

Vanuatu Klaemet Infomesen Blong Redy, Adapt Mo Protekt (Van-KIRAP)

Water and Climate Information Services (CIS):
Policy Review, Action and Communication Plan





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Cover photograph: Water is life. Photo Credit: The Vanuatu Independence.

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Acronyms

APCC	APEC Climate Centre
AWS	Automatic Weather Station
BoM	Australian Bureau of Meteorology
CDMS	Climate Data Management System
CLEWS	Climate Early Warning System
ClIDE	Climate Data for the Environment
ClIDesc	Climate Data for the Environment Services Application Client
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
FAO	Food and Agricultural Organization
GCF	Green Climate Fund
GEF-LDCF	Global Environment Facility - Least Developed Countries Fund
GFCS	Global Framework for Climate Services
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)
ICU	Island Climate Update
IWRM	Integrated Water Resource Management
NAPA	Vanuatu National Adaptation Programme of Action
NCCAS	Vanuatu National Climate Change Adaptation Strategy
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
NOAA	National Oceanographic and Atmospheric Administration (USA)
NSDP	National Sustainable Development Plan 2016-2030
PRSCS	The Pacific Roadmap for Strengthened Climate Services
PWD	Public Works Department
SPREP	Secretariat of the Pacific Regional Environment Programme
UNDP	United Nations Development Programme

Van-KIRAP	Vanuatu Klaemet Infomesen blong redy, adapt mo protekt (formerly known as CISRDP: Climate Information Services for Resilient Development in Vanuatu Project)
VCU	Vanuatu Climate Update
VFCS	Vanuatu Framework for Climate Services
VMGD	Vanuatu Meteorology and Geohazards Department
VMGD SDP	VMGD Strategic Development Plan
VNWS	Vanuatu National Water Resource Strategy 2008—2018

Executive Summary

The Vanuatu Klaemet Infomesen blong Redy, Adapt mo Protekt (Van-KIRAP) Project is delivering climate science to support decision makers and communities in Vanuatu to prepare for and adapt to climate variability and change. Although Vanuatu has been identified as a carbon sink, it is significantly affected already by changing weather patterns and the start of slow-onset climate change, such as warming oceans.

Assessments of vulnerability to climate change undertaken over the last two decades have identified Vanuatu as highly exposed to climate variability and change, and at risk of impacts, with the country ranked 9th globally under the Climate Risk Index for 1998–2017¹. The Government of Vanuatu and development partners have developed policies and strategies to improve access to reliable climate information and to ensure it is used effectively to minimise impacts. Both these objectives are expensive and difficult to achieve, and so the integration of climate information into planning processes has been slow.

Van-KIRAP will support VGMD to provide five target sectors, including the Water Resources Division and its stakeholders, with climate information ready to be used in current and planned activities. A sector Coordinator in the Water Resources Division will co-ordinate the Water and Climate Action and Communication Plan to advance the mainstreaming of climate information services into Water policy, planning, design and delivery.

This document reviews existing information on climate and climate change as they affect Vanuatu's Water sector and summarises current policies, strategies and frameworks. It provides the Water Climate Action Plan and Communication Plan developed through a collaboration between the Water Resources Division and the Vanuatu Meteorology and Geohazards Department (VMGD).

¹ German Watch (2019) Global Climate Risk Index 2019: Who Suffers Most from Extreme Weather Events? Weather-related loss events in 2017 and 1998 to 2017. Authors: David Eckstein, Marie-Lena Hutfils and Maik Winges, Munich, Germany.

1. Background

The Vanuatu Meteorology and Geohazards Department (VMGD) with support from the Secretariat of the Pacific Regional Environment Programme (SPREP) and funded by the Green Climate Fund (GCF) is leading the Vanuatu Klaemet Infomesen blong redy, adapt mo protekt (Van-KIRAP) Project.

Van-KIRAP “will increase the ability of decision makers, development partners, communities and individuals across five target sectors (agriculture, fisheries, infrastructure, tourism and water) to plan for and respond to the long- and short-term impacts of climate change.

The project will build capacity to harness and manage climate data, develop and deliver practical Climate Information Services (CIS) tools, support the coordination and dissemination of tailored information, enhance CIS related information and technology infrastructure, improve the accessibility of CIS to sectors and communities, and support the application of CIS through real-time development processes.

CIS provides people and organisations with timely, tailored climate-related information and tools that can be used to minimise the impacts of climate variability and change on lives, livelihoods, natural resources, property and infrastructure. CIS supports better policy, planning, and decision-making across sectors, and at national and community scales for both long- and short-term timeframes.

The Project is responding to priorities identified in the Vanuatu Framework for Climate Services (2016) and the VMGD Strategic Development Plan 2014–2023, developed through a national consultation and design process.

Without timely and tailored information about the impacts of climate variability and change, development sectors, governments and communities risk significant losses and damage from extreme events such as drought, heat waves, cyclones and flooding, and from slow onset changes, such as rising temperatures, sea-level rise and ocean acidification.²

In support of these objectives, Van-KIRAP commissioned the development of sector specific Climate Information Services (CIS) Action and Communication Plans. This document reflects the requirements of the water sector as it relates to CIS in Vanuatu.

2. Climate in Vanuatu

Vanuatu is one of the world’s most vulnerable countries to natural disasters. It experiences droughts, floods, cyclones, volcanic eruptions, landslides, tsunami and coastal inundation. Its location in the ‘warm pool’ of the South Pacific Convergence Zone (SPCZ) means its population is highly exposed to cyclone activity. Between 1950 and 2004 Vanuatu reported the highest number of disasters in the Pacific Islands Region.³

The landscape is characterised by six island groups (Provinces), of mostly mountainous volcanic origin; steep catchments lead to narrow coastal plains vulnerable to flooding. It has a tropical climate,

² SPREP, RFT: Climate Information Services Policy Review, Sector-Action and Communications Plan Consultancy, 2018

³ World Bank, Climate Risk and Adaptation Country Profile: Vanuatu, 2011

moderated by southeast trade winds from May to October, and moderate rainfall from November to April, often affected by cyclones from December to April. Vanuatu has a population of approximately 278,000 that is concentrated along the coastal environment that plays a vital role in the subsistence and commercial life of ni-Vanuatu.

Increased human activity in this coastal environment is placing greater pressure on sensitive areas such as beaches, coral reefs, seagrass and mangroves. Atolls, low-lying islands, and low-lying coastal areas of Vanuatu are particularly vulnerable to climate change consequences. Some of these climate related risks include the following:

- by 2040, daily temperatures will increase from 1995 levels by 1.2°C;
- sea level rise will continue and accelerate, so risks of coastal inundation will be high when combined with storm surges and high seas;
- ocean acidification may degrade 80% of coral reefs within 20 years;
- extreme temperatures will reach higher levels and become more frequent;
- extreme weather events, including cyclones and storms, will increase in intensity but not necessarily in frequency; and
- dry periods will last longer and extreme rainfall will be more frequent and intense, so Vanuatu will be susceptible to intensified erosion and flooding.

The economy is based primarily on small-scale agriculture, which provides a living for about two-thirds of the population (and is a particular source of income and livelihood for women). Fishing, offshore financial services, and tourism (with nearly 197,000 visitors in 2008), are other mainstays of the economy. Most of the population does not have access to a reliable supply of potable water, though 94.5% has access to 'improved' water sources, and deforestation exists as a major environmental challenge.

The main climate hazards for Vanuatu include tropical cyclones with high winds and wave energy, heavy rainfall resulting in flooding, extended periods without rain causing drought, rising sea levels threatening coastal environments and property, as well as sea temperature increase and ocean acidification impacting highly valuable coastal ecosystems and resources (including coral reefs, seagrass and fisheries). Pacific region adaptation costs across all vulnerable sectors are estimated to be between US\$158 – 775 million per annum until 2050 to prepare for best to worst case future scenarios (with US\$447 million under business-as-usual) (ADB 2013).⁴

3. Climate Services in Vanuatu

3.1. Vanuatu Meteorology and Geohazards Department (VMGD)

VMGD's mandate is decreed by the Meteorology, Geological Hazards and Climate Change Act (2016)— Act No.25 of 2016. The Act gives the VMGD wide ranging powers with respect to the execution of meteorological, geological and climate change related services.

⁴ SPREP, GCF Funding Proposal: Climate Information Services for Resilient Development in Vanuatu, 2016

VMGD is headed by the Director of VMGD, who is accountable to the Director General of the Ministry of Climate Change, Meteorology, Geohazards, Energy, Environment and Disaster Management. The Director General is also co-chair of the National Advisory Board on Climate Change and Disaster Risk Reduction (NAB) which facilitates and endorses the development of new DRR and CC programs, projects, initiatives and activities, acts as a focal point for information-sharing and coordination on CC/DRR, and guides and coordinates the development of national climate finance processes.⁵

VMGD is responsible for the collection, quality control, processing, storage and retrieval of meteorological and climatological data so that it may be utilised by a wide variety of stakeholders. One of its primary responsibilities is the preparation and publication of seasonal climate forecasts and long-term climate change predictions. VMGD provides technical expertise to the National Disaster Management Office (NDMO) and various climate-sensitive sectors during ENSO events, and disseminates advisories on significant climate events such as El Niño and La Niña. It also pursues climate variability and climate change research in support of national development strategies. In addition, VMGD has an active focus on community engagement, which includes raising awareness of its climate information and services, and how these might be utilised by various end-users.⁶

National climate products from VMGD

1. Vanuatu Climate Update (VCU) – the VCU is produced monthly and is an outlook of expected climate for the upcoming three months. It includes information on seasonal rainfall, tropical cyclones and sea surface temperature. The VCU is disseminated via the VMGD website and email and comes in both English and Bislama.⁷
2. ENSO (El Niño–Southern Oscillation) update
3. Climate Services: Report for Agriculture – produced from AWS data at a site and available via the VMGD website
4. Media release – El Niño, or La Niña, TC outlook
5. Tropical Cyclone Outlook – usually released early November
6. Klaod Nausara Animation – explains the impacts of El Niño and La Niña in Bislama
7. Brochures – La Niña and El Niño in English
8. ENSO handbook (DVD, brochures and a games toolkit)
9. Vanuatu Ocean Outlook – in trial
10. Early Alert Rainfall Watch – in trial
11. Rainfall data request – rainfall, temperature, etc.

⁵ World Meteorological Organization (WMO), Enhancing Early Warning Systems to build greater resilience to hydro and meteorological hazards in Pacific Small Island Developing States (SIDS): National consultation report, Jan 2018

⁶ SPREP, GCF Funding Proposal: Climate Information Services for Resilient Development in Vanuatu, 2016

⁷ SPREP, Vanuatu Framework for Climate Services, 2016

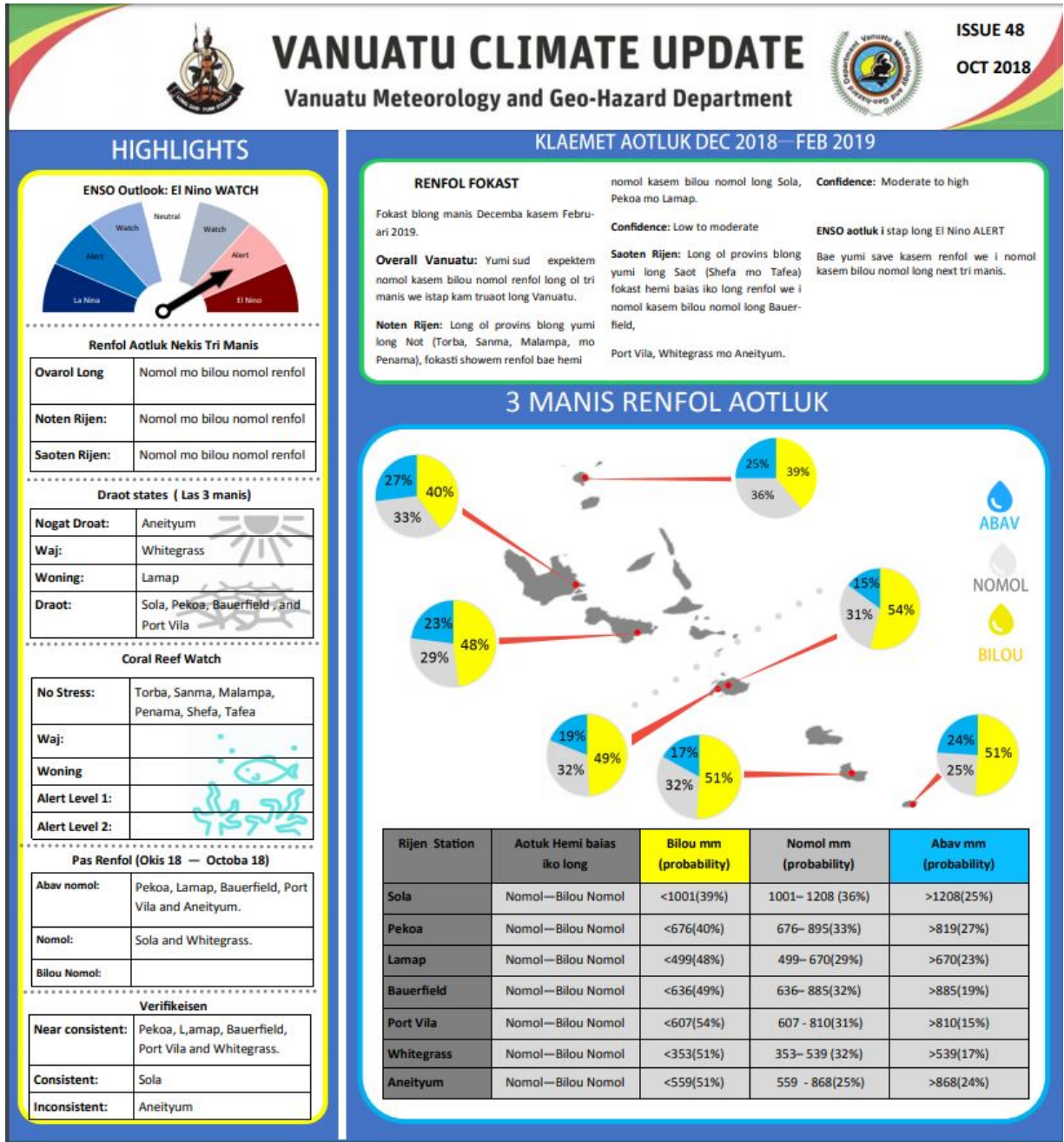


Figure 1: Vanuatu Climate Update (Source: VMGD)

National Climate stakeholder liaison by VMGD

1. VMGD Monthly climate briefings – Presentation on the climate summary and outlook information
2. VMGD 3-Monthly climate briefings – Presentation on the climate summary and outlook information
3. VMGD National Climate Outlook Forum
4. Media briefings – Radio talkback monthly.

Regional Climate products supported by partners

SPREP

1. Early Action Rainfall (EAR) Watch (request from VMGD)
2. Traditional Knowledge program (housed at VMGD) – survey form, database system
3. Climate Information Toolkit for the Pacific (<http://clikp.sprep.org/>) (supported by APCC)
4. Pacific Island Countries Advanced Seasonal Outlook (PICASO) – rainfall threshold predictions (<http://clikp.sprep.org/>) (supported by APCC)
5. SCOPIC/Seasonal Forecasting (in partnership with BoM) – 3 month prediction (<https://www.pacificmet.net/products-and-services/climate-bulletin>)

Australian Bureau of Meteorology (BoM)

1. COSPPac Bulletin (<https://www.pacificmet.net/products-and-services/climate-bulletin>)
2. SCOPIC/Seasonal Forecasting (in partnership with SPREP) – 3 month prediction (<https://www.pacificmet.net/products-and-services/climate-bulletin>)
3. Drought Monitoring Tool (allows to set thresholds for different water requirements)
4. ENSO Wrap-up (<http://www.bom.gov.au/climate/enso/>)
5. CliDE (climate data for the environment) (and CliDEsc which is supported by NIWA)
6. Sea-level information products (real time data monitoring and tide calendars)
7. Pacific Climate Change Data Portal (<http://www.bom.gov.au/climate/pccsp/>)
8. TC portal (<http://www.bom.gov.au/cyclone/history/tracks/>)
9. ACCESS-S dynamic model (in development) – outlook for season, month, fortnight and week
10. POAMA dynamic model – 3 to 9 month forecasts (SST+, hot spots, bleaching risk etc.)
11. ReefTemp Next Gen – 1 to 14 days SST, SST+, hot spots and bleaching risk maps)
12. Pacific Ocean Portal (now supported by SPC)

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

1. Climatology of Vanuatu: Past, present and future
2. Technical Report and non-technical country brochure
3. Regional Climate Consortium in Asia-Pacific (RCCAP) Portal
4. Websites and portals:
 - www.pacificclimatechangescience.org
 - www.pacificclimatefutures.net
 - www.pacificmet.net/rcc
 - www.rccap.org

Other Organisations

1. Tide Predictions Calendar (<http://www.bom.gov.au/pacific/projects/pslm/>) (SPC)
2. Pacific Ocean Portal (previously BoM)
3. RiskScape – Land-use planning tool that includes sea level, rainfall, elevation (NIWA)
4. Coral Reef Watch – 9-month SST+ and bleaching projections (NOAA & used by VMGD for Ocean Outlook) (<https://coralreefwatch.noaa.gov/satellite/baa.php>)
5. Bleaching Futures – downscaled coral bleaching return interval projections to 2100 for Vanuatu (NOAA/Symbioseas).

4. Water in Vanuatu⁸

The larger mountainous islands of Vanuatu have good ground and surface water resources whilst the low-lying islands have limited fresh ground water in shallow aquifers and rely heavily on rainwater. The mountainous terrain also creates challenges for traditional water carriers, the women and children, especially where sources are far from villages. There is generally abundant rainfall (from 100 mm per month in July to >400 mm per month in January) although this varies from north to south of the country and high mountainous islands create rain shadows on their leeward side.

Port Vila water supply is provided by a private company (UNELCO) under contract with the Government. The water supply for Luganville, Isangel and Lakatoro are managed by the Public Works Department. Water quality is generally good with chlorine used for water treatment in Port Vila and Luganville. There are at least six known private water suppliers around Port Vila operating outside the UNELCO concession area. These suppliers are not regulated, and no monitoring activity is known.

Outside these areas water supply is either taken from groundwater via open wells and bores, from surface water sources, or rainwater collection with storage in ferro-cement or polyethylene tanks. Demand for irrigated water is extremely low and limited to a few small horticultural sites. In these rural areas there is a range of different problems with the delivery of safe drinking water including intermittent supply caused by drought or damaged infrastructure, contaminated water and competing uses for drinking water causing conflict in communities.

Water reuse has not yet been considered and desalination has only been considered for disaster management. Bottled water is commonly available in supermarkets in urban centres.⁹

4.1 Water services in Vanuatu

4.1.1 Water institutional arrangements relating to climate

Government Ministries and Departments are using VMGD information, combined with their own monitoring and modelling, very effectively. For example, the Water Resources Division of the Department of Geology, Mines and Water Resources (DGMWR) issues a *Hydrological Drought Advisory* with associated actions and safety warnings, which is informed by climate information and forecasts. The Department of Geology, Mines and Water Resources have indicated that they are willing to share their rainfall, river flow and borehole data records with VMGD.¹⁰

4.1.2 Current use of climate information by the water sector

There is a close relationship between VMGD and the Department of Geology, Mines and Water Resources. Climate variability and change is mentioned in the National Water Strategy, 2008—2018.

⁸ Government of Vanuatu, Vanuatu National Water Strategy 2008-2018, 2007

⁹ Ibid.

¹⁰ SPREP; Vanuatu Framework for Climate Services, 2016.

The Vanuatu Climate Update and Monthly Climate Summary, and the NIWA Water Watch, are circulated to Provincial Water Officers, and this information is passed on (when relevant) to community water committees.

The Water Resources Division regularly accesses rainfall data from VMGD, and they also have a lot of historic rainfall data which could be shared”¹¹

4.2 Main climate impacts on water

El Niños, often associated with a drier-than-normal wet season, have a significant (negative) impact on the reception and collection of freshwater resources from springs and streams. Fresh water abstraction is also affected by too much rainfall and flooding. During both drier- and wetter-than-normal periods, water quality can be poor due to excess sedimentation, contaminants and/or bacteria.¹²

The main climate impacts on water supply in Vanuatu are drought and flooding related to ENSO and tropical cyclones. “Floods and droughts are also common in Vanuatu and are predicted to become more extreme with weather pattern changes. Flooding and poor farming practices have resulted in erosion, threatening land stability and the health of rivers and marine life in or around river mouths. In general, the islands with active volcanoes have all suffered negative effects on water quality due to contamination from a mixture of fluoride, hydrochloric acid, and sulphuric acid. This has created problems for rainwater collection systems and some surface water quality. Inundation of water resources caused by land subsidence, sea level rise and water extraction is becoming more common. The opinion of the National Disaster Management Office is that “if a village doesn’t have a problem with the quantity of drinkable water it has, it will have a problem with the quality of drinking water it has. This is an issue for almost every person living in a rural area.”¹³

Remote communities are particularly at risk if they run out of water, as people have to walk long distances to other sources of water or notify NDMO that they have run out and require emergency supply.¹⁴ The following table summarises the current impacts, sensitivities to climate change as well as the current adaptive capacity.¹⁵

11 SPREP; Vanuatu Framework for Climate Services, 2016.

12 Ibid.

13 Government of Vanuatu, Vanuatu National Water Strategy 2008-2018, 2007

14 SPREP; Vanuatu Framework for Climate Services, 2016.

15 Government of the Republic of Vanuatu, National Climate Change Adaptation Strategy for Land Based Resources 2012 - 2022, 2011

Table 1: Water sector sensitivity to climate change and adaptive capacity (Source: GoV)

Sector Impacts	Water	
	Current Sensitivity to Climate Change	Current Adaptive Capacity
<ul style="list-style-type: none"> • Droughts • Heat spells • Cyclones • Wind gusts • Floods • Sea level rise/ salt water intrusion 	<ul style="list-style-type: none"> • Lack of water storage and distribution infrastructure • Lack of financial resources for infrastructure maintenance • Lack of potable water caused by contamination • No water monitoring system in place • No water resource database of the quality, quantity and location of water resources in place • Competition of water use • No water reuse 	<ul style="list-style-type: none"> • Existing rainwater harvesting systems in some communities • Introduction of an Integrated Water Resource Management (IWRM) concept (based on the National Water Strategy) • Bottled water available in and around urban centers

5. Stakeholder Consultation Relating to Climate and Water

5.1 VMGD consultation

The VMGD regularly interacts with the Water sector through their 3 monthly climate stakeholder engagement and their annual national climate outlook forum (NCOF). VMGD have also undertaken engagements specifically with the Water sector over the last few years including through the development of the Vanuatu Framework for Climate Services, the Vanuatu Coastal Inundation Project and most recently through the Van-KIRAP project. The outcomes of these interactions are incorporated into this document.

5.2 Vanuatu Coastal Adaptation Project¹⁶

The Vanuatu Coastal Adaptation Project (VCAP), is a UNDP supported, GEF-LDCF led project which is working to build resilience and improve the quality of life in targeted vulnerable areas in the coastal zone through increased food production, improved infrastructure and sustained livelihoods.

5.3 Van-KIRAP Sector Consultations

From January to December 2018, several workshops and consultations were held with the Van-KIRAP team and the Water sector in which recommendations, actions and communication plans were iterated. The summary section below articulates the outcomes.

¹⁶ GEF, Vanuatu Coastal Adaptation Project: Climate Information and Services, Summary Sector tables, 2017

5.3.1 Van-KIRAP Inception Workshop – January 2018¹⁷

The Technical Inception Workshop for Van-KIRAP which was funded by the Green Climate Fund (GCF) was held on 22 February 2018 at the Holiday Inn in Port Vila. Its purpose was to officially launch and commence the project, refresh awareness of the stakeholders about the project, and review project activities, and implementation arrangements.¹⁸

One of the outcomes of the workshop was to identify the key project priorities for each sector. The priorities identified by Water sector are:

- Tailored information on rainfall forecasts on a daily / seasonal / longer term basis linked with early warning systems for water management actions at household and community scales; and water infrastructure and management decisions at the national level.
- More real-time access to climate data at the provincial level, in particular site-specific rainfall data.
- Early and real-time warning systems to be installed at the Sarakata River catchment in Santo. This catchment has a history of being flooded during severe weather events and resulting in the loss of lives and disruption of services.
- The Strategic Plan on Water Resources has activities that are being considered for funding: some are still unfunded. It is strongly recommended that the Water Sector Coordinator work closely with the Water Resources Department to link these activities to Van-KIRAP.

5.3.2 Van-KIRAP Sector Workshops – October 2018

The VMGD “with funding support from the GCF and the Secretariat of the Pacific Regional Environment Programme (SPREP), organised a Sector Consultation Workshop for Developing Climate Action and Communication Plans from 23 October—2 November 2018.”¹⁹ Pacific Science Solutions (PSS) facilitated and led the consultations with the workshop participants.

The workshop was structured in three parts. The first part was held in Port Vila and the Project Delivery Partners, sectors and other science organisations attended. Sector representatives were supported to draft Action and Communication Plans relating to their use of climate information. The second part of the workshop was held in Santo: provincial sector representatives were asked to review the draft sector action and communication plans written by their Port Vila colleagues. The last part of the workshop was held in Port Vila, where senior sector representatives reviewed and finalised their draft Action and Communication Plans.

See the Workshop Report for more information.

5.3.3 Van-KIRAP Follow-up Sector Consultation – December 2018

From 3 to 7 December, Pacific Science Solutions and SPREP conducted follow-up consultations with representatives from four sectors (agriculture, tourism, fisheries and water) to discuss their draft sector plans and seek their respective Directors’ preliminary endorsements. The draft plans incorporated the outcomes of the consultation workshops (Section 5.2.3.2). Further changes and inputs were provided during the follow-up meetings which have been incorporated in this document.

¹⁷ SPREP, Inception Report: Climate Information Services for Resilient Development Planning in Vanuatu (Van-CIS-RDP), 2018

¹⁸ Ibid.

¹⁹ SPREP, Van-KIRAP sector consultation workshop report, 2018

6. Summary of Outcomes for Water Sector

The following information comes directly from the policy review and consultations with VMGD and the Water Resources Division. The tables outline the proposed recommendations for the Water sector's use of climate services. The proposed actions should be undertaken in conjunction with a communication plan to ensure effective communication between the Water sector, its primary stakeholders and VMGD.

6.1 Recommendations

The recommendations from the VFCS and priorities identified at the Van-KIRAP Inception workshop were reviewed, updated and prioritised by the Water Sector at the Van-KIRAP Sector Consultation workshops. Participants added information and clarity to the recommendations.

Table 2: The final list of recommendations

RANK	LEAD GFCS PILLAR	RECOMMENDATION
1	Observations and Monitoring	Establish water data rescue and digitisation
2	Research, Modeling and Prediction	Early and real time warning system to be installed at the Sarakata River Catchment in Santo
3	Capacity Building	Conduct capacity building of M&E Unit staff
4	Research, Modeling and Prediction	Conduct research on effects of ENSO on water quality and quantity
5	User Interface	Enhance real-time access to climate data at the provincial level
6	Observations and Monitoring	Expand site specific rainfall data
7	Observations and Monitoring	Expand collection of surface water hydrological data (River Gauges) on major catchments around Vanuatu
8	User Interface	Develop flood management and response plan for Sarakata River
9	Climate Services Information System	Include climate information services into water infrastructure and management decisions at the national level
10	User Interface	Simplify climate information (use less jargon)
11	Climate Services Information System	Incorporate traditional knowledge relating to hydrology into water sector

6.2 Alignment of recommendations with National and Regional policies and plans

A review of the top 5 national and regional policies associated with Water and Climate were assessed for alignment with the recommendations. The outcome of this review is listed below. The documents reviewed were: Vanuatu National Water Resource Strategy (VNWS) 2008—2018; National Sustainable Development Plan (NSDP); Vanuatu Framework for Climate Services (VFCS); VMGD Strategic Development Plan (VMGD SDP); and Pacific Roadmap for Strengthened Climate Services (PRSCS).

Table 3: Recommendations aligned with National and Regional policies and plans

RANK	RECOMMENDATION	POLICY & PLAN ALIGNMENT
1	Establish water data rescue and digitisation	VNWS: Under the Strategic Direction portion of the VNWS, it is stated that "a regular monitoring programme would provide useful data for analysis to be entered into a centralised database. The database should be accessible to assist in decision making at all levels."
		NSDP: SOC 6.9 calls for the "[strengthening of] research, data and statistics for accountability and decision making."
		VFCS: The Water Resource Department of the "Ministry of Land and Natural Resources collects river flow, water quality, bore level and some rainfall data". Further, the "VMGD is responsible for the collection, quality control, processing, storage and retrieval of meteorological and climatological data so that it may be utilised by a wide variety of stakeholders."
		VMGD SDP: The relevant Key Outcomes under the Climate Division are as follows - Key Outcome 1: Improved management of historical, meteorological, hydrologic and other related environmental data; Key Outcome 2: Improved and sustained quality of meteorological, hydrologic and other related environmental datasets on the VMGD Headquarters server.
		PRSCS: Establish database for hydrological data storage
2	Early and real time warning system to be installed at the Sarakata River Catchment in Santo	NSDP: ENV 3.2 calls for "[improved] monitoring and early warning systems".
		VFCS: "An operational [early warning system] could be utilised by the VMGD to produce tailored climate bulletins, which could be disseminated to specific end users every month. These bulletins would combine climate summary and outlook information, be tailored and simplified, and include observed impacts...Bulletins could be developed for Sarakata Hydro Project"
		VMGD SDP: Key Outcome 6 under the Strategic Goals and Objectives of VMGD Divisions draws on the need to "develop, establish and operate an early warning system for floods".
3	Conduct capacity building of M&E Unit staff	NSDP: SOC2.4 Increase higher education opportunities, including technical and vocational training and skills
		VFCS: 11.1 Training should include a component on understanding what influences the climate of Vanuatu, for example ENSO. Such training should be at least every two years (plus regular short refresher courses) and could be done at the same time as training for provisional area secretaries, provincial government sector representatives. (pg.39)
4	Conduct research on effects of ENSO on water quality and quantity	VFCS: "An update to the ENSO Handbook for marine resource management is required, and the development of a climate–marine bulletin in partnership with the Department of Fisheries has been suggested."
5	Enhance real-time access to climate data at the provincial level	VFCS: Recommendation 4 states that "provincial government should work with the VMGD to tailor climate information so that it best meets their needs and directly informs their action and response plans".
		VMGD SP: Key Outcome 5 under the Administration and Corporate Services Division requires that "communication systems [be] developed for key management information outputs for Ministry requirements; and VMGD staff awareness"

RANK	RECOMMENDATION	POLICY & PLAN ALIGNMENT
6	Expand site specific rainfall data	<p>VNWS: Data on rainfall patterns and rainfall trends is necessary for the agricultural sector, communities vulnerable to drought and to provide forecasts of periods of above or below average rainfall for water availability particularly important with recent changes in climatic conditions.</p> <p>VFCS: Despite the very good coverage of VRN data collection sites, there is still a need for more real-time access to climate data at the provincial level, in particular site-specific rainfall data.</p> <p>PRSCS: Incorporate water quality measures in monitoring tools and systems.</p>
7	Expand collection of surface water hydrological data (River Gauges) on major catchments around Vanuatu	<p>VNWS: Under the Strategic Direction points in the VNWS, it is stated that "an expanded hydrological network will provide data needed to assess potential for hydroelectric or geothermal development. Data on surface water is necessary for the planning of transport networks, land use activities surrounding river systems, the mitigation of flood hazards and to provide flood warnings". Data on surface water is necessary for the planning of transport networks, land use activities surrounding river systems, the mitigation of flood hazards and to provide flood warnings.</p> <p>VMGD SDP: Key Outcome 2 under Climate Divisions calls for "improved and sustained quality of meteorological, hydrological and other related datasets on the VMGD Headquarters server.</p> <p>PRSCS: Implement hydrological / hydro-meteorological monitoring systems.</p>
8	Develop flood management and response plan for Sarakata River	<p>VNWS: Data on surface water is necessary for the planning of transport networks, land use activities surrounding river systems, the mitigation of flood hazards and to provide flood warnings</p> <p>NSDP: ENV 3.3 highlights the need to "strengthen post-disaster systems in planning, preparedness, response and recovery; ENV 3.4 "promote and ensure strengthened resilience and adaptive capacity to climate related, natural and manmade hazards"; ENV 3.5 "access available financing for climate change adaptation and disaster risk management".</p> <p>VMGD SDP: Key Outcome 6 under the Strategic Goals and Objectives of VMGD Divisions draws on the need to "develop, establish and operate an early warning system for floods". KO 1 under Climate Change and Disaster Risk Reduction requires the "[development of] integrated climate change and disaster risk reduction action plan(s)".</p>
9	Include climate information services into water infrastructure and management decisions at the national level	<p>VNWS: Appropriate and sustainable water and wastewater infrastructure installed to meet domestic, customary use targets and needs for sustainable development</p> <p>VFCS: Accurate weather forecasts are needed for day-to-day management of infrastructure projects, such as roading upgrades and maintenance. Seasonal forecasting would be useful to inform project planning and resource mobilisation, while climate change assessments are needed for future infrastructure investment planning.</p> <p>PRSCS: Predictions of seasonal flow for major rivers. Development of drought management plans including strategies for rainwater, surface water and groundwater.</p>
10	Simplify climate information (use less jargon)	<p>VNWS: Accurate, clearly presented information and response mechanisms appropriate to the relevant institutional arrangements including customary institutions will support improved accountability between government and stakeholders.</p> <p>VFCS: Climate information (e.g. as presented in the VCU) needs to have less jargon and be translated into simple terms e.g. using pictures and incorporating traditional knowledge (e.g. associated with water conservation and the use of grey water)</p> <p>PRSCS: Establish cooperative interaction between NMHs and water authorities and organisations on weather and climate related water resource management issues.</p>
11	Incorporate traditional knowledge relating to hydrology into water sector	<p>VFCS: Climate information (e.g. as presented in the VCU) needs to have less jargon and be translated into simple terms e.g. using pictures and incorporating traditional knowledge (e.g. associated with water conservation and the use of grey water)</p>

6.3 Policies relating to climate and water

Several national and sectoral policies, strategies, frameworks and plans support the need for the development and application of tailored climate information in the Water sector. This section outlines the references to climate and water in these documents and in related stakeholder engagement platforms. The Global Framework for Climate Information Services is also referenced. The review of these documents focusses on the integration of climate information services into the Water sector, and the findings of the review are provided in the Summary section below. *(Refer to Annexes for specific references from the documents below, on the provision and integration of climate information in the water sector.)*

6.3.1 Vanuatu National Water Resource Strategy (VNWS) 2008-2018

The National Water Resource Strategy provides “the Government of Vanuatu with a rational basis for sector-wide planning which involves direct engagement with local government and communities, civil society groups, private sector organisations and donors for effective national water resource management.”²⁰ It notes that “rural communities will benefit the most from greater access to safe drinking water supplies for domestic and customary use. The private sector will benefit from greater access to water purposes of economic development and environmental protection.”²¹

The Strategy makes only one reference to climate, referring to the risk that climate change (along with pollution) will increase the demands on existing water sources and “could be expected to limit the future availability of potable water, constrain its productive use and impact negatively on Vanuatu’s most precious resource, its pristine natural environment.”²²

6.3.2 Vanuatu Meteorology and Geohazards Department Strategic Development Plan (VMGD SDP) 2014-2023

The VMGD SDP sets the strategic context and direction for strengthening the capacity of the VMGD, with emphasis on developing and supporting “...state of the art technical services...” collectively through enhanced capacity, coordination and partnerships. The Strategy focuses on the following priorities (amongst others):

- Improved weather, climate and climate change services (including across multiple hazards, stakeholders and time frames)
- Improved observations and associated monitoring networks, and
- Enhanced capacity for both administrative/project management and research and development, outreach and communications.

The Strategy summarises the current situation (capacity, activities, products and services) for the relevant Divisions of the VMGD including Weather Forecasting and Services, Climate, Climate Change

20 Government of Vanuatu, Vanuatu National Water Strategy 2008-2018, 2007

21 Government of Vanuatu, Vanuatu National Water Strategy 2008-2018, 2007

22 Government of the Republic of Vanuatu, Vanuatu National Water Strategy -2008-2018, 2007

and Disaster Risk Reduction, Observations, and Information Communication Technology and Engineering.²³

The VMGD SDP under the Climate Division section has a specific Key Outcome relating to Water. Key Outcome 7 states the importance of the VMGD's Climate Division having a partnership or an agreement with other government agencies which enables it to access external holdings of useful climate and hydrology data.

6.3.3 Vanuatu Framework for Climate Services (VFCS)

"The VFCS is principally guided by the five pillars of the Global Framework for Climate Services, the VMGD Strategic Development Plan and by various national level stakeholder consultations. The stated goal of the VFCS is to "...ensure climate services for Vanuatu are of world-class standard, sustainable, are reaching all end-users, and are effectively helping people manage and adapt to climate variability and change in Vanuatu" (SPREP 2016). This Framework identifies the most pressing needs as:

- The development, through key stakeholder consultation, of tailored climate products (including training in their use), and
- Improvements to and formalization of mechanisms for communicating and disseminating climate information.

The Framework makes 18 specific recommendations, based around the five pillars of the GFCS, as priority actions. The VFCS aims to strengthen climate information development, provision, understanding and use throughout Vanuatu. It describes the following:

- Capacity of both providers and receivers (source and Next/End-Users) of climate services
- The interface platforms and networks used for dissemination of climate information and its value
- The kind of products that can be produced and tailored to user needs
- The research priorities that still require funding, and
- The requirement for high quality climate observations fundamental to all services."²⁴

The VFCS identifies the most pressing needs as tailored climate products and formalisation of mechanisms for communicating and disseminating climate information. It makes three recommendations for the water sector: first, there is still a need for more real-time access to climate data at the provincial levels, in particular site-specific rainfall data. Secondly, the VCU needs to have less jargon and be translated into simple terms (e.g. pictures, traditional knowledge), and thirdly additional research is required on the effects of ENSO on water quantity and quality and bore water data needs to be digitised.

6.3.4 Vanuatu National Climate Change Adaptation Strategy (NCCAS)

The National Climate Change Adaptation Strategy is designed to guide the implementation of efficient and effective activities to manage climate change impacts on the land-based resource sectors in Vanuatu. The NCCAS sets out a systematic, long-term approach for embedding climate change

²³ SPREP, GCF Funding Proposal: Climate Information Services for Resilient Development in Vanuatu, 2016

²⁴ SPREP; Vanuatu Framework for Climate Services, 2016.

adaptation into core sectoral functional activities. Sector specific action plans detail substantive interventions to address adaptation needs and specify the allocation of responsibilities and definitive implementation timelines.²⁵

The NCCAS notes that based on the IPCC predictions there will be saline intrusion into freshwater lenses, and that the threat to water resources will be compounded by reduced rainfall and increased sea levels. It discusses maladaptation, citing a water sector example, outlines in detail the impact on sectors and recommends specific adaption strategies for several disaster types (i.e. droughts, floods, heat stress etc).

6.3.5 National Sustainable Development Plan (NSDP) 2016-2030

The National Sustainable Development Plan “charts the vision and overarching policy framework for achieving a stable, sustainable and prosperous Vanuatu within the next fifteen years. It sets out the national priorities and context for the implementation of the Sustainable Development goals over the same period.”²⁶ Vanuatu’s development priorities are classed under the three pillars of society, environment and economy.

Under its environmental pillar the SDP has several goals and policy objectives. Three of the environmental goals—ENV3: Climate and Disaster Resilience, ENV4: Natural Resource Management and ENV5: Ecosystems and biodiversity—have water related policy objectives.

6.3.6 Republic of Vanuatu National Climate Change and DRR Policy 2016-2030

The Republic of Vanuatu National Climate Change and DRR Policy “provides the overall vision, principles, strategic goals, priorities and strategies for climate change and disaster risk reduction. Vanuatu’s strategic goal for climate change and disaster risk reduction is resilient development.

Strategic priorities are categorised under systems and themes. Systems include governance, finance, and knowledge and information. Strategic priorities that are categorised as themes include climate change adaptation and disaster risk reduction, low carbon development, and response and recovery.”²⁷

The document notes that some of the projected consequences of climate change on water are reduced availability of fresh water, saltwater inundation, and intrusion of saltwater into coastal land and groundwater.

25 Government of the Republic of Vanuatu, National Climate Change Adaptation Strategy for Land Based Resources 2012 - 2022, 2011

26 Government of the Republic of Vanuatu, Vanuatu 2030 The people’s plan: National sustainable development plan 2016 - 2030, 2015

27 World Meteorological Organization, Enhancing Early Warning Systems to build greater resilience to hydro and meteorological hazards in Pacific Small Island Developing States (SIDS): National consultation report, Jan 2018

6.3.7 Vanuatu National Adaptation Programme of Action (NAPA)

Vanuatu's NAPA "outlines the most urgent and immediate needs with respect to climate change and identifies several priority sectors (Agriculture/Food Security, Coastal Zones and Marine Ecosystems, Water Resources and Public Health) for action."²⁸

The NAPA notes several adaptation strategies relating to water: rainwater harvesting, desalination and other alternate water sources, and water management policies and programs. After prioritisation, water management policies/programs (including rainwater harvesting) was picked for development of a project concept.

6.3.8 Pacific Roadmap for Strengthened Climate Services (PRSCS)

The Pacific Roadmap for Strengthened Climate Services prioritises key actions identified for implanting the GFCS that are relevant to the Pacific. "The Roadmap focuses on the needs of both climate service providers and the key sectors that rely on their information and advice to inform planning and decision-making. It provides a guiding framework for the development of national and regional climate services targeting the Pacific priority areas."²⁹ Pacific Island Countries and Territories have adopted the five priority areas of GFCS and added a further two priorities: tourism, and fisheries and aquaculture.

The PRSCS provides a regional overview of the water sector and highlights drought monitoring and a project on conjunctive use of water. It discusses freshwater resources and other water related issues like water quality degradation, reduced institutional capacity and insufficient knowledge of water management practices.

The document includes some recommended actions which can be undertaken under the GFCS pillars to enhance Climate Information Services for the water sector. Some relevant examples are listed below:

²⁸ Ibid.

²⁹ SPREP, Pacific Roadmap for Enhanced Climate Services, 2017

Table 4: Recommended Actions for Water sector in PRSCS

NUMBER	LEAD GFCS PILLAR	ACTION	NATIONAL ACTIVITY / REGIONAL ACTIVITY
1	User Interface	Establish cooperative interactions between NMHSs and water authorities and organisations on weather and climate related water resource management issues	Regional and National
2	Climate Services Information System	Predictions of seasonal flow for major rivers.	Regional and National
3	Climate Services Information System	Development of drought management plans including strategies for rainwater, surface water and groundwater	National
4	Observations and Monitoring	Implement hydrological/hydro-meteorological monitoring systems	National
5	Observations and Monitoring	Database for hydrological data storage	National
6	Observations and Monitoring	Incorporate water quality measures in monitoring tools and systems	National

6.3.9 Global Framework for Climate Services (GFCS)³⁰

The Global Framework for Climate Services (GFCS) was formed as the principal outcome of the 2009 World Climate Conference 3. The GFCS provides a worldwide mechanism for coordinated actions to enhance the quality, quantity and application of climate services. The five priority areas under GFCS are: Agriculture and Food Security; Disaster Risk Reduction; Energy; Health; and Water. The Framework is built through user-provider partnerships that include all stakeholders.

The GFCS is built upon the following five components, or pillars (see Figure 5 below):

- i. **User Interface Platform (UIP):** a structured means for users, climate researchers and climate information providers to interact at all levels;
- ii. **Climate Services Information System (CSIS):** the mechanism through which information about climate (past, present and future) is routinely collected, stored and processed to generate products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises;

³⁰ <http://www.wmo.int/gfcs/>

- iii. **Observations and Monitoring (O&M):** to ensure that climate observations and other data necessary to meet the needs of end-users are collected, managed and disseminated and are supported by relevant metadata;
- iv. **Research, Modelling and Prediction (RMP):** to foster research towards continually improving the scientific quality of climate information, providing an evidence base for the impacts of climate change and variability and for the cost-effectiveness of using climate information;
- v. **Capacity Development (CD):** to address the particular capacity development requirements identified in the other pillars and, more broadly, the basic requirements for enabling any Framework-related activities to occur.”³¹

The primary focus of the GFCS is to enable better access to and use of climate information by users.

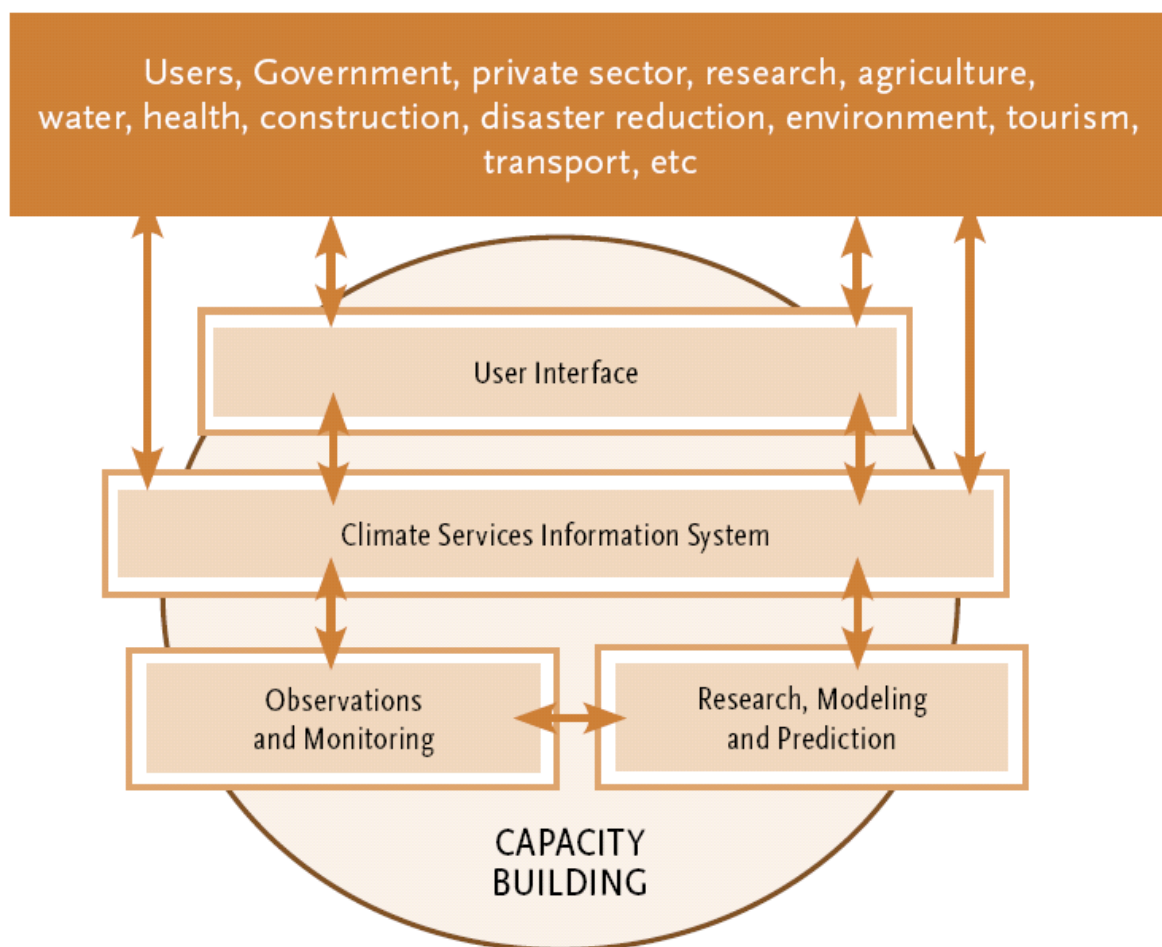


Figure 2: A schematic depicting the functional components of the GFCS (Source: WMO)

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6.4 Climate Information Services (CIS) Action Plan

Based on the final recommendations (Section 6.1), officers and contractors from the Water Resources Division developed the CIS Action Plan and the Communication Plan at the Van-KIRAP Sector Consultation workshops. The participants identified short-term, mid-term and long-term actions and sub-actions for each recommendation: short-term for periods of up to 6 months, mid-term ranging from 6 months to 2 years, and long-term ranging from 2 to 4 years. Required resources and budget implications are included but they will need to be revised and the actual cost estimated through further consultations amongst the key stakeholders. The following table outlines high level actions and sub-actions: a detailed workplan with costing and timeline will be agreed before the implementation of each recommendation. A Monitoring and Evaluation Plan will help to ensure successful implementation of the actions.

The key objectives of the Action Plan are:

1. To ensure Water Resources Division personnel and stakeholders are aware of and understand climate information and products; and
2. To enable them to readily access and effectively use this climate information for planning and decision-making at local and national levels.

Table 5: The Action Plan for the Water Sector

Rank	Recommendation	Proposed Action	Proposed Sub-action	Timing (ST,MT, LT)	Responsible Parties	Resources Required	Budget Implication	Assumption/Comments	
1	Establish water data rescue and digitisation	Prepare inventory of the water data currently available	Identify all available data (in electronic and paper format)	MT	M&E Unit and Sector Coordinator	Software, equipment, subject matter expertise, staffing	Funding required for trainer (ST Contract)	Possible funding from Van-KIRAP Activity 4.1.1	
			Digitising and systematic archiving of data that are still in paper form using digitising table				Procure equipment include tablets.		Funding for software and tablets
		Digitising and systematic archiving of data that are still in paper form using digitising table	Training of interns to use digitising table and provision of tablets				Funding for short term data entry staff		
			Training of officers to analyse and translate the data into tools and products that can be disseminated to clients and audiences						
2	Early and real time warning system to be installed at the Sarakata River Catchment in Santo	Installation of the river gauge at Sarakata River	Procure river gauge equipment (Review SPECS of equipment (submitted to Malcolm Dalesa) to ensure that it conforms with the latest technology)	MT, LT	M&E Unit and Sector Coordinator	Infrastructure, equipment, software, technical expertise, staffing	Funding for procuring of a river gauge, installation on Sarakata (contractor cost, travelling and allowance), and for on-going maintenance	Possible funding from Van-KIRAP Activities 4.3.1 and 3.4	
			Installation of gauge on Sarakata River				Funding for procuring Tideda and training		
		Training on the collection and analysis of data collected from the Sarakata station.	Request NIWA to install and provide training on data collection and Tideda software				Funding for development or procuring license for EWS software, relevant training and hardware		
			Collection and analysis of data from the Sarakata Station				Funding for awareness program, travel, DSA		
		Establishment of an early warning system for residents living along the Sarakata River.	Development of early warning system for the Sarakata River.						
			Awareness raising on warning system to settlements along the Sarakata River.						
3	Conduct capacity building of M&E Unit staff	Specific and specialised training for officers under the M&E Unit to ensure sustainability of the programme.	Training on translation of scientific data to produce tools and products for water users (both customary use and commercial use)	MT, LT	M&E Unit and Sector Coordinator, Database Officer, Advocacy and PR Officer, Provincial Water Supervisors, Provincial Rural Water Supply Officers	Software, subject matter expertise	Funding for trainers (i.e. hydrology, hydrogeology, tideda) or attendance at a training institution. Funding for appropriate software/models. Funding for training workshops, travel, DSA	Possible funding from Van-KIRAP Activity 1.2.1	
			Short courses on Hydrology and Hydrogeology						
			Training on tideda- Entry of data, analysis and translation of data into media tools						
			Projections and modelling using data that are available						
4	Conduct research on effects of ENSO on water quality and quantity	Develop hydrological drought vulnerability index for selected provinces	Develop proposal and identify research partners and ToR	MT, LT	M&E Unit and Community Development Officer, VMGD	Software, subject matter expertise	Funding may be required for external researchers	Possible funding from Van-KIRAP Activity 1.3.1	
			Water Quality Training						
5	Enhance real-time access to climate data at the provincial level	Establish effective communication with Provincial officers to disseminate information early	Development of communication strategy	MT, LT	M&E Unit and Sector Coordinator, VMGD	Subject matter expertise, staffing	Funding for technical expertise. Funding for additional telecommunications cost	Development of Communication Plan completed under Van-KIRAP Activity 1.2.1. Further possible funding from Van-KIRAP Activity 2.1.1	
			Ensure effective use of available networks (mobile) to disseminate information						Review egov system and ensure that emails and VoIP calls are made on a regular basis.
6	Expand site specific rainfall data	Expand rain gauge into areas of major networks/vulnerable catchment areas	Link with VMGD current rainfall network and identify gaps	LT	M&E unit and Sector Coordinator, VMGD	Technical expertise, staffing, funding, equipment (rain gauges)	Funding may be required to procure and install new rain gauges (including on-going maintenance) and purchase new tablet for water data collection in provinces		
			Procure and install new rain gauge on gaps and on major catchment (catchments with current surface and ground water level monitoring)						
			Utilise rainfall data to develop monthly bulletin for customary and commercial water users						
			Supply tablets to provinces for monitoring water data.						
7	Expand collection of surface water hydrological data (River Gauges) on major catchments around Vanuatu	Revive old River gauges (HYCOS stations)	Revive Tagabe River Station and Epule River Station	MT, LT	M&E Unit, VMGD	Technical expertise, staffing for monitoring and new manual river	Funding to revive old gauges and to procure new river gauges including installation and on-going maintenance		
		Install new river gauges on major catchments	Procurement of new manual river gauges and Installation of a new river gauge on the Teouma River (many activities are happening around the Teouma plain and within the Teouma Catchment area)						
8	Develop flood management and response plan for Sarakata River	Work with relevant NGOs and NDMO to ensure flood management plan is aligned with national disaster		MT, LT	M&E Unit, VMGD	Equipment, staffing, subject	Funding for community monitoring and simple flood monitoring equipment,		
9	Include climate information services into water infrastructure and management decisions at the national level	Incorporate climate variability and climate change information into current standards for water supply infrastructure	Mainstream climate change into Department of Water Resources strategy and Yearly Business Plans	ST, MT, LT	VMGD, M&E Unit	Staffing, subject matter expert	Funding for technical expertise may be required.	Possible funding from Van-KIRAP Activity 1.3.1	
			Review existing water infrastructure designs and ensure that it is according to the building/construction code. (cyclone/earthquake proof etc)						
10	Simplify climate information (use less jargon)	Simplify and translate to Bislama climate information tools and materials for communities	Identify materials that contain specific climate data for water users and simplify and translate into Bislama	MT, LT	VMGD, M&E Unit	Science communication expertise	Funding for translation and printing and dissemination	Possible funding from Van-KIRAP Activity 2.1	
11	Incorporate traditional knowledge relating to hydrology into water sector	Use of Traditional Knowledge relating to hydrology to adapt to climate change	Undertaken analysis to match hydrological events to documented traditional knowledge.	MT, LT	VMGD, M&E Unit	Subject matter expertise, staffing	Funding for technical expertise, training, and information gathering	Possible funding from Van-KIRAP Activity 2.1.3. This proposed action can be built upon the outcomes of the COSPPac/SPREP TK project	
Possible case study		Sarakata flood levels in relation to forecast matters and correlation of water use and weather using Luganville urban water system.	Identify materials that contain specific climate data with relation to urban water precautionary use in Luganville	ST, MT	DoWR, Van-KIRAP Sector coordinator		Funding for materials		

6.5 Climate Information Services (CIS) Communication Plan

A communication plan is a policy-driven approach to providing stakeholders with information. The Plan formally defines **who** should be given specified (**what**) information, **when** that information should be delivered and what communication channels (**how**) will be used to deliver the information.³² This section outlines the Communication Plan's objectives, the current status of the communication mechanism, and the content of the Plan. The Plan should be regularly reviewed and updated.

6.5.1 The Objectives of the Communication Plan for Water Resources Division

- To ensure that WRD personnel and contractors are receiving timely and relevant climate information and products for planning and decision-making at local and national levels.
- To ensure an effective and efficient channel for communication and information dissemination exists between VMDG and Water Resources Division, and within the water sector.

6.5.2 Linking climate information and products to sector specific operations

The following table outlines the types of climate information required for specific operational or decision-making processes within the Water sector. This information feeds into the Communication Plan (Table 6).

³² <https://whatis.techtarget.com/definition/communication-plan>

Table 6: Climate Information required for Water operation and decision-making processes

Category	Sector operation or decision-making process	Information/Product/Tool	Responsible person
Peri-urban	Security (yield) and safety (bacteria safe standard), VDWQS, advisory notice, Water Demand Management Program (WDMP)	EAR watch, Vanuatu Climate Update (Monthly), Drought Monitoring tool, SCOPIC, RiskScape	Technical Unit Manager, Operational Staff
Hydrology / Hydrogeology	Early warning systems, El Niño & La Niña events (flooding), water catchment management, water quality monitoring, hydro data collection	All the above including, CLEWS, PICASO, COSPPac	Hydrology team (M&E)
Rural Water Supply	Household, and community drinking water availability; droughts and conservation; advisory notice; water quality	All the above including, Monthly rainfall outlook	Technical Unit Manager, Operational Staff
Project Implementation	Construction designs (Cyclone proof) for RWCs + water supply systems (formal)	ENSO outlook	Technical Unit + Project Management Unit
	Project on ground implementation (construction of water infrastructure)	EAR, Vanuatu Climate Update, SCOPIC	

6.5.3 The current situation in the water sector

- The relationship between VMGD and the Water Resources Division is excellent, but more use could be made of the Provincial Water Officers and Community Water Committees as an information dissemination mechanism.
- The Vanuatu Climate Update and Monthly Climate Summary, and the NIWA Water Watch, are circulated to Provincial Water Officers, and this information is passed on (when relevant) to community water committees.
- The Department of Water Resources issue a Hydrological Drought Advisory with associated actions and safety warnings, which is informed by climate information and forecasts.

6.5.4 Table description

Responsibility: Nominates or delegates the personnel or agency responsible for sending the identified information or products to the intended audience.

Audiences/Receiver: Personnel or parties who should receive the information or the products. The diagram below outlines the information flow from VMGD to various personnel within Water sector.

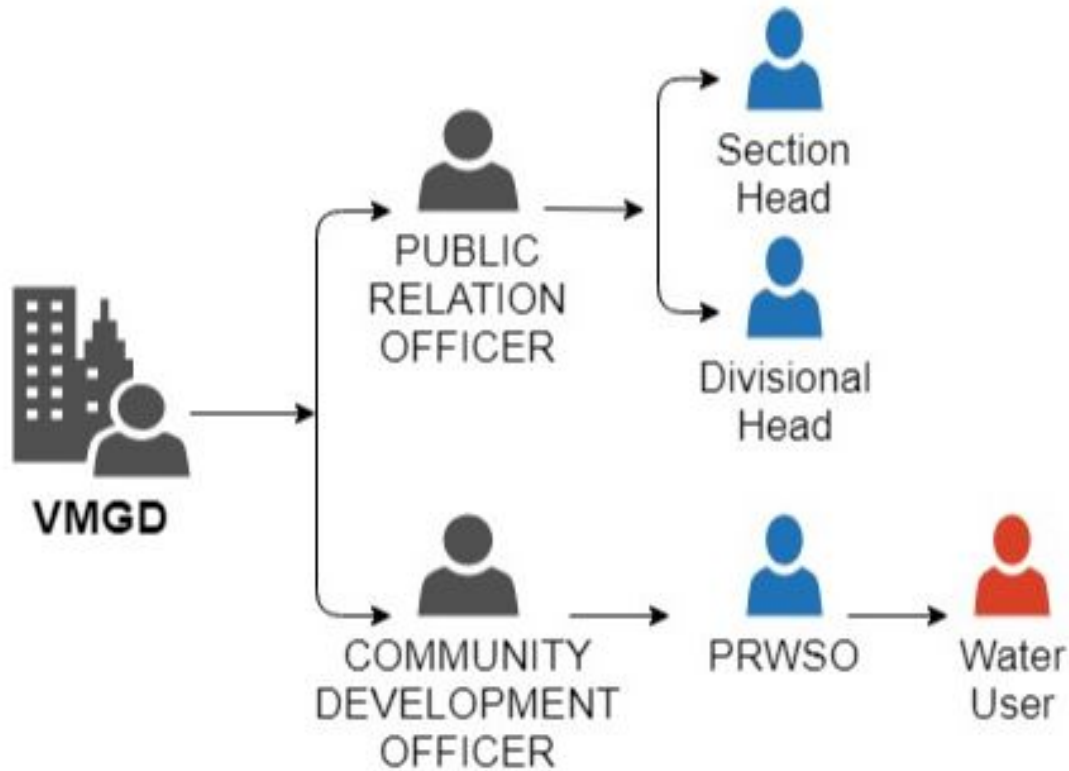


Figure 3: Climate information and products dissemination structure

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Mode of Information Dissemination: Effective channels or communication mediums that can be used to disseminate the information and the products may include: email, phone, Internet/webpage, social media (FaceBook), face to face meetings, print, etc.

Other Information: Describes the format (e.g. bulletin, brief summary, Excel etc.) and the most appropriate language (i.e. Bislama, English or French) for information or products.

Frequency and timing: frequency indicates how often the information is required or disseminated (i.e. weekly, fortnightly, monthly or annually). Timing indicates when in a defined period the information is required or made available (e.g. Vanuatu Climate Updates are available by the second week of each month).

Feedback Mechanism:

It is vital to measure results to understand whether objectives have been achieved. The regular evaluation process allows managers to make necessary adjustments during implementation in response to unexpected results and changed circumstances. Several feedback mechanisms are suggested for evaluating the effectiveness and the efficiency of the Communication Plan: regular surveys, feedback forms, follow up via phones, monthly reports, email, and face to face meetings. The timing and the mechanism for feedback can be mutually determined by the Responsible Party and the Audience. Feedback may be scheduled quarterly, six-monthly or yearly.

6.5.6 Updating the Communication Plan

During the life of Van-KIRAP, the Sector Coordinator will be responsible for:

- Initiating and scheduling feedback sessions with VMGD;
- Initiating and following-up on feedback sessions for other Responsible Parties, and providing feedback to VMGD
- Negotiating changes and incorporating agreed changes in the Plan; and
- Circulating the Plan to all Responsible Parties and Audience after each update

After the Van-KIRAP, it is recommended that this responsibility be taken up another relevant officer in Water Resources Division if the Sector Coordinator position no longer exists. This can be the Communication Officer.

Table 7: A detailed Communication Plan for the Water Sector

Responsibility (sender)	Audience (receiver)	Type of Information/product	Language	Format required	Mode of information dissemination	Frequency	Timing	Feedback mechanism
VMGD	Public Relations Officer, Community Development Officer (CDO)	Vanuatu climate update (VCU)	Bislama	Bulletin	Email, face to face, phone call, website, social media, proposed App, community boards	Monthly	2nd-3rd week of the month	Regular survey, feedback forms, follow up (extension officers/phone calls), email requested feedback
		Media release – El Nino, or La Nina, TC outlook	English and Bislama	PDF		As required and at the beginning of the TC season		
		Stake holders meeting Climate update – 3 monthly		Face to Face		Quarterly and as required		
		National outlook forum – annually		Face to Face		Annual		
		Brochures - La Nina and El Nino	English	Publications		On request		
		Vanuatu Ocean Outlook (VOU)	Bislama	Bulletin	Email and website	Monthly	2nd-3rd week of the month	Report in the NCOF
		Cloud Nasara Animation			Website and CD			
		Daily rainfall data	Raw data	Excel Spreadsheet	Email	Fortnightly		Email, face to face meeting, survey
		Early Rainfall Watch (Drought info)	English	Bulletin	Email	As available		
Special Climate Bulletin	English and Bislama	Bulletin	Email	As available				
Public	Section Heads	Vanuatu climate update (VCU)	English	Brief Summary	Email, face to face	Monthly	2nd-3rd week	Email, face to face meeting
		Special Climate Bulletin	English	Brief Summary	Email, face to face	Monthly		
Section Heads	Divisional Heads	Vanuatu climate update (VCU)	English	Brief Summary	Email, face to face	Monthly	2nd-3rd week of the month	Email, face to face meeting
		Special Climate Bulletin	English	Brief Summary	Email, face to face	As available		
Community Development Officer	Provincial water supervisors/Provincial water supply officers (PRWSO)	Vanuatu climate update (VCU)	Bislama	Brief Summary	Email, face to face, phone call, website, social media, proposed App, community boards	Monthly	2nd-3rd week of the month	Regular survey, feedback forms, follow up (extension officers/phone calls), email requested feedback
		Special Climate Bulletin	French		Email, face to face, phone call, website, social media, proposed App, community boards	Monthly		Phone, face to face, email
		Daily rainfall data	Raw data	Excel Spreadsheet	Email	Fortnightly		Phone, face to face, email
PRWSO	Water Users	Water shortage notices for times of drought or cruise ships; awareness programs for water conservation	Bislama, English and French		Radio, text, posted notices, social media posts	Time of event		Radio, text, posted notices and social media

7. References

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8. Annexes

The following text comes directly from the document noted in the title.

Vanuatu Meteorology and Geohazards Division Strategic Development Plan: 2014-2023

Of particular importance under the Climate Division are the following Key Outcomes (KO), Strategic Outputs (SO) and Key Performance Indicators (KPI):

- KO 1. Improved management of historical meteorological, hydrological and other related environmental data.
 - SO 1.1 The Climate Division is routinely digitising historical data for weather, climate, agrometeorology, and CBRN stations and has all paper-based records archived and stored according to the VMGD data management and quality policy, including archival of data in back-up sites.
 - KPI-CS01: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets from synoptic weather stations are preserved.
 - KPI-CS02: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets from climate stations are preserved.
 - KPI-CS03: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets for agro-meteorological stations are preserved.
 - KPI-CS01: Historical meteorological, hydrological, agro-meteorological and other related environmental datasets for the CBRN gauges' sites are preserved.
- KO 4. Monthly to seasonal climate information, forecasts, services and warnings are continually developed and routinely improved.
 - SO 4.1 An established set of quality management standard manuals is developed and produced for reference for climate services development and engagement with end users including capture of traditional knowledge and development of new indicators where needed.
 - KPI-CS14: Monthly to Seasonal climate information, forecast services and warnings for Vanuatu developed and produced.
 - KPI-CS15: Mechanism(s) for easy and regular access to climate information, forecasts, services and warnings developed and operational.
 - KPI-CS16: Early warning system for ENSO developed, established, implemented and maintained/sustained.
 - KPI-CS17: Traditional information/indicators collected and integrated with modern climate sciences, forecasts, information, services and warnings.

- KPI-CS18: Validation on monthly to seasonal climate prediction for all weather and climate observation stations conducted.
- KO 5. Drought information, forecasts, services and warnings are developed and routinely improved.
 - SO 5.1 Information and communications products and services from the Climate Division are routinely produced according to VMGD policy guidelines and quality management standards.
 - KPI-CS19: Climate summary for Vanuatu produced each year.
 - KPI-CS21: Early warning system for droughts developed, implemented and maintained/sustained.
- KO 7. Climate Division is provided access to relevant external datasets.
 - SO 7.1 VMGD has agreements and partnerships with other government agencies in place to enable the Climate Division with access to extent holdings of relevant climate and hydrological data.
 - KPI-CS24: Preservation of historical rainfall data coordinated with the DGMH.
 - VMGD had access to DGMH's real-time rainfall and other hydrological information and vice-versa

Vanuatu National Climate Change Adaptation Strategy (NCCAS)

The NCCAS notes the following:

“Vanuatu acknowledges the predictions of the Intergovernmental Panel on Climate Change (IPCC).

According to the IPCC, climate change in the Pacific may lead to

- a. Accelerated coastal erosion, saline intrusion into freshwater lenses and increased flooding from the sea
- b. Less rainfall coupled with accelerated sea-level rise compound the threat on water resources
 - i. declining human health from increasing temperatures and decreasing water availability due to climate change may increase burdens of diarrhoeal and other infectious diseases.”³³

“Climate change is also likely to differentially affect certain sectors and regions. For example...water resources especially in small islands will be affected by changes in rainfall and evapotranspiration.”³⁴

An example of maladaptation in the water sector is noted where “Short-term adaptation strategies of the water sector in response to a decrease in rainfall could include over-exploitation of groundwater resources, which could actually exacerbate vulnerability over the longer term.”³⁵

33 Government of the Republic of Vanuatu, National Climate Change Adaptation Strategy for Land Based Resources 2012 - 2022, 2011

34 Ibid.

35 Ibid.

The NCCAS also provides in Appendix 1 an SPC-GIZ ‘Coping with Climate Change’ table. This table thoroughly outlines the impact on sectors and specific adaptation strategies against droughts, cyclones, fire flooding, heat stress and sea level rise.

Vanuatu Framework for Climate Services (VFCS)

Recommendations³⁶

- Climate information needs to have less jargon and be translated into simple terms e.g. using pictures and incorporating traditional knowledge (e.g. associated with water conservation and the use of grey water).
- Additional research is required on the effects of ENSO on water quantity and quality (including groundwater). Bore water data (levels and water quality) is mostly still kept as paper records, so requires digitizing.

National Sustainable Development Plan 2016-2030³⁷

“The NSDP articulates the country’s main development priorities for the next 30 years. Of particular importance under the environmental goals and policy objectives are:

- ENV 3 – Climate and Disaster Resilience
 - ENV 3.2 – Improve monitoring and early warning systems.
 - ENV 3.4 – Promote and ensure strengthened resilience and adaptive capacity to climate related, natural and man-made hazards
- ENV 4 – Natural Resource Management
 - ENV 4.2 – Protect vulnerable forests, watersheds, catchments and freshwater resources, including community water sources.
- ENV 5 – Ecosystems and Biodiversity
 - ENV 5.6 – Enhance environmental monitoring, evaluation and research with relevant, open and transparent data sharing among relevant agencies.

Republic of Vanuatu National Climate Change and DRR Policy 2016-2030

The document notes that “potential impacts of climate change on Vanuatu’s agriculture, fisheries, forestry, tourism, health, transport and infrastructure sectors were considered. Projected consequences of climate change include:

- reduced availability of fresh water;
- saltwater inundation and intrusion of coastal saltwater into land and groundwater.

³⁶ SPREP; Vanuatu Framework for Climate Services, 2016.

³⁷ Government of the Republic of Vanuatu, Vanuatu 2030 The people’s plan: National sustainable development plan 2016 - 2030, 2015

Vanuatu National Adaptation Programme of Action

Most of Vanuatu's urban centres and outer islands are dependent on ground water for drinking, given the limited surface water. Increased temperatures are likely to increase the demand for potable water. Increased radiative load, greater run-off from high intensity rainfall events, decreased rainfall and associated increase in evaporation could reduce the rate of ground water recharge. Water shortages are already apparent in dry seasons in many areas.

These would become more pronounced and require more sophisticated technology to provide for drinking water of the populations. Higher intensity rainfall could lead to erosion, and greater sedimentation and contamination of drinking water.³⁸

Increases in sea level could cause salt-water intrusion into the shallow ground water lens in coastal areas. This would impact on both the agriculture sector in these areas as well as the availability of potable water. This effect would be most pronounced in small low-lying islands that are dependent on shallow ground water aquifers.³⁹

Population growth, particularly in urban areas, has already placed pressure on water resources and supply services. Climate change is likely to increase demand for water while impacting on the quality and availability of water resources. " ⁴⁰ Communities face "regular inundation due to rising sea levels; water scarcity due to limited rainwater catchments and storage capacity; and as result serious health issues.⁴¹

Water scarce areas including rain-shadow areas and small islands that depend entirely on rainwater and groundwater experience severe water shortage in the events of droughts and El Nino events. Often such communities are isolated with limited economic opportunities hence lack the capacity to afford water harvesting, storage facilities and distribution facilities. Any future climate change is most likely to compound current difficulties in such areas. "Salination of ground water resources is significant in Vanuatu's rural population and is already affecting the livelihood of some communities.

It notes that that the main climate issues and possible adaptation options in each province are⁴²:

TORBA Province	
Climate Change Issue and Vulnerabilities	Adaptation Options
Scarcity of Sustainable water sources and salination of groundwater resources (Ureparapara, Mota Lava, Mota, Torres & Mere Lava)	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity or establish mini-desalination plants.
SANMA Province	
Water scarce areas vulnerable to droughts	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity • Establish water distribution facilities

38 Government of the Republic of Vanuatu, National Adaptation Programme for Action (NAPA), 2007

39 Government of the Republic of Vanuatu, National Adaptation Programme for Action (NAPA), 2007

40 Ibid.

41 Ibid.

42 Ibid.

Salination of groundwater resources	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity • Establish water
PENAMA Province	
Salination of groundwater resources and limited reliable water sources	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity • Establish water distribution facilities • Enact by-law to protect and manage water shed areas
MALAMPA Province	
Salination of groundwater resources and limited reliable water sources El Niño events result in drought	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity • Establish water distribution facilities • Enact by-laws to protect and manage watershed areas
SHEFA Province	
Significant vulnerability to droughts especially on smaller islands due to lacking/limited underground water and limited capacity to capture and store rainwater	Increase rainwater catchment and storage capacity
Farming and logging in water catchment areas	<ul style="list-style-type: none"> • Ban/Control sand mining • Develop ICZM plan • Establish reserve in central Efate
TAFEA Province	
Salination of groundwater and limited sustainable water sources Farming, logging and settlements around water catchment areas	<ul style="list-style-type: none"> • Increase rainwater catchment and storage capacity • Establish water distribution facilities • Enact by-laws to protect and manage watershed areas

A project concept note on Integrated Water Resource Management is included in the document. The goal of the project is enhanced resilience of watershed through integrated water resource management and the goal will be achieved through the following:

- Assess the vulnerability and adaptive capacity of upland farmers and local institutions to climate change
- Build resilience of upland farmers to the impacts of climate change by developing sustainable livelihoods (eg diversified farming; agroforestry; conservation farming)
- Integrate climate change risks in protected area and watershed planning
- Develop a watershed-based early warning and monitoring system for climate phenomena such as ENSO
- Build capacity of government and civil society organisations in coping with climate change.

Global Framework for Climate Services (GFCS)⁴³

The GFCS is built upon the following five components, or pillars (see Figure 5 below):

- i. **User Interface Platform (UIP):** a structured means for users, climate researchers and climate information providers to interact at all levels;
- ii. **Climate Services Information System (CSIS):** the mechanism through which information about climate (past, present and future) is routinely collected, stored and processed to generate products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises;
- iii. **Observations and Monitoring (O&M):** to ensure that climate observations and other data necessary to meet the needs of end-users are collected, managed and disseminated and are supported by relevant metadata;
- iv. **Research, Modelling and Prediction (RMP):** to foster research towards continually improving the scientific quality of climate information, providing an evidence base for the impacts of climate change and variability and for the cost-effectiveness of using climate information;
- v. **Capacity Development (CD):** to address the particular capacity development requirements identified in the other pillars and, more broadly, the basic requirements for enabling any Framework-related activities to occur.⁴⁴

43 <http://www.wmo.int/gfcs/>

44 WMO, A step-by-step guide for establishing a national framework for climate services, 2017

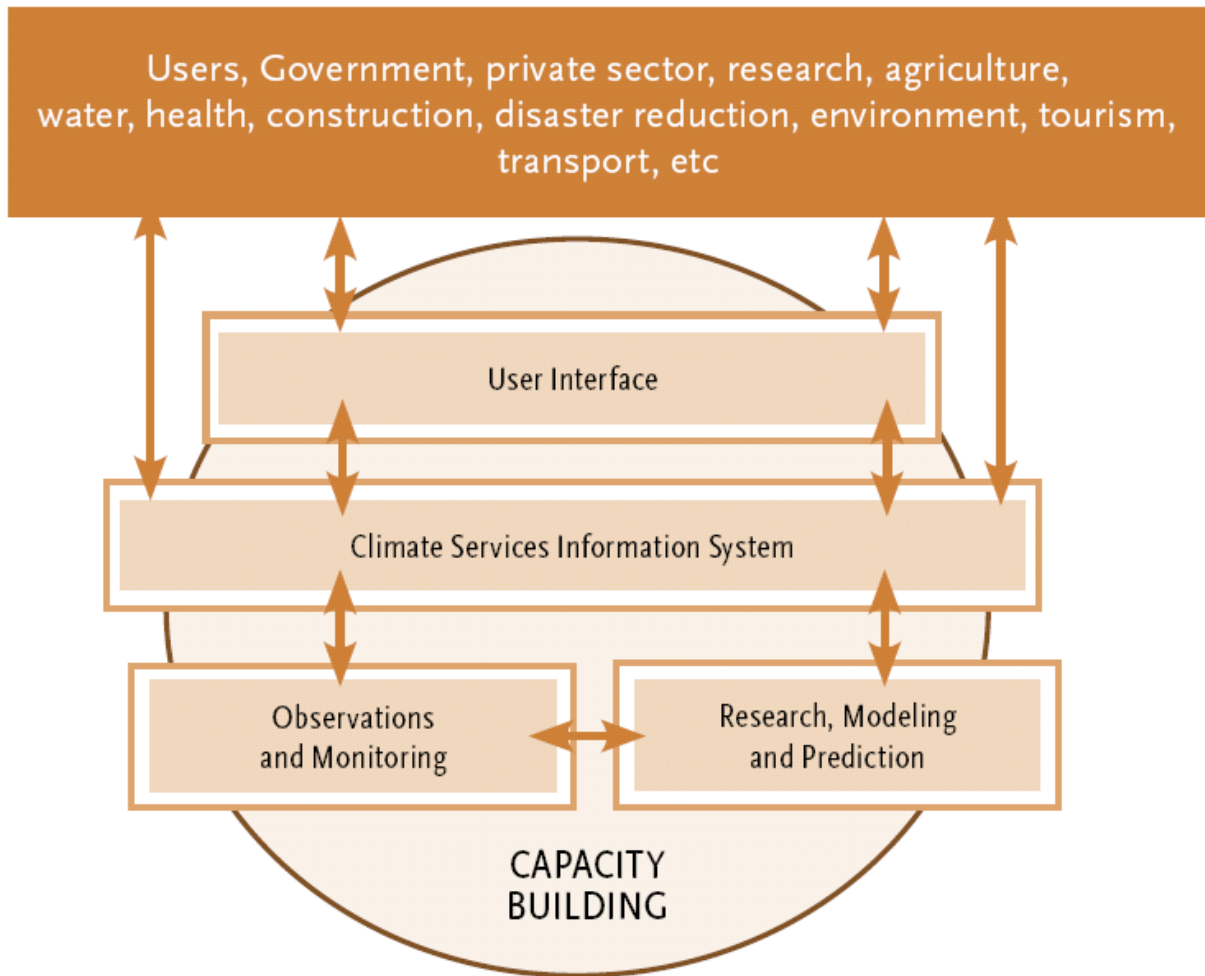


Figure 5: A schematic depicting the functional components of the GFCS (Source: WMO)

The primary focus of the GFCS is to enable better access and use of climate information by users.

Pacific Roadmap for Strengthened Climate Services (PRSCS)

The PRSCS notes:

“Water is fundamental to life. Population growth, urbanisation and agricultural use have increased demand for water throughout the Pacific Island countries. At the most basic level, people need freshwater supplies for drinking, but even resources for this purpose are being severely stretched in some depleted areas, and low-lying atolls are being contaminated by salt-water intrusion due to sea level rise and storm surge.

“Climate and water data collected on weekly, seasonal and annual timescales and at regional, national and local levels are essentials to the development of effective water management strategies, including flood and drought preparedness and response.

Freshwater Resources

There is a large diversity in freshwater resource characteristics in the Pacific which relate to:

- Physical nature of islands (size, topography, geology, etc.)
- Local and broad-scale climate
- Hydrology and water availability
- Demography (total population, percentage of urban and rural)
- Culture
- Degree of economic development

“Common or naturally occurring sources of freshwater include groundwater, surface water and rainwater. Less common and generally more expensive sources include desalination, importation and recycling of wastewater, e.g. for agriculture. Small islands in particular have more limited water resources, which are more susceptible to natural hazards including droughts, floods, tropical cyclones, earthquakes, tsunamis, volcanic eruptions, landslides, and sea level rise.

“Other water related issues affecting many Pacific Island countries include: water quality degradation; insufficient knowledge of water management practices resulting from insufficient education and training and institutional capacity; the use of inappropriate technology and methods; and an overall weak water governance. Some significant improvements have been made in recent years but more effort and, where necessary, external financial and knowledge resources are needed.”⁴⁵

45 SPREP, Pacific Roadmap for Strengthened Climate Services, 2017

Regional and National Actions for Water:

NUMBER	LEAD GFCS PILLAR	ACTION	NATIONAL ACTIVITY / REGIONAL ACTIVITY
1	User Interface	Establish cooperative interactions between NMHSs and water authorities and organisations on weather and climate related water resource management issues	Regional and National
2	Climate Services Information System	Predictions of seasonal flow for major rivers.	Regional and National
3	Climate Services Information System	Development of drought management plans including strategies for rainwater, surface water and groundwater	National
4	Observations and Monitoring	Implement hydrological/hydro-meteorological monitoring systems	National
5	Observations and Monitoring	Database for hydrological data storage	National
6	Observations and Monitoring	Incorporate water quality measures in monitoring tools and systems	National

Vanuatu Coastal Adaptation Project (VCAP)

One of the outcomes of VCAP stakeholder engagement was the following information:

“The main climate impacts on water supply in Vanuatu are drought and floods, typically related to ENSO and tropical cyclones. El Niño in particular can result in dryer than normal conditions, affecting freshwater supplies. The Vanuatu Climate Update and Monthly Climate Summary, and the NIWA Water Watch, are circulated to Provincial Water Officers, and this information is passed on (when relevant) to community water committees.

“The tables starting on the next page describe the weather and climate information that could help manage climatic impacts on water management and security, as discussed in the sector workshop.

“After a follow-up meeting with sector representatives, the following were prioritised as the initial needs for climate information:”⁴⁶

⁴⁶ GEF, Vanuatu Coastal Adaptation Project: Climate Information and Services, Summary Sector tables, 2017

1. Daily and monthly rainfall as a .csv file for all major islands
2. Monthly bulletin as a PDF file including:
 - Water quality
 - Seasonal rainfall outlook
 - Soil moisture
 - Rainfall to date
 - Rainfall/ drought outlook
 - Water tank level model (based on 22,500 L tank, 50² meter roof area, and 10 L/person/day)
 - ENSO outlook
 - Monitor catchments on Santo, South Malekula, Epi and Pentecost Islands
 - Actions/ recommendations based on the forecasts

Risk or concern	Climate and weather triggers	Whom does it affect? (i.e. government, private sector, and communities)	Why is it a problem? What is the impact (socially, economically and culturally)?	Would early warnings of the climate triggers be helpful?
Poor water quality – turbidity, sedimentation	Heavy rainfall	Community	Drinking water can become unusable	Yes
Flooding of water supply	Heavy rainfall; abnormal rainfall	Community, Government (infrastructure)	<p>Can lead to intrusion of surface water into wells and the ground water reservoir. This can lead to the well water becoming contaminated with biological and chemical contaminants.</p> <p>Damaging to the infrastructure: wells; pipes; pumping stations; etc.</p>	Yes
Lack of freshwater	High temperatures Periods of low rainfall	Community	<p>Community suffers.</p> <ul style="list-style-type: none"> -No water for drinking and cooking -Crops fail 	Yes

Risk or concern (copy from above if early warning would be helpful)	What actions could be taken with early warnings?	What data/ information is needed for the action?	How (i.e. email, text, radio) should the early warnings be communicated and how often?	Who will communicate the warnings and to whom?
Poor water quality – turbidity, sedimentation	People can be made aware of issues with the water supply. Warn them to boil, settle or otherwise treat the water to make it potable.	Water quality data Seasonal rainfall outlook Soil moisture content Annual rainfall to date	As required, then periodic until no longer required.	D.O.W.R will communicate to the Village Water Committee who will then inform the population.
Flooding of water supply	Clearing diversion channels around water source (wells, springs) Get ready to repair any damage that may occur to the infrastructure.	Maximum daily rainfall Flow data		
Lack of freshwater	Conservation of water when approaching dry season. Notices at the start of the wet season asking people to keep conserving water as the ground water has not yet started recharging. Let people know in advance before the springs dry up.	ENSO Dry period tracking Water storage/use models Local knowledge (when the springs dry/restart, how long it takes from the first rains until the ground water starts recharging) Flow data		

Sector	What climate data/ information is the priority for early warnings?	In what format (i.e. email, text, radio) should the early warnings be communicated?	How often?	Who will communicate the warnings?	To whom?
Hydrology and water	1. Rainfall for all major islands	E-mail .csv file	Daily and Monthly	VMGD to key Water rep	Water Department to enter into DSSAT model
	2. Bulletin including: <ul style="list-style-type: none"> ▪ Water quality ▪ Seasonal rainfall outlook ▪ Soil moisture ▪ Rainfall to date ▪ Rainfall/ drought outlook ▪ Water tank level model (based on 22,500 L tank, 502 meter roof area, and 10 L/person/day) ▪ ENSO outlook ▪ Monitor catchments on Santo, South Malekula, Epi and Pentecost Islands ▪ Actions/ recommendations based on the forecasts 	E-mail .pdf file	Monthly	VMGD to key Water rep	Water Department to disseminate to the public as required