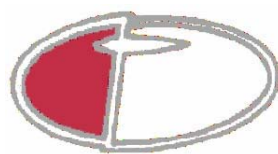


The 15th CERE S International Symposium on Remote Sensing



Promotion of Regional Environmental Studies in Asia



CERE S
Center for Environmental Remote Sensing,
Chiba University

千葉大学環境リモートセンシング研究センター
Center for Environmental Remote Sensing
Chiba University, Japan

A.KONDOH 近藤昭彦

Project 4: Application of Remote Sensing Methods to Regional Issues

Principle Members:

<u>Kondoh, A.</u>	Geography, Hydrology
Kuze, H.	Laser, Atmospheric Science
Hongo, C.	Agriculture Science

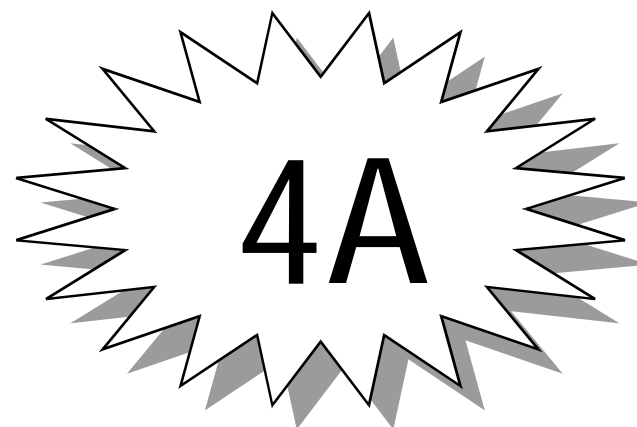
Four Main Themes of PJ4

Area Studies

Atmospheric Environment \Rightarrow PJ3

Application to Agriculture

Advanced Databases



Session of Project 4

13:30 – 15:00 Promotion of regional environmental studies in Asia (Project 4)

Achievement of Project 4, Promotion of Environmental Studies in Asia

[Akihiko Kondoh](#), CEReS

Toward better understanding the changes in hydrological environment in North China Plain : Applications of remote sensing and modeling

[Shen Yanjun](#), Center for Agricultural Resources Research, The Chinese Academy of Sciences (Invited)

Study on the Bortala river watershed hydrological process effects on the climate warming

[Dilinuer Aji](#), XinJiang Normal University (Invited)

Cyanobacterial bloom evaluation using MODIS-NDVI in Lake Tai, China

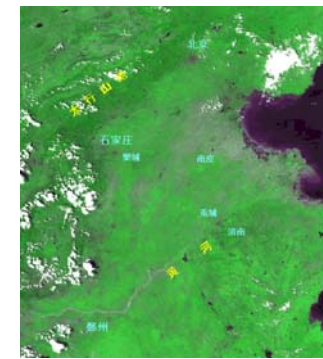
Han Xiuzhen, National Satellite Meteorological Center, China Meteorological Administration (Invited)

Some of Achievements

Achievement 1: Water problems in China

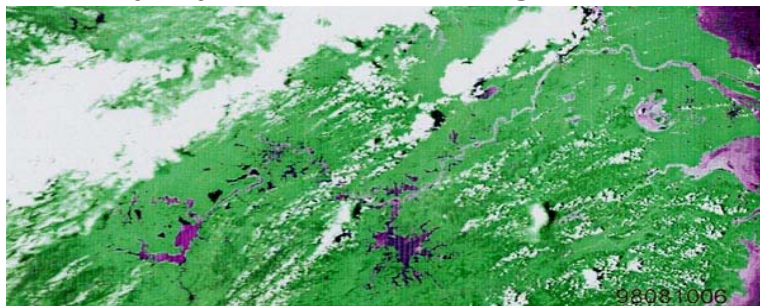
1-1 Hydrological Cycle in North China Plain, China

Fields research was started in 1998 concerning hydrological cycle (including flux studies) and its implications to water problems in North China Plain (NCP). Decadal collaboration with Chinese colleagues achieved proper recognition of current situation and future perspective of water resources in semi-arid NCP.



1-2 China's Great flood in 1998

China suffered great flood in Changjiang, Songhua and Nenjiang in 1998. Especially, flood hazard in Changjiang got worldwide news coverage. Because 1998 was the warmest year after global warming got a position of primary global concern, the floods were tend to be considered as the effect of global warming. Detailed monitoring of flood by satellite and field research with Chinese colleges revealed the floods are influenced not only by climatic change but also by human factors.



Achievement 2: Environmental monitoring in Asia

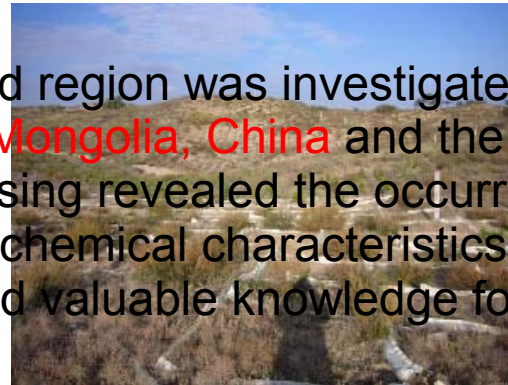
2-1 Herbaceous plant monitoring in semi-arid environment

Herbaceous plant in **Mongolia** that supports environment and life in semi-arid region was vulnerable to climatic change. The response of herbaceous plant to weather conditions was examined in Mongolia and Inner-Mongolian Plateau. The outcomes gave an implication on the response of grassland ecosystem to the global warming.



2-2 Groundwater degradation in arid region

Groundwater as a primary water resource in arid region was investigated in **United Arab Emirates, Turpan basin in western China, Inner-Mongolia, China** and the **Dead Sea Basin, Jordan**. Synthetic research including remote sensing revealed the occurrence of groundwater, changes in groundwater cycle, geochemical characteristics, accompanied water problems, and so on. The outcomes offered valuable knowledge for integrated water managing in arid regions.



2-3 Hydrological changes in Xinjiang, China

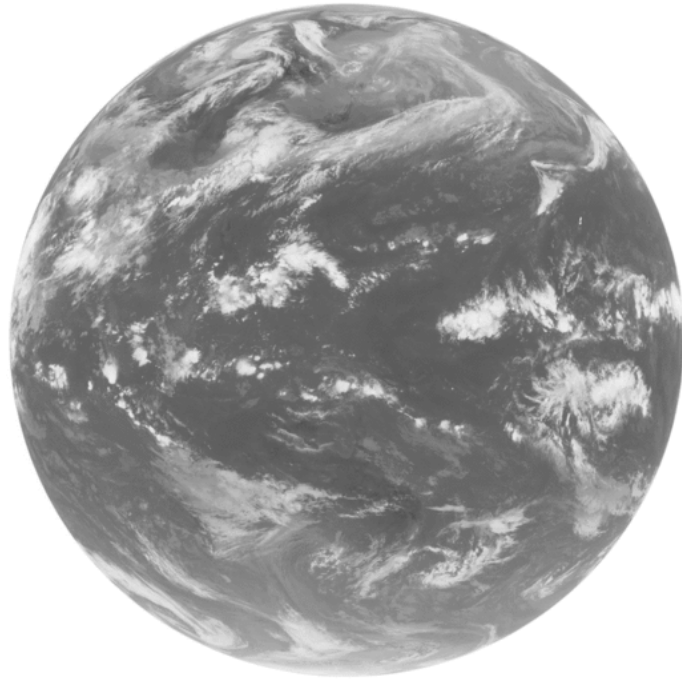
The response of regional water resources to the climatic changes was investigated in **Xinjiang, China**. Water resources were changing under the influences of both human factors and climatic factors. The outcome presented the holistic perspective of future water resources in Xingjiang.



2-4 Heat island studies in Tokyo Metropolitan Area

Heat islands in **Tokyo Metropolitan Area** were researched by using remote sensing and GIS. The results showed the decadal changes in heat islands and its effect to local weather conditions.

How we organize many area studies in Asia.



A Geographer's View

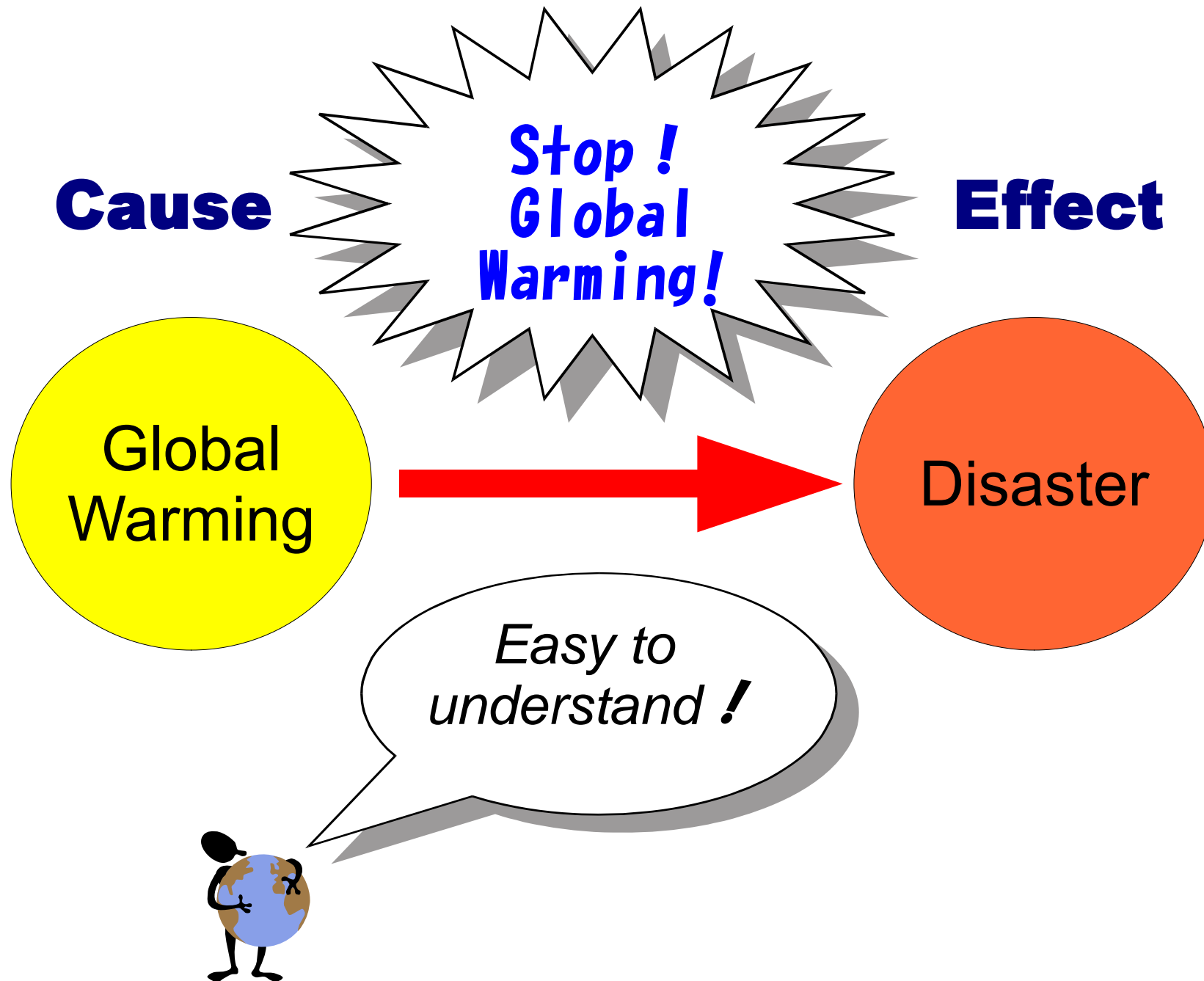
- The World is not unique.
- The world consists of many regions.
- Each region has its own characteristics.
- Understanding of the regionality is the only way to the solution of the problem

- To promote area study though it may be small but deep
 - Put the region in the global framework.

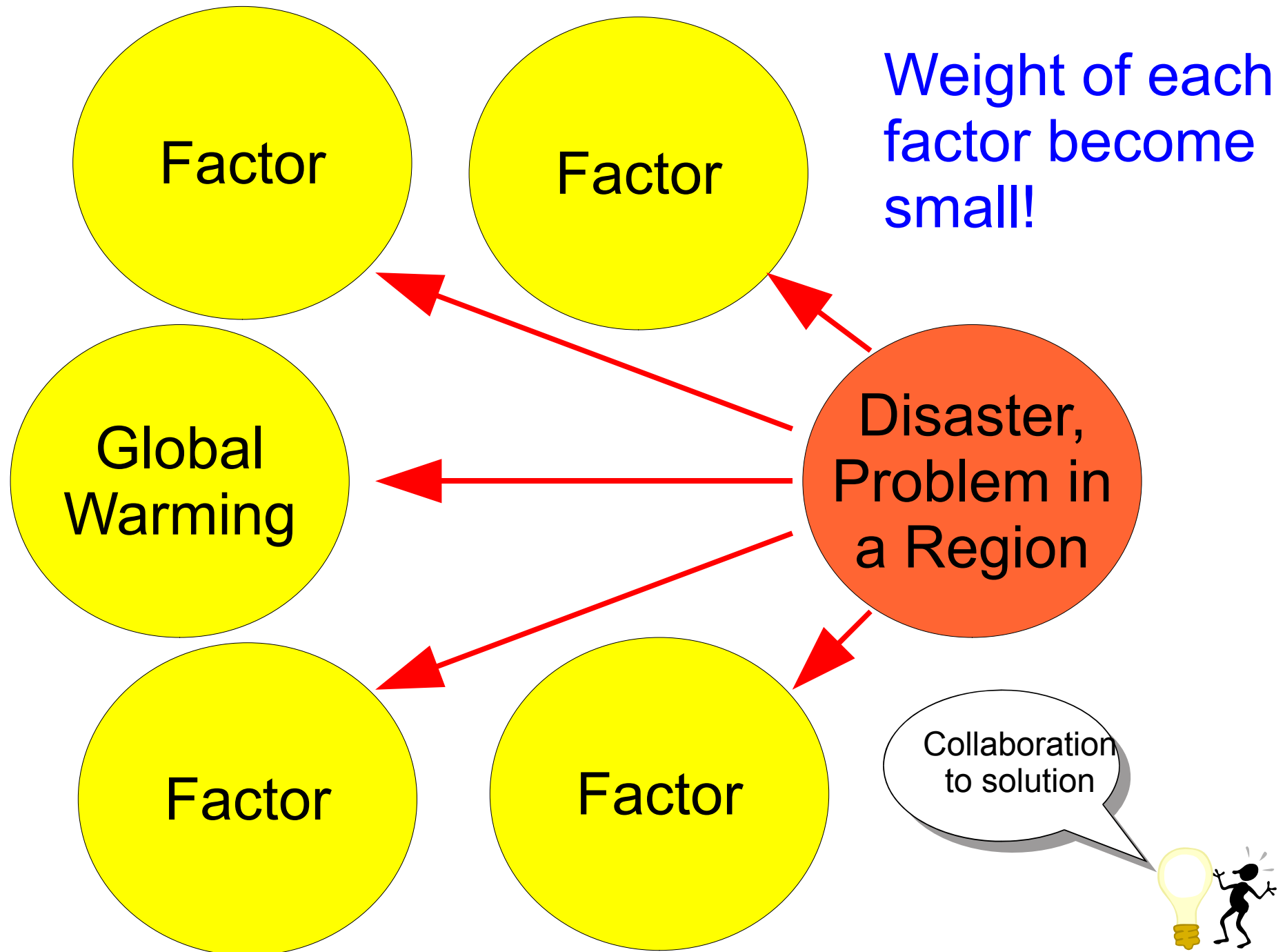


- To restore decoupling between scientist and society
 - Common problem to Collaboration for solution.

Common problem to Collaboration for solution.

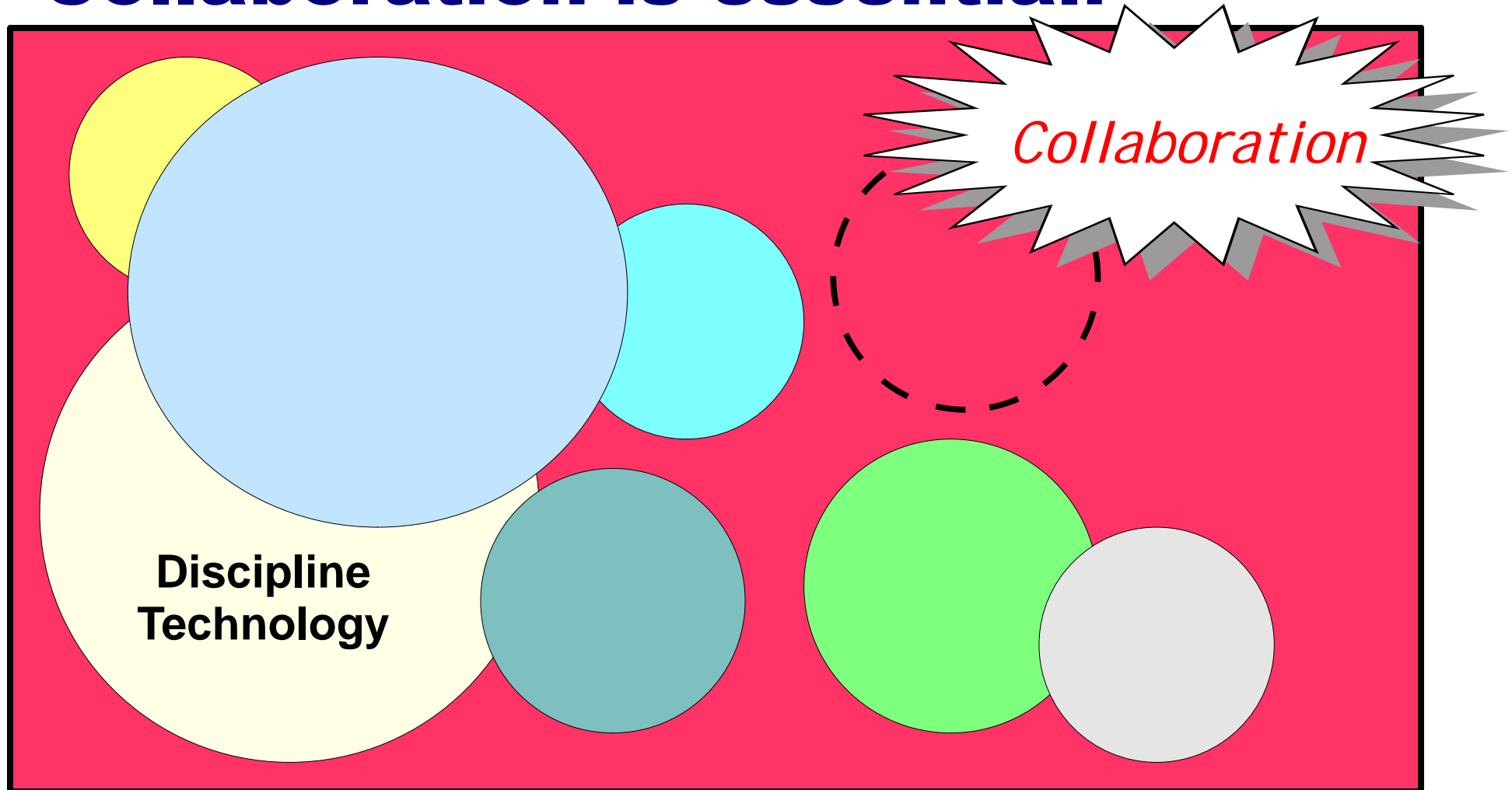


Seek the factors of a disaster!



Toward the solution to the problem

- Where is the position of RS?
- Collaboration is essential!



What is the problem to be solved?



It appears by integrating every factors.

Problem concerning the relationship between human and nature in a region.

What is the target of environmental remote sensing?

What can RS do to collaborate for solution?

Monitoring of earth surface in space and time domain.

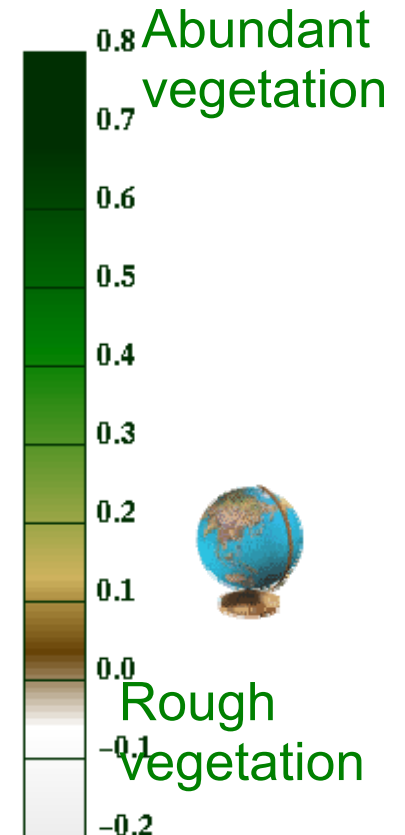
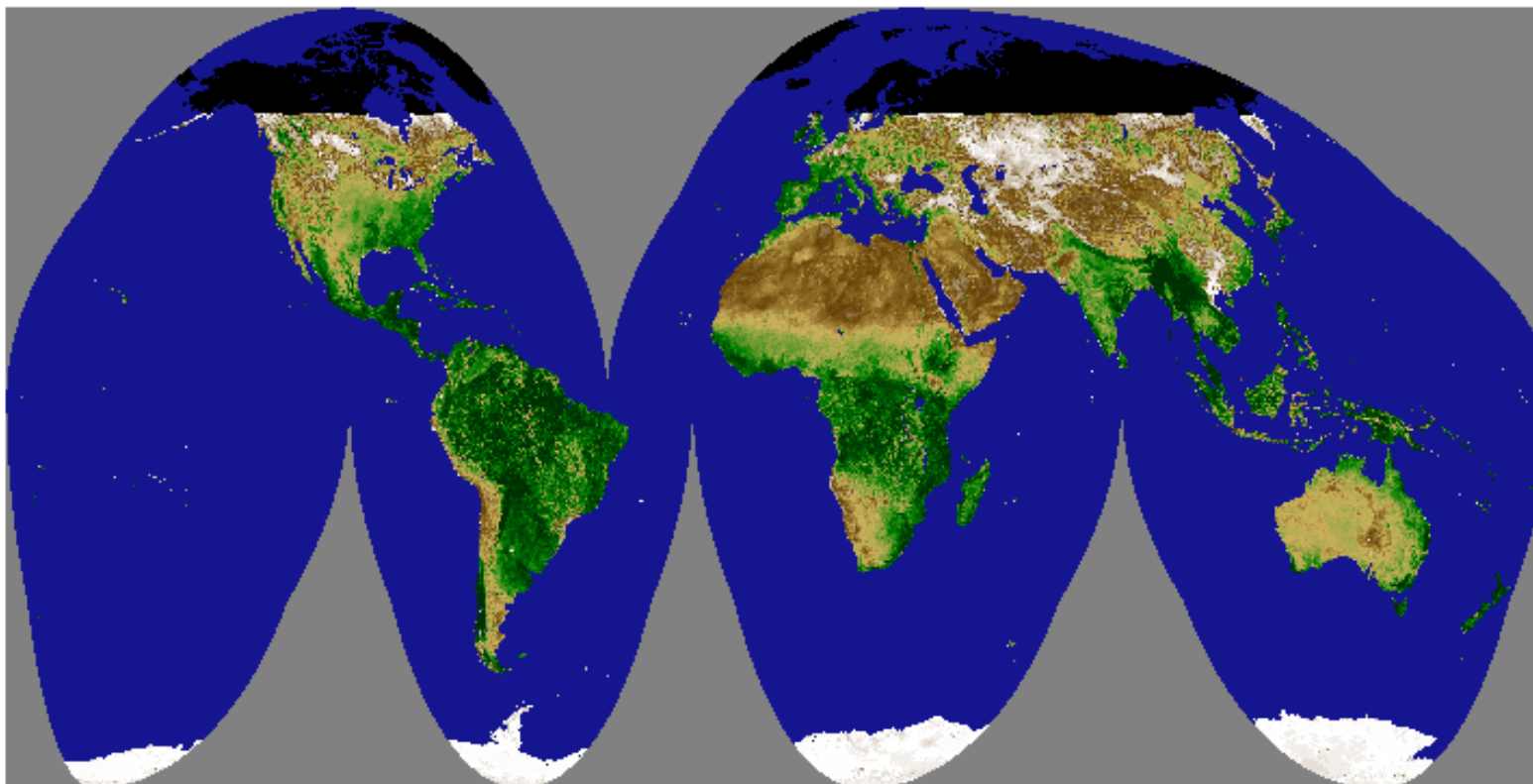
Monitoring by Global Dataset

—Locate the region in the view of Global—

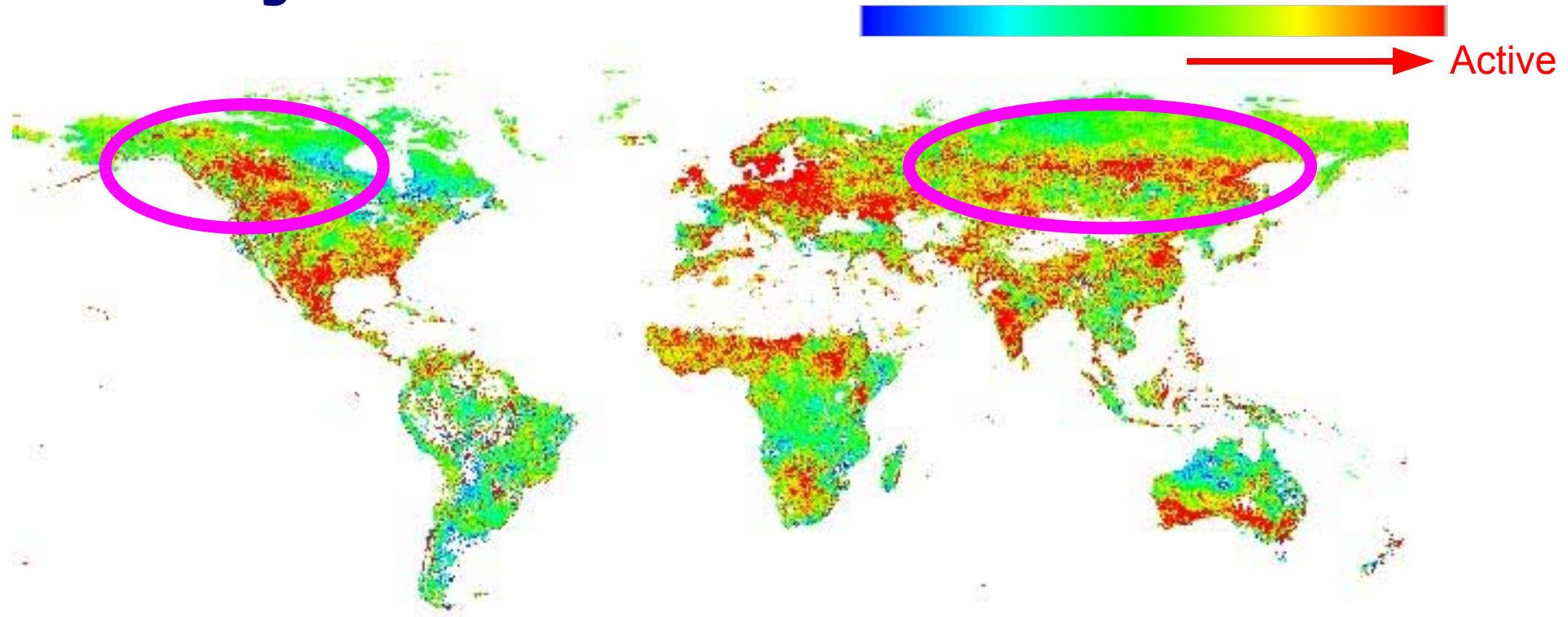
- NDVI Datasets by NOAA/AVHRR after 1981



GLOBAL NDVI 1990/01/01-1990/01/10



● Activity increased in northern forest



Greening of the boreal forest had been pointed out by several researchers from middle of 1990's.

Early snow extinction promotes long growing season (Myneni *et al.*, 1997).

Detection of the effect of G.W.



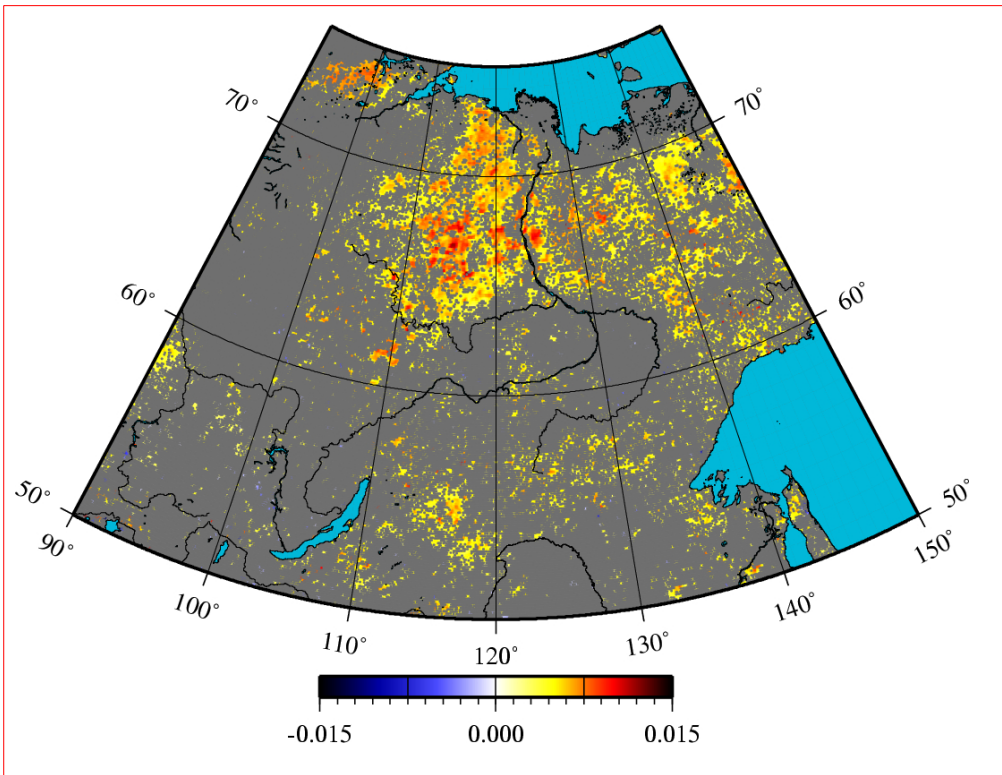
(Courtesy Dr. R.Suzuki)

Our outcome!

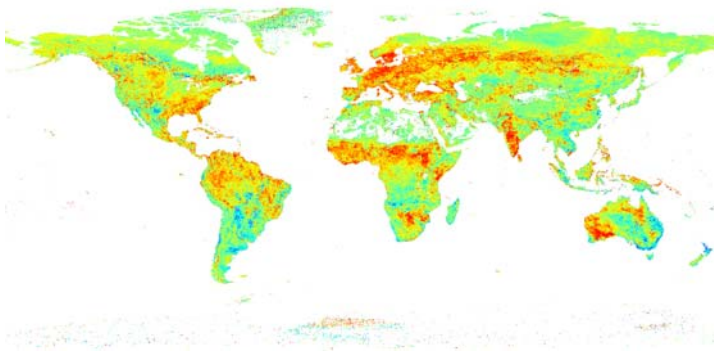
Satellite datasets denotes another vegetation change in the ecotone between tundra and boreal forest in eastern Siberia.



Bush invades into tundra region in Araska(Stow *et al.*,2004)



(Sakai *et al.*, 2007)



● Achievement in 1990's

- Greening of boreal forest
- Early snow extinction causes extension of growing season length

*Myneni et al. (1997),
NATURE, 386.*

● Explanation by climate factor

- easy to apply analytical method

● Explanation by human factors

- Simple cause-and-effect relationship is hard to apply
- Deep understandings to the region is necessary



Climate Factors

Temperature
Precipitation
Radiation

Human Factors

Agriculture
Industry
Urbanization

● ***Science has become an operational stage.***

● ***No more fund for beauty.***

(***IGBP SAC-IV, 1995***)

Global view

Extract the signal of vegetation change during past 19 years.

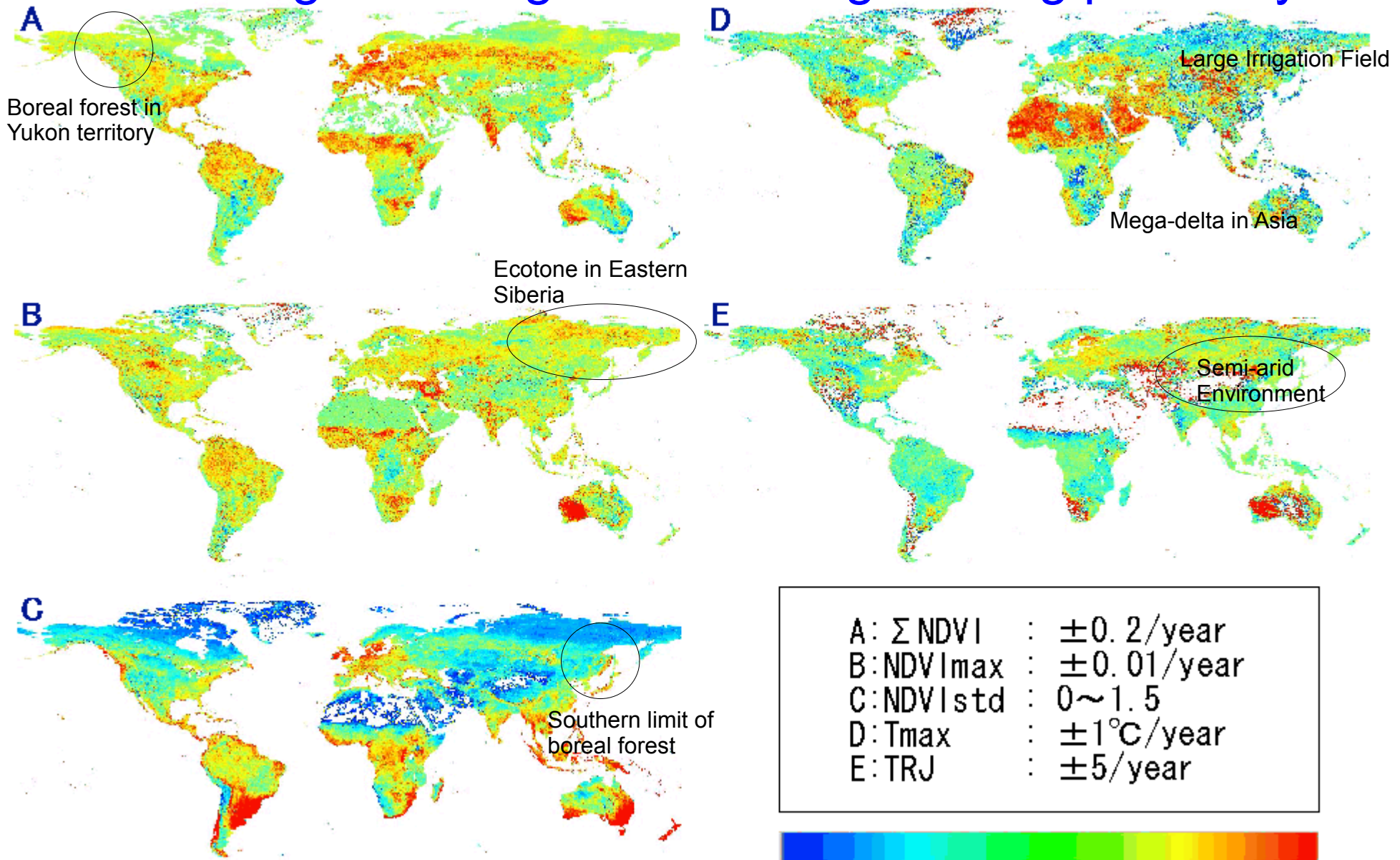
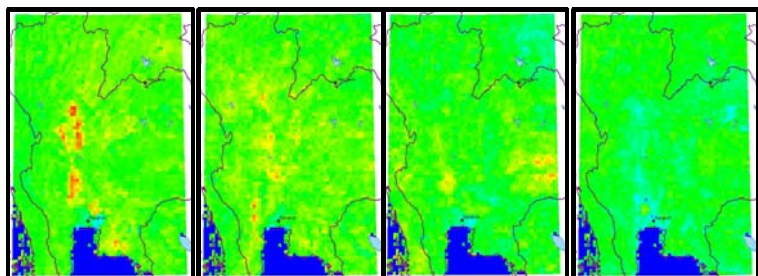


図1 1982年から2000年の間のパラメータのトレンド. A:年間のNDVIの積算値(Σ NDVI)、B:年間の最大NDVI(NDVImax)、C: Σ NDVIの標準偏差(NDVistd)、D:年間最大地表面温度(Tmax)、E:Ts-NDVI空間における年間の軌跡の傾き(TRJ).

To discover the signal of the change is important

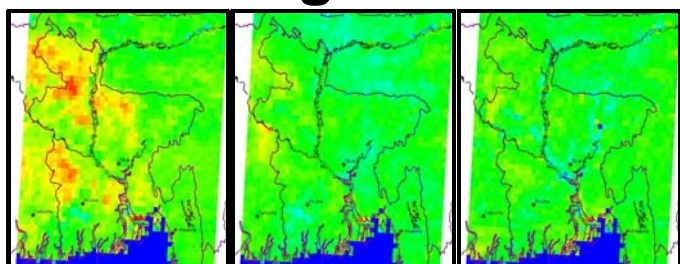
Vegetation change by human factor

Chao Phraya



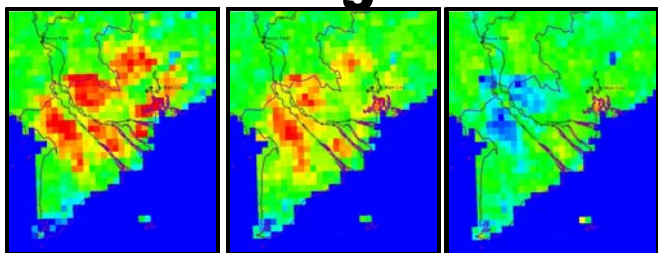
Dry Season (Jan.-Mar.) Dry Season (Apr.-Jun.) Rainy Season (Jul.-Sep.) Rainy Season (Oct.-Dec.)

Bangladesh



Boro Dry Season Aus Pre-Monsoon Aman After Flood

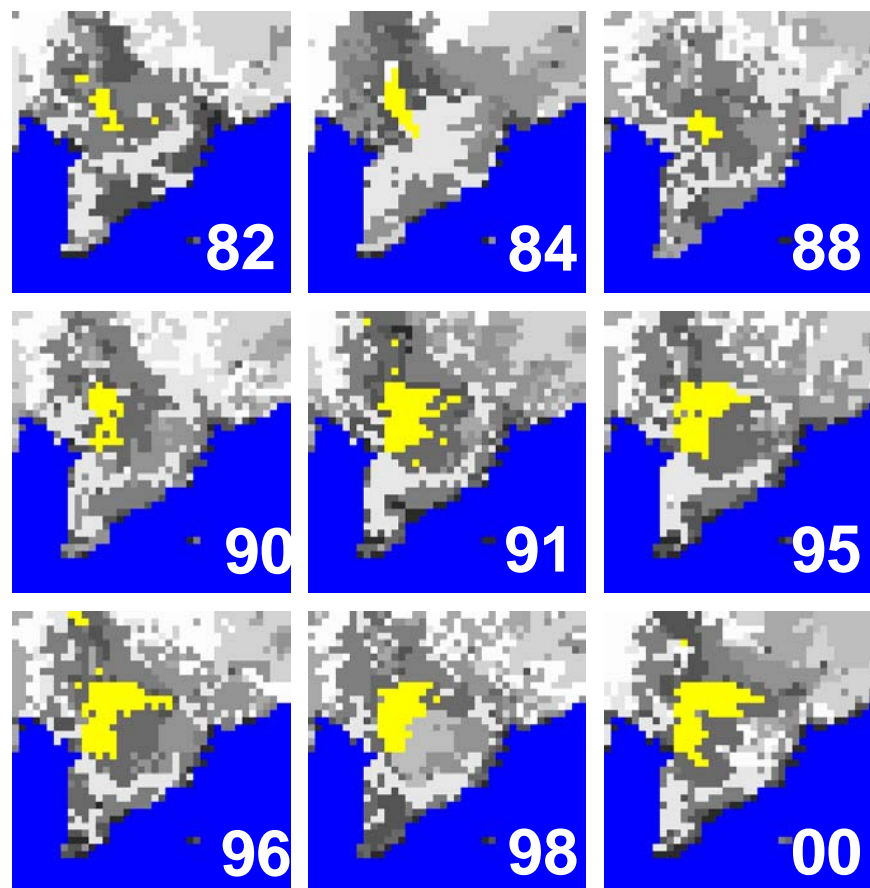
Mekong Delta



Dry Season Early Rainy Season Late Rainy Season

-0.2 +0.2

- Increase in dry season paddy
- Agronomic adaptation to the flood
- Pluses & minuses in the green revolution

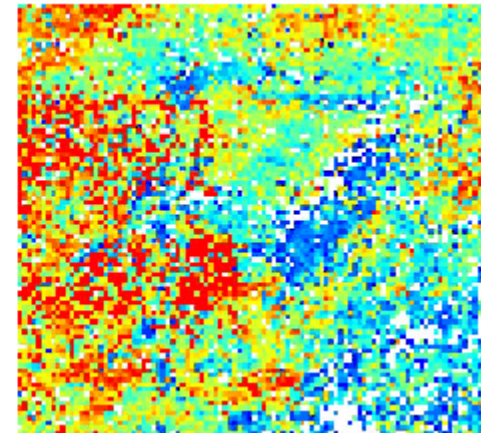
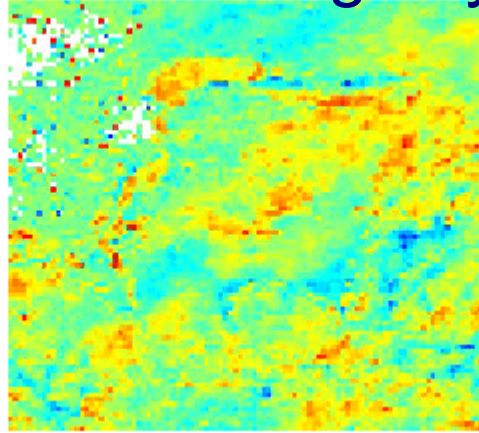
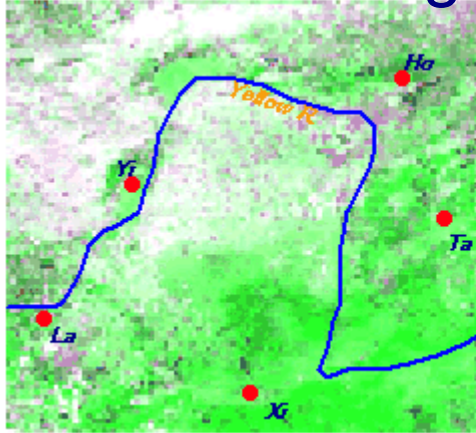


**Expansion of double cropping
in Mekong Delta**

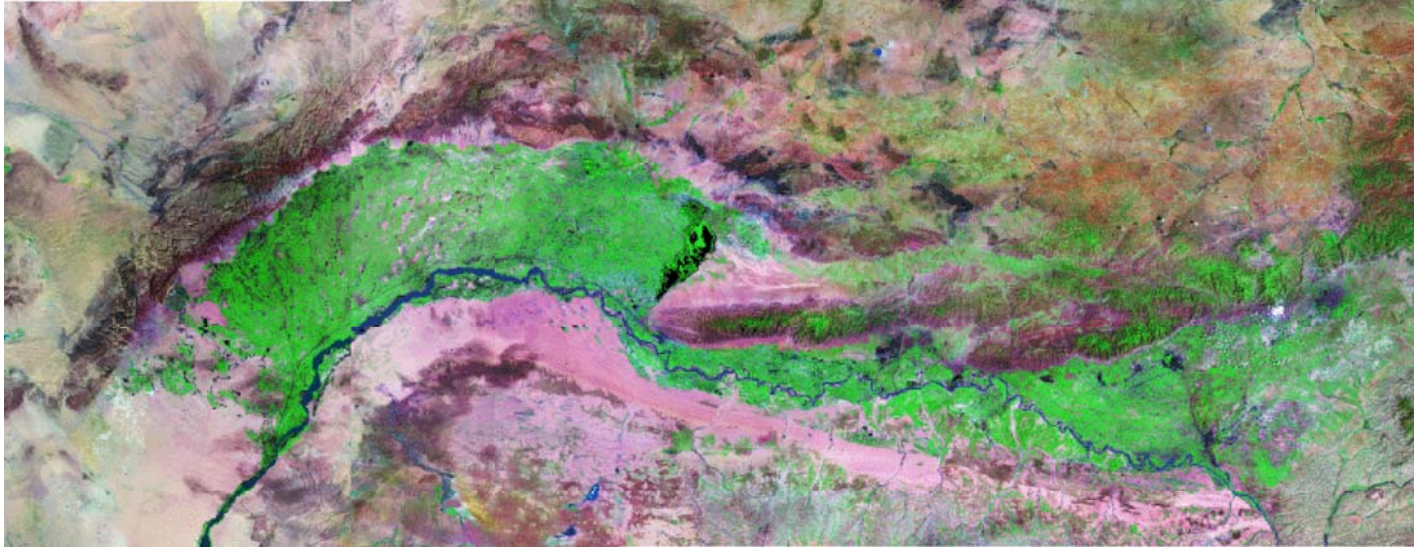
Trend of annual integrated NDVI in different seasons

Middle reach of the Yellow River

– Vegetation change by human factor -



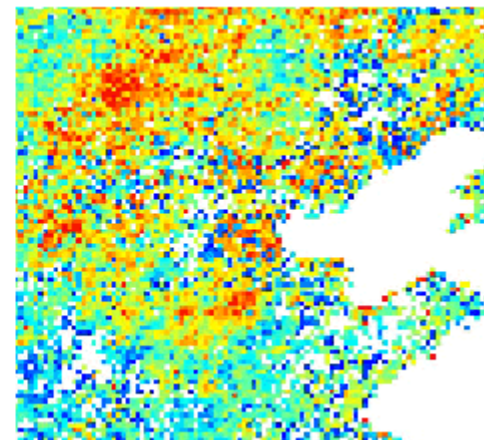
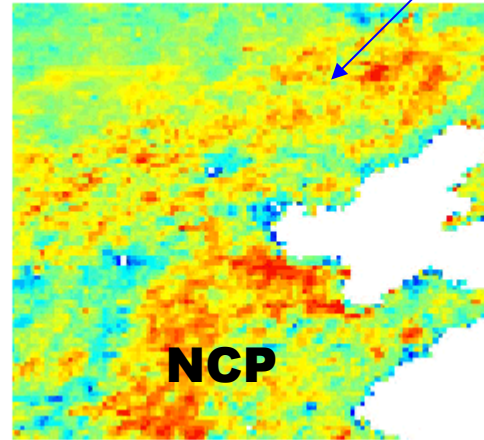
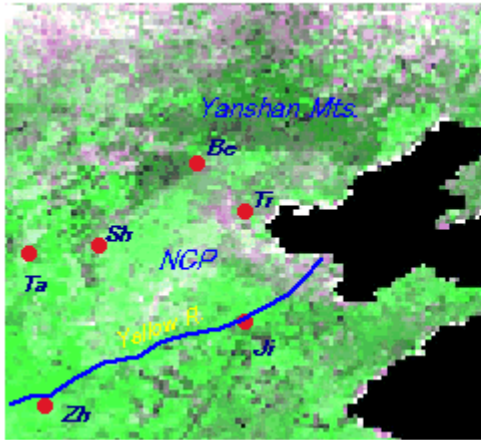
(Left) False colour image (Blue line denotes the Yellow River), (Middle) Trend in annual integrated NDVI, (Right) Trend in annual maximum TS.



Large irrigation field contributes the increase in food production, however, it causes the cut-off of the Yellow River.

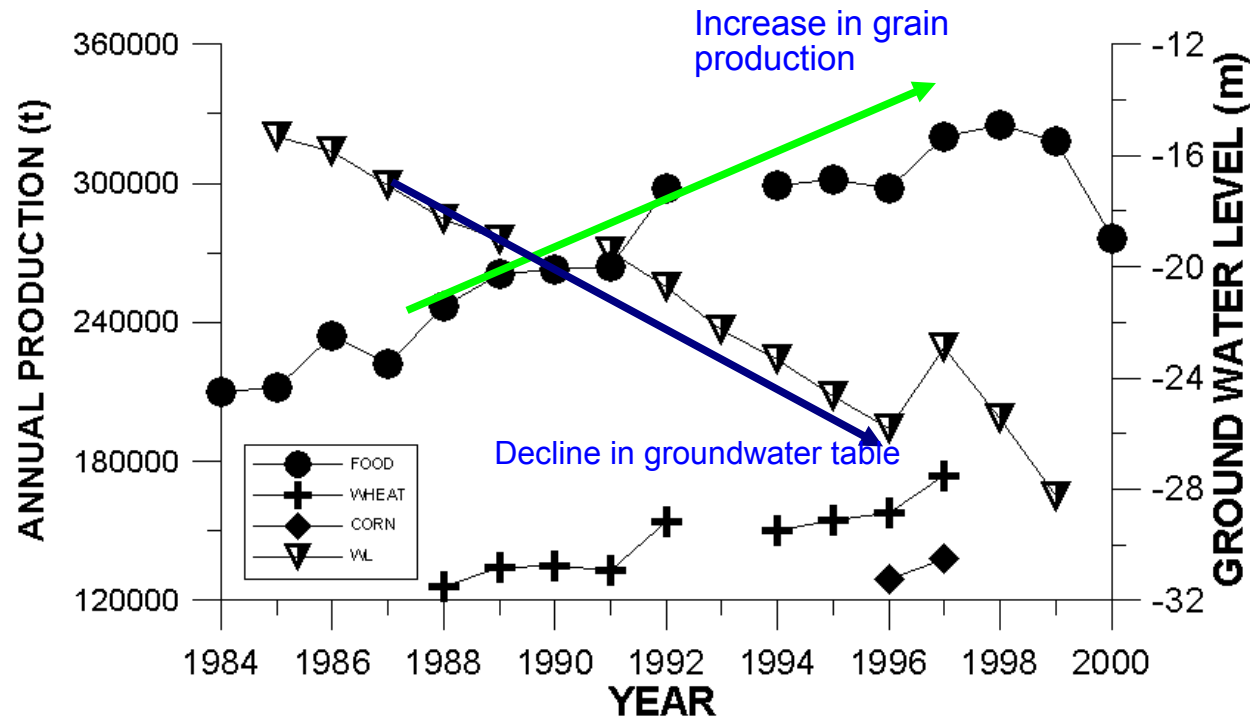
North China Plain

Yanshang Mts.



Some area shows large increase in NDVI.

(Left) False colour image (Blue line denotes the Yellow River), (Middle) Trend in annual integrated NDVI, (Right) Trend in annual maximum TS.

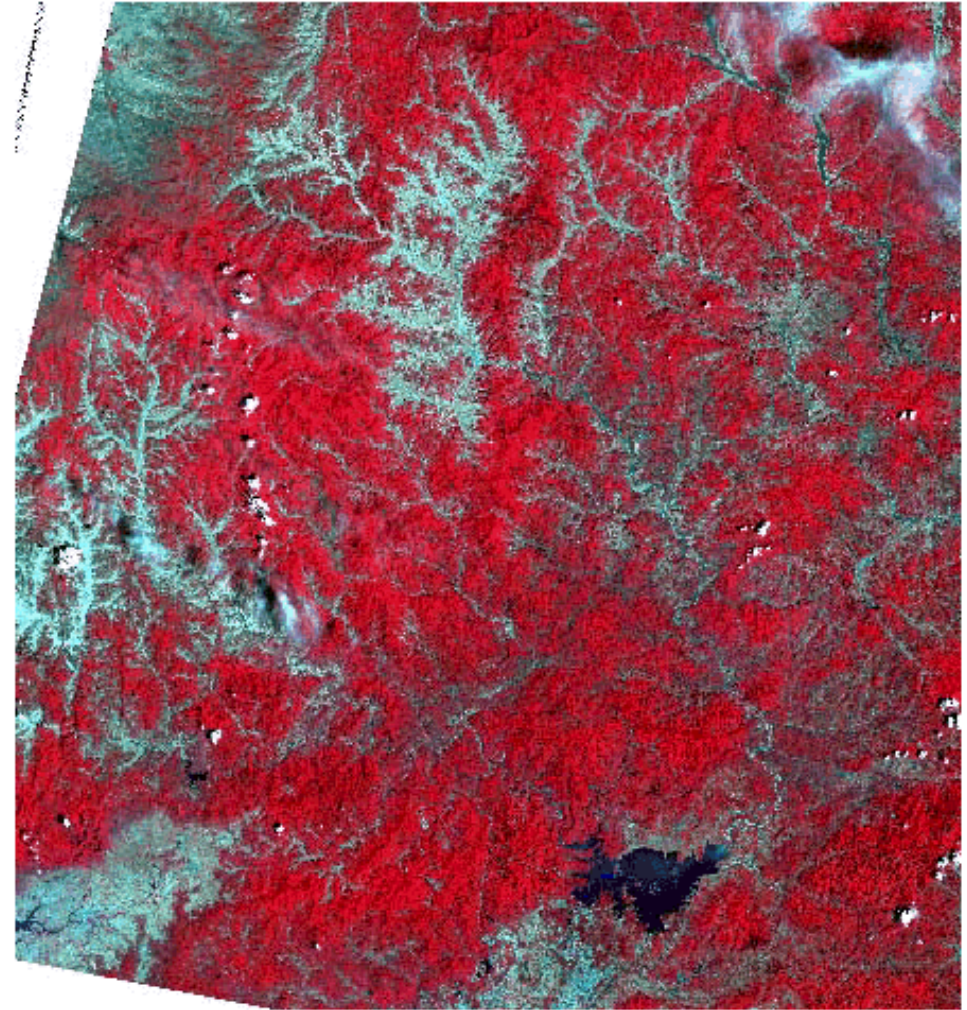
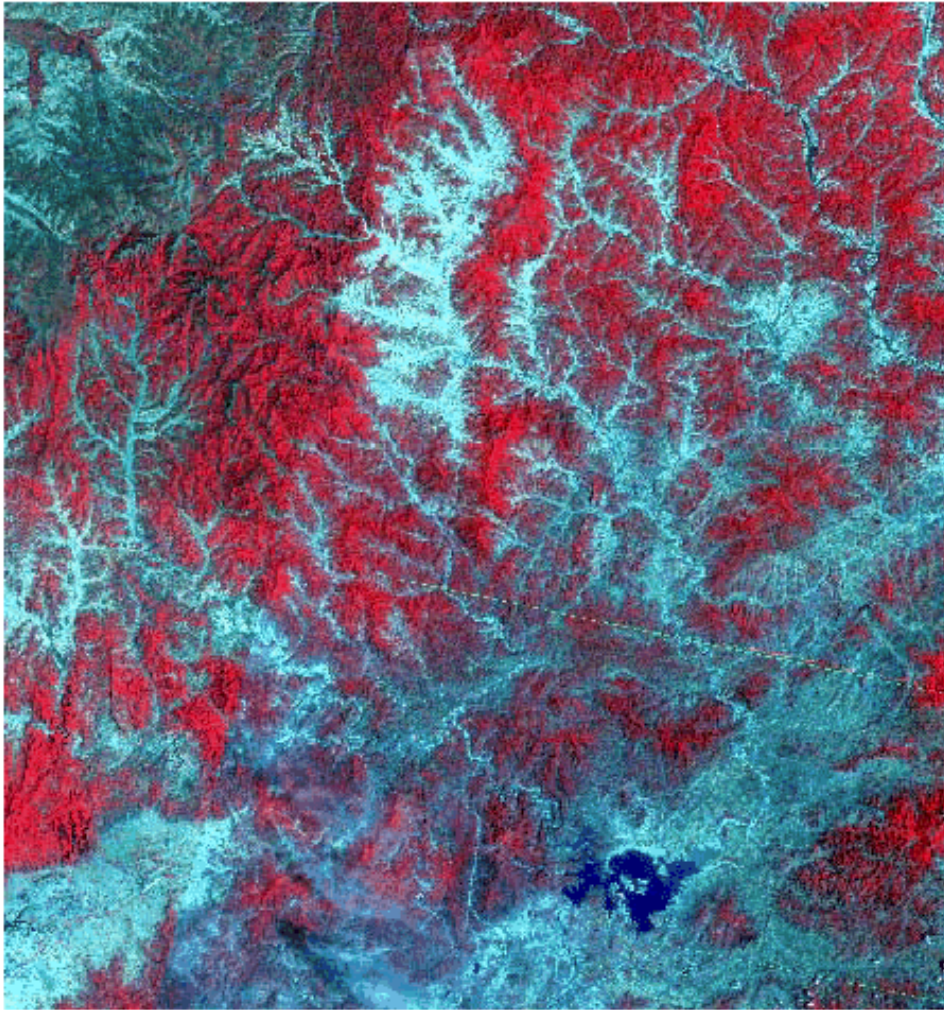


The increase in food production in NCP support large amount of population, however, groundwater table keep declining. It is a threat of sustainability of grain production.

Data from Luangcheng County(Courtesy CAS)

Yanshang Mountains in 1975 and 1999

Landsat-1 MSS and Landsat-7 ETM+



Restoration of the forest

Great Green Wall

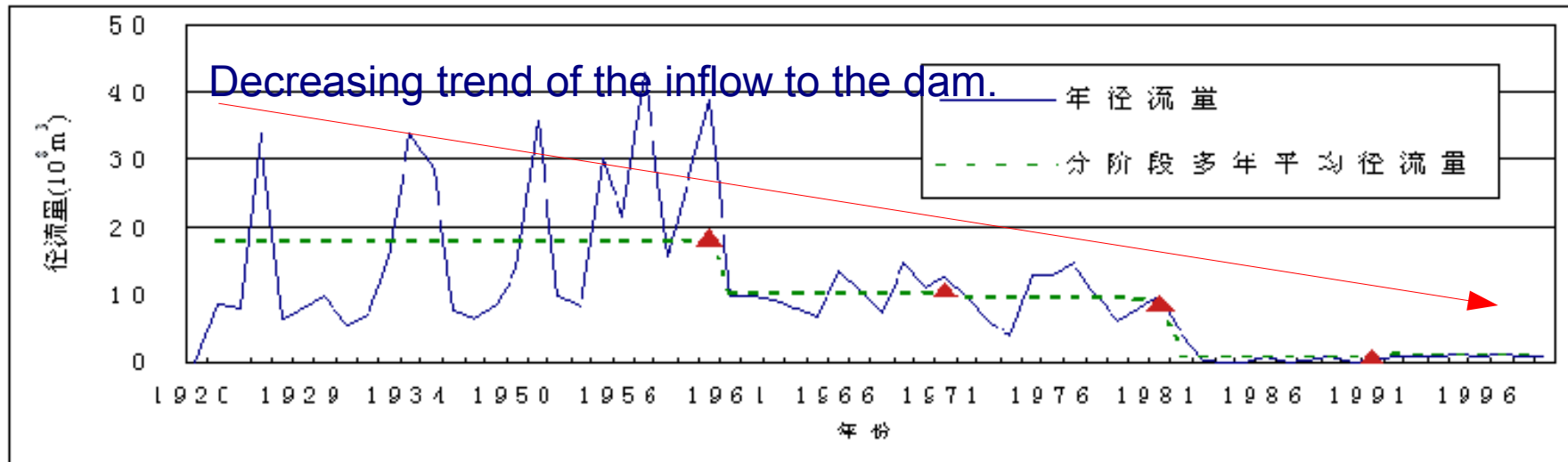
Yanshang: Watershed forest of Beijing

Decrease of inflow to Miyung dam

- Vegetation change in watershed -

What had happen?(assumption)

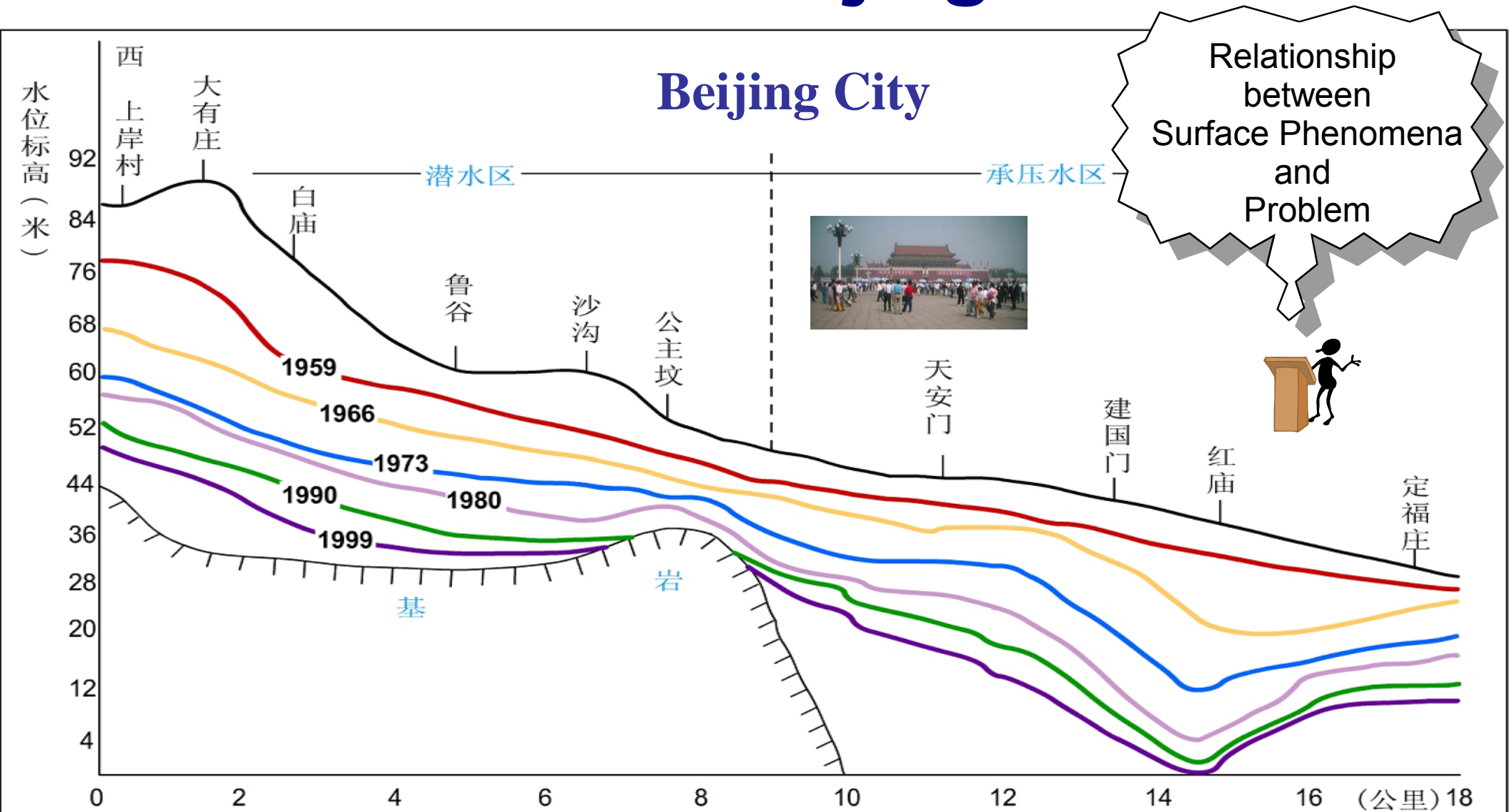
- Increase in vegetation
- Increase in evapotranspiration
- Decrease in discharge to the dam



Five Periods of Annual Runoff in Chaobaihe River



Groundwater Table Decline in Beijing

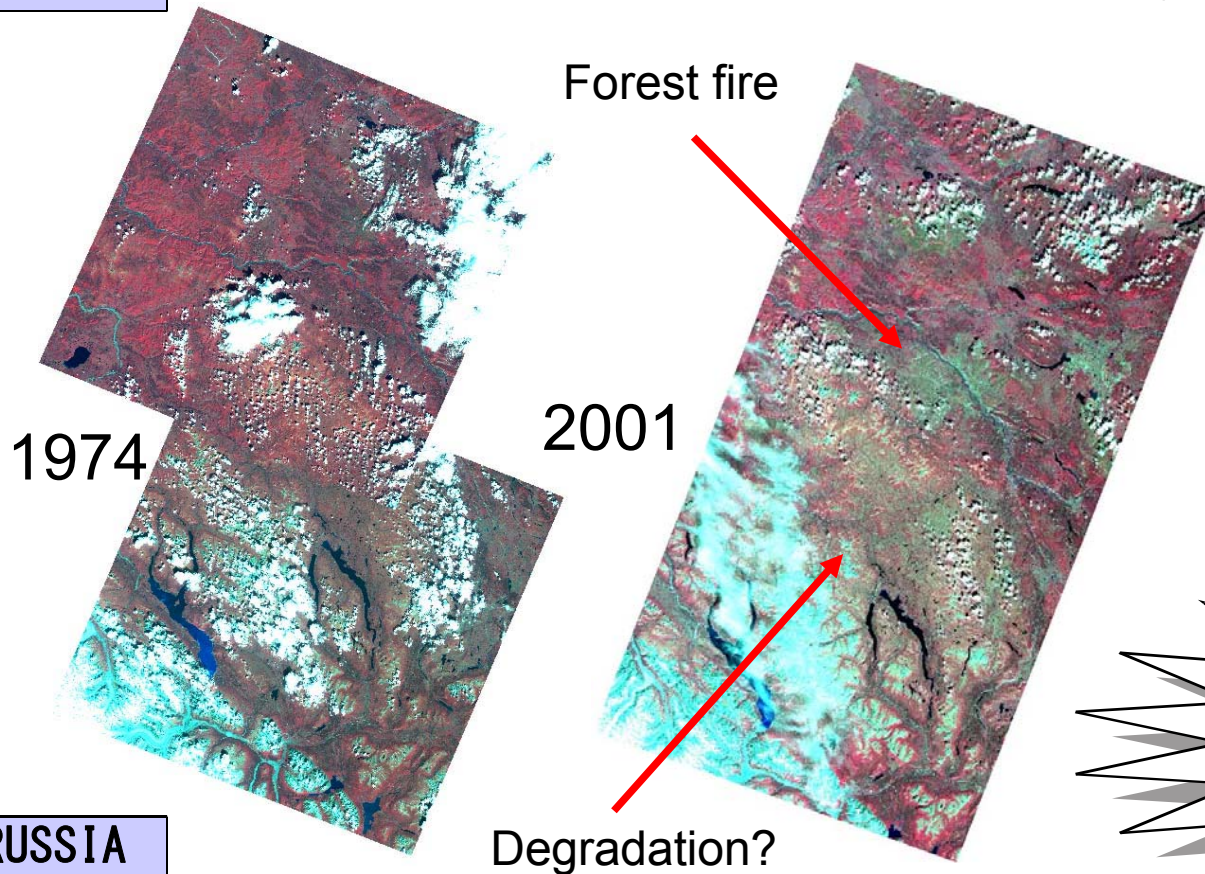


(Courtesy Song XianFang/CAS)

30-year change detected by satellite observation

CANADA

- wide area dessication possibly by Global Warming -



Vegetation changes in northern limit of boreal forest, Yukon territory, Canada.

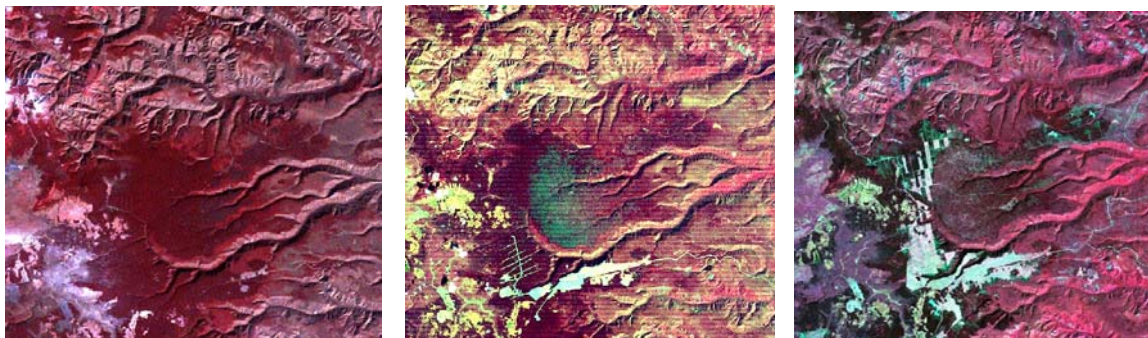
- Large forest fire and vegetation degradation -

Global warming change the ecosystem, and appear as a signal in satellite data

We have to find the very point and dispatch the information.

Southern and Northern Limits of Boreal Forest

RUSSIA



Vegetation change in the Sikhote-Alin Mountains, Primorsky, Russia.

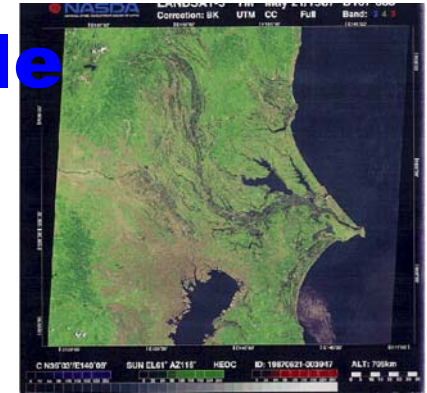
Vegetation change at the southern limit of boreal forest.

- logging, forest fire, and insect damage -

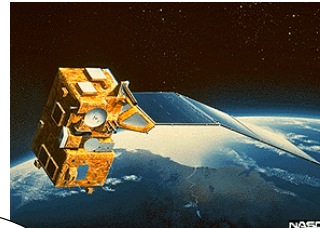
Monitoring of Environment in Local Scale



30 years of Earth Observation Many changes had happen



Courtesy of NASA



NASDA



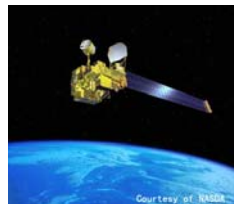
Courtesy of NASDA

1972 LANDSAT1
1986 MOS-1(Marine Observation)
1992 JERS-1 (Natural Resources)
1996 ADEOS-I(Earth Environment)
2002 ADEOS-II(Earth Environment)
2006 ALOS(Mapping, Disaster)

There remains
Many, many!

1972 UN Conference of the Human Environment
(the Stockholm Conference)
Statement for Human Environmental Quality
1992 Rio Environmental Summit
(Agenda 21)
Global Warming, Biodiversity
2002 Johannesburg Environmental Summit

How to share
small but deep
knowledges and experiences
In the region



Courtesy of NASDA



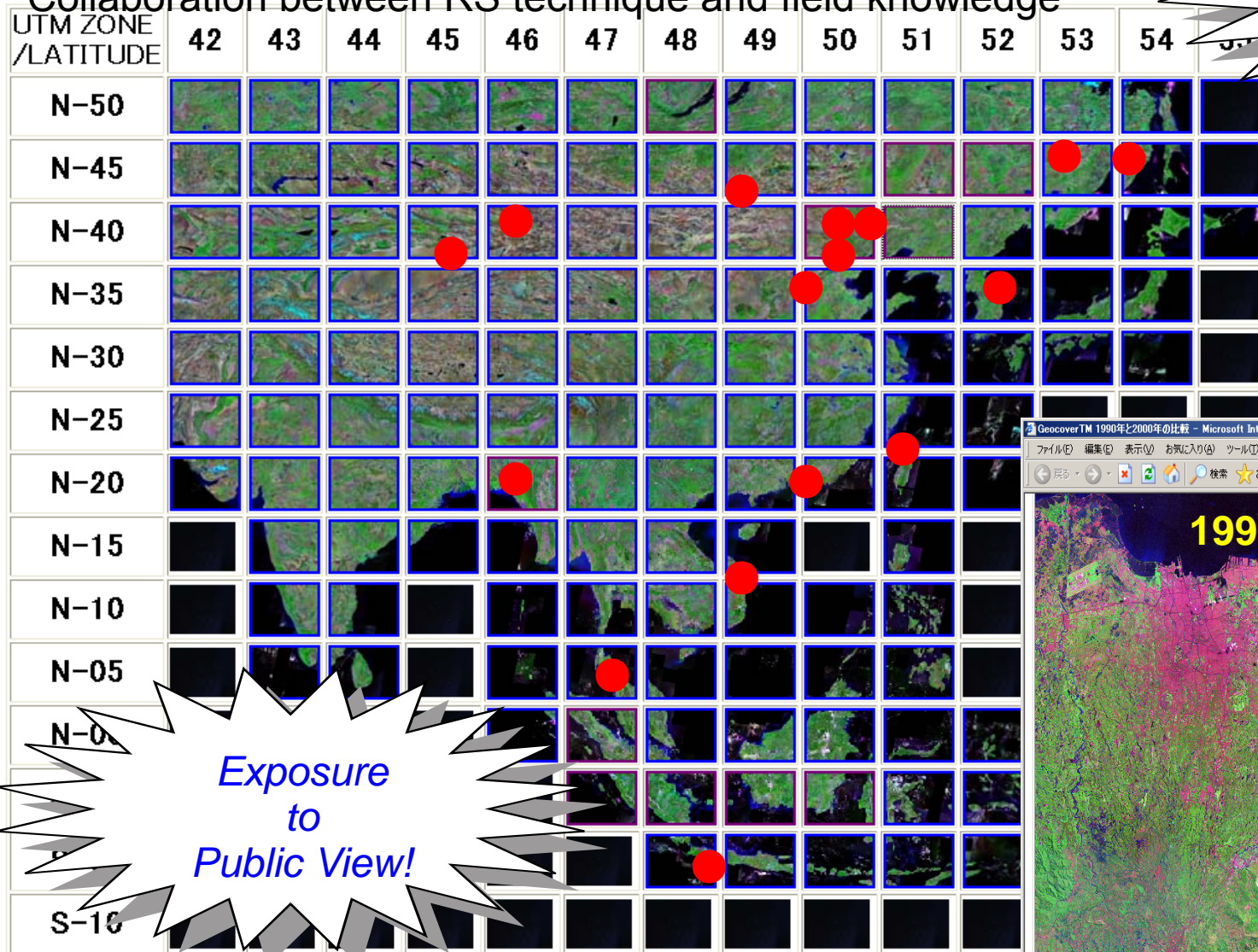
NASDA



2001

Multiple views from different sector, fields, ... is most important!

Collaboration between RS technique and field knowledge

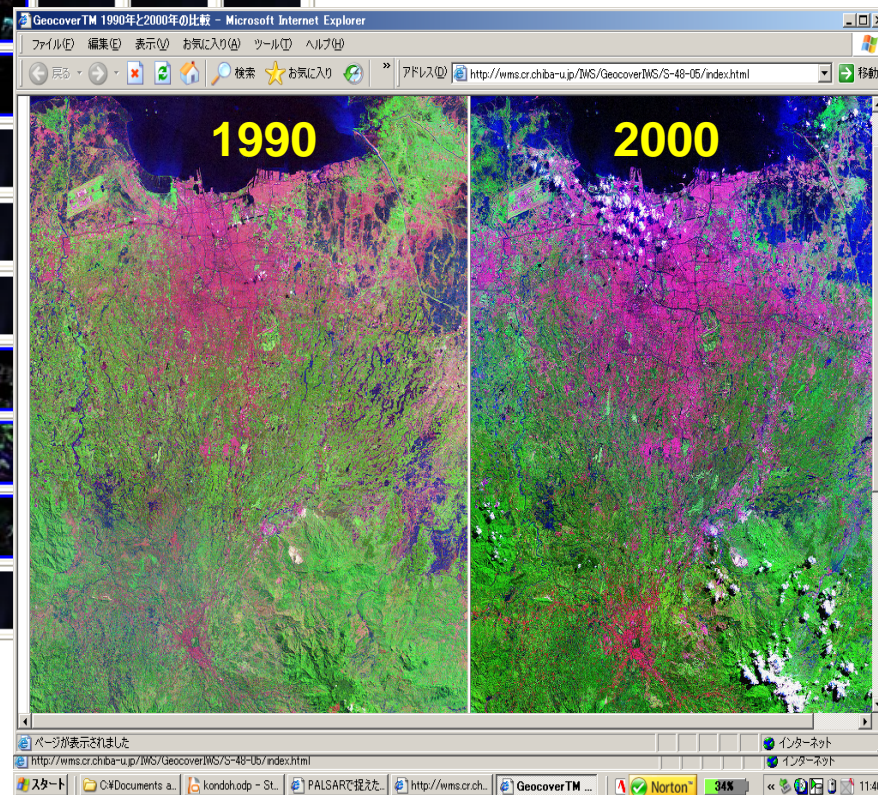


Exposure
to
Public View!

How we find the
Problem in the region,
to be solved

**NASA Geocover
TM Mosaic**

Landsat TM Images in
circa 1990 and circa
2000



<http://dbx.cr.chiba-u.jp/>

<http://wms.cr.chiba-u.jp/IWS/GeocoverIWS/>

Urbanization of Jakarta/Bogor

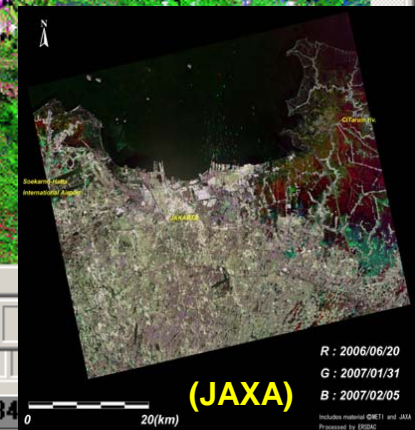
Increasing vulnerability to flood disaster

1990

2000

(CNN)

Urbanization and Land Characteristics



ページが表示されました

<http://wms.cr.chiba-u.jp/IWS/GeocoverIWS/S-48-05/index.html>

スタート

C:\Documents a...

kondoh.odp - St...

PALSARで捉えた...

<http://wms.cr.ch...>

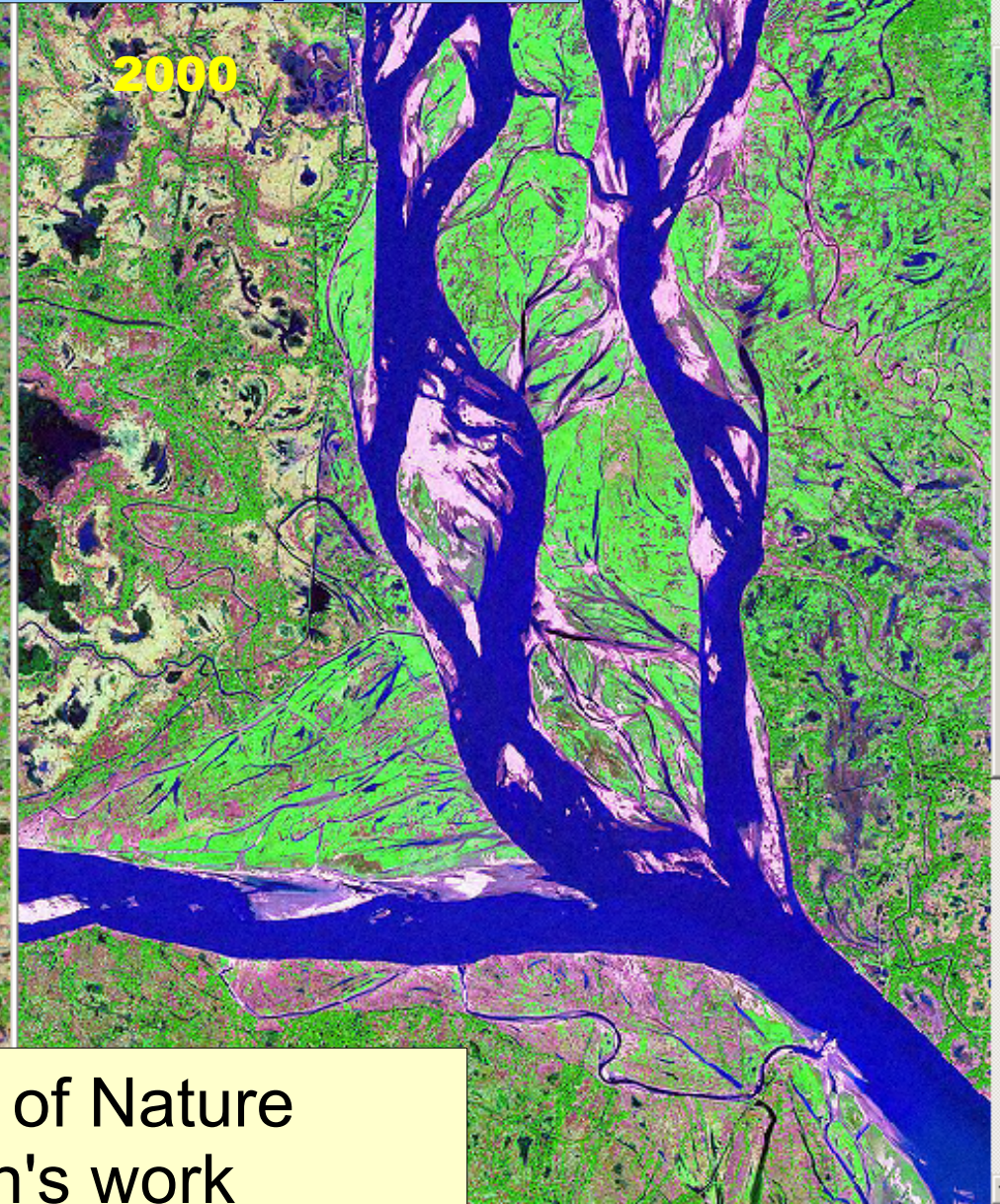
GeocoverTM ...

Norton

34

River Course Change

Confluence of Ganga and Brahmaputra



Working of Nature
Human's work

Erosion and Sedimentation at the mouth of Ganga

1990

2000

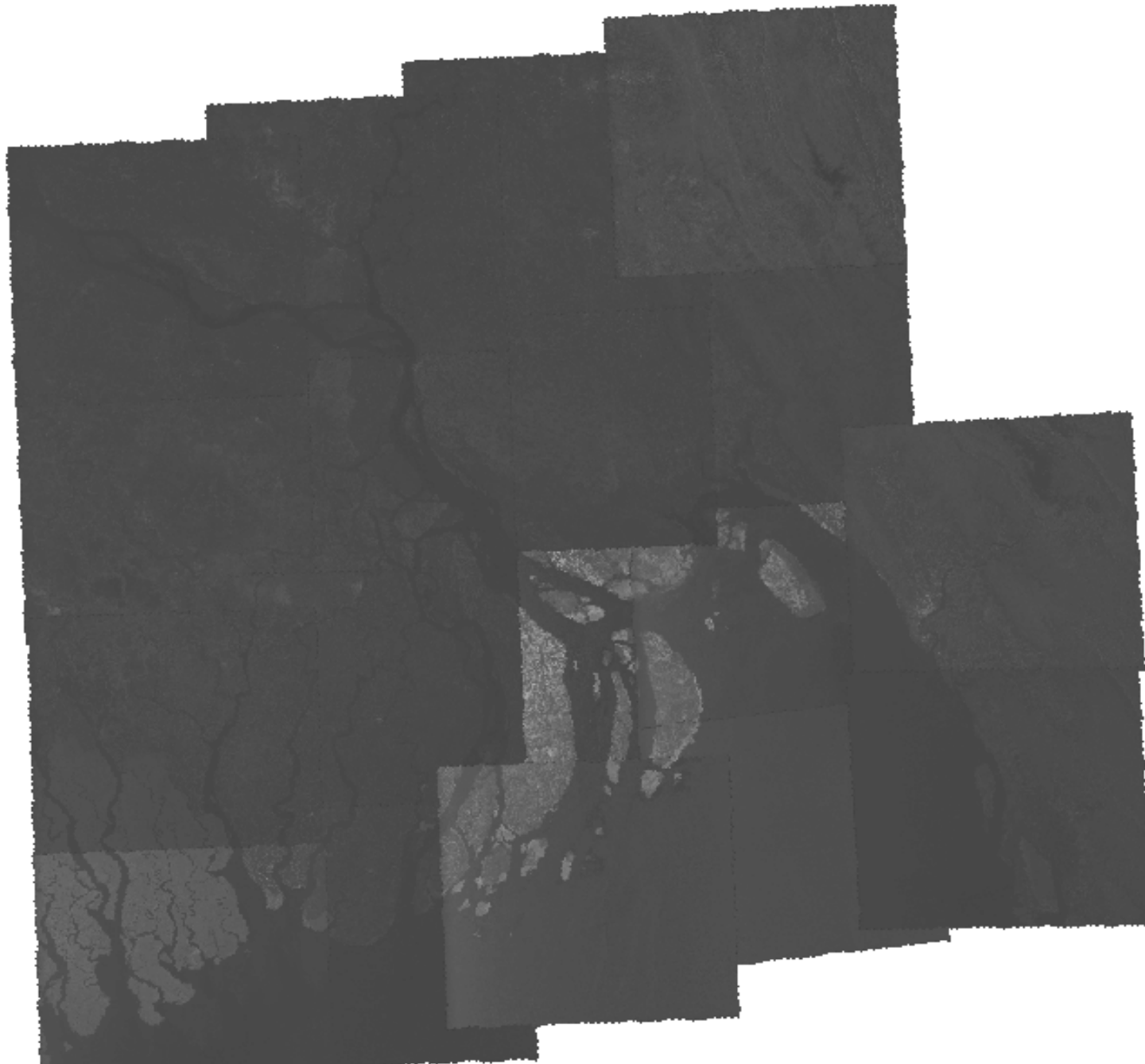
Working of Nature
Human's work

(Farakka dam, Google Earth)



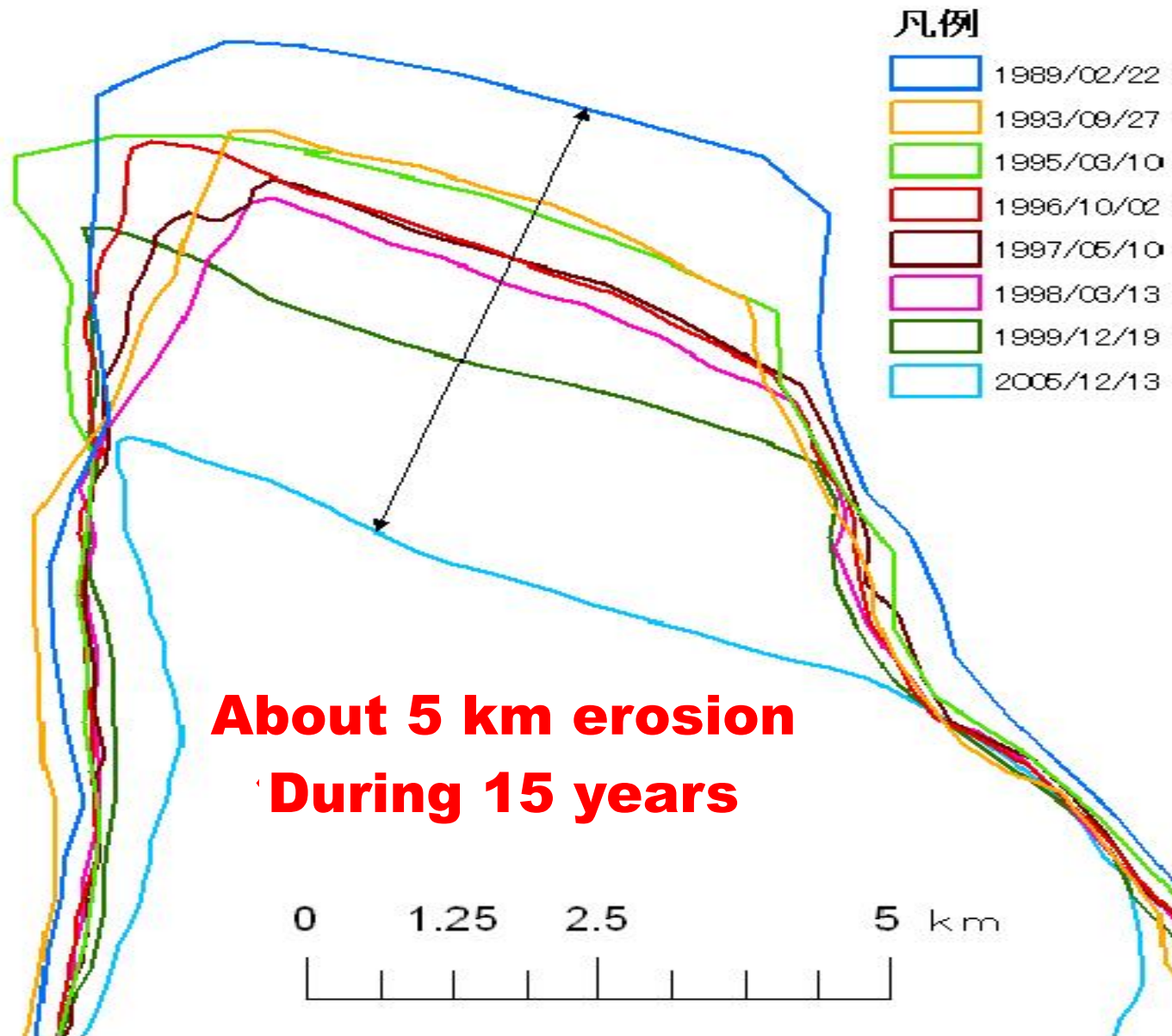
Utilization of SAR, All weather type sensor

The Ganges Delta, Bangladesh

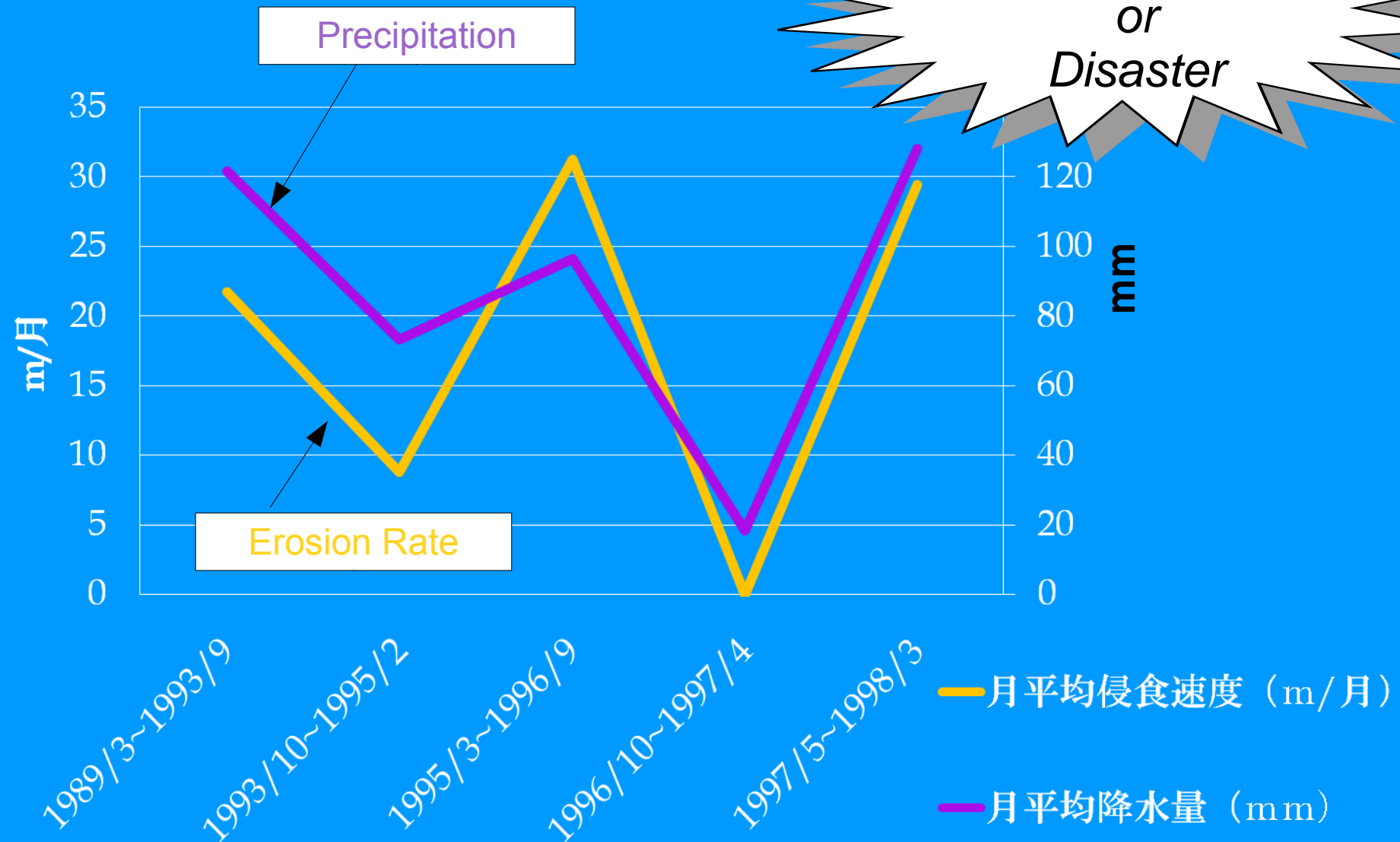


Erosion at the northern coast of Hatiya Island

(Courtesy Mr. Ohtani)



Erosion Rate and Precipitation



Inevitabilities by the nature and Life of Human

Characteristics of the Region

- Large amount of debris production due to tectonic zone
- World largest precipitation

What is the problem?

- Loss of the land : erosion
- Flood, High tide

What is the true problem?
Global warming?

True problem

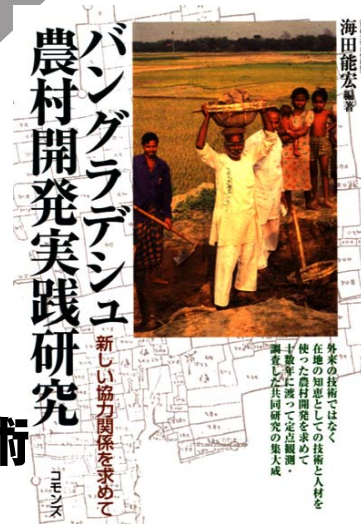
- Large population
- Socio-economical condition

Coutermeasure?

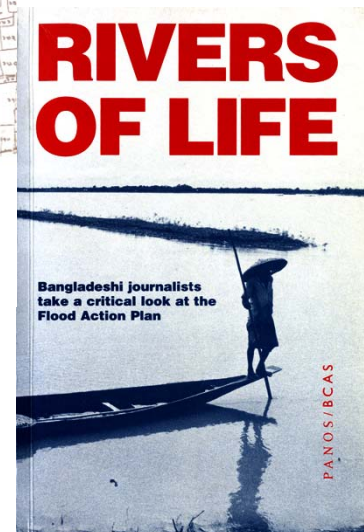
- Engineering adaptation
- Environmental adaptation (agronomic adaptation)



農村水文学
農民の持つ小技術
による適応



洪水は災害だろうか
河と共に生きる暮らし



Destruction of Tropical Forest

1990

2000



LUCC
Our Life

verIWS/N-47-00/index.html

移動

インターネット

スタート U#Documents and Se... kondon.odp - Starsuit... 3 Internet Explorer Adobe Photoshop

Norton

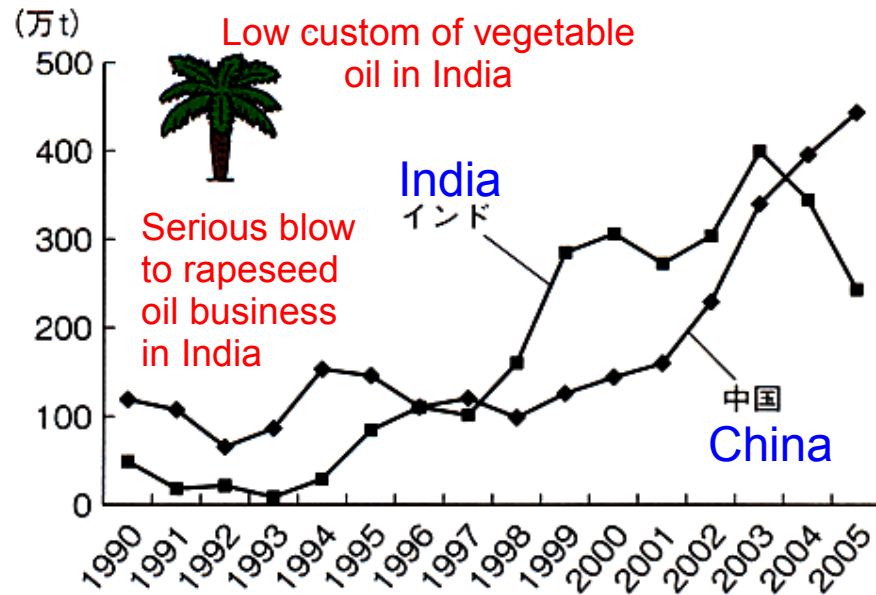
36%

12:01

Why tropical forest converts to plantation?

Import amount of palm oil in India and China

図3 中国とインドのヤシ油輸入量



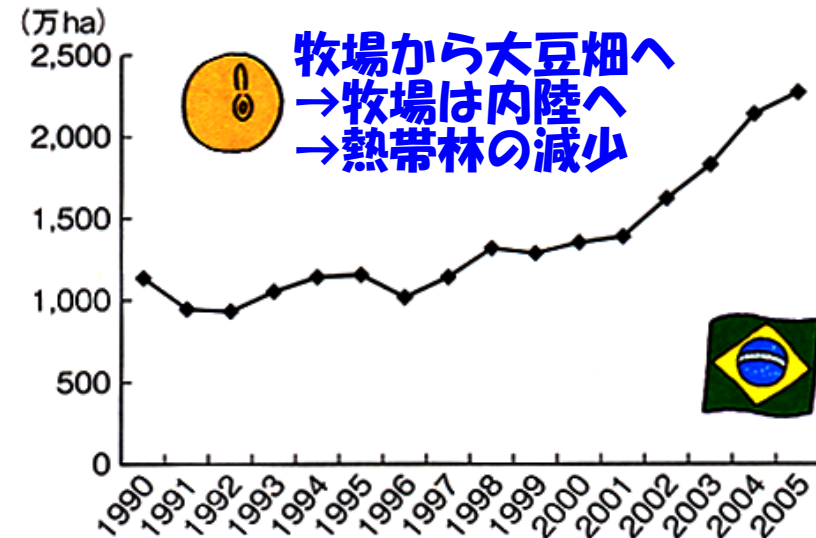
出所：FAO（国連食糧農業機関）STATより作図

本文中出所

- 1) FAO. (2006). Global Forest Resources Assessment 2005. FAO Forestry Paper 147. Food and Agricultural Organization. Rome.
- 2) FAOSTAT. <http://faostat.fao.org/site/291/default.aspx>

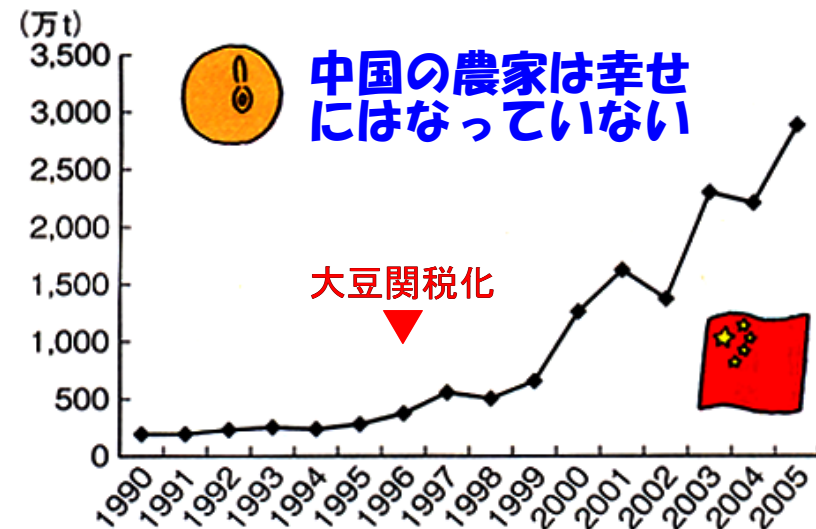
Contradiction between GW countermeasures and WTO agreement

図1 ブラジルの大豆収穫面積



出所：FAO（国連食糧農業機関）STATより作図

図2 中国の大豆輸入量



出所：FAO（国連食糧農業機関）STATより作図

（現代農業、2008年12月号、関論文より）

Wetland Monitoring

chiba-u.jp/TWS/GeocoverTWS/S-48-00/index.html

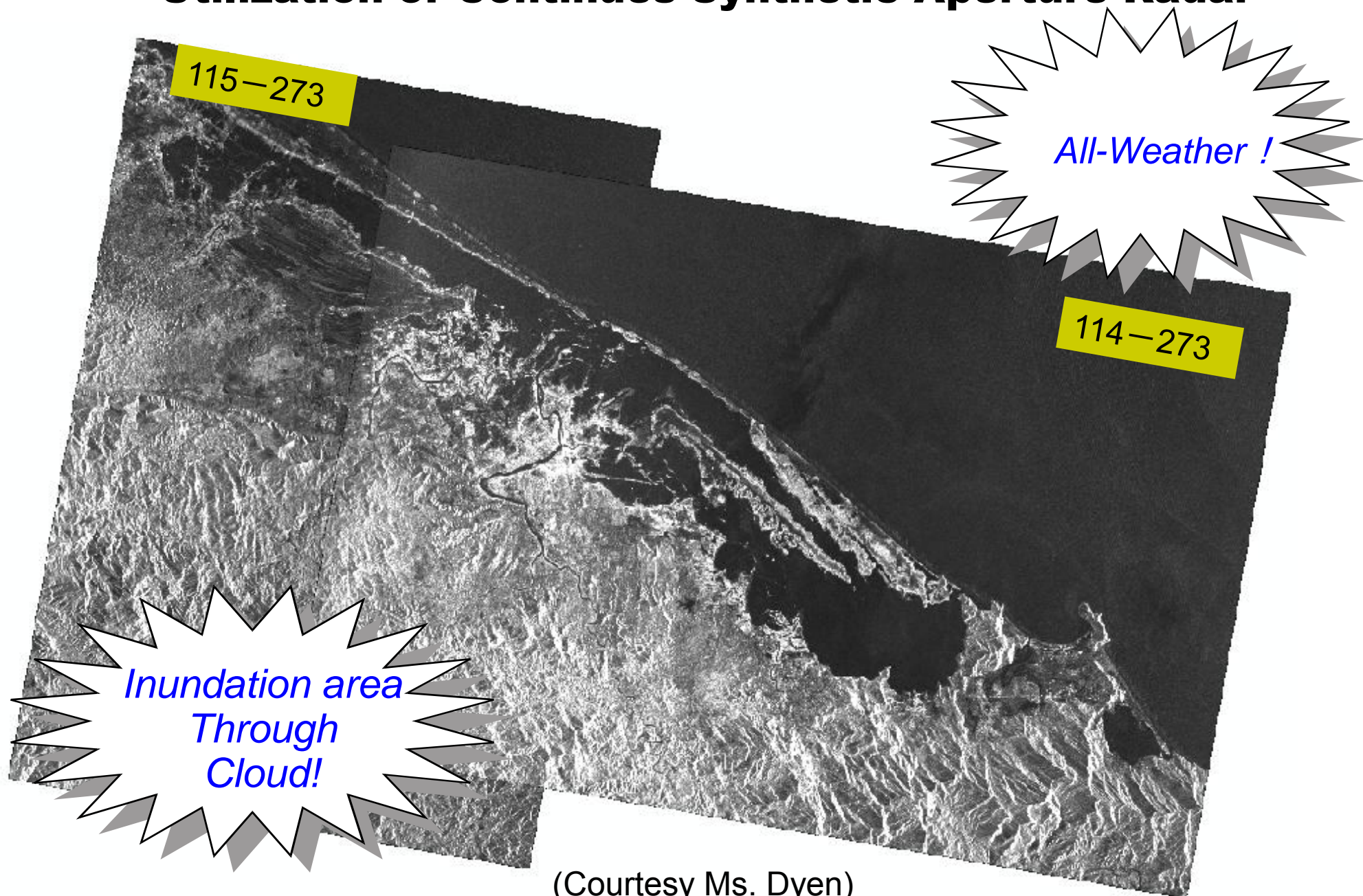
移動



**Shrimp Culture, Fish Culture
- A Case in Eastern Smatra -**

Flood Vulnerability Map in Hue Lagoon, Vietnam

—Utilization of Continues Synthetic Aperture Radar -



(Courtesy Ms. Dyen)

Early Rainy S.

Changes in Water Area

Late Dry S.

September

1998/09/17-18

August

1998/08/04-05

May

1998/05/08-09

October

1992/10/22-23

Early Dry S.

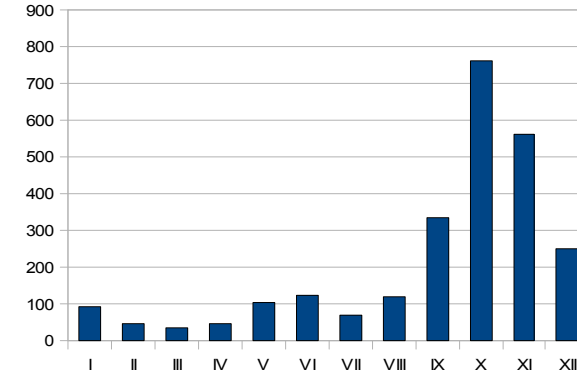
1995/02/05-06

February

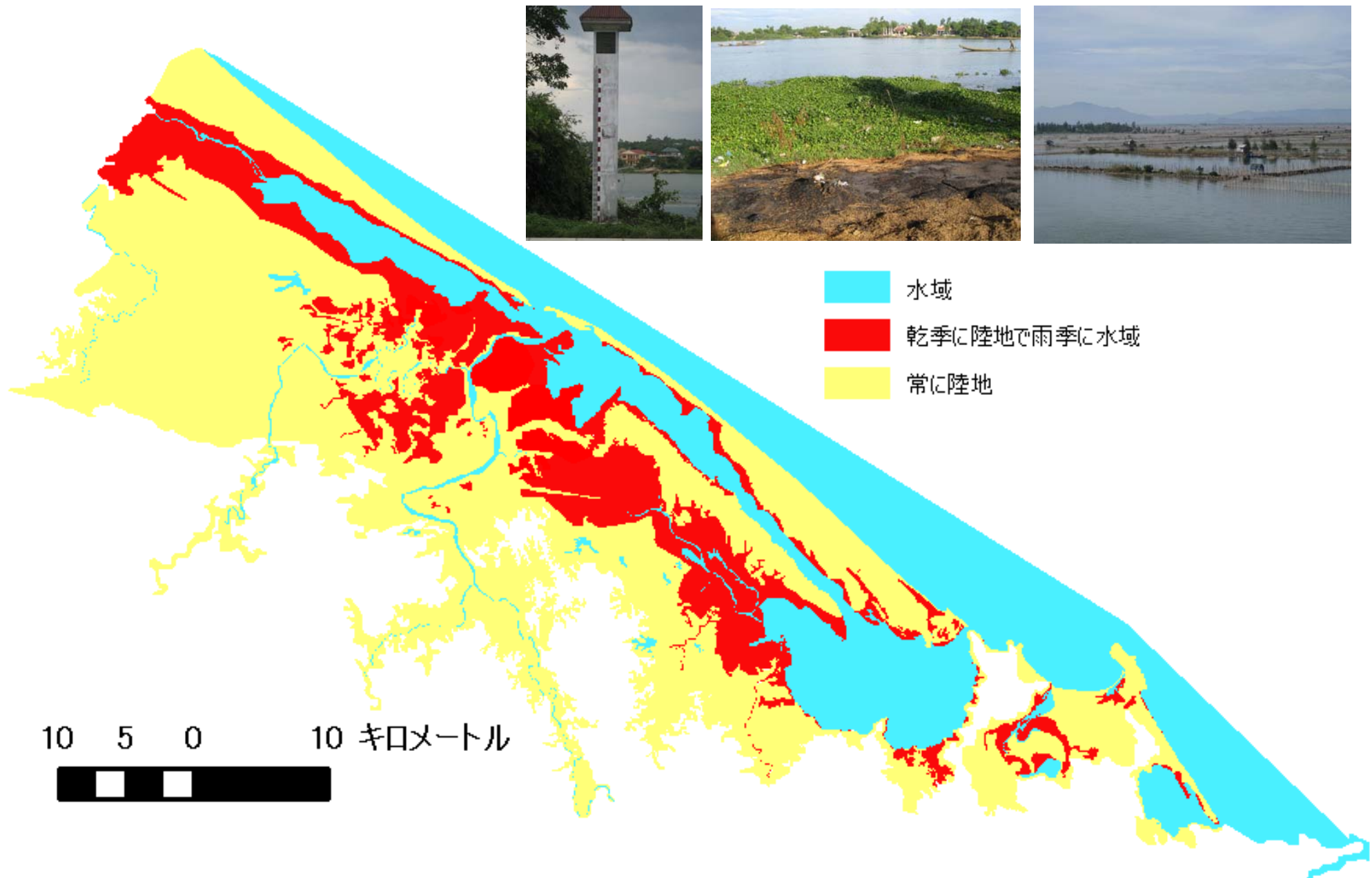
March

1998/03/25-26

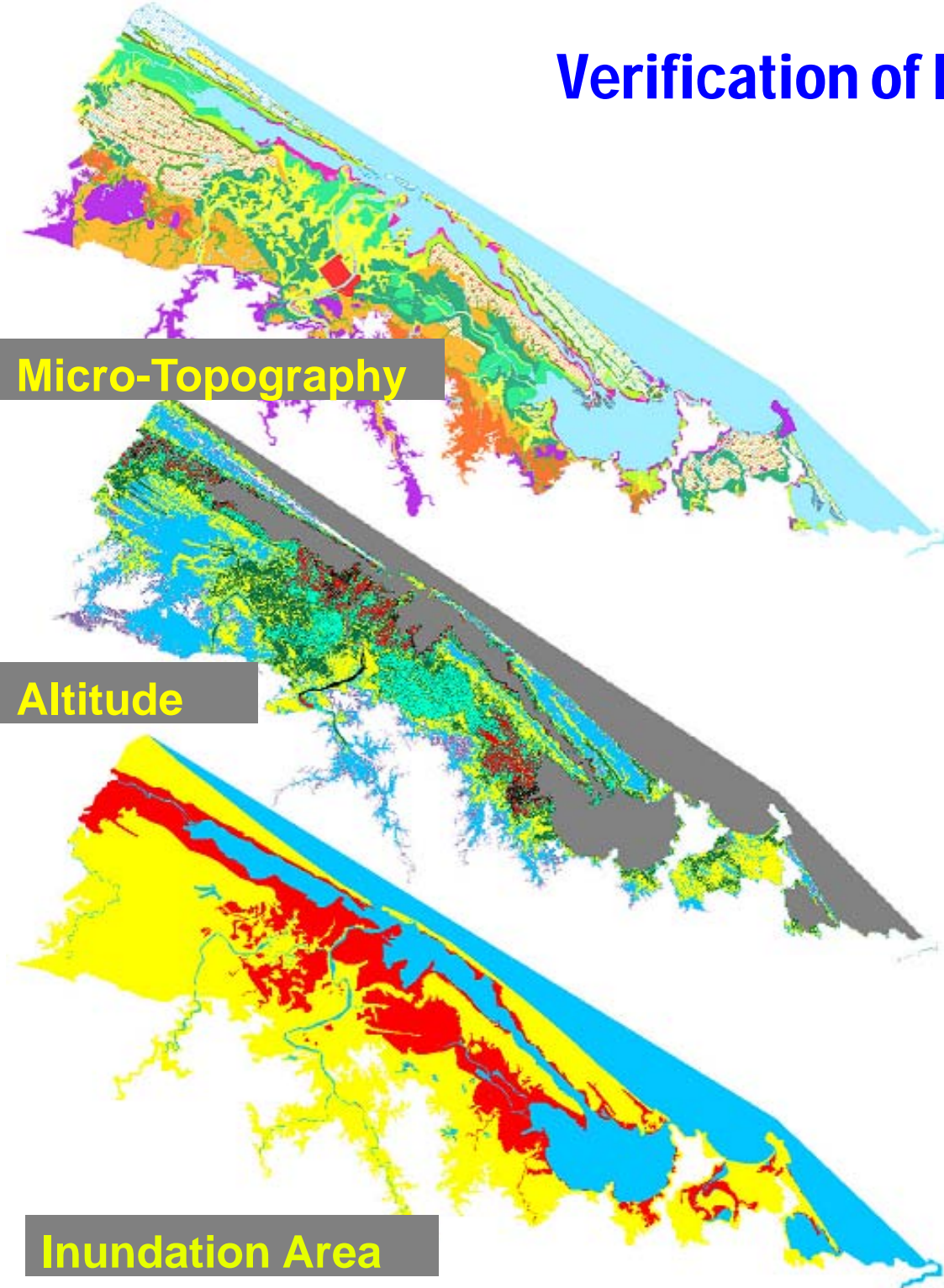
10 5 0 10 キロメートル



Inundation Area Classification Map



Verification of Inundation Classification Map

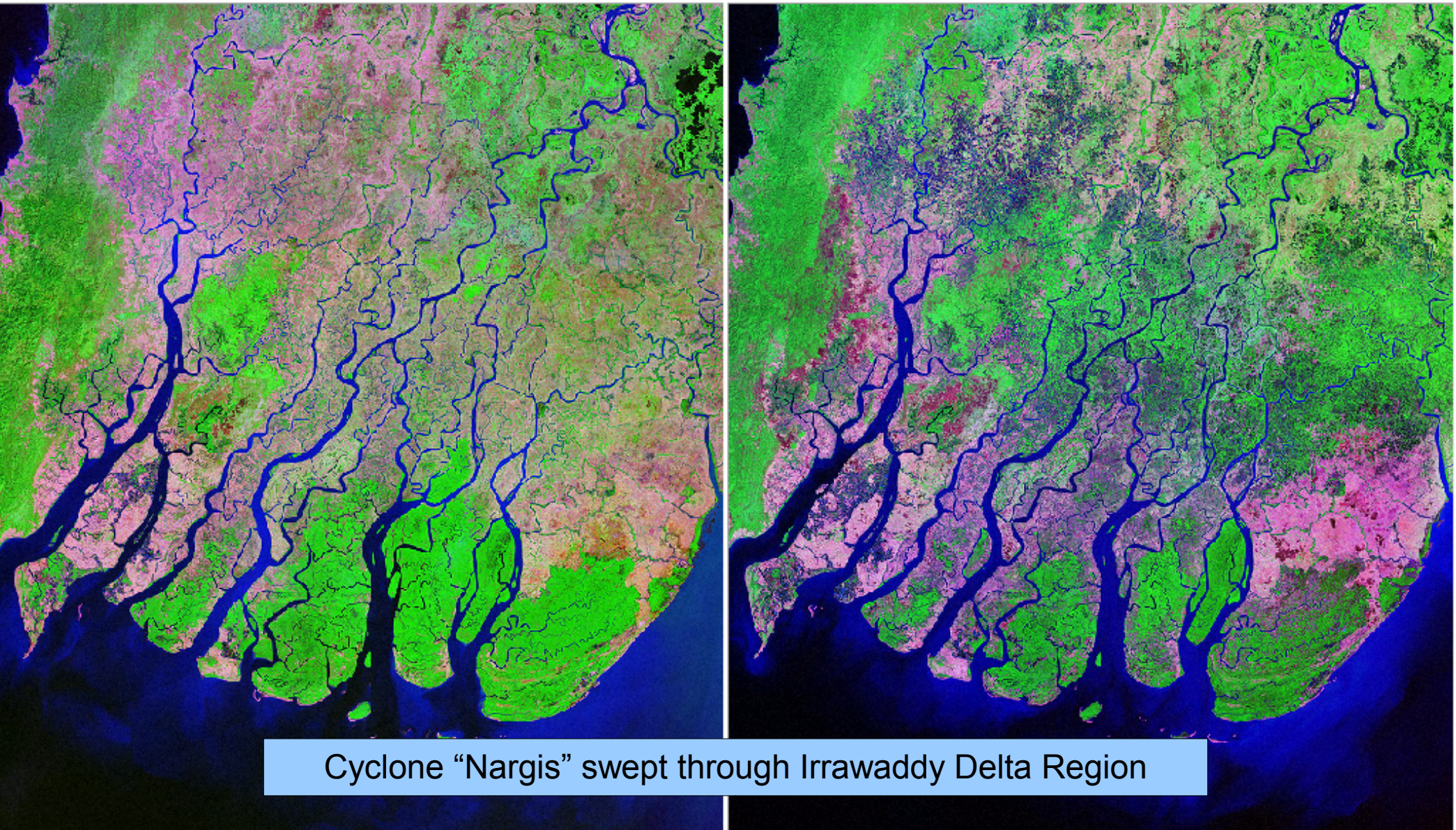


Satellite-driven data can be used to create inundation classification map in any area in the world.

Irrawaddy Delta in circa 1990 and circa 2000



[NASA Geocover](#) TM Mosaic Circa 1990(left) & Circa 2000(right)



Cyclone "Nargis" swept through Irrawaddy Delta Region

Dry season rice crop is promoted by the introduction of water pump around early 1990s.

Problems in Alluvial Lowland

LUCC in Irrawaddy Delta

Pump spread in early 1990s
Increase in dry season paddy
Adaptation to the life in delta?



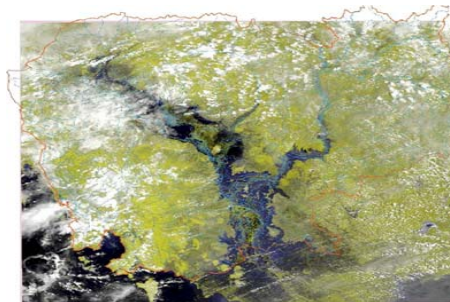
Countermeasure – Adaptation

Engineering adaptation
Large coastal cities in Japan
Agronomic adaptation
Cambodia, Vietnam, . . .
Environmental adaptation



Failure in engineering adaptation

Hurricane Katrina

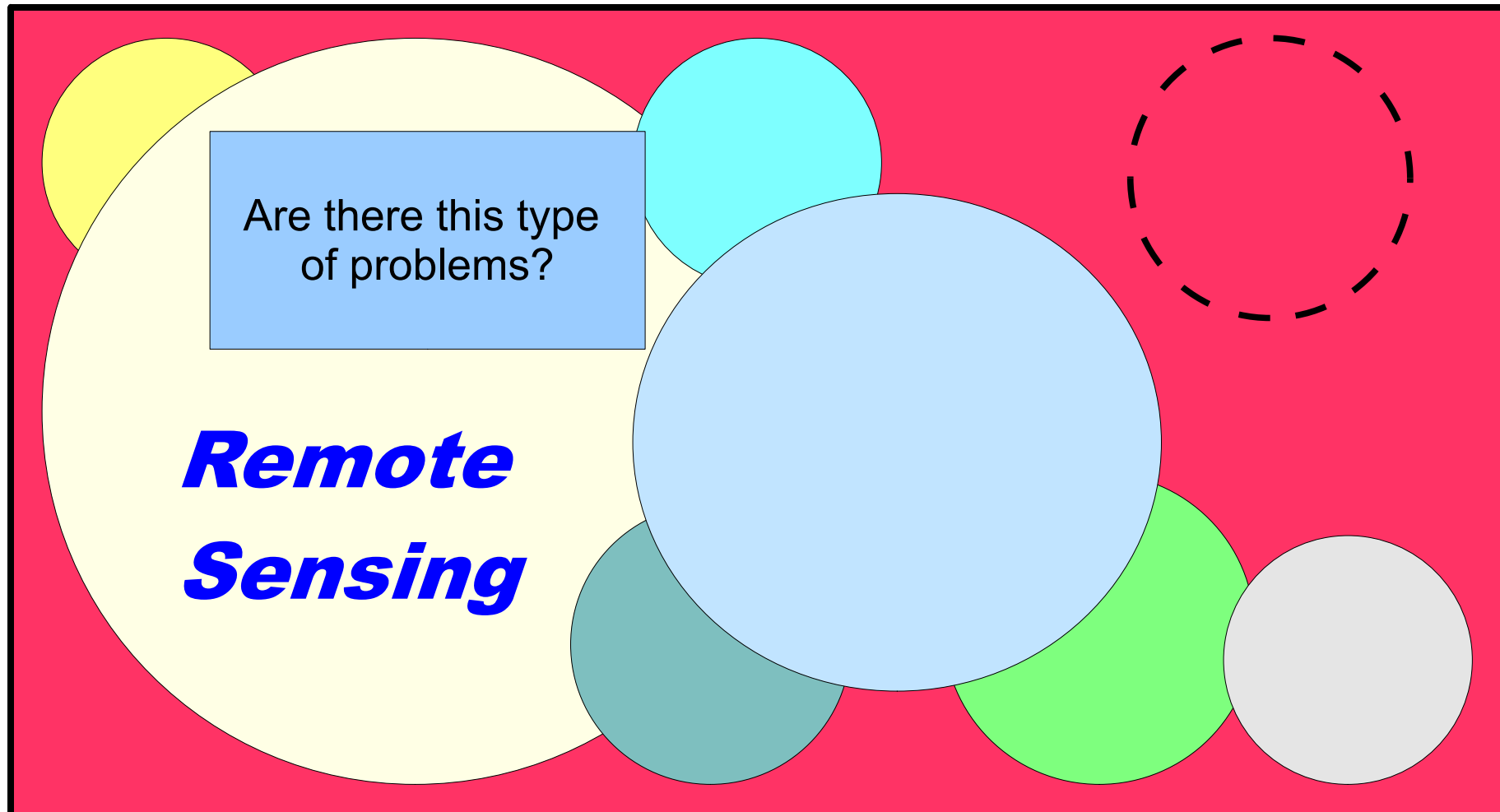


Role of Remote Sensing In the solution to the problem

- independent use or collaboration? -

Project 4

Problem to be solved



Toward Satellite Environmental Change Science

- Accumulation of Earth Observation Data during past 30 years
- Changes detected include climatic and human factors
- The problem is the one concerning the relationship between nature and human in the region
- We have to share the solution based on the real, holistic understanding of the problem.
- We have to find the signals of environmental changes, and locate it to global spatial framework.
- Toward satellite environmental change science.
- Solution should be based on collaboration.

