



**Asia-Pacific
Economic Cooperation**

Advancing Free Trade
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APEC Climate Symposium – Innovations in Climate Communication for Enhancing Human Security to Manage Risks of Climate Extremes

APEC Policy Partnership on Science Technology and Innovation

November 2021



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**APEC Policy Partnership on Science Technology and
Innovation**

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Executive Summary

The APEC Climate Symposium was held virtually on 13-14 July 2021 in cooperation with MET Malaysia. Over 400 participants from 20 APEC member economies and 6 non-APEC economies attended this event. The APEC Climate Symposium 2021, which focused on “Innovations in Climate Communication for Enhancing Human Security to Manage Risks of Climate Extremes,” aimed to support regional technical cooperation, strengthen climate resilience, and produce impactful recommendations for communication strategies for managing climate risks under the climate crisis.

In the first session, speakers shared their experience in implementing climate information services particularly in disaster risk reduction and water management. Expected roles of climate information providers were shared in order to make climate information more applicable in the Asia-Pacific region. Also, speakers suggested recommendations to enhance the coordination and use of climate information services to inform decision-making in response to the climate crisis.

The second session, “Exploring Innovative Communicating Strategies for Effective Climate Services”, focused on the need for effective climate information communications strategies given the status of the climate crisis and challenges they face when communicating the climate information. Also, effective strategies or solutions for better communicating climate information were suggested.

Experts brought together their varied experience and knowledge to build a more cohesive idea on how to enhance climate crisis preparedness through climate services, strategies for better communicating the climate information for societal benefits including disaster risk reduction, and the roles of scientists and users to promote communication amongst relevant stakeholders to make climate information more applicable to the society.

Background

The Asia-Pacific region has been impacted by many climate-related challenges including severe drought, floods, typhoons, heat and cold waves, and forest fires – all of which can be exacerbated by climate change. To promote sustainable growth and enhance human security, it is important to reduce the negative impacts of extreme climate events through the expansion of climate information services and effective climate communication.

During the previous Symposium held in 2019, participants including climate information producers and users generally agreed that there is still a large gap between climate information producers and users due to limited communication and strategies. In other words, while there is a large amount of climate information available, there is a need for better strategies to communicate them. If effectively communicated, climate information services can help facilitate climate-smart decisions to reduce the impacts of extreme climate events and enhance human security.

To further make progress on closing this gap, this Symposium focused more on identifying practical solutions on effective communication strategies for climate information. Through increased awareness of various communication strategies of climate information, participating economies benefited by gaining the ability to plan better communication of climate information to the public, which in turn contributes to decision-making that will minimize economic and social impacts.

In addition, participants noted in 2019 that while climate information service is essential to help address the growing demand for customized climate information, it does not always reach the users who need it most. In order to address this, information providers should engage the last-mile communities and work to bridge communication gaps by building institutional and technical capacity, concentrating on mechanisms that improve interaction with users.

Introduction

The overall objective of this project is to help APEC member economies gain the capacity and knowledge needed to establish effective communication strategies of climate information services. In order to do so, the event identified effective communication strategies for climate information and promoted communication of the information by bridging the gap amongst relevant stakeholders (climate information producers, intermediaries, and users) to improve human security in the region. To achieve this objective, panelists shared their knowledge and experiences on best practices and challenges in regards to communicating climate information and bridging the gap between the producers and users. Also, practical discussions on innovative climate communication strategies that are applicable to APEC member economies were held.

In terms of engagement, we had representatives from climate information producers, intermediaries, and user groups in order to promote mutual understanding and identify their expected roles from different perspectives. For this project, experts from the United Nations Development Program (UNDP) and Green Climate Fund (GCF) were invited. In addition, practitioners from various economies, including the USA, Australia, Malaysia, the Philippines, Samoa and the Republic of Korea also shared their experiences about their current endeavors to enhance climate crisis preparedness through climate services. Experts also shared their ways of effectively communicating climate information to users. Participants in all groups widened their general understanding of the definition of climate information and/or climate information services, as users and producers may have a different perspective on this matter. Moreover, by hosting representatives from both the public and private sectors relevant to climate information services, this project provided a unique opportunity where both parties can communicate and increase their understanding of each other's concerns, needs, and current endeavors, and ultimately seek opportunities for cooperation to better promote human security in the face of environmental challenges.

The Symposium was composed of two sessions across two days, with approximately 2 hours allotted for each day. For day 1, representatives from APEC member economies shared their efforts and challenges in implementing climate information services in their respective fields, such as disaster risk reduction and water management, and the needs and expectations from the climate information providers. They also explained the changing nature of climate-related risks and human security and ways to address uncertainty in climate and climate information for implementing climate information services. Finally, they provided recommendations to enhance the use of climate information to inform decision-making in response to the climate crisis. On day 2, experts discussed the need for effective climate information communications strategies as well as challenges for communicating climate information and provided some effective strategies and solutions for better communicating climate information.

Symposium summary

Session I - Enhancing Climate Crisis Preparedness through Climate Service

The APEC Climate Symposium 2021 opened virtually on Tuesday, 13 July 2021. For Session I – Enhancing Climate Crisis Preparedness through Climate Service, Prof. Jeongin Kim from Chung-Ang University, Republic of Korea began the session by introducing panelists and presented key discussion topics for each expert.

This session shared efforts and challenges in implementing climate information services in disaster risk reduction and water management. Expected roles of climate science to enhance climate crisis preparedness especially in application sectors including, but not limited to, water management was discussed. Insights on the changing nature of climate-related risks and human security and member economies' effort to increase resilience and mitigate around extreme events were explained. Recommendations to enhance the coordination and use of climate information services to inform decision-making in response to the climate crisis were suggested as well.

- Dr Ahmad Fairudz Bin Jamaluddin, Director, Atmospheric Science, and Cloud Seeding Division, Malaysian Meteorological Department, Malaysia
 - He shared the current status of extreme weather and climate events, efforts, and challenges in utilizing climate information for disaster risk reduction.
 - Over the recent years, the occurrence of these extreme weather events in Malaysia has increased.
 - MET Malaysia has a weather monitoring, warning, and forecasting system. With those systems, they collect and analyze the data using the NWP, the forecast information, or the weather warning are issued to the aviation, military, fishery and shipping, agriculture, oil and gas, sports, and recreation. Weather warnings are also issued to the disaster management agency and to the public.
 - Four main components of the early warning system: i) disaster risk knowledge on the hazards and the vulnerabilities; ii) monitoring and warning system; iii) dissemination and communication; iv) response capacity
 - For dissemination and communication, Malaysia uses TV, radio, and all the mass media communication such as Facebook, Twitter, etc.
 - One of the biggest challenges is **to produce a reliable forecast** due to its regional characteristic. For instance, the short drought period modulated by sub-seasonal climate phenomena such as MJO does not meet a seamless prediction. Also, difficulty in providing forecast information during extreme weather such as thunderstorms as the current weather model in Malaysia is unable to simulate strong wind that is associated with thunderstorms. challenges include a lack of observational data and limited remote sensing data, and the fact that MET Malaysia is solely dependent on its NWP model for forecasting and issuing the warning.
 - They suggest it is **necessary to build a capacity of forecasters with improved scientific understanding and technology, modeling.**
- Prof. Mayzonee V. Ligaray, Associate Professor, Institute of Environmental Science and Meteorology, University of the Philippines, the Philippines

- She shared experience of implementing climate information in water management and expected roles of and needs from climate science to enhance climate crisis preparedness especially in application sectors including water management.
 - Extreme events such as flooding, and drought have increased their frequency and lead to soil erosion and stream flow variation.
 - Considering all these water-related issues, it is important for us to monitor our water resources, assess the impacts of climate changes and anthropogenic activities, and establish a water management system.
 - For the implementation of climate information in water management, the most important diagram that needs to be understood is the hydrologic cycle. In addition, it is **important that the climate or weather data acquired is reliable since this will be reflected in the performance of water models.** From her experience, incorporating climate change scenarios in hydrologic models could help us improve the existing policies regarding water management to achieve a more sustainable future when it comes to water availability and the protection of water resources.
 - One of the challenges regarding climate extreme events such as typhoons is that there is **a lack of climate science awareness by the greater population.** To ease this, it is necessary to **integrate climate science into basic education.** **Promoting climate science awareness** will also improve climate crisis preparedness. Understanding the causes and effects of flooding and other hydro-hazards can help us find solutions in mitigating existing challenges as well as prepare for future flood events.
 - It will be advantageous for hydrologists to obtain reliable climate data from climate information providers to make climate information more applicable in the water sector. **Making climate information easier and more convenient to download** will facilitate the use of currently available climate information more widely.
- Roger S. Pulwarty, Senior Scientist, NOAA Physical Sciences Laboratory, USA
- He explained the changing nature of climate-related risks and human security, how to address uncertainty in climate and climate information for implementing climate information services, and shared recommendations to enhance the coordination and use of climate information services
 - The **nature of the physical risk is changing**, and, in some ways, we do not fully understand. Thus, the **traditional risk assessment and emergency management approaches are increasingly being challenged by systematic and evolving impacts of compound extremes, biodiversity loss, economic and other instabilities.** In this regard, we need to **navigate not just climate change but through a changing climate** in understanding and characterizing these cascading and compounding nature of structural and systemic climate risks, and then identify where the investments and financing can be prioritized.
 - **Basic and specialized services are requested to different users and the use of service production in decisions and actions** in order to add value to the service is another process. Thus, **the most important thing is how different communities and economies can make sense of a very vast array of data available, and data that is also changing over time from the past, present and into the future.**
 - He emphasized that the most important thing that makes the currently existing tools, products, and services valuable is the **broad dialogue of the**

sustained engagement along every time scale of the early warning information system with an example of the Caribbean Regional Climate Centre. This regional consortium is a key regional mechanism that champions the design, development and delivery of tailored climate products and services in the agriculture and food security, disaster risk management, energy, health, tourism, and water sectors.

- He also shared NOAA's role in climate services by explaining the existing NOAA Regional Climate Services Network and Climate Resilience Toolkit, which aims to enhance and simplify access to climate science data and information, including projections. **NOAA's Climate Resilience Toolkit** can be accessed at climate.gov website and it provides easy and robust access to climate projections for designers to provide adaptation/resilience decision services to their end users and consumers. It also conceives and articulates an overall plan for how USGCRP agencies may make their climate-related web presence more cohesive, coherent, and user friendly. Integrated Science and Assessment, a network developed in USA to do the impacts and needs assessments of the users and help to deliver the information produced by the regional centers was introduced as well. It is the network that enables people to choose from a variety of information and when to apply it. Without the network of people, the information or services could not be as useful as they could be. Thus, the key is the **governance of the information and services. It is very important to know how we manage, understand, use, and finance on climate information and climate information services for meeting economic environmental goals.**
 - He emphasized the importance of **making the link between risk management and resilience, ensuring coherence among the different agencies and different departments, developing the culture of partnerships** instead of taking co-production for granted and working with lower communities. The most critical thing is **how to best link emergency management responsibilities and the decision-making for climate-related resilience.** We need to **broaden the actor network across the risk management to resilience continuum and work with financing agencies on where to target that kind of investment** that gets us at emergency recovery but also helps us to plan into the long-term, considering that partners do share not only data but also responsibilities.
 - For complex problems, communication is critical but not sufficient. **The joint visioning across communities, public, private sectors, NGOs, the policy development, the implementation path to the sustainable future, and the sustainability of those collaborative learning networks are the key. The collaboration among those who monitor, forecast impacts and scenarios and plan for preparedness communication must move together as an integrated climate services system.**
- Dr Lynette Bettio, Team lead, Extended and long-range forecasting, Climate Environmental Prediction Services, Bureau of Meteorology (BoM), Australia
- She shared BoM's effort to increase resilience and mitigate around extremes and provided recommendations to enhance the use of a climate information service in response to a climate crisis.

- Extreme events in Australia are becoming more severe, and thus, they have increased risks of more frequent and intense extreme events. They are seeing extremes that have not been observed before and the compounding extreme events such as long-term drought and heatwave are seen as well.
- Bureau of Meteorology (BoM) addresses these is to **bring awareness and education around the changing risk landscape, so called 'climate report for Australia' which is released every 2 years and it gives details of how Australia's climate is changing and has a media event and media talks about it to the public.** Between the releases of each report, BoM gets timely information. They go out and strongly communicate the contents of the report to sectors and how they are going to be impacted in the future. For instance, they communicate how rainfall input is changing to the water sector. She highlighted that the natural hazards of the future will not be the same as the past and many hazards will be more intense and happen more often and unprecedented combination.
- In response to the severe bush fires season in Australia, they worked very hard to **highlight the changing risks and the need to plan for that changing risk into the future with climate services.** Australian Climate Service, the new program was introduced. **Through this webpage, a general idea of the current climate is provided to the public. One of the influential communication ways was to do the monthly video through public TV shows.** It helps to **educate people about what the conditions have been and what conditions are coming up for the coming season.**
- **'Climate Driver Update'** looks at those overall drivers that have been impacted in Australia and this has a high amount of viewership from different sectors such as water emergency services, government, university, finance, etc.
- *Case Study: A Heatwave Service for Australia, taken from Bettio et al (2019):* The Bureau's [heatwave service](#) was developed using several steps. Firstly, research was undertaken pointing to the **need** for such a service, the service was developed and extensively **tested**, and importantly the **delivery** and **communication** of the service was also given priority, especially through partnerships with relevant domestic state agencies. The delivery of the domestic heatwave service provides a model for the future development of services to support the Australian community.
- To minimize and accommodate the uncertainty of climate information in implementing climate information services in decision-making, some principles were shared: i) provision of relevant information to customer actual needs; ii) a long-standing relationship of mutual respect and trust; iii) education; and iv) timeliness of the advice so that it is provided with enough time for decisions to be made.
 - **It is important to make information relevant for decision makers to enhance the use of a climate information service in response to a climate crisis.** What information does the customer actually need and what decisions are they trying to make from that information are the key. **The information providers should tailor the information when providing them so they can make those decisions.** In addition, **building trust is another key as trust enables warnings of likely severe conditions to be heeded and acted upon.** It is essential to have **long standing relationships built up over a**

number of years and this trust increases when they see the application and utility of climate information that providers produce. Lastly, **education should not be underestimated**. With the seasonal forecast information, customers are more satisfied and comfortable with using the seasonal forecast information when they understand the science.

- **Prior to each season, BoM gives a number of standardized briefings across Australia prior to the severe weather season throughout all levels of the government and multiple emergency service agencies** in order to ensure that every stakeholder is getting the message with consistency, including fact-based scenario planning to stress the test systems. It also includes preseason briefing to emergency broadcasters so they are educated and aware of the likely issues. An example of **BoM's collaboration with emergency services in Australia to provide relevant public safety messages** in the face of increased chance of La Nina which means increased chance of flooding in the region. They demonstrated "A car can float in just 15cm of water" and reinforced the public safety message consistently throughout the season to remind people of that action of not driving through flood water. **Timely information is important to enhance the use of climate information. Prior to the preseason, BoM provides information on how unusual a certain event is and if there are any records or near records to help the public understand the extreme event.** She said this information can influence actions. It can also reinforce the risk information provided and highlight the need to incorporate climate information into future planning. This information provided in the pre-season briefing helps recovery, resilience and preparedness for the next event. **Building trust is key. A long-standing relationship** demonstrating the application of information to those needs over time builds up a strong relationship of mutual respect and trust. This type of trust enables warning of likely severe conditions to be heeded and acted upon. BoM also provides an **education program to help the general audience interpret climate outlooks so that people can incorporate that information into the decision.** She mentioned that if customers are more aware of the probabilistic nature of the forecasts and applications, they are more likely to trust the information provided. If there is a physical mechanism such as ENSO or IOD which may be influencing the forecast, there can be more confidence placed in the forecast, meaning customers are more likely to use the information.

- *Case Study: domestic Bushfire Outlook:* Prior to each calendar season the Bushfire and Natural Hazards CRC (BNHCRC) prepares an outlook on the likely fire potential across Australia in the upcoming fire season (see <https://www.bnhcrc.com.au/hazardnotes>). This is a long-standing relationship between the Bureau, the BNHCRC, and domestic state fire agencies. Over the years a strong trusted relationship has built up between all of the parties. Meetings are held prior to each season to discuss the performance of the previous outlook as well as the major influences on the upcoming outlook. The Bureau presents the current climate influences and antecedent conditions, while domestic state fire agencies talk to local conditions such as fuel loads, fuel dryness, or other factors that might impact fire potential in the coming season. The free exchange of ideas informing the outlook product and subsequent discussion means the meeting output is thorough and targeted.

The climate literacy of the group is high with the impact of climate drivers and forecast rainfall and temperature extremes well-understood in the context of likely impacts on fire conditions, and related decision-making processes. Prior to the devastating Australian Black Summer bushfires of 2019–20, climate information was supplied highlighting the long-running drought, large-scale climate drivers and outlooks, all of which pointed towards a very likely extreme fire weather season. In the bushfire outlook issued in late August 2019, much of the forested areas of eastern Australia had been identified as having above normal fire potential. This led to early preparation for the likely severe season, such as increased personnel and equipment. For the more benign fire season of 2020–21, increased grass growth due to the 2020 La Niña was reflected in an increased risk of grass fire away from forested areas in eastern Australia. However, the widespread forest fire risk was reduced, and risk management plans were able to be made around this information. As well as benefitting from the joint preparation of bushfire outlooks and briefings, this collaborative relationship has also led to targeted research around impact-based forecasts such as direct forecasts of forest fire danger index (FFDI) conditions. Individual forecasts of temperature and rainfall and preceding drought (inputs for the calculation of the FFDI) are now integrated into an FFDI outlook, instead of the rough interpretation of the individual inputs by the user. This demonstrated the capacity of the collaboration to respond to and facilitate customer needs, reducing inaccuracies and increasing the strength of the service.

- **Recommendations:** Following a climate crisis, a post-event analysis documenting the outcomes/impacts as well as evaluating the material provided in advance of the event can assist in the preparation for the next climate crisis. This should also include acknowledgment of the changing climate and the increasing intensity and frequency of extreme events. How rare was the climate crisis in a historical context? What if any attribution can be made? What is the relative frequency and intensity of the event, will these types of the event become more or less frequent? **Seamless forecasting:** This can assist in tailoring forecasts to user requirements. Forecasts can be provided at all timescales and outlook periods to meet the variable needs of decision-makers across all impacted sectors meaning an increased take up of climate information. **Live documentation of the event** – running documentation of any climate records broken or likely to be broken during the event aids in communicating the severe nature of the event and can influence decision making around the event. For example, if the public knows that an event is rare and outside their lived experience, it may have a greater influence on their decision-making and response and lead them to take greater and more timely steps to ensure their and others' safety. This requires a **strong and extensive data record**.
- *Case Study: State of the Climate report and use in Royal Society of Victoria's "Future Thinking Forums: The State of the Climate report draws on the latest climate research, encompassing observations, analyses, and projections to describe year-to-year variability and longer-term changes in Australia's climate. The report is a synthesis of the science informing our understanding of climate in Australia and includes new information about Australia's climate of the past, present and future. Science informs a range of economic, environmental, and social decision-making by governments, industries and*

communities. Produced every two years since 2010 the report is an authoritative voice on climate change within Australia and is used in the two-year period following release to communicate around changing climate risk. For example, the science of these reports formed the scientific physical basis of thought exercises from the Royal Society of Victoria in two Future Thinking Forums in 2018 and 2020. In 2018 the Topic was "Is Victoria's liveability resilient to extreme weather?" Science from the State of the Climate report including Future projections formed the basis of this deep thinking. The proceedings began with the description of two possible extreme weather scenarios: a severe heatwave and an extreme flooding and wind event. These scenarios were based on what could be Victoria's reality within the next two decades. Following the portrayal of these scenarios, speakers presented the challenges and current state of knowledge and innovation in the public sector and academia. Four sectors were the focus of the day: Urban Liveability, Human Health, Energy, and Transport. So in this example, the weather information formed the base of how different sectors would be impacted by changing climate risk. The partnership helped integrate science into the decision-making process. For example, the increasing intensity and frequency of heatwaves were discussed. Then the impact of heatwaves on human health was identified and leading on from this the need to develop climate-adapted building codes, cooling strategies and research on energy flows. In 2020 the topic was "Building our Resilient Future" with a focus on Water, Agriculture and Biodiversity. The previous summer's devastating bushfires lent a sense of urgency to this planning, with a window on possible future scenarios with further climate change. A number of invited speakers discussed how we can build resilience into our planning strategies for water, agriculture and biodiversity. The State government was invited to be part of this process so the discussion can help inform any future thinking around planning for climate change. At the heart of the demonstration of the changing physical risk – our climate is changing and we will need to adapt to some level of climate change, gives a solid foundation for future planning. Both of the scenarios presented enable science to form a foundation of future thinking around the subject of changing extremes and what would be needed in a future world to accommodate this changing risk. A clear message from these events is that science has a large role to play in informing the likely magnitude and direction of future change but that all sectors are needed to engage and cooperate around what will be needed to adapt to the changing risk. Furthermore, this will need a strong planning envelope from the government at many levels.

Session II – Exploring Innovative Communicating Strategies for Effective Climate Services

The morning session of July 14th commenced at 1:00 AM UTC online. Session II discussed views on the need for effective climate information communications strategies given the status of the climate crisis and challenges we face when communicating climate information. Also, effective strategies and solutions for better communicating climate information were suggested. The Session was chaired by Mr Sanny Ramos Jegillos, Senior Advisor and Team leader of Disaster Risk Reduction and Resilient Recovery for Building Resilience, UNDP Bangkok Regional Hub.

- There are some challenges that remain and highlighted a collaborative effort among various sectors at a global, regional, and local and community level is necessary.
- **The Asia-Pacific region is the most disaster-prone region in the world**, with the communities that live here facing ever greater risks from disasters, with climate change further increasing disaster risks. The pandemic has added to these existing risks through increasing vulnerability and affecting livelihoods, while several economies in the region have had to respond to one or more disasters taking place during the pandemic.
- **The importance of ensuring people’s access to climate information is highlighted in the global development frameworks.** The Sendai Framework for Disaster Risk Reduction mandates the significant reduction of disaster risks to safeguard lives, livelihoods, and economies. Target G of the Sendai Framework aims to ‘substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.’ Likewise, early warning systems are identified in Target 13.3 of the Sustainable Development Goals (SDGs) to, quote, ‘Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning’.
- **UNDP is helping Governments to achieve these Targets of the Sendai Framework and SDGs by institutionalizing Governments’ efforts on communicating climate information to communities so that during emergencies, Governments can provide this critical information and relevant support in a timely manner to reduce communities’ disaster risks.** For example, the Government of Bangladesh responded successfully to Cyclone Amphan, which was the most powerful cyclone to strike Bangladesh in 20 years. The cyclone made landfall in May 2020, while it was under lockdown due to COVID-19. The **Standing Orders on Disasters were the key factor to this success** as they clearly outlined both the roles and responsibilities for the Government and the participation and coordination between a wide range of stakeholders, and these Standing Orders were developed with support from UNDP. Immediately after Cyclone Amphan was detected, the Government implemented the Standing Orders on Disasters. As a result, the Ministry of Disaster Management and Relief mobilized field-level administrators, and before the cyclone made landfall, the Cyclone

Preparedness Programme (CPP) Board initiated evacuation procedures as outlined in the COVID-19 contingency plan and mobilized local CPP volunteers who were in charge of disseminating the early warning to communities and bringing people to the evacuation shelters. Over two million people were evacuated to the cyclone shelters whilst practicing social distancing to prevent further infections.

- UNDP's example of **supporting Governments to ensure that communicated climate information is targeted at and actionable by vulnerable groups, including women, persons with disabilities, and the elderly**. To support the effective communication of climate information to women and help women feel safer in taking an action to early warnings in Bangladesh, UNDP provided training to CPP volunteers and supported the recruitment of women, such that during the 2019 Cyclone Bulbul, a third of CPP volunteers were women. These volunteers played a crucial role in supporting the evacuation of women and children.
 - **UNDP is also supporting Governments to communicate climate information in adequate formats which can be accessed and understood by persons with different types of disabilities**, but there is still much more that can be done to support this.
- Needs for effective climate information communications strategies given the status of the climate crisis
- **Pacific Islands are particularly experiencing the increased intensity of cyclones leading to the devastation of the region**. With over 25,000 islands, many of which are low-lying, Pacific communities are facing an existential threat from global heating-driven impacts such as sea level rise and more intense cyclones caused by climate change. The Pacific Islands are only responsible for 0.14 per cent of global emissions and yet are among the most vulnerable to impacts from the climate crisis.
 - Global sea level rise is a critical threat to Pacific Islands. Seas are now rising twice as fast as the average in the twentieth century; when once habitable areas are swallowed up by the sea, communities are forced off their land and become internally displaced people, essentially refugees in their own economies. Rising seas also cause inundation, leading to the salinisation of agricultural land. **Pacific Islands are already being affected by sea level rise**, which has caused land loss and led to relocation for a number of communities.
 - Climate change is increasing the intensity of cyclones, leading to devastation across the region. The Pacific was recently hit by two category 5 cyclones in the space of twelve months. The first was Cyclone Pam which struck Vanuatu in March 2015, causing widespread damage across all six provinces.
 - The first was Cyclone Pam which struck Vanuatu in March 2015, causing widespread damage across all six provinces
 - Category 4 Tropical Cyclone Gita devastated Tonga in February 2018: the worst storm the kingdom had experienced in 60 years at the time. Gita

caused flooding, displacement, and destruction of significant landmarks including Tonga's Parliament House.

- During the first week of April 2020, Cyclone Harold devastated communities in the Solomon Islands, Vanuatu, Fiji, and Tonga.
- **The climate crisis has also exacerbated drought conditions in the Pacific**, a situation that has been particularly devastating for atoll islands whose freshwater sources are already scarce. One of the most severely affected was Tuvalu, whose government declared a state of emergency in the face of a water shortage.
- King tides are especially high tides that can cause coastal flooding, at times reaching up to 80 per cent higher than the average tide levels. Over time, rising sea levels are raising the limits of high tides. As sea levels continue to rise, king tides will cause increasing damage to coastal communities and territories
- As global heating continues to increase, these kinds of impacts will grow more serious. The IPCC Special Report on Global Warming of 1.5°C outlines the harm that will result from 1.5°C compared to 2°C, highlighting the fact that climate impact risks are lower for a temperature rise of 1.5°C compared to 2°C, and that half a degree is critically important for the future of the Pacific. Emphasized that plenty of **data and information does not create any value unless being accessed and utilized. A lack of digital infrastructure was mentioned as a barrier** for the Pacific to be access to climate information, and; thus, much of the information is accumulated in governments only and it is not being delivered to the community and to young people who could bring data and information produced to live.
- **A comprehensive and holistic approach needs to be taken to address systemic risks.** Climate change and natural disasters are both common challenges faced by the APEC region. Effectively dealing with disaster risks is an essential way for climate change adaptation while climate information is pivotal to finding feasible solutions to disaster risk reduction.
- Weather factors are affecting disaster risks in various ways. On one hand, they are causing an increase both in the number and the severity of natural disasters. On the other hand, climate change may result in environmental degradation, damages to the ecosystem, food shortage, water scarcity, and changes to livelihoods, which increase the vulnerability and exposure of economies, especially those most at-risk populations, to natural disasters. **The COVID-19 pandemic has also compounded the dual challenge presented by environmental challenges and health crisis.** To encourage a risk-informed, resilient, and risk-informed recovery in the post COVID-19, **climate information is expected to provide basic data and other services for disaster risk or emergency management.**
- Climate information is most widely needed and can be broadly used in disaster risk identification, assessment, early warning and monitoring, risk survey and other pre-disaster efforts.

As a climate information provider, **correctly communicating accurate information is important. Climate information becomes valuable only when we can truly connect the dots through effective communication.**

- Green Climate Fund(GCF) shared the continuous increase in demand for Climate information Early Warning Systems(CIEWS) from developing economies

- Challenges for communicating climate information from providers, intermediaries, users of climate information
 - In Pacific Islands, various groups of stakeholders conduct several climate-related projects but **there is a lack of mechanisms to enable good complementarity between each initiative**
 - **The largest challenge mentioned was placing users at the centre of decision making** around what information is actually produced, how it is produced, who is it disseminated by, do people understand it, can they access it, and once they receive it, do they actually know what to do with it.
 - Especially in the Pacific, it is related to **navigating the very complex network of actors that are involved in the provision and uptake of climate services**. There are different actors involved in the climate services' food chain. There are international guidance frameworks provided by the World Meteorological Organization (WMO), data providers who provide and support satellites and earth observation, agencies that provide model outputs, tools, and forecasts, global producing centers or regional science agencies, and regional development partners and funders that support the development of certain information services. In the Pacific, there are bilateral donors and multilateral climate funds such as GCF. Meteorological agencies from each member's economies and regional climate centers are the key organizations that keep linking up providers with users on the ground. Most importantly, there are the users such as provincial authorities, civil society organizations, groups and communities who are the ones that actually need to risk-informed decisions. **It is ideal that the users would be the center of decision making but it can be difficult to achieve.**
 - Suggested **effective and comprehensive institutional collaboration in conducting projects and programs that are supporting climate information services** as one of the solutions
 - In the Pacific where there is a number of agencies that are supporting seasonal and sub-seasonal predictions. Due to these supports, the region increased its capability over the past 5 years. However, as there are many different products available, it is necessary to have the capacity to be able to handle different products and to know how to choose the right outputs for their own economies. What is commonly seen when a number of different products produce slightly different results, end users are easily confused with the different information.
 - **Comprehensive institutional collaboration in the region as well as a focus on projects and programs, building the core capacity of Met. Services of member economies** that enables them to most effectively use

the information available and to tailor products and services for their stakeholders are important

- From GCF's perspective, it is very clear that climate-related impacts and disasters are on the rise. From the submissions of the Designated Centers of economies' plan to GCF, it is clear that climate information and the Early Warning System (EWS) have strong demand, 50% of NDCs highlighted their importance of them. However, the quality of the information provided is low and does not fit to address the types of challenges that we face.
 - **Shared major six challenges in communicating climate information.** First, there is a **lack of enabling environment for institutional effectiveness. Limited governmental finance and budgets allocation** was also mentioned. Due to this, many of Hydro-Meteorological Services and risk management agencies are under resourced and this does not enable them to be effective. In addition, **the complexity of production, dissemination and uptake of risk information** has become a very challenging area. **A lack of coverage and scale for effective service delivery** in terms of quantity and quality of hard infrastructure and inadequate soft infrastructure for ensuring delivery and uptake of risk information is also one of the main barriers. More importantly, **uncoordinated interventions by different institutions** limit the effectiveness of existing support to developing economies. Lastly, he mentioned that the **market barriers** exist in creating enabling conditions through policy incentives to de-risk investments. He pointed out that it is critical to induce a private sector to be part of the value chain.
 - **Impact of COVID-19 on climate information and Early Warning Systems.** The COVID-19 is heavily impacting weather observations and forecasts, as well as atmospheric and climate monitoring. A lack of observations over any area impacts the quality of the forecast and analysis products. While the global observing system is either partly or fully automated, some parts have already been severely affected by COVID-19. For instance, aircraft observations have declined by 80% since early February and close to 90% in the tropics and in the Southern Hemisphere. Also, the availability of surface data has decreased significantly, especially in Africa. Ocean observations have declined by 80% compared to the pre-COVID-19 baseline. Thus, there is a need to **transition to automation** which will improve the frequency and resilience of reporting
 - **Difficulties in data collection and information sharing among various government departments.** Second, lack of a comprehensive and systemic understanding of disaster risks, climate change and other environmental challenges. Third, recognizing the need for risk map zones and risk surveys.
- Effective strategies or solutions for better communicating climate information
- Delivering climate information and promoting its use for decision-making is like connecting the dots. We have been successful in marking a 'dot' for each field, and now it's time to connect these dots. It is hard to connect climate information to practice. Data that are not ready to be utilized are not information; they should be readily made available for the users to their

familiar form. However, the bigger problem is, like all other kinds of information, a selected part of information can be misleading. Both ends of the dots should truly understand what they are communicating.

- **Bridging the information is the key.** It may not be easy to nurture those 'bridges' in our system, and the APCC marks a unique and crucial position in that sense. APEC Climate Center not only produces high-quality climate information but also tries to reach out to domestic and sectoral authorities to promote its use for decision making.
- Sustainability of the climate-related projects highly depends on **capacity building** and thus, APCC has focused on hosting training programs, workshops, expert meetings to the member economies to ensure sustainability. **Effective communication of the most reliable information can be done through capacity building of the users.**
- There is a growing demand for **Climate Information Early Warning System (CIEWS)** from NDCs, 77% of the portfolio from Africa and the Middle East, 76% from Latin America and the Caribbean and 100% from Asia and the Pacific.
- Climate information and early warning services and a broader resilience landscape have the market potential for unlocking private sector investments and participation. And this will lead to scaling up currently existing and growing commitment across global, continental and domestic scales such as Paris Agreement, Sustainable Development Goals, Sendai Framework, Global Framework for Climate Services. This will serve as a unique opportunity to enhance coherence and complementarity of investments while leveraging private sector finance, public budgets and public-private partnerships.
- GCF sees that government is not only a consumer but also a seller of services to businesses and other consumers in integrating the information into the decision making process to inform. That is why GCF believes that **working closely with the government** brings a synergy to both governments and GCF. The government can provide important services to society to improve cost effectiveness while maximizing the performance of critical infrastructure and GCF provides CIEWG for several economies, **creating a strong pipeline of climate mitigation and adaptation projects.**
- GCF also catalyzes **climate innovations through ICT, big data, and cloud computing** to underpin project design and implementation, create strategic partnerships, quality management and improve policy.
- GCF **expands and replicates the knowledge on climate investment, science and technology** through institutional collaboration, monitoring, evaluation, and learning to ensure impact evaluation as a way of maximizing the impact
- **The suggested regular and interactive working mechanism among relevant government departments, industry, stakeholders be established to minimize inaccurate and outdated data collection, distribution, and**

access. ICT, big data and other digital technologies could be used to support and improve climate information dissemination through a platform.

- **A practical strategy to successfully deliver climate information services to end-users is to put users at the center of climate information services development.** It is to engage, support, and bridge between community groups and providers of climate information.
- Example: A Community based early warning system that was funded by Finland and implemented by a number of organizations in the Pacific.
- One model for knowledge brokering and bridging was piloted through the program which **formed domestic coordination committees** for the project in each targeted economy and this triggered the development of **formal relationships between meteorological services, domestic disaster management authorities, and Red Cross societies**, which in the past had operated separately.
- Bridging in the Red Cross societies as a **key intermediary** is the link between communities and Met.services was transformative. The project ended up through a coordination group, taking Met.services down to the community people with products and services that they produced for communities such as bulletins, verbal radio programs, and so on.
- Taking those elements down to community level and some **Met. Services actually took feedback from the community seriously and adapt and change their products.** For example, a community requested that a tropical cyclone tracking map include illustrations of what different wind speed actually mean. This was adapted and it showed in the picture the meaning of a certain category of the cyclone. This way, communities were able to understand what different categories of tropical cyclones meant and they knew what they had to prepare.
- **To formally engage intermediary organizations, it is essential to have resource to serve that function.** The resource includes capacity building, staff, and place, science background to serve as a knowledge broker among many others. She pointed out that some large-scaled climate information services projects and programs do not provide enough resources to enable these intermediary organizations to play that role. In this regard, it was suggested that one solution could be **to bring in intermediary organizations right at the beginning of the projects or programs**, instead of last minute in order to take the information produced from the invested infrastructure and science development to the last mile, to the users to maximize their impact.
- **Facilitating collaboration between climate information providers and Disaster Risk Reduction-related agencies will be helpful** as both might have a different understanding of climate information and services and there are often cases where users are unable to utilize the information for their decision making due to the difference.
- **Value youth audience** - First and foremost, recognise and value young people as a critical audience of your research. This means understanding the importance of framing data, research and science in a way that is accessible

and engaging for young people. The global youth climate strikes demonstrate, young people's voices are crucial to the collective "re-storying" of climate change and the influence young people can have in the dissemination of climate information, and in turn advocate and lobby decision-makers to act with the required urgency to address the climate crisis based on the science.

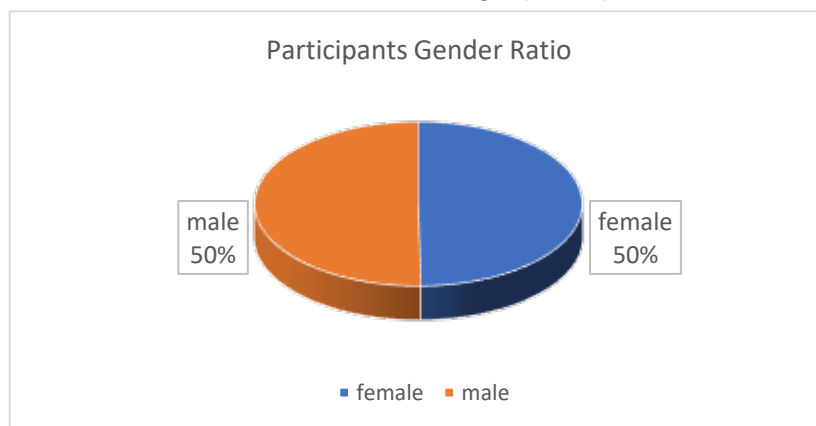
- **Climate communication to educate** – when developing climate communication to reach young people, do so with the intention to educate. Young people globally have been urgently calling for increased educational opportunities for interdisciplinary and participatory approaches to climate understanding. Knowledge is power and we have seen across our world that impact that youth voice can have in driving decision-making and bold climate leadership and action. Effective climate change messages are first and foremost about relevance and engagement: they must deliver, to quote one, 'something that young people can relate to themselves or their own community'
- In addition to this, the Pacific only makes up 0.14% of the global carbon emissions yet it is our islands who feel the impacts the first and worst. Climate science communities have a responsibility to communicate the data and science appropriately. Climate science communities also need to value the place of Indigenous and traditional knowledge holders because it is Indigenous communities who are the first conservationists. Climate change communication cannot be understood in the same way as climate change science, that is through the application of cold harsh logic and scientific discovery.

Symposium Outcomes

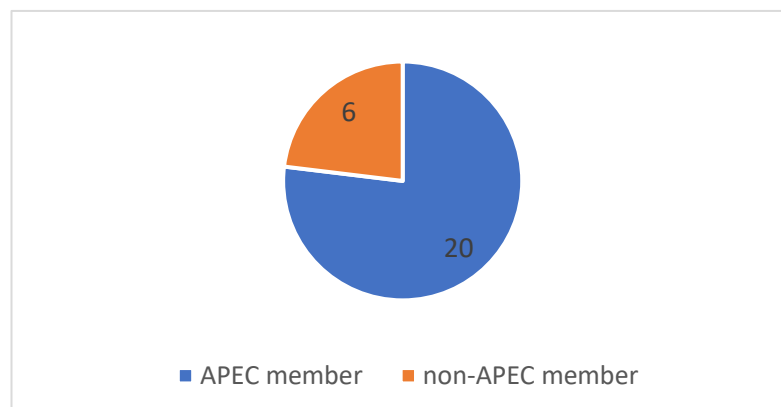
The target audience ranged from climate information producers such as NMHS, government authorities that benefit from the utilization of climate information, such as the ministry of environment, disaster risk management agency, and intermediaries in the position of interpreting and delivering the produced information to the public, such as representatives from the media. The audience also included representatives from the private sector such as insurance and business planning, agriculture and water-related sectors, and the general public.

The organizers circulated a nomination request to the APEC Emergency Preparedness Working Group (EPWG) and Policy Partnership on Science Technology and Innovation (PPSTI), to nominate representatives involved in high-level governmental decision-making in the field of climate-related emergency preparedness and climate information and services. As a result, a number of APEC representatives from the government, especially those who are responsible for climate prediction and/or services and its application for disaster risk management and related decision-making processes, attended the event.

In organizing the event, the project team strived to achieve a gender balance in speakers and participants and actively sought out participation from developing economies and women. As a result, this project achieved an almost one-to-one gender ratio of 213 females and 215 males amongst participants.



Participants attended from 26 economies, including 20 APEC member economies and 6 non-member economies.



The workshop drew a total of 428 attendees from a range of public sector stakeholders including disaster risk management, meteorological and hydrological agencies, academia, NGOs, and experts from international organizations.

Economy	Participants	Economy	Participants
Australia	2	Peru	1
Brunei Darussalam	1	the Philippines	239
Canada	3	Russia	7
Chile	2	Chinese Taipei	35
People's Republic of China	2	Thailand	6
Hong Kong, China	1	The United States	2
Indonesia	3	Viet Nam	3
Japan	4	Bangladesh	1
Republic of Korea	27	Ethiopia	1
Malaysia	75	India	2
Mexico	4	Portugal	1
New Zealand	2	Samoa	2
Papua New Guinea	1	Ghana	1
Total Participants	428		

Targeted project outcomes are considered as achieved based on participants' feedback.

1. Increased international dialogue and cooperation on communication strategies of climate information

- A majority of participants feel that we are in the middle of climate change, and thus participants recognize the i) necessity of increased understanding on climate change and extreme climate events; ii) importance of communication of climate information, and; iii) link between climate information services and disaster risk management
- The symposium provided an opportunity for participants to learn effective climate information communication strategies and collaboration efforts currently being implemented in other member economies for their reference
- Climate information providers were given a chance to better understand the challenges and needs of users, while climate information users were able to better understand the scientific and technical characteristics which hinder providers to provide very user-friendly information. This promoted a mutual understanding of stakeholders and exchange of views on communicating climate information services

2. Increased capacity to manage climate information services and user-friendly communication strategies

- A number of participants were interested in gaining knowledge and building capacity towards climate change, climate crisis, extreme climate events, their impacts, and responses. They said this Symposium served as a great tool for their knowledge and capacity building

- Participants recognized the importance of climate science education to better understand climate change. Various case studies and data were shared for participants in order for them to benchmark or use them as references for their work
 - This event raised awareness on the importance of climate education on climate change and extreme climate events for the public, as well as communication and collaboration among climate scientists, decision-makers, government, and users, in addition to the production of climate information
 - 26% of survey respondents responded 'low' to their levels of knowledge before the event while only 1% of respondents graded 'low' after the event. On average, the level of knowledge was 3.08/5.0 before the event and increased to 4.16/5.0 after the event.
3. (long-term) Applied policy recommendations in shaping domestic plans for communicating climate information
- Participants are planning to utilize the topics and contents of the Symposium for their work planning.
 - This event promoted the importance of communication of climate services, user-oriented climate information production and provision, and the linkages between climate information and relevant sectors including agri-meteorology, agri-climate, early warning, disaster risk management, etc.

From the expert presentations and discussion, some key recommendations and best practices were shared. The key suggestions and recommendations are listed below:

- i) COVID-19 is heavily impacting weather observations and forecasts as well as atmospheric and climate monitoring. A lack of observations over any area impacts the quality of the forecast and analysis products. While the global observation system is either partly or fully automated, some parts have already been severely affected by COVID-19. For instance, aircraft observations have declined by 80% in general, and by close to 90% in the tropics and the Southern Hemisphere since early February. Also, the availability of surface data has decreased significantly, especially in Africa. Ocean observations have declined by 80% compared to the pre-COVID-19 baseline. Thus, there is a need for the transition to automated observations, which will improve the frequency and resilience of reporting.
- ii) The COVID-19 pandemic has compounded the dual challenge presented by environmental challenges and health crisis. To encourage a risk-informed, resilient recovery in post-COVID-19, climate information should play a role in providing basic data and other services for disaster risk or emergency management.
- iii) There are various groups of stakeholders conducting climate-related projects, but the most important aspect is to have a mechanism to enable good complementarity between each initiative. Thus, it is recommended that we navigate the very complex network of actors that are involved in the provision and uptake of climate services and center users in decision-making.
- iv) For climate communication of climate services, effective and comprehensive institutional collaboration in conducting projects and programs that are supporting climate information services, as well as a focus on projects and programs, and building the core capacity of Meteorological agencies of

member economies, will enable them to most effectively use the information available and tailor products and services for their stakeholders.

- v) There is a growing demand for Climate Information Early Warning System (CIEWS) around the world. Climate information, early warning services, and the broader resilience landscape have the market potential for unlocking private sector investments and participation. This will lead to scaling up currently existing and growing commitments across the global, continental and domestic scales such as the Paris Agreement, Sustainable Development Goals, Sendai Framework, and Global Framework for Climate Services. This will serve as a unique opportunity to enhance the coherence and complementarity of investments while leveraging private sector finance, public budgets, and public-private partnerships.
- vi) Governments are not only consumers but also sellers of climate services to businesses and other consumers in integrating the information into decision-making process. Thus, working closely with governments will bring synergy to stakeholders.
- vii) To support and improve climate information dissemination through a platform, regular and interactive working mechanisms among relevant government departments, industries, and stakeholders will play a role in minimizing inaccurate and outdated data collection, distribution, and access. ICT, big data, and other digital technologies can be used as well.
- viii) A practical strategy to successfully deliver climate information services to end-users is to put users at the center of climate information service development in order to engage, support, and bridge the gap between community groups and providers of climate information.
- ix) Formally engaging intermediary organizations starting from the development of climate-related projects with enough recourse to serve the function will facilitate taking the information produced from the invested infrastructure and science development to the last mile, and end-users to maximize their impact.
- x) The sustainability of climate-related projects highly depends on capacity building, and effective communication of the most reliable information can be done through capacity building of the users.
- xi) It is recommended that following a climate crisis, a post-event analysis documenting the outcomes/impacts, as well as evaluating the forecast information provided in advance of the event, can assist in preparing for the next climate crisis. This should also include acknowledgment of the changing climate and the increasing intensity and frequency of extreme events. How rare was the climate crisis in a historical context? What, if any, attribution can be made? What is the relative frequency and intensity of the event, and will these types of the event become more or less frequent?
- xii) Forecasts should be provided at all relevant timescales and outlook periods to meet the variable needs of decision-makers across all impacted sectors, which would lead to increased uptake of climate information.
- xiii) Running documentation of any climate records broken or likely to be broken during the event aids in communicating the severity of the event, and can influence decision making around the event. For example, if the public is made

aware that the upcoming event is rare and outside of their lived experience, it may have a greater influence on their decision-making and response, leading them to take greater and timelier steps to ensure their safety. This requires a strong and extensive data record.

- xiv) It is important to make information relevant for decision makers to enhance the use of a climate information service in response to a climate crisis. The information providers should tailor the information provided so that users can make relevant decisions. In addition, building trust is key, as trust enables warnings of likely severe conditions to be heeded and acted upon. It is essential to have long standing relationships built up over years, and this trust increases the ability of the users to be able to identify the potential application and utility of the climate information that providers produce. Lastly, education should not be underestimated. In regards to seasonal forecast information, customers are more satisfied and comfortable with using seasonal forecast information when they understand the science. In this regard, it is suggested that climate science subjects be integrated into the basic education curriculum.
- xv) The most important thing that makes the currently existing tools, products, and services valuable is the broad dialogue of sustained engagement along every time-scale of early warning information systems. We need to broaden the actor network across the risk management-to-resilience continuum and work with financing agencies on where to target investment that allows for emergency recovery but also helps with long-term planning.
- xvi) For complex problems, such as responding to the climate crisis, communication is critical but not sufficient. Joint visioning across communities, public and private sectors and NGOs, policy development, implementation path to the sustainable future, and sustainability of those collaborative learning networks are the key. Collaborations among those who monitor, forecast impacts and scenarios, and plan for preparedness communication must move together as an integrated climate services system

Participants Feedback

In order to measure the success of this project, participants were requested to respond to a post-event survey on the efficiency and outcomes of the symposium, specifically on whether the objectives were met and if the information shared was able to bring about changes after the event. The survey included questions that compare the participant's level of knowledge prior to and after attending the Symposium. The survey also investigated the satisfactory level of the event organization and contents, as well as if any changes are likely to be placed into effect in the near future to evaluate the possible mid-term effects of the project. The gender aspects of the Symposium have been specifically highlighted by using gender-disaggregated data in analyzing the participation rate of both the invited panelists and participants.

Total 103 participants responded to the survey.

	Strongly agree	Agree	Disagree
1. The objectives of the training were clearly defined	67	36	0
	65%	35%	0%
2. The project achieved its intended objectives	37	64	2
	36%	62%	2%
3. The agenda items and topics covered were relevant	68	35	0
	66%	34%	0%
4. The content was well organized and easy to follow	59	41	3
	57%	40%	3%
5. Gender issues were sufficiently addressed during implementation	41	60	2
	40%	58%	2%
6. The trainers/experts/facilitators were well prepared and knowledgeable about the topic	69	34	0
	67%	33%	0%
7. The materials distributed were useful	40	58	5
	39%	56%	5%
8. The time allotted for the event was sufficient	49	47	7
	48%	46%	7%

Responses indicated that participants, in general, held positive perceptions of the event in terms of clearly defined objectives, with 98% of the respondents selecting 'excellent' or 'good'. Regarding participants' views on whether it achieved its intended objectives, 88% agreed that this project achieved its intended objectives. Moreover, all participants responded that the agenda items and topics covered were relevant to them. Except for 2% of participants, respondents said gender issues were sufficiently addressed during the implementation of this project. This may be contributed to the PO efforts in selecting experts as well as inviting representatives from APEC member economies while considering gender balance. All respondents answered that the trainers, experts, facilitators were well prepared and knowledgeable about the topic.

Moreover, participants indicated considerable knowledge gain across all the discussion topics. Most importantly, the rate of participants who indicated 'high' for their knowledge and skills after the event increased by 42%.

In terms of the material of the event, 95% of respondents agreed that the materials distributed were useful. Some comments were given by participants as Session II did not have any presentation files, as the session was designed to be a panel discussion session, where experts were given specific questions by a moderator to share their experience and insights without the restriction of prepared presentation materials in order to facilitate active discussion amongst the panelists and audiences. However, with this feedback, the PO has seen that pre-distributed presentation files are helpful for audiences, especially for virtual events. While 93% of respondents agreed that the time allotted for the event was sufficient, 7% of them felt that the time was not sufficient to cover this important topic. Before COVID-19, the APEC Climate Symposium was an offline three-day event, allowing the PO to design the event with many presentations, the allotted time for discussion, and networking amongst experts and participants. Due to the COVID-19 pandemic, the event was held online, which limited this type of opportunity to fully cover topics and have adequate time for an active discussion.

Participants suggested the following the improvements for a future event:

- Presentation materials for discussion will help participants follow the discussion more easily for an online event
- Participants suggested including talks on the economic impact of climate change and its response, and case studies from climate change responses of climate-vulnerable economies, and inviting high-level local government officials for future events
- Participants would appreciate more in-depth discussions on certain topics with an expert through formats such as breakout sessions
- Many acknowledge the importance and severity of climate change, climate crisis, and climate extremes and thus request continuous event organization to facilitate the exchange of knowledge and experience through the Symposium
- Training programs and consultations would be helpful to improve the application of knowledge and know-how gained from the event

[Annex I: Proceedings]

PROCEEDINGS OF THE APEC CLIMATE SYMPOSIUM 2021

INNOVATIONS IN CLIMATE COMMUNICATION FOR ENHANCING HUMAN
SECURITY

TO MANAGE RISKS OF CLIMATE EXTREMES

VIRTUAL

13- 14 JULY 2021

This document summarizes the presentations and discussions from the APEC Climate Symposium (APCS) 2021, held virtually in cooperation with the Malaysian Meteorological Department (MET Malaysia) on 13-14 July 2021.

Acknowledgements

The APEC Climate Symposium 2021 was organized by the APEC Climate Center (APCC) with collaborative support from the Malaysian Meteorological Department (MET Malaysia) with institutional support from the Asia-Pacific Economic Cooperation (APEC).

APCC would like to extend its sincerest thanks to its invited speakers, honoured guests, and all participants for their contributions to the event's success.

Overview

1. The APEC Climate Symposium 2021 was conducted from 13-14 July 2021 virtually. The meeting of the APCC Working Group was also held in conjunction with the event.
2. The event was attended by more than 500 participants from 23 economies – Australia, Bangladesh, Canada, Chile, People’s Republic of China, Ethiopia, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Samoa, Chinese Taipei, Thailand, The United States, and Viet Nam. The participants included invited speakers and discussants, representatives from domestic Hydrological and Meteorological Services, government officials, private sectors, non-governmental agencies, and academia. Experts from a diverse range of backgrounds, including climatology, disaster risk management, water resources and international development were invited to discuss better enhancing climate crisis preparedness through climate service and exploring innovative communication strategies for effective climate services. A complete list of participants can be found in Annex I.

Executive Summary

3. The APEC Climate Symposium 2021, which focused on “Innovations in Climate Communication for Enhancing Human Security to Manage Risks of Climate Extremes,” aimed to support regional technical cooperation, strengthen climate resilience, and produce impactful recommendations for communication strategies for managing climate risks under climate crisis. In the first session, speakers shared their experience in implementing climate information services particularly in disaster risk reduction and water management. Expected roles of climate information providers were shared in order to make climate information more applicable in the Asia-Pacific region. Also, speakers suggested recommendations to enhance the coordination and use of climate information services to inform decision-making in response to the climate crisis. The second session, Exploring Innovative Communicating Strategies for Effective Climate Services, focused on the needs for effective climate information communications strategies given the status of the climate crisis and challenges they face when communicating the climate information. Also, effective strategies or solutions for better communicating climate information were suggested. Experts brought together their varied experience and knowledge to build a more cohesive idea on how to enhance climate crisis preparedness through climate services, strategies for better communicating the climate information for the societal benefits including disaster risk reduction and the roles of scientists and users to

promote communication amongst relevant stakeholders to make climate information more applicable to the society.

Opening Ceremony

4. The APEC Climate Symposium 2021 opened virtually on Tuesday, 13 July 2021. The Opening Ceremony began at 10:00AM (KST) with Ms Sangwon Moon, the head of the External Affairs Department at the APEC Climate Center (APCC), opening the ceremony and welcoming everyone to the event. She also thanked the co-host from the Malaysian Meteorological Department (MET Malaysia) for their help putting together the event. Ms Moon then introduced Dr. Won-Tae Kwon, the Executive Director of APCC, for her Opening Remarks. Dr. Kwon started her Remarks by sending her appreciation to the co-host and participants and spoke about the importance of the effective communication of climate information in disaster risk reduction. **Mr Muhammad Helmi Abdullah**, the Deputy Director General of MET Malaysia conveyed the Welcome Remarks by the Director General of the Malaysian Meteorological Department. He spoke about the importance of close cooperation and continuous discussion to further improve our capabilities in dealing with meteorological-related disasters. The session was closed with a virtual group photo.

Session I: Enhancing Climate Crisis Preparedness through Climate Service

5. Session I, chaired by Prof. Jeongin Kim, professor of the Department of Economics at Chung-Ang University in Korea, started at 1:00AM UTC on 13 July 2021. This session shared efforts and challenges in implementing climate information services in disaster risk reduction and water management. Expected roles of climate science to enhance climate crisis preparedness especially in application sectors including, but not limited to, water management were discussed. Insights on the changing nature of climate-related risks and human security and member economies' effort to increase resilience and mitigate around extreme events were explained. Recommendations to enhance the coordination and use of climate information services to inform decision-making in response to the climate crisis were suggested as well.
6. **Dr Ahmad Fairudz Bin Jamaluddin, Director, Atmospheric Science and Cloud Seeding Division, Malaysian Meteorological Department, Malaysia**

Dr Ahmad Fairudz Bin Jamaluddin started his presentation by talking about extreme weather phenomena in Malaysia. Malaysia experiences two monsoon seasons; namely the Northeast monsoon which starts from November to March and the Southwest monsoon which is normally occurred during May to September. The monsoon floods are strong and they come up with strong wind and rough seas. In the meantime, heatwave can also be expected to occur over the states in Peninsula of Malaysia in the month of January, February and March. During the Southwest monsoon, less rainfall is expected over the Malaysia. Droughts, forest fire and haze can be occurred during this season if the drought is extended. In between of those monsoon seasons, there is an inter-monsoon season which occurs in April and October. Strong thunderstorm is accompanied by the heavy rainfall with more than 50mm per hour. Strong wind which can reach more than 100km per hour and lightening is common event that normally comes with storm. In fact, that waterspout is also more evident during this time. **Over the recent years, the occurrence of these extreme weather events in Malaysia has increased.** As other Meteorological services, MET Malaysia has a Weather Monitoring, Warning and Forecasting System, including the radar system, the satellite, observatory station, upper air station, tide gauge and webcam. For the data that are collected from all these systems will be analyzed using the NWP. The forecast information or the weather warning are issued to the aviation, military, fishery and shipping, agriculture, oil and gas, sport and recreation. Weather warnings are also issued to the disaster management agency and also to the public. One of the main tasks of MET Malaysia is to come up with good and efficient early warning system. He explained four main components of the early warning system. First, forecasters should have the **disaster risk knowledge** of the hazards and the vulnerabilities. The second one is **monitoring and warning system**. Forecasters need to monitor the hazard in order to forecast hazard evolution and issue the warning when necessary. Third one is **dissemination and communication**. The disaster management agency should understand the warnings and get the preparation ready prior to the expected events. For dissemination, Malaysia uses TV, radio, and all the mass media communication such as Facebook, Twitter etc. The last one is the **response capacity**. The target audience or the public need to have knowledge, plan and take appropriate action especially for those at high risks.

Then, he shared MET Malaysia's challenge as a forecaster. One of the biggest challenges is to produce **reliable forecast**. As Malaysia is located over the tropical region, the development and movement of Mesoscale Convective System are difficult to forecast. Also, the short

drought period was mentioned as another challenge, which is modulated by **sub-seasonal climate phenomena such as MJO, which is not a seamless prediction**. Also, difficulty in providing forecast information during the extreme weather such as thunderstorms as current weather model in Malaysia is unable to simulate strong wind that associated to thunderstorm.

He explained that Malaysia monitors a fire and haze event, based on API Index as well as the hotspot and low visibility over the meteorological station throughout the states and regions. For the forecast, MET Malaysia utilizes specific forecast and monitors the sub-seasonal forecast issued by the other agencies. Ahmad also described that MET Malaysia does cloud seeding when API is more than 200 and challenges include a lack of observational data and limited remote sensing data, and the fact that MET Malaysia is solely dependent on its NWP model for forecasting and issuing the warning.

In terms of climate change, he explained Malaysia monitors the current level of climate change by monitoring the Green House Gas (GHG), climate model and climate trend. He highlighted that there is no doubt that the role of relief assistance during the crisis remains important and need to be enhanced at all levels. However, much greater intention needs to be given to preventive strategies that can be contributed to saving lives and protection assets before they are lost.

Dr Jamaluddin finalized his presentation by stating that, the accuracy and effectiveness of severe weather warnings has led to reduction in loss of lives and properties during weather related disasters. **The accuracy and effectiveness of early warning system can be enhanced by improved scientific understanding and technology and modelling, and increasing community awareness.**

7. Prof. Mayzonee V. Ligaray, Associate Professor, Institute of Environmental Science and Meteorology, University of the Philippines, the Philippines

Prof. Mayzonee V. Ligaray, explained the water-related challenges in the Philippines, including floods, landslides, tsunamis, drought, and heat waves. **Extreme events such as flooding and drought have increased its frequency and they lead to soil erosion and stream flow variation** which can transfer macro or micro pollutants to water bodies. Despite the abundant water bodies surroundings are respected, water shortage is still a threat to our daily lives. Considering all these water-related issues, **it is important for us to monitor our water**

resources, assess the impacts of climate changes and anthropogenic activities, and establish a water management system. These days, environmental models are often used to perform the activities required for these three objectives. She mentioned that for the implementation of climate information in water management, the most important diagram that needs to be understood is the **hydrologic cycle**. The hydrologic cycle is sensitive to any changes in the environment including the climate. Any changes in the climate caused by anthropogenic activities and natural events will have impacts on the water cycle. This impact can be accumulated and eventually lead to hydro-hazards. This is the reason why climate information is essential to the field of hydrology in general. When hydrologic models are built, the goal is to simulate the processes found in the hydrologic cycle and make the model to represent the actual hydrologic processes in the study area. That will help to understand how water moves in the environment which can give an idea of how water resources management could be improved. To achieve this, **it is important that the climate or weather data acquired is reliable since this will be reflected on the performance of water models.** She shared her experience of utilizing climate information in her research and **highlighted that incorporating climate change scenarios in hydrologic models could help us improve the existing policies regarding water management to achieve more sustainable future when it comes to water availability and the protection of the water resources.**

She pointed out that one of the challenges regarding climate extreme events such as typhoons are that **there is a lack of climate science awareness by the greater population.** Prof. Ligaray mentioned **the importance of integrating climate science to the basic education.** Promoting climate science awareness will also improve the climate crisis preparedness. Understanding the causes and effects of flooding and other hydro-hazards can help us find solutions in mitigating existing challenges as well as prepare for future flood events.

She finalized her talk by stating that climate science is an important tool in explaining the occurrences of hydro-hazards and aid people in preparing to be more resilient under changing climate. She also mentioned that it will be advantages for hydrologists to obtain reliable climate data from climate information providers to make climate information more applicable in water sector. Climate is crucial in simulating the hydrological processes in environmental models. **Making climate information easier and more convenience to download will facilitate the use of currently available climate information more widely.**

8. **Roger S. Pulwarty, Senior Scientist, NOAA Physical Sciences Laboratory, USA**

Dr Roger Pulwarty began his presentation by describing the changing nature of risks, nature of how we use information, the variety of knowledge that is available, and how that can inform and improve services that lead economic, environmental goals and also serve the needs of local communities. He mentioned that the **nature of the physical risk is changing** and, in some ways, we do not fully understand. He explained about the Global Framework for Climate Services (GFCS) and looked into how we develop in climate services to provide climate information to help individuals and organizations make climate smart decision. The Climate Service Information System (CSIS) component of the GFCS is the principle mechanism through which information about climate of past, present and future is being routinely archived, modelled, analyzed, processed and communicated. He also defined the Climate Services Information System as a system coherently organizes different types of climate information and facilitates technical assistance to help decision makers understand how to integrate climate information into their planning processes. In this regard, **information development chain** was introduced and this includes observations, modelling, forecasting and service delivery, which is very complex as it requires communication processes and value-adding processes. Basic and specialized services are requested to different users and the use of service production in decisions and actions in order to add the value to the services is another process. The link is to connect this information development chain with the service delivery value chain. Roger highlighted that the most important thing is how different communities and economies can make sense of very vast array of data available, and data that is also changing over time from the past, present and into the future.

During his talk, he emphasized that the most important thing that makes the **currently existing tools, products and services valuable is the broad dialogue of the sustained engagement along every time scale of the early warning information system** with an example of Caribbean Regional Climate Centre. This regional consortium is a key regional mechanism that champions the design, development and delivery of tailored climate products and services in the agriculture and food security, disaster risk management, energy, health, tourism and water sectors.

He also shared NOAA's role in climate services by explaining the existing NOAA Regional Climate Services Network and Climate Resilience Toolkit, which aims to enhancing and simplifying access to climate science data and information, including projections. **NOAA's Climate Resilience Toolkit** can be accessed at climate.gov website and it provides easy and robust access to climate projections for designers to provide adaptation/resilience decision services to their end users and consumers. It also conceives and articulates an overall plan for how USGCRP agencies may make their climate-related web presence more cohesive, coherent, and user friendly. Integrated Science and Assessment, a network developed in USA to do the impacts and needs assessments of the users and help to deliver the information produced by the regional centers was introduced as well. It is the network that enables people to choose from the variety of information and when to apply it. Without the network of people, the information or services could not be as useful as they could be. Thus, the key is **governance of the information and services. It is very important to know how we manage, understand, use and finance on climate information and climate information services for meeting economic environmental goals.**

He added that the **traditional risk assessment and emergency management approaches are increasingly being challenged by systematic and evolving impacts of compound extremes, biodiversity loss, economic and other instabilities.** For instance, New Orleans in the United States faced some major crisis with hurricanes and flooding from upstream and it was difficult to respond and shelter people due to COVID-19 which has little to do with climate. In this regard, we need to **navigate not just for climate change but through a changing climate** in understanding and characterizing these cascading and compounding nature of structural and systemic climate risks, and then identify where the investments and financing can be prioritized. Dr. Pulwarty also emphasized the importance of **making the link between risk management and resilience, ensuring the coherence among the different agencies and different departments, developing the culture of partnerships** instead of taking co-production for granted, and working with lower communities. The most critical thing is **how to best link emergency management responsibilities and the decision-making for climate-related resilience.** We need to **broaden the actor network across the risk management to resilience continuum and work with financing agencies on where to target that kind of investment** that gets us at emergency recovery but also helps us to plan into the long-

term, considering that partners do share not only data but also responsibilities.

Dr Pulwarty lastly mentioned that for complex problems, communication is critical but not sufficient. We need to recognize the resilience as an iterative learning process. **The joint-visioning across communities, public, private sectors, NGOs, the policy development, the implementation path to the sustainable future and the sustainability of those collaborative learning networks are the key. The collaboration among those who monitor, forecast impacts and scenarios and plan for preparedness communication has to move together as an integrated climate services system.**

9. **Dr Lynette Bettio, Team lead, Extended and long-range forecasting, Climate Environmental Prediction Services, Bureau of Meteorology (BoM), Australia**

Dr Lynette Bettio began her talk by describing how extreme events are changing in Australia. **Extreme events in Australia are becoming more severe, and; thus, we have increased risks of more frequent and intense extreme events.** Also, they are seeing **extremes that have not been observed before.** In addition, the **compounding extreme events such as long-term drought and heatwave are seen as well.** One way Bureau of Meteorology (BoM) addresses these is to **bring awareness and education around the changing risk landscape, so called 'climate report for Australia' which is released every 2 years and it gives details of how Australia's climate is changing and has a media event and media talks about it to the public.** Between the releases of each report, BoM gets the timely information. They go out and strongly communicate the contents of the report to sectors and how they are going to be impacted into the future. For instance, they communicate how rainfall input is changing to the water sector. She highlighted that the natural hazards of the future will not be the same as the past and many hazards will be more intense and happen more often and unprecedented combination.

Dr Bettio then introduced '**Australian Climate Service,**' new program that was only announced couple of weeks ago. In response to the severe bush fires season in Australia, they worked very hard to **highlight the changing risks and the need to plan for that changing risk into the future with climate services.** For the seasonal forecasting services in Australia gets over 20 million web hits a year. **Through this webpage, general idea on current climate is provided to the public. One of the influential communication ways**

was to do the monthly video through public TV shows. It helps to **educate people about what the conditions have been and what conditions are coming up for the coming season.** She also introduced '**Climate Driver Update**' which looks at those overall drivers that have been impacted in Australia and this has a high number of viewership from different sectors such as water emergency services, government, university, finance, etc.

She emphasized that it is important to make information relevant for decision makers to enhance the use of a climate information service in response to a climate crisis. What information does the customer actually need and what decisions are they trying to make from that information are the key. **The information providers should tailor the information when providing them so they can make those decisions.** In addition, **building trust is another key as trust enables warnings of likely severe conditions to be heeded and acted upon.** It is essential to have **long standing relationship built up over a number of years** and this trust increases when they see the application and utility of climate information that providers produce. Lastly, **education should not be underestimated.** With the seasonal forecast information, customers are more satisfied and comfortable with using the seasonal forecast information when they understand the science.

She added that BoM does work directly with decision makers. **Prior to each season, BoM gives a number of standardized briefings across Australia prior to the severe weather season throughout all levels of the government and multiple emergency service agencies** in order to ensure that every stakeholder is getting the message with consistency, including fact-based scenario planning to stress the test systems. It also includes preseason briefing to emergency broadcasters so they are educated and aware of the likely issues.

Lynette then shared an example of **BoM's collaboration with emergency services in Australia to provide relevant public safety messages** in the face of increased chance of La Nina which means increased chance of flooding in the region. They demonstrated "A car can float in just 15cm of water" and reinforce the public safety message consistently throughout the season to remind people of that action of not driving through flood water.

She also mentioned that **timely information is important to enhance the use of climate information. Prior to the preseason, BoM**

provides information on how unusual certain event is and if there are any records or near records to help public understand the extreme event. She said this information can influence actions. It can also reinforce the risk information provided and highlight the need to incorporate climate information into future planning. These information provided in the pre-season briefing helps recovery, resilience and preparedness for the next event.

In terms of accommodating the uncertainty of climate information in implementing climate information services, she suggested **building trust is a key. A long-standing relationship** demonstrating the application of information to those needs over time builds up a strong relationship of mutual respect and trust. This type of trust enables warning of likely severe conditions to be heeded and acted upon. BoM also provides **education program to help general audience interpret climate outlooks so that people can incorporate that information into the decision.** She mentioned that if customers are more aware of probabilistic nature of the forecasts and applications, they are more likely to trust the information provided. If there is a physical mechanism such as ENSO or IOD which may be influencing the forecast, there can be more confidence placed in the forecast, meaning customers are more likely to use the information.

She finalized her talk by sharing Australian Climate Service's large coordinated response of emergency services: delivering the climate information to support emergency services and target climate adaptation, this service brings together best scientists to help better anticipate, manage and adapt to climate impacts now and for generations to come. By being more prepared, we can reduce the impacts of disasters and make our communities more resilient.

10. **Questions & Answers**

There was a question from the audience of how to define if the disaster is due to climate change or climate variability. Dr. Pulwarty explained that NOAA does attribution studies to analyze to what extent is this event or sequence of events influenced by climate change. Dr. Bettio added the importance of post-event analysis in order to give decision-makers for emergency services framework for their planning. Also, the importance of education on both climate change and climate variability was mentioned. Dr. Jamaluddin mentioned that climate variability can be excluded from the climate change as climate change is the combination of the anthropogenic activities and climate variability of all

the natural climate and the climate variability is how the climate responds to the increasing temperature due to anthropogenic climate. In terms of communicating climate information, Dr. Pulwary highlighted that it is **important to work with people to show their up-front investments pays them back immediately**. Water efficiency, behaviour practices, green infrastructures and energy and water actually **produce benefits for communities and the economic benefits are shown almost immediately**. Relevant stakeholders from climate service providers to policy makers are encouraged **to build the trust that the use of climate information brings benefits to the society both in a short term and longer term**. Dr. Bettio also added that it is necessary **to communicate general public in a plain language**. For instance, talking about extreme heat events rather than temperature increase in 1 degree is more meaningful to people as most people in Australia have actually experienced extreme heat.

Speakers brought up the issues of actual needs in terms of climate services interface and Prof. Ligaray mentioned it is important **to integrate climate science into a formal education system**. Dr. Bettio also addressed that climate communication is about how to communicate the climate information. People are becoming more aware of that now and some universities in Australia offer climate communication as a part of the course.

Then, Prof. Jeongin Kim, a moderator for the session concluded this session by appreciating all the speakers and participants for their active discussion.

Session II: Exploring Innovative Communicating Strategies for Effective Climate Services

11. The morning session of July 14th commenced at 1:00AM UTC online. Session II discussed views on the needs for effective climate information communications strategies given the status of the climate crisis and challenges we face when communicating the climate information. Also, effective strategies and solutions for better communicating climate information were suggested. The Session was chaired by MrSanny Ramos Jegillos, Senior Advisor and Team leader of Disaster Risk Reduction and Resilient Recovery for Building Resilience, UDNP Bangkok Regional Hub.

12. Mr Sanny Ramos Jegillos, Senior Advisor/Team leader of Disaster Risk Reduction and Resilient Recovery for Building Resilience, UNDP Bangkok Regional Hub

MrJegillos opened the session with his opening remarks. He began by noting the collaboration between UNDP and the APEC Climate Center. In 2015 and 2016, the strongest El Niño of the 21st century occurred in the Asia Pacific region and UNDP, APEC Climate Center, UNOCHA, UNESCAP and RIMES collaborated in publishing a policy brief, titled to “Enhancing Resilience to Extreme Climate Events: Lessons from 2015-2016 El Niño event in Asia and the Pacific” on how to better respond to the El Nino event in 2015 and 2016. The result was shared through a sub-regional workshop in Bangkok and other locations. In addition, sharing his recent experience of reviewing an upcoming book on El Nino, he said it was remarkable to know the improved relevance of climate information for decision making and policy making, for sectoral planning, contingency planning and in response compared to earlier times in 1997 and 1998. However, he also mentioned that there are some challenges remain and highlighted a collaborative effort among various sectors at a global, regional, and local and community level is necessary.

He mentioned that **the Asia-Pacific region is the most disaster-prone region in the world**, with the communities that live here facing ever greater risks from disasters, with climate change further increasing disaster risks. The pandemic has added to these existing risks through increasing vulnerability and affecting livelihoods, while several economies in the region have had to respond to one or more disasters taking place during the pandemic.

The importance of ensuring people’s access to climate information is highlighted in the global development frameworks. The Sendai Framework for Disaster Risk Reduction mandates the significant reduction of disaster risks to safeguard lives, livelihoods, and economies. Target G of the Sendai Framework aims to ‘substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.’ Likewise, early warning systems are identified in Target 13.3 of the Sustainable Development Goals (SDGs) to, quote, ‘Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning’.

He added that **UNDP is helping Governments to achieve these Targets of the Sendai Framework and SDGs by institutionalizing Governments' efforts on communicating climate information to communities so that during emergencies, Governments can provide this critical information and relevant support in a timely manner to reduce communities' disaster risks.** For example, the Government of Bangladesh responded successfully to Cyclone Amphan, which was the most powerful cyclone to strike Bangladesh in 20 years. The cyclone made landfall in May 2020, while it was under lockdown due to COVID-19. The **Standing Orders on Disasters were the key factor to this success** as they clearly outlined both the roles and responsibilities for the Government and the participation and coordination between a wide range of stakeholders, and these Standing Orders were developed with support from UNDP. Immediately after Cyclone Amphan was detected, the Government implemented the Standing Orders on Disasters. As a result, the Ministry of Disaster Management and Relief mobilized field-level administrators, and before the cyclone made landfall, the Cyclone Preparedness Programme (CPP) board initiated evacuation procedures as outlined in the COVID-19 contingency plan and mobilized local CPP volunteers who were in charge of disseminating the early warning to communities and bringing people to the evacuation shelters. Over two million people were evacuated to the cyclone shelters whilst practicing social distancing to prevent further infections.

He also explained UNDP's role in **supporting Governments to ensure that communicated climate information is targeted at and actionable by vulnerable groups, including women, persons with disabilities, and the elderly.** To support the effective communication of climate information to women and help women feel safer in taking an action to early warnings in Bangladesh, UNDP provided trainings to CPP volunteers and supported the recruitment of women, such that during the 2019 Cyclone Bulbul, a third of CPP volunteers were women. These volunteers played a crucial role in supporting the evacuation of women and children. **UNDP is also supporting Governments to communicate climate information in adequate formats which can be accessible and understood by persons with different types of disabilities,** but there is still much more that can be done to support this.

After his remarks, he introduced distinguished panelists for the session, Dr WonMoo Kim from the APEC Climate Center (APCC), Dr. Joseph Daniel Intsiful from the Green Climate Fund (GCF), Dr. Olivia Warrick who has been working at the interface of climate science, practice and

policy in the Pacific Islands region for over a decade, Ms Guan Yan from the International Cooperation Department of Domestic Disaster Reduction Center, Ministry of Emergency Management of China, and Ms Mary Moeono-Kolio, a young Samoan professional advocating for the education of Pacific young people and their participation in decision-making for climate change.

13. Discussion topic - What are the needs for effective climate information communications strategies given the status of the climate crisis?

For this topic, Ms Mary Moeono-Kolio began her discussion by sharing the current status of climate crisis in the Pacific region. She said the Pacific Islands only contribute less than half a percent of the world's global emissions but it is Pacific people and their economies who are facing existential threat from climate change and global heating which driven sea level rise. She emphasized that global sea level rise is critical threat to the Pacific Islands economies with the fact that the sea level is currently rising twice as faster than the average in the 20th century. This means that once inhabitable areas are being solidified by the sea, and the communities are being forced off the land and being displaced. Sea level rise has also led to increasing salinization of agricultural land across the Pacific Island economies, which is also exacerbated by various other issues. **Pacific Islands are particularly experiencing increased intensity of cyclones leading to the devastation of the region** and Pacific has recently got hit by cyclones for a few years. For instance, cyclone Pam struck Vanuatu and it caused a wide spread of damages across all 6 provinces in 2015. In 2018, category 4 tropical cyclone Gita devastated Tonga and it was the worst storm that the Tongan economy has seen in 60 years. Gita caused flooding, displacement and destruction of significant landmarks in Tonga. Last year in 2020, cyclone Harold devastated communities in Solomon Islands, Vanuatu, Fiji and Tonga. She also added that the **climate crisis has exacerbated drought conditions in the Pacific**, a situation that has been particularly devastating for atoll islands whose freshwater sources are already scarce. One of the most severely affected was Tuvalu, whose government declared a state of emergency in the face of a water shortage. Mary also highlighted the fact that climate impact risks are lower for a temperature rise of 1.5°C compared to 2°C, and that half a degree is critically important for the future of the Pacific.

Then, she through a question to the audience of the purpose of effective climate information strategy. From a youth perspective, she

addressed that there is much misinformation when so much information is available to young people as well as limited access to the information. **She emphasized that a plenty of data and information does not create any value unless being accessed and utilized.** In addition to policy makers and decision makers, it is valuable to be directed to every people who are influential. **A lack of digital infrastructure was mentioned as a barrier** for the Pacific to be accessible to climate information, and; thus, much of the information is accumulated in governments only and it is not being delivered to the community and to young people who could bring data and information produced to life.

Dr WonMoo Kim shared his views on this topic by discussing the value of climate information in response to climate crisis from a climate scientist's perspective. He said providing information as accurate as possible should be the top priority of the climate information providers' but what is equally important is to make sure that the information is communicated in a way that the users can understand the entire information on a level where they can fully take advantage of the information. He was confident that the quality of currently existing information is good in terms of different time-scales of weather forecasting, sub-seasonal and seasonal climate outlook, and global warming projections. However, the question is how we connect the dots and how we bridge the gap between the currently available high-quality climate information and the users that ultimately create value from the information. In this regard, he shared APCC's project experience of providing climate information to various sectors such as agricultural planning, disaster risk reduction, and natural resource management. He also shared an example of a user-defined threshold alert that can be utilized by the sectoral experts and authorities in their decision-making. He highlighted that **climate information becomes valuable only when we can truly connect the dots through effective communication.**

Ms Guan Yan continued the discussion by sharing her thoughts on needs on climate information services in disaster risk management. First, she commented that a comprehensive and holistic approach needs to be taken to address systemic risks. Climate change and natural disaster are both common challenges faced by the APEC region. Effectively dealing with disaster risks is an essential way for climate change adaptation while climate information is pivotal to finding feasible solutions to disaster risk reduction.

She also added that weather factors are affecting disaster risks in various ways. On one hand, they are causing an increase both in the number and the severity of natural disasters. On the other hand, climate change may result in environmental degradation, damages to ecosystem, food shortage, water scarcity, and changes to livelihoods, which increase the vulnerability and exposure of economies, especially those most at-risk populations, to natural disasters. The COVID-19 pandemic has also compounded the dual challenge presented by environmental challenges and health crisis. To encourage a risk-informed, resilient and risk-informed recovery in the post COVID-19, climate information is expected to provide basic data and other services for disaster risk or emergency management.

Lastly she mentioned that as some economies are now acting to shift the mindset from post-disaster response to pre-disaster prevention, from hazard-by-hazard reduction to multi-hazard comprehensive management, and from reducing disaster risk losses to mitigating disaster risks, climate information is most widely needed and can be broadly used in disaster risk identification, assessment, early warning and monitoring, risk survey and other pre-disaster efforts.

14. Discussion topic - What are the challenges for communicating climate information?

Dr Olivia Warrick began the discussion by sharing her view on challenges in implementing climate information services. She summarized the challenges she has been experienced working for interface between users of climate information and providers. **The largest challenge mentioned was placing users at the centre of decision making** around what information is actually produced, how it is produced, who is it disseminated by, do people understand it, can they access it and once they receive it, do they actually know what to do with it. Especially in the Pacific, it is related to navigating the very complex network of actors that are involved in the provision and uptake of climate services. There are different actors involved in the climate services' food chain. There are international guidance frameworks provided by the World Meteorological Organization (WMO), data providers who provide and support satellites and earth observation, agencies which provide model outputs, tools and forecasts, global producing centers or regional science agencies, and regional development partners and funders that support the development of certain information services. In the Pacific, there are bilateral donors and multilateral climate funds such as GCF. Meteorological agencies from each member economies and regional climate centers are the key

organizations that keep linking up providers with users on the ground. Most importantly, there are the users such as provincial authorities, civil society organizations, groups and communities who are the ones that actually need to risk-informed decisions. It is ideal that the users would be the center of decision making but it can be difficult to achieve. She suggested **effective and comprehensive institutional collaboration in conducting projects and programs that are supporting climate information services** as one of the solutions. She sees that **there is a lack of mechanisms to enable good complementarity between each initiative**. She shared an example of the Pacific where there is a number of agencies that are supporting seasonal and sub-seasonal predictions. Due to these supports, the region increased its capability over the past 5 years. However, as there are many different products available, it is necessary to have the capacity to be able to handle different products and to know how to choose the right outputs for their own economies. What is commonly seen when a number of different products produce slightly different results, end users are easily confused with the different information. Dr. Warrick finalized her discussion by mentioning that **comprehensive institutional collaboration in the region** as well as a **focus on projects and programs, building core capacity of Met. Services of member economies** which enables them to most effectively use the information available and to tailor products and services for their stakeholders are important.

Dr Joseph Intsiful continued the discussion on this topic looking at global context and zooming in the Asia-Pacific region. He said it is very clear that the climate-related impacts and disasters are on the rise. From the submissions of the Designated Centers of economies' plan to GCF, it is clear that climate information and Early Warning System (EWS) have a strong demand, 50% of NDCs highlighted the importance of them. However, the quality of the information provided is low and does not fit to address the types of challenges that we face. He shared **major six challenges in communicating climate information**. First, there is **a lack of enabling environment for institutional effectiveness. Limited governmental finance and budgets allocation** was also mentioned. Due to this, many of Hydro-Meteorological Services and risk management agencies are under resourced and this does not enable them to be effective. In addition, **the complexity of production, dissemination and uptake of risk information** has become a very challenging area. **A lack of coverage and scale for effective service delivery** in terms of quantity and quality of hard infrastructure and inadequate soft infrastructure for ensuring delivery and uptake of risk information is also one of the main

barriers. More importantly, **uncoordinated interventions by different institutions** limit the effectiveness of existing support to developing economies. Lastly, he mentioned that the **market barriers** exist in creating enabling conditions through policy incentives to de-risk investments. He pointed out that it is critical to induce a private sector to be part of the value chain.

He also addressed the **impact of COVID-19 on climate information and Early Warning Systems**. The COVID-19 is heavily impacting weather observations and forecasts, as well as atmospheric and climate monitoring. A lack of observations over any area impacts the quality of the forecast and analysis products. While the global observing system is either partly or fully automated, some parts have already been severely affected by COVID-19. For instance, aircraft observations have declined by 80% since early February and close to 90% in the tropics and in the Southern Hemisphere. Also, the availability of surface data has decreased significantly, especially in Africa. Ocean observations have declined by 80% compared to pre-COVID-19 baseline. Thus, there is a need to the transition to automation which will improve frequency and resilience of reporting. He finalized his discussion by summarizing the key contents discussed earlier.

Ms Guan Yan continued the discussion on the challenges in implementing climate information in decision-making and suggestions to tackle those challenges. She highlighted **the importance of evidence-based understanding of the disaster risk, climate change and other environmental challenges**. In order for climate information to be implemented more effectively and widely for decision-making, there needs to promote the comprehensive and multi-dimensional understanding of the risks.

She suggested that **regular and interactive working mechanism among relevant government departments, industry, stakeholders be established to minimize inaccurate and outdated data collection, distribution, and access. ICT, big data and other digital technologies** could be used to support and improve climate information dissemination through a platform. Ms Yan also added the importance of climate information for socio-economic development.

Dr WonMoo Kim responded to the topic, focusing on the flow of the information. He addressed that effective communication should solely based on the accurate information and a selective piece of information can be misleading. From the perspective of climate information

provider, it is important to make sure that information is correctly communicated as a whole to the users. Climate science itself has extended its knowledge to an extent and now it is time for us to connect dots embracing different language and culture of each field in delivering the produced climate information to application sectors. He suggested that **bridging the information is the key through intimate collaboration amongst relevant stakeholders**. He shared APCC's efforts in not only producing high quality climate information but also reaching out to the users including governmental or sectoral authorities to promote its use for decision-making.

15. Discussion topic - What are some effective strategies or solutions for better communicating climate information?

Dr WonMoo Kim began answering the question by sharing APCC's efforts for effective communication of climate information. APCC does its best to include state-of-the-art operational climate models in its Multi-Model Ensemble (MME) system for its climate prediction. It collects 15 climate models from 11 different economies in order to maintain its accuracy, stability and reliability of the climate forecast information it produces. In addition, APCC tries to listen carefully to the users' needs and demands for not only accurate, stable and reliable but also faster and finer information. In order to meet this demand, APCC further elaborates its presentation of the climate information by issuing the climate prediction earlier than its conventional date of a month and planning to provide higher resolution from the 250km to 100km resolution in the near future. In addition, APCC constantly develops new climate contents and their visualization to meet various applicational demands. Most importantly, Dr Kim shared APCC's experience of bridging the information between sectors; an inundation prediction and visualization system for disaster prevention, utilizing the satellite data and visualizing the real-time forecast on 3-dimensional map of the user's location amongst many others.

After explaining APCC's efforts, he emphasized the sustainability of those projects highly depends on capacity building and that APCC has focused on hosting training programs, workshops, expert meetings to the member economies to ensure the sustainability. He believes that **the effective communication of the most reliable information can be done through capacity building of the users**.

Dr Joseph Intsiful shared his experience of integrating climate information to decision-making in Early Warning Systems (EWSs) and Disaster Risk Management (DRM). He described the integrating

climate information into decision-making from the perspective of demand and supply. There is a growing demand for **Climate Information Early Warning System (CIEWS)** from NDCs, 77% of portfolio from Africa and Middle East, 76% from Latin America and the Caribbean and 100% from Asia and the Pacific.

He also mentioned that climate information and early warning services and broader resilience landscape have the market potential for unlocking private sector investments and participation. And this will lead to scale up currently existing and growing commitment across global, continental and domestic scales such as Paris Agreement, Sustainable Development Goals, Sendai Framework, Global Framework for Climate Services. This will serve as a unique opportunity to enhance coherence and complementarity of investments while leveraging private sector finance, public budgets and public-private partnerships.

He explained current GCF's investment in CIEWS and 21 % of projects are focused on modernization of hydro-met services from a production perspective and 79% focuses on sectoral applications, which is user-driven. It was said that government is not only a consumer but also a seller of services to business and other consumers in integrating the information into decision making process to inform. That is why GCF believes that working closely with government brings a synergy to both governments and GCF. The government can provide important services to the society to improve cost effectiveness while maximizing the performance of critical infrastructure and GCF provides CIEWG for several economies, creating a strong pipeline of climate mitigation and adaptation projects.

He also explained key paradigm shifts from GCF **to ensure sustainability of the investments**. In terms of the transformational planning and programming, climate science informs strategic plans and programming. The implementation aims at coherence, complementarity, efficiency and effectiveness. GCF also catalyzes **climate innovations through ICT, big data and cloud computing** to underpin project design and implementation, create strategic partnerships, quality management and improve policy. They also mobilize **investment at scale** with innovative financing options, blended finance and key partnerships to leverage and scale up the investment. Lastly, GCF **expands and replicates the knowledge on climate investment, science and technology** through institutional collaboration, monitoring, evaluation and learning to ensure impact evaluation as a way of maximizing the impact.

Dr Olivia Warrick addressed that a **practical strategy to successfully deliver climate information services to end-users is to put users at the center of climate information services development.** It is to engage, support, and bridge between community groups and providers of climate information.. In explaining, she shared her experience in the Pacific with a project focused on community based early warning system that was funded by Finland and implemented by a number of organizations. One model for knowledge brokering and bridging was piloted through the program which **formed domestic coordination committees** for the project in each targeted economy and this triggered the development of **formal relationships between meteorological services, domestic disaster management authorities, and Red Cross societies**, which in the past had operated separately. Bridging in the Red Cross societies as a **key intermediary** is the link between communities and Met.services was transformative. The project ended up through coordination group, taking Met.services down to the community people with products and services that they produced for communities such as bulletins, verbal radio program and so on. Taking those elements down to community level and some **Met. Services actually took feedback from the community seriously and adapt and change their products.** For example, a community requested that a tropical cyclone tracking map to include illustrations of what different wind speed actually means. This was adapted and it showed in picture the meaning of a certain category of cyclone. This way, communities were able to understand what different categories of tropical cyclone meant and they knew what they had to prepare. She also highlighted that **in order to formally engage intermediary organizations, it is essential to have resource to serve that function.** The resource includes capacity building, staff and place, science background to serve as a knowledge broker among many others. She pointed out that some large scaled climate information services projects and programs do not provide enough resources to enable these intermediary organizations to play that role. In this regard, it was suggested that one solution could be **to bring in intermediary organizations right at the beginning of the projects or programs,** instead of last minute in order to take the information produced from the invested infrastructure and science development to the last mile, to the users to maximize their impact.

Ms Guan Yan suggested **climate services to be integrated into the government disaster risk reduction strategic planning** such as domestic contingency planning and have them mainstream into policy and decision making. She also mentioned that taking a holistic

approach both for the government and other stakeholders to improve the capacity to access and use the climate information by tailoring climate information and services upon users' demands. **Facilitating collaboration between climate information providers and Disaster Risk Reduction-related agencies will be helpful** as both might have different understanding of climate information and services and there are often cases where users are unable to utilize the information for their decision making due to the difference.

Ms Mary moeono-Kolio began her answer by talking about the general principles of effective communication strategies. First, she suggested **value youth and recognize the value of young people as critical audience to climate science information**. The global youth climate strikes demonstrated that young people's voices are crucial to the collective 're-storying' of climate change and the influential young people can be involved in the dissemination of climate information, and in turn advocate and lobby decision-makers to act with the required urgency to address the climate crisis based on the science.

She also mentioned the **importance of education when developing climate communication to reach young people**. Young people globally have been urgently calling for increased educational opportunities for interdisciplinary and participatory approaches to climate understanding, not only providing information but also making the information accessible and relevant to them. **Effective climate messages are first and foremost about relevance and engagement**. They must deliver something that young people can relate to themselves or their own community. Unless the climate information, science and research data are assimilated by the communities, we cannot realize the impact of that information, knowledge and science. She shared various activities young Pacific people have done since 2015 to recognize and communicate the research, data, and information on climate change have bring impact to the Pacific. **Climate science communities are encouraged to value the indigenous and traditional knowledge holders** because it is indigenous communities who are the first conservationists. Instead of leaving them at the last component of climate projects and programs, those communities should be in the center.

Then, Mr Sanny Jegillos, a moderator for the session concluded this session by sharing his ideas arose from the session. First one is that there needs an appropriate frame or strategic narrative for early warning system and climate information services. The narratives should be considered from the perspective of users, including the

youth, people with disabilities, etc. The second point was made about the privatization of benefits with increased investment on knowledge, information, ICT. All those developments are enjoyed by certain people and the most vulnerable people are often marginalized and left behind. The privatization of benefits should be minimized and social construction of risks need to be reduced as well. He finished the session appreciating all the speakers and participants for their active discussion.

Closing Ceremony

16. Dr Won-Tae Kwon, Executive Director of the APEC Climate Center, concluded the symposium with a speech highlighting the importance of productive discussion and impressive progress regarding climate crisis preparedness and communication strategies for effective climate services. Also, she thanked organizing committee for their hard work and speakers and moderators for their contribution. Finally, she thanked all participants for their participations and interests on making APCS 2021 as a successful event. After this, the symposium ended.

[Annex II: Program]

Time	Session
Tuesday 13 July 2021	
10:00 – 10:10	<p>Opening Session</p> <ul style="list-style-type: none"> • Opening remarks by Dr Won-Tae Kwon, Executive Director, APEC Climate Center • Welcome remarks by Mr Jailan bin Simon, Director-General, Malaysian Meteorological Department
10:10 – 12:00	<p>Panel Discussion Session I <i>Enhancing Climate Crisis Preparedness through Climate Service</i></p> <p>Moderator Prof. Jeongin Kim (School of Economics, Chung-Ang University, Korea)</p> <p>Panelists</p> <ul style="list-style-type: none"> • Dr Roger S. Pulwarty (Senior Scientist, NOAA Physical Sciences Laboratory, USA) • Dr Lynette Bettio (Acting Manager - Operational Climate Services, Climate Environmental Prediction Services, Bureau of Meteorology, Australia) • Dr Ahmed Fairudz Jamaluddin (Director, Atmospheric Science and Cloud Seeding Division, Malaysian Meteorological Department, Malaysia) • Prof. Mayzonee V. Ligaray (Associate Professor, Institute of Environmental Science and Meteorology (IESM), University of the Philippines)
Wednesday 14 July 2021	
10:00 – 11:55	<p>Panel Discussion Session II <i>Exploring Innovative Communicating Strategies for Effective Climate Services</i></p> <p>Moderator MrSanny Ramos Jegillos (Senior Advisor/Team Leader, Disaster Risk Reduction and Resilient Recovery for Building Resilience, UNDP Bangkok Regional Hub)</p> <p>Panelists</p> <ul style="list-style-type: none"> • Dr WonMoo Kim (Research Fellow, Prediction Research Department, APEC Climate Center) • Dr Joseph Intsiful (Senior Climate Information and Early Warning Systems Specialist, Mitigation and Adaptation, Green Climate Fund, GCF) • Dr Olivia Warrick (Independent Consultant) • Ms Guan Yan (Director of International Cooperation Department, Disaster Risk Reduction Center of China) • Ms Mary Moeono Kolio (Wellington Coordinator, 350 Pacific Climate Warriors)
11:55 – 12:00	Closing