10 May 2006
Caen, France

7th International Conference on
The Environmental Management of Enclosed Coastal Seas

Asia-Pacific Coasts Session

Quality Status of the Asia-Pacific Coasts

Conference Report

Asia-Pacific Network for
Global Change Research

International EMECS Center

— Table of contents —

Preface

At EMECS 5 in Kobe, 2001, and at EMECS 6, in Bangkok, in 2003, the Asia-Pacific Network for Global Change Research (APN) and the International EMECS center jointly organized an Asia-Pacific Session to discuss the importance and diversity of coastal zone management in the Asia-Pacific region. Since EMECS 5, the APN has been working to publish a book cased on over 20 APN-funded activities on coastal zones and inland waters in the region, with research gaps and future directions identified for coastal environments. At the same time, the EMECS Center has been gathering information on the state of the environment and social conditions, in the region, and will soon publish a book containing the outcome of the research. At EMECS 7, the APN and EMECS wanted to provide researchers, decision-makers, and educators, from the Asia-Pacific region, an opportunity to be introduced to the two books, respectively.

The Asia-Pacific Coasts Session on 10 May, 2006, In Caen, France, concluded successfully with discussions on coastal vulnerability and risk management concerning storms surges and tsunami, in addition to the introduction of the APN and EMECS books. The Off-Sumatra Tsunami was featured from various aspects including recovery practices and lessons learned and the session ended with a Panel Discussion including the eight presenters. The Asia-Pacific Coasts Session provided participants with a better understanding of enclosed seas and coastal zone management between the Asia-Pacific region and other parts of the world.

On behalf of the Asia-Pacific Network for Global Change Research (APN) and the International EMECS Center, we would like to thank everyone who participated in the Session, and to those who contributed to the realization of the two books. Also, our thanks and appreciation goes out to Prof. Harvey and Prof. Yanagi, author and editor of the APN book and the EMECS book, respectively. We would also like to thank Prof. Mimura, the Co-chair of the APN Scientific Planning Group, who was one of the authors of the APN book, as well as editor of the EMECS book, and LOICZ (Land-Ocean Interactions in the Coastal Zone Project) of IGBP, for their research and as the major institution contributed to the APN projects. Lastly but not least, let us express our greatest appreciation to the Hyogo Prefectural Government for funding the Asia-Pacific Coasts Session, as well as for their continued support to the APN and the International EMECS Center.

Hiroki Hashizume
Director
APN Secretariat

Kunikatsu Nakajima
Executive Director
International EMECS Center

Welcome Address

Toshizo Ido

Governor of Hyogo Prefectural Government
Chair, Board of Directors, International EMECS Center

Good morning ladies and gentlemen, participants and panelists. As Chair of the Board of Directors of the International EMECS Center, I would like to thank you very much for attending the Asia-Pacific Coasts Session and extend a warm welcome to all of you.

Environmental protection of enclosed waters and coastal zones is a major issue, not only for Japan, but also for many countries in the Asia-Pacific region. For this reason, the International EMECS Center has been working to promote international exchange of environmental protection of enclosed seas and the Asia-Pacific Network for Global Change Research (APN) has been promoting research on coastal zone management as one of its scientific themes.

In January 1995, the Great Hanshin Earthquake hit south Hyogo, killing more than six thousand people and exactly ten years after that tragedy, another calamity occurred. On 26 December, two hundred and twenty thousand precious lives were lost in the Off-Sumatra Tsunami. Also, as we saw from the devastation of Hurricane Katrina, impacts from severe tropical cyclones, possibly influenced by global climate change, are becoming increasingly more frequent. We need to be prepared against the threat of strong sea surges and sea-level rise to our coastal zones because further economic development is anticipated owing to expansion of mega cities and the rapid increase of population.

In parallel with this, destruction of the nature by economic activities is still going on. For example, tropical forests are being transformed into farmland. Nature destroyed by man becomes a huge threat against man in turn. It is recognized that deterioration of the mountains and poor forest management are among the causes for the disasters by the Typhoon No. 23 in 2004. I believe that all human intelligence must be put together to tackle the regeneration of nature.

Coastal zones in the Asia-Pacific region are facing many problems; therefore Integrated Coastal Zone Management (ICM) is becoming a major factor of crisis management and emergency preparedness against natural disasters. There seems to be great interest in the Off-Sumatra Tsunami therefore this special session shows you the extent of the damage caused by the Tsunami, together with lessons learned from the recovery efforts as well as some activities of the EMECS Center and the APN on coastal zone management . I hope the outcome of this session provides suggestions on how we should continue with crisis management and environmental protection to enable sustainable development in the coastal zones.

This Asia-Pacific Session provides a great opportunity to focus on the theme of EMECS 7, which is “Sustainable Co-development of Enclosed Coastal Seas: Our Shared Responsibilities and to share information with our European, African and American colleagues, as well as those colleagues from countries in the Asia-Pacific region. I encourage your active contribution to the discussions. Thank you very much.

Introduction

Tsunami

Background - Asia-Pacific Coasts Session: Quality Status of the Asia-Pacific Coasts

The Earthquake off Sumatra caused a Tsunami, resulting in tremendous damage on the Asia-Pacific coastal zones. What is more, concerns have increased for the exacerbated impacts of strong tropical cyclones caused by climate change, associated storm surges and coastal flooding, after the unprecedented damage caused by Hurricane Katrina. These dramatic events indicate coastal vulnerability, both for present day hazards and for future climate change and sea-level rise. The impacts of such hazards are a serious threat to the Asia-Pacific coastal zones, due to high population growth, the number of megacities, and the economic activities expected in this century. For these reasons, management of future risks are an essential part of the Integrated Coastal Management (ICM). Integrated Coastal Management is parallel with environmental management, which are the main theme of the two books; State of Environment of the A-P Coastal Zones and Issues and future Directions of Research and ICM.

Co-achievement of risk management and environmental protection is a major issue for the sustainability of the coastal zones. During the Asia-Pacific Session, various aspects of the Off -Sumatra Tsunami will be introduced. Paying attention to the physical and social impacts and the lessons learned, we will discuss the state of the environment, the vulnerability and safety of society, and future directions of ICM, focusing on the Asia-Pacific region. These issues will be addressed by presenting overviews of the two books, reporting on tsunami and cyclone damage, including environmental damages, and discussing the lessons learned by recovery practices from their damage. The future direction of ICM will also be discussed.

The Asia-Pacific Network for Global Change Research (APN) and the International EMECS Center have jointly organised special forums and sessions at previous EMECS conferences to promote such activities. As an outcome of such efforts, the APN is about to publish its first book, “Global Change Impacts on Coastal Zone Management in the Asia-Pacific Region”, a comprehensive scientific manuscript dealingwith global change impacts on coastal zone management in the region. The book is subtitled “New Directions from the *Asia-Pacific Network for Global Change Research*” and is a follow-up to APN’s Coastal Zone Synthesis Report that was published in April 2005. The International EMECS Center has also prepared “The Synthetic Environmental Assessment on the Asia Coast,” an environment white paper proposed at the Asia Forum of EMECS in Kobe, Japan. At EMECS 7, the authors involved in the APN and EMECS research activities will present their recent synthesis outputs as a follow-up to their joint efforts.

Outline of the Session

The Asia-Pacific Network for Global Change Research (APN) and EMECS International Center jointly convened the Asia-Pacific Coasts Session at the 7th International Conference on the Environmental Coastal Seas Conference, on 10 May in Caen, France. The theme of the special session was *tsunami* and *coastal vulnerability*. Mr. Ido, Governor of the Hyogo Prefecture, Japan gave a welcome address, reporting on the need for environmental protection of enclosed waters and coastal zones. The Governor also touched on recent tragedies and the need for Integrated Coastal Zone Management (ICM) for crisis management and emergency preparedness. Mr. Hashizume, Director of the APN Secretariat, gave the opening remarks and introduced the programme for the session.

Professors Nick Harvey and Tetsuo Yanagi introduced the APN and EMECS books, giving highlights from various chapters. Several presenters then gave talks on the physical and socio-economic aspects of tsunami and storm surges. Professor Kojima, Japan, reported on *Coastal Vulnerability and Risk Management in the Asia-Pacific,* with a focus on storm surges. Prof. Kojima suggested that soft defense counter-measures such as hazard maps, evacuation and warning systems, and education are just as important as hard defense measures, such as seawalls, levees, etc. for storm surge vulnerability. Dr. Punya Charusiri, Thailand, presented on the *Morphology of Andaman Coastal Region, Southern Peninsular Thailand: Before and after 26 December 2004 Tsunami* and reported that changes of coastal morphology after tsunami are due to natural phenomena, as well as and human activity. He suggested the need for regular monitoring to see how quickly coastal equilibrium is re-established.

Dr. Darusman Rusin, Indonesia, gave a talk on Life after the *Tsunami for the People of Aceh: Social Aspects* highlighting recovery programmes mechanisms and the need for interdisciplinary approaches. Prof. Bandara, Sri Lanka, presented on the *Policy of Future Warning Systems* and the need for adequate disaster response mechanisms. In Sri Lanka, the Government established the Ministry of Disaster Management in Nov. 2005, which includes disaster warning, disaster management, and disaster risk management. Prof. Poh Poh Wong, Singapore, presented on *Post-Tsunami Directions for ICM* and how the Off-Sumatra tsunami changed the paradigm of ICM and various adaptation measures are needed. He reported that tsunami has an indirect relationship to global change. There is a need to adapt to global change over the next 100 years, but the impact from just one tsunami can be great; this provides lessons about vulnerability and the capacity to adapt. Prof. Wong described the need to look at both biophysical and socio-economic responses; one way is to adopt the Millennium Ecosystem Assessment's Mosaic Scenario. Prof. Piamsak Menasveta, Thailand, gave a talk on *Recovery Practices and Lessons Learnt.* He suggested that education is essential; the lack of knowledge contributed largely to the damage from the tsunami. The need for timely and appropriate warning systems was also highlighted.

Programme

Asia-Pasific Coasts Session (10 May 2006)

9:00-9:05 **Welcome Address**
Mr. Toshizo Ido
Governor of Hyogo Prefectural Government and Chair, Board of Directors, International EMECS Center

9:05-9:10 **Opening Remarks**
Mr. Hiroki Hashizume, Director, APN Secretariat

9:10-9:35 **Introduction of APN Book: Focus on the Future Direction of Coastal Research and Management**
Prof. Nick Harvey

9:35-10:00 **Introduction of EMECS Book: Focus on the State of the Environment and Social Conditions of the Asia-Pacific Region**
Prof. Tetsuo Yanagi

10:00-10:15 **Report of Coastal Vulnerability and Risk Management in the Asia-Pacific Region**
Prof. Haruyuki Kojima

10:15-10:30 **Break**

10:30-11:30 **Reports of the Off-Sumatra Tsunami**

Dr. Punya Charusiri
Bangkok, Thailand
"Morphology of Andaman Coastal Region, Southern Peninsular Thailand: Before and After 26 December 2004 Tsunami"

Dr. Darusman Bin Muhamad Rusin
Banda Aceh, Indonesia
"Life after the Tsunami for the People of Aceh: Social Aspects"

Prof. JMSJ Bandara
Moratuwa, Sri Lanka
"Policy of Future Warning Systems"

Prof. Poh Poh Wong
Singapore
"Post-Tsunami Directions for ICM"

11:30-11:45 **Report of Recovery Practices and Lessons Learnt**:
Prof. Piamsak Menasveta

11:45-12:30 **Panel Discussion**
Chair: *Prof. Nick Harvey*
Rapportuer: *Prof. Tetsuo Yanagi*

Protect Life & Ecosystems

About the Speakers (In order of appearance)

Prof. Nick Harvey (nicholas.harvey@adelaide.edu.au)

Nick Harvey is the scientific leader for the APN Global Change Coastal Zone Management Synthesis Project for the Asia-Pacific region. Nick is currently Chair of the international START-Oceania committee and was previously Vice-Chair of the International Scientific Steering Committee for LOICZ (Land-Ocean Interactions in the Coastal Zone) from 1997-2002. He has written over 100 scientific papers and books, including many on coastal science and management. He was recently appointed as one of a number of lead authors for the next IPCC (Intergovernmental Panel on Climate Change) assessment of the global impacts of climate change. Prof. Harvey is currently a Professor at the University of Adelaide, in South Australia, where he has held a number of senior positions including Director of the Graduate Centre for Environmental Studies; Head of Geography and Environmental Studies; Associate Dean (Research) and Executive Dean of the Faculty of Humanities and Social Sciences. He previously held a scientificposition in the South Australian Government in environmental impact assessment and was a member of the South Australian Coast Protection Board for seven years.

Prof. Tetsuo Yanagi (tyanagi@riam.kyushu-u.ac.jp)

Tetsuo Yanagi, D.Sci. (Kyoto), is a Professor of Coastal Oceanography at the Research Institute for Applied Mechanics, Kyushu University, Japan. He received his master and doctorate of science degrees from Kyoto University in 1974 and 1978, respectively. Prior to his current post, Dr. Yanagi served as a Professor at the Department of Civil and Ocean Engineering, Ehime University, Japan, until 1998. He also sat as a SAP member of IGBP/START/SARCS from 1993 to 1997, and as an SSC member of IGBP/LOICZ from 1993 to 1998. He has received distinction for his research works from the Japan-France Oceanographic Society in 1986 and the Ehime Prefectural Government in 1989. Among his recent book publications are “Introduction to Oceanography” (Koseisha-Koseikaku, 1988) and “Coastal Oceanography” (Kluwer, 1999).

Prof. Haruyuki Kojima (kojima@kyukyo-u.ac.jp)

Haruyuki Kojima, D.Eng. (Kyushu), is a Professor at the Department of Civil Engineering, Faculty of Engineering, Kyushu Kyoritsu University, Japan. He received his engineering degree from the Department of Coastal and Oceanographic Engineering, University of Florida, USA, and his doctorate from the Department of Civil Engineering Hydraulics, Kyushu University, Japan. Dr. Kojima’s research interests include coastal zone management, beach erosion protection and wave-structure interactions.

Dr. Punya Charusiri (punya@chula.ac.th)

Punya Charusiri, Ph.D. (Queen’s), is an Associate Professor and Head of the Research Unit for Earthquake and Tectonic Geology, Department of Geology, Faculty of Science, Chulalongkorn University, Thailand. He is an Economic Geologist and an Environmental Geoscientist whose field of research includes the (1) geology of Southeast Asia (e.g. tectonics and mineral deposits), (2) igneous petrogenesis of SE Asia, (3) remote sensing application and (4) paleo-earthquake of SE Asia. He received an award for his research works from the Geological Society of Thailand in 1983 and the Ratchadapisake Somphot Award from Chulalongkorn University in 1997.

Dr. Darusman Bin Muhamad Rusin (darus_01@yahoo.com)

Darusman Bin Muhamad Rusin, Ph.D. (Kansas State), is a lecturer and researcher on soil and water conservation at Syiah Kuala University, Darussalam, Banda Aceh, Indonesia. He is currently the Vice-Director for Academic and Student Affairs at Syiah Kuala University and Technical Advisor of the Aceh Development Board (BAPPEDA). He obtained his master and PhD degrees from Kansas State University, USA, in 1992 and 1994, respectively. His main areas of research deal with natural resources conservation and water use efficiency. As part of his community service, Dr. Muhamad Rusin has also served as consultant for the UNDP and FAO offices stationed in Indonesia for humanitarian assistance. He is a member of the Soil Science Society, Indonesia Soil Science, Soil Water Conservation and Agrometereology Society, Indonesian chapter.

Prof. JMSJ Bandara (bandara@civil.mrtac.lk)

Saman Bandara, Ph.D. (Calgary), is a Professor of Civil Engineering and Head of the Department of Transport and Logistics Management at the University of Moratuwa, Sri Sri Lanka and was past President of the Engineering Section of the Sri Lanka Association for the Advancement of Science. Dr.Bandara is actively involved in research and consultancy activities in the areas of Airport Planning, Traffic Engineering, Highway Construction, Disaster Management, Road Safety, Public Transport, Environmental Assessment and Operations Research, both at national and international levels. He has written over 50 national and international research publications in the above areas and has a joint patent for UniRoad Traffic Signal System to his credit.

Dr. Poh Poh Wong (geowpp@nus.edu.sg)

Poh Poh Wong, Ph.D. (McGill), is an Associate Professor at the Department of Geography, National University of Singapore. He is a Coastal Geomorphologist with wide experience on the coasts of Southeast, South and East Asia, especially of small islands. He also completed professional courses on tourism, ecotourism, and coastal zone management. Dr. Wong has published widely on geomorphological, tourism and management aspects of coasts and islands and has been strongly associated with several international science programmes and processes, including the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports and the Millennium Ecosystem Assessment (MEA). Since the beginning of 2005, he has focused mainly on tsunami impacts on coasts, their implications and rehabilitation in the post-tsunami phase. He has conducted field work in Southern Thailand, Aceh, Tamil Nadu and Sri Lanka, thus gaining an invaluable integrative overview to many issues. Apart from recent commentaries in the Coastal Society Bulletin and Singapore Journal of Tropical Geography, he has made presentations on tsunami impacts related to coastal rehabilitation, coastal management, tourism development, etc.

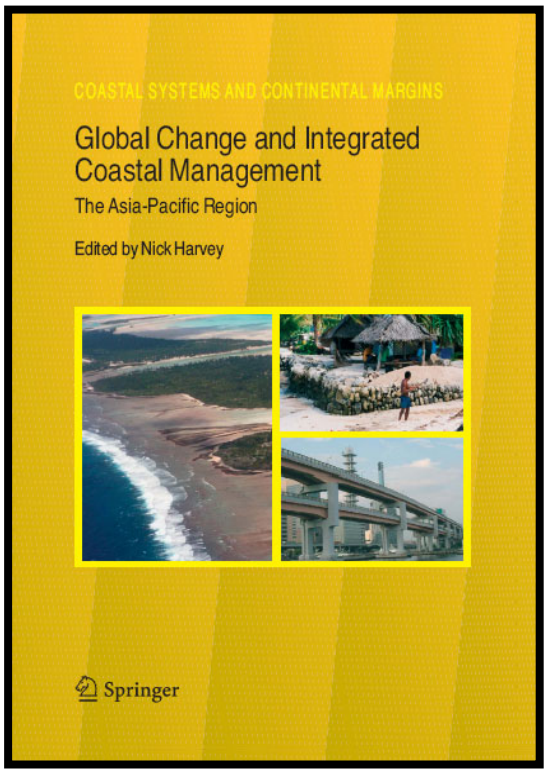
Prof. Piamsak Menasveta (mpiamsak@sc.chula.ac.jp)

Prof. Piamsak Menasveta is a Professor at the Marine Science Department, Faculty of Science, Chulalongkorn University, Thailand. He has taught, researched and published extensively in the areas of aquaculture, marine biotechnology, coral reef biology and heavy metal contamination in marine environment. He has received distinctions for his outstanding academic and research activities and was awarded the Knight Grand Cross (First Class) of the Most Noble Order of the Crown of Thailand and the Knight Grand Cordon (Special class) of the Most Exalted Order of the White Elephant.

Focus on the Future Direction of Coastal Research and Management

Nick Harvey
The University of Adelaide, Australia

Global change is predicted to have a significant impact on coastal environments of the Asia-Pacific region. The region is significant because phenomena such as the Asian Monsoon and the El Niño—Southern Oscillation (ENSO) phenomena, affect the world climate; it has diverse marine and terrestrial ecosystems, including the world largest areas of coral reefs and mangroves; it has almost two-thirds of the world's total human population; and its economic growth rate is the highest of any region in the world. The paper identifies important global change issues which will be relevant for the future management of coastal environments in the Asia-Pacific region. The most important of these is global warming and accelerated sea-level rise. The potential impacts from this are compounded by current issues such as unsustainable use of coastal resources; coastal impacts from poor catchment management; population increase and urbanisation pressure; coastal resource and development pressure on rural coasts. The paper addresses methods for tackling these issues in the context of the internationally accepted approach of Integrated Coastal Management (ICM) and the need to recognize the diversity of coastal management practices in the Asia-Pacific region. The paper also provides an overview of a new book dealing with global change issues and ICM in the Asia-Paciifc region. The book, to be published by Springer in mid-2006, is written by international coastal experts who have identified key directions for future global change research that will be of relevance for coastal management in the Asia-Pacific region.



EMECS 7 - ECSA 40 Conference
Caen, France, 9-12 April 2006

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Professor Nick Harvey
University of Adelaide, Australia

1

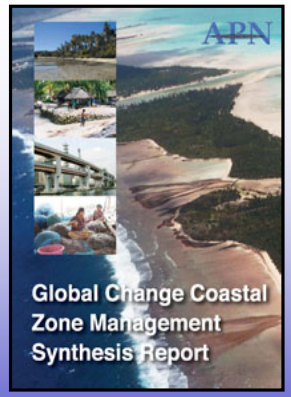
Coastal synthesis - Aims

- Evaluate achievements of APN coastal projects
- Review current coastal issues and research
- Identify future research direction for the region
- Report results to the APN to assist future policy

2

Output 1

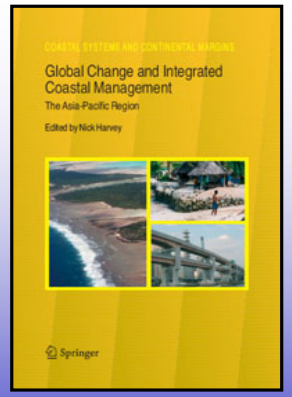
- 40 page monograph
- Published by APN
- Written for non-scientists
- Released APN 10th IGM, Kobe, Japan
- Publication date April 2005



3

Output 2

- 350 page book
- Published by Springer
- Written for scientists
- Preview copy EMECS 7, Caen, France
- Publication date June/July 2006



4

Global Change and Integrated Coastal Management: The Asia-Pacific Region

book chapters

		authors (23 from 12 countries)
1.	Introduction	*Harvey & Mimura*
2.	State of the environment	*Mimura*
3.	Coastal management	*Harvey & Hilton*
4.	Catchment-coast interactions	*Gao*
5.	Coastal evolution	*Nunn & Kumar*
6.	Humans and coastal change	*Nunn, Keally, King, Wijaya & Cruz*
7.	Hotspots of urbanization	*Wong, Boon-Thong & Leung*
8.	Pressures on rural coasts	*Talaue-McManus*
9.	Impacts of pollutants	*Koshy, Adeel, Lal & Mataki*
10.	Megadeltas	*Woodroffe, Nicholls, Saito, Chen & Goodbred*
11.	Future research directions	*Harvey & Mimura*

5

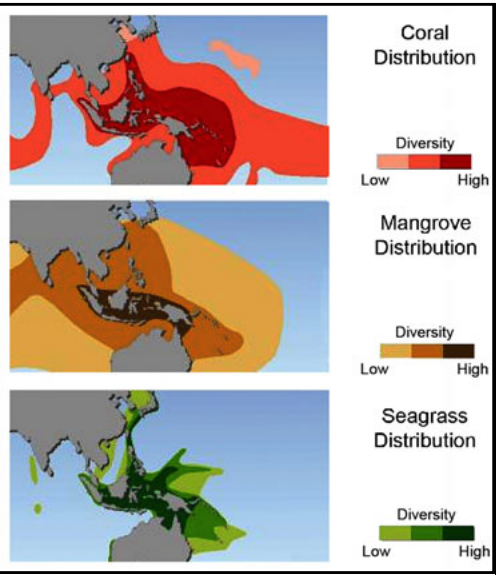
Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 1 - outline

- Introduction
- Importance of the region
- APN and its synthesis
- Scope of the book
  - Defining the region
  - Defining the coast
- Structure of book

6

Distribution and diversity of coral, mangrove and seagrass



Harvey & Mimura, 2006 Fig 1.1

7

Coastal resources and sustainability

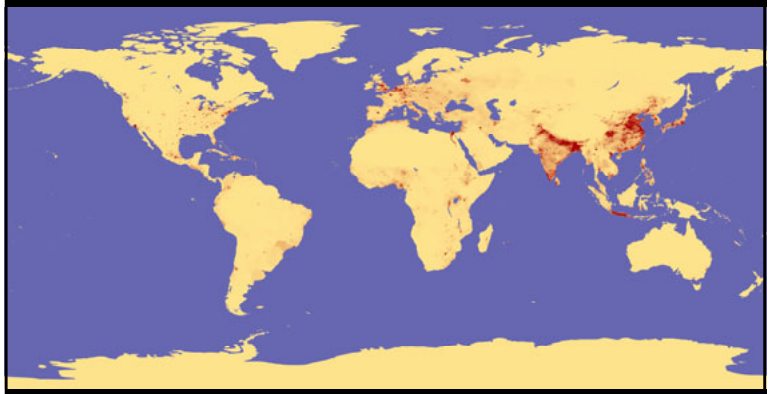
- Importance of coral reefs, mangroves and seagrass meadows
- Growing demand for goods and services
- Degradation of coastal ecosystems impacts greater on rural population
- Threats to regional food security

Photo Nick Harvey

Photo Nick Harvey

8

Population pressure in the Asia-Pacific Region in a global context



Harvey, Rice and Stevenson, 2005 Fig 8

9

Asia-Pacific coastal countries

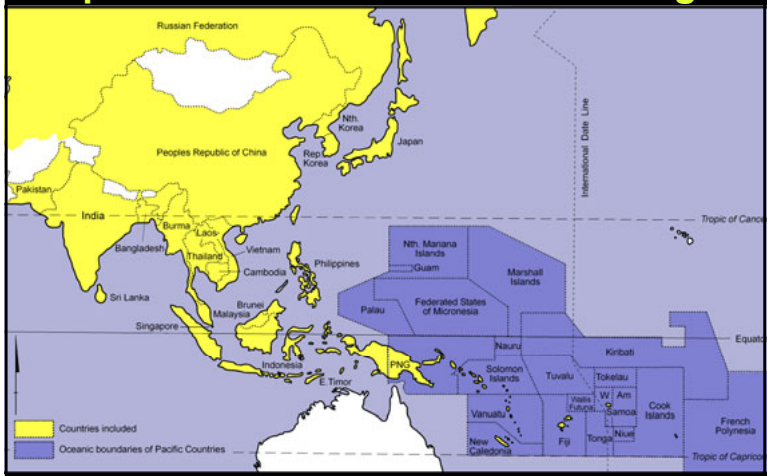
APN Countries (18)
Australia
Bangladesh
Cambodia
China
Fiji
India
Indonesia
Japan
Malaysia
New Zealand
Pakistan
Philippines
Republic of Korea
Russian Federation
Sri Lanka
Thailand
USA (Hawaii only)
Viet Nam

Pacific (18)
American Samoa
Cook Islands
French Polynesia
FSM
Kiribati
Marshall Islands
Nauru
New Caledonia
Northern Mariana
Niue
Palau
Papua New Guinea
Tonga
Tuvalu
Solomon Islands
Vanuatu
Wallis and Fortuna
Western Samoa

Non-APN Asia (5)
Burma
Brunei
East Timor
North Korea
Singapore

10

Scope of the Asia-Pacific Coastal Region



Harvey & Mimura, 2006 Fig 1.3

11

APN

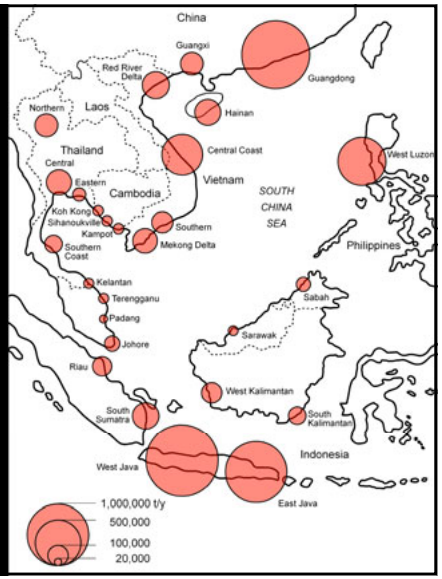
Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 2 - outline

- Introduction
- State of the environment
- Coastal ecosystems
- Fisheries and aquaculture
- Population and economic development
- Climate change and sea-level rise

12

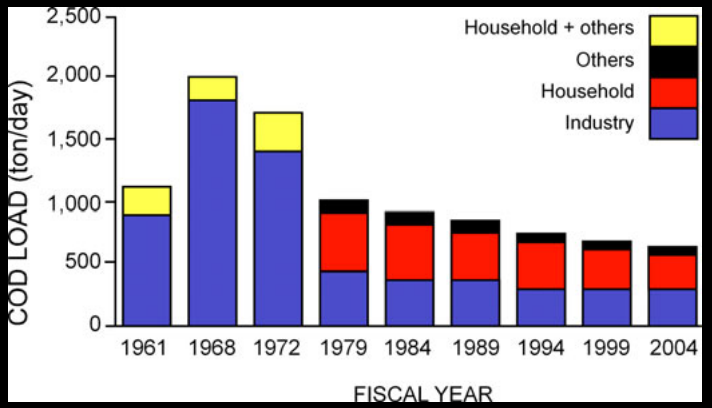
Biochemical Oxygen Demand from domestic sourses in East Asian Seas



Mimura, 2006 Fig 2.1

13

Trend in Chemical Oxygen Demand in the Seto Inland Sea, JAPAN



Mimura, 2006 Fig 2.3

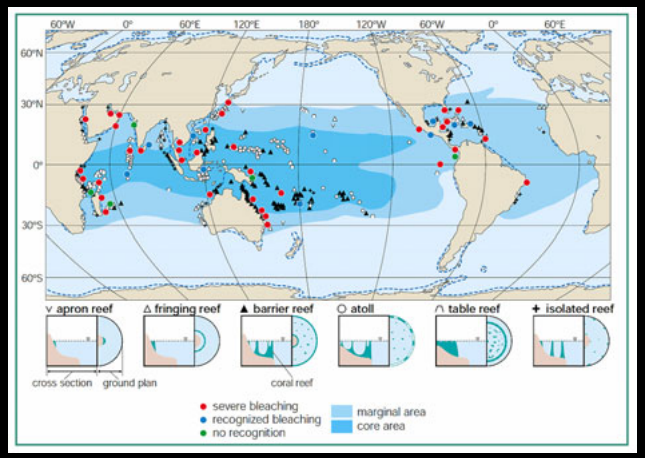
14

Firing Sea Prince near Yosu, Sori Island, KOREA

Mimura, 2006 Fig 2.4

15

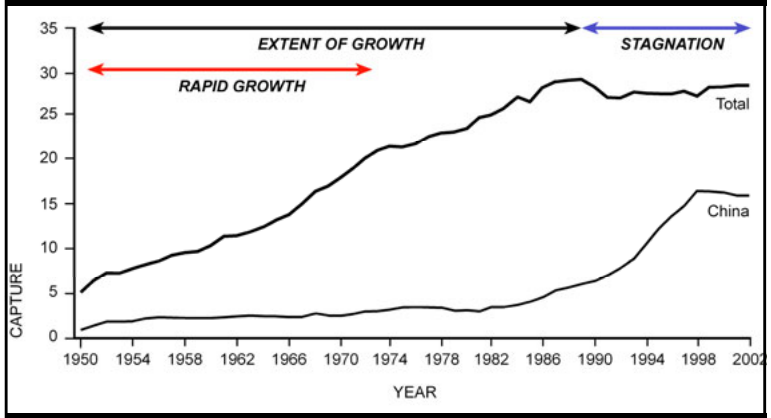
Coral bleaching 1997-1998



Mimura, 2006 Fig 2.5

16

Production in capture fisheries in China and Asia

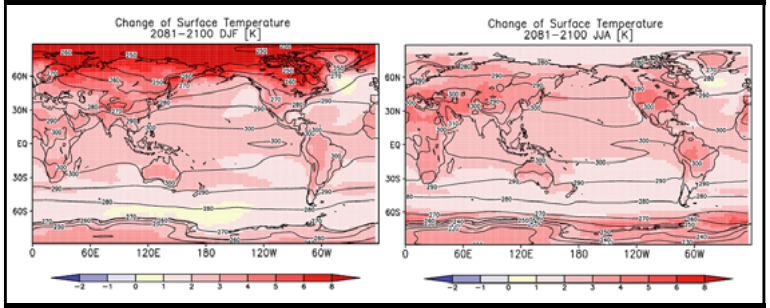


Mimura, 2006 Fig 1.1

17

Change of surface temperature

Northern winter | Northern summer

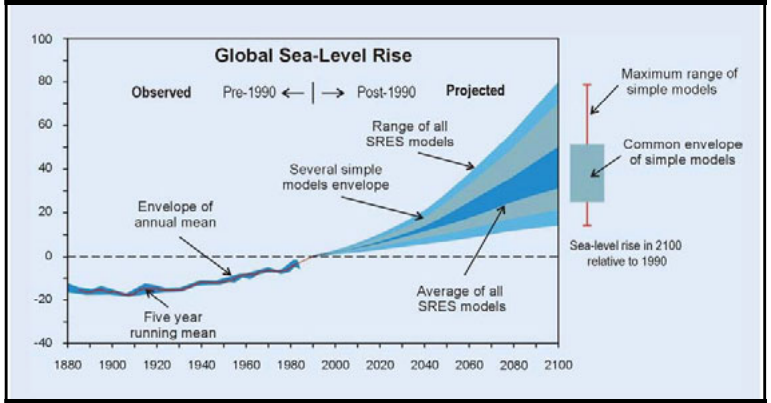


1) present model climate 1981-2000 = contours
2) changes 2081-2100 = shading

Mimura, 2006 Fig 1.1

18

Global sea-level rise



Harvey, Rice and Stevenson, 2005 Fig 7

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APN

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 3 - outline

- Introduction
- Integrated coastal management
- Drivers of coastal management
- Coastal management practices in the region
- Effectiveness of coastal management in the region
- Directions for coastal management research

20

Coastal management

- Coastal management influenced by global and local pressures
- Asia-Paciifc region characterized by diversity of management practices
- Integrated Coastal Management (ICM) seen as solution to problems
- Barriers to ICM and problems such as loss of community responsibility
- Need to recognize differences between countries

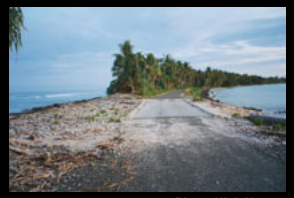


Photo Nick Harvey

Photo Paul Kench

21

22

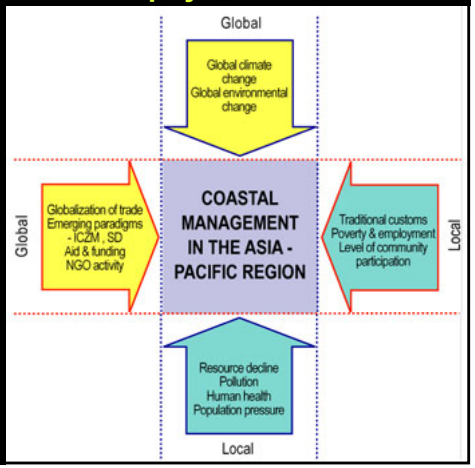
23

24

Drivers of Coastal Management

Biophysical drivers

Socio-economic drivers



Harvey & Hilton, 2006 Fig 3.3

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Integrated Coastal Management

Definition

Integrated coastal (zone) management involves the comprehensive assessment, setting of objectives, planning and management of coastal systems and resources, taking into account traditional, cultural and historical perspectives and conflicting interests and uses; it is a continuous and evolutionary process for achieving sustainable development.

(World Coast Conference Report, 1994 p 40)

26

Integrated Coastal Management

Definition

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(World Coast Conference Report, 1994 p 40)

27

Community Participation in Coastal Management

Top Down

Non-Participation - Government Decides

Public Consultation

Collaborative Management

Delegated Authority

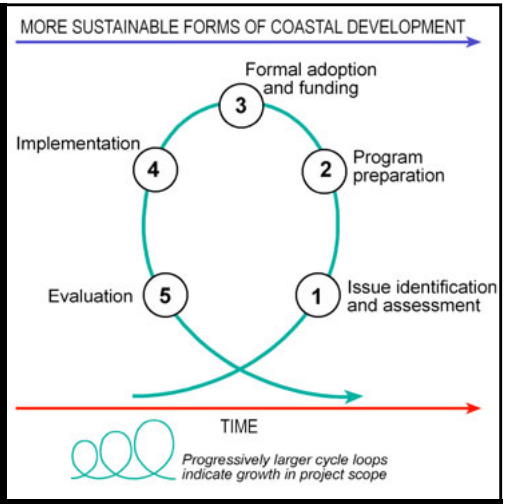
Bottom Up

Community Control

Harvey & Hilton, 2006 Fig 3.2

28

Cycles of development for integrated coastal management



Harvey & Hilton, 2006 Fig 3.1

29

PEMSEA ICM sites in Southeast Asia

Harvey & Hilton, 2006 Fig 3.4

30

Comparative assessment of ICM in the Asia-Pacific Region

	Trad practice	Comm approach	Regional plans	Special Area plans	Inter-Agency coord	National agenices
Singapore						
Solomon Islands						
Sri Lanka						
Taiwan						
Thailand						
Tonga						
Tuvalu						
Vanuatu						
Viet Nam						
Wallis and Fortuna						
(Western) Samoa						

KEY	
	No governmental recognition or provision made for this approach
	Some governmental recognition or provision made for the approach (and/or data lacking)
	Explicit government support and implementation of the approach

Source: based on expert judgement by the authors from available literature on ICM.

Harvey & Hilton, 2006 Table 3.3 (part only)

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APN

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 4 - outline

- Introduction
- Regional catchment-coast characteristics
- Processes and mechanisms of catchment-coast systems
- Methods and techniques for investigation
- Applications for catchment-coast development and management
- summary

32

Catchment-coast interaction

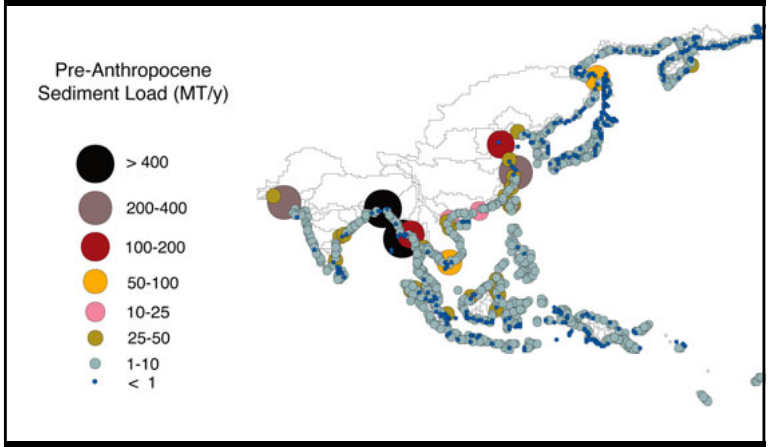
- Globally important rivers (eg Mekong, Red, Brahmaputra-Ganges)
- Environmental pressures related to agriculture and urbanisation
- Issues of dam construction affect water and sediment flow patterns
- Nutrient and pollutant discharges
- Need to better understand processes, mechanisms and management

Photo Nick Harvey

Photo Nick Harvey

33

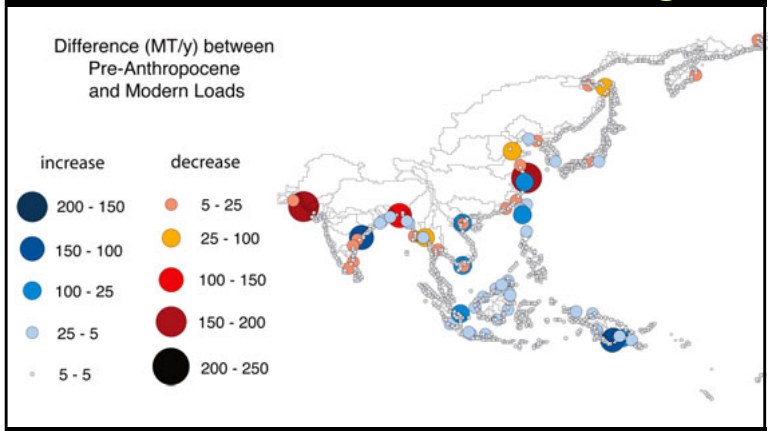
Pre-human sediment flux in the Asia-Pacific Region



Gao, 2006 Fig 4.1(a)

34

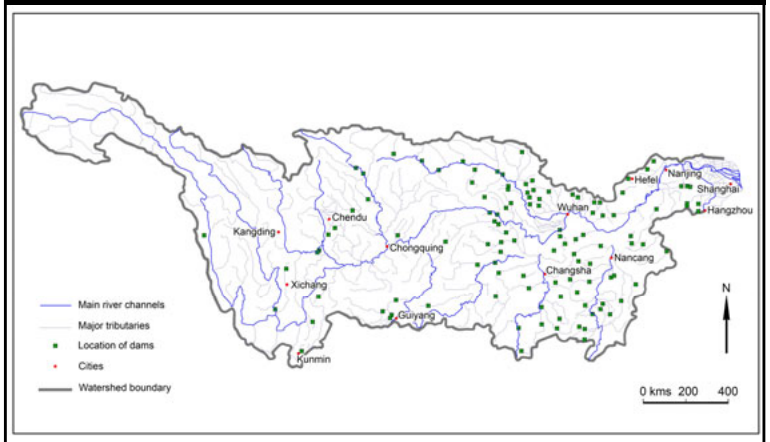
Change between pre-human and modern sediment flux in the Asia-Pacific Region



Gao, 2006 Fig 4.1(b)

35

Dams (> 10^8 m^3) on the Chanjiang River



Gao, 2006 Fig 1.1

36

Three Gorges Dam on the Chanjiang River, CHINA

Gao, 2006 Fig 4.3

37

APN

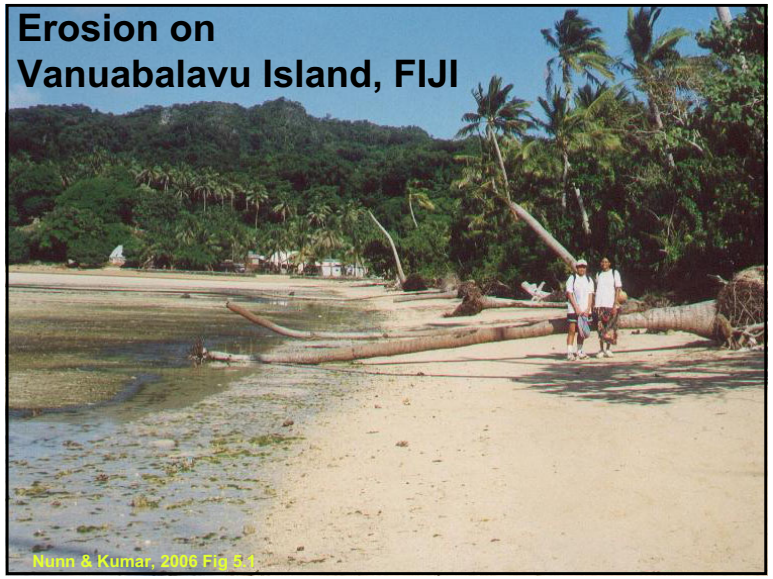
Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 5 - outline

- Introduction
- Drivers of coastal change
- Coastal history in the Asia-Pacific region
- Key thematic areas of research
- Key regional areas of research
- Gaps in research

38

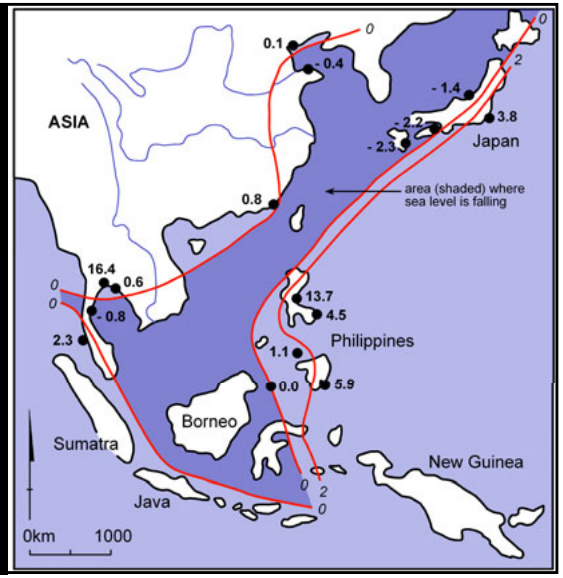
Erosion on Vanuabalavu Island, FIJI



Nunn & Kumar, 2006 Fig 5.1

39

Sea-level variation southeast Asia 1950-1991 (mm)



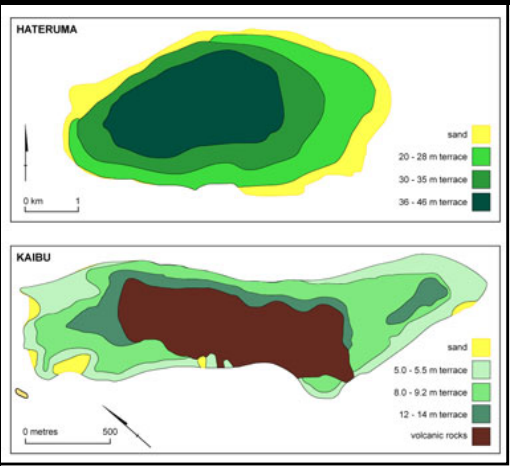
Nunn & Kumar, 2006 Fig 5.2

40

Coastal changes on two reef-fringed uplifted islands

Ryuku Islands, JAPAN

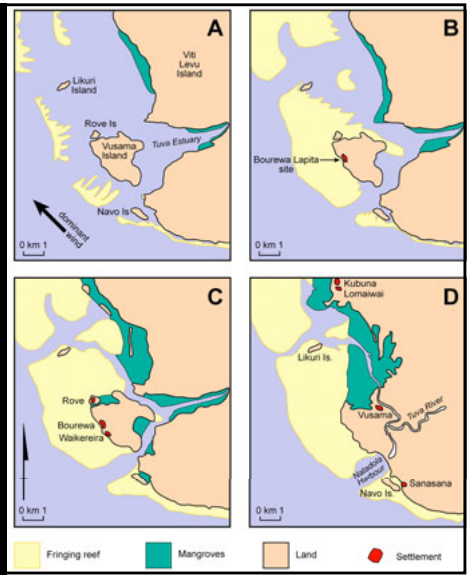
Lau Islands, FIJI



Nunn & Kumar, 2006 Fig 5.3

41

Palaeo maps of Bourewa Lapita site, Viti Levu, FIJI



Nunn & Kumar, 2006 Fig 1.1

42

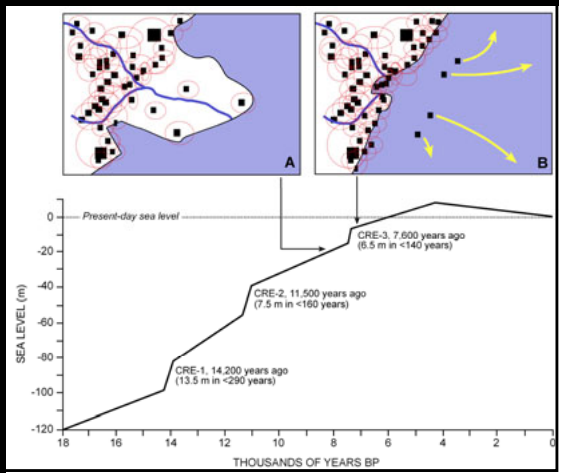
Chapter 6 - outline

Global Change and Integrated Coastal Management: The Asia-Pacific Region

- Human-environment interactions
  - Case study INDONESIA
- Coastal changes during human occupation
  - Case study JAPAN
- Institutional reponse to coastal change
- Understanding human reponse to coastal change
  - Case study PACIFIC ISLANDS
  - Case study NEW GUINEA
  - Case study JAPAN
  - Case study PHILIPPINES
  - Case study BANGLADESH
- Future research priorities

43

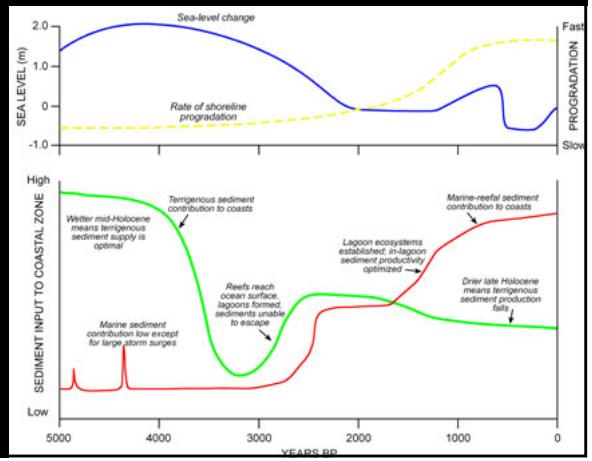
Hypothetical human response to sea-level rise on an Asian delta



Nunn et al, 2006 Fig 6.1

44

Conceptual model of sea-level change & coastal processes in the western Pacific



Nunn et al, 2006 Fig 6.2

45

Artificial coastal protection

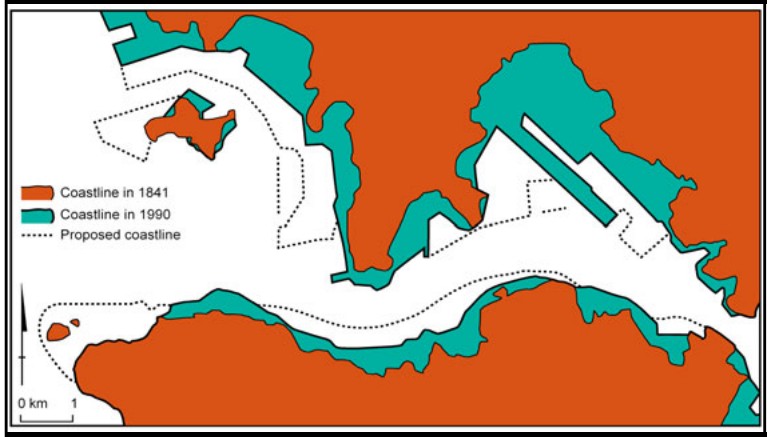
Male, MALDIVES

Aitutaki, COOK ISLANDS

Nunn et al, 2006 Fig 6.5

46

Changes in Victoria Harbour, Hong Kong



Nunn et al, 2006 Fig 6.6

47

1998 Aitape Tsunami, NEW GUINEA

Nunn et al, 2006 Fig 6.7

48

Adaption to erosion, Yadua Village, Viti Levu, FIJI

Early seawall

Mangrove re-planting

Nunn et al, 2006 Fig 6.8

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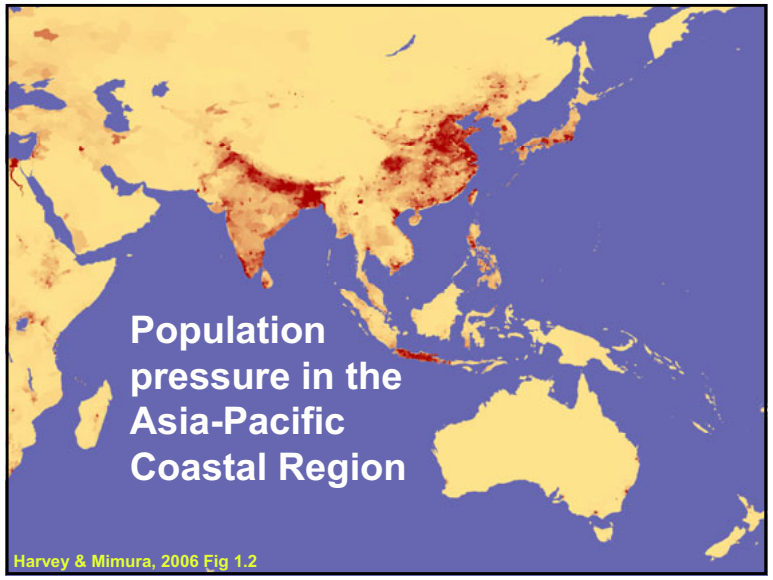
APN

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 7 - outline

- Introduction
- Population
- Urbanisation
- Megacities and urban regions
- Issues
- Research

50

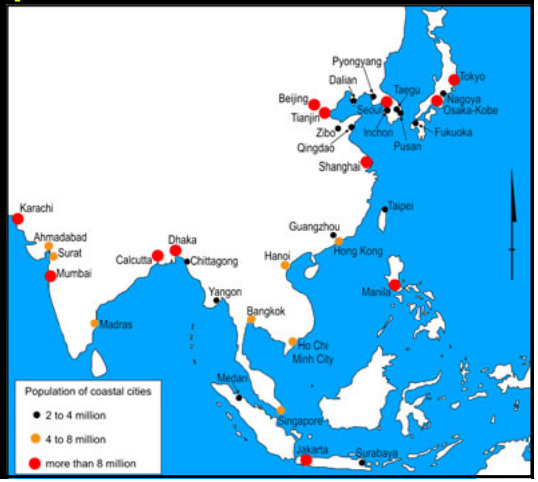


Population pressure in the Asia-Pacific Coastal Region

Harvey & Mimura, 2006 Fig 1.2

51

Coastal urban agglomerations with over 2 million people in the Asia-Pacific



Wong et al, 2006 Fig 7.1

52

EMECS7

Projections for Asian megacities in 2015

Urban conglomeration	Population (millions)
Tokyo, Japan	36.2
Mumbai, India	22.6
Delhi, India	20.9
Dhaka, Bangladesh	17.9
Jakarta, Indonesia	17.5
Calcutta, India	16.8
Karachi, Pakistan	16.2
Shanghai, China	12.7
Metro Manila, Philippines	12.6
Osaka-Kobe, Japan	11.4
Beijing, China	11.1

Harvey, Rice and Stevenson, 2005 Table 3

53

Kobe waterfront, JAPAN

Photo Nick Harvey

54

APN

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 8 - outline

- Introduction
- Coastal rural population
- Asia-Pacific fishers
- Asia-Pacific farmers
- Tourism in developing countries of Asia-Pacific
- Environmental issues and problems
- Rural poverty: challenges and opportunities
- Research targets

55

Pressure on rural coasts

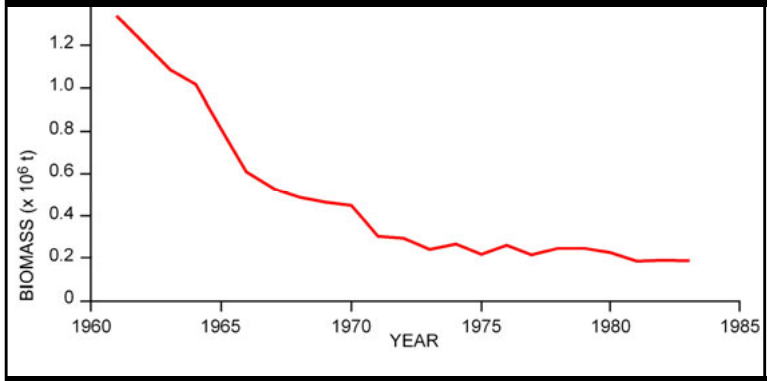
- 1 billion people on A-P rural coasts
- Over-fishing, coastal degradation affect sustainability of fishing and tourism
- Over 80% of global fishers and fish farmers
- 45-62% of global fish production and 68-87% of global aquaculture
- Many rural coastal dwellers live in poverty and vulnerable areas

Photo Liana Talaue-McManus

Photo Nick Harvey

56

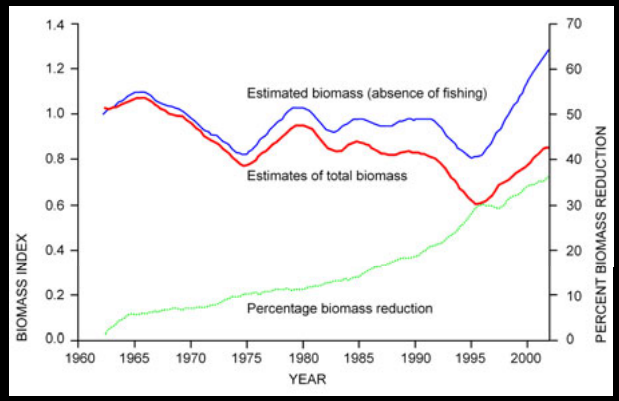
Biomass decline in the Gulf of Thailand fisheries over a 22 year period



Talaue-McManus, 2006 Fig 8.2

57

Biomass reductions in the Western and Central Pacific ocean

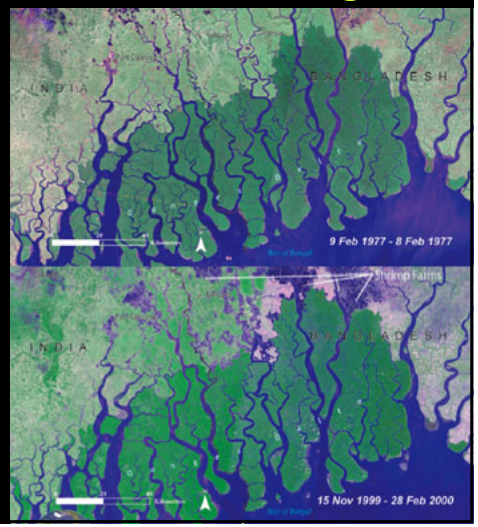


Blue = big-eye tuna
Red = model estimates of total biomass
Green = biomass reduction related to fishing

Talaue-McManus, 2006 Fig 8.4

58

Shrimp ponds in Sundarbans mangroves BANGLADESH



Talaue-McManus, 2006 Fig 8.7

59

Aquaculture ponds replace mangroves Gulf of THAILAND

Talaue-McManus, 2006 Fig 8.8

60

APN

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 9 - outline

- Introduction
- Synopsis of coastal projects in the Asia-Pacific
- Organic compounds
- Inorganic compounds
- Nuclear waste pollution
- Effects of industrial effluents
- Capacity building
- Legislative frameworks
- Observation and monitoring
- EEZ and pollution
- Conclusions and recommendations

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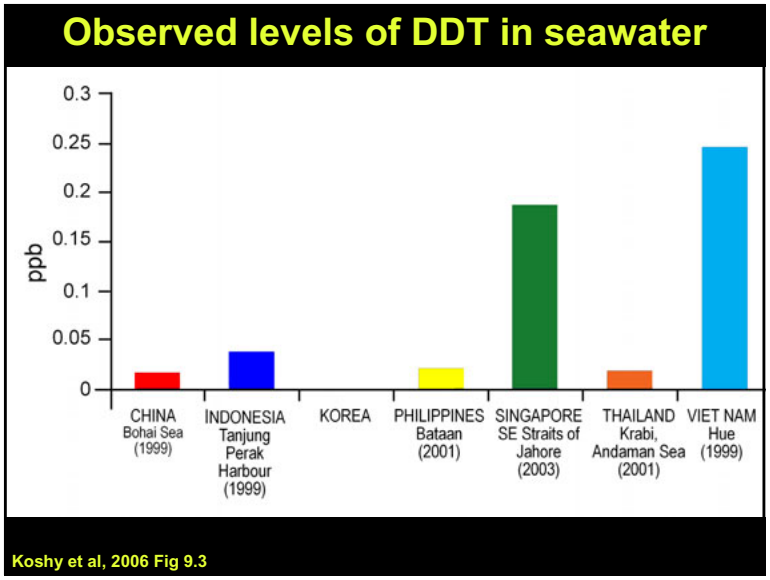
62

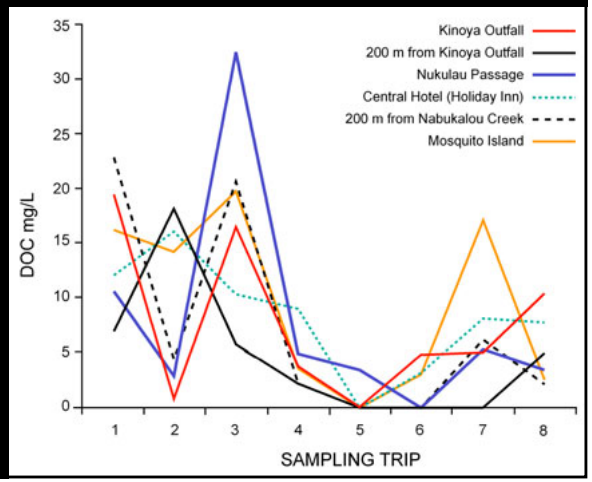
63



64

65

Baseline DOC study, Suva Lagoon, FIJI



Koshy et al, 2006 Fig 9.5

66

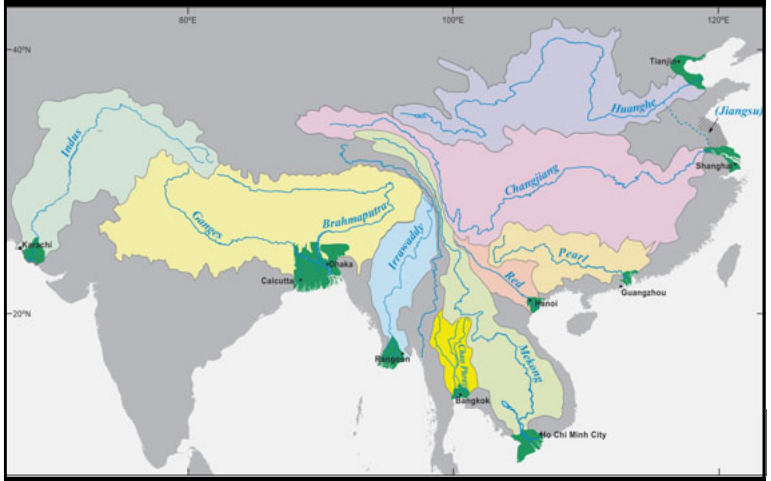
APN Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 10 - outline

- Introduction
- Recent gelogical evolution of megadeltas
- Delta morphology
- The human landscape
- Response to climate change
- Knowledge gaps and research directions

67

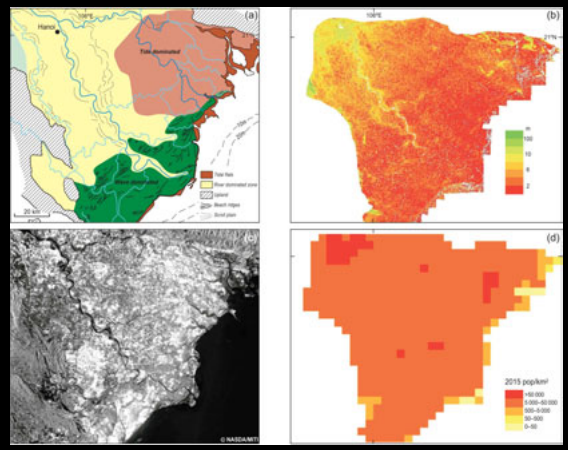
Asian large rivers and their megadeltas



Woodroffe et al, 2006 Fig 10.1

68

Red River Delta, VIET NAM



Woodroffe et al, 2006 Fig 10.4

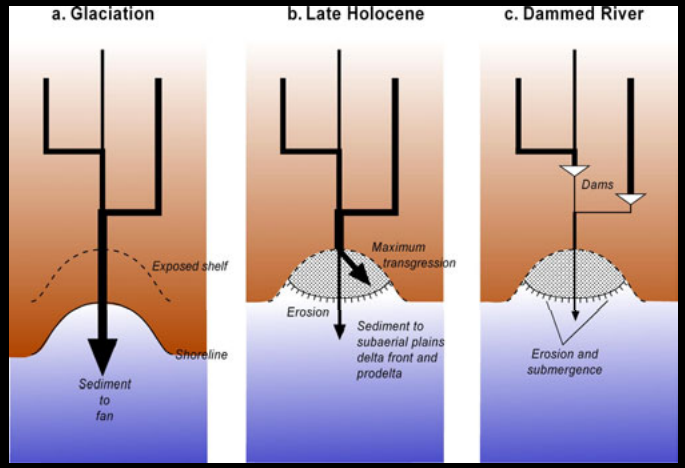
69

Ganges-Brahmaputra-Meghna Delta, BANGLADESH

Woodroffe et al, 2006 Fig 10.5

70

Delta sedimentation over time



Woodroffe et al, 2006 Fig 10.7

71

Global Change and Integrated Coastal Management: The Asia-Pacific Region

Chapter 11 - outline

- Introduction
- Lessons from ICM practice in the region
- Lessons from past global changes
- Human impact on coasts of the Asia-Pacific region
- Knowledge gaps and research directions
- Future global change research directions

72

Understanding coastal processes and change in the Asia-Pacific Region

1. Coastal ecosystems
   - cosystems sustainability, areas of rapid change, management
2. Coastal pollution
   - Degree and source, strategies at regional and global levels
3. Problem solving
   - Generate share data, develop solutions, share results

Harvey & Mimura, 2006

73

Coastal research related to global change

1. Future global change scenarios of global change
   - Basis for planning, develop sub-regional models
2. Impacts on natural environment
   - Identify SST and sea-level rise impacts on people & ecosystems
3. Impacts on human society
   - Assess impacts and adaptation strategies
4. Multiple stresses on environment and society
   - Develop models of multiple stress integrate with management
5. Sustainable development with global warming and sea-level rise
   - Pathways for climate change in national strategies and targets
6. Identify process thresholds and implications
   - Research into thresholds and strategies for rapid change
7. Adaptation
   - Research vulnerability, adaptation and adaptive capacity

Harvey & Mimura, 2006

74

Research on ICM methodologies for global change

1. Linkage and mechanisms for ICM in the region
   - Policy and ICM linkages, effectiveness of different approaches
2. Enhancement of ICM in the region
   - Develop more targeted strategies, include traditional knowledge
3. Dialogue between decision makers in the region
   - Pathways for cooperation, transboundary and regional initiatives
4. Science communication about future global changes
   - Develop communication strategies, culturally appropriate, positive
5. Research focus on most vulnerable environments
   - Atoll islands, delta coasts, areas of rapid population increase

Harvey & Mimura, 2006

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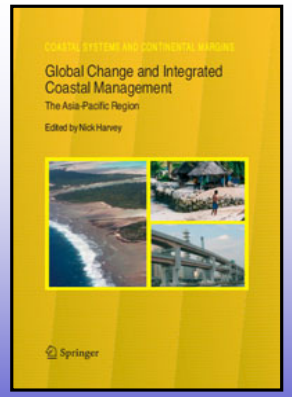
APN

Asia-Pacific Network for Global Change Research

CONCLUSION

- Considerable scope for research on global change and coastal management in the Asia-Pacific region
- New research directions face challenges
  1. Research funding
  2. Timely and meaningful outcomes
  3. Scientific results relevant for policy-makers
  4. Political will to act on results
- Scientists need to act quickly and communicate results effectively to general public and policy-makers



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Focus on the State of the Environment and Social Conditions of the Asia-Pacific Region

Tetsuo Yanagi
Kyushu University, Japan

While coastal zones are a center of various human activities and other urban economic activities, they also form a huge variety of ecosystems on wetlands and shallow water areas. Therefore, we now regard them as very important areas in terms of the preservation of the global environment. Above all, the Asian coastal zones are the areas in which we expect rapid urbanization and industrialization; it is urgent that some political measures must be proposed for governments, local governments, business enterprises and NGO to achieve sustainable development in Asia by assessing the current environmental situation and gaining future perspective on the basis of the latest scientific knowledge.

The international EMECS center, where the leading researchers of the environment management of the coastal zones are playing a central role, has been promoting the interchanges of research achievements on environmental preservation of enclosed coastal seas and littoral regions with the participation of the government and other major organizations. Additionally, we regularly have EMECS conferences with a view to deepening international exchanges. The implementation of “Asian-Pacific Coasts and Their Management: States of Environment” was proposed by the Asian Forum specially held at the 5th EMECS conference at Kobe, Japan in 2001. Since we have accepted this proposal, we have decided to draw up the environmental white paper aiming at implementation of the Asian-Pacific Coastal Zone Environmental Assessment as one of the projects of international EMECS center.

The contents and leading authors of this white paper are as follows:

1. Introduction (N.Mimura)
2. Drivers for changes of coastal zones (T.Yanagi and K.Cho)
3. Environmental problems in the coastal zone (H.Sekiguchi and A.Sanit)
4. Policy for the conservation and sustainable development of coastal zone (Y.Hirai, M.Yamao and A.Shikida)
5. Regional conditions (Y.Saito and M.Alino)
6. Conclusions (N.Mimura and S.Yamamura)

This book will be published by the end of 2006.

Focus on the State of the Environment and Social Conditions of the Asia-Pacific Region

Tetsuo YANAGI

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Kushu Univeristy,
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1

Asian-Pacific Coasts and Their Management: States of Environment

International EMECS Center

This book will be published by the end of this year

2

Background and Purposes

Asian coastal zone: rapid urbanization, industrialization

Preservation of coastal environment is very important.

5th EMECS at Kobe: proposal of white paper on the Asian coastal zone
(2001) for the environmental assesment.

International EMECS center began the work in January 2004

Steering Committee; Chair: N.Mimura
(11 members) T.Yamamura, T.Yanagi, K.Cho, Y.Saito
S.Aksornkoae, Y.Hirai, P.M.Alino
H.Sekiguchi, A.Shikida, M.Yamao

(Japan, Korea, Thailand, Philippines)

3

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5. Regional conditions (Y.Saito and M.Alino)
6. Conclusions (N.Mimura and S.Yamamura)

State – Drivers - Response

4

2. Drivers for changes of coastal zones

2.1 Monsoon and coastal zone

2.1.1 Environment of coastal zone

2.1.2 Regional characteristics

2.2 Natural environmental change

2.2.1 Climate change

2.2.2 Sea level rise and its impact

2.3 Human activities

2.3.1 Population and economics growth

2.3.2 Development of river basins

2.3.3 Development of coastal zone

2.3.4 Pollutants

5

3. Environmental problems in coastal zone

3.1 Coastal characteristics and changes in coastal features

3.2 Water and sediment pollution
3.2.1 Eutrophication and its cause/consequences
the case of the Seto Inland Sea, Japan
the case of the Philippines
3.2.2 Marine pollution and hazardous chemicals

3.3 Ecological changes
mangroves, coral reefs and sea grass

3.4 Fishery industry

3.5 Tourism

3.6 Other matters related to oil spills

6

4. Policy for the conservation and sustainable development of coastal zone

4.1 Recent movement and general concept
4.1.1 International trends of integrated coastal management

4.2 Policy movement of integrated coastal zone management
4.2.1 Developed countries
4.2.2 Developing countries
4.2.3 Small islands

4.3 Coastal zone management
4.3.1 Urban areas
4.3.2 Agriculture and Fisheries
4.3.3 Forestry and Mangrove
4.3.4 Wetland, coral reefs and beaches

4.3 Best practices in selected countires
Philippines, Malaysia, Thailand, and Japan

7

5. Regional conditions

5.1 East Asia
5.1.1 China
5.1.2 Korea
5.1.3 Taiwan
5.1.4 Japan

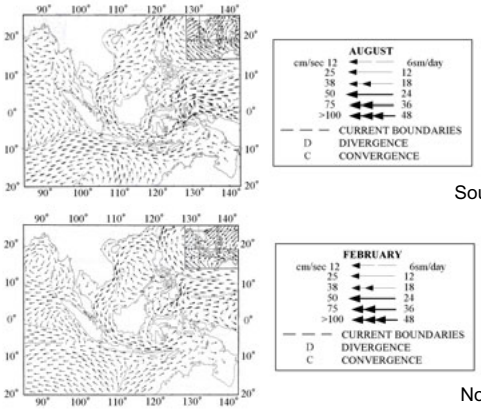
5.2 Southeast Asia

5.3 South Asia
5.3.1 Bangladesh
5.3.2 Pakistan
5.3.3 India
5.3.4 SriLanka

5.4 Islands in the Pacific islands

8

Monsoon climate

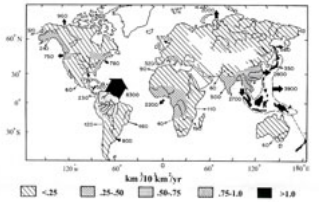


Southeast monsoon

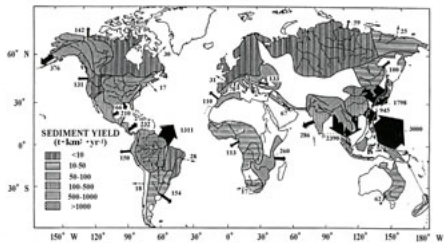
Northwest monsoon

9

Water and sediment loads



Water discharge



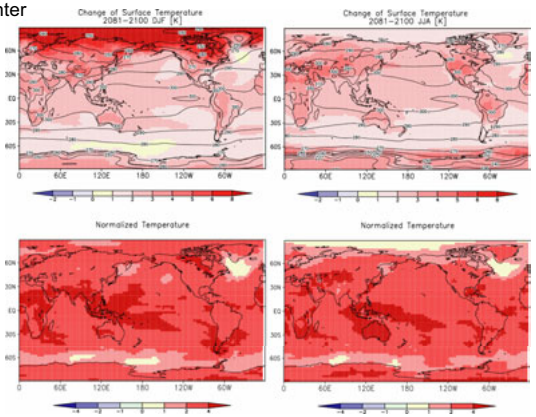
Sediment load

Milliman and Meade (1983)

10

Global warming
2-3^{O}C in East Asia

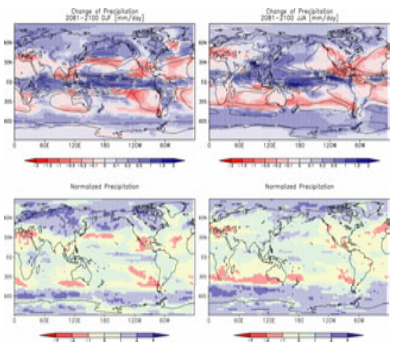
winter summer



11

Change of precipitation
50-70mm increase in East Asia especially in summer

winter summer



The intensity of tropical cyclones will be increased.

12

Sea level rise

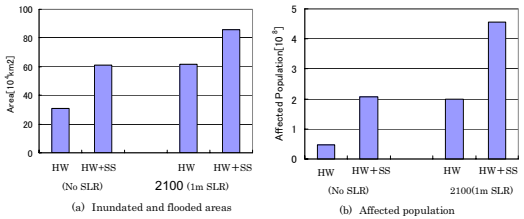
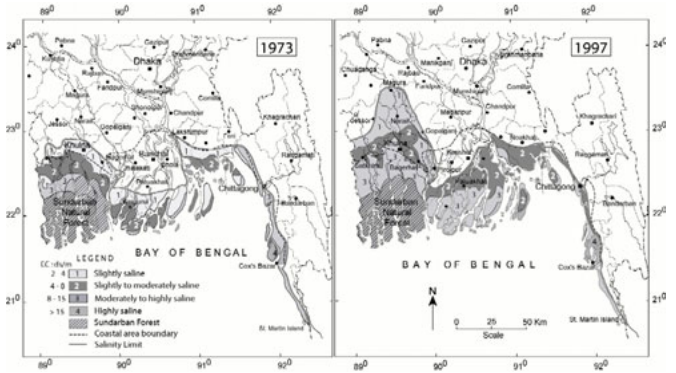


Figure 2.2.2.3 Affected area (a) and population (b) for present (no SLR) and 2100 (1m) in the Asia Pacific region (Mimura, 2000). HH, SS, and SLR represent high water, storm surge, and sea level rise, respectively.

13

Groundwater salinity in 1973 and 1997, Bangladesh



14

In the northern part of the Huanghe delta, the coastline retreated continuously from 1976 due to cutoff of fluvial sediment supply. The coastline in the southeastern part prograded seaward after 1976 as the end river channel shifted to the present course

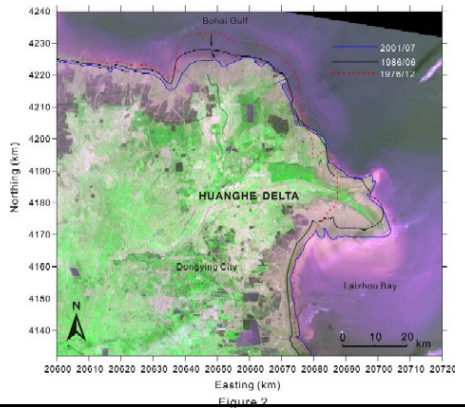
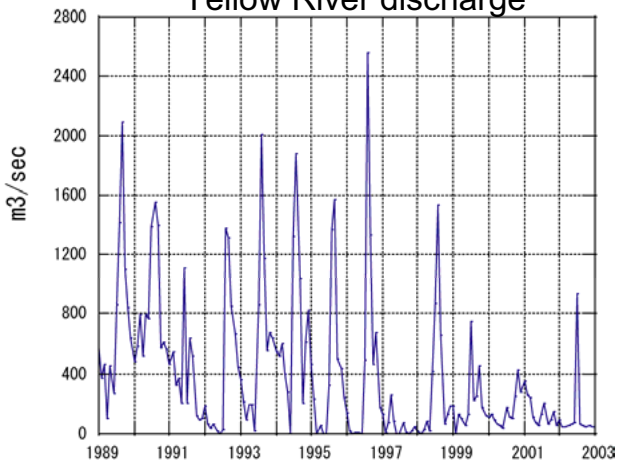


Figure 2

15

Year-to-year variation in Yellow River discharge



16

Yangtze River

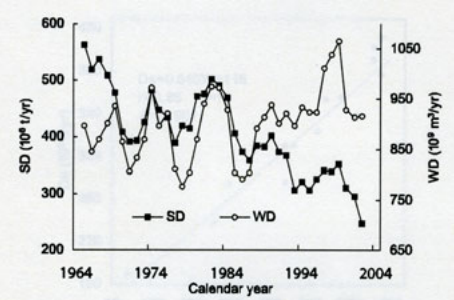


Figure 11. Three year running average SD and water discharge (WD) at Datong Station from 1965 to 2003 (data source is the Yangtze River Water Conservancy Committee).

17

Mega-cities (>10 millions)

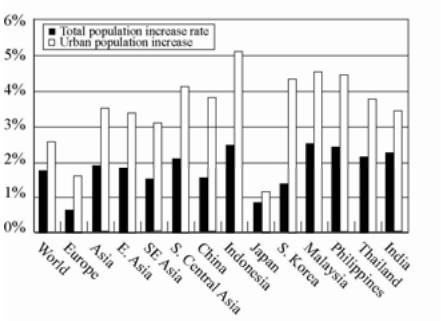
Fig.2.3.1.1 Main cities and their population in Asian-Pacific area.

17 in 2001 in the world

9 in Asia
- Tokyo
- Beijin, Shanghai
- HongKong
- Manila, Bangkok
- Jakarta
- Dhaka, Mumbai

18

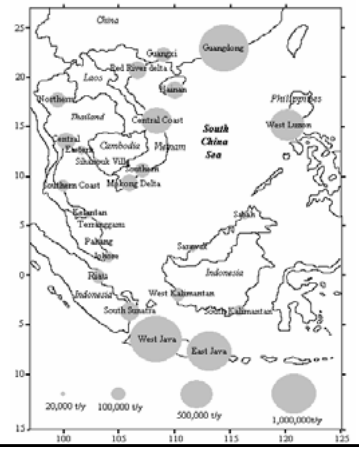
Urbanization



Average annual rates of increase in total and urban populations from 1970 to 1994 (United Nations, 1995).

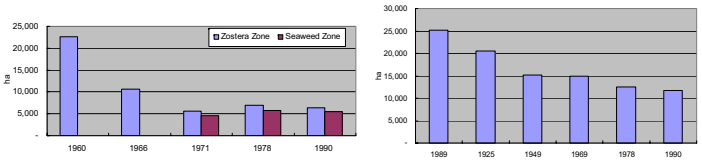
19

BOD loading in 2000



20

Seagrass beds and tidal flats



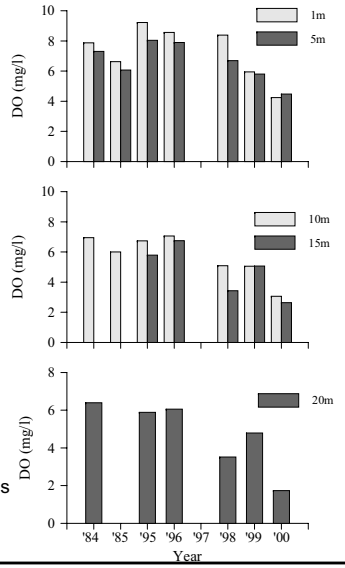
Due to increase of turbidity

Due to reclamation

Trends in the change of seagrass beds and tidal flats areas in the Seto Inland Sea, Japan

21

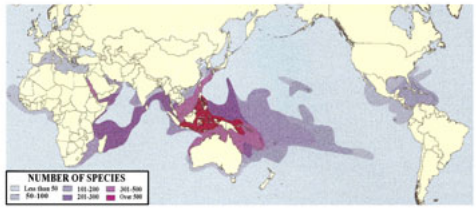
DO in Manila Bay, the Philippines



Oxygen-deficient water mass

22

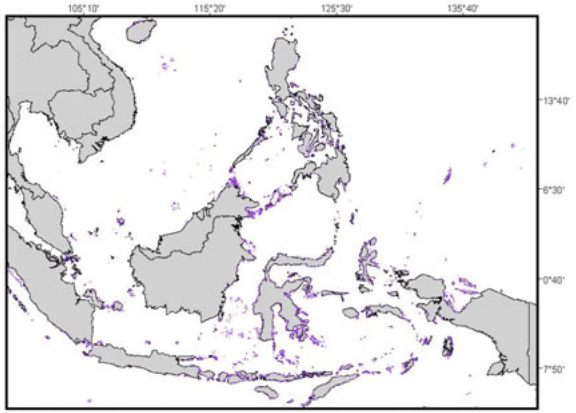
High diversity of corals



Eastern part of
The Gulf of Thailand

23

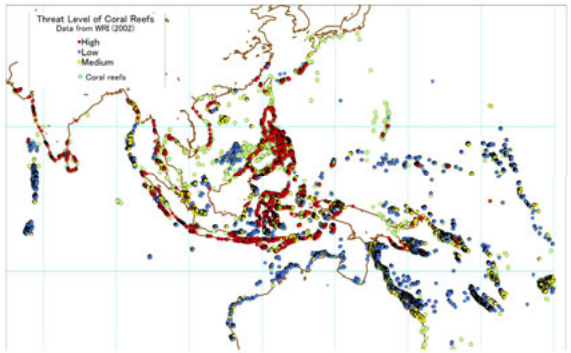
Distribution of coral reefs (violet) in Southeast Asia



24

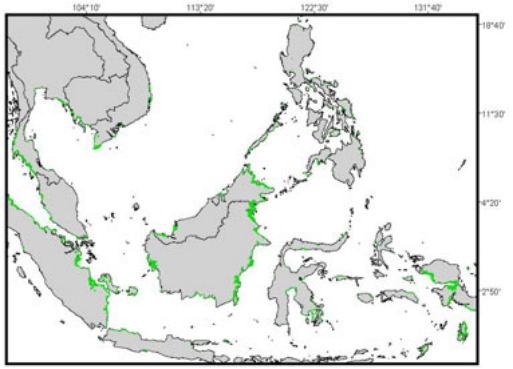
Threat of coral reefs

Bleaching, destruction, dynamite fishing and so on.



25

Distribution of mangrove areas (green) in Southeast Asia



26

Mangrove forests

Conversion of mangrove forests to shrimp ponds and resettlement areas in Southeast Asian countries

27

Mangrove forests

Shrimp farms along the coastal area in Sepang, Selangor

28

Charcoal production in the mangrove forest in southern Thailand.

29

Mangrove forests

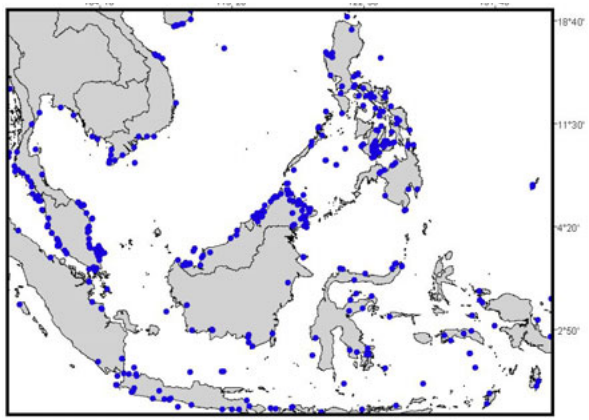
Thailand

Vietnam

Mangrove rehabilitation in abandoned shrimp ponds in Southern Thailand and in Red River delta

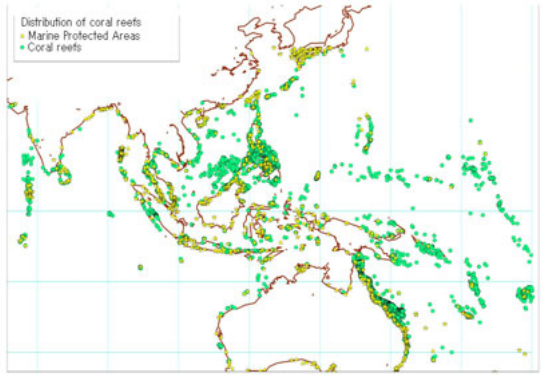
30

Distribution of marine protected areas (blue) in Southeast Asia



31

MPAs for coral reefs



32

Marine Protection Areas

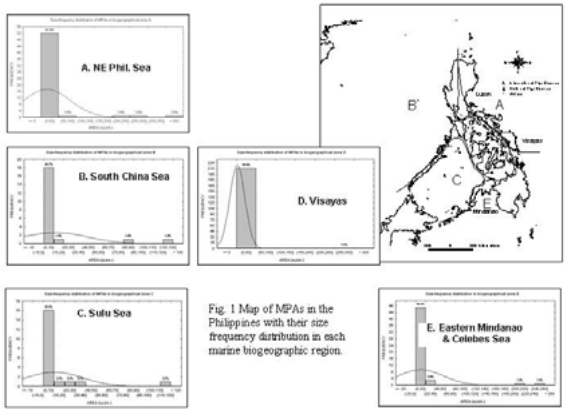
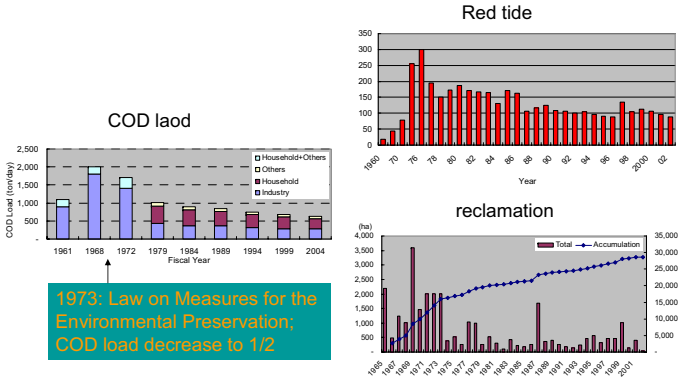


Fig. 1 Map of MPAs in the Philippines with their size frequency distribution in each marine biogeographic region.

33

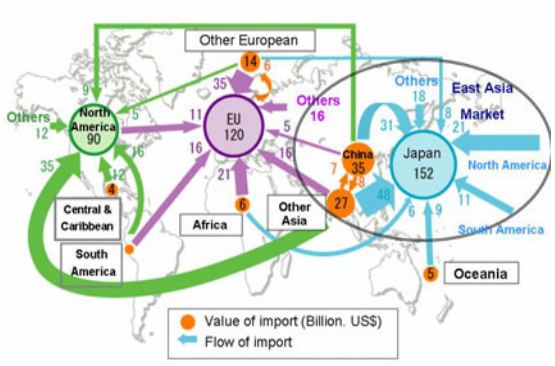
COD load, red tide and reclamation



Change in COD load, the number of occurrences of red tide and reclamation in the Seto Inland Sea, Japan

34

Fisheries industry

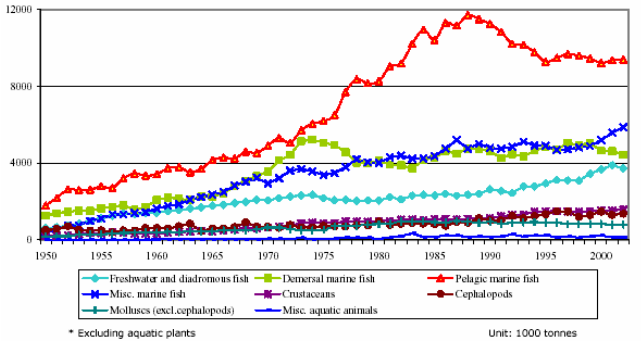


Source: Ministry of Agricultural, Forestry and Fisheries, Japan

Figure 3.4.1 Trade Flow of Fisheries Products (1999-2001)

35

Aquaculture in Asia and Pacific



36

Fish resources and marine environment

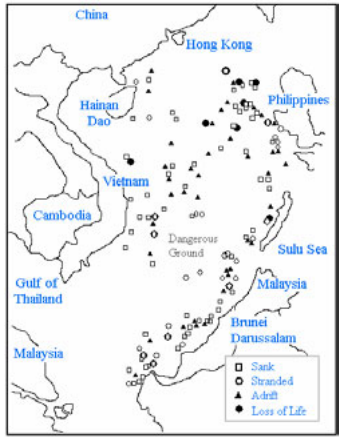
Fish resources management is very important.

Preservation of marine environment for aquaculture ground is very important for the sustainable aquaculture.

Carrying capacity of aquaculture ground.

37

Marine accidents resulting in oil and chemical spillage in the South China Sea, 1974-1994 (Olson, 1996).



38

Oil spill

The Sea Prince on fire near Yosu, Sori Island in 1995 due to typhoon

39

Tourist resort in a mangrove area, Malaysia

40

Carrying capacity for tourism

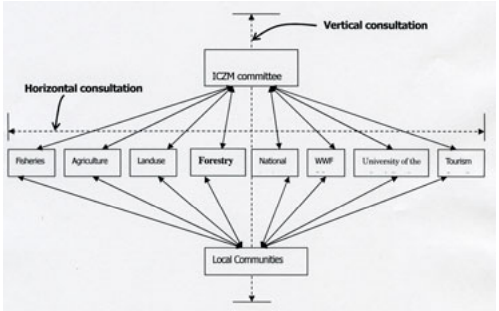
The establishment of carry capacity for tourism is also important.

Maximum tourist number must be defined for the preservation of the environment of tourism.

41

An integrated top-down and bottom-up approach of ICZM

Community-based management



PEMSEA (Partnerships in Environmental Management for the Seas of East Asia) has accumulated many experiences of ICZM in this region.

42

Report of Coastal Vulnerability and Risk Management in the Asia-Pacific Region

Haruyuki Kojima
Kyushu Kyoritsu University, Japan

1. Uniqueness of coastal zones

Special features such as daily tides, storm waves, tidal flats, mangrove forests, coral reefs, and vast sandy beaches exist only on the coast. On the other hand, coastal zones are used for human settlement, agriculture, trade, industry, and amenity and as shore bases for maritime activities such as shipping, fishing, aquaculture, and sea mining. In the same coastal zones, destructive natural disasters take place, killing ten of thousands of people and destroying upland properties, as demonstrated by the tsunami disaster due to the big Sumatra earthquake of 2004, and Hurricane Katrina of 2005.

2. Coastal zone development and coastal vulnerability

Sustainable development and utilization of coastal zones, such as the development of industrials and living activities, stabilization of fishery resources, development of seabed oil, natural gas and mineral resources, and utilization of ocean energy, are essential to the sustainable development of human society. Economic activities of many of the Asian countries heavily depend on developments of the coastal zones. In line with global trends, more than half of the region's population presently resides in the coastal zone of Asia. This evidence is clearly indicated by the rising of the number of mega-cities. The number of mega-cities have rise from five in 1975 to 17 in 2001, among those cities nine urban agglomerations being located in the coastal zone of the Asian area. The consequences of this population growth, accompanied by rapid urban expansion and industrial development, pose a significant threat to the vulnerability of the Asian coastal zones. All coastal areas are facing an increasing range of stress and shock caused by natural disasters like tsunami and storm surges.

3. Disaster caused by tropical cyclones

The study by Webster, ET al[1)] shows that by examining the number of tropical cyclones and cyclone days, as well as tropical cyclone intensity over the past 35 years, a large increase was seen in the number and proportion of hurricanes reaching categories 4 and 5. The largest increase occurred in the North Pacific, Indian, and Southwest Pacific Oceans, and the smallest percent of increase occurred in the North Atlantic Ocean. These increases have taken place while the number of cyclones and cyclone days has decreased in all basins except the North Atlantic during the past decade. Another study done by Mimura[2)] indicates that in the Asia- Pacific region at the present state, about 47 million people or 1.21% of the total population lives in the area below high tide level, while

270 million people or 5.33% live below storm surge level, suggesting that this region is already vulnerable to flooding by storm surges.

Last August, Hurricane Katrina induced large-scale storm surge disasters in New Orleans, USA. More than 1300 people were killed or left missing. About 75 percent of New Orleans' metropolitan areas were flooded due to failures of the regional flood protection systems. This incident brought our attention to storm surges hitting places below sea level could cause catastrophic damage and socioeconomic impact to coastal dwellers.

4. Risk management strategies

(1) Steady construction of storm surge defense facilities and inspection of their reliability should be carried in order to ensure inundation prevention according to storm surge defense plans.

(2) Reducing damage to a minimum requires not only defense efforts of coastal administrators and port facilities managers but also self-protection initiatives of local communities. All the stakeholders should take a comprehensive approach that incorporates city planning, ways of living and individuals' disaster defense actions. The measures against large-scale flooding should focus on the protection of human lives and the continuation or early restoration of social activities.

(3) State-of-the-art technology comprised of storm surge numerical model and GIS gives a good view of potentially vulnerable areas to storm surge events, providing to local residents valuable information for enhancing their awareness toward coastal vulnerability.

References: 1) P. J. Webster et al., Science, 309, 1844 -1846 (2005).
2) Nobuo Mimura, Proc. of APN/SURVAS/LOICZ Conf. on Coastal Impacts of Climate change and Adaptation, 21-26, 2001.

Report of Coastal Vulnerability and Risk Management in the Asia-Pacific Region

- Developments of Coastal Zone
- Vulnerabilities of Coastal Zone
- Recent Storm Surge Disasters
- Risk Management Strategies
- Summaries and Lessons Learned

1

Population of cities with 10 million inhabitants or more, 1950, 1975, 2001 and 2015

(millions)

City	Population
Year of 1950	
1 New York	12.3
Year of 1975	
1 Tokyo	19.8
2 New York	15.9
3 Shanghai	11.4
4 Mexico City	10.7
5 Sao Paulo	10.3

City	Population
Year of 2001	
1 Tokyo	26.5
2 Sao Paulo	18.3
3 Mexico City	18.3
4 New York	16.8
5 Mumbai (Bombay)	16.5
6 Los Angeles	13.3
7 Calcutta	13.3
8 Dhaka	13.2
9 Delhi	13.0
10 Shanghai	12.8
11 Buenos Aires	12.1
12 Jakarta	11.4
13 Osaka	11.0
14 Beijing	10.8
15 Rio de Janeiro	10.8
16 Karachi	10.4
17 Metro Manila	10.1

City	Population
Year of 2015	
1 Tokyo	27.2
2 Dhaka	22.8
3 Mumbai (Bombay)	22.6
4 Sao Paulo	21.2
5 Delhi	20.9
6 Mexico City	20.4
7 New York	17.9
8 Jakarta	17.3
9 Calcutta	16.7
10 Karachi	16.2
11 Lagos	16.0
12 Los Angeles	14.5
13 Shanghai	13.6
14 Buenos Aires	13.2
15 Metro Manila	12.6
16 Beijing	11.7
17 Rio de Janeiro	11.5
18 Cairo	11.5
19 Istanbul	11.4
20 Osaka	11.0
21 Tianjin	10.3

Note: Yellow shaded indicates mega-cities located in the Asian coastal zones
Sources: United Nations Population Division, *World Urbanization Prospects: The 2001 Revision*

2

Port/Harbor Development

Ranking of container throughput of ports in the world in 1980 and 2002

Year 1980 Rank	Port	Country, Region	Throughput (TEU)
1	New York	USA	1,947,000
2	Rotterdam	Netherlands	1,901,000
3	Hong kong	China	1,456,000
4	Kobe	Japan	1,456,000
5	Kaohsiung	Taiwan	979,000
6	Singapore	Singapore	917,000
7	San Juan		852,000
8	Long Beach	USA	825,000
9	Hamburug	Germany	783,000
10	Oakland	USA	782,000
12	Yokohama	Japan	722,000
15	Pusan	South Korea	634,000
18	Tokyo	Japan	632000

Year 2002 Rank	Port	Country, Region	Throughput (TEU)
1	Hong kong	China	18,100,000
2	Singapore	Singapore	17,040,000
3	Pusan	South Korea	9,453,356
4	Shanghai	China	8,610,000
5	Kaohsiung	Taiwan	8,493,000
6	shenzhen	China	7,613,754
7	Rotterdam	Netherlands	6,515,449
8	Los Angeles	USA	6,105,863
9	Hamburug	Germany	5,373,999
10	Antwerp	Belgium	4,777,387
11	Port Kelung	Malaysia	4,533,212
12	Long Beach	USA	4,526,365
13	Dubai	UAE	4,194,264
14	New York	USA	3,050,036
15	Tokyo	Japan	2,899,452
19	Yokohama	Japan	2,317,489
22	Kobe	Japan	2,265,991

Sources: CONTAINERISATION INTERNATIONAL YEAR BOOK 1981, 2003

3

Development of coastal tourism

Foreign exchange earnings from tourism in selected countries of ESCAP, 1993
(in million $US)

	Gross earnings from international tourism	Merchandise exports (million $US)	Tourism earnings as percent of GDP	Tourism earnings as percent of export earnings
Bangladesh	8	2,138	0.0	0.4
India	1,401	22,500	0.6	6.2
Indonesia	3,600	36,600	2.5	9.8
Malaysia	1,910	46,000	3.0	4.2
Maldives	120	35	30.0	
Pakistan	115	6,760	0.2	1.7
Philippines	2,300	11,375	4.2	20.2
Republic of Korea	3,502	82,200	1.1	4.3
Sri Lanka	210	2,786	2.0	7.5
Thailand	5,719	36,400	4.6	15.7

Sources: Country reports, and Economist Intelligence Unit country reports.

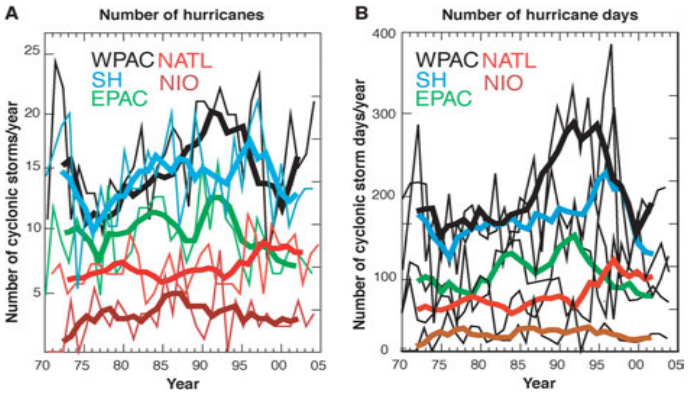
4

Coastal Vulnerabilities to Natural Hazards

- Storm Surge Disaster by Tropical Cyclone
- Tsunami Disaster by Earthquake
- Beach Erosion by Various Causes
- Sea-Level Rise by Global Warming

5

Regional time series for 1970-2004 for the ocean basins for (A) total number of hurricanes and (B) total number of hurricane days

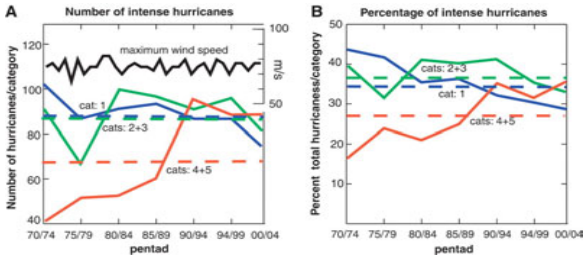


WPAC: Western Pacific , EPAC, NATL: North Atlantic Ocean, NIO: North Indian Ocean

Sources: P. J. Webster et al., Science 309, 1844 -1846 (2005)

6

Change in the Intensity of hurricanes according to the Saffir-Simpson scale (categories 1 to 5)



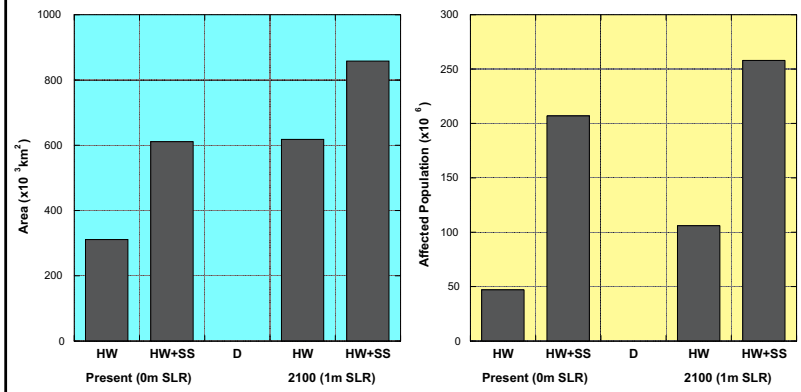
Change in the number and percentage of hurricanes in categories 4 and 5 for the 15-year periods 1975–1989 and 1990–2004 for the different ocean basins.

Basin	Period			
	1975Š1989		1990Š2004	
	Number	Percentage	Number	Percentage
East Pacific Ocean	36	25	49	35
West Pacific Ocean	85	25	116	41
North Atlantic	16	20	25	25
Southwestern Pacific	10	12	22	28
North Indian	1	8	7	25
South Indian	23	18	50	34

Sources: P. J. Webster et al., Science 309, 1844 -1846 (2005)

7

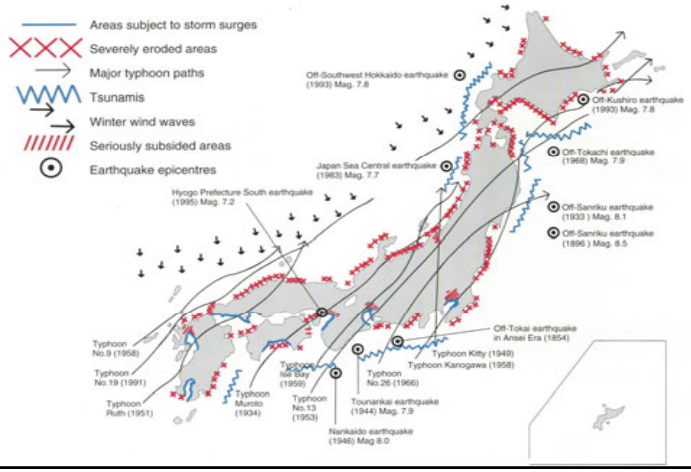
Areas and Population Affected by Storm Surge and Sea-Level Rise in the Whole Asia & Pacific Region



Sources: Nobuo Mimura, Proc. Of APN Conf. on Coastal Impacts of Climate change and Adaptation, 2001

8

Coastal Disasters in Japan



9

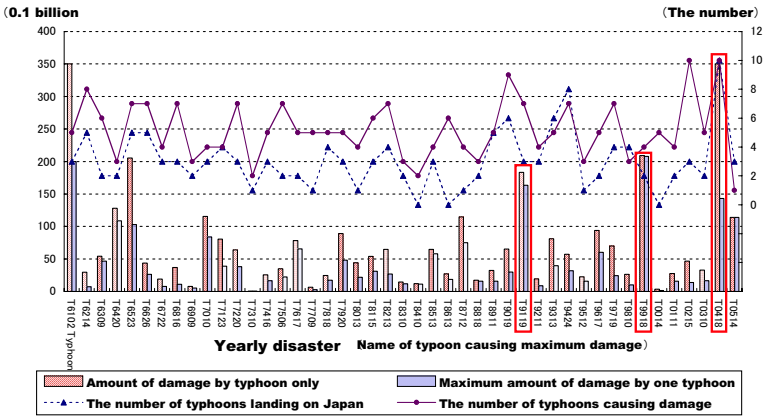
Major Storm Surge Disasters in Japan

Date	Typhoon No.	Damaged Region	Pressure (hPa)	Max. W.L. (T.Pm)	Surge Height(m)	Human Casualities	Damaged Houses
10/1/16	?	Tokyo Bay	?	3.0	2.1	1,324	55,733
9/13/27	T2709	Ariake Sea	?	3.8	0.9	439	1,420
9/21/34	T3407 (Muroto)	Osaka Bay	935	3.1	2.9	3,036	88,046
8/27/24	T4216	Suo Sea	940	3.3	1.7	1,158	99,769
9/17/45	T4516 (Makurazaki)	Southern Kyushu	910	2.6	1.6	3,122	113,438
9/3/50	T5028 (Jane)	Osaka Bay	928	2.7	2.4	534	118,854
10/14/51	T5115 (Ruth)	Southern Kyushu	924	2.8	1.0	943	69,475
9/25/53	T5313	Ise Bay	918	2.8	1.5	500	40,000
9/27/57	T5915 (Isewan)	Ise Bay	913	3.9	3.4	5,098	151,973
9/16/61	T6118 (2nd Muroto)	Osaka Bay	910	3.0	2.5	200	54,245
8/21/70	T7010	Tosa Bay	923	3.1	2.4	13	4,439
8/30/85	T8513	Ariake Sea	955	3.3	1.0	3	589
9/24/99	T9918	Yatsushiro Bay	945	4.5	3.5	12	845

- 13 Casualties in the past Occurred by Storm Surge.
- Six out of 13 Casualties occurred in the Kyushu Region.
- Since 1960, Number of deaths and Damages Decreased.

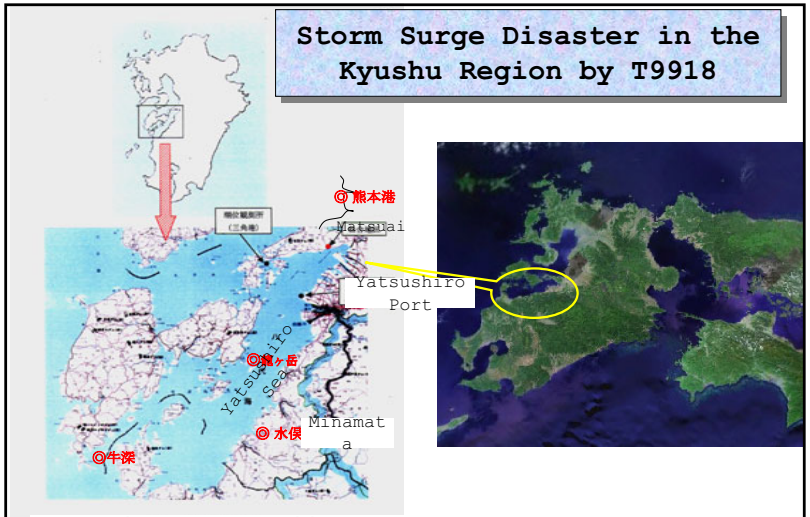
10

Trend of Damage of Port/Coastal Facilities by Typhoon



11

Storm Surge Disaster in the Kyushu Region by T9918

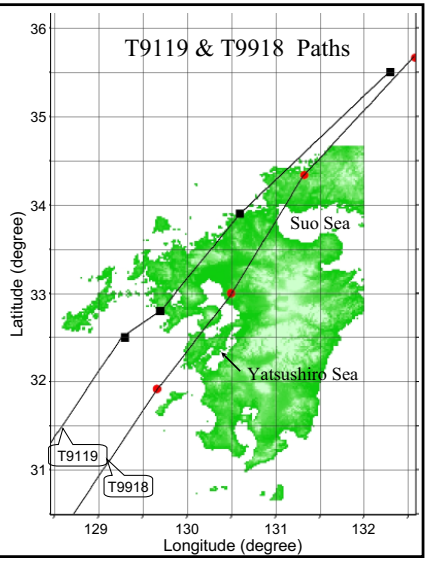


Locations of Yatsushiro Sea and Tide Station

12

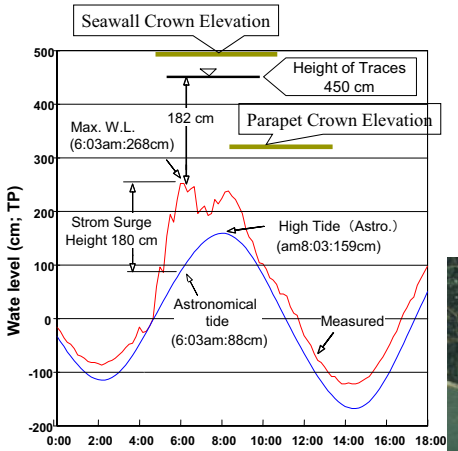
Recent Storm Surge Disasters

	T9119	T9918	
Observed Max. Wind Speed	58.9m/s	66.2m/s	
Storm wind Zone (over 25m/s)	390km	200km	
Strong Wind Zone (over 15m/s)	750km	650km	
Typhoon Record at the Time of Landfall			
Location	Sasebo	Arao	Amakusa
Storm Radius	300km	150km	190km
Central Pressure	940hPa	950hPa	945hPa
Wind Speed	50m /s	40m/s	40m/s
Forward Speed	50km/h	45km/h	35km/h

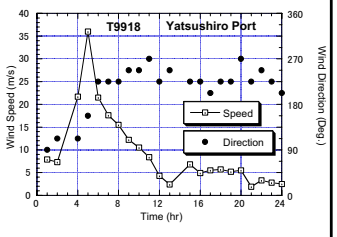


13

Relative Height of Water Level to Defense Structures



Tidal Record at Yatsushiro Port (9/24/99)



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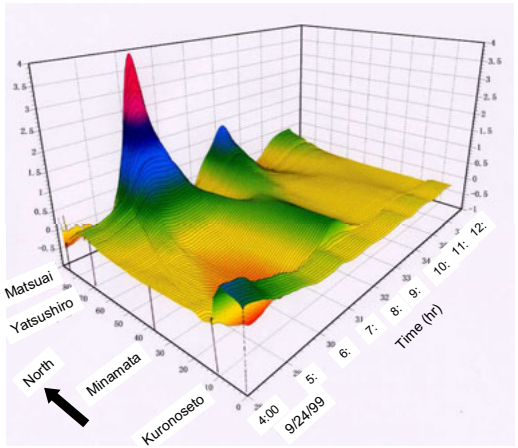


Storm Surge Simulation in the Yatsushiro Sea

Computed by Kumamoto Univ.

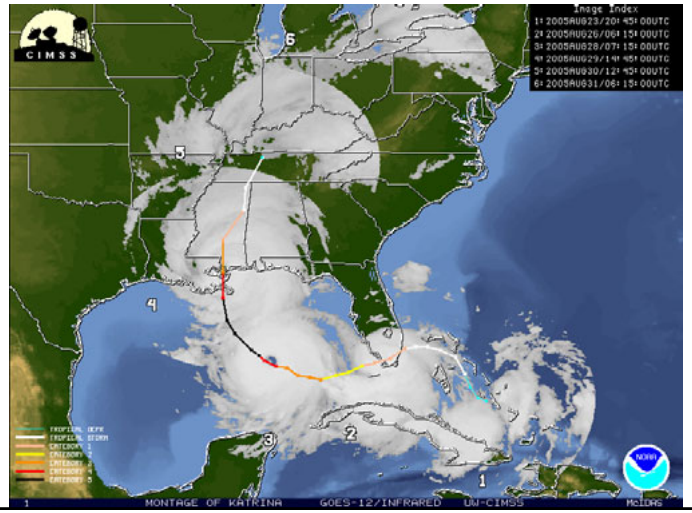
15

Storm Surge Disaster in Matsuai Ward

Photo of the Flooded Area in Matsuai Ward (Kumamoto Daily News、9/25/99)

16

Hurricane Katrina Storm Surge of August 29, '05



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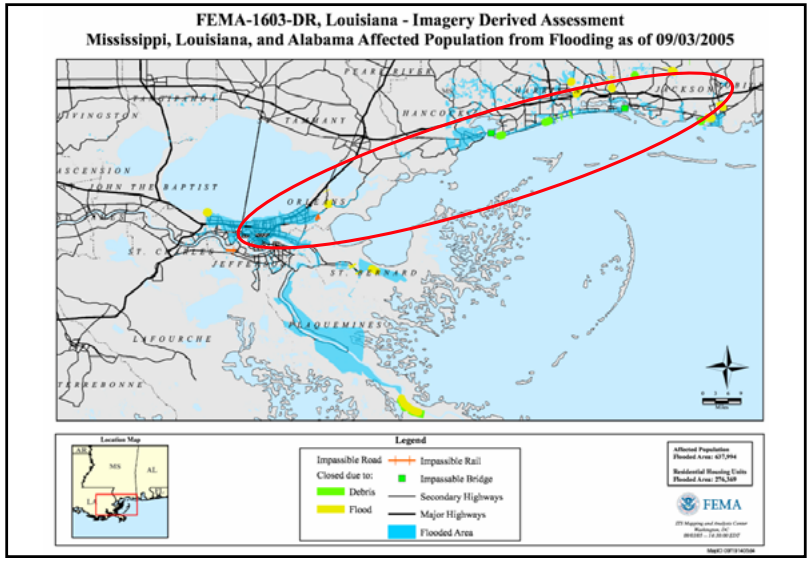
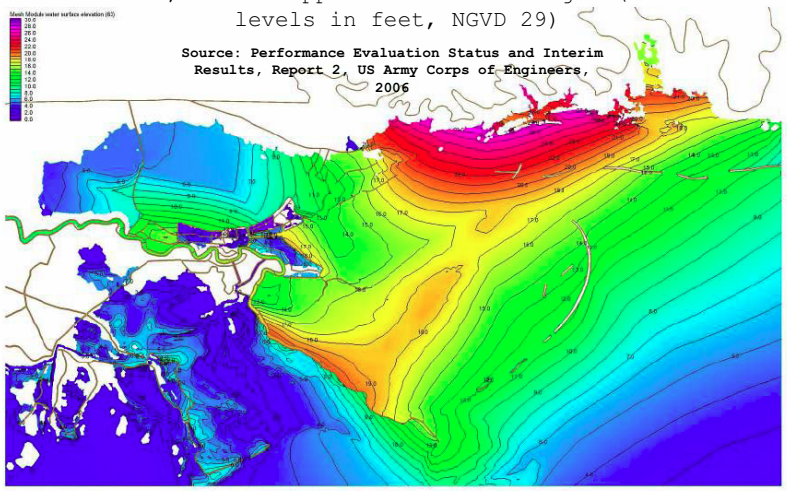


18

TF01 Maximum computed storm surge using the ADCIRC model, Mississippi to Louisiana region(water levels in feet, NGVD 29)

Source: Performance Evaluation Status and Interim Results, Report 2, US Army Corps of Engineers, 2006



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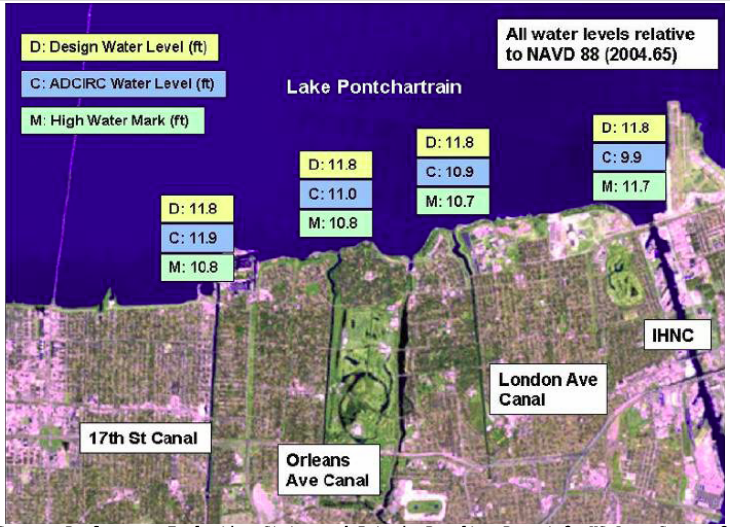

Source: Performance Evaluation Status and Interim Results, Report 2, US Army Corps of Engineers, 2006

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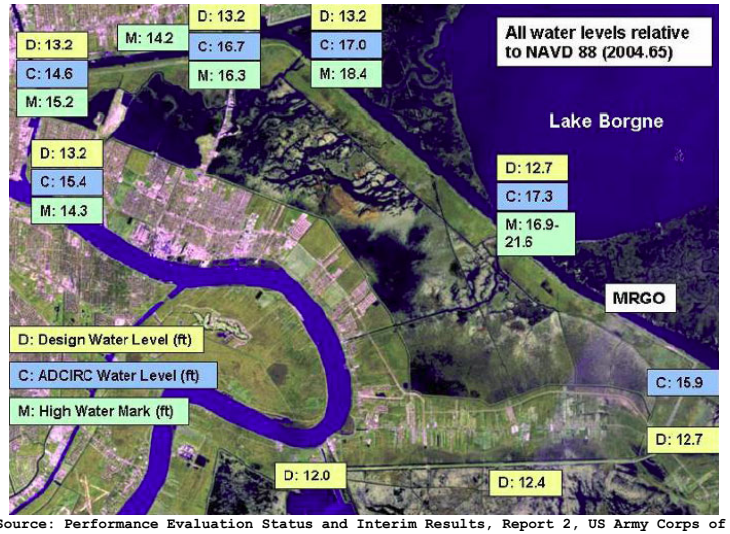

Source: Performance Evaluation Status and Interim Results, Report 2, US Army Corps of Engineers, 2006

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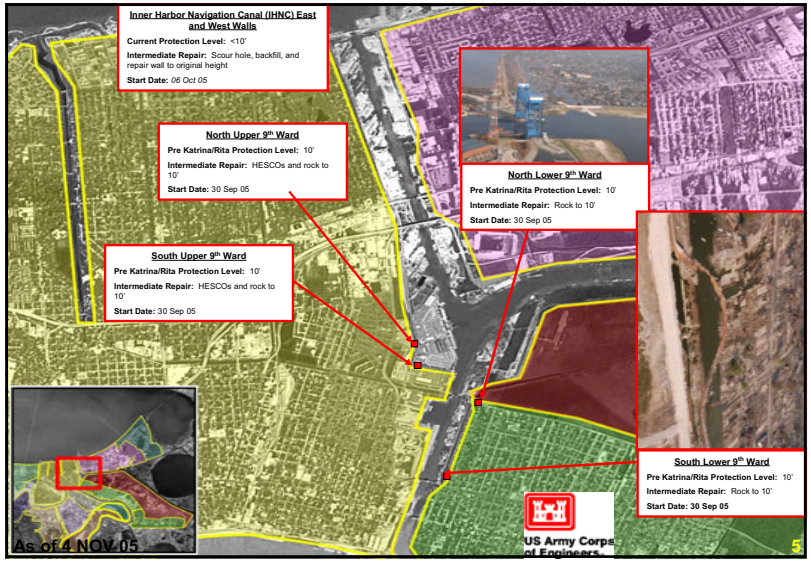


22

Aerial view of the South Breach of the Lower Ninth Ward (L. Harder, October 14, 2005).

Airborne digital imagery of the south breach at the Lower Ninth Ward. Water is shown flowing back into the IHNC. (courtesy NOAA, August 31, 2005).

23

24

25

Risk Management Strategies against Storm Surge

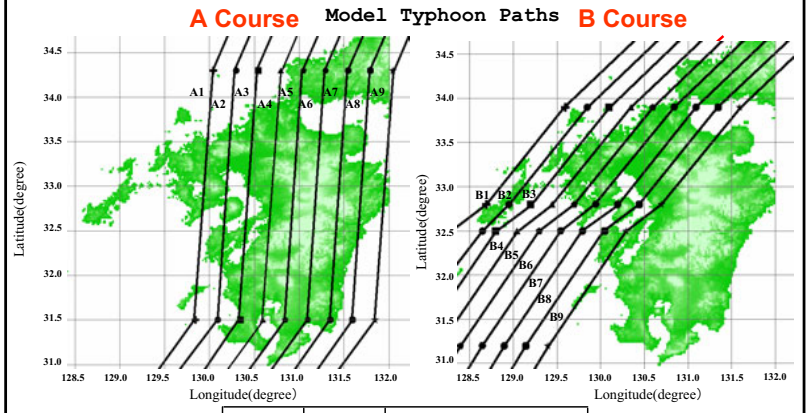
'Hard' Defense Measures **'Soft' Defense Measures**

QuickTimeý Ç²
TIFFÃiLZWÃj éLíÉvÉçÉOÉâÉÃ
Ç™Ç±ÇÃÉsÉNÉ`ÉÉÇ¾â©ÇÉÇ±Ç½Ç…ÇÖÍKóvÇ-ÇÍÃB

Hazard Map
Evacuation System
Public Awareness Education

26

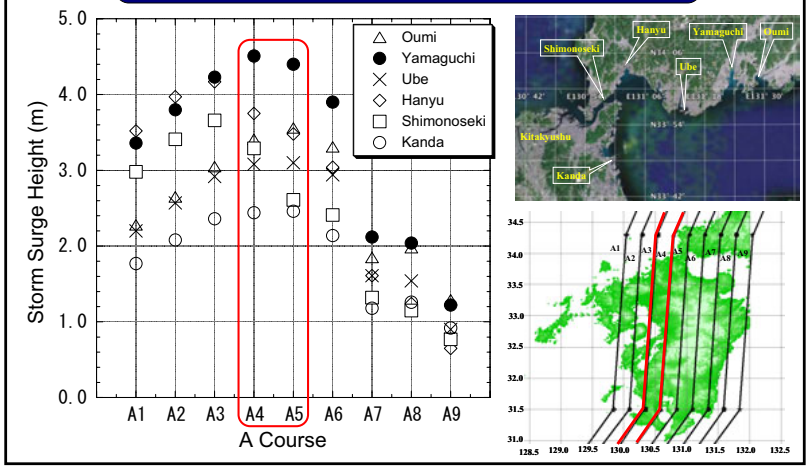
Method for preparation of hazard maps against storm surge



Course	Typhoon	Water Level(m)
A	T8013	Low _Water Level+0.00 (T.P.-2.10m)
B	T9119	

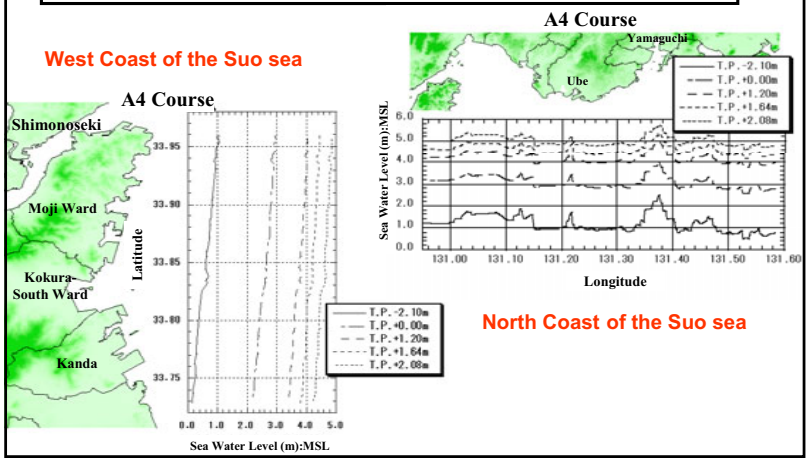
27

Maximum Storm Surge Height at Monitoring Points for A Courses



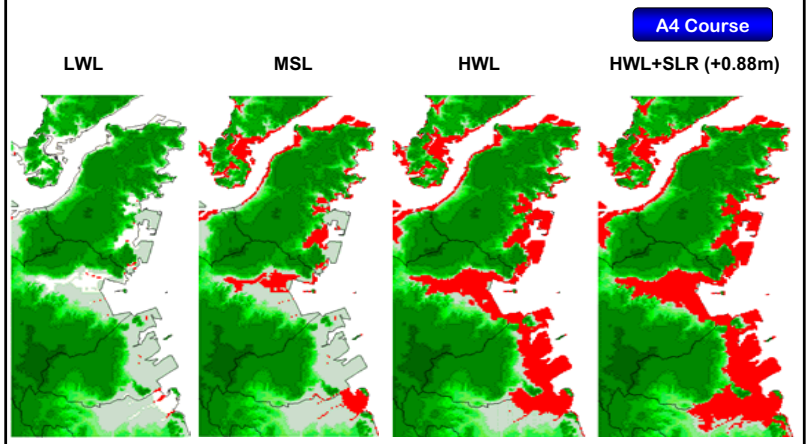
28

Longshore Distribution of Possible Maximum Sea Water Level (Computed Surge + Tide Level) for A Course



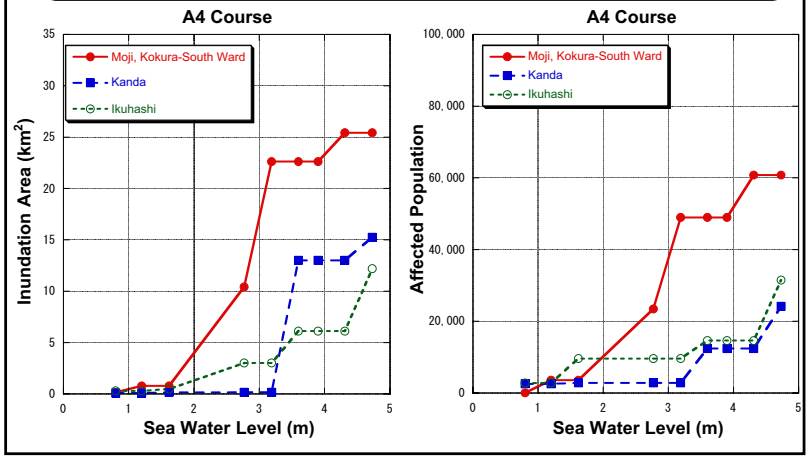
29

Possible Hazard Map by GIS



30

Area and Population Possibly Inundated by Storm Surge and Sea-Level Rise along the West Coast of the Suo Sea



31

Summaries and Lessons Learned

- The development of coastal zones, accompanied with population growth in the Asia-Pacific regions is ever increasing, which in turn pose a significant threat to vulnerability of the Asia-Pacific coastal zones.
- One of the most threatening natural disasters toward coastal vulnerability is storm surge produced by a tropical cyclone, as demonstrated by Hurricane Katrina of 2005 in the USA.
- Steady construction of storm surge defense facilities and inspection of their reliability should be carried in order to ensure inundation prevention according to storm surge defense plans.
- Reducing damage to a minimum requires not only defense efforts of coastal administrators and port facilities managers but also self-protection initiatives of local communities. All the stakeholders should take a comprehensive approach that incorporates city planning, ways of living and individuals' disaster defense actions. The measures against large-scale flooding should focus on the protection of human lives and the continuation or early restoration of social activities.
- State-of-the-art technology comprised of storm surge numerical model and GIS gives a good view of potentially vulnerable areas to storm surge events, providing to local residents valuable information for enhancing their awareness toward coastal vulnerability.

32

Reports of the Off-Sumatra Tsunami

1. Morphology of Andaman Coastal Region, Southern Peninsular Thailand: Before and After 26 December 2004 Tsunami

Phantuwongraj, S. Choowong, M.
Charusiri, P. Charoentitirat, T.
Chutakositkanon, V. Yumuang, S.

Chulalongkorn University, Thailand

The December 26, 2004 tsunami was triggered by a magnitude 9.1-9.3 earthquake along the Indian – Australian subduction zone off the northern coast of Sumatra. Hitting without any warning, the tsunami causing 1000's of fatalities, and huge economic losses in the popular tourist regions of Krabi, Phuket, and Phang-nga Provinces. This event conspires to conceal this hazard from the scientific community especially recovery practices and lesson learnt in geological perspectives. Tsunamis leave unique physical evidence of their impact, including, indications of maximum run-up elevation, maximum inundation height above ground, erosional landforms that affect pre-tsunami topography and abundant sedimentary structures on and within a sediment layer. We measured them all and followed up the recovery particularly in terms of geological concerns until the present day.

Lot of effects were detected, e.g., contamination of soil, surface water and groundwater, shore face sediments moved up onto the land, changes in morphology of inlet/outlet tidal channel, erosion of beach sediment. Erosion was one of clear geological hazards, locally severe, affected sand beaches and tidal inlets. This catastrophic nature of the 2004 tsunami also makes it no surprise that the sedimentation rate in 2004 would vastly exceed the average rate from earlier millennia. Until now, eroded shore face and beach sediments were recovered, but inland eroded channels are slowly returning. This suggests non-equilibrium between marine and fluvial processes. Our observation suggests that beach sediment recovery seems to occur faster than inland channel sedimentation which evidenced by absolute close of channel mouths by huge amount of marine sediments. This may leads to the variation of salinity in channel due to no transmission of fresh water and sea water via tidal inlet/outlet as usual process. The non-balance recovery processes need to pay attention urgently.

In conclusion, geological effects along the Andaman coast of Thailand have been investigated and currently followed up. We attempted to understand the nature of 2004 tsunami behavior with the hope that we, in the future, can infer these geological features to help investigating the paleo-tsunami events in this region.

MORPHOLOGY OF ANDAMAN COASTAL REGION, SOUTHERN PENINSULAR THAILAND: BEFORE AND AFTER 26 DECEMBER 2004 TSUNAMI

PRESENT BY

ASSOC. PROF. PUNYA CHARUSIRI, Ph.D

EATGRU RESEARCH UNIT
DEPARTMENT OF GEOLOGY
FACULTY OF SCIENCE
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ASSIST. PROF. DR. TITIMA CHAROENTITIRAT
DR. VICHAI CHUTAKOSITKANON
DR.KRUAWAN JANKAEW
MR. PITSANUPONG KANJANAPAYONT
ASSIST. PROF. SOMBAT YUMUANG

1

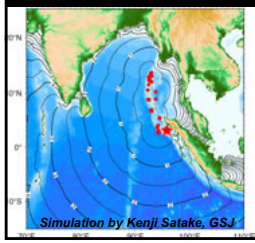
Short summary of 26 December 2004 Tsunami Event in Thailand

2

SEQUENCE OF THE 2004 EVENTS

- Submarine earthquake 9.1-9.3 magnitude, 7.58 a.m. local time.

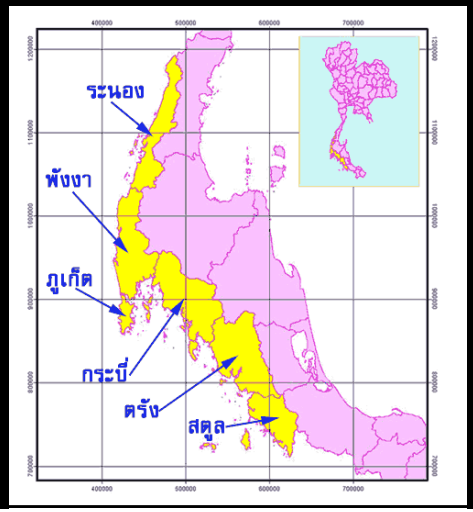
- Tsunami hit Phuket at 9.38 a.m., 10.28 a.m. at Khao Lak, Phang-nga until about 11 a.m. local time.



3

AFFECTED AREAS

- Ranong
- Phang-Nga
- Phuket
- Krabi
- Trang
- Satun



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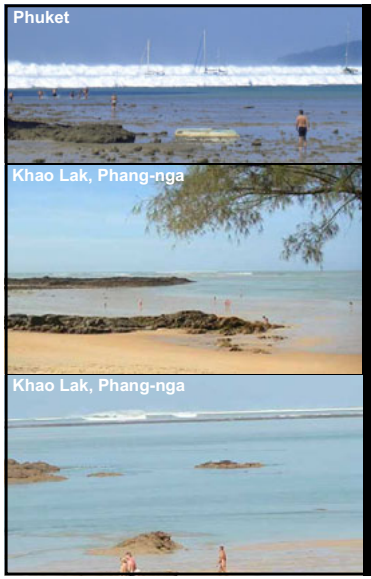


2004 TSUNAMI BEHAVIOR

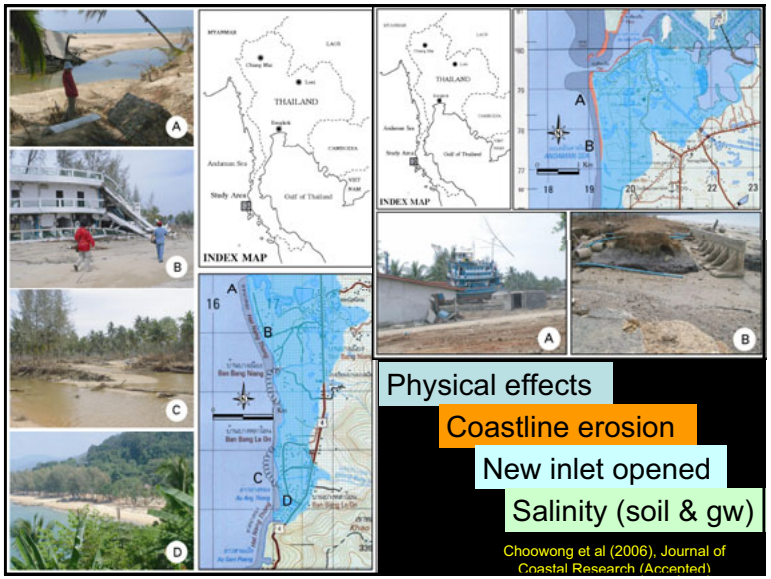
Unusual false ebb or drawdown/withdrawal effect

Emerged submarine exposures e.g., rocks, coral reefs

Drawdown distance depends on shoreface slope, tsunami wave period

Tsunami moving landward somewhat not differs from normal wave

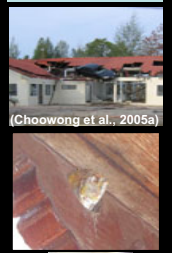
5



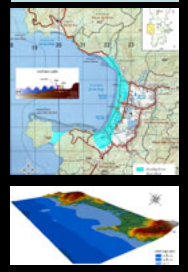
6

Other relevant 26 December 04 tsunami records from the Andaman coast

Wave height



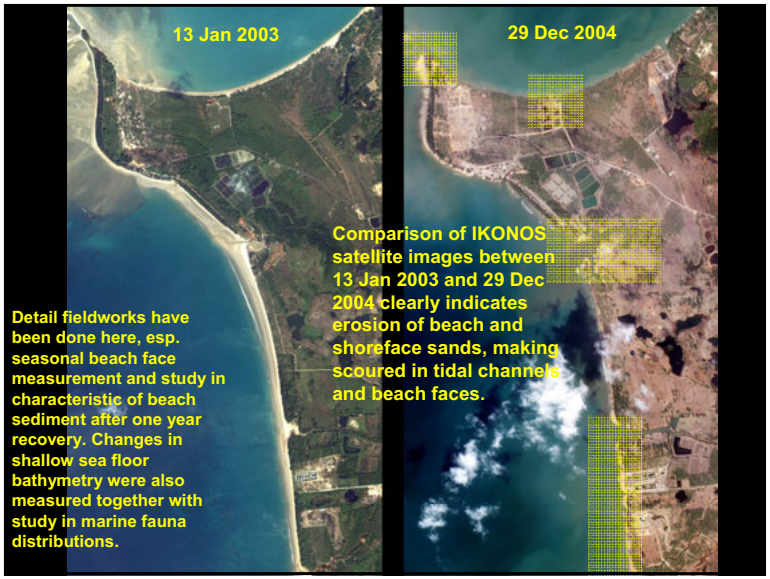
Inundated area



Infrastructures

Eyewitness

7



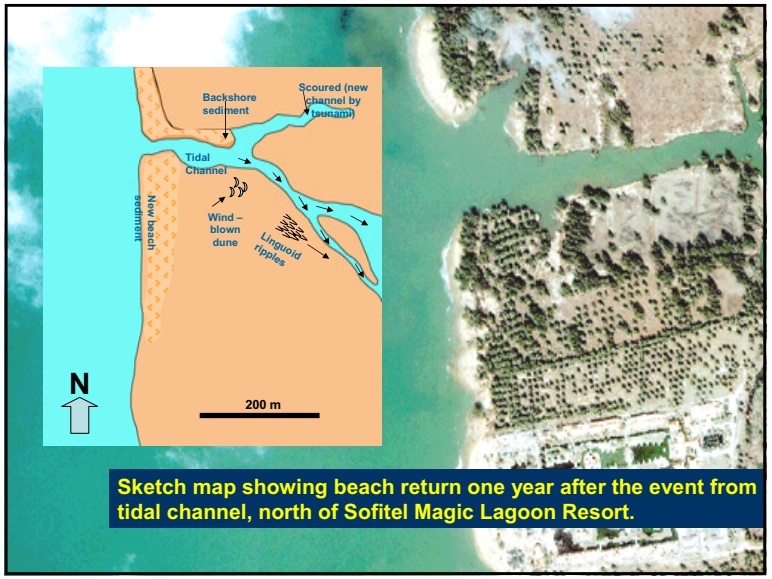
8


Inundation map of Pakarang Cape, Phang-nga, Thailand
Blue Village Pakarang Resort, Phang-Nga, 3 days after tsunami
Before
Small tidal delta and channel banks were opened wider. Parts of tidal, beach, channel sands were brought up to deposit on land.
After
Fine particles suspended during return-flow can still be observed clearly here 3 days after the event.

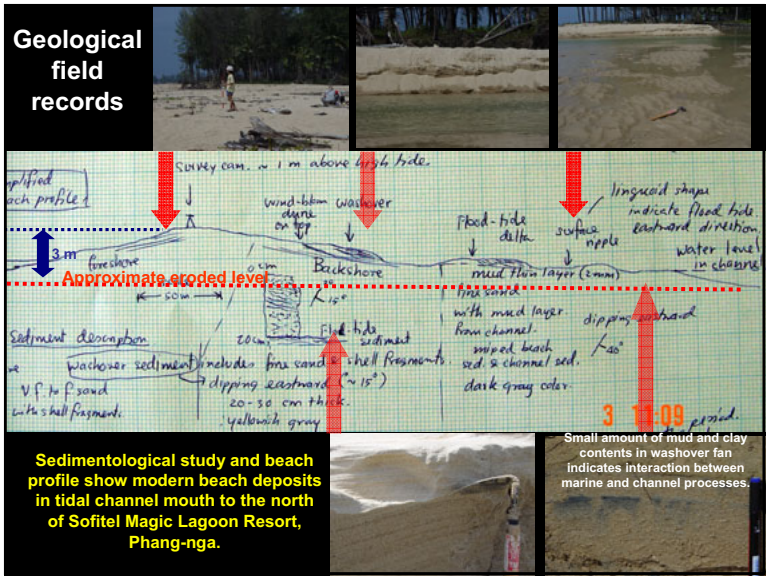
9


Follow up beach recovery from north of Sofitel Magic Lagoon Resort, south of Pakarang Cape
Beach sediments return almost 100 % in one year due to high accommodation space for sediments and very slow inland channel sediment transportation
New backshore sediments
New flood-tidal delta and washover deposits
Private sea wall is constructing
Modern beach deposit
2004 tsunami deposits
However, the 2004 tsunami deposits can be observed beneath modern beach sediments
(Work in progress by Sumet Phunthuwongraj, Master student, Dept.of Geology, Chulalongkorn University)

10

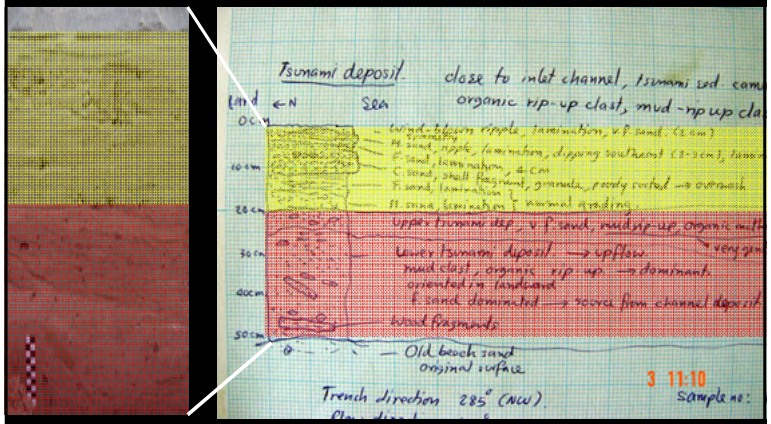

Backshore sediment
Scoured (new channel by tsunami)
Tidal Channel
New beach sediment
Wind – blown dune
Linguloid ripples
N
200 m
Sketch map showing beach return one year after the event from tidal channel, north of Sofitel Magic Lagoon Resort.

11


Geological field records
Approximate eroded level
Sedimentological study and beach profile show modern beach deposits in tidal channel mouth to the north of Sofitel Magic Lagoon Resort, Phang-nga.
Small amount of mud and clay contents in washover fan indicates interaction between marine and channel processes.

12

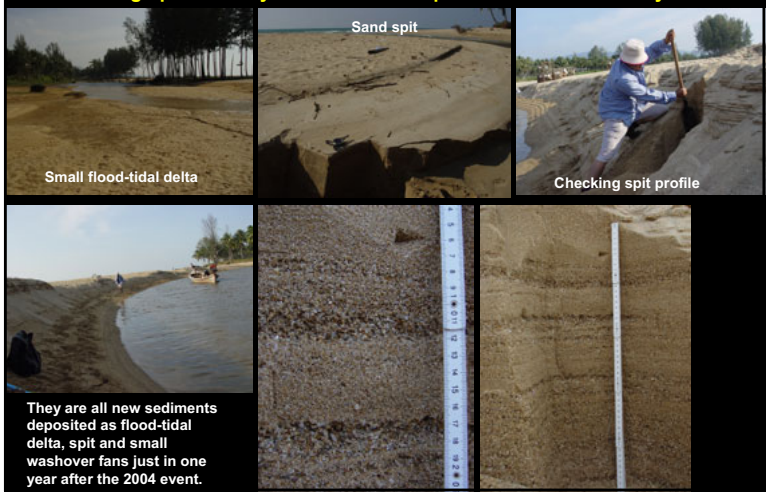
Detail sedimentological description in the field



New coastal beach sands superimpose on the 2004 tsunami deposits recorded from the base of tidal channel in the north of Sofitel Magic Lagoon Resort, Phang-nga.

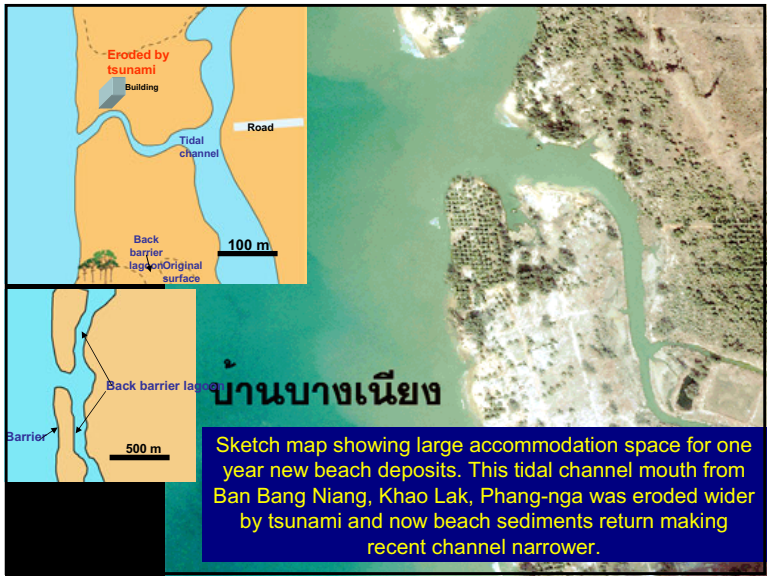
13

Beach sediments are filling up into eroded channel mouth of Khuk Khak area with approx. thickness 3 m from eroded ground surface. Detail stratigraphical study shows several depositional events in one year.



They are all new sediments deposited as flood-tidal delta, spit and small washover fans just in one year after the 2004 event.

14



Sketch map showing large accommodation space for one year new beach deposits. This tidal channel mouth from Ban Bang Niang, Khao Lak, Phang-nga was eroded wider by tsunami and now beach sediments return making recent channel narrower.

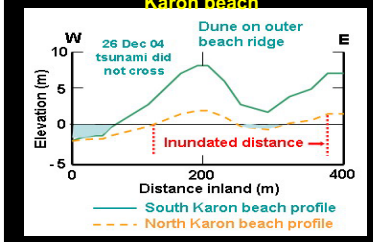
15

Discussion – before tsunami morphology

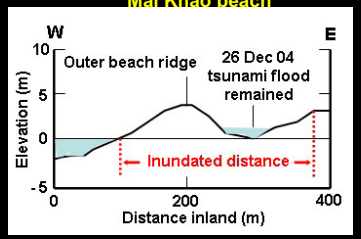
Beach morphology is one of important features to control the power of tsunami, inundated distance, water heights. Therefore, analysis in beach morphology after the 2004 event needs to be done carefully in one particular area or individual beach.

Karon beach, south of Phuket area, is one good example to explain that dune on outer beach can protect tsunami as natural wall, on the other hand, dune from Mai Khao beach, middle part of Phuket cannot protect tsunami wave due to lower in elevation.

Karon beach



Mai Khao beach



(Choowong et al., 2005, manuscript submitted to Journal of Asian Earth Sciences)

16

Discussion – after tsunami morphology

- Beach morphology was changed rapidly by severe erosion. Volume of beach sands, channel sediments was extensively lost from their locations and partly moved up to deposit on land (as called “modern tsunami deposits”).

- Follow up beach morphology and changes in bathymetry after tsunami is necessary and need to be done at least every year.

- Quick beach return leading to non-equilibrium in transformation of sea and fresh water becomes new environmental issue that strongly need a very detail and careful research.

Last slide! This is what we are doing now

17

Keep searching for paleo-tsunami records

Professors from California State University (Fullerton) and
Chulalongkorn University Tsunami Research Team

Thanks for your attention

18

2. Life after the Tsunami for the People of Aceh : Social Aspects

Darusman Bin Muhamad Rusin
Syiah Kuala University, Indonesia

The impacts of the earthquake and tsunami which struck Aceh on 26 December 2004 have created growing concerns by many Aceh people, particularly with regards to social aspects. The entry of international and local NGOs has influenced community behavior. Some people changed their daily activities from being fishers to farmers and businessmen to workers, etc. The social problems which occurred among communities were attributed to (1) weak coordination, (2) unequal distribution of support, (3) landownership, (4) internal competition, (5) high inflation rate, and (6) increased unemployment. It was recorded that the inflation rate in 2005 reached41.11%. Furthermore, social changes occurred possibly because of forced communalism and social interaction in barracks, shelters, tents and other relocation places. Thus, these changes must be analyzed to ensure that the people of Aceh remain self-sufficient and not dependant on external support. Although the 26December 2004 earthquake and tsunami devastated much of Aceh, it has also brought peace for the people of Aceh who have experienced civil conflict for about 30 years.

Life after Tsunami for Aceh People: Social Aspects

Prof. Dr. Darusman, M.Sc.
Syiah Kuala University, Banda Aceh, Indonesia

Asia-Pacific Coasts Session

9 – 12 May 2006, Caen, France

1

Earthquake and Tsunami in December 2004 and March 2005

2

Tsunami Impact:

It demolished houses, schools, hospitals, other public facilities and lives ……

More than 250 000 died/ missing are in Aceh alone…...

3

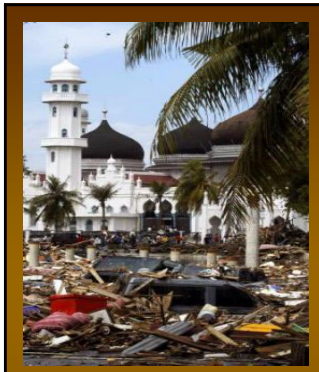
More Children and Women died

4

Collect what they can…

No places to live…

5



Ruins bury cars on main road

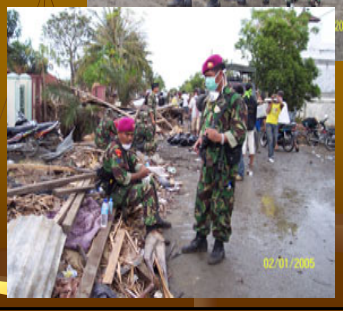
Need plenty of time to remove…

Survivors look for their cars and … other possessions

6

Tsunami Response

- Early Assistance Efforts



7

Transportation to the ruined area could not be reached by road, even communication failed

8

Every day was elapsed: Future plans
412 438 IDPs in 66 locations

9

Every piece of timber is valuable to establish a shelter

Loving much their village some don't want to leave it

10

Emergency clean water supply
foreign aid

11

Government establishes emergency houses for IDPs

A family without father moves from tent to emergency house

12


Debris of brick wall used for writing desk

13

Logistic Procurements

- Mechanism was formed and run in the civil emergency frame work.
- Bakornas, led by vice president coord emergency response
- Bappenas, coord a comprehensive plan for R & R
- Economic Ministry, coord for economic recovery

14

Goods Distribution

- In early stage: representatives of incoming foreign armies were given a guidance
- Tsunami people should follow the additional bureaucracy to obtain food, medicines, tents channeled by army

15

International presence, Assistances and New Problems

- Main task to lift dead bodies and clean debris

- GOI provided logistics supports and transportations

16

Cash for Work

17

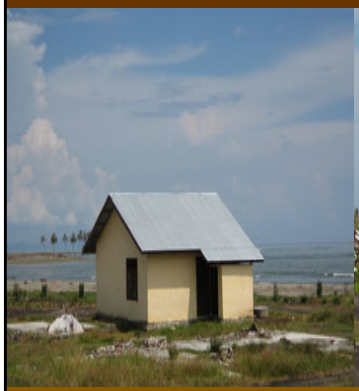
New Problems

- Hidden Agenda: FPI and World help
- Luxuriant and big houses
- Tent people could not afford renting a house to live
- Economic modernization led change in social systems
- Inflation rate 2005 was 41.11% (highest in Indonesia)

18

- International/local NGOs competing to put banners near the entrance areas
- Relocation places located not far from the main streets obtained satisfaction assistances on the contrary
- IDPs move back and forth from original house to barrack caused difficult management
- Barrack provided are far from their original village

19



Houses built near the sea

20

21

22

23

CONCLUSION

- Tsunami has ceased the conflict
- Tsunami has caused socio-economic Aceh people set back.
- In a long run, International supports in term of tech. exch and science will increase cap. Building Aceh people.
- Recovery program requires interdisciplinary/ integrated sectors

24


Give help or need more information please contact:
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Jl. Tgk. Chick Pantekulu No. 5
Darussalam, Banda Aceh 23111
Indonesia
Prof. Dr. Darusman, M.Sc
E-mail: Darus_01@yahoo.com
Cell: 62-08126900587

25

3. Policy of Future Warning Systems

JMSJ Bandara
University of Moratuwa, Sri Lanka

On 26th December 2006, a tsunami hit Sri Lanka in an area where the country was not prepared for such devastation. Many did not even know what a tsunami is. The entire event took place over a three-hour period and different parts of the island suffered damages to varying degrees. Thirteen out of twenty-five administrative districts were affected to some degree, and nearly 35,000 deaths and over 500,000 displaced people were estimated. It is also estimated that nearly 40,000 houses were completely damaged and another 40,000 were partially damaged. Furthermore, a significant proportion of schools, educational institutes, hospitals, water supply schemes, roads and bridges, railway lines, electricity and telecommunication infrastructure, fisheries harbours and tourists hotels were also damaged.

Since the tsunami, the Government of Sri Lanka has organized several initiatives for coordinated effort in disaster management. The parliament selected committee on Natural Disasters recommended immediate revisions to existing legislations on disaster response and management. Enactment of the Sri Lanka Disaster Management Act (Act No. 13 of 2005) was passed by the parliament in May 2005.

Under this act, the National Council for Disaster Management (NCDM) was established. The NDMC is chaired by H.E. President. For operational purposes, a Disaster Management Centre (DMC) was established. In November 2005, a new Ministry was established to function under the cabinet minister; the main objective of this Ministry is Disaster Management. In addition, a Comprehensive Disaster Risk Management (DRM) framework has also been initiated. This framework will coordinate multi-stakeholder efforts. As part of this initiative, the development of a *Road Map, which* focused on seven thematic components, was done by the Disaster Management Centre.

The Disaster Risk Management (DRM) framework consists of the following:

- Policy, Institutional Mandate & Institutional Development;
- Hazard, Vulnerability & Risk Assessment;
- Multi-Hazard Early Warning System;
- Preparedness & Response Plans;
- Mitigation & Integration of Disaster Risk Reduction into Development;
- Community Based Disaster Risk Management; and
- Public Awareness, Education & Training.

An Early Warning System for Sri Lanka is to be developed based on the detection of hazard, assessment of risk, dissemination of the warning and preparedness by the community to respond as advised in advance. There are five working groups in operation to coordinate the development of this early warning system. The first group concentrates on seismic measurements, data collection & exchange. The second is working on sea-level data collection and exchange, including deep ocean tsunami detection instruments. The third focuses on risk assessment. The fourth is working on tsunami hazard identification and characterization, including modeling & prediction. The fifth group coordinates the establishment of a system of inter-operable Centers. The Geological Survey & Ministry Bureau of Sri Lanka has been given the task of improving the seismographic network for the country. A real-time sea level observation network covering the Indian Ocean basin is to be maintained by NARA.

At present, NARA has established three monitoring stations for see level monitoring covering West, East and South. Sri Lanka is closely working with India, Indonesia, Malaysia, Thailand and Australia, who all plan to deploy deep-sea buoys for deep ocean tsunami detection. The establishment of a fully equipped and staffed Early Warning Centre is in progress. At present, the Department of Meteorology will act as the focal point in issuing warnings of an impending disaster


Asia Pacific Forum – EMECS 7 Caen 2006
SRI LANKA
Policy of Future Warning System
Prof. Saman Bandara
10th May 2006

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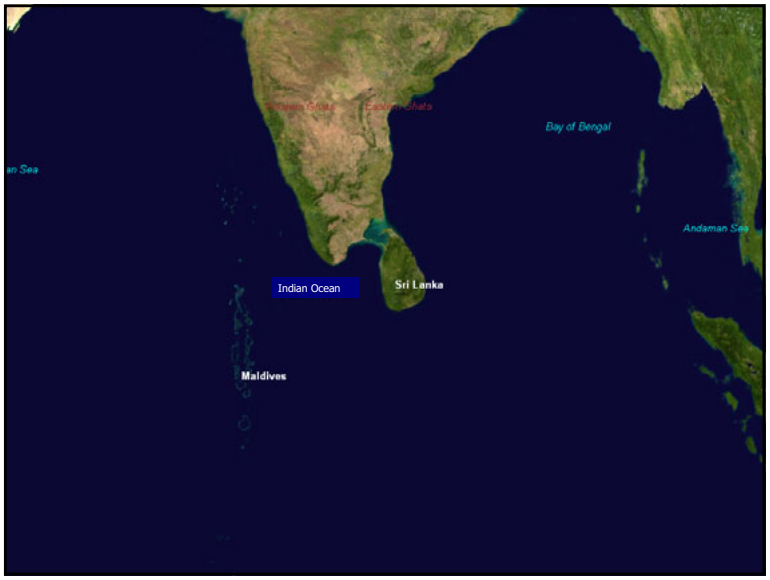
Bay of Bengal
Andaman Sea
Indian Ocean
Sri Lanka
Maldives

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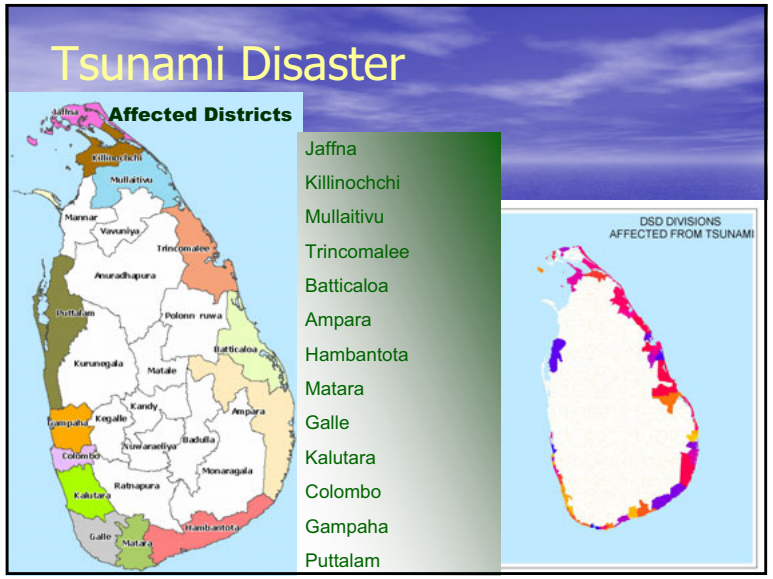
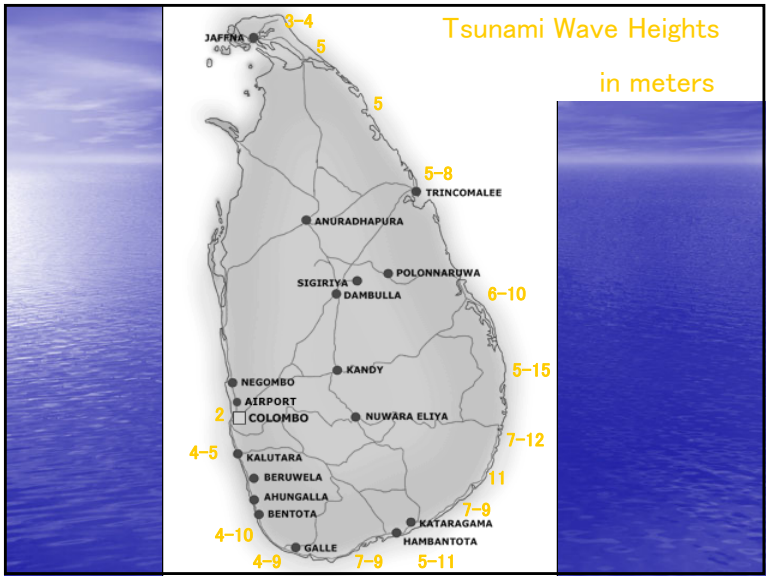

Tsunami Disaster
Affected Districts
Jaffna
Killinochchi
Mullaitivu
Trincomalee
Batticaloa
Ampara
Hambantota
Matara
Galle
Kalutara
Colombo
Gampaha
Puttalam
DSD DIVISIONS
AFFECTED FROM TSUNAMI

3


Tsunami Wave Heights
in meters
JAFFNA
TRINCOMALEE
ANURADHAPURA
POLONNARUWA
SIGIRIYA
DAMBULLA
KANDY
NEGOMBO
AIRPORT
COLOMBO
NUWARA ELIYA
KALUTARA
BERUWELA
AHUNGALLA
BENTOTA
KATARAGAMA
HAMBANTOTA
GALLE
3–4
5
5
5–8
6–10
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5–11

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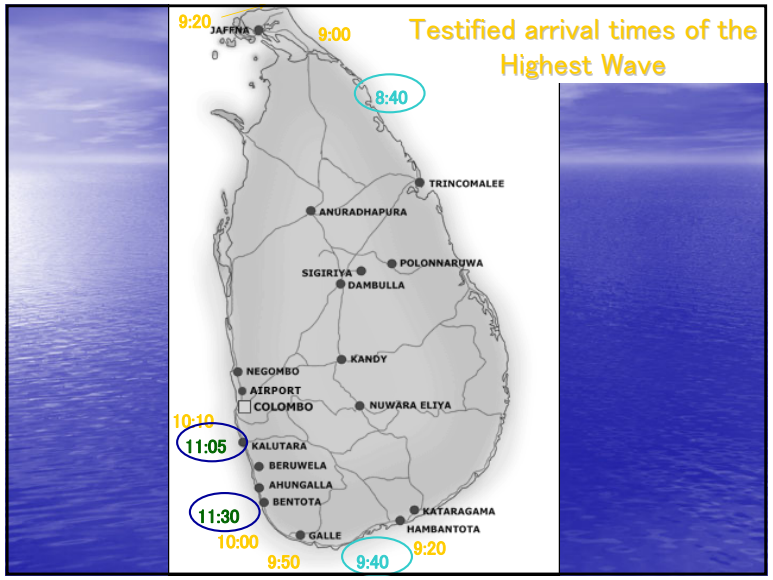


5

Housing

- Completely damaged – 39,560
- Partially damaged & cannot be used – 10,656
- Partially Damaged & can be used – 38,551

6

Livelihood

- Estimated loss of employment – 275,000

7

Water Supply

- 10 pipe borne water schemes damaged
- 50,000 house connections damaged
- Dug wells contaminated with sea water

Source: TAFREN

8

Health

- 72 Hospitals damaged
- 363 facilities such as clinics, dispensaries, offices etc. damaged

Source: TAFREN & UOM

9

Education

- 182 schools damaged
- 98 schools need to be relocated
- 282 schools used as internally displaced person (IDP) camps
- 4 universities partially damaged
- 3 advance technical training institutes & 13 vocational training institutes damaged

10

Fisheries

- 8 fisheries harbors damaged
- About 50 Anchorages damaged
- 15,300 fishing boats damaged

Source: TAFREN

11

Roads & Bridges

- Damages to national roads
- 300 km of Provincial roads
- 1,180 km of local authority roads
- 23 bridges damaged

Source: RDA, TAFREN

12

Railway

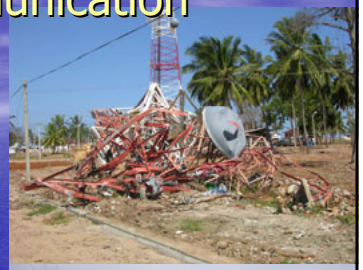
- 160 km of rail track
- 10 railway bridges
- 35 railway stations & 34 sub stations
- 176 km of signaling & communication network

13

Power & Telecommunication

- 6,500 km service lines, 600 km low voltage lines & 50 km medium voltage lines damaged
- 222,660 lost access to electricity
- Many towers & exchanges were damaged
- Service partially or totally affected

Source: TAFREN



14

Tourism

- 84 hotels damaged
- 3553 rooms affected

Source: TAFREN & UOM

15

Government Initiatives

- Parliament select committee on Natural Disasters
- Enactment of Sri Lanka Disaster Management Act - May 2005
- Establishment of National Council for Disaster Management (NCDM)– Chaired by H.E. the President
- Establishment of Disaster Management Centre (DMC)
- Establishment of Ministry of Disaster Management – Nov. 2005

16

Disaster Risk Management (DRM)

- Basis – Sri Lanka Disaster Management Act No. 13 of 2005
- Comprehensive DRM framework to coordinate multi stakeholder efforts
- Development of a *Road Map* focused on seven thematic components

17

DRM Framework

- Policy, Institutional Mandate & Institutional Development
- Hazard, Vulnerability & Risk Assessment
- Multi-Hazard Early Warning System
- Preparedness & Response Plans
- Mitigation & Integration of Disaster Risk Reduction into Development
- Community Based Disaster Risk Management
- Public Awareness, Education & Training

18

Early Warning System for Sri Lanka

Based on

- Detection of hazard
- Assessment of risk
- Dissemination of the warning
- Preparedness by the community to respond as advised in advance

19

Five Working Groups in Operation

- Seismic Measurements, Data Collection & Exchange
- Sea level data collection & exchange, including deep ocean tsunami detection instruments
- Risk Assessment
- Tsunami hazard identification & characterization, including modeling & prediction
- Establishment of a System of Interoperable Centres

20

Future Plan

- An improved seismographic network – GSMB
- A real time sea level observation network covering the Indian Ocean basin – NARA (Now 3 Locations)
- Deep ocean tsunami detection instruments – Working closely with India, Indonesia, Malaysia, Thailand and Australia who plan to deploy deep sea buoys
- Establishment of a fully equipped and staffed Early Warning Centre – At present the Department of Meteorology will act as the focal point in issuing warnings of an impending disaster

21

4. Post-Tsunami Directions for ICM

Poh Poh Wong
National University of Singapore, Singapore

The December 2004, Indian Ocean Tsunami was more than a human disaster with a death toll of more than ¼ million and more than 1.5 million people made homeless; it wrought environmental damage beyond the normal framework of ICM. Part of the human loss is explained by the destruction of coastal ecosystems, e.g. mangroves, coastal dunes, coral reefs. Also, the densely populated settlements were in low-lying areas without adequate setbacks or adequate protection from floods. Unlike the Pacific Ocean, communication networks had not been established, nor had a structure been organized to pass tsunami warnings to the coastal communities.

ICM faces new issues in the post-tsunami period. The most obvious is the substantial loss of land that was previously occupied. The “legal” rights to land was complicated by the loss of documents or the rights that come with squatting or occupying land are now not demonstrable. Conflict intensified between artisanal fishing and the tourism industry with their claims to be near the coast. Generally, the fishers were the losers because of their lower politico-economic clout.

Following the tsunami, the integration in ICM takes on a new meaning; it includes the integration of ecosystem rehabilitation with livelihood restoration. The restoration of the coastal ecosystems, such as mangroves and coral reefs, should now be seen as a process in which the livelihood of the local population is also restored sustainably. The tsunami has introduced a totally new risk to the coastal equations on equity and/or sustainability of land uses, communities, fishers, tourist industry, etc. It becomes necessary for tsunamis and other hazards to be considered in future coastal management plans. All these constitute a paradigm change in tropical ICM, which has not been sufficiently covered in existing principles of ICM from economically advanced countries.

In the long term, there is a need to reduce the vulnerability of coastal communities to natural hazards, including climate change and sea-level rise. Although tsunamis are not part of climate change, they have a bearing on the coping capacity of coastal communities to climate change. Of various approaches, the holistic socio-ecological perspective to examine coastal resilience would be most useful.

A proposal is made to use the Adapting Mosaic Scenario from the Millennium Ecosystem Assessment for evaluating the long-term adaptation of the tsunami-affected communities and coastal ecosystems. This is part of the socio-ecological perspective and to gain new knowledge in adaptation measures and pathways to hazards and climate change.

Post-tsunami directions for ICM

Presented at EMECS7 'Asia-Pacific Coasts Session'
10 May 2006, Caen

Poh Poh Wong
National University of Singapore
geowpp@nus.edu.sg

1

Objectives

- Tsunami of 26 December 2004 : impacts and implications.
- Directions for ICM in Asia-Pacific coasts in the post-tsunami phase.
  - New issues of ICM.
  - Importance of ecosystem rehabilitation and livelihood restoration.
  - Foresee a paradigm change in tropical ICM.
  - Propose evaluation on socio-ecological resilience : integrating ecosystem and socio-economic rehabilitation; adaptation to climate change (SLR) to include tsunamis and other hazards management.

2

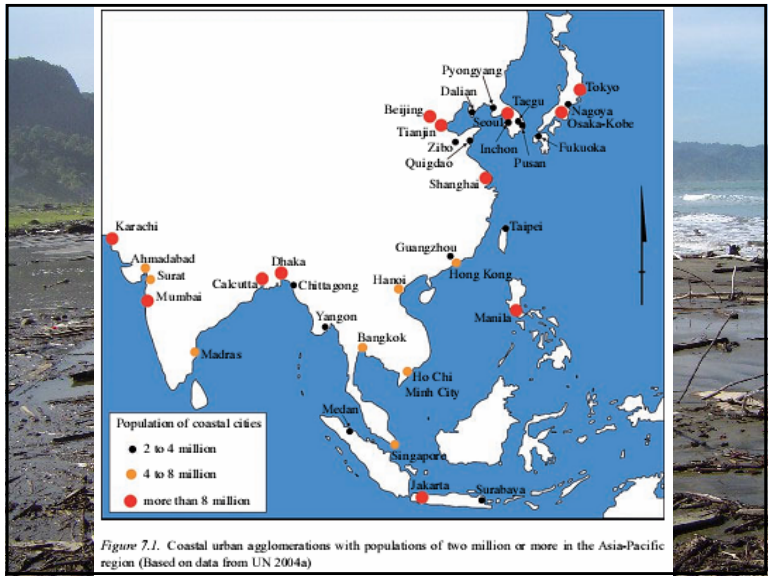


Figure 7.1. Coastal urban agglomerations with populations of two million or more in the Asia-Pacific region (Based on data from UN 2004a)

3

Vulnerability to natural hazards

- Natural hazard : potential threat to humans and their welfare.
- Vulnerability : exposure and susceptibility to losses; also climate change impacts.
- Disaster : realization of a risk.

4

Table 1 Natural disasters in Asian countries and their severity

	Earthquake	Tsunami	Storm surge and tidal wave	Coastline erosion	Flood	Typhoon and cyclone	Landslide	Volcanic eruption	Urban disaster
Japan	◎	◎	○	Serious	○	○	△	○	◎
China	◎	○	◎	Serious	◎	◎	◎	×	◎
Taiwan	◎	○	△	Minor	○	○	◎	×	◎
Vietnam	◎	○	○	Serious	◎	◎	○	×	◎
Thailand	×	×	○	Serious	○	○	△	—	◎
Cambodia	×	—	—	—	◎	×	△	—	×
Myanmar	○	×	×	Minor	○	○	△	—	×
Philippines	◎	◎	◎	Minor	◎	◎	○	◎	◎
Indonesia	◎	◎	△	Serious	◎	×	○	◎	◎
Malaysia	○	△	×	Minor	○	×	△	×	△
India	◎	×	◎	Minor	◎	◎	△	—	◎
Nepal	◎	—	—	—	◎	—	◎	×	○
Bangladesh	×	×	◎	Serious	◎	◎	×	—	◎
Papua New Guinea	○	○	×	Minor	○	—	○	◎	×
Pakistan	◎	×	×	Minor	◎	×	○	×	○

◎ disaster with a death toll of over 10,000 ○ disaster with a death toll of over 1,000 △ disaster with a death toll of over 100
× disaster that rarely occurs
Urban disasters: disaster occurring in cities, including urbanizing disasters, urban-like disasters, and urban disasters.

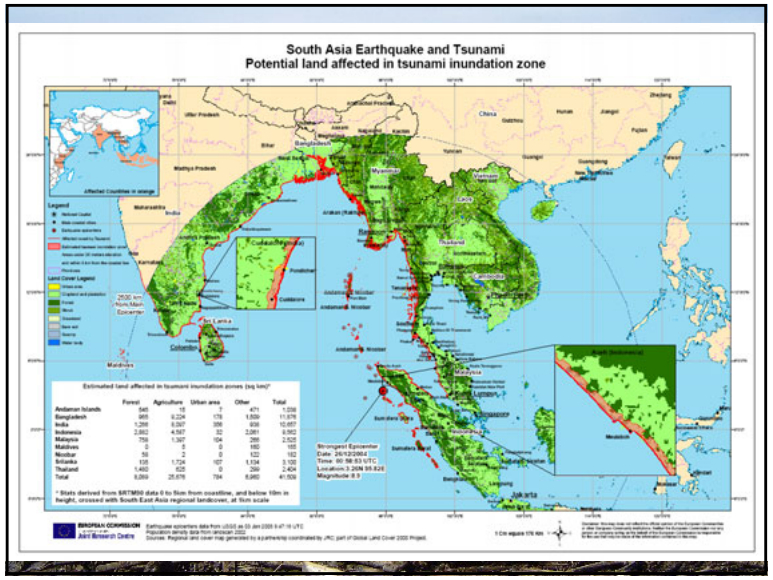
5

26 December 2004 tsunami

- Megathrust earthquake of 9.0 magnitude.
- Time of arrival of tsunami : 15-20 min to reach Sumatra and 2 hr to India/Sri Lanka.
- Wave height :
  - Sumatra : 10-15 m (*30 m)
  - Sri Lanka : 5-10 m
  - Tamil Nadu : 5-6 m
  - Thailand : 3-5 m (*11 m)

Guy Carpenter 2005

6



7

Human impacts : disaster

- Greatest impact and casualties in Indonesia, Thailand, India, Sri Lanka, Malaysia, Myanmar, Maldives and Somalia. Eleven countries reported deaths, some in tens of thousands.
- Death toll has been reported as above ¼ million. An underestimate as thousands are still missing and many more may have been killed in remote islands.
- More than 1.5 million people were left homeless around the region.

8

Main contributing factors

- Destruction of coastal ecosystems, e.g. mangroves, coral reefs, coastal vegetation, coastal dunes.
- High density settlements in low-lying areas without proper protection from floods, etc.
- Structures without adequate buffer zones. No enforcement of building regulations. Particularly in the case of tourist structures.

9

Another crucial factor : no warning

- Tsunami which struck 11 of the nations that border the Indian Ocean was a complete surprise for the people living there, but not for the scientists who are aware of the tectonic interactions in the region.
- Many seismic networks recorded the massive earthquake, but no tide gauges or other wave sensors to provide confirmation as to whether a tsunami had been generated.
- No established communications network or organizational infrastructure to pass a warning of any kind to the coastal communities.

10

Coastal land: issue

- Substantial loss of land in certain coastal sectors, e.g. Aceh, Khao Lak.
- Land previously occupied by users is no longer available.
- 'Legal' rights to land complicated by lack of legal documents or rights that come with squatting/occupying land are not demonstrable.

11

Buffer zones

- Need for two activities to be near the coasts – artisanal fishing and tourist industry.
- Fishers : housed in temporary shelters near the coast or resettled inland. Little or no clout. Socio-cultural issue in India too.
- Tourist industry remains near the coast : some response in terms of construction of walls, add height to backshore, restoration of coastal vegetation belt, etc.

12

Ecosystem rehabilitation + livelihood restoration

- Replant mangroves.
- Corals – fixing substrate, artificial reefs, transplanting corals, coral seeding.
- Restore beaches, coastal dunes, lagoons, etc.
- "Coastal habitat restoration should now be seen as a process in which the livelihood of the local population is also restored sustainably".
- Unlikely that affected population will get back their previous jobs.
- Economic opportunities have to be created after relief efforts.
- One useful development would be livelihood restoration linked to rehabilitation of coastal ecosystems, e.g. cleaning of polluted wells, treatment of soils, growing saplings, reconstruction of cultivated fields, etc.
- Range of construction activities, e.g. for houses, etc.

13

Hazard management within CZM

- Number of countries with CZM; Sri Lanka's CZM considered as model for developing countries.
- Evident that tsunamis were absent from coastal management plans; tsunamis were in the realm of hazard management.
- Imperative that potential tsunamis and other hazards be considered in future coastal management plans.
- Tsunamis introduced a totally new risk to coastal equations on equity and/or sustainability of land uses, communities, fishers, tourist industry, etc.

14

Paradigm change in CZM

- Integration of livelihood restoration and ecosystem rehabilitation, in addition to resolving coastal conflicts, reducing environmental degradation, enforcing setback lines, etc.
- Needed focus on coastal communities and integrate them in recovery of mangroves and coral reefs ecosystems.
- Include tsunamis within CZM.
- Much of existing principles of ICM from economically advanced countries do not cover the above.

15

Reducing vulnerability

- UNEP (Cairo Principles)
- Overarching principle : Reduce vulnerability of coastal communities to natural hazards by establishing a regional early warning system; & applying construction setbacks, greenbelts & other no-build areas in each nation, founded on a science-based mapped 'reference line'.

16

Tsunami and climate change

- Strictly tsunami is not climate-change; not considered in adaptation to climate change literature.
- But tsunami affects coping capacity of coastal communities to climate change.
- Tsunami influences and may well be more important than climate change and SLR in next 100 years; consider the possibility of another tsunami affecting some parts of Indian Ocean countries again; or a tsunami (has happened before) affecting Asian coastlines in Pacific Ocean.
- Thus important to include hazard management to tsunamis within climate change adaptation programme.
- Adaptation to climate change is within framework of ICM.

17

Socio-ecological resilience

Table 1. Examples of local- and regional-scale actions to enhance resilience in social-ecological systems exposed to abrupt change.

Elements of vulnerability	Local action	National and international action
Exposure and sensitivity to hazard	Maintenance and enhancement of ecosystem functions through sustainable use Maintenance of local memory of resource use, learning processes for responding to environmental feedback and social cohesion	Mitigation of human-induced causes of hazard Avoidance of perverse incentives for ecosystem degradation that increase sensitivity to hazards Promotion of early warning networks and structures Enhancement of disaster recovery through appropriate donor response
Adaptive capacity	Diversity in ecological systems Diversity in economic livelihood portfolio Legitimate and inclusive governance structures and social capital	Bridging organizations for integrative responses Horizontal networks in civil society for social learning

Adger et al. 2005

18

Proposal for consideration

- One of four scenarios in MEA, Adapting Mosaic Scenario could be used for tsunami-affected coastal ecosystems and communities.
- Post-tsunami represents opportunity to examine human adaptation.
- Template for certain parameters linking ecosystems and communities.
- Monitor selected sample areas/communities in different countries.
- Implement measures to reduce vulnerability to tsunami and climate change (SLR)

19

New knowledge: examples

- Salinization and impacts on crops and agricultural and rural activities? Economic activities?
- Standard fishing boats on traditional crafts and industries? On fisheries?
- Provision of health facilities on population growth?
- Standardized houses and impact on village landscape and residential/urban growth?
- Christian NGOs activities and impacts on socio-religious milieu of villages? Social issues?
- Adaptation measures and pathways to hazards and to SLR?

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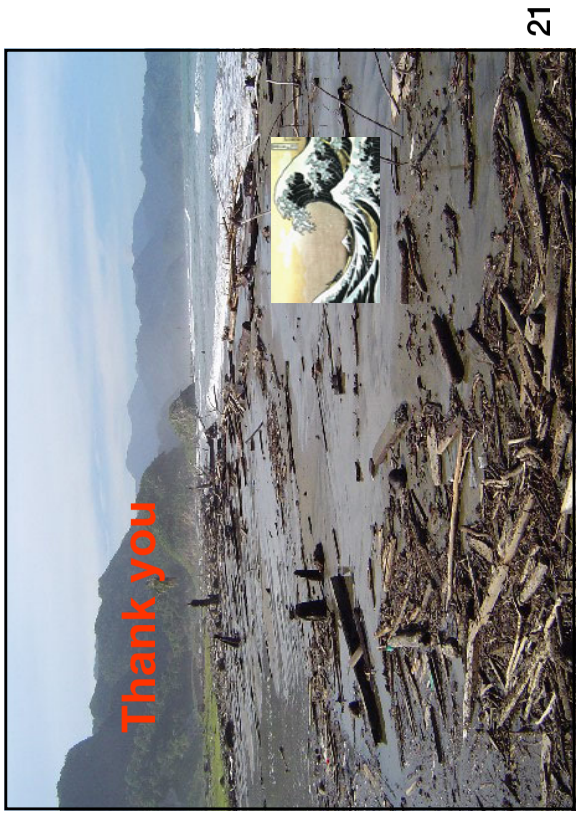
21
Thank you

Report of Recovery Practices and Lessons Learnt

Piamsak Menasveta
Chulalongkorn University, Thailand

The tsunami of 26 December 2004 caused massive damage to villages, towns, and nature along the Andaman Sea Coast of Thailand and left huge numbers of casualties in its wake. People living in these villages and towns lost their loved ones, homes and belongings. Almost everyone was affected both physically and mentally.

Following that disastrous day, many types of recovery efforts were undertaken. For instance, search and rescue, corpse identification, relief efforts, restoration, rehabilitation, research preparedness, and warning systems, were set up.

Scientifically, we observed a significant amount of sand, as much as 2 meters depth, missing from the sea floor in an area at 20 meters off Similan Island. The tsunami not only covered, but also scraped away the seafloor habitat. Run-up height differed from beach to beach, varying from 5 to 20 meters. The run-up height seemed to relate to the bathymetry of coastal areas. Khoa Lak, in Phangna Province, which was hardest hit by the tsunami, had the highest run-up height, around 20 meters. Inundated areas and beach erosion also varied from beach to beach depending on the run-up height and beach slope. The longest water intrusion into the land area was approximately 1500 m in the Khao Lak area.

Interestingly, coral communities were not affected that much. A high percentage of coral damage was found in the deeper water, between depths of 10 to 20 meters. In some locations, in the Similan group of islands, damage to the coral was as much as 30 percent. Most of the coral affected was of a large and massive type, such as table coral. Coral damage in shallow water varied from 0 to 5 percent. Mangrove forests were effective in protecting villages from the tsunami. Villages situated behind mangrove patches suffered less damage.

Many agencies, of various entities, rendered relief efforts to affected areas; the activities included village restoration, provision of occupational facilities and equipment, such as fishing boats and fish cages for raising fish. Students from several universities also took part in relief efforts. The effort made by a group of students at Thale Nok village is used as a case report.
Observations and data, such as the inundated area and wave height, are used for long-term strategies for future protection from tsunamis. Land use and buffer-zone, including retreat distance from the shoreline, are under consideration. However, there is a need to study appropriate legal mechanisms, since most land owners still refuse to retreat.

2004 TSUNAMI: LESSONS LEARNT

Dr. Piamsak Menasveta
mpiamsak@sc.chula.ac.th

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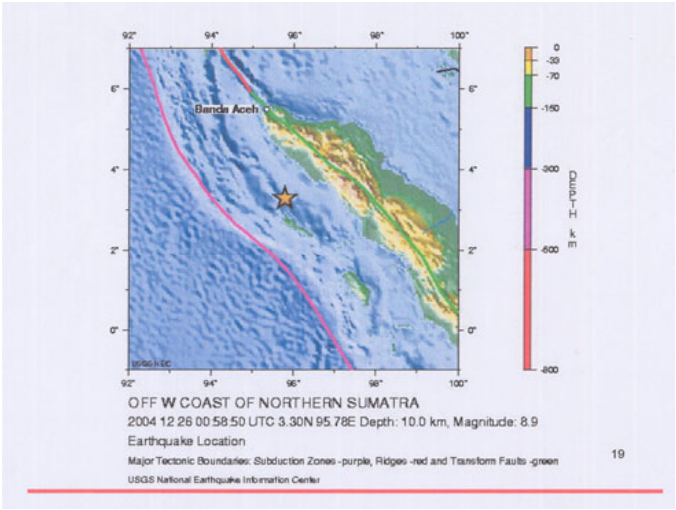

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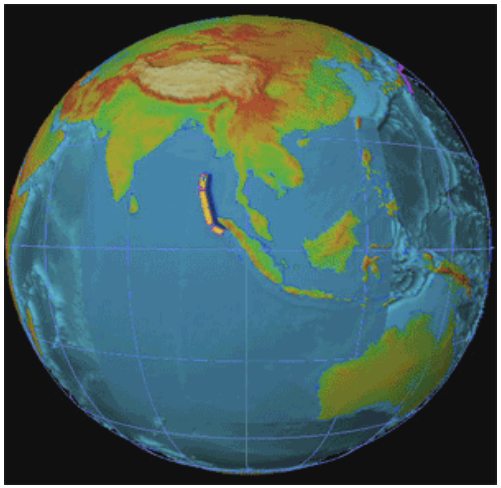

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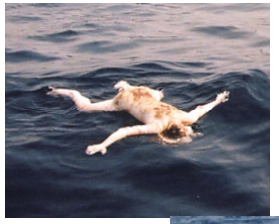

1 January 2005

Somber New Year

4

Photo: Tsunami destruction at Thailand's Khao Lak beach

5

Photo: Death bodies at Thailand's Phuket

6

Photo: Death bodies at Thailand's Phuket

7

Photo: Tsunami aids for disaster victims

8

Photo: Elephants pitch in to clear Tsunami damage

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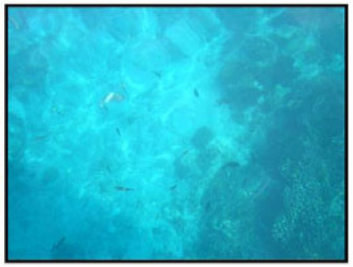

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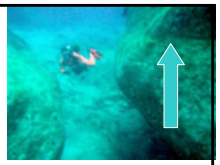
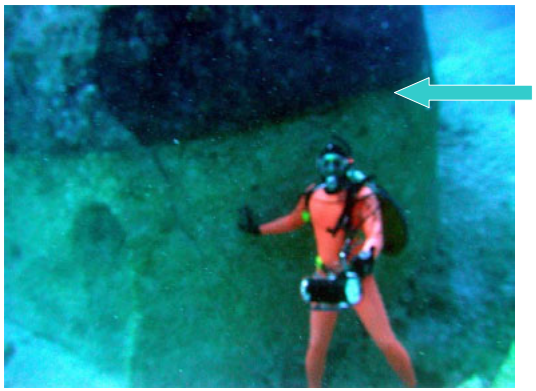
At 30 m depth of water on the seafloor





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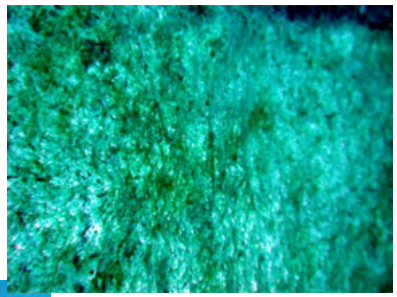
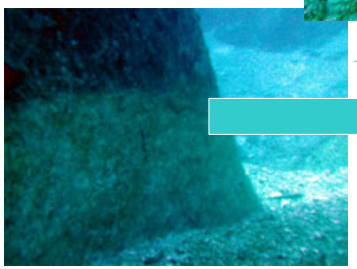
After 1 month





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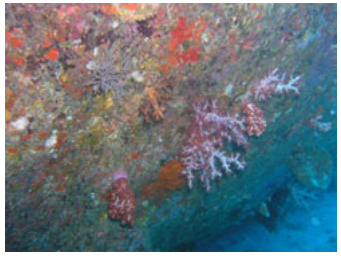

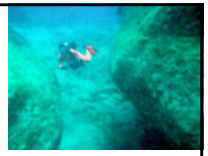

After 10 months

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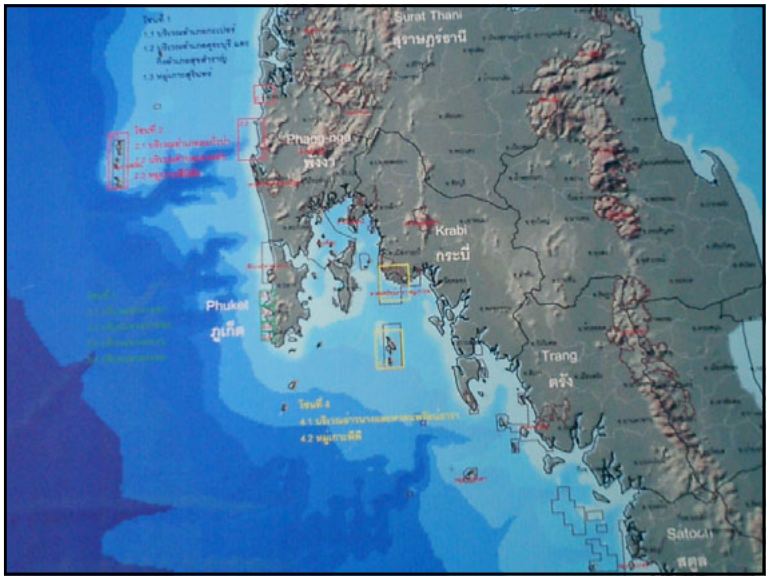

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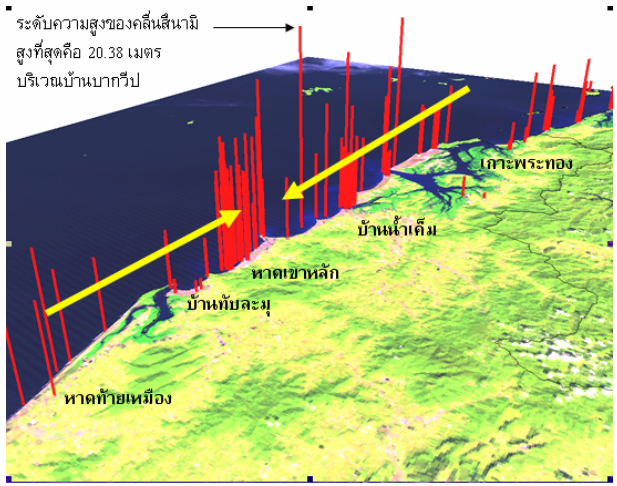

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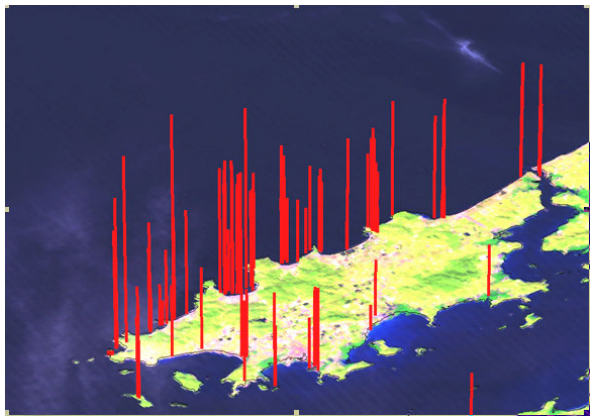

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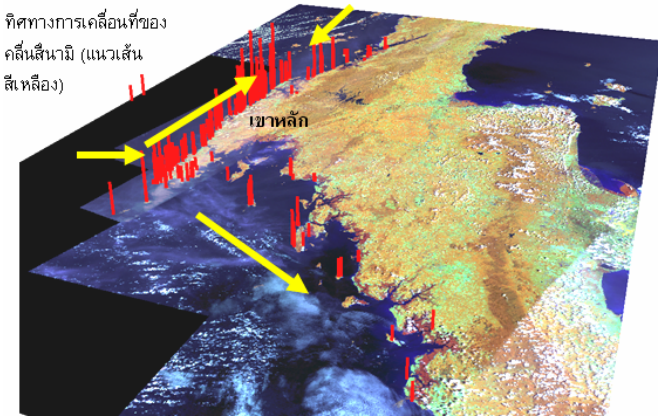
ทิศทางการเคลื่อนที่ของ
คลื่นสึนามิ (แนวเส้น
สีเหลือง)
เขาหลัก

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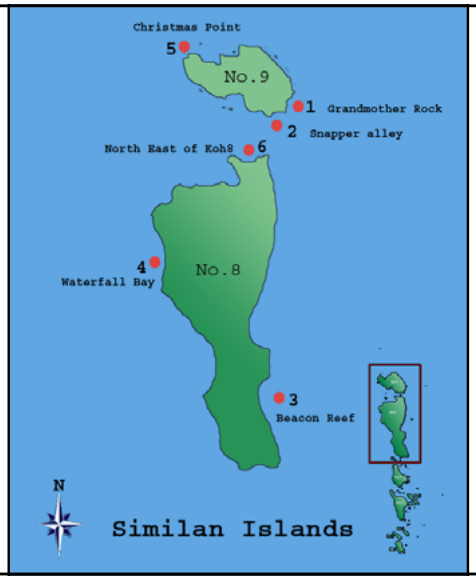
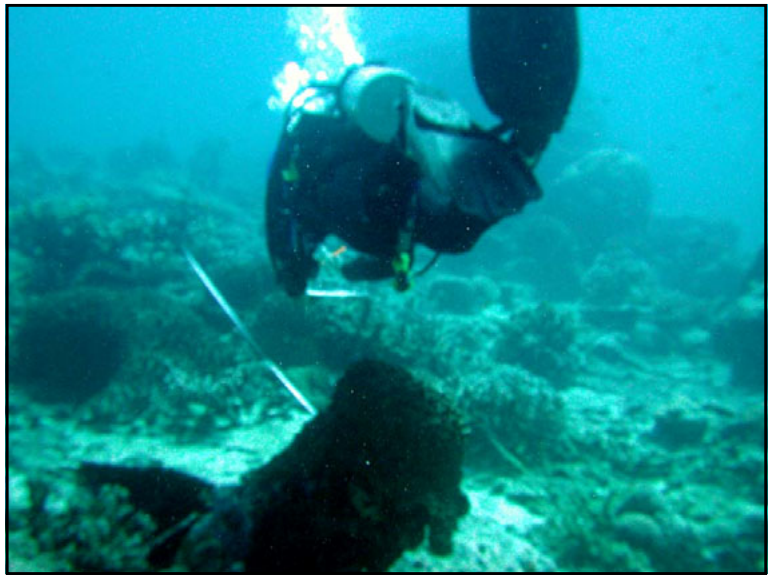

Christmas Point
5
No.9
1 Grandmother Rock
2 Snapper alley
North East of Koh8
6
4
Waterfall Bay
No.8
3
Beacon Reef
N
Similan Islands

18



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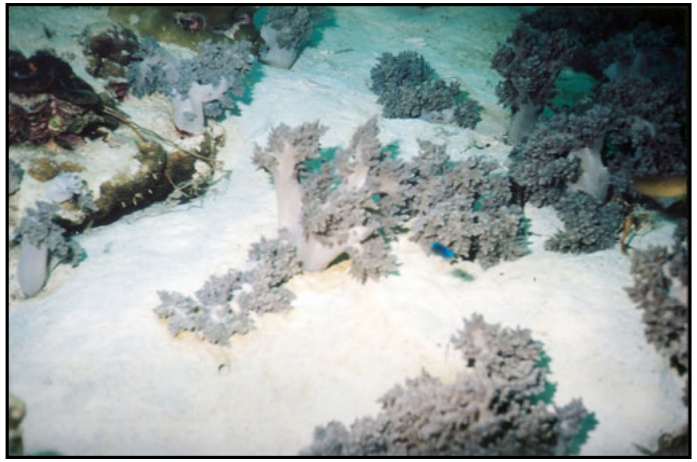

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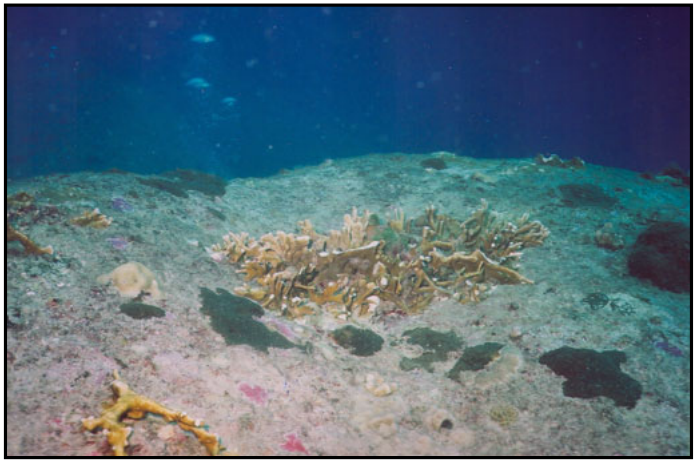
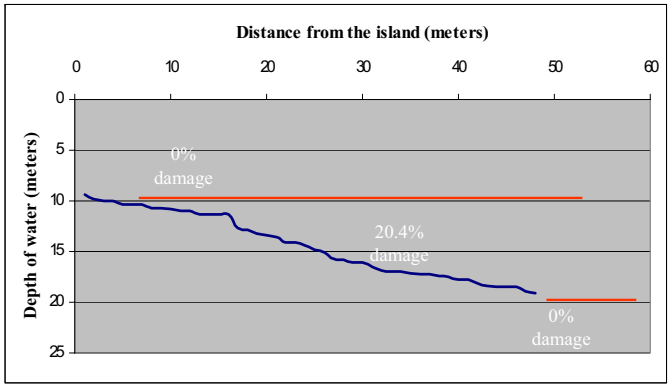


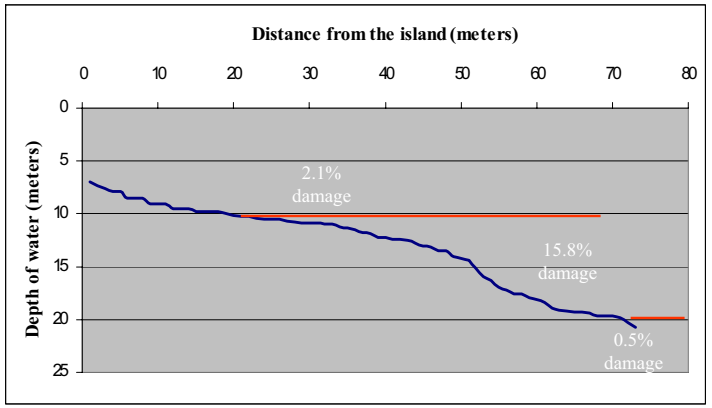
24

Slope of the seafloor at Waterfall and the percent of coral damage



25

Slope of the seafloor at Christmas Point and the percent of coral damage



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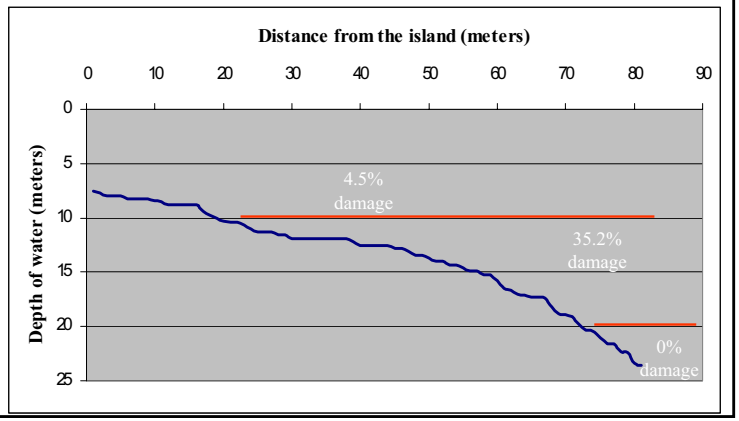
Slope of the seafloor at Snapper Alley and the percent of coral damage



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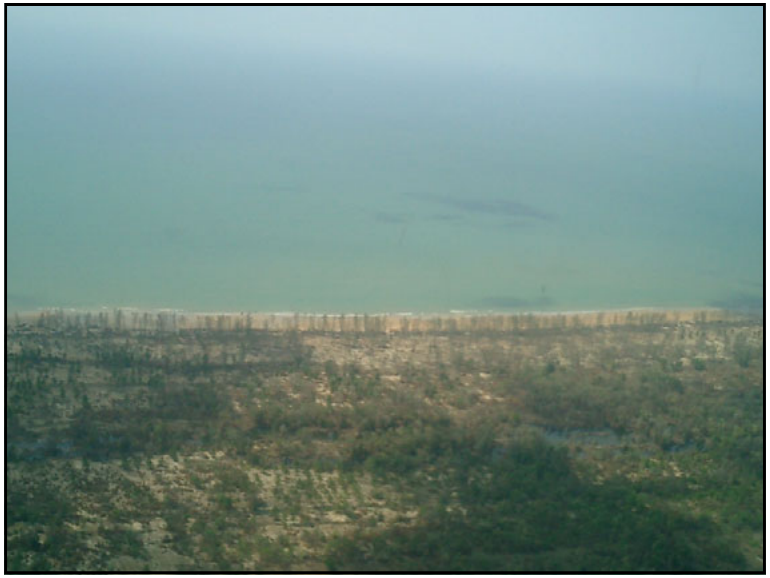

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Science Tsunami Camp

1. Construction Project
2. Villagers-Relations Project
3. Teaching Project
4. Welfare Team

39

40

โครงงาน (โครงก่อสร้าง)

Construction Project

41

โครงสัมพันธ์ชาวบ้าน(โครงสพช)

Villagers-Relations Project

42

โครงสัมพันธ์ชาวบ้าน(โครงสพช.)

Villagers-Relations Project

Attending a wedding ceremony

Making a dessert

43

โครงสัมพันธ์ชาวบ้าน(โครงสพช.)

Singing

44

โครงสัมพันธ์ชาวบ้าน(โครงสพช.)

Dancing, Drama performance

45

โครงสัมพันธ์ชาวบ้าน(โครงสพช.)

Sport, Cooking

46

โครงสอน

Teaching Project

47

โครงสอน
Teaching Project

48

49

โครงสวัสดิการ(โครงสวก.)

Welfare Team

Girls preparing food

50

โครงสวัสดิการ(โครงสวก.)

51

โครงสวัสดิการ(โครงสวก.)

Cooking and eating

52

โครงสวัสดิการ(โครงสวก.)

More cooking

Cloth washing

53

โครงสวัสดิการ(โครงสวก.)

Enjoy eating!

54

Science Tsunami Camp

OTOP Products

55

Science Tsunami Camp

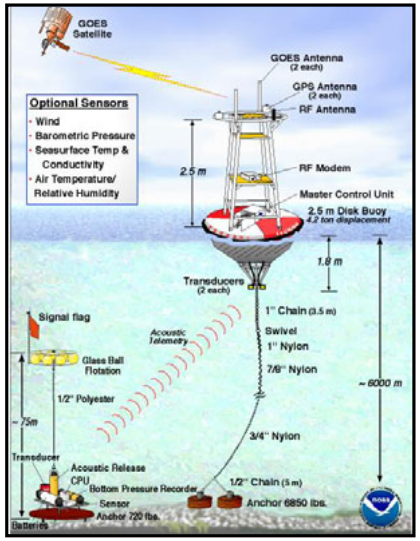
56

57

Thank you very much for your attention

At Baan Thale Nok, Ranong Province

58



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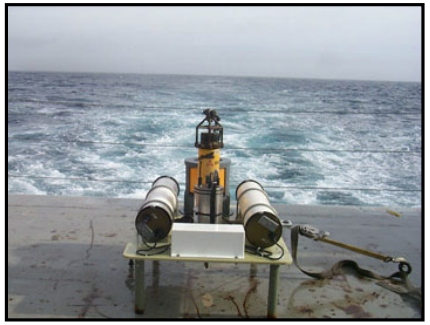

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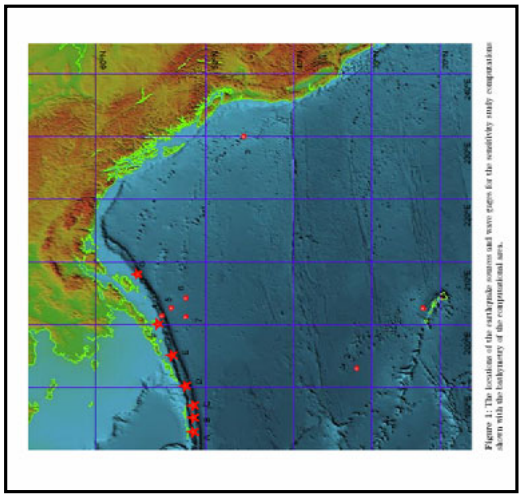


Figure 1: The locations of the earthquake sources and wave gages for the sensitivity study computations shown with the bathymetry of the computational area.

Panel Discussion

Chair : Prof. Nick Havey

Panelist : Prof. JMSJ Bandara Dr. Punya Charusiri Prof. Haruyuki Kojima
Prof. Piamsak Menasveta Dr. Darusman Bin Muhamad Rusin
Prof. Poh Poh Wong

Rapportuer : Prof. Tetsuo Yanagi

During the panel discussion, panelists were asked to elaborate on some points of their presentations. The following points were raised during discussions:

- **Prof. Piamsak Menasveta**, of Thailand, reported that education is essential to disaster preparedness. The necessity of education for disaster defence, particularly in the school environment, is very important.

- **Prof.Darusman Rusin,** of Indonesia, reported that people only struggled to protect their family soon after the tsunami knocked over but baby-boom phenomena occurs in Aceh at the moment.

- **Dr. Punya Charusiri**, of Thailand, emphasized that education is very important regarding Coastal Management. Few fishermen were killed since they had known about the threat of tsunami by word of mouth.

- **Prof. JMSJ Bandara**, of Sri Lanka, mentioned that early warning systems are needed since local people did not have knowledge on tsunami as well as European tourists.

- **Prof. Haruyuki Kojima,** of Japan, reported that counter measures against typhoons will provide good opportunities to cope with tsunami as well since waves caused by typhoons happen more frequently than those of tsunami.

- **Prof. Poh Poh Wong**, of Singapore, described that sea-level rise is a current concern, however it is not as great a threat, in the next 100 years, as tsunamis, caused by earthquake. We must learn how to develop our capacity, particularly in densely populated areas.

-**Prof. Nick Harvey**, of Australia, concluded that coastal zone vulnerability came from population concentration. We must not forget about this tsunami and would have to pay attention to the areas not densely populated like Kiribati as well.

Summary of the Asia-Pacific Coasts Session

Tetsuo Yanagi

During the Closing Plenary
Session of the EMECS 7

The discussion was focused on natural hazards on the coast, particularly tsunamis. It was recognised that soft defense counter-measures, such as hazard maps, evacuation and warning systems, and education are just as important as hard defense measures, such as seawalls, levees, etc. for storm surge vulnerability.

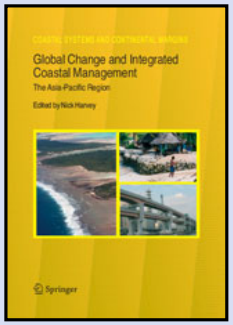
Changes of coastal morphology after tsunami are due to natural phenomena and human activity. So, there is a need for regular monitoring to see how quickly coastal equilibrium is re-established. Therefore, recovery programs require interdisciplinary approaches. For instance, following the tsunami, there is a dependency on external aid and social impacts due to the mechanism of support and the timing and delivery of aid should be taken into account.

On the coast of Sri Lanka, the disaster response mechanism was inadequate and the impact around the Sri Lankan coast variable. The government established the Ministry of Disaster Management in Nov. 2005, which includes disaster warning, disaster management, disaster risk management. Off-Sumatra. the tsunami changed the paradigm of ICZM and many kinds of adaptation measures have become important. Globally, there is a need to adapt to global change over the next 100 years, but the impact from just one tsunami can be great; this provides lessons about vulnerability and capacity to adapt. Also, one must look at both biophysical and socio-economic response. One way is to adopt the MEA Mosaic Scenario. Hard defense counter measure is important, e.g. the deployment of deep sea tsunami gage for the early-warning system. But the soft defense counter measure is more important for the integrated coastal zone management including natural disaster such as storm surge and tsunami.

Introduction of the APN and EMECS Books

Considerable scope for research on global change and coastal management in the Asia-Pacific region

- **New research directions face challenges**
  1. **Research funding**
  2. **Timely and meaningful outcomes**
  3. **Scientific results relevant for policy-makers**
  4. **Political will to act on results**
- **Scientists need to act quickly and communicate results effectively to general public and policy-makers**



- APN Book published June/July 2006
- EMECS Book published December 2006

1

Coastal vulnerability and risk-management in the Asia-Pacific region

Soft defense counter-measures, such as hazard maps, evacuation and warning systems, and education are just as important as hard defense measures, such as seawalls, levees, etc. for storm surge vulnerability.

Photo of the Flooded Area in Matsuai Ward (Kumamoto Daily News. 9/25/99)

2

Morphology of Andaman Coastal Region, Southern Peninsula Thailand: Before and After 26 Dec. 2004 Tsunami

- Changes of coastal morphology after tsunami are due to natural phenomena and human activity.
- There is a need for regular monitoring to see how quickly coastal equilibrium is re-established.

They are all new sediments deposited as flood-tidal delta, spit and small washover fans just in one year after the 2004 event.

3

Life After the Tsunami for the People of Ache: Social Aspect

- Recovery program requires interdisciplinary approaches
- Social impacts due to the mechanism of support and the timing and delivery of aid
- Following the tsunami, there is a dependency on external aid

4

Policy of Future Warning Systems

- **Variable impact around the Sri Lankan coast**
- **Inadequate disaster response mechanism**
- **Government established the Ministry of Disaster Management in Nov. 2005, which includes disaster warning, disaster management, disaster risk management**

5

Post-Tsunami directions for ICM

- Off-Sumatra tsunami changed the paradigm of ICM and many kinds of adaptation measures have become important.
- There is a need to adapt to global change over the next 100 years, but the impact from just one tsunami can be great; this provides lessons about vulnerability and capacity to adapt.
- There is a need to look at both biophysical and socio-economic responses…one way is to adopt the MEA Mosaic Scenario

ICM is a good idea, but difficult if there is no coast to manage!

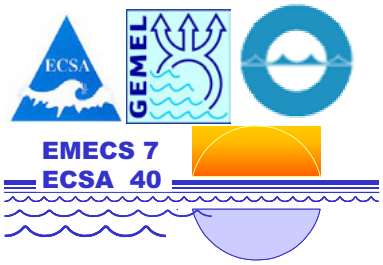
6

Report of Recovery Practices and Lessons Learnt

- Education is essential; lack of knowledge is most critical for the damage of the Off-Sumatra tsunami.
- Monitoring has been continued to clarify the long-term effects of tsunami to the coastal environment.
- There is a need for timely and appropriate warning systems

7

Outline of EMECS7



EMECS 7 / ECSA 40

7th International Conference on the Environmental Management of Enclosed Coastal Seas (EMECS 7)

40th Symposium of the Estuarine and Coastal Science Association (ECSA 40)

Date : May 9 (Tue.) – 12 (Fri.), 2006

Venue: CAEN EXPO-CONGRES,

<Add.> Centre de Congrès, 13, avenue Albert Sorel, BP 6260, 14065 CAEN Cedex 4, France

Tel. (33) 02 31 85 10 20 Fax. (33) 02 31 50 15 12

Main Theme: Sustainable co-development of enclosed coastal seas - Our shared responsibility -

Conference outline:

The seventh EMECS conference and the 40th ECSA Symposium will be built upon the general themes of 'co-development' and 'shared responsibility'. These two themes encompass the philosophy that the environment belongs to all and it follows therefore that we share responsibility for its sustainable use and protection for the benefit of future generations. A key-element is pluridisciplinarity, particularly building bridges between science, education and socio-economics. The main aim is to encourage cross-linkages between education and policy-making, in this case integrating the management of natural resources and environmental awareness cost-effectively through education and by local participation.

Organizers:

=Organizers=

GEMEL (Groupe d'Etude des Milieux Estuariens et Littoraux), ECSA (Estuarine and Coastal Science Association), EMECS (International EMECS Center)

=Co-organizers=

Université of Caen - Basse Normandie, Conseil Régional de Basse Normandie, Conseil Général du Calvados, Ville de Caen, Caen la Mer (Communauté d'agglomération Caennaise), IFREMER, Agence de l'Eau Normandie Seine, Union des Océanographes de France, Asia Pacific Network for global change survey

=Supporters=

UNEP, UNESCO, OECD, MEDCOAST

Languages: English (French) in plenary sessions / English in other sessions

<Program>

Date	Morning	Afternoon	Evening
May 9 (Tue.)	Opening Session (Plenary) Opening Address Keynote Speech Plenary Session : European Coastal Seas	Technical Session 1 (a) Technical Session 2 (a) Poster Viewing Session	Welcome reception
May 10 (Wed.)	**Special Session Ⅰ: Asia-Pacific Coast Session** Special Session Ⅱ: Students and Schools Partnerships (Part A) Technical Session 1 (b) Technical Session 2 (b) Technical Session 3 (a)	Special Session Ⅱ: Students and Schools Partnerships(Part B) Technical Session 1 (c) Technical Session 2 (c) Technical Session 3 (b)	
May 11 (Thur.)	Special Session Ⅱ: Students and Schools Partnerships (Part C) Technical Session 1 (d) Technical Session 3 (c) Technical Session 4 (a) Technical Session 5 (a)	Special Session Ⅱ: Students and Schools Partnerships (Part D) Technical Session 2 (d) Technical Session 3 (d) Technical Session 4 (b) Technical Session 5 (b)	
May 12 (Fri.)	Technical Session 2 (e) Technical Session 3 (e) Technical Session 4 (c)	Round Table Closing Session (Plenary) EMECS Declaration Awards Presentation Announcement of the EMECS 8	

Plenary Session:

*May 9 Opening Ceremony, European Coastal Seas

*May 12 Round Table, Closing Ceremony (EMECS Declaration, Awards Presentation, Announcement of the EMECS 8)

For detailed information on each session, please visit http://www.emecs.or.jp/englishver2/cnference/kaigi_er.html to download the full programme.

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