Development of integrated model for climate change impacts

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1. Background

2. Outline (Sectoral Assessment Factors)

3. Goal

4. MOTIVE Development Procedure

5. MOTIVE Composition

6. MOTIVE SYSTEM Operation

7. Outcomes and Effects

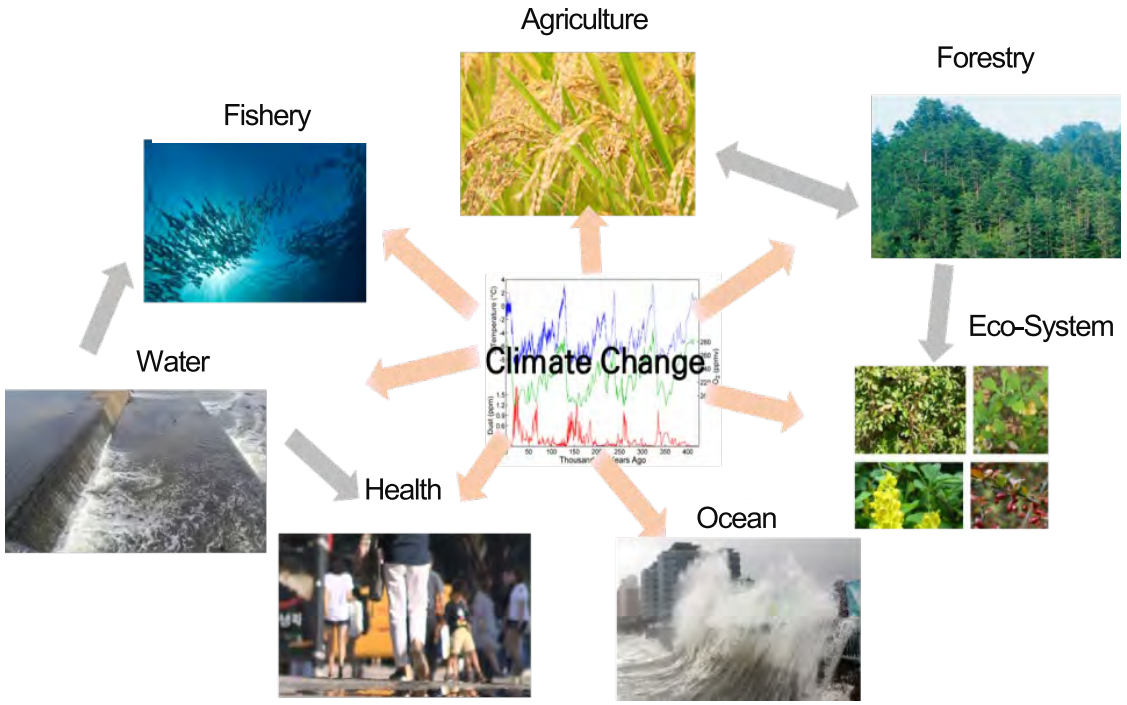
8. New Demands and Ongoing Research

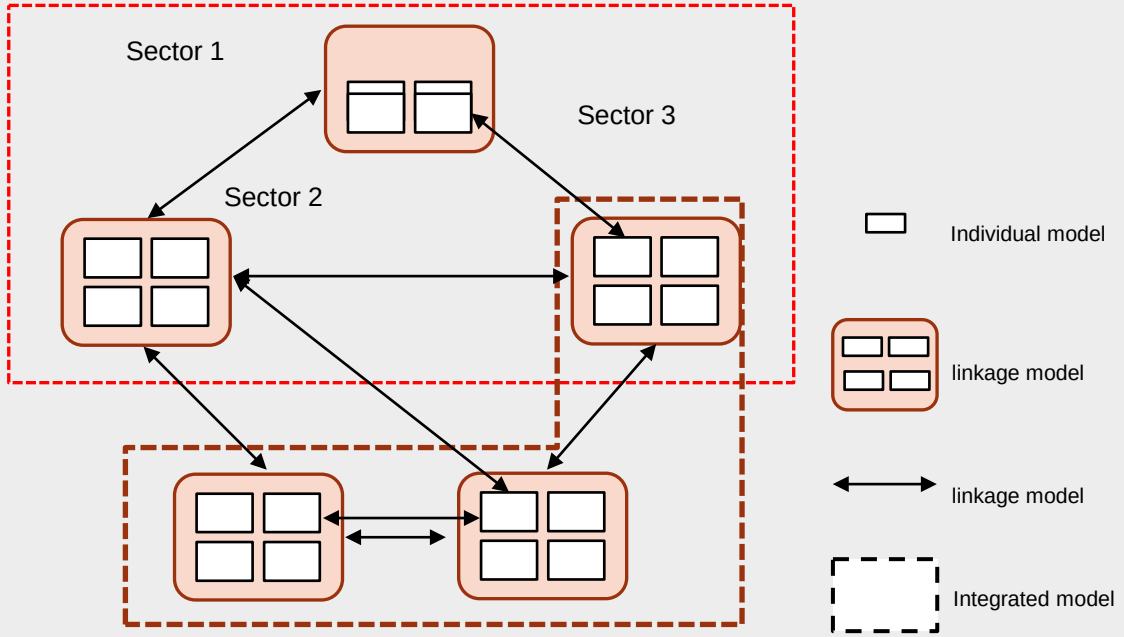
1. Background

- Lack of scientific climate change impact and vulnerability assessment tools
  - Prioritization of adaptation measures through scientific climate change impact and vulnerability assessment and minimization of maladaptation is necessary.
  - Climate change impact and vulnerability assessments have been conducted using various databases and expert weightings.
- Need for integrated assessment through the interconnection of various sectors' complex impacts
  - Despite the diverse, compounded impacts on various sectors due to climate change, impact and vulnerability assessments are still being performed by the sector.
- Development of risk-based evaluation methods centered on quantification and policy linkage
  - Development of risk-based evaluation methods for policy messages based on the scientific results of integrated assessment
    - Utilized when prioritizing adaptation measures.

1. Background

<Concept of integrated assessment model>





2. Outline (Sectoral Assessment Factors)

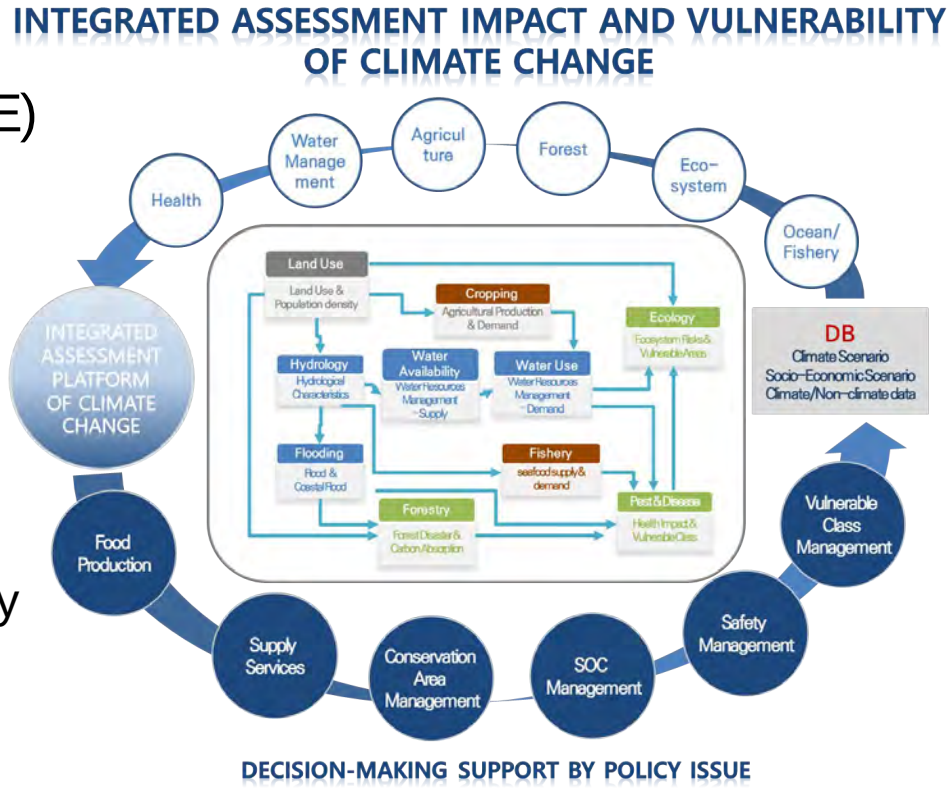
Scopes	
project period	2014.05.01. ~ 2021.03.31.
Resolution	South Korea, 1km x 1km (an administrative district, basin as a unit)
User	Central/Local Government, Researchers, Industry, etc.
Scenario	RCP4.5 & 8.5 / KMA (HadGEM2-AO/HadGEM3-RA/PRISM) & KEI (CESM/WRF/DDS) Climate scenario
System	User-Friendly GUI(web&stand-alone) Based System

Sectors	Assessment Factors
Ocean /Fishery	**13** types such as Sea-level rise(flood, inundation), Fishery primary productivity, Productive capability, Biomass size and Red tide
Health	**9** types such as Heat wave, Air pollution, Infection and Vector-borne disease
Water	**16** types such as Water quantity/quality and Aquatic ecology
Forest	**9** types such as Species distribution, Forest growth, Carbon circulation, Forest disaster(landslide) and Land coverage change
Agriculture	**19** types such as Suitable land for cultivation, Crop productivity, Farmland greenhouse gas cycle, Pest and Eco-System service
Ecosystem	**2** types such as Disturbing species and Climate-sensitive species

3. Goal

■ Development of **integrated assessment model reflecting Korean circumstance** to be utilized for designing 'science-based adaptation strategies'

- Developing cross-sectoral integrated assessment model(MOTIVE)
  - Sectors: Health, Water, Agriculture, Forest, Eco-System, and Ocean/Fishery (where all sectors partially include disaster components)
  - Developing integrated assessment-based model & platform for assessing main policy issues related to climate change (e.g. Preservation area management)
  - Developing methodologies for outlining risk-centric adaptation policy
  - and maximizing its application



3. Goal

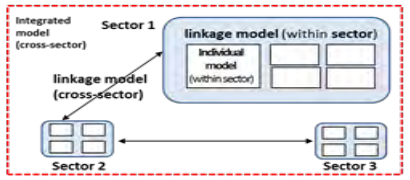
DB

- **Climate / Non climate DB** (including socio-economic scenarios)
- **Weather Generator** to derive the meteorological element (temperature, precipitation) at the sites where there is no observed data

MOTIVE computing server

Model development

- 6 Single-sector models
- Integrated (cross-sectoral) platform
- The Risk Evaluation Model (REM)



Model running

Assessment results

Time period	2030s, 2050s ,2080s
Spatial	South Korea 1km x 1km (an administrative district, basin as a unit)
Scenarios	RCP4.5 & 8.5 KMA & KEI scenario

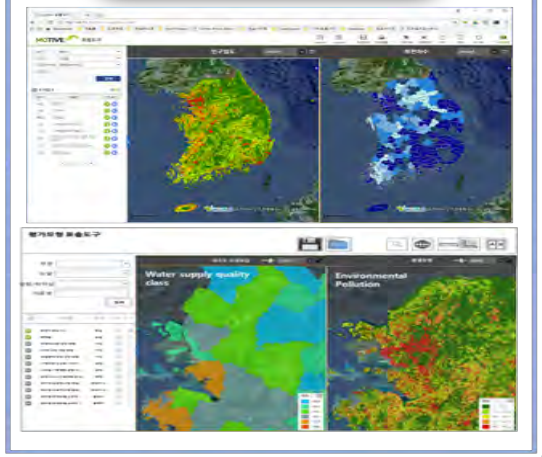
Example)

- **(Single-sector or Integrated platform)** Heat-related attributable deaths, attributable deaths due to PM10, attributable deaths due to O3, Crop yield, Streamflow, Habitat suitability for climate sensitive species, The distribution of CH4 emissions, ... so on.
- **(REM)** The degree of risk expressed in monetary units

Crop yield (rice) considering adaptive capacity (RCP 8.5 KMA scenario)

Display

Web GIS-based visualization tool



Providing additional information using MOTIVE (ex. Impacts of 2020s)

User

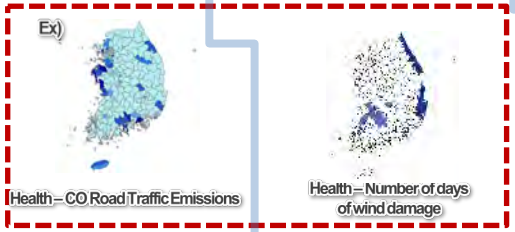
Central/Local Government, Researchers, Industry, etc.

Available to establish the objective polices and plans for adaptation

4. MOTIVE Development Procedure

DataBase Construction

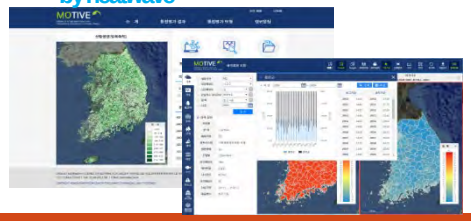
- **Climate Scenario :** KMA, KEI
- **Non-Climate DB :** Integration and standardization of climate change related information
- Future land use : Reflecting the SSP scenario



DBMS (Public)

- View model assessment result
- 68 assessment factors in 7 sectors

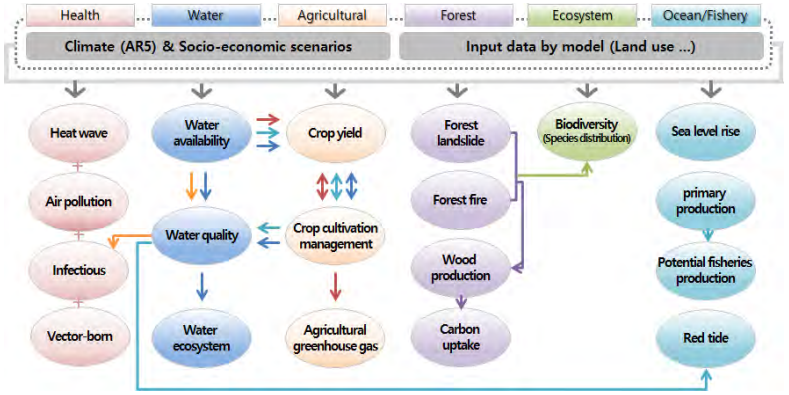
Ex) RCP 4.5, 2050s, number of deaths contributed by heatwave



Linkage Scenario set up

- **Identification of inter-sectoral interactions and verification of model linkage**

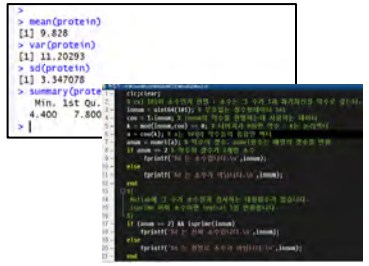
Ex) Estimation of agricultural production taking into account water supply
Ex) Estimation of ecosystem changes in consideration of forest fires and landslide



Individual Sectoral CUI Model

- Selection of factors greatly affected by climate change by sector
- Model development in connection with factors

Ex) Forestry factor linkage model (disaster/ growth /species/carbon absorption)



Individual Sectoral CUI Model

GUI Development

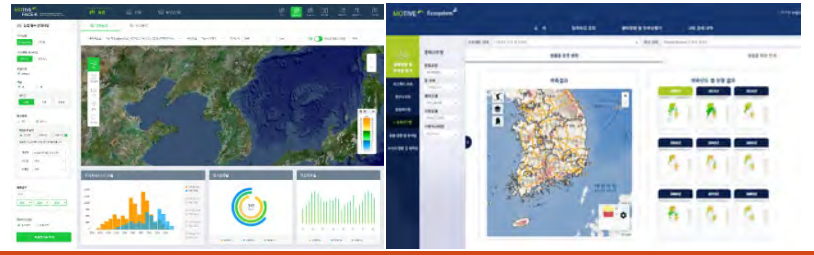
- Strengthen user interface to enhance usability of various consumers

Sectoral GUI Model

Sectoral GUI Model (Expert)

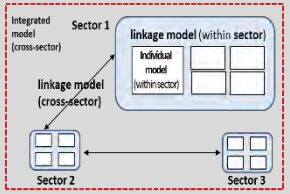
- Enables user direct simulation model
- Model based on linkage scenario and in/out-put data

Ex) Eco-system model (Linkage with Forest disaster)



5. MOTIVE Composition

Single-sector models and cross-sectoral models



to clearly identify
the interconnected impact
and vulnerability of climate change into each sector

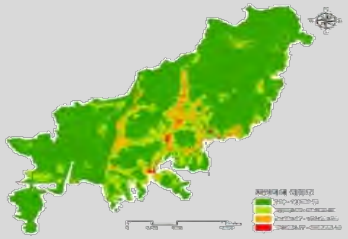
The Integrated Assessment Platform (IAP) and The Integrated Spatial Model (ISM)

to undertake rapid simulations of integrated impacts and to discover adaptation strategies for minimizing
the climate change impacts

The Risk Evaluation Methodology (REM)

ties that bind adaptation
policies and applied simulations

Ex) The risk of property damage in Busan

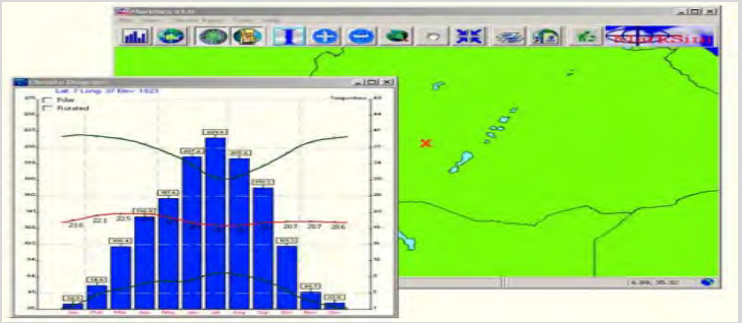


Display tool

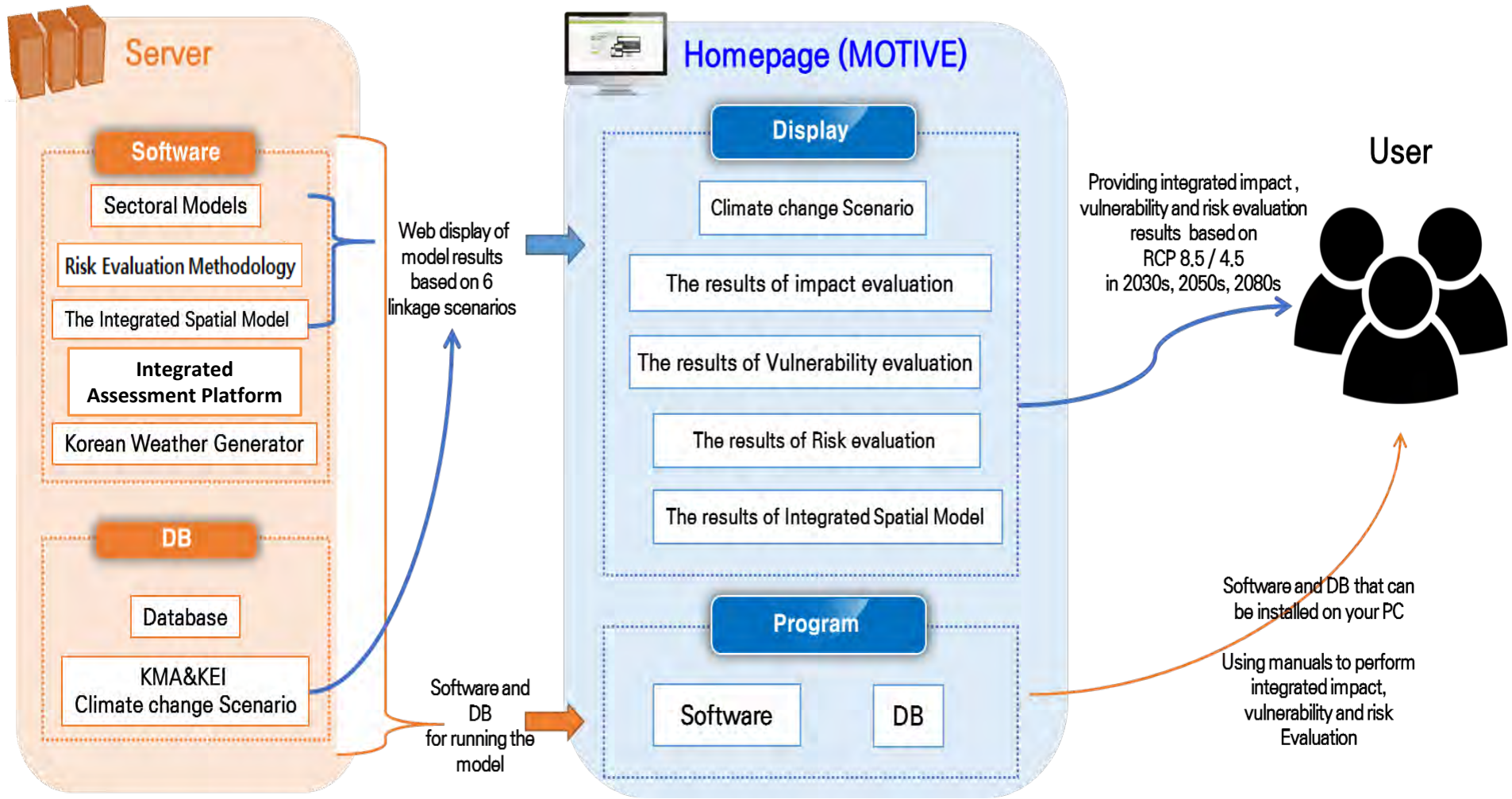
Web GIS-based
visualization tool
of MOTIVE

Climate (including KEI climate change scenario) /Non-climate DB system for driving MOTIVE and Korean Weather Generator

to derive the meteorological element (temperature, precipitation)
at the sites where there is no observed data



6. MOTIVE SYSTEM Operation

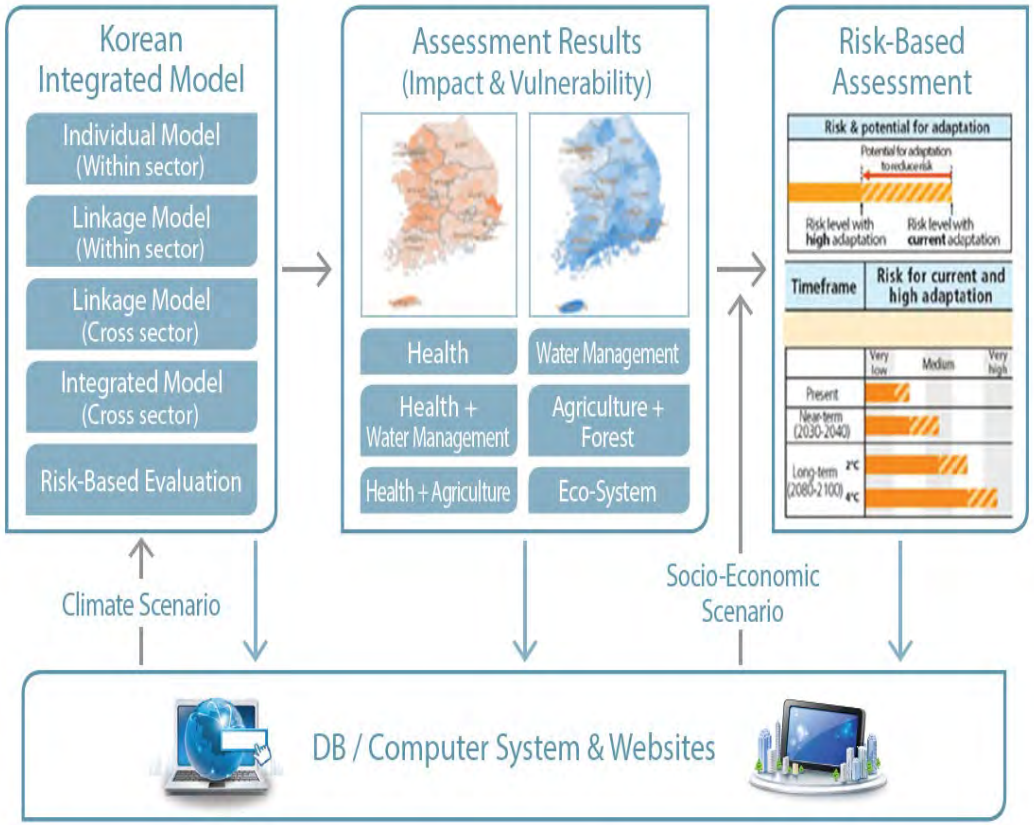


7. Outcomes and Effects

Diagram of Outcome

Effects

OUTCOME (User-Friendly GUI(web&stand-alone) Based System)



On Policy

-Establishment of foundation for efficient national climate change adaptation policy

-Minimizing mal-adaptation by prioritizing based on scientific analysis

On Industry and Economy

-Increase the number of professional employment through creation of new jobs in climate change adaptation sector

On Technology

-Establishment of scientific grounds for integrated management technology of CC daptation

-Establishment of national risk management system to cope with climate change

8. New Demands and Ongoing Research

■ To make wise decisions, we must predict the impacts of future climate change, reduce its risks, and evaluate economic feasibility.

- However, inconsistent information, a lack of unified systems, and difficulty in conducting scientific impact assessments make policy-making challenging.
- MOTIVE and VESTAP are not sufficient to fully comprehend the effects and economic impact of adaptation measures.

■ Thus, we need a decision-oriented integrated impact assessment platform to support the development of national and local climate adaptation plans, along with a shared and open platform for adaptation information and a customized service system based on scientific evidence to establish adaptation measures effectively.

8. New Demands and Ongoing Research

- Climate change scenarios
  - Meteorological agency and two or more new scenarios : Ensemble analysis using multiple climate change scenarios is necessary to resolve model uncertainty.

- Climate change assessment model
  - Development of models for six sectors including health, water management, agriculture, forestry, ecosystems, and industry, as well as a risk diagnosis module and an economic assessment module : Decision support is necessary, including the selection of impact assessment items by sector based on the opinions of policy makers and evaluation of the effectiveness of adaptation measures.

- Integrated impact assessment platform to support adaptation measures
  - The platform is centered on model simulations and results queries, allowing users to directly operate models and display results.

8. New Demands and Ongoing Research

■ Development of "decision-oriented integrated impact assessment platform" considering sector-specific impact prediction results, adaptation measures, and economic evaluation.

- Development of integrated impact assessment model within and between sectors based on climate change risks. → Establishment of realistic climate change adaptation measures.
- Development of risk and economic modules for evaluating the effectiveness of adaptation measures. → Derivation of adaptation strategies considering synergy and trade-offs among adaptation measures.
- Development of an integrated platform to maximize user convenience. → Performing a comprehensive service role for national adaptation information.

Let’s continue the conversation!

Post questions and comments in the IAIA23 app.

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