

2019 APEC Climate Symposium

Pathway to Sustainable Growth under a Changing Climate:

Enhancing Interaction between
Climate Science and Society

August 20 - 22, 2019

Teaching and Research Assistance Center (CADI),
University of Magallanes, Punta Arenas, Chile



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Welcome Message

On behalf of the organizers, the APEC Climate Center (APCC) is delighted to welcome you to Punta Arenas, Chile for the 15th annual APEC Climate Symposium (APCS) 2019. In close cooperation with the government of Chile, University of Magallanes, Dirección Meteorológica de Chile (DMC), and APCC, we are hosting this event to support regional technical cooperation, strengthen climate resilience, and produce impactful climate-related policy recommendations in order to build better capabilities to limit the impact of climate variability and change.

Chile, the APEC 2019 host economy, has put *sustainable growth* as one of the top priorities of the 2019 APEC agenda as it has been greatly affected by climate change. Increasing trends in intensity and frequency of climate and weather extremes due to climate variability and change are worsening the living conditions of vulnerable populations including Chile. Therefore, in order to enhance the adaptive capacity to climate change and achieve sustainable growth, it is crucial to have well-preparedness for climate extreme events, to address these climate vulnerabilities, and link them to decision-making to minimize adverse economic and societal impacts.

With a diverse group of participants bringing together expertise and experiences from research, application, and policy, APCS provides a unique opportunity to link innovations in science with decision-making processes in climate science and climate sensitive sectors. Particularly during APCS 2019, we believe active and vigorous discussions will take place in better connecting provider and user groups of climate information and enhancing the usability and applicability of the climate information and services.

APCS 2019 would not have been possible without the strong support of our valuable partners. I would like to offer our sincere gratitude to all of the members of the organizing committee and our co-hosts at the Dirección Meteorológica de Chile; University of Magallanes; APEC Chile Office; APEC Secretariat; and to all of the APCS speakers and participants.

Dr. Won-Tae Kwon

Executive Director
APEC Climate Center

Organizers

APEC Climate Center

The APEC Climate Center (APCC) was established in 2005 with the unanimous endorsement of the Asia-Pacific Economic Cooperation (APEC) senior officials and leaders at the first APEC Senior Officials Meeting in Seoul, Korea in 2005, to enhance the socio-economic well-being of APEC member economies by utilizing up to date scientific knowledge and applying innovative climate prediction techniques. Since then, APCC has provided value-added, reliable, and timely climate prediction to economies in the APEC region and beyond, while serving as a key climate information center to distribute climate data, prediction and related tools. APCC is a unique organization that catalyzes climate information-based solutions through three interconnected pillars of work: climate prediction and information services; climate information application and climate change response; and capacity building.

APCC hosts the annual APEC Climate Symposium, which provides a forum for various scientists, academics, policy-makers and other stakeholders to share the latest science innovations in climate prediction and explore climate information applications.

Dirección Meteorológica de Chile

The National Weather Service of Chile (Dirección Meteorológica de Chile, DMC) is the government agency in charge of weather and climate services in the economy. DMC is part of the civil aviation authority, the Dirección General de Aeronáutica Civil (DGAC), and it is the official Chilean representative at the World Meteorological Organization (WMO). The DMC administrates the economy's meteorological database, provides meteorological services to aviation and the agricultural sector, develops applied research and climate services. In addition, the DMC brings permanent support to economy's civil protection agencies in order to prepare for and respond to high-impact meteorological events. In addition to its central office in Santiago, the DMC has five regional meteorological centers located in Antofagasta, Easter Island, Puerto Montt, Punta Arenas, and King George Island, Antarctica, which provide weather and climate services to the general public, and to different productive sectors both public and private.

University of Magallanes

The University of Magallanes (UMAG) was created in 1981 as a successor to the Punta Arenas branch of the former State Technical University, which began in 1961. As a public institution with a solid tradition in the Chilean university system, at present the University of Magallanes has over three thousand students enrolled in its five distinguished faculties. Through teaching, research and extension activities, our institution aims to develop knowledge and human resources in the southernmost region of Chile and South America.

Program

Day 1. Tuesday, 20 August 2019

08:00 - 09:00	Registration	
09:00 - 09:30	Opening Ceremony	
09:00 - 09:05	Opening Remarks	Won-Tae Kwon Executive Director, APEC Climate Center
09:05 - 09:10	Welcome Remarks	Enrique Garrido Segovia Deputy Director, National Weather Service of Chile (DMC) Juan Oyarzo Pérez President, University of Magallanes
09:10 - 09:15	Congratulatory Remarks	José Fernández Dübrock Regional Governor of Magallanes
09:15 - 09:25	Commemorative Plaque Presentation	
09:25 - 09:30	Group Photo	
09:30 - 10:00	Coffee / Tea Break	
10:00 - 12:30	Keynote Session Climate Services for Sustainable Development under a Rapidly Changing Climate	
10:00 - 10:30	Reflecting about Antarctica: Their Role in a Changing Planet	Marcelo Leppe Director, Chilean Antarctic Institute
10:30 - 11:00	Climatology in Support of Climate Risk Management	Glenn McGregor Professor of Climatology, Durham University
11:00 - 11:30	Climate Services for Health – Realizing Social Impacts	Joy Shumake-Guillemot Officer in Charge, WHO-WMO Joint Office
11:30 - 12:30	Wrap-up and Discussion	
12:30 - 13:30	Lunch	
13:30 - 17:30	Session I Understanding of Extreme Climate Events and their Impacts	
13:30 - 14:00	Global Infrastructure for Predicting Climate Variability and its Potential for Anticipating Changes in the Occurrence of Local Climate Extremes	Arun Kumar Principle Scientist, CPC/NCEP/NWS/NOAA
14:00 - 14:30	The Changing El Niño in the 21st Century: Properties, Dynamics, and Impact	Jin-Yi Yu Professor, University of California, Irvine
14:30 - 15:00	Forecasting of Extreme Weather Events from Sub-Seasonal to Decadal Timescales	Paul Gregory Senior Prediction Scientist, Bureau of Meteorology
15:00 - 15:30	Coffee / Tea Break	
15:30 - 16:00	Meteorological Extreme Events: From Long-Duration Droughts to Major Floods	Jose Vicencio Meteorologist, National Weather Service of Chile (DMC)
16:00 - 16:30	Global Change in the Southern-Austral Region of Chile and its Impact in Future Climate	Jorge Carrasco Research Associate, Antarctic Gaia Research Center
16:30 - 17:30	Wrap-up and Discussion	
18:00 - 20:00	Welcome Reception	

Program

Day 2. Wednesday, 21 August 2019

09:00 - 13:00	Session II Innovating Early Warning System to Manage Impacts of Climate Extremes	
09:00 - 09:30	Shifting Hazards and Early Warning for a Changing Climate	Tim Manning Senior Advisor, Pacific Disaster Center
09:30 - 10:00	Overcoming the Creeping Nature of Drought by Tracking Invisible Energy Fluxes	Daeha Kim Research Fellow, Climate Analytics Department, APEC Climate Center
10:00 - 10:30	Risk Information Integration and Dissemination for Extreme Events	Tzu-Yin Chang Chief team leader, APEC Research Center for Typhoon and Society
10:30 - 11:00	Coffee / Tea Break	
11:00 - 11:30	The Warning System of Chilean Weather Service	Paola Uribe Meteorologist, National Weather Service of Chile (DMC)
11:30 - 12:00	How Early Is Early Warning of Climate Extremes	Ashbindu Singh President, Environmental Pulse Institute
12:00 - 13:00	Wrap-up and Discussion	
13:00 - 14:00	Lunch	
14:00 - 18:30	Session III Connecting Climate Information to Socio-Economic Values	
14:00 - 14:30	Tailoring Climate Information for Better Use : APCC's Effort	Jin Ho Yoo Director of Climate Services and Research Division, APEC Climate Center
14:30 - 15:00	Extreme Weather Early Warning Systems: Bridging the Climate Science – Health Divide	Sally J Edwards Regional Advisor, Pan American Health Organization
15:00 - 15:30	Urban Climate Information at the Service of Planning and Management of the Environment and Sustainable Development of Latin American Cities	Hugo Romero Aravena Associate Professor of Geography, University of Chile
15:30 - 16:00	Coffee / Tea Break	
16:00 - 16:30	Grasslands Monitoring in Magallanes, a Tool for Farm Planning as a Socio-Economic Benefit for the Region	Sergio Radic Schilling Director of Research, University of Magallanes
16:30 - 17:00	Economic Assessment of Hydro-Met Services and Products: A Value Chain Approach	Jeffrey Lazo Economist, Jeffrey K Lazo Consulting
17:00 - 18:00	Wrap-up and Discussion	

Day 3. Thursday, 22 August 2019

09:00 - 12:00	Wrap-up	
09:00 - 09:20	Session I Understanding of Extreme Climate Events and their Impacts	Seontae Kim Research Fellow, Climate Analytics Department, APEC Climate Center
09:20 - 09:40	Session II Innovating Early Warning System to Manage Impacts of Climate Extremes	Boksoon Myoung Research Fellow, Climate Analytics Department, APEC Climate Center
09:40 - 10:00	Session III Connecting Climate Information to Socio-Economic Values	Hugo Romero Aravena Professor, Department of Geography, University of Chile
10:00 - 10:30	Coffee / Tea Break	
10:30 - 12:00	Panel Discussion	
12:00 - 12:10	Closing Ceremony	
12:00 - 12:10	Closing Remarks	Won-Tae Kwon Executive Director, APEC Climate Center Enrique Garrido Segovia Deputy Director, National Weather Service of Chile (DMC)
12:10 - 13:00	Lunch	
13:00 - 18:00	Technical Tour to Fuerte Bulnes	

Overview

APEC Climate Symposium 2019

Since 2005, APCC has hosted the annual APEC Climate Symposium (APCS) in partnership with the APEC host economy on priority topic with important linkages to climate science. Despite recent advances in climate science and related applications, there are often large gaps in its use in the implementation or management of relevant issues. By bringing together climate scientists and policy makers, APCS aims to bridge these gaps through discussion on cutting edge science, sharing of best practices, and the advancement of policy.

Climate change poses numerous challenges for sustainable growth, affecting people everywhere, and disproportionately harming the poorest and most vulnerable. Since 2000, the East Asia Pacific has been impacted by 70% of the world's natural disasters, with negative effects encompassing more than 1.6 billion people. Increasing trends in intensity and frequency of climate and weather extremes are worsening the conditions of vulnerable populations, especially those with lower incomes, high dependency on climate sensitive industries (e.g. agriculture and forestry), and limited access to climate information. Thus, it is crucial to address these climate vulnerabilities and link them to decision-making in order to minimize adverse economic and societal impacts. As stated in the UNFCCC Sustainable Development Goals (SDGs), it is possible to limit the impacts of climate change with smart policies and innovations in technology.

This Symposium is to support regional technical cooperation, strengthen climate resilience, and produce impactful climate-related policy recommendations, which will produce sustained benefits for all APEC economies. Also the symposium increases awareness and understanding around the importance of utilizing climate information in climate change adaptation, and the different methods to do so. In turn, it contributes to sustainable and inclusive growth under climate change.

Session Information

Keynote Session.

Climate Services for Sustainable Development under a Rapidly Changing Climate

- » How climate services could contribute to achieving sustainable development around the world?
- » What does climate science communities do to analyze climate risks and options to better adapt to the challenges?
- » How those sciences can be translated into decision-making for policy makers to impact to its people?

Session I.

Understanding of Extreme Climate Events and their Impacts

- » What are the recent trends and impacts of extreme weather and climate events and what have caused them?
- » What are the most severe extreme weather events in Asia-Pacific region?
- » How they are being investigated to minimize its negative impact to the society?

Session II.

Innovating Early Warning System to Manage Impacts of Climate Extremes

- » What are the key elements for developing early warning system and risk management to reduce adverse impact of climate extremes?
- » How climate service-based early warning system is currently operated and implemented and the way forward?

Session III.

Connecting Climate Information to Socio-Economic Values

- » What is needed to promote socio-economic values of climate information?
- » What is the role of producers and end-users of climate services to facilitate better and more appropriate uses of climate services for social and economic benefits?
- » How climate information is being applied around the world?



APEC Climate Symposium 2019

Pathway to Sustainable Growth under a Changing Climate: Enhancing Interaction between Climate Science and Society



Keynote Session

Marcelo Leppe

Director, Chilean Antarctic Institute (INACHI), Chile

Glenn McGregor

Professor of Climatology, Durham University, UK

Joy Shumake-Guillemot

Officer in Charge, WHO-WMO Joint Office, Switzerland



Marcelo Leppe

Director, Chilean Antarctic Institute (INACHI), Chile

Biography

Dr. Marcelo Leppe is Director of the Chilean Antarctic Institute (INACH), Ministry of Foreign Affairs, Chile. He is an author of +30 scientific papers, principal investigator of several projects funded by Chilean and International agencies. Dr. Leppe's findings have re-written the natural history (particularly during the Cretaceous) in the Magallanes region and its connection with Antarctica. Also, he is a Chilean representative before the most important Antarctic forums, including the Antarctic Treaty System, COMNAP, and SCAR.

Reflecting about Antarctica: Their Role in a Changing Planet

The Paris Climate Accord, –or “Paris Agreement”– signed in 2015 by 196 United Nations members, was to enter into force on November 7, 2016, following the guidelines of the Intergovernmental Panel on Climate Change, which called for a global temperature increase of not more than 1.5 degrees Celsius, with respect to pre-Industrial era temperatures. Why should the planet's temperature not increase? Studies prior to 2017 estimated that sea levels would rise between 34 and 75 centimeters by the year 2100, provided that the Paris Agreement measures were implemented. This was the most optimistic scenario, and the great rallying cry through which the economies of the Earth would fall into line. There was also a great emphasis on some of the most dramatic effects of possible warming, such as ocean acidification, which in the coming centuries could be at its highest level in 300 million years; or that the industrial and small-scale fish catches would fall dramatically in a world where temperatures increased by more than 2 degrees C. But more recent studies show that this scenario, the most optimistic, is already impossible to achieve, and indicate that the increase would stabilize at around 2.7 degrees C, following implementation of the Paris Agreement practices. If none of the climate goals are implemented, the global temperature increases could reach 3.5 degrees C by the year 2100. One of the most notorious effects of this would be an increase of between 95 and 189 centimeters in sea levels. At least two arguments would be immediately confirmed. First, the world's largest reserve of water and the heart of the oceans' thermohaline circulation-- which is to say, Antarctica -- would be seriously affected in any of these scenarios. Second, the predictability of the models would depend on large multinational scientific efforts which must be recalibrated almost in real time. In Antarctic science in the coming years, these last concepts will become key aspects, since international collaboration and multidisciplinary are probably the only ways to reduce error and the duplication of effort. Moreover, the flow of data in real time will become essential in order to improve modeling and the predictability of such phenomena as global change. For Chile, one of the economy's closest to Antarctica, attempting to understand these changes transcends the constraints of political boundaries. It places us once again, just as during the earliest stages of mankind, in a position of inescapable vulnerability in the face of the elements, where our fragility can only be overcome through pooled, cooperative work. The Paris Agreement clearly points to this. Today more than ever, science has become the common language that connects economies, and I am pleased, particularly as the new director of the Chilean Antarctic Institute, that our Antarctic Science Program has taken this precept more and more into account.

Climatology in Support of Climate Risk Management

Climate risk management has emerged over the last decade as a distinct area of activity within the wider field of climatology. Its focus is on integrating climate and non-climate information in order to enhance the decision-making process in a wide range of climate-sensitive sectors of society, the economy and the environment. Given the burgeoning scientific literature that addresses a range of climate risks, the purpose of this presentation is to provide an overview of the nature of climate risk management and recent developments in the field of climatology that may contribute to the risk assessment component of climate risk management. Examples of how climate information can be used for managing climate related health risk will be presented.



Glenn McGregor

Professor of Climatology,
Durham University, UK

Biography

Glenn's research explores the relationship between atmospheric circulation and surface environmental processes and the extent to which weather patterns, air mass types and modes of atmospheric circulation (e.g. ENSO, NAO) might influence the intra-seasonal to inter-annual variability of health outcomes. This interest manifests itself most strongly in the field of Biometeorology, the discipline concerned with understanding the relationship between atmospheric processes and living organisms. Actively involved in climate and health research he has recently published a number of valuable overviews on 'heat and health'[1], 'humidity a primer for public health researchers'[2] and 'El Nino Southern Oscillation and Health: an overview for climate and health researchers'[3]. Glenn is the former World Meteorological Organisation's Lead Expert for Climate and Health, and member of the Shanghai Bureau of Meteorology's Meteorology and Health Lab, previous Chief Editor of the International Journal of Climatology and President of the International Society of Biometeorology and a past and current (6AR) IPCC Working Group II lead author. Glenn was also lead editor for the widely consulted WMO/WHO publication 'Heatwaves and Health: Guidance on Warning-System Development'[4] and is currently on the editorial boards for Weather and Climate Extremes and Anthropocene and is a member of Public Health England's Health Protection Unit's Research Advisory Board. Currently Professor of Climatology in the Department of Geography at Durham University in the UK, Glenn has held posts at the University of Auckland in New Zealand where he was Director of the School of Environment, King's College London, University of Birmingham, Hong Kong Baptist University, the University of Papua New Guinea and the Institute of Low Temperature Science, Hokkaido University, Japan. He graduated with his PhD from Canterbury University, NZ following obtaining a MSc (1st Class) and BSc from the University of Auckland, NZ.

[1] Heat: A primer for public health researchers. McGregor G.R. and Vanos J.K. Public Health 2017, <https://doi.org/10.1016/j.puhe.2017.11.005>

[2] Humidity: A Review and Primer on Atmospheric Moisture and Human Health. Davis R.E. McGregor G.R. Enfield K.B. Environmental Research, 144, 106-116, 2016

[3] El Nino Southern Oscillation (ENSO) and health: An Overview for climate and health research. McGregor

GR and Ebi K. Atmosphere 2018, 9(7), 282. <https://doi.org/10.3390/atmos9070282>

[4] Heatwaves and Health: Guidance on Warning-System Development G.R. McGregor, P. Bessemoulin, K. Ebi and B. Menne (eds.) WMO-No. 1142. World Meteorological Organization and World Health Organization, 2015 https://www.who.int/globalchange/publications/WMO_WHO_Heat_Health_Guidance_2015.pdf



Joy Shumake-Guillemot

Officer in Charge, WHO-WMO Joint Office, Switzerland

Biography

Joy Shumake-Guillemot leads the WHO/WMO Joint Office for Climate and Health in Geneva, Switzerland. She is an environmental health scientist and public health practitioner who has worked with WHO, WMO, UNICEF and others to develop public health policy and programming for climate adaptation and risk management. She has extensive field experience in Africa, Asia, and Latin America supporting public health and humanitarian assistance programmes. Her current work focuses on enabling WMO and WHO to work together to accelerate the availability, access and use of climate and weather information that can improve public health policy and practice. She is the founder and co-coordinator of the Global Heat Health Information Network; and plays a leading coordination role for the Health, Environment, and Climate Change Coalition (HECCC) between UN Environment, WHO, and WMO.

Joy is the lead author of the WHO Operational Framework for Climate Resilient Health Systems, the health strategy for the Global Framework for Climate Services, the Climate Service for Health Guidebook, and has contributed to numerous research, policy, and technical publications. Joy received her Doctor of Public Health in Environmental Health Sciences from Johns Hopkins University.

Climate Services for Health – Realizing Social Impacts

Health professionals around the world are increasingly recognizing the potential to harness the expertise of the meteorological and climatological communities to enhance disease detection and health risk monitoring, in order to provide insights to anticipate problems and take action to save lives. Climate services for health are an emerging field of applied science that brings together professionals from diverse sectors to create tools and services that improve understanding of weather and climate influences on health outcomes and service delivery. This presentation will describe how the World Health Organization and the World Meteorological Organization have joined forces to promote and accelerate the use of climate services for health. It will provide an overview the spectrum of common health policy and practice needs for meteorological and climatological information; and highlight emerging lessons and frontiers of innovation for achieving effective environmental and climate science applications for public health impact.





APEC Climate Symposium 2019

Pathway to Sustainable Growth under a Changing Climate: Enhancing Interaction between Climate Science and Society



Session I

Arun Kumar

Principle Scientist, CPC/NCEP/NWS/NOAA,
The United States

Jin-Yi Yu

Professor, University of California, Irvine,
The United States

Paul Gregory

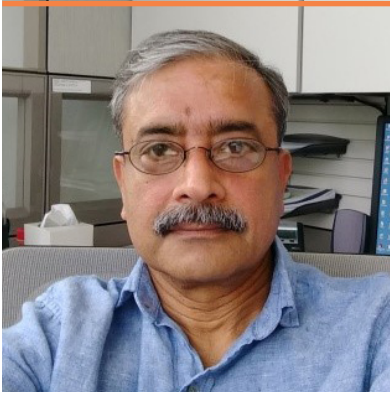
Senior Prediction Scientist, Bureau of Meteorology,
Australia

Jose Vicencio

Meteorologist, National Weather Service of Chile (DMC),
Chile

Jorge Carrasco

Research Associate, Antarctic Gaia Research Center,
Chile



Arun Kumar

Principle Scientist, CPC/NCEP/NWS/
NOAA, The United States

Biography

Arun Kumar is currently the Principal Scientist at Climate Prediction Center, National Centers for Environmental Prediction (NCEP). He joined NCEP in 1990 as part of the Coupled Model Project responsible for the development of a dynamical seasonal prediction system. He received his Ph.D. in 1990 from Florida State University. His professional interests include seasonal climate predictions and understanding of sub-seasonal to seasonal climate variability; global influence of El Niño-Southern Oscillation (ENSO); ENSO variability and tropical air-sea interactions; analysis of oceanic and atmospheric interannual variability in the coupled general circulation models. Dr. Kumar is also the Chair of the World Meteorological Organization's Expert Team on Operational Prediction from Sub-Seasonal to Longer-Time Scales (ET-OPSLS).

Global Infrastructure for Predicting Climate Variability and its Potential for Anticipating Changes in the Occurrence of Local Climate Extremes

Local climate extremes, for example, floods, prolonged drought, changes in the frequency of extreme weather events, have profound influence on various aspects of society. Recurrence of climate extremes at a local scale is modulated by large scale pattern of climate variability on different time-scales – Madden Julian Oscillation (MJO), El Niño – Southern Oscillation (ENSO), Interdecadal Pacific Oscillation (IPO), among others. Prediction systems from sub-seasonal, seasonal to decadal time-scales are now in place and provide routine predictions of the modes of climate variability. Prediction of large-scale modes of climate variability, in turn, can be utilized to anticipate changes in local climate extremes and used in decision making to increase society's resilience to their possible adverse influence. In this talk the current, and future developments in the global infrastructure for providing long-range predictions, and their potential utility for anticipating changes in climate extremes will be discussed.

The Changing El Niño in the 21st Century: Properties, Dynamics, and Impacts

The El Niño is one of the most powerful climate variation phenomena and has profound impacts throughout the Asian-Pacific region. Extensive research since the 1970s has produced theoretical frameworks capable of explaining the observed properties and impacts of El Niño as well as predictive models. However, the properties and impacts of the El Niño events observed so far in the 21st century have been noticeably different from those observed in the 20th century. These discrepancies have motivated the research community to revise conventional views of the El Niño.

The changes include the shifting of the El Niño location and the more complex ways in which the El Niño evolves from one event to another. Associated with these changes, the El Niño's impacts on broad areas of the Asian-Pacific region have become different from those documented during the 20th century. There is substantial evidence that the underlying dynamics of the 21st-century El Niño are also different from those in the 20th century, making its behavior more difficult to predict.

In the talk, I will discuss the changing properties of the 21st-century El Niño and how its impacts on the climate differs from the traditional El Niño. Specifically, I will describe changes in the El Niño impacts around the Pacific Rim, including the US Winter climate, East Asian droughts, Asian-Australian monsoons, and the northwestern Pacific subtropical High. Possible reasons for the recent change in the El Niño will also be discussed.



Jin-Yi Yu

Professor, University of California, Irvine, The United States

Biography

Dr. Jin-Yi Yu is Professor of Earth System Science at the University of California, Irvine, USA. He completed his B.S. from National Taiwan University, received his Ph.D. from the University of Washington, and performed postdoctoral research at the University of California, Los Angeles. Dr. Yu's research expertise is in climate modeling, dynamics, and diagnosis. His research work covers a wide range of issues, from global-scale climate changes in the coupled atmosphere-ocean system to regional-scale variations in the Asian and North American monsoons. In recent years, his research has focused on El Niño complexity and inter-basin interactions among the Pacific, Atlantic, and Indian Oceans.



Paul Gregory

Senior Prediction Scientist, Bureau of Meteorology, Australia

Biography

Prior to joining the Bureau of Meteorology in 2008, Dr. Paul Gregory worked for a decade in automotive and aerospace engineering modelling fluid dynamics and radiative heat transfer. Since 2008 he has been involved in many areas of the Bureau including solar radiation forecast verification, satellite data assimilation and numerical weather prediction. In 2015 he moved to the Bureau's Climate Prediction Services section, researching long-range prediction of tropical cyclones. Dr. Gregory is currently collaborating with the UK Met Office and ECMWF on sub-seasonal predictions of tropical cyclone genesis, and with Bureau scientists on seasonal and sub-seasonal predictions of bushfire weather. Dr. Gregory is also heavily engaged with Australian emergency services to operationalise these new products and services.

Forecasting of Extreme Weather Events from Sub-Seasonal to Decadal Timescales

Australia and other APEC economies are already experiencing severe climate change impacts. Many of these impacts are felt via weather extremes. Since 2014 Australia's Bureau of Meteorology has used dynamical models to provide seasonal forecasts of rainfall and temperature. Such products can inform impacts at seasonal timescales such as drought.

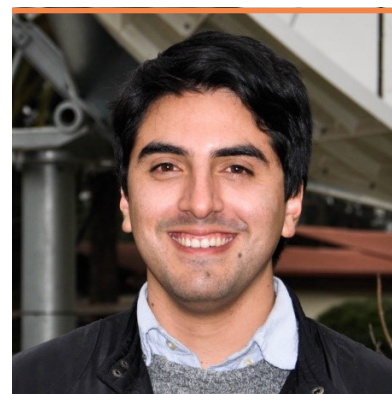
Upgrades to the Bureau's models has given us capability to issue forecasts of extreme weather at sub-seasonal (multi-week) timescales. Development products include skilful forecasts of heatwaves and tropical cyclones, while future work will examine bushfire danger. In addition to sub-seasonal forecasts, the Bureau has been engaged by Australian energy stakeholders to forecast weather extremes over decadal timescales. These projections nest high resolution Numerical Weather Prediction models inside Climate Projection models and enable stress-testing of energy demand and supply scenarios to inform infrastructure development over the coming decades. Such projections will also be sought after by the finance and insurance sectors and other infrastructure managers to allow disclosure of, and adaptation to, future climate risk.

Meteorological Extreme Events: From Long-Duration Droughts to Major Floods

Chile is experiencing the most extended and intense drought in recorded history, counting 10 un-interrupted years since 2010 and affecting the most populated area of the economy (Central Chile). Major effects have been observed in farming, water supplies in the economy's areas and a decrement snow accumulation over Andes cordillera, vital for summer water distribution. However, despite the dry winters during last years, severe hydro meteorological extreme weather events had occurred. By example, during march 2015, a strong Madden-Julian event in the tropics produced a Rossby wave that extended to Chile, triggering all time daily record accumulated rainfall over Atacama Desert (the driest desert in the world) with dozens of deaths and millions of dollars in infrastructure destruction due to unexperienced flash floods.

Summers has been also complicated for Chilean emergency agencies and population. Wildfires during December-March period has been increasing in both severity and intensity, in part thanks to previous dry winters and increasing summer temperatures. On January 2017, near 500 thousand hectares were burned between Valparaíso and Biobío, and also a complete town destroyed. These situation was generated due to a persistent heat wave that broke centenary records in Central Chile. Number of heatwaves continue increasing during this decade, but also, affecting unexpected places. During February 2019, another heatwave strokes this time southern Chile and Patagonia producing the first-time 30°C temperature over Tierra del Fuego and near 10 new daily maximum temperature between Temuco and Punta Arenas. We observed one of the most devastating forest fire in Patagonia after the heatwave over Aysén.

In the aim to inform to management agencies and authorities, as well to general population, Climate Service Office at DMC has establish a series of technical publications, reports, and meteo Chile blog posts; collecting weather data and producing analysis of these extreme weather events as soon as possible. In this way, DMC inform and produced critical information for the most important severe and extreme weather events, which also help to communicate scientific work on meteorology. We also participate and cooperate with universities to write as co-author papers about extreme weather events, which includes Chilean tornadoes, wildfires, heatwaves and flash floods; helping to produce scientific literature about these important topics. As an objective for next years, Climate Service Offices is preparing the NextGen forecast, where we want to include the possibility to predict extreme events within the next weeks.



Jose Vicencio

Meteorologist, National Weather Service of Chile (DMC), Chile

Biography

Mr. José Vicencio Veloso is a Meteorologist and works at Climate Service Office in the National Weather Service (DMC), monthly preparing the seasonal and subseasonal official forecast for Chile, analyzing extreme weather events and climate patterns that affect weather in Chile, helping to different state agencies and private sector to understand changes in weather and climate. He also create, participate as editor and write articles for MeteoChileBlog, a web site dedicated to communicate science and meteorology in a kind and simple way to community, as part of DMC challenges of reach most of population trough social media. José Vicencio is participating on ENANDES project to implement climate service in Chile during the next years, and is constantly helping to write scientific papers about extreme weather events. Right now, He is developing his master degree tesis about the mega-drought and hydroclimate changes in the last ten years in Chile, searching for possible triggers about the origin of the longest drought in the recorded history.



Jorge Carrasco

Research Associate, Antarctic Gaia Research Center, Chile

Biography

Jorge Carrasco received his PhD in meteorology/atmospheric sciences in 1994 from the Ohio State University in Columbus, OH, USA and added an on-the-job master program on Climate Change and Sustainable Development at the Spanish Vértice Business School in 2017. He had been affiliated with the Chilean Weather Service for 31 years where he started as a forecaster in 1983 and became Deputy Director from 2007 to 2013. Since 2009, Jorge is teaching Antarctic meteorology and climatology at the Universidad de Magallanes in Punta Arenas where he works as an Associate Researcher in the affiliated Antarctic GAIA Research Center since 2014. Jorge has also been part of Working Group I (Chapter 4) of the Fourth (2007) and Fifth (2013) IPCC Reports. He is currently member of the Societal and Economic Research and Application (SERA) Subcommittee Group of the WMO. He has participated in several research projects and published more than 100 articles and extended abstracts.

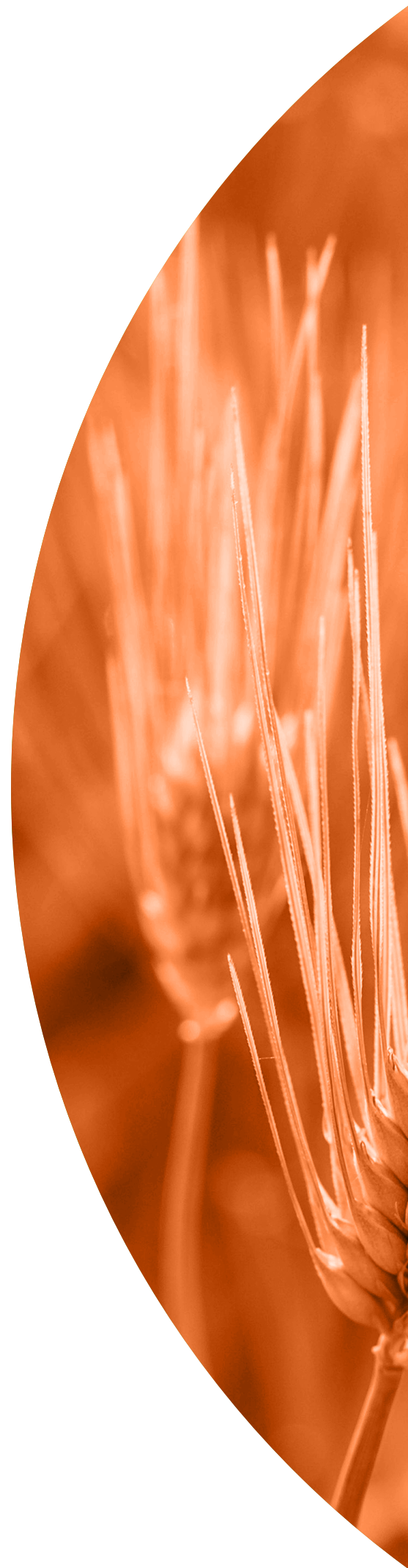
Global Change in the Southern-Austral Region of Chile and its Impact in Future Climate

An analysis of the surface air temperature reveals an increase in the Chilean territory in recent decades, mainly in the central valley and mountain range. However, part of this warming would be associated with the natural variability of the Pacific Decadal oscillation, which changed to a positive (warm) phase in 1977. A more detailed analysis reveals a decrease in temperature in the coastal seasons of northern and central Regions of Chile, as well as an increase in the interior of the same regions after 1977, which is mainly associated by the increase in the minimum air temperature. In the southern most region, maximum air temperatures show an increase in the last 2 decades. On the other hand, future simulations indicate an increase in surface air temperature of 0.5 C for the southern and austral regions of Chile and 1.5 C for the interior areas of the northern Chile by 2030. Increases that can reach 2o and 5 oC by the end of the 21st century, being higher in the northern Chile, mainly in mountainous areas, and the summer months would present the greatest changes (warmer summers). As for the rainfall regime, records indicate a decline in the southern region of the economy, a slight increase in the central region during the last quarter of the 20th century, but then a significant decrease has been occurring in this century. For the northern and southernmost regions, the precipitation shows a slight but not significant increase. Projections for the mid-to-late 21st century indicate that this observed behavior will continue with a decrease of 20% to 50% from current climate values, in the central and southern regions and an increase of about 20% in the austral Magellan region of the economy.

The consequence of the increase in air temperature and decrease in precipitation will result in a reduction in the ice masses, snow and mountain glaciers with an alteration in the economy's water resources, a southward shift of the agricultural-forestry characteristics with changes in the type of crops, possible emergence of diseases typical of tropical climates, alteration of fishery resources, among other specific changes associated with the diversity of ecosystems along the economy's territory. The southern-south region will also be affected by a higher surface air temperature and an increase in the altitude of the snow line, which at the same time leads to a change in the type of precipitation in mountain range (in the Northern and Southern Ice Fields) with increased events of rain and snowfall. Consequently, a decrease in cryospheric mass can be expected, as retreat and thinning of the glaciers. The new climate may be similar to the one that we see today 5 to 10 degrees to the north of current latitude.

Climate change is no longer just a scientific problem but is a global social problem that concerns all countries without exception. It is a threat to humanity where its effects and magnitudes of changes and impacts do not recognize economy's frontiers and are difficult to predict accurately, so they still have a degree of uncertainty, but at the same time the results are robust enough for the decision makers.

The problem of climate change is now a problem of the government and entire society, of policies and innovation, of information and incentives and of clean energy; engaging all actors from the local level to the international sphere. The atmosphere has no boundaries, nor its consequences. After decades of studies, there is already a governmental awareness that climate change needs to be addressed by reducing greenhouse gas emissions that cause it, mitigating its impacts and adapting to the changes that will happen. The great challenge that climate change has posed to us is: how to ensure growth with efficiency and stability without destroying, degrading or changing our environment, in order to have a global equitable society and sustainable developing harmonious with the climate system.





APEC Climate Symposium 2019

Pathway to Sustainable Growth under a Changing Climate: Enhancing Interaction between Climate Science and Society



Session II

Tim Manning

Senior Advisor, Pacific Disaster Center,
The United States

Daeha Kim

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APEC Climate Center, Republic of Korea

Tzu-Yin Chang

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and Society, Chinese Taipei

Paola Uribe

Meteorologist, National Weather Service of Chile (DMC),
Chile

Ashbindu Singh

President, Environmental Pulse Institute,
The United States



Tim Manning

Senior Advisor, Pacific Disaster Center, The United States

Biography

Tim Manning is a Senior Advisor to the Pacific Disaster Center, and coordinates PDC's Washington D.C. operations. Tim is a former Deputy Administrator of the U.S. Federal Emergency Management Agency, and for more than two decades has worked on both the front lines and in the senior most levels of homeland security, emergency management, and resilience at the state, local, federal, and international levels. Confirmed by the U.S. Senate in the spring of 2009, Tim served through the entirety of the Obama administration as a Deputy Administrator of FEMA where he was responsible for the federal government's efforts to prepare the economy to prevent, respond and recover from disasters and terrorist attacks and building a whole-of-society based resilience. He has served as state-level Cabinet Secretary for Homeland Security and Emergency Management and a Homeland Security Advisor to Governor Bill Richardson. He has been a firefighter-EMT in both large urban and wildland departments, a rescue mountaineer, and geologist. Tim also serves on the faculty of Georgetown University in the Disaster and Emergency Management program, as President of Berglind-Manning I.c., an international resilience and strategic policy consulting firm, and as a Senior Fellow at the Atlantic Council. Mr. Manning earned a Master of Letters with distinction in Terrorism and Political Violence from the University of St. Andrews, a Bachelor of Science in Geology from Eastern Illinois University, and is a graduate of the Center for Homeland Defense and Security Executive Leaders Program at the Naval Postgraduate School.

Shifting Hazards and Early Warning for a Changing Climate

Meteorological and climatological disasters are increasing with frequency, severity, and impact world wide. 2018 saw the fourth-highest number of billion-dollar disasters, behind only 2017, 2011, and 2016. Additionally, the past five years have been the hottest five years in human history, eight out of the top ten have been in the past ten years, and all of them in past twenty years. The atmospheric gasses that have the greatest impact on heat retention have increased to levels never before recorded or measured. While climate change cannot be scientifically linked to any specific individual disaster, we can predict that a changing climate will make disasters worse: more frequent and more intense storms and droughts, often in places unaccustomed to such events; reduce the effectiveness of, or render inoperable, infrastructure; exacerbate flooding; and even public health emergencies from the potential spread of insect-borne diseases into new areas. The disaster preparedness and response community has made enormous strides in its ability to prepare our communities for the risks and hazards they face and respond to the multitude of disasters impacting our communities. These efforts, however, and the targets against which success is measured, are all based on models and assessments of potential crises that are, in most cases, rooted and calibrated against an understanding of the hazards and disasters of the past. With shifting ocean currents and weather patterns, rising sea levels and increasing temperatures, new areas are exposed to new hazard conditions and existing risks are increasing. To face this uncertain and changing future, development of new models based on credible forecasts, early warning systems that can accommodate these models, and public awareness and education programs to widely apply these resources are needed to build resilient communities and reduce global disaster risk.

Overcoming the Creeping Nature of Drought by Tracking Invisible Energy Fluxes

Drought is a recurrent extreme climate that can persist for multiple years and thereby exert detrimental influences on sustainability of ecosystems and human societies. However, unlike other extreme climates (e.g., heatwaves, floods, and cold surges), onsets of drought events are often non-indicative, and thus make it difficult to prepare for following adverse impacts. This practical difficulty can be attributed in part to the vague drought definition. A general definition of drought is prolonged precipitation deficiency that leads to substantial hydrological imbalance. Precipitation, however, has an intermittent nature that hampers objective quantification of its deficiency. The vagueness of precipitation deficiency could result in incongruities between analyses for drought frequency, severity, and duration, hindering use of the information for drought risk management in practice. Indeed, tracking precipitation seems an ad-hoc analysis of drought characteristics rather than a proactive strategy for drought risk management.

As an alternative, drought could be monitored and assessed by a continuous time series of surface energy fluxes. The net radiation available on a land surface is transformed into latent and sensible heat fluxes. When land surfaces are dry, the latent heat flux is substantially limited due to the lack of water availability. In response, the sensible heat flux is increased by the energy conservation. In other words, anomalously low latent heat flux directly indicates a drought condition. Tracking the non-intermittent time series of latent heat flux could be more practical than precipitation-based drought monitoring and analysis. A practical advantage of tracking the invisible land-surface energy flux is its ability to capture the heatwave-driven flash droughts that could be followed by severe water-deficit-driven drought.

For early warning of severe, exceptional, and mega droughts, it is proposed to track land-surface energy fluxes alongside with monitoring dry spells and/or anomalous precipitation. It may allow decision-makers and practitioners to formulate efficient management policies that can reduce drought risks in a proactive manner.



Daeha Kim

Research Fellow, Climate Analytics Department, APEC Climate Center, Republic of Korea

Biography

Daeha Kim is a research fellow in the Climate Analytics Department of APEC Climate Center (APCC). He has been devoted to formulate efficient strategies for managing water resources in response to climate change and variability. His recent research focus is analytics for climate extremes in relation to their origins and consequences in atmospheric and hydrologic systems. Before joining APCC, he contributed to the Utah Water Resources Laboratory for 2011-2015, and studied efficient water management strategies in semi-arid snowmelt-driven hydrologic systems under climate change. In APCC, he has been developing efficient approaches for detecting extreme climates (e.g., the Standardized Evapotranspiration Deficit Index), and providing relevant research products for their practical uses.



Tzu-Yin Chang

Chief team leader, APEC Research Center for Typhoon and Society, Chinese Taipei

Biography

Dr. Chang was born in Taipei, Chinese Taipei. She received the B.Sc. and M.Sc. degrees in geography from the National Taiwan University, Taipei, Chinese Taipei, and PhD. degree in space science from the National Central University, Jhongli, Chinese Taipei, in 2000, 2002, and 2010, respectively. She is currently Chief Team Leader at Information Division of National Science and Technology Center for Disaster Reduction (NCDR) and APEC Research Center for Typhoon and Society (ACTS). Her research and interests covers the hydrological remote sensing and disaster surveillance.

Risk information Integration and Dissemination for Extreme Events

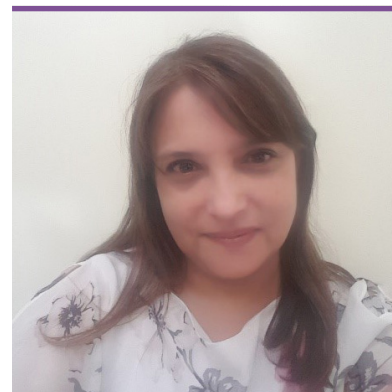
Not only the beautiful and natural environment Chinese Taipei is with, but also unique geographic position located. Because of situated in the subtropical monsoon region, there is a plum-rain season from May to June and Pacific typhoon season with torrential rains from July to October every year happened in Chinese Taipei. In addition to the Meteorological Disasters caused by strong wind and intensive rainfall, we also need to face the events from heat wave and extreme cold. For example, Chinese Taipei experienced a 62 hours long cold surge (1/23-1/26, 2016) and caused agricultural damage above 4600million (NTD). In our center, not only the weather data and numerical models has been integrated to provide accurate early warning for the officers and public, but also the risk map and damage assessment composed of infra data, spatial (GIS) data, sensor web and IoTs, and satellite imagery are delivered. Normally, disaster risk information including early warning and information which both disaster risk reduction and emergency preparedness disseminated to officers and public with graphics and web-GIS via multi-channels such as websites, APPs, social media and cell broadcasting service. The services have been started since 2016. 90% respondents including offices and public were satisfied with our service.

The Warning System of Chilean Weather Service

During the last years, meteorological events of extreme characteristic have been registered all over the planet. Chile is no stranger to these changes, it has been affected by heat waves, electrical storms, heavy rainfall, floods, snowfall and even tornadoes, as recorded at the end of May 2019. Faced with this scenario, the Chilean Weather Service, implemented in 2012 an early warning system, a unique and objective tool for an adequate decision making by governmental authorities.

The early warning system is an instrument that in its beginnings considered the local climatology. However, over time the system was adapted to the effect that meteorological phenomena registered in different parts of the country. This tool has 3 alert levels: warnings, alerts and alarms, which are sent to the National Emergency Office, to the authorities of the Government and is disseminated through various communication medias.

The alert system is a dynamic instrument that adapts to the new challenges presented by climate change and its severe conditions, allowing to provide timely and accurate information to inform the public and the authorities in order to mitigate its adverse effects.



Paola Uribe

Meteorologist, National Weather Service of Chile (DMC), Chile

Biography

Msc. Paola Uribe is a meteorologist from the National Weather Service of Chile (DMC), Chile. She works at the National Center of Prediction where she is the Chief and Coordinator of Hazards Forecasting and Reanalysis Unit. She has been a member of the International Hydrology Programme from the UNESCO, and she worked on the implementation on climate modeling for climate variability on The Andes. Also she is member of the Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services from World Meteorological Organization.

Her research interest now includes weather prediction modeling at the Antarctic Peninsula, as well as climate modeling, and the Teleconnections between the Antarctic climate and the impact in mid-latitudes.



Ashbindu Singh

President, Environmental Pulse Institute, The United States

Biography

Ashbindu Singh is President of Environmental Pulse Institute based in United States, whose mission is to bridge the gap between science and policy. He worked with the United Nations Environment Programme (UNEP) from 1990-2013 in various capacities before retiring as the Director of the Early Warning of Emerging issues Branch. Ashbindu Singh has a strong multidisciplinary background with postgraduate degrees in physical and natural sciences and a Ph.D. in environmental science.

He has over 100 publications in peer reviewed scientific journals and conferences, and over 35 UNEP reports on various environmental issues including global forests, threats to freshwater, coastal vulnerability, transboundary air pollutants, and the UNEP's all time the best seller and award winning publication **"One Planet many people: Atlas of our changing environment**. Within UNEP, the team under his direction was responsible for identification and communication of early warning of emerging environmental issues. He has also co-edited a book titled **"Reducing Disaster: Early Warning Systems for Climate Change"** published by Springer, June, 2014. He has won numerous awards including the United Nations 21 award for the **"Team Productivity"** in 2005 and the UNEP **Baobab Award 2008**.

How Early is Early Warning of Climate Extremes

Early warning systems (EWS) have evolved considerably during the past three decades, gaining wide attention in the 1980s during an extended period of droughts and famines in Africa. Today, formal EWSs exist for just about every type of hazard – technological, hydro-meteorological, and humanitarian. While tremendous success has been achieved in early warning of hurricanes/cyclones/typhons leading to effective advance actions, in other types of hazards public still gets a kind of 'late warning'. With increasing numbers of extreme events predicted by the Intergovernmental Panel on Climate Change (IPCC), the creation of an effective climate warning system is a critical strategy for helping humankind cope with climate change.

Nearly all efforts taking place in climate change focus on either mitigation for reducing emissions or on adaptation for adjusting to changes in climate. Although it is imperative to continue with these efforts, the ongoing pace of climate change and the slow international response suggests that a third option is becoming increasingly important: To protect the population against the immediate threat and consequences of climate-related extreme events, including heat waves, forest fires, floods and droughts, by providing it with timely, reliable and actionable warnings.

Although great strides have been made in developing climate-related warning systems over the past few years, currently these systems only deal with one aspect of climate-related risks or hazards, and have large gaps in geographic coverage and timelines. The communication of warnings and outreach to users also needs improvement. In future early warning of climate extremes should have a global coverage with special emphasis on most vulnerable developing countries and population, comprehensively provide timely alerts on climate-related risks, including droughts, floods, fires, heat waves and integrate the entire early warning landscape end-to-end from data collection, analysis, communication and to response of users.





APEC Climate Symposium 2019

Pathway to Sustainable Growth under a Changing Climate: Enhancing Interaction between Climate Science and Society



Session III

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Sally J Edwards

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The United States

Hugo Romero Aravena

Associate Professor of Geography, University of Chile,
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Sergio Radic Schilling

Director of Research, University of Magallanes, Chile

Jeffrey Lazo

Economist, Jeffrey K Lazo Consulting, The United States



Jin Ho Yoo

Director of Climate Services and Research Division, APEC Climate Center, Republic of Korea

Biography

Dr. Jin Ho Yoo is Director of Climate Services and Research Division at APEC Climate Center (APCC), where he manages most of climate information services and associated research activities.

He received his Ph.D in Atmospheric Sciences from Seoul National University, Korea in 2005. After completion of his degree, he worked the International Centre for Theoretical Physics, Italy on the Asian monsoon research and assisted scientists from Asian countries to enhance their capacity in climate prediction. He joined APCC in 2010 and served as the Head of External Affairs Department, Research Department, Climate Prediction Team, and Climate Prediction Department.

Tailoring Climate Information for Better Use: APCC's Effort

Seasonal climate prediction has been one of regular operational activities in most economies' meteorological services around the world. Global climate models, the outcome of state of art climate sciences, are major source of predictive information and about twenty model systems are under operation in the world. Several global and regional platforms for sharing the data and information from such models facilitate their use in the operational seasonal climate prediction.

Even with well-defined structure of operational seasonal climate prediction, the harnessing of such information in socioeconomic decision making is not very common. Many studies pointed out several gaps and issues hindering the use of climate information. In short, credibility and relevance of the information is key issues to be resolved. Tailoring is to transform the climate information into more usable form to enhance uptake of the information. Moreover, decision making structure itself needs to be changed for proper use of climate information. This change is only possible when the providers and users of information collaborate each other. APEC Climate Center (APCC), as a major providing platform of climate information in the Asia-Pacific region, has been strived to connect climate information into decision making in various aspects. In the presentation, past and current efforts of APCC and related issues will be discussed.

Extreme Weather Early Warning Systems: Bridging the Climate Science – Health Divide

The Sendai Framework for Disaster Risk Reduction 2015–2030 – the successor instrument to the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters – recognizes the benefits of multi-hazard early warnings systems and enshrines them in one of its seven global targets: “Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030”.

The Sendai Framework urges a paradigm shift in the way risk information is developed, assessed and utilized in multi-hazard early warning systems, disaster risk reduction strategies and government policies. It states “in order to reduce disaster risk, there is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risk and sharing such information and on how it is created; strengthening disaster risk governance and coordination across relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels”. The Framework aims to achieve “the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries”.

There are four basic elements to an early warning system where each part must function efficiently for the system to be successful:

- **Disaster Risk knowledge** builds the baseline understanding about risks (hazards and vulnerabilities) and priorities at a given level.
- **Detection, Monitoring, Analysis & Forecasting of Hazards and Possible Consequences** is the logical follow-on activity to keep up to date on how those risks and vulnerabilities change through time.
- **Preparedness and Response Capabilities** insists on each level being able to reduce risk once trends are spotted and announced — this may be through pre-season mitigation activities, evacuation or duck-and-cover reflexes, depending on the lead-time of a warning.
- **Warning Dissemination and Communication** packages the monitoring information into actionable messages understood by those that need, and are prepared, to hear them.

There are uncertainties and assumptions inherent in the development of early warning systems, which for weather purposes are not a concern. However, the temporal and spatial scales have implications for use in health. Climate scientist need to understand the needs of the health community in order to more usefully provide an early warning and health needs to understand the uncertainties and assumptions in order to use the early warnings issued.



Sally J Edwards

Regional Advisor, Pan American Health Organization, The United States

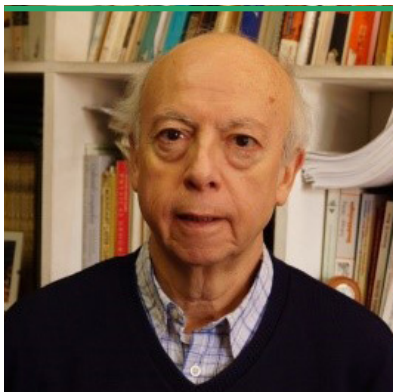
Biography

Following her Masters in Environmental Epidemiology and Policy from the London School of Hygiene and Tropical Medicine, she started working in the area of Climate Change at the London School of Hygiene and Tropical Medicine, working on the Climate Change Adaptation Strategies for Human Health (cCASHh) project, focusing on both the observed impacts of extreme weather events in Europe as well as the impacts of climate change on salmonella and campylobacter infections.

She started working at the World Health Organization in 2003 and has held several positions in various duty stations, including Geneva, El Paso Texas, Washington DC, Haiti and Barbados.

She was part of the team that developed the PAHO Plan of Action and Strategy for Climate Change and Human Health and has participated in organizing several congresses on Climate Change and Health in the Americas both at a regional level (Mexico 2013) and a sub-regional level (Barbados 2013). She supported economies in the Eastern Caribbean in developing their Plans of Action on Climate Change and Health, as well as supporting Barbados in the implementation of the GEF funded Piloting Climate Change Adaptation to Protect human Health project. She collaborated on a joint project with WMO, Health Canada and the Government of Dominica on a Vulnerability Assessment of current and future vulnerability to the health risks of climate change, as well as collaborating with the Caribbean Institute for Meteorology and Hydrology in the development of a Health Climatic Bulletin, and a consultancy to develop an early warning system for arboviral diseases in Barbados and Dominica.

She is currently based in Panama covering a range of topics including Heatwaves, Droughts, Environmentally Responsible and Resilient Health Services, and supporting countries in Central America in the area of Climate Change and Health.



Hugo Romero Aravena

Associate Professor of Geography,
University of Chile, Chile

Biography

Hugo Romero is Teacher of History and Geography (University of Chile), Master of Sciences in Territorial Planning (University of Cranfield, U.K.), Doctor in Geography and Land and Territory Planning (University of Zaragoza, Spain) and Diplomate in Geographical Information Systems Applied to the Environment (Federal Polytechnic School of Lausanne, Switzerland).

He has worked in the Department of Geography of the University of Chile since 1969 and directed the Millennium Interdisciplinary Research Nucleus on Vulnerabilities to Socio-Natural Disasters. Visiting Professor of Washington State University, United States; University of Extremadura (Spain), Poitiers (France) and in the Federal Universities of Paraná, Santa Catarina and Mato Grosso in Brazil; the Catholic University in Medellín, Colombia, the National Mexico State University and the Cordoba National University in Argentina. Member of the Core Group of the International Research Disaster Sciences Institute (IDIRes) of Tohoku University.

His topics of research are Urban and Regional Sustainable Development, Climate Change at regional and local scales, and Urban Climatology. He is currently the President of the Chilean Geographical Society and received the Chilean National Geography Award in 2013 and the Latin American Geography Award in 2019 for his outstanding contribution to the teaching, research and diffusion of this discipline.

Urban Climate Information at the Service of Planning and Management of the Environment and Sustainable Development of Latin American Cities

Contrary to what is expected from the global strategies and policies to reduce the risks of disasters in general, and floods, droughts, heat and cold waves, and high concentrations of atmospheric pollutants that affect the Latin American cities, in particular, it has been observed an increase in both the frequency and magnitude of natural hazards as in social vulnerability to disasters. Around 90% of the total Latin American population lives in metropolis, cities and towns. Urban settlements are the main human ecosystem in this region of the world.

What is the climate information that supports the planning and environmental management of Latin American cities? Are temporary and spatially adequate information available to differentiate what happens in different neighborhoods and urban socio-ecological landscapes? What is the status of the institutions that are in charge of early warning of disaster risks? How do urban communities participate in the management of risks and disasters that affect their neighborhoods?

Latin American cities have strength their sprawl process in an uncontrolled manner during recent decades and the replacement of natural soils by constructed surfaces increases heat sources everywhere. The urgent needs of housing and urban services for a majority of poor inhabitants, the spontaneity and precariousness of their homes, urban services, facilities and the lack of regulations and resources to accommodate millions of new residents, have increased the vulnerability of local communities to cope with climate change, variability and extreme events. At the same time, the patterns of consumption of the emerging middle classes and the concentration of wealth in the high-income population explain the suburbanization and generalization of gated villages, located at increasing distances from service centers, dependent on the private automobile and, therefore, participating of the greenhouse effect and the high concentration of air pollutants and their deleterious impacts on public health.

The planning and management of Latin American urban landscapes almost completely ignores the generation of urban heat islands, heat waves and hot spots, and the scientific, decision makers and social responsibilities involved in the definition of urban boundaries, designs of streets and neighborhoods, and the construction materials that are used. Deserts of cement, characterized by low and compact houses, without green areas, predominate in the whole region. The verticalization of the buildings that characterizes the modern and affluent districts of the cities is carried out without rigorous environmental assessments, so they actively participate in the origin of heat, humidity and ventilation islands. All urban regional interventions contribute to the disappearance of cold islands and corridors. The green infrastructure comprised of woodlands, agricultural crops and other features natural landscapes, are not properly appreciated.

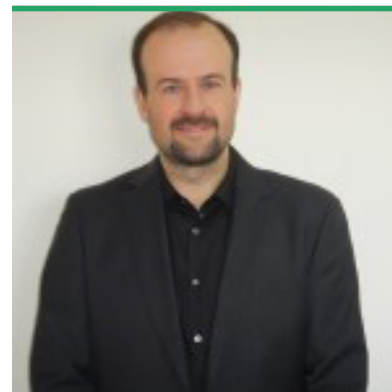
In Latin America, there is a lack of data and climate information about urban Local Climate Zones -homogeneous areas of land uses and covers characterized by specific climatic and social features-. The lack of information and education involves the inhabitants, authorities, planners, designers and builders of the cities. Generally, there are no enough data, information networks, adequate early warning systems and powerful political institutions responsible for evaluating the environmental changes that affect the quality of urban climates and of the air quality.

Therefore, especially the poorest and most vulnerable dwellers continue to settle in hazardous areas, explaining the increase in the numbers of killed and injured people by frequent disasters, the development of acute and chronic diseases and enormous damages to material and immaterial goods that are sorely lacking to improve the quality of life and to offer a genuine sustainable development of urban habitats.

Grasslands Monitoring in Magallanes, a Tool for Farm Planning as a Socio-Economic Benefits for the Region

The overall aim of this project was to develop and implement a dynamic system of monitoring on grasslands in the Magallanes region. The specific aims was to optimize the management of the grassland resource, by providing a scientific basis to underpin decisions on stocking rate, timing and duration which will be environmentally and economically sustainable, also to determine the vegetation change in the farm with the scenario of climate change.

In the system developed, a web platform is used to check grassland condition with a high update frequency throughout the year and using this tool to base decisions on pasture utilization. The inputs and support to the system will be from remote sensing images and climatic data from field-based automatic sensors. The integration of this information will enable grassland condition to be assessed and a dynamic analysis of trends carried out during each year and between years. The development of this tool will help those involved in decision making for better livestock management, and could potentially affect the grazing patterns around two million sheep in this region (more than 50% of the economy). The project will have wider benefits which will impact on the private, economy and scientific communities.



Sergio Radic Schilling

Director of Research, University of Magallanes, Chile

Biography

Dr. Sergio Radic Schilling is Agricultural Engineer and Master in Animal Production from the Universidad Austral de Chile and Ph.D. from the Queens University of Belfast in the United Kingdom. He is currently an Associate Professor at the Universidad de Magallanes and holds the position of Director of Research. He carries out teaching activities in the subjects of Soil Fertility, Grassland Management, and Forage, and he is a thesis advisor to undergraduate and graduate students. He has developed areas of research such as soil-plant relationship, and the use of remote sensing for grassland management, publishing different articles in domestic and international conferences, scientific journals and books. In the area of soil-plant relations, he has developed studies on aluminum toxicity in forage plants, nitrogen fixation in sub-antarctic environments, evaluation of native plants for their introduction in acid soils and evaluations of soil fertility in the region. In remote sensing, he has worked on the development of a platform for dynamic monitoring of the region's grasslands, and on the use of remote sensing as a farming support tool.



Jeffrey Lazo

Economist, Jeffrey K Lazo
Consulting, The United States

Biography

Jeffrey K. Lazo is an independent consulting economist with a background in environmental and natural resource economics, public economics, and non-market valuation. He is former Director of the Societal Impacts Program (SIP) at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado (2004 through 2017). His work focuses on the communication, use, and value of weather information and the economic impact of severe weather events including developing economic metrics for evaluation of the benefits of improved forecasting for solar energy, developing expert elicitation approaches for benefit estimates of improved hydrometeorological services in developing countries, and benefit cost analysis of programs to enhance weather forecasting. Working with The World Bank, the World Meteorological Organization (WMO), and USAID, Jeff is a co-author for a comprehensive guidance document on benefit cost analysis for economies' hydrometeorological services. Jeff led the benefit-cost analysis of the economy's hydrometeorological services in Mozambique, Bangladesh, Nicaragua, and Honduras. He is a recent member of the WMO Forum on the Socio-Economic Applications of Meteorological and Hydrological Services, WMO's WWRP Societal and Economic Research and Applications Working Group, and the AMS Commission on the Weather and Climate Enterprise Steering Committee. He is former editor of the American Meteorological Society journal *Weather, Society, and Climate*. Society and received the Chilean National Geography Award in 2013 and the Latin American Geography Award in 2019 for his outstanding contribution to the teaching, research and diffusion of this discipline.

Economic Assessment of Hydro-Met Services and Products: A Value Chain Approach

Weather and climate related hazards cause billions of dollars of damage and affect millions worldwide in both developed and developing countries. While not all of the impacts can be avoided or mitigated, with appropriate information systems and processes there are undoubtedly significant societal benefits of geo-spatial information on weather, water, and climate (WMO 2015). After briefly outlining economic methods and the types of questions addressed at the weather-economics interface, I discuss the economic impacts of weather variability as an example of economic analysis to better understand weather-society interdependencies (Lazo et al. 2011) and the value of current forecast information (Lazo et al. 2008). I then develop the concept of the "Weather Information Value Chain" as a tool for understanding the creation of value from hydro-met information as well as explicating the difficulties of valuation and opportunities for value enhancement. I then present three examples of valuation of hydro-met information in the context of a "value chain."

Reference: WMO, WBG, GFDRR & USAID. 2015. Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services. World Meteorological Organization, World Bank Group, Global Facility for Disaster Reduction and Recovery, and United States Agency for International Development, WMO No. 1153.

APEC Climate Symposium 2019 Program Book

Pathway to Sustainable Growth under a Changing Climate:
Enhancing Interaction between Climate Science and Society



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