Climate Prediction for Small Island Nations

Managing risks, maximizing opportunities

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

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Introduction from the Secretary-General of the World Meteorological Organization

This brochure shows how some of the world's smallest island nations are now using new climate prediction tools to boost their economies and enhance livelihoods in areas as diverse as renewable energy, agriculture and national economic planning. In these pages you will read about key champions of climate prediction services, such as the President of Seychelles and the Prime Minister of Samoa, who have been quick to realize the clear value of investing in such services, both to manage risks and to maximize economic opportunities posed by a changing climate.

This brochure also celebrates the great progress made by organizations such as the Caribbean Institute for Meteorology and Hydrology (CIMH). They are becoming global leaders in the use of Climate Outlook Forums (COFs) to actively assist key decision-makers from sectors such as agriculture, water and energy in understanding the implications of seasonal forecasts for the coming three to four months. As just one example, COFs provided the spark for Jamaica to use an innovative approach to climate prediction to manage the threats posed by coffee leaf rust disease while also identifying intelligent ways to boost production.

Small Island Developing States (SIDS) are disproportionally affected by weather extremes and climate change, including the increased severity of cyclones, storm surges, heavy rains, droughts, sea-level rise and ocean acidification. In 2014 at the Third International Conference on Small Island Developing States, leaders agreed the SIDS Accelerated Modalities of Action (S.A.M.O.A.) Pathway, which recognizes the critical need for these vulnerable countries to increase their resilience to disasters. Investments in disaster risk reduction, including early warning systems and adaptation measures for critical sectors, are therefore pivotal for building resilient communities and facilitating sustainable development. SIDS have demonstrated leadership in calling for action to reduce global greenhouse gas emissions while adapting to weather and climate extremes. They can also lead the way in applying weather and climate services to support vital economic sectors and vulnerable communities.

The World Meteorological Organization (WMO) supports SIDS through its Programme for Least Developed Countries. It also pursues more targeted actions such as capacity-building to enhance and strengthen the capacities of SIDS National Meteorological and Hydrological Services (NMHSs) and the development and application of science-based climate information and services in support of decision-making. WMO is now working with its partners to support increased investments in climate prediction services by all SIDS in the Caribbean, Indian Ocean and Pacific regions. Around the globe, over 50 small island nations share similar challenges in responding to the impacts of climate change as well as in cost-effectively implementing climate services because of their limited human, operational and financial resources.

WMO is also a lead partner in the implementation of the Global Framework for Climate Services, which provides a worldwide mechanism for coordinated actions to enhance the quality, quantity and application of climate services. The Global Framework for Climate Services has been specifically working to empower SIDS to make more informed decisions on climate-sensitive sectors through greater capacity development and direct technical support. It has also been working to enable greater sharing of information and best practices and collaboration between all small island nations and communities that share similar challenges, hopes and aspirations for sustainable development and improved livelihoods.

I invite you to read the entertaining and innovative case studies in this brochure and reflect on the fact that, despite their remoteness and limited resources, many SIDS are now leading the world in their application of climate prediction services to strengthen their economies and develop a brighter, more hopeful future for their communities.

(Petteri Taalas)
Secretary-General of WMO

Seychelles President backs climate prediction services for SIDS

In December 2015, James Michel was elected to serve his third and final term as President of Seychelles, the small island nation in the Western Indian Ocean that he has led since 2004. President Michel also co-chairs the Global Island Partnership, which brings together world leaders to promote action on sustainable development in order to reduce the vulnerability of SIDS to the impacts of climate change. The President firmly believes that investing in improved climate prediction services could help his country to strengthen key economic sectors such as tourism, fisheries and the production of renewable energy.

President Michel sincerely hopes the recent Paris Agreement on climate change will lead to concrete measures that will help to protect his vulnerable nation from the impacts of a changing climate. However, he now also believes that the increasing climate variability in Seychelles has led to a growing realization of the economic need to invest in improved climate prediction services:

"Improving our climate prediction services will help us to make more informed decisions about water resource management so we can try and prevent the increased risk of seasonal drought from impacting on people's health, food supplies and the wider economy", he says.

President Michel says his Government has now made a significant investment in strengthening the Seychelles Meteorological Service to support the production of better weather and climate information, including early warning services:

"If our National Meteorological Service can improve the way it uses climate prediction tools to make better predictions, our meteorologists can ultimately work with users to provide predictions that will help them to make better decisions", he says.

The President also says Seychelles is now working towards transforming its economy from one that relies on imported fossil fuels to one benefiting from clean and renewable sources of energy. A new wind farm at Port Victoria was opened in May 2014, and he says accurate climatic knowledge will be very useful

in helping to determine the right locations to install more wind farms.

President Michel also believes that improved forecasts of prolonged drought or intense rainfall could help farmers make more informed decisions, boost crop and livestock insurance and increase investment in communal water systems. With all these potential management benefits in mind, the President believes there is now some urgency to try to mainstream climate prediction services into decision-making for all climate-sensitive sectors, such as water, energy, agriculture, transport, tourism and disaster management:

"Mainstreaming climate forecasting services into national policies and strategies will help to enhance our planning and decision-making processes. This information can then ultimately be used to reduce climate-related losses and enhance benefits, including the protection of lives and property", President Michel says.

In 2015, Seychelles funded its first national COF and the President hopes these new forums will improve the way climate prediction information shapes the entire national planning and decision-making process. In fact, President Michel believes that SIDS could soon become the global leaders in the use of these new prediction services to reduce reliance on imported fossil fuel while increasing the use of renewable energy resources such as sunlight, wind and hydropower:

"Mainstreaming climate forecasting services into national policies and strategies will help to enhance our planning and decision-making processes."

President James Michel, Seychelles

"If SIDS are successful in doing this with limited resources, then it sets the pace for bigger countries with much greater resources to follow suit. This has a positive bearing on the economy of SIDS as well as on the economy of the bigger nations. Greater savings which are made through efficient planning processes can then be invested in other important sectors of national economies. This will eventually translate into an even lower carbon footprint for SIDS, at which point they will become the real champions in global greenhouse gas emission reduction", he says.

In May 2014, the Seychelles Government launched the Port Victoria Wind Farm as the country's first large-scale renewable energy project. The wind farm consists of eight wind turbines on two small islands off the coast of Mahe that produce nearly 7 GWh of energy, providing power to more than 2 000 homes and saving the national economy US$ 2 million every year. The development of the wind farm is a major step towards meeting the country's target of producing 15% of its energy from renewable sources by 2030. The project was delivered by Masdar and financed through a grant of US$ 28 million from the Abu Dhabi Fund for Development.

Photos: Shutterstock.com | Seychelles News Agency

Climate prediction boosts Jamaica's coffee industry

Jamaica's Blue Mountain Coffee industry is combining social science with the latest developments in climate prediction as part of an innovative approach to boost production and reduce the impacts of coffee leaf rust disease.

Coffee is Jamaica's second most important agricultural crop after sugar cane, and the sector employs approximately 120 000 people. In 2012, the Jamaican Ministry of Agriculture and Fisheries estimated the country exported more than US$ 13.8 million worth of coffee, mostly to Japan, which takes over 75% of the coffee produced in the Blue Mountains.

Gusland McCook from Jamaica's Coffee Industry Board says Blue Mountain Coffee is now a key part of the country's national identity: "People now make that linkage between Jamaica and Blue Mountain Coffee. So it's a very important crop both as an agricultural item but also as a tourism product", he says.

When the coffee leaf rust fungus first spread to Jamaica in 1986, growers tried to use chemicals to keep it in check. But experts now suspect that when coffee prices began to decline many growers tried to save money by cutting back on chemical sprays and fertilizer. This left many trees much more vulnerable to the fungus.

In December 2012 and September 2013, coffee leaf rust flared up again, and the Jamaican Coffee Industry Board estimates that Blue Mountain Coffee farmers experienced losses of around US$ 2 million. The economic damage was even greater for Central American countries, with estimated losses approaching US$ 350 million.

Most of Jamaica's coffee is produced by small-scale farmers and, at its peak in the 2003–2004 season, the Blue Mountain Coffee industry was producing 600 000 boxes of coffee that were earning the country US$ 30 million in export revenues. Production is now down to 200 000 boxes and revenues of just US$ 13 million. Developing an effective strategy for dealing with coffee leaf rust is viewed as a critical part of the Coffee Industry Board's long-term strategy to get production back to peak levels.

Coffee leaf rust tends to develop during extended periods of wet and humid conditions. Hurricanes can spread spores across different elevations and extended

drought periods can also weaken trees, making them more susceptible to the disease. The 2012 epidemic also raised concerns about increasing resistance to fungicides and the potential market impact caused by any increased use of chemicals, especially given that Japan has very strict regulations on minimum-residue limits of chemicals.

In 2013, CIMH supported one of the first-ever Caribbean COFs in Jamaica. These CariCOFs are designed to strengthen the interaction between NMHSs and the end users of climate information, such as the coffee industry. It was at this CariCOF meeting that a number of key partners were able to join forces and initiate a new project to try developing a climate early warning system that could help to identify the climatic factors that trigger the outbreak of coffee leaf rust.

This unique and innovative project was also designed to use social science approaches to understand how coffee farmers could help to co-create new climate prediction services that could also help to boost the overall productivity of Jamaica's coffee sector. The partners behind this collaborative effort include the International Research and Application Project (a partnership between Columbia University's International Research Institution for Climate and Society and the University of Arizona), the University of the West Indies, the Jamaican Coffee Industry Board, the Inter-American Institute for Cooperation on Agriculture and CIMH.

Zack Guido from the University of Arizona is one of the key people from the International Research and Application Project working on this project:

"Our work with the Jamaica coffee sector is innovative because it is trying to integrate both the physical climate and the social context to co-create useable climate information in direct partnership with Jamaican stakeholders. Also, developing climate information from multiple angles and then evaluating its effect traditionally hasn't been done before in climate services", he says.

Elizabeth Johnson, the representative of the Inter-American Institute for Cooperation on Agriculture in Jamaica, says it was the CariCOF that provided the starting point for the entire project:

"The Jamaica CariCOF is where we started to discuss and formulate the ideas for the early warning system for coffee leaf rust and it has been a wonderful collaboration", she says.

"The Jamaica CariCOF is where we started to discuss and formulate the ideas for the early warning system for coffee leaf rust and it has been a wonderful collaboration."

Elizabeth Johnson, Inter-American Institute for Cooperation on Agriculture

"With the early warning system, we are not only looking at the climactic factors and the plant and the pathogen, but we are also looking at the human and socioeconomic factors. For example, does the farmer have to make the decision of buying books and uniforms for his kids, or buying chemicals to spray at the same time?", Ms Johnson says.

Kevon Rhiney, from the University of the West Indies in Kingston, is managing the social science component of the project. He says this project is actually helping Jamaica to work out how the country can support the development of climate-resilient communities:

"It's about understanding the DNA, the fabric of these communities that we're working with, so we can figure out who are the decision-makers, the change agents

Photos: Sarah Hunter

and how we can work together in a very challenging environment. Since 2010, Jamaica has had over four major droughts, and we're learning how they actually cope with drought stress. Small farmers don't have the luxury of just putting fertilizers in the field because if there is an extended period of drought all of that fertilizer will go to waste. Then where are they going to get their money from? So you're really talking dollars and cents", Mr Rhiney says.

Mr Rhiney refers to this challenging environment as the "climate squeeze": "The challenge is that an increasingly variable climate could reduce the ability of these farmers to cope. So that's why it's very important to intervene in a way that is not just about climate but is also about all the other multiple pressures that these farmers have to deal with", he says.

To help understand better how farmers manage coffee leaf rust and the broader obstacles they face, about 600 households in 12 coffee-farming communities have been surveyed and interviews undertaken with key members of the entire coffee supply chain. Insights from the surveys, interviews and exploratory climate science research will help the research team hone in on the climate information that farmers can actually use. The project is already exploring the development of new seasonal forecasts and whether they could help

growers to anticipate their fertilizer and spraying needs. Fertilizer requires rain to deliver nutrients to the trees' roots, and spraying pesticide is ineffective if the rain simply washes the chemicals away.

Richard Sharp, the CEO of Clifton Mount, one of the most famous and respected coffee plantations in the Blue Mountains, is in no doubt about the potential benefits of this new project:

"Once you're able to forecast then you'll be able to decide when to plant, when to fertilize, and when to reap. If you're going to have excessive rain you may need to reduce your shade. If you're going to have extended drought then you're going to need to increase the shade. You know it's a tremendously powerful tool for us", he says.

"You know it's a tremendously powerful tool for us."

Richard Sharp, CEO of Clifton Mount Coffee Plantations

Photo: Zack Guido

Climate prediction services support honey production in Jamaica

Adrian Trotman, Chief of Applied Meteorology and Climatology at CIMH, says they only discovered how important their seasonal forecasts were for Jamaica's beekeeping community after their website crashed:

"When our webpage went down because of a fault we got an e-mail from a beekeeper in Jamaica saying: 'Where is your information? I make important decisions based on this information. I need it!'", he says.

The man in question is Roy Murray, Managing Director of Jamaica's Apiculture Products and Services Limited (APS), one of the country's largest commercial beekeeping businesses with more than 800 beehives located in six of Jamaica's 14 parishes. In Jamaica alone there are some 2 500 beekeepers with over 42 000 hives of honeybees that produce liquid honey, almost all for local consumption. Hive productivity averages about 27.7 kg of honey per year and beekeepers earn more than US$ 8.75 million from sales to retailers. Most of their product reaches consumers as bottled honey, with a total market value of about US$ 11.4 million.

While the industry employs 10 000 people on a seasonal, part-time or full-time basis, Mr Murray says the main goal of APS is to boost supply for its network of 300 local retail outlets while also building towards the longer-term goal of creating a viable export business. However, he says their business is almost totally at the mercy of variable climatic conditions:

"The performance of honeybees and honey production is very sensitive to weather and climatic conditions. From experience, the most important considerations for us are rainfall, drought, temperature and wind. Naturally, we have no control over any of these so we monitor them

closely to take actions that will mitigate adverse effects and allow maximum possible returns when conditions are favourable. There is nothing that a beekeeper can do but count his losses after the occurrence of an unseasonal weather event, such as prolonged rainfall, a cold front or high winds. These conditions can significantly diminish or wipe out a honey crop because of damage done to flowers that honeybees forage, as well as the restrictions on the bees.", he says.

Mr Murray says his company now makes important business decisions on the basis of information gleaned from the reliable forecast information provided by agencies such as CIMH and the National Meteorological Service of Jamaica:

"The CIMH has been giving very good three- to six-month rainfall and temperature forecasts, and the reliability of this information has also been improving", he says.

Mr Murray says CIMH's prediction that rainfall would be below normal during September–November 2015 meant they decided to purchase less sugar for feeding the colonies, which helped to directly reduce costs. While it is generally accepted that it is profitable for beekeepers to feed their bees in times of excess rainfall, it can be difficult and costly to do so at late notice because some advance preparation is required. Advance warning of above-normal rainfall gives farmers valuable time needed to prepare for bee-feeding activities.

"The CIMH has been giving very good three- to six-month rainfall and temperature forecasts and the reliability of this information has also been improving."

Roy Murray, Managing Director, APS

Below-normal rainfall can also lead to lower availability of nectar and less honey. During these times beekeepers avoid setting up new hives because they are more costly to keep. Given the harsh drought conditions that affected much of Jamaica in 2015 and the below-normal October rain, APS was originally anticipating another poor honey season and was considering a further reduction of its expansion plans. Thankfully, Mr Murray says these cuts may no longer be necessary because the most recent forecast has indicated there would above normal rainfall for much of the next honey season.

Photos: Yerba Buena Farm Jamaica | Petri-Ann Henry / Jamaica Observer | Shutterstock.com

The Caribbean leads the world in climate prediction services

Simon Mason, a senior climate scientist from the International Research Institute for Climate and Society at Colombia University, says there is a good reason why the Caribbean is leading the world in climate prediction:

"The Caribbean makes a lot of money out of its climate. Whether it's tourism, agriculture or energy. Because the islands are so small, the region is also very sensitive to water shortages", he says.

Mr Mason says that one of the most innovative products the Caribbean now produces is a seasonal drought outlook that combines a prediction for the next few months together with information on very recent rainfall patterns. According to him, the simple act of combining these two pieces of information can provide a much clearer indication of the likelihood that water shortages will occur.

Mr Mason is well positioned to comment on the current leadership provided by the Caribbean region. He wrote the software program that now makes it easier for climate scientists to make accurate seasonal forecasts up to three months into the future. He says the accuracy of longer range forecasts is based on new abilities to measure differences between the temperatures of the atmosphere and the ocean, the latter changing much more slowly:

"The ocean is critical for climate prediction, and the reason why we can predict the next few months is largely because of our knowledge of unusual conditions in the oceans. When we are forecasting the weather for the next few days, ultimately all we're doing is asking: 'What's the weather like now and how is it likely to change?' And that works out to a few days, but once you get out to about a week, any information that we have about what the weather's like now essentially becomes useless", Mr Mason says.

Mr Mason says the secret to making accurate predictions up to three months into the future is based on understanding when the surface of the ocean is unusually hot or unusually cold:

"Of course, if we're looking far into the future, we are not going to get it right all the time. So we need to be able to provide a forecast and have a very good idea of how confident we can be in that forecast. If we know

in advance how likely we are to be right or wrong, then we can start making sensible decisions about what to do and how much to invest", he says.

CIMH is the regional climate services provider. Based in Barbados, CIMH hosts the Caribbean Regional Climate Centre and manages the biannual Caribbean Climate Outlook Forum, or CariCOF. A COF is a national or regional meeting in which climate scientists typically present a seasonal forecast for the coming three to four months to key decision-makers in sectors such as agriculture, water, disaster-risk management, energy and health. These COFs are designed to strengthen the interaction between regional institutions, NMHSs and the end users of climate information.

"The Caribbean makes a lot of money out of its climate. Whether it's tourism, agriculture or energy."

Simon Mason, climate scientist, International Research Institute for Climate and Society, Colombia University

Elizabeth Johnson is the representative of the Inter-American Institute for Cooperation on Agriculture, based in Jamaica. She believes the main benefit of CariCOF is that it allows climate scientists the opportunity to sit around the table with representatives from sectors such as water, energy, agriculture and tourism to exchange ideas and look at climate-related problems in a different way:

"I think it would be beneficial as well to have sectors from all the ministries of national planning take part in this forum, because once they come and they see the potential of the information and see how it impacts all of the sectors, I think they will be able to see how they can use it in planning for the countries involved", she says.

CariCOF now typically occurs at the end of May, which marks the beginning of the wet/hurricane season, and then at the end of November for the dry season. For Mr Mason, the benefits of CariCOF are obvious:

"If we have a hurricane coming, the more advanced the warning, the more prepared we can be. The same is going to be true of climate events as well. If we're anticipating a drought coming, the sooner we can have an early warning of that, the longer time we have to prepare and the more effective we can be at mitigating those impacts", he says.

"While we need to manage the risks it is also very important that we look for opportunities to take advantage of favourable climate conditions."

Simon Mason, climate scientist, International Research Institute for Climate and Society, Colombia University

This work has also led Mr Mason to spend considerable time collaborating with leading climate scientists from the Caribbean region. Scientists who, he says, are very keen to demonstrate that the region can be one of the leading centres in the world for providing climate information. But while climate scientists are becoming much better at the science of prediction, Mr Mason believes the progress in the Caribbean has been based on the realization that these predictions need to be translated into information that organizations can actually use:

"For example, if we do have a lot of rain, what are the impacts going to be? What do I need to prepare for, and what damage do I need to prevent?" And Mr Mason stresses that this also means getting better at planning for good and bad seasons:

"It's very valuable for the agricultural sector to know if we're going to have a good season ahead of us. If they can be fairly confident that the rains will be very favourable this year, they can be confident in putting more investment into buying extra fertilizer or planting a larger percentage of their land. So, while we need to manage the risks, it is also very important that we look for opportunities to take advantage of favourable climate conditions as well", he says.

Photos: Shutterstock.com | Sarah Hunter

Climate prediction saves millions of dollars for Fiji's sugar industry

Ravind Kumar, Director of Fiji's Meteorological Service, says climate prediction services saved the nation's sugar industry millions of dollars in 2015:

"The industry had originally allocated millions of dollars for cane replanting, but this programme was shelved after we provided early warning of El Niño conditions and below-average rainfall. Without this early warning, millions of dollars would have gone to waste as severe dry conditions emerged later in the year", he says.

The Fiji sugar industry was established over 100 years ago and few other countries in the world depend as much on the effective management of this commodity. Sugar is Fiji's third highest export earner and it contributes up to 40% of the nation's total merchandise exports and 12% of its gross domestic product. One in four people in Fiji depend on the sugar industry for their livelihoods, and its small farm units still rely on manual planting and harvesting techniques.

Fiji's entire sugar crop is rainfed and therefore highly dependent on levels of rainfall. Sugar cane requires water during the initial growing period but then depends on dry, cool conditions for sucrose accumulation. Nearly all of the cane growers' management decisions are dependent on weather and climate forecasts, from initial land preparation and planning to fertilization, herbicide spraying, weed management, cane harvesting and shipping.

Mr Kumar says Fiji's geographical location makes it highly vulnerable to climate variability and the frequency of many extreme types of weather, such as tropical cyclones, storm surges, floods and droughts:

"Fiji lies in an active cyclone zone with one to two cyclones passing within Fiji's exclusive economic zone every season. The El Niño–Southern Oscillation is one of the major drivers of climate variability in the region, and floods and droughts are also a common occurrence. One of the worst floods to affect the country occurred in 2009, followed by two larger floods in 2012. More recently severe drought conditions have been experienced in 2010, 2014 and 2015", he says.

The Fiji Meteorological Service now provides a quarterly seasonal rainfall outlook to support the production of

sugar cane on Fiji's two main islands of Viti Levu and Vanua Levu. Sanjay Prakash, acting CEO of Fiji's Sugar Research Institute, says they now use this outlook to provide specific advice to farmers about different climate-related events that affect sugar cane production:

"Rainfall patterns have changed significantly, and this is affecting planting and total production. We are now seeing fewer rain days and less rainfall. In addition, there are longer spells of dry weather, which is also affecting production", he says.

Mr Prakash says that improvements in climate prediction are helping to support the development of the entire sugar sector in Fiji:

"Farmers can make use of climate predictions to avoid potential losses, minimize expenditure, maximize yields and minimize the environmental impacts of farming operations. These new climate prediction services are now allowing for better management of water and fertilizer applications. They are also helping to determine the crop varieties and locations for planting", he says.

The Fiji Sugar Corporation also uses this seasonal forecast information to support its milling and marketing activities. Better rainfall forecasts can help to boost profits by helping to determine exactly when the mills can be opened each season to allow the crop to achieve the highest possible sugar levels.

"Farmers can make use of climate predictions to avoid potential losses, minimize expenditure, maximize yields and minimize the environmental impacts of farming operations."

Sanjay Prakash,
acting CEO, Fiji Sugar Research Institute

Mr Prakash agrees that the sugar industry is now in a much better position to manage the risks and opportunities created by a varied and changing climate:

"Industry stakeholders are now making more use of climate information in their decision-making process, such as when to start or end the milling, where and when to plant, and when to apply fertilizer", he says.

Photos: Brent Stirton / WWF-Pacific

Climate prediction boosts Samoa's 100% renewable energy strategy

An innovative climate prediction project is helping Samoa to meet its ambitious target of producing 100% of its energy from renewable sources by 2017. Hydropower is by far the biggest source of renewable energy in Samoa, and the Afulilo Dam on Upolu Island generates around one fifth of the country's energy.

The Afulilo Hydropower Scheme was originally only designed to operate at full capacity during the wet season. Now, with support from the Australian-funded Climate and Oceans Support Programme in the Pacific, Samoa's National Meteorology Division has been able to work closely with the Electricity Power Corporation (EPC) to produce a water storage outlook model that can ensure a reliable supply of energy all year round.

The General Manager of EPC, Tologata Tile Lei'a Tuimalealiifano Tile, says the high variability of Samoa's rainfall had previously impacted on the reliability of Samoa's entire energy-supply network. He says the new water storage outlook model means they can now adjust their operational processes to enhance management of the available water resources at the reservoir.

The capacity of the Afulilo Dam is about 10 million cubic metres, providing enough storage to supply energy for up to six months. But it is the only one of the country's five hydropower facilities that is powered by water from a reservoir rather than rivers. Tologata observes:

"Nationally we have very limited storage capacity, so we rely heavily on Afulilo in terms of storing energy for the dry season. So that's why our partnership with the Met Service is very important, because they can inform us of what is coming and we can plan ahead. It puts us in a much better position to make informed decisions about managing load demand and scheduling critical maintenance of our facilities."

Tologata says EPC is now receiving clear operational and economic benefits from its ongoing partnership with Samoa's National Meteorology Division:

"When they advised us in 2015 that the El Niño could mean our worst-ever dry season, we were then able to reserve water and fix all our diesel generators so we would not suffer from a lack of electricity during a drought situation", he says.

Prime Minister Tuilaepa Lupesoliai Neioti Aiono Sailele Malielegaoi also believes that efforts to use climate prediction services to improve the efficiency of the country's hydropower generation are a key part of Samoa's renewable energy strategy:

"Climate forecasting services will play a key role because developing a better understanding of areas which are more prone to drought will allow us to allocate our climate change adaptation resources more effectively", he says.

The Prime Minister believes that Samoa is now well on its way to achieving its target of producing 30% of renewable energy from hydropower, 30% from solar power, 20% from wind power and 20% from biomass and waste:

"With hydropower we have quite a few small rivers which we identified way back in 1972, and we have been reasonably successful in generating hydropower during the rainy season. But it is also important to vary our own sources of supply to bring in solar and wind to replace the reduced output from our water resources," he says.

As recently as 2012, Samoa was generating 60% of its energy from diesel generators, with total fuel imports

Photos: Sarah Hunter

amounting to 95 million litres. Samoa's Prime Minister believes that lowering the nation's reliance on fossil fuels will help free up government funds and boost sustainable development.

In addition to improving the efficiency of the Afulilo Hydropower Scheme, Tologata says that new climate prediction services will help Samoa to identify five new sites for hydropower facilities which will further support the Government's drive to reduce Samoa's reliance on imported fossil fuels for power generation:

"The development of hydropower plants needs at least five or more years of historical data, so we have been collecting the rainfall and the streamflow data to help

"Climate forecasting services will play a key role because developing a better understanding of areas which are more prone to drought will allow us to allocate our climate change adaptation resources more effectively."

Prime Minister of Samoa, the Hon. Tuilaepa Lupesoliai Neioti Aiono Sailele Malielegaoi

support the future development of these new hydro-power plants", he says.

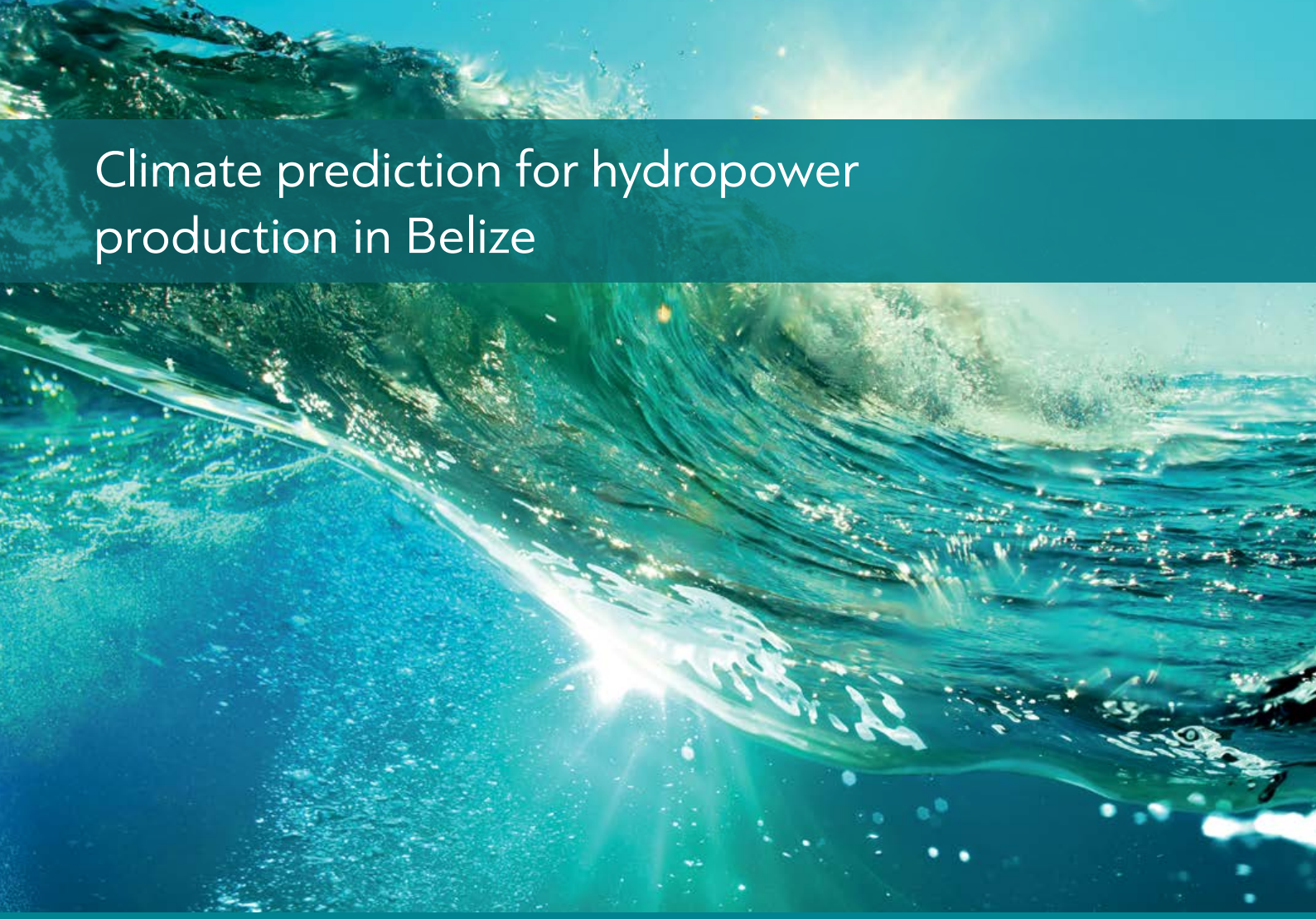
Salesa Nihmei, Climate and Meteorology Officer at the Secretariat of the Pacific Regional Environment Programme, says they now want to use the example provided by the relationship between Samoa's National Meteorological Division and EPC to demonstrate the value of investing in climate prediction services:

"We really want other interested sectors to understand there has to be an investment on both sides. If seasonal forecasting is going to deliver real value you need data from the Met Service, but you also need good data from their partner organizations. The different organizations that want to benefit from climate prediction services really need to make an investment from their side to be able to develop relevant models that will help to improve decision-making", he says.

Mr Nihmei says the real benefits of climate prediction will only start to flow when different sectors see the financial benefits and decide to commit real investment into co-developing products and services: "Once these organizations can see how they are able to save money then their managers will really be able to buy into it. The National Met Services will then be able to provide improved services because the different SIDS Governments will be able to clearly see the economic benefits", he says.

Photo: Sarah Hunter

Climate prediction for hydropower production in Belize



A partnership between Belize's National Meteorological Service and Belize Electricity Limited is helping to increase the efficiency of hydropower production from the Challilo Dam and hydropower facility. This new partnership is helping to provide longer-term rainfall forecasting and water supply data that will help manage national demand for hydropower.

Although located on the Caribbean coast of Central America, Belize includes more than 200 islands and is therefore recognized internationally as part of the SIDS group. Of the 240 GWh of total hydropower produced in Belize, the Challilo Dam provides an annual average production of about 230 GWh. In 2014 this represented approximately 44% of the country's annual energy supply, which is totally dependent on the availability of water resources.

Catherine Cumberbatch, Deputy Director of the Belize National Meteorological Service, says this new relationship emerged directly from efforts to improve the quality of their climate forecasting services for key sectors:

"For the past two years we have been holding National Climate Outlook Forums where we present our country seasonal forecast and try to find out the needs of our stakeholders. These forums helped us to understand the stakeholders' needs and how we can further assist them, and the energy sector was one such sector", she says.

As part of this process Belize was able to leverage over US$ 1 million in support from the World Bank-funded Belize Energy Resilience for Climate Adaptation Project. This project will involve the installation of automatic weather stations within the Challilo catchment area

and the development of a groundbreaking hydrological model, which will enable Belize Electricity Limited to use forecasting data to improve national hydro-energy management and planning for the nation's energy demand.

"We are really eager to have the Met Service provide us with stronger forecasting services because this is something that would definitely improve our management of the energy sector in terms of hydropower in Belize."

Kevin Longsworth,
Control Centre Manager, Belize Electricity Limited

Mr Kevin Longsworth, Manager of Belize Electricity Limited's Control Centre, says this new approach will help them to move away from a reliance on historical records: "The variations in the data from historical water flow are too big, so we need to have more variables and that can only happen by getting forecasting data from the Belize Met Service. If we know the volume of water that is coming into the dam each month this will let us know how much to draw down the dam levels each month and how to leave a certain margin for emergencies", he says.

Mr Longsworth says that hydropower is the key area that stands to achieve the greatest improvements in the Belize energy sector: "We are really eager to have the Met Service provide us with stronger forecasting services because this is something that would definitely improve our management of the energy sector in terms of hydropower in Belize. The hydro-energy sector is easier to control because you can store and manage it, unlike other alternative energies such as wind and solar, which are very variable and change instantly", he says.

Mr Longsworth says the rainfall data have also been subject to significant variation in recent years: "When we look at our historical data for water inflow during the rainy season it has been completely all over the place over the past five years. You don't know what next year will bring, so that is where we could really benefit by getting stronger projections for those periods of the year", he says.

Ms Cumberbatch says this project will not only build the country's dataset and capacity to understand trends and projections for the national energy sector, but it could also serve as useful model for other countries in the region.

Photos: Shutterstock.com | Belize Electricity Limited

Media training boosts climate prediction message

Adrian Trotman, Chief of Applied Meteorology and Climatology at CIMH, says it has become increasingly clear that meteorologists need to improve the way they communicate scientific information to the media and the wider public:

"We are trained to be scientists, to work on how to use equations, to use graphs, to use diagrams, to use maps, that's our training. Unfortunately, we have become poor communicators because we are used to talking with other meteorologists and climatologists who can understand our jargon. The real problem for us is that the way we say things and the way a farmer or a politician might understand this information is not necessarily the same thing", he says.

With support from WMO, CIMH has now developed a new media training programme in collaboration with the well-known BBC World presenter and journalist David Eades. As part of this training programme, over 35 meteorologists and journalists from throughout the Caribbean region participated in two separate training events designed to help increase understanding and cooperation between these two professions.

Mr Trotman says he now firmly believes that developing stronger and more trusted relationships with the media can also help to improve the way they communicate to decision-makers and the people who stand to benefit the most from this critical climate information:

"When it comes to communicating scientific information, there also has to be trust and understanding. The only way we can build this trust is through greater engagement and through interacting with each other on a more regular basis. And, in order to get better at communicating with our key audiences, we also have

to get better at listening to why this information is important to them", he says.

Mr Eades says the main objective of his training was to provide both the meteorologists and journalists with practical skills in communicating climate prediction information in a simple and engaging way. The training was also designed to help National Meteorology Services to produce more proactive stories that could communicate the business and economic benefits of climate prediction services:

"I think one of the biggest challenges for meteorologists is how do you get your message over to people who don't necessarily understand the subject in the way that you do, so that's basically most of us. I think the importance of looking at how you come across in the media is working out what is clear, what is simple, what are the good examples and good illustrations so that all of us understand what the questions are and what the answers are", he says.

The hands-on training package for meteorologists was specifically designed to provide practical techniques for engaging the media. A series of on-camera training exercises was also used to help them to communicate their key messages in a clear and simple way. A separate training was then designed to help journalists to understand the benefits of seasonal forecasts and how to relay critical information to people working in climate-sensitive sectors such as agriculture, energy, water, tourism and disaster risk reduction.

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Rupa Kumar Kolli explains Climate Outlook Forums

Mr Kolli is Chief of the World Climate Applications and Services Division at WMO. One of his main roles is to help WMO member countries strengthen their climate forecasting services and promote their use across climate-sensitive sectors such as agriculture, energy and water management.

What are the main benefits of Climate Outlook Forums?

All climate predictions have an inevitable element of uncertainty, and the COFs help the participating countries to understand these uncertainties and manage their climate risks in a more informed way. The main benefit is to help countries interpret the multiple sources of information on seasonal forecasts, develop a consensus-based regional climate outlook and ensure consistent regional input for country-level outlooks. The COFs also provide platforms for training national operational staff with a common purpose, networking, sharing of experiences, user interaction and expert guidance.

How much has the science of climate prediction improved since you started your professional career in climate prediction?

When I started out in climate prediction in the early 1980s, seasonal forecasting was mostly based on empirical models and historical data. Now we have very sophisticated atmosphere–ocean models that are being increasingly used for climate prediction by COFs. Seamless forecasting from weather to climate timescales using dynamical models is now entering the operational domain.

What impact have these COFs had around the world?

The number of deaths from weather and climate extremes has drastically reduced over the past few decades. This is largely due to early action powered by reliable weather and climate forecasts, and the latter includes early warnings provided by COFs. Many people now take these for granted, but the fact remains that the lead time provided by early warnings is crucial for large-scale interventions by Governments and aid agencies.

Why does WMO think it is important to try and improve the use of climate prediction services in the SIDS regions?

SIDS are sitting ducks for many weather and climate hazards, such as tropical cyclones, storm surges, floods, heatwaves, droughts and strong winds. Most SIDS economies are small and narrowly focused and therefore vulnerable to a range of external shocks. The capacities of weather and climate services within the SIDS are also very small, so regional consolidation of climate prediction capacities has become a necessity to ensure effective and reliable early warning and early action to cope with weather and climate extremes. Mainstreaming the use of science-based and actionable climate information in all climate-sensitive decisions is critical if we want to make SIDS truly climate smart.

Do you think climate prediction services can also help to provide SIDS with opportunities for sustainable economic development?

It is not uncommon to see one climate extreme wipe out years of investments in socioeconomic development in many developing countries, particularly SIDS. While many people talk about climate change they appear to perceive it as something happening in the distant future, but how we deal with the climate variability that is already happening will determine how we will be able to cope with the surprises that climate change will bring. If we can support more effective uses of climate predictions in our decision-making, this will help all of us to be prepared for future climate shocks.

Do you think the Caribbean is leading the world in the development of COFs and of tailored climate prediction services for different sectors?

The Caribbean was a bit late in embracing the COF concept, but they quickly came on top of it through active and enthusiastic involvement of the member countries and a brilliant coordination effort by the Caribbean Institute of Meteorology and Hydrology. CIMH has some really talented and passionate scientists who have been using innovative approaches to enhance the COF product portfolio, and it is clearly serving as a role model for COF operations around the world.

Photos: UNDP

"Mainstreaming the use of science-based and actionable climate information in all climate-sensitive decisions is critical if we want to make SIDS truly climate smart."

Rupa Kumar Kolli, WMO

What are the main barriers that are stopping more SIDS from utilizing climate prediction services to support national planning and sustainable development?

The main barriers are lack of awareness and appreciation of the socioeconomic benefits of climate prediction services, and also the absence of a suitable mandate in many countries to mainstream the use of authentic climate predictions in decision-making. Of course, many island countries also have very small meteorology services so they are also faced with basic capacity issues. It is very important to address the capacity development needs in terms of human-resource, infrastructural, institutional as well as procedural capacities. Another barrier is lack of effective communication strategies tailored to the capacities and contexts of the users in understanding and applying climate information.

What would be your greatest wish in terms of strengthening climate prediction services in the SIDS regions?

My greatest wish is to see all stakeholders in climate-sensitive sectors routinely using climate information in all their decision-making, much the same way as the aviation sector uses weather briefings. A pilot is aware of the uncertainties associated with weather forecasts but is mandated to use and apply the available information and knowledge. I would urge all small island leaders to support the development of National Climate Outlook Forums and National Climate Forums which can greatly help to support the use of climate predictions and products across all the different climate-sensitive sectors. In the future I hope these forums will become a regular feature of the climate service under the coordination of the National Meteorological and Hydrological Services of all Small Island Developing States.

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www.cimh.edu.bb | www.sprep.org | www.commissionoceanindien.org

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