

PACIFIC ROADMAP FOR STRENGTHENED CLIMATE SERVICES (2024–2033)



ClimSA
A joint project of the Secretariat of the Pacific Community (SPC) and the European Union (EU)



SPREP
Secretariat of the Pacific Region Environment Programme





The Pacific Meteorological Council Chair's

Foreword

This report was commissioned by the Secretariat of the Pacific Regional Environment Programme (SPREP) to assist in the planning for further supporting climate services in the Pacific in the decade commencing 2024.

The terms of the consultancy were to:

1. Evaluate the progress and achievements of the 2017-2026 Pacific Roadmap for Strengthened Climate Services (PRSCS);
2. Review and update the 2017-2026 PRSCS for the next 10 years; and
3. Develop an Implementation Plan including a Monitoring and Evaluation Framework.

The consultant, Dr Love, in undertaking these tasks worked with the Pacific Island Climate Service (PICS) Panel members and other members of the climate services community in the Pacific.

We note that climate services in the Pacific have improved substantially since the implementation of the Pacific Roadmap for Strengthened Climate Services commenced in 2017. The Report highlights recent successes in the area of climate services including the roles National Climate Outlook forums have had in building stronger relationships between the users of climate services and our National Meteorological Services, while Regional Climate Outlook forums have contributed much to building stronger collaborations among services users and climatologists across the Pacific.

But the task is not completed. The consultant's report shows a way forward that will assist in aligning our climate services activities with key strategic goals including: responding to the challenges of climate change, ensuring those in most need of climate services can access them, increasing collaborations between service providers and researchers and bringing the best science and technologies to bear in the preparation and delivery of climate services.

As a Council we have adopted this Report as the "Pacific Roadmap for Strengthened Climate Services" for the period 2024 to 2033.

Mr Fred Jockley

Director (Acting)

Vanuatu Meteorology and Geo-Hazards Department.

Chair, Pacific Meteorological Council, 2024.



Director-General's Foreword

I am pleased to say that over the past seven years the Pacific Roadmap for Strengthened Climate Services (PRSCS) has made great strides in providing the communities of the Pacific with a range of climate services enabling them to better plan for disasters associated with climate change, to assist them to develop science-based strategies to adapt to slowly evolving climate hazards such as sea level rise, changing rainfall patterns and changing habitats in the sea and on land as temperatures rise. This said, there is much work to be done as new impacts from climate change are detected and as the science associated with environmental responses to climate hazards evolves.

The work of implementing the PRSCS since 2017 has been undertaken by 14 countries in the Pacific¹, ably assisted by international partners from the edges of our region to Europe and the Caribbean. I look forward to consolidation of the work done by the PRSCS in the next decade. Important developments in linking a range of production models in agriculture, fisheries, energy production, water management to climate models offer promises of more efficient outcomes. Similarly, coupling health sector models for weather sensitive disease outbreaks with climate models provide opportunities to reduce the community impacts of climate related diseases

I thank all those involved with the PRSCS to this point in time and look forward to working with you over the next decade as the PRSCS develops further to meet new climate challenges.



Mr Sefanaia Nawadra

Director-General,
Secretariat of the Pacific Environment Programme

¹ Cook Is., Fiji, Kiribati, Marshall Is., Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Is., Tonga, Tuvalu, Vanuatu.

Acknowledgement

This updated roadmap was commissioned by the Secretariat of the Pacific Environment Programme (SPREP) with funding from the European Union Funded Climate Services and Related Application (ClimSA) Project. The roadmap was reviewed and updated by Dr Geoffrey Love, the consultant hired.



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Executive Summary

Chapter 1: A Desktop Review of the Pacific Roadmap for Strengthened Climate Services, 2017 – 2026.

The Roadmap 2017-26 has been implemented through the development of a list of 157 Actions, 100 under the five GFCS Components and 57 under eight thematic areas. No explicit linkage has been drawn in this Roadmap between the eight Guiding Principles and the 157 Actions.

There is an abundance of information indicating that Climate Services have improved substantially in the Pacific since the implementation of the Roadmap in 2017. This information comes from the WMO questionnaire of 2023/24, the proliferation of climate services on Pacific NMHS web sites, and the active participation of NMHS and climate service users in RCOFs and NCOFs.

The focus on the provision of services targeted to meet the needs of sectors of high national priority; agriculture, health, fisheries, energy, health, water, tourism, and disaster risk reduction has been a success, as has the use of NCOFs targeted at these sectors.

Currently there is no systematic monitoring and evaluation system in place for the Roadmap as an entity. The Roadmap appears to be highly

beneficial but a more concerted effort is needed to document this strengthening of climate services over the past, and next, decade.

The real-time weather observing network has, to date, formed the basis of climate analysis in the Pacific however there is a need to re-examine this network from a climate perspective and to fill gaps in the network's performance, including instrument calibration, accuracy standards, site locations, archiving of site metadata, etc.

There are concerns about the sustainability of large infrastructure projects if there is not sufficient investment training to enable the transfer of technical maintenance and development skills to local staff. The training of technical and professional NMHS staff would be greatly assisted by the creation of a regional training centre.

The linkages between the climate service providers and climate researchers need strengthening and there needs to be further work on the costs and benefits of climate services in the Pacific Islands.

Chapter 2: An Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.

In developing an Updated Roadmap, it was decided to take a "top down" approach. Starting with the Guiding Principles, the first step was to align the Updated Roadmap's Objectives as represented by the (modified) Guiding Principles.

From the Objectives it was a short step to list the Outputs that would meet the Objectives. Recognising that the Outputs are a result of Actions, and that too many Actions distract from the Strategic Objectives, the Outputs were consolidated into a smaller number of strategically significant Actions.

The next step was to identify Performance Indicators that, when measured, would provide a good accounting for the achievements of the NMHSs as compared to of the aspirations of the Eight Guiding Principles of the Roadmap. The Performance Indicators described in this Chapter are a

reasonable estimate of what can be monitored with current systems and operational capabilities. The number was limited to 17. Most NMHSs will probably monitor something less than the full set. Over time, with experience in their application, the Performance Indicators may be expected to evolve.

The priority areas for targeted service provision in the original Roadmap were: Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, Tourism and National Climate Services. Only the first seven of these will be carried forward in the Updated Roadmap (as per Recommendation 8).

In the Roadmap 2017-26 the GFCS Components and the Thematic areas formed a type of matrix arrangement, the Updated Roadmap proposes Monitoring of the priority areas as an integral part of the overall performance monitoring.



Chapter 3: Implementation Strategy for the Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.

This Chapter brings together a number of aspects arising from the description of the Updated Roadmap 2024-33; in particular the reduction in the large number of implementation actions, the aligning of Outputs and Outcomes with the Guiding Principles, and enabling the development of strategic outcome-focused, rather than activity-focused Performance Indicators.

The consolidation of Actions (or activities) from 157 to 38 has been made possible by using the

Guiding Principles to focus on the key strategic outcomes sought from strengthened climate services in the Pacific. These consolidated Actions are, in many cases a consolidation of a number of discrete activities to become a coherent, single output directed set of activities.

Monitoring of Performance Indicators for thematic (priority) areas is to be included with the regular, GFCS Component Performance Indicator monitoring.

Chapter 4: A Monitoring and Evaluation Framework for the Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.

For the Updated Roadmap to be able to demonstrate that it is of value to the Pacific community two things must happen:

- a) As noted in Chapter 1 and again in Chapter 3, cost – benefit studies of the value of climate services need to be prepared in collaboration with social scientists and the results shared with donors and Government decision makers; and,
- b) Performance Indicators of, *inter alia*, user satisfaction and wide spread uptake of climate services generated in the Pacific for the Pacific use, need to be routinely collected and shared with donors, Government and local communities.

Templates for the various Performance Indicators have been provided in this Chapter. It is expected

that as experience in monitoring develops the templates will evolve.

Introduction of a Monitoring and Evaluation Framework may require a culture change from NMHS decision making based on shared experience to one that includes Performance Indicators of user preference along with the costs and benefits of using climate services.

There will be initial costs in developing web-based applications to monitor services usage and there will be ongoing costs in conducting surveys, analysing survey data and sharing the findings from the analyses.

The PMC will have an oversight role.

The PICS Panel (possibly through a sub-committee) will need to assist in coordinating data collection and findings dissemination.



Recommendations

From Chapter 1:

Recommendation 1:

Guiding Principle vii of the 2017-26 Roadmap should be amended to encourage a balance between infrastructure and human resource investment (suggested additional text to the Guiding Principles is highlighted in red):

Principle vii Infrastructure enhancement: new projects should achieve a balance of investment in infrastructure and human resources development such that regional staff can sustainably integrate new infrastructure into existing systems and subsequently maintain the upgraded operational infrastructure beyond the lifetime of the upgrade project. Infrastructure enhancement projects to, where possible, use software tools that are interoperable, well supported and that have clear long-term sustainability.

Recommendation 2:

The Guiding Principles should form the basis for the high-level Outputs of an updated Roadmap. From there it will be clear which actions are needed for achieving the Objectives implicit in the Guidelines. Each of these Actions should be reviewed for alignment with the Guidelines and modified as necessary, as a part of preparing a new Roadmap Implementation Strategy 2024-33.

Recommendation 3:

That the Observation & Monitoring element of the Roadmap be expanded to Observation, Monitoring and **Data Management**, so as to explicitly recognize the important data management aspects associated with observation and monitoring of the climate.

Recommendation 4:

A part of the Roadmap Monitoring and Evaluation effort should be the maintenance of a consolidated record of consultative, educational and political engagements promoting climate services carried out by implementing NMHSs.

Recommendation 5:

Guiding Principle vi should be expanded to emphasise undertaking cross-discipline research into the costs and benefits of climate services:

vi Continuing Research: advanced climate science underpins informed decision making. Climate research must be systematically integrated into climate services. Furthermore, consideration needs to be given to working with social scientists and business people beyond the science community to undertake collaborative economic studies of the cost and benefits of climate services in the Pacific Islands.

Recommendation 6:

The Performance Indicators that form the basis of a Monitoring and Evaluation Strategy for the Updated Roadmap should relate directly to the Outputs specified to achieve the overall Objectives of the Roadmap.

From Chapter 2:

Recommendation 7:

Using the Guiding Principles; Outputs, Outcomes and Performance Indicators will be developed for each of the five GFCS Components. The Performance Indicators to be strategic level measures of the success or otherwise of the community-wide Outcomes arising from the delivery of the Updated Roadmap's Outputs. Outputs are to be consistent with the Eight, Updated, Guiding Principles.

Recommendation 8:

Only the priority service areas of Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, and Tourism be carried forward to the Updated Roadmap 2024-33.

Recommendation 9:

It is recommended that the Performance Indicators surveys for the GFCS Components also evaluate User Satisfaction with services targeted at Thematic (priority) areas. The 17 Performance Indicators are:

User Interface:

(1) Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate-sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential);

(2) Survey data of user satisfaction with various climate services, taking special note of:

- (a) the needs of women, minorities, the vulnerable;
- (b) those who communicate only in the local dialect; and,
- (c) thematic (priority) areas;

(3) Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.

Climate Service Information System:

(4) Completed steps towards a toolkit;

(5) The volume of climate data exchanged through

- (a) WIS;
- (b) GTS; and,
- (c) point-to-point Internet communications, for a chosen month each year;

(6) Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities.

Observations, Monitoring and Data Management:

(7) The volume of ECVs reported by all Pacific countries;

(8) The percentage of Pacific countries operating modern, relational climate databases;

(9) Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable; and,

(10) The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata).

Research, Modelling and Prediction:

(11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;

(12) The Number of applied model products available on the Pacific web sites and their monthly “hit” rates;

(13) Cost-benefit studies of climate services-based decisions are prepared and published; and,

(14) Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration.

Capacity Building:

(15) Progress in establishing a Pacific regional training centre;

(16) Level of international support for capacity building for climate services in the Pacific and the maintenance of a balance between investment in people and hardware; and,

(17) Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).

From Chapter 3:

Recommendation 10:

That the 38 Implementation Actions given in Annex 3.3 to the Implementation Strategy form the basis of implementation of the Updated Pacific Roadmap for Strengthened Climate Services 2024-33.

From Chapter 4

Recommendation 11:

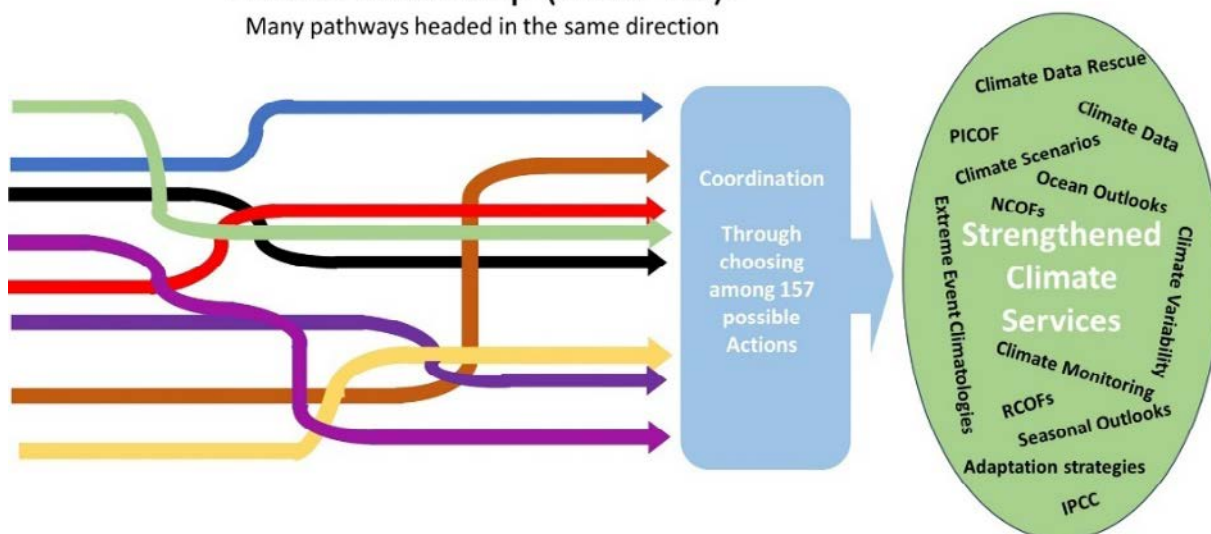
That the PICS Panel establish a small (possibly three person) sub-committee to provide technical leadership in the implementation of the Monitoring & Evaluation Framework.



A Desktop Review of the Pacific Roadmap for Strengthened Climate Services, 2017 – 2026.

Pacific Roadmap (2017-26):

Many pathways headed in the same direction



1.1 Introduction

In 2023 the Secretariat of the World Meteorological Organization (WMO) conducted a detailed questionnaire of the state of climate services provided by its Members and was willing to share the data obtained from the responses of the Cook Is., Fiji, Kiribati, Micronesia (Federated States of), Nauru, Niue, Papua New Guinea, Samoa, Solomon Is., Tonga, Tuvalu and Vanuatu (these being from 12 of the 14 countries implementing the PRSCS - the two that did not complete the WMO survey were Palau and Marshall Is.).

In late May 2024 SPREP conducted a four-day meeting in Vanuatu involving representatives from the Pacific nations' NMHSs. The consultant attended two days of the meeting (30 and 31 May 2024) that were set aside for review of the PRSCS and its update. The views of the NMHS representatives present at that meeting have been integrated into this Review document.

1.2 The PRSCS – Its Philosophical Underpinnings

The Foreword to the PRSCS document² succinctly spells out several key aspects of the Pacific Roadmap for Strengthened Climate Services:

"This Pacific Roadmap for Strengthened Climate Services is a guide to identifying and implementing the most critical priorities for each Pacific-island country, ensuring its government and communities have reliable and well-understood information on their climate. It is a "road map" rather than a "route map". On a road map, one can typically see several alternative routes between a starting point and a destination"

So, it must always be borne in mind that the PRSCS is not a single strategy for all to adopt, rather it lists Actions that each national climate service may, or may not choose to adopt. In the remainder of the Review the term "Roadmap", rather than the acronym PRSCS will be used because it constantly reminds us that we are dealing with a **Roadmap**. That said, it should be possible to understand the full scope of the national Roadmaps in the Pacific so that everyone can work together to put in place the best Pacific climate service that can be implemented given the available human and financial resources, science and technology. We need to be able to monitor and evaluate the national Roadmaps so that as a region the Pacific it can work collectively to provide the optimum climate service for everyone living and visiting there.

2

The document can be found at The Pacific Meteorological Desk <https://www.pacificmet.net>net>files>PacificRoadmapforStrengthenedClimateServices>

vices

The Roadmap Foreword also clearly states that:

“The Roadmap is closely aligned with the Global Framework for Climate Services (GFCS)³, a United Nations’ initiative led by the World Meteorological Organization to guide the development and application of science-based climate information and services to support decision-making in climate sensitive sectors.”

The GFCS’s five components (User Interface, Climate Services Information System, Observations & Monitoring, Research, Modelling & Prediction and Capacity Building) have been used to classify 100 Actions countries implementing the Roadmap can choose amongst. An additional 57 Actions are listed under 8 priority (thematic) areas (Agriculture, Disaster Risk Management, Energy, Health, Water, Fisheries & Aquaculture, Tourism, National Climate Services) – Figure 1. Annex 1.2 to this Study provides the 13 Tables of possible Roadmap Actions, included in this Study, but not in the published Roadmap are the Performance Indicators associated with some Actions as developed by the PMC’s Pacific Island Climate Services (PICS) Panel. No statistics relevant to these performance indicators were available at the time this desk-top was prepared.

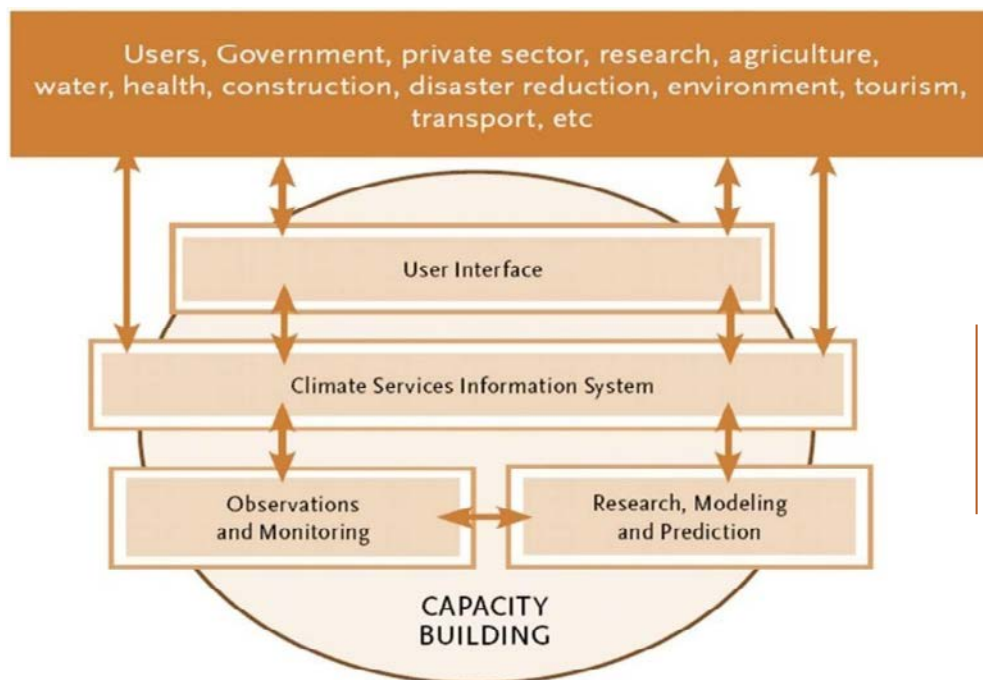


Figure 1: Schematic of the interacting components of the Global Framework for Climate Services and the community of users of the climate services.

Implementation of the Roadmap is being done so as to be consistent with eight Guiding Principles (Box 1.1). These Principles capture the following points: In essence the Roadmap’s deliverables are climate services such as; climate data, drought bulletins, forecasts of sea level rise, climate change scenarios, seasonal forecasts, and the like. These climate services are public goods that are developed in a global context. To the extent possible climate services should assist empowerment of gender and social minorities.

The climate services should represent value for money, including cross national border service provision when it is agreed this is the most effective and efficient way to provide the service. The climate services should be underpinned by the sharing of meteorological and hydrological data and products, and be developed through partnerships between the scientific, engineering and civil society communities. A key Guiding Principle is the concept of stakeholder engagement so as to ensure that the climate services provided are “fit for purpose”.

Finally, in the interests of economy, the use of open-source software is encouraged where ever possible. Guiding Principle vii makes a small, important but quite technical recommendation, somewhat unlike all the previous Principles. Noting the high levels of future investment in infrastructure and capacity development in the pipeline for the Pacific region⁴, it may be worthwhile adding to Principle vii to ensure that this is done sustainably.

³ The Global Framework for Climate Services can be found at: <https://wmo.int/site/global-framework-climate-services-gfcs>

⁴ Some projects that spring to mind are: COSPPac 3, ClimSA, CIS-PAC5, CREWS, Weather Ready Pacific. Each involving multiple countries, NGOs and Universities.

RECOMMENDATION 1:

Principle vii should be amended to encourage a balance between infrastructure and human resource investment (suggested additional text highlighted in red):

Principle vii: Infrastructure upgrading: **New projects should achieve a balance of investment in infrastructure and human resources development such that regional staff can sustainably integrate new infrastructure into existing systems and subsequently maintain the upgraded operational infrastructure beyond the lifetime of the upgrade project.** Open-source systems should be utilized where possible, focusing on software tools without proprietary implications.

One final observation relating to the Guiding Principles. They are clear and could, and probably should, form the basis for the high-level objectives of the Roadmap. In the Roadmap 2017-26, the Principles and Actions are not well linked.

RECOMMENDATION 2:

The Guiding Principles should form the basis for the high-level Outputs of the Roadmap. From there it will be clear which actions are needed for achieving the objectives implicit in the Guidelines of the Roadmap.

EIGHT GUIDING PRINCIPLES OF THE ROADMAP

The Roadmap is founded on, and shall be implemented and monitored by National Meteorological and Hydrological Services (NMHSs) with the following:

- i. Pacific focus within a global context: the work of the NMHSs is primarily focused on effective delivery of weather, climate, water and ocean services for the benefit of Pacific peoples and communities.
- ii. Gender and minorities empowerment: NMHSs recognise and support the need to operate and deliver services in ways that considerations of the needs of women, young boys and girls, people living with disabilities and vulnerable groups will be taken into account.
- iii. Value for money: NMHS services are essential to communities, villages, districts, at national and regional levels and are often delivered within limited resources. In some cases, depending on available resources, it may be more efficient to deliver certain services and support at a regional level, subject to bilateral and multilateral agreements.
- iv. Sharing information: NMHSs are committed to sharing data in line with international obligations and national policies, in particular, the World Meteorological Organization (WMO) commitment to free and unrestricted exchange of meteorological and related data and products.
- v. Partnerships: partnerships among NMHSs, their governments and stakeholders, with public and private sectors, with non-government organisations / civil society organisations (NGOs/CSOs), with WMO and other UN agencies, with regional and sub-regional inter-governmental agencies, and with donors and technical partners are critical to the success of this Roadmap. A co-ordinated approach enhances effectiveness in: increasing and using resources; targeting effort and managing potential overlap between agencies, organisations and development partners; and effective delivery of services to customers.
- vi. Continuing Research: advanced climate science underpins informed decision making. Climate research must be systematically integrated into climate services.
- vii. Stakeholder Engagement: it is essential to engage continually with stakeholders and customers to ensure weather, climate, water and ocean products and services meet their decision-making needs and are tailored and accessible.
- viii. Utilising open-source systems: use where possible of open-source systems, focusing on software tools without proprietary implications.

1.3 Viewing the Complete Pacific Roadmap

The Pacific Roadmap is, in essence a matrix of Actions, 100 to be undertaken as part of the GFCS Components (User Interface, Climate Services Information System, Observations and Monitoring, Research, Modelling and Prediction, and Capacity Building) and 57 as a part of the Thematic (Priority) Areas (Agriculture, Disaster Risk Reduction, Water, Health, Energy, Fishing and Aquaculture, Tourism, and National Climate Services) (Figure 2).

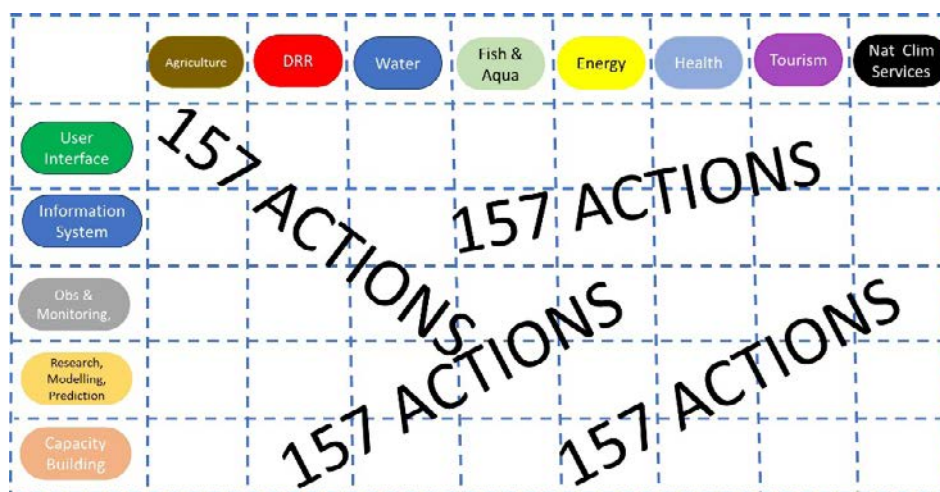


Figure 2: A schematic of the structure of the Action available for implementation by NMHSs.

The simplest way to determine the state of implementation of the Roadmap 2017-2026 would be to ask each of the 14 implementing countries to complete the 13 Table/157 Actions, describing which of the Actions they are undertaking. This was attempted, but in the short time available there was an insufficient response to consider reporting the results worthwhile.

Noting that this report is to be considered by the Pacific Meteorological Council (PMC) it was considered necessary that any evaluation of the Roadmap should consider how it measures up against the relevant Pacific Key Outcome (PKO) in the Pacific Island Meteorological Strategy (PIMS) 2017-26⁵. PKO 6 essentially calls for the implementation of the Roadmap and the called for high-level actions and sub-actions are (see Box 1.2):

- Develop and implement national strategies for improving and delivering climate services; servicing priority areas; and improving user interactions;
- Support PICOFS and NCOFS; and
- Establish Regional Climate and Training Centres.

As will be seen from the following analysis, to some degree or other all priority actions listed above (Box 1.2) have to some degree been achieved with the exception of the establishment of a Regional Training Centre which still remains a goal of the Roadmap.

A further approach, to assess in greater detail the progress of the Roadmap was to liaise with the WMO, asking whether the Secretariat in Geneva had undertaken a recent survey of climate services. The answer was "yes", they had, in 2023, with 12 of the 14 Pacific implementing countries responding (along with a high response rate from the rest of the World). The two Pacific countries that did not respond were Palau and the Marshall Is. As both of these countries have quite similar meteorological (weather and climate) service arrangements to those of the Federated States of Micronesia (FSM - which did respond), it was considered the FSM Roadmap implementation would be representative of, but not necessarily identical, to theirs.

The WMO questionnaire contained 136 questions, not necessarily all relevant to the Roadmap, eg, "Q1 - Nationally determined contribution to the Paris agreement". Some however were very relevant: eg., (Does your NMHS): "Q7- Identify key climatic factors of socio-economic significance at the national levels, establish baseline knowledge based on capacity assessments and co-define with stakeholders climate information needs for sectoral decision-making at national level".

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The PIMS 2017-26 can be found at: <https://www.preventionweb.net/publication/pacific-islands-meteorological-strategy-2017-2026>

BOX 1.2 EXTRACT FROM PACIFIC ISLAND METEOROLOGICAL STRATEGY

PRIORITY 3: IMPROVED CLIMATE AND HYDROLOGICAL SERVICES

PACIFIC KEY OUTCOME (PKO) 6:

Improved climate information and prediction services through the implementation of the Pacific Roadmap for Strengthened Climate Services

Implement Pacific Roadmap for Strengthened Climate Services (PRSCS) at the national and regional level.

Part 3 – Matrix of Pacific outcomes, high-level actions and sub-actions

PACIFIC KEY OUTCOME (PKO) 6:

Improved climate information and prediction services through the implementation of the Pacific Roadmap for Strengthened Climate Services

Implement Pacific Roadmap for Strengthened Climate Services (PRSCS) at the national and regional level

National Priority Action

1. In line with PRSCS;

- Develop and implement national strategies for improving delivery of climate services.
- NMHS to service Pacific priority sectors
- NMHSs to improve user interactions

Regional Priority Action (Regional Contributors: WMO, SPREP, BOM, NIWA, NOAA, APCC, JICA)

1. In line with PRSCS, implement regional actions such as;

- Support of the Pacific Islands Climate Outlook Forum (PICOFF)
- Implementation of a Pacific Regional Climate Centre (RCC)
- Establishment of a Regional Training Centre (RTC)

2. In line with PRSCS, implement regional actions such as;

- Support of national climate outlook forums (NCOF)

In order to gain a view of how each component of the GFCS was being implemented in the Pacific, between 4 and 8 questions were selected for each GFCS component and the responses analysed.

1.3.1 A View of the User Interface component of the Roadmap in the Pacific

The User Interface is the GFCS component through which the climate services are delivered and so it is vital that this interface work well. The 12 surveyed countries (Figure 3) use a quite diversified set of communication arrangements for their climate services (Internet, printed documents, free-to-air radio and television broadcasts, videos etc.), most produce services for priority areas; agriculture, fisheries and tourism being those typically targeted. Rainfall was a key climatic parameter and disaster risk management was a key national need. Somewhat striking was the low rate of implementation of a help desk function – one country only responded positively to this question. Overall, it would appear that the User Interface works fairly well, however, in the absence of baseline survey data there are no performance standards by which to judge these levels of positive response to particular questions.

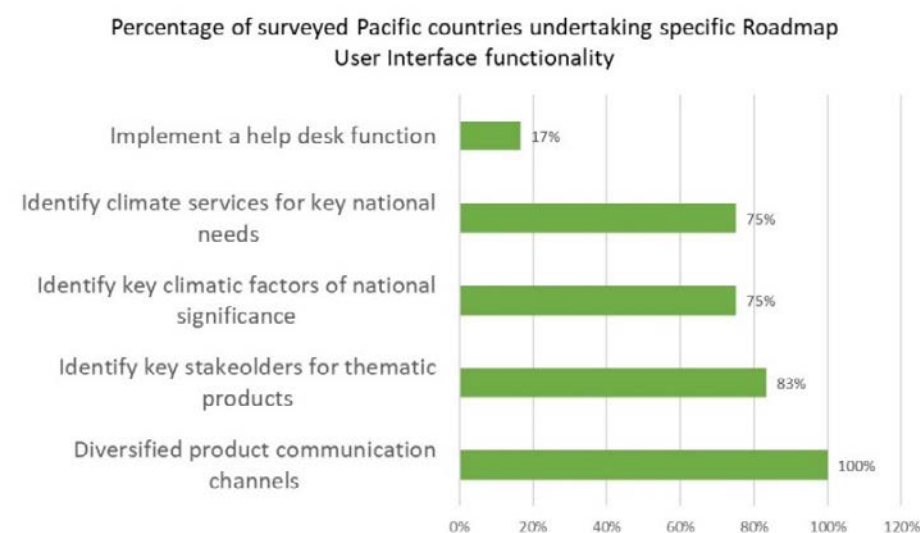


Figure 3: A sample of responses, by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the User Interface component. See Annex 1.3 for underlying data.

1.3.2 A View of the Climate Services Information System component of the Roadmap in the Pacific

The Climate Service Information System is the aggregate of a wide variety of communication methods including: word-of-mouth briefings from NMHS staff, printed newspapers and journals, free-to-air radio and television, social media via the Web, Web and other communications via telephones, Web portals of SPREP and NMHSs within the Pacific and beyond, etc.

Eight questions in the WMO survey directly addressed issues relating to the state of implementation of the Roadmap in the Pacific (Figure 4). Three questions received 100% positive response rate: Target products to priority areas, Coordinate RCOFs & NCOFs and Disseminate GPC and RCC products. The high level of national agreement on key areas requiring access to climate services shows how quickly the CSIS functions of the Roadmap have matured in the eyes of the NMHSs implementing it.

The limited ability of all countries to manipulate time series data to generate locally useful services and to publish climate information, even electronically, makes it very difficult to locally generate climate services in response to climate issues specific to the nation and so, it indicates the need for local capacity building or possibly, in small NMHSs, that there are not sufficient staff to undertake these tasks.

The computation of indices of climate extremes has only been undertaken by 58% of the respondents. It should be noted that through the Climate Change data portal climate extreme indices are available for 23 countries in the Pacific, including all 14 participating in the implementation of the Roadmap.

Finally, only 17% have registered climate products with the WMO Information System (WIS). This suggests that the Pacific Roadmap needs more pathways to the WIS.

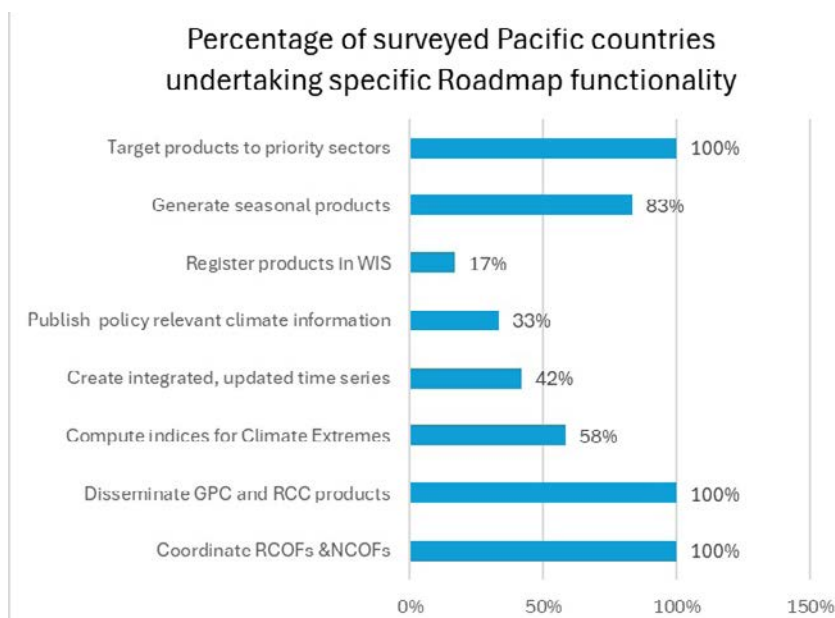


Figure 4: A sample of responses, by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the Climate Services Information System component. See Annex 1.3 for underlying data.

1.3.3 A View of the Observation, Monitoring and Data Management component of the Roadmap in the Pacific.

The Observation and Monitoring of the Roadmap includes the collection of meteorological and ocean data throughout the Pacific, the monitoring of these data and the storage and archival of the observations and their metadata. The storage should enable quick, cost effective accessible to those who wish to use the data for education, research and operational decision making.

The archival of the data and metadata should be aimed at preserving the data and metadata for the use by future generations. This in turn requires that skilled data management principles and practices be applied by the custodians of the data and metadata to ensure both their long-term preservation and easy, rapid access to those who can add value to their communities. WMO questionnaire asked a number of questions related to data management, responses to six of these are shown in Figure 5 (below).

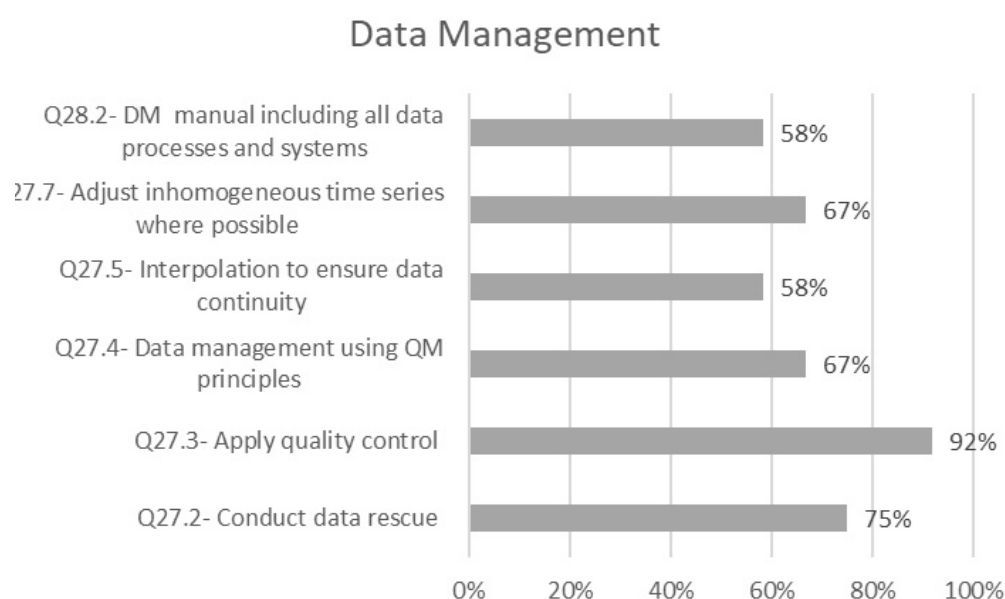


Figure 5: A sample of responses, by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the Data Management. See Annex 1.3 for underlying data

It is clear from the responses shown in Figure 5 that effective data management is recognized and practiced by a majority of NMHSs in the Pacific but more needs to be done, particularly in the areas of documentation, adoption of quality management systems and developing capabilities in time series management. Accordingly, it is suggested here, that this component of the Roadmap should include explicit recognition in its title that data management is an integral part of a successful observation and monitoring program (as noted by the **red text** in this Section heading). Six questions in the WMO survey directly addressed issues relating to the state of implementation of the Observation, Monitoring and Data Management portion of the Roadmap in the Pacific (Figure 5).

RECOMMENDATION 3:

That the Observation & Monitoring element of the Roadmap be expanded to Observation, Monitoring and **Data Management**, so as to explicitly recognize the important data management aspects associated with observation and monitoring of the climate.

The WMO questionnaire posed a number of questions to, inter alia, assess the capability of the Pacific NMHSs to observe the climate (Figure 6). The first feature of Figure 6 that stands out is that 92% of respondents feel that their country has an adequate weather observing system while 82% feel that there is a need to establish a national requirement for a climate observing system. In essence the need to monitor the WMO designated Essential Climate Variables (ECVs) requires long term stable sites, ongoing calibration checks and at times to a greater of accuracy than for weather observations used in operational day-to-day forecasting. For the Roadmap to succeed long-term there is a challenge here. Tackling the issue that weather observations alone are not sufficient to monitor all aspects of climate goes hand-in-hand with the need to establish national strategies to address identified gaps in climate networks, such as a clearer focus on observing more of the WMO's Essential Climate Variables and ensuring regular calibration of climate station instruments. Of some concern is that less than half of the NMHSs responding feel that there is in place a national strategy to identify gaps in the climate observing system.

A positive message from Figure 6 is the high percentage (all but one country) are able to create, document and archive national datasets – essential highways on the Roadmap.

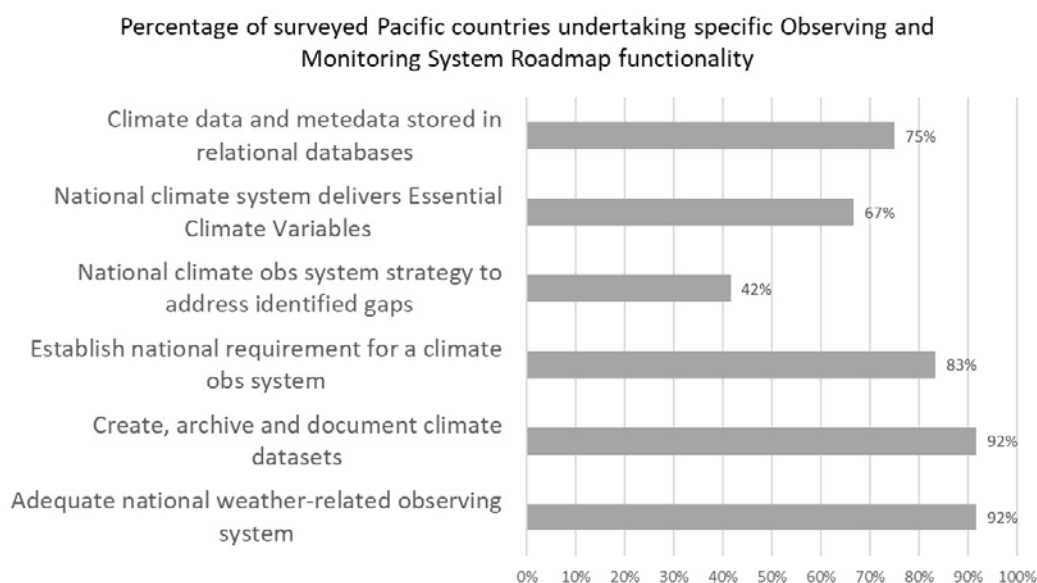


Figure 6: A sample of responses, by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the Observations, Monitoring and Data Management component. See Annex 1.3 for underlying data.

1.3.4 A View of the Research, Modelling and Prediction component of the Roadmap in the Pacific.

Seven questions in the WMO survey directly addressed issues relating to the state of implementation of the Research, Modelling and Prediction component of the Roadmap in the Pacific (Figure 7). The first feature of Figure 7 is the relatively low percentages of positive results compared to the other components. NMHSs have traditionally focused on the “weather problem”, climate services are new and, at times, calling for more NMHS resources than are available.

Small Pacific NMHSs do not have the resources (human or computing) to undertake modelling or model downscaling tasks. This portion of the Roadmap is one of small, faint set of foot trails rather than of super highways! A number of Pacific NMHSs are taking GPC and RCC products and bundling portions relevant to their national areas to serve priority clients (particularly agriculture and fisheries).

To build more roads on the Roadmap in this component all Pacific NMHSs need to build stronger linkages with tertiary educational institutions.

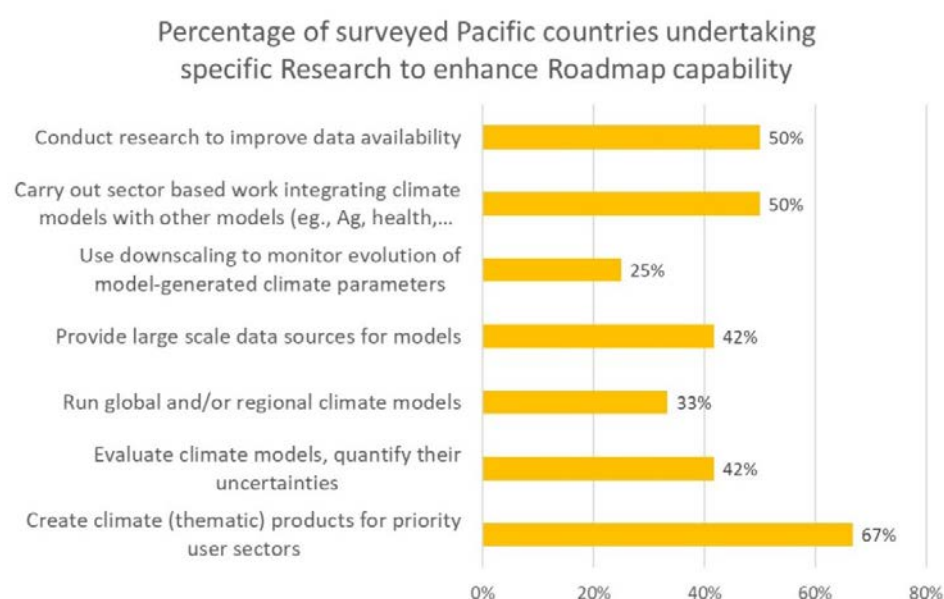


Figure 7: A sample of responses by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the Research, Modelling and Prediction component. See Annex 1.3 for underlying data.

1.3.5 A View of the Capacity Building component of the Roadmap in the Pacific

Four questions in the WMO survey directly addressed issues relating to the state of implementation of the Capacity Building component of the Roadmap in the Pacific (Figure 8). Capacity building is ongoing within the Roadmap. The strong support for RCOFs comes through in response to many questions of the WMO Questionnaire. RCOFs bring users and climate service providers together and they bring experienced climate scientists in contact with climate service providers – everyone learns from the experience.

A number of donor supported programmes have also built capacity, these include WMO/World Bank Climate Risk and Early Warning System (CREWS), Climate and Oceans Support Program in the Pacific (COSPPac), Weather Ready Pacific (WRP). These initiatives have conducted a range of training sessions and workshops throughout the Pacific.

The lowest response was support for the regional training centre and to engagement with institutions of higher learning (consistent with the conclusions in the Research, Modelling and Prediction section).

Climate-related activities associated with National Action Plans also contribute to the capacity building activities of the Roadmap.

Percentage of surveyed Pacific countries undertaking Roadmap-relevant outreach and training

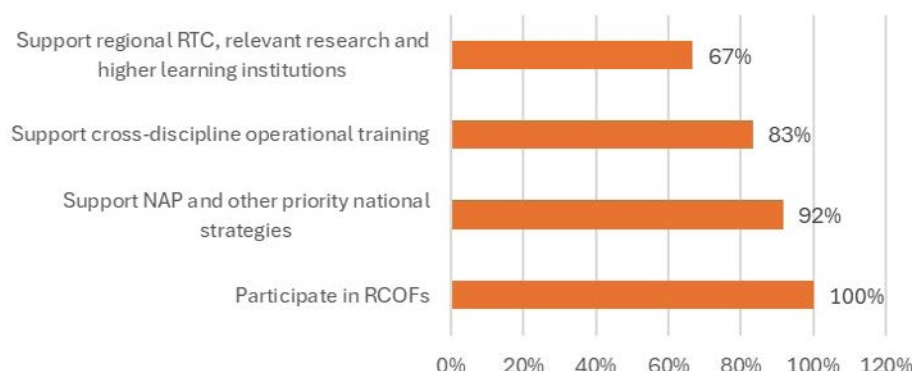


Figure 8: A sample of responses by NMHSs, from the WMO 2023 Questionnaire on Climate Services, focused on the Capacity Building component. See Annex 1.3 for underlying data.

1.4 The Contribution of the Priority (Thematic) Areas to the Roadmap

In its original formulation the GFCS envisaged four priority thematic areas of highly focused activity; agriculture, disaster risk management, health and water. In the WMO survey respondents were asked to rate the priority of five areas as somewhat later Energy had been added. Eleven Pacific countries provided a response, rating each on a scale of one to five, with five points being allocated to the most important. The maximum rating a theme could receive was 55, and more than one could (theoretically) receive this as respondents were not constrained in how many themes were rated 5 (or any other number for that matter). Figure 9 summarises the outcome from this exercise.

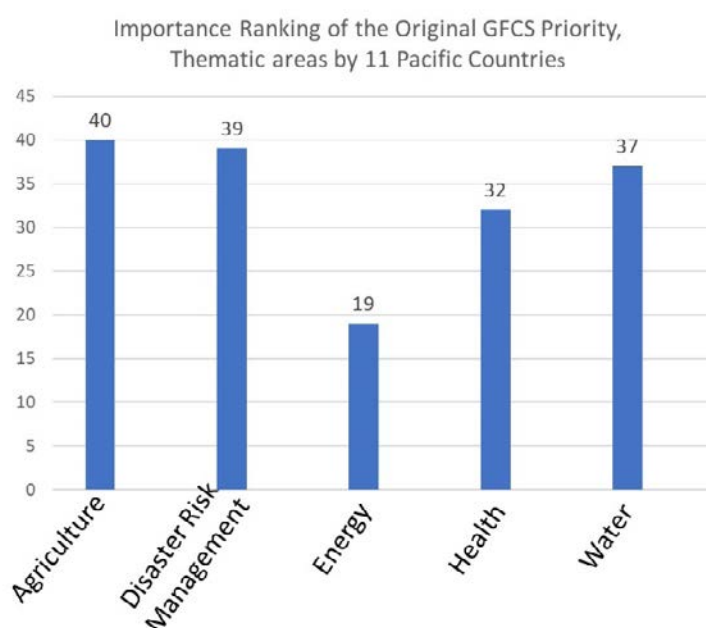


Figure 9: A ranking by 11 Pacific Island countries of the relative importance of the five original priority thematic areas for the WMO survey. The maximum possible score for a thematic area was 55. See Annex 1.3 for underlying data.

The Pacific community has added three further priority themes; fisheries and aquaculture, tourism, and national climate services. A survey of Pacific country web sites (discussed below), reveals many products directed at agriculture, the fishing industry and tourism.

1.4.1 A Brief Survey of Pacific-Island Climate Services

Surveying the climate services on NMHS web sites is another way of tracking services available using the Roadmap, however there is no information available relating to the hit rates on the various products, nor of the countries/organisations originating the hits. These data can and should be collected routinely for at least key products/services but this issue is considered further when monitoring and evaluation of the Roadmap are discussed.

Table 1 (below) provides a summary look at what is readily available in the way of web-based services originating from, or through Pacific NMHSs. It must be stressed that this is a “quick” summary, not an exhaustive listing of products/services.

Some messages relating to the Roadmap map features in the Pacific are (see Table 1):

- Links to the Climate Change Portal are an efficient way of giving access to a wide range of data and climate-related products, as called for in the Pacific Island Meteorological Strategy – PKO 5 (Box 1.3, National Action 2. & 3.). The Climate Change Portal is well maintained and has an effective interface to data and products;
- Seasonal outlooks, focusing on ENSO with a very country-specific focus relating to likely impacts are a very popular climate service that is widely provided;
- There is a broad range of thematic products meeting the needs in economic sectors such as: Agriculture; Disaster risk management; Water; Tourism; Fisheries and aquaculture; and Health.
- There are some sites providing both English and local dialect services;
- Information on the decadal and longer possible consequences from climate change through scenario data/information are only found on one site.
- The cost of maintaining a complex climate site is possibly beyond the resources of some small NMHSs.
- The COSSPac web site helps address the lack of web capability in small NMHSs.

COUNTRY/ SERVICE	National Climate Data	Link to COSSPac Data	Seasonal Outlooks	Climate Change Scenarios	Thematic Products	Languages	Other
COOK IS.			Summary format. ENSO focus		Early Action Rainfall (EAR) Watch Water		Link to NIWA ENSO Watch
FIJI	Yes	Yes, Pacific Climate Change portal	Yes	NextGen Projections	Water & Rainfall, Ag, Ocean, Tourism bulletins		Ocean Portal, You Tube video for subscribers
KIRIBATI			Yes - monthly climate outlook		Ocean outlook, EAR Watch	English and local dialect	
MARSHALL IS.		Yes, the Pacific Climate Change portal					Link to BOM.GOV.AU's Marshall Is page
MICRONESIA (FSM)							Link to NOAA page: www.weather. gov/prh/ No climate data
NAURU			Social media page		EAR Watch		Facebook page
NIUE							Link through BoM to COSSPac Niue page. National Framework on Weather, Water & Climate
COUNTRY/ SERVICE	National Climate Data	Link to COSSPac Data	Seasonal Outlooks	Climate Change Scenarios	Thematic Products	Languages	Other
PALAU							Link to NOAA page: www.weather. gov/gum/ WSO Palau. No climate data
PAPUA NEW GUINEA							Climate page under development
SAMOA	Yes	Yes, the Pacific Climate Change portal	Yes		Ocean Outlook Health, Water, Tourism bulletins		
SOLOMON IS.			Yes. ENSO outlook		Rainfall, Health Ocean bulletin		Traditional knowledge page
TONGA			Rainfall outlook		Ocean Outlook.	English and Tongan	
TUVALU			Yes		Bulletins for Health and Water	English local dialect	
VANUATU	Data request form		ENSO Update. Rainfall trend, SST, model outlooks		Health, Energy, Agriculture, Tourism, and Fisheries bulletins		

Table 1: A brief survey of the content of NMHS-climate related web sites. May 2024.

BOX 1.3 EXTRACT FROM PACIFIC ISLAND METEOROLOGICAL STRATEGY

PRIORITY 3: IMPROVED CLIMATE AND HYDROLOGICAL SERVICES

PACIFIC KEY OUTCOME (PKO) 5:

1. NMHSs contribution to climate change activities
2. NMHSs engagement in national climate change plans, policies and forums.
3. NMHSs engagement in climate change research and scenario risk analyses.

Part 3 – Matrix of Pacific outcomes, high-level actions and sub-actions

PACIFIC KEY OUTCOME (PKO) 5:

NHMS contribution to climate change activities

NMHSs engage in national climate change plans, policies and forums

National Priority Action

1. National Priority Action
2. Negotiate inclusion in national climate change forum
3. Contribute and analyse national climate and sectoral data for climate risk management and adaptation planning
4. Contribute to national understanding of climate change impacts and the application of climate change services.
5. Raise national government awareness of NMHS expertise in climate change.
6. Contribute to and participate in climate change and disaster risk reduction forums i.e. COP, FRDP, DRR platform etc.
7. Encourage and facilitate NMHS participation in climate change and disaster risk reduction forums.
8. Support and mentor NMHSs attend IPCC meetings and reporting from the Pacific
9. Regional training for NMHSs on Climate Change Negotiations

Regional Priority Action (Regional Contributors - WMO, ICAO, PASO, PIAWS panel)

1. Assist NMHSs in demonstrating the value of their contribution to climate change activities
2. Consider expanding PICOFs to include long-term climate change updates and planning implications.
3. More visible use of climate change information in decision making processes building partnerships making link

1.5 Other Climate Services “Success Stories” of the Pacific

Not all climate service-related activities are evident from inspection of web pages. An important climate service activity is that of interacting directly with the users of climate services, informing them of the science and data behind the services, advising them of the capabilities and limitations of the products and listening to the users’ views of the services they use.

One avenue for interacting directly with climate service users is the Climate Outlook Forum (COFs). At times they have been National (NCOFs), Regional (RCOFs) or Pacific-wide (PICOFs). An excellent example of the use of NCOFs is the work done by Fiji which has conducted five NCOFs since 2018. Initially the Fiji NCOFs were donor funded; most recently it was funded nationally. Fiji has focused its NCOF on economic sectors such as agriculture, fisheries, etc., and worked with key stakeholders in those sectors to better understand how climate services can best be generated to assist the users in making climate-sensitive decisions.



Figure 10: Advancing climate service through user consultation.

The NMHS staff of the Niue have in place a number of community-focused initiatives for advancing the understanding of climate services. These include working with boys and girls on climate-based projects (Figure 11) and engaging politicians with climate observing system projects (Figure 12).



Figure 11: Working with boys and girls to advance the understanding of climate services.



Figure 12: Niue Government Ministers visit the new AWS at Vaipapahi.

These are some examples of efforts to advance climate services in the Pacific. Similar efforts are being conducted by all NMHSs as a part of the Roadmap. It is important that a consolidated record of consultative, educational and political engagements promoting climate services be kept.

RECOMMENDATION 4:

A part of the Roadmap Monitoring and Evaluation effort should be the maintenance of a consolidated record of consultative, educational and political engagements promoting climate services.

1.6 Monitoring and Evaluation of the Pacific Roadmap

In essence the Roadmap 2017-26 has been implemented through NMHSs choosing which of the 157 Actions, described under the five GFCS components and eight thematic areas, they will undertake (Figure 13). These Actions have then been undertaken using both national government and donor funding. For some of these Actions, Performance Indicators have been developed but there has been no systematic monitoring and evaluation of the overall extent of the Roadmap's achievements.

Pacific Roadmap (2017-26):

Many pathways headed in the same direction

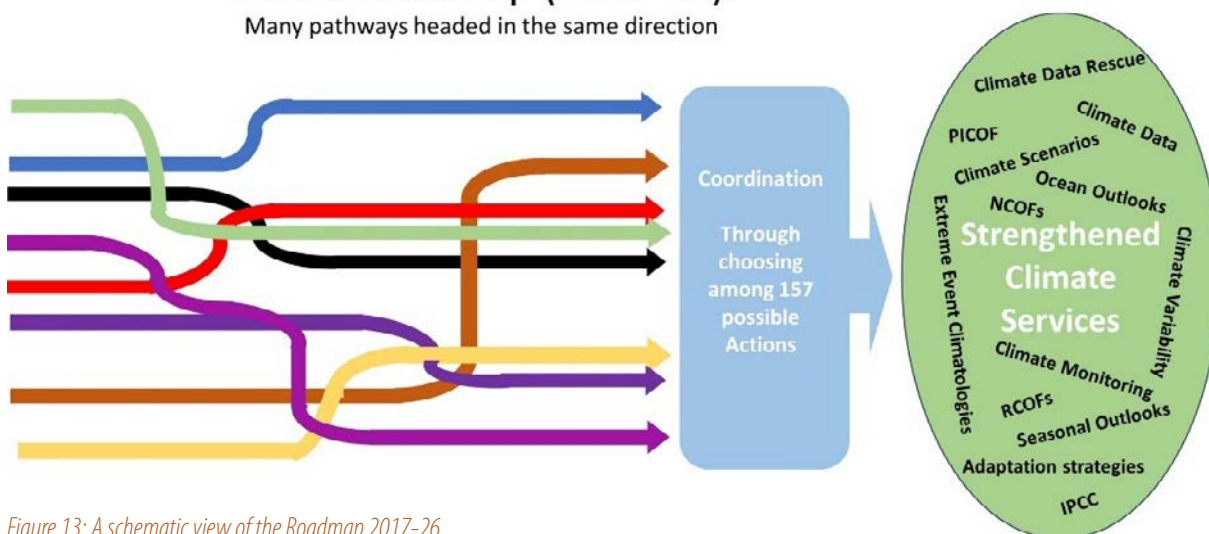


Figure 13: A schematic view of the Roadmap 2017-26.

As noted above, implementation of the Roadmap has not been done by NMHSs alone, rather the Pacific Island NMHSs have worked with donors such as the Australian Government (AUSAid and BoM: COSSPac), the Global Climate Fund (GCF), the European Union (ClimSA), the Korean Government, the New Zealand Government (NIWA: CliDE, CliDESc, CLEWS), the Japanese Government (JICA), The UN (including through the WMO, UNEP and UNDP), the US Government (USAID and NOAA: Weather Ready Pacific) and the World Bank (CREWS).

The Roadmap has underpinned a remarkable growth in the availability of climate services in the Pacific despite the negative impact of the Covid 19 outbreak in the period 2020 to 2023. The growth has not been uniform across the region, rather countries on the periphery of the region have collaborated with large and small countries within the region to improve access to data, to products from global and regional centres and enabled localized tailoring of services to meet unique national needs. The web survey shows that different countries have incorporated new climate products and services in different ways according to local needs and resources. In addition to new services and products, community level workshops and related activities have built local knowledge and capacity to utilize climate services.

The most striking absence in the implementation of the Roadmap is the commitment to a Roadmap-wide, consolidated monitoring and evaluation program. The WMO survey asked a small series of questions addressing monitoring issues (Figure 14). Perhaps the most encouraging statistic in Figure 14 is that 58% of Pacific NMHSs have a baseline of sector outcomes and 50% are monitoring and documenting the outcomes users of climate services experience.

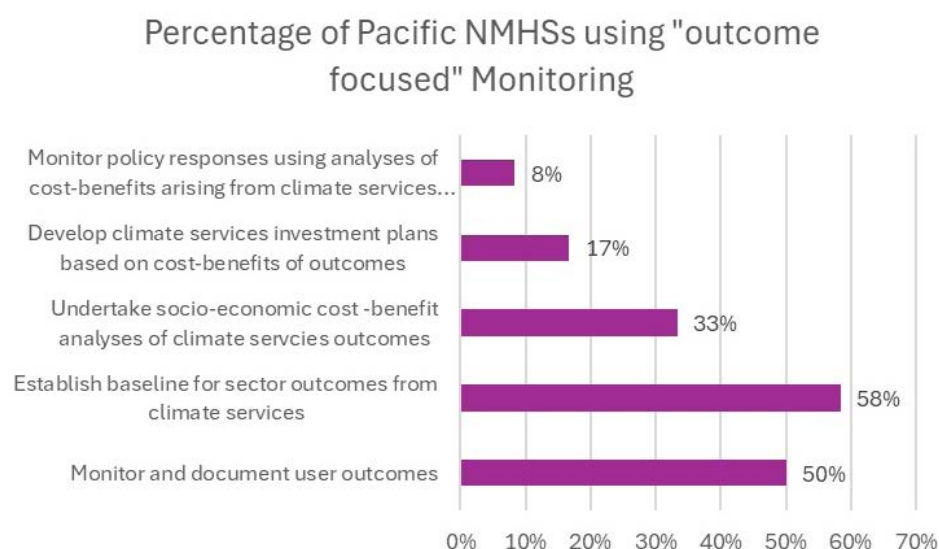


Figure 14: The ongoing Actions NMHSs are taking to monitor outcomes from the climate services they provide. See Annex 1.3 for underlying data.

The questions relating to the economics of climate services are less well responded to, however, in the long-run these issues will need to be addressed if regional policy makers are to assist in sustaining the new capabilities being developed through the various climate services projects underway.

Noting that Guiding Principle 6 is rather narrowly focused on the integration of climate science into climate services, it should be expanded to encourage cross-discipline research into the costs and benefits of climate services.

- vi** Continuing Research: advanced climate science underpins informed decision making. Climate research must be systematically integrated into climate services.

RECOMMENDATION 5:

Guiding Principle vi should be expanded to emphasise undertaking cross-discipline research into the costs and benefits of climate services:

vi . Continuing Research: advanced climate science underpins informed decision making. Climate research must be systematically integrated into climate services. Furthermore, consideration needs to be given to working with academics and business people beyond the science community to undertake collaborative economic studies of the cost and benefits of climate services in the Pacific Islands.

RECOMMENDATION 6:

The Performance Indicators that form the basis of a Monitoring and Evaluation Strategy for the Updated Roadmap should relate directly to the Outputs specified to achieve the overall Objectives of the Roadmap.

1.7 A Brief Concluding Summary of Chapter 1

- 1) The Roadmap has been implemented through the development of a list of 157 Actions, 100 under the five GFCs Components and 57 under eight thematic areas.
- 2) The Eight Principles upon which the Roadmap was developed have no explicit linkage to the 157 Actions.
- 3) There is an abundance of information indicating the Climate Services have improved substantially in the Pacific since 2017, when implementation of the Roadmap commenced. RCOFs and NCOFs have been very successful as have a variety of community outreach programs conducted by all Pacific NMHSs, but documentation of these efforts has not been systematically collected and shared.
- 4) The (real time) weather observing network has, to date, formed the basis of climate analysis however there is a need to re-examine this network from a climate perspective and fill gaps in areas including instrument calibration, accuracy standards, site locations, archiving of site metadata, etc.
- 5) There is no monitoring and evaluation system in place for the Roadmap as an entity beyond the annual reports to the PMC. The Roadmap appears to be highly beneficial but that is currently very difficult to establish using objective measures.
- 6) There are concerns about the sustainability of large infrastructure projects if there is not sufficient investment training to enable the transfer of technical maintenance and development skills to local staff.
- 7) Linkages between the climate service providers and climate researchers are weak.
- 8) There is a lack of work being undertaken on the costs and benefits of climate services in the Pacific Islands.

An Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.

2.1 Overview of the Updated Roadmap 2024-33

The Updated Pacific Roadmap for Strengthened Climate Services 2024-33 will remain a guide to identifying and implementing the most critical climate services priorities for each Pacific-island country, ensuring government and communities have reliable and science-based information on their climate.

As before, each Pacific country implementing the Updated Roadmap will be able to pursue its own route by choosing which Actions to undertake that contribute to the achievement of the Objectives of the Roadmap and fit with national objectives. The focus, however, will be on achieving outcomes that are in line with the Guiding Principles and that can be monitored and evaluated using a relatively small number of climate service Performance Indicators.

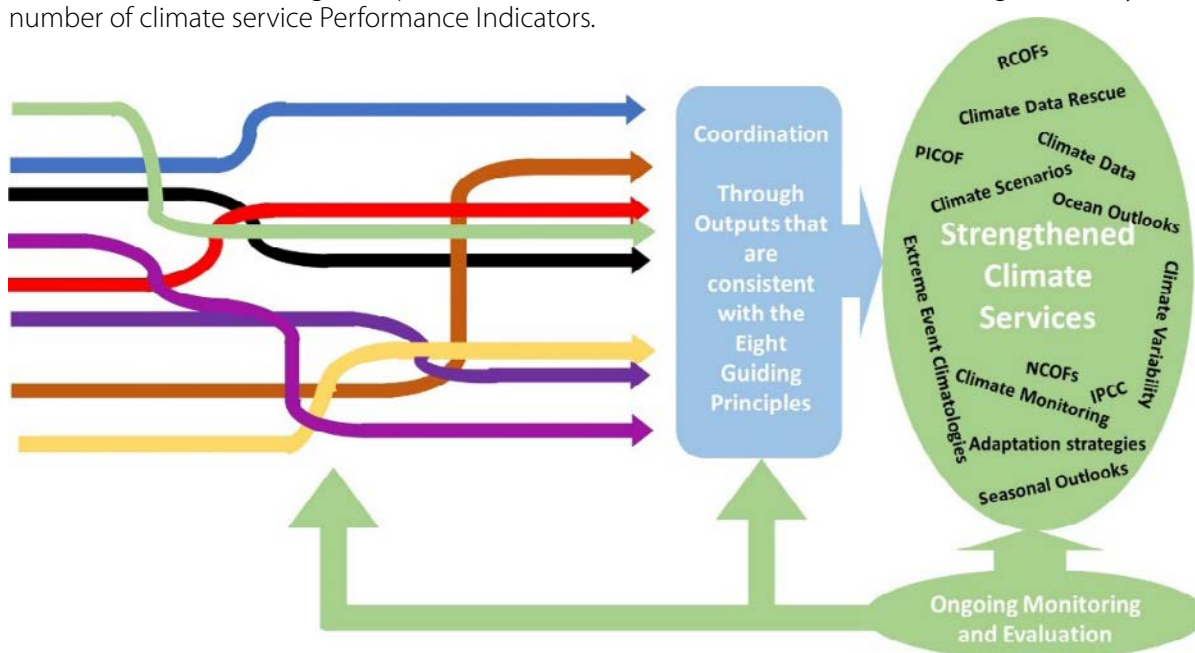


Figure 15: Schematic of the Updated Roadmap including coordination through Objectives / the Eight Guiding Principle and a Monitoring and Evaluation Strategy based around Performance Indicators that are consistent with the overall Objectives of the Updated Roadmap.

The Updated Roadmap 2024-33 will remain closely aligned with the Global Framework for Climate Services⁶ (GFCS). The GFCS's five components (User Interface, Climate Services Information System, Observations & Monitoring, Modelling & Prediction and Capacity Building) have again been used, this time with the Eight Guiding Principles as updated according to Recommendations 1, 3 and 5 (Box 2.1) as Objectives.

2.2 Updated Roadmap 2024-33

The Updated Roadmap 2024-33 is built upon a model that links the (Updated) Guiding Principles to Outputs from the GFCS five Components with the aim of producing a range of sought after Outcomes in the Pacific Island communities. Next, a set of Performance Indicators are developed that can be used to assess how effectively the Roadmap is working. Finally, a Monitoring and Evaluation process is to be established and maintained. This Monitoring and Evaluation process will use the Performance Indicators to routinely report to Roadmap stakeholders on the achievements of the Roadmap and of the need, should it arise, of further modifying the Guiding Principles. Over the decade 2024 to 2033 the Roadmap will remain responsive to the needs of the Pacific community and its visitors for climate services.

6

The Global Framework for Climate Services can be found at: <https://wmo.int/site/global-framework-climate-services-gfcs>

BOX 1.3 EIGHT GUIDING PRINCIPLES OF THE ROADMAP (UPDATED)

The Roadmap is founded on, and shall be implemented and monitored by National Meteorological and Hydrological Services (NMHSs) with the following:

- i. Pacific focus within a global context: the work of the NMHSs is primarily focused on effective delivery of weather, climate, water and ocean services for the benefit of Pacific peoples and communities.
- ii. Gender and minorities empowerment: NMHSs recognise and support the need to operate and deliver services in ways that considerations of the needs of women, young boys and girls, people living with disabilities and vulnerable groups will be taken into account.
- iii. Value for money: NMHS services are essential to communities, villages, districts, at national and regional levels and are often delivered within limited resources. In some cases, depending on available resources, it may be more efficient to deliver certain services and support at a regional level, subject to bilateral and multilateral agreements.
- iv. Sharing information: NMHSs are committed to sharing data in line with international obligations and national policies, in particular, the World Meteorological Organization (WMO) commitment to free and unrestricted exchange of meteorological and related data and products.
- v. Partnerships: partnerships among NMHSs, their governments and stakeholders, with public and private sectors, with non-government organisations / civil society organisations (NGOs/ CSOs), with WMO and other UN agencies, with regional and sub-regional inter- governmental agencies, and with donors and technical partners are critical to the success of this Roadmap. A coordinated approach enhances effectiveness in: increasing and using resources; targeting effort and managing potential overlap between agencies, organisations and development partners; and effective delivery of services to customers.
- vi. Continuing Research: advanced climate science underpins informed decision making. Climate research must be systematically integrated into climate services. Furthermore, consideration needs to be given to working with academics and business people beyond the science community to undertake collaborative socio-economic studies of the cost and benefits of climate services in the Pacific Islands.
- vii. Stakeholder Engagement: it is essential to engage continually with stakeholders and customers to ensure weather, climate, water and ocean products and services meet their decision-making needs and are tailored and accessible.
- viii. Infrastructure enhancement: new projects should achieve a balance of investment in infrastructure and human resources development such that regional staff can sustainably integrate new infrastructure into existing systems and subsequently maintain the upgraded operational infrastructure beyond the lifetime of the upgrade project. Infrastructure development projects to, where possible, use software tools that are interoperable, well supported and that have clear long-term sustainability .

RECOMMENDATION 6:

Using the Guiding Principles; Outputs, Outcomes and Performance Indicators will be developed for each of the five GFCs Components. The Performance Indicators to be strategic level measures of the success or otherwise of the community-wide Outcomes arising from the delivery of the Updated Roadmap's Outputs. Outputs are to be consistent with the Eight, Updated, Guiding Principles.

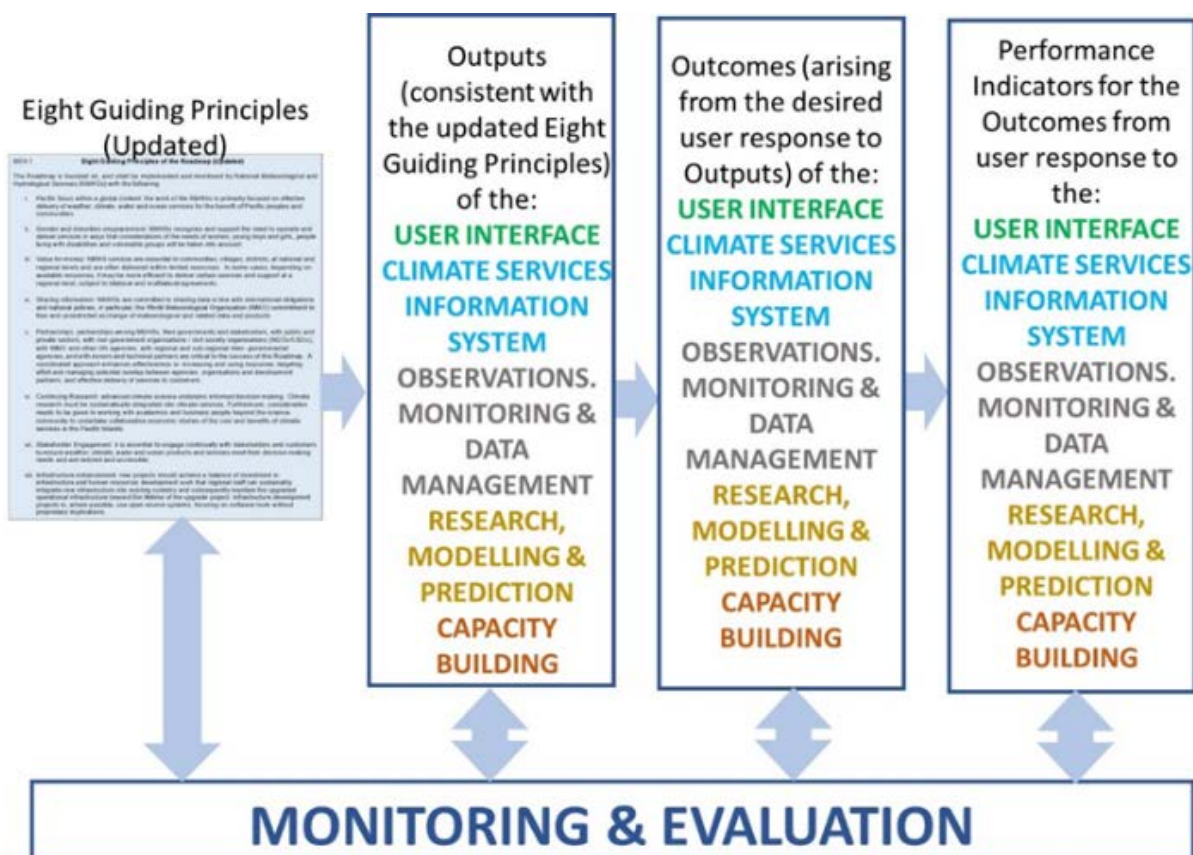


Figure 15: A schematic of the Updated Roadmap 2024-33.

2.2.1 Updated User Interface Component

The User Interface is the component of the Roadmap that links the user community to its other four components; climate services information system, observations, monitoring and data management, Research, monitoring and Prediction, and Capacity Building.

Three Guiding Principles set out objectives for the User Interface:

- Principle ii calls for climate services to be delivered in ways that meet the needs of vulnerable and dis-empowered groups;
- Principle v calls for the development of partnerships between NMHSs delivering climate services and a wide variety of community-based stakeholder groups; and,
- Principle vii calls for continuous engagement with stakeholders and customers to ensure weather, climate, water and ocean products and services meet their decision-making needs and are tailored and accessible.

Using these Guiding Principles the Outputs of the User Interface, the community-wide Outcomes sought from the User Interface and the Performance Indicators to be used to monitor and evaluate the User Interface are given in Table 2.

GFCS COMPONENT	OUTPUTS	OUTCOMES	PERFORMANCE INDICATORS
USER INTERFACE COMPONENT OF THE UPDATED ROADMAP: 2024-33	(Consistent with Principles ii, v and vii); the Updated Roadmap creates and sustains a wide range of partnerships among NMHSs, their governments and stakeholders, with public and private sectors, with Non-Government Organisations / Civil Society Organisations (NGOs/CSOs), with WMO and other UN agencies, with regional and sub-regional inter-governmental agencies, and with donors and technical partners in matters related to climate.	An increased understanding and use of climate data and information by the community. An increased understanding by NMHSs of the community's needs for these data and information.	(1) Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential). (2) Survey data of user satisfaction with various climate services, taking special note of: (a) the needs of women, minorities, the vulnerable; (b) those who communicate only in the local dialect; and, (c) Thematic, priority areas. (3) Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.

Table 2: The Outputs of, Outcomes from and Performance Indicators for the User Interface Component of the Updated Roadmap 2024-33.

2.2.2 Updated Climate Services Information System Component

The Climate Services Information System draws its data and some products from the Monitoring, Observations and Data Management Component and draws other products from the Research, Modelling and Prediction Component, integrates these to meet user needs and dispatches many sets of data and products, tailored to meet individual and collective needs, through a variety of communication channels; the Internet (including social media), free-to-air radio and television, news-papers, journal and magazines.

Two Guiding Principles set out objectives for the Climate Services Information System:

- Principle ii calls for climate services to be delivered in ways the meet the needs of vulnerable and dis-empowered groups; and,
- Principle iv calls for the sharing data in line with international obligations and national policies, in particular, the World Meteorological Organization (WMO) commitment to free and unrestricted exchange of meteorological and related data and products.

Using these Guiding Principles the Outputs of the Climate Services Information System, the community-wide Outcomes sought from the Climate Services Information System and the Performance Indicators to be used to monitor and evaluate the Climate Services Information System are given in Table 3.

GFCS COMPONENT	OUTPUTS	OUTCOMES	PERFORMANCE INDICATORS
CLIMATE SERVICES INFORMATION SYSTEM COMPONENT OF THE UPDATED ROADMAP: 2024-33	(Consistent with Principles ii and iv); the Updated Roadmap actively supports WMO practices for the observation of climate variables and for the exchange and management of these data and their associated metadata. The Updated Roadmap supports the generation of climate products to inform the community at large and people / organisations that have possibly high exposure to climate extremes of the current and possible future states of the climate. The Updated Roadmap encourages the use of every possible communications technology that can reach climate-sensitive users.	A Pacific Climate Services Toolkit at the regional and national levels becomes available to assist in the production of targeted climate services at national level. Regional climate data exchange is in accordance with WMO recommendations. Climate data and information (products) are exchanged using the most appropriate technologies for the product concerned and for the target audience.	(4) Completed steps towards a toolkit (5) The volume of climate data exchanged through the; (a) WIS, (b) GTS and (c) on point-to-point Internet communications for a chosen month each year. (6) Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities.

Table 3: The Outputs of, Outcomes from and Performance Indicators for the Climate Services Information System Component of the Updated Roadmap 2024-33.

2.2.3 Updated Observations, Monitoring and Data Management Component

The Observations, Monitoring and Data Management Component oversees the collection and management of climate observations in accordance with the guidelines of the WMO, in particular in accordance with the WMO Guide to Climatological Practices (WMO Publication No. 100), the WMO publication; "Climate Data Management Systems" (WMO Publication 1131) and other relevant publications.

Three Guiding Principles set out objectives for the Observations, Monitoring and Data Management Component:

- Principle i recognises that the Roadmap's services (including data gathered from observing systems) are for the benefit of Pacific peoples and communities and that they must be seen in a global context.
- Principle iii sets out two objectives: firstly, the climate services (including, but not only, climate observing systems) must represent value for money for those using them and secondly, resource constraints may require that not all services must be sourced nationally rather, at times sourcing must occur at the regional level.
- Principle viii calls new projects in the Pacific to achieve a balance of investment in infrastructure (including observing, monitoring and data management systems) and human resources (NMHS staff) development such that regional staff can sustainably integrate new infrastructure into existing infrastructure and manage the results sustainably.

Using these three Guiding Principles the community-wide Outcomes sought, and the Performance Indicators to be used to monitor and evaluate the success of the Observations, Monitoring and Data Management Component, are given in Table 4.

GFCS COMPONENT	OUTPUTS	OUTCOMES	PERFORMANCE INDICATORS
OBSERVATIONS, MONITORING & DATA MANAGEMENT OF THE UPDATED ROADMAP: 2024-33	(Consistent with Principles i, iii and vii); the Updated Roadmap supports increasing the number of stations in the Pacific reporting Essential Climate Variable (ECVs). An increase in national climate observing networks designed specifically to underpin national and regional climate services. Further implementation of national climate databases using relational (open source) databases that incorporate all relevant metadata. Further data rescue projects in countries holding many station years of Pacific meteorological data in paper form only.	Continuous review and upgrading of climate observing network sustainably. Improved data quality control and archiving. A better understanding of climate change in the Pacific from better ECV coverage. Improved access at national and regional level to climate databases and the meta-data they hold. A marked increase in historical data for key stations throughout the Pacific.	(7) The volume of ECVs reported by all Pacific countries. (8) The % of Pacific countries operating modern, relational climate databases. (9) Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable. (10) The volume of (measured in station years) climate data (along with their metadata) copied from paper format into Pacific climate, relational databases.

Table 4: The Outputs of, Outcomes from, and the Performance Indicators for the Observations, Monitoring and Data Management Component of the Updated Roadmap 2024-33.

2.2.4 Updated Research, Modelling and Prediction Component

Four Guiding Principles can be used to set out Outputs and Outcomes for the Research, Modelling and Data Management Component:

- Principle i recognises that the Roadmap's services (including research undertaken and monitoring and prediction systems implemented) are for the benefit of Pacific peoples and communities and that they must be seen in a global context.
- Principle iii sets out two objectives: firstly, the climate services (including advisory services) must represent value for money for those using them and secondly, resource constraints may require that not all services must be sourced nationally rather, at times sourcing must occur at the regional level.
- Principle iv calls for the sharing data (upon which all prediction models rely), in line with international obligations and national policies, in particular the WMO's commitment to free and unrestricted exchange of meteorological and related data and products.
- Principle viii calls new projects in the Pacific (including the development and implementation of prediction systems) to achieve a balance of investment in infrastructure and human resources development such that regional staff can sustainably integrate new infrastructure into existing infrastructure and manage the results sustainably. This Principle also calls for infrastructure development projects to, where possible, use open-source systems, focusing on software tools without proprietary implications.

Using these four Guiding Principles the Pacific Island community-wide Outcomes sought from, and the Performance Indicators to be used to monitor and evaluate the success of the Research, Modelling and Prediction Component, are given in Table 5.

GFCS COMPONENT	OUTPUTS	OUTCOMES	PERFORMANCE INDICATORS
RESEARCH, MODELING & PREDICTION OF THE UPDATED ROADMAP: 2024-33	(Consistent with Principles i, iii, iv and vi); the Updated Roadmap supports inter-disciplinary, applied research in the use of climate data to assist in better decision making in climate-sensitive areas, including cost-benefit studies. Studies to be undertaken in the areas of agriculture, health, water resources management, fisheries, etc. These studies to be through the interaction of NMHS staff, academia and climate-sensitive areas in both business and government. Better access and further support for the downscaling of climate change scenarios for the Pacific to assist policy makers in their work.	The ongoing development, testing, refinement and use of models that address the impact of climate variability and change on crops, malaria outbreaks, reservoir management, fish catches and the like. Closer collaboration between NMHSs and its user community through joint projects. Improved understanding of the costs and benefits of climate services. Improved understanding outside the NMHSs of the uses, capabilities and limitations of climate science.	(11) Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities. (12) Number of applied model products available on the Pacific web sites and their monthly "hit" rates. (13) Cost-benefit studies of climate services-based decisions are prepared and published. (14) Survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration and the number of collaborative articles published.

Table 5: The Outputs of, Outcomes from and Performance Indicators for the Research, Modelling and Prediction Component of the Updated Roadmap 2024-33.

2.2.5 Updated Capacity Building Component

Three Guiding Principles can be used to set out Outputs, Outcomes and Performance Indicators for the Capacity Building Component:

- Principle ii calls for climate services to be delivered in ways that meet the needs of vulnerable and dis-empowered groups.
- Principle iv calls for the sharing data (upon which all prediction models rely), in line with international obligations and national policies, in particular the WMO's commitment to free and unrestricted exchange of meteorological and related data and products.
- Principle viii calls for new projects in the Pacific (including the development and implementation of prediction systems) to achieve a balance of investment in infrastructure and human resources development such that regional staff can sustainably integrate new infrastructure into existing infrastructure and manage the results sustainably. This Principle also calls for infrastructure development projects to, where possible, use open-source systems, focusing on software tools without proprietary implications.

Using these three Guiding Principles the community-wide Outcomes sought from, and the Performance Indicators to be used to monitor and evaluate the success of the Observations, Monitoring and Data Management Component, are given in Table 6.

GFCS COMPO- NENT	OUTPUTS	OUTCOMES	PERFORMANCE INDICA- TORS
CAPACITY BUILDING	<p>(Consistent with Principles ii, iv and viii): the Updated Roadmap supports the ongoing balanced investment in human and physical resources to meet national and regional needs in a sustainable fashion.</p> <p>It supports the training of professional and technical staff, the mentoring of future leaders and education at the community level. It enables sustainable future investment in infrastructure (Observing systems, information technology and communications).</p>	<p>Sustainable services when projects are delivered and continue to function well, long after their initial operational implementation.</p> <p>Future leaders and senior managers are supported and mentored.</p> <p>The Pacific as a region provides data, products and leadership in the global effort to better understand our current climate and how it might evolve.</p>	<p>(15) Progress in establishing a Pacific regional training centre.</p> <p>(16) Level of capacity building for climate services by the PCCC and RCC and the maintenance of a balance between investment in people and hardware.</p> <p>(17) Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).</p>

Table 6: The Outputs of, Outcomes from and Performance Indicators for the Capacity Building Component of the Updated Roadmap 2024-33.

2.3 Thematic (Priority) Areas

The Roadmap 2017-26 designated 8 priority thematic areas for targeted service provision and/or action. These areas were: Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, Tourism and National Climate Services. The first seven of these thematic areas were very successfully pursued in many instances and will be carried over into the update of the Roadmap. The last priority, National Climate Services is a very legitimate priority, in fact it is the singular priority of the Roadmap itself and virtually every action successfully undertaken within the GFCS framework of strengthening climate services in the Pacific strengthens NMHS-based National Climate Services. To the extent this is true it would seem unnecessary to add it as a priority area to an entire activity devoted to the purpose of this priority area.

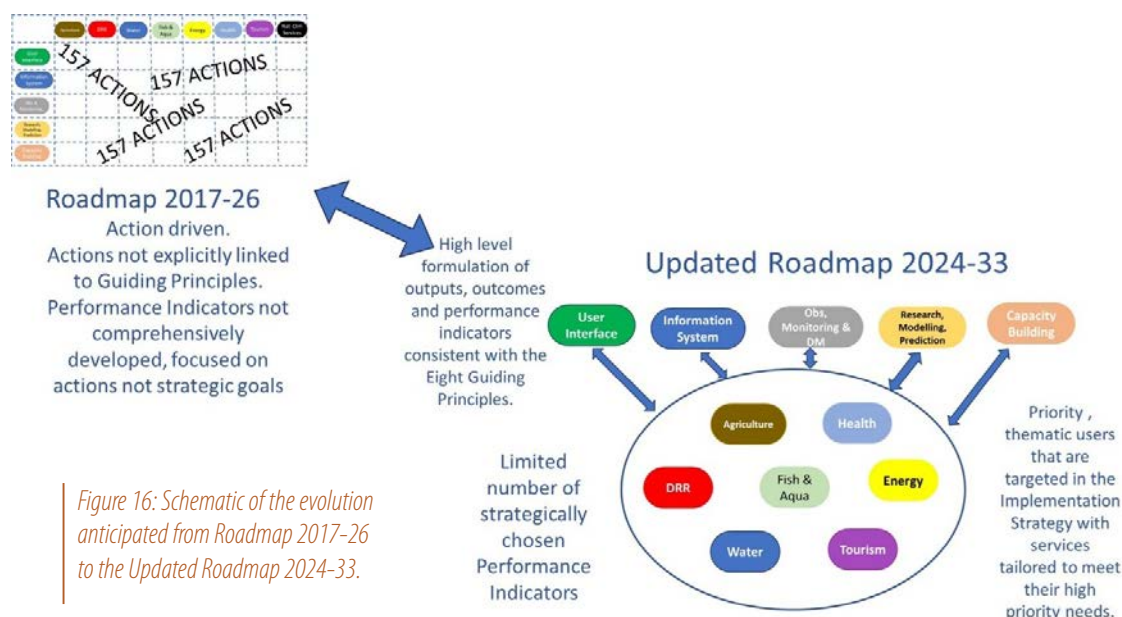


Figure 16: Schematic of the evolution anticipated from Roadmap 2017-26 to the Updated Roadmap 2024-33.

RECOMMENDATION 8:

It is recommended that only the priority service areas of Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, and Tourism be carried forward to the Updated Roadmap 2024-33.

RECOMMENDATION 9:

It is recommended that the Performance Indicators surveys for the GFCS Components also evaluate User Satisfaction with services targeted at Thematic (priority) areas. The 17 Performance Indicators are:

User Interface:

- (1) Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential);
- (2) Survey data of user satisfaction with various climate services, taking special note of:
 - (a) the needs of women, minorities, the vulnerable;
 - (b) those who communicate only in the local dialect; and,
 - (c) thematic (priority) areas;
- (3) Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.

Climate Service Information System:

- (4) Completed steps towards a toolkit.
- (5) The volume of climate data exchanged through the:
 - (a) WIS;
 - (b) GTS; and
 - (c) on point-to-point Internet communications for a chosen month each year.
- (6) Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities.

Observations, Monitoring and Data Management:

- (7) The volume of ECVs reported by all Pacific countries;
- (8) The percentage of Pacific countries operating modern, relational climate databases;
- (9) Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable; and,
- (10) The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata).

Research, Modelling and Prediction:

- (11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;
- (12) The Number of applied model products available on the Pacific web sites and their monthly “hit” rates;
- (13) Cost-benefit studies of climate services-based decisions are prepared and published; and (14) Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration.

Capacity Building:

- (15) Progress in establishing a Pacific regional training centre;
- (16) Level of international support for capacity building for climate services in the Pacific and the maintenance of a balance between investment in people and hardware; and,
- (17) Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).

In implementing Recommendation 8 the Roadmap Update will measure the success of the services provided to the Thematic Areas using the same generic, high-level (strategic) Performance Indicators as those applying to all services.

2.3.1 Generic Actions and Performance Indicators for all Thematic Areas for the GFCS Components: User Interface, Climate Services Information System, and Observations, Monitoring and Data Management.

Generic Actions across the GFCS components for the thematic areas	User Interface Actions	Climate Services Information System Actions	Observations Monitoring & Data Management Actions
Agriculture Disaster Risk Reduction Energy Health Water Fisheries & Aquaculture Tourism.	Establish links to technical specialists, community leaders, industry groups and others working in the thematic areas of national importance. Participate in regional thematic initiatives that impact upon your country. Explore preferred communication methods (media to be used, languages preferred, acceptable terminology, etc.). Arrange routine meetings and information bulletins where ongoing communication for operational purposes is necessary. Where necessary establish joint plans of action.	Support the User Interface links to priority clients. Develop portals for each of the priority thematic areas your country is engaging in. Support arrangements for secure exchange of information and data as necessary (e.g. in Health and DRR sectors). Work through the User Interface to establish data and information to be provided through the portal.	Establish the national requirement for a climate observing system if one does not already exist. Explore opportunities for accessing observational networks in other thematic areas that observe meteorological parameters - particularly agriculture, water, energy and tourism. Explore opportunities for observing additional parameters that support enhanced services to priority areas.

Table 7: The generic Actions (or activities) of the User Interface, Climate Services Information System, and Observations, Monitoring and Data Management GFCS Components that will be the focus of Thematic (priority) areas chosen by NMHSs.

Generic Thematic PIs across the GFCS components & M&E Actions	User Interface Performance Indicators	Climate Services Information System Performance Indicators	Observations Monitoring & Data Management Performance Indicators
Performance Indicators	User Satisfaction.	Web Usage Levels and User Satisfaction.	Web Usage of Observational data.
Monitoring & Evaluation-Related Actions	Routinely conduct user surveys in collaboration with climate services staff.	Routinely conduct analyses of web usage of climate services to determine priorities for services development.	Routinely conduct analyses of web usage of climate services to determine priorities for services development.

Table 8: The Performance Indicators for climate services provided to users in the priority areas of; Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, and Tourism. These Performance Indicators are consistent with those developed earlier for the three GFCS Components; User Interface, Climate Services Information System, Observations Monitoring & Data Management.

2.3.2 Generic Actions and Performance Indicators for all Thematic Areas for the GFCS Components: Research, Modelling and Prediction.

Generic Actions across the GFCS components for the thematic areas	Research, Modeling & Prediction Actions	Capacity Building Actions
Agriculture Disaster Risk Reduction Energy Health Water Fisheries & Aquaculture Tourism.	<p>Conduct applied research that links climate models and data with data from other areas (eg Health, Water, DRR, etc.) to better understand and forecast the impacts of climate and climate change. Conduct research across disciplines to assess the costs and benefits of climate services. Undertake research into the measurement of forecast skill for various thematic products; eg drought forecasts, extreme events (1:100-year floods, extreme temperatures, extreme rainfall, extreme coastal inundation).</p>	<p>Community education for adaptation to, and mitigation of, the impacts of climate change with a focus on women, the most vulnerable, youths and disabled. Training for meteorological technicians and meteorologists, with a focus on the new technologies included in donor funded projects. Cross-training of technicians and professional in the thematic areas along with meteorological staff, in areas of common interest, to facilitate closer operational links.</p>

Table 9: The generic Actions (or activities) of the Research, Modelling and Prediction, and Capacity Building GFCS Components that will be the focus of Thematic (priority) areas chosen by NMHSs.

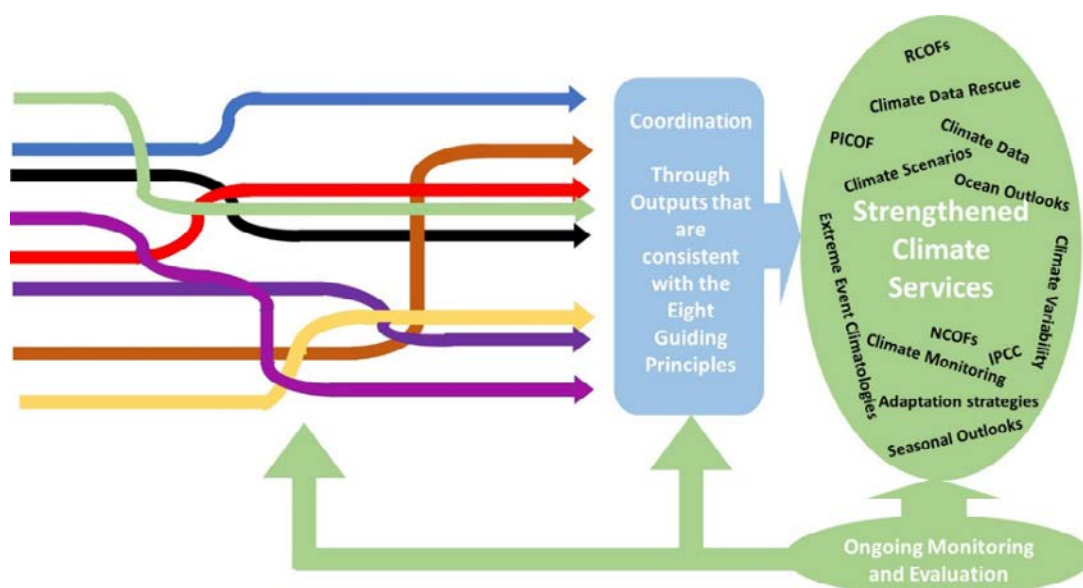
Generic Thematic PIs across the GFCS components & M&E Actions	Research, Modeling & Prediction Performance Indicators	Capacity Building Performance Indicators
Performance Indicators	Level of Productive Collaboration.	Trainee Satisfaction & NMHSs Needs Met.
Monitoring & Evaluation-Related Actions	Prepare an annual summary of research outcomes of all NMHSs.	Routinely conduct surveys of: (1) Trainee satisfaction with courses; and (2) Annually of NMHSs likely future needs for trainees, both technical and professional.

Table 10: The Performance Indicators for climate services provided to users in the priority areas of; Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, and Tourism. These Performance Indicators are consistent with those developed earlier for the two GFCS Components; Research, Modelling and Prediction, and Capacity Building.

2.4 A Brief Summary of Chapter 2.

- 1 The six Recommendations of Chapter 1 (the Desktop review) have been adopted in the strategic approach taken here in the Updated Roadmap 2024-33 and an additional four Recommendations have been proposed in this Chapter.
- 2 This strategic-level view explicitly links the Eight Guiding Principles to Outputs expected from the Updated Roadmap. These Outputs are used to define the expected Outcomes for the people of, and visitors to, the Pacific from the Updated Roadmap. Knowing the Outcomes that are expected to arise from the implementation of the Roadmap 2024-33, 17 Performance Indicators have been proposed that overtime can be used to cost-efficiently monitor and evaluate the performance of the five components of the Roadmap (as per Recommendation 7).
- 3 The priority areas for targeted service provision in the original Roadmap were: Agriculture, Disaster Risk Reduction, Energy, Health, Water, Fisheries and Aquaculture, Tourism and National Climate Services. Only the first seven of these will be carried forward in the Updated Roadmap (as per Recommendation 8).
- 4 In the Roadmap 2017-26 the GFCS Components and the Thematic areas formed a type of matrix arrangement, in essence the Updated Road map lowers the detail of specific Actions (or activities) to the Implementation Strategy. It is not proposed to focus the Monitoring and Evaluation Strategy on Actions (or activities), rather to focus on Outcomes for stakeholders and user community from Actions of the Updated Roadmap (see Recommendation 9).
- 5 The next steps in the development of the Roadmap 2024-33 are the preparation of:
 - an Implementation Strategy; and,
 - a Monitoring and Evaluation Framework.

Implementation Strategy for the Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.



3.1 Introduction

In common with the original Roadmap, the Implementation of the Updated Roadmap focuses on Actions that NMHSs may choose to undertake or not undertake. There is also a focus on regional co-operation between 14 or so independent Pacific NMHSs with support from donor countries that have supported the objectives (as derived from the Eight Guiding Principles) of the original Roadmap and are expected to continue doing so for the Updated Roadmap.

In an effort to simplify the evaluation of the Updated Roadmap the Update proposed that the focus be on the GFCS Components (User Interface, Climate Services Information System, Observations, Monitoring and Data Management, Research, Modelling and Prediction, and Capacity Development).

The Roadmap 2017- 26 developed an Action (or activity) list of 157 items. There was duplication between activities between GFCS components and within a single component as to whether it was a National Activity, Regional Activity or one that was both Regional and National. The new structure around planning by GFCS Component attempts to consolidate and simplify the listing of Actions.

3.2 Implementation Strategy for the Updated Roadmap

Many elements of the Updated Roadmap will be operationally delivered through the NMHSs of the Pacific Islands⁷. The implementation of the Updated Roadmap will be assisted through donor support from many avenues. It is not possible to make a realistic plan on sources and amounts of donor support for Pacific climate services, nevertheless it is possible to develop a flexible strategy for attracting and using wisely such support. It is hoped and expected that this Implementation Plan will assist Governments and their Departments and Agencies, along with donors better understand how climate services in the Pacific can grow in strength over the next decade and commit to being a part of this growth.

7

Including: Cook Is., Federated States of Micronesia, Fiji, Kiribati, Marshall Is., Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Is., Tokelau, Tonga, Tuvalu and Vanuatu.

The framework chosen to depict this growth environment is that of the GFCS and is shown schematically in Figure 17.

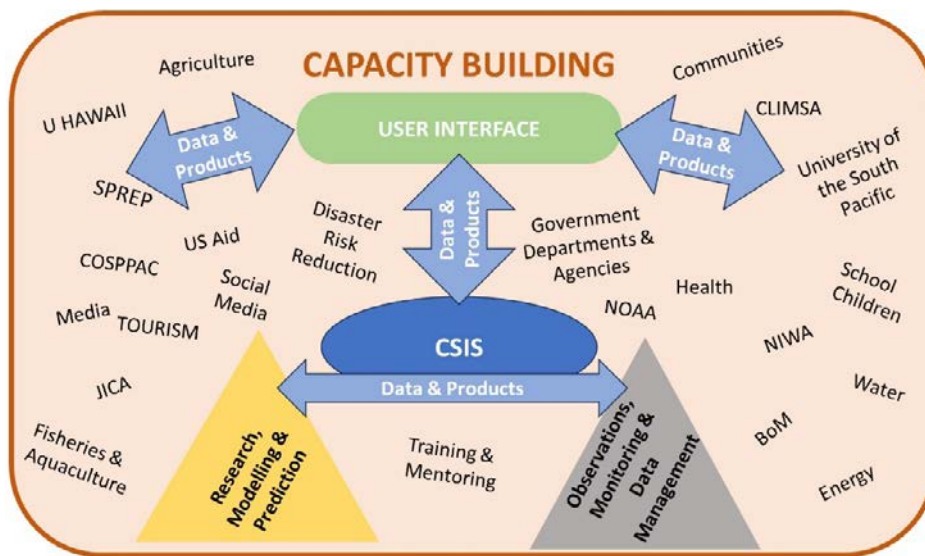


Figure 17: A schematic of the GFCS Components of the Pacific NMHSs working in the broader Pacific context.

3.2.1 Action to Implement the GFCS User Interface Component of the Updated Roadmap

The Roadmap 2017-26 called for 31 specific User Interface Actions, after review at the May 30 -31 meeting in Port Vila, Vanuatu they have been consolidated under a number of broader headings:

Communication Action

Communicate routinely with Stakeholders impacted by climate change and climate variability, including:

- Government
- Government agencies including: Emergency Management, Water agencies, Public Health authorities, Fisheries, etc.
- Private sector including: Agriculture, Aquaculture, Energy, Tourism
- Non-government organisations / civil society organisations (NGOs/CSOs),
- WMO and other UN agencies
- Regional and sub-regional inter- governmental agencies
- Donors
- Schools
- The community generally including: women, young boys and girls, people living with disabilities and vulnerable groups.

Communications Media – Act to:

Employ each type of media to best tackle the message to be conveyed and the intended receiving audience, including using: free-to-air radio and television, social media, telephone, newspapers and magazines, and the Internet.

Achieve effective “first mile” communication with Government, “last mile” communication with women, young boys and girls, people living with disabilities and vulnerable groups and communication with every intended audience between the “first mile” and the “last mile”.

Culture-relevant Action – Act to:

Communicate in the language best understood by the intended recipients.

Use terminology easily understood by the intended recipient and, where relevant, draw on relationships between the climate considerations and traditional knowledge.

NCOFs, RCOFs /PICOFs – Act to:

Participate in, and support Climate Outlook Forums whether national, regional or engaging the entire Pacific community.

Promote:

- The regular conduct of Climate Outlook Forums; and,
- The involvement of stakeholders from relevant Government agencies and the private sector.

Promote the use of Climate Outlook Forums to encourage the integration of climate services into decision making processes wherever the benefits that exceed the costs from doing so.

Communications Planning – Act to:

Implement a Communications Plan that includes all its service delivery components (weather, climate, hydrology, ocean services, aviation services, etc.,) with the various focus areas of the NMHS, using the Communications Plan as a vehicle to better meet user expectations. Annex 3.1 provides a more detailed description of how to develop a simple communications plan for a small NMHS.

3.2.2 Actions to Implement the GFCS Climate Services Information System (CSIS) Component of the Updated Roadmap

The Roadmap 2017-26 called for 19 specific CSIS Actions, after review at the May 30 -31 meeting in Port Vila, Vanuatu they have been consolidated under a number of broader headings:

Regional Climate Centre (RCC) – Act to:

Support and strengthen the RCC through participation in its programmes, to establish service agreements with key users and to reach agreement between RCC contributors on a “standard” range of RCC products.

Climate Services Operational Procedures – Act to:

Identify gaps in climate services and develop plans for addressing these.

Develop operational procedures common to climate service providers and the agencies that best understand the impacts of climate-related extreme events in their areas of responsibility.

Develop all operational procedures that are sensitive to the cultural context of the recipient: Climate bulletins to use languages understood by the intended recipients, if traditional knowledge is important in the recipient communities, then climate bulletins will highlight links between traditional views and the science and use terminology easily understood by the intended recipients.

Operational procedures to be established and documented in the circumstances where there are secondary providers of climate bulletins (such as television station climatologists, journalists, etc.).

Develop collaboration with secondary providers in the generation of new products and services.

A Climate Services Toolkit – Act to:

Develop and implement a toolkit that can downscale regional products to local scale and upscale local observational data to provide maps of climate parameters (monthly, seasonal and annual anomalies).

3.2.3 Actions to Implement the GFCS Observations, Monitoring and Data Management Component of the Updated Roadmap

The Roadmap 2017-26 called for 15 specific Observations, Monitoring and Data Management Actions, after review at the May 30 -31 meeting in Port Vila, Vanuatu they have been consolidated under a number of broader headings:

Observations, Monitoring and Data Management – Act to

Undertake joint action with the CSIS to establish regional policy and procedures for data exchange that provide access to Pacific Is., observational data for intermediate- and end-users.

Upgrade observing systems to meet WMO standards⁸ as described in the *WMO Guide to the Global Observing System* and *Manual on the Global Observing System* wherever they fall short of these standards.

⁸ WMO No. 488 - Guide to the Global Observing System (<https://community.wmo.int/en/wmo-no-488-guide-global-observing-system>) WMO No. 544 - Manual on the Global Observing System (<https://community.wmo.int/en/wmo-no-544-manual-global-observing-system>)

Observational Network – Act to:

Identify and address gaps in the range of parameters and spatial coverage of the climate observing system in the Pacific Islands (atmosphere, land surface and ocean) taking note of surface-based and remote sensing data streams currently available. Prioritise the gap filling needed according to expected user needs for the data.

Develop proposals for funding to establish, restore or replace observing stations, including climate reference stations, that would fill network gaps. These proposals to address the need for real-time access to the observational data.

Establish a funding mechanism for maintenance of existing stations to assist in sustainability of long-lived stations in particular.

Data Management – Act to:

Implement and sustain in all Pacific NMHSs relational databases for the storage of climate data and related metadata.

Undertake the conversion of older, paper-based meteorological records to digital formats and their storage in relational databases, focusing of critically located sites with long continuous records.

Support the repatriation of paper-based climate records from former colonial countries, along with digital copies of the data and metadata.

3.2.4 Actions to Implement the GFCS Research, Modelling and Prediction Component of the Updated Roadmap

The Roadmap 2017-26 called for 13 specific Research, Modelling and Prediction Actions, after review at the May 30 -31 meeting in Port Vila, Vanuatu they have been consolidated under a number of broader headings:

Climate Research, Modelling and Prediction – Act to:

Further link climate models with production models in agriculture, fisheries, water availability, etc.

Determine whether the future lies in using Artificial Intelligence to train forecast systems with climate outlooks and historical agriculture, fisheries, water availability, etc., productivity outcomes, to produce better decision-support systems.

Promote cross-disciplinary research to improving the effectiveness of warning systems serving diverse communities such as those in the Pacific - with a focus on meeting the needs of women, young boys and girls, people living with disabilities and vulnerable groups.

Link traditional knowledge of climate and climate variability with current science on these topics.

Improve and make available better techniques for verifying the accuracy and reliability of monthly, seasonal and annual outlook products.

Support the research needed to make Impact-Based Climate outlooks for conditions affecting agriculture, fisheries, water availability, energy, tourism, etc., sectors possible.

Encourage and support climatologists, economists and the business sector collaborations on research into the costs and benefits of climate services in the Pacific.

3.2.5 Actions to Implement the GFCS Capacity Building Component of the Updated Roadmap

The Roadmap 2017-26 called for 23 specific Capacity Building Actions, after review at the May 30 -31 meeting in Port Vila, Vanuatu they have been consolidated under a number of broader headings:

Regional Training Centre (RTC) – Act to:

Establish a Regional Training Centre that would provide professional level training for meteorologists and hydrologists, and provide technical level training on, *inter alia*:

- Observing system practices.
- Calibration of instruments in collaboration with the WMO Regional Instrument Centres (RICs).
- Database management.
- Management of product delivery systems.
- Management of climate monitoring and prediction systems.
- The effects of climate variability and change in priority (Thematic) areas.
- Resource mobilization through regional and extra-regional opportunities.

Create fellowships that would enable two-way exchanges of staff and students amongst the RCC and other regional and international academic institutions.

Climate Service Provision Operations – Act to:

Work with the donors funding new infrastructure to train sufficient (professional and technical) staff to maintain and manage the installed systems after project is commissioned.

Conduct capacity building programs on the use of existing and new products for both users and providers of climate services.

Provide opportunities for staff that interact with media as a part of their duties to receive media training before doing so.

Train staff in the use of Quality Management Systems and make use of the WMO Competency Framework.

Include Updated Roadmap strategies in National Planning processes.

The 38 Implementation Actions provided above are also presented at Annex 3.2, in a tabular format that may be imported into future operational planning documents.

RECOMMENDATION 10:

That the 38 Implementation Actions given in Annex 3.2 to this Implementation Strategy form the basis of implementation of the Updated Pacific Roadmap for Strengthened Climate Services 2024-33.

3.3 A Summary of the Key Aspects of Chapter 3

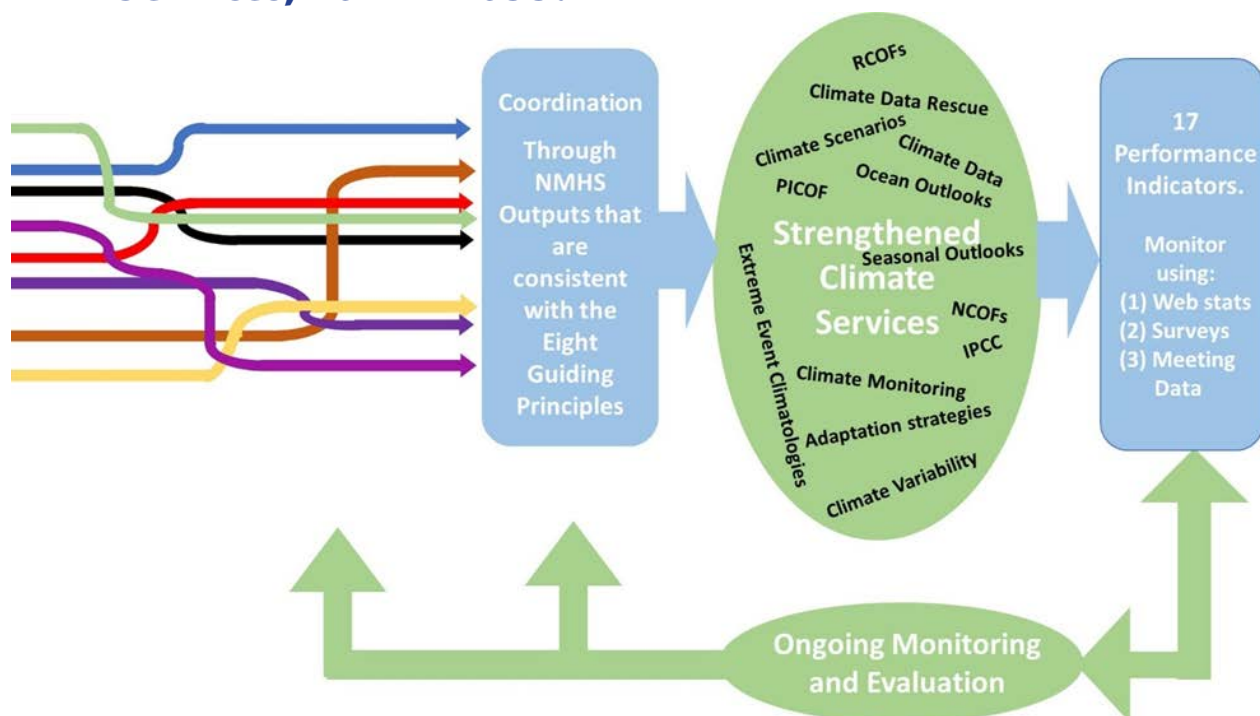
This document brings together several aspects arising from the Review of the Roadmap 2017- 26; in particular the reduction in the large number of implementation actions, the aligning of Outputs and Outcomes with the Guiding Principles, and enabling the development of strategic outcome-focused, rather than activity-focused Performance Indicators.

The consolidation of Actions (or activities) from 157 to 38 has been made possible by using the Guiding Principles to focus on the key strategic outcomes sought from strengthened climate services in the Pacific.

The final document will lay out how the Performance Indicators can be applied in an operational setting that seeks to minimize the resource required by the Monitoring and Evaluation framework and yet still give decision makers a good appreciation of progress being made in strengthening climate services and enable them to make the best implementation decisions through the next decade.



A Monitoring and Evaluation Framework for the Updated Pacific Roadmap for Strengthened Climate Services, 2024 – 2033.



4.1 Introduction

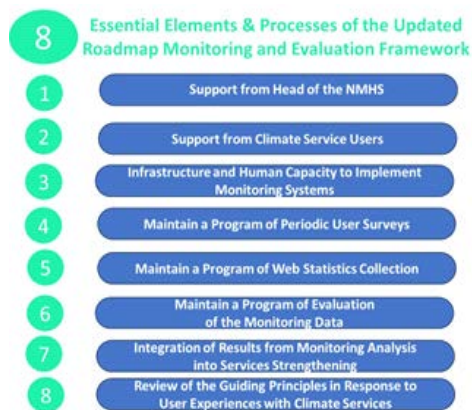
Of these 11 Recommendations made in this Document the most relevant for the Monitoring and Evaluation Framework (M&E Framework) is Recommendation Nine – which describes the 17 proposed Performance Indicators. The success or failure of this M&E Framework will be determined in a major way by the choice of the Performance Indicators. In essence they need to reflect the factors that are critical for the success of the Updated Roadmap and they need to be such that efficient implementation is possible. However, before reviewing the Performance Indicators it is useful to consider the elements and processes that will comprise the Updated Roadmap M&E Framework.

4.2 Elements and Processes of the Monitoring and Evaluation Framework

The 17 Performance Indicators of the Updated Roadmap have been chosen to best evaluate whether the objectives that are implicit in the Eight Guiding Principles are being achieved or not. A question posed at the recent workshop in Vanuatu⁹ was; “if we all implement a QMS (Quality Management System) for our climate services wouldn’t that be adequate for performance monitoring?” The short answer is “probably not”. Unless everyone implements a QMS and all those QMSs use the same Performance Indicators which are based around the Eight Guiding Principles it will remain very difficult to be able to determine how well the Updated Roadmap is working for the entire Pacific community.

The M&E Framework proposed here will require culture and operational changes in many NMHSs. The Head of each implementing NMHS will need to support data gathering activities such as; web statistics, user surveys, compilation of the records of stakeholder workshops and the like.

The analysis of the monitoring data is an important activity and feeding back the outcomes from the monitoring analysis to the user community, to staff, to Government and to donors is essential for ongoing support of climate services.



⁹ Technical Coordination Workshop & Validation Review: Pacific Regional Climate Centre Network and PIMS/PRSCS 2017-2026. 27-31 May, 2024 in Port Villa, Vanuatu

Finally, the regular review of the Guiding Principles by the PMC is an important management tool for continued strengthening of climate services in the Pacific.

In the next sub-sections of this Strategy the Performance Indicators are grouped according to the ways the monitoring data (that is; Performance Indicator data) will be secured. There are a number of key players in this Monitoring and Evaluation Framework if it is to succeed:

- The PMC will need to give the initiative its blessing and support;
- The NMHSs will need to organise the collection of national Performance Indicator data and relay this to the M&E Framework sub-committee of the PICS Panel.
- The PICS M&E Framework sub-committee will collate data and feed a series of documents (3 or 4 documents annually) back to the Heads of NMHSs for evaluation and management response.

4.2.1 Monitoring Using the Web

In principle, monitoring of PIs using statistics from Web-based services is the most cost-effective way monitor performance. The monitoring can be automated and arranged in an easy-to-analyse structure.

The practicalities of operational systems however can make this not so easy. If web-based PI monitoring is to be integrated into legacy systems and the authors of those systems are not easily accessible the task can be costly and result in operational interruptions.

Ideally, PI monitoring would be built into all new, operational service delivery systems. This includes statistics of user access and dwell times on individual products along with options for surveys of user satisfaction and user recommendations for service improvements.

As with all aspects of the update Roadmap, each NMHS can choose how far it goes in implementation. User Satisfaction with climate services is a critical consideration for the Updated Roadmap. The rate at which a particular product is accessed is a measure of User Satisfaction. The most direct measure of user satisfaction can be obtained by asking the user, in an online survey, how would they rate the product on a scale of 1 to 5, and, if the rating is less than 5, how can the product be improved? Such on-line survey techniques are being increasingly used in the commercial sector and should be considered for implementation as a part of the Updated Roadmap.

Finally, the Performance Indicator data from Web monitoring should include stratification by country of origin based on URL data. It is recognised that use of Virtual Private Networks (VPNs) can hide the true country of origin of a service request, but this should be of minor concern. An estimate of the use of the Updated Roadmap products and data by the 14 implementing countries is required. In the first few years of operation a baseline of user satisfaction will be obtained, in time it will be important to use variations from the baseline and the understanding of their causes in the management of climate services (products and delivery mechanisms)

Box 4.1: Monitoring Using the Web

User Interface

(2) Survey data of user satisfaction with various climate services, taking special note of:

- i. the needs of women, minorities, the vulnerable;
- ii. those who communicate only in the local dialect; and,
- iii. thematic (priority) areas;

(3) Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.

Climate Services Information System

(5) The volume of climate data exchanged through the:

- i. WIS;
- ii. GTS; and,
- iii. on point-to-point Internet communications for a chosen month each year;

(6) Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities.

Research, Modelling and Prediction

(12) The number of applied model products available on the Pacific web sites and their monthly "hit" rates.

Box 4.2: Monitoring Using Reports of Meetings

User Interface

(1) Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential);

Research, Modelling and Prediction:

(11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;

Capacity Building

(15) Progress in establishing a Pacific regional training centre;

(17) Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).

4.2.2 Monitoring Using Reports of Meetings (eg from Workshops, RCOFs/PICOFs, NCOFs, Donor/Stakeholder Meetings)

Monitoring the implementation of the Updated Roadmap is also carried out to determine whether it is: reaching the full stakeholder group; applying research effectively; training future climatologists and technicians; and, reaching all the user groups. Baselines of how the related Outcomes are being achieved can be built by systematically recording and sharing the summary reports of meetings. It may be useful to establish the use of a standard set of questions to be answered routinely by all meeting participants immediately prior to the end of the last meeting session. These questions to address whether the meeting met their expectations, how it might be improved, etc. The questionnaire responses to be tabulated and shared with the meeting summary.

4.2.3 Monitoring Using NMHS Collected Data

Ten of the PIs that need to be monitored by the 14 implementing NMHSs¹⁰ are best answered through an annual survey of the NMHSs (see Box 3 below). Information in relation to PIs (4), (7) and (8) will be simply provided.

PI (9), results from a “survey of user satisfaction with access to their national climate database”, will require an NMHS to either put in place an on-line survey or undertake a person-to-person survey by telephone or mail to be carried out. This survey should seek comments on how the database access might be improved.

PI (10), quantifying progress on digitising historical data records should be readily to hand if this task is a part of routine operations.

PI (11) is a straightforward request for the number of applied climate impact forecast models under development. Such models include coupling agricultural models to meteorological models that forecast rainfall and/or moisture deficiency, fisheries catch models with local forecasts of sea surface temperature, malaria outbreaks forecast model coupled to a meteorological model making rainfall forecasts, etc.

PI (12) goes the next step from PI (11) and seeks web statistics from any applied models in operation. What is the level of monthly usage, also of interest would be which countries are the user “hits” coming from.

PIs (13 and (14) would be best satisfied through the use of a short survey, to be completed by researchers collaborating with the NMHS.

PI (16) is asking each NMHS to provide some estimate of the level of donor support it is receiving on an annual basis and estimating the split of this support between investment in infrastructure (hardware and software) and human resources (training and further education).

This Section of the M&E Framework summarises how some or all of the Performance Indicators might be monitored, initially by the NMHS or the SPREP-based web server and then reported to a single point for collation and then evaluation of the strength of climate services Pacific-wide. The emphasis here has been on monitoring. But monitoring is just the start, there is evaluation of the monitoring data to reach management decisions, at a variety of levels, as to future directions nationally and for the Updated Roadmap Pacific-wide.

Box 4.3: Monitoring Using NMHS Collected Data

Climate Service Information System:

(4) Completed steps towards a toolkit.

Observations, Monitoring and Data Management:

(7) The volume of ECVs reported by all Pacific countries;

(8) The percentage of Pacific countries operating modern, relational climate databases;

(9) Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable; and,

(10) The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata).

Research, Modelling and Prediction:

(11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;

(12) The Number of applied model products available on the Pacific web sites and their monthly “hit” rates;

(13) Cost-benefit studies of climate services-based decisions are prepared and published; and,

(14) Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration.

Capacity Building:

(16) Level of international support for capacity building for climate services in the Pacific and the maintenance of a balance between investment in people and hardware.

10

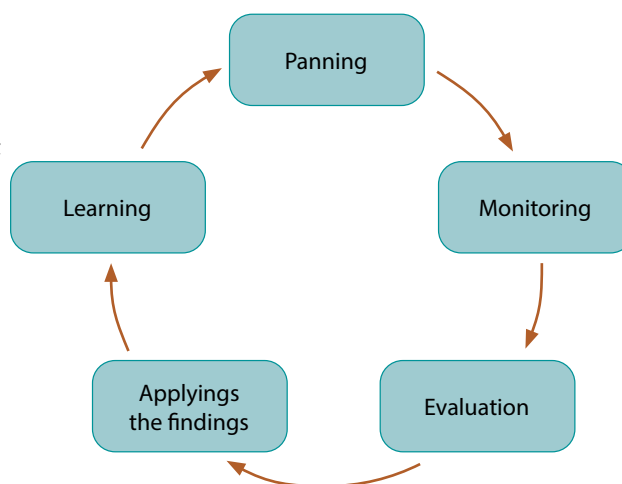
Cook Is., Fiji, Federated States of Micronesia, Kiribati, Marshall Is., Niue, Nauru, Palau, Papua New Guinea, Samoa, Solomon Is., Tonga, Tuvalu, Vanuatu.

4.3 The Full Monitoring and Evaluation Cycle

Monitoring and Evaluation, if it is to provide outcomes commensurate with the investment made in it, must be a part of a larger cycle - a cycle consisting of:

- Planning for M&E as a part of a broader program;
- Evaluating the results of the Monitoring;
- Taking note of the key lessons learnt (findings);
- Applying the findings; and,
- Revisiting the planning process.

The context of the M&E Framework for the Updated Roadmap for Strengthened Climate Services in the Pacific is important. The Updated Framework is carried out under the auspices of the Pacific Meteorological Council (PMC), implemented by 14 NMHSs with donor assistance, and with technical leadership from the Pacific Islands Climate Services (PICS) Panel of the PMC.



While the M&E Framework will be a distributed activity there will need to be some degree of centralisation if it is to give an ongoing picture of the progressive strengthening of climate services in the Pacific. This centralisation will take a number of forms, largely coordinated through the PICS Panel:

- Coordination of monitoring, as not all NMHSs will necessarily choose to monitor all Roadmap performance indicators;
- Collation of NMHS survey responses to achieve an overview of Roadmap performance indicators;
- Encouraging donors to ensure that new infrastructure includes the monitoring of Roadmap performance indicators into Web-based and other systems;
- Providing feedback to the PMC and to NMHSs on overall statistics and other qualitative information derived from the M&E Framework on the strengthening of climate services in the Pacific; Providing technical expertise on the M&E Framework.

RECOMMENDATION 11:

That the PICS Panel establish a small (possibly three person) sub-committee to provide technical leadership in the implementation of the Monitoring and Evaluation Framework.

Tables 11 and 12 (Below) list the Performance Indicators, along with roles and responsibilities for their Monitoring and Evaluation.

PI	GFCS Component	Entity Responsible for Monitoring	Leadership & Coordination of Monitoring	Coordination of Evaluation
	User Interface			
1	Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential)	NMHSs	PICS Panel	PMC NMHS Heads
2	Survey user satisfaction: (a) needs of women, children, the vulnerable, (b) language, (c) thematic (priority) areas.	Web Managers SPREP, COSPPac NMHSs	PICS Panel	PMC NMHS Heads
3	Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.	Web Managers SPREP, COSPPac NMHSs	PICS Panel	PMC NMHS Heads
	Climate Services Information System			
4	Completed steps towards a toolkit	NMHSs	PICS Panel	PMC NMHS Heads
5	The volume of climate data exchanged through the: (a) WIS, (b) GTS, (c) Point-to-point Internet	NMHS Web Managers	PICS Panel	PMC NMHS Heads
6	Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities	Web Managers SPREP, COSPPac NMHSs	PICS Panel	PMC NMHS Heads
	Observations, Monitoring and Data Management			
7	The volume of ECVs reported by all Pacific countries	NMHSs	PICS Panel	PMC NMHS Heads
8	The percentage of Pacific countries operating modern, relational climate databases	NMHSs	PICS Panel	PMC NMHS Heads
9	Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable	NMHSs	PICS Panel	PMC NMHS Heads
10	The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata)	NMHSs	PICS Panel	PMC NMHS Heads

Table 11: Performance Indicators, roles and responsibilities for Monitoring and Evaluation: GFCS Components of User Interface, Climate Services Information System and Observations, Monitoring and Data Management.

PI	GFCS Component	Entity Responsible for Monitoring	Leadership & Coordination of Monitoring	Coordination of Evaluation
	Research, Modelling and Prediction			
11	The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities.	Research collaborators with NMHSs	PICS Panel	PMC NMHS Heads
12	The Number of applied model products available on the Pacific web sites and their monthly "hit" rates	NMHSs	PICS Panel	PMC NMHS Heads
13	Cost-benefit studies of climate services-based decisions are prepared and published	Socio-economic collaborators & NMHSs	PICS Panel	PMC NMHS Heads
14	Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration	Researchers / NMHSs	PICS Panel	PMC NMHS Heads
	Capacity Building			
15	Progress in establishing a Pacific regional training centre	NMHSs	PICS Panel	PMC NMHS Heads
16	Level of international support for capacity building for climate services in the Pacific and the maintenance of a balance between investment in people and hardware	NMHSs/ Donors	PICS Panel	PMC NMHS Heads
17	Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).	NMHSs	PICS Panel	PMC NMHS Heads

Table 12: Performance Indicators, roles and responsibilities for Monitoring and Evaluation: GFCS Components of Research, Modelling & Prediction, and Capacity Building.

4.4 Templates for Performance Indicator Monitoring

As noted previously, performance indicators can be considered to fall into three categories;

- Those that can be monitored by recording activities on web servers which may or may not be located within NMHSs
- Those that can best be monitored through the use of meeting reports and surveys take at the end of meetings with climate service users and other stakeholders (donors, researchers and program managers); and,
- Those that are best monitored by NMHSs and reported annually through the PICS Panel.

In this Section templates are provided for reporting all 17 of the PIs that have been proposed in this Report.

4.4.1 Templates for Web-based Monitoring

Box 4.1 lists the Performance Indicators (PIs) that can most easily be monitored using Web-based tools, that is PIs 2, 3, 5, 6 and 12.

PI 3: Web-based Statistics

The logical starting point is PI 3 – Web-based statistics from servers that provide access to the Roadmap's services.

Box 4.1: Monitoring Using the Web

User Interface

(2) Survey data of user satisfaction with various climate services, taking special note of:

- (a) the needs of women, minorities, the vulnerable;
- (b) those who communicate only in the local dialect; and,
- (c) thematic (priority) areas;

(3) Web access statistics for climate data and products from various national web pages and other regional climate servers as an indicator of user interest.

Climate Services Information System

(5) The volume of climate data exchanged through:

- (a) WIS;
- (b) GTS; and,
- (c) point-to-point Internet communications for a chosen month each year;

(6) Survey data of user satisfaction with access to various climate services, taking special note of the needs of women and minorities.

Research, Modelling and Prediction

(12) The number of hybrid (climate and sector specific impact models combined) model products available on the Pacific web sites and their monthly "hit" rates.

For each such server there will be two spreadsheet templates:

- (a) Basic Web-based Statistics. This is a simple listing of each product available on the server and against that product a count of the monthly "hit" rate for it (Fig. 18); and,
- (b) Further information on the more popular products (see Fig 19). This spreadsheet expands the information held on the 30 to 50 most accessed products. For these more sought after products, the following additional data are monitored for each access:
 - a. Country or origin of the hit, based on the country designator in the URL; and,
 - b. The length of time (dwell time) each access lasted.

The distribution of country of origin of the hits provides an understanding of the distribution of service users while the average dwell time for each product provides further insight into how useful the product is for its user community.

Further Information on: PROD-UCT	Monthly Total "Hits"
Climate Outlook_Current	
Climate Outlooks_Archives	
Rainfall Outlook_Current	
Rainfall Outlooks_Archives	
ENSO Outlook_Current	12563
ENSO Outlooks_Archives	
Agriculture Outlook_Current	
Agriculture Outlooks_Archives	
Fisheries Outlook_Current	
Fiisherries Outlooks_Archives	
Health Watch_Current	
Health Watches_Archives	
Data_Temperature	
Data_Rainfall	
Data_Fire Danger	
Data_Rain Days	
Data_Atmospheric Pressure	
Radar Images_Historical	
Weather Maps_Historical	
Satellite Images_Historical	
Station Observations_Historical	
Et Cetera	
All Product Total Monthly "Hits"	

Figure 17: Template for Basic "Hit" Rate Information

ENSO Outlook_Current	URL Country	# of Hits/ Mo	Ave Dwell Time Sec	Total Dwell Sec
	CK	50	152	7600
	FJ	300	334	100200
	GU	23	201	4623
	MH	43	203	8729
	FM	76	384	29184
	NR	36	274	9864
	NU	12	218	2616
	PW	79	294	23226
	PG	321	205	65805
	SB	658	376	247408
	TG	472	245	115640
	TK	532	216	114912
	TV	326	135	44010
	VU	96	262	25152
	WS	583	389	226787
	AU	1003	231	231693
	KR	345	148	51060
	NZ	231	287	66297
	JP	126	182	22932
	UK	563	72	40536
	US	2316	137	317292
	OTHER	4372	107	467804
	TOTAL HITS	12563	177	2223370

Figure 19: Template for further information on the more sought after products

PI 2, 6 & 12: Web-based Survey of User Satisfaction

The Web-based survey of users' satisfaction should be focused on the more sought-after products as these may be expected to be having the greatest community impact. The process would be to ask the person accessing a product whether they would be willing to answer several short questions when they have finished viewing the product.

If their answer is "yes", the questions should be along the following lines:

- Some brief demographic background:
 - Age group. Under 21, 21 to 55, over 55 years of age.
 - Gender. Male or Female? (or possibly your preferred pronoun)
 - Are you disabled? (Yes/No)
 - Preferred language. (Clan Dialect, English, French, Other)
- Were you satisfied with product you have just accessed? Please rate somewhere on a scale 1 to 5, where 1 is unsatisfied and 5 is fully satisfied.

Template, Fig. 20 is an example of the data that might be collected through this process. It should be held in a relational database enabling accessing of satisfaction ratings for product type, by age group, disability, preferred language, country, etc.

Inclusion of products such as the Vanuatu Malaria Watch, which combines climate and health data in a single product is an example of products generated by collaborative cross-sector research the roadmap seeks to monitor through PI 6.

Country Code of Product User	Product Accessed	age<21	age21-55	age>55	M/F	Disabled/Vulnerable	Preferred Language	Satisfied 1-5
WS	Monthly SST			Y	M	N	CD	3
WS	ENSO Bulletin	Y			F	N	ENG	2
TG	Station Obs data		Y		M	N	CD	4
FJ	ENSO Bulletin		Y		M	Y	ENG	4
TV	Fisheries Bulletin	Y			M	N	CD	5
FJ	Fire Danger ratings		Y		F	Y	ENG	4
VU	Malaria Watch			Y	F	Y	FR	4
NZ	SST Data			Y	M	N	ENG	5
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

Figure 20: Template WSUS satisfaction survey data held in a relational database.

PI 5: Web-based Survey of Climate Data Exchange

Climate data are exchanged electronically through three distinct Internet-based systems:

- 1 The WMO Information System (WIS);
- 2 The WMO's Global Telecommunication System (GTS); and,
- 3 Point-to-point Internet communications using file transfer.

For the past decade the WMO has been engaged in transitioning from the GTS to the more modern WIS. While the WIS offers technical advantages there are costs to be met in making the transition. The costs come in three forms; new hardware, new software and staff training costs. While the GTS has great strengths its lack of flexibility of its store and forward architecture is being overcome through using ad-hoc, point-to-point, file transfers to move data and products outside the WMO systems. The effect is that climate data shared locally, through point-to-point mechanisms, may never contribute to the global understanding of just how our climate is changing.

Noting that Guiding Principle iv calls for the sharing of data in line with international obligations and national policies, in particular, the World Meteorological Organization's (WMO's) commitment to free and unrestricted exchange of meteorological and related data and products, an ongoing monitoring of the volumes of data and products being transmitted via each of the three mechanisms would enable a better understanding of the challenge the small Pacific nations face in sharing in the global exchange of climate data and products.

It is proposed that for one month each year, all Roadmap participants monitor the flow inwards and outwards of climate data and products on via each of the three mechanisms; WIS, GTS and ad hoc, point-to-point. Figure 21 is a suggested Template for reporting the survey of Internet-based Climate Data and Product Exchange.

NMHS	WIS - Data & Products IN (Gbyte/Mo)	WIS Data & Products OUT (Gbyte/Mo)	GTS - Data & Products IN (Gbyte/Mo)	GTS Data & Products OUT (Gbyte/Mo)	PtoP - Data & Products IN (Gbyte/Mo)	PtoP Data & Products OUT (Gbyte/Mo)
Cook Is.						
Fiji.						
FSM						
Kiribati						
Marshall Is.						
Nauru						
Niue						
Palau						
PNG						
Samoa						
Solomon Is.						
Tonga						
Tuvalu						
Vanuatu						
SPREP Samoa						
PCCC						

Figure 21: Template for reporting transfers of climate data and climate products for one month each year by each of the three mechanisms discussed above.

4.4.2 Templates for Monitoring Using Meeting Reports

Box 4.2 lists the Performance Indicators (1, 11, 15, and 17) that are most easily monitored using Meeting Reports.

Box 4.2: Monitoring Using Reports of Meetings

User Interface

(1) Meetings held: including RCOFs, NCOFs, community workshops, meetings between NMHSs and managers and leaders in climate sensitive sectors (agriculture, tourism, fisheries, water, etc.), and meetings with donors (existing and potential);

Research, Modelling and Prediction:

(11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;

Capacity Building

(15) Progress in establishing a Pacific regional training centre;

(17) Increasing number of people at the community level able to participate in climate-related workshops (especially women, youths, people with disabilities, vulnerable people and minority groups).

With regard to Performance Indicators 1, 11, 15 and 17, each meeting held with users of climate services, those focused on research-related outcomes, and those progressing the Regional Training Centre proposal should have clear objectives that are shared by all participants. At the completion of each meeting participants should be asked to complete a very short survey form requesting the same demographic data that was sought for the Web-based surveys:

- Age group. Under 21, 21 to 55, over 55 years of age.
- Gender. Male or Female? (or possibly your preferred pronoun)
- Are you disabled? (Yes/No)
- Preferred language. (Clan Dialect (CD), English (Eng), French (Fr), Other)

Additionally, the participants should be asked, on a scale of 1 to 5; “did the meeting achieve its objective” (the meeting objective should be re-stated on the survey form).

Two templates are proposed, the first is in essence a meeting log of all meetings for the year. For each entry in the Meeting Log (Figure 22) there will be a second, meeting specific dataset, created to summarise the participants responses to the “end of meeting” survey asked for their level of satisfaction that the meeting had achieved its objectives (Fig. 23).

Meeting Date	Meeting Title & Location	Meeting Purpose	# of Female Participants	# of Male Participants	# of Disabled/ Vulnerable Participants
27 to 29 May 2024	Weather Ready Pacific – Pacific Integrated Forecasting Platform.	Preparation of a plan and costs for the development of an integrated forecasting platform for the Pacific region is included in the WRP Implementation plan as an Inception and Phase 1 activity under KRA 2 – Production of Forecasts and Warnings.	8	22	?
30 & 31 May 2024	Review of the Pacific Roadmap for Strengthened Climate Services. Port Vila, Vanuatu	Review and update the current Climate Service roadmap, working closely with the Pacific Island Climate Service (PICS) Panel members. A key component of this review work is a validation workshop for all key stakeholders of the consultant’s proposals.	6	18	?
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

Figure 22: Template for Log of Meetings

The participants responses in Figure 23 do not need to, and should not, carry identification of the participants. In time more questions will likely be added to the “end of meeting” survey. One key question would be; “If you gave a Satisfaction rating of less than 5, could you please indicate what could be improved?” The responses to such a question do not lead to easy quantification but in the long run offer opportunities to improve the effectiveness in meetings by identifying and rectifying issues that prevent the meetings from achieving their objectives.

Meeting Title	Participant Nationality	Languages spoken	M or F	Age <21	Age 21-55	Age >55	Disabled Y/N	Satisfied: 1 To 5
Roadmap Review 30/31 May 24								
	VU	Eng/Fr/CD	M		Y		N	3
	FJ	Eng	F		Y		N	5
	WS	Eng/CD	F		Y		N	4
	TG	Eng/CD	M		Y		N	5
	AU	Eng	M			Y	N	4
	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.
	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

Figure 23: Template for a Single Meeting Participant Demographic and Satisfaction Data

4.4.3 A Template for Monitoring Using NMHS Collected Data

Box 4.3 lists the Performance Indicators (4, 7, 8, 9, 10, 11,12,13,14 and 16) that are most easily monitored using an annual National Roadmap Report, to be completed and forwarded to the PICS Panel by July 31 each year (commencing 2026). The Template below (Figure 24) follows the listing in Box 4.3 with some additional explanatory notes.

Box 4.3: Monitoring Using NMHS Collected Data

Climate Service Information System:

(4) Completed steps towards a toolkit.

Observations, Monitoring and Data Management:

(7) The volume of ECVs reported by all Pacific countries;

(8) The percentage of Pacific countries operating modern, relational climate databases;

(9) Survey data of user satisfaction with access to their national climate database, taking special note of the needs of women minorities and the vulnerable; and,

(10) The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata).

Research, Modelling and Prediction:

(11) The Number of applied climate impact forecast models under development for Pacific Island climate sensitive activities;

(12) The Number of applied model products available on the Pacific web sites and their monthly "hit" rates;

(13) Cost-benefit studies of climate services-based decisions are prepared and published; and,

(14) Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from the collaboration.

Capacity Building:

(16) Level of international support for capacity building for climate services in the Pacific and the maintenance of a balance between investment in people and hardware.

Structure of [NMHS's] National Roadmap Performance Indicator Report for [202X]

Introduction

[Some general comments concerning the NMHSs engagement with the PRSCS (Roadmap) process. In particular the support for providing data for the monitoring of the Roadmap's Performance Indicators (PIs).]

There are ten PIs that NMHSs may be able to provide data on. It is unlikely that an NMHS is contributing in all areas and so for those PIs in areas where the NMHS is undertaking no work this should be simply noted.

Performance Indicator 4: The [NMHS] has completed the following steps towards a developing / implementing a climate services toolkit.

Performance Indicator 7: The [NMHS] operates the following climate observing stations reporting the following Essential Climate Variables.

Country	Station Name	WMO Station #	ECVs Reported	Frequency
Fiji	Nadi	91680	Surface: Precipitation.	3 hourly
			Surface: Pressure.	3 hourly
			Surface: Radiation budget.	3 hourly
			Surface: Temperature.	3 hourly
			Surface: Water vapour.	3 hourly
			Surface: Wind speed and direction.	3 hourly
	Laucala Bay	91690	Surface: Precipitation.	6 hourly
			Surface: Pressure.	6 hourly
			Surface: Radiation budget.	6 hourly
			Surface: Temperature.	6 hourly
			Surface: Water vapour.	6 hourly
			Surface: Wind speed and direction.	6 hourly

Figure 24: Template for Reporting Essential Climate Variable recorded in accordance with WMO 2022 GCOS ECVs Requirements (GCOS 245)¹¹

Performance Indicator 8: [NMHS] is/is not [please choose] operating a system including a modern, relational climate database.

Performance Indicator 9: [NMHS] has / has not surveyed user satisfaction with access to the national climate database, taking special note of the needs of women minorities and the vulnerable. [If survey results are available please include them here.]

Performance Indicator 10: [NMHS] has/ has not digitised paper-based climate records and included them in the National Climate Database.

The volume of (measured in station years) climate data copied from paper format into Pacific climate, relational databases (along with their metadata) is observations for X stations with a total of Y years of data.

Performance Indicator 11: [NMHS] has the following applied climate impact forecast models under development for Pacific Island climate sensitive activities;

Performance Indicator 12: The Number of applied model products available on the Pacific web sites and their monthly "hit" rates.

11

The 2022 GCOS ECVs Requirements (GCOS 245) <https://library.wmo.int/records/item/58111-the-2022-gcos-ecvs-requirements-gcos-245#.ZFzCd6VBxjs>

NMHS	Applied model	Products	Monthly “hit” rates
Fiji	Sugar Cane Production	Bulletin – rainfall forecast driven	x
	Hydro-electricity generation	Bulletin – rainfall forecast driven	y

Figure 25: Template for Reporting Usage of Applied, Sector-specific Products

Performance Indicator 13: The description of any cost-benefit studies of climate services-based decisions.

Performance Indicator 14: Results from a survey of scientists collaborating with NMHS colleagues as to the challenges and rewards from their collaboration.

Performance Indicator 16: If you NMHS is currently the recipient of international donor support could you please describe:

- The level of international support for capacity building for climate services; and,
- The balance between investment in people skills and hardware/software assets.

4.5 Key Elements of the Monitoring and Evaluation Framework

1. For the Updated Roadmap to able to demonstrate that it is of value to the Pacific community two things must happen:
 - a. As noted in Chapter 1 and again in Chapter 3, cost – benefit studies of the value of climate services need to be prepared in collaboration with social scientists and the results shared with donors and Government decision makers; and,
 - b. Performance Indicators of, *inter alia*, user satisfaction and the wide-spread uptake of climate services generated in the Pacific for the Pacific use, need to be routinely collected and shared with donors, Government and local communities.
2. Introduction of a Monitoring and Evaluation Framework may require a culture change; from NMHS decision making based on shared experience to one that includes decision making based (at least in part) on Performance Indicators of user preference and with the costs and benefits of using particular climate services.
3. There will be initial costs in developing web-based applications to monitor services usage and there will be ongoing costs in conducting surveys, analysing survey data and sharing the findings from the analyses.
4. The PMC will have the oversight role.
5. The PICS Panel (possibly through a sub-committee) will need to assist in coordinating data collection and findings dissemination.

ANNEX 1.1: SOME ACRONYMS USED IN THIS REPORT

COF	Climate Outlook Forum
COSPPac	Climate and Ocean Support Program in the Pacific
CSO	Civil Society Organisation
DFAT	Department of Foreign Affairs (of Australia)
DRM	Disaster Risk Management
EAR Watch	Early Action Rainfall Watch
ECV	Essential Climate Variable
ENSO	El Nino Southern Oscillation
GFCS	Global Framework for Climate Services
IBF	Impact-Based Forecasts
JICA	Japan International Cooperation Agency
NCOF	National Climate Outlook Forum
NFWWCS	National Framework for Weather, Water and Climate Services (Niue)
NGO	Non-Government Organisation
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration (of the USA)
M&E	Monitoring and Evaluation
M&E F	Monitoring and Evaluation Framework
Micronesia (FSM)	Federated States of Micronesia
PI	Performance Indicator
PICOF	Pacific Island Climate Outlook Forum
PICS	Pacific Island Climate Services Panel of the PMC
PMC	Pacific Meteorological Council
QMS	Quality Management System
RCOF	Regional Climate Outlook Forum
RIC	WMO Regional Instrument Centre
PRSCS	Pacific Roadmap for Strengthened Climate Services
Roadmap	Pacific Roadmap for Strengthened Climate Services
SPREP	Secretariat of the Pacific Regional Environment Program
VPN	Virtual Private Network

ANNEX 1.2 ACTION TABLES FROM THE ROADMAP 2017-26 IMPLEMENTATION PLAN (PICS Panel - 2017)

Table A1.2.1(a): User Interface Actions – National

NUMBER	USER INTERFACE ACTIONS (National)	ACTIVITY NATIONAL/ REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Develop mechanisms (e.g. social media analytics, surveys, face-to-face meetings) to collect feedback from users and clients to evaluate appropriateness of timing and content of information products.	National				Collect input from stakeholders through an ongoing process of dialogue, outreach and feedback. Understand what information users need and how they want to receive it (eg. radio, community meetings, SMS etc). *Review existing lessons learnt from PICTs and incorporate findings. *Identify and implement best practices.
2	Engage at the community level to ensure effectiveness of information exchange.	National	NMHS, external provider	all PICTS	CROP agencies (eg. SPREP, SPC etc), Red Cross National Societies, USP, media agencies, NDMOs, NGOs, sectoral extension agents, local councils, municipalities, community leaders.	*Dialogue, outreach and feedback.
3	Establish/formalise regular seasonal or bi-annual National Climate Outlook Forums (NCOF)	National	NMHS			
4	Include representatives from relevant sectorial agencies in national climate outlook forums (NCOF)	National	NMHS	PNG, Solomon Islands, Fiji, Vanuatu, Tonga....	SPREP	NMHS working in coordination with sectors. Formal agreements in place with key agencies.
5	Develop and implement national climate services communication strategies	National				
6	Establish consultative processes for priority areas stakeholders (companies, ministries, development partners) and the NMHS to identify, design and implement required climate services for each sector	National				
7	Establish a scientifically-based quality control mechanism for the entire service production chain	National				
8	Regular systematic review of user feedback of value and relevance of climate services.	National				
9	Interact with key user communities on the best form of presentation and use of seasonal predictions.	National				
10	Establish MOUs or informal/formal working arrangements between Sectors and NMHS detailing roles and responsibilities	National	NMHS, NDMO			Formal MoUs and Service agreement in place for NMS, sector and NGO
11	Ensure climate services are integrated into government policies at national and community level	National				
12	Explore opportunities for the use of traditional knowledge and traditional calendar in sector	National				
13	Issue seasonal predictions and advisories in local languages whenever possible	National				
14	Translating terms into local dialect	National				

Table A1.2.1(b): User Interface Actions – Regional and Regional/National

NUMBER	CAPACITY BUILDING ACTIONS	NATIONAL ACTIVITY/REGIONAL ACTIVITY	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Develop Regional Partnerships and Networks for Enhancing Climate Services Capacities including the provision of mentoring and other tangible support by more established NMHSs	Regional				
2	Regularly review options for upgrading or introducing new methods and systems for seasonal prediction and develop strategies and plans for operational implementation of the improvements within NMHSs, including required training programs and the development of "toolkits"	Regional				
3	Establish Pacific Regional Climate and Meteorological Training Centre	Regional				
4	Establish a dedicated Help Desk to exchange information on best practice and to facilitate cooperation between other regions with similar issues to the Pacific, e.g. the Caribbean	Regional				
5	Engage with and monitor the outcomes of the various Pacific Meteorological Council panels and forums, in particular the Pacific Island Climate Services (PICS) Panel	Regional				
6	Transfer knowledge of adaptation options between countries with similar climate/priority areas based concerns	Regional				
7	Encourage NMHSs to develop education and outreach programmes with a particular emphasis on science education for girls and women	Regional				
1	Provide training of Met technicians, Met observers and calibration of AWS.	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	All operational staff have attended at least 1 training
		Regional	PICL	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Regional training programmes for Met technicians and observers
2	Install technological tools and processes to improve capability of national climate services	National	NMS	ALL	PSC, MOF	
		Regional	SPREP	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Guidelines for Staff Competency and staff number for provision of Climate Services
3	Identify where IT expertise can be sourced to assist with the maintenance of data management computing systems (hardware and software), either in-house or externally	National	NMS	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	Functional database and significant deficiencies rectified
		Regional	RCIM	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	Functional database and significant deficiencies rectified
4	Train NMHS staff in communicating effectively with media, communities and users	National				
		Regional				
5	Conduct capacity building and training programs on the use of existing and new products and services	National				
		Regional				
6	Facilitate or provide training for NMHS on: • Observing system practices, installation and maintenance; • Data base management and product delivery systems; • Climate monitoring and prediction practices and techniques; • The effects of climate variability and change in priority areas	National				
		Regional				
7	Use the WMO Competency Framework for climate services in developing, maintaining and improving staff skills	National				
		Regional				
8	Conduct training of personnel in the priority sectors on how to interpret meteorological/climate information	National				
		Regional				
9	Establish collaboration with regional and international academic institutions to carry out further research and to seek opportunities for fellowships/scholarship awards to carry out nationally based research	National				
		Regional				
10	Advocate for the need for scholarships for climatology studies at undergraduate and postgraduate level along with relevant technical training	National				
		Regional				
11	Build capacity by participating in formal arrangements for knowledge sharing at national, regional and international levels	National				
		Regional				
12	Conduct training programs on resource mobilisation that address both local and international opportunities	National				
		Regional				
13	Provide training on Pacific Climate Futures and other similar tools	National				
		Regional				
1	Enhance the capacity of service delivery sectors to use tailored weather and climate information for informed decision-making at all levels (from policymakers to community members)	National				
2	Develop national capacity development strategies	National				
3	Develop in-house social media/media liaison/ communication expertise	National				

Table A1.2.2: Climate Services Information System Actions

NUMBER	CSIS ACTIONS	NATIONAL ACTIVITY/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Develop guidelines and suites of standardised products for PICOFs	Regional				
2	Establish and sustain Pacific RCC Network	Regional				
3	Establish agreements between RCC-Network and global information providers to sustain access to the global data and products	Regional				
4	Ensure RCC-Network has operational access to climate information produced at national level	Regional				
5	Develop guidelines and suites of standardised products for the Pacific RCC	Regional				
6	RCC Network to provide a range of regionally oriented Climate Services Products	Regional				
7	Continue or support operational seasonal forecast and related resource tools, including web sites developed	Regional				
1	Develop or implement a range of routine climate monitoring tools and products that encapsulate the monthly, seasonal variations and longer term changes in climate	National	NMS	ALL	Govt Agencies	Need these services for Health security, Food Security
		Regional	SPREP	ALL		All PMC Panels have updated data portals and websites
2	Issue regular bulletins on the status of the varying climate, e.g. on seasonal or bi-annual and annual basis.	National				
		Regional				
		National				
3	Apply best practice to the communication of NMHS information products	Regional				Two-way and multi-stakeholder dialogue to identify what is best practice.
4	Define, build and make available a Pacific Climate Services Toolkit at the regional and national levels	National				
		Regional				
5	Incorporate Traditional Knowledge, practices and language in the information / impact forecasts	National	NMHS		SPREP	1. Expansion/Replicate of TK project to other countries
		Regional				1. Continue financing the COSPPac TK projects to deliver verification and merge for seasonal forecasting.
6	Establish as a matter of high priority the extent to which data resource tools and information web sites developed under project funding will continue to be supported and kept operational.	National	NMS	ALL	National Agencies	National policy on data exchange activates
		Regional	SPREP	ALL		Links to Roadmap, PIMS and Policy Frameworks DRR, FRDP
1	Develop a standard suite of data products that can be made available to users on a regular basis or quickly on demand	National	NMS	ALL	BOM, NIWA	All paper records are digitised and QC
2	Engage with the intermediate user community in the development of customised climate products and services	National				
3	Develop operating procedures for climate Information at national and community levels	National				
4	Package information in a useful format for decision makers (eg. community members, people of influence).	National				Information is being used by the decision-makers.
5	Utilise the available on-line tools for mapping local climate trends and projections	National				
6	Provide weather and climate warnings and information products more relevant and accessible to sectors	National	NMS	ALL		Special climate bulletins are produced and made readily available to sector agencies

Table A1.2.3: Observation and Monitoring Actions

NUMBER A1:G28	OBS & MONITORING ACTIONS	NATIONAL ACTIVITY/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Establish a national policy on data exchange that will facilitate access to the data by intermediate and end users	Regional			NIWA, SPREP, UNDP, GEF	Regional collaboration of development of CREWS Platform/product generators
1	Review the range of parameters and observing systems critical for monitoring local climate variability and change within the atmosphere, land surface and ocean domains	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Comprehensive report on observation system
		Regional	PICI	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Regional assessment of observing systems approved by PMC
2	Ensure as far as possible that observing systems are optimised to meet the standards required for both weather forecasting and climate needs	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA	Technical support or Engineering section established
		Regional	PICI	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Regional support for Engineering maintenance is established
3	Develop a subset of guidelines using WMO/OSCAR as a base, in association with local organisations in the key priority areas, agriculture, health, etc	National	NMS	ALL	Sectors Users,	Agreement with sectors with data sharing and data collection
		Regional	PICS Panel	ALL	Sectors Users,	Sharing lessons of successful approaches involving sector users.
4	Implement and sustain a suitable relational climate data base system	National	NMS	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	CLiDe is updated
		Regional	SPREP	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	
5	Secure continuing support for data portals.	National	NMS	ALL	SPREP	Sustainability of national projects
		Regional	SPREP	ALL		
6	Increased spatial mapping of key variables utilising open source Geo-statistical tools	National	NMS		Govt Agencies	Increased available spatial mapping of key variables utilising open source
		Regional		ALL	NIWA, SPREP, WMO, FAO, SPC	Increased available spatial mapping of key variables utilising open source at regional level
7	Develop and submit proposals for funding to establish, restore or replace observing stations including appropriate data communication systems	National				
		Regional				
8	Identify development of environmental databases and procedures for data collection	National				
		Regional				
9	Develop or implement a range of routine climate monitoring tools and products that encapsulate the monthly, seasonal variations and longer term changes in climate	National				
		Regional				
10	Explore the use of modern data collection and analysis systems for routine climate monitoring, e.g. satellite and instruments remote sensing, GIS information and analyses from Global Climate Prediction Centres	National	NMHS, Land Dept, Environment Dept	ALL	SPREP,	Increased use of satellite and instruments remote sensing and GIS information in NMSs and sector users
		Regional	SPREP	ALL	WMO, FAO	Increased use of satellite and instruments remote sensing and GIS information in NMSs and sector users
11	Establish a climate reference station	National	NMS	ALL	NIWA, SPREP, BOM	A reference station is identified
		Regional	JICA	ALL	NIWA, SPREP, BOM	Regional network of reference stations are supported
1	Perform observing system gap analyses and prioritise options for network repair, expansion and/or enhancements, including the need for automatic weather stations (AWS) especially on	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Gaps observation systems are filled and observations systems in the outer islands are functioning.
2	Establish a funded maintenance schedule for observing system equipment including AWSs	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Funded maintenance schedule in place
4	Assess the volume of climate records that have not been digitised and/or quality controlled, and develop a data rescue and data entry program, including where necessary submission in a suitable funding proposal	National	NMS	ALL	SPREP, WMO, JICA	Provision of IT expertise included in the Maintenance Plan

Table A1.2.4: Research, Modeling and Prediction Actions

NUMBER A1:A1:G2 3	RESEARCH, MODELING & PREDICTION ACTIONS	ACTIVITY Regional / National	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Continue to support and foster research into sub-seasonal climate prediction in the Pacific region	Regional				
2	Provide research support to the development of a Pacific Climate Services Toolkit	Regional				
3	Develop decision-support data analysis that overlay multiple types of information (e.g. for current agriculture production: soil analysis, with climate projections, or rain and temperature for human health applications)	Regional				
4	Establish an optimum space scale for seasonal outlooks to inform island and community scale activities	Regional				
1	Conduct or facilitate studies linking traditional climate and weather knowledge and science	National				COSSPac project already includes a component on harnessing traditional knowledge.
		Regional				*Ensure that there is a transition plan from COSSPac that includes the continuation and maintenance of the traditional knowledge DB.
2	Identify and document any systematic deficiencies in the seasonal forecasting system, e.g. poor performance at a particular time scale, time of the year, or phase of the ENSO cycle	National				
		Regional				
3	Support and foster research into impact-based forecast information for each sector	National	NMHS	ALL	WMO, BoM, NIWA, NOAA	National disaster related database established (Impact based database with both NMS and NDMO)
		Regional				Mechanism in place using the information from NMS to produce products with impact base information
4	Calculate and analyse statistical properties of extremes in weather and climate, including extreme event probabilities	National				
		Regional				
5	Analyse probabilities of occurrence and intensity of extreme events from sub-seasonal to multi-annual ranges	National				
		Regional				
6	Modelling of hydrological cycles and impacts for agriculture, water and hydropower production	National				
		Regional				
7	Promote and encourage cross-disciplinary research linking climate services, priority areas and gender	National				
		Regional				
8	Develop, implement and monitor the accuracy and reliability of a seasonal climate outlook/prediction service	National				
		Regional				
1	To provide the basis for strengthened support to the activities of the NMHSs and the PRSCS conduct assessments of the value, usefulness and economic benefits of climate services	National				

Table A1.2.5: Capacity Building Actions

NUMBER	CAPACITY BUILDING ACTIONS	NATIONAL ACTIVITY/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	Develop Regional Partnerships and Networks for Enhancing Climate Services Capacities including the provision of mentoring and other tangible support by more established NMHSs	Regional				
2	Regularly review options for upgrading or introducing new methods and systems for seasonal prediction and develop strategies and plans for operational implementation of the improvements within NMHSs, including required training programs and the development of "toolkits"	Regional				
3	Establish Pacific Regional Climate and Meteorological Training Centre	Regional				
4	Establish a dedicated Help Desk to exchange information on best practice and to facilitate cooperation between other regions with similar issues to the Pacific, e.g. the Caribbean	Regional				
5	Engage with and monitor the outcomes of the various Pacific Meteorological Council panels and forums, in particular the Pacific Island Climate Services (PICS) Panel	Regional				
6	Transfer knowledge of adaptation options between countries with similar climate/priority areas based concerns	Regional				
7	Encourage NMHSs to develop education and outreach programmes with a particular emphasis on science education for girls and women	Regional				
1	Provide training of Met technicians, Met observers and calibration of AWS.	National	NMS	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	All operational staff have attended at least 1 training
		Regional	PICI	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Regional training programmes for Met technicians and observers
2	Install technological tools and processes to improve capability of national climate services	National	NMS	ALL	PSC, MOF	
		Regional	SPREP	ALL	SPREP, BOM, NIWA, JICA, UNDP, NOAA, EU	Guidelines for Staff Competency and staff number for provision of Climate Services
3	Identify where IT expertise can be sourced to assist with the maintenance of data management computing systems (hardware and software), either in-house or externally	National	NMS	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	Functional database and significant deficiencies rectified
		Regional	BOM	ALL	UNDP, GCF, WMO, SPREP, NIWA, BOM	Functional database and significant deficiencies rectified
4	Train NMHS staff in communicating effectively with media, communities and users	National				
		Regional				
5	Conduct capacity building and training programs on the use of existing and new products and services	National				
		Regional				
6	Facilitate or provide training for NMHS on: • Observing system practices, installation and maintenance; • Data base management and product delivery systems; • Climate monitoring and prediction practices and techniques; • The effects of climate variability and change in priority areas	National				
		Regional				
7	Use the WMO Competency Framework for climate services in developing, maintaining and improving staff skills	National				
		Regional				
8	Conduct training of personnel in the priority sectors on how to interpret meteorological/climate information	National				
		Regional				
9	Establish collaboration with regional and international academic institutions to carry out further research and to seek opportunities for fellowships/scholarship awards to carry out nationally based research	National				
		Regional				
10	Advocate for the need for scholarships for climatology studies at undergraduate and postgraduate level along with relevant technical training	National				
		Regional				
11	Build capacity by participating in formal arrangements for knowledge sharing at national, regional and international levels	National				
		Regional				
12	Conduct training programs on resource mobilisation that address both local and international opportunities	National				
		Regional				
13	Provide training on Pacific Climate Futures and other similar tools	National				
		Regional				
1	Enhance the capacity of service-delivery sectors to use tailored weather and climate information for informed decision-making at all levels (from policymakers to community members)	National				
2	Develop national capacity development strategies	National				
3	Develop in-house social media/media liaison/communication expertise	National				

Table A1.2.6: Priority (Thematic) Actions – Agriculture

Lead GFCS Pillar	AGRICULTURE ACTIONS	ACTIVITY NATIONAL/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
User Interface	With agriculture advisers/extension officers, develop drought management plans for different subsistence and cash crops.	National	NMHS, national agricultural agencies	ALL	USP, SPC, FAO, NIWA, SPREP, WMO	Drought management plans are developed.
Climate Services Information System	Map Normalised Differential Vegetation Index (NDVI) estimates from satellites.	Regional				
Climate Services Information System	Prepare agro meteorological advisories, crop calendars, crop models, seasonal outlooks for crop yield forecasts.	National	NMHS?, national agricultural agencies	ALL	NMHS	Agro-met advisories, seasonal calendars and seasonal outlooks are in place.
Climate Services Information System		Regional			USP, SPC, FAO, NIWA, SPREP, WMO	
Climate Services Information System	Provide drought, irrigation and seasonal climate advisories to assist farmers	National	NMHS	ALL	MAI, NMS, National Agencies	Drought and irrigation advise and/or products available
Observations and Monitoring	Explore the use of agricultural extension officers as a resource for collecting routine meteorological and other agricultural data.	National	NMHS, national agricultural agencies	ALL	USP, SPC, FAO, NIWA, SPREP, WMO	Routine meteorological and agricultural data are available and utilised.
Research, Modeling and Prediction	Source estimations of (potential) evapotranspiration from climate models.	National Regional	WMO			National evapotranspiration data are available.
Research, Modeling and Prediction	Explore the impacts of climate change and changing seasonality on agriculture (eg salt water intrusion etc)	National	NMHS, national agricultural agencies	ALL	USP, SPC, FAO, NIWA, SPREP, WMO	Increased understanding of climate change and changing seasonality impacts on agriculture
		Regional	SPREP		USP, SPC, FAO, NIWA, SPREP, WMO	Sharing of examples of impacts.
Capacity Building	Increase the capacity of Agro-meteorology personnel	National	NMS and Min Agriculture	ALL	USP, SPC, FAO, NIWA, SPREP, WMO	Established Agro-met positions in NMSs
		Regional	SPREP		USP, SPC, FAO, NIWA, WMO	

Table A1.2.7: Priority (Thematic) Actions – Disaster Risk Management

NUMBER	Lead GFCs Pillar	DRR ACTIONS	ACTIVITY NATIONAL/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	User Interface	Improve the communication of seasonal forecasts as a risk management tool (simplify language, identify possible	National				
2	User Interface	Collaborate with NDMO on awareness training out in the community.	National	NMHS		WMO, SPREP, SPC	1 Number of join awareness training.2. Number of training complete. Number of material produce by different organisation.3. National disaster awareness program/ week done in collaboration with partners.4.
3	Climate Services Information System	Integrate climate analyses and forecasts into general and sector specific disaster risk reduction and response systems.	National	NMHS, NDMO	ALL	SPREP, SPC, WMO	different sectors including impacts. 2. Sector driver sub seasonal forecast
			Regional				1. Develop a methodology to address sub seasonal forecasting.2. Availability of sub seasonal products at the regional level
4	Climate Services Information System	Assess on an ongoing basis the risks of Tropical cyclone, flood and drought.	National	NMHS, NDMO	ALL	Sectors, SPC, SPREP, Humanitarian organisation, IFRC, National Red cross, RSMC	1. Number of sub national level risk assessment completed. 2. Tropical cyclone seasonal outlook downscale to provincial level.3. Sector specific outlook.4. TC data portal to be host and update locally
			Regional	RCC, RSMC, NIWA, BOM	ALL	NMHS, SPTO, Humanitarian organisations	1. Products established that communicate risk at different time scale
5	Climate Services	Risk analysis, e.g., flood risk maps, drought risk maps.	National				
6	Climate Services Information System	Establish and/or strengthen a national Climate Risk Early Warning System (CREWS)	National				
7	Climate Services Information System	Develop a national drought response plan and institute a national drought monitoring and early warning system. The system should meet the specific needs of government drought policy-making and declarations, as well as the	National	NMHS, NDMO	ALL	WMO, SPREP, SPC	1. Develop National disaster preparedness and response plans e.g. Hydrology and agricultural Drought
8	Observations and Monitoring	Collect historical disaster-related data, including loss and damage assessments and statistics (Hotspots).	National	NDMO, Appropriate ministry, NMHS	ALL	SPC, SPREP, Sectors, Clusters	National disaster related database established (Impact base database with both NMS and NDMO)
			Regional - Given upon request	SPREP, SPC			Mechanism in place using the information from NMS to produce products with impact
9	Research, Modeling and Prediction	Convene a regional group of experts to review projects and activities related to coastal flooding including sea level rise and extremes; evaluate the current state of applied research in this area pertaining to seasonal as well as long-term forecasting, and identify opportunities for coordination and collaboration among regional organizations, universities, and government agencies towards more efficient and effective development and	Regional				
10	Research, Modeling and Prediction	Calculate and analyse statistical properties of extremes in weather and climate, including extreme event probabilities.	National	NMHS	Countries with required capacity	WMO, BoM, NIWA, NOAA, RCC, PCCC....	1. Climate change data portal to be host within NMS. 2. Technical or scientific papers published. 3. Number of trainings no data
			Regional	RCC	ALL	NMS	1. Number of regional paper published. 2. Number of seasonal information produce. 3. Number of successful authorsto the IPCC
11	Research, Modeling and Prediction	Analyse probabilities of occurrence of extreme events from sub-seasonal to multi-annual ranges.	National	NMHS	-	WMO, BoM, NIWA, NOAA	1. Tailored made probability products for different sectors including impacts. 2. Sector
			Regional	RCC, NIWA, BOM	ALL	NMS	1. Develop a methodology to address sub seasonal forecasting.2. Availability of sub seasonal products at the regional level
12	Research, Modeling and Prediction	Develop systems for the early warning of severe weather events and climate extremes with different lead times, e.g., heat waves, dust storms.	National	NMHS	ALL	WMO, BoM, NIWA, NOAA	1. Develop or improve current early warning systems .2. Develop SOP for early warning
			Regional	BOM, RCC	ALL	NMS	Expand climate database e.g CLIDE to add climate applications

Table A1.2.8: Priority (Thematic) Actions – Energy

NUMBER	Lead GFCS Pillar	DRR ACTIONS	ACTIVITY NATIONAL/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	User Interface	Improve the communication of seasonal forecasts as a risk management tool (simplify language, identify possible)	National				
2	User Interface	Collaborate with NDMO on awareness training out in the community.	National	NMHS		WMO, SPREP, SPC	1 Number of join awareness training.2. Number of training complete. Number of material produce by different organisation.3. National disaster awareness program/ week done in collaboration with partners.4.
3	Climate Services Information System	Integrate climate analyses and forecasts into general and sector specific disaster risk reduction and response systems.	National	NMHS, NDMO	ALL	SPREP, SPC, WMO	different sectors including impacts. 2. Sector driver sub seasonal forecast
			Regional				1. Develop a methodology to address sub seasonal forecasting.2. Availability of sub seasonal products at the regional level
4	Climate Services Information System	Assess on an ongoing basis the risks of Tropical cyclone, flood and drought.	National	NMHS, NDMO	ALL	Sectors, SPC, SPREP, Humanitarian organisation, IFRC, National Red cross, RSMC	1. Number of sub national level risk assessment completed. 2. Tropical cyclone seasonal outlook downscale to provincial level.3. Sector specific outlook.4. TC data portal to be host and update locally
			Regional	RCC, RSMC, NIWA, BOM	ALL	NMHS, SPTO, Humanitarian organisations	1. Products established that communicate risk at different time scale
5	Climate Services	Risk analysis, e.g., flood risk maps, drought risk maps.	National				
6	Climate Services Information System	Establish and/or strengthen a national Climate Risk Early Warning System (CREWS)	National				
7	Climate Services Information System	Develop a national drought response plan and institute a national drought monitoring and early warning system. The system should meet the specific needs of government drought policy-making and declarations, as well as the	National	NMHS, NDMO	ALL	WMO, SPREP, SPC	1. Develop National disaster preparedness and response plans e.g. Hydrology and agricultural Drought
8	Observations and Monitoring	Collect historical disaster-related data, including loss and damage assessments and statistics (Hotspots).	National	NDMO, Appropriate ministry, NMHS	ALL	SPC, SPREP, Sectors, Clusters	National disaster related database established (Impact base database with both NMS and NDMO)
			Regional - Given upon request	SPREP, SPC			Mechanism in place using the information from NMS to produce products with impact
9	Research, Modeling and Prediction	Convene a regional group of experts to review projects and activities related to coastal flooding including sea level rise and extremes; evaluate the current state of applied research in this area pertaining to seasonal as well as long-term forecasting, and identify opportunities for coordination and collaboration among regional organizations, universities, and government agencies towards more efficient and effective development and	Regional				
10	Research, Modeling and Prediction	Calculate and analyse statistical properties of extremes in weather and climate, including extreme event probabilities.	National	NMHS	Countries with required capacity	WMO, BoM, NIWA, NOAA, RCC, PCCC....	1. Climate change data portal to be host within NMS. 2. Technical or scientific papers published. 3. Number of trainings no data
			Regional	RCC	ALL	NMS	1. Number of regional paper published. 2. Number of seasonal information produce. 3. Number of successful authorsto the IPCC
11	Research, Modeling and Prediction	Analyse probabilities of occurrence of extreme events from sub-seasonal to multi-annual ranges.	National	NMHS	-	WMO, BoM, NIWA, NOAA	1. Tailored made probability products for different sectors including impacts. 2. Sector
			Regional	RCC, NIWA, BOM	ALL	NMS	1. Develop a methodology to address sub seasonal forecasting.2. Availability of sub seasonal products at the regional level
12	Research, Modeling and Prediction	Develop systems for the early warning of severe weather events and climate extremes with different lead times, e.g., heat waves, dust storms.	National	NMHS	ALL	WMO, BoM, NIWA, NOAA	1. Develop or improve current early warning systems .2. Develop SOP for early warning
			Regional	BOM, RCC	ALL	NMS	Expand climate database e.g ClIDE to add climate applications

Table A1.2.9: Priority (Thematic) Actions – Health

NUMBER	Lead GFCS Pillar	HEALTH ACTIONS	ACTIVITY NATIONAL/ REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS	
1	User Interface	Enhance community awareness of potential impacts on human health of climate variability and change.	National	NMHS and MOH	All NMHSs	NGOs and other national government departments	1. Developing integrated and tailored climate information for the health sector (e.g. workshops, trainings, montly	
			Regional	SPREP, RCC, WMO, WHO	All NMHSs and MOH reps	PMC, RCC, SPREP	1. Conducting regional training on climate and health issues through PICOFS	2. Tailored climate and health products are produced
2	User Interface	Contribute to advisories on threats to health associated with weather and climate variability such as how	National and Regional	NMHS and MOHs	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Advisories are issued through multiple networks and all relevant	
3	Climate Services Information System	Develop disease specific early warning systems, e.g. Malaclim, for local implementation.	National	NIWA, BoM, NMHSs, MOHs	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Extend MalaClim from Solomon Islands to other PICs	2. Extend MalaClim or other similar tools to
4	Climate Services Information System	Issue early warning bulletins of conditions conducive to pests and	National					
5	Observations and Monitoring	Address data needs, including the collection of more valid and comprehensive health statistics, at the appropriate local, regional and temporal scales.	National	NMHS and MOH	All NMHSs and MOH reps	NGOs and other national government departments	1. Establishing MOUs for data sharing between NMHSs and MOH	2. Improving health data sets and establishing long-term data collection
			Regional	BoM, SPREP, RCC, WMO,	All NMHSs	PMC, RCC, SPREP	1. Extend MalaClim from Solomon Islands to other	
6	Observations and Monitoring	Where appropriate monitor air quality.	National and Regional	Environment Departments, NMHSs and	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Investiage data collection and data storage processes	
7	Observations and Monitoring	Monitor sea temperatures for conditions conducive to Ciguatera	National and Regional	SPC, BoM, NMHSs, MOHs	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Information for the health sector is included in	2. Trainings conducted with
8	Research, Modeling and Prediction	Develop models that combine climate parameters with disease	Regional					
	Research, Modeling and Prediction	Support research into expanding the knowledge of climate sensitive diseases of national importance through participation in national and regional research initiatives and projects.	National and Regional	Universities, Climate and Health Research Providers	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Climate and health research projects opearting in PICs (regional and national level)	2. Research papers (co-authored by all participants) published in peer reviewed journals

Table A1.2.10: Priority (Thematic) Actions – Water

NUMBER	Lead GFCS Pillar	WATER ACTIONS	ACTIVITY	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
			NATIONAL/REGIONAL				
1	User Interface	Establish cooperative interactions between NMHSs and water authorities and organisations on weather and climate related water resource management issues	National				
			Regional				
4	Climate Services Information System	Predictions of seasonal flow for major rivers.	National				
			Regional				
2	Climate Services Information System	Development of drought management plans including strategies for rainwater, surface water and groundwater	National				
	Observations and Monitoring	Implement hydrological/hydro-meteorological monitoring systems	National				
6	Observations and Monitoring	Database for hydrological data storage	National	NMS	ALL	BOM, WMO, NIWA, SPREP	
7	Observations and Monitoring	Incorporate water quality measures in monitoring tools and systems	National	Water Resource Departments, NMHSs and MOHs	All NMHSs	WHO, WMO, All NMHSs and MOHs	1. Investiage data collection and data storage processes. 2. Water quality monitoring tools are produced and used

Table A1.2.11: Priority (Thematic) Actions – Fisheries and Aquaculture

NUMBER	Lead GFCs Pillar	FISHERIES AND AQUACULTURE ACTIONS	ACTIVITY	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
			NATIONAL/REGIONAL				
1	User Interface	Encourage collaborative efforts between meteorological, oceanographic, biological and fisheries researchers and management agencies to better monitor and understand the impacts of short-term variability and longer-term change on oceanic fisheries	Regional	FFA, SPC, RCC, fisheries, PNA, WCPFC			
2	User Interface	Develop a fisheries Climate EWS	National	NMHS, fisheries			1. Assess how well current meteorological and ocean data collected locally meet the current needs for supporting local fisheries management. 2. Provide improved national meteorological and hydrological services to local fisheries agencies, enterprises and communities. 3. Adopt or develop methods of using ocean data to track key pelagic fish such as tuna. 4. ENSO related actions
			Regional	SPC, FFA, SPREP		RCC, BOM, NIWA, CSIRO, etc	
3	User interface	Identify risk assessment or management evaluation tools that incorporate climate variability in order to improve the ecosystem-approach to management of fisheries.	National				
			Regional				
4	User Interface	Identify how weather and climate tools can inform integrated coastal zone management relevant to coastal fisheries and marine aquaculture.	National				
			Regional				
5	Climate Services Information System	Provide downscaled coastal information for use in Fish Aggregation Device programs	Regional				
6	Climate Services Information System	Develop national ocean services portal (this can be done by national tailoring of a regional portal such as the COSPPac Ocean Portal).	National				Develop national ocean portals and virtual stations linked to relevant regional portals
7	Observations and Monitoring	Oceanic and coastal fisheries management organisations to inform their members about the advantages of making and reporting relevant marine meteorological and ocean observations to the various WMO/IOC (Intergovernmental Oceanographic Commission) observation and information systems	National	NMHS, maritime transport			X% of inter island shipping and transport collecting and reporting data
			Regional				Develop a strategy to help countries and vessels meet their marine weather observations under SOLAS
8	Observations and Monitoring	Ensure long-term commitments to monitoring systems for assessing fish stock status and to the conduct of routine integrated ecosystem assessments.	National	Fisheries, not NMHS			
			Regional				
9	Observations and Monitoring	Undertake lagoon monitoring for aquaculture	National				
10	Research, Modeling and Prediction	Improve understanding of the sensitivity of pearl and sea weed industries to rising sea temperatures.	National				
			Regional				
11	Research, Modeling and Prediction	Contribute to the understanding of the impacts of climate change on fisheries and aquaculture	National				
			Regional				
12	Research, Modeling and Prediction	Crown of Thorns starfish outbreaks and linkages to climate information	National				
			Regional				
13	Research, Modeling and Prediction	Conduct climate and sea-surge modelling for areas at risk and to inform new coastal development	National				
			Regional				

Table A1.2.12: Priority (Thematic) Actions – Tourism

NUMBER	Lead GFCs Pillar	TOURISM ACTIONS	ACTIVITY NATIONAL/REGIONAL	LEAD AGENCY	PRIORITY PICTS	POTENTIAL PARTNERS	KEY PERFORMANCE INDICATORS
1	User Interface	Establish a consultative process for tourism stakeholders [companies, ministries, development partners] and the NMHS to identify and implement required climate services for the tourism sector	National	NMHS and tourism		SPTO, PICS Panel, RCC	1. Identify focal points within tourism and NMHSs. 2. Develop service agreements with tourism and NMHSs, if needed and within relevant legal frameworks. 3. Jointly develop annual joint business plans between tourism and NMHSs
			Regional				
2	User Interface	Include representatives from tourism agencies in national climate outlook forums and regular	National				
3	Climate Services Information System	Establish a Climate EWS for tourism	National				
4	Capacity Building	Identify through workshops and other consultative processes the climate and ocean services that will address the specific needs of Pacific tourism sector	National				1. Host several workshops and stakeholder consultations. 2. Integrate climate services into tourism sector plans
			Regional				

Table A1.2.13: Priority (Thematic) Actions – National Climate Services

NUMBER	NATIONAL CLIMATE SERVICE ACTIONS	NATIONAL ACTIVITY/REGIONAL
1	Support the development of implementation plans for climate services at the national level	Regional and National

ANNEX 1.3: UNDERLYING DATA FROM THE WMO QUESTIONNAIRE

User Interface Data

NAME OF THE COUNTRY /Economic Status User Interface	Cook Islands High Income Member	Kiribati LDC&SID S	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesia (Federated States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive responses
Q48.4- Diversified channels of communication used to disseminate climate products (e.g. radio, social media)	1	1	1	1	1	1	1	1	1	1	1	1	100%
Q7- Identify key stakeholders for improving climate-related outcomes in priority sectors (UIPs - User Interface Platform - focused on GFCS - Global Framework for Climate Services - priorities: health, agriculture and food security, WRM - Water Resource Management, energy, DRM)	1	0	1	0	1	1	1	1	1	1	1	1	83%
Q8- Identify key climatic factors of socio-economic significance at the national levels, establish baseline knowledge based on capacity assessments and co-define with stakeholders climate information needs for sectoral decision-making at national level	1	0	0	1	1	0	1	1	1	1	1	1	75%
Q9- Identify feasible climate services for meeting priority needs and capacity needs/requirements for their development and delivery	1	0	0	0	1	1	1	1	1	1	1	1	75%
Q48.2- Helpdesk function	0	0	0	0	0	0	1	0	0	0	0	1	17%

Climate Services Information System Data

NAME OF THE COUNTRY /Economic Status Climate Services Information System	Cook Islands High Income Member	Kiribati LDC&SID S	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesia (Federated States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive responses
Q37.5- Coordinate RCOFs and NCOFs - National Climate Outlook Forums and assist users in forecast interpretation	1	1	1	1	1	1	1	1	1	1	1	1	100%
Q35.2- Disseminate climate outlooks provided by GPCs Global Producing Center of WMO, RCCs and RCOFs	1	1	1	1	1	1	1	1	1	1	1	1	100%
Q32.1- Compute Climate Indices and derived products for the monitoring of climate change and climate extremes using ETCCDI - Expert Team on Climate Change Detection and Indices (and other tools such as iTacs for example) and NCMP approach	0	0	0	0	1	1	1	1	1	1	1	0	58%
Q33.2- Create integrated, continually updated data product time series, e.g. combining satellite observations and reanalysis with station data	0	0	1	0	1	0	1	1	0	1	0	0	42%
Q34.2- Publish regular, quality controlled authoritative information on the status of climate relevant to policy making for climate adaptation	1	0	0	0	0	1	0	1	0	0	0	1	33%
Q36.5- Register forecasting products in WIS	0	0	0	0	1	0	0	0	0	0	1	0	17%
Q37.1- Generate sub-seasonal and seasonal forecast products	1	1	1	0	1	1	1	1	1	0	1	1	83%
Q46.2- Targeted dissemination of climate products to priority sectors (i.e. those based on data; regional and national climate monitoring products if available; seasonal outlooks provided by RCOFs and RCCs)	1	1	1	1	1	1	1	1	1	1	1	1	100%

Observations Monitoring & Data Management Data

Q1 - NAME OF THE COUNTRY	Cook Islands	Kiribati	Nauru	Niue	Papua New Guinea	Samoa	Solomon Islands	Tonga	Fiji	Micronesia (Federated States of)	Vanuatu	Tuvalu	% of positive results
Q27.1 Store data and metadata in relational databases	1	0	0	0	1	1	1	1	1	1	1	1	75%
Q27.2- Conduct data rescue	1	0	0	1	1	1	1	1	1	1	1	0	75%
Q27.3- Apply quality control	1	1	1	0	1	1	1	1	1	1	1	1	92%
Q27.4- Conduct data management including: quality assurance/quality control using QM principles	1	0	0	0	1	1	1	1	1	1	1	0	67%
Q27.5- Apply spatial and/or temporal interpolation to ensure data continuity	1	0	0	0	0	1	1	1	1	1	1	0	58%
Q27.6- Create, archive and document climate datasets	1	0	1	1	1	1	1	1	1	1	1	1	92%
Q27.7- Assess climate data homogeneity and adjust inhomogeneous time series where possible	1	0	1	0	0	1	1	1	1	1	1	0	67%
Q28.2- Adopt a strategy including: operating manual for ensuring security, integrity, retention policy and technology migration for data archival process and systems	1	0	0	1	0	1	0	1	1	1	1	0	58%

Observations Monitoring & Data Management Data

NAME OF THE COUNTRY /Economic Status Observing and Monitoring System	Cook Islands High Income Member	Kiribati LDC & SIDS	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesia (Federated States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive results
Q23.1- Operate and maintain adequate national observing systems, in support of the weather-related application areas of the WMO Rolling Review of Requirements:	1	1	1	1	0	1	1	1	1	1	1	1	92%
Q27.6- Create, archive and document climate datasets of the appropriate length, time resolution and units	1	0	1	1	1	1	1	1	1	1	1	1	92%
Q18- Establish national requirements for observational needs to support climate services	1	1	1	1	0	1	1	1	1	1	1	0	83%
Q20- Develop national observing strategy for weather and climate in order to address identified gaps	1	1	0	0	0	1	0	1	0		1	0	42%
Q24.3- Observing network delivers against ECVs - Essential Climate Variables	1	1	0	1	0	1	1	1	1	0	1	0	67%
Q27.1- Collect and store data and metadata in relational databases (OSCAR/Surface)	1	0	0	0	1	1	1	1	1	1	1	1	75%

Research, Modeling and Prediction Data

NAME OF THE COUNTRY /Economic Status Research, Modeling and Prediction	Cook Islands High Income Member	Kiribati LDC & SIDS	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesia (Federated States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive results
Q32.4- Create value-added products, such as graphics, maps and reports to explain climate characteristics and evolution, according to the needs of specific sectors such as health, agriculture, water and disaster management	1	1	0	1	1	1	1	1	1	0	0	0	67%
Q38.1- Evaluate the performance of climate models output and quantify the associated uncertainties	0	0	1	0	1	1	1	1	0	0	0	0	42%
Q38.2- Run Global and/or Regional Climate Models (sub-seasonal to decadal and longer)	0	0	1	0	0	1	1	1	0	0	0	0	33%
Q38.4- Provide large scale data resources as input to modeling, research, applications, etc.	0	1	0	0	1	1	1	1	0	0	0	0	42%
Q38.8- Apply statistical and geo-statistical analysis, including downscaling/calibration, to monitor the spatial distribution and temporal evolution of model output	0	0	0	0	0	1	0	1	0	0	0	1	25%
Q43.1- Work with sector-based research teams to develop applications models (e.g. to combine climate and agriculture information and produce food security knowledge products)	1	0	0	0	1	1	1	1	0	0	1	0	50%
Q30.1- Identify and engage research to improve data availability	1	0	1	0	0	1	1	0	0	0	1	1	50%

Capacity Building Data

NAME OF THE COUNTRY /Economic Status Capacity Building	Cook Islands High Income Member	Kiribati LDC&SID \$	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesi a (Federate d States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive results
Q35.1- Participate in RCOFs – Regional Climate Outlook Forums	1	1	1	1	1	1	1	1	1	1	1	1	100%
Q10- Verify status of and consult/support development and/or implementation of NAP and other national plans/strategies listed above reflecting priority needs	1	1	1	1	1	0	1	1	1	1	1	1	92%
Q44.1 - Neighbouring or other NMHS for basic education and cross-discipline operational training	1	1	1	1	1	1	1	1	0	1	0	1	83%
Q44.2 - RTC - Regional Training Centre, Education and/or Research Universities/institutions/organizations	1	1	0	1	1	1	1	1	0	1	0	0	67%

Outcome Related Data

NAME OF THE COUNTRY /Economic Status Relating to Outcomes	Cook Islands High Income Member	Kiribati LDC&SID S	Nauru High Income Member	Niue High Income Member	Papua New Guinea SIDS	Samoa SIDS	Solomon Islands LDC & SIDS	Tonga SIDS	Fiji SIDS	Micronesi a (Federate d States of) SIDS	Vanuatu SIDS	Tuvalu LDC & SIDS	Percentage positive Response
Q50.1- Establish ongoing monitoring systems for documenting user outcomes	1	0	1	0	1	1	0	0	0	1	0	1	50%
Q50.2- Establish baselines of sectoral outcomes for continuous evaluation of climate services	1	0	1	0	1	1	0	0	0	1	1	1	58%
Q51.1- Socio-economic analysis of cost-benefits of climate services conducted in collaboration with users		0	0	0	0	0	1	1	0	1	1	0	33%
Q52.1- Investment plans of climate sensitive sectors based on results of socio-economic analysis of cost-benefits of climate services	0	0	0	0	0	0	0	1	0	0	1	0	17%
Q52.2- Policy response as an outcome of the results of the socio-economic analysis of cost-benefits of climate services	0	0	0	0	0	0	0	0	0	0	1	0	8%

ANNEX 3.1: CREATING AND IMPLEMENTING THE NMHS COMMUNICATIONS PLAN

This is not a plan for climate services alone, rather, given the small size of Pacific Island NMHSs, it is a Communications Plan that includes climate services. Each NMHS should develop such a Plan, with the various focus areas of the Service using it as a vehicle to better meet user expectations.

Creating the Plan

1. Establish a Planning Team

The Team would consist of staff representing the Climate, Weather and Hydrology, the media liaison officer if the NMHS has one and be chaired by the Head of the NMHS or his/her representative. This Team would be responsible for preparing a detailed Plan and then implementing it.

2. Aims

The aims of the Plan would be to:

- ◆ Assist the NMHS in increasing the number and range of users of its services in the coming years.
- ◆ Enable NMHS staff to measure whether we're meeting the NMHS's objectives; and,
- ◆ Enable NMHS staff to continually improve the communication strategy.

3. Key Contents of the Plan

- ◆ **Objectives.** The Plan would include a list of the NMHS's communications objectives in order of priority.
- ◆ **Positioning Statement.** The Plan would, in plain language describe the NMHS and its unique capabilities.
- ◆ **Target Audiences.** The Plan would describe who are the NMHS is trying to reach.
- ◆ **Desired Actions.** The Plan would describe the activities that would enable implementation.

Implementation Activities

4. Messaging

Each Division would develop:

- ◆ **Article Topics.** Create a list of topics to generate articles for your website and Twitter Feed. These topics should appeal to specific target audiences and somehow contribute to your overall positioning.
- ◆ **Monthly / Seasonal Message Themes.** Themes to help guide the NMHS staff in their daily messaging. Include the proportion of messages for each theme. For example: 60% forecast or event related (climate, weather, hydrology); 20% school-focused educational campaigns; 15% fun, quirky but informative stuff; 5% inspirational quotes. Involve all staff and all areas in developing the themes and then prepare an annual list with the responsibility for the weeks spread across the NMHS.

5. Key Dates

NMHS as an entity and each services output Division has key dates that recur each year. Whether it's World Meteorological Day, a regional meeting, the start of the cyclone season, etc. These are to be listed so the communication team knows when they are coming. Each Division would take responsibility for planning and carrying out the events promoting the NMHS and reporting back to the Communications Team when they are over.

6. Campaigns

Campaigns are critical for harnessing all the time the NMHS would invest in the communication strategy. People don't take action on an issue unless they have motivated them through an educational campaign.

The Communications Team would schedule its campaigns in advance whenever possible and attempt to launch one at least every quarter. The more campaigns the NMHS launches, the better the NMHS staff would understand its users and stakeholder communities, enabling it to improve its communications over time.

7. Benchmarks for Success

This is one of the most important parts of the communication plan. Here is where the NMHS measures the impact of its communication efforts, both in terms of **intermediary benchmarks** (such as the size of your Facebook following or email distribution list) and **organizational objectives** (like responses to warnings, feedback from users).

This Communications Team would establish:

- ◆ A baseline (where are we starting in terms of your social media community size, website traffic volume, total donors, total members, etc.)
- ◆ Intermediary goals (every three months, what type of growth would we like to see?)
- ◆ End goals (where will we be in 12 or 18 months)
- ◆ Metrics for each platform the NMHS is using.

The NMHS would use its web site statistics for reviewing and updating the majority of the communications benchmarks each quarter.

Once the NMHS has decided on what will be the measures for success of the Communications Plan a monitoring program to gather the verifying data should be set up. Over time experience may lead to changes in measures and objectives (see the next Section).

8. Strategy Review Meetings

The Communications Team would schedule a strategy review meeting each quarter. This would enable the NMHS to determine what's working and what isn't, such as:

- ◆ Which benchmarks has the NMHS met or exceeded?
- ◆ Which benchmarks are elusive?
- ◆ What can we do to give the weaker areas a boost?
- ◆ What were the NMHS's biggest successes? Why?
- ◆ Do we need to adjust and update the Plan?

From time-to-time, as needed, the Communications Team would recommend to the Director updates to the Communications Plan.

ANNEX 3.2: TABLES OF ACTIONS FOR THE UPDATED ROADMAP: BY GFCS COMPONENT

User Interface

Communication Action - Act to:
1. Communicate routinely with Stakeholders impacted by climate change and climate variability, including: Government, Government agencies including: Emergency Management, Water agencies, Public Health authorities, Fisheries, etc., Private sector including: Agriculture, Aquaculture, Energy, Tourism Non-government organisations / civil society organisations (NGOs/CSOs), WMO and other UN agencies, Regional and sub-regional inter- governmental agencies, Donors, Schools, The community generally including: women, young boys and girls, people living with disabilities and vulnerable groups.
Communications Media – Act to:
2. Employ each type of media to best tackle the message to be conveyed and the intended receiving audience, including using: free-to-air radio and television, social media, telephone, newspapers and magazines, and the Internet.
3. Achieve effective “first mile” communication with Government, “last mile” communication with women, young boys and girls, people living with disabilities and vulnerable groups and communication with every intended audience between the “first mile” and the “last mile”.
Culture-relevant Action – Act to:
4. Communicate in the language best understood by the intended recipients.
5. Use terminology easily understood by the intended recipient and, where relevant, draw on relationships between the climate considerations and traditional knowledge.
NCOFs, RCOFs and PICOFs – Act to:
6. Participate in, and support Climate Outlook Forums whether national, regional or engaging the entire Pacific community.
7. Promote the regular conduct of Climate Outlook Forums and the involvement of stakeholders from relevant Government agencies and the private sector in these forums.
8. Support the use of Climate Outlook Forums to encourage the integration of climate services into decision making processes wherever the benefits that exceed the costs from doing so.
Communications Planning – Act to:
9. Implement a Communications Plan that includes all its service delivery components (weather, climate, hydrology, ocean services, aviation services, etc.,) within the various focus areas of the NMHS - using the Communications Plan as a vehicle to better meet user expectations. Annex 2 to this Implementation Strategy document provides a more detailed description of how to develop a simple communications plan for a small NMHS.

Table A3-1: User Interface Implementation Actions for Updated Roadmap 2024-33.

Climate Service Information System

Regional Climate Centre (RCC) – Act to:

1. Support and strengthen the RCC through participation in its programmes, to establish service agreements with key users and to reach agreement between RCC contributors on a “standard” range of RCC products

Climate Services Operational Procedures – Act to:

2. Identify gaps in climate services and develop plans for addressing these.
3. Develop operational procedures common to climate service providers and the agencies that best understand the impacts of climate-related extreme events in their areas of responsibility.
4. Develop all operational procedures that are sensitive to the cultural context of the recipient: Climate bulletins to use languages understood by the intended recipients, if traditional knowledge is important in the recipient communities, then climate bulletins will highlight links between traditional views and the science and use terminology easily understood by the intended recipients.
5. Operational procedures to be established and documented in the circumstances where there are secondary providers of climate bulletins (such as television station climatologists, journalists, etc.).
6. Develop collaboration with secondary providers in the generation of new products and services.

A Climate Services Toolkit – Act to:

7. Develop and implement a toolkit that can downscale regional products to local scale and upscale local observational data to provide maps of climate parameters (monthly, seasonal and annual absolute values and anomalies).

Table A3-2: Climate Services Information System Implementation Actions for Updated Roadmap 2024-33.

Observations, Monitoring and Data Management

Exchange of observational data – Act to

1. Undertake joint action with the CSIS to establish regional policy and procedures for data exchange that provide access to Pacific Is., observational data for intermediate- and end-users.
2. Upgrade observing systems to meet WMO standards as described in the *WMO Guide to the Global Observing System* and *Manual on the Global Observing System* wherever they fall short of these standards.

Observational Network – Act to:

3. Identify and address gaps in the range of parameters and spatial coverage of the climate observing system in the Pacific Islands (atmosphere, land surface and ocean) taking note of surface-based and remote sensing data streams currently available. Prioritise the gap filling needed according to expected user needs for the data.
4. Develop proposals for funding to establish, restore or replace observing stations, including climate reference stations, that would fill network gaps. These proposals to address the need for real-time access to the observational data.
5. Establish a funding mechanism for maintenance of existing stations to assist in sustainability of long-lived stations in particular.

Data Management – Act to:

6. Implement and sustain in all Pacific NMHSs relational databases for the storage of climate data and related metadata.
7. Undertake the conversion of older, paper-based meteorological records to digital formats and their storage in relational databases, focusing of critically located sites with long continuous records.
8. Support the repatriation of paper-based climate records from former colonial countries, along with digital copies of the data and metadata.

Table A3-3: Observations, Monitoring and Data Management Implementation Actions for Updated Roadmap 2024-33.

Climate Research, Modelling and Prediction

Climate Research, Modelling and Prediction – Act to:
1. Further link climate models with production models in agriculture, fisheries, water availability, etc.
2. Determine whether the future lies in using Artificial Intelligence to train forecast systems with climate outlooks and historical agriculture, fisheries, water availability, etc., productivity outcomes, to produce better decision-support systems.
3. Promote cross-disciplinary research to improving the effectiveness of warning systems serving diverse communities such as those in the Pacific - with a focus on meeting the needs of women, young boys and girls, people living with disabilities and vulnerable groups.
4. Link traditional knowledge of climate and climate variability with current science on these topics.
5. Improve and make available better techniques for verifying the accuracy and reliability of monthly, seasonal and annual outlook products.
6. Support the research needed to make Impact-Based Climate outlooks for conditions affecting the agriculture, fisheries, water availability, energy, tourism, etc., sectors possible.
7. Encourage and support climatologists, economists and the business sector collaborations on research into the costs and benefits of climate services in the Pacific.

Table A3-4: Research, Modelling & Prediction Implementation Actions for Updated Roadmap 2024-33.

Capacity Building

Regional Training Centre (RTC) – Act to:
1. Establish a Regional Training Centre that would provide professional level training for meteorologists and hydrologists, and provide technical level training on, <i>inter alia</i> : Observing system practices, Calibration of instruments, Database management, Management of product delivery systems, Management of climate monitoring and prediction systems, The effects of climate variability and change in Thematic (priority) areas, Resource mobilization through regional and extra-regional opportunities.
2. Create fellowships that would enable two-way exchanges of staff and students amongst the RCC and other regional and international academic institutions.
Climate Service Provision Operations – Act to:
3. Work with the donors funding new infrastructure to train technical sufficient (professional and technical) staff to manage the installed systems after project is commissioned.
4. Conduct capacity building programs on the use of existing and new products for both users and providers of climate services.
5. Provide opportunities for staff that interact with media as a part of their duties to receive media training before doing so.
6. Train staff in the use of Quality Management Systems and make use of the WMO Competency Framework.
7. Include Updated Roadmap strategies in National Planning processes.

Table A3-5: Capacity Building Implementation Actions for Updated Roadmap 2024-33.