ICUS REPORT 2010-03

INTERNATIONAL CENTER FOR
URBAN SAFETY ENGINEERING

INSTITUTE OF INDUSTRIAL SCIENCE
THE UNIVERSITY OF TOKYO

Forefront and Challenges of Geospatial Technologies for Environmental and Disaster Management in Southeast Asia

Edited by

Akiyuki Kawasaki
ICUS, IIS, The University of Tokyo, Japan

ISBN4-903661-41-5

Serial Number 48

Forefront and Challenges of Geospatial Technologies for Environmental and Disaster Management in Southeast Asia

27 November 2010
Pathumwan Princess Hotel, Bangkok, Thailand

Organized by

Regional Network Office for Urban Safety (RNUS),
School of Engineering and Technology,
Asian Institute of Technology;
International Center for Urban Safety Engineering (ICUS),
Institute of Industrial Science (IIS), The University of Tokyo;
Chula Unisearch, Chulalongkorn University; and
IIS Alumni Thailand Chapter

In cooperation with

Geo-Informatics and Space Technology
Development Agency (GISTDA);
Remote Sensing and GIS Association of Thailand
(RESGAT);
Japan Society of the Promotion of Science (JSPS),
Bangkok office;
and Japan Aerospace Exploration Agency (JAXA),
Bangkok office

Edited by

Dr. Akiyuki Kawasaki

FOREFRONT AND CHALLENGES OF GEOSPATIAL TECHNOLOGIES FOR ENVIRONMENTAL AND DISASTER MANAGEMENT IN SOUTHEAST ASIA

November 2010

PREFACE

Due to rapid and dynamic changes in economy, society and the environment in the context of globalization and localization, southeast Asia faces many new challenges and opportunities such as political democratization, administrative decentralization and improved governance, regional economic cooperation, trans-boundary resource management and sustainable development, gender bias-free, infectious diseases prevention, and disaster preparedness and response.

Among these many critical issues, consideration of the environment and disaster is drastically increasing in the region due to record flooding and draughts in recent years – especially in the Lower Mekong River basin.

At the same time, the potential of geospatial technologies such as Geographic Information System (GIS) and Remote Sensing as promising tools for integrated environmental and disaster information management and analysis is increasing. Remote Sensing allows us to evaluate and understand the status of environment and disaster in near-real time with wide coverage at multiple scales, and GIS allows rapid arrangement of geospatial data infrastructure and comprehensive analyses of various kinds of data at a local level.

To address the raise of public awareness to these issues, a half-day symposium, "Forefront and Challenges of Geospatial Technologies for Environment and Disaster Management in Southeast Asia," was held at the Phatumwan Princess Hotel, Bangkok, Thailand, on November 27, 2010. This symposium was co-organized by the International Center for Urban Safety Engineering (ICUS), Institute of Industrial Science (IIS), the University of Tokyo; the Regional Network Office for Urban Safety (RNUS), Asian Institute of Technology (AIT); Chula Unisearch, Chulalongkorn University; and IIS Alumni Thailand Chapter.

The objectives of this symposium were:

- To understand critical environmental and disaster problems in Southeast Asia
- To share and exchange knowledge, information and opinions among geospatial researchers, practitioners, and decision-makers.
- To discuss forefront and challenges of geospatial technologies for solving problems

In this symposium, we invited eight distinguished speakers in the field of geospatial technologies, environmental and disaster management from Thailand and Japan. Unfortunately, Prof. Haruo Sawada from ICUS, IIS, The University of Tokyo had to cancel his presentation due to a sudden health problem.

Overall, the symposium was completed successfully, with interesting, informative and exciting presentations and lively questions and discussions. We also obtained many positive evaluations through the questionnaire sheets answered by the participants. We hope this symposium contributed to promoting information exchange, mutual communication and understanding and research collaboration among universities, institutes, and private sectors in Thailand and Japan.

Finally, we appreciate the University of Tokyo's Institute of Industrial Science (IIS) Alumni Association for financially supporting this symposium as a pre-event of the 4th IIS Alumni Thailand Chapter party held at the same date.

Akiyuki KAWASAKI,

Table of Contents

SYMPOSIUM SUMMARY

November 27th, 2010

The International Center for Urban Safety Engineering (ICUS), the University of Tokyo, and the Regional Network Office for Urban Safety (RNUS), AIT organized a seminar titled "**Forefront and Challenging Geospatial Technologies for Environment and Disaster Management in Southeast Asia**" at Pathumwan Princess Hotel (Room Jamjuree Ballroom A) on November 27, 2010.

The seminar was held in half-day with eight distinguished speakers. The seminar was inaugurated by Dr. Akiyuki Kawasaki, Regional Network Office for Urban Safety (RNUS), and followed by the welcome and opening speech by Dr. Suvit Vibulsresth, National Research Council of Thailand, and member of IAA.

The speakers consists of Prof. Yoshifumi Yasuoka (Executive Director, National Institute of Environmental Studies, Japan); Dr. Anond Snidvongs (Acting Executive Director, Geoinformatics and Space Technology Development Agency (GISTDA); Mr. Shinichi Mizumoto (Director, Japan Aerospace Exploration Agency (JAXA); Assoc. Prof. Dr. Wataru Takeuchi (Director, JSPS Bangkok office and IIS, The University of Tokyo); Dr. Nitin Kumar Tripathi (Director, UNIGIS, AIT); Prof. Kimiro Meguro (Director, ICUS, IIS, The University of Tokyo); and Assoc. Prof. Dr. Charat Mongkolsawat (President, Remote Sensing and GIS Association of Thailand (RESGAT).

Among about 140 participants, 114 audiences retuned the questionnaire sheet to the secretariat, and their replies were as follows:

The list of the organizations in which total 114 audiences attended the seminar:

Organization	Number of audience
University	***47***
AIT	17
Chulalongkorn University	10
Srinakharinwirot University	7
Burapha University	3
Mahidol University	3
King Mongkut's Institute of Technology	2

Mahanakorn University	2
International Maritime Collage	1
Khon Kaen University	1
Prince of Songkla University	1
Thai Government	***49***
GISTDA (Geo-Informatics and Space Technology Development Agency)	12
Royal Irrigation Department	11
Department of Alternative Energy Development and Efficiency	3
Department of Public Works and Town & Country Planning	3
Office of Natural Calamity and Agricultural Risk Prevention	3
Department of Groundwater Resources	2
Department of National Park, Wildlife and Plant Conservation	2
Hydro and Agro Informatics Institute	2
Land Management Office	2
Navy Hydrographic Department	2
Bureau of Royal Rainmaking and Agricultural Aviation	1
Department of Drainage and Sewerage	1
Department of Mineral Resource	1
Electricity Generating Authority of Thailand	1
Office of the Public Sector Development Commission	1
Royal Thai Survey Department	1
Water Resource Engineering	1
Private sector	***13***
ASDECON Corporation Co., ltd	4

Panya Consultant Co., Ltd	2
ATP Consultant Co., ltd	1
Chevron Thailand	1
Design Div. Public Work	1
ESIRT	1
Picito Co., Ltd	1
Team Consulting Engineering and Management Co., Ltd	1
The Environmental Research and Training Center	1
International or foreign organization	***5***
JAXA (Japan Aerospace Exploration Agency)	3
JICA (Japan International Cooperation Agency)	1
UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific)	1

Additional desired seminar topics:

JSPS

- JSPS and its activities with Thailand
- Role of JSPS ban

Environmental

- Environmental impact prediction
- Strategy for Environmental Policy
- Health & environment

Tsunami

- Development of Tsunami Disaster mitigation system considering the characteristics of Indian ocean region
- Development of Tsunami disaster mitigation system

Climate

- Community-based climate centers
- Effect from climate change
- Data Sharing and Climate Change Research
- Water management under climate change in the future
- Adaptation in climate change
- Global climate change: impacts & mitigation
- Community based climate centers
- Scientific prediction of climate change phenomenon

- Monitoring modeling and assessment of climate variability in higher mountain

Flood water
- Geo spatial planning for flood water retention site
- Approaches to identifying areas at risk of rough and flood over Northeast Thai
- Flood disaster in 2010 and the west

GIS
- GIS and MIS Application for groundwater management
- GIS for traffic management
- GIT for rural urban linkage

Disaster
- Disaster mgt. Warming prevention
- Mitigations of Disaster
- Protection and monitoring in disaster

Other
- Applying of Historical data matching
- Coastal and Ocean data observation techniques
- Change detection forest
- Approaches to identifying areas at risk
- Should have more than study area in southeast Asia
- Applications in rural development
- Application of lease on land for civilization

Comments:

Time management
- Some speaker don't care about their time frame of presentation
- Too much packed schedule what discouraged the frequently asking of questions to the presenters
- The duration was too short

Venue
- Should have covered other aspects such as rural development application
- I insist for further continuity of such seminars for technology transfer and update recent developments in the area of geo-information
- complement and application
- real case, real time
- Very good seminar in field of disaster management.

Contents
- The room with 2 big columns blocking the audience
- Vision obstruction

- The conference room is not suitable for meeting.
- May consider other room

Other

- Promoting of research may be done actively by travelling to university in the area. All university would be appreciate to cooperate
- The promotion may be done in government unit or agencies.
- Overall it was a nice arrangement
- Overall the event was very well-organized

Welcome board

ICUS & RNUS booth

JSPS booth

JAXA booth

Registration

Welcome participant

Opening ceremony (Dr. Akiyuki Kawasaki)

Dr. Suvit Vibulsresth

Prof. Yoshifumi Yasuoka

Dr. Anond Snidvongs

Mr. Shinichi Mizumoto

Dr. Wataru Takeuchi

Dr. Nitin Kumar Tripathi

Prof. Kimiro Meguro

Dr. Charat Mongkolsawat

Participants

After-seminar: Alumni Party

Thank you present for Dr. Suvit

Thank you present for Dr. Nitin

Thank you present for Dr. Charat

Alumni Party Group Photo

Overview of Space Technology Development in Thailand

Dr. Suvit Vibulsresth

OVERVIEW OF SPACE TECHNOLOGY DEVELOPMENT IN THAILAND

SUVIT VIBULSRESTH
Former Executive Director, GISTDA
suvit@gistda.or.th

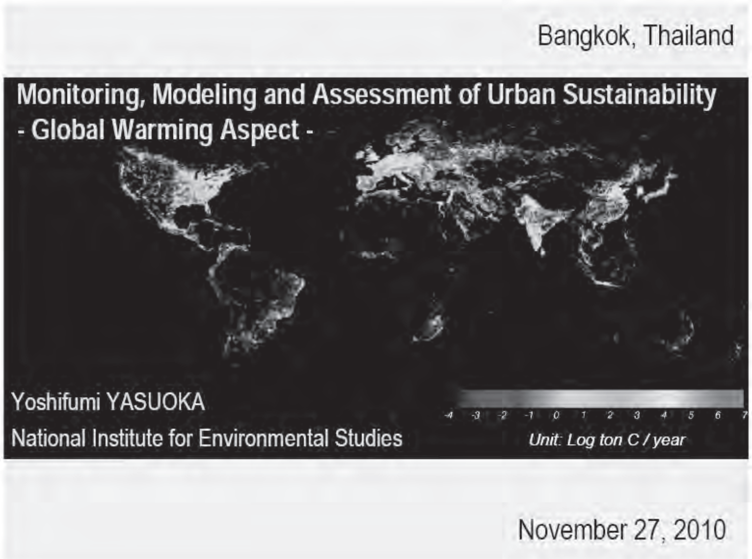
Space Technology in terms of remote sensing and geoinformation was first introduced into Thailand with the NASA Earth Resources Technology Satellite (ERTS) programme in 1972 when Thailand was accepted as one of the Principal Investigators (PI). Thailand National Remote Sensing Coordinating Committee was set up by the cabinet to liase with NASA and other international organizations under the leadership of Dr. Boon Indrambarya, the first coordinator of the Thai Programme. The success of the various application of ERTS (later called Landsat) data led to the establishment of Thailand Satellite Ground Receiving Station in 1981, first of its kind in Southeast Asia. The assistance and support from Canada, USA and Japan helped usher the Thai ground station into one of the top five biggest satellite data providers in the would during 1988 to mid 1990's. At the same period, most of the applications in agriculture, land use, forestry, etc. reached quasi-operational status. Universities offered bachelor and master degree courses in remote sensing, GIS, and related subjects both in Bangkok and in provincial universities. The active participation of Thailand in ESCAP Regional Remote Sensing Programme (RRSP) and later in Regional Space Application Programme (RESAP) and in ASEAN Committee on Science and Technology (COST), Subcommittee on Space Application (SCOSA) culminated in the government decision to build Thailand's first earth observation satellite (TRSS) with Canada in 1996. However, the economic crisis of 1997 compelled the cancellation of the project. When Geoinformatics and Space Technology Development Agency (GISTDA) was established as a public organization replacing Thaland Remote Sensing Center (TRSC) of the National Research Council in 2000, development of satellite project was revived, this time with France. The satellite, named THEOS was signed in min 2004 and launched in 2008. At present, THEOS is providing Thailand and other countries around the world with 2.5 m panchromatic and 17.0 m multispectral data for various applications ranging from urban planning, cartography, agriculture, forestry, land use planning, coastal erosion study and environmental monitoring. All the way, the spirit of coordination and cooperation domestically and internationally was the mainstay of Thai philosophy in space utilization. This was elaborated in the presentation.

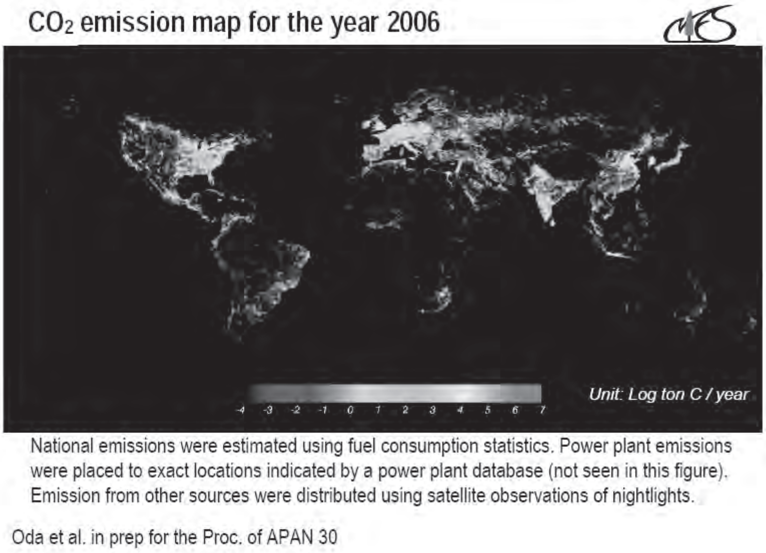
Monitoring, Modeling and Assessment of Urban Sustainability

Prof. Yoshifumi Yasuoka

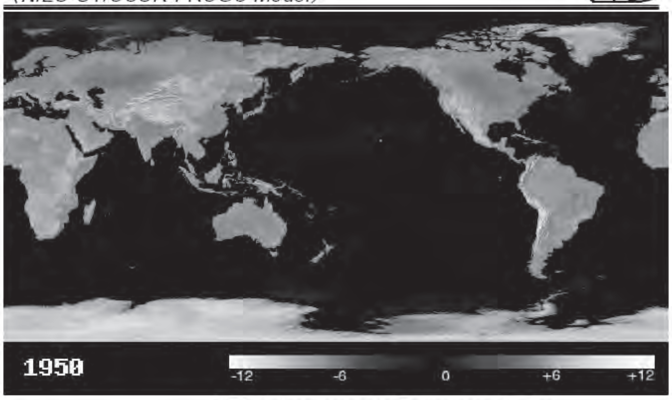
MONITORING, MODELING AND ASSESSMENT OF URBAN SUSTAINABILITY

YOSHIFUMI YASUOKA
Executive Director, National Institute of Environmental Studies, Japan
yyasuoka@nies.go.jp



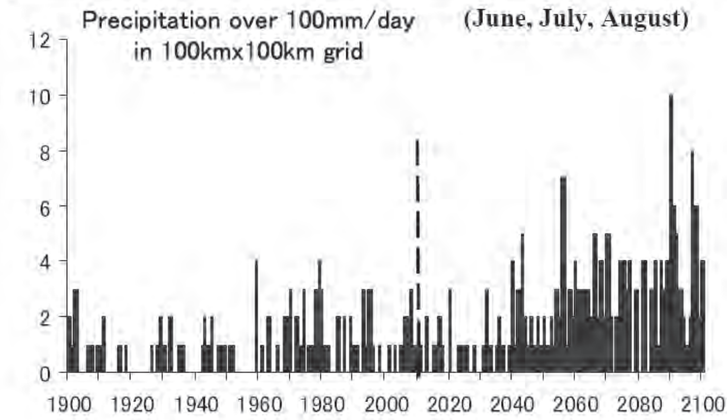


Prediction of Temperature
(NIES-UT/CCSR-FRCGC Model)



NIES: National Institute for Environmental Studies
UT/CCSR: The Univ. of Tokyo, Center for Climate System Research
FRCGC: Frontier Research Center for Global Change

Trend in Number of Heavy Rain Days in Japan



A1B NIES-CCRS/UT-FRSGC K-1 (After CCSR)

Urban Sustainability and Global Warming

@ Urban system has one of the greatest impacts on global warming.

@ Urban system is one of the most affected areas in global warming.

@ Managing urban system is essential in combating global warming.

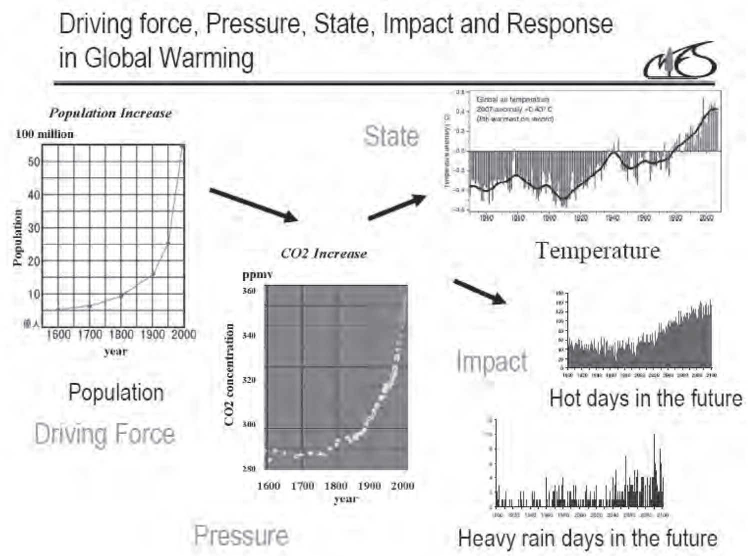
Overview

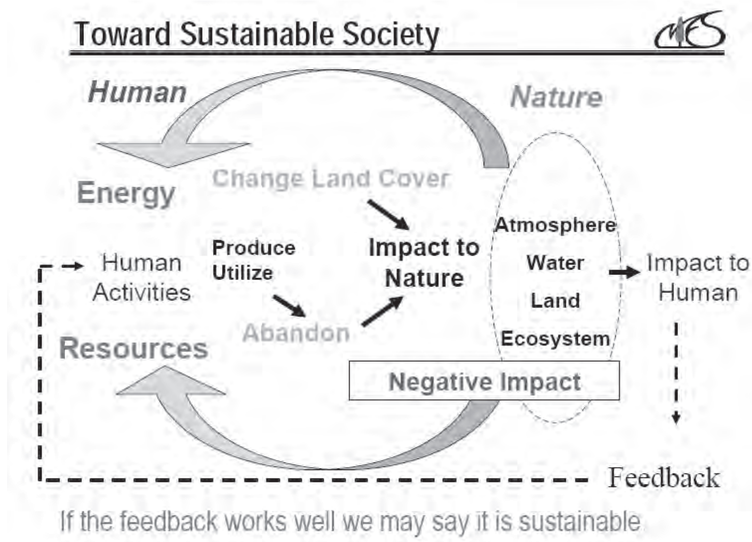
@ Global warming

@ Urban sustainability and global warming

@ How can geo-spatial technologies contribute to monitoring and assessment of urban sustainability ?

@ Conclusion





What are the risks for urban sustainability ?

Disasters

destroy urban systems.

Improper management of urban infrastructure

causes malfunctioning of urban activities.

Improper management of urban environment

causes degradation in urban atmosphere, water, land and ecosystems.

Improper management of global environment

may cause degradation in urban sustainability.

Disasters

New Orleans Flooding (2005/8)

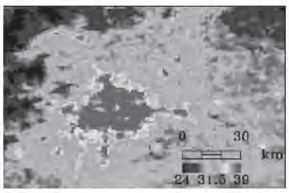
2000/3/9

2005/8/31

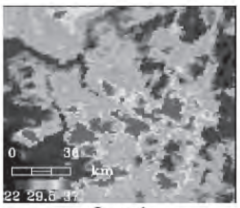
IKONOS images

Heat island condition observed from MODIS

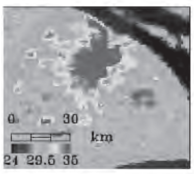
IIS/UT



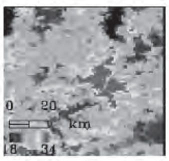
Beijing



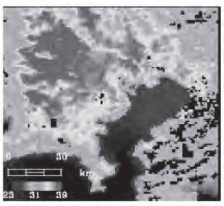
Seoul



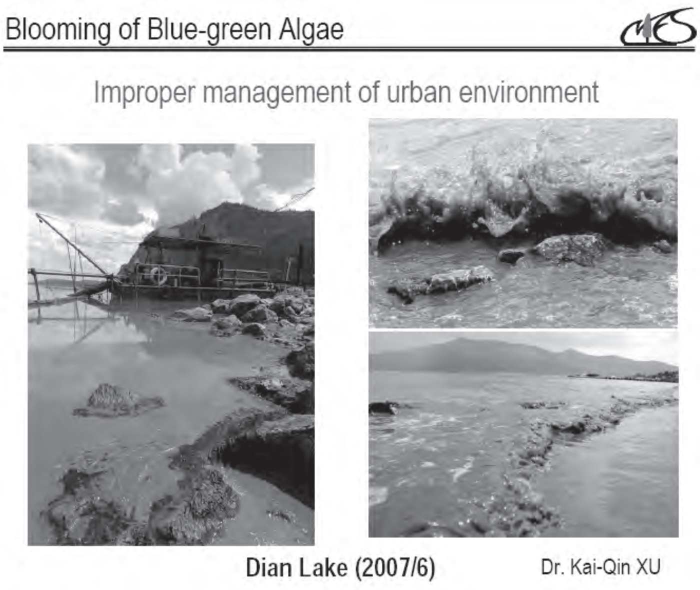
Shanghai

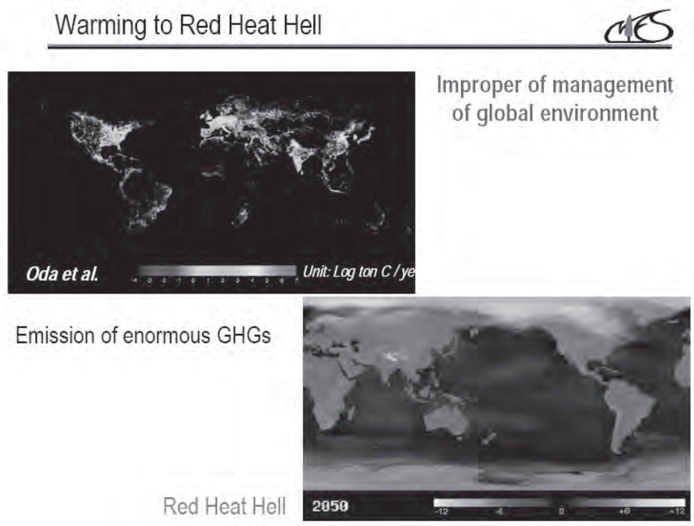


Pyongyang



Tokyo





Technologies for Urban Sustainability (Monitoring, Modeling and Assessment)

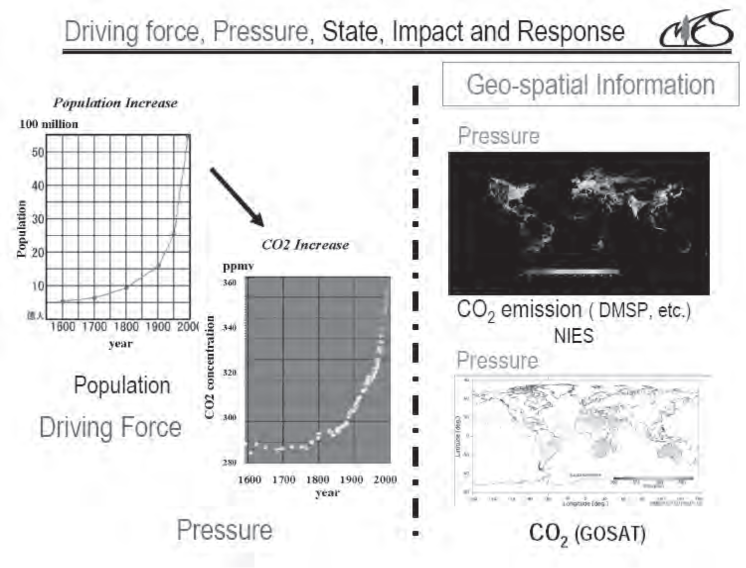
@ Remote Sensing

@ Geographic Information System

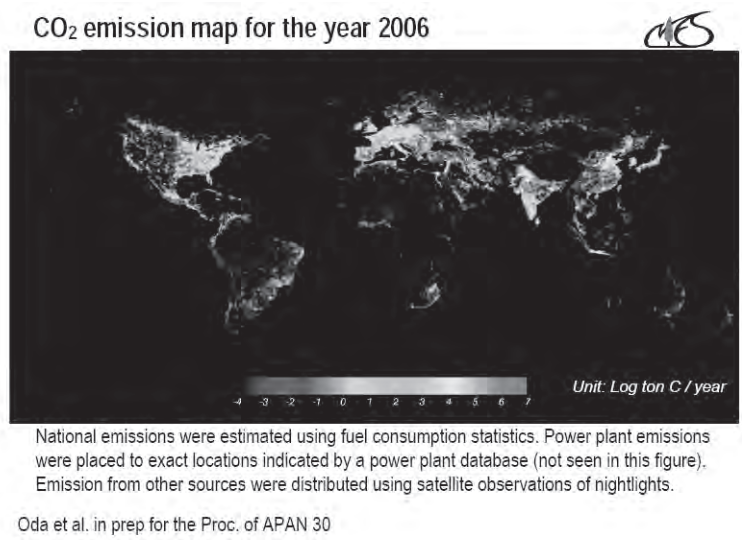
@ Image Processing

@ Modeling and Simulation

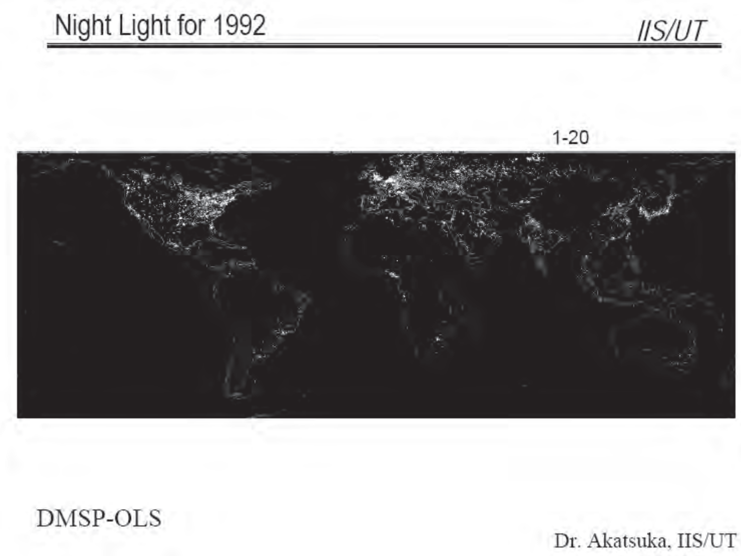
@ etc.



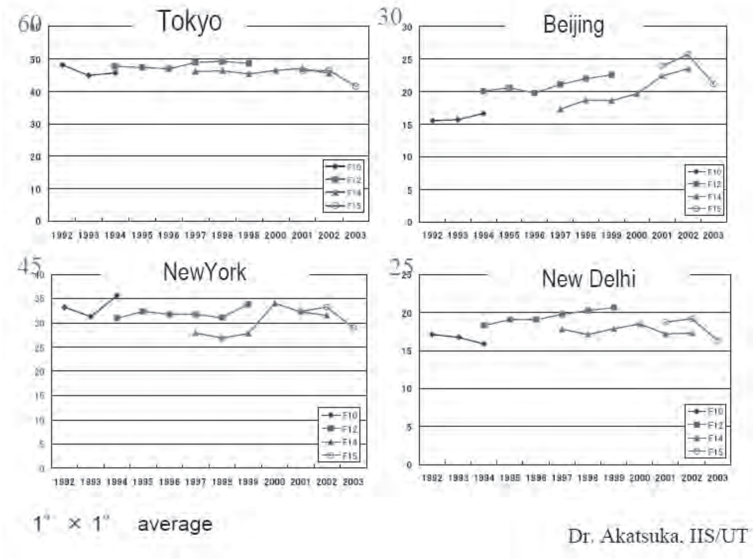
Driving force, Pressure, State, Impact and Response
Geo-spatial Information
Population Increase
100 million
Population
year
1600 1700 1800 1900 2000
CO2 Increase
ppmv
CO2 concentration
1600 1700 1800 1900 2000
year
Population
Driving Force
Pressure
Pressure
CO2 emission (DMSP, etc.)
NIES
Pressure
CO2 (GOSAT)

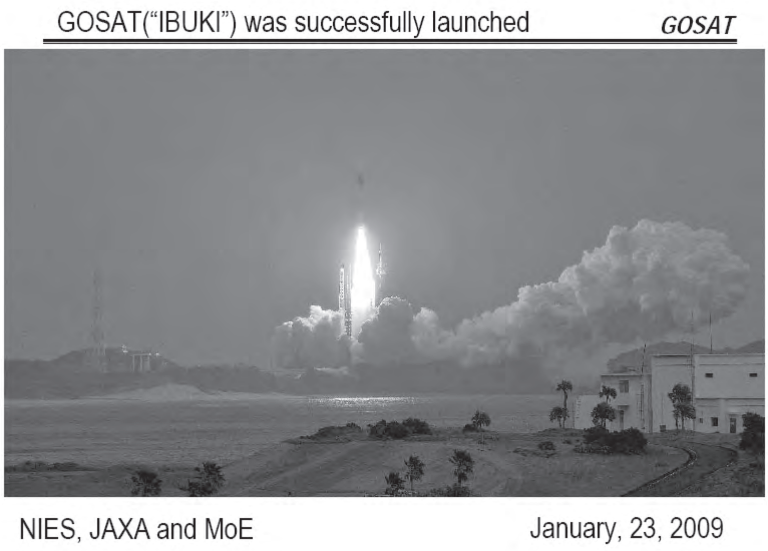


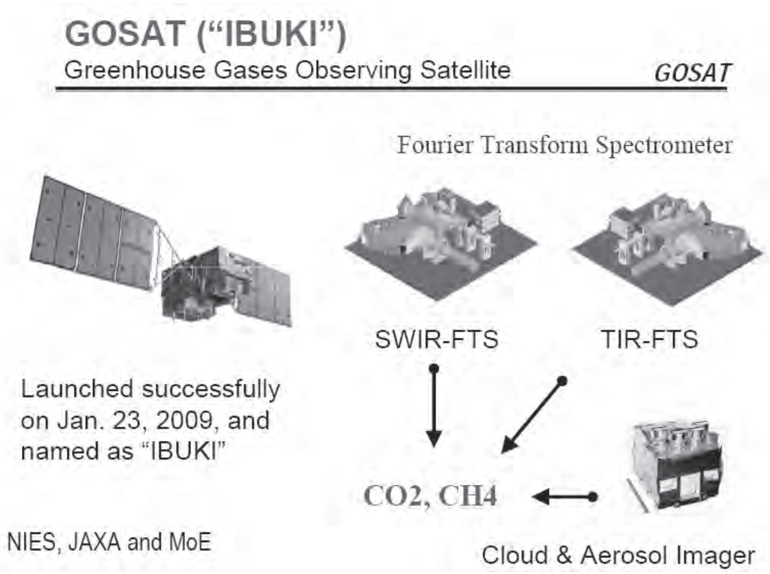
CO2 emission map for the year 2006
Unit: Log ton C / year
National emissions were estimated using fuel consumption statistics. Power plant emissions were placed to exact locations indicated by a power plant database (not seen in this figure). Emission from other sources were distributed using satellite observations of nightlights.
Oda et al. in prep for the Proc. of APAN 30

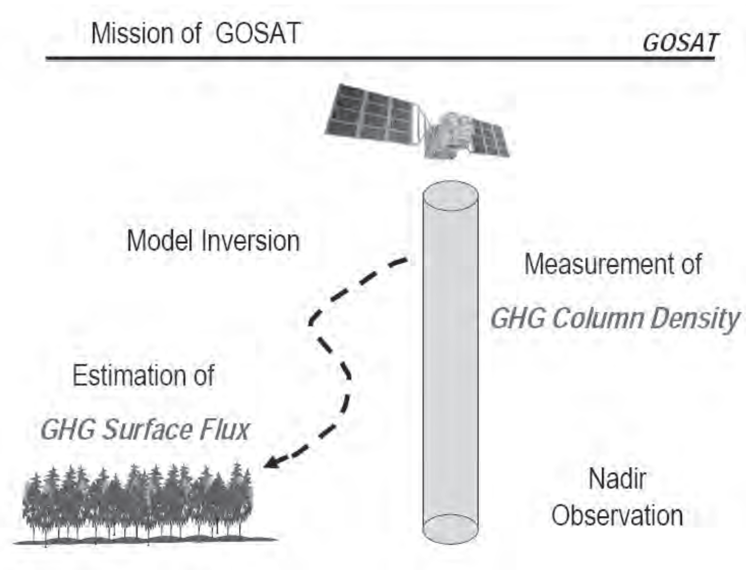


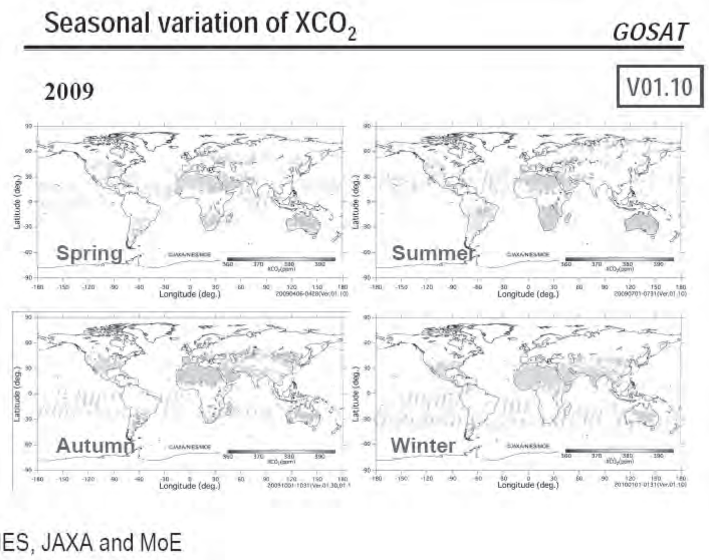
Night Light for 1992
IIS/UT
1-20
DMSP-OLS
Dr. Akatsuka, IIS/UT

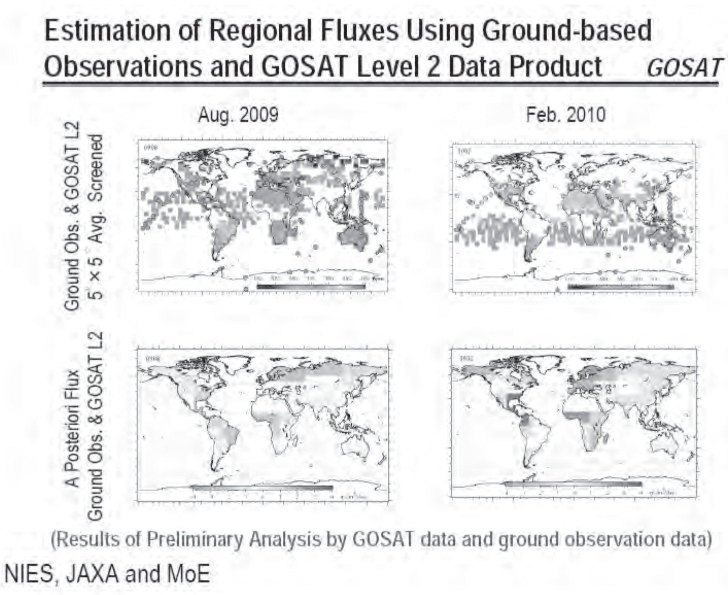

60
Tokyo
30
Beijing
45
NewYork
25
New Delhi
F10
F12
F14
F15
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
1° × 1° average
Dr. Akatsuka, IIS/UT

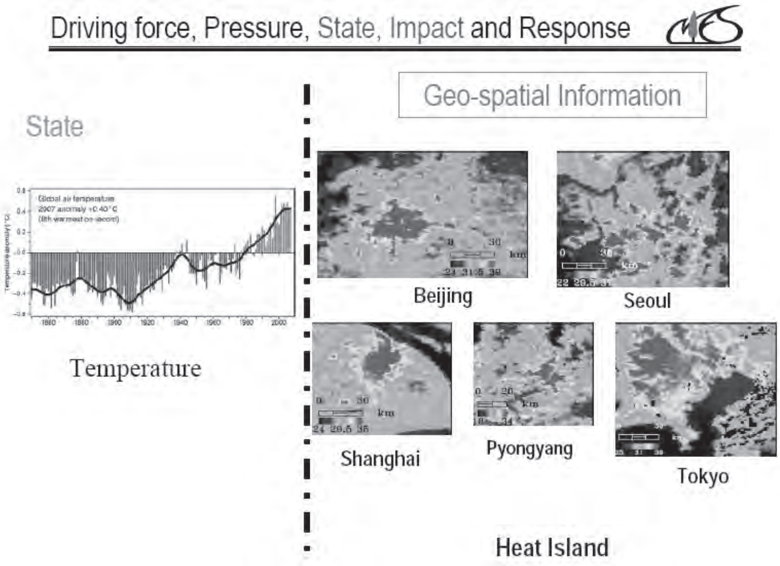

GOSAT("IBUKI") was successfully launched
GOSAT
NIES, JAXA and MoE
January, 23, 2009

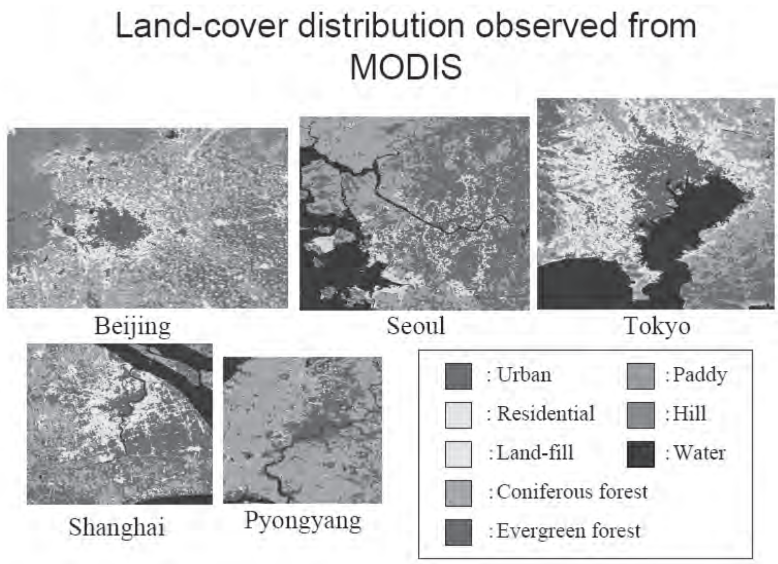

GOSAT ("IBUKI")
Greenhouse Gases Observing Satellite
GOSAT
Fourier Transform Spectrometer
SWIR-FTS
TIR-FTS
Launched successfully on Jan. 23, 2009, and named as "IBUKI"
CO2, CH4
NIES, JAXA and MoE
Cloud & Aerosol Imager

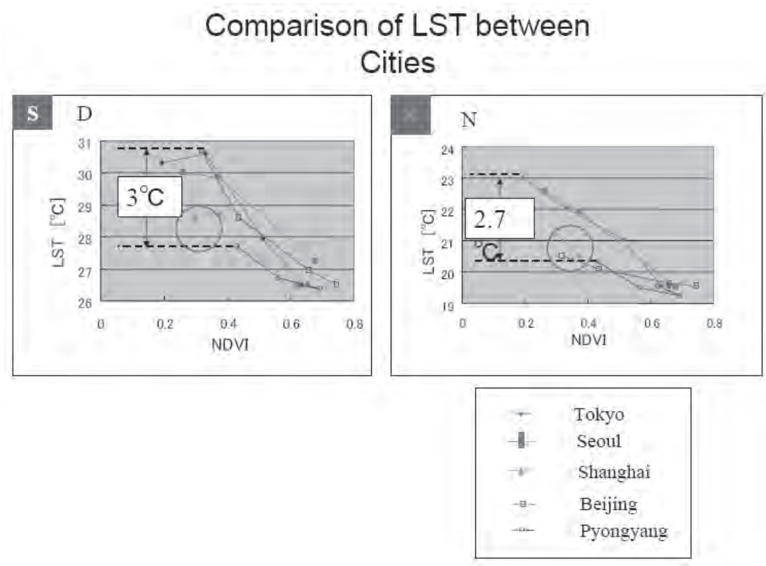

Mission of GOSAT
GOSAT
Model Inversion
Measurement of
GHG Column Density
Estimation of
GHG Surface Flux
Nadir
Observation

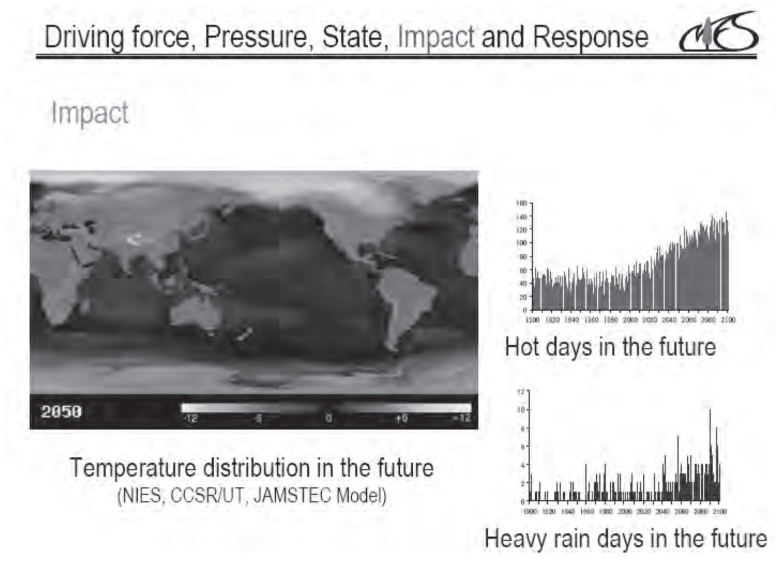

Seasonal variation of XCO_2
GOSAT
2009
V01.10
Spring
Summer
Autumn
Winter
Longitude (deg.)
Latitude (deg.)
NIES, JAXA and MoE

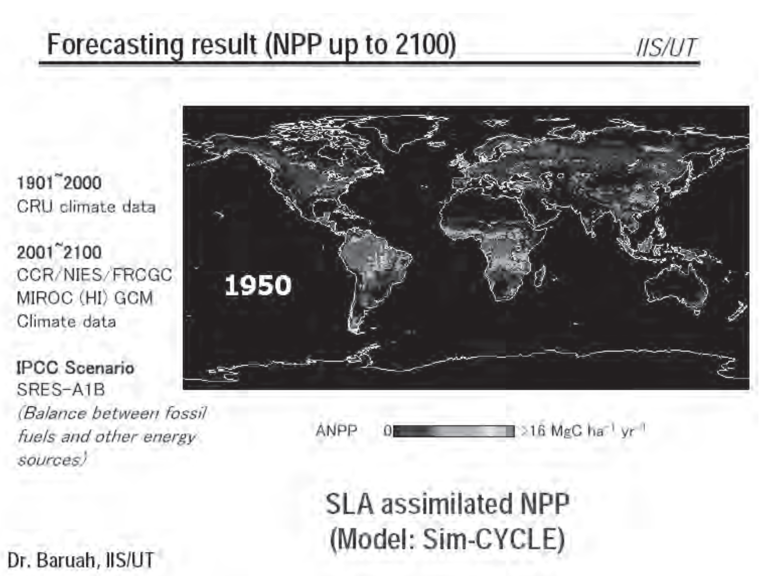

Estimation of Regional Fluxes Using Ground-based Observations and GOSAT Level 2 Data Product
GOSAT
Aug. 2009
Feb. 2010
Ground Obs. & GOSAT L2
5°×5° Avg. Screened
A Posteriori Flux
Ground Obs. & GOSAT L2
(Results of Preliminary Analysis by GOSAT data and ground observation data)
NIES, JAXA and MoE

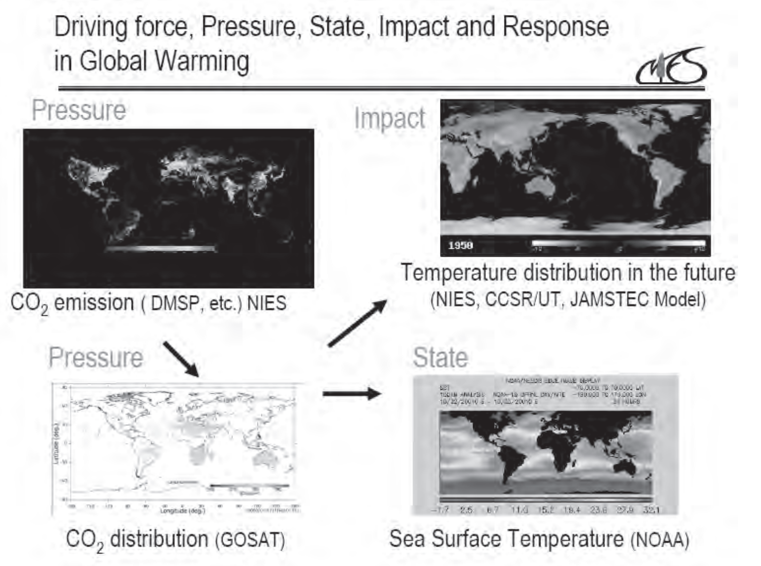

Driving force, Pressure, State, Impact and Response
State
Geo-spatial Information
Global air temperature
2007 anomaly +0.40°C
(8th warmest on record)
Temperature
Beijing
Seoul
Shanghai
Pyongyang
Tokyo
Heat Island

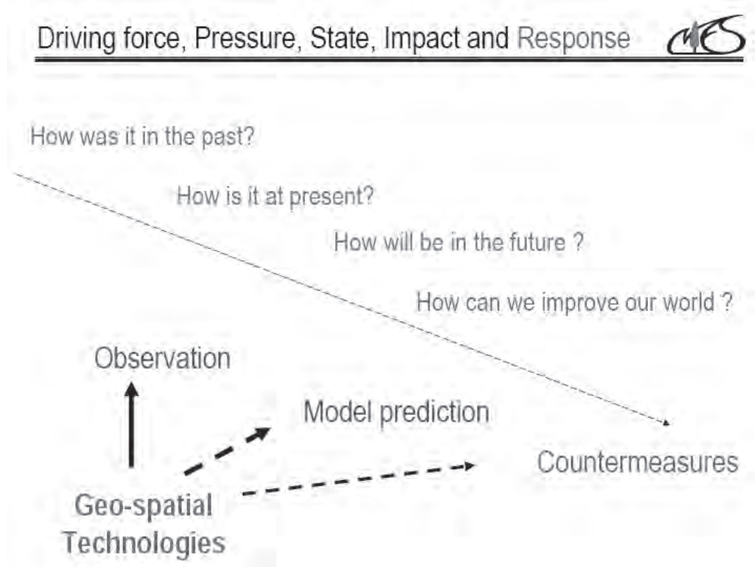

Land-cover distribution observed from MODIS
Beijing
Seoul
Tokyo
Shanghai
Pyongyang
: Urban
: Paddy
: Residential
: Hill
: Land-fill
: Water
: Coniferous forest
: Evergreen forest

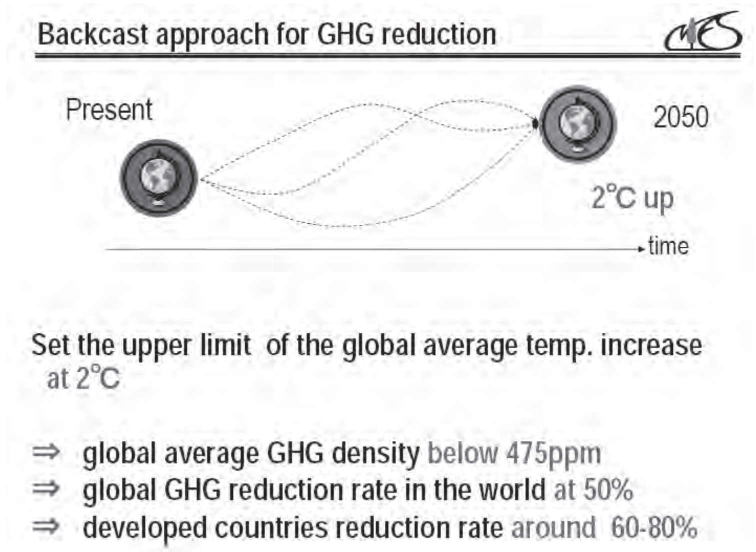

Comparison of LST between Cities
S
D
3°C
LST [°C]
NDVI
N
2.7 °C
Tokyo
Seoul
Shanghai
Beijing
Pyongyang

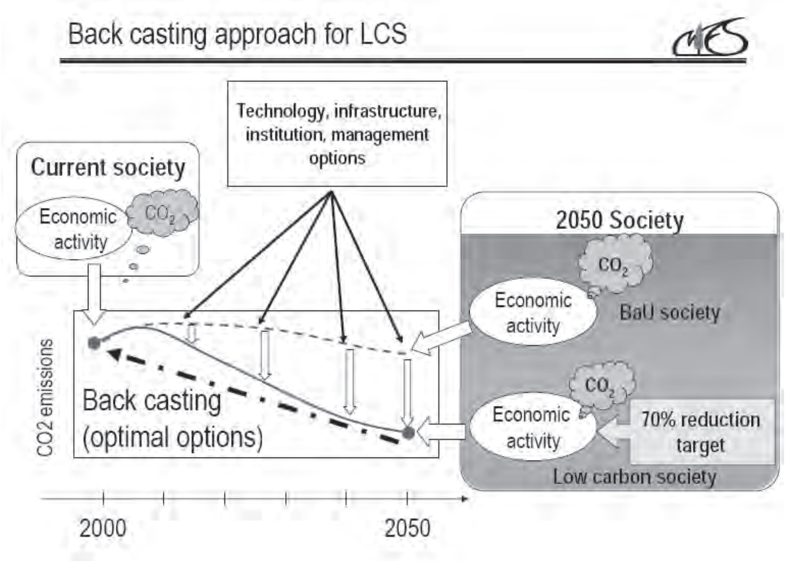

Driving force, Pressure, State, Impact and Response
Impact
2050
Hot days in the future
Temperature distribution in the future
(NIES, CCSR/UT, JAMSTEC Model)
Heavy rain days in the future

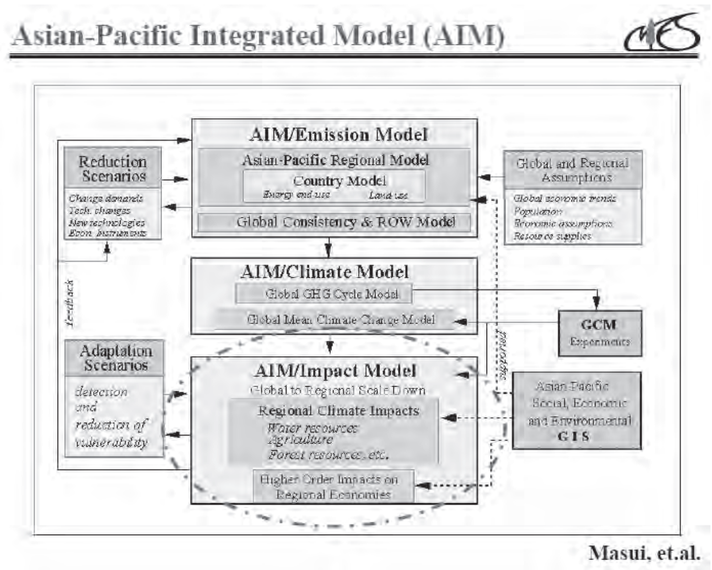

Forecasting result (NPP up to 2100)
IIS/UT
1901~2000
CRU climate data
2001~2100
CCR/NIES/FRCGC
MIROC (HI) GCM
Climate data
IPCC Scenario
SRES-A1B
(Balance between fossil fuels and other energy sources)
1950
ANPP 0 >16 MgC ha⁻¹ yr⁻¹
SLA assimilated NPP
(Model: Sim-CYCLE)
Dr. Baruah, IIS/UT

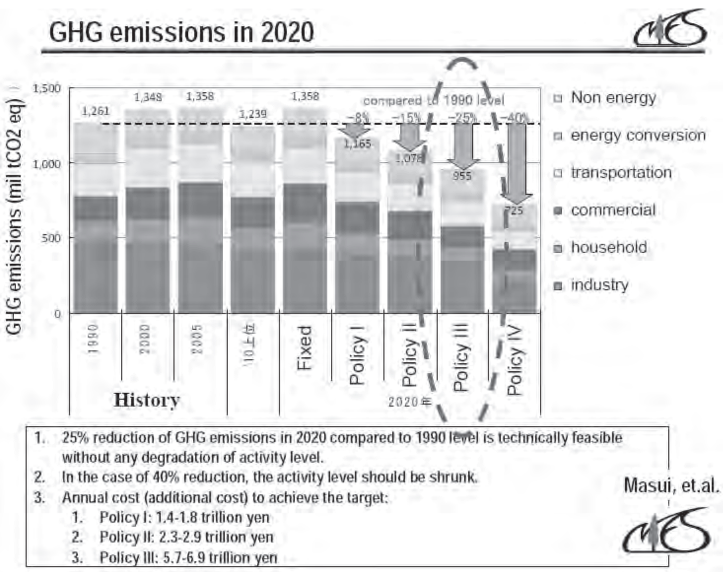

Driving force, Pressure, State, Impact and Response
in Global Warming
Pressure
Impact
CO2 emission (DMSP, etc.) NIES
Temperature distribution in the future
(NIES, CCSR/UT, JAMSTEC Model)
Pressure
State
CO2 distribution (GOSAT)
Sea Surface Temperature (NOAA)

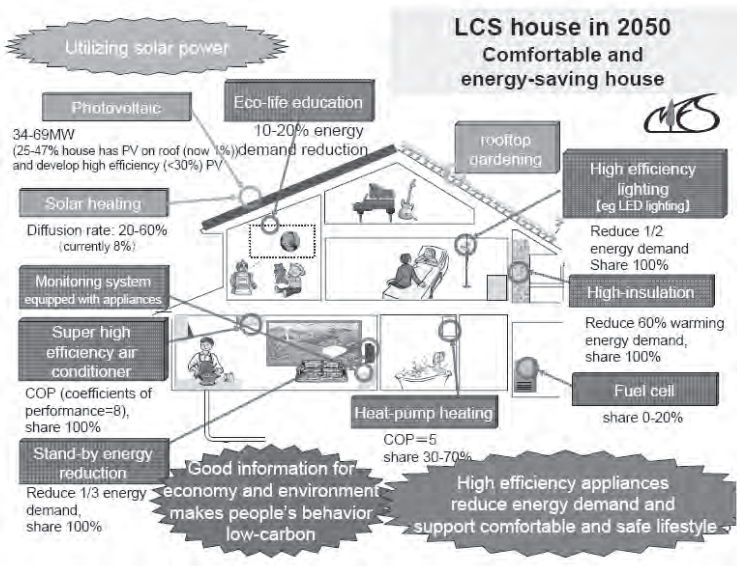

Driving force, Pressure, State, Impact and Response
How was it in the past?
How is it at present?
How will be in the future ?
How can we improve our world ?
Observation
Model prediction
Countermeasures
Geo-spatial Technologies


Backcast approach for GHG reduction
Present
2050
2°C up
time
Set the upper limit of the global average temp. increase at 2°C
⇒ global average GHG density below 475ppm
⇒ global GHG reduction rate in the world at 50%
⇒ developed countries reduction rate around 60-80%

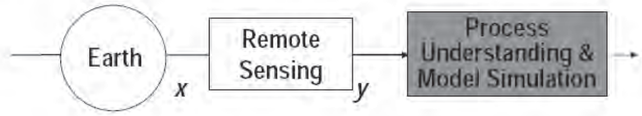

Back casting approach for LCS
Technology, infrastructure, institution, management options
Current society
Economic activity
CO2
2050 Society
Economic activity
CO2
BaU society
Economic activity
CO2
70% reduction target
Low carbon society
CO2 emissions
Back casting (optimal options)
2000
2050


Asian-Pacific Integrated Model (AIM)
AIM/Emission Model
Asian-Pacific Regional Model
Country Model
Energy end use
Land use
Global Consistency & ROW Model
Reduction Scenarios
Change demands
Tech. changes
New technologies
Econ. instruments
Global and Regional Assumptions
Global economic trends
Population
Economic assumptions
Resource supplies
AIM/Climate Model
Global GHG Cycle Model
Global Mean Climate Change Model
GCM
Experiments
feedback
AIM/Impact Model
Global to Regional Scale Down
Regional Climate Impacts
Water resources
Agriculture
Forest resources, etc.
Higher Order Impacts on Regional Economies
Adaptation Scenarios
detection and reduction of vulnerability
Asian Pacific Social, Economic and Environmental GIS
Masui, et.al.

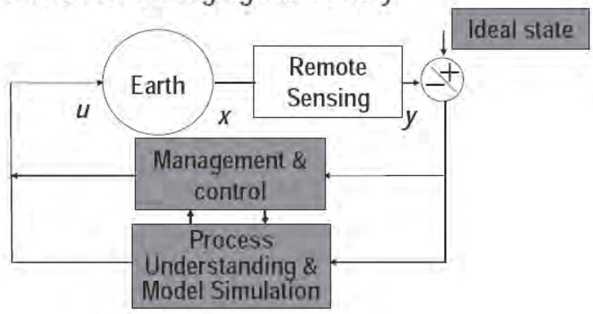

GHG emissions in 2020
GHG emissions (mil tCO2 eq)
1,500
1,000
500
0
1,261
1,348
1,358
1,239
1,358
compared to 1990 level
−8%
−15%
−25%
−40%
1,165
1,078
955
725
1990
2000
2005
Fixed
Policy I
Policy II
Policy III
Policy IV
History
Non energy
energy conversion
transportation
commercial
household
industry
1. 25% reduction of GHG emissions in 2020 compared to 1990 level is technically feasible without any degradation of activity level.
2. In the case of 40% reduction, the activity level should be shrunk.
3. Annual cost (additional cost) to achieve the target:
1. Policy I: 1.4-1.8 trillion yen
2. Policy II: 2.3-2.9 trillion yen
3. Policy III: 5.7-6.9 trillion yen
Masui, et.al.


LCS house in 2050
Comfortable and energy-saving house
Utilizing solar power
Photovoltaic
34-69MW
(25-47% house has PV on roof (now 1%)) and develop high efficiency (<30%) PV
Eco-life education
10-20% energy demand reduction
rooftop gardening
High efficiency lighting
[eg LED lighting]
Reduce 1/2 energy demand
Share 100%
Solar heating
Diffusion rate: 20-60%
(currently 8%)
Monitoring system equipped with appliances
High-insulation
Reduce 60% warming energy demand, share 100%
Super high efficiency air conditioner
COP (coefficients of performance=8), share 100%
Fuel cell
share 0-20%
Heat-pump heating
COP=5
share 30-70%
Stand-by energy reduction
Reduce 1/3 energy demand, share 100%
Good information for economy and environment makes people's behavior low-carbon
High efficiency appliances reduce energy demand and support comfortable and safe lifestyle

Observation for understanding our earth system



Observation for managing our society



Monitoring, modeling and assessment of urban sustainability

Need to cover on urban scale (local/regional) aspect to global --- spatial dimension

Need to cover from short-term aspect to long-term --- temporal dimension

Need to cover a variety of variables --- variable dimensions

Need to integrate monitoring, modeling and assessment with management

Toward Sustainable Earth

Any one single country
may not cover the whole issues over
global atmosphere, ocean, land and
human systems.

We need collaboration!

Community-based Climate Centers

Dr. Anond Snidvongs

COMMUNITY-BASED CLIMATE CENTERS

ANOND SNIDVONGS
Director, Southeast Asia START Regional Center (SEA START RC),
Chulalongkorn University; and Acting Executive Director,
Geoinformatics and Space Technology Development Agency (GISTDA)
anond@start.or.th

Community-based Climate Centers
A Tool to Increase Resilience to Local Climate

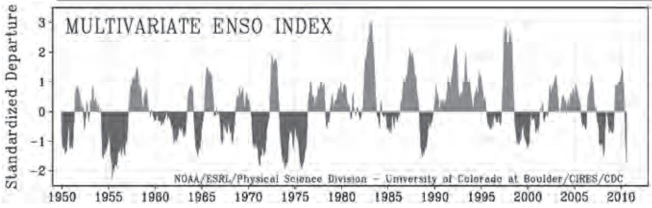
Anond Snidvongs
Director, Southeast Asia START Regional Center
Chulalongkorn University

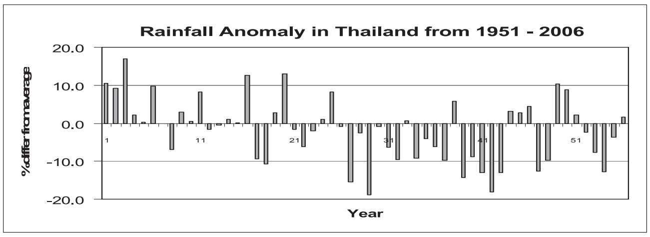
Major Climate Phenomena

Time scale (time periods where changes/differences may be realized)

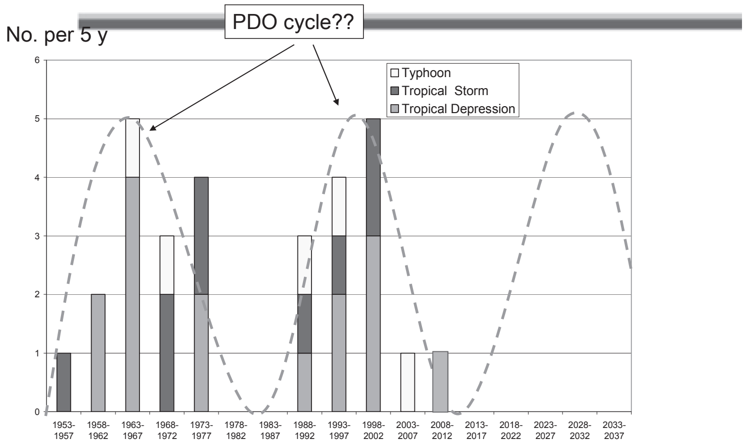
Hours-day	Day/night (diurnal) temperature, land/sea breezes, tides
Days-weeks	Spring/neap tidal cycle, storm events
Weeks-months	Madden-Julian Oscillation
Months-year	Winter/summer, monsoons, tropical storm season
Years-Decade	El Nino/La Nina events, Indian Ocean Dipole
Decades-century	Pacific Decadal Oscillation, GHG driven climate change

El Nino and La Nina Events

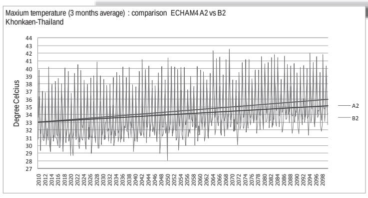


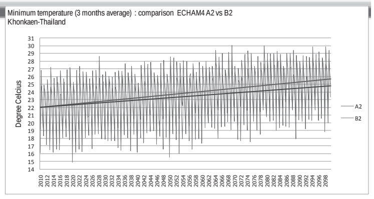


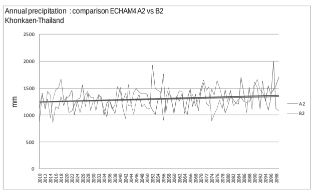
Tropical Storms in the Gulf of Thailand (1953-2010)

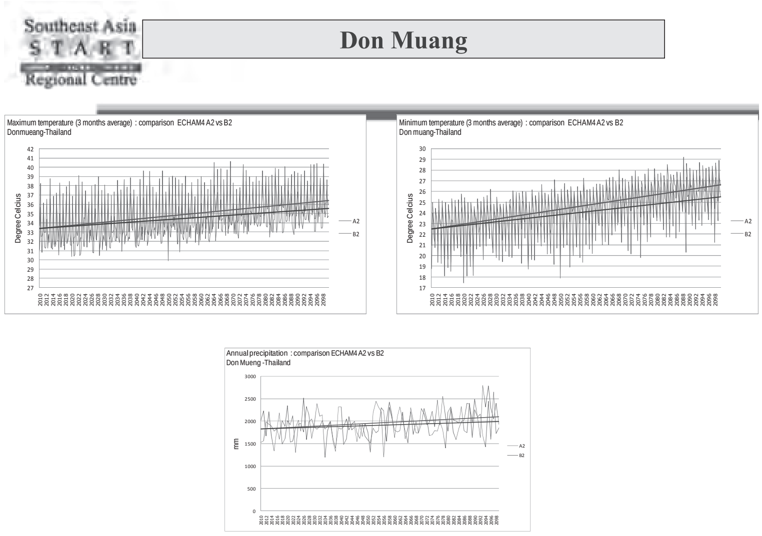


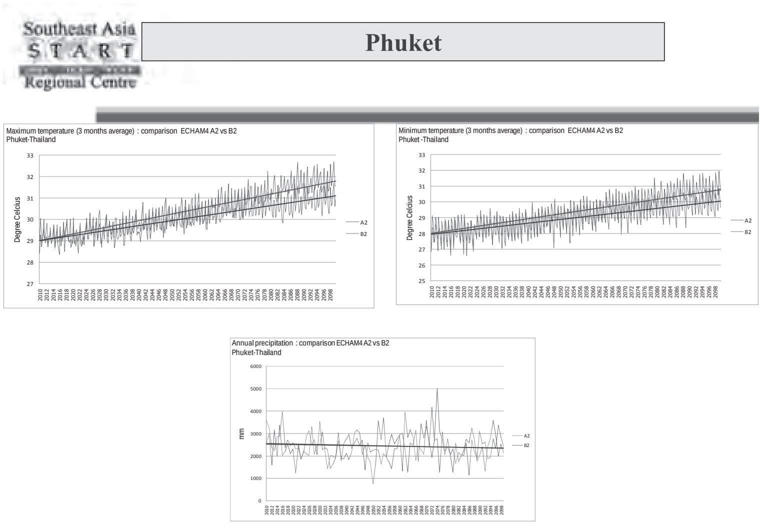
Khonkaen

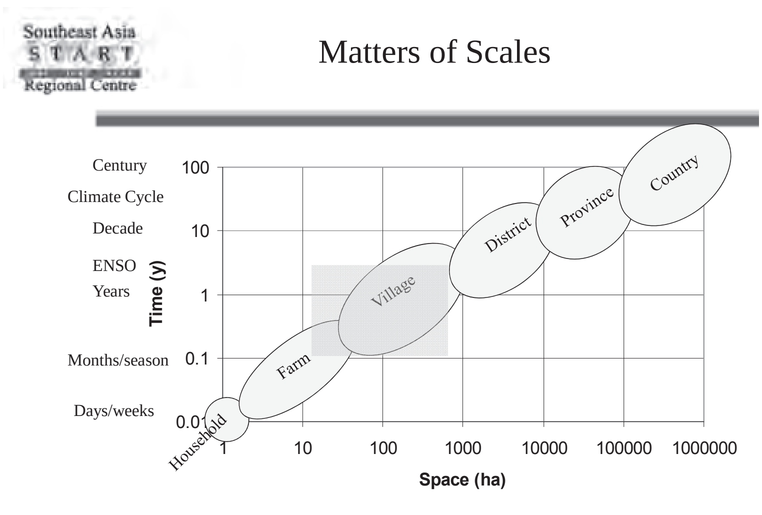







Southeast Asia
START
Regional Centre
Don Muang
Maximum temperature (3 months average) : comparison ECHAM4 A2 vs B2
Donmueang-Thailand
Degree Celcius
A2
B2
Minimum temperature (3 months average) : comparison ECHAM4 A2 vs B2
Don muang-Thailand
Degree Celcius
A2
B2
Annual precipitation : comparison ECHAM4 A2 vs B2
Don Mueng -Thailand
mm
A2
B2


Southeast Asia
START
Regional Centre
Phuket
Maximum temperature (3 months average) : comparison ECHAM4 A2 vs B2
Phuket-Thailand
Degree Celcius
A2
B2
Minimum temperature (3 months average) : comparison ECHAM4 A2 vs B2
Phuket -Thailand
Degree Celcius
A2
B2
Annual precipitation : comparison ECHAM4 A2 vs B2
Phuket-Thailand
mm
A2
B2


Southeast Asia
START
Regional Centre
Matters of Scales
Century
Climate Cycle
Decade
ENSO
Years
Months/season
Days/weeks
Time (y)
100
10
1
0.1
0.01
Household
Farm
Village
District
Province
Country
1
10
100
1000
10000
100000
1000000
Space (ha)

Southeast Asia START Regional Centre

Need to know local climate to improve local weather forecast
Weather:
•State of the atmosphere at any location at a particular time
Climate:
•Overall description of weather regime of a location
•Collections of weather over a long period
•Represent by narrative description or quantitative parameters

Southeast Asia START Regional Centre

Many ways to do weather forecast
Local/Synoptic-based
•Persistent
•Trend
•Climatology
Modeling-based
•Many from both national and international sources

Southeast Asia START Regional Centre

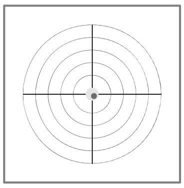
Components in Forecasting cycles

1. Centralized forecasting systems (synoptic network, weather typing, trend analysis, NWP, etc)
2. Scaling
3. Interpretation in to local contexts

No single model can be good at any situations, models (with different physics, numerical schemes, resolutions, boundary and initial conditions, etc.) provide uncertainties due to know scientific basis

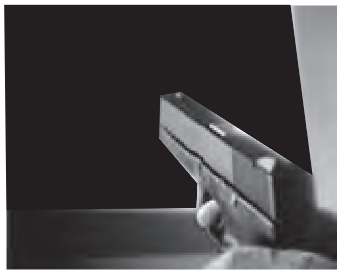
Concept of ‘Ensemble’
Local climatology (reasonably long-term observation of local weather) of the location are required to ‘calibrate’ and continue to ‘evaluate’ if re-calibration of ensemble may be needed

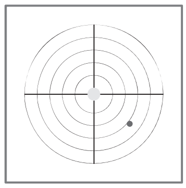
A medalist sharpshooter under a controlled condition



May easily hit the bull eye

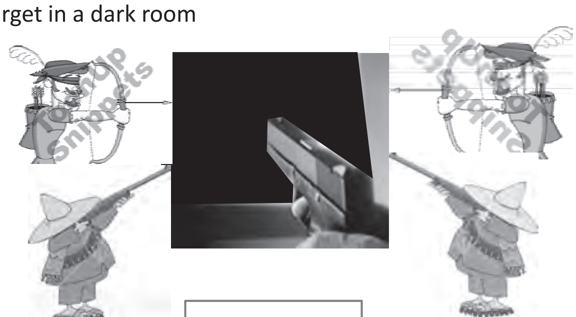
The same sharpshooter shooting at the target in a dark room



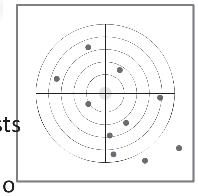


Will be very likely to miss the bull eye

Many shooters using various equipments from different angles aiming at the target in a dark room



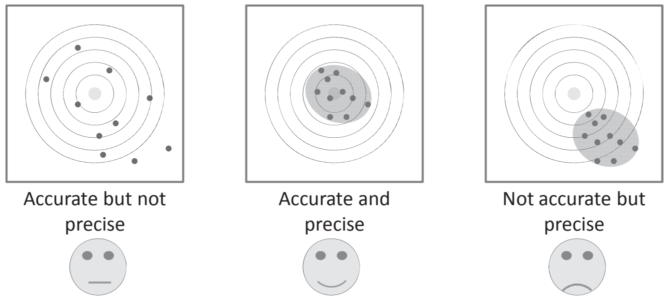
Will score theirs marks unevenly on the target (and not necessary that modern Olympic medalists will do better than Mr. Robin Hood or Mr. Pancho Villa!!)



But their distribution is likely to cover the bull eye

Third Common Misuses of Climate Models

- Overemphasize on multi models precision



'Sentinel Asia', 'SAFE' and JAXA's Earth Observation Activities

Mr. Sinichi Mizumoto

'SENTINEL ASIA', 'SAFE' AND JAXA'S EARTH OBSERVATION ACTIVITIES

SHINICHI MIZUMOTO
Director, Japan Aerospace Exploration Agency (JAXA), Bangkok Office
mizumoto.shinichi@jaxa.jp

RNUS Seminar 2010

JAXA's Role in Climate Change Adaptation and APRSAF, Sentinel Asia and SAFE

November 2010

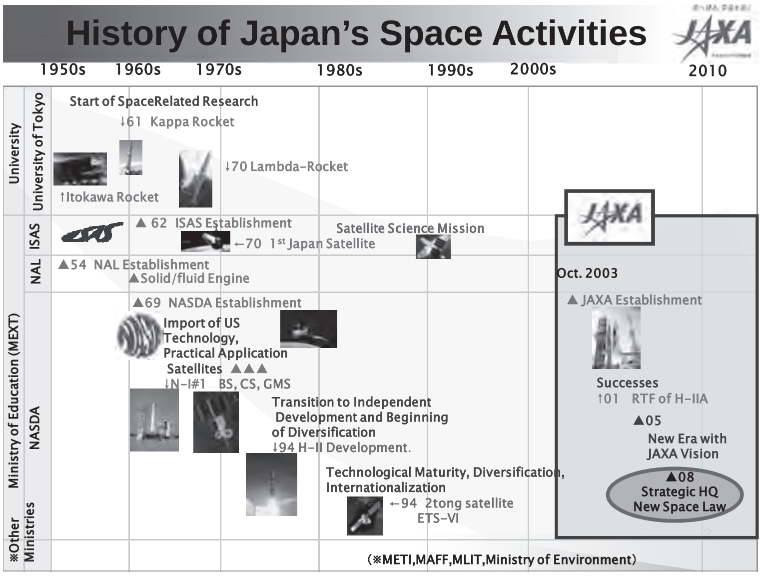
Shinichi Mizumoto
Director, Bangkok Office
Japan Aerospace Exploration Agency (JAXA)

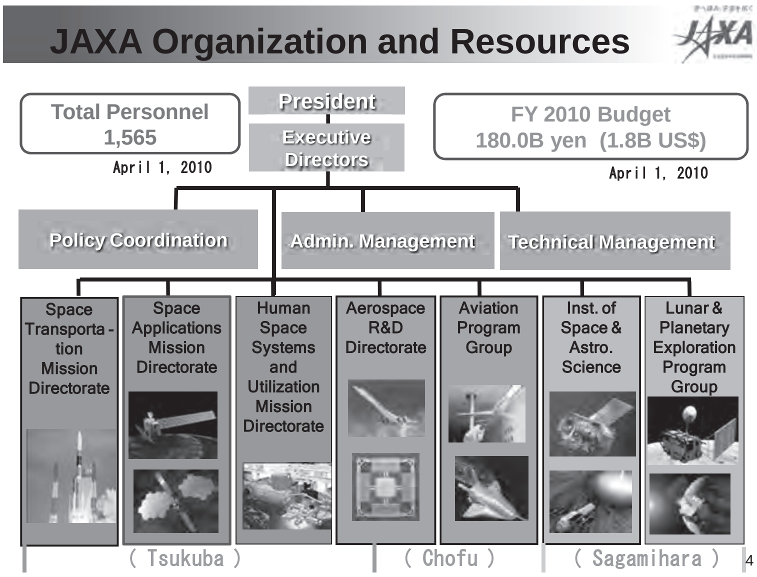
1

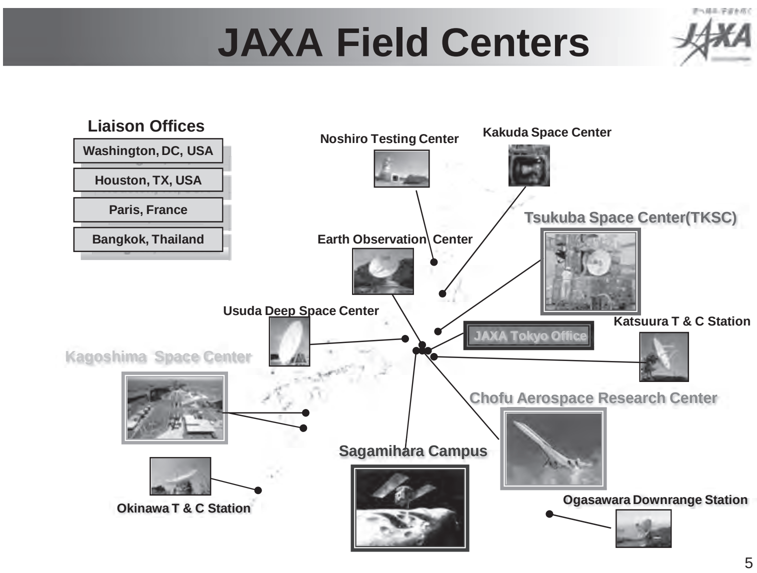
Contents

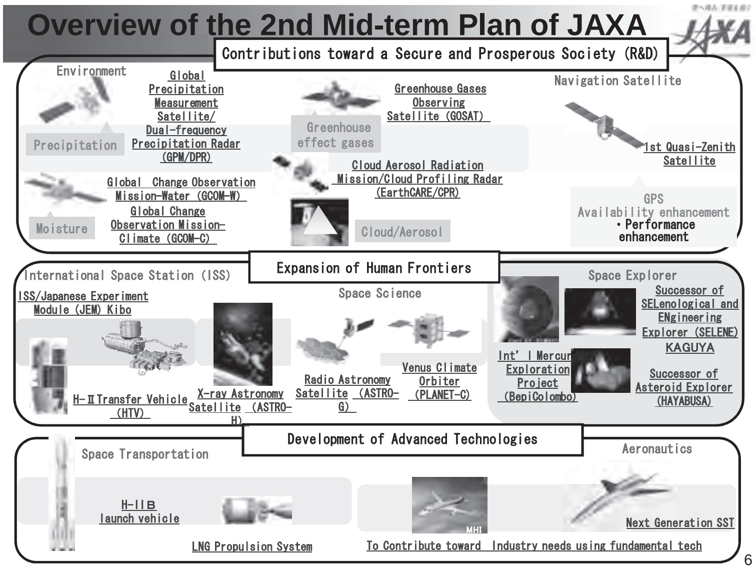
- **Outline of JAXA**
- **JAXA's Role in Climate Change Adaptation**
- **Asia-Pacific Regional Space Agency Forum (APRSAF)**
- **Initiatives of APRSAF / Sentinel Asia, Space Applications for Environment (SAFE)**
- **Cooperation between JAXA and AIT**

2

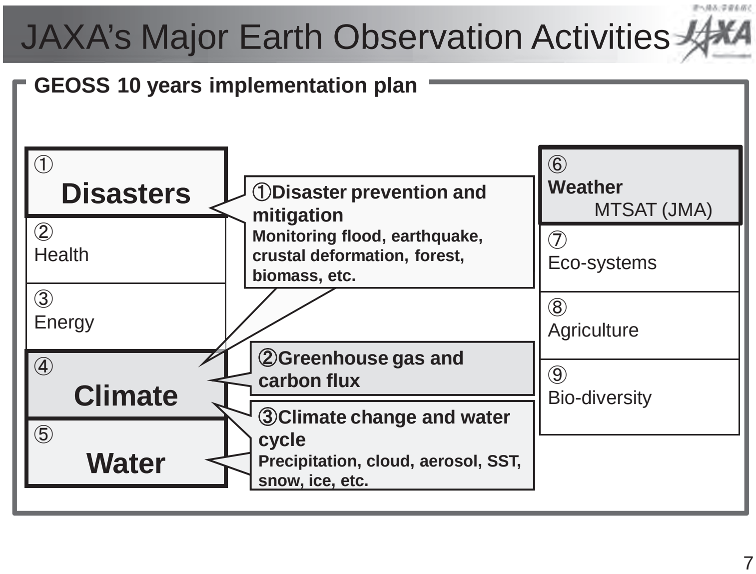

History of Japan's Space Activities
JAXA
1950s
1960s
1970s
1980s
1990s
2000s
2010
University
University of Tokyo
Start of SpaceRelated Research
↓61 Kappa Rocket
↓70 Lambda-Rocket
↑Itokawa Rocket
ISAS
▲ 62 ISAS Establishment
←70 1st Japan Satellite
Satellite Science Mission
NAL
▲54 NAL Establishment
▲Solid/fluid Engine
Ministry of Education (MEXT)
NASDA
▲69 NASDA Establishment
Import of US Technology, Practical Application Satellites ▲▲▲
↓N-I#1 BS, CS, GMS
Transition to Independent Development and Beginning of Diversification
↓94 H-II Development.
Technological Maturity, Diversification, Internationalization
←94 2tong satellite ETS-VI
Oct. 2003
▲ JAXA Establishment
Successes
↑01 RTF of H-IIA
▲05
New Era with JAXA Vision
▲08
Strategic HQ
New Space Law
※Other Ministries
(※METI,MAFF,MLIT,Ministry of Environment)


JAXA Organization and Resources
JAXA
Total Personnel
1,565
April 1, 2010
President
Executive Directors
FY 2010 Budget
180.0B yen (1.8B US$)
April 1, 2010
Policy Coordination
Admin. Management
Technical Management
Space Transporta - tion Mission Directorate
Space Applications Mission Directorate
Human Space Systems and Utilization Mission Directorate
Aerospace R&D Directorate
Aviation Program Group
Inst. of Space & Astro. Science
Lunar & Planetary Exploration Program Group
(Tsukuba)
(Chofu)
(Sagamihara)
4

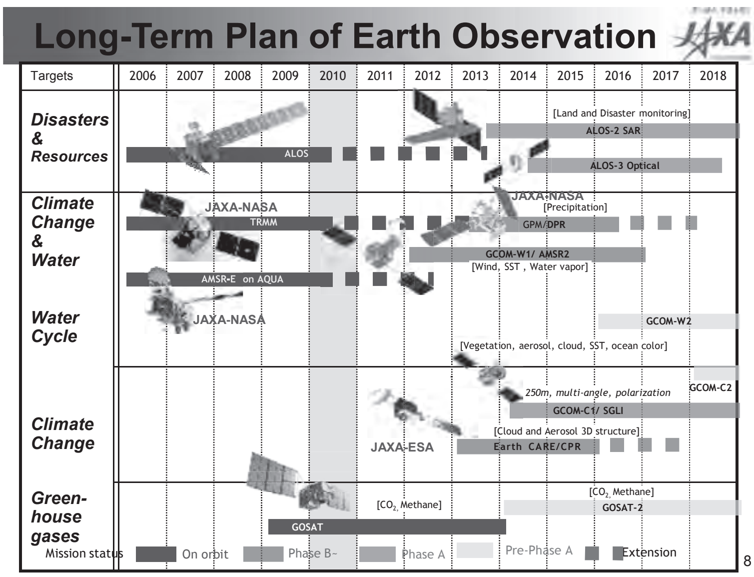

JAXA Field Centers
JAXA
Liaison Offices
Washington, DC, USA
Houston, TX, USA
Paris, France
Bangkok, Thailand
Noshiro Testing Center
Kakuda Space Center
Tsukuba Space Center(TKSC)
Earth Observation Center
Usuda Deep Space Center
JAXA Tokyo Office
Katsuura T & C Station
Kagoshima Space Center
Chofu Aerospace Research Center
Sagamihara Campus
Okinawa T & C Station
Ogasawara Downrange Station
5



Overview of the 2nd Mid-term Plan of JAXA
Contributions toward a Secure and Prosperous Society (R&D)
Environment
Global Precipitation Measurement Satellite/ Dual-frequency Precipitation Radar (GPM/DPR)
Precipitation
Greenhouse Gases Observing Satellite (GOSAT)
Greenhouse effect gases
Navigation Satellite
1st Quasi-Zenith Satellite
Global Change Observation Mission-Water (GCOM-W)
Global Change Observation Mission-Climate (GCOM-C)
Moisture
Cloud Aerosol Radiation Mission/Cloud Profiling Radar (EarthCARE/CPR)
Cloud/Aerosol
GPS Availability enhancement
・Performance enhancement
Expansion of Human Frontiers
International Space Station (ISS)
ISS/Japanese Experiment Module (JEM) Kibo
H-II Transfer Vehicle (HTV)
Space Science
X-ray Astronomy Satellite (ASTRO-H)
Radio Astronomy Satellite (ASTRO-G)
Venus Climate Orbiter (PLANET-C)
Space Explorer
Int' l Mercury Exploration Project (BepiColombo)
Successor of SELenological and ENgineering Explorer (SELENE) KAGUYA
Successor of Asteroid Explorer (HAYABUSA)
Development of Advanced Technologies
Space Transportation
H-IIB launch vehicle
LNG Propulsion System
Aeronautics
Next Generation SST
To Contribute toward Industry needs using fundamental tech
6



JAXA's Major Earth Observation Activities
GEOSS 10 years implementation plan
① Disasters
② Health
③ Energy
④ Climate
⑤ Water
①Disaster prevention and mitigation
Monitoring flood, earthquake, crustal deformation, forest, biomass, etc.
②Greenhouse gas and carbon flux
③Climate change and water cycle
Precipitation, cloud, aerosol, SST, snow, ice, etc.
⑥ Weather MTSAT (JMA)
⑦ Eco-systems
⑧ Agriculture
⑨ Bio-diversity
7



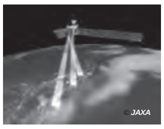
Long-Term Plan of Earth Observation
Targets
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Disasters & Resources
ALOS
[Land and Disaster monitoring]
ALOS-2 SAR
ALOS-3 Optical
Climate Change & Water
JAXA-NASA
TRMM
JAXA-NASA
[Precipitation]
GPM/DPR
GCOM-W1/ AMSR2
[Wind, SST , Water vapor]
AMSR-E on AQUA
Water Cycle
JAXA-NASA
GCOM-W2
[Vegetation, aerosol, cloud, SST, ocean color]
250m, multi-angle, polarization
GCOM-C2
GCOM-C1/ SGLI
Climate Change
[Cloud and Aerosol 3D structure]
JAXA-ESA
Earth CARE/CPR
Green-house gases
[CO2, Methane]
GOSAT
[CO2, Methane]
GOSAT-2
Mission status
On orbit
Phase B-
Phase A
Pre-Phase A
Extension
8

Advanced Land Observing Satellite(ALOS)

ALOS

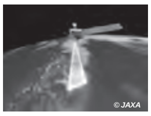
- Disaster monitoring
- Cartography
- Regional observation
- Resources surveying

ALOS Pansharpen (PRISM/AVNIR-2) image over Tokyo observed on August 29, 2006



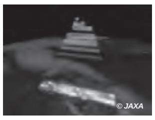
PRISM

Panchromatic Remote sensing Instrument for Stereo Mapping



AVNIR-2

Advanced Visible and Near Infrared Radiometer type 2



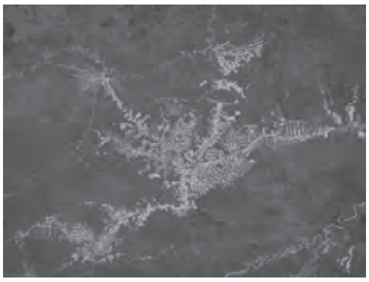
PALSAR

Phased Array type L-band Synthetic Aperture Radar

9

Monitoring Forest in Amazon(Deforestation)

1995 (JERS-1)

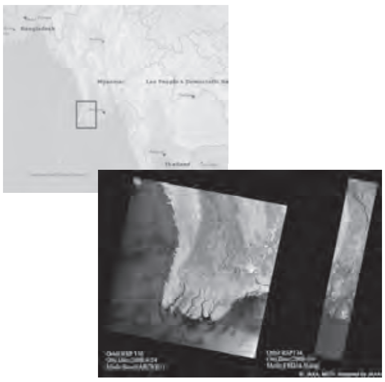


2007 (ALOS)

- **Within seven days after the data acquisitions, JAXA provides the quickly processed SAR images to IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis).**
- **The data are being utilized for the illegal deforestation monitoring.**

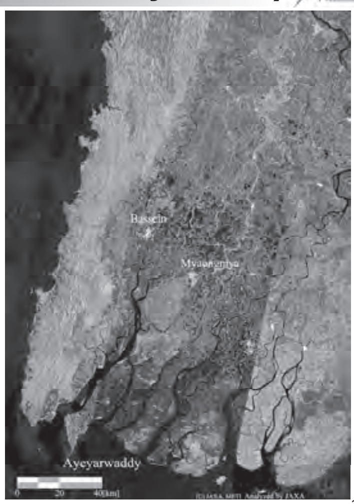
10

Disaster Monitoring (Flood in Myanmar)



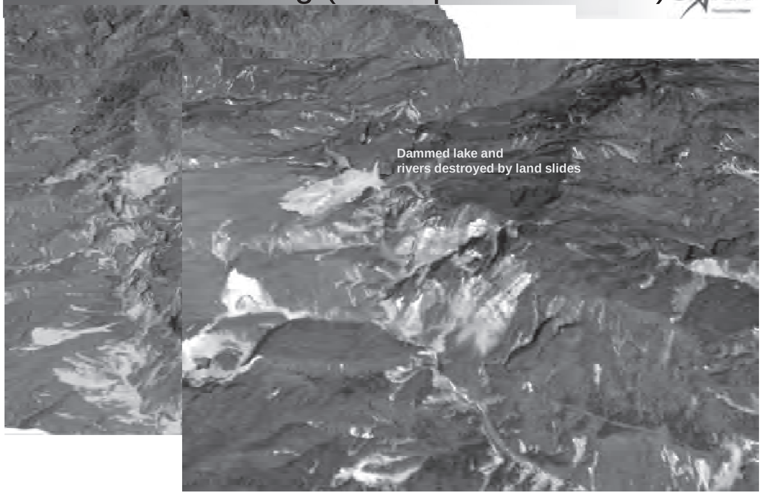
Myanmar was heavily flooded from May 2 to May 3, 2008, due to Cyclone "Nargis". JAXA decided to activate the ALOS/PALSAR to observe the area quickly, and succeeded to acquire image the area on May 6.

- Overlaying images with Apr. 24, 2008 ScanSAR (right)
  Blue: inundation area
  Yellow: expecting soil moisture increased



11

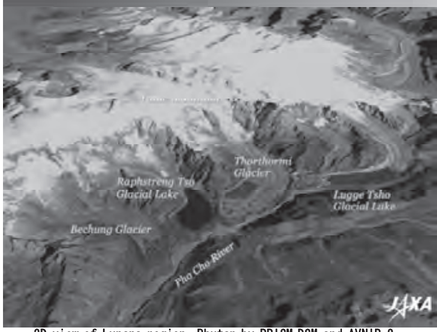
Disaster Monitoring (Earthquake in China)

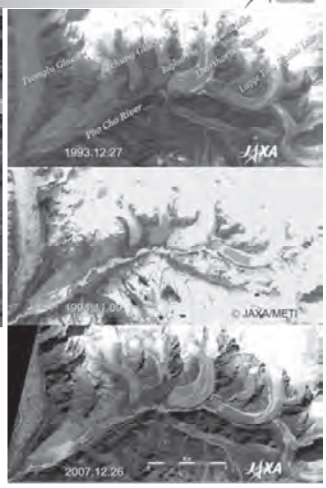


3D view in south-west China using PRISM/DSM and pan-sharpened image by PRISM and AVNIR-2 on June 4, 2008
- PRISM can generate digital surface model (DSM) - Many land slides have been occurred

12

Glacial Lake Outburst Flood Monitoring in Bhutan





3D view of Lunana region, Bhutan by PRISM DSM and AVNIR-2 acquired on Dec. 26, 2007

Temporal change of area of glacial lake in Bhutan

(ha)	Bechung	Raphstreng Tso	Thorthormi	Lugge Tsho
1993. 12. 27	1	127	0	118
1994. 11. 9	4	130	41	96
2007. 12. 26	18	126	88	127

*** This project is conducted in "Science and Technology Research Partnership for Sustainable Development" sponsored by JST and JICA.**

13

Tropical Rainfall Measuring Mission (TRMM)

- Major characteristics
  - Focused on rainfall observation. First instantaneous rainfall observation by three different sensors (PR, TMI, VIRS). PR, active sensor, can observe <u>3D structure of rainfall</u>.
  - Targeting tropical and subtropical region, and chose non-sun-synchronous orbit (inc. angle 35 degree) to observe diurnal variation.
- Major achievement in Japan
  - Demonstration of high quality and high reliability of a satellite onboard precipitation radar
  - Improvement of MWR precipitation retrieval by PR 3D observation
  - Pioneering precipitation system climatology by PR observation
  - Operational use in NWP *etc.*
  - New products including all-weather SST, global soil moisture

US-Japan joint mission

Japan: PR, launcher

US: satellite, TMI, VIRS, CERES, LIS, operation

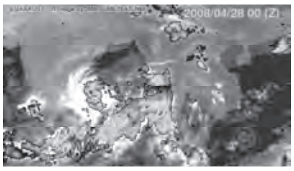
Launch	28 Nov. 1997 (JST)
Altitude	About 350km (since 2001, boosted to 402km to extend mission operation)
Inc. angle	About 35 degree, non-sun-synchronous orbit
Design life	3-year and 2month (still operating)
Instruments	Precipitation Radar (PR) TRMM Microwave Imager (TMI) Visible Infrared Scanner (VIRS) Lightning Imaging Sensor (LIS) CERES (not in operation)

14

Global Rainfall Map (GSMaP)

- GSMaP (Global Satellite Mapping for Precipitation) is originally funded by JST/CREST during 2002-2007, led by Prof. K. Okamoto.
  - Development of reliable MWR algorithm consistent with TRMM/PR and precipitation physical model developed by using PR (Aonashi *et al.*, 2009).
  - Combination of microwave radiometer retrievals with GEO IR by the moving vector (like CMORPH) and new Kalman filtering method (Ushio *et al.*, 2009).
- JAXA/EORC began to provide near-real-time version data of GSMaP (GSMaP_NRT) about 4-hour after observation *via*. password protected ftp site since October 2008.
- Hourly browse images, kmz files for GoogleEarth, and 24-hour movies are also available from Web server.

Near Real Time Global Rainfall Map on Web

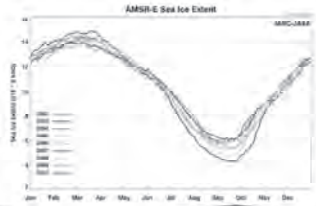


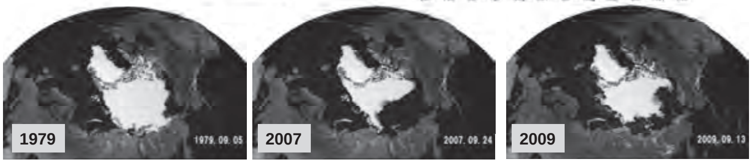
Cyclone "NARGIS" attacked Myanmar

Global Rainfall Map in near-real-time -- http://sharaku.eorc.jaxa.jp/GSMaP/

15

Monitoring Arctic Ice by AMSR-E





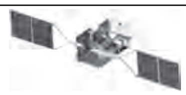
- **JAXA's AMSR-E instrument on the NASA's Aqua satellite monitors Arctic ice.**
- **On September 24, 2007, the Arctic ice measured its smallest since 1978, when satellite observation began.**

16

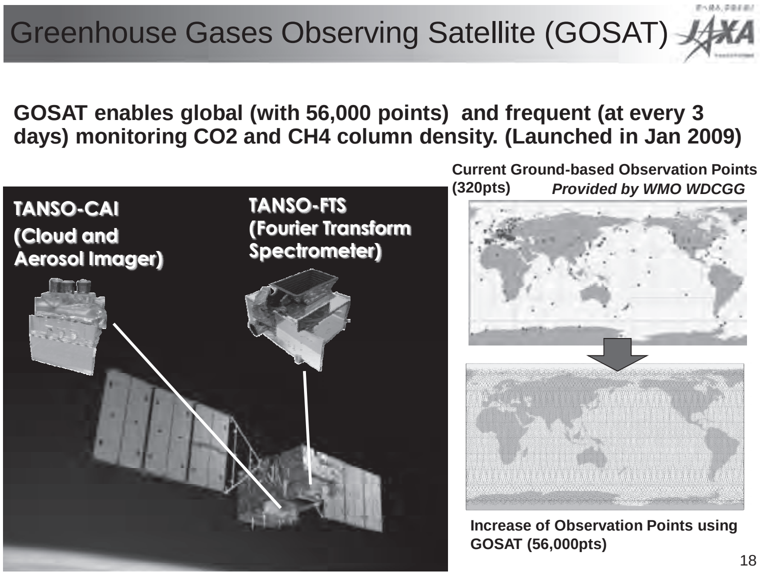
Global Change Observation Mission(GCOM)

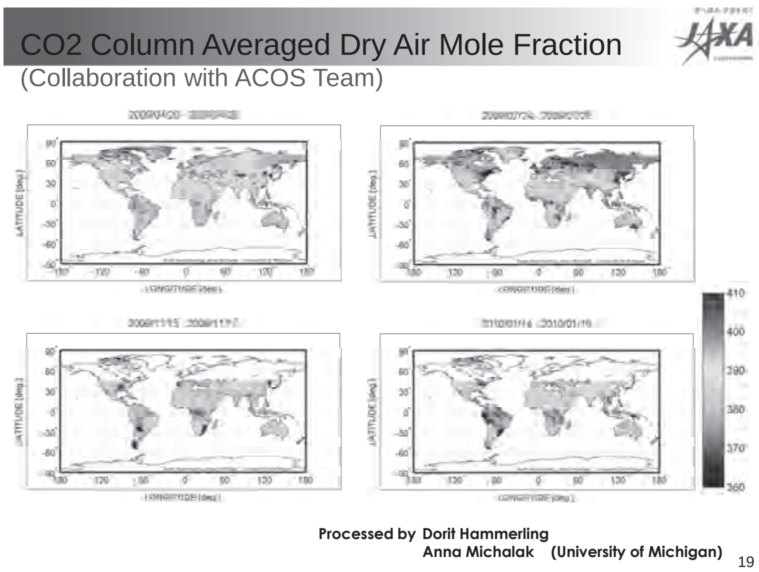
Main Mission

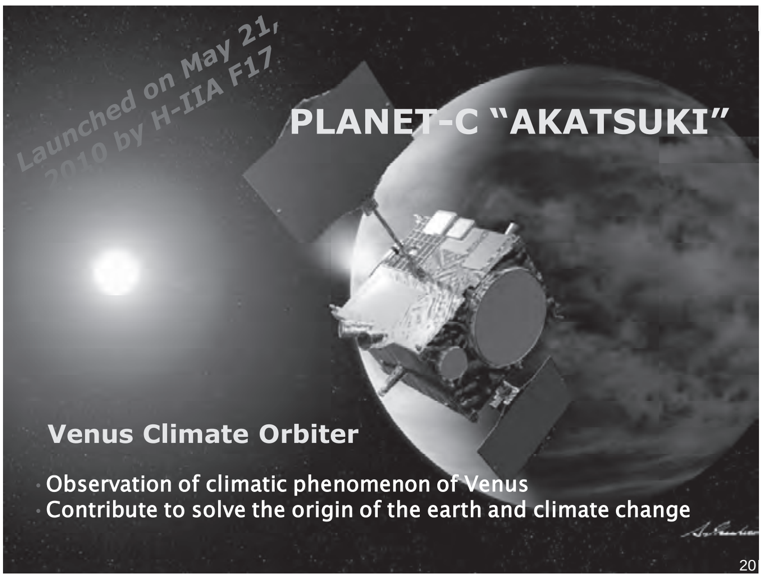
- **Establish and demonstrate the global and long-term Earth observing system (contribute to GEOSS)**
- **Contribute to improving climate change prediction in concert with climate model research institutions**

	GCOM-W	GCOM-C
Orbit	Type : Sun-synchronous orbit Altitude : 699.6 km Inclination : 98.2 degrees Local sun time : 13:30±15min	Type : Sun-synchronous orbit Altitude : 798 km Inclination : 98.6 degrees Local sun time : 10:30±15min
Satellite overview		
Mission life	5 years	
Launch vehicle	H2A launch vehicle	
Mass	1991kg (AMSR follow-on 340 kg and Sea Winds 240 kg included)	2093 kg (SGLI 460 kg included)
Instrument	• AMSR 2	• Global Imager follow-on instrument (SGLI)
Launch (target)	JFY 2011	JFY 2013

17


Greenhouse Gases Observing Satellite (GOSAT)
GOSAT enables global (with 56,000 points) and frequent (at every 3 days) monitoring CO2 and CH4 column density. (Launched in Jan 2009)
TANSO-CAI (Cloud and Aerosol Imager)
TANSO-FTS (Fourier Transform Spectrometer)
Current Ground-based Observation Points (320pts)
Provided by WMO WDCGG
Increase of Observation Points using GOSAT (56,000pts)
18


CO2 Column Averaged Dry Air Mole Fraction
(Collaboration with ACOS Team)
410
400
390
380
370
360
Processed by Dorit Hammerling
Anna Michalak (University of Michigan)
19


Launched on May 21, 2010 by H-IIA F17
PLANET-C “AKATSUKI”
Venus Climate Orbiter
· Observation of climatic phenomenon of Venus
· Contribute to solve the origin of the earth and climate change
20

Contents

21

Asia-Pacific Regional Space Agency Forum

Asia-Pacific Regional Space Agency Forum
APRSAF

- ◆Established in 1993 after the Asia-Pacific International Space Year Conference (APIC) in 1992
- ◆Enhance the development of space programs in the Asia-Pacific region and promote regional cooperation in the field of space technology and its applications.
- ◆[Participation] Space agencies, related governments, regional and international organizations, institutions responsible for applying space technology.
- ◆[Organizers] MEXT, JAXA and co-host organizations
  Past co-organizers: Government entities of Mongolia, Malaysia, The Republic of Korea, Thailand, Australia, Indonesia, India, Vietnam

Working Groups

- Earth Observation WG
- Communication Satellite Applications WG
- Space Environment Utilization WG
- Space Education And Awareness WG

- "Sentinel Asia" Disaster Management Support System
- "SAFE" Space Applications for Environment
- "STAR" Satellite Technology for the Asia-Pacific Region Program

22

Sentinel Asia

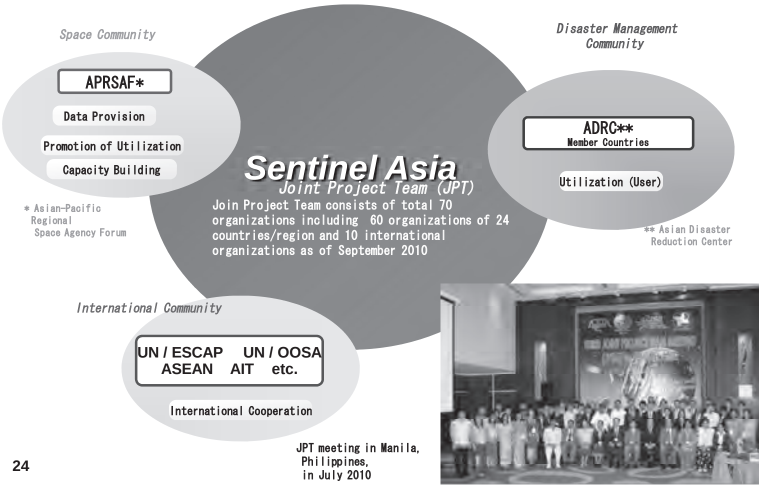
Sentinel Asia is a voluntary initiative led by APRSAF to support disaster management activities in the Asia-Pacific region by applying remote sensing and Web-GIS technologies.

- Oct 2005: **plan to initiate the pilot project was approved at APRSAF-12.**
- Feb 2006: **Joint Project Team (JPT) was organized. As of 2010/11, JPT consists of 60 agencies from 24 countries and 10 inn's organizations.**
- Step1 (2006-2007): **pilot project (completed).**
- Step2 (2008-2012): **in progress.**

Website
https://sentinel.tksc.jaxa.jp/

23

Framework of Sentinel Asia



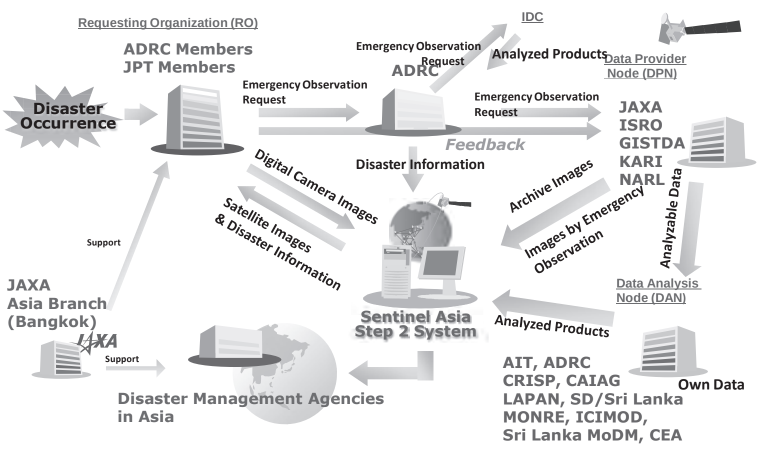
24

Main Activities of Sentinel Asia

- Emergency Observation
  accept emergency observation request from JPT and ADRC members
- Wildfire Monitoring
- Flood Monitoring
- Glacier Lake Outburst Flood Monitoring
- Capacity Building and Human Resource Development

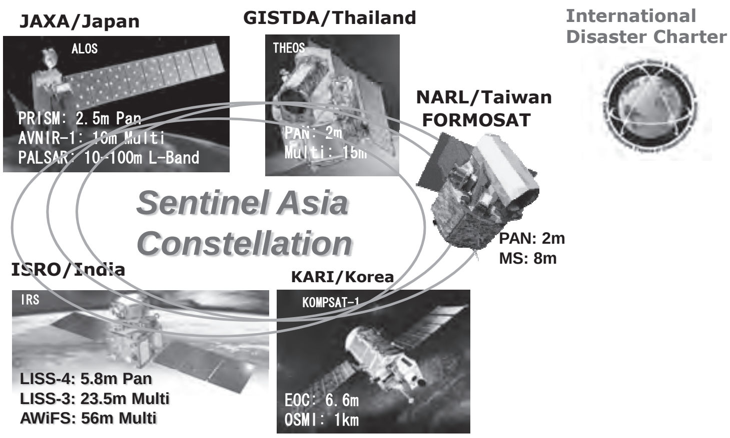
25

Flow of Emergency Observation



26

Satellites contributing to Emergency Observation

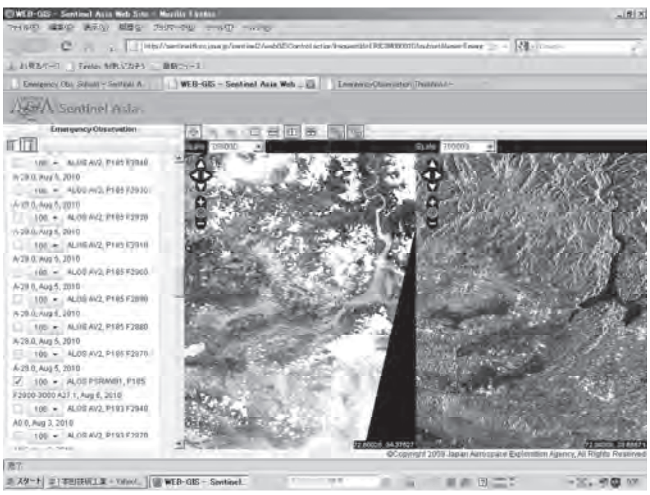


27

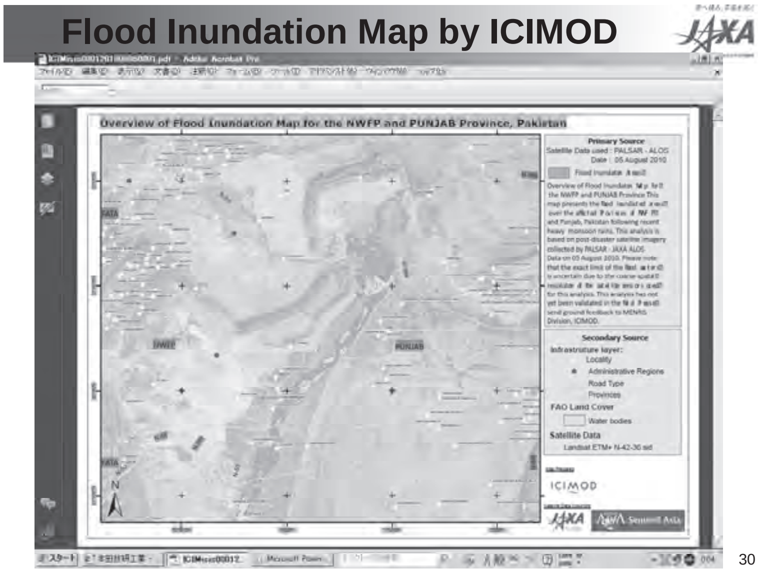
Regional Servers to be set up in 2010 (shown in red)

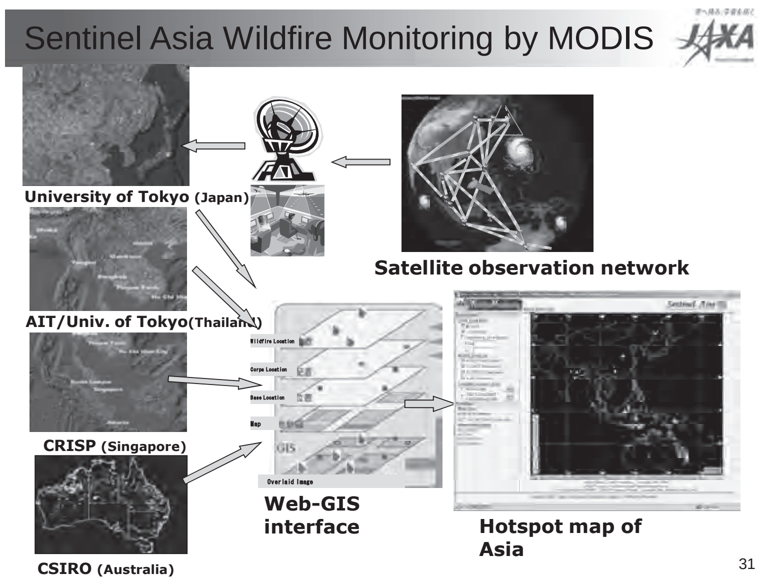
28

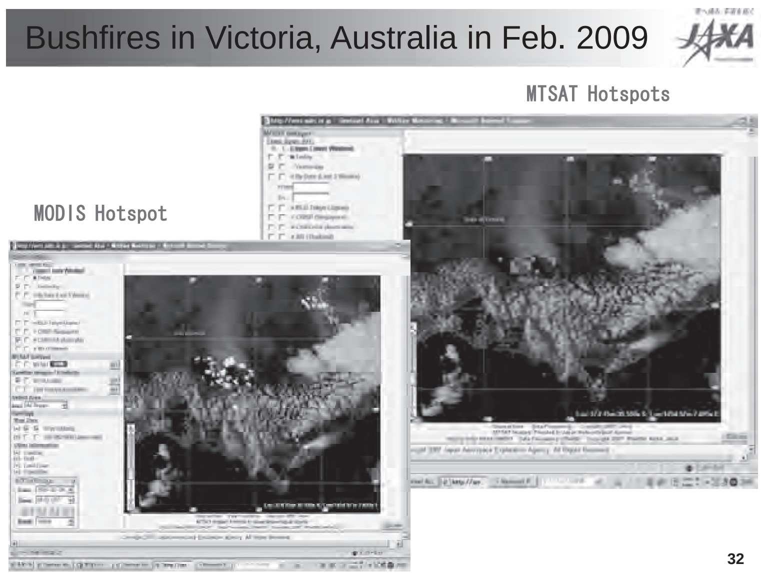
Flood in Pakistan: ALOS Imagery on 5 Aug. 2010



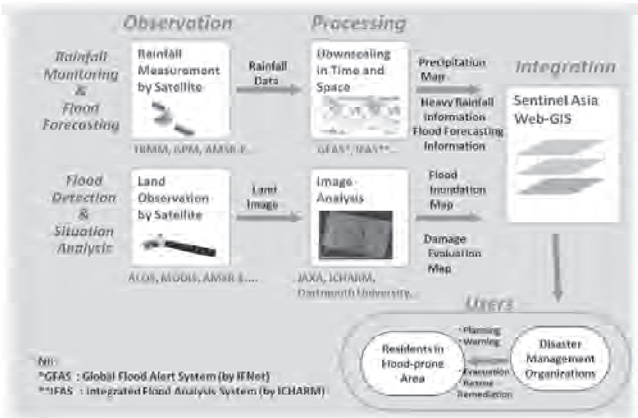
29


Flood Inundation Map by ICIMOD
Overview of Flood Inundation Map for the NWFP and PUNJAB Province, Pakistan
Primary Source
Secondary Source
ICIMOD
30


Sentinel Asia Wildfire Monitoring by MODIS
University of Tokyo (Japan)
AIT/Univ. of Tokyo(Thailand)
CRISP (Singapore)
CSIRO (Australia)
Satellite observation network
Web-GIS interface
Hotspot map of Asia
31

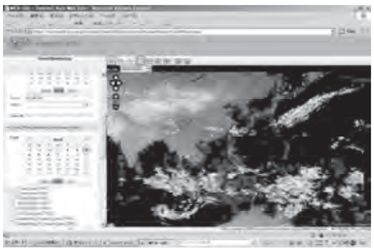

Bushfires in Victoria, Australia in Feb. 2009
MTSAT Hotspots
MODIS Hotspot
32

Sentinel Asia Flood Monitoring



33

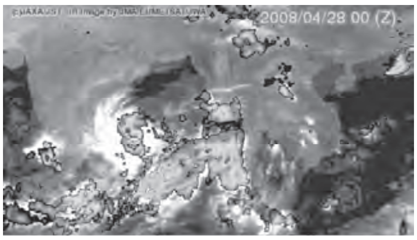
Precipitation Data



GFAS (Global Flood Alert Sysytem)
Accumulated daily precipitation

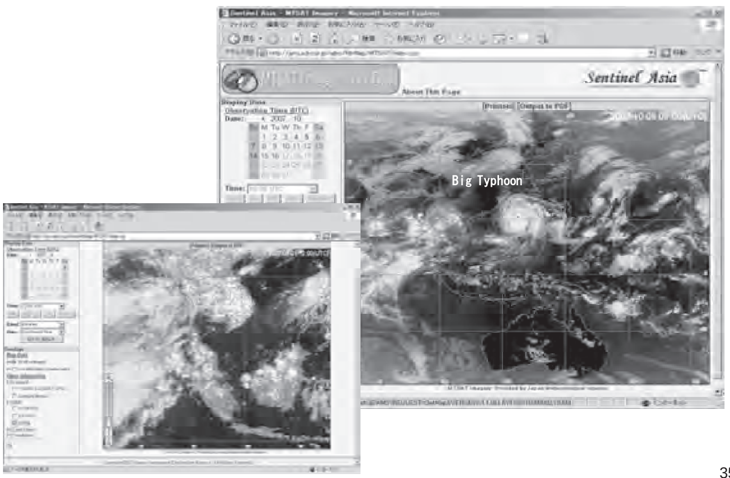
GSMaP (Global Satellite Map of Precipitation)
Near real-time hourly precipitation

Cyclone 'NARGIS' attacked Myanmar in May 2008

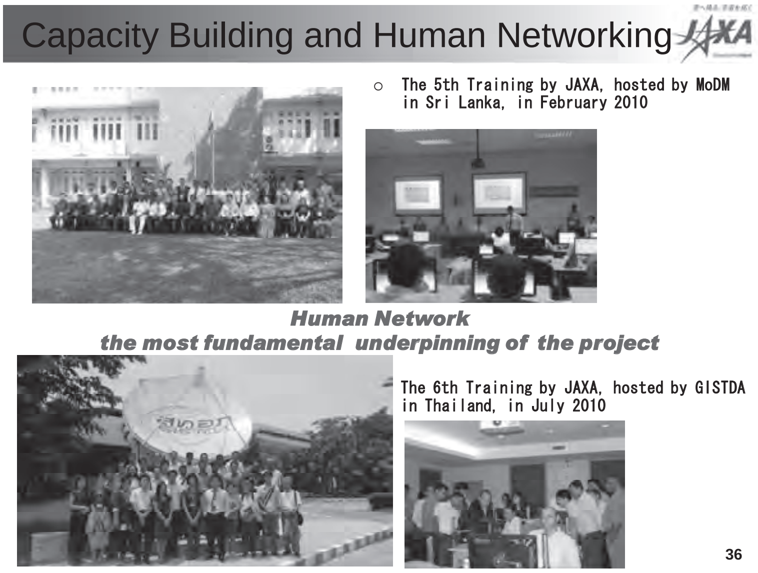


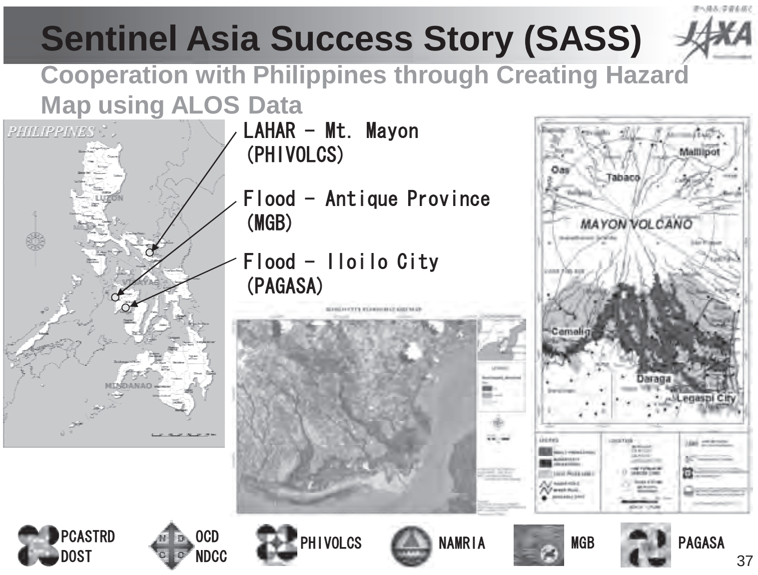
34

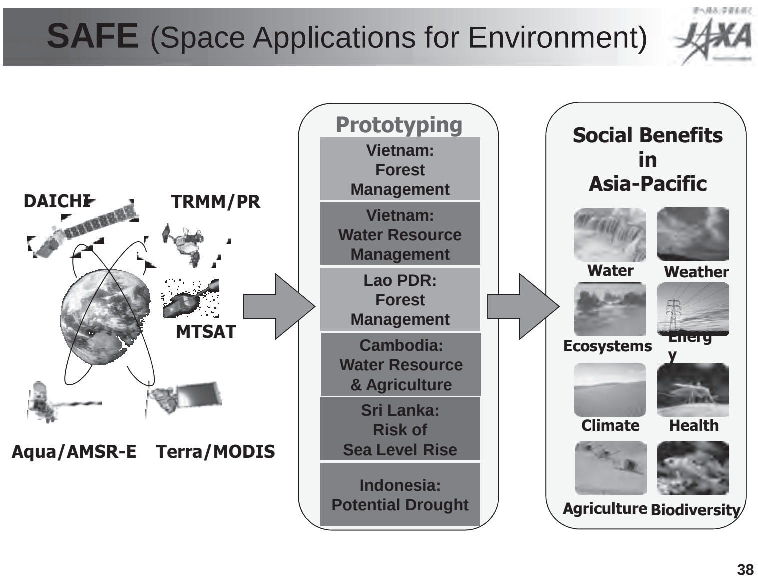
MTSAT(Meteorological Satellite) Imagery on GIS



35

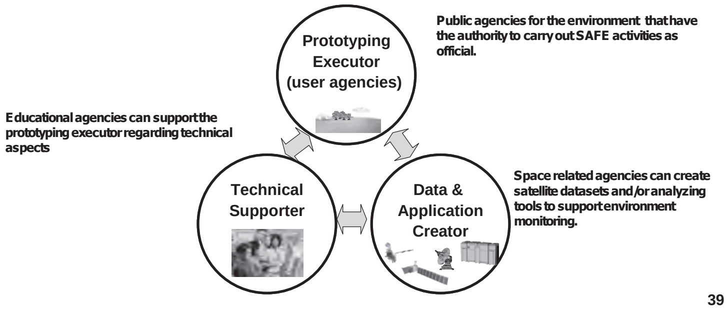

Capacity Building and Human Networking
JAXA
The 5th Training by JAXA, hosted by MoDM in Sri Lanka, in February 2010
Human Network
the most fundamental underpinning of the project
The 6th Training by JAXA, hosted by GISTDA in Thailand, in July 2010
36


Sentinel Asia Success Story (SASS)
JAXA
Cooperation with Philippines through Creating Hazard Map using ALOS Data
PHILIPPINES
LUZON
MINDANAO
LAHAR - Mt. Mayon (PHIVOLCS)
Flood - Antique Province (MGB)
Flood - Iloilo City (PAGASA)
Malilipot
Oas
Tabaco
MAYON VOLCANO
Camalig
Daraga
Legaspi City
PCASTRD DOST
OCD NDCC
PHIVOLCS
NAMRIA
MGB
PAGASA
37


SAFE (Space Applications for Environment)
JAXA
DAICHI
TRMM/PR
MTSAT
Aqua/AMSR-E
Terra/MODIS
Prototyping
Vietnam: Forest Management
Vietnam: Water Resource Management
Lao PDR: Forest Management
Cambodia: Water Resource & Agriculture
Sri Lanka: Risk of Sea Level Rise
Indonesia: Potential Drought
Social Benefits in Asia-Pacific
Water
Weather
Ecosystems
Energy
Climate
Health
Agriculture
Biodiversity
38

Framework of SAFE

- **The SAFE activities are implemented by issue-based prototyping project teams consisting of end users, technical supporters, and data and application providers.**



39

SAFE 2nd Workshop

SAFE #2 WS
Held in Sri Lanka on Jun, 2010
As co-host; Coastal Conservation Department
50 participants

<u>4 new proposals were submitted, and 2 out of them were approved as SAFE new prototyping.</u>

40

SAFE Prototyping Status

Status	Country	Theme
Success Story	VIETNAM	Integrated water resource management
	VIETNAM	Forest monitoring
On Going	CAMBODIA	Water Cycle and Agricultural Activities
	LAO PDR	Forest monitoring and management
	INDONESIA	Potential Drought Monitoring
	SRI LANKA	Risk of Sea Level Rise on Coastal Zone
New Proposal	PAKISTAN	Monitoring Water Cycle Variations & Assessing Climate Change Impacts
	SRI LANKA	Modeling ocean frontal zones using high resolution satellite and float data to locate tune fish aggregations

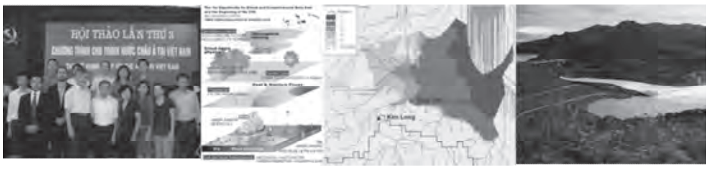
More detailes : <u>http://www.eorc.jaxa.jp/SAFE/index.html</u>

41

SAFE Prototyping

Integrated Water Resource Management in Vietnam

- Vietnamese National HYDORO-METEOLOGICAL Service , Ministry of Natural Resources and Environment (NHMS/MONRE) responsible for flood management and Metrological Service in Vietnam. NHMS is trying to strengthen the precipitation monitoring and reservoirs management under the Asian Water Cycle Initiative in cooperation with Univ. of Tokyo and JAXA.



42

SAFE Prototyping

Forest Management in Vietnam

- Vietnamese Forest Protection Department of Ministry of Agriculture and Rural Development (FPD/MARD) responsible for Forest Management in Vietnam. FPD has MODIS receiving station and provides wild fire Hotspots information to its rural branches. The target of FPD is to strengthen the forest management by using of MODIS.

43

Contents

44

Cooperation between JAXA and AIT

- Dispatch of faculty members to SET (School of Engineering and Technology) and GIC (Geo-Informatics Center)
- 'Mini-Projects' and other Capacity Building Programs with GIC
- Sentinel Asia and International Disaster Charter with GIC
- WINDS Utilization Experiments (Tele-Education) with SET
- QZS monitoring
- Others (ADRC Projects etc.)

45

Cooperation with GIC-AIT in Capacity Building

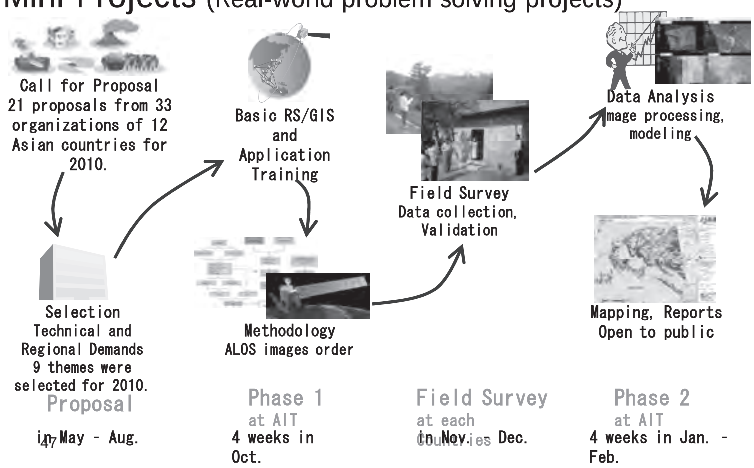
- For last 16 years starting from April 1995, JAXA has been entrusting a responsibility to the Geo-Informatics Center, Asian Institute of Technology (GIC-AIT) in Bangkok, to carry out various training programs mainly focusing on RS and GIS for the Asia-Pacific nations.
- The contents of the training programs were sometimes changed by the needs of the times. For last several years, JAXA and GIC-AIT concentrate on the Mini-Projects, a problem-solving type of training program.

16 year history of JAXA's Capacity Building activities in cooperation with GIC-AIT

46

Flow of 'Mini-Projects'

Mini-Projects (Real-world problem solving projects)



47

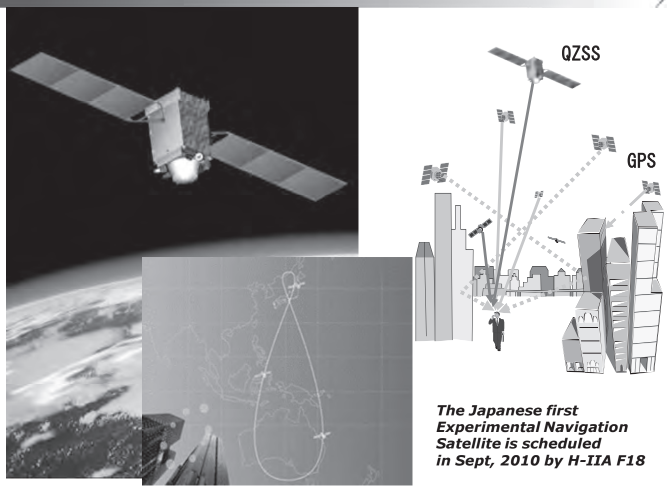
9 Mini-Projects selected for 2010

16 Participants of 16 Organizations from 9 Countries

1. Bhutan: Landslide
2. Indonesia: Flood
3. Kyrgystan: Landslide
4. LaoPDR : Drought
5. Nepal: Japanese Encephalitis
6. Pakistan: Habitat Evaluation of Western Horned Tragopan
7. Sri Lanka: Flood and Landslide
8. Thailand: Assessing Impact of Urbanization
9. Vietnam: Coastal Erosion Management

48

Quasi-Zenith Satellite System (QZSS)



The Japanese first Experimental Navigation Satellite is scheduled in Sept, 2010 by H-IIA F18

49

Conclusions

- JAXA aims to contribute to Climate Change Adaptation and Disaster Management, employing its Earth Observation Satellites.
- APRSAF is the largest framework for space cooperation in Asia and the Pacific region. APRSAF aims to strengthen partnerships between space agencies and user agencies.
- APRSAF conducts concrete cooperative activities and initiatives. The initiatives of APRSAF, such as Sentinel Asia and SAFE contribute to addressing regional issues, such as disaster risk reduction, environmental protection and natural resources management.
- JAXA and AIT cooperate tightly in Capacity Building (Mini-Project etc.), APRSAF, Sentinel Asia and so on.

50

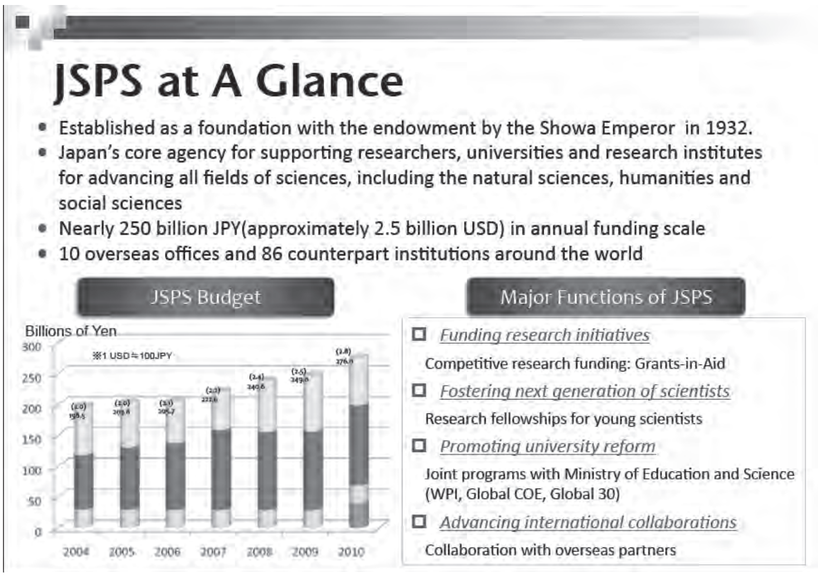

Please visit our web site !
http://www.jaxa.jp/index_e.html
Thank you for your attention
51
©JAXA/NHK

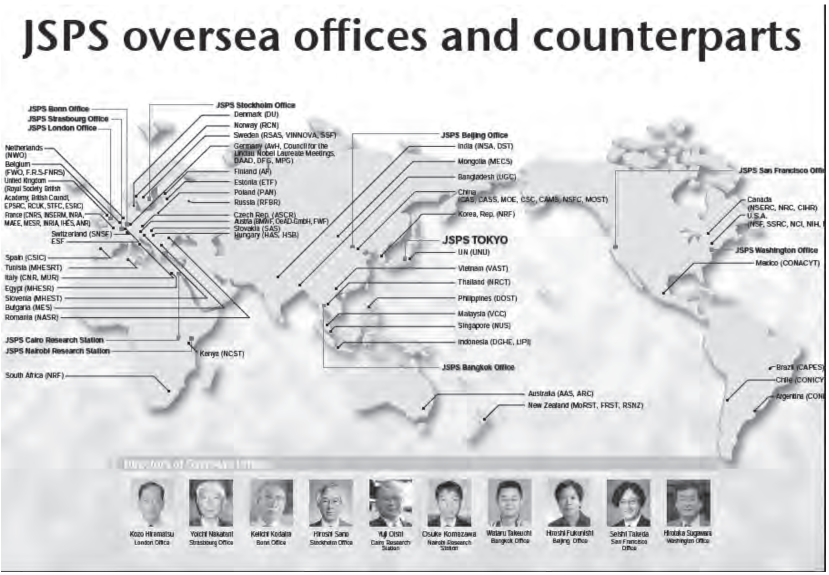
Role of JSPS Bangkok office for Promoting Research and Education in Southeast Asia

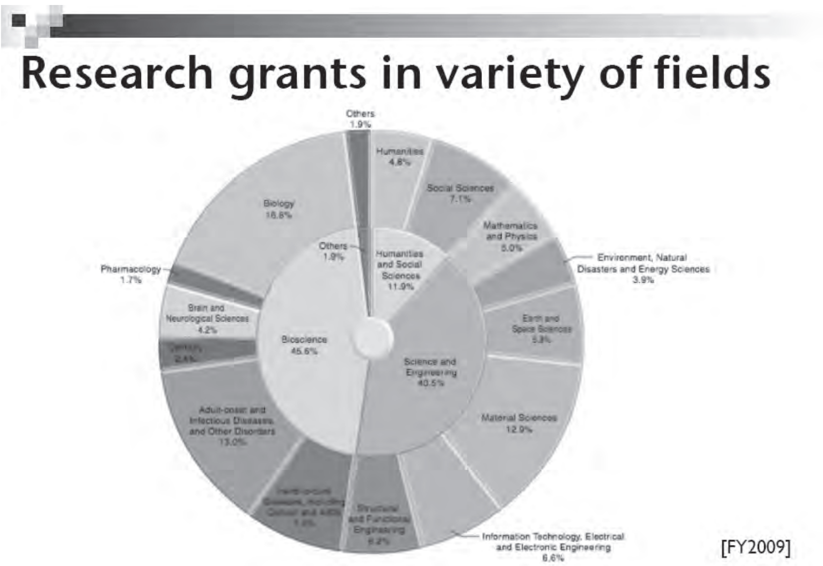
Assoc. Prof. Dr. Wataru Takeuchi

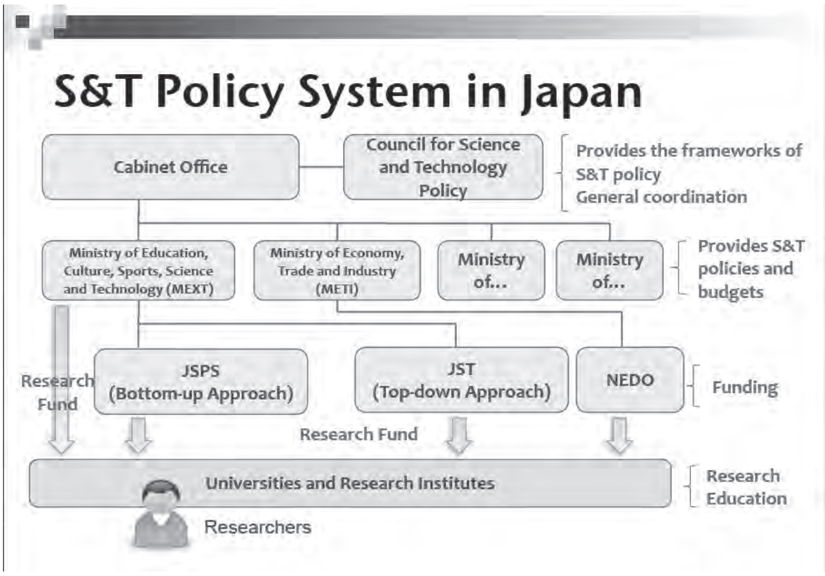
ROLE OF JSPS BANGKOK OFFICE FOR PROMOTING RESEARCH AND EDUCATION IN SOUTHEAST ASIA

WATARU TAKEUCHI
Director, JSPS Bangkok Office and IIS, The University of Tokyo
wataru@jsps-th.org



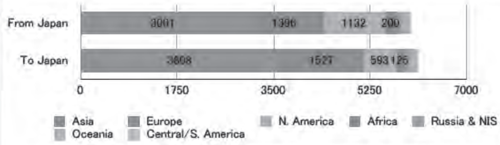

JSPS oversea offices and counterparts
JSPS Bonn Office
JSPS Strasbourg Office
JSPS London Office
JSPS Stockholm Office
JSPS Beijing Office
JSPS TOKYO
JSPS San Francisco Office
JSPS Washington Office
JSPS Cairo Research Station
JSPS Nairobi Research Station
JSPS Bangkok Office
India (INSA, DST)
Mongolia (MECS)
Bangladesh (UGC)
Korea, Rep. (NRF)
UN (UNU)
Vietnam (VAST)
Thailand (NRCT)
Philippines (DOST)
Malaysia (VCC)
Singapore (NUS)
Indonesia (DGHE, LIPI)
Kenya (NCST)
South Africa (NRF)
Australia (AAS, ARC)
New Zealand (MoRST, FRST, RSNZ)
Mexico (CONACYT)


Research grants in variety of fields
Others 1.9%
Humanities 4.8%
Social Sciences 7.1%
Mathematics and Physics 5.0%
Environment, Natural Disasters and Energy Sciences 3.9%
Earth and Space Sciences 5.3%
Material Sciences 12.9%
Information Technology, Electrical and Electronic Engineering 6.6%
Structural and Functional Engineering 6.2%
Adult-onset and Infectious Diseases, and Other Disorders 13.0%
Brain and Neurological Sciences 4.2%
Pharmacology 1.7%
Biology 16.8%
Others 1.9%
Humanities and Social Sciences 11.9%
Bioscience 45.6%
Science and Engineering 40.5%
[FY2009]

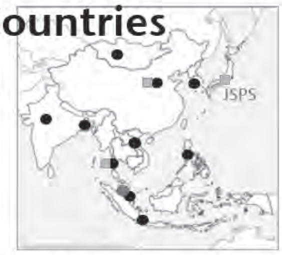

S&T Policy System in Japan
Cabinet Office
Council for Science and Technology Policy
Provides the frameworks of S&T policy
General coordination
Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Ministry of Economy, Trade and Industry (METI)
Ministry of…
Ministry of…
Provides S&T policies and budgets
Research Fund
JSPS (Bottom-up Approach)
JST (Top-down Approach)
NEDO
Funding
Research Fund
Universities and Research Institutes
Research
Education
Researchers

Cooperation with Asian Countries

Researchers exchange under JSPS Int'l program (2008)



Country	To JAPAN	From JAPAN
Korea	1054	1101
China	1107	921
India	280	145
Thailand	300	254
Indonesia	177	118
Vietnam	182	121
Malaysia	109	140
Singapore	50	23
Philippines	61	82



- China (CAS, CASS, MOE, NSFC, CAMS, MOST, CAC)
- Bangladesh (UGC)
- India (DST, INSA)
- Indonesia (DGHE,LIPI)
- Korea Rep. (KOSEF)
- Malaysia (VCC)
- Mongolia (MECS)
- Philippines (DOST)
- Singapore (NUS)
- Thailand (NRCT)
- Vietnam(VAST)

■ JSPS Bangkok Office

■ JSPS Beijing Office

4

Fellowships for Foreign Researchers

Number of invited researchers to Japan

Program (unit: person)	2006	2007	2008
Postdoctoral Fellowship	1,962	1,818	1,582
Invitation Fellowship (Long-term)	114	108	102
Invitation Fellowship (Short-term)	343	294	294
Total	2,419	2,220	1,978

11

KAKENHI (Grants-in-aid for science research)

◇ Competitive funding to support a high-caliber research based on the free ideas of researchers

◇ Covers entire spectrum of academic fields including the humanities, social sciences, and natural sciences

◇ Budget: \197 billion Yen (Fiscal 2009)
6% of Japan's total S&T budget (\3,5 trillion)
40% of the government's competitive funding (\491.3 billion)

◇ 24,000 newly selected projects out of 100,000 applications (Selection ratio: 24%)

◇ 57,000 new and carry-over projects supported

◇ **Eligible for foreign nationalities / accept English applications**

For foreign researchers in Japanese universities/research institutions...

・Provides English version of application guidelines/forms for easier application process in English

・Provides English version of KAKENHI Handbook which explains basic ideas of KAKENHI and its applications
(http://www.jsps.go.jp/english/e-grants/data/handbook.pdf)

5

RONPAKU (Dissertation PhD) Program

- Giving opportunities for young Asian/African researchers to obtain PhD degree from Japanese universities by submitting dissertation
- 30-40 fellows are newly selected every year from Asia and Africa
- Fellows are invited every year to visit their Japanese host researchers up to 90 days for 5 years
- Their host Japanese researchers are also allowed to visit the candidates in their countries up to 30 days in the same
- Roundtrip airfare, Stipend, Research grant

Ronpaku fellow at the medal award ceremony (2010 in Bangkok)

# of fellows successfully received PhD (1978-2008)

Country	#	Country	#
Thai	181	Malaysia	20
Indonesia	121	Vietnam	16
Philippines	67	Bangladesh	9
Korea	59	Singapore	3
China	46	Others	1
India	24	TOTAL	547

Asian core and AA science platform

Core University Program

- Started in 1978
- Providing a framework for international cooperative research in specifically designated fields and topics with a cooperation between JSPS and counterpart funding agencies
- Targeted countries: Asian countries

Modified to Asian CORE Program / AA Science Platform Program in 2005

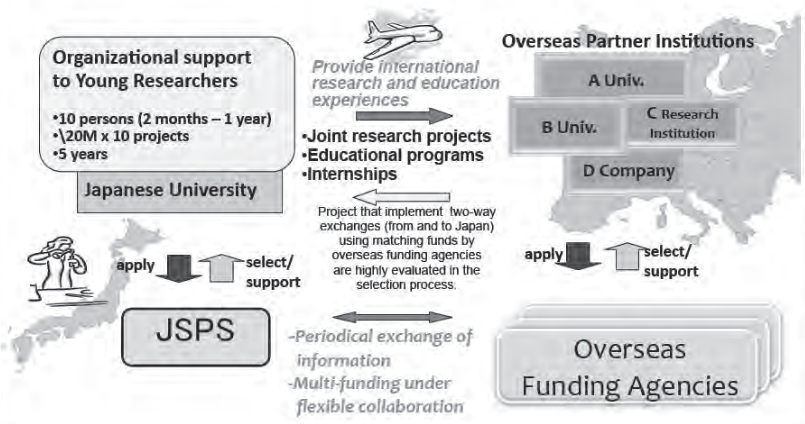
Asian CORE Program

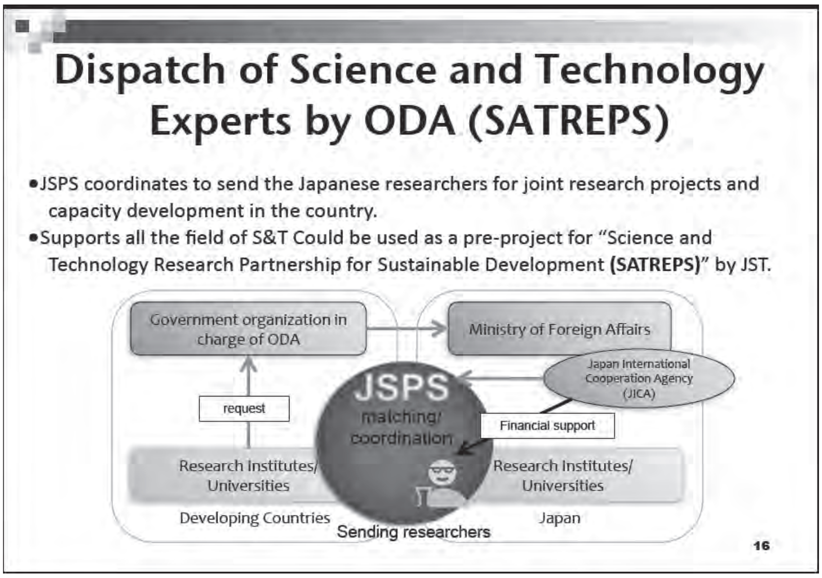
- Building Asian research hubs based on equal partnership by conducting world-class research and fostering new generations of talented young scientists
- Targeted countries: Asian countries
- Grants: 12 million JPY from JSPS + Matching fund from counterpart countries (required)
- Project Duration: 5 years
- Granted projects: 2006: 3 2007: 3 2008: 5 2009: 5 2010 : 5

Asia-Africa Science Platform Program

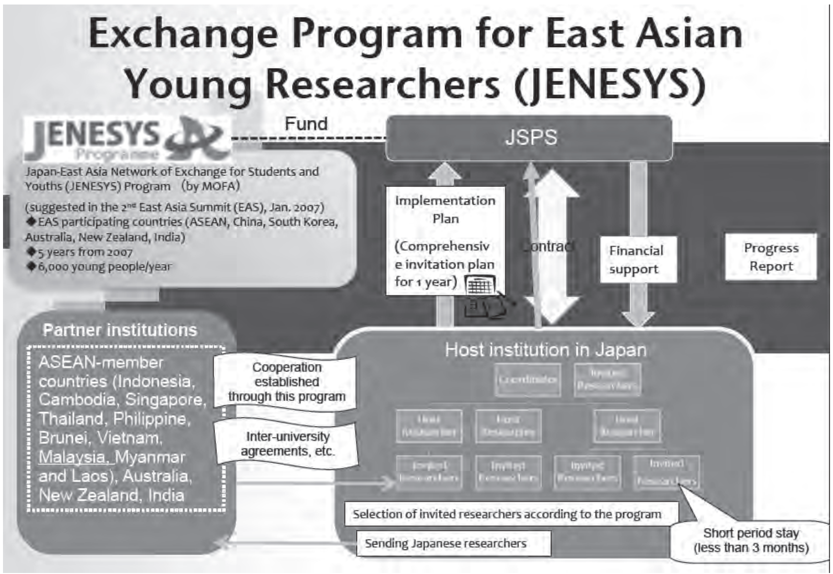
- Japanese research institutions take the lead in building research hubs and fostering young researchers to jointly contribute to Asia/Africa region
- Targeted countries: Asian and/or African countries
- Grants: 5 million JPY from JSPS + Matching fund from counterpart countries (favorable)
- Project Duration: 3 years
- Granted projects: 2006: 5 2007: 5 2008: 10 2009: 12 2010 : 11

International Training Program (ITP)

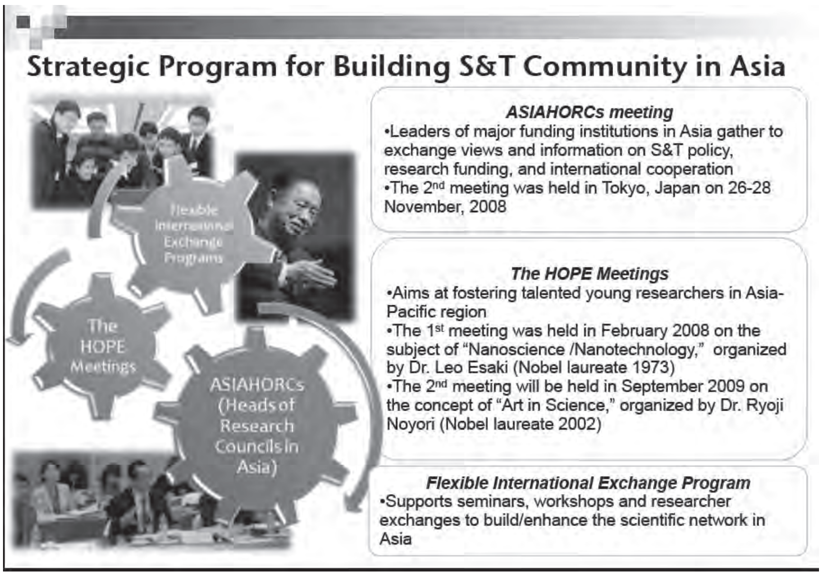




Dispatch of Science and Technology Experts by ODA (SATREPS)
•JSPS coordinates to send the Japanese researchers for joint research projects and capacity development in the country.
•Supports all the field of S&T Could be used as a pre-project for "Science and Technology Research Partnership for Sustainable Development (SATREPS)" by JST.
Government organization in charge of ODA
Ministry of Foreign Affairs
Japan International Cooperation Agency (JICA)
request
JSPS matching/ coordination
Financial support
Research institutes/ Universities
Research institutes/ Universities
Developing Countries
Sending researchers
Japan
16

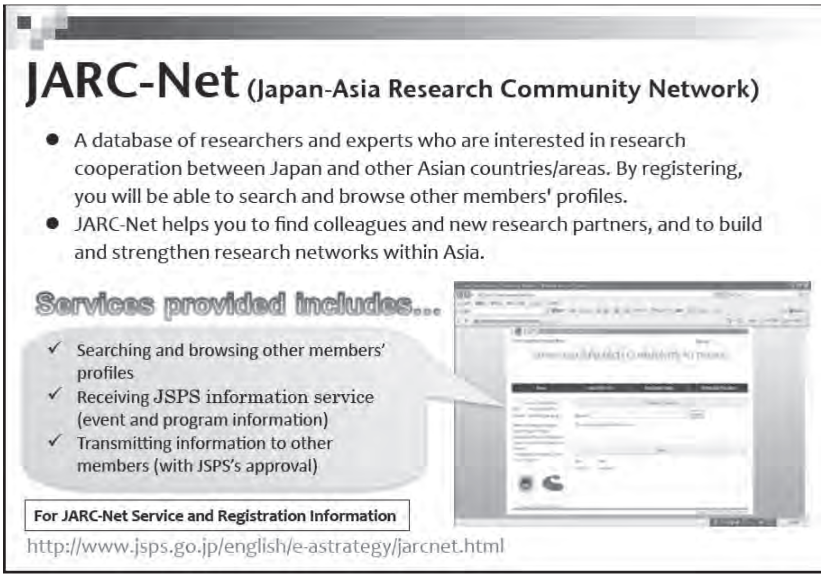


Exchange Program for East Asian Young Researchers (JENESYS)
JENESYS Programme
Fund
JSPS
Japan-East Asia Network of Exchange for Students and Youths (JENESYS) Program (by MOFA)
(suggested in the 2nd East Asia Summit (EAS), Jan. 2007)
◆EAS participating countries (ASEAN, China, South Korea, Australia, New Zealand, India)
◆5 years from 2007
◆6,000 young people/year
Implementation Plan
(Comprehensive invitation plan for 1 year)
Contract
Financial support
Progress Report
Partner institutions
ASEAN-member countries (Indonesia, Cambodia, Singapore, Thailand, Philippine, Brunei, Vietnam, Malaysia, Myanmar and Laos), Australia, New Zealand, India
Cooperation established through this program
Inter-university agreements, etc.
Host institution in Japan
Selection of invited researchers according to the program
Sending Japanese researchers
Short period stay (less than 3 months)



Strategic Program for Building S&T Community in Asia
ASIAHORCs meeting
•Leaders of major funding institutions in Asia gather to exchange views and information on S&T policy, research funding, and international cooperation
•The 2nd meeting was held in Tokyo, Japan on 26-28 November, 2008
The HOPE Meetings
•Aims at fostering talented young researchers in Asia-Pacific region
•The 1st meeting was held in February 2008 on the subject of "Nanoscience /Nanotechnology," organized by Dr. Leo Esaki (Nobel laureate 1973)
•The 2nd meeting will be held in September 2009 on the concept of "Art in Science," organized by Dr. Ryoji Noyori (Nobel laureate 2002)
Flexible International Exchange Program
•Supports seminars, workshops and researcher exchanges to build/enhance the scientific network in Asia
Flexible International Exchange Programs
The HOPE Meetings
ASIAHORCs (Heads of Research Councils in Asia)


Information
JSPS Fellow Alumni Associations
JSPS alumni associations have been established in the US, the UK, Sweden, Germany, France, Egypt, Kenya and Thailand in cooperation with JSPS Overseas Offices. In addition, former Indian, Korean, Bangladesh and Finnish fellows have recently established JSPS alumni associations in their countries.
UK
First General Assembly (4 June 2004)
GERMANY
12th Anniversary of the German JSPS-Club (11-12 May 2007)
SWEDEN
General Assembly 2007 (29 January 2007)
INDIA
First meeting held in Japan (28 October 2006)
FRANCE
Executive Meeting (7 July 2006)
US
General Assembly (17 November 2007)
KOREA
First General Meeting (19 July, 2008)
KENYA (Eastern Africa)
First Assembly(30 July, 2007)
EGYPT
Inauguration Ceremony (10 April, 2008)
BANGLADESH
Inauguration Ceremony (21 March, 2009)
FINLAND
Inauguration Ceremony (5 June, 2009)
THAILAND
Inauguration Ceremony (5 February, 2010)


JARC-Net (Japan-Asia Research Community Network)
A database of researchers and experts who are interested in research cooperation between Japan and other Asian countries/areas. By registering, you will be able to search and browse other members' profiles.
JARC-Net helps you to find colleagues and new research partners, and to build and strengthen research networks within Asia.
Services provided includes...
Searching and browsing other members' profiles
Receiving JSPS information service (event and program information)
Transmitting information to other members (with JSPS's approval)
For JARC-Net Service and Registration Information
http://www.jsps.go.jp/english/e-astrategy/jarcnet.html

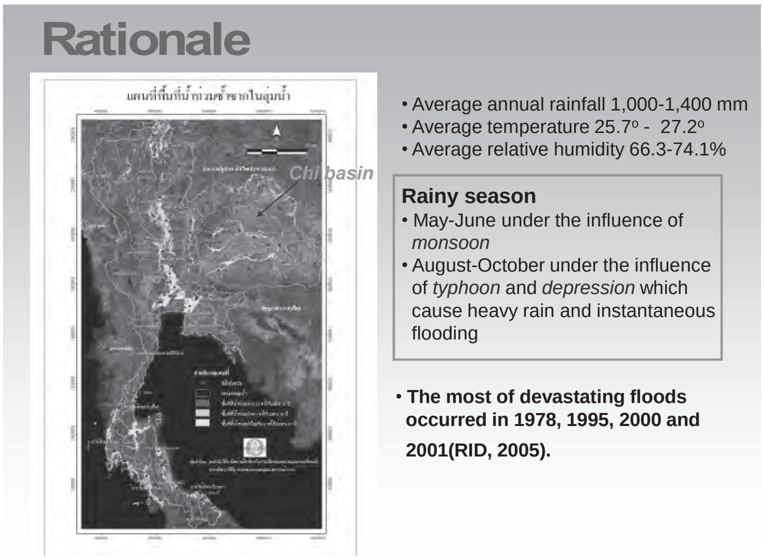

JSPS
2010-2011
JSPS
Japan Society for the Promotion of Science
www.jsps.go.jp/english/index.html
www.jsps.go.jp

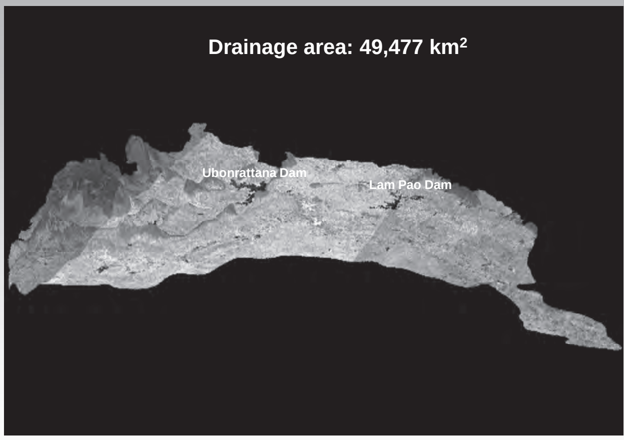
Geospatial Planning for Flood Water Retention Sites to Mitigate Flood and Drought in Chi River Basin, Thailand

Dr. Nitin Kumar Tripathi

GEOSPATIAL PLANNING FOR FLOOD WATER RETENTION SITES TO MITIGATE FLOOD AND DROUGHT IN CHI RIVER BASIN, THAILAND

NITIN KUMAR TRIPATHI
Director, UNIGIS, Asian Institute of Technology (AIT)
nitinkt@ait.ac.th





Relief map of Chi River basin

- Chi River Basin faces natural disasters such as floods and droughts, especially floods almost every year.
- The degree of devastation has dramatically increased in parallel with the expansion of affected areas during the past 2-3 years.
- Realizing the problem, Thai Government has started many projects such as the use of rubber weirs and construction of retention ponds to store runoff water and floodwater.

Government focus would be on building rubber weirs and construction of retention ponds to store runoff water (Source: Bangkok Post, September 16, 2005)

Objective

To develop a water budget model and plan water retention infrastructures to reduce the impact of flooding using integrated hydrological and hydrodynamic models, remote sensing ,GIS, and Analytical Hierarchy Process (AHP)

Integration of RS, GIS, DEM, hydrological and hydrodynamic models for water resources management

Sustainable water resources management

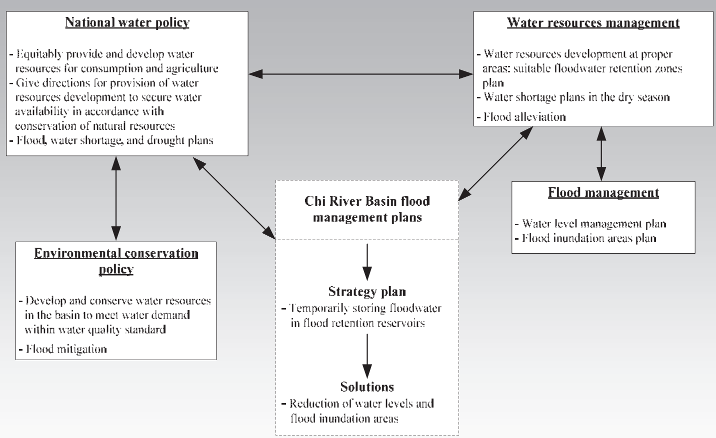
- It is economically, socially, and ecologically sound and meets the need of present without compromising the ability of future generations to meet their own needs
- Sustainability depends on economic, environmental, ecological, social, and physical goals.

Sustainability and technology

- Impacts of planning and management of water resources can be aided by the use of modern processing technology.
- computer-based optimization and simulation models
- exploring individual ideas, to test various assumptions, and to understand results of analyses
- predict the impacts of possible alternatives
- The resources and condition of future generations can be considered which depend on the actions today.

Thailand's national economic and social development plan (NESDP) (2007-2011)

- development under the 10th NESDP
- follow "the self sufficiency philosophy"
- self reliance, self immunity and development balance in all directions
- economic, social, and natural resources and environment



Conceptual framework of water resources management for this study

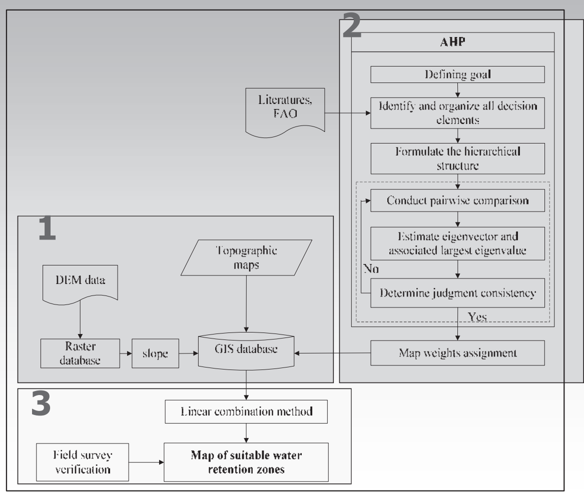
Guidelines on water resources management

- increasing water storage capacity
- proper water distribution in the basins
- water resources development at proper areas
- wetland rehabilitation, water drainage improvement
- flood prevention in both rural and urban areas

Where to store floodwater?

To develop a model for locating water retention zones using remote sensing, GIS and Analytical Hierarchy Process (AHP)

Methodology



Why AHP?

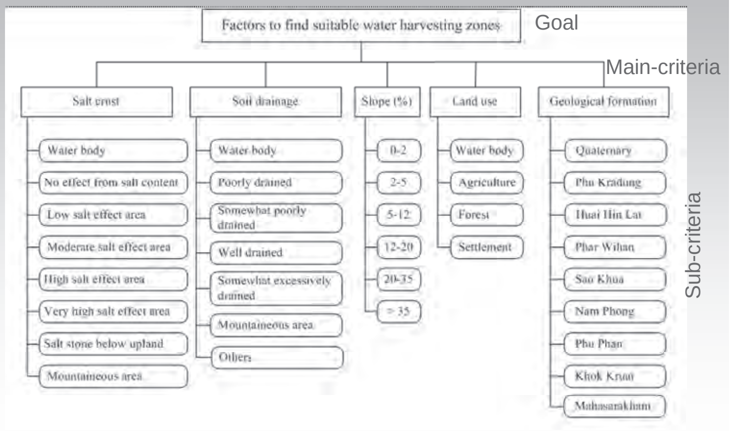
Multicriteria decision making (MCDM) problems

Multiple objective decision making (MODM)

Multiple attribute decision making (MADM)

AHP
- simple hierarchical structure
- simplicity
- sound mathematical basis
- widespread usage
- ability to measure inconsistency in judgments

Decision tree to determine the main and sub-criteria for suitable water retention zones



Three principles of AHP

2.Prioritisation

- Humans are well capable of evaluating two elements at a time.
- For many criteria; human mind has certain difficulties in dealing.
- Pair-wise comparison approach has used to uncover the relative-importance among all decision elements in a multiple attribute
- For example; A = 2B ; [B=(1/2)A]

Scale for pair wise comparison

Intensity of importance	Definition
1	Equal Importance
2	Equal to Moderate importance
3	Moderate Importance
4	Moderate to strong importance
5	Strong importance
6	Strong to very strong importance
7	Very strong importance
8	Very to extremely strong importance
9	Extreme importance

Source: "GIS and Multicriteria Decision Analysis". (Malczewski, 1999)

- **Pair-wise comparison of relative-importance** (assign scores by subjectivity)

$$a_{ij} = w_i / w_j \qquad \text{..................1}$$

$$A = \begin{bmatrix} 1 & w_1/w_2 & \dots & w_1/w_n \\ w_2/w_1 & 1 & \dots & w_2/w_n \\ \vdots & \vdots & ::: & \vdots \\ w_n/w_1 & w_n/w_2 & \dots & 1 \end{bmatrix} \qquad \text{..................2}$$

Main criteria

	Geology	Slope	Soil drain	Salt crust	Land use
G	1	1/2	1/4	1/6	1/2
S	2	1	1/3	1/4	2
SD	4	3	1	1/2	2
SC	6	4	2	1	5
L	2	1/2	1/2	1/5	1

Relative weights	Normalized weights
0.062	1.00
0.127	2.05
0.254	4.10
0.456	7.36
0.100	1.62

λ_{max} = 5.009; CI = 0.028; CR = 0.025 (≤ 0.10)

3.Synthesis

- Summation the score of each polygon: **Weighted Linear Combination method**

$$R_i = \sum_k w_k r_{ik}$$

- Normalized total score by the summation of weights of thematic maps

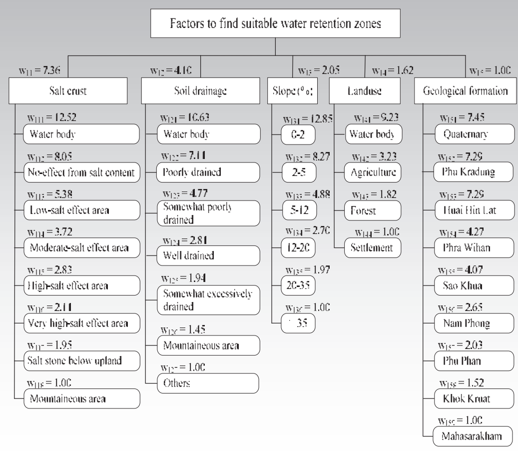
$$WHPI = (Gw1Gw2i + Sw1Sw2i + SDw1SDw2i + SCw1SCw2i + Lw1Lw2i)/\sum W1$$

w1 = weights of main criteria
w2i = all weights of sub-criteria

- Overlay all 5 thematic maps using ArcView; Union tool
- Classify suitability score classes

Results of Objective 1

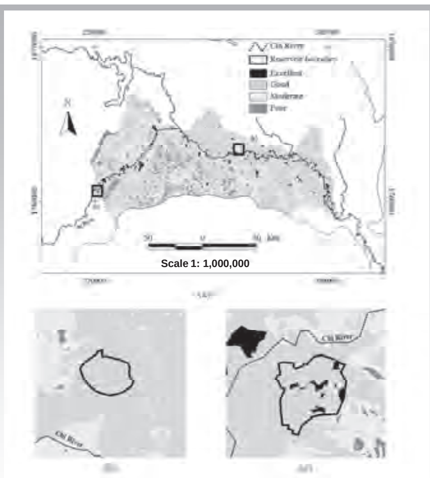
1) Relative weights



2) AHP-Suitable water retention zones map

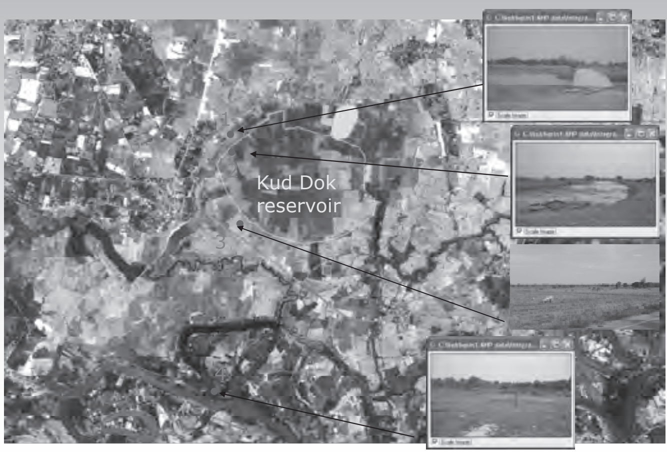
Suitability score classes (natural breaks method)

WHPI Ranges	Suitability Classes
1.40 - 4.04	Poor
4.04 - 5.40	Moderate
5.40 - 7.36	Good
7.36 - 11.44	Excellent



(a) AHP-Suitable water retention zones map for two sub-basins
(b) Kud Dok reservoir (proposed reservoir's boundary)
(c) Kud Jub reservoir (data from ROI6)

Field verification points of Kud Dok floodwater retention site



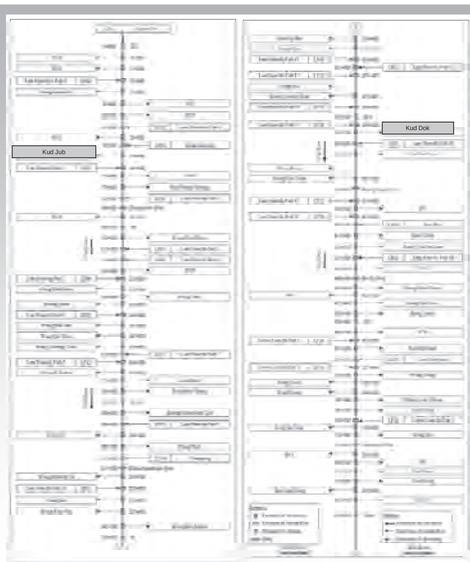
Field verification

(a) (b)

(a) Flood inundation areas in October 2006 for Kud Dok site
(b) Interviewing the villagers

Discussions (1) Expert who suggested the scores; and
(2) Experts of Regional Office of Irrigation 6

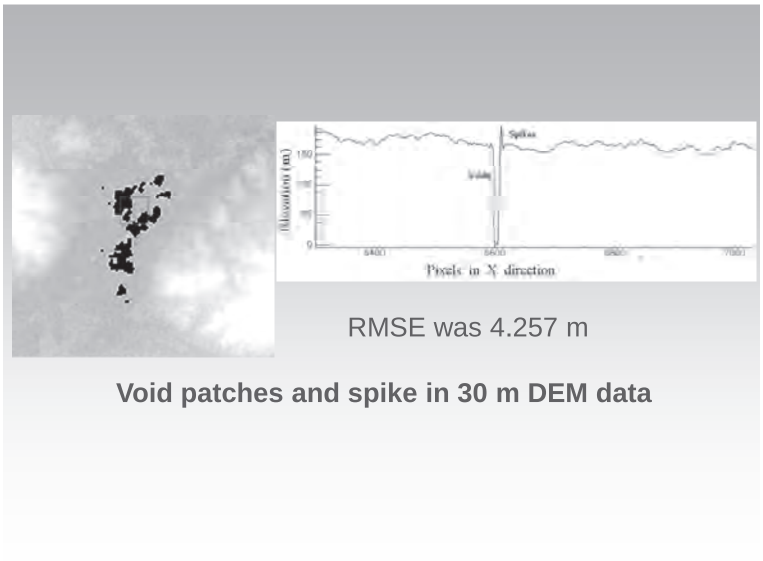
• 57 existing reservoirs
+ 2 reservoirs from

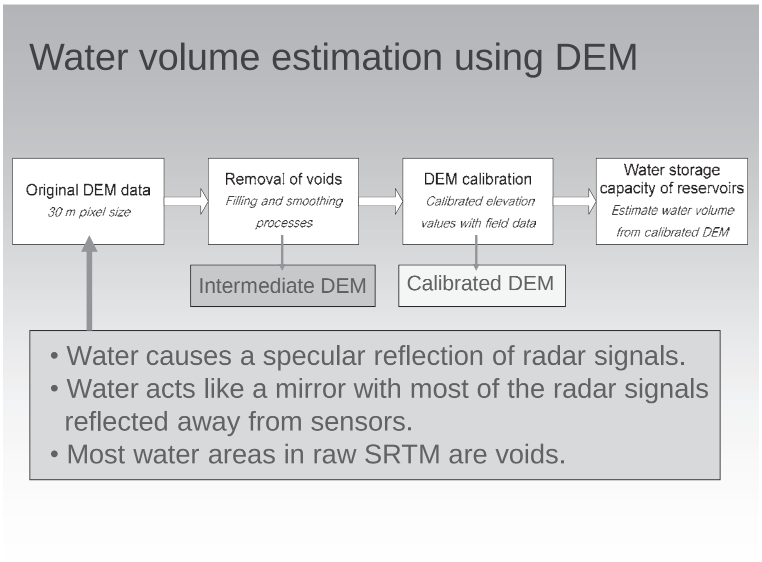


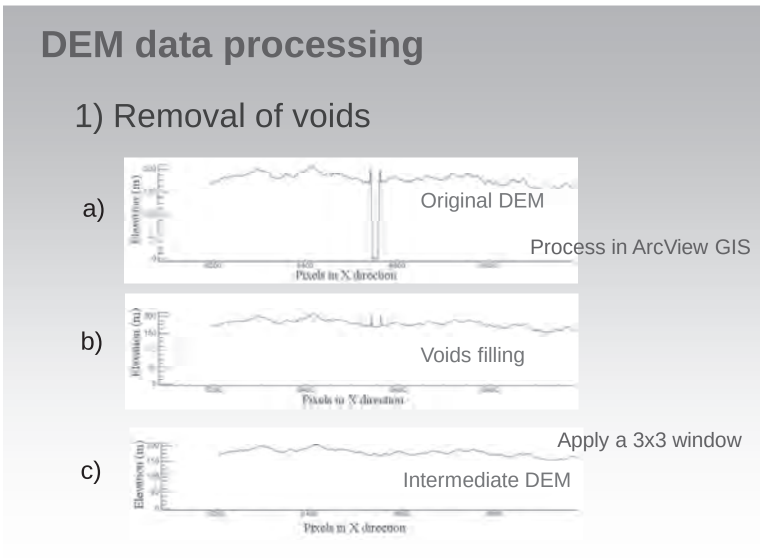
To improve the surface model by filling voids in DEM and calibrating processes for water volume estimation and analysis of flood inundation areas

Water volume estimation

- Approximation method:
  surface area x average water depth
- Elevation data from surveying instruments; costly and take time
- Elevation values from Space Shuttle Radar Topographic Mission (SRTM); 90 m
- DEM data with a 30 m square grid from RTSD; developed from SRTM and topographical data


Elevation (m)
Pixels in X direction
RMSE was 4.257 m
Void patches and spike in 30 m DEM data

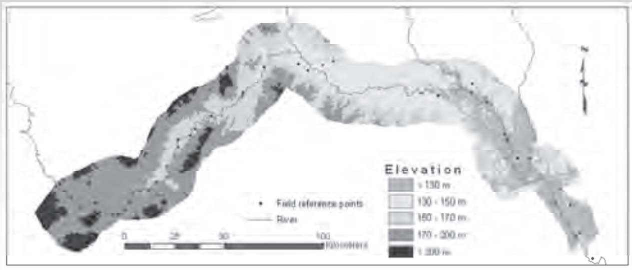

Water volume estimation using DEM
Original DEM data
30 m pixel size
Removal of voids
Filling and smoothing processes
DEM calibration
Calibrated elevation values with field data
Water storage capacity of reservoirs
Estimate water volume from calibrated DEM
Intermediate DEM
Calibrated DEM
• Water causes a specular reflection of radar signals.
• Water acts like a mirror with most of the radar signals reflected away from sensors.
• Most water areas in raw SRTM are voids.


DEM data processing
1) Removal of voids
a)
Original DEM
Process in ArcView GIS
b)
Voids filling
Apply a 3x3 window
c)
Intermediate DEM
Elevation (m)
Pixels in X direction

Data processing

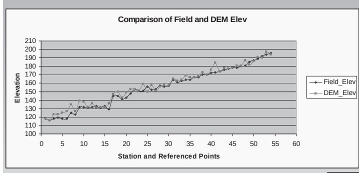
2) Calibration

- ❑ Combine Intermediate DEM values with known elevation data at the same locations
- ❑ Comparisons of 54 ground referenced points to establish the relationship

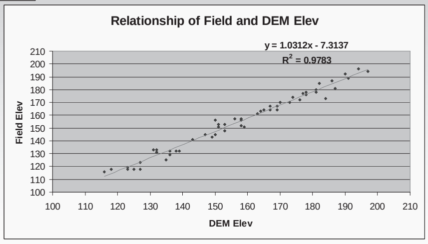


Ground reference points with known elevation

- ❑ Apply the relationship equation to correct the vertical error

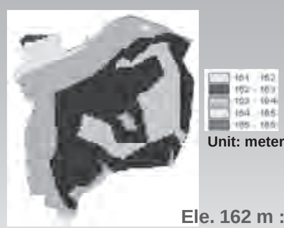


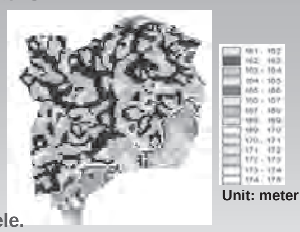
Calibrated DEM



RMSE was 3.094 m

Water volume estimation





Ele. 162 m :base ele.

(a) Field survey surface of Kud Jub

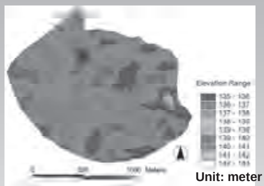
(b) Calibrated DEM surface of Kud Jub

Water level (m)	Water volume (MCM)		
	Original DEM	Calibrated DEM	Field DEM
163.0	-	0.56	0.83
164.0	0.49	2.58	3.46
165.0	0.61	5.88	7.40
166.0	2.55	9.55	11.69

- Average 25% error

Water Volume

1)

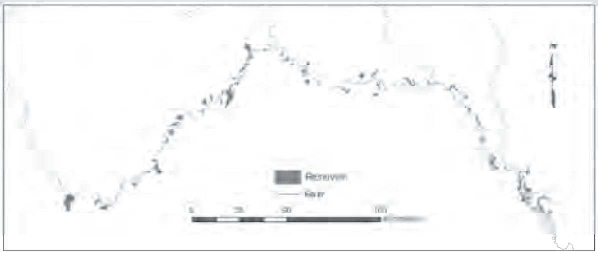


Kud Dok reservoir

Water level (m)	Water volume (MCM)	Surface area (Mm^2)
140	2.70	1.74
141	4.50	1.80
142	6.31	1.82
143	8.13	1.83

Ele. 139 m :base ele.

2)



To simulate the reduction of water levels and flood inundation areas of temporarily storing floodwater in retention reservoirs

Model selection

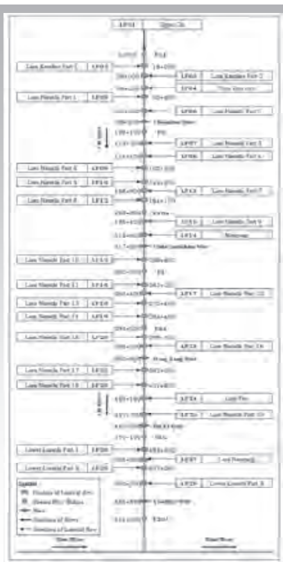
Model ⟶ forecasting

- Purpose of the effort
- Amount of data availability
- Degree of accuracy

➢ Rainfall-runoff; *NAM model*

➢ 1-Dimensional unsteady flow, solved by finite difference – implicit scheme; *MIKE11 model*

➢ Flood inundation areas; *MIKE-GIS model*



Hydrological model calibration (NAM model)

1) **Hydrological model calibration with discharges**
   - **E6C, E54**
   - **Calibration 1990 – 1999**
   - **Verification 2000 – 2001**

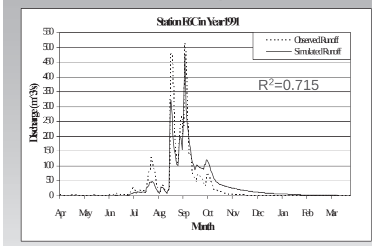
2) **Hydrological model calibration with water levels**
   - **Year 2000**

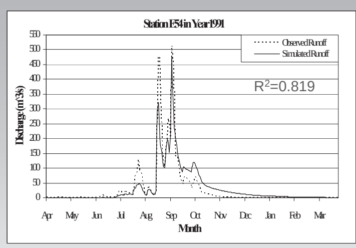
Results of calibrated parameter

	WL	E6C	WL	WL	WL	E54
Parameters	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Umax	10	17	20	19	19	20
Lmax	100	240	288	280	288	288
CQOF	0.350	0.350	0.100	0.100	0.100	0.505
CKIF	200	350	200	200	200	200
CK1,2	50	41	50	50	50	50
TOF	0.600	0.658	0.575	0.58	0.575	0.575
TIF	0.100	0.151	0.229	0.230	0.230	0.229
TG	0.01	0.632	0.881	0.881	0.881	0.881
CKBF	1000	1890	1000	1000	1000	1000

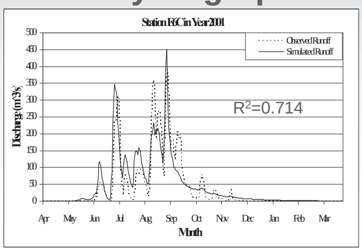
Group	Code of sub-basins
1	LF02, LF03, LF04, LF05, LF06
2	LF07, LF08, LF09, LF10, LF11,LF12
3	LF13, LF14, LF15
4	LF16, LF17, LF18, LF19
5	LF20, LF21, LF22, LF23, LF24, LF25
6	LF26, LF27, LF28, LF29

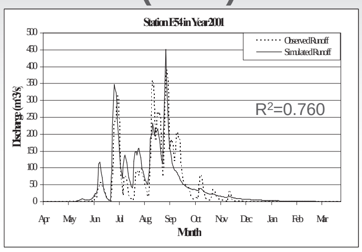
Hydrograph: Calibration (1991)





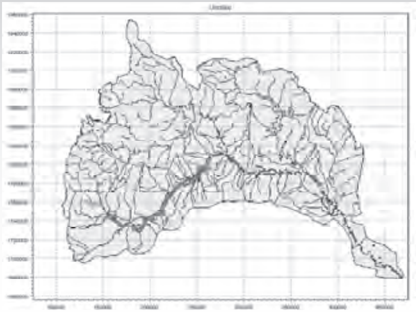
Hydrograph: Verification (2001)





Input data

- Chi river network: x ,y coordinates
- Cross sections; 614 cross sections
  (red = 323, green = 291)
- Discharge data and water level data (1996,2000,2001,2002)
- Lateral flow from NAM hydrological model



Boundary condition

- Upstream: discharges of station E21
- Downstream: water levels of station E20A
- Δt = 60 seconds

Calibration

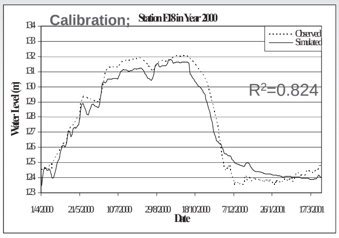
- **Return period analysis**
  - **Return Period of station E20A (Q_{max})**
  - **Log-Pearson type III distribution**

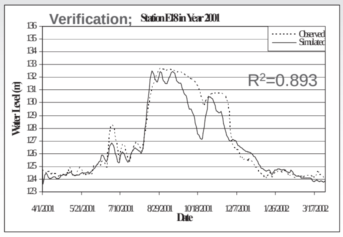
Return period (year)	Calculated Q_{max} (m^3/s)	Standard deviation (m^3/s)	Measured Q_{max} (m^3/s)	Year
25	2,922	516	2,706	2001
8	2,046	234	2,105	2002
5	1,724	169	1,756	2000
3	1,390	121	1,336	1996

- Calibration in year 2000
- Stages of station: E9, E16A, E1, E8A, E18,for internal calibration

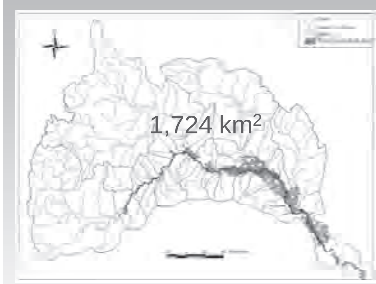
Manning, n, Parameter

Station	Km (from Upstream)	Manning' n
E21-E9	0+000 – 109+100	0.039 – 0.038
E9-E16A	109+100 – 183+800	0.038 – 0.035
E16A-E1	183+800 – 250+000	0.035 – 0.030
E1-E8A	250+000 – 293+200	0.030 – 0.033
E8A-E18	293+200 – 470+400	0.033 – 0.030
E18-E20A	470+400 – 614+000	0.025





Results of flood inundation areas

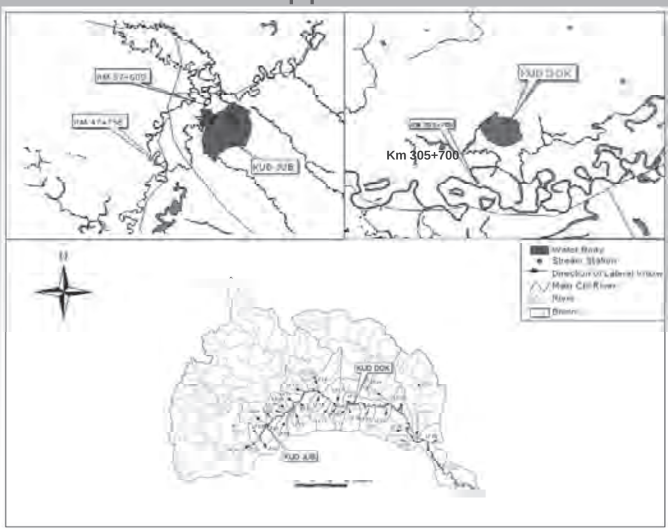


Flooding areas from *simulation* of 15 September 2001

Flooding areas from *Radarsat* of 15 September 2001

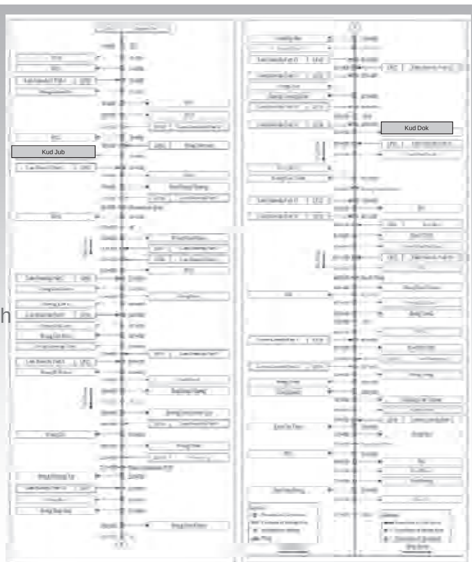
- 491 km^2 difference

Flood alleviation application



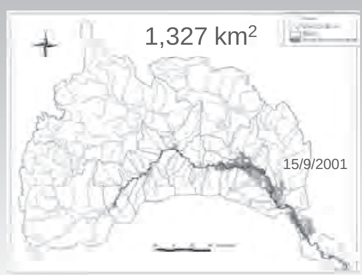
Fifty nine flood retention storage reservoirs scenario

- 57 existing reservoirs + 2 reservoirs from objective 1
- Water volume capacities from calibrated DEM
- Diverted discharges through natural channels
- Total storage capacity of 540 MCM



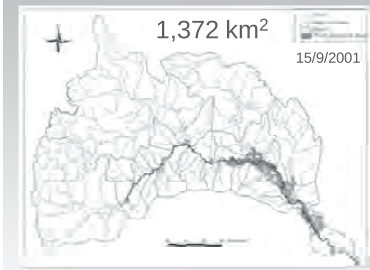
Results of simulation

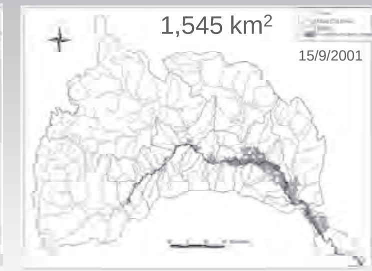
Divert discharges 80% of retention storage capacity (431 MCM)



Divert discharges 60% of retention storage capacity (323 MCM)

Results of simulation (cont)



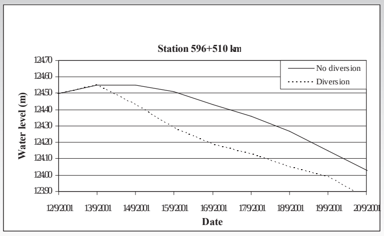


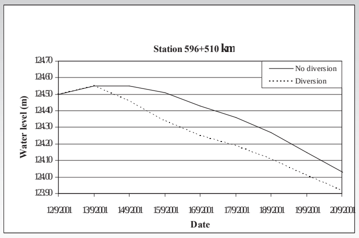
Divert discharges 40% of retention storage capacity (215 MCM)

Divert discharges 20% of retention storage capacity (108 MCM)

Reduction of flood water levels at Km 596+510 (downstream)

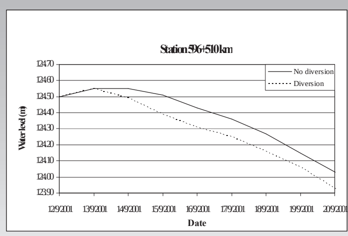
Date	Reduction of flood water level (m)			
	initial storage 20%	initial storage 40%	initial storage 60%	initial storage 80%
15/9/2001	0.23	0.18	0.12	0.06
18/9/2001	0.37	0.30	0.19	0.10

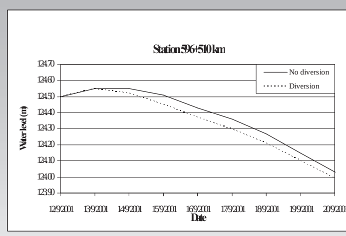




Divert discharges 80% of retention storage capacity (431 MCM)

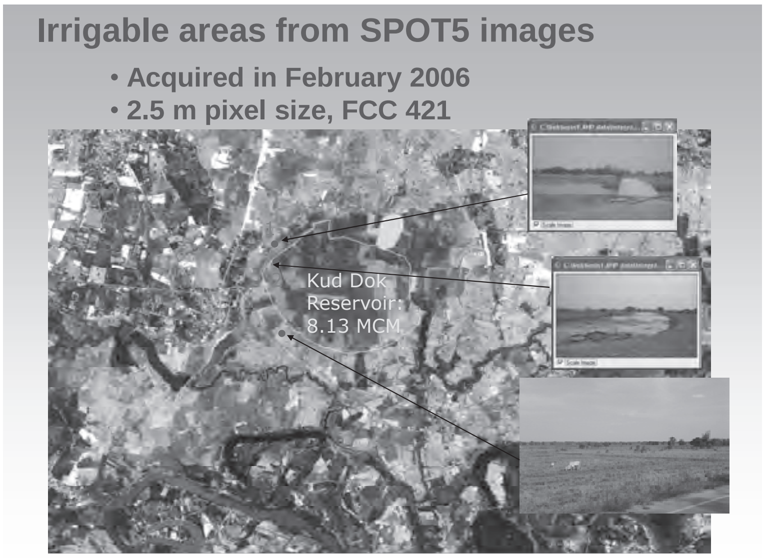
Divert discharges 60% of retention storage capacity (323 MCM)

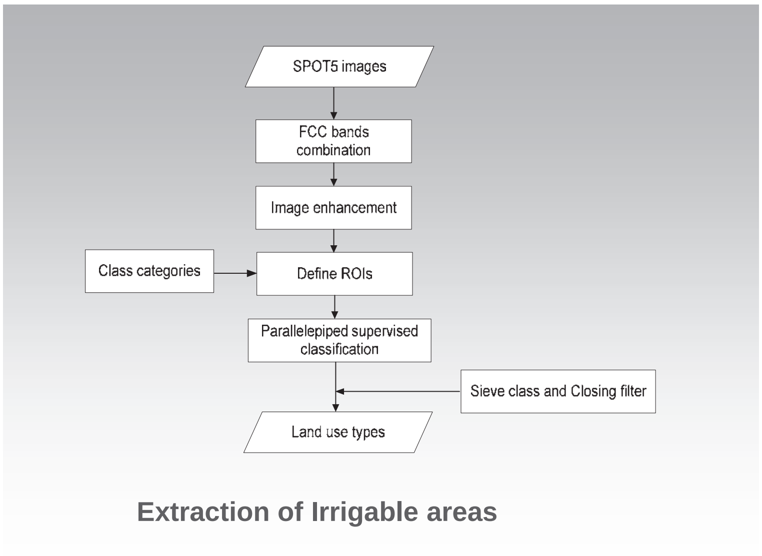


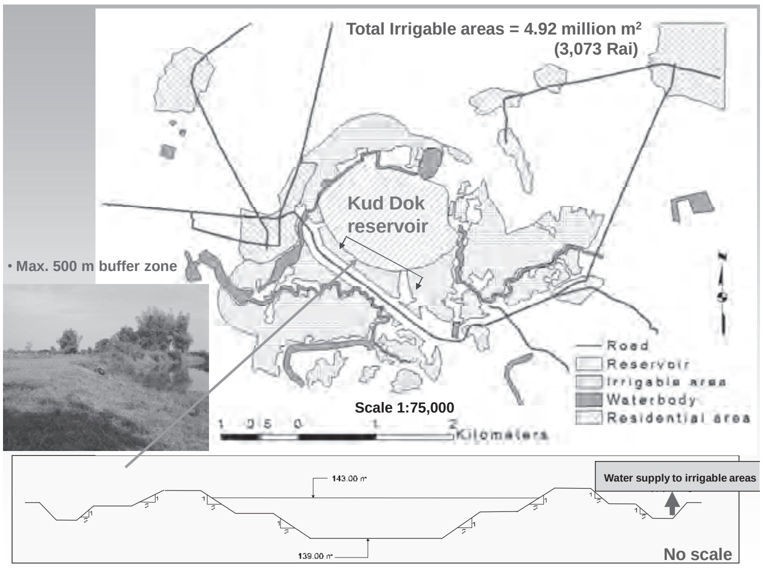


Divert discharges 40% of retention storage capacity (215 MCM)

Divert discharges 60% of retention storage capacity (323 MCM)


Irrigable areas from SPOT5 images
• Acquired in February 2006
• 2.5 m pixel size, FCC 421
Kud Dok
Reservoir:
8.13 MCM


SPOT5 images
FCC bands combination
Image enhancement
Class categories
Define ROIs
Parallelepiped supervised classification
Sieve class and Closing filter
Land use types
Extraction of Irrigable areas


Total Irrigable areas = 4.92 million m²
(3,073 Rai)
Kud Dok
reservoir
• Max. 500 m buffer zone
Road
Reservoir
Irrigable area
Waterbody
Residential area
Scale 1:75,000
1 0.5 0 1 2
Kilometers
Water supply to irrigable areas
143.00 m
139.00 m
No scale

Conclusions

A model was developed to assess suitable water retention zones by integrating five parameters such as salt crust, soil drainage, slope, land use, and geological formation including AHP through GIS.

The processes of filling voids and calibration in DEM facilitated water volume estimation.

The hydrological and hydrodynamic models could satisfactorily simulate hydrological and hydrodynamic components of the Chi basin, respectively.

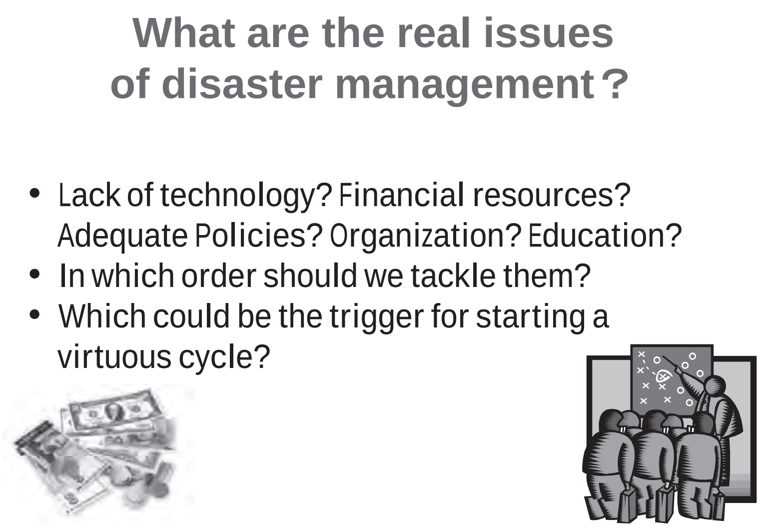
Diverted discharges of 80% retention storage capacities (431 MCM) could reduce flood inundation areas to great extent.

Development of Tsunami Disaster Mitigation System Considering the Characteristics of the Indian Ocean Region

Prof. Kimiro Meguro

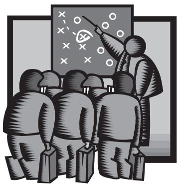
DEVELOPMENT OF TSUNAMI DISASTER MITIGATION SYSTEM CONSIDERING THE CHARACTERISTICS OF THE INDIAN OCEAN REGION

KIMIRO MEGURO
Director, ICUS, IIS, The University of Tokyo
meguro@iis.u-tokyo.ac.jp



What are the real issues of disaster management？

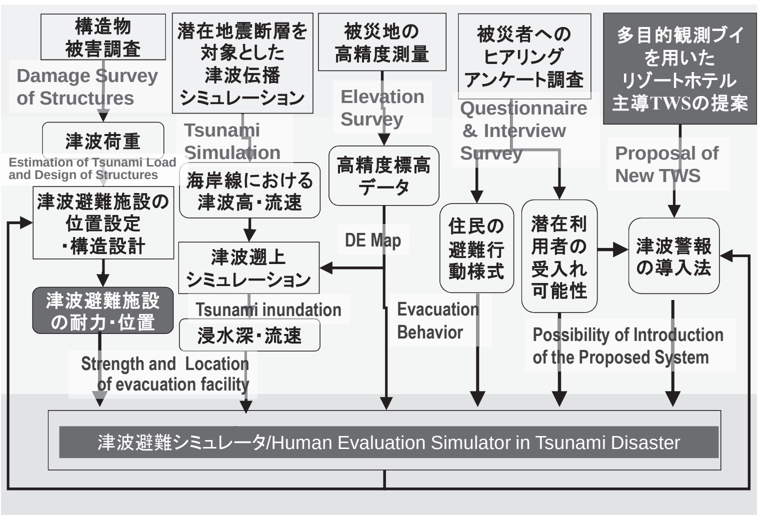
- Lack of technology? Financial resources? Adequate Policies? Organization? Education?
- In which order should we tackle them?
- Which could be the trigger for starting a virtuous cycle?



How to tackle future tsunami?

How about recovery and reconstruction plan, and land use plan?
Following the plan, when people move from the beach to inland by 100 to 200 m in Thailand and Sri-Lanka, and 2 to 3 km in some parts of Indonesia, is it possible to maintain their daily life ?
Especially, Fishermen and Resort Hotel persons?

各調査相互の関係/Structure of the Study



Damage Survey of Structures to Discuss the Impact due to Tsunami

構造物被害調査

安全な避難施設を実現するために

Structural damage/建物の被害

高架水槽の被害

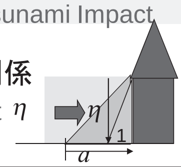
柱鉄筋の抜け出し
で全体崩壊

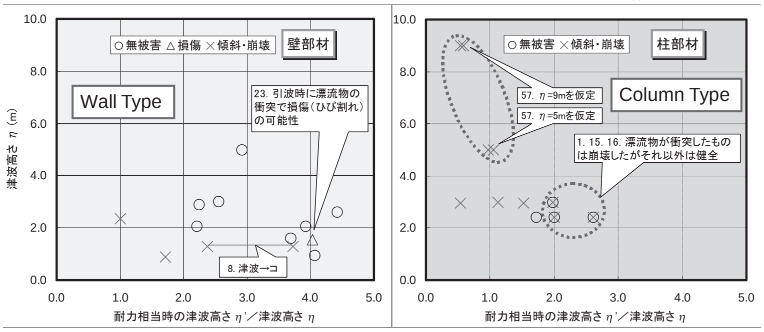
Galle
RC造

逆対称曲げに
よる柱折損

構造耐力と津波荷重の関係/
Relation between Structural Strength and Tsunami Impact

- 割増係数 a と津波高さの実測値 η の関係
- Relation between a and Real Tsunami Height η





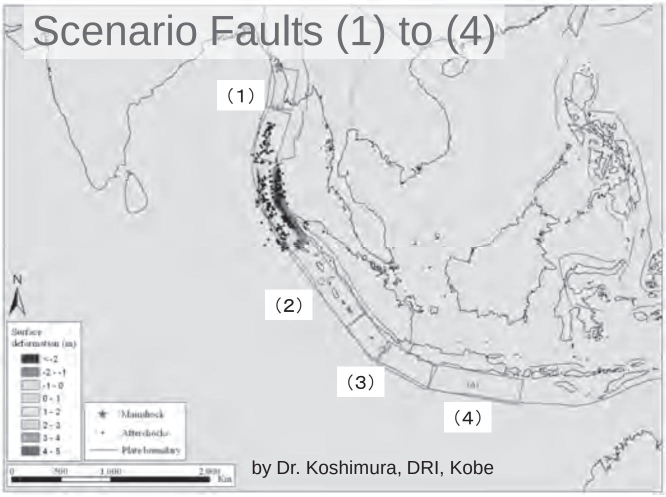
出典:東大・中埜/after Dr. Y. Nakano

Vulnerability Analysis
by Tsunami Simulation

潜在地震断層を対象とした
津波伝播シミュレーション

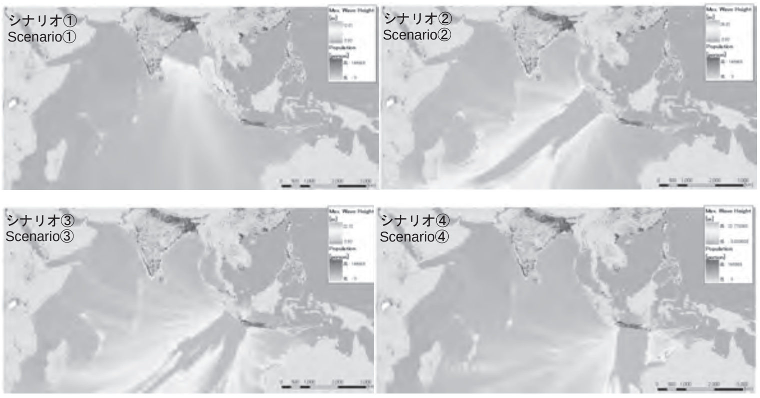
対策の対象となる
将来の津波を知るために

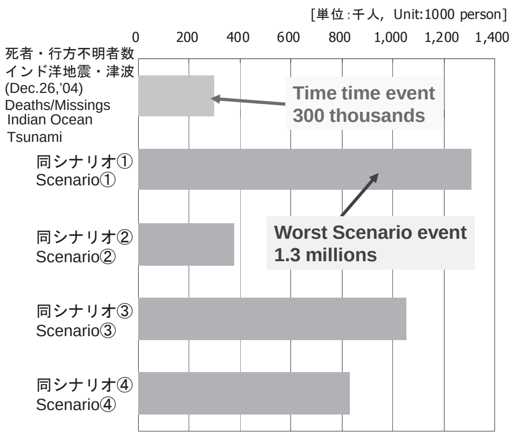
スンダ海溝沿いのシナリオ断層(1)～（4）



予想津波最大波高（シナリオ１～４

Estimated Maximum Wave Height
by the Scenario Eq. (1 - 4)





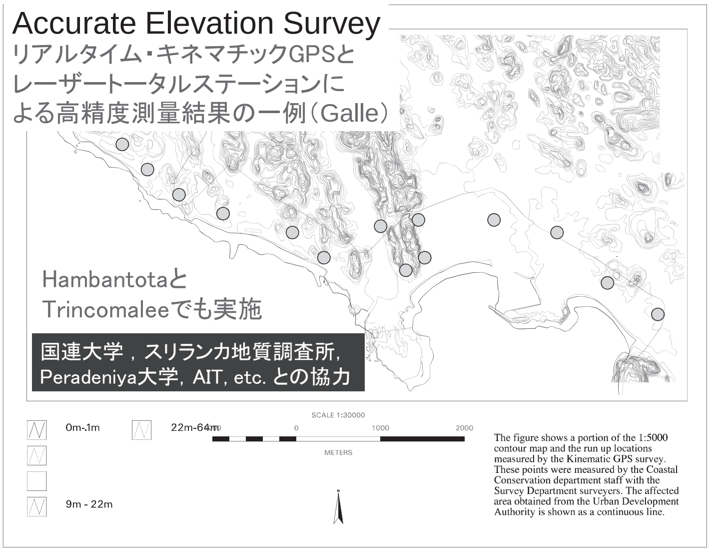
標高30m以下の沿岸部において4.1m以上の波高に
襲われると推定される人口

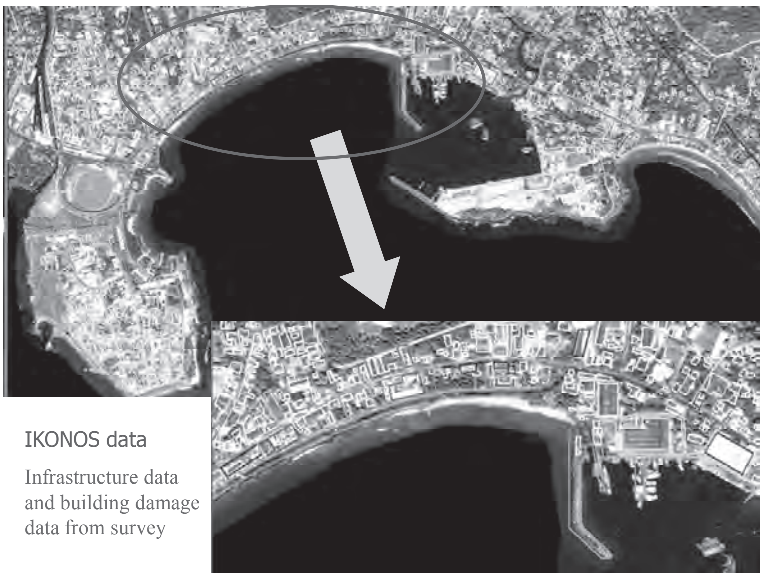
Estimated Coastal Population (living in the ground level less than 30m) under wave height more than 4.1m

Accurate Elevation Survey for Tsunami Inundation and Human Evacuation Simulation

被災地の高精度測量

津波浸水や避難行動
シミュレーションのために



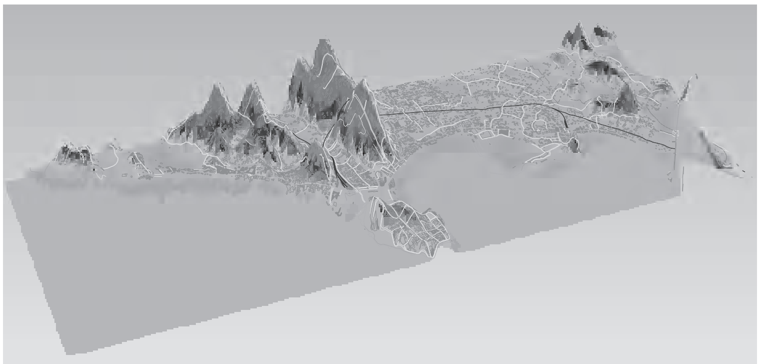


IKONOS data

Infrastructure data and building damage data from survey

3次元イメージ/3-D Image

リアルタイム・キネマチックGPSとレーザートータルステーションによる高精度測量結果の一例（Galle）



Interview and Questionnaire Survey

被災者へのヒアリング・アンケート調査

提案システムが受け入れられるか否か

関係者へのインタビュー/Interview Survey

インタビュー対象者

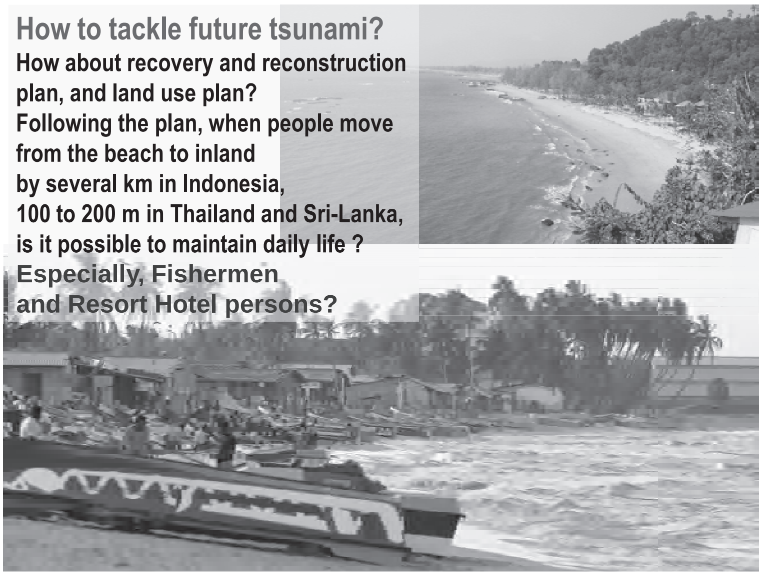
スリランカ/Sri Lanka
Sri Gemunu Beach Resort (PVT) LTD, GalleHotel
Hotel Club Oceanic, Trincomalee
Urban Development Agency, Trincomalee
Secretary of Government Agent, Trincomalee
Minister of Science and Technology
President of Tourist Board of Sri Lanka

タイ/Thailand
Vice Governor of Phuket
Governor of Phang-nga
Kamala Beach Hotel
Khao Lak Bay Front Resort
Phatong Merlin Hotel
President of Phuket Aministration Organization

提案に対する反応

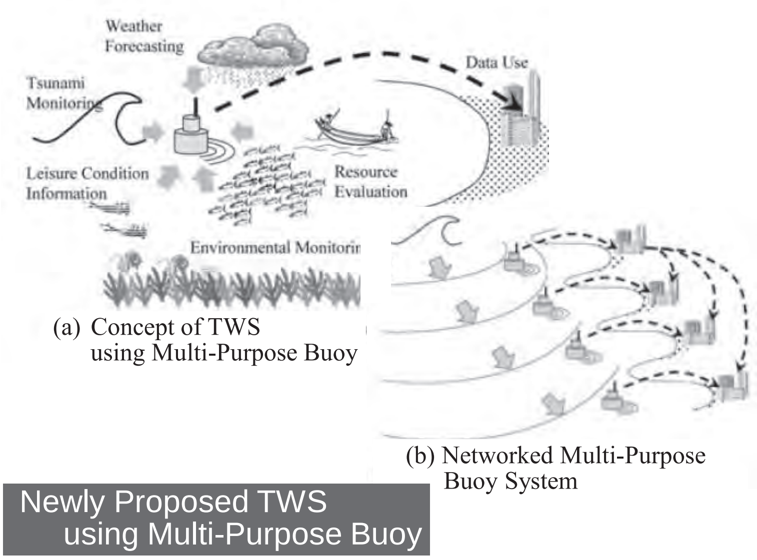
反応が良かった関係者
- TBS代表
- 被災していないホテルのマネージャー

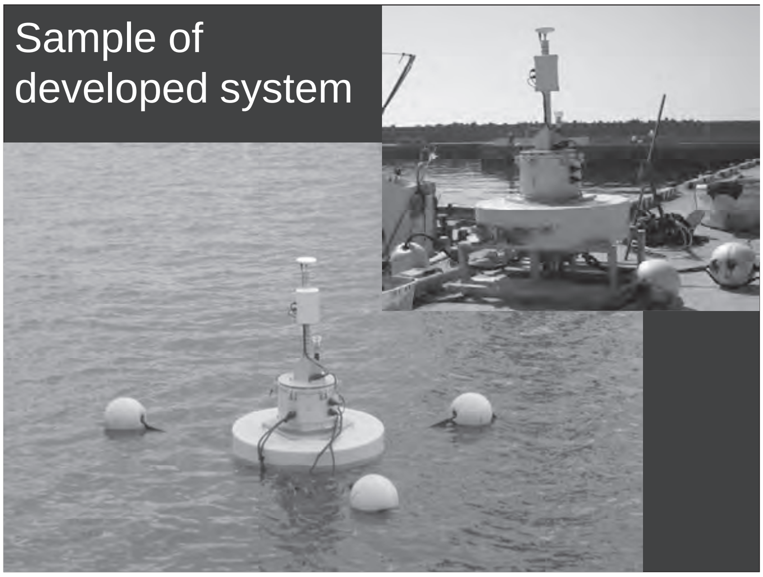
反応が良くなかった関係者
- プーケット県の副知事
- パンガー県の知事（中央政府からの指示待ちの姿勢）
- 被災したホテルのマネージャー(金がない）



Proposal of
Multi-Purpose Observation System
that can also be used for
Tsunami Warning

多目的観測ブイを用いた
リゾートホテル主導TWSの提案





In case that land use control is not feasible as a proper countermeasure against future tsunami, a reliable Tsunami Warning System (TWS) and proper evacuation facilities (EF), built at appropriate places, considering population distribution and enough resistance against tsunami wave load, are indispensable.

Therefore,

1) **Combining our proposed TWS and properly distributed EFs, <u>a new Tsunami Disaster Mitigation System</u> is proposed.**
2) **Multi-purpose oceanic observation buoys are used in our proposed TWS.**
3) **Optimal location of EFs with enough strength and capacity is discussed by Tsunami Simulation and Evacuation Simulation in Tsunami Disaster.**

1) **Combining our proposed TWS and properly distributed EFs, <u>a new Tsunami Disaster Mitigation System</u> is proposed.**
2) **Multi-purpose oceanic observation buoys are used in our proposed TWS.**
3) **Optimal location of EFs with enough strength and capacity is discussed by Tsunami Simulation and Evacuation Simulation in Tsunami Disaster.**

Important characteristics of our proposed TWS are
- **simplicity,**
- **economical efficiency, and**
- **daily-usability**

Without these characteristics, it is very difficult for Indian Ocean Rim countries with limited resource of technologies, researchers and experiences of tsunami disasters, compared to Pacific Ocean Rim countries, to continuously monitor tsunamis which occur at very low frequency but cause huge damage.

多目的ブイによる津波警報システム
Multi-purpose observation system

Tsunami Warning System

Proposed New TWS

Low Cost, Simple, and Daily Useable

The minimum unit of the proposed system would be one or two multi-purpose observation buoys operated by one beach society, such as hotel resort society or its network.
temperature, current velocity, wave height, moisture, etc. on a daily basis

Redundant and easier/cheaper to sustain
Because of more and simpler stations

With daily usability,
Weather forecast, Safety information,
Break unscientific rumor
Prediction of catch of fish, Fish dude ranch, etc.

Conventional TWS

Sophisticated but Expensive and Complicated

Useful for earth-science

But, from disaster mitigation purpose, frequency of use of the system is very small.

Difficult to maintain the system

Long return period of Tsunami
Limited resources, researchers and budget
Poor experiences of tsunami disaster

Cost of the System/必要経費

10～20 million yen/system

Tsunami Tax

assuming that

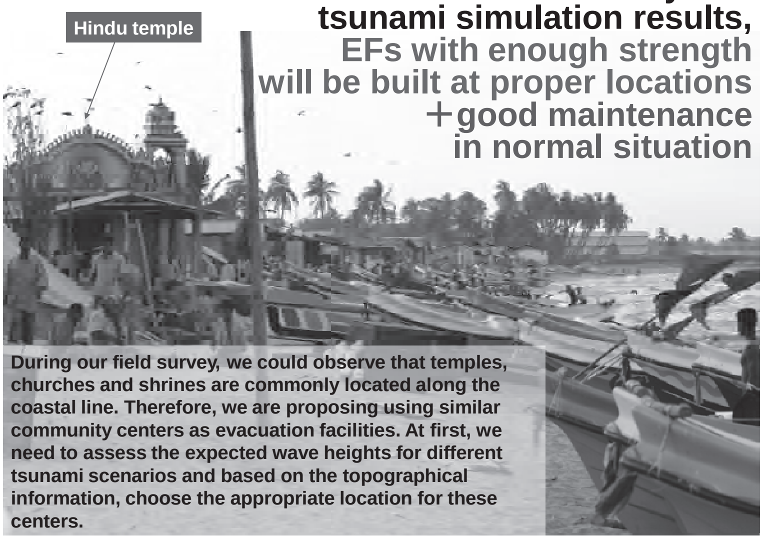
- **Life time of the system: 3 to 5 years**
- **Ave. No. of rooms in each resort beach: 200 to 500 rooms （Pattaya beach：20,000 rooms)**
- **Ave. No. of days of use of room: 100 to 200 days/year**

Cost needed to maintain the system (\yen/room/day)

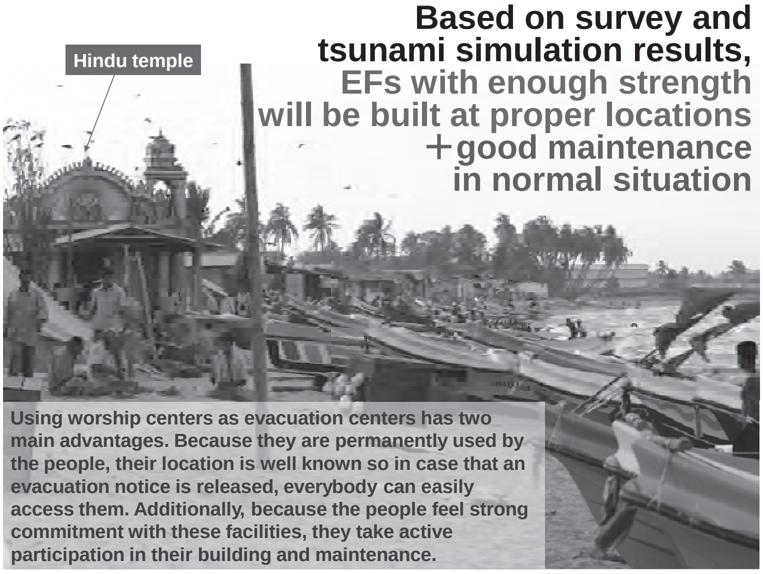
Cost (mill. yen)	Life time (years)	200 rooms/beach		500 rooms/beach	
		100 days	200 days	100 days	200 days
10	3	167	83	67	33
	5	100	50	40	20
20	3	333	167	133	67
	5	200	100	80	40

Based on survey and tsunami simulation results,
EFs with enough strength will be built at proper locations ＋good maintenance in normal situation

Hindu temple



During our field survey, we could observe that temples, churches and shrines are commonly located along the coastal line. Therefore, we are proposing using similar community centers as evacuation facilities. At first, we need to assess the expected wave heights for different tsunami scenarios and based on the topographical information, choose the appropriate location for these centers.



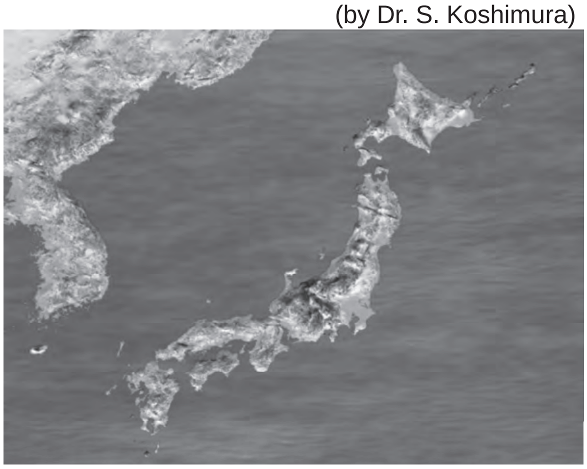
Effects of
Various Countermeasures
by
Simulation of Human Evacuation
in Tsunami Disaster

避難シミュレーションによる
津波災害対策の効果の評価

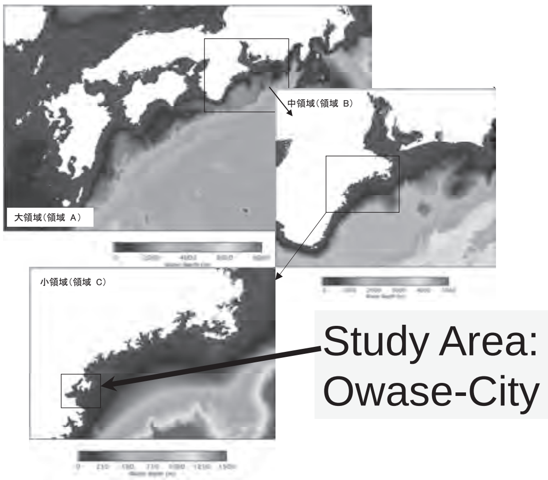
想定津波/Scenario Tsunami

中央防災会議想定の南海・東南海連動型地震

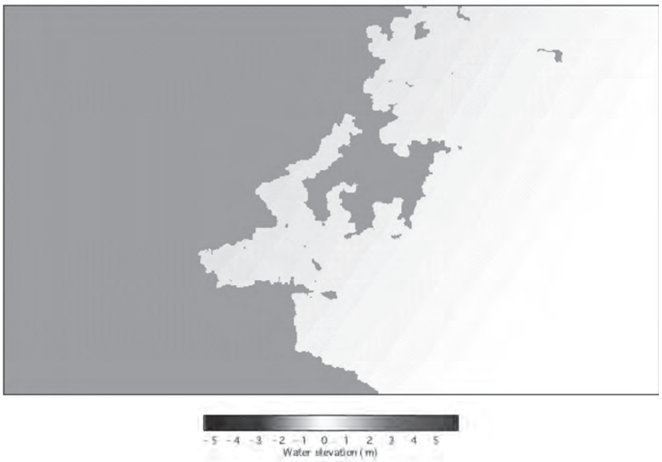
(by Dr. S. Koshimura)



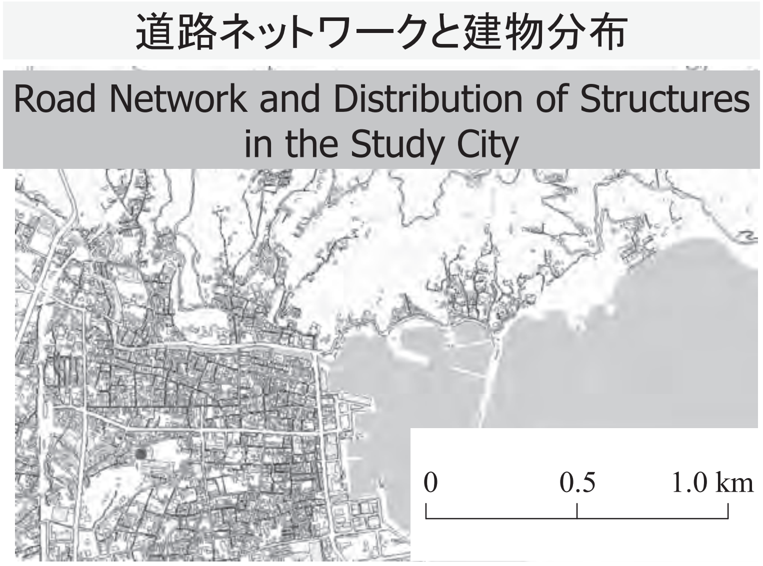
研究対象地域(尾鷲市)

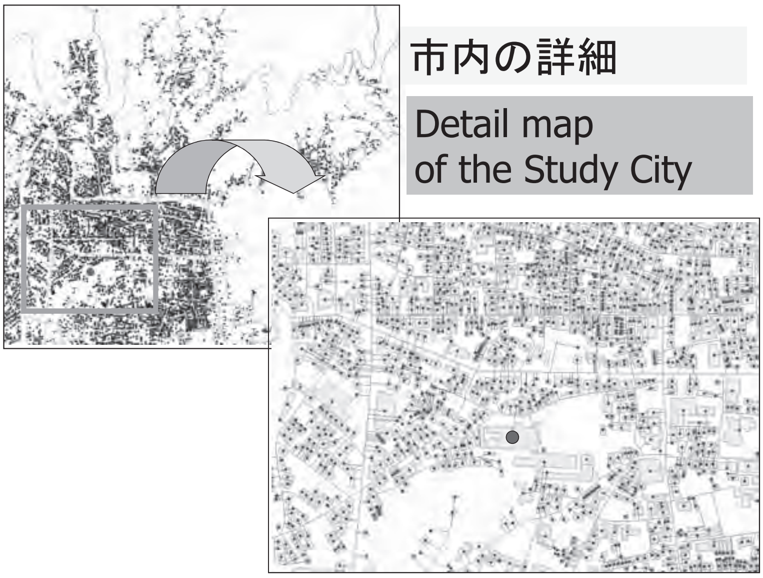


尾鷲市の津波浸水
Tsunami inundation Simulation (by S. Koshimura)



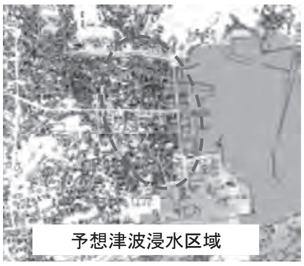
東南海地震（1944）での津波被害/
Past Tsunami Damage due to 1944 Eq.

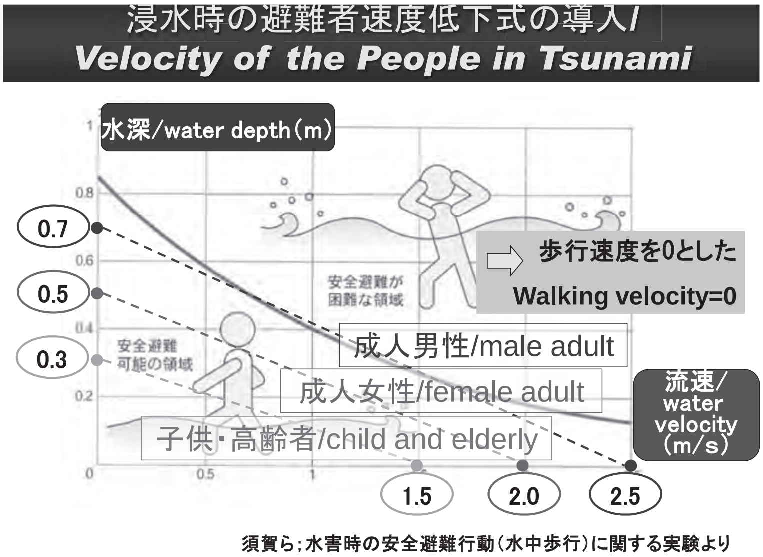

道路ネットワークと建物分布
Road Network and Distribution of Structures in the Study City
0
0.5
1.0 km

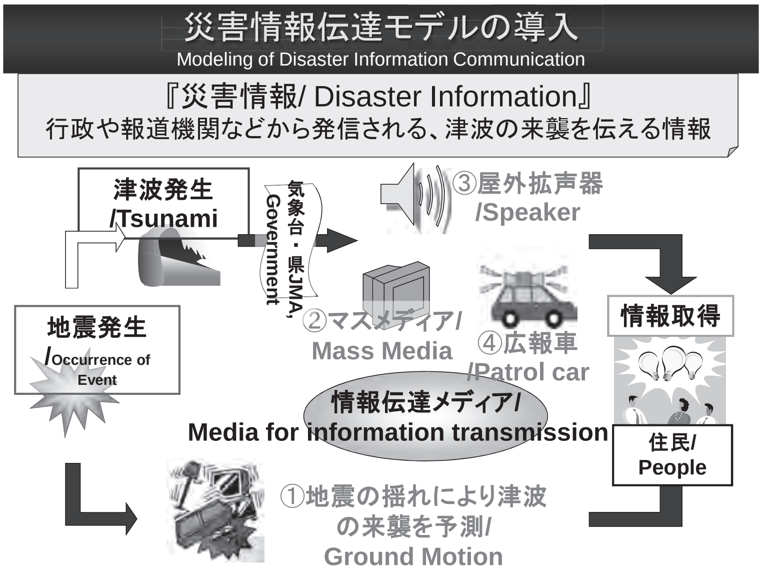

市内の詳細
Detail map of the Study City


○広域避難場所: Evacuation Spaces: parks, community centers, and schools
野地町駅前児童公園
福祉保険センター
中電天満荘広場
野地町駅前児童公園
尾鷲小学校
尾鷲市体育文化会館
市立中央公民館
中村山公園

○密集市街地 Crowded Area, Narrow Streets





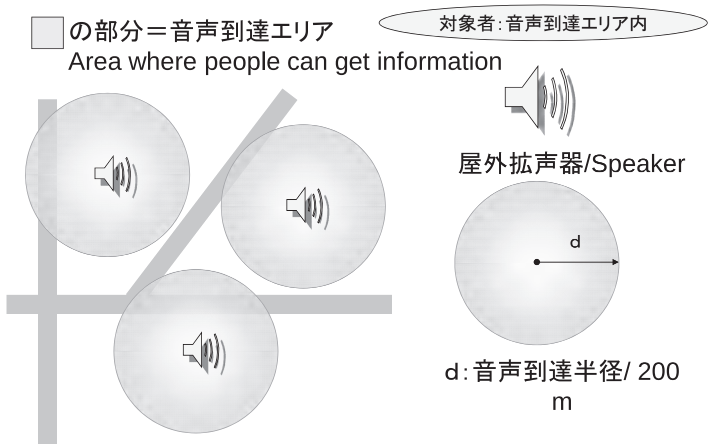


◇情報伝達パラメータ一覧
/ Parameters for Disaster Information Communication

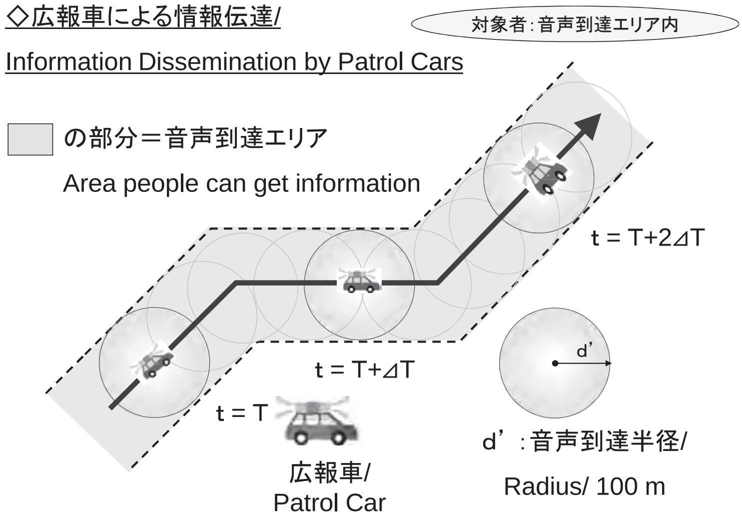
伝達方法	伝達パラメータ/Parameters		対象
①地震の揺れ/ Ground Motion	情報発信タイミング start time	1 分後/1min.	対象空間内の全住民/ all the people in the area
	情報取得率	30 %	
②マスメディア Mass Media	情報放送タイミング	2分後/2mins.	対象空間内の全住民/ all the people in the area
	情報放送回数	1 回	
	情報取得率	30 %	
③屋外拡声器 Speaker	情報放送タイミング	3分後/3mins.	音声到達エリア内にいる住民/ people who can hear
	配置数	11 基	
	音声情報到達範囲	200 m	
	情報取得率	30 %	
④広報車/ Patrol Car	発車タイミング	5分後/5mins.	音声到達エリア内にいる住民/ people who can hear
	台数	2 台	
	移動速度	20 km/hr	
	音声情報到達範囲	100 m	
	情報取得率	30 %	

今回の解析で変化させたパラメータ/ Parameters used for Study

◇屋外拡声器による情報伝達/
Information Dissemination by Speakers



◇広報車による情報伝達/
Information Dissemination by Patrol Cars



◇避難行動シミュレーション◇

Human Evacuation Simulation

避難行動シミュレーション
Human Evacuation Simulation

検討項目/ Discussion Points

①情報伝達の遅れが避難安全性へ及ぼす影響の評価

Effect by Delay of Information Dissemination

②津波避難ビルの効果の検証

Effects of Evacuation Buildings/Towers/Centers

③道路閉塞が避難安全性へ及ぼす影響の評価

Effects of Road Blockage by Collapsed Structures

避難行動開始時刻の決定/ Starting Time of Evacuation

Time for getting info.

避難開始時刻 ＝ 情報取得時刻 ＋ 避難準備時間

Starting Time of Evacuation

Time for Evacuation Preparation

情報伝達メディアにより災害情報を取得した時刻

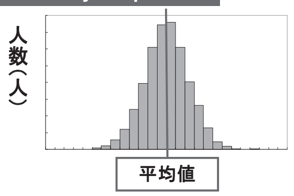
Case 1:
By Government / Mass Media

→行政の対応により変化する

避難行動の意思決定や避難の際の準備時間

Case 2: By People

→住民の対応により変化する



平均値μ ： ●(分)

標準偏差σ ： 1(分)

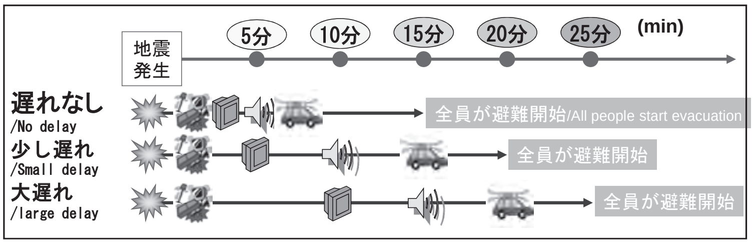
の正規分布で与える

①情報伝達の遅れが避難安全性へ及ぼす影響の評価

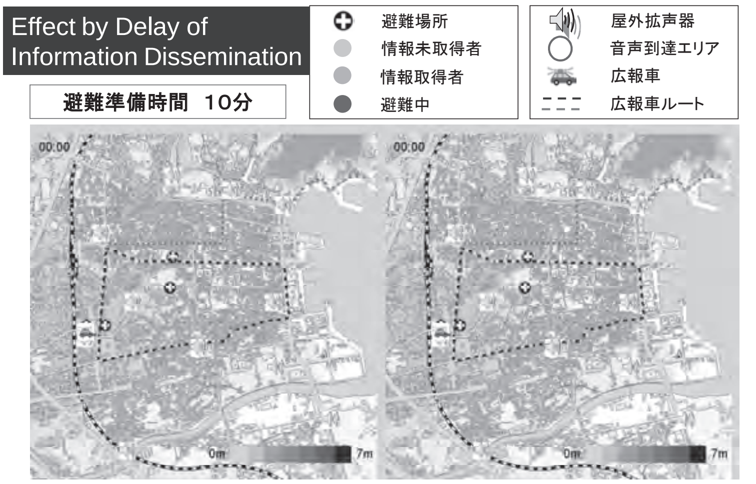
○シミュレーションケースの概要 Case 1:

情報取得率 → 50% 30% 10%		情報伝達開始時刻（分）				
		地震/Eq	マスコミ/M.M	拡声器/Spk	広報車/PTC	上限値/Max
情報伝達	遅れなし/No delay	1	3	5	7	15
	少し遅れ/Small delay	1	5	10	15	20
	大遅れ/large delay	1	10	15	20	25

＊避難準備時間を0分、5分、10分、15分と変化させた

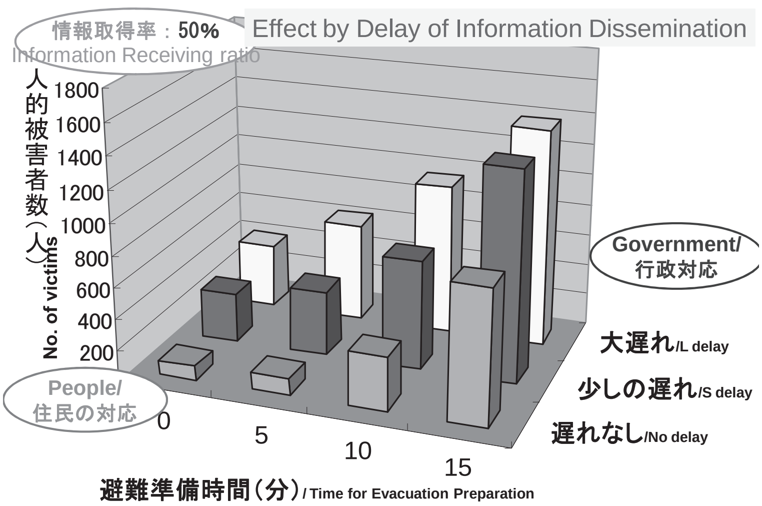


①シミュレーション結果（情報伝達の影響）

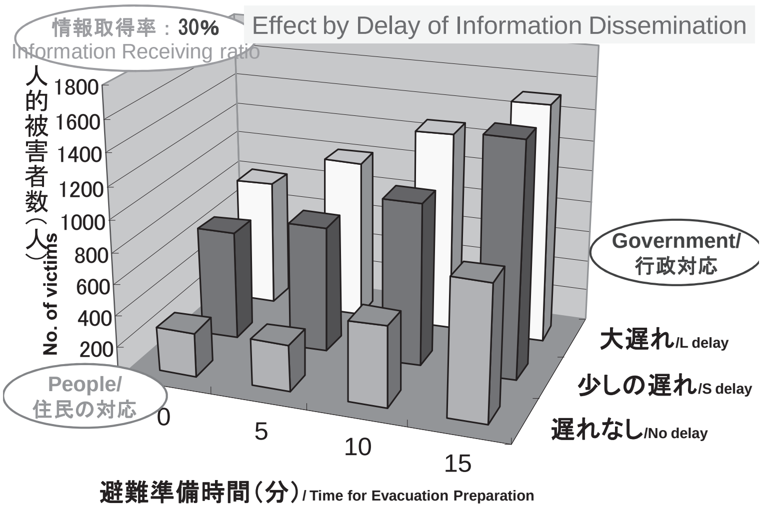


情報伝達の遅れなし/No delay　　情報伝達の少しの遅れ/Small delay

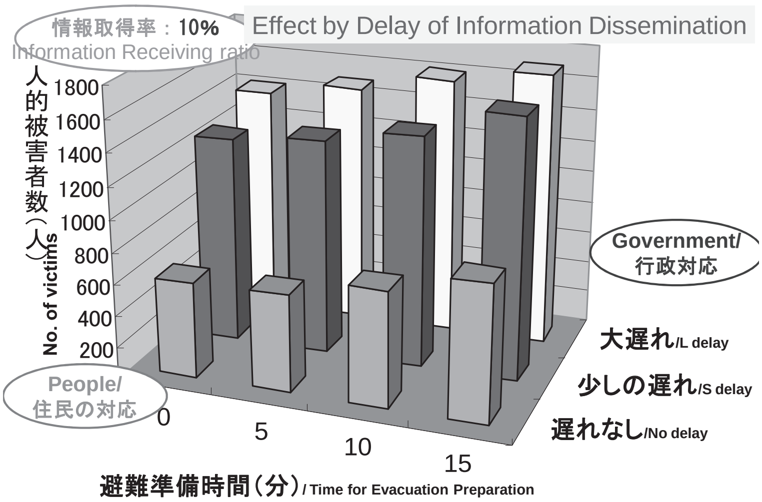
①人的被害の推移（情報伝達の影響）



①人的被害の推移（情報伝達の影響）



①人的被害の推移（情報伝達の影響）



②津波避難ビルの効果の検証/Effect of Evacuation Buildings

津波避難ビル・・・緊急時にのみ一時避難場所として利用できるビル

避難ビルの選定

問題点

低層住宅が密集しており、避難ビルとしての候補ビルが限定される

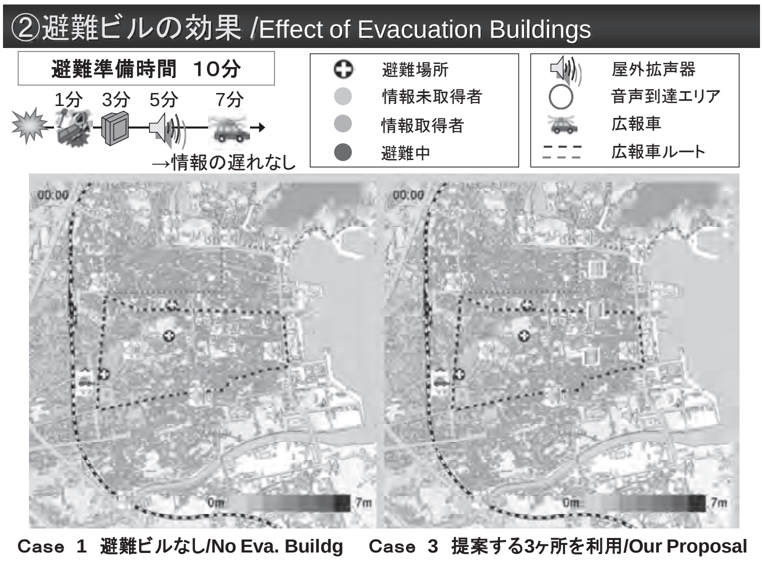
提案

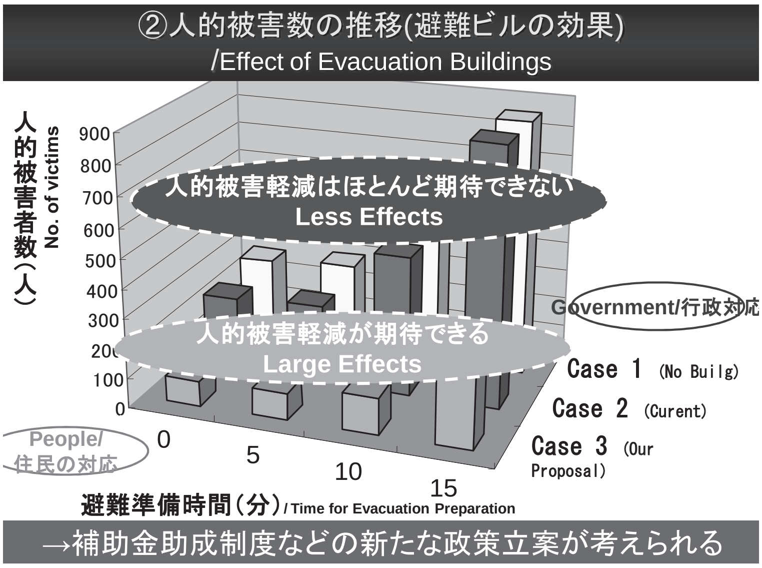
簡易的な一時避難場所のイメージ図

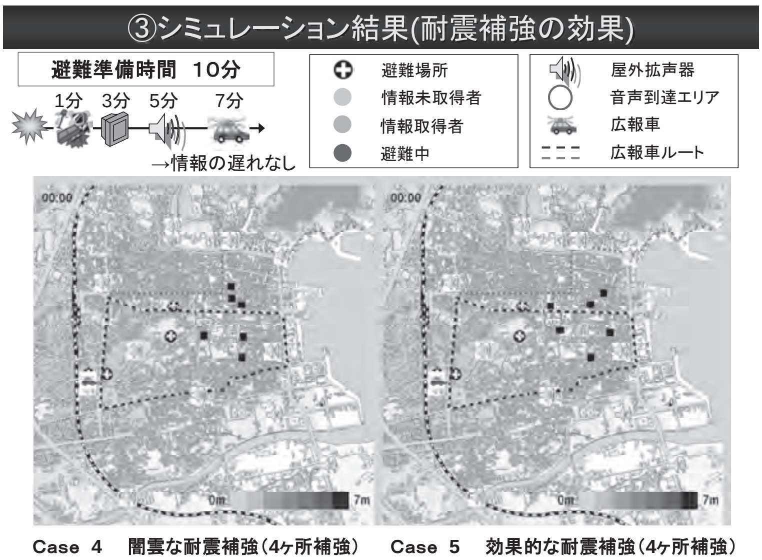
- 安価で経済的
- 密集地にも設置可能
- 多方向から進入可能

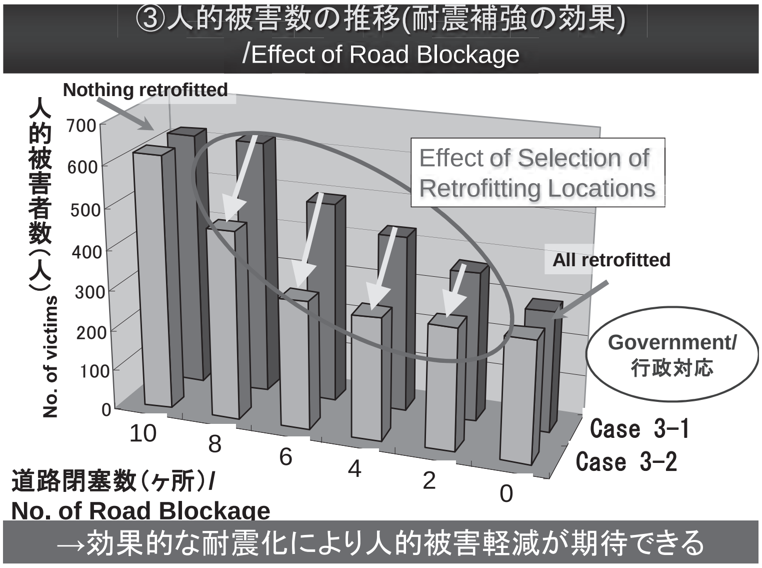
Case 1	避難ビルなし/No Eva. Buildg
Case 2	実際に利用されている避難ビル①を利用/Current
Case 3	新提案:一時避難場所②×3を利用/Our Proposal

＊情報伝達に遅れなし.　避難準備時間を変化させた.


②避難ビルの効果 /Effect of Evacuation Buildings
避難準備時間 10分
1分 3分 5分 7分
→情報の遅れなし
避難場所
情報未取得者
情報取得者
避難中
屋外拡声器
音声到達エリア
広報車
広報車ルート
Case 1 避難ビルなし/No Eva. Buildg
Case 3 提案する3ヶ所を利用/Our Proposal


②人的被害数の推移(避難ビルの効果)
/Effect of Evacuation Buildings
人的被害者数(人)
No. of victims
900
800
700
600
500
400
300
100
0
人的被害軽減はほとんど期待できない
Less Effects
人的被害軽減が期待できる
Large Effects
Government/行政対応
People/
住民の対応
Case 1 (No Builg)
Case 2 (Curent)
Case 3 (Our Proposal)
0
5
10
15
避難準備時間(分) / Time for Evacuation Preparation
→補助金助成制度などの新たな政策立案が考えられる


③シミュレーション結果(耐震補強の効果)
避難準備時間 10分
1分 3分 5分 7分
→情報の遅れなし
避難場所
情報未取得者
情報取得者
避難中
屋外拡声器
音声到達エリア
広報車
広報車ルート
Case 4 闇雲な耐震補強(4ヶ所補強)
Case 5 効果的な耐震補強(4ヶ所補強)


③人的被害数の推移(耐震補強の効果)
/Effect of Road Blockage
Nothing retrofitted
人的被害者数（人）
No. of victims
700
600
500
400
300
200
100
0
Effect of Selection of
Retrofitting Locations
All retrofitted
Government/
行政対応
10
8
6
4
2
0
Case 3-1
Case 3-2
道路閉塞数（ヶ所）/
No. of Road Blockage
→効果的な耐震化により人的被害軽減が期待できる


ICUS, IIS
University
of Tokyo
Thank you
Kimiro MEGURO
目黒　公郎
Meguro Lab.
IIS, The University of Tokyo

Approaches to Identifying the Areas at Risk of Flood and Drought Over Northeast Thailand

Assoc. Prof. Dr. Charat Mongkolsawat

APPROACHES TO IDENTIFYING THE AREAS AT RISK OF FLOOD AND DROUGHT OVER NORTHEAST THAILAND

CHARAT MONGKOLSAWAT
Khon Kaen University
charat@kku.ac.th

Objectives

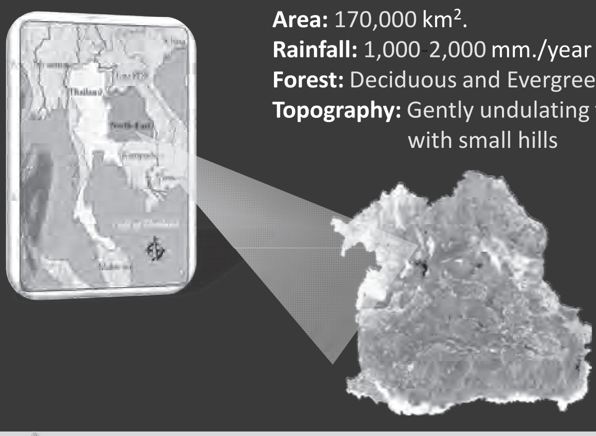
- To explore the recurrent areas of floods using multi-temporal RADARSAT data and to present the flood extent as related to sub-basin characteristics, rainfall pattern and stream hydrology.
- To predict drought-related vegetation stress using satellite-derived data.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

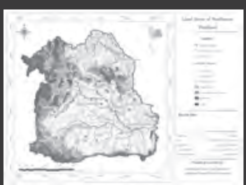
Study Area

- Northeast Thailand

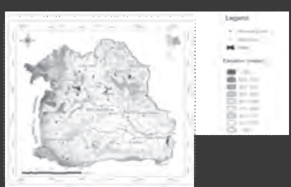
Area: 170,000 km^2.
Rainfall: 1,000-2,000 mm./year
Forest: Deciduous and Evergreen forests
Topography: Gently undulating terrain with small hills



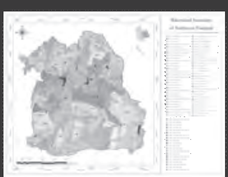
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



Landform



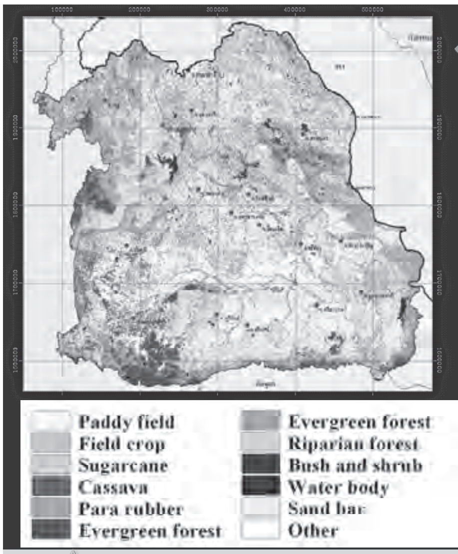
Elevation



Mekong, Chi, Mun Sub-basins

Water body and hydrological networks

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



❖ Land use/ Forest

Land use type	Area Km²	%
Paddy field	88,428.44	53.93
Field crop	5,939.15	3.54
Sugarcane	5,868.35	3.25
Cassava	8,468.98	5.04
Para rubber	1,711.50	1.07
Evergreen forest	6,233.46	2.96
Deciduous forest	42,616.61	24.46
Riparian forest	4,590.21	2.71
Bush and shrub	157.88	0.09
Water body	4,709.40	2.88
Sand bar	51.33	0.03
Other	50.03	0.03
Total	168,825.34	100.00

Source: SPOT (2007) and THEOS (2009)

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Mekong River Basin

Upper Mekong Basin (UMB)

- 18 % of total flow

(China 16% & Myanmar 2%)

Lower Mekong Basin (LMB)

625,000 km2

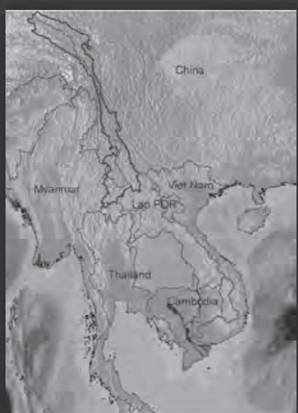
82 % total flows

- Cambodia – 18%
- Lao PDR– 35%
- Thailand – 18%
- Viet Nam – 11%

Upper Mekong gives 18% of annual flow, of that 2% comes from China.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

❖ Mekong River Is one of the world's great rivers. It rises in the Tibetan Plateau flows through 6 countries in its journey over 4,500 km to the South China Sea.



Mekong River Basin

- China
- Myanmar
- Laos

Upper Basin

- Thailand
- Cambodia
- Viet Nam

Lower Basin

Discharge: 475 km^3 / year
Area: 795,000 km^2

Murray-Darling
Discharge: 12.6 km^3 / year
Area: 1,073,000 km^2

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

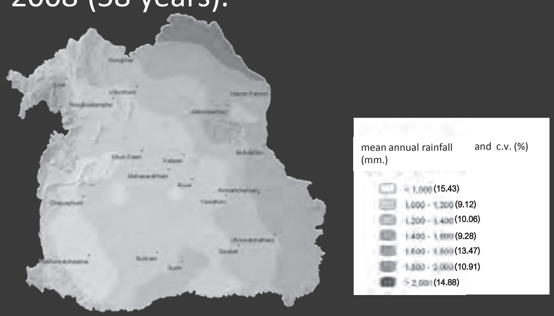
MRB water resource

Description	China	Mya	Lao	Thai	Cam	V/N	Total
Catchment (Km²)	165,000	24,000	202,000	184,000	155,000	65,000	795,000
% of Basin	22%	3%	25%	23%	19%	8%	
% of country		4%	97%	36%	86%	20%	
Average Flow (m^3/s)	2,410	300	5,270	2,560	2,860	1,660	15,060
Percentage	16%	2%	35%	18%	18%	11%	

Variability of Rainfall

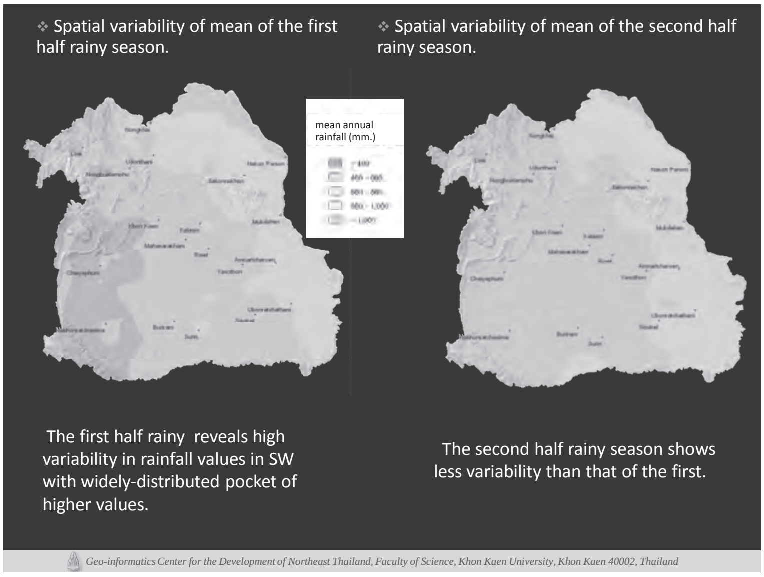
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

❖ Spatial variability of mean annual rainfall 1951-2008 (58 years).

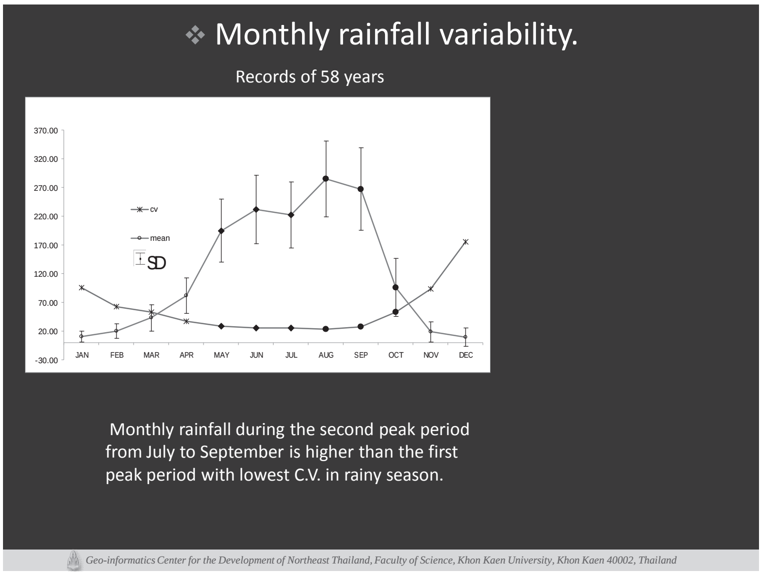


A pattern of increasing the mean rainfall from SW to NE is evident in all of the classes. C.V ranges from 9.12-15.43%,although pockets of erratic rainfall is present.

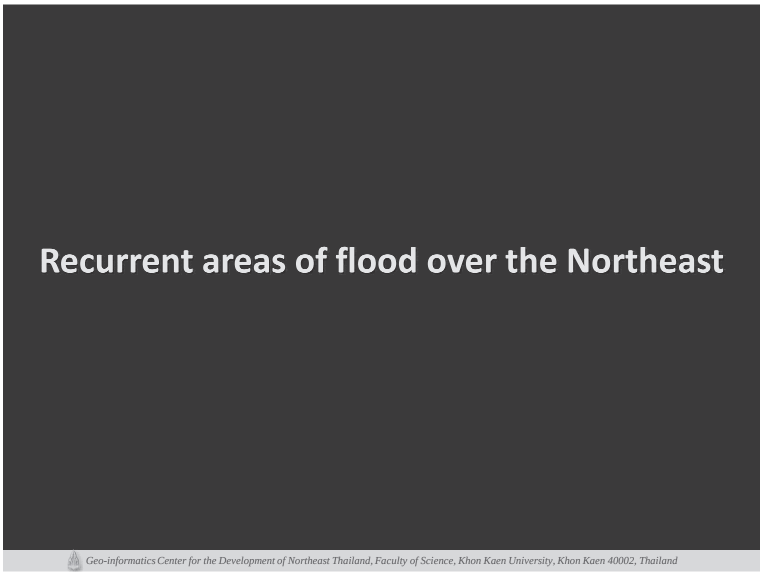
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



❖ Spatial variability of mean of the first half rainy season.
❖ Spatial variability of mean of the second half rainy season.
mean annual rainfall (mm.)
The first half rainy reveals high variability in rainfall values in SW with widely-distributed pocket of higher values.
The second half rainy season shows less variability than that of the first.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



❖ Monthly rainfall variability.
Records of 58 years
370.00
320.00
270.00
220.00
170.00
120.00
70.00
20.00
-30.00
cv
mean
SD
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Monthly rainfall during the second peak period from July to September is higher than the first peak period with lowest C.V. in rainy season.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



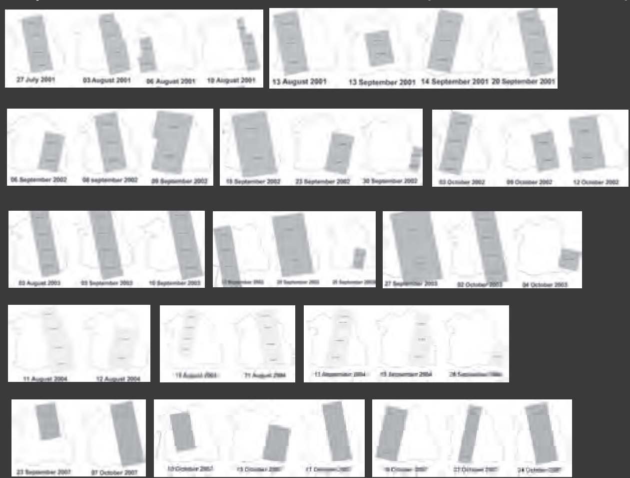
Recurrent areas of flood over the Northeast
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Methodology

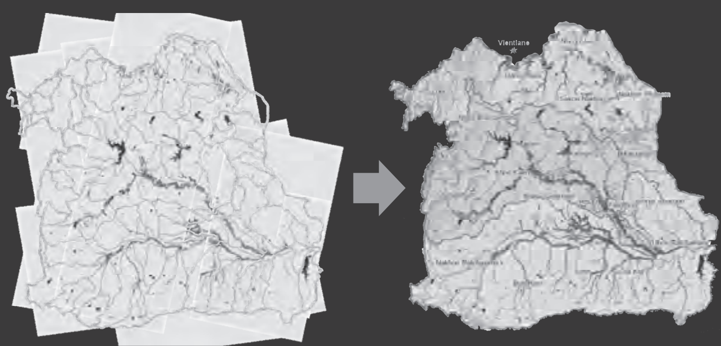
- The recurrent flood extent over the Northeast was established, based on the flood events in 2001 2002, 2003, 2004, and 2007 as seen by RADARSAT.
- Based on the sub-basins, we identified the flood area as related to rainfall, time of concentration, landform, discharge and return period .

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Acquisition dates of RADARSAT data(C band W mode)



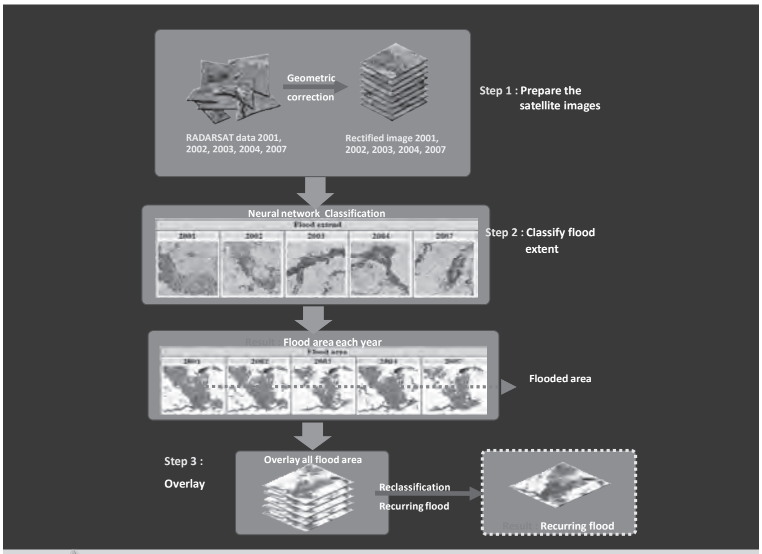
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



Flood areas were interpreted scene by scene and combined ,covering the entire NE

Flood areas over the sub basins

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Cumulative Rainfall

- Calculation of the cumulative rainfalls summed over the preceding 5, 10, 15, 25 and 30 days prior to imaging Radar by which the acquired flood extent was performed.
- Establishment of the cumulative rainfall over the sub-basin areas was made.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Time of concentration (Tc)

- Estimate of the Tc for the sub-basins was based on:

$$Tc = L^{1.15} / 7700H^{0.38}$$

L = length of travel

H = slope

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Recurrent flood and landform

- Overlay of landform map layer on the recurrent sub-basins area of flood was carried out.

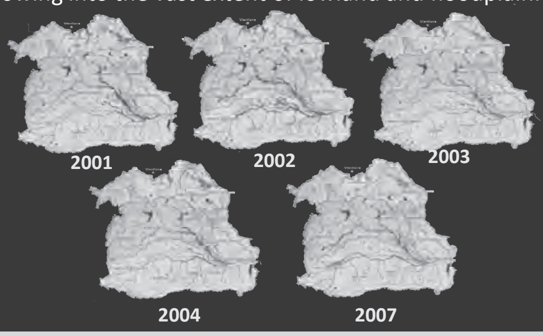
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Return period

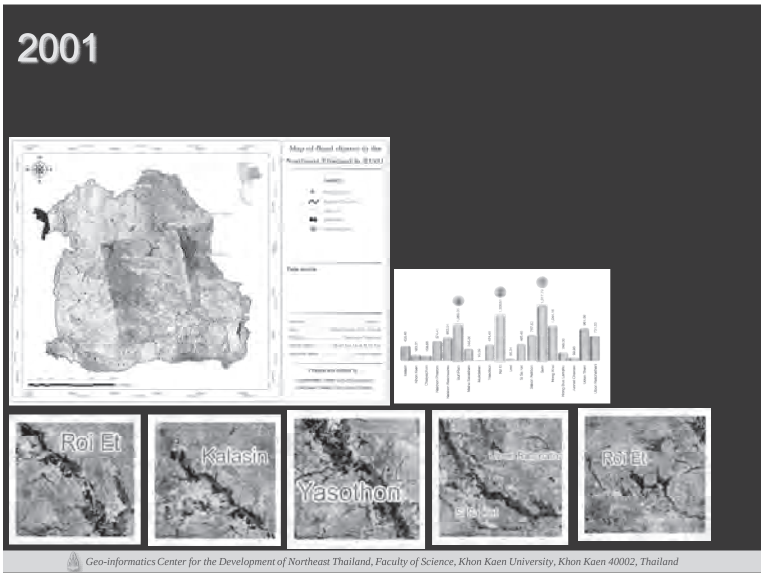
- Gumbel distribution was used to calculate the return period(recurrence interval) in sub-basins having gauging stations.
- We performed analysis on42 sub-basins,each of which had 2-4 stations.

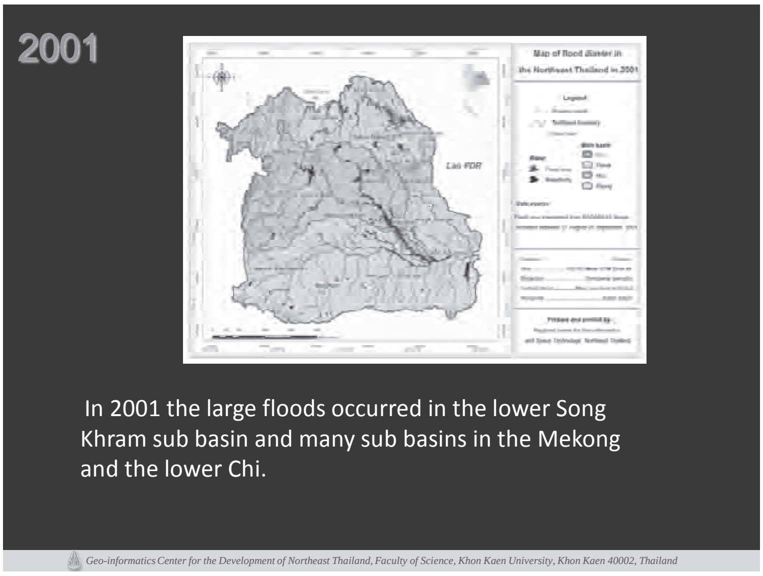
Result – The areas of inundation

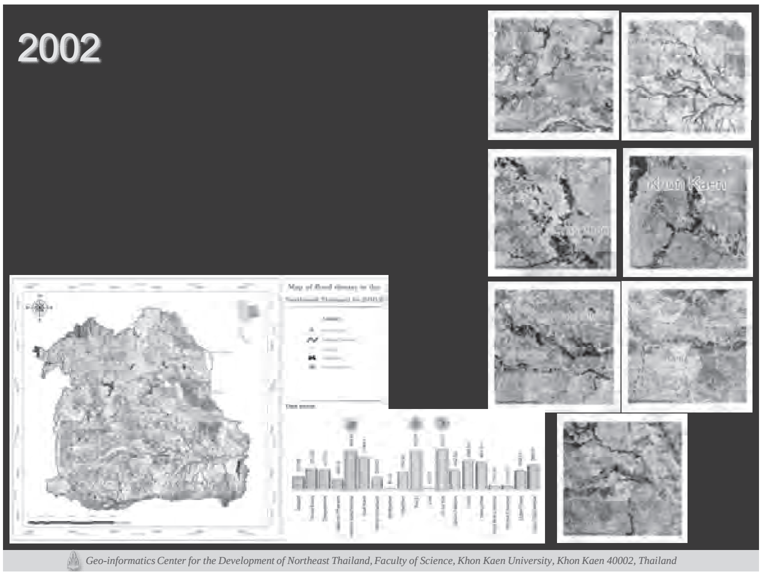
- The inundation areas accounted for large and recurrent areas over the downstreams and the confluences of main rivers and tributaries. The flood water stored during the peaks of cumulative rain was discharged into downstream areas and over spilled the bank, overflowing into the vast extent of lowland and floodplain.

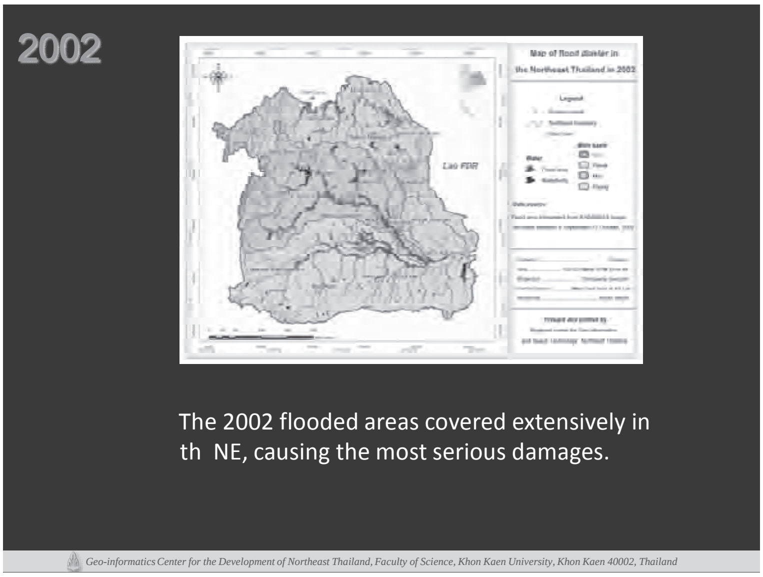


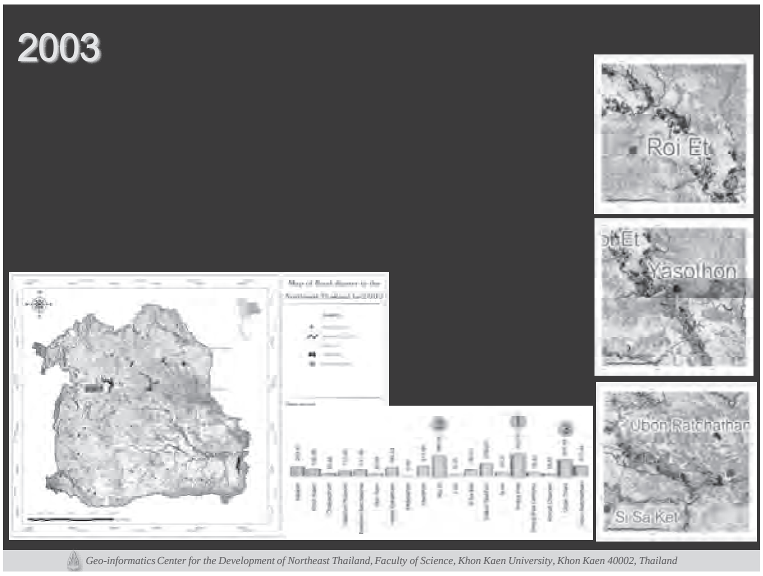
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

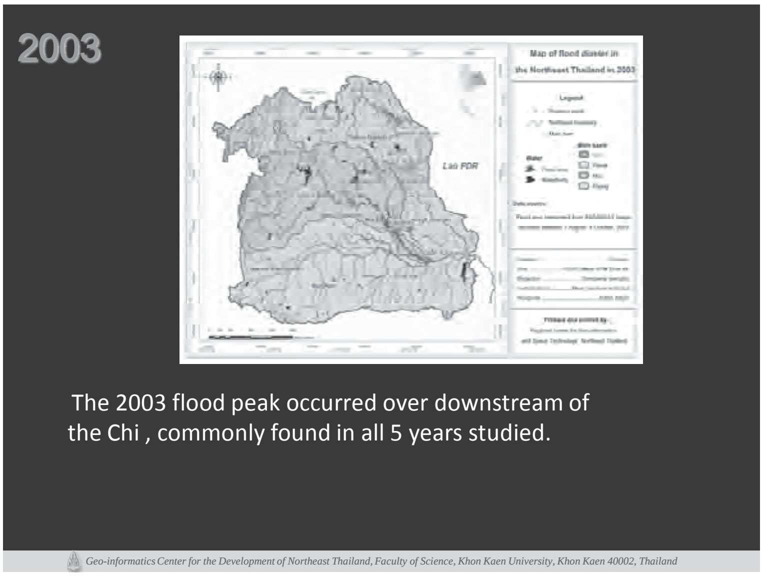

2001
Roi Et
Kalasin
Yasothon
Roi Et
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


2001
Map of flood disaster in the Northeast Thailand in 2001
Lao PDR
In 2001 the large floods occurred in the lower Song Khram sub basin and many sub basins in the Mekong and the lower Chi.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

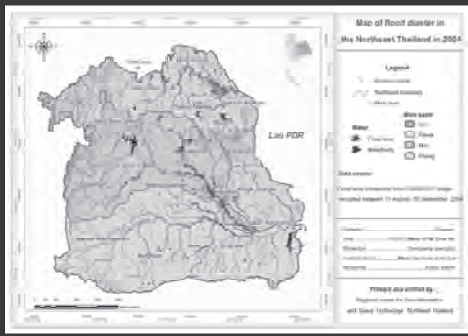

2002
Khon Kaen
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


2002
Map of flood disaster in the Northeast Thailand in 2002
Legend
Lao PDR
The 2002 flooded areas covered extensively in
th NE, causing the most serious damages.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


2003
Roi Et
Yasothon
Ubon Ratchathan
Si Sa Ket
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


2003
Map of flood disaster in the Northeast Thailand in 2003
Legend
Lao PDR
The 2003 flood peak occurred over downstream of
the Chi , commonly found in all 5 years studied.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

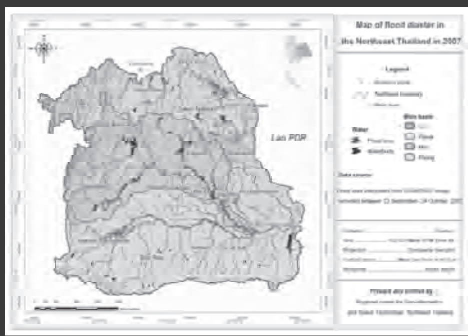
2004



The2004 large floods were predominantly river floods,with the most serious flooding occurring in downstream of Song Khram and Chi.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

2007



Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

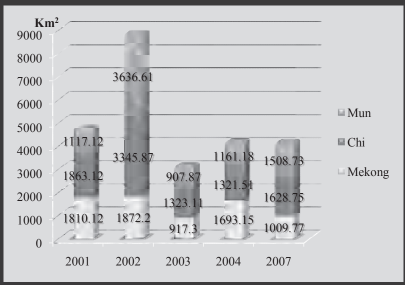
- **Flood areas over the Northeast for 2001, 2002, 2003, 2004 and 2007, the largest area of flood occurred in 2002 for the Mun and Chi, in 2004 for the Mekong.**

Year	Flood area (km^2)	Percent
2001	4,790.37	2.84
2002	8,854.68	5.24
2003	3,148.28	1.86
2004	4,175.83	2.47
2007	4,147.25	2.46

Total area of the Northeast = 168,825.34 km^2

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Flood areas of the watershed in 2001-2004, 2007



Watershed	% of flood				
	2001	2002	2003	2004	2007
Mekong	37.79	21.14	29.14	40.55	24.35
Chi	38.89	37.79	42.03	31.65	39.27
Mun	23.32	41.07	28.84	27.81	36.38
Total	100.00	100.00	100.00	100.00	100.00

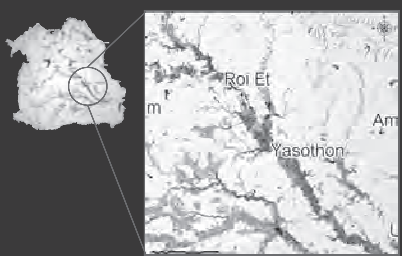
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Result - The recurrent flood extent

- The recurrent flood areas for all 4 and 5 years were found at the downstream and confluences of the main rivers and its tributaries.
- Of the total flooded areas, the recurrent areas accounted for 8.68, 7.46, 10.67, 20.75 and 52.44 % for 5,4,3,2 and 1 year respectively. Most river floods resulted from rainfall events such as excessively prolonged rainfall and were intensified by basin area,shape,slope, altitude, landuse and drainage network.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Result - The recurrent flood extent (Cont.)



Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Result - The recurrent flood extent (Cont.)

❖ The affected villages accounted for 3,820, 1,576, 815, 619 and 839 villages for 1 year, 2 year, 3 year, 4 year and 5 years flood respectively.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

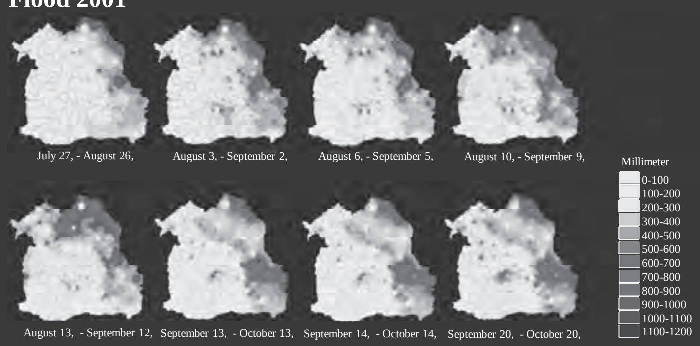
Cumulative rainfall and flooded areas

- ❖ The mean cumulative rainfall summed over the preceding imaging exceeding 200 mm is likely to bring about the floods.
- ❖ The amount of flood-producing rainfalls reaching 200 mm varied from 15 days to 30 days.
- ❖ The prolonged period of rainfall as a result.
- ❖ of tropical cyclone/depression usually 2-3 storms occurring periodically, could intensify the severity of flood.

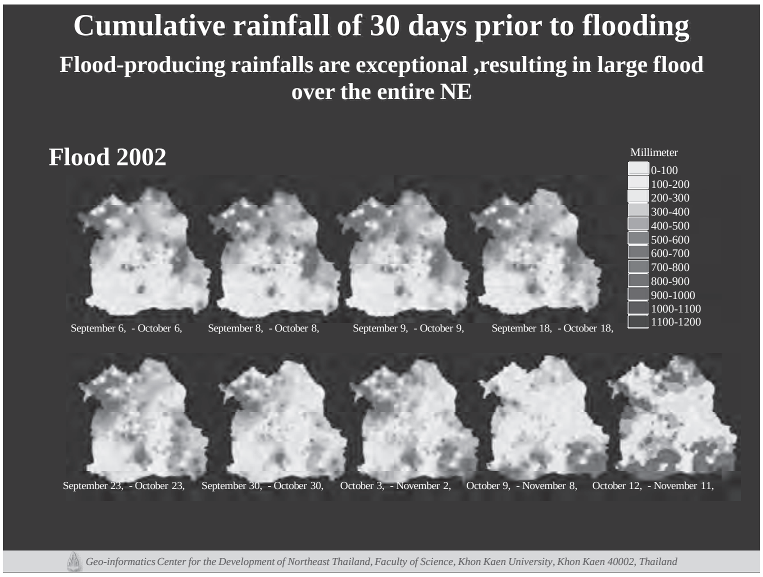
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

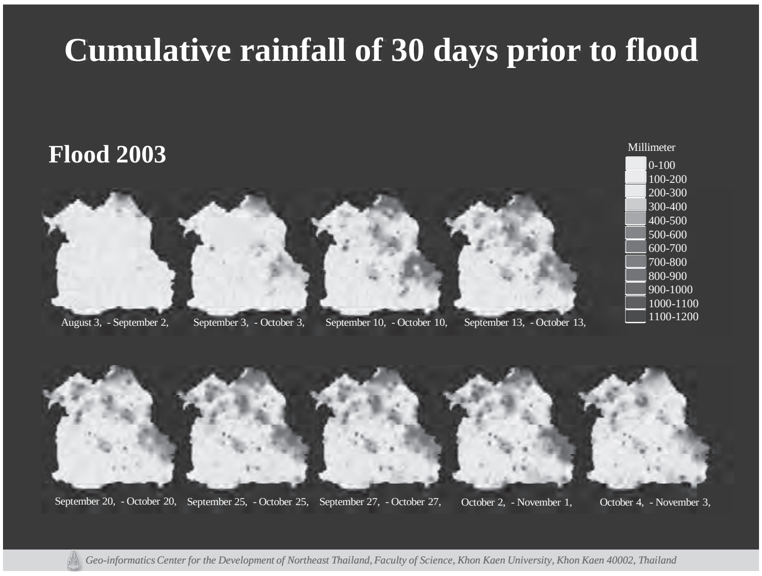
Cumulative rainfall of 30 days prior to flood Increasing rainfall from SE to NE is evident, producing large floods in the Mekong and Chi.

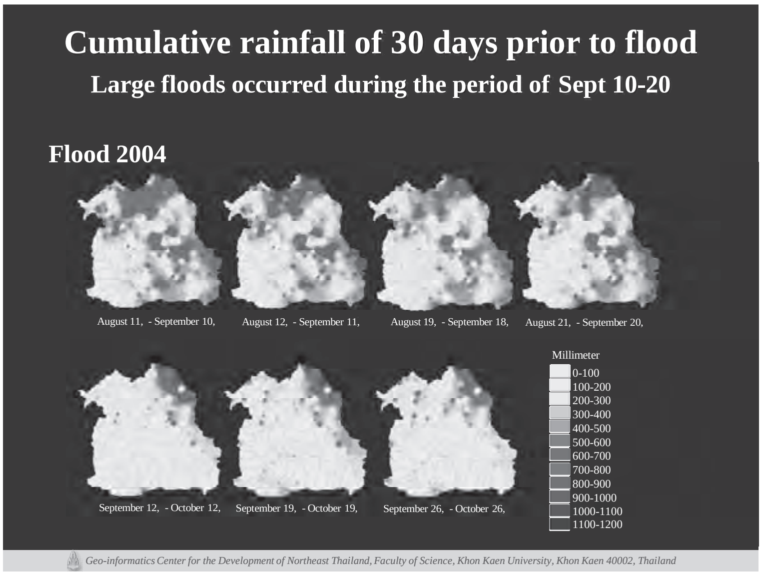
Flood 2001



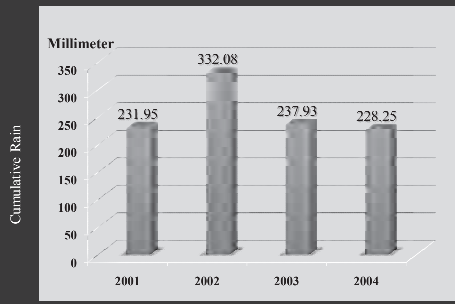
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Cumulative rainfall of 30 days prior to flooding
Flood-producing rainfalls are exceptional ,resulting in large flood over the entire NE
Flood 2002
Millimeter
0-100
100-200
200-300
300-400
400-500
500-600
600-700
700-800
800-900
900-1000
1000-1100
1100-1200
September 6, - October 6,
September 8, - October 8,
September 9, - October 9,
September 18, - October 18,
September 23, - October 23,
September 30, - October 30,
October 3, - November 2,
October 9, - November 8,
October 12, - November 11,
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Cumulative rainfall of 30 days prior to flood
Flood 2003
Millimeter
0-100
100-200
200-300
300-400
400-500
500-600
600-700
700-800
800-900
900-1000
1000-1100
1100-1200
August 3, - September 2,
September 3, - October 3,
September 10, - October 10,
September 13, - October 13,
September 20, - October 20,
September 25, - October 25,
September 27, - October 27,
October 2, - November 1,
October 4, - November 3,
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Cumulative rainfall of 30 days prior to flood
Large floods occurred during the period of Sept 10-20
Flood 2004
August 11, - September 10,
August 12, - September 11,
August 19, - September 18,
August 21, - September 20,
Millimeter
0-100
100-200
200-300
300-400
400-500
500-600
600-700
700-800
800-900
900-1000
1000-1100
1100-1200
September 12, - October 12,
September 19, - October 19,
September 26, - October 26,
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Mean of cumulative rain of 30 days before flood

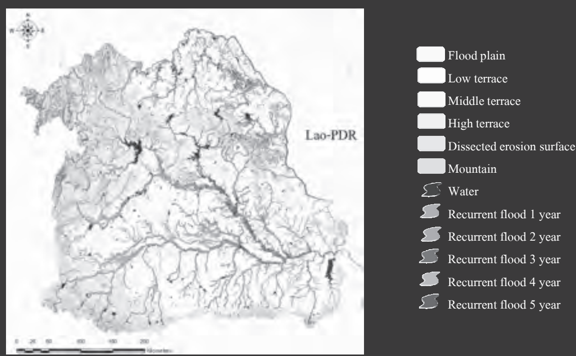


The magnitude of the 2002 rainfall exceeded those of the 2001,2003 and 2004,causing the most serious floods.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

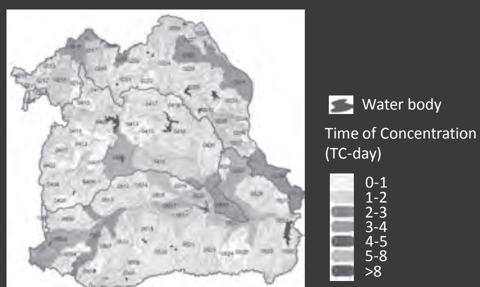
Landform and recurrent flood areas

❖ About 75% of the Flood areas occurred over the flood plain and low terrace. The rest was found over the low lying areas of the middle. terrace.



Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Time of Concentration (TC-day) Sub-basins in Northeast Thailand



Mekong

TC(day)	No. of watershed	Percent
0-1	9	32.14
1-2	13	46.43
2-3	1	3.57
3-4	0	0.00
4-5	2	7.14
5-8	1	3.57
>8	2	7.14

Chi

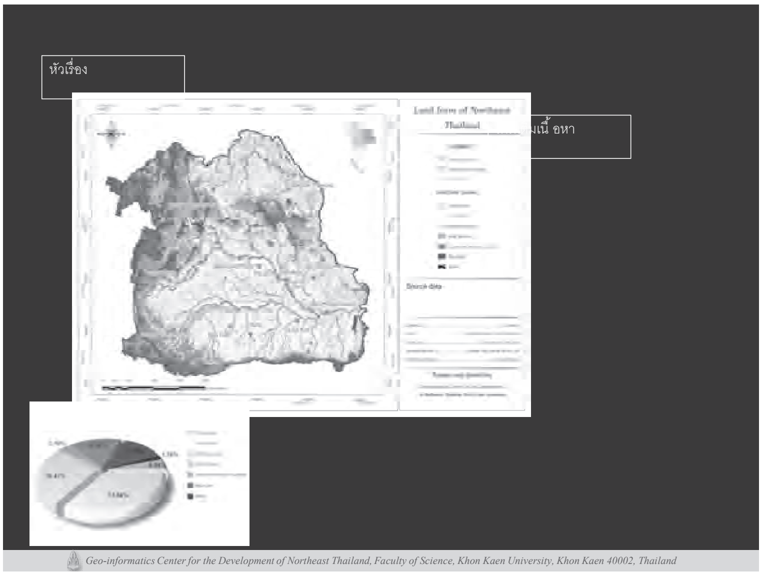
TC(day)	No. of watershed	Percent
0-1	11	55.00
1-2	6	30.00
2-3	1	5.00
3-4	0	0.00
4-5	1	5.00
5-8	1	5.00
>8	0	0.00

Mun

TC(day)	No. of watershed	Percent
0-1	7	22.58
1-2	17	54.84
2-3	3	9.68
3-4	2	6.45
4-5	0	0.00
5-8	1	3.23
>8	1	3.22

Of the total sub-basins, the sub-basins with high Tc in the Mekong,Chi and Mun were identified.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand



The recurrent sub-basins of floods in all years

Discharge and return period

Sub basin	Station	2001		2002		2003		2004	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Mekong									
Huai luang	Kh.53	21.80	1	151.90	35	12.00	1	4.00	1
Upper part of songkhram river	Kh.74	245.60	2	467.00	7	326.60	3	287.00	2
	Kh.93	130.00	1	177.90	2	122.30	1	74.40	1
Lower part of songkhram river	Kh.28A	398.20	2	250.40	2	-	-	-	-
	Kh.58A	666.60	3	683.70	3	356.30	2	-	-
	Kh.77A	26.8	1	33.70	1	24.20	1	-	-
	Kh.78	0.00	-	-	1	32.60	1	-	-
Chi									
Fourth part of chi river	E.1	649.60	3	1,340.00	20	809.20	5	398.90	2
	E.18	1,890.00	10	1,512.00	6	924.00	3	1,126.20	4
	E.8A	519.10	3	1,330.00	35	746.10	-	-	-
Yang river	E.54	186.40	1	410.00	4	228.40	1	276.80	2
	E.57	30.10	1	38.30	1	16.00	1	14.08	1
	E..70	300.80	1	603.90	6	503.20	3	365.84	1
Lower part of chi river	E.20A	2,690.00	14	2,009.00	6	1,493.10	3	1,717.50	4
Mun									
Second part of mun river	M.104	141.80	2	408.20	4	-	-	-	-
Third part of mun river	M.5	857.00	2	2,005.00	6	897.50	4	1,162.00	-
	M.7	4,692.00	7	5,500.00	12	2,770.00	3	2,813.00	3
Lam sa bai	M.155	56.50	1	30.80	1	33.60	1	28.70	1
	M.179	-	-	975.00	4	632.20	2	396.20	1

1 = Discharge ()
2 = Return period (year)

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

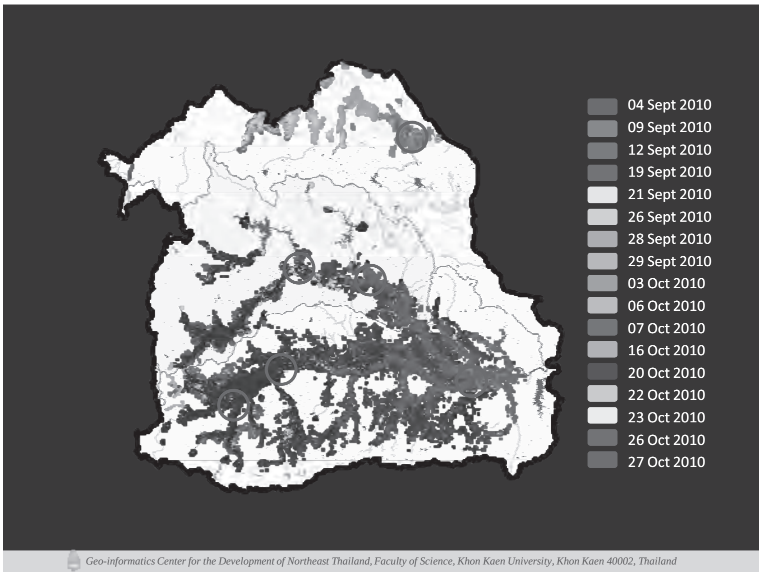
Discharge and return period

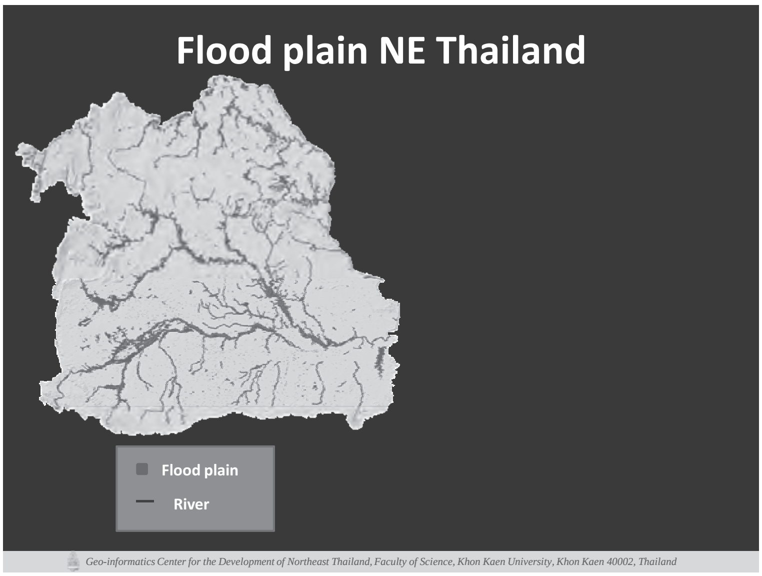
Station	Equation	R^2	Return period				
			2	5	10	25	50
Kh.28A	y = 356.7ln(x) + 95.04	R^2 = 0.939	342.29	669.13	916.37	1,243.21	1,490.46
Kh.53	y = 39.47ln(x) + 12.10	R^2 = 0.958	39.46	75.62	102.98	139.15	166.51
Kh.58A	y = 421.4ln(x) + 173.0	R^2 = 0.913	465.09	851.22	1,143.31	1,529.43	1,821.53
Kh.74	y = 164.1ln(x) + 154.9	R^2 = 0.966	268.65	419.01	532.75	683.12	796.86
Kh.77A	y = 83.76ln(x) + 47.44	R^2 = 0.807	105.50	182.25	240.30	317.05	375.11
Kh.78	y = 60.77ln(x) + 8.617	R^2 = 0.943	50.74	106.42	148.55	204.23	246.35
Kh.92	y = 241.6ln(x) + 214.4	R^2 = 0.862	381.86	603.24	770.70	992.08	1,159.54
Kh.93	y = 178.7ln(x) + 62.12	R^2 = 0.946	185.99	349.73	473.59	637.33	761.20
E.1	y = 382.1ln(x) + 205.4	R^2 = 0.975	470.25	820.37	1,085.22	1,435.33	1,700.18
E.8A	y = 308.2ln(x) + 232.7	R^2 = 0.969	446.33	728.73	942.36	1,224.76	1,438.39
E.18	y = 726.7ln(x) + 184.2	R^2 = 0.871	687.91	1,353.78	1,857.49	2,523.36	3,027.07
E.54	y = 188.6ln(x) + 165.2	R^2 = 0.774	295.93	468.74	599.47	772.28	903.01
E.57	y = 58.34ln(x) + 28.78	R^2 = 0.984	69.22	122.67	163.11	216.57	257.01
E.70	y = 155.2ln(x) + 322.5	R^2 = 0.897	430.08	572.28	679.86	822.07	929.65
E.20A	y = 835.8ln(x) + 490.2	R^2 = 0.967	1,069.53	1,835.37	2,414.70	3,180.54	3,759.87
M.104	y = 276.8ln(x) + 5.21	R^2 = 0.921	197.07	450.70	642.57	896.19	1,088.06
M.5	y = 933.5ln(x) + 329.3	R^2 = 0.969	976.35	1,831.71	2,478.76	3,334.12	3,981.17
M.7	y = 1812.ln(x) + 1066.	R^2 = 0.884	2,321.98	3,982.30	5,238.28	6,898.60	8,154.59
M.155	y = 81.15ln(x) + 42.95	R^2 = 0.918	99.20	173.56	229.80	304.16	360.41
M.179	y = 592.7ln(x) + 159.5	R^2 = 0.953	570.33	1,113.41	1,524.24	2,067.33	2,478.16

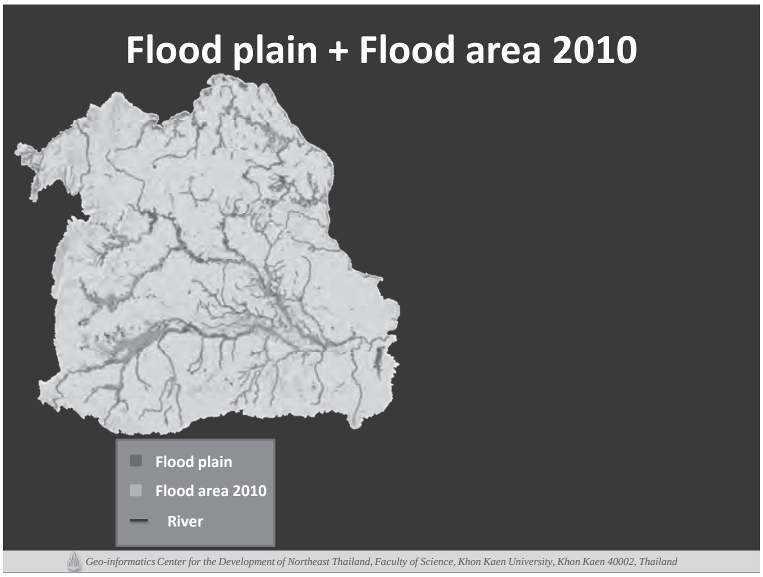
Y=discharge, x=return period

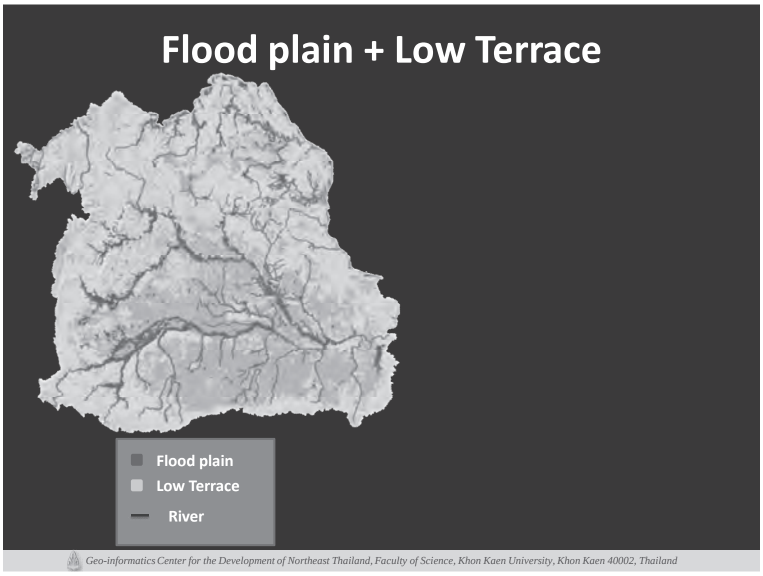
Recent flood in NE Thailand

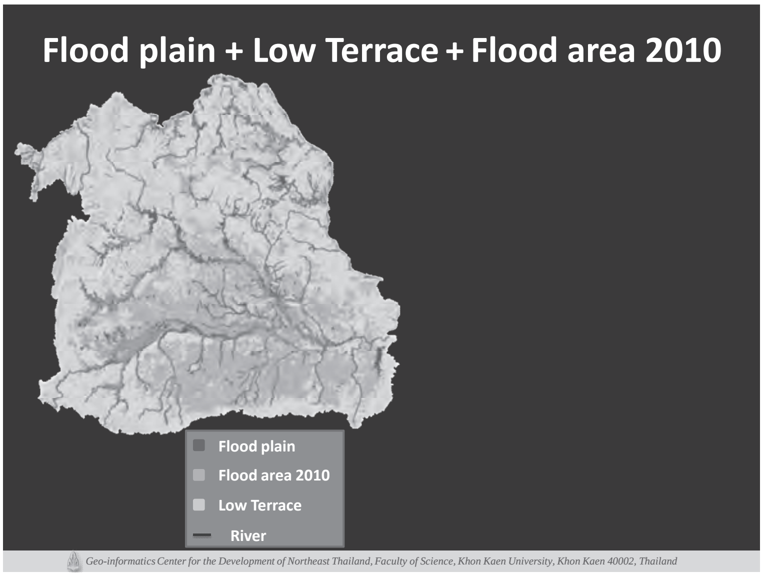
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

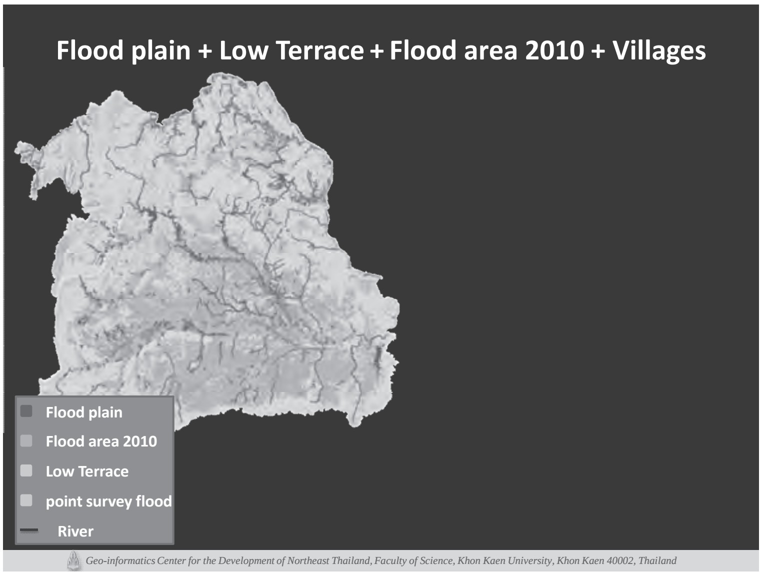


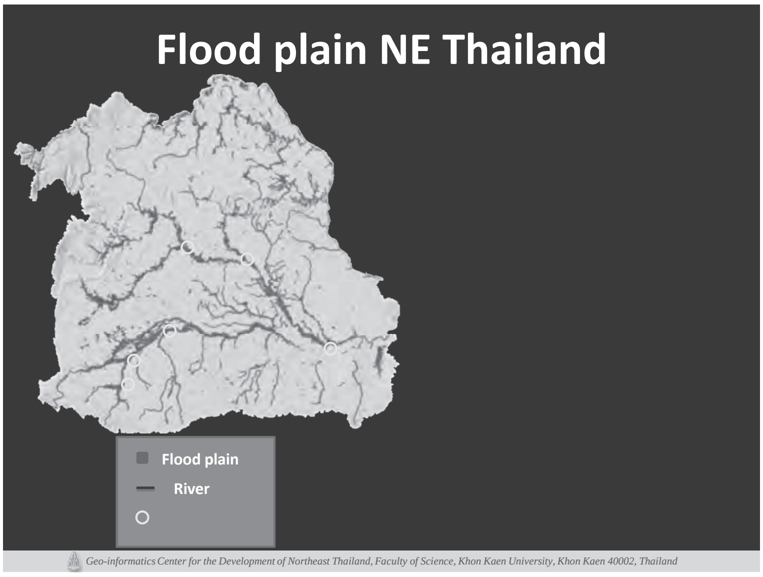


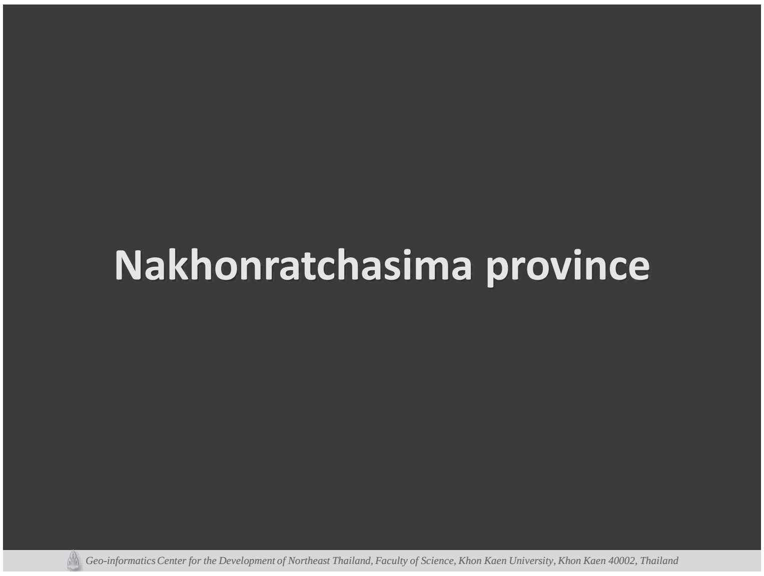

Flood plain + Flood area 2010
Flood plain
Flood area 2010
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

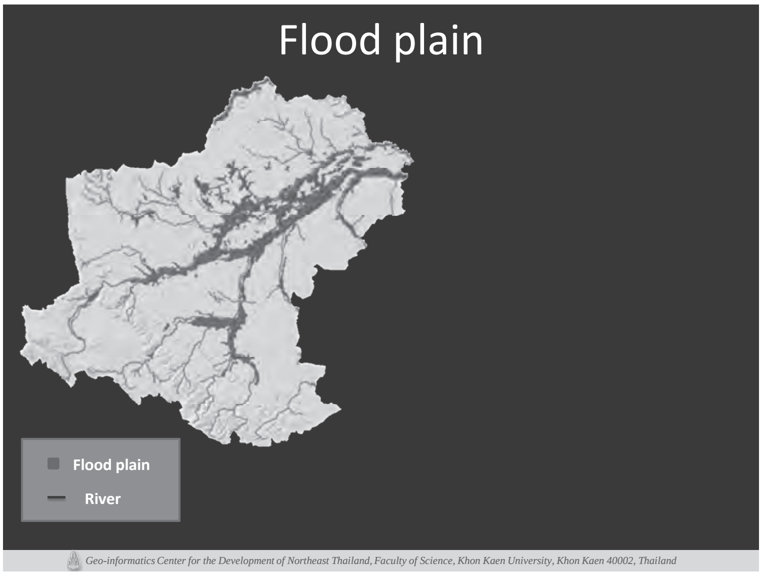

Flood plain + Low Terrace
Flood plain
Low Terrace
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

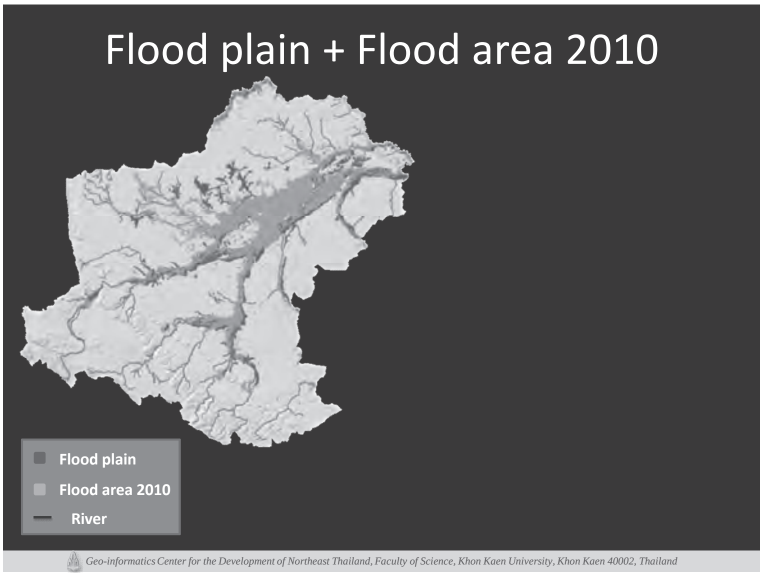

Flood plain + Low Terrace + Flood area 2010
Flood plain
Flood area 2010
Low Terrace
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

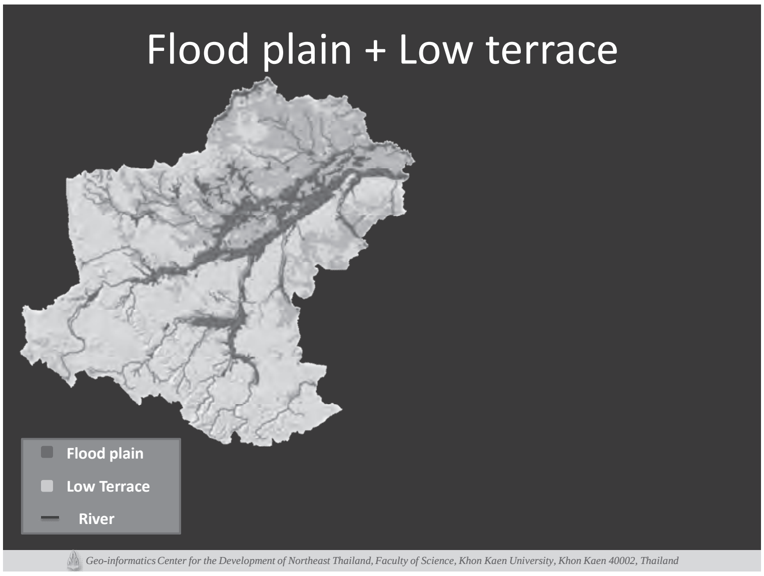

Flood plain + Low Terrace + Flood area 2010 + Villages
Flood plain
Flood area 2010
Low Terrace
point survey flood
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

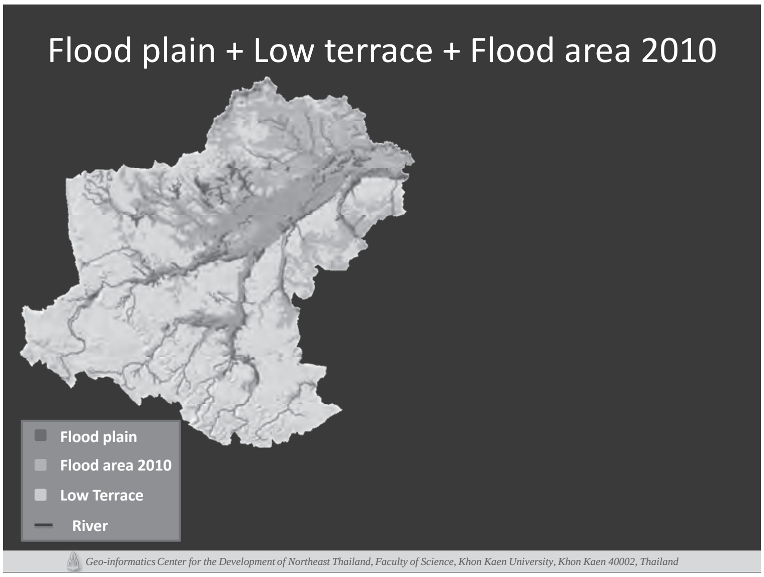

Flood plain NE Thailand
Flood plain
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

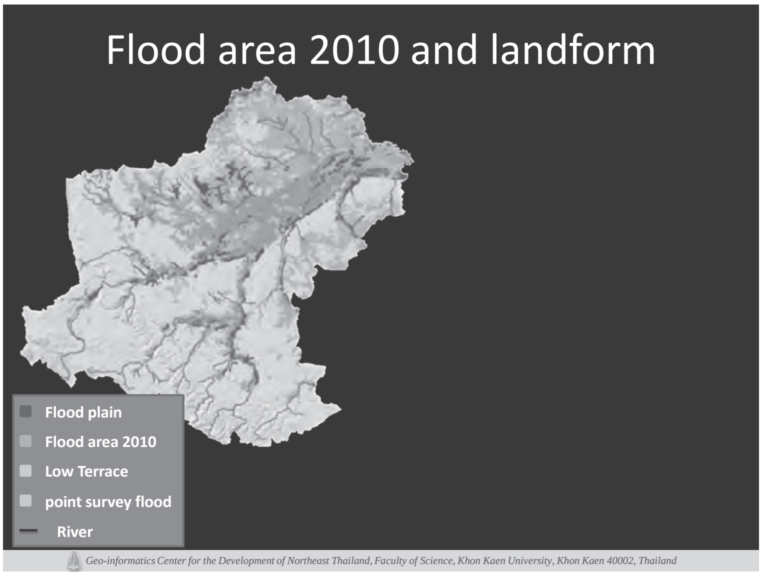

Nakhonratchasima province
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

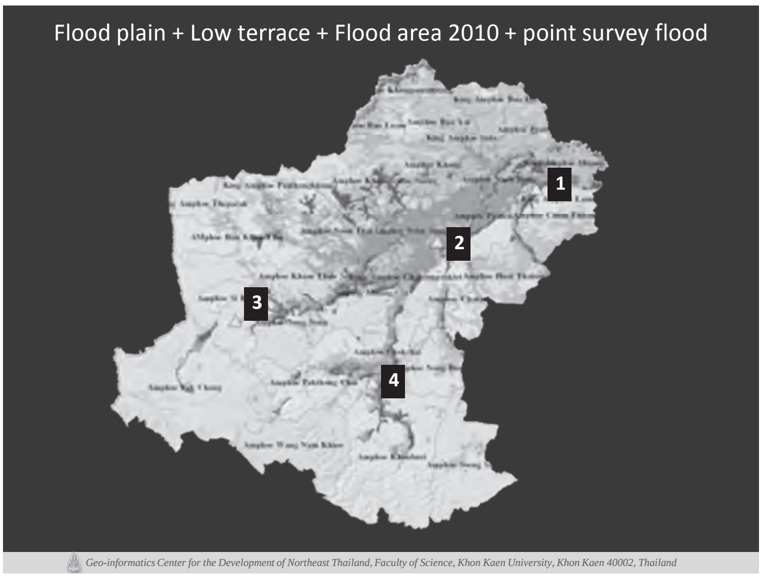

Flood plain
Flood plain
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

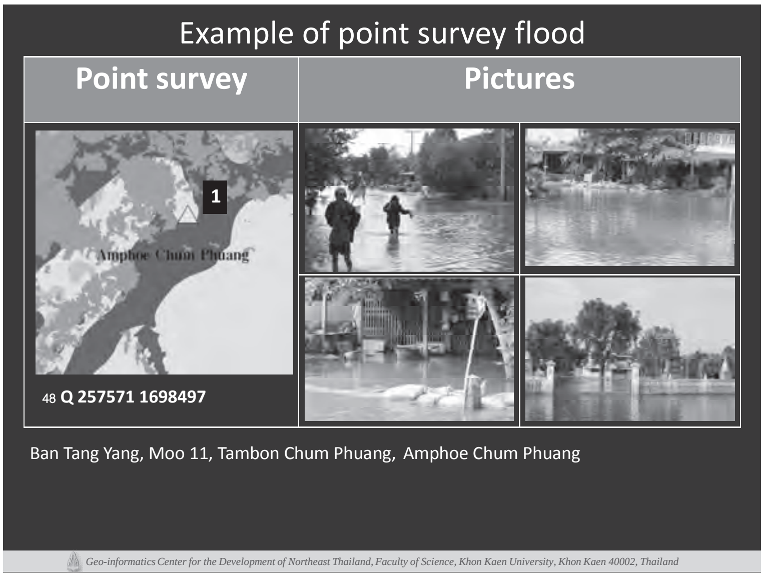

Flood plain + Flood area 2010
Flood plain
Flood area 2010
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

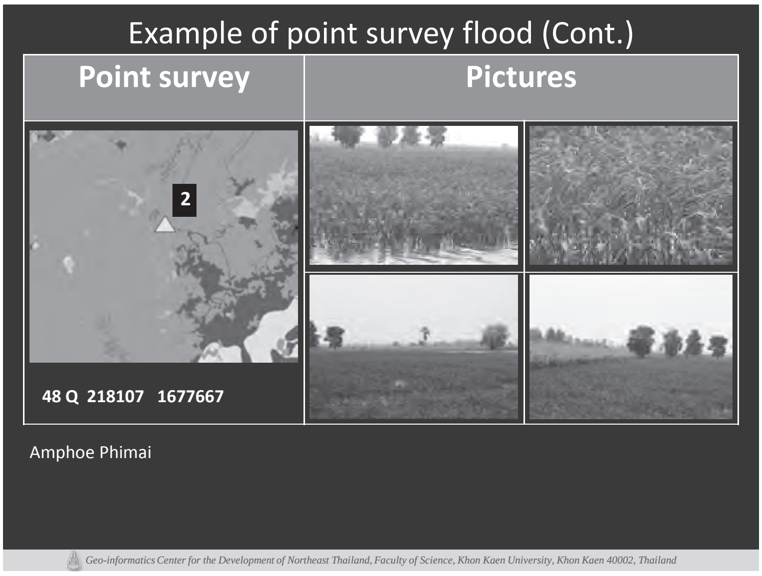

Flood plain + Low terrace
Flood plain
Low Terrace
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

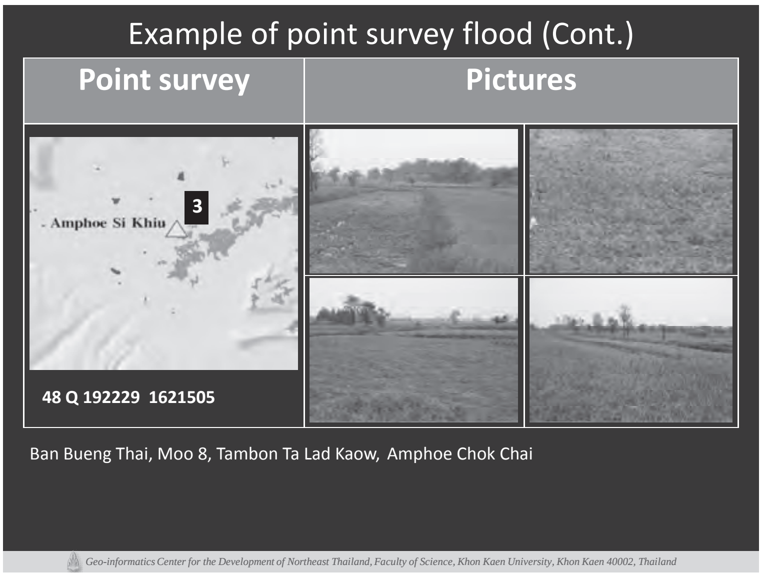

Flood plain + Low terrace + Flood area 2010
Flood plain
Flood area 2010
Low Terrace
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Flood area 2010 and landform
Flood plain
Flood area 2010
Low Terrace
point survey flood
River
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Flood plain + Low terrace + Flood area 2010 + point survey flood
1
2
3
4
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Example of point survey flood
Point survey
Pictures
Amphoe Chum Phuang
1
48 Q 257571 1698497
Ban Tang Yang, Moo 11, Tambon Chum Phuang, Amphoe Chum Phuang
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Example of point survey flood (Cont.)
Point survey
Pictures
2
48 Q 218107 1677667
Amphoe Phimai
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Example of point survey flood (Cont.)
Point survey
Pictures
Amphoe Si Khiu
3
48 Q 192229 1621505
Ban Bueng Thai, Moo 8, Tambon Ta Lad Kaow, Amphoe Chok Chai
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Example of point survey flood (Cont.)

Point survey	Pictures
 48 Q 137529 1646131	

Ban Non Na, Moo 8, Tambon Lad Bua Kaow, Amphoe Sikhio

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Drought NE Thailand

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Method

Data source:

- Rainfall data over 70 stations in Northeast Thailand of 8 years (2001-2008).

- Multitemporal Terra-Modis data of the 16 day composite image data at 250 m resolution during the period 2001-2008 and 2010 available from *WIST (https://wist.echo.nasa.gov)*

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Method (Cont.)

Rainfall Analysis:

- Mean annual rainfall, mean 16 days rainfall and their standard deviations for 8 years record were analyzed at the entire stations.
- The cumulative rainfalls summed over the preceding months and its slope gradient for each year.
- Spatial interpolation of mean annual rainfall for 8 years performed using Inverse Distance Weighted method.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Method (Cont.)

- Based on relationship between rainfall and satellite derived-indices.
  - Satellite-derived indices
    NDVI, NDWI and NDDI
- Comparison of the changes in NDVI and NDWI values of pairs of images for different dates.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Method (Cont.)

Satellite derived indices:

The Normalized Difference Vegetation Index

$$NDVI = (\rho NIR - \rho Red) / (\rho NIR + \rho Red)$$

Where **ρ**NIR and **ρ**Red are the reflectance values at 0.857 µm and 0.645 µm, respectively

The Normalized Difference Water Index

$$NDWI = (\rho NIR - \rho SWIR) / (\rho NIR + \rho SWIR)$$

Where **ρ**NIR and **ρ**SWIR are the reflectance values at 0.857 µm and 1.65 µm, respectively

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Method (Cont.)

Satellite derived indices:

The Normalized Difference Drought Index

NDDI = (NDVI - NDWI) / (NDVI + NDWI)

Where NDVI = The Normalized Difference Vegetation Index
NDWI = The Normalized Difference Water Index

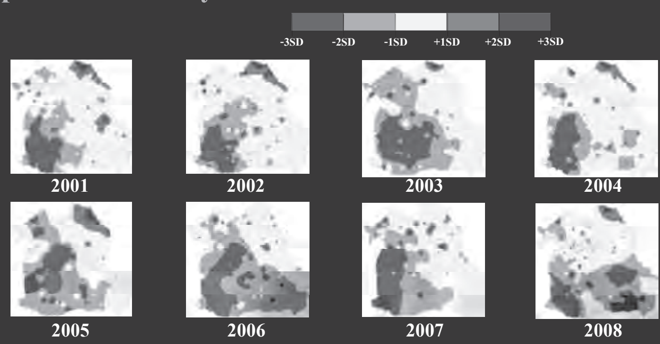
(Proposed by Gu et al 2007)

Method (Cont.)

- Comparison of the changes in NDVI and NDWI values of pairs of images for different dates. Phenology of vegetation provides information on the spatio-temporal pattern of drought.
  - dNDVI = $NDVI_1$ - $NDVI_2$
  - dNDWI = $NDWI_1$ - $NDWI_2$
- The step of SD from the mean dNDVI or dNDWI determines the magnitude of the change.
  - -1SD to 1SD = no change
- The severity of drought can be derived from the SD step, the greater SD step the higher change.

Spatial Variability of Rainfall: Results

$\bar{X}$ = 1,442.09
SD = 428.27

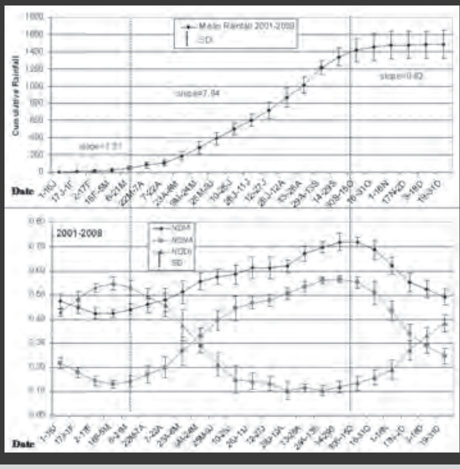


- The difference in spatial rainfall is shown by the step of standard deviation.
- A board pattern of increasing rainfall from southwest to northeast is evident.

Results (Cont.)

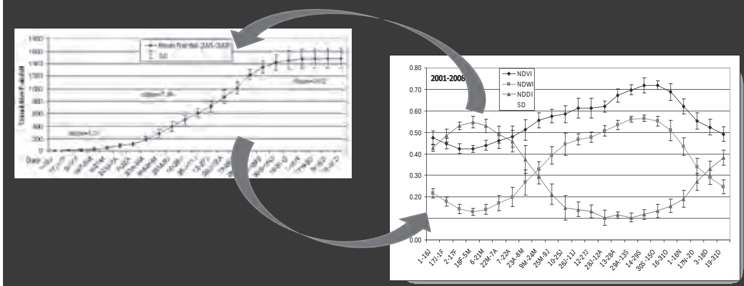
Temporal Variability:

- Show relationship between cumulative rainfall and NDVI NDWI and NDDI values cover.



Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

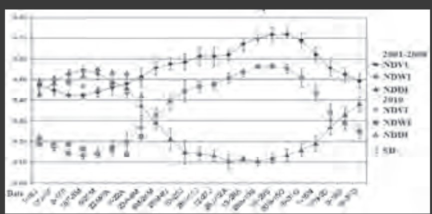
Results (Cont.)



- The high NDVI and NDWI values are strongly correlated with the greenness of the areas in contrary to the NDDI value.
- Increase of NDDI values occurs during the dry period.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

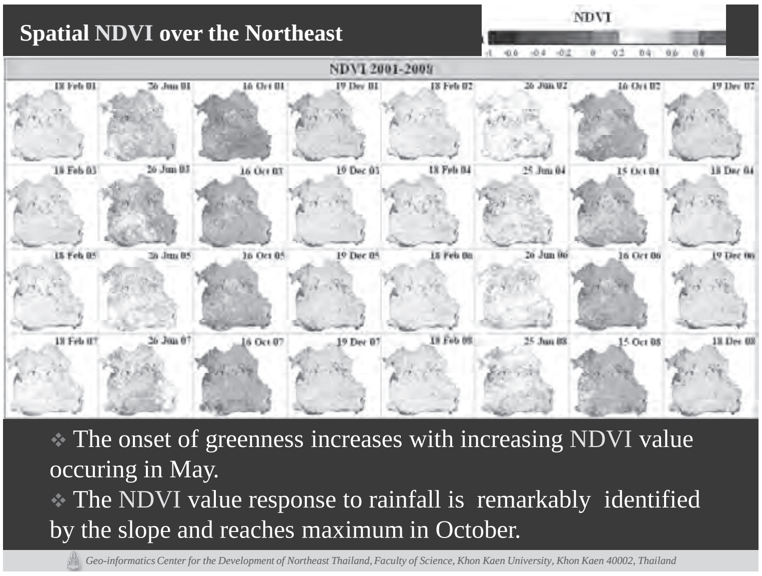
Results (Cont.)

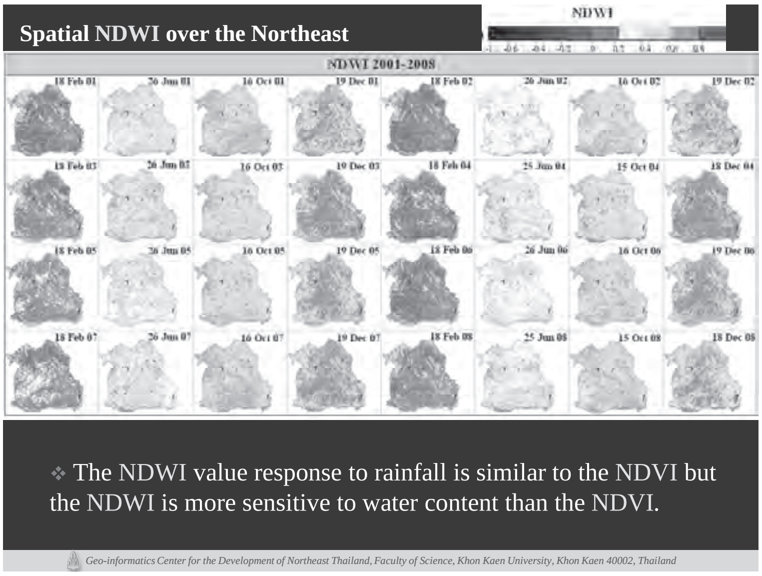


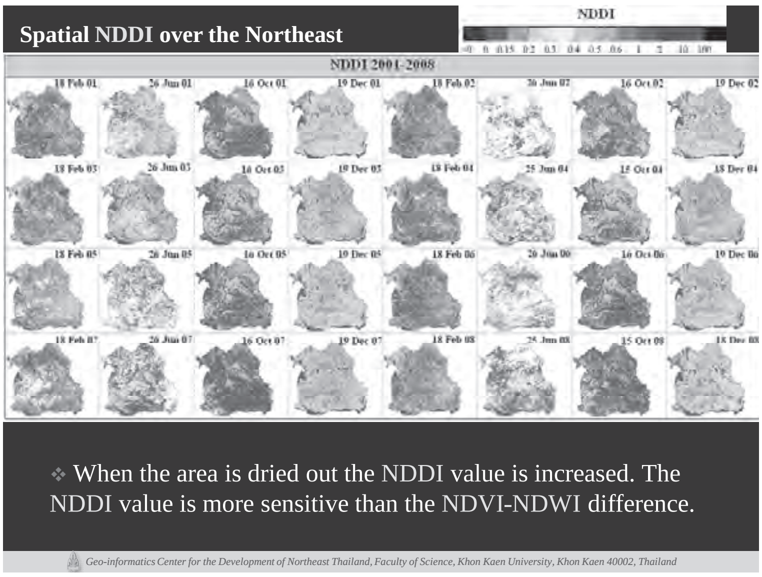
Drought identification for the dry period of 2010

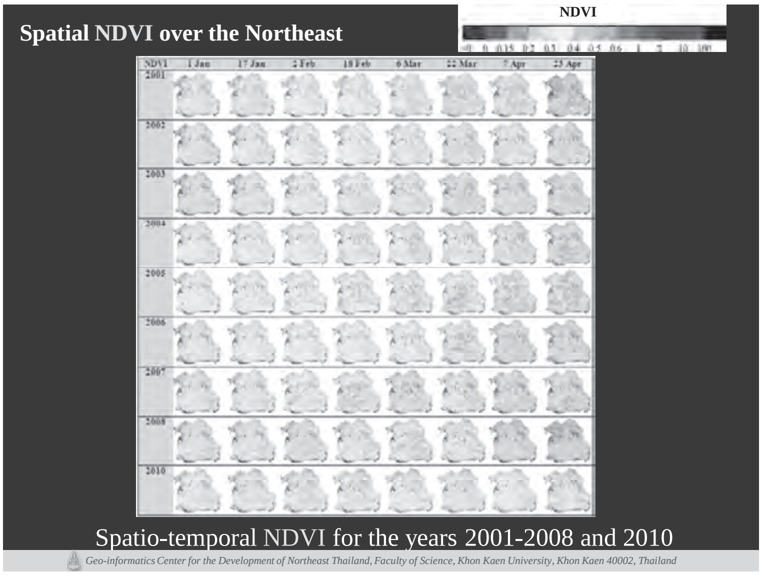
- With the mean values of NDVI, NDWI and NDDI the drought severity for the year 2010 can be identified.
- No distinction of NDVI values with increasing or decreasing water content can be observed.
- Greater response to drought is remarkably identified by NDWI and NDDI values.
- NDDI values are more sensitive and evident for drought identification as a result of greenness and water content.

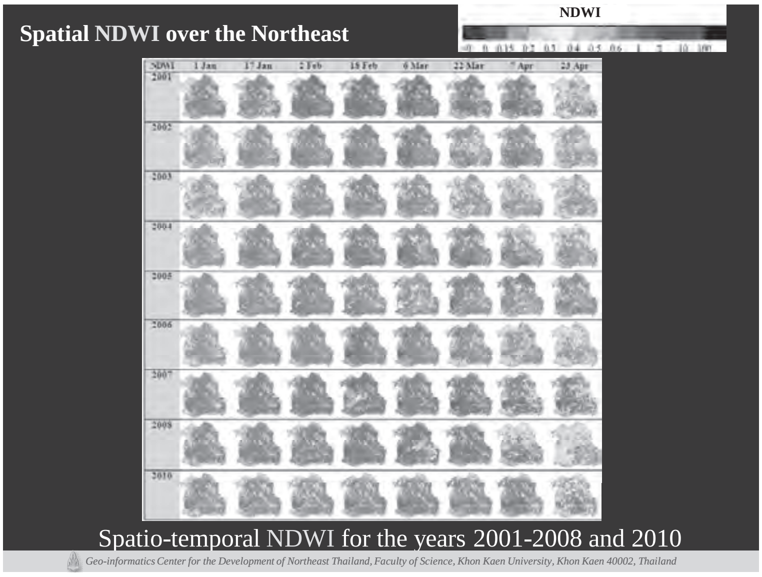
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

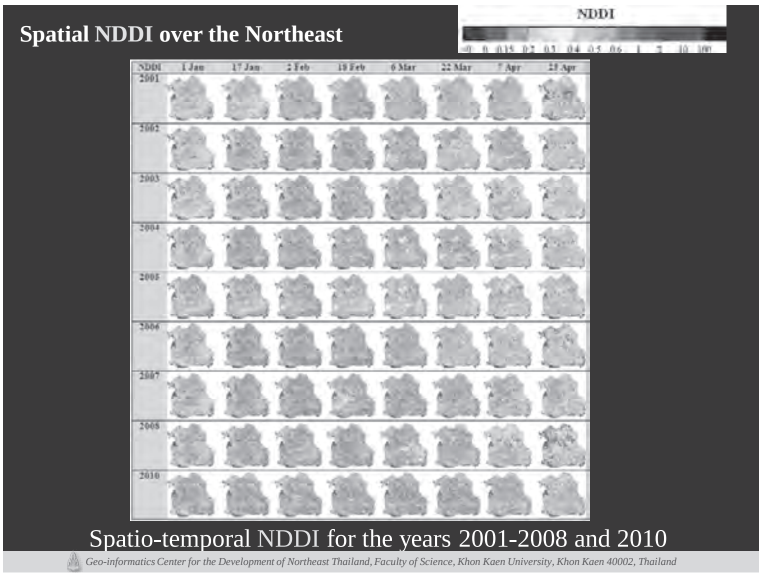

Spatial NDVI over the Northeast
NDVI
NDVI 2001-2008
❖ The onset of greenness increases with increasing NDVI value occuring in May.
❖ The NDVI value response to rainfall is remarkably identified by the slope and reaches maximum in October.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Spatial NDWI over the Northeast
NDWI
NDWI 2001-2008
❖ The NDWI value response to rainfall is similar to the NDVI but the NDWI is more sensitive to water content than the NDVI.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

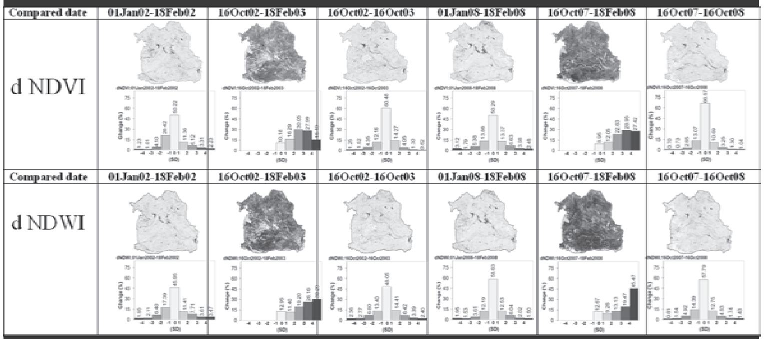

Spatial NDDI over the Northeast
NDDI
NDDI 2001-2008
❖ When the area is dried out the NDDI value is increased. The NDDI value is more sensitive than the NDVI-NDWI difference.
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Spatial NDVI over the Northeast
NDVI
NDVI 1 Jan 17 Jan 2 Feb 18 Feb 6 Mar 22 Mar 7 Apr 23 Apr
2001
2002
2003
2004
2005
2006
2007
2008
2010
Spatio-temporal NDVI for the years 2001-2008 and 2010
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Spatial NDWI over the Northeast
NDWI
NDWI 1 Jan 17 Jan 2 Feb 18 Feb 6 Mar 22 Mar 7 Apr 23 Apr
2001
2002
2003
2004
2005
2006
2007
2008
2010
Spatio-temporal NDWI for the years 2001-2008 and 2010
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand


Spatial NDDI over the Northeast
NDDI
NDDI 1 Jan 17 Jan 2 Feb 18 Feb 6 Mar 22 Mar 7 Apr 23 Apr
2001
2002
2003
2004
2005
2006
2007
2008
2010
Spatio-temporal NDDI for the years 2001-2008 and 2010
Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

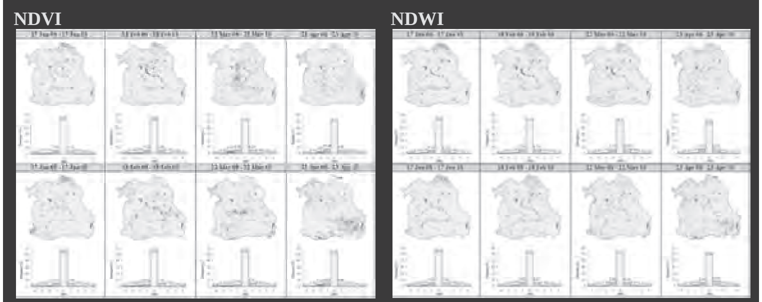
NDVI/ NDWI images differencing and their associated histograms of the changes



❖ The NDVI value is substantially sensitive to vegetation cover but the NDWI is sensitive to both vegetation cover and water content.
❖ The severity of the change can be derived from the SD steps, the greater step the higher changes.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

NDVI/ NDWI images differencing and their associated histograms of the changes



Comparison of pairs of NDVI/ NDWI images differencing and the histograms of the changes in 2010 and the previous years.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

Conclusion

Flood

❖ Flood events in the past over the Northeast were geographically confined to the lower parts of the Mun, the Chi and the Mekong as viewed with the Radarsat images of 2001, 2002, 2003, 2004 and 2007.
❖ The flood in 2010 were exceptional flood which was confined to the reach upstream of the Mun.
❖ The study provided insights into cumulative rain-inducing flood, discharge and return period and the time concentration.

Drought

❖ Changes in phenological state of different vegetation covers identify the spatio-temporal pattern of drought.
❖ With availability and rapid access to satellite data and difficulty in gathering the continuous spatial coverage of climatic data, the satellite derived indices can be used to monitor the drought condition for the vast extent.

Geo-informatics Center for the Development of Northeast Thailand, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand

APPENDIX I: BROCHURE

Forefront and Challenges of Geospatial Technologies for Environmental and Disaster Management in Southeast Asia

13:00 – 17:30, Saturday, 27th November, 2010

Venue: Jamjuree Ballroom A, Phatumwan Princess Hotel, Bangkok

Organizers

Regional Network Office for Urban Safety (RNUS), School of Engineering and Technology, Asian Institute of Technology
International Center for Urban Safety Engineering (ICUS), Institute of Industrial Science (IIS), The University of Tokyo
Chula Unisearch, Chulalongkorn University

In cooperation with

Geo-Informatics and Space Technology Development Agency (GISTDA); Remote Sensing and GIS Association of Thailand (RESGAT); Japan Society of the Promotion of Science (JSPS), Bangkok office; Japan Aerospace Exploration Agency (JAXA), Bangkok office; IIS Alumni Thailand Chapter

Presenters

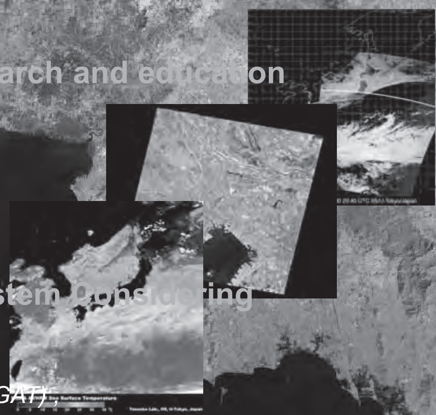
Prof. Dr. Suvit Vibulsresth
(National Research Council of Thailand, and member of IAA)
Overview of space technology development in Thailand

Prof. Yoshifumi Yasuoka
(Executive Director, National Institute of Environmental Studies, Japan)
Monitoring, modeling and assessment of urban sustainability

Dr. Anond Snidvongs
(Director, Southeast Asia START Regional Center (SEA START RC), Chulalongkorn University, Acting Executive Director, Geoinformatics and Space Technology Development Agency (GISTDA))
Community-based Climate Centers

Dr. Masahiko Honzawa
(Japan Aerospace Exploration Agency (JAXA); Bangkok office)
Sentinel Asia

Assoc. Prof. Dr. Wataru Takeuchi
(Director, JSPS Bangkok office and IIS, The University of Tokyo)
Role of JSPS Bangkok office for promoting research and education in Southeast Asia



Dr. Nitin Kumar Tripathi
(Director, UNIGIS, AIT)
Title TBD

Prof. Kimiro Meguro
(Director, ICUS, IIS, The University of Tokyo)
Development of Tsunami Disaster Mitigation System considering the Characteristics of the Indian Ocean Region

Assoc. Prof. Dr. Charat Mongkolsawat
(President, Remote Sensing and GIS Association of Thailand (RESGAT), Faculty of Science, Khon Kaen University)
Approaches to identifying areas at risk of drought and flood over Northeast Thailand

Prof. Haruo Sawada
(ICUS, IIS, The University of Tokyo)
Natural environments in the Mekong River Basin

Admission to this event is FREE, but we would appreciate it if attendees register by email or fax in advance

Contact: **Regional Network Office for Urban Safety (RNUS),** School of Engineering and Technology,
Asian Institute of Technology (AIT), P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand
Tel: (+66-2) 524-6418 Fax: (+66-2) 524-5565 E-mail: rnus@ait.ac.th **URL: http://www.set.ait.ac.th/rnus**

APPENDIX II: SYMPOSIUM PROGRAM

PROGRAM OVERVIEW

"Forefront and Challenges of Geospatial Technologies for Environmental and Disaster Management in Southeast Asia"

Venue: **Phatumwan Princess Hotel (Jamjuree Ballroom A)**

Date: **27 November 2010**

MC: Akiyuki Kawasaki, *Visiting Faculty of AIT and Project Assoc. Prof. of ICUS, IIT, Univ. of Tokyo.*

13:05-13:10	Opening
13:10-13:25	**Overview of space technology development in Thailand** Prof. Dr. Suvit Vibulsresth *(National Research Council of Thailand, and member of IAA)*
13:20-13:45	**Monitoring, modeling and assessment of urban sustainability** Prof. Yoshifumi Yasuoka *(Executive Director, National Institute of Environmental Studies, Japan)*
13:45 14:15	**Community-based Climate Centers** Dr. Anond Snidvongs *(Director, Southeast Asia START Regional Center (SEA START RC), Chulalongkorn University; and Acting Executive Director, Geoinformatics and Space Technology Development Agency (GISTDA))*
14:15-14:45	**'Sentinel Asia', 'SAFE' and JAXA's Earth Observation Activities** Mr. Shinichi Mizumoto *(Director, Japan Aerospace Exploration Agency (JAXA), Bangkok office)*
14:45-15:10	**Role of JSPS Bangkok office for promoting research and education in Southeast Asia** Assoc. Prof. Dr. Wataru Takeuchi *(Director, JSPS Bangkok office and IIS, The University of Tokyo)*
15:10-15:30	Coffee Break Poster display by JAXA, JSPS, ICUS, RNUS
15:30-16:00	**Geospatial planning for flood water retention sites to mitigate flood and drought in Chi River Basin, Thailand** Dr. Nitin Kumar Tripathi *(Director, UNIGIS, Asian Institute of Technology (AIT))*
16:00-16:25	**Development of Tsunami Disaster Mitigation System considering the characteristics of the Indian Ocean Region** Prof. Kimiro Meguro *(Director, ICUS, IIS, The University of Tokyo)*
16:25-16:55	**Approaches to identifying areas at risk of drought and flood over Northeast Thailand** Assoc. Prof. Dr. Charat Mongkolsawat *(President, Remote Sensing and GIS Association of Thailand (RESGAT) , Faculty of Science, Khon Kaen University)*
16:55-17:20	**Natural environments in the Mekong River Basin** Prof. Haruo Sawada *(ICUS, IIS, The University of Tokyo)*

APPENDIX III: BIOGRAPHY

Suvit Vibulsresth, Dr. Eng.

Affiliation:
Member, National Research Council of Thailand (NRCT)

Brief Career:
Director, Remote Sensing Division, NECT
Secretary-General, NRCT
Deputy Permanent Secretary, Ministry of Science & Technology
Executive Director, GISTDA
Executive Board, GISTDA
Visiting Professor, University of Tokyo

International Contribution:
First Vice Chairman, Committee on the Peaceful Uses of Outer Space, UN

Motto: “Remote Sensing for Mankind”

Dr. Suvit graduated Osaka University, and received his Ph.D from the University of Tokyo. He was a director of the Department of Remote Sensing on the National Research Council of Thailand, and became the first Director GISTDA.

Last year, he received the honor of the order of the Rising Sun from the Japanese Government. This honor is the result of his continuous contribution to establishing friendship and scientific cooperation between Japan and Thailand, particularly in the field of remote sensing.

Biography

Dr. Yoshifumi YASUOKA
Executive Director, National Institute for Environmental Studies
(Professor Emeritus of the University of Tokyo)

He received the B. Eng., M. Eng. and Ph. D degree in applied physics and mathematics from the Univ. of Tokyo, Japan in 1970, 1972 and 1975 respectively. He was with the National Institute for Environmental Studies from 1975 to 1998, serving as researcher, senior researcher and section head in Environmental Information Division. At the NIES last two years he served as a director of the Center for Global Environmental Research. In 1998 he moved to the University of Tokyo as a Professor at the Institute of Industrial Science and at the Faculty of Engineering. In 2007 he moved to the National Institute for Environmental Studies as an Executive Director. He is also a Professor Emeritus of the University of Tokyo. His major research field is remote sensing, GIS and spatial data analysis for environment and disaster assessment. He was a president of Japan Remote Sensing Society since 2002 to 2004.

Anond Snidvongs, PhD

Affiliation:

AIMES Scientific Steering Committee (Member), START Scientific Steering Committee (Ex-officio)

Thailand (Member)

Research interests:

- Chemical Oceanography , Physical Oceanography , Climatology, Meteorology , Pollution , Limnology , Chemical Oceanography , Physical Oceanography , Climatology, Meteorology , Pollution , Limnology
- Descriptive oceanography, material transport across continental shelf, material transport and inputs from drainage basins, global changes
- Southeast Asia, Gulf of Thailand, South China Sea, Andaman Sea, Northeastern Ind

Academic Societies & Scientific Organizations:

Member, GISTDA Executive Board

Acting Executive Director

Geo-Informatics and Space Technology Development Agency

Mr. Shinichi Mizumoto
Director of Bangkok Office
Japan Aerospace Exploration Agency (JAXA)

Mr. Shinichi Mizumoto is the Director of Japan Aerospace Exploration Agency (JAXA) Bangkok Office. He promotes international cooperation in space applications and space technology between JAXA and space or space-related agencies of Asian countries. He also facilitates the Asia-Pacific Regional Space Agency Forum (APRSAF), the framework for space cooperation in the region and initiatives of APRSAF such as Sentinel Asia, Space Applications for Environment (SAFE) and STAR Program.

Before the appointment of the Director of JAXA Bangkok Office, Mr. Mizumoto worked for the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japanese Government and promoted Research and Development of Nanotechnology and Material Sciences, Ocean Science and Technology and so on.

Mr. Mizumoto also worked for the Ministry of Economy, Trade and Industry (METI) of Japanese Government and was in charge of international nuclear energy cooperation and nuclear safety regulations.

Mr. Mizumoto received a Master of Engineering degree in Nuclear Engineering from Kyushu University in 1991.

Wataru Takeuchi, Ph. D. (Japanese)

Affiliation:

Director, Japan Society for the Promotion of Science (JSPS), Bangkok office

Associate Professor, Institute of Industrial Sciences (IIS), The University of Tokyo

Brief Career:

2004- Postdoctoral fellow, IIS, The University of Tokyo

2005- Research Associate, IIS, The University of Tokyo

2007- Assistant Professor, IIS, The University of Tokyo

2007- 2009 Visiting Assistant Professor, Asian Institute of Technology (AIT), Thailand

2010- Associate Professor, IIS, The University of Tokyo

2010- 2012 Director, JSPS Bangkok office

Research interests:

- Remote sensing of environment and disaster
- Sensor web
- Satellite observation network over Asia

Academic Societies & Scientific Organizations:

- American Geophysical Union (AGU)
- Remote Sensing Society of Japan (RSSJ)
- Japan Society of Photogrammetry and Remote Sensing (JSPRS)

Nitin Kumar Tripathi, PhD

Affiliation:

Coordinator, Remote Sensing and GIS FoS

Director, UNIGIS@AIT Centre

School of Engineering and Technology, Asian Institute of Technology

Brief Career:

1988-1989 Lecturer, MNNIT, Allahabad, India

1989-1999 Asst. Professor, Indian Institute of Technology, Kanpur, India

1999 onwards Assoc. Professor, Asian Institute of Technology

2005 Onwards President, Association of Geoinformation Technology (AgIT)

Research interests:

- Disaster Monitoring and Management
- Positioning Systems (GNSS, IPS)
- Coastal Zone Planning and Management
- HealthGIS

Editor:

Editor-in-Chief, International J. of Geoinformatics (2005 Onwards)

Editor, Chemistry and Environment

Kimiro Meguro, Dr. Eng.

Affiliation:

Director and Professor, International Center for Urban Safety Engineering (ICUS)
Institute of Industrial Sciences (IIS), The University of Tokyo (UT)

Brief Career:

After receiving his Ph D degree from UT in 1991, Dr. Meguro joined UT's INCEDE (International Center for Disaster-Mitigation Engineering) as one of the founding members. Dr. Meguro joined ICUS as an Associate Professor in 2001 and has become Professor and Director in 2004 and 2007, respectively. From 2010, besides ICUS Director, he has also become Professor of the Center for Integrated Disaster Information Research (CIDIR) at the Interfaculty Initiative in Information Studies, the University of Tokyo.

Research interests:

Dr. Meguro has wide range of research field in disaster reduction from structural to non-structural measures. As a specialist of numerical simulation, he has developed several new models by which total behavior of structures and/or materials from a sound state to a complete discrete state can be simulated. Applying these models, he has been studying dynamic failure behavior that is highly nonlinear. While in the other field, or as a specialist of non-structural measures and policy making, he has proposed some important social systems and policies. He has been working on the human evacuation problems during disaster and he has come out with the idea of a new model in which large number of people having different characteristics and changes of circumstances of the evacuation field in case of disaster can be simulated. He is also studying the application of new technologies, like virtual reality, information technology and/ or GIS/ RS to disaster mitigation issues, for example: Evacuation, Fire-fighting drill, Risk assessment, Education on disaster, Disaster management manual, etc.

CHARAT MONGKOLSAWAT DR. Eng

Affiliation

- Associate Professor
  Dept. of Computer Science
  Fac. of Science
  Khon Kean University (KKU)
  Khon Kean, Thailand
- President
  Remote Sensing and GIS Association of Thailand

Brief Career:

1998-2006, Director, Computer Center, KKU

2001-2008, Director, Regional Center for Space Technology and Geoinformatics, NE. KKU

2000-2007, Director, Geoinformatics Center for Development of Northeast Thailand ,KKU

2000-2004, Member of, Executive board GISTDA

Research Interests:

- Remote Sensing and GIS for Disaster Management, Land Suitability for Crops.
- The Mekong Basin, Northeast Thailand.
- Agroecosystem and Ecosystem Diversity.

Akiyuki Kawasaki, Dr. (Eng.)

Affiliation:

- Project Associate Professor, International Center for Urban Safety Engineering (ICUS), Institute of Industrial Sciences (IIS), The University of Tokyo (UT)
- Visiting Faculty, Water Engineering Management, and Coordinator, Regional Network Office for Urban Safety, School of Engineering and Technology, Asian Institute of Technology

Brief Career:

After getting his doctoral degree and working at Yokohama National University, Dr. Kawasaki conducted research at UT, United Nations University, and at Harvard University.

Dr. Kawasaki has over 13 years of experience utilizing GIS for multidisciplinary environmental research while developing systematic approaches for integrating a wide range of data models, data formats, and research methodologies into a common GIS computing environment. Using GIS as the main tool, he has been conducting research on both disaster management, such as landslide and earthquake response, and environmental management, such as an integrated approach to evaluate the potential impact of precipitation and land-use change on stream flow. His current main study area is the Mekong River basin.

INTERNATIONAL CENTER FOR URBAN SAFETY ENGINEERING
Institute of Industrial Science, The University of Tokyo
4-6-1 Komaba, Meguro-ku,
Tokyo 153-8505, Japan
http://icus.iis.u-tokyo.ac.jp
E-mail: icus@iis.u-tokyo.ac.jp

Tel: (+81-3)5452-6472
Fax: (+81-3)5452-6476