

Global Challenges on Water Resources and Disaster Management and Position of Earth Observation in Addressing them

Kenzo Hiroki

**Professor, National Graduate Institute for Policy Studies (GRIPS)
Coordinator, High-level Experts and Leaders Panel on Water and
Disasters (HELP)**

Why Water and Disasters?

Glimpse of a water-related disaster, March 11th, 2011

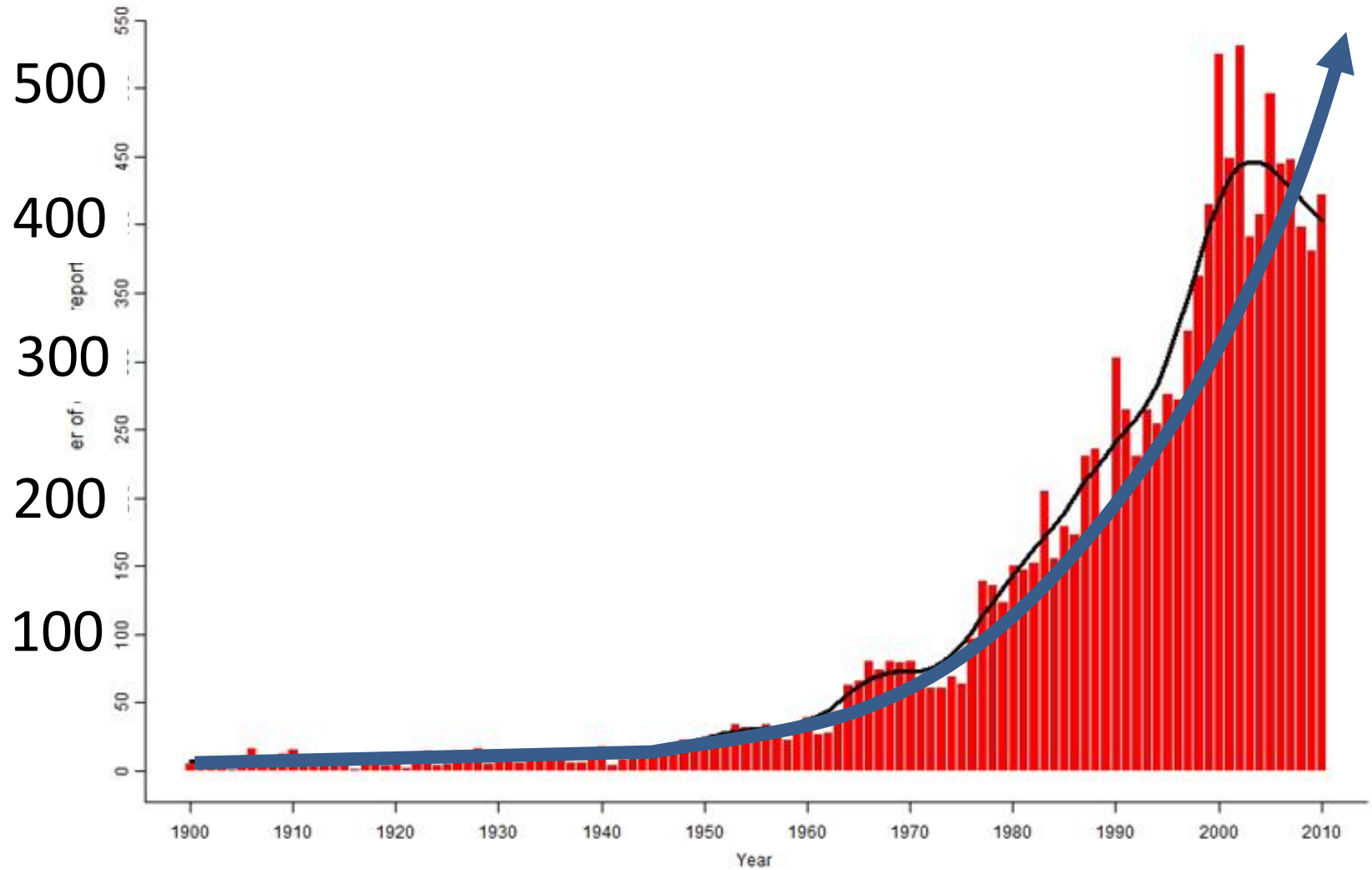
Viewed from Kamaishi City Hall

Why Water and Disasters?

**We should not repeat the Tragedy
for our family, people, and nation**

**Disasters are increasing in
numbers and impacts**

Number of reported natural disasters(1900-2010)



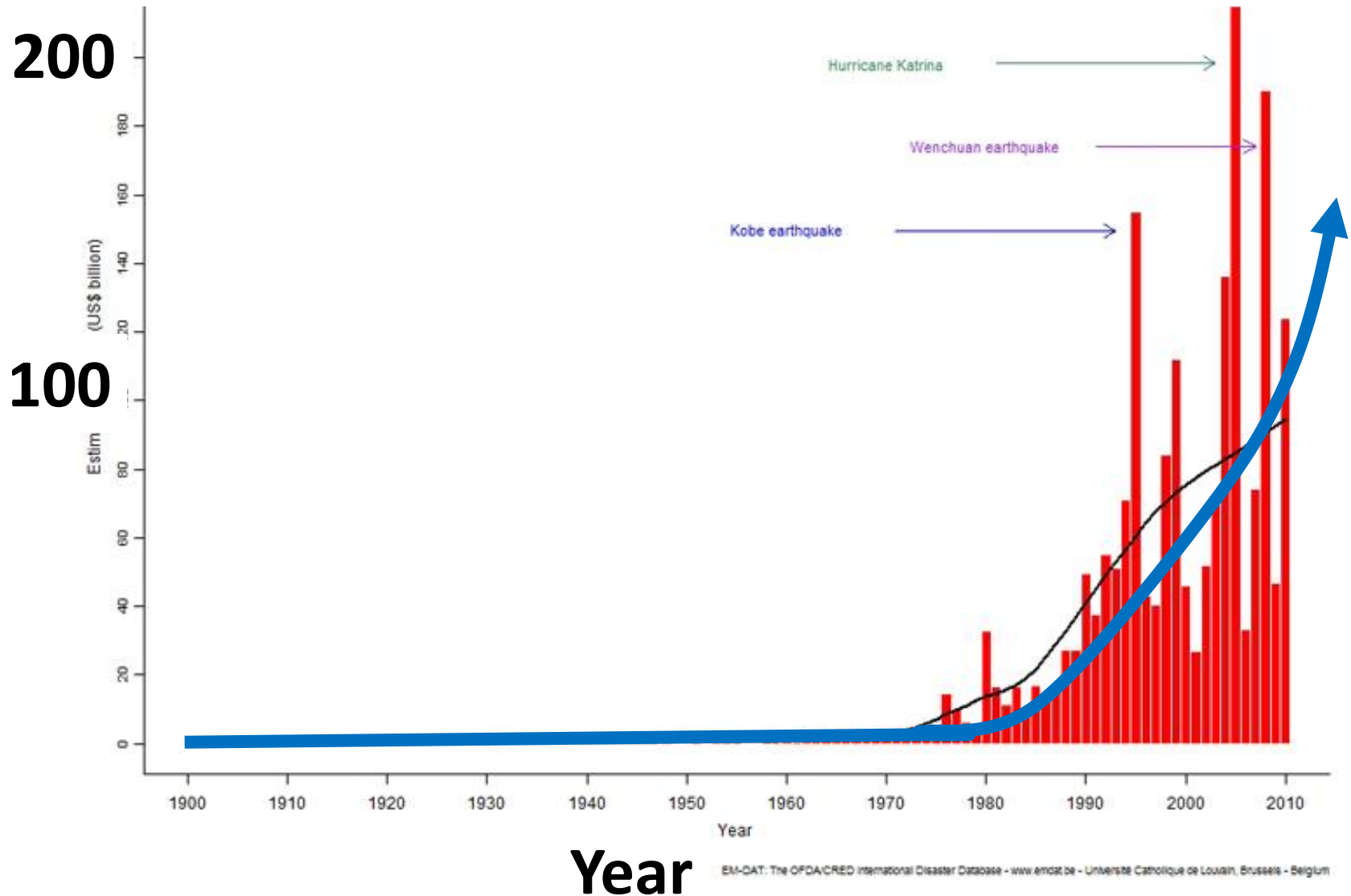
Year

EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium

Source: ISDR "EM-DAT"

Estimated damage caused by natural disasters (1900-2010)

Billion USD



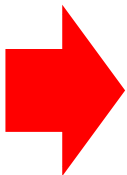
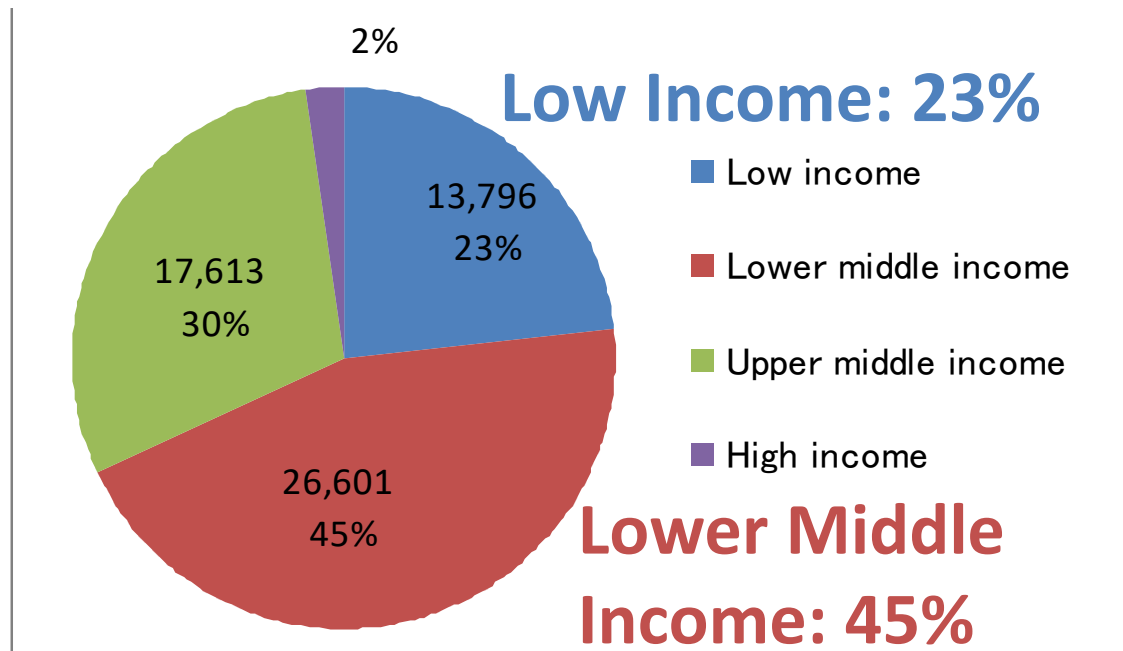
EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium

Source: ISDR "EM-DAT"

**“Water and Disasters” is strongly linked to
poverty issue**

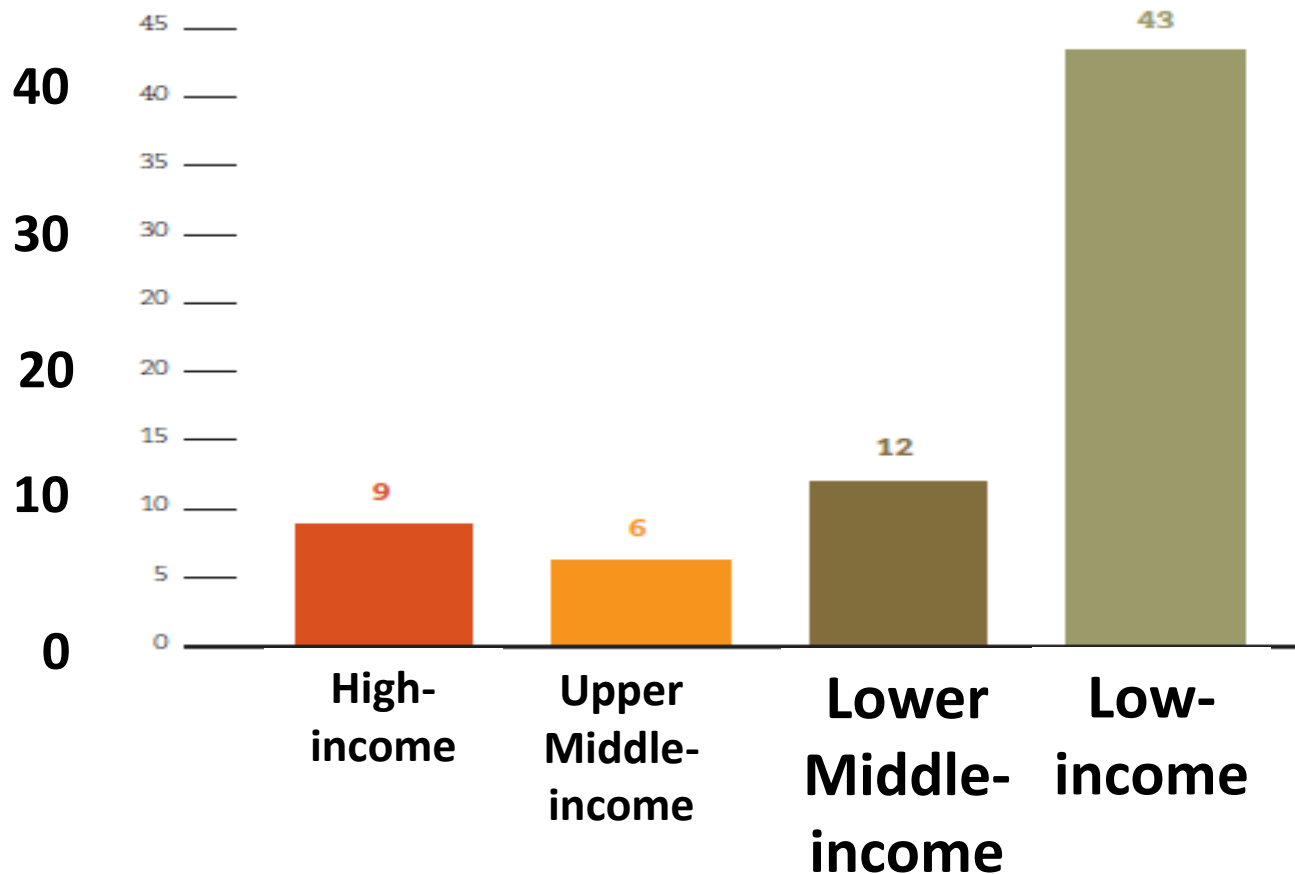
Number of fatalities by floods (2001-

- 70 % of human loss by flooding are from “low income” or “lower middle income” countries -



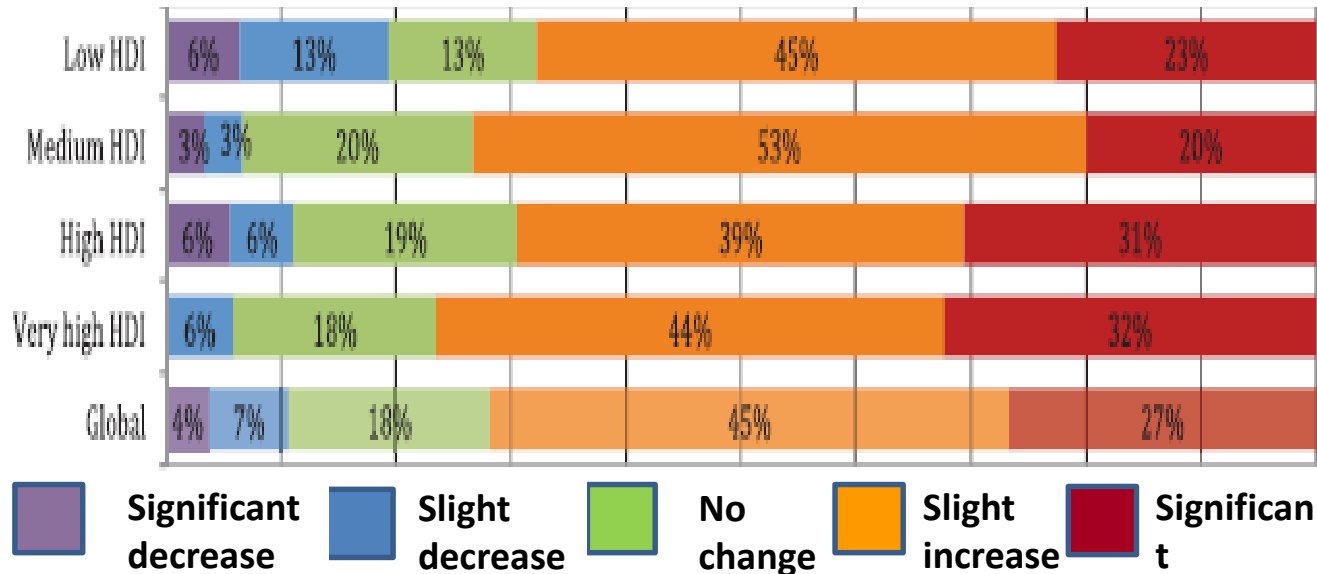
Water and disasters are strongly linked to poverty issues

Number of disaster deaths per one million inhabitants by income groups (1994-2013)



Disaster management is gaining importance within government

Perceived change in the importance of disaster management over the past 20 years



70% of countries think disasters have become more important among the government priorities

Emerging Challenges in addressing water-related disasters

- From Heavy Rain Disaster in West Japan, July 2018 -

Lessons of Heavy Rainfall Disaster in West Japan in July, 2018

Heavy Rain Disaster in West Japan in July, 2018

- Heavy rainfall hit West Japan on June 28th - July 8th, 2018
- 220 people were dead and 9 are missing (the worst as rain disaster since 1982); 9,786 Houses were totally or severely destroyed; 36,038 houses were immersed.
- Evacuation Directives were given to 916,000 people, and Evacuation Advisory to 2.3 million people were announced.
- Key infrastructures were damaged. E.g, Water supply to 262,322 households were suspended

Breached river levee and flooding between Takahashi River and Oda River



Mud flow in Hiroshima



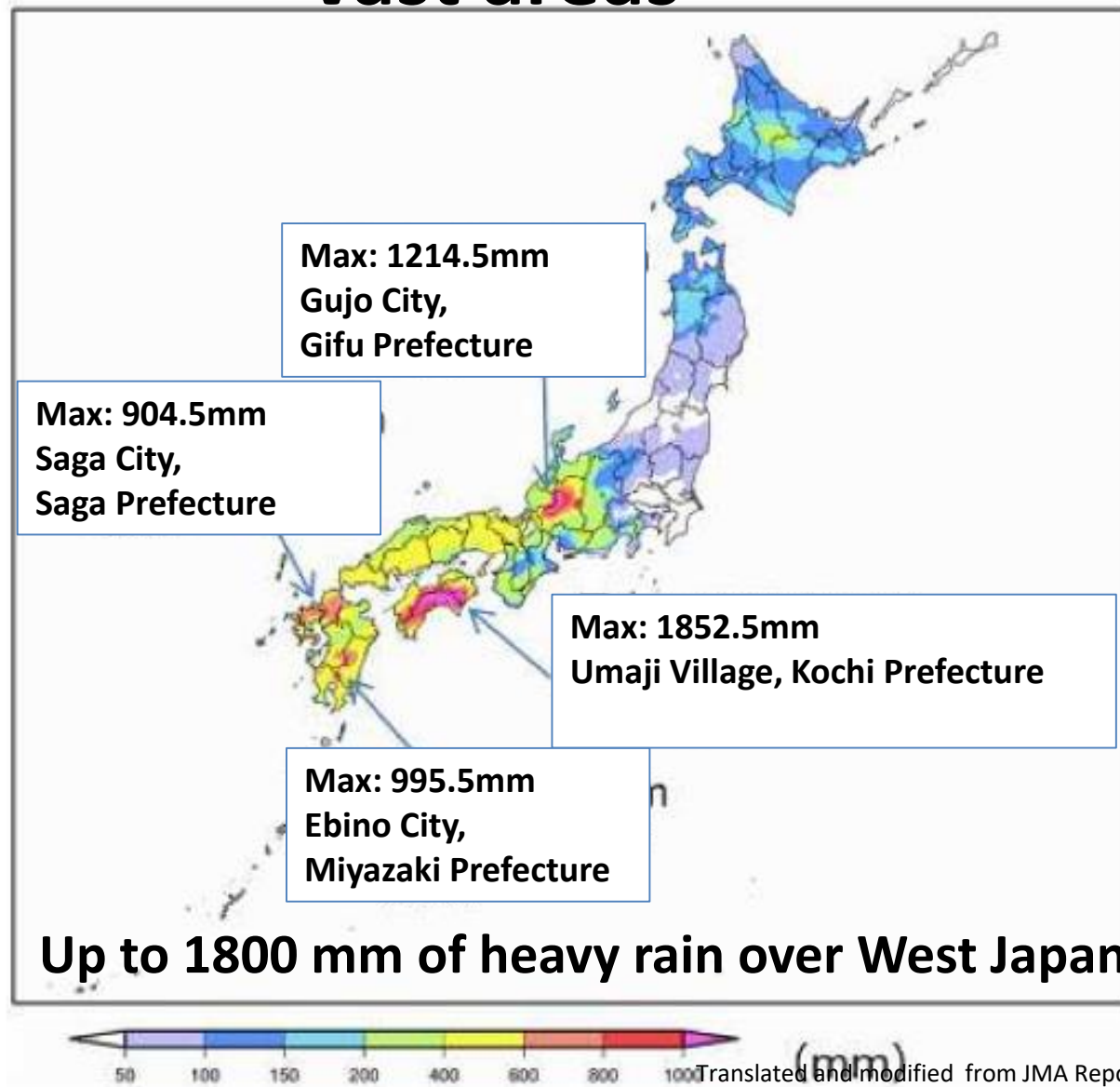
Mud flow in Kyoto



Cliff fall in Fukuoka



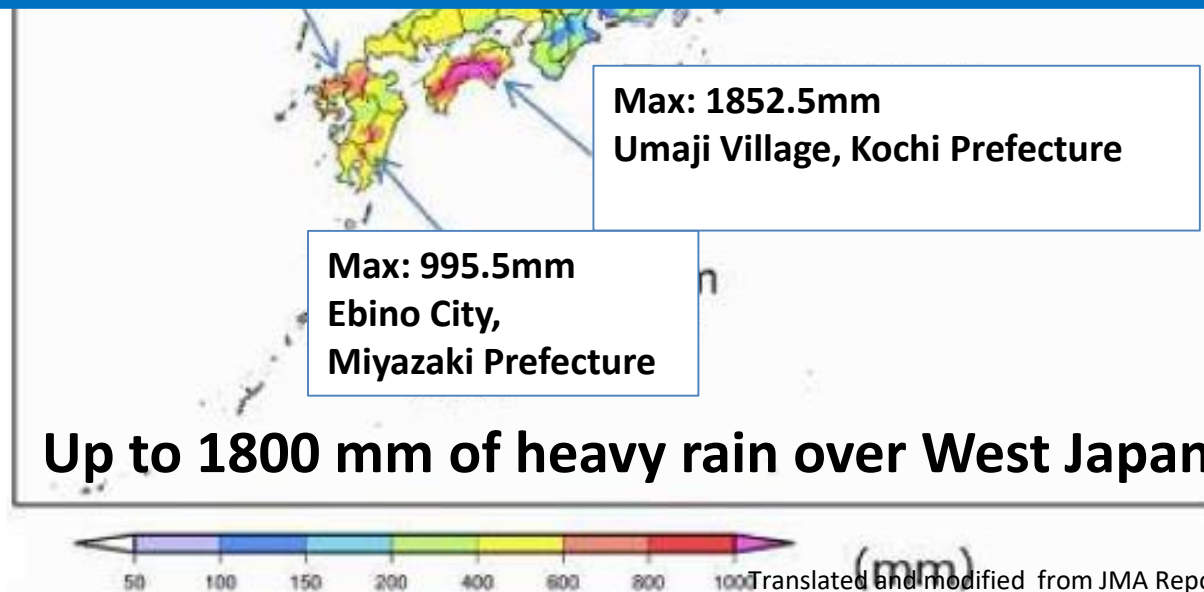
Lesson 1. Extreme downpour can happen over vast areas



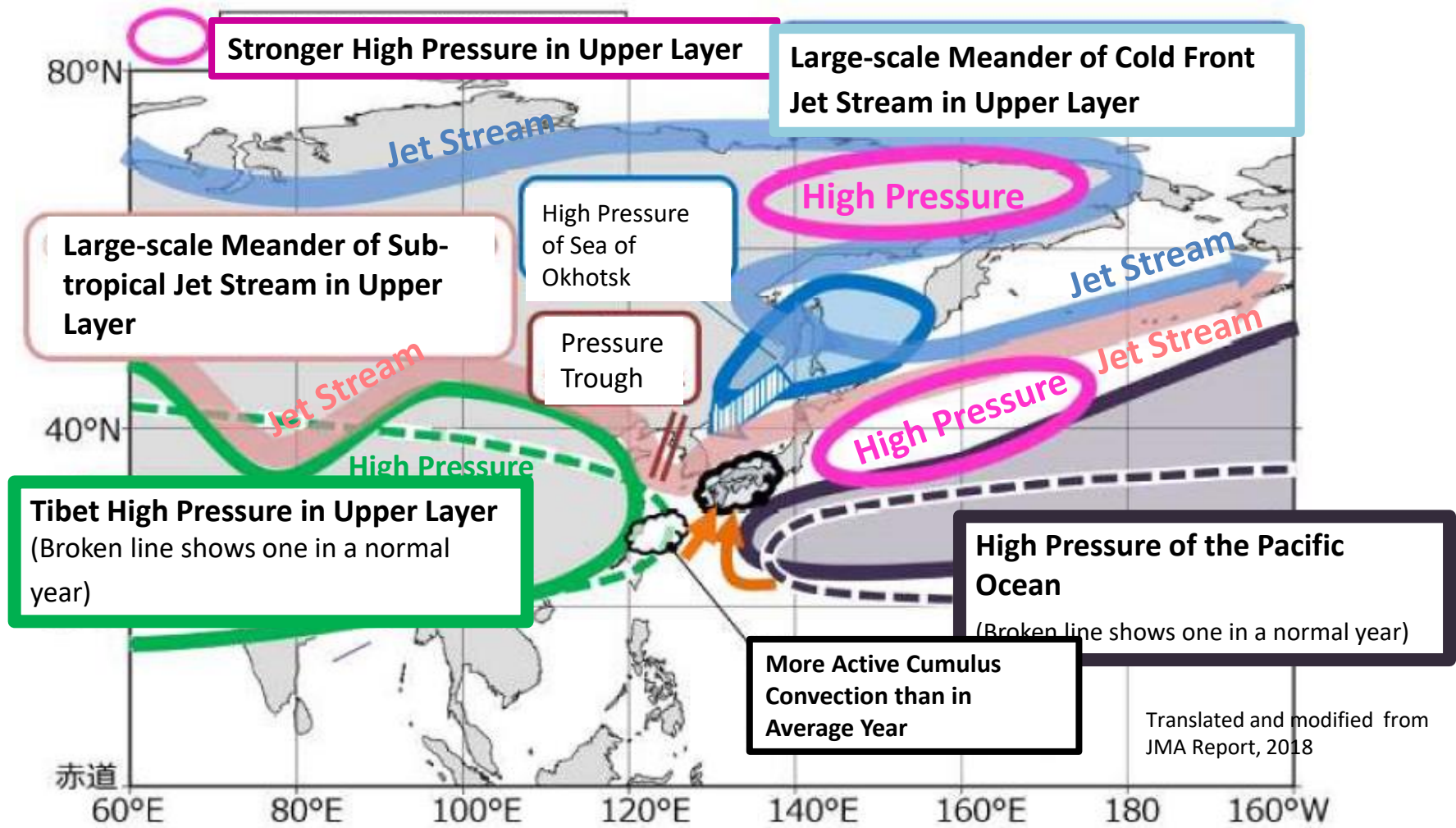
Translated and modified from JMA Report, 2018

Lesson 1. Extreme downpour can happen over vast areas

- Up to 40%-80% of annual precipitation fell on some cities in less than a week.
- 33 out of the whole 47 Prefectures received damage.



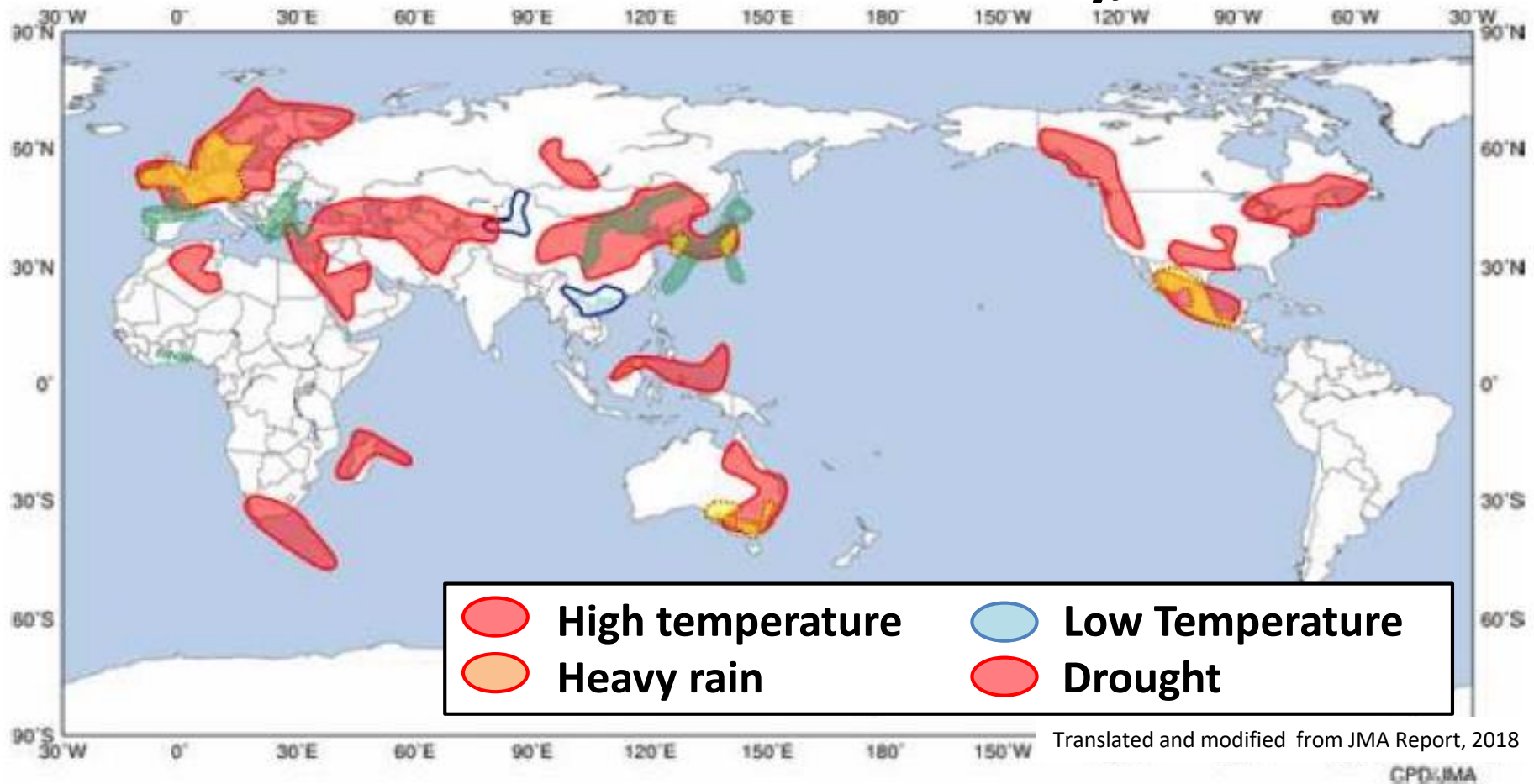
Lesson 2. Climate Change should be addressed locally and globally now.



Unusual layout of atmospheric pressures due to global warming caused simultaneous downpour over West Japan

The global warming led to global irregularity of weather events on earth.

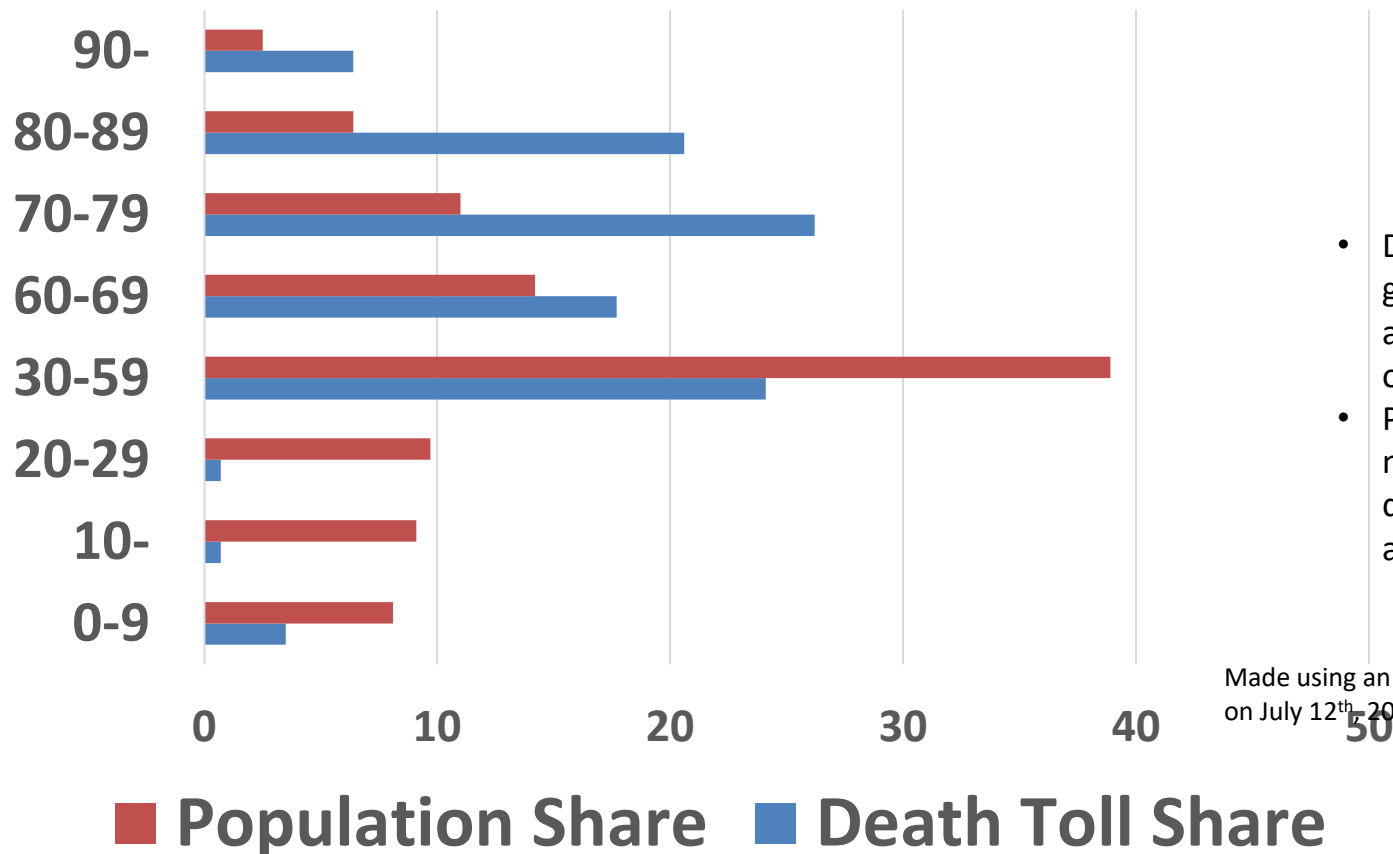
Unusual Weather Events in July, 2017



Lesson 3. Social change is a new challenge for Disaster Risk Reduction

70% of the death were 60 years old or older, a disproportionate figure-

Comparison of disaster death toll share and population share



- Death toll share by age group is according to an article by Asahi Shimbun as of July 12th, 2018
- Population share is that of national share and may differ from the disaster area

Made using an article of Asahi Shimbun Article on July 12th, 2018

Impacts of Climate Change in Asia through extreme hydro- meteorological events

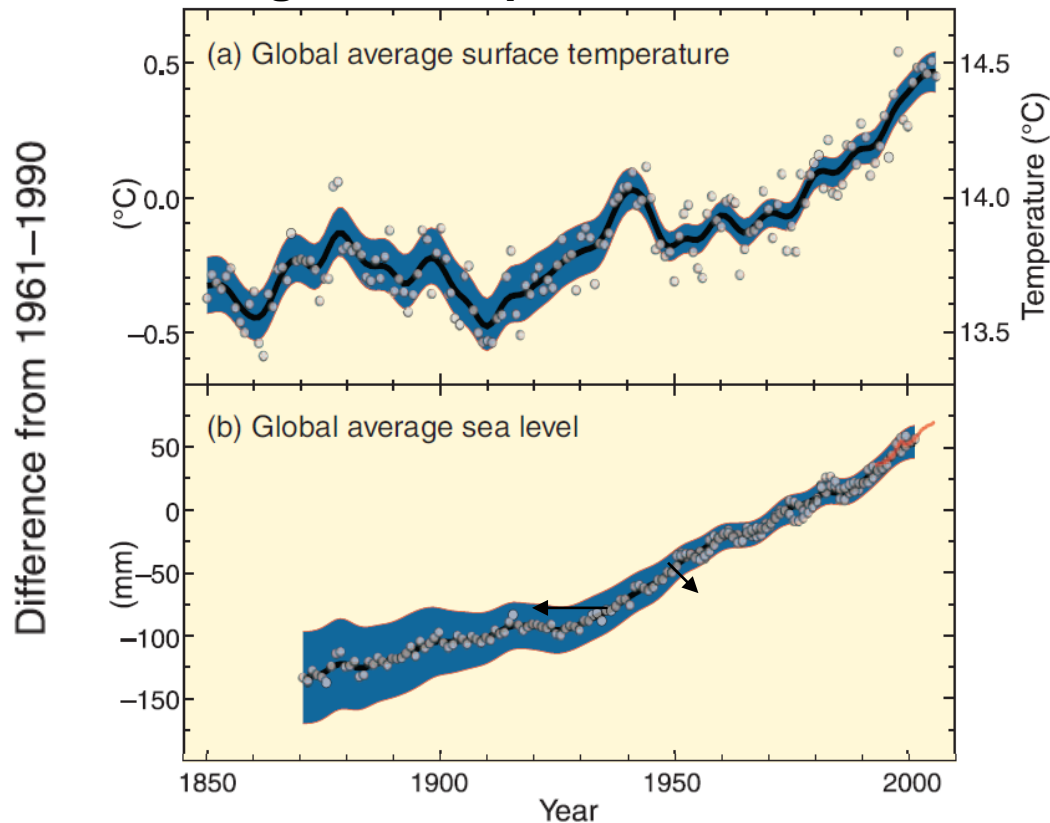
- Findings through Sosei Program by
ICHARM et al. and others-**

Temperature and sea level is already rising

–the problem is real and happening now–

- ✓ Global average surface temperature rises 0.74 degrees Celsius in the past 100 years
- ✓ Global average sea level has risen by 17cm/100yrs
- ✓ Faster increase of the both in recent years

Changes in temperature and sea level



Source: IPCC SR4

Probability map of temperature change in the late 21st century in East Asia

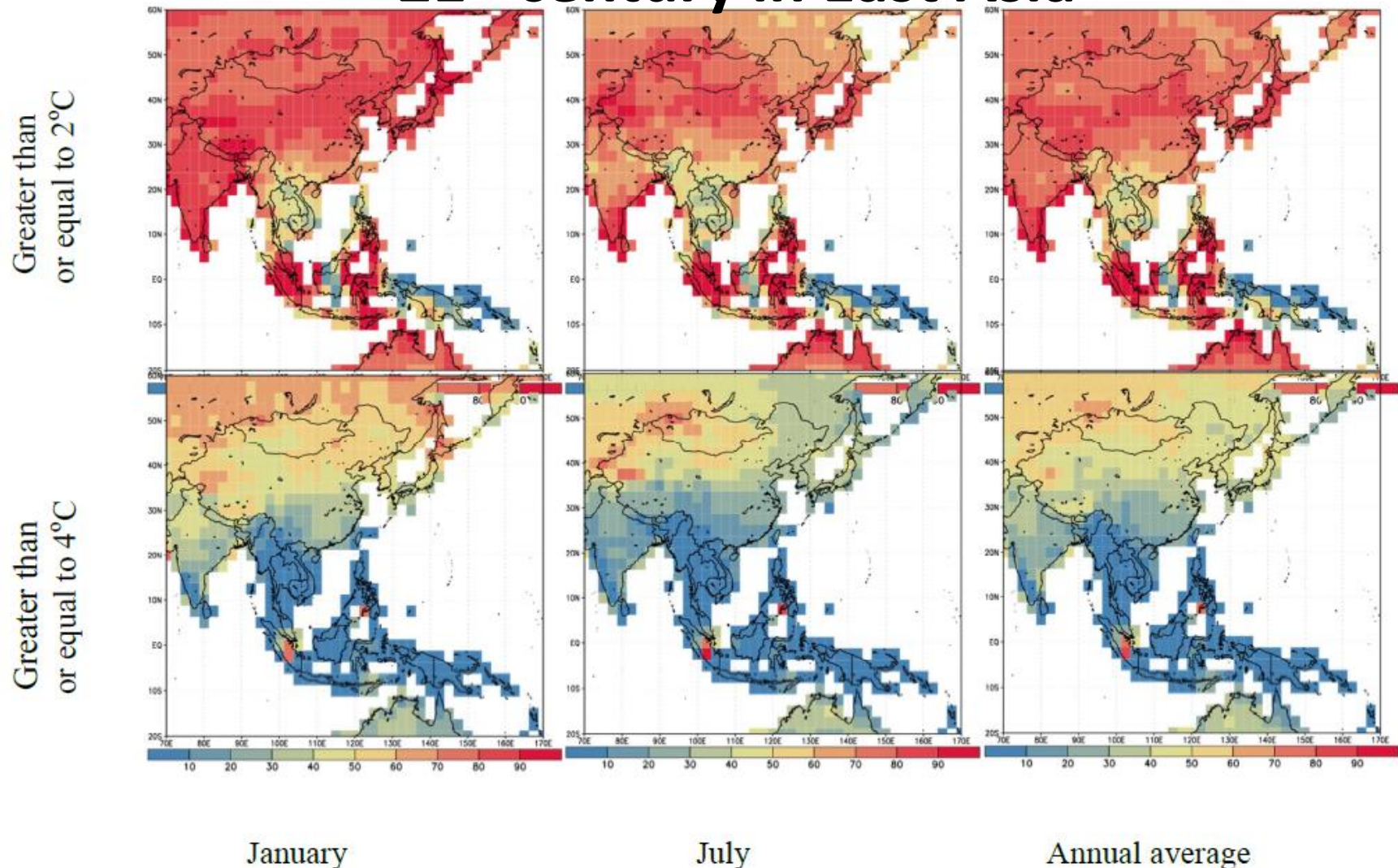


Figure 8 : Probability map of temperature change in the late twenty-first century in East Asia (NIED, 2017) (Probability (%) of temperature increase: Greater than 2°C (figures above) and 4°C (figures below), respectively. Average for January (left), July (center), and annual average (right)) (see VI. Appendix 8.) (Dairaku, 2016)

Annual precipitation change in major rivers in Asia

“10-38% Increase is projected in the Asian Continent”

-by ICHARM, Sosei Program -

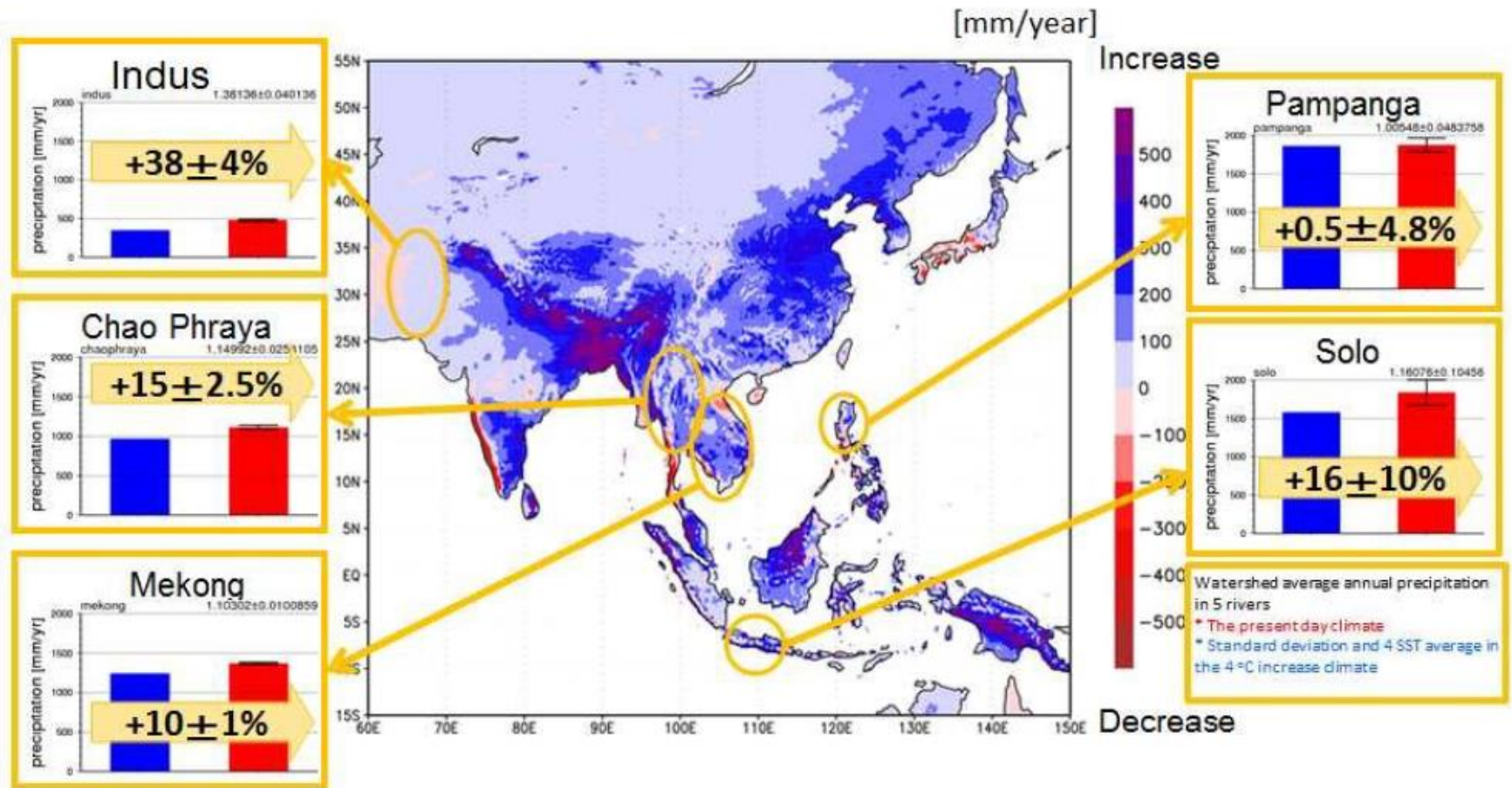


Figure 10 : Annual average precipitation in the present-day climate and the 4 °C-increase climate over Indus River, Chao Phraya River, Mekong River, Pampanga River, and Solo River (ICHARM, SOUSEI Program, 2017)

Increased flooding depth, area, period, and damage in the Pampanga River under Climate Change Scenario

-by ICHARM, Sosei Program -

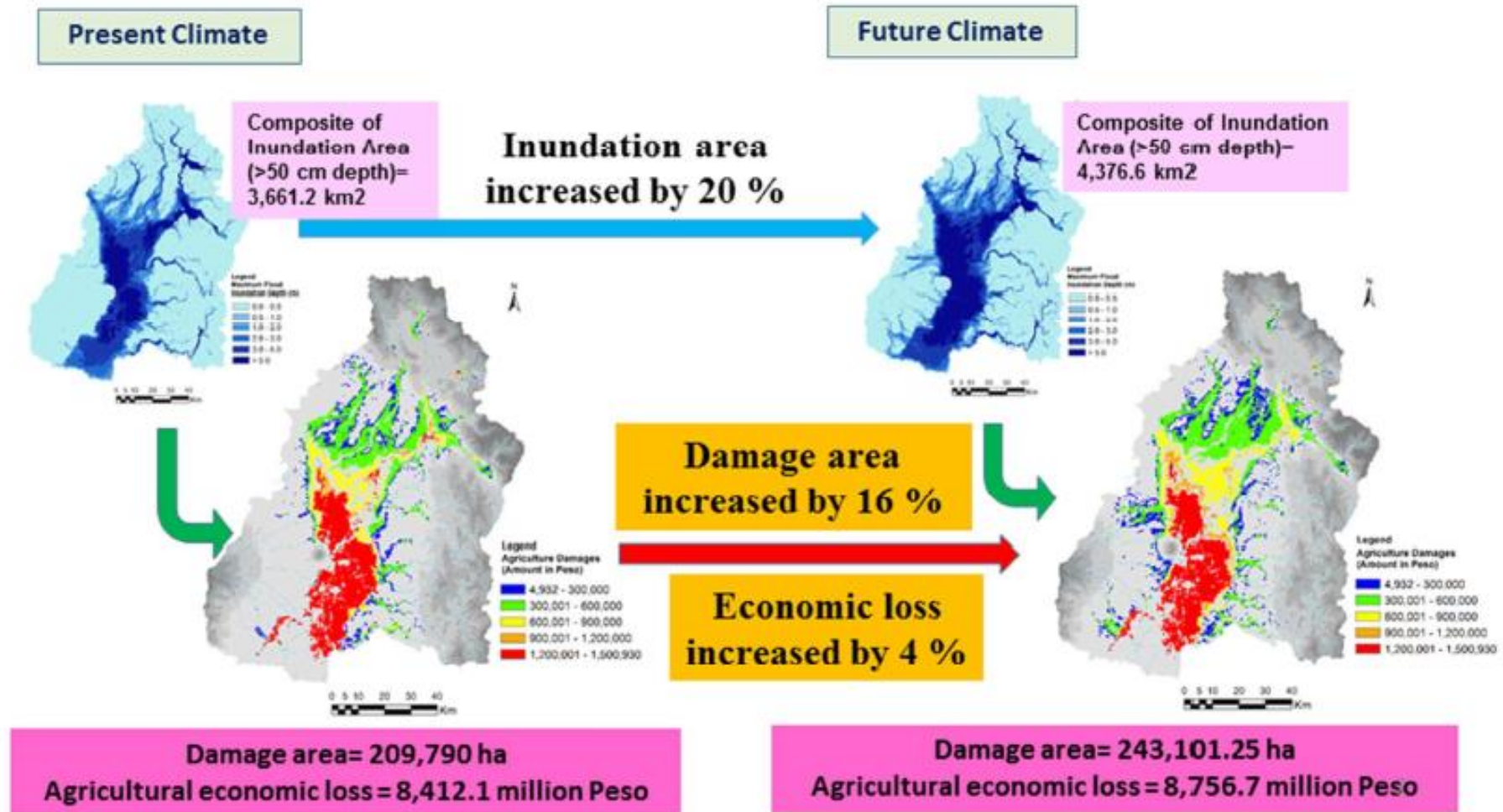


Figure 12 : Estimation of inundation depth, inundation area, inundation period, agricultural damage quantity, and agricultural damage brought by 100-year precipitation over Pampanga River (ICHARM, 2017)

Predicted surge intrusion and flood expansion under Climate Change Scenario

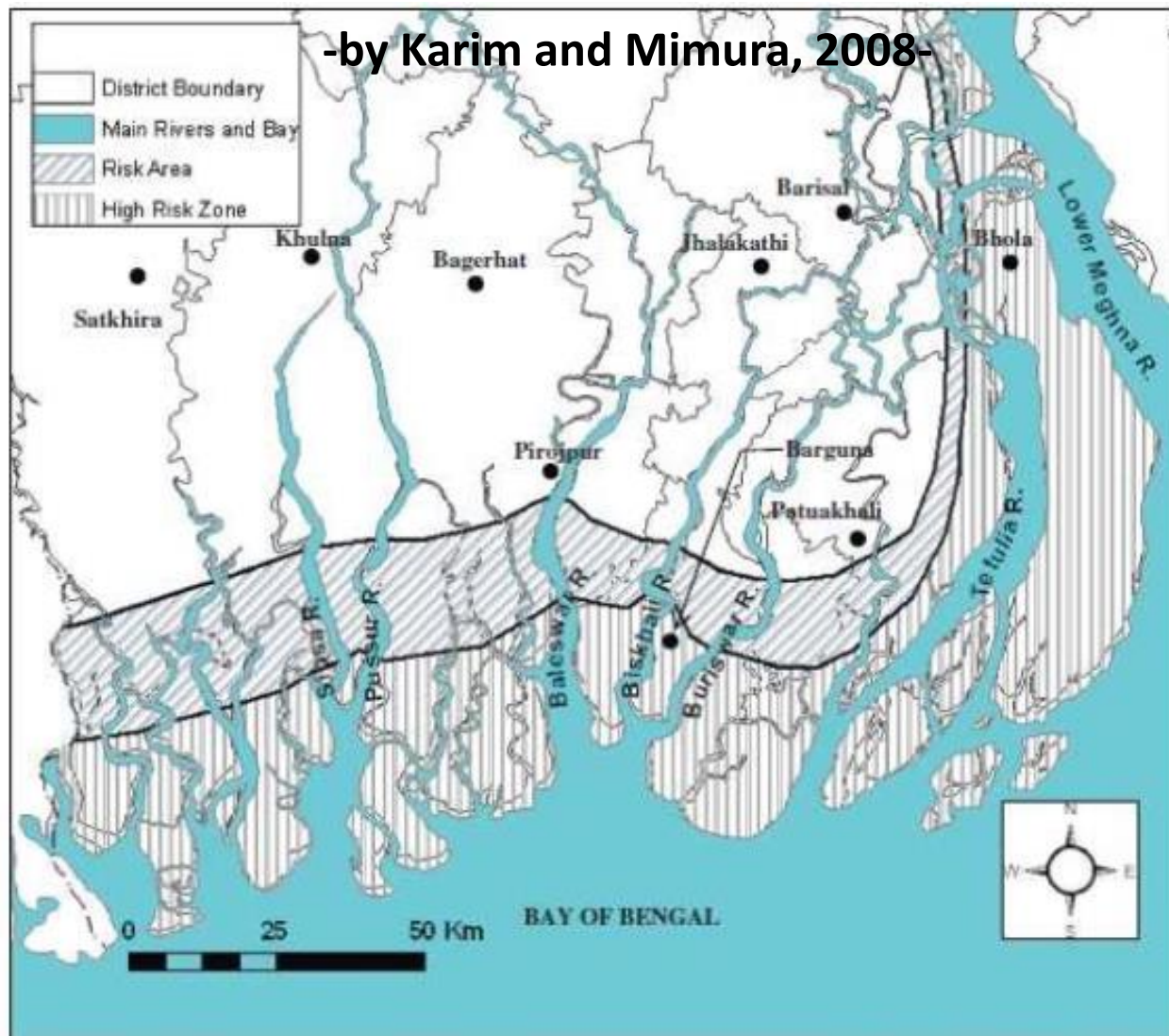


Figure 20 : Predicted surge intrusion length and flooding area under 2 °C of SST rise and 30 cm of sea level rise (above) and Flood risk map corresponds to a typical projected climate (Karim and Mimura, 2008)

Decrease in duration of rice cultivation due to salinity intrusion in the Mekong Delta under climate change scenario

-by Khang et al., 2010-

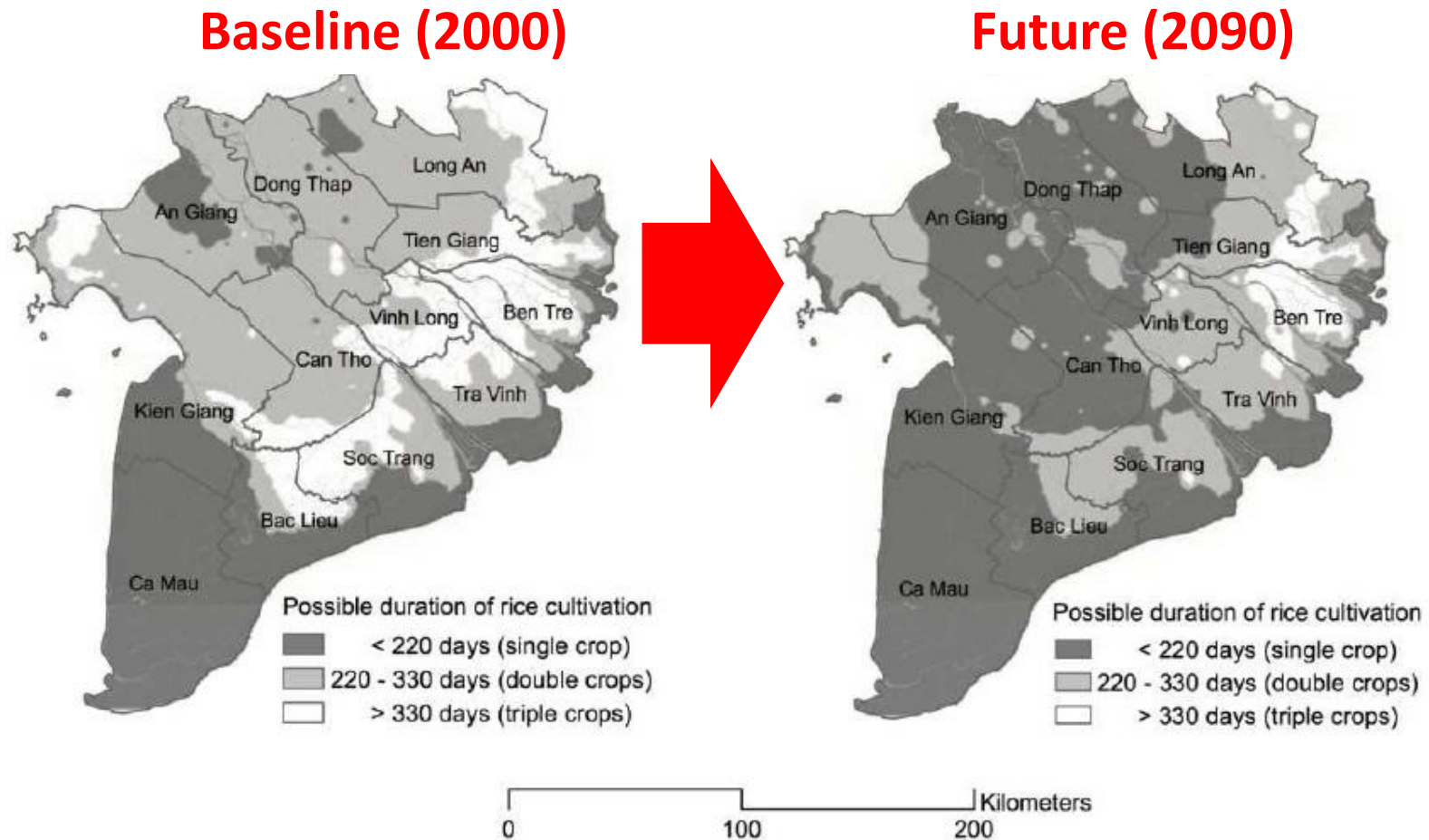
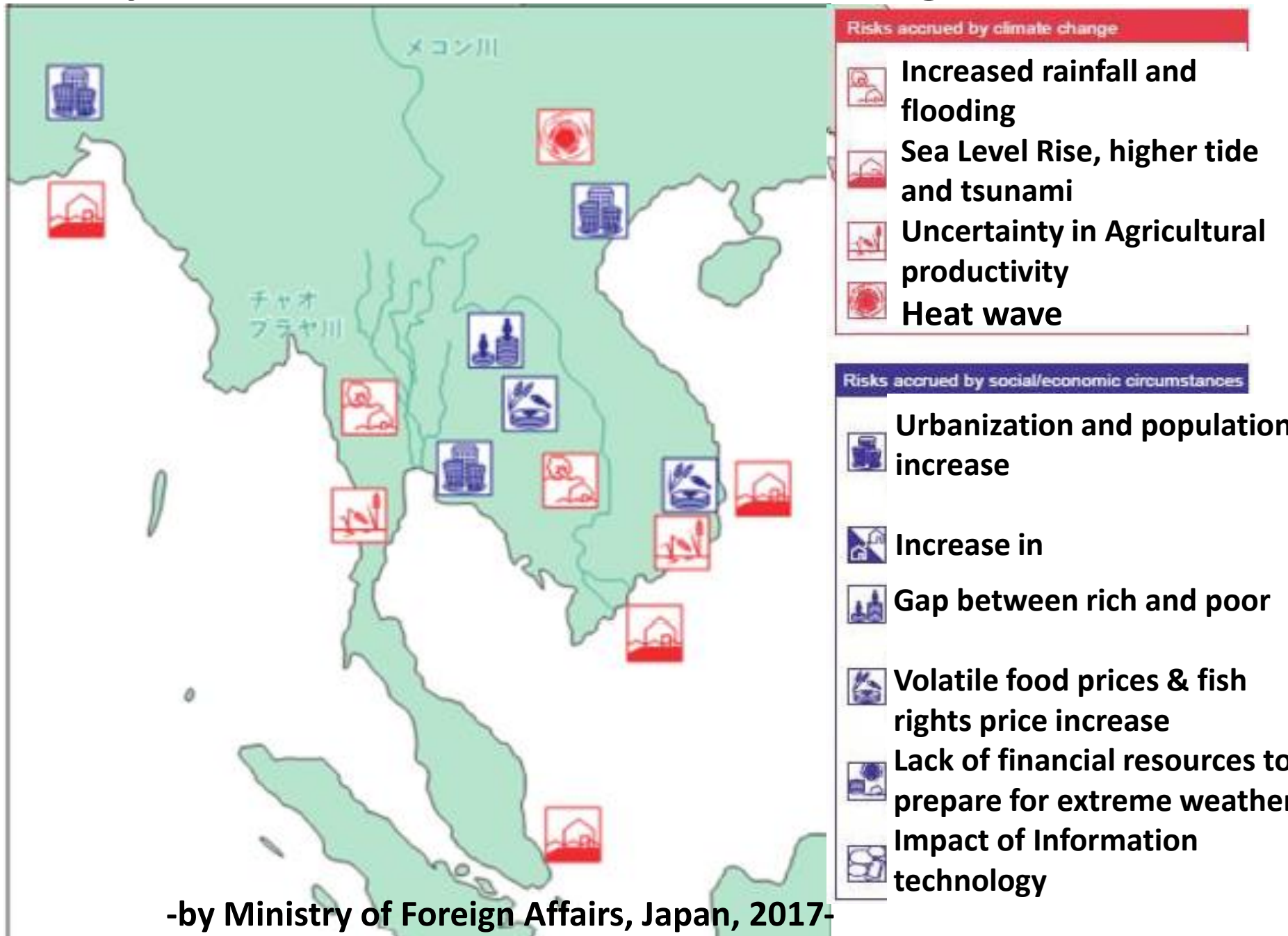


Figure 16 : Spatial distribution of the possible duration of rice cultivation as a result of salinity intrusion and flooding in the baseline (left) and future scenario (right) (Khang et al., 2010)

Risks by Climate, Economic, and Social Change in the SE Asia



Impacts of Climate and Socioeconomic Changes to Small Island (Atoll) Countries

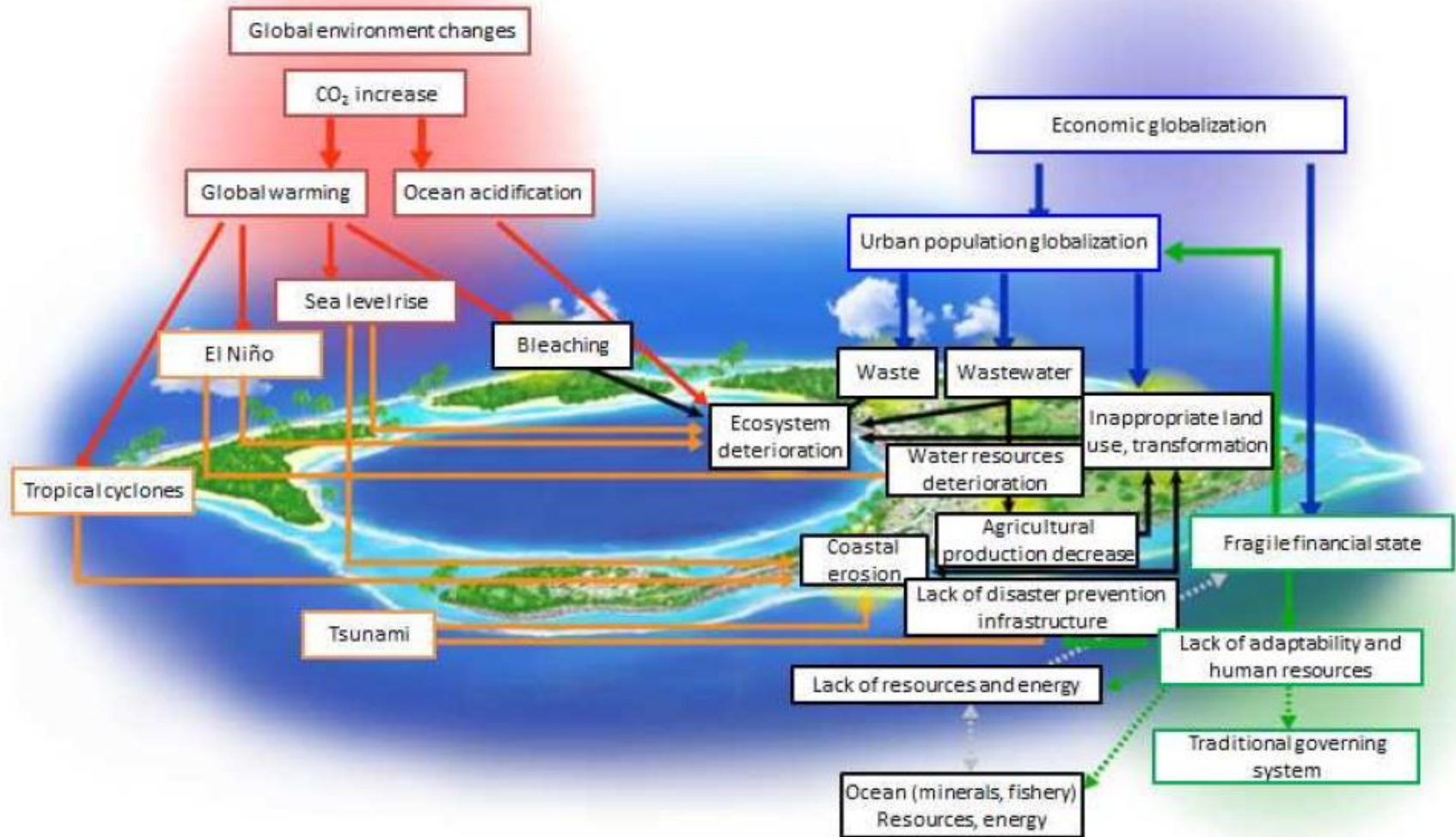
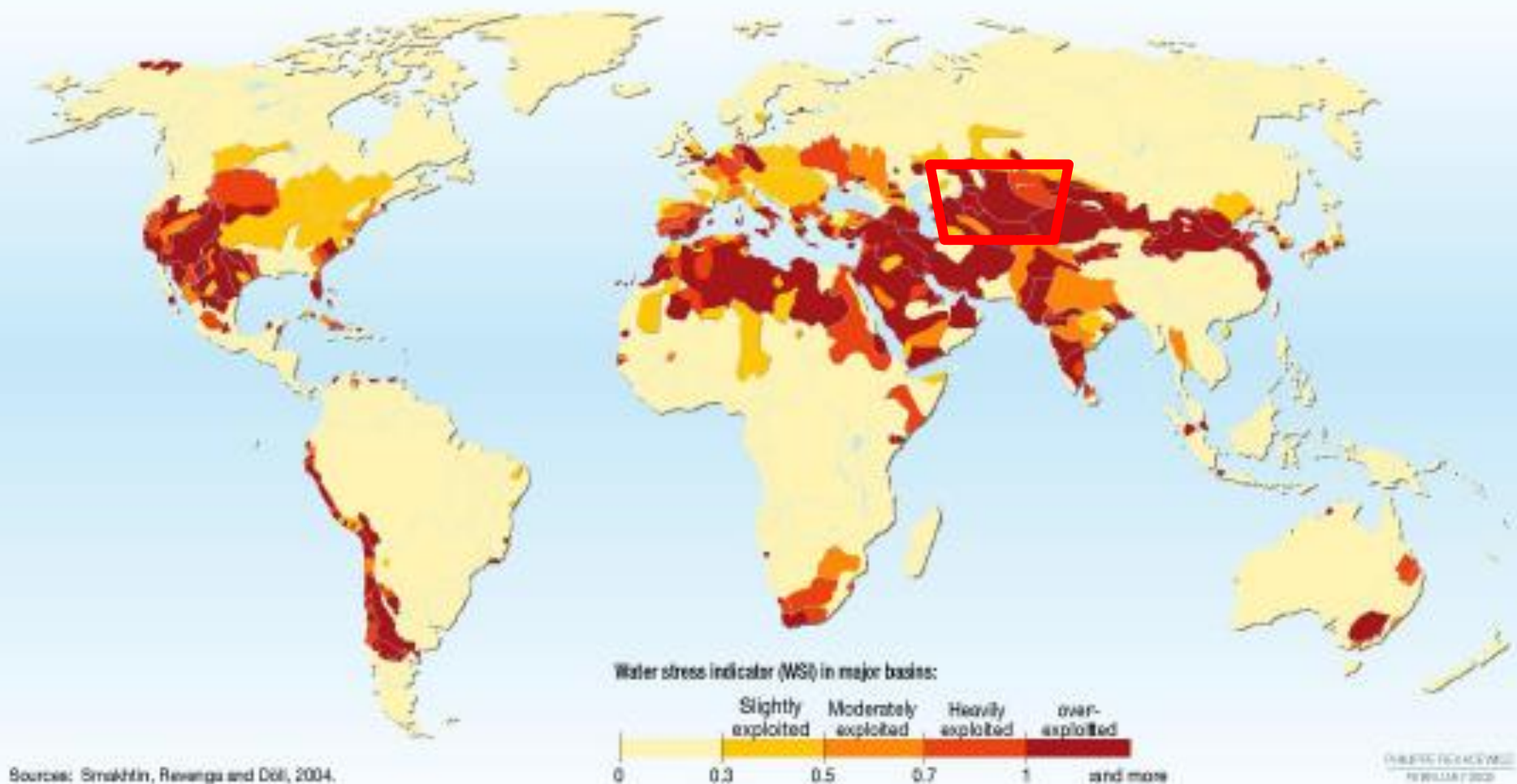


Figure 26 : Problems surrounding atoll countries (Kayanne, H. et al., 2014)

Water Scarce Area in the World



Water Scarcity Index (UNEP)

Shrinking Aral Sea

Source : UNEP



 IWRM is needed in Many (All) Parts of the World

IWRM in the entire water cycle

Integrated use of surface and ground water

- ✓ Setting benchmarks and targets
- ✓ Integrated use of water using the targets
- ✓ Scenario-based management

Groundwater
Recharge



Conservation of forests
and watersheds

Coordination with
rain/recycled water
management



People's
participation



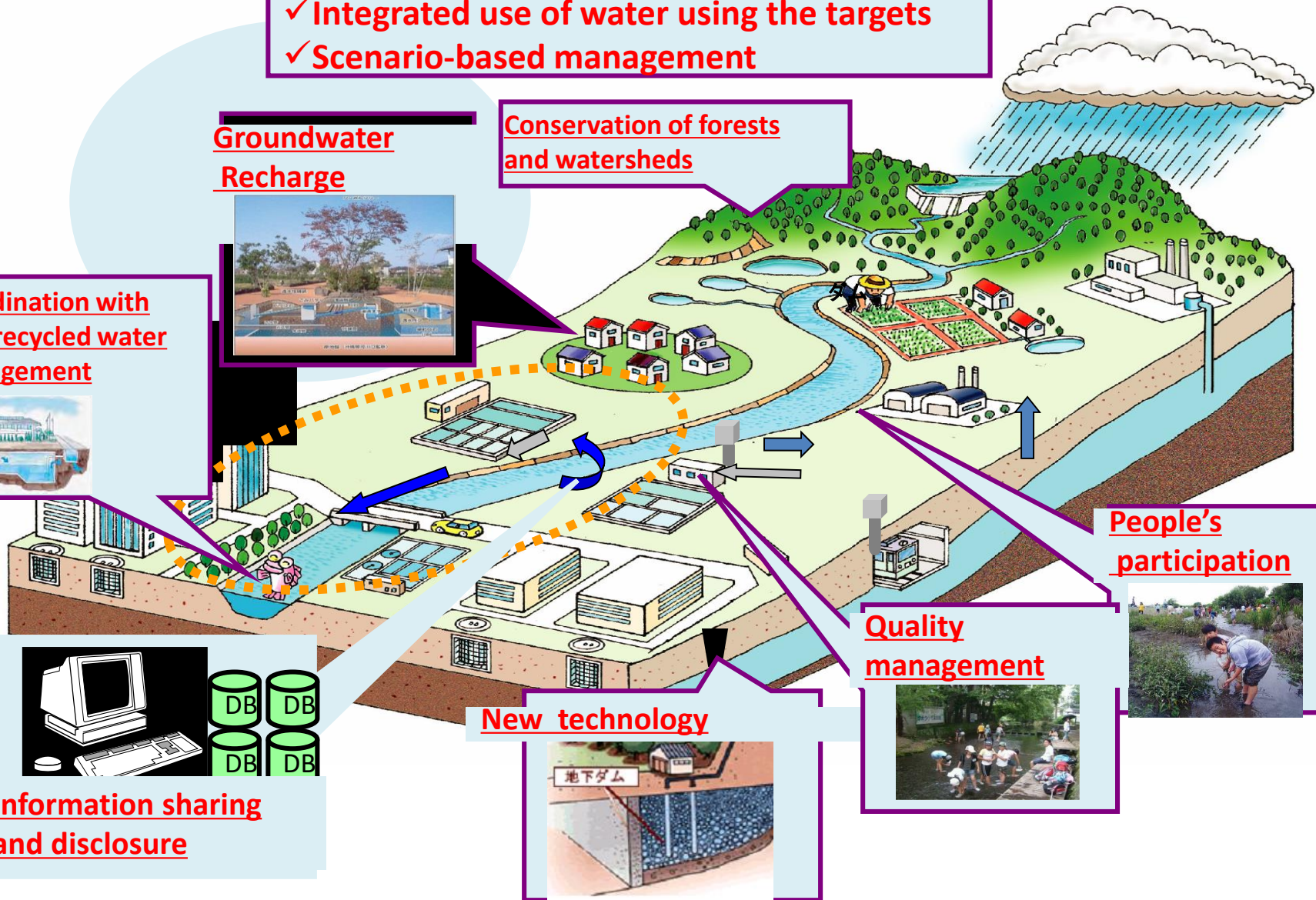
Quality
management



New technology



Information sharing
and disclosure



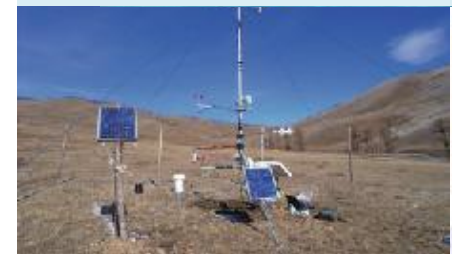
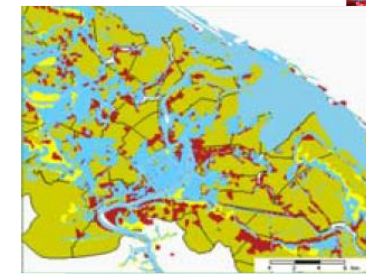
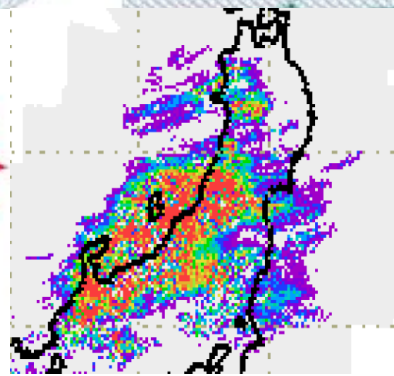
Using satellite information for IWRM

Flood Forecast, Basin monitoring, Climate Change Adaptation, Disaster management, etc.



Link to simulation & forecast system

Observation Satellites



地上観測

Ground & surface sensors

Ocean and seabed observation

Integration of database on water, air and land



From lessons of the recent experiences and study on Asia Messages to Earth Observation Community (EOC)

EOC=Academia, practitioners, and all stakeholders (incl. water)to engage in planning, research, application, funding, and use of earth observation

- **Extreme hydrological events are expected to happen simultaneously in vast areas in countries of Asia.**
 - **Multiple decision and actions should be made in coordinated and swift manners.**
 - **Informed decision through multi-stakeholder platform is indispensable.**
 - **Countries in Asia ban and should share cornucopia of information including geospatial ones.**



Proactive participation by EOC is critical in meeting those challenges. The help of GEO will be greatly appreciated by all.

- **Climate Change is affecting extreme weather events globally and locally .**
 - **Empirical DRR solution based on statistical data analysis may not meet the challenge.**
 - **Innovative method for DRR taking into full account of Climate Change should be developed with help of EOC.**
 - **Decision makers should establish adaptive policy based on advice by scientific community including EOC.**
- **Our society is changing. Community should be strengthened to help vulnerable people, but information sharing is the challenge.**
 - **GIS based DRR system should be built to strengthen capability of the community to help the vulnerable. EOC can give useful advice in building the system.**

Position of Earth Observation in Key International Documents

- **Earth Observation is a must to address DRR and water adaptation locally and globally.**
 - **Does international community recognize this?**
-
- ✓ **Earth Observation is firmly positioned key international agreements and recommendations.**
 - ✓ **Country platform for DRR is also strongly positioned and support to it has been called for.**
 - ✓ **Science and Technology is expected to play more important role in decision making on W and DRR.**

Sendai Framework

Four Priorities for Action

Priority 1: Understanding disaster risk

- (a) To promote the collection, analysis, management and use of relevant data and practical information...**
- (c) To develop, periodically update and disseminate, as appropriate, location-based disaster risk information, including risk maps...;**
- (d) To systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts...;**

Sendai Framework

Four Priorities for Action

- (f) To promote real time access to reliable data, make use of space and in situ information, including geographic information systems (GIS),... ;**
- (h) To promote and improve dialogue and cooperation among scientific and technological communities, other relevant stakeholders and policymakers in order to facilitate a science policy interface for effective decision-making in disaster risk management;**

Six Targets of SDG6



6.1 SAFE DRINKING WATER

EVERY **15 SECONDS** A CHILD DIES FROM A PREVENTABLE **WATER BORNE DISEASE**
200 MILLION HOURS = THE TIME **WOMEN & GIRLS** SPEND FETCHING WATER EVERY DAY



6.6 WATER-RELATED ECOSYSTEMS

GROUNDWATER PROVIDES **DRINKING WATER** TO AT LEAST **50%** OF THE GLOBAL POPULATION
THE EFFECTS OF **CLIMATE CHANGE & URBANIZATION** WILL IMPACT THE **WATER-CYCLE** - INCLUDING VITAL **GROUNDWATER RESERVES**



6.2 SANITATION AND HYGIENE



MORE THAN **1 IN 3** PEOPLE HAVE NO ACCESS TO IMPROVED **SANITATION**. **1 IN 7** STILL PRACTICE **OPEN DEFECATION**



SOME COUNTRIES **LOSE AS MUCH AS 7% OF GDP** BECAUSE OF INADEQUATE SANITATION



6.5 INTEGRATED WATER RESOURCES MANAGEMENT



2/3 OF THE WORLD'S POPULATION COULD FACE **WATER STRESS** BY 2025

ACCESS TO **WATER** POSES THE BIGGEST **SOCIETAL AND ECONOMIC RISK** OVER THE NEXT TEN YEARS



6.4 WATER EFFICIENCY



70% = AMOUNT OF TOTAL **WATER CONSUMPTION** USED FOR **AGRICULTURE**

85% = INCREASE IN **WATER DEMANDS** CAUSED BY RISING **ENERGY PRODUCTION** BY 2035



6.3 WATER QUALITY



OVER **80%** OF **WASTEWATER** WORLDWIDE IS DUMPED — **UNTREATED** — INTO WATER SUPPLIES



2 MILLION TONS = AMOUNT OF **HUMAN WASTE** DISPOSED IN **WATER COURSES** EVERY DAY



- ✓ Very ambitious targets. Praise the UN and the world.
- ✓ The targets are related to other development agenda such as health, food, education, and gender
- ✓ IWRM is included as Target 6.5 as an “integrator” of SDG6

SDG targets and Indicators related to WRM

SDG Target	Indicator and Custodian Agency
11.5. By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters,...	Indicator 11.5.1: Number of deaths, missing persons and persons affected by disaster per 100,000 people (ISDR)
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as app	6.5.1 Degree of integrated water resources management implementation (0–100) (UNEP) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation (UNESCO/UNECE)
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time (UNEP/Ramsar Convention)

High Level Panel on Water (HLPW) *Special Advisor*



Kevin Rutte
Prime Minister
Netherlands



János Áder
President
Hungary



Emomali Rahmonov
President
Tajikistan



Dr. Han Seung-soo
Former Prime Minister, Republic of Korea



Macky Sall
President,
Senegal



Enrique Peña Nieto
President,
Mexico



Ameenah Gurib-Fakim
President,
Mauritius

Co-chairs

Co-convened by:



Pedro Kuczynski
President
Peru



Jacob Zuma
President
South Africa



Abdullah Ensour
Prime Minister
Jordan



Sheikh Hasina
Prime Minister
Bangladesh



Malcolm Turnbull, PM
Australia



UNITED NATIONS



Antonio Guterres
UN Secretary-General



WORLD BANK



Jim Yong Kim
President
World Bank Group

Recommendations in HLPW Outcome Document on Disaster Risk Reduction

HEADLINE RECOMMENDATION

Shift focus of disaster management from response to preparedness and resilience

DETAILED RECOMMENDATIONS (1/2)

- **Disaster risk prevention and resilience should be integrated in long-term planning.**
- **Platforms on Water Resilience and DRR among all stakeholders should be formulated in countries to facilitate dialogue and scale up community-based practices.**

DETAILED RECOMMENDATIONS (2/3)

- Global research networks, global disaster database, integrated scientific tools for assessing risks, and a global platform integrating science and policy including higher education should be developed and put into support of countries.
- Financing for and investment in water-related DRR and resilience should be doubled within the next five years.
- “Principles on Investment and Financing” should be used to make effective use of this increased investment and could help increasing investments in countries.

FINAL DECLARATION

High-Level International Conference on the International Decade for Action “Water for Sustainable Development”

We, the participating representatives of states and organizations, Hereby declare to:

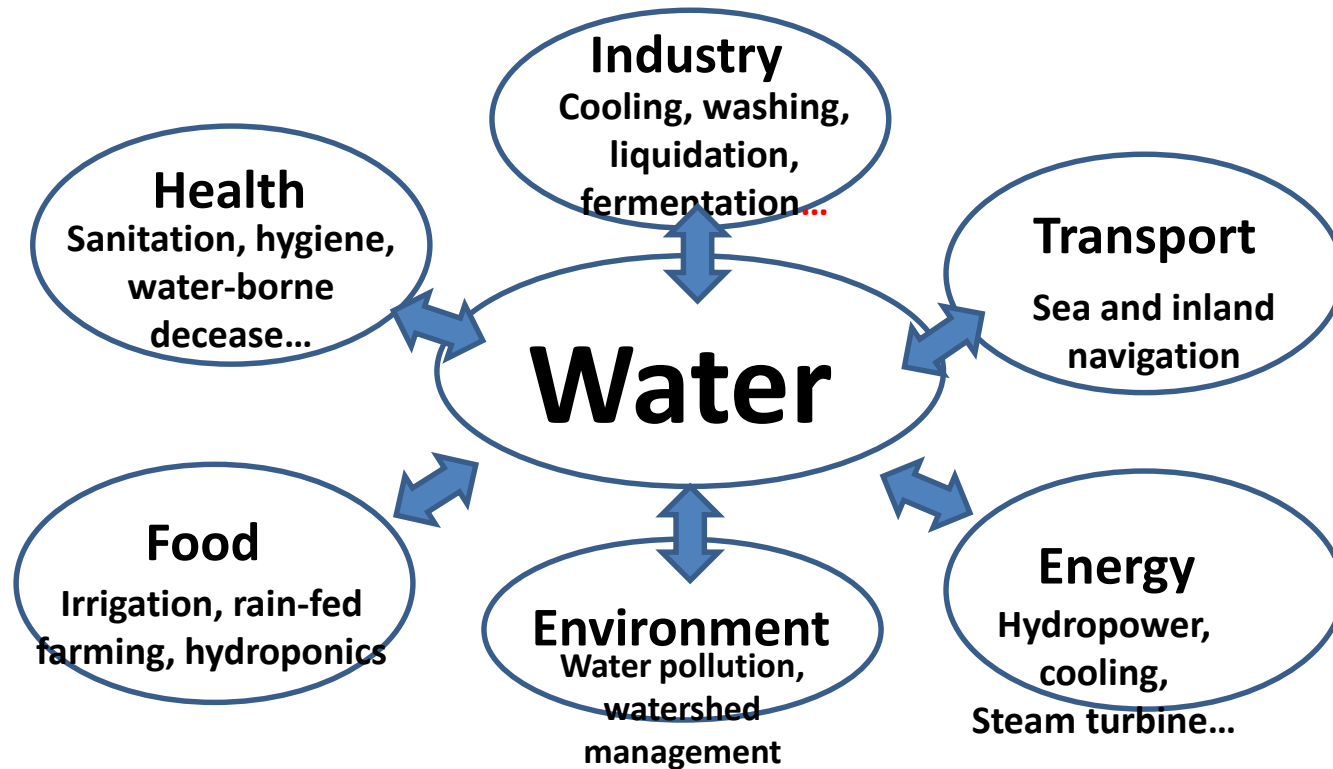
- Promote actions to address water-related disasters... by integrating science into policy, ... by substantially increasing investment in disaster risk reduction and establishing financing and investment principles and by supporting alliance of alliances..., contributing to promote action for climate change adaptation and disaster risk reduction activities;...**
- Invite countries to consider the establishment of Water Action Decade centers and partnerships on specific themes, such as one for water and disasters, ...**

National Water Cycle Management Plan, Japan

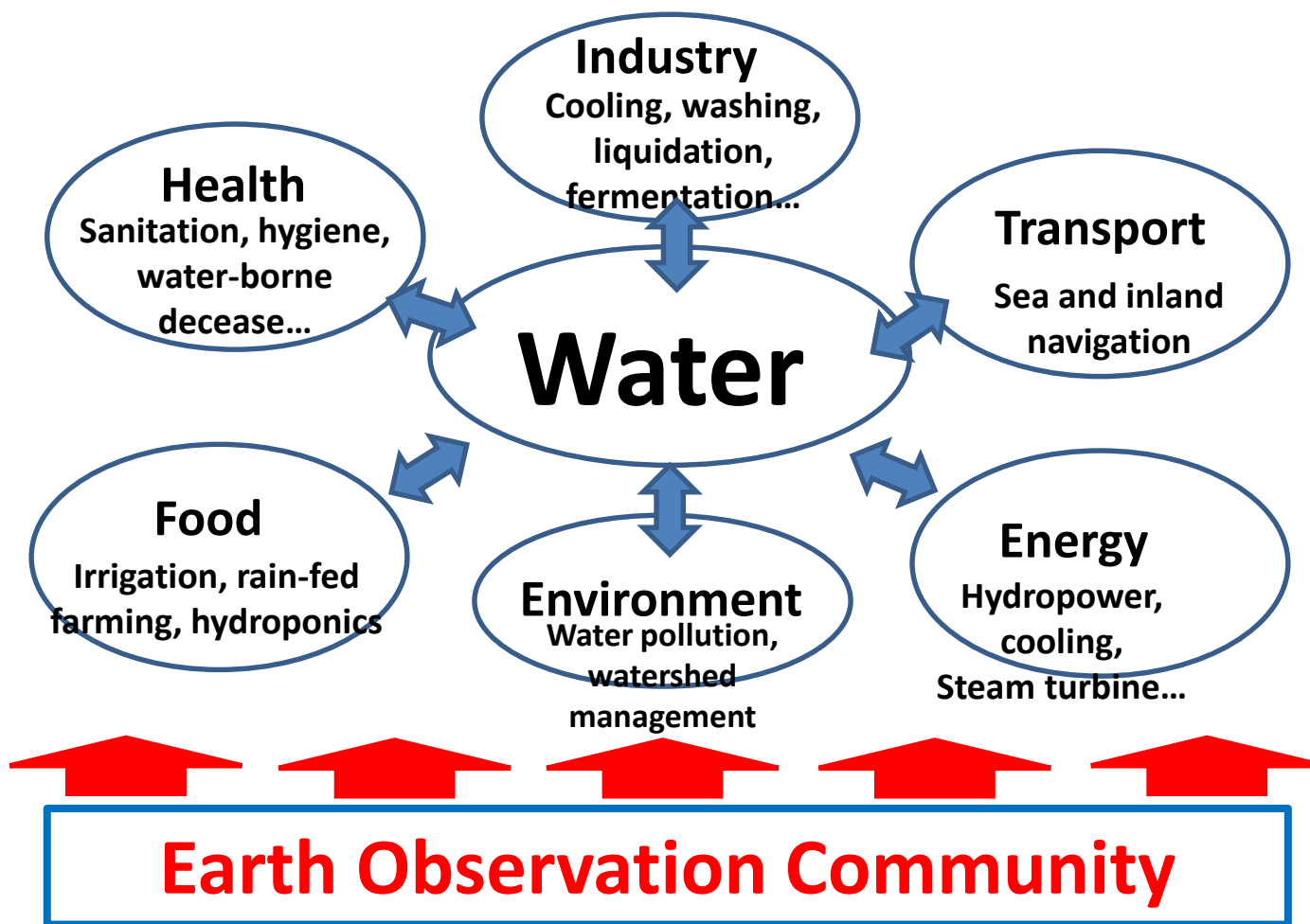
Chapter on “use of satellites”

- 1. GEO should be utilized as effective Framework of International Collaboration**
- 2. Monitoring of water cycle and water-related disasters should be strengthened by satellites**
- 3. Research and development system on global observation, analysis, and application by satellites should be strengthened. Their use, coordination, and collaboration should be promoted.**
- 4. Constant and seamless earth observation system by constellation of earth observation satellites should be built.**
- 5. Water cycle database system should be developed and operated in progressive manners. The database should be distributed on sub-real time basis and shared among countries.**

Water as a Key Element in Sustainable Development



Water as a Key Element in Sustainable Development **supported by GEO**



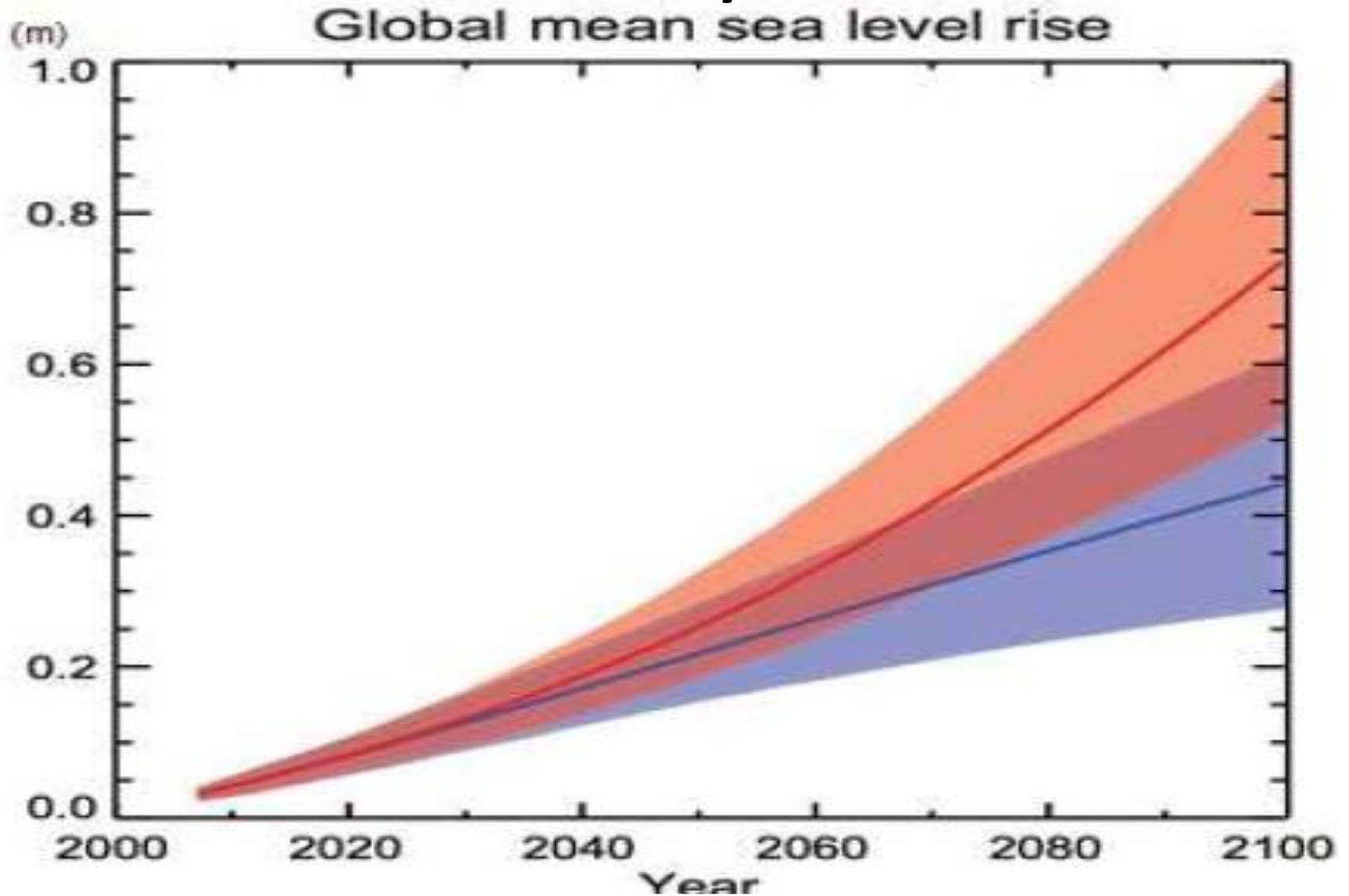
Thank you

In Summary

- Water-related Disasters are increasing in numbers and severity. New challenges for DRR are emerging due to Climate and Social Changes. The Challenges can be solved only by proactive use of global observation data and information.**
- While Integrated Water Resources Management is a must for securing water and preventing catastrophes in the world, effective implementation of IWRM requires multiple basin-wide geospatial information. Water and Earth Observation Communities can jointly help to build effective IWRM System in many parts of the world.**

- **The UN and International Community recognize the challenges and propose approaches that aim to integrate informed decision making based on science and technology with emphasis on earth observation.**
- **The priority actions include founding platforms on Water Resilience and DRR among all stakeholders and building global research networks, global disaster database, integrated scientific tools for assessing risks, and a global platform integrating science and policy including higher education**

Projection of sea level rise by Climate Change for the next 100 years



Projection of global mean sea level rise (IPCC, 2014)

Increased frequencies of the maximum daily precipitation in South China under Climate Change Scenario

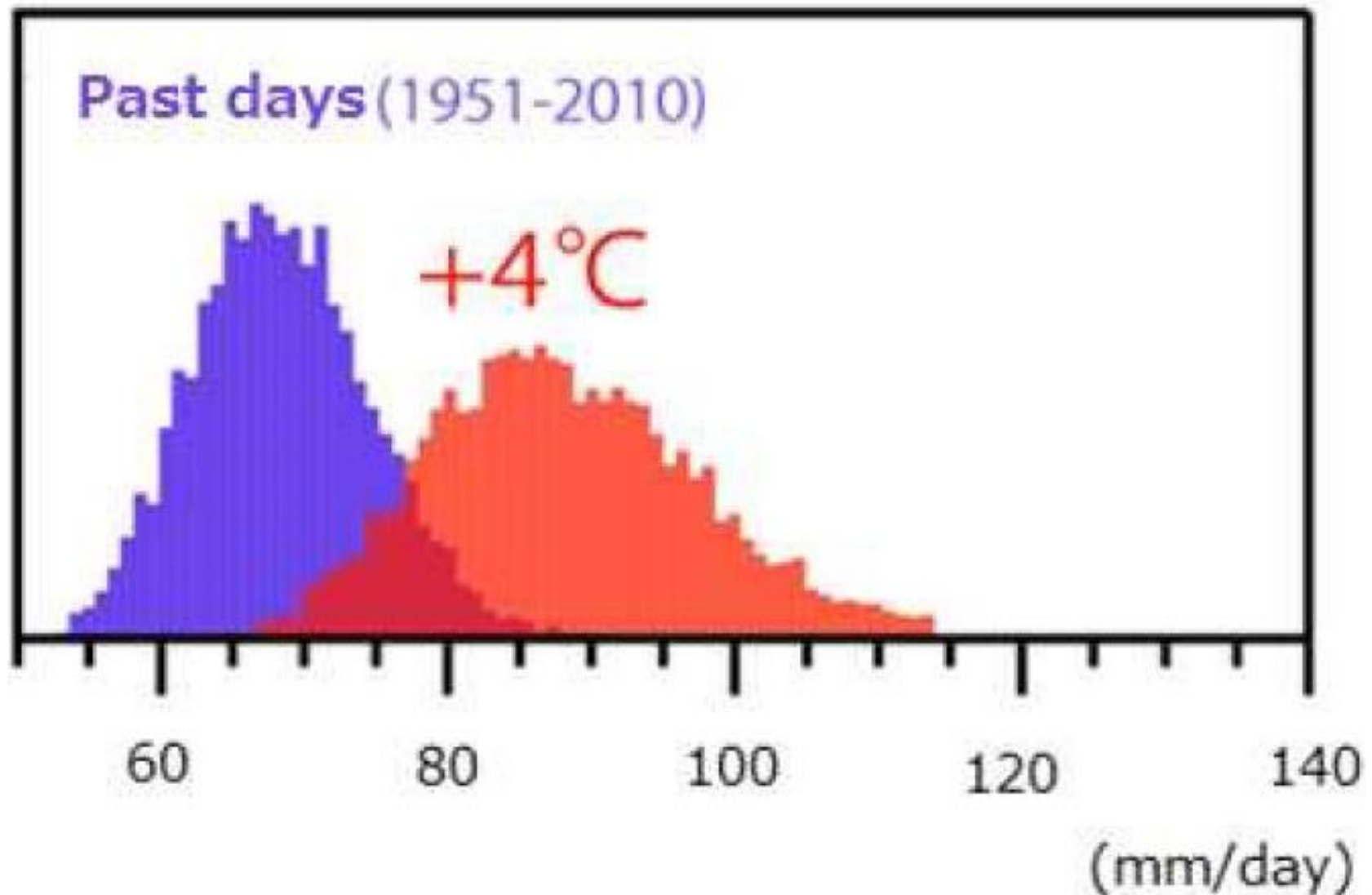


Figure 9 : Distribution of frequencies on the annual maximum daily precipitation averaged over South China (NIES, SOUSEI Program, 2017)