

## Climate Services in Asia Pacific

### Emerging Trends and Prospects

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#### **Asia Pacific Climate Service Workshop**

**What:** A balanced mixture of governmental, industrial, and academic experts working in the Asia Pacific weather/climate services, disaster prevention agencies, private companies, and research institutions gathered to discuss the emerging trends of climate services while proposing ways for future development of climate services in the Asia Pacific region.

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In light of the intensifying climate anomalies and increasing extreme weather worldwide, the need for developing national climate services to help citizens mitigate risks and initiate adaptation is rapidly becoming critical. The Asia Pacific region has seen its poverty, inequalities, and disaster risks from climate events closely intertwined (United Nations 2019). Therefore, it is crucial for Asia Pacific to engage in timely and coordinated development of climate services in all nations (Kim et al. 2019). For this purpose, the Central Weather Bureau (CWB) of Taiwan organized the first Asia Pacific Climate Service Workshop (APCSW), held in Taipei in October 2019, to foster interchange of climate service experiences and enhance regional cooperation of climate service operations. The APCSW was designed to share the experiences of conducting climate service among government agencies of different countries and private companies in the Asia Pacific region and beyond, aiming for better future coordination. Speakers from nine countries working for national meteorological services, government agencies, private sectors, and academia shared the emerging trends and future challenges of climate services from their own experiences and unique perspectives. Most of the successes and experiences presented in this workshop are market oriented or funded by local government, showing the strength and growing capability of a public climate service in Asia Pacific.

The APCSW was opened by honorable guests including Asian government officials overseeing disaster prevention and mitigation. The opening remarks highlighted local extreme weather events in recent years and their profound impacts on the economy and agriculture, serving as testimony of the increasing influence of climate change and the necessity for governmental climate services. Agriculture and energy, two priority areas proposed by the Global Framework for Climate Service (GFCS), were referred to while the progress of current climate service development was introduced.

In the keynote session, three senior experts from different international institutes over-viewed the critical elements and future challenges of climate services. Fiona Horsfall, chief of the Climate Services Branch of the National Weather Service of the United States, called for partnership formation and the adoption of a collaborative and holistic approach in developing climate services. In this process, communication is critical in driving decision-makers and climate information users to learn the science and adjust their habits toward taking action. Daniela Jacob, director of Climate Service Center Germany, emphasized that in the current era of global warming, climate services are positioned to be the source of key strategic information for many sectors and users to adapt to climate extremes. The key sectors for adaptation are water, food, infrastructure, natural environment, and disaster risk management, and the key factors for developing future climate services are innovation, systematic approaches for data and product quality, and education and communication strategies. Pao-Kuan Wang, director of the Research Center for Environmental Changes of Academia Sinica in Taipei, mentioned from the perspective of climate science that, despite the increasing importance of climate forecast, the uncertainty associated with it is still substantial, as several large-scale processes in the atmosphere, oceans, and cryosphere and the interactions among them are not yet fully understood (Wang et al. 2017). Continuing data collection and fundamental research is necessary in order to improve climate forecast and increase the value of climate services.

### **Tailored solutions are required for risk reduction and management**

During the main sessions, speakers shared their experiences of climate services development in various countries and sectors. Delegates from the meteorological departments of Thailand

and Vietnam both emphasized that it is crucial to understand the user needs of climate information, so tailored services can effectively assist in mitigating capricious weather and natural conditions from villages to cities. The audience learned that risk reduction and management are paramount given that different weather and climate phenomena at unique times and in unique locations impact individual sectors.

Extreme weather conditions carry substantial risks to human lives and properties as well as business operations. The Extreme Climate Services provided by the Korea Meteorological Administration (KMA) and the Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) both aim to provide targeted and extensive information regarding extreme climate events and associated trends for specific users, while user feedback can subsequently improve such tailored services. Weather and climate risks can be alleviated through closer collaboration between climate information providers and specific sectors. For example, the CWB and the Council of Agriculture in Taiwan have been working in tandem to provide refined forecasting as well as an early warning system for the agricultural sector to build climate resilience. In the private sector, Japan's Weathernews Inc. has developed a risk communication service to enhance mutual communication with clients in different industries and markets to increase benefit by using customized meteorological forecasts that reduce risk.

### **Enhance climate communication and engagement through leveraging local partnerships or knowledge**

The role of communication and engagement is salient in the outreach of climate services, but how to enhance the efficiency of communication depends largely on who you are and whom you communicate with. In Asia, where population density is high and small scale, diverse farming abounds, the key factor for enabling effective communication lies in the level of localization, as demonstrated by the APCSW speakers.

The ArgoMet project in Tonga, shared by the delegate from the Asia-Pacific Economic Cooperation (APEC) Climate Center (APCC), shows that local working groups and traditional knowledge and know-how sharing are indispensable when it comes to sustainable climate services for agriculture. The Indonesian Agency for Meteorology Climatology and Geophysics (BMKG) runs a climate field school to bridge the gap of farmers' knowledge on climate information and to raise their awareness on climate information and its impact. The field school has proved to be effective, and BMKG has extended it to the fishery sector. In a community-based adaptation program aimed at prioritizing local communities in the face of climate change risks, the International Climate Development Institute (ICDI) highlighted the need for mediators, such as social workers or local nongovernmental organization (NGOs), to help the most vulnerable local groups. In the Philippines, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) introduces methods like social network analysis and cultural domain analysis to elicit local farmers' perceptions on climate conditions, so small-holder farmers can benefit more from tailored and intuitive climate products.

### **The prospect of climate services in creating economic value should be highlighted to encourage private-sector involvement**

The development of climate services is still at its early stage, and this is especially true in many parts of the Asia Pacific region. Public perception of climate change may still be inadequate, which in turn could result in insufficient public spending on climate service development. Hence, it is important to constantly assess the economic value created by different initiatives of climate services and to identify the market value as well. The Chung-Hua Institution for Economic Research (CIER), in collaboration with the CWB in Taiwan, demonstrated an application of the contingent valuation method (CVM) to the economic benefits of CWB's climate service that was built recently for fishery and aquaculture. However, despite the economic

benefits brought about for the fishery and aquaculture industries, tailoring for the individual needs of weather and climate information from a wide range of businesses is beyond the capability of any national meteorological department. Two established weather consulting companies from Japan illustrated their role in revitalizing weather business beyond the scope and capacity of government agencies.

### **Embrace information technology to extend the accessibility and frontier of climate services**

The APCSW shared the different information platforms for delivering climate information and toolkits, facilitating collaboration, and gathering feedback. These platforms are mostly implemented using state-of-the-art information technology, which can speed up information exchange, increase data processing capacity, enhance data gathering, and possibly enable smooth human-machine interfaces. Speakers of the APCSW kept reminding us that embracing information technology while developing and promoting climate services will greatly enhance climate communication and extend the frontier of climate services. For example, the Utah Climate Center has undertaken research on drought informatics by machine learning of social media data, while the Japanese companies presented the utilization of artificial intelligence to tackle food loss due to climate anomalies and develop chat-bots for better communication with their users. At National Taiwan University, an interdisciplinary climate-smart team found that data protocol and knowledge classification must fit into an open data platform to connect to as wide an audience as possible.

In conclusion, the key lessons from this 2-day workshop include tailored solutions that are required for the specific risk reduction and management issues involved in the unique weather and climate phenomena. The development of adaptive measures will take multi-governmental and cross-institutional efforts through sectoral partnerships. International collaboration with data, information, knowledge, and the implementation of international protocols will speed up these partnerships. Meanwhile, the prospect of climate services in creating economic opportunities and enhancing economic value should be developed in parallel. At the end of the forum, the speakers concluded that *leadership, communication, and core values* are key factors that will lay the foundation of future climate services. In light of the emerging trends and future challenges of climate service, the following crucial elements for future development of climate service are worth reemphasizing:

- communication in preparing stakeholders for cultivating and utilizing climate services,
- steering of policies to improve collaborative partnerships among different agencies, and
- strengthening of information sharing and co-development.

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