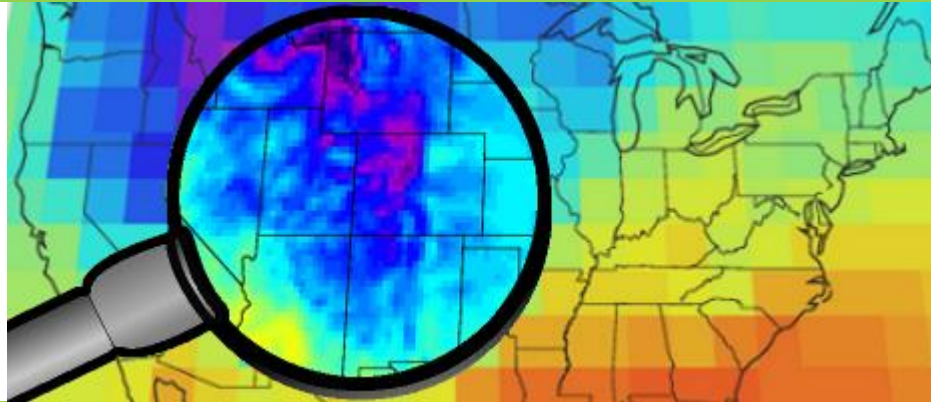
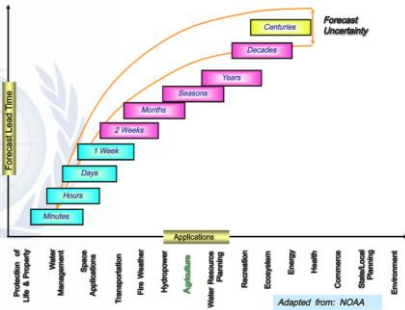


APCC
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Downscaling and Seamless Climate Service for Adaptation against Climate Change



Jaepil Cho

2017/08/21

Overview

1. Climate Changes and SDGs

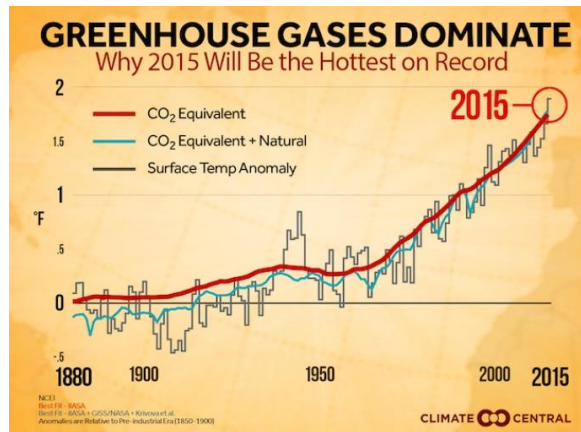
2. APCC's Seamless Climate Service

3. C. Change Impacts and Adaptation

4. APCC's Downscaling Platform

Climate Changes and SDGs

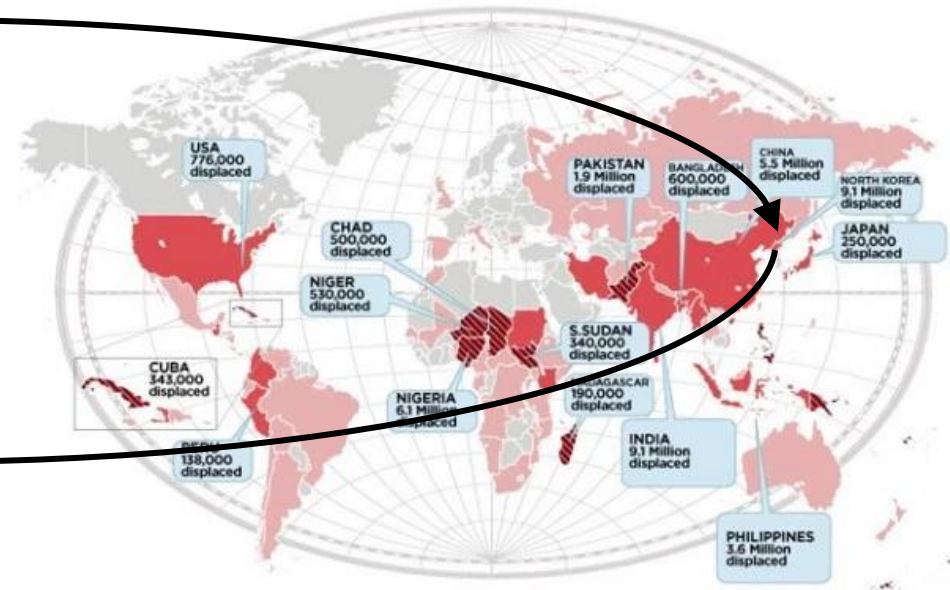
Global Warming and Climate Change Impact on National Scale



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

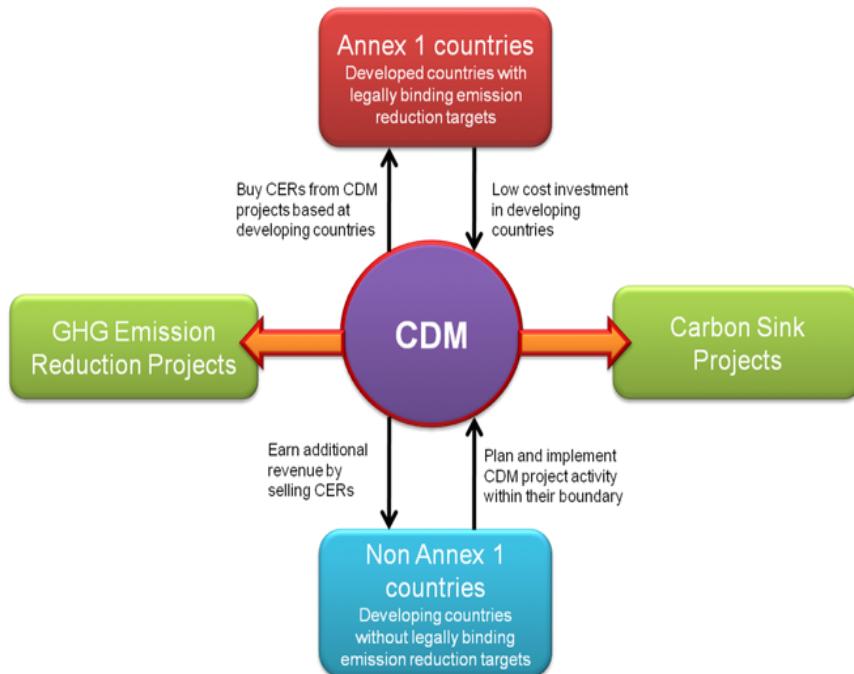


IN 2012, EXTREME WEATHER DROVE
MORE THAN 32 MILLION PEOPLE
 FROM THEIR HOMES



98% OF CLIMATE REFUGEES WERE FROM DEVELOPING COUNTRIES.

Adaptation as one of core components of the 2015 Paris Agreement

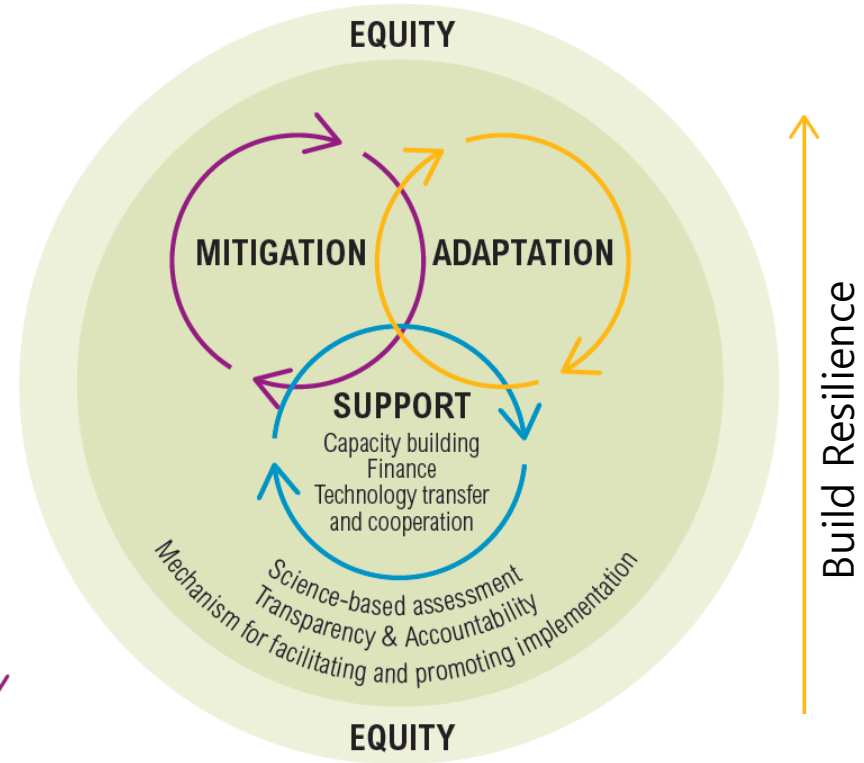


Source: <https://studentclimates.wordpress.com>

CER: Certified Emission Reduction

CDM: Clean Development Mechanism

Reduce GHGs to Net Zero



- 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

SDG 6: Clean Water and Sanitation

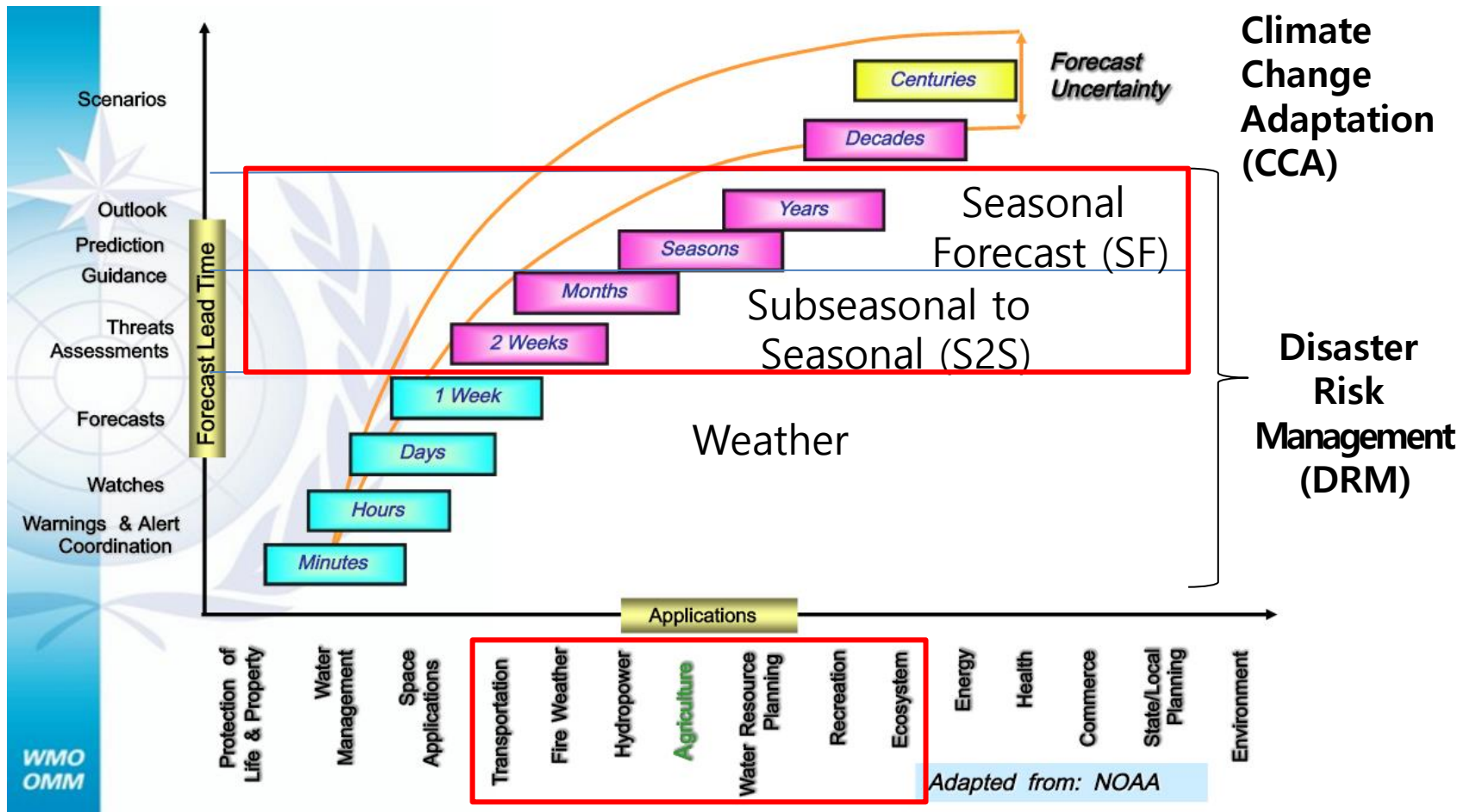


Ensure availability and sustainable management of water and sanitation for all

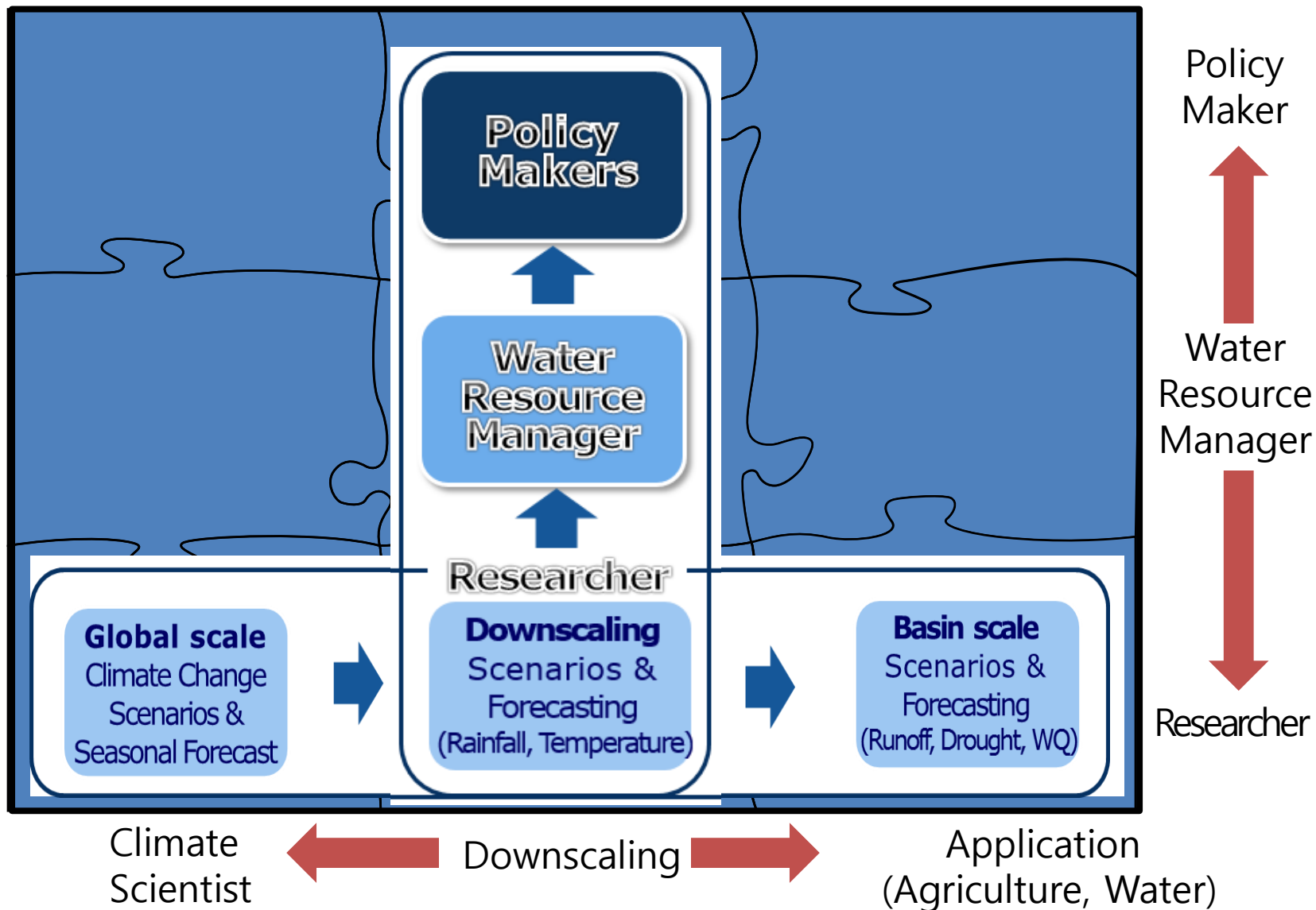
1. equitable access to safe and affordable drinking water
2. access to adequate and equitable sanitation and hygiene
3. improve water quality
4. increase water-use efficiency across all sectors
5. implement integrated water resources management at all levels
6. protect and restore water-related ecosystems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

Seamless Climate Service

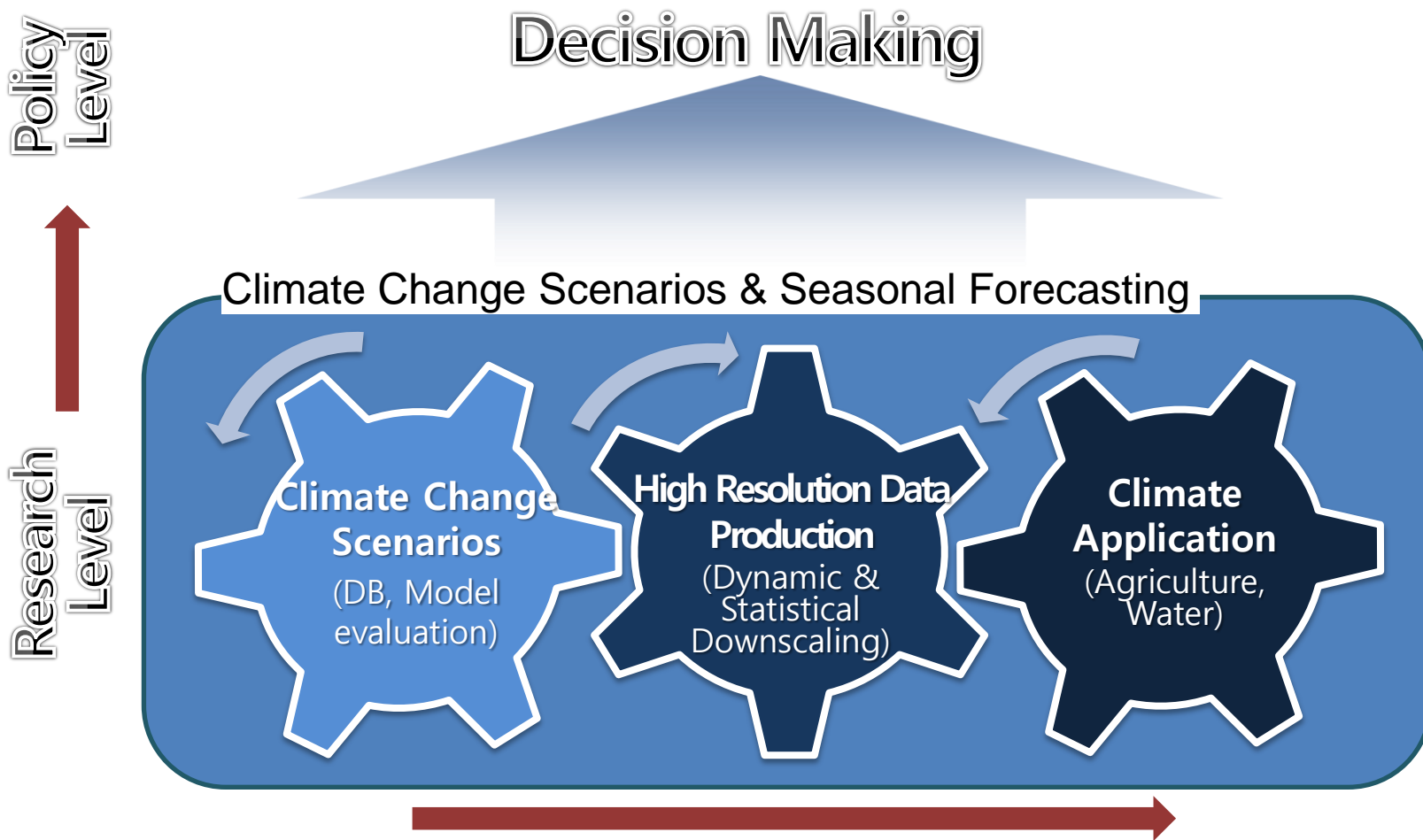
Seamless Prediction and Services Framework



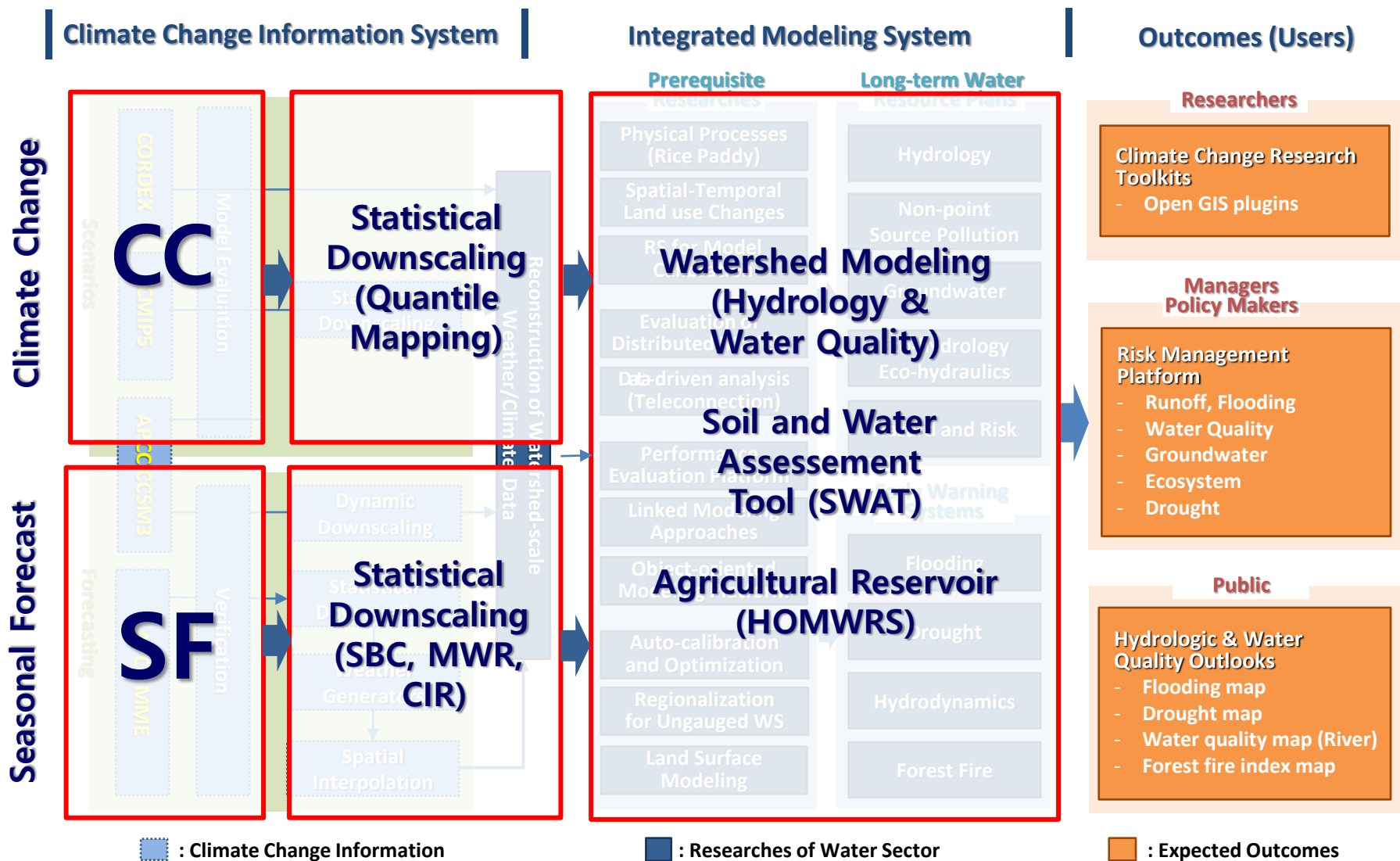
Quiz: What is in the picture?



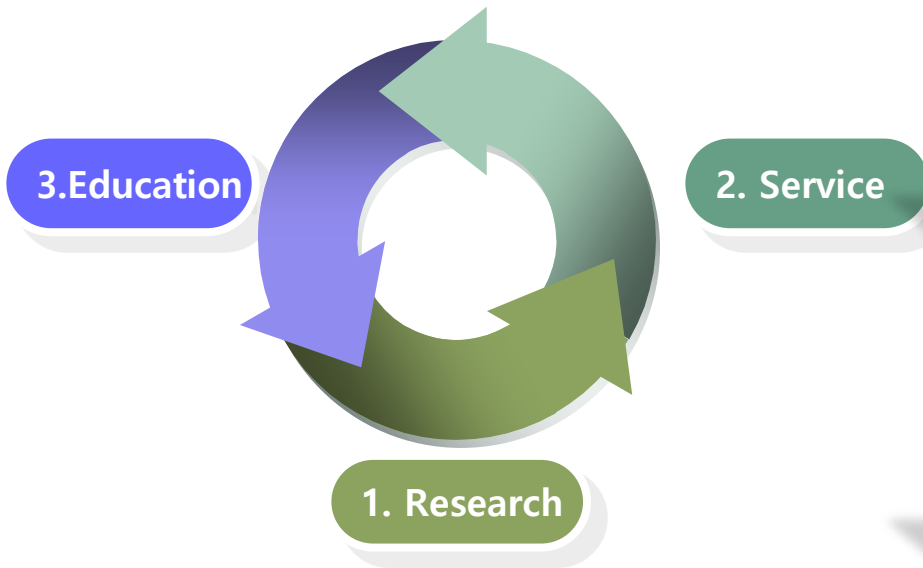
APCC's research components and goals



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
 © Author(s) 2016. CC Attribution 3.0 License.

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


Jaepil Cho¹, Chang-Min Shin², Hwan-Kyu Choi², Kyong-Hyeon Kim², and Ji-Yong Choi³
¹Research Department, APEC Climate Center, Busan, 48058, Korea
²National Institute of Environmental Research, Incheon, 22689, Korea
³Seoul National University, Daejeon, 35151, Korea

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[†]

JAEPIL CHO¹, GWANGDON KO², KWANGYOUNG KIM³ AND CHANSUNG OH^{4*}
¹Climate Change Research Team, Climate Research Department, APEC Climate Centre, Busan, Republic of Korea
²Farmland & Irrigation Development Office, Rural Community Development Division, Korea Rural Community Corporation, Naju, Republic of Korea
³Agriculture Engineering Research Group, Rural Research Institute, Korea Rural Community Corporation, Ansan, Republic of Korea
⁴Future Policy Research Group, Rural Research Institute, Korea Rural Community Corporation, Ansan, Republic of Korea

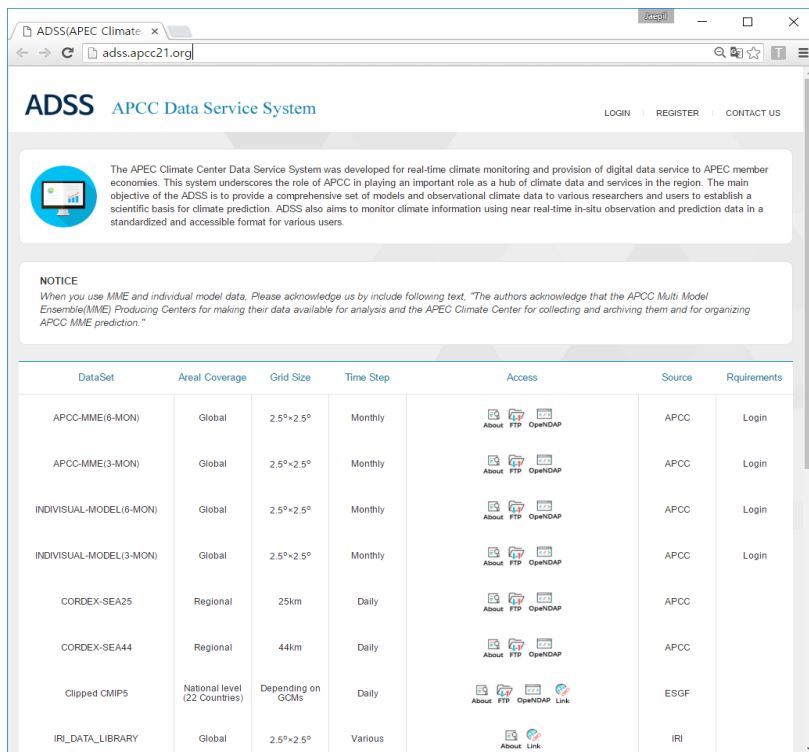
Climatic Change
 DOI 10.1007/s10584-015-1503-2



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

Kwang-Hyung Kim¹ · Jaepil Cho¹

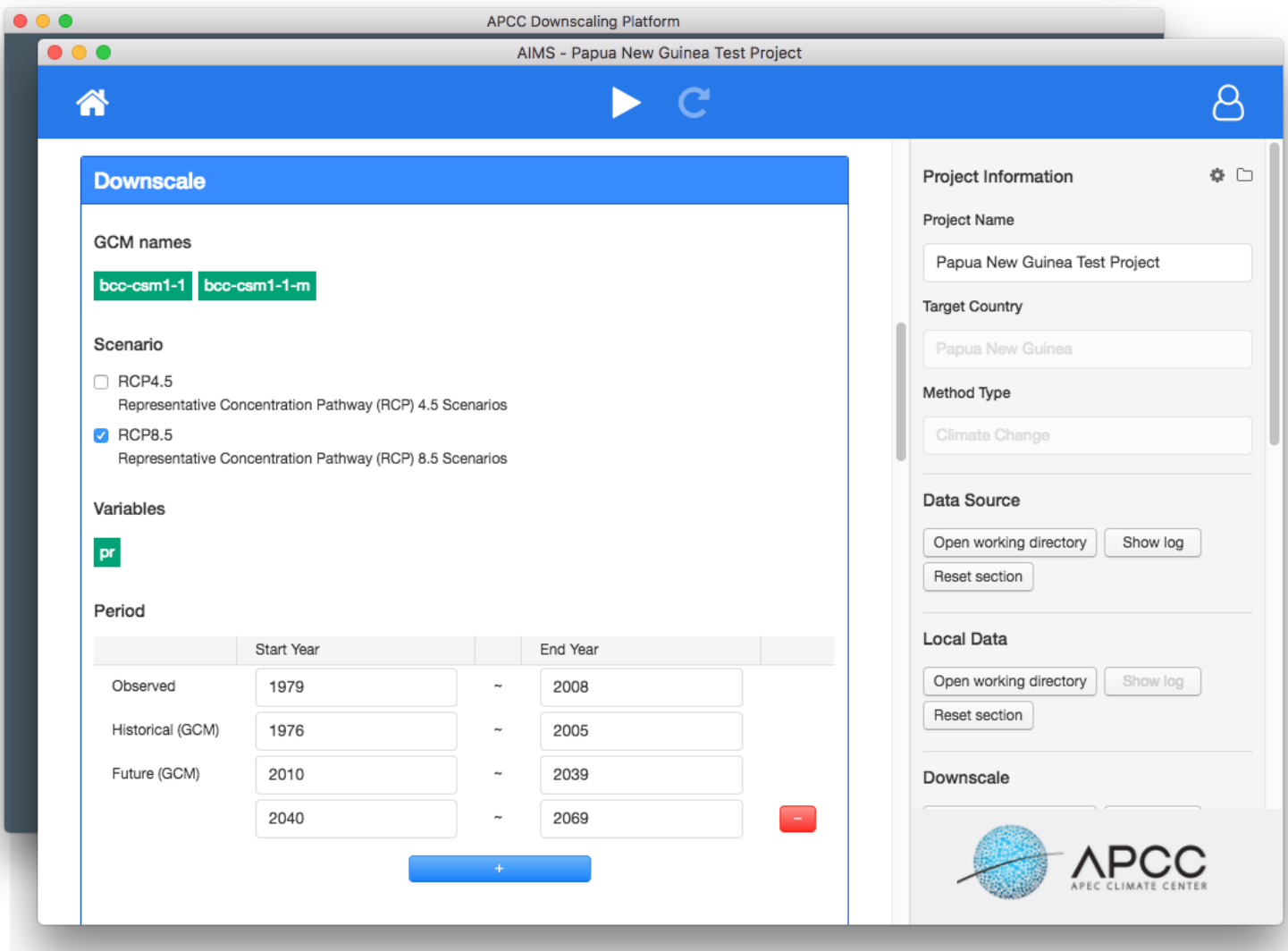
- 29 Global Climate Models (GCMs)
- 6 Weather variables
 - **Precipitation, Min. temperature, Max. temperature,** Wind speed, Relative humidity, Solar radiation
- ❖ APCC's ADSS : <http://adssapcc21.org/>



DataSet	Areal Coverage	Grid Size	Time Step	Access	Source	Requirements
APCC-MME(6-MON)	Global	2.5°×2.5°	Monthly		APCC	Login
APCC-MME(3-MON)	Global	2.5°×2.5°	Monthly		APCC	Login
INDIVIDUAL-MODEL(6-MON)	Global	2.5°×2.5°	Monthly		APCC	Login
INDIVIDUAL-MODEL(3-MON)	Global	2.5°×2.5°	Monthly		APCC	Login
CORDEX-SEA25	Regional	25km	Daily		APCC	
CORDEX-SEA44	Regional	44km	Daily		APCC	
Clipped CMIP5	National level (22 Countries)	Depending on GCMs	Daily		ESGF	
IRI_DATA_LIBRARY	Global	2.5°×2.5°	Various		IRI	

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

AIMS: APCC Integrated Modeling Solution



APCC Downscaling Platform
AIMS - Papua New Guinea Test Project

Downscale

GCM names

bcc-csm1-1 bcc-csm1-1-m

Scenario

RCP4.5
Representative Concentration Pathway (RCP) 4.5 Scenarios

RCP8.5
Representative Concentration Pathway (RCP) 8.5 Scenarios

Variables

pr

Period

	Start Year		End Year
Observed	1979	~	2008
Historical (GCM)	1976	~	2005
Future (GCM)	2010	~	2039
	2040	~	2069

Project Information

Project Name: Papua New Guinea Test Project

Target Country: Papua New Guinea

Method Type: Climate Change

Data Source

Open working directory Show log
Reset section

Local Data

Open working directory Show log
Reset section

Downscale

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

Evaluation Procedures

User-selected
Variable, RCPs
Future periods

GCMs

Down-
scaling

Climate
Change
Indices

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

All GCMs

All DS methods

User-selected GCMs

User-selected DS method

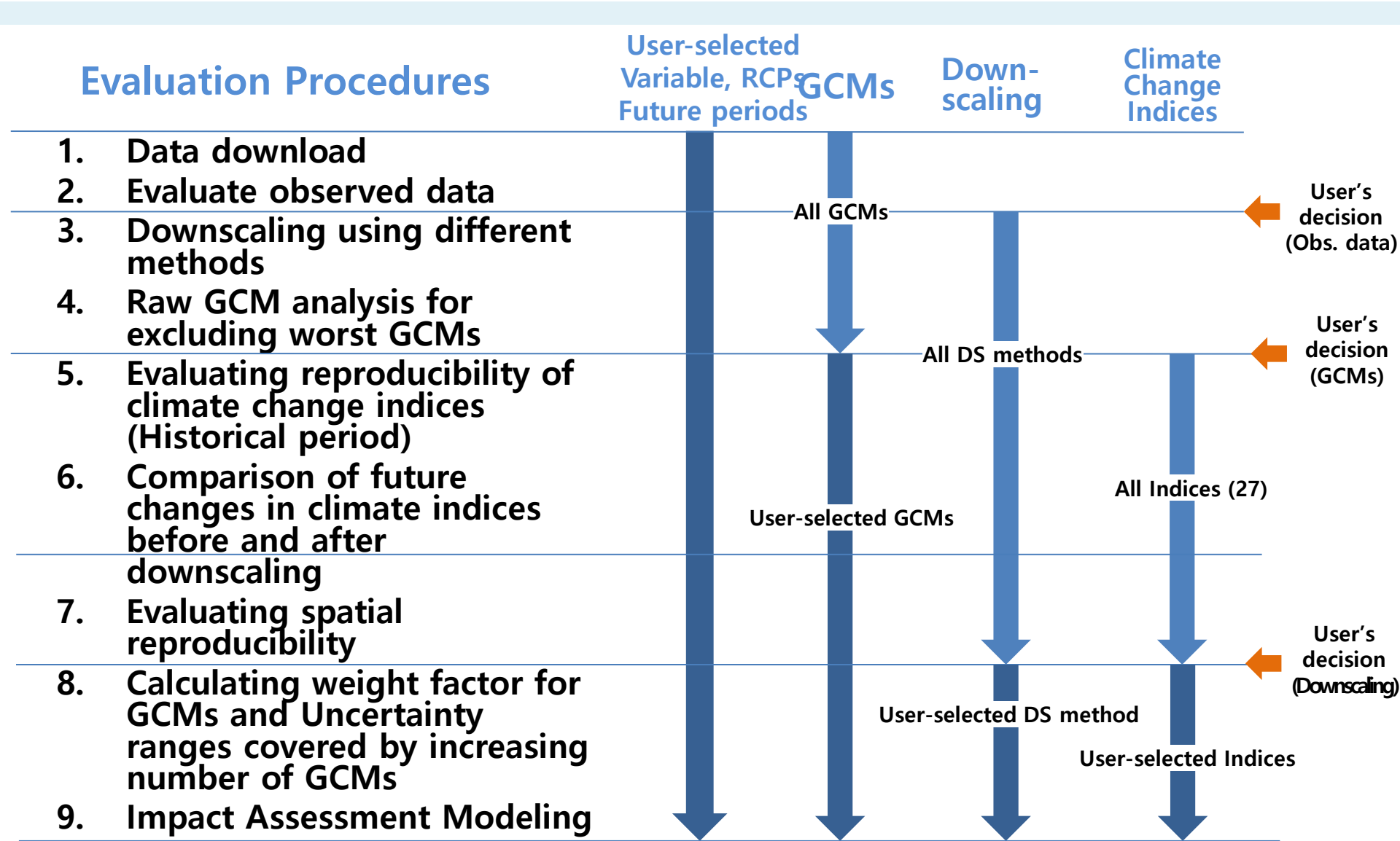
User-selected Indices

All Indices (27)

User's
decision
(Obs. data)

User's
decision
(GCMs)

User's
decision
(Downscaling)



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)

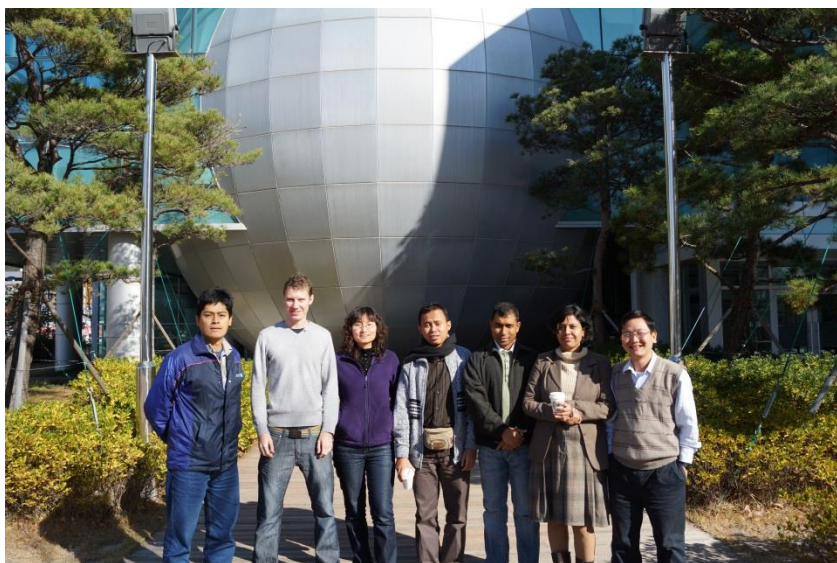
- Policy or Decision maker
- 2-3 days
- Application (water and agriculture) sectors
- Discuss how to integrate climate adaptation and mitigation measures in national level plans
- Need to collaborate with international organizations (UNDP, FAO, etc.)

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)

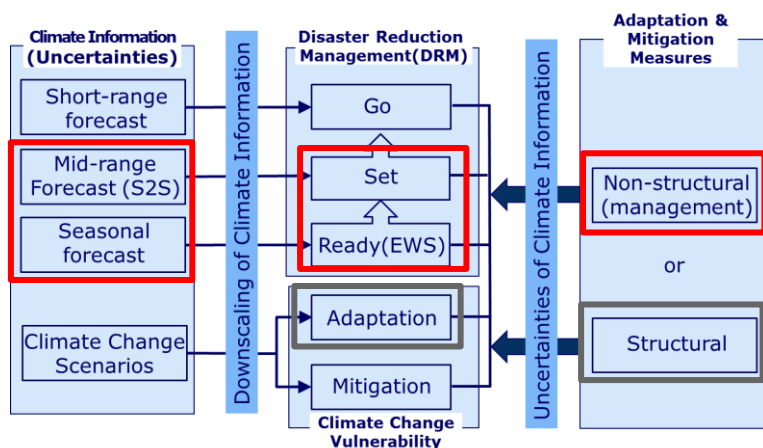


- strengthen the ability of participants to develop projects that tackle climate change for their country-specific needs. In particular, this workshop focused on the official development assistance (ODA) fund of the Korean Government, which is intended to promote economic development and to improve quality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

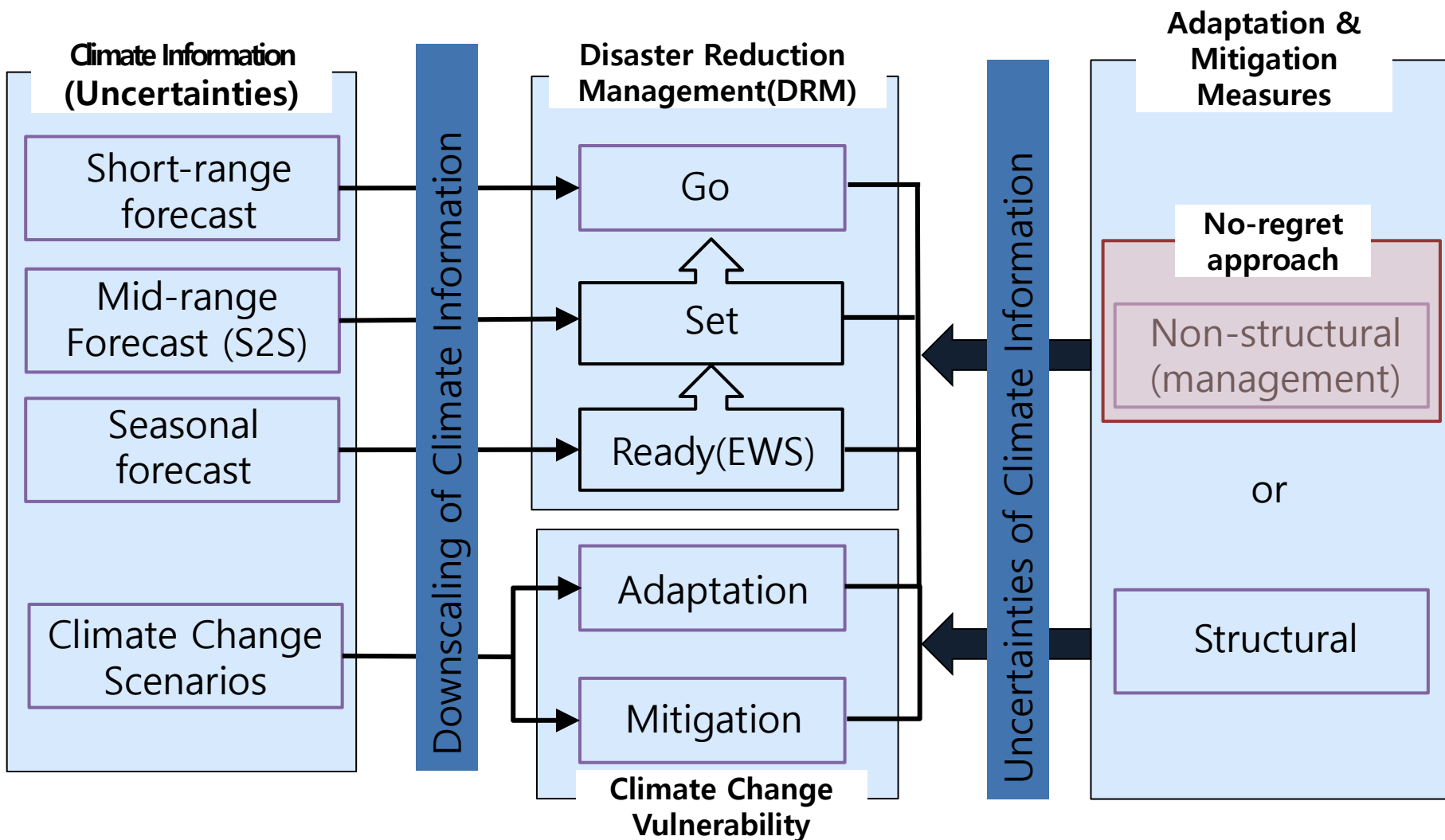
Education: APEC Climate Symposium



- 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*)

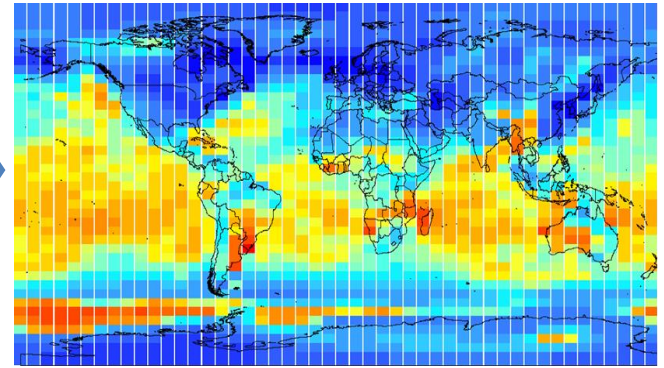
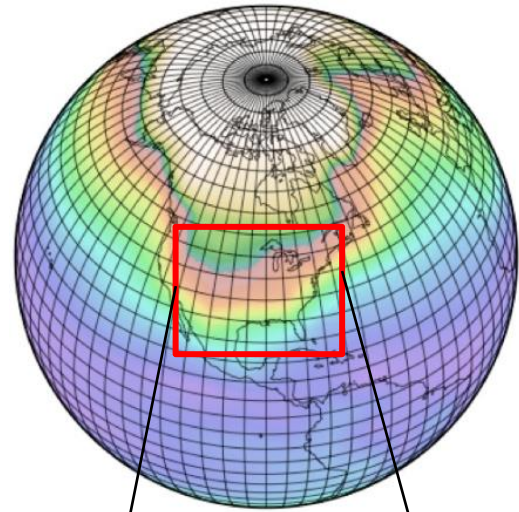
Downscaling and Adaptation



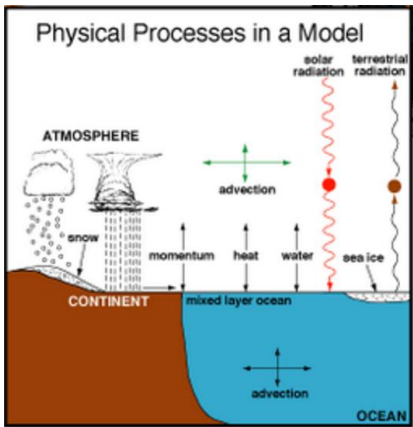
Climate Information Created Using GCMs and RCMs



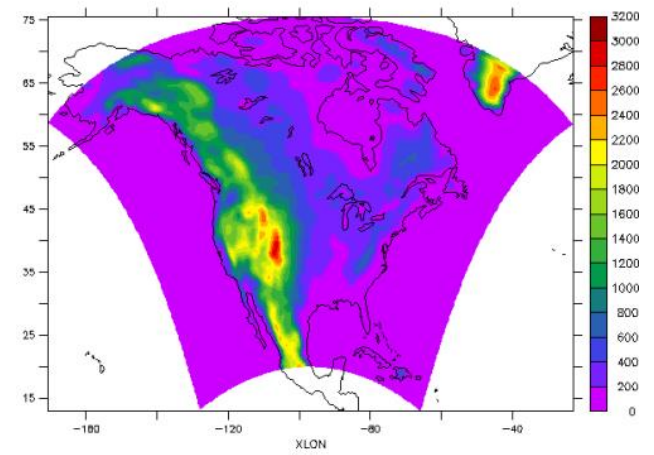
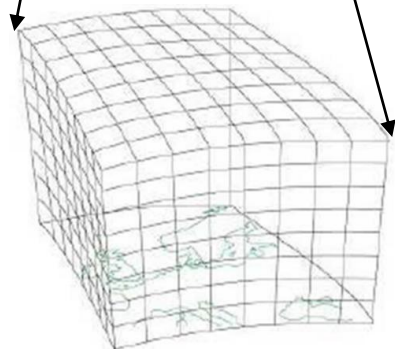
Real Earth System



GCM: Global Climate Model



Processes in GCM



RCM: Regional Climate Model

Necessary for spatial downscaling and bias-correction

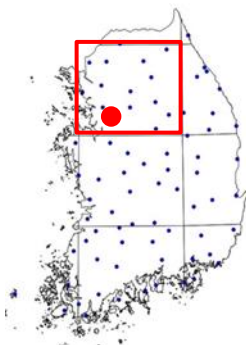
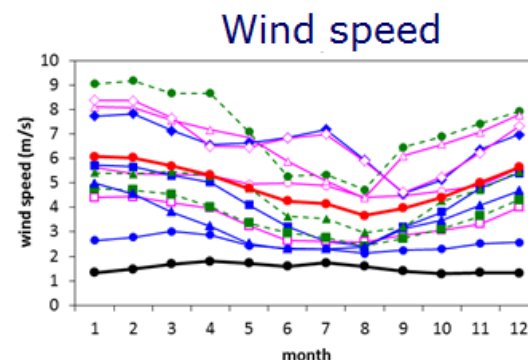
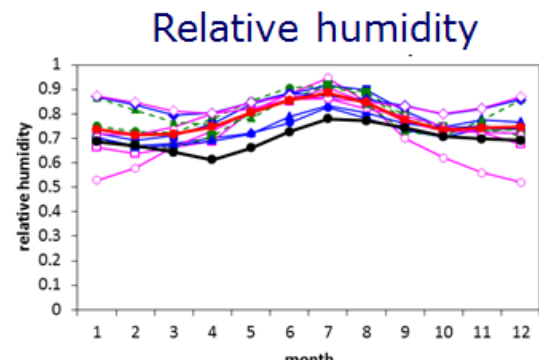
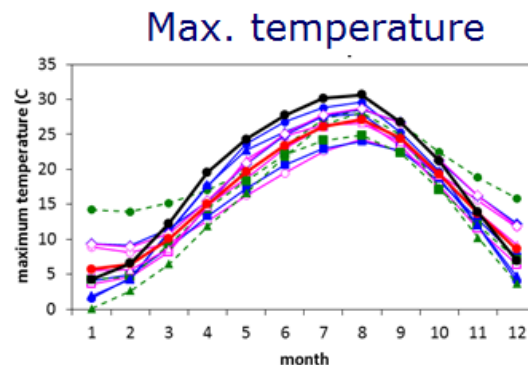
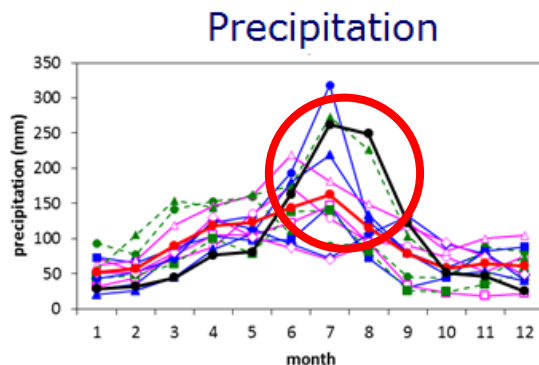
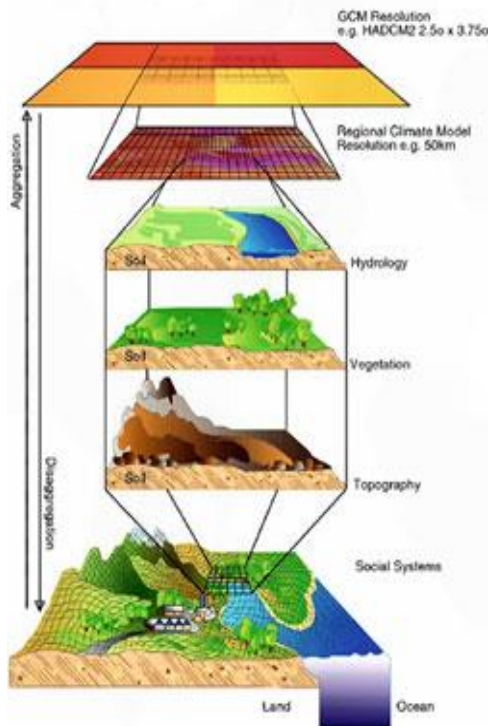


Image courtesy of the UK Met. Office



- | | | | |
|--------------|--------------|----------------|------------------|
| ● KMA-12.5km | ■ GFDL-CM3 | ▲ HadGEM2-CC | ◆ MIROC-ESM |
| ○ bcc-csm1-1 | □ GFDL-ESM2G | △ inmcm4 | ◇ MIROC-ESM-CHEM |
| ◆ CanESM2 | ■ GFDL-ESM2M | ▲ IPSL-CM5A-LR | ● MME |
| | | | ● Observed |

➔ Requires spatial downscaling and bias-correction

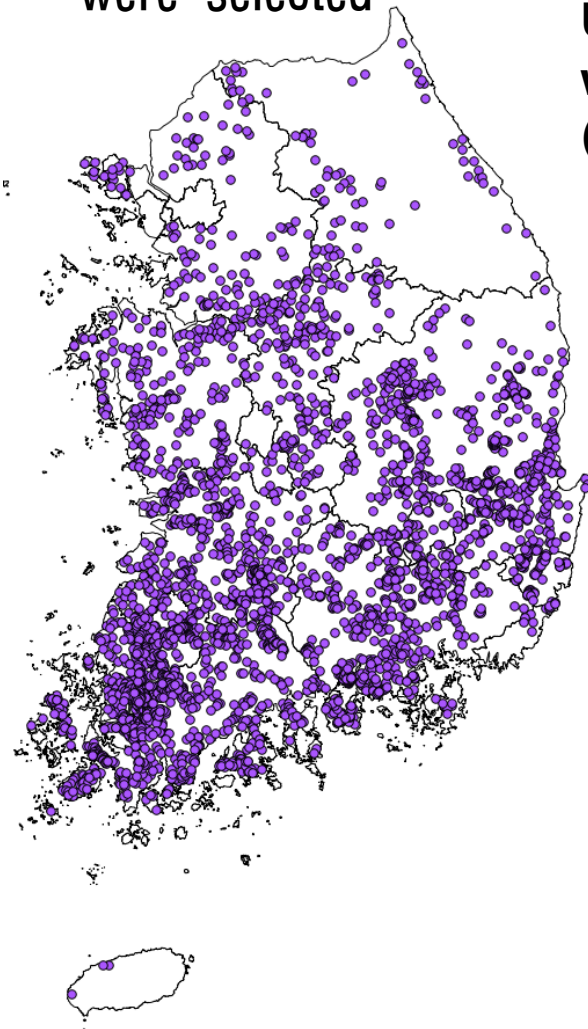
Agricultural drought with respect to reservoirs: vulnerable to changing climate



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

Climate change impact assessment on agricultural reservoirs

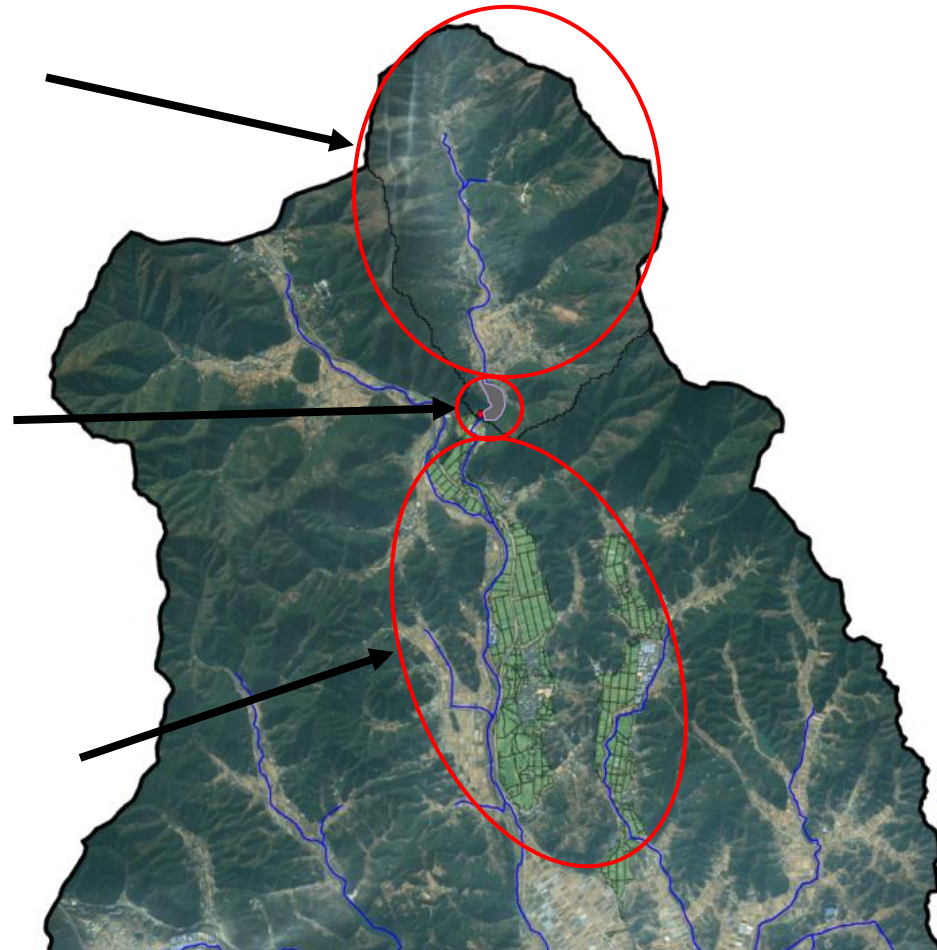
- ❖ 3372 reservoirs managed by Korea Rural Community Corporation (KRC) were selected



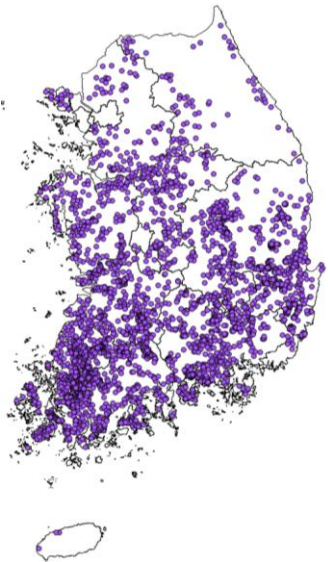
Upstream watershed (Inflow)

Reservoir (storage)

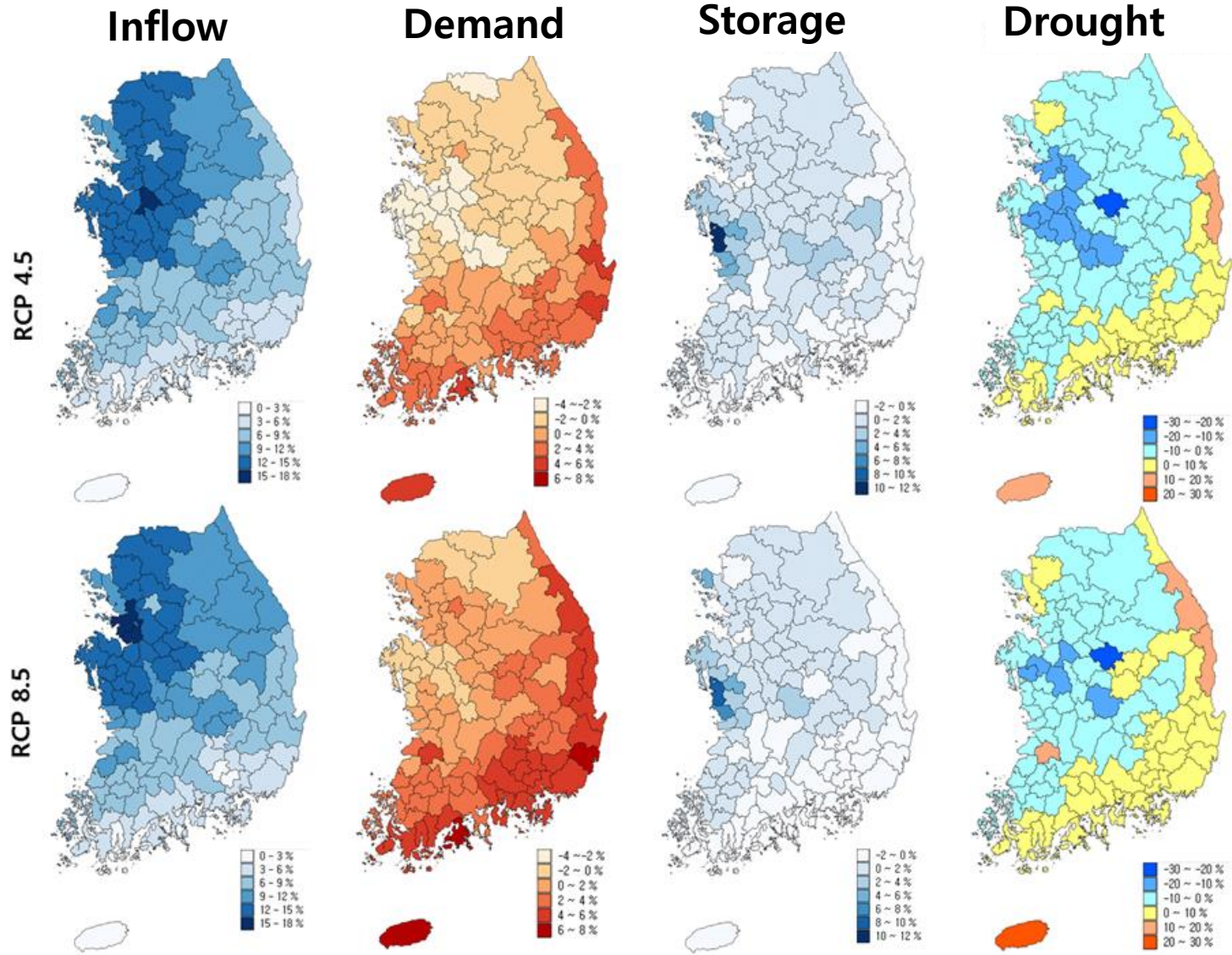
Irrigation Area (Demand)



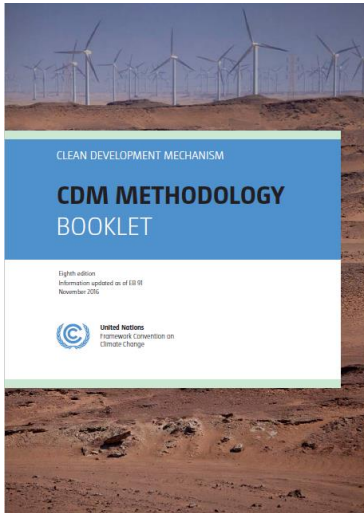
Climate Change Impact on Agricultural Reservoir in Korea



- Based on 3372 reservoirs managed by KRC



Changes in water management (irrigation) as a mitigation measure

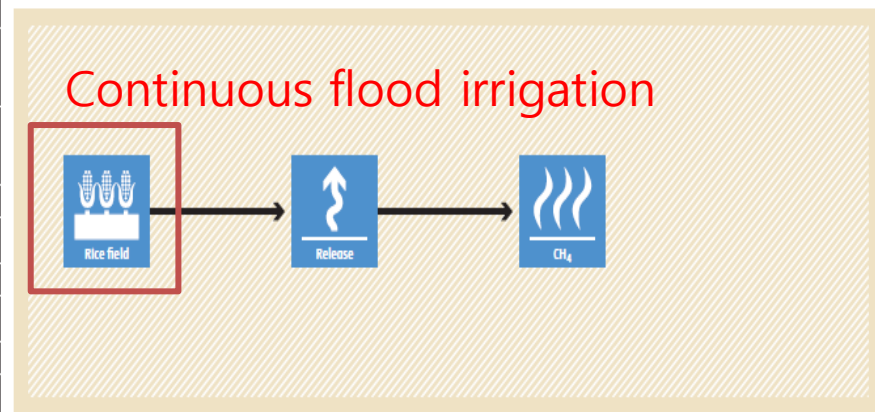


- Activity types
 - Displacement of a more-GHG-intensive output
 - Renewable energy
 - Energy efficiency
 - GHG destruction
 - GHG emission avoidance
 - Fuel switch
 - GHG removal by sinks

Methane emission reduction by adjusted water management practice in rice cultivation

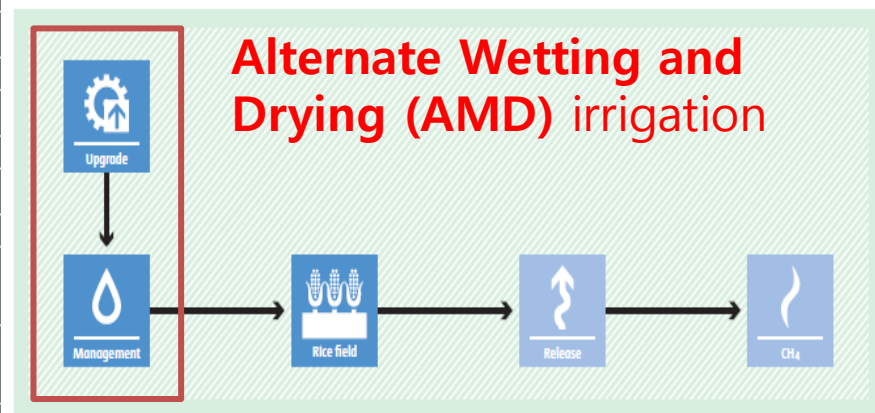
BASELINE SCENARIO

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



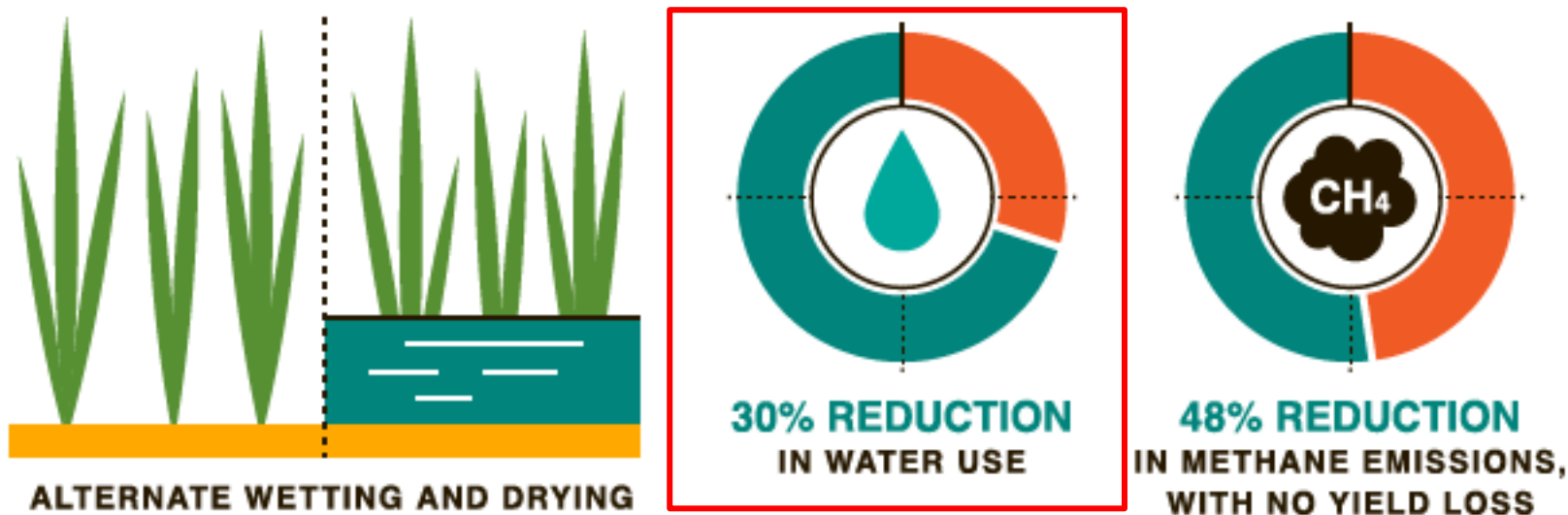
PROJECT SCENARIO

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).

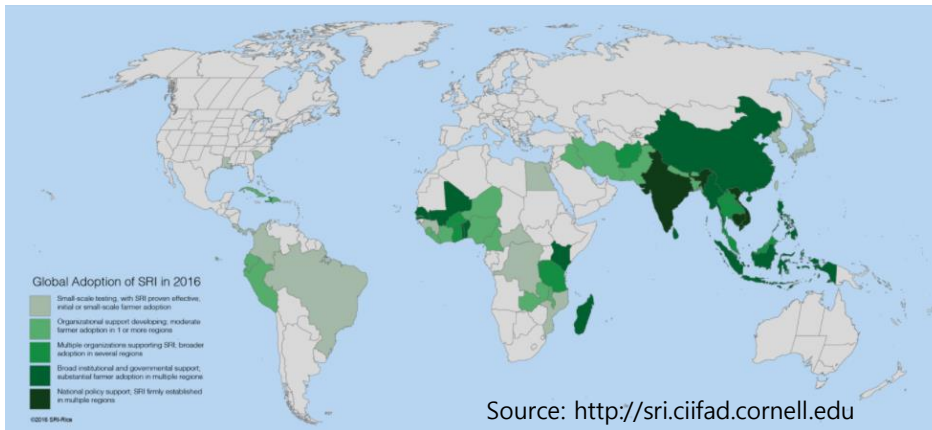


Source: <https://ccafs.cgiar.org/bigfacts/#theme=evidence-of-success&subtheme=crops&casestudy=cropsCs3>

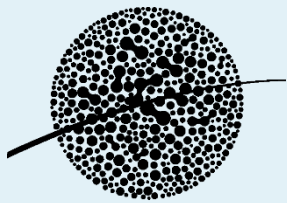
- In addition, yields can be increased and non-point source pollutants can be reduced.

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	●

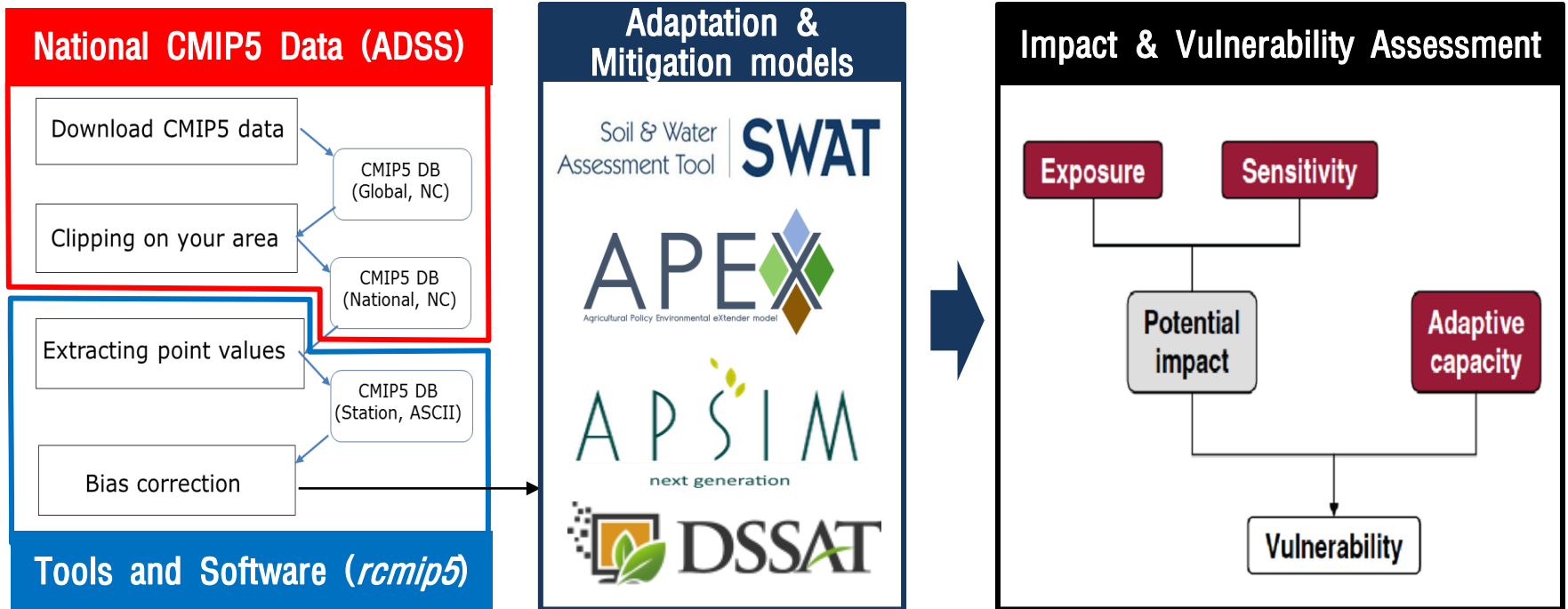


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Downscaling Platform



& Other 17 member economies (2017)



User input (Observed weather station data)

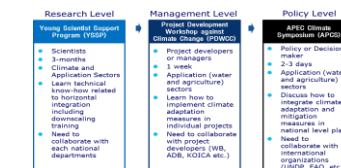
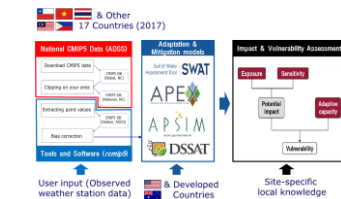
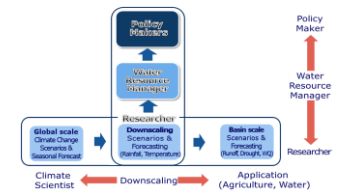
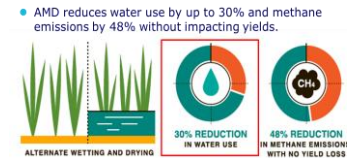
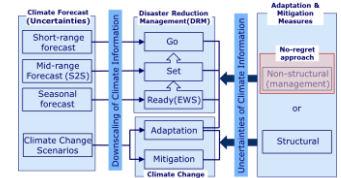


& Developed Countries

Site-specific local knowledge

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





By HikingArtist.com

Thank You!