

Review and Future Direction of Research on Delta at Risk and Resilience to Water-Related Disasters

Alvin Yesaya & Prof. Akiyuki KAWASAKI
Civil Engineering, University of Tokyo, Japan



**THA
2019**

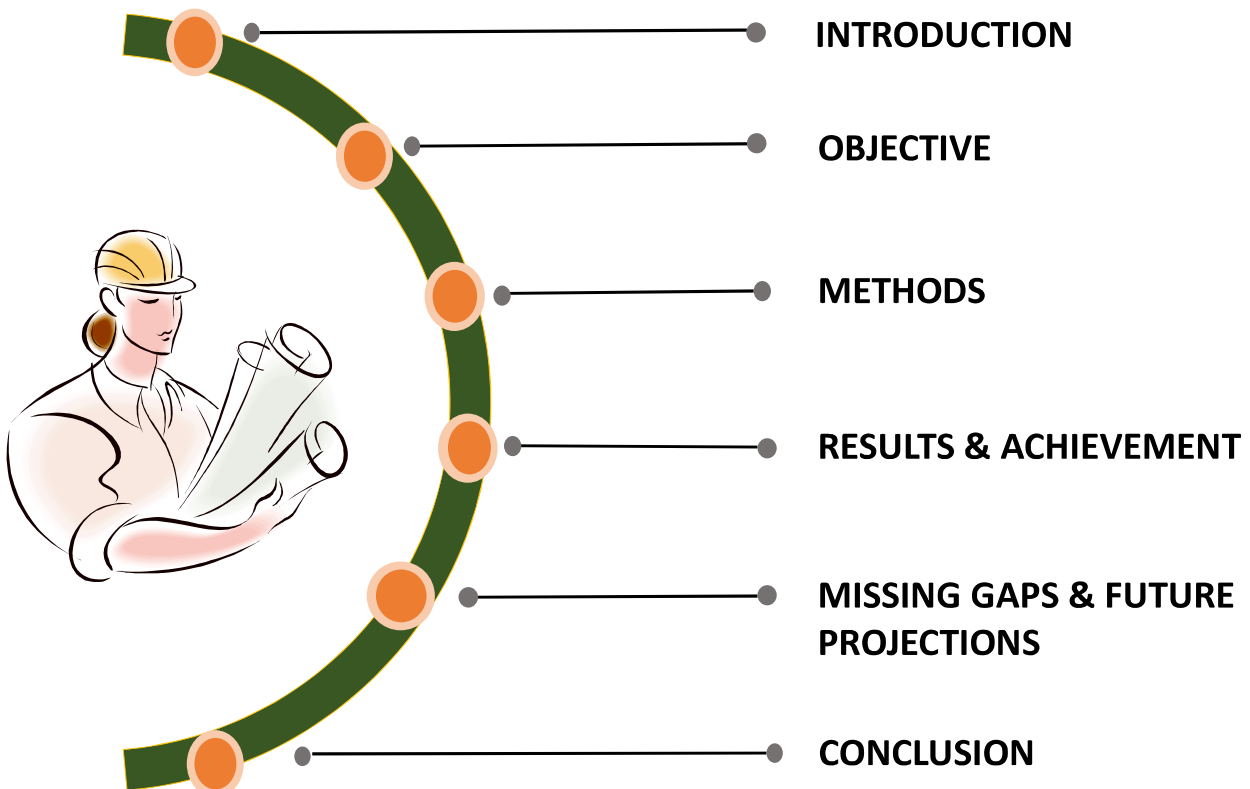
**International Conference on
Water Management and Climate Change towards Asia's
Water-Energy-Food Nexus and SDGs**
23-25 January 2019, Swissôtel Bangkok Ratchada, Thailand



OUTLINE

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INTRODUCTION

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2011, Great East Japan
Earthquake, Sendai



2004, Indian Ocean earthquake
and tsunami



Sendai Framework for Disaster Reduction
2015-2030

Hyogo Framework for Action
2005-2015

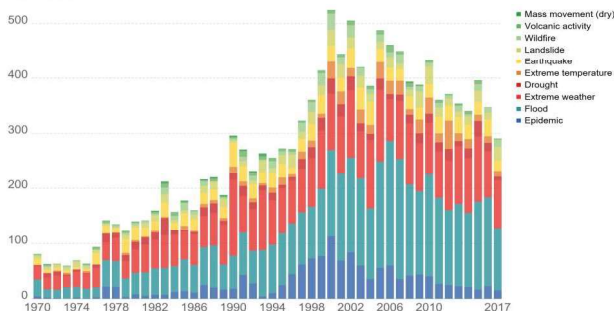
SDGs
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Sustainable Cities and Communities

Strengthening
Resilience

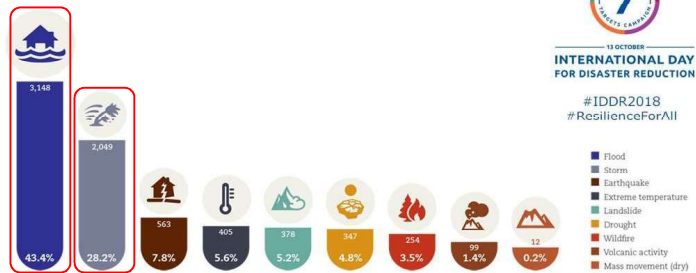
Global reported natural disasters by type

The annual reported number of natural disasters, categorised by type. This includes both weather and non-weather related disasters.



Source: EMDAT (2017); OFDA/CRED International Disaster Database, Université catholique de Louvain - Brussels - Belgium
OurWorldInData.org/natural-disasters - CC BY-SA

Numbers of disasters per type 1998-2017



Source: CRED, UNISDR, 2018



#IDDR2018
#ResilienceForAll

UN data (2016) at presents 50% people live in megacities and 2/3 are located in coastal zone.

Current information about delta at risks (International Geosphere-Biosphere programme.2014)

1% The amount of Earth's land area occupied by delta

24 The number of major deltas are sinking

the likely range of global average sea-level rise possible by 2100 if emissions continue unabated. Sea level will continue to rise beyond 2100

45-82cm

85% The percentage of major deltas that experienced severe flooding in the last decade

source : <https://www.unisdr.org/archive/61121> ; source : <http://www.iqbp.net/multimedia/multimedia/deltasatrisk.5.62dc35801456272b46d351.html>. images.google.com

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INTRODUCTION

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Vulnerability is defined as: "The conditions determined by physical, social, economic, and environmental factors or processes, which **increase the susceptibility** of a community to the impact of hazards".
UN/ISDR. Geneva 2004.

Resilience: "The **capacity** of a system, community or society potentially exposed to hazards to **adapt**, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures."
UN/ISDR. Geneva 2004

7 Global Targets:

1. Reduce Global Disaster Mortality
2. Reduce the number of affected people globally
3. Reduce disaster economic loss in term GDP
4. Reduce disaster damage to critical infrastructure, health and education
5. Increase the number of countries with national and local disaster risk reduction strategies
6. Enhance international cooperation to developing countries to support national actions of Sendai framework
7. Increase the availability and access to multi-hazard warning systems and disaster risk assessments

Strengthening
Resilience

SDGs

Sendai Framework for Disaster
Reduction 2015-2030

2015

2030

2007

Global Platform on
Disaster Reduction

Hyogo Framework for
Action 2005-2015

2005

1994

1999

2002

The Johannesburg
Plan of Action

First World Conference on Disaster Reduction
and the Yokohama Strategy for a Safer World

UNISDR was created

source : <https://www.unisdr.org>

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Delta at risk and resilience to water-related disasters

According to UN data (2016) at presents 50% people live in megacities and 2/3 are located in coastal zone. At least 80% of national population lives within 100 kilometers from the coastline (Martinez et al. 2007). UN predicts in 2030, inhabitant in urban cities will increase to 60%.

Current information about delta at risks (International Geosphere-Biosphere programme.2014)

1%	The amount of Earth's land area occupied by delta
24	The number of major deltas are sinking
45-82cm	the likely range of global average sea-level rise possible by 2100 if emissions continue unabated. Sea level will continue to rise beyond 2100
85%	The percentage of major deltas that experienced severe flooding in the last decade

Based on data above, delta cities are vulnerable, this study will summarizes holistically the current resilience systems against water-related disaster to identify which scope should be expand in the future

source : <http://www.igbp.net/multimedia/multimedia/deltasatrisk.5.62dc35801456272b46d351.html>

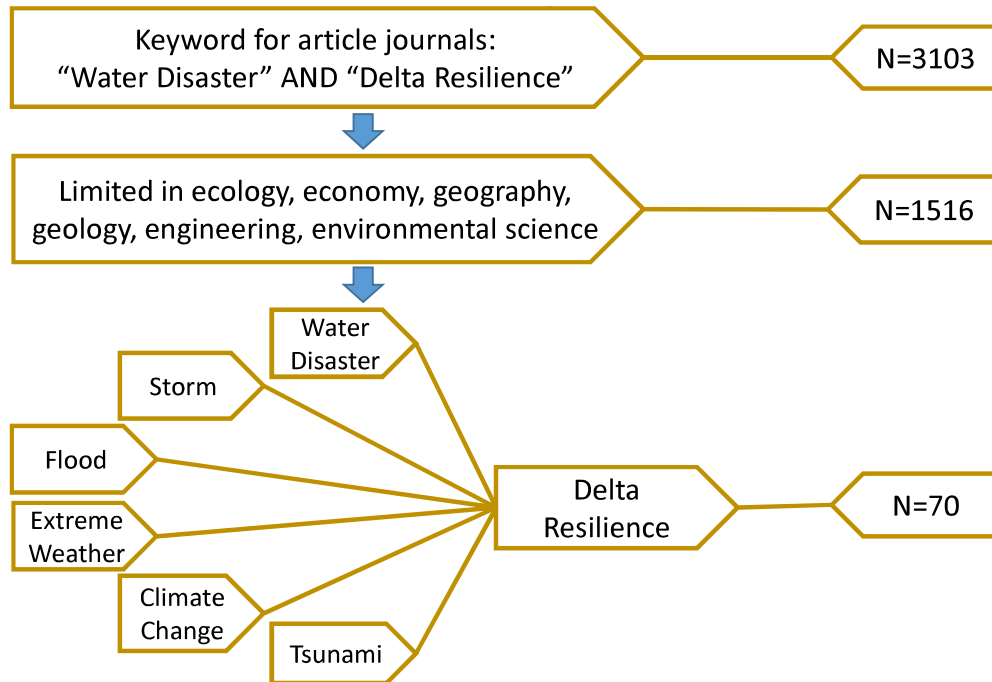
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1. Collecting **the number of studies** which related with resilience against water disaster among delta cities in the world
2. Explaining **current trend of methodologies**, approaches, and limitation of previous research related with resilience concept in cities towards water catastrophe
3. Finding **missing gaps and future path** of research of delta city towards resilience to water disaster



Scopus Database and Literature search for water related disaster within 20 years publishing



Additional article from company/NGO related with delta city and water disaster.

Journal paper	: 70
Company/NGO document	: 10
Book/Thesis	: 3
Total	: 82



Water related disaster that uses in this paper review are classified (Walter M. Grayman 2011):

1. **Flood** : coastal flood, riverine flooding, flash flood, dam failure
2. **Storm** : typhoon, hurricane, tropical cyclone, tornado, local storm
3. **Climate change** : Global sea water level, changing rainfall pattern
4. **Tsunami**

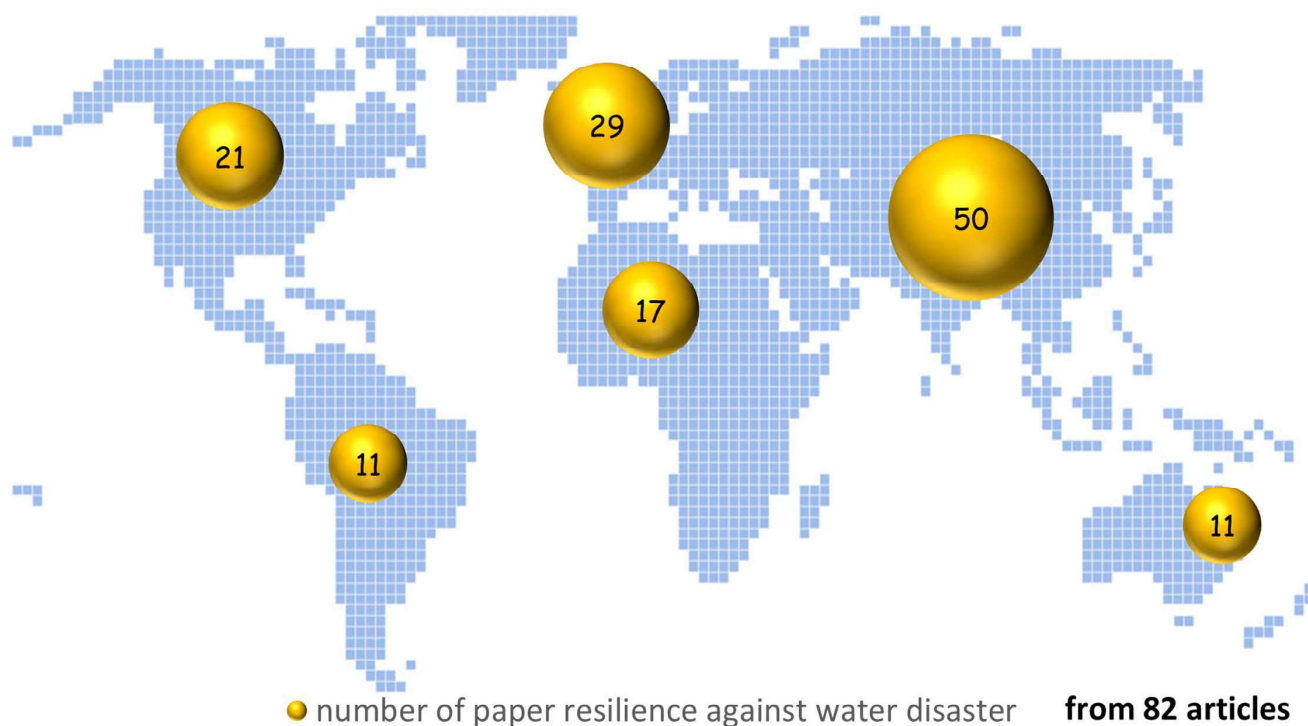
Resilience is the **endurance** of system to absorb the disruption and changes of circumstances or variable and **still persist** (Holling 1973).

Resilience of disaster that uses in this study are (Carl Folke 2006 & David Chandler 2014):

1. Engineering resilience
2. Social & Ecology resilience
3. Governance resilience



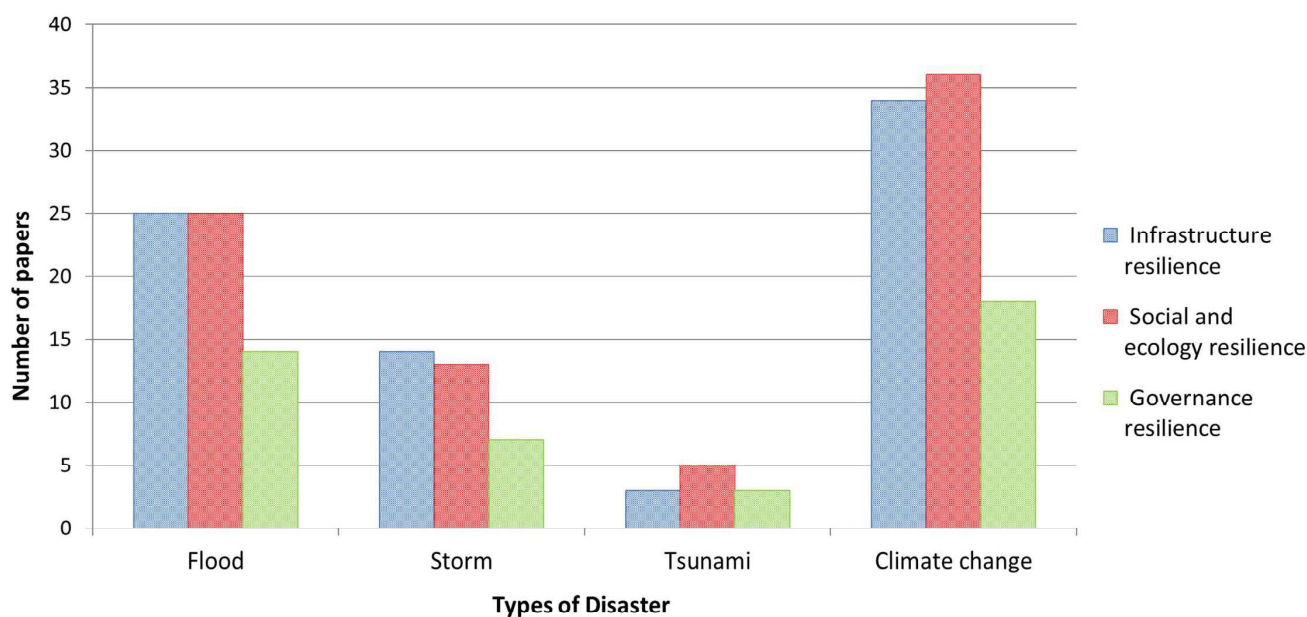
World map distribution of existing paper with kinds of water disasters and resilience



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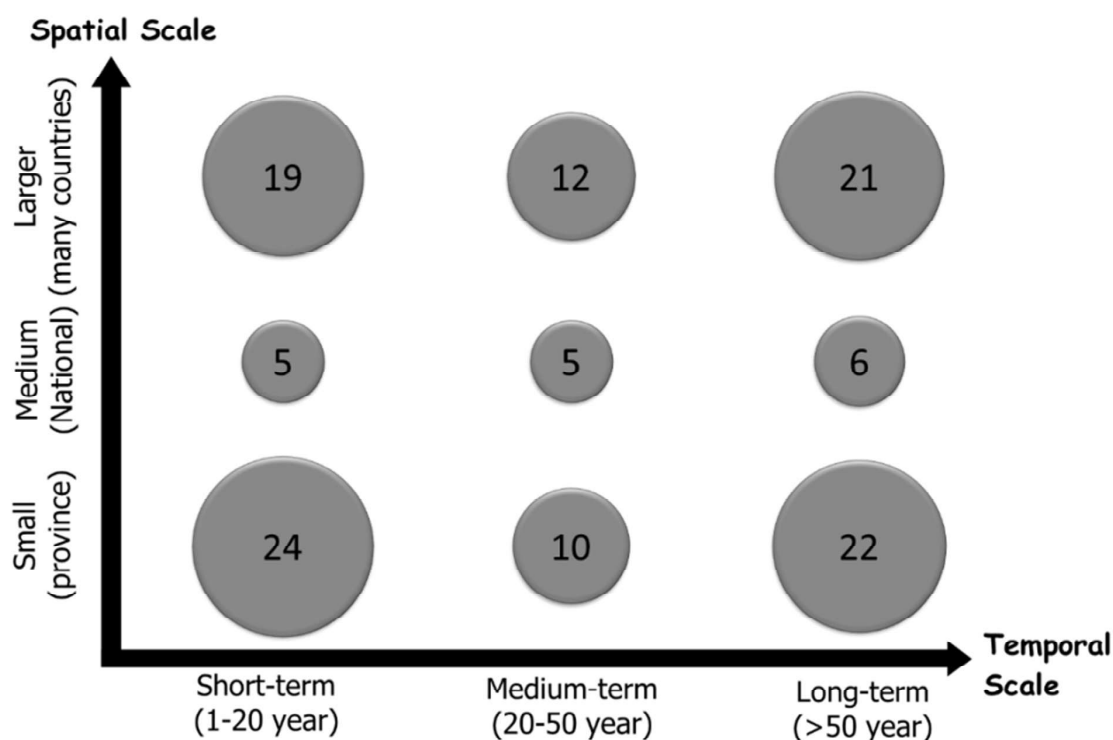
World map distribution of existing paper with kinds of water disasters and resilience



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The remaining methodology approach of study in spatial and period scale



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Author	Methods	Result/Conclusion	Spatial Scope			Type of Resilience		
			S	M	L	Infra	Social	Gov
Syvitski, 2009	Using High resolution Shuttle Radar Topography in delta related to mean sea level to see delta sinking and Moderate Resolution Imaging Spectroradiometer images to set the recent flooding from storm surge or river run-off	Most of the deltas are sinking faster than global sea level rising and below sea level, so during the storm surge it will be easy to inundated.			✓	✓		
Jeuken, 2015	Comparing 4 deltas (Dutch Delta Program, Thames estuary 2100, PlaNYC2013, Jakarta Coastal Defence) with approaching of adaptation planning framework and find the most adequate actions	Adaptations planning in deltas should prepare for future scenarios of climate, subsidence, socioeconomic with a robust and flexible actions			✓	✓	✓	✓
Nguyen KV, 2013	Qualitative and quantitative approaches to conceptualize household resilience to floods in Mekong delta, Vietnam by forum group discussions, questionnaire, and interview.	characteristics of household resilience are capable of self-organizations (supply food during flood season), cope the disturbance in terms housing sector, doing creative things (create jobs for local labor in flood seasons)	✓				✓	
Verschuur, J., Kolen, B., & van Veelen, P. C., 2017	Doing flood risk assessment combining from economic risk (GDP) and fatal risk (population) based on inundation simulation of global hydrological model (PCR-GLOBWB) with climate change projections in 2030 RCP8.5 (worst scenario)	38 deltas cities has been assessed with measuring flood index every city and Risk in million Euro annually. The highest rank of total list in 2015 is Buenos Aires, Argentina and in 2030 is Tianjin, China. The lowest ranks in 2015 and 2030 is Port Elizabeth, South Africa		✓	✓		✓	

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Recent Achievement

The advancement of technology in **Geographic information system** (GIS) of satellite images is enhancing the global scope of study, for example the subsidence (Syvitski, Nature 2009) and increasing sea level because of climate change.

The calculation of sea level and rainfall prediction for 100 years mainly based on the RCPs graph from **IPCC fifth Assessment Report (AR5) in 2014**.

Nowadays researcher has tendency to combine **infrastructure resilience and anthropogenic** for estimating the susceptibility of delta city. Many researcher realized that involving human activities and community resilience has big impact to against disaster and not only in traditional way (build of structure).

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MISSING GAPS

- Lack of research in **Oceania**. Oceania will experience serious impact of raising sea water level because of the climate change
- Few of papers assess **national scale** and in the medium term (20-50 years)
- Research locations **concentrate in 1 country**. For example in Asia and Europe mostly are taken in Bangladesh/Vietnam and Netherland respectively, almost more than 10 paper.
- Total of big delta based on the Department of Geology & Geophysics at Louisiana State University data is 75 places. The research currently only **covers around 70%** from total.
- The amount of paper about **tsunami resilience assessment is very slight** and only based on historical data

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1. Integrating with **policy sector** to reassess the delta vulnerability index
2. Creating research about **tsunami prediction** in world wide scope and profiling the risk assessment in delta city. Even there is no technology for earthquake (generate tsunami) prediction yet, the impact might devastate the delta city
3. Evaluating socio-economy impact does not only based on GDP but also in **psychology and level of awareness** of citizen toward the disaster as additional parameter
4. Integrate **Representative Concentration Pathway (RCP) socioeconomic pathways (SSP) , share climate policy assumption (SPA)** might complete all aspects of science, socio-economic, and policy to stipulate the resilience actions against water-related disasters.

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- Continuing research development in water disaster in delta city is really important due to urbanization and climate change effect
- Researcher should combining social and science effect for assessing the vulnerability score of city in delta
- Predicting and preparing tsunami resilience are strongly encourage for researcher in this field
- Shifting to do the research in Oceania rather than focus in Asia. Africa also needs development of study
- Creating global parameter for delta city and renewing the climate change scenario (IPCC)

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THANK YOU

