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

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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.

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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 National 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 oo 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 system 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 impacts 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 regards, **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 regards, 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 stakeholders are 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 award 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 services bring 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 Mr. Sanny 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, UDNP Bangkok Regional Hub**

Mr. Jegillos opened the session with his opening remarks. He began by noting the collaboration between UDNP 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 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 National 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 regards, 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 National Designated Centers (NDCs)' 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 complementary 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 national coordination committees** for the project in each targeted economy and this triggered the development of **formal relationships between meteorological services, national 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 came to a close.

Annex I. Participants List

#	First Name	Last Name	Gender	Economy	Organization
1	Lynette	Bettio	Female	Australia	Australian Bureau of Meteorology
2	Joseph	Intsiful	Male	Ghana	Green Climate Fund
3	Ahmad Fairudz	Bin Jamaluddin	Male	Malaysia	Malaysian Meteorological Department
4	Olivia	Warrick	Female	New Zealand	OCWConsulting
5	Yan	Guan	Female	People's republic of China	National Disaster Reduction Center
6	WonMoo	Kim	Male	Republic of Korea	APEC Climate Center
7	Jeongin	Kim	Male	Republic of Korea	Chungang University
8	Mary	Moeono-Kolio	Female	Samoa	350.org Pacific Climate Warriors
9	Sanny	Jegillos	Male	the Philippines	United Nations Development Programme
10	Mayzonee	Ligaray	Female	the Philippines	University of the Philippines Diliman
11	Roger	Pulwarty	Male	United States	National Oceanic and Atmospheric Administration
12	Paul	Gregory	Male	Australia	Bureau of Meteorologoy
13	Mohan Kumar	Das	Male	Bangladesh	National Oceanographic And Maritime Institute (NOAMI)
14	Harnina	Morani	Female	Brunei	Brunei Darussalam Meteorological Department
15	Marielle	Alarie	Female	Canada	ECCC (Environment and Climate Change Canada)
16	Ryan	Muncaster	Male	Canada	Environment and Climate Change Canada
17	Radenko	Pavlovic	Male	Canada	Environment and Climate Change Canada (ECCC)
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22	Ting-Huai	Chang	Male	Chinese Taipei	Central Weather Bureau/Taipei
23	Meng-Shih	Chen	Female	Chinese Taipei	Central Weather Bureau
24	Kovia	Lo	Female	Chinese Taipei	Central Weather Bureau
25	Enya	Liu	Female	Chinese Taipei	Central Weather Bureau
26	CHING-TENG	LEE	Male	Chinese Taipei	Central Weather Bureau
27	YUNCHING	LIN	Female	Chinese Taipei	Central Weather Bureau

28	Jyh-Wen	Hwu	Male	Chinese Taipei	Central Weather Bureau
29	Jen-Her	Chen	Male	Chinese Taipei	Central Weather Bureau
30	Chin-Tzu	Fong	Male	Chinese Taipei	Central Weather Bureau
31	Yeu-woo	Lin	Male	Chinese Taipei	Central Weather Bureau
32	JING-SHAN	HONG	Male	Chinese Taipei	Central Weather Bureau
33	Weipeng	Huang	Female	Chinese Taipei	Central Weather Bureau
34	Trengshi	Huang	Male	Chinese Taipei	Central Weather Bureau
35	Ming-Ying	Lee	Male	Chinese Taipei	Central Weather Bureau
36	Leon	Shen	Male	Chinese Taipei	Central Weather Bureau, Taiwan
37	Hui-Ling	Chang	Female	Chinese Taipei	Central Weather Bureau
38	PangYen	Liu	Male	Chinese Taipei	Central Weather Bureau
39	WAN-YU	CHANG	Female	Chinese Taipei	Central Weather Bureau
40	I-Han	Tseng	Female	Chinese Taipei	Central Weather Bureau, Taiwan
41	Szu Ying	Lee	Female	Chinese Taipei	Central Weather Bureau
42	Dayi	Chen	Male	Chinese Taipei	University of Taipei
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44	Cheng-Chi	Dung	Male	Chinese Taipei	Central Weather Bureau
45	Yuan-Tang	Lin	Male	Chinese Taipei	Central Weather Bureau (CWB)
46	Yong-Hua	Ji	Female	Chinese Taipei	Central Weather Bureau
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51	Jia-Hong	Xie	Male	Chinese Taipei	Meteorological Satellite Center
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58	Shairi	Mathur	Female	India	DRT
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158	Hae-Jeong	Kim	Female	Republic of Korea	APEC Climate Center
159	Uran	Chung	Female	Republic of Korea	APEC Climate Center
160	Sangcheol	Kim	Male	Republic of Korea	APEC Climate Center
161	Sae-Rim	Yeo	Female	Republic of Korea	APEC Climate Center
162	Daeun	Jeong	Female	Republic of Korea	APEC Climate Center
163	Sun Hee	Shin	Female	Republic of Korea	APEC Climate Center

164	Young-Mi	Min	Female	Republic of Korea	APEC Climate Center
165	HYUN ROK	LEE	Male	Republic of Korea	APEC Climate Center
166	Yun-Young	Lee	Female	Republic of Korea	APEC Climate Center
167	Soo-Jin	Sohn	Female	Republic of Korea	APEC Climate Center
168	Jongwook	Kang	Male	Republic of Korea	APEC Climate Center
169	Suhee	Han	Female	Republic of Korea	APEC Climate Center
170	Jinho	Yoo	Male	Republic of Korea	APEC Climate Center
171	bong geun	Song	Male	Republic of Korea	APEC Climate Center
172	Wooseop	Lee	Male	Republic of Korea	APEC Climate Center
173	Evgeniya	Larina	Female	Russia	RVC
174	Svetlana	Emelina	Female	Russia	Hydrometeorological Research Center of Russian Federation
175	Elena	Nabokova	Female	Russia	Hydrometcenter of Russia
176	Irina	Kulikova	Female	Russia	Hydrometeorological Research Center of Russian Federation
177	Kaverina	Ekaterina	Female	Russia	The Hydrometeorological centre of Russia
178	Kseniya	Sumerova	Female	Russia	HYDROMETEOROLOGICAL CENTER OF RUSSIA
179	Valentina	Khan	Female	Russian	Hydrometeorological Research Center of the Russian Federation
180	Azarel	Maiai	Female	Samoa	Secretariat of the Pacific Regional Environment Progamme
181	Dr.Benjawan	Sucharit	Female	Thailand	The meeting Of Rajabhat University
182	Prof. Dr. Somrerk	Chandra-ambhorn	Male	Thailand	King Mongkut's University of Technology North Bangkok
183	Byeongcheon	Ko	Male	Thailand	IUCN
184	Thanasith	Iamananchai	Male	Thailand	Thai Meteorological Department
185	Anurat	Saringkarnphasit	Male	Thailand	Thai Meteorological Department
186	Chalump	Oonariya	Male	Thailand	Thai Metorological Department
187	Sanny	Jegillos	Male	the Philippines	United Nations Development Programme
188	Jona	Cabaguio	Female	the Philippines	Global Affairs Canada
189	Theresa Krista	Jolejole	Female	the Philippines	Department of Technology - Food and Nutrition Research Institute
190	Chester	Francisco	Male	the Philippines	DOST-FNRI
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192	Allan	Siano	Male	the Philippines	DOST-PCAARRD
193	Rusy	Abastillas	Female	the Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration
194	REMEDIOS	CIERVO	Female	the Philippines	PAGASA
195	Jorybell	Masallo	Female	the Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
196	Engelbert R.	Lalican	Male	the Philippines	Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD)
197	Michelle	Cabañas	Female	the Philippines	DOST-PAGASA
198	Jairus	Josol	Female	the Philippines	Ateneo de Manila University
199	Nissi Abigail	Buenaobra	Female	the Philippines	Office of Civil Defense- DND
200	Tanya Celina	Cauntay	Female	the Philippines	Office of Civil Defense
201	Ben	Salvador	Male	the Philippines	National Defense
202	FERGUS PHILIP M.	HERMANO	Male	the Philippines	MARITIME INDUSTRY AUTHORITY
203	Guillan May	Tibule	Female	the Philippines	Office of Civil Defense - National Capital Region
204	Paola	Alvarez	Female	the Philippines	Department of Finance
205	Yrah Kriselle	Tanbengco	Female	the Philippines	Department of Finance
206	Liza	Mazo	Female	the Philippines	Office of Civil Defense
207	Saturnino	C. Carranza	Male	the Philippines	Sorsogon State University, Sorsogon City, Philippines
208	Renato	Solidum	Male	the Philippines	Department of Science and Technology
209	LUDWIG	FEDERIGAN	Male	the Philippines	Climate Change Commission (Philippines)
210	Elbert	Hibionada	Male	the Philippines	Department of the Interior and Local Government
211	Mariecar	Robles	Female	the Philippines	PAGASA
212	Feliciano, Jr	Calora	Male	the Philippines	DOST-PCAARRD
213	Marie Antonette	Mc Stay	Female	the Philippines	Department of Human Settlements and Urban Development
214	Jamie Angeli	Gutierrez	Female	the Philippines	Department of Finance
215	Hiasma	Gani	Female	the Philippines	Department of Social Welfare and Development
216	Joan	Abejuela	Female	the Philippines	LGU Dumingag

217	Mark Anthony	Sefuentes	Male	the Philippines	World Vision Development Foundation, Inc.
218	April Love	Castillon	Female	the Philippines	Philippine Atmospheric Geophysical and Astronomical Services Administration
219	Jan Jacob Glenn	Jansalin	Male	the Philippines	University of the Philippines Los Banos
220	Michelle Ann	Ruiz	Female	the Philippines	Philippine Commission on Women
221	Richard	Loredo	Male	the Philippines	MUNICIPAL DISASTER RISK REDUCTION AND MANAGEMENT OFFICE
222	Brendo	Arnoza	Male	the Philippines	MDRRMO
223	Maria Kristine Josefina	Balmes	Female	the Philippines	Philippine Commission on Women
224	RICHARD	ALISER	Male	the Philippines	LOCAL GOVERNMENT UNIT OF PITOGO
225	RUBEN M.	BUBURAN	Male	the Philippines	LGU- MANUKAN, ZN
226	Lorenz Arnel	Jumao-as	Male	the Philippines	National Police Commission Regional Office No. IX
227	Maria	Cagay	Female	the Philippines	Center for Disaster Preparedness Foundation, Inc.
228	Alvidon	Asis	Male	the Philippines	League of Cities of the Philippines
229	Terry Joy	Pacas	Female	the Philippines	National Food Authority
230	Frank Gray	Sorromero	Male	the Philippines	Philippine Red Cross
231	Aiza	Crucillo	Female	the Philippines	Laguna PDRRMO
232	Aldwin	Cejo	Male	the Philippines	Laguna PDRRMO
233	Siegfried	Crucillo	Male	the Philippines	Laguna State Polytechnic University - San Pablo City Campus
234	Joshua Federick	Vitaliz	Male	the Philippines	Municipality of Santa Cruz
235	Arlon Ryan	Chavez	Male	the Philippines	Famy, Laguna LGU
236	Jessie Christopher	Lapinid	Male	the Philippines	City Government of Zambona
237	Miguel Carlo	Morillo	Male	the Philippines	Rizal Prvincial Government
238	John April	Terrenal	Male	the Philippines	CDRRMO Cabuyao
239	ELOISA	ROZUL	Female	the Philippines	Provincial Government of Cavite
240	Alberto	Lastimado Jr.	Male	the Philippines	Western Mindanao State University
241	Kia	Piñero	Female	the Philippines	Zamboanga State College of Marine Sciences and Technology
242	Khristian Kier	Alberto	Male	the Philippines	Philippine Ports Authority- Port Management Office Zamboanga
243	Cutie Dorina	Valencia	Female	the Philippines	Bay MDRRMO

244	Alfer Mae	Caong	Female	the Philippines	Western Mindanao State University
245	Myke Patrice	Ordoveza	Female	the Philippines	Disaster Response Management Division
246	VERNET NICO	PAVINO	Male	the Philippines	CITY GOVERNMENT OF SAN PEDRO
247	OCD XI	Regional Office XI	Male	the Philippines	Office of Civil Defense XI
248	Darwin	Rondilla	Male	the Philippines	LGU - Luisiana
249	Myra Rose	Flores	Female	the Philippines	LGU- Luisiana
250	Rosy Jane	Evangelista	Female	the Philippines	LGU - Luisiana
251	Conrado	Capuno Jr.	Male	the Philippines	LGU Mabitac Laguna
252	Mhel	Briz	Male	the Philippines	PDRRMO
253	Peter Bennett	Mangaser	Male	the Philippines	Society of Environmental Engineering Student Chapter Western Mindanao State University
254	Alleah Kezza	Malang	Female	the Philippines	SEEP-SC
255	Euvimil Nina	Asuncion	Female	the Philippines	Department of Finance
256	Edward	Arañez	Male	the Philippines	Land Transportation Office Region 4A CALABARZON
257	Baby Ner	Lazado	Female	the Philippines	Land Transportation Office
258	Katrina	Nuñal	Female	the Philippines	Armed Forces of the Philippines
259	Jeremiah	Gaer	Male	the Philippines	Office of the Deputy Chief of Staff for Finance Management, J10
260	Abe Danielle	Pongyan	Female	the Philippines	Armed Forces of the Philippines
261	Laila	Gallardo	Female	the Philippines	Armed Forces of the Philippines
262	Karina Gloria	Bardilas	Female	the Philippines	ODCS for Financial Management, J10, AFP
263	Mardie Lyn	Hufana	Female	the Philippines	AFP
264	Glenda	Ilagan	Female	the Philippines	ARMED FORCES OF THE PHILIPPINES
265	Jaya Grace	Patacsil	Female	the Philippines	Armed Forces of the Philippines
266	REBECCA	SANIDIAD	Female	the Philippines	ARMED FORCES OF THE PHILIPPINES
267	Richard	Jaramilla	Male	the Philippines	Office of the financial management J10
268	Nikki Rose	Dapanas	Female	the Philippines	Ecosystems Work for Essential Benefits, Inc. (ECOWEB)
269	Virginia	Cariño	Female	the Philippines	Armed Forces of the Philippines
270	Jouanna Marie	Matanguihan	Female	the Philippines	Armed Forces of the Philippines

271	Famela Joy	Dahonog	Female	the Philippines	Armed Forces of the Philippines
272	Christofer	Feliciano	Male	the Philippines	Office of the Deputy Chief of Staff for Financial Management, OJ10, Armed Forces of the Philippines
273	Manny	Artitchea	Male	the Philippines	LGU-Mabitac, Laguna
274	SHERYL	PERALTA	Female	the Philippines	Armed Forces of the Philippines
275	Maria Norie	Pineda	Female	the Philippines	Armed Forces of the Philippines
276	MERITZEL JOY	TIJAP	Female	the Philippines	Armed Forces of the Philippines
277	Cynthia	Eugenio	Female	the Philippines	Deputy Chief of Staff for Financial Management, J10, AFP
278	Herminigildo	Bulaclac	Male	the Philippines	Philippine Ports Authority
279	Allyssa	Malaga	Female	the Philippines	Society of Environmental Engineers of the Philippines (Student Chapter)
280	Simren Joshua	Cena	Male	the Philippines	Land Transportation Office RIV-A
281	Aries Dos	Campos	Male	the Philippines	National Economic and Development Authority - Cordillera Administrative Region
282	Ernesto	Fajilagot	Male	the Philippines	Philippine Ports Authority
283	Riomar	Subiza	Male	the Philippines	Department of Education
284	Suzette Claribelle	Panopio	Female	the Philippines	Department of Agriculture IVA
285	VERALEW	DE VERA	Male	the Philippines	NATIONAL FOOD AUTHORITY REGION IV
286	Marius Stephen	Torres	Male	the Philippines	Department of Finance
287	MARIA RESHELLE	DE VERA	Female	the Philippines	LOCAL GOVERNMENT UNIT OF CALAMBA
288	GENEROSO	MOMONGAN	Male	the Philippines	512 CEC,5TH CEISG, CEISSAFP
289	Neil Adrian	Cabiles	Male	the Philippines	Department of Finance
290	Hazel	De Chavez	Female	the Philippines	NEDA
291	Estrella	Wailan	Female	the Philippines	National Economic and Development Authority
292	Col Roderick	Garcia	Male	the Philippines	Armed Forces of the Philippines
293	LTC Bebverly	Librada	Female	the Philippines	Armed Forces of the Philippines
294	Irene	Colendres	Female	the Philippines	Armed Forces of the Philippines
295	Chrismond	Mercado	Male	the Philippines	Armed Forces of the Philippines
296	Alylen	Buraga	Female	the Philippines	Armed Forces of the Philippines
297	Dorcas	Quiming	Female	the Philippines	Armed Forces of the Philippines
298	Rei Carla	Asuncion	Female	the Philippines	Armed Forces of the Philippines

299	Clemente	Parong	Male	the Philippines	PHIL ARMY
300	Charles	Salazar	Male	the Philippines	Armed Forces of the Philippines
301	Michael	Cayabyab	Male	the Philippines	AFP
302	Anselmo	Javier	Male	the Philippines	AFP, DND
303	Melchor Jr.	Avenilla	Male	the Philippines	PDRRMO Quezon
304	Joanne Karish	BUmagat	Female	the Philippines	Armed Forces of the Philipines
305	Sariel	Salamat	Male	the Philippines	PDRRMO Quezon
306	William Edzar	Lipit	Male	the Philippines	PDRRMO Quezon
307	Omar	Gajo	Male	the Philippines	PDRRMO Quezon
308	Christopher	Antona	Male	the Philippines	PDRRMO Quezon
309	Niel	Parco	Male	the Philippines	PDRRMO Quezon
310	John Carlo	Calanog	Male	the Philippines	PDRRMO Quezon
311	Raymond Ferdinand	Quin	Male	the Philippines	Armed Forces of the Philippines
312	Rex	Cabrestante	Male	the Philippines	Armed Forces of the Philippines
313	Rosemarie Ann	Marasigan	Female	the Philippines	Philippine Atmospheric, Geophysical and Astronomical Services Administration
314	MARILOU	GIMANG	Female	the Philippines	LOCAL GOV'T UNIT-LEON B POSTIGO, ZN
315	Elnuel	Vergara	Male	the Philippines	Philippine Army
316	5th Mechanized Infantry Battalion	Armor Division	Male	the Philippines	Philippine Army
317	ABEL	RESPONSO	Male	the Philippines	Philippine Army
318	LEONARDO	PEÑA	Male	the Philippines	AFP
319	Mia Crisel	Dalogo	Female	the Philippines	Bureau of Fife Protection
320	Marie Elaine	Mascariña	Female	the Philippines	Cyber Battalion, Army Signal Regiment, Philippine Army
321	GARY	MASEDMAN	Male	the Philippines	5TH FINANCE SERVICE FIELD OFFICE, FINANCE CENTER PHILIPPINE ARMY
322	JEROME	PUBLARIZ	Male	the Philippines	5TH FINANCE SERVICE FIELD OFFICE, FINANCE CENTER PHILIPPINE ARMY
323	Nonito	Salabao	Male	the Philippines	Philippine Army
324	Mac Gyver	Corbito	Male	the Philippines	ASR, PA
325	John Timotie	Racelis	Male	the Philippines	Bureau of Fire Protection

326	ARIEL	KALAHI	Male	the Philippines	PHILIPPINE ARMY
327	Joneve	Miraveles	Male	the Philippines	1FAB, AAR, PA
328	DOMINIC	SORIANO	Male	the Philippines	Cybn, Army Signal Regiment, PA
329	Vincent	Dacomos	Male	the Philippines	Philippine Army
330	Ali	Manadao	Male	the Philippines	Philippine Army
331	Racquel Vener	Villena	Female	the Philippines	Philippine Statistics Authority (PSA) Region IV-A
332	Leila	Fernandez	Female	the Philippines	Education Sector
333	PERCIVAL	ALCANAR	Male	the Philippines	PHIL-ARMY
334	JOSEPH	GALAPIA	Male	the Philippines	PHIL-ARMY
335	June Philip	Ruiz	Male	the Philippines	Department of Health
336	Roderick	Napulan	Male	the Philippines	Department of Health
337	Roxan	Sustiguer	Female	the Philippines	16FSFO, FCPA
338	MAJ LIWANAG	MANTARING	Female	the Philippines	Armed Forces of the Philippines Health Service Command
339	Monique Jessica	Galang	Female	the Philippines	Armed Forces of the Philippines
340	Luisa Deinielle	Mendoza	Female	the Philippines	Armed Forces of the Philippines
341	Geraldson	Pascual	Male	the Philippines	Philippine Navy
342	Glenn	Cruz	Male	the Philippines	Department of Health
343	Shavey	Laureano	Female	the Philippines	Fortress Psychological Testing and Counseling Center
344	FRANCIS JOHN	GABAWA	Male	the Philippines	PHIL. ARMY
345	Kenneth	Baldoraso	Male	the Philippines	11ISU, AIR (P), PA
346	GINO ANTONIO	BENAVIDES	Male	the Philippines	Philippine Air Force
347	Ramil	Sahol	Male	the Philippines	NAVSOCOM
348	Rajiv	Capatoy	Male	the Philippines	Philippine Air Force
349	ARIEL	ROSUELO	Male	the Philippines	Armed Forces of the Philippines
350	GUINEVRE	LARRODER	Female	the Philippines	PHILIPPINE AIR FORCE
351	carfer	esden	Male	the Philippines	AFP
352	Mary Gene	Rana	Female	the Philippines	Office of the Deputy Chief of Staff for Financial Management, OJ10, AFP
353	Jan Michael	Almonte	Male	the Philippines	Philippine Navy
354	Sheila Marie	Mendoza	Female	the Philippines	Bureau of Fire Protection
355	Edzel Kim Lowie	Abliter	Male	the Philippines	Philippine Navy

356	JAKE LEONARD	LONIEGO	Male	the Philippines	Philippine Army
357	Dominic	Lañada	Male	the Philippines	Philippine Army
358	Danilo	Denna Jr	Male	the Philippines	Philippine Army
359	Alvin	Batalla	Male	the Philippines	Philippine Army
360	Noel	Caibigan	Male	the Philippines	Philippine Army
361	Leonard Paul	Quebec	Male	the Philippines	Armed Forces of the Philippines
362	Nadzwa	Sabtal	Female	the Philippines	DENR
363	Joseph	Palattao	Male	the Philippines	AFP
364	Esperanza	Cayanan	Female	the Philippines	Philippine, Atmospheric, Geophysical and Astronomical Services Administration
365	THELMA	CINCO	Female	the Philippines	Philippine Atmospheric, Geophysical and Astronomical Administration (PAGASA), DOST
366	Alberto	Caber	Male	the Philippines	AFP PEACEKEEPING OPERATIONS CENTER
367	Maria Theresa	Escolano	Female	the Phipippines	Office of Civil Defense Calabarzon
368	Ruben L	Carandang	Male	the Phipippines	Department of national defense
369	Anna Marie	Phalashol	Female	the Phipippines	Philippine Institute of Environmental Planners(PIEP)-Caraga Chapter
370	FELICIANO G. JR	CALORA	Male	the Phipippines	DOST-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD)
371	Nieves	Bonifacio L.	Female	the Phipippines	Office of Civil Defense
372	Bryan	Christ	Male	the Phipippines	Department of budget and management Region IX
373	Gerard Marie T	Enriquez	Male	the Phipippines	Department of budget and management Region IX
374	Bob	No	Male	the Phipippines	Armed Forces of the Philippines
375	Jobo	Añonuevo	Male	the Phipippines	Municipal Government of Lumban
376	Myica	Nacionales	Female	the Phipippines	Armed Forces of the Philippines
377	Reymart	Mangune	Male	the Phipippines	Office of Civil Defense Region 3
378	Richard	Santos	Male	the Phipippines	Office of Civil Defense Region 3
379	Cristina	Dela Cruz	Female	the Phipippines	Provincial Government of Aurora, Philippines
380	Lerrie	Hernandez	Female	the Phipippines	Department of the Interior and Local Government
381	Randie	Bacani	Male	the Phipippines	National Commission of Indigenous Peoples Region 3

382	JONATHAN	SANTOS	Male	the Phipippines	DEPARTMENT OF FOREIGN AFFAIRS
383	Elenita	Ordonio	Female	the Phipippines	Department of Trade and Industry
384	ROWENA	MARGALLO	Female	the Phipippines	MINES AND GEOSCIENCES BUREAU – REGION III
385	WILFREDO	CRUZ	Male	the Phipippines	BUREAU OF FISHERIES AND AQUATIC RESOURCES (BFAR)
386	Lee Ann	Manlapat	Female	the Phipippines	DENR Regional Office 3
387	Mary Joy	Manlapig	Female	the Phipippines	DENR Regional Office 4
388	Donna	Sitchon	Female	the Phipippines	Environmental Land Use and Urban Planning and Development Division
389	Christine Joy	Timoteo	Female	the Phipippines	Department of Human Settlements and Urban Development Region 3
390	Alyssa Denise	Carreon	Female	the Phipippines	Department of Environment and Natural Resources Region 3
391	JILIAN PRINCESS	BATHAN	Female	the Phipippines	DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES REGION 3
392	CRISALIE	BOCOBO	Female	the Phipippines	DENR REGION III
393	DONAVER	GUEVARRA	Male	the Phipippines	REGIONAL PUBLIC AFFAIRS OFFICE
394	Maria Auren	Cabalquinto	Female	the Phipippines	Department of Environment and Natural Resources
395	Lorie Gene	Gaba	Female	the Phipippines	Department of Environment and Natural Resources - Region 3
396	MICHAEL	LOPEZ	Male	the Phipippines	Department of Environment and Natural Resources
397	Veronica	David	Female	the Phipippines	Department of Environment and Natural Resources, Region III
398	Abigail	Maglaqui	Female	the Phipippines	Department of Environment and Natural Resources Region 3
399	JUDELYN	FRANCISCO	Female	the Phipippines	DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES REIGONAL OFFFICE 3
400	Cynde	Pagador	Female	the Phipippines	Department of Environment and Natural Resources – R3
401	KARL KEVIN	TALLORIN	Male	the Phipippines	Department of Environment and Natural Resources REGION 3
402	JESSA	ESCUDERO	Female	the Phipippines	Department of Environment and Natural Resources
403	Marife	Castillo	Female	the Phipippines	Department of Environment and Natural Resources
404	Leonora	Santos	Female	the Phipippines	Department of Environment and Natural Resources Region 3

405	Christian Josph	Cortez	Male	the Phipippines	Department of Environment and Natural Resources Region 3
406	Ma. Teresa	Limpin	Female	the Phipippines	Department of Environment and Natural Resources – Region 3
407	Maria Teresita Macanas	Semana	Female	the Phipippines	Commission on Higher Education Regional Office - III
408	Zacarias Daniel	Baricuatro	Male	the Phipippines	Pampanga Provincial Disaster Risk Reduction and Management Office
409	Maria	Cruz	Female	the Phipippines	Environmental Management Bureau Region 3
410	Ben Patrick	Soliguin	Male	the Phipippines	National Economic and Development Authority Region IV-A
411	JAMES	ROMERO	Male	the Phipippines	Department of Environment and Natural Resources – EMB Region 3
412	JERIC	REPATO	Male	the Phipippines	COMMISSION ON HIGHER EDUCATION REGIONAL OFFICE 3 (CHEDRO3)
413	Aira	Cunanan	Female	the Phipippines	Dept. of Labor and Employment Regional Office III
414	Violaine Sarah	Sauro	Female	the Phipippines	Armed Forces of the Philippines
415	Nelia	Bajora	Female	the Phipippines	Department of Interior and Local Government
416	ARTURO JR	LEE	Male	the Phipippines	NATIONAL INTELLIGENCE COORDINATING AGENCY
417	Noel	Lacadin	Male	the Phipippines	MINES AND GEOSCIENCES BUREAU – REGION III
418	Lorelei	Bendijo	Female	the Phipippines	Office of Civil Defense
419	Noriben Jay	Lubguban	Male	the Phipippines	Local Government Unit
420	RICHEL	LAGULAO	Female	the Phipippines	DENR-CENRO Ramon Magsaysay
421	Impas	Nathaniel	Male	the Phipippines	Office of the President
422	WILMER	AGUSTIN	Male	the Phipippines	PAGASA
423	USO Dan	Salasim	Male	the Phipippines	LGU Isabera City
424	Maria Edna	Cantos	Female	the Phipippines	Maritime Industry Authority Region IV
425	Magdalena	Navarro	Female	USA	National institute of Standards and Technology
426	HOANG	PHUC LAM	Male	Viet Nam	Viet Nam Meteorological and Hydrological Administration
427	TIEN ANH	DO	Male	Viet Nam	Viet Nam Meteorological and Hydrological Administration
428	DUC CUONG	HOANG	Male	Viet Nam	Ministry of Natural Resources and Environment