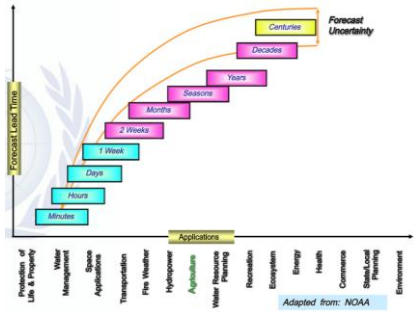
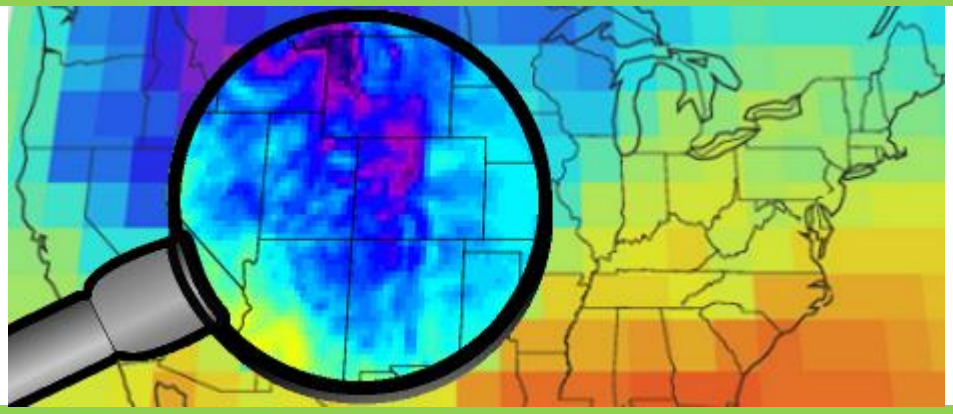
APCC
APEC CLIMATE CENTER

Downscaling and Seamless Climate Service for Adaptation against Climate Change





Jaepil Cho

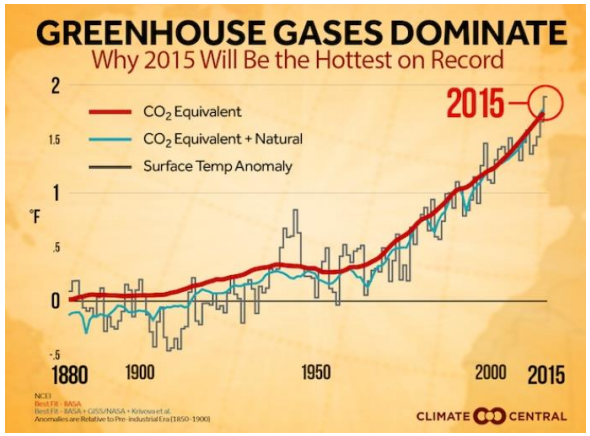
2018/10/15

Overview

1. Climate Changes and SDGs
2. APCC's Seamless Climate Service
3. C. Change Impacts and Adaptation
4. APCC's Downscaling Plotform

Climate Changes and SDGs

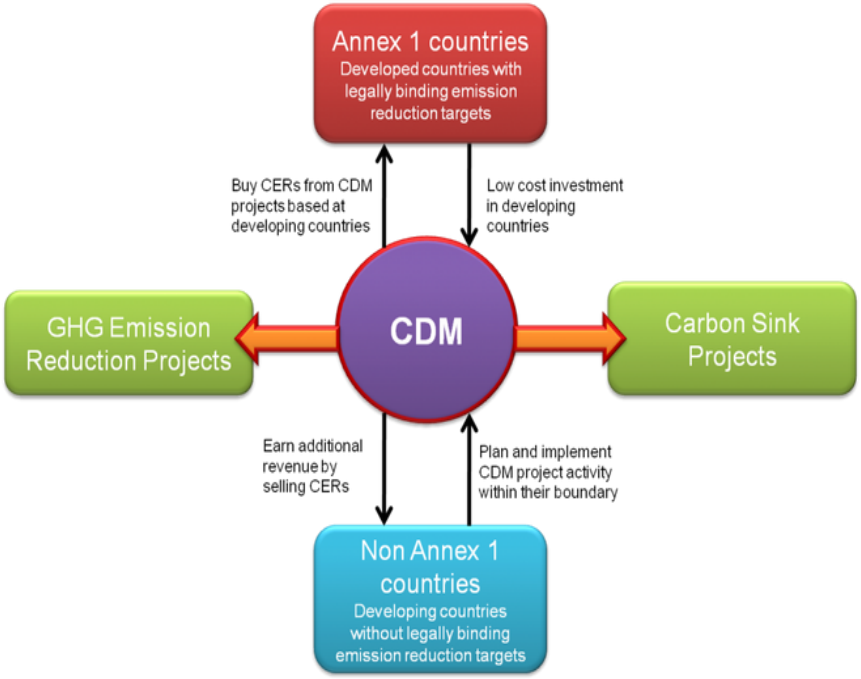
Global Warming and Climate Change Impact on National Scale



Source: http://www.climatecentral.org/news/global-warming-key-driver-record-heat-19734

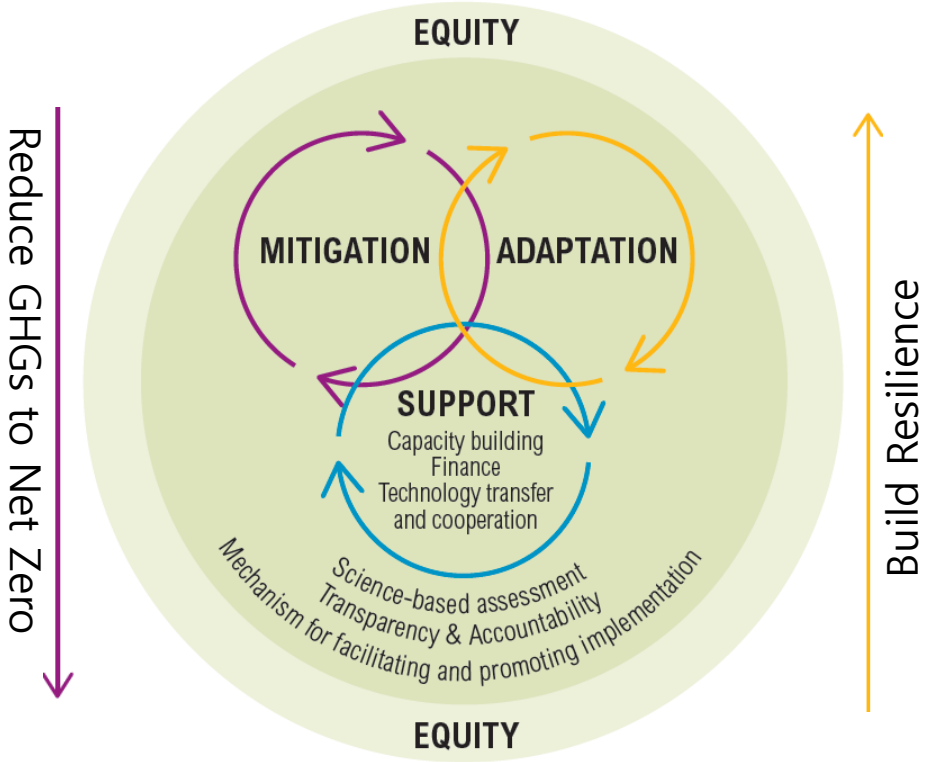
https://awcungeneva.com/2014/12/

Adaptation as one of core components of the 2015 Paris Agreement



Source: https://studentclimates.wordpress.com

CER: Certified Emission Reduction
CDM: Clean Development Mechanism



- Even though the GHG emission is reduced, effect of reduced GHG will be revealed after many years.
- Adaptation is especially important in developing countries since those countries have less capacity to adapt.

Transforming our world: the 2030 Agenda for Sustainable Development

Source: https://www.solactive.com

- These 17 Goals build on the successes of the Millennium Development Goals, while including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities.
- Climate Action (13) SDG can be influenced by other SDGs such as Affordable and Clean Energy (7) and Industry, Innovation and Infrastructure (9)
- Climate Action (13) directly or indirectly affects other SDGs

SDG 13: Climate Action

Take urgent action to combat climate change and its impacts*

1. Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
2. Integrate climate change measures into national policies, strategies and planning
3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Source: https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals

SDG 6: Clean Water and Sanitation

Ensure availability and sustainable management of water and sanitation for all

1. equitable access to safe and affordable drinking water
2. access to adequate and equitable sanitation and hygiene
3. improve water quality
4. increase water-use efficiency across all sectors
5. implement integrated water resources management at all levels
6. protect and restore water-related ecosystems
7. expand international cooperation and capacity-building support to developing countries
8. Support and strengthen the participation of local communities

SDG 2: Food security & sustainable agriculture

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

1. end hunger and ensure access by all people to safe, nutritious and sufficient food all year round….., end all forms of malnutrition….
2. double the agricultural productivity and incomes of small-scale food producers …
3. ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
4. maintain the genetic diversity of seeds ….
5. Increase investment….
6. Correct and prevent trade restrictions and distortions in world agricultural markets ….
7. Adopt measures to ensure the proper functioning of food commodity markets ….

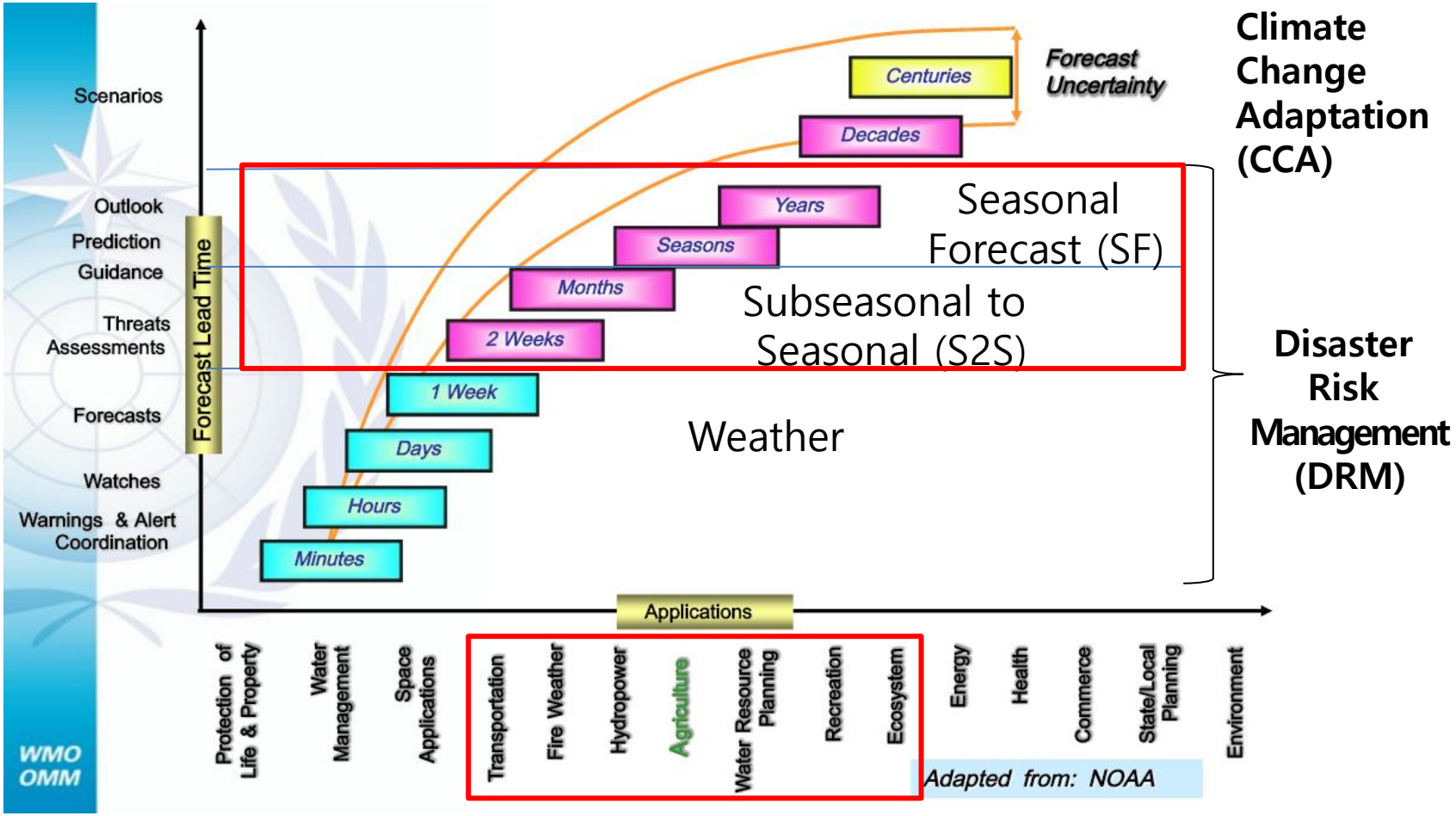
SDG 7: Sustainable and modern energy for all

Ensure access to affordable, reliable, sustainable and modern energy for all

1. ensure universal access to affordable, reliable and modern energy services
2. increase substantially the share of renewable energy in the global energy mix
3. double the global rate of improvement in energy efficiency
4. enhance international cooperation to facilitate access to clean energy research and technology….
5. expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries …

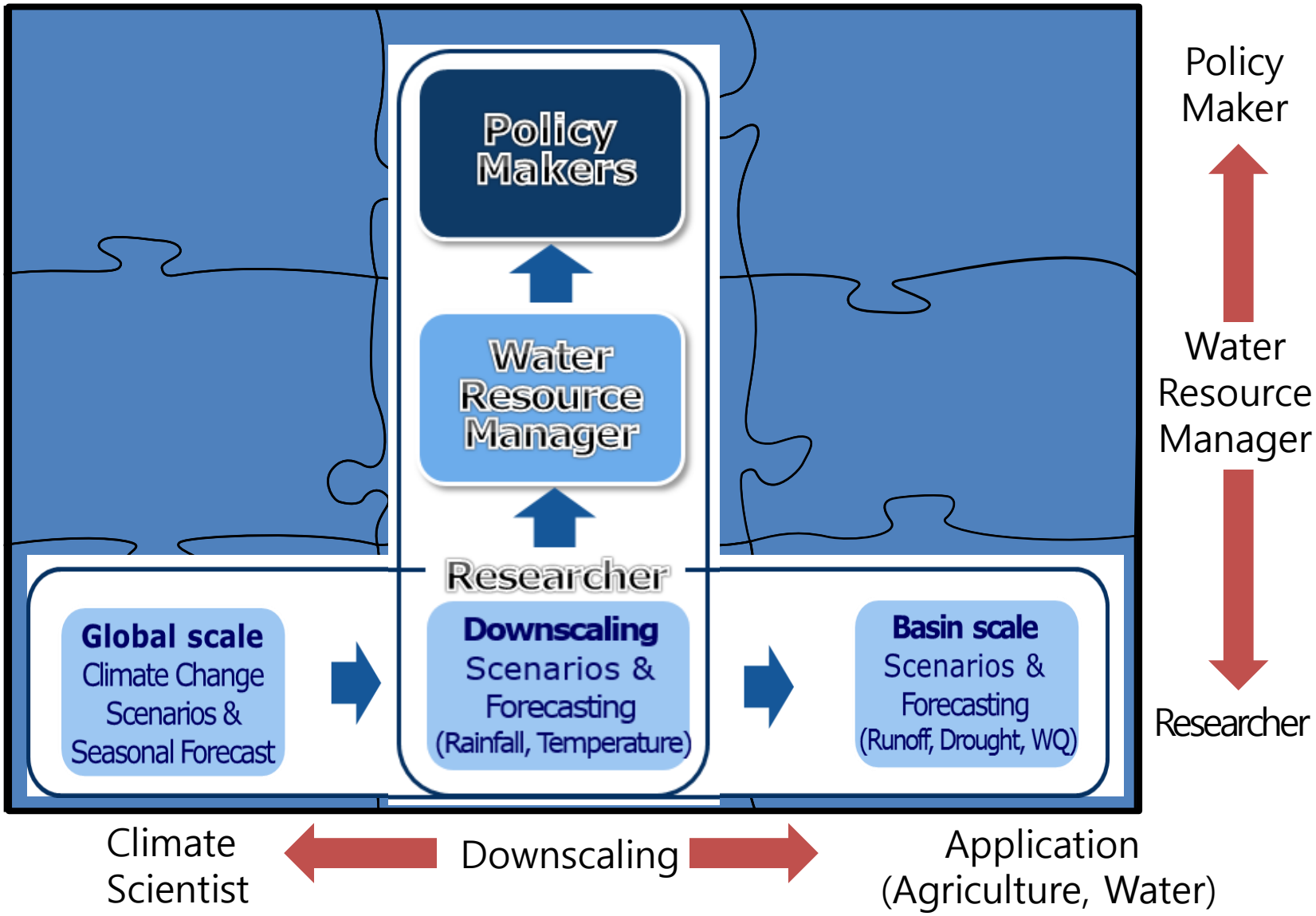
Seamless Climate Service

Seamless Prediction and Services Frameworke

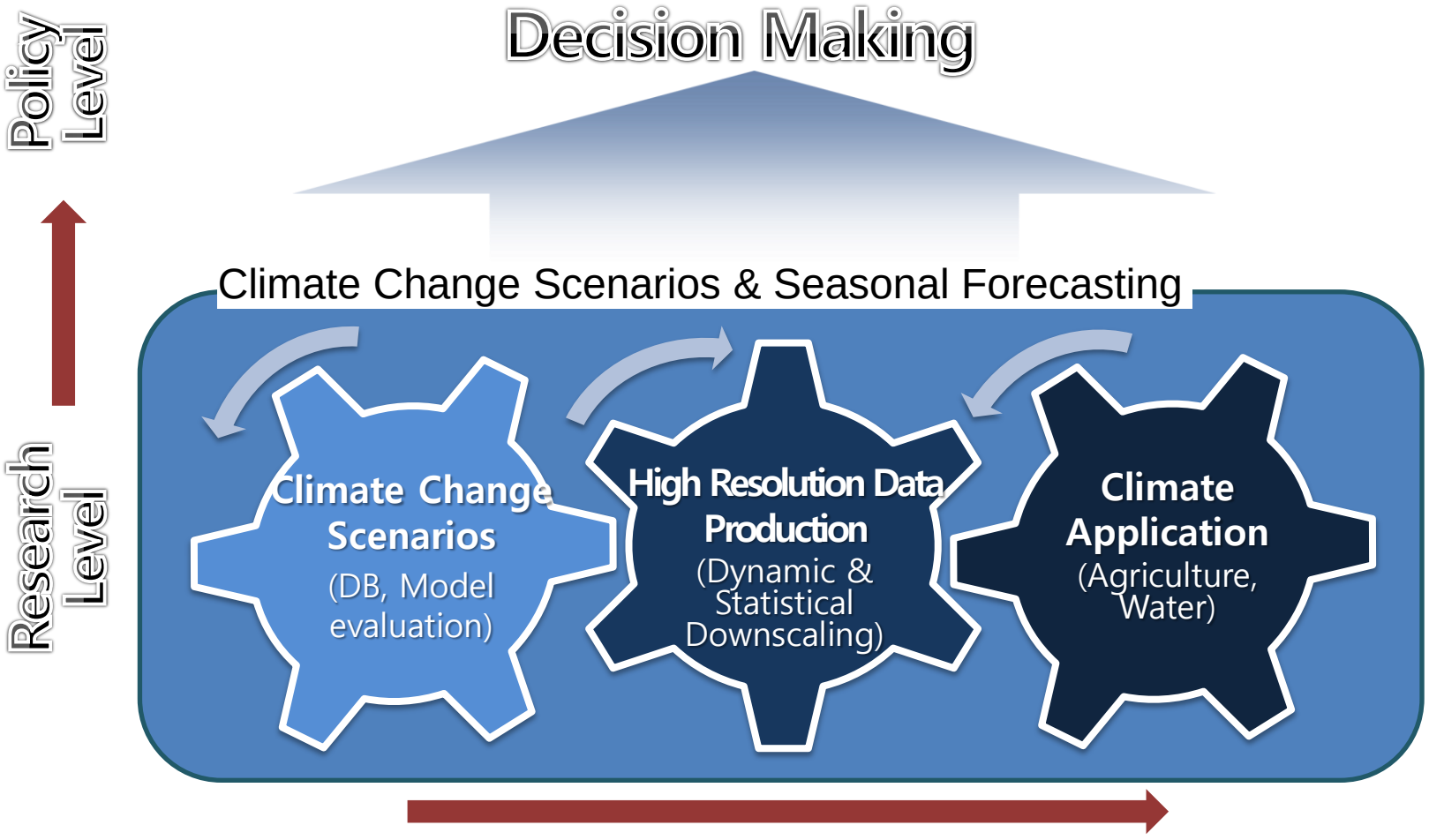


Source: http://slideplayer.com/slide/1447561/

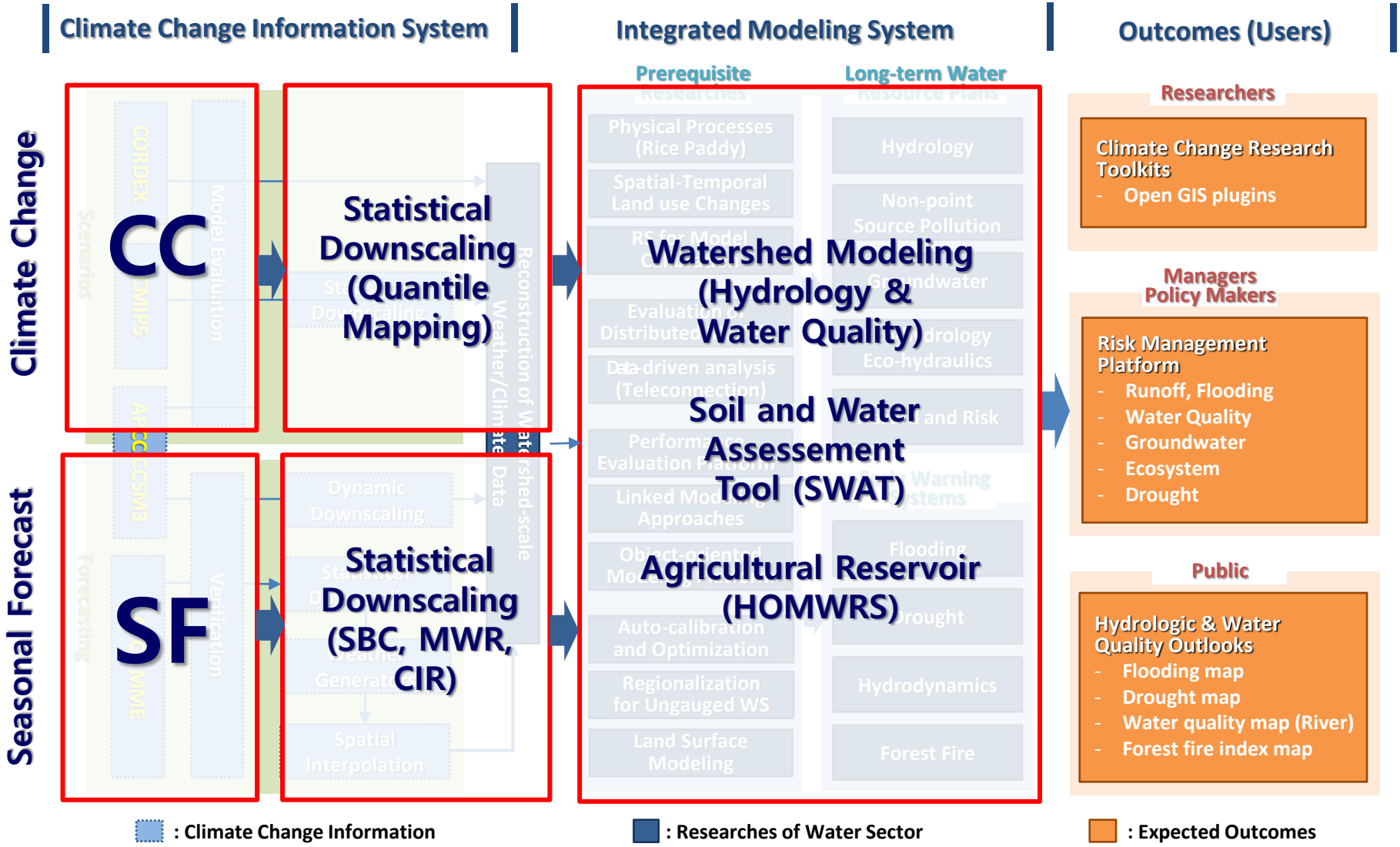
Quiz: What is in the picture?



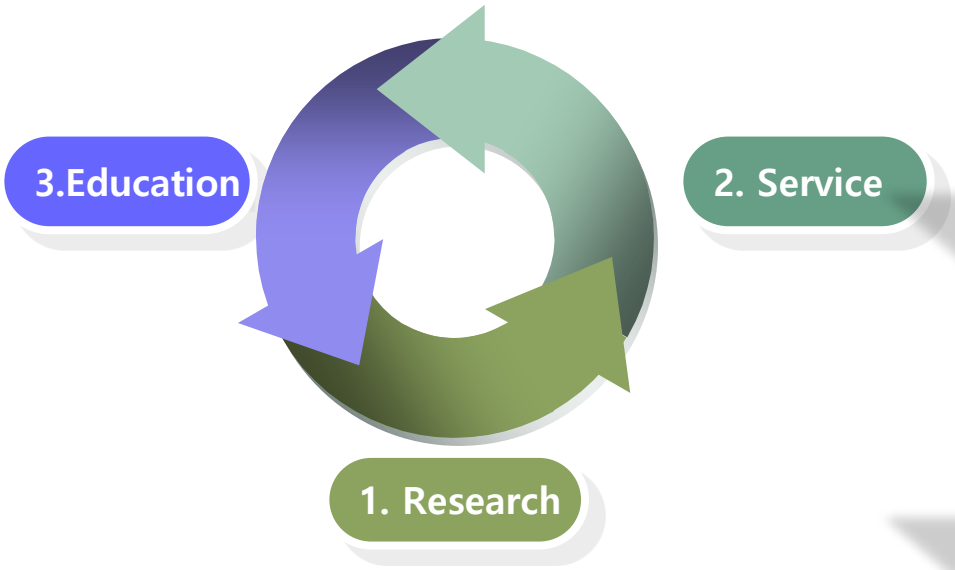
APCC's research components and goals



Framework of APCC Water Sector (old version)



Cycle of developing user-centered climate service



Research

Proc. IAHS, 374, 175–185, 2016
proc-iahs.net/374/175/2016/
doi:10.5194/piahs-374-175-2016

Development of an integrated method for long-term water quality prediction using seasonal climate forecast

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IRRIGATION AND DRAINAGE
Irrig. and Drain. **(2016)**
Published online in Wiley Online Library (wileyonlinelibrary.com) **DOI**: 10.1002/ird.2035

CLIMATE CHANGE IMPACTS ON AGRICULTURAL DROUGHT WITH CONSIDERATION OF UNCERTAINTY IN CMIP5 SCENARIOS†

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Climatic Change
DOI 10.1007/s10584-015-1503-2

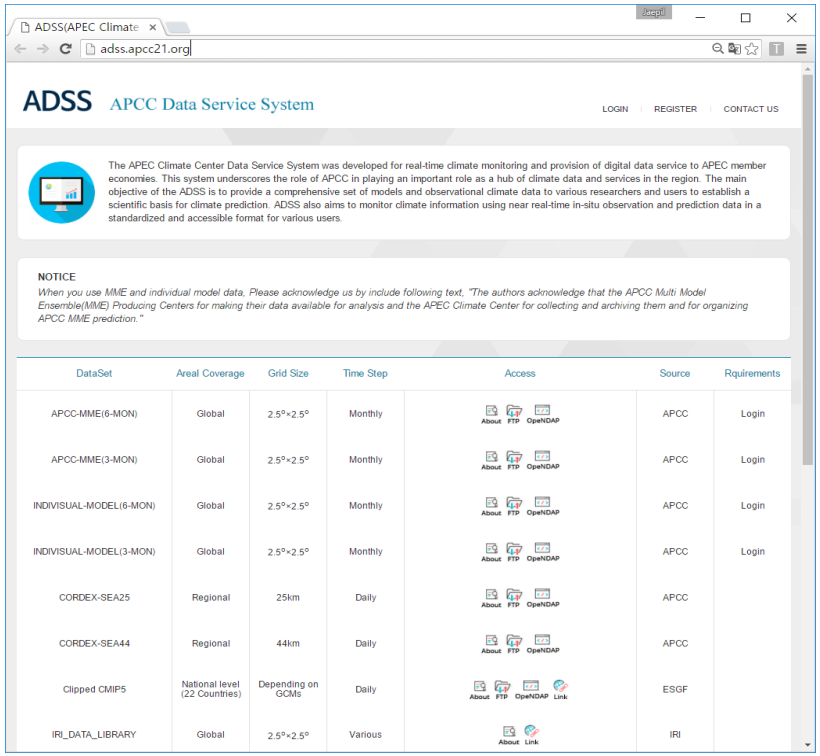
Predicting potential epidemics of rice diseases in Korea using multi-model ensembles for assessment of climate change impacts with uncertainty information

Kwang-Hyung Kim[1] · Jaepil Cho[1]

Climate Service: National CMIP5 daily Data

- 29 Global Climate Models (GCMs)
- 6 Weather variables
  - **Precipitation, Min. temperature, Max. temperature**, Wind speed, Relative humidity, Solar radiation

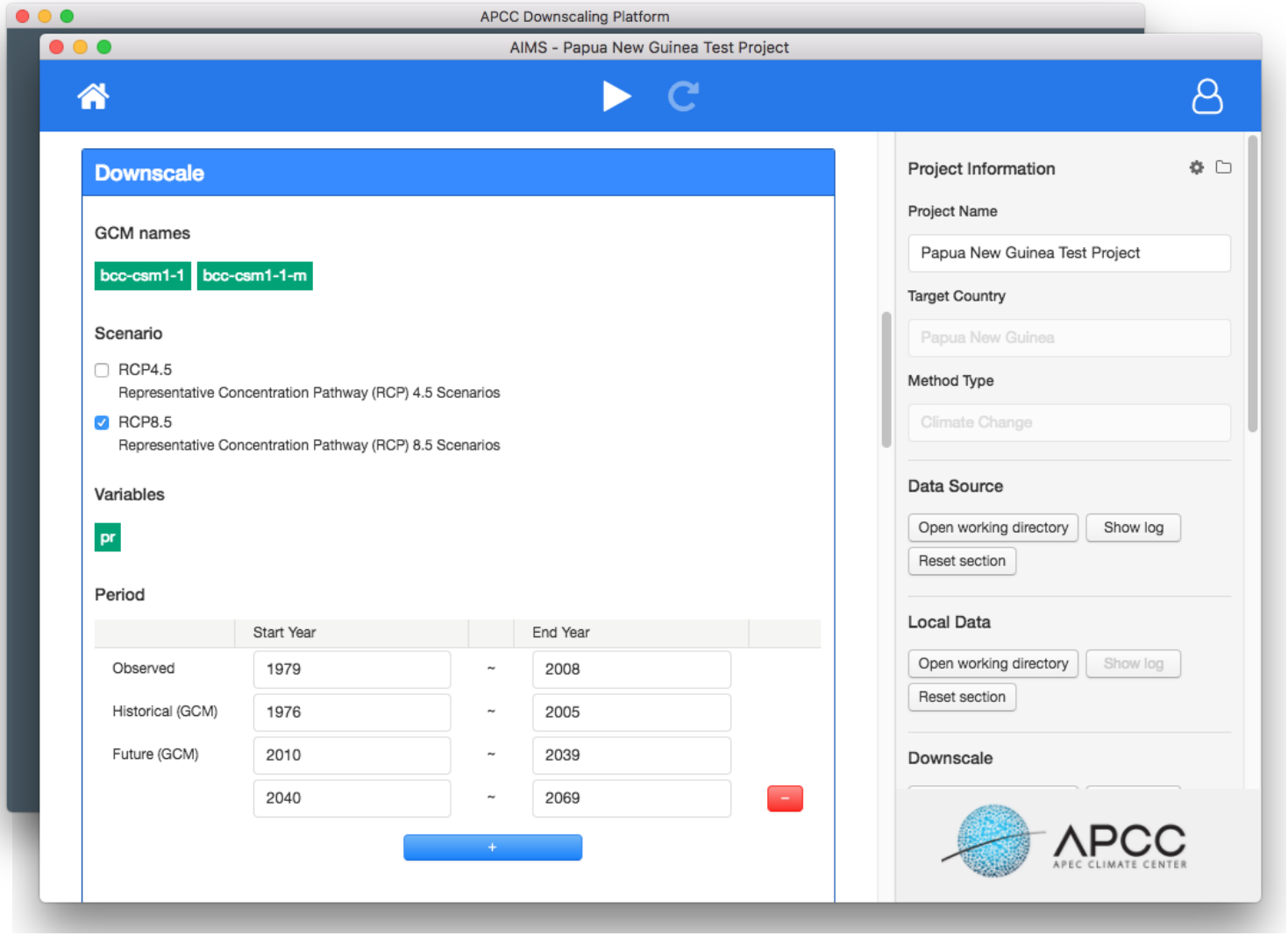
❖ APCC's ADSS : http://adss.apcc21.org/



Bangladesh, Burma, Chile, Cuba, Egypt, Ethiopia, Federated States of Micronesia, India, Indonesia, Kenya, Malaysia, Marshall Islands, Mongolia, Nepal, Philippines, Pakistan, Samoa, Tanzania, Thailand, Tonga, Vietnam, Zambia

Climate Service: Development of user-centered downscaling Tools

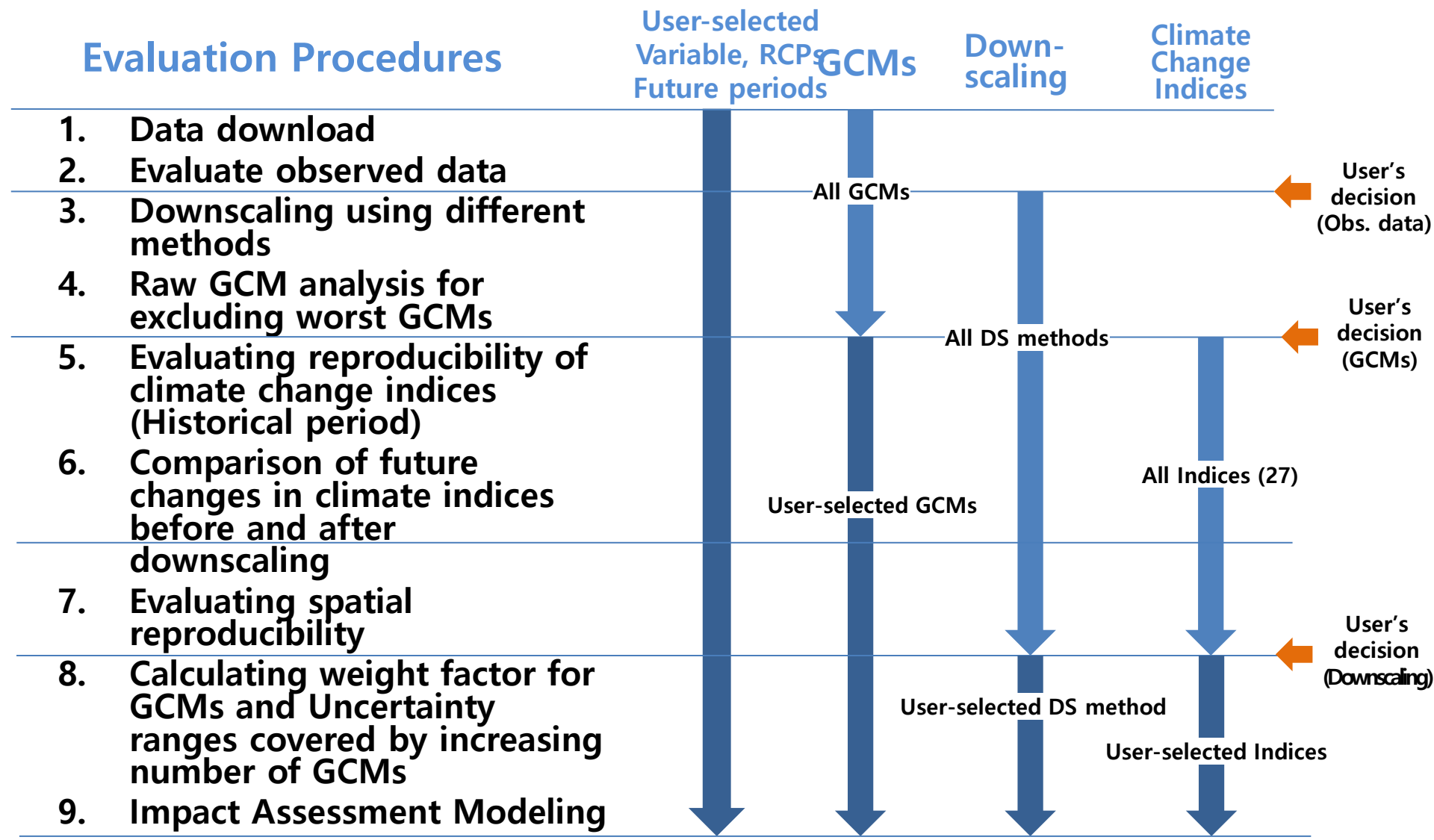
AIMS: APCC Integrated Modeling Solution



Climate Service: Guideline (procedure) for use of downscaled climate change scenario data

Evaluation Procedures

1. Data download
2. Evaluate observed data
3. Downscaling using different methods
4. Raw GCM analysis for excluding worst GCMs
5. Evaluating reproducibility of climate change indices (Historical period)
6. Comparison of future changes in climate indices before and after downscaling
7. Evaluating spatial reproducibility
8. Calculating weight factor for GCMs and Uncertainty ranges covered by increasing number of GCMs
9. Impact Assessment Modeling



Education: Capacity Building Platform (Vertical Integration)

Research Level

Young Scientist Support Program (YSSP) (3 month)

- Scientists
- 3-months
- Climate and Application Sectors
- Learn technical know-how related to horizontal integration including downscaling
- Need to collaborate with departments in each nation

Downscaling Training Program (1 week)

Management Level

Project Development Workshop against Climate Change (PDWCC)

- Project developers or managers
- 1 week
- Application (water and agriculture) sectors
- Learn how to implement climate adaptation measures in individual projects
- Need to collaborate with project developers (WB, ADB, KOICA etc.)

Policy Level

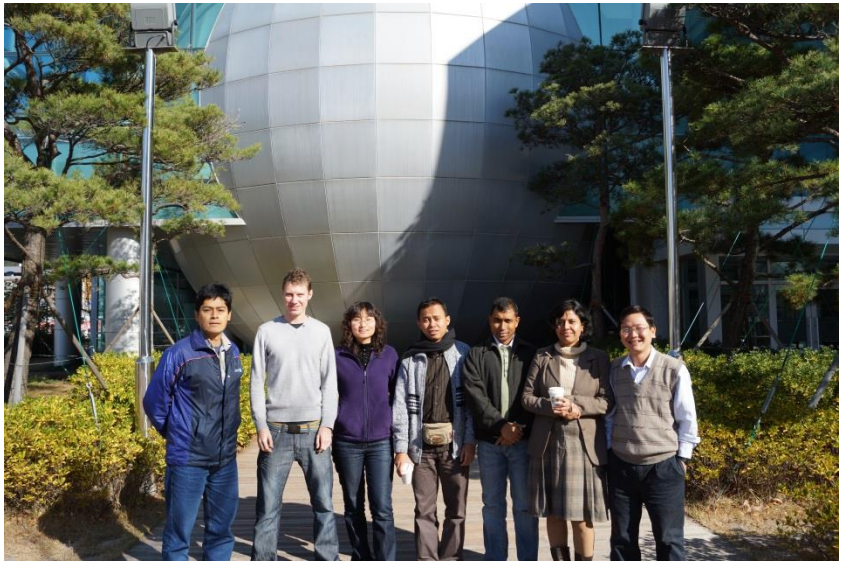
APEC Climate Symposium (APCS)

- Policy or Decision maker
- 2-3 days
- Application (water and agriculture) sectors
- Discuss how to integrate climate adaptation and mitigation measures in national level plans
- Need to collaborate with international organizations (UNDP, FAO, etc.)

Education: Statistical Downscaling Training Program (SDTP)

- 2016: Generation of Regional Climate Data derived from Statistical Downscaling Technologies
- 2017: User-oriented Statistical Downscaling of Climate Information in Agriculture and Water Resources

Education: Young Scientists Support Program (YSSP)



- APCC supports the research of outstanding young scientists from developing countries as visiting scientists for a period of approximately 3 months
- APCC provides data, equipment, and support from our research staff

- The visiting scientists conduct research on themes such as:
  - climate prediction and monitoring
  - climate change and impact assessments
  - climate informatics
  - climate applications to relevant sectors

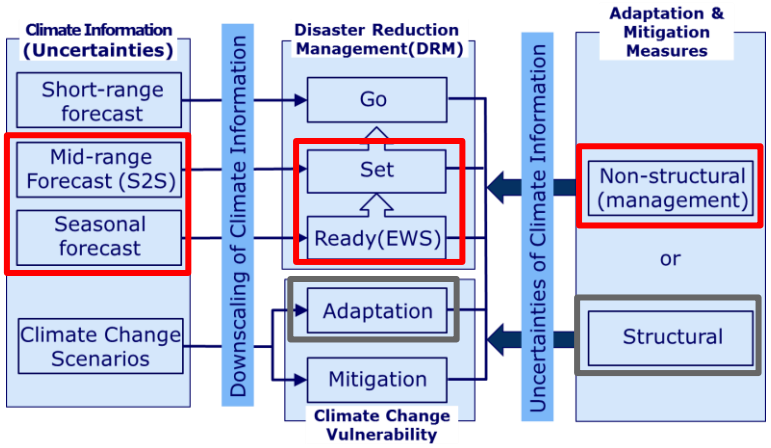
Education: Project Development Workshop against Climate Change (PDWCC)

- strengthen the ability of participants to develop projects that tackle climate change for their country-specific needs. In particular, this workshop focused on the official development assistance (ODA) fund of the Korean Government, which is intended to promote economic development and to improve quality of life in developing countries

Chandpur-Comilla Integrated Flood Control, Drainage and Irrigation Project

- Scope of the Project:
  - The project will **improve dry season irrigation facilities** and help to sustain monsoon crops to an area of 61,650 ha. The multiple objectives of the project includes **protection of project area from pre-monsoon & monsoon flood, reduction of the flood intensity, reduction of damages to crops, properties and lives due to floods, improvement of drainage congestion**. The project will further **provide facilities for dry season irrigation** which will accelerate the agricultural production, fisheries and other income generating activities.

Develop decision support system for drought forecasting and flood forecasting



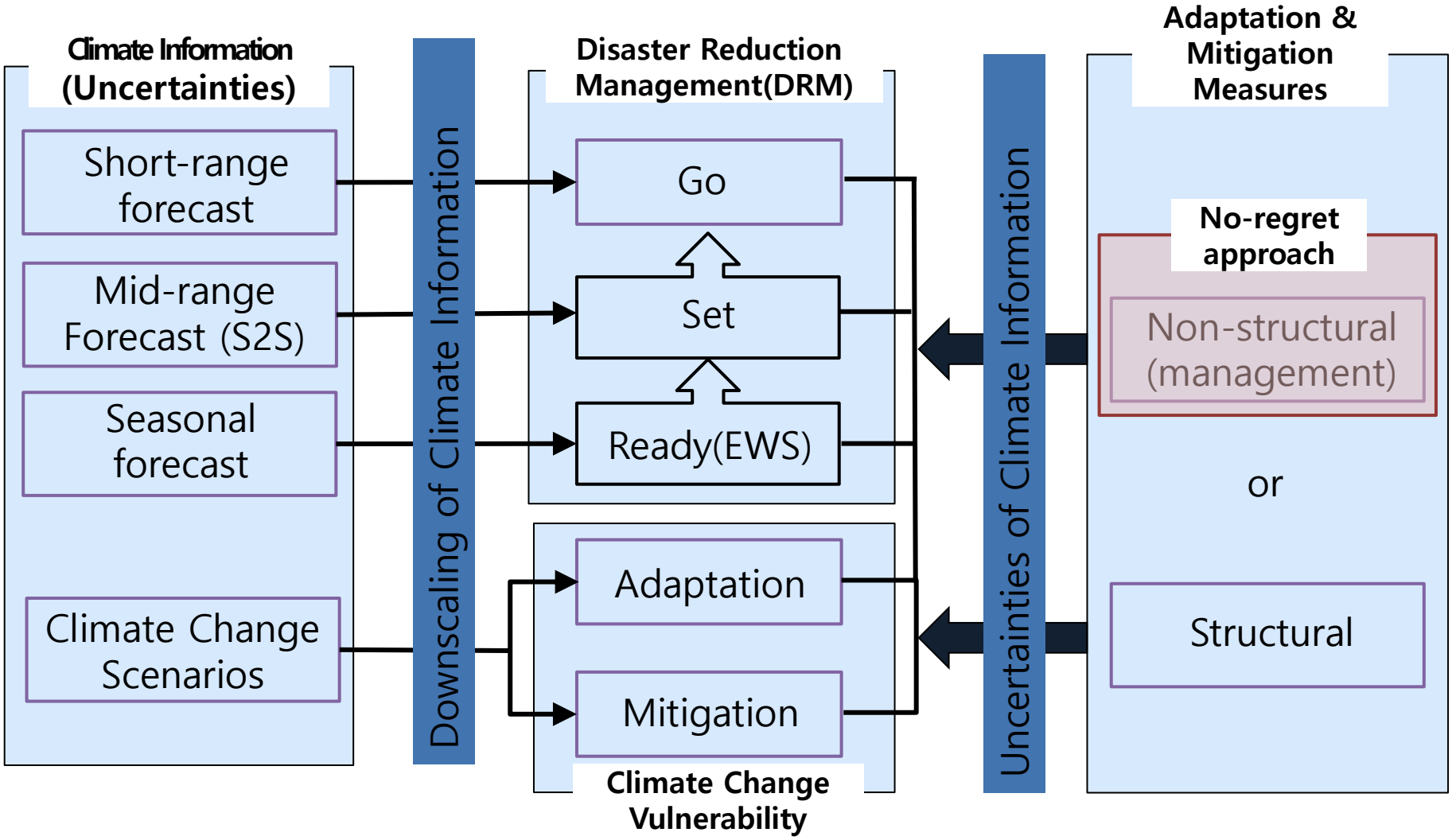
- **Monitoring** *vs.* **Forecasting/Projection**
- **Short-, Mid-, Long-range forecaset** *vs.* **Climate change projection (Disaster reduction management** *vs.* **Climate change adaption or mitigation)**
- **Mitigation** *vs.* **Adaptation**
- **Structural** *vs.* **non-structural**
- **Top-down** *vs.* **Bottom-up**
- **Program** *vs.* **Project**
- **Software** *vs.* **Hardware**
- **Research** *vs.* **Management (Operational)** *vs.* **Policy levels**

Education: APEC Climate Symposium

- Annual event held since 2005
- Highlights state-of-the-art climate prediction techniques as well as the application of climate information for social welfare and economic prosperity

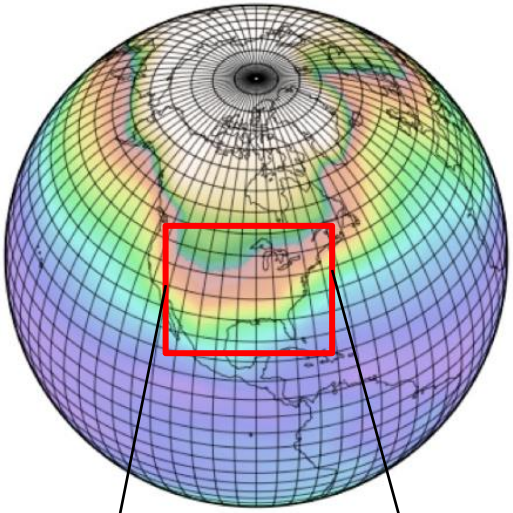
- 2012:"Harnessing and Using Climate Information for Decision Making", with a focus on the Agriculture Sector *(St. Petersburg, Russia)*
- 2013: "Regional Cooperation on Drought Prediction Science to Support Disaster Preparedness and Management" *(Jakarta, Indonesia)*

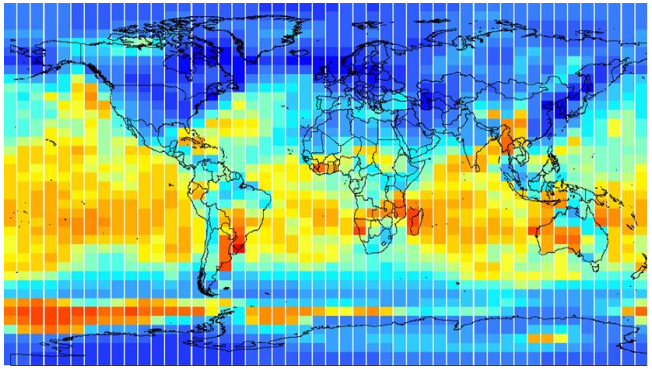
Downscaling and Adaptation



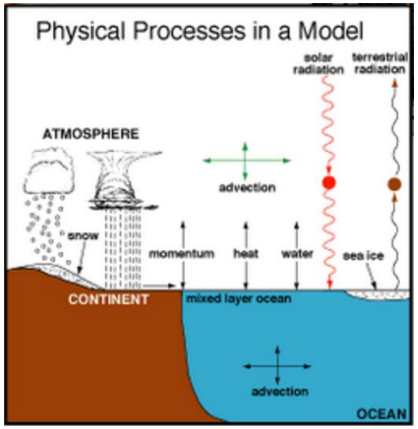
Climate Information Created Using GCMs and RCMs

Real Earth System

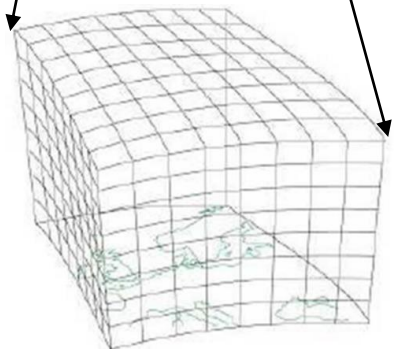


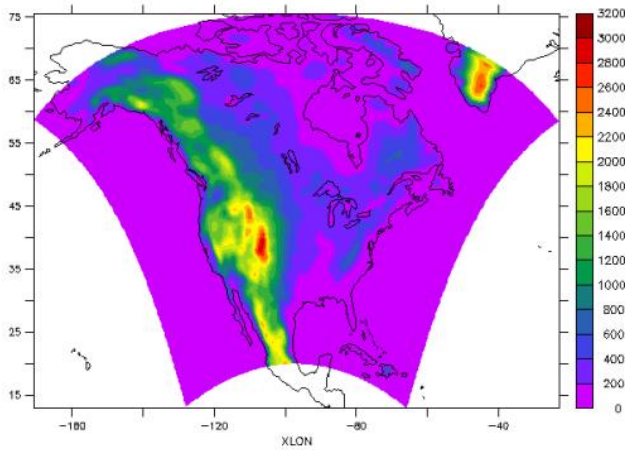


GCM: Global Climate Model



Processes in GCM





RCM: Regional Climate Model

Necessary for spatial downscaling and bias-correction

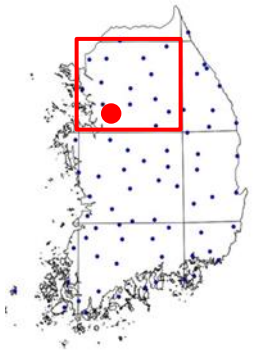
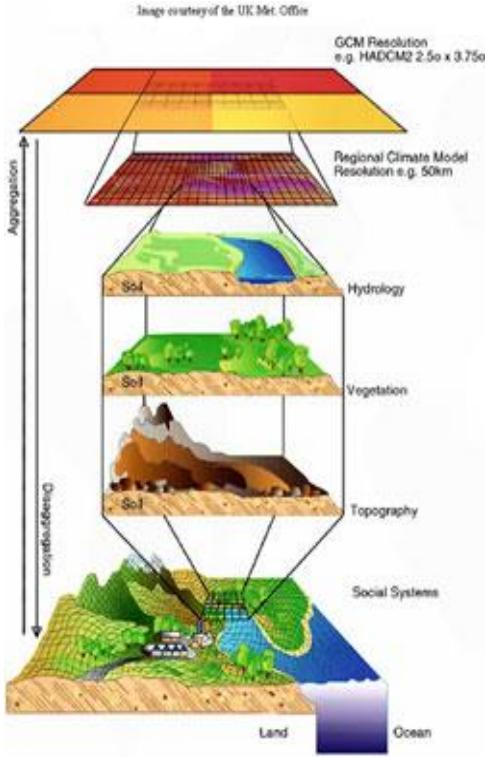
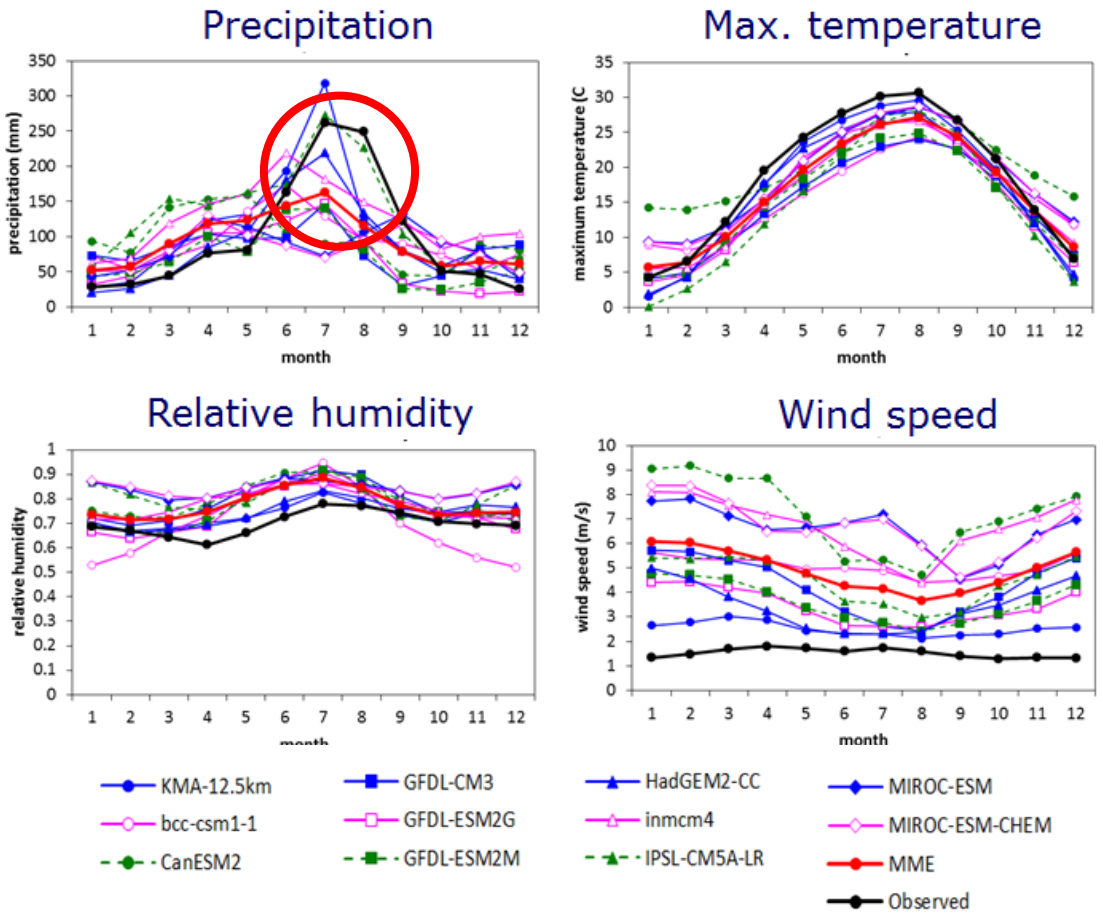


Image courtesy of the UK Met. Office





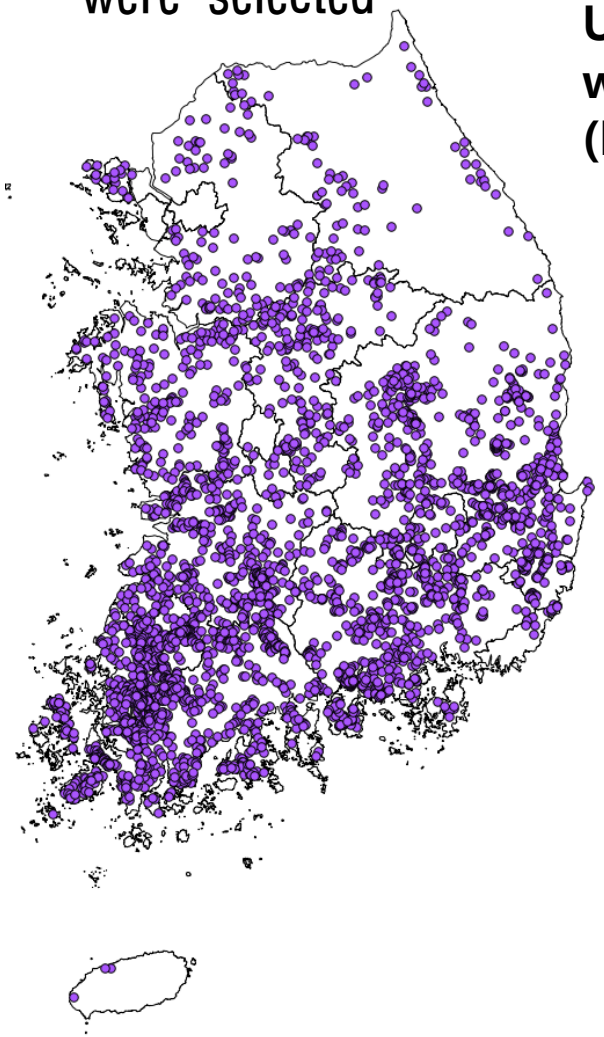
➡ Requires spatial downscaling and bias-correction

Agricultural drought with respect to reservoirs: vulnerable to changing climate

Source: http://blog.daum.net/sangkunlee/969

Climate change impact assessment on agricultural reservoirs

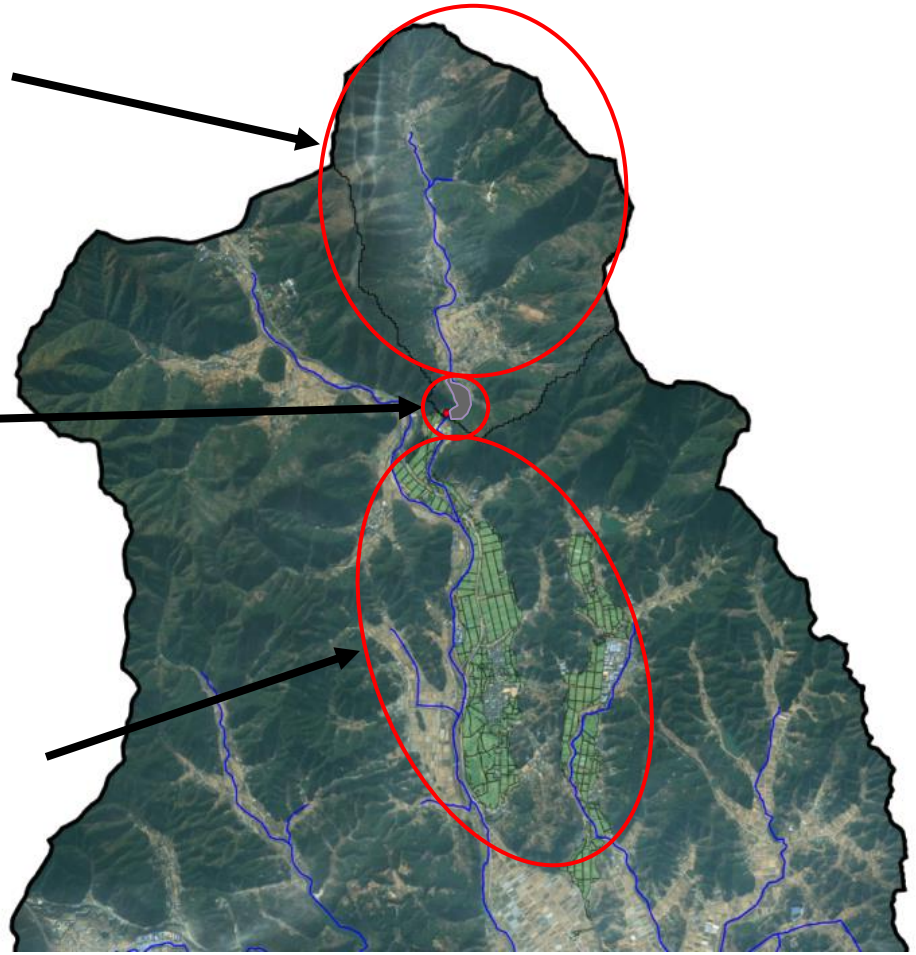
- 3372 reservoirs managed by Korea Rural Community Corporation (KRC) were selected



Upstream watershed (Inflow)

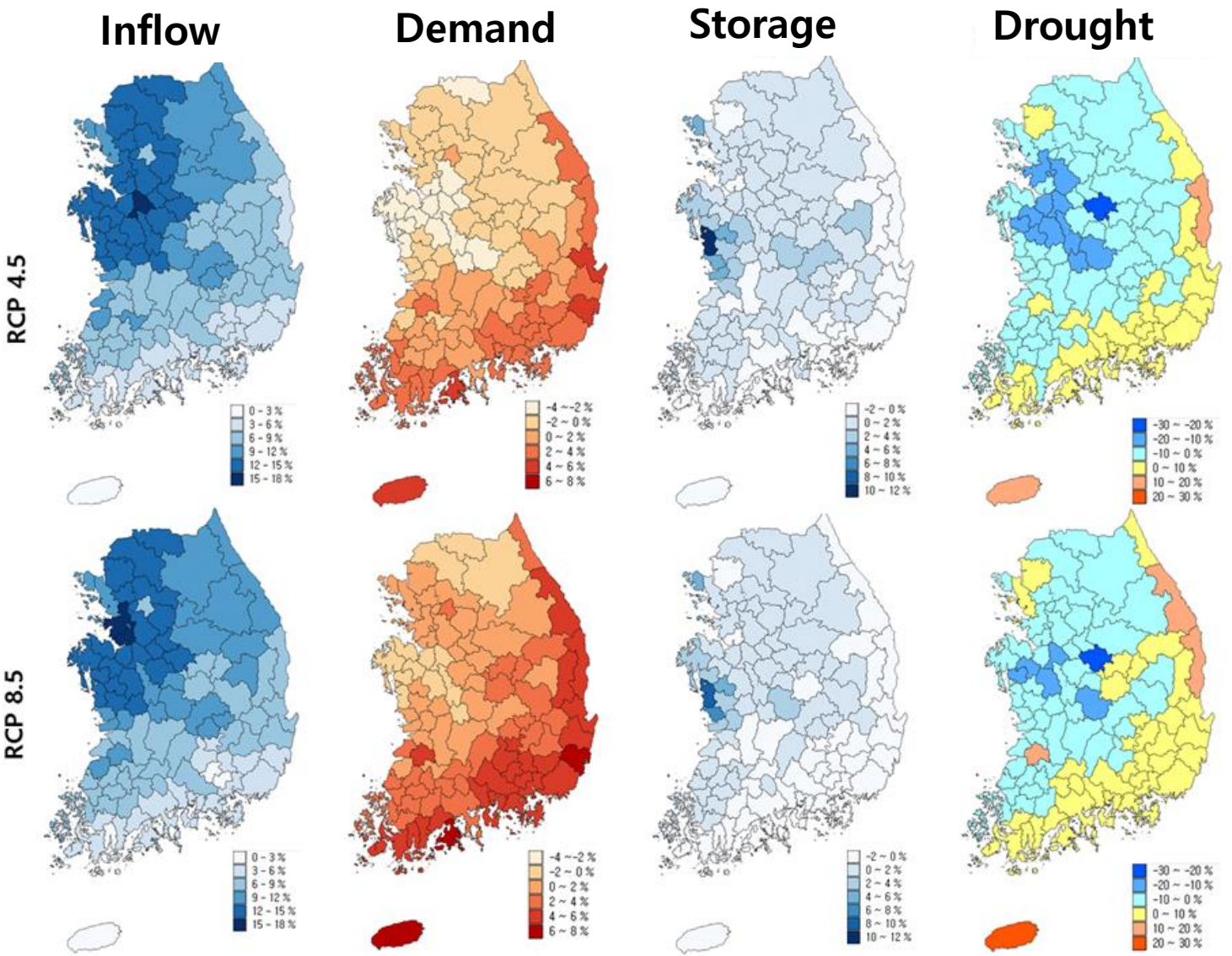
Reservoir (storage)

Irrigation Area (Demand)

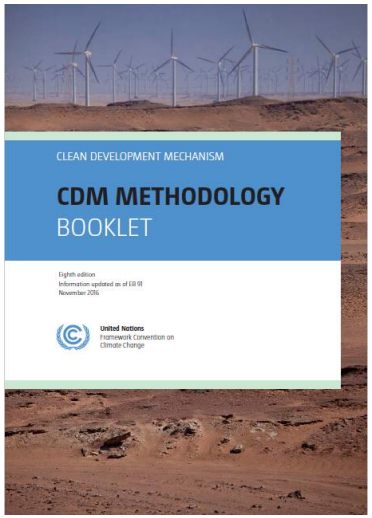


Climate Change Impact on Agricultural Reservoir in Korea

- Based on 3372 rese
  managed by KRC fo



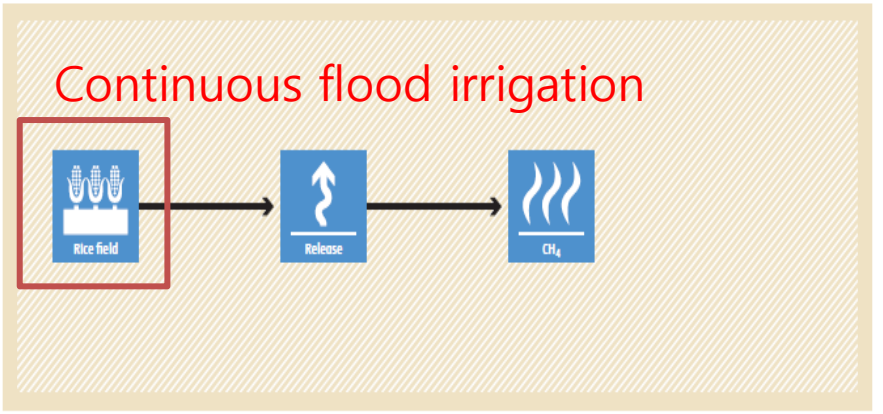
Changes in water management (irrigation) as a mitigation measure



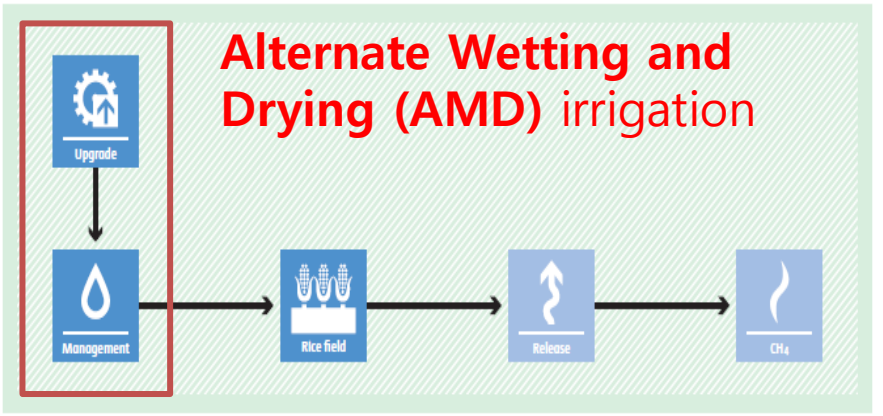
- Activity types
  - Displacement of a more-GHG-intensive output
  - Renewable energy
  - Energy efficiency
  - GHG destruction
  - GHG emission avoidance
  - Fuel switch
  - GHG removal by sinks

Methane emission reduction by adjusted water management practice in rice cultivation

BASELINE SCENARIO
Generation of methane due to anaerobic decomposition of organic matter in rice cropping soils.

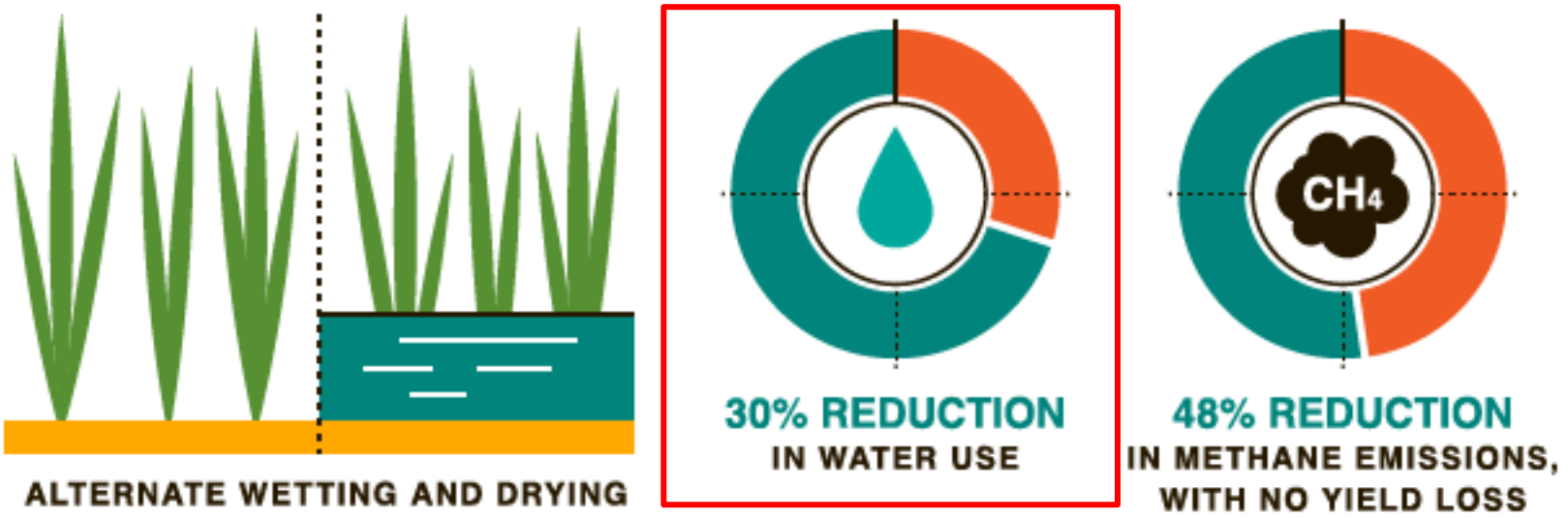


PROJECT SCENARIO
Methane emission avoidance, for example, by changing the water regime during the cultivation period from continuously to intermittent flooded conditions and/or a shortened period of flooded conditions.



Alternate Wetting and Drying (AMD) as an adaptation measure

- AMD reduces methane emissions by 48% and water use by up to 30% without impacting yields (Vietnam).

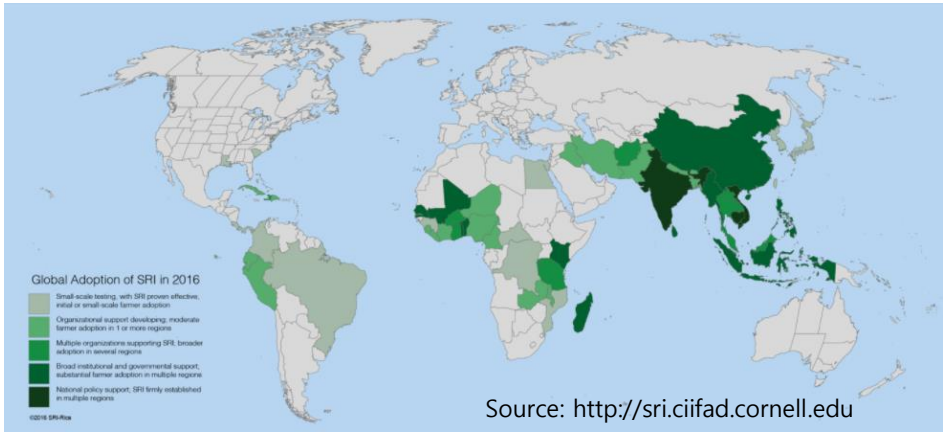


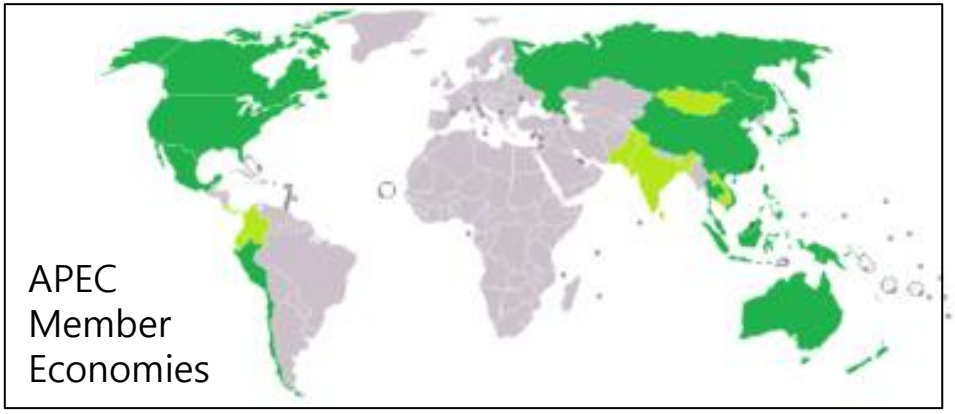
Source: https://ccafs.cgiar.org/bigfacts/#theme=evidence-of-success&subtheme=crops&casestudy=cropsCs3

- In addition, yields can be increased and non-point source pollutants can be reduced.

Adoption of AWD in APEC member economies

- AWD has been validated by rice farmers in several APEC member economies

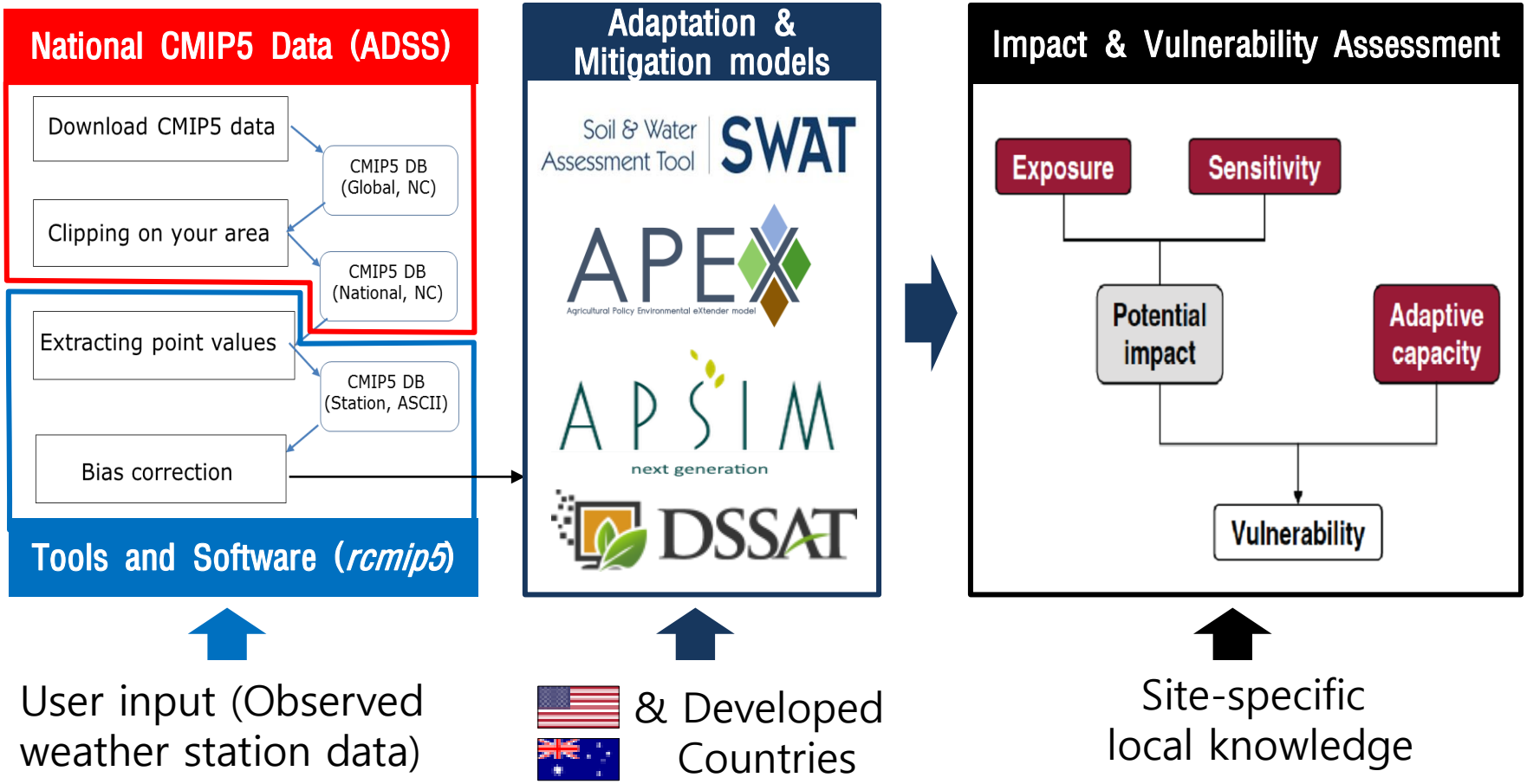




APEC Member Economies	Adoption of SRI (2016)
Australia	
Brunei Darussalam	
Canada	
Chile	
Hong Kong	
Indonesia	●
Japan	●
Malaysia	●
Mexico	
New Zealand	
Papua New Guinea	
People's Republic of China	●
Peru	●
The Philippines	●
Chinese Taipei	●
Russia	
Singapore	
Republic of Korea	●
Thailand	●
The United States	
Viet Nam	●

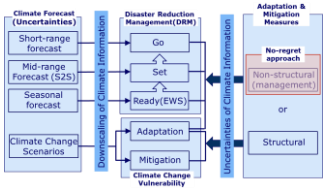
Downscaling Platform

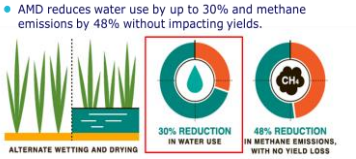
& Other 17 member economies (2017)

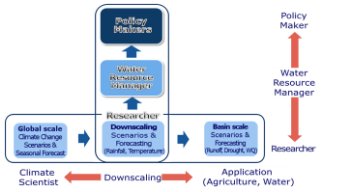


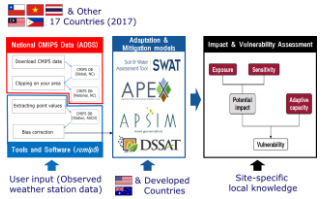
Concluding remarks

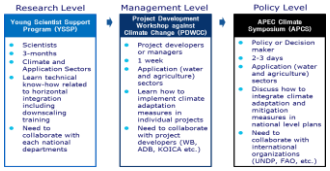
- Seamless climate service for adaptation and mitigation
- Alternate Wetting and Drying (AMD) water management as a potential measure for both adaptation and mitigation
- Importance of horizontal and vertical integrations
- Downscaling platform for integrating climate information into application sectors: providing guide line, climate data, and downscaling tools
- Capacity building platform for integrating climate service in research, management, and policy levels











Thank You!