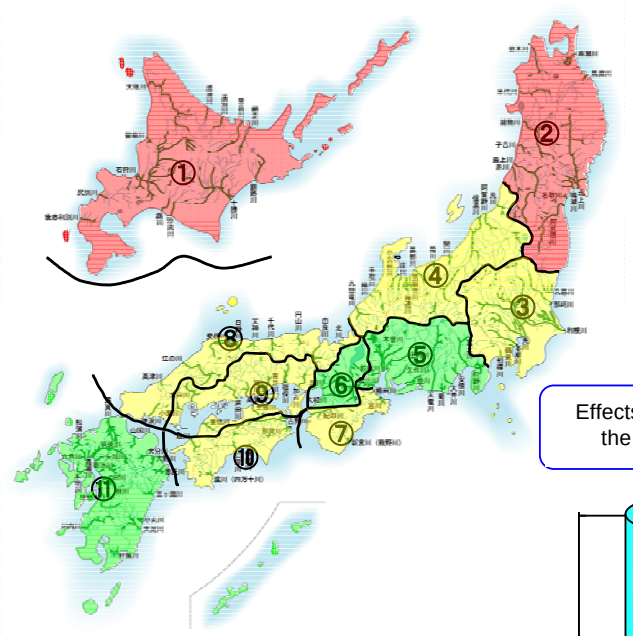
Development of base technology for helping specify and select a group of measures against large-scale flood disasters under climate change

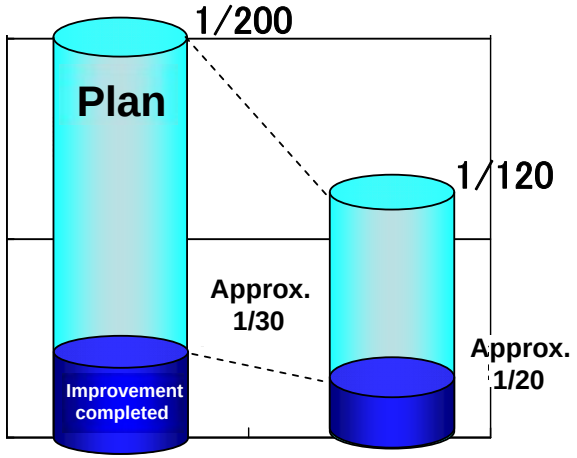
Research project: Fiscal Year 2010 through 2013

Effects of climate change of concern



Effects of rainfall amount increase in 100 years on the safety level against flood in the Ara River

Rate of increase of annual maximum daily precipitation (future/present)
(Calculated base on GCM20 (A1B scenario))
→ Concerns about frequent occurrence of intensive rainfall



Safety level against flood (return period)

→Rainfall amount increase by 10 to 20% greatly deteriorates safety level against flood.

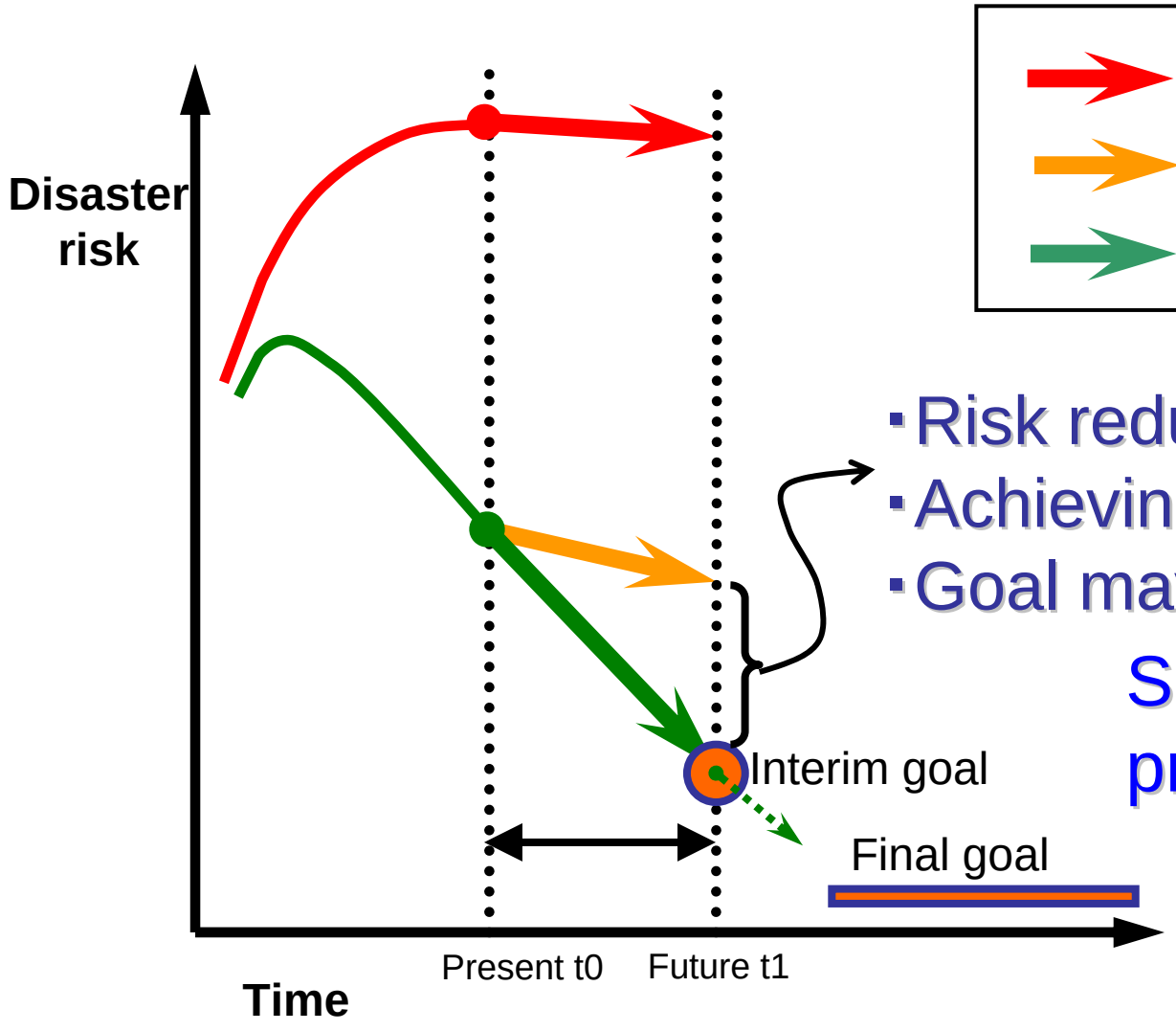
Low level of flood control facilities development relative to intensive land use

Disaster risk increase under climate change

Double difficulty

Basics of flood disaster adaptation measures under climate change

～Reaction to flood disasters in Japan～



- Risk reduction slows down
- Achieving the goal is delayed
- Goal may not be achieved

Solving the above problems is required.

Difficulties on the mitigation of flood disasters under climate change

- Existing measures have been developed under strict constraints.➔Preventing the delay of progress of risk reduction and achieving goals as planned under climate change are extremely difficult.➔Innovating conventional flood control measures is required.
- Uncertainty is involved in the prediction of heavy rain under climate change.
  ➔How to reflect uncertainty in measures?

Solutions to the problems

- Improving the accuracy of heavy rain prediction and identifying the reliability of prediction
- Increasing measure options
- Developing a new flood control planning theory
- Reducing the frequency of disaster occurrence and considering the disasters that may occur➔Adopting detailed risk assessment on a full scale

Results and bottlenecks of previous studies

- Coordination with the “Innovative Program of Climate Change Projection for the 21st Century” implemented by the Ministry of Education, Culture, Sports, Science and Technology in fiscal year 2007 through 2011, to which the latest predictions of heavy rain under climate change are input.➔It takes some time and some uncertainty remains.
- Measure option menus that serve adaptation measures are generally available.➔The menus remain as menus. No planning methods have yet been developed to select appropriate options and prepare adaptation measures based on the basin conditions and feasibility.
- Risk assessment methods that enable detailed measure assessment are under review.➔Whether risk assessment methods are usable or not has yet to be known.
- “Integrated water resources management” guidelines➔Concepts and general remark should be linked to the introduction of case studies.

Objectives and basic stance of the research project

【Objectives】

- To enhance practicable measure options.
- To establish risk assessment methods as a fundamental technology for assessing measures.
- To present a basis for adaptation measures planning methods.
  ➔➔➔Base technology that helps define and select a group of measures.

【Basic stance for conducting research】

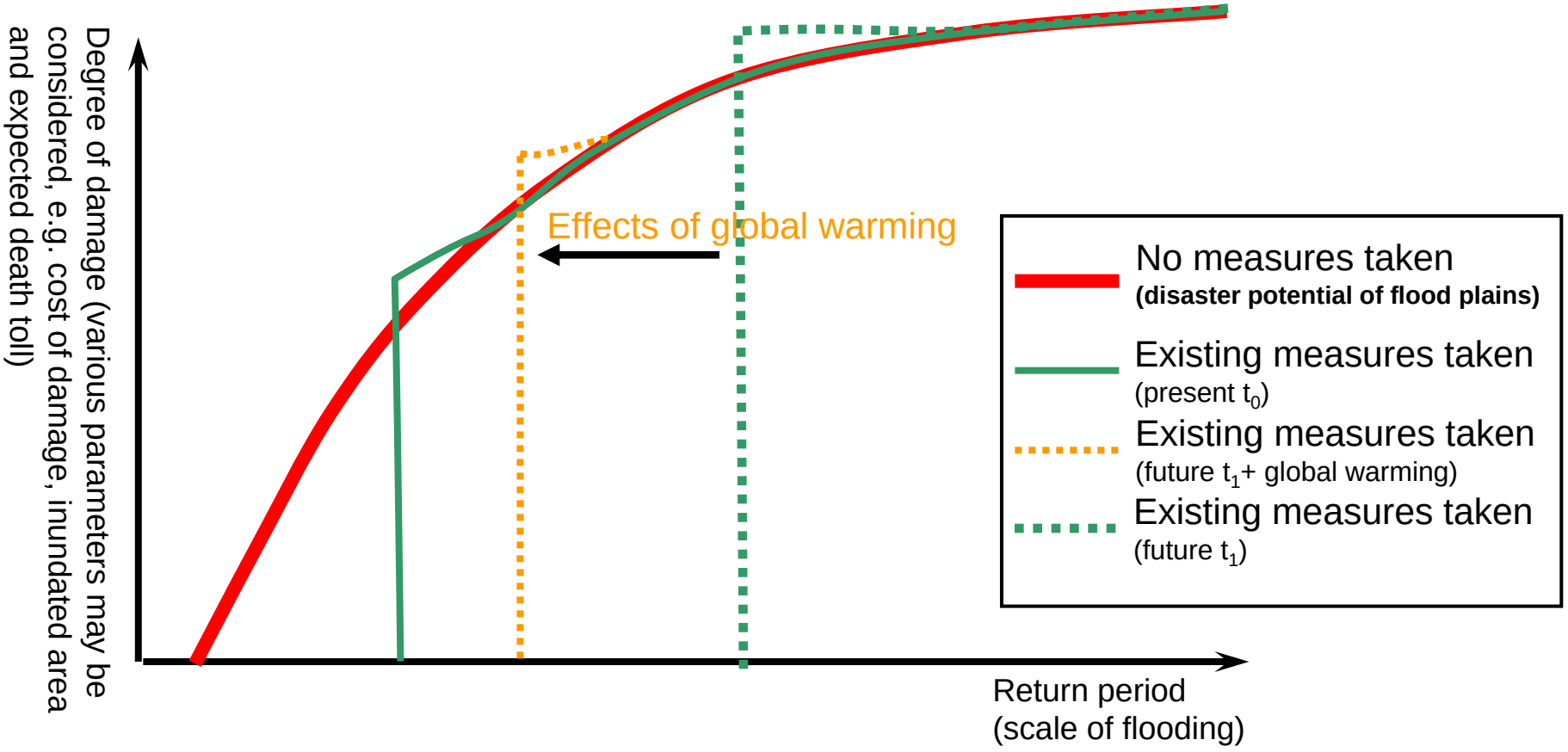
- Prediction of heavy rain will be left to outside researchers. Focus will be placed on how to use the predictions.
- Emphasis will be placed not on the development of new measure options but on the determination of their usefulness and enhancement of options.
- Emphasis will be placed on feasibility review. To that end, field data collected by administrative authorities will be identified and used to the maximum extent possible.
- Emphasis will be placed on the interaction of the “study of specific data close to those available in case studies” and the “development of methods”. Basins will be classified.➔Representative basins will be selected.
- “Integrated management” approach: Research will be conducted focusing on flood control. Compatibility and incompatibility with other fields of measures will be examined and specific conditions will be sought under which integrated measures are beneficial.

Research programs

Theme	Fiscal year of implementation			
	2010	2011	2012	2013
(i) Research concerning the flood disaster risk assessment methods				
(i)-1 Establishing methods for defining future meteorological conditions and socioeconomic change scenario	Defining meteorological conditions and socioeconomic change scenario	Re-defining meteorological conditions		
(i)-2 Developing flood disaster risk assessment methods for various types of damage	Primary proposal	Final proposal		
(i)-3 Developing methods for calculating damage reduction by respective measure options	Primary proposal	Final proposal		
(ii) Research concerning the methods for selecting and combining measure options (planning methods)				
(ii)-1 Refining measure options and identifying conditions for applying measure options based on their feasibility	Primary proposal of options	Final proposal of options	Reviewing feasibility and application conditions	
(ii)-2 Identifying the effectiveness of alternatives incorporating multiple measure options for reducing damage	Primary proposal of alternatives	Final proposal of alternatives	Identifying the effectiveness for reducing damage	
(ii)-3 Reviewing the methods for selecting and combining measure options (adaptation measures planning methods)		Primary proposal	Final proposal	
(iii) Research on “integrated” measures				
(iv) Research on the development of base technology		Primary proposal		Final proposal

Establishing risk assessment methods as a basis for measure assessment
—Theme (i)—

- Risk: (Damage) × (probability of occurrence (return period)
- Making it possible to state the relationship of the degree of damage and probability of occurrence (return period) for key damage parameters

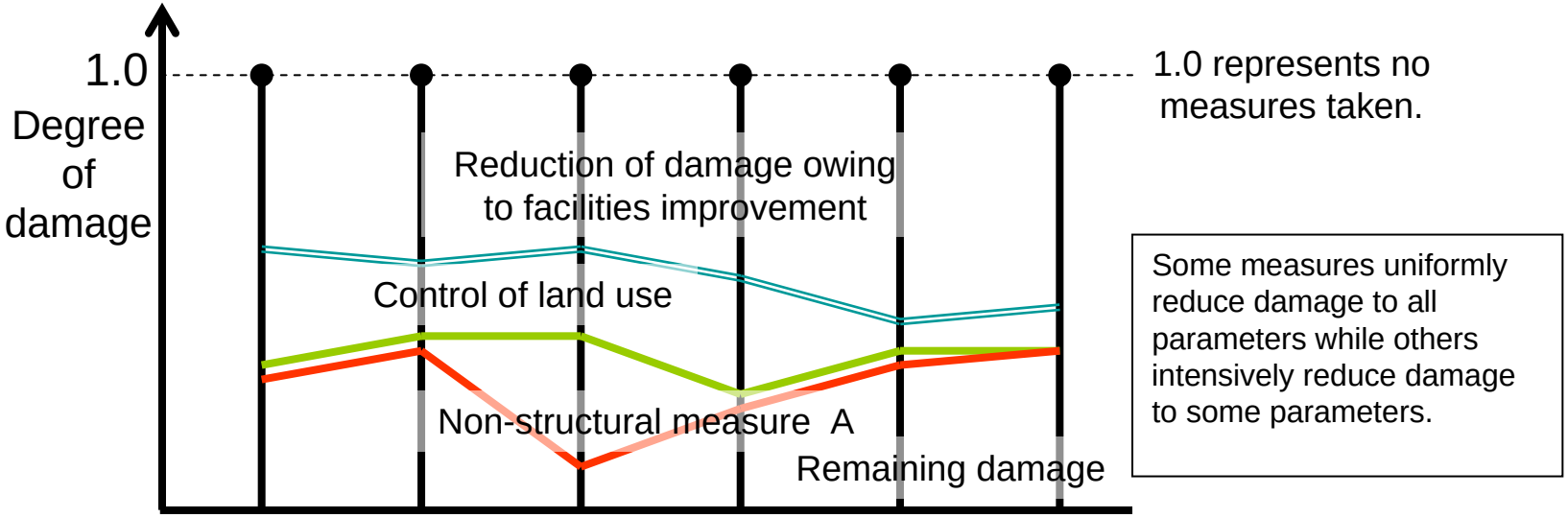


Developing flood disaster risk assessment methods for various types of damage - Sub-theme (i)-2 -

- Methods will be sought for comprehensively assessing the types of damage reduced by measures and to what degree damage is reduced.

➔Identifying the benefits and positioning of different types of measures applied.

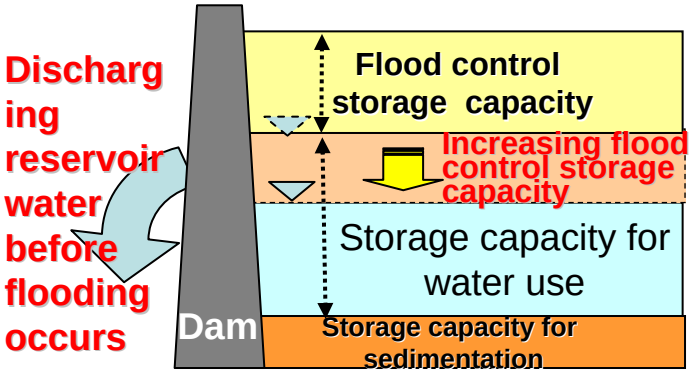
➔Emphasis will be placed on avoiding simple discussion on substitution between structural and non-structural means.

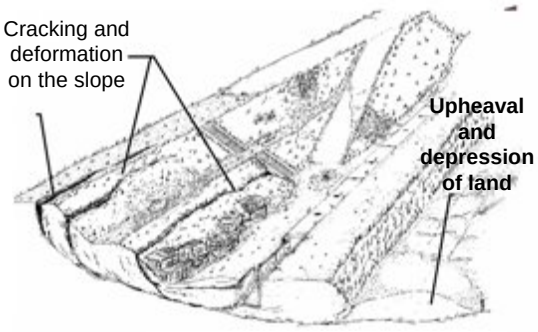


Damage parameters (direct economic damage, personal damage, indirect economic damage, economic impact over a wide area, time required for restoration and rehabilitation, etc.)

Refining measure options and identifying conditions for applying measure options based on their feasibility
- Sub-theme (ii)-1 -

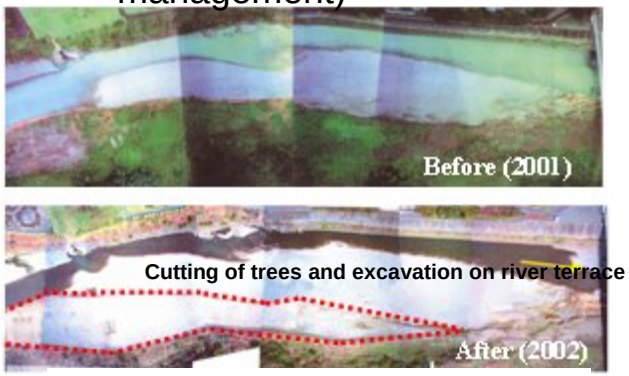
Example 1: Intensive use of existing facilities





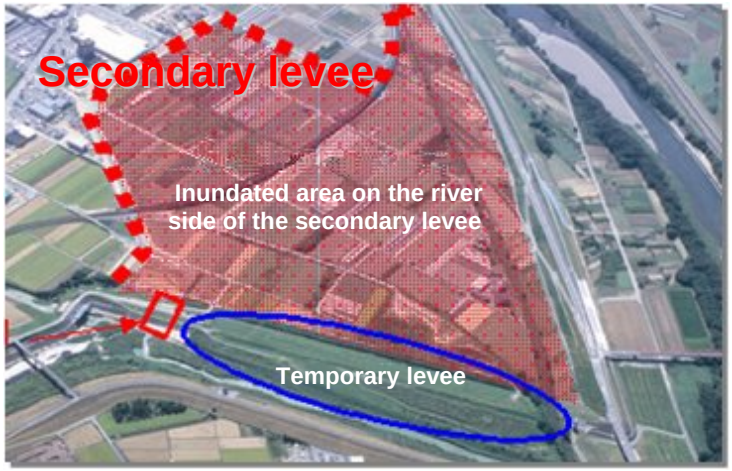
Inspection of the levee

Example 2: Refinement of river channel and levee management (identification of the effects of management)



Control of discharge capacity (image)

Example 3: Strategic control of the flooding of rivers



Example 4: Improving runoff control capacity over a wider area

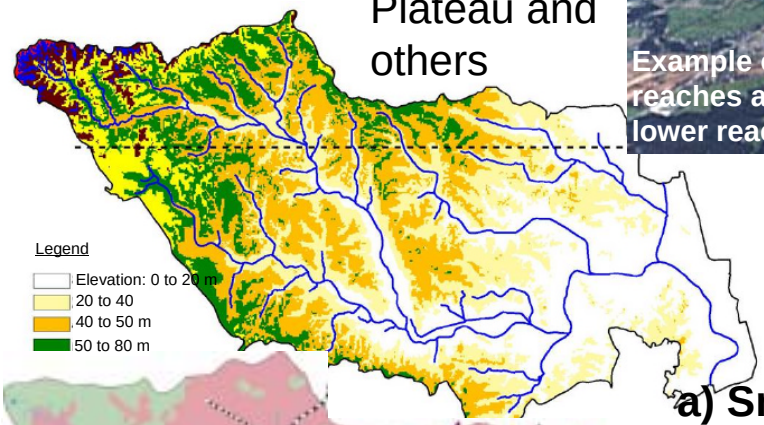
Identifying the effectiveness of alternatives incorporating multiple measure options for reducing damage - Sub-theme (ii)-2 -

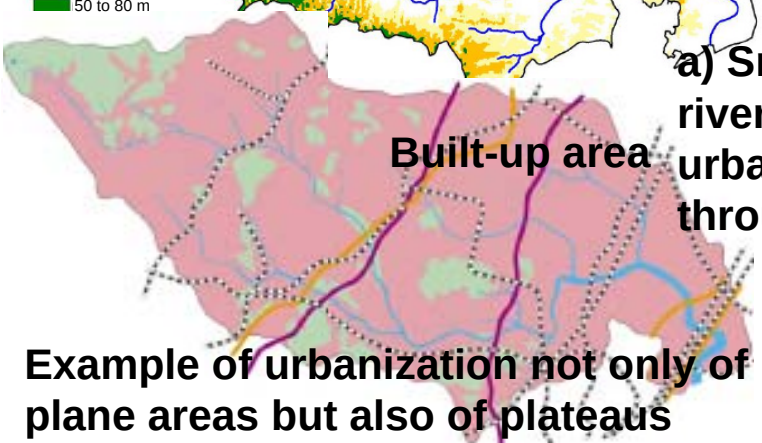
Classification of basin➔Selection of a representative basin area

Example of arable land in the upper reaches and a built-up area in the lower reaches

b) Basin with large arable land and a regional hub city in the plane area

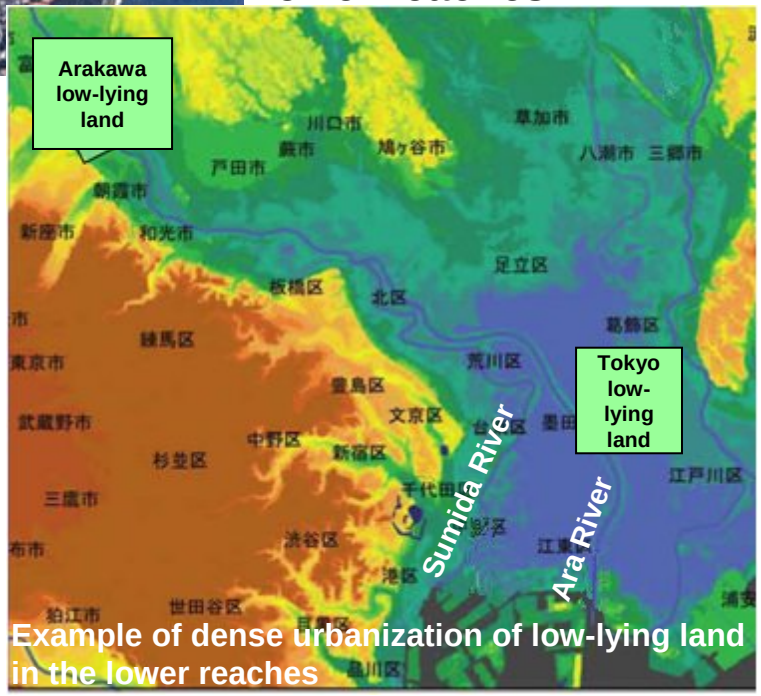
c) Large river basin with a big city in the lower reaches





a) Small to medium river basin that was urbanized throughout the area

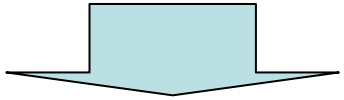
Example of urbanization not only of plane areas but also of plateaus



Example of dense urbanization of low-lying land in the lower reaches

Reviewing the methods for selecting and combining measure options (adaptation measures planning methods) - Sub-theme (ii)-3 -

- Estimating the effects of combinations of adaptation measures in representative basins
- Identifying the influences of long-term conditional changes in demographics, land use, economic growth, social structure, etc. in river basins on the effects of measures
- Identifying regional actions to minimize damage left after the implementation of combinations of measures, and the difficulty of taking such actions
- Reviewing the compatibility and incompatibility of a group of measures serving separate objectives and the methods for integrating different measures ((iii) Research on “integrated” measures)



- Presenting a basic framework for writing a prescription fit for the patient to help determine what adaptation measures are suitable to a specific type of basin.
- Identifying universality and individuality of the above framework

Time-line of this research project

Innovative Program of Climate Change Projection for the 21st Century (fiscal year 2007 through 2011)

FY 2009

Develop an image of framework for planning adaptation measures.

Initiate the research project.

Use the research results obtained in fiscal year 2009 or earlier.
- Methods for reflecting the predictions of changes in heavy rain occurrence due to climate change in the analysis of river planning
- Methods for using X-band radar for controlling urban flood disasters
- Draft plan for applying risk assessment methods

FY 2010

Refine flood disaster risk assessment methods and measure options (primary proposal)

FY 2011

"Case studies of implementation of excellent adaptation measures in Japan and other countries", a study report prepared jointly by Japan, the Netherlands, United States and United Kingdom.

Develop guidelines on base technology including a basis for adaptation measures planning methods (primary proposal)
Refine flood disaster risk assessment methods and measure options (final proposal)

FY 2012

?

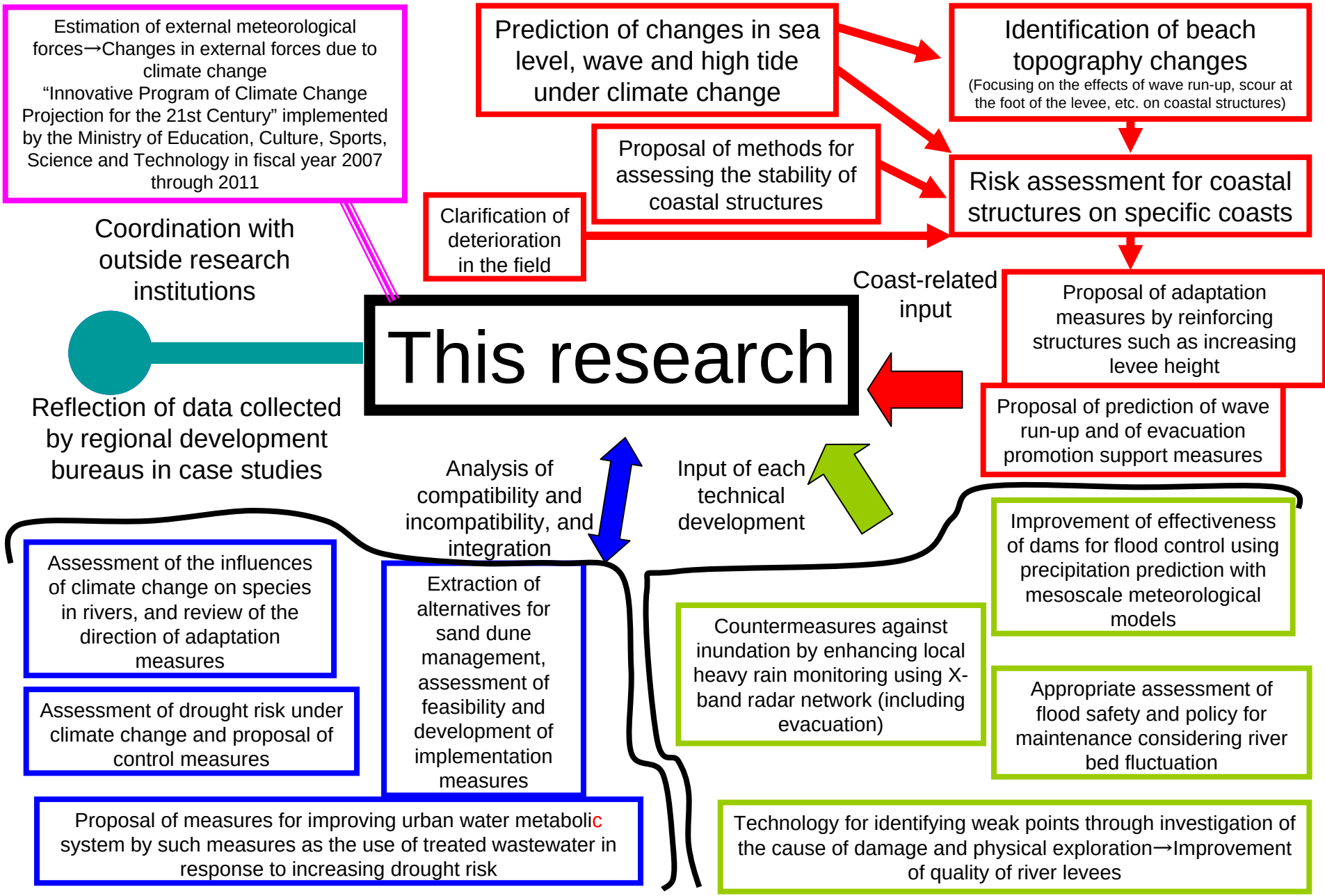
IPCC Fifth Assessment Report will be completed (plan).

Develop guidelines on base technology including a basis for adaptation measures planning methods (final results)

FY 2013

Recommendations of the Panel on Infrastructure Development, Ministry of Land, Infrastructure, Transport and Tourism (June 2008)
"Discussions should be made in the next five years (2013) on the publication of disaster risk assessment methods and assessment results, and on the concept of security in the basin and procedural steps."

Coordination with other related researches



Need, efficiency and effectiveness

Need	Recommendations for active implementation of adaptation measures Science Council of Japan (2008), Council for Science and Technology Policy (2009) and Panel on Infrastructure Development, Ministry of Land, Infrastructure, Transport and Tourism (2008)
Efficiency	・Establishment of a system for receiving data on representative basins and the latest predictions of climate change ・Establishment of a system for using field data ・Building of an organization for integrated deployment of research resources available in related departments (Climate Change Adaptation Research Group)
Effectiveness	・The results of research work in progress can be consecutively reflected in the implementation of measures. ・Results are compiled in guidelines and used for promoting adaptation measures in specific basins.