2022 APEC Research Center for Typhoon and Society (ACTS) Annual Meeting (2022ACTS) & 2022 ACTS Expert Meeting / Policy Dialogue Report

APEC Policy Partnership for Science, Technology and Innovation

October 2024

Asia-Pacific
Economic Cooperation

Asia-Pacific
Economic Cooperation

Report

2022 APEC Research Center for Typhoon and Society (ACTS)
Annual Meeting (2022ACTS)
(PPSTI 06 2022S)

Seattle, 4 August 2023, Physical (In-Person)

&

2022 ACTS Expert Meeting / Policy Dialogue

Taipei, 9 December 2022, Virtual

APEC Policy Partnership for Science, Technology and Innovation

October 2024

APEC Project: PPSTI 06 2022S

Produced by

Project Overseer:
APEC Research Center for Typhoon and Society (ACTS)
Chinese Taipei

Editor

Yanling Lee (Sophia)
Secretary-General
APEC Research Center for Typhoon and Society (ACTS)
886-2-8195-8673
E-mail: sophiancdr@gmail.com

For
Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 68919 600
Fax: (65) 68919 690
Email: info@apec.org
Website: www.apec.org

APEC#224-PP-04.4 ISBN: 978-981-94-1374-4

Table of Contents

Executive Summary

The Role of APEC Research Center for Typhoon and Society (ACTS) APEC Resilient Science and Technology under PPSTI and APEC

Economic development and sustainability can be severely impacted by climate extremes and natural disasters extensive interruptions to daily livelihood, lifeline systems, critical infrastructure or education. Under APEC, through cross-fora coordination and collaboration, Policy Partnership for Science, Technology and Innovation (PPSTI) and Emergency Preparedness Working Group (EPWG) provided one of the best networks to synergise resources at the regional level to benefit APEC stakeholders on strengthening disaster risk management and sustainable development. Considering the dynamics and diverse impacts of natural disasters, we encouraged continuous investment in science, technology and innovation for resilience on adaptation countermeasures. In light of this, ACTS hosted capacity building activity under PPSTI with cross-fora engagement on STI as one of the APEC ECOTECH priority.

Dr. Hwanil Park, Vice Chair 2021-2024 of PPSTI, Science and Technology Policy Institute, Republic of Korea addressed the severe impact of climate extremes on economic activity and the important role of ACTS for capacity building on STI through cross-fora collaborations in the opening at the ACTS expert meeting and policy dialogue in Taipei. Moreover, Dr. Christin Kjelland, the Senior Advisor, Office of Science and Technology Cooperation, U.S. Department of State thanked ACTS for the great efforts in arranging a crucial set of interesting topics and discussions including the unique climate science and technology help to reduce the impact of future disasters. She highlighted in the opening remarks of the ACTS annual meeting that “building a resilient, interconnected, innovative and inclusive future for all, we need to focus on policy aspects for support the capacity building on data infrastructure, women-led gender responsive on openness, transparency, harness, equality and fairness for synergies” in Seattle.

A step forward

ACTS identified challenges, opportunities, and common interests to formulate **APEC Non-Binding Climate Resilience Guiding Principles** for capacity building as well as information and good/best practices sharing on how to apply smart solutions and policy to climate-related sectors including weather prediction, disaster monitoring on STI with a gender perspective and grass-root empowerment amidst pandemic spreading to overcome critical environmental and societal challenges through public private partnership.

Acknowledgements

The ACTS Annual Meeting and related Meetings was organised by the APEC Research Center for Typhoon and Society Climate (ACTS) co-sponsoring by **The Republic of Korea**; **Thailand;** and **the United States** with collaborative support from the U.S. Department of State, the APEC Emergency Preparedness Capacity Building Center (EPCC) under EPWG and APEC Climate Center (APCC) under PPSTI facilitated by the cross-fora institutional support from the Asia-Pacific Economic Cooperation (APEC) through EPWG, ACTWG, SCSC, SMEWG, CTI-DESG, FMP-DRFI and ABAC.

ACTS would like to express our profound appreciation to the honorable delegates and guests, distinguished experts and speakers for their contributions and endeavours on disaster risk reduction (DRR) and climate change adaptation (CCA) to leave no one behind towards **Climate Resilient APEC** on sustainable and inclusive growth.

Background

APEC was facing the pressing challenges of a dynamic environment on economic development over natural disasters, climate extremes and pandemic spreading. Over the past two decades, APEC remained as one of the most vulnerable regions to disaster and climate crisis. With increased frequency and intensity of climate variability and extreme events, disaster impacts can easily reach the threshold and jeopardise human security to a greater extent in APEC region.

In light of this, APEC strived to enhance resilience to natural disaster through better utilising science, technology and innovation (STI) for policy and decision-making on real-time or near real-time information sharing for emergency preparedness. Smart technology, solutions and scientific-based or evidence-based approaches have been widely adopted in DRR and CCA to tackle disaster and extreme events for prediction, monitoring, mitigation and recovery. The smart digital tools and solutions such as IoT and AI can play a critical role in risk communication and information dissemination that trigger proactive actions in various sectors on cross-cutting issues including food security, energy, disaster preparedness, and climate crisis. In this context, we can better facilitate the data flow and information dissemination through public and private partnership for human security from the decision-making process to emergency preparedness.

To resolve the interoperability among stakeholders across borders for information sharing, a whole-of-society approach on public private partnership is critical for networking under APEC. Stocktaking the efforts undertaken to overcome data sharing barriers of current methodologies in dealing with DRR and CCA, we can work as a team to respond as a whole of society. To achieve the goals of developing STI-based smart solutions and policy on DRR and CCA, ACTS expert meeting/policy dialogue in Taipei served to discuss how to leverage the frontier smart solutions and policy to strengthen DRR and CCA for a resilient, inclusive, balanced and sustainable APEC. Following the concluding summary, 2022 ACTS invited the stakeholders to brainstorming the guiding principles for climate resilient city and community in Seattle.

For creating a resilient future for sustainability, ACTS aimed to synergise the investment and resources in STI and continue to promote capacity building for better emergency preparedness through cross-fora collaboration. Meanwhile, the project collected and shared good/best practices and policy through public private partnership for climate and supply chain resilience for a sustainable future. The output of guiding principles can be of good reference for APEC member economies to better respond to,

prepare for and recover from disasters and climate crises. By learning the current endeavors and best practices to address climate change and disaster risk management using smart digital solutions and technology, member economies in APEC can mitigate the impact, reduce life loss, and recover faster from the impact.

Introduction

The 2022 ACTS Annual Meeting was organised by the APEC Research Center for Typhoon and Society Climate (ACTS) in APEC Resilience Week during 2023 SOM3 Cluster in Seattle co-sponsoring by The Republic of Korea; Thailand; and the United States with collaborative support from the APEC Emergency Preparedness Capacity Building Center (EPCC) under EPWG facilitated by the institutional support from the Asia-Pacific Economic Cooperation (APEC).

APEC Resilience Week – 2022 ACTS Annual Meeting aimed to achieve enhancing APEC resilience through science, technology and innovation for DRR and CCA amidst COVID-19 for building the capacity and knowledge on demand for applying smart technologies and solutions to tackle pressing societal challenges through public private partnership. This project helped us in sharing the best practices for the resilience of common goals, needs and interests to contribute to the APEC region according to BCG Principles towards Sustainable Development Goals (SDGs) and further explore:

- the risk associated with climate and environment is getting severe and affecting our lives that great threats to economic development and sustainability regionally and globally
- the smart solutions and technologies as critical enablers in providing scientific evidence and solutions in responding to the risks.
- the network of collaboration or partnership among stakeholders in multi-sectors for tackling the challenges.

ACTS Hosts 2022 ACTS Annual Activities in Two Phases:

APEC Webinar – 2022 ACTS Expert Meeting / Policy Dialogue, 9 December 2022 in Taipei

ACTS hosted the ACT Expert Meeting / Policy Dialogue on 9 December 2022 as one of the APEC Webinar Series on Resilience online (virtual) in Taipei to refine and explore the key areas for synergising the institutional capacity. As a steering committee meeting of the 2022 ACTS annual meeting, back-to-back cross-fora collaborated with

the EPWG-APECRW Expert Meeting / Policy Dialogue dated 8 December 2022 to echo Chinese Taipei's EPWG initiative - APEC Resilience City/Community (ARC).

Ten-eighteenths of the honorable delegates and distinguished speakers were female (up to 56% female participation rate), the diverse backgrounds of five APEC member economies (Australia, Japan, Republic of Korea, Chinese Taipei and Thailand) from public and private sectors attended the 2022 ACTS Expert Meeting / Policy Dialogue. The collective efforts for brainstorming from climatology, disaster risk management, AI technology, community-based strategy, climate change adaptation and all-hazard approach for resilience are significant. Bringing forward the concluding summary, ACTS well-structured the ACTS Annual Meeting in Seattle.

2022 ACTS Annual Meeting, 4 August 2023 in Seattle

To echo SFDRR's priorities which emphasized the whole of society's involvement and the PPSTI Strategic Plan (2016-2025) on "Promoting Enabling Environment for Innovation", the key objectives of the policy dialogues for formulating the framework:

1. Mitigating Climate Extremes: showcase best practices sharing of natural disasters and climate extremes amidst the pandemic spreading for consultancy to enabling sustainable recovery through "Public-private-partnership".

2. Providing Decision-Relevant Science and Technology Information: share the capacity of research, science and technology on scenario basis for risk communication.

3. Engaging Stakeholders'' Participation: include academia, business, NGOs, NPOs and government at all levels in coping with situations and impacts for PPP operation.

Align with the Manila Framework and aimed at capacity building amidst COVID-19 spreading for "increasing sustainability and inclusion and sustainability of recovery", the 2022 ACTS annual meeting focused on policy dialogues for increasing inclusion and sustainability for recovery. Via promoting public-private partnerships on science and technological innovation, we managed to work on how to mitigate climate extremes via sharing decision-relevant information, science and technology for engaging "APEC Climate Resilient Society" initiative.

Focusing on impact-based solutions, 2022 ACTS Annual Meeting explored the future endeavors for ACTS attempts to maximise the socio-economic development of member economies for promoting people-centered and gender-responsive multi-hazard approach with shared or open technology.

Cross-fora Collaboration

ACTS activities were endorsed as one of APEC Internet Digital Economy Roadmap (AIDER's) key focus areas (KFAs) for implementation on DESG's 2022 Report to discuss systems or solutions that would enable cross-sectoral digital collaborations. ACTS Annual Meeting encouraged to synergise the investment and resources in STI for capacity building on emergency preparedness amidst COVID-19. Leveraging the frontier smart technology and innovation on strengthening disaster risk management and climate security, ACTS engaged cross-fora collaboration and invited the expertise from DESG, ABAC, and SMEWG to contribute the insightful vision with experiences and good/best practices sharing.

Through cross-fora coordination and collaboration, PPSTI and EPWG provided as one of the best network to synergise resources at the regional level to benefit APEC stakeholders on strengthening DRR and CCA for sustainable development.

The Expected Outputs and Outcomes

With public private partnership on STI, ACTS can work together with member economies to mitigate the social and economic impact of climate emergency, natural disasters and pandemic spreading on better preparedness for building resilience.

Hosting both virtual and physical activities on topics-oriented discussions and policy dialogues to accommodate time differences of member economies, ACTS followed the concluding summary to benefit the APEC member economies on common interests toward a climate resilient APEC. A well-structured capacity building materials on STI and guiding principles benefited the APEC family and circulated among cross-fora collaboration under APEC Resilience Week to direct echo to the CT's Initiative - APEC Resilience City and Community (ARC) under EPWG for facilitating the interoperability KFA of AIDER-DESG.

To foster cross-fora collaboration coordinated by the program directors of PPSTI and EPWG, ACTS invited representatives from cross-fora engagement facilitated by APEC secretariat. The diverse group of expertise allowed the sessions to cover broader perspectives from STI application for DRR and CCA to climate smart agriculture and gender empowerment. Experts brought together their fruitful experiences and insights to showcase how emerging economies can better prepare for, respond to and recover from the impact of disasters and climate crises amidst pandemic spreading. The participants consisted of policy-makers, researchers, and practitioners responsible for climate change and climate-relevant sectors based on the common interests in DRR

and CCA. The highlights were summarised as follows together with a guiding principle for information in Annex I:

Highlights

Opening

To Harness the Power of Science and Technology to Address the Challenging in Every Scale for Resilient APEC

APEC was facing pressing societal challenges from the cascading impacts of natural disasters, climate extremes and pandemic spreading. “Carriers of the virus and bacteria are human beings and animals such as COVID-19 does not need a passport or visa to cross the border and travel worldwide”, said Prof. Kenji Watanabe, Chair of The Council for Critical Infrastructure Protection (Cabinet Secretariat), Japan. To address the most pressing challenges and reinforce our commitments towards resilience, the APEC Resilience Week opened in Seattle on 4 August 2023 and arranged a crucial set of interesting topics for discussions including the unique climate science and technology focus on helping to reduce the impacts.

Building a resilient, interconnected, innovative and inclusive future for all, “we need to focus on policy aspects for support the capacity building on data infrastructure, women-led gender responsive on openness, transparent, harness, equal and fair for synergies.” highlighted by Dr. Christin Kjelland, the Senior Advisor, Office of Science and Technology Cooperation, U.S. Department of State in the opening remarks.

To further contribute to the APEC family, APEC EPCC and ACTS shouldered to carry out the climate change Adaptation (CCA) and disaster risk reduction (DRR) efforts in line with the sustainability development goals (SDGs) and circulated the guiding principles for collaboration, adaptation and cohesion for policy-making towards resilient APEC.

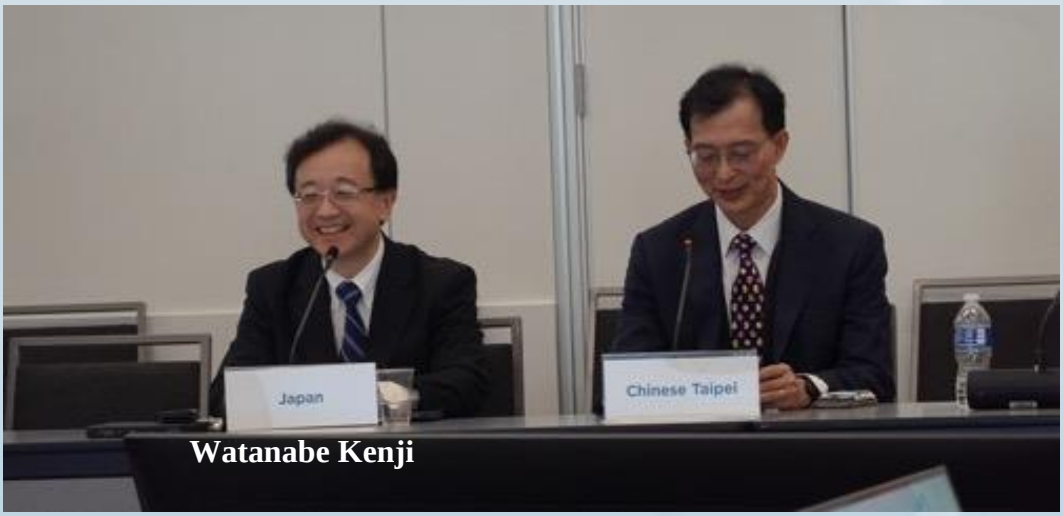
APEC Research Center for Typhoon and Society (ACTS) encouraged to synergised the investment and resources in science, technology and innovation in the APEC region for inclusive disaster risk reduction. For better capacity building on emergency preparedness, ACTS attempted to leverage the frontier smart technology and innovation on strengthening disaster risk management and climate security and implements this project in two phases as following:

- Promoting interoperability and discuss systems or solutions that would enable cross-sectoral digital collaborations.
- Sharing strategies, policies, counter-measures and best/good practices.
- Hosting in-person events, the 2022 ACTS Annual Meeting on 4 August 2023 in conjunction with the APEC Resilience Week in Seattle during SOM 3 Cluster to encourage full participation and engagement.
- Empowering women active participation, 50% of the honorable delegates and distinguished speakers and experts were female. 60% of the participants were female from 10 APEC member Economies – Australia; Chile; Korea; Japan; Peru; the Philippines; Singapore; Chinese Taipei; Thailand; The United States of cross fora collaboration among ABAC-APFF, APEC Climate Center, SCSC, SMEWG, PPSTI, FMP-DRFI.
- Echoing EPWG EPCC's CT initiative of "APEC Resilient City/Community (ARC) for Inclusive Disaster Risk Reduction" and in line with APEC disaster risk reduction framework (APEC DRRF).

- Concluded with a “Guiding Principles” focused on policy aspects for supporting the capacity building on data infrastructure, women-led gender responsive on openness, transparency, harness, equality and fair for synergies. The ACTS annual meeting materials, guiding principle, APEC Publication: 2022 ACTs Report & Proceedings as well as Project Completion Report were available and circulated for engaging cross-fora activity for future collaboration among EPWG, PPSTI, SCSC, SMEWG, CTI-DESG and FMP-DRFI.

Critical Infrastructure Protection and Cascading Events Simulation for Disaster-sensitive Metropolitan Areas

Kenji Watanabe



Watanabe Kenji

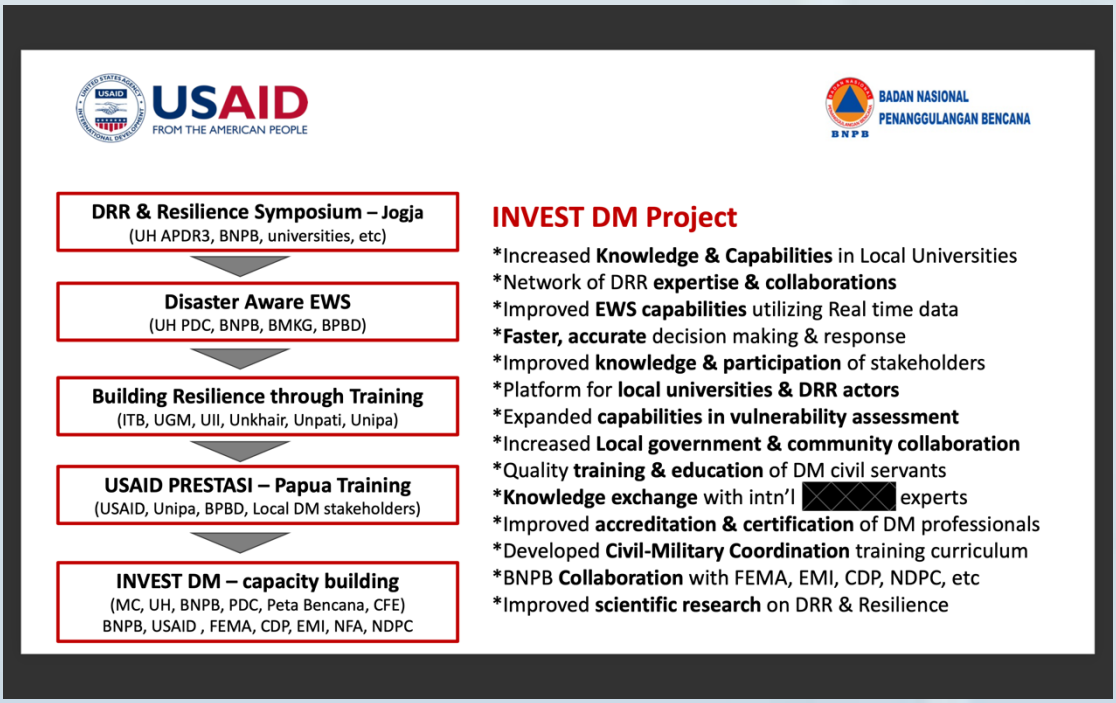
“Critical infrastructure security is a corner stone to a resilient city. Japan is dedicated to critical infrastructure protection including cyber security.” Prof. Watanabe Kenji, Chair of the Council for Critical Infrastructure Protection (Cabinet Secretariat) introduced a series of projects implemented in the disaster sensitive metropolitan areas such as Tokyo, Osaka and Nagoya on critical infrastructure protection lives and properties, economic activity, logistics, etc. dialogue among stakeholders across the boundary to develop a prototype model and toll to dynamic predict disruption that may occur in a large-scale disaster. Meanwhile, utilising technological seeds for visualising disaster risk and impacts for simulation on practical scenarios to deliver capacity building programs for training and drills, he showcased the Minato-Ward/Tokyo & Kyoto Station as a good practice for sharing. For future development, a framework for collaboration with multi-disciplinary modeling for disaster-sensitive elements and linkages were provided.

Investing in Human Capital for Disaster Management - FEMA, USAID, UNDRR, BNBO and UOH Collaboration Under EPWG to Accelerate SDGs and Climate Action for Adaptation in APEC
Karl Kim

Karl Kim, the Executive Director of the University of Hawaii National Disaster Preparedness Training Center (NDPC) introduced the training program on all-hazards capabilities to develop and deliver training and educational programs for homeland security and disaster management focus on natural hazards, coastal communities, special needs, islands, and territories. Partner with FEMA, the University of Hawaii, and its external partners teamed up to deliver training, products, and services. Since 9 February 2010, INVEST DM 2.0 served communities in building resilience, equity, and inclusivity.

Furthermore, NDPC provided a certified program on a multi-disciplinary approach to planning, social sciences and natural sciences of Disaster Management and Humanitarian Assistance (DMHA) cross-cutting in architectural, public health, social work, and civil engineering professions emphasise community involvement. The

training program focused on a rigorous and productive graduate-level curriculum and DRR skills to enter public and private sectors; local to international. Senior leaders' knowledge exchange is important for moving forward. ED Kim said, "the training program will greater focus on inclusivity for under-represented groups to provide nature-based solutions for build back better".

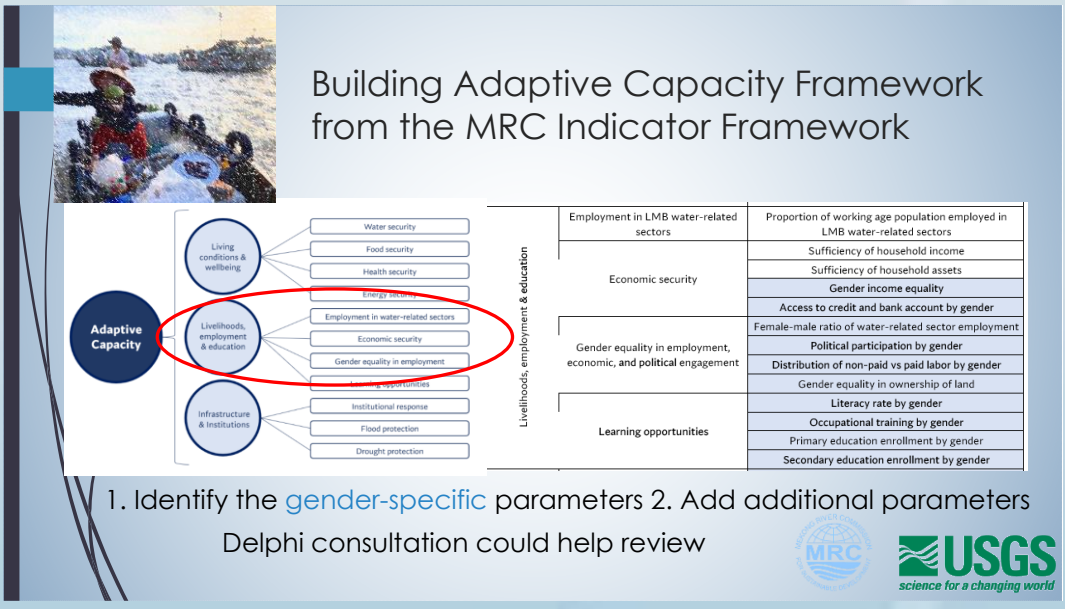


Climate Response Strategy
Matthew Andersen

To Partner for Inclusivity Towards APEC Resilience City and Community

In line with the APEC Aotearoa Plan of Action (APA) 2021 on "preventing, detecting, responding to, and recovering from, pandemics", Matthew Anderson, Senior Scientist for Biology from the U.S. Geological Survey (USGS) led the cross-border collaboration among Canada; Japan; Thailand; and the United States to establish a WOAH wildlife health center in the Asia-Pacific. The basic structure of the project aimed to engage cross-border networking for technical build capacity in the field to monitor wildlife health and emerging infectious diseases to achieve APA's important and aggressive goals.

The Climate Response Strategies for Capacity Building



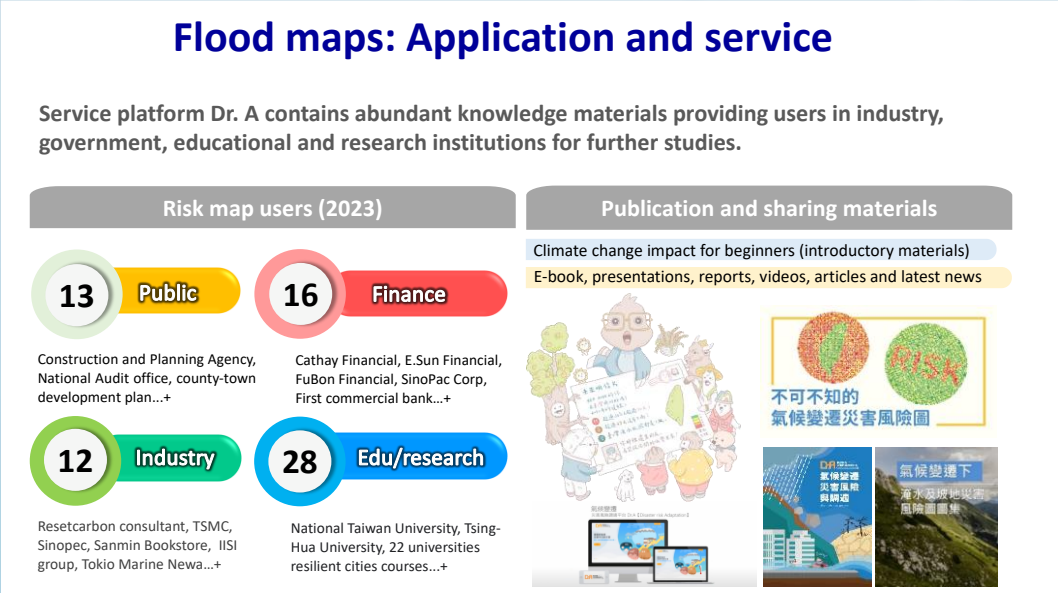
In another hand, to explore the possible countermeasures using modeling & simulation solutions in preparing for and responding to the cascading disaster events, Matthew Anderson of USGS introduced the NEXVIEW project using the adaptive multiple disciplinary approach to implement climate response strategies in Viet Nam and beyond for strengthening the resilience of Southeast Asia DRR and CCA on assessing how natural resources changes can affect the people of the lower Mekong River.

Call Upon Enhancing Critical Infrastructure from Quality Standard and Practices Perspectives

ACTS aimed to develop guiding principles and concepts of strategic sourcing for synergy based on cross-fora collaboration with SCSC. On consensus, Ms. Magdalena Navarro, Senior International Program Manager/Physical Scientist of National Institute of Standards and Technology (NIST) called attention to that “The disaster resilience of our physical infrastructure and communities today is determined in large measure by the building codes standards and practices used when they were built. With few exceptions, these legacy of codes, standards, and practices-which have evolved over several decades-are oversimplified and inconsistent with current risk assessments.” Thus, APEC needed decision support tools to modernize codes, standards, and practices consistent with the risk as well as risk-based storm surge maps for the design of structures in coastal regions guiding by an improved hurricane intensity classification scale.

“As construction and rebuilding costs continue to rise, there is increasing recognition of the need to move from response and recovery to proactively identifying and mitigating hazards that pose the greatest threats.” She further emphasised the importance of strengthening health systems for pandemic prevention, preparedness, and response (PPR), Climate Resilient APEC must be built base on a resilient, equitable, and sustainable health systems for ensuring the quality growth.

Climate Emergency Preparedness for All
Yanling Lee (Sophia)



Chinese Taipei launched the Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP), to engage interdisciplinary cooperation and information

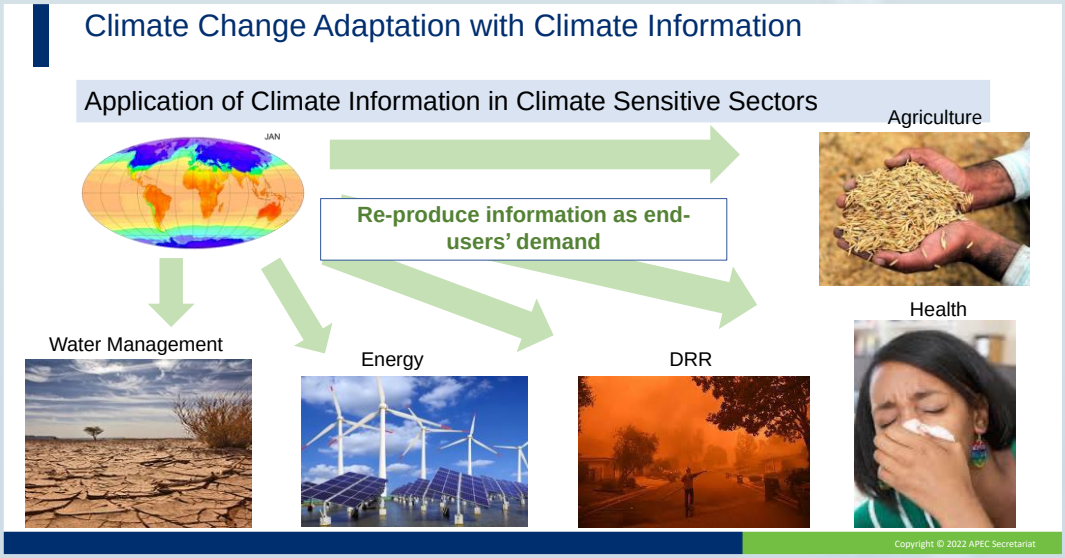
integration for climate change research. TCCIP reached out to the international connection and collaboration on climate change research for enhancing regional capacity. Through producing high resolution projections for policy making in response to climate crisis, TCCIP promoted climate change service online for DRR and CCA.

TCCIP research was divided into three functions on mission-oriented approach: climate projection and application, impact assessment and adaptation, and climate service and advocacy with a matrix structure to support each other to achieve designated outcomes. In the case of flood, TCCIP offered risk maps using 33 statistical downscale models with different resolution and spatial scale to support government, industry, research and people on demand.

Coordinating Science and Research for Responding to the Climate Crisis Under the Sea and Beyond
Sarah Zaunbrecher

National Oceanic and Atmospheric Administration (NOAA) worked with the private sector as well as the international partners to coordinate science and research for responding to the climate crisis and tackle societal challenges for human security and welcomed the APEC family to utilise NOAA oceanic and atmospheric research efforts to create products and tools to deliver science-informed decision-making for enabling better forecasts, earlier warnings for natural disasters, and empowering the blue economy.

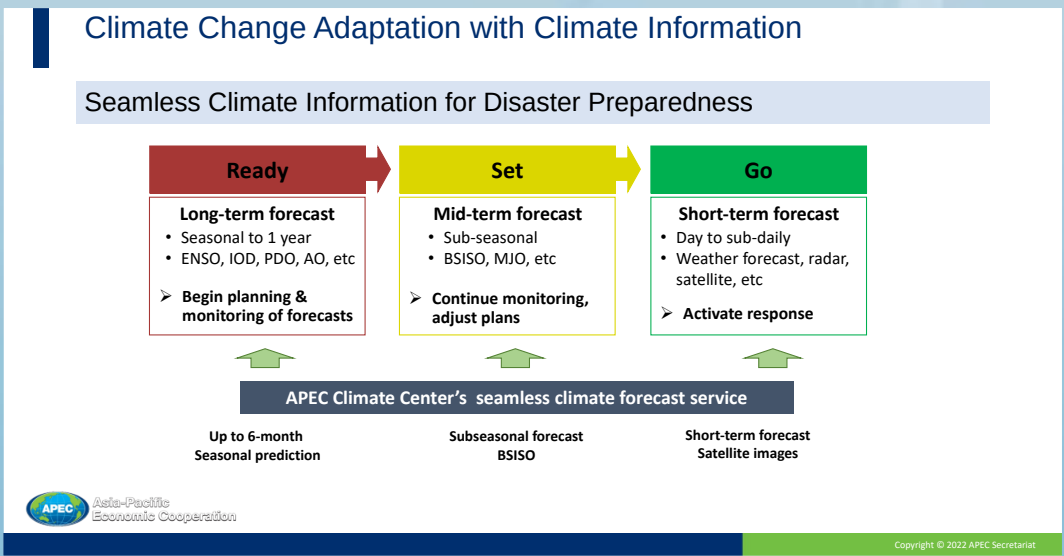
The U.S. Drought Monitor, climate resilience toolkits, and the National Integrated Heat Health Information System were launched to support local and regional decision making. Northeast Climate Adaptation Partnership/Regional Integrated Sciences and Assessment (CAP/RISA) program was one of the best practice for DRR through PPP among the New York City Department of Health and Mental Hygiene, the New York Major's Office of Recovery and Resiliency, and the POINT, a community group, to use heat risk metrics to co-create a social vulnerability index for heat.



The APEC Climate Center Strives to Strengthen Scientific and Technological Cooperation Across the APEC Region

Value of Climate Information to Respond to the Climate Crisis

Sangwon Moon



APEC Climate Center (APCC) highlighted that the Republic of Korea is experiencing a rate of warming more rapidly than the global average in terms of annual temperature, sea-level temperature and sea-level rise. In the past decade, Korea suffered the economic losses due to climate crisis and invested around two or three times of the losses for recovery. The APEC Climate Center committed to APEC economies and societies to deal effectively with the consequences of current climate-related hazards through the provision of climate information and technical support for DRR and CCA to implement “Ready-Set-Go” framework. It can be useful to identify actions according to the various climate forecast information on demand for decision making.

APEC Resilience Week – 2022 ACTS Expert Meeting/ Policy Dialogue

The 2022 ACTS Expert Meeting / Policy Dialogue was conducted in line with the action plan of the APEC DRRF, the Aotearoa Plan of Action and the APEC Putrajaya Vision 2040, 2022 ACTS Expert Meeting / Policy Dialogue highlighted in the Digital Economy Steering Group (DESG) - Work Program for the Implementation of the APEC Internet and Digital Economy Roadmap (AIDER) as one of the Key Focus Area (KFA) for Promotion of Interoperability, 2022 ACTS annual meeting contributed to exploring the strategic approaches toward enhancing APEC's human security agenda and promote resilient and secure growth.

For featuring scientific sessions on APEC member-need-driven policy making, the 2022 ACTS Expert Meeting/Policy Dialogue fully discussed framework, systems, countermeasures and solutions that enable cross-sectoral digital collaborations. To tackle the cascading impact of natural disasters, climate extremes and pandemic spreading, the event focused on the impact-base and people-centered approach to cover the information and good/best practices sharing on scenario basis especially for "New Normal" to enable practical application and access to open data and big data for sustainable resilience and benefit the APEC family as a whole society on inclusive growth.

The virtual expert meeting and policy dialogue supported the APEC 2022 Thailand priority of "balance in all aspects" on sustainability and connectivity with shared goals under the APEC Disaster Risk Reduction Framework (APEC DRRF) of an open, dynamic, resilient, and peaceful Asia-Pacific community (APEC 2022 Bangkok Goals

on BCG economy), this project aimed to achieve the goals of DRR and CCA through exploring science, technology, innovation, and digitalisation policy for decision-making.

To “Promoting Enabling Environment for Innovation - Promote Public Private-Partnerships for Science and Technological Innovation, ACTs structured the expert meeting and policy dialogues for connectivity and inclusivity. The event focused on policy, knowledge, best practices and information sharing amidst COVID-19 spreading. It is valuable for facilitating collaboration on synergy to mitigate the cascading impact of natural disasters, climate extremes and pandemic spreading on a scenario basis for resilient and inclusive APEC. Moreover, the project supported regional science and technology capacity building to strengthen the regional connectivity in line with the PPSTI Strategic Plan (2016-2025).

Gender Empowerment

Ten-eighteenths of the honorable delegates and distinguished speakers were female (up to 56% female participation rate) with diverse backgrounds from five APEC member economies (Australia; Japan; Republic of Korea; Chinese Taipei; Thailand) consisting of regional and global institutions from both public and private sectors. The collective efforts and brainstorming from climatology, disaster risk management, AI technology, community-based strategy, climate change adaptation and all-hazard approach for resilience were fully discussed and summarised.

Activity Overview

In “Sustainable innovation: The Next Generation of Forecasting and Early Warning”, experts shared their expertise on delivering the policy-led disaster risk reduction countermeasure of how to mitigate the climate/pandemic/economic impact in APEC to promote climate resilience and capacity building including the lessons learnt from recent challenges. It provided a brief overview of the work toward sustainable development under APEC for promoting Climate Resilient City and Communities of ACTS. The best practices sharing and work progress through climate risk-informed approach and impact-based forecasting benefited the APEC family on climate resilience for urban planning and showcased the synergy in the field of quality infrastructure, climate disaster risk financing and investment, nature-based solutions for blue and green economy, people-centred and gender-responsive, multi-hazard early warning systems/platform/network. The key considerations of discussions on effectiveness and efficiency of DRR and CCA amidst pandemic spreading are summarised on how to utilise smart digital solutions for research and development,

early warming, response, preparedness, recovery, risk awareness/communication, and information dissemination in tackling natural disasters and climate crises.

Opening Ceremony

The 2022 ACTS Expert Meeting/Policy Dialogue opened in the morning of Thursday, 9 December 2022. The Opening Ceremony began at 09:00 AM (TPE) with the welcoming address by Dr. Wei-Sen Li, Executive Director of APEC Research Center for Typhoon and Society (ACTS), to convey the appreciation on behalf of Chinese Taipei for the activity participation from PPSTI as well as cross-fora gathering online for the APEC webinar to contribute to the “Climate Resilient City initiative” in APEC. Moderate by Dr. Yanling Lee (Sophia), the Secretary General of ACTS with the honour to welcome Dr. Hwanil Park, Vice Chair of APEC Policy Partnership on Science, Technology and Innovation (PPSTI) to deliver the opening remarks.

Dr. Hwanil Park, Vice Chair 2021-2024 of PPSTI, Science and Technology Policy Institute, Republic of Korea. He thanked the host for the opportunity to join this critical webinar for building APEC resilience as a whole of society. He took note of the economic development and sustainability can be severely impacted by climate extremes and natural disasters on extensive interruptions to daily livelihood, lifeline systems, critical infrastructure or education in the past decades. Thus, he addressed the critical role of APEC Research Center for Typhoon and Society (ACTS) on promoting “APEC Resilient Science and Technology” under PPSTI for building the capacity of STI and engaging synergies through cross-fora collaborations towards resilient and sustainable APEC.

He also recognised that institutional and financial support for community disaster management activities is important for ensuring the sustainability of APEC economic activities. In light of this, PPSTI continued to promote policy-led DRR actions toward self-motivated communities driven by local knowledge for planning to succeed the whole-of-society approaches that ACTS advocates to supporting community capacity building.

Plenary Session I: Sustainable City and Community

Moderated by Dr. Yanling Lee (Sophia), the project overseer, began at 09:20 AM (TPE) on 9 December 2022. This session shared the current status of sustainable innovation and showcased the policy-led DRR and CCA summarised as following:

1. The current action plan, innovative approach and AI technologies in climate change adaptation are introduced and discussed. Experts also shared their views on climate crises, community-based strategy and capacity building programs within or across borders for implementation.
2. The session finalised to utilise digital tools of early warming for capacity building, to implement the BCP strategy and action plan in higher education, and to streamline the way towards collaborations on climate risk-informed approach and impact-based forecasting are summarised.

Dr. Yanling Lee (Sophia), the project overseer, introduced Ms. Panisa Harnpathananun, Division Director, Division of Higher Education Innovation and Future Skill Development, Office of National Higher Education Science Research and Innovation Policy Council to brief "The Best Practice Sharing on Capacity Building, Higher Education Policy on Promoting People-Centred, Gender-responsive, Nature-based Solutions for Blue and Green Economy on BCG".

The Best Practice Sharing on Capacity Building, Higher Education Policy on Promoting People-Centred, Gender-responsive, Nature-based Solutions for Blue and Green Economy on BCG (Thailand)

Ms. Panisa Harnpathananun started her briefing by sending her appreciation to the ACTS and participants. She introduced the BCG strategy and action plans 2021-2027 and showcased a set of policies formulation in Thailand highlighted the “higher education sandbox”. It was for unlocking restricted rules for new higher education model testing to encourage universities to be relevant in new global contexts. Meanwhile, Thai government launched the “Higher Education Development Fund” to support funding for developing high-performance manpower and excellence in higher education institutions to build “High-Skilled Workforce Development Platform” for knowledge sharing.

Climate Risk and Early Warning Systems (CREWS) Implemented an Early Warning System for Drought in Papua New Guinea (Australia)

Professor Yuriy Kuleshov, Science Leader for the Climate Risk and Early Warning Systems (CREWS) at the Australian Bureau of Meteorology and Professor at the

SPACE Research Centre, Royal Melbourne Institute of Technology (RMIT) University showcased the best practices in Papua New Guinea (PNG) on implementing the Climate Risk and Early Warning Systems (CREWS) as an international initiative. To build PNG's resilience to the impact of future droughts strike, CREWS developed an early warning system (EWS), Drought Watch and Alert stages for some provinces in PNG. EWS can trigger warning up to six months prior to the drought emergency. This clearly demonstrated the value of develop drought EWS for DRR and CCA on mitigate human suffering and economic losses.

Enhancing APEC Resilience Through AI Applications in Climate Change Adaptation (Korea)

Dr. Jinyoung Rhee, Research Fellow, Prediction Research Department, APEC Climate Center introduced APCC, the platform for climate prediction information, and summarised the outcomes and findings of 2022 APEC Climate Symposium on "Enhancing APEC Resilience Through Artificial Intelligence (AI) Application in Climate Change Adaptation". Bring the fruitful discussion and conclusion forward, APCC committed to further applying AI technology for enhancing APEC resilience and the building capacity of APEC member economies to tackle the pressing challenges of the climate crises. Moreover, she highlighted the importance of engaging the international collaboration and partnership on AI applications can benefit APEC for DRR and CCA as a conclusion.

Questions and Answers

There were questions from the participants and experts:

1. How to deliver BCG in Higher education to tackle disaster and climate crises?
2. In spite of drought, will CREWS provides EWS for floods in the future?
3. How efficient the AI application can support DRR and CCA?

Discussion

For the first discussion topic, Thailand expert addressed the current level of higher education for capacity building on BCG. The experts and participants highly valued the policy-let strategy and action plan with an appropriate funding allocation to realise BCG commitment by 2027.

The second topic of the discussion was on early warning system of CREWS initiative. Australian expert showcased CREWS on drought for the indigenous people in PNG. The experts and participants were interested in whether the scope of the project

deliverables can be extended to flood and other related climate crises and the answer was positive. The CREWS will provide CREWS services on flood in the near future.

The third topic of the discussion was on AI application for climate prediction. Experts addressed the current level of credibility and reliability of AI technologies for climate change adaptation especially for prediction. APCC was working to collaborate in this area. It is important that AI application in prediction is ready in certain specific functions of work. Thus, given relatively straight forward and well-defined problems, most of the time, AI answers right. A continuous STI effort on AI is important to adopt the matrix and evaluate those tools depending on the situation simulation verified by scientists. Thus, it is fundamentally important to develop AI tools together with the stakeholders who will be using those tools to acquire reliability and creditability.

Data-driven weather prediction seemed very close to the numerical prediction in data processing; thus, the accuracy and the performance of the models are good to a certain extent but the credibility and reliability of these models are still uncertain. In this context, there is still a lot of work and effort needed for building credibility and reliability in the climate change model. Using AI technologies with cautious where relevant, it shall be further discussed on barriers to capacity, especially knowledge of relevant AI tools within both private and public sectors, poor international cooperation networking on various critical issues were also mentioned.

The ACTS Expert Meeting and Policy Dialogue showcased innovative practices of capacity building on community resilience, including investing in DRR actions for ensuring inclusive growth from a wide range of stakeholders. Through the discussion, it was affirmed to encourage science, technology, innovation, capacity building, higher education policy on promoting people-centred, gender-responsive, nature-based solutions and local knowledge for the blue and green economy on BCG including:

1. understanding hazards and risks incorporated,
2. promoting interoperability on easy access to early warning systems,
3. enhancing APEC resilience through smart technology and AI applications in DRR and CCA
4. building confidence in taking immediate DRR actions,
5. targeting the whole of society approach for proactive emergency preparedness in practice, and
6. linking daily life and economic activity with DRR concept for emergencies preparedness.

The discussion session was finalised with sharing thoughts on: 1) integrating climate change information, 2) building innovation capacity in higher education in line with BCG to further support science and technology development of early warning systems and 3) applying AI technologies in tackling climate crises and disaster impact.

Session II: Industry, Innovation and Infrastructure Resilience

The second plenary session focused on Industry, Innovation and Infrastructure Resilience to explore "The importance of integrating resilience in environmental, social, and governance – Harvest the Fruits of DRR Science and Technology to save Lives and Livelihoods," commenced at 10:30 AM (TPE) on 9 December 2022. It showcased the importance of regional resilience on climate and business resiliency through collaboration and innovation transformation. Experts discussed the roles of government, international organisations, and private sectors on how to promote international cooperation. Experts and participants shared the best practices on how to empower emerging economies in the APEC on better DRR and CCA for resilience.

Furthermore, the discussion was conducted interactively processed in-depth brainstorming on how to mitigate the climate/pandemic/economic impact and promoted climate resilience and capacity building including the lessons learnt from the pressing challenges. It also introduced programs or projects through risk-informed approach to the work toward industry, innovation and infrastructure safety as well as climate resilience for sustainable growth. This session involved the best practices sharing and work progress on facilitating decision making support for "Climate Adaptation, Food Security, Pandemic Spreading", "Digital Transformation", "Business Continuity and Supply Chain Resilience." This Session was moderated by Dr. Yanling Lee (Sophia), the Project Overseer to introduce Dr. Takahiro Ono, Visiting Researcher, Asian Disaster Reduction Center and Manager of Corporate Planning Department, Tokio Marine Holdings to brief "All Hazard Approach in VUCA World "

All Hazard Approach in VUCA World (Japan)

Dr. Takahiro Ono from Japan highlighted the cascading impact of climate crises, pandemic spreading and cyber-attacks. He introduced all-hazard approach to tackle "New Normal" with flexibility to cope with in this VUCA (volatility, uncertainty, complexity and ambiguity) world. Compared to the situation and scenario-based response according to the past experiences, he indicated that building the capacity to recognise the situation and the skill set to creatively mix match is needed. These procedures can facilitate the quick recovery from the "new normal" in the VUCA world. For building back better in the post-disaster recovery, the business sectors will have to

face the ever-changing of marketplace and consumer behavior after the cascading impacts in a flexible manner. In this context, the all-hazard approach in the VUCA world addressed the critical concept of aiming not only to resume business back to normal operation but to resume business back better for tackling future "New Normal" as well as responding to the marketplace and consumer behavior change.

The Chinese Taipei Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) (Chinese Taipei)

Dr. Wei-Sen Li, Executive Director, APEC Research Center for Typhoon and Society (ACTS) further addressed the critical step forward in Chinese Taipei and showcased how Chinese Taipei tackled the cascading climate crisis through "the Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP)". To resolve the societal challenges, TCCIP, a government policy-led project consolidated the basic research outcomes and improved risk analytics such as dynamic and multi-hazard risk assessment, forecasting of extreme events, real-time detection of events, its potential impacts, early warning to early action through the provision of situational awareness and decision support. TCCIP processed data to generate situation assessment report as well as adopted grid operations technology as the best possible solution to keep in line with international standards/principles/practices for seamless communication and application.

The recognition of the efficient CCA in Chinese Taipei enhanced the overall emergency operation at the central level in building the capacities to manage disaster risk and its complex, compound and cascading impacts. TCCIP shared information online to optimize the targeting of every alert to the general public for enhancing risk awareness for communication to better prepare for and respond to the climate crisis.

Live with the Climate Risk for Resilience (Chinese Taipei)

Dr. Yanling Lee (Sophia), Secretary General, APEC Emergency Preparedness Capacity Building Center (EPCC) briefed "Live with the Climate Risk for Resilience" and highlighted the importance of the whole of society participation for resilience and the contribution of the advocators, expertise, practitioners, and etc. cross-border for implementing "Plant Back Better (PBB)" initiative to resolve the cross-cutting issues through public private partnership under APEC. When disasters strike, with the heavy task force deployed for relief, search and rescue, the disaster-affected economy suffered mostly the cascading impacts often tended to be exhausted in response to the emergency rather than mitigating the upcoming challenges and aftermath. In this context, the neighboring economy or APEC economies may have the capacity of DRR

and CCA that can provide immediate help and assistant in terms of STI capacity on either providing tangible resources or intangibles (knowledge, information or situation assessment/analysis) feedbacks to mitigate the possible immediate impact and to prepare for the upcoming cascading impact. Benefit from the collaboration across boarder, the disaster-affected economy can manage to focus on resources allocation for preparedness, response and recovery with the risk-informed information sharing and warning sent by the neighboring economies to tackle the upcoming treats and mitigate the aftermath prior to the upcoming disasters or climate emergency strike amidst pandemic spreading.

Thus, APEC or neighboring economies can definitely help to support and facilitate the knowledge/information/data flow through sharing the capacity of science, technology and innovation for better response to and recover from the impact or cascading impact while disaster strike. Through information sharing of situation assessment on the potential risk, APEC economies can work as a team through cooperation on public private partnership for proactive countermeasures. The capacity building and information sharing showcased by Plant Back Better (PBB) standing as an APEC paradigm for cross border PPP best practice of APEC Resilient City and Community on demonstrating a self-sufficient community-based climate-smart agriculture strategy for inclusive and sustainable growth towards a resilient APEC on SDGs.

Questions and Answers

There were questions from the participants and experts:

1. How to further enhance resilience based on all-hazard approach in VUCA? Did the business continuity planning (BCP) guidebook under APEC multi-year project cover to update and include pandemic spreading scenario such as COVID-19 for regional supply chain resilience where applicable?
2. Did TCCIP provide data, information and resources open to the general public?
3. Did the climate smart agriculture stand still amidst COVID-19 spreading?

Discussion

The discussion session began with the first question focusing on ‘risk and business continuity planning amidst COVID-19. Discussing the human resource allocation and remote workers (work at home) during the COVID-19 lockdown. The first topic of discussion, ‘how to empower emerging economies in the APEC region for better adopting all-hazard approach in VUCA world for DRR and CCA and overcoming critical environmental challenges’ was followed.

Dr. Takahiro Ono answered that the fundamental principle of VUCA is to facilitate and keep the lights on for awareness while enabling and accelerating the quality BCP for sustainable growth. He further mentioned that the Asia-Pacific region was facing increasingly complex risks, VUCA helped analyse and responded to them proactively. A successful strategy will have to include smart preparedness, innovative ecosystems and integration of climate risks. The first one was 'smart preparedness.' Smart preparedness relied on intelligent solutions to tackle systemic risks and support lifesaving responses. It can take advantage of frontier technologies to improve risk analytics, digital solutions, impact forecasting and early warnings. The second one was 'Innovation Ecosystems.' Innovation ecosystems incorporated the latest technological and other developments to synchronise institutions, technologies and policies in an agile way and carry out appropriate dynamic scenario planning. Such ecosystems can mitigate trade-offs between competing priorities and ensure that the complete package was cost-effective and risk-informed. The last one was 'Integrating Climate Risk and Disaster Management.' To prepare for disasters during climate change, all infrastructure investment for DRR and CCA must be risk-informed. Infrastructure in this case covered not only discrete assets such as roads and buildings but also collective set of systems that can be synchronised to provide essential services.

Dr. Wei-Sen Li emphasised the importance of the government in policy making to drive the change and the industrial development as well as to engine the economic growth. He highlighted the critical element of scientific-based evidence in support of the policy making for DRR and CCA on sustainable growth. With stocktaking of the overarching research and development outputs and outcomes, the TCCIP provided comprehensive information online with open access to the APEC family and the world for better response to, prepare for and recover from the climate crises and beyond. TCCIP focused on the niche to resolve the societal challenges/issues for DRR and CCA in practical to mitigate disaster impacts and reduce agriculture, life losses and etc. through scientific-based information sharing online to the general public and policy-making suggestions to the government for raising the risk awareness and communication for DRR and CCA on a whole of society concept.

In light of this, Dr. Yanling Lee (Sophia) especially highlighted the importance of trust for a whole of society concept. It is correlated between the ability of humans to cope with the change and the trusts/capabilities on DRR and CCA for an APEC resilient city and community. The local knowledge embedded community-based strategy and project "Plant Back Better (PBB)" showed its resilience to be effective in sectors that matter like health, education, energy, and agriculture collective efforts. Government, international organizations, and private sectors have played the key roles to ease the

adoption and address the right elements from a policy, scientific, engineering, and human aspect.

Trust is built on a transparent process and understanding of how climate smart solutions function and the consensus reached prior to serve a societal need. The smart policy and solution of PBB showcased how a positive relationship between humans and technology works for a “Climate Smart Agriculture Community”. It must be based on the community’s need to empower women, children, elderly and indigenous people and utilise the local knowledge to meet their expectations for DRR and CCA amidst COVID-19 spreading. PBB demonstrated as a self-motivated and self-sufficient living project since 2019 under APEC.

Moreover, she also added that the comprehensive information must be simple and easy to understand with packages for training and communications to ensure everyone can manage to work as a team to respond to, prepare for and recover from disasters and climate crises through proactive countermeasures. Encouraging a holistic engagement strategy can foster community involvement which is pivotal to promote principles and values in time on-site that support or promote the development of all-hazard approach countermeasures on scientific-based smart solutions for DRR and CCA. A positive relationship of providing real-time transparent information can also boost public confidence while mitigating impacts and relief the fears. Continued to build capacity on smart solutions and develop human capacity is critical to promote the business continuity planning for supply chain resilience towards APEC sustainable and inclusive growth as a whole of society.

To promote international cooperation on information sharing cross-border under APEC, she mentioned that it required dialogues at community through public private partnership for motivating practitioners and community people to tune the mindset and behaviour to work as a group across the borders. She addressed that It’s important for team building on the value of DRR and CCA with tangible short-term outputs and outcomes. Thus, the project can be active and renovate from time to time and harness the local knowledge to stand still as a living self-sufficient and self-motivated community in the long run.

Conclusion

The Healthier the Human Resources, the More Resilient the Society.

The More Resilient the Society, the Quicker Recovery the Business.

The Quicker Recovery the Business, The More Resilient the Supply Chain.

The More Resilient the Supply Chain, the More Sustainable the APEC Economies.

The climate challenge is significant. The ability to process data into information for situation assessment for better preparedness through alerting/early warning is critical and timely. Understanding the societal challenges and taking proactive actions is a must for DRR and CCA. The regional resilience in APEC can be built on and benefit from the institutional capacity while collaborating on synergy. To further building capacity in APEC, continuous invest in capacity build, share good/best practices and local knowledge through a robust cooperation networking and utilise the newly developed technologies or smart solutions can ensure a more resilience future for APEC. The concluding summary provided herewith were as following:

Risk Financing, Resilient Infrastructure and Investment for Micro Small and Medium Enterprises (MSMEs) & Small and Medium Enterprises (SMES) Empowerment

APEC economies need guiding principles and capacity building programs through public private partnership for resilience. Most SMEs/MSMEs in APEC are vulnerable to the disaster and climate crisis which led to the weak business continuity for operation and resulted the supply chain interruption. It is important to focus on a sectoral and targeted approach.

Economies will have to identify priority sectors where have the most significant impact for DRR and CCA in terms of risk management and funding allocation. The guiding principles can be of good reference to lead APEC economy to work as a whole of society to think of disasters and climate crises as dynamic recurring events with the lifecycle for disaster risk management for mapping out smart solutions and policy. Thus, the guiding principles can help in empowering economies in the APEC region for scaling up the capacity in science, technology and innovation to better prepare for, respond to and recover from the climate crises and disasters through public private partnership.

Science, Technology and Innovation Enablement

Strengthening resilience required a multi-hazard approach for mitigating cascading impact. This project findings highlighted the importance of public private partnership to engage the scientific, technology and innovation community with public and private actors to develop and implement impact-based human-centered risk-informed early warning information in a timely manner.

Gender and Community Empowerment

With cutting-edge science, the outputs of this project showcased innovative best practices for DRR and CCA. The expert meeting policy dialogue highlighted the mutual interest in partnerships between the public and private sectors in meeting disaster risk challenges. Panel speakers also highlighted the critical role of the private sector in shoring up community resilience in times of disaster while pandemic spreading, as well as in investing in DRR.

CCA and DRR agendas are mutually critical in terms of resilience to hazards community-based DRR that increased the disaster resilience of a community by strengthening its local capacity. The importance of resilience was highlighted during the conference as an example of urban infrastructure designed to mitigate the impacts of climate-related and disaster-related challenges.

Climate Resilient City/Community

Concluding the 2022 ACTS Expert Meeting / Policy Dialogue with identify the common interests; STI strategies, policy, countermeasure or regulatory aspects, the good/best practices illustrated how to apply smart solutions to climate-related sectors including weather prediction, disaster monitoring using satellite through AI, and conservation need to be further developed for cross-fora collaboration on synergy. Experts brought together their experiences and insightful vision on how to help emerging economies to better adopted digital tools to tackle natural disasters, climate crises amidst pandemic spreading as well as to overcome environmental and societal challenges. Through the discussion session, experts and participants discussed and concluded the key areas to further explore in the second phase of delivering the future public private collaboration from crisis to resilience. Through the discussion session, delegates, experts and participants discussed and concluded:

- To further explore in the second phase of delivering the future STI collaboration from crisis to resilience in the ACTS Annual Meeting in Seattle.
- On APEC economies need guiding principles and capacity building programs through STI for resilience.
- On APEC are vulnerable to the disasters and climate crises which led to the weak business or digital economy. We shall highlight the importance of focusing on STI for a resilient future.

ACTS expressed its profound appreciation to all of the honorable delegates and distinguished experts, speakers and participants for their active participation and fruitful contribution.

Closing Ceremony

Dr. Yanling Lee (Sophia), the project overseer concluded the event with a summary highlighting the importance of productive presentation and discussion on inviting and investing STI joint efforts on improving regional resilience against natural hazards and climate emergencies. She thanked organising committee for their hard works and delegates, experts, speakers, discussants, and moderators for their contributions. Finally, she thanked all participants for their active participation and interests in making ACTS meeting a successful event.

Adjourned.

[Annex I Guiding Principles – APEC Non-Binding Climate Resilience Guiding Principles]

ACTS Annual Meeting
4 August 2023
Seattle

APEC Non-Binding Climate Resilience Guiding Principles

Gender and Community Empowerment

1. Support communities and whole of the society to have access to real-time and reliable data through an easy access web-based platform.
2. Support targeted, localised and simplified communication strategies for human behaviour change that supports effective early warning systems.
3. Provide long-term support both tangible and intangible resources to facilitate self-motivated indigenous communities to develop their own adaptive disaster risk reduction (DRR) and climate action approaches.
4. Understand economy needs in the local contexts. DRR and climate change adaptation (CCA) countermeasures should include sufficient flexibility to adapt to local and community conditions.
5. Involve communities in DRR processes, ensuring diverse representation. Mobilise all stakeholders to understand risks, prevent and mitigate them, and establish anticipatory response mechanisms.

Science, Technology and Innovation Enablement

6. Adaptive and innovative DRR approaches i.e. artificial intelligence for CCA.
7. Leverage the role of stakeholders for innovation with local knowledge and experience.

Risk Financing, Resilient Infrastructure and Investment for Micro Small and Medium Enterprises (MSMEs) & Small and Medium Enterprises (SMEs) Empowerment

8. Plans should be inclusive and accessible, include DRR and CCA risk-informed investment decisions, strategies to deal with natural disaster, climate emergency and epidemic.
9. Strengthen cooperation between public and private sectors and in particular, financial institutions to embed multi-hazard risk analysis for DRR and CCA.
10. Establish science, technology and innovation networks and interoperability mechanisms that support MSMEs to manage residual risk and recover from cascading impact of natural disasters, climate emergency and epidemic for DRR and CCA such as fair insurance options or catastrophe bond.

[Annex II: Proceedings]

PROCEEDINGS OF

APEC WEBINAR
2022 ACTS EXPERT MEETING / POLICY DIALOGUE

TAIPEI / VIRTUAL, 9 DECEMBER 2022

2022 ACTS ANNUAL MEETING

SEATTLE / IN-PERSON, 4 AUGUST 2023

TO INVITE AND INVEST SCIENCE, TECHNOLOGY AND INNOVATION (STI) **JOINT EFFORTS** ON IMPROVING REGIONAL RESILIENCE AGAINST **NATURAL HAZARDS** AND **CLIMATE EMERGENCY**

This document summarizes the presentations and discussions from:

2022 ACTS Expert Meeting / Policy Dialogue held on 9 December 2022 in Taipei
&
2022 ACTS Annual Meeting held on 4 August 2023 in Seattle

Overview

ACTS hosted the ACT Expert Meeting / Policy Dialogue on 9 December 2022 as one of the APEC Webinar Series on Resilience online (virtual) in Taipei to refine and explore the key areas for synergising the institutional capacity as a steering committee meeting of the 2022 ACTS annual meeting for “Climate Resilience City and Community”. Following up the fruitful outcomes of 2019 ACTS Annual Meeting in APEC Resilience Week (APECRW) held in Taipei from 30 September 2019 to 2 October 2019, the ACTS Expert Meeting/Policy Dialogue back-to-back hosted with EPWG - APECRW Expert Meeting/Policy Dialogue dated 8 December 2022.

Focusing on impact-based solutions, 2022 ACTS Expert Meeting aimed at exploring the future endeavors to mitigate impact on socio-economic development of all member economies, ACTS commits to promote open multi-hazard smart solutions and policy for networking on people centered and gender-responsive perspectives.

Cross-fora Collaboration

ACTS activities cross-fora endorsed by APEC Internet Digital Economy Roadmap (AIDER) to implement as one of the Key Focus Areas (KFAs) to discuss systems or solutions that would enable cross-sectoral digital collaborations on promoting interoperability listed on APEC’s Digital Economy Steering Group (DESG). In this context, ACTS invited the expertise from EPWG, SMEWG, DESG, ABAC, and etc. to attend the APEC Webinar - ACTS Expert meeting/policy Dialogue dated 9 December 2022 and contribute the insightful vision with practical experiences sharing for refining the agenda.

Leveraging the frontier smart technology and solutions to strengthen human security for resilient digital economy, ACTS Annual Meeting on 4 August 2023 in Seattle encouraged to synergise the investment and resources in STI in the APEC region and continue to promote “Climate Resilient City/Community” initiative for capacity building amidst pandemic spreading.

The expected outputs and outcomes

Through public private partnership on STI, we can work together to mitigate the social and economic impact of climate crises, natural disasters and pandemic spreading on

better emergency preparedness for building “Climate Resilient City”. ACTS invited expertise with diversity background for resolving the cross-cutting issues and beyond. The first phase implementation contributed to well-structure the project outcomes and deliverables based on the common interests and pressing challenges.

Through in-depth scientific-based research and practical good/best practice sharing, APEC Webinar - ACTS Expert Meeting/Policy Dialogue dated 9 December 2022 served as a consultation to refine the 2022 ACTS Annual Meeting over risk-informed impact-based forecasting of climate crises to further focus to discuss people-centred, gender-responsive, multi-hazard early warning systems/platform/network targeted on “Build Back Better”.

The collective efforts and common interests through brainstorming were from climatology, disaster risk management, AI technology, community-based strategy, climate change adaptation and all-hazard approach for resilience. To carry out the conducing summary, ACTS Annual Meeting accommodated the topic-oriented panel in the APEC Resilience Week to host a half-day workshop to identify the smart solutions and policy for climate crisis mitigation, adaptation and preparedness.

Two Phases Deliverables

The ACTS Expert Meeting targeted on facilitating data flow and interoperability to provide STI information to resolve cross-cutting issues and to mitigate the cascading impacts of health, climate crises and disasters across border. Thus, ACTS engaged cross-fora collaboration through PD from APEC Secretariat. Nominations sought from representatives of APEC economies, representatives of both public and private sector from CTI and other related working groups representatives including PPSTI, EPWG, FMP, SMEWG, PPWE, HWG, ACTWG, HRDWG, ABAC and DESG, in particular, highlighting welcoming and encouraging the nominations of qualified female experts, speakers and participants. The targeted audiences including (but not limited to) to acquired fully and active participation:

- Representatives from the government agencies related to emergency preparedness, disaster risk reduction, resilience, capacity building, climate crisis, pandemic spreading, business continuity, supply chain connectivity, climate smart technology, community-based disaster risk management strategy, disaster risk

financing and investment, digital economy and sustainability, etc.;

- Decision makers, professionals and practitioners working in the emergency preparedness, especially those who are in charge of disaster risk reduction and sustainability development inclusion policies, and/or those directly involved in the policy making and implementation processes;
- Other groups including academics, researchers, non-profit organisations.

The events stayed in the capacity of fully engagement and well-structured to showcase the good/best practices of STI under APEC.

[Annex III: Program]

APEC Webinar: 2022 ACTS Expert Meeting / Policy Dialogue
Thursday, 9 December 2022, Taipei

To invite and invest STI joint efforts for Climate Resilient City	
TIME *(GMT+8)*	AGENDA ITEM
09:00 – 09:20	**Opening** This section will provide a brief overview of the work undertaken in APEC to promote the resilience from Challenge to Action. This will involve the work progressed under EPWG, PPSTI, HWG, SMEWG, TPTWG, TELWG, PPWE, ABAC, and etc.
5 mins	**Opening Remarks** • Dr. Hwanil Park, Vice Chair 2021-2022, Science and Technology Policy Institute, Republic of Korea
5 mins	**Welcome Address by host Economy and Group Photo**
5 mins	**Review of the 2019 ACTS** • Dr. Wei-Sen Li, Executive Director, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei ➢ To give a recap of the results/ outcomes of the 2019 ACTS and invite members to provide additional feedback, comments or sharing, if any.
5 mins	**Highlight Key Area of the 2022 ACTS Expert Meeting / Policy Dialogue** • Dr. Wei-Sen Li, Executive Director, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei ➢ To give a brief overview of the work undertaken in APEC to promote the resilience from Challenge to Action.
09:20 – 10:20	**Sustainable City and Community** **Plenary Session 1: Sustainable Innovation: the next generation of forecasting and early warning** This section will showcase the Policy-led disaster risk reduction countermeasure of how to mitigate the climate/pandemic/economic impact in Asia-Pacific region to promote climate resilience and capacity building including the lessons learned from recent challenges. It will also provide a brief overview of the work toward sustainable development under APEC for promoting Asia Pacific Resilient City and Communities. This will involve the best practices sharing and work progressed

To invite and invest STI joint efforts for Climate Resilient City	
TIME *(GMT+8)*	AGENDA ITEM
	on climate risk-informed approach and impact-based forecasting for climate resilience and urban planning of the: • Quality Infrastructure • Climate Disaster Risk Financing and Investment • Nature-based Solutions for Blue and Green Economy • People-centred and Gender-responsive, Multi-hazard Early Warning Systems/Platform/Network **Moderator:** Dr. Yanling Lee (Sophia), Secretary General, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei
9:20-9:35 15 mins	**Plenary Speaker: Thailand** Ms. Panisa Harnpathananun, Division Director, Division of Higher Education Innovation and Future Skill Development, Office of National Higher Education Science Research and Innovation Policy Council to brief "The Best Practice Sharing on Capacity Building, Higher Education Policy on Promoting People-Centred, Gender-responsive, Nature-based Solutions for Blue and Green Economy on BCG"
9:35-9:50 mins	**Plenary Speaker: Australia** Prof. Yuriy Kuleshov, Science Leader for the Climate Risk and Early Warning Systems (CREWS), the Australian Bureau of Meteorology to brief "CREWS Implemented an Early Warning System for Drought in Papua New Guinea"
9:50-10:05 15 mins	**Plenary Speaker: The Republic of Korea** Dr. Jinyoung Rhee, Research Fellow, Prediction Research Department, APEC Climate Center to brief "Enhancing APEC Resilience Through AI Applications in Climate Change Adaptation"
10:05-10:15 10 mins	**Q & A**
10:15-10:20 5 mins	**Wrap up** Dr. Yanling Lee (Sophia), Secretary General, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei

To invite and invest STI joint efforts for Climate Resilient City	
TIME *(GMT+8)*	AGENDA ITEM
10:20 – 10:30	Tea/Coffee Break
10:30 – 11:30	**Industry, Innovation and infrastructure Resilience** **Plenary Session 2: The importance of integrating resilience in environmental, social, and governance - Harvest the Fruits of DRR Science and Technology to save Lives and Livelihoods** This section will showcase the importance of regional resilience on climate and business resiliency through collaboration and innovation transformation. How to mitigate the climate/pandemic/economic impact in Asia-Pacific region to promote climate resilience and capacity building including the lessons learned from recent challenges will be highlighted. It will also provide a risk-informed approach of the work toward industry, innovation and infrastructure safety and climate resilience for promoting Asia Pacific Resilient City and Communities. This will involve the best practices sharing and work progressed on facilitating decision making support for: • Climate Adaptation, Food Security, Pandemic Spreading • Digital Transformation • Business Continuity and Supply Chain Resilience **Moderator:** Dr. Yanling Lee (Sophia), Secretary General, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei
10:30-10:45 15 mins	**Plenary Speaker: Japan** Dr. Takahiro Ono, Visiting Researcher, Asian Disaster Reduction Center and Manager of Corporate Planning Department, Tokio Marine Holdings to brief "All Hazard Approach in VUCA world "
10:45-11:00 15 mins	**Plenary Speaker: Chinese Taipei** Dr. Wei-Sen Li, Executive Director, APEC Research Center for Typhoon and Society (ACTS) to brief “the Chinese Taipei Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP)”
11:00-11:15 15 mins	**Plenary Speaker: Chinese Taipei**

To invite and invest STI joint efforts for Climate Resilient City	
TIME *(GMT+8)*	AGENDA ITEM
	Dr. Yanling Lee (Sophia), Secretary General, APEC Emergency Preparedness Capacity Building Center (EPCC) to brief “Live with the Climate Risk for Resilience”
11:15-11:25 10 mins	**Q & A**
11:25-11:30 5 mins	**Wrap up** Dr. Yanling Lee (Sophia), Secretary General, APEC Emergency Preparedness Capacity Building Center (EPCC) to brief “Live with the Climate Risk for Resilience”
11:30 – 12:00 **Smart Resilient City on Public Private Collaboration** 10 mins	**Conclude the 2022 ACTS Expert Meeting / Policy Dialogue and identify the common interest and needs under APEC for 2022ACTS. These may include strategies, policy, countermeasure or regulatory aspects. The scope of the interactive session designed to refine the future public private collaboration from crisis to resilience.** Dr. Yanling Lee (Sophia), Secretary General, APEC Emergency Preparedness Capacity Building Center (EPCC) to brief “Live with the Climate Risk for Resilience”
12:00	**Closing**

2022 ACTS Annual Meeting
Friday, 4 August 2023, Seattle

ACTS Annual Meeting
August 4, 2023

Opening 9:00

- ***Welcoming Address by the Representative of the Host Economy***
  Christin Kjelland, *Senior Advisor, Office of Science and Technology Cooperation, U.S. Department of State, The United States*

- ***Opening Address***
  Jiunshen Hwang, *Councilor, Representing Chinese Taipei Senior Official*

- ***Opening Remark – Critical Infrastructure Protection and Cascading Events Simulation for Disaster-sensitive Metropolitan Areas***
  Kenji Watanabe, *Chair of The Council for Critical Infrastructure Protection (Cabinet Secretariat), Japan*

9:30

20 minutes each for Keynote Speakers

Keynote Speech

INVESTING HUMAN CAPITAL FOR DISASTER MANAGEMENT
Karl Kim, *Executive Director, National Disaster Preparedness Training Center, University of Hawaii*

CLIMATE RESPONSE STRATEGIES
Matthew Andersen, *Senior Scientist for Biology, the U.S. Geological Survey (USGS), theUnited States*

10:10

ACTS Annual Meeting
August 4, 2023

Panel 10:30

Bridging the Gap Among Decision or Policy-makers - Technology to Enable the Environment for Climate Resilience
Moderator ***Kenji Watanabe*** *, Board member of The Advisory Board for Food Security (Ministry of Agriculture, Forestry and Fisheries), Japan*

10-15 minutes talks (introductory presentation or oral briefing or video delivered by each Panelist prior to Q&A)

- *Possible Countermeasures Using Modeling & Simulation Solutions in Preparing for and Responding to the Cascading Disaster Events*
  Matthew Andersen, *Senior Scientist for Biology, the U.S. Geological Survey, The United States*
  Technologies for Building Climate Resilience

- *Climate Emergency Preparedness for All*
  Yanling Lee, *Secretary General, APEC Research Center for Typhoon and Society (ACTS), Chinese Taipei*

- *Coordinating Science and Research for Responding to the Climate Crisis*
  Sarah Zaunbrecher, *Program Analyst, the United States National Oceanic and Atmospheric Administration (NOAA) Oceanic and Atmospheric Research (OAR) International Activities Office, The United States*

- *Value of Climate Information to Respond to the Climate Crisis*
  Sangwon Moon, *Head of External Affairs Department, APEC Climate Center (APCC), Korea (Pre-recorded video)*

11:30

Closing Remark

Surfing Climate Crisis for Resilience

[Annex IV: Speakers' Short Bio, Abstract and Presentation]

APEC Webinar – 2022 ACTS Expert Meeting / Policy Dialogue

Sustainable City and Community

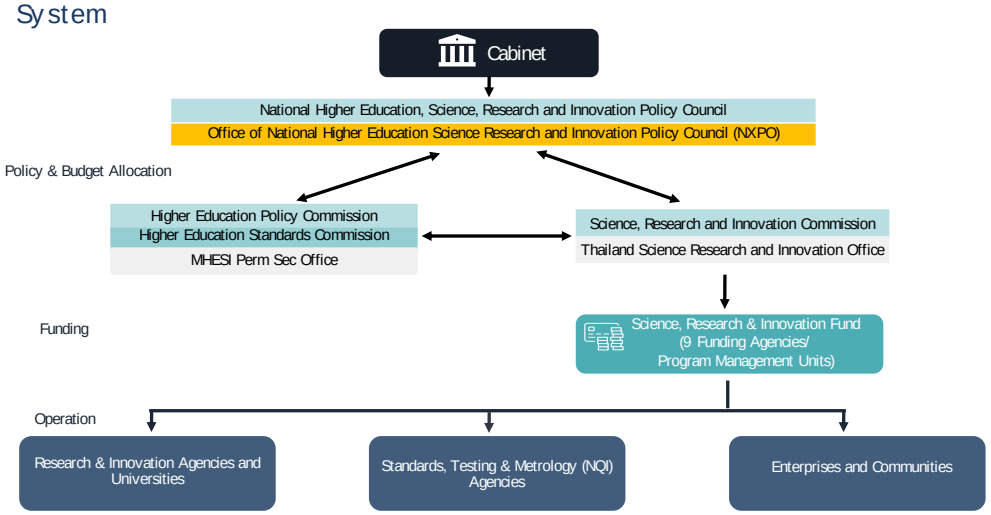
Plenary Session 1: Sustainable Innovation: the next generation of forecasting and early warning

Plenary Speaker: Thailand

The Best Practice Sharing on Capacity Building, Higher Education Policy on Promoting People-Centred, Gender-responsive, Nature-based Solutions for Blue and Green Economy on BCG

Ms. **Panisa Harnpathananun**, Division Director, Division of Higher Education Innovation and Future Skill Development, Office of National Higher Education Science Research and Innovation Policy Council

Structure of Higher Education, Science, Research and Innovation (HESRI) System



The Global Trends Impact on Workforce and Learning Style

❑ Technology disruption

World Economic Forum (WEF) estimated that by 2025, 85 million jobs may be displaced by a shift in the division of labour between humans and machines, while 97 million new roles may emerge that are more adapted to the new division of labour between humans, machines and algorithms.

Emerging jobs

Emerging jobs (Post COVID-19) in STEM

Specialists in Artificial Intelligence, Machine learning, E-commerce, Robotics Engineer

Professionals in Software, Application, Digital Transformation, Automation, Cybersecurity, Internet of things

Emerging jobs (Post COVID-19) in Social Sciences and Humanities

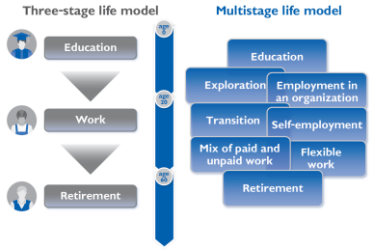
Social and emotional supporter, family therapist, career counselor, speech and language therapist, Substance Abuse and Mental Health Counselor, Welfare and Housing Specialist

Source : 1) WEF (2020) Future of jobs 2020 & 2) Mckinsey Global Institute analysis

❑ Aging Society and Multiple life model

"Multistage Working Life Model"

- People living longer, Longer working life span, Many jobs for life
- Studying and working together in some part of life



Lifelong Learning (LLL)

- For flexible future work and personal life
- Various learning models (degree & non-degree)
- Multiple channels for easy access
- Bite-sized Learning

Source : Lynda Gratton and Andrew Scott (2017) The Corporate Implications of Longer Lives

3

The Global Trends Impact on Workforce and Learning Style

❑ Impact of COVID-19 on workforce

School closures

- Decreased learning
- Increased educational inequality
- Lack of necessary internships and trainings

Economic crisis

- Dropping out of school
- Declining family support for education
- The government's education budget has decreased.
- The quality of education and teaching has declined.
- Private educational institutions are closed

Short term effects

- 25% temporary workforce reductions, 20% permanent layoffs

Long term effects

- The quality of labor in the future is decreasing.
- The industry has a shortage of skilled workers.

Source : 1) WEF (2020) Future of jobs 2020 และ 2) TDRI &NXPO (2021) โครงการสำ
ยุทธศาสตร์การพัฒนาเศรษฐกิจไทยในโลกหลังโควิด-19 และบทบาทของ อวช.

4

❑ Education inequality

1 in 5 of Thailand student facing educational inequality

Problems of access to education in COVID-19 pandemic

- 271,888 EEFI scholarship students (in 29 provinces) faced learning access problems (No TV, Computer &Electric)
- Estimated 65,000 children will drop out of school at the end of 2021 academic year
- Learning & Skill Losses → Limit Employment Opportunities → Chronic poverty

From : Equitable Education Research Institute (EEFI)

Other Global Trends

- ❑ Generation Divide
- ❑ Gig Economy
- ❑ Geopolitical shifts
- ❑ War of Talents
- ❑ Climate Change

4

BCG Strategy and Action Plan 2021 – 2027

Source: NSTDA, 2022

Expected Outcome in 2027

Sustainability of resources and the environment

- 1/4 reduction in natural resource consumption
- 20% reduction of greenhouse gas emissions
- add at least 0.5 million ha of forest area

Socioeconomic prosperity

- improve income inequality of 10 million people
- reduce the proportion of undernourished population to 5%
- increase health inequality of at least 300,000 people
- increase the number of energy self-sufficient communities by 20%.

Sustainable economic growth

- economic value of the BCG industries up by 1 trillion THB
- 20% increase in the proportion of high-value products and services
- at least 50% more income to the grassroots

Self-reliance

- at least 1 million workers are retrained
- 1,000 new startups and IDEs
- improve negative technology balance of payment by at least 20%
- 20% reduction in medical and health supplies import

Source: NSTDA, 2022

13 Mechanisms to drive BCG Policy

01 Create digital repository of bioresources, cultural capital and local wisdom

02 Replenis Local/Domestic resources

03 Develop BCG corridor

04 Transform agricultural system

05 Improve quality and safety of street food and local food

06 Build a biobased economy

07 Create demand for innovative goods and services derived from BCG model

08 Promote sustainable and green tourism

09 Promote the development and manufacturing of sustainable goods and services

10 Raise the standards of products and services

11 Support BCG startups

12 Develop manpower to support BCG model

13 Promote international collaboration

Source: NSTDA, 2022

THE COMMITTEE OF BIO CIRCULAR GREEN ECONOMY

Executive board Committee
- The Chairman: H.E. General Prayut Chan-o-cha
- The Vice Chairman: H.E. Don Poramudwinai
- The Vice Chairman: H.E. Anek Laothammatas
- Secretary of Committee: Dr.Narong Sirilertworakul (NSTDA)

National BCG Driving Committee
- The Chairman : H.E. Anek Laothammatas
- The Vice Chairman: Prof. Sirirurg Songsivilai
- Secretary of Committee: Dr.Narong Sirilertworakul (NSTDA)

01 **Law Sector**
Chair: Secretary General of Office of the Council of State

02 **Tourism and Creative Economy Sector**
Chair: Mr. Kalin Sarasin (Chairman, The Thai Chamber of Commerce and Board of Trade of Thailand)

03 **Agricultural Sector**
Chair: Mr. Yukol Limlamthong (Former Deputy Prime Minister and Former Minister of Agriculture)

04 **Biodiversity Sector**
Chair: Mr. Sanit Aksornkoae (Chairman, The National Economic and Social Development Council)

05 **Food Sector**
Counsellor: Mr. Sakarindr Bhumiratana (Former President of King Mongkut's University of Technology Thonburi (KMUTT))
Chair: Mr. Thiraphong Chansiri (President and CEO of Thai Union Group Pcl.

06 **Medical Devices Sector**
Chair: Mr. Pairash Thajchayapong (Senior Advisor and Specialist, the National Science and Technology Development Agency (NSTDA))

07 **Capacity Building and Human Development Sector**
Chair: Mr. ... (MHESI) (D... Secretary ... Education ... Innovation

Infrastructure Sector
Chair: Mr. Isara Vongkusolkit (Honorary Chairman of Mitr Phol Group)

09 **Energy Material and Chemical ...**

... and Vaccine Sector
Chair: Mr. Piyasakol Sakolsatayadorn (Former Minister of Public Health of Thailand, Chairman of Mahidol University Council)

11 **Circular Economy Sector**
Chair: Mr. Wijarn Simachaya (President of Thailand Environment Institute)

Source: NSTDA, 2022

8

Thailand Talent Landscape : Manpower Demands from 12 Target Industries in Thailand (2020-2024)

		Critical positions	Functional competencies
High Wealth & Medical Tourism	15,432	• Digital Marketing Specialist • Digital Platform Developer	• Digital Marketing • Design Thinking
Advanced Agriculture & Biotechnology	14,907	• Aerospace Engineer • Crop Modelling Analyst	• Biotechnology • Data Science • Machine Learning • Crop Modelling
Food for the Future	12,458	• Nutritionist • Food Stylist	• Food Tech. & Innovation • Food & Drug Regulation
Future Mobility	12,231	• Automation Engineer • Material Engineer	• Electronic Technology • Electric and Hybrid Vehicle Technology
Intelligent Electronics	6,434	• Electrical Engineer • Programmer • Software Engineer	• Computer Aided Manufacturing • Artificial Intelligence
Civil Defense	5,219	• Material Engineer • AI Specialist	• Cyber Security • Cloud Computing
Workforce Development & Education	12,254	• Career and Skill Development Counselor	• Career and Skill Matching • Curriculum Development

		Critical positions	Functional competencies
Digital	30,742	• Data Scientist • Full-Stack Developer	• Security Assessments • Data Visualization and Data Engineering
Aviation & Logistics	29,289	• Ground Services Officer • Logistics Data Specialist	• Accident and Incident Response Management • E-Logistics IT Solutioning
Medical Hubs	17,732	• Chemist/Biologist • Bioprocess Engineer/Technician	• Good Manufacturing Practices Implementation • Biorisk Management
Industrial Robotics	10,020	• Robotics Control Engineer • Software Integration Engineer	• Robot Programming and Programming Pendant • Embedded system • Sensor Technology
Bioenergy & Biochemicals	9,836	• Biologist • Agriculture Specialist	• Bioinformatics • Downstream Processing

Source: NXPO (2020) Future Competencies for 12 Target Industries (2020-2024)

9

Paradigm Shift of Higher Education

สอวช

From Three-stage life to Multi-stage life: Support Lifelong Learning

From Institution-based to National credit bank: Integrated national credit bank

From limited to opened education opportunity: Increase accessibility & affordability

From Supply-driven to Co-creation: Co-design with the private sector

From Degree-oriented to Employability-oriented: Response to industrial demands

1 2 3 4 5

Paradigm Shift of Higher Education through L E N S

Lifelong Learning Support (Broader Target)
National Agenda (Competitive Change)
Education Goal (Quality Change)
Sustainable System (System Change

10 9 8 7 6

From Supply-side to Demand-directed financing: Budget policy for real demands

From Limited access to Opened access: Encourage good governance

Towards Creative Ecosystem: Support creative economy and develop human capital

From Local perspective to Global perspective: World-recognized education hub

From Content-based to Competency-based: Focus on learner's outcome

10

Higher Education Sandbox

Unlocking the restricted rules for new higher education model testing

to encourage universities being relevant in new global contexts

Higher Education Act B.E. 2562 Section 69

For the benefit of creating innovations in higher education, the Minister may propose the Policy Council to propose to the Cabinet for a resolution that higher education institutions/departments are able to provide education that is different from the higher education standards.

Existing higher education standard

~~Study period~~
~~Credit~~
~~Lecturer qualification~~
~~Learner qualification~~
~~Quality assurance system~~
~~Course revisit~~

Cabinet / Policy Council / University Council

Innovation in higher education

- New higher education standard
- New quality assurance system

Benefits

THAILAND BOARD OF INVESTMENT

กรมสรรพากร THE REVENUE DEPARTMENT

Network

Enterprises

❑ Expected outcome

1. Preparing graduates having competencies that meet the needs of industries and entering workforces into the industries in a timelier manner to solve the issue of workforce shortage, such as digital industry
2. Creating innovations in higher education that are relevant to new global contexts and new lifestyles
3. Providing flexible educational models that people with all ages and all socioeconomic status have access to quality higher education
4. Shifting paradigm and transforming manpower preparing in higher education system

16

Higher Education Development Fund

❑ To develop high-performance manpower and excellence in higher education institutions

University and Higher Education System

Higher Education Development Fund

Transformation

Objectives >>

- To produce graduates & manpower with high performance and potential
- To develop excellences in higher education institutions
- To develop & raise standards of higher education
- To develop an innovative system for human resource development for lifelong learning

17

High-Skilled Workforce Development Platform

Employers

Benefits for skill development of personnel

- Tax incentives : 250% tax deduction on personnel training costs
- 50% personnel training funds, not exceeding 5 million baht within 2 years (<100,000 baht/ person)
- Tax benefits from recruitment of interns
- Tax benefits from co-investments

Employment support programs

- Tax incentives : 150% tax deduction on salary payments
- 50% personnel wage contribution not exceeding 5 million baht within 2 years (<100,000 baht/ person/ month) for Startup (established within the last 5 years)

Student

- MHESI supports experiential learnings through existing campaigns : "Reinventing University" and "Higher Education Sandbox"

BOI-promoted enterprises identify workforce demands

The Council of Engineering Dean of Thailand and The Council of Science Dean of Thailand (66 higher education institutions)

Platform

Manpower Development Platform

1. Upskill & Reskill
2. Co-creation (CWIE/ Sandbox)
3. Employment & Career Development

High-performance engineers and scientists

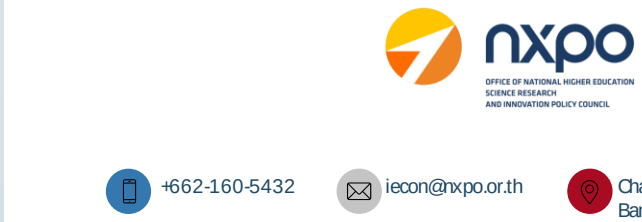
- engineer 10,000 Persons/ Year
- scientist 10,000 Persons/ Year

Supports the targeted industries such as BCG, 12-S-Curve

Impact

- High performance manpower > 20,000 persons/ year, Support investments > 70,000 million baht/ year
- Increase productivity of workforce by 10% for higher education workforce. (~ 500,000 persons/ year)

11



+662-160-5432 iecon@nxpo.or.th Chamchuri Square Bangkok, Thailand www.nxpo.or.th

Plenary Speaker: Australia

Climate Risk and Early Warning Systems (CREWS) Implemented an Early Warning System for Drought in Papua New Guinea

Prof. **Yuriy Kuleshov**, Science Leader for the Climate Risk and Early Warning Systems (CREWS), the Australian Bureau of Meteorology to brief "CREWS Implemented an Early Warning System for Drought in Papua New Guinea"

Professor Yuriy Kuleshov, Science Leader for the Climate Risk and Early Warning Systems (CREWS) at the Australian Bureau of Meteorology and Professor at the SPACE Research Centre, Royal Melbourne Institute of Technology (RMIT) University

Abstract

The Climate Risk and Early Warning Systems (CREWS) international initiative has been established in 2015, recognizing the urgency of enhancing early warning systems (EWSs) to assist vulnerable economies with climate change adaptation. CREWS assists Least Developed Economies (LDCs) and Small Island Developing States which are particularly vulnerable to the impact of climate extremes, including droughts, floods, and tropical cyclones. In Papua New Guinea (PNG), severe drought caused by the strong El Niño in 2015-2016 affected about 40% of the population, with almost half a million people impacted by food shortages. To build PNG's resilience to impact of future droughts, CREWS developed an EWS. CREWS-PNG was implemented in partnership with the World Meteorological Organization's Space-based Weather and Climate Extremes Monitoring (SWCEM). The SWCEM was established recognizing needs to better utilize and improve monitoring of weather and climate extremes from space to complement surface-based observations. The first SWCEM demonstration project was successfully implemented in Asia and the South-West Pacific, with focus on monitoring drought and heavy precipitation. The developed Drought EWS integrated SWCEM satellite-derived products – the Standardized Precipitation Index and the Vegetation Health Index - as a monitoring component, and probabilistic rainfall forecast from dynamical climate model as a forecasting component. EWS generates

maps of staged drought early warning - No Drought, Watch, Alert and Emergency. Retrospective analysis of drought early warning for PNG has been conducted to evaluate its efficiency. It was found that during the 2015-2016 El Niño-induced drought, many PNG provinces were at the stage of Drought Emergency from August to October 2015. Drought Watch and Alert stages for some provinces were triggered up to six months prior to Drought Emergency. This clearly demonstrates value of the developed drought EWS. If such EWS would be available back in 2015, drought early warning could be communicated well in advance, and appropriate drought mitigation measures could be taken to reduce human suffering and economic losses. CREWS achievements in developing and implementing EWS for Drought in PNG have been recently presented at the Asia-Pacific Ministerial Conference on Disaster Risk Reduction (https://public.wmo.int/en/media/news/early-warning-system-drought-implemented-png-crews). Thanks to CREWS, the PNG National Weather Service now issues monthly Drought Update Bulletin and distributes it to a broad range of stakeholders including the Disaster Management Team, agriculture, water and other sectors. CREWS and WMO SWCEM are important contributors to the UN target: "Early warning systems must protect everyone within five years". Based on our experience in PNG, we highly recommend establishing similar EWSs in other vulnerable economies in Asia-Pacific.

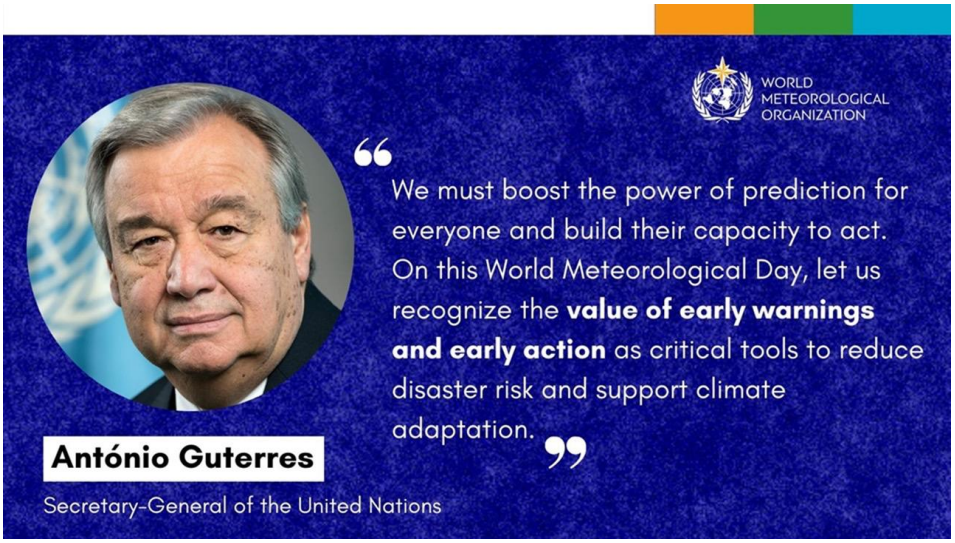
Key Words: Climate Risk and Early Warning Systems (CREWS); Space-based Weather and Climate Extremes Monitoring (SWCEM); Early Warning System for Drought; Papua New Guinea; Climate Change Adaptation and Disaster Risk Reduction.

Climate Risk and Early Warning Systems (CREWS) Implemented an Early Warning System for Drought in Papua New Guinea

Professor Yuriy Kuleshov
Australian Bureau of Meteorology
Royal Melbourne Institute of Technology (RMIT) University

Early Warning and Early Action

UN unveils ambitious target to adapt to climate change and more extreme weather



2

CREWS

- Developing and least developed economies (LDCs) are particularly vulnerable to the impact of climate extremes, including droughts, floods, and tropical cyclones.

- Recognizing the urgency of enhancing early warning systems to assist vulnerable economies with climate change adaptation, the Climate Risk and Early Warning Systems (CREWS) international initiative has been established at COP-21 in Paris in 2015.

CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

3

CREWS

CREWS has already supported 73 members through

- 9 government projects
- 7 regional projects
- 1 global project.

WORLD METEOROLOGICAL ORGANIZATION

WORLD BANK GROUP

GFDRR

UNDRR
UN Office for Disaster Risk Reduction

CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

4

CREWS PNG

Sweet potatoes gardens completely destroyed by frost in a village garden near Sirunki in Enga Province.
Photo: credit to Mr Kasis Inape.

- In Papua New Guinea (PNG), severe drought caused by the strong El Niño in 2015-2016 affected about 40% of the population, with almost half a million people impacted by food shortages.
- To build resilience to impact of future droughts, CREWS implemented project (2018 – 2022) developing EWS for drought in PNG

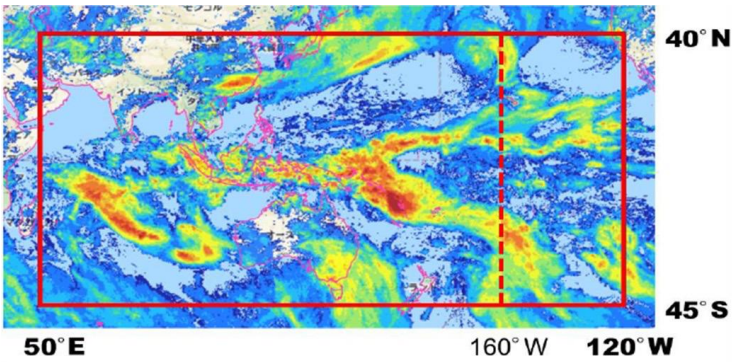
5

WMO SWCEM

- CREWS-PNG was implemented in partnership with the World Meteorological Organization's (WMO) Space-based Weather and Climate Extremes Monitoring (SWCEM).
- WMO established the SWCEM flagship initiative, recognizing needs to better utilize and improve monitoring of weather and climate extremes from space to complement surface-based observations.

6

SWCEM Implementation in Asia-Pacific

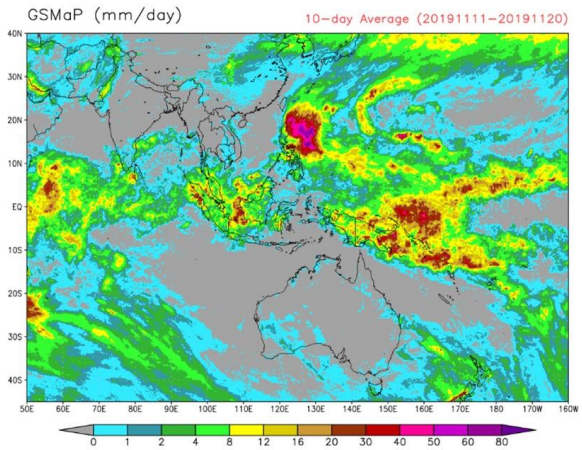


SWCEM in Asia-Pacific - monitoring drought and heavy precipitation, implemented in geographical domain 40°N to 45°S; 50°E to 120°W.

CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

7

SWCEM Operational Products



CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

JAXA and NOAA

Mean precipitation estimates

- hourly
- daily (00-23UTC)
- pentad (5-day)
- weekly (Monday– Sunday)
- 10-days
- monthly

Statistics:

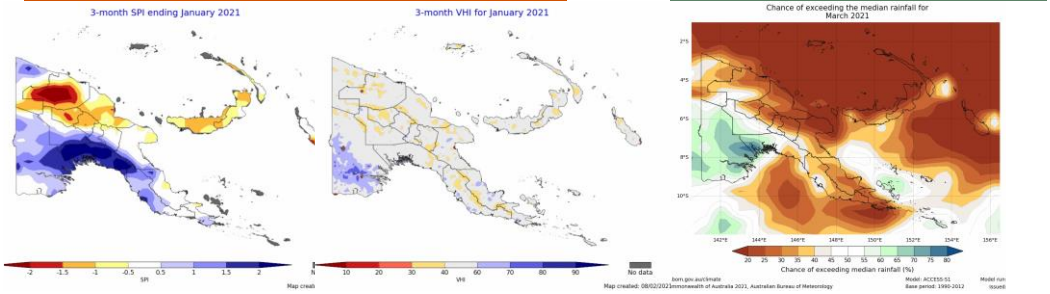
- Climate normal
- 90th ～ 99th Percentiles
- Percentage of rainy days (>=1mm/day) in a month

Indices: SPI, NDVI, VHI

8

CREWS PNG: Drought EWS

Monitoring Inputs + **Forecasting Inputs**



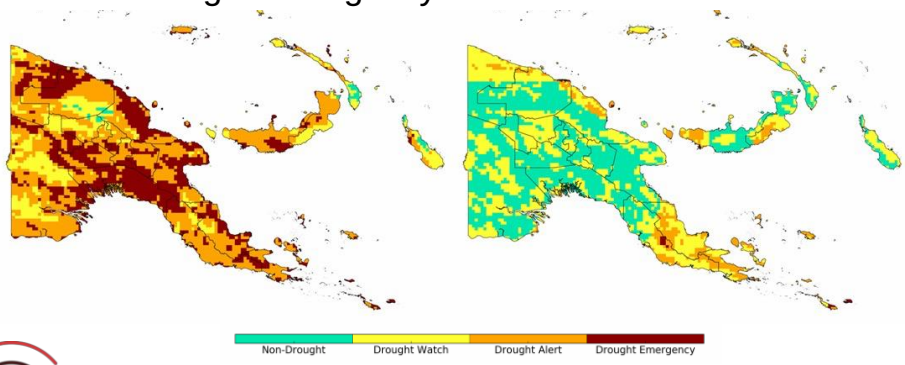
SWCEM: SPI | **SWCEM: VHI** | **WMO GPC LRFs: Rain**

Drought EWS: SWCEM satellite-derived products - monitoring component and ACCESS-S S2S products – forecasting component

9

CREWS PNG: Drought EWS

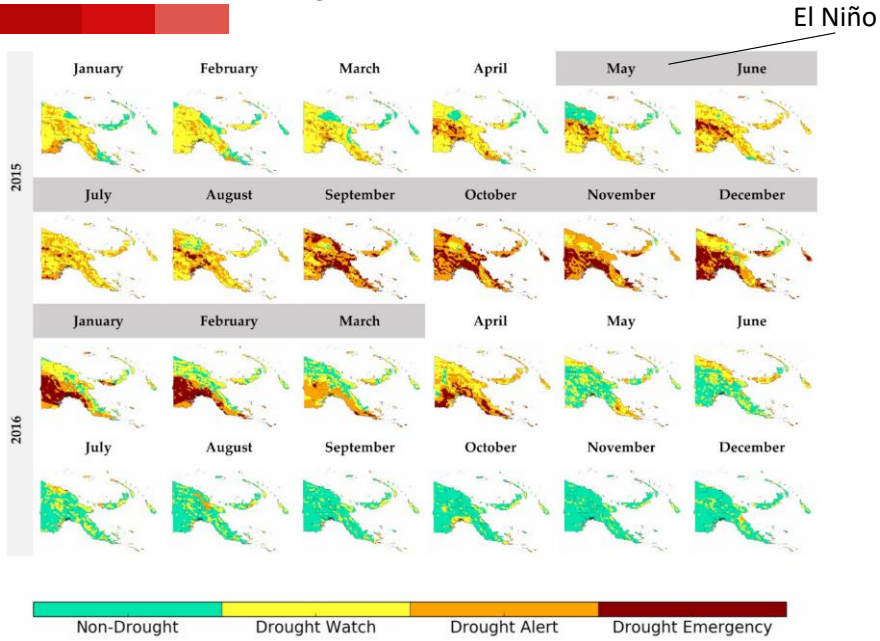
The CREWS project developed drought EWS for PNG. It generates maps of staged drought early warning - Watch, Alert and Drought Emergency.



Maps of drought early warning for PNG for September 2015 and May 2016.

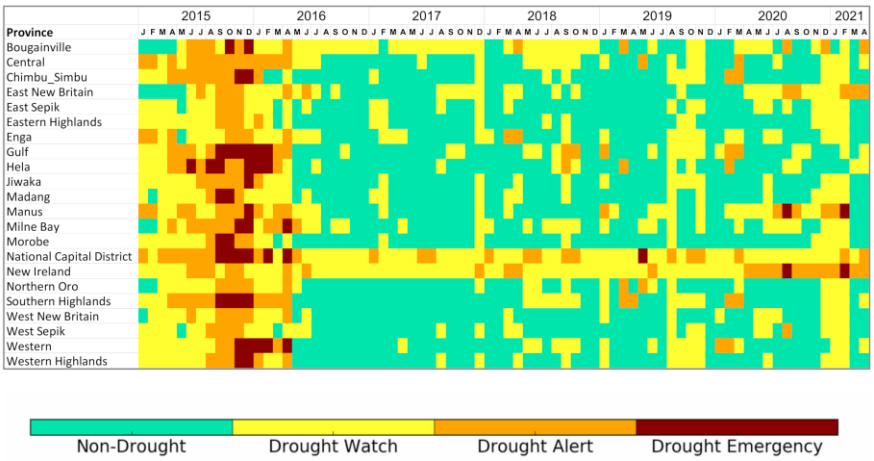
10

CREWS PNG: Drought EWS



11

CREWS PNG: Drought EWS

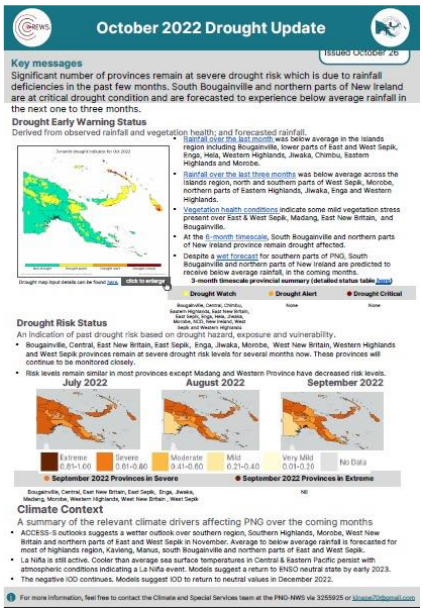


CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

Drought early warnings for 22 provinces in PNG for 2015-2021.

12

CREWS PNG Operational Product: Drought Update



October 2022 Drought Update

Issued October 28

Key messages

Significant number of provinces remain at severe drought risk which is due to rainfall deficiencies in the past few months. South Bougainville and northern parts of New Ireland are at critical drought condition and are forecasted to experience below average rainfall in the next one to three months.

Drought Early Warning Status

Derived from observed rainfall and vegetation health; and forecasted rainfall.

- Rainfall over the last month was below average in the Islands region including Bougainville, lower parts of East and West Sepik, Enga, Hela, Western Highlands, Jiwaka, Chimbu, Eastern Highlands and Morobe.
- Rainfall over the last three months was below average across the Islands region, north and southern parts of West Sepik, Morobe, northern parts of Eastern Highlands, Jiwaka, Enga and Western Highlands.
- Vegetation health conditions indicate some mild vegetation stress present over East & West Sepik, Madang, East New Britain, and Bougainville.
- At the 6-month timescale, South Bougainville and northern parts of New Ireland province remain drought affected.
- Despite a wet forecast for southern parts of PNG, South Bougainville and northern parts of New Ireland are predicted to receive below average rainfall, in the coming months.

3-month timescale provincial summary (detailed status table here)

Drought Watch	Drought Alert	Drought Critical
Bougainville, Central, Chimbu, Eastern Highlands, East New Britain, East Sepik, Enga, Hela, Jiwaka, Morobe, Northern, New Ireland, West Sepik and Western Highlands	None	None

Drought Risk Status

An indication of past drought risk based on drought hazard, exposure and vulnerability.

- Bougainville, Central, East New Britain, East Sepik, Enga, Jiwaka, Morobe, West New Britain, Western Highlands and West Sepik provinces remain at severe drought risk levels for several months now. These provinces will continue to be monitored closely.
- Risk levels remain similar in most provinces except Madang and Western Province have decreased risk levels.

July 2022 August 2022 September 2022

Extreme 0.81-1.00 | Severe 0.61-0.80 | Moderate 0.41-0.60 | Mild 0.21-0.40 | Very Mild 0.01-0.20 | No Data

September 2022 Provinces in Severe | September 2022 Provinces in Extreme

Bougainville, Central, East New Britain, East Sepik, Enga, Jiwaka, Madang, Morobe, Western Highlands, West New Britain , West Sepik

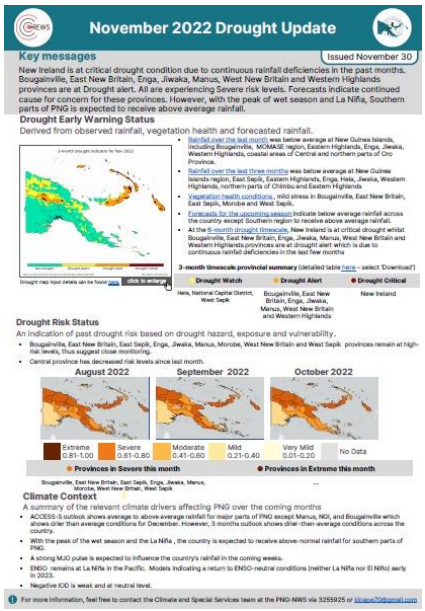
Nil

Climate Context

A summary of the relevant climate drivers affecting PNG over the coming months

- ACCESS-S outlooks suggests a wetter outlook over southern region, Southern Highlands, Morobe, West New Britain and northern parts of East and West Sepik in November. Average to below average rainfall is forecasted for most of highlands region, Kavieng, Manus, south Bougainville and northern parts of East and West Sepik.
- La Niña is still active. Cooler than average sea surface temperatures in Central & Eastern Pacific persist with atmospheric conditions indicating a La Niña event. Models suggest a return to ENSO neutral state by early 2023.
- The negative IOD continues. Models suggest IOD to return to neutral values in December 2022.

For more information, feel free to contact the Climate and Special Services team at the PNG-NWS via 3255925 or kinane70@gmail.com



November 2022 Drought Update

Issued November 30

Key messages

New Ireland is at critical drought condition due to continuous rainfall deficiencies in the past months. Bougainville, East New Britain, Enga, Jiwaka, Manus, West New Britain and Western Highlands provinces are at Drought alert. All are experiencing Severe risk levels. Forecasts indicate continued cause for concern for these provinces. However, with the peak of wet season and La Niña, Southern parts of PNG is expected to receive above average rainfall.

Drought Early Warning Status

Derived from observed rainfall, vegetation health and forecasted rainfall.

- Rainfall over the last month was below average at New Guinea Islands, including Bougainville, MOMASE region, Eastern Highlands, Enga, Jiwaka, Western Highlands, coastal areas of Central and northern parts of Oro Province.
- Rainfall over the last three months was below average at New Guinea Islands region, East Sepik, Eastern Highlands, Enga, Hela, Jiwaka, Western Highlands, northern parts of Chimbu and Eastern Highlands.
- Vegetation health conditions, mild stress in Bougainville, East New Britain, East Sepik, Morobe and West Sepik.
- Forecasts for the upcoming season indicate below average rainfall across the country except Southern region to receive above average rainfall.
- At the 6-month drought timescale, New Ireland is at critical drought whilst Bougainville, East New Britain, Enga, Jiwaka, Manus, West New Britain and Western Highlands provinces are at drought alert which is due to continuous rainfall deficiencies in the last few months

3-month timescale provincial summary (detailed table here - select 'Download')

Drought Watch	Drought Alert	Drought Critical
Hela, National Capital District, West Sepik	Bougainville, East New Britain, Enga, Jiwaka, Manus, West New Britain and Western Highlands	New Ireland

Drought Risk Status

An indication of past drought risk based on drought hazard, exposure and vulnerability.

- Bougainville, East New Britain, East Sepik, Enga, Jiwaka, Manus, Morobe, West New Britain and West Sepik provinces remain at high-risk levels, thus suggest close monitoring.
- Central province has decreased risk levels since last month.

August 2022 September 2022 October 2022

Extreme 0.81-1.00 | Severe 0.61-0.80 | Moderate 0.41-0.60 | Mild 0.21-0.40 | Very Mild 0.01-0.20 | No Data

Provinces in Severe this month | Provinces in Extreme this month

Bougainville, East New Britain, East Sepik, Enga, Jiwaka, Manus, Morobe, West New Britain, West Sepik

Climate Context

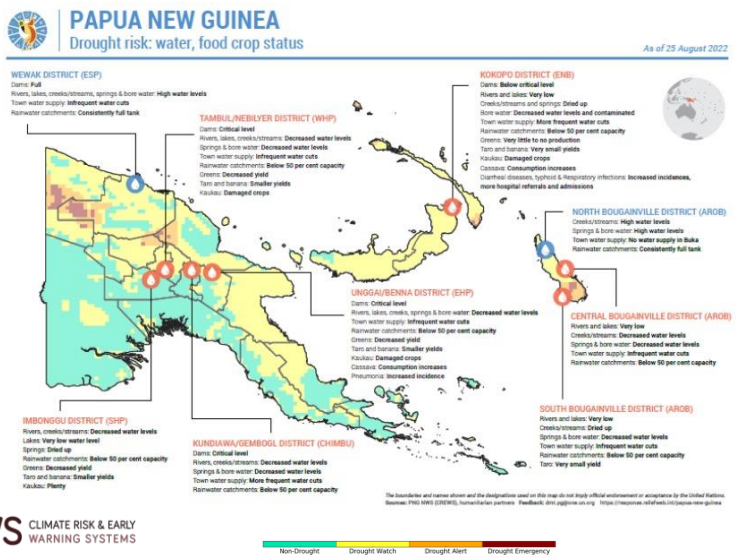
A summary of the relevant climate drivers affecting PNG over the coming months

- ACCESS-S outlook shows above average to above average rainfall for major parts of PNG except Manus, NOI, and Bougainville which shows drier than average conditions for December. However, 3 months outlook shows drier-than-average conditions across the country.
- With the peak of the wet season and the La Niña , the country is expected to receive above-normal rainfall for southern parts of PNG.
- A strong MJO pulse is expected to influence the country's rainfall in the coming weeks.
- ENSO remains at La Niña in the Pacific. Models indicating a return to ENSO-neutral conditions (neither La Niña nor El Niño) early in 2023.
- Negative IOD is weak and at neutral level.

For more information, feel free to contact the Climate and Spacial Services team at the PNG-NWS via 3255925 or kinane70@gmail.com

13

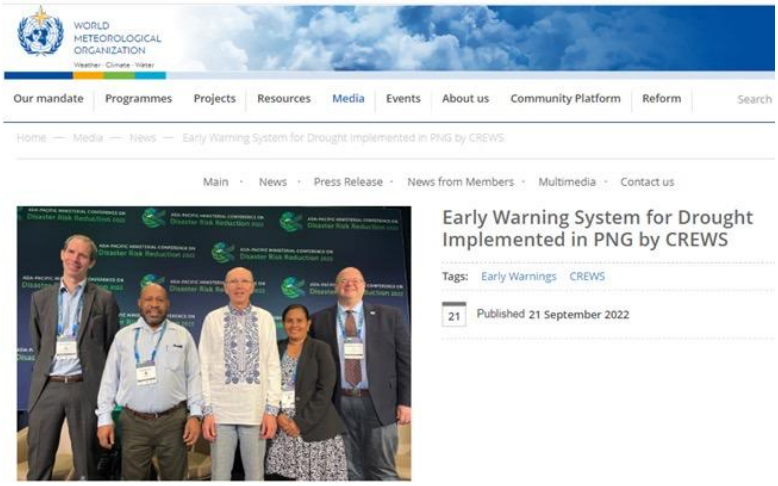
PNG Disaster Management Team



CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

14

Asia-Pacific Ministerial Conference on Disaster Risk Reduction (APMCDRR 2022)



CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

https://public.wmo.int/en/media/news/early-warning-system-drought-implemented-png-crews

15

Recommendations

Early Warning – Early Action

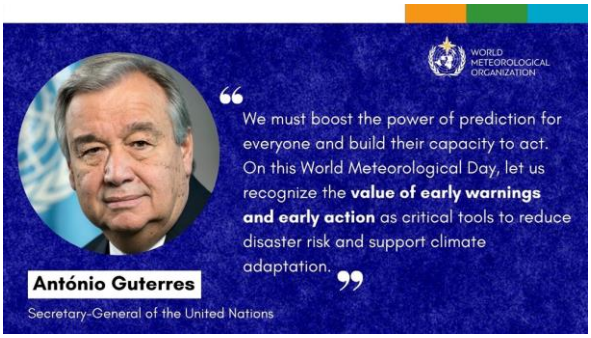
CREWS International Initiative proved to be very helpful in assisting most vulnerable economies - Small Island Developing States and Least Developed Economies (LDCs) - with Climate Change Adaptation and DRR.

Strengthening cooperation between providers of Early Warning information and key stakeholders including the Disaster Management Team. This enhances efficiency of Early Warning and Early Actions to monitor and proactively mitigate the potential impacts of drought on vulnerable populations in at-risk areas.

17

Early Warning and Early Action

UN unveils ambitious target to adapt to climate change and more extreme weather



CREWS and WMO SWCEM are important contributors to the UN target:

"Early warning systems must protect everyone within five years".

We invite Asia-Pacific economies to work with us on future CREWS projects to help protect populations from climate hazards and build resilience implementing Early Warning Systems.

18

Plenary Speaker: The Republic of Korea

Enhancing APEC Resilience Through AI Applications in Climate Change Adaptation

Dr. **Jinyoung Rhee**
Research Fellow
the Prediction Research Department
The APEC Climate Center

She is a Research Fellow for the Prediction Research Department of the APEC Climate Center. Since she received her Ph.D. from the University of South Carolina, USA, in 2007, she has been working on various projects for climate change adaptation and vulnerability assessment, disaster risk management, hydrological and meteorological drought monitoring and predictions, and Artificial Intelligence/Machine Learning for climate predictions. She is leading the AI team for the development of AI base technologies for objective climate predictions.

Abstract

The APEC Climate Symposium 2022 was conducted on 15-16 September 2022 both online and offline in Cha-Am, Thailand. The event was attended by 246 participants from 31 economies – Australia; Brunei Darussalam; Chile; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; New Zealand; Papua New Guinea; Peru; the Philippines; Chinese Taipei; Thailand; USA, Viet Nam; Samoa; Bangladesh; Brazil; Egypt; Ethiopia; India; Kiribati; Lao PDR; Mongolia; Nepal; Pakistan; Uganda; Spain; Switzerland; and Zambia. The participants included invited speakers and discussants, representatives from Hydrological and Meteorological government agencies, private sectors, non-governmental agencies, and academia. Experts from a diverse range of backgrounds, including climatology, disaster risk management, conservation, AI technology and international development were invited to discuss ways to enhance APEC resilience through AI applications in climate change adaptation.

The APEC Climate Symposium 2022, which focused on “Enhancing APEC resilience through AI applications in climate change adaptation,” aimed to benefit APEC member economies to gain the capacity and knowledge necessary for applying AI technologies

in climate change adaptation. In the first session “Tackling climate change with AI,” experts shared their expertise on how AI technologies can help the climate change adaptation and discussed key considerations in utilizing AI technologies in tackling climate change. The second session “Application of AI towards the resilient APEC,” focused on the case studies on applying AI technologies to climate-related sectors including weather prediction, disaster monitoring using satellite through AI, and conservation. Also, challenges, opportunities, efforts amongst stakeholders on utilizing AI technologies towards resilient APEC were shared. Experts brought together their varied experience and insights on how emerging economies can better adopt AI technologies in climate change and overcome critical environmental challenges. Through the discussion session, experts and participants discussed and made recommendations on the use of AI technologies in tackling climate change as well as application of AI technologies to various climate-related fields such as climate prediction, disaster risk reduction, agriculture, biodiversity and so on. With the knowledge and experience shared by the experts, participants increased their understanding on the use of AI technologies in tackling climate change.

Keywords: climate change adaptation, resilience, Artificial Intelligence, APEC Climate Symposium, APEC Climate Center

Outline

- APEC Climate Center
- APEC Climate Symposium

- APCS 2022: Enhancing APEC Resilience through AI application in Climate Change Adaptation
  - ✓ Tackling climate change with AI
  - ✓ Application of AI towards the resilient APEC

APEC Climate Center

BACKGROUND

Established in 2005 with the endorsement of 21 APEC member economies during the 13th APEC Economic Leaders' Meeting

2005 APEC host economy: Republic of Korea

GOAL

To add value to climate information for the society and economy, and to reduce damages caused by extreme events and natural disasters utilizing up-to-date climate prediction and monitoring information in the APEC region

VISION

To be a leading climate prediction center in Korea and the APEC region

APEC Climate Center

Climate Prediction

Platform for climate prediction information among world leading climate prediction centers

01 Production and Distribution of Climate Prediction Information for better management of extreme events in the APEC Region

02 **Predictability improvement** and uncertainty diagnosis through collection and reanalysis of various model outcomes

03 Research development and online services for improving prediction information and applicability

* Platform to conduct real-time collection, analysis, and distribution of global high-value climate information

► **Collect global climate prediction information into APCC**

APEC Climate Center

Collaboration

APEC Climate Symposium

for developing better joint coping strategies for climate extremes and growing international climate networks in the Asia-Pacific region

Annual Meetings

Year	Venue	Subject
2022	Virtual / Thailand	Enhancing APEC Resilience through Artificial Intelligence (AI) Application in Climate Change Adaptation'
2021	Virtual	Innovations in Climate Communication for Enhancing Human Security to Manage Risks of Climate Extremes
2019	Chile	Pathway to Sustainable Growth under a Changing Climate: Enhancing Interaction between Climate Science and Society
2018	Papua New Guinea	Overcoming the Challenges of an Uncertain Future with Enhanced Climate Information and Services
2017	Vietnam	Building Resilient Agro-Food Systems from Production to Consumption: for Sustainable Food Security using Climate Information
2016	Peru	Smart Climate Information and Accountable Action: Achieving Sustainable Food Security in a Changing World
2015	Philippines	The use of Weather and Climate Information for Efficient Disaster Risk Management
2014	China	Managing Climate Extremes and Hydrologic Disasters: Scientific Prediction and Emergency Preparedness
2013	Indonesia	Regional Cooperation on Drought Prediction Science to Support Disaster Preparedness and Management
2012	Russia	Harnessing and Using Climate Information for Decision Making: An In-Depth Look at the Agriculture Sector
2011	United States of America	Harnessing and Using Climate Information for Decision Making
2010	Republic of Korea	Building Adaptive Capability to Extreme Climate Events through Networking among APEC Economies and Relevant Organizations and Projects
2009	Singapore	APEC Climate Center for Climate Information Services to Society
2008	Peru	APEC Climate Center for Climate Information Services to Society
2007	Republic of Korea	Operation of APEC Climate Center for Climate Information Services
2006	Republic of Korea	Implementation of APEC Climate Center for Climate Information Services
2005	Republic of Korea	Implementation of APEC Climate Network for Climate Information Services

APEC Climate Symposium 2022

Enhancing APEC Resilience through Artificial Intelligence (AI) Application in Climate Change Adaptation

APCC and Thai Meteorological Department Co-hosted

Opening remarks by Mr. Caiwut Thankamanusorn, Minister of Digital Economy Society, Thailand

Closing remarks by Executive Director Do-Shick Shin from APEC Climate Center

- The symposium aimed to benefit APEC member economies to gain the capacity and knowledge necessary for applying AI technologies in climate change adaptation.
- The event was attended by 246 participants from 31 economies (15 APEC members and 16 non-members).

APCS 2022

Session I: Tracking Climate Change with AI

- The <u>current level of credibility and reliability</u> of AI technologies for climate change adaptation
  - AI's credibility and reliability for long-term climate change is currently *moderate*, but there are many *opportunities and challenges* in extending AI technologies for climate change adaptation: converting raw data to climate-relevant information, improving operational efficiency, improving forecasting, etc.
- <u>Are AI technologies advanced enough</u> to be applied in various sectors such as climate prediction, biodiversity, etc.?
  - AI is good at solving narrow well-defined problems.
  - AI tools are not yet advanced enough to recommend policies, simulate the whole earth's functioning or understanding how people behave.
  - Physics-informed AI is proved to be powerful at addressing the challenges of extrapolation to new unseen regimes, large uncertainties, and physical inconsistency.

Session I: Tracking Climate Change with AI

- Advantages, challenges, and barriers in the application of AI technologies
  - Advantages: Good at scaling up human-solvable tasks w/ abundant data, digesting vast volumes of data, enabling unprecedented scientific discoveries, etc.
  - Disadvantages: Not good at explaining, may not be physically consistent or meaningful, cannot extrapolate to unseen regimes, can have large uncertainties, learn biases and errors that exists in the data, etc.
  - Challenges: Techno-solutionism, requires deep expertise, requires a highly inter-disciplinary team, lack of benchmark curated datasets, lack of training data, etc.

Session I: Tracking Climate Change with AI

- Considerations in developing and applying AI technologies in tackling climate change and a way forward
  - Collaboration across disciplines / between academia, industry and governments
  - Careful examination of what is being learned by AI models, what are the biases and uncertainties, does it serve the problem at hand well, etc.
  - Emphasis on reproducible, extensible, reusable, and scalable AI workflows - many solutions are hard to scale to a wider range of problems
  - Open science, open-source technologies, and willingness to innovate together
  - Greater funding for high-risk, high-reward AI initiatives keeping in mind that the cost of climate change to the world is massive

Session II: Application of AI towards the resilient APEC

- Roles of governments, international organizations, and private sectors on how best to transfer the AI technologies and promote international cooperation
  - International cooperation: Concerted dialogues – more international workshops of real practice for member economies
  - Recommendations for government action:
    - Trust building on the added value of AI for DRR
    - Human capacity building – AI literacy and upskilling programs, funding or facilitating secondment programs for AI experts within climate-relevant sectors, etc.
    - Data and digital infrastructure, research and innovation funding, and deployment and system integration

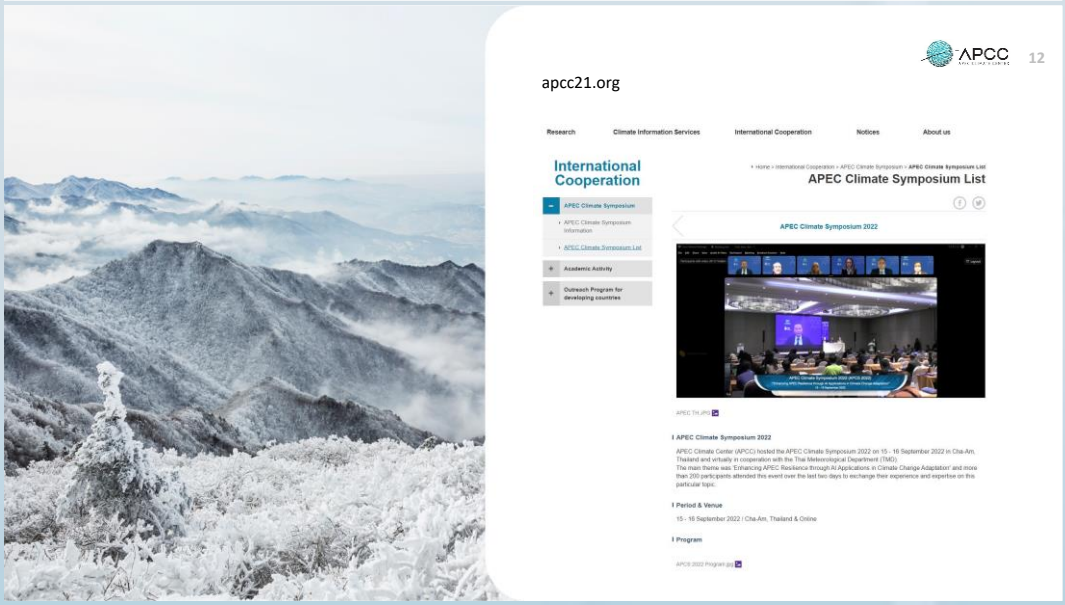

Session II :Application of AI towards the resilient APEC
Chair: Prof. Ir. Dr. Faridah Othman (Professor, Dept. of Civil Engineering, University of Malaya)

Speakers
- Weather Prediction by using Support Vector Machine - Dr. Waltana Kanbua (Director, Meteorological Development Division, Thai Meteorological Department)
- Disaster Monitoring using Satellite through AI - Prof. Seonyoung Park (Professor, Dept. of Applied Artificial Intelligence, Seoul National University of Science and Technology)
- AI and Resilience from a Conservation Perspective - Dr. Dave Thau (Global data and technology lead scientist, Global Science, World Wildlife Fund)

Discussion
- Ms. Kelly Forbes (Executive Director, AI Asia Pacific Institute)
- Prof. Seree Supratid (Director, Climate Change and Disaster Center, Rangsit University)
- Dr. Sanjay K Srivastava (Chief, Disaster Risk Reduction, UNESCAP)

Session II: Application of AI towards the resilient APEC

- How to empower emerging economies in the APEC region for better adopting AI technologies for climate change adaptation and overcoming critical environmental challenges
  - Sharing of data, developing tools and advanced AI-related research
  - Standardization and internationally recognized guidelines
  - Intergovernmental platforms: scaling up adoption of AI, exchanging challenges and practices
  - Close collaborations through concerted dialogues
  - Citizen Science can play a role



Industry, Innovation and infrastructure Resilience

Plenary Session 2: The Importance of Integrating resilience in Environmental, Social, and Governance – Harvest the Fruits of DRR Science and Technology to Save lives and livelihoods

Plenary Speaker: Japan

All Hazard Approach in VUCA world

Dr. **Takahiro Ono**
Manager, Corporate Planning Department
Tokio Marine Holdings, Inc.

In his corporate role, Takahiro Ono interacts with various international initiatives related to natural disaster risks and management at Tokio Marine.

On disaster risks management, he has been assisting the Asia-Pacific Economic Cooperation (APEC)'s Emergency Preparedness Working Group (EPWG) from 2011. Served as the main resource persons of Business Continuity Planning (BCP) experts from Japan to deliver the training course for the Small and Medium Enterprises Working Group (SMEWG) on Multi-year Project - "Improving Natural Disaster Resilience of APEC SMEs to Facilitate Trade and Investment".

He has also served the standard-setting efforts of the International Standardization Organization (ISO) as an expert to develop the TC292" Resilience and Security," and the TC268 "Smart Community Infrastructure," which is an ongoing project.

Prior to his current role at Tokio Marine, he was seconded to Ministry of Economy, Trade and Industry, Asian Disaster Reduction Center and Mitsubishi Corporation Insurance Co. from 2005 to 2022. He is Doctor of Engineering and Specially Appointed Professor of Tohoku University since 2022.

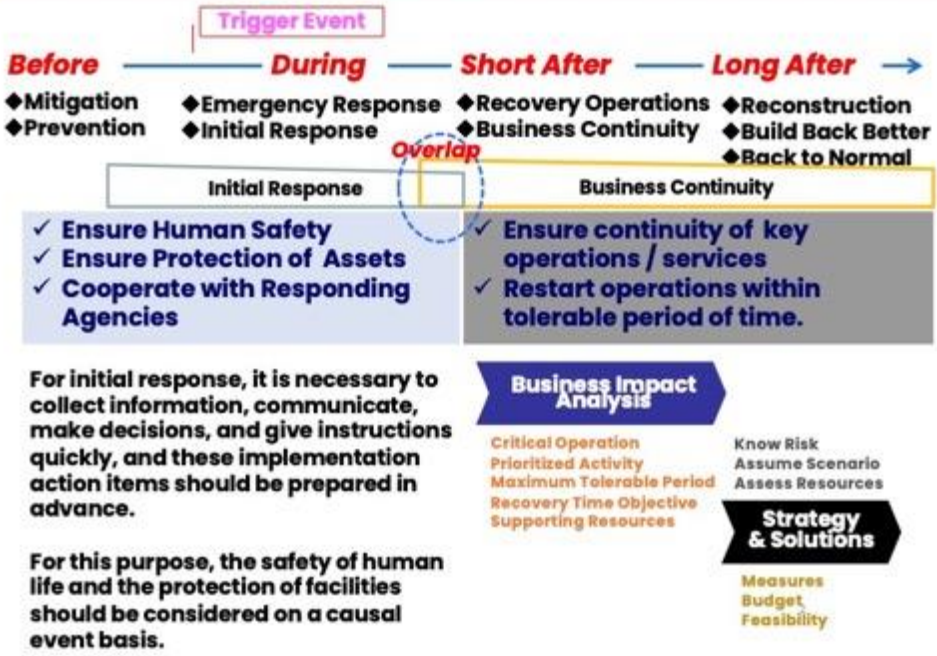
Abstract:

Climate change is exacerbating windstorms, floods, and other weather-related disasters, causing significant human and economic damage. New risks such as COVID-19 and cyber-attacks are also emerging. In this VUCA world, complex and

cascading unpredictable disasters are likely to occur soon. Currently, economies, regions, and organizations are preparing based on scenarios derived from past experiences, but it may become difficult to respond to a series of events that exceed expectations. To respond to such unexpected events, it is desirable to develop response procedures and strategies for each operational resource that becomes unusable based on the consequences of the event, rather than the cause of the event, and to flexibly combine these response procedures according to the situation that is happening. This approach is called the " all hazards approach," and it requires more than ever the ability to recognize the situation and the skill set to combine these procedures in a flexible manner. This report describes this all hazards approach. In addition, although there have been many situations where BCPs have been formulated with the aim of achieving Back to Normal, it has become necessary to assume Back to New Normal in response to changes in market and consumer behavior. This paradigm shift is also proposed.

Key words: All hazard approach, BCP, business continuity, consequence based, resilience.

Initial Response to Business Continuity



For initial response, it is necessary to collect information, communicate, make decisions, and give instructions quickly, and these implementation action items should be prepared in advance.

For this purpose, the safety of human life and the protection of facilities should be considered on a causal event basis.

Business Impact Analysis

Critical Operation
Prioritized Activity
Maximum Tolerable Period
Recovery Time Objective
Supporting Resources

Know Risk
Assume Scenario
Assess Resources

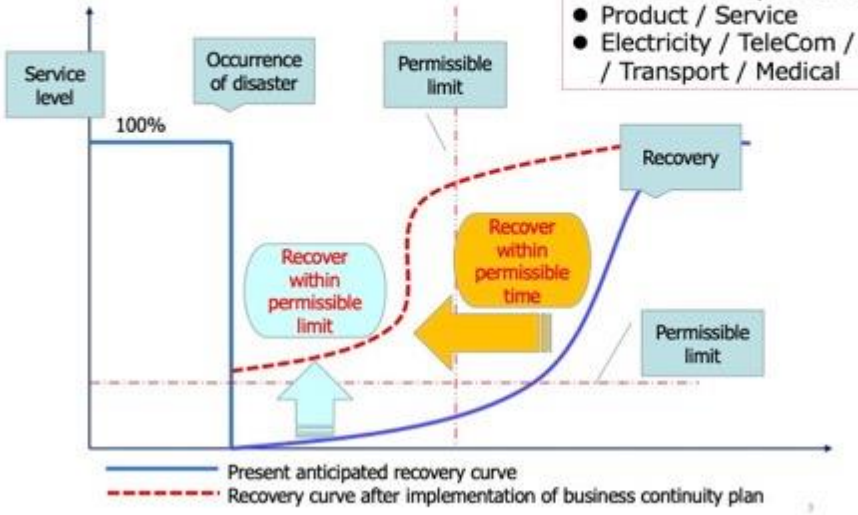
Strategy & Solutions

Measures
Budget
Feasibility

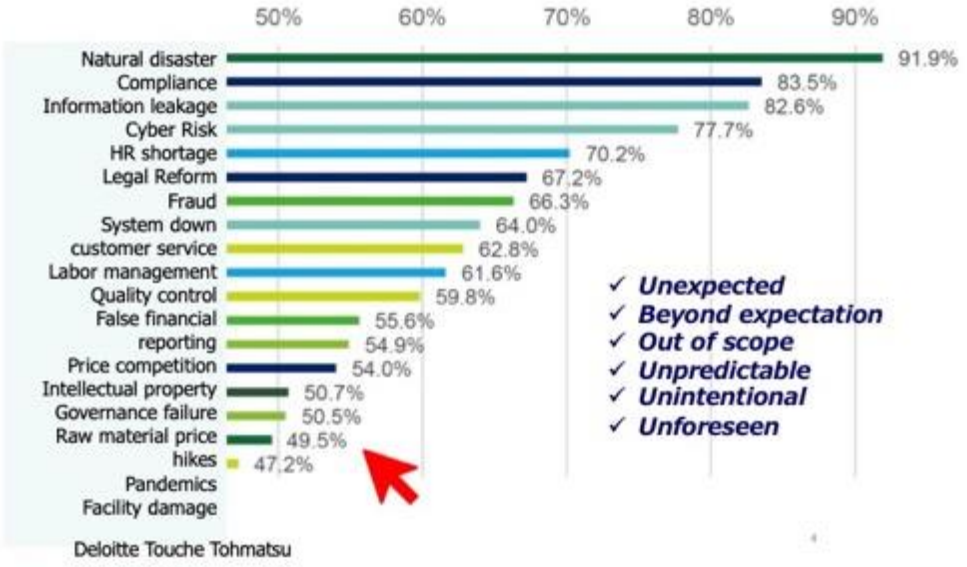
Business Continuity Planning

Business continuity is the capability of an organization to continue delivering products and services within acceptable timeframes at predefined capability during a disruption.

- Pre assess impact of failure
- Product / Service
- Electricity / TeleCom / Finance / Transport / Medical



Risk from 2019 Report



Deloitte Touche Tohmatsu

To Be a Good Company

All hazard approach / Consequence base

- Unpredictable VUCA era: New risk, Extreme weather, Complex and cascading type
- Focus on the consequence rather than the cause event

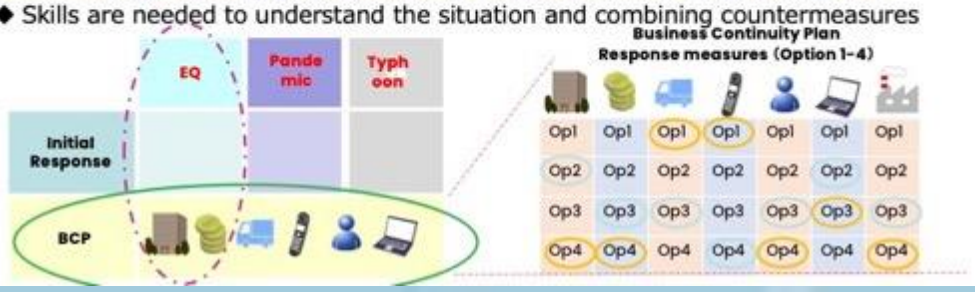
◆ Experience from past disaster, estimate and make a plan, measures
  - ✓ Lifeline Electricity 3days, Gas 2wks, Water 1month
  - ✓ Facility 2wks, commutable staff number, supplier and vender situation

◆ Possibility that the situation will not turn out as expected>>> Unexpected

- Not assuming any specific cause
- Simply assume that the necessary resources are not available for some reason
- Prepare the response measures need to be taken for each resource failure.
  - ✓ Electricity outage for 24 hours, Measure: wait for restoration
  - ✓ Electricity outage for 3+ days Measure: Shift to an alternative site

◆ Respond by choosing a combination of measures meet the actual situation

◆ Skills are needed to understand the situation and combining countermeasures



Paradigm shift

- To date, strategies and measures for recovery have been based on the assumption that customer and market needs will continue to exist
  - ✓ Recognize importance of behavior change / identify market demand fluctuations
  - ✓ Strategies based on the idea of Back to New Normal.
  - ✓ Opportunities for stepping stones to innovation.

Change of market and demand → recovery aiming to go back to the original state. (Until Now)

Change of market and demand → Continue the business in the direction of changing the core business axis. (From Now)

- Building a flexible system that can seamlessly incorporate efforts during normal times into emergencies
  - ✓ No longer necessary to gather for decision-making at emergency management headquarters meetings, etc.
  - ✓ Since we have become familiar with teleworking and online correspondence on a regular basis, there are fewer problems and lack of communication due to online use in a case of emergency.
  - ✓ It is the same as training and exercising every day.

6

Conclusion

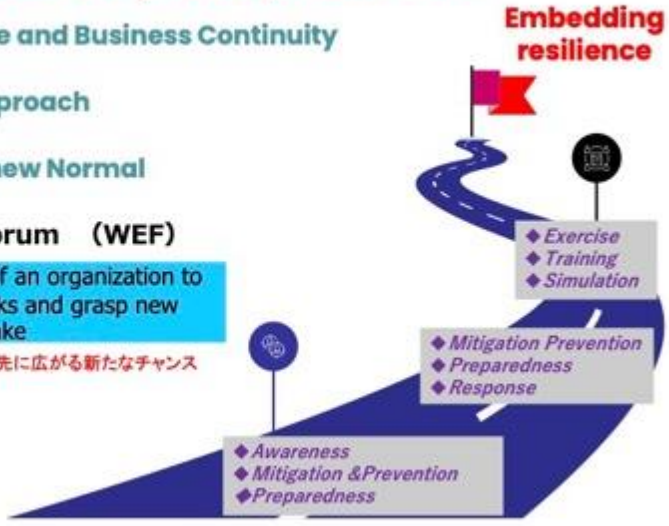
Has there ever been a disaster that followed a predicted scenario?

- ➢Initial Response and Business Continuity
- ➢ All hazards approach
- ➢Back to old or new Normal

World Economic Forum (WEF)

Resilience is the ability of an organization to overcome external shocks and grasp new opportunities in their wake

外部からの衝撃を乗り越え、その先に広がる新たなチャンスをつかむ組織の能力



7

Plenary Speaker: Chinese Taipei

The Chinese Taipei Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP)

Dr. **Wei-Sen Li,** Executive Director, APEC Research Center for Typhoon and Society (ACTS)

Dr. Li have been involved in APEC Emergency Preparedness Working Group (EPWG) as Co-chair and is a member of IRDR Scientific Committee. He has a wealth of experience in the development and implementation of disaster risk reduction and management systems. His responsibilities include building capacity in the region through engaging public-private partnership to better mitigate and respond to emergencies and natural disasters in APEC economies. Dr. Li holds a PhD in Civil Engineering from National Central University, where he specializes in structure dynamics, seismic design and earthquake engineering. Currently, he leads international collaboration and conducts research on large-scale urban disasters and disaster risk management in NCDR.

Abstract

The Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) coordinated by National Science and Technology Center for Disaster Reduction (NCDR) is one of three major climate change projects funded by National Science and Technology Council in Chinese Taipei. TCCIP produces climate change data for impact assessments and adaptations and support climate change adaptation (CCA) policy framework to the Cabinet since 2009. TCCIP aims to strengthen cross-level and cross-sector CCA through climate-related research to support Sustainable Development Goals (SDGs) in Chinese Taipei. In this context, TCCIP strives to achieve the mid-term goal of the National Science and Technology Council (NSTC) in proactively responding to the climate emergency and enhancing the systemic resilience in Chinese Taipei. TCCIP is divided into three functional mission-oriented teams to meet the mission of advancing user-driven climate change related science research and cultivating climate change science services. TCCIP teams can function

independently and work collaboratively for synergy on the integration of research, development and operation.

Team one consolidates climate information and conducts climate change analysis including the improvement of climate analytical techniques for producing high-resolution observation and projection data sets. Value-added studies such as analyzing climatic patterns are one of the team's critical deliverables to meet each sector on demand. Team two investigates climate change impact and adaptation application including the evaluation of climate change hazards, impacts and adaptation strategies in ten thematic areas (agriculture, water resources, landslide, inundation, coastal zones, fisheries, forestry, cattle farming, health, and urban heat island). Developing an adaptation framework, knowledge system and tailor-made digital tools and maps is one of the key deliverables of Team Two. Team three acts as the main climate information service center for TCCIP by providing updated information and promoting climate change information services as well as responsible for well-maintained functions and operation of TCCIP's integrated platform (e.g., climate change data store and adaptation resources kit). Its regular operation of renewing tools and knowledge of the TCCIP platform is based on the feedback provided by users in practice. It is extremely important to engage cross-disciplinary collaboration and communication to activate the knowledge transfer process for promoting CCA and its related research results through changing mindset and behaviour for enhancing risk awareness as a whole of society under APEC.

Keywords: TCCIP, integrated platform, climate change adaptation (CCA), cross-disciplinary collaboration and communication, Sustainable Development Goals (SDGs).

The Chinese Taipei Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) – a brief introduction

Lee-Yaw Lin, Wei-Sen Li

Chinese Taipei

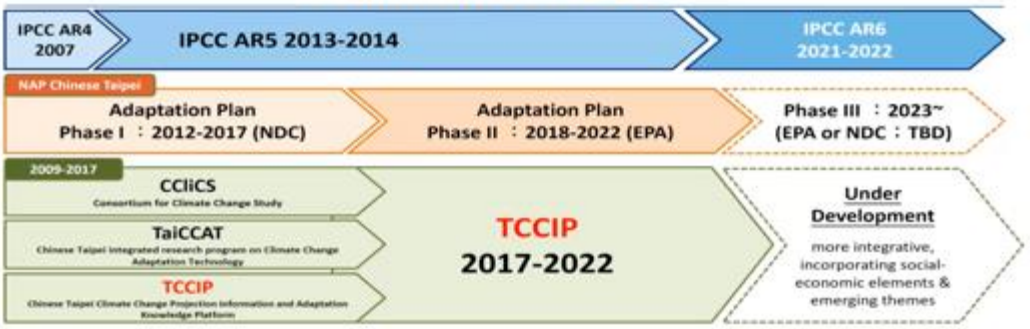
Outlines

1. TCCIP: a brief overview
2. Current outcomes
3. Future works

TCCIP: A BRIEF OVERVIEW

Climate change adaptation in Chinese Taipei

Evolution of TCCIP

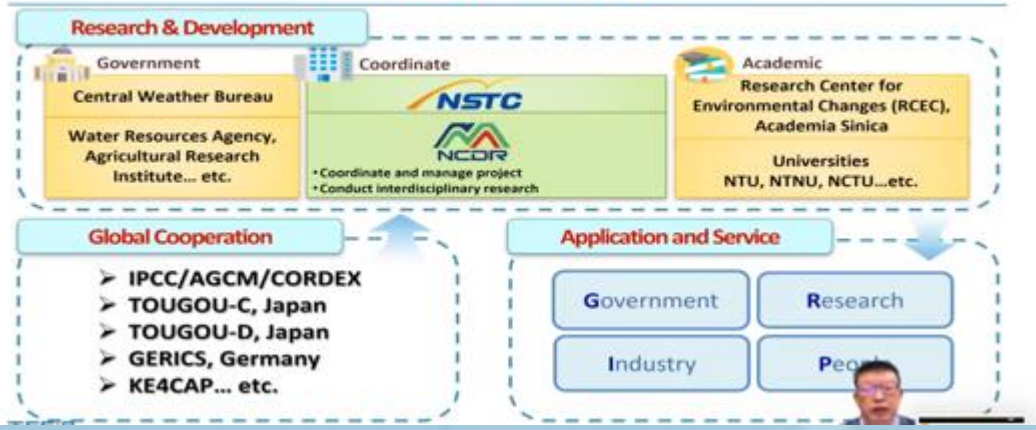


Issue routine reports of climate change research

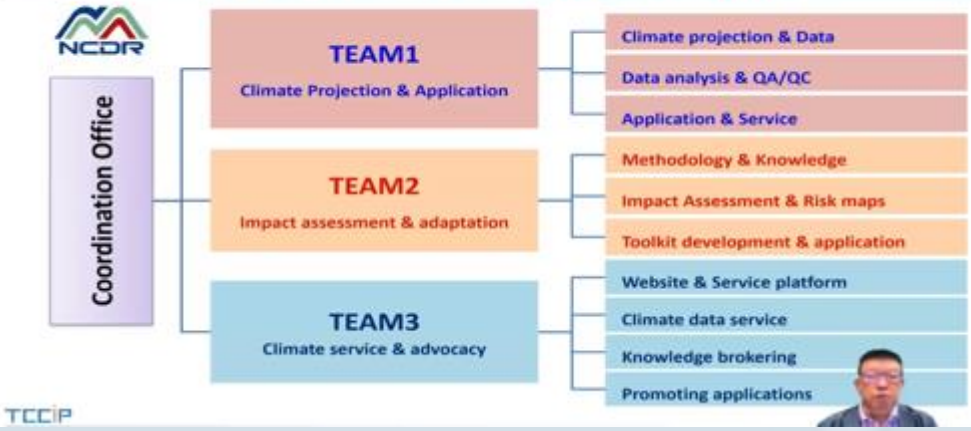
The Goals of TCCIP

1. Produce high resolution projections of climate change in Chinese Taipei through scientific methods.
2. Build interdisciplinary cooperation and information integration for climate change research.
3. Extend global connection and collaboration on climate change research for enhancing regional capacity.
4. Apply results of TCCIP to policy making at governmental level.
5. Issue routine reports of climate change research and achievement of Chinese Taipei.
6. Promote climate change service.

Structure of TCCIP



TCCIP research teams and topics



Framework of TCCIP 3 Teams

CURRENT OUTCOMES

- **Team1** - Climate projection & application
- **Team2** - Impact assessment & adaptation
- **Team3** - Climate service & advocacy

Team1 members

PI

GCM	Statistical Downscaling	Dynamical downscaling	Grid data	Satellite solar radiation	Air pollution modelling
Academia Sinica RCEC Prof. HSU, HUANG-HSIUNG	NTNU Prof. CHEN, CHENG-TA	NCDR Cheng, CHAO-TZUEN	NTNU A/Prof. WENG, SHU-PING	CWB CHANG, YU-CHENG	Academia Sinica RCEC TSAI, I-CHUN

Member

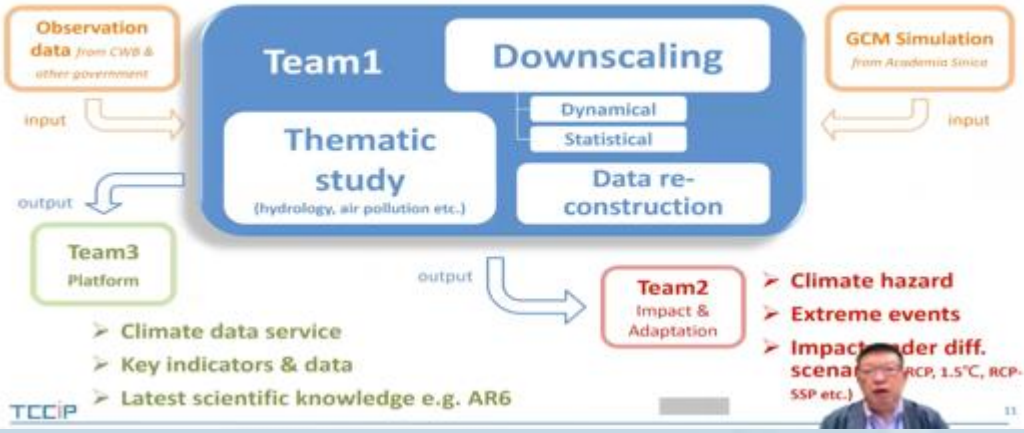
RCEC(×1): TU, CHIA-YING
NCDR (Post-Doc)(×2):
TUNG, YU-HSIANG; LIU, HSIAO-WE

Research Assistant(×9):
TSAI, HUNG-PENG; LIN, HSIU-LI; YANG, CHENG-TAO; WENG, MIN-CHUAN; H[illegible]-JUNG; CHIANG, HSIN-YU, LIN, PING-YI; WANG, CHUN-YU; CHIEN, YU-TANG

TCCIP

10

Team1 is the cornerstone for all TCCIP studies



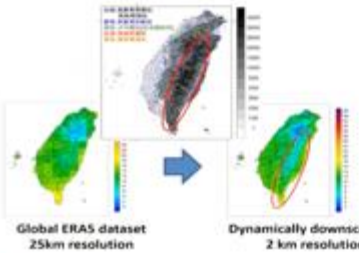
TCCIP

11

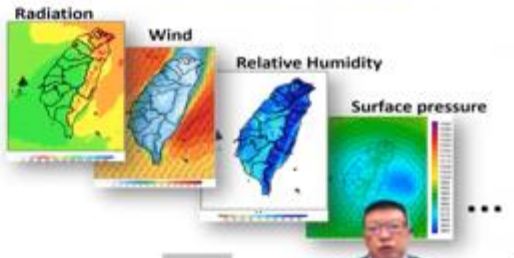
Reconstruction of Chinese Taipei's historical climate data

2018	2019	2020	2021	2022
Develop model	Verify data	Complete 40yr reconstruction	User testing/ promotion	Establish climate service

1. **Complement regions without observation data**



2. **More variables available for analysis**

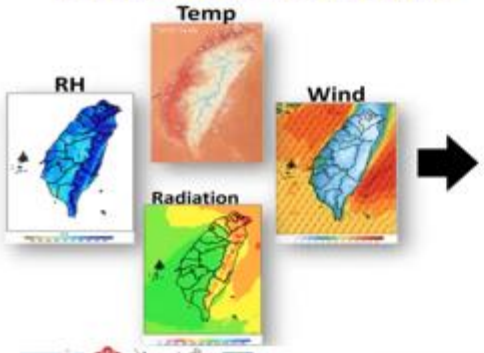


TCCIP

12

Reconstruction data application : urban heatwave

Reconstruction hourly data



Hi-Res. Thermal Comfort Index @Taipei

Effect of climate change on air pollution

❑ Assess the impact of climate change on air quality in Chinese Taipei

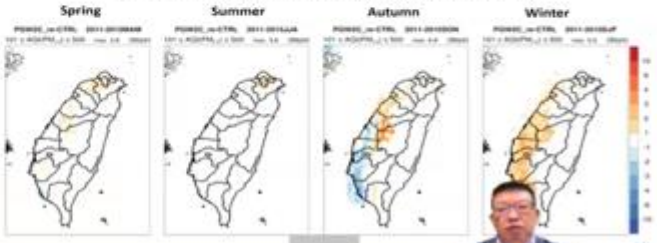
2020 — 2011~2015 Model simulation & adjustment

2021 — Apply 2℃ scenario

2022 — Apply 4℃ scenario

Increase of high-pollution days in the mid & western regions during Autumn /Winter seasons

Changes in the number of high-pollution days



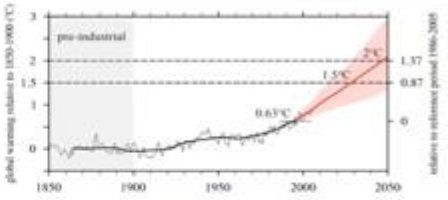
Evaluate application of temperature scenarios

❑ Fixed warming scenarios(1.5, 2, 4℃)

- Simplify climate scenarios
- Support decision-making
- Easy update to CMIP6 & future data

Scenario	No. of GCM	Time (median)
1.5℃	98	2029
2℃	83	2045
4℃	19	2072

baseline：1976-2005

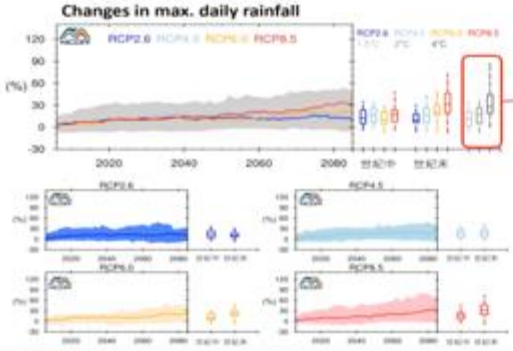


Applied in:

Application example: climate indices for hydrology

➢ The addition of 1.5℃、2℃、4℃ scenario to the indices

Changes in max. daily rainfall



Fixed warming scenario

	Rate of change (%)				
Percentile	5	25	50	75	95
1.5°C	-7	2	+11	21	34
2°C	-7	6	+17	26	36
4°C	1	19	+28	44	86

*Model uncertainties presented in percentiles

RCPs

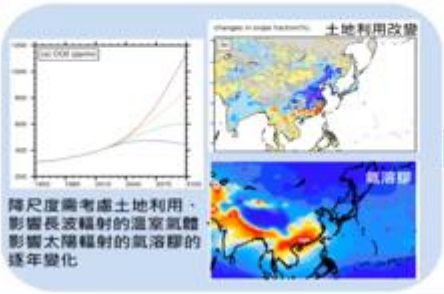
	Mid-century					End of 21st century				
Percentile	5	25	50	75	95	5	25	50	75	95
RCP2.6	-3	5	+13	23	35	-6	6	+10	18	30
RCP4.5	-2	6	+17	26	35	-5	6	+16	26	43
RCP6.0	-7	4	+9	21	29	-6		+21	30	50
RCP8.5	-4	7	+17	23	48	-7		31	46	73

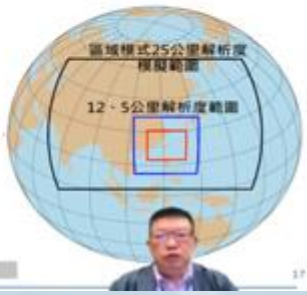
TCCIP

IPCC AR6 contribution: TaiESM

■ The Chinese Taipei Earth System Model (TaiESM), developed by Academia Sinica with support from NSTC, is Chinese Taipei's **first self-developed GCM to participate in the CMIP6 cycle**

NSTC





TCCIP

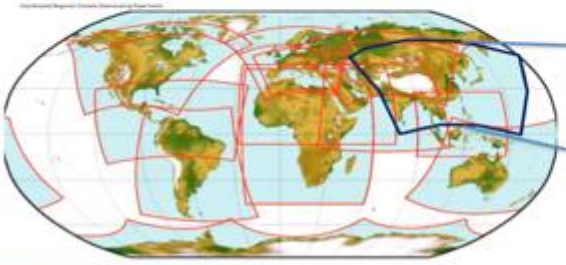
Participate global research networks

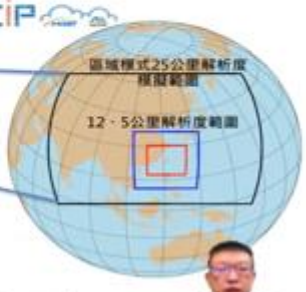
World Climate Research Programme (WCRP) CORDEX-East Asia

Establish hi-res. regional downscaled data with multiple model & scenario through global collaboration

WCRP CORDEX

TCCIP





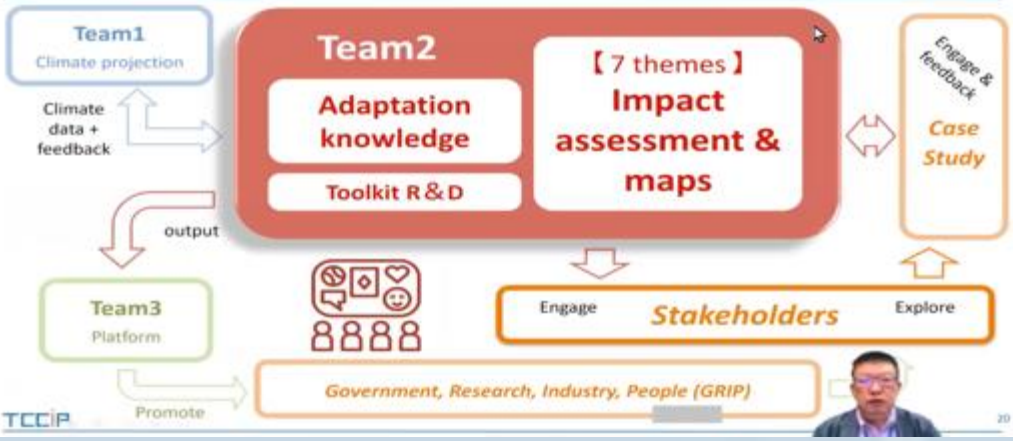
14 regional initiative worldwide

TCCIP

Team2 members

❑ Focus on adaptation knowledge & selected themes:

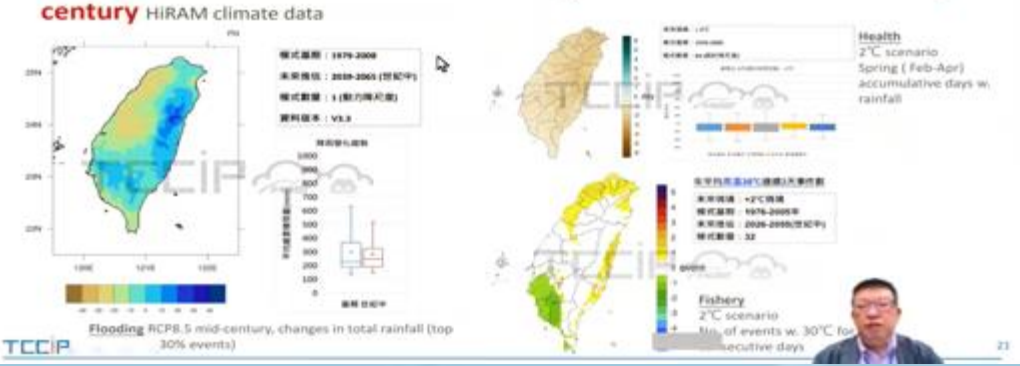
Team2 engage stakeholders & address adaptation



Impact Assessment & Impact maps

❑ **Dynamic Downscaling** (flooding, landslide): **user-based mid-century** HiRAM climate data

❑ **Statistical Downscaling** (water, agriculture, fishery, health) **produce 2℃ scenario hazard maps**



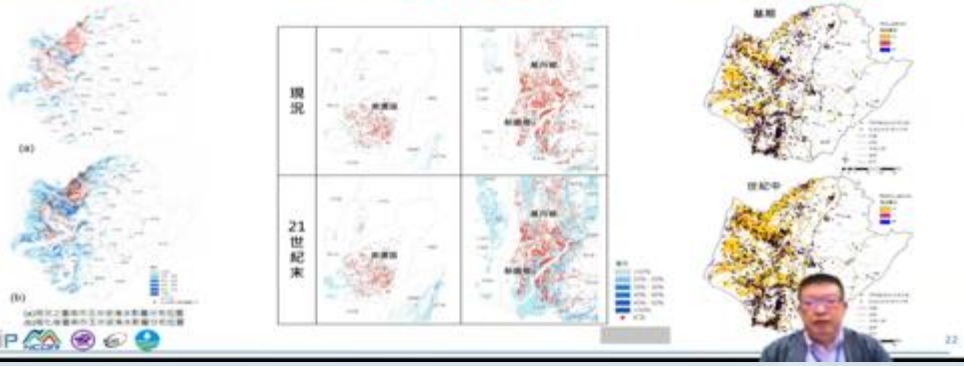
Flooding RCP8.5 mid-century, changes in total rainfall (top 30% events)

Application of impact maps: Flooding

Maize analysis (2020)
Assess effect of flooding under in major cultivation area @Tainan

Adzuki bean analysis (2021)
Assess distribution & probability of flooding >0.2m @GaoPing region

Transport system (2021)
Evaluate potential hotspots of railway systems @Tainan



TCCIP

Example of Toolkits: HydroImpact

Accelerate climate data processing & simulation

- Integrate climate data from 62 GCMs

Climate Data
↓
Hydrological Model
↓
Data & Indicator

TCCIP

Attempts to practice adaptation: Case studies

Data | Model | Policy | Gov. | Stake-holder | Useful

【Agriculture】
Rice Crops @Xinfeng, Hsinchu

【Water Resources】
Industrial Park @Taichung
Water Resources Master Plan

【Flooding】
Annan District, Tainan City
SanYe River catchment

【Coastal】
Yongxing harbour, New Taipei City
Coast of Toucheng, Yilan
Integrated Coastal Zone Management Plan

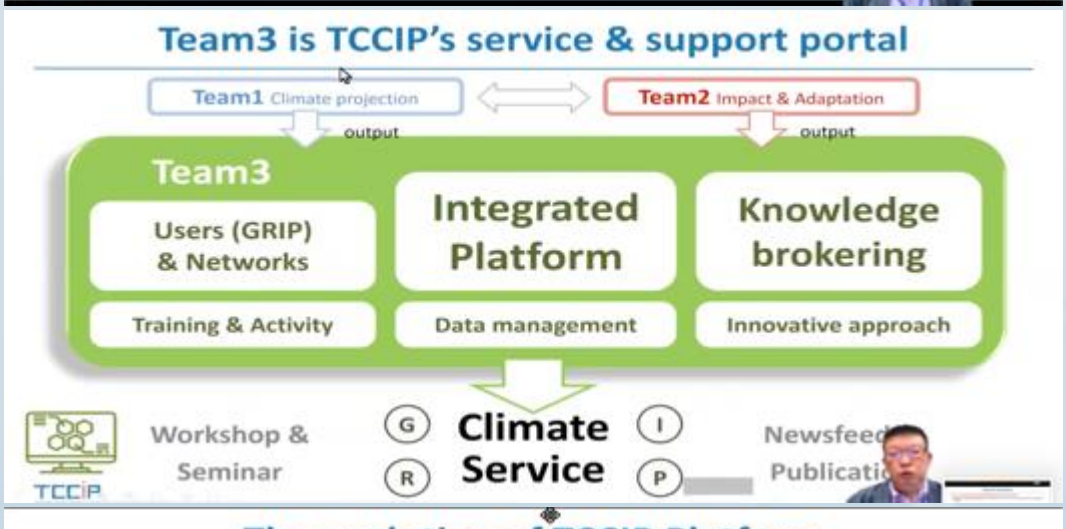
【Landslide】
Jinnuan Tribe, Taoyuan
Xiuluan Tribe, Hsinchu

【Fishery】
Fangyuan Township, Changhua
Yongan & MiTuo, Kaohsiung

【Health】
Dengue fever @Tainan & Ka...ng

TCCIP

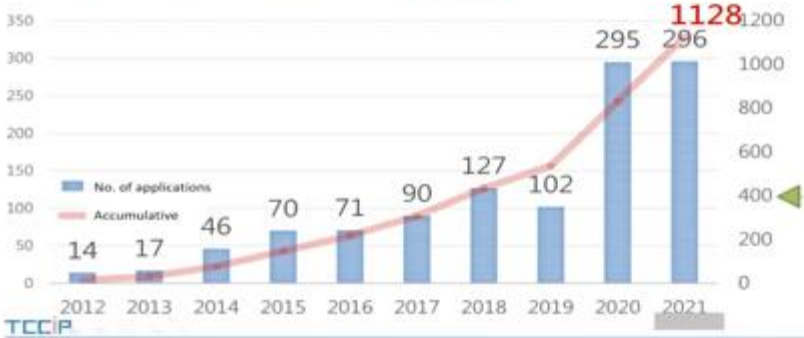

Team3 members
Focus on climate service, knowledge brokering & application
Establish integrated platform in collaboration with Center for High-Performance Computing (NCHC)
Supervision
CHEN, YUNG-MING
Climate data
TUNG, YU-HSIANG
Knowledge
LI, HSIN-CHI
Promotion
LIU, TZU-MING
Partner
LIN, HSI-CHING
Platform
LI, CHENG-KUO
Other members
Research Assistant(×6):
LIN, SHIH-YAO; SUN, TIEN-HSIANG; CHANG, CHIA-WEI; HUANG, YEN-CHEN; LI, HUI-LING;
TCCIP


Team3 is TCCIP's service & support portal
Team1 Climate projection
Team2 Impact & Adaptation
output
output
Team3
Users (GRIP) & Networks
Integrated Platform
Knowledge brokering
Training & Activity
Data management
Innovative approach
Workshop & Seminar
G
R
Climate Service
I
P
TCCIP


The evolution of TCCIP Platform
TCCIP
NSTC
氣候變遷平台
TCCIP 1.0
Develop basic infrastructure
(2012-2015)
1st generation
TCCIP 2.0
Focus on application
(2012-2015)
2nd generation
TCCIP 3.0
Identify targets (GRIP), integrate adaptation knowledge & tools
3rd generation
TCCIP

Statistics of TCCIP data service

- Total no. of data applications reached **1128** (until Jul. 2021)
- 461 applications in 2021, ↑**61%** compared to 2020



Accumulative Applications ≈ SDG target×3

Chinese Taipei SDG 13.3.3 Target in 2020: 400 ...ications

TCCIP

Adaptation knowledge: Existing case studies

- Categorized with reference to the IPCC AR5 report (ch14, 2014)

Structural/physical
- Engineering and Built Environment
- Technological Options
- Ecosystem-Based Adaptation

Social
- Education & training
- Information & early warning

Institutional
- Economic instruments
- Legislation & policies

- Current collected **226** case studies worldwide (incl. cases in Chinese Taipei) for 7 thematic areas
- Example: agriculture↓

TCCIP

Promotion through multiple approaches

- **Newsletter**
  - Dedicated newsfeed to subscribers
  - Notification of climate date updates to existing users
- **Social Media**
  - Facebook fan page
  - YouTube channel
- **Podcast, Broadcast**
  - In collaboration with the Climate Change Education Promotion Program
  - Topics include general knowledge, agriculture, fishery, aquaculture, water resources, health, sustainability, ESG etc.

facebook YouTube

TCCIP

Global network: the KE4CAP project

- Attend **12 virtual workshops** from Jun. 2020 to Sep. 2021, share experience on **success & obstacles** encountered with other climate service platforms
- Took part in the **KE4CAP survey**, initiated Jul. 2020
- Experience of the TCCIP is assimilated into the **KE4CAP official website** & **reports**

TCCIP

Dedicated introduction of TCCIP Website on KE4CAP website

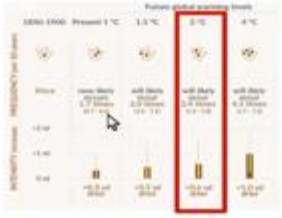
- **Share knowledge & experience** with other climate service platforms
- **Global exposure** of the TCCIP platform to the world

ON-GOING WORKS

- AR6 projections & applications
- Support adaptation policies

AR6 projections & applications

- Explore **potential applications** based on the report, exploit opportunities to better demonstrate & communicate scientific evidence to stakeholders
- **Consider SSPs** & how to incorporate into / update existing impact research
- Conduct **preliminary simulation** using AR6 downscaled data, in preparation for the WGII report

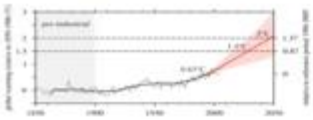


TCCIP

Support adaptation policies

Explore & propose warming scenarios (1.5/2/4℃) to assist policy

- Avoid complicated climate scenarios
- Support decision-making
- Updates data more easily



Scenario	No. of GCM	Median	Distribution
1.5℃	98	2029	2015-2071
2℃	83	2045	2029-2084
4℃	19	2072	2067-2085

Baseline: 1976-2005

- Current NAP bottleneck: **voluntary & inconsistent** risk assessment efforts
- Planning ahead: **establish an unified framework** & methodology for the next phase

TCCIP

Thanks for your attention ☺

TCCIP

MOST

Plenary Speaker: Chinese Taipei

Live with the Climate Risk for Resilience

Dr. **Yanling Lee**, Secretary General, APEC Emergency Preparedness Capacity Building Center (EPCC)
Assistant Research Fellow, International Collaborations
National Science and Technology Center for Disaster Reduction

Secretary General, APEC Research Center for Typhoon and Society

Dr. Yanling Lee (Sophia) Ph.D. in the Architecture, Civil Engineering and Industrial Management Engineering, Nagoya Institute of Technology, Japan and MBA (Master in Business Administration) from Coventry University, UK. She is an Assistant Research Fellow coordinating the international collaboration at the Cabinet think tank of disaster management, National Science and Technology Center for Disaster Reduction (NCDR), in Chinese Taipei since 2005 and serving as the Chinese Taipei official focal point of contact under APEC Emergency Preparedness Working Group (EPWG) as well as the Secretary General of APEC Emergency Preparedness Capacity Building Center (EPCC). She has a wealth of experience in policy making coordination and capacity building through engaging public-private partnership to better prepare for and respond to natural disasters among APEC economies in cross-cutting issues. Prior to the above-mentioned experience, she was a coordinator both in Investment Promotion and Development and R & D Section; Coordination and Service Office for Asia-Pacific Regional Operations Center of Committee of Economic Planning and Development, Executive Yuan since 1998 responsible for Asia-Pacific Regional Financial Center and Government Restructure Affairs; a Media Research Analyst in Leo Burnett Advertising and a System Engineer as well as a Money Market Dealer at the Bank of Nova Scotia.

Abstract

The importance of capacity building for the resilience of communities and people to disasters has been noted by the APEC family. Economic activity based on human

security for operation and quick recovery from disasters, climate crises and pandemic spreading. The Plant Back Better (PBB) initiative highlighted the importance of smart science, technology and innovation, cross-fora engagement, building consensus and a strong network of cooperation as well as gender and community empowerment for the resilience on common goals, needs and interests to contribute to the APEC region as a whole according to BCG (Bio-Circular-Green) Principles towards SDGs (Sustainable Development Goals). Live with the climate risk for resilience, it is important to harmonise climate policy for socio-economic development and develop impact-based as well as natural-based smart technologies and solutions for disaster risk reduction and climate change adaptation (CCA). APEC funded PBB project boosted digital economy growth by promoting supply chain resilience, people-centered and gender-responsive, multi-hazard information platform and network to synergise cross-sectorial institutional capacity through practical community-based strategy on public private partnership toward SDGs. For smart agriculture, policies and solutions, PBB initiative shows its strength to seamlessly linkage between their daily activity in food security in normal times as well as disaster risk reduction and climate change adaptation efforts in emergencies. The pilot PBB project at the Ati tribe in the Philippines showcases how to be self-sufficient and resilient to live with the risk of extreme events to tackle prolonged drought, floods, and the pandemic spreading of COVID-19.

Key words: The Plant Back Better (PBB) initiative, climate crisis, public private policy (PPP), gender-responsive, capacity building, Sustainable Development Goals (SDGs).

Asia-Pacific Economic Cooperation

APEC Emergency Preparedness Capacity Building Center

Plant Back Better Initiative

Live with the Climate Risk for Resilience

Yanling Lee (Sophia)
Secretary General
APEC Emergency Preparedness Capacity Building Center

The importance of integrating resilience in environmental, social, and governance - Harvest the Fruits of DRR Science and Technology to save Lives and Livelihoods

Best Practices for Food Security

PBB in Conjunction with UN SDGS

2

APEC funded project – Plant back better (PBB)
collaborations with the Philippines in Iloilo City

- "Plant back better"
  1. Resilient-and-sustainable plantation of vegetables and flowers
  2. Integrated Smart and Sustainable Micro business model
- To have local partners to succeed the project
  1. Iloilo City Government
  2. National Resilience Council
  3. SM Group
  4. Manila Observatory
- Other stakeholder
  1. NCDR, EPCC
  2. World Vegetable Center
  3. Known You Seed Company

Project implementation

Up to 56% of experts and practitioners are Women

- **1st Phase**
  - Iloilo City, April 30- May 02, 2019
  - Initial on-site survey
  - Planning with the local
  - Resilient plantation
- **2nd Phase**
  - Iloilo City, August 08-10, 2019
  - Inaugurate the Learning Garden
  - To plant vegetables in community
- **3rd Phase**
  - Taipei, September 30 - October 2, 2019
  - APEC Resilience Week
  - 13 members and 100 participants

Asia-Pacific Economic Cooperation

2019 APEC Resilience Week (2019 APEC RW)

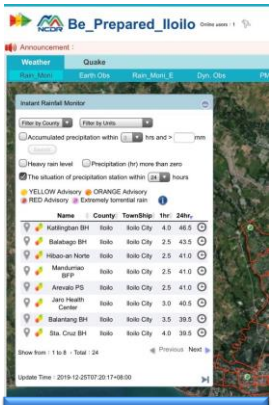
APEC Emergency Preparedness Capacity Building Center

- **13** APEC member economies
- **594** participants attended 3-day-APEC Resilience Week activities to
- Focus on climate adaptation countermeasures for food security.

Sep. 30 ~ Oct. 2, 2019 **Taipei**

APEC Plant back better (PBB) on Cross-border PPP Amidst COVID-19

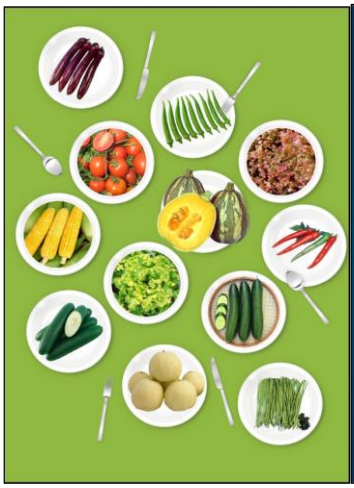
Sustainable Food Supply Chain with Nutrition

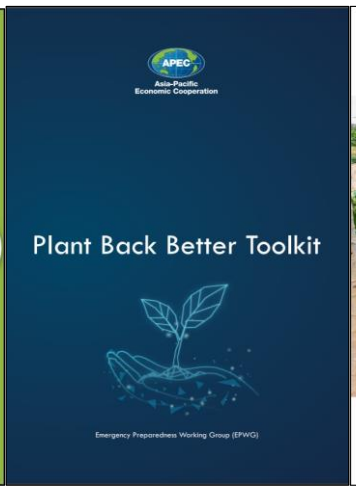


Smart ICTs support on Early Warning of Weather Related Disasters

Circular Economy in 2020 while Lock-down

Publication on “Plant Back Better”





- **Toolkit download link**
  - https://www.apec.org/Publications/2020/04/Plant-Back-Better-Toolkit
  - https://www.apec-epcc.org/resources/publications/
- **Video clips to introduce “Plant Back Better”**
  - https://www.youtube.com/watch?v=mw85_loTJ7k

'Green Care' promotes physical and mental health and well-being through garden farms for vulnerable adults and children

Preference

Confident

Need

Dignity

Motivation

Simple

8

Thank for your attention

Wei-Sen Li, Yi-Chung Liu, Ke-Hui Chen, Chi-Ling Chang and I-Chuan Liao

Yanling Lee (Sophia)
E-mail: sophiancdr@gmail.com

9

2022 ACTS Annual Meeting

Welcoming Address by the Representative of the Host Economy

Dr. Christin Kjelland

Senior Advisor Office of Science and Technology Cooperation

Bureau of Oceans and International Environmental and Scientific Affairs (OES)

Christin currently serves as Senior Advisor in the Office of Science and Technology Cooperation, covering topics including research integrity, G7, and APEC. In 2019-2020, Christin served with the White House Office of Science and Technology Policy as a Policy Advisor for International Affairs. Christin was Chair of the APEC Policy Partnership on Science, Technology, and Innovation in 2017 and 2018, and Vice Chair in 2015 and 2016. Prior to joining the State Department, Christin earned a Masters of International Affairs degree focusing on Asia and Natural Resources from The George Washington University. Christin also worked at a Minneapolis-based environmental consulting firm on environmental education and conservation programs. She taught English in South Korea as a Fulbright Scholar from 2005-2006.

Opening remark

Critical Infrastructure Protection and Cascading Events Simulation for Disaster-sensitive Metropolitan Areas

Prof. Kenji Watanabe
Chair of the Council for Critical Infrastructure Protection (Cabinet Secretariat), Japan

Kenji Watanabe is a professor at the Graduate School of Engineering, and also the head of Disaster & Safety Management Division of the Nagoya Institute of Technology in Nagoya, Japan.

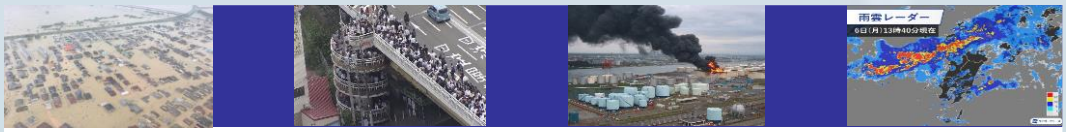
Based on his 20 years business and professional experiences in structured finance, risk management, system & operation design at the Mizuho Bank, PricewaterhouseCoopers, and IBM Business Consulting Services, he is recognized as a SME (Subject Matter Expert) in operational risk management, business continuity management (BCM), and critical infrastructure protection (CIP).

In those professional fields, he has been assigned as a chair of several governmental committees in Japan at the Cabinet Secretariat, the Ministry of Economy, Trade and Industry (METI), Ministry of Agriculture, Forestry and Fisheries (MAFF), Small and Medium Enterprise Agency, several local governments, and industry associations. He is the principal investigator of the 5 year project “Regional Resilience Enhancement through Establishment of Area-BCM at Industry Complexes in Thailand” to Enhance regional resilience through visualization of disaster risks with industry, government and academia collaboration. Joining the industrial complex-based area BCM project in Kumamoto where TSMC will build a new semiconductor factory.

He also provides professional advisory in risk management and disaster management to major corporations in automotive manufacturing industry and energy (electricity & gas) industry. Working with the Corporate Security Division of Nissan and Toyota on a contract basis.

He has also been a national expert in the ISO/TC292 (Security & resilience) for the last 15 years and mainly contributed in developing ISO22398 (Societal security – Guidelines for exercises) and ISO22397 (Societal security – Guidelines for establishing partnering arrangements) as the responsible WG Convenor.

He has BA (Kyoto University) in Forestry-Erosion Control, MBA (Southern Methodist University) and PhD (Waseda University) in Information, Production and Systems. He is also assigned as a Visiting Researcher of the National Research Institute for Earth Science and Disaster Resilience and a Senior Researcher of the Disaster Reduction and Human Renovation Institution.



Critical Infrastructure Protection and Cascading Events Simulation for Disaster-sensitive Metropolitan Areas

Resilience Enhancement with Visualization of Consequences of Large-scale Disasters

Opening Remark
ACTS Annual Meeting (Seattle 2023)

August 4th, 2023

Kenji Watanabe
Professor of Graduate School of Social Engineering & Head of Disaster and Safety Management
Nagoya Institute of Technology（Nagoya, JAPAN)
&
Chair of the Council for Critical Infrastructure Protection (Cabinet Secretariat, JAPAN)

1

AGENDA

Introduction: Overview of CIP(Critical Infrastructure Protection) in Japan

1. Background of our social implementation project
2. Project overview
3. Conducting workshops with our project results
4. Case study (Minato Ward/Tokyo & Kyoto Station)
5. Next steps

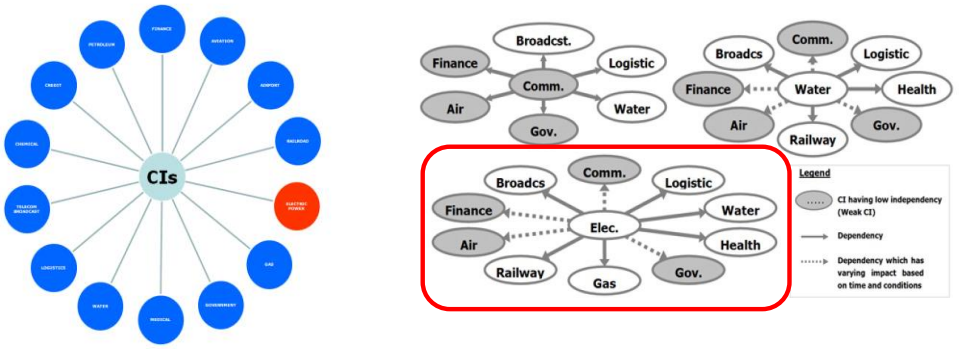
Introduction: Overview of CIP in Japan

14 critical infrastructure defined by the Act

- As of 2023, **Cyber Security Basic Act in Japan defined 14 sectors as the national critical infrastructure** to be protected from cyber threats:
  information and communications, finance, aviation, airports, railroads, electricity, gas, government and administrative services, healthcare, water supply (drinking water), logistics, chemicals, credit, and petroleum.
- Each of the critical infrastructure sectors **does not exist independently**, but rather provides services while interdependent on each other, and the electric power sector is **the hub of the interdependence among these critical infrastructures**.
- The electric power sector is in a position to demand a more resilient cybersecurity system because the **social and business impacts of service outages and functional degradation in the sector would be significant**.
- This makes it **an ideal target for cyberattacks** that could cause social disorder or demand a ransom.

Introduction: Overview of CIP in Japan

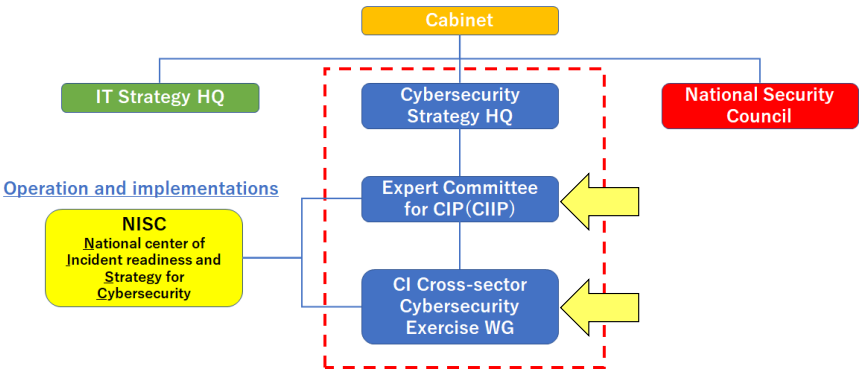
Electric power sector is the hub of the interdependence among CIs



- Changes in the industrial structure associated with the **deregulation** of, and the introduction of **new technologies** to, power generation, transmission, distribution, and control have brought about **a phase that can no longer be managed within the existing framework for information security alone.**

Introduction: Overview of CIP in Japan

Organizational structure for CIP in Japan & electric power sector efforts



- Electric power companies (existing and new entrants), competent ministries (Ministry of Economy, Trade and Industry and Agency for Natural Resources and Energy), industry associations (Federation of Electric Power Companies of Japan, etc.), and electric power ISAC (Information Sharing and Analysis Center), are working to strengthen the cybersecurity system **based on public-private partnerships.**

1. Background of our social implementation project

Background of our social implementation project ①

Emerging unexpected disaster chains as disaster sensitivity increases

【 Social issues and bottlenecks to be solved 】

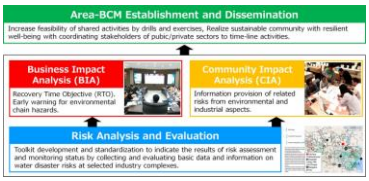
- In metropolitan areas such as Tokyo, Osaka, and Nagoya, there is an extreme concentration and interdependence of functions that support socioeconomic activities, as well as flows of people, logistics, money, and information.
- Therefore, there is a serious concern that a single large-scale disaster could trigger a complex chain of disasters that could spread rapidly and cause more damage than expected.
- In particular, in the greater Tokyo metropolitan area, commuters, who create a large day-night population difference, and in the Chubu area, logistics and human flows from east to west, which support Japan's economic and industrial activities, are exposed to major disaster risks.

Background of our social implementation project ②

Launch of a project to develop a model for predicting the disaster chain in the event of a large-scale disaster and attempting to implement the model in society

【 Technological seeds to be utilized and methods to solve them 】

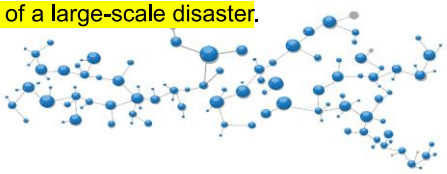
- The technological seeds of the project are technology for visualization of disaster risks and their impacts, and technology for generating disaster scenarios for training purposes.



SATREPS：Area-BCM Project

SIP Project (Cabinet Office)

- Through repeated dialogues with local governments and core companies that oversee disaster response in the greater Tokyo metropolitan area, the Kansai region, and the Chubu region that connects the two, we will develop a prototype model and tools to dynamically predict disruptions that occur when socioeconomic activities are disrupted or problems are amplified due to the disaster chain of a large-scale disaster.



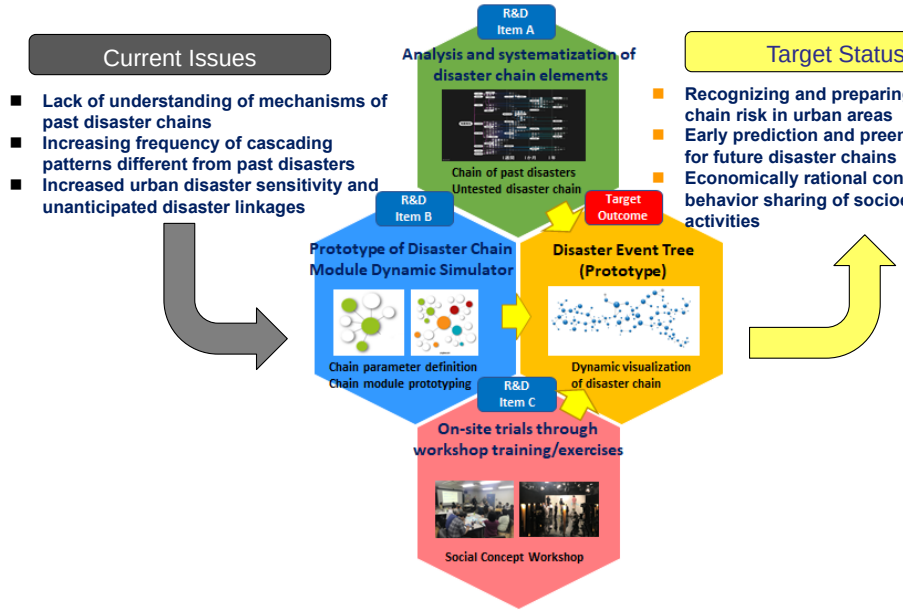
2. Project overview

Project overview ①

JST・RISTEX（ Socio-Technical Research Program ）Solve for SDGs

Current Issues

- Lack of understanding of mechanisms of past disaster chains
- Increasing frequency of cascading patterns different from past disasters
- Increased urban disaster sensitivity and unanticipated disaster linkages



Target Status

- Recognizing and preparing for disaster chain risk in urban areas
- Early prediction and preemptive action for future disaster chains
- Economically rational contractionary behavior sharing of socioeconomic activities

Project overview ②

Cross-industry participation and cross-disciplinary approach

Leader: Kenji Watanabe, Nagoya Institute of Technology
Collaborator: Shingo Nagamatsu, National Research Institute for Earth Science and Disaster Resilience (NIED)

Participating and Cooperating Organizations：
Senshu University, Kansai University, Hyogo Prefectural University, Tohoku University, Institute for Crisis Management Education, Inc., NHK, Tokio Marine-Nichido Risk Consulting, Mitsubishi Corporation Insurance, National Science and Technology Center for Disaster Reduction (Chinese Taipei)

- Assuming public and private organizations, local governments, local disaster management organizations, etc. as parties involved
- Foster awareness of the issues and promote understanding of the significance of participation through hearing surveys of past disaster chain cases.
- Raise awareness through disaster reporting and verification special programs with the cooperation of the media.
- Cooperating organizations that have subsequently joined the project:

Fujitsu Research Institute, Disaster Reduction and Human Renovation Institution, TEPCO Design

- Collaborative Entities

Kyoto Prefectural Government Crisis Management Division
Tokyo Metropolitan Government Minato Ward Disaster Prevention Division
Kyoto Station Disaster Countermeasures Council for People Who Have Difficulties Returning Home, etc.

3. Conducting workshops with our project results

Conducting workshops with our project results ①

Creation and organization of occurrences by decision makers and stakeholders

Based on the damage assumptions:

- Each person should write on the card about five events that should not happen and must be avoided in the organization's operations, business, and disaster response.

- Share with all participants the cards that each described, and
- The cards of similar events are grouped together and organized into about 15 to 20 cards.
- Add cards for events that come to mind during the process of organizing the cards.

Conducting workshops with our project results ②

Determination of dependencies (from/to) between occurrences (collegial)

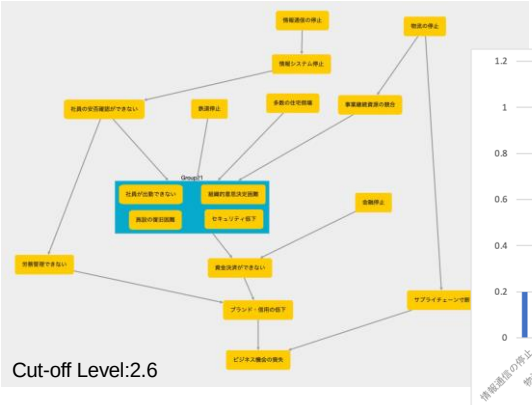
初期確率	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
イベント名	情報通信の停止	物流の停止	鉄道停止	金融停止	多数の住宅倒壊	施設の復旧困難	社員が出勤できない	組織的意思決定困難	セキュリティ低下	社員の安否確認ができない	ブランド・信用の低下	サプライチェーン寸断	資金決済ができない	労務管理できない	情報システム停止	ビジネス機会の喪失	事業継続資源の競合
情報通信の停止																	
物流の停止																	
鉄道停止																	
金融停止																	
多数の住宅倒壊																	
施設の復旧困難	0.4	0.5	0.05	0.3	0.3		0.3	0.5	0.05	0.05	0.05	0.05	0.3	0.05	0.6	0.05	0.7
社員が出勤できない	0.1	0.1	0.8	0.05	0.5	0.6		0.05	0.6	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
組織的意思決定困難	0.9	0.05	0.05	0.05	0.1	0.5	0.6		0.05	0.6	0.05	0.05	0.05	0.05	0.7	0.05	0.05
セキュリティ低下	0.6	0.05	0.05	0.1	0.05	0.8	0.5	0.3		0.05	0.05	0.05	0.05	0.05	0.6	0.05	0.5
社員の安否確認ができない	0.9	0.05	0.05	0.05	0.3	0.3	0.3	0.05	0.05		0.05	0.05	0.05	0.05	0.9	0.05	0.05
ブランド・信用の低下	0.05	0.1	0.05	0.3	0.05	0.3	0.05	0.6	0.5	0.05		0.05	0.9	0.7	0.7	0.3	0.05
サプライチェーン寸断	0.3	0.8	0.3	0.3	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05
資金決済ができない	0.3	0.05	0.05	0.9	0.05	0.3	0.3	0.05	0.6	0.05	0.05	0.05		0.05	0.8	0.05	0.05
労務管理できない	0.7	0.05	0.05	0.05	0.05	0.3	0.3	0.05	0.05	0.6	0.05	0.05	0.05		0.8	0.05	0.05
情報システム停止	0.9	0.05	0.05	0.05	0.05	0.3	0.3	0.05	0.3	0.05	0.05	0.05	0.05	0.05		0.05	0.05
ビジネス機会の喪失	0.6	0.5	0.05	0.5	0.05	0.6	0.6	0.6	0.3	0.05	0.5	0.9	0.6	0.1	0.7		0.05
事業継続資源の競合	0.1	0.6	0.3	0.05	0.05	0.3	0.05	0.05	0.3	0.05	0.05	0.05	0.05	0.05	0.1	0.05	

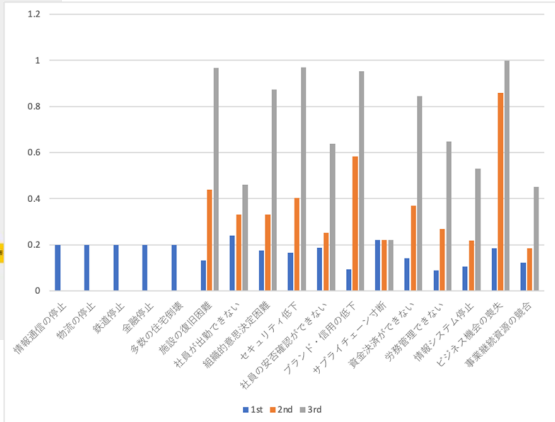
Rate the probability of a row heading event occurring when a column heading event occurs on a 5-point scale.

- Almost unlikely 0.05
- Not very likely 0.2
- Likely 0.5
- Quite likely 0.8
- Almost certainly likely 0.95

Conducting workshops with our project results ③

Creation of a chain structure tree and discussion of escalation points (points at which sensitivities increase rapidly)



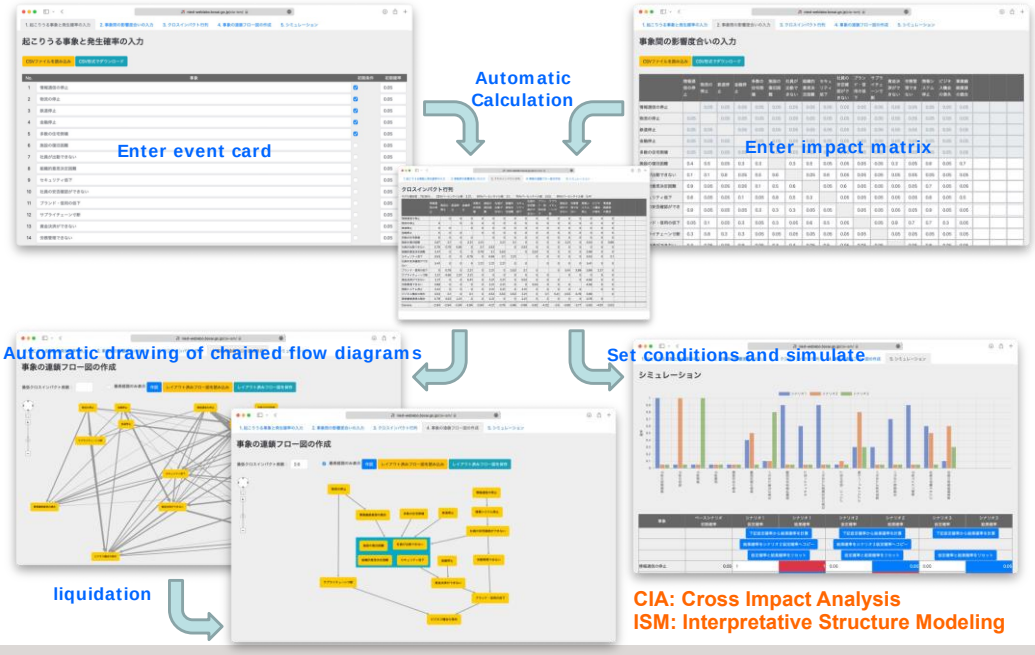


【Sample Discussion Points】

1. **What are the possible disaster chain scenarios?**
2. **What is the escalation point (the point at which the chain of events rapidly expands)?**
3. **What countermeasures are required?**

Conducting workshops with our project results ④

Prototype and trial simulator with structured tools by CIA-ISM*



CIA: Cross Impact Analysis
ISM: Interpretative Structure Modeling

4. Case Study (Minato-Ward/Tokyo & Kyoto Station)

① Disaster Prevention and Crisis Management Office, Minato-Ward, Tokyo

② 4 railroad operators in Kyoto Station (Council of countermeasures for persons having difficulties returning home from the station)

4. Case Study (Minato-Ward & Kyoto Station)

① Disaster Prevention and Crisis Management Office, Minato-Ward, Tokyo

② 4 railroad operators in Kyoto Station (Council of countermeasures for persons having difficulties returning home from the station)

Case Study ②【Railroad Operators in Kyoto Station】

Workshop with decision makers in the event of a disaster: 4 Railroad operators in the Kyoto Station

Date	November/2022 and JAN/2023
Objective	Verification of measures for people who have difficulty returning home in the area around Kyoto Station
Workshop Participants	Kinki Nippon Railway Company, JR Tokai Railway Company, JR-West Railway Company, Kyoto Municipal Transportation Bureau
Workshop Flow	■ Present damage assumptions (workshop scenarios) ■ Identification and sharing of each company's response ■ Organize issues to be addressed in the future
Agenda	■ Instructions for workshop ■ Workshop execution

JR西日本　近畿日本鉄道　JR東海

Case Study ②【Railroad Operators in Kyoto Station】

Possibility of simultaneous disruption at Kyoto Station with a major disaster

出所：JR東海WEBサイト

出所：近畿日本鉄道WEBサイト

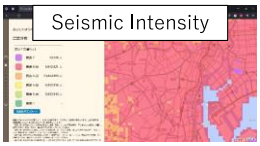
出所：京都市交通局WEBサイト

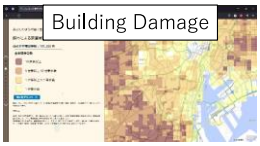
Dairy average of passengers is 452,540 and more in the peak tourist seasons

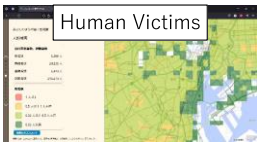
Case Study ②【Railroad Operators in Kyoto Station】

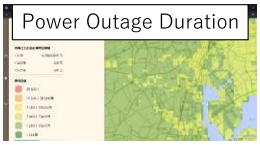
Damage Assumption (Sample) : Simulation by NIED was assigned as the initial situation.

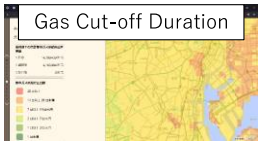
あなたのまちの直下型地震
https://nied-weblabo.bosai.go.jp/amcj/

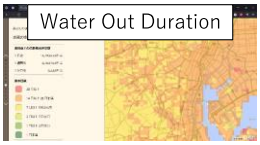


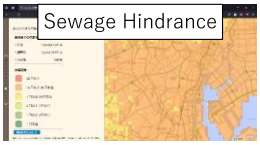


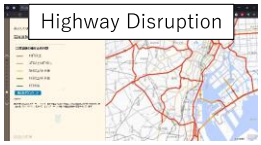


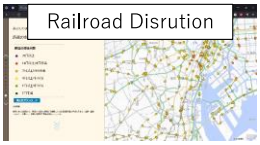












Case Study ②【Railroad Operators in Kyoto Station】

Workshop Objective: To envision a spatio-temporal chain of effects of hazards with no "right answer"

- Visualize the chain of damage caused by a possible disaster based on causal relationships (past and logical)
- Assume a spatio-temporal chain of events leading up to the situation to be avoided
- Examine the current disaster management process in light of the above scenario
- Consider action plans for awareness (coordination with stakeholders, development of hardware and software, etc.)




5. Next Steps

Next Steps

Provide a framework for collaboration with an modeling for disaster-sensitive elements and linkages

- Tuning the simulator for workshop/exercise ussge and improvement of user interfaces.
- Expand workshops to stakeholders (hotels, commercial facilities, temples, shrines, companies, etc.) who are responsible for the next process (temporary evacuation and stay) of railroad operators
- Visualization of the chain of disasters in large terminals (major stations, airports, etc.), especially in the human flows are concentrated in metropolitan areas, and development of a foundation for a communication and coordination system involving stakeholders in other regions, especially in Tokyo.
- Integration the simulation model and workshops into the field of cybersecurity in the critical infrastructure protection.

Keynote Speech – Investing Human Capital for Disaster Management

Prof. **Karl Kim**
Executive director, National Disaster Preparedness Training Center, University of Hawaii

Karl Kim, PhD is Executive Director of the National Disaster Preparedness Training Center (**ndptc.hawaii.edu**) and Professor of Urban & Regional Planning at the University of Hawaii, where he has served as Vice Chancellor for Academic Affair

USAID DARI RAKYAT AMERIKA

BADAN NASIONAL PENANGGULANGAN BENCANA BNPB

INVEST DM 2.0

Investing in Human Capital for Disaster Management

Karl Kim, Ph.D.
Eric Yamashita
Charles Ham

Lilik Kurniawan, Ph.D.
Berton Panjaitan, Ph.D.
Prasetio Wiojaksono

University of Hawai'i Manoa | Mercy Corps Indonesia | PetaBencana.id

NDPTC | MERCY CORPS

NDPTC

- Member of the **National Domestic Preparedness Consortium** (NDPC), all-hazards capabilities.
- Develop and deliver training and educational programs in **homeland security** and **disaster management**. Focus on natural hazards, coastal communities, special needs, islands, and territories.
- Partner with **FEMA** and **the University of Hawai'i**, and external partners to deliver of training, products, and services.
- Since February 9, 2010, serve communities in building **resilience**, **equity**, and **inclusivity.**

Website: NDPTC.hawaii.edu & NDPC.us

NDPTC

University of Hawai'i Manoa | DURP

- Disaster Management and Humanitarian Assistance (DMHA) **Certificate.**
- A **multi-disciplinary** approach to planning, social sciences, & natural sciences.
- **Cross-cutting** in architectural, public health, social work, and civil engineering professions emphasizes community involvement.
- **15-credit** plus 1 credit (capstone) certificate in building disaster risk reduction competence and professionalism.
- Perspectives on hazards, disasters, and risk reduction through **coursework** and **seminars.**
- Focus on a rigorous and productive **graduate-level** curriculum.
- DRR skills to enter **public** and **private** sectors; local to international.

Website: DURP.hawaii.edu & DMHA program

DRR & Resilience Symposium – Jogja
(UH APDR3, BNPB, universities, etc)

Disaster Aware EWS
(UH PDC, BNPB, BMKG, BPBD)

Building Resilience through Training
(ITB, UGM, UII, Unkhair, Unpati, Unipa)

USAID PRESTASI – Papua Training
(USAID, Unipa, BPBD, Local DM stakeholders)

INVEST DM – capacity building
(MC, UH, BNPB, PDC, Peta Bencana, CFE)
BNPB, USAID , FEMA, CDP, EMI, NFA, NDPC

INVEST DM Project

*Increased **Knowledge & Capabilities** in Local Universities
*Network of DRR **expertise & collaborations**
*Improved **EWS capabilities** utilizing Real time data
***Faster, accurate** decision making & response
*Improved **knowledge & participation** of stakeholders
*Platform for **local universities & DRR actors**
*Expanded **capabilities in vulnerability assessment**
*Increased **Local government & community collaboration**
*Quality **training & education** of DM civil servants
***Knowledge exchange** with intn'l & national experts
*Improved **accreditation & certification** of DM professionals
*Developed **Civil-Military Coordination** training curriculum
*BNPB **Collaboration** with FEMA, EMI, CDP, NDPC, etc
*Improved **scientific research** on DRR & Resilience

INVEST DM 2.0

Investing in Human Capital for Disaster Management

Outcome 1:
The Organizational capacity of **Pusdiklat** is strengthened and its service delivery accelerated by developing and implementing appropriate Disaster Management (DM) certified **in-service training** and **pre-service education**

Outcome 2:
BNPB has the capacity to create and manage **workforce planning** and **development** through the implementation of **Human Capital Development Plan** (HCDP).

Outcome 3:
BNPB has established and strengthened national **Emergency Operation Center** (EOC) systems and strategies to capacitate its workforce and to develop cross-linkage with relevant working units such as **Pusdatinkom** (Center for disaster management data, information, and communication).

Outcome 4:
BNBP has the capacity to develop effective **systems and strategies** to support the sub national government to implement **Minimum Service Standard** (MSS) on DM.

Including:
- Gender and Disability Inclusion
- Monitoring, Evaluation, Learning, and Communication
- Governance

INVEST DM 2.0

The University of Hawai'i Roles

2023 - 2024	Outcome	Partner
1. Knowledge exchange and capacity building.	Webinars, Knowledge Exchange	Education & Training Center
2. Develop new relationships between BNPB and FEMA	MOU , Regional Offices	Legal, Organizational & Cooperation Bureau
3. Feasibility Study of Emergency Management Professional Program	Comparative study	HR Bureau
4. Support Study Mission to US agencies	Study mission	System & Strategy
5. Integration of Job Typing & Training for Rapid Response	Comparative study	Emergency Response

2022 Study Mission Takeaways and Outcomes

1. Integrate planning and budgeting	• Integration: DRR, Climate Change, sustainable development, pandemic • Stress on: Natural Based Solution, strengthening CCA community
2. Regionalize operation	• USA- 10 regional FEMA in 50 states • Indonesia: 7 regional BNPB hubs, 34 + province (support: office, training center, EOC, logistic & equipment warehouse)
3. Digitalize everything	• Digitalization of BNPB efforts • "Orange Book" – database of certified personnel.
4. Invest big in human capital	• Internal: 1. basic knowledge, 2. Specialized Skill, 3. Assessment, 4. Leadership development • External: Specialized Skills – profession certification • Strengthening InaDRTG Sentul – world class
5. Establish a stronger regional presence [on disaster management for the Asia & the Pacific]	• ASEAN chair • ASEAN Regional Disaster Emergency Exercise in Indonesia – 2023 • Research Center

2018 Lombok Island Earthquakes

- 560 Deaths & 226,204 Houses destroyed/damaged
- Civil-Military Coordinated Response
- Housing & Tourism Recovery

Source: DG ECHO

2018 Palu Earthquake, Tsunami, & Liquefaction

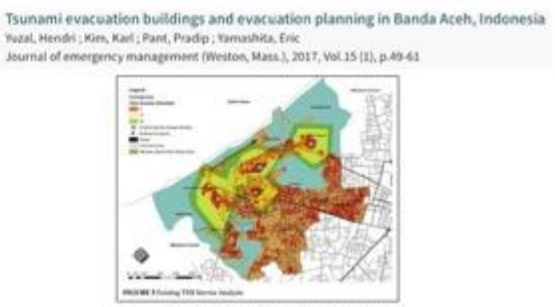
- 4,340 Deaths & 70,000 Houses destroyed/damaged
- Civil-Military Coordinated Response
- Early Warning System & Mitigation

Source: UNOCHA

2004 Aceh & Nias Earthquake and Tsunami

- 230,000 death toll
- Collaboration - Emergency Preparedness Working Group
- Indonesia Disaster law 2007 – BNPB establishment 2008

Source: AFP



Source: Yuzal, Kim, Pant & Yamashita, 2017

NDPTC

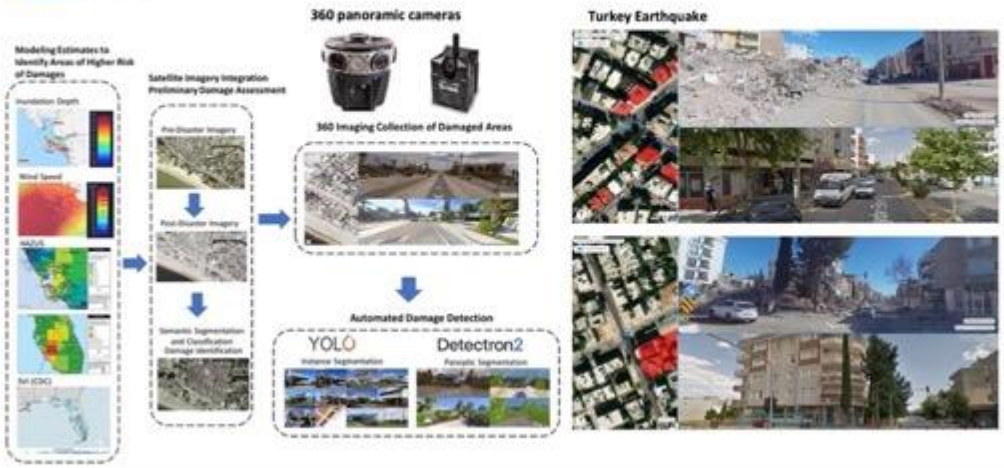
BADAN NASIONAL PENANGGULANGAN BENCANA

2023 Turkiye Earthquake

- 50,227 Deaths & 214,000 Houses destroyed/damaged
- Indonesia Humanitarian Assistance
- USAR, food, water, health, blanket, tent, financial

NDPTC

Rapid Integrated Damage Assessment (RiDA)



USAID FROM THE AMERICAN PEOPLE

BADAN NASIONAL PENANGGULANGAN BENCANA

2023 Turkey Humanitarian Assistance Case Study

NDPTC

UNDRR
UN Office for Disaster Risk Reduction

GPDRR Takeaways

1. Leave No One Behind
2. Focus on Vulnerable, At-Risk Populations.
3. Greater Emphasis on Recovery Capabilities.
4. Green Infrastructure and Nature-based Solutions.
5. Address Climate Adaptation.


Transportation Research Interdisciplinary Perspectives

Dispatches from the field: The 2022 United Nations Global Platform for Disaster Risk Reduction in Bali, Indonesia

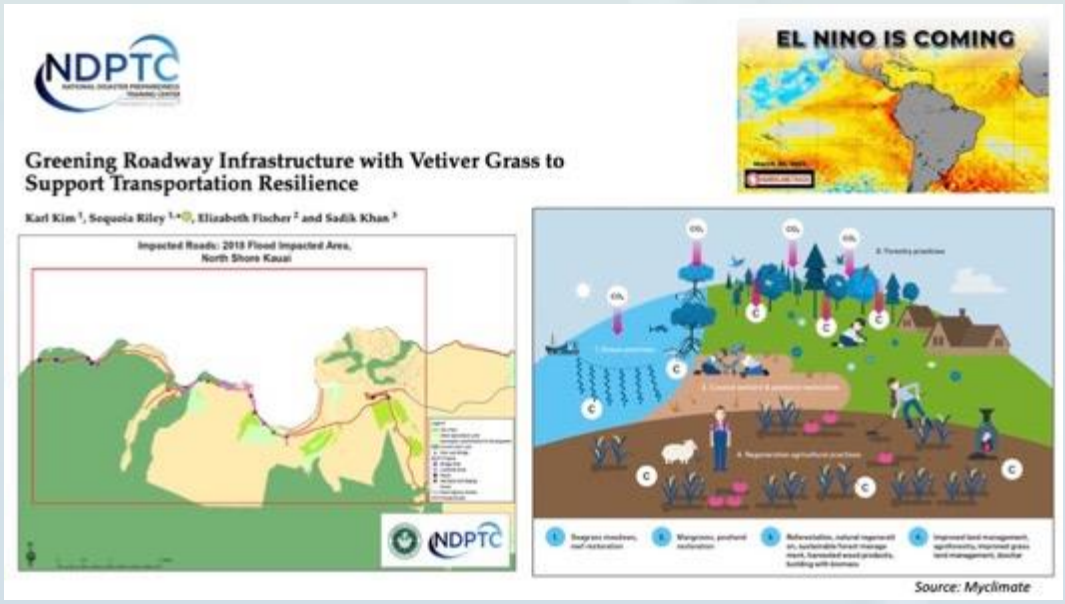
UNDRR
UN Office for Disaster Risk Reduction

Midterm Review
SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030

BADAN NASIONAL PENANGGULANGAN BENCANA
BNPB

Indonesia's Message in SFDRR Midterm Review in the United Nations in May 2023

- COVID-19 recovery lessons calls for better **preparedness** from **all hazards.**
- Urgent **acceleration** in SFDRR, Paris Agreement, & Ocean Decade for SDG Goals.
- **Joint efforts** in health protocols implementation, vaccination, and social economy recovery are key for COVID-19 pandemic control and economic stability.
- Importance of **DRR Governance** and **multi-hazard EWS** for Asia Pacific & the world.
- **Disaster Management Master Plan 2020-2044** guideline as reference for "Realizing disaster resilient Indonesia for sustainable development" vision.
- **Community Resilience** starts from the villages through science & innovation investment and incorporating **local wisdom.**
- Disability Disaster Resilience (DIFGANA) established for **equity** and **inclusion.**
- Build an **alert culture**, encourage **participation**, implement **resilient infrastructure**, and encourage **innovation** and **partnership.**


Greening Roadway Infrastructure with Vetiver Grass to Support Transportation Resilience
Karl Kim [1], Sequoia Riley [1,*], Elizabeth Fischer [2] and Sadik Khan [3]
Impacted Roads: 2018 Flood Impacted Area, North Shore Kauai
NDPTC
EL NINO IS COMING
Source: Myclimate


NDPTC
FEMA
Certified Course
Course Catalog
NDPTC Course Information
Course Description
Course Title:
Nature-Based Solutions for Mitigating Hazards (MGT-484)
Status:
Description:
Target Audience:
Learning Objectives:
Contact Hours:
IACET Credits:


USAID
FROM THE AMERICAN PEOPLE
BADAN NASIONAL PENANGGULANGAN BENCANA
BNPB
INDONESIA NEW CAPITAL PLAN
Kota Kinabalu
MALAYSIA
Kuching
BORNEO
Samarinda
Balikpapan
INDONESIA
The proposed site is in East Kalimantan, Borneo
Jakarta
Rationale: Over-populated and sinking Jakarta , closer location for eastern islands,
Concept: Forest City, Smart City
-75% Green area & disaster mitigation
- Estimated cost: US$ 32 Billion
- Current: basic infrastructure & housing.
- Completion target: Aug 2024
BNPB in Nusantara
- Staffing relocation, Office, Training Center, Emergency Operation Center, Logistic & Equipment Warehouse
- Integrated Wildfire Management Center

USAID
FROM THE AMERICAN PEOPLE

BADAN NASIONAL PENANGGULANGAN BENCANA
BNPB

Equity & Inclusivity: Regional Office




USAID
FROM THE AMERICAN PEOPLE

BADAN NASIONAL PENANGGULANGAN BENCANA
BNPB

Next Steps Forward

1. Senior leaders **knowledge exchange**
2. Greater focus on **inclusivity** – Social Vulnerability Index for Under-represented groups
3. **Build Back Better** - Green Infrastructure (Nature-Based Solutions)
4. **Continuous** learning/adaptation/transformation

USAID
DARI RAKYAT AMERIKA

BADAN NASIONAL PENANGGULANGAN BENCANA
BNPB

INVEST DM 2.0

Investing in Human Capital for Disaster Management
A consortium of
Mercy Corps (Prime) | Mercy Corps Indonesia
The University of Hawaii at Mānoa
PetaBencana Foundation

University of Hawai'i Manoa
Mercy Corps Indonesia
PetaBencana.id
NDPTC
MERCY CORPS

Keynote Speech – Climate Response Strategies

Matthew Andersen
Senior Scientist for Biology, the U.S. Geological Survey (USGS), the United States

International Science Advisor, Biology

International Programs

Expertise

Environmental Project Development and Administration

Aquatic Ecology

Leading multi-disciplinary science teams

Fisheries

Science Decision Support

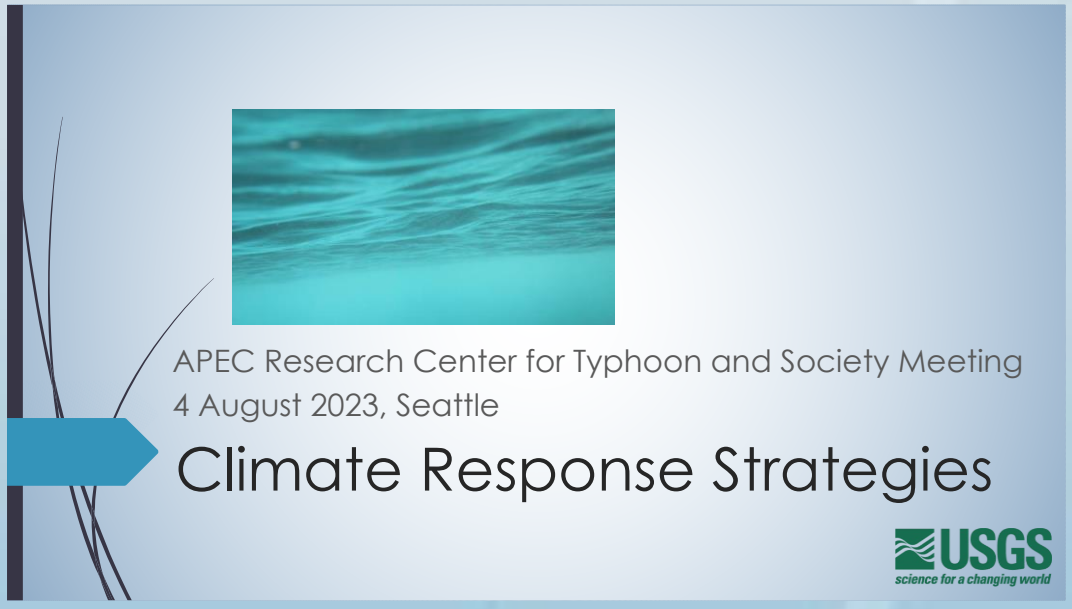
Matthew Andersen (he/him) is the senior biologist for the USGS Office of International Programs.
As of early 2023 Andersen has more than 28 years of professional science experience. The majority of his work experience has been in aquatic and wetland habitats, but he also spent years working in the southwestern deserts of the US.

He began his professional experience with a private consulting firm working in Arizona, California, Nevada, and Utah. He then worked for the State of Utah for six years, collaborating with regional and federal scientists and agency personnel in the Intermountain West.

Andersen has worked for USGS since November 2005 at positions in Arizona, Louisiana, and Virginia. He has held positions of increasing responsibility, always supporting collaborative applied projects among diverse scientists and institutions while increasing the size and scope of the programs. He has focused his work on science that delivers practical information for managers, decision makers, and the public.

He worked on mitigation of desert habitats disturbed by development, then expanded his work to helping conserve native aquatic species in the intermountain western US, supporting collaborative research among zoologists and ecologists in coastal Louisiana, coordinating science for priority ecosystems across the US, and leading development of decision support tools for the Lower Mekong River Basin in Southeast Asia.

Just as USGS is a science advisor in the US, so Andersen seeks to understand and deliver solutions for the international biophysical and socioeconomic science that USGS can support. He supports a diverse assemblage of USGS scientists with global experience by leading proposals and projects in nations where they seek to continue their work, including Angola; Botswana; Brazil; Cambodia; China; Fiji; Georgia; Kuwait; Kyrgyzstan; Lao PDR; Mexico; Namibia; Palau; Peru; the Philippines; Thailand; and Viet Nam. Areas of USGS science supported include biology, ecology, hydrology, and veterinary medicine.



Current USGS Climate Science Activities

Carbon	Monitoring and management strategies for carbon
Minerals	Assessing minerals availability
Extreme Events	Understanding and monitoring risks from extreme events
Natural Solutions	Developing nature-based solutions for climate impacts
Land Use	Evaluating land use trade-offs
Water	Understanding climate change impacts on water and people

USGS science for a changing world

NEXVIEW

Assessing How Natural Resources Changes Affect the People of the Lower Mekong River

USGS science for a changing world

Three Products: NexView, Groundwater, Gender
Authors, Sponsors, Cooperators

- USGS Authors: K.A. Powlen, S. Haider, K.W. Davis, W.R. Belcher, S. Shah, N. Burkardt, S.S. Romañach, M.E. Andersen
- MRC Member Country Authors: O. Chantha, T. Nettasana, V. Phetpaseuth, D.T. Trung
- Sponsors: US Department of State; USGS; and Japan Ministry of Agriculture, Forestry, and Fisheries; Mekong River Commission
- Cooperators: Arizona State University, Can Tho University, Institute de Technologie du Cambodge, US Army Corps of Engineers

MAFF Ministry of Agriculture, Forestry and Fisheries 農林水産省

USGS science for a changing world

Groundwater in the Mekong River Delta

- Externally impacted
  - Climate changes
  - Development
- Locally Over-utilized
- Multiple physical impacts
  - Reduced availability
  - Land subsidence
  - Saltwater intrusion

USGS science for a changing world

Stress Response: Socioeconomic Vulnerability to Groundwater Change

NexView

MODFLOW Groundwater model

- Simplified assumptions
- 20-year baseline
- 20 years of climate change

Water Demand

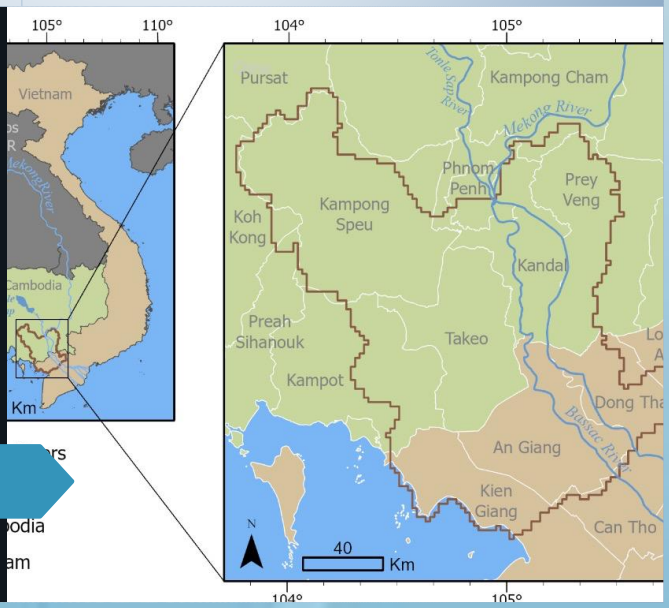
- Domestic and livelihood water needs

Socio-economic Data

- Adaptive capacity

USGS science for a changing world

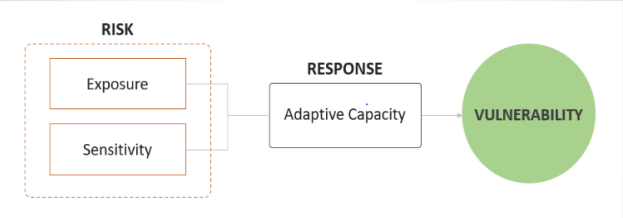
Study Area



USGS science for a changing world

Vulnerability (IPCC, 2007)

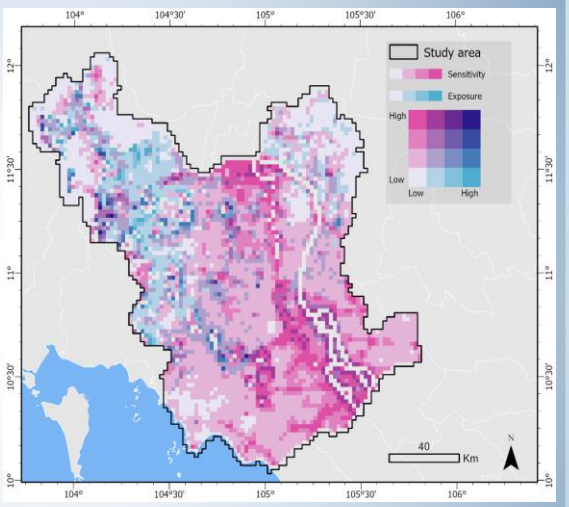
- **Risk**
  - **Exposure**: the degree to which a system will experience change
  - **Sensitivity**: The degree to which the population is affected by that change
- **Response**
  - **Adaptive Capacity**: Ability to absorb or adapt to change



USGS science for a changing world

Risk

- Pink: **Sensitivity**, total water needs
- Blue: **Exposure**, MODFLOW 6 outputs
- Purple: Highest risk of water stress

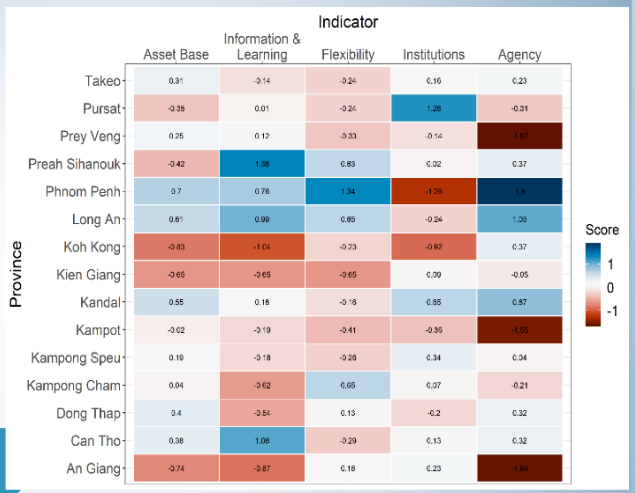


NexView

USGS science for a changing world

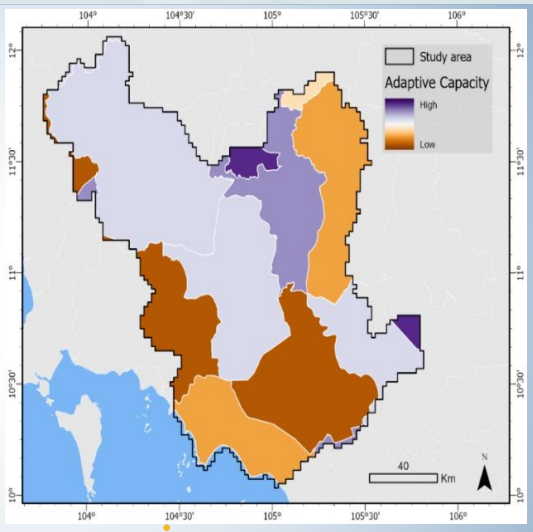
Adaptive Capacity (Response)

Publicly available data



USGS science for a changing world

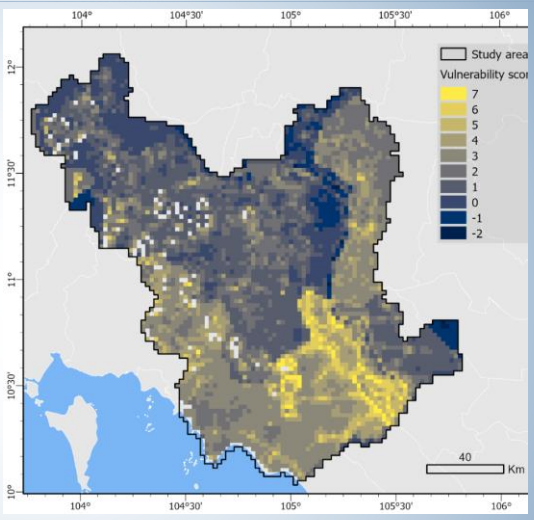
Adaptive Capacity Summary Map



NEXVIEW USGS science for a changing world

Vulnerability Map

- Relative values
- Exposure + Sensitivity
– Adaptive Capacity
= Vulnerability
(for demonstration only)



NEXVIEW USGS science for a changing world

MRC requested two studies from USGS, Delivered in 2022-23

- **Conceptual Groundwater Models** for 2 Transboundary Aquifers
  - Lao PDR and Thailand
  - Cambodia and Viet Nam
  - Large data gathering effort with MRC and National Consultants
  - Supports future numerical modeling (MODLFOW)
- **Assessment Framework for Measuring Social Vulnerability to Climate Change**
  - How do vulnerability and gender intersect?
- MRC data and use of new data to support State of the Basin 2023

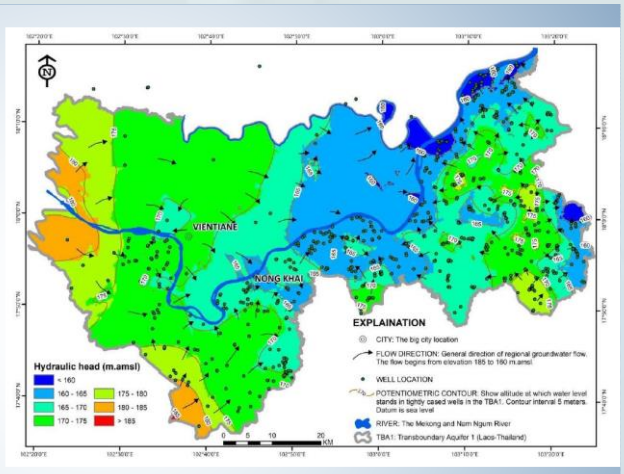
MRC USGS science for a changing world

Conceptual Groundwater Model: Lao PDR - Thailand

Data rich

Vientiane Area

Flows generally parallel or toward Mekong River



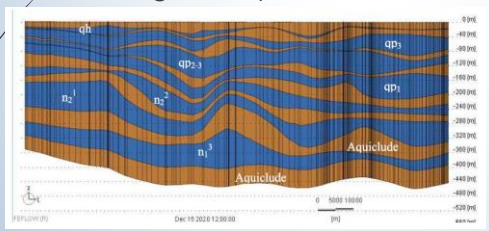
Conceptual Groundwater Model: Cambodia – Viet Nam

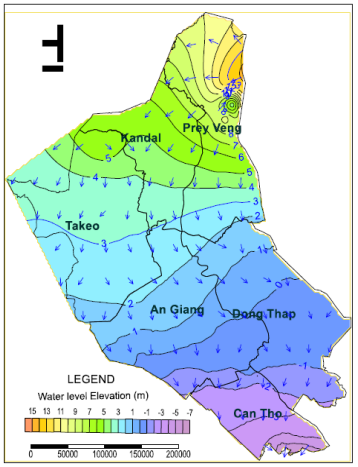
Data rich

South of Phnom Penh

Multiple aquifers

Flows generally south

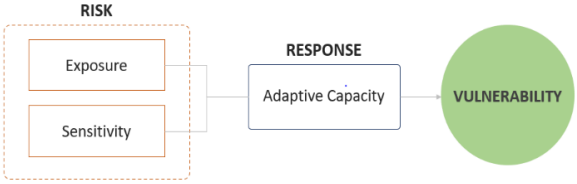




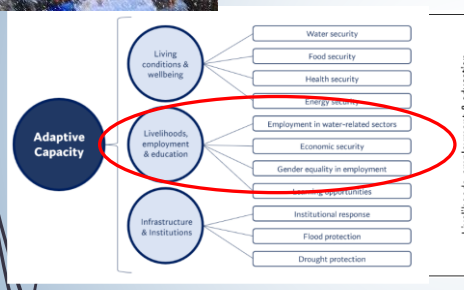
qp3 aquifer

2023 Vulnerability Study

- **Risk**
  - **Exposure**: floods, droughts, extreme storms
  - **Sensitivity**: The degree to which the population is affected by that hazard
- **Response**
  - **Adaptive Capacity**: Ability to absorb or adapt to change; calculate for men and women and compare



Building Adaptive Capacity Framework from the MRC Indicator Framework



Livelihoods, employment & education	Employment in LMB water-related sectors	Proportion of working age population employed in LMB water-related sectors
	Economic security	Sufficiency of household income
		Sufficiency of household assets
		Gender income equality
		Access to credit and bank account by gender
	Gender equality in employment, economic, and political engagement	Female-male ratio of water-related sector employment
		Political participation by gender
		Distribution of non-paid vs paid labor by gender
		Gender equality in ownership of land
	Learning opportunities	Literacy rate by gender
		Occupational training by gender
		Primary education enrollment by gender
		Secondary education enrollment by gender

1. Identify the gender-specific parameters 2. Add additional parameters

Delphi consultation could help review

Humans are an integral part of the natural world

- Efforts to link climate change and development changes to impacts to people and livelihoods need to continue
- Monitoring and modeling needs dynamic updating, not static perspectives, because these resources change

Plenary Session Bridging the Gap Among Decision or Policy-makers Technology to Enable the environment for Climate Resilience

Panelist: The United States

– Possible Countermeasures Using Modeling & Simulation Solutions in Preparing for and Responding to the Cascading disaster Events

Technologies for Building Climate Resilience

Matthew Andersen

Senior Scientist for Biology, the U.S. Geological Survey (USGS), the United States

International Science Advisor, Biology International Programs

Expertise

Environmental Project Development and Administration

Panelist: Chinese Taipei

Climate Emergency Preparedness for All

Yanling Lee (Sophia)

Assistant Research Fellow National Science and Technology Center for Disaster Reduction (NCDR);
Secretary General, APEC Emergency Preparedness Capacity Building Center

Dr. Yanling Lee (Sophia) Ph.D. in the Architecture, Civil Engineering and Industrial Management Engineering, Nagoya Institute of Technology, Japan and MBA (Master in Business Administration), Coventry University, UK. She is an Assistant Research Fellow responsible for the international collaboration at the Cabinet think tank of disaster management, National Science and Technology Center for Disaster Reduction (NCDR) since 2005 and serving as the Chinese Taipei official focal point of contact under APEC Emergency Preparedness Working Group (EPWG) as well as the Secretary General of APEC Emergency Preparedness Capacity Building Center (EPCC) under EPWG and the APEC Research Center for Typhoon and Society (ACTS) under PPSTI. She dedicated to policy making, capacity building and gender empowerment through engaging public-private partnership to better prepare for and respond to natural disasters among APEC economies in cross-cutting issues. As a whole of the society, DRR activities need to link with people's daily activity or welfare/social protection system to continuously benefit everyone in the community and uphold the supply chain connectivity with quality human resources in a healthy planet for economic activities. Thus, she aimed to promote and accelerate actions through incentives to motivate and navigate the long-term living project in conjunction with DRR knowledge, local value and involvement for sustain the local DRR efforts for resilience towards inclusivity of Leave No One Behind.

Climate Emergency Preparedness for All

Yanling Lee (Sophia)
Secretary General, APEC Research Center for Typhoon and Society

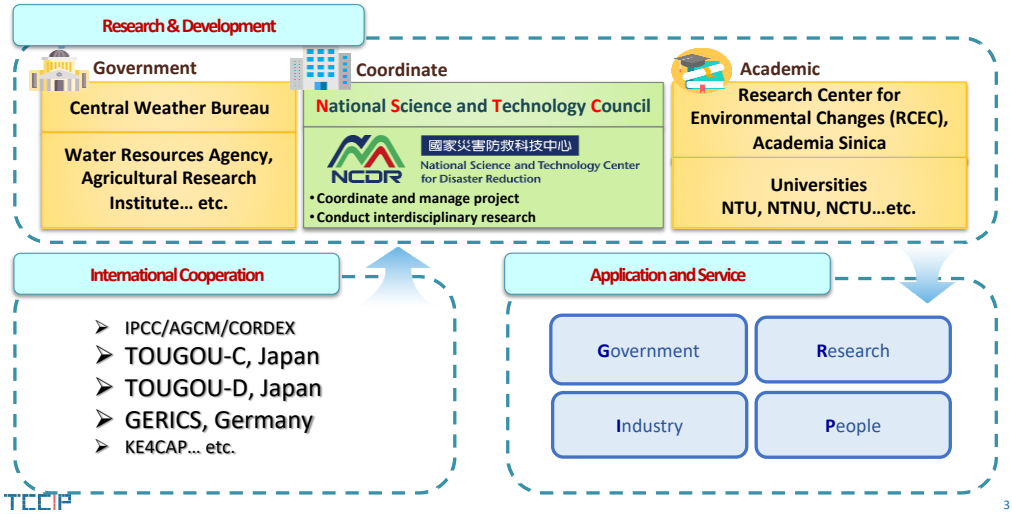
APEC Resilience Week
ACTS Annual Meeting
Seattle, The United States
August 4, 2023

Chinese Taipei's Goals of Climate Project

1. Produce high resolution projections of climate change in Chinese Taipei through scientific methods
2. Engage interdisciplinary cooperation and information integration for climate change research
3. Outreach international connection and collaboration on climate change research for enhancing regional capacity
4. Apply outcome of TCCIP to policy making at governmental level
5. Produce routine reports on climate change on research
6. Promote climate change service

Chinese Taipei Operating Framework of TCCIP

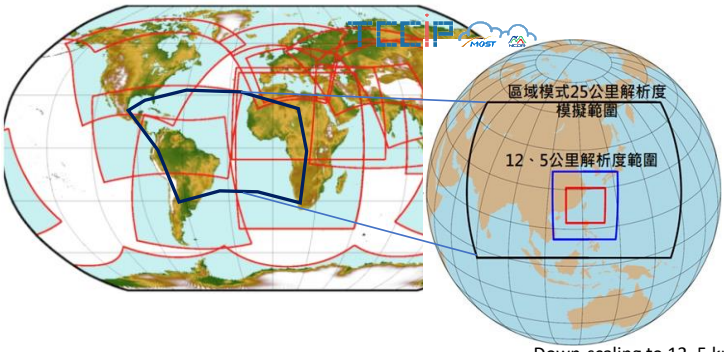
Taiwan Climate Change Projection Information and Adaptation Knowledge Platform



Join international research networks

World Climate Research Programme (WCRP) CORDEX-East Asia

Establish hi-res. regional downscaled data with multiple model & scenario through international collaboration



14 regional initiative worldwide

Down-scaling to 12, 5 km res from 25 km regional res

4

TCCIP research teams and topics

Coordination Office

TEAM1
Climate Projection & Application
- Climate projection & Data
- Data analysis & QA/QC
- Application & Service

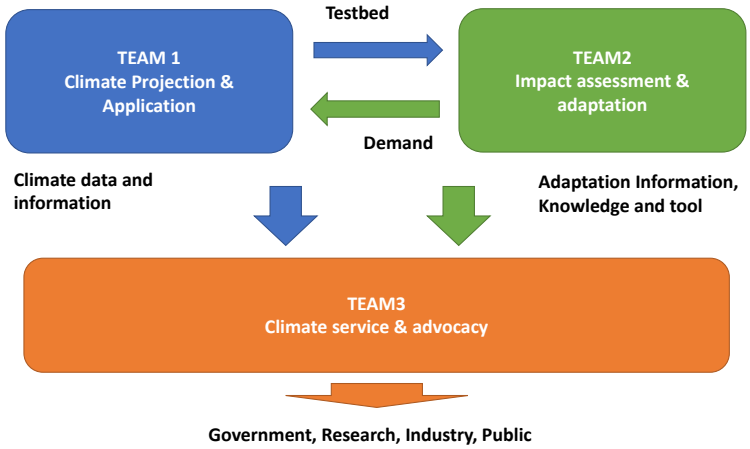
TEAM2
Impact assessment & adaptation
- Methodology & Knowledge
- Impact Assessment & Risk maps
- Toolkit development & application

TEAM3
Climate service & advocacy
- Website & Service platform
- Climate data service
- Knowledge brokering
- Promoting applications

TCCIP

5

TCCIP 3 Teams

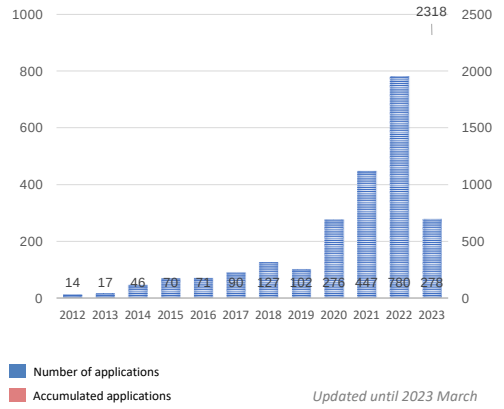


6

TCCIP: Long-term climate service provider

Total of 2318

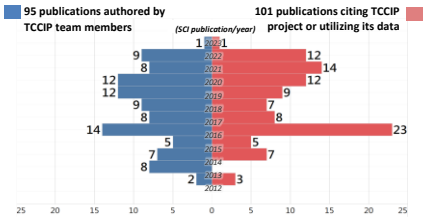
Project applications using TCCIP data products & information



Updated until 2023 March

Total of 196 SCI publications

Authored by TCCIP team or cited TCCIP project and data



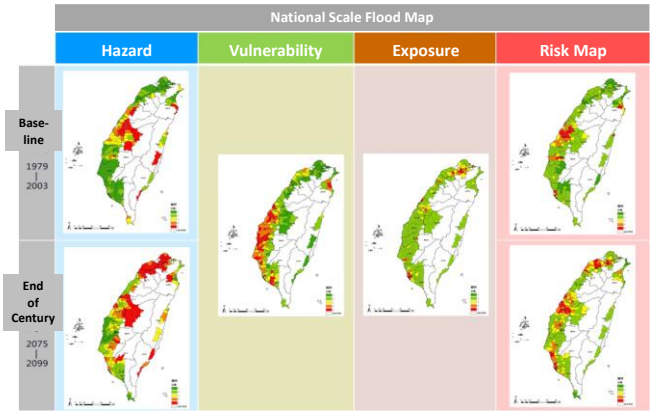
Support 8+ governmental agencies on policy-making

Disaster Reduction	Science and Technology Committee	Disaster Reduction Strategy
	Soil and Water Conservation Bureau	Slope land Disaster
Resource Safeguarding	Ministry of the Interior	National Land Use
	Energy Bureau	Energy Infrastructure
	Water Resource Agency	Water resource adaptation
Industrial Stability	Industrial Bureau	Climate Risk in Key Industries
	Forestry Bureau	Forestry White paper drafting
	Council of Agriculture	Resilient Agriculture

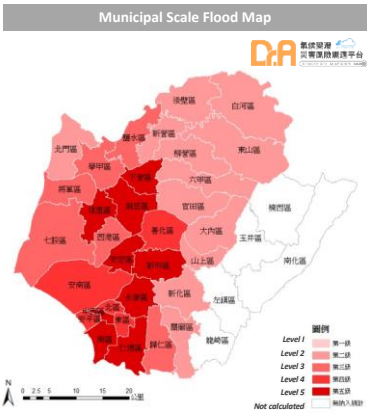
Flood maps based on climate change scenarios

- **Produce risk maps using 33 statistical downscaled models**
- **Maps with different resolution and spatial scale are available on service platform Dr. A**

National Scale Flood Map



Municipal Scale Flood Map



Flood maps: Application and service

Service platform Dr. A contains abundant knowledge materials providing users in industry, government, educational and research institutions for further studies.

Risk map users (2023)

13 Public

Construction and Planning Agency, National Audit office, county-town development plan...+

16 Finance

Cathay Financial, E.Sun Financial, FuBon Financial, SinoPac Corp, First commercial bank...+

12 Industry

Resetcarbon consultant, TSMC, Sinopec, Sanmin Bookstore, IISI group, Tokio Marine Newa...+

28 Edu/research

National Taiwan University, Tsing-Hua University, 22 universities resilient cities courses...+

Publication and sharing materials

Climate change impact for beginners (introductory materials)

E-book, presentations, reports, videos, articles and latest news

APEC Resilience Week

Thanks for your attention

Project Overseer APEC Research Center for Typhoon and Society (ACTS)
Dr. Yanling Lee (Sophia) sophiancdr@gmail.com

Panelist: The United States

National Oceanic and Atmospheric Administration, the United States

Sarah Zaunbrecher

Coordinating Science and Research for Responding to the Climate Crisis

Abstract

National Oceanic and Atmospheric Administration (NOAA) Oceanic and Atmospheric Research (NOAA Research) works with public, private, and foreign partners to conduct science and research in response to the climate crisis. Data collected is used to improve technology and create climate information and products that are guided by societal challenges and can be used to support science-informed decision making. NOAA's wide range of publically available resources and data include the U.S. Drought Monitor, climate resilience toolkits, and the National Integrated Heat Health Information System. These resources have shown to be invaluable to local and regional decision makers, who can use these products to address community needs. One example is the NOAA-funded Northeast Climate Adaptation Partnerships/Regional Integrated Sciences and Assessment (CAP/RISA) program, which worked with the New York City Department of Health and Mental Hygiene, the New York City Mayor's Office of Recovery and Resiliency, and the POINT, a community group, to use heat risk metrics to co-create a social vulnerability index for heat. This index helped city decision makers target their support toward New York City's most heat vulnerable neighborhoods. Through regional and local engagement and public access to science and data, NOAA Research's science can be used to support decision makers to reduce risks from climate change to life and property throughout the United States.

Keywords: NOAA, climate, heat, drought, urban heat

Coordinating Science and Research for Responding to the Climate Crisis

Sarah Zaunbrecher, National Oceanic and Atmospheric Administration (NOAA), United States

ACTS Annual Meeting (August 4, 2023)





Science for societal challenges

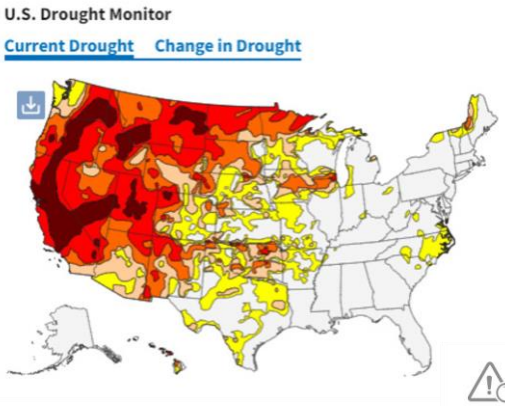

FROM DATA TO DECISION-MAKING

Data collection	Processing & storage	Research & modeling	Product development	Dissemination	Application
satellites weather radars buoys ships aircraft water level stations and more	authoritative archives of historical weather & climate information	data analysis & world-class predictive models	products, tools, & educational resources	weather forecasts climate reports extreme weather	community decision-making

3

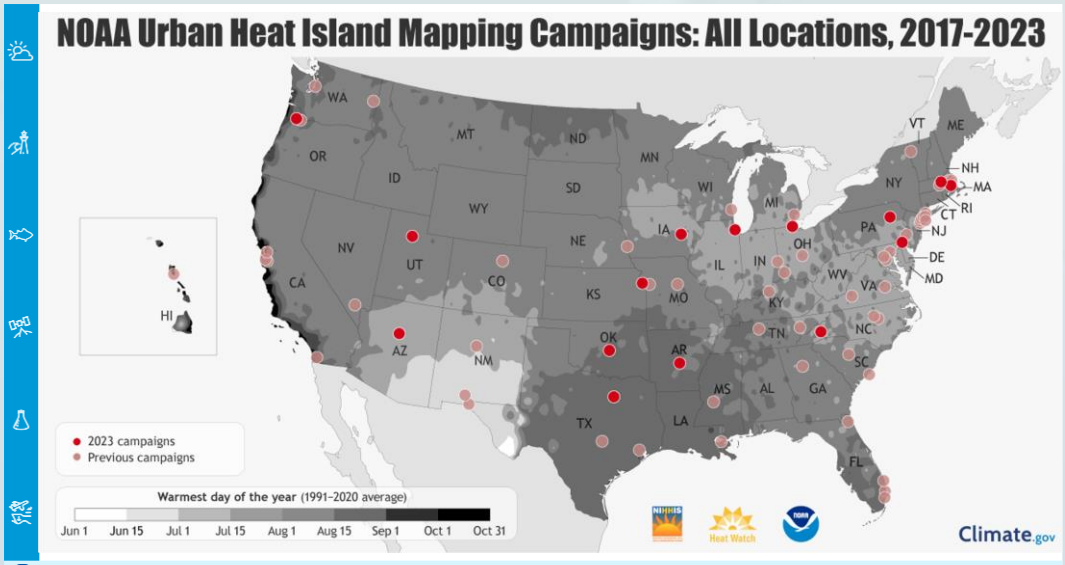
Advancement in Ocean Observations

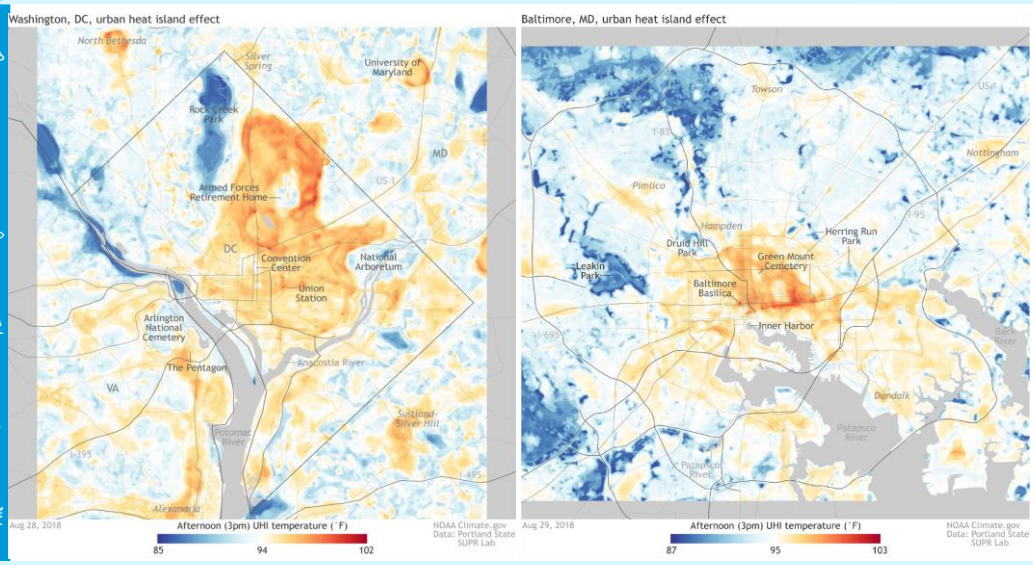
Climate Information Services and Products

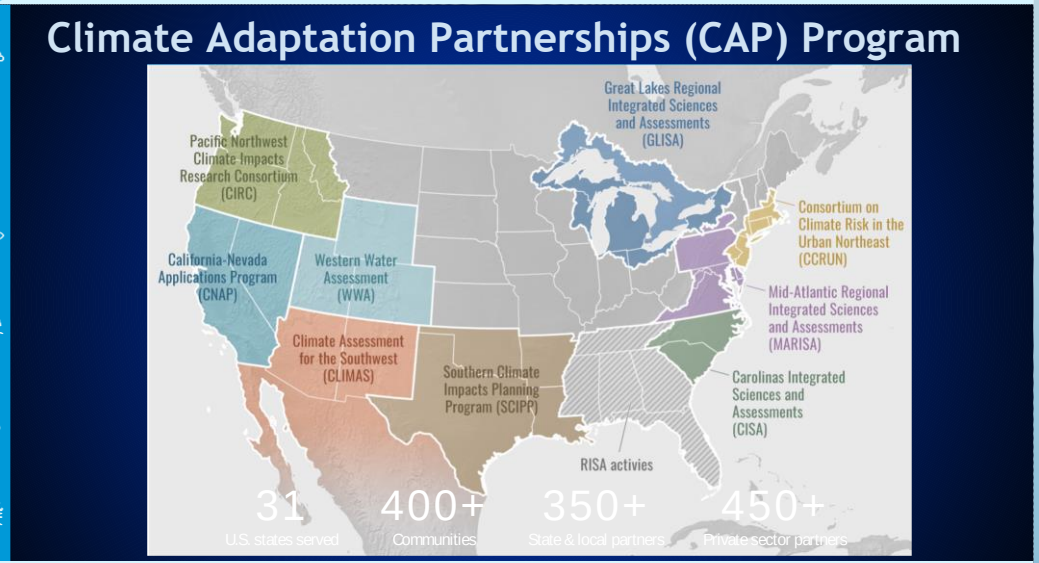


toolkit.climate.gov

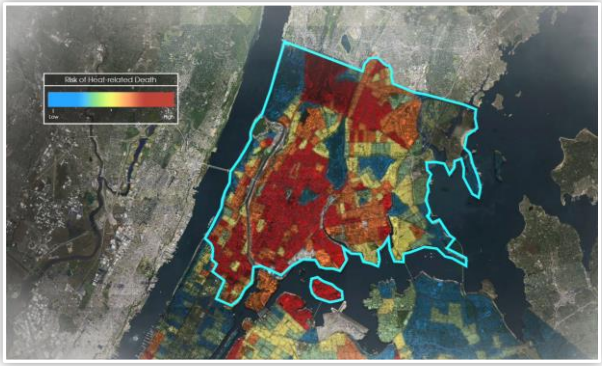
'Steps to Resilience' framework


NOAA Urban Heat Island Mapping Campaigns: All Locations, 2017-2023
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
VT
ME
NH
MA
RI
CT
NJ
DE
MD
HI
2023 campaigns
Previous campaigns
Warmest day of the year (1991–2020 average)
Jun 1
Jun 15
Jul 1
Jul 15
Aug 1
Aug 15
Sep 1
Oct 1
Oct 31
Heat Watch
Climate.gov


Washington, DC, urban heat island effect
North Bethesda
Silver Spring
University of Maryland
Rock Creek Park
MD
Armed Forces Retirement Home
US 1
DC
Convention Center
National Arboretum
Union Station
Arlington National Cemetery
The Pentagon
Anacostia River
VA
Suitland-Silver Hill
Potomac River
I-395
I-495
Alexandria
Aug 28, 2018
Afternoon (3pm) UHI temperature (°F)
85
94
102
NOAA Climate.gov
Data: Portland State SUPR Lab
Baltimore, MD, urban heat island effect
Towson
I-83
Pimlico
Hampden
Druid Hill Park
Herring Run Park
Leakin Park
Green Mount Cemetery
Baltimore Basilica
Inner Harbor
I-95
I-695
Dundalk
Patapsco River
Aug 29, 2018
Afternoon (3pm) UHI temperature (°F)
87
95
103
NOAA Climate.gov
Data: Portland State SUPR Lab


Climate Adaptation Partnerships (CAP) Program
Great Lakes Regional Integrated Sciences and Assessments (GLISA)
Pacific Northwest Climate Impacts Research Consortium (CIRC)
Consortium on Climate Risk in the Urban Northeast (CCRUN)
California-Nevada Applications Program (CNAP)
Western Water Assessment (WWA)
Mid-Atlantic Regional Integrated Sciences and Assessments (MARISA)
Climate Assessment for the Southwest (CLIMAS)
Southern Climate Impacts Planning Program (SCIPP)
Carolinas Integrated Sciences and Assessments (CISA)
RISA activies
31
U.S. states served
400+
Communities
350+
State & local partners
450+
Private sector partners

Climate Adaptation Partnerships (CAP) Expands Capacity to Adapt to a Changing Climate



Source Video NOAA CAP's CCRUN Team:
Responding to the risk of extreme heat on vulnerable populations

Collaborative Science
NE CAP
Heat Vulnerability Study

Engagement and Action
NYC Cool Neighborhoods

Recommendations

- Improve data
- Public access to science
- Empower local communities

Plenary Speaker: Korea

Value of Climate Information to Responds to the Climate Crisis

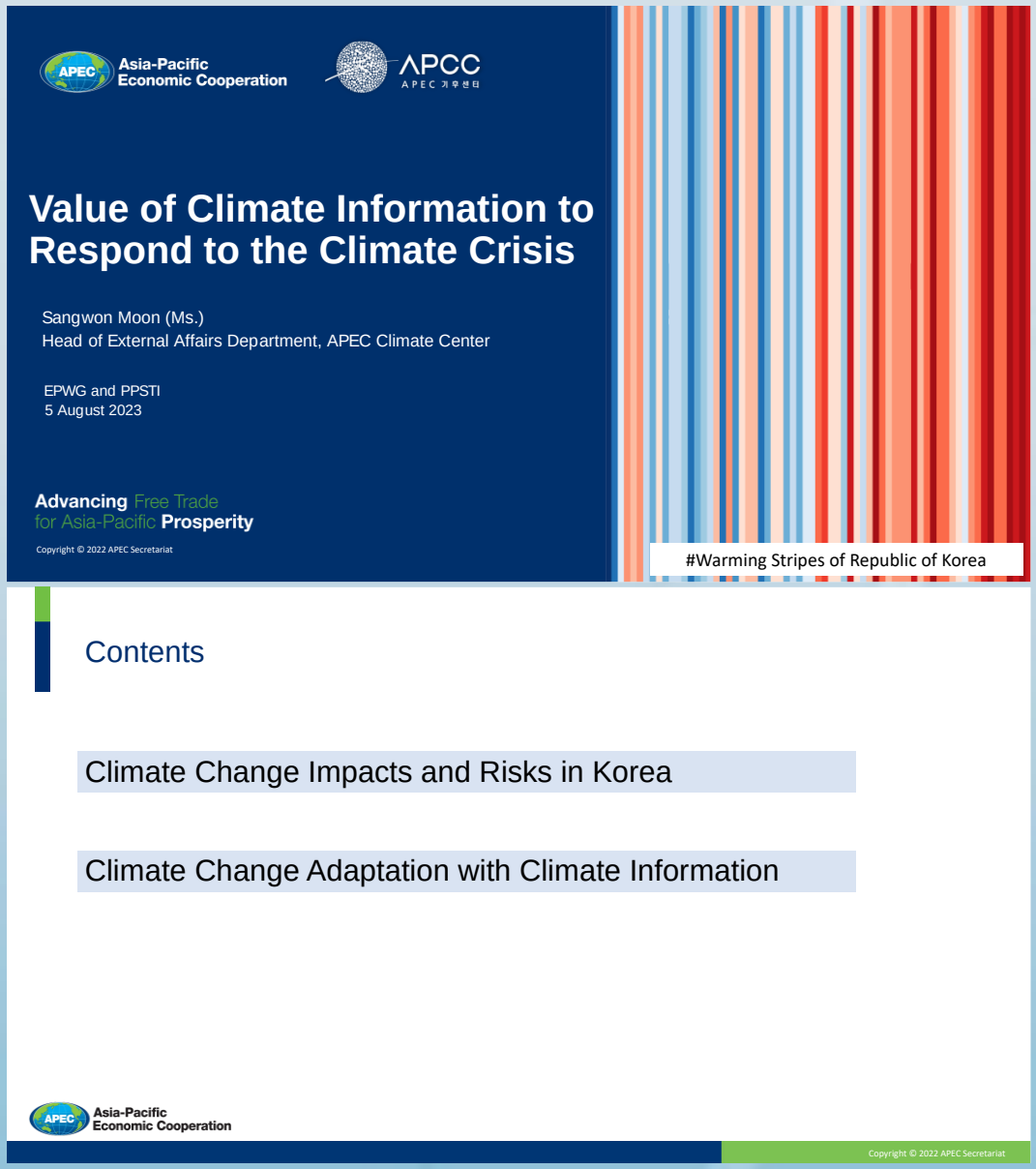
Sangwon Moon is a Head of External Affairs Department at the APEC Climate Center. She graduated from Pukyong National University with a major in International Area Studies. She has been working in the field of international cooperation since 2006. She joined the APEC Climate Center in 201 and since then she has designed various training programs and scientist support programs on understanding of climate information, analyzing and downscaling data, and applying climate information on climate-sensitive sectors. She has also managed various international projects in the Asia-Pacific region including the Pacific Islands securing fund from GCF and UN related organizations. She is promoting various projects that can spread the value and use of climate information services in the Asia Pacific region.

Abstract

Based on the Republic of Korea's report submitted to the UNFCCC, Korea is experiencing a rate of warming more rapidly than the global average. The average annual temperature, sea-level temperature and sea-level rise in Korea are greater than the global average. The escalation of frequency and intensity of heavy rains, heat waves, abnormally warm days in winter, and cold waves has resulted in significant property losses and casualties. In the past 10 years, natural disasters in relation to climate change have led to economic losses of KRW3.7 trillion, with recovery expenses estimated to be roughly two or three times this amount. The APEC Climate Center strives to strengthen scientific and technological cooperation across the APEC region to help economies and societies deal effectively with the consequences of current climate-related hazards through the provision of climate information and technical support. Recent advances in climate science, including the production of seamless climate forecasts at different time scales, can be explicitly incorporated into the disaster

risk management cycle. To effectively utilize seamless climate information in DRR implementation, “Ready-Set-Go” framework can be useful in identifying actions under the different range of uncertainty produced from the various climate forecast information. Providing tailored climate information to end-users in a suitable format is also essential to ensure implementation in reducing and managing disaster risk to better support decision making.

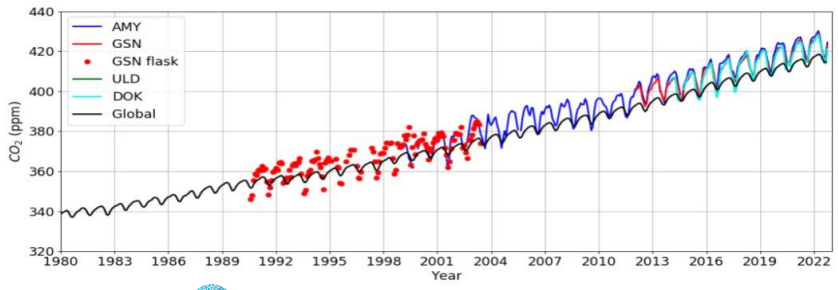
Keywords: Climate Information, Climate Information Services, Climate Change Adaptation, Climate Crisis, Climate Change Impacts



Climate Change Impacts and Risks in Korea

1/5

- CO2 concentration hits 425 ppm record high since observation
  - Increased about 15% from 1999 (24 years ago) when the first observation was made.
  - The global average CO2 concentration is 417.1 ppm, which is 2.2 ppm increased, highest record since observation



Asia-Pacific Economic Cooperation APCC APEC CLIMATE CENTER

Resources: Report of Global Atmosphere Watch 2022

Climate Change Impacts and Risks in Korea

2/5

- The ROK is experiencing a rate of warming more rapidly than the global average.
- Over the past 109 years (1912-2020), the average annual temperature in Korea has increased by approximately 1.6℃ , surpassing the global average of 1.09℃ .
- Sea-level temperature has risen by 1.23 ℃ over the last 50 years (1968-2017), which is 2.6 times greater than the global average of 0.48 ℃ .
- Sea-level has increased by 2.97mm annually over the past 30 years (989-2018), surpassing the global average annual rise of 1.7mm.
- Frequency and intensity of heavy rains, heat waves, abnormally warm days in winter, and cold waves has resulted in significant property losses and casualties.
- In the past 10 years (2011-2021), natural disasters in relation to climate change have led to economic losses of 3.7 trillion won (equivalent to approximately 3.1 billion US dollars), with recovery expenses estimated to be roughly two or three times this amount.

Asia-Pacific Economic Cooperation APCC APEC CLIMATE CENTER

Resources: The ROK's Report to the UNFCCC

Climate Change Impacts and Risks in Korea

3/5

Sector	Major Impacts
Water Resources	· **Increase in summer rainfall and a rise in the frequency of extreme rainfall** events in the past 30 years · Increase in frequency and intensity of droughts with substantial regional disparity
Agriculture	· The northern margins of **arable land shifted northward** · Increase in over-wintering and **exotic pests** · Changes in the **distribution and pattern of weed growth**
Oceans and Fisheries	· **Increase in sea temperature** (0.025℃/year) and decrease in pH of seawater (0.019/20years) · Increase in risk of disasters in coastal areas, such as flooding and tsunamis due to sea-level rise · Increase in risk of changing **spatial distribution of fish species and the mass destruction of aquaculture organisms** due to higher sea-level temperature · Increase in the occurrence of hazardous species, such as **harmful algae, toxic plankton,** and jellyfish

Asia-Pacific Economic Cooperation APCC APEC CLIMATE CENTER

Resources: The ROK's Report to the UNFCCC

Climate Change Impacts and Risks in Korea

4/5

Sector	Major Impacts
Industry and Energy	· Significant impacts on the transportation industry through '**pot-holes' and/or 'blow-up**' phenomena of pavement structures **due to heat waves and heavy rain** · Adverse effects on the leisure and tourism industry caused by typhoons and floods
Health	· Increase in mortality rate due to heat waves · Higher prevalence of **mosquito-borne infectious diseases** and food poisoning caused by norovirus
Human Settlements and Welfare	· Cities experience adverse impacts of climate change while also contributing to the worsening of climate change through the emission of greenhouse gases · Rural areas experiencing the higher impacts of climate change due to the **decline in population, aging, income reduction, and insufficient infrastructure**

Asia-Pacific Economic Cooperation APCC APEC CLIMATE CENTER

Resources: The ROK's Report to the UNFCCC

Future Impacts and Risks in Korea

5/5

- Gradual increase in average annual temperature and precipitation level in the ROK is expected.
- Average annual temperature in Korea will increase by 1.8 to 4.7℃ by the end of the 21st century, compared to current levels.
- Average annual precipitation is to increase by 5.5 to 13.1% in the same period.
- Subtropical climate area in Korea will expand leading to an increase in high-temperature indices like heat waves and tropical nights, as well as a decrease in low-temperature indices.

Asia-Pacific Economic Cooperation APCC APEC CLIMATE CENTER

Resources: The ROK's Report to the UNFCCC

Copyright © 2022 APEC Secretariat

Climate Change Adaptation with Climate Information

1/5

How to cope with unprecedented extreme events?

- Infrastructure for disaster preparedness alone is limited (Hardware)
  - It is necessary to prepare effective adaptation plan (Software) to tackle with climate crisis.
- Essential Information : Climate Forecast Information

Climate Update 2022-2026 by UK Met Office / WMO

"The update harnesses **the expertise of internationally acclaimed climate scientists and the best prediction systems from leading climate centers around the world to produce actionable information for decision-makers.**"

- Anticipatory action with Climate Forecast Information -> Maximize the effectiveness of preparation

Asia-Pacific Economic Cooperation

Copyright © 2022 APEC Secretariat

Climate Change Adaptation with Climate Information 3/5

Climate Information, the golden time for anticipatory action

- Climate prediction information provides a long preceding time to support end-users' decision-making

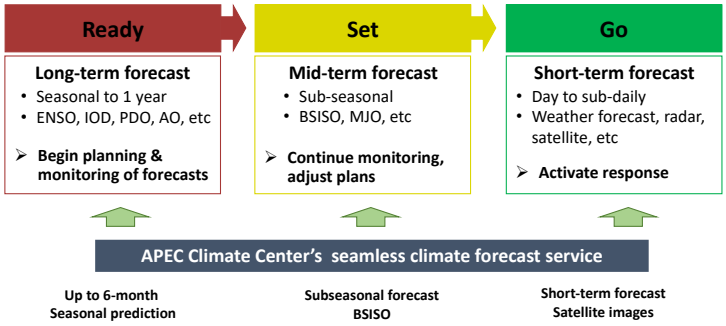
  Prediction information of weeks to months have relatively low predictive performance compare to short term forecast for the next few days, but it is highly recommended that decision-makers use it as a scenario for a preemptive response to extreme events in the mid to long term.

- **Seasonal Forecast** : Average of atmospheric and ocean conditions forecast for 1 to 3 months
- **Subseasonal to Seasonal Forecast** : Average of atmospheric and ocean conditions forecast for 2 weeks to 2 months

Asia-Pacific Economic Cooperation

Climate Change Adaptation with Climate Information 4/5

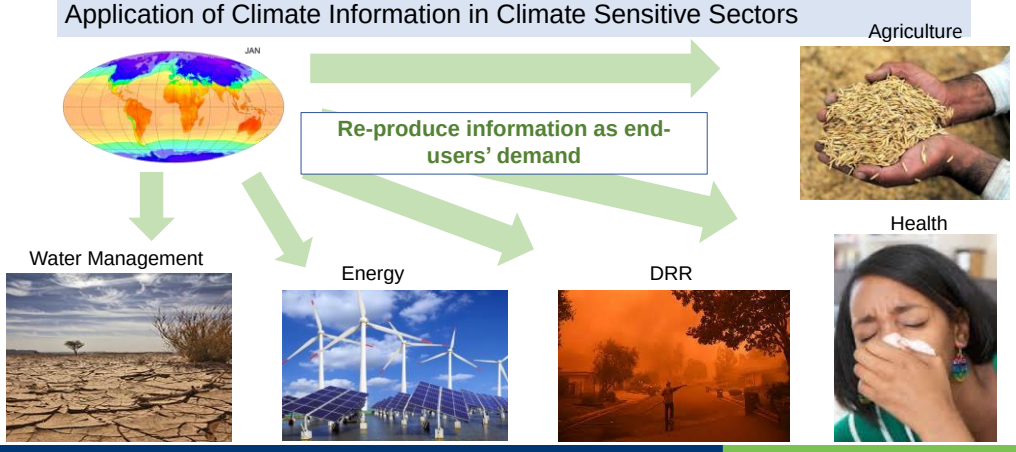
Seamless Climate Information for Disaster Preparedness



Asia-Pacific Economic Cooperation

Climate Change Adaptation with Climate Information 5/5

Application of Climate Information in Climate Sensitive Sectors



Climate Change Adaptation with Climate Information

APEC Climate Symposium 2023

- Theme : Enhancing Energy Security in a Changing Climate for a Resilient Future in APEC
- Date : 18-19 October, 2023
- Format : Hybrid (Online and Offline)
- Relevant Fora : PPSTI, EPWG, EWG (Administration Circular will be shared via PD)
- Agenda
  - Keynote : Challenges and opportunities of climate service to promote the energy transition for 2050 net-zero target
  - Session1 : Enhancing energy security using climate information
  - Session2 : Renewable and clean energy to adapt climate change
  - Session3: Best practices or policy efforts to enhance energy security
  - Discussion: Policy recommendations and discussion on energy system transition and energy security

Asia-Pacific Economic Cooperation