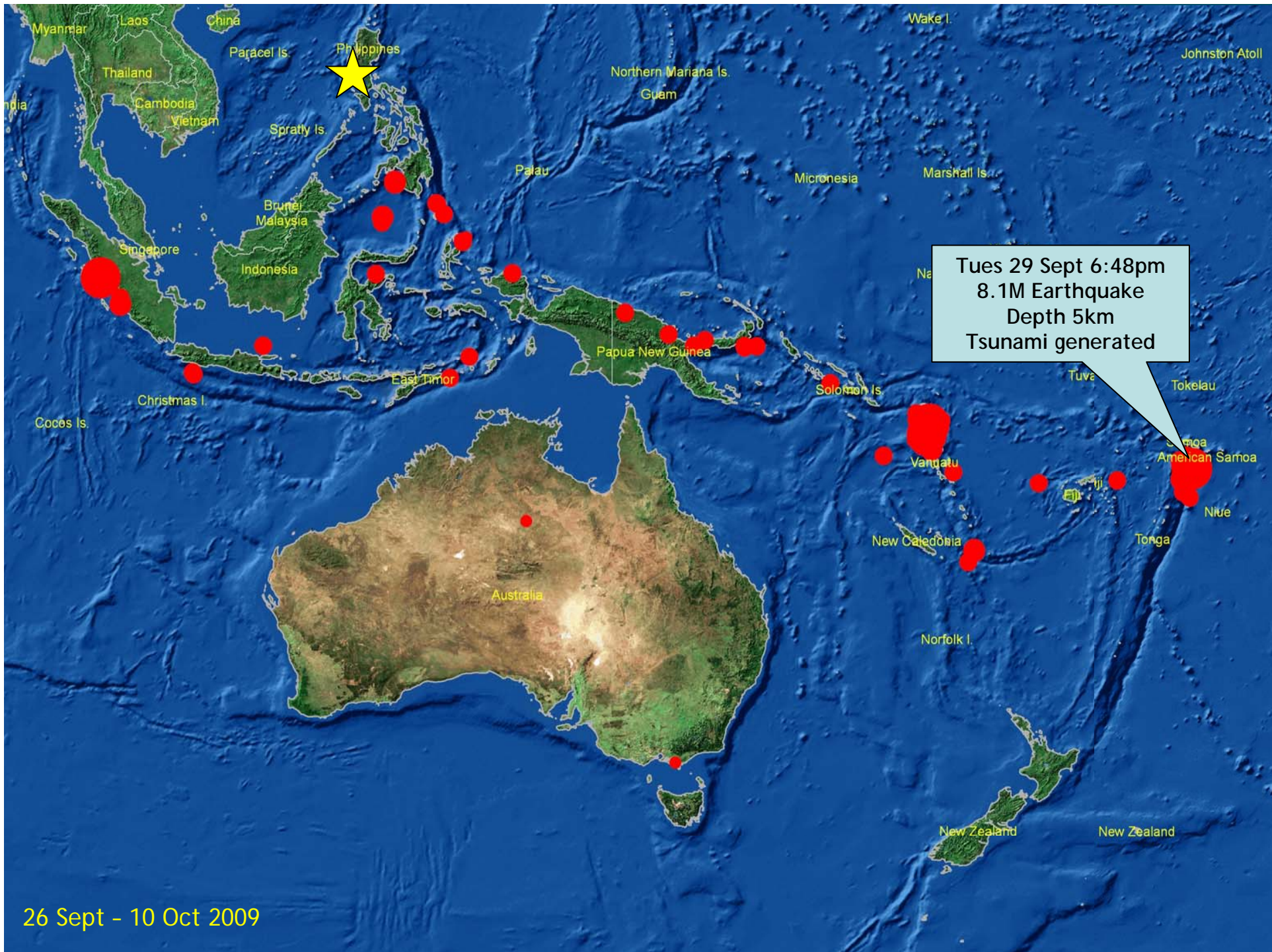
# Natural hazards

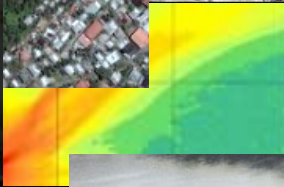
# Climate change



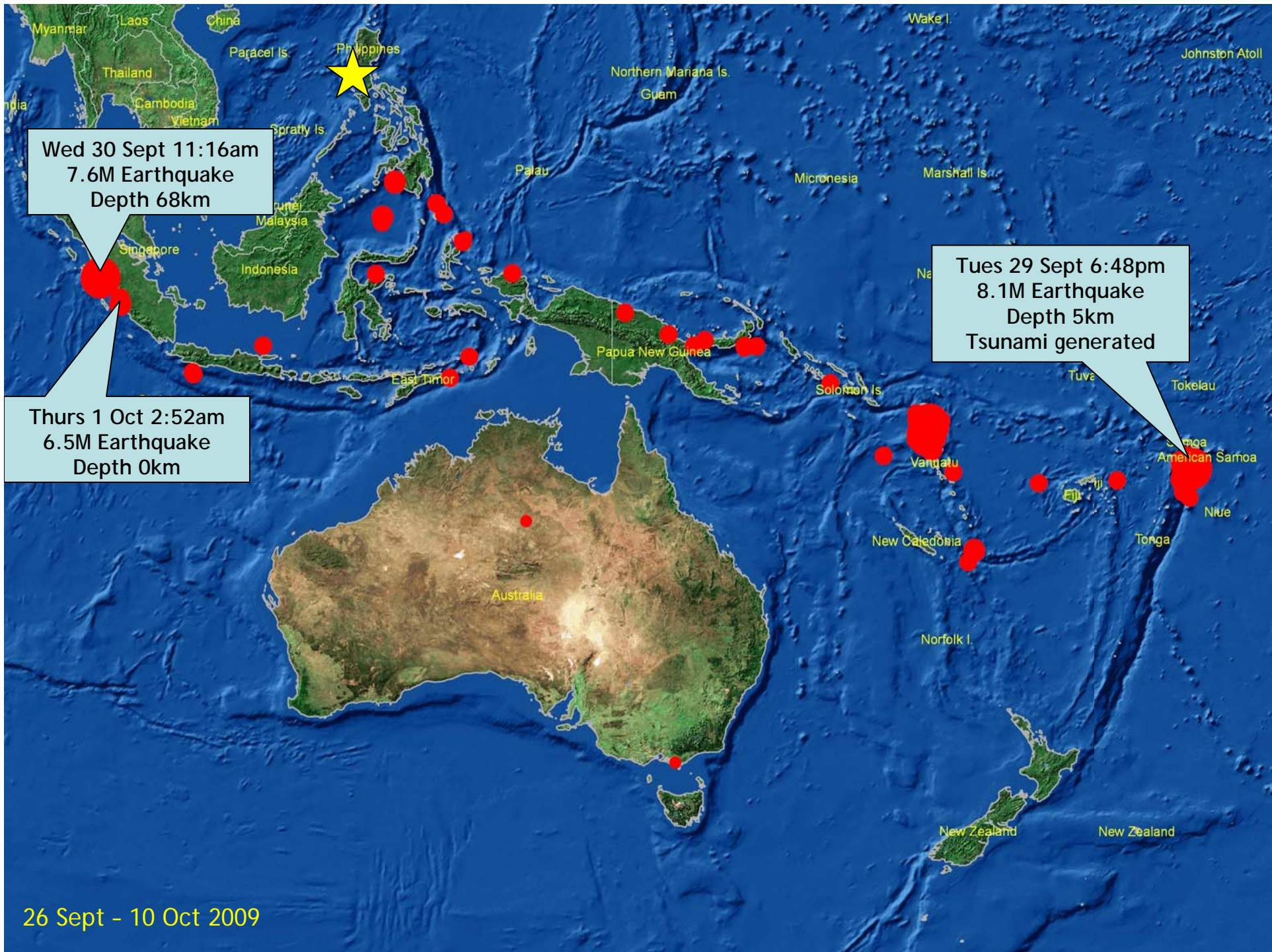
## Asia-Pacific context... summary

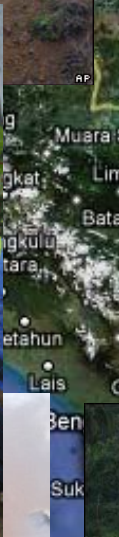
- Region frequently subjected to many natural hazards
- Population and urbanisation is growing
- Development unplanned and in the most vulnerable regions
- Disasters are common. Many countries affected by multiple hazards
- Countries with high population densities at high risk
- Mega-disasters have happened...and will continue
- Disaster risk reduction is an emerging priority, and recognised by national leaders
- The effects of climate change is an unknown variable
- More detailed analyses are being undertaken

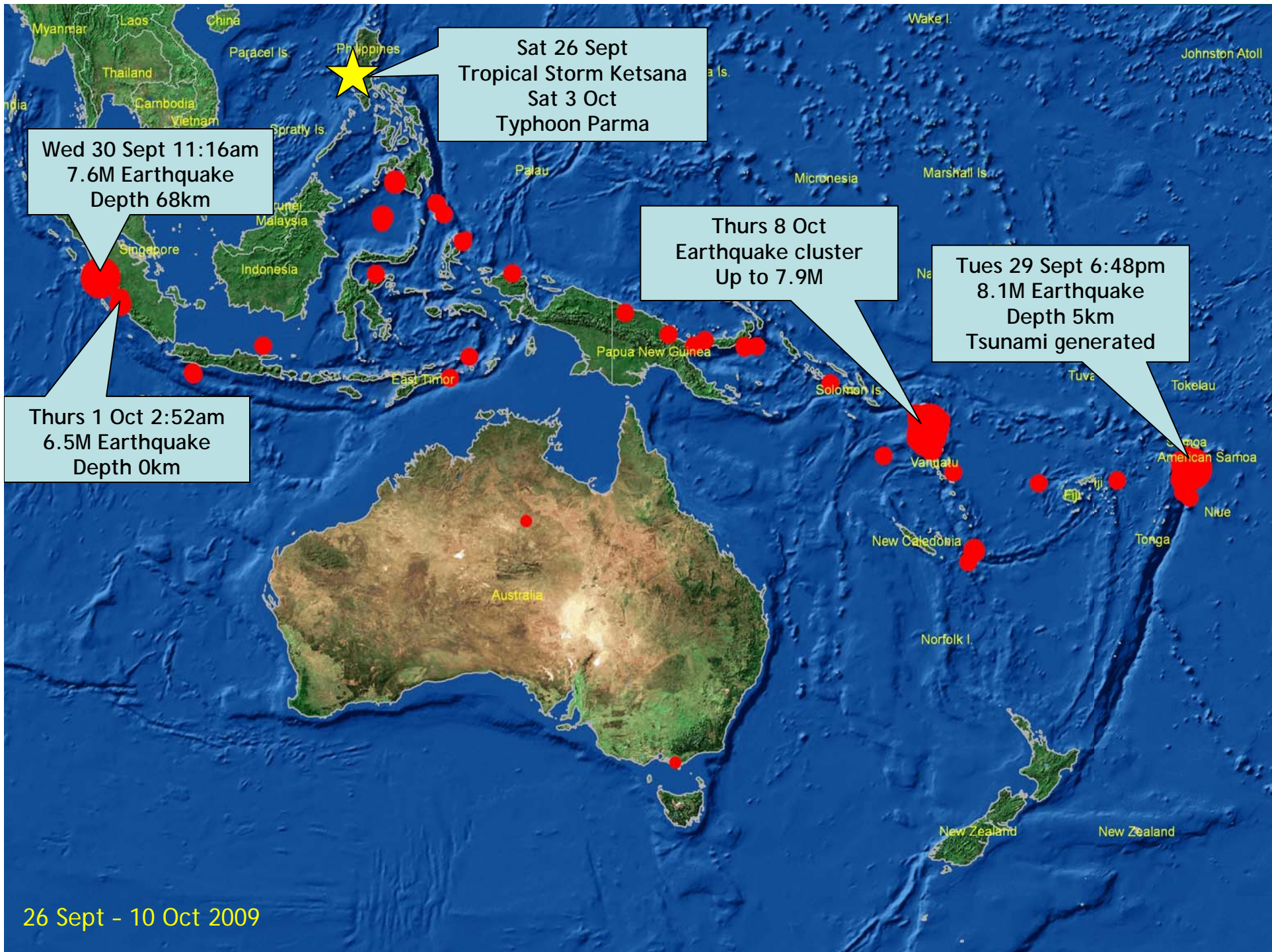












26 Sept - 10 Oct 2009

# YOU COME AGAIN



The issue...

Geo-information technologies have a vital role to play in disaster risk reduction and climate change adaptation

We are the geo-information experts  
What do we know about DRR?

# UNRCC background

Governments of Member States stimulate surveying and mapping of their national territories

Include application of modern technology in surveying and mapping in developing countries, GIS for application in basic mapping and applied mapping such as mapping for statistics, population census, environmental protection, tourism, land use, and cadastral registration; legal aspects in map production; and toponymy

This is about providing fundamental data

# PCGIAP Statutes

Cooperate in the development of a regional geographic information infrastructure

To define the nature of a regional geographic information infrastructure that each country in the region can contribute to in order to meet regional and global mapping and GIS requirements

**This is about making data and information available to a wider community**

# 17<sup>th</sup> UNRCC-AP, Bangkok Sept 2006: Resolution 1

## 1. Geo-information for mitigating large scale disasters

*“make more effective and efficient use of geo-information by decision makers for disaster monitoring, assessment and management”*

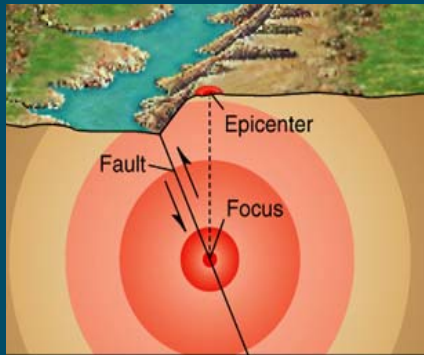
*“realization of improved environmental and sustainable development decision making”*

*“apply best practices in the development of appropriate geo-databases and applications”*

**This is getting into delivery of data and information to support risk management**



# Risk methodology



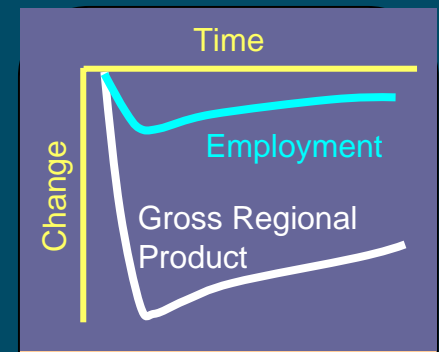
Hazard



Exposure



Vulnerability

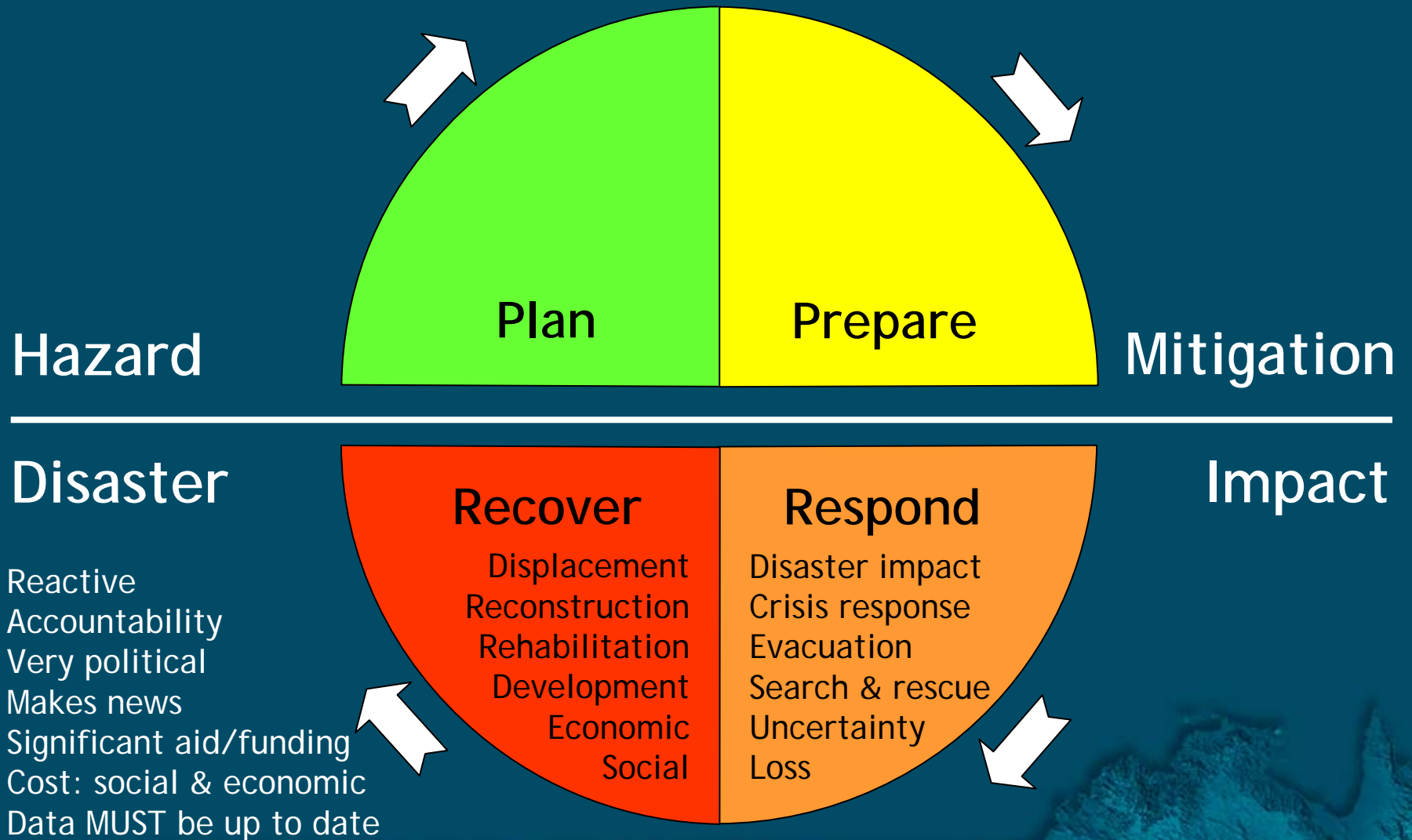


Impact

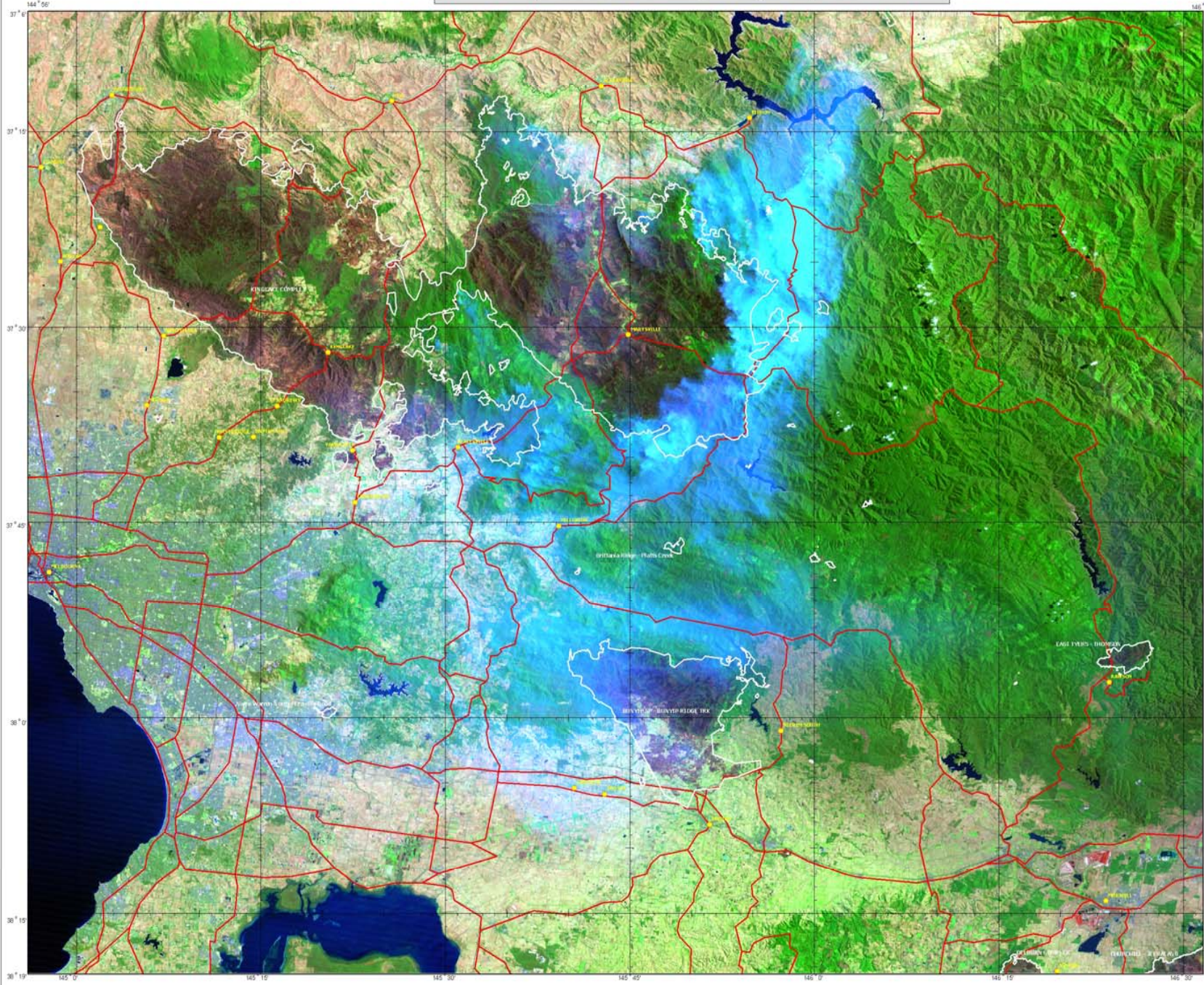
# Disaster risk management cycle



# Disaster risk management cycle



Major Victorian Bushfires February 2009 - Kinglake Complex Area



Australian Government

Geoscience Australia  
National Mapping & Information Group  
National Earth Observation Group

Landsat 5 Satellite Image  
17 February 2009



- Bushfire Area
- Populated Places
- Major Roads



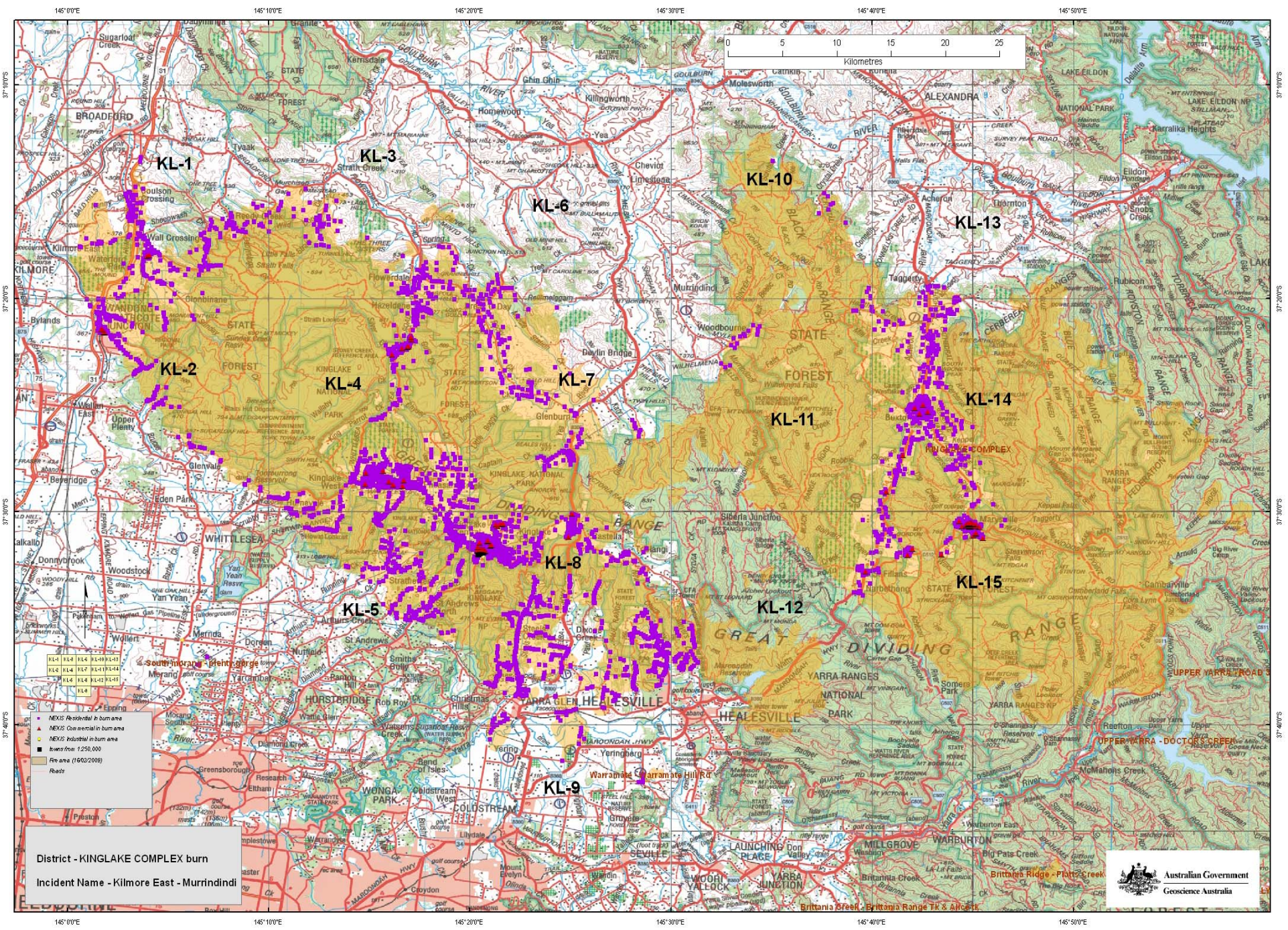
0 5 10 km  
1:250,000

UNCLASSIFIED

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Prepared for Department of Human Services  
Date: 6 March 2009





District - KINGLAKE COMPLEX burn  
 Incident Name - Kilmore East - Murrindindi

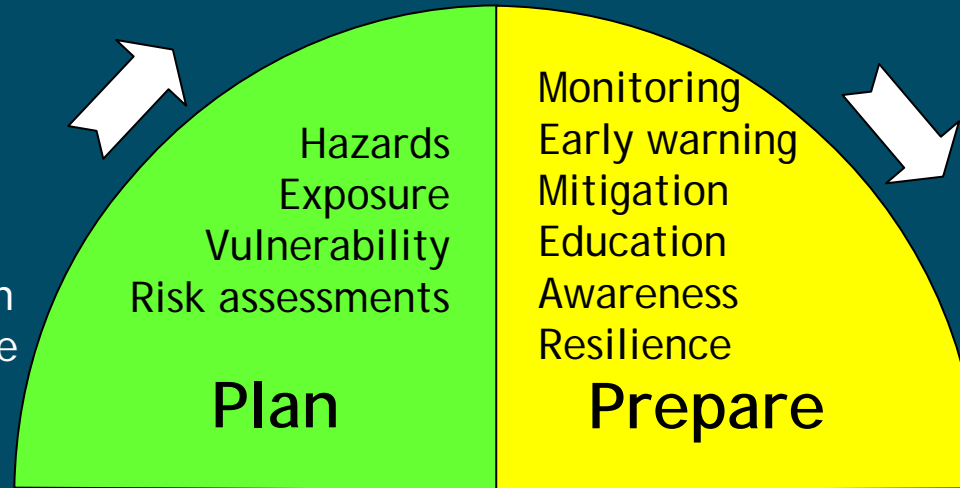
- NEXIS Residential burn area
- NEXIS Commercial burn area
- NEXIS Industrial burn area
- Area from 1:250,000
- Fire area (16/02/2009)
- Roads



# Disaster risk management cycle

Pre-emptive  
Long lead times  
No interest  
Minimal funding  
Not political  
Does not make news  
Cost/benefit unknown  
Data often out of date

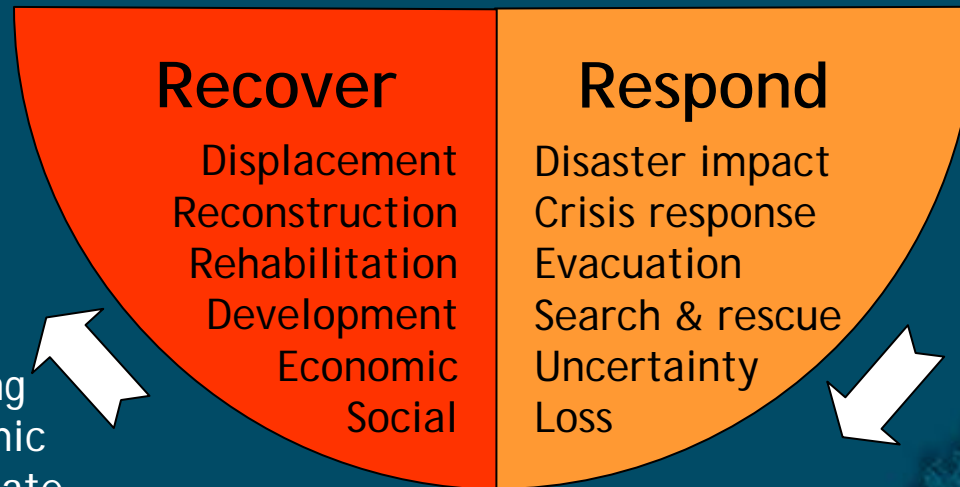
## Hazard



## Mitigation

## Disaster

Reactive  
Accountability  
Very political  
Makes news  
Significant aid/funding  
Cost: social & economic  
Data MUST be up to date



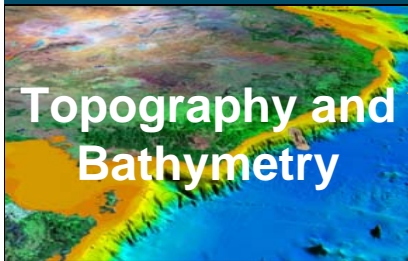
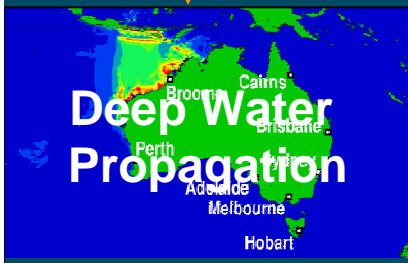
## Impact

# Australian Tsunami Warning System





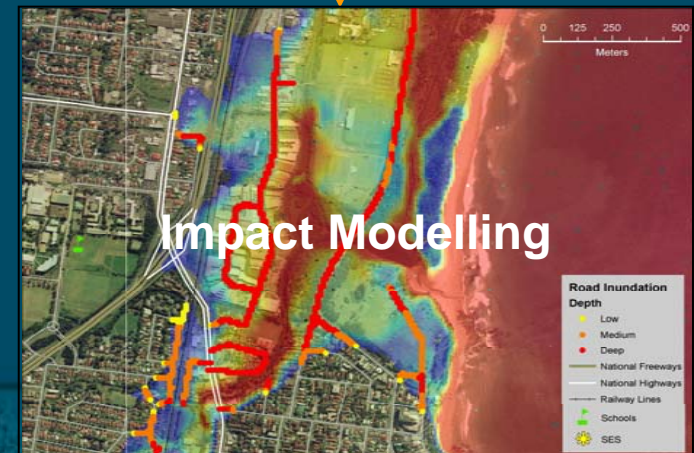
# Tsunami impact modelling



$$\frac{\partial U}{\partial t} + \frac{\partial E}{\partial x} + \frac{\partial G}{\partial y} = S_0 +$$

**Inundation Model**

$$U = \begin{bmatrix} h \\ uh \\ vh \end{bmatrix}, E = \begin{bmatrix} uh \\ u^2h + gh^2/2 \\ vvh \end{bmatrix}$$



# Australian probabilistic tsunami hazard



## The issue...

Geo-information technologies have a vital role to play in disaster risk reduction and climate change adaptation

We are the geo-information experts  
What do we know about DRR?  
What geo-information is needed?

# Hazards



Event propagation  
Hazard models

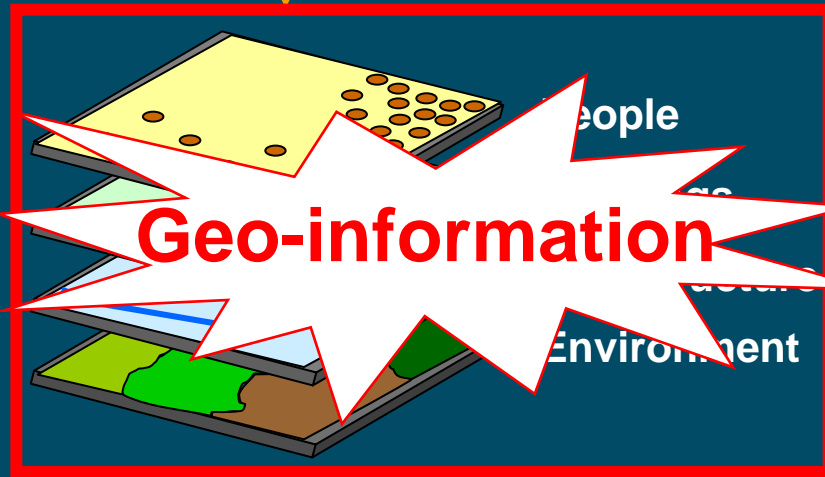
# Society



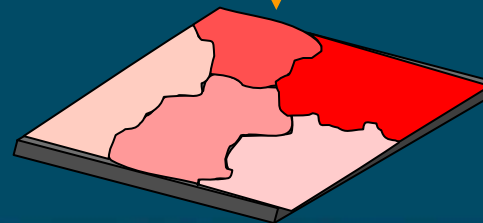
# Impacts



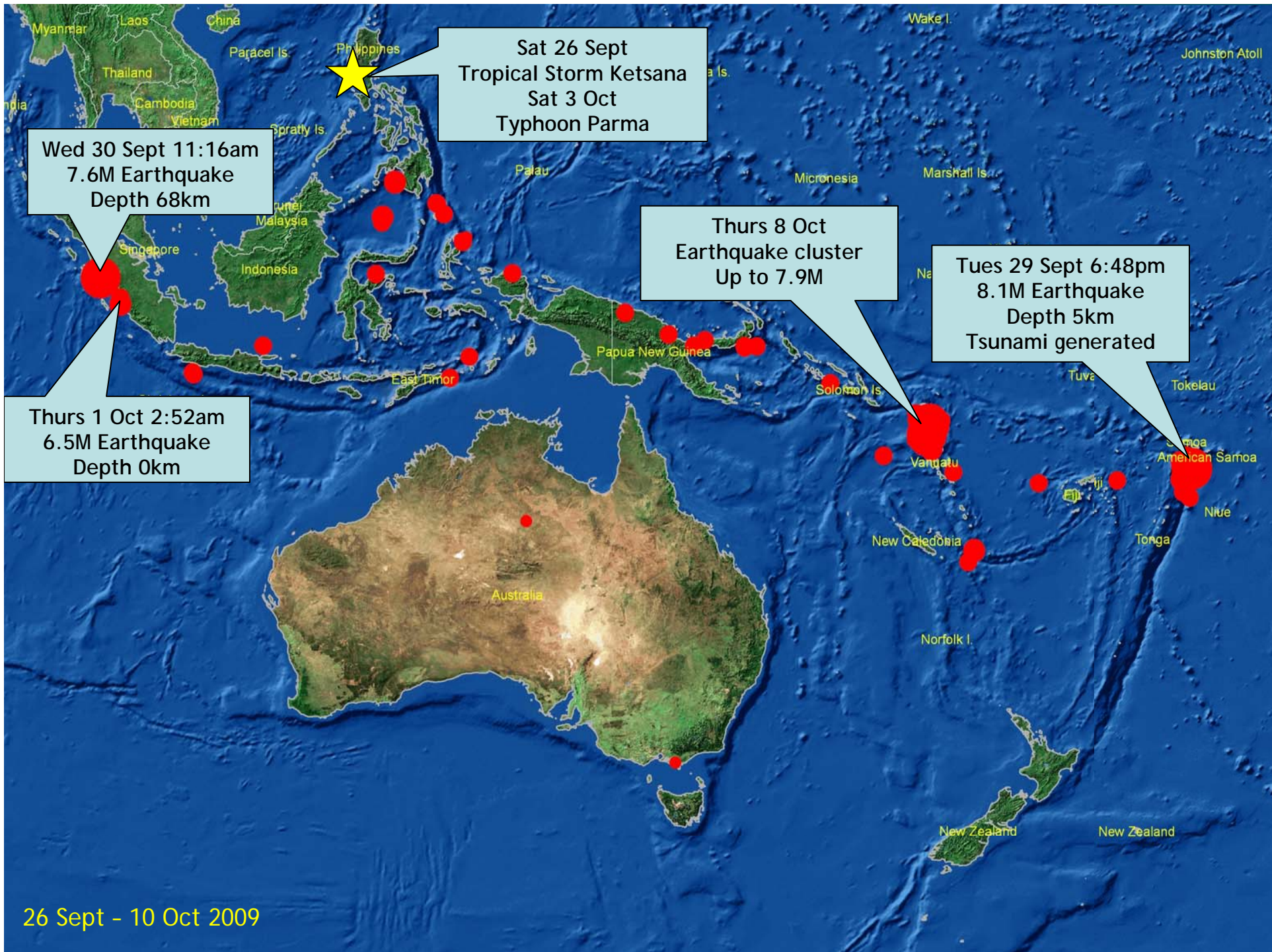
Exposure  
Vulnerability

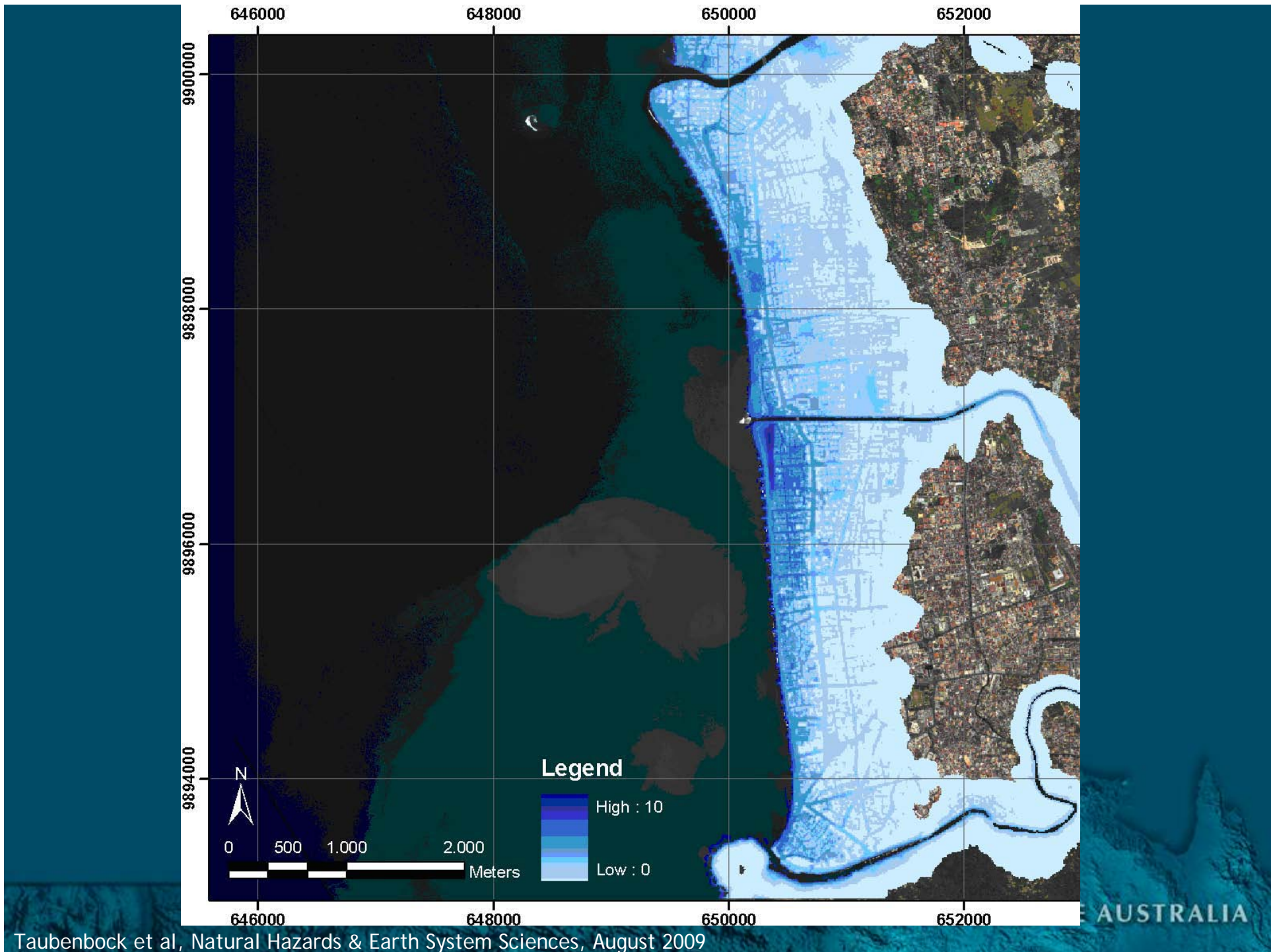


Area of impact over time

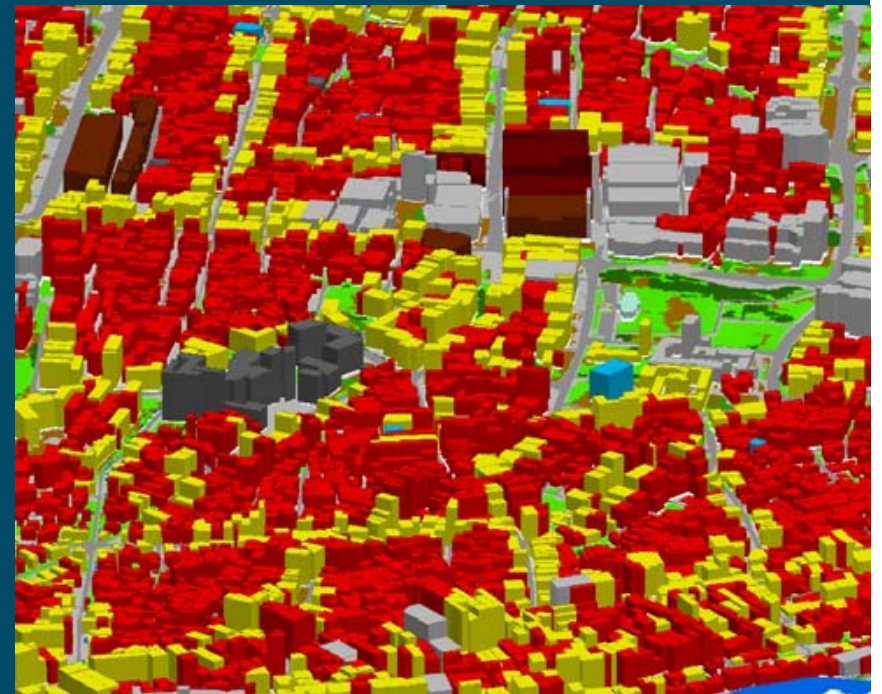


Damage, Disruption  
Recovery, Cost





Taubenbock et al, Natural Hazards & Earth System Sciences, August 2009



### Legend

#### Buildings – land use

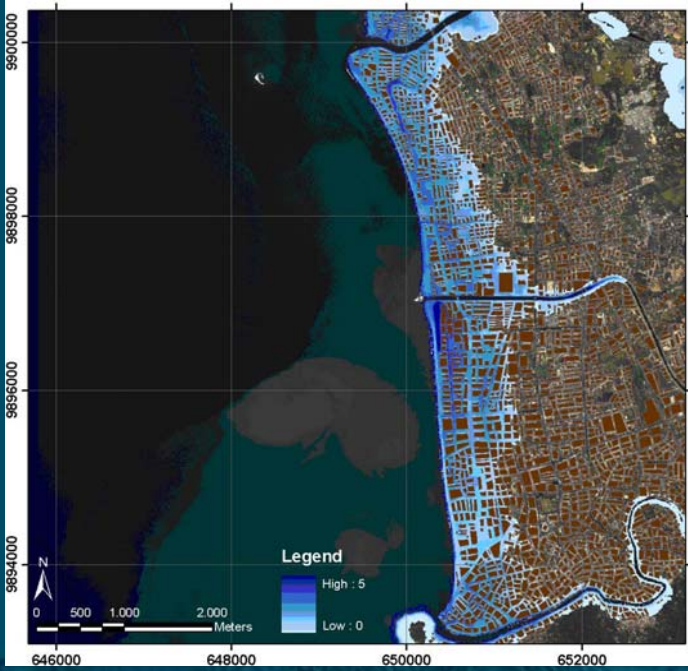
- residential
- mixed usage / harbour
- hotel
- market / shopping mall
- industry
- commercial use / offices
- university / school
- mosque
- hospital

#### Land cover

- streets
- sealed areas
- grassland
- forest
- bare soil
- water

City model of Padang, Indonesia derived from high resolution satellite data and DEM

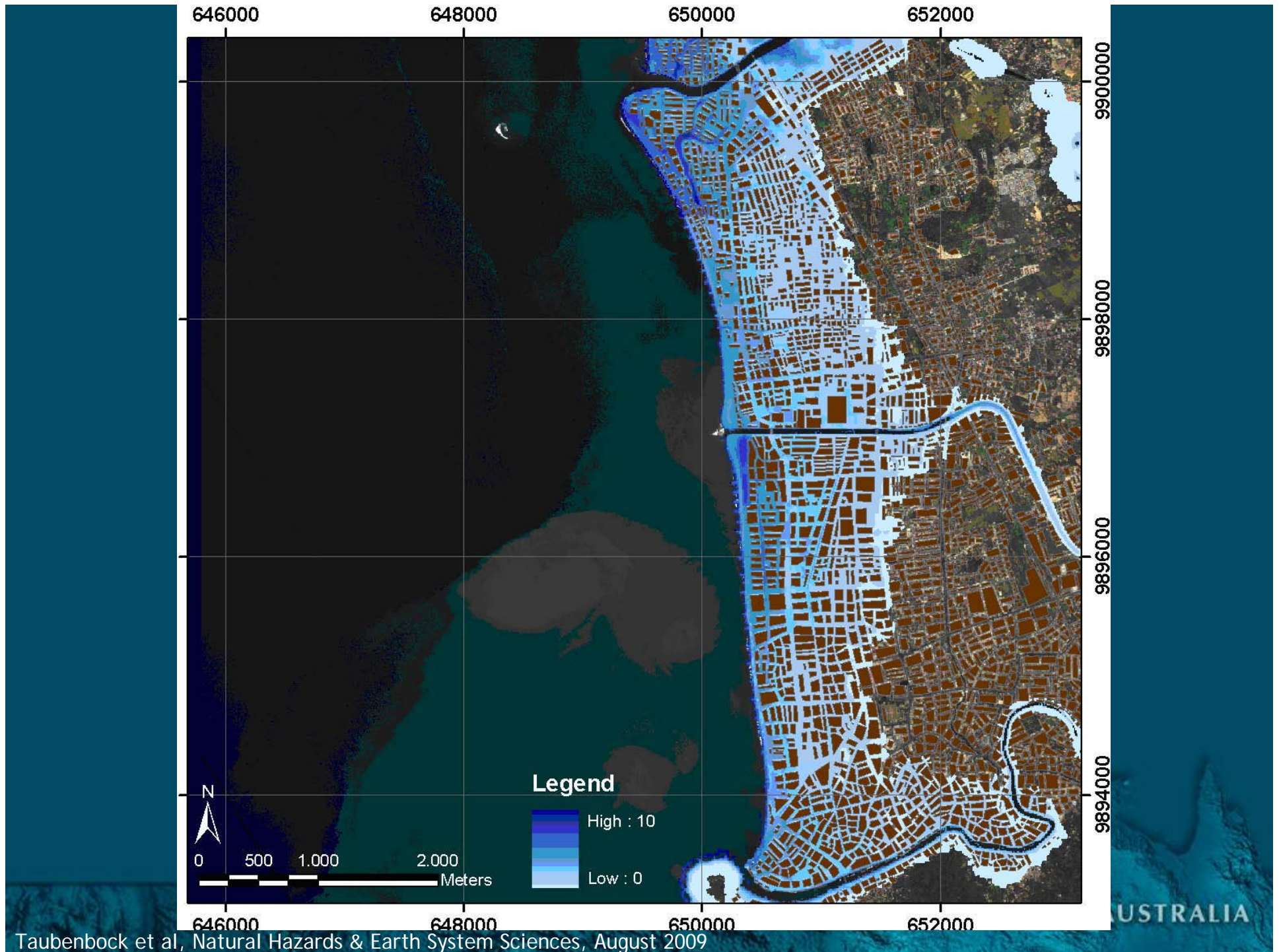
GEOSCIENCE AUSTRALIA

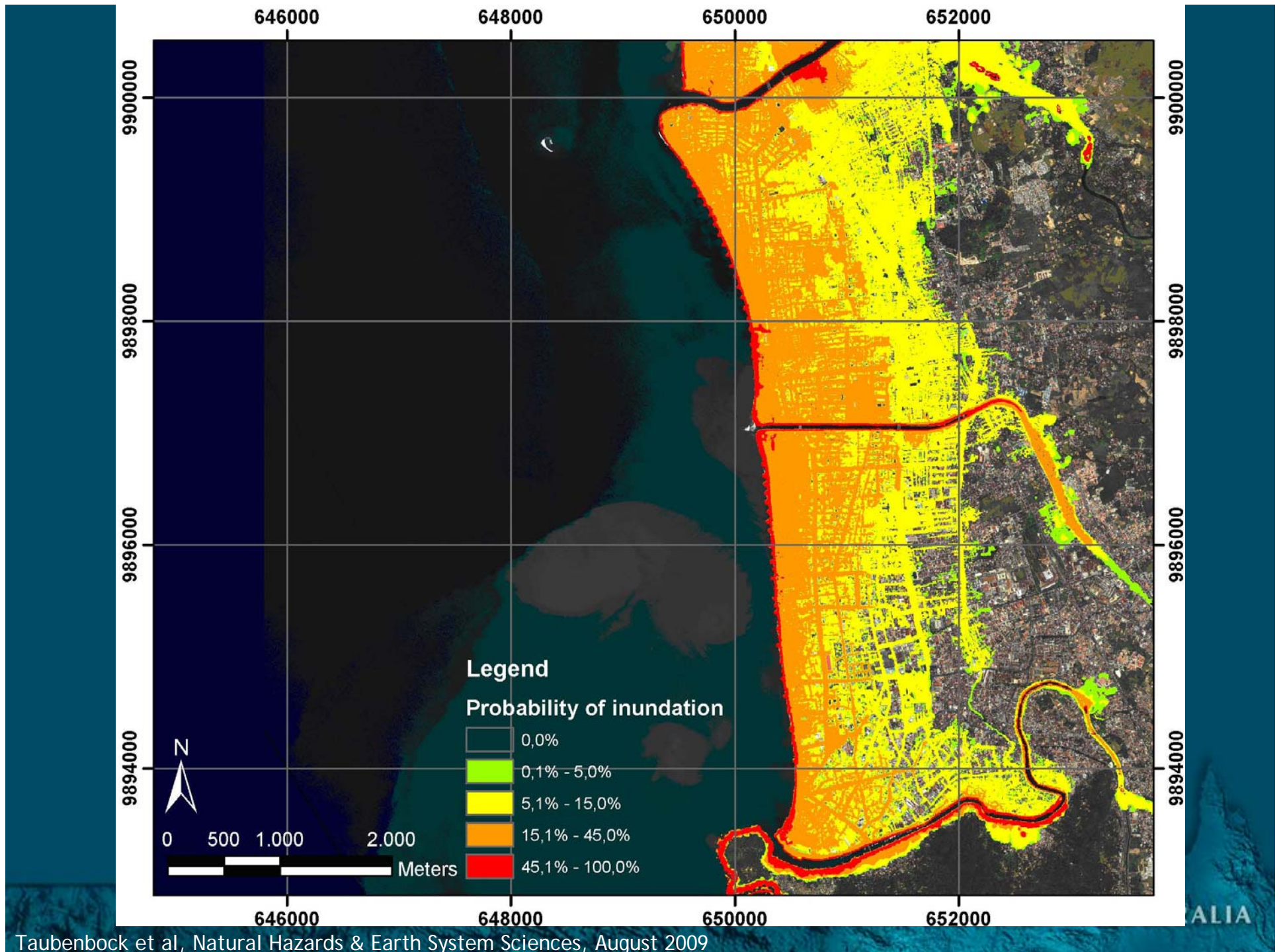


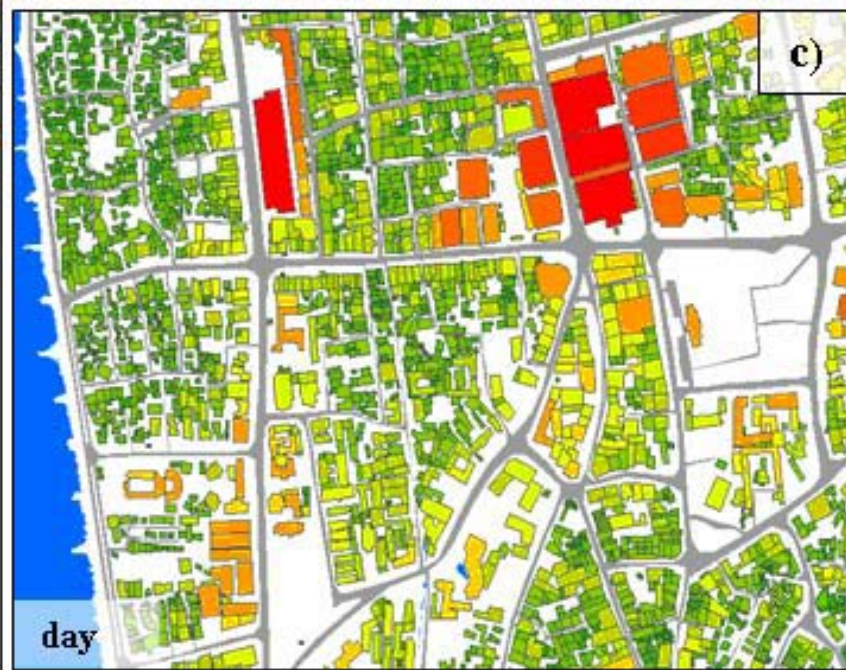
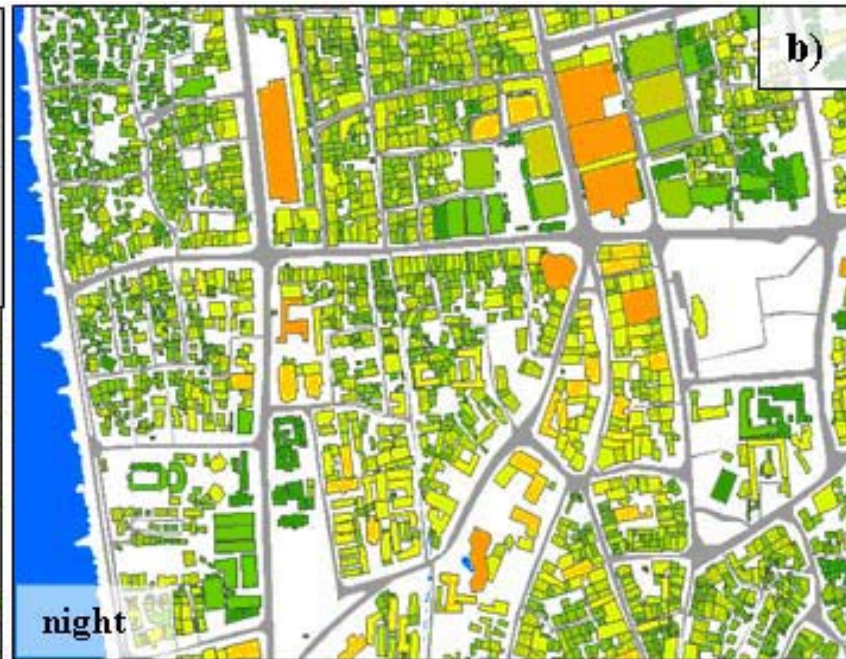
Tsunami inundation sequence for Padang City

Taubenbock et al, Natural Hazards & Earth System Sciences, August 2009

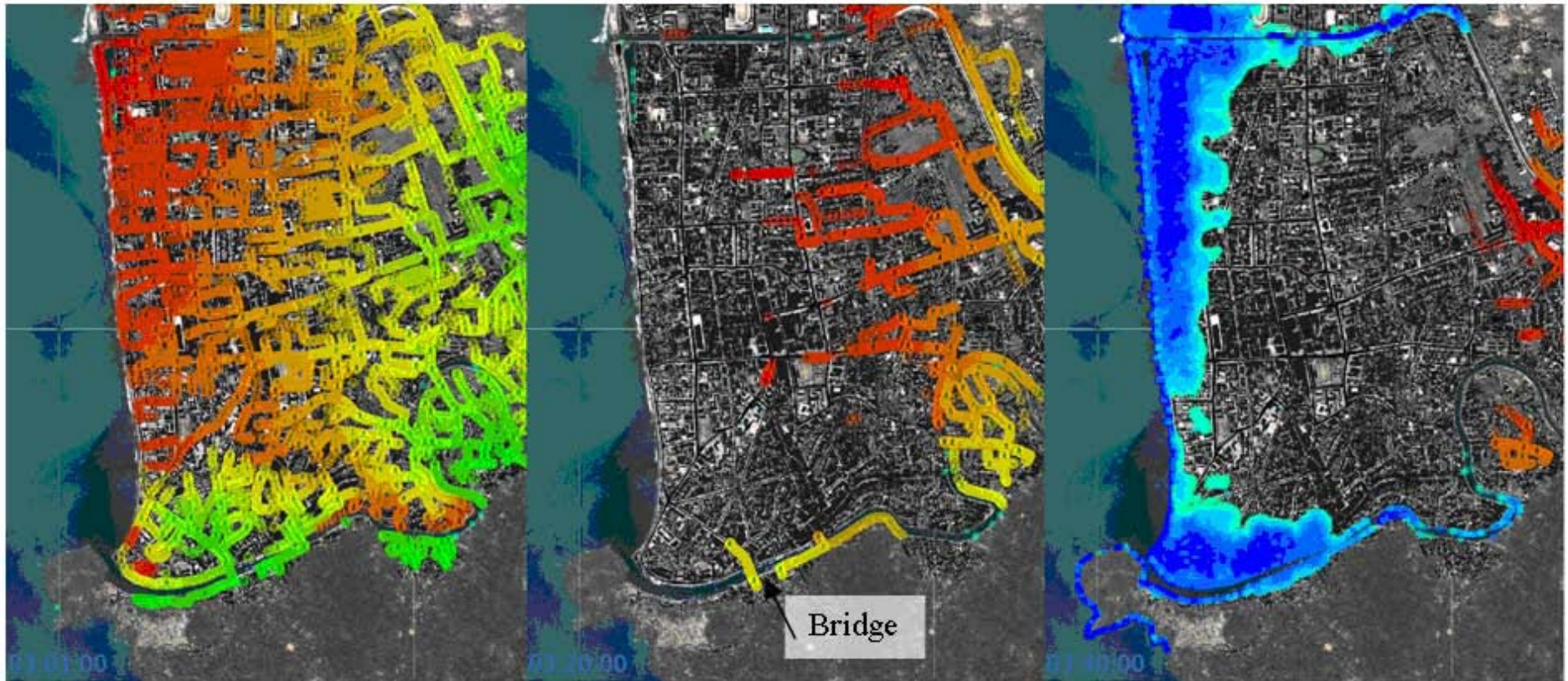




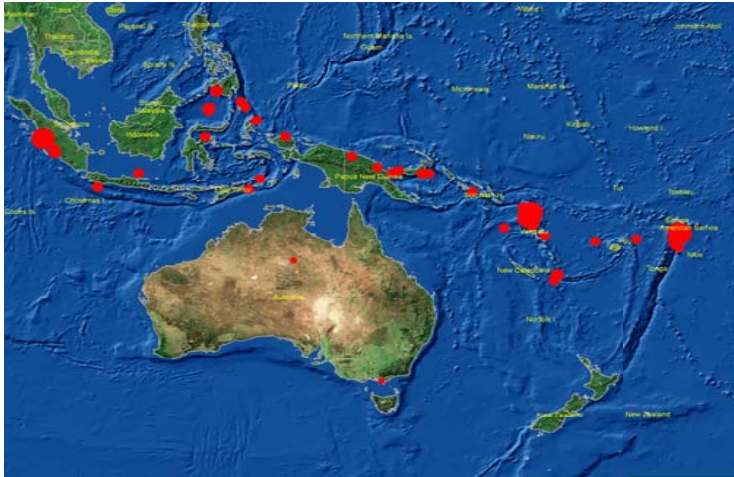




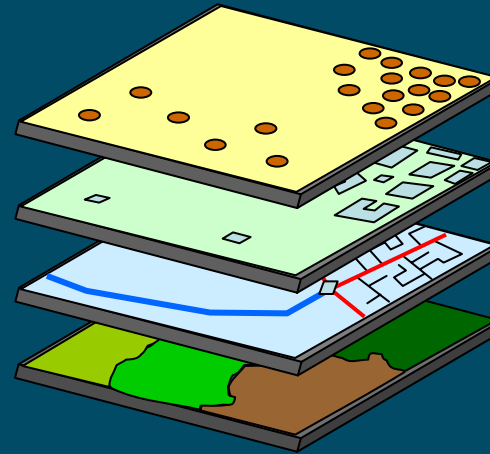
Population distribution of Padang at building level



Evacuation sequence: 1min, 20min, 40min. Evacuation time increases as colour moves from green to yellow to red



**Reduce Exposure and Vulnerability**

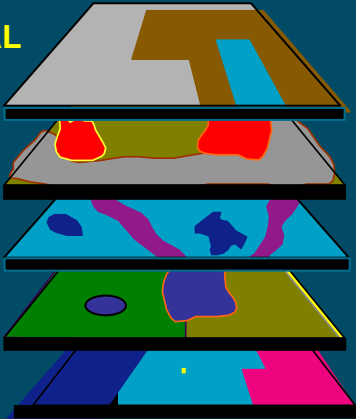


**People**  
**Buildings**  
**Infrastructure**  
**Environment**

## Spatial Data Infrastructures

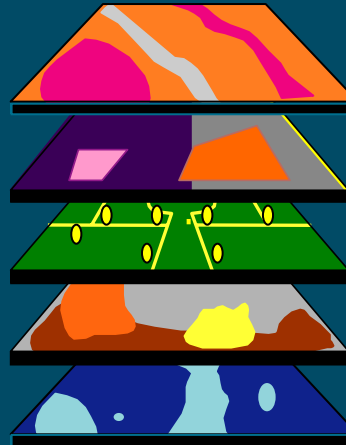
### FUNDAMENTAL

Imagery  
Topography  
Bathymetry  
Roads  
Cadastre  
Addresses  
Census  
Demography  
Admin. Bdys.



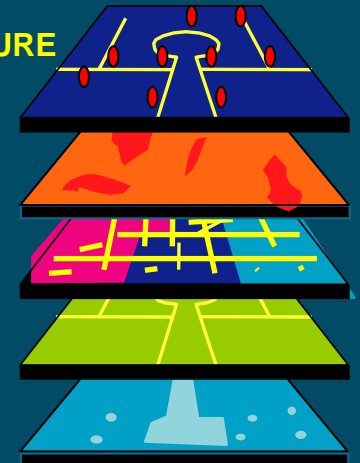
### SERVICES

Police  
Fire  
Ambulance  
SES  
Schools  
Hospitals  
Aged care  
Community facilities  
Buildings



### INFRASTRUCTURE

Electricity  
Gas  
Telecoms  
Water  
Transport  
Health  
Broadcasting  
Banking  
Industry



## Disaster Risk Reduction

**Scenarios**  
**Event models**  
**Impact analysis**

**Exposure**  
**Vulnerability**  
**Hazard maps**

**Social profiles**  
**Economic loss**  
**Risk assessments**

**Casualties**  
**Fatalities**  
**Cost**

AUSTRALIA

## The issue...

Geo-information technologies have a vital role to play in disaster risk reduction and climate change adaptation

We are the geo-information experts  
What do we know about DRR?  
What geo-information is needed?  
What can we do about it?

# Geo-information technologies... summary

- Natural hazards, now being influenced by climate change, interact with geography and human demography in creating disasters
- Understanding the hazards, exposure and vulnerability is critical to managing the level and duration of impacts
- Fundamental geo-information must be captured, integrated and made available - SDI, but this is just the start
- National exposure databases, combined with appropriate modelling and analysis techniques, contribute significantly to decision-making
- Appropriate education and awareness tools are vital to building capacity and capability

Focus on *“the transparent and ubiquitous use of spatial data (SDI) particularly on applications such as regional disaster mitigation and reduction objectives, including addressing issues of data availability, needs, modelling and delivery of ‘fit for purpose’ data and information”*

# Geo-information technologies... directions

- Many organisations and governments have major investments in spatial data. Important to establish an interoperability framework that allows the existing SDI to be leveraged by actors for purposes beyond mapping
- Requires agreed and established data access policy and protocols
- Establishment of an authoritative data catalogue service would increase the effectiveness of spatial capability by improving the access, coordination, quality, usage and understanding of data and data services available for emergency management
- Business as usual and crisis management operational arrangements, for the sharing of spatial information in a timely manner, must be fully defined and agreed
- Geo-information tools are critical for incident management and crisis coordination. However, there is a recognised requirement for senior decision makers to be made aware of the benefits of this technology, what can be provided and by whom



Thank you...

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