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**Action Plan**

**FEBRUARY 13, 2008**

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The Pacific Climate Information System (PaCIS) provides a programmatic framework to integrate ongoing and future climate observations, operational forecasting services and climate projections, research, assessment, data management, outreach, and education to address the needs of American Flag and U.S.-Affiliated Pacific Islands (USAPI). PaCIS and the concept of a Pacific Regional Climate Centre trace their roots back to the 1997-1998 El Niño season and initial discussions of Pacific climate services at a workshop held in conjunction with the 1999 Pacific Regional Environment Program’s (SPREP) meeting of the Pacific Regional Meteorological Services Directors (RMSD). These early discussions identified a regional vision for ***resilient and sustainable communities using climate information to manage risks and support practical decision-making in the context of climate variability and change*.** PaCIS has embraced this same vision.

Future planning for a number of U.S. climate programs in the Pacific including: the Pacific El Niño Southern Oscillation (ENSO) Applications Climate (PEAC) Center; the Pacific Islands Regional Integrated Science and Assessment (Pacific RISA) program; U.S. National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) operational climate services; NOAA National Environmental Satellite, Data, and Information Service (NESDIS) National Climatic Data Center (NCDC) Integrated Data and Environmental Applications (IDEA) Center; Pacific Risk Management ‘Ohana (PRiMO); and other related climate activities in the region will be organized within the context of PaCIS.

In addition to meeting the specific needs of American flag and USAPI as an integrated climate information system, PaCIS will also provide a venue to discuss the role of U.S. contributions to other climate and climate-related activities in the Pacific including, for example, observing system programs such as the Pacific Islands Global Climate Observing System (PI-GCOS) and the Pacific Islands Global Ocean Observing System (PI-GOOS). It is anticipated PaCIS will also serve as the United State’s contribution to the World Meteorological Organization’s Regional Association V Regional Climate Centre and thus serve as a step towards a regional climate service for the Pacific.

In order to further define the roles and capabilities of PaCIS, a Steering Committee has been formed. Steering Committee membership includes representatives of institutions and programs working in the fields of climate observations, science, assessment, education, outreach, users, and services in the Pacific as well as selected individuals with expertise in similar regional climate science and service programs in other regions. The PaCIS Steering Committee will provide a forum for sharing knowledge and experience and guide the development and implementation of this integrated, regional climate information program. The Steering Committee’s deliberations will be accomplished within the context of the PaCIS vision, mission, and three main program elements shown on the following page. Along with the Steering Committee, there will be three working groups, one for each of the three main program elements.

**Pacific Climate Information System**

**vision**

*Resilient and sustainable Pacific communities using climate information to manage risks and support practical decision-making in the context of climate variability and change.*

**mission objectives**

The PaCIS mission includes the following objectives:

1. Clarify climate information needs to guide climate education, outreach, user information needs, observations, products, services, research and assessment;
2. Enhance regional and local capacities to maintain and sustain climate observational network and supporting systems in the Pacific;
3. Provide access to critical data, research and new climate information products and services;
4. Translate research and assessment results into useful and usable climate information;
5. Interpret global and regional climate forecasts and projections for local applications;
6. Enhance regional and local capabilities to manage risks and support sustainable development in the context of climate variability and change; and
7. Enhance collaboration among national, regional and international institutions and programs involved in climate information services.

**program elements**

To address the mission objectives, PaCIS will be implemented in the context of three program elements:

* Education, Outreach and User Information Needs
* Operational Climate Observations, Products and Services
* Research and Assessment

# Contents

# CHAPTER 1 – Demonstrated Value in Forecasts and Regional Dialogue - 1997-1998 El Niño

# CHAPTER 2 – EMERGENCE OF THE REQUIREMENT FOR A CLIMATE INFORMATION SYSTEM

*2.1 First Discussions: Regional Meteorological Service Director’s Meeting*

*2.2 Regional Dialog Among Likely Partners*

*2.3 Climate-related Regional Programs*

*2.3.1 Global Climate Observing System and Pacific Islands Global Climate Observing System*

*2.3.2 Global Ocean Observing System, Pacific Islands Global Ocean Observing System, and Pacific Islands Integrated Ocean Observing System*

*2.3.3 Pacific Regional Environment Programme*

*2.3.4 Pacific Islands Applied Geosciences Commission*

*2.3.5 World Meteorological Organization Regional Association V Regional Climate Centre*

*2.3.6 Other Related Institutions and Programs.*

*2.3.7 Future Collaboration*

*2.4 Climate Information Services Lessons Learned*

# CHAPTER 3 –Pacific Climate Information System

*3.1 Vision*

*3.2 Mission Objectives*

*3.3 Program Elements*

*3.3.1 Education, Outreach and User Information Needs*

*3.3.2 Operational Climate Observations, Products and Services*

*3.3.3 Research and Assessment*

*3.4 Pacific Climate Information System Implementation*

*3.4.1 Pacific Climate Information System Concept and Guiding Principles*

*3.4.2 PaCIS Steering Committee*

*3.4.3 PaCIS Executive Director*

*3.4.4 Working Groups*

*3.4.5 Timeline*

**CHAPTER 4 – Conclusion**

**Appendices**

*Appendix A: Useful Acronyms*

*Appendix B: Current Climate Related Programs in the Pacific*

*Appendix C: Evolution of PaCIS*

*Appendix D: PaCIS Steering Committee Terms of Reference*

*Appendix E: PaCIS Steering Committee Membership Organizations, Programs and Specialties*

*Appendix F: PaCIS Steering Committee Members*

*Appendix G: PaCIS Working Groups Terms of Reference*

*Appendix H: PaCIS Working Groups Members*

**Bibliography**

**Chapter 1: Demonstrated Value of Climate Forecasts and Regional Dialog: The 1997 – 1998 El Niño**

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The 1997-1998 El Niño event offered vivid examples of some of the impacts of changes in climate to people in the U.S. Flag and U.S.-Affiliated Pacific Islands (USAPI):

* Water rationing in Majuro, Republic of the Marshall Islands, where water access at one point was limited to 1 hour every 14 days in February 1998[[1]](#footnote-1);
* Crop losses in the Federated States of Micronesia, Republic of the Marshall Islands, the Commonwealth of the Northern Mariana Islands and the Republic of Palau;
* Job losses in the fishing sector in the Federated States of Micronesia;
* Wildfires in the Federated States of Micronesia, the Republic of Palau, Guam and the State of Hawaii; and
* Environmental impacts such as dry stream beds and coral bleaching.

According to Techur Rengulbai, Chair, Bureau of Public Utilities, in the Republic of Palau’s Ministry of Resources and Development, the Republic of Palau experienced a nine-month drought during the 1997-1998 El Niño (Rengulbai, 2003). As a result of the dry conditions and temporary decrease in sea level elevation associated with the 1997-1998 El Niño-Southern Oscillation (ENSO), approximately one-third of the nation's taro crop, a predominantly subsistence crop, failed. Wildfires destroyed 20 percent of Palau’s forest, savannah, and agricultural lands. Elevated sea surface temperatures and decreased sea levels produced coral bleaching and subsequent mortality of 30 percent of Palau’s coral reefs. These reefs support valuable commercial and subsistence fishing and serve as the foundation for much of Palau’s tourism industry[[2]](#footnote-2).

As described by Hamnett, et al. (2000), scientists and government officials throughout the Pacific agreed that advanced seasonal-to-inter-annual forecast information provided by the Pacific ENSO Applications Climate (PEAC) Center coupled with a sustained program of education and outreach had great value and helped to mitigate the negative impacts of the 1997-1998 events. PEAC Center efforts included face-to-face meetings and workshops; education activities; public relations campaigns; PEAC Center publications; and outreach efforts which enabled many communities to plan appropriately. Because of the relationships and connections established by PEAC Center through early and continuous contacts, there was enough credibility and trust for several communities and governments to plan and take actions such as to improve their water storage and capture systems, as well as petition for additional resources, based strictly on the forecasts provided. This experience highlighted the importance of a regional and local approach to climate in the Pacific where “eyeball-to-eyeball” contact is vital. Personal connections increase the likelihood people will understand and use the forecasts. In addition, USAPI learned mitigation/adaptation lessons from discussions with other locations experiencing similar impacts and these discussions helped to reinforce the accuracy of the forecast.

After the 1997-1998 El Niño event, an assessment funded by the United Nations (UN), University Center for Atmospheric Research (UCAR), United Nations University (UNU), World Meteorological Organization (WMO) and the International Strategy for Disaster Reduction (ISDR) identified key lessons learned. Two of these lessons focused on the need for an organized framework which promotes dialogue and feedback from climate information users, researchers, educators, operations and observations. These are:

* Effective climate information and prediction services require an appropriate framework where users recognize prediction possibilities, providers recognize the essentials to predict, and scientific information is in a form which can be readily assimilated to decision-making;
* Effective disaster reduction strategies are possible and are more sustainable if they are multi-disciplinary in nature and integrated within broader policy concepts pertaining to a society’s economic growth and social development (International Decade for Natural Disaster Reduction); (Glantz, 2001, p. 22)

The 1997-1998 El Niño event reinforced the need for an integrated, multidisciplinary approach towards creating a framework to reduce redundancies, to share resources and knowledge, and to produce high-quality and equitable climate data and products.

In the Pacific and elsewhere in the world, events such as the 1997-1998 strong El Niño and the weaker El Niños in 2002, 2004, and 2006 have shown timely and effective climate forecasts and assessment information are leading to enhanced resilience in sectors such as water resource management, disaster management (including drought, flood and fire management as well as tropical cyclones), agriculture, health, fisheries, and tourism. While acknowledging the anecdotal (“indirect”) nature of support for these conclusions, the National Research Council’s report entitled *Making Climate Forecasts Matter* points towards the usefulness of climate information on actions taken by weather-sensitive sectors and actors. They found the users considered the value of past climate forecasts as a guide on the usefulness of future climate information (National Research Council, 1999). [[3]](#footnote-3)

**Chapter 2: Emergence of the Requirement for a Pacific Climate Information System.**

***2.1 First Discussions: Regional Meteorological Service Directors Meeting***

In July of 1999, the Secretariat of the Pacific Regional Environment Programme (SPREP) convened its sixth meeting of Regional Meteorological Service Directors (RMSD) in Tahiti, French Polynesia. At a workshop held in conjunction with the 1999 SPREP meeting, initial discussions occurred regarding the growing need for a regional climate service. Those early discussions identified a regional vision which PaCIS has also embraced for *resilient and sustainable communities using climate information to manage risks and support practical decision-making in the context of climate variability and change*.

***2.2 Regional Dialogue Among Likely Partners***

In September 1999, SPREP and the New Zealand’s National Institute of Water and Atmospheric Research (NIWA) launched the *Island Climate Update* (ICU) during the SPREP Council Meeting in Guam. The ICU was put in place in response to growing demand from SPREP members for climate information and products, in particular, seasonal climate forecasts. NIWA in October 2000 began a monthly audio conference call engaging regional meteorological offices and government and non-government climate scientists in the south Pacific and United States for discussions to further improve the seasonal outlooks issued in the ICU.

This collaboration proved so effective that in January 2004, PEAC initiated a monthly Pacific call with PEAC Center personnel, National Weather Service (NWS) personnel in USAPI including U.S. territories, former trust territories, and Hawaii, and university and government climate scientists. This call provides a forum for climate scientists and local offices to discuss the previous month's climate in the Pacific, the current and forecasted ENSO situation, and various rainfall forecast models’ predictions for the next three months. This collaboration has increased 1) the regional NWS representatives’ education and awareness of seasonal climate variability and 2) the climate scientists understanding of the regional and local climate information needs.

***2.3 Climate-Related Regional Programs***

During this period of regional dialogues and the identification of a regional climate service, many climate-related programs, systems, and organizations started activities in the Pacific or became more focused on climate-related issues. The following is a cross-section of these programs, systems, and organizations. Appendix B provides a complete list of ongoing Pacific regional climate programs being implemented by PaCIS partners and Appendix C provides additional details on some of these programs, systems, and organizations.

*2.3.1 Global Climate Observing System and Pacific Islands Global Climate Observing System (also see Appendix C.1)*

The Global Climate Observing System (GCOS) Secretariat is housed at the WMO and is co-sponsored by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), and International Council for Science (ICSU). GCOS was created in 1992 (as an output of the Second World Climate Conference in 1990) to provide “a long-term, user-driven operational system capable of providing comprehensive observations across domains that are required for monitoring the climate system…(and) an operational framework for integrating, and enhancing as needed, the observational systems of participating countries and organizations into a comprehensive system focused on the requirements for climate issues.” (Salinger et al p. 3)

The GCOS provides an operational framework for integrating, and enhancing as needed, observational systems of participating countries and organizations into a comprehensive system focused on the individual national and common regional requirements to support climate issues. GCOS works in partnership with other existing and developing observing systems such as the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System, and the Global Observing System and Global Atmospheric Watch of the WMO, and as of 2004 with the publication of the GCOS Implementation Plan, comprises the climate societal benefit component of the Global Earth Observing System of Systems (GEOSS).

In August 2000, SPREP and the GCOS Secretariat organized the first Regional Implementation Workshop on Improving Global Climate Observing Systems. This workshop laid the conceptual framework for a Pacific Islands GCOS (PI-GCOS) program (<http://pi-gcos.org>) and a PI-GCOS Action Plan to accomplish the goals of the program. PI-GCOS is a crucial part of the greater GCOS effort and is especially important due to the strength of climate signals in the Pacific, such as ENSO, which need to be measured and analyzed in order to predict possible impacts in the Pacific region and other regions worldwide.

*2.3.2 Global Ocean Observing System, Pacific Islands Global Ocean Observing System, U.S. Integrated Ocean Observing System, and Pacific Islands Integrated Ocean Observing System (also see Appendix C.2)*

“GOOS is a permanent global system for observations, modeling and analysis of marine and ocean variables to support operational ocean services worldwide. GOOS provides accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible, and the basis for forecasts of climate change.” (<http://www.ioc-goos.org>). GOOS comprises the oceanographic societal benefit component of GEOSS.

The Pacific Islands GOOS (PI-GOOS) was first established at the Pacific Regional GOOS Capacity Building Workshop in Suva, Fiji in 1998. At that meeting, the Pacific Islands Applied Geosciences Commission (SOPAC) was identified as the interim secretariat.

PI-GOOS’s vision is to “assist development via improved capacity building, long-term ocean observations and delivery of useful products to the region.” (SOPAC, 2006) Along with its vision, PI-GOOS’s purpose is to integrate present ongoing ocean research, data usage, and monitoring activities into the Pacific Islands Regional Ocean Policy to address issues relevant to management and development of ocean and coastal resources and environments, as well as to broaden the scope of activities for marine environment protection and marine resources management. It facilitates, encourages and widens data usage to develop enabling tools and services for better and sustainable use of ocean resources and ocean environment. The PI-GOOS Global Regional Alliance will trigger opportunities for new activities and new partnerships both within and outside the region. (<http://ioc.unesco.org/GOOS/Pacific/pacgoos.htm#_ftn1>)

The U.S. Integrated Ocean Observing System (IOOS) is a coordinated national and international network of observations and associated data transmission, management, analyses, and modeling. The system is designed to systematically and efficiently acquire and disseminate data and information on past, present and future states of the oceans and U.S. coastal waters (IOOS Development Plan). The Ocean Action Plan recommended IOOS be the U.S. contribution to GOOS.

The Pacific IOOS (PacIOOS) is a critical component of the U.S. IOOS in the Pacific. It relies on a participatory process involving partnerships among the providers and users of information (Shea, 2005b). As initially designed, it will consist of a variety of project-based coastal observing systems and requires an understanding of the observational systems and the programs they support. PacIOOS is a problem-focused, integrated program involving:

* Enhancements to regional and local observing systems;
* Data assimilation, analysis, modeling and assessment;
* Data communications and information management;
* Technology development (including observational pilot/demonstration projects);
* Education and Training; and
* Continuous, interactive dialogue with decision makers and other key stakeholders.
1. In 2007, NOAA awarded the University of Hawaii’s School of Ocean and Earth Sciences and Technology (UH SOEST) an initial implementation grant focused on the State of Hawaii. In light of this award, UH SOEST will assume primary responsibility for the future development of PacIOOS. It is hoped that the PacIOOS’s network and knowledge will be invaluable to PaCIS while integrating information and communication through PaCIS will in turn benefit PacIOOS.

*2.3.3 Secretariat of the Pacific Regional Environment Programme (also see Appendix C.3)*

SPREP is an intergovernmental organisation established by Pacific region governments and jurisdictions to promote co-operation and provide assistance to protect and improve the region’s environment and ensure its sustainable development. Members identified SPREP’s Climate Change programme component as a priority because of the members’ current and future vulnerability to anticipated adverse consequences of climate change.

Recent SPREP’s climate change achievements and support to members have consisted of the following:

* A regional Framework for Action on Climate Change has been revised and adopted by the Pacific Islands Forum
* Pilot adaptation projects in four Pacific Island Countries and Territories supported by funding by the Government of Canada have demonstrated ways to increase community resilience to climate change
* The Pacific Islands Renewable Energy Project has been completed and another project “Global Environment Facility Renewable Energy” developed
* The regional strategy to implement the Montreal Protocol has supported the phase out of ozone depleting substances
* Support provided for climate observations in the region
* Effective participation in international multi-lateral environmental agreements negotiations (e.g., United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity)
* Housing the PI-GCOS Program on behalf of the region.

In 2007-2008, SPREP will emphasize adaptation work and the development of policy positions (especially internationally) because direct funding exists or is planned to support this emphasis. In 2007-2008, SPREP plans:

* Subject to Global Environment Facility (GEF) approval, to initiate a major project on adaptation in the region; the Pacific Adaptation to Climate Change project (PACC).
* To seek support for further adaptation work that targets specific areas of interest (such as the links between climate change and biodiversity).
* To provide support to countries to participate effectively in international meetings (UNFCCC and Kyoto Protocol), and identify opportunities
* Subject to GEF approval, to initiate a regional project on renewable energy to reduce greenhouse gas emissions.
* To provide support for climate observation in the region
* Subject to UNEP agreement, to implement a regional network to support the phase out of ozone depleting substances.

*2.3.4 Pacific Islands Applied Geosciences Commission (also see Appendix C.4)*

The Pacific Islands Applied Geosciences Commission (SOPAC) is an intergovernmental, regional organization with 20 member countries, including 18 Pacific island countries and territories, as well as Australia and New Zealand. SOPAC’s work is carried out through its Secretariat, based in Suva, Fiji. SOPAC was established in 1972 under the UN Economic and Social Commission of Africa and Pacific (ESCAP) as a project called the Committee for Coordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas (CCOP/SOPAC), to promote offshore mineral and petroleum prospecting. The secretariat became autonomous in 1984 with the funding of its member countries, donor countries and international agencies to steer its annual operations. While the initial focus of its work was on marine mapping and geosciences, recent years have seen a broadening of this scope to include hazard assessment and risk management, environmental vulnerability, oceanography, energy, water and sanitation and information and communication technologies.

SOPAC’s mandate is to contribute to sustainable development, reduce poverty and enhance resilience for the people of the Pacific by supporting the development of natural resources, in particular non-living resources, investigation of natural systems and the reduction of vulnerability, through applied environmental geosciences, appropriate technologies, knowledge management, technical and policy advice, human resource development and advocacy of Pacific issues.

SOPAC looks at climate issues through its three operational programs which offer a unique balance of intervention capacity and a wealth of expertise to address these issues.

* The Ocean and Islands program focuses on research, development and management of non-living resources in ocean and islands systems addressing issues relating to seabed resources (minerals and hydrocarbons), seabed mapping, seamounts, oceanographic modeling, and maritime boundary delimitation and monitoring of ocean processes.
* The Community Lifelines Programme aims to strengthen national capacities in energy, water and sanitation, information and communications technology.
* Finally, the Community Risk programme works at reducing of community vulnerability through improved hazard assessment and risk management.

*2.3.5 World Meteorological Organization Regional Association V Regional Climate Centre (also see Appendix C.5)*

The WMO’s Regional Association V has called for a Regional Climate Centre (WMO RA V RCC) to be established in the Regional V area which stretches from the east Pacific to Australia, New Zealand, Indonesia, and Malaysia. It is envisioned all RA V Members would contribute to a virtual RCC and PaCIS would serve as the U.S. contribution to the WMO RA V RCC, and this was endorsed at the most recent RA-V meeting in Adelaide, Australia, in May 2006.

 In 2002 WMO formed a RA V Task Team on Regional Climate Centre Services and Seasonal to Inter-annual Forecasting. The Task Team prepared a final report including recommendations and distributed it to the President of RA V and the RA V Working Group on Climate Related Matters in September 2005. It recommended that in the short term, RA V continue to work with organizations and agencies already carrying out Seasonal to Inter-annual and RCC related activities. In the longer term, as part of its ongoing activities, the RA V Working Group on Climate Matters would consult further with these existing organizations in the four sub regions with the purpose of developing and implementing a plan to create a proposed virtual RCC with its multiple nodes. In May 2006, WMO RA V appointed Co-Rapporteurs on RCC, Dr. Jim Salinger from New Zealand and Mr. Tham Chen Wan from Singapore, to carry on the work.[[4]](#footnote-4)

Based upon responses by the South Pacific Island Countries and Territories to a survey conducted by the WMO RA V Task Team and earlier studies, the National Meteorological/Hydrological Services (NMHSs) indicated a RCC should focus on activities and generate products that were of broad regional interest, while NMHSs would focus on the tailoring of the regional products for local use, generate other local products and work directly with local users. The NMHSs identified the following five specific areas and the top three items in each area (four for research) for a RCC.

* Operational Activities. Provide interpretation and assessment of relevant output products from global prediction centres; provide climate analysis and monitoring products covering the region or sub-region; and provide regional or sub-regional climate advisories to NMHSs.
* Co-ordination Functions. Develop systems to facilitate harmonization between and assistance in the use of Seasonal to Inter-annual (SI) forecast products generated locally and at other centres; foster the sharing and use of SI forecasts and information from climate and other scientific disciplines (very high rating as a RCC function and high interest by NMHSs); and assist the introduction of climate information and predictions into early warning and disaster prevention systems.
* Data Service. Assistance with the rescue of climate data sets; assistance with the development and maintenance of software modules for standard applications; and advice on data quality management.
* Training and Capacity Building. Train NMHS staff in SI Forecasting methods and characteristics to enable NMHSs to strength their provision of climate services; assist in the identification and introduction of appropriate decision models for end-users, especially as to how such models relate to probability forecasts; and assist in technical capacity building of NMHSs.
* Research and Development. Study climate variability and predictability in the region; develop tools for objective climate analysis and prediction; promote research, development and application of methodologies to harmonize and unify information from varied sources for regional and sub-regional products; and promote studies of climate impacts and the economic value of climate information.

*2.3.6 Other Related Institutions and Programs*

In addition to the programs, systems, and organizations listed above, many others contribute to climate programs and related activities in the Pacific and are listed in Appendix B. Additional details on some of these programs, systems, and organizations can be found in Appendix C. With all of the climate-related activities being conducted by these various groups, the need for PaCIS became clearly evident.

*2.3.7 Future Collaborations*

There are additional climate-related programs in the Pacific which PaCIS has not currently identified. These may include non-profit organizations, state-funded programs, university research and international initiatives and they represent great opportunities for future collaborations. As one of their initial tasks, the PaCIS working groups will complete a thorough inventory of ongoing climate activities in the Pacific.

***2.4 Climate Information Services Lessons Learned***

The East-West Center, with a grant from the National Oceanic and Atmospheric Administration’s (NOAA) Office of Global Programs (OGP), began a review of the first ten years of the PEAC Center program in 2003. A key part of this review was a workshop held in June 2004 at the East-West Center in Honolulu Hawaii at which PEAC Center partners and users discussed the future of PEAC. Based upon the lessons learned from 10 years of PEAC Center activities, including analysis of the effectiveness of those activities in relation to the significant ENSO event in 1997-98, the workshop participants made several key recommendations:

* **Strengthening collaboration with users**, including core users and identifying new users;
* **Strengthening and expanding critical partnerships**, incorporating the entire climate science and applications community (users, PEAC Center, Pacific RISA, WMO, SPREP, SOPAC, PI-GCOS, etc,);
* **Strengthening and enhancing the PEAC Center product line**, enabling opportunities for feedback and revision, adding extreme rainfall and flood information, exploring new product lines including sea-level, downscaling, compositing, etc.; and
* **Setting PEAC Center in the context of broader Pacific regional goals and opportunities,** increasing involvement in climate adaptation and mainstreaming, contributions to poverty reduction, economic development, social/cultural preservation, climate racism, etc. (Shea, 2003)

The discussions held at the PEAC Center workshop also resulted in the realization of a shared goal of a Pacific climate risk management information system.

The following matrix (page 16) provides an overview of the contribution of various regional partners to the three identified PaCIS Program Elements given in the Forward and described in more detail in Chapter 3. For each of the three PaCIS Program Elements, three sub-elements are listed to provide additional breakout information.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Research and Assessment** | **Assessment** | X | X |  | X |  |  |  | X |  | X |  | X | X | X | X | X |  | X |
| **Research** | X | X | X | X |  | X |  | X |  |  |  | X |  |  | X | X |  | X |
| **Decision Support Tools** | X | X |  | X |  | X |  | X |  |  |  | X | X | X | X |  |  | X |
| **Operational Climate Products and Services** | **Regional Testbed** | X |  | X |  |  |  |  |  |  |  |  |  |  | X |  |  |  | X |
| **Forecasting and Climate Services** | X |  | X |  |  |  |  | X |  |  |  |  |  |  |  | X | X | X |
| **Obs and Data Products** | X |  | X |  | X | X | X | X |  |  |  |  | X | X | X | X | X | X |
| **Education, Outreach and User Information Needs** | **User Engagement** | X | X |  | X | X | X | X | X |  | X |  | X | X | X | X | X | X | X |
| **Outreach** | X | X |  | X | X | X | X | X |  | X |  | X | X | X | X |  | X | X |
| **Education** | X |  |  | X | X | X | X | X |  | X |  | X | X | X | X | X | X | X |
| **Organization**(\* = International) | UH SOEST | UH SSRI | UH IPRC/APDRC | UOG WERI | PI-GCOS | PI-GOOS | Pac-IOOS | BoM\* | SOPAC\* | SPREP\* | NIWA\* | Pacific RISA | IDEA/PRIDE | PRiMO | East-West Center | NWS CPC | NWS CS | PEAC Center |

# Chapter 3 – Pacific Climate Information System

As shown in Chapters 1 and 2, experience gained from the 1997-1998 El Niño, on-going climate programs in the region, and planning for WMO RA V RCC highlighted the requirement for PaCIS.

***3.1 Vision***

*Resilient and sustainable Pacific communities using climate information to manage risks and support practical decision-making in the context of climate variability and change.*

***3.2 Mission Objectives***

The PaCIS mission includes the following:

1. Clarify climate information needs and guide monitoring, research and assessment;
2. Provide access to critical data, research and new climate information products and services;
3. Translate research and assessment results into useful and usable climate information;
4. Interpret global and regional climate forecasts and projections for local applications;
5. Enhance regional and local skills and capabilities to manage risks and support sustainable development in the context of climate variability and change; and
6. Enhance collaboration among national, regional and international institutions and programs involved in climate information services.

***3.3 Program Elements***

To address the mission objectives, PaCIS will be implemented in the context of three program elements:

* **Education, Outreach and User Information Needs**
* **Operational Climate Observations, Products and Services**
* **Research and Assessment**

***3.4 Pacific Climate Information System Implementation***

*3.4.1 Pacific Climate Information System Concept and Guiding Principles.*

The concept for the Pacific Climate Information System (PaCIS) is to create an integrated program of assessment, research, observations and operations implemented through a network of climate science, services and applications experts including users, researchers, and government offices. PaCIS’s integrated program will address the key PEAC Center review recommendations to strengthen collaboration with its partner institutions and communities and to strengthen and expand critical mechanism for greater integration of research with operations and applications (Shea 2005a). The following are key lessons learned from the PEAC Center review and Pacific RISA (see Appendix C) activities which can be considered guiding principles for PaCIS:

* Early and continuous partnership and collaboration with users along with shared learning and shared responsibilities is essential.
	+ Among partners in climate information system;
	+ Across local, national, regional and international governments;
	+ Between/among providers and users; and
	+ Among user communities.
* Education, outreach and dialogue activities play a critical role:
	+ Raising awareness and understanding;
	+ Identifying impacts and exploring solutions;
	+ Building trust and credibility; and
	+ Providing for continuous evaluation and revision.
* Building trust and credibility is a long-term endeavor:
	+ Establishing and sustaining “eyeball-to-eyeball” contact;
	+ Building on existing institutions and trusted information brokers;
	+ Maintaining awareness between events—i.e., focus on establishing a sustained, climate information system not just an event-based early warning system; and
	+ Accommodating relative successes and failures (e.g., 1997-1998 vs. 2001-2002)
* Forecasts or projections of future conditions must be set in an appropriate context:
	+ Problem to be addressed
	+ Historical events, patterns and trends
	+ Traditional knowledge and practice
	+ Useful and usable information appropriate to the intended application and decision-making community
* Decision-makers in many sectors are interested in climate information on a continuum of timescales from extreme events through seasonal and inter-annual timescales to projections of changing conditions on timescales of decades and longer:
	+ Exploring linkages across timescales is important
	+ Extreme events can be a galvanizing focus for planning, response and capacity-building
* Early experience points to a number of scientific, technical and institutional constraints in specific places/sectors, including:
	+ Communications—systems and language
	+ Difference in forecast skill with season, place and parameter
	+ Political and institutional boundaries—for both users and providers of climate information
	+ Forecasts remain limited by observations, model deficiencies (related to computational constraints and physical parameterizations) and inherent uncertainties
	+ Understanding of consequences, vulnerabilities and options for risk management still fairly limited.

*3.4.2 Pacific Climate Information System Steering Committee*

The PaCIS Steering Committee is a mechanism and a forum to ensure that all entities with a regional stake in PaCIS have a voice in formulating consensus positions, in carrying out agreed upon policies, and in performing the necessary tasks to implement a consolidated regional program. The goal of the Steering Committee is to take a proactive and systematic approach to support the emergence of an effective, integrated and well-coordinated U.S. PaCIS program. Its membership reflects key partnerships and capacities at the regional, U.S. national and international level. (See Appendix E for a detailed list of the proposed organizations and their representatives on the PaCIS Steering Committee.)

Specifically, the PaCIS Steering Committee will be called upon to:

* Provide strategic guidance for PaCIS program structure and content;
* Lead the development of an initial PaCIS Action Plan, associated implementation documents, and periodic revisions to these documents as required;
* Designate and provide oversight for PaCIS Working Groups who are responsible for detailed descriptions and implementation of PaCIS program elements;
* Further integrate PaCIS program elements through the guidance of programmatic and management activities;
* Periodically review the progress of PaCIS priorities and activities;
* Promote effective integration of PaCIS into the broader community of regional climate programs in the Pacific, including PI-GCOS, PI-GOOS, and the emergence of a WMO RA V Regional Climate Centre for Oceania;
* Participate in relevant formal and ad hoc activities of PaCIS;

* Act as a regional advocate for using climate information to manage risks and support practical decision-making in the context of climate variability and change;
* Facilitate the exchange of information among sponsoring and participating organizations and agencies; and
* Coordinate with other groups which have an interest in using climate information to manage risks and support practical decision-making in the context of climate variability and change.

The PaCIS Steering Committee is expected to do most of their work through phone, email and/or fax. The Committee will meet generally as issues warrant or at least once every 12-18 months. During the first two years of the Steering Committee, more frequent meetings may be required. The Steering Committee Terms of Reference format was adopted at the inaugural Committee meeting August 17–18, 2006 and can be found in Appendix E of this document. Meetings of the Steering Committee shall be open to all interested individuals and organizations within the region to attend.

*3.4.3 Working groups*

The PaCIS Steering Committee will establish and direct the activities of working groups to support the PaCIS Mission Objectives and Steering Committee’s identified tasks. At a minimum, three working groups will be established one for each of PaCIS’ three program elements stated above. The PaCIS Steering Committee can establish other temporary or permanent working groups as necessary to meet its responsibilities. Working groups will accomplish their work in coordination and collaboration with representatives from relevant organizations, programs, and institutions.

The goal of the working groups is to effectively and efficiently develop and design work plans to implement each program element with representatives from relevant organizations, programs, and institutions and then to guide, direct, oversees, and conduct activities identified in the work plan to improve climate services in the Pacific.

Specifically, the working groups will be called upon to:

* Complete an inventory of regional activities and identify gaps in each program element;
* Develop detailed plans for PaCIS program priorities and conduct, direct, and guide activities in each program element;
* Create plans for future PaCIS activities in each program element (e.g., future proposals to NOAA and other funding agencies);
* Identify opportunities for greater integration among program elements and partners; and
* Periodically (minimum every six months), report to the PaCIS Executive Director on their progress. The Executive Director will then in turn update the Steering Committee.

The membership of the PaCIS working groups will include a balanced representation of the principal stakeholders in the region and members who reflect user communities representing key sectors affected by climate variability and change, NOAA’s NWS Pacific Region Weather Service Office representatives, and core scientific expertise.

The PaCIS Steering Committee shall designate membership in the working groups. The PaCIS Steering Committee will appoint Chairs or Co-Chairs for each working group. The Chairperson or Co-Chairs will represent their program elements as members of the Steering Committee. Each working group chairperson will convene and make required arrangements for meetings of the working groups in consultation with the Steering Committee’s Chairperson and the Executive Director. See Appendix G for the Terms of Reference for PaCIS working groups.

Tables 3.4.3.1, 3.4.3.2 and 3.4.3.3 provide a general description of proposed priorities identified by the Steering Committee and initial PaCIS activities which should be undertaken in each of these program elements.

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| ***Table 3.4.3.1 Education, Outreach and User Information Needs*** |
| Priorities | Initial Activities |
| **1. Ensure effective user feedback and dialogue.** | a. Design, implement and evaluate formal mechanism(s) for user feedback |
| b. Design and implement local user workshops |
| c. Evaluate existing website and provide recommendations for improvements including online user feedback |
| **2. Create appropriate public education materials on climate variability, climate change and related risk management.** | a. Survey of current materials available (formal and informal) |
| b. Identify perceived needs |
| c. Develop and distribute climate information products and support curriculum development |
| **3. Support WSOs and WFOs role as local expert and coordinator for climate products and information services.** | a. Survey of personnel, training, and technical support needs and secure additional resources |
| b. Provide required workshops, training, materials and tools (train the trainer) |
| c. Establishing partnerships w/other experts in climate and applications |

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| ***Table 3.4.3.2 Operational Climate Observations, Products and Services*** |
| Priorities | Initial Activities |
| **1. Develop and routinely evaluate PaCIS services.** | a. Evaluate current products and services**,** identify gaps, and recommend changes   |
| b. Establish a formalized joint climate products/services test bed for the Pacific**i.** Develop evaluation criteria **ii.** Develop an effective method of transitioning new applications to operations **iii.** Create criteria and guidelines to evaluate the usefulness of new products and services (NCEP/CPC, NWS Climate Services) |
| c. Identify requirements for new research, observations, services and training |
| **2. Support consistent and coordinated regional climate information services.** | a. Participate in regional coordination activities (e.g., regional forecast teleconferences) |
| b. Contribute to the emergence of a WMO RA V RCC  |
| c. Participate in regional climate risk management coordination activities (e.g., PRiMO) |
| **3. Support regional observation and information (data) management systems.** | a. Establish a mechanism for identifying gaps in local, regional and global observing systems  |
| b. Support PI-GCOS, PI-GOOS, PacIOOS and other regional observing system programs |
| c. Support regional to local data stewardship, management, product development activities and initiatives |

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| ***Table 3.4.3.3 Research and Assessment*** |
| Priorities | Initial Activities |
| **1. Implement an effective program of regional downscaling and local applications.** | a. Survey existing and planned activities in regional modeling and downscaling and assess their applicability in/for the Pacific |
| b. Identify needs and develop new tools, products, and services in response to user needs |
| c. Coordinate with and provide feedback to national, regional and international climate modeling, prediction and diagnostic centers |
| **2. Expand our understanding of nature and consequences of climate extreme events in region.** | a. Enhance and integrate historical databases on climate related extreme events in the region; including actual events (e.g., tropical cyclones) as well as climatic teleconnections (e.g., ENSO or Pacific Decadal Oscillation) |
| b. Consolidate and expand historical database on the demographic and socioeconomic impacts of those climate related extreme events and adaptation strategies |
| c. Integrate indigenous/traditional and local knowledge and practices |
| **3. Enhance resilience through understanding of regional vulnerability and support for climate adaptation.**  | a. Develop long term plan for Pacific RISA in context of PaCIS (regional Pacific climate risk management) |
| b. Contribute to Intergovernmental Panel on Climate Change (IPCC) and other regional climate assessment activities |
| c. Identify research and service needs and opportunities to enhance resilience and support sustainable development |

*3.4.4 Pacific Climate Information System Executive Director*

The NOAA NWS Pacific Region Climate Services Program Manager will serve as the Executive Director of PaCIS. The Executive Director will support the implementation of PaCIS’s programmatic framework and overall strategic guidance. Responsibilities of the Executive Director include:

* Supporting the work and activities of the Steering Committee and Working Groups and coordinating the efforts of the working groups;
* Identifying opportunities for greater collaboration within and outside of the regional climate community; and
* Identifying challenges and opportunities (including recommendations for the working group priorities and actions).

*3.4.5 Timeline*

The PaCIS Action Plan will be a “living” document. The following timeline provides a snapshot of PaCIS implementation over the coming eighteen months:

* August 17– 18, 2006 – Inaugural Steering Committee Meeting;
	+ Terms of Reference modified and approved
	+ Action Plan reviewed and revisions noted
	+ Working group structure defined and chairs and potential members identified
	+ Identification of “Next Steps”
* October 2007 – Modified Action Plan and Terms of Reference sent out for final approval
* November 2007 – Action Plan posted on PaCIS site;
* Early 2008 – Inaugural working group meetings held;
	+ Timeline and delegation of working group actions
	+ Development of work plans and preparation of detailed timelines and activities of items in the Action Plan and submit to Steering Committee
* Mid 2008 – Steering Committee Meeting;
	+ Steering Committee reviews and approves detailed Action Plan submitted by working groups
* Mid 2008 – Initial PaCIS Implementation Plan approved.

# Chapter 4 – Conclusion

**“The provision of climate services in the United States is evolving in response to the combination of a growing knowledge base, a growing appreciation of the importance of climate in human endeavors, and a greater demand for climate information.” (National Resource Council 2001)**

The Pacific Islands are ideally situated as a testing ground for a regional climate information service. The Pacific experiences strong climate variability impacts, most notably from the El Niño-Southern Oscillation (ENSO). During strong ENSO events, worldwide impacts occur from changes which begin in the tropical Pacific Ocean. In the past, forecast information has helped some communities in the Pacific to prepare for these events and have improved their resilience in these areas. More communities will be able to increase their resilience to climate variability and change on all time scales with improved: 1) quality of climate information and forecasts and 2) improved interpretation of this information and the potential impacts for each region.

In order to increase resilience through improved forecasts and increase awareness and understanding of forecasts, the Pacific climate science and applications community needs an integrated end-to-end system which identifies and nurtures partnerships, creates and supports opportunities, maximizes collaborations and ensures redundancies are minimized. The integration of improved climate information and coordination among partners enhances resource managers’ and decision makers’ capabilities to prepare better-informed risk management plans, helping to reduce risks from climate impacts ranging from short-term events to longer-term changes. Through this improved climate information system, island communities will be better able to build resilience and sustainability, improve their ability to adapt to changes in climate, better manage their risk, and have additional information to support their particular decision making.

The Pacific Climate Information System (PaCIS) is being developed to integrate ongoing climate observations, operational forecasting services, research, modeling, assessment, information management and education and create the framework for a successful climate service in the Pacific.

Through PaCIS’s programmatic framework and overall strategic guidance, climate principle stakeholders will strengthen their ability to integrate their knowledge, form partnerships and identify and advocate for opportunities to improve climate services in the Pacific. The dialogue supported by PaCIS will enable the “Team Pacific” to more effectively understand and advocate for their needs on a regional versus individual level. Ultimately, this will lead to increased climate literacy, improved climate products, improved resilience and sustainability of communities, poverty reduction, social and cultural preservation, economic development and reduction of climate impacts on less developed countries or parts of countries.

PaCIS will also serve as a United State’s contribution to the World Meteorological Organization’s RA V Regional Climate Centre.

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| **Appendix A: Useful Acronyms**  |
| **APDRC** | Asia Pacific Data Research Center |
| **BoM** | Australia Bureau of Meteorology |
| **BoM NCC** | Australia Bureau of Meteorology National Climate Centre |
| **CCOP** | Committee for Coordination got Joint Prospecting |
| **CCSP** | Climate Change Science Program |
| **CIG** | Climate Impacts Group |
| **CONUS** | Contiguous United States |
| **CPC** | Climate Prediction Center (NOAA NWS NCEP) |
| **CPO** | Climate Program Office (NOAA OAR, formerly the Office of Global Programs) |
| **ENSO** | El-Niño Southern Oscillation |
| **EPA** | Environmental Protection Agency |
| **ESCAP** | UN Economic and Social Commission of Africa and Pacific |
| **FMS** | Fiji Meteorological Service |
| **FSM** | The Federated States of Micronesia |
| **GCOS** | Global Climate Observing System (NOAA NCDC) |
| **GEF** | Global Environment Facility |
| **GEOSS** | Global Earth Observing System of Systems |
| **GOSIC** | Global Observing System Information Center (PI-GCOS) |
| **ICSU** | International Council for Science |
| **ICU** | “*Island Climate Update”* |
| **IOC** | Intergovernmental Oceanographic Commission (UNESCO) |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IPRC** | International Pacific Research Center (University of Hawaii) |
| **IRI** | International Research Institute for Climate and Society  |
| **ISDR** | International Strategy for Disaster Reduction (UN) |
| **JIMAR** | Joint Institute for Marine and Atmospheric Research (University of Hawaii, SOEST) |
| **L3MTO** | Local 3-Month Temperature Outlook |
| **L3MOLEI** | Local 3-Month Outlook La Nina El Nino Impact on Temperature and Precipitation |
| **MJO** | Madden Julian Oscillation |
| **NCDC** | National Climactic Data Center (NOAA) |
| **NCEP** | National Center for Environmental Prediction (NOAA NWS) |
| **NESDIS** | National Environmental Satellite, Data, and Information Service (NOAA) |
| **NIWA** | New Zealand National Institute for Water and Atmospheric Research  |
| **NMHS** | National Meteorological/Hydrological Service |
| **NOAA** | National Oceanic and Atmospheric Administration (United States Department of Commerce) |
| **NOAA IDEA Center** | NOAA Integrated Data and Environmental Applications Center (NESDIS NCDC) |
| **NWS** | National Weather Service (NOAA) |
| **NWS CSD** | National Weather Service Climate Services Division (NOAA) |
| **OAR** | Office of Oceanic and Atmospheric Research (NOAA) |
| **PACC** | Pacific Adaptation to Climate Change |
| **Pacific RISA** | Pacific Regional Integrated Sciences and Assessments Program (East-West Center) |
| **PacIOOS** | Pacific Islands Integrated Ocean Observing System (NOAA) |
| **PaCIS** | Pacific Climate Information System |
| **PDO** | Pacific Decadal Oscillation |
| **PEAC Center** | Pacific ENSO Applications Climate Center  |
| **PI-GCOS** | Pacific Islands Global Climate Observing System (NOAA NCDC) |
| **PI-GOOS** | Pacific Islands Global Ocean Observing System (NOAA) |
| **POAMA** | Predictive Ocean Atmosphere Model for Australia |
| **PRICIP** | Pacific Region Integrated Climatology Information Products |
| **PRIDE** | Pacific Region Integrated Data Enterprise  |
| **PRiMO** | Pacific Risk Management ‘Ohana  |
| **PSC** | Pacific Services Center (NOAA) |
| **RCC** | Regional Climate Center (NOAA NWS; do not mistake w/ WMO RA V RCC) |
| **RDS** | Regional Decision Support (NOAA Climate Program) |
| **RISA** | Regional Integrated Sciences and Assessments |
| **RMSD** | Regional Meteorological Service Directors (WMO) |
| **SIDS** | Small Island Developing States  |
| **SOEST** | School of Ocean and Earth Science Technology (University of Hawaii) |
| **SOI** | Southern Oscillation Index |
| **SOPAC** | Pacific Islands Applied Geosciences Commission  |
| **SPREP** | Pacific Regional Environment Programme |
| **SST** | Sea Surface Temperature |
| **SSRI** | Social Science Research Institute (University of Hawaii) |
| **UCAR** | University Center for Atmospheric Research |
| **UH** | University of Hawaii |
| **UN** | United Nations |
| **UNEP** | United Nations Environment Programme |
| **UNESCO** | United Nations Educational, Scientific and Cultural Organization |
| **UNFCCC** | United Nations Convention on Climate Change |
| **UNU** | United Nations University |
| **UOG/WERI** | University of Guam, Water and Energy Research Institute  |
| **USAPI** | United States Affiliated Pacific Islands |
| **USGCRP** | United States Global Change Research Program |
| **USGS** | United States Geological Survey |
| **WCM** | Warning Coordination Meteorologists  |
| **WFO** | Weather Forecast Office (NWS) |
| **WMO** | World Meteorological Organization |
| **WMO RA V RCC** | World Meteorological Organization Regional Association V Regional Climate Centre (do not mistake with the 6 RCCs in the US administered by the NOAA NCDC) |
| **WSO** | Weather Service Office |

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| **Appendix B: Current Climate Related Programs in the Pacific** |
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| ***Climate Observation Programs*** |
| Pacific Islands Global Climate Observing System **(PI-GCOS)** |
| Pacific Islands Global Ocean Observing System **(PI-GOOS)** |
| Pacific Islands Integrated Ocean Observing System **(PacIOOS)** |
| United States Geological Survey **(USGS)** |
| ***Information Management*** |
| NOAA Integrated Data & Environmental Applications **(IDEA)** Center |
| Pacific Islands Global Climate Observing System **(PI-GCOS)** |
| Pacific Islands Global Ocean Observing System **(PI-GOOS)** |
| Pacific Region Integrated Data Enterprise **(PRIDE)** |
| ***Research (Physical, Climate and Socioeconomic)*** |
| University of Hawaii (UH) International Pacific Research Center **(IPRC)/Asia Pacific Data Research Center (APDRC)** |
| University of Hawaii (UH) Department of Oceanography, School of Ocean & Earth Science Technology **(SOEST)** |
| University of Hawaii (UH) Social Science Research Institute **(SSRI)**, Climate and Environment Program |
| University of Guam, Water & Energy Research Institute **(UOG/WERI)** |
| New Zealand National Institute for Water & Atmospheric Research **(NIWA)**  |
| The Nature Conservancy (NOAA Sectoral Applications Research Program funded) |
| Pacific Islands Global Ocean Observing System **(PI-GOOS)** |
| Australia Bureau of Meteorology **(BoM)** National Climate Centre |
| ***Assessment*** |
| Pacific Regional Integrated Sciences & Assessments **(Pacific RISA)** |
| Pacific ENSO Applications Climate **(PEAC)** Center |
| ***Forecasting and Services***  |
| Weather Service Office **(WSO)** Climate Services Focal Point |
| Warning Coordination Meteorologists **(WCM)** |
| Pacific ENSO Applications Climate **(PEAC)** Center |
| NOAA National Weather Service Weather Forecast Office Honolulu Hawaii **(NWS WFO Honolulu)** |
| NOAA National Weather Service Climate Services Division **(CSD)** |
| International Research Institute for Climate and Society **(IRI)** |
| NOAA Climate Prediction Center **(CPC)** |
| NOAA Regional Climate Center **(RCC)** |
| ***Education and Outreach*** |
| Pacific Island Applied Geosciences Commission **(SOPAC)** |
| Pacific Regional Environment Programme **(SPREP)** |
| Pacific Regional Integrated Sciences & Assessments Program **(Pacific RISA)** |
| Pacific Islands Global Ocean Observing System **(PI-GOOS)** |
| Pacific Region Integrated Data Enterprise **(PRIDE)** |
| Pacific Risk Management 'Ohana **(PRiMO)** |
| Pacific ENSO Applications Climate **(PEAC)** Center |

**Appendix C: Evolution of PaCIS**

PaCIS planning builds on the early foundations described in Chapters 1and 2 of this plan and a suite of ongoing U.S. programs that will form the core of PaCIS. This appendix provides an overview of the core programs.

***C.1 U.S. Contributions to Pacific Islands Global Climate Observing System (PI-GCOS) (Also see Section 2.3.1)***

Since then, U.S. contributions and support to the PI-GCOS program have:

*C.1.1* Funded support for the regional PI-GCOS officer;

*C.1.2* In conjunction with MetService NZ, NZAID and NZ Ministry of Transport (MOT) via the US/NZ Climate Change partnership, and Met Office UK, funded support for the Pacific Technical Support Program (TSP) to restore, upgrade and maintain upper air observing programs (PI-GUAN) in the Cook Islands, Fiji, Kiribati, Tuvalu, Solomon Islands, Vanuatu and PNG. The TSP also assisted with maintaining GSN surface networks in selected South Pacific Islands.

*C.1.3* Developed with support from the Global Observing System Information Center (GOSIC) and in concert with the regional PI-GCOS Program Officer, a new Pacific Islands GCOS portal in order to facilitate the access to Pacific Islands GCOS datasets which are held in a diverse group of data centers. This portal, located at <http://pi-gcos.org>, has become a key tool aid in the management of the Pacific Islands Regional GCOS Program, as well as providing administrative information for use by the regional program officer. The regional portal has also begun hosting web sites for various Pacific Island Meteorological Services which has been a great capacity building support activity for the region. In 2007 as a result of collaboration between the BOM and the U.S. GCOS Program via the U.S./Australia Climate Action Partnership, a new robust server was procured and implemented at the APDRC in Honolulu that will host all three regional observing systems (PI-GCOS, PI-GOOS, and Pacific HYCOS) using a consistent platform and common web interface.

*C.1.4* Contributing in-kind support and facilitation to achieve the goals of PI-GCOS by assuming the role as the Secretariat of the region’s PI-GCOS Science and Technology (S&T) Panel. The S&T Panel is a subsidiary body established to provide advice and guidance to the PI-GCOS Steering Committee.

*C.1.5* Facilitated important bi-lateral climate agreements. Specifically in the Pacific, the U.S. GCOS Program Office is involved in funding projects with Australia and New Zealand. These bi-laterals cover a wide range of projects dealing with climate prediction, ocean observing, stratospheric detection, water vapor measurements, capacity building and training, and communication of information, and will focus the attention and resources of all these countries towards developing a more sustainable and robust GCOS program and have been of particular benefit to the Pacific Islands region.

*C.1.6* In conjunction with the National Institutes of Water and Atmosphere (NIWA) in New Zealand, implemented three new long-term projects which are:

* The implementation of a global stratospheric water vapor measurement station in Lauder, New Zealand;
* The implementation of a new ship track for trace gas measurements that has been implemented on a car carrier ship on a route between Nelson, New Zealand, and Nagoya, Japan;
* Digitization of long-term paper records of climate data across the region by NOAA and NIWA in a 5-year long program.

*C.1.7* Supported PI-GCOS Action Plan and Implementation Team meetings and associated logistics; supported through SPREP the organization of a data management workshop; as well as some support for related ocean observation work at the SOPAC; and provided resources to help stage other workshops, as well as providing presenters on various topics.

***C.2 Pacific Islands Global Ocean Observing System (GOOS) and Pacific Islands Integrated Ocean Observing System (PacIOOS)***

See Section 2.3.2

***C.3*** ***Pacific Regional Environment Programme (SPREP)***

See Section 2.3.3

***C.4 Pacific Applied Geoscience Commission (SOPAC)***

See Section 2.3.4

***C.5 World Meteorological Organization***

See Section 2.3.5.

***C.6 Australia Bureau of Meteorology***

The Bureau of Meteorology’s National Climate Centre (BoM NCC) is implementing a project on enhancing the capabilities of a group of Pacific Island countries and territories in the generation and application of seasonal climate forecasts. The Bureau of Meteorology has an active climate research program in a wide variety of areas related to the tropical Pacific, including tropical cyclone research, analysis and modeling of tropical processes, such as the Madden/Julian Intra-seasonal Oscillation (MJO), the development of a coupled seasonal forecast model (Predictive Ocean Atmosphere Model for Australia (POAMA)) and associated research on downscaling. More information is available at: <http://www.bom.gov.au/bmrc/basic/exprest_hp.htm>.

***C.7 New Zealand National Institute of Water and Atmospheric Research***

National Institute for Water and Atmospheric (NIWA) Research produces climate forecasts for the South Pacific in the “Island Climate Update” (ICU). The ICU is now a multi-national monthly climate bulletin. Its primary goal is to assist Small Island Developing States (SIDS) of the South Pacific make informed planning and management decisions relating to climate sensitive sectors like agriculture, water, tourism, fisheries, energy through the provision of timely and accurate seasonal climate forecasts. The success of ICU is hinges on the multinational collaboration amongst all the organizations and stakeholders involved. A number of organizations and countries are involved in drawing together the seasonal forecasts. These include: BoM, Meteo-France (New Caledonia and French Polynesia), Fiji Meteorological Service (FMS), Samoa Meteorological Service (SMS), National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Pacific Region, NOAA Climate Prediction Center (CPC) and the International Research Institute for Climate Prediction (IRI). There have now been more than 60 seasonal rainfall outlooks issued for the Southwest Pacific and the results have been promising.

***C.8 NOAA Climate Programs in the Pacific***

NOAA has a strong history of developing and supporting climate programs in the Pacific. The NOAA Climate Program Office (CPO), the National Weather Service (NWS), and the National Climatic Data Center (NCDC) have been working together in the Pacific region through several key programs with demonstrated success. These programs include:

* PEAC Center;
* Pacific RISA; and
* PI-GCOS.

The history and on-going successes of these programs provide a strong foundation for science-based climate information services in the Pacific and thus contribute to the fulfillment of top NOAA priorities. (NOAA Annual Guidance Memorandum for FY 2008 – 2012, p. 4, “Understand climate variability and change to enhance society’s ability to plan and respond”).

*C.8.1 Pacific El Niño-Southern Oscillation (ENSO) Applications Climate (PEAC) Center*

PEAC Center was originally conceived at a workshop organized jointly by the University of Hawaii and NOAA Office of Global Programs (OGP), the forerunner of the Climate Program Office (CPO) in 1992. That initial workshop provided an opportunity for representatives of the climate research community to meet with individuals from potential forecast user communities in the U.S.-Affiliated Pacific Islands (USAPI). Sectors represented at this meeting included disaster management, water and power utilities and fisheries among others. The 1992 workshop confirmed the potential usefulness of ENSO forecasts in these sectors and Workshop participants specifically set a long-term goal to “Establish a Pacific ENSO Applications Climate Center to provide:

* **Routine production and delivery of tailored forecasts;**
* **An institutional focus for translation, interpretation, communication, education and outreach; and**
* **Enhanced partnership among the scientific community, government agencies and local decision makers**.” (Schultz and Hamnett 1992).

In 1994, PEAC Center was initiated as a small research pilot project that took the form of a partnership involving NOAA’s OGP and the U.S. National Weather Service (NWS), the University of Hawaii, the University of Guam and the Pacific Basin Development Council (the Governors of Hawaii, Guam, American Samoa and the Commonwealth of the Northern Mariana Islands). It was established to provide ENSO forecasts and information products to the USAPI. Initially, PEAC Center focused on:

* Improved historical datasets with an initial emphasis on rainfall;
* Expanded access to and interpreting ENSO forecast products being developed by the NWS, the International Research Institute for Climate and Society at Columbia University (IRI) and other forecasting and research institutions in the region;
* Expanded public awareness and understanding of the ENSO cycle and the potential societal benefits of forecast applications; and
* Identifying specific applications opportunities.

During this time, the OGP was expanding support for social science research and regional climate forecast applications projects. PEAC Center offered an especially exciting opportunity for this line of research due to the strength of the ENSO signal in the Pacific and the fact that ENSO impacts on Pacific Island communities are so closely connected to the safety and development of those communities. (1)

The 1997-1998 ENSO event provided an opportunity for the PEAC team to undertake efforts aimed at assessing the consequences of ENSO for the jurisdictions it serves. PEAC Center alerted its clients through the *Pacific ENSO Update* (a newsletter and website that act as PEAC Center’s primary information dissemination vehicle) and through briefings, forecasts and public information campaigns about the potential impacts of ENSO. These included: increased probability of tropical cyclones followed by drought and wildfires and the potential impacts to agriculture, health, local ecosystems and fisheries. PEAC Center’s educational efforts helped to prompt communities to prioritize repairs of water distribution and catchment systems, enabling them to better manage drought conditions. PEAC Center outreach also enabled communities to plan for added stress to power and utilities management and emergency management, such as fire control and flood response. (Shea 2003)

In addition to providing education and outreach, PEAC Center solicited feedback in order to understand what information is most useful to users and which formats are most easily interpretable. “PEAC Center has proven that the “end-to-end” concept is not only feasible, but can actually be used to reduce the suffering and the cost of extreme climate events associated with the ENSO cycle.” (Hamnett et al 1999, p. 12) (<http://www.soest.hawaii.edu/MET/Enso/subdir/update.dir/PEAC-orgchart.html>)

The transition of PEAC Center from research to operations began in 2000 with responsibility assigned to the U.S. National Weather Service Pacific Region (NWS PR) Weather Forecast Office (WFO) Honolulu. Close collaboration with the University of Guam and the University of Hawaii remains an integral part of PEAC Center operations. Additional information can be found on the PEAC Center website at <http://www.soest.hawaii.edu/MET/Enso/index2.html>.

Through PEAC Center, NOAA and its partners have demonstrated their continued commitment to an integrated, end-to-end climate program which combines observations, research, prediction and assessment activities which will be an important component in the emergence of an effective climate information service for the Pacific.

*C.8.2 Pacific Regional Integrated Sciences and Assessments (RISA)*

The RISA program is funded through NOAA CPO.

The RISA program began with university-based efforts in regions of the United States where recent advances in integrated climate sciences held the greatest promise to assist decision-making. Much of the first-generation RISA success built on breakthroughs in predicting variability, change, and impacts of climate processes occurring in the tropical Pacific Ocean. This is the area where El Niño and La Niña conditions, which affect much of the western and southern United States, as well as Mexico, originate. (Institute for the Study of Planet Earth, 2004)

The Pacific RISA, located at the East-West Center in Honolulu, Hawaii, began in 2003 and built on many of the needs identified in the 2001 Pacific Islands Regional Assessment Group’s report to the U.S. Global Change Research Program (USGCRP).

The Pacific RISA program supports the emergence of an integrated program of climate risk management in the Pacific region. With an emphasis on reducing Pacific Island vulnerability to climate-related extreme events such as drought, floods and tropical cyclones, this emerging RISA builds substantially on existing regional efforts in climate science and services, including over a decade of regional experience in the development and use of ENSO-based forecasts. Led by researchers at the East-West Center in Hawaii, Pacific RISA works in close collaboration with scientific, educational institutions and regional organizations throughout the Pacific. The program focuses heavily on sustaining a continuous process of dialogue with decision-makers and emphasizes the effective engagement of Pacific Island communities, governments and businesses in developing effective policies to build resilience and sustainability in key sectors such as water resource management, coastal resources, agriculture, tourism, disaster management and public health. (<http://research.eastwestcenter.org/climate/risa/>)



Due to the pre-existing climate applications and product strengths in the region, the Pacific RISA was able to work with PEAC Center and other partners including the NWS to conduct a review of the first decade of PEAC Center operations. In addition, the Pacific RISA supported the organization of meetings, briefings and workshops to explore the climate-related vulnerabilities of American Flag and U.S.-Affiliated Pacific Islands (funded by the NOAA Coastal Services Center). (Shea, 2005a)

Along with PEAC Center, the Pacific RISA has been working to sustain an on-going process of shared learning and joint problem solving through continuous interaction and information flow between users and providers of climate information. The Pacific RISA has an established network that can be enhanced and expanded and thus contribute considerable value to climate services in the Pacific and thus PaCIS.

*C.8.3 NWS Climate Services*

In 2001 NWS began the process of institutionalizing and expanding its climate services activities with the formal creation of the Climate Services Division (CSD) in its Office of Climate, Water, and Weather Services in Silver Spring, MD. CSD was formed to oversee the process, including managing and developing the program’s resources, assuming responsibility for policy, coordination of producer and customer requirements, ensuring training of field personnel, and facilitating partnerships. By the end of 2003, Climate Services Program Managers had been named in all six NWS regional headquarters and Climate Services Focal Points at all local offices and River Forecast Centers as the first step in the *NWS Regional and Local Climate Services Implementation Plan* (2003). Currently, a web infrastructure, comprehensive training program, and partnerships are in place to support local Focal Points who are delivering a full suite of climate services under the guidelines laid out in the formally adopted *NWS Regional and Local Climate Service Delivery: Operations Document* (2006). The web infrastructure includes standardized web pages providing public access to both existing and new NOAA climate data, information and prediction products, and a variety of outreach, data stewardship, and local climate analysis tools. The training program consists of both residence and distance teaching (web casts, tele-training and interactive web modules) in both climate science (variability, prediction, and change) and climate services operations. In the Pacific, trained Climate Service Focal Points are currently coordinating the delivery of local climate services in their offices. As laid out in the *Operations Document* (2006) each must:

* “Serve as a customer interface” both proactively and reactively in coordination with partners (like the Hawaii State Climatologist);
* “Be the steward and conscience for continuity/integrity of the historical climate record” as part of a team consisting of NCDC, the NOAA IDEA Center, the new Pacific RCC, and other stakeholders in data management, (<http://research.eastwestcenter.org/climate/risa/RISA-stakeholders.htm>) and
* “Participate in NWS climate analysis, monitoring and prediction activities” through conducting local studies, monitoring local conditions and sharing the knowledge with customers, and providing local expertise to enhance and augment the NWS suite of forecast products.

These roles are fully consistent with and support the missions of both PEAC Center and the NOAA IDEA Center and NWS Climate Services is formally linked to both.

In connection with (3) above, in July, 2006, CSD released the first in a suite of local forecast products, the Local 3-Month Temperature Outlook (L3MTO), to be developed and introduced under a comprehensive, several year plan. The L3MTO is a localized extension of the Climate Prediction Center’s 3-Month Temperature Outlook. Although this product is exclusive to the CONUS region, it acts as a strong foundation for the next local outlook product scheduled for release in 2007, the Local 3-Month Outlook of La Nina El Nino Impacts on Temperature and Precipitation (L3MOLEI). The L3MOLEI will be the first of the CSD products that will integrate the Pacific Region into its monthly National forecast products domain. The Pacific Region in fact, along with select sites in Eastern and Western CONUS Regions will act as the test bed for this new product. The product will be processed, hosted and tested in the Pacific Region. An interactive interface, also under development, is designed to compliment and enhance the product. The interface will allow Weather Forecast Offices and Weather Service Offices the ability to test additional climate variables (aside from temperature and precipitation). Variables exhibiting strong ENSO correlations (like sea level) may then be accepted and added into the monthly, automated forecasts. In perhaps the most ENSO responsive area in the world, this feature is a promising tool for the Pacific Region. Its impact on local resource management and mitigation throughout the Pacific island nations is patent. (Hollingshead, 2006)

*C.8.4 NOAA NWS Climate Prediction Center*

In the 1980's the National Weather Service established the Climate Prediction Center (CPC), known at the time as the Climate Analysis Center (CAC). The CPC is best known for its United States climate forecasts based on El Niño and La Niña conditions in the tropical Pacific. The Climate Prediction Center's products are operational predictions of climate variability, real-time monitoring of climate and the required data bases, and assessments of the origins of major climate anomalies. The products cover time scales from a week to seasons, extending into the future as far as technically feasible, and cover the land, the ocean, and the atmosphere, extending into the stratosphere.

These climate services are available for users in government, the public and private industry, both in this country and abroad. Applications include the mitigation of weather related natural disasters and uses for social and economic good in agriculture, energy, transportation, water resources, and health. Continual product improvements are supported through diagnostic research, increasing use of models, and interactions with user groups.

The Climate Prediction Center working with national and international partners is at the forefront of turning this new understanding into practical tools and useful products for predicting such events and their impacts months to seasons in advance to reduce vulnerability and exploit opportunities for beneficial impacts.

Better predictions of extreme climate episodes like floods and droughts could save the United States billions of dollars in damage costs. Water, energy and transportation managers as well as farmers would be able to plan and avoid or mitigate these losses. For example, the CPC's seasonal climate forecast based on the 1997/98 El Niño saved Californians $500 million to $1 billion for they were able to take mitigation measures six months in advance of heavy rains.

*C.8.5 Additional NOAA Supported Programs*

In addition, NOAA supports a number of additional climate research and data management activities in the Pacific region including:

* Joint Institute for Marine and Atmospheric Research (JIMAR, University of Hawaii, SOEST)
* International Pacific Research Center (IPRC, University of Hawaii)
* Asia Pacific Data Research Center (APDRC, University of Hawaii)
* Social Science Research Institute, Climate Applications and Society Program (SSRI, University of Hawaii)
* Climate impacts research conducted by individual NOAA line offices
* University of Guam , Water and Energy Research Institute (UoG/WERI) research programs on climate and water

***C.9 Other Climate Related Activities in the Pacific***

There are several other climate activities in the Pacific that work with integrating climate data and communicating to decision-makers, including the Hawaii State Climate Office and the NOAA Integrated Data and Environmental Applications (IDEA) Center.

*C.9.1 Hawaii State Climate Office*

The Hawaii State Climatologist works out of the Hawaii State Climate Office, which was founded in 2000. The office is located at the University of Hawaii Manoa at the Department of Meteorology. The State Climatologist collects and analyzes climate information (such as temperature and rainfall) and provides information to the public. The Hawaii State Climate Office provides rainfall and temperature updates and summaries on their website as well as links to relevant climate stations in the state. The State Climatologist is often one of the first places that government officials and the public query when they have questions about climate data and impacts. The office is a designated American Association of State Climatologists Recognized State Climate Office (AARSCO), which required endorsement by WFO Honolulu, the Western Region Climate Center, and NCDC and implies approved service capabilities. (<http://www.soest.hawaii.edu/MET/Hsco/>)

*C.9.2 NOAA Integrated Data and Environmental Applications Center*

In March 2004, a NOAA-wide Pacific Region Integrated Data Enterprise (PRIDE) Committee was established to evaluate environmental data requirements and information needs in the Pacific region. PRIDE aims to advance NOAA’s mission objectives and meet critical regional needs for ocean, climate, and ecosystem information to protect lives and property, support economic development and enhance the resilience of Pacific Island communities in the face of changing environmental conditions. NOAA’s National Climatic Data Center (NCDC) initiated efforts to support the emergence of a NOAA Integrated Data and Environmental Applications (NOAA IDEA) Center through contractual arrangement with the East-West Center in Honolulu, Hawaii.[[5]](#footnote-5)

The NOAA IDEA Center will advance NOAA’s mission objectives to help meet critical regional needs for ocean, climate, and ecosystem information to protect lives and property, support economic development and enhance the resilience of Pacific Island communities in the face of changing environmental conditions. Its initial program elements include:

* **Support for Regional and Global Observing Systems and Programs, including PI-GCOS, PI-GOOS and PacIOOS;**
* **Development of New Integrated Data Products and Environmental Applications;**
* **User Engagement, Education and Outreach; and**
* **Establishing the Critical National, Regional and International Partnerships**

The Pacific Region Integrated Climatology Information Products (PRICIP) project is an example of a regional effort to develop new integrated data products and environmental applications and provide an important part of the foundation of the IDEA Center. The PRICIP project will improve our understanding of patterns and trends of storm frequency and intensity —“storminess”— within the Pacific region and develop a suite of integrated information products that can be used by emergency managers, mitigation planners, government agencies and decision-makers in key sectors including water and natural resource management, agriculture and fisheries, transportation and communication, and recreation and tourism. Ultimately, PRICIP will work towards the development of a national comprehensive coastal climatology program.

The NOAA IDEA Center’s goal to enhance integration of NOAA data and information systems will provide an additional network as well as a greater understanding of climate data in the Pacific as a component of PaCIS.

***C.10 Related Regional Activities***

*C.10.1 Pacific Risk Management ‘Ohana (PRiMO)*

PRiMO is an ‘ohana (family) of risk management partners and stakeholders in the Pacific. PRiMO’s goal is to “improve the development and delivery of risk management-related information products and services in the Pacific.” “PRiMO was established at the 2004 Roundtable of Federal Hazard Mitigation Partners in the Pacific Islands (FHMPPI), held in Honolulu in March 2004. PRiMO brought together representatives from agencies, institutions, and organizations involved in Pacific risk management-related projects and activities with the overall goal of enhancing communication, coordination, and collaboration among the ‘ohana of partners and stakeholders involved in this work.” (PRIMO 2006)

PRiMO established several working groups, or hui o hana with designated activities to carry out on a yearly basis. The following is a list of the PRiMO hui o hana:

* **Communications**
* **Education, & Outreach**
* **Training**
* **Risk Reduction & Post-Disaster Evaluation**
* **Observations & Data Management**
* **Data Analysis & Decision Support Tools**
* **Traditional Knowledge & Practices** (PRiMO 2006)

The PRiMO network is another example of an integrated network that can contribute to and benefit from a larger PaCIS framework. PRiMO is expected to be a significant partner for PaCIS particularly in the context of engaging other federal partners involved in climate risk management activities in the region.

**Appendix D: PaCIS Steering Committee Terms of Reference**

*TERMS OF REFERENCE*

PACIFIC CLIMATE INFORMATION SYSTEM (PaCIS) STEERING COMMITTEE

**1. PURPOSE AND BACKGROUND OF PaCIS**

PaCIS will provide a programmatic framework and overall strategic guidance for the development and implementation of an integrated program of climate[[6]](#footnote-6)1 observations, research, modeling, forecasting, operational services, assessment, information management and education and outreach that will address the needs of the American Flag and U.S. Affiliated Pacific Islands. In addition, PaCIS will help ensure an effective U.S. contribution to the emergence of a World Meteorological Organization Regional Association V Regional Climate Centre (WMO RA V RCC).

These Terms of Reference establish the scope and responsibilities, establishment of working groups, membership, and procedures of the PaCIS Steering Committee.

Discussions of a Pacific Climate Information System can trace its roots back to the 1997-1998 El Niño season and to a Pacific climate services workshop held in conjunction with the 1999 Secretariat of the Pacific Regional Environment Programme (SPREP) meeting of the Pacific Regional Meteorological Services Directors. Those early discussions identified a regional vision for *resilient and sustainable communities using climate information to manage risks and support practical decision-making in the context of climate variability and change.*  The United State’s Pacific Climate Information System has embraced this same vision.

In this context, the Pacific Climate Information System will provide the programmatic framework to integrate a variety of activities in support of its vision, mission objectives and program elements, which are as follows:

**Vision:** *Resilient and sustainable Pacific communities using climate information to manage risks and support practical decision-making in the context of climate variability and change.*

**Mission Objectives:**

1. *Clarify climate information needs and guide monitoring, research and assessment;*
2. *Provide access to critical data, research and new climate information products and services;*
3. *Translate research and assessment results into useful and usable climate information;*
4. *Interpret global and regional climate forecasts and projections for local applications;* do we want to
5. *Enhance regional and local skills and capabilities to manage risks and support sustainable development in the context of climate variability and change; and*
6. *Enhance collaboration among national, regional and international institutions and programs involved in climate information services.*

**Program Elements:**

* Education, Outreach and User Information Needs
* Operational Climate Observations, Products and Services
* Research and Assessment

**2. SCOPE AND RESPONSIBILITIES OF THE STEERING COMMITTEE**

The PaCIS Steering Committee is a mechanism and a forum to ensure that all entities with a regional stake in PaCIS have a voice in formulating consensus positions, in carrying out agreed upon policies, and in performing the necessary tasks to implement a consolidated regional program. The goal of the Steering Committee is to take a proactive and systematic approach to support the emergence of an effective and well-coordinated U.S. PaCIS program.

To meet these responsibilities, the PaCIS Steering Committee will:

* Provide strategic guidance for PaCIS program structure and content;
* Lead the development of an initial PaCIS Action Plan and associated implementation documents and periodic revisions to those documents as required;
* Designate and provide oversight for PaCIS Working Groups who are responsible for detailed descriptions and implementation of PaCIS program elements;
* Further integrate PaCIS program elements through the guidance of programmatic and management activities;
* Periodically review the progress of PaCIS priorities and activities;
* Promote effective integration of PaCIS into the broader community of regional climate programs in the Pacific, including PI-GCOS, PI-GOOS, and the emergence of a WMO RA-V Regional Climate Centre for Oceania;
* Participate in relevant formal and ad hoc activities of PaCIS;

* Act as a regional advocate for using climate information to manage risks and support practical decision-making in the context of climate variability and change;
* Facilitate the exchange of information and collaboration among sponsoring and participating organizations and agencies; and
* Coordinate with other groups who have an interest in using climate information to manage risks and support practical decision-making in the context of climate variability and change.

**Working Groups**

The PaCIS Steering Committee will have the authority to establish and direct the efforts of working groups as needed to support Steering Committee responsibilities. At a minimum, working groups will be established to support the development, oversight, and conduct of activities to support PaCIS’ three program elements given in Section 1.

The Steering Committee can establish other temporary or permanent working groups as necessary to meet its responsibilities. The working groups’ membership shall be designated by the PaCIS Steering Committee. In addition, the Steering Committee will be responsible for providing guidance on the working groups’ terms of reference.

**3. MEMBERSHIP OF PaCIS**

The membership of the PaCIS Steering Committee will include a balanced representation of the principal stakeholders in PaCIS:

* Representatives of NOAA and other U.S. Federal Government climate and climate risk management programs and offices;
* Representatives of universities and other scientific, technical and educational institutions active in U.S. climate observations, research, assessment, modeling, information management, and education in the Pacific;
* Representatives of other major operational and research institutions supporting climate observations, research, forecasting, operational services, assessment, information management and education/outreach in the Pacific;
* Representatives of programs undertaken in the context of U.S. climate bilateral and multilateral agreements (e.g., Climate Bilaterals with Australia, New Zealand);
* Representatives of regional organizations and programs focused on assisting island nations in their efforts to respond to climate change, climate variability and sea level rise; and
* Representatives of programs using climate information to manage risks and support practical decision-making in the context of climate variability and change.

These core institutions will be permanently represented on the PaCIS Steering Committee.

In addition, the Steering Committee will include membership that reflects user communities representing key sectors affected by climate variability and change, Pacific Weather Service Office representatives, and core scientific expertise. These individuals will be appointed for terms of three years renewable.

Based on their significant contributions to using climate information to manage risks and support practical decision-making in the context of climate variability and change, the initial membership on the PaCIS Steering Committee shall include the representatives listed in Annex A. Annex A may be amended as needed by consensus of the Steering Committee.

**4. PROCEDURES**

At the first Steering Committee meeting, the Committee will elect a Chair and Vice Chair. Thereafter, the Committee will hold elections every two years. The Chair and Vice Chair can be reelected for one additional term. The NOAA NWS Pacific Region Climate Services Program Manager will serve as the Executive Director of PaCIS.

As necessary, either the Chair of the Steering Committee or the PaCIS Executive Director may call meetings of the Committee. The PaCIS Executive Director in consultation with the Steering Committee Chair will convene and make the necessary arrangements for these meetings.

The PaCIS Executive Director in consultation with the Steering Committee Chair will provide advance notification of meetings and distribute an agenda to members of the Steering Committee in a timely manner. The Steering Committee will meet generally as issues warrant or at least once every 12 -18 months. Attendance at meetings of the Steering Committee shall be open to all interested individuals and organizations within the region.

The Steering Committee by consensus may amend these procedures as needed.

**Appendix E: PaCIS Steering Committee Membership Organizations, Programs and Specialties**

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| ***Membership Organizations, Programs and Specialties*** |
| **Australia Bureau of Meteorology (Bureau)** |
| **Decision Support Science Expert** |
| **East-West Center** |
| **National Center for Environmental Predictions, Climate Prediction Center (NCEP CPC)** |
| **National Weather Service, Pacific ENSO Applications Climate (PEAC) Center**  |
| **New Zealand National Institute for Water and Atmospheric Research (NIWA)** |
| **MeteoFrance** |
| **NOAA Climate Program Office (CPO)** |
| **NOAA Climate Regional Decision Support (RDS)** |
| **NOAA NESDIS NCDC Integrated Data and Environmental Applications (IDEA) Center** |
| **One NOAA** |
| **NOAA Pacific Region Executive Board (PREB)** |
| **NOAA Pacific Services Center (PSC)** |
| **NOAA NWS Climate Services**  |
| **Pacific Islands Global Climate Observing System (PI-GCOS)**  |
| **Pacific Region Key Sectors Users**  |
| **Pacific Region Weather Service Offices** |
| **NOAA NWS PR Climate Services Program Manager** |
| **Pacific Regional Environment Programme (SPREP)** |
| **East-West Center** |
| **Pacific Risk Management Ohana (PRiMO)** |
| **Pacific Island Ocean Observing System (Pac-IOOS)** |
| **Pacific Islands Global Ocean Observing System (PI-GOOS)** |
| **RISA Representative (non-Pacific)** |
| **University of Hawaii, School of Ocean and Earth Science Technology (SOEST), Joint Institute for Marine and Atmospheric Research (JIMAR)** |
| **Social Science/Climate Applications Expert** |
| **Pacific Islands Applied Geosciences Commission (SOPAC)** |
| **US GCOS Program Office, NCDC** |
| **US Geological Survey** |
| **National Marine Fisheries Service** |
| **Operational Prediction Expert** |
| **PaCIS Working Group Chairs (ex-officio)** |

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| **Appendix F: PaCIS Steering Committee Members** |
| **Organizations** | **Committee Members** |
| **NOAA IDEA Center** | Eileen Shea **(Chair)** |
| **Development Bank of American Samoa** | Utu Abe Malae **(Vice Chair)** |
| **NWS PR CS Program Manager/PEAC Center** | Jim Weyman **(Executive Director)** |
| **Australia BoM** | Mike Coughlan |
| **CPO** | Chet Koblinsky  |
| **Decision Support Science** | Roger Pielke, Jr. |
| **East-West Center** | Nancy Lewis |
| **GCOS** | Howard Diamond |
| **Federated States of Micronesia Environmental Protection Agency** | Joseph Konno |
| **NCEP CPC/RDS** | Wayne Higgins |
| **NIWA** | Jim Salinger |
| **MeteoFrance** | Luc Maitrepierre |
| **NOAA Pacific Regional Executive Board** | Jeff LaDouce |
| **NWS Climate Services** | Director NWS/CSD (TBD) |
| **One NOAA and PSC** | Bill Thomas |
| **SOPAC/PI-GOOS** | Paul Eastwood |
| **PRiMO** | PRiMO Executive Director (TBD) |
| **RISA** | Ed Miles |
| **Social Science Information System Aspects of Climate Change** | Mickey Glantz |
| **SPREP and PI-GCOS** | Dean Solofa |
| **UH SOEST JIMAR** | Tom Schroeder |
| **NWS Weather Service Office, Majuro** | Reggie White |
| **US Geological Survey** | Gordon Tribble |
| **National Marine Fisheries Service** | Noriko Shoji  |
| **Operational Prediction Expert** | Jim Laver |
| **Education Working Group** | Chairperson ex-officio |
| **Observation Working Group** | Chairperson ex-officio |
| **Research Working Group** | Chairperson ex-officio |

**Appendix G: PaCIS Working Groups Terms of Reference**

*TERMS OF REFERENCE*

PACIFIC CLIMATE INFORMATION SYSTEM (PaCIS) Working Groups

**1. PURPOSE AND BACKGROUND of PaCIS**

These Terms of Reference are intended to provide a framework for the establishment, composition, and operation of Pacific Climate Information System (PaCIS) working groups. PaCIS will provide a programmatic framework for the development and implementation of an integrated program of climate[[7]](#footnote-7)1observations, research, modeling, forecasting, operational services, assessment, information management and education and outreach that will address the needs of the American Flag and U.S. Affiliated Pacific Islands. In addition, PaCIS will help ensure an effective U.S. contribution to the emergence of a World Meteorological Organization Regional Association V Regional Climate Centre (WMO RA V RCC).

These Terms of Reference (TOR) establish the scope and responsibilities, establishment of working groups, membership, procedures of the PaCIS working groups, govern the PaCIS working groups, and help to guide and foster PaCIS priorities and activities. These TOR may be revised as necessary by the steering committee.

Discussions of the Pacific Climate Information System can trace their roots back to the 1997-1998 El Niño season and initial discussions of Pacific climate services at a workshop held in conjunction with the 1999 Secretariat of the Pacific Regional Environment Programme (SPREP) meeting of the Pacific Regional Meteorological Services Directors. Those early discussions identified a regional vision for *resilient and sustainable communities using climate information to manage risks and support practical decision-making in the context of climate variability and change*. The United State’s Pacific Climate Information System has embraced this same vision.

In this context, the Pacific Climate Information System will provide the programmatic framework to integrate a variety of activities in support of its vision, mission objectives and program elements which are as follows:

**Vision:** *Resilient and sustainable Pacific communities using climate information to manage risks and support practical decision-making in the context of climate variability and change.*

**Mission Objectives:**

1. *Clarify climate information needs and guide monitoring, research and assessment;*
2. *Provide access to critical data, research and new climate information products and services;*
3. *Translate research and assessment results into useful and usable climate information;*
4. *Interpret global and regional climate forecasts and projections for local applications;* do we want to
5. *Enhance regional and local skills and capabilities to manage risks and support sustainable development in the context of climate variability and change; and*
6. *Enhance collaboration among national, regional and international institutions and programs involved in climate information services.*

**Program Elements:**

* Education, Outreach and User Information Needs
* Operational Climate Observations, Products and Services
* Research and Assessment

**Establishment of Working Groups**

The PaCIS Steering Committee will establish and direct the efforts of working groups as needed to support the Steering Committee’s responsibilities. At a minimum, working groups will be established to support the development, oversight, implementation, and conduct of activities of PaCIS’ three program elements stated above. The PaCIS Steering Committee can establish other temporary or permanent working groups as necessary to meet its responsibilities. Working groups will accomplish their work in coordination and collaboration with representatives from relevant organizations, programs, and institutions.

**2. SCOPE AND RESPONSIBILITIES**

The goal of the working groups is to effectively and efficiently define, initiate and conduct activities that improve climate services in the Pacific and to address the three PaCIS program elements.

Specifically, the working groups will be called upon to:

* Complete an inventory of regional activities and identify critical gaps in each program element;
* Develop and oversee detailed plans for PaCIS program priorities and activities in each program element;
* Create plans for future PaCIS activities in each program element (e.g., future proposals to NOAA and other funding agencies);
* Identify opportunities for greater integration among program elements; and
* Periodically, at minimum every six months, report to the PaCIS Executive Director on working group progress. The Executive Director will then, in turn, update the Steering Committee.

Additional priorities and activities for the working groups are outlined in Annex B of the PaCIS Action Plan.

**3. MEMBERSHIP**

The membership of the PaCIS working groups should include a balanced representation of the principal stakeholders in the region;

* Representatives of NOAA and other U.S. Federal Government climate and climate risk management programs and offices;
* Representatives of universities and other scientific, technical and educational institutions active in U.S. climate observations, research, assessment, modeling, information management, and education in the Pacific;
* Representatives of other major operational and research institutions supporting climate observations, research, forecasting, operational services, assessment, information management and education/outreach in the Pacific;
* Representatives of regional organizations and programs focused on assisting island nations in their efforts to respond to climate change, climate variability and sea level rise; and
* Representatives of programs using climate information to manage risks and support practical decision-making in the context of climate variability and change.

In addition, the working groups will include membership that reflects user communities representing key sectors affected by climate variability and change, Pacific Weather Service Office representatives, and core scientific expertise. The PaCIS Steering Committee shall designate membership in the working groups.

**4. PROCEDURES**

The PaCIS Steering Committee shall appoint Chairs or Co-Chairs for each working group. The Chairperson or Co-Chairs will represent their program elements as members of the Steering Committee.

Meetings of the working groups will be convened and arranged for by each working group Chairperson in consultation with the Steering Committee’s Chairperson and the Executive Director.

Advance notification of meetings and an agenda will be distributed to members of the network in a timely manner. Meetings will generally be held only as issues warrant, or at least once every three months funds permitting. To the maximum extent possible working group deliberations will be conducted by phone, fax, email or other virtual or electronic means.

Attendance at meetings of the working groups shall be open to all interested individuals and organizations within the region.

**Appendix H - PaCIS Working Group Members**

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| **Appendix H-1: Education, Outreach, and User Information Needs Working Group Members.** |
| **Organizations** | **Committee Members** |
| **WFO Honolulu Warning Coordination Meteorologist** | Ray Tanabe **(Chair)** |
| **SOPAC**  | Delaine (Tagaloa) Cooper **(Vice-Chair)**  |
| **NOAA Outreach and Public Relations** | Delores Clark |
| **NIWA** | Ashmita Gosai |
| **WFO Guam Warning Coordination Meteorologist** | Chip Guard |
| **SPREP** | Tamara Logan |
| **User, Development Bank of American Samoa** | Utu Abe Malae |
| **RMSD** | Arona Ngari |
| **Australia BoM** | Janita Pahalad |
| **PSC/OCRM** | John Parks |
| **User, OERC** | Olai Polloi |
| **WSO Climate Service Focal Point** | Ellinor Lutu-McMoore |
| **PEAC Center** | Sarah Jones |
| **NOAA PSC** | Nadia Sbeih |
| **NOAA CSD** | Diana Perfect |
| **UH SSRI** | Cheryl Anderson |
| **FSM EPA** | Joe Konno |
| **NMFS/PIFD/ESOD** | Lucas Moxey |

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| **Appendix H-2: Operational Climate Observations, Products, and Services Working Group Members.** |
| **Organizations** | **Committee Members** |
| **PEAC Center** | Sarah Jones **(Chair)** |
| **SOPAC/PI-GOOS** | Paul Eastwood **(Vice Chair)** |
| **Fiji Meteorological Service**  | Simon McGree |
| **SPREP/PI-GCOS** | Dean Solofa |
| **IRI** | Tony Barnston |
| **Australia BoM** | Janita Pahalad |
| **GCOS** | Howard Diamond |
| **User, Canneries** | Pete Galeai |
| **NCEP CPC** | Luke He |
| **New Caledonia Meteorological Service** | Luc Maitrepierre |
| **UH SOEST** | Mark Merrifield |
| **IPRC/APDRC** | Jim Potemra |
| **NIWA** | Jim Salinger |
| **NOAA IDEA** | Eric Wong |
| **NWS PR WSO** | Reggie White |
| **User, RMI OEPPC** | Yumi Crisostomo |
| **WFO Honolulu Observing Program Leader** | Mark Farnsworth |
| **Climate Services Product Development** | Annette Hollingshead  |
| **Fisheries** | Lucas Moxey |

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| **Appendix H-3: Research and Assessment Working Group Members.** |
| **Organizations** | **Committee Members** |
| **UH SSRI /Pacific RISA** | Cheryl Anderson **(Chair)** |
| **SPREP** | Taito Nakalevu **(Vice Chair)** |
| **PEAC Center** | Rashed Chowdhury |
| **Hawaii State Climatologist** | Pao-Shin Chu |
| **User** | Kea (Thomas) Duarte |
| **USGS** | Gordon Tribble |
| **PRiMO** | PRiMO Executive Director |
| **WFO Honolulu Senior Service Hydrologist** | Kevin Kodama |
| **UOG/WRI** | Mark Lander |
| **NOAA IDEA Center** | John Marra |
| **IRI** | Simon Mason |
| **IPRC** | Jay McCreary  |
| **Decision Support Science** | Roger Pielke Jr.  |
| **UH/SOEST** | Tom Schroeder  |
| **SOPAC/PI-GOOS** | Paul Eastwood |
| **CDC/ESRL** | Randy Dole  |
| **User, SPC Women In Fisheries** | Veikila Vuki |
| **WHO/UNDP Climate and Health** | Navi Litidamu  |
| **Meteorological Service of New Zealand**  | Penehuro Lefale |
| **Fisheries** | Jeff Polovina |

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1. Information provided by Reginald White, Meteorologist in Charge, Weather Service Office, Majuro, Republic of the Marshall Islands. [↑](#footnote-ref-1)
2. Information provided by Mary Power, SOPAC. [↑](#footnote-ref-2)
3. Excerpts of “Living with a Climate in Transition: Pacific Islands Experience” were used for this section with the permission of Eileen Shea. Pacific RISA, East-West Center. [↑](#footnote-ref-3)
4. Information provided by Jim Salinger, NIWA. New Zealand. [↑](#footnote-ref-4)
5. This section includes excerpts taken from the NOAA IDEA Center Informational One-Pager with permission from Eileen Shea, Pacific RISA Director. East-West Center. [↑](#footnote-ref-5)
6. 1 “The climate system is the highly complex system consisting of five major

components: the atmosphere, the hydrosphere (including oceans), the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and human-induced forcings such as the changing composition of the atmosphere and land-use change.” (IPCC, 2001, Climate Change 2001: The scientific basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. J.T Houghton, Y Ding, D.J Griggs, et al (eds). Cambridge and New York: Cambridge University Press. Appendix I – Glossary, Editor: A.P.M. Baede) [↑](#footnote-ref-6)
7. 1 “The climate system is the highly complex system consisting of five major

components: the atmosphere, the hydrosphere (including oceans), the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and human-induced forcings such as the changing composition of the atmosphere and land-use change.” (IPCC, 2001, Climate Change 2001: The scientific basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. J.T Houghton, Y Ding, D.J Griggs, et al (eds). Cambridge and New York: Cambridge University Press. Appendix I – Glossary, Editor: A.P.M. Baede) [↑](#footnote-ref-7)