Innovate UK MiGHT Malaysian Industry-Government Group for High Technology Newton-Ungku Omar Fund SCIENCE to ACTION

Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur

Communication of Geohazard Information:

An overview of examples from South East Asia.

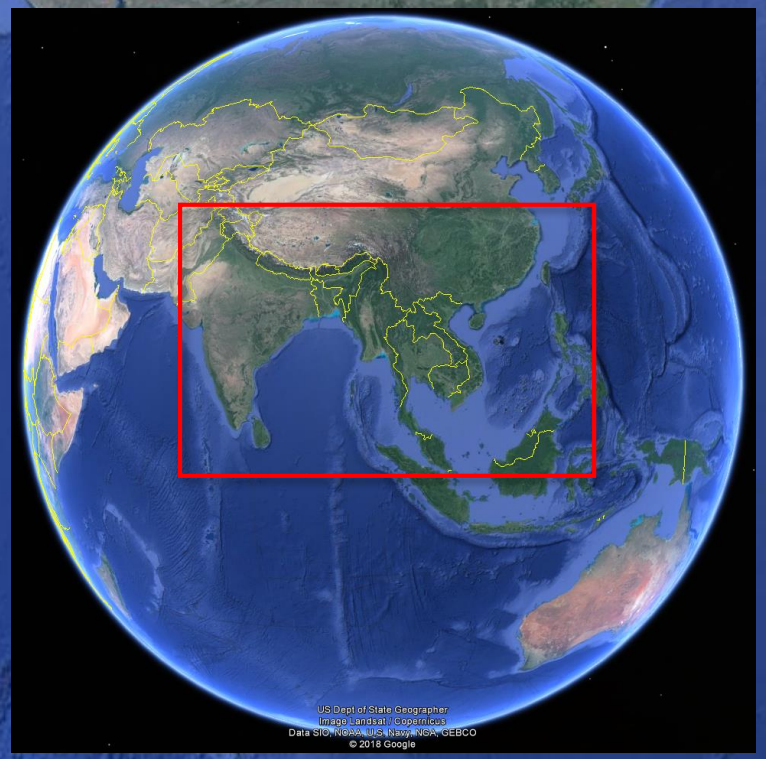
Dr. Alan Thompson (Director),

Cuesta Consulting Ltd.

Cuesta

UNIVERSITY OF CAMBRIDGE · British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL · seadpri · UNIVERSITY OF MALAYA · METMalaysia · UCL · CERC · UKM PAKARUNDING · CORE Expert Systems · GMT Geomapping Technology Sdn Bhd · JBA consulting · Cuesta · GEOLOGICAL SOCIETY OF MALAYSIA · Asian Network on Climate Science and Technology (ANCST)

Case Studies



Khyber-
Pakhtunkhwa

Da Loc

Metro
Manila

Uttaradit

Kanchanaburi

Vietnam

Mekong
Delta

Pulau
Pinang

Case Studies

a) Flood risk mitigation strategies at household level: A Case of Khyber Pakhtunkhwa (KP) Province, Pakistan

b) Building coastal community resilience, Case Thanh Hoa Province, Vietnam

c) Lessons learnt from field analysis of hazards in Kanchanaburi, Thailand

d) Vietnam's solutions to reduce the risk of flood

Local level, low cost solutions to flood risk

e) A Case Study of River Bank Erosion in Vietnam

f) The Big One; The Magnitude 7.2 West Valley Fault Earthquake

Modelling-based approaches

g) Spatial modelling of slope failure in Pulau Pinang, Malaysia

h) Management of a landslide in local area at Tambon Nam Phai, Amphoe Nam Phad, Uttaradit Province, Thailand

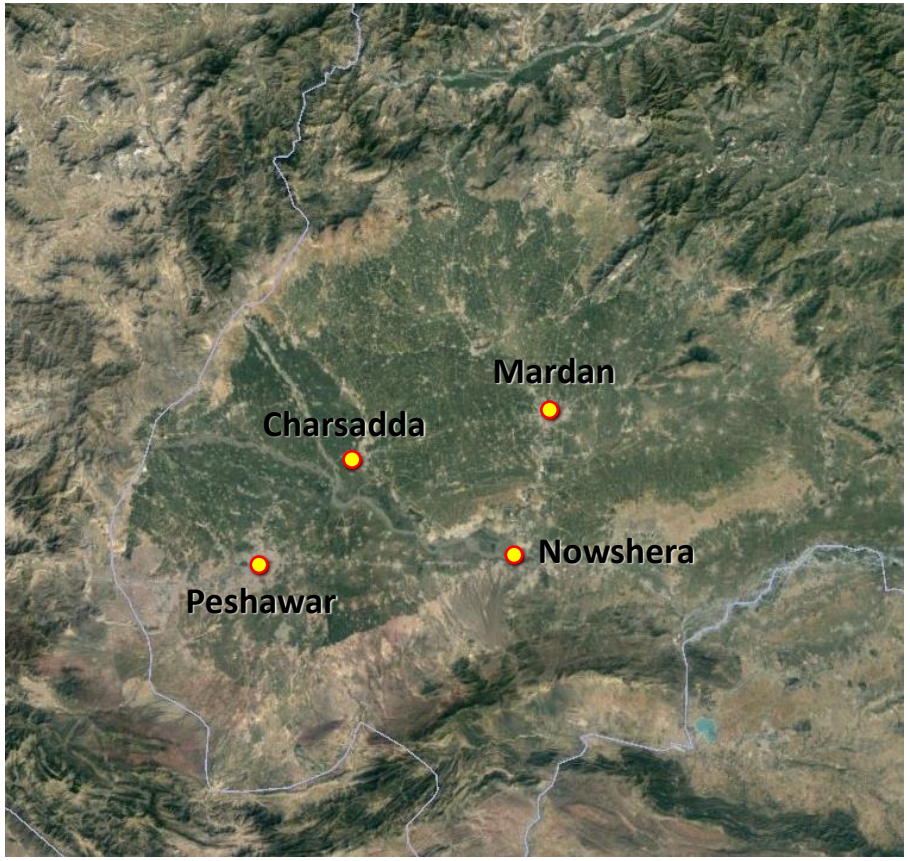
Integrated approaches to slope hazards

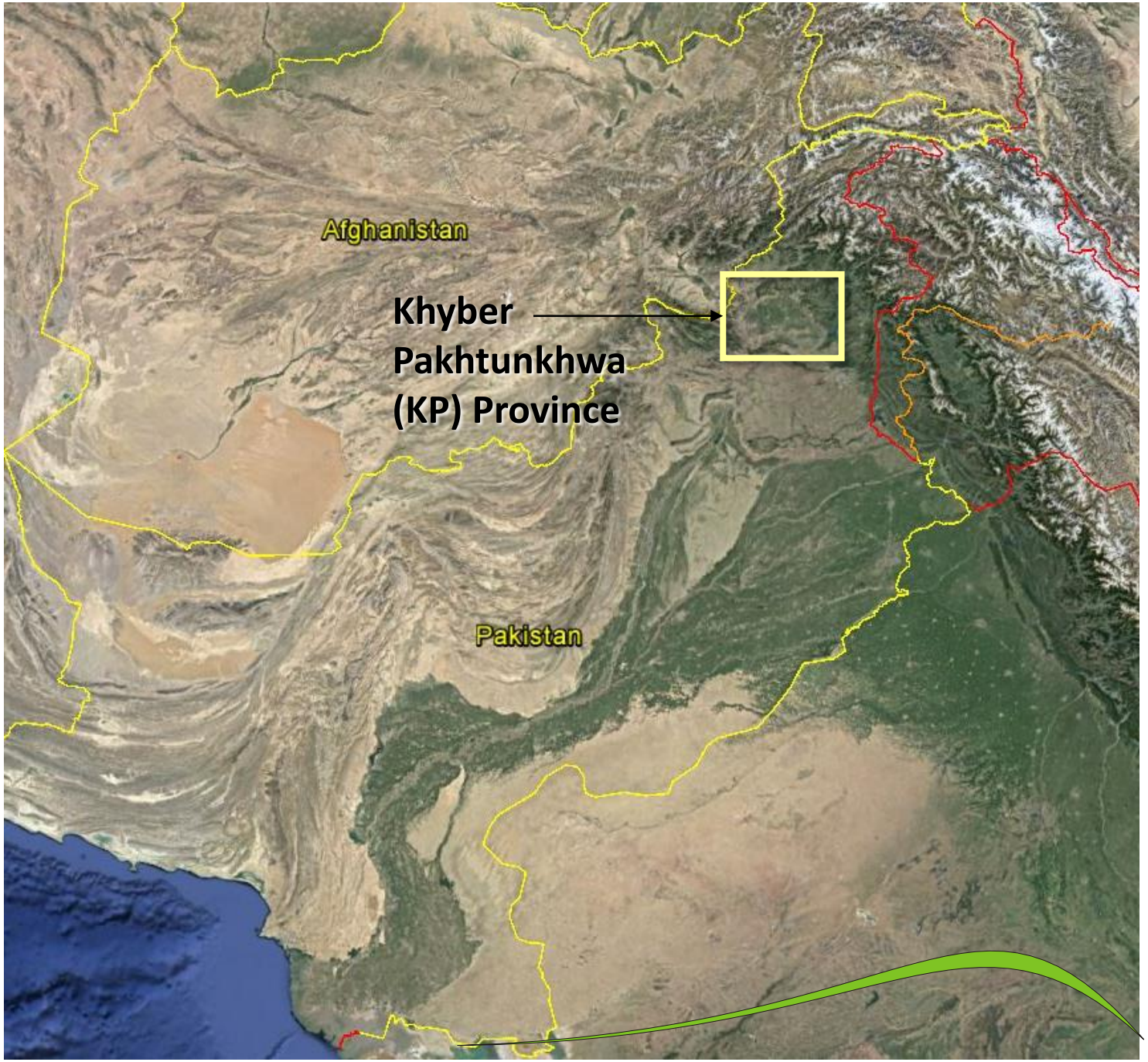
i) Big data and IOT supported disaster management system for disaster resilient city

Theoretical, high technology approach

a) Flood risk mitigation strategies at household level

Nasir Abbas Khan & Ashfaq Ahmad Shah

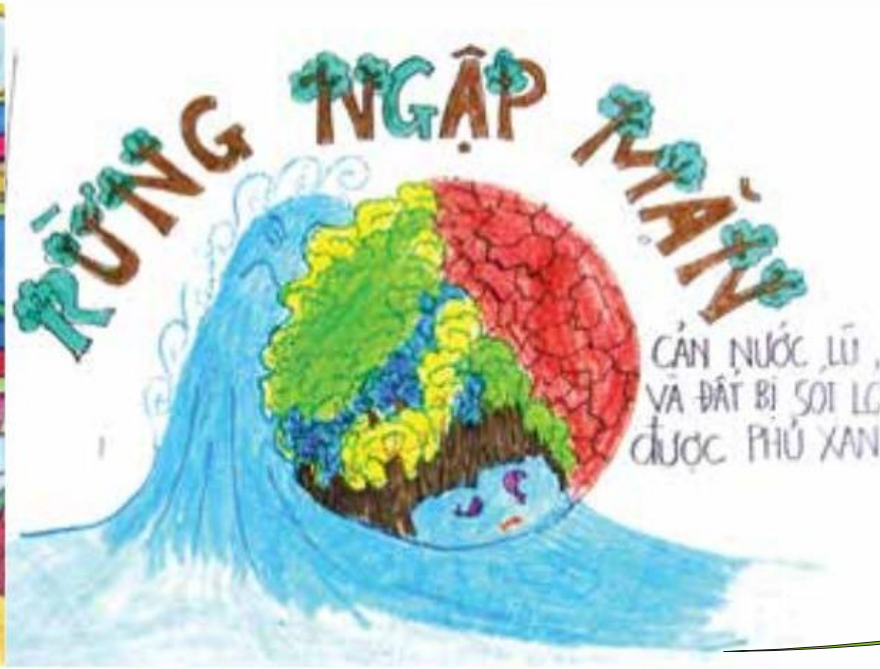


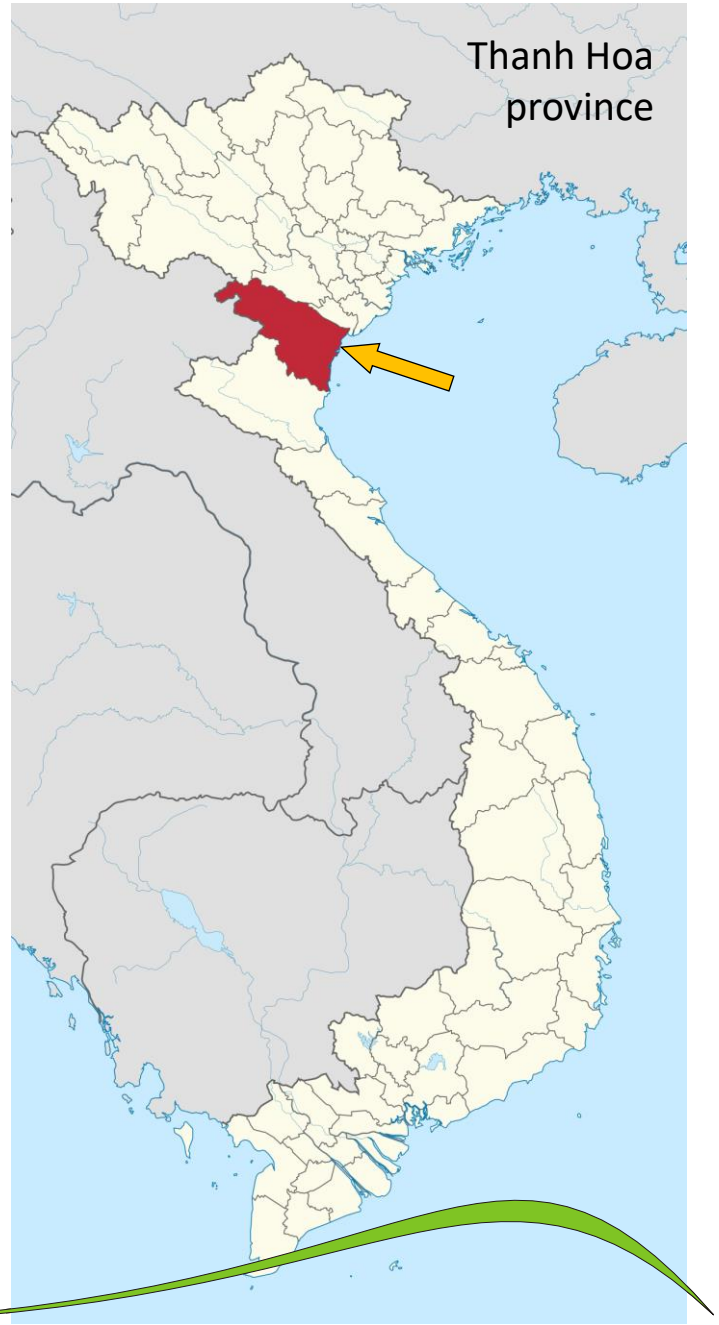


- Rural area affected by monsoonal flooding.
- 2010 flood affected millions of households.
- Early warnings ineffective due to lack of training, lack of infrastructure, outdated dissemination and inadequate resources.
- Simple local level mitigation solutions have helped to improve resilience.
  - **Elevated ground floors**
  - **Foundation strengthening**
  - **House construction with reinforced material**
  - **Food storage on 2nd floor**
- But more strategic and financial assistance is needed to utilise higher-tech solutions.

b) Building coastal community resilience

Nguyen The Manh





- Flooding of coastal communities from tidal waves and typhoons.
- Climate change increasing risks.
- Ecosystem-based Disaster Risk Reduction (DRR) – reducing coastal flood impacts by planting mangroves as a natural barrier.
- Project sought to restore and establish new institutions for community-based management of mangrove forests, building capacities for DRR, enhancing understanding and community involvement.

Da Loc, Thanh Hoa province

Building Coastal Resilience in Vietnam

An integrated, community-based approach to mangrove management, disaster risk reduction, and climate change adaptation.

Experiences from CARE in Da Loc and Nga Thuy Communes, Thanh Hoa Province, 2006-2014

care

c) Lessons learnt from field analysis of hazards

Nguyen The Manh

Kanchanaburi province

- Monsoonal flood risk, including overtopping of dams.
- Simple early warning systems based on traditional knowledge (e.g. behaviour of clouds).
- ‘Head of Village’ relied upon as source of authority.
- Maps of local vulnerability and risk prepared by local communities.
- Social networking in rural areas relies on electronic communication.

d) Vietnam's solutions to reduce the risk of flood

Nguyen Thi Tinh

- Frequent monsoonal flooding & landslides.
- High population density within low-lying, flood-prone coastal plains.
- More than 70% of population at risk.
- Losses caused by flooding have increased over the last 10 years.

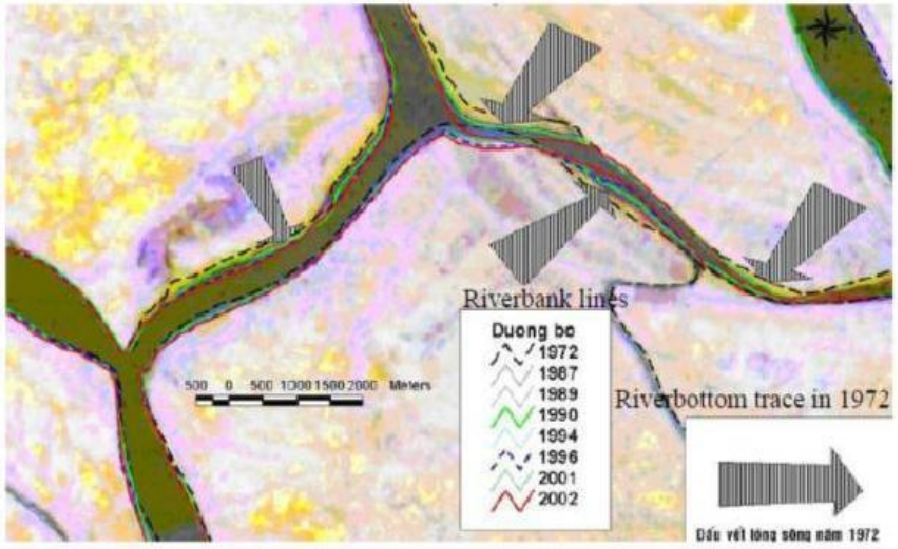
- Government-led disaster risk analysis, monitoring and education programme – encouraging people to join in disaster prevention strategies.
- Communication – emergency information broadcast to local communities.
- Improved emergency responses, involving military, local volunteers and civilians.
- Planning and building hydrological infrastructure.
- Protecting & planning forests to control flooding.
- Continuous improvement and increased capacity in flood forecasting, modelling, research & training.
- International Cooperation

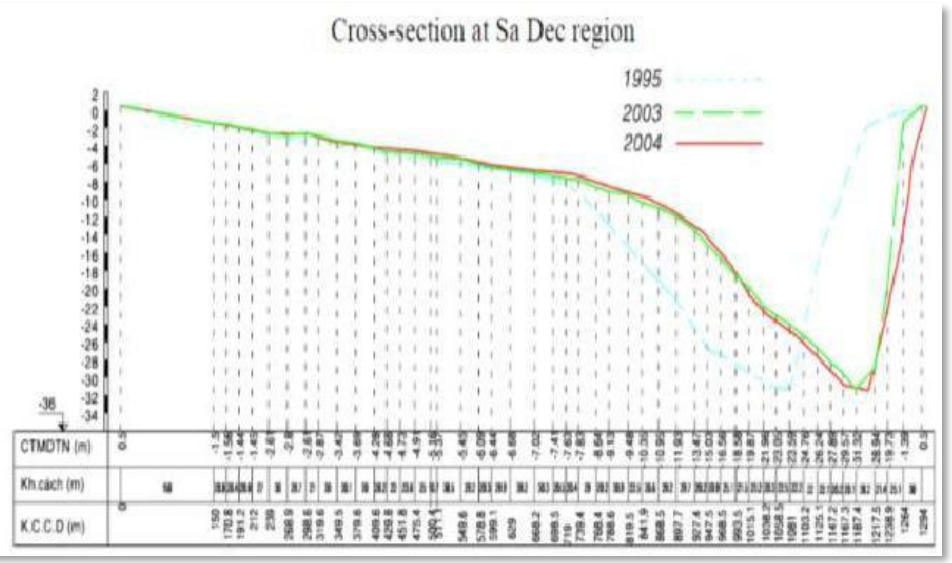
e) A Case Study of River Bank Erosion in Vietnam

Kim Seng

Lower Mekong Delta

- National Government - funded project to understand river behaviour – prompted by the high cost of preventing bank erosion, which had meant townships having to be relocated.
- 2D and 3D modelling of channel changes – compare well with empirical observations.

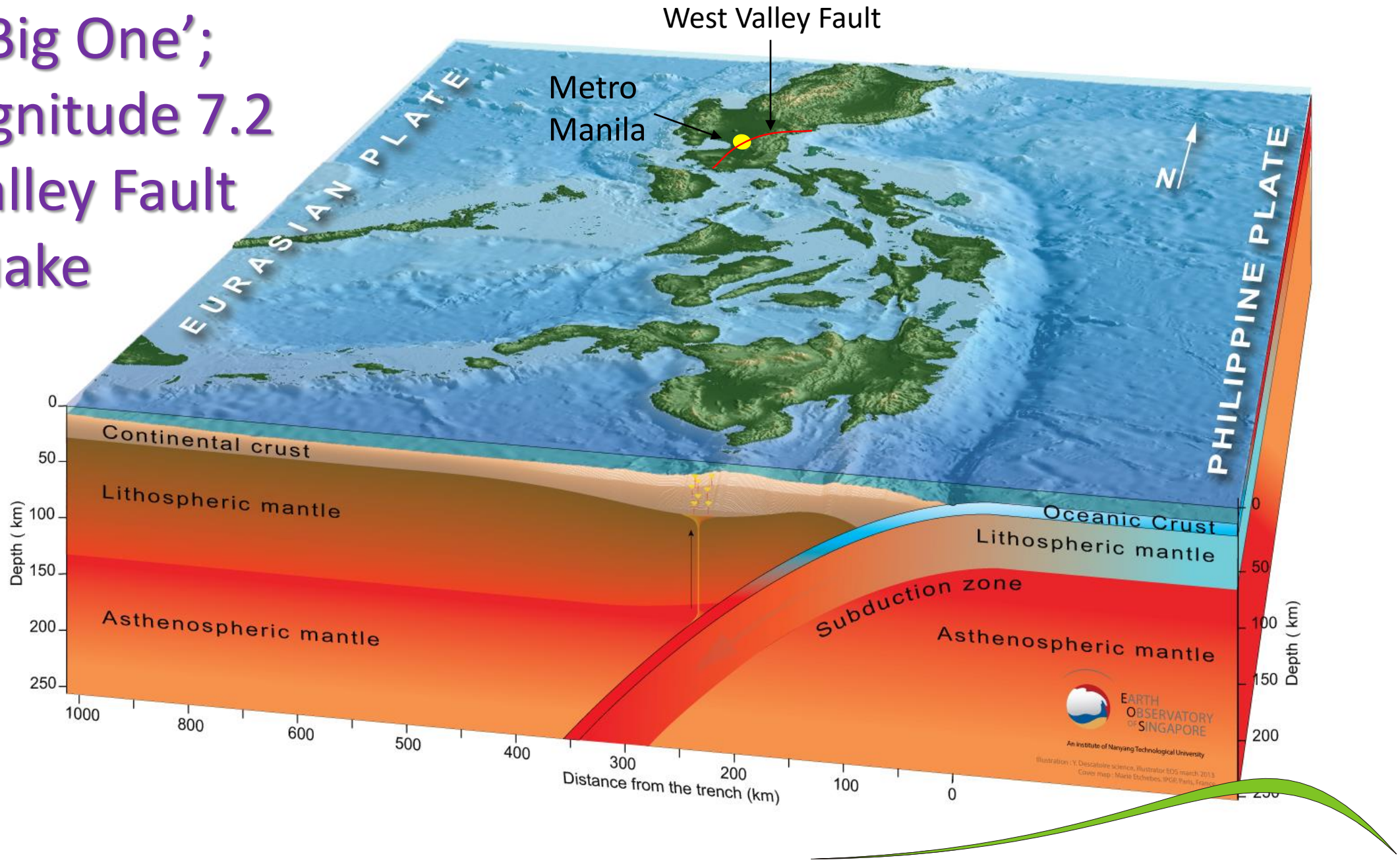




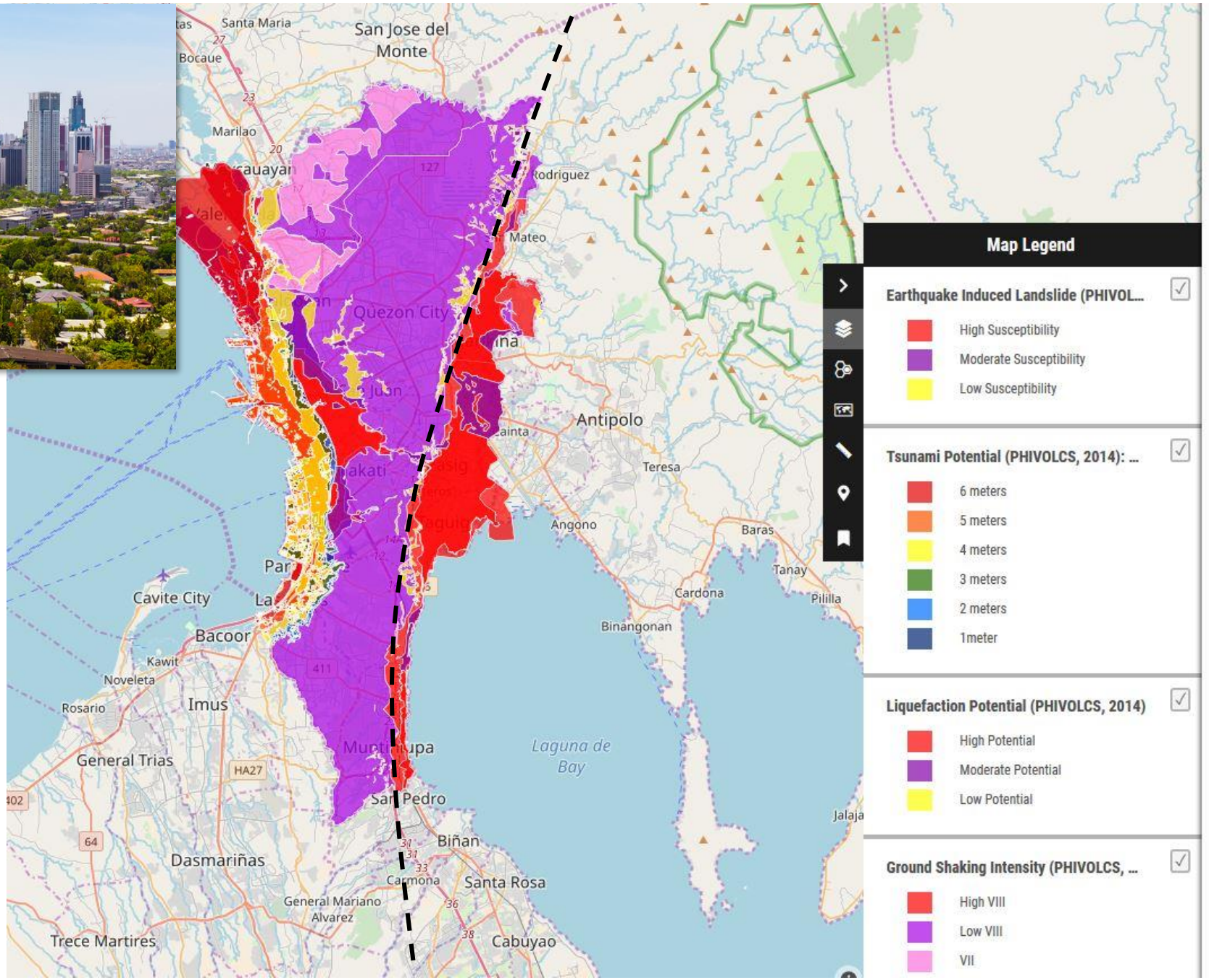
- Models enable the authority to make policy decisions, manage resources and restore the riverbed system in order to facilitate transportation.
- … *But the model has many limitations*

f) ‘The Big One’; the Magnitude 7.2 West Valley Fault Earthquake

Kristian Azul



- Major earthquake expected: recurrence interval is 400 to 600 years; last movement 360 years ago.
- Extensive modelling has been carried out to predict effects and to plan accordingly.



- Expected effects include:
  - **Ground shaking**
  - **Tsunami**
  - **Landslides**
  - **liquefaction**
- Expected consequences include:
  - **Destruction of buildings and structures**
  - **Breakout of fires**
  - **Human injuries and death**
  - **Breakage of communication lines and roads affecting inflow and outflow of help, relief goods, emergency services.**

- Resilience can be designed-in to minimise these effects
- **But how reliable is the model?** (no records of previous events)
- And **how best to communicate the risk?**

Duterte creates earthquake resiliency office for greater Metro Manila area

Dharel Placido, ABS-CBN News

Posted at May 10 2018 06:15 PM

Emergency workers hold an earthquake drill at Ortigas Center in Metro Manila, July 14, 2017. Mark Demayo,

Government Preparedness

- **Programme Management Office to deal with preparedness, mitigation, resilience.**
- **Civil Defence office to deal with regular earthquake drills and post-earthquake operations.**

Communication

"The minimisation of damage and casualties can only be achieved if the technology we use is appropriate, plans are well designed, and more importantly, the population knows what to do and cooperates."

Fake News ? ….

7.1 Magnitude Quake Expected To Hit Metro Manila

A 7.1 magnitude quake is expected to hit Metro Manila and nearby provinces covered by its 100-kilometer fault line, according to a social media page.

Recently, the Facebook page "President Rodrigo Duterte" has posted a warning of a possible major earthquake that could strike Metro Manila.

The major earthquake has a magnitude of 7.1, which could possibly kill over 30, 000 people and injured more than 100, 000 people, according to a study.

False online message said that 30,000 people would perish … it even gave false information about how the city had been divided into four zones to make way for a smooth rescue operation.

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Home Category / Metro / Public warned on false earthquake predictions

Public warned on false earthquake predictions

37 SHARES

Share it!

Updated January 27, 2018, 4:18 PM

By Dhel Nazario

The Metropolitan Manila Development Authority (MMDA) has appealed to the public to refrain from disseminating information through text messages and social media about earthquake predictions.

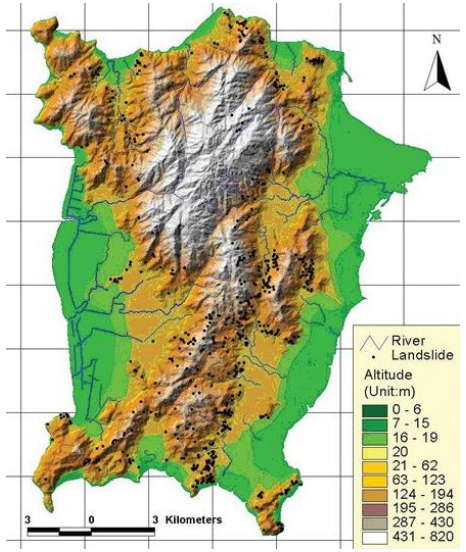
Government Response:

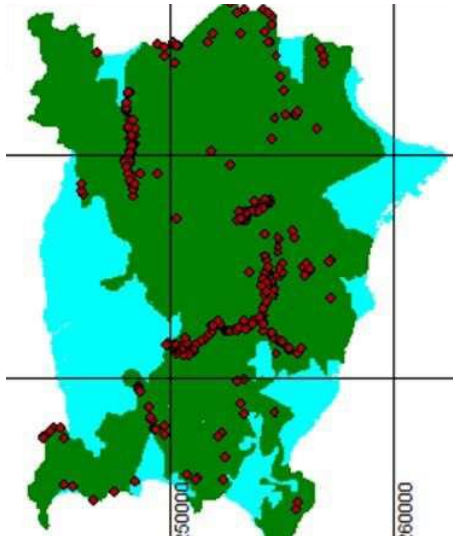
"Please refrain from sending out information about earthquake prediction via SMS and social media"

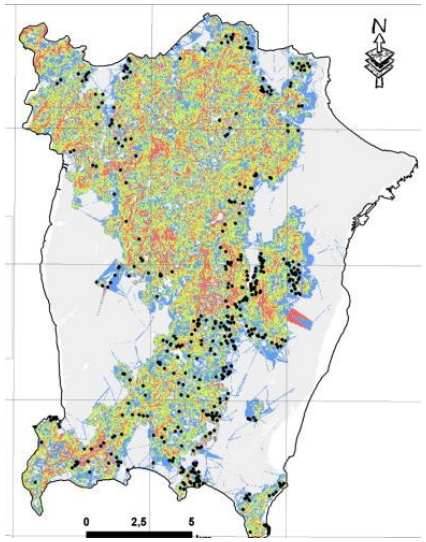
"Refer to information provided by the authorities on verified social media channels"

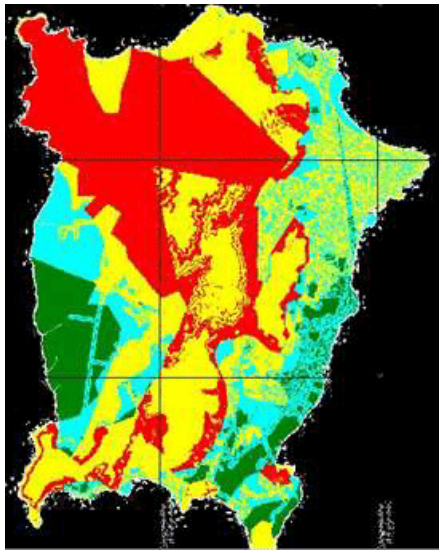
g) Spatial modelling of slope failure in Pulau Pinang, Malaysia

Nuriah Abd Majid









Risks increased by the expansion of urban development into areas susceptible to slope failure (hilly or highland terrain and deeply-weathered granitic rocks).

The *combined* actions of academics, engineers and planners are needed to find and implement solutions.

… communication!

The factors which trigger landslides include geology, rainfall, topography, slope angle, soil type, river activity, highway construction, excavation,

(… and quarry blasting?)

- Spatial modelling of slope failure is important in reducing disasters by guiding development away from high risk areas.
- This needs to be reflected in forward planning policies.
- Central and/or local Government has responsibilities to make this happen.

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OPINION

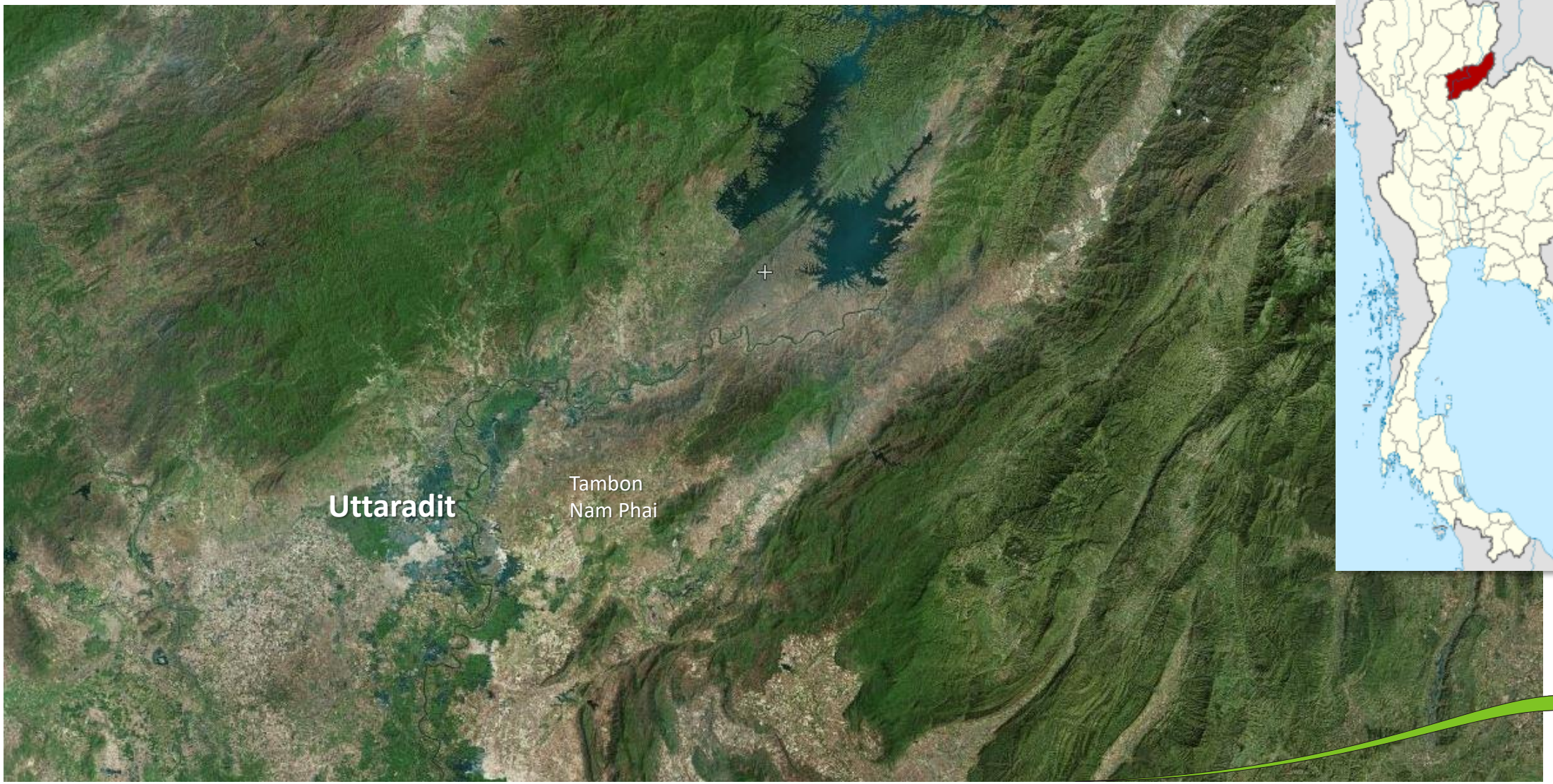
Is Penang govt responsible for the landslide?

By Contributor 136

Last Updated 24th October, 2017, 3:37 PM

h) Management of a landslide in Uttaradit Province, Thailand

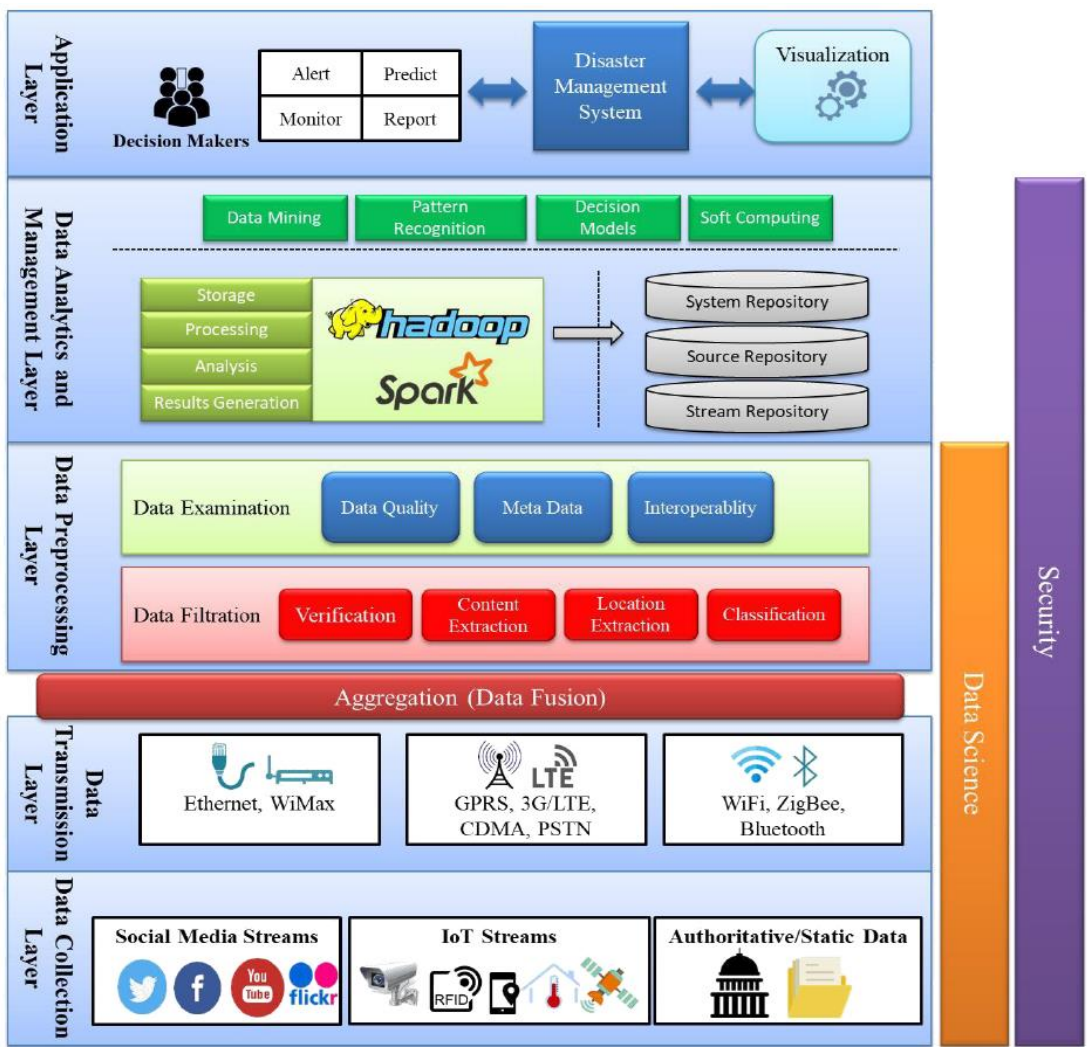
Sitthinon Kultaksayos

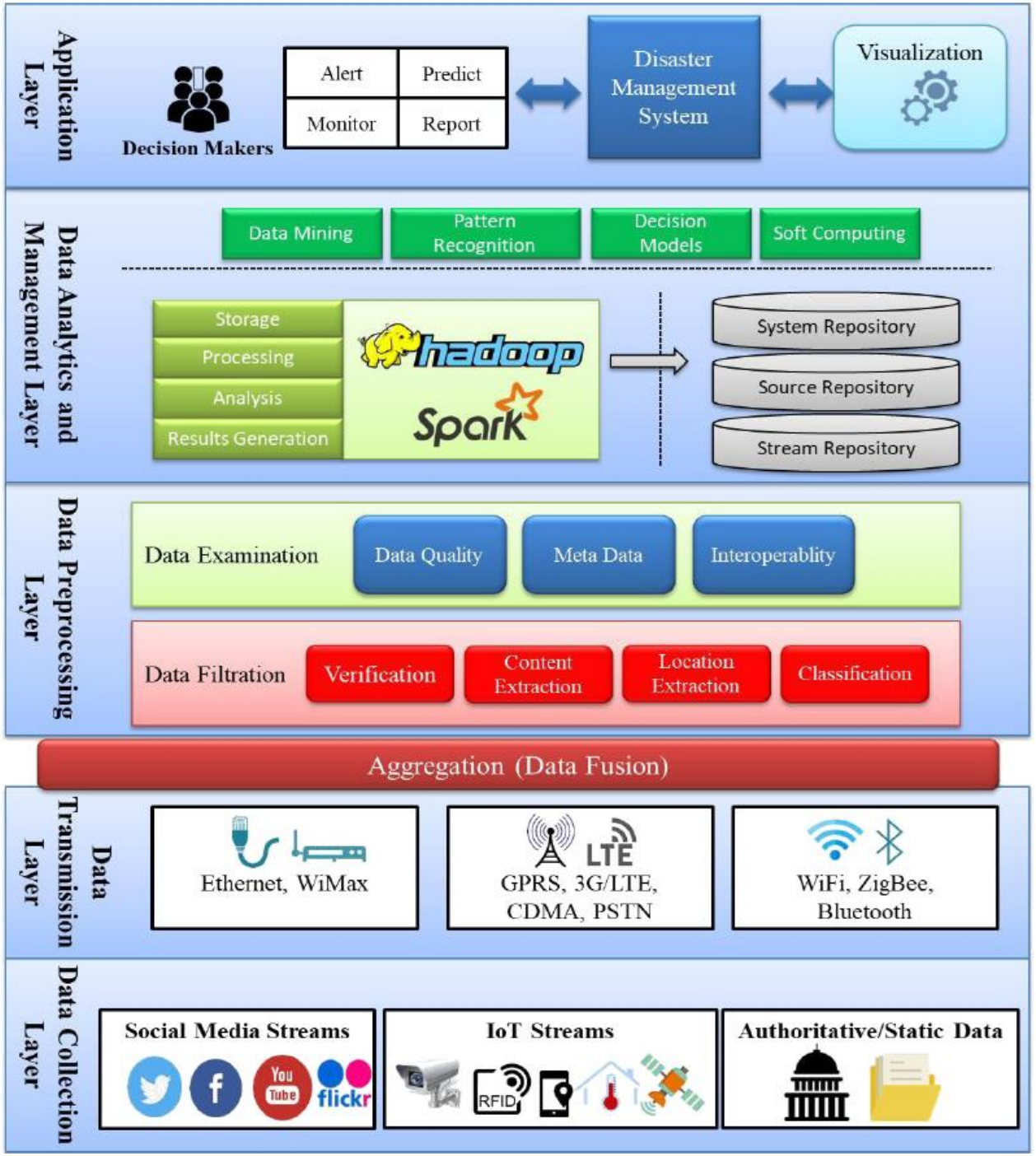


- Large historic landslide in 2011
  - **Whole villages and 109 houses destroyed;**
  - **6 people killed, one missing;**
  - **6,720 sq.km of farmland damaged**
- Causes of landslide
  - **Steep mountain slopes and steep braided streams;**
  - **Fault zone with many fractures and deep weathering;**
  - **Prolonged heavy rainfall triggering soil movement;**
  - **Encroachment of forestry onto unstable slopes.**
- Solutions
  - **Rainfall monitoring provides early warnings for evacuation**
  - **Planning controls and inter-departmental co-operation**
  - **Publicity to raise awareness and stricter control of illegal forestry recommended**

i) Big data and IOT-supported disaster management system for disaster resilient city

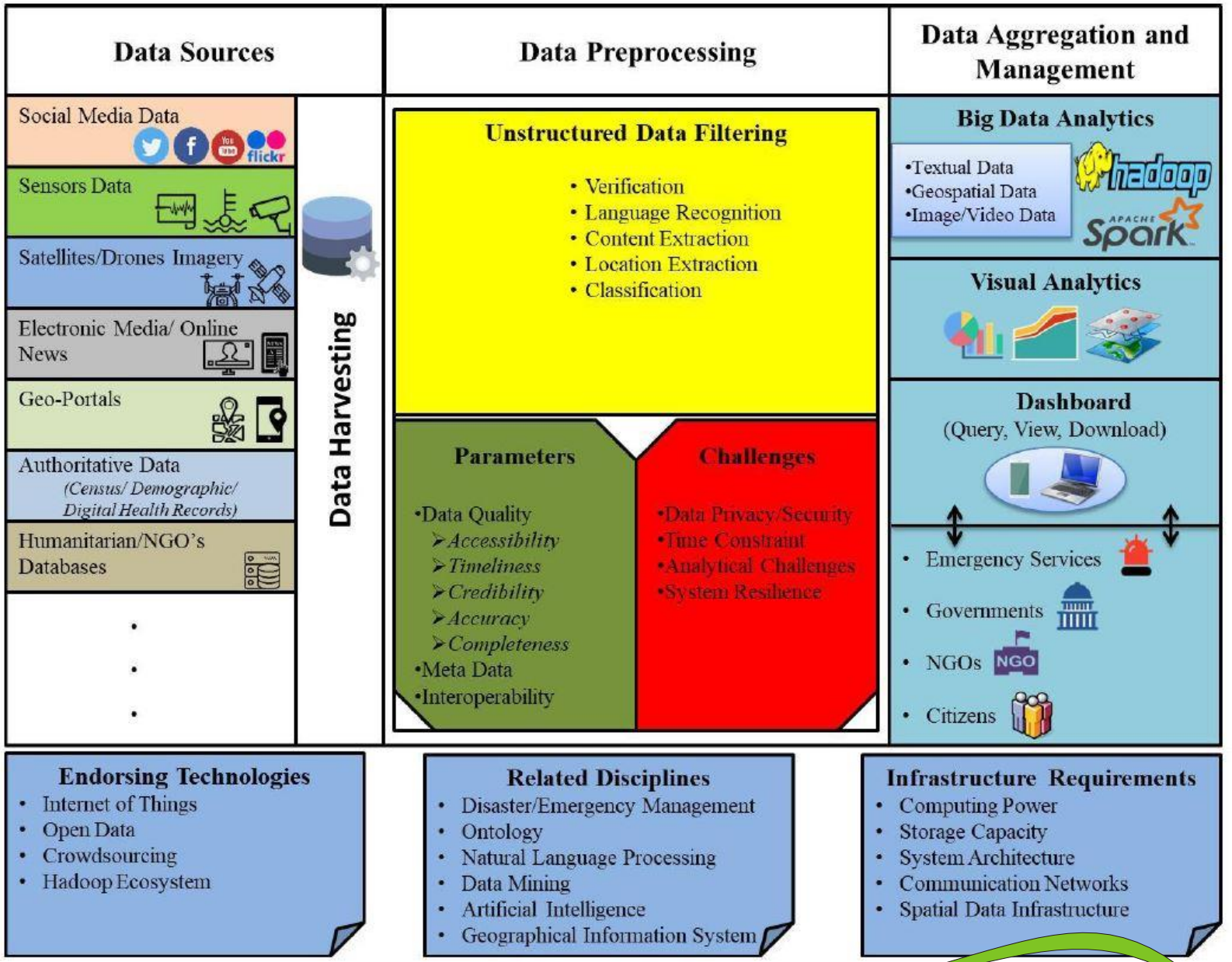
Syed Attique Shah





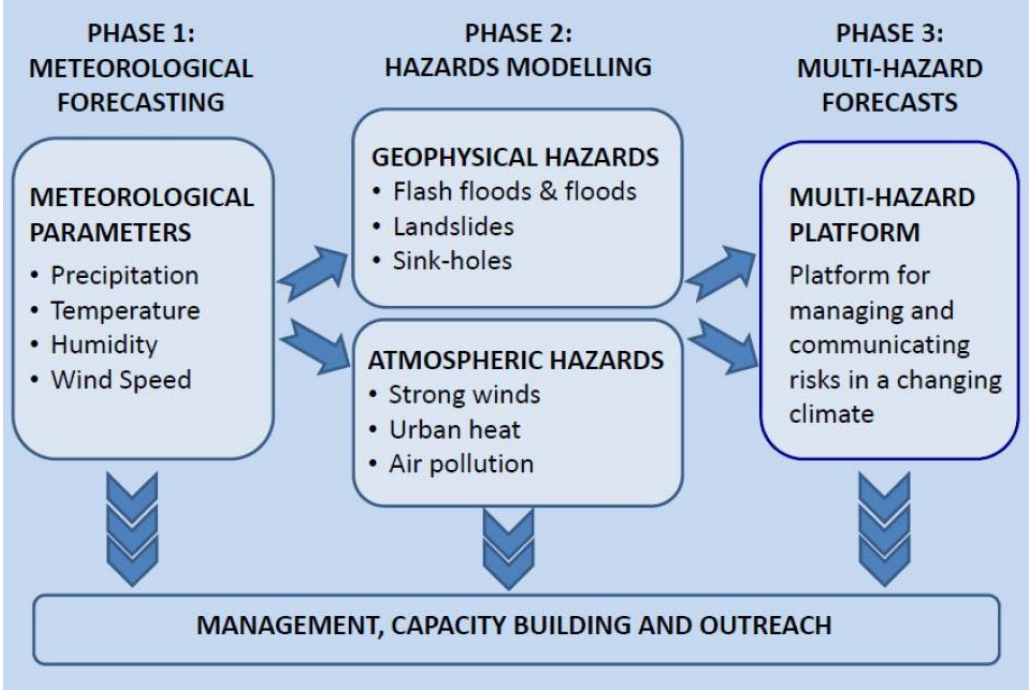
- Accurate and real-time decision-making in disaster management demands the utilisation and integration of multiple state-of-the-art technologies.
- **Big Data** processing enables useful insights to be extracted from huge sets of unstructured data.
- The **Internet of Things** (IoT) allows devices to communicate with each other, enabling the integration of heterogeneous sensors and smart devices.
- World growth in urban populations has stimulated a growing need for embedded systems to improve services and infrastructure … the '**smart city**' city concept.

- All of these developments have potential for utilisation in disaster management processes, from forecasting, early warning and hazard assessments to the coordination and management of response and recovery.
- Big data also enables new data sources to be utilised (social media, in-situ sensors, crowd-sourced online mapping).
- IoT provides a platform that integrates different types of data and processes them efficiently to allow new insights to be gained.



Developing these ideas further will require:

- Investigation of the research gap in big data system planning and design for DRR.
- Development of a framework for effective utilisation of the big data concept in understanding, predicting and coordinating response and recovery.
- Development of a framework for operational system design and multi-organizational planning and collaboration.
- Design of the functional architecture and philosophy of a Disaster Resilient Smart City (DRSC) through the integration of IoT and big data technologies.
- Establishing a sequential data filtration method to deal with the quality concerns associated with unstructured big data.



All of this has close parallels with the current NUOF project to create a multi-hazard platform for Kuala Lumpur

Key messages from the selected case studies

- **Disaster risk reduction (DRR) needs to be tackled at many different levels**, from simple low-cost methods of improving resilience to the use of sophisticated modelling to gain a better understanding and to predict outcomes.
- But **care is needed** to ensure that models are built on reliable data and are ‘reality-checked’.
- **All methods of DRR require effective communication**, at every level, but this needs to be properly controlled to ensure accuracy and confidence, and to avoid fake news.
- **Prevention is better than cure**: Detailed studies and planning controls can help to avoid the encroachment of development into hazardous areas.

Key elements of communicating risk:

- Understand the hazard(s).
- Be able to explain the hazards, and their development implications, in ‘Plain English’.
- Be able to explain the levels of confidence / uncertainty involved.
- Understand the target audiences and their specific needs for information (Planners, Developers, Insurers, Emergency Services, General Public, etc.).
- Decide how best to communicate with each group so that they can understand and act upon the key messages.
- Deliver that information